THE ENCYCLOPÆDIA BRITANNICA

NEW VOLUMES

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SECOND	„	ten	„	1777—1784.
THIRD	„	eighteen	„	1788—1797.
FOURTH	„	twenty	„	1801—1810.
FIFTH	„	twenty	„	1815—1817.
SIXTH	„	twenty	„	1823—1824.
SEVENTH	„	twenty-one	„	1830—1842.
EIGHTH	„	twenty-two	„	1853—1860.
NINTH	„	twenty-five	„	1875—1889.
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VOLUME XXXI

ENGLISH LITERATURE to OYAMA, IWAO

GEORGE E. MAYCOCK

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G. T. B.	Sir George Thomas Beilby, F.R.S., LL.D., D.Sc. Director of Fuel Research, Department of Scientific and Industrial Research. See the biographical article: Beilby, Sir George Thomas.	**Fuel.**
G. W. Ri.	George Washington Riley, Ph.B., D.O. Late President, New York State and City Osteopathic Societies. President, American Osteopathic Association, 1917–8.	**Osteopathy.**
H. A. B.	Brigadier-General Henry Arthur Bethell, C.M.G. Late Royal Field Artillery. Author of *Modern Guns and Gunnery*; *Modern Artillery in the Field.*	**Ordnance** (*in part*).
H. A. G.*	Harold Atheling Grimshaw, B.A., M.Sc. (Econ.). Lecturer in Public Administration at the London School of Economics, London University. Member of the International Labour Section of the League of Nations, Geneva.	**Hours of Labour** (*in part*).
H. B.*	Herbert Brande. Formerly Editorial Writer on *The Chicago Tribune.*	**Newspapers** (*in part*).
H. B. B.	Harold Beresford Butler, C.B., M.A. Deputy-Director, International Labour Office, League of Nations. Formerly Principal Assistant Secretary, Ministry of Labour. Member of the British Delegation at the Peace Conference.	**International Labour Organization.**

H. Ca.	Rev. Henry Carter. Member of British Central Licensing Control Board (Liquor Traffic), 1916–21. Author of *The Control of the Drink Trade*; *The Church and the New Age*; etc.	**Liquor Laws and Liquor Control:** *United Kingdom.*
H. Ch.	Hugh Chisholm, M.A. Formerly Scholar of Corpus Christi College, Oxford. Editor of the 10th, 11th and 12th editions of the *Encyclopædia Britannica.* Financial Editor of *The Times*, 1913–20. See the biographical article: Chisholm, Hugh.	**English Literature** (*in part*); **Finance;** **George V.;** **Holden, Sir E. H.;** **Montessori System.**
H. Cl.	Sir Hugh Clifford, G.C.M.G. Governor of Nigeria. In the Federated Malay States, 1883–1903; in the West Indies, 1903–7; in Ceylon, as Colonial Secretary, 1907–9. Administered the British Sphere of Occupation in Togoland throughout the World War. Author of *Studies in Brown Humanity*; *Further India*; *The German Colonies*; etc.	**Gold Coast;** **Nigeria.**
H. C. D.	Harrison Clifford Dale, A.M. Fellow of the American Geographical Society. Professor of Economics and Political Science, University of Idaho. Author of *The Ashley-Smith Explorations and the Discovery of a Central Route to the Pacific: 1822–1829*; etc.	**Idaho.**
H. E. A. C.	Henry Evan Auguste Cotton, C.I.E., L.C.C. Formerly Scholar of Jesus College, Oxford, and Advocate of the High Court at Calcutta. Author of *Calcutta Old and New.* Late Editor of *India.*	**Gandhi, M. K.**
H. F. Ba.	Henry Frederick Baker, Sc.D., F.R.S. Lowndean Professor of Astronomy and Geometry, Cambridge. Fellow of St. John's College, Cambridge.	**Mathematics:** *Geometry.*
H. I. P.	Herbert Ingram Priestley, M.A., Ph.D. Associate Professor of Mexican History and Librarian of the Bancroft Library, University of California. Author of *José de Gálvez, Visitor-General of New Spain*; etc.	**Guatemala; Honduras;** **Huerta; Madero; Mexico;** **Nicaragua; Obregon.**
H. Jn.	Sir Herbert Jackson, K.B.E., F.R.S. Director of Research, British Scientific Instruments Research Association. Emeritus Professor of Chemistry, University of London.	**Glass** (*in part*).
H. J. W.	H. J. Wilson, C.B., C.B.E.	**Labour Legislation:** *United Kingdom.*
H. L. C.	Hugh Longbourne Callendar, M.A., LL.D., C.B.E., F.R.S. Professor of Physics in the Imperial College of Science, South Kensington. Author of *Properties of Steam*; *Thermodynamic Theory of Turbines.*	**Heat.**
H. M. Sa.	Herbert Mitchell Sanders, M.A. Assistant Secretary to the Board of Inland Revenue. Assistant Secretary to the Royal Commission on the Income Tax, 1919–20.	**Income Tax:** *United Kingdom.*
H. P.	Henri Pirenne. Rector of the University of Ghent. Member of the Royal Academy of Belgium and of the Institute of France. Corresponding Member of the Royal Historical Society. Author of *Histoire de Belgique*; etc.	**Fredericq, Paul.**
H. P.*	Hugo Preuss, Dr. Juris. Formerly Lecturer at the University of Berlin and Professor Public Law at the Berlin University College of Commerce. Municipal Deputy and Municipal Councillor in Berlin. After the Revolution Secretary of State for the Interior and Minister of the Interior for the Reich up to the German acceptance of the Peace of Versailles. Member of the Prussian Constituent Assembly and of the first Diet of the Republic of Prussia. Bore the leading part in drafting, and carrying through the Constituent Assembly of the Reich, the new Republican Constitution of Germany. Author of *Das deutsche Volk und die Politik*; etc.	**Germany:** *Republican Constitution.*
H. P.-G.	Harry Pirie-Gordon, D.Sc., M.A. Served in the World War. Deputy Governor of Jerusalem, 1918. Editor of *A Brief Account of the Advance of the Egyptian Expeditionary Force.*	**Hejaz Railway.**
H. P. W.	Henry Parker Willis, Ph.D. Professor of Banking in Columbia University. Director of Research, Federal Reserve Board. Author of *American Banking*; *The Federal Reserve*; etc.	**Federal Reserve Banking System.**
H. Sa.	Hirosi Saito, M.A. Secretary of Embassy and Consul in the Japanese Diplomatic and Consular Service. Member of the Japanese Delegation to the Peace Conference in Paris, 1919, and to other Inter-Allied and International Conferences in Europe, 1919–21.	**Formosa;** **Japan;** **Korea.**
H. Si.	H. Sinzheimer. Professor in the University of Frankfort-on-Main.	**Germany:** *Factory Council Law.*
H. v. H.	Major-General Hans von Haeften. Late General Staff, German Army. Director in the Archives of the Reich. Formerly member of the Historical Section of the Great General Staff. During the World War a General Staff Officer with the troops. Representative of the Supreme Command at the Foreign Office, 1918.	**Noyon, Battle of.**

H. W.	Hartley Withers. Editor of the Financial Supplement of the *Saturday Review.* Formerly Editor of *The Economist.* Author of *The Meaning of Money*; *Case for Capitalism*; etc.	**Money Market.**
H. Wf.	Humbert Wolfe, C.B.E.	**Labour Ministry:** ***United Kingdom*;** **Labour Supply and Regulation:** ***United Kingdom.***
H. W. W.	Herbert Wrigley Wilson, M.A. Sometime Scholar of Trinity College, Oxford. Author of *Ironclads in Action.* Contributor to *The Cambridge Modern History.* Assistant Editor of *The Daily Mail.*	**Northcliffe, Lord.**
J. A. Ro.	James Alexander Robertson, Ph.B., L.H.D. Chief of the Near Eastern Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D.C. Managing Editor of *The Hispanic American Historical Review.* Co-editor of Blair and Robertson's *The Philippine Islands, 1493–1898* (55 vols.). Compiler of *Bibliography of the Philippine Islands*; etc.	**Guam.**
J. A. W.	James Albert Woodburn, A.B., Ph.D., LL.D. Professor of American History, Indiana University. Member of the American Historical Society. Author of *The American Republic and its Government*; etc.	**Indiana.**
J. Bro.	John Brownlee, M.A., M.D., D.Sc. Director of Statistics, Medical Research Council.	**Epidemiology** ***(in part).***
J. C. P.	John Carl Parish, Ph.D. Associate Editor of the State Historical Society of Iowa. Lecturer in Iowa History in the State University of Iowa. Author of *The Man with the Iron Hand*; *Robert Lucas*; *John Chambers*; etc.	**Iowa.**
J. de G. H.	J. de Graff Hunter, M.A., Sc.D. Mathematical Adviser to the Survey of India. Author of *Formulae for Atmospheric Refraction and their Application to Terrestrial Refraction and Geodesy*; *Survey of India*, Prof. Papers Nos. 14, 1913 (*The Earth's Axes and Triangulation*), and 16, 1918.	**Geodesy** ***(in part).***
J. E. W.*	Jeanne Elizabeth Wier, B.Bi., B.A. Professor of History and Political Science in the University of Nevada. Executive Secretary of the Nevada Historical Society.	**Nevada.**
J. F.	James Ford, Ph.D. Associate Professor of Social Ethics in Harvard University. Sometime Division Manager, U.S. Housing Corporation. Editor of the Report of the U.S. Housing Corporation. Author of *Co-operation in New England*; etc.	**Housing:** ***United States.***
J. F. M.	James F. Muirhead, M.A., L.H.D., F.R.G.S. Author of *America, the Land of Contrasts*, and of Baedeker's Handbooks to London, England, the United States and Canada. Editor of Muirhead Guidebooks, Limited (The Blue Guides).	**London.**
J. G. de R. H.	Joseph Gregoire de Roulhac Hamilton, M.A., Ph.D. Kenan Professor of History and Government in the University of North Carolina. Author of *Reconstruction in North Carolina*; *North Carolina since 1860*; etc.	**North Carolina.**
J. H. Ho.	Jacob H. Hollander, Ph.D. Professor of Political Economy in Johns Hopkins University. Author of *David Ricardo*; *The Abolition of Poverty*; *War Borrowing*; etc. Treasurer of Porto Rico, 1900–1. Financial Adviser of the Dominican Republic, 1908–10.	**Haiti.**
J. J.	James Johnstone, D.Sc. Professor of Oceanography in the University of Liverpool. Author of *Conditions of Life in the Sea*; *British Fisheries*; etc.	**Oceanography.**
J. J. C.	Brigadier-General John Johnston Collyer, C.B., C.M.G., D.S.O. Late Chief of the General Staff, Union of South Africa.	**German South-West Africa.**
J. J. T.	Sir Joseph John Thomson, O.M., D.Sc., Hon. F.R.S.E., LL.D., Ph.D., F.R.S. See the biographical article: Thomson, Sir Joseph John.	**Gases, Electrical Properties of.**
J. K.	Joseph Kitchin, F.S.S. Manager in London of the Union Corporation, Limited.	**Gold.**
J. K.*	Lieutenant-Colonel Johann Kubena. Austro-Hungarian Engineer Corps. Formerly of the Munitions Department of the Austro-Hungarian War Ministry.	**Munitions of War:** ***Central Powers (in part).***
J. M. L.	James Miller Leake, A.B., Ph.D. Professor of History and Political Science in the University of Florida. Author of *The Virginia Committee System and the American Revolution*; etc.	**Florida.**

J. N.	JEAN NICOD, AGRÉGÉ DE PHILOSOPHIE (Paris), B.A. (Cantab.). Teacher of Philosophy in the Lycée of Laon, France.	**Mathematics:** *Logic and Foundations.*
J. N. M.*	JOHN NICOLAS MAVROGORDATO, M.A. Author of *Cassandra in Troy*; *Letters from Greece*; *The World in Chains*; etc.	**Greece.**
J. O. P. B.	JOHN OTWAY PERCY BLAND. Author of *China*; *Japan and Korea*; *Houseboat Days in China.* Joint-author of *China under the Empress Dowager.* Served in Chinese Maritime Customs, 1883–96. Shanghai Correspondent for *The Times*, 1897–1910.	**Hankow;** **Hart, Sir Robert;** **Manchuria;** **Mongolia.**
J. R. Co.	JOHN ROGERS COMMONS, A.B., A.M., LL.D. Professor of Economics, University of Wisconsin. Author of *Documentary History of American Industrial Society*; *History of Labor in the United States*; *Principles of Labor Legislation*; etc.	**Hours of Labour:** *United States;* **Labour Legislation:** *United States;* **Labour Supply and Regulation:** *United States.*
J. S.*	JULIUS SZEKFU, PH.D. Lecturer at the University of Budapest.	**Hungary** *(in part).*
J. S. D.	JOHN STEWART DOW, B.Sc., A.C.G.I. Assistant Editor of the *Illuminating Engineer.* Joint-author of *Modern Illuminants and Illuminating Engineering*; etc.	**Illuminating Engineering;** **Lighting, Electric.**
J. S. Ha.	MAJOR JULIAN SOMERVILLE HATCHER. Ordnance Department, U.S. Army. Member of the American Institution of Mining and Metallurgical Engineers. Life Member of the National Association of America. Experimental Engineer at the Government Small Arms Plant, Springfield Armory. Formerly Chief of the Machine-Gun and Small Arms Section, Ordnance Department.	**Machine-Guns.**
J. S. N.	JOSEPH SHIELD NICHOLSON, Sc.D., LL.D., F.B.A. Professor of Political Economy in the University of Edinburgh. Author of *Principles of Political Economy*; *Money and Monetary Problems*; etc.	**Inflation.**
J. S. Nc.	JOSEPH SINCLAIR NICHOLSON, M.A.	**Juvenile Employment:** *United Kingdom.*
J. Vi.	JONAS VILES, PH.D. Professor of American History in the University of Missouri.	**Missouri.**
J. Wa.*	JANE HARRIETT WALKER, L.R.C.P., L.R.C.S.E., M.D. (Brussels). Medical Superintendent, East Anglian Maltings Farm and East Anglian Children's Sanitoria, Mayland, Suffolk. Member of Departmental Committee on Provision for Treatment of Tuberculosis, 1911–2. President, Medical Women's Federation, 1917–20. Consulting Physician, Elizabeth Garrett Anderson Hospital, London, etc.	**Infantile Mortality:** *United Kingdom.*
J. We.*	JOSEPH WELLS, M.A. Warden of Wadham College, Oxford. Author of *Oxford and its Colleges*; *A History of Wadham College.*	**Oxford.**
J. W. G.	JOHN WALTER GREGORY, D.Sc., F.R.S., M.I.M.M. Professor of Geology in the University of Glasgow. Author of *The Great Rift Valley*; *The Dead Heart of Australia*; British Museum Catalogues of Fossil Bryozoa, etc. Victoria Medallist of the Royal Geographical Society. Bigsby Medallist of the Geological Society.	**Geology:** *Cosmic.*
J. W. H.-M.	JAMES WYCLIFFE HEADLAM-MORLEY, M.A., C.B.E. Historical Adviser to the Foreign Office. Formerly Fellow of King's College, Cambridge. Author of *Election by Lot at Athens*; *Life of Bismarck*; Special Reports issued by the Board of Education on Classical Studies in Germany; *The History of Twelve Days*; *The Issue*; etc.	**Europe.**
J. W. S.	JOHN W. SCANE, M.D. Assistant Dean, Faculty of Medicine, McGill University.	**Medical Education:** *Canada.*
K. C. M. S.	KENNETH CHARLES MORTON SILLS, M.A., LL.D. President of Bowdoin College, Brunswick, Maine. Candidate of the Democratic Party in Maine for the U.S. Senate, 1916. President of the Board of Visitors to the Naval Academy at Annapolis, 1920–1.	**Maine.**
K. W.	SIR KINGSLEY WOOD, M.P. Parliamentary Private Secretary to the British Minister of Health. Author of *The Law and Practice of Housing*; etc.	**Housing** *(in part).*
L. C. W.	LAWRENCE C. WROTH, A.B. First Assistant Librarian, Enoch Pratt Free Library, Baltimore. Author of *Parson Weems: A Biographical and Critical Study*; etc.	**Maryland.**
L. J.	MAJOR-GENERAL SIR LOUIS JACKSON, K.B.E., C.B., C.M.G. Commander of the Legion of Honour. Knight of St. Stanislas. Late Royal Engineers. Formerly Director-General of Trench Warfare Supply, and Controller of Chemical Warfare Research, British War Office.	**Mining, Military.**

L. J. S.	Leonard James Spencer, M.A., Sc.D., F.G.S. Assistant Keeper in the Mineral Department, British Museum Natural History. Editor of the *Mineralogical Magazine*. Author of *The World's Minerals*.	**Mineralogy.**
L. M.	Lewis Melville. Author of biographies of Thackeray, Sterne and William Cobbett, and of many works on the social life of the Georgian period.	**Newspapers** (*in part*).
L. Ro.	Sir Leonard Rogers, C.I.E., M.D., F.R.C.P., F.R.S., I.M.S. (retired). Physician and Lecturer, London School of Tropical Medicine. Late Professor of Pathology, Calcutta. Author of works on fevers in the tropics and bowel diseases in the tropics; etc.	**Kala-Azar.**
L. V.*	Luigi Villari. Officer of the Crown of Italy. Chevalier of St. Maurice and St. Lazarus. Italian Croce di Guerra. Chevalier of the Legion of Honour. French Croix de Guerre. British Military Cross. Member of Staff of League of Nations. Formerly attached to the Italian Foreign Office. During the war, Liaison Officer with the Allied Armies in Macedonia, and after the Armistice at Constantinople, and Secretary, Inter-Allied Commission, Smyrna.	**Italy.**
M. C. L.	Morris Charles Lamb, F.C.S., F.R.M.S. Director of the Light Leather Department of the Leathersellers' Company's Technical College, London. Author of *Leather Dressing, including Dyeing, Staining and Finishing*; etc.	**Leather.**
M. G.*	Major M. Greenwood, M.R.C.P., M.R.C.S. Medical Officer (Medical Statistics), Ministry of Health. Reader in Medical Statistics, University of London.	**Epidemiology** (*in part*).
M. K. W.	Captain M. K. Wardle.	**France** (*in part*).
M. Pa.	Maurice Pain. General Secretary of the French Ministry of the Devastated Regions.	**France:** *Invaded Regions.*
M. R.*	Maurice Réclus. *Conseiller d'État.* Colonial Editor of *Le Temps*.	**France** (*in part*); **French Equatorial Africa** (*in part*); **Indo-China, French.**
M. V.*	Hon. Martin Vogel, A.B. (Columbia). Formerly Assistant Treasurer of the United States, New York.	**Liberty Loan Publicity Campaigns.**
N. B.	Sir Edward Napier Burnett, K.B.E., M.D., F.R.C.S., F.R.C.P. (Edin.). Director of Hospital Services, Joint Council of the British Red Cross and the Order of St. John. Formerly Chairman, Hospitals Economy Committee, War Office.	**Hospitals:** *United Kingdom*; **Medicine, International.**
N. N. G.	Lieutenant-General N. Golovine. Russian Cross of St. George. British Military C.B. French Croix de Guerre. Commander of the Legion of Honour. Formerly Professor in the Russian General Staff College.	**Kaledin, Alexei.**
O. B.	Otmar Best. Member of the Staff of the *Deutsche Allgemeine Zeitung*.	**Germany:** *Political History* (*in part*).
O. G. L.	Orin Grant Libby, Ph.D. (Wisconsin). Professor of American History, University of North Dakota. Secretary of the State Historical Society. Editor of *Collections of State Historical Society of North Dakota* (vols. i.–iv. and vi.).	**North Dakota.**
O. J. R. H.	Osbert John Radcliffe Howarth, O.B.E., M.A. Assistant Secretary of the British Association. Sometime of the Geographical Section, Naval Intelligence Department. Editor of the *Oxford Survey of the British Empire*.	**Geography;** **Malay States, Federated;** **Malay States, Non-Federated;** **Netherlands India.**
O. Kr.	Otto Kriegk, Ph.D. (Göttingen). Member of the Staff of the *Weser Zeitung*, Berlin Office.	**Hamburg.**
P. B.	Paul Bourson. Member of the Commissariat-General of the French Republic at Strasbourg.	**France** (*in part*).
P. C. P.	Paul Chrisler Phillips, M.A., Ph.D. Professor of History in the University of Montana. Joint-author (with N. J. Lennes) of *The West in the Diplomacy of the American Revolution*. Author of *The Story of Columbus*; etc.	**Montana.**
P. G.*	Pieter Geyl, Litt.D. (Leiden). Professor of Dutch Studies in the University of London.	**Holland** (*in part*).

P. H. N.	Paul Henry Nystrom, Ph.D. Formerly Professor of Economics in the Universities of Wisconsin and Minnesota. Director of the Retail Research Association. Author of *Economics and Retailing*; *Retail Selling and Store Management*; *Textiles*; etc.	**Marketing.**
P. M. H.	Peter Martin Heldt. Engineering Editor of *Automotive Industries*. Author of *The Gasoline Automobile*.	**Motor Vehicles.**
P. T. M.	Hon. Sir Patrick Thomas McGrath, K.B.E., LL.D. Editor of the Newfoundland *Evening Herald*. President of the Legislative Council, Newfoundland.	**Newfoundland.**
P. Vi.	Sir Paul Vinogradoff, M.A., D.C.L., LL.D., Dr. Hist., Dr. Juris. Corpus Professor of Jurisprudence, Oxford. Author of *Villainage in England*; *The Growth of the Manor*; *Outlines of Historical Jurisprudence*; etc. See the biographical article: Vinogradoff, Sir Paul.	**Gutchkov;** **Kornilov** (*in part*); **Lenin;** **Milyukov;** **Nicholas II.**
R. A. V	Rolland A. Vandergrift, M.A. Assistant in History in the University of California.	**Los Angeles.**
R. B. F.	Raymond Blaine Fosdick, B.A., M.A., LL.B. Formerly Commissioner of Accounts, City of New York. Author of *American Police Systems*; *European Police Systems*; *Keeping our Fighters Fit*; etc.	**New York City.**
R. C.	Rt. Hon. Lord Robert Cecil, M.P. Representative of Great Britain on the League of Nations Commission at the Peace Conference, 1919. Representative of South Africa at the Assembly of the League of Nations at Geneva, 1920. Chairman of the League of Nations Union. See the biographical article: Cecil, Lord Robert.	**League of Nations.**
R. C. F.	R. C. Farmer, D.Sc., Ph.D. Late Chief Chemist, Explosives Department, Ministry of Munitions.	**Explosives** (*in part*).
R. D. O	Richard Dixon Oldham, F.R.S., F.G.S., F.R.G.S. Author of numerous papers on various aspects of Geology and kindred subjects.	**Geology:** *Dynamical*; **Isostasy.**
R. E. F.	Captain Raymond Ernest Field, O.B.E.	**Medals and Decorations.**
R. Gi.	Roy Gittinger, Ph.D. Dean of Undergraduates and Professor of English History in the University of Oklahoma. Author of *The Formation of the State of Oklahoma*; etc.	**Oklahoma.**
R. G. C.	R. G. Collingwood, M.A., F.S.A. Fellow and Tutor of Pembroke College, Oxford.	**Luxemburg.**
R. G. H.-V.	Lieutenant-Colonel Richard Granville Hylton Howard-Vyse, C.M.G., D.S.O. Royal Horse Guards. Served during the World War as Chief-of-Staff of 5th Cavalry Brigade and 5th Cavalry Division in France, and of Desert Mounted Corps in Palestine.	**Mounted Troops.**
R. G. L.	Raphael Georges Levy. Senator of France. Member of the Finance Committee of the Senate.	**France:** *Finance.*
R. H. B.	Ralph Harrub Blanchard. Assistant Professor of Insurance at Columbia University. Author of *Liability and Compensation Insurance.*	**Insurance:** *United States.*
R. J. D.	Lieutenant-Colonel Reginald John Drake, D.S.O. Late North Stafford Regiment and General Staff.	**Intelligence, Military:** *Secret Service.*
R. Jo.	Sir Robert Jones, K.B.E., C.B., D.S.M. (U.S.A.), F.R.C.S., Hon. D.Sc. (Wales), Hon. LL.D. (Aberdeen). Lecturer in Orthopaedic Surgery, Liverpool University. Director of Orthopaedic Surgery, St. Thomas's Hospital. Surgeon to the Royal National Orthopaedic Hospital. Hon. Adviser in Orthopaedic Surgery, Ministry of Pensions.	**Orthopaedic Surgery.**
R. K.	Lieutenant-Colonel Rudolf Kiszling. Late General Staff, Austro-Hungarian Army. Now of the Kriegsarchiv, Vienna.	**Luck, Battles of.**
R. K. H	Lieutenant-Colonel Robert Knox Hezlet, C.B.E., D.S.O. Royal Field Artillery. Superintendent of External Ballistics, Ordnance Committee. Author of *Nomography*; *Interior Ballistics*; etc.	**Nomography.**
R. L. W.	Ray Lyman Wilbur, A.M., M.D., LL.D. President of Leland Stanford Jr. University, Cal.	**Leland Stanford Jr. University.**
R. M. Wi.	R. McNair Wilson, M.B., Ch.B. Fellow of the Royal Society of Medicine. Editor, Oxford Medical Publications. Late Research Worker in Cardiology, Medical Research Committee. Consultant to the Ministry of Pensions in Trench Fever.	**Fasting; Heart Disease; Immunity; Medicine and Surgery:** *General Progress.*

R. P.*	Robert Peele, E.M. Professor of Mining in the School of Mines, Columbia University. Hon. Member of the Institution of Mining and Metallurgy, London. Author of *Compressed Air Plant*. Editor-in-chief of Peele's *Mining Engineer's Handbook*; etc.	**Mining.**
R. P. B.	Robert Preston Brooks, Ph.D. Dean of the School of Commerce, University of Georgia; formerly Professor of History. Author of *A History of Georgia*; *The Agrarian Revolution in Georgia*; etc.	**Georgia (U.S.A.).**
R. P. D.	R. Palme Dutt. Late Scholar of Balliol College, Oxford. Author of *The Two Internationals*. Editor of *The Labour International Handbook*.	**International, The.**
R. R.*	Rémy Roure. Labour Correspondent of the *Éclair*, Paris.	**France** (*in part*).
R. Ro.	Colonel Sir Ronald Ross, K.C.B., K.C.M.G., F.R.S., F.R.C.S., Hon. M.D., D.Sc., etc. Nobel Medical Prizeman, 1902. Author of *The Prevention of Malaria*; etc. See the biographical article: Ross, Sir Ronald.	**Malaria.**
R. S. T.*	Robert Scott Troup, M.A., C.I.E. Professor of Forestry in the University of Oxford. Author of *The Silviculture of Indian Trees*; etc.	**Forestry** (*in part*).
R. Wi.	Robert Wilson, M.A., B.Sc., F.R.Econ.S.	**Industrial Councils.**
S. C. H.	S. C. Hammer, F.R.S.A. Chief Archivist and Librarian of the Norwegian Foreign Office, Christiania.	**Norway.**
S. J. B.	Solon Justus Buck, Ph.D. Superintendent of the Minnesota Historical Society. Associate Professor of History in the University of Minnesota. Author of *The Granger Movement*; *Illinois in 1818*; *The Agrarian Crusade*; etc.	**Minnesota.**
S. J. B.*	S. Josephine Baker, M.D., D.P.H. Director, Bureau of Child Hygiene, Department of Health, New York City. Consultant in Child Hygiene, U.S. Public Health Service. Former President, American Child Hygiene Association.	**Infantile Mortality:** *United States.*
S. L. C.	Stevenson Lyle Cummins, M.D., LL.D., C.B., C.M.G. Colonel, Army Medical Service (retired). David Davies Professor of Tuberculosis, University College of South Wales and Monmouthshire. Principal Medical Officer, King Edward VII. Welsh National Association.	**Influenza.**
S. McC. L.	Samuel McCune Lindsay, Ph.D., LL.D. Professor of Social Legislation in Columbia University. President of New York Academy of Political Science. Editor of American Social Progress Series. Author of *Railway Labour in the United States*; *Financial Administration of Great Britain*; etc.	**Liquor Laws and Liquor Control:** *United States.*
S. S.	Somerville Storey. Literary Critic of *Le Monde Nouveau*, Paris.	**French Literature.**
S. S. L.	Major-General Sidney Selden Long, C.B. Assistant Director of Supplies, 1909–12. Director of Supplies and Quartering, 1913–4. Director of Supplies and Transport, War Office, 1914–6.	**Food Supply:** *Feeding of the British Army During the World War.*
S. T. H. W.	Captain Stanley T. H. Wilton, R.N. Assistant Director of Naval Ordnance, British Admiralty.	**Ordnance** (*in part*).
S. W. M.	S. W. Morrison. Board of Trade, London.	**Glass** (*in part*).
T. A. R.	Thomas Arthur Rushton. Editor and writer on social subjects.	**Housing** (*in part*).
T. Ba.	Sir Thomas Barclay. Barrister-at-Law. Vice-President and Acting President of the Institute of International Law. Author of *Problems of International Practice and Diplomacy*; *New Methods of Adjusting International Disputes*; *Collapse and Reconstruction*; etc.	**International Law.**
T. C. P.	Theodore Calvin Pease, Ph.B., Ph.D. Assistant Professor of History in the University of Illinois. Author of *The Leveller Movement*; *The Frontier State* (Vol. II. of *Illinois Centennial History*); etc.	**Illinois.**
T. N. C.	Thomas Nixon Carver, Ph.D., LL.D. Professor of Political Economy in Harvard University. Author of *The Distribution of Wealth*; *Principles of Rural Economics*; *Principles of Political Economy*; etc.	**Federal Farm Loan System.**

T. Se.	Thomas Seccombe, M.A. Professor of English Literature, Queen's University, Kingston, Ontario. Assistant Editor of the *Dictionary of National Biography*, 1891–1901. Author of *The Age of Johnson*; etc.	**English Literature** (*in part*).
T. S. A.	Thomas Sewall Adams, Ph.D. Professor of Political Economy in Yale University. Advisor on Taxation, U.S. Treasury Department.	**Excess Profits Duty:** *United States*; **Income Tax:** *United States.*
T. W. Ho.	Sir Thomas William Holderness, Bart., G.C.B., K.C.S.I. Late Permanent Under-Secretary of State for India. Author of *Peoples and Problems of India*; *Narrative of the Indian Famine, 1896–97*. Editor of the 4th edition of Strachey's *India*.	**India.**
U. B. P.	Ulrich Bonnell Phillips, Ph.D., F.R.H.S. Professor of American History in the University of Michigan. Author of *The Life of Robert Toombs*; *American Negro Slavery*; etc.	**Michigan.**
V. G.	Valtyr Gudmundsson, M.A., D.Ph. Knight of the Dannebrog. Professor of Icelandic Language and Literature in the University of Copenhagen. Member of the Icelandic Parliament, 1894–1914. Editor of the Periodical *Eimreidin*. Author of *Privatboligen paa Island i Sagatiden*; *Islands Kultur*; etc.	**Iceland.**
V. L. E. C.	General Victor Louis Émilien Cordonnier. See the biographical article: Cordonnier, Victor Louis Émilien.	**Frontiers, Battles of the:** *Part III.*
W. A. La.	Sir William Arbuthnot Lane, Bart., C.B., M.S. Consulting Surgeon to Guy's Hospital, etc.	**Intestinal Stasis.**
W. A. P.	Walter Alison Phillips, M.A. (Oxford and Dublin). Lecky Professor of Modern History in the University of Dublin. Member of the Royal Irish Academy. Author of *Modern Europe*; *The Confederation of Europe*; etc.	**Ireland:** *History.*
W. Bn.	William Bateson, M.A., F.R.S. Author of *Materials for the Study of Variation*; *Mendel's Principles of Heredity*; *Problems of Genetics*; etc. See the biographical article: Bateson, William.	**Genetics;** **Mendelism.**
W. B. S.	W. B. Shaw. General Secretary, Alumni Association, University of Michigan. Author of *History of University of Michigan.*	**Michigan, University of.**
W. C. M.	William Clinton Mullendore, A.B., J.D. Attorney-at-Law. Late Assistant Counsel and Liquidator, United States Food Administration. Representative, American Relief Administration, Berlin, Germany, 1920.	**Food Supply:** *United States.*
W. C. M.*	Wallace Carlton Murphy, B.A., M.A. Professor of History in the University of Mississippi.	**Mississippi.**
W. E. El.	Walter Elliot Elliot, B.Sc., M.B., Ch.B., M.P. Secretary, Medical Committee, House of Commons.	**Health Ministry.**
W. F. F.	Walter Francis Frear, LL.D. Formerly Chief Justice and late Governor of Hawaii. Chairman of the Hawaiian Code Commission. Hon. Member of the Royal Geographical Society of Australasia. Author of *The Evolution of the Hawaiian Judiciary*; *The Development of Hawaiian Statute Law*; etc.	**Hawaii.**
W. F. W.	Walter Francis Willcox, Ph.D., LL.D. Professor of Economics and Statistics, Cornell University. Author of *The Divorce Problem—a Study in Statistics*; *Supplementary Analysis and Derivative Tables, 12th Census*; etc.	**Negro.**
W. Gr.	Walter Gravell, Ph.D. Regierungsrat in the Statistical Offices of the Reich, Berlin. Member of the German Statistical Society. Author of *Abhandlungen über Bevölkerungs-, Berufs- und Betriebsstatistik*; etc.	**Germany:** *Statistics.*
W. G. D.	W. G. Duffield. Professor of Physics, University College, Reading.	**Moseley, H. G. J.**
W. H. B.	Sir William Henry Beveridge, K.C.B., M.A., B.C.L. Director of London School of Economics and Political Science. Formerly Permanent Secretary of the Ministry of Food. Author of *Unemployment: A Problem of Industry*; etc.	**Food Supply** (*in part*).
W. H. Di.	William Henry Dines, B.A. (Cantab.), F.R.Met.S., F.R.Ae.S., F.Inst.P., F.R.S. See the biographical article: Dines, William Henry.	**Meteorology.**

W. H. W.	Sir William Henry Willcox, K.C.I.E., C.B., C.M.G., M.D., F.R.C.P. Consulting Physician to the Mesopotamia Expeditionary Force, 1916–9. Physician to St. Mary's Hospital, London.	**Mesopotamia: *Medical Conditions.***
W. J.*	Lieutenant-Colonel Wilhelm Junck. Austro-Hungarian Engineer Corps. Formerly of the Munitions Section of the Austro-Hungarian Military Technical Committee and the Munitions Department of the War Ministry.	**Munitions of War: *Central Powers (in part).***
W. J. C.*	W. J. Childs. Late of the Intelligence Department of the Admiralty (Geographical Section).	**Georgia;** **Ottoman Empire.**
W. K. McC.	William Kidston McClure, M.A. (Oxon.). Late Correspondent of *The Times* in Rome. Correspondent of *The Times* on the Italian Front, 1915–7. Author of *Italy's Part in the War*; *Italy in North Africa*; Chapters on Italy in *The Times History of the War*; etc.	**Italian Campaigns;** **Italo-Turkish War.**
W. L. B.	Captain William Lewis Blennerhassett, D.S.O., O.B.E. French Croix de Guerre. Acting British Vice-Consul at Kovno, Lithuania.	**Finland; Isvolsky, A. P.;** **Lithuania.**
W. L. G.*	William L. Griffith. Permanent Secretary, Office of the High Commissioner for Canada, London. Author of *The Dominion of Canada*; article on "Canada," *Oxford Survey of the British Empire.*	**Manitoba; New Brunswick; North-West Territories; Nova Scotia; Ontario.**
W. M.-Lo.	Lieutenant-Colonel Wilhelm Müller-Loebnitz. Late General Staff, German Army. Ober-Archivrat in the Reichsarchiv. Formerly in the Military History Section of the Great General Staff. During the World War served on the General Staff of XII. Corps and VI. and "A" Armies, and as a Regimental Commander. Author of *Der Wendepunkt des Weltkriegs* and other monographs.	**Lys, Battles of the.**
W. O. S.	William Oscar Scroggs, A.M., Ph.D. Financial writer on the *New York Evening Post.* Formerly Professor of Economics and Sociology, Louisiana State University. Author of *Filibusters and Financiers.*	**Louisiana.**
W. Rn.	Walter Rosenhain, B.A., D.Sc., F.Inst.P., F.R.S. Superintendent, Metallurgy Department, National Physical Laboratory. Author of *Introduction to the Study of Physical Metallurgy*; *Glass Manufacture*; etc.	**Metallurgy.**
W. R. Ma.	William R. Manning, Ph.D. Economist, Latin-American Division, Department of State. Author of *Nootka Sound Controversy* (Justin Winsor Prize Essay of American Historical Association, 1904); *Early Diplomatic Relations Between the United States and Mexico* (Albert Shaw Lectures, Johns Hopkins University, 1913); etc.	**Havana.**
W. T.	Wilfred Trotter, M.S. (Lond.), F.R.C.S. Surgeon, University College Hospital.	**Nervous System (Surgery).**
W. T. L.	Walter Thomas Layton, M.A., C.H. Fellow of Caius College, Cambridge. University Lecturer, Cambridge University. Lecturer, Workers' Educational Association, 1916–9. Member of British Munitions Council during the World War. Temporary Director, Economic and Financial Section, League of Nations. Director, National Federation of Iron and Steel Manufacturers. Director, Welwyn Garden City. Author of *Capital and Labour*; *Introduction to the Study of Prices.*	**Munitions of War: *United Kingdom (in part).***
W. W. M.	William Watts Macon. Editor of *The Iron Age*, New York.	**Iron and Steel.**
X.	Initial used for anonymous contributors.	
Y. D.	General Youri Danilov.	**Kornilov (*in part*).**

ENCYCLOPÆDIA BRITANNICA

VOLUME XXXI

THE SECOND OF THE NEW VOLUMES

ENGLISH LITERATURE (*see* 9.645*).—A retrospect, from the vantage-ground of 1921, over the progress of English literature in recent years showed no sign of degeneracy in literary quality. From a purely national point of view, English writers have probably never stood higher comparatively in the world of letters. The commerce of the book-world and the ply of the "best sellers" may vary; but if we regard the curve of literature as a whole, it is justifiable to claim that, during the past generation, the best English work has not been deflected from the direction in which literary progress had been steadily moving.

The acme of the English novel was reached already in the last quarter of the 19th century. And among novelists still living in 1921 Thomas Hardy held a position of lofty preëminence. In these later years his work as a poet had given him a second title to fame. Even more than in the case of his finest tragic novels, his tragic epic, *The Dynasts*, is full of a great pity and a great patience. Like all great tragedy it is cathartic. Like all great art, it exalts and enlarges.

In Sir J. M. Barrie, by origin a typical Scot, who, together with Hardy, had received the Order of Merit, fantasy had achieved its highest embodiment since *Midsummer Night's Dream*. Faërie had, in him, become naturalized on the English stage; and it has been for the theatre that all his later work was done—a constantly growing range of work, from *Peter Pan* to *The Admirable Crichton, Cinderella, What Every Woman Knows, Dear Brutus, The Twelve-Pound Look, The Old Lady Shows Her Medals*, and *Mary Rose*. Hardy and Barrie between them had created an atmosphere of the theatre in which it had become possible for an imagination worthy of English literature to move and breathe and have its being.

In the forefront of literary activity in 1921, the work of H. G. Wells and of Bernard Shaw, though less creative, sounded its challenge to the future—Wells as the sociological autobiographer of his time, Shaw as a satirist, often as bitter as Swift, and with something in him of a new Gulliver.

H. G. Wells's skill as a writer is shown in the almost animal realism of his presentment, not in one or two books merely, but a score. In his fiction he is specially autobiographic:

> "I recall an underground kitchen with a drawered table, a window looking up at a grating, a back yard in which, growing out by a dust-bin, was a grape-vine; a red-papered room with a book-case, over my father's shop, the dusty aisles and fixtures, the regiments of wine-glasses and tumblers, the rows of hanging mugs and jugs, the towering edifices of jam-pots, the tea and dinner and toilet sets in that emporium, its brighter side of cricket goods, of pads and balls and stumps. Out of the window one peeped at the more exterior world, the High Street in front, the tailor's garden, the butcher's yard, the church-yard and Bromley church tower behind, and one was taken upon expeditions to fields and open places. This limited world was peopled with certain familiar presences, mother and father, two brothers, the evasive but interesting cat."

Upper-class life he saw (from the point of view of the servants' hall) when on his father's death in 1878 his mother became housekeeper in the family in which she had formerly been lady's maid, at Up Park near Petersfield, the "Bladesover" of *Tono-Bungay*, which also enshrines some early experiences in the chemist's shop at Midhurst. He had a bitter struggle, both for livelihood and for education, beginning work as a draper's assistant at the age of 15, and experiencing in his own person some of the humiliations he has described in *Kipps*. Striving to educate himself, he took a humble post as assistant master in an obscure school, and from this in turn he escaped with the aid of a Government scholarship to the Royal College of Science, South Kensington. It was his good fortune to come under Huxley, the leading exponent of the new science of biology and one of the most stirring spirits in the intellectual unrest of the time. Economically and socially the immediate gain for Wells was the London B.Sc. degree with first-class honours in zoölogy; upon his mental development the effects were far-reaching. It is really of himself under the name of "Oswald" that Wells speaks in this passage from *Joan and Peter:*

> "Those were the great days when Huxley lectured on zoölogy at South Kensington, and to him Oswald went. Oswald did indeed find science consoling and inspiring. Scientific studies were at once rarer and more touched by enthusiasm then than a quarter of a century later, and he was soon a passionate naturalist, consumed by the insatiable craving to know how. That little long upper laboratory in the Normal School of Science, as the place was then called, with the preparations and diagrams along one side, the sinks and windows along the other, the row of small tables down the windows, and the ever-present vague mixed smell of methylated spirit, Canada balsam and a sweetish decay, opened vast new horizons to him. To the world of the eighteen-eighties the story of life, of the origin and branching out of species, of the making of continents, was still the most inspiring of new romances. Comparative anatomy in particular was then a great and philosophical 'new learning,' a mighty training of mind; the drift of biological teaching towards specialization was still to come."

It was partly due to ill-health as a hard-worked young don that Wells turned his attention from the more scholastic region of scientific journalism and text-book to writing romance of the Jules Verne variety. In this he achieved a rapid success. It is still delightful for a reader to recall the thrill of first contact with *The Time Machine* and *Doctor Moreau's Island*, soon to be followed by *The Wheels of Chance*, and the *War of the Worlds*, in the middle and later 'nineties. Some critics will maintain that, in technical skill and professional drollery, Mr. Wells never surpassed *The Wheels of Chance* or *The Sea Lady*. In 1900, however, came *Love and Mr. Lewisham*, which was regarded as a landmark; but it was eclipsed in the direction of sociology of contemporary life by *Kipps* in 1905 and the more ambitious *Tono-Bungay* in 1909. Nor will the war-period in England be understood without *Mr. Britling Sees It Through*.

*** These figures indicate the volume and page number of the previous article.**

George Bernard Shaw, who was born in Dublin in 1856, came of English Protestant middle-class stock. "I am a typical Irishman," he says; "my family came from Yorkshire. My father was an ineffective, unsuccessful man, in theory a vehement teetotaller, but in practice a furtive drinker. I never learnt anything at school, a place where they put *Caesar* and *Horace* into the heads of small boys, and expect the result to be an elegant taste of knowledge of the world. I took refuge in total idleness at school, and picked up at home quite unconsciously a knowledge of that extraordinary literature of modern music from Bach to Wagner, which has saved me from being at the smallest disadvantage in competition with men who only know the grammar and mispronunciation of the Greek and Latin poets and philosophers. For the rest my parents went their own way and let me go mine." He combined the unaccustomed arts of critic, logician and sceptical journalist. He was haunted by wit, largely of the caustic variety of Samuel Butler (the author of *Erewhon*). The *conferencier* of a silken skein, he drew an audience like a magnet, but he ridiculed English ideas of a "sport" and a "gentleman," his unpopularity flaring in 1914 in a tract called *Common Sense and the War*. To him a typical Englishman was a wildly absurd and enthusiastic fellow (Nelson); Wellington, a typical common-sense Irishman, was better. Church and public-school ideas became his butts. He preferred the provocative method to any other. From critic and quasi-novelist he became playwright. His first play, *Widowers' Houses*, written in 1885, was not produced until 1892, and then with scant success. He followed this with *The Philanderer* (1893), a satire on the emancipated woman, and *Mrs. Warren's Profession*, a treatment of commercialized vice, which was refused performance by the censor. *Arms and the Man*, a brilliant satire on military glory, *Candida* (1894), *The Man of Destiny* (1895), a mock-heroic skit on Napoleon, and *You Never Can Tell* (1896), a farcical treatment of the New Woman, followed. These seven plays were all distinguished by their attack upon some time-honoured sham, their reduction to reality of some pretentiously false view. Perhaps because of their slight success as acting plays, Shaw published them in two series, *Plays Pleasant and Unpleasant* (1898). He made the prefaces to these volumes elaborate comments on the technical and social qualities of the plays; and, further to guide his readers, he expanded the stage directions into full descriptions, character sketches and explanations, thus adapting the play to a public which was accustomed to read novels. Prose drama was once more restored to the library. The later plays were more immediately successful on the stage, but Shaw continued to publish them as books, and, by the aid of the prefaces, to use them as effective propaganda for his views on art, the theatre, history and society. He attacks the illusion of history in *Caesar and Cleopatra*, and of romantic morality in *The Devil's Disciple*, published in *Three Plays for Puritans* (1900). In *Man and Superman* (1903) he represents courtship as a war of the sexes, and man as the victim of woman, who is the incarnation of nature's purpose and the will to live. In *John Bull's Other Island* (1904) he attacked English domination of Ireland, and made the preface a powerful arraignment of military rule in Egypt. He attacks poverty in Butlerian vein in the persons of those weak members of society who accept it, and looks forward to their extinction with the extension of a better race. The attitude, called "pragmatism," of accepting as true only beliefs that will work, is shown by his attack on the ideas of reform by punishment, or of the improvement of society by marriage and the home. In such volumes as *Androcles and the Lion* and, later, *Back to Methuselah*, he conversationalizes and essayizes at the same time, giving modern dialect the benefit wherever possible.

The psychology of the end of our period has forced us, more or less, to isolate these four outstanding personalities, Hardy, Barrie, Wells and Shaw, as representing the most dominant forces of contemporary influence. But an enumeration of other prominent living representatives of English letters in 1921 shows that there had been no falling-off in distinction since the century opened. A list of some 50 would find honoured veterans (Morley, Frederic Harrison, Bryce, Trevelyan) side by side with long-established critics in Saintsbury, Gosse, Sidney Colvin, W. P. Ker; dramatists in Pinero and Henry Arthur Jones; and, among the middle generation, writers of genius already fully recognized before 1900 in Rudyard Kipling, William Watson, W. B. Yeats, Alice Meynell and Robert Bridges. With them may be named, in alphabetical order:—Lascelles Abercrombie, Maurice Baring, Max Beerbohm, Hilaire Belloc, Arnold Bennett, E. F. Benson, Laurence Binyon, "George Birmingham," Augustine Birrell, John Buchan, G. K. Chesterton, A. Clutton-Brock, A. Conan Doyle, Joseph Conrad, W. H. Davies, Walter De La Mare, C. M. Doughty, Oliver Elton, John Galsworthy, Charles Graves, Rider Haggard, Maurice Hewlett, R. S. Hichens, Anthony Hope-Hawkins, A. E. Housman, W. H. Hudson, Stephen Leacock, Sidney Lee, W. J. Locke, E. V. Lucas, J. W. Mackail, Stephen McKenna, Compton Mackenzie, John Masefield, George Moore, Henry Newbolt, Alfred Noyes, Herbert Paul, A. Quiller-Couch, Walter Raleigh, George W. Russell ("A. E."), Owen Seaman, May Sinclair, De Vere Stacpoole, A. B. Walkley, Hugh Walpole, Margaret Woods, Israel Zangwill.

In fiction, preëminently among literary productions, the temporary displacements of popular vogue are numerous. During 1910–21, while the cult of Henry James and of Joseph Conrad had gathered strength, the genius of Rudyard Kipling had found no new utterance. The most characteristic writers of fiction during this period were Wells, Arnold Bennett, Galsworthy, Compton Mackenzie, Stephen McKenna, E. V. Lucas, W. J. Locke, W. L. George, Hugh Walpole, Gilbert Cannan and May Sinclair. A great change had come over the spirit of fiction and its frankness since the days of the eminent Victorians. "Psycho-analysis" had become its theme. Galsworthy's *Dark Flower* and *Beyond* are almost entirely taken up with the analysis of sex-attraction; Wells and Shaw are strangely intent upon the life-force; and with writers like Compton Mackenzie, W. L. George, D. H. Lawrence and Gilbert Cannan, it becomes almost an obsession. The emancipation for which the novelists of an earlier generation had sighed was achieved with a lack of effort that was almost instantaneous in the 20th century.

Yet withal, the humanitarianism of Galsworthy and the dramatic regionalism of Arnold Bennett have formed solid enrichments of the literary stock in English fiction. Note must be taken, too, as characteristic also of the two last-named, of a fine vein of literary epicurism in those contemporary writers to whom style is inseparable from ideas. Among novelists who are also essayists this has been a marked feature of the work of Hilaire Belloc and E. V. Lucas; hardly less marked in the case of Filson Young; most marked of all in that of George Moore, whose *Brook Kerith* and *Heloïse and Abelard* stand out as perhaps the most deliberately "artistic" pieces of English composition in the period. The epicurism of George Moore is even more definitely embodied in those intimate records of his Irish literary associations (*Hail and Farewell:—Ave; Salve; Vale*) which may well be, to a later generation, more interesting than anything in his fiction. Nor from this selection of contemporary epicures in style can reference be omitted to the writings of Max Beerbohm (*Works; More; Yet Again; A Christmas Garland; And Even Now*)—an ironist of delightful fastidiousness.

England is proud of her ironists. When Samuel Butler, the author of *Erewhon*, died in 1902, his views were set forth in the posthumous novel, *The Way of All Flesh*, one of the seminal satires of to-day. In his union of logic with irony Butler belongs with Huxley and Matthew Arnold, as he is their peer in the mastery of a superbly clear and idiomatic English style. He differs from them in that he possessed also a certain gnome-like impudence of fancy, which led him into strange ambiguities and throws a veil of seeming irresponsibility over much of his writing.

Outside fiction, it is remarkable how much of the wealth of English *belles lettres* has revolved round historical biography and world history, as systematized in great men and "heroes." The conclusion of Swift that history was formed by the essence of innumerable biographies may indeed seem to have been demonstrated in recent years by the production in England of the *Dictionary of National Biography* and by such individual cases as

G. E. Buckle's completion of the *Life of Disraeli;* while Lytton Strachey's re-readings in biography (*Eminent Victorians* and *Queen Victoria*) have added a new interest to its study.

In tracing the contemporary developments of English poetry, it has been said that the "aesthetic" movement of the 'nineties came more or less definitely to fill the void caused by the ebb-tide of Tennyson, Browning, Rossetti and Morris. Swinburne and Meredith, Bridges and William Watson, may be added to these names of poets already established by the end of the 19th century. In 1855, when Tennyson was crowned by the young men of England at the Sheldonian, poetry was "the thing," and this was due to Tennyson. Tennyson had, indeed, invented a new poetry, a new poetic English; every piece that he wrote was a conquest of a new region. The early attitude of Morris to Tennyson is described by Morris's biographer as defiant adoration. He perceived his limitations, however, in a manner remarkable for a man of twenty or so. *Sir Galahad* made too much noise and was not nearly mediaeval enough for him. The rise and reign of the Browningesque and the picturesque followed—the decay of Victorianism as a purely decorative art. Then came the rise and decline of the aesthetic philosophy in the 'nineties, with the introduction of the muscular influence of Henley, Kipling, Davidson, Henry Newbolt, and, still more recently, Masefield, to whom have been added all those included among the Georgians. And yet there is no abrupt period of severance. *A Shropshire Lad*, written when A. E. Housman (b.1859) was little more than thirty, is not the most easy of modern verse, but is still the best-loved when it is most read. Robert Bridges' early poems include lyrics which are among the most perfect work, in magic of cadence or in formal prosody, since Carew, Wither and Herrick.

The conspicuous poets among the Georgians are not, perhaps, of the first rank, but far more than in the last century they are poets of democracy. They are poets of a diversity of ideas, and are acclaimed, as often as not, for refusing imaginative idylls in order to write of the common sights and sounds of the everyday world in which we live. Among the new poets are included Lascelles Abercrombie, C. M. Doughty, Sturge Moore, Belloc, Chesterton, W. H. Davies, A. Noyes, L. Binyon, James E. Flecker, Edward Thomas, Rupert Brooke, W. W. Gibson, Ralph Hodgson, John Masefield, W. De La Mare, John Freeman, Siegfried Sassoon, J. C. Squire.

In 1895 the *Yellow Book* sought to shock the primness of the "eminent Victorians," as they came to be satirized. It scarcely needed *Patience* or *The Green Carnation* to disillusion the attitudinizing of A. Symons, Le Gallienne and their disciples. With the end of the century the philosophy of the aesthetes was wearing thin. The "Yea Man" and muscular Christian repudiated this languid aestheticism ("The first duty of life is to be artificial"). But it was reinforced to some extent by the "Celtic revival" (you could hardly obtain a more artificial adjective than that), as represented by W. B. Yeats. Remarkable work in the Spenserian vein was achieved by Charles Montagu Doughty (b.1843), whose *Dawn in Britain* (1906) reacts against Victorian feeling as Walpole reacted against Brunswick. These constant reactions are typical of an over-studied literature. It needs the architecture of Hardy to surpass it in *The Dynasts*. The distant and almost planetary point of view taken in the immense poetic dramas is contradicted most exhaustively by John Masefield (b.1874), a "Shropshire Lad" in reality, who scorned the finished elegiac of Housman and the minute tedium of the novel for the Crabbe-like medium of *The Everlasting Mercy* (1911) and for the counterpoise to the Celtic dialect play in *The Tragedy of Nan*. Of Masefield's realistic novels in verse the best is probably *Dauber* (1912). Versatile though he is, he has never completely succeeded in developing the irony of circumstance so exactly as Hardy; but he has drawn others into it, like Lascelles Abercrombie, who in *Deborah* (1913) achieves a fine approach to the Miltonic drama. The change that was foreshadowed in the unequal *Daffodil Fields* (1913) was completed by the battlefield and the great telling of *Gallipoli* (1916). Thence Masefield's prose and verse suffered a war change, and with it his writing gained in poetry and true utterance. In *August 1914* he reached a noble elegy:—

> These homes, this valley spread below me here,
> The rooks, the tilted stacks, the beasts in pen,
> Have been the heart-felt things, past speaking dear
> To unknown generations of dead men.

Of poets lost during the war, memories of their craftsmanship is perhaps most insistent in the case of Rupert Brooke (1887–1915) and Edward Thomas (1878–1917).

Edward Thomas, one of the little-known but most individual of modern English poets, was born in 1878. For many years before he turned to verse, Thomas had a considerable following as a critic and author of travel books and biographies. Hating his hack-work, yet unable to get free of it, he had so repressed his creative ability that he had grown doubtful concerning his own power. It needed something foreign to stir and animate what was native in him. So when Robert Frost, the New England poet, went abroad in 1912 for two years and became an intimate friend of Thomas, the English critic began to write poetry. Loving, like Frost, the *minutiae* of existence, the quaint and casual turns of ordinary life, he caught the magic of the English countryside in its unpoeticized quietude. Many of his poems are full of a slow, sad contemplation of life, and reflection of its brave futility. It is not disillusion exactly; it is rather an absence of illusion. *Poems* (1917), dedicated to Robert Frost, is full of Thomas's fidelity to little things, as unglorified as the unfreezing of the "rock-like mud," a child's path, a list of quaint-sounding villages, birds' nests uncovered by the autumn wind, dusty nettles—the lines glow with a deep and almost abject reverence for the soil.

In 1913 Rupert Brooke, of Grantchester, was elected a fellow of King's College, Cambridge, aged 26. After travel and recreation he sought fresh faith and hope in the struggle. After seeing service in Belgium (1914) he spent the following winter in a training camp in Dorsetshire, and sailed with the British Mediterranean Expeditionary Force in February 1915, to take part in the Dardanelles campaign. Brooke never reached his destination. He died of blood-poisoning at Skyros, April 23 1915.

Another poet whose early death extorted a rare eulogy from a fellow writer, D. Goldring, was James E. Flecker (1884–1915), a student of André Chenier and later of the Parnassians, whose beatified dreams sing in the *Golden Journey to Samarkand* (1913) and *The Old Ship*. His *Burial in England Ode* shows noble evidence of a faith to which English witnesses were many.

Events in Ireland have emphasized the increased attention devoted of late years to the Irish literary revival (*see* IRELAND: *Language and Literature*). Anglo-Irish literature had its beginning in the early days of the 19th century, but it was not until about 1840 that there was a definite movement for the re-creation of an Irish culture in English. This movement was forwarded by Thomas Davis, and it took its title from Davis's newspaper, *The Nation*. There were many eloquent writers then in prose and verse. Carleton, the Banims and Gerald Griffin were the novelists of the time; Mangan, Ferguson, Davis, Walsh and Cullinan were the poets; Mitchell and Davis were the political and social writers. But while Davis and his group were working for the creation of a new Irish culture, the famine of 1846–7 altered the whole life of the country. Meanwhile, from the *Nation* period, when the poet Mangan worked with the scholar O'Donovan to produce versions of the Irish bardic poems, there had been a close connexion between Celtic research and Anglo-Irish poetry. The most valuable poetry written in the next forty years came from Celtic originals or from suggestions in Celtic originals. Sir Samuel Ferguson, who survived from the *Nation* days, treated the famous "Ultonian" or "Red Branch" epic cycle (the cycle that has the hero Cuchullain for its central character) as Tennyson was treating the Round-Table cycle, writing narrative or dramatic poems about the different episodes. He translated a few of the modern folksongs, bringing into English poetry an unfamiliar rhythm in such versions as those of *Cean Duv Deelish* and *Cashel of Munster*, poems that have the beauty and the spirit of the originals. Aubrey de Vere wrote Catholic poetry; but the two poems by him that deal with

Celtic life in Ireland, *Bard Ethell* and *The Wedding of the Clans*, represent his strongest work. Dr. Sigerson, in his generation, made metrical translations of Irish poetry from the 8th to the 18th century, and his collection, *Bards of the Gael and Gall*, was an important influence on the new Irish poetry.

With the 'eighties came a period of social and political conflict in Ireland. But out of the political welter emerged the Gaelic League. And it was this organization that henceforth provided a soil and a shelter for the new poetry, although this new poetry was still to be in English.

It must be said, however, that, despite the heroic activity displayed during well-nigh thirty years, the Gaelic movement as such, with its classes, societies, athletic clubs, readings and revivals, represented in 1921 something of a provincialism, with its future (to use a Hibernicism) rather behind it than before it. The Gaelic School is remarkably lacking in Irish jollity. The historic Irishman of literature, as shown by Moore, Thackeray, Lover, Lever, "George Birmingham," Somerville and Ross, has managed somehow to survive any modern Celtic presentment. At no time has Irish poetry as a whole been distinctly national; and the epithet "Celtic" is a misnomer if it be used to appropriate to Irish poets the characteristics of brooding melancholy, wistful mysticism and fervent idealism. The inspiration of the Irish poets is at least as much climatic and local as racial. It is no depreciation of the work done by Irish writers in recent years, aggressively self-conscious and artificial though much of it is, to say that, even in those faculties more peculiarly attributed to the Celt, he has never approached the depth and breadth of the Teuton; the whole literary output of the "Celtic fringe," so called, sinks into insignificance in comparison with the work of the Teuton and the Saxon.

The unbiassed observer who does not allow his vision to be blurred by the rose-coloured haze that wraps the propaganda literature of Sinn Fein will indeed have no hesitation in declaring that, judged by its own aims and ideals, the Gaelic movement has, on the whole, been a failure. Gaelic may indeed survive and may even prosper, although the fruits of its revival as a language are likely to remain inaccessible to all but the elect,—but it can never dominate, least of all will it be able to oust its rival, English. The odds are too great on the other side. This does not mean, of course, that the movement has been barren of results. It has provided a meeting-ground for thousands of Irish men and women who prior to 1893 seemed almost hopelessly separated by their own local political or sectarian associations. It has helped to bring to light again the old world of ancient Ireland from its manuscript tomb in Irish and Continental libraries. More important than this, it has circulated the glad news that there is indeed a native Irish literature, and an Irish tradition.

Such as it is in Irish literary circles, the group of writers which stands for distinct contemporary ideas is of almost exactly the generation of H. G. Wells, John Galsworthy and Arnold Bennett—W. B. Yeats (b.1865), George W. Russell ("A. E."), Douglas Hyde, Standish O'Grady, J. M. Synge and George Moore. The linguistic and dry-as-dust part, but much also that stands for the Irish Ireland idea—that is for an Irish-speaking, -writing and -thinking country—is mainly due to Hyde and O'Grady. But much also is due to the counter-influence of George Moore and of J. M. Synge, the latter of whom wrote unrivalled dialect, often poetic but often, too, rather quizzical comedy.

For a good many people, Protestant and un-Irish in speech, the most self-conscious representative of the group, artificial though he be, William Butler Yeats, is, nevertheless, the indicating number of the Celtic revival. None of Yeats's lyric rises perhaps to the plane of the more inspired lines of "A. E." or the happier dialectic efforts of J. M. Synge, but in three poems of his earlier period, *The Wanderings of Oisin* (1889), *The Countess Cathleen* (1892) and *The Land of Heart's Desire* (1894), Yeats has conceived and written something which is peculiarly his own. In the volume of *The Wind among the Reeds* (1899), Yeats reaches his finest and most original work in shorter lyrics. Yeats's mystical broodings of spirit lie outside the highway of poetry. They are as unintelligible to the common mind as the arcana of Blake. But Yeats has lived among men, and he is not guiltless of conscious artifice where Blake would have been wholly natural. Perhaps the most beautiful poems of the volume are "The Host of the Air," "Into the Twilight" and "The Song of Wandering Angus." The first-named, considered only as prosody, does not come short of "The Lake Isle of Innisfree."

The year 1899 not only saw the publication of *The Wind among the Reeds;* it found the poet busied with the workings of the Irish Literary Theatre, and it marked a point of declination in his lyric powers. *In the Seven Woods* (1903) contains no poetry as individual as the preceding volume, though it includes the stirring stanzas of "Red Hanrahan's Song," a poem which, with splendid imagery of clouds, winds, yellow pools and flooding waters, breathes the love of Ireland's bare hills, bog waters and warm soft rain. Other songs, however, suggest English and Elizabethan rather than Celtic models. The short series of love poems printed in *The Green Helmet* (1910) is metaphysical and not very distinctive; in *The Wild Swans of Coole* (1919) Yeats touches again the old melodies skilfully, but in the mood of an imitation of his earlier self. If not altogether with the short lyric, with poems of a different kind Yeats has shown himself the poet of an esoteric beauty, in a character and a manner that are all his own. Further, the three poems already mentioned may be regarded as the prelude to Yeats's phase as a dramatic poet. The first of these is in form derived from the Middle Irish dialogues of St. Patrick and Oisin, and represents the mythical hero relating to the saint the story of his wanderings in the paradises of pagan mythology, and his passionate love of Niam. The most striking characteristic of this early poem is that magical impression seldom surpassed or even approached in the modern mythology of poetic dream. We are caught once more in the faërie to which Huon of Bordeaux, of the mediaevals, primitively introduced the mechanicals of Athens.

George W. Russell, whose work appears under the monogram "A. E.," is, in the proper sense of the word, a mystic, though mysticism is scarcely a characteristic of the Irish; the Irish mind is rather intellectual than mystical. Like all mystics he is content to express a single idea. In all his volumes of verse, in *Homeward*, in the *Earth Breath*, in the *Divine Vision*, he has put into pregnant verse his all-sufficing thought. Men are the strayed heaven-dwellers—the angels who "willed in silence their own doom," the Gods who "forgot themselves to men." Involved in matter, now they are creating a new empire for the spirit. He has been drawn, too, to the study of Celtic remains; the old Irish mythology seems to him a fragment of the doctrine that was held by the Egyptians, the Greeks and the Indians. He alludes to the Irish divinities as if they were as well known as Zeus or Eros or Apollo. He is the mystical poet of our civilization, and nearly all of what the West has found in the Indian poet, Rabindranath Tagore, is in the poems of "A. E."

In the 'nineties the ascendancy of the national drama of Norway made a few Irish writers, W. B. Yeats, George Moore, Edward Martyn, think of experimenting with a national theatre for Ireland. They began by producing in Dublin, for three successive seasons, plays written by Irish writers but presented by English actors. The experiment closed unsuccessfully in 1901. Meanwhile the activities of the Gaelic League and other national societies had produced a company of Irish players. The company was now ready to further any experiments that Yeats, as the leader of the Irish dramatic movement, might make. Yeats brought into the company a writer who was to elucidate the movement, John M. Synge (1871–1909). Synge wrote six plays for the Irish theatre, five of which they produced, *The Shadow of the Glen*, *Riders to the Sea*, *The Well of the Saints*, *The Playboy of the Western World* and *Deirdre of the Sorrows*,—the last a powerful dramatization of the Exile of the Sons of Usnech, which forms one of the three "Sorrows of Story Telling" and has persisted in Irish tradition for at least a thousand years.

Amid the outpouring of new books, pointing in no special literary direction, creative English literature at its best, viewed from the standpoint of 1921, showed a stability of purpose, fundamentally unaltered by the advent of new ideas. In spite of the whirlpools of Armageddon, the old Laboriositas was returning to the book-world. The St. John the Baptist, moreover, of a series of events without a parallel in human annals had been a representative, and a very perfect one on the whole, of English *belles lettres*. John Locke, Smollett, Edmund Burke, in earlier days, had all been pointers of remarkable accuracy where mighty events were concerned; but they have been surpassed in our own day by George Meredith, as a forerunner of the world-upheaval. The whole of his prose work is topical to the main end. His greatest novel was most political and most prophetic. In military matters he claimed none of Mr. Wells's technique nor of Mr. Shaw's "common sense." But he had the advantage of knowing something about history, and he has written more to the point than any historian.

In May 1909 Hardy wrote memorably:—

> He spoke as one afoot will wind
> A morning horn ere men awake.
> His note was trenchant, turning kind.
>
> He was of those whose wit can shake
> And riddle to the very core
> The counterfeits that time will break.
>
> So that, when now all tongues declare
> His shape unseen by his green hill,
> I scarce believe he sits not there.
>
> No matter. Further and further still
> Through the world's vaporous vitiate air
> His words ring on—as live words will.

It is interesting to note that Thomas Hardy, Meredith's successor in the leadership of English letters, owed the form of his *Desperate Remedies* greatly, as it happened, to Meredith, the publisher's reader. But Meredith himself, curiously enough, was "afflicted by Hardy's twilight view of life." "Twilight view of life" is an extraordinary charge for Meredith to bring. If Hardy does not dwell upon happiness, something must be allowed for temperament; he is vocal to tragedy rather than to joy. He must not be held "unperceiving because undemonstrative." To dwell on happiness is, simply, not his business. To Hardy the world is very old, and the life of man is very brief. The Romans used to think and talk in Casterbridge as men do to-day; over Egdon Heath the generation of men pass ceaselessly and leave no trace. Men and women are always snatching at happiness, striving to express and to fulfil themselves, and breaking themselves against a power that takes no heed of them. The structure of Hardy's work, as became an architect, is unspeakably superior to Meredith's; and in spite of *Jude*, his style is never really "obscure." In reading the pages of *Two in a Tower* one is struck by the pure beauty of the prose. And Hardy, although determinist, is never a real pessimist. Watching from infinity, he shows human life as futile and trivial. But when individuality is intensified and desire exerted, as in the love of man and woman, then, despite the hostility or indifference of the governing power, we see human life heroically grand. There is no trace of contempt, except in case of life's "little ironies." The charge of pessimism cannot stand. In the normal view of passion and in the glorious view of rustic philosophy and humour, Hardy is Shakespearean at his best, just as Barrie, his nearest younger rival in English letters, is Shakespearean in his eerie twilight glimpses of faërie. In their successive preëminence the quality of English literature has been worthily maintained. (T. Se.; H. Ch.)

ENNEKING, JOHN JOSEPH (1841–1916), American painter (*see* 9.647), died at Hyde Park, Mass., Nov. 17 1916.

ENVER PASHA (1881–), leader of the Young Turks, was of very humble origin. He was born in Abana, near the Black Sea, where his father was a bridge-keeper and his mother followed the despised profession of laying out the dead. His father was Turkish, his mother Albanian, and he had a Circassian grandmother. He entered the Turkish army as a subaltern without money or influence but gained admission to the staff college at Constantinople, and from there went to Salonika, the headquarters of the Young Turk movement. He fought with Bulgarian and Greek guerrilla bands, coming meanwhile in contact with the representatives of the new ideas, and finding in Talaat, the minor telegraph official, a politician after his own heart. In 1908, as aide-de-camp of Gen. Hussein Hilmi, he, with Niazi Bey, imported the flag of revolution in the Macedonian mountains, originally with the object of restoring the constitution of 1876, which had been disregarded by ʽAbdul Hamid, but also to save himself from a threatened arrest. ʽAbdul Hamid professed to yield and Enver entered Constantinople as a fêted hero. But he realized that his time was not yet come. He went to Berlin as major and military attaché, and there, from 1909 to 1911, he pursued his military studies and enjoyed a social career as a ladies' favourite. His stay was only once interrupted, when, in 1909, he hastened to Salonika, and with Mahmud Shevket undertook a brief and victorious campaign against the reactionaries, who hoped to regain unfettered power under ʽAbdul Hamid. After taking the capital and deposing ʽAbdul Hamid, Enver returned to Berlin. Having learned to speak good German, he took command at Benghasi in the Italo-Turkish War. He also wrote a book called *Tripoli*, dealing with this period.[1] The Peace of Lausanne brought his work in Africa to an end, and he returned to Constantinople to find Turkey in the midst of the war with the Balkan States. During the Dec. armistice, Enver, then a lieutenant-colonel, was made chief-of-staff of the X. Army Corps, of which he soon was virtually in command. His attempt at a landing at Sharkoi (in the E. of the Gallipoli peninsula), on Feb. 8 1913, miscarried, as indeed did all Enver's military enterprises. During the peace negotiations, when Kiamil, as Grand Vizier, took the wise course of deferring to the wishes of the British, Enver with his friends arrived in front of the Sublime Porte, shot the War Minister, Nazim Pasha, turned out Kiamil, forced himself upon the Sultan, and in collusion with the Young Turk Committee filled all the offices with Young Turks.

The new Vizier, Mohamed Shevket, was assassinated in June 1913, and this further enraged the Committee against the Old Turks and the Union Libérale. The body of the state was now purged of all elements which would not blindly carry out the policy of the Committee. More than 1,200 officers, among them 153 generals and colonels, were dismissed by Enver in one day. Enver put himself at the head of the troops, and in July 1913 made a triumphal entry into Adrianople, which had already been evacuated by the Bulgarians. On Jan. 3 1914 he promoted himself major-general and made himself Minister of War.

Now began a period of hasty measures and reckless decrees. At one time the Turkish script was altered, with the result that officers were unable to read their reports or orders; then the Enverie, a highly unpractical head-covering, reminiscent of a child's paper hat, was invented and introduced; in March 1914 he demanded and obtained the hand of Princess Nadjie, the Sultan's niece, made himself general of a division, and began, moreover, to take thought for his financial future. When at last he was forced to flee from Constantinople, the bridge-keeper's son owned 320 houses in the city, and he had also acquired interests in banks and mines.

When the World War broke out Enver began to cherish strategical ambitions. In the winter of 1914–5 he led an entire Turkish army in the disastrous offensive in the snow-covered mountains on the Russo-Turkish border. With Liman von Sanders, the chief of the German military mission, his relations were strained, and the situation was not improved by certain Germans who flattered Enver and intrigued against Liman von Sanders. He became a megalomaniac to whom no one dared offer a word of advice. He had no share in the Dardanelles defence, but took all the credit for it. In internal politics he became, by degrees, the absolute ruler of the country. When the Turkish collapse came, he fled by way of Odessa to Germany. In 1919 he was condemned to death at Constantinople *in contumaciam*. In the same year, after a brief exile among friends in Germany, he fled to Russia. There at first he helped Denikin to maintain the independence of the Caucasus, but when the latter made a political approach towards the Entente, Enver left him, stayed for a short time in Azerbäijän, and was mixed up in adventures in Asia Minor. He was reported in 1920–21 to have been employed at Moscow as director of the Asiatic department in the Soviet Government, and to have posed at the Baku Congress of Oriental Peoples as the leader of a great Socialist movement in the middle east and north Africa.

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[1] A German version was issued in 1918.

EPIDEMIOLOGY.—In recent years more study has been given to that branch of the science of medicine which, under the name of epidemiology, displays the general factors which operate upon populations or aggregates and lead to the outbreak of a sickness affecting several persons within a short interval of time. The unit of the epidemiologist is a population, while the unit of a physician is an individual.

The first scientific epidemiologist was Hippocrates, whose treatises *On Epidemics* and *On Airs, Waters and Places* remain models of epidemiological inquiry. In the latter work, he displayed the correlation between the physique, habits of life and climatological advantages or disadvantages of various populations and the types of illness prevalent amongst them. In the former, by means of an intensive study of the diseases prevailing through a series of years in one and the same place, he established the conception of an epidemiological type or *constitution* determined to a greater or less degree by meteorological conditions. Incidentally Hippocrates described some forms of epidemic disease, such as mumps, in terms fully applicable to modern experience. He also recognized the tendency of particular types of epidemic sickness to appear at a change of season, especially near the vernal or autumnal equinox. In treating of disease as a mass phenomenon, of epidemics, Hippocrates exhibited the scientific caution and zeal for the collection of objective data upon which to found an induction which have rendered immortal his clinical studies. Galen, whose authority for many centuries overshadowed that of the founder of Greek scientific medicine, systematized the theoretical teaching of Hippocrates but recorded few fresh observations. According to Galen, a disease was a function of three variables: the innate or acquired constitution (crasis or temperament) of the body, disordered habits of life, atmospheric changes (metastases). Illness became epidemic when, some abnormal modification of the atmosphere having occurred, the temperaments, or crases, of a sufficient number of the persons exposed were apt to give rise to illness. He recognized the contagious nature of certain diseases, such as ophthalmia and phthisis, but, in his terminology, contagion was very different from what we now understand by it. He had no notion of a vital infective principle, a *contagium vivum*, but looked upon the transmission of disease from person to person more as one now looks upon the setting into vibration of a series of tuning-forks when their fundamental notes are struck. None of the post-Galenical or Greek physicians or of the Arabian writers added much to our practical knowledge of epidemiology. In the 16th century, Girolamo Fracastoro (1483–1553) clearly enunciated the principle of *contagium vivum* and, in the next generation, Guillaume Baillou (1538–1616) in his *Epidemiorum et ephemeridum libri II.* (first printed in 1640) resumed the plan of actually describing the forms of illness prevalent in successive years which was the foundation of Hippocratic epidemiology.

Neither the importance of Fracastoro's principle nor the value of the method originated by Hippocrates and adopted by Baillou were realized by contemporary physicians, and, although accurate description of particular outbreaks accumulated during the 17th century, a general science of epidemiology was still to seek.

The honour of being the second founder of scientific epidemiology is usually assigned to Thomas Sydenham, and although this physician had no notion of the importance of Fracastoro's ideas and in his adoption of the Hippocratic plan had been anticipated by Baillou, the attribution is just.

To Sydenham (1624–89) belongs the credit of having realized that the succession of diseases is not chaotic and of having attempted to deduce from personal observations extended over more than 20 years a general doctrine of epidemiology. Sydenham's observations are not always clearly recorded, nor were his conclusions entirely free from inconsistencies, but his main principles were the following. He thought that all types of disease prevalent at any one time bore the imprint of a common "constitution"—the ultimate source of which he supposed to be indefinable telluric variations—the overt expression of the constitution was a "stationary fever," found in different clinical settings. Hence two different specific "diseases" prevailing during one "constitution" resembled one another more closely than did instances of the same "disease" observed under two different "constitutions." To this distinction he attached the greatest importance as a practitioner of medicine;—"This only, fortified by a multitude of exact observations, I do confidently hold, that the aforesaid species of disease, in particular the continued fevers, may vary so enormously that you may kill your patient at the end of the year by the method which cured sufferers at the beginning of it."

Sydenham classified his successive "constitutions" in accordance with the clinical form of illness most usually observed under it and closely watched the changes of symptomatic form which heralded the emergence of a new "constitution."

Although in modern times this notion of an epidemiological succession has been a fruitful hypothesis and many of Sydenham's predictions as to the decline of reigning diseases and their replacement by others have been accurately fulfilled, his immediate influence upon epidemiological thought was much less effective than his moulding of clinical practice. The reason is that to sift the wheat from the chaff of his ideas required a new instrument, viz. a statistical method applied to numerical data. Neither method nor adequate data existed at the end of the 17th century. The science of epidemiology owes almost as much to Sydenham's contemporary, the London draper John Graunt (1620–74), who founded vital statistics, as to the English Hippocrates. During the 18th century some annalists of sickness, especially the elder Wintringham (1689–1748), Huxham (1692–1768), Van Swieten (1700–72) and Anton Störck (1731–1803), provided more data on the Hippocratic model, and practical contributions to the art of hygiene and the control of particular epidemics were made by such investigators as Lind (1716–94), Pringle (1707–82), Monroe (1727–1802), Brocklesby (1722–97) and Blane (1749–1834). Contemporaneously, a series of illustrious mathematicians, from Pascal to Laplace, were forging the instruments of statistical research which in the hands of Farr were destined to render great advances in scientific epidemiology possible. It cannot, however, be said that the general doctrines of epidemiology were notably improved or that the opinions entertained by physicians at the beginning of the 19th century differed greatly from those of their predecessors.

During the first 30 years of the 19th century unrivalled opportunities were afforded for the study of particular epidemic diseases, especially typhus and typhoid, owing to the Napoleonic Wars and the industrial revolution with its attendant social disorganization. A new interest in public health matters, especially in England, led to the accumulation of facts respecting the circumstances attending the outbreak of epidemic diseases. Before the establishment of the English General Register office (in 1837) official reports upon epidemiological matters, particularly cholera, had been furnished and the ground prepared for the work soon to be undertaken by William Farr (1807–83).

Broadly speaking, the state of epidemiological knowledge at the beginning of the reign of Victoria was as follows. The contagious nature of the diseases known as zymotics was fully recognized and the specific difference between scarlet fever and diphtheria understood. The relation between pollution of water supplies, cholera and certain other forms of "continued fever" with intestinal lesions had also been perceived. Experience of vaccination had firmly established a belief in the possibility of immunizing mankind against one form of epidemic disease. At least one physician, Robert Watt, of Glasgow (1774–1819), had contributed new evidence of a statistical character in favour of Sydenham's doctrine of epidemiological succession, while the remarkable increase of malignity which began to characterize scarlet fever during the third decade of the century and the return of pandemic influenza (a disease described by many writers in and before the 18th century) had impressed the same ideas upon the general body of the medical profession. On the other hand, the fundamental distinction between typhoid and typhus fever and the epidemiological importance of the distinction had only been realized by a few exceptional men, and statistical data necessary for the assessment of the epidemiological factors common to groups of diseases and for the testing of epidemiological theories were fragmentary.

The Spread of Epidemics.—Modern epidemiology is based on the collections of statistics which began half way through the 19th century, and on the associated information which was obtained as to the causation and course of epidemics by careful local inquiry into all the conditions. It is true that before this some countries, such as Sweden, had published the figures of the deaths from numerous infectious diseases for series of years, but though these figures are very interesting they represent more or less special conditions. Since about 1840, especially in Europe, in India and America, carefully collected information exists respecting many epidemics and epidemiological conditions. Sufficient evidence is now available to examine any theory which may be offered to account for the facts. Advance has been made on a number of lines: on the modes of spread of infection; on the theory of the course, recurrence, and size of epidemics; on the relation of epidemics to climatic conditions and the cause of these relations; on the knowledge of the life history of the organisms which cause epidemics; on the conditions of living which favour the spread of infectious disease.

With the discovery of the organisms which cause disease and with the careful observation in the field as to the manner in which disease spreads from person to person, many new points of view have emerged. It is no longer sufficient to talk vaguely of fomites. Most diseases have their special forms of spreading which account for practically all the cases. Thus measles and smallpox are exceedingly infectious from person to person. Enteric fever is nearly always carried by contaminated water or contaminated food. Cholera is spread by water and flies. Other diseases have been found to be practically non-infectious from person to person unless by means of an intermediate parasite. Thus typhus and trench fever are carried by lice, while yellow fever and malaria require the intervention of the mosquito. The mode of spread of some diseases, however, is still obscure. Among these scarlet fever must be placed. While direct infection undoubtedly takes place a satisfactory elucidation of the problems of its dissemination has not yet been arrived at.

For accurate thinking on infectious diseases it must be noted that disease-producing organisms possess two qualities: one, the power of causing the disease, and the second the power of producing a severe attack of disease. The first may be termed infectivity and the second virulence. These qualities must not be confused. In point of fact they are not associated in any constant degree. Sometimes an epidemic begins with a large number of severe cases and sometimes the reverse. In certain diseases the height of the epidemic seems to be associated with severe disease, in others with that of milder type. The former at least holds for a certain number of large epidemics of measles of which the statistics have been investigated. The latter is the case both in Glasgow and London in regard to the autumnal prevalence of scarlet fever.

That an epidemic might possess a definite form capable of calculation seems to have been advanced first by Dr. Farr. In 1840 he graduated the decline of the great smallpox epidemic in England to the normal curve of error, and obtained a very close representation of the facts. He promised further discussion but seems to have given none till 1867. In this year he returned to the subject in connexion with the cattle plague, writing a letter to the *Daily News* in which it was stated that though in the popular conception plague was advancing with such rapidity that all the cattle of the country might be destroyed, in reality the force of the epidemic was spent, and that if the form of the epidemic curve up to that point were taken as a basis of calculation the future course could be foretold. The prediction proved to be very near the truth.

The theory of the course of the epidemic, however, as a guide to the solution of the problem has unfortunately not proved so fertile as might have been hoped. Some facts are quite definite. The curve of the epidemic is generally found to be symmetrical, the fall corresponding closely to the rise, though in some diseases the ascent is more rapid than the descent, and in some the reverse. The equation of the curve which describes the majority of epidemics, as found by trial apart from theory, is

$$y=\frac{a}{\left(1+\frac{t^2}{b^2}\right)^n}$$

where y is the number of cases at time t, t being measured from the centre of the epidemic. Curves closely resembling that given by the above equation arise on a number of hypotheses of which two are discussed. First, the organism may be assumed to possess at the beginning of the disease a high degree of infectivity which decreases as the epidemic goes on. If the loss of infectivity is according to geometric law, the normal curve of error already used by Dr. Farr is the result. It is sufficient to state that on various probable hypotheses regarding exposure to infection, etc., the normal curve may be so modified as to take the form found by observation. Secondly, a similar type of curve arises if we consider an epidemic dies out from lack of susceptible persons. It is not possible to distinguish statistically these hypotheses from the consideration of the epidemic form alone. In one case, however, the second hypothesis can be tested. If the form of the epidemic be calculated by assuming different degrees of infectivity on the part of the organism, an infectivity which remains constant during the epidemic, it is found that this curve becomes flatter and flatter the smaller the degree of infectivity. Now with regard to plague in India among brown and black rats living more or less in the same circumstances, it is observed that many more brown rats are infected than black. In such circumstances the form of the epizoötic should be different in the two species if the decline is due to lack of susceptible individuals. As a matter of fact it is nearly identical: a fact which tells strongly in favour of the hypothesis that the epidemic ends because of loss of infectivity on the part of the organisms. This example would be crucial but for the fact that the flea on which the spread of the epizoötic depends has a law of seasonal prevalence of its own to which both the epizoötics must conform. In many cases, however, the only feasible explanation of the course of an epidemic is that the organism loses the power of infecting as the epidemic proceeds. It is impossible to suppose, for instance, with regard to the great epidemic of smallpox in London in 1901–2 that there were only 8,000 people susceptible, out of a population of 6,000,000. As the course of this epidemic was typical, rising and falling in the manner found to be characteristic, it cannot be argued that the decline was due to the action of the health authorities; all they can have done is to limit the extent of the epidemic, leaving its course unchanged. It is clear, therefore, that in circumstances like this there is some biological factor at work as distinct from a statistical factor. It may then be taken that epidemics in general have a particular form which is identical in many different diseases: plague, influenza, scarlet fever, etc. Even great differences of time do not bring about much change, the form of the epidemic of plague in Sydney in 1900 being nearly identical with that in London in 1665.

The next point requiring consideration is the periodicity in the epidemics of infectious diseases. Taking measles as an example, the common explanation is that each epidemic ends from the exhaustion of the number of susceptible persons, and that it is only when a new population of susceptible children has accumulated that a further outbreak occurs. This explanation fails to account for many of the facts. Even after the very large epidemic of measles in Glasgow in 1906, it was found that nearly half of the children admitted to the fever hospitals immediately thereafter suffering from other diseases had not suffered from measles so that there must have been, with the high infectivity of the epidemic, plenty of susceptible material. The disease subject to the most extensive inquiry hitherto has been measles. Using the method of the periodogram the statistics of London and all the chief towns of the British Isles have been analyzed. It is found that in almost no case is there only one period to be discovered. In London there are several, the chief of which is 97 weeks. This periodicity is found over the whole city. If the application of this mathematical method of analysis be admitted, this coexistence of epidemics of different periods, each appearing at its own time, seems to prove that the termination of an outbreak of the disease is due to loss of infectivity on the part of the organism. Periodicity in other diseases is well known. Thus in the city of Liverpool the epidemics of scarlet fever occurred at regular intervals of four years from 1850–78. On one occasion alone was there an exception when the interval between two epidemics was three years in place of four. A similar periodicity of five years has been observed in Glasgow. There is one specially interesting example, namely the occurrence of plague in Bombay. In many places, such as Hong-Kong, the period between each epidemic is rigidly a year. In such a case the influence of the season of the year seems a sufficient explanation. But the case of Bombay is different. The first epidemic in 1897 had its maximum about the 40th day of the year. From this point until the last year for which statistics are available (1918), the date of the maximum of the epidemic has steadily advanced into the year, advancing about 80 days in 20 years or an average four days a year. It is difficult to account for a phenomenon like this except as being due to some property of the organism. The conclusion must be arrived at that while some periodicities of disease are strictly seasonal, others are not so, and require some further explanation.

A further important application of mathematics to epidemiology has been made by Sir Ronald Ross in his studies on malaria. Here the factors influencing the spread of the disease are numerous. Rainfall and temperature, the number of persons carrying the organism in their blood, and the number of mosquitoes and the proximity of the breeding-places of the mosquito to the abodes of men are all capable of quantitative measurement, and of furnishing guidance in the adoption of suitable administrative measures.

Climate and Weather.—The relationship of epidemics to climate has received much attention in recent years, though in many cases the cause of seasonal prevalence is elusive. Thus why scarlet fever should be so regularly an autumnal disease is not at all clear. On many cases, however, much light has been thrown. The discovery, for instance, that malaria was carried by the mosquito elucidates the seasonal distribution of that disease. A temperature of a certain height with associated pools of water is necessary for the rapid development of the mosquito and also a certain degree of temperature for the development of the parasite in the mosquito. In the same way the zone to which sleeping sickness is limited is a narrow region in which the climate and environment are suitable to the life history of one particular tsetse fly. Much light has been thrown on the epidemiology of plague by the discovery that it was carried to man from the rat by means of the flea. Humidity is necessary for the growth of the flea, and consequently epidemics of plague can hardly occur at seasons of the year when it is warm and dry. Thus the epidemics of plague in Bombay which have advanced progressively later and later into the year now occur when the flea is no longer at its greatest prevalence. With this change the number of cases and deaths has greatly diminished.

The epidemics of summer diarrhoea are also obviously climatic. The organism which causes the epidemic has not yet been discovered, but there is definite evidence that the amount of the disease is very closely associated with the summer temperature. When in London the weekly average of the air temperature rises above 60° F. and remains above that limit a large mortality is the result. Some evidence exists associating the occurrence of the disease with the presence of the house-fly, the fly carrying putrefying organisms from the garbage on which it feeds; but the presence of the fly and of diarrhoea at the same time does not prove that they are cause and effect. Both may well be abundant purely as, or the result of, a coincidence, the climatic conditions favouring both in an almost equal measure. A more difficult problem is the relation of weather to such infective diseases as the pneumonia of childhood. This disease is clearly associated with the winter season of the year but it does not seem specially affected by any special class of weather in that season. In the present state of knowledge it is in those diseases which depend on the spread of the organism by means of parasites that the most close association with weather has been made out.

Effect of Organisms.—We now come to the question on the relation of epidemics to the organism which causes them. Why an organism should be capable at one time of causing a great epidemic and at another only a few sporadic cases of a disease has not yet been found out. That organisms do vary in the power of infecting in this manner is a truism to anyone who has administered in the health departments of a large city. At one time the merest contact with a case of smallpox, for instance, will give rise to a large number of cases. At another time a patient suffering from smallpox may even attend in the gallery of a theatre without giving rise to a case of infection.

In recent years, a considerable amount of evidence has accumulated that an organism having found a suitable host or succession of hosts may have its virulence unusually exalted, and if the virulence can be exalted in this manner it is probable that some similar conditions may give rise to a great increase in the power of infection. At any rate, there is no doubt that in certain conditions organisms become highly infective and even the best sanitary precautions exercised in such circumstances can do little more than limit the amount of the disease. But there are further considerations which arise. It would seem as if at times two series of epidemics may coincide and may even mutually influence one another so as to produce a profound joint effect. Thus the great epidemic of influenza in the autumn of 1918 was associated with great activity of other pneumonia-producing organisms, the result being that the death-rate was of extreme amount and was distributed with age in a manner not found in any recent epidemic of influenza.

Environment.—While an epidemic may in many cases be chiefly or even wholly due to the active condition of the causal organism it is to be remembered that the vitality and environment of the persons affected must also play a part. Thus, for instance, typhus fever introduced into a crowded slum in which lice are plentiful will almost certainly cause considerable havoc, but even here the havoc will be determined to a certain extent by the season of the year. If the weather be cold the people are crowded together on account of the demand for warmth, and the chance of infection is increased. In addition, in the winter food is often scarce and consequently vitality is low. If on the other hand the invasion of the organism takes place during the summer a large epidemic will be unlikely. But though these factors act, yet if an organism has an exalted state of activity, an epidemic of the disease may occur at any season of the year, even the most unlikely. Plague, for instance, especially in temperate climates, is essentially a disease of the warmer part of the year, yet it has been known occasionally to occur in large epidemics in the middle of winter, while epidemics of typhus of considerable size have been recorded in the summer time. The great epidemic of influenza in the autumn of 1918 is a marked example, such a season being in the extreme degree a very unusual one for an outbreak of this disease. What part special susceptibility on the part of the population, due to change in vitality, played in this case is not known. Some other influences also act. There is some evidence that fatigue predisposes to enteric fever, an army on the march drinking polluted water tending to have a larger number stricken than a similarly conditioned civil population. Further, it cannot be doubted that the accumulated effect of seasons may tend to depress health and increase susceptibility to certain diseases. The cumulative effect of winter cold may be perhaps traced in children in relation to death from whooping-cough, the average minimum temperature in the winter preceding the maximum number of deaths from whooping-cough by about six weeks, while the form of the two curves is very much the same. The deaths from whooping-cough are due very largely to broncho-pneumonia, yet the seasonal distribution of whooping-cough is not identical with that of the latter disease. Thus scarlet fever, being an autumnal disease and following the hot summer, might in the same way be ascribed to depression produced by continued hot weather, making certain persons more susceptible to the disease. But as scarlet fever is a disease almost absent in warm climates this explanation can hardly be complete, and some other factor must be necessary. None of these questions, however, have at present been sufficiently investigated to allow any dogmatism.

Another point of importance requires special reference, and that is the problem of "carriers," as individuals infected with a disease and cured as regards themselves, but who yet continue to harbour and distribute the parasite, are called. Cholera follows the pilgrims' way, enteric fever the carrier cook, diphtheria the carrier school-teacher.

References.—The most important of the epidemiological writings of Hippocrates are the *Epidemics* (Books 1 and 3) and the treatise on *Airs, Waters and Places*, both included in the Sydenham Society's translation (by Francis Adams) and in Littré's text (with French translation). Galen's most important works are *De Febrium Differentiis* and his comments on the Hippocratic *Epidemics* (both in Kuehn's edition with Latin translation). The best edition of Sydenham is that edited for the Sydenham Society by Greenhill. An excellent general account of the progress of knowledge is contained in Haeser's *Lehrbuch der Geschichte der Medizin und der epidemischen Krankheiten*, 3 vols. 3d ed. (1882). English epidemiological history is fully related in Dr. Charles Creighton's *History of Epidemics in Britain*, 2 vols. (1894).

Two papers by Greenwood on the "Epidemiology of Plague in India," *Journal of Hygiene*, vol. x. p. 349 and vol. xi. p. 62, give examples of modern epidemiological method, while his Report "On the Rise, Spread, etc., of Epidemic Diseases," *Internat. Congress of Medicine*, Sec. xviii., London 1913, gives a full study with literature. Two papers by John Brownlee discussing "Theory of Epidemiology in Relation to Plague" (*Proc. Roy. Soc. Med.* 1918, vol. xi., p. 86) and the "Periodicities of Epidemics of Measles" (*Proc. Roy. Soc. Med.* 1919, vol. xii., p. 77) give an account of the statistical and mathematical methods which may be used. Ross's *Prevention of Malaria* and Boyce's *Yellow Fever and its Prevention* discuss theory and practice in all their forms. (J. Bro.; M. G.*)

EPSTEIN, JACOB (1880–), Anglo-Russian sculptor, was born at New York Nov. 10 1880, of Russian-Polish parents. He was educated in Paris and settled in England in 1904. He first came prominently into public notice in 1907, when he received a commission for executing 18 figures to decorate the new buildings of the British Medical Association in the Strand. His work was violently attacked, and led to a prolonged newspaper controversy, and in 1909 he produced designs for the tomb of Oscar Wilde at Père Lachaise, Paris, which considerably shocked French taste. His other work includes the decoration of Church Square, Pretoria, and a number of portrait busts, amongst others those of Lady Gregory and Miss Iris Tree.

ERITREA (*see* 9.745).—Surveys made since the settlement of the Danakil frontier with Abyssinia in 1908 gave the colony an area of about 45,800 sq. miles. Proposals made in 1915 that Kassala should be transferred to Eritrea from the Anglo-Egyptian Sudan and Jubuti ceded to the colony by France were not entertained (*see* AFRICA, *History*).

No complete census had been taken up to 1921, when the pop. was roughly estimated at 350,000, including 115,000 Abyssinians. Europeans, apart from soldiers, numbered about 4,000, mostly Italians; next in importance came the Greek community. Asmara (pop. 15,000 including 2,000 Europeans), rebuilt since the Italian occupation, possesses several fine buildings and is the seat of Government; Massawa, the chief port, had some 4,000 inhabitants, including about 400 Europeans and 500 Asiatics (Arabs and Indians). Massawa is in wireless telegraphic communication with the Italian station at Coltano, near Pisa, and with Mukdishu, Italian Somaliland. For local Government purposes Eritrea is divided into eight "commissariats," but certain regions, such as the sultanate of Raheita and other parts of the Danakil country, are not directly controlled by Italy. At the head of the administration is a civil governor, responsible to the Minister for the Colonies.

The chief concern of the authorities in the period 1910–21 was the development of the resources of the country and of the transit trade with northern and central Abyssinia and with the Sudan. Efforts to settle large numbers of Italians in the highlands were abandoned. That region, the only part of Eritrea where Europeans could live permanently, was already largely occupied by Abyssinian agriculturists. While development was hindered by lack of adequate means of transport and the disinclination of Italian capitalists to invest money in the colony (foreign capital was not sought), progress was made. The railway, State owned, from Massawa to Asmara, 75 m. long, was completed in 1912; it rises to 7,700 ft., the altitude of Asmara. A further section of the railway was opened in Dec. 1914, and in 1915 a loan of £800,000 to be spread over five years was authorized by the Italian Treasury to complete the line via Keren to Agordat—184 m. from Massawa and on the main caravan route to Kassala. The route to Adowa (Adua), N. Abyssinia, was improved, and from the port of Assab, on the Danakil coast, a good road was built to the frontier at Ela, whence a caravan route goes to central Abyssinia.

The Asmara-Agordat railway opened up the Khor Baraka district, where the cultivation of cotton was successfully undertaken by an Italian company. Cotton was also grown in the river Gash (Mareb) area and irrigation work began in 1915. It was estimated that 140,000 ac. were suitable for cotton-growing. Ginning mills were erected at Agordat and Massawa.

An industry which made considerable progress was that in vegetable ivory—the collection of nuts from the dum palm, which grows on the banks of the Baraka, the lower Mareb and other regions. The exports rose in 1917 to 10,000 tons, valued at over 1,000,000 lire. Salt deposits were worked in the neighbourhood of Massawa and in the Danakil country. In 1917–8 a Decauville line was built from Fatima harbour, 76 m. S. of Massawa, to serve the Dalol potash mine, which lies 10 m. within the Abyssinian border. The Decauville line, 46 m. long, stopped at the frontier. Stock-raising remained, however, the principal occupation of the people, and skins and hides the most valuable export. Salt, dum nuts and mother-of-pearl are the chief other exports. Cotton goods and dura (Indian millet) are the chief imports. The value of imports at Massawa rose from 17,160,000 lire in 1911 to 47,591,000 in 1917, and was 103,811,000 lire in 1918 (the result of inflated prices). Exports increased from 8,818,000 lire in 1911 to 21,660,000 in 1917 and were valued at 85,254,000 in 1918. The value of transit trade was returned at 3,351,000 lire in 1911, 5,845,000 lire in 1915, 2,498,000 lire in 1917 and 5,415,000 lire in 1918. Many of the goods classed as exports of the colony were however reëxports from Abyssinia or the Sudan. The value of the internal trade with Abyssinia was unascertained, that with the Sudan reached a value of about £100,000 in 1918–9. Oversea trade is mainly with Italy, Aden and India. The shipping which entered Massawa in 1911 had a total tonnage of 206,000, in 1915 the tonnage was 356,000, in 1918 it had fallen to 103,000 tons.

There was (1919) a military force 12,000 strong (3,000 Europeans, 9,000 Abyssinians). Eritrea also supplied battalions for Tripoli, Cyrenaica, and Italian Somaliland. Eritrean troops served with distinction in the hostilities in Tripoli, 1911–4, and in the World War.

Up to 1921 Eritrea had not become self-supporting, though between 1915 and 1920 revenue raised in the colony doubled. For 1920–1 ordinary revenue was estimated at 10,132,000 lire, civil expenditure at 12,049,000 lire and military expenditure at 3,857,000 lire. The Italian Treasury made a grant of 6,650,000 lire. Signor (afterwards Marquis) G. Cerrina Feroni, who had served in the colony for several years, was in 1919 appointed governor.

See Tommaso Tittoni, *Italy's Foreign and Colonial Policy* (English trans. 1914); *Eritrea*, a British official handbook, with bibliography (1920); the *Rivista Coloniale* and the *Bollettino* of the Italian Geographical Society. (F. R. C.)

ERNLE, ROWLAND EDMUND PROTHERO, 1ST BARON (1852–), British agriculturist and politician, was born at Clifton-on-Teme Sept. 6 1852, the third son of the Rev. Canon Prothero, rector of Whippingham, Isle of Wight. He was educated at Marlborough and Balliol College, Oxford, where he took his degree in 1875, subsequently being elected to an All Souls fellowship. He remained at Oxford for some years as a fellow and tutor, and became well known as an authority upon agriculture. From 1883 to 1884 he was university proctor, and in 1894 became editor of the *Quarterly Review*, retaining this post till 1899. In 1898 Mr. Prothero became chief agent to the Duke of Bedford, and in this capacity his experience on agricultural questions was much extended. In 1910 he unsuccessfully contested the Biggleswade division of Beds. as a Unionist. In 1913 he was a member of the royal commission on railways, and in 1914 was elected member for Oxford University. He sat on the departmental committees on the home production of food (1914) and the increased price of commodities (1915), and in 1916, on the formation of Mr. Lloyd George's Government, became president of the Board of Agriculture. He resigned his office in 1919 and was raised to the peerage. Lord Ernle published *Pioneers and Progress of English Farming* (1887), and *English Farming, Past and Present* (1912); besides the *Life and Correspondence of Dean Stanley* (1893); *Letters of Edward Gibbon* (1896); a *Memoir* of Prince Henry of Battenberg (privately printed, 1897); *Letters and Journals of Lord Byron* (1898–1901) and *Letters of Richard Ford* (1905). His *Psalms in Human Life* (1903; enlarged 1913), tracing the influence of the Psalter on the notable men of succeeding generations, had a great popular success.

ERZBERGER, MATTHIAS (1875–1921), German politician, was born Sept. 20 1875 at Buttenhausen in Württemberg. He began life as a national school-teacher and in 1896 became a member of the staff of the *Deutsches Volksblatt* at Stuttgart. In 1903 he was elected as a representative of the Catholic Centre party in the Reichstag, and soon, by virtue of his unusually varied activities, took a leading position in the parliamentary party. He occupied himself in particular with colonial questions. During the World War, although he had at first put forward in letters to leading military authorities, since published, extravagant plans for the German annexations, he soon became a most active agent in attempts to draw the Allies into negotiations for peace. He was the real author of the so-called Peace Resolutions adopted by the Reichstag July 17 1917. He likewise employed his relations with the Austrian Imperial Court in order to work for an early conclusion of peace. In Oct. 1918 he entered the Government as a Secretary of State after he had contributed to bring about the fall of Bethmann-Hollweg. Entrusted with the task of conducting the negotiations for the conclusion of the Armistice, he signed (Nov. 1918) the Armistice agreement in the saloon railway carriage of Marshal Foch in the Forest of Compiègne. After the elections for the National Assembly he entered the new Government of the German Republic in Aug. 1919 and was appointed Finance Minister of the Reich. In the National Assembly he succeeded in forcing through the new measures of taxation, notwithstanding the vigorous attacks made upon him by the Right. He set himself in particularly sharp opposition to the German National party (the old Conservatives), on whom he laid the responsibility for the World War; the result was a personal dispute with the leader of the Nationalists, the former Secretary of State for the Treasury, Dr. Helfferich, and Erzberger was ultimately compelled to bring an action against Dr. Helfferich for slander. The action resulted in Helfferich's being condemned to pay a small fine (the German law does not admit of any damages or penalties for slander);

the court, however, in its judgment took the line that Helfferich's allegations regarding Erzberger's corrupt business practices and untruthful statements on the part of Erzberger were justified. Erzberger was consequently compelled by his party to resign his ministerial office. During the case an attempt was made upon his life as he was leaving the court by a youth who had been brought up under reactionary influences. He was rather seriously wounded by the bullet from the assassin's pistol. Erzberger was once more returned to the Reichstag at the general election of Jan. 1920, but in accordance with the wish of his party abstained from immediate participation in politics, as proceedings had been instituted against him on a charge of evading taxation. In 1920 he published a memorandum endeavouring to justify his policy during the war, and he followed it with interesting disclosures regarding the attitude of the Vatican in 1917 and the mission of the papal legate in Munich, Pacelli, to Berlin. Erzberger's power in German politics was based upon his great influence with the Catholic working classes in the Rhineland and Westphalia, in central Germany and in Silesia. In the industrial regions of these districts the Catholic workmen were organized in their own trade unions on lines of very advanced social policy, and Erzberger became the leading exponent of their views in the Reichstag and on public platforms. On the other hand, he incurred the strong opposition of the conservative and landed section of the Catholics, of some of the higher clergy like Cardinal Archbishop Hartmann of Cologne (d. 1919) and of the Bavarian agricultural interest as represented by the Bavarian Catholic People's party in the Diet at Munich and in the Reichstag in Berlin. Erzberger continued to be pursued by the relentless animosity of the reactionary parties, the Conservatives (now called *Deutsch-Nationalen*) and the National Liberals (now styling themselves the *Deutsche Volkspartei*). This hostility, which amounted to a real vendetta, was based, not so much upon the foreign policy of its victim, his negotiation of the Armistice terms and the decisive influence which he exercised in securing the acceptance of the Treaty of Versailles, as upon his financial policy both as Finance Minister in 1919 and as the Democratic Catholic supporter and, it is said, the political adviser of the Catholic Chancellor of the Reich, Dr. Wirth, in the preparation in the summer of 1921 of a fresh scheme of taxation designed to impose new burdens upon capital and upon the prosperous landed interest. The denunciations of the Conservative and National Liberal press undoubtedly went beyond the ordinary limits of party polemics. Thus the *Tägliche Rundschau* observed, in allusion to Erzberger's personal appearance, "he may be as round as a bullet, but he is not bullet-proof." The climax of these attacks was that Erzberger was assassinated on Aug. 26 1921 while taking a walk with a parliamentary colleague in a lonely part of the Black Forest near Griesbach. The assassins, two well-dressed young men, were very generally believed to have been at least voluntary agents of the reactionary and military cliques. The assassination caused great political excitement, and exacerbated existing party feuds.
(C. K.*; G. S.)

ESHER, REGINALD BALIOL BRETT, 2nd Viscount (1852–), English politician and writer, eldest son of the 1st Viscount Esher (*see* 9.768), was born in London June 30 1852. He was educated at Eton and Trinity College, Cambridge, and afterwards entered politics, becoming private secretary to the Marquess of Hartington in 1878. From 1880 to 1885 he sat as Liberal member for Penrhyn and Falmouth, and in the latter year unsuccessfully contested Plymouth. From 1895 to 1902 he was secretary to the Office of Works. He succeeded his father in 1899 and in 1901 was appointed deputy constable and lieutenant-governor of Windsor Castle. In 1902 he was appointed one of the commissioners who inquired into the conduct of the S. African War, in 1903 he was chairman of the War Office Reconstitution Committee, and in 1905 became a permanent member of the Committee of Imperial Defence. From 1909 to 1913 he was chairman of the Territorial Force Association of the county of London. Lord Esher was selected by King Edward VII. as one of the editors of the *Letters of Queen Victoria*, which appeared in 1907, and he produced *The Girlhood of Queen Victoria* (1912). His other works include *Footprints of Statesmen* (1892); *To-day and To-morrow* (1910); *The Influence of King Edward* (1914); *After the War* (1918); and *The Tragedy of Kitchener* (1921).

ESMEIN, JEAN PAUL HIPPOLYTE EMMANUEL ADHÉMAR (1848–1913), French jurist, was born at Touvérac, Charente, Feb. 1 1848. In 1888 he became professor of law in the university of Paris, and in 1904 member of the Institute of France. His best-known works are *Cours élémentaire d'histoire du droit français* (1895) and *Éléments de droit constitutionnel français et comparé* (1903). He died July 22 1913.

ESSAD (*c.* 1875–1920), Turkish pasha and Albanian leader, sprang from the rich Albanian family of the Toptani, and was born at Elbasan. In his youth he sought and obtained the favour of 'Abdul Hamid. He entered the political service of the Sultan, enriched himself therein, and, as was then usual, became a pasha while still a young man. In Elbasan he played the leading political part. When the Turkish Revolution broke out, Essad quickly bent his steps to the new path, which seemed to him the most promising, and was deputy for Albania in the first Turkish Parliament. His influence over the somewhat uncertain Albanian population, and the desire of the Constantinople Government not to have so exceedingly cunning and skilful a man for their enemy, led to his being in 1912 given the high command at Scutari, then under siege by the Montenegrins, though he knew almost nothing of military matters. Indeed, he never showed himself to the troops except once, in March 1913, when he had 50 men shot for an insignificant revolt. Political antagonisms and personal motives combined to make the town commandant, Hasan Riza, the target of his hatred. This honourable Old Turk was the soul of the defence of Scutari; and, in order to have a free hand for his own secret dealings with the Montenegrins, Essad had him assassinated on Jan. 13 1913. On April 25 Essad took the lead in the unreal and theatrical ceremony of handing over the fortress to Montenegro, but when the princedom of Albania was constituted after the Balkan War, Essad became Minister of War and also Minister of the Interior to William of Wied, and brought his policy into close touch with that of Italy. During the World War he was president of the Albanian delegation in Paris but appeared at frequent intervals at Salonika and on the Albanian front as a guerrilla leader. He succeeded in bringing about the overthrow, by a so-called National Assembly in Cusonio, of the "Provisional Government of Durazzo" which was under Italian influence, and this National Assembly purposed to proclaim Essad King of Albania. But on June 13 1920 he was killed in front of the Hotel Continental in Paris by Aveni Rustam, an Albanian.
(F. C. E.)

ESTHONIA (Eesti) was declared an independent republic on May 19 1919. The former Russian province of Esthonia (*see* 9.797) was extended by the Russian law of April 12 1917 over the four northern districts of Livonia, inhabited by Esthonians, namely Pernau (Parnu), Fellin (Viljandi), Dorpat (Tartu, russ. Youriev) and Verro, and the island of Ösel or Ezel (Saaremaa). The Russo-Esthonian peace treaty of Feb. 2 1920 added Narva, parts of the Yamburg and Gdov districts of the province of Petrograd and of the district of Pechori (Petserimaa) of the province of Pskov. This new strategic frontier runs from 10 m. E. of the Narova river across the Peipus lake towards Isborsk. The western frontier bordering Latvia includes the town of Valk ceded to Esthonia by arbitration on ethnographical grounds, and runs in the same direction towards the Baltic Sea. Thus Esthonia's political boundaries coincide almost completely with the linguistic extension of the race. The area, 18,300 sq. m., is larger than Switzerland, Denmark or Holland.

The population of the former province of Esthonia was estimated in Jan. 1913 at 492,000; United Esthonia, as the republic is called, has a pop. of 1,500,000 (according to Martna 1,750,000). About 90% of the pop. belong to the Esthonian race, 4% to the Russian and 2·4% to the German Balto-Saxons (called Balts, Germano-Balts, in Esthonia "Saksa," who formerly numbered 21,800, 4,700 forming the nobility, 300 the clergy). There were in Dec. 1920 about 40,000 resident foreigners, chiefly Russians.

Until 1918 the Balts were economically preponderant both in town and country. To this class belonged most of the owners of the big estates ("Baltic barons"), the commercial magnates and the chief traders and merchants in the larger towns, but great changes have since taken place. During 1897–1900 the average annual rate of increase showed a slow growth of pop., 9·3 per 1,000 in Esthonia and 8·0 in Livonia. About 300,000 Esthonians are colonists in Russia and Siberia, having emigrated chiefly because of the economic dependence of the landless agricultural population. Before the war the birth-rate averaged 28, the death-rate 20 per 1,000. The predominant religion is Protestant, with a small number of Greek Orthodox Christians.

About 74 % of the pop. is rural, 60 % being engaged in agriculture. This rural pop. was formerly divided into three main groups of which the first has been suppressed, (*a*) large landowners with 829 estates, (*b*) peasant-proprietors, a middle class (nicknamed the "grey barons") owning 50,961 holdings, and (*c*) the tenants of small allotments and agricultural labourers forming about three-quarters of the rural pop., whom it was proposed to settle partly on the estates nationalized by the State. The economic consequences of this social dislocation were in 1921 the problem of the day, but the race and class hatred were so strong that these difficulties were disregarded.

The figures for 1919 supplied by the Ministry of Labour showed a decrease of workers engaged in industry; 271 private concerns employed 15,417 workers (printing works and large business concerns are included); the Government employed 21,006 persons (on railways, post and telegraphs, harbour works, timber industry). Of the private industries the more important were: cotton, 3,007 workers; yarn and wool, 2,000; flax, hemp and rope, 1,200; paper, 1,232; metal and shipbuilding, 3,700; cement and bricks, 625; tanneries, refineries and soap, 345; food production in steam mills, starch, etc. 612; chemical (matches, gas), 820. Before the war the cotton mill at Kraenholm near Narva with 600,000 spindles had 12,000 workers, in 1920 only 2,700; of capital invested, 45 % was Russian, 30 % English and 25 % German. Want of fuel and raw material stopped work in flax spinneries, cloth works and leather factories. In 1921 the Russo-British shipyard was trying to sell its floating dock; a new company was initiating the sugar industry and an English firm was promoting the mechanical treatment of flax. Foreign capital was wanted for industry as well as for the revival of agriculture. The coöperative system takes a large share in public educational work (theatres, libraries, museum, literary society). The figures for 1917 were: 99 societies of mutual credit with 42,606 shareholders; 98 coöperative supply stores with 15,052 members; 12 agricultural coöperative societies with 2,018 members; 138 coöperative milk societies. A wholesale coöperative society is preparing for large activities in timber, flax, fish, vegetables and manufactured goods. Before the war Esthonia and northern Livonia were almost self-supporting in regard to foodstuffs. Wheat for the towns and sugar were supplied from Russia, while dairy products, pigs, potatoes (spirits) were exported. It is impossible to estimate separately the losses from war, revolution, military occupation and the suppression of the large estates. The figures available are conflicting. Statistics published by the Ministry of Agriculture showed that the area of arable land and agricultural production in 1920 were approximately the same as in 1916, while critics advanced totally different figures, and professional circles and influential parties like the Maaliit, formerly led by K. Paetz, complained of the ruinous influence of socialistic doctrines on economic policy. As in the other border-states, the large number of government officials and their corrupt methods were subjects of frequent discussion in the daily press. There seemed no doubt that the productive capacity of the country had been at least temporarily reduced.

Natural Resources.—The republic in 1921 owned 1,170,000 ac. of coniferous woods and 650,000 ac. of leafy or mixed woods. Over 90 % of this area, forming 79·2 % of the large estates, was nationalized with the latter and is managed by the State. Together with the concessions in Russia granted by the Peace Treaty these are expected to rank as assets. Extensive deforesting in the course of the war for fuel and for military purposes made serious inroads upon the forest area. The local need of fuel has rendered exportation on a large scale impossible. Concessions of combustible shale to a British-Belgian company were in prospect in 1921. There is a cement factory at Port Kunda. Near Izborsk are concessions of plaster of Paris and at Suurup of limestone. Peat occurs in the Yupre district. The Narova rapids are expected to develop 600,000 H.P. By Art. 33 of the Land Act of Oct. 10 1919 all natural resources of the soil are property of the republic.

Except Baltic Port, which is to be declared a free port, all Esthonian seaports are icebound for some time of the year. The port of Revel (Tallinn)—depth 23–30 ft., length of quay 10,904 ft., capacity of tonnage 55,000, warehouse area 1,333,005 sq. ft.—is the most important. The total quay length of the Esthonian harbours (Revel, Pernau, Narva, Port Baltic, Hapsal, Arensburg, Kunda, Loksa, Rohukula) is about 30,000 ft., and shipping of a total tonnage of 145,000 can be berthed. Special harbour dues, 4d. per each gross registered ton. For the first half of 1920 the shipping which entered Revel was 709 Esthonian ships, net tonnage 27,886; 29 German, net tonnage 18,653; 107 Finnish, 16,860 tons; 47 Swedish, 10,001 tons; Danish, 6,882 tons; 2 American, 5,055 tons; 1 French, 1,190 tons; British none. Total shipping 948 with 91,524 net tonnage. In 1913 590 steamships entered Revel with a tonnage of 477,154. Of these 192 were German, 149,362 tons; 132 Russian, 91,361 tons; 70 British, 78,138 tons.

Imports and exports for 1920 amounted, according to the Government returns, to 3,912,394 and 7,675,508 tons respectively; the total value for the second half of 1920 in Esthonian marks (based upon the rate of exchange £1 = E.mk. 270) was 703 millions for the imports, 738 millions for the exports and 961 millions for goods in transit. Nevertheless Esthonia suffered from an adverse exchange. In March 1920 £1 = 350 E.mk., in May 1920 = 240, in May 1921 = 1,075. Imported goods were beyond the purchasing power of the population. The prosperity of the Baltic states is based chiefly on internal trade and foreign trade with Russia. For 1920 Esthonia received from Great Britain coal, petroleum, cotton and sugar, 1,142,759 tons, exporting to her 3,531,362 tons of timber, paper, pulp, etc. Germany exported to Esthonia 1,298,670 tons of salt, iron goods, and fertilizers, and received 275,905 tons of potatoes. Imports from other countries were miscellaneous and of minor importance. Esthonia exported in 1920 potatoes, spirits, timber, pulp, paper, flax, bricks and cement, and imported flour, sugar, herrings, salted fish, salt, leather, wool, cotton, iron, agricultural machinery, coal, petrol, fertilizers.

After the German occupation, when the Russian frontier was closed, the factories worked with a minimum production, having no markets; stocks of raw material became short and all factories were cut off from their financial bases because the Revel banks, which were obliged to keep nearly all their deposits in Russia, were practically bankrupt. With the financial help of the German military authorities, the factories worked for Germany and the Ukraine, but most goods were put into stock. The first provisional Government did much to promote industry; later, however, the Central Professional Union of Workers exercised a deleterious influence.

Origin of the Esthonian Republic.—The declaration of independence of May 19 1919 stated that "no material improvement had been effected by the Russian revolution in 1917," that later "Esthonia was sacrificed to Germany under the Brest-Litovsk Treaty"; that in Nov. 1918 "the Soviet armies attacked her, bringing in their train more suffering and misery"; and that "in consideration of this the Esthonian nation was under no obligation to respect the union with Russia." After the fall of Tsardom the Esthonians feared anarchy more than Russification, but after the defeat of Russia it was German preponderance which they chiefly dreaded. They were thus virtually compelled to declare for independence. On April 12 1917 the Russian provisional Government accorded the enlarged Esthonian province a representative body (Diet, "Maapaen" or "Maanoukogu") and the right to recall all their nationals from the Russian colours with a view to the formation of a national defence force. On July 1 and Nov. 15 1918 the Diet declared its independence and rejected the proffered aid of Germany. With the exception of their Bolshevik section, all Esthonian political parties under the leadership of K. Paetz and others based their policy on the defeat of Germany, although that country's power was still unbroken. The Balto-Saxons, on the contrary, especially the majority of the gentry, released from the allegiance to the throne, which to most of them meant the Russian State, decided to turn to Germany for help. Their disbelief in the creative power of the Esthonian people at that moment was all the more to be excused, seeing that the capital was under the rule of Esthonian Bolsheviks, whose leader, Anwelt, was openly preparing a reign of red terror. The marshal of the nobility, Baron Dellingshausen, on Jan. 28 1918 invited the Germans to occupy Esthonia; they took Revel on Feb. 25. Over a hundred hostages were taken by the retiring Bolsheviks; of these Dellingshausen was to be tried in Petrograd, whilst the majority were transported under ghastly conditions to Siberia; through the intervention of Germany they were, however, repatriated. On Feb. 24 an Esthonian provisional Government was formed (Paetz, Wilms, Poska, Larko, Kukk and others) and an independent republic proclaimed. Germany did not recognize this Government, but established a régime of military occupation under which the Balts were made dominant; this lasted over eight months. The German occupation widened the gulf between class and race and postponed the formation of an Esthonian force hostile to Germany. Still the power of the local Bolsheviks was broken, many lives were saved and thousands of Esthonians effected their escape from Soviet Russia. England, France and Italy, informed of the views of Esthonia, expressed in May their readiness to grant provisional recognition to the Esthonian National Council as a *de facto* independent body (Prize case of the ss. "Kayak," Admiralty Court of Appeal, Jan.–Feb. 1919), while the German Emperor was considering the request initiated by the Baltic nobility (April 13) for annexation by Germany. There could hardly have been a greater contrast between the two sections of the Esthonian population. The Nov. Armistice contained a clause compelling the Germans to maintain order and law in the occupied territories of Russia, while neither the Allies nor the local governments which came into being had sufficient forces available to resist the advance of the Russian red forces and the rising of the local pro-Bolsheviks. Even then the Esthonian National Council insisted upon taking over all responsibility; on Nov. 14 the German representative, the Social-Democrat deputy Winnig, resigned in their favour. On Nov. 19 an evacuation agreement was signed, which, however, had not the expected effect of leaving the Esthonians in possession of the military stores, etc. All that was available for the defence of the country were two units, some 600 men strong, under Col. Weiss, of Baltic volunteers (the Baltic regiment), including 18 barons, Stackelberg in the ranks, prepared to assist in combating Bolshevism. At first Gen. Laidoner, later knighted by the King, had at his disposal this intrepid corps, besides 3,000 volunteers from Finland under Gen. Wetzer, enlisted by means of a loan of 20 million mks. guaranteed by the Revel banks. The Esthonian units in process of formation were at that moment keener against the retiring Germans than against the Bolsheviks.

The War against Soviet Russia (Nov. 1919 to Feb. 2 1920).—The Russian red army—nominally Esthonian Communists—invaded Esthonia as the German troops retired. For some weeks three-fourths of Esthonia experienced the full measure of Bolshevik methods. The cruelties and massacres at Dorpat (liberated Jan. 14 1919), Narva, Vesenberg, etc., produced an anti-Bolshevik feeling among the Esthonian soldiery. A Finnish loan and war material from Great Britain helped to arrest the enemy's advance 30 m. from Revel, and the Bolsheviks were driven out of the country in the course of a month. But fresh forces were threatened—Latvia having become Bolshevik—all along the 300 m. of land frontier. With the help of the British navy, which in Dec. prevented the Bolshevik fleet from taking Revel, it again became possible in May to land forces in the rear of the enemy (Luga river) in coöperation with Russian anti-Bolshevik forces, a coöperation which tended to grow less close towards the autumn. The commanding town of Pskov was taken when an unexpected incident threatening a new German danger necessitated military operations in the direction of Riga. This town (*see* LATVIA) had on May 22 been liberated by a daring raid in which a decisive part was played by the Baltic Landeswehr under the command of a German, Major Fletcher, one-third of which consisted of volunteers from Germany. The advance of this force northwards conflicted with the views of the Entente powers. The Esthonians detached troops and armoured trains to this new front. Fighting began near Venden (June 2), an armistice declared on June 11 was broken, and fighting continued near Rup (June 13), followed by a victorious advance towards Riga. According to the terms of the armistice of July 3, drawn up by Gen. Sir H. Gough, while the Baltic section obtained an English commander, Col. A. R. Alexander, the purely German section of the opponents had to evacuate Riga, where the Latvian Government of Ulmanis was reëstablished. Esthonia received the thanks of the Lettish National Assembly for the liberation of northern Latvia, and an agreement for mutual help—the nucleus of a Baltic federation—was signed on July 20. Another incident described as "a German conspiracy against Latvia" diverted the Esthonian forces from the Bolshevik front—the Bermondt affair; an arrangement made by Gen. Marsh in July for a combined advance in Sept., with the help of Bermondt's Russo-German volunteer force, was cancelled at the instance of Latvia, and the Esthonians had again to assist Latvia. Meanwhile, in order to divide their enemies, the Soviet Government offered peace to Esthonia. The North-Western Government retorted by recognizing Esthonia's independence (Aug. 11). A sum of $50,000,000 was advanced by the United States (Aug. 15). Russian vessels were sunk by the English in the Kronstadt harbour, and the Esthonians continued to assist—though half-heartedly—the ineffective offensive against Petrograd in Oct. After Sept. 12, in accordance with a vote of the Constituent Assembly, the Esthonians prepared the ground in Latvia, Lithuania and Finland for peace negotiations with Russia. (The Dorpat Conferences, Sept. 29–Oct. 1, and Nov. 9, further developed the idea of a Baltic federation.) On Nov. 20 Gen. Yudenich handed over the command to Gen. Laidoner, and on Nov. 26 terminated his military operations. The Soviet army was stopped at Narva (Nov. 22) and the Russian white army sought refuge in Esthonia. On Dec. 1 peace pourparlers were resumed. On Dec. 4 hostages were exchanged as provided in the armistice signed at Dorpat (Dec. 3). After extensive negotiations (Krassin, later Joffe, for the Soviet Power, J. Poska for Esthonia) a treaty of peace was signed on Feb. 2 1920, and approved by the London declaration of Feb. 24. The chief stipulations of this treaty provided for the suppression of all armed vessels on the Peipus lake; Russia declared herself prepared to join in any future recognition of the international neutrality of Esthonia; foreign troops were to be demobilized (Russian white army); Russian State property devolved to Esthonia, Russia to pay 15,000,000 gold rubles (about £1,500,000) while Esthonia was not to be held responsible for Russia's debts (this was counter to the French point of view); Russia was to return all property removed from Esthonia; Esthonia to have the preferential right to build a railway from Revel to Moscow; a timber concession for 2,600,000 ac.; a favoured-nation clause and the fixing of a strategic frontier and ethnographic boundaries in the Pechora district were included. Russia obtained the concession that transit freights should in no case exceed the local charges and that no import and transit duties should be levied by Esthonia; further she obtained preferential rights to the electric power from the Narova waterfalls. Russia, anxious to extend her outlet towards the West, offered similar advantages to Latvia, Lithuania, Finland, the Ukraine, Georgia and Poland, thus creating a new situation in Eastern Europe. Esthonia was the first to become the continental market of exchange for the trade between Western Europe and Russia (under Gukovsky, chief of the Soviet trade delegation at Revel, which became a centre of speculation).

Esthonian policy before and after the peace was in close touch with Great Britain (missions of Gen. Gough, Gen. Talent, Col. Percy Gordon) and the United States (Col. Green, Prof. Morrison). Esthonia received from these countries respectively military, financial and medical aid (*e.g.* against typhoid imported by Russian refugees), as well as moral support in consolidating her independence and in coping with the preponderance of the gentry, the pro-German or pro-Russian reactionary barons. The problem involved in the land question deserves special attention, being typical of the changes initiated in all the border states (Latvia, Lithuania, Poland, Rumanian Bessarabia and Georgia), which adopted the system of appropriation by the State of all large agricultural estates without adequate compensation, the management of forests by the State, and the sub-division of arable land into small holdings (decrees of Dec. 17 and Feb. 28 1918, the Land Act of Oct. 10 1919). A Constituent Assembly was convened after the liberation of the territory on April 28.

The 120 members were divided into three leading parties: (*a*) Democrats or Peasant party, a bourgeois party—leader Paetz; (*b*) Labour party, socialists—leader Strandmann, later prime minister, promoter of the agrarian reform; (*c*) Moderate Social Democrats and Social Revolutionaries. A provisional constitutional charter was framed on June 6 1919 and definitely adopted in an amended form on June 15 1920 (translated into English, *Baltic Review*, L., vol. i., Nos. 2 and 3). The power of the State was declared to be "in the hands of the people"; Esthonian was to be the official language. Every Esthonian citizen was given the right to determine his own nationality, the members of minority nationalities being entitled to form corresponding autonomous institutions; where the majority of the inhabitants were not Esthonians the local language was recognized as the official language (this applied chiefly to Swedish, Russian and German). The people exercise their political rights (*a*) by plebiscite, (*b*) by their initiative in legislation, and (*c*) by election to the State Assembly (Riigikogu). No law passed by this Assembly can come into force if opposed by one-third of the legal number of members pending a plebiscite. The State Assembly is composed of 100 members elected for three years by universal suffrage. The governor, *i.e.* the head of the State (Riigiwanem or State Elder), acts as prime minister. The other ministers are elected by the Assembly. They must resign on failure to obtain a vote of confidence. The State Court of Justice is elected in the same way, and selects the local judges for life.

The Church is separated from the State, all glebe land and incomes based upon former public law being abolished without compensation by the Land Act. The Minister for Foreign Affairs, J. Poska (d. 1920), supported by the Constituent Assembly, negotiated the peace with Soviet Russia and prepared the *de jure* recognition of Esthonia. The decision of the Supreme Council at Paris on this matter (Jan. 21 1921) was not adopted by the United States. Admission to the League of Nations was refused on Dec. 17 1920 owing to the attitude of the French and British delegates.

The Constituent Assembly dissolved itself on Dec. 21 1920. The State Assembly began its functions on Jan. 4 1921. Labour (22 seats) and Social Democrats including Communists (34) formed the majority; the remainder (44 seats) belonged to the Peasants' party, Christian, popular party and national minorities. The Cabinet was a Coalition; premier, K. Paetz. Its programme reflected the problems and tendencies of the day: (1) Estates to be divided into small holdings; (2) enforcement of Land Act to harmonize with the food problem; (3) estates managed by State officials to be either let or divided; (4) suitable buildings on estates to be arranged for industry; (5) consolidation of internal peace; (6) de-control; (7) organization of minorities; (8) religion to be taught in the schools if so desired; (9) *emigrés* to be repatriated; (10) compensation for nationalized land to be reëxamined.

At the municipal elections the Social Democrats lost a number of seats, but on the other hand Communistic plots were sporadically referred to in the press.

The Land Problem.—The division of property before the Land Act of Oct. 1919, according to official figures for United Esthonia, with the exclusion of the Pechori district, was as follows:—

	Total acreage.	Av. incl'd'g waste land.
(A) Large Estates		
(*a*) belonging to individual owners		
734 manorial estates (knights' estates)	3,791,718	5·165
95 entailed estates (110)	998,133	10·507
61 small estates	74,456	1·286
890	4,864,307	
(*b*) belonging to corporations		
8 to the nobility corporations	109,712	13·714
101 to the Russian State	851,945	8·534
19 to the Peasant Land Bank	168,575	8·872
3 charitable endowments	20,477	6·825
108 Church estates (glebe land)	133,796	1·239
18 to townships (corporations)	102,376	5·688
257	1,386,881	
Total	6,251,188	
(B) Small Holdings		
23,023 leased farms on large estates	1,375,329	59·73
50,961 farms owned by the occupiers	4,349,614	84·76
	5,724,943	

Of the large estates 79% (84%) was forest and 1,386,881 ac. agricultural land. Hardly 1% of the small holdings is under forest, while 4,927,763 ac. are agricultural land.

This division of property, large and small farming being conducted in independent self-contained units, proved economically progressive. (Only some 12,000 leasehold farms in North Esthonia were too small.) But social and political conditions as well as racial antagonism produced a change tantamount to a social revolution, accomplished by a coalition of the petty bourgeoisie and the proletariat with a speed attributed to the danger of a spontaneous Bolshevik move. The beginning was made by the decree of Dec. 17 1918 empowering the State to take possession of "badly managed" estates. This was not a corn production act, nor a means of enforcing proper cultivation; no notice was served, no directions given to the landlord, no default established, no arbitration admitted, no compensations. The economic result was negative (as shown by the Agricultural Conference Nov. 1918), but the measure satisfied some aspirations, seeing that in the course of a year some 300 landlords were dispossessed. On Feb. 28 1919 another decree promised the division of the large estates among the soldiers and the landless agricultural workers, and on Oct. 10 of the same year an agrarian reform was passed by the Constituent Assembly. It was based on the assumptions that the rights of the landlord were non-existent in the cases (*a*) of entails, (*b*) of glebe land, (*c*) of estates seized by Sweden after 1680 and restored to their owners by Russia according to Art. XI. of the Nystad Treaty of 1731 (this applied to ⅚ of the manorial estates) and (*d*) with regard to former waste land (peasant land) reunited to the demesne according to the Statutes of 1849 and 1856 (about ⅙ of this category of land). No compensation was therefore to be granted in these cases. The fact that during the German occupation the landlords were prepared to cede ⅓ of their land for German colonization, and the desire to prevent confiscation without order and programme as in Russia, were also of moment.

According to the Act of Oct. 10 the nationalized land fund had to be redivided on the following lines: (*a*) Leased farms remained the property of the occupier; (*b*) forests were to be managed by the State (Art. XXVI.); (*c*) the manorial houses, gardens and parks became the property of the State (Art. XXVII.); (*d*) glebe land must either be let to church parishes or distributed to neighbouring boroughs; (*e*) arable land was to be allotted in small holdings to soldiers, their relatives and landless workers, with hereditary tenure. The former owners were to move from their homes, only foreigners to remain in occupation of their lands and homes, until a definite compensation Act could be passed and the indemnity paid. The principles on which compensation was to be calculated were laid down in the Act (Art. XII.–XIV.) and, unless alterations should be introduced, would lead to the following consequences.

The valuation of the land for the former land tax was to be the limit of the indemnity. Therefore (*a*) many mortgagees, banks as well as private persons, would lose their security, although since 1864 all such charges had been duly registered. In Northern Esthonia mortgages of 34,352,400 rubles would be deprived of security to the mortgagees. (*b*) The value of the buildings alone was insured against fire in 449 estates for a sum of 42,544,264 rubles, while the proposed amount of compensation for 468 estates amounted to 11,981,450 rubles. (*c*) In numerous estates the value of drainages effected for the last 25 years is higher than the promised compensation for the land. (*d*) The rate of indemnity for live stock and implements was from 15 to 150 times lower than their market value. Even Esthonian politicians (Toennison) appeared doubtful whether the ruin of the landlords would prove ultimately of economic benefit to the country, and amendments were being discussed in order to restore confidence and improve the money market. The Ministry of Agriculture reports concluded: "In spite of all difficulties 20,000 farms were established by spring 1920. The lack of inventory is one great obstacle. Many of the agricultural workmen due to this have not succeeded in becoming tenants and therefore oppose the distribution of land. A certain percentage of the new landholders will fall out of the ranks; but the production problem is not considered to be insolvable." An Esthonian critic (A. Busch) in a monograph insisted that live stock and implements were deteriorating and that not a single building had been erected since the law was passed. The transformation of large holdings into small holdings required a new investment of capital, which was totally lacking.

BIBLIOGRAPHY.—Apart from the official publications of the Esthonian Government quoted at length in the non-official periodicals published in Paris and London, sources of information were scanty in 1921. The proceedings of the Paris Peace Conference were not yet accessible. The literature on the subject is either panegyric, propagandistic or detractory. *Mémoire sur l'Esthonie présentée par la Délégation esthonienne à la Conférence de la Paix, 1919;* Martna, *Memorie della Delegazione estone* (Rome, 1919); in German, *Die Esten und die Estnische Frage;* in French, *L'Esthonie et les Esthoniens* (Paris, 1919); *Revue Baltique* (Paris, Sept. 1918, in progress); *Esthonian Review* (London, July 1919–June 1920); *Baltic Review* (London, Aug. 1920, in progress); Oskar Bernmann, *Die Agrarfrage in Estland* (1920); *Courland, Livonia and Esthonia* (handbooks prepared under the direction of the Historical Section of the Foreign Office, 50, London, 1920); Gastón Gaillard, *L'Allemagne et le Baltikum* (1919); Baron Alfons Heyking, *The Baltic Problem* (1919); Russian Liberation Committee, *The Baltic Provinces* (anonym. by Baron Korff, 1919); Alexis Engelhardt, *Die deutschen Ostseeprovinzen Russlands* (3rd ed., 1916). All such publications represent various points of view. (A. M.)

EUCKEN, RUDOLF CHRISTOPH (1846–   ), German philosopher and religious teacher (*see* 9.878). During the World War Eucken, like many of his academic colleagues, took a strong line in favour of the causes with which his country had associated itself. After the war he became the chief leader of the new idealist movement in Germany, which obtained many adherents among politicians as well as among sections of the general public hitherto averse to the tendencies it represents. The representatives of the main current of this movement regarded Christianity as the culminating point of religious aspirations, but based no hopes upon the Christian churches ever deepening the religious consciousness. Other currents continued to identify themselves more or less with the churches, and a common ground was found in great assemblies of men and women of the younger generation, generally in the open air, where plans were discussed for strengthening the moral fibre of the nation in view of the overwhelming problems arising out of Germany's political and military collapse.

After 1910 Eucken published the following works and pamphlets:—*Grundlinien einer neuen Lebensanschauung* (2nd ed. 1913); *Können wir noch Christen sein?* (1911); *Erkennen und Leben* (1912); *Die Lebensanschauungen der grossen Denker* (10th ed. 1912); *Die Träger des deutschen Idealismus* (1915); *Mensch und Welt: eine Philosophie des Lebens* (1918; 2nd ed. 1920); *Deutsche Freiheit: ein Weckruf* (1919); *Einführung in die Hauptfragen der Philosophie* (2nd ed. 1920).

EUGENE, ARCHDUKE (1863–   ), Austro-Hungarian field-marshal, was born May 21 1863 at Gross-Seelowitz in Moravia. In his military career he had become commander of the XIV. (Innsbruck) Corps and army inspector when, before the outbreak of the World War, considerations of health compelled his retirement. It was only after the retreat of the Austro-Hungarian troops from Serbia in Dec. 1914 that the Emperor handed over to him the command of the army holding the Danube–Save line. After the Italian declaration of war the Archduke took over the command on the south-western front. At the time of its greatest extension his constantly changing area of command stretched from the Ortler to the sea. The battles fought under his directions on the Isonzo and on the Tirol front formed a series of successes. As a staff commander the Archduke was associated with Gen. Alfred Krauss (born 1862 at Zara), who was also known as a writer on military subjects. Under the new regulations concerning army commands in Jan. 1918 the Archduke received no further active command. As Grand Master of the Teutonic Order he remained unmarried. His unaffected character made him very popular.

EUGENICS (*see* 9.885*), the name coined by the late Sir Francis Galton (from Gk., εὐγενής, well-born), and first used by him in his work on *Human Faculty* (1883), for what he defined as the "science of improving stock, which is by no means confined to questions of judicious mating, but which, especially in the case of man, takes cognizance of all influences that tend, in however remote a degree, to giving more suitable races or strains of blood a better chance of prevailing over the less suitable than they otherwise would have had." The word "science" used in this connexion is apt to be a little misleading. "Science" is used to denote two different things; it may mean the knowledge of a particular group of the laws of nature, or it may be used to denote the *art* of applying this knowledge in order to effect a desired object. It is clear from the context that it was in the second sense that Galton intended to use the word "science," and therefore a shorter and perhaps less ambiguous definition of eugenics would be "the application of our knowledge of the laws of heredity to improving the quality of the human race."

The aim of eugenics is therefore not primarily the collection of facts, but the construction and advocacy of practical proposals. The character of these proposals will of course depend on our conception of the laws of heredity, but the study of these laws forms the subject matter of the science of genetics. Genetics is a department of biology; and the last word in all controversies connected with heredity must rest with the biologist.

Like all the other laws of nature, the laws of heredity can only be ascertained by the carrying out of carefully thought-out experiments under standard conditions. It thus follows that these laws must be investigated by dealing with animals and plants since we are not allowed to subject our fellow-beings to experiments or to control their mating. When we deal with human statistics we must therefore interpret them according to the laws which we have deduced from our standardized experiments on the lower organisms, and in working with these statistics, the help and criticism of skilled mathematicians constitute invaluable aids to research, but mathematics applied to data unsifted by the biologist are valueless.

The popular conception of the best method to improve our race is to improve the environment, and for measures of this kind the American investigators have adopted the term *euthenics*. "All men are born free and equal," stands in the fore-front of the American constitution; and it is assumed that the differences between them are due to differences in up-bringing, to their mental and material circumstances in fact. If this supposition were justified it followed that the great remedy for many of our social ills was the extension of education, and on this supposition the social reformers of the 19th century have proceeded. Now it may be conceded that in order to bring out the full potentialities of any organism a favourable environment is necessary; if the soil be too dry the seed will either not germinate at all or if it does germinate it will produce but a poor and sickly plant; but all gardeners know that no amount of moisture or manure will ever produce from seed of inferior stock the plants which can be raised from fine varieties. If the poultry-keeper wishes for a large egg supply he must choose the breeds of fowl which he will keep; no matter how he feeds the inferior breeds he will not obtain from them a good yield of eggs.

One of the first questions therefore which presents itself to the eugenist for solution is whether the mental and moral qualities of men are inherited according to the same laws as govern the production of eggs by fowls. Galton endeavoured to find an answer to this question, but the means which he adopted were decidedly crude. For instance, he obtained records of what he termed the good tempers and bad tempers of married people[1] and tried to find out what proportion of the children were good-tempered or bad-tempered; and again he went through old lists of the results of examinations at Cambridge,[2] and tried to show that a large proportion of the sons of those who had attained distinction in these examinations later rose to occupy important positions themselves. These methods certainly did give indications that character and ability were inherited, but they were open to grave objections. Thus it might be said that estimates of good temper and bad temper on the part of observers were unanalyzed haphazard impressions incapable of accurate measurement; and again, so far as the inheritance of mental ability was concerned, it was pointed out that a boy could inherit from his mother as strongly as from his father, and that in the case of Cambridge scholars there were no means of ascertaining the mental capacities of the mothers.

Since Galton's time, however, enormous strides have been made in attacking the problem of accurately measuring mental ability. The extension of compulsory education to all the children of the leading nations of Europe and the standardization of the curricula of education have provided investigators of mental ability with a very large amount of material. After many years' work and thousands of trials on the children of the elementary schools of Paris, Drs. Simon and Binet succeeded in elaborating a series of tests[3] by means of which they could measure the degree of intelligence attained by growing children. The distinctive feature of these tests was their independence of any special type of instruction. They were so framed that, for example, a child on attaining the age of three could be reasonably expected to do the things prescribed for a child of three, and fail to do those allotted to a child of four. For instance:—

At 1 year a child should recognize food.

At 2 years (1) walk; (2) obey a simple direction.

At 3 years (1) point out nose, eye and mouth; (2) repeat two digits; (3) enumerate the objects in an engraving; (4) tell his surname; (5) repeat a sentence with six syllables.

At 4 years (1) tell whether it is a boy or a girl; (2) name a key, knife and a penny; (3) repeat three numerals; (4) point out the longer of two lines.

At 5 years (1) discriminate the heavier of two boxes; (2) copy a square; (3) repeat a phrase with 10 syllables; (4) count four pennies; (5) reconstruct a card cut diagonally into two pieces.

Similar tests were devised suitable to the intelligence of children of every age up to fifteen. At this age the growth of mental capacity as distinct from attainment seems to be complete. If a child of three could perform the tests arranged for a child of four he was said to be advanced; if he could only perform those suitable for a child of two he was said to be backward.

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[1] *Natural Inheritance* (1889).

[2] *Hereditary Genius* (1st ed. 1869, 2nd ed. 1892).

[3] For a full account of these tests see "The Measurement of Intelligence," by Dr. T. Simon (trans. by Dr. W. C. Sullivan), *The Eugenics Review*, vol. vi., No. 4, Jan. 1915.

**** These figures indicate the volume and page number of the previous article.***

This scale devised for the school children of France has been tested in the elementary schools of Italy and of the United States. It has been found to be right in principle, although tests and ages require some slight adjustment when applied to children of other races than the French.

Now when we apply these tests to the unfortunate people denominated imbeciles and feeble-minded, we make the surprising discovery that some of them, although they may live to an advanced age, are never able to perform the tasks allotted to a child of three and that none of them can do more than pass the tests suitable to a child of ten. Here then is the explanation of mental defect; it is the failure of the mind to develop further than to a certain stage. The next step was to ascertain whether or not this unfortunate character was hereditary, and the merit of solving this, perhaps the most important of eugenic problems, must be accorded to Dr. Goddard,[1] a doctor attached to the staff of the Vineland Institution for insane and mentally defective children in the state of New Jersey. This institution is a charitable one, which takes in defective children and gives them the best education which they are capable of receiving. All the inmates are tested on admission, and at suitable intervals afterwards, by the Simon-Binet scales.

Now Dr. Goddard secured the services of a certain number of educated investigators, who received a special course of training in the institution itself and were then sent forth to investigate the ancestry of the inmates so far as this could be accomplished. This they did by gaining the confidence of the relatives of the inmates, to whom the acceptance of the care of their afflicted children by the Vineland Institution was a great boon, and who were naturally anxious to learn about their progress and quite ready to talk about the first appearance of what to them was an ordinary malady. In this way the investigator was enabled to find out whether any of the brothers or sisters of a particular child were mentally defective, whether his parents or his grandparents had been similarly affected, or whether there were circumstances pointing to some accident as the cause of the trouble. By proceeding along these lines it was possible to draw up an ancestral chart for each inmate of the institution. In this chart a square indicated a male relative, a circle a female; if it appeared that the relative was mentally defective the square or circle was blackened—if on the other hand the relative was clearly normal a square (or circle as the case might be) with the letter N inscribed was placed on the chart. Where definite information was lacking a blank square or circle was added.

The chart was revised at intervals, a fresh investigator being employed for the research on which the revision was based. In practically no case did renewed inquiry lead to the conclusion that relatives formerly regarded as defective were really normal; on the contrary, at every fresh examination more doubtful cases resolved themselves into definitely feeble-minded ones and the child's chart was correspondingly blackened.

The net results of Dr. Goddard's investigations were as follows. In the case of 6,000 children a mentally defective ancestor was ascertained; and about one-fourth of these children were definitely feeble-minded and about one-fourth definitely normal; the mental condition of the remainder could not be ascertained. In the case of 1,500 children there was a definite history of an accident which might be regarded as the cause of the mental condition, and 804 children are classified as of "neuropathic" ancestry, *i.e.* the descendants of epileptic or hysterical parents, a condition which seems akin to feeble-mindedness. It should be remarked that these numbers included not only the inmates of the institution but their brothers and sisters and cousins who were outside and many of whom were quite normal mentally. Where both parents were mentally defective practically all the children were feeble-minded: out of 750 such children investigated only six were reported as normal; and considering the low grade of sexual morality maintained by such people the parentage of these children must be the subject of considerable doubt. In the case of one such family, where both parents were mentally defective, two children out of a large number were normal but these two were *black* and therefore of obvious illegitimate origin. Where one parent was defective and the other, though normal, had a defective ancestor, then as a rule some of the children in the family were defective and others normal. The same results were obtained where both parents themselves were normal but where one of them was descended from a defective ancestor.

Now these results are in accord with the newest and best-attested results of researches into the inheritance of certain characters in the lower animals and in plants; the laws governing this kind of inheritance are termed Mendelian because they were first ascertained by Gregor Mendel, an Augustinian monk in the middle of the 19th century. Mendel's work was unnoticed by most of his contemporaries and was only rediscovered and confirmed by further research in 1900. Briefly the laws which he discovered may be summarized thus:—

(1) In different breeds or strains of the same species characters often appear in pairs so that only one of the pair appears in one strain: such characters are termed allelomorphs. (2) When two such strains are crossed, in the first generation of hybrids only one of the allelomorphs appears: this is termed the dominant character; the allelomorph which fails to appear is termed the recessive character. (3) If the first generation of hybrids be used as parents of a second generation of hybrids, one-fourth of these will exhibit the recessive character, and these if used to propagate a further generation will give rise to nothing but recessives for however many generations propagation may be carried on. (4) In cases (such as plants) where self-fertilization is possible the three-fourths of the second hybrid generation which exhibit the dominant character can be individually tested as to their hereditary potentialities. It is then found that one-third of them (*i. e.* one-fourth of the whole generation) give rise to nothing but dominants, but the remainder (*i.e.* one-half of the whole generation) behave as did the first generation of hybrids, *i.e.* each gives rise to progeny three-fourths of which exhibit the dominant character and one-fourth the recessive character.

These results were interpreted by Mendel as proving that the first generation of hybrids produced two kinds of germ cells in equal numbers, each kind bearing one of the allelomorphic characters, and that these two kinds were mixed at random in fertilization. Bateson and Punnett[2] later gave reasons for believing that the recessive quality of a character was due to the fact that it was caused by the absence of something which was present in the dominant, and that when two germ cells united in fertilization, if one of them bore the dominant character, that was sufficient to ensure the appearance of that character in the resulting organism.

Mental defect is therefore a recessive character due to the want of something in the fertilized egg which gives rise to the mentally defective child, something which is present in the germ from which the healthy child originates. We now understand why two defective parents can give rise only to defective children and why a normal child can spring from the union of a normal and a defective parent, and further why such a child may in turn give rise to defective children as well as to normal ones.

The social implications of this discovery are fundamental and far-reaching. We see at once—and this is in accordance with the experience of the Vineland authorities—why all efforts to raise the mentally defective above a certain level by education are bound to fail. Further, we see that unless such defectives are segregated for life and prevented from breeding they constitute a constant source of potential poison to the race.

If we regard all children who fail to attain a greater mental age than nine as defective, they can be conveniently arranged in three groups, viz. (*a*) those who never attain a mental age of more than three years, who are termed idiots; (*b*) those who never attain a mental age of more than six years, who are termed imbeciles; whilst (*c*) those reaching mental ages of seven, eight and nine years are termed in English law "feeble-minded," but by the American authorities "morons" (Gk., μῶρος, foolish). Neither idiots nor imbeciles constitute a social danger since their incapacity is so great that they are unable to support themselves in the ordinary battle of life and must therefore be maintained in institutions, but morons possess sufficient intelligence to struggle along in the lowest social grade and in the poorest-paid employments, and it is just these grades of society which produce an enormous crowd of children which in former times died out but which our philanthropists now endeavour to keep alive at the expense of taxes levied on the better grades of society.

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[1] H. H. Goddard, *Feeble mindedness* (1914).

[2] W. Bateson and R. C. Punnett, "A Suggestion as to the Nature of Walnut Comb in Fowls," *Proc. Camb. Phil. Soc.*, vol. xiii, 165. See *Mendel's Principles of Heredity*, by W. Bateson (1919).

The gradual lowering of the grade of mental capacity in the whole population which must result from these conditions is not the full extent of the evil. Not only are the morons defective in intelligence, they are also defective in self-control which is the basis of all morality. American investigators have applied the Simon-Binet tests in certain large American cities to the delinquents who appear before police-courts: and their results point to the conclusion that a large proportion of the thieves, prostitutes and habitual drunkards are mental defectives. In one case, to give one example, it was found that 50% of prostitutes were indubitably feeble-minded—and this proportion was arrived at when a large number of doubtful cases had been put down as normal.[1] There seems to be no tendency such as Lombroso postulated in these unfortunates to commit crime for its own sake; their crimes are simply due to an inability to control the tendency to the gratification of their own desires and passions, irrespective of the consequences to others and to themselves.

Dr. Goddard points out that there are two totally different kinds of inebriates to be met with, viz. (1) ordinary people who have lapsed into drinking habits but who are quite capable, if they become sufficiently frightened, of being completely cured, and (2) morons, ready to repent with tears and to sign any pledge, but certain within a week to plunge again into intemperance.

These conclusions which run counter to so many popular prejudices have naturally awakened much criticism and opposition. It should be stated that Dr. Goddard's work has been repeated at various places in the United States, and that similar results have been obtained, but it is to be feared that in many cases his extreme care and the constant repetition of his investigations which he practised have been omitted. Hence Dr. Heron[2] and Prof. Pearson[3] have pointed out that the methods of ascertaining the degree of mental defect were often extremely unsatisfactory and unconvincing and Goddard's methods of ascertaining the feeble-mindedness of the parents and other relatives of feeble-minded children have been criticized as being based on impressions which the investigators derived from mere gossip. On the face of it there is much in this objection, but on the whole Goddard's answer to it is satisfactory. He says first that the investigators were carefully trained so that their judgment could be relied on, and secondly that when different investigators examined the same case, at considerable intervals, they arrived at concordant results. From the point of view of students of heredity it is of far greater importance that the inheritability of mental defect should have been established in the carefully standardized investigations of Dr. Goddard than that obvious blunders should have been demonstrated in many of the parallel investigations carried out elsewhere.

A school of English social reformers of which Dr. Saleeby has been a prominent member have endeavoured to account for most of these cases of mental defect by the action of what they term racial poisons. They maintain that alcohol, when drunk in immoderate amounts, and the toxins of the venereal disease syphilis both attack the germ cells carried in the parents' bodies and not only tend to cause the production of diseased and defective children but that these children if they survive and reproduce likewise give rise to imperfect offspring. Now it is conceded on all hands that the toxins of syphilis do in certain cases penetrate the placenta, and interfere with the growth of the embryo; nay more, that the embryo itself may become infected. As a result horribly malformed and diseased infants are born, but when these survive they appear to get rid of the syphilitic infection before the completion of adolescence, and there is no reliable evidence that their germ cells are defective or diseased.

With regard to alcohol it seems clear that immoderate indulgence in alcohol about the time of conception and during pregnancy tends to produce children with weakened constitutions, but again there is little or no evidence that their germ cells are weakened. It is true that one investigator (Stockard)[4,5] claims to have proved that by making guinea-pigs inhale the vapour of absolute alcohol for several hours daily he succeeded in causing them to produce weakened offspring. In these young guinea-pigs injuries to the eyes and nervous system were prominent, and these weaknesses were transmitted in increased degree to subsequent generations without further exposure to the influence of alcohol. The stock died out in the fourth or fifth generation. It would, however, be exceedingly rash to generalize from these experiments. Pearl[6] repeated them, using the domestic fowl instead of the guinea-pig, and found that the chicks produced by alcoholized parents were on the whole hardier than those whose parents were left untouched. The present writer has repeatedly introduced large quantities of absolute alcohol by subcutaneous injection into the bodies of white mice, so that they passed into a state of complete insensibility, yet even after repeated treatment of this kind they recovered and became the parents of offspring which were apparently quite healthy. Finally, considering the enormous extent to which alcohol has been consumed by the British nation during the last 300 years it is obvious that if any permanent injury had been done to the germ cells, it should be now a diseased and crippled nation instead of a virile people such as it sufficiently proved itself to be in the World War of 1914–8. That the causes of mental defect cannot be found in the alcoholism of the parents was definitely proved by Goddard. Of 300 children born of defective parents not alcoholic 99% were mentally defective; and of 130 children born of alcoholic defectives 98½% were defective.

Mental defect must be assigned to the same cause as that which produces other types of Mendelian recessive. It is the common experience of all who have bred large numbers of animals or cultivated large numbers of plants, that from time to time Mendelian recessives turn up, and no more definite cause for their appearance has ever been suggested than that of " accidents of division " in the ripening germ cells. These recessives in many cases show varying degrees of defect which closely recall the grades of mental defect met with amongst the feeble-minded. For instance, in the cultures of the fruit-fly *Drosophila ampelophila* made by Prof. Morgan and his pupils various grades of blindness have appeared. The normal pigment necessary to the function of vision is of a dark red colour: complete albinos in which the eyes are white frequently occur, and also various imperfect grades of red classified by Morgan as cherry, eosin, etc. The occurrence of these defectives in the fruit-fly is certainly not attributable either to syphilis or to alcohol, and there is no more reason to attribute the occurrence of mental defectives in the human race to these causes than there is to assign these " race-poisons " as causes of the defectives in the fruit-fly.

As the results of the inquiry into the nature of human heredity are so startling and seem to involve such grave consequences it is obviously the first step in eugenic endeavour to make them as widely known as possible, so as to prepare public opinion for the practical steps which sooner or later must be taken. With this object the Eugenics Record Office was established in America by the Carnegie trustees and placed under the able presidency of Dr. Davenport. In England Sir Francis Galton by a bequest in his will founded a chair of Eugenic Research in University

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[1] *Report of the Massachusetts Commission for the Investigation of the White Slave Traffic so-called.*

[2] David Heron, *Mendelism and the Problem of Mental Defect: I. A Criticism of Recent American Work*, Biometric Laboratory Publications (Questions of the Day), No. 7.

[3] Karl Pearson and Gustav Jaederholm, *Mendelism and the Problem of Mental Defect: II. The Continuity of Mental Defect*, *ibid.*, No. 8. *Mendelism and the Problem of Mental Defect: III. The Graduated Character of Mental Defect*, etc., *ibid.*, No. 9.

[4] C. R. Stockard and Dorothy Craig, " An Experimental Study of the Influence of Alcohol on the Germ-Cells," *Archiv für Entwicklungsmechanik*, vol. xxxv. (1913).

[5] C. R. Stockard and George N. Papamcolaou, " Further Studies of the Modification of Germ-Cells," *Jour. Exp. Zool.*, vol. xxvi. (1918).

[6] R. Pearl, " The Experimental Modification of Germ-cells," pt. ii., *Jour. Exp. Zool.*, vol. xxii. (1917).

College, London, to which his friend Prof. Karl Pearson was appointed. Prof. Pearson has established a biometrical laboratory in which a large amount of valuable statistical work has been accomplished and much evidence adduced bearing on such questions as the inheritability of consumption, etc. The Eugenics Education Society, the object of which was not research but an endeavour to make the results of research widely known, was founded in London under the honorary presidency of Sir Francis Galton. Its first president was Sir James Crichton-Browne, its second president Mr. Montagu Crackanthorpe, to whom succeeded Maj. Leonard Darwin in 1911.

The cause of eugenics owes a great debt to Maj. Darwin for having pointed out clearly wherein fitness to survive in the eugenic sense really consists. On this subject much confusion has reigned not only in the minds of the general public but also in the minds of the first enthusiasts for eugenic reform. Attention was at first concentrated on physical health and muscular development, and it was an easy task for opponents to point out that the "big blonde beast" of Nietzsche was not the most desirable type of man, and that men of great talent and initiative often were so in spite of the handicaps of physical disease or infirmity, that Caesar and Mahomet both suffered from epilepsy and that Robert Louis Stevenson died of consumption.

As Bateson[1] has well put it: "We animals live not only on account of but in spite of what we are." Maj. Darwin[2] has emphasized the fact that the decisive factor in the human struggle for existence is general ability and that, broadly speaking, when we compare together members of the same profession—the greater the ability the greater the pay.

It is an easy task for the critic to point to individuals who though able and virtuous have become poor, and to others who though rich are idle and vicious, but these exceptional cases do not detract from the generalization insisted on by Maj. Leonard Darwin that on the whole the poor deserve to be poor and that their ranks are continually swollen by the descent of the unfit from the superior strata of society. It may be added that if the rich persist in being idle and vicious then riches have a strong tendency to disappear—a fact borne witness to by the Lancashire proverb, "It takes three generations to pass from clogs to clogs"; further, that if the able and virtuous poor persist in well-doing they invariably rise to affluence in one or two generations, so that these apparent exceptions to Maj. Darwin's generalization have a way of righting themselves.

Birth Control

The Dean of St. Paul's (the Rev. Dr. Inge),[3] a prominent member of the Eugenics Education Society, has pointed out that during the first half of the 19th century, when no free education was provided, there were far more emergences of men of talent and ability from the masses than during the second half when every effort had been made to "raise the poor" by education, sanitation and doles. Maj. Darwin has called attention to the discovery of harmless and painless means of sterilization by X-rays: so that limitation of the birth-rate by preventing conception is now easily accomplished.

Formerly the natural fecundity of all classes of society was allowed to flow on unchecked: even under these circumstances larger families were born to the poor than to the rich because the poor marry early and improvidently, which is one of the main causes of their poverty, but the greater death-rate amongst their children prevented the poorer strata of society from increasing relatively to the rich. Now, however, the rich limit their families to a number which they can easily support, and this number tends to become smaller and smaller as heavier taxation is levied to provide for the survival and education of large families of the poor. Eugenists contend that the State is in this way deliberately cutting off its best stocks which raised it to greatness in the past, and on the continuance of which its whole future depends. Against this whole policy the Eugenics Education Society has raised a continuous protest and the Eugenics Record Office of America has published a valuable series of bulletins[4] showing the awful progeny of criminals, paupers and lunatics that have sprung from a single worthless family during the last 100 years, and some American states have passed somewhat hastily conceived laws designed to cause criminals and idiots confined in state prisons to be sterilized.[5]

It is indeed obvious that mere restraint of marriage will avail little since it by no means prevents illegitimate union, and amongst the lowest strata of society the marriage ceremony is frequently dispensed with. The only way in which the cruel methods of natural selection can ultimately be avoided is by the sterilization of the unfit; in a word, by preventing parents who are unable properly to support the offspring which they have already produced from producing any more. A first feeble step in this direction may be found in the regulation which until recently was enforced in English poorhouses, forbidding husbands and wives to live together, but public opinion would now be opposed to any extension of this principle: people generally are so obsessed with the liberty of the subject that the liberty of the depraved and worthless to pollute society by a stream of worthless progeny has not been seriously challenged.

The reckless reproduction of the poor in England is sometimes defended on the ground that it contributes to the population of the British overseas dominions and so to the up-building of the British Empire. But on closer analysis we find that this defence will not hold. The great British dominions have very clear conceptions about the type of immigrant whom they desire and whom alone they will admit. They desire people of initiative and adaptability and these are just the qualities which are lacking in our submerged tenth. Incidentally the submerged tenth are without the means of emigration, and the dominions have wisely refused to accept immigrants who come to them on "assisted passages." As things were in 1921 England was being threatened more and more with the fate of becoming a reservoir of the unfit, since it is the fit who both emigrate and limit their families in accordance with their means. The Dean of St. Paul's has pointed out that between the years 1700 and 1800 the population of Great Britain increased by 30% but that between 1800 and 1900 it increased by no less than 300%. Statistically, therefore, it appears that the British Isles are rapidly approaching a condition of over-population, even if they have not already attained it. What is needed is not an increase in the birth-rate but a rigorous selection of those who are to be the parents of the future generation. In former ages this selection was accomplished by famine and pestilence. Ireland in 1846 had eight millions of starving peasantry living a life little better than that of the pigs which they housed in their cabins. The famine and emigration in 40 years reduced the population to four millions who might be described as thriving farmers. The Black Death in the 14th century wiped out two-thirds of the population of England: the following century was the most prosperous and happy time for the agricultural labourers of England of which there is any record. Well has it been said: "In the good old days people died in the country as fast as they now die in the slums of cities, and they died in the cities as fast as white people die on the coast of Guinea." If things go on as they are such a selection will again sooner or later be accomplished by nature; the whole purpose of eugenic propaganda is to make clear that we are approaching such a catastrophe; and to endeavour by humane and wise methods to avert it; to so arrange matters by legislation that the enterprising and provident shall be the parents of the future race and that drunkards, wastrels and reckless shall be debarred from handing on their vices to posterity.

See Francis Galton, *Hereditary Genius* (1869; 2nd ed. 1882); *Human Faculty* (1883); *Essays in Eugencis* (Eugenics Education

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[1] *Materials for the Study of Variation* (1894).

[2] "Presidential Address to the Eugenics Education Society," *Eugenics Review*, Oct. 1914.

[3] *Outspoken Essays* (1920).

[4] A. H. Estabrook and C. B. Davenport, *The Nam Family*, Eugenics Record Office (1912).

[5] Indiana, Washington, California, Connecticut, Nevada, Iowa, New Jersey, New York, North Dakota, Michigan, Kansas, Wisconsin. For details see Popenoe, *Applied Eugenics*, pp. 191–4.

Society, 1909); Edward Schuster, *Eugenics* (1913); W. C. D. Whetham and C. D. Whetham, *Introduction to Eugenics* (1912), *Heredity and Society* (1912), *The Family and the Nation* (1909); C. B. Davenport, *Heredity in Relation to Eugenics* (1911); H. H. Goddard, *Feeble-mindedness: its Causes and Consequences* (1914); *The Kallikak Family: a Study in the Heredity of Feeble-mindedness* (1912); A. F. Tredgold, *Mental Deficiency* (Amentia) (2nd ed. 1914); Alfred Binet and Th. Simon, translated by Clara Town Harrison, *A Method of Measuring the Development of the Intelligence of Young Children* (1912); Paul Popenoe and Roswell Hill Johnson, *Applied Eugenics* (1920). (E. W. MacB.)

EUGÉNIE [Marie-Eugénie-Ignace-Augustine de Montijo] (1826–1920), ex-Empress of the French (*see* 9.885). During the World War she turned her home at Farnborough into a military hospital. She followed with intense sympathy the fluctuating fortunes of France, and lived to see the injustice of 1871 corrected by the Treaty of Versailles. She died on July 11 1920 at Madrid, while on a visit to her nephew, the Duke of Alva. A few days previously she had undergone an operation for cataract, and succumbed to an attack of uraemia.

EUROPE (*see* 9.922).—In dealing with the general European situation during the years which intervened between 1909 and the outbreak of the World War, the historian is faced with the fact that the importance of this period lies in the conclusion. Always there is before us the problem: was the war with which it terminated the inevitable outcome of deep-seated causes, or was it an avoidable result of demonstrable blunders and crimes? A consideration of this problem makes it necessary to revert briefly to previous events. Much which in 1910 was obscure has been elucidated by later publications; much which was then a conjecture or hypothesis has been verified; and much which could then only be tentatively suggested can now be frankly said.

The Triple Alliance.—The chief characteristic of the first years of the 20th century is the rivalry of the two political groups into which Europe was divided. As we can now see, the establishment of the Triple Entente (England, France, Russia) was a necessary and inevitable counterweight to the Triple Alliance (Germany, Austria and Italy); for this latter alliance, so long as it stood alone, gave to Germany a preponderance upon the continent of Europe so great as to be a permanent check on the free diplomatic activities of other states, and possibly a danger to their independence. It is true that the original alliance between Germany and Austria in 1879 had been a method of maintaining peace and securing the *status quo.* At that time Germany under Bismarck was, as he said, a satiated state; all that it required was time and peace for the development of its internal resources. In order to secure this he had built up an extraordinarily complicated system of alliances and agreements. We have first the original Austro-German Alliance of 1879, which was repeatedly renewed and remained in force until the outbreak of the World War. This treaty, which was published in 1881 in an incomplete form, bound the two empires to help each other in case it was attacked by Russia; if either was attacked by a third Power, the other was to observe at least a benevolent neutrality, and if the attacking Power was supported by Russia, then to come to the assistance of its ally. Side by side with this treaty of mutual defence against Russia, in 1881 Germany and Austria entered into an alliance with Russia, the chief point of which was a mutual engagement to act together in all Balkan matters. This treaty was renewed in 1884 for three years. It lapsed in 1887, and for it was substituted the "Reinsurance Treaty" between Germany and Russia alone, by which each party agreed to maintain benevolent neutrality towards the other in case of a war with a third Power. This was not to apply in the case of a war against Austria or France if this resulted from an attack against one of these latter Powers by one of the parties to the treaty. In addition, Germany recognized the rights historically acquired by Russia in the Balkan Peninsula, and particularly the legitimacy of her preponderant and decisive influence in Bulgaria and in Eastern Rumelia. There was to be no modification of the territorial *status quo* in the Balkans without previous agreement and the principle of the closing of the Straits was reaffirmed. This lapsed in 1891; Caprivi is reported to have said that it was too complicated for him. Meanwhile, in 1882, the Triple Alliance was arranged between Austria, Germany and Italy, the essential point of which was that Germany and Austria were bound to come to the assistance of Italy if she was attacked by France, and similarly, Italy to come to the assistance of her allies if either of them was attacked or engaged in a war with two or more Great Powers; a special protocol stated that this treaty could not in any case be regarded as being directed against England. In 1883 Rumania, by a separate treaty with Austria, to which afterwards Germany and Italy adhered, became attached to the group, the allies binding themselves to defend Rumania if she was attacked. The text of this treaty was kept strictly secret; it was a personal act of the King of Rumania, and was communicated to no one except the prime minister. In 1887 the Triple Alliance was renewed and extended, the two German Powers now undertaking to support Italian interests in North Africa, both in Tripoli and Morocco; these clauses included an undertaking to support Italy in any action that she might take to safeguard her position, even to war with France. In 1891 the third treaty of the Triple Alliance reasserted in a strengthened form the Mediterranean obligations to Italy; a very important clause (VII.) determined that every advantage, territorial or other, obtained either by Austria or by Italy in the Balkans should be based on the principle of reciprocal compensations.

These four Powers formed a coherent group, but to it other states were more loosely attached. In 1887, when there were cordial relations between the British and the German Governments, Lord Salisbury, by an exchange of notes, came to an agreement with Italy and Austria to maintain the *status quo* in all the eastern waters of the Mediterranean, while Italy undertook to support Great Britain in Egypt; Great Britain on her side expressing her intention to support the action of Italy in North Africa. There was also an agreement between Italy and Spain as to Morocco, and at this time Serbia also was attached by a separate treaty to Austria.

We see that this very elaborate structure of treaties and agreements was really approximating to a general European system into which in one form or another there were brought Austria, Italy, Rumania, Spain, Serbia, Great Britain, and even Russia; the whole object was the isolation of France, and it served its purpose of securing to Germany full and peaceful enjoyment of all that she had gained by the war of 1870–1. The extension of this system to the Mediterranean was advantageous to Great Britain in so far as it tended to strengthen her position in Egypt. The pivot was Germany and the centre of gravity was the German army; this it was which held the whole together. It was a system in which Europe could acquiesce only so long as the policy of Germany was passive; a reaction must inevitably arise if Germany began a policy of active expansion. With the accession of a new emperor and the resignation of Bismarck, the Triple Alliance, while unchanged in form, acquired a new meaning. The period of rest and recuperation in Germany was over, and the new empire, conscious of its strength, began to stretch out with great ambitions towards the other quarters of the globe. The immense growth of German wealth, the skill with which the mineral and agricultural resources were developed, and the expansion of manufactures naturally led to an extension of foreign trade. German agents, supported by German bankers, were to be found in every part of the world; there was a great development of maritime shipping, and this naturally led to the acquisition of extra-European dependencies and the extension of political interests. The first years of the new Emperor's reign appear a tentative experiment; with the appointment of Herr (afterwards Count and then Prince) von Bülow, first as Foreign Secretary and afterwards as Chancellor, the new tendencies became the deliberate and conscious policy of the German Government. It was inevitable, even with the best possible intentions, that numerous causes of friction should arise with other nations, and especially with Great Britain, for there was no part of the world (except perhaps South America) in which the expansion of German influence did not touch British interests.

Franco-Russian Alliance.—Germany could embark with full confidence on this great policy of expansion just because her essential security at home was so well guarded; hers was the only alliance on the continent. But ever since 1870 acute observers had foreseen that, some day or another, France and Russia would join together in order to redress the balance of the continent. This event took place in Aug. 1891. The agreement (which was formulated in an exchange of notes) was based on "the renewal of the Triple Alliance and the more or less probable adhesion of Great Britain to the political views of this alliance." It contained two clauses: one that the two Governments would agree together on any question of such a kind as to endanger the general peace; and the other that, in case either party was menaced by an attack, they would agree together on the measures to be taken. Two years later, however, after long negotiations in which many difficulties were encountered, this was supplemented by a military convention (Dec. 1893–Jan. 1894): if either France or Russia were attacked by Germany, France or Russia respectively would apply all her forces to attack Germany. If the forces of the Triple Alliance, or one of the Powers of which it consisted, were mobilized, France and Russia would immediately mobilize. The number of troops to be employed was specified, and it was agreed that there should be joint action between the general staffs and interchange of all information relative to the armies of the Triple Alliance.

But even after this there was little real cordiality in the relations between Russia and France. Russia, moreover, was occupied with Asiatic affairs, and had come to a friendly agreement with Austria as to the Balkans which was confirmed by an exchange of notes on May 8 1898. The internal dissensions of France (it was the time of the Dreyfus trial) weakened the influence of that country abroad. France indeed was protected against the danger of a new attack from Germany, but received little support from Russia in the normal discussion of diplomatic matters. The essential change took place at the turn of the century. Up to this period Great Britain had held aloof from the continental system. The British occupation of Egypt had resulted in a continued estrangement from France, and on the whole there was a tendency towards a close understanding with Germany and the other members of the Triple Alliance. This understanding was now broken. The first serious differences arose out of South African affairs. The Krüger telegram of 1896 was a flash of lightning; no storm followed, but this and the intense animosity against Great Britain shown during the Boer War were symptoms that could not be neglected. By a large party in Germany the consolidation of British power in South Africa was regarded as the loss of a sphere which they had marked out for German expansion. Though the matter is still extremely obscure, there is no doubt that during 1898, 1899, and 1900 proposals were discussed in every chancellery in Europe for a European coalition against England, and the impression produced in other countries was that such a coalition would be welcomed by Germany. Equally important was the altered attitude of Germany towards the Near East. The great and legitimate expansion of German commercial and economic interests was accompanied by a growing cordiality with the Porte, and during his visit to Damascus in 1897 the German Emperor proclaimed himself the protector of all Mahommedans throughout the world—an utterance which from anyone but him would have been justly regarded by France and Great Britain as an unparalleled provocation. There was also a serious conflict of interests in the Far East. The evidence which came from many sources was sufficient to make it obvious to every British statesman that a continued political isolation was dangerous. England must have friends, and friends on whom she could rely.

From 1898 to 1901 advances were repeatedly made to Germany by Great Britain, and the project of a definite diplomatic understanding, nay even of a defensive alliance, was ventilated. The suggestions were accompanied by warnings that if an arrangement with Germany was not reached, then recourse would be had to the opposed alliance. The offers were rejected; the warnings disregarded. To the German Foreign Office, to Prince Bülow and to the Emperor, it was an axiom that there could be no real friendship, as they said, "between the whale and the bear." They feared, or professed to fear, that an alliance with England would only mean that they would be used as a military advance post against Russia; in the case of war the brunt of the fighting would fall upon them, while Great Britain would gather up the spoils in Asia. "The danger was imminent that if Germany allied herself with England she would have to undertake the rôle against Russia that Japan assumed later single-handed." They believed that they could do better business by playing off the rival empires against one another, by refusing to commit themselves either to Russia or to England, and by using the rivalry to extend their own influence and possessions.

The German Navy.—But there was another influence at work. One of the chief tasks which the German Government had set itself was the building of a great war fleet. It was the considered opinion of German statesmen that, if they were to come to a friendly diplomatic arrangement with England, this would inevitably compel them to limit their naval development; they affected to think that a fleet built by a Germany friendly to England would be a fleet built under patronage and limited by the British insistence on superiority at sea. This they did not desire; they preferred, therefore, full freedom to build against England, trusting that it might be possible to avoid a serious conflict during what Prince Bülow calls the "danger period of construction." It was indeed the new naval ambitions, more even than the rejection of the British offer of an alliance, that conditioned the whole European situation. After all, in 1887 Bismarck had offered an alliance to Lord Salisbury, and the rejection of this offer did not mean any serious misunderstanding. The building of the German fleet was an action of a very different character. It could only be compared to the similar work by which from 1857 onwards the Prussian army, after a period of comparative stagnation and inefficiency, was brought up to the highest point of perfection, and we know how this great instrument of war, when perfected, was used to further Prussian policy. There could be no doubt that the navy, when completed, would also be used for the same object, and in fact the responsible spokesmen of Germany took care to leave no doubt on this point. They wanted the fleet to support their diplomacy. In the memorandum which accompanied the great Navy bill of 1900 this was clearly stated. The navy must be such that, "even for the greatest sea Power, a war with it would involve such risks as to jeopardize its own supremacy."

It would be an error to suppose that the German Government were deliberately looking forward to forcing a war with England. Still more misleading to assume, as so many did in England, that the object was an invasion. There has never been forthcoming any evidence of any kind to justify the belief that the German military and naval programme included the landing of a hostile force upon England's shores. The danger was of quite a different character, but it was none the less serious. The calculation was that if there was a fundamental difference between British and German policy, the possession of a great fleet would enable Germany to get her way, because England might be put in such a position that she would not dare to risk war. And what was the kind of point on which such a difference of policy might arise? Had the German fleet been in existence during the Boer War, there can be no shadow of a doubt that it would have been used to support European intervention. And again, it had become the avowed policy of the German Emperor to use his friendship with the Sultan as a means of winning the confidence of the Mahommedan world, and this—we have his own words for it—was an instrument which might in necessity be used to render impossible the position of England in Egypt or to arouse difficulties in Mesopotamia, in Persia, in India itself. It was the calculation that if any such controversy arose, Germany would not be alone; if she were allied to some other Great Power which possessed a formidable navy—Russia, France, Japan, or the United States—the predominance at sea, on which the very existence of the British Empire depended, would be imperilled.

It is not necessary to enter into details of the German fleet, nor to discuss the very complicated controversies which constantly recurred. It is sufficient to point out the main outstanding facts which are beyond dispute. The building of the German fleet was governed by the Law of 1900 (that of 1898 was purely preliminary), which was amended in 1906, 1908 and 1912. The original Law determined that the permanent establishment of the fleet should be 38 battleships and 20 armoured cruisers; each ship was to be replaced once every 25 years. By this the standard of building was finally set down. The Act of 1908 determined that battleships and cruisers were to be replaced once every 20 years instead of 25. That of 1912 increased the number of battleships and cruisers to 61. The effect of this would be that, when the programme was completed, Germany would have five squadrons of battleships, of which three were to form the active fleet, two the reserve. In order to understand the full effect it must be remembered that the Law, though it determined the number of vessels, did not deal with their character, size, or fighting power. When dreadnoughts and super-dreadnoughts were introduced, an old ship of (say) 10,000 tons would be replaced by one of 25,000 to 27,000 tons with a corresponding increase in speed and armament. Moreover, especially by the last Law of 1912, arrangements were made for a very great addition of smaller vessels, destroyers and submarines, and above all for keeping the personnel of the navy at such a standard that the whole of the fleet would be available at any time of the year. The total effect was that there was stationed in the Baltic and in the North Sea a fleet stronger than any other except that of Great Britain, and larger and more powerful than the whole of the British fleet had been 20 years before.

This menace was one which had to be met. No child could suppose that it would not affect the whole trend of British policy. The Germans themselves knew this well. What they feared was that England would attack while she still enjoyed her previous naval supremacy and before the German fleet had grown large enough to be dangerous. But this policy of a "preventive" war was never even seriously considered by responsible British statesmen. Their answer was the only possible one. In the first place the British fleet must be strengthened and its whole organization altered. A fleet, like an army, must be found in the place where it is wanted. In the old days the North Sea had been empty of ships; it was in the Channel, in the Mediterranean, in the Atlantic, that the British fleet was placed. The centre of gravity was the Straits of Gibraltar. Circumstances were now changed, and so a great reorganization was effected by which outlying stations were denuded of ships and the bulk of the fleet was stationed in the North Sea.

The Mediterranean had also, however, to be guarded. Austria was increasing her fleet, and Italy was an ally of Germany. As early as 1900 a naval agreement (this has not been published) had been made between the three Powers of the Triple Alliance. To meet this danger in 1912 it was agreed by England that France should concentrate the greater portion of her fleet in the Mediterranean; in the event of a common war with Germany it would fall to the British fleet to defend the northern and western coasts of France. In the same year a naval convention was concluded between France and Russia; with the building of the Kiel Canal the importance of the Baltic in naval strategy had increased. In 1913 a further naval convention between the three Powers of the Triple Alliance was made, and in May 1914 proposals were made for naval conversations between Russia and Great Britain; it is to be noted that at the end of June in the same year the enlargement of the Kiel Canal, by which the biggest ships could pass through it, was completed.

All this was not enough. The German plan was based on the assumption that Germany would be able to gain further allies in addition to those she already had. England also must have allies. Now that Germany was becoming the second naval Power, England could no longer afford to regard with equanimity German military predominance upon the continent of Europe, for this might eventually mean the further weakening of France and, whether by war or by diplomacy, German control over the Low Countries. It might also mean the pressing down of German influence through the Balkans into the Mediterranean. It must never be forgotten that the acts of the Triple Alliance dealt not only with the continent of Europe, but with the Mediterranean and the shores of Africa. The success of the German schemes required one of two things, either an alliance with other states against England, or such increase of German preponderance that they would become, for political purposes, subject to German will. It was necessary, therefore, for England to guard against either contingency, and she could only do so by entering into a firm understanding to join with them in resistance to any unprovoked act of German aggression.

These considerations were so weighty that alone they are sufficient to explain and justify the action of the British Government. The further information which has now become available completely substantiates them. We now know from the letters of the Kaiser to the Tsar, which were published after the Russian Revolution, that throughout the whole of the reign of Nicholas II. the German Emperor had been using the strongest personal pressure upon him to bring about an alliance between Germany and Russia, the point of which was avowedly directed against Great Britain, an alliance into which France would be forced to come. This had been his policy long before the establishment of the Entente with France; whatever the subject of the diplomatic negotiations at the moment might be—whether it was Armenia or Crete or South Africa or Egypt, neutrality during the Russo-Japanese War, or Morocco—always we see the same ambition. He hoped to create trouble for India by encouraging a Russian move on Afghanistan, and for this purpose to arouse the slumbering passions of Islam: "Remember what you and I agreed upon at Peterhof, never to forget that Mahommedans were a tremendous card in our game in case you or I were suddenly confronted by a war with the certain meddlesome Power." He encouraged Russia to give support to Turkey as against Great Britain in the Persian Gulf:—

> "Last but not least, an excellent expedient to kill British insolence and overbearing would be to make some military demonstrations on the Perso-Afghan frontier. . . . Even should the forces at your disposal not suffice for a real attack on India itself, they would do for Persia."

All this culminated when on July 24 1905 he persuaded the Tsar to sign the Treaty of Björko, a secret alliance against England which it was his hope would afterwards be joined by France. This is the kind of method by which he professed to be guarding the peace of Europe. The judgment of King Edward made to a Danish diplomatist may be recalled: "I will admit this, that with a man of so impulsive a temperament as the German Emperor at the head of the greatest Power in Europe, anything may happen." This correspondence was secret, but in diplomacy there is no absolute secrecy, and the rumours of it must be taken into account if we are to understand the profound distrust which was felt for Germany during these years.

Franco-British Entente.—These were the circumstances in which a great change of policy took place. The first step was the British alliance with Japan. In this it had originally been contemplated that Germany should be a partner. But Germany did not accept the opportunity offered her, and, in addition, German action over the Manchurian agreement showed that no confidence could be placed in any German engagement. The alliance therefore was one between Japan and Great Britain alone. In 1904 a colonial agreement was reached between England and France, by which the numerous points of friction between the two countries were settled. The essence was that France recognized the British position in Egypt. To do so was a bitter blow to most cherished French traditions and ambitions. In return for this Great Britain recognized the special position of France in Morocco and gave up to France her claims and interests. This agreement in its original inception had, at any rate in England, no special point directed against Germany. It was probably due chiefly to Lord Cromer; but his efforts were supported by Lord Lansdowne and King Edward VII. The object was merely to clear away the outstanding causes of controversy with France, but it was to have far-reaching results.

This agreement was quite unexpected and very unwelcome in Berlin. The whole basis of German diplomacy was cut away

Europe at once took on a new aspect. In the ordinary diplomatic negotiations Germany must look forward to a situation in which she was confronted no longer by disunited and antagonistic States, but by great Powers, acting in union and coöperation. Even the Triple Alliance itself was shaken, for it was obvious that Italy could not be depended upon in any serious conflict with both France and England. It must therefore be the chief object of German diplomacy to drive a wedge between England and France. For this reason, from this time onwards, every diplomatic incident, even of minor importance, at once reverberated throughout the whole of Europe. This is illustrated by the Morocco affair. Morocco was of great importance to France; it was essential to England that no hostile Power should be established on the north-western coast of Africa; apart from this, Morocco was merely of trivial importance to the rest of the world, including Germany. But Morocco was made the test of the Entente. Germany, taking advantage of the temporary crippling of Russia by her military and naval defeat in the Far East and the internal disturbances which followed, brought the full weight of her military superiority to bear upon France, and thereby forced her into a conference and brought about the resignation of Delcassé. This action defeated its own object. It cemented the union between France and Great Britain, and as soon as it became obvious that France, by entering into this union, exposed herself to the threat of war, it was inevitable that England should take steps, if necessary, to protect her new friend. It was the threats by Germany which gave a military side to what had at first been merely a diplomatic arrangement.

No doubt the French handling of the whole matter was open to criticism, but there was a peculiarity about the arrangement of 1904 which placed Great Britain in a delicate position. As was pointed out at the time in France, England, while she gained definite and defined rights which France surrendered to her in Egypt, gave in exchange only eventual rights in Morocco; France, in return for a definite surrender, got nothing but hopes; England acquired Egypt, France merely the prospect of acquiring Morocco. In these circumstances there was obviously an absolute obligation on Great Britain to see to it that her support of France in Morocco should not be half-hearted; had this support been withdrawn simply because some of the subsequent details of French action were open to criticism, then the worst possible construction might have been placed on the good faith of the British Government; it would have appeared that, after having secured themselves in Egypt, they had seized on a subterfuge so as to avoid carrying out their side of the agreement.

Anglo-Russian Entente.—Not only did the German attempt to separate Russia from France fail, but in 1907 an arrangement was made by which the outstanding points of difference between Great Britain and Russia in Tibet, Afghanistan and Persia were settled. The approximation between the two empires, which had for so long been in a state of complete rivalry, was cemented by a meeting between King Edward VII. and the Tsar, which took place at Revel in June 1908. The chief and almost only subject of discussion was the state of affairs in the Balkans, and it was agreed that there should be common action for bringing about a reform in Macedonia. Very misleading statements with regard to these conversations have been constantly repeated by high authorities in Germany, as, for instance, that the definite understanding was arrived at that the two Powers should attack Germany together in the year 1916. There is no truth of any kind in this. The meeting was followed shortly (Aug. 12) by one between King Edward and the Austrian Emperor at Ischl. This also has been the subject of equally erroneous statements, as, for instance, that King Edward tried to persuade the Emperor to secede from the alliance with Germany. This is quite untrue, and was not in accordance with the principles of British policy. The subjects of discussion were very different. The Austrian Emperor gave an undertaking that his Government would not take any isolated action in the Balkans without informing and consulting the other Powers, and the King tried to induce him to use his influence to dissuade Germany from continuing the increase of the German fleet. The whole object was the maintenance of peace, and much would have been done to secure this if a stoppage could be put to the rivalry in shipbuilding between England and Germany, and if no surprise action was taken in the Balkans.

The Annexation Crisis, 1908.—It was the contrast between the language used by the Emperor Francis Joseph on this occasion and the action of Austria in the sudden annexation of Bosnia and Herzegovina eight weeks later which explains the intensity of feeling shown by the British Government and Sir Edward Grey as to the latter point. Apart from this and the general principle of the sanctity of treaties, they foresaw how dangerous would be the effect of the joint Bulgarian and Austro-Hungarian action upon public opinion in Turkey. It was the annexation which more than anything else brought to a head the passionate national feeling among Christians and Moslems to which all the wars which followed were due, and the conclusion of the crisis was reached in such a way as to leave the most intense animosity in Serbia against Austria, and to insure that the full support of Russia would be given to Serbia and that henceforward the Balkans would once more become the field for the activities of Russian diplomacy, which had never been scrupulous in the methods which it used.

The episode is important, for in it is to be found the explanation of much which happened in 1914. Just when it seemed as though the very prolonged and acrimonious controversy might be reaching a conclusion, Count Pourtalès, the German ambassador, delivered to M. Isvolsky "a peremptory demand" that Russia should without conditions agree to the abrogation of Article 25 of the Treaty of Berlin, that is, should recognize the annexation. It would no doubt be wrong to speak of this as an ultimatum; there was no threat of war; it may be described rather as a diplomatic ultimatum; an immediate decision was asked for, and it was intimated that, if the answer was unfavourable, Germany would "*lâcher l'Autriche sur la Serbie.*" It is important to understand what this threat—for it was a threat—implied. A war between Austria and Serbia would have placed Russia in a most disadvantageous position; weakened as she was, she could not have come to the help of Serbia, because under the system of alliances Germany would, if necessary, come to the help of Austria. It was in fact a threat that, if the demand was not complied with, Austria, depending upon the ultimate support of the German army, should be given *carte blanche* to free herself of Serbian opposition. It may be added that Germany showed some disposition to use a similar threat to England. Before this, Russian resistance collapsed; they agreed to the German demand without even consulting France and Great Britain. The success was a notable one, but it was dangerous. It was one which could not be repeated. Russia had given way to threats once; she could not afford to do so a second time. It left an intense feeling of indignation in St. Petersburg, which persisted, and became one of the most dangerous factors in the European situation. Personally M. Isvolsky, who soon resigned the post of Foreign Minister, henceforward became the active partisan of an anti-Austrian policy, and was only anxious to revenge himself for the humiliation which had been placed upon him first by Count Aehrenthal and secondly by Germany. The German Government, it is true, did their best to smooth away the impression caused by the harshness of their action, and, after having shown Russia how little the Entente was able to defend her against the Triple Alliance, attempted to win Russian friendship. But the effect of these efforts was obliterated by the German Emperor, who, in a visit to Vienna in the autumn of 1910, took occasion to recall how he had come to the help of his ally "in shining armour."

Agadir.—The annexation crisis had occurred at a moment when the relations between France and Germany were comparatively friendly; an attempt had been made at establishing economic and financial coöperation in Morocco. An awkward episode (the German consul at Casablanca was inducing soldiers of the Foreign Legion to desert and was arrested) was settled by arbitration. But this coöperation did not last long. The ambitions of the Colonial party in Germany could not be reconciled with the complete political control which France aimed at. A new and very serious crisis arose in 1911. The French, in consequence of a civil war in Morocco, followed by the abdication of the Sultan, advanced to Fez. This appeared to show a desire to disregard obligations of the Convention of Algeciras. Germany, in order to support her claim to be consulted, took a step which, as so often happened, could be interpreted as a threat. She sent a small ship-of-war to Agadir. It was of course assumed, not only abroad but in Germany itself, that this action meant that the German Government proposed to claim part of the western coast of Morocco and were even intending to land troops in order to enforce this claim. It seems probable that the German Government themselves had not at the moment really made up their minds precisely what they wanted. The obvious answer to this German move would have been the dispatch of a French or British warship—a policy which was strongly pressed by some of the French. The combined wisdom and moderation of the British and French Governments prevented them answering a threat by a threat, but the renewal of the old methods, the clear intention of once more forcing France into separate conversations without England and thereby extorting unwelcome concessions, could not be overlooked. A final understanding between France and Germany would have been welcomed by the British Government, but they could not stand aside and see France forced under the threat of war to cede to Germany either a position in Morocco itself or quite excessive cessions elsewhere. In a speech at the Mansion House on July 21, Mr. Lloyd George, then Chancellor of the Exchequer, said:—

> "I conceive that nothing would justify a disturbance of international good-will except questions of the gravest national moment. But if a situation were to be forced upon us in which peace could only be preserved by the surrender of the great and beneficent position Britain has won by centuries of heroism and achievement—by allowing Britain to be treated, where her interests are vitally affected, as if she were of no account in the cabinet of nations—then I say emphatically that peace at that price would be a humiliation intolerable for a great country like ours to endure."

Shortly afterwards separate conversations were begun between Germany and France on the basis that Germany would agree to disinterest herself in Morocco completely, receiving in return territorial concessions in other parts of Africa. There were many anxious moments, for some of the German demands were excessive, but eventually an agreement was reached by which France surrendered to Germany important parts of her possessions on the Congo. As in the previous Morocco discussions, the importance of the episode lay not so much in the immediate question at issue as in the attempt of Germany to separate England and France and to intimidate France. As before, this had the natural result of strengthening the union between France and England, and taking a stage further the military and naval accompaniments of this agreement.

Great Britain and Germany, 1909–14.—The final settlement of the Moroccan question led to an improvement in the relations between Great Britain and Germany. One of the first acts of Bethmann Hollweg, who on the resignation of Prince Bülow became Chancellor in 1909, had been to make proposals which might bring about an amelioration of the relations between Germany and England, and for the next four years conversations with this object continued. The negotiations turned on two points: (1) a naval arrangement, the object of which would be to prevent the two countries continuing on an unlimited rivalry of armaments; (2) a general political understanding by which each country should be assured that the other would not join in attacking it in case of war. From 1909 to 1911 the discussions took the form of conversations of the ordinary diplomatic nature, interspersed with public speeches in the two Parliaments. They were broken off in the summer of 1911 owing to the Agadir difficulty, but after that had been surmounted, were resumed at the beginning of 1912, when on Feb. 9 Lord Haldane was, in consequence of a suggestion from Germany, sent on a special mission to Berlin. On neither point did these negotiations lead to any definite result. As to the naval agreement it seems clear that Bethmann Hollweg would have welcomed it, but that his support was not strong enough against the opposition of Tirpitz and the Emperor. The proposals for a general political agreement broke down because, as soon as a precise formula was put forward, it appeared that Germany would not be satisfied with any arrangements except one which would be so worded as to imply that Great Britain would be debarred from coming to the assistance of France if she were attacked. Anything of this nature was of course out of the question, for, as Sir Edward Grey said on Nov. 27 1911, "one does not make new friendships worth having by deserting old ones." What Lord Haldane suggested was a statement that: "England declares that she will neither make nor join in any unprovoked attack upon Germany. Aggression upon Germany is not the subject and forms no part of any treaty, understanding or convention to which England is now a party, nor will she become a party to anything which has such an object." What Germany asked for was a statement that: "If either of the high contracting parties becomes entangled in war with one or more Powers, the other party will at least observe toward the Power so entangled benevolent neutrality, and will use its utmost endeavour for the localization of the conflict." This, of course, could not be accepted. None the less, the very fact that this attempt had been made, though it failed, left the relations between the two Governments more cordial; even more important was the practical illustration afforded by the subsequent Balkan troubles as to the importance of coöperation between them. Everything tended to show that the peace of Europe could be maintained if Germany and Great Britain, while each maintaining full loyalty to its own associates, were willing, when any difficulty arose, to communicate frankly and freely with one another and to discuss the best method of settlement. By this means the two alliances might cease from their rivalry and gradually be merged in a general concert. This was a system which Sir Edward Grey deliberately adopted; the whole handling of political difficulties was based upon this, and so long as Germany acted in a similar spirit things went well. When the World War ultimately broke out, it was because Germany, in a very grave crisis, ceased this coöperation and in profound secrecy made herself the associate of schemes the success of which would have been most detrimental to one of the partners in the Triple Entente. Meanwhile, during 1913 and the first half of 1914, negotiations were begun and carried through to a successful issue by which the two chief outstanding points of controversy were in fact removed. A settlement was at last brought about with regard to the Bagdad railway and the reversion of the Portuguese colonies in Africa.

The situation in Germany was, of course, the subject of the most careful study by those who were responsible for directing British policy. Opinions were much divided in England; there was even a belief, which was probably well founded, that neither Herr von Bethmann Hollweg nor Herr von Jagow desired anything but the best relations. On the other hand, it must remain a matter of comparative indifference whether in any particular year the German administration then in office was well disposed. Their position was at the best very precarious. All information, both from public and confidential sources, showed that a very large section of educated German public opinion was animated by feelings of intense animosity against England, and although this party was at the moment in opposition to the Government, at any time they might come into office, all the more because of the very unreliable character of the Emperor, of whom the only thing that could be said with certainty was that no one could foresee what he would do. Moreover, there was another factor to be kept in mind. Good relations between Great Britain and Germany might be valued, not for their own sake, but merely as a device for separating Great Britain from her associates. It was an obvious policy to encourage a spirit of conciliation, so that if there was a serious conflict with Russia, English public opinion would refuse support to Russia. To put it brutally, Germany had no reasons to fear a war if England stood out; according to all instructed German expectations the crisis of any great European war would be over in the first two months. All that was necessary then was to secure that England should remain neutral during the first stage; if once the essential victory in France were secured, then nothing else really mattered. Germany would quite well be able to acquiesce in an interference of Great Britain at a later stage, for, though this might be used to moderate the claims of the victors, it would not eliminate the fact of the victory. It was the consciousness of this which made it absolutely necessary that every advance to Germany should be accompanied by the clearest and most public intimation that the union of the Entente was not thereby weakened. So we get the key to British policy: the maintenance of the two alliances, but the frank and friendly discussion between Great Britain and Germany on each point of difference as it arose.

This was a policy which required great skill, firmness and a cool head. For this reason, in the very critical circumstances, the direction of British policy was kept to a large extent in the hands of a small group—Sir Edward Grey, Mr. Asquith and Lord Haldane; just as it had been recognized that foreign policy should be kept out of the ordinary party conflict, so it became necessary not to allow vacillation to arise from the conflict of opposed groups in the Cabinet. It was, as subsequent events were to show, a misfortune that some of the other countries concerned were not guided with equal skill and firmness.

Austria and the Balkans.—It is not in the stronger but in the weaker states that the occasions for war arise—not in Germany, France and England, but in Russia, Turkey and Austria-Hungary; for when a Government is weak, popular passions have their way, and the best plans of the wisest statesmen may be frustrated. As the long reign of the aged Emperor Francis Joseph of Austria was nearing its end, the whole internal fabric of his empire was growing out of joint, and there was neither purpose, skill, nor foresight to remedy this. As will often happen in such circumstances, there were many who hoped to find in a spirited foreign policy an escape from internal difficulties. One party, reverting to the older Austrian traditions, looked to a war with Italy, for it was a peculiarity of the situation that, while Italy and Austria were allies, they were always arming and intriguing against one another, and the Government of Trieste, by its strongly anti-Italian acts, fomented the spirit of irredentism which had only for a time been suppressed during the first years of the Triple Alliance. But it was the Slav problem which presented the greatest difficulty, and this had both its internal and its external aspect. At home the settlement of 1868 had given to Germans and Magyars constitutional predominance in the Dual Monarchy which was not justified by their numerical proportion. The strong Slav spirit found expression in the growing ambitions of the Czechs, while the southern Slavs, Croats and Serbs alike were in open opposition to the misgovernment of Budapest. At the same time the Magyars, with singular blindness, refused to take any steps to remedy the just grievances of the Rumans of Transylvania. This national discontent when suppressed at home naturally turned for help abroad, and the internal dislocation of the Habsburg Monarchy became involved in the Balkan troubles. From 1894 there had been a cessation of the secular rivalry of Austria and Russia; Russia was occupied with her Far Eastern schemes, and the two empires had agreed on the maintenance of the *status quo*, an agreement which was cemented and continued at Mürzteg in 1897. The Austrian position in the Balkans depended upon the alliance with Rumania and an important understanding with Serbia, which had become almost a client state of Austria. The mutual hostility between Serbia and Bulgaria, Bulgaria and Greece, ensured the continued equilibrium. In order to maintain this state of things, the Austrian Government did not scruple to condone, if it did not actually encourage, the assassination of King Alexander of Serbia. But this instrument they lost by the foolish attack upon Serbian commercial prosperity, the beginning of a definite and final rupture, which, as we have seen, led to and was aggravated by the annexations. From this time it was the one object of the Serbian nation to achieve its expansion at the expense of Austria. To Russia the discontent of the southern Slavs of the monarchy was a welcome weapon. In the rivalry of the two empires a new stage had been introduced. Russia, by fomenting Serbian intrigues, might hope to strike a blow at the very existence of the Habsburg Monarchy itself. There was only one method of meeting this, and that was internal reconstruction. This was said to be the object of the heir to the throne, but, in view of the obstinate resistance to be expected from Hungary, nothing could be done during the lifetime of the old Emperor.

This was the state of things when a new and quite unforeseen evolution began in the Balkans.

The Balkan Wars.—It had long been agreed that to Italy should fall the reversion of Tripoli. The increasing disorder of the Turkish Empire, the obvious failure of the Young Turks to establish an orderly and civilized government, made it appear that the time for action had come. In Sept. 1911, at the very crisis of the Agadir incident, without previous warning the Italian Government presented an ultimatum to Turkey, and three days later, on Sept. 29, declared war. On Oct. 4 an Italian force landed in Tripoli, which, during the next months, was occupied with the very difficult task of subduing the resistance both of the Arab population and of the Turkish troops. A full year was in fact to pass before, by the victory of Sidi Bibal, the kernel of the resistance was overcome. Meanwhile, in order to force the Turkish Government to agree to a cession of the province, the Italian fleet in Feb. 1912 appeared before Beirut, and in May occupied Rhodes and the islands of the Dodecanese. It was clear that an Italian attack on Turkey in the Aegean would arouse the hopes and ambitions of the Balkan States themselves. There were abundant causes of trouble. The Young Turks had no more succeeded in bringing peace and order into Thrace and Macedonia than had the Government of 'Abdul Hamid; the religious rivalry, the exploits of the Comitadji, the massacres and ravages by the Turks, continued in this unhappy country, and it seemed as though it were becoming the declared policy of the Turkish Government to remove the Macedonian difficulty by the extermination of the inhabitants. Experience had shown them that no serious help would come from the Great Powers, who, fearful of the consequences of Balkan troubles, adhered with what we may call unintelligent obstinacy to the doctrine of the *status quo*. If anything was to be done, the Christian States must do it themselves. In Feb. 1912 negotiations were begun under the deepest secrecy between Serbia and Bulgaria, and on March 13 there was signed a treaty of friendship and alliance, by which the two kingdoms mutually guaranteed to one another their political independence and the integrity of their territory, and agreed to support one another with all their forces if either were attacked by one or more states. More than this, they agreed to support one another if any of the Great Powers attempted to occupy any part of the Balkans which was at present under Turkish dominion, a clause which was obviously directed against Austria. This treaty was accompanied by a secret additional treaty and a military convention; the first of these was in fact in the nature of an offensive alliance against Turkey and was followed by detailed arrangements as to the disposal of any Turkish territory which might be acquired. The treaty was to be communicated to Russia, and all matters undetermined in the treaty were to be settled by the arbitrament of Russia. The military convention determined precisely the nature and character of the help to be given in the case of a war with Turkey or with Austria or Rumania. This treaty was in accordance with the agreement submitted to the Russian Government, but they did not communicate it to their allies. It was followed in May by a similar treaty between Greece and Bulgaria, the initiative to which was to a large extent given by Mr. J. D. Bourchier, the well-known correspondent of *The Times*. The whole scheme was one unparalleled in recent years; the Balkan States, so long the clients and the playthings of the Great Powers, had at last agreed on that which no one who knew their mutual animosities had believed possible: they had joined together to free their co-religionists from the Turks and if necessary to protect the Balkans against the external aggression of any Great Power.

The action prefigured in the treaties was hastened by the conclusion of the war between Turkey and Italy; negotiations were entered into during the month of August and were brought to a conclusion by the Treaty of Lausanne signed on Oct. 18, by which Turkey surrendered Tripoli to Italy, the future of the Aegean

Is. being reserved for later arbitration. It was necessary, if the attack on Turkey were to be made, that it should take place at once so as not to leave time for preparation. On Oct. 8 Montenegro declared war; on the 13th the three other allied states presented an ultimatum demanding the immediate grant of autonomy to Macedonia; on the 14th the population of Crete declared themselves independent of Turkey, and formally joined Greece; and on the 17th the declaration of war was sent.

These events seem to have been carried out without the privity of any of the Powers except Russia, and were equally unwelcome to all—to the Entente as much as to the Triple Alliance. At the last moment a hasty and ill-advised scheme was put forward by the joint action of Austria and France for localizing, if not preventing, the impending hostilities; the united Great Powers of Europe declared that in the event of hostilities they would not permit any alteration of the territorial status. At least German opinion seems to have anticipated rapid success for the Turks, a success which would have been welcome to them; they were speedily disappointed and disillusioned. Before the end of the month the Turkish army had been defeated and routed by the Bulgarians in the two great battles of Kirk-Kilisse and Lule-Burgas; the Serbians had overrun the whole of Macedonia, the Turkish force opposed to them fleeing in panic and disorder. The Greeks, advancing from the south, occupied southern Albania and also quickly made their way to Salonika. Within a month the Turkish rule in the Balkans had come to an end; there was left to them only Constantinople and parts of Thrace. The Bulgarians advanced rapidly towards the capital; it was for the moment their dream that it would be a Bulgarian army which would rescue San Sofia from the Moslems, and Ferdinand hoped that the day was approaching when he would ride as a conqueror into the streets of Constantinople. They were disappointed. In a series of battles, Nov. 17–22, the Bulgarian assault on the lines of Chatalja failed; cholera made its appearance in the army and on Dec. 3 an armistice was concluded.

It remained for Europe to determine its attitude towards these unexpected events. The danger was extreme that the Balkan might become a European war.

The Austrian Government was determined to put a barrier to Serbian ambition. The arrangements with Bulgaria were based on the assumption that Serbia should gain her reward by the annexation of the northern part of Albania and should thereby obtain access to the Adriatic. This Austria would not permit. She did not wish to see a Slavonic State having access to a sea which she looked upon as her own. In this matter she could depend upon Italian support. Austrian troops were mobilized; garrisons in Herzegovina were placed upon a war footing, and the situation was aggravated by numerous personal incidents, as for instance by stories which were put about that the Serbians had imprisoned and ill-treated an Austrian consul. War between Austria and Serbia was imminent, but if it broke out Serbia would be supported by Russia, and in answer to Austrian military preparations, Russian troops on the south-western frontier were placed on a war footing. A war between Austria and Russia would, in consequence of the complicated system of alliances, inevitably bring in Germany and France, and thereby bring about the great struggle which everyone wished to avoid. The danger was averted by France, Great Britain and Germany, who worked together to bring about conciliation. It had been arranged that, side by side with the peace negotiations which were taking place in St. James's Palace, the ambassadors of the Great Powers in London should sit in conference under the presidency of Sir Edward Grey. It was agreed that France and Great Britain should give their support to Austria, and that Albania should be set up as an independent state. This removed the essential point of controversy, and in February the Austrian Emperor sent Prince Hohenlohe on a special mission with a letter to the Tsar. It was agreed that the two Powers should demobilize, and from this time the extreme friction began to diminish. But the refusal of Serbian access to the Adriatic was to have unexpected results. It cut away the basis on which the division of the spoil had been arranged between the Balkan States. The Serbian Government therefore demanded a larger portion of Macedonia than had been originally assigned to her. They based this claim also on the point that Bulgaria had not provided her due share of forces to fight in the western area, while Serbia had contributed more than she was bound in the struggle for Adrianople. Under these circumstances an appeal to the Tsar to arbitrate was enjoined. But before he had even received the appeal, a catastrophe took place. The old animosity against Bulgaria, which had been for so many hundreds of years traditional among the Greeks and Serbians, was again growing. The armies were in Macedonia still in closely adjacent quarters. The Bulgarian Government, under what influence we do not know, determined on a sudden blow, and on June 29 an attack in form was delivered by the Bulgarians against the Serbian forces. Immediately afterwards the Greeks in Salonika attacked the Bulgarians. This new fratricidal war had scarcely begun when two new champions entered the field. The Turks denounced the armistice and a fortnight later retook Adrianople. On July 18 Rumania, with a fresh army, entered the field, declared war on Bulgaria, and occupied the Dobruja. Before this great superiority of force the Bulgarians, who had lost so heavily in the war—the dead alone were 30,000—had no course open but to capitulate. On the demand of Rumania a conference was summoned to Bucharest, which on July 30 arranged an armistice, and on Aug. 11 the Peace of Bucharest was signed. By this Bulgaria had to surrender to Serbia the whole of Macedonia, to Greece a large part of the northern shore of the Aegean, while to Turkey she had to restore Adrianople and to Rumania to surrender the Dobruja.

The situation left by the Treaty of Bucharest was very precarious. It was obvious that Bulgaria would not willingly acquiesce in the loss of territory and prestige. The mutual animosity between Serbia and Austria continued, and the Prince of Wied did not show himself capable of coping with the very serious difficulties in Albania. There were acute differences between Turkey and Greece, and the renewal of war seemed imminent. But these mere local complications could doubtless have been overcome so long as no one of the Great Powers intervened; separate action by any one of them must almost inevitably bring about the great trial of strength between the rival alliances. It was the object of every responsible statesman to prevent this arising. The immediate danger arose from Austria and Russia. Austrian policy was inclined towards Bulgaria and desired to see the Treaty of Bucharest overthrown. In the summer of 1913 they proposed an immediate attack on Serbia; in this they did not have the support of Berlin. The German Government was clearly dissatisfied with the Austrian handling of the Serbian difficulty, and also with the unneccesary harshness with which the Hungarians treated the Rumans. They rightly saw that an amelioration of the position must be found in an internal reform of the Dual Monarchy. On the other hand, German ambitions were becoming a serious danger. Count Wangenheim, who had succeeded Marschall von Bieberstein as ambassador to the Porte, was with great assurance strengthening the German control at Constantinople. This was a development which Russia could not regard with equanimity. A crisis was reached during the winter, when Gen. Liman von Sanders was not only appointed to reorganize the Turkish army, but was given actual control over the army corps stationed in Constantinople. This led to a strong protest from Russia, and was followed by very violent press polemics between Germany and Russia. It is clear that Russia was becoming impatient. It looked as though Germany, with the conclusion of the Bagdad agreement, and in other ways, would gain complete control over Turkey, military, political and economic. This, if achieved, would be a formidable impediment to the ultimate realization of what had for so long been the permanent object of Russian policy—not only the opening of the Straits but the control of Constantinople. In February, as we now know, the situation was reviewed; it was agreed that these hopes could only be achieved as the result of a European war, and that it was necessary to prepare the scheme for landing troops on the Bosporus if the contingency arose. Russia did not take her allies into her confidence. The most serious element in the situation was that, more and more, the old rivalry between Austria and Russia, which had always been found manageable, was giving place to a direct conflict of interests between Russia and Germany herself. So long as Austria alone was concerned, it could be hoped that Germany, who had no desire to embark on a European war merely in defence of the local Austrian interests, would intervene in some way or another and join with England in keeping the peace. So soon as the direct ambitions of Germany herself were involved, this security was removed. Moreover, the commercial treaty made between Russia and Germany in 1892 was running out; Germany had succeeded in imposing upon Russia conditions which subordinated Russian interests to those of Germany. Any negotiations for the renewal of the treaty must certainly react on the political situation. Already the very anticipation of this had aroused all the strong national spirit in both empires. The Russians in particular were determined not to anticipate a renewal of the humiliating position in which they had so long been placed.

The preceding narrative will have shown how complex was the diplomatic situation. But after all, this was nothing new in the history of Europe, and the points at issue in almost every case concerned not the vital security of any one of the Great Powers, but rather the external extension of their power and influence. It might therefore well have been hoped that, with prudence and self-restraint on the part of the leading statesmen, peace might be kept. Experience showed that a solution could be found for each particular problem as it came up, either by separate negotiations between the interested Powers, or by substituting for the mutual rivalry of two hostile groups common action of the Concert of Europe. This was the principle by which Sir Edward Grey was always guided, and it was his hope that in it he might have the support of the German Government. It was a policy which could only be successful if it was accompanied by a frank recognition of the existing facts, with the avoidance of subterranean intrigues.

The Rivalry in Armaments.—So long then as England could depend on German coöperation, war might well have been avoided had the trouble been merely diplomatic. There were, however, other elements. Diplomatic controversy was accompanied by the rivalry in armaments. European Ministers of War were ceaselessly occupied in perfecting the armies. The continued expansion of German population enabled this to be done within the limits of the Law of 1871, which determined that the strength of the army on its peace footing should be 1% of the population. In 1893, by reducing the term of service from three to two years, the number of trained men was increased by nearly 50% without any increase in the peace establishment. Further increases in the peace establishment were made in 1899, in 1905 and in 1911. In 1912, after Agadir, the establishment was raised to 723,000. The Balkan wars, ending as they did in the collapse of Turkey and the increased power of Serbia, were made the reason for a still further addition. The peace strength was raised to 870,000 men, and to meet the extraordinary charges involved in this the Government had recourse to the dangerous expedient of a capital levy of £50,000,000. Each of these laws was of course answered in France and in Russia, and in 1913 France, always confronted by the fundamental disadvantage of her smaller population, had no resource except to raise the period of compulsory service with the colours from two to three years. It was obvious that this state of things could not continue. The strain on the finances and on the manhood of the nations was becoming overwhelming. But when it was proposed that the limitation of armaments should be discussed at the Hague Conference in 1907, it was Germany who answered that she could take no part in any conference where this matter was on the agenda. At the same time the general staffs were planning in detail every step in the campaign. To Germany the "war on two fronts" had become a household conception. All the details were worked out by Schlieffen—the instantaneous blow on France which must be delivered and carried through before the more slow-moving Russian battalions were on their way. But if this blow was to be successful it must be delivered not on the guarded frontier to the east, but across Belgium. And so all the preparations were made, the lines were built, military camps established, the dislocation plans worked out. This could not be hidden. France had to devise her counter-moves to the opening gambit. If the war began with an unprovoked attack by Germany, then the French hoped they would not be alone; they could depend on the coöperation of Great Britain and Russia. But this coöperation would be futile unless it had been planned in advance. The safety of France would depend upon the promptitude of her allies. The mobilization of Germany would be almost instantaneous. That of Russia must be accelerated, and every detail be prepared for placing the army on the frontier at the earliest moment. Hence we get the building of strategic railways in Poland and a great reorganization of the army. But this again was represented in Germany as a menace, which was made a reason for further increases in the German army. The effect was felt even in the most unmilitary of nations. Belgium, whose security was once more threatened, had to introduce compulsory military service, and Great Britain could not stand out. The war when it came would not move with the deliberation of the great collisions of earlier days when it was sufficient for Great Britain to begin to collect an army after the first shot had been fired. Whatever the course of events might be, one thing was clear to everyone—the result would be determined to a large extent during the first six weeks. If, as seemed probable, the war began with the German invasion of Belgium, then British troops must be there to protect the soil of Belgium and of France. Therefore, as early as 1906, Sir Henry Campbell-Bannerman approved the conception of conversations between the general staffs to discuss the forms of coöperation in the event of war. But if this coöperation was to be effective, the British army must be ready. And so a great reorganization took place, carried through by Lord Haldane as Minister of War, the result of which was that, for the first time in her history, England would at the outbreak of the war be able, if necessity required and the occasion justified it, to place some 150,000 men in the north of France before the first contact took place; in 1912 the agreement as to military conventions was embodied in an interchange of notes between England and France.

German Militarism.—The rivalry in armaments and the inordinate growth of the armies had a double effect. It directly influenced the diplomatic discussions. Neither side could avoid the apprehension that their opponents might be deliberately intending to force the issue; as soon as this apprehension arose, then military preparations must begin, even while diplomatic discussion was continuing; but the very suggestion of this would at once bring the general staffs into the discussion. They, intent only on ensuring that, if there was to be war, nothing should be left undone which would secure victory, might easily divert the negotiations which normally had as their object the avoidance of war, and substitute the object of bringing about war at a favourable moment and under favourable auspices. Much therefore depended on the submission of the military to the political element. This was completely secured in those western democratic states in which the control over the Government lay in the hands of Parliament; the situation was less favourable in the three eastern monarchies—in Russia, where a weak ruler and an incompetent and dishonest bureaucracy were struggling against the rising forces of revolution; in Austria, where conflict of nationalities threatened the very existence of the state; in Germany, where it was the official doctrine taught by Bismarck, the theme of every speech of the Kaiser, that the power, the influence and the existence of the nation were based upon the army. The world was never allowed to forget that if Germany was now the greatest Power in Europe, it was because the German army had marched to Paris in 1870, and, if necessity arose, could do so again; and the German people were never allowed to forget that it was the Prussian army by which German unity had been achieved, and it was on the army, carried out with the spirit of and trained by Prussian officers, that the existing constitution depended. The influence of the German Emperor ultimately depended on the prestige which he had inherited, and, if the crisis came, he could only maintain his power by the same methods by which it had been attained.

It was in Germany and Germany alone that organized and official opinion put forward, as the very basis of political life, frank and unabashed, the power of the sword. Historically this could easily be explained, and no nation can free itself from its own past. English opinion, just because it required the maintenance of sea-power, on which the existence of the Empire and the security of the nation depended, was always prompt to recognize the equal necessity to Germany of a strong army. But it could not be obscured that, while in other nations the maintenance of great armaments was regarded as a burden of which they would gladly be freed, in Germany the increase of military power was welcomed as an end in itself. It was not merely a weapon of security, an instrument of Government—it was the basis of the state; the efforts of the pacific writers were not merely criticised on their merits, but condemned as heresy. And this was no mere academic principle—it was made the corner-stone of German diplomacy. Whatever the question at issue might be, always there was heard from Germany the ultimate appeal to the German army. This bred a habit of impatience. Whenever Germany was worsted in diplomacy—and this often happened—there were many who would cry out that after all there were other means by which she could secure the victory.

Every increase in German armaments required an appeal to the patriotism of the people. These appeals could not be made without arousing a dangerous spirit. The German Government had been glad to secure the support of the newly formed *Flottenverein* for their great naval programme; its emissaries found their way into every town and village in the country, and the literature they disseminated necessarily encouraged hostility to Great Britain. The Pan-German League openly advocated a policy which would have involved Germany in war with every country in the world, but the rising spirit of Chauvinism had spread far more widely, and the very fact that it was criticised by the Socialists tended to make sympathy with it the hallmark of a "good German." The Government, which depended for the naval and military votes on the spirit of militant patriotism, found that they had aroused a force which they could not, even if they would, control. During the year 1913 the centenary celebrations of the great events by which Germany freed herself from the Napoleonic yoke added fuel to the flame. Inspired by the intense consciousness of Germanic superiority, the Germans were ready, when the time came, to emulate in war, as they had surpassed in peace, the deeds of their forefathers.

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For the growth of the German navy see Archibald Hurd, *The Command of the Sea* (1912); for Austria-Hungary: H. Wickham Steed, *The Growth of the Habsburg Monarchy* (4th ed., 1919); Dr. Seton-Watson, *The Southern Slav Question and the Habsburg Monarchy* (1911); for Morocco: Caillaux, *Agadir* (1919); Tardieu, *La Conférence d'Algeciras* (1907); E. D. Morel, *Morocco in Diplomacy* (1912, republished as *Ten Years of Secret Diplomacy*, 1920); *Documents Diplomatiques: Affaires du Maroc* (1912). (J. W. H.-M.)

THE OUTBREAK OF WAR

The Murder of the Austrian Archduke.—The preceding pages of this article describe the state of Europe when, on Sunday, June 28, the Archduke Franz Ferdinand, the heir to the Austrian throne, and his wife, while on an official tour of inspection in Bosnia and Herzegovina, were murdered at Serajevo, the capital. The two assassins were young men of 20 years of age, natives of Bosnia and therefore Austrian subjects. Such evidence as is available seems to show that the motive for the crime must be traced to the intense racial animosity which had existed in Bosnia since the time of the annexation, increased as it was by the growing discontent in Croatia, and by the rising tide of aggressive nationalism in Serbia; no evidence has been forthcoming which would compromise any responsible Serbian officials, still less the Serbian Government itself. Among the accomplices were indeed two residents of Serbia, a major named Jankasitch and a Croatian exile, Tziganovitch, the first being a Comitadji chief, the second a temporary railway clerk. All the other accomplices seem to have been Bosnians. The two assassins were eventually condemned to penal servitude; of the accomplices three were executed. This crime created a great sensation. It happened at the time of the German festivities at Kiel, associated with the completion of the enlargement of the canal, at which a British squadron was present. They were at once broken off. The German Emperor returned to Berlin. He intended to go to Vienna to attend the funeral of the Archduke, and at the same time to discuss the political situation with his ally; this project was abandoned, for the police had intelligence of a great plot; twelve assassins were on their way to Vienna.

Elsewhere, except among the comparatively few who really understood how precarious was the position in the Balkans, it was the personal aspect of this event which attracted attention. The general feeling was one of deepest indignation, and of the warmest sympathy for Austria and for the aged Emperor, Francis Joseph, whose life had already been so full of tragedy. In Austria it was regarded as a grave political portent. The death of the Archduke seems to have been treated in the highest quarters with remarkable equanimity, but the crime which was no isolated act was looked on as a blow at the very existence of the monarchy. The relations with Serbia had for long been the cause of grave disquiet, internal as well as external. There had in fact just been drawn up a very important Austrian memorandum for communication to the German Government; in it the Balkan situation was discussed, and stress was laid on the scheme attributed to Russia of creating a new Balkan league, which was to include Rumania and be used as an offensive weapon against the Triple Alliance. In this scheme the disaffection in Bosnia and Croatia, which was fermented by the agitation from Serbia, would be a dangerous instrument. Against this it had been intended to propose a pro-Austrian anti-Serbian alliance with Bulgaria and Turkey, which could be used also to check the pro-Russian influences in Rumania. Count Berchtold and his colleagues now determined immediately to use this new opportunity so as to rid themselves once and for all of the menace to the monarchy caused by the Yugoslav propaganda; by doing so they would be bringing to an issue, on an occasion favourable to themselves, the great rivalry in the Balkans with Russia.

The policy of Count Berchtold was apparently influenced by three motives: (1) the quite justifiable determination for the punishment of the murderers and their accomplices, together with the prevention of similar acts in the future; (2) the desire to show that the Austro-Hungarian Monarchy was not effete, helpless and incapable of action; (3) to gain a great and permanent political advantage as against Russia. Of these the second seems to have been the most important. There was a general feeling throughout the empire that the Government must show its strength by some strong act, a feeling which was encouraged by the language used by the German ambassador in Vienna: "What Germany looked for was a firm and definite plan of action; if this was forthcoming she would be completely on the side of Austria." But Austria could not take action unless sure beforehand of German support. Count Hoyos was therefore despatched on a special mission to Berlin. He took with him both the memorandum written before the murder and also an autograph letter of the Emperor to the Kaiser of July 2, in which the dangers to Austria of the Serbian agitation for the union of all Southern Slavs under Serbia was pointed out. In view of this the policy of Austria must be the isolation and diminution of Serbia and the suppression of Serbia as a political factor in the Balkans; it was necessary for the peace of Europe that the criminal agitation in Belgrade should not continue with impunity.

The Decision in Berlin.—This letter was delivered personally by Count Szögyény, the Austrian ambassador, on July 5 to the German Emperor, who was due to leave for his annual holiday in the North Sea on July 7. It was during these two days that the decision on which so much was to depend was made. The information available up to the end of 1921 as to the actual course of events in this respect still left much obscure. During the war it was circumstantially reported that a joint council was held between Austrian and German statesmen and soldiers at which a plan of political and military action was decided. It now seems clear, however, that no such formal meeting took place, an omission which has naturally been the subject of hostile criticism in Germany; the very serious diplomatic steps which were to follow ought undoubtedly to have been preceded by a thorough sifting of the whole situation—political, military, naval and economic. The Kaiser, after receiving Count Szögyény and Count Hoyos before he left for Norway, had, as he could not well avoid having, separate conversations with representatives of the army and navy. It is beyond doubt that the final decision was one for which he was immediately and personally responsible. While explaining that he must, of course, consult the Chancellor on a matter of serious European importance, the Count was authorized to inform the Austrian Emperor that in this question he could "depend on the complete support of Germany." "This especially applied to Austrian action against Serbia." "In the Kaiser's opinion there must be no delay. Russia's attitude would certainly be hostile, but he had for years past been prepared for this; if it was to come to a war between Austria-Hungary and Russia she could be convinced that Germany would stand at her side with her usual fidelity. Moreover, Russia, as matters stood, was in no way ready for war, and would certainly consider before appealing to arms." This is confirmed by the diary of Herr Mühlon and the comments on it by Herr Helfferich, from which we can gather that those who had been brought into contact with the Kaiser understood that he was determined that on this occasion there should be no drawing back; his support would be given to Austria, and Austria would be sure that he would continue it to the end; he was especially urgent that Austria should act quickly; delay would increase the risk of a European war.

The Kaiser left Berlin for his visit to Norway, as arranged, on July 7. The official German answer, though more guarded, was in accordance with his language. In it the Chancellor explained that the view of the German Government was that the relations between Austria and Serbia were a matter within the competence of Austria alone; Germany therefore did not propose to claim any right to interfere. What this, of course, meant was that Austria received a free hand to couch her demands on Serbia in such terms as she chose; Germany already knew that they would be such as to make war very probable. But Austria had already been assured that, if this action led to war with Russia, Germany would be at her side. It is noticeable that no advice or warning was given that the demands on Serbia should be so modified as to avoid this danger. On the other hand great attention was given to the diplomatic preparation; everything was to be done to secure for a war with Serbia the support or neutrality of the neighbouring states. With this object the Kaiser, though strongly against his own personal inclination, agreed that the King of Bulgaria should be asked to join the Triple Alliance, and, in view of the great German interests in Turkey, negotiations with the same object should be entered into with the Porte. What above all interested them was the position of Rumania and Italy. The situation in Rumania caused much anxiety, for King Charles let it be known that he would probably not be able to bring the country with him into a war with Russia on the side of the Germanic Powers; all, however, was to be done to strengthen German influences in that country. As to Italy it was agreed that its Government should not be informed beforehand as to the blow which was impending against Serbia, but Germany pressed very strongly that Austria should be prepared to offer to Italy suitable compensation for any gain in territory or political influence in the Balkans which might accrue to her.

Analysis of the objects and motives of the German Government is all the more difficult because, in its political composition, it had no powerful personality such as Bismarck had once been, and its actions were the result of many conflicting influences, while decisions were always liable to be deflected by the impulsive and vacillating character of the Kaiser himself. There was in the first place genuine indignation at the crime of Serajevo, an indignation which in the Kaiser's mind took the characteristic form that there must be coöperation between all monarchical States against elements of disorder. This motive was one which, no doubt, it was hoped when the time came he would use with effect upon the Tsar. Politically there had long been dissatisfaction at Berlin with the conduct of affairs in Austria; the force and decision which were needed in an ally were wanting. It was hoped, therefore, that the opportunity would be used to remedy this defect. But there were further and greater objects which would follow automatically; if Russia could be persuaded to stand aside while Serbia was overrun by the Austrian army, it would become evident that Russian protection was of no avail to Serbia; Serbia would be pushed out of the way, and thereby the Germanic Powers would gain in fact the control of the Balkans and the road to the East. It was an essential part of the scheme that Great Britain and France should be urged to use their influence to keep Russia quiet; if they did not do so then the responsibility for any extension of the war which ensued would seem to attach to them; if they did then the internal harmony of the Triple Entente would be weakened; Russia would feel that she had been deserted by her allies. It was possible that these results might be obtained without a European war. If, however, Russia was determined to meet the challenge and war resulted, it was hoped that matters could be so arranged that the responsibility for the war should appear to fall on Russia and the Entente. The general condition of Europe was very threatening; it seemed probable that under any circumstances the "great war" must ensue shortly; it was believed that Russia would be ready in about two years. If there was to be a war the summer of 1914 seemed on the whole to be favourable to Germany. The Kiel Canal had been enlarged; the army was at the height of efficiency; the diplomatic situation seemed favourable; there were very serious labour troubles in Russia, serious parliamentary disputes in France, and it appeared as if there might soon be open rebellion in Ireland, with possibly something approaching mutiny in the British army. It was indeed impossible to depend on Italy; but if Bulgaria and Turkey could be won over this would counteract the uncertainty of Rumania's action.

German support having been secured, the Austrian Government proceeded to prepare the text of the demands to be presented to Serbia. The great point was that they should be so drafted that they would be unacceptable; the object was not a mere diplomatic victory but war; it was held that nothing would meet the situation and restore the authority and prestige of the monarchy short of an effective display of military strength. It was agreed, however, in consequence of the strong pressure used by Count Tisza, who alone was in opposition to the policy proposed, that the annexation of any part of Serbia, apart from a rectification of the frontier, should be repudiated; on the other hand, it might well be that, as a result of a successful war, portions of Serbia should be assigned to Bulgaria and Albania. The actual drafting of the ultimatum was apparently entrusted to Count Forgach, formerly Austro-Hungarian minister at Belgrade, who had been closely concerned in the concoction and manipulation of the Friedjung forgeries. On July 17, the final draft, having passed the Council of State, received the approval of the Emperor, Francis Joseph, but it was determined to postpone its presentation till July 23; it would be better to delay until M. Poincaré, the French President, who was to visit the northern courts, had left St. Petersburg.

These arrangements were conducted in the greatest secrecy. All that was known outside was that Austria was contemplating some serious action against Serbia; this was naturally sufficient to cause apprehension and anxiety, but, during the days of waiting, the Austrian Government used its influence to damp down the very violent denunciations of Serbia in the Viennese press, and in other ways tried to still the vigilance of the other Powers. As late as July 19 they assured the Russian ambassador in Vienna that nothing dangerous to the peace of Europe was being undertaken, and in consequence he went on a holiday. The British Government and nation, whose attention was preoccupied at the moment with the Irish problem, were inclined to regard the local dispute between Serbia and Austria as not being one in which they were vitally concerned; and Mr. Asquith's Cabinet, which was perhaps not very well informed as to Balkan matters, was late in realizing how imminent was the danger. On July 16, the British ambassador, Sir Maurice de Bunsen, was able to give Sir Edward Grey a warning which was corroborated from unofficial sources. None the less the belief that there would be a real danger of European war was slow in maturing in Great Britain, in spite of the anxiety felt in a few well-informed quarters. This attitude was based on a belief that, after all, the German Government would not support Austria in any reckless policy.

The Austrian Note.—The ultimatum was presented at 6 P.M. on Thursday, July 23, by Baron de Giesl to Dr. Patchou, as M. Pashitch, the Serbian prime minister, was absent from Belgrade. The note had been admirably drawn up to fulfil the avowed object that it should contain demands which could not possibly be complied with. It required that Serbia should first of all officially publish on the front page of the Official Journal a condemnation of the Serbian propaganda against Austria-Hungary, regret for the part taken by Serbian officers and officials in this propaganda, and a promise of amendment in the future. There were in addition ten requirements, which include, among others, the dissolution of "Narodna Obrana," the suppression of any publication which incited to hatred and contempt of the monarchy, the elimination from public instruction in Serbia (including the teaching body) of anything that served as propaganda against Austria-Hungary, the removal from the army and the administration of officers and officials guilty of such propaganda whose names might be communicated by the Austro-Hungarian Government, the collaboration in Serbia of Austro-Hungarian representatives for the suppression of the movement against the territorial integrity of the monarchy, and that Austro-Hungarian representatives should take part in judicial proceedings against all the accessories to the plot of June 28 on Serbian territory. A reply was required by 6 o'clock on the evening of Saturday July 25.

As was immediately pointed out by everyone who read this document it would be impossible for the Serbian Government to accept all these demands; no such requirements had ever been directed to a fully sovereign State—in particular the requirement that unnamed officials should be dismissed on the request of the Austro-Hungarian Government, and that Austro-Hungarian officials should take part both in police and judicial proceedings on Serbian soil, was clearly one impossible to be granted. There could be only one conclusion, that Austria intended to force a war with Serbia and that in doing this she had deliberately prepared to meet the opposition of Russia. But it was clear that Austria could not have taken this step without the previous consent of Germany. It was therefore at once concluded that the two Germanic Powers had determined immediately to challenge Russia, and with Russia France, to a great trial of strength. This view was supported by a note which on the following day was delivered at St. Petersburg, Paris and London, in which the German Government announced that they considered the procedure and demands of the Austrian Government to be both equitable and moderate. (It is now known that these words had been written at a time when the German Government did not precisely know what the demands of the Austrian Government would be. It did not occur to anyone outside that the Government of a great State could be guilty of such unparalleled levity; it was naturally assumed that they had seen and approved the text of the Austrian note beforehand, and all their disclaimers were received with incredulity.) The German Government also emphasized their opinion that the questions at issue between Austria and Serbia should be settled by these two States alone, and lastly, they intimated that interference by any other Power would be followed by incalculable consequences. This could obviously mean nothing except that Germany was backing up Austria, would support her even up to a war with Russia, and that a threat was intended to France and Great Britain that, unless they put themselves on the Austrian side and brought pressure to bear upon Russia to withdraw her support from Serbia, a European war would result.

The news reached St. Petersburg just after M. Poincaré had left. The secrecy with which the ultimatum had been engendered, the misleading assurances, the absence of any warning to or consultation with other States, all seemed to point to a deep-laid plot. The reaction was precisely what was to be anticipated. The greatest indignation was expressed and the indignation was genuine. M. Sazonov at once asked for assurance that he should have the full support of France and Great Britain against this unparalleled act of aggression; the only method of avoiding war with Germany was, he said, that Germany should know that she would be confronted by the united forces of the Entente. At the same time Russian military preparations were at once begun; it was decided at a meeting of the Russian Council of State on July 25 that all preliminary steps should be taken and that Sazonov should be authorized to give the signal for mobilization as soon as it seemed to him necessary. Meanwhile a public communiqué was issued that Russia could not remain indifferent to the fate of Serbia. Similar language was used in private and official interviews. It was from the beginning perfectly clear that Russia intended to resist the Austrian scheme, by war if necessary.

In these circumstances much depended on the action of Great Britain. During these days France could do little, for the President and the Foreign Minister were at sea. Russia and France both pressed Sir Edward Grey to declare himself. The situation was a difficult one. He clearly could not, as the Russians asked, give an unconditional promise to join with Russia if war ensued; by doing so he would incur the danger of increasing the influence of the war party which undoubtedly existed at St. Petersburg. Moreover, he would not have the full support of the Cabinet, nor apparently of the country. On the other hand he could not give the promise of neutrality which Germany asked for, nor could he even press Russia too strongly to suspend her military preparations, for, by so doing, he would in fact be giving his support to an act of aggression against a State with which he was in the closest diplomatic agreement. He therefore saw from the beginning that the only possible means of avoiding a European

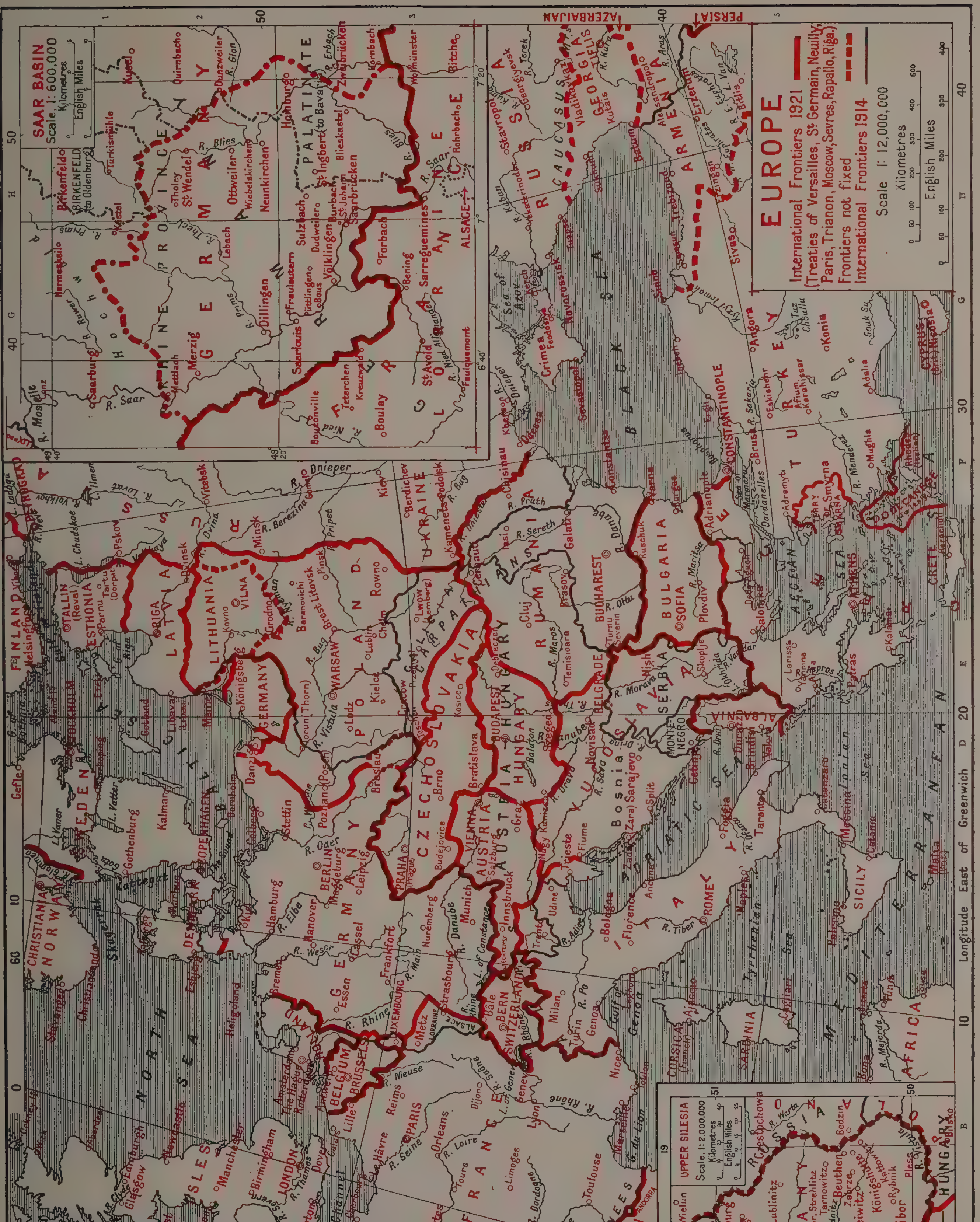
EUROPE
International Frontiers 1921 (Treaties of Versailles, St Germain, Neuilly, Paris, Trianon, Moscow, Sevres, Rapallo, Riga)
Frontiers not fixed
International Frontiers 1914
Scale 1: 12,000,000
Kilometres
English Miles
SAAR BASIN
Scale 1: 600,000
UPPER SILESIA
Scale 1: 2,000,000
Longitude East of Greenwich
ATLANTIC OCEAN
NORTH SEA
BLACK SEA
MEDITERRANEAN
ADRIATIC SEA
AEGEAN SEA
BALTIC
FRANCE
GERMANY
POLAND
CZECHOSLOVAKIA
AUSTRIA
HUNGARY
RUMANIA
BULGARIA
JUGOSLAVIA
ALBANIA
GREECE
ITALY
SPAIN
SWITZERLAND
BELGIUM
HOLLAND
DENMARK
SWEDEN
NORWAY
FINLAND
ESTHONIA
LATVIA
LITHUANIA
RUSSIA
UKRAINE
TURKEY
ARMENIA
GEORGIA
AZERBAIJAN
PERSIA
BRITISH ISLES
AFRICA

war was to bring about some form of mediation or conciliation by which time would be gained; then some means might be found of settling the crisis in a peaceful way. For the next five days, supported by France, he pursued this path with energy and resource. In accordance with the practice of the last years he depended on the coöperation of Germany. To intervene directly between Austria and Serbia was out of the question; if Russia became involved the only remedy would be joint action of Great Britain and Germany. He knew that he had the support of Prince Lichnowsky, the German ambassador in London; he hoped for the coöperation of the German chancellor; he did not know how fundamental was the difference between the German ambassador and his Government.

His first suggestion was that Austria should give Serbia more time, and not, as was threatened, break off diplomatic relations if Serbia did not accept all the requirements of the ultimatum by 6 o'clock on Saturday, July 25. This proposal, which was supported by Russia, received no support in Germany, and in fact reached Vienna almost too late. It was at once rejected there. The Serbian answer was actually delivered at the appointed hour on July 25. It was very conciliatory. It went to the furthest possible extreme in compliance; every demand was granted with the exception of two: the dismissal of unspecified officials and officers and the coöperation on Serbian soil of Austrian officials. The Austrian minister, however, at once, in accordance with his instructions, left Belgrade. Sir Edward Grey, however, now began to press for mediation, not between Austria and Serbia, but between Austria and Russia, by the four Powers, Great Britain, Germany, France and Italy. On July 27 he converted this into a firm proposal for submission of the points at issue between Austria and Russia to a conference of the ambassadors in London. This proposal was rejected by the Germans on the ground that they could not ask Austria to submit to what would in fact be an Areopagus of the Powers. They also would prefer separate conversations between Austria and Russia, which Sazonov had meanwhile suggested. One of the reasons for the rejection was, as has since been explained, that they would not trust their own ambassador in London.

The text of the Serbian answer to the Austrian note was received in London on July 27. Sir Edward Grey at once pointed out that this reply could surely be made the basis of negotiations, and pressed that, if Austria continued her intransigeant attitude, it would appear that she was deliberately aiming at war. These representations were fully reported to Berlin by Prince Lichnowsky, who warned the German Government that, if they continued their negative attitude, they would no longer be able to depend upon the neutrality of Great Britain. These representations were without effect. The German Government indeed on July 27 forwarded Sir Edward Grey's proposals to Vienna, but at the same time they informed Count Szögyény, the Austrian ambassador, that they did so merely because they did not wish to alienate Great Britain, and in no way associated themselves with the proposals which they did not wish to see adopted. The negative attitude of Berlin, the apparent refusal to do anything to restrain Austria, inevitably produced the conviction that Germany was no longer working for peace. If this were so there then remained only one means of avoiding war, that Great Britain should give a formal warning that in the event of war she would be found on the side of Russia and France. This was from the beginning strongly urged both at Paris and St. Petersburg; a first step in this direction was the order given to the British fleet (which had been assembled for manœuvres) not to demobilize; this order was made public on July 28.

However, on the morning of July 28, some change became apparent in the German attitude. The Kaiser had returned to Potsdam from his North Sea cruise on the afternoon of July 27. There was at once laid before him the text of the Serbian answer, which, owing to very serious delay, for which the Austrians were responsible, had not reached Berlin until that day. He saw that it left to the Austrians no defensible ground for a declaration of war. "A brilliant achievement; this is more than could have been expected. A great moral success for Vienna, but with it every ground for war disappears, and Giesl ought to have remained quietly at Belgrade. *I* would never have ordered mobilization." He therefore, on the morning of July 28, caused to be sent to Vienna a proposal that Austria should be satisfied with the occupation of Belgrade and a defined limit of territory, and should issue her demands from there. This would give to the military feeling of Austria that satisfaction which they might reasonably demand. As was pointed out: "If Austria continues her refusal to all proposals for mediation or arbitration, the odium of being responsible for a world war will in the eyes of the German people fall on the German Government. On such a basis, however, a successful war on three fronts cannot be started and carried through." The weakness of this proposal was that it was based on the assumption that war with Serbia would have begun; but as soon as war began, clearly Russia must mobilize. No settlement could be successful unless it provided for a mutual understanding as to the military measures to be taken on both sides; such an understanding must be made at once and communicated to Russia. The Emperor's proposal assumed that while Austria began a war with Serbia, Russia should cease all military measures. This clearly was impossible.

Austrian Declaration of War against Serbia.—Russian mobilization was in fact becoming imminent. The preliminary work had proceeded rapidly; reports came to Germany from all parts of the Russian Empire showing the activity of the preparations. The Russian position never changed. They would not proceed to the next stage until Austria took overt action either by a military advance or declaration of war. As soon as she took either of these steps, Russia would mobilize part of her forces. This contingency was realized on Tuesday, July 28. Austria had issued an order for the mobilization of eight army corps on July 26, and now sent a declaration of war against Serbia in an open telegram to Belgrade. The Austrian Government had informed Germany of their intention to do this the day before, but no warning or suggestion that some delay would be useful was given. Germany in fact was now beginning to experience the results of the very ill-considered language used three weeks before; the Kaiser had insisted then on the necessity for rapid and vigorous action; to press now for moderation and delay would have exposed him to the charge of vacillation which on other occasions his actions had appeared to justify, and from which he had boasted that on this occasion he would be free.

As soon as the news of the declaration of war reached St. Petersburg it was decided that partial mobilization must follow; the German and other Governments were immediately informed. This decision was confirmed when on the same day the Austrians broke off the separate conversations with Russia which Sazonov had suggested, giving as a reason the declaration of war with Serbia, an act for which they themselves were entirely responsible. Even now, however, there was a delay of 24 hours. The next morning news came that the Austrians had begun to attack and were bombarding Belgrade. Further delay seemed impossible. Apparently the Tsar signed the ukase for the mobilization of 13 army corps in the early afternoon of Tuesday, July 28. After doing so he caused Count Pourtalès, the German representative in St. Petersburg, to be assured that it was not his intention to take any threatening measures against Germany, and that mobilization did not necessarily imply war even against Austria. About 7 o'clock that evening Count Pourtalès called on Sazonov, and under instructions from the German chancellor warned him that any further military preparations or mobilization would involve German mobilization, and that German mobilization meant war. This message was so worded that it seemed to prohibit even partial mobilization against Austria. The German explanation is that it was meant as a friendly warning, but it was taken, not unnaturally, as something in the nature of an ultimatum. The effect was that the order for partial mobilization was that very evening changed into one for the general mobilization of the whole army. There were many reasons for this. Mobilization included also dislocation of the scheme for drawing up the Russian army on the frontier. The whole arrangements for the scheme would depend on whether it was to be merely a warning directed against Austria, or whether an immediate war against both empires was imminent. To change from partial mobilization to general mobilization would be an extremely difficult and complicated task. If partial mobilization would, as seemed to be the case, bring about war with Germany, Russia might find herself in an extremely dangerous situation.

Meanwhile there was great anxiety in Berlin. The Government were not well informed as to the intentions of Austria, and answers to telegrams were long delayed. There was also a serious divergence between the political and military authorities. The general staff were becoming very nervous. If there was to be war it was essential that it must begin at once in order that they might gain the advantage which came from their higher stage of military preparation. Every day that elapsed would have the result of enabling Russia to enter the campaign sooner than had been anticipated. On the other hand, from the political point of view, especially having regard to the effect on public opinion in Germany and in Great Britain, it was most important to avoid action which might appear provocative. Matters must be so arranged that the appearance of aggression would fall upon Russia. The whole situation appears to have been discussed in a council which met at the palace at Potsdam that evening. There is no authentic record of the discussion, but from subsequent revelations it is clear that a demand was made by the general staff for immediate mobilization, and was refused. It was, however, determined to make a strong effort to avoid the danger, which was becoming more apparent, of active British intervention in the war; with this object, that very evening between 9 and 10 o'clock, the German chancellor sent for Sir Edward Goschen, the British ambassador, and made him a strong offer for British neutrality. In return for this Germany would be prepared to promise that in the event of a successful war no part of France would be annexed by Germany. This suggestion was, of course, the next day indignantly refused. Scarcely, however, was the interview over when a fresh telegram from Prince Lichnowsky was received, containing a friendly warning from Sir Edward Grey that, if war resulted, England would probably not be able to keep out of it. This produced something like consternation. The negotiations with Austria as to Italy had not been proceeding favourably, and all the information seemed to show that Italian support would *not* be forthcoming. The very same night three additional telegrams were dispatched to Vienna couched in the most pressing and urgent terms, exhorting the Austrian Government not to continue their refusal against all projects of mediation; if they did so they would be dragging Germany into a European war, in which Italy would not be on the side of the Triple Alliance and in which Great Britain would be among the enemies,—a war, therefore, which would be fought under the most unfavourable conditions. It was only by using the last measure, the threat of war, that British influence for peace began to be effective—but too late.

Russian and German Mobilization.—Among the numerous other telegrams sent out from Berlin on this evening was one from the Kaiser to the Tsar, again impressing on him in the strongest terms the danger of mobilization. In consequence the Tsar, shortly before midnight, telephoned both to the chief of the Russian general staff and to the Minister for War, instructing them to alter the determination already arrived at; there is some conflict in the evidence as to whether he ordered the cessation of all measures of mobilization, or merely that partial mobilization should be substituted for general. However this may be, the Minister for War, General Sukhomlinov, who was much impressed by the dangerous position into which Russia was drifting, and by the inextricable confusion which would be created if the mobilization orders which had already been sent out were countermanded, determined on his own responsibility to disobey the orders which he had received and to leave things as they were; and he told the chief of the staff, General Januskevitch, to ignore the Tsar's instructions. In consequence the order for general mobilization was maintained. M. Sazonov does not appear to have known this; anyhow he told the French ambassador that the order for general mobilization had been issued, but subsequently revoked. At a meeting which took place the following morning, July 30, the situation was again discussed, and on this occasion Sukhomlinov, according to his own evidence given at his subsequent trial, "lied to the Tsar" and allowed him to believe that his orders had been executed. During the same morning a further interview between Sazonov and Pourtalès had resulted in the drafting of a formula by which it was hoped that a way out of the difficulty would be found. This had been sent to Berlin. The answer to it came in the late afternoon and was an uncompromising refusal. During the day there was telegraphed from Berlin news of a false press announcement that German mobilization had been ordered; this was contradicted very shortly afterwards. As a result of these events and the information that the Austrian bombardment of Belgrade was continuing, the Tsar in the afternoon reconfirmed the decision of the previous evening that general mobilization should be proceeded with. He seems never to have been informed of the disobedience to his orders. The notices were put up throughout the Russian Empire during the course of the night, and on the following morning the fact was public. There was, however, some delay in communicating it abroad; the news does not seem to have reached either Paris or London until very late in the afternoon. It reached Berlin shortly after midday. The Kaiser at once left Potsdam for Berlin and ordered the proclamation of *Kriegszustand*, the first step before mobilization; a telegram was also sent to Pourtalès that he should immediately call on Sazonov and inform him that unless the order for general mobilization was recalled within 24 hours Germany would consider herself at war with Russia. No answer was given; German mobilization was proclaimed the next day, Saturday, Aug. 1, and war was declared at 5 o'clock in the afternoon.

The Russian order for general mobilization seems on all grounds to have been ill-advised; from the military point of view delay was advantageous to Russia. Politically it provided the German Government with the pretext which was essential to them: for the moment it appeared as if Germany was defending herself against a Russian invasion; the solidarity of the nation was secured and even the Socialists ceased their criticism and opposition. It was this which made the Reichstag, which assembled on Aug. 3, almost unanimous in its support of the war measures laid before it. It also destroyed any slender possibility of still avoiding war. The decision seems to have been due not so much to any deliberate desire for war, as to the state of nervous panic which prevailed in the sinister situation by which Russia was suddenly confronted; owing to the provocative and menacing action of Austria and Germany there was no cool and balanced judgment or strong hand to exercise control. All accounts agree that even Sukhomlinov was overwhelmed by the crisis, and the Tsar throughout was in a state of pitiable indecision.

The extreme rapidity with which these events took place frustrated all the efforts at mediation which were in progress. Sir Edward Grey had put forward a new plan, very similar to the German Emperor's proposal that Austria should issue her terms from Belgrade, but he had accompanied it by conditions which, if accepted, would have got over the mobilization difficulty. This had been communicated by Berlin to Vienna, but no answer had been received when Germany, by her ultimatum, broke through all the negotiations. None the less, even as late as Saturday, Aug. 1, this and other suggestions continued to be the subject of an interchange of telegrams. While they ceased to have any practical importance it may be noted that, in a telegram of July 31, the Austrian Government so far deviated from their previous attitude as to accept the idea of mediation by the four Powers between Austria and Serbia. This was a considerable concession, but it was in fact superseded by a personal telegram from the Austrian Emperor sent almost at the same time, and its value was diminished because it was accompanied by the condition that Austrian military action against Serbia should continue, but that Russia should discontinue all her military preparations. It need not be said that on these lines no arrangement could have been made, for this would have implied that Russia should stand passively by, watching the defeat of the Serbian army and allowing Austria to occupy the whole of Serbian territory. There is indeed no indication that, so far as Austria was concerned, the postponement of the Russian general mobilization would have had any effect upon the final issue. The order for general mobilization was determined on the afternoon of July 30, and issued on July 31, before Russian mobilization was known.

France and Germany.—In accordance with the terms of the Franco-Russian Alliance, an aggressive war declared by Germany against Russia inevitably entailed war with France. The French President, M. Poincaré, and the premier, M. Viviani, reached Paris on the evening of July 29; they at once telegraphed to Russia that France would fulfil the obligations of her alliance, while continuing her efforts to preserve peace. From the beginning of the crisis France had, like all other nations on the continent of Europe, immediately begun all the necessary military preparations. Even the smaller States, such as Holland, had from the beginning of the week been doing the same thing. It is not necessary to enter into the discussion which took place at the time as to the particular stage of military preparations reached in each country on each day. The Austrian ultimatum to Serbia was an act of such a nature that, followed as it was by the rupture of diplomatic relations and the declaration of war, no responsible Government could afford to lose a moment in carrying through every measure short of the final act of calling up the reserves, to which the name of "mobilization" is generally given. Suffice it to say that by July 31 the French and German covering troops on the frontier were both in position. The French, however, in order to avoid any untoward incident, took the precaution of keeping their troops 10 km. from the frontier. This was not imitated by the Germans, and in fact could not be, for the great fortress of Metz was actually on the frontier, and there seems no doubt that before July 31, on several occasions, German troops had crossed the French frontier. The Russian mobilization, the consequent German mobilization, and the declaration of war against Russia, made it imperatively necessary for the German Government without any delay to settle the issue with France. As has already been pointed out, the basis of their whole plan of operations was an instantaneous invasion of France. They therefore could not allow a day to pass unused; if there was to be war with France, it must come at once. Accordingly at 7 o'clock on July 31, Herr von Schoen, the German ambassador in Paris, called on M. Viviani and announced that he would come again the next day to learn what the attitude of France would be in case of a war between Germany and Russia. He came in consequence on Aug. 1, and was informed merely that "France would do that which her interest dictated." French general mobilization was ordered on Aug. 1, at almost exactly the same time as that of Germany. It would have been natural that the actual declaration of war by Germany should immediately have followed; it was, however, delayed for two days, partly in consequence apparently of a misunderstanding which arose in London. Lichnowsky telegraphed that he had received an inquiry whether Germany would stand out if England secured the neutrality of France. What seems to have been meant was an idea that both France and Germany should remain neutral, leaving Austria and Russia alone at war; this was misinterpreted as a suggestion that France should remain neutral in a war between Germany and Russia. Nothing could have been more favourable to Germany than this, but subsequent revelations have shown that even French neutrality alone would not have been accepted by Germany. Herr von Schoen was instructed, if France promised to remain neutral, to demand that she should hand over the fortified cities of Toul and Verdun to Germany as a guarantee. That such a proposal should ever have been seriously entertained shows how abnormal was the mentality of Berlin. There was never the slightest doubt that France could not leave Russia unprotected against a combined attack from both Germany and Austria.

The situation at the end of the week was a very anxious one in Paris. War with Germany was now certain, and France might anticipate that within a few days the whole force of the German army would be thrown against the frontier. The future of France seemed to depend upon the action of Great Britain. But in London all seemed uncertain. The strongest representations were made by M. Cambon to Sir Edward Grey, and the President of the French Republic addressed an autograph letter to King George urging the vital necessity for help from England. No promise could be given. The British Cabinet were then divided. Neither they nor, as was thought, the country would have approved of the interference of Great Britain in a continental war in which her interests and honour were not immediately involved.[1] Though Great Britain could not stand by and passively watch the defeat and dismemberment of France, this might be a reason for preparing to intervene if at any time it became necessary, but not for taking part as a principal from the beginning. There was indeed one point in which, admittedly, both British interests and British honour were closely concerned, viz.: the neutrality of Belgium. Great Britain was bound by the Treaties of 1839 to intervene if either party to a war violated that neutrality. Following, therefore, the precedent of 1870 Sir Edward Grey, on July 30, addressed a message both to the French and the German Governments, drawing their attention to this point and asking for assurance that Belgian neutrality would be respected. The answer from France was quite satisfactory. The German Government, on the other hand, said that they were unable to give any answer to the question. On Sunday, Aug. 2, Sir Edward Grey, on his own responsibility, without obtaining the consent of the Cabinet, took another step. He informed the French that if a German fleet attacked France in the Channel or the Atlantic, Great Britain would immediately intervene with her fleet. Apart from the Belgian question, it would still have been possible for Germany to keep Great Britain neutral by limiting the war against France to land operations, and it would clearly have been in her interests to do so.

All then seemed to depend on the Belgian question. On Monday, Aug. 3, the German Government formally declared war against France. The actual reasons given were statements that the French had violated German territory by dropping bombs from aeroplanes, and in other ways. The German Government has since acknowledged that these statements were untrue. Meanwhile it became known in London (Aug. 2) that German forces had crossed the Luxemburg frontier and occupied the Grand Duchy, the neutrality of which was guaranteed by the Great Powers, Germany herself included; and also that the German minister at Brussels (as Sir E. Grey told the House of Commons on Aug. 3) had delivered a note to the Belgian Government demanding free passage for their troops across Belgian territory; if this was granted they undertook to leave Belgium at the end of the war with her independence and territory unimpaired, and in fact held out hopes of increase of territory at the expense of France, either in Europe or in the colonies. If the request was refused, Belgium would be treated as an enemy. An answer was required within 12 hours. This action was excused by the statement that the German Government had reliable information that French forces intended to enter Belgium. But it is now known that the whole note, including this statement, had been drafted more than a week before by the general staff. After a midnight sitting of the Belgian Council of State, presided over by the King, a refusal was handed to Herr von Below. Before this happened German troops had already crossed the frontier, and in consequence Herr von Below received his passport and was requested to leave the country immediately.

These events were decisive for Great Britain. All the doubts by which the Cabinet and large sections of the country had been assailed during the previous week were at once swept aside. On the afternoon of Aug. 3, Sir Edward Grey explained the menacing nature of the situation to the House of Commons, and on the next day (after a further statement in Parliament by the Prime Minister) an ultimatum was dispatched to Berlin requiring the German Government to respect Belgian neutrality. This was presented by Sir E. Goschen to Herr von Jagow; as the request was refused, he demanded his passport, and war between Great Britain and Germany began at midnight (Aug. 4–5).

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[1] Nevertheless, it was being vigorously contended by *The Times* during this juncture that British interests and honour *were* involved, though the "pacifist" section of the London Press as vigorously denied it. (Ed. *E.B.*)

BIBLIOGRAPHY.—The chief authority for the events dealt with above is the official correspondence published by the various Governments. A translation of the full text of all documents published at the beginning of the war will be found in *Collected Diplomatic Documents relating to the Outbreak of the European War*, printed by the Stationery Office (1915); there are numerous other collections, as for instance *The Times Documentary History of the War*, vols. i. and ii. (1917); Mach's *Official Diplomatic Documents relating to the Outbreak of the European War*, containing both the originals and the translations (notes unreliable; 1916); useful selections are those by Reinach, *Histoire de Douze Jours* (1917), and Max Beer, *Das Regenbogenbuch*. The original German White Book was very incomplete and has been superseded by the later publication, *Deutsche Dokumente zum Kriegsausbruch, Vollständige Sammlung der von Karl Kautsky zusammengestellten amtlichen Aktenstücke, mit einigen Ergänzungen*, edited by Graf Max Montgelas and Prof. Walter Schücking, 4 vols. (1919). There has also been published the full text of the Austrian correspondence, *Diplomatische Aktenstücke zur Vorgeschichte des Krieges 1914*, 3 parts (1919); see also Dr. Roderich Gooss, *Das Wiener Kabinett und die Entstehung des Weltkrieges* (1919). The original British White Book, on the other hand, gives a faithful and practically complete account of the action of the British Government as recorded in the official papers and correspondence in the Foreign Office Archives. To these should be added the Rumanian and the Greek White Books (*Le Livre Blanc Grec—Les Pourparlers Diplomatiques 1913–7* (1918), Berger-Levrault), also the Austro-Hungarian Red Books on the relations to Italy and Rumania.

Other Publications.—The very numerous works which appeared during the war are to a great extent superseded owing to the further information which is now available. Of them the more important are: J. M. Beck, *The Evidence in the Case* (1914); J. W. Headlam, *The History of Twelve Days* (1915); J. W. Headlam, *The German Chancellor and the Outbreak of War* (1915); Wm. Archer, *The Thirteen Days* (1915); C. Oman, *The Outbreak of the War, 1914–8* (1919); *J'Accuse*, by a German (Dr. Richard Grelling: 1915); Dr. Richard Grelling, *The Crime* (1917).

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(J. W. H.-M.)

Europe After the War

Under the heading of WORLD WAR, the diplomatic history of the war period itself is separately dealt with. European history was mixed up in this period with world history. It remains here to speak of the new Europe resulting from the war.

The changes produced in the political system of Europe by the war and the peace settlement were in their magnitude and importance comparable only to those embodied in the similar settlements made by the treaties of Westphalia, the Peace of Utrecht and the Congress of Vienna. The territorial settlement (see accompanying map) affected directly or indirectly every nation on the continent except Spain and Portugal. It was made partly by the treaties signed at Versailles, St. Germain, Trianon, Neuilly and Sèvres, but these left several matters undecided which have been dealt with by subsequent agreements. In the summer of 1921 the principal districts left undetermined were Upper Silesia, East Galicia, the eastern frontiers of Poland and the boundaries of Albania.

Western Europe.—In western Europe the most important result has been the increase in the territory and influence of France, who has recovered the lost provinces of Alsace and Lorraine, which are now again incorporated in France. Her hope was permanently to detach the left bank of the Rhine from Germany, and, by joining this territory with Belgium and Luxemburg into a French sphere of influence, to secure herself against the danger of a fresh German invasion. This object was only partially attained. By a provisional arrangement, which normally would not last more than 15 years, the principal Allied and Associated Powers, among whom in all matters of western Europe France naturally took the leading place, had the right to occupy the Rhine with the bridgeheads and virtually control all German territory on the left bank of the river; inter-Allied control was exercised by a civil commission which sat at Coblenz under French chairmanship. Clauses of the Treaty of Versailles gave the control and navigation of the Rhine to an international commission, and France had for a period of 15 years acquired certain rights over the port of Kehl on the right bank of the river. The territory of the Saar valley had also for a period of 15 years been separated from Germany and placed under the control of a commission appointed by and responsible to the League of Nations, the full ownership of the mines being given to France. The chairman of the commission was French, and French influence was dominant; French troops continued to be maintained there, a contingency not contemplated by the Treaty. The final decision as to the fate of this district was reserved for a plebiscite in 1935; under this the inhabitants would have the right to opt either for restoration to Germany, incorporation with France, or a continuance of the existing system.

The Grand Duchy of Luxemburg retained its independence and status as a sovereign State, but the close connexion with Germany was severed, and in May 1921 a treaty for economic union with Belgium was signed, under which there would be a customs union between the two countries, and the railways would be jointly managed. In addition to this, Belgium, under the Treaty of Versailles, acquired a small increase of territory at the expense of Germany in Eupen and Malmedy, and was also freed from the limitations on her full sovereignty imposed by the settlement of 1839; she henceforward took her place among the other European States without the restrictions of permanent and guaranteed neutrality. This was the end of a system which in one form or another had played an important part in European politics for some 200 years. Belgium also entered into a military convention with France.

Central Europe.—It was in the centre and the east of Europe that the greatest changes took place. The three great monarchies, which since the days of Catherine, Frederick the Great and Maria Theresa had dominated so large a portion of the continent, disappeared. In Petrograd, Berlin and Vienna, the old centres of authority, the court made way for Republican Government, and the great armies by which Europe was overawed ceased to exist. But the character of the change in each case was very different. Germany came out of the war a united State; all projects for disruption, for instance, in the Rhine Provinces or Bavaria, failed, and she still was in population the largest country, except Russia, on the continent of Europe, and in area second only to Russia and France. She had ceded Alsace-Lorraine to France, to Denmark the northern portion of Schleswig, to Poland the greater part of the provinces of Posen and West Prussia; the city of Danzig, which commands the mouth of the Vistula, was created a sovereign State under the guarantee of the League of Nations, but by a treaty was incorporated within the Polish customs frontier, the control of railways, port and foreign relations being given to Poland. Memel and the surrounding district were ceded to the principal Allied and Associated Powers, ultimately, no doubt, to be transferred to Lithuania. A large slice of Upper Silesia was transferred to Poland. In addition to this, for a maximum period of 15 years the left bank of the Rhine was subject to inter-Allied occupation and control, and Germany was forbidden to maintain any troops or fortifications within this area or within 50 m. of the right bank of the river, and for the same period was deprived of the Saar valley.

Even more important than the loss of territory were the economic and financial disabilities imposed on Germany by the peace settlement, and the state of internal instability caused by the Revolution. The general effect was that, for the present, Germany was unable to take any active part in European politics; she had become a passive element in the continental system and the utmost that she could do was to concentrate on the slow and arduous task of internal reconstruction, which at the best must take many years. The prime occupation of France was to secure the safeguards which would be necessary when the process of recovery had been completed.

By far the most striking of the changes was the disappearance from the map of Europe of the great Habsburg Monarchy, which since the days of Charles V. had played so important a part. This is an event to which there is no parallel in European history. It is the first time that one of the Great Powers of Europe has, not by slow and prolonged process, but by a sudden collapse, ceased to exist. As an immediate result there was added to the European system one new State (the new Austrian Republic), and three others were so changed that they might equally well be considered as new members of the family of nations.

1. The ancient kingdom of Bohemia, which since 1526 had been merged in the Habsburg possessions, reappeared under the title of Czechoslovakia. To quote the preamble to one of the treaties signed at St. Germain:—

> "The union which formerly existed between the old Kingdom of Bohemia, the Margravate of Moravia and the Duchy of Silesia on the one hand, and the other territories of the former Austro-Hungarian Monarchy on the other, has definitely ceased to exist, and the peoples of Bohemia, of Moravia and of part of Silesia, as well as the peoples of Slovakia, have decided of their own free will to unite, and have in fact united, in a permanent union for the purpose of forming a single sovereign independent State under the title of the Czecho-Slovak Republic."

What this means is that to the old territories of the Bohemian Crown was added a large portion of the ancient Hungarian kingdom, which was inhabited by the Slovaks, a race closely akin to the Czechs. It was strongly urged by some that the German-speaking portions of Bohemia and Moravia should be allowed, if they so desired, to unite themselves with the new Austria or with Germany. This was wisely and inevitably refused by the Peace Conference, but, on the other hand, by a special treaty signed at Paris on July 28 1920, that portion of the small duchy of Teschen, the population of which was predominantly Polish, was separated from the rest and united with the new Poland. In addition to these territories, that portion of the kingdom of Hungary which was inhabited by the Ruthenians was also incorporated with Czechoslovakia, but the Treaty of St. Germain gave to it the right of autonomy.

2. On the south there was achieved the union in one State of nearly all the South Slavs; the small kingdom of Serbia, which a few years before the war numbered only some three million inhabitants, was increased to an important State with a pop. of 14 millions, including Croatia, part of the Banat, and portions of the former Austrian provinces of Dalmatia, Carniola and Istria. As a symbol of the changed condition, the kingdom of Serbia took the title of the Kingdom of the Serbs, Croats and Slovenes, but it is often spoken of as Yugoslavia.

3. The settlement of the frontiers between this State and the kingdom of Italy was the subject of long, arduous and often critical negotiations, which were settled finally by the Treaty of Rapallo of Nov. 1920. By this Italy acquired nearly the whole of Istria; the town of Fiume, which was the special subject of controversy, became a self-governing community, closely attached to Italy. Italy on the other hand surrendered the claims she had under the Treaty of London to other portions of the Dalmatian coast, retaining only Zara and a few islands. To the problems of Europe was added that of the Adriatic, which seems destined to become the object of rivalry between Italy, Yugoslavia and Greece. In the north, Italy acquired the most generous settlement of her claims to all Italian lands, not only Trieste and Gorizia and the Trentino, but also the whole of Tirol up to the Brenner Pass and the main chain of the Alps, and for the first time thereby extended to her natural geographical frontier; as a result of this, 700,000 German-speaking Tirolese and a large number of Slavonic race in Istria came under the Italian Crown.

4. On the east, Rumania acquired part of the Banat and the whole of Transylvania, in addition to Bessarabia, her population thereby being about doubled. Here again it was impossible to draw a line by which all the Rumanians of Hungary should be assigned to Rumania without at the same time transferring the allegiance of a large non-Rumanian population, chiefly Magyars and Czechlers (a branch of Hungarians), who also include the German colony of Siebenbürgen.

The only portion of the old monarchy which in the summer of 1921 had not been definitely assigned was the province of Galicia. It was a matter of course that the western part, purely Polish in population, should go to Poland, and in fact the incorporation was effected immediately after the conclusion of the Armistice. On the other hand East Galicia, which comprises a pop. of over 4,500,000 and an area of some 17,000 sq. m., is inhabited by a population Russian in origin and speech, to which the name of Ruthenian or Ukrainian is generally applied. The Poles, however, claimed this, partly on historical grounds and partly because of the great interests in the country of the Polish aristocracy who owned large portions of the land. No decision was arrived at by the Peace Conference, but in July 1919 the Polish army was permitted to occupy the territory; proposals for assigning it with guaranteed autonomy to Poland broke down, and the Polish Government was in 1919–21 in practically undisturbed control. In the Treaty of Sèvres of Aug. 10 1920, in which many minor frontier questions were settled, clauses were included assigning West Galicia to Poland, but the Poles refused to sign this treaty, presumably on the ground that by doing so they would appear to acquiesce in a differentiation between eastern and western Galicia; no Polish Government could afford to give up its claim to East Galicia. The result was that technically the whole of the province still belonged, in the middle of 1921, to the principal Allied and Associated Powers, to whom it was ceded by the Treaty of St. Germain on Sept. 10 1919. West Galicia must, doubtless, remain an integral part of Poland. The future of East Galicia, however, remained a source of anxiety. Poland would be satisfied with nothing less than complete and unconditional sovereignty; the British Government was morally pledged by the support which it gave to the Ruthenians during 1919 not to surrender them, without stringent safeguards, to the rule of a nation whom they professed to regard as their hereditary enemy, and a restored Russia or an independent Ukraine would probably try to establish a claim to this district.

5. Of the old Austro-Hungarian Monarchy little remained when all these cessions had taken place. On the one hand we have the ancient crown lands of the Habsburgs, Upper and Lower Austria, Salzkammergut, Tirol and Vorarlberg. The Conference having refused to permit the union with Germany which was desired by large portions of the population, these were constituted as the Republic of Austria (the title of German Austria, which was at first taken, did not receive the approval of the Paris Conference), with a pop. of about 6,000,000. It is, except for the great city of Vienna and its suburbs, a predominantly mountainous and agricultural district. The problem of the future of Austria had a dual side, that of the country and that of Vienna. No city had suffered so much by the war and the peace; cut off from former trade connexions, left with a pop. of two millions of whom so many earned their livelihood from the presence of the court and the administration, the population would have been condemned to a slow process of starvation but for the assistance provided chiefly from America and Great Britain. The future of Austria remained one of the problems of Europe. France was unalterably opposed to the union of Austria with Germany, for this would, quite apart from the serious increase to German population, produce a Germany which extended from the Alps to the Baltic, and cut off western from eastern Europe. Such a Germany would be a grave menace to the other States and would compromise both Switzerland and Czechoslovakia.

6. The proud and ancient Magyar Monarchy, which had existed for over 1,000 years, and which, by the sway it exercised over the subject Slavs and Rumans, and by the influence it wielded in the Dual Monarchy, had attained a position in Europe beyond what the numbers of the ruling race warranted, was now reduced to a small State of about seven millions. Surrounded by jealous neighbours which had grown by its fall, with frontiers equally unfavourable for defence or trade, and still suffering from the effects of the revolution, the Magyars could only watch and wait for an opportunity to retrieve something of their lost power and territory. After the Bolshevik Revolution of 1919, power came into the hands of the reactionary parties, supported by the peasants; the State was still in theory a monarchy, but a monarchy without a king. The Emperor Charles was still the crowned king of Hungary; he made two visits to the country in a vain attempt to recover his crown, but the return of a Habsburg was vetoed both by the Allies and by the other successor States, for in view of the former history and great pretensions of the House this could not be regarded as a merely domestic Hungarian matter.

The substitution of this complex of States, each with its own problems and ambitions, for the great military monarchy completely altered the whole balance of the continent. During the period immediately succeeding the Peace, they were chiefly occupied with internal matters, especially the framing of new constitutions; Czechoslovakia and Rumania were confronted with the serious problem of incorporating in the new system large numbers of unwilling citizens. The severance of old-established commercial ties necessarily caused grave dislocation of trade; all suggestions for the reëstablishment of some kind of commercial union broke down, chiefly owing to the very strong opposition to anything which might lead to the restoration of the financial and commercial supremacy of Vienna. On the other hand close relations were set up between Czechoslovakia, Rumania and Yugoslavia; these States entered into a system, to which the name of "Little Entente" was applied, which had for its first object their mutual protection against any proposal to restore the Habsburgs in Hungary, but showed also a tendency for common action even against the Western Powers.

North-Eastern Europe.—The Paris Conference was not in a position to determine the territorial settlement so far as it dealt with the former possessions of the Russian Empire, for the final decision on these matters required the assent of Russia, and there was at the time no recognized Russian Government and no official representative of Russia at Paris. The settlement, so far as it went, was therefore the result of local action for which the Allies had no direct responsibility. All that they could do was to insert in the Treaty of Versailles a clause that the determination of the eastern frontiers of Poland must be submitted to the principal Allied and Associated Powers.

The governing factor was the terrible fate of Russia, which far surpassed the disasters that the war had brought upon central Europe. The defeats sustained by the Russian armies had during the war brought about the occupation by German forces of Poland and of the Baltic provinces. The overthrow of the autocracy in March 1917 was followed by a complete dissolution of the Russian army; in Oct. of the same year there was established the Communist Government under Lenin and Trotsky.

By the treaties of Brest Litovsk the Bolshevik Government was forced to accept the separation from Russia not only of Poland but of the Baltic provinces and of the Ukraine, which was occupied by German forces, while at the same time the Allies supported the attempts which were being made by Kolchak and Yudenitch to overthrow the Bolsheviks. Further calamities followed. In accordance with the avowed principles of their party the first step of the new Government was to eliminate those classes—the court, the aristocracy, the bureaucracy and the middle classes—by whom hitherto the country had been administered. Large numbers, including the Tsar and Tsarina and their children, were put to death. Others fled the country, and those who remained were condemned to a life of obscurity and penury. Many doubtless succumbed to the hardships and starvation they had to endure. This action naturally brought about a state of civil war, for the representatives of the old *régime* desired to overthrow the Government which was being built up by their destruction. The condition of civil war continued for another two years. It was conducted with great ferocity on both sides, but after the failure of Denikin in South Russia in 1920 the Bolsheviks succeeded in establishing their rule over all those territories which were of Russian race and language. The long continuance of the civil war had, however, the effect for the time of preventing the Bolsheviks from a military advance towards the west, and it left the country greatly impoverished. Meanwhile, as could have been anticipated, the attempt to govern Russia in accordance with Communist doctrines failed. In particular the peasants, who were now in occupation of the land, refused to provide food for the inhabitants of the towns; the whole system of transport and production broke down, and to add to the other calamities there was a serious failure of crops both in 1920 and 1921. The Bolshevik Government was ostracized by the rest of Europe, and all attempts to extend their authority over the separated western provinces failed. After the Armistice, Poland within undefined limits was recognized by the Allies as a sovereign State, the nucleus of which was "Congress Poland"; to this were added the Polish territories taken from Germany and Austria. On the east, the new Polish State was at war with the Bolsheviks. The causes of enmity were, first, the avowed intention of the latter to impose their form of government upon Poland, and secondly the delimitation of the frontier. The Poles claimed almost the whole of the territories which had belonged to the ancient kingdom, including as they did large portions of White Russia and the Ukraine, the population of which was almost exclusively Russian. The Polish Government, however, who were also at variance with Denikin, refused to give him that assistance which might possibly have led to the success of his arms. After his collapse in the spring of 1920, the Poles, disregarding advice given them by the British Government, took the offensive, invaded the Ukraine and advanced as far as Kiev; they were unable to maintain their position; during the month of July they were rapidly driven back by the Bolshevik armies, who entered Congress Poland and nearly reached Warsaw. Negotiations for an armistice were begun at Minsk, but, owing to the excessive demands of the Bolsheviks, no agreement could be reached. Helped by French military advice and by supplies from western Europe, the Poles quickly recovered courage, and during the month of Aug., with little fighting, drove out the invading Bolshevik army and again advanced into White Russia and the Ukraine. As a result of these events negotiations were begun for an armistice, and in the early months of 1921 a series of treaties was arranged by which the whole of the western frontier of Russia was determined. This was followed by an agreement between Great Britain and Russia, by which trade relations were resumed (March 19 1921), a policy to which France was strongly opposed.

The result of these events was that there were temporarily separated from Russia all those territories included in the empire, the population of which was of non-Russian race, and five new States were added to the European system.

1. Finland had already severed herself from Russia before the end of the war, to a large extent owing to the support given to the White Government by Gen. von der Goltz and a small detachment of German troops. As soon as the war was over the Government was recognized by the Allies, and by the Treaty of Dorpat of Oct. 14 1920 the Bolsheviks also recognized the independence of the country and the boundaries were fixed. By this the connexion between Finland and Russia, which had existed since it was conquered from Sweden in 1809, ceased. Reminiscences of the older Swedish connexion were revived by a dispute which arose as to the Åland Is., which stretch across the mouth of the Gulf of Finland; the population was entirely Swedish and had expressed a desire for union with Sweden. Owing to the intervention of the Allies, this matter, which threatened to lead to war, was referred for settlement to the

League of Nations, who in May 1921 issued their award: they were to remain a part of Finland, with local autonomy.

2. The former Baltic provinces, after their separation from Russia during the war, organized themselves into three States, Latvia, Esthonia and Lithuania, with republican institutions; with the help first of the Germans and afterwards of the Allies, they succeeded after severe fighting in repelling several Bolshevik attacks, and at the beginning of 1921 Latvia and Esthonia were formally recognized by the Allies. The relations to Russia were determined by treaties signed at Reval in April 1921. Formal recognition of the Government of Lithuania by the Allies was still delayed during 1921, chiefly owing to the fact that the Poles were desirous of bringing about some kind of union between Lithuania and Poland. The boundaries of the two States remained at issue, both of them claiming the city of Vilna. After the repulse of the Bolsheviks in 1920, it was in Oct. of the same year seized by a lawless act of force on the part of the Polish Gen. Zeligowski, with the scarcely veiled connivance of the Polish Government. It was agreed that the dispute should be referred to the League of Nations.

3. The most important change was the reconstitution of an independent Poland, a natural result of the fall of the three military monarchies responsible for the partitions. The frontiers of the State created great difficulties and serious differences between the Allies, and it was only late in 1921 that, after reference to the League of Nations, a decision was arrived at regarding Upper Silesia (*see* SILESIA).

The future of this part of Europe depended on Russia and Poland. It had been the ambition of Poland, in which she was supported by France, to succeed to the position which in older days the Polish Monarchy had held, and with very extensive territory which, had all her claims been granted, would have contained a pop. of nearly 40 millions, to be a permanent barrier between Germany and Russia. But ambitions of this nature require great administrative capacity as well as extended possessions. The Poles, largely owing to the continuous warfare in which they were involved, found little time for dealing with the administrative problems; the finances fell into a state of disorder, the Polish mark being quoted in 1921 at 8,000 to the pound sterling. The amalgamation of Russian, Austrian and Prussian Poland presented grave difficulties, and there was danger lest Poland might become a source of weakness rather than of strength. The permanent peace of Europe in the east could not be secured until a friendly and pacific Government was established in Russia, and it was unlikely that any settled Russian Government would acquiesce in the complete separation of the Baltic provinces, which intervene between Russia and the sea, or in the permanent cession of large portions of White Russia and the Ukraine to Poland, inhabited as they are by a population Russian in origin and speech.

The Balkans.—The result of the war in the Balkans was, first, the completion of the process by which the Turkish Empire in Europe ceased to exist, and secondly a continuation of the work of the Treaty of Bucharest by which Bulgarian ambitions were sacrificed to the rival States of Serbia and Greece. By the Treaty of Sèvres the Sultan was deprived of all his European possessions except Constantinople, where he enjoyed only the shadow of authority, the Straits, so long the centre of international rivalry, being transferred to international control. The decision of the Treaty of Bucharest, by which Macedonia was divided between Serbia and Greece, was maintained; but in addition, by the Treaty of Neuilly, Greece came into the possession of the whole of the north coast of the Aegean (thereby cutting off Bulgaria from this sea) as well as Thrace, including the city of Adrianople. On the north the whole of the Dobrudja was assigned to Rumania; Bulgaria therefore came out of the war with a territory of about 71,000 sq. m. and pop. of five millions, much the smallest of the Balkan States—a great disappointment in view of the high ambitions which had been entertained such a short time before. Another new State was permanently added to Europe in Albania, which at the Assembly of 1920 was admitted as a member of the League of Nations. The final decision as to the frontiers had not yet been arrived at in 1921, owing to the difficulty of reconciling the rival ambitions of Greece and Italy. There were many other causes of unrest. The Balkan settlement had been markedly favourable to Greece, chiefly owing to the confidence given by the Allies to M. Venizelos. The Greek elections of 1920, which brought about the fall of that statesman and (after the early death of King Alexander) the restoration of Constantine, had therefore more than local importance. It seemed for the moment as though the whole basis of the settlement had been destroyed. The Treaty of Sèvres was not ratified. The Turkish National party under Kemal Pasha, which had established itself in Anatolia, with its capital at Angora, claimed for Turkey not only the whole of Asia Minor, but large parts of Thrace, including Adrianople, while the extremists went so far as to demand the restoration of the whole Turkish Empire, including Mesopotamia and Palestine. There was some evidence of serious discord between the Allies; both Italy and France entered into separate negotiations with the Kemalists. At the Conference of London, March 1921, which was attended by representatives both of the recognized Government in Constantinople and of the Kemalists, an attempt was made to find some basis of agreement between the Greeks and the Turks; this failed; a state of war followed, and though the Greeks started their campaign in Asia Minor successfully, their effort was brought to a standstill in the autumn.

Looking at Europe as a whole, it is seen that in 1921 the political system which had existed for so long, depending on the mutual rivalries and coöperation of some five or six great States, approximately equal in power, had for the time ceased to exist. Of them there remained only Great Britain, France and Italy; Germany, though she had retained her unity, was prevented from asserting her place as an independent European Power by the very stringent disarmament conditions which had been imposed upon her, and also by the economic difficulties involved in the reparation clauses of the Treaty. The immediate result therefore was the ascendancy of France, who had, at any rate for the time, regained the position as the leading continental State, which in earlier days had come to be regarded as her permanent prerogative. This position France was aiming at making permanent, first by cementing her control over all countries on the left bank of the Rhine, and secondly by the establishment of a powerful Poland, the policy of which should be subservient to that of France. The interests of Italy were concentrated on the south-east of Europe, the Mediterranean and western Asia.

As a result of the war and the peace, the immediate general control, at any rate over all matters springing out of the treaties, was vested in the "Principal Allied and Associated Powers"—Great Britain, France, Italy, the United States and Japan; as the United States did not ratify the treaties, and Japan took little part in European affairs, the group practically consisted, up to the autumn of 1921, of the three other Powers, with whom for certain purposes Belgium was associated. The organs through which they worked were the Ambassadorial Conference sitting at Paris, and the Council of Prime Ministers, which met from time to time to deal with larger political matters. It followed from this that the peace and order of the continent, which was so essential in order to give an opportunity to repair the ravages of the war and meet the grave economic difficulties under which Europe was labouring, ultimately depended upon the friendly coöperation of these three Powers. This coöperation was not maintained without difficulty. In particular there were serious differences between Great Britain and France with regard to the treatment of Germany, the execution of the reparation clauses of the Treaty, and as to Polish affairs. These reached a crisis when in March 1920 the French, without consulting their Allies, occupied Frankfurt and other towns on the right bank of the Rhine, and again in July–Aug. 1921, when there was a grave difference of opinion as to Upper Silesia. There were also open disagreements as to the Near East. The unity of aims which alone could give efficiency to their joint action was wanting.

Side by side with the Supreme Council was the League of Nations, but the relation of the two organs had not been clearly differentiated. The League had not the power and resources to deal with matters in which larger political issues were involved, and its activities were chiefly confined to those specific matters referred to it by the treaties of peace, or to other matters of minor importance in which its help was invoked, as, for instance, the Åland Is. and Vilna. In 1921 it included all European States with the exception of Germany and Russia, but these two together represented a potential force equal to that of almost the whole of the rest of the continent, and the League was not yet able to take the position, which its advocates anticipated, of a final Court of Appeal whose decisions would be, if necessary, enforced. So far indeed the hopes of a new era in international relations had not been fulfilled. Disarmament had been imposed upon Germany, Austria, Hungary and Bulgaria, and there had been a great reduction of armaments in Holland and Scandinavia; but France and Italy maintained the older system, and the new States, intent on their independence and integrity, were determined to rely on their own strength. In particular, Poland, occupied as she had been in the war with Russia, and with the enforcement of her territorial claims on her other frontiers, maintained an army of some six or seven hundred thousand men, an army which was a heavy burden on the finances and the resources of the country.

After the Napoleonic War, the Great Alliance, supported as it was by large armies, was in fact able to impose its will upon the continent. In a not dissimilar situation France, Great Britain and Italy together had neither the resources nor the unity of will which would have been requisite even if they desired to imitate their predecessors; in particular, England, occupied with urgent difficulties of finance, and burdened with great responsibilities in other parts of the world, was intent, so far as possible, on avoiding new continental entanglements. The task of supervising the execution of the treaties of peace was in itself more than sufficient to occupy the Allies, and in consequence the smaller States were enabled to show an independence, the attainment of which was one of the avowed objects of the Allies in the war. Europe had been freed from the danger of one European predominance; it showed no disposition to accept that of the victors in the war. In this state of affairs the smaller States were tending to associate themselves in local groups—*e.g.* in Scandinavia, the Baltic States, the successor States of Austria-Hungary—and the political problems by which the continent was still distracted more and more assumed a local rather than a general character. It might be hoped that, though slowly, the animosities excited by the war would subside, and that these local groups would be able to concentrate their attention on the very urgent economic problems, the settlement of which was so essential to the future welfare of the continent.

See *A History of the Peace Conference of Paris*, edited by H. W. V. Temperley, 1920.

EVANS, SIR ARTHUR JOHN (1851–), English archaeologist, was born at Nash Mills, Herts., July 8 1851, the eldest son of Sir John Evans, K.C.B. (*see* 10.2*). Educated at Harrow, Brasenose College, Oxford, and Göttingen, he was elected fellow of Brasenose and in 1884 keeper of the Ashmolean Museum at Oxford, holding this post till 1908. He travelled in Finland and Lapland in 1873–4, and in 1875 made a special study of archaeology and ethnology in the Balkan States. In 1893 he began his investigations in Crete, which have resulted in discoveries of the utmost importance concerning the early history of Greece and the eastern Mediterranean (*see* 1.246, 7.421). A member of all the chief archaeological societies in Europe, he was given hon. degrees at Oxford, Edinburgh and Dublin, and was made a fellow of the Royal Society. In 1911 he was knighted. His chief publications are: *Cretan Pictographs and Prae-Phoenician Script* (1896); *Further Discoveries of Cretan and Aegean Script* (1898); *The Mycenaean Tree and Pillar Cult* (1901); *Scripta Minoa* (1909 *et seq.*); and reports on the excavations at Knossos. He also edited, with additions, Freeman's *History of Sicily*, vol. iv.

EVANS, SIR SAMUEL THOMAS (1859–1918), British judge, was born at Skewen, near Neath, May 4 1859. He was educated at the local school and at London University, being afterwards admitted as a solicitor (1883). He practised for some years at Neath, but in 1891 was called to the bar, where he soon built up a large practice, his numerous Welsh connexions being of great value. In 1890 he was elected Liberal member for Mid-Glamorganshire, and held the seat until 1910. In 1901 he became a Q.C., in 1908 was elected a bencher of the Middle Temple, from 1906–8 was recorder of Swansea, and in 1908 was knighted and appointed solicitor-general by Sir Henry Campbell-Bannerman. In 1910 he was raised to the bench, becoming president of the Probate, Divorce and Admiralty division. On the outbreak of the World War the Prize court was reëstablished, and the work here done as president by Sir Samuel Evans was of the highest value, many of his judgments laying down principles of great importance. He was created G.C.B. in 1917, and died in London Sept. 13 1918.

EVERT, ALEXEI (1857–1917), Russian general, was born in 1857 and entered the army in 1876 after finishing his course at the infantry military school in Moscow and receiving a commission in the Volinsky Guard Regiment. He passed through the academy of the general staff, and was appointed on the general staff. Later, after commanding an infantry regiment, he was in 1900 promoted to the rank of general. In the war with Japan 1904–5, he served on the commander-in-chief's "quartermaster" (*i.e.* general) staff and later as the chief of the staff of the I. Army. In 1906 he became chief of the general staff, but very soon afterwards he was appointed commander of the XIII. Corps. In 1912 he was commander of the troops of the Irkutsk military district. In Aug. 1914, while commanding the IV. Army, he participated in the victory of the Russians in the Galician battle, for which he was awarded the cross of St. George of the 4th degree. In Oct. his army was thrown on the W. bank of the river Vistula, where under his leadership it fought in the fierce battles of the winter of 1914–5 and the summer of 1915. In Aug. 1915 he was appointed commander-in-chief of the north-western group of armies, and he extricated the armies under his charge from a very critical position during the Vilna–Molodechno operations. In 1916, in order to relieve pressure on the western front, several attempts to break through the German line were made on his front, causing great losses of men and ending unsuccessfully. In March 1917, at the beginning of the Revolution, he was relieved of his duties, and he was later reported to have been killed by the Bolsheviki.

EXCESS PROFITS DUTY AND TAX.—The outbreak of the World War in 1914, and the consequent gigantic increase in the public expenditure of the belligerent nations, led inevitably, not only to an increase in the weight of existing taxes, but also to a search for fresh sources from which substantial amounts of revenue could be raised. It soon became clear that, among the potential sources of additional revenue, the taxation of "excess profits" merited serious consideration, and the subject was explored in many countries, with the result that, during the war, taxes of this character were imposed in the United Kingdom, Australia, Canada, New Zealand, South Africa, France, Italy, the United States of America and other countries. The characteristic features of these taxes were:—(i.) that they were charged in respect of the profits of trading concerns as such rather than of individuals, and (ii.) that the amount payable was determined, not by reference to the total profits of a concern, but by reference to its profits in excess of a certain standard, ascertained separately in each case on a prescribed basis. It was in the basis adopted for the computation of the standard that the main difference in principle between the various taxes was found, and in this respect the taxes fell into two distinct classes. On one basis the tax may be described as essentially a tax upon war profits, inasmuch as it was levied upon profits arising during or after the war in excess of a standard representing the profits or average profits of a period prior to the war. On the other basis, the tax took the form of a tax on profits in excess of a prescribed return on capital, and the standard was generally calculated by reference to a percentage upon the capital employed in earning the profits. It was the former of these two principles which was adopted as the general basis of the tax in the United Kingdom (where a tax on excess profits was first imposed), although the latter principle

** These figures indicate the volume and page number of the previous article.*

appeared as a secondary feature in the scheme. Both bases, either separately or in combination, appeared in the schemes adopted in other countries.

UNITED KINGDOM.—The taxation of excess profits in the United Kingdom was effected by means of two separate and distinct imposts, viz. the munitions exchequer payments (commonly known as the munitions levy) and the excess profits duty. The character and the causes which led to the introduction of these two imposts were essentially different. The munitions levy, which applied only to a restricted class of concerns, viz. those engaged on the production of munitions of war or work allied thereto, was not primarily designed for the purpose of raising revenue. Owing to the urgent need of producing munitions in enormous and ever-growing quantities, it became necessary in the early part of 1915 that the Government should control the operations of these concerns and lay down conditions as to the employment of labour therein, conditions which were regarded as prejudicial to labour interests, and it was ultimately arranged that, while on the one hand labour would accept the proposed conditions, the owners of such concerns would for their part agree to hand over to the Government any amount by which their profits exceeded a certain standard. The amount so handed over was the munitions levy, and this levy was thus imposed as part of what may be termed a bargain made between capital, labour and the State, in order to secure increased production of necessary war materials.

The excess profits duty, on the other hand, was imposed purely for fiscal purposes, and, unlike the munitions levy, was a tax on trades and businesses in general. But while it was essentially a means of raising large amounts of revenue, the excess profits duty met a growing popular demand for a curtailment of the large profits made in many classes of trade owing to the war. Early in the war it had become obvious that, owing to restricted supplies of, and enormously increased demands for, various commodities, huge profits were being reaped by those who traded in those commodities (*see* PROFITEERING), and there was an ever-increasing volume of opinion, which became more and more insistent as the war continued, that those huge profits, due directly to war conditions, must not be allowed to remain in the possession of private traders, but should be appropriated by the State either in whole or in part, and applied towards meeting the cost of the war. It was this growth of public feeling, the feeling that the war must not become a means whereby certain citizens could enrich themselves at the expense of the community while others were dying on the battlefield, as well as the urgent financial needs of the State, which led in the middle of 1915 to the proposals for the taxation of excess profits, and then to the actual imposition of the excess profits duty.

In the following outline the excess profits duty, although it was imposed at a later date than the munitions levy, is dealt with first, as the more important and more general.

General Scheme of the Excess Profits Duty.—The excess profits duty, which was first imposed by the Finance (No. 2) Act, 1915, was charged on the excess profits of businesses which were either carried on in the United Kingdom or carried on abroad and owned by persons residing in the United Kingdom. The duty extended to all classes of business, including agency, with the following exceptions, viz.: (*a*) husbandry in the United Kingdom, (*b*) offices or employments, (*c*) professions, and (*d*) commercial travellers. The duty was charged upon profits, in excess of a pre-war standard of profits, arising in an accounting period, *i.e.* a period, not exceeding 12 months in length, which normally corresponded with the period for which the accounts of the business were made up. Although the Finance (No. 2) Act, 1915, was not passed until the end of 1915, the duty was imposed with retroactive effect and charged by that Act upon the excess profits arising in any accounting period which ended after Aug. 4 1914 (the date of the commencement of the war) and before July 1 1915. The duty was regularly continued by each annual Finance Act to the year 1920 inclusive and in each case the period of charge was extended for what was practically another year. These later Acts, while introducing certain modifications of detail, did not materially affect the general scheme of the duty.

Rate of Duty.—The excess profits duty was originally imposed at the rate of 50%, but that rate was varied in succeeding Acts. The changes in the rate of duty at successive periods are set out in the following table.

TABLE SHOWING VARIATIONS IN THE RATE OF EXCESS PROFITS DUTY, 1915–21.

Period of Incidence	Rate of duty on excess profit per cent.
For a year from the commencement of the first accounting period	50
From the end of the first year to Dec. 31 1916 .	60
From Jan. 1 1917 to Dec. 31 1918	80
From Jan. 1 1919 to Dec. 31 1919	40
From Jan. 1 1920 to the termination of the duty, viz. the end of the final accounting period .	60

In the case of a business which commenced after Aug. 4 1914, the rate of duty was 50% in respect of any accounting period ending on or before Aug. 4 1915, and 60% for any other accounting period or part of an accounting period up to Dec. 31 1916.

Pre-War Standard of Profits.—As stated above, the duty was charged on profits in excess of a pre-war standard. This standard was based upon the pre-war profits of the business; but in order to avoid the imposition of too heavy a burden upon the taxpayer in cases where the pre-war profits were small in amount, alternative methods of measuring the pre-war standard were provided, the taxpayer being given the choice of adopting that standard which was most favourable to him. It must, however, be made clear that, whatever standard was adopted, it was a standard based upon actual facts and not upon hypothetical conditions. The normal standard was one based upon the average profits of the business in the best two out of the last three pre-war years. Where there had been only two years of pre-war trading, the standard was the average profits of those two years, or (at the option of the taxpayer) the profits of the second of those two years. Where there had been only one year of pre-war trading, the standard was for that year.

Alternative methods of computing the standard, which could be adopted by the taxpayer, if he so desired, were as follows:—(i.) A standard based on the average profits of four out of the last six pre-war years (restricted to cases in which the average profits of the last three pre-war years were 25% less than those of the preceding three years); and (ii.) a percentage standard, *i.e.* a standard computed at the statutory percentage rate upon the capital employed in the business. (The basis on which capital was computed and particulars of the statutory percentage rate are set out and explained in the section which follows.)

In the case of a business which had less than one year of pre-war trading or was not commenced until after the outbreak of the war, the standard was normally a percentage standard; but an alternative standard was provided, computed by reference to the pre-war earnings of the proprietor of the business, whether those earnings arose from a profession or employment or from some other business.

As regards accounting periods ended after Dec. 1919, a further alternative standard was provided (by the Finance Act, 1920) applicable in general to businesses carried on by individual owners, partnerships and private companies, whether those businesses were commenced before or after the outbreak of war. This standard, known as the substituted standard, only took effect for accounting periods ended after Dec. 31 1919. The substituted standard was computed by adding to the percentage standard a sum of £500 in respect of each proprietor working full time in the business—subject to the limitation that the standard was not to exceed £750 for each working proprietor.

Capital and the Statutory Percentage Rates.—The capital taken into account for purposes of excess profits duty was broadly speaking the proprietor's capital actually employed in the business, and was computed by deducting the amount of the liabilities from the value of the business assets. In making that computation the following principles were followed:—(i.) Investments outside the business were not taken into account (except in the case of investment, etc. companies), as the capital they represent was not capital employed in the business. (ii.) Debentures and other loan capital were treated as liabilities, and the amount thereof was consequently deducted in making the computation. (iii.) Assets in general (apart from cash or debts) were valued at cost (or, if not acquired by purchase, at their value when they first became assets of the business), subject to any proper deduction for wear and tear, etc. The result of a computation on these lines was an amount which, though it might differ from the amount of capital shown in the balance sheet, was a measure of the proprietor's capital, including reserves, employed in the business.

For ascertaining the percentage standard, the statutory percentage rates prescribed in the Acts relating to the excess profits duty were applied to the capital computed on the above basis.

The percentage rates, some of which were varied from time to time during the lifetime of the duty, differentiated between companies on the one hand and private businesses on the other, a lower rate being prescribed in the case of companies on the ground that in their case a deduction from profits was normally allowed in respect of remuneration paid to the directors and managers, whereas no deduction was allowed for remuneration paid to the proprietor of, or partner in, a private business.

The statutory percentage rates applicable for the purpose of determining the percentage standard were as follows:—

	In the case of companies or other bodies corporate.	In the case of private businesses.
(i.) In respect of accounting periods ended on or before Dec. 31 1916	6%	7%
(ii.) In respect of accounting periods ended after Dec. 31 1916—(*a*) In the case of a business having one or more pre-war years	6%	8%
(*b*) In the case of a business having less than one pre-war year or a business commenced since the outbreak of war	9%*	11%*

*Increased by 2% for accounting periods ended after Dec. 31 1919.

Provision was made, however, for an increase of the statutory percentage rate in cases where a class of trade could prove an application that special risks attached to the employment of capital in that trade. Such applications, which could only be made on behalf of a class of trade as a whole and not by individual concerns within a class, were dealt with by a board of referees specially appointed by the Treasury.

Statutory Allowance.—In computing excess profits, a deduction of £200 per annum was allowed in the case of every business. This amount was subsequently increased in the case of small businesses:—(i.) In respect of accounting periods ended after Dec. 31 1916, by varying amounts up to a maximum addition of £400 per annum, and (ii.) in respect of accounting periods ended after Dec. 31 1919, by varying amounts up to a maximum addition of £800 per annum.

Computation of Profits.—Profits both in the accounting periods and in the pre-war years were computed by reference to the actual profits arising in those periods, and it was a general principle of the tax that a similar basis of computation should be adopted throughout. Subject to certain exceptions, the general basis of computation of profits was the same as that adopted for purposes of income tax. Income derived from investments (save in the exceptional case of investment concerns) was excluded from the computation of profits; but the income-tax method was departed from in allowing a deduction in respect of interest on borrowed money. In three other directions in particular a departure was made from the general scheme of computing profits for purposes of the income tax. In the first place, the amount allowable as a deduction in respect of the remuneration of directors and managers of a business was expressly restricted to the amount so paid in the last pre-war trade year, unless the commissioners of Inland Revenue (the assessing authority) directed otherwise. In practice, the commissioners restricted the allowance to the amount paid in the last pre-war year in cases where the director or manager was in a proprietary position. In other cases, the increased remuneration paid was in general allowed as a deduction either in whole or in part. In the second place, a deduction from profits was expressly authorized by section XI. (3) of the Finance (No. 2) Act, 1915, in respect of special depreciation due to the war of capital assets employed in the business and of expenditure on repairs deferred in consequence of the war. In the third place, recognition was given in the excess profits duty to the principle that variations of capital imply variations of profit, and where the capital employed in the accounting period varied in amount from that employed in the standard period, an adjustment was made—a deduction (at the statutory percentage rate) being allowed in respect of any increase in the amount of capital in the accounting period as compared with that in the standard period, and an addition being made in respect of any corresponding decrease.

Apart from the general provisions for the computation of profits, special provisions were enacted with respect to investment companies, coöperative societies, the shipping industry and businesses carried on by municipal authorities; and the duty was extended by the Finance Act, 1918, to profits arising from certain sales of trading stock which were in the nature of capital transactions.

Set-off in Respect of a Deficiency of Profits Below the Standard.—At the time when the excess profits duty was first introduced, the view was taken that, having regard to the very high rate at which the duty was charged, it was necessary to take into consideration the general position of the trader over the whole lifetime of the duty. This view led to the introduction into the Statute of a provision under which the taxpayer became entitled to set off, against the excess profits duty of one accounting period, a sum equivalent to the duty on the amount by which his profits in another were below the standard.

Administration of the Duty.—Unlike the income tax, many of the assessments to which are made by a number of local bodies, the administration of the excess profits duty was expressly placed by Statute in the hands of one central authority, the commissioners of Inland Revenue, by whom the assessments were made, the main part of the work being carried out under their direction by H.M. Inspectors of Taxes. By this means it was possible to secure a measure of uniformity of practice which was otherwise unattainable in the case of a tax of so novel and difficult a character. From the assessments made by the commissioners of Inland Revenue the trader had a statutory right of appeal to either the general commissioners of Income Tax (local bodies appointed for the purposes of the income tax) or to the special commissioners of Income Tax. From the decisions of those commissioners, an appeal lay to the courts on a point of law at the instance of either the trader or the assessing authority (the commissioners of Inland Revenue).

On certain specific points, the settlement of a matter in dispute between the trader and the commissioners of Inland Revenue was reserved for the board of referees appointed by the Treasury, from whose decision an appeal lay to the courts on a point of law.

The duty was collected by the commissioners of Inland Revenue, and payment was required to be made two months after the notice of assessment was issued, though the commissioners of Inland Revenue were empowered to accept payment by instalments in suitable cases. Discount at varying rates was allowed on prepayment of duty, and certain Government securities issued during the war could be tendered in satisfaction of the duty.

Termination of the Excess Profits Duty.—In the early part of 1921, Mr. Chamberlain, then Chancellor of the Exchequer, announced that the Finance bill of that year would contain proposals for bringing the excess profits duty to an end. The decision to terminate the duty gave rise to almost as many difficult problems as did its imposition, the most important being those connected with the restriction of the duty to a uniform aggregate period of charge for all businesses alike and with reliefs to compensate for the heavy drop in the values of trading stocks after the termination of the duty.

The proposals embodied in the Finance bill of 1921 contemplated that, in the case of businesses which were in existence before Aug. 4 1914, the liability to excess profits duty would terminate on such a date as would result in each business being subject to the duty for a period of seven years from the commencement of the first accounting period. As such businesses commenced liability at different dates they would terminate liability at different dates, but in no case would liability cease before Aug. 5 1920, or after Aug. 4 1921. Businesses which did not come into existence until after Aug. 4 1914, would, it was proposed, cease to be liable to the duty at a fixed date, Dec. 31 1920. As regards the valuation of trading stocks it had been recognized from 1917 onwards that traders holding stocks of commodities might be involved in very heavy losses shortly after the termination of the excess profits duty and that some relief from excess profits duty in respect of such losses might fairly be given. Provisions of a highly technical character for granting this relief were included in the Finance bill of 1921.

General Observations.—In general, the administration of the duty proceeded smoothly and without any serious friction, and this was undoubtedly due in the main to the patriotic attitude adopted by taxpayers. Recognizing the necessity of the State to levy large sums by way of taxation, the taxpayer, notwithstanding the very high rates at which the duty was imposed, was not disposed during the war to raise issues affecting his liability, unless those issues were of a serious character involving very large sums.

That the duty proved a great success from the point of view of the Exchequer is evidenced by the following figures of its yield. These figures include the yield of the munitions levy:—

Financial Year.	Budget Estimate.	Amount paid into the Exchequer.
1915–6	—	£ 140,000
1916–7	£ 86,000,000	139,920,000
1917–8	200,000,000	220,214,000
1918–9	300,000,000	285,028,000
1919–20	280,000,000	290,045,000
1920–1	220,000,000	219,181,000
1921–2	120,000,000	—

It was anticipated that in 1922–3 some further substantial amount would be yielded, approximating to £70,000,000

The following figures giving the approximate excess profits arising in the undermentioned periods may be of interest:—

Accounting periods ended	Approximate amount of excess profits
Between Aug. 5 1914 and March 31 1917	£600,000,000
During the year ended March 31 1918	420,000,000
During the year ended March 31 1919	460,000,000
During the year ended March 31 1920	500,000,000

Although the duty proved invaluable as a means of producing revenue, experience showed that a tax of this character (*i.e.* one which has regard to the profits of a particular period as a standard) is one which is only suitable for adoption as a temporary measure in times of emergency. Where the circumstances are such that increased profits are being made by any considerable section of the community, an excess profits duty is certainly a most useful expedient for raising money quickly from those who are able to pay. But it is perhaps not suitable for adoption in normal times and circumstances or as part of a permanent scheme of taxation. It is in some respects unequal in its incidence as between one taxpayer and another, and unless the rate of duty is kept low it tends to discourage enterprise and to lead to extravagance and evasion.

Excess Mineral Rights Duty.—This duty was imposed as a complementary duty to the excess profits duty and, broadly speaking, remained in force over the same periods.

At the time when the excess profits duty was imposed upon traders on the ground that they were making excessive profits from the sale of general commodities, it was pointed out that, owing to the war, owners of mineral royalties were obtaining largely enhanced royalties. It was therefore decided to impose a duty on these enhanced royalties in so far as the increase was due to an increased rate of royalty and the duty so imposed was the excess mineral rights duty. The excess royalty on which duty was charged was computed by reference to the royalty paid in the pre-war years, and the rates of duty were the same as for excess profits.

The duty applied to only a limited number of taxpayers, was easy to administer and presented very few difficulties in practice. The yield was approximately some £250,000 per annum.

Munitions Levy.—The munitions levy—the official title of which was the munitions exchequer payments—was imposed by the Munitions of War Acts, 1915 and 1916, and the rules made thereunder. It applied only to businesses (mainly concerned in the manufacture of munitions and war material) which were subject to Government control under the Munitions of War Acts, and the period of liability commenced in each case from the date when the business was made a controlled establishment under those Acts. Different businesses consequently commenced to be liable to the levy at different dates according to their respective dates of control; the earliest date at which any business was controlled being July 2 1915. The levy was repealed by the Finance Act, 1917, as from Dec. 31 1916. The scheme was to allow the owner of the controlled establishment to retain a certain amount of profit (defined as the "divisible profit") the whole of the balance of profit in excess of that amount being taken by the State. The "divisible profit" was measured by a standard amount of profit plus one-fifth of that standard and the standard was normally the average profit of the controlled establishment in the two years before the war.

Various allowances were prescribed in the rules (1915) relating to the levy, among the more important of which were allowances for increased output, increased capital, capital expended specially for purposes of munition work, and the rendering of special service.

Although controlled establishments were subject to this special levy they were also subject, like all other businesses, to the general tax, the excess profits duty. Provision was, however, made that only the higher of the two charges should be payable. The result was, therefore, that while the two imposts ran concurrently, controlled establishments were liable like other trading concerns to excess profits duty and were also liable to a possible additional charge representing the excess (if any) of the munitions levy charge over the excess profits duty charge.

When the rate of the excess profits duty was increased to 80% as from Jan. 1 1917, it became clear that in practically every case the excess profits duty would exceed the munitions levy charge. In these circumstances there was no object in continuing the munitions levy and that impost was repealed as from Dec. 31 1916.

The levy was administered at first by the Minister of Munitions; but when the levy was repealed by the Finance Act of 1917, the administration was transferred to the commissioners of Inland Revenue, the body in whom the administration of the excess profits duty was vested. Appeals against assessments to the levy were referred to a board of referees under the Munitions Acts.

In itself the munitions levy can hardly be regarded as a scheme of taxation; rather it was a means of restricting the amount of profits which the State was prepared to allow owners of certain particular classes of business to retain. In this respect an analogy to the munitions levy may be found in the coal-mines excess payments imposed by the Coal Mines Control Agreement (Confirmation) Act of 1918, and the coal levy imposed by the Coal-Mines Emergency Acts of 1920 and 1921, which were applied to the coal-mining industry, and which had the effect as from March 1 1917 to March 30 1921 of restricting the amount of profit the owners of that industry might retain, the balance being taken by the State. (G. B. C.)

UNITED STATES.—In the United States the "excess-profits tax" (Act of March 3 1917), together with the "war excess-profits tax" (Act of Oct. 3 1917), and the "war-profits and excess-profits tax" (Act of Feb. 24 1919), was a natural product of the feeling that the abnormal expenses due to war should be borne so far as possible by taxes upon the increased profits of business which war usually brings. During the American Civil War the state of Georgia had adopted (1863) a tax on business profits in excess of 8% on the capital stock, varying from 5 to 25% according to the amount of such excess profits. But this experiment had been forgotten when the World War broke out, and the demand for special taxation of war profits first found expression, following the example of England, in the munition-manufacturers tax of Sept. 8 1916.

While the earlier plans for excess-profits taxation had attempted to confine it to profits directly attributable or traceable to the war, this limitation was soon abandoned and the net was spread for an increase or excess of profits during the war over normal profits earned prior to the war, allowance being made through a percentage of capital for (*a*) new business concerns, (*b*) additional investment by old concerns, and (*c*) concerns whose profits were abnormally low during the pre-war period. When the United States on March 3 1917 adopted its first excess-profits tax for the purpose of creating a "Special Preparedness Fund," Canada's plan of disregarding pre-war profits was followed, and a tax of 8% imposed upon the net income of partnerships and corporations in excess of "the sum of (*a*) $5,000 and (*b*) 8% of the actual capital invested."

The American decision to ignore pre-war profits was made deliberately by the framers of the law on the grounds that a deduction based upon invested capital is simpler, better designed to serve as the basis of a permanent tax, and more equitable in that it prevents taxpayers from securing immunity from taxation during the war on the ground that they had been unusually prosperous before the war. Eventually this decision precipitated an important controversy between the adherents of a "war-profits tax" (with the normal deduction based on pre-war earnings) and the advocates of an "excess-profits tax" (with the normal deduction computed as a percentage of invested capital); but the victory rested on the whole with the latter, although minor use of the pre-war profits was made in the tax finally collected for the year 1917, and for the one year 1918 a dual or alternative tax was imposed, the taxpayer paying in effect an 80% war-profits tax, or an excess-profits tax at progressive rates of 30 and 65%, whichever was the higher. For the year 1919 and thereafter, however, only the excess-profits tax was retained.

Rates and Exemptions.—Under the American tax the normal exemption or "excess-profits credit" consists of a specific exemption of $3,000 plus 8% of the invested capital. Profits or income in excess of this credit but not in excess of 20% of the invested capital are taxed at the rate of 20% and the remaining or higher profits are taxed at the rate of 40%. Under the American Act of Oct. 3 1917 the specific exemption to individuals and partnerships was $6,000 but to corporations only $3,000.

Taxpayers Subject.—The American law of 1917 applied to all trades and businesses including professions and occupations, but in case the trade or business had no invested capital or not more than a nominal capital, the tax was virtually an additional income tax equal to 8% of the income in excess of $3,000 for corporations and $6,000 for other taxpayers. Beginning with 1918, however, the tax was confined to corporations, excluding personal-service corporations (*i.e.* those "whose income is to be ascribed primarily to the activities of the personal owners or stockholders who are themselves regularly engaged in the active conduct of the affairs of the corporation and in which capital, whether invested or borrowed, is not a material income-producing factor") which are taxed substantially as partnerships. This limitation was due to dissatisfaction with the attempt to tax professional men under the Act of 1917, and a recognition that the income-tax proper bears more lightly upon corporations than upon other taxpayers. Under the income tax the entire income or profit of an individual is subject to normal tax and surtaxes (the latter rising to 65%), whether the income is spent or reinvested; but the corporation does not pay income surtaxes and its stockholders pay surtaxes only on the profits which are distributed. After 1917, therefore, the excess-profits tax became a compensatory or balancing tax upon the income of corporations similar to the 5% corporation profits tax adopted in 1919 for the same purpose in the United Kingdom.

Yield.—Judged by the standard of productivity, the most important quality of a war tax, the excess-profits tax was conspicuously successful during the war. The yield of the tax is shown herewith:—

Excess-Profits Tax Returned for Calendar Year	
1917—	
Individuals, etc.	$ 101,249,781
Partnerships	103,887,984
Corporations	1,638,747,740
Total	1,843,885,505
1918	2,505,565,939
1919	(est.) 1,315,000,000
1920	(est.) 520,000,000

The figures for 1918 represent possibly the largest annual amount ever produced in one country by a single tax. During the crucial years 1917–9 the excess-profits tax produced more than 25% of the total ordinary receipts (excluding receipts on account of public debt). Although the rates were severe, rising to 80% for 1918, the tax was collected without crippling industries owing to the high level of profits and to the protective effect of the normal exemption, the relief provisions, and the large degree of administrative discretion authorized in practically all excess-profits tax laws. Indeed, after payment of the heavy war income and profits taxes combined, the corporations of the United States had left, in each of the years 1917–9 inclusive, larger money profits than in any other year for which statistics exist, except the year 1916.

Weakness of the Tax.—Both political parties had promised the repeal of the excess-profits tax in the year 1921. This was partly explained by the sharp decline in its productivity under peace conditions, reflected in the statistics given above. But in the main the unpopularity of the tax was due to the effect of its high rates in stimulating extravagant expenditures by the taxpayers subject to it; the general belief (probably ill-founded in part) that it was passed on loaded with additions to the general body of consumers; its limitation to a small proportion (in number) of the business concerns; its great complexity which left the taxpayer uncertain as to his liability and threatened to cause, in the words of the Secretary of the Treasury, an administrative breakdown; and most of all to its capricious inequalities. The essential object of the tax was to lay a heavy tax upon "supernormal" income or profits. But to determine what constituted "normal" profits was a task of great difficulty. Where this normal profit was determined on the basis of pre-war profits, to use the words of the British Chancellor of the Exchequer, "prosperous concerns with a large pre-war profit standard might escape liability for the tax because their present profits, though high, are not in excess of their standard, and, at any rate, they pay tax on what all of us think an unduly low scale." In the United States, where the normal exemption was computed as a percentage of invested capital, corporations which had been liberally capitalized gained an unfair advantage over those which had been conservatively financed. The American tax unquestionably bore more heavily upon hazardous industries than upon those with more stable earnings. Thus for 1918, among corporations liable for excess-profits tax, the average ratio of the tax to net income was 30%. But construction companies paid 48%, manufacturing industries 38%, mining 25% and banks only 9%. This tax, said the Secretary of the Treasury in 1919, "encourages wasteful expenditure, puts a premium on overcapitalization and a penalty on brains, energy and enterprise, discourages new ventures, and confirms old ventures in their monopolies."

See Treasury Department, Regulation No. 41, relative to the *War Excess-Profits Tax* of 1917. (T. S. A.)

EXCHANGES, FOREIGN (*see* 10.50).—In no department of finance was there a greater upheaval as the result of the World War than in that of national currency-values as shown in the foreign exchanges. The theory of foreign exchange is sufficiently explained in the earlier article. It remains to deal here with the historical developments subsequent to 1910.

For some years immediately preceding the World War there had been a gradual movement on the part of all important countries towards the establishment of their currencies on a gold basis. It is true that only in England, the United States and India was there an absolutely free and unrestricted gold market, yet all the other leading countries, with the exception of China and Brazil, may be considered to have achieved this object, for although, as regards most of them, difficulties were placed in the way of those who desired to withdraw gold from their respective State banks for the purpose of export, yet it was generally understood that, in the last resource, these banks would part with gold rather than permit their exchanges to depreciate below their gold parity. The result was that exporters and importers in all these countries could trade with each other without troubling themselves about possible fluctuations in exchange. Rates moved within very narrow limits and merchants could ignore them.

Even in the case of such countries as Italy and Spain, which had not quite succeeded in stabilizing their exchanges (*i.e.* bringing their currency-values up to the gold par), the risk of loss through sudden and violent fluctuations in exchange rates was very slight. It was only when trading with China, Brazil, Portugal, and a few small South American and Central American states, that merchants felt it necessary to take exchange risks into account, and the more prudent were in the habit of avoiding such risk by buying or selling exchange for forward delivery.

Most banks and banking houses in England and elsewhere bought and sold foreign exchange, but they did not do so primarily with the object of making large profits, for very little money could be made out of exchange operations when fluctuations were small and of rare occurrence. Their chief object was to meet the requirements of their customers. Indeed, foreign banks having branches in London regarded their foreign exchange trading departments as the least expensive form of advertising. In fact, when one looks back to those times, one realizes that the currencies of nine-tenths of the world were for all practical purposes identical. One felt just as certain of getting 25 francs or 20 marks for a pound sterling as of getting twelve pence for a shilling or 100 centimes for a franc.

War-time Conditions.—In reviewing conditions that ruled during the early days of the war, one cannot but wonder at the remarkable adaptability of the London foreign exchange market, particularly when account is taken of the numerous obstacles and restrictions that the British Government considered necessary, for good reason, to put in the way of exchange transactions. When the British Treasury assumed complete control over the London exchange market at the outbreak of the war, they had three important objects in view: first, to prevent British capital from being sent abroad; secondly to close every avenue by which enemy nations might carry on their trade with direct or indirect assistance from England; and thirdly to enable every British or Allied trader to obtain or to dispose of all the "exchange" necessary to carry on his legitimate business.

The following are some of the difficulties that had to be contended with: All communication between England and enemy countries was strictly prohibited. All letters and telegrams to and from England were opened and read by official censors and were subject to indefinite delay, if indeed they ever reached their destination. No transactions of a "speculative" nature were permitted. No gold coin or bullion was allowed to be exported from Great Britain without a licence, which was almost always refused. Exchange dealers were not permitted to deal with neutral banks or firms unless they obtained from them their signatures to the following declaration:—

> We undertake to the best of our ability that the account which you keep in our name on your books will not be utilized by us or by third parties for our account in any way which will, either directly or indirectly, assist, or be for the benefit of, any enemy of Great Britain, including any person, firm or company on any list published by His Britannic Majesty's Government and called the Statutory List; and, further, that any business whatsoever that we request you to undertake for our account will neither facilitate, nor compensate, nor clear transactions in any way or at any time connected with an enemy of Great Britain, including any person, firm or company on any list published by His Britannic Majesty's Government and called the Statutory List.
>
> We understand this undertaking to apply to every kind of transaction for which we utilize our account with you, including (but *not* excluding any other transactions which might directly or indirectly benefit any enemy of Great Britain or her Allies as above stated):—
>
> All sight or telegraphic payments to private individuals, firms, banks, etc., in Great Britain or other countries.
>
> The transfer of pounds sterling and/or foreign moneys to or from neutral countries on behalf of ourselves or third parties.
>
> The collection of remittances, coupons, drawn bonds, etc.
>
> The opening of documentary credit for the import and/or export of goods to or from our country or other countries.
>
> The collection and/or negotiation of cheques and bills on Great Britain and other countries.
>
> All cheques and bills drawn by us to the order of third parties.
>
> All payments, telegraphic and mail, that we make in sterling through your intermediary.
>
> All moneys that you receive in sterling from other parties for the credit of our account and/or moneys ordered to be held at the disposal of third parties.
>
> Bills domiciled payable with you.

British banks and bankers, dealing with foreign countries, had to fill up once a week and send to the Ministry of Blockade, a printed form showing under four columns:—

(a). The approximate total of available cash sterling balances held for account of persons, firms and corporations domiciled in each country (*less* overdrafts);

(b). The approximate total of British Treasury bills and other sterling bills, payable in Great Britain, *held at their free disposal* for persons, firms and corporations domiciled in each country;

(c). The approximate sterling equivalent of foreign currency balances with banks in each country;

(d). The approximate sterling equivalent of currency overdrafts " Nostro " abroad at banks in each country.

No British firm or institution was permitted to work in exchange in joint account with a neutral firm or institution. It was not permissible to execute an order for a neutral to buy or sell foreign exchange unless it was stated for whose account the order was given. It was not permissible for exchange dealers to keep in foreign countries more than the minimum cash balances necessary for keeping their accounts open. An official list was sent periodically to all exchange dealers from the finance section of the Ministry of Blockade containing the names of persons and firms whose transactions it was undesirable to facilitate or finance. The last of these lists (colloquially known as "Black Lists"), which was circulated in Dec. 1918, contained no less than 10,000 names of persons or firms with whom it was not permitted to trade either directly or indirectly. It was not permissible to telegraph in cypher, though as a concession when ordering telegraphic transfers of money one private " check " word was permitted in each telegram, but this only to lessen the risk of fraud. (A few recognized codes in general use could, however, be employed, but the telegram had to commence with the name of the code and a small fee was charged by the censor.)

Troublesome these restrictions undoubtedly were, but they were not unreasonable; and foreigners, both Allies and neutrals, recognized that they were necessary and were not intended in any way to hamper them in carrying out their own legitimate trade. A large and increasing volume of orders to buy and sell foreign exchange came to the London market from the continent of Europe and also from America, with the result that London never lost its preëminent position as the world's centre for foreign exchange. Indeed, the great increase in the volume of exchange transactions that started very shortly after the declaration of peace, when exchanges were decontrolled and all restrictions were removed, found England better equipped than ever before for maintaining its leading position.

In this connexion the three subjoined tables, A, B and C, for London business done on various foreign centres, are of interest. The first (A) shows the highest and lowest exchange quotations during a normal pre-war year, the second (B) gives similar quotations for a post-war year, and the third (C) is a record of the rates at which actual transactions took place on one day in 1921:—

TABLE A.—Pre-war Rates—1912.

	Method of Quoting.	Lowest.	Highest.
New York . .	Dollars per pound .	4·84$\frac{13}{16}$	4·88$\frac{1}{4}$
Paris . . .	Francs per pound .	25·13	25·29$\frac{3}{4}$
Brussels . .	Francs per pound .	25·31	25·40
Germany . .	Marks per pound .	20·41$\frac{1}{4}$	20·55
Amsterdam .	Guilders per pound .	12·06$\frac{5}{8}$	12·10$\frac{1}{2}$
Italy . . .	Lire per pound . .	25·34	25·63
Madrid . .	Pesetas per pound .	26·58	27·34
Stockholm . .	Crowns per pound .	18·17	18·29
Christiania .	" " " .	18·17	18·29
Copenhagen .	" " " .	18·17	18·29
Lisbon . .	Pence per milreis .	46$\frac{1}{4}$d.	49$\frac{5}{8}$d.
Vienna . .	Crowns per pound .	24·06$\frac{1}{2}$	24·25
Bombay . .	Pence per rupee .	1s. 3$\frac{15}{16}$d.	1s. 4$\frac{5}{32}$d.
Buenos Aires .	Pence per gold peso.	48$\frac{3}{16}$d.	48$\frac{13}{16}$d.

England was by no means the only country where foreign exchange transactions were subject to strict State control. In Germany, in fact, restrictions were far greater than in England. In that country dealings in foreign exchange were confined, officially, to certain firms and banks, numbering in all 28, who were granted licences by the German chancellor permitting them to do that kind of business. The offices where such transactions were authorized were known as *Divisenstellen* or " Foreign Exchange Offices." Official rates governing exchange transactions were fixed by the State Bank. These varied from time to time. Table D (on p. 42) gives the highest and lowest official Berlin rates for the years 1916, 1917 and 1918.

It will be noticed how very steady were the Austrian, Hungarian and Bulgarian exchanges, especially during 1917. Even that on Constantinople varied only about 5% during that year. If one compares these with the variations in the French, Italian and American rates of exchanges as quoted in London in 1917, one will find that the German control was, on the whole, rather more successful, for although the difference between the highest and lowest quotations for the " pegged " dollar was barely $\frac{1}{4}$ of 1%, that for the French franc was about 2$\frac{3}{4}$% and that for Italy was as much as 31 per cent.

TABLE B.—Post-war Rates—1920.

Percentage of Variation.	Lowest.	Highest.	Method of Quoting.
25·75 Montreal	3·65	4·59	Dollars per pound
25·19 New York	3·21$\frac{1}{2}$	4·02$\frac{1}{2}$	" " "
68·83 Paris	40·75	68·80	Francs per pound
32·90 Holland	8·65	11·50	Guilders per pound
112·00 Italy	50·00	106·00	Lire per pound
52·26 Spain	18·98	28·90	Pesetas per pound
247·82 Portugal	5$\frac{3}{4}$d.	20d.	Pence per milreis
44·21 Norway	18·57	26·78	Crowns per pound
8·44 Sweden	17·07	18·51	" " "
32·20 Denmark	19·60	25·91	" " "
205·08 Finland	59·00	180·00	Finnish marks per pound
204·16 Germany	120·00	365·00	Marks per pound
20·26 Switzerland	19·40	23·33	Francs per pound
57·55 Belgium	40·40	63·65	" " "
96·85 Greece	25·40	49·50	Drachmas per pound
170·83 Bucharest	120·00	325·00	Lei per pound
233·33 Vienna	480·00	1,600·00	Crowns per pound
246·15 Prague	130·00	450·00	" " "
521·62 Warsaw	370·00	2,300·00	Polish mks. per pound
90·77 Rio de Janeiro	9$\frac{3}{4}$d.	18$\frac{17}{32}$d.	Pence per milreis
44·68 Buenos Aires	50$\frac{5}{8}$d.	73$\frac{1}{4}$d.	Pence per gold peso
100·00 India	1s. 4$\frac{3}{4}$d.	2s. 9$\frac{1}{2}$d.	Sterling per rupee
29·02 Japan	2s. 4d.	3s. 0$\frac{1}{8}$d.	Sterling per yen
145·16 Shanghai	3s. 10$\frac{1}{2}$d.	9s. 6d.	Sterling per tael
2·60 Singapore	2s. 3$\frac{5}{8}$d.	2s. 4$\frac{13}{32}$d.	Sterling per dollar

TABLE C.—Rates on Jan. 25 1921.

Percentage of Variation.	Lowest.	Highest.
9·00 Paris.	50·00	54·50
0·17 Amsterdam	11·39	11·41
8·27 Belgium	47·75	51·70
0·80 Spain	27·50	27·72
3·71 Italy.	101	104$\frac{3}{4}$
0·16 Switzerland	24·04	24·08
0·91 Stockholm	17·46	17·62
2·05 Christiania	19·55	19·95
3·78 Copenhagen	18·50	19·20
0·52 New York	3·80	3·82
0·46 Canada	4·30	4·32
4·00 Portugal	6$\frac{1}{4}$d.	6$\frac{1}{2}$d.
0·50 Buenos Aires	49$\frac{7}{8}$d	50$\frac{1}{8}$d.
1·00 Greece	50	50$\frac{1}{2}$
1·80 Finland	111	113
9·35 Germany.	203	222
8·33 Austria	1,200	1,300

Among the other difficulties that the German trader had to contend with were these:—No German current coins or banknotes were permitted to be sent abroad unless permission had been obtained previously from the State Bank. No German or foreign money could be sent abroad for the purpose of acquiring securities or merchandise of any description without the permission of the State Bank. This prohibition also extended to barter. No foreign credits of any description in German currency were permissible without the sanction of the State Bank. The Imperial chancellor had the power to authorize the State Bank to requisition from the possessor any foreign currencies, foreign balances or other " means of payment abroad," giving in exchange their full value in German marks at the official exchange then ruling. Persons or institutions acquiring or disposing of foreign exchange in any shape or form were obliged to give full information as to the nature of the business in question to the State Bank, and the *Divisenstellen* were empowered to make it a condition that this information should be given before doing business with them. Persons infringing any of these regulations or found to be giving false information, rendered themselves liable to fines varying from 100 to 50,000 marks and to imprisonment for periods not exceeding one year. In addition to this, the money or goods in question might be declared forfeit to the State.

Secrecy on the part of the *Divisenstellen* was ensured by an edict rendering anyone guilty of betraying any information obtained liable to a substantial fine or imprisonment.

The business of German money changers was very much hampered and restricted by emergency legislation. Money changers were certainly permitted to buy and sell foreign currencies against their equivalent in German marks, but the total amount so exchanged for one and the same person or firm by one or more money changers on one single day could not exceed 1,000 marks, nor in one calendar month 3,000 marks, unless special permission had been granted by the State Bank. Certain exceptions were made. For instance, it was not necessary to obtain permission to send funds abroad for the purpose of providing for the necessary disbursement of ships, nor for the purchase abroad of German war bonds or exchequer bonds. That part of Belgium occupied by German troops was treated in an exceptional manner and its exchange could be purchased or sold to any extent. Still, even in Germany, a very large export and import business could be carried on with Holland, Switzerland and Scandinavia. That trade was practically impossible with more distant countries was due to the blockade and not to foreign exchange restrictions.

In order to appreciate the effect produced by the war on the mechanism of dealings in foreign exchange, it is necessary to bear in mind the position previously occupied by the sterling bill throughout the world. Owing to the fact that London had been, for a far longer period than any other country, an absolutely free market for gold, and that the Bank of England had been willing to cash its notes on presentation, in gold to any extent, both for internal use and for export, the "exchange" of the whole world centred round the sterling bill, which had come to be regarded as actual *interest-bearing gold*. Nearly every foreign state bank was in the habit of keeping a certain portion of its reserve in sterling bills, which were renewed from time to time, as they became due, and only "melted" when and as these banks desired to replenish their stocks of gold.

Another thing to be remembered is the facility with which the Government banks of England, France, Germany, Belgium, Holland and other countries, could, until the outbreak of war, control their exchanges by raising or lowering their official discount rates. If, for instance, the rate of exchange between London and Paris was such that gold was being sent in inconvenient quantities from England to France, the Bank of England would raise the bank rate (and thus the value of money) in London to a sufficient extent to make it profitable for French banks to leave their money in England, or English bankers would draw three-months bills on France, in order to meet the demand for remittances to that country. Such bills, being almost invariably of the highest quality, were eagerly sought for by French banks and readily discounted in Paris.

The *immediate* effect of the outbreak of hostilities at the opening of Aug. 1914 was to break down the whole fabric of foreign exchange throughout the world. Credit, as regards foreign exchange, for the time being ceased to exist, and in every country there was a rush on the part of bankers and merchants to bring home their credit balance from abroad and to "melt" all their foreign bills. The movement of exchanges at the beginning of Aug. 1914 was most interesting. In America, for a short time, it was quite impossible to obtain exchange to meet indebtedness by remittances to London, and the value of the pound sterling in New York in consequence rose in one day as much as 30 per cent. On the other hand, in Paris the value of the pound depreciated 4 per cent. And this was in spite of the fact that, contrary to what prevailed in other countries, no prohibition was then put on the export of gold from the Bank of England.

In London, during the Aug. 1914 bank-holiday interval, which was prolonged by Royal Proclamation from Monday the 3rd until Friday the 6th, in order to avoid a panic, one of the most important problems before the British Treasury was the reestablishment of foreign exchange, since it was recognized that, until this was accomplished, it would be quite impossible to carry on the foreign trade of the country. It was necessary in the first instance to reëstablish the position of the sterling bill. For this purpose two things were necessary:—(1) to induce English accepting houses to continue to grant legitimate trade credits, and (2) to induce banks and discount houses to discount these acceptances when created. The accepting houses realized that an unknown but probably a large proportion of their acceptances would not be provided for by the drawers at due date, while the discount houses believed that many of the bills bearing their endorsements or guaranteed by them might not be met by the acceptors. Neither acceptors nor endorsers therefore felt themselves justified in adding to their liabilities.

These two apparently insuperable difficulties were overcome by the Treasury, with the assistance of the Bank of England. The Government, by a series of proclamations, relieved the endorsers of all approved sterling bills of their liability as endorsers, and authorized the Bank of England to advance at interest to all approved English acceptors, who, for reasons connected either directly or indirectly with the war, should not receive the money necessary to meet their acceptances at maturity, loans to meet these bills, repayable on or before one year after the termination of the war. Almost immediately these measures had the desired effect, and so far as the import trade of the United Kingdom was concerned exchange very soon resumed more or less its normal position. All trustworthy export houses abroad were sure of being able to finance their exports to Great Britain, and could rely on finding a ready market in London for their sterling bills. Cash payments, owing to the irregularity of the post, were usually made by telegraphic transfers. Exchange operations resulting from British export trade were not found so easy to carry out, and it was in this connexion that the mechanism of exchange underwent most change. No belligerent country other than England had been able in the early days of the war to maintain a free discount market; and throughout Europe, in those countries where gold had hitherto been obtainable, its export was prohibited. The result was that, in continental rates of exchange on London, although there was a limit as to the extent of a fall, owing to there still being a free gold market in England, there was no limit as to a rise. As a result, no prudent bank or exchange dealer in London kept any substantial balance abroad, and portfolios of bills in foreign currency (formerly held to the value of tens of millions of pounds) were no longer maintained. Their place in the business was taken by Treasury bills.

TABLE D.—Official Rates of Exchange in Berlin.

	Holland.	Denmark.	Sweden.	Norway.	Switzerland.	Vienna.	Madrid.	Bulgaria.	Constantinople.
	Parity: Fl. 100 equals M.168¾	Parity: Kr. 100 equals M.112½	Parity: Kr. 100 equals M.112½	Parity: Kr. 100 equals M.112½	Parity: Fr. 100 equals M.81—	Parity: Kr. 100 equals M.85—	Parity: Pts. 100 equals M.81—	Parity: Leva. 100 equals M.81—	Parity: £1 (Turkish) equals M.1—
1916									
Highest .	239½	164	171¾	167¼	116⅞	71·57	—	79½	—
Lowest .	217	148⅝	149¾	148¾	101⅝	63·95	—	76½	—
1917									
Highest .	314¾	233	259¾	234¼	158¼	64·45	136½	80¾	21·05
Lowest. .	220¾	161½	171¾	165¼	116⅞	63·95	124½	79½	19·90
1918									
Highest .	364	225½	250¼	238¾	178¾	66·25	141	80	21·10
Lowest. .	215½	152½	162¼	159¼	112½	53·95	103	79	18·85

The prohibition against selling stock-exchange securities owned by foreigners on the London market, and the difficulty in the way of selling securities held in England on any other market except that of New York, combined with the British Government having assumed practical control of all credit operations, resulted in the very early days of the war in foreign exchanges being swayed almost entirely by actual trade transactions. Thus, the American sterling exchange (London on New York) after the first month or so of the war remained at a rate then considered low, because Great Britain was importing vast quantities of food and munitions from the United States and a large adverse balance of trade was being created. On the other hand in countries like France and Italy, who made large purchases in England, the exchange rose (*i.e.* depreciated in value) to heights that had not hitherto been reached. The same thing occurred even to a greater extent with regard to the Russian exchange (rubles). Russia in pre-war days had met its large indebtedness to England to a considerable extent by the export of food-stuffs, but owing to the closing of the Black Sea and the Baltic ports it was unable to carry on its export trade to anything like the normal extent. Heavy as was the depreciation in these rates of exchange, it would have been much heavier were it not for the fact that the British Government assisted its Allies to obtain large credits in London and in other markets.

In the case of countries like Brazil, Argentina and Chili, it had become almost impossible to obtain exchange on London. This was especially the case in Brazil where the export trade is seasonal. Before the war it had been the custom for South American banks to obtain financial credits in London during the periods when trade bills were not forthcoming, and by means of bills drawn against these credits their debts to Europe were tided over. These credits were eventually liquidated by means of trade bills created during the export season. In the early stages of the war European creditors either had to wait for their money or to accept very unfavourable rates.

Nevertheless, chiefly owing to the action taken by the British Government, the mechanism of foreign exchange was less seriously affected on the whole than might reasonably have been expected. Only for a very short period and between very few countries was trade held up altogether on account of exchange difficulties, but the fluctuations of *rates* of exchange between most countries became so great that the cost of exchange soon became a very important factor and had to be reckoned with, even in transactions on which the margin of profit was considerable.

During the first year of the war the pound sterling had maintained its value fairly well in all neutral countries and particularly so in the United States, which was neutral until April 1917.

At the end of 1915 the leading exchange rates with countries open to business on the London market were as follows:—

Montreal	4·74½	Christiania	17·25
New York	4·74½	Stockholm	17·10
Paris	27·73	Copenhagen	17·35
Amsterdam	10·83	Petrograd	159
Italy	31·45	Calcutta	1/4$\frac{1}{16}$
Madrid	25·05	Rio de Janeiro	12⅛
Lisbon	34d.	Buenos Aires	49⅛
Switzerland	24·90		

England however had been pouring money into America in ever-increasing amounts, to pay not only for those commodities for the supply of which England in normal times depends to a large extent on America, such as cereals, cotton, etc.—and these at very high prices—but also for the vast quantities of war material of all kinds which were being manufactured at high pressure and even higher cost both for England and for its Allies. Exchange to meet the payments for these articles as they became due was provided partly by the export of gold. Between Oct. 1 and Dec. 31 1915, gold to the value of over seventeen million pounds sterling was withdrawn from the Bank of England for export to New York alone—partly by the proceeds of the sale through ordinary channels of the bulk of what may be described as the floating stock of American securities held in England, and partly by the calling in as they became due of all the short-term loans that had been made by English investors to America. Indeed, at the very beginning of the war, the city of New York was called upon to repay £13,500,000 that happened to fall due at that time; and as this large sum had to be found very quickly on a panicky and depleted exchange market, as high an exchange as $6.75 had to be paid per British pound for prompt cable payment. It must have been evident at the time that, owing to the fact that England had just become involved in a life and death struggle with a desperate and powerful antagonist, whereas America could not but profit through its neutrality, the pound must depreciate and the dollar appreciate. But the demand in New York had to be met regardless of cost.

It is a curious and interesting fact that when the dollar was at its worst, *i.e.* $6.75 to the pound on Aug. 3 1914, the premium on the pound in New York was $1.79, whereas when the British pound was at its lowest value, about $3.19 in Feb. 1920, it was at a discount of only $1.64½.

Very soon after the outbreak of the war, the principal foreign exchanges tended to group themselves into four divisions on the London market. These became known as the "Allied exchanges," the "Enemy exchanges," the "Neutral exchanges" and the "Eastern exchanges." Whether we take as a basis the pound sterling or the United States dollar (to which, in fact, the pound was steadily linked in value from the commencement of 1916 till four months after the Armistice was declared), we find, speaking generally, that the Allied exchanges were at a discount, the Enemy exchanges at a greater discount, and the Neutral and Eastern exchanges at a premium.

The reason is not far to seek. Of the Allies, only England and France could be described as wealthy; and—partly because the war on the western front was waged mainly on French territory so that not only the most fertile part of France but also the chief centres of French industry were devastated, and also because the French were very inadequately taxed during the whole period of the war—French international credit was not maintained on the same level as that of England. The other Allies were lacking in accumulated wealth, and very soon became financially dependent, primarily on England and to a smaller extent on France. But the leading neutrals, who in Europe comprised Holland, Spain, Switzerland and the three Scandinavian kingdoms and in S. America the Argentine Republic, were in a very favourable financial position. The European neutrals could trade to their great pecuniary advantage with both groups of belligerents, and could take full advantage of the great demand that sprang up for their produce. Spain could supply France with textiles and metals, Norway and Sweden could meet the demand for timber and paper (which was much increased by the closing of the Baltic ports), and Denmark and Switzerland were able to supply both sides with dairy produce. In addition to these advantages the important mercantile fleets of Holland, Scandinavia and Spain were able to earn large profits because of the great rise that took place in freights. Indeed, throughout the war, preference was generally given by shippers to ships owned by neutrals, because the risk of their being sunk was considered somewhat less and the rates of insurance on their cargoes were therefore materially lower.

The eastern countries, China, India and Japan, were, it is true, belligerents, but their financial burdens were but slight compared with those of their European colleagues; and since China and India were large exporters of raw materials, while Japan assumed gradually the position of Germany as the chief supplier of the less costly manufactured articles, all three countries profited greatly by the war.

It may be asked why, although the United States was a free gold market and the pound was "pegged" (see below) to the dollar, both the sterling and dollar exchanges should have been for so long a period at a considerable discount in Spain and in Scandinavia. Indeed, on one day in Nov. 1917 the pound sterling was worth no more than Kr. 9·90 in Stockholm, and in April 1918 it was only saleable at Kr. 11·90 in Christiania and Copenhagen. The explanation is that, fearing the evils that might arise from "inflation," these four countries, one after another, announced that they would no longer purchase gold in any other form than that of their individual currencies, excepting on terms that would render such importation unprofitable. After the end of the war, when the demand for their produce slackened, these countries suffered from this somewhat original form of legislation by which gold was refused in payment. The exchanges of all of them fell to a substantial discount in New York, and three out of the four went to below their pre-war value as expressed in sterling.

Control of Exchanges.—Towards the end of 1915 the future outlook for sterling in New York began to assume a very serious aspect. The normal floating stock of American securities (as apart from regular investments) held in England was nearly exhausted, while the demands on America for war material were greater than ever. The British Government then decided that a supreme effort must be made to control foreign exchanges in general, and more particularly to ward off at all costs the threatened collapse in the gold (or in other words, the international) value of the pound sterling, as represented by its dollar exchange. Realizing, very wisely, that this task was too vast and too difficult to be dealt with in an adequate manner by any of the existing Government departments, they appointed a small committee which was known as the "London Exchange Committee" and gave them a free hand to deal with the situation as they thought best. The members of this Committee, which was under the chairmanship of the then governor of the Bank of England, Lord Cunliffe, included Sir Brien Cokayne (afterwards Lord Cullen), deputy-governor of the Bank of England; Sir Edward H. Holden; Sir Felix O. Schuster; Mr. Gaspard Farrer; Mr. Stanley Baldwin; the Hon. Sydney Peel. Later Mr. Baldwin retired and was replaced by Mr. H. G. Levick. The Committee were mainly men of international reputation, not only conversant with foreign exchange but also accustomed to deal with vast sums of money, and whose capacity had been proved by the success of the institutions they controlled. The activities of this Committee were not confined to American exchange, although that was considered to be its principal task, for the maintenance of the American exchange in itself was a support to the exchanges of the Allied nations and a great help to neutrals, for whose commercial transactions it was the only element of steadiness. It also watched carefully other exchanges, especially that of Holland, the wealthiest and most important of European neutral states.

Before starting their work the London Committee had to convince themselves that the means at their disposal were adequate for their task. What were these means? First came the stock of gold in the vaults of the Bank of England, over which they were given control, but this was none too large as a reserve against the Bank of England notes and the ever-increasing amount of Treasury notes that had taken the place of gold as the medium of circulation. Secondly, there was a considerable stock of gold held independently in the vaults of the London clearing banks, but this also was better left untouched if possible, as it formed a most valuable secret reserve that could be used to replenish the stock of gold held by the Bank of England should need arise, as indeed it did later on. Then there was the fresh gold coming in regularly from the gold-mines of the British Empire, averaging about £55,000,000 per annum or about 65% of the total world's production. This valuable "gold-income" was also placed at the disposal of the Committee to do with as they thought best. Finally, there was an unknown but certainly a very large quantity of foreign and colonial stocks and shares remaining in the hands of British investors and having an international market on realization: owners of these securities (*see* DOLLAR SECURITIES MOBILIZATION) were invited to sell them or to lend them to the British Government on favourable terms, and power was taken to commandeer them at market price should it become advisable to do so, but the amount forthcoming voluntarily was found to be ample.[1]

Having completed their exhaustive enquiries, the Committee decided that the means at their disposal were adequate and that the object in view was worth the cost. They embarked on their great task in Jan. 1916, and from that date until March 1919 the pound sterling was steadily maintained at a figure in New York equivalent to about par if allowance is made for the increased cost of freight and insurance for gold. It was not until March 1919 that it was decided that, the object having been achieved, control or "pegging" might be removed and the exchange allowed gradually to take its own course without interference.

It may be mentioned here that while financial authorities have been unanimously of opinion that this "pegging" of the American and English exchanges was the greatest, the most difficult, the most far-reaching in its effects, and the most successful of all the financial schemes embarked on during the war, there are some who think that the control was enforced for a longer period than was necessary, in view of the great expense entailed and the manifest fact that an exchange cannot be stabilized by artificial means for all time.

The Anglo-American exchange was the only one that was actually "pegged" or fixed, but the other exchanges were watched with equal care, and where ordinary means did not suffice gold shipments were made to Holland as well as to America. Important negotiations were entered into with such Governments as Argentina, Uruguay, and especially Japan, and proved very useful in maintaining some sort of stability for the pound, while other understandings were effected with various banks in Scandinavia, Spain and Switzerland.

The decontrol took place without any flourish of trumpets, and it was some little time before the world realized its full significance. It was not until July 1919 that the American sterling exchange fell below $4.50, nor till Dec. of that year that it broke below the $4.00 mark. In Feb. 1920 it fell below $3.50, when it touched $3.19, the lowest point recorded. In April 1920 it temporarily rose once more to over $4.00, but subsequently declined again below that level. The fluctuations in exchange after decontrol gave rise to a vast amount of speculation.

One of the chief causes contributing to the success of the task of the London Exchange Committee was the confidence inspired in the minds of neutrals, for it stands to reason that, great as were the resources placed at their disposal, the amount of the indebtedness of England to America soon became much larger, increased as it was by England assuming responsibility

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[1] The value of the foreign securities actually deposited in this way at the British Treasury reached the high figure of £438,311,000; this amount was considerably larger than had been expected. In addition to this, securities were sold to the Bank of England to the value of £46,000,000 and to the "Dollar Securities Committee" of £170,044,000. The following table gives fuller details of these operations:—

	Purchases £.	Loaned Securities £.	Total £.
Dollar bonds . .	136,002,988	39,571,276	175,574,264
Dollar shares . .	48,263,552	60,718,776	108,982,328
Sterling bonds . .	27,803,232	115,160,124	142,963,356
Sterling shares . .	875	—	875
Registered stocks .	4,119,358	171,851,047	175,970,405
Home railways . .	—	17,494,182	17,494,182
Franc bonds . .	—	338,340	338,340
Krone bonds . .	—	452,894	452,894
Florin bonds .	9,300	364,550	373,850
Florin shares . .	445,091	—	445,091
	£216,644,396	£405,951,189	£622,595,585

These figures are exclusive of a special creation of $40,000,000 Canadian Pacific Railway 4 per cent Dollar Debenture stock, deposited by the Canadian Pacific Railway Company. Of the total amount purchased, as given in the first column, *i.e.* £216,644,396, the Bank of England bought £48,600,000 and the Dollar Securities Committee £170,044,000. The deposits on loan on March 31 1919 amounted, therefore, to £405,951,000, which, with the deposits on loan sold to the Treasury, £24,360,000, and the £8,000,000 special deposit of the Canadian Pacific Railway Company, made the balance actually deposited £438,311,000. As will be seen from the above table, dollar securities constituted the major portion of those mobilized. Of the American securities, amounting to £250,543,000, which came into possession of the Treasury, £177,614,000 or more than 70 % were bought for resale in New York, and £72,928,000 or 29 % were still held in Great Britain at the time this report was made. A good deal was subsequently disposed of, bringing the total amount redeemed by the United States to about £200,000,000.

for debts contracted by its Allies for the purposes of the war. In fact, England may be said to have shouldered the entire burden until April 1917, when America joined the Allies. The neutrals believed in England's financial strength, and they also recognized that the pound sterling was interchangeable with the dollar on a basis which, with allowance for the increased cost of freight and insurance, was approximately equal to pre-war par value. In other words, since America remained on a real gold basis, and the English and American exchanges were linked together, England was for practical purposes also on a gold basis. They therefore were equally content to leave their rapidly accumulating foreign credit balances either in England or America, in whichever country a better rate of interest was obtainable. In order to offer an inducement for them to select England, the British Government authorized the Bank of England on their behalf to pay to British banks and bankers a specially high rate of interest on deposits emanating from customers in neutral states (*see* MONEY MARKET). Thus neutrals were able to get in England a rate of interest for their balances substantially higher than they could have got with equal security in America. They therefore abstained to a great extent from converting their sterling into dollars, which would have added greatly to the difficulties and expenses of the London Exchange Committee.

Vast as this operation of "pegging" the sterling exchange in America was, it was only part of a still more ambitious scheme. The object in view was to stabilize at the same time the French, the Russian and the Italian exchanges. With France success might have been possible, although France lacked one of the great essentials for that purpose, *i.e.* a gold "income." None, or practically none, of the newly mined gold of the world was controlled by France. The Bank of France, however, possessed a very large stock of gold, amounting to £169,351,920 at the beginning of 1915, and the quantity of gold coin circulating in France was larger than in England. The French also had many investments abroad even apart from their holdings of Russian securities; but they were unwilling to make the great sacrifices that were necessary to ensure success. Their taxation was infinitely lighter than that of England. The logical mind of the Frenchman argued thus:—"If we lose the war we are ruined anyway. If we win, then we shall have power to force the defeated enemy to foot our bill down to the last franc. So why worry now?" They certainly did not over-estimate the power of the conqueror to dictate his own terms, but they omitted to take into their calculations the possibility that the defeated nations might be unable to pay what was demanded of them. At any rate they endeavoured to stabilize the French franc largely on money borrowed, first from the British Government and English investors and accepting houses, and later from America. Such an attempt was foredoomed to failure, and the wonder is that they were able to keep their rate of exchange as favourable (or as far from unfavourable) as they did for so long a period. The movements of the French exchange as well as those of other countries will be seen in the annexed tables.

With Italy it was still more difficult, and the various attempts that were made to prevent a breakdown in that exchange were not very successful; but then Italy was absolutely unable to rely on its own resources, much as it might wish to have done so, and it cannot justly be accused of backwardness in the imposition of taxes. As regards Russia, the attempt might well be described as farcical, since it resulted chiefly in enabling wealthy Russians to remove their money from their own country to places of safety abroad, at the expense of the British Government and the English accepting houses, who gave their unwilling assistance not with the object of making a profit, but because their patriotism was appealed to.

Table E gives the rates of exchange on New York ruling in London at the beginning and the middle of each month from Jan. 1914 to Dec. 1920.

Indian Exchange.—In striking contrast to the success that crowned the efforts of the London Exchange Committee in dealing with the Anglo-American exchange, was the failure of the Indian Government to maintain the pre-war ratio between the British pound and the Indian rupee that had existed without a break since 1898.

TABLE E.

	1914	1915	1916	1917	1918	1919	1920
Jan.	$4\cdot81\frac{1}{2}$	$4\cdot85\frac{1}{2}$	$4\cdot77\frac{3}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{1}{2}$	$3\cdot78\frac{3}{4}$
	$4\cdot83\frac{1}{2}$	4·84	$4\cdot76\frac{7}{8}$	$4\cdot76\frac{13}{32}$	$4\cdot76\frac{13}{32}$	$4\cdot76\frac{9}{16}$	$3\cdot69\frac{5}{8}$
Feb.	$4\cdot84\frac{3}{4}$	4·84	$4\cdot76\frac{1}{2}$	$4\cdot76\frac{7}{16}$	$4\cdot76\frac{13}{32}$	$4\cdot76\frac{1}{2}$	3·29
	$4\cdot83\frac{3}{4}$	$4\cdot82\frac{3}{8}$	$4\cdot76\frac{1}{2}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{13}{32}$	$4\cdot76\frac{7}{16}$	3·41
March	$4\cdot83\frac{5}{8}$	$4\cdot81\frac{1}{4}$	$4\cdot76\frac{7}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{13}{32}$	$4\cdot76\frac{7}{16}$	$3\cdot63\frac{1}{4}$
	$4\cdot84\frac{5}{8}$	4·80	4·77	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{13}{32}$	4·58	3·79
April	$4\cdot84\frac{3}{4}$	4·80	$4\cdot76\frac{15}{16}$	$4\cdot76\frac{3}{8}$	do.	$4\cdot68\frac{1}{4}$	3·87
	$4\cdot85\frac{1}{4}$	$4\cdot79\frac{11}{16}$	4·77	$4\cdot76\frac{7}{16}$	do.	$4\cdot65\frac{3}{4}$	$3\cdot96\frac{1}{2}$
May	$4\cdot85\frac{1}{4}$	$4\cdot79\frac{5}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{7}{16}$	do.	$4\cdot69\frac{3}{8}$	$3\cdot85\frac{5}{8}$
	$4\cdot85\frac{3}{8}$	4·79	$4\cdot76\frac{15}{16}$	$4\cdot76\frac{7}{16}$	do.	$4\cdot64\frac{7}{8}$	$3\cdot82\frac{1}{2}$
June	$4\cdot86\frac{1}{8}$	$4\cdot78\frac{7}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{3}{8}$	do.	$4\cdot63\frac{1}{4}$	$3\cdot90\frac{7}{8}$
	$4\cdot86\frac{3}{4}$	4·77	$4\cdot76\frac{1}{2}$	$4\cdot76\frac{3}{8}$	do.	$4\cdot61\frac{1}{2}$	$3\cdot96\frac{7}{8}$
July	$4\cdot87\frac{5}{8}$	$4\cdot77\frac{1}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{13}{32}$	$4\cdot50\frac{3}{4}$	$3\cdot95\frac{15}{16}$
	$4\cdot85\frac{1}{8}$	$4\cdot76\frac{7}{8}$	$4\cdot76\frac{7}{16}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{13}{32}$	$4\cdot29\frac{1}{4}$	$3\cdot88\frac{1}{4}$
Aug.	(6·00) nom.	$4\cdot76\frac{3}{4}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{13}{32}$	$4\cdot76\frac{7}{16}$	$4\cdot35\frac{3}{4}$	$3\cdot62\frac{3}{4}$
	nom.	$4\cdot67\frac{1}{2}$	$4\cdot76\frac{1}{2}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{3}{4}$	$4\cdot28\frac{3}{4}$	$3\cdot60\frac{1}{8}$
Sept.	(5·00) nom.	4·63	$4\cdot76\frac{7}{16}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{9}{16}$	$4\cdot18\frac{11}{16}$	$3\cdot56\frac{1}{16}$
	4·95	$4\cdot68\frac{1}{4}$	$4\cdot76\frac{13}{32}$	$4\cdot76\frac{5}{16}$	$4\cdot76\frac{1}{2}$	$4\cdot16\frac{1}{4}$	$3\cdot51\frac{5}{8}$
Oct.	$4\cdot96\frac{1}{2}$	$4\cdot72\frac{1}{4}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{1}{2}$	$4\cdot23\frac{1}{4}$	$3\cdot48\frac{3}{4}$
	$4\cdot97\frac{1}{2}$	$4\cdot66\frac{1}{4}$	$4\cdot76\frac{7}{16}$	$4\cdot76\frac{13}{32}$	$4\cdot76\frac{9}{16}$	$4\cdot15\frac{5}{8}$	$3\cdot47\frac{3}{8}$
Nov.	$4\cdot90\frac{1}{2}$	$4\cdot65\frac{5}{8}$	$4\cdot76\frac{7}{16}$	$4\cdot76\frac{13}{32}$	$4\cdot76\frac{9}{16}$	$4\cdot16\frac{5}{16}$	$3\cdot41\frac{5}{8}$
	4·88	$4\cdot69\frac{1}{2}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{1}{2}$	$4\cdot05\frac{5}{8}$	$3\cdot45\frac{3}{4}$
Dec.	4·89	$4\cdot70\frac{3}{4}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{3}{8}$	$3\cdot88\frac{1}{4}$	$3\cdot48\frac{3}{4}$
	$4\cdot87\frac{3}{4}$	$4\cdot72\frac{5}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{3}{8}$	$4\cdot76\frac{1}{2}$	$3\cdot73\frac{1}{2}$	$3\cdot53\frac{5}{8}$

The Anglo-Indian exchange has always been a very difficult one to deal with, and it took five years' hard work (from 1893 to 1898) on the part of a particularly well-managed department of the Indian Government to establish the ratio of 15 rupees to the English sovereign, or 1s. 4d. per rupee. With great difficulty and at vast expense to the Indian taxpayer, this ratio was maintained during the war until Aug. 1917, when the Indian Council in London announced that they would no longer sell Indian exchange under 1s. 5d. per rupee. In April 1918 the rate was raised to 1s. 6d.; in May 1919 to 1s. 8d.; in Sept. of that year to 2s. 0d.; in Nov. to 2s. 2d. and in Dec. 1919 to 2s. 4d. In Jan. 1920 the rate was reduced to 2s. 0d., at which rate it was hoped that the exchange might be maintained, but by this time the Indian Government had been forced to come to the conclusion that the task of controlling the Anglo-Indian exchange was altogether beyond their power, and having spent on their attempts well over £20,000,000 and having caused losses far exceeding this amount to the Anglo-Indian trading community, while achieving no adequate result, they abandoned the attempt to interfere with the natural movements of their exchange.

In the course of their operations they purchased from the United States practically the whole of their accumulated stock of silver, amounting to 200,000,000 ounces. They suspended their weekly offerings of rupee exchange in London, and for a considerable period offered sterling exchange on the Indian markets. But it was to no purpose. The phenomenal rise in prices of commodities up to the early days of 1920, and their subsequent rapid fall, made their task too heavy for them, and after having reached 2s. 9½d. on Feb. 14 1920, the value of the rupee fell away till it touched 1s. 3d. on March 7 1921.

It must be borne in mind, however, that it is a far simpler task to "peg" an exchange to one which remains on a free gold basis—as was that of England before the war, and as that of America still remained—than to do so to that of a country whose currency is purely a fiduciary one and is subject to violent fluctuations in countries having a gold standard. In fact, during 1920 the average gold value of the pound note was only 14s. 6d. or 27½% discount, equivalent to 4½ pence on a 1s. 4d. rupee.

Chinese Exchange.—From time immemorial the Chinese exchange has been based on the price of bar silver, and the rate of exchange between Shanghai and England still rises and falls with the market price in London of that metal. It is true that the fluctuations in this exchange have been extraordinarily violent in recent years, but so have the movements in the price of silver. In this connexion it may be said that a large proportion of the supplies of silver that came to the London market during 1919 and 1920 was in the form of the melted silver currencies of France, Belgium, Germany and Austria, which were withdrawn from circulation and melted into bars. So much of this silver came into that market during this period that, notwithstanding the fact that the U.S. Treasury made an agreement with the American producers to purchase an amount of silver sufficient to replace what they had sold to the Indian Government at the fixed rate of a dollar an ounce, it was obtainable in large quantities at prices considerably below what it was costing to produce it in many of the most important mines. And yet the French, Belgian, German and Austrian Governments were making substantial profits in terms of their own depreciated currencies.

South African Exchange.—Up to the time of the outbreak of war, there was almost a stereotyped London rate of exchange on S. Africa, never varying beyond the cost of sending gold either way—usually, buying 0·5% discount, selling 0·5% premium. Owing to the difficulty in getting the natives to take and circulate notes, gold was the S. African currency in common use. In normal times there is a considerable leakage of gold from S. Africa. This rose to considerable proportions after the war had commenced owing to the heavy premium on gold in other countries. Even after a law had been passed prohibiting the export of gold, a considerable amount of smuggling took place and continually reduced the amount of sovereigns held by the S. African banks. In order to replenish their stocks, the banks had to import sovereigns from England, resulting in the strange spectacle of the largest gold-producing country of the world importing gold. This was due to the fact that all the fresh gold produced by the mines was requisitioned by the British Government.

Owing to the shortage of sovereigns, and the shipping of gold being a considerable expense to the banks, exchange facilities to exporters from England were somewhat restricted, and in May 1920 a premium of 8% was charged for remittances to S. Africa. The scheme by which a Federal Reserve bank for S. Africa was authorized to issue inconvertible notes to take the place of the gold currency, caused the exchange to drop to par in Aug. 1920, and the swing of the pendulum, encouraged by a considerable increase in the import of goods, created a shortage of funds in London and sent the exchange in the other direction until 6% was charged for remittances on London in S. Africa in Nov. 1920. Hence the strange phenomenon of the currency of the greatest gold-producer in the world being at a discount as compared with the British Treasury note.

Rates of Exchange.—Table F gives the chief rates of exchange ruling in London on three typical days: the end of July 1914; the day on which the Armistice was declared (Nov. 11 1918); and the last working day of the year 1920. There are also given the pre-war parity rates; the highest and lowest rates touched during the war, and also the highest and lowest rates touched between Armistice day and Dec. 31 1920; and that of Aug. 10 1921. The Austrian and German rates of exchange current during the war are those obtained from neutral countries.

TABLE F.—Comparative Rates on London.

Place	Method of Quoting	Pre-War Parity	Rate of Exchange July 30 1914	Highest Rate during War	Lowest Rate during War	Highest Rate between Armistice and 12–31–20	Lowest Rate between Armistice and 12–31–20	Rate of Exchange Nov. 11 1918	Rate of Exchange Dec. 31 1920	Rate of Exchange Aug. 10 1921
New York	Dollars to £.	$4.8744	4.90500 (cable)	6.50	4.49	4.76¾	3.21½	4.76⅝ 4.76¾	3.53½ 3.55	3.64 3.67
Montreal	Dollars to £.	$4.8744	4.95 (cable)	5.12	4.49	4.86½	3.65	4.86 4.86½	4.09 4.12	4.05 4.08
Paris	Francs to £.	Frs.25.207	24.75 25.15	29.02	24.80	68.80	25.80	25.80 25.86	59.50 59.90	46.65 46.87
Brussels	Francs to £.	Frs.25.207	25.00 25.25	38.50	25.323	63.65	25.95	—	56.70 57.00	48.10 48.30
Italy	Lire to £.	Lire 25.207	25.60 27.00(29th)	45.65	25.00	106.00	30.25	30.25 30.37½	101 102	83 84
Switzerland	Francs to £.	Frs.25.207	25.12½ 25.25	26.50	18.50	25.20	18.95	23.98 24.05	23.14 23.18	21.67 21.75
Athens	Drachmas to £.	Drs.25.207	25.12½ 25.18½	—	—	49.50	22.50	—	48 48½	66 67
Russia	Rubles to £10.	Rbls.94.60	102 103 nom.	†430.00	95.00	—	—	—	—	—
Helsingfors	Fmks. to £	Fmks. 25.207	25.37 25.42(27th)	44.60	25.802	180.00	41.75	—	115 118	235 245
Madrid	Pesetas to £.	Pts.25.207	25.92 26.02(29th)	26.90	15.95	28.90	18.60	24.00 24.15	26.43 26.53	28.15 28.31
Lisbon	Pence to escudos	53⅓ per esc.	45½d 46½d(29th)	42½d.	27½d.	36d.	5¾d.	30½d. 31½d.	6d. 7d.	6¾d. 7d.
Amsterdam	Florins to £.	Fls.12.0867	12.15 12.16(29th)	12.45	9.01	11.88	8.65	11.45 11.48	11.25 11.27	11.77 11.82
Berlin	Marks to £.	Mks.20.418	20.55 20.70(29th)	32	20.60	365.00	67.50	—	257 259	293 297
Vienna	Kronen to £.	Krs.24.02	24.40 24.70(29th)	53	24.80	1600	160	—	1500 1550	3150 3350
Prague	Kronen to £.	Krs.24.02	—	—	—	450	80	—	305 310	282 290
Warsaw	Marks to £.	Mks.20.418	—	—	—	2300	67	—	2200 2300	7200 7400
Bucharest	Lei to £.	Lei 25.207	—	—	—	325	50	—	282 285	280 285
Belgrade	Dinar to £.	D. 25.207	—	—	—	145	58	—	125 130	145 155
Christiania	Kronor to £.	Krs.18.13⅛	18.26 18.36(29th)	19.75	11.90	26.78	16.75	17.53 17.58	22.95 23.15	28.50 28.70
Stockholm	Kronor to £.	Krs.18.13⅛	18.26 18.36(29th)	19.75	9.90	18.51	15.92	17.10 17.20	17.66 17.72	17.45 17.55
Copenhagen	Kronor to £.	Krs.18.13⅛	18.28 18.38(29th)	19.75	11.90	25.91	17.48	17.80 17.90	23.05 23.20	23.30 23.50
Alexandria	Piastres to £.	97½	97⅜ 97⅝ (29th)	98½	96	97¾	97⅛	97¼ 97⅜	97¼ 97¾	97 15/32
Bombay	Sterl. to rupee	16d.	1s.3⅞d. 1s.4d.	1s.6 1/16d.	1s.3⅝d.	2s.9½d.	1s.4¾d.	1s.6d. 1s.6 1/16d.	1s.5⅝d. 1s.5¾d.	1s.3⅝d. 1s.3 11/16d.
Yokohama	Sterl. to yen.	24 9/16d.	2s.0¼d. 2s.0½d.	2s.4d.	2s.1 7/16d.	3s.0⅛d.	2s.1d.	2s.3¼d. 2s.3⅝d.	2s.8d. 2s.8¼d.	2s.7½d. 2s.7¾d.
*Shanghai	Sterl. to tael.	—	2s.3⅞d. 2s.4⅝d.	5s.6d.	2s.1⅛d.	9s.6d.	3s.10½d.	5s.0d. 5s.1d.	4s.1d. 4s.2⅛d.	3s.6⅓d. 3s.7½d.
Singapore	Sterl. to dollars	28d.	2s.3 29/32d. 2s.4 3/16d.	2s.4 9/32d.	2s.3 13/16d.	2s.4½d.	2s.3⅝d.	2s.3 29/32d. 2s.4 3/32d.	2s.3 21/32d. 2s.3 31/32d.	2s.3 11/16d. 2s.3 15/16d.
Rio de Janeiro (90d.)	Pence to milreis	27d.	15 11/16d. (29th)	15½d.	10 7/16	18 9/16	9¾	13 15/16	9 13/16 (30th)	8
Buenos Aires	Pence to dollar.	47⅝d.	48½ (Aug. 4)	55	46⅝	73¼	50 9/16	50 13/16 51 13/16	51 51⅛	44⅜ 44½
Valparaiso (90d.)	Pence to gold peso	18d.	9⅛ (29th)	17⅜	7	15 13/16	8 29/32	12⅜	9 11/32	—
Montevideo	Pence to dollar	51d.	51⅛ (90d.)(29th)	66	49⅞	73	49½	58⅝ 59⅝	49½ 50½	43½ 44

*Shanghai exchange being on a silver basis there was at no time a fixed parity between its currency and that of London. †To Jan. 7 1918.

TABLE G.—Value of pound sterling, Dec. 31 1920.

	Dec. 31 1920 Middle rate.	Compared with pre-war par value, £ sterling premium.	Purchasing power of £1 as compared with pre-war value.		Dec. 31 1920 Middle rate.	Compared with pre-war par value £ sterling discount of.	Purchasing power of £1 as compared with pre-war value.
France	59·70	136¾ %	£ 2 7 4	New York	3·54¼	27¼ %	£0 14 6
Belgium	56·85	125½ %	£ 2 5 1	Montreal	4·10½	15¾ %	£0 16 10
Italy	101½	302¾ %	£ 4 0 6	Holland	11·26	6¾ %	£0 18 8
Norway	23·05	27 %	£ 1 5 5	Sweden	17·60	2½ %	£0 19 6
Denmark	23·12½	27½ %	£ 1 5 6	Switzerland	23·16	8 %	£0 18 5
Finland	116·50	362 %	£ 4 12 5	Argentina	51 1/16d.	6¾ %	£0 18 8
Germany	258·00	1,163½ %	£ 12 12 8	Japan	2/8⅛	23½ %	£0 15 4
Greece	48·12½	91 %	£ 1 18 2	India	1/5 11/16	9½ %	£0 18 2
Austria	1,525·00	6,249 %	£ 63 9 9	Shanghai	4/1 9/16	43½ %	£0 11 3
Rumania	283·50	1,024½ %	£ 11 4 11				
Portugal	6½d.	720 %	£ 8 4 0				
Spain	26·48	5 %	£ 1 1 0				
Brazil	9 13/16d.	63 %	£ 1 12 8				
Warsaw	2,250·00	10,920 %	£110 4 0				
Prague	307½	1,180 %	£ 12 16 0				

On Sept. 1 1921 the London rates were as follows:—New York, 3·73½; Montreal, 4·14¼; Paris, 47·56; Belgium, 48·97; Italy, 84; Holland, 11·74; Spain, 28·61; Switzerland, 21·84; Stockholm, 17·16; Christiania, 27·55; Copenhagen, 21; Berlin, 319; Portugal, 6; Greece, 66¼; Bucharest, 317; Finland, 258; Vienna, 3,100; Prague, 312; Warsaw, 10,650; India, 1s. 4¾d.; Yokohama, 2s. 7⅛d.; Buenos Aires, 43¾; Rio de Janeiro, 7⅞; Serbia, 168; Bulgaria, 450; Budapest, 1,450.

Table G shows the changes that took place in the value of the pound sterling in different countries as between pre-war basis (1914) and Dec. 31 1920, the left section showing where the pound had risen to a premium and the right section where it had fallen to a discount.

In order to understand accurately the extent of the depreciation of the various exchanges since they ceased to have a gold standard, it is better to take as a basis for comparison the American gold dollar rather than the British paper pound.

Table H shows the rates of exchange ruling in New York (*a*) immediately before the declaration of war, (*b*) just after America joined the Allies, and (*c*) when the Armistice was declared. Table I gives the rates ruling on Dec. 31 1920, and includes those of several countries not previously quoted in America.

Speculation.—During the war speculation in foreign exchanges was almost entirely confined to the six neutral states of Europe—Holland, Denmark, Sweden, Norway, Spain and Switzerland—and to the United States, which was free to deal in all exchanges until it came into the war in 1917. These countries traded very extensively with both groups of belligerents, and quickly amassed very large profits through selling their produce and manufactures at high prices, and also through obtaining abnormally high freights with their steamers. Much of this money was paid in the currency of the purchasing countries and large foreign balances were thereby accumulated. The natural effect was to depreciate the value of the pound, the franc, the lira, the ruble, the mark and the Austrian crown, all considerably but in different degrees. Most of the neutral export merchants and shippers became large sellers of foreign credits, and had they not been able to do so they would have been obliged to cease exporting, but there are always people in every country willing to buy almost anything at a price, and it did not take long before the speculative habit which is the invariable result of sudden prosperity was turned in the direction of foreign exchange, and not only bankers and banks but also private individuals indulged in a perfect orgy of speculation.

Many of these speculators bought sterling exchange, others bought marks. They frankly backed the side they thought would win, and gained or lost accordingly, but there were others who thought it more prudent to "hedge"—that is, to divide their risks and turn part of their money into pounds and part into marks. These persons omitted one very important factor from their calculations, *i.e.* that the prospect of loss in the value of the currency of the losing side must of necessity be immeasurably greater than the prospect of gain in that of the winning side.

TABLE H.—New York Rates (in dollars).

Place.	Method of Quoting.	Pre-war Parity.	August 1914.		May 1917.		November 1918.	
			Rate of Exchange.	Per cent of pre-war Parity.	Rate of Exchange.	Per cent of pre-war Parity.	Rate of Exchange.	Per cent of pre-war Parity.
London	Dollars per £1	4·8665	5·50	113·02	4·7556	97·72	4·7575	97·76
Paris	" Fcs. 100.	19·3	21·74	112·64	17·52	90·78	18·55	96·11
Milan	" Lire 100.	19·3	20·41	105·75	14·28	73·99	15·75	81·61
Yokohama	" Yen 100.	49·85	49·90	100·10	51·13	102·58	54·75	109·83
Petrograd	" Rbs. 100.	51·5	51·56	100·12	28·10	54·60	—	—
Berlin	" Mks. 400.	95·2	96·25	101·10	59·537	60·83	58·520	61·47
Vienna	" Krn. 100.	20·3	20·37	100·34	9·593	46·09	8·10	39·90
Amsterdam	" Fls. 100.	40·2	41·25	102·61	41·25	102·61	42·25	105·10
Copenhagen	" Kr. 100.	26·8	27·50	102·61	28·70	107·09	27·00	100·75
Stockholm	" Kr. 100.	26·8	27·50	102·61	30·00	111·94	29·00	108·21
Zurich	" Fcs. 100.	19·3	21·51	111·45	19·82	102·69	20·32	105·28
Madrid	" Pts. 100.	19·3	20·85	108·03	22·75	117·88	20·70	107·25
Buenos Aires	" Pap. Pes. 100	42·45	—	—	44·26	104·26	45·253	106·60
Valparaiso	" Pes. 100.	18·80	19·12	101·70	23·17	123·24	25·51	135·69
Bombay	" Rps. 100.	32·44	33·00	101·73	32·50	100·18	35·15	109·90
*Hong-Kong	" H.K. $100.		46·45		58·00		80·00	
*Shanghai	" Taels 100.		64·00		86·50		124·00	

* Hong-Kong and Shanghai exchanges being on a silver basis, there was at no time a fixed parity between their currencies and that of New York.

TABLE I.—New York Rates, Dec. 31 1920.

Nominal Gold Value.		Dec. 31 1920.	Per cent of Discount.
4·8665 dollars to £	England	3·52½ dollars for £	27·6
19·3c. to 1 franc	France	5·89 cents for 1 franc	69·3
23·8c. to 1 mark	Germany	1·38 cents for 1 mark	94·3
19·3c. to 1 lire	Italy	3·46 cents for 1 lira	82·1
40·2c. to 1 guilder	Holland	31·30 cents for 1 guilder	22·1
19·3c. to 1 peseta	Spain	13·45 cents for 1 peseta	30·3
19·3c. to 1 franc	Switzerland	15·20 cents for 1 franc	21·2
1·08 dollars to 1 escudo	Portugal	10·30 cents for 1 escudo	81·1
19·3c. to 1 franc	Belgium	6·17 cents for 1 franc	67·9
20·26c. to 1 crown	Austria	0·24 cents for 1 crown	98·7
20·26c. to 1 crown	Czechoslovakia	1·15 cents for 1 crown	94·3
19·3c. to 1 leu	Rumania	1·28 cents for 1 leu	93·3
19·3c. to 1 drachma	Greece	7·25 cents for 1 drachma	62·4
26·8c. to 1 crown	Norway	15·65 cents for 1 crown	41·6
26·8c. to 1 crown	Sweden	19·85 cents for 1 crown	26·0
26·8c. to 1 crown	Denmark	15·65 cents for 1 crown	41·6
19·3c. to 1 finmark	Finland	2·90 cents for 1 finmark	84·9
23·8c. to 1 mark	Poland	0·17 cents for 1 mark	99·3
51·46c. to 1 ruble	Russia	0·45 cents for 1 ruble	99·1
100c. to $1	Canada	86·6 cents for $1	13·4
42·45c. to 1 peso	Argentina	33·15 cents for 1 peso	21·9
32·44c. to 1 milreis	Brazil	14·00 cents for 1 milreis	56·8
48·66c. to 1 rupee	India	26·00 cents for 1 rupee	46·5
49·85c. to 1 yen	Japan	48·37 cents for 1 yen	3·0

For instance, a Dutch speculator might have bought £10,000 for 100,000 guilders and at the same time 300,000 marks for another 100,000 guilders: this was in the early part of 1916 when it was doubtful which side would win the war. On Jan. 1 1921, if he realized his holdings he would have gained about 10,000 guilders on his sterling but lost 70,000 guilders on his marks. Should, however, this speculator have been tempted by the greater depreciation to have bought Austrian crowns and French francs, he would have lost half his money on the realization of his francs and practically the whole when he sold his crowns. It was, however, chiefly in their mark investments that neutral states lost a large proportion of their war profits.

Another very favourite speculation was the Russian ruble. Speculation in this currency started very early in the war and continued long after the establishment of the Soviet Government. To a great extent it took the form of buying actual ruble notes, and large masses of these came to Europe partly via Scandinavia and partly through Siberia. Many of them found a home in America, but large quantities remained in Sweden and in England. It was somewhat strange that this buying of ruble notes should have continued notwithstanding frequent announcements made by the Bolshevik leaders that it was their intention to issue fresh notes in sufficient quantities to destroy effectually their value as a purchasing instrument. It was only when it was realized that the Soviet Government were printing so-called "Imperial" notes in limitless quantities, using for that purpose the original plates and producing a spurious article quite undistinguishable from the original, that the speculators at last realized that their rubles were not only absolutely worthless at the moment but that there was but slight prospect of their having any value even in the distant future.

It was not however until the Anglo-American exchange was decontrolled, and restrictions as to dealing in certain exchanges were definitely removed in the belligerent countries, that speculation became general. Decontrolled exchange without a gold basis presented all the elements dear to the speculator—an unlimited supply of the article, violent and frequent fluctuations, ease in buying or in selling to any extent, no fear of being "cornered," and an international market. The volume of speculative business soon became much larger than that of transactions done for legitimate trade purposes. But foreign trade could still be carried on without the merchant running exchange risks unless he decided to do so. A system was elaborated by which for any bona-fide trade transaction a merchant enjoying good credit could purchase or sell his foreign exchange at a rate based on that of the day on which he did his transaction, for future delivery at dates that synchronized with his requirements. It was only when trading with countries whose exchange could not be sold in the ordinary way for immediate delivery, that he was unable to arrange for his future deliveries.

The Ter Meulen Plan.—To avoid this difficulty, a scheme was drawn up in the autumn of 1920, known as the "Ter Meulen Scheme" (from the name of its originator, a partner in the firm of Messrs. Hope & Co. of Amsterdam). It was accepted by the League of Nations and was intended to assist impoverished nations which under existing circumstances were unable to attract funds for the financing of essential imports. Up to the end of 1921 this scheme was not in actual operation, but the plan proposed was recognized as one which would have an important bearing, if adopted, on the business of foreign exchange.

The Ter Meulen Scheme was as follows, the text of the League of Nations articles (Nov. 1920) being here slightly abbreviated:—

International Credits Scheme

An International Commission shall be constituted under the auspices of the League of Nations.

The Commission shall be appointed by the Council of the League of Nations and shall have discretion to appoint agents and sub-Commissions.

The Governments of countries desiring to participate shall notify to the Commission what specific assets they are prepared to assign as security for commercial credits to be granted by the nationals of exporting countries.

The Commission, after examination of the assets, shall determine the gold value of the credits which it would approve against the security of these assets.

The participating Governments shall then be authorized to issue bonds to the gold value approved by the Commission. The bonds shall be in such form, with such date of maturity and rate of interest, as the Commission may decide and shall, in particular, enumerate the assets pledged against the bonds. The denomination of each bond and the specific currency in which it is to be issued shall be determined by the participating Government in agreement with the Commission, in accordance with the conditions applicable to the particular transactions in respect of which they are issued.

The service of these bonds which will be obligations of the issuing Government shall be specifically secured out of the revenue of the assigned assets.

The assigned assets shall be administered by the participating Government or by the International Commission as a majority of the Council of the League of Nations may determine on the proposal of the International Commission.

Out of the revenues from the assigned assets there shall be purchased foreign currencies sufficient to provide (*a*) cover for the coupons falling due in the next year, (*b*) a sinking fund calculated to redeem at maturity 10% of the bonds outstanding, (*c*) a reserve in such foreign currency or currencies as the International Commission may determine for the redemption of any bonds sold as a consequence of failure by the importer to fulfil his contract. Any surplus remaining after the provision of these services shall be at the free disposal of the participating Government.

The participating Government will be free either to pledge its own bonds as collateral for credits for approved imports on its own account or to lend the bonds to its nationals as collateral for credits for approved imports on private account.

Each bond shall before issue be countersigned by the Commission in proof of registration.

The fundamental purposes of the scheme being to facilitate and expedite the import of such raw materials and primary necessaries as will enable the borrowing countries to reëstablish production especially for export, bonds secured on the assigned assets shall not be utilized as collateral for credits for the import of other commodities.

For each borrowing country the Commission will draw up, in consultation with the participating Government, a schedule of approved imports which will be regarded as falling within the definition of raw materials and primary necessaries.

Particulars of each transaction must be registered with the Commission, which, before countersigning a registered bond will satisfy itself that the credit is for an approved import and that the period for which it is proposed to be granted is a reasonable one.

The same conditions as govern the pledge of the bonds as the collateral for credits for imports on private account shall apply in cases where the participating Government pledges its own bonds as collateral for imports on Government account.

After having received bonds duly countersigned the importer will pledge them with the exporter.

Pledged bonds shall be dealt with as follows:—(*a*) In the absence of any failure by the importer to fulfil his contract with the exporter, the coupons on their due date and the bonds as they are released shall be returned to the importer who shall return them to his Government forthwith. (*b*) In the event of the importer not fulfilling the terms of his contract, the exporter (or his assigns) may either hold the bonds until maturity, or if he prefers he may at any time sell them in accordance with the laws and customs of his country, providing that before the bonds are sold a reasonable opportunity shall be given to the issuing Government to repurchase them by paying to the exporter the amount of his claim. The proceeds of such sale shall be applied by the exporter towards covering his claims against the importer. Any surplus not required for this purpose shall be accounted for by the exporter to the participating Government. (*c*) Any coupons or bonds returned to the participating Government or purchased by such Government shall be forthwith cancelled in accordance with the regulations to be prescribed by the International Commission; cancelled bonds may subsequently with the approval of the Commission be replaced by other bonds either in the same or in a different currency in accordance with the conditions governing the original issue of bonds.

Bank Notes.—An unusual form of speculation sprang up during 1918–9. Orders were received in England, France and the United States from neutral countries for the purchase of English, French and American bank-notes at rates of exchange very much more favourable to the sellers than those current for ordinary bank credits. The French and the American Governments very soon forbade the export of their bank-notes but the British Government, after giving the matter mature consideration, decided that more advantages than disadvantages were to be gained by permitting the export of Bank of England notes, even if the ultimate destination of these notes were found to be the enemy countries. It was afterwards ascertained that these banknotes were actually bought for enemy account, and many of them are believed to have found their way to Turkey and Bulgaria. Subsequent events proved that the action of the purchasers, though perhaps not patriotic, was from a financial point of view a prudent one, as it was evident in 1918 that in the very probable event of the Allies winning the war, the value of the pound sterling in terms of their own currency was certain to increase to a far greater extent than the 10 or 15% beyond the then current rate of exchange on London that they were willing to pay to convert their currency into sterling in the only way they could do it, while at the same time circumventing the vigilance of the British Ministry of Blockade.

Business Developments.—One interesting and important result of the enormous increase of the volume of foreign-exchange transactions carried out in London, which, after the Armistice, established itself more firmly that ever as the world's clearing-house for that class of trade, has been a remarkable development in the business of the London foreign-exchange brokers.

Exchange brokers have existed in London for centuries, but their business was generally confined to buying and selling foreign exchange for merchants and for those bankers who had no direct relations with foreign countries. They were in the habit of meeting twice a week on the Royal Exchange, where the exchange dealers also attended, and foreign bills of exchange and cheques were then sold to the best buyers, and official rates of exchange were fixed. It is true that with the advent of the telephone it became more and more the custom to carry through the more important transactions, especially those between exchange dealers themselves, by means of telephonic communication, but such transactions were far from numerous, and, such as they were, they were generally done in a leisurely manner. Now all this is changed. The leading exchange brokers confine themselves entirely to working between the various exchange dealers. From ten in the morning until six in the evening their offices are a regular pandemonium. Some of them employ as many as 40 or 50 private telephones in addition to several general ones, and the largest of them carry through on an average about two-hundred transactions a day, mostly for very large sums. They make it their business to keep their clients posted in all the various and quick movements that occur almost from minute to minute in exchange rates, and carry out their transactions with the rapidity and accuracy without which business of that class would be impossible. They assume no financial liability, for when their contracts are passed their responsibility ceases. To succeed—and their business is a very lucrative one though their scale of commission is infinitesimal—they need discretion, integrity and intelligence. They must never discuss one client's business with another client, nor divulge the name of a buyer to a seller or vice versa, until the transaction is completed. The service the broker renders to the dealer is an extremely valuable one, and the result is that there is practically no business done between dealers without the intermediary of a broker. An interesting fact in this connexion is that, at the end of 1920, the biweekly meetings that had been held between dealers for generations "on 'Change" were abolished.

Partly because this system of employing exchange brokers enables large and numerous transactions to be carried out with great rapidity, partly because the temperament of the chief London dealers in foreign exchange is such that they are easily able to resist the temptation to speculate to any great extent on their own account, partly because those who deal in foreign exchange in London are banks and bankers of the highest standing, but more particularly because the sterling bill has by no means lost its prestige throughout the world, London has established herself more firmly than ever as the central foreign exchange market of the world, and all day and every day there is a constant flow of cables and telegrams from all quarters bringing orders to buy and sell every possible kind of exchange in amounts that were never imagined possible in pre-war days.

Lessons of the War.—Many lessons have been taught by the new conditions brought about by the war. One of the most important of these is that State interference with the natural movements of exchange, excepting for a limited period and with success practically assured, is a mistake and likely to lead to disastrous results. The "pegging" of the pound sterling to the American dollar—certainly so long as America was a neutral Power—proved nevertheless to be wise and legitimate. The attempts of other countries to stabilize their exchanges at that time were for the most part unsuccessful.

Another fact that has been brought to light is that, to a creditor country, especially one which depends for its prosperity to a large extent on its export trade, a favourable exchange is a distinct disadvantage, which can only be overcome if the nationals of that country are willing to invest a substantial proportion of the value of their exports in those foreign countries which buy their goods. An outstanding example of such a country is America, for up till the spring of 1921 Americans were only just beginning to acquire the habit of investing their money outside their own country; this rendered it extremely difficult for their export merchants to finance their business, as the majority of foreign importers were only able to pay for their goods by means of their own currencies.

It does not follow, however, that an American merchant would be absolutely precluded from selling goods (say) to Poland against payment in Polish marks merely because no one in America would be willing to invest his money in that country. So long as exchange dealers or speculators in another country whose own currency is in fair repute would be willing to purchase Polish marks either directly or indirectly against dollars—that is to say, either paying for the Polish marks in American dollars or in some currency that could be converted into dollars if the American exchange dealer so desired—so long could the American merchant continue to sell his goods to Poland against payment in that country's currency.

On the other hand, manufacturing countries whose exchanges have depreciated heavily and rapidly are in a very favourable position to compete in foreign markets. They can buy their raw materials abroad just as cheaply as any other country, while, as has been proved, the rise in the cost of manufacture—particularly as regards wages—lags far behind any rapid rise that may take place in exchange rates. Such a country would be able to undersell its competitors to a considerable extent while still making very large paper profits. As an example: the first serious set-back in trade that occurred in Germany after the declaration of peace, was when the German rate of exchange fell temporarily from 365 to 120 marks to the pound, in the early part of 1920. Had the internal value of the mark, that is to say its purchasing power within the boundaries of Germany, depreciated to anything approaching its external value, it would not have been possible for German trade to revive as rapidly as it did.

It is safe to predict that in a highly civilized country, well organized for trade purposes, such as Germany, the internal and external value of its currency must equalize itself approximately sooner or later, but the process is slow and gradual, and during the years that intervene it may be possible for that country to build up an export trade on so firm a basis that it would be difficult for other countries to oust it from its position, even when it is no longer helped by favourable exchange conditions. In fact, it is a mistake to suppose that any country derives advantage from the greater depreciation of another country's currency. The latter cannot afford to import from the former anything beyond its merest necessaries, and on the other hand it is able to undersell it in all competitive markets. (E. L. F.)

EXPLOSIVES (*see* 10.81–4).—In the World War of 1914–8 the use of high explosives went beyond anything previously known. Economic considerations played a large part in determining the types used, and their methods of manufacture. Many improvements were introduced to save labour and eliminate waste in production, but it became evident very early in the struggle that to meet the demand with existing types was a sheer impossibility, and this led to the adoption of others, hitherto untried and unproved. Apart from military uses, explosives also play an essential part in industrial work, the necessary supply for which had also to be maintained during the war period. The main types of these had been standardized for years, but the experiences of the war have had some effect in influencing the uses of industrial explosives. The conditions which have to be met by commercial explosives are not so stringent as in the case of military explosives. Thus the latter are liable at any time to be subjected to hostile fire, and must therefore be very insensitive to shock; this precludes many of the explosives which are in use for commercial mining, etc.

Military Uses.—High explosives for military purposes are required for the bursting charges of artillery shells, air and trench-mortar bombs, grenades, naval mines, torpedoes, depth charges, as well as for land mines and demolitions in the field. For the two last-mentioned purposes ordinary commercial blasting explosives may on emergency be used, but a serious danger will be involved to the user if the explosive is of such sensitiveness as to be "set off" by the impact of hostile fire. On this account it is generally undesirable to use explosives containing nitroglycerine, which form such a large part of the blasting explosives produced for industrial purposes.

The choice of explosives for shells requires special care, as the shock of discharge is so great in modern ordnance that only explosives which are very insensitive to shock can be safely used. For this reason gunpowder was regarded for many years as the only safe explosive for the bursting charges of common shell. The premature explosion to which guncotton gave rise had tended to confirm this view; so that gunpowder, in spite of the comparative mildness of its explosion, remained in universal use until the introduction of picric acid by the French in 1885.

Picric Acid.—This was discovered by Woulffe in 1771, but its explosive properties remained for a long time unrecognized. Sprengel had demonstrated its capability of detonation in 1871. In 1885 Turpin, a French chemist, applied it to the filling of shell, for which, by reason of its stability and insensitiveness to shock, as well as its extremely violent action when properly detonated, it proved eminently suitable. Shortly after this, picric acid under various names, either with or without the addition of other substances such as collodion or paraffin wax to reduce its sensitiveness, was universally adopted by the Great Powers as a high explosive for shell-filling. Picric acid can be melted and poured into the shell, where it sets into a compact mass—the method adopted in the British service. It was first used in actual warfare by the British army in the S. African War of 1899–1902 under the name of "lyddite." Picric acid is also the main or sole constituent of the French mélinite, the Japanese shimosé powder, and the Austrian ékrasit. Lyddite can hardly be said to have fulfilled in the S. African War the somewhat exaggerated claims made for it, as the shells, especially of the smaller sizes, were uncertain in their detonation, but this was due to the fear still prevailing of premature explosion in the bore, which prevented the use of a sufficiently powerful detonating impulse in the percussion fuze being employed. In the World War of 1914–8, after this disability had been removed, through the employment of a fulminate detonator and a suitable exploder system, shells filled with lyddite were amongst the most certain and violent in their action. When completely detonated, these shells give a dense black smoke due to unconsumed particles of carbon through lack of sufficient oxygen for complete combustion. This smoke is of great assistance to the gunner in enabling him to locate their explosion and so to adjust the range as required.

The manufacture of picric acid has been carried out for many years by the so-called "pot process," and this was retained essentially unchanged throughout the war. In this process, phenol (carbolic acid) is first heated with sulphuric acid, whereby phenol-sulphonic acids are formed, as for instance in the following equation:—

$$\underset{\text{Phenol.}}{C_6H_5OH} + \underset{\text{Sulphuric acid.}}{2H_2SO_4} = \underset{\text{Phenol disulphonic acid.}}{C_6H_3(SO_3H)_2OH + 2H_2O}$$

This on cooling forms a buttery mass, which is then transferred to earthenware pots and diluted. Nitric acid is allowed to trickle in slowly through glass syphons, and thus converts the sulphonic acids to tri-nitro-phenol or picric acid, which has the formula $C_6H_2(NO_2)_3$-OH. The residual acid is drained off and the crystals of picric acid are thoroughly washed and then carefully dried on glass plates in a warm chamber. The last operation is the most dangerous part of the manufacture and is carried out at a distance from the nitration process. The main recent developments have been directed towards increasing the yield of picric acid and economizing acids, on the one hand by recovering the residual sulphuric acid, and on the other hand by collecting the large volumes of nitrous fumes evolved during the nitration process, which were formerly allowed to go to waste, thereby causing a serious contamination of the atmosphere.

At a later stage of the war a continuous process was patented for the manufacture of picric acid. In this process the phenol sulphonic acids were caused to traverse a long trough constructed of acid-proof bricks, and nitric acid was injected through a series of aluminium jets at intervals along the trough. This method saves a great deal of handling, and is claimed to give very good yields of picric acid. Under ordinary circumstances the yield of picric acid is about 180 lb. from each 100 lb. of phenol.

An alternative process, which was introduced and used with success during the war, was based on the intermediate formation of di-nitro-phenol. This process started out from benzene and passed through the following stages:—

$$\underset{\text{Benzene.}}{C_6H_6} \qquad \underset{\text{Mono-chloro-benzene.}}{C_6H_5Cl} \qquad \underset{\text{Di-nitro-chloro-benzene.}}{C_6H_3(NO_2)_2Cl.}$$

$$\underset{\text{Di-nitro-phenol.}}{C_6H_3(NO_2)_2OH} \qquad \underset{\text{Picric acid.}}{C_6H_2(NO_2)_3OH.}$$

The final nitration was effected with concentrated nitric and sulphuric acids; the picric acid being washed free from acid and dried in stoves as in the phenol process.

Trinitrotoluene (*T N T*), which is known officially as Trotyl, is a high explosive very similar in its action to picric acid and had been discovered by Wilbrand in 1863. Its manufacture in small quantities in Great Britain had been taken up some 15 years before the outbreak of the World War, mainly for export or as ingredient of certain blasting explosives, and about 1893–4 it was made on a more considerable scale in Germany, where its value as a shell-filling became recognized some ten years later. T N T has the advantage of melting at a lower temperature than picric acid, and of not forming sensitive salts (picrates) with metals; added to which it is even less sensitive to shock and consequently less liable to give rise to premature explosions in the bore of the gun. The lower melting point of T N T (81° C.) enables it to be melted in steam-jacketed pans, whereas picric acid (121·6° C.) needs hot-air chambers or oil baths.

The manufacture of T N T in Great Britain prior to the war was very small, and the best methods had to be worked out from first principles after the outbreak of war. The existing processes were slow and wasteful, and it was necessary to find the best conditions for expediting the process and obtaining the highest possible yield of T N T with the greatest economy of sulphuric and nitric acids.

T N T is made from toluene ($CH_3C_6H_5$) by the action of nitric acid (HNO_3) as indicated in the following equations:—

$$CH_3C_6H_5 + HNO_3 = H_2O + CH_3C_6H_4(NO_2) \text{ (mono-nitro-toluene)}$$
$$CH_3C_6H_4(NO_2) + HNO_3 = H_2O + CH_3C_6H_3(NO_2)_2 \text{(di-nitro-toluene)}$$
$$CH_3C_6H_3(NO_2)_2 + HNO_3 = H_2O + CH_3C_6H_2(NO_2)_3 \text{ (tri-nitro-toluene).}$$

A continuous process was introduced during the war, and proved very successful. In this process, mono-nitro-toluene entered at one end of the plant and strong sulphuric acid at the other, the nitric acid being introduced at intermediate points.

In all of these processes the product is a crude T N T of melting point 74 to 77° C. In general this is good enough for explosive purposes, but for special uses it has to be purified by crystallization or by washing with alcohol.

A more recent purification process consists of a treatment with sodium sulphite, which destroys the chief impurities—the isomeric tri-nitro-toluenes. There are six possible tri-nitro-toluenes, which differ according to the relative positions of the nitro groups in the molecule. These are all known, but only three of them are formed by direct nitration. The first stage of the nitration gives mainly ortho- and para-nitro-toluene with about 3 to 4% of meta-nitro-toluene. On further nitration, ortho- and para-nitro-toluene can give the normal symmetrical tri-nitro-toluene; the meta compound cannot do so and consequently gives other isomers as shown below:—

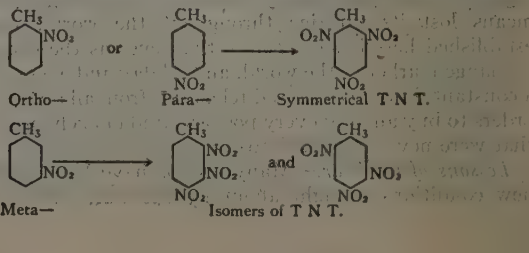

Other Nitro Compounds.—Picric acid and T N T are nitro derivatives of phenol and toluene respectively. In fact practically all military high explosives are nitro derivatives of aromatic compounds, which latter are produced from the distillation of coal tar. This source of toluene was supplemented by the use of certain natural petroleums which contain benzene and toluene, and the supplies of phenol were augmented by synthetic production from benzene, another derivative of coal tar. Nevertheless, these sources of supply were not equal to the demand, and other means of supplementing them had to be found in the war.

Thus tri-nitro-cresol, which is closely allied to picric acid, was much used by the French, as well as di-nitro-naphthalene and di-nitro-phenol, to supplement picric acid. Tri-nitro-anisol, hexa-nitro-diphenylamine, hexa-nitro-diphenyl sulphide and others were largely used by the Germans. All of these are derived from coal tar and are consequently limited to the available supply of this raw material. Only by finding some material available in larger quantity, with which these nitro compounds could be mixed, was it possible to cope with the demands. The above nitro compounds have the feature in common that they contain insufficient oxygen for their complete combustion: hence the most suitable admixture is a salt rich in oxygen.

Ammonium Nitrate.—Of all the available salts, the one which stands out by reason of its accessibility and suitability for the purpose is ammonium nitrate, a substance known as early as the 17th century and yet destined to play a most important part in the development of high explosives in the 20th century.

Mixtures of nitro derivatives of the aromatic compounds with ammonium nitrate, of which Roburite, Ammonal, and Dreadnought powder are amongst the best known, had long been used commercially for blasting purposes, particularly in fiery mines, where the high temperature of explosion of those containing nitro-glycerine is liable to cause explosion of the fire-damp.

Ammonium nitrate explosives are also cheap and safe both to make and to handle, owing to their great stability and insensitiveness. They are useful for many purposes where the greater *brisance* or shattering power given by nitro-glycerine is not required. One of their main disadvantages is the hygroscopicity or moisture-absorbing power of ammonium nitrate, which necessitates suitable protection or "waterproofing" from the air in order to prevent the explosive becoming so damp as to fail to respond to the detonating impulse. Although this protection can be readily given in shells and other articles of ammunition, it was probably their characteristic of deliquescence together with the difficulty of detonating such explosives effectively which was responsible for the delay in their adoption for military purposes, except possibly in Austria, where ammonal was to some extent in vogue. Moreover, the peace-time requirements before the war could be amply met in England from lyddite, of which the properties were well known. When, however, other sources of supply of high explosives in gigantic quantities had to be found, ammonium nitrate opened up the best, if not the only, solution, as far as the resources of Great Britain permitted. Yet ammonium nitrate by itself is hardly an explosive at all. By means of a very powerful detonator it is possible to cause a mild explosion and the disruption of the ammonium nitrate molecule, but under ordinary circumstances no "explosive" precautions need be taken in its manufacture or transport—a matter of considerable advantage in providing the quantities of several thousand tons a week which were required.

Prior to the World War, ammonium nitrate was made by neutralizing nitric acid with ammonia

$$\underset{\text{Nitric acid.}}{HNO_3} + \underset{\text{Ammonia.}}{NH_3} = \underset{\text{Ammonium nitrate.}}{NH_4NO_3}$$

but the war demands were such that it was necessary to circumvent the necessity of erecting nitric acid plants on such a large scale. This led to the introduction of methods depending on double decomposition of salts.

(1) A modification of the ammonia soda process, as indicated in the equation:—

$$\underset{\text{Sodium nitrate.}}{NaNO_3} + \underset{\text{Ammonium bicarbonate.}}{NH_4-HCO_3} = \underset{\text{Sodium bicarbonate.}}{NaHCO_3} + \underset{\text{Ammonium nitrate.}}{NH_4NO_3}$$

(2) From calcium nitrate, made either by the arc process or by the action of calcium chloride on sodium nitrate:—

$$\underset{\text{Sodium nitrate.}}{2\,NaNO_3} + \underset{\text{Calcium chloride.}}{CaCl_2} = \underset{\text{Calcium nitrate.}}{Ca(NO_3)_2} + \underset{\text{Sodium chloride.}}{2\,NaCl.}$$

$$\underset{\text{Calcium nitrate.}}{Ca(NO_3)_2} + \underset{\text{Ammonium carbonate.}}{(NH_4)_2CO_3} = \underset{\text{Calcium carbonate.}}{CaCO_3} + \underset{\text{Ammonium nitrate.}}{2NH_4NO_3}$$

(3) From sodium nitrate and ammonium sulphate:—

$$\underset{\text{Sodium nitrate.}}{2\,NaNO_3} + \underset{\text{Ammonium sulphate.}}{(NH_4)_2SO_4} = \underset{\text{Sodium sulphate.}}{Na_2SO_4} + 2\,\underset{\text{Ammonium nitrate.}}{NH_4NO_3}$$

In view of its extreme solubility in water, it is difficult to purify the ammonium nitrate completely from the salts which accompany it. The dry salt is very deliquescent and precautions must be taken after drying to avoid the introduction of moisture. A peculiarity of ammonium nitrate is that it undergoes transitions to different crystalline forms at certain temperatures, for instance at about 32° C. and 85° C. the crystalline form changes and also the specific gravity. This point is of considerable importance in shell-filling.

Amatol.—The high explosive which was used in the largest quantities by Great Britain during the war was "Amatol," under which name various mixtures of ammonium nitrate with T N T are comprised. These form powerful high explosives capable of detonation with a considerable velocity. "Amatol 40/60" contains 40% of ammonium nitrate to 60 of T N T and is sufficiently fluid when heated to permit of its being poured in the molten condition. "Amatol 80/20" contains 80% of ammonium nitrate, which is approximately the proportion necessary for complete combustion of the T N T. This can be compressed into shells, or forced in in a plastic condition above the melting point of the T N T. Either of these methods is much more expeditious than the operation of pouring the molten explosive into the shell and allowing it to solidify.

Apart from amatol, mention should also be made of certain other ammonium nitrate explosives which were used during the war. Ammonal had been used in Austria before the war and contained ammonium nitrate, T N T, aluminium powder, and charcoal. At a later stage the aluminium was reduced to 3%, as this metal was in great demand for air-craft purposes, and the charcoal was omitted, the resultant mixture being termed alumatol. Sabulite contained ammonium nitrate, T N T, and calcium silicide.

War Requirements.—The extent to which the three main high explosives were employed is well illustrated from the table on the following page of quantities manufactured in Great Britain during successive years of the war (*see also* MUNITIONS OF WAR). For the purpose of comparison, a table of industrial requirements is added, showing the amount of explosives used in mines and quarries.

So far as Great Britain was concerned, the war was practically fought on the three high explosives, picric acid (lyddite), T N T, and amatol. These necessitated enormous importations of sodium nitrate from S. America for the manufacture of nitric acid and ammonium nitrate, as well as the importation of sulphur and pyrites for the equally necessary sulphuric acid. Nitric and sulphuric acids are the life-blood of the explosives manufacture, whether it be high explosives or propellant explosives. Without the command of the sea this would have been impossible.

Perchlorate Explosives are analogous to the ammonium nitrate explosives. The perchlorates were discovered by Stadion in 1815. Sodium perchlorate is obtainable by electrolytic methods from common salt, and is readily converted to ammonium perchlorate. Ammonium perchlorate has the advantage of not being hygroscopic like ammonium nitrate, but on the other hand explosives made from it are generally more sensitive to shock and friction than those containing ammonium nitrate, and are consequently liable to be exploded by the penetration of a rifle bullet or the shock of discharge in a gun. An example of the ammonium perchlorate type of explosives is blastine, which was used in considerable quantities during the war. It contains ammonium perchlorate, sodium nitrate, di-nitro-toluene and paraffin wax.

Industrial Explosives.—Industrial explosives are not liable to be exposed to such severe conditions of mechanical shock as military explosives (shock of discharge of a shell from a gun, hostile enemy fire, etc.). This permits of the application of types

British Military Requirements, 1914–8.

	1914 from Aug. 4	1915	1916	1917	1918	Total short tons
Picric acid (Lyddite), tons (2,000 lb.)	331	2,475	18,492	32,053	15,160	68,511
T N T, tons (2,000 lb.)	143	7,347	51,139	94,796	84,979	238,404
Ammonium nitrate, tons (2,000 lb.)		9,184	62,512	147,648	204,457	423,801
Total, short tons	474	19,006	132,143	274,497	304,596	730,716

British Industrial Requirements, 1915–8.

	1915	1916	1917	1918	Total short tons
Gunpowder, tons (2,000 lb.)	6,827	6,288	6,318	5,618	25,051
Permitted explosives, tons (2,000 lb.)	4,918	5,505	5,778	5,680	21,881
Other explosives, tons (2,000 lb.)	3,361	3,606	3,771	3,636	14,374
Total, short tons	15,106	15,399	15,867	14,934	61,306

of high explosives containing nitro-glycerine (dynamites, etc.), and potassium chlorate (cheddites), which are of great utility. Moreover, in industrial work great violence is not always required; in many cases it is desired to dislodge the material with as little shattering as possible, and this leads to a range of explosives differing widely in their velocities of internal combustion.

For individual classes of work special requirements have to be met; thus for blasting in enclosed spaces it is important to avoid the formation of poisonous gases such as carbon monoxide; for work in coal-mines, where inflammable dust and gases may be present, it is important to avoid explosives which give a powerful flame, and might thus ignite the coal-dust or gases.

As examples of the types of industrial explosives in use we have (1) explosives in which liquid nitro-glycerine is absorbed in wood-pulp, kieselguhr, etc., with the addition of nitrates and other salts; (2) blasting gelatine, gelatine dynamite and gilegnite, in which the nitro-glycerine is gelatinized with nitro-cotton; (3) ammonium nitrate mixtures; (4) gunpowder and various allied mixtures; (5) cheddites containing potassium chlorate mixed with castor oil and nitro compounds; (6) mixtures containing potassium and ammonium perchlorates.

In recent years the methods of liquefying air have undergone great advances, and this has led to the use of liquid oxygen for explosive purposes. A cartridge of carbonaceous material is dipped into liquid oxygen and is then inserted into the bore-hole and detonated. This forms a very direct means of supplying the oxygen necessary for the combustion of the carbon, but, as the liquid oxygen evaporates quickly, the mixture must be exploded within a few minutes, or it loses its explosive properties.

Powerful explosives may also be made by mixing liquefied nitric peroxide with combustible materials. Nitric peroxide is readily liquefied, and as its boiling point lies at 21°C., there is no difficulty in keeping it in the liquid condition. On explosion, the oxygen passes from the nitric peroxide to the combustible substances. Since, however, nitric peroxide is very poisonous, precautions must be taken in its manufacture and handling.

An interesting development in industrial explosives is their application to agricultural purposes. Useful results have been obtained, especially in America and South Africa, in breaking up hard ground and in removing tree stumps.

Action of High Explosives.—The destructive effect of high explosives in munitions and in the blasting of rocks is due to the very sudden pressure of gases developed, and also in the case of shells to the projection of fragments of the envelope itself.

An explosive may be defined as a substance containing potential energy which can be suddenly released through its rapid decompositions into hot gaseous products. These tend to occupy a far greater volume than the original substance from which they sprang, and in doing so exert great pressure on the containing vessel or any material with which they are in contact.

Explosives may be solids, liquids or gases, but those used for industrial or military purposes are for the most part solid, for the sake of convenience in handling, and almost invariably contain oxygen. The transformation into gas is usually due to a process of internal oxidation or burning, and the heat evolved tends further to expand the gases. Under ordinary circumstances, combustion can only take place slowly, being limited by the rate at which fresh air or oxygen can be supplied to the burning material. In explosives, on the other hand, oxygen in a loosely combined form is present in intimate contact with the combustible materials. This proximity may be merely mechanical as in the case of gunpowder, or "interatomic" as for example in T N T. Gunpowder is a purely mechanical mixture of three ingredients, potassium nitrate (saltpetre), charcoal and sulphur, each of which is in itself non-explosive. The oxygen in the potassium nitrate is striving to attach itself to the charcoal and sulphur, which form the combustible materials, and is enabled to do so as soon as external energy, usually in the form of a flame, is applied sufficient to break down the link or bond between the nitrogen or oxygen in the molecule of nitrate. Combustion can then only proceed at the points where the particles of charcoal and sulphur come into contact with the oxygen supplied to them. This explains the advantage of good incorporation and the greater rapidity of fine grain powders, but at best the proximity of the three ingredients to one another cannot be closer than is obtainable by purely mechanical means. In a high explosive such as T N T, which is a definite chemical compound $(C_6H_2(NO_2)_3CH_3)$, the oxygen, loosely linked to the nitrogen, is available to unite with the carbon and hydrogen *in the same molecule.* The elements are therefore in atomic proximity and, consequently, the disruption of the molecule of T N T into hot gases can proceed at a rate which, in comparison with that of gunpowder, is almost instantaneous. The greater the volume of gases produced the greater will be the pressure formed. The rapidity with which the transformation takes place determines the disruptive effect or *brisance* of the explosion—a very high rate of explosion corresponding to a sudden blow and a low rate to a prolonged push. In high explosives the explosion wave is propagated with an acceleration until it reaches its maximum, or "velocity of detonation."

In order that the velocity may reach its maximum, it is necessary that a sufficiently powerful initiating impulse be given. In general the explosive must be confined in a metal tube in order to detonate with its maximum velocity; and since the communication of the explosion from particle to particle is retarded by many air-gaps in the mass of the explosive, some compression is usually necessary in order to enable the maximum rate of detonation, which is a definite physical constant for each explosive, to be attained.

The effect of physical condition on the mode of explosion is seen in modern smokeless propellants. Nitro-cellulose in its ungelatinized condition is a high explosive, but when gelatinized by solvents so as to form a horny compact mass (with or without nitro-glycerine) it burns relatively slowly from the exterior surface, instead of being resolved *en masse* into gas.

There is no definite line of demarcation between a "high" and what may for the want of a better term be called a "low" explosive, such as gunpowder. No intensity of initial impulse can cause the latter to explode at a greater velocity than about 300 metres per second. In the recognized high explosives the velocity of detonation may reach to about 8,000 metres per second and is never less than two or three thousand. In a slow explosive, such as gunpowder, good tamping is requisite to obtain the best results, as the gases have time to find the line of least resistance, but with a high explosive the inertia of the explosive itself and of the super-imposed atmosphere offers almost as much resistance to the intensely sudden evolution of gases as does a solid body. In consequence high explosives are sometimes said to "strike downwards." This of course is an erroneous expression, as at the moment of detonation the force of the explosion must be equal in all directions, but the tangible result of a crater blown in the ground is visible to the senses, whilst the considerably larger hole blown in the air is not. It is this untamped effect of high explosives which makes them so much more effective for most military purposes than gunpowder.

Thus we have in explosives a store of molecular energy in a condition of unstable equilibrium, requiring some form of external energy to release it. This may consist of ignition, friction, percussion or the action of a detonator, which imparts a violent shock to the explosive and at the same time emits a flash of flame.

Mercury Fulminate.—For stable high explosives a detonator is almost invariably used. Indeed, it is almost impossible to cause an insensitive explosive such as amatol to detonate without such an initial impulse. The discovery of fulminate of mercury by Howard about the year 1800 had a far-reaching effect on military and industrial explosives. This sensitive chemical compound is readily caused to detonate by heat, friction, or percussion.

It is consequently manufactured only under the greatest precautions in small quantities at a time. It is made by first dissolving mercury in nitric acid, and then pouring the solution into alcohol. A vigorous reaction takes place, and after a time the mercury fulminate separates out. It has then to be washed and finally dried very carefully at a low temperature.

Mercury fulminate revolutionized the methods of bringing about explosion, being first used in percussion caps for igniting gunpowder, and thereby displacing the cumbersome and uncertain method of flint and steel. At a considerably later date its value as a detonator or igniting agent for more stable high explosives became recognized, for which purpose it is now mainly used. When required simply for ignitory purposes a mixture with potassium chlorate, which causes a larger and hotter flame, is generally employed.

In order to appreciate the function of the detonator it is necessary to consider that in an explosive substance each molecule in its decomposition gives out a surplus of energy, and so provides the initial impulse required to decompose the neighbouring molecules. When, however, a high explosive such as T N T is merely ignited, the decomposition propagates itself slowly at first, and may cease altogether owing to external cooling; in any case, the velocity of decomposition increases but gradually, and it is only after a considerable quantity has decomposed that detonation ensues. As much as five tons of T N T have been known to burn off without explosive violence, though this is by no means always the case.

The particular value of fulminate of mercury as a detonating agent is due to the fact that the explosion wave is in the first place very easily initiated in it by heat or friction, and in the second place is accelerated to its maximum almost instantaneously, so that complete detonation of the bulk immediately ensues, and the detonation is similarly imparted to any high explosive, with which the fulminate is in contact. Owing to the sensitiveness of the fulminate, not more than about 10 grains of the detonating substance is employed in artillery shell. In order to communicate the detonation to the stable high explosive in a shell, it is usual to "step up" the detonation wave. Thus the fulminate detonates a core of an explosive of intermediate sensitiveness such as tetryl (tri-nitro-phenyl-methyl-nitro-amine), and this detonates the main high explosive. Similarly, when it is desired to detonate a slab of wet guncotton, it is necessary to insert a "primer" of dry guncotton between the detonator and the wet guncotton.

Detonators of standard sizes are made for commercial blasting purposes; thus the size known as No. 8, containing 30·9 grains of fulminate, is in common use for blasting, and was used during the war in Mills grenades and trench-mortar bombs, where the shock of discharge is very much less than in a gun.

Another compound which has come into use to a considerable extent as a detonating substance is lead azide (PbN_6). This is an example of an explosive containing no oxygen or combustible matter—its explosion is due to a simple disruption of the molecule into lead and nitrogen.

Properties of High Explosives.—The investigation of the behaviour of explosives on detonation is attended by considerable difficulties. Some account of recent methods is given by Sir R. Robertson in the *Journal* of the Chemical Society, 1921, vol. cxix, p. 1, from which the appended data are taken.

Important advances have been made in methods of measurement of the time-pressure curve of high explosives. The explosive is detonated at one end of a suspended steel bar and causes a wave of compression to travel along the bar. This is reflected at the far end as a wave of tension which causes a disc lightly attached to be projected into a ballistic pendulum, whereby the momentum developed over a very small time interval, usually about five millionths of a second, is obtained.

Explosives in the Future.—It is natural to inquire what are likely to be the future developments of explosives. If the history of the application of explosives be broadly reviewed, it is somewhat striking that the materials used for explosive purposes in the World War of 1914–8 were practically all chemical compounds which have been known for at least 50 years. Indeed, the history of the last century has been much more concerned with discoveries relating to the methods of application of explosives than the discovery of new explosive compounds. The popular imagination readily accepts stories of new explosives of fabulous violence, but experience shows that it is not in such directions that research has met with its greatest successes. Until about the middle of last century gunpowder held the field, although guncotton, nitro-glycerine, picric acid, mercury fulminate, ammonium nitrate, and the chlorates and perchlorates were all known compounds. Only one of these—namely, mercury fulminate—was used at all, and this only in its capacity as a simple igniter. The successive steps which led to the utilization of one after another of the modern explosives were first directed towards the nitric esters—nitro-glycerine and nitro-cellulose. Nitro-glycerine was brought into a form in which it could be practically used, by absorbing it into the pores of kieselguhr and later by incorporating it into gelatinized explosives, thus giving rise to extremely powerful combinations. In the utilization of nitro-cellulose, the initial problem was to bring it into a sufficiently stable condition to render it safe against spontaneous explosion. The discovery of the conversion of nitro-cellulose to a gelatinous condition by treatment with solvents led to valuable blasting explosives such as gelatine dynamite, and, more important still, formed the basis of the modern smokeless propellants.

The method of initiating the detonation of high explosives by mercury fulminate dates from 1867, and opened the way to the ultimate utilization of very insensitive explosives for blasting and military purposes. The importance of this discovery will be realized when it is considered that it rendered possible the use of a wide range of ammonium nitrate and other mixtures for industrial purposes, and the use of T N T and amatol for military purposes in the World War. Many more steps in the investigation of detonation were, however, necessary before the mechanism of gun-shells was so perfected as to give efficient detonation combined with perfect safety; and although the use of aromatic nitro compounds, as represented by picric acid, for shell purposes was introduced about 1886, it is only in the present century that the methods of detonation have been so perfected as to render these high explosives an outstanding factor in warfare.

The number of new explosives which have been patented is enormous, but these consist almost entirely of different mixtures of known ingredients, nor is it likely that any spectacular discovery will be made in the nature of a new compound of unprecedented power. In the first place, granted that the oxygen is correctly balanced against the carbon and hydrogen, the chemical energy can only be increased by lowering the heat of formation. This might be done to some extent, and compounds of somewhat

Behaviour of Explosives on Detonation.

Explosive.	Total gases (c.c. per grm.)	Heat evolved (cal. per grm.)	Stability test c.c. per hr. per kilo. after 40 hrs. in a vacuum.			Relative insensitiveness to impact (Picric Acid = 100).	Velocity of Detonation.	
			80° C.	120° C.	140° C.		Density.	Metres per sec.
Tri-nitro-toluene	728	924	—	—	9	115	1·57	6,950
Tri-nitro-benzene	820	940	—	—	0	107	—	—
Tri-nitro-phenol (Picric Acid)	744	914	—	—	0·6	100	1·63	7,250
Tetryl	794	1,090	—	8	—	70	1·63	7,520
Tetra-nitro-aniline	—	—	—	18	—	86	—	—
Nitro-cellulose (13 % 1.N)	875	982	—	—	5,000	23	1·2	7,300
Nitro-glycerine	713	1,478	—	3,660	—	13	—	—
Mercury Fulminate	—	—	2·5	—	—	10	loose	3,000

greater power are, in fact, known, but the increase of power is almost invariably accompanied by chemical instability and mechanical sensitiveness to shock and friction, which make it difficult to apply such explosives in a practical way. Advances have been made in the discovery and application of useful intermediary explosives of the tetryl type, and there is room for further advances in this direction, but these are limited in scope. In the sphere of propellants, it appears likely that advances may be made in the direction of improvements on the present methods of gelatinizing by volatile solvents, the introduction of compounds of greater stability, and the attainment of greater power without the erosion which has hitherto limited it.

All investigations must naturally be subservient to a great extent to economic considerations. In the World War the availability of raw materials was a factor of decisive importance, and this limited the choice of compounds which could be made in large quantities. The necessity of importing the materials necessary for the manufacture of explosives is bound to direct attention to materials which can be obtained from home sources. This lends a special significance to the fixation of atmospheric nitrogen in the form of ammonia and nitric acid. It points also to the further development of perchlorates, which can be manufactured electrolytically from materials obtainable in most countries; and further investigations may overcome the present difficulties in the use of liquid oxygen.

In the future, as in the past, the advances will probably lie mainly in the direction of improvements in the methods of application of explosives, unless some method should be discovered whereby the enormous energy of disintegration of the atoms could be released at will; this cannot however be said to be within sight, and it is perhaps well that such stupendous forces should be withheld from human control until a greater sense of international responsibility is developed in mankind.

(C. D. C.; R. C. F.)

FABRE, JEAN HENRI (1823–1915), French entomologist, was born at St. Léons in Aveyron Dec. 21 1823. At ten years old he went to Rodez as a choir boy and there received the elements of a classical education, continuing it further at the normal school of Vaucluse. But his whole bent was for science, and, after he had become a teacher at Carpentras, he worked in his spare hours at physics and mathematics and became interested in insects, the study of whose habits was to form his life-work (*see* 3.626, 6.672, 14.180). Later he became a teacher of physics, first at Ajaccio and afterwards at Avignon. His first observations were published in *Annales des Sciences Naturelles* (1855–8), followed a good deal later by *Souvenirs Entomologiques* (1879–1907). He was a Chevalier of the Legion of Honour. He died at Serignan, Provence, Oct. 11 1915.

FAGUET, ÉMILE (1847–1916), French critic and man of letters (*see* 10.125*), continued up to 1914 to publish several volumes annually of critical and literary studies, more especially concerning Rousseau (*Rousseau penseur*, 1910; *Vie de Rousseau*, 1911; *Les Amies de Rousseau; Rousseau artiste*, etc., 1912). Amongst others may be noted a volume on *Madame de Sévigné* (1910); a study of *Rostand* (1911); *En lisant Molière* (1914) and *Msgr. Dupanloup* (1914). He died in Paris June 7 1916.

FAIRBAIRN, ANDREW MARTIN (1838–1912), British nonconformist divine (*see* 10.129), died in London Feb. 9 1912.

FAIRBANKS, CHARLES WARREN (1852–1918), American politician, was born near Unionville, O., May 11 1852. On graduating from Ohio Wesleyan University (1872) he became a newspaper reporter in Pittsburgh. He was admitted to the bar in 1874, and began practice at Indianapolis, Ind., where he was made solicitor for the receiver of the Indianapolis, Bloomington and Western railway. Henceforth he had much to do with railway affairs and became a railway financier. He attained a prominent place in state politics, being chairman of the Republican State Convention in 1892, 1898, and 1914. He was in charge of McKinley's campaign in Indiana, preceding the National Convention in 1896; and the following year he was elected to the U.S. Senate, having been nominated by the Republicans over several prominent candidates, including Gen. Lew Wallace. He was chairman of the U.S. representatives on the British-American Joint High Commission for dealing with Canadian questions in 1898 and 1903, being reëlected to the Senate in the latter year. At the Republican National Convention in 1904 he was unanimously nominated for Vice-President with Theodore Roosevelt and was elected. In 1912 he had a large part in the making of the Republican platform. In 1916 he was again nominated by the Republicans for Vice-President but was defeated. He died at Indianapolis June 4 1918.

FAISAL (1885–   ), Arab Emir, third surviving son of Husein, King of the Hejaz, was born at Taif in 1885. He spent his infancy at Rihab in accordance with the tradition of the Qoreish. At the age of eight he was brought to Mecca, where he began his early studies, but was afterwards sent to Constantinople to join his father and here he received a good modern education. On attaining manhood he held official appointments under the Turkish Government. With his brothers, he took an active part in the constitutional movement which led to the deposition of ʿAbdul Hamid, as a part consequence of which the emirate of Mecca was restored to his father Husein ibn ʿAli in 1908, Faisal returning to Mecca with him. He followed a military career, and commanded the Arab contingent in the Turkish operations against the Idrisi in 1911–3. In 1914 he was elected deputy for Jidda in the Turkish Parliament. Up to that time he was not markedly prominent among his brothers, but from 1915 he favoured Arab Nationalist aspirations, and (with his brother ʿAbdulla) furthered his father's anti-Ottoman designs. At the outbreak of the Arab revolt in 1916 he commanded the rebels at Medina, and, in the crisis which followed the failure to capture the city, he came much to the front. He organized the revolting tribes each under its tribal leader, devised a scheme for the formation of an Arab regular army, and developed a particular school of irregular warfare. He commanded the Arab northern forces which, after the taking of Akaba (July 1917), constituted a friendly army of the right wing of the Egyptian Expeditionary Force. He led the Arab troops at their entry into Damascus 1918, and to him, subsequently, was entrusted the task of setting up, in the eastern area of Syria, a provisional military administration to exercise control until peace was signed. Faisal presented the case of the Arabs before the Peace Conference in Paris on Feb. 6 1919. His administration maintained comparative security throughout 1919. In March 1920 he was proclaimed King of Syria at Damascus by the Syrian National Congress, but this proceeding received no official sanction from the Allied Powers, and the régime was overturned by the entry of French troops into Damascus in July of the same year, Kerak then becoming the headquarters of Faisal's administrative district. He spent some time in London in 1919 and again in 1920–21. On Aug. 23 1921—with the support of the Arab notables, ascertained by a referendum—he was crowned King of Iraq (*see* MESOPOTAMIA) and became ruler of the new State set up under the mandate accepted by the British Government.

FALKENHAYN, ERICH VON (1861–   ), Prussian general, was born Sept. 11 1861 at Burg Belchau in the district of Thorn. He took part in the China expedition of 1900 and remained in China with a brigade of occupation till 1903. In 1906 he was appointed chief-of-staff of the XVI. and afterwards of the IV. Army Corps; in 1913 he was promoted to the rank of lieutenant-general and was appointed Prussian Minister of War. He succeeded Gen. von Moltke in Dec. 1914 as chief of the general staff of the army and was advanced to the rank of general of the infantry. It was on his initiative that the Russian lines were broken through at Gorlice–Tarnow on May 2 and 3 1915, and he likewise helped to plan the summer offensive of that year against Russia and the operations by which in the winter of 1915–6 Serbia was overrun. He was made responsible, however, for the ill-success of the German attacks of 1916 at Verdun, and was replaced as chief of the general staff by Hindenburg in August of that year. He was then assigned the leadership of the IX. Army against Rumania and commanded in the fighting at Hermannstadt and on the Targu Jin. In 1917 he took command of the so-called Asiatic Corps, for operations in the Caucasus, etc., and in 1918 and 1919 was at the head of the X. Army. He wrote an interesting account of the German conduct of the war during its first two years entitled *Die oberste Heeresleitung in ihren wichtigsten Entschliessungen 1914–16* (1919).

FALKLAND ISLANDS BATTLE.—The battle of the Falklands, one of the principal naval actions of the World War, was fought on Dec. 8 1914 to the S.E. of the Falkland Is., between a British battle-cruiser squadron under Vice-Adml. Sir F. Doveton Sturdee and the German East Asiatic Squadron under Adml. Graf von Spee. The British ships were:—

"Invincible" (flag.), Capt. Percy Beamish, b. c., 1908, 8 12-in., 25½ knots.

"Inflexible," Capt. R. F. Phillemore, b. c., 1908, 8 12-in., 25½ knots.

"Carnarvon" (Rear-Adml. A. P. Stoddart), Capt. H. L. Skipwith, a. c., 1904, 4 7·5-in., 6 6-in., 20 knots.

"Cornwall," Capt. W. M. Ellerton, a. c., 1904, 14 6-in., 22½ knots.

"Kent," Capt. J. D. Allen, a. c., 1903, 14 6-in., 22 knots.

"Glasgow," Capt. John Luce, l. c., 1911, 2 6-in., 10 4-in., 25½ knots.

"Bristol," Capt. B. H. Fanshawe, 1911, 2 6-in., 10 4-in., 25½ knots.

"Macedonia," Capt. B. S. Evans, a. m. s.

The following composed the German squadron:—

"Scharnhorst," a. c., 1907, 8 8·2-in., 6 5·9-in., 20½ knots.

"Gneisenau," a. c., 1908, 8 8·2-in., 6 5·9-in., 20½ knots.

"Leipzig," l. c., 1906, 10 4·1-in., 20½ knots.

"Nürnberg," l. c., 1908, 10 4·1-in., 22 knots.

"Dresden," l. c., 1908, 10 4·1-in., 25½ knots.

Also three supply ships, "Seydlitz," "Baden," "St. Isabel."

** These figures indicate the volume and page number of the previous article.*

Adml. Sturdee had arrived at Stanley Harbour, in the Falklands, only the day before, in the forenoon of Monday, Dec. 7. The "Canopus," an old battleship, was already there, moored in Port Stanley waiting in conjunction with a body of sturdy volunteers to resist von Spee's expected attack. It was Adml. Sturdee's intention to coal at once and continue the pursuit of von Spee on the 9th, but his own colliers had not arrived and there were only three in harbour. It was arranged that the "Carnarvon," "Bristol" and "Glasgow" should coal first, the battle cruisers next, and the "Kent" and "Cornwall" last. The squadron was ordered to keep steam for 12 knots at two hours' notice, and the "Macedonia," an armed merchant ship, took the guard for the night. No sooner had coaling started than it was found that the coal in one collier had deteriorated, and at first only two colliers were available. The "Carnarvon" and "Glasgow" had finished by 6 A.M., and at first flush of dawn the "Bristol" and "Invincible" started to coal. By this time another collier had arrived, and the "Inflexible" began coaling about the same time. The "Kent," "Bristol" and "Cornwall" had not begun. The "Bristol" had her fires drawn to remedy defects, and the "Cornwall" an engine opened up at six hours' notice. This was the situation when, at eight o'clock, the "Glasgow" fired a gun. This was to call attention to a signal which had been flying for some minutes at the look-out station on Sapper Hill. It reported two strange ships in sight. A scene of bustle and commotion ensued. Colliers were cast off and great clouds of smoke began to pour from the funnels as the ships raised steam. At 8:14 A.M. the signal went up to prepare to weigh. The "Kent" by this time had taken over guard from the "Macedonia" and had passed down the harbour towards the entrance. The ships which had appeared so unexpectedly on the scene were the "Gneisenau" and "Nürnberg," which von Spee had sent on in advance. They approached from the south-west to within about 14,500 yd. and the men could be seen fallen-in on their decks ready to effect a landing. They were not in sight from the "Canopus," but a fire control station had been set up on the hill, and at 9 A.M. she opened fire with her 12-in. guns over the sand dunes. The shots fell short, but they made the "Gneisenau" turn away for a time to increase the range. The "Scharnhorst" was still some 15 m. from the entrance, but the clouds of smoke rising over the hills had aroused von Spee's suspicions and he ordered the supply ships to keep away. From the "Gneisenau" there came a report of six men-of-war in the harbour, and the Admiral ordered steam in all boilers, directing the "Gneisenau" at the same time to steer east and not to accept battle. By 10 A.M. the "Invincible," "Inflexible" and "Cornwall," which by dint of strenuous exertions on the part of her engine-room staff had got steam up, were under weigh and leaving harbour. They were vomiting out huge clouds of smoke which concealed them for a time, but it cleared away for a few minutes, revealing the tripod masts of battle cruisers, and von Spee knew that his hour of trial had come.

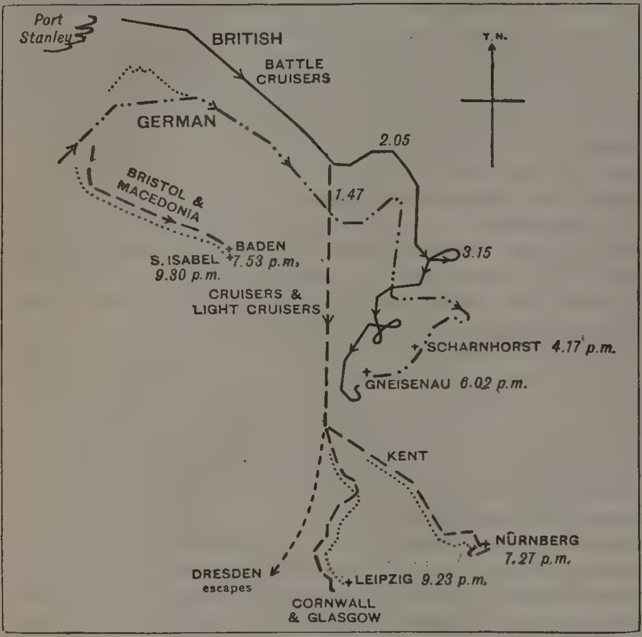
Port Stanley
BRITISH
BATTLE CRUISERS
T.N.
GERMAN
2.05
BRISTOL & MACEDONIA
1.47
BADEN
S. ISABEL 7.53 p.m.
9.30 p.m.
3.15
CRUISERS & LIGHT CRUISERS
SCHARNHORST 4.17 p.m.
GNEISENAU 6.02 p.m.
KENT
NÜRNBERG 7.27 p.m.
DRESDEN escapes
LEIPZIG 9.23 p.m.
CORNWALL & GLASGOW

FIG. 1.—Battle of Falklands.

By 10:20 Sturdee was clear of the harbour; the enemy was well down to the south-east about 11 m. off and the British Admiral hoisted the "General Chase," a signal for each ship to steam as hard as she could after the enemy. It was a perfect summer day with a blue cloudless sky and calm sea. A light wind was blowing from the north-west. Masses of black smoke were pouring from the battle cruisers' funnels and a great white wake was growing at their stern.

The engagement resolves itself into two phases. A chase from 10:20 A.M. to 1:28 P.M. and the action from 1:28 P.M. to 6:10 P.M. (*see* figs. 1 and 2). By 11 A.M. the enemy were showing above the horizon and the battle cruisers had eased to 24 knots. The "Glasgow" was on the "Invincible" port bow, the "Kent" on her quarter. The "Carnarvon" and "Cornwall" were five m. astern, and to give Rear-Adml. Stoddart in the former a chance to get up the Admiral reduced to 20 knots. The "Bristol" by extraordinary exertions on the part of her engine-room staff had managed to raise steam. Some ladies off Port Darwin had seen von Spee's colliers, and the information was passed to Port Stanley and then to Adml. Sturdee, who dispatched the "Bristol" and "Macedonia" to deal with them. By 11:30 A.M. the chase was gradually coming round to south-east by east. The "Carnarvon's" efforts to get up were unavailing and Sturdee increased speed. By 12:50 P.M. the battle cruisers were going 25 knots, overhauling the enemy fast.

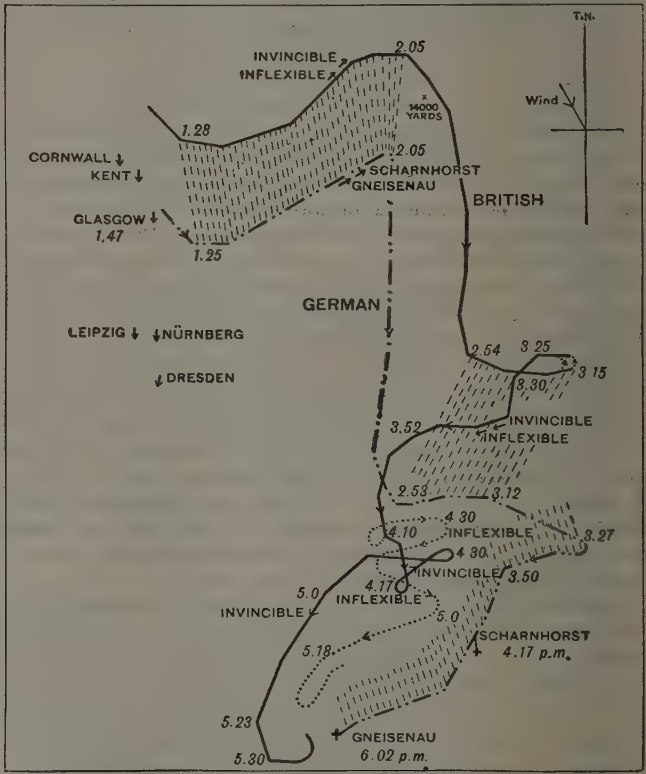
T.N.
INVINCIBLE
INFLEXIBLE
2.05
14000 YARDS
Wind
1.28
CORNWALL
KENT
2.05
SCHARNHORST
GNEISENAU
BRITISH
GLASGOW
1.47
1.25
GERMAN
LEIPZIG
NÜRNBERG
DRESDEN
2.54
3 25
3 15
3.30
3.52
INVINCIBLE
INFLEXIBLE
2.53
3.12
4 30
4.10
INFLEXIBLE
3.27
4 30
INVINCIBLE
3.50
4.17
5.0
INFLEXIBLE
INVINCIBLE
5.0
SCHARNHORST 4.17 p.m.
5.18
5.23
GNEISENAU 6.02 p.m.
5.30

FIG. 2.—The Main Action.

The "Leipzig" was beginning to feel the pace and was dropping behind. At 12:55 P.M. her range had dropped to 16,000 yd. and the "Inflexible" opened fire. Von Spee seeing his light cruisers in danger ordered them to scatter, and they broke off to the southward, but Adml. Sturdee was ready for the contingency, and the "Glasgow," "Cornwall" and "Kent" went after them in hot pursuit. Von Spee turned to E.N.E. to accept action and took station ahead of the "Gneisenau," while Sturdee's battle cruisers to the northward of him turned into line ahead on an easterly course. At 1:25 P.M. they opened fire, the "Invincible" on the "Gneisenau" and the "Inflexible" on the "Scharnhorst," at first, shifting target later when the "Scharnhorst" passed ahead.

The action which followed may be divided into three phases; an opening encounter from 1:25 P.M. to 2 P.M., then a pause from 2 P.M. to 2:45 P.M. in which the chase was resumed, and the final engagement. The opening shots were fired at about 14,000 yd., and von Spee led round to the north-east for a few minutes to close, continuing at 13,000 yd. on a north-easterly course, which gave the "Carnarvon" a chance of coming up. About 1:40 P.M. the "Invincible" was hit, and Sturdee turned to port to open the range and take advantage of his heavier guns.

Dense clouds of smoke were pouring from the battle-cruisers' funnels, and the north-easterly course and north-westerly wind carried it southward towards the enemy, smothering the range. By 2 P.M. the range had increased to 16,000 yd. and fire was checked. The "Invincible" led round to the south-east at 2:05 P.M. to close, but the enemy was lost to sight for a few minutes in the smoke, and when he reappeared he was found to have turned right away to the southward in the direction of his light cruisers. Sturdee in reply turned to the southward and increased speed, and the chase began again. It continued for nearly 40 minutes. By 2:45 the range was down again to 15,000 yd. and turning two points to port Sturdee opened fire. Von Spee did not reply for some minutes, then deciding to accept action he turned to the east again and opened fire at 2:55 P.M. The action ran to the eastward till 3:15 P.M. with the range falling from 12,000 to 10,000 yards.

The British guns were now establishing their mastery. A fire had broken out in the "Scharnhorst" and the "Gneisenau" was listing and showing signs of severe damage. But again the smother of smoke down the range made spotting difficult, and at 3:15 P.M. Adml. Sturdee to escape from it turned the battle cruisers to port together. The "Inflexible" was now leading to the westward and found herself for the first time free from smoke. Von Spee might have continued his course to the eastward which would have opened the range again to something like 17,000 yd. at the expense of a concentration of fire on the "Gneisenau" in rear, but he preferred to continue the battle on a parallel course, and led round to starboard in succession bringing his starboard guns into action. The "Scharnhorst" shifted fire to the "Inflexible" and was engaged by her. The action now ran to the south-westward with the British battle cruisers circling widely round the enemy, maintaining a range of about 14,000 yards. By 4:5 P.M. the "Scharnhorst" was bearing east on a south-westerly course; she had been hit several times and was listing heavily to port; her superstructure was a mass of ruins, and her speed had been reduced to 12 knots. The smoke was again driving down the range, and at 4:10 P.M. the "Inflexible" to get rid of it turned to starboard and engaged the "Gneisenau" on a north-easterly and opposite course. The "Invincible" did not follow her but ran on to the south-eastward. The end was now near. At 4:17 P.M. the "Scharnhorst" heeled completely over to port; her stern rose steeply in the air and she went down. As she disappeared the "Invincible" turned to starboard and ran to the northward for ten minutes, then ordering the "Inflexible" to take station astern, and turning to port at 4:30 P.M. shaped course to the westward. The "Gneisenau" was some 13,000 yd. to the south-eastward, still struggling along on a south-westerly course. No sooner had the "Inflexible" formed astern of the flagship than the range was again obscured by smoke, and finding it impossible to see the enemy she turned 14 points to port at 4:45 P.M., and leaving the flagship ran to the eastward towards the enemy, opening on him with her starboard guns before the beam and turning to the south-westward at 4:55 on his starboard quarter at 10,000 yards. The "Invincible" meanwhile held on, and turning to the south-westward at 4:52 kept the "Gneisenau" on her port beam at about 12,000 yards. The "Gneisenau" was now under a heavy concentrated fire. By 5:15 she was in a sorry plight. The after turret was out of action, the foremost funnel gone and the ship was barely making headway. A drizzling rain had commenced to fall. At 5:30 P.M. the "Inflexible" ceased fire under the impression that she had struck, but the enemy's fore turret still maintained the contest. At 5:45 P.M. she fired her last shot. She had received some 50 hits and was sinking slowly. At 6 P.M. she went down, stern first. The British battle cruisers rescued 188 survivors from the icy water.

The German light cruisers when they left the squadron had headed south at full speed with the "Kent," "Cornwall" and "Glasgow" in pursuit. When the chase began, the "Nürnberg" was the centre ship, with the "Leipzig" about a mile on her starboard beam, and the "Dresden" ahead about four m. on the port bow. The speeds attained by various ships are difficult to ascertain with absolute certainty. The "Leipzig" was the slowest ship and was probably unable to go more than 20½ knots; the "Dresden" was the fastest and was able to go about 25½ knots, and possibly something over, while the "Nürnberg" could probably go 22. All the German ships had been cruising continuously for four months with no facilities for repair, and probably found it difficult to maintain their speeds. On the British side, the "Glasgow" could go 25½ knots, and the "Cornwall" and "Kent" can be credited with 22½ and 22 knots respectively. There could be no doubt as to the sequel once the British armoured cruisers got within range. The Germans had nothing heavier than the 4·1-in., good guns for their size but no match for the 14 6-in. carried by the armoured cruisers. When the German light cruisers broke off at 1:25 P.M. and the chase began the British cruisers were some 10 to 11 miles behind them. The "Glasgow" did not turn after them till 1:33 P.M., then going 24 knots she overhauled the "Kent" and "Cornwall" and crossed their bows.

According to German accounts Capt. Luce was overhauling the "Dresden" slowly for a time, but at 2:53 P.M. when some four m. ahead of the armoured cruisers he yawed and opened fire with his 6-in. guns on the "Leipzig," damaging one of her ventilating fans, which brought the steam pressure down. The armoured cruisers were now gradually creeping up, and about 4 P.M. the enemy cruisers began to scatter, the "Dresden" going off to the south-west, the "Nürnberg" to the south-east, and the "Leipzig" continuing to the southward. Capt. W. M. Ellerton of the "Cornwall" immediately arranged with Capt. J. D. Allen of the "Kent" that he would take the "Leipzig," leaving the "Nürnberg" to the "Kent." This left the "Dresden" to the "Glasgow," but Capt. Luce thought her speed too great and preferred to remain with the armoured cruisers.

About 4:15 P.M. the "Kent" opened fire on the "Nürnberg" and the "Cornwall" on the "Leipzig," and by 4:30 the latter was being straddled. The "Glasgow" now definitely abandoned all attempt to follow the "Dresden," which disappeared about 5 P.M. in a squall of rain. Turning to the eastward at 4:27 P.M. she passed astern of the "Cornwall," bringing her broadside to bear on the "Leipzig." The chase continued to the south-eastward, for half an hour the "Cornwall" keeping the enemy on the starboard bow, and steering a more easterly course to keep her guns bearing. About 4:50 the "Leipzig" turned to the south-west, and the "Cornwall" following suit had her now on the port bow and brought her port guns into action. The "Leipzig" was now beginning to suffer from the effects of the combined fire, and the "Cornwall" and "Glasgow" had no difficulty in keeping her at ranges of 9,000 to 10,000 yards. By 6 P.M. rain was falling, and as the target was becoming indistinct Capt. Luce made a signal to close. The "Cornwall" now began to fire lyddite with immediate effect. By 6:35 P.M. the "Leipzig" was blazing fore and aft, though still firing fitfully and going some 15 knots. At 7 P.M. her mainmast and her funnels had gone and she was practically only a burning wreck, though her flag still flew defiantly at the foremast. After opening the seacocks about 150 of her crew mustered amidship hoping to be saved. But as she made no sign of surrender the "Glasgow," after waiting half an hour, closed and opened fire again with terrible effect on the men gathered on her decks. Two green lights went up which were read as a signal of surrender and boats were lowered to perform the work of rescue, but she was heeling heavily to port, and at 9:23, while the boats were approaching, turned over and disappeared, some 80 m. south of the spot where her flagship had sunk five hours before. Only five officers and thirteen men were saved. The British cruisers had suffered little. The "Cornwall" had been hit 18 times, and had a list to port, but had suffered no casualties. The "Glasgow" had been hit twice with one man killed and four wounded. The "Kent" all this time had been vigorously pursuing the "Nürnberg" to the south-east. She had started some seven miles behind her, but the engine-room staff performed prodigies, and by feeding the fires with all the spare wood in the ship the range was brought down to 12,000 yd. by 5 P.M. The "Nürnberg" now opened fire with her stern guns. The "Kent's" shots were falling short, and mist and rain were seriously reducing the visibility. Within the next quarter of an hour however, the "Kent" scored a couple of hits, one of which penetrated the "Leipzig" below the waterline aft and did serious damage. Then came a dramatic change. Two of the "Nürnberg's" boilers gave out, her speed dropped to 19 knots and the "Kent" commenced to overhaul her rapidly. At 5:45 the "Kent" was on her port quarter some 6,000 yd. off, and the "Nürnberg" turned to port to engage her. There was no time to lose in the failing light and Capt. Allen forced the pace. Keeping the enemy well abaft the beam to avoid torpedo fire he closed in to 3,000 yards. The pace was too hot for the "Nürnberg" and she turned right away at 6:02. But the "Kent" followed her close. By 6:10 the enemy was on fire with only two guns in action; the "Kent" continued to hit, and circling right round her bows raked her at 3,500 yards. By 6:25 she was a burning wreck, listing heavily and down by the stern, but with her flag still flying. The "Kent" opened fire again and the flag came down. Just before 7:30 she turned over and sank, but though a search was kept up till 9 P.M. only seven survivors were found. The "Kent" had been hit 40 times, but suffered little structural damage and lost only four killed and 12 wounded.

Meanwhile the colliers "Santa Isabel" and "Baden" had been found by the "Bristol," who had chased them to the southward and eastward and captured them about 4 P.M. They were valuable ships, but Adml. Sturdee had given orders to sink all transports, and though they were not transports but ships full of valuable coal they were sunk. The supply ship "Seydlitz" got off to the southward and found safety amongst the icebergs. The "Dresden" reached Magellan Straits on Dec. 10 and anchored in Cockburn Channel with only 150 tons of coal left. Thence she made for Punta Arenas, where news came of her on the 12th, though three long months elapsed before our cruisers could hunt her down.

This was the end of the chase and the encounter known as the battle of the Falklands. It was the one decisive naval battle of the war—the end of von Spee's squadron, of von Spee, and of both his sons. It marked the termination of a definite phase of the struggle at sea. Cruiser warfare collapsed. Germany could no longer challenge the control of the outer seas, and outside the North Sea and Baltic the command of the sea was won.

(A. C. D.)

FARNELL, LEWIS RICHARD (1856–), English classical scholar and archaeologist, was born at Salisbury Jan. 10 1856. Educated at the City of London school and Exeter College, Oxford, he was elected fellow of his college in 1880 and subsequently rector in 1913. In 1920 he became vice-chancellor of the university. After graduating he studied classical archaeology at the universities of Berlin and Munich, and travelled much in Greece and Asia Minor. In 1909 he was elected the first Wilde lecturer in comparative religion, and he was Hibbert lecturer in 1911. He published *Cults of the Greek States* (5 vols., 1896); *The Evolution of Religion* (1905); *Greece and Babylon* (1911); *The Higher Aspects of Greek Religion* (1912).

FARRAND, LIVINGSTON (1867–), American educationist, was born at Newark, N.J., June 14 1867. After graduation from Princeton in 1888, he studied medicine at the College of Physicians and Surgeons, New York, and received the degree of M.D. in 1891. During the next two years he studied at Cambridge (England) and at Berlin. From 1893 to 1903 he taught psychology at Columbia University as instructor, and, after 1901, adjunct professor; from 1903 to 1914 he was professor of anthropology. In 1897 he accompanied the Jesup North Pacific Expedition, which visited the Indians of British Columbia, and published two monographs as results of his own investigations. From 1905 to 1914 he was executive secretary of the National Association for the Study and Prevention of Tuberculosis; and from 1912 to 1914 was treasurer of the American Health Association, during the same period editing the *American Journal of Public Health*. From 1914 to 1919 he was president of the university of Colorado, but in 1917 was granted leave of absence, following his appointment by the International Health Board of the Rockefeller Foundation to direct the work against tuberculosis in France. In 1919 he was made chairman of the Central Committee of the American Red Cross. In 1921 he was elected to succeed Jacob Gould Schurman as president of Cornell University. He was the author of *Basis of American History* (1904) and various articles on psychology and anthropology.

FARWELL, SIR GEORGE (1845–1915), English judge, was born at Codsall, Staffs., Dec. 22 1845. He was educated at Rugby and Balliol College, Oxford, where he took his degree in 1866. He was called to the bar in 1871. In 1891 he became a Q.C. and in 1895 a bencher of Lincoln's Inn, while in 1899 he was raised to the bench. In 1900 he came into prominence over the case known as the Taff Vale judgment (*see* 27.142), since his decision, though reversed by the court of appeal, was upheld in 1901 by the House of Lords, and ultimately led to the passing of the Trade Disputes Act (1906). In 1906 Farwell was made a lord of appeal, but resigned this position in 1913. He died at Dunster, Som., Dec. 30 1915. He published *Concise Treatise on the Law of Powers* (1874).

FASTING (*see* 10.193).—The adoption of "hunger-striking" in prison by some of the militant suffragettes in England, just before the World War, and by Irish Sinn Feiners subsequently, has served to call attention to the physiological fact that the human body is capable of more prolonged fasting (abstinence from food) than had generally been realized. Before they gave these demonstrations of endurance, fasts of 40 or 50 days had been regarded as extreme cases. In 1920, however, the Lord Mayor of Cork, Terence McSwiney, maintained his hunger strike in Brixton prison during 74 days, and, though subject to fits of delirium, he was stated to have been conscious until within a few days of his death.

From a purely scientific point of view it is regrettable that no definite medical record of this and other long "hunger strikes" was officially published, in such a way as to provide positive evidence that no "food" (apart from water and medicines) was taken, since there were naturally suspicions to the contrary in spite of all questions in Parliament on that point being answered in the negative. It can only be assumed that such allegations were unfounded. It has been shown therefore that, if the hygiene of fasting is carefully carried out, the mere lack of food becomes of small moment to the preservation of life for several weeks. The beginning of a fast is its most painful period, for during the first 48 or 36 hours hunger pains, occasioned by peristaltic contractions of the stomach, persist. These pains at first increase in severity during some hours, then, if no food is taken, they begin to pass away. Once they have disappeared they do not, as a rule, return. The fasting individual passes into a condition of comparative ease and comfort. The future now depends on the care with which the debris, collecting in the alimentary canal, is evacuated—for the bowel goes on producing waste matter in spite of the absence of food. Purgation is therefore necessary, and enemata are usually administered. The skin tends to exude an oily detritus, and unless this is removed constantly a fæcal odour will be experienced. Here again, however, the beginning is the worst period. After some days the problem of maintaining health is much simplified, and the patient, though increasing in weakness, experiences small inconvenience. This period is, however, often characterized by hallucinations, the mind being dissociated from its material surroundings. Visions are frequently described and strange manifestations announced. The patient is now approaching the time when he must break his fast or die. Recent investigation suggests that death will be due to acid poisoning, and it is stated that the administration of what are called "buffer salts," for example the acid phosphate of sodium, is instrumental in postponing the fatal issue. In any case the end is apt to occur suddenly, the patient becoming collapsed without warning. If the fast is broken with a little fruit juice and then milk given for a day or two no untoward results seem to follow. Indeed, many people derive benefit and practise occasional fasting for a short period as a therapeutic measure. The Allan treatment of diabetes is an instance in point. There are many cases on record of men walking considerable distances on the 40th day of a fast, and shorter fasts have been fairly common. It need scarcely be added that water is taken throughout the period of abstinence in all instances. (R. M. Wi.)

FAWCETT, MILLICENT GARRETT (1847–), British writer and political worker, was born at Aldeburgh, Suffolk, June 11 1847, the seventh child of Mr. Newson Garrett. In 1867 she married the economist Henry Fawcett, subsequently Postmaster-General (*see* 10.215), and during her husband's life was closely associated with him in all his work, his blindness making him in many ways extremely dependent upon her. She herself produced various works on economics, including *Political Economy for Beginners* (1870), *Tales in Political Economy* (1875), and, with her husband, a volume of *Essays and Lectures* (1872). Mrs. Fawcett had for many years been interested in the higher education of women and in their economic and political future, and was one of the early workers for women's suffrage, becoming more prominent in the cause after her husband's death (1884). By about 1870 various small societies had grown up with the purpose of advancing the cause of women's suffrage, and in 1896 these were amalgamated under the name of the National Union of Women's Suffrage Societies, Mrs. Fawcett in 1907 becoming the president of this movement. The body was for some years the only important suffrage society, and most of the pioneers of the movement belonged to it; but in 1906 the Women's Social and Political Union was formed, pledged to work by militant, as opposed to constitutional methods. Mrs. Fawcett was strongly opposed to the tactics of the militant suffragists, and expressly dissociated the N.U.W.S.S. from any sympathy with such methods. The constitutional methods adopted by the body of which she was president included an alliance formed with the Labour party (1912) by which the society agreed to support Labour candidates in preference to Liberal when the latter proved unsatisfactory on the suffrage question. Mrs. Fawcett in 1912 produced her work *Women's Suffrage*, and her other books include *Lives* of Queen Victoria (1895) and Sir William Molesworth (1901), and *Five Famous French Women* (1906).

Mrs. Fawcett's only child, Miss Philippa Garrett Fawcett, had a distinguished career at Newnham College, Cambridge, where in 1890 she was bracketed equal to senior wrangler. She became in 1905 principal assistant in the Education Officer's department of the L.C.C.

FAYOLLE, MARIE-EMILE (1852–), French marshal, was born at Puy (Haute Loire) May 14 1852. He entered the École Polytechnique in 1873, and on leaving in 1875 was posted to the 16th Regt. of artillery. As a subaltern he saw service in Tunis. He was promoted captain in 1882. In 1889 he passed through the École de Guerre, to which, in Nov. 1889, he returned as assistant to Col. Ruffey, who was then artillery lecturer. At this time Foch was lecturer in tactics, and Maud'huy and Pétain joint lecturers in infantry. In 1900 Fayolle succeeded Ruffey as artillery lecturer and held the appointment for seven years. He was promoted lieutenant-colonel in 1902 and colonel five years later. In Nov. 1908 he took over command of a regiment of artillery, and in 1910 he was made a general of brigade; but as on May 14 1914 he had passed the age limit and had not received further promotion he was placed on the retired list. On the outbreak of the World War he was recalled and given command first of a reserve brigade and then of the 70th (Reserve) Division. This division took part in the abortive Lorraine offensive of Aug. 1914. It distinguished itself in the defence of Nancy and was made the subject of a special order of the day by de Castelnau. In Oct. 1914 the division again received special notice—this time for the part it played in the fighting on the line Gavrelle–Bailleul. On Oct. 11 Fayolle was made a Commander of the Legion of Honour. In June 1915 the division was again made the subject of a special army order by Gen. d'Urbal who commanded the X. Army. On May 13 1915 Gen. Fayolle had been, contrary to the custom in the case of retired officers and in face of considerable opposition, promoted a temporary general of division. In June of the same year he succeeded Gen. Pétain in the command of the XXXIII. Corps. On Feb. 26 1916 he was promoted to the command of the VI. Army, and on March 25 following was confirmed in his rank as general of division. In command of the VI. Army, he carried out the French portion of the Somme offensive (July 1916–Nov. 1916). On Oct. 8 1916 Fayolle was made a Grand Officer of the Legion of Honour. In May 1917 he again succeeded Pétain, this time in the command of the centre group of armies. In Nov. he went to the Italian theatre in command of the French forces that were sent thither after the disaster of Caporetto. He returned in Feb. 1918 and took an important part in repelling the German offensives of March–June 1918, and in the Allied counter-offensive from July 18 onwards as commander of the northern group of armies. On July 10 he was given the Grand Cross of the Legion of Honour. Somewhat tardily he was, in Oct. 1919, awarded the Médaille Militaire. But not long afterwards he was, with Lyautey and Franchet d'Espérey, given the highest grade of all, that of Marshal of France.

FAZY, HENRI (1842–1920), Swiss statesman and historian, was a member of a family which at the date of the Revocation of the Edict of Nantes (1685) came from Dauphiné to Geneva to seek protection for religious reasons. Its most prominent member was his great-uncle, the Radical statesman, James Fazy (*see* 11.591), whose biography (1887) was written by him. He was born at Berne on Jan. 31 1842. He studied at Geneva for his doctorate in philosophy and law, became a member of the Genevese cantonal parliament in 1868, and was member of the cantonal executive from 1897 till his death. He was a Radical in politics, but of a more moderate type than his great-uncle, and founded a Radical "group," opposed to the more extreme section. Carteret, the successor of James Fazy as leader of the latter, died in 1889, and henceforward Henri Fazy played a more and more prominent part in Radical Genevese politics. As a member of the cantonal executive he had charge of the Department of Finances, and was much criticised by Gustave Ador, the leader of the Democrats or Whigs. In 1880 his proposal to separate Church and State in Geneva was rejected by the people, but was finally accepted by them in 1907. He was a member of the Swiss Conseil National from 1896 to 1899, and from 1902 onwards. After the Radical defeat of 1918 he was the only member of his party who was not turned out of office, but he became more and more conservative as time went on. In 1914, as the senior member of the Swiss Conseil National, he protested solemnly against the violation of the neutrality of Belgium.

For many years he was the archivist of Geneva, and also professor of Swiss history at the university of Geneva (1896–9 and from 1902). In the latter capacity he wrote much on Genevese history. In 1887 appeared the *Life of James Fazy*, in 1890 the *Constitutions de Genève*, in 1891 *L'Alliance de 1584 entre Berne, Zurich et Genève*, in 1895 *Les Suisses et la Neutralité de Savoie*, in 1897 *La Guerre du Pays de Gex et l'Occupation genevoise, 1589–1601*, in 1902 *Histoire de Genève à l'Époque de l'Escalade, 1589–1601*, in 1909 *Genève et Charles Emmanuel* and countless papers in the *Proceedings* of the Institut National Genevois. He died at Geneva Dec. 22 1920.

FEBVRE, ALEXANDRE FRÉDÉRIC (1835–1916), French actor (*see* 10.231). He retired from the Paris stage in 1893, and made a final tour of certain European capitals the following year. He died in Paris Dec. 14 1916.

FEDERAL FARM LOAN SYSTEM [United States].—The Federal Farm Loan Act of 1916 was adopted in the United States for the following reasons. Increasing use of costly equipment and the rising price of farm land had combined to make the problem of financing the American farmer a difficult one. His need for short-time credit, generally, had been met in various ways. Country merchants frequently advanced supplies to a farmer and received their pay after his crop was marketed. Manufacturers of farm machinery and of fertilizers also did a large credit business. A great many small country banks had sprung up since 1890 whose chief function was to supply short-time credit to farmers. The chief difficulty, however, was to supply long-time or mortgage credit. When the farmer must make a heavy investment, he needs a long loan. The only satisfactory security he can offer is a mortgage, and the market for farm mortgages is limited, because comparatively few persons with money to lend are experts in farm values or otherwise in a position to deal safely in farm mortgages. This difficulty was accentuated in new communities by the lack of local lenders with sufficient expertness. It had in the past been partly, but only partly, overcome in various ways. Local mortgage brokers or banks having the necessary expertness, could lend on a limited number of mortgages, and after adding their own endorsements, discount the loans with eastern investors. In other cases, some of the large insurance companies sent their own experts into selected regions to place loans secured by mortgages. Again, a number of large corporations, commonly called mortgage banks, were organized to lend on mortgage security and to sell their own bonds to the investing public. Such a corporation, having bought a number of mortgage notes aggregating $100,000, would deposit them with a trustee as security for its own bonds to the same amount. These bonds were then sold to the general investing public, but sold on the general reputation of the corporation issuing them, and not on the buyer's expert knowledge of the individual mortgages.

In order to extend this principle and enable it to meet the need for mortgage credit throughout the country, the Federal Farm Loan Act of 1916 was passed. This Act created a Federal Farm Loan Board, to consist of the Secretary of the Treasury and four others to be appointed by the President, and to have general administrative control of the system. Under this Board there were created 12 farm land banks, located in the 12 different districts into which the country was divided, each bank to be the centre of the farm loan system for its own district. In each district there were to be organized, under its farm land bank, an indefinite number of farm loan associations, composed wholly of farmers desiring to borrow money on mortgage; and they borrow from the farm land bank of their district.

The 12 Federal farm land banks are located in the following cities:—Springfield, Mass., Baltimore, Md., Columbia, S.C., Louisville, Ky., New Orleans, La., St. Louis, Mo., St. Paul, Minn., Omaha, Neb., Wichita, Kan., Houston, Tex., Berkeley, Cal., Spokane, Wash. There was also a provision in the Federal Farm Loan Act permitting joint stock mortgage banks, such as those already described, to come in under the Federal farm loan system. Twenty-five had done so before Feb. 15 1921, with capital stock of $7,966,000, with bond issues aggregating over $76,000,000, and with loans to farmers aggregating almost $78,000,000. Every Federal farm land bank was required to have, before beginning business, a subscribed capital stock of not less than $750,000. This provided the initial fund from which to purchase the first batch of mortgages from the farm loan associations. Additional funds were to be raised through the sale of bonds to the investing public. Each issue of bonds was to be based upon a batch of mortgages previously purchased and deposited as security under the direction of the farm loan board. In order to assure a sufficient amount of capital stock, it was provided that in case the total $750,000 of capital stock of any Federal farm land bank was not subscribed within 30 days after the opening of the books, it was made the duty of the Secretary of the Treasury "to subscribe the balance thereof on behalf of the United States." In order still further to assure the farm land banks a working capital, in case the public was slow to invest in the farm loan bonds, amendments were passed (Jan. 18 1918 and May 26 1920) authorizing the Secretary of the Treasury to purchase $200,000,000 of such bonds during 1918–21.

On Dec. 31 1920 the U.S. Government held $6,832,680 of the capital stock of the farm land banks and their bonds to the amount of $182,235,000. The total bonds authorized and issued by them was $333,784,500. The total capital stock of the 12 farm banks amounted to $24,591,515 held as follows:—

By the U.S. Government	$6,832,680
By National Farm Loan Ass'ns.	17,663,725
By borrowers through agents	79,230
By individual subscribers	15,880

The total amounts loaned by the 12 Federal land banks up to Nov. 30 1920 were as follows:—

Springfield	$13,550,345
Baltimore	14,732,783
Columbia	20,406,515
Louisville	27,691,200
New Orleans	25,811,705
St. Louis	30,951,675
St. Paul	49,554,700
Omaha	48,905,890
Wichita	31,531,300
Houston	40,754,766
Berkeley	18,645,900
Spokane	46,084,535
Total	$368,621,314

Under the operation of this Act and its amendments, such moneys as are secured from the sale of bonds, either to the Secretary of the Treasury or to the investing public, are loaned by the farm land bank to farm loan associations within its district in return for mortgages given by individual farmers to these farm loan associations. The course of the money is, therefore, as follows: first, from the investor to the farm land bank in exchange for bonds; second, from the farm land bank to the farm loan association in exchange for a batch of mortgages; third, from the farm loan association to the individual farmer in exchange for an individual mortgage. The securities, however, proceed in the opposite direction; first, a mortgage is given by the individual to his local farm loan association in exchange for money; second, this and other similar mortgages are transferred from the farm loan association to the farm land bank in exchange for money; third, the farm land bank deposits these mortgages under the direction of the Federal farm loan board and, on that security, issues its own bonds and sells them to investors.

It was provided in the Farm Loan Act that the bonds of the farm land banks were to be exempt from taxation. The purpose of this exemption was to make such bonds so attractive to the general investor as to compensate for a low rate of interest. This low rate of interest on the bonds would then enable the farm land banks to accept farm mortgage notes paying a low rate of interest, and thus the farmer would be able to borrow at a lower rate than would be necessary if the farm loan bonds were subject to taxation. Those issued prior to May 1 1920 paid 4½%. Subsequent issues pay 5%. This provision was bitterly attacked on the ground that it was class legislation, or discrimination in favour of farmers as against other classes. The matter was under litigation for many months, but finally in Feb. 1921 the Supreme Court decided in favour of the constitutionality of the Act. (T. N. C.)

FEDERAL RESERVE BANKING SYSTEM.—The Federal Reserve Banking System of the United States is the outgrowth of a movement for what was called "banking reform," which had been in progress for about 20 years prior to the enactment of the Federal Reserve Act on Dec. 23 1913.

The National Banking System, which in 1913 contained a total of about 7,500 members, had been organized during the Civil War, the constituent Act being passed in 1863 and modified in the following year. It provided for the creation of independent institutions operating under the general requirements of the National Banking Law, but organized directly at the will of prospective stockholders. The fundamental basis of the law was "free banking," as reflected in general authority to organize banks provided that the capitalization of each institution should not be less than a specified sum varying with the population of the place in which the proposed bank was to be situated. The minimum of capitalization was $50,000 (changed in 1900 to $25,000). Currency issued by the national banks was based upon and protected by Government bonds which each bank was required to purchase in a specified amount, not exceeding, however, a sum equal to the capital of the bank. Bond purchase provisions were later modified, but the essential principle remained. When these bonds had been purchased they were deposited with the Treasurer of the United States who thereupon issued circulating notes to the bank. Each bank was required to maintain a specified reserve which amounted to 25% in the case of banks located in three central reserve cities (New York, Chicago and St. Louis), while in reserve cities (eventually nearly 50 in number) the requirement was 12½% cash in vault and 12½% in the form of balances in banks in the central reserve cities. All other banks were required to keep 15% reserve, of which 6% had to be cash in vault and 9% might be in the form of balances in the banks of central reserve cities.

This system had proved inadequate because in time of stress or panic there was no recognized means for relieving hard-pressed banks; also the currency was inelastic, being limited by the amount of bonds available, and being slow in its issue and even slower in redemption. During and shortly after the panic of 1893, an agitation was started in favour of some plan for the issue of "emergency currency" as a means of preventing the development of acute panics; this ultimately grew into a demand for a currency not purely of emergency nature but elastic as required by business needs, and therefore including issues of ordinary bank-notes protected by the joint guarantee of the banks. The only practical outcome of this agitation was seen in certain sections of the Gold Standard Act of 1900. These provided for refunding the outstanding U.S. bonds at a rate (2%) which precluded the growth of a premium while it authorized banks of $25,000 capital in places with less than 3,000 people. Both provisions tended to make the issue of notes easier. Although numerous bills were urged, especially after 1907, the proposed plan for a really elastic note issue was never seriously considered by Congress because of the unwillingness of the larger banks to guarantee notes issued by a great many small institutions. After the panic of 1907 the so-called Aldrich-Vreeland Act was adopted (May 30 1908). This made provision for the organization of "national currency associations" which would have been allowed to issue notes based upon commercial paper or other securities deposited by constituent banks with the associations in question. At the time, however, the plan did not get into practical operation, partly because the difficulties attendant upon the panic of 1907 had been overcome before the Act was enacted. Contemporaneously with the Aldrich-Vreeland Act, provision was made for the creation of a body called the National Monetary Commission, which continued investigations for several years and eventually proposed a bill for general banking reform, ordinarily described as the Aldrich bill. This measure contemplated the creation of a central banking organization with branches. The plan still retained the fundamental concept of an emergency currency, but the proposed institution was not equipped with the ordinary powers, duties and responsibilities which had been found necessary in central banking experience abroad. It has been supposed that the Aldrich bill would have been adopted in its original or a modified form if the Republican party, under whose auspices it had been developed, had not been defeated in Nov. 1912. The Democratic party having come into office in the spring of 1913, the duty of enacting banking legislation was necessarily assumed by it and in June of that year a bill embodying what afterward became the Federal Reserve Act was introduced into congress. The measure had been under construction and preparation from about March 1912 onward, and a first draft of it had been presented to President-elect Wilson soon after the election of 1912. It was then approved by the President-elect, and the process of perfecting and improving it went on during the winter of 1912–3 under direction of a House of Representatives Committee. This bill when introduced had thus been under consideration at the hands of the special committee of the House Banking and Currency Committee for about 15 months prior to the date of its introduction, while preliminary studies had been undertaken even earlier. The bill consequently was quickly completed, went through Congress during the middle of 1913 and became law on Dec. 23 of that year.

Theory of Federal Reserve System.—The theory of the Federal Reserve Act was the separation of the central banking functions of the past from practical bank operation, the latter being carried on through distinct reserve banks under the general direction of a board vested with the banking functions of the past. To carry out this idea, the Federal Reserve Act provided for the creation of a number of central institutions whose membership was to consist of national banks, while institutions organized under state law (banks and trust companies) might at will also become members. Each such bank was obliged to contribute a sum equal to 3% of its capital and surplus and to become liable for an additional 3% which might be called in case of necessity. The central directing mechanism of the system was the Federal Reserve Board, which consisted of five members chosen by the President of the United States with the Secretary of the Treasury and the Comptroller of the Currency as members *exofficio.* No two of these five selected members were to be chosen from the same Federal Reserve district. An essential and fundamental requirement of the Act was the compulsory transfer of the reserves of member banks to the Federal Reserve banks, the reserve provisions requiring a minimum of vault cash and a minimum of balances on the books of the Federal Reserve bank, while a certain percentage of the required reserve might be either in vault or in the Federal Reserve bank. This was the so-called "divided reserve." The maximum required reserve (in central reserve cities) was 18%, of which 5% was to be in vault, 6% with the Federal Reserve bank, and 7% either in vault or with the reserve bank at the discretion of the member. Each reserve bank was authorized to issue currency protected by notes and bills growing out of commercial, industrial or agricultural operations. These notes and bills were to have a maximum maturity of 90 days, except where they were the product of agricultural transactions, in which case the maturity was raised to 180 days. Deposits of these notes were to be made with an officer known as the Federal Reserve Agent, there being one such officer at every Federal Reserve bank. Each Federal Reserve bank was governed by a board of directors, six of whose members (three bankers and three business men) were chosen by constituent member banks voting in three separate groups according to size of capital, while three (including the Federal Reserve Agent who was also the chairman) were chosen by the Federal Reserve Board. The Federal Reserve Board was given the function of passing on and establishing rates of discount, such rates, however, being originally named by the boards of directors of the several Federal Reserve banks. The task of dividing the country into districts was placed in the hands of an organization committee with instructions to establish not less than eight nor more than twelve such districts. This committee eventually divided the country into 12 districts with a Federal Reserve bank in each, and the President of the United States named the Federal Reserve Board in accordance with the new law, the new organization taking office Aug. 12 1914. On coming into existence, the board proceeded to organize a Federal Reserve bank in each district; the member banks paid in their stock subscriptions Nov. 2, and the Federal Reserve banks opened for business Nov. 16 1914. As thus organized the initial paid-in capital of the system at opening was about $18,000,000, while the gross reserve balances were $256,000,000. These balances at the outset were obtained chiefly through actual transfers of specie and legal tender money ($205,000,000), although in some cases rediscount credits were granted to aid members in establishing the necessary legal balance. Each bank was at the outset equipped with a small staff of officers and employees and a uniform accounting system. The beginning of the year 1915 found the system in operation, but with its transactions upon a small scale. Its first duty was to aid in the retirement of the emergency currency which had been issued shortly after the opening of the World War under the terms of the Aldrich-Vreeland Act as modified by Congress just after the outbreak of the war in such a way as to render the working of its provisions rather more flexible than was possible under the original legislation. At the outset, however, the system was of considerable service in controlling the outflow of gold which had proved to be an embarrassing feature of the economic changes that immediately succeeded the opening of the war, while it also aided in other emergency measures. Various measures were adopted with this end in view the best known being the so-called hundred-million-dollar "gold pool" formed after the outbreak of the war to provide exchange and to check gold losses.

Operation of the System.—The operation of the Federal Reserve System may be divided into three distinct periods, the first from Nov. 2 1914 to the declaration of war by the United States April 6 1917; the second extending from the latter date to a period some time after the conclusion of the Armistice of Nov. 11 1918 (the date most aptly chosen for the close of this period probably being Nov. 4 1919); while the third period extended from the latter date to the close of the year 1920. During the first or pre-war period the functions of the system were concerned largely with the organization of its own constituent units and the modification of banking practice in the United States and with the establishment of methods suited to the initiation of the new plan. These functions naturally fell into two main groups: (1) in the internal organization of the Federal Reserve banks, and (2) in the establishment of satisfactory relationships between them and their members. In the latter category should be placed the work done in perfecting coöperation between the banks and the clearing houses of the different communities and in developing methods of collection, in working out plans for rediscounting with the least possible delay and friction, and other matters of equal importance. In the same group of functions must also be placed the work done by the Federal Reserve System in developing a new standard for commercial paper. The Federal Reserve Act had given to the Federal Reserve Board the duty of defining commercial paper. Consequently, one of the first undertakings of the board was the establishment of regulations designed to cover the different classes of commercial paper and the processes to be pursued by reserve banks in discounting such paper. These regulations did not have the force of law since they merely amounted to a statement of the standards with which commercial paper must comply in order to be "eligible," that is to say, to be rediscountable at the Federable Reserve banks. Nevertheless, the growing power of the Federal Reserve banks was such that these standards of eligibility rapidly came to be recognized through the whole of the banking community. Progress was made in the matter of securing nearly identical methods of preparing financial statements to be used for the purpose of testing the credit position of firms who were presenting paper for discount. An outstanding element in the work of the Federal Reserve Board during this first period was the national and district clearance and collection system. The Federal Reserve Act had authorized the board to act as a clearing house for the several reserve banks, and early in 1915 the board took action by establishing the so-called Gold Settlement Fund at Washington. Each bank contributed originally a sum of $1,000,000 in gold, the entire amount being stored in the Treasury or the sub-treasuries. Claims accumulated by reserve banks upon one another were each week telegraphed as an aggregate to the board at Washington and offset against one another, the net debit or credit balances in the fund being registered in a set of books created for that purpose. The size of the fund grew rapidly and eventually reached a maximum of about $500,000,000. A second section of the fund was established to provide for clearances growing out of the accounts of Federal Reserve Agents as distinct from the bank to which they were accredited. The Gold Settlement Fund probably would not have been successful alone had it not been supported by some plan for the collection of items originating within the several districts. Such a plan was, however, worked out and put into effect in practically final form beginning about July 1 1916. This was the so-called "intradistrict" collection system. It provided for the depositing of cheques (at first only on member banks but finally on any other bank or any banker) by members or holders of clearing accounts with Federal Reserve banks. These cheques were sent to the banks upon which they were drawn, the latter being required to remit the proceeds in cash or acceptable exchange or to authorize the charging off of these remittances upon the books of the reserve banks. Member banks, of course, habitually followed the latter plan, while non-members who had no account with the reserve bank were obliged to furnish exchange or send coin. Although there was opposition from the banks which had previously made a profit out of this kind of exchange business, the opposition gradually lessened. Possibly the most vigorous form which it assumed was seen in the amendment to the Federal Reserve Act adopted in 1917, in which exchange charges made by member banks were recognized but which, on the other hand, practically neutralized such charges by providing that the Federal Reserve banks should not be permitted to pay exchange. The matter was promptly tested in the courts, and as a result of favourable decisions and of the evidently beneficial character of the system, the number of banks which agreed to clear at par was extended until in 1920 it included more than 29,000 institutions—practically all the banks of the United States. The total operations of the Federal Reserve intradistrict clearing system were at the rate of $13,124,000,000 per month during the year 1920.

War Finance.—Although the Federal Reserve System had practically established itself during the two and a half years of its existence prior to the entry of the United States into the war in April 1917, it was doubtful whether the resources of the system were sufficiently large to enable it to bear the strain which all recognized would be thrown upon it as soon as war demands began to make themselves felt. Accordingly Congress, upon recommendation of the Federal Reserve Board in June 1917, passed an amendatory Act which provided that nothing should be counted as reserve except balances on the books of Federal Reserve banks. The United States had declared war on April 6 1917, and almost immediately thereafter many of the larger State banks and trust companies, which had previously hesitated to become members, filed their applications, actuated partly by patriotic desire to strengthen the Government's accounts and partly by the fact that the severe financial stress of the war would be most easily met by the institutions which had joined the system. This movement into the Federal Reserve System was accelerated through the amendatory Act to which reference has already been made, so that in the course of the year 1917 the resources of the System were enormously increased, while its gold holdings were vastly added to through the gradual withdrawal of coin not only from the vaults of banks but also from circulation. Shortly after the declaration of war the Secretary of the Treasury had placed an issue of $50,000,000 of treasury certificates of indebtedness with the reserve banks, but it was promptly recognized that this plan of financing was unsound; and subsequent issues, both of long-term bonds and of Treasury certificates, were placed with member banks and so far as possible with the public through the reserve banks acting as intermediaries. It was seen from the outset, however, that in order to keep the rate of interest on Government bonds at a low figure and to insure wide distribution of the bonds, it would be necessary to guarantee their holders that they could borrow freely by using them as security at rates which would involve no expense. Consequently, from the date of the First Liberty Loan (June 1917) onward, banks all over the country undertook to loan to their customers on Liberty Bonds such amounts as the customers might need, running up to a total close to the face of the bonds, and at the same time reserve banks undertook to rediscount the notes collateraled with these bonds when received from the member banks. As the Government itself had entered, upon a wide scale, into business enterprises growing out of the war, a large and increasing volume of its payments for supplies, services and other needs was made out of the proceeds of bonds and certificates and this class of paper accordingly superseded in a corresponding degree paper which would otherwise have been made by business men for the purpose of financing their ordinary transactions. Both in order therefore to assist the rank and file of the public in absorbing Liberty Bonds and to facilitate the Government's own operations, there were large additions to the portfolios or holdings of reserve banks and the amount of the notes they issued and the deposits they entered on their books increased rapidly. At the end of 1917 there was outstanding in notes $1,247,000,000 while reserve deposits were $1,446,773,000 and total resources were $3,089,945,000. These conditions were more and more accentuated as the war continued, particularly in view of the fact that the U.S. Government found it necessary to advance large sums to foreign countries, selling Liberty Bonds in order to provide the means for so doing. The consequence was an enormous increase of general prices brought about partly by the steady draft upon the consumable commodities in the country which were exported in great quantities (the total shipments during 1918 being $6,149,087,545 as against $2,484,018,292 in 1913), while they were partly due also to the great increase of bank-notes and bank deposits both on the books of members and of the reserve institutions themselves. It had been hoped that upon the declaration of the Armistice there would be a reaction to more conservative methods of financing, but the enormous commitments which had been made in sending about two million soldiers to France and in taking from the Allied Governments their obligations to a total eventually of about $9,600,000,000, constituted a situation which could not be immediately altered. In fact, war expenses continued to increase for several months after the Armistice, and the floating of a Fifth, or Victory, Loan, early in 1919, was essential in order to fund some part of the immense floating indebtedness of nearly $10,000,000,000 for advances to foreign countries, fully $2,500,000,000 of such advances being actually paid after the Armistice. The war finance period thus in effect extended to the middle of 1919 at least. By that time, however, the advance of prices was tremendous, and a very serious question arose as to whether the reserve banks ought to announce a material increase in their rates of discount. The objection to their doing so was strongly urged by the Treasury authorities, because such a policy would result in increasing the cost of money to the Government.

After the War.—The final conclusion of the operations attendant upon the Fifth, or Victory, Loan created a financial situation which was distinctly better from the standpoint of the Treasury than that which had existed before, and somewhat reduced the opposition of the department to a restoration of normal discount rates. Accordingly in Nov. 1919 a tentative advance in the rate of discount on all classes of commercial paper was made. This had but little effect upon the volume of credit outstanding, although it kept the rate of expansion below that which would otherwise have been unavoidable. Experience during the next six months showed that much more positive action would have to be taken, for speculation continued. It was not so intense in stocks and securities as during the month immediately after the Armistice, but prevailed very widely in staple materials as well as in many classes of finished products. In order to check this development of speculation, it was essential to limit the extension of credit to traders and manufacturers as well as to farm interests, which were seeking to obtain bank accommodation in order to carry large quantities of products which they withheld from the market. The rate of discount was eventually raised in May 1920 to a maximum of 7 per cent. Meanwhile a change in the personnel of the Treasury Department had occurred, and one of the features of the new régime was an alteration of policy with respect to methods of borrowing. The Treasury Department now advanced its offered rate of interest on certificates of indebtedness to a maximum of 6%, a figure more nearly corresponding to the prevailing rate in the open market. These advances took place practically simultaneously with corresponding action by the Bank of England and the British Government. The effect in both countries was beneficial in two ways—it tended to place the Government's obligations more freely in the hands of investors and thus to take them out of the banks, while the advance in discount rates coupled with the initiation of an anti-speculative policy and the withholding of credit from those who desired to hoard and store products tended strongly to bring commodities directly upon the market. The consequence was the administration of a sharp check to the growth of credit, and during the latter part of the year 1920 there was a decided restriction of the total amount of new bank accommodation granted both by the reserve banks and by their members, while there was a very decided reduction in the degree of activity with which bank deposits were used. In addition to these changes in bank position was the fact that the extraordinarily high prices which had ensued upon the close of the war, reaching their peak in May 1920, declined rapidly from the middle of 1920 onward, eventually reaching, at the close of the year, an average level of about 190 as compared with 272 in May and 100 in 1913. This rapid decline tended to curtail the demands upon reserve banks and had the effect of eliminating the borrowing of many concerns which had been conducting operations on an unsound and semi-speculative basis. The close of the year 1920 found the reserve banks with $3,552,922,000 in notes outstanding, with total discounts amounting to $2,687,393,000 and total resources to $6,282,755,000.

Expansion of Reserve Banks.—Before the entry of the United States into the war the operations of the Federal Reserve banks had been restricted, for reasons already explained, so that the personnel employed was necessarily limited. It had not been found necessary to expand the number of offices although the Federal Reserve Act had authorized the creation of branches both at home and abroad. Early in the history of the system a branch of the reserve bank at Atlanta had been established at New Orleans because of the importance of that city as a port of communication with South America. This, however, continued for a good while to be the only branch bank in the system. The great expansion of operations resultant upon the fiscal transactions of the Treasury coincided with the upward swing of business which resulted from the complete establishment of the collection system. It was found that greater efficiency could be secured through the opening of new offices at strategic points, and before Jan. 1 1921 there had been created in all 22 branches. These branches varied to some extent in the scope and character of their functions, certain of them acting primarily as collection agencies while others added thereto very considerable powers in the rediscounting of paper and the holding of reserves. In some cases, as on the Pacific coast, creation of branches resulted from the fact that the district in which they were situated was so large that as a mere matter of convenience it was desirable to establish some local offices. In other cases the creation of branches grew out of peculiar local conditions or a need for recognition of the importance of some industrial centre outside the city in which the parent bank was situated. The local branch offices were usually given a comparatively simple organization and wherever possible the effort was made to have them practically dependent upon the bank of the district. To facilitate this closeness of relationship and also to ensure prompt action in connexion with clearance and rediscounting operations a leased wire system, including both telegraph and telephone, was put into operation between the various banks in 1917, uniting the whole series of parent offices and branches with the board in Washington and rendering possible practically instantaneous communication upon matters of business policy. While it was never deemed expedient to establish actual branches in foreign countries, the system early in the war entered into agency relationships with the Bank of England whereby that institution was to hold funds in trust for the Federal Reserve banks jointly while they in turn were to undertake similar duties for the Bank of England. It was understood at the time that the agency relationship would not, until after the war at least, lead to the performance of functions involving the buying and selling of bills or operations in the discount market. Similar relationships were later concluded with the Bank of France, the Bank of Japan and various other international institutions, but in all cases the relationship was on a restricted basis and never resulted in the undertaking of international discount operations. From the opening of the war onward, the personnel of the Federal Reserve banks expanded very rapidly, as was necessary in order to comply with the heavy demands that were made upon the banks for services. For the year 1920 the personnel of the banks probably averaged about 10,000 persons, while their combined earnings for that year were $181,000,000, and their total expenses of operation, $29,889,000, or about 16½ per cent. Earnings which had been small before the war, some banks barely making expenses and others paying a little less than the 6% dividend provided for in the Act, shot up rapidly, as the result of heavy Government loans and the large advance made by the reserve banks in connexion therewith. For the year 1920 the earnings of the entire system, after setting aside all reserves, providing for depreciation, etc., were well over 200% on the capital. This, of course, was an abnormal condition resulting from the financing of the war period and corresponding to similarly heavy earnings at the central banks of foreign countries. Under the terms of the original Federal Reserve Act all earnings above 6% on the capital stock were to be transferred to the Government in lieu of a franchise tax. The receipts of the Government in the form of profits from the Federal Reserve banks, therefore, from the beginning to the close of 1920 amounted to about $150,000,000.

Influence of Reserve Banks on Banking and Business.—The influence of reserve banks upon business conditions in the United States is seen in the results of their effort to establish more uniform discount rates throughout the country, in their success in harmonizing commercial paper practices, in their relief of banks which would otherwise have been obliged to close on account of inability to rediscount paper, and in a variety of other less important ways. The question how far the reserve banks have succeeded in establishing a discount market or in providing a basis for financing foreign trade, both points which had been much under discussion prior to the passing of the Act, were in 1921 still matters of controversy. The provision of the Reserve Act which was intended to aid in the promotion of foreign trade authorized member banks to make bank acceptances and reserve banks to rediscount and buy such acceptances. It was natural that some time should elapse before much practical effect could be given to this provision, but it would probably have gone into operation as the result of a gradual and normal evolution had it not been for financial necessities caused by the war. In general the effect of the war was to disorganize all financial methods and systems previously in use, and this was as true in the field of commercial paper as in any other. Early in the war American foreign trade was placed upon a credit basis, and due to the difficulty of selling the obligations of belligerent Governments there was a strong temptation to obtain as much credit as possible upon a pure banking basis. The result was the lengthening of the maturity of the bankers' acceptance by every possible means and eventually the introduction of the so-called "renewal acceptance," whereby groups of banks entered into agreements which involved the making of acceptances for financing American exports to belligerents and others, at the same time that other groups agreed to buy or discount these acceptances, the first groups in return undertaking to discount acceptances made by the second group and used to take up the first issue. This was, of course, a sheer perversion of the intent of the acceptance, and when after the close of the war there developed a widespread practice of inflation and "kiting," followed eventually by an effort on the part of some accepting banks to repudiate acceptances because of the fact that heavy reductions in prices had occurred, the result was to impair confidence in American acceptances and to retard considerably the movement for their development. However, so far as gross volume is concerned, the new type of paper maintained a very substantial development until 1921 when the total amount in existence was estimated by the Federal Reserve Board as approximately six hundred million dollars, but during the first half of 1921 the value declined largely. Financing of foreign trade has been on so abnormal a basis and the trade itself has been so one-sided that it would be difficult to form a conclusive estimate of the effect of reserve banking in that connexion further than to say that without the general underlying strength which had been afforded by the system it would probably have been impossible for the United States to finance any such enormous volume of trade as it actually took care of. The effect of the Reserve System upon interest and discount rates has undoubtedly been to stabilize and harmonize them. Not only has there been a narrower variation of rates in different parts of the country than had been expected but the system has on the whole held the rates down. During the war this stability was partly due to wartime control. Subsequent to the close of the war there was a rebound to much higher rates of discount, but even these were probably by no means as high as they would have been, had it not been for the existence of the system.

Relations to Foreign Financing (*The Edge Act*).—While the original Federal Reserve Act had provided for the organization of foreign branches by qualified national banks, only a few banks showed real interest in the branch plan and only one or two took up the formation of branches on a considerable scale. Hence the adoption of an amendatory Act which authorized national banks to unite for the formation of banks which should engage in foreign trade financing. A few such banks were organized, but here also the interest of the different institutions was soon found to be limited. One reason assigned for the hesitation of banks in organizing the new corporations was the fact that they might be compelled to give to competitors an undue amount of knowledge of their own transactions. While, therefore, a few foreign trade institutions were organized, usually under the laws of New York state, with stockholders (banks) scattered throughout the country, it was evident within a year or so that this attempt to provide for the financing of foreign trade had been unsuccessful. Only in South America and the Far East (and there as a result of the provisions of the original Federal Reserve Act authorizing the creation of branches) did the banking system of the United States gain a distinct foreign development. The lack of foreign financing mechanism was obscured during the war years because of the necessity to which many foreigners were subjected of keeping their balances in New York and generally in dealing with American banks regardless of the conditions established by the law. Immediately after the close of the war modifications of this state of things began, and it became apparent that as soon as Government financing of American export trade ceased it would be impossible to maintain exportation long on anything like the basis which had existed during the war. A measure recognizing the need for an organization for export banking was taken under advisement in the winter of 1918–9 and was eventually made law in Oct. 1919. Meanwhile many American enterprises had fallen into the habit of financing their own foreign trade by extending long credits to buyers, while borrowing heavily from their own banks on domestic account in order to get the funds they needed to carry on trade elsewhere. In this way between the date of the Armistice and the close of 1920 there had been built up a foreign unfunded balance representing the difference between American exports and American imports reliably estimated as high as $4,000,000,000. One outcome of this great export balance was seen in continuous and violent disturbances of rates of foreign exchange, sterling (which had a normal par of $4.86) being depressed as low as $3.25, while other currencies suffered similarly and in some cases to a greater degree. This condition of affairs gave an impetus to the idea of establishing upon a national scale "Edge Act" corporations under the legislation already referred to, and during the winter of 1920–1 an effort was made to bring about the investment of capital in such undertakings, their purposes being to facilitate the movement of American goods to foreign countries on long-term credit.

Conclusion.—The Federal Reserve System between its organization at the end of 1914 and the close of the year 1921 passed through a remarkable development which not only vastly increased its resources as compared with any figures they would have been likely to reach had it not been for the war, but also necessitated active participation on the part of reserve banks in many types of financial transactions from which they might otherwise have abstained. The results of this activity were both good and bad—good in increasing the activity of the system and in affording an opportunity to be of direct and material usefulness; bad in bringing about a mushroom growth which prevented or curtailed the development of methods and practices upon a scientific basis. The system as a whole, especially those features which were at first thought to be of doubtful practicability, had definitely found its place and established its effectiveness. There had been improvement in methods of business financing, in the type of commercial papers, and in the use of modern instruments in connexion with the conduct of foreign trade. There had also been a large advance in economy, promptness and effectiveness, in domestic exchange, and in the collection of cheques. Priceless service was rendered to the U.S. Treasury during the war and through it to the world at large, since without the aid of the Federal Reserve System the financing of the war would probably have been impossible. On the other hand, the Federal Reserve System was the instrument through which an inflation of credit and prices occurred in the United States. The post-war attempt to curtail such inflation was not begun at a sufficiently early date, but was steadily working during 1921.

AUTHORITIES.—Reports of Secretary of the Treasury and of the Federal Reserve Board, 1914–20 inclusive; Federal Reserve Bulletins, 1915–20 inclusive. (H. P. W.)

FEDERAL TRADE COMMISSION.—This American Commission was created by Act of the U.S. Congress, approved Sept. 26 1914, for the prevention of unfair methods of competition in commerce. It is composed of five members appointed by the President, and confirmed by the Senate: not more than three members may be of the same political party. The Commission elects its own chairman. It entered upon its official duties March 16 1915. With it was merged the Bureau of Corporations, previously under the jurisdiction of the Department of Commerce.

If the Commission has reasons to believe that a "person, partnership or corporation" practises any unfair method to the prejudice of the public interest, it shall serve a notice upon such party, submit a statement of the charges, and set a date for a hearing. The party complained of has the right to appear and show cause why the Commission should not require the cessation of practices alleged to be in violation of the law. If the party refuses to obey the orders of the Commission, the Commission may apply to the U.S. Circuit Court of Appeals. Banks and common carriers are excepted, they being under other Federal supervision. The Commission is empowered to investigate from time to time "the organization, business, conduct, practices, and management" of any commercial corporation and its relation to any other corporation, and to make recommendations for a readjustment of its business alleged to be violating the anti-trust laws, including those relating to price discriminations, intercorporate stock-holdings, and interlocking directorates. The purpose of the Commission is to advise and regulate rather than to punish. It is also empowered to investigate trade conditions of foreign countries as affecting the foreign commerce of the United States, and to report to Congress with recommendations. The Commission comprises three departments: administrative; economic, in charge of investigations; and legal, for enforcing its findings.

FEJERVARY, GEZA, FREIHERR VON (1833–1914), Hungarian statesman and general, was born March 15 1833. He began his career in the army, and as a captain he won in 1859, for a heroic action on the hotly contested heights of San Martino in front of Solferino, the highest military decoration of the former monarchy, the cross of Maria Theresa. In 1872 he became State Secretary in the Hungarian Ministry of National Defence (Honved) and Minister of National Defence in 1884. In 1895 he persuaded the Emperor Francis Joseph to agree to the religious and political reforms of the Wekerle Ministry. In 1903 he resigned, together with the prime minister, Szell, owing to the rejection of a bill to increase the contingent of recruits, and was appointed captain of the Hungarian Life-Guards organized at that time. He was appointed premier June 18 1905. The parliamentary majority declared that the Fejervary Ministry was unconstitutional, and organized a national opposition against it. Fejervary nevertheless succeeded in settling these differences by the so-called Pactum, on the basis of which the Wekerle Ministry was formed April 8 1906. From this time onwards Fejervary's political activity ceased and he resumed his military career. On the death of Prince Esterházy, captain of the Hungarian Body-guard, Fejervary was appointed his successor. He died of cancer of the tongue April 25 1914. (E. v. W.)

FÉLIX, LIA (1830–1908), French actress (*see* 10.239). Her appearance in Sardou's *La Haine* in 1874 marked the end of her theatrical career. Inferior in talent to Rachel, she possessed a beauty which her more famous sister had not. She died in Paris on Jan. 15 1908.

FENWICK, ETHEL GORDON [MRS. BEDFORD FENWICK] (1857–), British nurse, was born at Spynie House, Morayshire, Jan. 26 1857. She was educated privately, and in 1878 entered the Children's hospital at Nottingham to be trained as a nurse. After a short time at the Royal Infirmary, Manchester, she became a sister at the London hospital (1878–81), and in 1881 was appointed matron of St. Bartholomew's hospital. In 1887 she married Dr. Bedford Fenwick (b. 1855), the well-known gynaecologist, and henceforth devoted herself largely to the work of reorganizing and raising the status of the nursing profession. From 1889 to 1896 she was managing directress of the Gordon House Home hospital, and in 1887 founded the British

Nurses' Association, of which she was the first member. Mrs. Bedford Fenwick has been a member of many medical and nursing congresses and has also contributed many papers to medical journals. She became in 1893 editor of the *British Journal of Nursing*, and was a prominent member of the Society of Women Journalists.

FERDINAND (1861–), ex-King of Bulgaria (*see* 10.269), played a leading part in the negotiations which led to the Balkan Alliance and the Balkan War of 1912. It was generally believed in Bulgaria that the costly prolongation of the war in Thrace was attributable to his ambition to capture Constantinople, and that it was he who, as commander-in-chief, gave Savov the order to attack the Serbs on June 29 1913. Thus the responsibility for the disastrous second Balkan War rested with him. There is no doubt that it was Ferdinand's policy, carried out by a subservient and discredited set of ministers, which brought Bulgaria into the World War on the side of the Central Powers. He abdicated in favour of his son Boris on Oct. 4 1918 and retired to Coburg. Queen Eleanor died at Euxinograd Sept. 12 1917 (*see* BULGARIA: *History*).

FERRIER, PAUL (1843–1920), French dramatist (*see* 10.288), died at Nouan-le-Fuzelier Sept. 11 1920.

FIBRES (*see* 10.309).—Science and technical industry during the World War were necessarily impressed into war service. "Fibres," animal and vegetable, had an obvious prominence in the actual *matériel* of warfare, and their most ordinary applications assumed intensified importance. An interesting point arose in Germany and among her allies in the emergency adaptations which were devised under the stress of short supplies of staple raw materials. These restricted supplies directly influenced the production of military explosives; cotton cellulose was supplemented or replaced by wood cellulose for producing nitro-cellulose propellant explosives. The wood cellulose to be used for this purpose was prepared from the "bisulphite" pulps of the paper industry, by hydrolytic treatments under which these crude "celluloses" were purified by the removal of 10 to 15% of their weight of the less stable celluloses. The final product was characterized by a much-increased proportion of α-cellulose (Cross and Bevan), and by structural changes of the fibre; effects which may be comprehensively described as "cottonizing." This modified cellulose has been established in Germany as "Supersulfit," and for paper-making uses it has increased the range of application of wood cellulose in substituting rag celluloses. Restricted supplies of cotton, as of flax or hemp and jute, also affected the textile industries of these countries, and forced the production of twisted paper yarns to an industry of large dimensions, the estimated output in the concluding year of the war being 200,000 tons. The applications of these yarns covered a wide range of textile effects, some of which are permanently adopted. But in the main such products are substitutes, with the fundamental defect of the short fibre-length (2–3 mm.) which characterizes the better-prepared pulps of the papermaker.

These developments in any case are a permanent contribution to fibre technology, and have reopened a number of problems in the borderland region between the textile and paper-making industries, which have the common objective of producing a structure in continuous length from discontinuous elements, with the fundamental distinction of dry and wet methods. It is evident that if the control of longer fibres (*e.g.* 7–15 mm.) on the Fourdrinier machine can be realized, there would result an interesting extension of this competition of methods, in which a decisive factor would be the relative cost of production.

Another raw material to claim attention especially under the stress of war conditions was the fibre of the common nettle. The textile potentialities of the *Urticaceae* have long been recognized and the most conspicuous members of the order, which furnish the Ramie or Rhea fibre, are the basis of established industry. With their characteristics of great length of (bast) fibre they have the defects of extreme variability of dimensions, and require preparation by chemical methods of separation; from the plant, moreover, the yields of fibre on the crop-weight are low. Notwithstanding these defects, which are exaggerated in the case of the nettle, the industrial utilization of the plant has been seriously prosecuted in Austria and Germany, and it appears that, under the condition of an integral working-up of the crop material to salable products, there is a prospect of commercial development. Such treatment of the non-fibrous cellular debris of this crop-plant, as of others, after separation of the primary product—in this case the fibre—is indicated in recent developments of fermentation processes.

Still dealing with the emergency problems of the war period, the revival of the long-known effects of treating jute fibre with caustic soda (mercerizing) is noted. These effects are expressed in the descriptive term "woollenizing": the fibre is so modified as to present many points of resemblance to wool. It yields to the "carding" process, and mixes well with wools: mixtures containing up to 60% of the vegetable fibre can be worked up through the sliver and roving stages and finally spun to useful yarns. These were worked on an increasing scale in the Central European countries during the war period.

As a result of the shortage of the staple paper-making raw materials, the European industry was served in part by miscellaneous supplies of material. In England the reeds of the East Anglian rivers and other districts were brought into requisition, and experimental quantities of numerous fibrous materials were worked up into paper and boards.

The restriction in supplies of food-stuffs in Germany and Austria-Hungary brought forth a crop of substitutes (*Ersatzstoffe*). In the agricultural section attention was directed to the food value of the fibrous components of vegetable material—celluloses and ligno-celluloses—generally classed as indigestible, and cattle foods were adopted containing considerable proportions of these more resistant elements of plant structures.

The literature on this subject has more than the passing interest of the episode, and attention may be directed to the following:—"Digestibility of Birch Wood," Rubner, *Chem. Ztg.* 1915, 39, 86; "Wood Cellulose as Fodder," Schwalbe, *Z. Angew. Chem.* 1918, 31, 347, and Scurti and Morbelli, *Chem. Zentr.* 1919, 90, 1112, and on "Cereal Straws after various Chemical Treatments," Godden, *Jour. Agr. Soc.* 1920, 10, 437; Fingerling, *Z. Angew. Chem.* 1918, 31, 347; Pringsheim, *ibid.* 1919, 32, 249.

These researches are obviously related to the more specific investigations of the destructive resolution of the celluloses, fibrous and cellular, to ultimate products of low molecular weight. The developments of Power Spirits Ltd. and H. Langwell have established intensive bacterial fermentations even of the resistant cellulose which have the external characteristics of the familiar operations of the brewer and distiller in the production of alcohol. Langwell's investigations have therefore brought these transformations within such control as to become industrial operations, and as the main products are alcohol and acetic acid there is the obvious economic basis for commercial development.

It is clear that such developments are only indirectly involved in the subject-matter of this article, since the fibrous celluloses and ligno-celluloses subserve as such their special adaptations to human requirements. It is possible to apply such processes to the utilization of the non-fibrous rejecta of such crop plants as flax, hemp, sisal, manila and phormium, to the production, *e.g.* of acetic acid, which would make for the economic working-up of material, and the covering of costs of production of the staple fibres yielded by these plants.

The direct contributions of these investigations to organic science are obvious and far-reaching: they extend and define certain constitutional relationships of the celluloses, as chemical individuals, of first importance; and elucidate many aspects of the plant world in its primary functions as well as its correlations of interdependence with the animal world.

The influence of war conditions likewise brought about the extension of the applications of the Kapok "fibre" (seed hair) in the composition of marine life-saving appliances. These depend primarily on the low density of a mass of this fibre, even when much compressed, as in the stuffing or filling of the familiar life-saving jackets which now replace the cork-lined appliances of the 19th century. The flotation powers of an enclosed mass of Kapok is measured in terms of the volume of unit weight (1 gramme) when forced by hand compression into a regular cylinder. This volume is 10–12 cub. cm., and is a multiple of the volume of an equal weight of cork substance of highest quality. The fibre has the further advantage of being compressible in mass whereas cork is relatively rigid. A jacket can therefore be constructed and filled with the fibre in such a way as to carry out the ideal distribution of floating effect so as to prevent submergence of the mouth of the wearer. The properties of the fibre causing this are in the main structural. The fibre canal holds a relatively large volume of air: the smooth contour of the fibre and the resilience of the air-filled tube give a large interstitial (air) volume of the mass even under considerable compression.

In a general survey of the fibre industries there is no disturbance of their fundamental perspectives nor any radical changes in their many-sided technology to record during 1910–21. The developments of the artificial (celluloses) fibres was rather impeded under the stress of war conditions, though without prejudice to the financial prosperity of the leading manufacturing corporations. There is a new manufacture of an artificial silk from the cellulose acetate of the British Cellulose Co. (Dreyfus processes). This product, as a cellulose ester, has certain properties—*e.g.* lower specific gravity, with a water-resistant quality—which are points of superiority in relation to the cellulose "artificials." On the other hand, it is of lower tensile strength, of inferior dyeing capacity, and its cost of production is higher. Its production therefore is limited in scale.

In raw fibrous materials for the paper-making industry, there have been developments in the production of cotton-seed lint, and the preparation of pulp from the bamboo, and of a concentrated fibre (quarter-stuff) from the papyrus (*Cyperus*). (See E. de Segundo, "Residual Fibres from Cotton Seed," *Jour. R. Soc. Arts*, Feb. 1919; C. F. Cross, "Cellulose Industries," *ibid.* 1920 [Cantor Lectures]; W. Raitt, "Paper Supplies from India," *ibid.* May 1921.)

Note should be made of an investigation by W. L. Balls of the ultimate structure of the cotton fibre. By a chemical reaction which induces a controlled distention (by hydration) of the cell wall, without structural distention, the dimensions of the structure are exaggerated to a large multiple which brings into evidence a series of concentric rings which are the daily growth rings of the hair or fibre (*Proc. R. S.*, B., vol. xc. 1919). (C. F. C.)

FILON, (PIERRE MARIE) AUGUSTIN (1841–1916), French man of letters (*see* 10.345), died at Croydon May 13 1916. In 1910 he published a short biography of *Marie Stuart*, and in 1911 *L'Angleterre d'Edouard VII.* and a dramatic poem *Shakespeare amoureux.* His *Souvenirs et documents*, relating to his former pupil, the Prince Impérial, appeared in 1914.

FILTER-PASSING GERMS.—The discovery by Pasteur of the significance of microbic life in the phenomena of fermentation, putrefaction and disease and the development by Koch of an appropriate technique for the new science of bacteriology had already led in a comparatively few years to the determination of the causation of many infectious diseases of man and animals. There remained, however, a number of diseases of man and animals—and amongst these some common maladies such as typhus, measles, smallpox, foot and mouth disease, swine fever, rabies and cattle plague—in which the cause had not been discoverable by the methods of microscopical examination and cultivation which proved successful in so many cases. It was suggested by Pasteur, who searched in vain for the infective agent of rabies, that some microbes were too small to be visible with the optical apparatus at disposal. There is no reason *a priori* to suppose that the lower limit of size of microbic organisms should be of a dimension at present discernible, and the question raised by Pasteur was answered ten years later by the discovery made by Loeffler in 1898 that the virus of foot and mouth disease was invisible. The limit of visibility of a particle is in the last instance conditioned by the wave length of light. With the best modern microscopes employing white light of which the average wave length is 0·55μ ($\mu = \frac{1}{1000}$ mm.) this limit is rather less than 0·2μ. If ultra-violet light of half this wave length is used, photographs of objects of about 0·1μ in diameter can be made. The existence of particles of much smaller size can be demonstrated by the method of dark-ground illumination (Tyndall phenomenon), when they appear as bright points. The limit appears to depend upon the intensity of illumination and with direct sunlight is 0·004μ.

Invisibility of a microbe commonly handicaps every effort at its isolation, propagation and identification, but does not render them impossible of achievement, for the existence of a living virus in an optically clear liquid may still be demonstrated by its power to infect an animal or plant, or produce recognizable chemical changes in a medium. The existence of these ultra-microscopic viruses was brought to light unexpectedly through the instrumentality of so-called "bacterial filters." These are constructed of fine-grained unglazed porcelain, clay or infusorial earth. They are commonly moulded in the shape of hollow candles and fired at a high temperature. Liquid is made to pass through the walls of the filters, which vary from a quarter to half an inch in thickness, by hydrostatic pressure or by suction with some form of exhaust pump. Use of such filters to separate bacteria from the products of their activity was first made in 1871. Since that time they have become a usual part of the equipment of a bacteriological laboratory and have been extensively employed to free water from microbes for domestic use. In structure the wall of a filter resembles a bed of sand on a diminutive scale, with crevices of variable size between the particles and a good many splits and holes of larger dimensions throughout the matrix. The different types of filter vary in their permeability according to the fineness of the pores and thickness of the wall. The smallest passages are of the order of 0·2 to 0·5 in the case of the porcelain filters and 0·2 to 0·8 in those made of infusorial earth. The size of the smaller pores is of the same order of magnitude as that of the smallest bacteria, and the power of a filter to hold back these microbes depends upon the walls being of sufficient thickness to ensure that a bacterium will become impacted in one of the smaller passages through which the liquid in which it is suspended has to pass. If a filter through which a liquid containing bacteria in suspension has been filtered be allowed to remain for a few days immersed in a nutrient fluid, the bacteria caught in the interstices divide and multiply and generally manage to grow through the walls of the filter, for, during growth, the cells can adapt themselves to the size and shape of the crevices. On this account filters cannot be relied upon to render drinking-water secure unless removed and sterilized by heat at least every second day. The similarity in magnitude of filter-pore and bacterium is not a coincidence, but due to selection of material for the manufacture of the filters of such size of grain as to afford a bacteria-free filtrate and at the same time the maximal flow of liquid. In other words, bacterial filters have been made to fit the known microbes.

The first discovery of an ultra-microscopic or filterable virus was made by Loeffler in 1898 in the course of some experiments upon foot and mouth disease in which a filter of infusorial earth was being used to remove ordinary recognizable bacteria from the diluted contents of the superficial vesicles which are characteristic of this disease. The filtrate was free from any particles visible by the microscope and no bacteria developed in it on cultivation. Nevertheless, injection of this filtrate into animals caused the disease. Material removed from the vesicles of the animal so infected and filtered again reproduced the disease in a fresh animal. Similar experiments were carried out through a number of generations of experimental animals, so that there was no doubt that a virus capable of propagation was contained in the filtrates. In the next few years the filterability of the virus was established in the case of infectious pleuro-pneumonia of cattle, South African horse-sickness, fowl plague and mosaic disease of the tobacco plant, in which patches of discoloration occur in the leaves and, spreading rapidly, destroy them. With the exception of the virus of pleuro-pneumonia, which is just on the margin of visibility, all are invisible.

The first virus of a human disease which was found to be small enough to pass a bacterial filter was that of yellow fever. The observation was made by the American commission to study yellow fever in Havana in 1901. The cause of yellow fever has recently been shown to be an organism which, owing to its thinness and motility, can pass through a bacterial filter.

Up to the year 1921 the virus of 38 diseases of man, animals or plants had been found to pass through a bacterial filter by some reliable observer. The more important of these are the following: foot and mouth disease, contagious bovine pleuro-pneumonia, mosaic or spotted disease of the tobacco plant, African horse-sickness, fowl plague, yellow fever, cattle plague, sheep-pox, *epithelioma contagiosum* of birds, swine fever, rabies, cow-pox (vaccinia), *molluscum contagiosum* of man, equine infectious pernicious anaemia, canine distemper, "blue tongue" of sheep, dengue fever, papataci or sand-fly fever, smallpox, trachoma, poliomyelitis, scarlatina, measles, typhus fever, and trench fever. There are many observations indicating that the primary cause of pandemic influenza may be a filterable virus.

Two filterable viruses fall into a class apart. They are distinguished from the others in that they do not seem to produce disease directly by their poisonous activities but rather to stimulate certain cells of the body in the neighbourhood of their inoculation to excessive and anarchical development. The injection of these viruses into certain varieties of fowls leads to sarcomatous new-growths of great malignity. In the one case it is a pure sarcoma, in the other a mixed tumour, an osteo-chondro sarcoma. These malignant tumours spread not only by proliferation at the point of origin but some of the cells of which they are composed, boring their way into blood vessels and lymphatics, are carried all over the body, giving rise to similar tumours in internal organs. The metastases as well as the primary tumours contain the virus, and if extracted with water and filtered through a bacterial filter, whereby all the cells of which the tumour is composed are held back, the filtrate may be dried and powdered and the powder retains its original property of exciting the formation of these malignant tumours in suitable animals into which it is injected. The experiment may be repeated indefinitely through generations of young chicks, showing that the virus propagates itself and appears to live in some sort of symbiotic manner with the particular cells it excites to inordinate development.

It frequently happens that one observer succeeds in passing a particular virus through a filter, whilst another fails. When the particles of a virus are of the same order of magnitude as the crevices of the filter this may well happen, as in any case the majority will be retained in the wall of the filter. Even when the size of the particles of virus are much less than that of the smaller pores, they are liable to be deposited upon the walls of the minute passages under the influence of surface action and the filtrate becomes thereby greatly reduced in concentration.

In addition to size, shape, and rigidity of particles, the conditions under which filtration is carried out, pressure, temperature and amount of liquid passed through the filter, exert an influence. With high pressure some may be forced through which would otherwise be obstructed. This is particularly the case when the particles are of unequal dimensions in two planes. The nature and reaction of the liquid in which the virus is suspended is also of importance. If suspended in a colloidal solution such as blood serum or a slimy emulsion of nerve tissue, high dilution is necessary for the colloidal particles of the solution or emulsion are themselves deposited on the walls of the pores and rapidly reduce the permeability of the filter. Reaction plays a part by modifying the electric charge on the particles and thereby facilitating or hindering their aggregation and deposition on the surface of the filter pores which is also charged.

The fact that a virus, under certain circumstances, traverses a bacterial filter, does not tell us any more as to its nature than that it is very small, or at least very thin, and of the order of 0·1 to 0·2 μ or less in its smallest diameter. It is not necessary to assume a *contagium fluidum* in the case of those viruses which are outside the range of visibility under the best optical arrangements at present available. The particulate nature of the infective agent of rabies, fowl plague, variola and vaccinia, is indicated by the fact that the upper layer of a liquid containing them may be deprived of infectivity by prolonged subjection to a powerful centrifugal force.

Little is known about most of these filterable viruses. They appear to be of various natures, and the only property common to them is minuteness. The parasite responsible for yellow fever is a small spirochaete, those occasioning bovine pleuro-pneumonia and human poliomyelitis are just on the margin of visibility and have been cultivated in artificial media. Some of them occur in the blood of the patient during the acute stage of the illness and are transported to a fresh host by the bite of blood-sucking insects. The infections of yellow fever and dengue are conveyed by the mosquito (*Stegomyia fasciata*). That of papataci fever is transmitted by the sandfly (*Phlebotomus papatasii*), and that of typhus and trench fevers by lice. In each case some days elapse before the insect is capable of handing on the infection, indicating that an interval for the multiplication of the parasite is necessary. It is possible that a stage in the life-history of the parasite can only occur in the body of the insect host. Some filterable viruses, such as smallpox, cowpox, foot-and-mouth disease, and *molluscum contagiosum* give rise to superficial lesions, and are spread by contact; others occasion catarrh of the respiratory passages and are distributed by coughing and intimate contact, as in distemper, measles, scarlet fever and pleuro-pneumonia. In many cases the precise method of infection had still been undetermined in 1921. (C. J. M.*)

FINANCE (*see* 10.34).—The continuous developments of national finance in the different countries of the world during 1910–21 are dealt with in articles under separate headings, where the relevant statistics in each case will be found (*see* ENGLISH FINANCE, and the sections on "finance" in the articles under country-headings, *e.g.* UNITED STATES, FRANCE, GERMANY, etc.). Under other headings also the mechanism of finance and the chief subjects of general financial-economic interest are further discussed, historically and statistically, on their own account. Thus the new developments of special moment arising in connexion with the market for securities are discussed under STOCK EXCHANGE, those affecting the money-market under MONEY-MARKET, questions of foreign exchange under EXCHANGES, FOREIGN, banking under BANKING (together with the article on the new FEDERAL RESERVE BANKING SYSTEM in the United States), and insurance in its various forms under INSURANCE. Similarly, reference may be made to the articles NATIONAL DEBT, GOLD, SILVER, WAR LOAN PUBLICITY CAMPAIGNS (British), LIBERTY LOAN PUBLICITY CAMPAIGNS (American), DOLLAR SECURITIES MOBILIZATION (as part of British Government finance during the war), SAVINGS MOVEMENT, INFLATION, PROFITEERING, INCOME-TAX, EXCESS PROFITS DUTY, COST OF LIVING, WAGES, PRICES, FOOD SUPPLY, RATIONING, CAPITALISM, COMMUNISM, MARKETING, etc., for particular questions which have either loomed larger, or emerged as practically new problems, in the financial and commercial world. Incidentally, the financial effects of the World War form an integral part of the history of every form of human activity during the period, and therefore receive appropriate consideration under numerous other headings where the subject-matter belongs to the sphere of business and economics.

It only remains here to gather up the threads of the general world-situation in finance, as it stood towards the close of 1921.

The end of the war had left the whole financial world in 1919 in a state of chaos.[1] Its conditions were comprehensively reviewed in 1920 at the International Financial Conference which, as arranged by the League of Nations in Feb., met at Brussels from Sept. 24 to Oct. 8. There were 86 representatives of

TABLE I.—*National Wealth, and Budget Revenue and Expenditure (in dollars) 1913–1920.*[2]

Country	Pre-war Income per head.	Pre-war Government Revenue per head (gross).	Percentage (*c*) is of (*b*).	Estimated present national income per head, 1920.	Government Revenue per head (gross), 1920.	Percentage (*f*) is of (*e*).	Government expenditure (net) per head, 1920.	Percentage (*h*) is of (*e*).
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)	(*h*)	(*i*)
U.S.A.	364	7·5	*2*	730	70	*10*	70	*10*
Australia	258	17	*7*	342	28	*8*	63	*18*
United Kingdom	243	19	*8*	416	100	*24*	100	*24*
France	185	22	*12*	239	34	*14*	84	*25*
Canada	180	17	*9*	335	33	*10*	75	*31*
Germany[3]	149	8	*5*	72	11	*15*	25	*35*
Italy	110	14	*13*	88	12	*14*	25	*28*
Japan	30	6·5	*22*	76	8	*11*	10	*13*

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[1] Nothing is said here of Russia, which, economically and financially, was in collapse, with its internal and external trade-relations completely paralyzed (*see* RUSSIA). It may be mentioned that, in 1921, a somewhat farcical turn was given to the hopeless depreciation of the ruble by an official exchange-rate of 133,000 rubles to the £ being "fixed" by the Soviet government. Any other huge figure would have done as well! The progress of ruble inflation is shown by the following figures for the total issues in circulation (in million rubles):—Aug. 1914, 1,700; Jan. 1915, 3,215; Jan. 1916, 5,737; Jan. 1917, 9,225; Nov. 1917 (Kerensky), 18,917; Jan. 1919 (Bolshevist), 61,265; Jan. 1920, 225,216; Jan. 1921, 1,168,598; Jan. 1922 (est.), 2,000,000.

[2] Pre-war figures in dollars at par of exchange: post-war at exchange of Sept. 30 1920. [3] Reparations liability excluded.

39 countries at the conference—Argentina, Armenia, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, China, Czechoslovakia, Denmark, Esthonia, Finland, France, Germany, Greece, Guatemala, Holland, Hungary, India, Italy, Japan, Latvia, Lithuania, Luxemburg, New Zealand, Norway, Peru, Poland, Portugal, Rumania, the Serb-Croat-Slovene State (Yugoslavia), South Africa, Spain, Sweden, Switzerland, United Kingdom, United States, and Uruguay.

TABLE II.—*National Taxation per head in 1920, in dollars.*

State	Taxation per head in $ at par of exchange.		Taxation per head in $ at exchange rates on Sept. 30 1920.	
	Direct	Indirect and Taxes on Transactions.	Direct	Indirect and Taxes on Transactions.
Belgium	19·7	14·1	7·1	5·1
France	32·2	40·2	11·1	13·8
Italy	12·9	27·6	2·8	5·9
Portugal	4·4	8·4	0·7	1·2
United Kingdom	68·6	38·9	48·9	27·7
Australia	15·1	16·5	10·8	11·8
British India	0·19	0·63	0·01	0·41
New Zealand	45·8	26·8	32·8	19·2
South Africa	6·3	5·8	4·5	4·2
Holland	16·2	10·5	12·6	8·2
Spain	6·6	5·2	5·0	4·0
Switzerland	4·6	4·2	3·8	3·5
Sweden	13·9	9·7	10·3	7·2
Norway	36·8	11·5	19·9	6·2
Denmark	27·8	19·6	14·9	10·5
Finland	19·4	27·4	3·1	4·4
Greece	3·1	7·4	1·6	4·0
U.S.A.	37·0	16·8	37·0	16·8
Japan	2·9	2·5	3·0	2·6

In the Final Report of the Conference (as adopted on Oct. 8), it was pointed out that the effects of the World War had varied immensely according as the various nations had been involved in it. Among the European belligerents, Belgium, Bulgaria, France, Germany, Great Britain, Greece, Italy and Portugal, had become burdened with an enormous volume of debt, internal and external. Their internal debt (converted into American dollars at par) had reached about 155 milliards (thousands of millions of dollars) as compared with about 17 milliards in 1913; and their new external debt was about 13 milliards. Their expenditures had increased by amounts varying between 500 and 1,500 per cent, reaching between 20 and 40 per cent of their national incomes, the highest percentage being shown by France. In spite of attempts to restore their financial equilibrium, in some instances by the imposition of additional taxation, they still showed (with the exception of Great Britain) a large gap between income and expenditure.

TABLE III.—*The Burden of Debt, 1913–20, in dollars.*

Country	Average pre-war income per head.[1]	Pre-war gross debt per head.[1]	Percentage of (*c*) to (*b*).	Estimated average income per head, 1920.[2]	Gross debt per head, 1920.[2]	Percentage (*f*) is of (*e*).
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)
U.S.A.	364	12	*3*	730	223	*31*
Australia	258	10	*4*	342	217	*63*
United Kingdom	243	75	*31*	416	582	*140*
France	185	164	*89*	239	379	*158*
Canada	180	68	*38*	335	313	*93*
Germany	149	18	*12*	72	52[3]	*72*[3]
Italy	110	82	*74*	88	102	*116*
Japan	30	26	*85*	76	31	*41*

[1] At par of exchange. [2] At exchange on Sept. 30 1920. [3] Reparations liability excluded.

They had lost a large proportion of their pre-war gold-holdings and had enormously increased their paper currencies. A number of new states had been created as the result of the war, while some previously existing states had had their territories profoundly modified. These included Armenia, Austria, Czechoslovakia, Esthonia, Finland, Germany, Hungary, Latvia, Lithuania, Poland, Rumania, Serbia and Turkey. In most of them the machinery of an orderly financial system was not yet in operation in 1920.

TABLE IV.—*Gold Movements, 1913–1919: In Dollars at par of Exchange (000,000's omitted).*

Country	Gold in Banks and in Circulation 1913.	Gold in Banks 1919.
(1) EUROPEAN—		
Belgium	68	51·3
France	1,192	1,078
Italy	289	204
Portugal	16·5	10·6
United Kingdom	764	574
Holland	71·7	256
Spain	92·4[1]	471
Switzerland	44	100
Sweden	30·8	75·6
Norway	17·9	39·2
Denmark	19·6	60·8
Finland	10·6	8·2
Greece	8	10·7
Rumania	31·8	1·3
Germany	836·7	261·4
Austria-Hungary	295	46·7
Bulgaria	10·8[1]	7·1
Total	3,798·8	3,255·9
(2) OTHER COUNTRIES—		
Australia	206	211
Canada	144[1]	185
New Zealand	33·5	33·1
South Africa	36[1]	33·6
U.S.A.	2,930	4,183[2]
Argentina	245	465
Japan	206	1,029[2]
Total	3,800·5	6,139·7
Grand Total of European and Other Countries	7,599·3	9,395·6

[1] Gold in banks only. [2] Includes gold in circulation.

In the neutral European countries, including Denmark, Holland, Luxemburg, Norway, Spain, Sweden and Switzerland, financial difficulties were also serious. Heavy expenditure had been incurred owing to the war, and they had had largely to increase their internal debts. This increase in expenditure was mainly due to rise of prices. In some cases it had been met by increased taxation, but Holland, Switzerland and Spain showed considerable budget deficits. During the war their trade balances had been made artificially favourable, owing to demand by the belligerents for their products, and the stoppage of imports; and the resulting accumulation of gold in their banks had led to expansion of currency and a further rise in prices. After the war they had to import goods to replenish stocks, and, owing to the premium on their exchanges as compared with the depreciated currencies of the belligerents, it was difficult to maintain their export trade; thus what would otherwise have seemed favourable factors had become an embarrassment.

It was the countries outside Europe that were most favourably situated economically. Some of them had been able to pay off a large part of their external debts and had even made loans to former creditors. This was particularly the case with the United States of America. But there, too, the accumulations of gold had helped the rise in prices, and the appreciation of exchange rendered more difficult a maintenance of exports, for which the restoration of purchasing power among their European customers was necessary.

In every country of the world, the purchasing power of the national currency had diminished; and the cost of living, as expressed in terms of that currency, had increased. With few exceptions, neutrals as well as belligerents (the United States standing alone in this respect) had ceased to be on a gold basis, and in any case the value of gold itself in terms of commodities had diminished to about one-half. International trade had been dislocated, and diverted from its normal channels. The inability of Europe to export during the war had forced normal customers to look elsewhere, and to develop production at home or in new centres overseas; and Europe's need for imports had compelled realization of her foreign capital holdings, which were thus no longer available as a credit basis. Instability and depreciation of exchange impeded both buyer and seller. With half the world producing less than it consumed and having insufficient exports to pay for its imports, credits alone could bridge the gulf between seller and buyer, and credits were rendered difficult by the very causes which made them necessary.

TABLE V.—*Notes in Circulation (000,000's omitted), 1913 and 1919.*

Country	Notes in Circulation.	
	1913	1919
Belligerent Countries of Europe.		
Belgium (Franc)	1,067	4,786
Bulgaria (Leva)	189	2,299
France (Franc)	5,713	37,327
Germany (Mark)	2,562	62,036
Greece (Drachma)	311	1,412
Italy (Lira)	2,783	18,814
Portugal (Milreis)	91	382
United Kingdom (£)	35	449
Austria-Hungary (Krone)	2,494	54,481
Finland (F. Mark)	113	1,124
Rumania (Leu)	571	6,603[1]
Neutral Countries of Europe.		
Denmark (Krone)	151	489
Holland (Gulden)	317	1,099
Luxemburg (Franc)	6·2	224
Norway (Krone)	108	454
Spain (Peseta)	1,924	3,856
Sweden (Krone)	234	748
Switzerland (Franc)	318	1,061
Countries Outside Europe.		
Argentina (Peso)	777	1,278
Australia (£)	9·9	56·8
Brazil (Milreis)	899	1,748
British India (Rupee)	645	1,829
Canada ($)	211	440[2]
Japan (Yen)	426	1,336[3]
New Zealand (£)	1·7	7·8
South Africa (£)	2·4	9·0[2]
United States of America ($)	1,069	4,212
Uruguay (Peso)	21·5	69·3

[1] Includes notes of National Bank of Rumania and notes issued during the German occupation; excludes kronen, ruble notes, etc. [2] March 1920. [3] February 1920.

Such being described as the position in 1920, the Conference came to its recommendations. And the Report premised that, first and foremost, what the world still needed was peace. "Finance" was, after all, only a reflection of commercial and economic life; as the wealth of the world consists of the products of man's work, the sum total of human prosperity could only be increased by an increase of Production; and all that organized international action could provide would be conditions favourable to Production, the most important of which lay outside the financial sphere. Social content, and the "will to work," must first be restored. Yet, even if a maximum Production were to be attained, it still required a financial system which would facilitate exchange and distribution, and herein lay the problems which the Conference had met to consider. The financial statements presented by the various countries showed that, on the average, about 20 per cent of national expenditures was still being devoted to armaments, and the Conference affirmed that "the world cannot afford this expenditure." There must be an agreement to reduce it. In nearly three out of four of the countries represented, and in nearly 11 out of 12 of European countries, budgets in 1919–20 did not balance, and many of them showed no prospect of doing so in the near future. Where national expenditure was higher than existing revenue, fresh taxation must be imposed. Government subsidies, concealing the real cost price of commodities, must be abandoned. Loans required for urgent capital purposes must be raised out of the real savings of the people; and since these savings had so largely been pledged ahead for past war-credits, the first step must be to fund undigested floating debts. Currency inflation (which had substantially represented undertaxation or the existence of an unscientific system of taxation) must be stopped, and it was desirable to take any possible steps towards the restoration of an effective gold standard; but deflation must be carried out gradually and with great caution, and the Conference regarded it as useless to attempt to fix the ratio of existing fiduciary currencies to their normal gold value, nor would it recommend any scheme of "stabilization" for the value of gold, believing that neither an international currency nor an international unit of account would serve any useful purpose. Attempts to limit fluctuations in exchange by artificial control on exchange operations were futile and mischievous; but in countries where there was no central bank of issue one should be established, and if the assistance of foreign capital were required for its promotion some form of international control might be necessary.

TABLE VI.—*Comparison of Foreign Trade in 1913 and 1919 (value in dollars).*

Countries	Imports			Exports		
	Value			Value		
	1913 $(000,000's)	1919	1919 as % of 1913	1913 $(000,000's)	1919	1919 as % of 1913
EUROPEAN—						
United Kingdom	3,206	6,401	200	2,554	3,454	135
Germany	2,567	1,487	58	2,407	392	16
France	1,625	4,044	249	1,328	1,114	84
Belgium	895	665	74	701	271	38
Italy	704	1,835	261	485	539	111
Switzerland	370	660	178	265	612	231
Spain	252	176	70	204	257	126
Sweden	227	612	269	219	379	173
Denmark	206	528	256	171	163	95
Portugal	96	114	120	38	57	150
Finland	96	164	171	78	44	56
Bulgaria	36	55	153	18	33	183
Greece	34	293	862	23	136	590
EXTRA-EUROPEAN—						
U.S.A.	1,757	3,733	212	2,448	7,751	317
India	733	935	127	809	1,237	153
Canada	659	906	137	436	1,195	274
Argentina	479	601	125	501	948	189
China	416	900	216	294	878	298
Australia	380	364	96	365	576	158
Japan	362	1,120	310	313	1,072	343
Brazil	326	357	109	318	584	183
South Africa	195	205	105	132	209	158
New Zealand	104	130	125	102	229	224
Peru	30	53	177	44	117	267

The Conference recognized that time would be needed for financial reconstruction, and some countries could not resume economic activity without foreign assistance; but a warning was given generally that external credits should not be accorded directly by foreign Governments. It was suggested that an international organization should be formed for arranging credits for states which needed the means of paying for essential imports, and such states would have to notify what assets they were prepared to pledge as security; bonds issued against such a state guarantee might be used as collateral for credits intended to cover the cost of commodities (the Ter Meulen plan: *see* EXCHANGES, FOREIGN). Meanwhile, international commerce should, as soon as possible, be freed from artificial impediments.

Finally, the Conference drew the attention of the League of Nations to the advisability of providing various miscellaneous reforms,—unification of laws relating to bills of exchange and bills of lading, reciprocal treatment of branches of foreign banks in different countries, publication of financial information in a clear comparative form, an international clearing-house, and other such matters; and an international understanding was also advocated under which, while effective systems of taxation should be adopted in each country so as to ensure full contribution from individuals according to their capacity to pay, there should be avoided any such incidence of "double" taxation which would form an obstacle, as it was still doing, to the investment of capital abroad.

Among the documents presented to the Conference (and published with the Report) there was included a large amount of material of permanent value to the financial historian, the nature of which can only be indicated here—statements of the existing financial position in each country, together with analyses of international trade movements, gold holdings and currency expansion, and papers by financial experts on the main outstanding problems. Taken as a whole, these documents provided a full comparative account of the changes in the international financial position between 1913 and 1920.

In the separate articles on national finance in this Encyclopaedia, under the headings for each country, its history during the extended period of 1910–21 is sufficiently narrated to make it unnecessary here, however, to refer to anything but general and comparative international considerations; and for the purpose of showing the salient changes between the pre-war and post-war positions the most instructive figures presented to the Brussels Conference (comparison being best shown in terms of dollars) are probably those reproduced in the accompanying tables (partly rearranged), representing national wealth (income) as compared with budget revenue and expenditure (Table I.), national taxation in 1920 (Table II.), the burden of debt (Table III.: *see* also NATIONAL DEBT), gold-movements between 1913 and 1919 (Table IV.), notes in circulation (Table V.), and the amount of foreign trade (Tables VI. and VII.). For the foreign-exchange problem, *see* EXCHANGES, FOREIGN; but here the comparative figures are brought up to the latest available dates in the two tables (VIII. and IX.) which show the London rates on Dec. 22 1921, and the New York rates on Jan. 14 1922.

In spite of the recommendations of the Brussels Conference, very slight progress was made during 1921 so far as the general position of international finance was concerned. The depression in trade, affecting more particularly the United Kingdom and the United States—the only countries intrinsically capable of functioning up to their productive capacity—consequent on the lack of international purchasing-power, and really representing a world-condition of underconsumption (mistakenly called "overproduction" by those who looked only at its superficial aspect), added to the difficulties of immediate recovery. The protracted controversies in the political arena over reparation-payments by Germany, due partly to aggressive French insistence, partly to a general lack of comprehension of their economic aspects, left European statesmen little opportunity to devote themselves to ordinary business questions. The instability of the exchanges made the situation peculiarly difficult for the business men themselves. The fact that the United States, during 1920–1, had disinterested itself in European troubles, and was not lending the financial assistance and coöperation which had been so confidently expected when the war ended, was a vital factor in the financial *détente*. British Labour was in serious conflict with Capital and with the Government; and the troubles in Ireland, together with the public demand for more drastic Government economies in expenditure ("anti-waste"), made it impracticable for Great Britain to take the lead in securing any material advance towards a constructive world-policy in international finance. A theoretically correct, but practically premature, policy of "deflation," on the part of the official pundits in London, together with the crippling effect of the very high scale of taxation, kept British Government finance technically "sound," but it checked British industrial and commercial enterprise at a stage when wiser counsels, if they could have been brought into operation, should, it may be thought, have put into the forefront the provision of financial facilities for the rebuilding of British trade. And in the United States the same policy, adopted by the American bankers and Government from the lead given by the Bank of England and in Whitehall, was followed, as in Great Britain, by a great increase of unemployment, although, merely from a financial point of view, it might have seemed that American resources should now have been ample—by contrast with British—for a more "adventurous" programme. In the financial history of 1919–21 no fact, indeed, is likely to seem more remarkable eventually than that, during this period, the United States, which had been unhurt by the war and had made enormous profits during the course of it—which had been converted from a debtor into a creditor country,

TABLE VII.—*Foreign Trade: Value in National Currency* (*000,000's omitted*).

Country	1913			1919		
	Imports	Exports	Excess of Imports over Exports + Excess of Exports over Imports −	Imports	Exports	Excess of Imports over Exports + Excess of Exports over Imports −
	Belligerent Countries of Europe.					
Belgium (Franc)	4,636	3,634	+1,002	5,246	2,296	+ 2,950
Bulgaria (Leva)	189	93	+ 96	964	552	+ 412
France (Franc)	8,421	6,880	+1,541	29,778[1] 29,188[2]	8,713[1] 7,429[2]	+21,065[1] +21,759[2]
Germany (Mark)	10,770	10,099	+ 671	32,376	10,057	+22,319
Greece (Drachma)	178	119	+ 59	1,619	753	+ 866
Italy (Lira)	3,646	2,512	+1,134	16,517	5,189	+11,328
Portugal (Milreis)	89	35	+ 54	231	110	+ 121
United Kingdom (£)	659	525	+ 134	1,467	798	+ 669
Finland (Mark)	495	405	+ 90	2,505	843	+ 1,662
	Neutral Countries of Europe.					
Denmark (Krone)	771	637	+ 134	2,357	734	+ 1,623
Holland (Gulden)	3,918	3,083	+ 835	2,825	1,411	+ 1,414
Spain (Peseta)	1,306	1,057	+ 249	899	1,316	− 427
Sweden (Krone)	847	817	+ 30	2,499	1,589	+ 910
Switzerland (Franc)	1,920	1,376	+ 544	3,533	3,298	+ 235
	Countries Outside Europe.					
Argentina (Peso)	496	519	− 23	620[3]	959[3]	− 339
Australia (£)	78	75	+ 3	82	131	− 49
Brazil (Milreis)	1,007	982	+ 25	1,334	2,179	− 845
British India (Rupee)	2,257[4]	2,490[4]	− 233[4]	2,326[4]	3,058[4]	− 732[4]
Canada (Dollar)	659	436	+ 223	941	1,241	− 300
Japan (Yen)	726	629	+ 97	2,125	2,051	+ 74
New Zealand (£)	21·4	21	+ 0·4	30	52	− 22
South Africa (£)	40	27	+ 13	46	47	− 1
United States of America (Dollar)	1,757	2,448	− 691	3,733	7,751	− 4,018

[1] Including Alsace-Lorraine. [2] Excluding Alsace-Lorraine. [3] Estimated on nine months of 1919. [4] Including treasure.

Table VIII.—*London Rates of Exchange (Dec. 22 1921).*

New York (to £)	$4.20½	Greece (to £)	103 dr.
Paris (to £)	53 fr.	Budapest (to £)	2,800 kr.
Brussels (to £)	55 fr. 20c.	Warsaw (to £)	12,000 m.
Berlin (to £)	755 m.	Helsingfors (to £)	217 m.
Vienna (to £)	11,500 kr.	Mexico (d. to $)	33d.
Amsterdam (to £)	11 fl. 42 c.	Buenos Aires (d. to $)	43½d.
Switzerland (to £)	21 fr. 51 c.	Rio (d. to milreis)	7¼d.
Stockholm (to £)	16.85 kr.	Valparaiso ($ to £)	39.60
Christiania (to £)	26.75 kr.	Calcutta (d. to rupee)	16d.
Copenhagen (to £)	20.85 kr.	Shanghai (d. to tael)	43d.
Italy (to £)	93 l. 50 c.	Yokohama (d. to yen)	27⅜d.
Madrid (to £)	28 pes. 35 c.		

Table IX.—*New York Rates of Exchange (Jan. 14 1922).*

London (to £)	$4.23	Spain (to 100 pes.)	$15.
Paris (to 100 fr.)	8.23	Holland (to 100 fl.)	36.87
Belgium (to 100 fr.)	7.88	Greece (to 100 dr.)	4.50
Switzerland (to 100 fr.)	19.45	Denmark (to 100 kr.)	20.
Italy (to 100 l.)	4.44	Norway (to 100 kr.)	15.72
Berlin (to 100 m.)	0.56	Sweden (to 100 kr.)	24.95
Austria (to 100 kr.)	0.04	Shanghai (to 100 taels)	75.
Hungary (to 100 kr.)	0.17	Calcutta (to 100 rupees)	28.
Czechoslovakia (to 100kr.)	1.66	Japan (to 100 yen)	47.75
Yugoslavia (to 100 kr.)	0.35	Argentina (to 100 paper dollars)	33.625
Poland (to 100 m.)	0.04¼	Brazil (to 100 paper milreis)	12.875
Rumania (to 100 leu)	0.82	Chile (to 100 paper pesos)	9.55
Finland (to 100 m.)	1.89		

and had been the recipient of such huge amounts of gold from Europe—should, in its banking operations, have only hoarded this gold, without utilizing it as a further basis of interest-producing credit, up to the point of accumulating a domestic banking reserve of about 75 per cent, at a time when the whole of the rest of the world was in want of capital to set business going again. The American people were slow to see that the appreciation of the dollar was a source of weakness, not of strength.

On Jan. 1 1922, according to the U.S. Treasury Department's annual Report, the stock of gold (which had reached the highest point yet known), the amount of Federal Reserve notes, and the total stock of money, in the United States, showed the following figures (in dollars) as compared with the corresponding figures on Jan. 1 in the preceding years back to 1915:—

Jan. 1	Gold $	F.R. Notes $	Total Money $
1922	3,656,988,551	2,781,791,260	8,282,433,487
1921	2,784,834,427	3,735,719,345	8,372,959,004
1920	2,787,714,306	3,295,789,145	7,961,320,139
1919	3,080,510,011	2,559,843,920	7,780,793,606
1918	3,040,439,343	1,350,764,025	6,256,198,271
1917	2,864,841,650	300,106,180	5,012,045,517
1916	2,312,444,489	214,125,000	4,401,988,337
1915	1,815,976,319	17,199,225	3,972,373,686

In spite of this apparent evidence of monetary wealth in the United States, trade had languished there during 1920 and 1921, and complaints of overtaxation were as rife as in England. American public opinion had not yet realized the interdependence of international finance in its bearing on national economic prosperity, nor had any general appreciation of the full meaning of the expositions of financial doctrine given at the Brussels Conference penetrated to the hearts of the business community. It still remained for the world's statesmen to put their heads seriously together in a coöperative effort to restore world-consumption, through a revival of world-purchasing-power, to the level of world-productive-power, the first essentials being peace, reductions in State expenditure, and a new progress in private savings for capital investment.

It was not till the Washington Conference, at the end of 1921, that the United States once more came into practical touch, officially, with the European situation; and even then its scope did not include the great international financial problems still awaiting attention. At the opening of 1922, however, the prospect was held out of another general financial conference, as proposed by the Italian Goveanment to be held at Genoa in March; and it seemed likely in various other directions that, during the year, an improvement might be seen in the functioning of world-finance. (H. Ch.)

FINLAND (*see* 10.383).—The remarkable development of Finnish nationalism in the closing decades of the 19th century was primarily directed against the Swedish language and Finno-Swedish cultural domination. Through the revival of their own singularly rich and beautiful tongue, the Finns of Finland had learnt to think of their country as "Suomi," as utterly distinct from Sweden and Russia, as possessing thought and literature of its own. Though open to European influences, specially in their art, and taking their political ideas from Scandinavia and Germany, the "Fennomans" (Finnish Finns) climbed "unto a language island" and, developing along extremely democratic lines, took no part at all in Russian affairs and showed little interest in those of Scandinavia. There was no sympathy even with the Russian proletariat in its early struggles, while the revolutionaries were cold-shouldered.

Second Period of Russification 1908–14.—The successive governors of Russia, however, regarded the "Suomilaiset" (or the people of the fens) as a strange and totally different nationality from themselves, although the Finno-Ugrian race blended with the Slav is to be found all over northern Russia; they could not forget that the "country of the thousand lakes" had been under Swedish rule for 600 years, and cherished a civilization wholly alien to their own. This so obviously democratic, almost self-governing grand duchy of Finland was a thorn in the side of the vast autocratic Russian State conception. Out of this train of thought arose Russia's first attack upon the liberties of Finland during the dark years 1899–1906.

This article does not deal with the first attempt at Russification when the Finnish constitution was suspended and the country came under the rule of the military dictator, Gen. Bobrikov. This earlier period of repression was arrested by the Russian Revolution of 1905 which, in the wake of the disasters of the war against Japan, forced a weakened Tsardom to concessions. The manifesto of the Emperor-Grand Duke of Nov. 4 (Oct. 22) 1905 annulled all unconstitutional interferences of the preceding seven years and enabled the dominant Finnish Constitutional party to democratize the Diet on the broadest basis—full adult suffrage, regardless of property, class or sex, coupled with proportional representation based on d'Hondt's distributive principle which contains safeguards against the tyranny of the majority. That was gain. But the Russia of post-revolution days was still the landlocked colossus whom Panslav aspirations directed against all that was alien in language, religion, character and administration. What had led to conflict with the Tsar now led to conflict with the imperial Duma—the tendency to create one vast homogeneous Russia stretching from the Norwegian coast to the Pacific. In this scheme of power, the first step towards the ultimate possession of the warm-water ports of Scandinavia was, once again, the Russification of Finland.

The initial cause of friction was, as on previous occasions, the question of the payments to Russia in lieu of military service. The Diets had voted an annual indemnity of 10 million Finnish marks in respect of the years 1905–8, though reluctantly, not only on account of the financial burden the people were called upon to shoulder, but by reason of the unconstitutional argumentations upon which the demands were based. More particularly, the first one-chamber Diet which passed the grants in respect of the years 1907 and 1908 expressed the hope that this matter be either thereby considered regulated or else settled forthwith in a constitutional manner. This notwithstanding an imperial ukase, dated Oct. 7 1909, declared the issue to lie solely within the competence of the Crown, and peremptorily fixed an annual contribution which, beginning at 10 million Finnish marks, was to increase automatically by a million a year until, in 1919, it was to attain its maximum total of 20 millions of Finnish marks. The objections of the Diet, which was even now ready to compromise, were answered by its dissolution and the annual amounts due made over to the Russian exchequer. The same occurred with the new Diet in March 1910 in respect of the contributions for the years 1910 and 1911. Finally the Duma, by the imperial law of Jan. 23 (10th) 1912, approved of the principle of the Finnish annual indemnity in lieu of military service.

The interference of the Tsar with the constitutional rights of Finland was provocative and for that reason opened the new era of conflict. From the spring of 1907 to the spring of 1909 had supervened the two "crowded years of glorious life," of great internal progress and political development. The old feuds of "Sveckoman" (Swedo-Finn) and "Fennoman" (Finno-Finn) had been taken up with renewed vigour. Aristocracy, middle class and proletariat were all politically equal; capital and labour, though frequently in conflict, yet fought their battle more scientifically than anywhere else in Europe. But by the end of 1909, the fresh wave of Russification paralysed all recent progress. The large measures of domestic reform passed by the Diet, and generally accepted by the Senate, were laid before the Tsar and never heard of afterwards. Such was the fate of the bill for the total prohibition of alcohol, as of measures relating to the care of children, insurance, old-age pensions, education, public health and the betterment of the condition of the "torpare" (landless worker upon the soil). Civil marriages, however, were instituted, illegitimate children placed upon a better basis, and the principle of "equal pay for equal work" was applied in teaching, in the printing trade and, in 1913, in the State service.

As early as June 2 (May 20) 1908 an imperial instruction had dealt with the regulation of Finnish affairs which affected the interests of the Russian Empire as a whole. It provided that the measures passed by the Diet and sanctioned by the Senate were no longer to be conveyed to the Tsar through the Secretary for Finland, but in order to obtain the imperial assent had to come before the Council of Ministers. To stifle opposition, the imperial ukase of March 27 (14th) 1910 laid down that the question as to whether Finnish affairs affected the interests of the Russian Empire or not rested not with the Finnish Diet, but with the imperial Duma. The new law came into force on June 30 (17th) 1910 after having been passed by the Duma amid triumphant shouts of "Finis Finlandiae."

This, "The Imperial Legislation Act," taken as a whole, never came into working since in the last resort it meant the complete unification of the grand duchy of Finland with Russia in language, education, finance, customs, laws, monetary system, press restriction, rights of assembly, etc. But inconsequently applied though it was, it roused great indignation not only in Finland, but throughout Europe. The claim of this bill, which was that the assurances given by the Tsars depended upon their autocratic rule and became null when they delegated some of their governing power to the Duma, called forth protests from members of the British, German, French, Italian, Dutch and Belgian Parliaments.

Directly the "Imperial Legislation Act" had come into force, two imperial laws were laid before the Diet which, however, refused them both and was promptly dissolved. The bills thereupon came before the imperial Duma, which passed them rapidly. One of these was the law of Jan. 23 (10th) 1912, already referred to above, in which the Duma affirmed the principle of an annual Finnish indemnity in lieu of military service, while the other, of Jan. 20 (7th) 1912, accorded full citizen rights to temporary Russian residents in Finland. This last-named measure, apart from its manifest injustice, led to great confusion in the overlapping of two fundamentally different codes of law, but the judges who resigned, rather than be a party to it, were deprived of their pension rights. Every single provisional governor was forced to leave the service or did so voluntarily; many high officials suffered imprisonment or exile. The government of the country was carried on by a packed Senate, in which after 1912 sat not only pliable Finns but Russian-born members; the Diet was capriciously summoned and dismissed, the press censored. Thus the conflict with the Duma in the years 1910–4 led to sufferings analogous to those in the struggle against the high-handedness of the Tsar in 1899–1906.

In addition, it should be mentioned that Finnish propaganda abroad met with less success on this occasion, for one thing because it was a twice-told tale, for another because England had, by the logic of European events, been drawn towards Russia politically.

Effects of the World War, 1914–8.—In these circumstances supervened the World War of 1914, and it was left to Lt.-Gen. F. Seyn, the governor-general, to supervise the stringent censorship and the harassing restrictions of personal liberty which an unprecedented situation called for in all the countries of Europe. Though Finland escaped the horrors of foreign war upon its own soil, a descent of the German armies upon the coast was a military eventuality which had to be taken into account. Accordingly two lines of trench covering the chief railway lines were constructed across Finland, one system of fortified lines running from Tornea to Helsingfors, the other from Kajana to Kotka. Besides, the long sea border of the grand duchy was exposed to enemy action from the sea; and some 40,000 tons of the Finnish mercantile marine, which sailed under the Russian flag, exposed to destruction in the open waters of the Baltic Sea, remained locked in the harbours of the Bothnian gulf. This heavy loss to seaborne commerce was balanced by the extraordinary advantages which Finnish industries derived from the war partly by reason of the low tariff prevailing, partly through the influx of Russian labour. Industries connected directly with military supply, as also the iron, leather, glass, drugs and polishes trades and paper-manufacturing concerns, attained unexampled prosperity. The Russians, who were well aware that the Finnish people at the end of a 15 years' constitutional struggle did not love them, strongly garrisoned the country, but, the discipline in the Tsarist armies being maintained at a high standard, collisions between the military and the civil population were few. The Russian authorities, impulsive as was their wont and inconsequent in their application of the law, suffered from divided councils, and were alternately bent on reconciliation and repression. There being no means as in Sweden and Denmark to take advantage of leaks in the Allied blockade, the price of living gradually rose, railway fares and telephone costs being raised by 25%. But the country was relieved of the burden of the annual military indemnity, and the Russians, in their sporadic anxiety to please, were strangely negligent of such essential precautions as the surveillance of telephonic communications. There was, however, a special 5% tax on property and mortgage.

The course of the war, which during the first two years carried the Austro-German invading hosts through Poland and Lithuania to the confines of Great Russia proper by the marshes of the Pripet, was followed by the Finns with the anxiety of a people whose hope lay in a Russia which, weakened by a colossal military effort, would again be willing to respect the legal rights of the grand duchy. The Polish manifesto of the Grand Duke Nicholas was held to leave the Russian Government with a programme aiming at the final destruction of Finnish autonomy and nationality. Under the circumstances sympathy for the sufferings of Belgium was obscured by the consideration that France and England were the allies of that Russia which, if she emerged victorious, would again turn oppressor. In 1915 a Finn set fire to the Allied stores at Archangel in service, as he considered, to his Finland, where, as is now known on the authority of M. Sario who became Foreign Secretary of the White Government in 1918, persons were not wanting who referred to German victories as "our victories." Only some 2,000 Finns volunteered for the Russian army, where, however, they fought with traditional valour under their own officers. About the same number enlisted in the German army, though ostensibly only for service on the eastern front, and did not return until the *coup d'état.*

Towards the close of 1916 the magnitude of the industrial effort in neglect of agricultural development was fast bringing its own punishment. Finland had changed—as far as her size, climate and scanty population allowed—from an agricultural to an industrial country in two and a half years. The ruin of her dairy trade drew workers into the factories, and, an ever more considerable part of Russian war material manufacture passing into Finnish hands, labour streamed in from the country and from across the Russian border. Wages rose with the increasing cost of food, and great fortunes were made while there was yet considerable unemployment. This happened in a country which even normally produced but five-sixths of her needful foodstuffs, at a time of world shortage and under pressure of an ever more effective blockade; in one, too, which, while the old order survived in Russia, was debarred from any sort of political expression. True, elections were still held in 1916, and resulted in the return of a Social Democratic majority, but the Diet was not allowed to function.

The Russian Revolution, March–Nov. 1917.—Then came the Russian Revolution. The Tsar Nicholas II. Alexandrovich abdicated on March 15 1917 and the new Provisional Government of Russia almost with its first breath restored representative government in Finland. The Russianized Senate was dissolved and a temporary body of twelve, half of whom were Social Democrats and the remainder members of the bourgeois parties, took up the executive power. Gov.-Gen. Seyn was replaced by Stakovich, while Rodichev, a tried friend, became Secretary of State for Finland. Kerensky, visiting Helsingfors at the end of the month, placed a wreath at the foot of the statue of Rüneberg, the national poet, and uncovered his head when the Finnish national anthem was intoned. The former Socialist speaker of the Diet, M. Tokoi, was nominated president of the Senate; Kullervo Manner, a young Finnish Social Democrat, was made speaker of the Diet; Vaino Jokinen, his former collaborator on the workman's journal "Tyomies," and Lauri Ingman, a clergyman and a Swede of the Swedish party, became vice-speakers.

It was then quite clear that ever since 1907 the one constant factor in Finnish political life had been the growth of the Social Democratic vote. But now that anarchy corroded the body politic of the disintegrating Russian Empire, the possessing classes of Finland quailed before the rising power of a party which was morally saturated with Marxist doctrines and politically orientated towards Russia. The economic conditions justified the worst fears of the bourgeoisie, for not only had the vehement industrial development of the last three years strengthened the "hooligan element," but the Imperial Legislation Act of 1910 and the conditions of the war had brought a large number of Russians into the country as settlers and even as refugees from famine and nascent revolutionary disorders. Beside the Swedo-Finns (about one-tenth of the population) and the Finnish-speaking Finns there was now this large fluctuating industrial element reinforced by some 40,000 Russian civilians. Apart from these, there were the Russian soldiers who, ever more irregularly paid, bade fair to become a danger to the State.

The Swedish party represented the most conservative elements in Finland, the nucleus of the largest property owners. There was, it is true, a Swedish branch of the Social Democratic party and also a number of purely Swedish capitalists, yet on the whole the Swedish element was bourgeois and its desire for independence economic since it foresaw the inevitable bankruptcy of Russia.

The Social Democrats, on the other hand, saw in Russia the possible social revolution and intended to go faster than any Miliukov or even Kerensky. Under such conditions the Diet which assembled on April 5 could do as little as the cumbrous governing body of six Social Democrats and six bourgeois representatives.

As far as the Swedish party was concerned, conciliatory relations were to be maintained with Russia until the Peace Conference, but the party congress which was held in May made it clear that independence was the final aim. Even before that the *Hufoudstadtbladet* argued that nothing short of complete independence suited the country's needs, and the Finnish Government in the Diet solemnly proclaimed that such was its policy. But this Diet, containing 80% of Social Democrats, 12% of Old and Young Finns, 6% Swedes and 2% Agrarian labourers, the bourgeois did not consider to be truly representative of the nation, on the ground that, at the time of its election in 1916, most people still boycotted the Diet by way of protest against Russian manipulation of the elections; it was only the Socialists who never gave up the class war.

The struggle between the Provisional Russian Government and the Finnish Diet crystallized around the declaration which was embodied in what became known as the "Law of July 18 1917." In this, the Diet resolved that it alone decided, confirmed and put into practice all laws of Finland, including those relating to home affairs, taxation and customs. It made the final decision regarding all other Finnish affairs which the Emperor-Grand Duke decided according to the arrangements hitherto in force, though the provision of this law expressly stated that it did not apply to matters of foreign policy, to military legislation and military administration. The Diet was to meet for regular sittings without special summons and to decide when these were to be closed. Until Finland's new form of government was determined, the Diet was to exercise the right of deciding upon new elections and its dissolution. It asserted its control over the executive power in Finland which was, for the present, to be exercised by the economic department of the Finnish Senate whose members were to be nominated and dismissed by the Diet. This law reflected the standpoint of the Social Democratic majority of the Diet which demanded complete internal and economic freedom for the country, but was always ready to recognize Russia's supremacy in military matters and in foreign policy. The radical group of the Swedish Popular party, aiming further, proposed the following amendment:—"The Diet, which regards it as its right and duty to demand full independence in the name of the Finnish people and reserves in this respect its full freedom of action, resolves, etc." This amendment, however, was rejected by 125 votes to 63, but the motion of the main committee not to submit the new law to the Provisional Russian Government for its sanction was passed by 104 votes to 86. An address was, however, forwarded to the Russian Provisional Government, in which it was expounded that, Finland having always been in relation with the Tsars of Russia but not with any Russian Government, the overthrow of Tsardom had automatically set the country free.

The Russian Provisional Government met this explanation by passing a resolution at the end of July, declaring that under no circumstances would it consent to the separation of Finland from Russia, wherefore it dissolved the Diet and ordered new elections for the beginning of October. The Finnish Diet, however, in its turn, disputed the Russian Provisional Government's right to exercise the prerogative of dissolution, and a deadlock ensued.

Pourparlers in Aug. between the Gov.-Gen. Stakovich and the Finnish leaders proved of no avail, although the Russian Federalist Congress in session at Petrograd on the 17th and 18th of that month sought "to work out a basis upon which the Federalists could unite and then prepare for the elections to a Constituent Assembly." Thus the plan for a republic of all the Russias guaranteed autonomy in everything but matters relating to a whole and united Russia.

But it was precisely that which the Finns did not want, anxious as they all were, regardless of party, to avoid taking any part in Russian affairs. Even the Socialists, willing as they were to concede the control of foreign policy and the conduct of military affairs to the larger Power, yet met any kind of representation upon any sort of Russian governing body with a categorical refusal.

In its domestic policy the Social Democratic majority of this Diet was similarly averse to any comprehensive measures of collective reorganization pending events in Russia. Thus the capitalist development of the country was allowed to follow its course. The reform bills passed in recent years and held up by the Tsar were passed *en bloc*, among these the total prohibition of alcohol and the eight-hour day. The municipal councils were democratized and a war bonus was added to the wage of all workers, part being paid by the State and part by the employer. The fixing of maximum prices for food and the control of the supply of fuel, bread, milk, sugar and butter were merely the extension of the work initiated by the pre-revolutionary Senate.

Such action, however, did not strike at the root of the evil, for it was easy to see that a famine threatened the country. Nothing was done to avert it save that large quantities of grain were purchased from America which, owing to difficulties of transit, could not be delivered until starvation and civil war menaced Finland. From about March 1917 to Feb. 1918 there was a veritable strike mania; every trade, every municipal body, every committee even, flung down its job and the Diet and the Senate alike were unable to cope with the situation. The long printers' strike brought it about that from the beginning of July to the middle of Aug. no Moderate papers appeared, though the Social Democrat journals continued to be published. The trouble lay in the dilatoriness of the Russian Provisional Government in confirming the measures passed by the Diet and the Senate which had been hung up by the Tsar since 1910. The All-Russian Congress of Workers and Soldiers, which was already under Bolshevist influence, had met early in July and urged the Provisional Government to grant full autonomy to Finland and all executive power to the Diet, which action gained it the sympathy of the Finnish Socialists. A "general strike" was called for against the wishes of Tokoi and Manner, and the Diet was to reassemble despite the threats of the governor-general that its doors would be guarded and sealed. After two or three days of disturbances, this ill-considered move collapsed, but the Russian Provisional Government proposing that the economy department of the Finnish Senate should have the supreme power, Tokoi dissolved the governing body composed of six Social Democrats and six Bourgeois representatives because it was too evenly balanced for effective administrative work. Thereupon the Socialist senators resigned while the Moderates were induced to form a Senate. This was regrettable, as the Russian Provisional Government now gave way, and on Aug. 24 ratified a number of the reform measures passed by the Diet and Senate between 1911 and 1914. A day later the Moscow conference, under Menshevik influence, expressed its desire to retain all power over Finland which the restored constitution allowed.

Meanwhile the failure of the general strike and the appointment of Nekrasov as governor-general in place of Stakovich influenced the elections for the Diet which, completed by Oct. 2 1917, proved a setback to the Social Democrats and caused the Old and Young Finns, the Swedes and the Agrarians to form a Moderate *bloc* of 108 members. The absorbing controversy, whether the Senate (through its economy department) was to hold the supreme power or the Diet, was settled on Nov. 15 by Alkio, the leader of the Agrarians, in favour of the latter, and on Nov. 28 a Moderate Senate of eleven members was elected. Still, however, nothing was done to increase the food production. Though countered by the Moderate coalition, the Social Democrats were still the strongest individual party in the House, and would have had the bulk of the people behind them if they had been able to seize and nationalize the land. The economic conditions, beyond a doubt, rendered this task very difficult, for in Finland, as in Russia, the cultivation of the soil was carried on individually and the transfer to the State would have been a delicate operation.

The Bolshevist advent to power in Russia between Nov. 4 and 15 1917 deepened the pro-Russian sympathies of the Finnish Social Democrats who had been alienated by Kerensky's equivocal policy, while the bourgeois parties, arguing that there was now no settled government in Russia, desired complete independence. On Dec. 6 1917 the Diet and the now bourgeois Senate drew up a very old-fashioned declaration of independence which, however, historically marks the birth of Finnish freedom. As the Socialists still sought an understanding with Russia, the bourgeois *bloc*, which governed the situation since it had furnished the new administration at the beginning of the month, acting with great haste sent the declaration to Sweden and Germany at once. Both these Powers replied that Finland must first obtain full recognition of her independence from Russia. The Diet then decided to approach the Constituent Assembly in Russia through a friendly manifesto which explained that the assertion of independence was not a hostile act and that a joint committee would settle outstanding questions so that Russia could proceed with her war without fear of trouble from Finland. But as the Constituent Assembly was not allowed to meet, the Finnish Senate finally appealed to the Bolshevist Government and was informed on Jan. 4 1918 that the steps taken conformed with the policy and programme of the Bolshevists. Immediately afterwards the Swedish Government recognized the independence of Finland and was followed by the other Scandinavian countries. Recognition by France preceded recognition by Germany.

The Finnish Civil War Feb.–May 1918.—At this time the social and economic differences between the political parties were too deep to admit of an easy settlement. The possessing classes,—that is to say primarily the Swedo-Finn and Finno-Finn bourgeoisie, but especially the first-named—rather than see the wealth amassed during three years of the World War taken from them by the rising Social Democrats, were jeopardizing the newly won independence, now by intrigues which aimed at the cession of the Åland Is. to Sweden, now by manœuvres which tended to set Finland under the heel of Germany. The Moderate *bloc* to which the Swedo-Finns adhered was anyhow determined to break away from Russia, and its leaders openly discussed the chances of union with Sweden on the one hand and the adoption of some German prince as grand duke on the other.

Apart from that, there were some Finnish contractors who had allowed the Russian Government credit for the provision of war material, food and clothing, and did not desire to incur the loss which a complete rupture of relations was certain to entail. They therefore stood for the maintenance of the connexion with Russia.

Principally, however, the Social Democrats believed that Socialist governance had come to stay in Russia, and they were not minded to protect Finnish capital from seizure if the birth of a coöperative commonwealth in Finland could thereby be accelerated. When the Bolshevist *coup d'état* in Russia became known, they unwisely fraternized with the Russian soldiers stationed in Finland, and with their help rejected municipal bodies and replaced them by Social Democrat committees. Such action was hardly designed to relieve the ever-growing food difficulties and laid their party open to the reproach of harbouring anarchical tendencies. The Socialists were almost all Maximalists and anti-militarists, and, as such, averse even to the formation of a democratic citizen army maintained for purposes of order and defence. They pinned their faith on the Muscovite connexion to save their country from invasion—oblivious of the fact that the Russian soldier, freed of the restraints of a discipline which had become his second nature, starving and unpaid, was, to say the least, an uncertain factor. While free passes were given, whole trainloads of revolutionary *soldateska* arrived from Petrograd nominally to assist the Socialists in their active differences with the bourgeoisie, but in reality to create disturbances. Having massacred their officers and any bourgeois elements which remained among them, they entered the so-called Finnish "Red Guards," and ransacked the country. The reactionaries, getting together the doubtful elements of the disbanded *gendarmerie* and their own adherents, organized the "White Guards." German arms and explosives were imported by one side; Russian bayonets by the other. At Christmas 1917 matters came to a head at Åbo, where the Social Democrats imprisoned the governor and the chief of the police. For about a week the "Red Guards," which were composed of casually armed Social Democrats, remained on duty notwithstanding the fact that their pay had been suspended by the local Moderate bourgeois authorities. Then they gave up their job, and Russian troops and "hooligan elements" seized the opportunity to sack a part of Åbo. After some days' disorders, hurriedly summoned "Whites" from another district and some of the original "Reds" restored order together. But the bourgeois *bloc* neglected to introduce a democratic citizen army and opposed the reactionary efforts of the Swedish party to form a conscript army round the nucleus "White Guards."

The Bolsheviks were clearly bent on precipitating civil war in Finland, and poured arms, munitions and troops into the country for the ostensible purpose of helping the Social Democrats. For this reason the Senate on Jan. 29 addressed a protest against the action of the Russian Government to the various Powers which had recognized Finnish independence. But it was too late, as now even the sanest Social Democrats were swept into a flood of Bolshevism. Helsingfors on that very day was seized by the Red Guards and by Feb. 8 1918 the *coup d'état* had occurred and "Whites" and "Reds" were in brutal conflict everywhere.

The German Intervention, March–May 1918.—The Diet belatedly adopted, on Jan. 17 1918, certain measures suggested by Senator Kaarlo Castrén for the strengthening of the White Guard formations. As these were insufficient to save the White army, which was under the command of the former Russian general of cavalry, Baron Carl Gustav Emil Mannerheim, the necessity arose of seeking foreign intervention. As regards this it is known from the Swedish statesman Branting that the Finnish Government, when it "made its official proposal for a Swedish intervention . . . . . . had simultaneously asked in Berlin for a German armed intervention." Thus Sweden, had she assented, would have been dragged into the war, as "nobody can imagine that Germany would have refused an offer so favourable to her hegemony in the Baltic."

This judgment is true, for while Sweden refused official help, the Germans did not hesitate. After all, they had kindled the Bolshevist fires in the East and sent war material into Finland for the express purpose of fomenting troubles which they could exploit to their own advantage. The situation was favourable to them, for as Mr. E. Löfgren, Minister of Justice in the Swedish Coalition Government of 1918, publicly explained, "the Finns immediately after the declaration of their independence had entered into negotiations for a treaty with Germany, which in a commercial political sense made Finland the ally and vassal of Germany. . . ." The allusion is to the Finno-German treaty of March 7 1918.

But since the public knew little of the underground workings of German policy, the landing of a German composite division in the Åland island of Ekerö on March 3 and in Finland by April 3 caused the Prussian general officer commanding, Count Rüdiger von der Goltz, to be hailed as the liberator of the country. He had initially some 12,000 men under his orders, viz., three dismounted cavalry regiments, three Jäger battalions, Bavarian mountain artillery, two heavy batteries, a squadron of cavalry, and sundry technical and supply formations which were subsequently reinforced by the detachment "Brandenstein," consisting of three infantry battalions, one cyclist battalion, a squadron of cavalry and two batteries. He had further the support of the German navy in the landing operations, and the remnant of the 2,000 Finnish exiles who had joined the German army in 1915–6 and made up the famous "27th" Jägers, who were as well drilled in Pan-Germanism as in military science. Gen. von der Goltz, by landing in the rear of the Red forces and holding part of these in a successful action near Karis on April 6, enabled Gen. Mannerheim to win the battle of Tammerfors, while he himself, by a rapid advance on Helsingfors, between April 11 and 13, freed this capital which he officially entered on April 14. Finally his victory over the Reds in the three days' battle (April 30–May 2) of Lahti-Tavastehus contributed to Mannerheim's decisive defeat of the Red eastern army near Viborg on April 28–29. The remnants of the Red army being forced eastwards into Russia, the campaign ended in a month with the complete victory of the Whites.

The terrible cruelty of the Reds, however, led to the White Terror as the price the country had to pay for being dragged into "Mittel-Europa." Some 15,000 men, women and children were slaughtered in cold blood, and by June 27 1918 73,915 Red insurrectionaries, including 4,600 women, were prisoners of war.

The Diet, which met in June 1918, was Moderate, since the Socialists or 46% of the electorate were excluded from the register. It authorized Senator Pehr Evind Svinhufvud, who under the Russian régime had been an exile from his country, to exercise the supreme power in so far as it had not already been conferred on the Senate which was bringing forward proposals for a monarchical form of government by offering the crown to Prince Frederick Charles of Hesse, brother-in-law of the German emperor.

But the Germans pursued the ulterior object of securing Finnish military coöperation against the Murman railway, which, having been built by English enterprise during the war, was now guarded by a British expeditionary force. The claim of the liberators upon the gratitude of the Finns was assuming the most peremptory forms known to diplomacy, when, three days later, on July 18, events took place on the western front which marked the turn of the war to Germany's disadvantage. One collision between a Finnish force and a detachment commanded by a British officer, Lt. Quinn-Harkin, occurred in northern Karelia, but valuable time was gained until the rapid transformation of the European war, culminating in the Armistice of Nov. 11 1918, caught Finnish reaction between wind and water. Svinhufvud, the pliant tool of Germany, relinquished the supreme power, and was succeeded on Dec. 12 by Gen. Mannerheim as regent, who formed a Coalition Government composed of six Republicans and six Monarchists. The persons discredited by their extreme pro-Germanism, among them Gen. Thesleff, the Minister of War, were replaced in order to obtain the recognition of Finland by the Great Powers and secure the food supply of which the country stood in need. The definite orientation towards the Entente marked the transition from the monarchist period of German influence towards the democratic régime associated with England and America.

The German troops, in part mutinous, were conveyed back to Germany in the middle of Dec., but with difficulty, as the German navy refused to transport units which had remained faithful to the Emperor. Gen. Mannerheim, who as regent wielded the power of a quasi-dictator, was a monarchist, but not a pro-German.

Events in 1919 and 1920.—The year 1919 witnessed the growth of the Republic of Finland out of the ashes of a country laid waste by civil war. Mannerheim organized the "Skyddskorps" or Protective Guards, a body of over 100,000 men, whose loyalty to the existing order of society could be relied upon.

The general election of March 1 1919 showed the following division of parties: Social Democrats 80, Agrarians 42, Coalitionists 28, Progressives 26, Swedish 22, Christian Labour two. The Social Democrats had thus diminished by 12 since the 1917 elections. This was largely attributable to the disfranchisement of over 40,000 voters for participation in the Red revolt. The tendency towards a republican form of government was outlined by the Agrarian party, composed of small landowners hostile to the claims of the Swedish-speaking Monarchist section.

Mannerheim's popularity being immense with the parties of the Right and the army, the temptation of exploiting the military impotence of Soviet Russia was very great. In 1919 continued the Entente intervention on the Murmansk and Archangel fronts, and when the 237th Brigade (Gen. Price), which formed part of the expeditionary force under the English Maj.-Gen. Maynard, at the end of May reached Medvyejva Gora at the head of Lake Onega, the Finnish Government offered coöperation in return for the possession of Petrozavodsk. The offer being declined, a Finnish volunteer force nevertheless assaulted the town independently, but without success. Again, at the close of the year, when the White-Russian Gen. Judenitch was marching on Petrograd, Mannerheim went so far as to sound the Allies as to their views on the proposed Finnish intervention. But he received no encouragement from Paris or London, nor from the Moderates at home.

Already on July 17 of that year the Finnish Diet had resolved to establish a republic, with a president to be elected every six years, and, on July 25, Prof. Kaarlo Juho Ståhlberg was chosen as the first president by 143 votes against 50 recorded for Mannerheim. It was then that the Vennola Government, which was a coalition of the Progressive and Agrarian parties, came into power. Though it commanded only 64 out of 200 seats in the Diet, it marked a great administrative improvement from a democratic point of view. It introduced the Amnesty bill, which after a chequered career was passed by the Diet on Dec. 18 by 165 votes to 68. Its adoption synchronized with the abandonment of the Communists by the extreme Left. The *de jure* recognition of the republic was accorded by Great Britain soon after the instalment of Ståhlberg.

The outstanding event of the year 1920 was the signing of a peace treaty with Soviet Russia, which after long negotiations was signed at Dorpat on Oct. 14, the military defeat of the Bolsheviks by the Poles being a contributory factor. Pechenga was ceded to Finland, which thus obtained the much-desired outlet on the Arctic Ocean, while Russia retained eastern Karelia, where, after the collapse of Gen. Skobelzine's White-Russian front in Feb., fighting had occurred with Bolshevik troops with results satisfactory to Finnish arms. The treaty was approved on Dec. 1 by the Diet with only 27 dissentient voices and ratified on Dec. 11 by the President. Finland soon after was admitted as a member of the League of Nations.

Åland Islands Dispute.—The question of the Åland Is. was, in its simplest form, whether the group of islands adjacent to Finland and inhabited by a few thousand people of Swedish extraction should belong to Sweden or to Finland. In its wider aspect, however, the whole network of islands which form the archipelago of Åbo and that of the Åland Is. constituted the key of the defence of the coast of Finland and of the gulfs of Bothnia and Finland against attack from the west. In 1920, as in previous years, sovereignty was claimed over these islands by Finland on the ground that it was for her a question of existence, though autonomy was given to the Ålanders and for the safety of Sweden the absolute demilitarization of the islands was conceded. Under such circumstances the question was referred on June 19 1920 to the League of Nations, and in June 1921 (*see* ÅLAND ISLANDS) its decision was given in favour of Finland.

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FINLAY, ROBERT BANNATYNE FINLAY, 1ST VISCOUNT (1842–), British lawyer and politician, was born at Edinburgh July 11 1842. He was educated at Edinburgh Academy and University, and graduated in medicine. In 1867 he was called to the bar, in 1882 becoming a Q.C. and bencher of the Middle Temple. He was elected as Conservative member for Inverness Burghs in 1885, and held this seat until 1892. In 1895 he regained the seat, and was made Solicitor-General in Lord Salisbury's Government, when he was knighted. In 1900 he became Attorney-General, remaining in the Government until the Conservative defeat of 1906. In 1910 he successfully contested Edinburgh and St. Andrews Universities, and in 1916, on the formation of Mr. Lloyd George's Government, became Lord Chancellor and a life peer. He retired in 1918, and in 1919 was created a viscount. Lord Finlay received hon. degrees from various universities, and from 1902 to 1903 was lord rector of Edinburgh University.

FISCHER, EMIL (1852–1919), German chemist (*see* 10.426), died in 1919.

FISCHER, THEOBALD (1846–1910), German geographer, was born at Kirchsteitz, Thuringia, Oct. 31 1846. He was educated at the universities of Heidelberg and Halle, and at first devoted himself to history. A travelling tutorship directed his attention to geography, and he visited many parts of Europe in the pursuit of this study, but especially the Mediterranean lands, including North Africa (Atlas lands). The "Mediterranean region," perhaps the primary example now in the study of regional geography, is a conception the world owes to Fischer: his thesis for the rank of *Privatdozent* in the university of Bonn (1876) was entitled *Beiträge zur physischen Geographie der Mittelmeerländer*, and his most important publications are a collection of *Mittelmeerbilder* and his work on the Mediterranean peninsulas of Europe in Kirchhoff's *Allgemeine Länderkunde*. He held professorships of geography at Kiel (1879–1883) and at Marburg from 1883 until his death, which took place on Sept. 17 1910.

FISHER, ANDREW (1862–), Australian statesman, was born at Crosshouse, Kilmarnock, Aug. 29 1862, and began life as a coal-miner. He emigrated to Queensland at the age of 23 and eight years later was elected to the Queensland Legislature. He was Minister of Railways in the short-lived Dawson Ministry of 1899, and in 1901 was elected a member of the Commonwealth Parliament, retaining his seat for 15 years. He joined Mr. Watson's Labour Cabinet of 1904 as Minister for Trade and Customs, and when Mr. Watson in 1907 resigned his leadership of the Labour party Mr. Fisher succeeded him. In 1908 he became Prime Minister, but his administration lasted only six months. At the general election of 1910, however, his party was returned with a sweeping majority, and he was Prime Minister for three years, during which period he tackled the question of imperial defence, adopted Lord Kitchener's report of 1909, passed a measure establishing universal military training, and invited Adml. Henderson to visit Australia and report on its naval needs. In 1913 his party was in a minority in the Lower House and he therefore resigned in favour of Mr. (afterwards Sir) Joseph Cook; but at the special election of Aug. 1914 he was again returned to power and took vigorous action for Australia's participation in the World War. At the end of 1915 he resigned and took up the High Commissionership vacated by Sir George Reid. This office he held until 1921. He represented Australia at the coronation of King George V. (1911), and was that year sworn of the Privy Council.

FISHER, HERBERT ALBERT LAURENS (1865–), British man of letters and politician, was born in London March 21 1865. He was educated at Winchester and New College, Oxford, being elected in 1888 to a fellowship at his own college. After further study in Paris and Göttingen, he returned to Oxford as tutor at New College, and soon earned recognition as a scholarly historian. He delivered the South African lectures in 1908, the Lowell lectures in 1909, and in 1911 was Chichele lecturer in modern history. He was also a member of the royal commission on the public services of India (1912–5). In 1912 he became vice-chancellor of Sheffield University. In 1915 he was appointed a member of the Government committee on German outrages. On the formation of Mr. Lloyd George's Government in 1916, Mr. Fisher accepted the invitation to become Minister of Education, and was elected to Parliament for the Hallam division of Sheffield. In 1918 he became member for the English universities.

An Education bill was introduced by him Aug. 10 1917, the most noteworthy proposals of which were the removal of the limit of the 2d. rate which might be raised by local authorities for education, the establishment of nursery schools for children under five, the amending of the law of school attendance, the placing of further restrictions upon the employment of children of school age, the improvement of measures for physical training, and the establishment of continuation schools for young people up to the age of eighteen (*see* EDUCATION).

Mr. Fisher has published *The Mediaeval Empire* (1898); *Studies in Napoleonic Statesmanship* (1903); *A Political History of England* (1906); *Bonapartism* (1908); *Life of F. W. Maitland* (1910); *The Republican Tradition in Europe* (1911); *Political Unions* (1911) and *Napoleon Bonaparte* (1913); besides essays and review articles.

FISHER, IRVING (1867–), American economist, was born at Saugerties, N.Y., Feb. 27 1867. He studied at Yale (A.B. 1888), Berlin, and Paris. He at first taught mathematics at Yale; but in 1895 was made assistant professor of political economy, and in 1898 professor. He was editor of the *Yale Review*, 1896–1910. He served as chairman of many commissions dealing with public health, prohibition, and labour. An authority on money inflation, he proposed that the purchasing power of the dollar be stabilized (*see* DOLLAR STABILIZATION). His plan was to replace coined gold dollars by "gold bullion dollar certificates" which should command such weight of gold bullion as might legally be declared to constitute a dollar at that particular time. The weight of this ideal gold dollar would be adjusted at intervals in accordance with its power to purchase commodities as shown by the "index number" of prices.

His writings include: *Mathematical Investigations in the Theory of Value and Prices* (1892); *Elements of Geometry* (with A. W. Phillips, 1896); *A Brief Introduction to the Infinitesimal Calculus* (1897); *The Nature of Capital and Income* (1906); *The Rate of Interest* (1907); *National Vitality* (1909); *The Purchasing Power of Money* (1911); *Elementary Principles of Economics* (1913); *Why is the Dollar Shrinking?* (1914) and *Stabilizing the Dollar* (1919).

FISHER, JOHN ARBUTHNOT, 1ST BARON (1841–1920), British admiral (*see* 10.428), on relinquishing the office of First Sea Lord in Jan. 1910 remained in retirement until 1912, when he was appointed chairman of the royal commission on oil fuel. He was a firm believer in oil as fuel for the navy, with its corollary the internal combustion engine. He foresaw its effects on the design of war vessels, and the far-reaching tactical results to be derived from the employment of capital ships that would show no funnels or smoke, have immense sea-keeping powers, and be fuelled at sea from tankers.

After the outbreak of the World War, the retirement of Prince Louis of Battenberg, in Nov. 1914, from the post of First Sea Lord, led to Lord Fisher's being again installed in that office at the Admiralty. His presence was immediately felt in the dramatic and brilliant piece of strategy which resulted, under Adml. Sturdee, in the destruction of Adml. von Spee's squadron off the Falklands. Fisher then, with the coöperation and hearty support of Mr. Churchill, initiated a great building programme of cruisers, monitors, destroyers and small craft to the number of some 600 keels, pressing the American shipyards into the service, necessarily at an enormous cost. Everything had to be subordinated to haste, and in fact most of the craft were actually delivered within six months. Although primarily designed for a great strategic move into the Baltic, which Lord Fisher had himself drawn up in detail, this vast armada was gradually diverted from its original purpose to various other uses—among them the naval attempt to force the passage of the Dardanelles; and it was the War Council's decision to proceed with this that ultimately (May 1915) led to Lord Fisher's resignation of his post as First Sea Lord. In the following July he was appointed chairman of the Inventions Board, and in 1917 gave important evidence before the Dardanelles Commission. In 1919 he published two books—*Memories* and *Records*. These collections of unconventional and more or less fragmentary utterances taken down in shorthand inevitably suffer from a lack of sequence and coherence, and they are of little value as a guide to their author's actual achievements. After some months of illness Lord Fisher died on July 10 1920, his last public act being a press campaign in favour of economy. He was then in his eightieth year.

It was still difficult in 1921 to form a just estimate of the value to his country of Lord Fisher's long and arduous service. In some ways the results of his strenuous life were disappointing to himself and to those whom his strong and rugged personality impressed with a sense of almost superhuman genius and power; as well as to those, such as the journalists whom he knew well how to flatter, who took him exactly at his own valuation. It needed an experience like that of the late King Edward to see the weak and unprotected places in the strong man's armour, and to understand where what was fine in him needed support and protection. Like so many men in his service, Lord Fisher suffered from the disadvantages of an incomplete education—a defect not likely to be felt in actual fighting service, but apt to become more and more of a handicap as a man advances in his profession and deals with wider and more complex problems than those involved in merely technical developments. Lord Fisher was temperamentally as well as by training unable to make use of a staff, in the modern sense of that term; he thought alone, formulated his large but vague conceptions of war and strategy alone, and attempted practically alone to work them out—with inevitable results. It is remarkable that so powerful and in some ways attractive a personality neither produced any school nor influenced any notable group in the navy; and even of the men whom he selected and furthered, practically none except Lord Jellicoe came to great distinction or achieved any signal success. Many of the schemes with which his name is most closely associated—Osborne, the training of the engineering branch, the system of the "common entry" for example—proved failures and had to be abandoned or completely remodelled. Although he was sponsor while First Sea Lord for the Dreadnought principle of design, and for such infinitely important technical developments as water-tube boilers, turbines, etc., his theory that "speed is armour," as applied to North Sea warfare, proved to be dangerous, and the battle cruisers designed in accordance with it were to some extent at a disadvantage as a result of reliance on aphorism rather than on the logical and thought-out harmonization of means, conditions and end. Some of the more extreme examples of this class, still under construction on his retirement from the Admiralty, had to be abandoned or altered or adapted to other uses. On the other hand, in his large conceptions of warfare, in his prevision of the war with Germany and its date, in his concentration of the navy in the North Sea as a training ground, in his strategical strokes, such as the destruction of the von Spee squadron, and his conception of a Baltic campaign early in the war (never carried out), and in his untiring advocacy of an offensive policy (also overruled), Lord Fisher showed a true genius and grasp of the essentials of naval warfare which alone would make him a memorable figure in British history. His character was a combination of strength, ingenuity and simplicity; by some mysterious throwback he had, both physically and mentally, a strong oriental strain in his composition; and the Bible was his favourite and most familiar book. He read, however, not so much to educate and enlarge his mind, as to seek and find confirmation of his own views and conceptions of things. In that respect he was like a great artist, who assimilates everything in life that will contribute to the endorsement and magnification of his own genius, and rejects the rest. He was sometimes ruthless and violent in his methods, although rather less so than he would have the world believe; there were indeed veins of beauty and modesty in his character, and he came nearest to true greatness when he was most simple. His were a life and character essentially of the kind to provoke violent controversy and sharp divisions between his admirers and accusers; but when these have died away his figure will stand out, even among the strong men of his day, as that of an enemy to shams and pretences, to sloth and incompetency, and as a passionate lover and defender of his country. (F. Y.)

FITZMAURICE-KELLY, JAMES (1858–), English man of letters, was born at Glasgow June 20 1858. Educated at St. Charles's College, London, he became Taylorian lecturer in

Spanish at Oxford in 1902 and Gilmour professor of Spanish language and literature from 1909 to 1916, when he was transferred to London as Cervantes professor of Spanish language and literature to the university of London. This post he resigned in 1920. He became a fellow of the British Academy and corresponding member of the Royal Spanish Academy and other Spanish societies, and a Knight Commander of the Order of Alphonso XII. Amongst his publications are a *Life* of Cervantes (1892); an Introduction to the editio princeps of *Don Quixote* (1898–9); a *History of Spanish Literature* (1898); *Cervantes in England* (1905); *Cervantes and Shakespeare* (1916) and many other books and papers.

FLAMETHROWERS (Germ. *Flammenwerfer*).—The World War revived the old weapon of "liquid fire." No doubt, the use of incendiary projectiles and devices had never altogether vanished from modern warfare, but these have usually been employed for destruction of material rather than for effect on personnel, and we have to go back to the sieges of mediaeval times to find examples of the use of heat, as such, to repulse an enemy. The townspeople of a mediaeval city, having only massacre to expect if their walls were stormed, observed no limitations in their choice of weapons, and not only used incendiaries proper to destroy the besiegers' hoarding-work and catapults but also boiling oil against the bodies of the men. From time to time in modern history proposals have been made for flame-throwing devices, and one such was actually experimented with in Prussia about 1700. But until modern methods of storing a gas propellant under pressure came into being, anything in the nature of an effective flamethrower was impossible.

In reality therefore the flamethrower dates from experiments made in Germany a few years before the World War, when, no doubt in consequence of the trench warfare of Port Arthur, Richard Fiedler produced in 1906 a service model which was under experiment when the war broke out. Like other weapons of siegecraft this was brought into the field as soon as the nature of the fighting changed from open-field warfare to trench warfare. Already in the winter of 1914–5 they appeared sporadically on the western front, and they obtained their first striking success in the Bois d'Avocourt (Verdun) on Feb. 26 1915. It should be noted that the use of such weapons was not prohibited by the Hague Convention, save in so far as it might be called a weapon "calculated to cause unnecessary suffering"—a phrase which is susceptible of many interpretations. In this it differed from the gas warfare initiated at Ypres in April 1915, although by the accident of circumstances gas and flamethrowers have come to be associated in the popular mind.

When the German *Flammenwerfer* appeared it was considered essential both in France and in England to design weapons of this class at once; in England the question of their employment was reserved, but it was felt that the soldiers who were exposed to flame attack should, for reasons of *moral*, be made aware that similar devices were available on their own side. In France the military authorities proceeded without hesitation to the creation not only of the apparatus but of the units to work them. This difference in the way in which flamethrowers were regarded in the two chief Allied countries persisted to the end of the war. The French used them as constantly as the Germans, whereas in the British Army their employment on service was limited to a very few occasions in the battle of the Somme, and to the Zeebrugge attack of St. George's Day 1918. By the American Expeditionary Force they were not used at all, though the question of their employment was taken into consideration. In 1919 they figured largely in the local street-fighting by which the German Republic made good its authority.

The flamethrower essentially consists, in all designs, of (*a*) a container filled with some mixture of heavy and light oils; (*b*) a strong-walled vessel filled with air, nitrogen, CO_2, etc., under high pressure; and (*c*) a discharge tube with nozzle and in most cases an ignition device. Between (*a*) and (*b*) is a reducing valve, and between (*b*) and the nozzle a firing valve or trigger. When air or gas under high pressure is admitted into (*a*) from (*b*) it expels through (*c*) a powerful jet of oil, which when ignited (either at the nozzle or subsequently) becomes "liquid fire."

Flamethrowers are essentially short-range weapons, whose characteristic effect is to make an area untenable by living beings, by actual burning and also by heating the surrounding air to an intolerable temperature. This effect imposes, as a condition of their use, maximum range, not only because range as such is a desirable military quality but because the operators themselves must not be put out of action by their own weapon. Range, however, is difficult to obtain with a liquid jet. Even *in vacuo* such a jet with an initial velocity of 50 metres per second would not theoretically range to 300 yd., and, owing to the resistance of the air, the maximum range ever known to have been attained in practice was 134 yd. actual throw (with an experimental British type of heavy flamethrower). Beyond the actual range of the jet there is of course an area (which varies according to the conditions of the shoot) made momentarily untenable owing to the heating of the air, and this area extends laterally as well as forward. But the fact of limited range remains a constant drawback. It is especially pronounced with the light portable types, few of which outrange the hand-grenade.

Amongst the design factors influencing initial velocity and therefore range, two are of principal importance, the pressure of the gas propellant in the oil container and the loss of energy in the discharger pipe and nozzle. The first would seem, at first sight, to be limited only by the weight and strength of the containers—those of the gas "bottle" in the first instance and those of the oil container secondarily. But in practice the size of the nozzle orifice sets an upper limit to working pressure; if it is too small in proportion to the pressure the liquid, instead of being propelled in a consistent jet, is atomized and loses its forward energy very soon. But the larger the orifice the greater the quantity of liquid discharged per unit time. Hence, to obtain a long throw of any useful duration the flamethrower must be large, heavy and cumbrous. Conversely, when minimal weight is important, either range or duration must be sacrificed. Up to the limit thus fixed, of course, maximal pressure is aimed at in design, and it is found that, with modern materials and workmanship, gas bottles capable of standing the unreduced or storage pressure and oil containers able to endure the reduced or working pressure can be constructed within practicable weights.

The second important factor is loss of head, which varies with the length and smoothness of the internal surface of the discharge system, and is affected still more by the occurrence of abrupt bends and contractions in the piping or nozzle. A discharge system as straight, as short, and as large in bore as possible is therefore aimed at. But here again practical limits exist. In all heavy and medium and in most "knapsack" flamethrowers the position of the container has no relation to the axis of the jet. It is not, like a gun, pointed in the direction of the target, but is built in under cover or stood up on the ground or carried on a man's back, and aim is taken by pointing the nozzle only. Hence the most that can be done is to smooth out the angles of bend as much as possible and to diminish the length of piping to the strict minimum. Large bore is always desirable but not always attainable, since increased volume of oil per unit time means either increased dimensions for the oil container or diminished duration of action without reloading.

The dimensions of the nozzle itself, in this connexion, are important as affecting the form of the jet. Progressively, in its passage through the air, the solid vein of liquid breaks up into globules and loses its forward energy; the higher the initial velocity the longer this break-up is delayed, and velocity is, as we have seen, a function of working pressure and orifice dimensions. Moreover, the larger the vein itself the less surface it presents to disintegration by the air for a given volume; and the same reasoning excludes all cross-sections of the nozzle other than circular.

The oils employed varied, in the World War, according to available supplies, but were always in principle mixtures of heavy oil and light oil (petrol or benzol), the former for the sake of maintaining forward energy in the air (giving "sectional density" in ballistic language), the latter for ease of ignition. In winter the proportion of light oil was increased up to one-third in the French service.

The propellant gases used were also varied. Compressed air, being most readily available, was probably the most frequently employed. The Germans even tried compressed oxygen, a most dangerous expedient when nozzle-ignition is employed, as the mixture in the interior of the container is liable to detonate if a back flame from the jet reaches it.[1] This risk attaches also in a lesser degree to compressed air, and inert gases are always preferable. CO_2 has the disadvantage that it forms a deposit in the piping and so increases loss of head, and in the end nitrogen—either the pure product of chemical factories or a "deoxygenated air," produced in the field by a mobile plant—was generally accepted.

So far only the expulsion of the oil jet has been considered. Broadly, there are two forms of ignition. In the one the ground occupied by the enemy is sprayed with the unignited oil, and then fired by throwing on to it incendiary bombs or grenades. This is mechanically the simplest way, and it gives the most thorough effect, since all parts of the ground, even the floors of trenches, are set on fire. But the throwing of grenades on to the correct spot is a difficult matter, especially with the long-range heavy flamethrowers, and surprise effect—which, in the opinion of some, is the principal if not the only asset of the weapon—is entirely lost. The other method is to fix an igniter to the nozzle; this fires the jet at the outset, ensures surprise and moral effect, for the liquid-fire jet, with its roar, its heat, and heavy smoke intermingled with darting masses of flame, is a terrifying thing. On the other hand nozzle-ignition presents very difficult problems which have never been satisfactorily solved, and the actual burning effect is more local than is the case with the simpler method. On the whole nozzle ignition is to be preferred whenever a reasonably certain ignition device is available. The French made use of both methods, the Germans and British exclusively, or almost exclusively, of nozzle ignition. It was at one time supposed that the unignited jet ranged farther than the flaming jet, but this is not proved. French experiments indicate that what is lost in "sectional density" by igniting the jet is regained by the fact that the surrounding air, heated to a high temperature, offers a lessened resistance.

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[1] A very serious accident occurred on one occasion in England from this cause, an oxygen bottle having been accidentally substituted for an air bottle.

Ignition devices may be simple portfires (or even petrol-soaked wads) attached by hand to the nozzle and ignited before aim is taken, or more elaborate electrical and mechanical devices. In all cases they are required to ignite, not the oil itself, which emerges in too rigid a column to respond to the spark, but the film of petrol vapour which forms round the column. The spark must be emitted by the igniter as close as possible to the emerging jet without actually touching it. Moreover it must be protected against the wind. Further, the igniter must remain alight and in the correct position during the duration of the throw; this condition is very difficult to satisfy in the case of portable flamethrowers which operate by a succession of short, sharp jets controlled by a trigger, save by the clumsy expedient of a long-burning portfire. Amongst the many forms of ignition three may be specially mentioned:—

(*a*) A British pattern in which two sparking-plugs were mounted in a cup containing petrol, and fired by a magneto generator.

(*b*) A French type, giving the very long burning required for the successive shots of the portable flamethrowers by means of a tubular magazine fixed to the nozzle. In this magazine was a long stick of alumino-thermic composition, which was continually urged forward by a spring as its head burned away. Primary ignition of the portfire itself was by means of a cerium-steel "briquet."

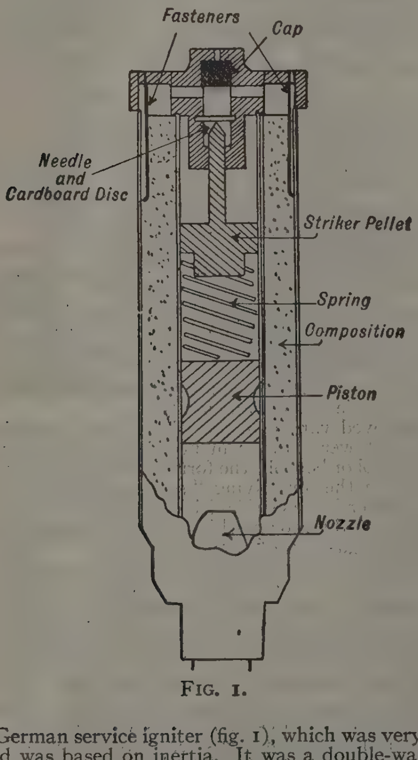

FIG. 1.

(*c*) The German service igniter (fig. 1), which was very ingeniously devised and was based on inertia. It was a double-walled cylinder attached to the nozzle-tube. The space between the inner and outer walls was filled with an alumino-thermic composition, open to the air at the top. Inside the hollow of the cylinder and in prolongation of the bore of the nozzle-tube were a piston, a spring, a striker-needle mounted on a pellet, and a cap with powder-relay. Between the cap and the striker-needle was a fixed disc of cardboard. On release the sudden impact of the jet on the piston compressed the spring and the striker against the cardboard disc, then after a moment the needle penetrated this disc, and the spring, decompressing itself, forced it on to the cap and so fired the powder relay that ignited the composition. The attachments which secured the striker, etc., in the bore of the cylinder were instantly burned through, and the jet, blowing out these obstructions, issued and was ignited by the burning composition as it emerged.

The types of flamethrower designed by the three belligerents were classified, broadly as heavy, medium or semi-portable, and portable. Those of the heavy class, built for range, all required fixed installations; medium types were simply smaller editions of the heavy types, kept down in weight so as to be able to follow up an advance without undue difficulty; while the portable weapons were without exception designed for use in the course of the attack itself, and especially for the "mopping-up" of captured trenches and for securing the flanks of a line of trenches during "consolidation." In reality, therefore, there are only two types, the heavy and the light, and these are technically very different.

Heavy Flamethrowers.—Of the various types of heavy flamethrower which were evolved in the war, the British show both the best ranging power and also perhaps the greatest variety, this latter being due to the fact that, officially, they never passed beyond the experimental stage into that of a "service store."

The first model to be tried was that designed by an American, Joseph Menchen, which was put before the War Office in March 1915. This was a very large apparatus, several containers being coupled up in series to a single pipe and nozzle, the latter being aimed from under cover by means of power derived from a by-pass on the air bottle (a complication subsequently abandoned). The intention of the branch of the War Office concerned (which subsequently became the Trench Warfare Department of the Ministry of Munitions) was to employ the apparatus not in trenches, for which it was evidently too cumbrous, but to mount it in a large armoured vehicle of the caterpillar class. Such a vehicle was built, concurrently with the first tanks but on a larger scale so as to be able to carry a big supply of oil for the flamethrower, which in the Menchen design had a range of 100 yards. This idea of the flamethrower-tank was, however, allowed to drop owing to a variety of causes, of which the principal were the dislike of the British G.H.Q. in France for flamethrowers generally, and the concentration of caterpillar-building resources at home on the gun-carrying tank. Experiment proceeded therefore on heavy types intended for trench warfare, and greater lightness and simplicity than was possible with the Menchen design was aimed at. Later in 1915 the Department produced a heavy flamethrower "battery" which embodied many of the features of the Menchen, and some of those of the Hersent apparatus which had been evolved in France. This "battery" is typical of the normal heavy flame-thrower.

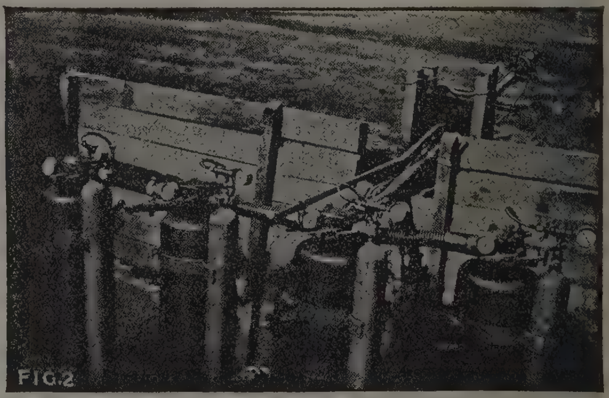
FIG.2

The "battery" (fig. 2) consisted of four vertical cylinders 16 in. in diameter and 48 in. high; on the top of each cylinder was a valve (controlled at first by a wheel and later by special mechanism) which was attached to a siphon tube in the interior of the container. The four valves were connected up in series by short lengths of flexible metallic tubing. The container communicated by a length of flexible tube with a rigid tube terminating in a nozzle; this discharge tube was mounted in the trench parapet behind a shield in such a way that the jet could be delivered in any direction and with any elevation. In the final container valve—*i.e.* that leading to the delivery piping—was mounted a trigger valve. On each container was strapped a gas bottle (compressed air, later nitrogen) containing 60 cub. ft. of gas compressed to 1,800 lb. per sq. inch. Between this and the oil container were interposed a reducing valve (to reduce the storage pressure to a working pressure of 250 lb. per sq. in.) and a pressure gauge. Each oil container, when filled about three-quarters full (as was the usual practice), held 25 gal. and weighed 180 lb. filled. Ignition was at the nozzle by means of the electric device above mentioned. The range of this model was about 90 yd. actual throw. This apparatus, modified in details, was operated on one or two occasions in very unsuitable conditions during the battle of the Somme 1916, and was then rejected by G.H.Q.[1] But before experiment was abandoned two important alterations were made. (*a*) The valves between the separate containers were done away with, and the freer flow of oil thereby obtained enabled a "record" range of 134 yd. to be reached. (*b*) The "director tube" built into the parapet was replaced by a so-called "monitor," a lazy-tongs device carrying a short, universal-jointed, nozzle-tube, which was raised above the parapet only during firing, the whole installation at other times being below ground in a dugout. Other improvements were made to facilitate assembly and taking down in trench conditions. On one occasion a complete "battery" of four containers and monitor was taken down, removed, reassembled, filled and fired in slightly less than 15 minutes by ten men. The container unit was also lightened.

French heavy flamethrowers were substantially of the same character as the British model just described, but simpler. They did not range quite so well. Storage pressure was somewhat higher, working pressure slightly lower than in the British engines. The unit container was shorter and wider, and of lower capacity; the "battery" usually consisted of three containers placed one behind the other and connected by coupling-pipes at an acute angle to a single collector-tube which carried the nozzle. As above mentioned nozzle ignition and ground ignition were both used.

The German *Grof* (*grosser Flammenwerfer*) was similar in capacity to the British "battery" type, but otherwise resembled the French.

A heavy flamethrower of an entirely different type was the Livens, designed by Capt. Livens, R.E. In this the containers were, so to speak, elongated until they took the form of a single long 9-inch pipe stowed horizontally in a deep dugout or gallery. In the pipe worked a floating piston which separated the gas and the oil positively. Along this pipe, at intervals, were placed refilling tanks, so arranged that at the conclusion of each shoot the pipe-container could be refilled with oil very quickly by power supplied from the main reservoir of propellant gas. In the model here described three shoots could be made, each of 80 gal., in four minutes. The propellant gas, stored in the usual bottles, was admitted to a welded reservoir which was tested to 1,800 lb. per sq. inch. This equalizing reservoir gave a powerful and steady drive at the relatively high working pressure of 325 lb. per sq. inch. At the end of the container pipe was a "monitor" or rising discharger, arranged on the principle of a hydraulic ram, worked by the oil itself. This rose through a hole in the roof of the dug-out, delivered its shot, and sank automatically when the oil which supported it was drained off below.

Portable Flamethrowers.—These were used to a far greater extent in the World War than were the heavier types. In most cases the container with the gas bottle strapped to it was carried on the man's back, and the discharger tube with nozzle carried in his hand, the two being connected by the usual flexible pipe. The necessary lightness was obtained of course by the sacrifice of ranging power, both quantity of oil and working pressure being lower (3 gal., and 140–170 lb. per sq. in. respectively in the French "Schilt" types).

The general principles were similar to those of the heavy flamethrowers, except in the method of release. Whereas in the heavy types a single long-ranging shot of great power is fired in one blast, in the light type—or at least in those light types designed after the requirement had been realized—a succession of very short spurts is arranged for by a quick-acting trigger-valve of some sort. This enables the user to move hither and thither, driving back now one party of the enemy, now another, or clearing several dugouts in succession without reloading. In earlier French patterns ignition was by incendiary grenades after a shot of unignited oil, but the tactical usefulness of this weapon, even more than that of the heavy type, suffers by this limitation, and in all later French models nozzle-ignition is fitted. Of these the Schilt "No. 3 bis" may be taken as representative (fig. 3). Its outstanding characteristic is the power of delivering very many short shots without reloading. The "record" is no less than 103, but such a figure can only be obtained at the expense of range, and the usual practice was to use up one filling in about 8 or 10 shots with a range of rather less than 30 metres. The ignition device is the "tubular magazine" mentioned earlier and burns for 8–9 minutes. The dimensions are: container 2 cm. thick, 35 cm. high and 20 cm. in diameter, tested to 427 lb. per sq. in. with a capacity 3 gallons. The gas is at a storage pressure of 2,133 lb. per sq. in., which a reducing valve converts to a working pressure 171 lb. per sq. inch. The trigger valve has to be held down in operation and instantly springs up and closes the passage of oil if the operator is shot—an important point, as experience had shown in the case of the earlier small flamethrowers, which emptied themselves in a single shot. A tap is also fitted, at the origin of the flexible tube, which is turned on in going into action. The flexible tube is about 2 ft. long, and ¾ in. in bore, the nozzle pipe also 2 ft. long with an orifice of $\frac{9}{32}$ inch. The total weight, full, is about 65 lb. Fig. 3 shows the apparatus in action. Like all French flamethrowers it was designed by Capt. Schilt of the Paris *sapeurs-pompiers*, who also organized the special flamethrower companies named after him.

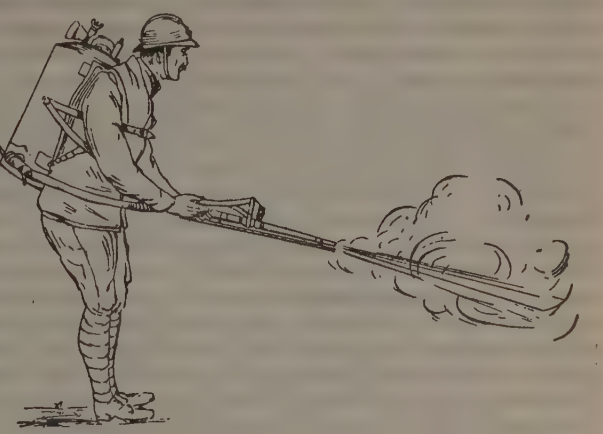

FIG. 3.

The original German light *Flammenwerfer*, known as *Kleif*, was a 3-gallon engine which presents no particular point of interest. It was replaced by a smaller weapon known as *Wex*, which had a capacity of 2¾ gal. and was fitted for successive shots. Both "*Kleif*" and "*Wex*" were operated by two men, one carrying the container knapsack-fashion while the other carried the discharge pipe and moved about as required.

The early British types known as the Norris, or Norris-Menchen, were of much the same general design as the Schilts; the first emptied themselves at one shot, the later ones had trigger valves. Another type, invented by Lt. Lawrence, R.E., and originally designed to throw either poison-gas or flame or both, was, after modification to convert it into a flamethrower pure and simple, found to possess a much longer range, as well as a better balance of the elements of the design than any existing model. Its range was no less than 45 yd., and it was capable of maintaining that range for some 15 to 18 shots from a single filling of 3 gallons. Safety was ensured by the use of inert gas and by the fact that if the operator lost control all valves automatically closed. This type was under manufacture in Russia in 1917 at the time of the Revolution. Experiments were also made in England with smaller models, some of which were used in the Zeebrugge landing in 1918. Finally, a flame projector was designed but never actually used, which acted in the same way as a land mine, *i.e.* it was buried and left to itself, inert, till the enemy in his advance stumbled upon a tripwire which set the machine in operation.

Tactical Uses.—Flamethrowers used in the World War were in all the three countries which employed them engineer weapons. In Great Britain those used on service were manned by a unit of the Special Brigade R.E. In France Capt. Schilt, the designer of the Schilt throwers in use, organized some seven companies of engineers known as *compagnies Schilt* for flamethrower work. In Germany it was the special province of a unit of pioneers which from small beginnings finally became the Guard Reserve Pioneer regiment, and lent its weapons and its men to the "assault battalions" as required. These battalions generally included in their attack formations a number of portable "Kleifs" or "Wexs." The G.R.P.R. also found heavy machines (two-coupled) and personnel for shell-hole warfare and anti-tank defence.

In reviewing, even generally, their tactical work in the war, and estimating their future potentialities, it is obvious that a clear distinction must be drawn between the heavy and the light types. The intermediates were, and so far as can be seen will always be, an unnecessary type possessing the defects without the virtues of the others.

Too little use was made in the war of true heavy types, such as the British "battery" and "Livens," for any final judgment to be passed on their usefulness. But it is evident that that usefulness will be confined to siege warfare, so far as ground installations are concerned. Quite apart from the necessity of burying the whole apparatus in shell-proof dugouts, the difficulty of supplying it with oil for constant use is considerable: eighty gallons of mixture with a specific gravity of ·8—the contents of a Livens tube weigh 640 lb. without the transport receptacle, and three shots can be fired in four minutes. Stated in this way the problem is the same as that of supplying an 11-in. howitzer emplaced in the foremost trench. The load can be brought up in smaller units, it is true, whereas a shell cannot be subdivided for transport. But it is nine times as bulky, and continuous supply would be as difficult in the one case as in the other. Another consideration is the material itself—in some conditions of warfare petrol and oil may be more precious than iron and steel. Thirty "Livens" machines on one mile of front would consume about 1,000 gal. of petrol (neglecting the oil) per minute of actual continued activity. Fifty-five minutes of this activity on one mile of front would consume as much essence as the whole fleet of lorries belonging to the French Army consumed in a day during the winter of 1917–8. Evidently then the heavy flame projector if used at all will only be used in situations and tasks for which no more economical and handy weapon is available. The question is—do such situations exist? And the answer is evidently that, even if they do exist, they are not found on any considerable frontage at the same time. And so we find that the utility of the immobile heavy flamethrower is restricted to certain points and certain circumstances, such as may here and there be found (but not necessarily foreseen) in siege warfare. Any future that the heavy flame projector may possess in field warfare, or even in large-scale trench warfare, then, will depend on its being made mobile, *i.e.* on its being mounted in a tank.

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[1] The available sets were handed over to Russia, a company of escaped Russian prisoners of war being formed and trained in England to handle them. No use was apparently made either of the apparatus or the trained men, owing to the Revolution.

The portable flamethrower, on the contrary, found many occasions of useful employment in varied conditions during the World War. Amongst its rôles were: surprise attack following a stealthy approach, to enable an infantry attack to debouch from trenches; "mopping-up," *i.e.* clearing a captured trench system of isolated but still dangerous parties of the enemy while the main attack presses on; blocking the flanks of a captured length of trench; forcing the surrender of enemy parties which have taken refuge in dugouts (perhaps the most frequent, if not the principal rôle in trench-warfare offensives); holding off close attack upon a party withdrawing, *e.g.* after a raid; engaging a strong point frontally while infantry work round the flanks. This catalogue shows the variety of functions which may be and have been carried out by small flamethrowers. It will be noticed that many of these rôles are by no means peculiar to trench warfare, and also that nearly all presuppose close coöperation with small bodies of infantry, the tactical units of the future. It is too much to say that the flamethrower is indispensable in the performance of the average battle task of modern infantry, but it is, on occasion, undeniably more useful than other close-range auxiliaries of the infantryman. Its main handicap is the difficulty of maintaining oil supply in an advance of great depth. This is serious, and may restrict it to employment in the methodical attack and defence of fortified regions. (C. F. A.)

FLECKER, JAMES ELROY (1884–1915), British poet, was born at Lewisham Nov. 5 1884, the son of the Rev. W. H. Flecker, D.D., afterwards headmaster of Dean Close school at Cheltenham. He was educated at Uppingham and Trinity College, Oxford, proceeding later to Caius College, Cambridge, where he studied oriental languages for two years before entering the consular service. He was sent to Constantinople in 1910 and to Beyrout in 1911. There he married a Greek lady. But his health failed early and he died at Davos Platz, Switz., Jan. 3 1915. His poetic output, though small, was choice, showing much affinity with the French Parnassien school, as well as with Swinburne and Francis Thompson. During his lifetime he published four small volumes of poetry; one more and two privately printed volumes appeared after his death, and his *Collected Poems*, with an introduction by J. C. Squire, were published in 1916. He also left two unpublished dramas, *Hassan* and *Don Juan*. A short satire, *The Last Generation* (1908), and a novel, *The King of Alsander* (1914), were his only important prose works.

FLEMING, SIR SANDFORD (1827–1915), Canadian engineer and publicist (*see* 10.494), died at Halifax, N.S., July 22 1915.

FLINT, ROBERT (1838–1910), Scottish divine and philosopher (*see* 10.521), died at Edinburgh Nov. 25 1910.

FLORIDA (*see* 10.540).—The pop. of the state in 1920 was 968,470 as compared with 752,619 in 1910, a gain of 215,851 or 28·7% for the decade. There were 17 cities with a pop. of over 5,000; those exceeding 10,000 with their proportional gain for the decade were:—

	1920	1910	Increase %
Jacksonville	91,558	57,699	58·7
Tampa	51,608	37,782	36·6
Pensacola	31,035	22,982	35·0
Miami	29,571	5,471	440·5
Key West	19,945	18,749	6·0
St. Petersburg	14,237	4,127	245·0

Despite a comparatively rapid growth of its cities and towns the pop. of the state was still predominantly rural. The urban pop. (those living in cities and towns of over 2,500 inhabitants) numbered 355,825 in 1920, 36·7% of the whole, as contrasted with 219,080 or 29·1% in 1910. This gave Florida the largest proportion of urban population of any southern state. During the winter months the population was each year largely augmented by thousands of tourists and winter residents. The E.-coast and Gulf-coast resorts were the chief objectives, but many of the inland towns and cities were beginning to attract visitors. In 1916 the Baptists were numerically the strongest denomination, with a membership of 131,107; the Methodists second, with 114,821; followed by the Roman Catholics, 24,650; Episcopalians, 10,399; Presbyterians, 10,170; and Congregationalists, 2,878.

Industries and Commerce.—Florida's most extensive industry is agriculture. According to figures of the Florida Experiment Station there were approximately 6,000,000 ac. of land in farms in 1920, not including open or fenced range lands. Of this, 1,700,000 ac. were in crops and 200,000 ac. of crop lands were idle; 180,000 ac. were in fruit; 1,120,000 ac. were in pasture; and 2,800,000 ac. in woodland. On approximately one-third of the cultivated acreage crops were produced by intertillage (the growing of two or more crops on the same land at one time) and by succession planting (where two or more crops follow each other on the same land during the year). The number of farms in Florida in 1910 was 50,016; in 1920, according to preliminary figures of the U.S. census, 54,006. Fruit was the most important crop. By the practical eradication of citrus canker, and the control of the white fly, through the vigorous campaign that has been waged against these enemies of citrus growth under the direction of the State Plant Board, the citrus industry has been greatly benefited and has prospered despite the fact that some of the groves in the more northern parts of the state have suffered by several severe winters. In 1920 the production of oranges was 8,500,000 boxes valued at $18,700,000, and of grape fruit 5,000,000 boxes valued at $10,000,000. In the sub-tropical part of the state pineapples, lemons, guavas, and avocadoes were grown profitably on a commercial scale. Other fruits were peaches, pears, bananas, grapes, figs, and limes. Other crops produced in Florida, with their 1920 yields and values were:—

Crop	Quantity	Value
Indian corn (bus.)	10,530,000	$10,530,000
Oats (bus.)	1,020,000	612,000
Hay (tons)	132,000	2,508,000
Wild hay (tons)	20,000	500,000
Peanuts (bus.)	3,220,000	4,798,000
Rice (bus.)	72,000	126,000
Irish potatoes (bus.)	2,625,000	5,250,000
Sweet potatoes (bus.)	4,275,000	5,130,000
Sorghum syrup (gal.)	84,000	840,000
Sugar-cane syrup (gal.)	6,110,000	6,000,000
Cowpeas (bus.)	184,000	506,000
Velvet beans (bus.)	1,300,000	2,500,000
Cotton (bales)	18,000	1,530,000
Tobacco (lb.)	4,620,000	2,218,000
Pecans (lb.)	3,000,000	1,250,000

The encroachments of the boll weevil and the scarcity of farm labour, together with the unsettled condition of the cotton market, caused a falling off in the production of cotton during the decade 1910–20, and in many sections where cotton used to be raised it is no longer planted. The tobacco-growing section of western Florida produces profitably a shaded leaf, grown from Cuban and Sumatran seed, which is in great demand in cigar manufacturing. The pecan industry is comparatively new, most of the commercial groves having been planted since 1905. It is believed that in the northern part of the state, the pecan crop soon may compete closely with the citrus crop of the southern part of the state. The open winters and light soil of Florida make many of its counties well adapted to the production of early vegetables for the northern markets. The industry is developing rapidly and the Florida producer can put vegetables on the northern markets earlier than any of his competitors. The chief obstacle in the way of further development of this industry is costly rates and inadequate railway freight service. The latest available figures on truck production, for the season of 1917–8, the trucking season being the winter, spring and early summer months, are given by the Florida Commissioner of Agriculture as follows:—

Crops	Ac.	Crates	Value
Onions	1,155	94,489	$ 175,539
Lettuce	2,683	747,346	518,874
Celery	1,661	854,298	798,161
Peppers	8,039	845,213	1,363,264
Irish potatoes . . .	38,596	4,552,465	4,403,361
Cabbage	10,253	1,032,379	1,358,633
Tomatoes	21,186	2,852,426	6,287,557
Squashes	596	82,543	124,716
Egg-plant . . .	1,616	358,737	596,336
Cucumbers . . .	2,497	350,516	497,615
Watermelons (cars) . .	7,558	2,773	494,636
Beets	380	73,571	105,391
String Beans . . .	8,006	1,360,136	1,933,578

In Florida much attention is paid to stock-raising. During the decade 1910–20 there has been a consistent grading up of both beef and dairy herds. Especially is this true of dairy herds, the average value of milch cows being more than five times as much in 1921 as in 1910. The live stock in Jan. 1920 was: horses, 60,000 valued at $8,400,000; mules, 40,000 valued at $7,840,000; milch cows, 156,000 valued at $11,232,000; cattle other than milch cows, 945,000 valued at $25,798,000; sheep 95,000 valued at $494,000; swine, 1,588,000 valued at $20,644,000; a total for all stock of 2,884,000 head with a total valuation of $74,408,000.

In 1916 the total value of minerals produced in the state was $5,859,821, the more important of which were phosphates, lime, limestone, brick, tile, and fuller's earth, of which latter Florida produced in that year more than three-fourths of the entire output of the United States. Phosphate production according to the last available figures in the Ninth Annual Report of the Florida Geological Survey was, in long tons:—

	1913	1916
Pebble		
Exported	887,398	172,427
For use in U.S.	1,168,084	1,296,331
Total	2,055,482	1,468,758
Hard Rock		
Exported	476,898	28,045
For use in U.S.	12,896	19,042
Total	489,794	47,087
Grand Total	2,545,276	1,515,845

The total mineral production for 1919 was put by the State Geological Survey at a valuation of $10,603,620.

In 1916 the output of lumber was 1,425,000,000 ft., in 1918 950,000,000 ft. In 1918 Florida stood second in the production of cypress with a total of 85,376,000 ft., and sixth in production of yellow pine with a total of 765,912,000 ft. The high prices of lumber during most of the decade 1910–20 made this industry highly profitable. Naval stores are produced from the pine forests, where the sap of the trees is collected and distilled, yielding turpentine and rosin. In 1905 Florida's naval stores were valued at $9,901,905. In 1917 there was a production of 8,824,295 gal. of turpentine valued at $13,018,447, and of 414,226 bar. of rosin valued at $3,260,107, or a total valuation for naval stores of $16,278,554. The manufacture of cigars and, to a much smaller extent, cigarettes is carried on chiefly in Tampa and Key West. In 1905 the gross value of production was $16,764,276. In 1917 Florida produced 469,301,042 cigars valued at $30,127,941 and 7,800,000 cigarettes valued at $154,000. A rapidly growing Florida manufacture is the production of commercial fertilizers, large amounts of phosphate mined within the state being used for this purpose.

History.—The outbreak of the World War in 1914 interrupted two of Florida's more important exports to Europe, naval stores and phosphates, thus creating a temporary business depression. In the naval stores industry the recovery was comparatively rapid, owing to the high prices of and increased domestic demand for the products during the period of the war, with the exception of its early months. The phosphate industry was more seriously affected, as Germany had been a large purchaser of Florida phosphates. Many of the Florida phosphate mines closed down, to resume operation only after the signing of the Armistice.

The political history of the state during the decade 1910–20 was uneventful. The question of prohibition played a large part in state politics until the ratification of the Eighteenth (Prohibition) Amendment to the Federal Constitution by the Florida Legislature Dec. 14 1918. Since 1876 Florida has been uniformly democratic and, except in 1916, when a contested primary election in the democratic party resulted in the nomination of Sidney J. Catts as a prohibitionist and in his election as governor, all of the state's executives have been democrats. The governors after 1910 were: Albert W. Gilchrist, 1909–13; Park Trammell, 1913–7; Sidney J. Catts, 1917–21; and Cary A. Hardee from 1921.

A proposed constitutional amendment to effect reapportionment was passed by the Legislature in 1921, to become operative if voted on favourably in Nov. 1922. This measure would give more adequate representation to parts of Florida that have increased greatly in population. Several new counties have been created since 1910. From territory taken from De Soto co. the four new counties of Glades, Hardee, Highlands, and Charlotte have been formed; Lafayette co. has been divided, the southern part to be known as Dixie; Hillsborough's western part has become Pinellas co.; Flagler co. has been formed from the northern territory of Volusia and the southern part of St. John's; parts of Palm Beach and Dade have been joined to create Broward; the western part of Walton and eastern part of Santa Rosa have been combined under the name of Okaloosa; part of Bradford has been made into Union; part of Manatee into Sarasota; parts of Washington and Walton have become Bay; parts of Osceola, St. Lucie and Palm Beach are now known as Okeechobee; and from the northern part of Orange Seminole has been created.

Florida furnished 42,301 soldiers, sailors and marines for the World War and the casualties among them were 1,171, including 467 dead. The state's subscriptions to the Liberty and Victory loans were: First Liberty Loan, $5,271,000; Second $8,611,000; Third $18,053,900; Fourth $27,538,100; Victory Loan, $17,918,100—the total for the five being $77,392,100. (J. M. L.)

FLYING CORPS.—Aviation, as a military service, took new organized forms during the World War, and its development in this respect is dealt with in the following pages; the art of flying itself is treated under AERONAUTICS. At the present time, the general name of "Air Force" has come into official use to cover the different forms of organized military and naval aviation, but earlier in the World War the usual term was "Flying Corps." The development of the British air forces will be treated here first.

I. MILITARY AVIATION.—The first official appearance of any form of aircraft as part of the British army (for the navy, see later) was in 1878, when a Royal Engineers balloon equipment store was established at Woolwich Arsenal. In the following years, besides practice in manœuvres (both field and siege), experimental work was carried on at Woolwich, and later at Chatham, in the direction of getting a better gas, a more suitable fabric for the envelope, and more adequate means of filling the balloons than existed at the time. The question of transport for balloons was also carefully gone into. As a result of this decision a small factory, depot and school of instruction were started at Chatham in 1883. In 1884 it was decided to include a balloon detachment among the R.E. units mobilized for service in Bechuanaland and in the following year a similar detachment was sent on service in the Soudan. In 1890 the balloon section was recognized as an individual unit of the R.E.; the factory and the school were moved to Aldershot, the depot remaining at Chatham. At this time its strength was 33 all ranks.

Up to the beginning of the S. African War of 1899–1902 the organization of the balloon section remained the same. On the outbreak of that war it was decided to send balloons to S. Africa, and three sections in all went out.

In 1902 the first British airship, "Nulli Secundus," was commenced at the balloon factory, which also continued research into man-lifting kites, photography, signalling between ground and balloons, petrol motors, elongated balloons and mechanical hauling apparatus. In 1905 the balloon factory was moved to S. Farnborough, and experiments were carried out at Gibraltar with a view to seeing to what extent balloons could be utilized in spotting submarines and mines.

The growing importance of aeronautics was signalized in Oct. 1908 by the appointment of an appropriate standing sub-committee of the Committee of Imperial Defence. This committee reported in Jan. 1909 in favour of a small expenditure being authorized for building a rigid airship for the navy, and experimenting on non-dirigibles for the army, but recommended discontinuance by the balloon establishment of its experiments with aeroplanes for progress in which it would be better to rely on private enterprise. In April 1909 the "Advisory Committee for Aeronautics" was appointed under the presidency of Lord Rayleigh to advise on questions relating to the science of aeronautics, to arrange when necessary for experimental work at the National Physical Laboratory and generally to advance the practical application of the science.

In Oct. 1909 the balloon factory and balloon school at S. Farnborough, which had hitherto been under one control, were separated, a commandant of the school and superintendent of the factory being appointed. The next step of any importance was the formation in 1911 of the Air Battalion R.E. This Air Battalion absorbed the existing elements of the balloon section, and consisted of a headquarters and two companies, No. 1 (airship and kite) and No. 2 (aeroplane), the latter being the first heavier-than-air unit to form part of the British army. The expansion of the Air Battalion on mobilization was provided for by the selection of officers of the regular army to form the Air Battalion Reserve.

At this time there were less than 12 efficient aeroplanes and two small airships for both naval and military requirements, while France had 250 aeroplanes and several airships, and Germany had 20 to 30 military aeroplanes and about 20 airships. Towards the end of 1911, therefore, it was realized that the rapid development of aeronautics abroad rendered necessary further study of the possibilities of aviation in its relation to Imperial Defence, and on Nov. 18 1911 the Prime Minister requested an air sub-committee of the Committee of the Imperial Defence to consider the question. This sub-committee delegated to a technical sub-committee the task of drawing up a scheme. Its main recommendations, accepted by the air sub-committee and finally by the Committee of Imperial Defence and the Government, were as follows:—

(*a*) That the British air service should be regarded as one, and called the "Flying Corps." This corps to provide the personnel necessary for naval and military wings, for the Central Flying School and for a Flying Corps Reserve. (*b*) That the Central Flying School should be established on Salisbury Plain at the joint expense of the Admiralty and the War Office, but administered by the latter. (*c*) That after graduating as pilots at the Central Flying School officers should go for further instruction to the Naval Flying School at Eastchurch, or to a military squadron as the case might be, or else pass into the reserve of the Flying Corps.

The technical sub-committee also recommended that the technical requirements for both wings of the Flying Corps should be provided by the army aircraft factory, which should henceforth be known as the "Aircraft Factory." This aircraft factory, which was the direct descendant of the balloon factory, and out of which was eventually evolved the Royal Aircraft Establishment, should be charged with the higher training of mechanics for the Flying Corps, the repair of engines and machines, research and experiment.

Further, it was recommended that in order to secure close collaboration between the naval and military wings, the Central Flying School, the aircraft factory and the Advisory Committee on Aeronautics, a permanent air sub-committee of the Committee of Imperial Defence should be constituted under the chairmanship of the Under-Secretary of State for War, and having as its members the senior officers of the corps and the factory, with War Office and Admiralty representatives.

With regard to the supply of personnel for the Flying Corps, the technical sub-committee recommended that its officers should be exclusively graduates of the Central Flying School, the supply being from either the navy or the army or by direct entry from civil life. After graduating, officers should serve continuously for four years in the Flying Corps with the naval wing, military wing, on the permanent staff of the Central Flying School or the Flying Corps Reserve. The Flying Corps Reserve to consist of personnel only, and to be divided into two classes:—(*a*) those who were required to keep themselves in flying practice; (*b*) others not under this obligation. The first were to receive a retaining fee.

It was estimated that the navy would require 40 officers trained as pilots per annum. As regards the military wing, the seven aeroplane squadrons considered necessary for the Expeditionary Force would require a total of 182 officer pilots and 182 N.C.O. pilots. Assuming four years of active flying work as the limit for the average individual and adding 25% for casualties, failures, etc., the number eventually to be passed through the Central Flying School per annum would be about 164. In addition it was recommended that 15 civilians should be trained annually as pilots and passed into the Reserve.

With regard to the naval wing of the R.F.C., the technical sub-committee recommended that after being at the Central Flying School officers should then pass on to Eastchurch for further training in the special forms of naval aeronautics. It was, incidentally, further recommended that in view of the great cost involved it was not considered advisable to build rigid airships.

As regards the military wing of the Flying Corps, it was recommended that it should comprise all branches of military aeronautics, including aeroplanes, airships and kites, and should accordingly absorb the existing Air Battalion of the R.E. For an expeditionary force of six divisions and one cavalry division it was estimated that one headquarters, seven aeroplane squadrons of 12 machines each, one airship and kite squadron and one line-of-communication workshop would be required. The organization of a squadron was to be headquarters (seven officers, 17 other ranks), and three flights of four machines each (each flight consisting of four officers and 46 other ranks).

On May 13 1912 the R.F.C. was inaugurated. The programme adopted for its development, apart from a few alterations in detail, was on the lines recommended by the technical sub-committee. The first two squadrons to be formed of the military wing were Nos. 1 and 3. The former was No. 1 (Airship) Co. of the Air Battalion. It had on charge two airships, "Beta" and "Gamma," the "Delta," "Zeta" and "Eta" being added subsequently, as well as man-lifting kites and free balloons for training. No. 3 Squadron was formed from No. 2 (Aeroplane) Co. of the Air Battalion. Later in 1912 Nos. 2 and 4 squadrons were formed,[1] and in June the Central Flying School opened at Upavon. Wing headquarters and the line-of-communication R.F.C. workshop (later known as the Flying Depot and then as the Aircraft Park) were located at S. Farnborough. The naval airship service, which had been constituted in connexion with naval airships experiments in 1909 and disbanded in 1912, was re-raised and attached to No. 1 Airship Squadron.

Considerable progress was made in 1913 both in organization and otherwise, and at the end of the year 92 officers were serving with the military wing, 25 officers in the reserve and 22 in the special reserve. Other ranks totalled 999. The approximate strength of the naval wing was 125 officers, including warrant officers, and 500 men. The annual report of the Central Flying School showed that 28 naval and 69 military officers had passed out, and 14 N.C.O.'s. had obtained 2nd-class pilot certificates. Experiments with machine-guns mounted on aeroplanes were made during 1913 by the military wing, and the aeroplane inspection department was formed at S. Farnborough.

A sub-committee of the Committee of Imperial Defence, appointed in 1913 to consider the control of aircraft in peace and war, recommended that the Aerial Navigation Act of 1911 should be amended so as to give power to requisition aircraft in time of war, and that the commandant of the Central Flying School should keep a register of privately owned aircraft. The Aerial Navigation Act of Feb. 1913 amended the previous Act in accordance with these recommendations. It was also laid down that one of the conditions in qualifying for the Royal Aero Club certificate should be an obligation to serve in any branch of the R.F.C. in time of war.

In Sept. 1913 a directorate of military aeronautics was formed at the War Office. It was to be an entirely self-contained department, and its head had direct access to the Secretary of State. It was charged with the general administration of the Army Air Service, and was made responsible for all work in connexion with the personnel and equipment of the Central Flying School, the military wing and the Royal Aircraft Factory.

In Jan. 1914 it was decided that in war each squadron should have 12 active and three reserve aeroplanes, and the flying depot 21 reserve machines. In peace, squadrons were to have 21 aeroplanes and the flying depot 28. The airship material of No. 1 Squadron was handed over to the Admiralty, who became responsible for all lighter-than-air craft, and the squadron was re-formed as an aeroplane squadron.

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[1] No. 5 was formed in 1913 and Nos. 6 and 7 in the first half of 1914.

Development during the World War.—The directorate of military aeronautics had, prior to the outbreak of war in Aug. 1914, drawn up a mobilization scheme providing for the dispatch overseas of 4 squadrons and the retention in England of 2 squadrons. The register of civilian pilots and privately owned machines had also been drawn up. All the existing squadrons were short of pilots, though nearly up to establishment in N.C.O.'s and men. The Central Flying School had been formed on a scale calculated gradually to build up the establishment of the naval and military wings that had been laid down, and was not capable of meeting at short notice the requirements that arose out of the emergency. Even the mobilization of four squadrons, therefore, was rather more than the existing resources of machines and pilots justified, and it became necessary to draw upon the Reserve and the Central Flying School.

On Aug. 3, when mobilization commenced, Maj.-Gen. David Handerson, director of military aeronautics at the War Office, was appointed general officer commanding the R.F.C., with the Expeditionary Force, and Maj. W. S. Brancker took over the War Office work as assistant director.

On Aug. 13 and 15, Nos. 2, 3, 4, and 5 Squadrons (less one flight of No. 4 left behind for Home Defence), flew from Dover to Amiens, followed by R.F.C. headquarters, the mechanics and transport of the squadrons, and the Aircraft Park, proceeding by boat and train. The Park was established at Amiens.[1]

The three main problems confronting the military aeronautics directorate at the War Office, after the departure of the Expeditionary Force, were (*a*) the training of pilots, (*b*) provision of skilled other ranks, (*c*) manufacture of aeroplanes and engines.

With regard to (*c*), coördination between the military aeronautics directorate and the Air Department of the Admiralty had hitherto been regulated by the air committee of the Committee of Imperial Defence; but on the outbreak of war the other preoccupations of its members led to a complete cessation of its functions and no controlling influence remained to balance the claims of the two wings.

With regard to (*a*) and (*b*), the existing organization provided for no expansions on the scale to be expected in the near future, and, with the exception of the Central Flying School, which had already been seriously depleted in both personnel and equipment, Farnborough was the only station in commission. No. 1 (Reserve) Aeroplane Squadron was formed at Farnborough and undertook the training of pilots. The number of mechanics was short, and skilled civilians were enlisted direct into the R.F.C. At the end of Sept. 1914 some pilots were sent home from France in order to reënforce the instructional resources at home, the demand for the replacement of wastage and for forming new squadrons promising to become heavy in the near future. The policy of expansion adopted was for the formation of as many reserve squadrons as the personnel permitted, and for each reserve squadron, in addition to training pilots *ab initio*, to be responsible for producing the nucleus of a service squadron.

By Oct. 1914 the scheme for the organization of the new armies had been drawn up by the War Office, and since experience in the field had made one artillery observation squadron per division a basis for estimating requirements, with, in addition, two or three fighting and reconnaissance squadrons per corps, it thus early became apparent that eventually at least 60 service squadrons would be required by the B.E.F. The question of long-distance bombing raids into Germany was not overlooked, but the urgency of the army's needs for coöperating units was such that their provision was for the time of primary importance and detailed consideration of an aerial offensive was postponed.

With the gradual increase in the number of units both at home and in the field, the need for decentralization became apparent, and led to the adoption of the "Wing" as an intermediate organization between the squadron and headquarters. Further, it was found in France that the tactical employment of aircraft suffered through their being controlled directly by G.H.Q. instead of being allotted permanently to subordinate commands. Accordingly, in Nov. 1914 wings were formed, and this reorganization of the R.F.C. (headquarters and squadrons) in the field synchronized with that of the higher army commands, the 1st Wing being allotted to the I. Army, and the 2nd Wing to the II. Army. It was laid down at the time that wings would be allotted to certain areas and would coöperate with units in that area. Special missions and strategical reconnaissances would be ordered by R.F.C. headquarters.

At home in the meantime the formation of No. 1 and No. 7 Squadrons (temporarily held up in order that all efforts might be concentrated on preparing No. 6 Squadron for overseas) was being proceeded with, the two squadrons being moved a little later to Netheravon, where a school had been started as an annex to the Central Flying School. The formation of other squadrons and reserve squadrons soon followed.

In France, during the opening months of 1915, the scope of R.F.C. activities rapidly extended, and the demands made on it for bombing, photography, message-dropping and artillery observation increased. Accordingly, a 3rd Wing was formed (March 1) and the number of squadrons in each wing was increased to three, a decision that led to the formation, in France, of No. 16 Squadron and the dispatch from England of Nos. 1, 7 and 8 Squadrons (March–April 1915). These increases necessitated a corresponding extension to the Aircraft Park. In Jan. 1915, an establishment of 50 squadrons was sanctioned. At the end of July a programme of development was drafted providing for the raising of 30 service squadrons and 10 reserve squadrons by Jan. 1 1916, and another 30 service squadrons with five reserve squadrons Dec. 1 1916. This development programme was based essentially upon what were considered the army's requirements in aircraft, the scale adopted being one squadron per corps for artillery observation and photography, one squadron for each army and one squadron for G.H.Q.

By this time aerial fighting had become general, and aircraft were armed so as to enable reconnaissance and artillery observation machines to protect themselves. After some experience it became evident that pure fighting machines would be required and that upon their ascendency over the enemy would depend command of the air and consequently the freedom from hostile interference so necessary for artillery machines to function efficiently. The machine that proved itself to have the last word in aerial combat was the fast, easily manœuvred fighting scout, which though designed for scouting ultimately developed into the modern fighting machine.

It was not, however, until early in 1916 that the policy of having scout squadrons was generally adopted,[2] the practice up to then having been to allot a few scouts to each squadron. Thus it was that at the time of the drafting of the 1915 programme the two-seater machine largely predominated.

In Aug. 1915, it was decided that the increase in the number of wings (the 6th Wing being now formed, and the 7th and 8th following in Nov.) demanded the institution of a higher intermediate formation, and in Sept. the brigade organization was adopted under this. Each brigade, commanded by a brigadier-general, was to consist of three wings and one Aircraft Park—the R.F.C. then in the field forming the 1st Brigade. The 2nd Brigade comprised the 4th, 5th and 6th Wings and the independent stations of Montrose and Brooklands. Under the Administrative Wing were placed the units at Farnborough and Northolt. A school of aerial gunnery was also opened at Dover (subsequently moved to Hythe) and the Aircraft Park organization was recast.

A school and officers' depot (subsequently known as the School of Military Aeronautics) was started in Nov. at Reading where officers joining the R.F.C. could be put through a course in engines, rigging, artillery coöperation, map reading, signalling, etc., before joining a reserve squadron for instruction in flying. A wireless telegraphy school was also formed at Brooklands.

Towards the end of 1915 it was decided to increase the strength of the R.F.C. in France so as to have one brigade or two wings with each army, and in addition to have one or two wings with G.H.Q. One of the wings in each brigade to be entrusted with close reconnaissance, photography and artillery work with corps and divisions, the strength of the wing being calculated at one squadron per corps, whilst the other wing would be available as required by the army commander for bombing, reconnaissance and patrol operation. This involved an establishment for the R.F.C. of 70 service squadrons and 20 reserve squadrons, which besides training pilots functioned as draft-producing units.

At the end of Jan. 1916, the brigade organization took definite shape in France, with the 1st, 2nd and 3rd units as "corps wings" and the 10th, 11th and 12th Wings as "army wings."

The question of home defence against aerial attack now became of primary importance. Up to Jan. 1916, a certain number of aeroplanes and pilots had been allotted to Home Defence, but on the War Office taking over the responsibility for anti-aircraft defence from the Admiralty in Feb. 1916, a definite Home Defence organization was adopted. At first some 25 B.E.C.2. aeroplanes were allotted to the defence of London, but were scattered about in small detachments and placed under officers commanding various reserve squadrons. As this was found unsatisfactory, all the detachments were placed under a single officer, whose headquarters were at Hounslow. As further development became necessary certain squadrons were converted into Home Defence Squadrons. In April a new Home Defence Squadron was constituted out of various detachments employed on Home Defence duties, and in June the Home Defence wing was formed to include all Home Defence units. This wing was attached to G.H.Q. Great Britain for operations. The two brigades at home were merged into one, this brigade being known as the 6th Brigade and later as the Training Brigade. It was also decided to raise the number of aeroplanes in each squadron from 12 to 18. This increase was to a large extent due to improvements in wireless telegraphy which enabled a larger number of machines to work on a given front. Subsequently, Fighter Reconnaissance (Army) Squadrons were raised to 24 machines per squadron.

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[1] On Oct. 7 eight machines of No. 6 Squadron flew to Bruges to take part in the operations of the 7th Division. By the 16th of the month, however, this squadron had withdrawn S. and had come under the orders of R.F.C. headquarters.

[2] No. 24 Squadron with De Haviland Scouts was the first of this type to go overseas on Feb. 6 1916.

It may be interesting here to examine the factors that tended to influence the policy that governed development as the war went on. It was out of events in France that these governing factors arose, and the requirements formulated by R.F.C. headquarters set the standard which those at home strove to reach. The scale that was adopted in the summer of 1915 provided for one squadron per corps for artillery observation, close reconnaissance, and photography; one squadron for each army headquarters and one squadron (to be later increased to two) for G.H.Q. for extended reconnaissance and special missions. The War Office accordingly committed itself at the time to providing 27 squadrons by the end of March 1916, but events in the field led to a request that this number should be increased by two artillery observation, one long-distance reconnaissance squadron and two fighting squadrons (one of single-seater machines and one of two-seaters). In June 1916, a revised schedule of anticipated requirements for the spring of 1917 was prepared, based upon the increase of the B.E.F. to five armies of four corps each and the growing importance of aerial fighting. This scheme, which provided for 66 squadrons (including 23 artillery and 20 fighter squadrons, with five night-flying squadrons and later 10 long-distance bombers, as well as two medium-distance bombers and four fighter squadrons under G.H.Q.), marked the growing importance of the fighter, a conception of an offensive into the enemy's country by means of long-distance bombers, and a break-away from the idea that close coöperation with other fighting forces was the beginning and the end of aerial operations.

By the middle of Nov., however, aerial fighting had increased still more, and the vital importance of the constant struggle for air supremacy had been so often emphasized that 20 fighting squadrons supplementary to the above programme were asked for. This meant a proportion of two fighting to one artillery squadron, in place of the parity in numbers of the two types previously accepted as a basis. So vital a question did the supply of fighters appear at the time that it was urged that, failing the 20, at least 10 extra squadrons should be provided, even at the expense of delaying the bombing and night squadrons. The situation in France in June 1917 showed that there was a total of 52 squadrons of different types. In addition to raising new squadrons, existing squadrons had to be equipped with more modern machines. It was, therefore, impossible for the War Office to promise that more than 73 squadrons would be in France by the end of 1917, including the five R.N.A.S. units.

In June 1917, the Air Board drew up a scheme providing for the expansion of the R.F.C. to 200 service squadrons and 200 training squadrons. Further evidence of the growing realization of the value of the aerial offensive is afforded by the fact that this proposal embodied (in addition to fighter squadrons) the raising of, at first, 40 bombing squadrons (DH9 and larger machines) to be organized into wings of five squadrons each, the wings to be grouped into four brigades. G.H.Q. France were accordingly asked to be ready for 40 squadrons in addition to 86 already expected to be ready by Aug. 1918. In Nov. 1917, the 1918 programme was drafted as follows:—

40 squad. single-seater fighter.
15 squad. single-seater fighter for ground fighting.
15 squad. two-seater fighter reconnaissance.
1 squad. long-distance 2-seater for reconnaissance and photography.
10 squad. short-distance day-bombers.
10 squad. short-distance night-bombers.
21 squad. for corps work.
1 squad. long-distance machine carrying Q.F. gun.

In addition, for the Bombing Brigades:—

25 squad. day-bombers.
20 squad. night-bombers.
20 squad. two- or three-seater long-distance fighters.
1 squad. long-distance machine with Q.F. gun.

This programme for 179 squadrons involved the supply of 2,400 machines for armies and 1,028 for the bombing brigades.

Finally, in Feb. 1918, 240 squadrons (in addition to training units) was accepted as the goal to be reached, 179 being for France and Italy, 40 for other theatres, and 21 in reserve.

Meanwhile, at the end of 1916 the home organization included:—(1) The Administrative Wing, Farnborough; (2) the Training Brigade of 9 wings, totalling 21 service squadrons and 43 reserve squadrons; (3) the Home Defence Wing, comprising 11 service squadrons and one depot squadron for the training of night pilots; (4) the Kite Balloon Training Wing, including a training depot, an inspection branch and two schools of instruction. The following training centres and schools had been formed, in addition to numerous reserve squadrons: —(1) Recruit Training Centre, Halton Camp; (2) School for Wireless Operators, S. Farnborough; (3) Balloon Training Wing, Roehampton; (4) No. 1 Balloon School, Larkhill; (5) No. 1 School of Military Aeronautics, Reading (including Equipment Officers' School and the School of Technical Training for other ranks); (6) No. 2 School of Military Aeronautics, Oxford; (7) Cadet Wing, Denham; (8) School of Aerial Gunnery, Hythe; (9) Central Flying School, Upavon; (10) Wireless and Observers' School, Brooklands; (11) Scottish School of Fitters, Edinburgh.

In Nov. 1916, with a view to meeting the deficiency in the supply of skilled men, arrangements were made to place about 400 men continuously under instruction at various polytechnic institutes throughout the country. During 1917 further expansion of the Home Defence service took place. A Northern Home Defence Wing was formed with headquarters at York and the Home Defence Wing became the Home Defence Group, which, as other wings were formed, subsequently became the 6th Brigade, and by 1918 had become responsible for the aerial defence of England and the South of Scotland, coöperation of coastal batteries, and the training of night-fighting pilots and night-bombing pilots for France. Other developments at home during 1917 included the formation of aircraft depots which were transferred from the Army Ordnance Department to the R.F.C., principally for the supply of spares. Acceptance parks were also formed the duties of which were to receive aircraft from the manufacturers, to erect, test and finally issue them to units or dispatch them overseas. The creation of a Department of Production under the Ministry of Munitions placed on a more satisfactory basis the supply of equipment for the R.F.C. The number of training units had increased to such an extent that it was found necessary to form them into groups (southern, northern, eastern, western). These groups became, shortly, brigades (the old training brigade then becoming the division), and the standard training unit, the reserve squadron, was renamed "training squadron."

For theatres of war other than France, separate arrangements were made from time to time for providing for the requirements in Egypt, E. Africa, Mesopotamia, Salonika, and Palestine.

II. Naval Aviation.—The British Admiralty's first practical steps in aeronautics were taken in June 1908, when as a result of the Committee of Imperial Defence recommendations, it was decided to build a rigid airship. This ship, known as No. 1 naval airship (the "Mayfly"), was completed in May 1911, but was wrecked in the following September. This experience discouraged further attempts until Feb. 1911, when two civilian pilots offered their services free, with two machines, for the instruction of four naval officers as aeroplane pilots. Four naval officers were accordingly selected out of some 200 volunteers to undergo a six-months' course of instruction on the Royal Aero Club ground at Eastchurch. At the end of the year, land adjacent to the Royal Aero Club ground at Eastchurch was purchased by the Admiralty, and a naval flying school was formed there, four officers having in the meantime qualified as pilots. Thereafter, pupils were trained continuously at the school both before and during the World War. Apart from being used for training purposes, Eastchurch was the scene during 1911 and 1912 of many interesting experiments in the application of aircraft to naval uses. On the formation of the R.F.C., it was decided to form an Air Department at the Admiralty, this Department actually coming into being in Sept. 1912. By June 1913, the total number of aeroplanes and seaplanes in possession of the Naval Air Service were 37, and by October, 61 were in commission with three airships.

In Aug. 1913, the Admiralty decided to establish air stations at various points along the coast. An "Inspecting Captain of Aircraft" was placed in general charge, under instructions from the Director of the Air Department of the Admiralty. He was also responsible to the commander-in-chief home fleets regarding all matters concerning aircraft with ships afloat.

In June 1914, the increasing importance of the naval wing R.F.C. led to a reorganization of the service, and the R.N.A.S. came into being. It comprised the Air Department, Admiralty; the Central Air Office, Sheerness; the Royal Naval Flying School, Eastchurch; the Royal Naval Air Stations and all seaplanes, aeroplanes, airships, seaplane ships, balloons, kites and other types of aircraft that might from time to time be employed for naval purposes. Regulations were drawn up for the entry of officers as probationary flight sub-lieutenants direct from civil life and special designations were instituted for the various commissioned ranks in the flying branch.

With regard to airships, which by this time had passed entirely under Admiralty control, in the early part of 1913 German activity with rigid airships of the Zeppelin type led to a reconsideration of the question as to whether similar aircraft should be constructed for the British navy, and it was decided to arrange for the construction of two rigid and six non-rigid airships. In June 1913 orders were accordingly placed for one Parseval in Germany, two Parsevals with Vickers, one Forlanini in Italy and two others of this type with Messrs. Armstrong. A contract for one rigid airship was signed with Messrs. Vickers in March 1914. But on the outbreak of the World War delivery of the airships building in Germany and in Italy became impossible, and the British firms could not complete the airships they had begun. Work ceased on the rigid airship in the early stages of construction, but was resumed during the war, and on completion this airship became known as Naval Airship R9.

It had been decided at the end of 1913 that the Admiralty should take over all airships and airship equipment from the army. Accordingly, on Jan. 1 1914 the naval and military airship sections were amalgamated at Farnborough, and the navy took over control of all airship administration.

The War Period.—At the outbreak of the World War the stations on the organized east coast system of aerial patrol were as follows:—Eastchurch, Isle of Grain with advanced bases at Westgate and Clacton, Felixstowe, Yarmouth, Immingham, Calshot, Dundee, Cromarty and Fort Grange. There was also the airship station at Kingsnorth. Patrols were organized between the Humber and the Thames estuary, and a cross-Channel seaplane and airship patrol was started between the Isle of Grain and Ostend, a temporary base for seaplanes being established there. The Channel seaplane patrol was discontinued when the enemy advanced to Ostend. An additional base was established at Skegness, and for a short time, until Aug. 12, the naval machines at Eastchurch were reënforced by machines from No. 4 Squadron R.F.C. The Admiralty acquired as seaplane-carriers the "Engadine," the "Riveria" and the "Empress," structural alterations being necessary before the ships could be used for the purpose. The necessity for aircraft to coöperate with the Grand Fleet led to the establishment of a base for seaplanes and aeroplanes at Scapa Flow, a seaplane-carrier, the "Campania," being later commissioned to convey machines with the fleet when it proceeded to sea.

The first Naval Air Service aeroplane unit to proceed overseas was formed at Eastchurch, and went to Ostend on Aug. 27 1914 to coöperate with the naval division at Antwerp. In order to protect the United Kingdom against German airship raids, an aircraft and seaplane base was established at Dunkirk.

In the meantime the organization of the R.N.A.S. at home underwent rapid development, both in the matter of the training of pilots and the construction and design of machines. On Sept. 3 1914, the R.N.A.S. assumed responsibility for the defence of the United Kingdom against hostile aircraft attacks, and a special anti-aircraft section was formed in the Air Department. The coast patrols were continued both by seaplanes and by airships, an additional station for these patrols being opened at Dover.

In 1915 squadrons and wings were formed and sent overseas to Dunkirk and the Dardanelles. A detachment of three seaplanes proceeded to E. Africa and subsequently to Mesopotamia. Towards the end of Feb. 1915 the naval squadron at Dunkirk was relieved by No. 1 Naval Squadron, which had been forming at Gosport, and proceeded to the Dardanelles as No. 3 Wing. Later the 2nd Wing from Eastchurch also proceeded to the Dardanelles where, moreover, were sent the seaplane-carriers "Ark Royal" and "Ben-my-chree." In the early part of Sept. 1915 the R.N.A.S. units at Dunkirk and Dover were amalgamated into the 1st Wing under the command of the senior Air Service officer at Dover. During the year a small unit of seaplanes coöperated with the fleet in the operations against the "Königsberg" on the E. coast of Africa.

Increased activity of enemy submarines led in Feb. 1915 to the building of a small airship known as the S.S. type (Submarine Searcher). Whilst this small airship proved successful within its restricted radius of action, an airship with a longer effective range was found to be necessary and the "Coastal" type was designed. Some 30 of these ships were eventually ordered. This development necessitated the establishment of various airship bases around the coast. In Nov. 1915, a scheme for the establishment of a large central school exclusively for the R.N.A.S., but similar to the Central Flying School, was proposed, and resulted in the establishment of training stations at Cranwell and Frieston early in 1916. In that year also a school for training both R.N.A.S. and R.F.C. personnel was opened in France. The policy of offensive patrols started by the R.N.A.S. units at Dunkirk during the latter part of 1915 was developed throughout 1916 and they worked in close coöperation with the R.F.C. on the western front.

At the end of Feb. 1916 a squadron of Sopwith 1½-strutter machines was formed with the intention of bombing factories in the Essen and Düsseldorf districts, the raids being carried out from England. Instead of this, however, the squadron was eventually used for long-distance bombing from French territory and was designated the 3rd Wing R.N.A.S.[1] A considerable number of raids were carried out by this wing, which was based near Belfort. During 1916, too, the activities of the R.N.A.S. in the Mediterranean and in E. Africa were increasingly prominent; and at home additional stations were formed round the coast, mainly for anti-submarine and anti-Zeppelin patrol. In the course of the year valuable coöperation was given to the army by squadrons of the R.N.A.S. operating on the French front, in Palestine, at Salonika, and elsewhere. The year 1917 marked the definite realization of the bombing policy already adopted by the R.N.A.S. Handley Pages and DH4 machines began to be delivered in the spring of 1917, and special bombing squadrons were organized at Dunkirk. Considerable development took place, too, in the employment by the R.N.A.S. of "lighter-than-air" craft in anti-submarines operations and in escorting convoys.

When the war started, the airships available for the R.N.A.S. were the former army airships, "Beta," "Gamma," "Delta" and "Eta," and the Naval Airships 2, 3 and 4, the total personnel employed in airship work being 23 officers and warrant officers and 171 ratings. During 1915, as already noted, new types of airship, known as "Submarine Searchers" and "Coastals" were added; and at the end of 1916 the strength of the naval airship service had risen to 192 officers and 1,540 ratings.

During 1917 standard designs for the different classes of airships were adopted. The "Submarine Searcher" had evolved into a type called the S.S. Zero, and an improved "Coastal" (designated C-Star) was adopted. New ships of the rigid type were also being built, two of which (R27 and R29) were completed in the spring of 1918. The next ships to be completed were the R31, constructed mainly of wood after the Schütte-Lanz design, and a sister ship, the R32, followed by R33 and R34. At the time of the Armistice there were five rigid and 98 non-rigid airships of different classes in commission. The personnel totalled 580 officers and 6,580 ratings.

III. ADMINISTRATIVE SYSTEM.—As already indicated, the British army and navy, at the opening of the World War, had separate administrative organizations for their air services. It was not till the creation of the Air Ministry in 1917–8 that the two were amalgamated. At the War Office, before that, the directorate of military aeronautics was divided into its own technical branches; and its organization developed under further technical subdivisions, as the duties to be dealt with increased in complexity and volume. Similarly, the organization of the Admiralty Air Department was subdivided in administrative sections.

It was inevitable that, even with the best will in the world, the two departments would enter into competition with one another for personnel and material; and as the war progressed this question became acute. Early in Feb. 1916, the Prime Minister appointed a "Joint War Air Committee," to coördinate, design and supply material for the naval and military Air Services. In addition to the chairman, Lord Derby, the committee included representatives of the War Office and the Admiralty, with Lord Montagu of Beaulieu as independent advisory member. This committee was authorized to refer any question disputed between the Admiralty and the War Office to the Government. After two months, however, this committee collapsed, following on Lord Montagu's resignation. Since the chairman was not himself a member of the Government he lacked the necessary authority to arbitrate between two great departments of State, each of which had its own organization, *esprit de corps* and aspirations; moreover, no clearly defined division of functions was adopted between the War Office and the Admiralty.

The next attempt at reorganization was the formation of the first Air Board in May 1916, with Lord Curzon as president, the other members being Lord Sydenham, Rear-Adml. Tudor, Rear-Adml. Vaughan Lee, Lt.-Gen. Sir David Henderson, Brig.-Gen. Brancker, and Maj. J. L. Baird, M.P. It was to be free to discuss policy and make recommendations to the War Office and Admiralty, but had no authority with regard to policy. It could, however, recommend types of machines for the army and navy Air Services. If either the War Office or the Admiralty declined to follow the Board's advice, the Board were empowered to refer the matter to the War Committee of the Cabinet. It was further charged with the organization and coördination of supply and material, and with the prevention of competition between the two fighting departments. It was provided that the Board should discuss air problems with representatives of the army and navy and such bodies as the Naval Board of Inventions and Research, the Inventions Branch of the Ministry of Munitions, the Advisory Committee for Aeronautics, National Physical Laboratory, etc. It was laid down also that the Board should be provided with a secretariat.

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[1] The original 3rd Wing had been disbanded on the withdrawal of the Dardanelles expedition.

On the formation of Mr. Lloyd George's War Cabinet in Dec. 1916, Lord Curzon resigned the position of president and Lord Cowdray took his place in Jan. 1917. This second Air Board came into being under the New Ministries and Secretaries Act of 1916; and under this Act the president of the Air Board was specifically "deemed to be a Minister," and the Air Board a "Ministry." An Order in Council of Feb. 17 1917 laid down that the Board, in addition to the president, should consist of (*a*) the Parliamentary Secretary, (*b*) the appropriate member of the Board of Admiralty; (*c*) the appropriate member of the Army Council; (*d*) the two controllers of aeronautical supplies and of petrol engines in the Ministry of Munitions; and such additional members as might be appointed by the president.

For carrying out its duties the Air Board comprised a secretariat, a technical department, and a directorate of requisitions and statistics. Towards the end of 1917 the staff of the technical department was composed largely of officers drawn from the naval and military Air Services. Its duty was to consider and advise the Board as to the design of aeroplanes, seaplanes, engines and accessories, and, with this object, to carry out the necessary experiments and trials, and to keep in close touch with the scientific bodies and committees which were concerned with aeronautical research.

When the Admiralty and the War Office communicated to the Air Board the numbers of aeroplanes, seaplanes, and accessories required by the two Services for a given period, and when the Air Board had determined to what extent these requirements could be complied with and had come to a decision regarding design, requisitions were passed to the Controller of Aeronautical Supplies, whose department (a section of the Ministry of Munitions) was also housed in the Air Board Office. The Air Board also dealt with similar requisitions by Allied Governments (other than those in connexion with lighter-than-air craft and wireless telegraphy).

The director of requisitions and statistics kept analytical records of requirements, etc., and of the progress made in construction. A Central Air Intelligence Division was also established.

Aeronautical inventions were referred for consideration to an Inventions Committee, which was in touch with the Advisory Committee for Aeronautics, and the National Physical Laboratory. The department of the Controller of Aeronautical Supplies (Ministry of Munitions) placed contracts in accordance with the designs approved by the Air Board and carried out inspection during manufacture. The Controller of Aeronautical Supplies also had the Royal Aircraft Factory under his administration.

In addition to the departments of the Air Board and of the Controller of Aeronautical Supplies, there were also housed in the Air Board Office the H.Q. administration of the R.N.A.S. under the Fifth Sea Lord and Director of Air Services, and that of the R.F.C. under the Director-General of Military Aeronautics.

With sundry expansions in internal organization this Air Board continued to function until the new Air Ministry was created at the end of 1917, absorbing the existing Air Board organization as well as the military aeronautics directorate and the Admiralty Air Department (although a "division" with a similar designation was still retained at the Admiralty).

The Air Ministry came into being under the Air Force Constitution Act (1917), which provided definitely for the amalgamation of the two flying services under the title of the Royal Air Force. In accordance with this Act the Air Ministry was constituted as a department of State, the final authority being vested in an Air Council which was formed in Jan. 1918 as follows:—

The Secretary of State (president), chief of the air staff, deputy chief of the air staff, master-general of personnel, controller-general of equipment, director-general of aircraft production, administrator of works and buildings, parliamentary under-secretary.

IV. THE ROYAL AIR FORCE.—The Royal Air Force itself did not come into being until April 1 1918. At that time the R.F.C. at home consisted mainly of (*a*) the Training Division, (*b*) the 6th Brigade (Home Defence), (*c*) the Balloon Wing, and (*d*) miscellaneous establishments. The R.N.A.S. units were organized into a number of groups directly under the Admiralty.

On the formation of the R.A.F. the United Kingdom was divided into five areas, comprising all units of the new service (with the exception of a few directly under the Air Ministry). Each area was further subdivided into groups. The Training Division and its brigades were done away with, the former's functions being assumed by the training directorate of the Air Ministry. The technical administration of airship stations remained under the control of the superintendent of airships at the Admiralty, naval operation groups were under the naval commander-in-chief concerned for operations, but their maintenance and administration was the concern of the appropriate area headquarters. Units of the R.A.F. serving with the Grand Fleet were entirely controlled by the commander-in-chief.

At the same time it was decided to form an Independent Air Force. In Oct. 1917 it had already been decided to return to the policy that had been visualized when, in 1916, the dispatch of the 3rd Wing R.N.A.S. to Belfort was being contemplated. Squadrons No. 55, 216 and 100, were then sent to the Nancy area, and they carried out bombing operations against German towns during the closing months of the year and the spring of 1918. By April 1918 the 8th Brigade, as the force was designated, had been reënforced by No. 99 Squadron; and when now it was reëstablished as the Independent Air Force six more squadrons (104, 97, 215, 115, 110 and 45) were added.

In planning the post-war organization of the R.A.F., it was assumed that in the immediate future nothing in the nature of a general mobilization need be contemplated, that efforts should be concentrated on providing for existing needs, and on founding a highly trained and efficient force, inherently capable of expansion should the necessity arise. The purpose was, accordingly, to limit the number of service squadrons to what was considered essential to meet existing responsibilities, to devote the remaining resources to perfecting the training of officers and men, and to construct a sound framework on which to build the R.A.F. of the future. In forming the framework it was felt that the main portion of the R.A.F. would consist of an independent force, together with the personnel required to carry out aeronautical research. In addition, there would be a small part of it specially trained for work with the navy, and a small part specially trained for work with the army. It seemed possible that the main portion, the Independent Air Force, would grow larger and larger, and become the predominating factor.

The training for officers and men is briefly as follows:—The channels of entry for permanently commissioned officers are through the Cadet College at Cranwell, from the universities, and from the ranks. The Cadet College is the main channel. The course lasts two years, during which the cadets are thoroughly grounded in theory and practice and learn to fly the approved training machine. On leaving the College, the cadets are commissioned and posted to a squadron. Apart from courses that every officer will normally pass through, such as gunnery and air pilotage, officers will be required, after five years' service, to select the particular technical subject they will make their special study during their subsequent career, *e.g.* navigation, wireless, engines.

The career of an officer commissioned from the universities or from the ranks will be identical with that of those from the Cadet College, except that they will be taught to fly at training wings before joining the squadron. Short-service and seconded officers will be taught to fly at training wings, and will attend a course of aerial gunnery and probably one of air pilotage.

With regard to the other ranks—the most difficult problem—it was decided to enlist the bulk of those belonging to long apprenticeship trades as boys, who will undergo a course of three years' training before being passed into the ranks. The boys, on successfully passing their final examination, will be graded as leading aircraftsmen, and a certain number will be specially selected for a further course of training, at the end of which they will either be granted commissions or promoted to N.C.O.'s. Those granted commissions will join the Cadet College. The mechanics, of whom more than half will belong to short apprenticeship trades, are enlisted as men and receive 12 months' training before being posted to units. Non-technical men are given a short course of recruit training at the R.A.F. depot at Uxbridge.

The R.A.F. estimates for 1920–1 provided for an establishment of 29,730 officers, warrant officers, non-commissioned officers, aircraftsmen and boys (exclusive of those serving in India).

V. THE FUTURE OF AIR-FIGHTING.—It is now universally recognized that in future wars the operations of naval and land forces will be largely influenced by the degree of assistance that can be rendered by aircraft. It is equally clearly understood that such assistance can only be rendered to the full extent of the resources available if air supremacy has been definitely established and can be successfully maintained. It is realized that, as is the case with sea command, air supremacy is an issue that can only be settled by combat (assuming a certain degree of equality and of readiness to fight in the opposing air forces). It is therefore by the air fighting and consequently by the air fighter that subsequent operations, whether on sea or on land or in the air, will be influenced.

Whether the last word in air fighting would always rest with the small, swift, easily manœuvred machine was in 1921 still an open question. It is possible that we shall see, in the future, armament replacing speed as the determining factor in aerial tactics, and that aerial battleships will be evolved capable not only of fighting but of carrying the war into the enemy's country and crippling his power of resistance in the early stages of the struggle. It is in recognition of this principle that the French Military Air Service has been divided into formations the functions of which are purely ancillary to the army, and into formations whose functions it is first to establish air supremacy and secondly, when its attainment makes it possible, to develop the essentially offensive form of aerial war, the long-distance bombing raid. Accordingly, in addition to coöperating formations, the French maintain what is analogous to the British Independent Air Force, a force composed entirely of fighters and bombers.

There is no doubt that ultimate air power must depend largely upon the place of aviation in the economic life of the community, but this does not mean that air power is focussed entirely in a flourishing civil industry. The suddenness and effectiveness that lies in aerial action must lead to a striking force being held in constant readiness to act whenever war appears imminent. The manner of employment of this force, and the efficiency it displays, may have a vital bearing upon the subsequent course of the war, and no country would risk doing altogether without some form of standing military air force.

There is also every indication that civil and military aircraft will tend to develop along divergent lines, and that the civil machine will never be a factor in air supremacy excepting as an auxiliary. The most important factor in the civil machine is productive economy, whereas the designer of service craft strives for destructive performance; and individual aircraft can hardly be equally efficient for both purposes. (A. W. H. E. W.)

VI. GERMAN AIR FORCES.—Before the World War, the German military air service, in splitting off from its parent body, the Pioneers, had been made administratively part of the Communication Troops. From Oct. 1912 the Flying Troops had formed a separate entity within the Communication service. Nevertheless, when it took the field in Aug. 1914, and for some months thereafter, they were still nominally under the inspector-general of Communication Troops, an arrangement which worked badly in practice besides tending to prevent the growth of *esprit de corps* in the flying service. It was not till Aug. 25 1915 that it was freed from this control.

But already on March 11 1915 all German formations serving at the front had been placed under a "*Chef des Feldflugwesens*," and a month later this officer (Col. Thomsen) was made the official superior of all other army services as well, his functions including control of all motor transport included in the air establishment.

About the same time a staff officer for aviation was appointed to the H.Q. of each army, but it was not until Nov. 1916 that this officer was renamed "*Kommandeur*" and placed in executive command of the air forces within his province.

Somewhat earlier than this, on Oct. 8 1916, Gen. von Hoeppner had been appointed "*Kommandierender General*" of the military air forces, with Thomsen as his chief of the staff. As in the German army system a "*Kommandierender*" (*i.e.* Commander of an Army Corps and its Region) enjoyed wide powers, both under the laws and under the regulations, and as the office of chief-of-staff likewise carried with it known and definite powers, the status of the air force was for the first time thereby assured. Moreover, the commanding general, not being under any army or group of armies H.Q., had direct access to G.H.Q. From this point, the organic development of the air force went on straightforwardly. But it is interesting to note that even in the German system, with all its sense of order and organization, conservatism sufficed to delay the consummation till nearly two and a half years after the outbreak of war.[1]

In spite of army proposals however, no single command was ever created in German military and naval air forces, which remained wholly separate to the end. One retarding influence was the particularism of the various German states. The Württemberg Government, for instance, gave formal orders to its own aviation depot unit not to supply flying officers to any but Württemberg units.

The working organization in the field as finally developed was as follows:—The commanding general had his own H.Q., and reported direct to the chief of the general staff of the army. His immediate air service subordinates were the "*Kofls* (*Kommandeur der Luftstriebkräften*)," one to each army, with as above mentioned, occasional groupings of the forces of several armies under one "*Kofl.*" Under his orders, flights of aircraft were commanded by group commanders (instituted 1917) who gave instructions to the flight commanders and through whom their *liaisons* with the military command, and especially the artillery, passed.

At each corps H.Q. a staff officer looked after both operations and *liaison*.

In the earlier years of aviation, the confidence of the German authorities and public in the lighter-than-air ship retarded the growth of aviation. But in 1912 the dangers of further neglecting the aeroplane were realized, and an active propaganda resulted in a national subscription for the manufacture of aeroplanes and the training of pilots. In the autumn of the same year an army flying school was provisionally established and this became permanent in the spring of 1913. At the moment of mobilization 254 pilots and 271 observers were available.

The following summary of the development of German aviation units during the war, while necessarily brief, will serve to show how the needs revealed by war experience were successively met by changes of organization.

In the beginning, German aviation units like others were for general service, the same machines (two-seater fighters) serving all purposes, reconnaissance, spotting, bombing and fighting.

In the middle of 1915 came the first specialization of functions—the separating out of air-fighting elements. These units (two-seater fighters) were originally known as "battle squadrons" and had the rôle of barring the German front line against Allied aircraft as well as such bombing as was then done. But the necessities of aerial combat very soon produced a further subdivision on this side, "Fokker" flights (of single-seaters, equivalent to British "scouts") undertaking the offensive air battle and the residue the protection barrage and the bombing. Presently they too subdivided into protective flights and bombing flights (the latter being grouped later in squadrons).

When the fighting elements separated off from the reconnaissance elements, the latter (organized in flights only and allotted as required to groups) were limited to their proper functions, and a further specialization presently came about by which artillery flights were separated from reconnaissance flights. In these artillery flights the personnel was largely, if not entirely, drawn from the artillery, but their special character did not prevent them from being used occasionally for photographic work. Many, though not all, artillery flights were equipped with wireless telegraphy apparatus.

The high-fighting "*Fokker abteilung*," always increasing in numbers as it became more and more evident that the British policy of offensive protection was the true one, developed into the "pursuit flight" (*Jagdstaffel*). Occasionally, a number of these pursuit flights were grouped into a semi-permanent squadron under a leader of note, *e.g.* Richthofen; a squadron of this kind was colloquially and very aptly called a "circus," both on account of the acrobatic powers of its members and the fact that it moved up and down the front as its services were required to obtain local control of the air.[2] The old "*Kampfgeschwader*," charged with protective barrage and with bombing, was also subdivided into two parts—the so-called protective flight, whose duty was local escort for friendly, and local barrage against enemy reconnaissance machines, and the pure bomber, for whom more and more powerful machines were evolved and whose radius of action was constantly increased.[3]

Lastly, the protective flight, whose defensive function was discredited, became a battle flight (*Schlachtstaffel*). The practice of low-flying for direct intervention in a ground battle had been growing steadily since the battle of the Somme, and in the German and Allied offensives of 1918 it attained a maximum. In contrast to the British custom of training and trusting flights of the reconnaissance type (called contact patrols) to carry out this dangerous duty, the Germans treated it as an essentially combatant function, and used for it a branch of the aviation service which had always belonged to the fighting as distinct from the reconnaissance side. In the last phase some of the battle flights had armoured machines.

On the combatant side therefore, German aviation was finally classified into three branches: pursuit flights (high-fighting for command of the air, with 18 machines per flight); bombing squadrons (long-distance bombing, with about 24 machines per squadron); battle flights (low-fighting in connexion with ground operations, *i.e.* bombing and machine-gunning of troops and transport, with six to twelve machines per flight, average about eight). One other type of fighting unit was created for air defence at home. It was known as the "*Kampfeinsitzerstaffel*" (single-seater battle flight), and restricted to local defence of munition areas, etc.

From statistics given in Neumann's *Die deutschen Luftstreitkräfte*, it appears that, apart from reserve machines, the Germans employed for various purposes during the war 220 machines in 1914, 480 in 1915, about 1,100 in 1916, about 1,300 in 1917, and about 3,500 in 1918. Interesting and significant figures are given by the same author as to numbers and losses in personnel, and expenditure of *matériel.* In actual flying personnel at the front, the highest total present at one time (in 1918) was about 5,500, with a like number under training at home. The total deaths of flying personnel or candidates in the war numbered 6,840, of whom about two-thirds died at the front. The number of wounded and injured (7,350) is little more than that of the dead. Approximately 2,128 planes were lost under known circumstances (about 1,900 of these on the western front). In addition about 1,000 missing were presumed as lost. In all, 47,637 machines and 40,449 motors were taken on charge from contract. The monthly expenditure of fuel at the end of the war was 7,000,000 kgm., and the total for the whole war about 232,000,000 kgm. Rather over a million bombs were dropped, of which 860,000 were of the 12-kgm. type and 710 of the monster 1,000-kgm. type.

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[1] Shortly after the creation of the "Commanding General," some grouping of air forces within the group of armies was effected by making the "Air Force Commanders" of one of its armies responsible for coördination of effort, and to a certain extent for distributing forces as well.

[2] After Richthofen's death his squadron was officially designated by his name and the number 1 as a permanent organization. Two other squadrons were formed in the summer of 1918.

[3] The original bombing squadron was a group set aside in 1915 for the ultimate purpose of bombing England from Calais, when that port should have been occupied by the Germans. The rapidity of air evolution in the war is well shown by the fact that within a year of that date, London was bombed by an aeroplane based on Ghent.

The organization of German naval aviation before the war was considerably in arrears as compared with that of army flying. The predominance of the airship was the main cause of this, but other causes contributed, especially, it is said, the lack of interest in seaplane design on the part of manufacturers, whose establishments (except that of Friedrichshafen) were far from water. The first seaplane competition, organized by a few enthusiasts, was to have been held on Aug. 1 1914. Only some 20 naval officers had been trained as pilots in the single existing seaplane station.

These conditions continued to hamper progress for some time after the outbreak of war, as the army impounded all the motor manufacturing resources for its own needs. Nevertheless, seaplanes were established on the Flanders coast by Dec. 1914, and thereafter the organization of the seaplane service expanded till there were finally 32 stations in the different theatres of war and on the German coast. For naval work, the organic unit was the station; the equipment, of course, varying according to the work expected of each station.

At the same time, a number of aeroplane flights organized as such, were created by the navy for land service, of which nine or ten served in the eastern and south-eastern theatres. The other fifteen, in Flanders, belonged to the Marine Corps, a mixed organization responsible for the land defence of the Yser front, the coast defence of the Belgian coast and the submarine operations based on that coast. The commander of Flying Troops of that corps had under him a correspondingly mixed air force.

Naval aviation generally was under the control of a naval aviation chief, who was independent of the army air authorities.

Airship Organization.—In spite of the popular enthusiasm evoked by the work of Count Zeppelin and other airship constructors before the war, the naval and military authorities were not, before the war, very ready to commit themselves to a strong and permanent air organization. The army airship organization dated only from 1906–7 and the naval from 1910–1. The army acquired Z1 in 1906 and Z2 in 1909, and after the wreck of the latter, a pause occurred in which commitments were avoided pending further competitive experiments between the Zeppelin, Parseval and Gross types. In 1912, however, the decision went in favour of the Zeppelin and the Schütte-Lanz, and airship battalions were formed to fly and to maintain airships.

At the outbreak of war the army possessed seven ships (six Zeppelin and one S-L) of the rigid type, and two others, and took over three more from private ownership. Organization, nominally by battalions, was in reality dependent on the number and station of ships. This rapidly increased. But from the first there was a strong current of opinion adverse to the airship in land warfare, and the authorities concerned with personnel looked with disfavour on the huge landing parties which the ships required at each station. In spite, therefore, of the occasional achievements of individual ships,[1] it was decided early in 1917 to discontinue the army airship service. The still useful ships were handed over with part of the air personnel to the navy, and the remainder of the personnel was allocated to the army kite balloon service.

Excluding Parseval and small airships—the manufacture of which was discontinued at the outbreak of war—37 Zeppelin and 10 S-L ships were commissioned by the army from first to last, of which 17 were lost in action, 9 lost from other causes, 17 scrapped, and 4 handed over to the navy on discontinuance.

The navy, on the other hand, beginning later than the army, went on developing the airship service to the end of the war. In Aug. 1914 it possessed only one ship, obtained from the Zeppelin company to replace Government ships lost in 1913.

Inclusive of the effective ships taken over from the army in 1917 74 ships were commissioned for naval service, of which 23 were lost in action, 30 from other causes (4 by lightning), and 11 were scrapped.

Kite Balloons.—The development of dirigible airships and of aeroplanes, in Germany as elsewhere, thrust the captive balloon into the background, and although 8 field and 15 fortress balloons were mobilized in 1914, the question of their abolition was actually being considered when the unexpected coming of trench warfare opened up a new field for them. Early in 1915 the introduction of power winches (at first improvised in the field) and of the parachute added greatly to their efficiency, and by the end of that year more than 40 sections, each of 2 balloons, were in the field. But the war experience of 1916, and notably the sight of Allied sausage balloons, hanging in the air "as thick as grapes," compelled the army authorities to develop their kite balloon service at a faster rate. The organization, hitherto in single unconnected sections, was expanded to provide over 50 staffs, each of which controlled 2 to 3 sections of balloons. In the end, 184 such sections existed in the field, as well as a certain number lent to Turkey or employed in instructional duties. In the latter part of the war the admittedly inferior balloon of German design was replaced by one of the Caquot type, a captured specimen being copied almost exactly.

In all, 1,870 kite balloons of all types were delivered from contract and about 350 power winches. In course of the war about 600 balloons were lost in action (75% to 80% by aeroplane attack), 100 by weather and other causes, and 500 condemned as unserviceable.

The *Meteorological Service* in the German army formed part of the air forces, although its observations and reports served the artillery, chemical warfare and other branches as well. At the beginning of the war an embryonic organization already existed, with a central section at Berlin, 14 sections at airship stations and aerodromes and 2 sections organized on a mobile basis. These last at once expanded to 8 (one per army) and by the close of the war these 23 units had grown to a total of 316.

The general lines of the organization were as follows:—(1) The Berlin H.Q.; (2) Western Front H.Q. at Brussels; (3) Eastern Front H.Q. at Warsaw; (4) South-eastern Front H.Q. at Temesvar (later Sofia), and (5) Turkish H.Q. at Constantinople. Under each of these (except the last) there were in strength varying according to conditions, *Hauptwetter Warten,* which were concerned with focussing information from Berlin, from the naval weather service, and from the front, and also with local meteorological services for troops behind the line in occupied areas (*e.g.* flying schools); and *Armee Wetter Warten* which had the chief tactical and technical responsibility at the front, and controlled a network of minor units, some attached to particular services but most distributed on an area basis.

Air Defence.—In Germany and at the front the commanding general of air forces was responsible for air defence. A few mobile guns only were available for anti-aircraft work in 1914, but the 75-mm. guns captured in the advance to the Marne and especially the high velocity Russian field guns taken on the eastern front, provided a considerable A.A. armament, pending the design and supply of special ordnance. By the end of the war the original 20 guns had grown to a total of over 2,000. The evolution of technical adjuncts of air defence, searchlights and direction-finding detectors (*see* AIR DEFENCE), proceeded as on the Allied side.

As regards organization, after various alternative methods had been tried, the Germans separated off all "*Flak*" (*Flugabwehr Kanone*) troops from the rest of the artillery and centralized the control in each army area in the hands of a special officer, to whom all subordinate *Flak* commanders were alone responsible though they were authorized to advise corps commanders on the technical aspects of air defence in the corps area. In 1916 the *Flak* service passed with the rest under the control of the new commanding general of air forces; thenceforward all the means of air defence were coördinated under the same authority in each area, both in the field where "Commanders of air forces" (see p. 87) exercised local control, and in Germany, where a deputy of the commanding general was responsible for defence of munition areas. This organization ensured an intimate connexion between guns, aeroplanes, observation posts and lights, based on a common doctrine taught in the *Flak* depot at Freiburg and in *Flak* schools at the front.

VII. UNITED STATES.—In the United States, as elsewhere, the organization of air forces before the World War was in its infancy, and although between 1914 and the entry of the United States into the war a certain amount of air research and training had been carried on, and some practical war experience gained in Mexico, yet their position as neutrals prevented the American authorities from obtaining technical data concerning the progress in aviation that was evidently being made by the belligerents.

In April 1917, therefore, when the Allies invited America to train and equip a force of 5,000 aviators for service in Europe, there was little likelihood of the demand being met. At that date the American forces possessed 55 machines of which a scientific commission had just declared 51 to be obsolete, and about 75 trained officer pilots.

The first necessities, therefore, were instructors and training machines. Of the latter, or rather of a type of the latter considered good enough for primary instruction, delivery in quantity began before the winter of 1917, and by the Armistice there were about 9,500 planes and 17,500 engines suitable for training.

The need of instructors was met partly by borrowing British and French officers, and partly by retaining the best pupils in the early classes to become instructors to those formed later. In the sequel, 8,600 pilots were graduated from the elementary courses and 4,000 from the advanced courses before operations ceased, and some

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[1] In many respects the most remarkable achievement of airships in the war was the voyage of L59 in the autumn of 1917. This was a naval ship, but the service in question was overland. Starting from Yamboli in Bulgaria the attempt was made to reach von Lettow-Vorbeck in E. Africa with medical and other small and valuable stores. This ship was recalled by wireless after passing Khartum, but returned safely, after a 7,000-km. voyage lasting 96 hours. The record for endurance, however, was held by LZ120 (101½ hours).

6,500 more were at that date in training. After graduating from the advanced course, pilots and observers joined the expeditionary forces where they underwent a final training before going into action. The total of qualified flying officers in March 1918 was 2,248 in the United States and 650 overseas; these numbers had grown in July 1918 to 4,974 in the United States and 2,692 overseas, and in Nov. 1918 to 7,118 in the United States and 4,307 overseas (of whom, however, only 1,238 were as yet at the front). Inclusive of ground personnel and students, the total personnel of the U.S. air forces was nearly 200,000 at the date of the Armistice.

In the production of service machines for these men to fly, grave difficulties arose, none the less grave because in the excitement of the time unreasonable expectations had been formed and encouraged.

After study of the problem, not only from the standpoint of qualitative efficiency in the machine but also from that of man production, the British DH4 (observation and day-bombing) and the Handley Page and Caproni night-bombers were selected as standard types for American production, being redesigned to take American motors.[1] For pursuit flights, only non-American machines were employed. At the end of the war, out of the 7,889 service planes on charge, about half were American-built, and of the total of 22,000 engines nearly three-quarters.

With kite balloons, these supply troubles seem hardly to have existed. From zero (or rather from an establishment of 20 borrowed balloons) in Jan. a total of 662 had been reached by Nov., of which 43 had been destroyed, 35 handed over to the British and French, leaving 574 in service.

The organization of the American air forces in the field was by squadrons, classified as pursuit, observation, day-bombing and night-bombing. The premier American squadron was one of American volunteers, the "*Escadrille Lafayette*," which had been serving in the French army and was transferred to the U.S. army in the winter of 1917–8. In the spring of 1918 squadrons formed and came into the field in twos and threes, but in the late summer DH4 machines became available in large numbers, and observation and day-bombing squadrons began to increase more rapidly. From a July total of 15 squadrons, the figure of 30 was reached in Sept. and 45 in the first week of Nov. (exclusive of balloon companies in each case). The machines, however, were still preponderantly of foreign make. Twenty-six squadrons and 14 balloon companies took part in the St. Mihiel battle, and 45 squadrons with 740 machines, and 23 balloon companies in the final Meuse-Argonne battles.

(C. F. A.)

FOCH, FERDINAND (1851–), French marshal, was born at Tarbes Oct. 2 1851, his father being a civil official and his mother's father an officer of Napoleon's army. Educated at Tarbes, Rodez, and finally at the Jesuit colleges of St. Michel (Loire) and St. Clément (Metz), he was preparing for the entrance examination for the École Polytechnique when the war of 1870 broke out. He enlisted in the army, but saw no active service, and returned to Metz, then in German occupation, to complete his studies, entering the École Polytechnique in Nov. 1871. On being commissioned in 1873 he was posted to the artillery, in which arm the whole of his regimental service was spent. As a captain, he became a student of the Staff College (École de Guerre) in 1885 and left, with fourth place, in 1887. From this time till 1901, save for a period in which as major he commanded a group of horse artillery batteries, his work lay in the general staff of the army, the staff of formations and the École de Guerre. It was in the École de Guerre that he developed his doctrines and his influence on the education of the army. From 1895 he was assistant-professor, and from 1898, as lieutenant-colonel, professor of military history and strategy in that institution, first under Gen. Langlois, and then under Gen. Bonnal, the two leaders of military thought whose work, with his own to complete it, established the new French doctrines of war, based on re study and application to modern conditions of Napoleon's practice. This is the key idea of Foch's classical treatises, *Principes de Guerre* and *La Direction de la Guerre*.

Foch's career as a professor at the École de Guerre lasted hardly more than five years. The army was at that time in the midst of acute political troubles. The Minister of War, Gen. André, was engaged in a drastic, and not overscrupulous attempt to make the army safe for democracy; the Dreyfus affair was running the last stages of its fierce course, and, in his responsible post at the École de Guerre, Foch was an obvious target of attack, as an openly devout and practising Catholic, educated under Jesuit influence. He was returned to regimental duty, and his promotion to colonel only took place in 1903.

In 1905 Clemenceau, then Prime Minister, determined to make use of his military ability to the full, irrespective of political considerations, and, after a short time spent as deputy chief of the general staff, he was appointed commandant of the École de Guerre. Already in 1907 he had been made general of brigade. In 1911 he was promoted general of division and in 1912 corps commander. In 1913 he was appointed to command the most exposed of all the frontier corps, the XX. at Nancy, and he had held this appointment exactly a year when he led the XX. Corps into battle. Foch was then the only intellectual master of the Napoleonic school still serving. And the doctrines of the brilliant series of war school commandants, Maillard, Langlois, Bonnal, Foch, had been challenged, not only by the German school (*see* 25.994), but also since about 1911 by a new school of thought within the French army itself, which, under the inspiration of Gen. Loiseau de Grandmaison (d. 1915), criticised them as lacking in vigour and offensive spirit, and conducing to needless dispersion of force. The younger men carried the day, and the French army took the field in 1914 governed by a new code of practice. But history decided at once and emphatically against the new idea in the first battles of August, and it remained to be seen whether the Napoleonic doctrine would hold its own, give way to doctrines evolved in the war itself, or, incorporating the new moral and technical elements and adapting itself to the war of national masses, reappear in a new outward form within which the spirit of Napoleon remained unaltered. To these questions, it must be admitted, the war has given an ambiguous answer which will long provide material for expert controversy.

It was, in reality, as a leader in the field, far more than as thinker, that Foch personally influenced the course of the war on the western front. His conduct of operations in the first battles before Nancy, as a corps commander, presents no special characteristics, but in a few weeks he was placed at the head of the newly formed IX. Army, to fill the gap in the line caused by the divergent directions of retreat of the IV. and V. This army he commanded in the battle of the Marne, being opposed to the German III. Army and part of the II. in the region of Fère Champenoise and the Marais de St. Goud. After several crises he finally repulsed the attack, and initiated a counterstroke round which a legend promptly grew up and on which was founded a popular reputation that, no doubt, gave Foch the one element lacking in his equipment for the highest commands—prestige. Almost immediately after the battle, when the mutual attempts of Allies and Germans to outflank one another's northern wing produced the so-called "race to the sea," Foch was designated assistant to the commander-in-chief and sent north to coördinate the movements of the various French armies and eventually those of the British and Belgian armies concentrating towards Flanders. Over the French army commanders he possessed the powers of a commander-in-chief, but over the British and Belgian forces, like Joffre, he had no authority. This delicate relation, in the midst of one of the greatest crises of the war—one which for Britain and Belgium was of graver import than even that of the Marne,—inevitably led at times to friction between the coequal commands, and after the war a rather unworthy controversy was waged in the press as to some incidents of this period. But in sum, the reputation which Foch already enjoyed amongst European soldiers before the war, and the fact that he had long been in intimate relations with Gen. Sir Henry Wilson, deputy-chief of Sir John French's staff, enabled him to carry out successfully a mission with which no other general could have been entrusted.

After the battle of Ypres and the stabilization of the fronts, Gen. Foch commanded the French "Group of Armies of the North" during 1915 and 1916. In this period, under Joffre, he was responsible for the offensives in Artois during the spring and autumn of 1915, in which again he stood in close relation to the British on his left, though now the sectors of each were exactly defined and there was neither a crisis nor an intermingling of forces such as those of the Ypres period. Moreover, the general headquarters of the two commanders-in-chief, Joffre and French, were now fixed, and the two armies made their liaison between St. Omer and Chantilly rather than through the local headquarters of Foch, who was no longer assistant commander-in-chief, but a subordinate.

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[1] The British "Bristol Fighter," originally selected as one of the types, proved unsuitable for adaptation to American engines and was not adopted. It should be added that American machines were designed to suit these motors, but none had passed into quantity production at the Armistice.

In 1916 Foch's group of armies supplied the French element in the battle of the Somme. Towards the close of that battle, his reputation underwent a temporary eclipse, motived no doubt largely by the disappointment felt both in England and in France as to the results; but also and perhaps more by somewhat obscure domestic intrigues within the French staff. At that time the movement for Joffre's supersession had come to a head, and, it is said, his adherents within the headquarters sought to maintain him in power by suggesting that Foch, the most likely candidate for the place, was broken down in health. Though this did not prevent the removal of Joffre, it excluded Foch from the succession. Gen. Nivelle was appointed commander-in-chief, and a certain control by him over the British forces was agreed to by Mr. Lloyd George's Government, then newly in office. Foch was relieved of his command and sent first to the Swiss frontier to report on the possibilities of attack and defence in that quarter and then to Italy to negotiate with the Comando Supremo as to aid from France in case of a disaster to Cadorna's forces. But on May 15 1917, after the tragic failure of Nivelle's offensive and the supersession of that general by Pétain, M. Painlevé called Foch to Paris as chief of the general staff of the French army. But in this capacity his influence only became really effective after the accession to power of the Clemenceau Ministry in November. From that point to the events of March 1918, the evolution of Foch's authority was rapid. He was first, as adviser to Clemenceau and as a soldier whose counsels carried more weight than those of any other, a powerful indirect influence in the inter-Allied discussions as to the plan of campaign for 1918. Then as French member of the "Executive Committee," a sort of board of inter-Allied command founded in Jan. 1918, he took his place almost as *de jure* president of that body. Lastly, the storm of the German offensive broke on the British V. Army on March 21, and although Haig and Pétain managed by cordial coöperation to reconstruct the broken line and check the German advance, the situation remained so critical that the last step was taken. On March 27 Foch by general consent was nominated to coördinate the operations of the British and French in France. On April 14 the title and authority of commander-in-chief was granted to him by the two Governments concerned, and on April 15, April 17 and May 1 respectively by the Belgian, American and Italian Governments.

On Aug. 6 1918 Foch was made a marshal of France. In the interval the Germans had renewed their offensives four times, and more than once there had been a crisis as grave as that of March which Haig and Pétain had had to face, notably on May 27. But these crises had been surmounted, and towards the end of June, with his resources greatly augmented through the emergency measures taken by the American Government, the British sea transport authorities and Gen. Pershing in France, he could begin preparations for his counter-offensive. The story of the battles in Champagne in which the last German offensive and the first Entente counter-offensive coincided (July 15–18), of the battles on the Somme area about Amiens (Aug. 8) and Bapaume–Peronne (Aug. 21), and of the simultaneous offensives of the Americans on the Meuse–Argonne front, the British on the Cambrai–St. Quentin front, and the Belgian, British and French under King Albert in Flanders (Sept. 26–28) is told elsewhere (*see* also the article Tactics). From Sept. 26 to the Armistice the whole front from the sea to Verdun was one continuous battlefield, controlled by one commander-in-chief. An extension of this battlefield into Lorraine, where the final blow was to be delivered on Nov. 14, was only prevented by the capitulation of the enemy.

After the war Marshal Foch received the highest honours from his own country and from the Allies. In one of his frequent visits to London he was created a field-marshal in the British Army, and he was also awarded the O.M. He became a member of the *Académie Française* in 1919. He had a great reception in the United States on his visit in 1921.

Various biographical sketches of Marshal Foch have appeared, for the names of which the reader is referred to any good subject index. The history of the single-command idea will be found in detail in M. Mermeix's *Les Crises de Commandement* and *Le Commandement unique* (part I.) and that of the internal politics of the French headquarters in the same, and in J. de Pierrefen's *G. Q. G., Secteur I.* (2 vols.), Paris 1920. The story of his final campaign, from the point of view of Foch's headquarters, is given in Louis Madelin's *La Bataille de France* and R. Recouly's *La Bataille de Foch.*

(C. F. A.)

FOGAZZARO, ANTONIO (1842–1911), Italian novelist and poet (*see* 10.590), published in 1910 his last novel, *Leila*, a sequel to *Il Santo*. He died at Vicenza March 7 1911. *Ultime*, a volume of his latest writings, appeared in 1913.

A collection of records and memorials of the poet was published in two volumes in 1913–4. See also Eugenio Donadoni, *Fogazzaro as Man and Writer* (1913); L. Gennari, *Fogazzaro* (1918); and A. F. Crispoliti, *Antonio Fogazzaro; Discorso commemorativo* (*1911*).

FOOD SUPPLY.—During the World War of 1914–8 practically all the belligerent and neutral countries of Europe experienced a shortage in the supply of food and other necessaries. The shortage was traceable to three distinct causes: first, the diversion of productive power to destruction or to making the means of destruction; second, the increased rate of consumption of those who were fighting or were undertaking harder physical labour than usual in the production of munitions; third, the deliberate blockades which with varying success the belligerents directed against one another and against neutrals. The blockades had as one feature a destruction of shipping which is perhaps sufficiently important to be reckoned as a fourth cause of shortage, additional to the other three. These causes of reduced supply or increased demand applied more or less to all useful articles; they naturally produced their most sensible effects in the case of necessary articles and above all in that of food. There, the failure of the ordinary channels of supply to meet the demand sooner or later became in every European country so serious as to call for direct intervention by the Government and to make "food control" one of the features of the war. Every country had its succession of food controllers.

The degree of the food shortage and the methods available or adopted for dealing with it naturally varied from one country to another. In all of them it may be said that the food controller had three main problems to consider, namely, the maintenance of supplies, the regulation of prices, and the control of consumption by distribution and rationing. The three problems are naturally connected. A solution of the first of them so complete as to keep supplies up to or above the pre-war standard would prevent the other two from arising at all or at least in any serious form; this happened with bread-stuffs in the United Kingdom. On the other hand an attempt to fix prices without controlling supplies would lead either to a disappearance of supplies or to their distribution in an unjust and wasteful manner. While the problems are thus connected, the third of them—distribution and rationing—can to some extent be described separately and is so described under the heading of Rationing. The present article will deal mainly with the action taken in respect to supplies and prices and will touch on distribution and rationing only to indicate points of contact. No attempt can be made here to describe, even in outline, food control in all countries. All that can be attempted is to give some account of what was necessary and what was accomplished in the United Kingdom, and to mention the salient points of similarity or difference in the experience of other countries.

For the first two years of the war questions of food control attained little prominence in the United Kingdom. The cutting off of the Central European sources of sugar supply led to the anticipation of a considerable shortage of that particular food, and a Royal Commission was established in Aug. 1914, which undertook on Government account the purchase and importation of all supplies from that time onwards. A special organization for securing army meat from abroad was also found necessary from the beginning; this involved control of refrigerated tonnage under the Board of Trade. A system for obtaining weekly reports on retail prices (mainly through the staff of the Labour Exchanges) was put into action at the outbreak of the war; these reports yielded material for subsequent estimates of the increase of the cost of living. The use of cereals and sugar for brewing was limited by an Output of Beer Restriction Act, coming into force on April 1 1916. Apart from this, food supplies were allowed for two years and more to take their course.

By the autumn of 1916, prices, which had risen more or less steadily from the beginning of the war, reached a level which began to evoke acute discontent, and the prospects of an intensified submarine campaign caused anxieties for the future. Two important steps were taken. The first was the establishment in Oct. 1916 of a Royal Commission on wheat supplies, parallel to that on the sugar supplies. This Commission almost immediately took on an international character through the signing in Nov. 1916 of the "Wheat Executive Agreement" between Great Britain, France and Italy, under which the purchase, importation, distribution and shipping not only of wheat but of all cereals was arranged on a common basis for the three Allies, the administrative work being undertaken in London. The Wheat Executive gradually extended its activities to other allies and even to neutrals. The Wheat Commission and the Sugar Commission retained their existence as separate bodies even after the appointment of the food controller, but the latter in practice decided questions of policy and became responsible for supplies of cereals and sugar as of all other foods.

The second step was the making of an Order in Council under the Defence of the Realm Act (Nov. 16) which practically empowered the Board of Trade to introduce a complete system of food control, by regulating the importation, production, distribution, prices and quality of all kinds of food or articles necessary for the production of food. Food control actually began under this Order in Council, immediate steps being taken to lengthen compulsorily the extraction of flour (*i.e.* increase the proportion of the wheat berry which was made into flour, and so into human consumption, as against that which was left as "offals" to be used as feeding-stuffs for animals), to fix milk prices and to restrain extravagance in public meals. The Government of the day at the same time announced their intention to appoint some person with adequate authority to exercise these extended powers, in other words a "Food Controller." Before a suitable candidate for the post could be prevailed upon to accept it, the Government itself fell. The new Coalition Government of Dec. 1916 included among its novelties a food controller to whom full powers were given under a "New Ministries Act." The first holder of the new post, Lord Devonport, gave valuable support to the Wheat Commission in securing adequate tonnage and foreign credits, and carried a stage further the policy of conservation of cereals already embodied in the Output of Beer Restriction Act and the order lengthening the extraction of flour. To facilitate this the whole of the flour-mills were taken over and run on Government account as from April 1917. An appeal to the public to ration themselves voluntarily on the basis of 4 lb. of bread per head per week, 2½ lb. of meat and ¾ lb. of sugar was issued in Feb. 1917, and, backed by an extensive advertising campaign, produced a definite though limited effect on the bread consumption, particularly of wealthy and middle-class households who were better able to obtain alternative foods; for the working-classes alike in industry and in agriculture the suggested ration of 4 lb. a head was impracticably low and among them the appeal met with little response. The failure of the potato crop gave trouble and a first illustration of the dangers of price fixing. Considerable thought was expended by successive committees in devising better methods for the distribution of sugar, but before any could be adopted Lord Devonport resigned (June 1917).

During the spring of 1917, the submarine menace was growing. The very possibility of feeding the people seemed to be threatened. Meanwhile, the people themselves were mainly disturbed by the rise of prices and the bad distribution of sugar. The reports of the Commissioners on Industrial Unrest, received in June 1917, emphasized these two points above all as the causes of unrest. With the coming of the second food controller, Lord Rhondda, the food problem had reached a more serious stage and was met by far more serious measures.

Lord Rhondda prepared himself and the Ministry of Food to deal thoroughly with all three aspects of supplies, prices and distribution. First he attacked prices. In Sept. 1917 the price of bread was lowered from 1s. or 1s. 1d. to 9d. for the quartern loaf, the difference being paid by the Government as a subsidy. At about the same time there was fixed a scale of prices for meat and for live stock, descending month by month from 74s. per cwt. in Sept. 1917 to 60s. in the following January. The fixing of meat and live-stock prices needed to be and was intended to be accompanied by measures for regulating slaughter and marketing, but for various reasons the latter measures did not become effective till the end of 1917. The scale of prices standing by itself gave the farmers a strong inducement to hurry on their beasts to market, so as to profit by the early high prices and avoid the later low ones; too many beasts were thrown on the market before Christmas and too few were kept for the new year; how the ensuing shortage, aggravated by large purchases of home-grown meat for the army and by other circumstances, was dealt with by rationing in the early part of 1918 is described elsewhere.

On the general principle of controlling supplies of all essential foods as a condition of fixing prices Lord Rhondda never hesitated. This policy was carried out most completely in the case of imports. Cereals and sugar were already being imported by the two commissions. Under Lord Rhondda all bacon, ham, lard, cheese, butter and similar provisions, all oils and fats (edible and otherwise), condensed milk, canned meat and fish, eggs, tea and even such extras as apples, oranges, jam and dried fruits, brought into this country, came to be directly imported by the Ministry of Food or requisitioned on arrival. All home-produced meat and cheese and most of the butter passed through the hands of the Ministry as also, through the control of flour-mills, did all the wheat and most of the barley. Even the whole potato crop of 1918 was taken over under a scheme framed in the time of Lord Rhondda, though not put into force till after his death. Ultimately 85% of all the food consumed by civilians in Great Britain was actually bought and sold by the Ministry of Food. The only important exceptions were milk, fresh fish and fresh vegetables. The total turnover of the Ministry's trading (including the two Royal Commissions) was nearly £900,000,000 a year.

Lord Rhondda made a budget of the food required for the country as a whole, and then took steps to see that that amount of food was available. This was partly a matter of securing imports; for this was needed, on the one hand tonnage, and on the other finance, that is to say, foreign credits; the Ministry of Food acting through or with the Governments concerned made bargains with the producers for the whole exportable surplus of Canadian cheese or Australian wheat or American bacon. It was partly a matter of encouraging food production at home. A vigorous food production campaign was started under the Ministry of Agriculture, and the Ministry of Food coöperated with the agricultural departments, in fixing only such prices as appeared likely to secure adequate supplies. In effect, in fixing prices for home produce, it made bargains with the farmers as to the prices at which, with whatever show of reluctance or grumbling, they would be able and willing to produce and to deliver their produce to the Ministry or its agents. The legal power of the Ministry to fix any prices it thought good was absolute; the prices for home produce were actually fixed only after apparently interminable consultations, and were prices which could be expected to produce the required supplies, and did.

The largest single source of imported supplies was the United States. Here a special department of the Ministry was established (Oct. 1917), to purchase on its behalf all food-stuffs other than cereals, for which an organization already existed in the Wheat Export Co.; a branch in Toronto dealt with Canadian supplies. The department speedily grew into an international organization of vast scope; the "Allied Export Provisions Commission" purchased between Oct. 1917 and Feb. 1919 nearly 2¼ million tons of food valued at £267,000,000, at a cost for administration amounting to about $\frac{1}{15}$ of 1 % on this turnover. All these figures exclude cereals and sugar.

The success of this policy of ensuring supplies by direct purchase abroad and consultation at home was unquestionable. The United Kingdom came nearer than any other European country to maintaining during the war a pre-war standard of supplies, and at the same time achieved a far more equitable distribution. This was due to the fact that there was a single national authority making itself responsible for looking after food supplies as a whole, and for using such influence with other departments as would secure that they were forthcoming.

Upon control of supplies was founded an even more extensive control of prices. Once goods were in the hands of the Ministry, it only remained to fix the margins of profit to be allowed to the various classes of distributors and the resulting prices to the public. This was done on the basis of "costings—" that is to say, investigation of the actual costs incurred and margins of profit required by typical distributors; effect was given to the recommendations of the Costing Department of the Ministry by statutory orders fixing the prices or the profits to be allowed at each stage. Ultimately out of everything consumed in the United Kingdom by way of food and drink, 94% was subject to fixed maximum prices. Almost the only articles untouched were fresh vegetables, canned fruits, honey, salt, vinegar, spices, aërated waters and meals in restaurants. Many of these but barely escaped, and only the Armistice prevented the Ministry of Food from fixing prices for soap and candles. It did regulate the prices of tallow, beehive sections, horsemeat and desiccated coco-nut as well as those of oil cakes and other feeding-stuffs. At the time of Lord Rhondda's appointment, many authorities were inclined to say that any fixing of maximum prices must check supply and lead to the disappearance of the article in question. Lord Rhondda secured himself against this by controlling the supply to start with and only fixing the price when the supply was assured. In one or two cases alone, of which beer and the "disappearing rabbit" are the most familiar, did he depart from this policy; he then did so more or less deliberately because it seemed more important to give the public the comfort of protection against profiteering than to ensure them the food.

Lord Rhondda died in July 1918, after a year of office as food controller and nine months of active work. His successor (from July to Dec. 1918) was Mr. J. R. Clynes, who had previously held the post of Parliamentary Secretary at the Ministry and, amongst other matters, had taken an active part in the formation and work of the "Consumers' Council"; this was an advisory body, consisting mainly of representatives of trade unions and coöperative societies, which did a great deal to keep the Ministry in touch with the feelings and grievances of working-class consumers. Mr. Clynes naturally made no great changes from the policy of Lord Rhondda. The most marked feature of his tenure of office was the development of international action, following upon a visit to Europe of the American food controller, Mr. Hoover. An Allied Food Council, consisting of the four food controllers of Britain, France, Italy and the United States, with a standing "Committee of Representatives," was established in Aug. 1918. There was thus extended to food generally the plan already in force in respect of cereals (and to a less extent sugar and one or two other articles), of making international instead of merely national programmes of food requirements, and presenting these international programmes to the financial authorities and the shipping authorities for supply if possible of the necessary foreign credit and tonnage.

By the latter part of 1918, the submarine menace had been practically mastered by the convoy system, and the limits of the food problem had been defined by the success of rationing. The greatest pinch of all, however, was apparently still to come. Considerations of shipping dictated a concentration of traffic on the shortest route—the N. Atlantic—and the abandonment so far as possible of any attempt to get supplies from the Far South and the Far East. Financial considerations by a natural reaction dictated the exact opposite; the British Treasury had relatively ample sterling credit for purchases in Australia, very few pesos in S. America and hardly a cent to spare in the United States or Canada. The Ministry of Food, and other supply departments, constantly found themselves being offered ships only where they could not get credit, and credit only where they could not get ships. On top of this standing or rather gradually growing difficulty came in Sept. 1918 the necessity, as it then appeared, of hastening the transport of the American army so as to deliver a decisive blow in the coming spring. The framing of shipping programmes had by that time reduced itself to a division of two lions' shares between the Ministry of Munitions and the Ministry of Food (or their international extensions), with a few scraps for import of raw cotton or fertilizers and the like; each of these departments was compelled to accept for the winter of 1918-9 a provisional import programme totally inadequate for its needs and to hope that the war would end before its stocks ran out.

This hope was realized. The Armistice of Nov. 11 put an end to hostilities though not to food control, or food shortage in the United Kingdom or other countries. The Ministry of Food, under two more food controllers—Mr. G. H. Roberts (from Jan. to Feb. 1920) and Mr. C. A. McCurdy (from March 1920 to March 1921), lived longer after the end of hostilities than it had done during them, and after its formal demise on March 31 1921, left a substantial legacy of work and staff to be transferred as a "Food Department" to the Board of Trade. The winding up of a business so vastly beyond the scope of any private concern and the adjustment of accounts with the accuracy required of public departments inevitably took much time. The problem of judicious de-control, that is to say of handing back to private traders the responsibility for maintaining food supplies, without risking any failure of supplies or any excessive rise of price, proved exceedingly difficult; it was complicated by more than one change of view as to the speed with which and the extent to which de-control should be accomplished. A reason for not hastening the end of food control appeared in the disturbed condition of industry and the perpetual threat of paralysis in the essential services of coal or transport. The success with which, during the railway strike of Oct. 1918, the supplies and distribution even of perishable foods were maintained by the Ministry of Food shed lustre on its declining years.

At the end of 1918 the Ministry of Food issued a short memorandum with tables and diagrams illustrating its work under the four main heads of supplies, stocks, prices and rationing.

In respect of supplies a comparison is made in the accompanying table of the amounts of the principal food-stuffs available per head for consumption in 1918 and before the war, in the United Kingdom, Germany and Holland:—

Weekly Domestic Consumption of Bread, Meat, Fats and Sugar per Head per Week in the United Kingdom, Germany and Holland. Pre-war and 1918.

	United Kingdom		Germany		Holland	
	Pre-war	1918	Pre-war	1918	Pre-war	1918
	lb.	lb.	lb.	lb.	lb.	lb.
Bread and flour	6·12	6·57	6·44	4·06	7·25	3·06
Meats	2·50	1·54	2·25	0·49	1·50	0·44
Sugar	—	·50	—	0·33	—	0·52
Fats	0·51	0·45	·56	0·15	0·70	0·37

The consumption during 1918 is based on the rations, except in the case of bread in the United Kingdom, where the actual consumption is taken. In the case of sugar no figure of pre-war domestic consumption is given by the Ministry of Food; it is commonly estimated at about 1 lb. per head per week.

It appears from the table that in 1918 the United Kingdom "had half as much bread again as Germany, three times as much meat and fat, and substantially more sugar. As compared with Holland, the United Kingdom had twice as much bread, three times as much meat, more fats, and practically the same amount of sugar." In comparison with pre-war consumption, the bread consumption per head in the United Kingdom had actually increased slightly in 1918; fats had fallen very little; meat had fallen by a little over a third; sugar had fallen somewhat, but an exact comparison was impossible. In all cases the deficiency in 1918 on pre-war figures was far greater, both for Germany and for Holland. In respect of stocks, the figures show how at Sept. 1 1916 wheat, fats, meat and sugar were near the pre-war level, "a dangerous point in war, having regard to the uncertainties of transport," and by Sept. 1918 had been built up to a level ensuring safety for the coming winter.

The course of prices is shown in two stages; one from July 1914 to July 1917, when the main development of food control in the United Kingdom began, and the other from July 1917 to Oct. 1918. For each of these periods the course of British food prices is contrasted (*a*) with that of the prices of certain other staple articles (textiles, coal and soap) in the United Kingdom; (*b*) with that of food prices in France, Germany and Sweden, respectively:—

Rise in Price of Food and Other Necessary Articles in United Kingdom. (Price in July 1914=100.)

	July 1917	Oct. 1917	July 1918	Oct. 1918	Average monthly increase between	
					July 1914 and July 1917	July 1917 and Oct. 1918
Principal controlled foods . . .	205	194	202	216	2·92	0·73
Principal controlled foods assuming no subsidy on bread . . .	205	205	208	232	2·92	1·86
Principal uncontrolled foods .	186	229	311	347	2·39	10·73
All principal foods	203	198	213	229	2·87	1·73
Textiles, leather, etc. . . .	234	245	294	313	3·72	5·27
Coal . . .	135	135	163	177	0·97	2·80
Soap . . .	133	150	233	233	0·92	6·67
Candles . . .	184	184	329	348	2·33	10·93
Household oils .	215	286	319	319	3·20	6·93

Comparison between Prices of Bread, Beef, Butter and Milk, in the United Kingdom and in Other Countries. (Price in July 1914=100.)

	July 1917	Oct. 1917	July 1918	Oct. 1918	Average monthly increase between	
					July 1914 and July 1917	July 1917 and Oct. 1918
United Kingdom	185	179	179	195	2·36	0·67
France . .	170	160	203	220	1·94	3·33
Italy . .	149	154	255	264	1·36	7·67
United States .	140	148	153	161	1·11	1·40
Sweden . .	160	178	268	305	1·66	9·67
Switzerland .	180	187	213	215	2·22	2·33
Germany . .	181	201	249	228	2·25	3·13
Austria . .	318	367	502	622	6·05	20·27

The following comments from the memorandum of the Ministry of Food are interesting:—

"The effect of the introduction of price control from July 1917 onwards is very marked. The rate of increase for controlled food since that date is one-quarter of the rate before then and is also very much less than the rate for other articles and for other countries. If the prices of such food had continued after July 1917 to rise at the same rate as before, they would in Oct. 1918 have stood not 115% but 150% above the pre-war level. If they had continued after July 1917 at the same rate as textiles, they would have reached 185%. The controlled foods cover 94% of the total food expenditure.

"The keeping down of food prices is of course to some extent due to the introduction of the bread subsidy. Though with this allowance the effect of control in slowing down the rise of prices is naturally less, it is still clearly marked. The rate of increase in food prices after July 1917 remains little more than half the rate before then, and less than the rate of increase for any of the other articles shown. To this result two distinct factors have contributed—one, the fixing of prices and margins by the Ministry of Food on a costing basis in this country; the other, the action of the Government of the United States and other exporting countries in controlling the prices paid to the producers there.

"It is probably no exaggeration to say that a large part of the population have been better fed during the war than at any previous period, because for the first time they have been assured of regular work and wages. A number of luxuries and subsidiary foods—fruit, canned fish, sweets, etc.—have been cut off. The supply of essential foods, though reduced as a whole, has been sufficient for all because it has been fairly distributed among rich and poor."

The Ministry of Food in the United Kingdom accomplished, with a reasonable minimum of mistakes, the work for which it was established. The rationing system adopted is dealt with separately under RATIONING. Two cautions or criticisms are not out of place. First, the administrative machinery required was very extensive. The staff directly employed by the Ministry, either at headquarters or in the offices of the Divisional Food Commissioners and Livestock Commissioners, numbered at its maximum over 8,000. In addition the local food control committees employed varying numbers, rising at times of exceptional pressure to as many as 25,000 persons. The printing and stationery bill for a single year exceeded £1,500,000. The expenditure was no doubt fully justified by results, and under the arrangements made it did not fall on the taxes but was covered by a trifling percentage on the price of the articles in which the Ministry dealt. Second, while the profits and margins secured by distributors were undoubtedly lower than they would have been in a time of scarcity without control, they were probably not as low as in a time of plenty without control but with competition. The policy was adopted, indeed no other policy was possible, of preserving the normal channels of trade. This meant that the margin at each stage of distribution, *i.e.* the difference between the price at which the distributor received his supplies and that at which he was compelled to pass them on, had to be fixed at a point which would afford a living to the distributor of average or less than average efficiency. The more efficient distributor could still make very large profits and did so; he had no motive for cutting prices in order to increase business, since his share of the total business was stereotyped.

If the position of the United Kingdom be briefly compared with that of other countries, it is seen that the central fact facilitating food control in the former was that it had to look to imports rather than to home production for the bulk of its supplies. This simplified the problem of the British food controller (till he was driven to rationing) by making it largely a question of how much shipping he could extort from the shipping controller and how much foreign credit from the Treasury. Both Italy and France produced a larger proportion of their cereals at home, and required less meat. In Italy even sugar was mainly home grown. For the food controllers of Central Powers, questions of importation hardly arose. Their main problem—and one which they solved only to a limited degree—was that of inducing the farmer to give up a fair proportion of his produce at the official price to the public authorities. They seem, indeed, to have been considerably less successful than the British food controllers in getting agreement with the agricultural population on production and prices; sometimes, at least, prices were fixed which the farmers regarded as arbitrary and which they evaded systematically by contraband sales. Two minor features may be mentioned as having simplified the British task. One is the concentration of the great bulk of flour-milling in the United Kingdom in a small number of important mills (less than 700), which could be readily controlled and which furnished the only easy market to the farmer and the corn merchant; in most other countries mills are more numerous and smaller, and it is common for the farmer to grind his own corn. The other is the limited power of the British municipal authorities. In Germany it was the natural thing for the separate municipal councils to act as independent organs of food control, making their own contracts with neighbouring rural districts for the supply of food to their citizens, fixing prices in their markets, and rationing when need arose. This made possible competition, confusion and difference of standard between the authorities, and made difficult a survey of the nation's needs and resources as a whole. In the United Kingdom, Lord Rhondda, as housekeeper for a family of forty millions, made a single bargain with each group of producers, put all the supplies from different sources into one pool, and distributed them fairly at standardized prices.

In the United States (see p. 98) the problem was different. That country in itself experienced no shortage of any essential food, but became the great source of supply to all the Allies in Europe, and gained in importance as shipping was concentrated on the shortest and most defensible N. Atlantic route. To perform this function it applied (1) a great food production campaign, (2) a campaign for voluntary food saving in order to leave a surplus for the Allies. It had then to face the administrative problems of getting these supplies along the railways and through the ports in competition with munitions, and with its own army. (W. H. B.)

FEEDING OF THE BRITISH ARMY DURING THE WAR

The feeding of any army is a feature of the Supply Department, the term "supplies," from a military point of view, being applied to all stores and articles required for the maintenance of an army in the way of food or fuel for men, forage for beasts, or fuel, petrol and oil for aircraft or mechanical transport, hospital requirements in the way of food, medical comforts, etc., with the exception of medicines, drugs or surgical appliances (*see* generally SUPPLY AND TRANSPORT).

For a proper understanding of the problem of feeding a modern army, and of what was done in this connexion by Great Britain during the World War, it is necessary to recall how armies were fed in the past. In primitive times, when one nation or tribe invaded another, the subsistence of an invading army depended upon indiscriminate individual plunder. The process was so wasteful that this individual plunder was soon supplanted by a more economical system of gathering the spoil into heaps or magazines; but accumulation is but a means to the end of distribution, and in return for such distribution of victuals a deduction or stoppage was soon made from the pay of the soldier. This was the beginning of the financial control of the department of supply. The third stage was to organize plunder more thoroughly by compelling inhabitants to form magazines, or in other words, by recourse to requisition. The fourth stage was speedily reached by its being discovered that such magazines were more readily and effectively created if the inhabitants were paid instead of compelled to fill them; thus for robbery was substituted purchase, and instead of the military hand was substituted the financial hand, and the hold of the Treasury over the province of supply was strengthened. As the means of communication improved, the mobility of armies called for a better organization of supply. It became imperative to import foodstuffs from a distance, as, owing to the growth of armies, the theatre of war was no longer able to maintain them from its local resources. To bring food from a distance requires transport, and consequently the Treasury or civil side were gradually obliged to organize a transport as well as a supply system. In military operations, the maintenance of order on roads, and means of communication, are of first importance, and order cannot be maintained without discipline. Transport therefore very early passed under the military or semi-military control, whereas supplies remained much longer under civilian or Treasury control, with the result that there was constant friction.

For two long centuries in Great Britain the Treasury struggled against the concession of any financial powers to any military department, and as a consequence, untold millions of money were wasted; only in 1888 the two Departments of Transport and Supplies were blended into one and placed upon a military footing by the creation of the Army Service Corps, thus bringing these two important services completely and entirely under the commander-in-chief, or as it is to-day under the Army Council.

What might be described as the first systematized endeavour to feed British troops in the field was introduced during the wars in the Low Countries. The Treasury appointed a commissary, who was invested with supreme financial control, and was responsible for the maintenance of the army. His system of going to work was to make a contract with some individual to supply the army with bread and bread waggons, and with the supply of this article his responsibility for the feeding of the army came to an end; all other provisions were a regimental matter and were furnished by private speculators, namely, vintners, sutlers and butchers. This system of contracting practically continued, with slight if any modification, right down to the outbreak of the World War, with considerable modifications, of course, as the centuries and years passed, so far as the soldier's ration was concerned; meat was added first, and bread and meat formed the sole ration issued free to the troops in England up till towards the end of the 19th century, when during peace-times a soldier got a money allowance in addition, for the purpose of buying the remaining portion of his rations.

During the ordinary peace-times, and before the outbreak of the World War in 1914, the system in force in Great Britain as regards the feeding of the army was by means of contracts. The General Officers holding the chief commands made arrangements by periodical contracts, varying in duration from anything to 3, 6 or 12 months, for the supply of commodities required.

The soldier was supplied with his bread ration 1 lb., his meat ration $\frac{3}{4}$ of a lb. He was credited personally with 3d. per diem. This sum was supplemented in a well-run unit by an additional grant of $\frac{1}{2}$d. or so from the canteen funds; the money was expended in the Regimental Institute on the remaining portion of the soldier's food, *i.e.* groceries, vegetables, extra dishes, etc.

In war-time the entire maintenance of the soldier became the duty of the State, so that from providing only two articles, bread and meat, the State was faced with the problem of providing a complete and full diet, consisting of a very large number of articles and other requirements.

In order to fulfil these duties, the system in the past had been for the War Office to enter into a number of contracts with numerous army contractors for the supply of the various goods required. The contractors would undertake to supply so much biscuit, cheese, jam or any other of the many and various articles, either delivered at the base of operations abroad, or more frequently on board ship at a port of departure in this country. In order to insure that the requisite quality of the goods was kept up, a number of (generally speaking, retired) officers were appointed to carry out periodic inspections at the factories or other places of production. It will be readily seen that such a system was bound to lead to grave abuses, and at the termination of every war up to that of 1914–8, there had always been either grave complaints or scandals, necessitating an enquiry as to why the troops were supplied with bad food, and frequently as to why the State was swindled.

In the event of a general mobilization, the laid-down scheme or plan was that so far as the Expeditionary Force was concerned, the War Office would enter into contracts for the supply of the necessary articles required; the supply of meat being insured by employing contractors to drive live cattle behind our army in the field, and all other supplies to be obtained as explained above. For the feeding of the troops mobilizing or being trained at home, general officers and commanders-in-chief were to make their own arrangements in the way of entering into contracts to meet the requirements of their troops, and this system was practically the same as had been approved and agreed on ever since any proposal for general national defence had ever been considered.

Early in 1909, the British War Office, having received information as to the rapid mobilization plans for the German army, decided that it would be necessary to increase the rapidity of British mobilization, and with this end in view, instructions were issued for considerable acceleration. Up to that time it had always been considered that it would be quite impossible for any Expeditionary Force to leave Great Britain in under three weeks, whereas under the new proposed scheme it was suggested that the larger portion could be in a position to depart almost in as many days. In order to carry out these proposals, it was of course necessary to accelerate considerably the supply mobilization machinery. There was at Woolwich Dockyard an accumulation of preserved meat, biscuit, tea, coffee, sugar, jam, salt, medical comforts, etc., sufficient for the requirements of the Expeditionary Force for a few days. The proposal then was that, by means of urgent priority telegrams, army contractors would be got into touch with, and arrangements made for all supply requirements at the earliest possible moment.

In July 1909, Col. (later Maj.-Gen.) S. S. Long (b. 1863), on vacating the position of Commdt. of the A.S.C. Training Establishment at Aldershot, was posted as Assistant-Director of

Supplies at Woolwich Dockyard, and on assuming charge there he found that the total written instructions as regards supply mobilization in the event of war were embodied in some three or four typewritten sheets of foolscap, the bulk of the instructions being little more than pious hopes. Up to that period, Col. Long (who, having been through the S. African War, had in that war become D.A.A.G. and then A.A.G. for transport) had been looked upon at the War Office as a leading transport authority, he having compiled the official text-book upon this important subject. He proceeded to make a close study of the whole supply problem, with the result that he gradually evolved a new system for the feeding of the British Expeditionary Force. This system was put into operation from the outbreak of the World War to its termination, without being in any way materially altered. Instead of the costly and wasteful way of obtaining and driving live cattle for the purpose of meat supply, behind the armies, he proposed that frozen-meat ships, loaded up with tens of thousands of carcasses of sheep or quarters of beef, be placed at convenient ports, and from these ships the fresh meat supply would be absolutely guaranteed, and at a cost very slightly above the usual price pertaining during peace-times, and much less than half what it had cost in any previous war. The frozen meat ships not only fulfilled the purpose of insuring the meat supply, providing an adequate reserve of from 50 to 60 days at a time, but they also served a further purpose of acting as cold storage for quantities of hospital supplies, such as fish, poultry and many other commodities required for the invalid feeding of the many sick and wounded.

The original supply mobilization proposals presupposed army bakery companies, moving immediately behind the troops and baking bread to meet the requirements. In the S. African War of 1899–1902, similar arrangements had been made, but actual practice had proved that it was impossible of fulfilment, and the bulk of the British troops were then almost entirely fed upon the much-disliked army biscuit. Col. Long now suggested that the more feasible and sound plan was to locate the army bakeries a long distance in the rear of the fighting troops; that the loaves of bread as baked should be put 50 at a time into the cheap, loosely woven sacks which are readily and plentifully to be obtained in the trade at comparatively small cost, known as offal sacks, and by this means they would be readily handled and railed forward daily to the troops right into the fighting line. His recommendations and their adoption were proved quite correct, with the result that for the first time in its history, the British troops were during the World War fed largely on bread instead of biscuit, in spite of the vast numbers under arms. Instead of the old system of contractors putting the goods they had contracted to supply on board ship, or delivering overseas, Col. Long suggested that a definite home port should be selected as the spot from which all supply requirements for the army would be despatched, to be known as "The Home Base Supply Port," and after consultation with the Admiralty it was finally agreed that Newhaven should be earmarked for this purpose. It was then arranged that directly on the outbreak of war, an already earmarked staff in the way of Naval Embarkation Officer and officer in charge of the Supply Depot, with all the necessary staffs, etc., would instantly proceed to this port, taking over all the available stores, and generally carrying out the duties of such a port, whilst all contractors would consign their goods to that port, where they would be thoroughly examined and passed as sound and fit to be embarked on the various supply ships. In order further to protect the public and the soldier's interests, arrangements were made with the Public Analytical Department of Somerset House, for that department to send a staff of chemists down to Newhaven to analyze the goods on the spot, so as to save time; and it is only right to emphasize the debt of gratitude due to the Analytical Department for insuring not only that the goods were of the proper quality, but also that the fighting soldiers were adequately fed.

During the years that followed from the end of 1909 onward to 1912, the schemes and plans to be adopted in the event of a general mobilization and the despatch of the B.E.F. were gradually elaborated and extended, until at the end of 1912 all supply requirements had been most fully thought out and provided for, together with complete instructions for the Home Base Depot, the overseas depots, etc. Nothing remained to be done in the event of mobilization beyond putting the scheme in force.

Meantime, Col. Long had been evolving schemes for the modernizing of the feeding of a nation in arms, which he foresaw must result in the event of a great European war, involving general mobilization. However, at this period—although directly under the War Office, not being a member of the War Office staff—he found little opportunity of ventilating his opinions or successfully bringing his suggestions to notice. In Jan. 1913, Gen. Long moved from Woolwich Dockyard into the War Office becoming Director of Supplies. He then set to work to inaugurate an entirely new system, the essence of which was the complete elimination of contractors with the British forces either in the field or at home. Except in a very minor degree as regards home forces, everything required for the forces would thus be obtained direct from the factories, so that the middleman's opportunity had disappeared.

Up to this time it had been left to individual generals, commanders-in-chief, commanders of district or coast defence, to make their own arrangements and contracts, so far as feeding and forage were concerned, with the result that in the event of war occurring, there would have been a very large number of authorities going on the general markets of the country, and purchasing not only against the public, but against each other. This old system, in circumstances such as those at the outbreak of the World War of 1914, would have undoubtedly created a veritable Eldorado for the unscrupulous contractor, who would thus have been enabled to make vast fortunes; and there is very little doubt that, had the old system continued, a very much worse question would have arisen owing to the uncontrolled purchasing by a large number of authorities, since in addition to those named above, the War Office itself and the Admiralty would also have been heavy buyers, and a panic would undoubtedly have occurred on the market. Furthermore, under such a system, it would be absolutely impossible to move troops in large bodies from one part of the country to another.

Gen. Long pointed out that only one system was possible or would insure safety, and that was for one Government department under one individual alone to be responsible for all army maintenance. According to his proposals, it was suggested that three great base depots be formed, one in London, one at Bristol and one at Liverpool, and that in addition, a number of main depots be created, one at Glasgow for the supply of Scotland, one in Dublin to meet the requirements of troops in Ireland, and three down through the centre of England, at Leeds, Northampton and Reading; the idea being that at each of these great depots—at which cold storage was available—would be accumulated sufficient reserves of rations of all kinds to meet the requirements of so many hundred thousand men for a given number of days, so that when it became necessary to move large bodies of troops in any direction desired, all that it was necessary to do was to increase automatically the reserves of the depot affected by the number of troops based thereon; the War Office being entirely responsible for the provision of these depots. The general proposal was that each of these proposed depots should be very carefully surveyed, all plans and arrangements drawn out, together with the necessary establishment of officers and other personnel. Standing orders and full instructions would be prepared for each depot, so that, in the event of being required, everyone connected therewith could step into their place with the minimum of confusion. Then, should occasion arise, for the first 10 days after mobilization was ordered the depot would not be called upon to perform any duties other than organizing itself and receiving the supplies which would be poured into it, under arrangements to be made centrally by the War Office. Meanwhile at the War Office itself would be kept not only full details of each depot, but a consolidated return showing the total requirements, so that directly mobilization was ordered the Contract Branch of the War Office, working under the instructions of the Director of Supplies, would at once proceed to make the necessary contracts to purchase the supplies required to meet the needs of each particular depot. Under the old system it was, of course, obvious that, in the event of a general mobilization, the ordinary contract system of feeding the troops in the United Kingdom would necessarily break down, owing to the fact that at many of the stations the contractor would possibly be only a small butcher or baker, supplying depots of possibly one or two hundred men in number, whereas on mobilization that same depot at once expanded into several thousand, entirely beyond the ordinary small contractor.

Gen. Long's proposal for dealing with this matter was that on mobilization, as all contracts failed, and owing to popular excitement, possible inflation of prices, etc., it would not be possible to make other satisfactory contracts, every commanding officer would be authorized to take credit in his regimental messing accounts for 2s. for every man present with or joining the unit under his command, and similarly the sum of 1s. 9d. per diem per horse, and that he was then to make the best local arrangements he could with the money in question for the feeding of his men and animals. This system would go on for 10 days. At the end of that period the great depots throughout the country would be stocked and in working order and ready to take up the whole army supply throughout the United Kingdom.

These ideas were so novel and completely at variance with the general accepted ideas of the past, that when Gen. Long first made these proposals, they met with determined opposition from the finance side of the War Office. It was not indeed till July 1914 that he succeeded in getting his way and forcing the civil side of the War Office to accept his proposals, and it was not until towards the end of that month that the final instructions to all commands went out, directing exactly what was to be done in the way of feeding men and animals on mobilization. Similarly he met with strong opposition to his proposals for the formation of the great depots, not only from the civil side of the War Office, but also from the military as well.

Incidentally this complete change of system of army supply, and entire departure from all the laid-down rules of army feeding of the past, successful as it was from an army point of view, was if possible of even greater importance to the nation at large. Had the old system continued and been in operation when the war broke out, every army contractor, and every trader who aspired to be such, would instantly have proceeded to buy up the market and corner the various commodities, in the hopes of selling them at a great profit under contract to the various generals seeking to make contracts for the feeding of the troops under their command. As a matter of fact, in a measure this did happen on the outbreak of the war, so far that holders of goods and commodities withheld their stocks and ceased to put them on the market. Immediately after the outbreak of the war, it suddenly became impossible to buy a number of household requirements in the way of sugar, bacon, etc., owing to there being none on the market; well-to-do people, in a panic, began to lay in stocks at exorbitant prices, and from many large towns came the sounds of ominous murmurings from the poorer population who were unable to obtain their daily food. This continued for some three or four days; and it was not generally realized that it was the adoption of Gen. Long's system that suddenly restored an absolutely free market, with commodities little if anything above the prices prevailing at the end of July 1914. The reason for this was that the War Office being the sole buyers, and finding that importers, manufacturers and holders of goods were refusing to sell, Gen. Long, without waiting for authority, and taking the law into his own hands, proceeded to requisition certain requirements urgently wanted by the Expeditionary Force. He thereby forced the Government to pass immediately a requisitioning Act, and within 24 hours the holders of commodities were throwing their goods on the market, fearing to hold lest they should be requisitioned. Also, the War Office being the only buyers of meat other than the ordinary public, they were in the position of forcing the meat market to continue reasonable prices under the threat of requisition if they failed to do so. This close control over the meat market was practically maintained right up to the middle of 1916, when the price of good average quality frozen meat to the Government landed in England was only a decimal point or two over 6d. per pound, and to the public at large only some couple of pence more.

During peace-time, in order to insure that the quality of supplies composing the soldier's ration should be kept up to a good sound standard, all A.S.C. officers were carefully trained so as to be good judges in this respect, and in addition, some exceptionally well-qualified officers were appointed special inspectors. On the outbreak of war, of course, all such officers were necessarily required for the fighting formations or for other almost equally important duties in connexion with the mobilized armies, and consequently the general inspection of supplies as to quality had to be relegated to a number of retired officers. The result of this in the past had been that, although such officers did their best, many of them had been retired for a great number of years, and were entirely out of touch with modern requirements, or, owing to age or infirmity, the work required was beyond their capabilities. The day following the outbreak of the World War, Dr. MacFadden, the medical head of the Public Health Department of the Local Government Board, went to Gen. Long at the War Office, to know if he could be of any assistance to him. Gen. Long at once replied that there was no one who could do more for the country and the soldier than the Local Government Board if they would undertake the duties; he was well aware that, under the procedure adopted by great Government departments, opposition would be raised by the Military Medical Authorities and the War Office, to the idea that the Local Government Board should in any way be allowed to interfere with the food of the soldier or the methods of its supply, etc.; but he for his part could not devise any system for a proper inspection, whereas the Local Government Board had all machinery ready to its hand, which could be turned over for the protection of public interests, and also the soldier's, without it costing one single penny. Gen. Long therefore proposed to Dr. MacFadden that he (Dr. MacFadden) should undertake the entire responsibility of seeing that all food-stuff supplied for use of the soldier should be of unexceptional quality, thoroughly sound and good, and fully complying with all the conditions of purchase; that he himself (Gen. Long) would supply Dr. MacFadden with copies giving specifications of everything in the way of food-stuffs; he would also supply Dr. MacFadden with a list of every factory, warehouse or other persons supplying the War Office with food-stuffs throughout the United Kingdom, and keep him so supplied; and then, if Dr. MacFadden would supply to each Health Officer a copy of the specifications and a list of the premises where food was being stored or manufactured for the War Office within that Health Officer's area, and request him to keep the closest watch upon the same, and immediately to take action under the Public Health Acts, if any wrong were committed or attempted—then a perfect system of inspection would be attained.

All these duties Dr. MacFadden readily undertook, and the result exceeded the most sanguine expectations. The prosecutions were singularly few, but this undoubtedly was largely due to the closeness of the inspection. Medical Officers of Health threw themselves whole-heartedly into the scheme, and not only visited factories daily, but posted their inspectors of nuisance almost continuously on the premises. As a result of the first prosecution, a letter was sent to the Medical Officer of Health for the district in question, by Gen. Long on behalf of the Army Council, thanking him for his public services in safeguarding the interests of the country and more particularly the interests of our fighting men. The result of this was that every Medical Officer of Health throughout the United Kingdom redoubled his efforts to insure the best of quality, in the hopes that, could he catch a supplier slipping, he would then have the good fortune to obtain a similar letter. It is a well-known fact in official life that one Govt. Dept. objects to giving credit to another department for any work which it may do, and consequently it is not to be wondered at that little or no acknowledgment was made by the War Office for the services which were performed for them by the Local Government Board in general, and Dr. MacFadden and all his officers in particular. The Local Government Board also undertook to send specially qualified Health Officers abroad to see that the quality of preserved meat being manufactured in both the United States and S. America was kept up to the highest possible standard.

It is unnecessary to go in detail into the very slow but gradual improvement of the soldier's ration in war. The appalling mistakes and lack of suitable feeding for the British armies during the various modern campaigns from the Napoleonic wars down to the outbreak of the World War can in a large measure be read in the various histories of those wars. The starvation and neglect of the armies in the Crimea are well dealt with by Kinglake; but although Great Britain had been involved in a great number of minor wars, the authorities still seemed to lack the power of organizing our supply service upon a proper basis. To take only two campaigns to exemplify the fact:—the Egyptian War caused many complaints and grumblings as to the unsuitability or lack of proper food, and the heavy cost of the same, although at that period the improvement of the soldier's diet was greatly in advance of previous campaigns; S. Africa showed still more improvement, but owing to the lack of system it was a frequent complaint that the supplies on arrival at the front were in a rotten and putrid condition—there were many instances of their arriving in that condition at the base of operations at Cape Town or other ports. The cost was out of all proportion to what it should have been. Great fortunes were made by unprincipled contractors, and at the end of that war a lengthy enquiry was held into many grave irregularities.

Shortly before the outbreak of the World War, some experiments in food values had been carried out in America, and under War Office orders similar experiments were carried out in England. A special committee was appointed by the War Office to go into the whole question, and to recommend a suitable "active service" diet for the soldier. The result of this committee's labours was that a very carefully balanced diet was got out, which would be not only palatable, but also would contain all the necessary calories or energy units sufficient to maintain the normal man exposed to the rigours of a bad climate on active service. The recommended daily ration for the soldier on active service was as follows:—

Bread—1¼ lb. or biscuit 1 lb. or flour 1 lb.

Meat—	
Fresh, if obtainable	1¼ lb.
Preserved	1 "
Bacon	4 oz.
Meat extract (part of iron ration)	1 "
Cheese	3 "
Fresh Vegetables, when available	8 "
Or peas, or beans, or potatoes, dried	2 "
Tea	5/8 "
Jam	4 "
Sugar	3 "
Salt	½ "
Mustard	1/20 "
Pepper	1/36 "
Limejuice	1/320 gal.
Rum	1/64 " (At discretion of G.O.C. on recommendation of medical officer.)
Tobacco	2 oz. a week.

This ration undoubtedly gave universal satisfaction. The only improvement that it contained over that supplied to troops in S. Africa was the addition of the 4 oz. of bacon and 3 oz. cheese; but the really great improvement was that the quality was invariably well maintained, and the soldier received the same with the utmost regularity.

During the last week in July 1914, the officers who were earmarked for the command of the eight great supply depots in the United Kingdom attended at the War Office under instructions which had been issued some few weeks earlier, and before the imminence of the outbreak of the war had ever occurred to anyone, in order that as a precautionary measure they might receive some general instructions as to the new method of feeding the army on mobilization, and in order that they might then visit the actual spot where they would be employed in the event of the necessity arising, so as to be thoroughly *au fait* with the whole position so far as they were concerned. This visit to the War Office was certainly well-timed, so that after the whole of their duties had been fully explained to them by Gen. Long, they at once proceeded to their war stations, and as a consequence, on Aug. 4 1914, they had already had some few days to work out their preparations locally.

On Aug. 5, so perfect were the supply arrangements, that many trains had already been loaded and were on their way to Newhaven; the necessary Supply Officers and personnel crossed on that day to France; and on Aug. 6, two days after the declaration of war, British supply ships were already steaming across the Channel, actually preceding the troops by some hours.

The Director of Supplies, Expeditionary Force, attended at the War Office the day following the declaration of war, when he received not only printed instructions, which had been most carefully prepared as regards his own duties, but copies of instructions for Supply Officers of base depots, rail depots, advance depots and for all Supply Officers doing duty with formations.

From the moment the Expeditionary Force left, the Director of Supplies Overseas was in close daily correspondence with the Director of Supplies at the War Office, so that, as a matter of fact, the latter officer kept his hand upon the feeding of the army down to the very smallest particular.

Under a good system it is comparatively easy to maintain an army when it is victoriously advancing, but the great test of war is the maintenance of an army in retreat. If proof were ever needed as to the perfection of the supply arrangements, it is in the fact that during the British retreat to the Marne, so far as the official records go, there was only one occasion when a division went a day without its food, and was compelled to fall back on the emergency ration, consisting of 1-lb. tin of preserved meat, 1 lb. biscuit done up in a small linen bag and a grocery ration, and even on the one occasion when the division missed its daily supply of full rations, it was not the fault of the Supply Units of the Formation, but owing to bad staff work, as it was subsequently found that there were supply columns looking for this division on its right, on its left and even between it and the advancing Germans. When the forces in France were joined by divisions of native troops from India, there was a breakdown of the Indian Military Supply system; the War Office took up the duties, and never in its history had native troops been so well fed and looked after.

When it became necessary to send an expedition to the Dardanelles, and later on to Salonika, then to E. Africa, the supply system was expanded to meet requirements with apparent ease. The system, as laid down and provided for, continued in existence throughout the whole war in all theatres of operations, with the exception of Mesopotamia, which was under the Indian Government, and which, as is well known, hopelessly broke down; whereas Gen. Long's system remained in force from start to finish with but the very slightest modifications.

The business of supply being officially part of the quartermaster-general's department, at the head of which, during the World War, was the late Gen. Sir John Cowans, it must be recollected that, so far as the Expeditionary Force was concerned, Gen. Long's proposals had been agreed to during the earlier period when Gen. Sir Herbert Miles was quartermaster-general. As regards the general regulations for supply mobilization introduced by Gen. Long in 1913, Sir John Cowans was then quartermaster-general, but it is only right to say that there was not a single detail of the work which originated from him, and the greater bulk of it was carried through without even his knowing exactly what was being done. There are War Office minutes in existence, in which Gen. Cowans himself acknowledged that, so far as the supply system was concerned, during the first 20 months of the war—at the end of which Gen. Long, knowing that it was running smoothly, left the War Office—he had never in any way interfered therewith.

The crowning success of the whole British Supply system during the World War is undoubtedly the fact that not only were the troops, in spite of their great number, the best fed that the world has ever seen, but from a cost point of view possibly the cheapest fed, considering the enormously inflated world prices; and throughout the whole course of the war, for the first time in British military history, there was a complete absence even of rumours of corruption in connexion with the feeding of the army.

(S. S. L.)

UNITED STATES

Upon its entry into the World War, the U.S. Government was confronted with the fact that the previous heavy demands upon the country's markets had drained the grain reserves and diminished other important basic stocks, such as the number of breeding hogs. This situation was aggravated by the fact that the 1917 wheat harvest was far below normal and the corn crop failed to mature properly. The Government therefore found food control one of the first of its war problems. This control required measures which, without unduly disturbing the normal economic conditions within the country, would (1) increase American exports, particularly of breadstuffs, meats, fats and sugar; (2) maintain such stability in prices as would encourage the domestic producer and thus increase production, while protecting domestic consumers against speculation and profiteering; (3) regulate the distribution of food exports and imports so that only the necessary minimum should go to neutrals, that the maximum should be properly divided among the Allies, and that leakage to the enemy should be prevented; (4) enable the Government to regulate buying in the home markets so as to further all these policies.

The Government Agency for Food Control.—To give the executive branch of the Government the necessary powers, Congress passed as war measures the Embargo Acts (June 15 1917 and Oct. 6 1917), the Food Control or Lever Act (Aug. 10 1917) and the Food Survey Act (Aug. 10 1917). The Embargo Acts gave control over imports and exports, with power to license and fully regulate export and import operations. The Food Survey Act gave additional powers to the Department of Agriculture to enable it more effectively to assist the farmers.

The Lever or Food Control Act conferred upon the President the following powers:—(1) To license those engaged in the importation, manufacture, storage or distribution of foods or feeds, and to issue rules and regulations governing such licensees (retailers doing less than $100,000 business annually being especially exempted from this provision); (2) to buy and sell wheat, flour, meal, beans and potatoes; (3) to requisition foods and feeds for the army and navy and for public uses connected with the common defence; and (4) to create agencies for carrying out the purposes of the Act. The Act also prohibited under severe penalties the hoarding of foods and feeds, or their destruction for the purpose of enhancing their price, or conspiracy for that purpose. Other practices such as making excessive charges for foods or services in connexion with foods were made unlawful, but no penalty was provided. The Act gave no powers for price-fixing, but Congress itself fixed a minimum price of $2.00 per bus. for the 1918 crop of wheat, and gave the President power to fix minimum prices for subsequent wheat crops.

By executive order of Aug. 10 1917, the President created a governmental agency designated the U.S. Food Administration. This order appointed Herbert Hoover, food administrator, and delegated to him the powers granted to the President by the Food Control Act. Mr. Hoover, since the outbreak of the war in Europe, had been chairman of the Commission for Relief in Belgium, where he had demonstrated his ability as an economist and organizer and gained unrivalled experience in war-time food problems. The Government had called him home soon after the United States entered the war in order that he might give his advice as to the measures to be taken.

The Food Administration had thus become, by Act of Congress and executive order, the special war agency of the Government for food control. Although it worked in coöperation with the Department of Agriculture, it was a distinct agency, and the food administrator was responsible directly to the President. Because it was a war emergency agency, the food administrator could arrange that those who were associated with him in the direction of the work should, like himself, serve without compensation. As volunteers they could without reservation seek the voluntary coöperation of households, farmers and the food trades, and upon such coöperation the achievements of the food administration were principally based.

With the approval of the governor a federal food administrator was appointed in each state and territory, and he, in turn, selected a local administrator in every county and large city. In all, some 8,000 volunteers gave their whole time to the work of the Administration, and part-time service was given by some 750,000 members of the various committees, chiefly women. About 3,000 persons, chiefly clerks, received salaries. Two great governmental corporations were also created to assist the Food Administration. The first of these was the Food Administration Grain Corp. (which after July 1 1919 became the U.S. Grain Corp.), which eventually was given a capital of $150,000,000. This corporation acted as the buying and selling agency for the Government chiefly in the matter of wheat control, though it dealt to some extent in practically all the commodities in which the Government was authorized to deal by the Lever Act. The other corporation was the Sugar Equalization Board, capitalized at $5,000,000, and authorized to coöperate with the Allies in the purchase of sugar. It was through the Sugar Equalization Board that the distribution of the 1918 and 1919 sugar crops was controlled.

Food Conservation.—The problem of increasing American exports involved the reduction of both the waste and the consumption of all commodities, and the substitution at home of certain surplus commodities for those particularly required abroad. This was the basis of the appeals for food conservation, which became the most familiar incident of food control. The European Governments had adopted rationing (*see* RATIONING) as the basis of food conservation. Mr. Hoover and his associates, however, relied chiefly upon the spirit of self-sacrifice of the American people for this war service, and in America conservation was achieved mainly by the voluntary action of individual citizens, stimulated and directed principally by influential women who volunteered their services. With the coöperation of the entire press, an intense educational and patriotic appeal for conservation was made throughout the country. Days which became popularly known as "less" days were established. One day of the week was designated by the Food Administration as that on which a certain important food should not be served or eaten; for example, there was in each week a meatless day, a porkless day, and more than one wheatless day, and these were almost religiously observed by practically the whole population as a patriotic duty. So effectively was conservation impressed upon the public mind that a new verb, "to hooverize," came into common use to describe food saving, and was soon used to designate saving in other commodities as well.

The most effective measure for securing national observance with uniform and definite rules for saving was the pledging of housewives, hotel and restaurant keepers, and retail dealers to the voluntary observance of "less" days and other standardized methods of saving. As a result of campaigns for signed pledges, some 14,000,000 families, 7,000 hotels and public eating-places, and 425,000 retail dealers were enrolled in the United States as definitely pledged to the observance of the food conservation programme. Retail dealers in food were eventually required to limit their sale of wheat flour and to require the purchase of a certain specified proportion of substitutes as an accompaniment of every purchase of wheat flour. Wasteful commercial and industrial practices such as faulty loading of railroad cars with perishable foods and the acceptance by bakers of bread returned when stale were prohibited.

In the Lever Act, Congress provided that after Sept. 10 1917, foods, fruits, food materials or feeds should not be used in the production of distilled liquors, and further gave the President power to prohibit the use of these materials in the production of malt or vinous liquors when he should determine a necessity therefor existed. On Dec. 10 1917, the President issued a proclamation limiting the consumption of foodstuffs by brewers in the production of malt liquors to 70% of their consumption in the year 1917. Maltsters and near-beer manufacturers were also licensed and subjected to rules limiting their use of grain. In Sept. 1918, the grain supply outlook called for further restriction on consumption and on Sept. 16 1918, the President issued a proclamation prohibiting the use after Oct. 1 1918, of any food or feed, except malt already manufactured, in the production of malt liquor, including near-beer. This proclamation brought into operation full restrictions against the use of food-stuffs in the production of any distilled or malt liquor. Since these were measures taken for the conservation of food-stuffs only, they did not, however, prohibit the sale of intoxicating beverages, although a "War Time Prohibition Act," passed by Congress Nov. 21 1918, did provide for war-time prohibition pending demobilization of the army, and beginning on July 1 1919. This, however, was a measure of prohibition for protection of the soldiers and not a food control measure. The use of food in other manufacturing trades was also controlled and restricted by the regulations of the Food Administration, particularly the use of sugar in the manufacture of candy and other non-essential sweets. The conservation programme was in full force from Sept. 1917 until Nov. 1918, when it was withdrawn shortly after the Armistice. The results show that after the United States came into the war, and notwithstanding the exhaustion of its reserves and the decrease of its basic supplies, the volume of food exports to the Allies in these critical months was such that it saved the Allied situation. Without very much more than the usual shipments from the United States the food supply of the Allies would have been reduced below the danger point. In the three years before the war the average food exports were 6,959,055 tons. In the fiscal year 1917–8 the exports were 12,326,914 tons, and, in 1918–9, 18,667,378 tons.

Stimulation of Production.—The Department of Agriculture exercised its great influence and used its machinery to reach the farms of the United States with patriotic appeals and advice for the stimulation of production. Response to these appeals, which were disseminated also by the Food Administration, resulted in a considerably increased crop production of 1918. The most important instrument of the Government for stimulating production, however, was the power of the Food Administration to influence prices. This power enabled the Government to guarantee a minimum price to the farmers for wheat, and to assure, though not to guarantee, stabilized prices for hogs, cottonseed products, other vegetable oils, sugar and dairy products. These prices were controlled by the Food Administration through its control of Allied, neutral and Government purchases in the domestic market, supplemented by agreements with the producers of the commodities controlled. In Aug. 1917, a commission composed of representatives of various interests of the population, consumers and producers (though the farmers were given a majority representation), was appointed by President Wilson to determine a fair price for the 1917 crop of wheat. The price agreed upon was $2.20 per bus., which was a 10% increase over the minimum price fixed by Congress in the Lever Act for the 1918 and 1919 crops. This price was then maintained through the Food Administration Grain Corp., which bought at terminal markets any surplus offered at the agreed fair price. The price guaranteed for the 1919 crop was $2.26 per bushel. The effect of these measures was shown in a greatly increased acreage planted in wheat. In 1918 there were 59,181,000 ac. yielding 921,438,000 bus., and in 1919, 73,243,000 ac. yielding 940,987,000 bus., as compared with 52,316,000 and 45,089,000 ac. producing 636,318,000 and 636,655,000 bus., in 1916 and 1917 respectively, when there had been no guarantee. In Nov. 1917 the Food Administration gave an assurance to the farmers of a minimum price for hogs, calculating this price on the basis of the price of corn, the principal hog-feed. Despite the fact that there had been already a decrease of 5,000,000 stock hogs at the beginning of this attempt at stimulation, the number of hogs slaughtered in public markets in the fiscal year 1916–7 was 40,201,018, in 1917–8, 35,543,037, and in 1918–9, 44,398,389. The assurance given in the fall of 1917 did not affect production until the spring of 1918, and showed its effect most clearly in the heavy marketing season in the fall of 1918. Producers of vegetable oils (from cottonseed and peanuts) were assured in Sept. 1918, of 17½ cents per lb. for their crude oil, and this price was maintained for them until July 1 1919. The supply of all vegetable oils in the United States was in 1916, 1,745,574,000 lb., in 1917, 1,742,931,000 lb., and in 1918, 1,911,917,000 lb. It was not possible to secure any great increase in domestic sugar production because of the labour shortage, and special attention was therefore devoted to the stimulation of West Indian production. In Aug. U.S. and Cuban producers were assured of $7.35 per 100 lb. refined, Atlantic seaboard basis; this was increased in Sept. 1918 to $8.49 for Cuban and $8.82 for U.S. sugar, and this price was held until Sept. 1919 by the Sugar Equalization Board. In 1917 the total sugar produced in American and Cuban territory was 5,159,000 tons, in 1918, 5,500,000 tons and in 1919, 6,052,000 tons. These statistics of increased production of wheat, hogs, vegetable oils and sugar show that the producers of the United States responded quite as effectively as did the consumers to the appeals of the Government for war service in the matter of food.

Price Stabilization.—Under the highly artificial and unusual conditions of world supply and of concentration of demand upon the U.S. markets there was constant danger of wide and rapid fluctuations in the prices of affected commodities. One of the principal problems of the Government was the prevention, or at least mitigation, of fluctuations of prices for food products in order, first, to safeguard farmers against sudden and disastrous reductions of price such as would discourage production; second, to protect consumers against undue rises which would bring hardship to wage-earners and the industrial population generally, cause strikes and impair war-time efficiency. Again the United States profited by the experience of European Governments and avoided the difficulties which had been found to follow attempts to secure price stabilization by fixing maximum prices. With the Government's control over the large purchases, and the consequent power to influence the demand and the price at which the dominant buyers bought, it was found possible to secure the desired stability by the commercial operations of purchase and sale and the regulation of distributors without unduly disturbing the normal business methods of the country. The direct control for stabilization purposes was largely confined to breadstuffs (wheat and rye), pork products, beef products, sugar, preserved fruits, and certain dairy products; as it was evident that if the prices of these basic commodities for which there was the greatest demand could be held at a stabilized level, the prices of other commodities connected with them could not fluctuate. For example, if the price of pork products was held stable, the price of corn, which is chiefly consumed by hogs, could not vary from its proper relation to hog prices. Indirect control over the prices of certain products such as wheat, rye, barley, pork products, canned fish and condensed milk, was in the hands of the Government through its control over the foreign buying, because these commodities were exported in such quantities that the power to determine the export price practically determined the price in domestic markets. In the case of sugar, agreements were executed with the Allied Governments which gave a joint commission control of the buying in Cuban and Porto Rican markets, and this arrangement combined with the Government's powers in regard to producers, gave effective control over this commodity. With reference to rice, canned sardines, cottonseed products, dried fruits and city milk, agreements were reached with producers and manufacturers that provided for the maintenance of such stabilized prices as would protect producers and the public. With basic prices thus controlled, the inflation of prices in the hands of the distributors between the producer and consumer was prevented chiefly by fixing for each link in the chain of distribution a maximum margin of profit. This was possible with wholesale distributors because they were licenced by the Food Administration and required to observe its rules and regulations. Retailers of less than $100,000 gross business annually, being exempt from licence, were not subject to regulations, except indirectly through the wholesalers. The most effective method of control devised for the retailers was the publication of a "fair price list" in the local papers of each city and town, stating what was considered a fair maximum price for each of the principal commodities. These prices were determined by Fair Price Boards made up of local business men and women selected by the Food Administration's representatives. Care was taken to keep each local Fair Price Board correctly informed as to basic prices so that the maximum prices fixed for its locality would differ from those elsewhere only in so far as costs were increased or decreased by local conditions. The principal feature of this control and stabilization of prices for food products in the United States as distinguished from that in Europe is that control in the United States was exercised through the ordinary machinery familiar to the trade, that is, through the pressure of sales and other business methods, supplemented to only a slight extent by legal regulations as such. The particular advantage of this policy was that it allowed prices to respond to the real changes in value brought about by the inevitable war-time expansion of currency and credit and the increase of production in other lines, while it prevented rapid fluctuations from local and fleeting causes. The success of this control is apparent from the small rise in food prices during the war period, particularly in comparison with the rise both preceding and succeeding the control period. The chief aim of the control, namely, the protection of both the consuming public and the farmer, was shown to have been successful by the industrial peace and prosperity during the war and the increased production of the farmer.

Control of Speculation and Profiteering.—In addition to the measures above described as "price stabilization," the Food Administration had special rules and regulations governing food distributors which were particularly aimed at the prevention of profiteering and speculation under war conditions. Food distribution inevitably is a speculative business. The great supply comes on the market during a comparatively short period of the year, and the function of the distributor is to hold and distribute this supply throughout the year. A part of the distributor's profit must be regarded as an allowance for the speculative risk he necessarily takes in respect to his future market. This, like the other factors of his profit, is ordinarily regulated by competition under the law of supply and demand; but in time of war, when the demand was practically unlimited, the Food Administration had to interpose further checks. The principal measures were the following:—(1) As stated above, maximum margins were established for licenced dealers; that is, a fixed percentage of profit was prescribed which the licensee was forbidden to exceed. The determination of these margins was one of the most difficult problems of the food administrator, particularly because a margin sufficient for the large-scale operator, whose turnover was large and efficiency high, would not provide any profit for the small operator with higher costs. To have driven the small operator out of business would have deranged the competitive system after the war and left the public exposed to the danger of control of food supplies by a few large concerns. (2) The trading in futures on produce exchanges was restricted, and for some commodities, (sugar, cottonseed oil, butter, etc.) entirely eliminated. In the case of other commodities like corn, where the trading in future supplies is an indispensable part of the system of distribution, the quantity that could be sold under any one contract to any one firm was limited through the coöperation of the exchanges. The fact that the

Government bought and sold wheat made dealing in futures in that commodity non-essential and it was prohibited absolutely. (3) The period and volume of holdings of food in storage were regulated and without special permit from the Food Administration could not be changed. The prosecution of hoarders under the hoarding provisions of the Lever Act also prevented dealers from holding excessive quantities of food for speculation. (4) Detailed regulations were made in the different trades requiring that all food should pass in straight lines through the chain of distribution. A miller, for example, was allowed only to sell to a wholesaler, a retailer or consumer. A wholesaler could buy only from a miller and sell only to a retailer or consumer. This prevented the addition of unnecessary layers of profit to the price of food passing through too many hands on the road from producer to consumer. (5) The embargo on exports without permit was a very effective discouragement to the speculator. With a controlled market in the United States the speculator's chief hope lay in foreign sales and these were also subject to the inspection of Government agents who would not approve permits for the exporting of obviously speculative shipments. (6) The stabilization of prices, above discussed, was one of the important implements in preventing speculation. The Food Administration was able, for example, to advise the public that during considerable periods flour should be about $12.50 per barrel retail, and sugar about 10 cents per pound. These announcements served, just as did the published decisions of the Fair Price Committees, to restrain through the power of public opinion those who wished to profiteer. (7) Profiteering by licensees of the Food Administration could be punished by withdrawal of the licence to operate the business. The Food Administration maintained an enforcement division which exacted penalties from detected profiteers, but only in a comparatively few cases were licences revoked. For the most part the profiteer was allowed to continue his business after publicly expressing his contrition and paying to some organization such as the Red Cross a fine in excess of his undue profits. Flour-millers were also under agreement to turn over to the Government, by a nominal sale to the Grain Corp., their profits in excess of an agreed amount. Receipts from this source exceeded $6,000,000. Hoarders of food were also subject to criminal prosecution and penalty under a special provision of the Lever Act.

Control of Exports.—The first object of this control was to confine American food exports so far as possible to the Allies, forcing neutrals to go to more distant markets for any commodities which they could thus obtain. The second object was to tighten the food blockade against the enemy by preventing direct or indirect leakages. An example of indirect leakage was the large exportation from the United States of feed by neutrals, who thus greatly increased their live stock herds, and then shipped a large part of the resultant animal products into Germany. Since the American and Allied populations were denying themselves severely because of the lack of shipping, it was deemed a just war measure to require the neutrals to do without goods that would benefit the enemy only, if the supplying of those goods required shipping from the United States. The Government maintained representatives in each neutral country in Europe and South America for determination of their production and of the actual necessities of their imports to prevent suffering among their population. It was further necessary to require measures of rationing among neutrals to limit their consumption. While neutrals did not suffer undue privations, subsequent reports from Germany showed that under this pressure the German supply of food from adjoining neutral sources fell from 77,000 million calories per month in 1917 to less than half that amount per month in 1918. Furthermore, the neutrals were required to furnish shipping to the United States as a consideration for their supplies of food and other commodities, and upwards of 1,000,000 tons of neutral shipping was thus transferred to Allied service. The control of exports was removed by the War Trade Board, the governmental agency exercising it, early in 1919, although its removal proved premature as it facilitated speculation which resulted from over-exporting food for commercial purposes.

Control of Imports.—The important food commodities imported by the United States before the war were sugar, coffee, vegetable oils, rice and cocoa. The price of these commodities was influenced to a considerable degree, after the United States entered the war, by the elimination of competition between the United States and any of the Allies when purchasing in the same foreign markets. Prices were thus kept at reasonable figures for domestic consumers and the expenditure of excessive sums in foreign markets was prevented. One special concern of the Food Administration, acting as the agency in control of imports, was the retention of ships sufficient in number and size to carry essential imports. Small vessels and sailing ships not capable of transatlantic transport were assigned to the shipping division of the Food Administration, and arrangements were made with committees of the various trades to assign space to their members and to issue import permits, after agreement as to conditions of sale within the United States. The control over imports was thus coördinated with the control over exports so as to harmonize with the general price stabilization programme of the United States.

Cost and Accomplishments of Food Control.—The total of Congressional and Presidential appropriations expended by the Food Administration from beginning to end was $7,862,669. Since the Food Administration was the governmental food control agency, this sum may be taken as the governmental expenditure for food control. The $155,000,000 of capital of the Grain Corp. and the Sugar Equalization Board was handed back to the Government intact, and large profits were earned by each corporation. The neutral countries advanced the charges for their shipping enormously and to protect the United States against this excessive cost, a profit was made on the sales of food to them. The profits of the Grain Corp. and Sugar Board during the period of the Food Administration, in operation at home and abroad, exceeded $60,000,000. The food control may therefore be credited by the Government with a net profit of $50,000,000. But the savings of the people of the United States through the control of prices, through the prevention of discontent and strikes, and through the contribution of food to the Allies, cannot be measured in dollars. The possibility of great achievement under severely trying conditions was again demonstrated because of the spirit of willing sacrifice and coöperation exhibited by the American people. America came through the war with its markets intact and its distributing and producing agencies improved rather than the reverse, so that it was able to supply sufficient food in the months following the Armistice to save practically the whole of Europe. This latter achievement is not a part of the story of food control but it is a very interesting sequel to it. The value of the food commodities furnished to the Allies and the liberated countries from July 1917 to July 1919 amounted to about $3,670,000,000. (W. C. M.)

FOOTBALL: *see* SPORTS AND GAMES.

FORAIN, JEAN LOUIS (1852–), French painter and illustrator (*see* 10.628). His cartoons and caricatures during the World War were among the most striking and vigorous in the French press. Afterwards he devoted himself rather to easel painting of a symbolical character.

FORAKER, JOSEPH BENSON (1846–1917), American politician (*see* 10.628), died in Cincinnati, May 10 1917. His retirement from the Senate in 1909 followed the publication of certain letters supporting the charge that he had received money from the Standard Oil Company. In 1914 he was again a candidate for the Senate in the Republican primaries, but was defeated by Warren Gamaliel Harding. In 1916 he published *Notes on a Busy Life.*

FORBES-ROBERTSON, SIR JOHNSTON (1853–), English actor (*see* 10.639), was knighted in 1913, and retired from regular work on the stage in the following year.

FORD, HENRY (1863–), American manufacturer, was born on a farm at Greenfield, near Detroit, Mich., July 30 1863. He received only a common-school education in the local school and when about 15 years old went to Detroit, where he learned the machinist's trade. There a little later he began to work for the Edison Illuminating Co., and became interested in the problems of self-propelled vehicles. He worked on the construction of a gasoline engine, making all the parts himself, and in 1892 produced his first motor-car, a very clumsy vehicle, somewhat resembling a tricycle propelled by a one-cylinder engine. He continued his experiments and in 1898 was able to interest a few capitalists in his scheme. He had from the beginning a sincere desire to benefit the people, and was determined to produce a car which could be sold at a price within reach of persons of small means, the profits to come from quantity sales. His plan, however, did not coincide with that of the other members of the early company, and he withdrew. In 1903 he organized and became president of the Ford Motor Co. of Detroit, which ultimately became the largest producer of cars in the world, turning out at a very low price no fewer than 1,000,000 in the single year, 1920, and employing 75,000 men. Parts were standardized and methods devised for quickly assembling the various units that went to make up each car. At the beginning, however, serious difficulties were encountered. As early as 1895 a patent had been secured by George B. Selden, of Rochester, N. Y., which seemed to cover every type of gasoline engine used on a self-propelled vehicle. This supposed "blanket" patent had led other manufacturers of automobiles to form the Association of Licensed Automobile Manufacturers. They paid for the privilege of using the engine and announced that they would sue any unauthorized producer. Suit was brought against the Ford Motor Co. the very year of its organization, and prospective buyers of the Ford cars were warned that they would be subject to prosecution. The Ford Co. advertised their car widely, declaring that they would give full protection to their customers. At first the suit brought against the Ford Co. was successful, but on appeal it was declared in 1910 that the Selden patent applied to a particular type of engine only, and that the engine manufactured by the Ford Co. did not infringe the patent. In 1909 the Ford Co. erected a factory just outside Detroit, covering 47 acres. As the demand for cars increased, other plants were erected in Canada and England. In 1914 a profit-sharing plan was announced whereby a large percentage of the company's profits would be returned to the workers, and at the same time a minimum wage of five dollars a day was fixed. In 1919 the minimum wage was set at six dollars for approximately 28,000 of the workmen. The company undertook to do much for the welfare of its men, providing a large body of social workers among them, and furnishing legal and medical aid free. A school was founded for giving instruction to foreigners in the English language. This was all undertaken with the idea of securing greater efficiency in the shops. In 1914 Mr. Ford contributed $2,000,000 to a hospital that was building in Detroit, and later added $3,000,000. On the outbreak of the World War he came forward as a pronounced pacifist, and in Sept. 1915 announced that he had set aside $1,000,000 to fight preparedness in the United States and other countries then at peace. In Dec. 1915 he chartered a ship, and with a band of invited pacifists sailed for Europe, hoping to bring about a conference of the belligerents that would result in peace before Christmas. But nowhere was official recognition given the party and dissension arose among themselves. Mr. Ford, after reaching Christiania, returned to America, where he continued to work against preparedness. He assailed the Navy League and the National Security League, alleging that they were supported by munition manufacturers. In Sept. 1916 be brought suit for $1,000,000 against the *Chicago Tribune* for libel, having been called an anarchist in one of its editorials. After three years' litigation he was awarded six cents and the costs of the trial. When America entered the World War he gave full support to the Government and became a member of the Shipping Board, devoting his attention to standardizing production. He placed his efficient plants at the disposal of the Government and some were converted into producers of submarine chasers and small tanks. In 1918 he accepted the Democratic nomination for U.S. senator from Michigan, but his Republican opponent, Truman H. Newberry, was awarded the election. Charges of excessive expenditure and fraud were lodged against Mr. Newberry, who was tried and convicted. On appeal the U.S. Supreme Court reversed the decision. On Jan. 12 1922 the Senate decided, by a vote of 46 to 41, that Newberry was entitled to retain his seat. On Jan. 1 1920 Mr. Ford resigned as president of the Ford Motor Co., being succeeded by his son, to devote himself to developing the farm tractor business. Shortly before, he had purchased the *Dearborn* (Mich.) *Independent*.

FOREL, FRANÇOIS ALPHONSE (1841–1912), Swiss geographer, was born at Morges on Lake Geneva Feb. 2 1841. He was trained for and practised in the medical profession, but his life-interest was found in the lake on whose shore he lived, and, from that, in limnology, the science of lakes. The study of Lake Geneva in all its associations led him to that of geology, physics, biology, and anthropology, and he set forth the results of his researches in the three stately volumes of *Le Léman* (1892–1902). On the science of limnology more generally his standard work is *Handbuch der Seenkunde* (1901); in this connexion his investigations of the previously mysterious movements of lake-waters known as seiches call for special notice. Among other researches of Forel's, those in seismology and upon Swiss Alpine glaciers are noteworthy. He died at Morges Aug. 7 1912.

FORESTRY (*see* 10.645).—The period 1910–21 was dominated by the abnormal conditions produced by the World War of 1914–9, which demonstrated, as only such a gigantic upheaval could have demonstrated, the vital importance of timber in time of war and the necessity for maintaining adequate and readily accessible supplies of this commodity.

(1) British Empire.—The war found Great Britain, accustomed to rely mainly on imports from abroad, without any efficient organization for the supply of home-grown timber. The development of the submarine campaign, the growing scarcity of shipping, and the necessity for employing the available shipping as little as possible for the conveyance of such a bulky article as timber, served to focus attention on the question of ensuring supplies of home-grown timber in the event of another great war. The whole question was examined in detail by a forestry sub-committee of the Reconstruction Committee, appointed in 1916, the terms of reference being:—" To consider and report upon the best means of conserving and developing the woodland and forestry resources of the United Kingdom, having regard to the experience gained during the war." The final report of this sub-committee (Cd. 8881, 1918) drew attention to the risk involved if future home-grown supplies are not safeguarded, and proposed a scheme calculated to render the United Kingdom independent of imported timber for three years in an emergency. This scheme, while making due allowance for an improved yield from existing woods, recommended the afforestation in 80 years of 1,770,000 ac. of unplanted land, of which two-thirds should be planted in the first 40 years. The cost of the scheme was estimated at £3,425,000 during the first 10 years, with a possible total expenditure of £15,000,000 during the first 40 years, after which it was reckoned that the scheme should be self-supporting. Apart from the question of financial returns, however, the sub-committee justified its proposals on the ground that forests are a national necessity and that the interests of national safety demand that more timber should be grown in the British Isles. With the view of carrying this scheme into effect it was proposed to constitute " a forest authority equipped with funds and powers to survey, purchase, lease and plant land and generally to administer the areas acquired, with compulsory powers to be exercised, after due enquiry and the award of fair compensation."

The recommendations of the sub-committee resulted in the passing on Aug. 13 1919 of the Forestry Act (9 and 10 Geo. 5, ch. 58) and the constitution of a forestry commission consisting of three paid and five unpaid members equipped with wide powers for the promotion of afforestation, the production and supply of timber, the purchase or lease of land suitable for afforestation, the purchase or sale of standing timber, the establishment of woodland industries, the promotion of forestry education, experiment and research, and the destruction of pests and vermin. This marks the most important step yet taken in regard to British State forestry; as a result a definite programme of land acquisition and planting has been framed and is being carried out, a forest service has sprung into being, and the outlook of State forestry in the United Kingdom is clearer than it has ever been in the past. Not the least of the benefits conferred by an extensive scheme of afforestation will be the encouragement of small holdings by providing employment in the form of forest work at a time of the year when agricultural work is suspended.

The Imperial Outlook.—The year 1920 marked an important step in the progress of forestry in the British Empire, in that for the first time a forestry conference representative of the various parts of the Empire assembled in London at the invitation of the British Forestry Commission. The deliberations of this conference tended to confirm the view that, generally speaking, the Empire is dissipating its vast natural forest resources, and that if the conservation and regeneration of the forests are to be carried out effectively, each Government of the Empire should lay down a definite forest policy to be administered by a properly constituted and adequate forest service. The conference emphasized the necessity for a systematic survey of the forest resources of the different parts of the Empire, with a view to the collection and dissemination of facts as to the state of the forests and the demands on them; and in order to effect this object it recommended the establishment of an Imperial Forestry Bureau, incorporated by Royal Charter, somewhat on the lines of the Imperial Mineral Resources Bureau. This bureau, to be supported mainly by funds provided by the Governments of the Empire, would have for its chief objects the collection and dissemination of information on matters connected with forestry and forest resources, and the coördination of work done by existing agencies.

The recommendations of the conference have not yet had time to take full effect, but its first fruits were in evidence in the early part of 1921, when in the first place the preliminary steps towards the establishment of an Empire Forestry Association were completed, and in the second place the important question of the future training of forest officers formed the subject of recommendations by a committee specially appointed to enquire into the matter. The newly constituted Empire Forestry Association is an unofficial organization, not directly connected with the proposed Forestry Bureau; its chief objects are to serve as a link between the associations already existing in the United Kingdom and other parts of the Empire, and between individuals engaged in forestry work, to foster public interest in forestry throughout the Empire, to ensure general recognition of the importance of forest management, to collect and circulate information as to existing forest conditions and the future timber requirements of the Empire, to provide a clearing-house of information and a centre for coöperation, and to organize meetings for the discussion of the problems connected with the growth and utilization of timber. Among other functions of the Forestry Association will be the publication of a quarterly journal.

The question of the future higher training of forest officers for those parts of the Empire having no place of higher training of their own was discussed at some length by the British Empire Forestry Conference, which recommended that the training should be carried out at one central institution, and that a complete university education should be regarded as a necessary preliminary to this training. An interdepartmental committee on imperial forestry education, appointed to prepare a scheme for giving effect to the resolutions of the conference, recommended that the work already being done by universities in maintaining courses of training in forestry should not be interfered with, but that efforts should be made to coördinate all these courses, to bring them up to a common level, and to utilize them as a preliminary to a higher course of training at one central institution. It was proposed that this institution should be located at Oxford, incorporated with the university, and governed by a board appointed one-half by the university and the other half by the departments or Governments concerned, who should jointly guarantee to the board an annual sum sufficient to pay the costs of the institution. It was further proposed that the institution should be responsible not only for the higher training of new recruits for the various forest services, but also for the provision of special or revision courses for officers already serving, and that it should become a centre for research in silviculture, forest entomology, pathology, soil science, and matters affecting forest production generally. These proposals, if carried out intelligently, should be of far-reaching importance in so far as the future personnel of the forest services of the Empire is concerned, for it has been recognized for some time and the matter was emphasized during the discussions of the British Empire Forestry Conference, that the methods of recruitment and training in force hitherto have left much to be desired, and that a great improvement in the standard of forestry education is required.

Great as has been the progress in the past in some parts of the Empire, in other important parts scientific forestry may be said to be as yet in its infancy, and the importance of forest conservation and systematic management is as yet imperfectly realized. Nevertheless, if legislation can be accepted as an indication of the desire to remedy matters, there are signs of a better appreciation of the duties of the State towards forestry during recent years, for since 1906 and during the war numerous forest enactments have been passed in different parts of the Empire.

India had introduced forest legislation long before this period, in the shape of the Indian Forest Act (VII. of 1878) which with certain amendments is the basis of forest policy of the present day. Under this Act State forest for waste land may be set aside as reserved or protected forest; the Act also provides for the constitution of village forests, the protection of forests and trees, the control of forest produce in transit, and other matters. Other special enactments in the Indian Empire are the Burma Forest Act (IV. of 1902), the Madras Forest Act (V. of 1882), and certain forest regulations applying to other provinces.

Forest legislation in the *Malay States* in the form of the Straits Settlement Ordinance (No. XXII. of 1908) is founded on Indian practice, and follows the Burma Forest Act. In the Federated Malay States a Federal enactment, following the Indian model, was passed in 1914 and revised in 1918 as Enactment No. XXXIV. of 1918; the Unfederated States have separate enactments.

In *Canada* the Forest Reserves and Parks Act passed by the Dominion Parliament in 1906, with subsequent amendments, authorizes the setting apart of forest reserves and Dominion parks. The British Columbia Forest Act of 1912, with subsequent amendments, places the forests under the charge of the Forest Branch. The Forest Fires Prevention Act of Ontario, passed in 1917, provides for the protection of forests from fire and for the appointment of a provincial forester. The Nova Scotia Forest Protection Act of 1913 and the New Brunswick Forest Act of 1918 provide for fire protection, and the latter establishes a forest service. Quebec has forest legislation dealing with fire protection and other matters.

In *Australia* forest legislation appears in various forms. The Forest Act of South Australia, which dates from 1882, places the control of forests in the hands of a commissioner with considerable powers. The Queensland State Forests and National Parks Act, 1906, provides for the setting aside of State forests and national parks, and the Land Act of 1910 deals with timber rights and sales. In Victoria forest legislation is represented by the Forest Act of 1907, as consolidated and amended in 1915, and the Forest Act of 1918, which places the forests under a commission of three with wide powers. The New South Wales Forestry Act of 1916, which consolidated forest legislation, provides for the constitution of State forests and their control by a commission of three. In New Zealand a State Forest Act was passed in 1908, but as it proved defective in certain respects it was amended by Section 34 of the War Legislation and Statute Law Amendment Act of 1918.

In *South Africa* the Union Forest Act of 1913, amended in 1917, consolidates the laws of the four provinces of the Union and deals with the tenure, demarcation, regulation and protection of forests. In *Southern Rhodesia* the Cape Colony Forest and Herbage Act of 1859 and the ordinances of the Rhodesian Legislative Council provide for forest protection. In *British East Africa* (Kenya Colony) the Forest ordinances of 1911, 1915 and 1916 give wide powers for constituting reserved forests, and provide for a forest service and other matters. In *Nyasaland* the Forest ordinance of 1911 and the Crown Lands ordinance of 1912 prohibit the cutting of certain kinds of timber. In *Nigeria* the Forest ordinance of 1916 gives the governor wide powers in forest matters.

This brief sketch of legislative action taken, particularly in recent years, indicates the awakening interest in the natural forest resources of many parts of the Empire. There was still in 1921, however, much to be done before future progress could be assured. One of the most pressing needs is the building up of adequate and efficient services of trained forest officers where these do not exist; in this way the forests will be brought by degrees under scientific management, and the wasteful methods of felling and conversion which have so often been a feature of forest exploitation in the past, and the destruction of extensive areas of valuable coniferous forests, will be kept in check. Apart from direct State action, however, much good should result from measures which will influence public opinion towards an appreciation of the value, utility, and national importance of forests, and the necessity for safeguarding their future by conservation, protection, and efficient management.

War Supplies.—During the war the timber resources of Great Britain itself were taxed to their utmost. For some years prior to 1914 the annual imports of manufactured timber averaged about 10,000,000 loads. The imports diminished in 1914 to 8,433,000 loads, in 1915 to 7,666,000 loads, in 1916 to 6,319,000 loads, and in 1917 to 2,875,000 loads. At the outbreak of war there were considerable stocks of imported timber which, together with imports, mainly from northern Europe, sufficed to meet all urgent military demands during the first year of the war. In the latter part of 1915, however, owing largely to the advent of the submarine campaign, it was found necessary to take steps towards an increase in the supply of converted timber, although even prior to this, anxiety had been felt as to the maintenance of the supply of pit props for the mines. It was at this time, therefore, with the appointment of a Home-Grown Timber Committee under the Board of Agriculture, that the first serious steps were taken towards utilizing home-grown timbers to the utmost, while at the same time ensuring the greatest possible economy in the use of timber. Early in 1917 the tonnage stringency and the necessity for curtailing imports called for stricter control; this control was assumed by the War Office, who took over the staff of the Home-Grown Timber Committee and formed a Timber Supplies Department under a Director of Timber Supplies. This department was handed over soon afterwards to the Board of Trade. The exploitation of the home timber resources was carried out not only by British labour, but also to a large extent by the Canadian Forestry Corps and other units. Canadian sawmilling plants were erected in many parts of the country, and the production of sawn timber went on to the extent of depleting many well-wooded districts, the reforestation of which will present an urgent problem for some time to come.

During the war the British army played an important part in the exploitation of the French forests, and here again the Canadian Forestry Corps, which at the close of hostilities numbered some 17,000 men, did signal service in providing the requisite supplies of timber for military purposes.

The eastern theatres of the war were supplied largely from India. Figures available refer only to the period from April 1917 to Oct. 1918, during which timber supplies were in the hands of the Indian Munitions Board. The total quantity of timber shipped during this period to overseas destinations, namely, to Mesopotamia, Egypt, Salonika, Aden, East Africa, the Persian Gulf and elsewhere, amounted to 198,000 tons, while in addition 30,000 tons were utilized for war purposes in India, making a total of 228,000 tons, or an average of 12,600 tons a month. In addition railway sleepers were supplied for over 1,800 m. of track. The bulk of the work connected with the exploitation of the forests for the supply of this timber was done by the Indian Forest Department.

TABLE I.—*Area of British Empire Forests.*

Square miles (rounded off to nearest ten).

Country	Agricultural Land	Forest: Merchantable	Forest: Unprofitable or Inaccessible	Forest: Total	Other Land	Total Land Area
United Kingdom	97,080	3,860	1,320	5,180	17,210	119,470
British India (State forest only)	431,900	126,310	125,160	251,470	407,430	1,090,800
Canada (as a whole)	689,060	390,630	541,790	932,420	2,108,190	3,729,670
British Columbia	15,700	—	—	149,300*	188,000	353,000
Quebec	40,000	203,490	312,130	515,620*	135,240	690,860
Australia—						
Queensland	15,000	10,000	50,000	60,000	595,500	670,500
New South Wales	—	17,190	—	17,190	292,270	309,460
Victoria	43,750	4,690	7,810	12,500	31,630	87,880
S. Australia	—	250	—	6,000	—	380,070
W. Australia	71,830	4,770	21,000	25,770	878,320	975,920
Tasmania	—	940	—	17,200	—	26,210
New Zealand (State forest only)	27,520	2,140	14,230	16,370	59,690	103,580
S. Africa, Union of	20,930	—	—	2,360	449,810	473,100
Newfoundland	—	—	—	10,000	—	42,000
Kenya Colony	47,170	3,600	1,500	5,100	192,790	245,060
S. Rhodesia	2,210	18,300	73,200	91,500	58,790	152,500
Nyasaland	—	—	—	3,000	—	43,610
Swaziland			Practically nil.			6,500
Uganda	—	—	—	1,200	—	92,740
Gold Coast	10,890	14,000	24,110	38,110	31,000	80,000
Nigeria	100,800	50,400	168,000	218,400	16,800	336,000
Sierra Leone	—	—	—	1,000	—	31,000
Malay States	8,300	21,170	14,100	35,270	8,930	52,500
Trinidad	760	800	380	1,180	50	1,990
Bahamas	—	—	—	430	—	4,400
Jamaica	—	50	1,000	1,050	—	4,200
Cyprus	1,890	630	50	680	1,010	3,580
British Honduras	40	2,400	3,600	6,000	1,960	8,000
British Guiana	900	13,000	64,780	77,780	10,800	89,480
Ceylon	4,870	4,820	15,540	20,360	250	25,480
Total				1,857,520		9,185,700

*Omitted in total.

Imperial Statistics.—A complete survey of the forest resources of the British Empire was in 1921 still far from being an accomplished fact, and in many cases area statements must for the present be accepted as only roughly approximate. Subject to this limitation the accompanying tables, compiled from information furnished by the different Governments concerned to the British Empire Forestry Conference in 1920, give the latest statistics available. Of the two area statements, Table I. gives the estimated area of forest, agricultural land and other land in each country, and Table II. gives a classification of the forest area according to ownership. Certain parts of the Empire, for which statistics are not available, have been omitted.

Table III. shows the quantities and values of exports and imports. As the figures refer partly to pre-war periods and partly to the period of the war they are not fairly comparable, and in the latter case, at all events, must be regarded as largely abnormal. The balance is + or − according as the total exports are greater or less than the total imports.

It will be seen that the chief importing country of the British Empire is the United Kingdom and the chief exporting country is Canada. During the period 1909–13, however, the United Kingdom drew 88 % by volume and 83 % by value of her imports from without the Empire, the chief sources being Russia, Scandinavia, S.W. Europe (for pitwood) and the United States. Of the Indian exports teak represents about 85 %, while imports consist mainly of jarrah timber and railway sleepers from Australia and deal and pine timber. Of a total of 7,133,800 loads exported by Canada, 1,058,000 loads valued at £3,525,000 were imported by the United Kingdom. S. Africa imported 10,452,000 cub. ft. of unmanufactured timber from Scandinavia, 2,632,200 cub. ft. from the United States, 440,500 cub. ft. from Australia, and 92,900 cub. ft. (teak) from India; imports of manufactured timber were chiefly from Scandinavia. As regards the Australian states, about half of the W. Australia imports were from the United States and rather more than one-sixth were from Scandinavia, while of the exports, about one-third went to the Eastern states and the remainder to India, the United Kingdom, New Zealand and S. Africa in the order named; imports into Victoria consisted mainly of soft-woods from Scandinavia, the United States, Canada and New Zealand: Queensland imports were principally from overseas and exports were to other States of the Commonwealth: New South Wales exports were chiefly to New Zealand, the Pacific Is. and the East. (R. S. T.*)

(2) UNITED STATES.—At the beginning of 1921 the United States was facing the certainty of a future shortage of timber. Yet a continuous supply is absolutely indispensable for the prosperity of the nation. The dangerous condition of forest depletion has already been reached. The U.S. Forest Service, in a report on *Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership*, submitted to the Senate June 1 1920, sets forth that of the original 822,000,000 ac. of virgin forest only 463,000,000 ac., little more than half, are left. Of this but 137,000,000 ac. are virgin timber. There is some second growth of saw-timber size on 112,000,000 ac.; 133,000,000 ac. have second growth under saw-timber size; and 81,000,000 ac. (as much as the combined forest areas of Germany, Denmark, Holland, Belgium, France, Switzerland, Spain and Portugal)

TABLE II.—*Classification of British Empire Forest Area by Ownership.*

Square miles (rounded off to nearest ten).

Country	State			Corporate Bodies	Private Individuals	Total
	Devoted to Timber Production	Other Forest	Total			
United Kingdom	110	30	140	50	4,990	5,180
British India	126,310	125,160	251,470	8,000	77,000	336,470
Canada (as a whole)	234,340	635,580	869,920	62,500		932,420
British Columbia	14,700	115,000	129,700	3,900	15,400	149,000
Quebec	192,080	312,140	504,220	2,030	9,370	515,620
Australia—						
Queensland	6,250	46,880	53,130	9,370*		62,500
New South Wales	7,880	4,620	12,500	—	4,690	17,190
Victoria	6,500	5,500	12,000	190	310	12,500
S. Australia	250	—	250	—	—	6,000
W. Australia	10	4,600	4,610	—	310	4,920†
Tasmania	940	—	940	—	—	17,200
New Zealand	—	—	16,370	—	—	16,370
S. Africa, Union of	—	—	880	40	1,440	2,360
Newfoundland	—	—	—	—	—	10,000
Kenya Colony	2,200	2,800	5,000	—	100	5,100
S. Rhodesia	—	36,600	36,600	18,300	36,600	91,500
Uganda	—	—	1,200	—	—	1,200
Gold Coast	—	—	—	38,110	Native Communities	38,110
Nigeria	3,140	—	3,140	215,260		218,400
Malay States	3,200	28,570	31,770	2,500	1,000	35,270
Trinidad	330	830	1,160	—	20	1,180
Bahamas	—	—	430	—	—	430
Jamaica	—	—	1,050	—	—	1,050
Cyprus	630	50	680	—	—	680
British Honduras	—	—	6,000	—	—	6,000
British Guiana	—	77,780	77,780	—	—	77,780
Ceylon	4,220	11,300	15,510	4,680	160	20,360

*In process of clearing for settlement purposes, which may explain differences for total area of forest in Tables I. and II.

†Merchantable forest only.

TABLE III.—*Average British Empire Annual Exports and Imports.*

(Quantities and values in thousands.)

Country (1)	Exports		Imports		Balance, plus or minus	
	Quantity (2)	Value f. o. b. (3)	Quantity (4)	Value c. i. f. (5)	Quantity Col. (2) — Col. (4)	Value Col. (3) — Col. (5)
United Kingdom* (1909–13)—						
Wood and timber	120·8 loads	£1,015·5	10,204·3 loads	£27,561·4	−10,083·5 loads	−£26,545·9
Wood manufactures	—	£2,211·9	—	£2,695·2	—	−£483·3
Pulp of wood	15·3 tons	£122·8	859·5 tons	£4,058·5	−844·2 tons	−£3,935·7
British India (1914–8)—						
Timber	1,647·9 cub. ft.	£395·9	4,373·2 cub. ft.	£531·9	−2,725·3 cub ft.	−£136·0
Canada (1914–8) (as a whole)—						
Sawn lumber	356,689·4 cub. ft.	$30,765·5	99,070·9 cub. ft.	$10,603·6	+257,618·5 cub. ft.	+$20,161·9
Pulp wood	102,933·3 cub. ft.	$6,412·5	Nil	—	+102,933·3 cub. ft.	+ $6,412·5
British Columbia (1919)—						
Overseas	9,072·7 cub. ft.	Not avail.	Negligible	Negligible	+9,072·7 cub. ft.	Not avail.
Quebec (1918)	132,192·3 cub. ft.	$14,877·4	—	$746·5	+132,192·3 cub. ft.	+$14,130·9
Australia—						
Queensland—Timber	2,000·0 cub. ft.	£500·0	6·0 cub. ft.	£1·5	+1,994·0 cub. ft.	+£498·5
New South Wales (1910–8)—						
Timber	1,633·7 cub. ft.	£201·1	12,241·5 cub. ft.	£1,046·4	−10,607·8 cub. ft.	−£845·3
Victoria (1913–7)—Timber	74·9 cub. ft.	—	10,365·5 cub. ft.	—	−10,290·6 cub. ft.	—
W. Australia (1909–19)—Timber	181·3 loads	£689·1	18·2 loads	£97·8	+163·1 loads	+£591·3
S. Africa, Union of (1913)—						
Unmanufactured	—	£3·3	15,618·0 cub. ft.	£980·8	—	−£997·5
Manufactured	—	£5·7	3,882·0 cub. ft.	£577·7	—	−£572·0
Newfoundland (1909–12)—Timber	3,677·3 bd. ft.	$71·1	1,632·4 bd. ft.	$53·9	+2,044·9 bd. ft.	+$17·2
British E. Africa—						
(Kenya Colony) (1913–8)	327·4 cub. ft.	£11·9	159·6 cub. ft.	£16·7	+167·8 cub. ft.	−£4·8
S. Rhodesia (1913–9)—Timber	34·1 cub. ft.	£10·5	258·1 cub. ft.	£42·5	−224·0 cub. ft.	−£32·0
Nyasaland (1917–9)	Nil	—	—	£0·8	—	−£0·8
Uganda (1913)	—	—	—	£3·2	—	−£3·2
Gold Coast (1909–18)—Timber	1,383·5 cub. ft.	£159·7	346·2 cub. ft.	£45·0	+1,037·3 cub. ft.	+£114·7
Nigeria (1912–3)—Timber	1,388·7 cub. ft.	£92·3	522·8 cub. ft.	£64·2	+865·9 cub. ft.	+£28·1
Malay States (1913–8)—						
Firewood	—	$1·7	—	$590·5	—	−$588·8
Planks	—	$1,531·3	—	$383·2	—	+$1,148·1
Timber	—	$164·0	—	$1,183·6	—	−$1,019·6
Trinidad (1906–18)—Timber	152·0 cub. ft.	£17·8	889·5 cub. ft.	£65·3	−737·5 cub. ft.	−£47·5
Bahamas (1907–13)—Lumber	293·8 cub. ft.	£11·2	71·4 cub. ft.	£5·2	+222·4 cub. ft.	+£6·0
Bermuda (1919)—						
Lumber	—	—	46·4 cub. ft.	£5·5	−46·4 cub. ft.	−£5·5
Manufactured wood	—	—	—	£18·8	—	−£18·8
Jamaica (1914–8)—Lumber	—	—	8,905·9 bd. ft.	£50·5	−8,905·9 bd. ft.	−£50·5
British Honduras (1914–9)—						
Timber	8,305·9 bd. ft.	$739·0	1,447·9 bd. ft.	$41·6	+6,858·0 bd. ft.	+$697·4
British Guiana (1915–9)—Timber	122·7 cub. ft.	£15·0	337·7 cub. ft.	£41·9	−215·0 cub. ft.	−£26·9
Cyprus (1910–4)—Timber	—	—	—	£21·7	—	−£21·7

*The United Kingdom exports include 87,500 loads which are re-exports, valued at £795,200.

have been cut, burnt and neglected until they produce practically nothing. The United States is cutting what timber remains more than four times faster than it is being reproduced. In addition to the actual timber shortage, the forests remaining are so far from the wood-using industries that the distance to markets often makes the shipping of needed supplies either unduly costly and uncertain or altogether impracticable.

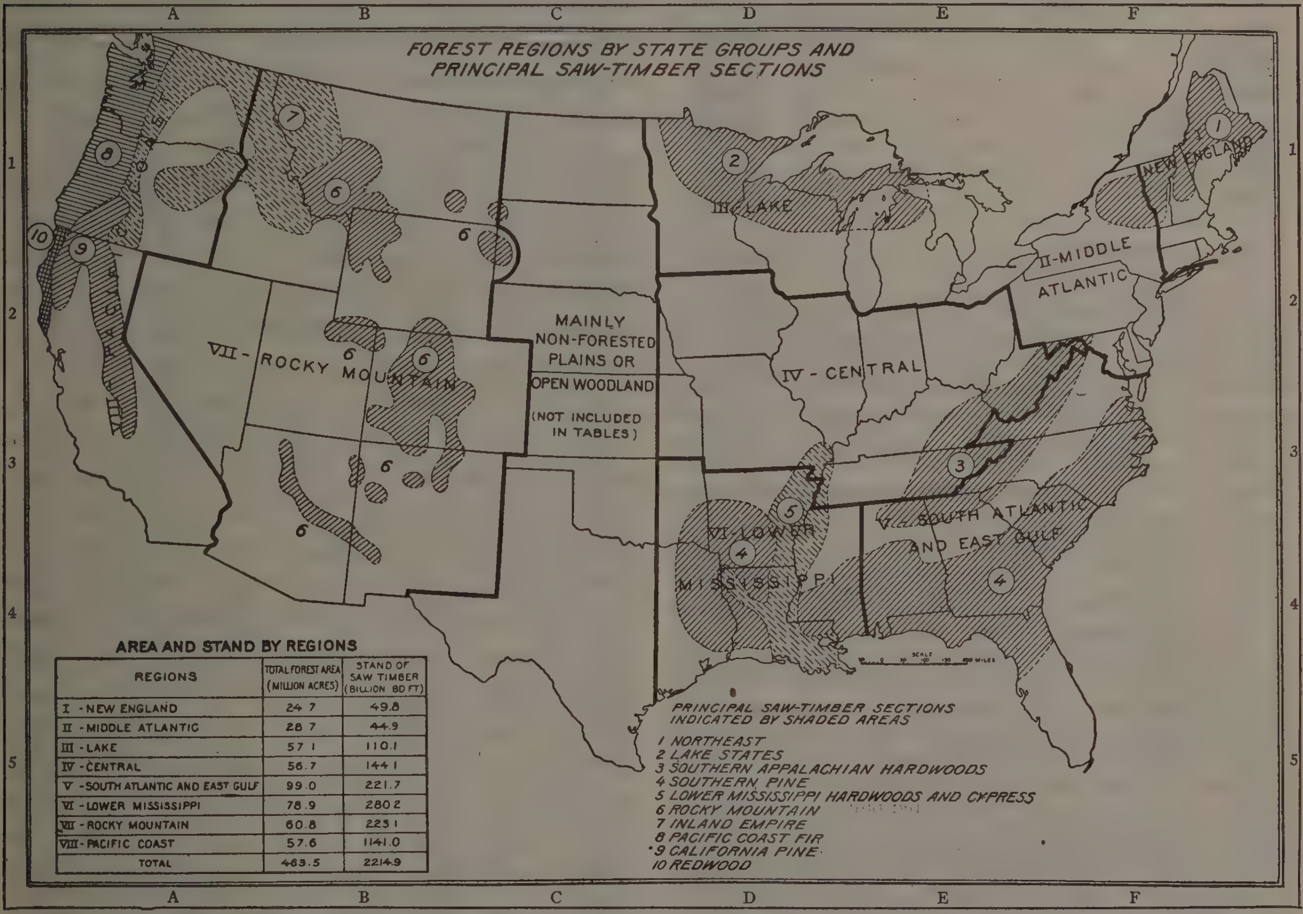
FOREST REGIONS BY STATE GROUPS AND PRINCIPAL SAW-TIMBER SECTIONS
A
B
C
D
E
F
1
2
3
4
5
I-NEW ENGLAND
II-MIDDLE ATLANTIC
III-LAKE
IV-CENTRAL
V-SOUTH ATLANTIC AND EAST GULF
VI-LOWER MISSISSIPPI
VII-ROCKY MOUNTAIN
VIII-PACIFIC COAST
MAINLY NON-FORESTED PLAINS OR OPEN WOODLAND (NOT INCLUDED IN TABLES)
SCALE
MILES
PRINCIPAL SAW-TIMBER SECTIONS INDICATED BY SHADED AREAS
1 NORTHEAST
2 LAKE STATES
3 SOUTHERN APPALACHIAN HARDWOODS
4 SOUTHERN PINE
5 LOWER MISSISSIPPI HARDWOODS AND CYPRESS
6 ROCKY MOUNTAIN
7 INLAND EMPIRE
8 PACIFIC COAST FIR
9 CALIFORNIA PINE
10 REDWOOD

AREA AND STAND BY REGIONS

REGIONS	TOTAL FOREST AREA (MILLION ACRES)	STAND OF SAW TIMBER (BILLION BD FT)
I - NEW ENGLAND	24.7	49.8
II - MIDDLE ATLANTIC	28.7	44.9
III - LAKE	57.1	110.1
IV - CENTRAL	56.7	144.1
V - SOUTH ATLANTIC AND EAST GULF	99.0	221.7
VI - LOWER MISSISSIPPI	78.9	280.2
VII - ROCKY MOUNTAIN	60.8	223.1
VIII - PACIFIC COAST	57.6	1141.0
TOTAL	463.5	2214.9

Of the 48 states, 30 produce less wood than they use. These include by far the larger part of the agriculture, industries, wealth and population of the nation. They are Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Georgia, Ohio, Indiana, Illinois, Kentucky, Missouri, Michigan, Wisconsin, Minnesota, Nebraska, Kansas, Oklahoma, Colorado, Iowa, North Dakota, South Dakota, Nevada, New Mexico, Utah and Wyoming.

The merchantable timber remaining in the United States is estimated at 2,215,000,000,000 board-feet. About one-half of it is in Washington, Oregon and California, and over 60% W. of the great plains. Concentration of ownership has kept pace with forest destruction, and half the privately owned timber in the United States is held by 250 owners. The depletion of resources is not limited to saw-timber. Since 1909 the country has ceased to be self-supporting in newsprint and other paper, and in 1919 the production of naval stores had fallen off 50% from that of 1899, the first year of satisfactory statistics. Shortages in other forest products are developing also. Since wood is the most generally useful of all materials, and since the shortage and high price of wood affect all industries and all people, its supply has become one of the country's chief economic problems. The 137,000,000 ac. of remaining virgin forest is being cut at the rate of 5,500,000 ac. a year, and at that rate will be exhausted in 25 years. The 81,000,000 ac. of devastated, unproductive forest land is being added to at the rate of 3,000,000 ac. annually. Since three-fourths of the standing timber is virgin timber and since four-fifths of the forest supplies are in private hands, the first and most necessary step is to stop the devastation of privately held timber lands. The next most necessary step—and both are indispensable—is the stopping of forest fires. A careful study of the kinds and quantities of forest products available throughout the world leads to the conclusion that little relief from timber shortage can be found in the importation of forest products from other lands. Because the United States must have wood, and because it cannot be secured abroad, it must be grown at home.

Government Action.—The largest and most effective organization engaged in providing future supplies of timber is the U.S. Forest Service. Most of its personnel is employed in caring for the national forests, which in 1920 included 156,632,053 ac., as against 153,933,700 ac. a year before. Roughly, they contain one-fifth of the actual timber land in the United States. There are 152 national forests, of an average area of 1,000,000 ac., each in charge of a forest supervisor. The annual gross receipts in money to the Government from them are almost $5,000,000.

During the year ending June 30 1920, 597,563 ac. of forest land were cruised, 6,719 ac. planted, 13,222 timber sales involving 1,294,233,000 board-feet of timber made, and 31,301 grazing permits issued for 2,035,432 head of cattle and 7,280,584 sheep, in addition to other live stock. The receipts and expenditures for the national forests during 1910–20 were:—

	Receipts	Expenditures
1910	$2,041,181.22	$2,791,275.62
1911	1,968,993.42	3,395,730.77
1912	2,109,256.91	3,433,285.36
1913	2,391,920.85	3,396,762.44
1914	2,437,710.21	3,337,048.83
1915	2,481,469.35	3,261,455.16
1916	2,823,540.71	3,427,140.41
1917	3,457,028.41	3,868,562.60
1918	3,574,930.07	4,265,367.00
1919	4,358,414.86	4,286,747.00
1920	4,793,482.28	4,554,861.00

It is interesting to note that in 1919 and 1920 the national forests were self-supporting. They are well handled and efficiently protected, and their management has gradually won for them the enthusiastic support of western people, many of whom had been hostile to the service and its policies. Permanent improvements in the national forests are estimated to have a value of almost $13,000,000. They include 5,043 m. of roads, 29,419 m. of trails, and 25,031 m. of telephone lines. A substantially complete land classification of the national forests has been made. By the Weeks law, enacted March 1 1911, 1,796,788 ac. of forest in the southern Appalachian and White mountains of the eastern United States have been added by purchase to the national forests. The investment is a good one, since the present value of the land and timber sold is notably more than the original price plus the cost of care and protection. The average price paid per acre was $5.24. The purchased land is distributed in the following States:—

States	Acres
Alabama	62,966
Arkansas	36,529
Georgia	153,665
Maine	32,153
New Hampshire	401,026
North Carolina	326,786
South Carolina	18,612
Tennessee	246,675
Virginia	387,888
West Virginia	130,488
Total (as of June 30 1920)	1,796,788

It is expected that in the end not less than 7,000,000 ac. will have been acquired under the Weeks law. In addition to the purchase of forest land by the Government, the Weeks law authorized the coöperation of one state with another or with the United States in the protection of forests from fire. An amount ranging from $100,000 to $200,000 has been appropriated by Congress yearly for coöperation under this system, which contemplates that the state shall expend an amount at least equal to that expended by the Federal Government. Twenty-four states have taken advantage of it and the results are excellent.

Forest Products.—The Forests Products Laboratory at Madison, Wis., maintained by the U.S. Forest Service in coöperation with the university of Wisconsin, was established in 1911. It studies forest products and the best methods for their utilization. The total of its expenditures to Jan. 1921 is about $2,000,000, and a conservative estimate of the value of its work to American industries is not less than $30,000,000. During the World War about two-thirds of the force of the laboratory was occupied with problems related to war work. Among them were the mechanical and physical properties of different species of woods, methods of seasoning, substitutes for spruce in the construction of aeroplanes, and the strength of laminated structures for plywood. More recently, box testing has resulted in important savings in the manufacture of boxes and has greatly reduced the damage to boxed commodities. The laboratory has made a total of 500,000 tests on the mechanical properties of wood. A study of the influence of decayed wood on the quantity and quality of wood-pulp showed that the loss in stored pulp was probably not less than $5,000,000 a year, much of which could be prevented. This service now has four experiment stations, mainly in the West.

During 1910–20, state departments of forestry increased in number and extended the scope of their work. Thirty-four states now recognize forestry in this way, but the work of their departments is still weak and far below the standard of the Federal service. The area of forest land and the number of forests owned by the states are shown in the following table:—

State	Number of State Forests	Area (Acres)
Connecticut	5	3,702
Indiana	1	2,000
Maryland	5	3,500
Massachusetts	5	13,000
Michigan	82	289,515
Minnesota	4	333,000
New Hampshire	43	11,002
New Jersey	7	16,590
New York	2	1,838,322
North Carolina	1	340
Ohio	2	1,720
Pennsylvania	26	1,108,476
South Dakota	2	80,000
Vermont	13	20,135
Wisconsin	1	380,443
Total ac.		4,101,745

Much encouragement has been given by state departments to private planters of forest trees. Pennsylvania distributes annually about 3,000,000 forest-tree seedlings and "transplants" to private owners who pay only the cost of packing and shipping. The state contemplates an increase of this number to 20,000,000 and the raising of the trees at state-maintained charitable and correctional institutions. New York in 1919 distributed 2,225,000 seedlings at the cost of production. Most of the states supply technical advice to owners of woodland. In many of the states private forest fire protective organizations are common and usually efficient. In the West their work is confined mainly to the protection of valuable standing timber. Elsewhere it covers large areas of second growth or devastated land.

Wood is an essential munition of war and is required in enormous quantities by armies in the field. The U.S. army alone used 450,000,000 board-feet of timber and 560,000 cords of firewood during the war. The 20th Engineers, with a personnel of 18,000 men, operated 81 saw-mills in France and cut approximately 2,000,000 board-feet of timber, ties, piles and poles, in addition to enormous quantities of firewood, every working day. This regiment, composed mainly of lumbermen, was officered largely by trained foresters. Within one year after its formation 90% of the recruited men had landed in France, had built their own railway connexions, and had cut 300,000,000 board-feet of timber and railroad ties, 38,000 piles, and 2,878,000 poles and entanglement stakes. At least 75% of the wood used by the A.E.F. came from the forests of France.

During the decade 1910–20 technical instruction in forestry was crystallized and advanced, and popular instruction and practical demonstration in forestry has taken on a notable extension. Forestry is now widely taught in the agricultural colleges, vocational schools, and in the biological courses of colleges, normal schools, and public schools. Most of the forest schools which give technical instruction were established between 1900 and 1910. There are now 20 technical forest schools in America, a number entirely adequate to meet present demands. The Yale school of forestry and the department of forestry at Harvard grant the degree of Master of Forestry. Most of the other forestry schools give undergraduate courses leading to the degree of Bachelor of Science in forestry or Bachelor of Forestry. Some of the best known are those at the university of Maine, Cornell and Syracuse universities in New York, the Pennsylvania State Forest Academy, and the universities of Michigan, Minnesota, Montana, Idaho, Washington and California.

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FORMAN, HARRY BUXTON (1842–1917), British man of letters and civil servant, was born in London July 11 1842. He was educated at Teignmouth, and at the age of eighteen entered the postal service, where he remained until his retirement in 1907, being successively controller of the packet service and second secretary. He was for many years associated with the foreign branch of the service. It is, however, as a man of letters, and particularly as an authority on Shelley and Keats, that he is best known (*see* 24.832). His first book, *Our Living Poets*, was published in 1871, and was followed in 1876 by the first volume of his edition of the *Prose and Poetical Works of Shelley*, and in 1886 by the *Shelley Library*. He also published editions of *Keats* from 1883 onwards, and in 1896 *Elizabeth Barrett Browning and her Scarcer Books*. His last publication, *Books of William Morris*, appeared in 1897, in which year he was made C.B. He died at St. John's Wood, London, June 15 1917.

FORMOSA (TAIWAN).—The island of Taiwan (Formosa), which was ceded to Japan by China in 1895 (*see* 10.669), has an area of 13,839 sq. m., and in 1920 the pop. was 3,654,398, representing a density per sq. m. of 264 inhabitants. The chief towns are Taihoku, Tainan, Kagi and Taichu.

Administration and Finance.—Taiwan was placed under a civil administration in April 1896, and legislative steps were taken in the following year to put the finances of the island on an independent footing. Meanwhile a grant was made from the National Treasury, varying from £710,847 in 1897 to £71,699 in 1906, when the subvention was withdrawn owing to the satisfactory financial condition of the island. The 1920–1 budget balanced with an estimated revenue and expenditure of 94,451,263 yen.

Government Monopolies.—The Government monopoly undertakings of the island are opium, salt, camphor and tobacco, the importation of opium and the manufacture and smoking of the drug being strictly prohibited since 1896, except by licence in the case of confirmed smokers. The efforts made by the Government to educate the people with regard to the evil effects of opium-smoking were so successful that the number of licensed smokers had decreased from 117,000 in 1900 to 52,000 in 1919.

In May 1899 the Government took steps to improve the quality and increase the quantity of salt produced, which had hitherto suffered from the fluctuations due to irregular and sporadic private enterprise. There are now some 4,000 ac. of salt fields and sufficient salt is produced to satisfy local requirements and also for export to Japan, Chosen, Karafuto, etc. In 1899 the production of camphor was also controlled and in 1905 the monopoly system was extended to Taiwan-cut tobacco, in both cases with beneficial results.

Trade.—The chief commodities exported from Taiwan are tea, rice, sugar, camphor, turmeric, flax, hemp, jute and coal. In 1897 the volume of trade with Japan and overseas trade was 31,230,000 yen; in 1907 it was 58,340,000 yen; in 1910 108,880,000 yen (largely owing to the development of the sugar industry) and in 1912 125,520,000 yen. The World War seriously affected the results in the next few years, but in 1919 the figure of 332,520,000 yen was achieved. Exports to Japan and Korea were 142,200,000 yen and to other countries 35,620,000 yen, the total imports being valued at 154,700,000 yen. The balance of trade in favour of exports was thus 23,120,000 yen, chiefly due to the increased output and higher value of coal and to the good condition of the sugar market.

Agriculture and Industry.—Almost the whole of Taiwan is a rice-growing country, yielding two crops a year. In 1919 the rice crops amounted to 24,419,275 bus., an increase of 18% on the crop of 1909.

The oolong and souchong teas, produced in the north of the island, are important exports to foreign countries; the value of the oolong exported abroad in 1919 was 5,346,327 yen, a falling-off against 1918, probably owing to heavy stocks in the American market.

The sugar industry enjoyed great prosperity in 1916 and 1917, the value of the exports being 11,317,643 yen and 15,775,205 yen respectively. There are some 37 modern sugar refineries in the island with a capacity of 29,200 tons, about 25 less well equipped with 2,550 tons' capacity, as well as about 250 out-of-date establishments.

With regard to mineral products, the northern part of the island is again the more productive, as gold, alluvial gold, silver, copper, coal, petroleum and sulphur are all found there. The total value of mineral products in 1919 was 11,167,426 yen; the gold produced being 20,740 oz. (or 22,374 oz. including alluvial gold), valued altogether at 910,311 yen. The coal production was 1,086,907 metric tons (value 8,825,002 yen), the copper 877 metric tons (value 713,221 yen), silver, 20,185 oz. (value 41,459 yen), and sulphur 1,441 metric tons (value 85,791 yen). The value of petroleum was small; and though the oil fields are widely distributed over the island, most of them remain practically unexploited.

The fishing industry of Taiwan owes much of its present prosperity to Government encouragement, although owing to the favourable ocean currents, fishing can be carried out all round the island. Artificial rearing of oysters, prawns, carp, etc., is carried out both in salt and brackish waters, and it is a characteristic of the Formosan fisheries that whilst the natural produce is valued at about 4,000,000 yen, the value of the products of fish culture is 2,000,000 yen.

Communications.—The first postal service was opened in April 1895, when, prior to the restoration of peace between Japan and China, the Japanese army occupied Hokoto and established a field post-office. In 1896 postal service for the general public was commenced under the control of the Minister of Communications. In Oct. 1900 the Postal and Telegraph Laws, which had been put into force in Japan proper, were brought into operation in Taiwan by Imperial Ordinances and in the same year the telephone service was first opened between Taihoku and Tainan.

A great increase in the business of the post-office savings bank took place during 1910–20, the number of depositors having risen from 90,893 in 1909–10 to 358,204 in 1918–9, the deposits increasing from 1,900,700 yen to 5,518,178 yen in the same period.

In 1899 the Government commenced planning out a trunk line from north to south of the island, connecting the ports of Keelung and Taku and passing through Taihoku, Taichu and Tainan. Branch lines, further opening up the rice, sugar, tea and mining districts, were gradually completed, so that at the end of the financial year 1918–9 there were 346 m. of railway open to traffic.

In the same year over 9,000,000 passengers and more than 2,000,000 tons of goods were carried, the receipts being 8,013,559 yen.

In addition to the state railways, there were at the end of 1918 over 1,000 m. of railway belonging principally to sugar factories and about 600 m. of track for hand-propelled cars, an important means of local transport peculiar to the island. (H. Sa.)

FORREST, JOHN FORREST, 1st Baron (1847–1918), Australian statesman (*see* 10.672), was acting Premier of Australia in 1907 during the absence of Mr. Deakin in London, took office again as Treasurer in Mr. Hughes's "National" Cabinet of 1917 but resigned owing to ill-health early in 1918, when he was raised to the peerage, the first Australian to be so honoured. He died, however, at sea on his way to England to take his seat in the House of Lords, Aug. 3 1918.

FORSYTH, PETER TAYLOR (1848–1921), British Nonconformist divine (*see* 10.677), died in London Nov. 11 1921. Among his recent works were *The Person and Place of Christ* (Congregational lecture, 1909); *The Principle of Authority* (1913) and *This Life and the Next* (1918).

FORTIFICATION: *see* SIEGE WARFARE.

FORTIS, ALESSANDRO (1841–1909), Italian statesman, was born in 1841. He joined Garibaldi in 1866 as a volunteer and fought under him in the Trentino, in 1867 at Mentana and in 1870 in France. Under the influence of Aurelio Saffi he became a Republican, and was arrested as a Mazzinian conspirator in 1874. In 1876 he abandoned the Republican party, although still adhering to Democratic ideals. Elected deputy for his native town of Forli in 1880, he helped the royal visit to Romagna, hitherto regarded as a hot-bed of anti-monarchical views. He made a reputation as a parliamentary debater, but lost favour with his constituents who were largely Republican, and only held his seat with the help of Livio Quartaroli, mayor of Forli, and Saffi; when they died his position became untenable and he was not reëlected. He then won a seat at Poggio Mirteto, which he continued to represent until his death. He became Minister of Agriculture in the Pelloux Cabinet (1898–9), and in 1905, on the fall of the Giolitti Cabinet, became premier. But his administration fell after seven months over the commercial treaty with Spain, which aroused the violent opposition of the Italian vine-growers. He reconstructed the Ministry, but was beaten at once and had to resign, Jan. 30 1906. He died Dec. 4 1909.

FOSTER, SIR GEORGE EULAS (1847–), Canadian statesman, was born in Carleton co., New Brunswick, Sept. 3 1847. After a brilliant career in the university of New Brunswick, and also at Edinburgh and Heidelberg, he returned to Canada and taught in various local schools, eventually becoming professor of classics and ancient literature in a local university. In 1882 he became Conservative member for King's co., New Brunswick, in the Canadian Parliament; in 1885 entered the Cabinet of Sir John Macdonald as Minister of Marine and Fisheries; and in 1888 became Minister of Finance, which position he held until the defeat of his party in 1896. He represented York, New Brunswick, 1896–1900, and from 1904 sat in the Dominion House of Commons as representative for North Toronto. He was appointed Minister of Trade and Commerce in the Borden administration, 1911, and upon the formation of the Union Government in 1917 retained the portfolio. A brilliant debater, a thorough believer in tariff protection for Canadian industries and preferential trade within the British Empire, he made a series of speeches in Great Britain in 1903, on the invitation of Mr. Chamberlain, in support of Imperial trade preference. He was one of the Canadian representatives to the coronation of King George and Queen Mary, June 1911, and was Canadian representative on the Dominions Royal Commission appointed by King George, 1912. He was sworn of the Imperial Privy Council in 1916, and the same year was appointed one of the four representatives of Great Britain to the Economic Conference of the Allies at Paris. In 1918 he was created K.C.M.G., and in 1920 was head of the Canadian delegation to the first assembly of the League of Nations at Geneva, being subsequently elected vice-president of the assembly.

FOUILLÉE, ALFRED JULES ÉMILE (1838–1912), French philosopher (*see* 10.737 and 18.250), died at Lyons July 16 1912.

FOWLER, WILLIAM WARDE (1847–1921), British classical scholar and ornithologist, was born at Langford Budville, Som., May 16 1847, the second son of John Coke Fowler, stipendiary magistrate of Swansea. He was educated at Marlborough and at Lincoln College, Oxford, graduating first class in *literae humani-*

ores 1870, and being elected to a fellowship at his college two years later. From 1882 to 1904 he was sub-rector under W. W. Merry. In 1909–10 he was Gifford lecturer at Edinburgh. He combined exact scholarship with a living interest in the ancient world which made his classical studies, especially of Roman history, both readable and popular. They included a *Life of Julius Caesar* (1892); *The Roman Festivals of the Period of the Republic* (1899); *Social Life at Rome in the Age of Cicero* (1909); *The Religious Experience of the Roman People* (1911) and *Roman Ideas of Deity* (1914). Equally delightful were his writings on birds, *A Year with the Birds* (1886); *Tales of the Birds* (1888); *Summer Studies of Birds and Books* (1895); *More Tales of the Birds* (1902) and many occasional papers. His latest work included *Essays in Brief for War Time* (1916) and studies of Virgil's *Aeneid*. He died at Kingham, Oxon., June 14 1921.

FOX, JOHN (1863–1919), American writer, was born at Stony Point, Ky., Dec. 16 1863. He graduated from Harvard in 1883. His books, which depict the life of the Kentucky mountaineers, include *A Mountain Europa* (1894); *A Cumberland Vendetta* (1895); *Hell-for-Sartain* (1896); *The Kentuckians* (1897); *Crittenden* (1900); *Bluegrass and Rhododendron* (1901); *The Little Shepherd of Kingdom Come* (1903); *Christmas Eve on Lonesome* (1904); *Following the Sun Flag* (1905); *A Knight of the Cumberland* (1906); *The Trail of the Lonesome Pine* (1908) and *The Heart of the Hills* (1913). He died at Big Stone Gap, Va., July 8 1919.

FRACTURES, in surgery (*see* 4.201).—Further improvements in the treatment of fractured bone have been made, especially as the result of experience during the World War.

Before treatment of any fracture is undertaken, it is essential that an accurate knowledge of its detail be obtained. A diagnosis is made by X-ray photographs taken in two places at right angles to each other. The result, too, of treatment is noted by this means, and the progress of union ascertained by testing at intervals the degree of mobility between the fragments under the X-ray screen.

A fracture in which there is displacement of the fragments is always a serious injury, and the treatment is often difficult. The first aim of treatment is to restore the bone to its original anatomical alignment (reduction). The second is to keep this alignment, and at the same time to maintain the function of the muscles and joints of the limb. The two are interdependent, as the return of function depends to a very great extent on the accuracy of the reduction.

Two main methods of treatment are available in order to restore the alignment of the bone: non-operative and operative.

Non-Operative Treatment.—One of two methods may be chosen, depending on the site and nature of the fracture:—(*a*) Immediate reduction by forcible traction and manipulation, and maintaining the restored position by appropriate splinting. (*b*) Gradual reduction. In this method continuous extension (traction by means of weights) is applied to the limb in order to cause relaxation of the muscles. The fragments will then tend to resume their normal position, or can be more easily manipulated into such position.

Operative Treatment.—The object of operative treatment is to expose the fractured ends of bone, to replace them accurately in their original alignment, and in most cases to secure them in this position.

The best means by which to fix the fragments is still *sub judice*, but many materials have been used, notably bone grafts, metal plates and screws, bone pegs, metal wire, etc.

The bone graft has been widely used during the past few years. Its widest application is probably in cases where there is actual loss of bone substance, and the graft is used as a medium round which new bone may grow (old compound fractures). In the simple fracture its function is that of an internal splint to secure the fragments after reduction, and its value here is limited at present to the less severe cases. In the severe fractures the best method so far of securing a firm fixation is by means of a metal plate and screws (Arbuthnot Lane). Metal wire and bone pegs are valuable only in cases of injury to the smaller bones. When the fracture is in the neighbourhood of or involving a joint, as a rule the fragments are replaced in position only.

After-Treatment.—By whatever method the alignment of the bone is restored, the limb is splinted so that it is possible to commence at an early date general massage of the limb, and active movements of the joints in the neighbourhood of the fracture.

The splinted limb is suspended from an overhead frame-work. By a system of weights and pulleys a very wide range of movement is permitted to the patient, while the injured limb is maintained immobilized. This arrangement facilitates also the nursing of these often difficult cases. For fractures of the lower limb various forms of ambulatory splints have been devised to permit of walking at an early stage in the treatment.

Compound Fractures.—In the case of compound fractures, some by reason of their situation are necessarily either directly or indirectly compound, *e.g.* a fracture of the mandible (lower jaw), or certain fractures of the base of the skull. The majority of compound fractures, however, occur in the limb bones. These may be caused by some violent force striking the limb, lacerating the skin and soft structures surrounding the bone, and at the same time fracturing the bone. Dirt, clothing, etc., are thus carried into the wound. Many thousand such cases occurred in the war from the effects of gunshot. On the other hand, a bone may be broken, and afterwards, from the continuation of the violence or from the crumpling of the limb, the sharp end of one of the fragments may be forced through the muscles and skin.

In either case the important point is that the injured tissues have been exposed to infection by micro-organisms and provide in their damaged condition very favourable soil for their growth. If infection (sepsis) gains a foothold, the condition is a serious one always, and at the worst may involve loss of the limb or even life, at the best a long and tedious treatment.

The first object in the treatment of a compound fracture is to convert it into a simple one. This is accomplished by an excision of all lacerated tissue, and closure of the wound (primary suture). The treatment is then continued as for a simple fracture. In a large number of cases during the World War, the wound had become infected before continuous treatment was possible. The primary consideration, therefore, was to deal with the sepsis, and the results of septic absorption.

As the result of experience certain principles were evolved, which advanced the treatment of these serious cases to a marked degree. The main principles may be briefly summarized as follows:—

(1) To obtain an accurate reduction of the bone fragments and coincidently of the soft structures, thus enabling them to combat at a greater advantage the effects of sepsis.

(2) By efficient splinting to ensure a complete immobilization of the whole limb; the chance is then given for a natural barrier against the spread of infection to be formed in the limb.

(3) To use a simple, cleansing, and as far as possible painless treatment for the wound itself. Of the many treatments tried, it is probable that the Carrel-Dakin method of intermittent irrigation is in these respects the best.

(4) To close the wound when it has become bacteriologically clean (secondary suture). (F. D. S.)

FRAMPTON, SIR GEORGE JAMES (1860–), English sculptor, was born in 1860. He received his art training at the Royal Academy schools, where in 1887 he obtained a gold medal and the travelling studentship, and later under Mercié in Paris. In 1884 he exhibited "Socrates Teaching," but after some years tried experiments in other mediums than marble, with successful results. Frampton was elected A.R.A. in 1894, and received many important commissions, including a memorial statue of Queen Victoria for Calcutta; the sculpture on the exterior of Lloyds, London; the sculpture on the Glasgow art galleries; and the figures on the spire of St. Mary's, Oxford. He was elected R.A. in 1902, and in 1908 was knighted. His later works include busts of King George and Queen Mary for the Guildhall; "Maternity" (1905); a full-length seated statue of the Marquess of Salisbury (1907); the "Peter Pan" statue in Kensington Gardens (1912) and the Edith Cavell monument (1920). He also produced various fine designs for medals, including those commemorating the C.I.V. force and the coronation.

FRANCE, ANATOLE (1844–), French critic and novelist (*see* 10.775), produced three new novels after 1910: *Histoire Comique* (1911); *Les Dieux ont soif* (1912) and *La Revolte des Anges* (1914). He also wrote a play, *La Comédie de celui qui épousa une femme muette* (1912). *Le Petit Pierre*, a sequel to his early book *Le Livre de mon Ami*, appeared in 1918. These books, with two war utterances, *Sur la voie glorieuse* (1914) and *Ce que disent nos morts* (1916), make up his later literary output. On Oct. 11 1920 he was married in Paris to Mlle. Emma Leprévotte. He was awarded the Nobel Prize in literature in 1921.

FRANCE (*see* 10.775*).—The convulsions of the World War deeply disturbed the work of the statistical machinery of France, both central and local. Ten departments of the country were for several years in enemy occupation, and the result was that in 1921 no proper statistical information as to the population and its activities during that period was obtainable. In many places local records had been destroyed, and the central statistical bureau was deprived of many of its workers.

Population.—The quinquennial census, which was first taken in 1831, was interrupted in 1916 by the war. It was again taken in March 1921. The last previous complete census returns, those of 1911, showed the total pop. to be 39,604,992, including 1,152,096 foreigners, a slight decrease as compared with the 1906 figures. The organized efforts made to stem the fall in the birth-rate and to reduce infant mortality by the granting of preferential treatment to large families and by hygiene had not met with the success they deserved, and the losses in war-time came to aggravate the problem.

The census taken in March 1921 (provisional figures) gave France a total pop. of 37,499,394, of whom 1,415,128 were foreigners. These figures do not include the French troops abroad in the occupied territories of Germany, nor the French forces in the plebiscite zone of Upper Silesia and the mandate territory of Syria, nor do they include the pop. of the recovered provinces of Alsace and Lorraine. As the distribution of parliamentary representation is based upon pop., it should be noted that the two constituencies of Aveyron contain 181,821 and 145,942 French inhabitants; the two divisions of the Bouches-du-Rhône have 507,224 and 187,715; the two of Calvados, 229,478 and 148,061; the two of the Loire-Inférieure, 331,630 and 314,316; the Maine-et-Loire 253,395 and 219,209; the Pas-de-Calais, 545,023 and 406,572; the Basses-Pyrénées 219,193 and 161,686; and the four divisions of the Seine have as French pop. 955,539, 785,232, 996,174 and 1,440,652. Table 3 gives the details of the departmental population. Including Alsace-Lorraine, the census showed a total pop. of 39,402,739, of whom 1,550,449 were foreigners.

Male pop. in 1911 numbered 19,254,444; the female pop. was 19,937,689, an excess of females over males of 683,245. This preponderance of females in France has been steadily more marked since 1886. For every 1,000 males there were 1,014 females in 1891, 1,033 in 1901 and 1,035 in 1911, when the proportion was 50·87 females, as compared with 50·80 in 1901. The growth in female population is due both to increased female births and to increased female longevity. Congestion in urban areas at the expense of agricultural districts was a marked feature of 1911 returns, and it was anticipated that this movement would be shown even more clearly in 1921 returns.

Table 1.—*Towns of over 100,000 Inhabitants.*

	1906	1911
Paris	2,711,931	2,847,229
Lyons	430,186	523,796
Marseilles	421,116	550,619
Bordeaux	237,767	261,678
Lille	196,624	217,807
St. Étienne	130,940	148,656
Le Havre	129,403	136,159
Toulouse	125,856	149,576
Roubaix	119,955	122,723
Nantes	118,244	170,535
Rouen	111,402	124,987
Reims	102,800	115,178
Nice	99,556	142,940
Nancy	98,302	119,949
Toulon	87,997	104,582

Table 2.—*Towns of 50,000–100,000 Inhabitants (1011).*

Amiens	93,207	Orleans	72,096
Limoges	92,181	Le Mans	69,361
Angers	83,786	Troyes	55,486
Brest	90,540	St. Denis	71,759
Nîmes	80,437	Levallois-Perret	68,703
Montpellier	80,230	Clermont-Ferrand	65,386
Dijon	76,847	Versailles	60,458
Tourcoing	82,644	Besançon	57,978
Rennes	79,372	Boulogne-sur-Seine	57,027
Tours	73,398	St. Quentin	55,571
Calais	72,322	Boulogne-sur-Mer	53,128
Grenoble	77,438	Béziers	51,042

Table 3.—*Departmental Population (1921).*

Department	Total Pop.	French	Foreign
Ain	315,757	307,398	8,359
Aisne	421,515	402,285	19,230
Allier	370,950	369,377	1,573
Alpes (Basses-)	91,882	87,070	4,812
Alpes (Hautes-)	89,275	86,852	2,423
Alpes-Maritimes	357,759	257,042	100,717
Ardèche	294,308	293,258	1,050
Ardennes	277,791	253,989	23,802
Ariège	172,851	168,309	4,542
Aube	227,745	224,575	3,170
Aude	286,532	260,061	26,471
Aveyron	332,940	327,763	5,177
Bouches-du-Rhône	841,996	694,939	147,057
Calvados	384,501	377,539	6,962
Cantal	199,401	198,924	477
Charente	316,249	314,877	1,372
Charente-Inférieure	418,310	416,148	2,162
Cher	304,800	303,793	1,007
Corrèze	273,808	273,484	324
Corse	281,959	275,581	6,378
Côte-d'Or	321,088	316,970	4,118
Côtes-du-Nord	557,824	557,091	733
Creuse	228,344	227,900	444
Dordogne	396,702	394,955	1,747
Doubs	284,975	270,978	13,997
Drôme	263,509	261,026	2,483
Eure	303,092	294,703	8,389
Eure-et-Loir	251,259	249,426	1,833
Finistère	762,514	762,048	466
Gard	396,169	382,020	14,149
Garonne (Haute-)	424,482	413,505	10,977
Gers	194,406	189,664	4,742
Gironde	819,404	794,057	25,347
Hérault	488,215	436,004	52,211
Ille-et-Vilaine	558,574	556,800	1,774
Indre	260,535	259,802	733
Indre-et-Loire	327,743	325,203	2,540
Isère	525,522	503,169	22,353
Jura	229,062	223,278	5,784
Landes	263,937	261,414	2,523
Loir-et-Cher	251,528	249,889	1,639
Loire	637,130	618,169	18,961
Loire (Haute-)	268,893	268,365	528
Loire-Inférieure	649,723	645,978	3,745
Loiret	337,224	334,738	2,486
Lot	176,889	176,139	750
Lot-et-Garonne	239,972	234,734	5,238
Lozère	108,822	108,820	2
Maine-et-Loire	474,786	472,604	2,182
Manche	425,512	423,457	2,055
Marne	366,734	355,661	11,073
Marne (Haute-)	198,865	195,185	3,680
Mayenne	262,447	261,903	544
Meurthe-et-Moselle	503,810	459,889	43,921
Meuse	207,309	196,687	10,622
Morbihan	546,047	545,623	424
Nièvre	270,148	267,395	2,753
Nord	1,788,518	1,616,772	171,746
Oise	387,760	370,105	17,655
Orne	274,814	272,772	2,042
Pas-de-Calais	989,967	951,595	38,372
Puy-de-Dôme	490,560	487,534	3,026
Pyrénées (Basses-)	402,981	380,879	22,102
Pyrénées (Hautes-)	185,760	180,246	5,514
Pyrénées-Orientales	217,503	183,068	34,435
Rhin (Haut-) (Belfort)	94,338	89,590	4,748
Rhône	956,566	917,957	38,609
Saône (Haute-)	228,348	225,028	3,320
Saône-et-Loire	554,816	550,227	4,589
Sarthe	389,235	387,523	1,712
Savoie	225,034	211,988	13,046
Savoie (Haute-)	235,668	223,522	12,146
Seine	4,411,446	4,177,597	233,849
Seine-Inférieure	880,671	862,793	17,878
Seine-et-Marne	349,257	339,276	9,981
Seine-et-Oise	921,673	887,523	34,150
Sèvres (Deux-)	310,060	309,421	639
Somme	452,624	440,202	12,422
Tarn	295,588	290,852	4,736
Tarn-et-Garonne	159,559	158,124	1,435
Var	322,945	270,450	52,495
Vaucluse	219,602	210,845	8,757
Vendée	397,292	396,596	696
Vienne	306,248	305,431	817
Vienne (Haute-)	350,235	349,522	713
Vosges	383,684	377,847	5,837
Yonne	273,118	270,468	2,650

These figures indicate the volume and page number of the previous article.

The distribution of the active population in 1911 according to occupation showed that, in spite of the townward movement, agriculture was the chief concern of the country. During and since the war it is suspected that industry has made heavier demands upon labour. Table 4 gives 1911 figures (in thousands).

TABLE 4.—*Occupation Statistics.*

Occupation	Males	Females	Total
Agriculture	5,279	3,238	8,517
Manufactures	4,951	2,535	7,486
Trade	1,218	835	2,053
Liberal Professions and Public Services	888	337	1,225
Domestic Service	158	771	929
Soldiers, Sailors and Fishermen	718	3	721
	13,212	7,719	20,931
No Occupation	6,042	12,219	18,261

The number of foreigners in France, which had decreased from 1,130,211 in 1891 to 1,038,871 in 1901 (the proportion per 10,000 inhabitants falling from 297 to 269), increased in the period 1901–11 to 1,159,835, or 296 per 10,000. The principal nationalities represented were, in 1911: Italians, 419,234; Belgians, 287,126; Spaniards, 105,760; Germans, 102,271; Swiss, 73,422; British, 40,378; Russians, 35,106. The large number of Italians and Belgians in France was due to the labour requirements of the textile industries in the north and of the mineral fields in the east.

The only official vital statistics, of more recent date, available in 1921 are partial and approximate in character. They relate to 77 out of 87 departments (the other 10 having been invaded), and are based upon the *bulletins d'état civil*, or ordinary registration statistics, and not upon the more satisfactory data of the general census returns. Subject to these reservations, the figures of the years 1911–9 are summarized in Table 5.

TABLE 5.—*Vital Statistics.*

	Population (in thousands)	Marriages	Births	Deaths
1911	33,085	255,036	602,978	647,284
1912	33,065	253,534	608,690	579,175
1913	33,095	247,880	604,811	587,445
1914	33,085	169,011	594,222	647,549
1915 *	34,290	75,327	387,806	655,146
1916	33,650	108,562	315,087	607,742
1917	32,980	158,508	343,310	613,148
1918	32,780	177,822	399,041	788,616
1919	32,315	447,207	403,502	620,688
1920 (first 6 months).				
77 Departments	33,079,103	269,454	336,642	300,406
90 Departments †	41,476,272	333,241	424,668	356,722

* Increase due to the influx of refugees from the invaded departments and from foreign countries.

† Including Moselle, Upper and Lower Rhine (Alsace-Lorraine).

Table 5 shows the great decline of the birth-rate due to the war, and its rapid recovery in 1918 and 1919. The high mortality in 1918 is to be attributed to the epidemic of influenza.

Divorces in the 77 departments numbered 12,344 in 1913, decreased until 1915, but increased to 8,121 in 1918 and to 11,657 in 1919. During the first six months of 1920 the total was 9,614, more than double the figure for the corresponding period of 1919.

The number of recruits of the 1921 class who were passed as fit for army service was 272,000 (including Alsace and Lorraine), and their proportion to the total of young men liable for service with this class was 78 %, a higher figure than that of the 1913 class. The strictness of the medical examination is shown by the number of *ajournés* (recruits expected to come up to the physical standard at some future time), which was 61,943. The proportion between the corresponding number of births and the number of young men attaining the age for military service reached 75 %, for the first time, in 1921. It had been rising slowly for the past 20 years but had not previously gone beyond 73 per cent. Reckoning the actual number of men passed by the doctors, and the average number of *ajournés* to be subsequently added, the 1921 class constitutes a distinct improvement on its predecessors. The privations endured during the war do not appear to have had such bad results as were feared in regard to the physical development of the youth of the country. This is attributed by the military authorities to three causes: the decrease in the consumption of spirits, the influence of athletic sports, and, to a certain extent, a better knowledge of sanitary and dietary conditions among the peasantry.

An official report on crime statistics in France from 1914–9 shows that while the total number of crimes and offences was below the average, there was a distinct increase of criminality among women and minors under 18 years of age. Before the war, out of every 100 persons convicted 12 were women and 5 minors, but during the war period these proportions rose to 30 and 14 respectively. Abortion and infanticide more than doubled.

In regard to minor offences, only thefts show an increase (62,869 in 1919 against 36,401 in 1913). There was a considerable decrease in the prosecutions for begging and being without visible means of subsistence. Common assaults decreased by more than 50 %, and there was a similar diminution in all offences generally due to drink. The report attributes this result to legislation against drunkenness and the prohibition of absinthe. The figures, however, are not an exact reflection of the situation, the operations of justice having been greatly hampered by circumstances.

Constitution.—The only constitutional change made in France between 1910 and 1921 was the adoption of a new system of voting at parliamentary general elections. Previously, the seats went to the candidates receiving the highest number of votes, as in England, with this difference, that if no candidate received an absolute majority—that is to say, at least one more than half the total votes polled—a secondary election, known as the *scrutin de ballotage*, became necessary, on which occasion an actual and not an absolute majority was sufficient.

There are two varieties of the majority system. One consists of dividing the constituency into sections, each of which elects one member. The other may consist of the election of a list of as many candidates as there are seats in the constituency (in France, the department). The first of these systems is known as the *scrutin d'arrondissement* and the second as the *scrutin de liste*. For many years there was an agitation in France against the prevailing system (*scrutin d'arrondissement*) because it was regarded as unfavourable to the general principles by which politics should be guided. A deputy elected by a comparatively small body of voters often became the mere mouthpiece of local interests and was inclined to put those of the nation in the background. It eventually became evident that the *scrutin d'arrondissement* was definitely condemned. Parliament, however, did not replace it by the *scrutin de liste* pure and simple, because it was felt that this system was too absolute and too hard on minorities. In a department, for instance, returning 10 members and having 50,000 electors, a list which obtained one vote less than the other ran the risk of not being represented at all and losing all 10 seats to the opposition. The result would be something very much like oppression of the minority, and there might be a temptation for the minority to put forward its claims in illegal ways instead of through the constitutional parliamentary channel. Parliament, therefore, in 1919, abolished the majority system of voting and adopted a compromise between the proportional voting system and the other. The present system is a majority one, tempered by concessions to minorities, or it might be described as a proportional system giving a kind of bonus to majorities.

Two terms require definition before any explanation of the French electoral system can be given—the "electoral quotient" and the "average." The former is the figure obtained by dividing the number of votes cast by the number of seats to fill. The average of a list is, as the word implies, the number of votes cast for the list divided by the number of candidates. A list obtains as many seats as the number of times the electoral quotient is contained in the average of the list. As an example take the hypothetical case of a department returning five members. There are three lists of candidates—Conservative, Radical and Socialist—and the voting is as follows:—

Conservatives (5 candidates)		Radicals (4 candidates)		Socialists (3 candidates)	
A	15,000	F	12,000	L	9,500
B	14,500	G	11,500	M	9,000
C	14,000	H	11,000	N	8,500
D	13,500	J	10,500		
E	13,000				
Total	70,000	Total	45,000	Total	27,000
Average	14,000	Average	11,250	Average	9,000

The total votes cast being 34,250, the division of this number by 5 (the number of seats to fill) gives the electoral quotient, 6,850. The average of the Conservative list contains this quotient twice (13,700) with 300 over. The average of the Radical list contains the quotient once, with 4,500 over, and the Socialist list contains the quotient once, with 2,250 votes over. The first list thus gets two seats, the second one and the third one, and these seats go to the candidate having obtained the greatest number of votes. Consequently the candidates returned are A, B, F and L. The allotment of the fifth seat, which is made in virtue of the highest average and not the quotient, will be explained further on. It will be observed that L, who receives only 9,500 votes, is declared elected, while D, with 13,500, is unsuccessful. This apparent anomaly is explained by the theory that party principles are of more importance than persons. D's votes count towards the success of his list, which obtains two seats while L's has only one, and there is no obligation to consider the personal feelings of D.

As above mentioned, the proportional system is tempered in France by bonuses offered to majorities. Any candidate polling more than half the total votes cast is elected, and in his case there is no question of quotients or averages. Consequently, if all the candidates on one list obtain more than half the total votes cast, the list is elected *en bloc*. This happened in some 20 constituencies when the first general election took place under the new law in 1919. If any seats are left over after the quotient operation has been worked out, they go to the lists having the highest average. In the example given above, the Conservative list has the highest average, 14,000. It, therefore, obtains the fifth seat, and C is declared duly elected. This provision sometimes produces surprising results. In a department returning six members, each of the three lists may have the quotient once with a large number left over; and if the average of list No. 1 be only a single vote more than that of list No. 2, No. 1 list gets all the three seats left over. This was illustrated in the department of the Gard, where the Conservative list obtained 4 seats and the Radicals only 1, although the latter polled nearly as many votes as their adversaries.

When a candidate on a list obtains an absolute majority, this is so much net profit for his list, as his votes continue to count for the average. When there is only a single candidate, he may be elected either on an absolute majority or if he has more votes than are cast for the candidates elected on the strength of the quotient. It may also happen that two lists may each get three times the quotient although there are only five seats to fill. In such a case the seats go to the highest average. In the Haute-Vienne, a list which obtained the quotient three times did not get a single seat. Three candidates on the other list were elected by absolute majorities, and the two remaining seats went to this list in virtue of the higher average.

In addition to the bonus to majorities, and the maintenance of the absolute majority (thus facilitating coalitions which the law was designed to prevent), the French system contains another anomaly—the maintenance of the old system for by-elections. These are decided exactly as they were before the law of 1919, with a *scrutin de ballotage* if the first ballot does not give an absolute majority.

France had not yet in 1921 accorded the vote to women, although the Chamber of Deputies, in May 1919, voted a bill recognizing the full political rights of Frenchwomen. At the annual Women's Suffrage Congress, held in Paris in May 1921, the reports from all the provincial organizations showed that public opinion was moving steadily in favour of the change.

Church and State.—After an interval of 17 years, diplomatic relations between France and the Holy See were resumed in May 1921, when M. Jonnart, the French ambassador extraordinary, presented his credentials to the Pope. It may be useful here briefly to relate the circumstances which attended the estrangement between the Church and its "eldest daughter." M. Loubet, President of the French Republic, paid an official visit to the King of Italy at Rome from April 24–28 1904, without taking any official notice of the Holy See. On April 28, Cardinal Merry del Val, Papal Secretary of State, protested against the visit of the head of a Catholic State to the Quirinal. The first news of this protest was given by M. Jaurès in his paper, the *Humanité*, on May 16, and on the 21st the anti-clerical premier, M. Combes, who probably had a good deal to do with the disclosure, recalled M. Nisard, French ambassador to the Vatican. On July 30 the Government also recalled its *chargé d'affaires*, Baron de Courcel, in consequence of utterances by Mgr. Geay, Bishop of Laval, and Mgr. Le Nordez, Bishop of Dijon, which showed that certain provisions of the Concordat were interpreted differently by Church and State. The relations between France and the Holy See were thus broken off by the French Government acting in the exercise of its prerogatives. The position was unchanged at the time of the outbreak of the World War, but there had long been a growing conviction in France that the estrangement was not only unnecessary but harmful to French interests, and that, if only in virtue of the principle expressed in the saying "*Les absents ont toujours tort,*" it was a mistake for France, who still considered herself the protector of Catholic missions in the East, to be without admission to so unequalled a political observatory as the Vatican. This feeling was strengthened in the course of the war by the attitude of the French clergy, who espoused the national cause in the most whole-hearted manner. Thousands of priests of military age served in the ranks and set a magnificent example to their fellow soldiers. The diocese of Lyons alone lost 147 priests and divinity students. The French bishops, especially in the invaded area, showed great courage and fortitude under the most trying circumstances. Amid the perils and hardships of war, innumerable French citizens, combatants and non-combatants alike, discovered that the consolations of religion were not an empty phrase. When the war came to an end, anti-clericalism as a political force had ceased to exist in France, and, after the elections in 1919, there was no longer any valid reason for adhering to the policy of M. Combes. In March 1920 M. Millerand's Cabinet brought in a bill for the reëstablishment of the French embassy to the Vatican. The bill was voted by the Chamber of Deputies on Nov. 30 by 391 to 179. Up to the beginning of June 1921 the bill had not passed the Senate, but the Government, headed by M. Briand, felt justified in acting upon it without further delay and resuming the relations broken off by his predecessor in 1904. By a curious coincidence, M. Combes died on the very day on which this was done.

Apart from considerations of foreign policy and expediency, there were two strong arguments in support of M. Briand's action. The motive for the recall of the French ambassador in 1904 was the protest raised by Pope Pius X. because the President of the French Republic ignored him during his official visit to the Quirinal. The Pope's successor (Benedict XV.) stated on May 23 1920 in his encyclical "Pacem Dei munus pulcherrimum" that henceforth no protest would be raised against visits by heads of Catholic States to the Quirinal. The primary cause of the conflict was thus removed. The second cause resided in differences of interpretation of the Concordat, but as this instrument was abolished by the separation of Church and State in France, there could be no such differences in future.

Education.—During the period 1910–21 the State educational system remained uniform throughout France, varied only by the changes in the programme which take place about every 10 or 12 years in accordance with what are considered to be the requirements of succeeding generations of scholars. Many French experts reproach the university authorities with an excessive tendency to lower the level of secondary education in response to the desires of parents, who, in general, seem to favour a shortening of the period of study and the hastening of the time when their sons will be able to begin their careers. There is some reason to fear that the intellectual level of the country may to some extent be sacrificed to utilitarianism. In the years immediately following the war, the leaning towards the modern science side of instruction was very marked. At the beginning of the 1920 winter term the only vacancies in the Paris *lycées* for boys were on the classical side.

In addition to the ordinary degrees, French universities are allowed to grant diplomas in special subjects, such as applications of science and commercial science. Certificates for knowledge of French are also issued to foreigners who have gone through a course of study of the language. The special certificates granted by French universities in 1920 were: Paris, 172; Aix and Marseilles, 12; Algiers, 4; Besançon, 11; Bordeaux, 37; Caen, 31; Clermont, 6; Dijon, 6; Grenoble, 517; Lille, 12; Lyons, 143; Montpellier, 50; Nancy, 160; Poitiers, 9; Rennes, 10; Strassburg, 19; Toulouse, 127.

(G. A.; G. A. R.)

AGRICULTURE AND INDUSTRY

Agriculture.—Agriculture still remains the main occupation of the French. At the outbreak of war over 60 % of its labour was mobilized and invasion robbed the country of the resources of the richest agricultural provinces. These causes, together with shortage of phosphate manures, brought about a very serious falling-off in production. Table 6 gives the statistics of the chief crops:—

TABLE 6.—*Principal Crops* (*in thousand quintals*).

	1913	1916	1917	1918	1919
Wheat	86,919	55,767	39,488	61,435	48,438
Maslin (mixed rye and wheat)	1,490	1,079	879	959	927
Rye	12,714	8,471	6,993	7,349	7,070
Barley	10,437	8,331	8,980	5,982	5,143
Oats	51,826	40,223	34,462	25,619	24,429
Maize	5,430	4,225	4,118	2,479	2,990
Millet	186	153	319	89	125
Sarrasin (buckwheat)	5,664	2,739	2,272	2,242	2,675

The law passed on Oct. 25 1919 formed a Chamber of Agriculture in each department. There are regional offices at Paris, Rennes, Nancy, Bourges, Lyons, Clermont-Ferrand, Bordeaux and Marseilles.

Before the war France was independent with regard to wheat. This is no longer the case, and during the year 1919 she required about 35 million quintals from abroad. The figures for 1919 show a drop of 40 % in production since the war. France before the war was third on the list of wheat-producing countries, coming after the United States and Russia. In 1919 she dropped to fourth place behind the United States, India and Canada. During the war the wheat problem was met partly by the purchase of foreign wheat, and also by releasing from the army peasants belonging to the 1888, 1889, 1890, and 1891 classes—about 250,000 men in all; by the use of African labour, prisoners-of-war and tractors. The chief step taken to encourage wheat-growing was the raising of the price of wheat and, from 1915, the direct purchase of the crop by the State. The quintal of wheat had been worth 29·49 francs in 1914. The requisition price was 30 francs until March 1916, and then rose to 33 francs on Aug. 1 1916; 36 francs, April 1917; 50 francs, July 1917; 75 francs, Aug. 1918; 73 francs, 1919. The State sold the wheat to millers in the provinces at 43 francs, in Paris at 31·90 francs. The budgetary cost of this method was 2,500 million francs in 1919.

The area of land under cultivation in 1913, the last complete year before the war, and in 1918, is shown in Table 7.

TABLE 7.—*Land under Cultivation* (*in hectares*).

	1913	1918
Arable land	23,651,100	20,881,480
Meadow land	4,908,668	4,601,480
Grass land	1,490,870	1,476,190
Pasturage (including *pacages*)	3,648,150	4,157,410
Vines	1,616,621	1,566,884
Kitchen gardens	266,845	253,380
Nursery gardens	960,410	801,490
Woods and forests	9,886,701	9,746,719
Uncultivated land	3,793,450	4,549,290
Unclassified land	2,729,764	4,917,896
Total area	52,952,579	52,952,219

Statistics for other crops are given in Table 8. With regard to potatoes, France, as a result of the war, has turned from an exporting to an importing country. In 1912 the balance in her favour was about 17 million francs; whereas in 1919 her imports amounted to 128,519,000 francs, and her exports only to 13,727,000 francs.

TABLE 8.—*Other Crops* (*in thousand quintals*).

	1913	1916	1917	1918	1919
Mangold-wurzel	252,201	154,910	160,896	108,173	104,933
Swedes and turnips	34,540	25,173	25,318	20,451	17,780
Cabbage	82,749	55,106	57,042	52,506	40,449
Trefoil, Lucerne sanfoil	316,432	108,864	90,344	86,581	75,151
Green fodder	186,227	111,117	91,860	83,340	59,586
Meadows	156,914	157,218	131,291	117,908	128,156
Potatoes	135,859	87,811	109,226	65,197	77,635
Root artichokes	17,793	14,920	15,780	10,528	11,562
Sugar-beet	59,393	19,886	21,085	11,424	10,830
Beet for distilling	20,505	7,915	7,024	3,417	3,471
Hemp	219	42	40	68	98
Flax	69	41	20	88	69
Hops	36	19	17	4	8
Tobacco	260	146	77	88	141

Live Stock.—The war had a disastrous effect upon French herds, as is shown by a comparison (Table 9) of the figures at the beginning of 1918 with those of the beginning of 1914.

TABLE 9.—*Live Stock* (*in thousands*).

	1913	1918
Horses	3,231	2,233
Mules	193	139
Asses	360	311
Cattle	14,807	12,251
Sheep	16,213	9,061
Swine	7,048	4,377
Goats	1,453	1,197

Wine.—War had practically no effect upon the wine-grower, as is shown by the following figures of production, which are given in thousands of hectolitres: 1913, 44,171; 1914, 59,981; 1915, 20,442; 1916, 36,068; 1917, 38,227; 1918, 45,160; 1919, 51,461. The price of ordinary wine was 16 francs the hectolitre in 1914, and it rose in great jumps to 135 francs the hectolitre in 1918. No figures were yet obtainable in 1921 showing the effect upon the wine-growing industry of the disappearance of its best foreign customer, Germany, and of the prohibition legislation in the United States, which had been third on the list of foreign purchasers of champagne.

Statistics with regard to agriculture were in 1921 greatly in arrears. For instance, the latest available figures for the butter industry were pre-war, and many of the figures with regard to the chief crops and wines for 1917, 1918 and 1919 were provisional.

Industries.—Coal.—The production of coal and other solid mineral fuels was greatly affected by the World War. The whole of the Valenciennes and part of the Pas-de-Calais mining districts were invaded at the beginning of hostilities, thus depriving France of mines which, in 1913, had produced over 18,000,000 tons of coal. In those parts of France which escaped invasion all the younger miners were mobilized, leaving only the men belonging to the territorial forces. This state of affairs continued for some time, but in 1915 the need of an increased output of coal was recognized, and a certain number of miners were recalled from their corps and sent to the mines in the centre and south.

Table 10 gives the total production and the number of persons employed in the mines of France.

TABLE 10.—*Coal Production and Workers.*

	Tons	Persons
1914 (second half)	7,400,000	62,000
1915	19,500,000	72,000
1916	21,300,000	78,000
1917	28,900,000	115,000
1918	26,200,000	114,000

The decrease in production in 1918 was due to military operations in the Pas-de-Calais coal-fields, where some mines ceased working.

Production during the war period amounted to about 70 % of the pre-war output. To make up for the deficiency, large quantities of coal were imported, as shown in Table 11.

TABLE 11.—*Imports of Coal.*

	Total in tons	From Great Britain	From the United States
1914 (second half)	5,346,000	4,700,000	—
1915	19,700,000	18,900,000	145,000
1916	20,420,000	18,700,000	53,000
1917	17,453,000	15,800,000	57,000
1918	16,830,000	15,300,000	17,000

The result of the efforts made since the end of the war to bring the damaged French coal-mines back to their former productiveness is shown by the statistics as to the amounts of coal won in 1919 and 1920. In France the totals were 25,274,304 tons in 1920 and 24,476,766 in 1919. In the Saar coal-fields the totals were 9,410,433 tons in 1920 and 8,970,848 in 1919. The number of workers in the pits was 143,405 in 1920 (Dec. 31) and 113,240 in 1919; at the surface, 81,063 in 1920 and 62,832 in 1919. The coal consumed at the mines in 1920 was 3,838,486 tons, or 15 % of the output.

The mines in the department of the Nord in Jan. 1921 had regained 43·5 % of their pre-war output. At the beginning of 1919 they produced only 1,535 tons; a year later it was 122,055 tons, and in Jan. 1921 it was 353,297 tons. Even the Pas-de-Calais mines, comprising the Lens and Liéven pits, which were actually on the battle-front for years and suffered worse than any others, had been nearly cleared of water in the spring of 1921.

Table 12 gives the output of the French coal-fields for Jan. 1921, and affords some idea of their comparative importance.

TABLE 12.—*Details of Coal Output, Jan. 1921.*

District and Coal-field	Coal tons	Lignite tons
Arras (Pas-de-Calais)	579,606	—
Douai (Nord and damaged mines in Pas-de-Calais)	250,243	—
Saint-Étienne (Loire)	219,329	—
Lyons (Blanzy, La Mure)	153,335	617
Clermont-Ferrand (Saint-Eloy, Brassac)	83,324	74
Alais (Alais, Graissesac)	93,167	2,932
Toulouse (Carmaux, Aubin)	105,667	708
Marseilles (Fuveau)	3,118	61,226
Nantes (Vouvant, Maine)	5,131	—
Bordeaux (Ahun)	2,497	1,925
Nancy (Ronchamp)	5,136	374
Strassburg (Moselle)	255,471	—
Totals	1,756,024	67,856

Industrial Fuel.—Before the war Germany supplied France with 78 % of her imports of the coke she required for her iron-works and other metal industries. Germany was thus able to alter the price of her coke according to circumstances, thereby benefiting her own iron and steel manufactures and making it increasingly difficult for France to compete with her in metal exports. On the average, the French ironmaster paid for coke 13 fr. a ton more than his German and 12 fr. more than his English rival.

Reckoning 12 tons of coke per ton of pig-iron, the relative expenditure for fuel in the production of a ton of pig-iron was in 1912:—France 36 fr.; Belgium 29 fr.; Germany 22 fr.; England 20 fr.

As regards the prices of coal and coke—a question of primary importance to the national industry—the position of France at the time of the war was that home coal at the pit-head cost about 40 % more than in England and 20 % more than in Germany. As about one-third of the quantity consumed in France had to be imported, the average price of coal, 19 fr. a ton, reckoning that of imports, was 2 fr. a ton (12 %) higher in France than in Belgium, 5 fr. (36 %) higher than in Germany and 7 fr. (60 %) higher than in England.

In the period following the Armistice the fuel problem was temporarily solved by the quantities of coal which Germany was compelled to deliver, and also by imports of coal from the United States, which became larger and larger as the supplies from Great Britain dwindled in consequence of miners' strikes and the necessity of stopping or limiting exports. In 1921 the position could only be regarded as uncertain, the supply of coal at reasonable prices to French industries being largely dependent upon the political relations between France and Germany.

Iron.—As the result of the war and more immediately of the invasion of the Briey district, the output of iron ore was at first much reduced. The figures are given in Table 13.

TABLE 13.—*Iron* (*in tons*).

	Output	Imports	Exports
1914 (second half)	370,000	701,486	4,828,591 (whole year)
1915	620,000	271,159	94,863
1916	1,680,000	627,604	74,561
1917	2,034,000	507,908	126,532
1918	1,572,000	118,610	68,346

Imports of iron were chiefly from Spain and Portugal, and practically the whole of the exports to England.

In 1920 France produced 13,871,137 tons of iron ore, 23,145 workers being employed in the process. The figures for 1919 were respectively 9,430,000 tons and 19,558 workers. In each case the Lorraine output is included. Pre-war French territory produced 5,800,000 tons. The Lorraine contribution rose from 7,127,000 tons in 1919 to 8,074,989 tons in 1920, this quantity being still considerably below the pre-war level. In round figures, France and Lorraine combined were producing at the end of the year 1920 about 30,000,000 tons less than their pre-war output.

Steel.—In 1913 France took fourth place on the list of steel-producing countries, her output being 5,093,000 tons, or 6·8 % of the total. She imported 106,900 tons, exported 477,300 and consumed 4,722,600. Out of the 5,093,000 tons 3,592,000 represented finished products.

The occupation of large tracts of the country by the enemy immediately reduced the steel output by about 60 %, but a great effort was put forward to make good the loss. Many new steel-works were constructed, chiefly in the centre, and existing works modernized their plant so as to contribute as much as possible to the production of the steel so urgently needed for the manufacture of artillery and for other military purposes. The number of new steel-works thus brought into being by the necessities of national defence exceeded 250, with a total capacity of 1,900,000 tons. As many of these new establishments took the place of others which were either worn out or unsuitable to new conditions, the increase in the national output of steel was estimated at not more than 950,000 tons a year.

Other Minerals.—Table 14 shows the output of ores other than iron during the second half of 1914 and the four following years.

TABLE 14.—*Output of Other Ores* (*in tons*).

	1914 (2nd half)	1915	1916	1917	1918
Gold	12,469	13,077	23,518	24,343	6,155
Zinc, Lead, Silver	12,839	23,778	34,295	38,125	25,087
Copper and Tin .	40	95	1,057	1,377	811
Antimony . .	380	6,353	19,037	19,453	10,020
Manganese . .	1,870	10,324	10,807	11,589	9,871
Tungsten . .	6,061	6,062	7,289	8,548	7,414
Iron Pyrites . .	51,421	196,606	219,371	280,797	260,310

France produces more bauxite ores, from which aluminium is obtained, than any other country. Her output in 1913 was 309,294 tons, of which she exported 65 per cent. The United States produced 213,605 tons, Great Britain 6,153 tons and Italy 6,952 tons. Germany was dependent on France for 95 % of her imports of these ores. In addition, a large part of the French ores exported to Switzerland found its way to Germany in the shape of aluminium.

During the war the French output of bauxite dropped to 56,522 tons in 1915, advancing to 106,200 tons in 1916 and 120,916 tons in 1917. In this period the United States made great strides and reached an output of 568,690 tons in 1917—nearly twice the quantity produced in 1915.

In regard to aluminium, France produced 13,500 tons, or 26 % of the world's output (63,700 tons), in 1913. She exported about half this quantity. The production of aluminium was so greatly stimulated during the war that it rose from 63,700 tons in 1913 to 176,000 tons in 1917. This increase was of course chiefly due to metallurgical researches, which showed that aluminium could be adapted to many new uses. The curious alloy known as *duralumin*, which automatically tempers itself in course of time, was one of the most remarkable results of these researches.

France has very little copper ore, and the output of her colonies has been insignificant. The principal mines, 'Ain Barbor and Akhaides, both in Algeria, produce about 5,000 and 2,000 tons a year respectively. French metallurgists, however, have been very successful in transforming the crude metal into the finished and half-finished forms of copper and brass required by various industries.

The war deprived France of 95 % of her copper, through the enforced stoppage of the foundries at Givet (Compagnie Française des Métaux) and Briache-St.-Vaast (Pas-de-Calais). Measures were immediately taken to meet the deficiency. Large foundries were built, among them being one, under the control of the Ministry of Munitions, having an annual capacity of 15,000 tons of bars and 20,000 tons of sheet brass and copper. Considerable extension was given to the electrolytic process of copper-refining, which, before the war, was represented only by two or three small establishments with a total annual output of 2,400 tons. France now (1921) has three large electrolytic copper-works, at Pauillac (Gironde), St. Tour and Le Palais, with a total production of 25,000 tons.

The net result of the war was a smaller increase in the output of metallic copper, due to improved processes, and a very large increase in sheets, bars, wires and tubes. The capacity of the French foundries in 1919 was estimated at 170,800 tons a year of sheet copper and brass, as compared with 31,600 tons in 1913, and 151,000 tons of bars as compared with 21,300 tons in 1913. This production being considerably in excess of home requirements and export possibilities, the return of peace entailed a reduction in the French foundries, especially those producing sheets and bars. Their future appeared to be in the production of aluminium, especially as France possesses large quantities of the ores from which this metal is obtained, whereas the copper smelters are dependent on Japan for most of their raw material.

France produces very little lead ore. Before the war she was importing about 40,000 tons a year, of which 60 % came from Algeria and Tunis. During the war the Tunisian mines were greatly developed as the result of military requirements, and it was estimated that, with peace conditions fully restored, French foundries would be able to reckon on an annual supply of 135,000 tons of ore, representing 80,000 tons of the metal.

The zinc ore produced in France in 1913 amounted to 51,000 tons, and more than three times this quantity was imported; but about half the imports came either from French colonies or from mines controlled by French companies. As in the case of copper, the French zinc smelters do a great deal of transformation work. France, for instance, used to send Belgium twice the weight of sheet zinc she received from Belgium in the form of raw material. The new works erected since the war are expected to give an annual output of 30,000 tons.

Timber.—As 18·7 % of French territory consisted of forest land, the supply of timber before the war was considerable, the last annual estimate being 7,912,000 cub. metres, exclusive of firewood. It was nevertheless inadequate to home requirements, and in the same year 1,560,000 tons were imported. The coal-mines in northern France, for instance, derived only one-third of their pit props from their own country, the other two-thirds being imported from Russia and Scandinavia. The war made serious inroads on the national reserves. The enemy held 600,000 ac. of forest land, which became exhausted if not entirely destroyed. The whole war zone comprised 800,000 ac. of forest land, which will have to be replanted to a large extent. It was estimated that France would have to import 5,000,000 or 6,000,000 cub. metres of timber a year for five or six years after the war, quite apart from the requirements of the devastated regions, which were put at 10,000,000 cub. metres.

Motive Power.—The motive power produced in France, March 1906, the latest date for which general statistics were available in 1921, was estimated at 3,550,000 H.P., of which 2,604,000 was produced by steam-engines, 773,000 by hydraulic power, and 173,000 by other mechanical means. These figures comprise all agricultural, commercial and industrial establishments, public services and stationary engines used by railways, tramways, etc., but not railway locomotives, steamboats or motor-cars. Between 1901 and 1906 the total energy produced by steam-engines increased from 1,761,000 to 2,604,000 H.P., an increase of nearly 48 per cent. Water-power increased from 575,000 to 773,000 H.P., or 34 per cent.

At the same date there were 13,432 locomotives and 198 motor-driven tractors, representing a total development of about 7,000,000 H.P. on railways and tramways. Exclusive of the navy, there were 1,784 steam-propelled vessels engaged in maritime or pleasure traffic, and 1,169 steam-propelled vessels used for internal navigation. Their total development was estimated at 1,202,000 horse-power. There were, according to the taxation returns, 31,286 motor-cars, developing 337,106 H.P., and 31,863 motor-cycles, developing 60,000 H.P.

The total production of motive power in France in 1906 thus approximated 12,150,000 horse-power.

About 55,000 waterfalls were utilized for the production of power, 53,300 of these being on non-navigable watercourses and 1,700 on navigable rivers and canals. Omitting temporarily unutilized or abandoned waterfalls, the number actually utilized may be put at 43,500, of which about 42,000 were on non-navigable and 1,500 on navigable rivers and canals. The average output per waterfall was 18 horse-power. Of the total, 3,770 falls were used wholly or partly for the production of electricity. In regard to electrical energy, more recent official statistics show that the total amount of electric power produced by public-service enterprises in 1918 was 1,000,631 kilowatts, and the length of high-tension mains in use was 35,420 kilometres. There were 1,568 private installations producing 261,802 kilowatts.

The departments producing the largest quantities of electrical energy (in kilowatts) were: Seine 286,340, Isère 55,197, Nord 42,141, Seine-Inférieure 39,853, Rhône 27,668, Loire-Inférieure 25,223, Ariège 25,114, Bouches-du-Rhône 24,487, Alpes-Maritimes 22,284, Dordogne 20,951, Meurthe-et-Moselle 20,684.

According to a report presented to the Ministry of Public Works in July 1920 by a special commission appointed in 1919, the total water-power produced in France at the end of 1919 was 1,165,000 horse-power. Machinery in course of erection was expected to give an additional 550,000 horse-power. Plans for the construction of other plant estimated to give an additional 3,000,000 H.P. were already under examination.

M. Hegelbacher, a leading French authority, estimates the total water-power of France, constantly available and available six months of the year, at 4,500,000 and 9,000,000 H.P. respectively, distributed as follows:—

	Constant	Partial
Centre, Vosges, Jura	900,000	1,800,000
Northern Alps	1,000,000	2,000,000
Southern Alps	1,300,000	2,600,000
Pyrénées and rest of France	1,400,000	2,800,000

Before the war only 13 % of the 4,500,000 H.P. was utilized. France takes the third place among European countries in respect of available water-power, the figures (in H.P. per sq. km.) being: Norway, 36·6; Sweden, 20·0; France, 15·9.

One of the most comprehensive attempts ever made in France to utilize water-power was in 1921 being carried out on the Upper Rhône. For many years it was supposed that this river, owing to the speed of its current, could not be used for navigation unless elaborate engineering improvements, the cost of which was prohibitive, were carried out. The development of engineering and hydro-electric science, however, raised the question whether the cost of these works could not be recouped in great measure by the generation of electric power which they would make practicable, and whether the river could not be simultaneously made navigable and become an important source of industrial energy. The answer to these questions will be ascertained when the works on the Upper Rhône are completed. About 100 m. of the river, from Génissiat down to Lyons, is divided into 17 reaches, in most of which it was intended (in 1921) to install plants for generating electricity from the force of the current. The total amount obtainable in this way is estimated at 200,000 horse-power. The heights of the falls vary between 14 ft. 7 in. and 43 ft. 10 in.

An attempt to utilize the tides as a source of power was being planned under Government supervision and with state assistance, in Aber Benoit Bay, on the Brittany coast. This bay possesses natural rocky basins which are regularly filled by the flow and empty themselves with the ebb, and the theory is that the outfall of these basins can be directed to turbines placed permanently under the outfalls, intermediary reservoirs being made so as to regulate as far as possible the outfall from the basins.

Engineering Industries.—The French engineering industry has long been inadequate to supply the national requirements in machinery. In 1890 imports and exports nearly balanced, but since then the former have grown much more rapidly than the latter. In 1913 the imports came to 204,800 tons, valued at 297,000,000 fr., and the exports to 82,261 tons, valued at 106,000,000 francs. Marine engines were built by about a dozen firms, and there were between 50 and 60 makers of fixed internal-combustion engines. The fabrication of motors of the Diesel type is on the increase.

France is largely dependent on foreign countries for machine tools. These articles were made in 1913 by about 20 French firms, employing between 3,000 and 3,500 workers. Their output was about 10,000,000 fr., one-fifth of the value of machine tools imported.

The extent to which France was dependent, at the time of the war, on foreign industry for machinery is shown in Table 15, in francs, compiled from the customs returns for 1913.

In a report presented to the Comité consultatif des Arts et Manufactures, three causes for the comparative inactivity of the French engineering industry were set out: (1) inadequate tariff protection, or rather the irregularity of the tariff, as regards raw materials and finished articles; (2) the cost of raw materials; (3) lack of enterprise. The last of these three causes was, according to the report, the most potent of all. Many of the leading firms in the industry appeared to be afraid to branch out into any new direction or even to make any real attempt to modernize their equipment and methods.

Table 15.—*Machinery (in francs).*

	Imports	Exports	French Output
Motors of all kinds	30,000,000	11,500,000	100,000,000
Machine Tools and Small Machines	52,000,000	16,000,000	65,000,000
Agricultural Machinery	45,275,000	14,775,000	120,000,000
Motor-cars	19,250,000	229,000,000	45,000 chassis
Railway Material	23,335,000	6,715,000	*
Textile Machinery	22,882,000	2,539,000	20,000,000
Printing and Sewing Machines, Typewriters, etc.	44,765,000	5,363,000	23,000,000

*650 to 700 engines, 2,000 carriages and 18,000 trucks.

The construction of cranes, derricks, movable bridges and other large pieces of machinery required, more especially at seaports and in important factories, for lifting and moving heavy weights has long been one of the weak points in the French engineering industry. Before the war nearly everything of this kind was imported, and 40 % of the imports came from Germany. Even in the case of equipment for French Government undertakings most of the machinery of this kind was made in Germany, though it was sold by French firms acting for the German manufacturers, who were enabled, by the export bonuses paid by their Government, and also by their own enterprise, to defy competition. In reality they sold at cost price, making their profit out of the bonuses. Many large contracts for private firms, railways, chambers of commerce, etc., were carried out by German engineering firms under the cover of French names. The plans were generally drawn up by the Germans and recopied by French draughtsmen, and the tenders were made by French firms, including some of high standing. These firms would, no doubt, have preferred to do the whole of the work themselves, but they were handicapped by lack of credits. Tenders for work of this kind do not, as a rule, leave a large margin of profit, and as the risk was borne by the German manufacturer, and the French intermediary was sure of remuneration for his services, the latter preferred to play the secondary part. The result was that French firms confined themselves to weighing-machines and small articles. During the war two or three works were started in the Paris district, but their output was small, and it would appear that in this branch of industry, and, in fact, in large metal work generally, France must be dependent on imports for some years to come.

Textile Industries.—Before the World War the French textile industry gave employment to more than one-third of the national supply of labour, if we include not only the actual manufacture of materials but the ready-made clothing and lingerie trades. About 40 % of all the raw materials imported were utilized by the textile industry, which, unfortunately for France, was very largely concentrated (on account of proximity to the coal-mining centres) in a part of the country open to invasion. The invaded districts contained 81 % of the total number of wool spindles, 93 % of the flax spindles and 29 % of the cotton spindles.

France imports about eight times as much raw wool as she produces, her position in this respect being similar to that of most of the leading European countries, which purchase vast quantities of wool from Australia, Argentina, etc., card it, comb it, make it into yarn and finally into materials with which to clothe their millions of inhabitants. Before the war France came fourth in the list of countries producing combed and carded wool and yarns. In 1910 she had 2,700,000 spindles engaged in transforming the wool into yarn, and this branch of her industry was distinctly flourishing. The exports of woollen yarn rose steadily after 1905. In 1913 they amounted to 14 times the value of imports and exceeded £4,000,000. Half of the total export went to Great Britain.

The woollen industry in the Roubaix district, which employed 43,000 hands in 1914, suffered severely during the occupation. The Germans not only removed such machinery as they thought of use to them but also appropriated all the stocks of raw wool, amounting to 989 tons. The total loss to the Roubaix wool industry was estimated at 652,000,000 fr. (1914 value). As the mill structures and workmen's dwellings were spared, it was found possible to resume work sooner than was expected after the war. Some wool-combing works were able to start again in March 1919. At the end of 1920 83 % of the productive capacity had been restored in this branch. A parallel recovery occurred in the weaving section, but was subsequently checked by the economic crisis in the autumn of 1920 and the restriction of bank credits and Government advances.

The French cotton industry, the principal centre of which is at Lille, was in a flourishing condition when the war broke out. Its spinning-mills had an annual capacity of 241,000 tons of yarn and its weaving-mills of 162,000 tons of cloth (of which 13,500 tons was available for export). Like the Roubaix woollen mills, the cotton mills in the Lille, Roubaix and Tourcoing districts suffered severely from German depredations and exactions. The losses in Lille were estimated at 126,000,000 fr. and in Roubaix and Tourcoing at 538,000,000 francs. In each centre a strenuous effort was made towards recovery when peace was restored. Lille had half a million spindles working again at the beginning of 1920, and 570,000 at the end of June, this being about 40 % of the number in operation before the war. Roubaix and Tourcoing made a similar recovery, though the mill-owners had to contend against difficulties which were not entirely due to the war. In 1914 the textile factories worked 10 hours a day, but in April 1919 the daily hours of labour in all factories were reduced to eight. This automatically cut down the output of the textile industry by 20%, there being no possibility of a larger production per hour for the machinery. Another difficulty was a shortage in the supply of labour. Many women left the factories as soon as their husbands returned from the war, and their places were taken by children between 13 and 16 years of age.

As regards the consequences of the war to the French flax-spinning industry, it may be sufficient to say that 95% of the mills were in the Lille district. When hostilities ceased, only one mill was in a sufficiently undamaged condition to be able to resume operations in a few weeks. Subsequently the work of restoration made remarkable progress, and at the end of 1920 about 250,000 out of 600,000 spindles were working again. Simultaneously an effort was made to increase the national output of flax, and at the end of 1920 the area under cultivation was 125,000 ac., or more than twice as much as before the war. Of this area 75,000 ac. are in the Nord, 20,000 in Brittany, 15,000 in Normandy, and 12,000 in the Lower Loire.

Armentières with its cotton-cloth and flax mills, Valenciennes and Cambrai with their muslins and handkerchiefs, Reims with its wool-combing and carding, Caudry with its tulle and embroidery, and many other ruined towns had by 1921 made equally gallant efforts to rise from ruin. Wool seemed to have made the best recovery, inasmuch as in Oct. 1920 Roubaix and Tourcoing had regained 85% of the normal output and were employing 93% of the pre-war number of workers. Cotton was not far behind, but flax was estimated to be three years from a return to normal conditions. Old centres of the woollen industry, such as Mazamet, Elbeuf and Vienne, developed considerably during the war, and new ones were established in Lyons and other textile centres, but it seemed probable they would be gradually transferred back to Roubaix, which has the advantage of proximity to the coal-fields and the port of Dunkirk, and of a nucleus of labour accustomed to textile work.

Among the minor textile industries the manufacture of ribbons, which has its chief centre at St. Étienne, deserves mention. It is carried on by about 170 firms, employing 80,000 workers, and its normal annual production represents a value of about 100,000,000 francs. About half of this is exported, principally to Great Britain (56% in 1913). Another important branch of textiles is the manufacture of tulle, lace and embroidery. The principal centres of production are Caudry and Calais (tulle and guipure), Le Puy (ordinary hand-made lace), Normandy, the Vosges, Brittany and Haute-Savoie (lace *de luxe*), and Tarare (tulle curtains). The total output has never been even vaguely estimated, but it is believed to exceed 200,000,000 francs' worth of lace and guipure and 150,000,000 francs' worth of embroidery. Before the war France exported over 60,000,000 francs' worth of machine-made lace a year. Out of 776 tons, 490 went to the United States and 62 to Germany.

Silk.—The production of raw silk in its various forms being an industry specially adapted to poor countries with large supplies of cheap labour, France imports nearly the whole of the raw silk she requires for her manufactures. Before the war she took 16% of the world's output and was the second-largest consumer of raw silk in the world, the first place being held by the United States with 37 per cent. Good silk is produced in the Cevennes, but the quantity represents only 10% of the requirements of the French weavers, who are dependent on Italy, China and Japan.

The three centres of the silk-weaving industry in France are Lyons, St. Étienne and Picardy, but the first alone can really be said to count, inasmuch as Lyons produces 99% of the entire annual output. Three-fourths of this consists of pure silk materials and one-fourth of silk mixed with cotton or wool. Its value in an average year is estimated at about £24,000,000 (reckoning the franc at the par exchange value), the exports at £16,000,000, and home consumption at £10,000,000, the balance being made up of £2,000,000 in imports. During the war many silk-weaving looms were used for making woollen materials. Exports of silk were unaffected at first, and actually increased in 1915 and 1916, but declined materially in 1917.

Lyons silks, which are well known all over the world, had an excellent opportunity, during and after the war, of establishing themselves in the United States and S. American markets, in which they had to face German competition before 1914. That this opportunity had not been grasped by 1921 was due, according to French observers, to the extremely individualistic temperament of the Lyons manufacturers, who would not combine for the purpose of acquiring new markets. M. Ennemond Morel, in his report to the Comité consultatif des Arts et Manufactures, says that another condition necessary to progress—the continual introduction of new and improved machinery—is also unobtainable owing to the strong inherited peculiarities of the Lyonnais character, " which is incomprehensible to those who have never come in contact with it."

The manufacture of artificial silk, which began with the Chardonnet process about the year 1890, has developed into an important industry employing 11,000 workers and producing 1,400 tons a year, or about 12% of the world's output. The principal centre is at Besançon, where the Chardonnet process is used (800 tons). Next come the Givet and Izieux works, which use the Despeissis process (500 tons), and finally Arques, which makes artificial silk out of wood pulp (100 tons).

Paper.—The French paper industry has always been largely dependent on imports of raw material. Out of 645,000 tons of pulp consumed in 1913, 465,000 tons were imported, and of other raw materials, such as waste paper and rags, there were also large purchases abroad, French paper manufacturers apparently finding it more profitable to import this raw material than to buy in the home market. It must be admitted that France, in spite of her large extent of forest land, is poorly supplied with wood suitable for conversion into pulp. The *epicea*, which is the type of the paper-producing tree, is rare in France. Efforts are being made to substitute *alfa*, of which there are enormous supplies in Algeria and Tunisia, for wood pulp. The use of wild hemp, papyrus, millet stalks, bamboo, rice stalks and baobab, all of which are produced in abundance by France's West African colonies, is still in a very early stage.

Ceramic Industry.—The ceramic industry is among those that made the greatest efforts towards development during the World War. It was considerably affected by the invasion, which reduced its output to an extent varying from 25 to 50 per cent. The lack of coal and labour also kept most factories down to about a third of their ordinary capacity; but the war led French manufacturers to use home materials, which they had previously neglected, especially for making tiles and stoneware. Some branches of the industry were greatly stimulated by war needs. For instance, in 1917 611,935 tons of heat-resisting materials were produced (exclusive of crucibles) instead of 350,000 in 1913. Makers also showed a distinct tendency to combination, especially in regard to the use of fuel and the management of ovens. A national ceramic institute was formed, chiefly for developing technical education. The output of crucibles, only 750 tons in 1913, was increased nearly 20 times and considerable impulse was given to graphite mining in Madagascar.

Dye Industry.—In France, as in other countries, the dye industry was completely overshadowed by that of Germany. Under pressure of war necessity, three new companies for the manufacture of dyes were founded and the total capital invested in the industry in 1919 was about 80,000,000 fr., but, apart from synthetic indigo and the colours obtainable from sulphur, only a small variety of dyes was produced, and there was a great lack of those required for cotton printing. The needs of the country were so pronounced that the experts who advised the French Government requested the insertion in the Peace Treaty of clauses requiring Germany to supply not more than 5,000 tons of coal by-products and 5,000 tons of dyes every year for 20 years.

Artificial Perfumes.—France is fairly well supplied with the artificial perfumes obtained from coal-tar. She has eight factories, some of which are important, producing musk, ionone (essence of violets), terpineol (essence of lilac), vaniline, heliotropine and coumarine, but she was nevertheless a good customer for Germany's synthetic perfumes, as well as for her pharmaceutical products. The discovery and sale of drugs for the cure of human ills has never attracted much attention in France, possibly on account of the innate conservatism of the people and also through the disinclination of French medical men to prescribe new specialties instead of their own combinations of known remedies.

Glass.—The principal effect of the war on the glass industry was to encourage the manufacture of retorts, tubes and other laboratory implements, which were previously obtained from Germany, and of optical glass. The output of window-glass has also risen considerably above the pre-war figure. At one time the dumping policy of the Germans and Bohemians enabled them to sell a lamp chimney in Paris for 5 centimes, while the price for the same article in their own countries was 14 centimes. The Germans even succeeded in selling large quantities of bottles, in spite of the fact that France, a great wine-producing country, had thirty or forty modern bottle factories. The liberation of French industry from German competition is especially marked in regard to glass.

Motor-cars.—The output of chassis in 1913 was estimated at 45,000, of which only 2,000 were for commercial cars. These chassis were built by 48 firms, employing 33,000 workers, of whom 70% were in the Paris and 11% in the Lyons district. Including the manufacture of radiators, coach work, magnetos, accumulators, tires, etc., the motor-car industry must have employed at least 100,000 workers.

After the war the French motor-car industry chiefly concerned itself with the production of high-class and expensive cars. In spite of an import duty of 45% *ad valorem* and the additional protection, at one time amounting to about 300% in all, given by the depreciation of the franc, very few French makers endeavoured to meet the demand for a moderate-priced car, either in home or foreign markets. As regards the latter, they no doubt felt themselves unable to compete with American makers, and they did not consider the home market sufficiently promising. It was generally estimated that no one living in Paris or any other large French city could keep a private car on less than 100,000 fr. a year, and incomes of this size were very rare in France. The number of cars registered (66,150) in 1919 showed an actual decline on the previous year.

Chemicals.—In the 20 years, from 1893 to 1913, the imports of chemicals quadrupled while the exports only tripled, and at the end of the period the difference between exports and imports was about the same as it was at the beginning. The war brought about extraordinary changes in the French chemical industry. France became able to export certain articles, such as cyanide of calcium, chlorides, chlorates and bromides, of which she previously produced only insignificant quantities. The import of sulphuric acid and ammonia salts ceased and the capacity to export salts of sodium greatly increased. Table 16 shows the estimated production and consumption of chemicals in 1920.

TABLE 16. *Chemical Industry 1920, in tons.*

	Productive capacity	Consumption
Carbide of Calcium	200,000	
Cyanide of Calcium	300,000	
Ammonia Salts	200,000	150,000
Chloride of Sodium	1,360,000	1,160,000
Salts of Sodium	800,000	650,000
Chlorine (liquid)	90,000	15,000
Bromine	500	200
Commercial Sulphuric Acid	2,250,000	1,500,000

France is poorly supplied with the raw materials of the chemical industry except as regards salt. In 1914 only one mine of pyrites (on which the production of sulphuric acid largely depends) was being worked. It produced 293,000 tons in 1913. During the war work was resumed in two previously abandoned mines, but the result was insignificant, and the French industry remained dependent on imported pyrites, chiefly from Spain, where about 75% of the production is controlled by British and 15% by French companies.

The restoration of Alsace should render France independent as regards potash. The Alsatian deposits, which are between the Vosges and the Rhine, extending from near Mulhouse to beyond Colmar, consist of two superimposed layers, the lower being much the larger. Its area is 120 sq. m., and it is estimated to contain 1,472,000,000 tons of crude potash richer in quality than the German deposits. Under German rule the annual output of the Alsatian potash-mines was limited to 5% of the German production, and in 1913 was 50,000 tons, or slightly more than the whole French consumption then.

Before the war France ranked sixth among the salt-producing countries. The eastern departments, such as Meurthe-et-Moselle, Haute-Saône, Doubs and Jura, supplied 856,000 tons of rock-salt in 1913, and the southwest (Landes, Basses-Pyrénées and Haute-Garonne) 43,000 tons. The evaporation of sea-water gave 382,500 tons. These resources are now increased by about 80,000 tons, from Alsace-Lorraine.

Radium.—France, where radium was first experimented with and discovered by M. and Mme. Curie in 1898, has no known deposits of suitable ore. Before the war there were three French factories, at Nogent, St. Denis and Gif, and their total output in 1913 was 435 centigrammes, the gramme being then worth £30,000. A fourth plant for the treatment of radium-bearing ores was established during the war, but much greater progress was made in the United States and England, and, in view of the cost of importing ore, it is questionable whether the production of radium can be remunerative in France.

Aviation.—The position of the French industry at the outbreak of war is shown by Table 17.

TABLE 17. *Aviation Manufacturing Firms, 1914.*

	Paris District	Other Districts
Motors	22	1
Aeroplanes	27	7
Seaplanes	13	5
Airships	7	0
Propellers	6	0
Hangars	5	1
Totals	80	14

The industry was to a large extent concentrated in Paris, but most of the factories were small and worked independently, so that they were very imperfectly prepared for the demands of the army. The French makers nevertheless succeeded not only in producing constantly varying types of military machines for their own country but were able to export to the Allies. England bought 59 French machines in 1915, but was afterwards independent. In this year the French exports totalled 22,427,000 fr., but subsequently decreased as the Allies built up their own aeroplane industries for war purposes. An instance of this development is the fact that in 1918 Italy supplied France with 1,762 motors, against 3 in 1917. It was thus evident, long before the close of hostilities, that the countries which had been France's allies in war would be her rivals in the peace-time developments of the aeronautical industry.

Economic Prospects in 1921.—The spirit in which the economic leaders of France proposed to deal with the extremely difficult situation remaining after the war was shown in the conclusions of the monumental report drawn up by a committee of experts under the presidency of M. Clementel, Minister of Commerce, and published at the end of 1919. France, it is there pointed out, must both reconstitute and develop. She must live as much as possible on her own resources so as not to add to her foreign debt. She must increase exports so as to reduce it.

"This plan," the report continues, "can be achieved. The France of to-morrow will have 30% of the world's supply of iron ore and will rank second in the list of producing countries, immediately after the United States. This iron ore can be exchanged for the raw materials which France requires. But there is something more to be done. France can no longer rest content with exporting her natural wealth. She must compete in the foreign markets of manufactured goods and export machinery as well as ore. The effort to produce must apply to all industries engaged in the transformation of raw materials. Only in this way can we return to a healthy condition of foreign exchange and shake off a crushing burden of debt.

"It is not enough, however, to produce, even at advantageous prices. We must sell. We must find customers, and keep them, and this last result can only be attained if we take a lesson from the results achieved by Germany and make up our minds to modern methods, which means that we must study markets so as to find out what is wanted and then adapt our manufactures to the demand. We must cease to try to make foreign buyers accept our ideas as to what goods are best, and we must make our manufactures conform to the ideas of buyers. Furthermore the French banks must adapt themselves to the system of long credits, to which German competition owed its development in foreign markets.

"A revision of our customs tariffs has become indispensable. Our import duties should be reduced as far as possible, so as not to constitute a premium on lack of enterprise and so as not to expose our export trade to reprisals. Though France now holds the second rank among the countries of the world for iron ore, she has not enough coal to transform this ore into iron and steel. Her wealth would be useless to her if a customs barrier stood between her and those who supply her with coal. What is true of coal is equally true of other raw materials, and we must thus come to the conclusion that the theory of compensating tariffs is out of date and that our legislation must be on a wider basis."

After thus defining the essential principles to be followed in regard to national economic progress, the report draws attention to certain internal obstacles, such as lack of labour, the low birth-rate, the spread of tuberculosis and syphilis, the drink traffic, insanitary housing and other conditions contrary to economic and industrial development. According to an estimate by M. March, Directeur de la Statistique Générale, if the population of France had gone on increasing at the average rate until 1935, the country would then have had 12,300,000 males between 16 and 65 years of age, but, after allowing for the numbers of men killed in the war (1,400,000) and the consequent deficit in male births between 1914 and 1919, the figure for 1935 cannot be put at more than 10,300,000. It must also be remembered that among the male survivors of the war there were 350,000 who were totally disabled as regards military service, 450,000 who were partially disabled, and an unknown number of men who sustained less serious injuries. These figures indicate a lessening of the available supplies of labour over and above the decrease caused by actual loss of life.

The ravages of tuberculosis in France are shown by the fact that, while the increase in population for the years 1909, 1910, 1912 and 1913 was 15,000, 71,000, 58,000 and 42,000, respectively, the deaths from tuberculosis in those years were 85,085, 84,956, 83,727 and 84,443. In 1912 the number of deaths from tuberculosis was 38,083 in England and 85,976 in Germany. In the same year the rates of mortality from this disease were 1·76 per thousand inhabitants in France, 1·30 in Germany, 1·04 in England and 0·93 in Belgium.

The drink danger to France is summed up in figures supplied by the *Statistique Générale* and the *Ligue Nationale contre l'Alcoolisme.* It gives the quantity of distilled alcoholic liquor (expressed in litres of proof spirit per head of population) as 5·02 in France, 3·23 in Belgium, 3·10 in Russia before the war, 2·84 in the United States, 2·8 in Germany, 1·88 in Switzerland, 1·82 in Norway, 1·74 in the United Kingdom, and 0·67 in Italy.

The conversion of war-time equipment to the requirements of peace was one of the principal problems of French industry in 1920–1. Aeroplane motor makers were now turning out machine tools, of which 48,000,000 francs' worth was imported in 1913, this quantity being nearly five times as much as the home output. Half of these imports came from Germany. Machinery used for making shells and small arms has been adapted to the manufacture of certain portions of textile machinery, sewing-machines (of which 3,633 tons came from Germany in the last year before the war) and typewriters. Some constructors of tanks have turned their attention to agricultural machinery. The practical results of these adaptations, and their capacity to withstand foreign competition, cannot of course be known until after the restoration of something like normal conditions.

The conditions necessary for obtaining the best results from French industry after the war are thus set forth by M. Rateau in his report to the Consulting Committee on Arts and Manufactures:—

(1) The formation of manufacturers' syndicates should be developed as much as possible, and manufacturers themselves should be asked to abandon their present individual policy. The question whether syndicates should not be made compulsory should be examined and discussed.

(2) The State should be asked to give more active coöperation to industry and keep in closer and more permanent touch with it, while at the same time leaving full scope to private initiative.

(3) Factories and workshops should be specialized.

(4) The standardizing of machinery should be very thoroughly investigated.

(5) Manufactures should be concentrated in the smallest possible number of factories.

(6) There should be scientific control of manufactures.

(7) Special and general laboratories, which are indispensable to industry, should be created.

(8) Inventions should be protected by utilizing them better.

(9) Technical education of all kinds should be developed.

(10) A system of technical evening schools should be built up.

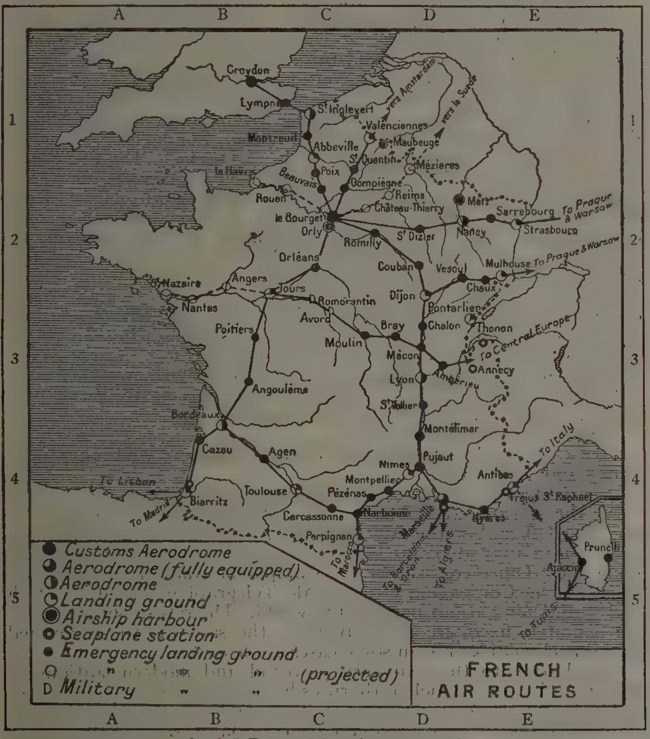
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Valenciennes
Montreuil
Abbeville
St Maubeuge
St Quentin
Mézières
le Havre
Beauvais
Poix
Compiègne
Reims
Rouen
Château Thierry
Metz
Sarrebourg
To Prague & Warsaw
le Bourget
Orly
Nancy
Strasbourg
Romilly
St Dizier
Orléans
Couban
Vesoul
Mulhouse
To Prague & Warsaw
St Nazaire
Angers
Tours
Chaux
Nantes
Romorantin
Dijon
Pontarlier
Avord
Bray
Chalon
Thonon
Poitiers
Moulin
Mâcon
To Central Europe
Annecy
Lyon
Ambérieu
Angoulême
St Vallier
Bordeaux
Montélimar
Cazau
Agen
To Italy
Pujaut
Nîmes
Antibes
Montpellier
To Lisbon
Toulouse
Pézenas
Fréjus St Raphael
Biarritz
To Madrid
Carcassonne
Narbonne
Marseille
Hyères
Perpignan
To Morocco
To Barcelona
To Algiers
Pruncli
Ajaccio
To Tunis
● Customs Aerodrome
◕ Aerodrome (fully equipped)
◑ Aerodrome
◔ Landing ground
◉ Airship harbour
⊙ Seaplane station
• Emergency landing ground
○ " " " (projected)
D Military " "
FRENCH
AIR ROUTES

Aerial Route Map (see *p. 119*).

COMMUNICATIONS

Railways.—France has never been well provided with railway communication. When the war of 1870 broke out, the total length of her railway systems was only 9,658 miles. M. de Freycinet's development scheme was the cause of more rapid progress between 1875 and 1890, after which date the rate of extension slackened. In 1912 the total length of main and branch lines was 31,600 miles. This gave France the third place among European countries as regards the length of her railway system, but in proportion to population and geographical area only the sixth and eighth places respectively.

This deficiency in the national equipment was a serious handicap during the greater part of the World War, not only as regards military operations but the conveyance of the vast quantities of supplies. The ports on the Channel and Atlantic immediately became congested, and one of the most urgent tasks of the French engineers was to lay many miles of sidings and create sorting stations. In all about 620 m. of new track were laid in France during the war

Some of the French railways accomplished something like miracles in the face of enormous difficulties. The Northern railway was suddenly called upon, in March 1918, to provide 172 troop trains a day after having for some time run only 18 of these trains a day. The military train mileage which was 621,000 in Feb. doubled in May, although Amiens was under the enemy's fire. On the Eastern line, the daily number of troop trains reached 198 on May 5. The effort was continued after the onrush of the enemy had been stopped and the forward movement of the Allied troops begun. On Aug. 28 1918, the Northern line was running 25,000 waggons of all kinds, chiefly over tracks which had been torn up by the enemy and hastily relaid. After the Armistice, the conveyance of troops and prisoners required the French railways to provide 206 trains, 10,156 vans and trucks, 550 passenger carriages and 750 engines. The damage done to the Northern railway alone comprised 500 bridges and culverts, 12 tunnels, nearly 2,000 m. of telegraph and telephone lines, 590 buildings, 150 water-tanks and 20,000 tons of metal work.

On Jan. 1 1919, the rolling-stock on the French railways was: locomotives 14,574, goods trucks 368,683, passenger carriages and vans 43,956. The corresponding figures on Aug. 1 1914 were: locomotives 13,800, goods trucks 376,000, passenger carriages and vans 49,320. On the other hand, 2,854 locomotives and 46,337 trucks and carriages were out of use on Jan. 1 1919, as compared with 1,720 locomotives and 19,314 trucks and carriages on Aug. 1 1914.

Under the terms of the Armistice, France obtained 2,600 locomotives and 70,000 trucks and carriages from Germany, so that she entered upon the peace period with apparently a large increase in her railway rolling-stock, but much of it was more or less useless, the scarcity of skilled labour during the war having prevented proper repairs.

France in 1913 had six engineering works producing railway locomotives. Four of the six were in districts subsequently occupied by the enemy. The total output was between 650 and 700 engines a year. The other rolling-stock manufactured in France was about 2,000 passenger carriages and 18,000 goods trucks a year. During the last few years preceding the war, from one-third to one-sixth of the new engines required by the French railways were imported from abroad, the exports being almost entirely confined to Belgium and the French colonies. Since the war, new workshops have been built, one of which at Nantes has a capacity of 200 locomotives a year. It was estimated that in a few years France would be in a position to meet all her own requirements in railway rolling-stock, and possibly to export it, on condition that the placing of orders by the companies was carried out with more regularity than in the past.

Improvement in railway communications with other countries is greatly needed. The only two routes between France and Italy, via Modane and Ventimiglia, are overcharged with traffic. The Modane line through the Alps is liable to interruption by floods. Some progress has, however, been made with a new line between Nice and Coni (Cuneo), which will serve the Milan district. Between France and Spain there are two lines, via Hendaye and Cerbère. Two others have been begun, from Ax-les-Thermes to Ripoll and from Oloron to Quera. Many other extensions are held up through financial and other causes. Public opinion appears to be strongly in favour of the Channel-tunnel scheme.

Little has been done in France towards the electrification of railways. With the exception of the Paris–Versailles line on the left bank of the Seine, and the Orléans line between Paris and Juvisy, the only French railway company to use electric traction is the Midi, which can obtain power comparatively cheaply from the Pyrénéan waterfalls. This company has planned to electrify 170 m. of its system, but the work is not completed. Before the war, the State railway had made arrangements to electrify all its Paris suburban lines, and part of the work was carried out. It was resumed in 1920, and, it is estimated, will be finished in 1926.

One of the weakest points in the system of communications is to be found at Havre. This important port is not only imperfectly connected with other towns in its own region but only one railway line links it with the largest and most active centre it has to serve —Paris. Rouen is better off than Havre in this respect, as it extends on both banks of the Seine and, for the conveyance of goods at any rate, can make use of river transport, but many of its industrial districts, and parts of its port, are badly served by rail in the direction of Paris. The building of a new line from Havre, connecting with the Paris main line at Pont de L'Arche and thus relieving the pressure on the route through the Rouen bottle-neck, has been advocated for many years, but up to the summer of 1921 its execution had not been undertaken. A petroleum pipe-line between Havre and Paris was, however, in course of construction.

Another project under consideration was designed to improve communications between Switzerland and the Atlantic coast, so as to attract traffic which would otherwise continue to follow the Hamburg, Rotterdam and Antwerp routes. Before the war, Berne was 15 hours from Antwerp, 16½ hours from Hamburg and 21 hours from Bordeaux. The problem from the French point of view is how best to reduce the time of transit between Berne and Bordeaux. The nature of the French lines (as they existed in 1921) does not permit of trains being run at greater speed. The central French mountain mass, which stands directly on the line between these two points.

prevents the construction of tracks with small gradients and wide curves. The best solution of the problem is to be found in a new line, 115 m. long, connecting the Orléans system, near Limoges, with the P.-L.-M. railway near St. Germain-des-Fossés. This would shorten the journey between Bordeaux and Lyons by over three hours, but financial considerations have been adverse.

Shipping.—France, in 1914, had seven shipbuilding yards with the following number of drydocks from 300 to 600 ft. long: Chantiers de France 5, Chantiers de St. Nazaire et Penhoët 4, Chantiers de Normandie 5, Chantiers de la Loire 7, Chantiers de la Gironde 4, Chantiers de Provence 6, Forges et Chantiers de la Méditerranée (La Seyne and Havre) 11. Other shipyards of smaller dimensions were: Chantiers Normand 3, Delaunay-Belleville 2, Chantiers Dubigeon 2, Chantiers de Bretagne 4, Dyle et Bacalan 3, Société Provençale 2, Barriel 4. There were also yards at St. Malo, Paimpol, etc., for the construction of wooden vessels. The output of these yards before the war is shown in Table 18, based on Bureau Veritas figures.

TABLE 18. *Shipbuilding Output.*

	Steamers		Sailing Vessels	
	No.	Tonnage	No.	Tonnage
1912	41	124,665	66	9,000
1913	31	105,820	35	6,068
1914	22	93,830	18	2,353

The figures for vessels purchased abroad in 1912–4 are shown in Table 19.

TABLE 19. *Steamers Purchased Abroad.*

	Steamers		Sailing Vessels	
	No.	Tonnage	No.	Tonnage
1912	62	96,858	10	2,203
1913	77	79,379	5	1,294
1914	17	30,416	3	1,717

In spite of foreign purchases, the French merchant fleet did not increase in proportion to those of other countries. It amounted, in 1914, to 2,498,286 tons. This was reduced, by war and other losses, to 1,932,862 tons at the end of 1917, despite the addition of 301,000 tons of vessels built or purchased abroad. At the conclusion of hostilities, the French tonnage was further reduced to 1,448,242 tons, against which should be set another 400,000 tons of vessels built or purchased abroad. In round figures, the actual loss of tonnage during the war was 1,000,000. Moreover, many vessels afloat were practically useless owing to lack of repair. Shipbuilding during the war amounted to only 150,000 tons, and as the capacity of the French yards was estimated at 140,000 tons a year, the net deficit in new ships, as the result of 4½ years of war, was 630,000 tons —150,000=480,000. This, added to the actual loss, represents a deficit of about a million and a half tons of shipping due to war.

After the war France had five new shipbuilding concerns with from six to eight drydocks and able to build ships of from 3,000 to 8,000 tons. These companies and their capital (including both shares and debentures) were as follows:—Chantiers Navals Français 60,000,000 fr., Ateliers et Chantiers de la Seine Maritime 30,000,000 fr., Compagnie Générale de Constructions Navales 35,000,000 fr., Société Normande de Constructions Navales 25,000,000 fr., Chantiers Généraux de Cette 45,000,000 francs.

The progress made in the restoration of the French mercantile marine after the war is shown by figures published in the *Annuaire du Comité des Armateurs de France.* They give 1,886,919 as the gross tonnage on Jan. 1 1919, and 2,076,963 at the end of that year. Six months later (June 30 1920) the gross tonnage had risen to 2,180,345. If we include the *flotte d'état* (vessels worked by the State during the war and intended for gradual transfer to French ship-owners) we find that 19 months after the close of hostilities, the French merchant fleet was nominally stronger than it was before the war, inasmuch as the *flotte d'état* amounted to 452,943 tons, in addition to 150,000 tons of former enemy ships temporarily handed over to purchasers. The *flotte d'état,* however, was an acquisition of doubtful value, many of the ships having been purchased only under the pressure of war necessities. As regards quality of material, the French mercantile marine in 1921 was certainly below the 1914 standard, and its working was heavily handicapped by the eight-hour day.

The post-war mercantile shipbuilding programme, based on shipowners' requirements and the gradually increasing capacity of the yards, old and new, is shown in Table 20.

TABLE 20. *Shipbuilding Programme 1919–23.*

Year	Number of Ships	Gross Tonnage
1919	86	374,344
1920	159	605,665
1921	172	704,361
1922	176	765,377
1923	183	793,405

The completion of this programme depended on a considerable reduction in naval shipbuilding, a sufficient supply of steel and other materials and of skilled labour and the ability of the yards to carry out their contracts.

Wireless Telegraphy.—As soon as the practicability of communication by wireless telegraphy was demonstrated, the French Government took steps to utilize the new process, but at first only for military and naval purposes. A military station was established at the Eiffel Tower, in Paris, under the control of the War Ministry. The navy had two stations, one at Ushant, on the north-west coast, and the other on Porquerolles I. on the coast of Provence. Up to the time of the World War, however, the transmission and reception of messages was uncertain, the instruments then in use not being adaptable with sufficient exactitude to varying wave lengths. Considerable technical progress was made during the war. To assist the Eiffel Tower in the work of maintaining communication with Allied armies operating away from the French front, the War Ministry built a new station at La Doua, near Lyons, and the Ministry of Marine erected, at Basse-Lande, near Nantes, a very powerful station which enabled it to keep in touch with French naval forces in distant seas. These three stations also sent out propaganda messages, and smaller stations along the coasts kept up communication with Allied vessels in the Atlantic, the Channel and the Mediterranean. While the war was still in progress, the U.S. military authorities began the construction, at Croix d'Hins, near Bordeaux, of a new station which was to be reserved for messages between the American army headquarters and Washington. This station was not completed until after the close of hostilities. It was eventually able to transmit messages, under favourable conditions, to distances of about 7,000 m., and to communicate with the United States, Japan, Madagascar and the French colonies generally. This station, at the time the most powerful in the world, was handed over to the French War Department on Nov. 15 1920, and was formally presented to the French Government by Admiral Magruder, on behalf of the U.S. Government, about a month later.

The use of wireless telegraphy for civilian purposes in France may be said to date back to 1904, in which year the Post Office took over the naval stations at Ushant and Porquerolles, through which private messages to and from ships at sea were then transmitted. This service has been considerably developed, and in June 1921 nine stations were open in connexion with it—at Boulogne-sur-Mer, Havre, Ushant, La Bouscat (Bordeaux), Saintes-Maries de la Mer, Marseille, Cros de Cagnes (Nice), Bonifacio and Fort de l'Eau (Algiers). Other stations, such as Dunkirk, Dieppe, Cherbourg, Lorient and 'Ain el Turk (Oran) were also available to the public. Short-range stations were being established in mountainous districts so as to enable communication to be maintained in case of interference with the ordinary telegraphic circuits by snowfalls or other causes. There was also wireless communication between France and the principal islands on the coast. Messages to places abroad were sent from four stations—La Doua (Lyons), Croix d'Hins (Bordeaux), Basse-Lande (Nantes) and the Eiffel Tower and there were receiving stations at Villejuif, near Paris, Poitiers, Neuchâtel, Chartres, Basse-Lande and the Eiffel Tower. Communication by wireless had been established with the following countries:—

Europe:—Great Britain, Hungary, Yugoslavia, Bulgaria, Rumania, Norway, Austria, Poland and Turkey.

Asia:—China and Indo-China.

Africa:—French Colonies in northern, western and equatorial Africa and Madagascar.

America:—United States and West Indies.

All the stations available to the public are under the control of the Post Office, but the two great stations which were under construction in 1921 at Sainte Assise, near Melun, were to be worked, under Post-Office control, by the Compagnie Radio-France, an offshoot of the Compagnie Générale de Télegraphie Sans Fil, which had stations in various parts of the world. The rates, which are not yet definitely fixed, are generally about the same as those charged by cable companies but in some cases are less.

In addition to the two very powerful and modern stations at Sainte Assise, the French authorities had begun in 1921 to construct transmitting stations which would eventually form a great intercolonial system. Those at Saida (Algeria), Bamako (Upper Senegal), Brazzaville (Congo), Antananarivo (Madagascar) and Saigon (Indo-China) were to be completed in the summer of 1921. Others were to be established at Jibuti, Numea, Tahiti and Cayenne (Guiana).

Aerial Navigation.—Before the war the length of air journeys seldom exceeded 250 m. and very little extra weight could be carried. It did not seem likely that aviation could serve any real commercial purpose, at any rate for several years to come. The technical progress made under pressure of war necessities was, however, so great that every country which had taken part in the hostilities, and, through the force of circumstances, found itself in possession of a well-developed aviation industry, set to work to make the best use of it in the service of peaceful enterprise, especially as this new industry would be indispensable to military operations.

In 1919 French civilian aviation, then at its beginning, was controlled merely by a department of the War Office. This department soon developed into what was called the "Organe de coördination générale de l'aeronautique" under which the various scattered aviation services were placed. Aviation first obtained its autonomy by the creation, in Jan. 1920, of a separate Under-Secretaryship of

State, for the control and development of air transports. The meteorological services previously connected with five different ministries were placed under the new department.

It was apparent from the outset that commercial aviation could be neither a purely private nor a purely State enterprise. If the State held aloof, the great initial expense would check development and keep down competition, so that when a service was established, there would be a tendency, in the absence of competition, to take advantage of the situation and exploit the public. If, on the other hand, the State accepted a monopoly of the enterprise, the result would be to create an artificial atmosphere unfavourable to development. Nevertheless, the State necessarily had to exercise some sort of control. The new means of transport called for a discipline similar to that of the mercantile marine. There were certain international obligations which could not be carried out in the absence of regulations enforced by law. There could be no general system of air navigation without air ports, landing grounds, repair and supply stations. All these formed part of a foundation which only the State could direct and maintain. The companies who contemplated embarking upon the business had few suitable machines, and the public had to be gradually educated to the utility of the new service. It was evident that the industry must have State support.

From the first it appeared that the main lines of communication would be as follows (*see* Map, p. 117):—

London, Calais, Paris, Dijon, Lyons, Marseilles, Italy, and the East.

Amsterdam, Brussels, Valenciennes, Paris, Bordeaux, Bayonne, and Spain.

Havre, Paris, Strassburg, Central Europe and the East.

Bordeaux, Toulouse, Marseilles, Italy and the East.

Casablanca, Oran, Algiers and Tunis.

At the end of 1919, very little had been done towards the work of providing these routes with landing and supply stations, repair shops, wireless and weather services. The Government had only four stations: at Le Bourget, near Paris; Bordeaux; Avignon, and Lille. Repairs could be effected only at Le Bourget and Bordeaux. There was no weather service, and communication by wireless between the various lines was uncertain.

At the end of 1920 considerable progress had been made. Thirteen air ports, stations or landing-places had been fitted up, there were seven emergency landing-places and negotiations were in progress for the purchase of land for 28 others. Some had nothing but a caretaker and a telephone; others had appliances for temporary repairs, and others again had regular workshops. Some were provided with corrugated iron shelters about 100 ft. square. The process of marking out the routes had begun. Seven lighthouses, each visible at 25 m., were in use. Another, with a range of 90 m., was being built in the summer of 1921 with a view to flights across the Mediterranean. There were 10 wireless stations giving communication between the terminal stations of the Paris-London, Paris-Brussels, and Paris-Strassburg lines. The aerodromes at Le Bourget and Saint Inglevert, on the Paris-London route, were also provided with wireless telephone apparatus for communication with the pilots of machines in the air. The meteorological system included 20 stations, divided into three groups covering the whole country. These stations sent out weather reports four times a day and also recorded observations of great use to air navigators.

In 1919, despite the uncertainty of the situation and the almost complete absence of organization, four French companies, with the help of State subsidies, were carrying on regular air transport.

There was considerable development in 1920 as regards the number of new enterprises and the additional lines, both national and international, opened to traffic.

On the purely French system, the Nîmes-Nice line, worked for nine months in 1920, carried 25 passengers and 215 kgm. of parcels. The Paris-Cabourg line in five weeks carried 44 passengers and 882 kilogrammes. The results for the first four months of 1921 showed still further progress.

Flying had become sufficiently well established in France in the summer of 1921 to justify the publication of a monthly time-table. It may be of interest to summarize the information given therein as to the various services in operation in France:—

Bordeaux-Toulouse-Montpellier line. Daily, except Sundays and holidays. Time, Bordeaux to Toulouse, 1½ hours; Toulouse to Montpellier, 1½ hours. Fares: Bordeaux-Toulouse, 88 fr.; Toulouse-Montpellier 88 francs. Goods, 3 fr. 30 centimes per kilogramme.

Nîmes-Nice line. Mondays and Thursdays. Time, 2 hours 50 minutes. Fare, 240 fr. Goods, 4 fr. 50 centimes per kilogramme. Connexion at Avignon with express trains on P.-L.-M. main line.

Toulouse-Spain-Morocco line. Toulouse-Barcelona. Tuesdays, Wednesdays, Fridays and Sundays. Time 2½ hours. Fare, single 468 fr., return 795 francs. Toulouse-Alicante-Malaga-Rabat-Casablanca. Mondays, Wednesdays, Thursdays and Saturdays. Fares from Toulouse to Alicante 924 fr., to Malaga 1,068 fr., to Rabat 1,560 fr., to Casablanca 1,680 fr. Goods Toulouse to Rabat 9 fr. per kgm., Casablanca 10 francs.

Paris-London, daily, except Sunday. Worked by four companies. Time, from 2½ hours to 3 hours. Fares, single 300 francs. Goods 7 fr. 50 centimes per kgm. up to 6 kgm., 6 fr. from 6 to 25 kgm., 5 fr. above 25 kilogrammes.

Paris-Brussels-Amsterdam line. Daily to Brussels and Rotterdam; Tuesdays, Thursdays and Saturdays to Amsterdam. Fares, Brussels 175 fr., return 300 fr.; Amsterdam 300 fr., return 500 francs. Goods, from 2 fr. 50 centimes to 6 fr. 50 centimes according to weight and distance.

Paris-Strassburg-Prague-Warsaw. Paris to Strassburg, Tuesdays, Thursdays and Saturdays. Strassburg to Prague and Warsaw, Mondays, Wednesdays and Fridays. Fares, Strassburg 150 fr., Prague 500 fr., Warsaw 800 francs. Goods from 2 fr. to 6 fr. 50 centimes per kilogramme.

Bayonne-Bilbao-Santander line. To Bilbao daily, except Sundays. To Santander, Mondays only. Fares, Bilbao 100 fr., Santander 150 francs. Goods, from 75 centimes to 1 fr. 50 centimes per plate kilogramme.

Rivers.—France's river traffic in normal times is considerable (42,000,000 tons a year). Practically the whole is carried in ordinary barges, the costs of vessels with auxiliary engines having been found too great to compete with the older styled transport. A few cement barges were built during the war, in consequence of the shortage of plates, but as one of these vessels weighs about 220 tons more than a steel barge of the same length (150 ft.), the cost of traction is prohibitive. (G. A.)

The Rhine.—The traffic on the Rhine is controlled by a system of treaties which dates back to 1804. Before that date the many riverain states used their position to levy toll upon river traffic; only boatmen of specified states were allowed to carry on their trade within certain sections of the river. The appearance of the Republican armies on the Rhine naturally put an end to this archaic system of complicated restricted monopoly. In 1804 Napoleon and the German representative signed the First Convention of the Rhine, in which the principle of free navigation and the suppression of tolls was laid down. This Convention has had many successors. When the Treaty of Versailles was signed the Mannheim Convention of Oct. 17 1868 was still in force. This instrument maintained the freedom of international navigation and the suppression of all traffic taxes. The International Control Commission of the Rhine was entrusted with the duty of enforcing its stipulations. It was formed by commissioners, appointed by Holland, Prussia, Hesse, Bavaria, Baden and France. The Treaty of Frankfurt shut France off from the Rhine. After 1871, Germany sought more and more to make her authority predominant in the Control Commission, and only to apply those clauses of the Convention which accorded with German interests. Thus in 1911 an imperial law created navigation taxes on German rivers, but the empire at that time had not the courage to ignore the protests of the other states, and to apply this law to the treaty rivers of the Rhine and the Elbe. During the war, in 1917, however, a transport tax was applied to Rhine traffic, in defiance of the Mannheim Convention, and in spite of the protests of Holland, the only non-German state represented on the Commission. When Marshal Foch, commander-in-chief of the Allied armies, came to the Rhine in 1918, like Napoleon, these fetters were again broken. The question of admitting Switzerland to the Commission had been raised in Berlin in 1903, when the Prussian Minister of Public Works declared: "The admission of Switzerland is not to be desired. We have already seen what the admission of Holland has cost us. To-day Switzerland, a riverain state of the Rhine, has been admitted, and the Treaty of Versailles lays down that the Control Commission of the Rhine provided for by the Mannheim Convention, shall consist of 19 members, two representatives each of Holland, Switzerland, Great Britain, Italy and Belgium, four representatives of the German river-side states, four of France, who is given the right to nominate the president of the Commission. The seat of this new Commission is in the old palace of the German Emperor, which was built at Strassburg in 1888, and is now known as the Rhine Palace. Article 354 of the Versailles treaty charges the Control Commission with the task of revising the Mannheim Convention, which was being done in 1921 under M. Claveille.

France, by reason of Art. 358 of the Versailles treaty, has the right to take Rhine water for canals already in existence or still to be built. The same clause gives her exclusive rights in the energy produced by river improvement, provided that she pay to Germany half the value of the energy so produced. It is proposed to build a Grand Canal d'Alsace which, running alongside the Rhine from Huningue (Hüningen) north of Basle, will join the river again near Strassburg. This canal will improve navigation, and produce hydraulic power. At Strassburg the fall in the Rhine amounts to as much as 66 cm. per kilometre. From Brisach to Basle it varies between 90 cm. and 1·02 metres per kilometre. The Rhine is a wild and capricious river, especially between Basle and Strassburg. The stream has been tamed between Strassburg and Lauterburg, where the fall is only 44 cm. per km., but between Basle and Strassburg this has not been possible. The river is constantly making its own bed deeper, but in front of Istein the digging-down process has reached a resisting, rocky bottom, and in ten years' time a cataract will have been formed there which will make all navigation impossible. The system of controlling the waters, which has been successfully used between Strassburg and Lauterburg, is not applicable to the Strassburg-Basle reach. Moreover, with high-water-mark there are only two metres of water on this latter stretch, and traffic is only possible during three months of the year. Also, so strong is the current that only small cargoes can be taken up-stream from Strassburg to Basle, 500 tons instead of 1,500 as far as Strassburg, and a tug-boat of 1,000 H.P. is required to tow five or six hundred tons up to Basle. The construction of this lateral canal is the only method by which traffic between Strassburg and Switzerland can be really made practical. The proposed canal is to have a breadth of over 86 metres, and a depth of between 6 and 7 metres, dimensions which are not much below those of the Panama Canal. The speed of the current would be not more than 1·20 metres per second, less, therefore, than the river current below Strassburg. The size of the locks will be 25 by 170 metres. Taking 300 working days of 12 hours, half of which for the up-stream journey, it will be possible to take up 1,800 strings of barges, each with a capacity of between 2,000 and 2,400 tons—a yearly total of between 3,600,000 and 4,300,000 tons. Night traffic would double this figure. The total imports of Switzerland amount to about £7,000,000. Cost of transport will be extremely low.

Hydraulic Power.—Between Huningue and Strassburg the Rhine yields 800,000 horse-power. It is impossible to harness this by canalizing the Rhine itself, owing to the formation of its bed and the necessity for building 30 locks and 30 weirs, which would delay traffic very considerably, and not give the best results. With a lateral canal, a barrage will be built across the river near Huningue, where the waters will be brought into the canal with a very small drop, leading to a series of locks. At each lock (of which there will probably be eight between Huningue and Strassburg) hydro-electric stations will use the power developed by the falling water. The idea of harnessing the Rhine below Basle was studied by an Alsatian engineer, René Koechlin, in 1890, and in 1909 the Control Commission of the Rhine unanimously adopted the Kembs plan, so-called after the Alsatian village near which the first power station was to be built. In spite of the wide favour given to the construction of the lateral canal, it should be noted that the majority of Swiss engineers support the idea of seeking to increase the navigability of the river between Strassburg and Basle by a system of controlling locks.

The Port of Strassburg.—The municipality of Strassburg began the construction of the port in 1898. The work was completed in 1901 at a cost of 13,000,000 francs, the whole of which was borne by the municipal budget. In its first year the port handled 540,000 tons. By 1914 the figure had increased to 1,989,000 tons. This prosperity incited the German town of Kehl, situated exactly opposite Strassburg on the right bank, to follow the example of the capital of Alsace. While Strassburg had been left without support from the imperial authorities, the Grand Duchy of Baden came eagerly to the assistance of Kehl in its effort to meet Alsatian competition. The port was presented by the Grand Duchy with three docks and 11 km. of wharf accommodation; and was given the through traffic which Strassburg did not enjoy. The Alsatians fought hard against this system of nepotism, but could obtain no satisfaction until after the Armistice. The importance of Strassburg as a port of France is very great. France has sea-boards north, west and south—Strassburg gave her a port on the east. The Rhine ports traffic amounted to 6,000,000 tons in 1913—that is to say, three times the total traffic of all French seaports. If France was to secure her share of this traffic, steps had to be taken in the provisions of the Peace Treaty to ensure the extension and steady development of Strassburg.

The town is uniquely situated from the point of view of international traffic, and with its port could become the turn-table of Central Europe. Kehl, its German rival, could not be allowed to strangle the trade of French Strassburg, and Art. 65 of the Versailles treaty lays down that, three months after the putting into force of the treaty the port of Strassburg and the port of Kehl shall become one for working purposes for a period of seven years. The extension of the Strassburg port was in progress in 1921, and Kehl was handling the traffic. In the event of the work at Strassburg not being finished by the end of six years, the Rhine Control Commission is entitled to prolong the temporary arrangement made by Art. 65 for a period not exceeding three years. The French State has assumed the financial burden of extending the port, the works of which will very largely benefit both the east and the south-east of France.

When the French regained Strassburg, there was not an Alsatian tug or barge in the port. Before the war the Alsatians had tried to build their own river fleet, but it had been quickly absorbed by the Baden Trust. In 1918 the total Rhine tonnage was about 5,600,000 (10,688 vessels), valued at 250,000,000 marks; of which the Germans owned nearly half. The Peace Treaty, taking into account the fact that a river fleet cannot be improvised overnight, provided for the cession to France of a portion of the German Rhine fleet. An American arbitrator was charged by the Reparations Commission with the task of determining the nature and value of the cessions to be made, which were in three categories—namely: shipping, shipping shares, and dock property in Rotterdam. Mr. Hines, the arbitrator, in his decision of Jan. 8 1921, declared that Germany should immediately hand over 254,150 barge tonnage, and 23,760 towing horse-power. On April 8 1921, France countersigned an agreement with Germany which places dock equipment at her disposal in the Rhenish ports of Rheinau, Mannheim, Ludwigshafen, Cologne, Duisburg, Ruhrort, and Rotterdam. A school was opened at Strassburg in July 1919 for instruction in the navigation of the Rhine, which requires special knowledge. There was a surtax of 36 fr. per ton on all extra-European imports which entered France through a non-French seaport. The Rhine is the only French river of which the mouth is not French, and the question arose whether this tax should be applied to goods arriving in Strassburg. French Chambers of Commerce, in agreement with the Strassburg Chamber of Commerce, successfully urged that this tax on bonded goods should not be applied to merchandise coming to Strassburg from Antwerp. The traffic of the port of Strassburg had in 1921 reached a pre-war figure. (P. B.)

FOREIGN TRADE

The position of France, in regard to foreign commerce, at the time of the World War was characterized by great uncertainty. In 1912, 1913 and the first half of 1914 there was general uneasiness and stagnation. The possessors of capital would take no risks. The Balkanic wars, the Agadir scare, and great political dissensions at home, all contributed to create an atmosphere which was very unfavourable to business.

France had a protectionist Customs tariff dating from 1892. It comprised a general tariff for countries having no commercial treaty with France, and a minimum tariff for countries conceding corresponding advantages to French trade. Germany enjoyed the most-favoured-nation treatment in virtue of Clause 11 of the Treaty of Frankfurt. In course of time the protectionist tendency became accentuated. The increases in import duties were considerably more numerous than the reductions. The so-called "Padlock Act" empowered the Government to raise duties without waiting for parliamentary approval. This Customs policy, tempered by the commercial treaties, had one advantage. It endowed the foreign trade of the country with a certain amount of stability, but it caused the expansion of that trade to become extremely slow. It protected home manufactures against foreign competition, but, as a system of defence, it was considerably weakened by the existence of the most-favoured-nation treatment. In short, the position during the few years preceding the war showed no marked symptom of economic progress. The exports, with slight fluctuations, amounted to about 80% of the imports. The totals, expressed in values and in weights, for the four years 1910–13 are shown in Table 21. These figures indicate slow but regular progress, due to increased imports of raw materials and increased exports of manufactured articles, but the balance of trade showed a deficit which amounted to 22% in 1913. The same state of affairs showed itself during the first half of 1914. The exports amounted to 3,375,953,000 fr. and the imports to 4,410,746,000 fr., so that there was every prospect of the totals for the whole year being very similar to those of preceding years.

TABLE 21. *Exports and Imports, 1910–13.*

	Exports		Imports	
	Value in francs	Quantity in metric quintals	Value in francs	Quantity in metric quintals
1910	6,233,805,000	155,127,080	7,173,332,000	357,183,540
1911	6,075,859,000	160,060,180	8,065,828,000	404,284,450
1912	6,712,580,000	203,265,070	8,230,846,000	397,463,890
1913	6,880,217,000	220,745,130	8,421,332,000	442,203,860

France's economic life was more seriously affected than that of any other belligerent country when war broke out. A tenth part of her territory—by far the richest part in minerals and manufactures—was invaded during the first month of the struggle and was subsequently almost entirely devastated. The coal output was abruptly reduced by 60 per cent. The German occupation of the Briey and Longwy districts inflicted a severe blow on the metal industry. The territory held by the enemy throughout the war comprised 85 out of 170 blast furnaces, 48 out of 164 Martin furnaces and 53 out of 100 converters. Productive appliances were reduced by 64% as regards cast-iron and by 60% as regards steel. In spite of this great and sudden reduction in her manufacturing resources, France succeeded in supplying the needs of her naval and military forces and her civilian population. Arms and munitions factories were erected all over the country. The Government became their only customer, and as they were without raw materials, coal and chemicals, the Government also became the agency through which they obtained their supplies. All this miracle of energy would have been impossible but for the alliance with Great Britain, whose naval supremacy enabled supplies and materials of all kinds to be imported. The natural result of the transformation of so many manufacturing plants into munition factories was to bring exports down to a very small figure, while imports increased by leaps and bounds. Simultaneously there was a decrease in the wealth derived from agriculture. Crops produced, on the average, only about half the normal amount. The wheat crop dropped from 90,000,000 to 49,000,000 quintals. The ports, which were much too small to deal with the vast quantities of goods brought from abroad, became congested. The Government departments were unable to handle the problems of supply which came before them. Under the pressure of necessity, supplies of all kinds were bought at any price. Ordinary notions of the value of money became obliterated. Freights, in consequence of the tremendous demand and the effects of the German submarine campaign, soared to fantastic heights and the Government was often forced to sign very costly contracts. The effect of all these abnormal conditions on the foreign trade of the country is shown in Table 22:—

TABLE 22. *Exports and Imports, 1914–8.*

	Exports		Imports	
	Francs	Metric quintals	Francs	Metric quintals
1914	4,868,834,000	126,638,240	6,402,169,000	334,345,900
1915	3,937,369,000	40,910,750	11,035,794,000	320,492,560
1916	6,214,594,000	37,300,150	20,640,419,000	400,600,160
1917	6,012,698,000	30,111,240	27,554,055,000	348,326,080
1918	4,722,694,000	37,181,380	22,301,384,000	293,499,870

It appears from the table that the balance of trade which was 22% against exports in 1913, rose to 31% in 1914, 180% in 1915, 232% in 1916, 358% in 1917, and 372% in 1918.

Throughout the war France lived under a system of regulations and restrictions. It was absolutely necessary to prevent various kinds of produce, which were urgently needed in France, from leaving the country and international trade had to be interfered with so as to prevent the indirect supply of goods to the enemy, who tried in every possible way to neutralize the effects of the blockade. When hostilities ceased, it was found necessary to continue some of the war-time regulations and restrictions for a considerable time. The state of exhaustion, the collapse of production and the high cost of living, which the Government had to try to alleviate in every possible way, all made it impossible to return at once to freedom of commerce. The Government remained the sole purchaser of raw materials and of the necessaries of life. The position, however, improved very rapidly. The instinctive industry of the French people reasserted itself, and favourable symptoms were observed. Commercial treaties having been denounced, the Government could choose the Customs policy required by the altered circumstances. A decree issued in June 1919 restored the former freedom of importation to nearly all the articles hitherto prohibited, but at the same time the principle underlying the Customs tariffs was subjected to a radical alteration. The specific duties were replaced by *ad valorem* duties, but it was soon found that these were not satisfactory. In July of the same year the specific duties were restored but with various additions, styled coefficients. These extra charges, which were moderate at first, were steadily increased as the exchange and coal problems became more and more pressing. Actual prohibition was even resorted to (in April 1920). This policy—the outcome of French manufacturers' apprehension of competition from countries with still more depreciated currency—aroused great opposition, and finally increased coefficients superseded prohibition.

The revival in production was quite rapid in France, in spite of the coal shortage which prevailed in 1919 and 1920. Table 23 shows the improvement in the trade balance.

TABLE 23. *Exports and Imports.*

	Exports		Imports	
	Francs	Metric quintals	Francs	Metric quintals
1919	11,879,600,000	55,643,800	35,799,267,000	384,471,685
1920	22,434,757,000	124,673,464	35,404,951,000	509,296,203

The result, which would have been still better but for the general economic crisis which occurred towards the end of 1920, show that a considerable effort towards recovery was made. The deficit in the trade balance, which was 201% in 1919, was reduced to 58% in 1920. For the first time there was a decrease in imports, under the head of values though not of weights.

If we compare the quantities and not the values of goods exported by France, it appears that the total weight, which reached 220,000,000 quintals before the war, and which fell to the lowest figure on record, 30,000,000 in 1917, was a long way in 1920 from the 1913 figures. The increase in values is more apparent than real if the greatly enhanced prices of all commodities be taken into account. Although the tonnage entering French ports in 1920 was only 15% more than in 1913, the increase in values was 320 per cent. The export figures show a decrease of 44% in tonnage and an increase of 226% in values.

French trade with foreign countries in 1920 is shown in Table 24:—

TABLE 24. *Foreign Trade, 1920; in Francs.*

	Imports from	Exports to
England	6,746,959,000	3,511,943,000
Germany	2,658,429,000	1,180,261,000
Belgium	2,568,665,000	3,913,986,000
Switzerland	802,940,000	1,441,694,000
Spain	849,368,000	883,676,000
Italy	891,530,000	1,061,516,000
United States	7,061,721,000	1,770,892,000
Brazil	652,603,000	303,716,000
Argentine Republic	2,053,819,000	379,319,000
Other foreign countries	7,893,071,000	4,602,237,000
Algeria	960,475,000	1,926,006,000
Tunisia	218,628,000	318,422,000
Morocco	152,398,000	493,857,000
Other French colonies	1,894,345,000	647,232,000

In brief, the situation at the end of 1920 was that exports had not returned to the pre-war level and the inflation of imports had been only very slightly reduced. Smaller quantities of food-stuffs had been purchased abroad but there was an increase under the head of manufactured articles.

These conclusions were modified by the statistics for the early part of 1921. In the first four months of that year, the exports actually exceeded the imports. Compared with the corresponding period of 1920, imports showed a decrease of no less than 5,720,089,000 fr. and exports an increase of 1,111,940,000 francs. These figures reflect the conditions which affected trade and industry all over the world. They show how greatly the depreciation of a national currency acts as a stimulant to exports and a check on imports. The decreased imports of raw materials (3,578,000,000 fr. during the first four months of 1921 and 5,861,000,000 fr. during the corresponding period of 1920) illustrate the extent to which the industrial activity of France was reduced. On the other hand, the difference is not so great as it seems, in view of the fall in prices.

The future of France's foreign trade seemed in 1921 to depend very largely upon the amount of wisdom that might prevail in regard to Customs policy. Only the future could show whether there was to be pronounced protectionism, accompanied by heavy duties, or a system of treaties of commerce concluded for reasonable periods and relating to specified articles. Arrangements of this kind had been made with Canada and Czechoslovakia, and others were in course of negotiation (June 1921) with Spain, Switzerland and Poland. There seemed ground to hope that when the inflation of currency had been reduced and exchange returned to a more normal level, France would reap the fruits of the efforts she had made since the war to reconstitute her mercantile marine, improve her ports and navigable rivers, and stimulate her manufacturers to greater enterprise in foreign markets. Before the war, there was a tendency in France to attach exaggerated importance to the influence of capital. France was proud to be called " the banker of Europe." She discovered by sad experience that this alluring title had brought nothing but loss and disappointment. The influence of capital did not prevent Turkey, a country to which France had lent vast sums, from going over to the enemy, and the still vaster sums advanced to Russia had also been lost, apparently beyond recall. It would not be surprising if the result of this object-lesson were to convince the French people that it is better to work and produce than to live on the interest of one's money, and that they had it within their power to become a great manufacturing country with an important share in the world's trade. (G. A. R.)

Finance, 1909–21

French finances underwent such changes during the World War that in 1921 there seemed to be no relationship at all between the present-day budgets and those of 1909–10, so enormously had figures been swollen, taxes increased, and their nature modified. From this latter point of view the whole French fiscal system has been changed. Up to the eve of war direct taxation was levied in France, following the principles of the first revolution, in accordance with external signs of wealth, chiefly in accordance with the letting value of the tax-payer's residence. This does not mean that capital was not touched. Taxation was levied in the form of inheritance duties on the whole of an estate, on the transfer of house property, and securities were taxed annually on the income, and by imposts on stock-exchange transactions. A few weeks before the opening of hostilities a global income tax was introduced, of the modest amount of 2%. The execution of this measure was delayed, but in 1916 it was put into operation, the figure rising rapidly to 12% and then 20%. The law of June 25 1920 brought the maximum up to 50%, with a sliding scale, making this super-tax of 50% only applicable to that portion of incomes exceeding 550,000 francs. In 1917 a further tax was introduced which varied according to whether the income was derived from agriculture, professions, etc. Thus the old system, which had been applied for over a century, and which, although frequently modified, had subsisted in its first conceptions, had given way to a new system which, although more in conformity with modern theories, could not in 1921 be said to be as solidly founded as was its predecessor.

I. *The System of Taxation.*—The system of taxation until 1914 was formed by four kinds of taxation: 1. The so-called direct contributions—that is to say, levied on four kinds of external signs of wealth, namely (*a*) revenue from land and house property, (*b*) doors and windows, (*c*) the personal figure arrived at by the letting value of the house or flat occupied by the tax-payer, and (*d*) license tax paid by traders, manufacturers, and some of the liberal professions, which varies according to occupation. 2. The so-called indirect contributions consisting of fixed or proper proportional duties, levied (*a*) on the transfer of property, (*b*) on the emission and negotiation of stocks and shares, and (*c*) on private contract notes. 3. Consumption taxes, levied on French produce, such as alcohol, wine and sugar. 4. Customs duties, levied on a large number of imports.

Direct contributions were reformed by the law of July 31 1917, which suppressed the taxation on personal property, doors and windows, and licences, and placed a tax on different categories of income. A tax is placed on industrial and commercial profit made during the preceding year. It is levied upon all concerns belonging to one person, globally, either at the head office, or at the office of the chief person concerned.

The tax is calculated on the net profit of those companies which are by law bound to communicate their balance-sheets to the registry office, and upon those individuals or companies which, before April 1 of each year, have furnished the authorities with a summary of their profit and loss account. In the absence of a declaration the taxable profit is fixed by applying an appropriate coefficient to the turn-over of the concern. The fixed tax of 4·5% was raised to 8% by the law of June 25 1920. An annual tax of 3·75%, raised by the same law to 6%, is placed upon agricultural profits, which are considered as being equal to half the rental value of the land. If, however, the real profit does not reach half the rental value the taxpayer is entitled to a proportionate reduction. Incomes of over 1,250 fr. from this source are taxable, and no declaration of income is required. Incomes derived from public or private payment, salaries, annuities, etc., are subject to a tax of 3·75%, raised to 6% by the law of June 1920. In fixing the taxable figure the net value of such payments, whether they be in money or kind, is taken into account. Employers, whether they be companies or individuals, are required to furnish the authorities with a list of their employees. People engaged in professions, or in other occupations which are not subject to special income tax have to pay 6 per cent. Interest from mortgages, loans, and bank deposits is also taxed.

Such are the chief provisions of the law which has established a schedular income tax in France. While it has suppressed former taxation, the old forms of taxation still exist as the basis of local taxation, and will do so until new laws have been voted.

A fresh tax is that on the turn-over (*chiffre d'affaires*) which is levied on all businesses in France save the selling of bread, the products of State monopolies and, of course, stamps and stamped paper issued by the Government. Further exceptions are made in favour of those trades and businesses whose prices, charges or commissions are fixed by public authorities, such as marine brokers, stock brokers, chemical manufacturers, insurance companies, public entertainers and public carriages. Exception is made in these cases because enterprises of this kind are already taxed in other ways. The *chiffre d'affaires* tax is fixed at 1%, a tenth of which goes to the department and the commune. The various imperfections of this tax have led to certain alterations which were adopted by Parliament in June 1921.

II. *The Budgets.*—The Budget on the eve of war, 1914, in millions of francs was as follows:—

Expenditure		Revenue	
Public Debt	1,318	Taxation	3,616
Salaries of Public Officers	19	Monopolies	1,005
General Administration Services	3,336	Domains	64
Regie	651	Budgetary Sundries	68
Restitution	49	Extraordinary Revenue	507
		Receipts (*recettes d'ordre*)	111
		Algerian credit	2
	5,373		5,373

With this may be compared the ordinary Budget of 1921:—

Expenditure		Revenue	
Public Debt	11,248	Taxation	13,901
Salaries of Public Officers	39	Monopolies	2,526
General Administration Services	8,877	Domains	145
Regie	2,455	Budgetary Sundries	157
Repayments and Restitution	129	Extraordinary Revenue	5,200
		Algerian Credits	6
		Alsatian-Lorraine Credits	408
		Receipts (*recettes d'ordre*)	494
	22,748		22,837

In presenting the Budget of 1913, which did not reach 5,000 million fr., M. Klotz told Parliament that he begged his colleagues to reduce the demands of their departments to what was strictly necessary. He analyzed an increased credit of 167 millions due to military expenditure, social demands, and the development of national equipment. Justifying the demand for the army he pointed out the advantages given to soldiers serving more than their legal time, the allowances given to those supporting a family, the placing of officers in a special reserve, the reorganization of the artillery and of medical officers, premiums given to motor-lorry owners, increase in the pay of officers, increased assistance to old soldiers, increased cost of living and of material, and the increases in the budget strength of men and horses. The social programme comprised demands for the Ministry of Labour, for compulsory insurance and for increase in the benefits of voluntary insurance; help for mutual societies and advances for building societies. Public works called for large sums for the improvement of internal waterways and seaports. The full programme for the former amounted to 440 million francs.

The ordinary budgets of 1914 and of 1921, it will be seen, balanced. The latter, however, almost five times as big as that of 1914, only balanced thanks to 5,200 million fr. of extraordinary revenue derived from the war profits tax and the disposal of war stocks. The ordinary budget of 1921 has also, side by side with it, an extraordinary budget of 3,000 millions, entirely covered by loan resources, and a budget of recoverable expenditure, under the terms of the Peace Treaty, by which Germany and her allies had become responsible. This budget comprised the sums necessary for reparation of war damage, caused among others to civilians who lost in life or limb or were victims of any act of cruelty which has lowered their health, their capacity for labour, or touched their honour; to prisoners of war who have been badly treated. Germany also owed pensions or compensation to the military victims of the war, wounded, sick and invalided, the amount of the sum being the capital value of pension or compensation due to them; the cost of relief given to prisoners of war and their families, allowances given to the dependents of mobilized men, the losses incurred by civilians who were obliged to work without pay, and all damage done to property.

According to the Treaty of Versailles the Reparation Commission had to fix the total debt to Germany as it did by the prescribed date, May 1 1921, the figure being 132,000 million marks (gold), to which was added the sums lent to Belgium by the Allies; Germany was to pay an annual interest charge of 5% on the debt, and 1% for amortization. The annual payment was to be 2,000 million marks (gold), and a sum equal to 26% of the value of German export trade. The complete annuity, that is to say, 6% on 132,000 million marks, would amount to 7,920 millions. If Germany was to reach this figure her total export trade must amount to nearly 25,000 million marks (gold). The French share of the moneys obtained from Germany being fixed at 52%, it is easily seen how small a sum she would obtain to meet the charges arising from the reconstitution of the devastated regions and the payment of pensions. These figures for the year 1921 were (in millions of francs):—

Ministry of Finance	3,827
Justice (Judicial and Prison Services)	1
Foreign Affairs	2
War	14
Public Instruction	244
Fine Arts	30
Technical Instruction	1
Colonies	1
Agriculture	9
Public Works	393
Posts and Telegraphs	26
Merchant Shipping	14
Liberated Regions	10,231
Pensions Services	1,737
Hygiene	10
	16,540

The expenditure of the Ministry of Finance comprised pensions to invalids, widows and orphans; allowances to elder relatives; pensions to civil victims of the war; the salaries of the staffs employed by these different services; the reconstruction of documents destroyed during the war; the reinstallation of administrative services in the liberated regions; and of tobacco manufactury of Lille. The Ministry of Justice had to meet the expenses of reconstituting the *Actes de l'État Civil;* the register of mortgages; of repairing the damage done to prisons and other institutions. The Ministry of War had to meet the charges arising from the repair of barracks and other necessary buildings. The Ministry of Public Instruction had charge of the central and departmental orphanages, and had on its books at the beginning of 1921, 587,000 children, who, at 360 fr. a head, would cost 211 millions; 120,000 more children were to be adopted. Fine Arts would require 30 millions for the protection and repair of monuments and public buildings damaged by war. The claim of the colonies arose from the losses suffered by Mahommedans. The Ministry of Agriculture had to repair a number of institutions such as the agricultural school of Rethel and the industrial schools at Douai, and make good the havoc wrought in the forests. Public Works required 100 millions for road building and other works, 70 millions for the rebuilding and working of electrical power stations in the liberated regions, 90 millions for canals, 50 millions for railways in the north and the east, 83 millions for extraordinary expenditure on Alsace-Lorraine railways, due to the condition in which they were left by the Germans. The Ministry for the Liberated Regions claimed 10,231 millions, a sum which was reduced by Parliament to 9,000 millions; 7,000 millions of this would go in payment of war damage and advances for industrial reconstitution; 140 millions were devoted to relief for the inhabitants; 720 millions to works undertaken by the State; 220 millions for transport. These figures give but a general idea of all the work that had to be accomplished in the devastated districts. The Ministry of Pensions required 28 millions for the staff and central administration; 1,470 millions for advances on pensions and bounties; and 4 millions for the relief of the families of the killed.

These 16,000 million francs of expenditure had to be added to 20,000 million already granted for the same purposes, as recoverable expenditure, in the financial year of 1920. It was thus a total of nearly 37,000 million francs that France had already advanced in two years to the account of Germany.

Apart from these budgetary credits other expenditure swelled the total, which, capital and interest included, was estimated to be 60,000 million francs on May 1 1921.

The key to the financial situation of France is in this budget of "recoverable expenditure." Had Germany carried out her undertaking; that is to say, had she paid to her conquerors a sum corresponding to the admitted damage done, the situation of France, although still serious, would not have been one beyond her power to face. By working energetically, as she had begun to do, at reducing expenditure, and perfecting the system of new taxation, France should be able to have a regular revenue of 20,000 millions to balance expenditure, which ought to be brought down to that figure. To do this, the various new services which were created during the war, and which in different ways had led to excessive expenditure, must disappear. The coal and wheat control must be got rid of, and the State merchant fleet sold as quickly as possible. The railway budget must be balanced; all useless expenditures suppressed, and only the most urgent public works, or those likely to be productive within a very short space of time, undertaken.

Meanwhile, awaiting the settlement of the debts of Germany, the French Treasury in 1921 had to meet the following charges in thousands of millions of francs:—

Ordinary Budget	[illegible]2
Extraordinary Budget	3
Recoverable Expenditure	16
Supplementary Credits	2
Repayment of Foreign Debt	6
Deficit on Previous Budgets	2
Special Account	3
Railways	1
Repayments to the Bank of France	2
	57

III. *The State Balance Sheet—Railways.*—It is possible to do for the French State what is done by every individual and every company: that is, simply to draw up a balance sheet, to make a statement of the State's resources and commitments, of its credit and debit. Naturally we do not, as in the case of private concerns, find that the credit equals or is greater than the debit. The fundamental and essential source of a modern State's revenue is taxation levied on its citizens. Its real wealth, therefore, lies in the individual wealth of the latter, and consists in their sum total. Nevertheless, apart from this resource of annual tribute, the State possesses a domain which varies in importance according to the nation, and which does represent something. It is only the paying elements of such a domain which can be usefully entered on a balance sheet.

France possesses her sea coasts; land which in certain parts has been left by the sea; her lakes, rivers and navigable streams; canals; ports; forests, national roads, and the bridges and other works connected with them; public buildings, palaces, museums, chateaux, Government offices, parks and gardens. The State also owns railway lines, the exploitation of some of which has been conceded to private companies, while the State itself runs others, some of which it has built, others of which have been bought back from the companies before the expiration of their concessions. The buildings in which public services are housed might be looked upon as an active resource if, in drawing up the accounts of each of those services, they were debited with an annual rent. But such is not the case. The postal service, for instance, is not debited with the rent of the public buildings which it occupies, nor even with that of buildings leased by the State in certain towns for the accommodation of posts and telephones. The postal service is not debited with the wear and tear of the telegraphic and telephonic wires, nor with the wireless telegraph stations which it uses every day. In fact, no accounts of this sort are kept for any of the public services. All the prefects and sub-prefects, the courts of justice, troops, occupy premises the rental of which does not figure in the accounts of any of the ministers concerned. The seashore and the dried beds of changing rivers are so little exploited that they need not be taken into account. Land and river communications might produce revenue worthy of figuring in a balance sheet, were tolls taken. The tolls which existed a few years ago have been abolished, and traffic is everywhere free; it is the budget which keeps up the roads, rivers, canals and ports. In the ports certain dues are levied on shipping for the profit of the State, the municipalities, and the chambers of commerce which have participated in the cost of the harbour works. Although some receipts are obtained from these sources, they do not represent realizable wealth. The forests of the State domain, however, are both productive and alienable. It is clear, nevertheless, that they cannot be given up. Both from the point of view of health, and general security, they ought to belong to the community; but they are a realizable asset. Twice before, in 1848 and 1870, they were given to the Bank of France as security for loans to the Treasury. The value of the year's output figures in the budget of 1921 was estimated at 57 million francs. The chief national asset is formed by the main railway lines, which in 1921 had a length of about 50,000 km., and represent an installation cost of at least 25,000 million francs. In spite of the importance of the sums thus spent in railway construction the Treasury has derived no profits. It has to be remembered in this respect how great, in France and elsewhere, was the upset caused in railway administration by the war. Before 1914 the five private companies, the Eastern, the Paris-Lyons-Mediterranean, the Northern, the Orléans, and the Southern railways, had gross revenues which exceeded their expenses. The Northern, P.-L.-M. and Eastern even showed a profit both with their preference and ordinary shares. The Orléans and the Midi lines had to avail themselves of the guarantee of the State which made them a varying annual payment. The Western railway, exploited by the State itself, was in very much less favourable position. The proportion of expenditure to revenue was much greater than that of the least successful private worked line. War changed this situation profoundly. Part of the Eastern and Northern systems had been destroyed, and those two companies had had to spend vast sums in rebuilding their lines. Other causes had upset railway accounts. The Eight Hours' Day law had been rigorously interpreted and had led to a great growth in the staff. Excessive increases in salaries and wages had been made. In spite of raising the tariff, which had been done by decree on several occasions, a deficit was shown each year, that of 1920 being not less than 3,300 millions.

A Convention had been signed between the Ministry of Public Works and the six railway lines, the State railway coming in on the same footing as the private companies, but this Convention had not yet been approved by the Senate. In theory it should do away with the deficit, as it enables tariffs to be raised until receipts and expenditure balance, and the companies making any surplus pay it into a common fund so as to equalize revenue. Meanwhile the railway companies were a heavy burden on the budget. It was indispensable that expenditures should be cut down, and it was impossible to count only upon raising the tariffs to balance the railway budgets. For goods traffic of many sorts the existing rates were already prohibitive, and traffic of many kinds of merchandise had either slackened off considerably or had stopped. The scheme of having a common fund was therefore far from being the final remedy for the present evil.

A few figures will show the contrast between the pre-war and the post-war conditions. The total length of railway lines exploited by the State and the five big companies was 41,000 km. The deficit in 1913 was 80 millions francs. In 1920 it amounted to 3,200 millions. Of the five private companies, gross receipts rose from 1,693 millions in 1913 to 4,467 millions in 1920. The net yield of 696 millions became a deficit of 1,081 millions. The charges of 986 millions added to this last figure give a general deficit total of 2,067 millions. The working coefficient has passed from 59% to 124%. In 1921, therefore, this large railway system, far from producing revenue, laid a heavy burden on the budget.

As a matter of fact, when one comes down to analyse the actual elements of the real property of the State, there is nothing which corresponds to the fortune of an individual.

Railways, as we have seen, are not revenue-producing. The Western railway belongs to the nation. It consisted in 1921 of lines bought about half a century before, and of the old Western company system which was bought at the beginning of the 20th century. It had for long shown a deficit. The Treasury had still annual payments to make to complete the purchase of the first State line, and to pay off the shares and stocks of the Western company, which would be finished in about 30 years' time, and to pay the 4 and 5% interest on the bonds issued by the Treasury in order to meet the expenses of the system. The State was half proprietor of the lines leased to the five big companies, and would become again full proprietor within the next 30 or 40 years at most. It would then own some 40,000 km. of railway line which would have no more capital charges to support, since the stocks and shares would have been paid off. (The concession to the Northern line expires on Dec. 31 1950; the Eastern on Nov. 26 1954; those of the West and of the Orléans lines on Dec. 31 1956; the P.-L.-M. on Dec. 1 1958; and the Southern on Dec. 1 1960.) This was the situation in 1913, but since then the Northern and the Eastern companies had had to meet an expenditure amounting to many thousands of millions, due to war damage: running costs had risen in a quite unexpected manner, and the situation was not the same as when favourable working costs made it possible to foresee the time when the companies, no longer availing themselves of the State guarantee of their interest, would in some cases share profits with the Treasury, or at any rate would be able to amortize their capital by the period laid down, so as to hand over their systems to the State between 1950 and 1960, free of all capital charges. It was impossible in 1921 to foretell what would be the results of the new convention, but at the best it would be a long time before railways ceased to weigh upon French finance. It would be a very fine result if they could only manage to earn enough revenue to balance their working costs and capital charges.

A close study of the proposed Convention shows that enough had not been done to provide for reduction of working costs. It only laid down that, when working costs move up, tariffs must follow suit, until expenditure is covered, but in that case Parliament will have to forgo its right of fixing maximum rates. If those maximum rates are prohibitive they will reduce or stop traffic, and the State will have to subvention the common fund of the railways. It is hoped to stave off this unfortunate event, by giving the railway companies a management bonus. First of all there should be a definite settlement of accounts during the war period. When this had been done it might be possible, with some modifications, to go back to the railway conventions of 1883, which really did encourage the railway companies to work their lines properly. The chief resource of the Treasury, therefore, was in taxation.

IV. *Foreign Trade and Exchange.*—One of the results of the World War was to extend the finances of the belligerents beyond their own frontiers. Nearly all the nations engaged had to consider not only their expenditure at home, but also what they were forced to incur abroad, and to calculate the resources which might meet this situation and the subsidies which had to be furnished by one Ally to others.

France more than any other community suffered this necessity, for the double reason that she had to support a greater military effort and that a part of her territory was invaded. Also, from the very beginning of hostilities, she was deprived of her principal coal-fields and factories in which an essential portion of her metallurgic industry was concentrated. All her male population between 20 and 50 years old was called to the colours, and she had no agricultural labourers left nor workmen for her manufactories. She had therefore to import from foreign countries enormous quantities of food, coal, arms and ammunitions. Throughout the war her imports continued to grow, while her exports decreased and fell considerably below what they had been in 1913. This can be seen by the figures of her foreign commerce (in millions of francs):—

	Imports	Exports	Balance of Imports
1914	6,402	4,868	1,534
1915	11,035	3,937	7,098
1916	20,640	6,214	14,426
1917	27,554	6,012	21,542
1918	22,301	4,722	17,579
1919	35,799	11,879	23,920
1920	35,404	22,434	12,970
1921 (Four months)	7,118	7,400	282

A glance at this table explains why France had to contract the enormous foreign debt of which the details have been given earlier. This table also gives the key to the persistent rise in exchange with various countries which reached its height in the course of 1920. The acquisition of this enormous extra amount of merchandise involved the purchase of a corresponding quantity of foreign moneys, far exceeding French credit in the countries concerned. It was this which caused the rise of the pound sterling to 68 fr., and of the United States dollar to 17 francs. In the first months of 1921 the situation was greatly changed, owing to the rise in the quantity of exports. The changing in the commercial balance was immediately reflected in an easing of the tension in exchange. In May 1921 the pound sterling fell below 47 fr., and the dollar to less than 12 fr.

Another element contributed to the condition of exchange. This was the circulation of notes of the Bank of France; when that circulation increased, prices and exchange both rose. It progressed in the measure indicated below (in millions of francs):—

End of 1913	5,713
" " 1914	10,042
" " 1918	30,250
" " 1919	37,274
May 6 1921	38,832

Thus, as with foreign trade, it was after the Armistice that the balance was most completely upset. The increase in French circulation of notes was greatest at that moment, that is, during the same year that French imports touched their culminating point. Subsequently the circulation remained almost stationary.

(R. G. L.)

War Money.—At the outbreak of war, in July 1914, panic and the hoarding instincts of the population led to the complete disappearance not only of gold but of all silver and gradually even of copper coinage. The lowest note then in circulation was of 50-fr., and the immediate crisis was met after a while by the issue by the Bank of France of 5, 10 and 20-fr. notes. The output of the Mint was increased but immediately absorbed. The State being unable to meet the situation, municipalities, chambers of commerce, public companies, and even private individuals, were forced to manufacture their own small change. There was only one department, that of the Hautes-Alpes, in which none of this war money was issued. This currency was of four different kinds: (1) The notes and tokens of cardboard or metal issued by municipalities, chambers of commerce, and tradesmen in the non-invaded districts of France. (2) The notes issued by invaded communes, by invaded towns or groups of towns. (3) The Alsace issues. (4) The notes and tokens used in prisoners' camps and camps of concentration and internment In the non-invaded districts it was usually the municipality or the chamber of commerce which issued the notes, which were guaranteed by a deposit in the Bank of France. In the invaded districts it was the towns themselves which guaranteed repayment. In Paris it was not until March 1920 that the chamber of commerce decided to issue small notes of the denominations of 2 fr., 1 fr., and 50 centimes By that date the small-change crisis in Paris had led to very considerable discontent. All sorts of efforts had been made to meet it: stamps had been enclosed in celluloid discs; the big hotels had issued their own metal or cardboard tokens; big works were paying small amounts to their employees with similar vouchers; in clubs the ticket system was in force. The artistic merit of the notes was nowhere very great; the paper used was generally bad, and there was a considerable profit for the issuing establishments arising from the large numbers of notes which were torn, lost, or absorbed by the vast number of collectors and souvenir hunters.

(R. G. L.)

THE INVADED REGIONS

It is almost impossible to paint a general picture of the conditions which prevailed in the occupied territories of France during the war, martial law being capable of the most varying interpretations according to circumstances and the character of the men called upon to administer it. The story of Lille, which was occupied by the Germans from Oct. 13 1914 till the eve of the Armistice in 1918, gives a general idea of the conditions under which the French in occupied territory lived throughout the war.

It should be noted first of all that nearly everywhere the Germans preserved the existing local municipal bodies. At times, however, as at Cambrai, on Jan. 5 1915, without in any way consulting the inhabitants, they changed the composition of the municipal bodies. It should also be added that in the very large majority of cases, mayors and municipal councillors, although able to flee from the enemy, remained behind to perform their duties at their posts. When the Germans entered Lille they appointed Gen. von Heinrich as governor. He had under him the Gen. von Grävenitz. The first step taken by the Germans was to call upon the population under pain of death to deliver to the *mairie* all arms, munitions and explosives in its possession. Motor-cars had to be handed over, and troops billeted and fed. Meetings of more than five persons were prohibited; restaurants had to be closed by 9 P.M., which was curfew for all inhabitants. During the day the shutters of all dwelling and business houses had to remain open. Hostages were taken for the good behaviour of the population, among whom were the prefect, M. Trepant, and Bishop Charost. At the start, these hostages had to sleep at the Citadel, being split up for this purpose into six batches. This method was abandoned on Dec. 31 1914, but was readopted on July 3 1915. Three weeks later this form of petty tyranny was given up, and the hostages were instead ordered to report twice a day in person at the *Kommandatur*. It was not until Oct. 5 of the same year that this formality was dispensed with. Throughout the whole period of occupation a rain of regulations fell upon the town from the military police. People guilty of the slightest breach of any one of these many decrees were subject to severe penalties rising from fine to imprisonment. Those penalties were inflicted in the most ludicrous cases. Thus there were sentences of four days' imprisonment passed upon inhabitants whose timepieces were not regulated on German time. Policemen and civilians had to salute all German officers above the rank of a sub-lieutenant; bicycles had to be delivered to the Germans, under a penalty of a 300-mark fine or three months' imprisonment. The exchange value of the mark was declared to be fr. 1·25. In Dec. 1914 certain boundaries were traced in the town, across which the inhabitants must not go. In Feb. 1915 all written communications, even with localities behind the German lines, were forbidden. Naturally, wireless telegraph installations were confiscated, and it was forbidden to pick up newspapers dropped by Allied aeroplanes upon the town. The governor decreed in 1915 that there should be a census of all water-wells, that horses should be reëxamined with a view to their serving in the army, and that all proprietors of vehicles and harness, as well as of photographic apparatus should declare them. Von Grävenitz, who was responsible for the institution of passes, without which it was impossible to leave Lille, decreed that they should be delivered on payment of one franc, and were valid for six weeks for daily journeys between Lille and the nearest village. Every inhabitant of the town who desired leave had to have one of these passes and also an identity card which the German police could demand at any moment. Failure to produce such a card involved a fine varying between 3 and 30 marks, or 2 or 3 days' imprisonment. Even inside the town itself, it was difficult to get about, because of a decree issued in March 1915 prohibiting motor-cycle and motor-car traffic. From the start, the town was forced to feed the troops of occupation, and von Grävenitz, in a decree (Nov. 23 1914), took pains to lay down the menu. Thus, an officer's lunch had to consist of soup, two meat and two vegetable dishes, cheese, dessert, and half a bottle of wine. Non-commissioned officers got no cheese, and beer instead of wine. The inhabitants upon whom troops were billeted had to bear the cost of lighting, heating and laundry. It is hardly necessary to add that the municipality found it almost impossible to see that these copious menus were provided; indeed, for a time the occupied districts were threatened with famine. In Feb. 1915 the meat ration was cut down to 150 grammes per head, and it was only through relief work of the Dutch Government and a Spanish-American committee that the civilian population obtained food.

On Jan. 19 1916, all Frenchmen in the town between the ages of 17 and 60 had to register themselves on a penalty of imprisonment. The people were prohibited from standing at their windows and from travelling by tramway without special permit. On Nov. 4 1914, it was decided that Lille should pay an indefinite sum. Payments on account were to be made as follows: Nov. 10 1914, one million francs; Nov. 17, 2 millions; Nov. 24, 3 millions, and the indefinite remainder by Dec. 1. The mayor and the bishop did their utmost to raise the money demanded by the enemy, and paid the first two millions. They were unable to obtain the third million, and von Heinrich agreed to accept a total payment of seven millions on Dec. 1.

Damage and Reconstruction.—The best way of showing the extent to which the ten invaded departments of France suffered from the war, and the effort made to repair the damage done, is to compare pre-war statistics with figures taken at the date of the Armistice and on Dec. 31 1920. The ten departments concerned, those of the Aisne, Ardennes, Marne, Meurthe-et-Moselle, Meuse, Nord, Oise, Pas-de-Calais, Somme and Vosges, had, when war was declared, 6,523,260 inhabitants, or 16% of the total population of the country, paying 18% of the total taxation. They formed the richest portion of France: rich in resources, in artistic treasures and historical associations. Lille, Cambrai, Turcoing and Arras were, before invasion, daily increasing the value of their textile, metal, glass and alimentary industries, while the mines of those regions yielded 90% and 55% of the total output of iron and coal respectively. There were 11,500 works, producing at full working 83% of the pig iron, 94% of the woollens, 90% of the linens, 60% of the cottons and 70% of the sugar output of France. Altogether there were 25,763 industrial establishments, with a rental value of 108,200,000 fr.—a third of the rental values of the whole country. The smaller metal trade alone employed 100,000 workmen. In the Meurthe-et-Moselle the iron industry employed 38,000 people, and kept 76 furnaces going. Power stations produced 300,000 kilowatts of electrical energy, or nearly 50% of the total. Trade and agricultural communications were insured by a splendid system of roads and railways, with many bridges and viaducts. It was the most flourishing and the best-equipped part of France.

When the Armistice was signed 1,400,000 people had been killed, 800,000 crippled, and 3,000,000 wounded. Municipal life had ceased in 3,256 of the 3,524 communes occupied by the enemy. Nearly 4,000,000 hectares of land had to be put in order again, of which 1,757,000 hectares were agricultural. There were 265,000,000 cub. metres of trenches to fill in; 300,000,000 sq. metres of barbed wire to pull up; nearly 300,000 houses to be rebuilt completely, and about the same number to be repaired. Shell-fire had damaged 3,296 schools, 2,674 churches, 2,447 *mairies*, and 49 hospitals; 523,000 milch cows, 469,000 sheep and goats, and 367,000 horses, donkeys, and mules, had been carried away by the Germans. Two-thirds of the area and productivity of the coal-fields of the departments of the Nord and the Pas-de-Calais had been destroyed; 220 pits had to be reconstructed. The Lens-Liévin-Carvin-Meurchin and Drocourt (Pas-de-Calais) fields were completely destroyed, and the workings were flooded. The destruction done to the coal-mines was estimated at 880,000,000 francs. The majority of the power stations had either been systematically destroyed or emptied of their material, the resulting damage amounting to 210,000,000 francs. Of 200 gas works 150, serving 323 towns, had been damaged to the extent of 60,000,000 francs. In the iron trade, in the department of the Meurthe-et-Moselle alone 50 blast furnaces had been badly damaged or completely destroyed. Foundries and rolling-mills had been either stripped of their equipment or destroyed on the spot. As typical examples of German devastation there were the steel works of Denain-Anzin (Nord), of Homécourt (Meurthe-et-Moselle), and Mont-St. Martin. The first establishment, which had 8 blast furnaces, 3 Martin and 1 Thomas steel plants, and 20 rolling-mills, in 1914 produced 400,000 tons of pig iron, the same amount of steel, and 350,000 tons of finished goods. The Germans left of it nothing but a heap of ruins. At Homécourt only the skeleton of 7 blast furnaces remained; the Thomas plant was blown up by dynamite; the Martin plant was taken to pieces and removed to Germany; the rolling-mills and electric plant were smashed. At Mont-St. Martin, where the installation had cost 8,000,000 francs, the buildings were emptied of their contents and destroyed. The iron and steel trade suffered losses estimated at 2,300,000,000 francs. The minor metal trade losses amounted to 1,100,000,000 francs.

Terrific havoc was wrought in the textile industries by shell-fire, by pillage, and through destruction by the retreating enemy. In the region of Fourmies (Nord), where there was no serious fighting, of 74 works 6 only appeared to be workable, and those only after very great repairs. The other 68 had either been burned, demolished, or emptied of their equipment. At Lille, Roubaix, Tourcoing, the same systematic pillage had taken place. Armentières, which had 8,000 looms before the war, was nothing but a heap of ruins. At Sedan, the centre of the cloth trade, only 15 looms were in working order. Together with the cost of the buildings destroyed, the damage amounted to 950,000,000 francs.

The importance of the agricultural-alimentary industries of the devastated regions before the war can be measured by the fact that they absorbed one-third of the motive power used by the whole industry throughout the country. Of 214 sugar factories in existence before the war, no less than 145 had suffered. The buildings of 90 of them had been destroyed, and the machinery of 130. Eleven refineries and 72 distilleries had been completely demolished. The brewing industry suffered heavily. Of the 2,825 breweries in France in July 1914, over 1,800 were destroyed, pillaged, or emptied of their machinery. The total loss suffered by this industrial group was estimated at 600,000,000 francs. The glass, mirror and crystal and chemical industries suffered losses amounting to 800,000,000 francs. There were many quarries in the devastated regions. Their losses amount to about 20,000,000 francs. The tanneries, of which there were 141, working 1,248,000 skins a year, suffered damage amounting to 25,000,000 francs. To this long list of ruins to be repaired must be added 52,000 km. of roads, 2,400 km. of railways, and 3,500 bridges and viaducts. Over 3,500 industrial establishments had been destroyed or badly damaged; 2,000,000 families had been ruined; 2,700,000 people had been driven from their homes. Never before had a country been called upon to repair such a mountain of ruin.

Undismayed by the magnitude of the task and the countless difficulties at the start, France immediately took in hand the work of reconstruction. The first great difficulty was the provision of labour, with so many killed, so many still suffering from wounds and the shock of war. Material was also lacking in a country exhausted by four years of a war to which all its energies had been devoted. Rapid transport was necessary, but impossible to expect from a railway system and a rolling stock worn out by war service. Added to these difficulties there were the crises of exchange and credit, and the financial strain due to the cost of war and lower yield of taxation. Also the French merchant marine had been reduced by a third. The following statistical information will show the intensity of effort made.

The population of those districts which were directly affected by the war, which in 1914 was 4 676,398, on Nov. 1 1918 was 1,944,000, rose to 3,524,600 on Nov. 1 1919, and to 4,066,397 on Dec. 31 1920. (It has to be borne in mind, in considering these figures, that there were large tracts of country which, although invaded by the Germans, either did not remain long in their occupation or did not suffer greatly from war or deliberate destruction.) By the end of 1920 municipal life had been resumed in 3,216 out of 3,256 communes. Of 6,690 schools open before the war, with 580,467 attendants, 6,613 had reopened, with an attendance of 397,978 children. Shells had been removed from 3,415,239 of the 3,800,000 hectares to be put in order; 218,934,793 cubic metres of trench had been filled in; 249,014,302 sq. metres of barbed wire had been removed. The first furrows had been traced on 2,000,000 hectares. Of the 42,100,000 cubic metres of ruin, 26,172,495 had been cleared. By the end of 1920 280,825 of the 600,000 houses destroyed or damaged had been rendered more or less habitable, although endless difficulties with labour and material had prevented solid reconstruction of the necessary housing. The Government had endeavoured to meet the housing difficulty by building temporary cottages and huts; 41,128 wooden huts, 60,605 temporary wooden cottages, and 29,860 temporary houses, made of débris, had been provided, thus giving housing to 1,685,883 people.

By 1921 26,000 km. of roads had been rendered practicable, and 8 000 km. had been repaired Nearly 4,000,000 tons of material had been used on metalled roads; 1,980 bridges, mainly temporary, had been built; and all the main railway lines had been got to work; 1,220 out of the 1,503 bridges and railway viaducts on those lines having been repaired. Of the 2,385 km. of local lines which had been damaged, 1,805 had been partly repaired, and 675 were again in working order, with 191 temporary and 183 permanent bridges built. Destruction of the waterways had almost been made good.

Very great results had been obtained by the Government in restoring the agricultural wealth of the liberated regions. Of the 1,757,000 hectares of arable land to be restored to cultivation, by 1921 1,700,000 had been levelled and 1,400,000 broken up. In the autumn of 1919 and the spring of 1920 a total area of 961,578 hectares had been sown as follows: wheat, 304,924 hectares; barley, 37,579; rye, 39,444; oats, 334,495; beets, 57,709; potatoes, 46,432; other crops, 140,995. The results of the effort towards agricultural reconstitution exceeded all expectation. The ten liberated departments in 1921 were self-supporting, from the point of view of cereals, and it was possible to foresee in the near future that the rest of the country would be able to benefit from their surplus supplies. While this fine result was no doubt mainly due to the tireless energy of the peasant population in the north and east, the Government itself deserves some of the credit for what was done. A special department (*Service de la Motoculture*) broke up 275,670 hectares; harrowed 16,883 hectares; harvested 31,796; restored to cultivation 66,985; and carried out threshing representing 2,280 working days. Moreover, the Ministry of Liberated Regions furnished farmers with 462 tractors; 15,400 ploughs; 28,733 harrows; 14,935 mowers; 11,680 reapers and binders; 11,353 cream separators and churns; 25,150 carts; 56,638 sets of harness; and 185,865 other machines.

At the same time the work of re-forming the live stock of the country was carried on, and these regions were given 125,360 cattle; 133,455 sheep and goats; 197,326 horses, donkeys and mules. It should be noted that Germany did not do her part in reconstituting French live stock, and only delivered 65,560 cattle, 110,455 sheep and goats, and 31,926 horses, donkeys and mules; whereas her theft amounted respectively to 523,000, 469,000 and 367,000.

Industrially, with the assistance of the Treasury, much was done to repair war losses in the 15 months which followed the Armistice. By the end of 1920 80 % of the industrial concerns were in full working order, and 26 % were partly at work. As was to be expected, it was the big establishments which first resumed their activities. It is in comparing the number of people employed industrially in 1914 and on Dec. 31 1920 that the best idea of the situation of industry in the devastated regions can be obtained. In 1914 there were 791,000 people employed in the works, and the corresponding figure for the end of 1920 was 365,450, of whom 77,451 were directly employed in the work of restoration. An immense amount of work was done in reconstituting the limits of communes and of private property, the deeds and plans of which had disappeared.

At the outset of any consideration of the financial effort which this work entailed, it should be recalled that on April 17 1919 a law was passed declaring the principle that the damage suffered by the invaded districts was a charge upon the whole country. The legislature, interpreting the wishes of the country, considered that it was the nation's duty to restore the martyred provinces and to accept all their responsibilities resulting from devastation, even before any indemnity had been received from the enemy. Considerable capital was therefore necessary. By March 31 1921 the sum of 15,818,820,812 francs 45 centimes had been advanced to the liberated regions. Taking into account relief, 1,078,994,000 francs, and sums expended on works and purchases, 4,734,492,155 francs, the various expenses and expenditures of the departments for industrial and agricultural restoration, the moneys allotted to the rebuilding of devastated France amounted on March 31 1921 to 23,548,759,000 francs. In this figure the cost of railway reconstruction necessitated by acts of war has not been taken into account. It should be noted that the cost of administration had been low, not exceeding 2·17 per cent. (M. Pa.)

French Colonies

The colonial domain of France, including colonies, protectorates, and countries for which France has a mandate, covers an area of 10,426,000 sq. km., an area nearly 20 times greater than that of France. The pop. numbers 55,000,000, nearly one and a half times that of France. The general trade of this colonial empire amounted in 1919 to over 7,000 million francs. In 1918 the figure was about 5,000 million francs. In 1913, the last normal year before war, it only amounted to 3,250 million francs. Exports and imports practically balanced each other. Although these figures appear small when compared with those of the British Empire, the French colonial empire is the second largest in the world, and its building-up is one of the best achievements of the Third Republic. The chief characteristic of these possessions is their variety. It is true that these colonies lie almost entirely in temperate or hot countries. Islands as well as vast continental stretches go to form this empire, which includes one of the greatest deserts of the world, the Sahara, as well as some of the greatest rivers, the Congo, the Niger and the Mekong. There are towering mountains, immense forests, and extremely fertile plantations. The produce of these colonies is also varied. It includes rice, sugar, wood, cotton, phosphates, cereals in great abundance, coal (but only in Indo-China), and metals of every kind. From the ethnical point of view its races include such different types as the Arab and the Berber, the Annamite, and the Congolese and Sudanese negroes. Although dotted over four continents, Africa, Asia, America and Oceania, it consists mainly of two big groups, one in Asia and the other in Africa. It is this latter portion of French colonial possessions which is by far the most important and the most full of promise. The French African empire, leaving Madagascar out of account, stretches in one unbroken sweep from Algiers to Brazzaville, and from Dakar to Abesher. It is formed by three great geographical unities: northern Africa, western and equatorial Africa, which encircles the Sahara and join at the central point of Lake Chad, with coast-line on the Mediterranean and the Atlantic. The great advantage of these possessions is their territorial continuity, and that some day a trans-Saharan railway will be able to run from Algiers to Brazzaville without leaving French territory. The gem of all the French colonies is N. Africa—Algiers, Tunis and Morocco. There three great advantages exist; the climate is temperate, the country is suitable for colonization by the French and all the other Mediterranean peoples, who acclimatize themselves as if they were in their mother-country, and, above all, these colonies are close to France. This situation is unique, and renders the colonies ten times more valuable. Such are the general characteristics of the French colonial empire. It was only during the war that France realized how valuable it was to her. The colonies were drawn on for material resources, and in particular for troops. Soldiers came into field against Germany in hundreds of thousands from the French colonies. All that could be obtained from these dominions has not yet been so drawn. French colonial policy is open to many reproaches, especially from an economic point of view. The exploitation of these countries has not been pushed forward with enough energy, nor, more important still, with the necessary method. It has been carried on without a general programme, without stability of purpose, by improvisations, by little jerks, a system which has led to failures and, which is worse, to delays. M. Albert Sarraut, Minister for the Colonies in 1921, drew up a list of the great public works which had to be carried through in the colonies. In this programme he has applied the most recent doctrines of industrial organization, in particular the principle of division of labour, by which each colony will have to cease frittering away its efforts, and will have to concentrate upon the production or the industry to which its soil, climate or native traditions are the most suited. This programme of works covers railways, roads, canals, ports, irrigation, and farming, and provides for an expenditure of about 4,000 million francs. The chief of these works are the extension of the port of Dakar, the completion of the Thies–Kayes railway line, and irrigation works in the valley of the Niger in French West Africa; the railway line from Brazzaville to the Atlantic, in French Equatorial Africa; the rebuilding of the central Cameroon line, and the extension of it as far as Yaunde; in Indo-China, harbour works at Saigon, Haiphong, Tourane, Kwangchow-Wan, the completion of the Vinh–Donghoi line, and the continuation of the line across Indo-China from Tourane to Saigon; harbour works at Madagascar and at Jibuti. (M. R.*)

Army

The French army of 1921 was essentially in a stage of transition between the army of the World War, which had grown out of the pre-war national army (*see* Army: *French*), and the army of the future, which had to be adapted to future needs.

Demobilization.—In spite of the inevitable difficulties, especially in providing employment, demobilization after the Armistice of 1918 was carried out smoothly. The army was demobilized in ten échelons, as shown in the tables below, the whole procedure being directed by a specially created Under-Secretariate of State for Demobilization. The demobilization of these échelons was carried out in two stages, separated by an interval (April 3 1919 to July 9 1919) due to the necessity of retaining with the colours a sufficient strength to enforce, until the signature of the Treaty of Versailles (June 28 1919), the observance by the enemy of the conditions imposed by the Armistice. The tables below show the progressive movements of demobilizable personnel towards the demobilization depôts, whence the men were dispatched to their homes. The great task of transporting the men was successfully carried out, the first six échelons by special trains, the last four by utilizing the leave-trains.

After Jan. 1919 no men of the 1906 or older classes had been sent to the armies as reënforcements.

Movements to the Demobilization Depots.—1st Stage.

Échelon	Classes	Personnel of the Armies	Personnel of *Régions Territoriales*
1st	1891 to 1893	from 25·12·18 to 8·1·19	from 9·1·19 to 19·1·19
2nd	1894 to 1897	" 21· 1·19 " 4·2·19	" 5·2·19 " 14·2·19
3rd	1898 & 1899	" 15· 2·19 " 23·2·19	" 24·2·19 " 26·2·19
4th	1900 to 1902	" 27· 2·19 " 7·3·19	" 8·3·19 " 10·3·19
5th	1903 & 1904	" 11· 3·19 " 19·3·19	" 20·3·19 " 22·3·19
6th	1905 & 1906	" 23· 3·19 " 31·3·19	" 1·4·19 " 3·4·19

2nd Stage.

Échelon	Classes	All Personnel
7th . . .	1907	9·7·19 to 20·7·19
	1908	21·7·19 " 30·7·19
	1909	31·7·19 " 9·8·19
8th . . .	1910	8·8·19 " 15·8·19
	1911	16·8·19 " 22·8·19
	1912	23·8·19 " 29·8·19
9th . . .	1913	21·8·19 " 6·9·19
	1914	7·9·19 " 12·9·19
	1915	13·9·19 " 18·9·19
10th . . .	1916	19·9·19 " 24·9·19
	1917	25·9·19 " 30·9·19

After the demobilization of class 1917 there remained with the colours two classes—those of 1918 and 1919, the latter having been called to the colours prematurely. The general mobilization of the army ceased on Oct. 23 1919, when hostilities were officially declared to be at an end.

Men called to the colours during the war, of ranks from captain inclusive downwards, received a fixed gratuity of 250 francs, with an additional bonus of 15 francs for each month of embodied military service; for each month of such service spent actually at the front, this bonus was at the higher rate of 20 francs.

The Army in 1921.—The actual situation in Jan. 1921 may be summed up as follows. France had an army of 100,000 men on the Rhine for 15 years (six infantry and one cavalry divisions). The strength of troops under arms was 830,000 men, made up as follows:—French (including 10,000 in the colonies), 572,000; natives of N. Africa, 152,000; foreigners and natives of other colonies, 106,000. In the 572,000 French troops were included the 1919 class (226,700), the 1920 class (first contingent, called up April 1920, 166,200; second contingent called up Oct. 1920, 83,000); voluntarily enlisted (45,500); voluntarily reënlisted and commissioned (40,000), and those in the colonies (10,000).

The new army laws of Dec. 1920 to May 1921 would take full effect on Oct. 1 1923. Until that date the army was to be gradually reorganized in accordance with these laws.

The organization of the nation in arms rests on universal, obligatory, equal and personal service. It is based on the principles of the inviolability of the military frontiers (which, for 15 years, include the Rhine), and of preparation for an administrative, industrial, and agricultural mobilization of the country.

The peace strength of the army is intended to be such as will secure for the nation the necessary time for the mobilization and concentration of its reserves, and for the organization of the entire productive forces of the country. The army in peace is further a school of instruction for the nation in arms, and a vast well, producing instructed reserves. The national army of 1914 had given place to the conception of the mobilized nation; the new army laws were directed to provide for the uncertain conditions of the transition period, in which the problem to be faced was not so much to meet and overcome foreign aggression as to be ready to maintain, by force if necessary, the conditions secured by the Treaty of Versailles.

The active army is recruited by contingents called to the colours each half year, and by voluntary engagements and reëngagements. Every Frenchman who is physically fit is obliged to serve 1½ years in the active army, 18½ years in the active army reserve, and 10 years in the territorial army. Time in excess of 1½ years spent in the active army, on voluntary engagement or reëngagement, is deducted from the period to be spent in the active army reserve. In peace-time only Frenchmen or naturalized Frenchmen may be enrolled, but foreigners declaring themselves without nationality may serve their time in one of the "*régiments étrangers.*" In time of war, the Minister of War is entitled to create corps of veterans by voluntary enlistment of men who have completed their full military service.

Soldiers of all arms are debarred from voting while serving with their unit. Each year returns are made, in every commune, of the young men reaching the age of 19 in that year. The classes are incorporated in two contingents. The first contingent, formed in April of the year following that in which the age of 19 was attained, comprises all those born before July 1 in the birth year of the class. The second contingent, formed in Oct. of the year following that in which the age of 19 was attained, comprises all those born after June 30 in the birth year of the class. Thus, the April contingent of the class 1923 would contain men born in 1903, before July 1; the Oct. contingent of the same class, those born in 1903 after June 30. Two brothers of the same class need not serve together—the younger being put back till his brother's 18 months' service is completed. Young men passing through the military schools in order to become regular officers contract an engagement for the period spent at such school *plus* six years from the date of their passing out. In case of emergency, a contingent that has completed its 18 months' service may be retained with the colours, and men in the first two years of their period in the active army reserve may be recalled to the colours. The above conditions hold good for Algeria, Tunisia and Morocco; and, with certain reservations, for all other French colonies and protectorates.

The principles governing the allocation, in peace-time, of each class's effectives to the different arms and services are the proportion of losses anticipated for each arm in war and the special class of men demanded by the conditions inherent in different arms and services. An increase in the numbers of native troops and the voluntary enlistments for technical troops are the main factors that make it possible to maintain the requisite strength with the reduced period of 1½ years' service in the active army.

The arms are five: infantry, cavalry, artillery, engineers and air forces. *Chars-de-combat* are classified under infantry, and the transport service under artillery.

Native regiments are increased, as compared with the army of 1912, as follows:—infantry regiments, from 4 to 42; cavalry regiments, from 4 to 14; artillery regiments, from 4 to 6.

The active army consists of:—(1) Personnel of the five arms; (2) the corps of general officers and general army services (staff services and "*Corps du Contrôle de l'Administration de l'Armée*"); (3) special staffs and services, *e.g.* supply, health, veterinary, interpreters, recruiting, remounts, research of various kinds, physical training, military justice, military schools, and construction services; (4) the gendarmerie.

The number of infantry divisions in France and the occupied European countries is laid down as 32 (to which must be added a mixed detachment of police for the Sarre territory and Corps of Occupation of Constantinople), the number of cavalry divisions as 5, and of air divisions as 2.

The grouping of troops for colonies, protectorates, and territories occupied under mandate from the League of Nations, is subject to the exigencies of the local political and military considerations of the moment. The allotting of troops of all arms by theatres of operations is fixed by decree as occasion arises.

The old system of basing the organization of army corps on districts (*régions territoriales*) was no longer feasible, owing to the increase or creation of technical troops whose rôle was not conformable to territorial districts, and to the necessity, inherent in modern war, of creating in war-time great new units not foreseen in peace-time. Moreover, the independent army organized on a territorial framework was incompatible with the conception of the economical mobilization of the entire forces of the nation. The "*Projet de loi sur l'organisation générale de l'armée*," dated Jan. 18 1921, made the territorial organization and the organization of the formations of the army independent of one another. The active army, with its reserve, would, under this law, consist of the 20 youngest classes. The territorials would not, properly speaking, be an army, but a mass of formations, composed of the 10 oldest classes, organized for military work behind the army or at home. The 21 *régions territoriales* (20 excluding Algiers) created by the laws of 1873, 1897 and 1913, were maintained. Of the three military governments (Paris, Lyons, and Metz and Strassburg) created by the laws of 1875 and 1919, that of Lyons was suppressed. The army was to be grouped in higher formations (divisions and non-divisional formations). Thus, the *formation d'organisation* could be changed, and would be commanded, without reference to the "regional organization." Thus, in war-time, there would be *no reserve formations*, but one great "mobilized active army," consisting of as many "higher formations" as could be formed and maintained out of the two classes of the active army and the 18 classes of the active army reserve. The active army in peace-time is thus seen to consist of a number of divisions and non-divisional formations, which, for peace purposes, are under the general control of the *général de division* commanding the *région* in which the headquarters of the division or formation is situated. The active army in war consists of these divisions and non-divisional formations, increased, if necessary, up to the limits imposed by the resources of the 20 youngest classes. These formations can be grouped, as the situation demands, in army corps, armies, and groups of armies. (M. K. W.)

NAVY

During the World War certain changes were made in the distribution of the French fleet, and in the purposes for which its stations were used. Thus, the trading station of the Ocean became the base of reserve cruisers. The trading station of the Mediterranean became one of the naval bases and a port for reserve cruisers; the Toulon naval munition works was devoted to the production of shells for the army; the electricians' station of the Mediterranean became a base for general fleet purposes, just as the torpedo school at Brest was converted into a torpedo base. The schools at Brest and Toulon for cadets, both of the executive and engineer classes, were abolished; St. Raphael became the main naval aviation school, and Brest and Bandol the chief listening schools.

The whole naval building and distribution programme was profoundly altered by the war. From a building point of view, army mobilization put an end to the activities of nearly every French shipyard. Even armour plate ceased to be manufactured at Le Creusot, because the men engaged in that industry had been called to the colours. This was remedied to a certain extent, but from a general point of view it may be said that the industrial activity of public and private naval armament establishments was closed down, except in those cases where the plant and staff could usefully be employed in filling up the gaps of the industrial equipment of the country for army purposes.

The main task of the French navy during the war was in the Mediterranean, the Channel, and at the Dardanelles. Its losses were 166 vessels, of which 117 were due to enemy action and 49 were the result of collision and other marine casualties. The vessels lost by enemy action were: the battleships "Bouvet," "Suffren," "Gaulois" and "Danton"; four battle cruisers, "Gambetta," "Admiral Charner," "Kleber" and "Dupetit-Thouars"; one protected cruiser, "Chateaurenault"; 13 torpedo-boats; 10 submarines; two gunboats; one sloop; one transport; six auxiliary cruisers; 48 patrol-boats and mine-sweepers; 26 requisition transports; and one salvage vessel. Forty-one of these ships were lost by mine explosion; 58 were torpedoed by submarines; one, a submarine, was lost by aerial bombardment; the rest were sunk by shell-fire. Five torpedo boats, two submarines, two river gunboats, three vedettes, four submarine chasers, 25 patrol-boats and mine-sweepers, and two chartered transports were lost by collision, or by navigation accidents. The following vessels, which were damaged by shell-fire, torpedo or mine, were repaired: three battleships, one coastguard battleship, nine torpedo-boats, six patrol-boats and mine-sweepers, and one submarine. The losses in personnel, including those suffered by the marine brigade at the front, amounted to 10,896 killed, of whom 316 were officers. Those missing at sea amounted to 4,754, of whom 203 were officers.

When the Armistice negotiations began the French fleet comprised 1,296 craft on the active list. The majority, 874, was employed upon anti-submarine work. There were 735 vessels detailed for convoy, patrol and fishery protection duty. There were 139 submarine chasers, 192 mine-sweepers, and 70 vessels were engaged in war-pilotage. The fighting force of the fleet was formed by 117 battleships, cruisers, and destroyers, and 43 submarines. Although France quite naturally looked upon the navy as a subsidiary service during the war, thanks to the British fleet, she nevertheless provided 11% of the patrol-boats; 6% of the torpedo-boats; and 17% of the submarines in the Atlantic and the Channel.

The French navy, in Aug. 1914, only owned eight flying machines, and no more than 200 men were attached to the service of naval aviation. When the Armistice was signed the number of men employed in this service amounted to 11,000, and the navy had 1,264 air-planes or water-planes, of which 370 were in active service, and 257 dirigible and captive balloons. During the last year of the war the naval aeroplane service had over 70,000 flying hours and nearly 4,000,000 flying miles to its credit; and the lighter-than-air service had been in the air for over 12,000 hours, covering over 500,000 miles.

In 1921 the battle fleet of France consisted of three 1912 battleships, the "Bretagne," "Provence," and "Lorraine"; four battleships of the 1910–1 programme; four of the 1906 programme; five of the 1905 budget: the remainder were, in order, the "Courbet," "Jean-Bart," "France," "Paris"; "Diderot," "Condorcet," "Voltaire," "Vergniot"; "Justice," "Vérité," "Democratie," "Patrie" and "République." The 1912 battleships were of 23,500 tons, steaming 20 knots; the 1910–1, of 23,400 tons and the same speed; and the rest had a steaming capacity of about 19 knots.

Of battle cruisers, France had three of the 1907–8 programme of 14,000 tons; three of the 1904 budget of 12,500; four of the 1900 programme of 10,400 tons; two of 1900 of 9,500 tons; one of the 1901 programme of 7,700; one of the 1899 programme of 11,300 tons, and one of the 1895 programme of 5,350 tons. There were six protected cruisers, which might be regarded as obsolete; one old cruiser which had been converted into an aeroplane tender; and some 70 destroyers and torpedo-boats, most of them of ancient date. French submarines numbered 43; the Peace Treaty had given to France a certain number of obsolete German units. (G. A.)

THE FRENCH LABOUR MOVEMENT

The most prominent feature in the contemporary French labour movement has been the check given to "Syndicalism," as represented by the *Confédération Générale du Travail* (C.G.T.). This body is peculiar inasmuch as it is quite independent of political parties. Its organization is somewhat complicated. The workers of any one trade—builders for instance—have their National Federation, which is constituted by delegates appointed by the various building trades syndicates, masons, carpenters, etc. The various federations—building trades, metal workers, railwaymen, etc.—each elect a delegate, and their delegates together form one section of the C.G.T. Another section is formed by delegates elected by regional groups of all syndicated workers without distinction of trades. The C.G.T. is thus a body formed by delegates of regional unions on one hand and of national trade federations on the other. It groups labour representatives nationally and regionally—vertically and horizontally. The men thus elected form the National Committee of the C.G.T. It meets every three months, lays down the broad lines of syndicalist policy and every two years appoints the administrative committee of the C.G.T.

It should be noted that all these various groups preserve their autonomy as regards action provided that they observe the general statutes of the C.G.T., the chief of which declares that the C.G.T. groups working-men without distinction of religious or philosophical opinions with the object of suppressing "wages and employers." Every two years the bureau of the C.G.T. has to give an account of its stewardship to the National Congress, at which every syndicate, no matter what the number of its members may be, has one vote.

Such was the organization in 1921. It changed but little in form during 1910–20, but one slight modification whereby provincial delegates were allowed to sit every three months on the National Committee considerably modified its operation after 1918. Up till then provincial organizations were always represented by Parisian "militants," usually extremist in tone. Fernand Pellontier, Pouget and Griffuelhes were then the organizers of the C.G.T., by which they hoped to wean the syndicalist movement from the influence of the parliamentary Socialists who were in favour of accepting social reforms. Their aim was to bring about a syndicalist revolution, and, as preparation for this upheaval, to accustom the working classes to "direct action," "sabotage," "anti-militarism" and violence of every kind were weapons to be used.

This doctrine of 1910 was systematized by the syndicalist thinker Georges Sorel. All social reform was scorned by these revolutionary syndicalists as being nothing but an opiate administered to the working-classes. Thus the Workmen's Pensions bill (1910), which made contributions from employers and employed obligatory, was vigorously resisted by the C.G.T.

More moderate men, however, while they were in favour of the independence of the C.G.T. from socialism, opposed violence and supported reform and parliamentary action. For three months indeed, one of their number, Niel, held the post of general secretary of the organization after the failure of the postal and railway strikes of 1909–10. The revolutionaries, however, after storming the offices, drove him from power. Constant street disturbances, May Day riots, prosecutions for seditious anti-militarist propaganda, make up the history of the C.G.T. in the few years before 1914. The fact that it had not more than 300,000 subscribing adherents kept funds low—in accordance with the doctrine that revolutionary action can only be obtained by a vigorous minority. At Havre (1912) the independence of the C.G.T. from all political parties was again affirmed, but the C.G.T., which declared that syndicalism was sufficient to itself, nevertheless desired to convince the world at large of this truth. International syndicalism met with but little success, for the German syndicalists would not look at plans for a general strike in the event of war.

C.G.T. and War.—Resolutions had been frequently adopted at C.G.T. congresses making it the duty of every member of the C.G.T. to reply to mobilization orders by proclaiming a general strike. But when mobilization was ordered on Aug. 1 1914, national enthusiasm swept away even the recollection of such decisions. French syndicalists had many reasons for suspecting the sincerity of German revolutionary pacifism, and on Aug. 3 Jouhaux, secretary general of the C.G.T., speaking at the funeral of Jaurès, preached the duty of national defence. This lead was accepted so loyally that none of the contemplated arrests of anti-militarist agitators was effected. Throughout the war Jouhaux and his followers observed the "*union sacrée*" and indeed began to perceive that capital and labour might have interests in common. A noteworthy sign of this new feeling was the presence of Jouhaux at the 1917 banquet of the federation of French manufacturers and merchants.

A small group of men inside the organization looked upon Jouhaux as a "traitor" to the cause, and sought at Kienthal and Zimmerwald the means of bringing the war to an end, at the same time encouraging agitation in this sense among workmen in France. By 1917 large numbers of men had been sent back from the front to work in munition factories. Considerable discontent prevailed, which led to grave strikes especially in the Loire. The settlement of those disputes in no way disarmed the extremists, who were dazzled by the Russian Revolution. The split widened with time, and peace in no way improved matters. The strength of the C.G.T. was officially recognized by the appointment of Jouhaux to be a delegate of the French Government for the consideration of Labour questions at the Peace Conference in Paris. He subsequently became a member of the International Labour Bureau, the director of which, Socialist deputy Albert Thomas, while Minister of Munitions, had exerted great influence over labour.

Syndicalism flourished at this period. Its effectives had risen from 300,000 before the war to 2,000,000. One cause of this is to be found in the special treatment given to labour during Albert Thomas' term of office. Skilled men obtained exemption from the army with greater ease than before, wages had been greatly increased, and in negotiations the C.G.T. had become an officially recognized body, of which it was almost necessary to be a member. M. Jouhaux, its head, played an important part in Government councils, and M. Clemenceau himself at one time wanted to offer him office as Minister of Labour. C.G.T. doctrine had in fact ceased to be a bogey. It still kept all its pre-war revolutionary formulae, but they had ceased to have any real meaning. During the war labour had been given many opportunities of studying the intricate mechanism of State affairs and of appreciating that Karl Marx had perhaps not said the last word upon modern economic problems. Many of them began to ask themselves whether they were after all able with their experience and with existing labour organizations to take over, as they desired and hoped to do, the responsibility of national production. Without, therefore, throwing overboard their theoretical conceptions, they nevertheless began to see the need of caution and further knowledge if they were not to fall when their time came to take power. Moreover, they clearly saw that war had left the country in such a condition that ill-considered action might lead to general chaos. Proudhon thus took Marx's place. While Jouhaux in 1919 declared that revolution was "the workshop taking the place of Government," Merrheim maintained that the only chance of success for syndicalist ideas lay in carefully prepared economic revolution, and began to fight Bolshevism. This doctrine aroused the sympathy of the professional classes, who came to the assistance of the C.G.T. when it formed an Economic Labour Council for the elaboration of its new programme. It was composed of civil servants, engineers, technical experts, men of science and coöperative workers. Civil servants who had obtained the right of forming a union of their own adhered to the C.G.T. The Eight Hours' Day bill became law, and Clemenceau, speaking as prime minister to the C.G.T. leaders, told them that the time had come to take their place in Government. The movement was at its topmost height.

While the leaders were thus daily increasing their prestige and influence in the country at large their position with the rank and file was being equally steadily undermined by the "extremist" opposition. Strike followed upon strike, and wage demands continued to soar. The revolutionary elements, who reproached the C.G.T. with having failed to launch a revolution during the war or during demobilization, got ready for open warfare. Extremists organized demonstrations on May 1 1919, which ended in fatal rioting. Jouhaux at once gave ground to the revolutionaries, and resigned from his post at the Peace Conference. A general strike, prepared for July 21, failed owing to the firmness of the Government. The C.G.T. then retired into splendid isolation. Its chief concern was the elaboration of schemes for the nationalization of railways, mines and motive power. In April 1920 the extremists, with the growing support of Socialist Communists, captured control of the railwaymen's union and proclaimed a strike—the second within three months. Instead of disavowing it the C.G.T., in support of the movement, decreed a number of successive strikes, calling out miners, transport workers, dockers and seamen. Society, however, stood firm and the C.G.T. met with disaster. Within a few weeks it lost two-thirds of its members. The leaders who had failed to withstand pressure from the extremists were held by them to be responsible for the débâcle, and in every meeting they were assailed with the utmost ferocity. The Orleans Congress (held in Sept. 1920) was in its way a defeat for the extreme Left, whose leaders were in gaol awaiting their acquittal on a charge of having conspired against the State. That defeat was more apparent than it was real, for the Bolshevist Left forced the moderates to accept in the very heart of the C.G.T. the formation of revolutionary syndicalist committees whose avowed object it was to get rid of the official leaders, to resume pre-war doctrines and to link up with Moscow.

In 1920 the C.G.T. tried, but without complete success, to exclude all those who adhered to the Bolshevists. Its members then were about 600,000. It was still, however, linked up with the reformed International Federation of Syndicates, and its chief concern was to devise a plan whereby German labour could collaborate in restoring the devastated regions.

Socialist Party.—Although the C.G.T. always theoretically declared itself to be quite independent from the Socialist movement, concerted action was frequent before the war and machinery was created to coördinate their action.

The Socialist party in 1910 had about 60,000 members and was composed of many conflicting schools. Even after the process of unification differences between the sects were frequent, and all the tact and authority of Jaurès were needed to preserve the semblance of harmony. The organization of the party had at its base local sections grouped into departmental federations, the delegates from which formed the National Council. This body appoints an executive committee. The Socialist parliamentary group, which always kept rather aloof from the party organization itself, was represented at the annual Congress.

The funds of the Unified Socialists were obtained from 50-c. subscriptions from all adherents and an annual subscription of 3,000 fr. from deputies. The official organ was *l'Humanité*.

Before the war there were three tendencies clearly defined within the party. There were the followers of Jules Guesde, who believed in the utility of social reforms and in the possibility of acquiring power by constitutional means. They were opposed to Socialist acceptance of office in a "bourgeois" ministry. They rejected the general strike, anti-clericalism and anti-patriotism, and fought against any understanding with other parties and notably against the *bloc* of the Left which controlled national policy during the Combes and Waldeck-Rousseau Ministries. They were austere doctrinaires and pure Marxists. Thus Guesde refused to vote for workmen's pensions.

Jaurès and his followers were more broad-minded and would have accepted ministerial office. They believed in social reform, were ardent in the fight against the Church, and advocated union with other groups of the Left. Gustave Hervé (who subsequently has become reconciled to patriotism) in those days led the extremists. He preached rebellion in the time of war and scoffed at all the theories of Karl Marx. These three schools clashed at every National Congress but the conciliatory skill of Jaurès always produced a resolution so ambiguous in its phraseology as to be adopted with unanimity. Since syndicalism had emancipated itself from the Socialist party the action of this latter was almost entirely parliamentary. Its policy was simple: Abroad an understanding with Germany, Alsace-Lorraine being definitely abandoned, no colonial conquests, evacuation of Morocco or, at most, peaceful penetration of that country; at home social reforms, State monopolies, taxes on capital and income, reduction of term of military service and adoption of militia system.

Jaurès leavened all this dough with his great eloquence. Guesde spoke rarely and always bitterly. Marcel Sembat showed with wit, in his book *Faites un Roi, Sinon Faites la Paix*, that socialism was the only safeguard against war.

On July 31 1914 Jaurès was assassinated by a fanatic, Raoul Villain (afterwards acquitted). Jaurès had just returned from Brussels where the German Socialists Müller and Scheidemann had declared that their followers would not vote German war credits. This promise was not kept, and the French Socialist party also voted war credits on Aug. 4 1914.

In 1915 the first signs of dissension in the Socialist ranks became visible. Up till then the participation of Jules Guesde, Sembat and Albert Thomas in the Ministry had been accepted without opposition by the party. This changed, however, when the idea of a compromise peace first made a small number of converts among Socialist deputies. In 1916 this section grew in influence. It created its organ *Le Populaire*, and had as its leaders Paul Faure and Jean Longuet. Still further advanced along the road to compromise were the extremists Alexandre Blanc and Raffin-Dugens, who were linked up with revolutionary syndicalists and took part in the manœuvres for peace at Zimmerwald and Kienthal. The position did not change much until the Russian Revolution. While Albert Thomas, Marcel Cachin and Ernest Lafont were sent to Russia in the hope of preserving the military alliance, the extremists and Longuet's followers clamoured for passports for their delegates to the proposed Stockholm Socialist Peace Congress.

The Bolshevist Revolution had two effects upon the French Socialist party. It widened the gap between the patriotic "Majority" section and those who espoused the cause of Lenin, and it aroused public opinion against "defeatist" Socialism. Meanwhile Longuet and his followers defeated Renaudel, and the patriotic section and all Socialist connexion with the Government was broken. At the Congress of 1920 a number of deputies were excluded. They had refused during the general elections to fight in the same lists as Jacques Sadoul, a notorious French officer who was playing a big Bolshevist part in Russia, and who had been sentenced to death *in contumaciam* by French court-martial. This was the first scission. The extremists were growing in numbers, and it was soon the turn of Longuet and his followers. At the Tours Congress adhesion to the Soviet was voted by a large majority and the moderates were expelled.

In 1921 there remained three parties amid the ruins of former Socialist unity. The Communist party, having *l'Humanité* and the *Internationale* as its organs, belonged to the Soviet or Third International. Its leaders were Marcel Cachin, Frossard, Daniel Renoult, Souvarin, Rappoport, Amedée Dunois and Victor Meric. Its organization was centralized, and its affairs were controlled by a central committee. Fourteen deputies represented it in the Chamber of Deputies, and its adherents numbered about 100,000.

The Socialist party had *Le Populaire* as its organ. It had about 50,000 members and 60 representatives in Parliament, among whom the chief were Sembat, Guesde, Basly, Leon Blum and Paul Boncour. The French Socialist party, the third portion, was of minor importance. (R. R.*)

POLITICAL HISTORY

The political history of France from 1909 until 1913 was that of a slow awakening of the country to the real meaning of German foreign policy. One danger signal was given in 1905 with the Casablanca incident; 1911 furnished another warning when the German gun-boat "Panther" appeared off the Moroccan port of Agadir. In 1913 the new German army law and special taxation for military purposes made the menace even more clear. At the outset of this period, however, internal politics, rather than those of Europe, occupied attention. On July 20 1909, the Clemenceau Ministry was defeated on a personal question, arising from a remark made during a naval debate on M. Delcassé's foreign policy. Briand followed Clemenceau in office three days later.

Briand Ministry.—The new premier took the portfolio of the Interior, and had as his chief colleagues Barthou, Justice; Millerand, Public Works; Viviani, Labour; Cochery, Finance; Gen. Brun, War; Adml. Boué de la Peyrère, Marine. Briand, in his ministerial declaration, July 27, showed by concentrating on social reform (old age pensions, income tax, customs tariff, and reorganization of the civil service) that he hoped to be allowed to let the sleeping dog, Germany, lie, and to prosecute a liberal policy, both towards capital and labour at home. During the recess which followed soon after his arrival in office he made an eloquent appeal (Oct. 10) at Périgueux, for the broader handling of political questions; for greater tolerance of opinion; for the destruction of parish-pump politics, and the cleansing of the "stagnant pools" of local interest in which national issues were all too frequently decided in a purely selfish sense. This speech, in which for the first time the policy of appeasement was openly preached by a Republican minister, made a great stir among public and Parliament, and aroused the fear among Socialist-Radicals and Socialists that too close a *rapprochement* with Conservatism was intended. Briand managed, after the assembly of Parliament, to allay these apprehensions.

Electoral reform, on the basis of proportional representation, was the first measure submitted to Parliament. The claims of this system had been advocated by an influential body of Parliamentarians, and their propaganda had made headway. Nevertheless, political leaders felt disinclined to take a leap in the dark, and Briand, having made the vote upon the matter one of confidence, the reform bill was rejected. After voting the State purchase of the Ouest railway, the House strengthened the protective system of 1892 by voting a general increase in the customs tariff—which was justified, or at any rate rendered necessary by the new fiscal burdens placed upon home industry by social legislation.

Elections of 1910.—Considerations of a large policy, rather than those of small concrete interests, dominated the elections of 1910. The Socialist-Radicals, having put through their drastic anti-clerical programme, had started upon equally sweeping schemes of social reform. Class appetites had been aroused, and every fresh act of social legislation led to an increase of the economic, social and political demands of Labour and its leaders. A series of strikes and disturbances, in 1907–8–9, some of them requiring to be quelled with great severity, coupled with the steady growth of taxation, had aroused the "black coat" population to the perils of demagogic competition. Radicals, never at any time very advanced, broke with their Socialist and Socialist-Radical associates, thus putting an end to the union of the Left which had waged the war against the Church.

While the extreme Left became more and more clamorous in its voicing of the demands of Labour, moderate Radicals sought to create a party of Order with which to stem the rising flood of taxation, and to curb the precocious proletarian ambition. Briand was the natural leader of such an effort. At Périgueux he had already drawn the attention of the country to the dangers of political and class intolerance. Speaking to his constituents at St. Chamond on April 15 he was more definite. After declaring that the spirit of party and anarchism were the worst enemies of society, he outlined a programme of government, the chief feature of which was a proposal intended to tame the Labour movement by giving to workmen's syndicates the rights and responsibilities of property and corporative status. These unions, under the influence of the extremist leaders of the Confédération Générale du Travail, were fast becoming dangerous centres of anarchy and hotbeds of class-hatred. Briand proposed to alter this by giving these unions full legal status. This was the concrete expression of his policy of appeasement.

The results of the elections were (the corresponding numbers in the previous Chamber are shown in brackets): Reactionaries (80) 71; Nationalists (16) 17; Progressives (60) 60; Left Republicans (82) 93; Radicals and Socialist-Radicals (269) 252; Independent Socialists (29) 30; Unified Socialists (55) 74. These results favoured Socialists at the expense of their Radical allies. Proportional representation was favoured by the great majority of the electorate, and became part of ministerial policy as laid down on June 1 1910 by the prime minister, Briand.

During the autumn vacation of that year a big railway strike gave Briand an opportunity of displaying statesmanlike courage, and of driving a further wedge in between the extreme and the moderate elements of the Left. The strike first broke out on the Nord railway, and spread to the Ouest and Midi systems. The Est and Paris–Lyons–Mediterranée lines were not greatly affected. There was a good deal of violence used by strikers, and *sabotage* was practised on a large scale. Briand faced the situation with great firmness, and used the army, not only in protecting property, but also in actual strike-breaking. All railway servants of military age were called to the colours, placed therefore under martial law, and left at their civilian posts, desertion of which became thus a military offence. Agitators among the men were drastically weeded out, and within a week a strike movement of a magnitude previously unknown in France had collapsed. The struggle had been carried on with great determination on both sides, and left much bitterness behind it. Briand's action in mobilizing strikers had naturally aroused the fury of the Socialists, who, on the reassembly of Parliament, attacked the legality of his action. The Ministry was kept in power thanks to the growing scission on the Left of the House, but a reconstruction of the Government was deemed advisable. Briand resigned on Nov. 2, and next day formed another Cabinet.

Briand's Reconstructed Ministry.—This new Government was composed exclusively of moderate Radicals. MM. Millerand and Viviani, who represented the Left wing in the Ministry, went out of office, and it was soon evident that Briand intended to lean more and more upon the Centre. He refused, in spite of very great pressure, to force the railway companies to reinstate the men dismissed as a result of the strike, and pressed forward his policy of compelling Labour organizations to confine their activities entirely to questions directly concerning their trade. Reconstructions seldom live long, and the enemies of the Ministry having failed to defeat Briand on social questions turned to the old and oft-tried weapon of anti-clericalism. MM. Malvy and Paul-Meunier, with an interpellation as to the spirit in which the Congregations Law was being observed, reduced the majority to six. Briand resigned on Feb. 27 1911, and M. Monis, a senator of advanced Radical views, succeeded him.

Monis Ministry.—M. Monis formed a purely Socialist-Radical Ministry. He himself took the Interior, and his chief colleagues were: Caillaux, Finance; Cruppi, Foreign Affairs; Berteaux, War; and Delcassé, Navy. Promise far outstripped performance with this collection of democratic talent. Faced with the concrete problems of office, the preachers of almost revolutionary social reform found but little to alter in the programme of their predecessors. They did, however, yield to Socialist pressure on the question of the reinstatement of railway strikers; but before the necessary legislation was passed, the Ministry fell. The same sterility marked the rest of the Government's social efforts; and its advanced Radicalism did not save it from serious disturbances arising out of the delimitation of the Champagne zone. In the Aube and the Marne the rioters were for a few days completely out of hand. The disorders were suppressed, and all attempt at fixing the Champagne zone was for the moment abandoned.

Monis, the premier, and Berteaux, Minister of War, were both victims of an accident at the start of an aeroplane race from Paris to Madrid on May 21. Berteaux was killed outright, but Monis, although seriously injured, remained in office, appointing Gen. Goiran to the vacant portfolio. The death of Berteaux, a man of great wealth and influence in Radical circles, was a great loss to an already weakened Cabinet. The situation, both at home and abroad, was full of difficulty. Socialist opposition to the Fez expedition (April–May) and difficulties with the administration of the Old Age Pensions bill would probably have been enough to bring about the collapse of the Ministry, which, however, fell on a question of the supreme command of the army in time of war. Parliament refused to give a vote of confidence to the Government, which declared that decisions as to the supreme command were its sole concern, and the Ministry resigned.

Caillaux in Power.—There was no real question of policy at issue. The Chamber had tired of the ineffectual mediocrity of M. Monis, and required more brilliant leadership. This was provided by M. Joseph Caillaux, who, on becoming prime minister, went from Finance to the Interior. M. Klotz became Minister of Finance, Cruppi Minister of Justice, and de Selves Minister of Foreign Affairs. Delcassé remained at the Navy, and Messimy took the War Office. This Ministry, by its mistakes, made a permanent mark upon the world's history. Its members were full of professed social and fiscal ambitions, which found their only manifestation in pettifogging party practice. From the point of view of internal politics it represented many of the worst influences of bigoted Radical tyranny, and in home affairs it was quickly discredited. Abroad its policy was well-nigh disastrous, and by its weakness, and by the tortuous secret diplomacy of Caillaux towards Germany, it very nearly plunged Europe into war.

Agadir.—Foreign affairs very soon absorbed the whole attention of both Parliament and public. Negotiations which had been in progress for some time with Germany over Morocco were given a definitely threatening aspect by the arrival of the German gun-boat "Panther" at the undeveloped port Agadir. Caillaux, who had always believed in the possibility of conciliation with Germany, conducted secret negotiations with Berlin without consulting the Cabinet, and without indeed informing his own Minister for Foreign Affairs of what was on foot. Throughout the summer European diplomacy was thereby plunged into the darkest bewilderment, and statesmen in more than one capital, unaware of Caillaux's underground conversations, were speaking and acting at cross-purposes with each other. It was impossible to maintain complete secrecy. M. Clemenceau among others became aware that something was going on, and public dislike of the trend of events led to an outburst of national feeling in September. Although the agreement of Nov. 4 1911, which resulted from official negotiations with Germany, was ratified by Parliament, the Cabinet, and its head in particular, had so lost in influence that the resignation of M. de Selves on Jan. 9 1912 brought about the collapse of the Government the next day. Caillaux's negotiations with Germany subsequently formed the subject of special parliamentary inquiry. The sordidness of the whole story and the light-hearted way in which Caillaux had played fast and loose with the honour of France and her friendship with Great Britain thoroughly disgusted the country, which had already shown many signs of discontent with the rule of narrow-minded Radical mediocrity even under a premier of undoubtedly brilliant talent. A recoil from Caillautism was inevitable.

Poincaré in Power.—Raymond Poincaré undertook the task of giving to the country the "national" Cabinet it desired. Three former prime ministers took office in his Government, the kernel of which was formed by Poincaré, Foreign Affairs; Klotz, Finance; Léon Bourgeois, Labour; Millerand, War; Delcassé, Navy; and Briand, Justice. Foreign affairs remained the chief preoccupation. The acute point of crisis with Germany was past, but the whole European situation was unstable, and called for the closest watchfulness. In home affairs, electoral reform took up the greater part of Parliament's attention. Vigorous action was taken against anti-militarist and revolutionary propaganda.

Presidential Election.—M. Fallières' term of the presidency of the Republic came to an end at the beginning of 1913. There were two candidates for the succession, Poincaré and Pams. Poincaré rallied to his support a great weight of feeling outside Parliament, whilst inside both the Senate and the Chamber of Deputies he had behind him the bulk of the Moderate Republican votes, and nearly all the Conservative elements. Clemenceau, alarmed by the almost reactionary nature of Poincaré's candidature, led the campaign on behalf of Pams, a Radical Republican of classic mediocrity, with such fire as to secure his adoption as Republican candidate in the party caucus meeting on the eve of Versailles. Poincaré, however, refused to withdraw his candidature, in spite of all the appeals made to him by Radical stalwarts to observe party discipline. The second ballot at the National Assembly, held at Versailles on Jan. 17 1913, showed that he had accurately estimated the general opinion of Parliament. He received 483 votes, his opponent Pams only obtaining 296. This result, while constituting a victory for Conservatism, was also a sign that people, alarmed by the portents in the international sky, wished to have a strong man at the head of the republic, and one capable of playing his own part in the relations of the republic with foreign Powers. Before Poincaré was installed at the Élysée (Feb. 18 1913), his successor as prime minister, Briand, was faced by the need to meet the growth in the military strength of Germany, which could not be left unchallenged.

Briand's New Ministry.—On Feb. 27 a first step was made towards this end, when a bill was tabled in the Chamber of Deputies, opening an extraordinary military credit of £20,000,000 for war material. On March 6, M. Étienne, Minister of War, brought in a bill raising the period of obligatory military service from two to three years. Before the bill could be proceeded with the Briand Ministry came to grief in the Senate, and, after an adverse vote of 33 on proportional representation, Briand resigned on March 18, having been in office for 56 days. The Electoral Reform bill was among the fixtures which Briand took over from Poincaré. It provided for proportional representation by means of the electoral quotient. The bill had been passed by the Chamber of Deputies, where Socialist support rendered Radical opposition ineffectual. In the Senate, however, the Radical *bloc* remained firm. Clemenceau saw in the bill an excellent opportunity of scoring against President Poincaré, who was a firm supporter of the measure. Moreover, he, with many other orthodox Radicals, was alarmed by the somewhat chauvinistic manner in which Poincaré's return to the Presidency had been greeted by the reactionary party, and suspected, in proportional representation, a device to increase the power of the Right.

Barthou's Government.—The crisis brought about by the defeat of Briand on this point was fortunately of short duration, and, on March 21, M. Barthou was able to form a ministry. Its chief concern was to carry on the policy of its predecessor, and to press forward with unabated determination the military proposals before Parliament. So bitter was the opposition to the Three Years' Service bill that Barthou experienced no difficulty whatever with regard to proportional representation, which almost imperceptibly dropped for the moment out of the realm of practical politics. The critics of the Three Years' Service bill were recruited from among the ranks of the Socialists and Socialist-Radicals. They did not deny that some answer to Germany was necessary; that something had to be done to increase the military efficiency of France; but they urged that the Government, in asking the country to accept another year of military service, was demanding a sacrifice which would not be in proportion to the results achieved. They argued that it would be both less costly and more effective to reform the whole conception of army organization on the general lines advocated by the Socialist leader Jaurès and to aim at the adoption of the Swiss militia system. The utmost concession the Opposition was willing to make was to agree to an increase of six months in the total service.

The hostility against the proposals of M. Barthou was not confined to politicians. Very active propaganda against them was carried on throughout the country by Communists and Anarchists, and by anti-militarist agitators belonging to the Confédération Générale du Travail. This activity for a time had serious effects upon army discipline, and in more than one provincial garrison mutinies broke out. Happily they were not of a grave nature, and prompt action by the Government in arresting the ringleaders, and in showing their dupes and the country the unpatriotic motives which inspired the agitation, soon put an end to the unrest in the army. Legislation calling for the heavy sacrifice of a further year's military service naturally could not be popular; but the military activity of Germany, and the tone of speakers on the other side of the Rhine, left France in no doubt as to what was in store. The country realized the necessity for the fresh effort asked of it. Barthou fought the bill through the Chamber with skill and courage. He had to contend with violent opposition from the Socialists, and with all the dilatory tactics the ingenuity of Radicals could devise. After 22 sittings had been spent in discussing counter-proposals, the House began the consideration of the Government bill on July 7, and, by 339 votes to 223, carried the essential clause. By the end of the summer the whole bill had become law, and the main task of the Barthou Ministry was at an end. Hostility towards the Ministry was in no way abated, and Caillaux led his followers to victory on Dec. 2, inflicting defeat by 290 votes to 265 on a vote authorizing a loan of £52,000,000, mainly for non-recurring military expenditure. The Finance Minister, M. Dumont, asked that fiscal immunity should be extended to the proposed new *Rente*, a request which, as Caillaux pointed out, would have cut at the root of any just income tax, since between one-tenth and one-twelfth of French wealth is invested in *Rente*.

A Doumergue Cabinet.—Attempts were made to solve the crisis which had arisen, without paying due regard to the claims of the Socialist-Radicals. Both M. Ribot and M. Jean Dupuy tried unsuccessfully as Moderate Republicans to enlist the support of Caillaux and his friends. In these circumstances M. Ribot advised the President of the republic that the new head of the Government would have to be chosen from among the Left. Recollections of the part played by Caillaux in Franco-German relations made it difficult for the leader of the Socialist-Radicals himself to take office as premier; and it was M. Doumergue who, after a week of negotiations, formed a Government on Dec. 8, composed almost exclusively of Socialist-Radicals. The Ministry was Gaston Doumergue, prime minister and Foreign Affairs; René Renoult, Interior; Bienvenu-Martin, Justice; Noulens, War; Monis, Marine; Caillaux, Finance; Viviani, Public Instruction; Malvy, Commerce; Fernand David, Public Works; Lebrun, Colonies; Raynaud, Agriculture; Metin, Labour; Under-Secretaries of State, Peret for the Interior, Maginot for War; and Jacquier for the Fine Arts.

Interest in the new Ministry was confined to its financial proposals, and its attitude towards the Three Years' Military Service law. It soon became apparent that, whatever ministers had said about the new law when in opposition, they had no intention of interfering with its working. The preceding Government's bill for the issue of perpetual *Rente* was withdrawn, and a policy of Radical finance was outlined, based upon the taxation of acquired wealth. As a matter of political fact the chief aim of MM. Doumergue and Caillaux was to stay in power long enough to give to the approaching general elections a pronounced Socialist-Radical flavour. The waning power as a battle-cry of anti-clericalism, the personal talents of Caillaux, the involved condition of the French budget, no less than the real unfairness of the incidence of taxation, made of Caillaux's financial plans the main plank of his party's fighting programme. In the forefront of those plans were taxes on income and on capital. Before the year was over the electoral campaign had begun.

The Fédération des Gauches.—Briand, in a speech to his constituents at St. Étienne, voiced again those arguments in favour of conciliation which he had put forward at Périgueux and at St. Chamond. He attacked the old Radical school for its desire to keep alive for its own political benefit all the old class and clerical feuds. He recalled Caillaux's secret dealings with Germany, and dwelt scathingly upon demagogic plutocrats, who raised the dagger above wealth with such ferocity of mien that it was difficult to say whether they intended to strike at riches or to defend them. Briand rallied to his standard a large number of moderate men belonging to all opinions, and for electioneering purposes they formed a fighting body known as the *Fédération des Gauches.* It had the support of men like Millerand, Barthou, Klotz and Ribot, and carried on a vigorous campaign throughout the country in favour of the Three Years' Service law, and in opposition to the proposed taxation of income. When the Chambers reassembled after the New Year recess, finance was still their main business. The Briandists sought in vain to shake the Government majority. The Lower House, after a month's debate, approved the fiscal proposals of the Government by a majority of 115. In the Senate, however, which, being more Radical in politics, was therefore more Conservative in economics, Caillaux had to make concessions and on minor points suffer defeat.

Madame Caillaux.—Opposition to Caillaux and his policy found its most virulent expression in the columns of the *Figaro*, where, day after day, were published documents affecting the personal and political honour of M. Caillaux, as well as of his wife. These attacks were brought to a tragic end on March 16 1914, when Madame Caillaux, having previously taken lessons in revolver-shooting, called upon the editor of the *Figaro*, Gaston Calmette, and fired five shots at him. He died a few hours afterwards. The publication of the documents in the *Figaro* sought to prove that Caillaux had, throughout his political career, taken advantage of his position as Minister of Finance to line his own pockets, and that in particular he had brought such pressure to bear upon the judicial authorities that a notorious financial swindler, Rochette, was enabled to abscond while awaiting his trial. This was the most serious charge brought against him as a public man. The *Figaro* had, however, also started the publication of some very intimate letters written by M. Caillaux to his second wife, the shooter of Calmette, while she was still his mistress. In these documents, public and private matters were discussed with cynical licence; and in one of the letters Caillaux boasted to his mistress that in the Senate he had, as Minister of Finance in the Waldeck-Rousseau Ministry, "smashed the income tax (his pet measure) while appearing to defend it." The sensation caused by Madame Caillaux's deed was great. Rioting between Radical and Royalist gangs broke out during Calmette's funeral, and for some days Paris was in one of her typically effervescent moods. This manifestation was controlled without much difficulty, but it was less easy to limit the political effect of the crime. Caillaux at once resigned office, but Monis, Minister of Marine, was also deeply involved, as having been the prime minister who ordered the Procurator-General to postpone the trial of Rochette, and thus made it possible for him to escape to Mexico. Monis remained to face the storm in Parliament, which appointed a committee of inquiry as the result of further revelations made by Barthou. The findings of that committee, and the censure passed upon Monis and Caillaux, were approved by the House after stormy debate. The parliamentary session ended on April 4, and from that date to May 10, when the second ballots determined the composition of the new Chamber, politicians in vain tried to stir the electorate from its indifference. Even the Calmette murder, the Three Years' Service controversy, and the income tax aroused but few people from their apathy. None regretted the deceased Chamber, and few were sufficiently awake to the growing dangers in Europe to take much interest in the election of deputies who were destined to form the French Lower Chamber throughout the war.

Elections of 1914.—A clear-cut issue between opposing parties is found but seldom in French elections, but the general tendency of the 1914 elections could be discerned. They were a fight between the Moderate Republican elements who elected Poincaré to the presidency of the republic, and who voted for the Three Years' Service bill and the Socialist-Radical and Unified Socialist groups. The political composition of the new Chamber was:—Unified Socialists, 102; Independent and Republican Socialists, 30; Unified Radicals, 136; Alliance Démocratique, 100; Independent Radicals and Left Republicans, 102; Progressists and Republican Federation, 54; Action Liberale, 34; Right, 36; Independents, 16. The only marked change was in the Socialist party. They made an electioneering pact with their neighbours, the Socialist-Radicals, by which they gained many seats in the first ballot; and where Catholics saw their candidate badly placed in the second ballot, and opposed to a Socialist and a Radical, their votes were transferred to the Socialist rather than to the anticlerical Republican. Thanks to these two factors, as well as to a slight growth of Socialism in the country, the Socialist party made a net gain of 35 seats. The general effect of the elections was to strengthen the advanced Radical and Socialist *bloc* at the expense of the Briandists and the electors of M. Poincaré. This *bloc* of Socialists, Caillautists, Radicals and Independent Radicals numbered 226, and, although not an absolute majority in the House, Government without it was impossible.

Viviani Prime Minister.—In accordance with custom, Doumergue resigned before Parliament reassembled on June 1. It was found exceedingly difficult to replace him. The ministerial crisis lasted a fortnight, and more than one ministerial combination came to grief on the Socialist-Radical refusal to subscribe to a programme which did not include an early return to two years' service, or at least a drastic modification of the Three Years' law. It was on this point that M. Viviani's first attempt failed. The President of the republic, who had openly declared his intention to safeguard the new military law, then tried to bring about a Cabinet free from Socialist-Radical influence. M. Ribot rashly undertook to form such a ministry. It was boycotted by the *bloc*, and did not live a full 24 hours. The Chamber refused, by a majority of 44, to give it a vote of confidence, after hearing the ministerial declaration of policy. During the debate which led to this division advanced Radicals gave clear proof of their determination to reject any Government which was not in its essence recruited from their ranks. These circumstances led M. Poincaré again to summon Viviani, who, after this demonstration of Radical strength, and in view of the necessity of closing rapidly a ministerial crisis which had already lasted too long, found no difficulty in forming a ministry, and in finding a formula with regard to the Military Service law which, by its ambiguity, was acceptable to all save the extreme Left. It was composed as follows:—René Viviani, prime minister and Foreign Affairs; Bienvenu-Martin, Justice; Malvy, Interior; Noulens, Finance; Messimy, War; Gauthier, Marine; Augagneur, Public Instruction; René Renoult, Public Works; Gaston Thompson, Commerce, and Posts and Telegraphs; Fernand David, Agriculture; Raynaud, Colonies; Colyba, Labour; and, as Under-Secretaries, Abel Ferry, Foreign Affairs; Dalimier, Fine Arts; Lauraine, War; Jacquier, Interior; Ajam, Mercantile Marine.

During the debate upon the ministerial declaration policy, the premier strengthened those passages in the Government programme which dealt with the Military Service law. He gave some content to critics of that measure by announcing the Government's intention to introduce a number of bills providing for the military training of the young, and for the better utilization of reserves, but was firm in saying that until that new legislation had shown its efficiency in practice, there could be no question of reducing the term of military service. This programme was far from satisfying the Socialists and some disgruntled Radicals, but they only mustered on the vote of confidence which ended the debate 139 votes to 362. The ministerial crisis was thus ended, but, more important, an end had been put to the agitation for a repeal or revision of the Service law.

Three Years' Service Law.—All possibility of tinkering with this law was abolished by the proceedings of the Senate on July 13, on which date the European outlook was overcast, when Charles Humbert made a sensational speech revealing the poverty of the French army in artillery and war material of every kind. Clemenceau supported him in his demand for an inquiry. Messimy, Minister of War, admitted that while the French field gun was superior to that of Germany, the French heavy artillery could not compete with that of her neighbour; that Germany was far ahead of France in the supply of engineering materials; that frontier fortresses were but poorly equipped; that bridge-building material was lacking; and that the French soldier would have practically but one pair of boots at his disposal on the day of mobilization. He pointed out that Germany had spent between 1900 and 1905 £28,000,000 on her army, as compared with French expenditure of £11,250,000. From 1906–10 Germany had spent £37,200,000, and France £19,000,000; from 1911–13 German military outlay had been £23,400,000 and French £16,500,000. Messimy maintained that the ground lost could be made good by 1919, and that the first step towards doing that could be taken by the Senate in passing the military credits for £56,320,000 which were then before it. This Parliament did, before adjourning on July 15.

It is difficult to estimate to what extent the public revelation of French military unpreparedness made during this debate encouraged the Central European States in their bellicose designs. Certain it is that both from Berlin and from Vienna the French ambassadors reported to their Government that the proceedings in the Senate had had a deplorable effect upon public opinion, and had considerably strengthened the hearts of the jingo parties in both states. Although the French Foreign Office had in its archives despatches from more than one of its ambassadors warning it in the most urgent manner of the perilous condition of European affairs, or perhaps because it was deemed advisable to remind Germany of the solidity of the Franco-Russian alliance, the French President's visit to Russia was carried through according to programme. Poincaré left at midnight on July 15 1914, accompanied by the premier and Foreign Minister Viviani.

Madame Caillaux's Trial.—From the point of view of internal politics, it was undoubtedly desirable that the trial of Madame Caillaux for the assassination of Calmette should take place during the parliamentary recess, and while the Chief of State was abroad. Caillaux, who, in spite of the sensation caused by his wife's action, had again been returned to Parliament for Mamers, had lost no opportunity of giving to the whole *affaire* its full political flavour, and saw quite clearly that in court not only would his wife be on trial for her life, but he also and the whole of his policy and party would be arraigned. He subsidized newspapers and inspired campaigns, some of which were but thinly veiled threats of blackmail upon the President of the republic. He succeeded in making of his wife's trial the all-absorbing question of the day. The assassination of the Archduke Francis Ferdinand, the thunderclouds in the East, and revelations as to French unpreparedness, all failed to distract public attention from the Caillaux drama. The trial opened on July 20, and for a week France gave herself up to morbid contemplation of the rottenness of the social and political life of many of her leading men and women. The greatest lawyers of France were engaged in the case: Maître Ferdinand Labori for Madame Caillaux, and Maître Chenu for the Calmette family. Both defence and prosecution sought for mud with which to bespatter those concerned in the case; and, whether a witness were a minister, an actor, a journalist, or a woman, mud was found in plenty. There was no questioning the facts that Madame Caillaux shot Calmette; that she purchased the revolver on her way to the *Figaro* office; that she had carefully learned how to use a revolver; and that she had left a note for her husband telling him that she meant to take justice into her own hands. Nevertheless, after an impassioned speech by Maître Labori, she was acquitted by the jury—a result due more to the nature of the questions left to the jury's decision by the judge, and to the dependence of the Bench upon the favour of ministers, than to any consideration of the rights and wrongs of the case. The Caillaux propaganda outside the court increased as the trial proceeded, and sought to give to the proceedings the appearance of a political trial in which Caillaux's political adversaries were trying to find in the homicidal impulses of his wife a weapon with which to kill their chief political opponent. Temper rose rapidly to fever-heat, and by the time the verdict was given war-fear and war-fever helped to send up the temperature of Caillaux's most ardent supporters, the Socialists and Syndicalists, and of his most bitter enemies, the Royalists. The boulevards were packed with struggling *Camelots du Roy*, and gangs of the *Jeunesse Républicaine*, whose contending battle-cries of *"Vive Caillaux!"* and *"Caillaux Assassin!"* mingled with *"À Berlin!"* and *"À bas la guerre!"*

Outbreak of the World War.—This local rowdyism in no way echoed the real feeling of the country, which saw with courage, but without any exultation or jingo fever, the approach of war. The President of the republic returned to Paris from his Russian visit on July 29, and was warmly cheered as he drove with Gen. Joffre to the Élysée. There was perhaps a significance even in the warmth of those cheers; but had the scuffling on the boulevards been due to really deep feeling for or against war, the murder of Jean Jaurès, the idolized leader of the Socialists, as he was dining in a Paris café on July 31, would inevitably have led to very serious rioting. He was shot down by a Paris student named Raoul Villain, whose mind had apparently become affected by the ferocity of Royalist attacks upon the People's Tribune. (Villain was not brought to trial until March 1919, when, to the astonishment of everybody, he was acquitted.) The body of Jaurès was carried by Socialist stalwarts along the boulevards to his home at Passy without there being any disturbance of order. The next morning France was placarded with a ministerial proclamation explaining the crime and identifying the Government with the feelings of horror and grief which it had aroused.

Mobilization orders were posted throughout the country on Aug. 1; and at the same time was issued a presidential proclamation explaining that, though mobilization did not of necessity mean war, it had become a necessary step in view of the bellicose actions of Germany. The proclamation appealed to the country to refrain from any emotional displays which might embarrass the last efforts of diplomacy to preserve peace. These exhortations to be calm seemed to be superfluous. Mobilization was carried out quietly even in the effervescent capital. Scenes of jingoism were rare, and their significance was slight. A few Germans were naturally hailed as spies and roughly handled and some German shops were smashed up. A true picture of the national attitude towards war is to be seen in the sitting of Parliament on Aug. 4, when a presidential message was read outlining the history of diplomatic negotiations and their failure to weaken or stay the warlike intentions of Germany. In both Houses members stood in complete silence during the reading of the address, but the concluding appeal *"Haut les cœurs, et vive la France!"* was followed by the singing of the *Marseillaise.* In this demonstration of patriotic unity, in the applause which marked the words, "We are no longer partisans here, we are all Frenchmen," Socialists and Monarchists joined with equal fervour.

L'Union Sacrée.—Thus was born the political truce, the *Union Sacrée*, which for the first two years of war enabled French Governments to continue in office without having to meet open attack. For the first two years of war this immunity against criticism had its good points. It gave greater stability to the country's affairs; the supreme command had the sense of continuity essential for the preparation of the offensives of a long war. The system had also its disadvantages, for it meant lack of control, and, since rigorous censorship was imposed, the stifling of all public opinion. At the very outset of the war changes were made in the Ministry. Viviani, so as to free himself for the general control of the Cabinet, gave the portfolio of Foreign Affairs to M. Doumergue; Augagneur became Minister of Marine, and Sarraut succeeded him at the Ministry of Public Instructions.

Ministerial Changes.—On the eve of the first battle of the Marne the Ministry was further strengthened, Viviani resigning on Aug. 26 and forming a new Government. The steady advance of the enemy, the disasters at Charleroi and Mons, and the prospect of battle at the very gates of the capital, called for the presence of stronger men. The most important change was that which put Millerand in the place of Messimy at the War Office. Delcassé returned to the post from which German arrogance had forced him years before—to the Foreign Office; Augagneur took the Navy, Ribot Finance; and, as a concrete sign of the *Union Sacrée*, Socialist deputies were authorized by the party for the first time to take office in a bourgeois Cabinet. Marcel Sembat, one of its wittiest leaders, became Minister of Public Works, and Jules Guesde, a Socialist veteran of uncompromising principles, joined the Ministry without portfolio. The label "National Defence" was fixed to this Cabinet, which was representative of nearly all political parties. Its first concern was the defence of Paris. The day this Ministry was formed Gen. Galliéni replaced Gen. Michel in the military governorship of the city. The appointment of such a resolute die-hard as Galliéni to this post was a clear indication that, if the worst came, Paris would be defended and fought for even through her streets. The impression made by this appointment upon the public, which knew nothing of the course of events at the front, or indeed realized how near the front was drawing, was heightened by the arrival of thousands of refugees, who streamed into the capital from the direction of Amiens and Compiègne.

Departure for Bordeaux.—The closing days of Aug. were marked by a great exodus of useless mouths. The Government endeavoured, in conditions of great difficulty, to evacuate as many people as possible from Paris, but was naturally hampered in so doing by the fear of causing anything like a general panic among the population. It was therefore unable to issue any proclamation, and what measures it took to encourage people who were not forced to remain in Paris to leave for the provinces had to be carried out more or less *sub rosa.* Its own departure to Bordeaux took place by stealth. The Government and the President of the republic were bluntly informed by the commander-in-chief, Joffre, that their presence in Paris during a battle which would decide the fate of the capital could only give to the army unnecessary preoccupations of a political nature, and that they would best serve national interests were they to betake themselves well out of the zone of operations. The President of the republic and the ministers left Auteuil station secretly on the night of Sept. 2, and it was not until the following day that the country was told of this momentous step, in a proclamation which appealed to it "to fight and to endure," and which called upon members of Parliament to rally around the Government at Bordeaux, so as to form with it "a rampart of national unity." The Government was naturally followed to Bordeaux by all the embassies and legations, with the exception of those of the United States, Spain, Denmark and Norway, which were charged with the interests of one or other of the belligerent Powers. For days the roads to Bordeaux were encumbered with the heavy motor traffic of well-to-do refugees; the ordinary railway-travelling public had to put up with very great delays upon the line; the diplomatic train itself took over 24 hours to reach the temporary seat of the French Government. Most of the members of Parliament were prompt in their response to the appeal of the Government that they should go to Bordeaux. There was therefore not a little indignation when the Government almost immediately declared closed the session of Parliament which had been technically adjourned since Aug. 4. Discontent showed itself in a half-hearted attempt to prepare the Alhambra and Apollo music-halls for a meeting of the two Chambers. No session, however, was held at Bordeaux. Most deputies realized that a resumption of political activity in Bordeaux, while the fate of Paris was in doubt, would be viewed unfavourably by the country. Parliamentarians, moreover, had more immediate duties to perform in their constituencies. Parisian deputies had naturally remained behind, and for a time assisted Gen. Galliéni in his task of preparing Paris for the fight. Their activities in Paris were such as to lead to some misapprehension, and the fear that there might arise some sort of double government in the country. Those apprehensions were dispelled after a visit paid by Briand to Paris. After the Marne the Government remained at Bordeaux, endeavouring to make good the many deficiencies in army equipment and training revealed in the opening stages of hostilities. Shell shortage was the chief difficulty, and Millerand also had to consider the terrible deficiencies of French army medical services. Motor ambulances were practically non-existent; wounded had been left for days untended and lying in the filth of cattle and horse trucks; the hospitals themselves were not sufficiently numerous; they were badly organized and lacked elementary equipment. It was upon this second point that criticism of the Government first became open. Clemenceau, whose daughter was nursing in one of the Bordeaux hospitals, defying the censorship, daily thundered against the rottenness of Millerand's medical services; and when his paper, *L'Homme Libre*, was suppressed, it reappeared as *L'Homme Enchaîné*.

All the chief organs of public opinion had followed the Government into exile from the capital, and those which were unable to find printing accommodation at Bordeaux spread themselves through the cities of the south. During this period, in spite of vigorous censorship, sufficient became known to Parliamentarians and to journalists to make it apparent that the complete immunity from criticism which the Government had enjoyed could not with public safety be maintained. The demand that the censorship be relaxed, and that Parliament should be summoned to meet once more, became insistent.

Return to Paris.—The solidification of the front along the trench positions of the Aisne and of Flanders made it possible for the public services to return to Paris, which they did during the month of December. On Dec. 22 1914 the prime minister, Viviani, addressed the Chamber of Deputies, which had not met since Aug. 4. Even vehement critics of Government realized that at this first meeting of the Chamber under war conditions but one feeling could be voiced—the national resolve to fight on to victory. Viviani, in language strikingly similar to that used by Mr. Asquith previously at the Guildhall, declared, "France, in accord with her Allies, will not lay down her arms until she has avenged outraged right, and regained for ever the provinces ravished from her by force, restored to heroic Belgium the fulness of her material prosperity and her political independence, and broken Prussian militarism." He made an eloquent appeal for the maintenance of national unity, saying, "In order to conquer, heroism on the front does not suffice. Union must prevail within our walls. Let us preserve the *union sacrée* intact. To-day, as yesterday and to-morrow, let us have but one battle-cry, 'Victory,' but one vision before our eyes, 'La Patrie,' and one ideal, 'Right.'"

Parliamentary Criticism.—By the end of 1914 all sections of French opinion had realized that the British had been right in predicting that the war would be long; and those behind the scenes became seriously alarmed at the lack of preparation for a long-drawn-out struggle, the lack of a comprehensive and far-sighted programme of munitions and finance. Parliament had patriotically surrendered all its powers of criticism and control to the executive Government during the critical opening months of hostilities. Early in 1915 deputies, realizing that the only chance of victory lay in proper organization of the whole people for war, and that the trench line was a sufficient barrier behind which to accomplish this work, claimed once more to take an active part in the work of Government. The organization of French parliamentary life was very well adapted to parliamentary control. Through its big committees, representing all political groupings, the Chamber in peace-time was able to examine in detail all Government bills and all Government action. Those committees ceased to function in Aug. 1914, and did not resume their activities until 1915. When the regular 1915 session of Parliament met on Jan. 12, it was decided, with a view to reducing public sittings to a minimum, to increase the work placed upon those committees. The immediate financial necessities of the country were met by a bill authorizing the issue of Treasury and National Defence bonds. A number of other bills, dealing with points of minor importance, arising out of the war, were also submitted to the House, regulating such questions as naturalization of enemy aliens, marriage by proxy for men serving at the front, and prohibiting throughout the country the sale of absinthe. Throughout the first five months of this year finance occupied the chief place in parliamentary orders of the day, and Ribot, Minister of Finance, experienced no difficulty whatsoever in obtaining all the credits he considered necessary for the prosecution of the war. Outwardly all seemed quiet, but behind the closed doors both of Senate and of Chamber of Deputies Committees, the Government, and particularly Millerand, were being vehemently criticized for their alleged failure to provide the armies in the field with the vast amount of ammunitions of every kind required by trench warfare.

The attack upon Millerand was developed from every side, and the first public contentious debate in Parliament took place on a bill proposed by an advanced Radical, Dalbiez, providing for a vigorous combing-out in war factories and public offices. This bill, although opposed by Millerand, was accepted, though in an amended and somewhat mitigated form, by the Chamber on June 26. On July 1 a less direct attack upon the Minister of War was met, when the Government, forestalling a demand for the appointment of four war under-secretaries, created two such offices, and nominated Joseph Thierry, who was Minister of Public Works in the Barthou Administration, to be Under-Secretary of War for Commissariat, and Justin Godart to be Under-Secretary entrusted with the control of the medical services.

Meanwhile, M. Clemenceau, as president of the Army Committee of the Senate, was preparing a strong case against the whole administration of the War Office, and paving the way to public debate on the organization of parliamentary control, and the general relations which should exist in wartime between the three great organs of war-government, Parliament, Government, and the Supreme Command in the field.

The Military Control.—It was inevitable that any political crisis should either affect or be caused by the relations between the Supreme Command and the Government, and in considering the political history of France during the war this fact has always to be borne in mind. Quite apart from the many politicians who, with more vanity than sincerity, believed themselves to be the heaven-sent Carnots of the great war, there was wide-spread and not unfounded discontent with the bureaucratic methods of M. Millerand, and a wonder whether Gen. Joffre, with his "nibbling" methods and his vast patience, were really suited to the supreme control of the army. To these broad causes of dissatisfaction there was added one of a purely political nature, when Gen. Sarrail, who had always been identified with advanced Radicalism, was removed from his command at Verdun. (He subsequently became commander-in-chief at Salonika.) This had aroused the political passions of the Left, and they were still further inflamed by the presence of a practising Roman Catholic at the head of the medical services of the army, and by reports of religious pressure being brought to bear upon French wounded. This feeling came to a head when the Radical and Socialist-Radical groups called upon the prime minister to accept parliamentary control over all war services, and hinted to him that the departure of the Minister of War from the Cabinet would give it increased strength. M. Millerand, who, throughout the crisis, had displayed a fine obstinacy, declined to resign, and Viviani, after a prolonged Cabinet Council, announced that neither he nor any other member of the Cabinet would resign, thus leaving the Chamber the grave responsibility of upsetting the Government by a direct vote. Millerand, at an important sitting on

Aug. 20, vigorously defended his administration, and appealed to the House to support him in seeing that there should be no confusion between the parliamentary control and military authority, the principle he laid down being that "in war, authority and responsibility cannot be divided. Each military chief controls the actions of his subordinates, and is himself responsible for his acts to his superiors. The commander-in-chief is responsible to the Government, which can remove him if it does not approve of his acts." Only Viviani's eloquence, and an uneasy feeling among deputies that the country could not be expected to tolerate in war-time the upsetting of a Government after a debate held behind closed doors, defeated the proposal for the holding of a secret session of Parliament, at which all facts and figures concerning the army should be revealed.

When Parliament reassembled on Sept. 16 all further political agitation was stayed by the imminence of a French offensive in the Champagne, and by the involved state of Balkan affairs. By the end of the first week in Oct. disappointment with the results of allied diplomacy in the Balkans and the indecisive result of the French operations in Champagne led to a renewal of the demand for a secret parliamentary debate. The collapse of the Government was brought about by the resignation of Delcassé, Minister of Foreign Affairs. The division which followed the debate upon that resignation showed clearly that the Viviani Ministry was doomed. On Oct. 29 Viviani, in tendering his resignation to the President of the republic, stated that the last division of the Chamber had shown that a large minority favoured the holding of a secret session, which he had himself formally opposed. He considered it necessary that another should seek to re-create that parliamentary unity which was more than ever necessary to the country.

New Briand Ministry.—The new Cabinet was composed as follows:—Briand, prime minister and Foreign Affairs; Viviani, Justice; Gen. Galliéni, War; Rear-Adml. Lacaze, Marine; Malvy, Interior; Ribot, Finance; Méline, Agriculture; Sembat, Public Works; Clémentel, Commerce; Doumergue, Colonies; Painlevé, Public Instruction and Inventions; de Freycinet, Bourgeois, Combes, Guesde, Denys Cochin, Ministers of State; Jules Cambon, ex-ambassador to Berlin, became Secretary-General of the Foreign Office. With its under-secretaries the Government contained 23 members. It was very varied in its political complexion, comprising three Unified Socialists, three Independent Socialists, six Radicals and Socialist-Radicals, two moderate Republicans, one Progressist, and one member of the Right. The inclusion of such political veterans as Méline, Combes, and de Freycinet, who were soon known as the Elder Statesmen, and the placing of a soldier and a sailor at the head of the fighting services, were the only innovations of note, and Briand, in declaring that the motto of his Government was "Peace through Victory," took an early opportunity of assuring the world at large, and the enemies of France in particular, that the change of Government, far from being due to any change of policy, was but a reflection of the country's desire for a more vigorous prosecution of the war. Briand lost no time in pressing forward the first and most important part of his programme—that aiming at coördination of Allied effort in every field of the war, military, naval, financial, economic and diplomatic. With this end in view a number of Allied conferences were held in France during Nov. and a significant change was made in the functions of Gen. Joffre. His command, which had been confined to the armies of the North and the East, was extended so as to comprise the control of all French armies operating in Europe. Thus the Salonika Expedition came within his command. With closer working between the Allies it became necessary to give Joffre freedom for the consideration of large strategical questions, and, with that in view, Gen. Castelnau was appointed chief of the general staff.

Throughout the winter of 1915–6, those efforts for coördination continued in many a wordy conference, but when the Germans began the battle for Verdun, in March 1916, not much progress had been made. The critical situation at Verdun prevented any voicing of the discontent of Parliament at the slow progress made, both with this matter, and with the failure of the Government to make parliamentary control effective in the field. On March 16, Gen. Galliéni was forced by ill-health to resign (he died on May 27). Gen. Roques (b. 1856) succeeded him. He had made a reputation for himself at Verdun.

The remaining months of spring were filled with efforts to obtain Allied coördination, and with the critical development of the Verdun battle. When Parliament met again on May 18, financial requirements once again claimed immediate attention, and, for the first time, new taxation was imposed on the country. The constant political anxiety for parliamentary control, and for frank and full information as to the progress and conduct of the war, was strengthened by events upon the Verdun front, and finally Briand was forced by parliamentary pressure to accept a secret meeting of the Chamber. The immediate cause for this secret meeting was the change in the command of the Verdun armies. Gen. Pétain, who was appointed to the command after a hurried visit of inspection by Gen. Castelnau, was decorated a few days afterwards for having "adjusted a delicate situation." It became known that, before Castelnau's visit, preparations had been made for the evacuation of Verdun and the whole of that region on the right bank of the Meuse. Parliament desired to be acquainted with the elements of the delicate situation which Gen. Pétain had adjusted, and to be assured that, if there were any guilt in the matter, punishment should be awarded. There was also a desire for full information as to the steps taken to organize the Verdun front, for defensive purposes, before the German attack broke on Feb. 21, it having been reported by a member of the House (Major Driant, subsequently killed at Verdun) that the defensive organization was extremely defective. No Government worthy of the name could accept any secret debate which would give to Parliament the opportunity of discussing questions which were the sole concern of the military command, and which would hand over to the passion of politics the stability of command in the field. Briand therefore made it clear to the House that, if there were to be any secret debate, it must not be restricted to points of detail; that the discussion should cover the whole general policy of the Government; and that no vote should be taken in secret sitting.

The Secret Session.—For the first time in French history, the Chamber of Deputies constituted itself a secret committee on July 16. As a matter of fact, there was nothing which could be communicated to the House sitting in secret committee, with which its delegates on the Army Committee and Foreign Affairs Committee had not already become acquainted; and, as was remarked by one member, when the Government accepted the idea of a secret meeting, it was only a means of taking the whole country into its confidence. The proceedings, which were stormy, ended on June 22, and, at the public session which immediately followed, a motion of confidence in the Government was carried by 444 votes to 8. The advocates of parliamentary control had made headway, however, for the motion, while declaring that the Chamber desired strictly to refrain from intervention in the conception, direction or execution of military operations, adding that it meant to watch with increased care over the output of munitions and general army supplies. It further indicated the intention of the Chamber to have recourse to the procedure of secret committees, and, with the assistance of the Government, to organize a direct delegation for control on the spot of all services entrusted with army supplies.

The continuance of the battle of Verdun, and the bursting of the struggle of the Somme, made further political action against the Government impossible throughout the summer, although there can be no doubt that, had it not been for the pressure of the front upon internal affairs, Briand's Ministry would not have survived as long as it did. The proverbial luck of the prime minister came to his assistance at a critical moment in the summer, when, on Aug. 28, Rumania entered the war upon the Allied side. It was a brief gleam of good fortune, and probably nothing but the beginnings of a pacific movement on the extreme left of the Socialist wing kept the Government in power in the autumn. Time after time have extremists, by ill-timed attacks, kept the French Ministry from extinction, and when such men as Brizon, who went to Zimmerwald to discuss peace with German Socialists, daily insulted in the Chamber the ideals for which his countrymen were dying at the front, it was easy for a tactician such as Briand to profit by the indignation aroused.

Reconstruction of the Ministry.—These political considerations, and the necessity for the Loan of Deliverance, subscriptions for which were opened on Oct. 5, being undisturbed by political trouble, kept the Chamber more or less quiet until November. The difficulties of the country were, however, steadily growing; and it was apparent that the Government had lost the fund of energy and foresight with which it had started. Economic troubles were becoming extremely irksome; practically nothing had been done, save by dead-letter decree, to stamp out hoarding; transport, both by rail and sea, had been allowed to lapse into chaos, except for military purposes. In the early part of Nov. the Government, conscious of its shortcomings, and anxious to forestall parliamentary criticism, as well as to meet the growing public indignation, appointed M. Claveille, the head of the Western State railway, to be Director-General of Transports and Imports. An under-secretaryship of State for civil and military food supplies was also created, and the post was entrusted to M. Joseph Thierry. A number of food restrictions were also decreed, most of which, except in the remoter districts, remained very much a dead letter. On Nov. 28 all these matters of discontent, to which were naturally to be added the course of eastern affairs, the question of effectives (the 1918 class registration had been voted six days previously), and the High Command, brought about a further secret meeting of the Chamber. At the meetings, which occupied nine days, criticism of the Government was outspoken, and it was only after promising a smaller Ministry and reorganization of the High Command that Briand was able to obtain a vote of confidence. In his reconstructed Ministry Briand remained prime minister and Minister of Foreign Affairs; Ribot at Finance; Adml. Lacaze at Marine; Malvy at the Interior; Viviani stayed in the Ministry with the consolidated portfolios of Justice, Public Instruction and Labour; Clémentel took over the new portfolio of National Economy (Commerce, Industry and Agriculture); Herriot became Minister of Transport and Supplies; Albert Thomas, Minister of Armaments; Doumergue, Colonies; Loucheur, Under-Secretary for Armaments; and Gen. Lyautey was transferred from Morocco to the Ministry of War.

A Ribot Ministry.—This new combination had a brief and exciting existence. Accusations of dictatorship were made as soon as Briand, thinking to meet the Chamber's demand for firmer government, asked for power to settle a number of questions by decree. Both the deputies and the senators held a number of secret sessions, in which nearly every one of the Government's acts was vehemently criticized by speakers on all sides; and, early in 1917, it was clear that the Ministry could not long continue to face the growing hostility of Parliament. It died of anaemia. Its leader, wearied by the strain of office, and harassed almost beyond bearing by incessant criticism, partly no doubt patriotic, and also without doubt very largely political, could no longer see his way clear through this very dark period in the war. He lacked the reserve strength of character and the men required to deal with economic difficulties and to stir the country out of the war-weariness which was creeping over it. The immediate cause of his collapse was the resignation of Gen. Lyautey, a straightforward soldier with a horror of politics, and the supple compromises of the politicians. He resigned on March 14, after voicing his distrust of secret sittings. Briand failed to find a successor to him, and the whole Cabinet went on March 17.

M. Ribot met the Chamber four days later with a Ministry in which there were not many changes. It was composed as follows: Ribot, prime minister and Foreign Affairs; Viviani, Justice; Painlevé, War; Adml. Lacaze, Marine; Thomas, Munitions; Thierry, Finance; Malvy, Interior; Steeg, Public Instruction; Desplas, Public Works; Clémentel, Commerce; Fernand David, Agriculture; Viollette, Supply; Léon Bourgeois, Labour. This new combination was slightly more Radical than its predecessor, and its chief point of interest was the nomination of Painlevé to the Ministry of War. When the Briand Ministry was reconstructed in Dec., Painlevé declined that portfolio, and joined the Left in criticism of Briand's war-leading.

The Army Command.—One reason for this refusal had been the appointment of Gen. Nivelle to the High Command, and it was inevitable that one of the first things to be undertaken by the Government was a reorganization of the army command. Gen. Nivelle had prepared plans for a general offensive to be started on the Champagne front at Easter-time. He was allowed, after much criticism from the Ministry of War and from other commanders, to proceed with his arrangement in a modified form. Although the offensive produced some fruit, in the shape of prisoners and guns captured and territory re-won, it failed entirely in its main objective. Gen. Nivelle complained bitterly that the responsibility for this failure lay on the shoulders of M. Painlevé, whom he charged with having intrigued against him with generals under his command, and with having, by exaggerating losses sustained by the French in the operations, undermined the confidence of the troops in his leadership. He also charged the Government with not having done its duty in repressing the pacifist and seditious propaganda in the rear, which had affected the *moral* of some of his troops.

Gen. Pétain was appointed to the chief command on May 15, Gen. Foch becoming chief of the general staff with very extensive powers. May and June were filled with labour troubles of a very wide-spread nature. They coincided with mutinous developments among the troops at the front, and with the demand of the Socialists for passports for Stockholm to take part in the proposed international meeting for the discussion of peace. It was evident that behind all this agitation there were foreign men and foreign money. Labour troubles were smoothed down, a number of concessions being granted in the way of shorter hours; the military troubles led to the execution of a good many of the ringleaders, and also to attempts being made to improve the system of leave, and to release the older men from service at the front. Public opinion, which had been rendered very uneasy by these many signs of weakening *moral*, both military and civilian, became even more alarmed as the result of M. Caillaux's activities in preparing the way for peace. An attack delivered in the Senate by M. Clemenceau upon the way in which Malvy, the Minister of the Interior, had allowed a whole number of antipatriotic organs to carry on pacifist and pro-German campaigns in France brought matters to a head.

Painlevé Premier.—By the end of Aug. the position of the Government had become impossible. M. Malvy resigned on Aug. 31, and a week later the whole Cabinet followed suit. The Socialists refused to support Ribot in forming another Cabinet. He had incurred their enmity by refusing to allow their delegates to attend the Stockholm meeting, and they made the continued presence of any of their number in the Government dependent upon utterly inacceptable conditions of control, which, had they been put into effect, would have made the Government the prisoner of a Socialist Soviet system. Painlevé, however, found more favour in their eyes; but he refused to exclude Ribot from the Ministry, and, in spite of Socialist and Socialist-Radical opposition, the latter stirred up by M. Caillaux, retained him as Minister of Foreign Affairs. The new Ministry was Radical and Socialist-Radical in a more pronounced degree than any previous war Cabinet. Its birth was attended by intrigue and bitter party feeling. It represented the last and despairing effort of the old Radical gang and the Socialist extremists to save themselves from the advent to power of Clemenceau, whose fearless exposure of M. Malvy's backslidings had earned him tremendous popularity in the country. Painlevé was too closely identified politically with Malvy and his friends for it to have been possible for him to control the gathering storm. When he became prime minister, the first of the long series of treason scandals had been opened up. Almeyreda had died in prison; Bolo was in gaol; and more than one member of the Chamber of Deputies was involved in suspected dealings with enemy subjects.

Clemenceau in Power.—When, on Oct. 5, a definite accusation of treason was made against M. Malvy, the days of the Painlevé

Government were numbered. M. Caillaux, it was clear, could not escape searching investigation into his war-time activities. On Nov. 13 the Ministry was defeated by 279 votes to 186, and all the eleventh-hour efforts of Socialists and Socialist-Radicals could not keep Clemenceau from power.

Clemenceau quickly got to work, and showed, by the choice of his colleagues, that he intended to have as little as possible to do with the political patchwork system whereby each successive prime minister regrouped around him all the eminent failures of his predecessor's Cabinet. He himself, as a fighting leader, took the only portfolio which in his eyes had any importance at the moment—that of the Ministry of War. The rest of his Cabinet was as follows:—Nail, Justice; Pichon, Foreign Affairs; Pams, Interior; Klotz, Finance; Georges Leygues, Marine; Clémentel, Commerce; Claveille, Public Works; Loucheur, Munitions; Lafferre, Public Instruction; Henri Simond, Colonies; Colliard, Labour; Jonnart, Blockade; Boret, Supplies and Agriculture. Of these only Klotz, Clémentel, Claveille and Loucheur had held office previously during the war. M. Clemenceau surrounded himself by five under-secretaries at the War Office, one of whom was charged with the administration of military justice. The ministerial declaration read to Parliament on Nov. 20 was in its tonic effect upon the country as stimulating as a victory at the front. "The war and nothing but the war" was, he declared, his Government's one thought. "We have one sole, simple duty," he said, "to stand fast with the soldier; to live, suffer and fight with him; to cast from us everything that is not for our country." The rhetorical portions of his declaration amounted to a moral mobilization of the whole country. The concrete passages were concerned with treason, food restrictions and finance. Towards treasonable propaganda the Government would act without mercy. All such cases would be tried by court-martial; they would tolerate no more pacifist campaigns, neither treason nor half-treason. Within the month effect had been given to this determination. Those cases which had already been opened were handed over to the military legal authorities; the Malvy case had been sent before the High Court; the prefect of the Paris police had been removed from his post; the Government had applied for the suspension of parliamentary immunity in the case of Senator Humbert, Joseph Caillaux and two other members of Parliament. The parliamentary immunity was suspended before the end of the year; Caillaux was arrested on Jan. 14.

The Treason Scandals.—The chief *affaires de traison* which were investigated by military justice and the High Court were those arising out of M. Caillaux's visits abroad and activities at home, from M. Malvy's administration as Minister of the Interior, the sale of *Le Journal*, the policy of the *Bonnet Rouge*, and Bolo's connexion with both these last-named matters. All the cases were closely connected one with the other, and the prosecution sought, in the conduct of each one of them, to show that M. Caillaux was involved in all. Bolo was on friendly terms with Caillaux and Malvy, and had acquired an interest in the *Journal* and the *Bonnet Rouge*. His was the first case to come for trial before the third Paris court-martial. The case opened on Feb. 4 1918, when Bolo and a subordinate figure, Porchère, were in the dock, Cavallini, an Italian, who was also charged, being in Italy. Lt. Mornet, acting as public prosecutor, outlined the case. He charged Bolo, under nine different clauses of the penal, military and criminal code, with "having entered into communication with the military power of Germany, notably through the ex-Khedive of Egypt, with the object of favouring enemy undertakings; having with the same object in view received from Cavallini moneys sent by the German Government to the ex-Khedive in order to create a pacifist movement; having in 1915 endeavoured for the purposes of the enemy to buy shares in the *Figaro* with money of German origin; having in 1916 received money from the German Government for the purpose of creating a movement of opinion favourable to the enemy in the French Press; having furnished to M. Humbert, director of the *Journal*, enemy money with a similar intention." The prosecution showed that Bolo had made efforts, ever since 1915, to corrupt the French Press. After Germany had lost the first battle of the Marne she turned round in search of other weapons with which to restore her military fortunes. Bolo, who was a hanger-on of the former Khedive of Egypt, went to see him in Switzerland, where he was playing an important part in the German system of espionage and intelligence. Bolo suggested pacifist operations in the French Press. Herr von Jagow, then German Minister for Foreign Affairs, accepted the scheme submitted and promised to support it with 10 monthly payments of 1,000,000 francs. In March 1915, the ex-Khedive received 2,000,000 marks from Germany, and paid a portion of this sum to Bolo, who invested 150,000 francs in the *Rappel*, and tried to obtain interest in *La Revue*, the *Cri de Paris*, the *Figaro*, and *l'Information*. The German Government, apparently considering that it had not received its money's worth from this payment, a large portion of which was devoted by Bolo to the settlement of his personal and pressing debts, did not carry out the rest of the programme. Bolo thereupon played for higher game, and, having obtained an option on the controlling interest in the *Journal*, went to America, where he was provided with £336,700 by the German Government, £220,000 of which he used to purchase shares in the *Journal*.

The Bolo case aroused an immense sensation, not only because of the revelation of the danger to which France had been exposed from treason from within, but also on account of the high position occupied by many of the witnesses, and perhaps especially by reason of its bearing upon the cases of MM. Caillaux and Malvy, with both of whom, as the correspondence produced showed, Bolo had been on intimate terms. Fruitless attempts were made by the defence to compromise the President of the republic, Poincaré, and to discredit the Clemenceau Government. Eleven questions were put to the court on the last day of the trial, Feb. 14, and to each the unanimous reply of guilty was returned. Bolo was condemned to death, Cavallini was sentenced to death *in contumaciam*, and Porchère was sentenced to three years' imprisonment. Bolo, after appealing both to the courts and to the President of the republic against his sentence, after trying to save his life by eleventh-hour revelations, was executed at Vincennes on April 17.

Bonnet Rouge Trial.—Twelve days later the gang of the *Bonnet Rouge* came before the third court-martial. In this case there were seven accused, four of whom were charged with intelligence and commerce with the enemy—Duval, Marion, Goldsky and Landau; one, Joucla, with intelligence with the enemy only; and two others, Vercasson and Leymarie, principal private secretary of the Minister of the Interior, with complicity in commerce with the enemy. The first notification of the case was the arrest at the Franco-Swiss frontier of Duval, who was then found to be the bearer of a German cheque for over six thousand pounds. The investigations of the French police showed that the *Bonnet Rouge* was the centre of a chain of newspapers established in Paris, with no other apparent purpose than that of spreading despondency and doubt among the French as to the justice of their cause, and suspicion as to the honesty and loyalty of their Allies. The arrest of Almeyreda soon followed that of Duval. Almeyreda was an unsavoury and needy hanger-on of politics, who had fished in the troubled waters of anarchist and communist ideas before the war; had furnished Caillaux with a bodyguard of toughs to protect him during the trial of his wife for the murder of Calmette, and remained in touch with him as well as with Malvy throughout the war. He founded the *Bonnet Rouge* in 1913 as a weekly paper, and with funds supplied by Caillaux, after the murder of Calmette, transformed it into a daily publication in 1914. It was on his representations that, when the war broke out, M. Malvy, then Minister of the Interior, agreed not to proceed with the arrest of those who were nationally suspect, and of whom a list had been prepared in anticipation of war. This list included a number of political undesirables, among whom was Almeyreda himself. He was found dead in gaol on Aug. 14 1917, and, although he was known to be a morphine maniac, the circumstances of his death, and the interest which certain highly placed personages had in his disappearance, led to definite charges against the prison authorities. At the trial it was shown that Duval had received about £40,000 from a Mannheim banker called Marx, who acted as distributor of German Secret Service money in Switzerland during the war. It was also shown that in the Ministry of the Interior complete chaos prevailed in the police services, which were themselves in conflict with the secret services of the War Office; that it was with the connivance of M. Malvy (who, as Minister of the Interior, had subsidized the *Bonnet Rouge*) and his *chef de cabinet*, Leymarie, that Duval obtained passports for some of his visits to Switzerland.

The trial ended on May 15, when Duval was sentenced to death, Marion to ten, Landau to eight, Goldsky to eight and Joucla to five years' imprisonment with hard labour. Leymarie was sentenced to two years' imprisonment and a fine; and Vercasson to two years' imprisonment with benefit of the First Offenders' Act, and a fine of 5,000 francs. Duval's appeal was dismissed on July 11, and he was shot a few days afterwards, on the eve of the opening day in the proceedings against M. Malvy, who, for three years during the war, and in five successive Governments, had been Minister of the Interior.

The Malvy Case.—Malvy appeared before the Senate, sitting as a High Court, on July 16 1918. The charges against him, in practice though not in law, were first formulated by Clemenceau in his attack upon the Ribot Government in July 1917, when he showed how greatly negligent administration at the Ministry of the Interior had encouraged defection, both at the front, and behind the lines. That attack led to Malvy's resignation, and to the fall of the Ribot Government, and later, in Oct. 1917, it was given a sensational sequel by the Royalist, Léon Daudet, editor of the *Action Française*, who, acting as chief spy-hunter during the war, had aroused public and Parliament to a knowledge of the danger of allowing enemy agents and traitors complete freedom of action in France. In his newspaper for months he had attacked Malvy; and on Oct. 4, in a letter addressed to President Poincaré, he roundly accused Malvy of having betrayed France during the three years' term of his office during the war; of having communicated the French plan of attack on the Chemin des Dames in the spring of 1917 to the enemy, and of being partly responsible for the military mutinies which followed that attack. So slow is the machinery for bringing a member of Parliament to trial before the High Court, that the report of the Senate Committee on the charges was not read until July 16. It was upon that report that M. Malvy was charged with a number of acts committed between 1914 and 1917, calculated to favour the cause of the enemy, and to incite French soldiers to revolt. The reporter, Senator Pérès, briefly dismissed the definite charge of treason made by Daudet, but examined in some detail the effect of Malvy's policy of tolerance and slackness on the *moral* of troops at the front. He showed that while first Gen. Nivelle, and afterwards Gen. Pétain, were vehement in their requests for sterner measures in dealing with defeatist propaganda, Malvy and his police turned a deaf ear towards them, and that Malvy actually, on the eve of the military mutinies which affected over a hundred French battalions in the front zone, complained of "myths that are too easily believed." The military and civil police were constantly at warfare. The soldier urged that foreign and other suspects should not be permitted to roam about the country; and while Malvy maintained with equal vigour that it would disturb public opinion to make many arrests, the police in his care actually furnished passports and gave missions to men whom their own services had denounced as enemy agents. One passage of the report which had special bearing on the approaching Caillaux case was that in which it was shown that when Caillaux was visited by an Austrian peace agent, and while he was being shadowed by the police, he was warned by Malvy.

The Public Prosecutor, in his opening, ignored Daudet's accusations, and charged Malvy with culpable negligence in the administration of his office; with having been, instead of a servant of his country, the servant of a politician, Caillaux, who desired to keep his power in politics although he was himself discredited and out of office. Instead of acting as the sword against the suspect and the treason-monger, whenever the name of Caillaux was involved he acted as the shield, ordering that surveillance and prosecution should be stopped, restraining what zeal his police possessed in controlling and stopping the activities of secret anarchist printing works, revolutionary committees, and the spreading of Bolshevik and pro-German doctrines. The Public Prosecutor showed that Malvy had been duly warned in a document drawn up by one of his own chief officials, known as the Red Book. This work, of which six copies only were made, was given to the President of the republic, the prime minister, the prefect of police, Hudelo, and Malvy himself. The vital period in the case was that which followed Gen. Nivelle's unsuccessful offensive in the Champagne. It was then, as Caillaux subsequently wrote, in *Mes Prisons*, that his own policy of conciliation with Germany, and Clemenceau's policy of victory over Germany came to grips. The country was low-spirited, war-weary, and suffering from a bad political and economic leadership. It was at this time that the defeatist propaganda became most intense. The agitation for a Socialist Peace Conference at Stockholm had made considerable headway among the people; the *Bonnet Rouge* and all its offspring were most active; men coming back from leave were addressed by agitators, given seditious literature; the *Bonnet Rouge* was distributed free in the trenches; troop-trains returning from the front had on several occasions to be kept out of Paris, so clamorous were the men for peace; in 118 battalions, including some of the best troops in the French army, mutinies broke out and had to be repressed with military severity; the streets of the capital were filled with strikers, and labour troubles were spreading through the provinces. All that the military leaders had dreaded had come to pass, and any action Malvy took was always in favour of the agitator.

The evidence given at the trial by police officials, civil servants, and soldiers, concerned with the *moral* of the army and employed in the intelligence services of the country, showed that the whole machinery of police and counter-espionage had been devoted to the protection of political patrons, their friends and allies, rather than to defending France and confounding the designs of the enemy. Complete anarchy prevailed. Police records were lost, suppressed or stolen by the various personages most concerned. Official fought official, department was arrayed against department, ministry against ministry, to such an extent that the public and the Senate could have been pardoned in believing that Malvy and his friends and officials thought themselves engaged, not in a struggle for national existence, but in a civil service war. Political capital was naturally made by the defence out of the fact that Cabinet sanction, delivered by successive prime ministers, Viviani, Briand and Ribot, had been obtained for the acts performed and the policies pursued by Malvy as Minister of the Interior in their respective Governments; and the solidarity of politicians was shown when those three former prime ministers, with the latitude allowed by the elastic customs of the law, made with their testimony three speeches for the defence.

The trial came to an end on Aug. 6, after a lot of legal and political quibbling, when the Senate, definitely dismissing Daudet's charge of direct treason, found Malvy guilty of "forfeiture"—a charge correspondent to the old one of "forfaulture"—by 101 to 81. This amounted to declaring that Malvy had been guilty of such gross general negligence as amounted to treason. The Court found:—

> "That M. Malvy, acting as Minister of the Interior, and in the exercise of his functions from 1914 to 1917, has failed in, violated and betrayed the duty of his task in conditions which place him in a position of forfeiture, and has therefore come under the criminal provision of Art. XII. of the law of 1875. The Court therefore condemns M. Malvy to five years' exile, but without civic degradation."

The verdict pleased no one in particular, but it was delivered on a day when Gen. Foch's nomination to be Marshal of France marked the beginning of victory. It aroused no political or public sensation, and, on Aug. 10 Malvy, after protesting his innocence, left Paris for San Sebastian and exile.

The Caillaux Trial.—Caillaux did not actually come up for trial until Feb. 17 1920, although it was the third time that the Senate had sat as High Court to consider his case. The previous dates in the case were:—(*a*) demand for suspension of Caillaux's parliamentary immunity, Dec. 11 1917; (*b*) immunity voted by

Chamber, Dec. 23; (*c*) Caillaux arrested, Jan. 14 1918; (*d*) decision to try him before High Court of Senate, Oct. 1918; (*e*) Senate Committee's report on case, Sept. 17 1919. All the time that Caillaux was under arrest, a part of which period he spent in a nursing home, he was under constant examination, either by the military authorities, or by Senator Pérès, who was appointed to report on his case. The indictment against Caillaux was one of having "since the declaration of war, in 1914-5-6-7, in France and especially in Paris, and abroad, sought to undermine the security of the State abroad by manœuvres, machinations, and intelligence with the enemy, favouring the undertakings of the enemy against France or against her allies fighting against a common enemy, and of such a character as to favour the progress of enemy arms; crimes punishable by Arts. 77 and 79 of the Penal Code, and by Arts. 205 and 64 of the Code of Military Justice." The act of accusation reproached Caillaux with the fact that while the rest of his colleagues in Parliament were pursuing a common national policy, Caillaux remained outside that community and was indeed the man upon whom Germany pinned her hopes of a premature peace. This document maintained that when Germany gave 20,000,000 francs for the purchase of the *Journal* to Lenoir, whose father had been employed by Caillaux during his secret Moroccan negotiations, she saw behind Lenoir Caillaux himself, and that the same thought inspired them in their dealings with Bolo. This tendency of the German Government to look upon Caillaux as their man was further shown by German censorship and army orders forbidding any praise of Caillaux which might compromise a person "whose activities may still be useful to us." This German trust in Caillaux was, according to the prosecution, based upon his pre-war negotiations with Germany in connexion with Morocco, and was further explained by Caillaux's connexion with the *Bonnet Rouge* and its group of defeatist newspapers. Caillaux, the act of accusation roundly declared, was "the pivot of treason." His own actions in S. America in 1914, and in Italy in 1916, went to support the arguments of the prosecution. In S. America, whither he was sent on a mission created in order to keep him out of mischief in France, he fell straight into the hands of a German agent, who kept his Government informed of Caillaux's actions and conversations. On his return from S. America at the beginning of 1915 he received the visit of Hungarian agents acting the part of Germany, who desired to engage in peace negotiations with him. During his Italian journeys Caillaux was again the centre of all the disaffected elements, and his conversation was such as to arouse alarm in the minds of the Italian Government and the foreign embassies and legations. He spoke freely of France being exhausted by the war, and of the time when he would assume power again and conclude peace with Germany.

In a safe which Caillaux had rented in a Florence bank, a number of extremely important documents were discovered, among them being a plan for a *coup d'état*. This plan provided for a complete change of all army commanders and generals; for the dismissal of the Chamber; for the summoning to Paris of certain regiments; for the arrest of a number of the chief patriotic politicians and newspaper directors; and the creation of a small ministry composed of dependable men. Peace, according to these notes, was only to be made after a referendum, and a law, which Caillaux himself called the Rubicon, was to be passed according to which for a period of 10 months the President of the republic could govern by decree. The document included a list of possible collaborators, and mentioned among those people who might be used, Landau, who was serving a sentence for treason, and Almeyreda, who committed suicide in prison while awaiting his trial on the same charge. Ceccaldi, a Corsican friend of Caillaux, was to be appointed prefect of police, in control of all the Secret Service of France. All the people belonging to the Royalist *Action Française* were to be arrested and tried for treason.

Caillaux defended himself with the utmost vigour. He declared that it was not his fault, or by his desire, that all the undesirable agents of Germany looked upon him as their prey; that he was a patriot who had a policy. That policy might be right or wrong, but the mere fact of having opinions could not be regarded as a crime. As to the plan for the *coup d'état*, it consisted simply of notes jotted down with the natural detachment of a politician, and there was nothing to show that they represented his real convictions. He vigorously fought witnesses from Italy and S. America, but in spite of all his mental ability, was unable to furnish the High Court with a plausible excuse or explanation of the fact that he had been, throughout the war, the magnet for every intriguer for premature peace. On April 23 1920, Caillaux was condemned to three years' imprisonment, for ten years to the loss of his civic rights, and for five years to reside within a zone to be indicated to him by the Government, as well as to the costs of the case, amounting to about 53,000 francs. This verdict meant, since he had been already imprisoned for three years, that he was released the next morning. He went to live at Mamers, and was forbidden to come to the capital without permission from the Government. The formal verdict of the Court found him guilty of having been in relation with enemy agents in S. America, in Paris, and in Italy; with having been in correspondence with the enemy; and with having, owing to "guilty thoughts or ambitions," given to the enemy information of the greatest value to him for the conduct of his defeatist propaganda in France; but exonerated him from the guilty intention required by Art. 77 of the Penal Code. The verdict was given at a time when the whole trial had ceased to have the burning importance it would have had during the war, and when Caillaux, in any case, would have had to disappear from French political life.

The Journal.—In addition to Bolo, Senator Charles Humbert, who had played an important part in the Army Committee of the Senate; Pierre Lenoir, the son of a wealthy publicity agent, who had been employed by Caillaux; Desouches, an ex-barrister; and Georges Ladoux, captain of infantry, employed at the Central Intelligence Department in Paris, were involved in the charges arising from the purchase of the *Journal.* They were brought to trial before the Third Court-Martial, on March 31 1919. After sitting for 34 days, the Court found Lenoir guilty of intelligence with the enemy; Desouches guilty of commerce with the enemy; and acquitted Charles Humbert and Capt. Ladoux. Pierre Lenoir was condemned to death on May 8 and Desouches was sentenced to five years' imprisonment, and a fine of 20,000 francs. These were the main treason cases, but a host of minor treasonable fry was brought to trial by the energy of Clemenceau's military justice.

Clemenceau and Man-power.—He was no less vigorous in keeping the promises of his ministerial declaration in other directions, and the country was given an example of what resolute government can achieve when it has a clear aim before it, and takes its courage in both hands. The Painlevé Government, in a desperate effort to cling on in office, had declared it impossible not to release the older men from service in the army. Clemenceau tackled the man-power nettle in quite another manner. He roundly informed the Chamber that, in spite of approaching American aid, thanks to the disaffection of Russia and the general losses suffered by the French armies, the outlook for the future was not bright. The army demanded more men, and Clemenceau, who declared that his only war aim was to conquer, lost no time in getting them. The debate on Dec. 28 1918 showed that the Chamber intended to support Clemenceau who, far from holding out hopes of release to the older men with the colours, reminded the House that there were 1,200,000 mobilized men working in the rear who would if it were at all necessary have to return to the colours. He announced that the 1919 class would at once be got ready for active service, and that two classes of released conscripts would at once be called back to the army for a period of six weeks or two months, in order to carry through the programme of defensive works declared by G.H.Q. to be indispensable. A rigorous comb-out of all Government offices was carried through by M. Jeanenney, and all mobilized men of the 1914 class employed in State establishments in the rear were placed at the disposal of the commander-in-chief. Heavy increases in taxation, and a rain of decrees restricting consumption, closing shops and suspending manufacture of certain goods, were further evidences of the Draconian nature of the Government's policy. The food restrictions, however, remained (especially in the large towns) very largely a dead letter. From this point of view Great Britain was far ahead of France. Nevertheless, life was made irksome in more than one direction, and with events going far from well at the front; with great raiding activity on the part of the German air squadron; and with the opening of the bombardment of Paris on March 23 by a gun situated over 70 m. distant from the capital, the French people, and the Parisian population in particular, had many reasons for despondency.

The alert courage and tireless energy of Clemenceau throughout those dark months acted as a tonic both on the army at the front, where he was known as *Père la Victoire*, and upon the civilian populations in the rear. Clemenceau was constant in his visits to the trenches, whence he always returned with a fresh store of serene confidence. The appointment of Gen. Foch to be chief of the western front was also bracing in its effects. Throughout the summer the Government was called upon to deal with some firmness with the growing section of extremists in the Socialist and Syndicalist parties, which, with every fresh reverse in the field, redoubled their opposition to Clemenceau. By the first week of June the question of the defence of Paris had again been considered, and some preliminary work had been done in preparing plans for evacuation. By June 25 the department of the Seine was declared to be within the army zone. Confidence in the army was however markedly greater than it had been when Paris was imperilled in 1914. It received a striking justification when the great French counter-offensive broke mid-July.

The Armistice.—From that day to the signature of Armistice on Nov. 11 1918 the political history of France was written by the triumphant armies sweeping the Germans out of the country. The population had been prepared for victory, and in Paris had seen for some weeks tangible signs of the discomfiture of the Germans, in the masses of captured cannon which filled the Place de la Concorde and lined the Champs Élysées up to the Arc de Triomphe. When it was announced, on the morning of Nov. 11, that the Armistice had been signed, the whole country gave itself up to rejoicing, while Allied leaders continued the preliminary discussions with regard to the meeting of the Peace Conference. The month of Nov. was filled with scenes of triumph in the liberated regions and in the recovered provinces of France, where the inhabitants gave to the returning French troops a welcome which had not grown any the less cordial for keeping. The King of the Belgians and King George both paid official visits to Paris. King George, accompanied by the Prince of Wales and Prince Albert, arrived in Paris on Nov. 28 for a visit of two days. Great cordiality was the tone of the official speeches, and of the public reception given to the British sovereign.

Peace Conference.—Opposition to Clemenceau, which he had with ruthless methods kept under in defeat, dared not show itself while the German armies were being swept beyond the frontier. When the Armistice was signed, however, it again became apparent in Radical-Socialist and Socialist quarters, and even among Radicals of a less extreme character, who felt that, while Clemenceau might be an excellent man for the waging of war, he was not likely to prove a satisfactory negotiator of a peace by which the whole future of the world would be settled. Such was the overwhelming popularity of Clemenceau, however, that this reaction against his almost dictatorial power made but a faint ripple on the political surface. With his customary sturdy self-confidence, Clemenceau never for an instant contemplated leaving the making of peace to other hands than those which had forged the victory. He refused to accept a general debate upon foreign policy, and turned a deaf ear to all parliamentary criticism of his qualities as a peacemaker. The opposition brought matters to a division on Dec. 17, but could only muster 170 votes. A frontal attack upon the Ministry was again begun on Dec. 26, when some of the motives animating the opposition were clearly expressed. A great number of parliamentarians felt indeed that it would be unwise to permit a one-man Government such as that of Clemenceau to negotiate peace. By private intrigue, and in the public press, Clemenceau was urged to go back to the cabinet system which prevailed throughout the war until his arrival in power, and, if not to form a coalition Ministry, at least to include among the French delegates to the Peace Conference some of the political leaders of the country, such as Briand, who were not in his Ministry. The debate ended on Dec. 29, when Clemenceau and Pichon outlined the attitude the French Government would adopt towards questions of peace. During its course the Government was invited by the Socialists Marcel Cachin and Albert Thomas, and by the Radical-Socialist Franklin-Bouillon, to declare its policy with regard to nearly every world problem, including the League of Nations, the frontiers of Alsace-Lorraine, the future of the Saar, the resumption of relations with the Vatican, the left bank of the Rhine, the Middle and Near Eastern questions, Africa, and Russia. Clemenceau frankly stated that although the old political system of the world appeared to be discredited, he still remained faithful to it. He pointed out that, had that old system been developed, had the United States, Great Britain, France and Italy, before the war declared that whoever attacked one of them would have to expect the other three to join in the task of common defence, there would have been no war. It would be his aim, he said, to preserve during the Peace Conference the alliance of those four Great Powers, and he would make every sacrifice to maintain that entente. He declined to be drawn into any further and more detailed explanation of the policy he would pursue at the Conference, pointing out that, although he desired to obtain satisfaction for every just claim of France, there might be some which would have to be sacrificed in the interests of humanity in general, and that he did not want to arouse hopes which might be doomed to disappointment. He declined on political grounds to discuss the arguments which he intended to use in negotiation with the other Allied statesmen. The division figures gave the Ministry a vote of confidence by 398 to 93, a demonstration of parliamentary support almost as striking as that of the public support given to Mr. Lloyd George by the general elections on the eve of peace.

The French opposition, during this skirmish, made much of President Wilson's presence in Europe. He arrived in Paris on Dec. 14. In France his various messages, his notes to Germany and to the Allies, had been read by large masses of the people as heralding the dawn of a new era. They appealed by their very ambiguity of phraseology to the latent idealism of the Latin mind. This somewhat ignorant and crude emotion was fostered by the authorities through the press, which for weeks before his departure from America was busy fanning enthusiasm for the great American who was to put into effect the teachings of the Sermon on the Mount. Other sections of the community were led by motives of quite another nature to acclaim President Wilson as the great leader of civilization. While the official press was loud in praises, for reasons of courtesy no doubt, but mainly for reasons of policy, the extremists endeavoured to make the most of Wilson, to wrest him, as it were, from the arms of Clemenceau and his supporters. They did their utmost to exploit the difference of character and of outlook which without doubt existed between Clemenceau and the President. Both these forces, together with the undoubted enthusiasm aroused by America's participation in the war, led to Wilson being given a reception in France such as had never before welcomed a foreign chief of state. Clemenceau's attitude towards the League of Nations, to take but one point of difference between the two men, was that he was quite prepared to study the idea, and even to give it a trial, but that until that safeguard of international peace had proved its efficiency he could sacrifice nothing which helped in any way to build up the security of France against aggression.

The opposition to Clemenceau also sought to make capital for internal political purposes out of differences of opinion between the British and French Governments as to the policy to be pursued towards Russia. Under the influence of Marcel Cachin and Moutet, two Socialist deputies who had visited Russia after the revolution, the Socialist party was steadily tending towards support of Bolshevist principles, and bitterly resented Clemenceau's refusal to accept Russian revolutionaries as his political gods. In spite of the overwhelming size of the Government majority at the end of the debate on Dec. 29 1918, his opponents, although defeated, were not dismayed, and piled up a mass of interpolations upon every imaginable question of home and foreign politics. On Jan. 16 1919 there were no fewer than 13 interpellations before the Chamber waiting for a day to be fixed for their discussion. Clemenceau said that he could not possibly agree to resume the debate which had already ended in a vote of confidence for the Government. He pointed out that the Peace Conference had already begun its labours, and that if the Government were to be allowed to work properly therein, the Chamber must exercise its right of interpellation in a moderate spirit, and refrain in public debate from making capital out of supposed divergencies of opinion between different Governments. As in the matter of choice of the French peace delegation, so in this matter, Clemenceau relied upon his popularity with the country to get for him his own way. Instead of nominating, as he had been urged to do, eminent politicians to the peace delegation, he chose his collaborators at the Conference from his own Ministry and his own officials. M. de Tasta, French ambassador at Berne, was appointed general secretary of the Conference; the other delegates being Pichon, Minister of Foreign Affairs; Klotz, Minister of Finance; Jules Cambon, former French ambassador in Berlin, and André Tardieu (b. 1876), High Commissioner for Franco-American Affairs. Of these men the last was, after Clemenceau, the most important member of the delegation, and he was destined in later days to become the chief defender of Clemenceau and the Treaty of Versailles in the long campaign made against both in Parliament. He was an attaché at Berlin in 1897, acted as prime minister's secretary under Waldeck-Rousseau until 1902; he then became foreign editor of the *Temps*, where he made his influence widely felt; he has held chairs at the École des Sciences Politiques and at the École de Guerre; he entered French politics in 1914; acted as censor at the beginning of the war; served in the field until he was invalided out, when he was appointed French High Commissioner to the United States.

Clemenceau and the Opposition.—In France more than in any other country the actions and deliberations of the first six months of 1919 were to form the bulk of the political raw material of the country for years to come. The presence of the Peace Conference in Paris, moreover, had a very great influence upon the whole affairs of the country. Delegates swarmed in the streets of the capital. There were no fewer than 70 of them at the first sitting. Each of them was accompanied by a cloud of experts, secretaries and other minor officials. They filled the hotels and restaurants, and contributed very largely to increasing the almost prohibitive cost of living. The British delegation occupied two giant establishments, the Hotels Astoria and Majestic; the Baltimore and La Pérouse hotels accommodated minor officials; and special printing works were built for the British delegation in the Bois de Boulogne. Mr. Lloyd George and Mr. Balfour occupied large flats in the rue Nitot opposite the Bischoffsheim residence which President Wilson, after leaving Prince Murat's palace, made his home. The American delegation was housed at the Hotel Crillon, and there was hardly a single state represented which did not have one hotel of its own. The press had the over-magnificent residence of the late M. Dufayel in the Champs Élysées placed at its disposal as a club. In spite of this gathering of diplomats, the hangers-on of diplomacy, and statesmen, there was but very little of the public "junketing" which marked the Congress of Vienna. Clemenceau would have none of it, and this feeling was shared by Lloyd George and President Wilson. Any socially brilliant functions which might have been held, would have aroused comment in Parliament, and both Clemenceau and Lloyd George were acutely conscious throughout the proceedings of the importance of looking after their respective Chambers.

Clemenceau, although strong in repeated and heavy votes of confidence, was nevertheless aware that the trust reposed in him by the Chamber of Deputies was due rather to the fact that the Chamber of Deputies had no alternative than that it loved him for himself alone. On several occasions during the Conference, when a point which he considered vital for France was at stake, he threatened to resign rather than to ask his Parliament to accept the suggested compromise. He was attacked with the utmost ferocity in the years which followed the signature of peace, for having sacrificed the interests of France to the friendship, both personal and political, which he had always entertained for Great Britain. During the progress of the Conference, however, his critics either did not dare or did not care to come into the open. Clemenceau's appearances in the Chamber were few and far between. He reserved his strength, his patience and his passion for the discussion of peace, and left the Chamber to glean what information it could through the public press and the workings of its various committees.

He was forced to suspend his work for a time on Feb. 19. As he left his house in the rue Franklin to drive to the Ministry in the morning a French anarchist, Émile Cottin, emptied a Browning pistol into his car. He was wounded by one of the bullets below the left shoulder-blade, and stood the shock with extraordinary calmness, transacting business in his own house within a few hours of the attempt. As week after week passed without showing any perceptible advance towards the conclusion of peace, and without there being any sign of the Government intending to consult Parliament with regard to the terms, considerable dissatisfaction was shown. It was expressed in violent criticism in a debate in the Chamber on March 26 by Franklin-Bouillon, president of the Foreign Affairs Committee; by the Budget Committee of the Chamber, which expressed to Clemenceau its regret that he did not intend to communicate the peace terms to the Chamber until after their signature, and that while the country was in a situation without any precedent Parliament should thus be confronted with a *fait accompli*, and should have no other method of expressing its opinion of the peace than by accepting it or rejecting it in all its clauses; and by the Senate, where an unofficial manifesto was signed by every member present, reminding Clemenceau of what France expected to find in the Treaty of Peace. At the same time, the Confédération Générale du Travail had placarded Paris and the provinces with a vigorous protest against what it termed the *sabotage* of peace.

Internal French Situation.—Clemenceau's strength as a war fighter and his pertinacity as a negotiator of peace, cannot be denied. Neither can the failure of his administration to cope with current economic and labour questions be disputed. From the start of his Ministry the more or less Draconian decrees as to food restrictions were not applied in the spirit in which they were drawn up. The Food Minister, Vilgrain, opened a number of State stores for the sale of groceries and other food-stuffs, but was unable by this method to make any impression upon prices. A bill was introduced on Feb. 5, inflicting drastic penalties upon speculative profiteering, but that measure also remained without effect. A hundred municipal butchers' shops were opened, but they also failed to stem the rising tide. These economic factors, together with political aspirations aroused by the course of events in Russia, led to a number of labour disturbances during the first four months of the Peace Conference.

Clemenceau was never a popular figure with Labour; his action in suppressing strikes had been far too vigorous for the workman's taste. They were therefore all the more surprised when, on Jan. 1, Clemenceau received the syndicalist delegates and asked the Confédération Générale du Travail to submit to him their economic demands, so that he might communicate those which were ripe for discussion to the Peace Conference. The moderate leaders, however, who were quite willing to accept this offered coöperation of Clemenceau, were unable to control the rank and file movement which led to a transport strike in Paris on Jan. 24, which brought to a standstill nearly all the city's methods of communication. Claveille immediately placed those services under military control, and the next day work was again resumed. On Jan. 27 there was further trouble on the P.L.M. system where a one-minute strike was called by the local executive.

The acquittal of Villain on March 30 for the assassination of Jaurès gave to Labour's economic discontent a political impetus, and in spite of the introduction of an eight-hour-day bill by M. Colliard, Minister of Labour, on April 8 Labour remained sulky. The bill was adopted after three days' discussion, on April 18. In spite of this and other indications of the conciliatory attitude of the Government toward Labour, the extremists pressed forward with their plans for an unusually impressive Labour Day demonstration which as it happened to be but a day or two after the arrival of the peace delegates at Versailles, the authorities determined should be either peaceful or suppressed with the utmost vigour. Workmen employed in the following trades decided to come out: metal, building, shipbuilding, arsenals, miners, seamen, transports, dressmaking, theatres, concerts, municipal services. The postal and telegraph services only opened at 10 in the morning, and telephone operators struck for half an hour in the morning and half an hour in the evening. Electricians struck for 2 hours. It was at first decided to hold no public demonstration and to restrict the programme to a series of private meetings. At the last moment, however, it was decided to march in procession from the Place de la Concorde to the Place de la République. The Government issued a prohibition of any such demonstration, and troops were massed round Paris.

The day ended with rioting of a serious nature. There were a number of casualties on both sides, and as a result of the vigour with which the Government maintained its authority, M. Jouvaux, secretary of the General Confederation of Labour, resigned his position as a supplementary Labour delegate to the Peace Conference, and two other Socialists holding Government positions, M. Bouisson, Commissioner for Merchant Marine, and Compère-Morel, Commissioner for Agriculture, left their posts. The feeling left among the working-classes was one of great bitterness, and leaders did not accept their defeat. During the next two months strike after strike occurred, affecting all sorts of people from bank clerks and milliners to railwaymen and miners. It would be impossible to give any one reason for this discontent, which was due to both economic and political causes. The main factor of the first was the high cost of living, and of the second the faulty application of the ill-considered eight-hour-day bill, which led to a great amount of dispute in its interpretation, and with some piece-workers to a reduction of wages. In many cases the Confédération Générale du Travail found itself powerless to control the rank and file, who were inflamed by revolutionary propaganda, and by the circulation of quite unjustified statements that the Government intended to send large numbers of French troops to fight against the Russians.

These partial strikes continued throughout June, and the General Labour Federation decided, in unity with Italian labour, to proclaim a 24 hours' general strike in France on July 21. This strike was to be " a formidable warning to cease all armed intervention in Russia; to demobilize rapidly and without restriction; to reëstablish constitutional liberties; and to grant full and entire amnesty." It was also to be considered as a declaration of war upon the high cost of living. This move met with such faint-hearted support from Labour itself, and aroused such violent protest from the rest of the community, that on July 20 the C.G.T. decided to abandon its action. They had the satisfaction, however, of seeing a defeat inflicted on the Government two days before that decision was arrived at. This adverse vote was taken on a question of food policy, and the Food Controller, M. Boret, resigned. Clemenceau appointed Noulens to succeed him, and again managed to obtain a majority.

Peace Treaty Criticism.—The text of the Peace Treaty, and of the Franco-British and Franco-American Conventions accompanying it, was tabled at the Chamber of Deputies on June 30. The Chamber at once nominated a Peace Committee to report upon the document, M. Barthou being elected its president. His report was submitted to the Peace Committee on Aug. 5. It recommended the ratification of the Treaty, but drew attention to some of the provisions for ensuring French security on the Rhine, pointing out that their application would call for constant vigilance. He also criticized the exclusion from the pact of the League of Nations of those clauses proposed by France with a view to increasing the safety of her Eastern frontier. There naturally could be no question of a rejection of the Treaty; but its reception by Parliament was lukewarm. Parliament felt that it had not been allowed to play a proper part in the deliberations which had produced the document, and certain sections, notably the Right, were critical of the clauses dealing with the left bank of the Rhine and reparations. Tardieu, replying for the Government on Sept. 3, in the debate upon that report, outlined arguments which he subsequently developed at greater length in his book *La Paix*. The debates of that summer were academic or, at the most, preliminary to the storm of criticism which Clemenceau's work subsequently aroused. The Opposition had failed to upset the Government on economic questions; it was impossible for national reasons to try to do so on the Peace Treaty, and the House accepted the idea that Clemenceau would remain in power to "make" the approaching elections. The treaty was ratified by 372 votes against 52. There were 73 abstentions.

Elections of 1919.—On Oct. 2 a General Election bill was tabled in the Chamber fixing the dates for the elections as follows:—Chamber of Deputies, Nov. 16; Municipal Councils, Nov. 23; Mayoralty, Dec. 7; Councils General, Dec. 14; Senate, Jan. 11 1920. At the beginning of Nov. Clemenceau, speaking in Strassburg, made a programme speech which served as the rallying-ground for the widely diverse elements composing the *bloc national*. He made a fine appeal to all Frenchmen to realize that upon them depended whether they would in labour and tranquillity reap the benefits of the peace they had won. He dwelt upon the necessity for stable government, based on a large and solid majority; and his electioneering cry he found in Bolshevism, which had, indeed, made considerable progress, but, as was shown by the result of the elections, was far from being a national danger. The elections were fought with some bitterness, especially in the Seine, where Millerand and Barrès were the chief candidates of the *bloc national*, and where Longuet, the leader of the Socialists, figured on a list with Capt. Sadoul, a French officer serving with the Bolshevist army, who had been condemned to death by French court-martial for treason. The *bloc national*, comprising the moderate elements of the Chamber, and many of the extreme Conservatives, swept the country. The results of the elections were:—Conservatives and Liberal Action, 111 (a gain of 46); Progressives, 125 (a gain of 75); Left Republicans, 139 (a gain of 43); Radicals and Socialist-Radicals, 147 (a loss of 102); Socialist Republicans, 34 (a loss of 3); Unified and Dissident Socialists, 70 (a loss of 35).

Presidential Election: Resignation of Clemenceau.—This new Chamber met on Dec. 8, when it gave a welcome to the 24 deputies elected for Alsace-Lorraine. On Dec. 18 M. Deschanel was reëlected to the presidency of the Chamber by 478 votes out of 505. The Minister of Finance tabled two bills, one authorizing an additional credit amounting to 43 million sterling for the financial year 1919, and the other a vote on account for the first three months of 1920. The most important immediate business before Parliament was to proceed with the election of a successor to M. Poincaré in the presidency of the republic. Clemenceau, although not anxious to fill that office, was nevertheless prepared to accept it as the result of a more or less unanimous vote. The election of Deschanel to the presidency of the Chamber gave Clemenceau's opponents an opportunity of urging Deschanel to stand, and both he and Clemenceau agreed to abide by the decision of the preliminary meeting of the Republican groups of the Chamber and the Senate. Clemenceau was narrowly defeated in this party ballot, and withdrew his candidature. M. Deschanel was elected President in the National Assembly of Versailles on Jan. 17 1920 by 734 votes out of the 888 cast. Clemenceau placed the resignation of his Ministry in the hands of the President of the republic on Jan. 18 and retired into private life. Millerand, who had taken the chief part in organizing the parliamentary elections, formed a Cabinet as follows:—Millerand, prime minister and Minister for Foreign Affairs; L'Hopiteau, Minister of Justice; Steeg, Interior; François Marsal, Finance; Lefèvre, War; Landry, Navy; Honnorat, Public Instruction and Fine Arts; Le Trocquer, Public Works and Transport; Ricard, Agriculture; Isaac, Commerce, Industry, Posts and Telegraphs; Sarraut, Colonies; Jourdain, Labour; Ogier, Liberated Regions; Maginot, Pensions and War Allowances; Breton, Hygiene.

The new President was installed in office on Feb. 18, and two days later M. Poincaré was appointed president of the Reparations Commission. The last days of Feb. a strike starting on the P.L.M. was extended by a miners' strike in the northern coal-fields. Both movements were due to the high cost of living. These partial strikes were very largely test movements organized in a more or less underground manner, without the full approval of the C.G.T. in whose directing committee Communists were struggling to obtain the ascendancy. May-day passed quietly, but was followed by a series of strikes ordered by the C.G.T. The programme of action which was then put forward showed that the Communists had carried the day. It included the formation of a national economic committee for the reorganization of production; the constitution of an international syndicate for the distribution of raw material; and the formation of an international fleet with a view to the regulation of freights; control of imports; reorganization of rail transport; international distribution of war burdens; the stoppage of Colonial expeditions; and disarmament. The seamen, dockers and miners were called out in support of the railwaymen. The strike was never popular, and the Government's action in arresting leaders was well supported by the public. On May 9 the C.G.T. mobilized more strikers, calling out the metal-workers, builders, underground railway and omnibus employees, aeroplane-workers, and all dockers. By that date the defeat of the strike was certain. Men were breaking away in very large numbers from their unions, and in spite of terrorism were returning to work. Evidence having been obtained of Russian participation in the movement, a large number of arrests was made. On May 21 the C.G.T. decided by 96 votes to 11 to admit defeat, and work was resumed on the following morning. The defeat was the worst ever inflicted on a big Labour organization, and it was calculated that over half a million members were lost by the extremist nature of the action.

Millerand and the Presidency.—No sooner was this crisis over than the Government was faced with one of an unusual and perplexing nature. M. Deschanel, President of the republic, while travelling by night to Montbrison, fell from the window of his compartment on to the track while the train was travelling at a good speed. No one noticed the accident, and it was not until Montargis was reached the next morning that the absence of the President was discovered. M. Deschanel was fortunate in not being seriously injured in his fall, but the shock, together with the effect of months, if not years, of life at high pressure, made it impossible for him to resume his functions. By the middle of Sept. after a further relapse, it became clear that he would have to resign his office. This was done formally on Sept. 16.

The course of events during the period which elapsed between Deschanel's accident and his resignation, was such as to favour the candidature of M. Millerand to the presidency. The prime minister's handling of Labour troubles had given him a great hold upon the Chamber; and although the growing friction with Britain and Millerand's attitude towards peace problems both roused discomfort in Parliament, the trend of events, especially after the Spa conference and the brilliant success of the French aid given to the Polish army in Aug., more than made good any gaps in his prestige. He accepted candidature, after issuing a statement that if he were sent to the Élysée he would pursue the policy he had advocated as prime minister. M. Millerand's action in boldly stating a programme shocked constitutional purists among the revolutionaries. After his election on Sept. 23, when he obtained 695 out of 892 votes, Millerand explained in further detail that he intended to play a larger part than had hitherto been taken by presidents of the republic in the field of foreign affairs; and that he contemplated constitutional reform the tendency of which would be to increase the usefulness of his office. The ministerial crisis resulting from this change in the presidency was settled by M. Georges Leygues stepping into Millerand's vacant place, the Cabinet remaining otherwise unchanged.

The new Government's statement of policy was naturally approved after a very brief debate. At the same sitting a presidential message was read, in which Millerand again referred to the advisability of constitutional reform, and dwelt upon his intention to act as guardian in the application of the Versailles Peace Treaty. André Lefèvre, the Minister of War, resigned his office on Dec. 16, in order to have his hands free to press for the rigorous disarmament of Germany. He was succeeded by M. Raiberti, president of the Finance Committee of the Chamber.

This Ministry of M. Leygues was never intended to be anything but a stop-gap. It enabled Millerand to get his feet into the stirrups without receiving too much advice as to how to ride the horse of state from former presidents or prime ministers. M. Leygues' chief task was to follow closely the lines laid down for him by M. Millerand in the various meetings which were still taking place with regard to peace between allied statesmen. He fell from power at precisely the moment when it seemed fit that M. Briand should take the reins. This he did in the middle of Jan. 1921. His chief concern was Franco-British relations, which, ever since the Armistice, had been drifting into troubled waters.

Franco-British Relations, 1919–21.—With the disappearance of Germany as a world-power, it could not but be that a principal factor in the Franco-British Entente had ceased to exist. Even during the war, in meetings between statesmen and soldiers of the two countries, there were many differences of opinion. Yet, when the Armistice was signed, relations between the two countries were excellent. It was inevitable, however, that in the sharp exchange of views at the Peace Conference, when not only the vital interests of the moment but also the far-distant future of nations was at stake, individual interests should tend to supplant the common sacrifice of war-days. French public opinion, when it studied the conditions of peace, became persuaded that in the Peace Conference the British delegation, and Mr. Lloyd George in particular, were there not so much as statesmen settling the world's affairs from the high mountain of humanity, but as political travellers who had to show results to the house which employed them. This French point of view is stated here without the criticisms, comments and corrections, which might be aroused by it. There were two great crises during the Paris Peace Conference, and the solution accepted by Clemenceau in each case formed the subject not only of diplomatic action and discussion abroad, but of political agitation and criticism in the French Parliament itself. They were due to marked divergencies of views between France and Great Britain as to the future of the left bank of the Rhine, the Saar Valley, and reparations. In the discussion of these three questions two main tendencies soon became apparent. Mr. Lloyd George, according to André Tardieu, was anxious lest the conditions to be imposed upon Germany would be such as would lead her to refuse to sign. This anxiety and the dread of the possible extension of Bolshevism throughout Europe found their most direct expression in a memoir Mr. Lloyd George drafted on March 26 1919, in which he enjoined moderation upon himself and upon his allies. To this memorandum the French Government replied that it was in complete agreement with Mr. Lloyd George in desiring to make a lasting and therefore a just peace, but that it did not think that, by softening down the European territorial clauses, his object would be obtained. It pointed out that the great war for Germany had not been a European war but a world war; that all her colonies, all her navy, a large portion of her merchant fleet, and her foreign markets were to be taken from her. It was these clauses which would hurt her, and it was an illusion to believe that she would be soothed by giving to her better European territorial conditions. The Note drew the attention of the British Government to the fact that if its suggestions were accepted a certain number of complete and definite guarantees would be given to maritime nations which had not suffered from invasion, such as Great Britain; for instance, the cession of the German colonies, the handing over of the German war fleet; the surrender of a large part of Germany's merchant marine, and for a time, the exclusion of Germany from foreign markets. To continental countries, on the other hand, to those which had most suffered from the war, partial and limited solutions of their difficulties were offered, such as the reduced frontiers of Poland and Bohemia, the limited defensive undertaking with regard to the protection of France, and the limited exploitation of the Saar coal-fields. With a foresight justified by subsequent events, M. Tardieu, who drafted this Note, pointed out that the inequality of the proposed solutions would be likely to have detrimental effects upon inter-Allied relations after the war. On the points thus detailed, however, compromise agreements were reached during April 1919, and the text of the Treaty was handed to the Germans on May 7.

It was after that date, on May 25, that a second crisis broke out. It lasted until June 16. All Mr. Lloyd George's fears as to the probability of the Germans refusing to sign the Treaty had been reawakened, and he suggested a number of concessions on such questions as disarmament, the occupation of the Rhine, reparations, Dantzig and Silesia. It required a very determined effort on the part of the French peace delegation to prevent a last-hour revision of the terms. The settlement of the question of the left bank of the Rhine undoubtedly caused the most perturbation among French politicians. Marshal Foch on Nov. 27 1918, and again on Jan. 10 1919, had urged that, for the security of France, the Rhine must become the western military frontier of Germany, and that that nation should be deprived of the military spring-board on the left bank she had used with such effect in 1914. This proposal had been discussed in March and refused by Great Britain, and instead of the occupation and independence of the left bank, Great Britain and the United States offered the military guarantee against any aggression on the part of Germany, the undertaking of Great Britain being dependent upon American ratification of that agreement. This was not forthcoming. Clemenceau, after a hard fight, succeeded in inserting in the Peace Treaty a clause to the effect that if, within 15 years—the period of occupation laid down in the Treaty—Germany had not fulfilled her engagements, that period could be prolonged. There were many Frenchmen, and notably Marshal Foch, who refused to see in this compromise a sufficient safeguard for French frontiers, or for the execution of the Treaty of Versailles. Their number naturally grew when the American Senate refused to ratify the Treaty, and not only the American but the British undertaking to give military aid to France, were she attacked by Germany, fell to the ground.

In the treatment of the problem of the Saar coal-fields and of reparations, the French also thought that Lloyd George looked exclusively to British interests. Great though the criticisms were against the Treaty of Versailles, they were as nothing compared with the resentment aroused in France by the application of that Treaty by Great Britain. The coal agreement at Spa, which made France pay heavily to the British Government for her coal, the British encouragement of the Emir Faisal and other elements in the Middle East which were regarded by the French as antagonistic, the British negotiations for the resumption of trade with Bolshevist Russia, the anti-Polish attitude of the British Government during the Peace Conference over the Dantzig Corridor, and afterwards during the Polish-Bolshevist War, the intransigent attitude adopted in favour of Greece and against the Turkish Nationalists—all contributed towards disagreement between France and Great Britain.

These were French criticisms, and represented French causes for dissatisfaction with British policy after the Armistice. An equal number of British complaints against French policy could undoubtedly be found. The result was that in 1920 and 1921 a good deal of diplomatic friction was occasioned from time to time; and it was renewed in Dec. 1921 as the result of the French attitude towards disarmament at the Washington Conference. But it was clearly in the predominant interests of both Great Britain and France that they should bring their respective peace policies into agreement, and march forward hand in hand. The moment was perhaps not ripe for a formal alliance, but in 1921 there were influential people on both sides, and in England notably Lord Derby, who were working towards a restoration of completely cordial relations between France and England, in preparation for a definite understanding which might form the foundation of permanent peace in Europe. (G. A.)

FRANCIS FERDINAND (FRANZ FERDINAND VON ESTE) (1863–1914), Archduke of Austria, was born at Graz Dec. 18 1863. His father was the Archduke Charles Louis, second of the younger brothers of the Emperor Francis Joseph; his mother was the Princess Maria Annunciata, daughter of the Bourbon King Ferdinand II. of the Two Sicilies. His mother died while he was a child, but he was affectionately cared for by his father's second wife, Maria Theresa of Braganza, daughter of the exiled Portuguese Prince Dom Miguel of Braganza. He received the education usually given to members of the imperial family, not too thorough a one, as his succession to the throne was not anticipated. In later years, when he had become heir to the throne, Francis Ferdinand worked with iron industry to fill in the gaps in his education; he learned the languages of the nations over whom he appeared to be called to rule, and took pleasure in obtaining instruction from leading men of science in their special branches of knowledge. He showed special interest in the natural sciences and in the plastic and pictorial arts, but had little taste for poetry and music.

When the education prescribed for him was completed Francis Ferdinand, still following the archducal tradition, entered the army, which kept him for many years away from the imperial palace. In 1875 he took the name of Austria-Este, as heir of his uncle the Duke of Modena, with whose death the male line of this branch of the house became extinct, and of his possessions in Austria-Hungary and Italy. Until the death on Jan. 30 1889 of the Crown Prince Rudolf, Francis Ferdinand was only known in limited circles, and even then he did not at first play any prominent part. For although his father, the next heir to the throne, showed little inclination to make use of his rights when occasion offered, his uncle the Emperor did not give Francis Ferdinand any share in the business of government. He devoted himself as before to his military duties and to the management of his extensive estates. In 1892–3 he made a world tour, which he described in two volumes issued in 1895. He himself states the chief aim of his travels to have been the satisfaction of his desire to become acquainted with foreign systems of government, and to get into touch with foreign peoples and persons and foreign manners and customs. But his delight in the adventures of the chase—he was an excellent sportsman and an admirable shot—his strongly developed feeling for nature, and the desire of his friends and relations to strengthen the uncertain health of a prince born of a consumptive mother counted among the reasons for the long journey. The last aim was not realized; Francis Ferdinand's sufferings notably increased after his return, and compelled him, after his father's death in May 1906 had made him heir-apparent to the throne, to spend considerable periods in southern resorts. The undisguised haste with which many people, especially those connected with the court, who had hitherto courted him, deserted him, now that he was seriously ill and his succession improbable, hardened the prince's character, which was not naturally gentle, increased his distrust of the men who surrounded him, and heightened his contempt for mankind.

When his health improved he returned home and spent a considerable time very actively on his estate at Konopischt, where he established a model farm and gained the reputation of a close-fisted and not very popular master. Even then he was not invited by Francis Joseph to take part in state affairs; yet the Emperor frequently commissioned him to represent him abroad, and gradually allowed him to exercise greater influence in military matters. In 1896 Francis Ferdinand became a cavalry general, and on April 1 1898 he was placed at the disposition of the supreme army command; in 1902 he became an admiral of the Austro-Hungarian fleet. Learned bodies and artistic societies gave him their highest places of honour. He became honorary member and later curator of the Imperial Academy of Science at Vienna and patron of the Academies of Science in Prague and Cracow.

On July 1 1900 Francis Ferdinand married Countess Sophie Chotek (1868–1914), after having overcome by tenacious persistence the obstacle due to the fact that the lady was not of royal family, and renounced, a few days before the ceremony, the succession rights of any children of the union. This renunciation was not only inscribed in the records of the imperial family, but ratified in the Austrian and Hungarian Parliaments and sanctioned by a law of Dec. 4 1900. The consort of the heir to the throne was raised to princely rank with the title of Hohenberg; later on she received the rank of duchess with the style of "highness." Of this marriage were born a daughter, Sophia (b. 1901), and two sons, Max (b. 1902) and Ernest (b. 1904). The influence of his ambitious, clever, rigidly Catholic wife on the heir to the throne was lasting. The difficulty of providing her with a position at Court corresponding with his own and her desires estranged him from the majority of the members of the imperial house, and influenced unfavourably his relations with Francis Joseph, with whom he had never really been on intimate terms. Still his influence increased as years went on; the Emperor gradually allotted to him responsibilities of his own, not only in military matters but occasionally in questions of domestic politics. Yet until Francis Ferdinand's death the Emperor reserved for himself the final decision in every question which arose. The difference of outlook of the two men became more and more marked; for with advancing age Francis Joseph was less and less willing to consider far-reaching reforms, was anxious to avoid any conflict with the nationalities, and preferred advisers who knew how to untie a knot gently instead of hacking through it. It is not surprising that he did not like Francis Ferdinand, who advised rapid and energetic action and, if necessary, methods of violence. So it happened that the nephew did not take into sufficient consideration the jealousy with which his aged uncle guarded his rights as a ruler; he repeatedly spoke of the responsibility which God had imposed on him with his right of succession; he would express a curt opinion on men and things when he knew that they did not correspond with the view of the sovereign. The estrangement increased; personal contact became rarer; Francis Ferdinand came into the Emperor's presence only on exceptional occasions; as a rule he contented himself with expressing his views in writing, and they very rarely agreed with his uncle's. For Francis Ferdinand was decidedly opposed to the preponderant influence exercised in ever-increasing measure by the Magyars in both the domestic and the foreign affairs of the Dual Monarchy, and blamed the complaisance shown by Francis Joseph to all Hungarian demands which did not directly threaten the unity of the monarchy or seriously menace the rights of the throne. Francis Ferdinand was convinced that this Magyar preponderance must be broken in the interests of the monarchy and the dynasty. As to the way in which this struggle was to be conducted his opinion varied from time to time. For some time he was wholly in the camp of the Federalists, and directed his efforts to the splitting-up of the monarchy into a series of states possessing equal rights and held together by a strong central Government. At another period, especially just before the first Serbian crisis, he inclined to "Trialism" as the best solution. At that period he contemplated the union of the Southern Slavs as an independent state within the Habsburg dominions, but abandoned this scheme when he realized that the union of the Austrian and Hungarian Slavs in a separate national system would merely forward the intentions of the Belgrade Government. Later, strongly influenced by the Hungarian minister Kristoffy, he inclined to the idea of attempting, by a change which would leave the dualism of the monarchy as such untouched, to strengthen unity by changing the Delegations into a central Parliament and attaching the annexed provinces Bosnia and Herzegovina, with a state organization of their own, to the Empire. The opposition which he met on all sides from the ruling party in Hungary strengthened his conviction that here lay the essential obstacle to the healthy recovery of the monarchy. In the severe conflicts between the Magyars and the Crown from the beginning of the 20th century onwards he, therefore, maintained the opinion that no concession must be made, and that there should be no shrinking even from the use of armed force for the defence of the rights of the monarchy and the dynasty. The conclusion of the struggle, after a duration of more than five years, in a compromise was a bitter disappointment to Francis Ferdinand, and strengthened his dislike for the Magyar leaders, among whom he particularly hated Stephen Tisza, whose high standing he recognized.

He was more successful in his opposition to the Magyar attempts for the partition of the army. In this, as in the questions of the language to be used in the words of command and response, and of the regimental colours and emblems, he had the Emperor's support, and was able to hinder the accomplishment of the Magyar desires.

The zeal with which Francis Ferdinand sought for the solution of domestic political problems by strengthening the central power is explained by his firm conviction that this was the indispensable condition of the position of the monarchy as a Great Power, which he desired to maintain and to increase. Francis Ferdinand was not an unconditional adherent of the group which thought his aim would only be attained by force of arms. He repeatedly foiled their intentions. But he was firmly determined to tread this path if it was the only one by which the goal could be reached. Personal inclination and a conviction of the commanding position of Great Britain made him regard the establishment of good relations with that Power as desirable. Towards the French, and still more towards the Italians, his attitude was cool and negative. He was convinced that it was impossible to establish permanently friendly relations with the Italian nation, and that there must inevitably be a day of reckoning between the monarchy and Italy. He never adopted an anti-Slav policy. Not only did he wish, from the point of view of his plans for internal reconstruction, to avoid conflicts with the principal representatives of the Slav nationalities, but he recognized in the Tsar of Russia the strongest support against revolutionary movements in monarchical states. Nor is it true that he wanted to see Serbia struck out of the list of independent Balkan states; he merely expressed the decided opinion that the encroachments of the Greater Serbia movement on Austro-Hungarian soil should be resisted with all the forces of the monarchy. He stood faithfully by Germany, with whose ruler his relations became more and more intimate, in spite of the difference between the characters of the two men. Yet no one was less inclined to contemplate the monarchy falling into a relation of dependence on her powerful ally than Francis Ferdinand, whose whole being was informed with a sense of the majesty of the Habsburg-Lorraine dynasty.

Francis Ferdinand was a man of more than average ability. He had a power of quick comprehension; possessed in a high degree the ability to recognize the essential point in any business in which he was engaged, and, unlike his uncle Francis Joseph, did not allow his general impressions to be clouded by too close attention to detail. What he lacked was knowledge of men, calmness and constancy in his relations with the men who had been placed in high offices of state by his influence: Beck, Aehrenthal, Conrad, Auffenberg and others lost, not always for any serious reason, the favour of the heir to the throne as quickly as they had won it. The influence of his wife, ill-natured tittle-tattle to which he listened more and more, and the outbursts of ungovernable rage to which he became increasingly prone with the years, all helped to make intercourse with him more difficult, and prevented a great many persons holding high positions, socially and intellectually, from approaching him. He never enjoyed any wide popularity, and indeed did not seek it.

He asked from the citizens of the monarchy not affection, but submission to the will of the ruler. For to him the State was identified with the divinely appointed person of the monarch. He understood by *viribus unitis* the union of all the forces of the State for the advantage of the Crown, which on its side had to guard the interests of all. This conception accounts for the fact that he took no particular interest in any of the numerous nationalities of the monarchy. He had undoubtedly German sympathies; but the German Austrians were to him merely the bulwark of the throne and of the power of his House; it would never have occurred to him to make dynastic sacrifices for their sake. Even against the Catholic Church, of which he was a convinced adherent, he maintained the rights of the throne with unbending severity, being in this matter also a true Habsburg.

His tragic end—he was shot June 28 1914 with his wife by Bosnians of Serbian nationality at Serajevo—brought on the World War.

There is no proper historical account of his life and activities. The sketch, *Erzherzog Franz Ferdinand, unser Thronfolger*, a special number of the *Oesterreichische Rundschau* (1913), is purely super-

ficial. His descent is given in *Ahnentafel S. k. H. des durchl. Herrn Erzherzogs Franz Ferdinand von Oesterreich-Este*, drawn up by Otto Forst (1910). See also Paul von Falkenegg, *Erzherzog Franz Ferdinand von Oesterreich-Este* (1908); H. Heller, *Franz Ferdinand* (1911).
(A. F. Pr.)

FRANCIS JOSEPH I. (1830–1916), Emperor of Austria and King of Hungary (*see* 10.942*).—In the last years of his reign Francis Joseph continued to strive to preserve peace for his realm, while maintaining the prestige of Austria-Hungary and her position as a Great Power. Perceiving that this aim was threatened by the confusion reigning in the Balkans, he agreed to the plan of his Foreign Minister, Aehrenthal, to take advantage of the Young Turk movement to annex the territories of Bosnia and Herzegovina occupied in 1878, and to embody them permanently in the monarchy. During the serious crisis following on the annexation Francis Joseph backed Aehrenthal with the whole weight of his influence, and subsequently supported him in his endeavours to restore friendly relations with the Great Powers which had been signally disturbed by the annexation, and to put an end to the risk of international conflicts. By his personal intervention he in fact repeatedly succeeded during the years 1908 to 1914 in averting dangers threatening the peace of Europe. When in 1912 the Balkan wars, which he had untiringly but unsuccessfully striven to avert, began, he thought they were the gale before the hurricane, and when, in Aug. 1913, the Peace of Bucharest provided a provisional settlement he expressed the opinion that this peace was only the breathing space before a fresh war. The behaviour of the Serbs filled him with the greatest anxiety. When the murder of the heir to the throne, the Archduke Francis Ferdinand, led the Vienna Government to take energetic measures against Serbia, Francis Joseph hesitated to follow, and it was with a heavy heart that he gave his consent to the dispatch of the severe ultimatum to Serbia, and, after its rejection, to the declaration of war. He did not believe that the war could be localized, as he would have wished it to be, and was pessimistic about the chances of a world war. Even then he was of the opinion that "war is beyond our strength," and said he would be glad if the monarchy escaped "with a black eye." The attitude of the rulers of Italy and Rumania offended him deeply, and strengthened his doubt of a favourable outcome of a war against an ever-increasing number of adversaries. Francis Joseph stood immovably by the alliance with Germany, to whose ruler he was bound by a friendship based on reciprocal liking; it never occurred to him to separate from his ally. He would never have agreed to a separate peace; yet he favoured and supported every endeavour to put an end to the war by a peace which should safeguard the interests of all his allies and the position of Austria-Hungary as a Great Power.

In all questions affecting the constitution of the monarchy, and in particular the relations between Austria and Hungary, Francis Joseph continued in the later years of his reign to stand by the principles of the *Ausgleich* of 1867. He would not consider the federalization of the Empire, but stood unmoved on the basis of dualism. He went a long way to meet the efforts of the Hungarian Government for independence, but refused energetically during this period demands tending towards the severing of the remaining bonds between the two halves of the monarchy, especially that of the united army. In the increasingly violent conflicts between the different nationalities inhabiting the Cis-Leithan territories Francis Joseph stood above party. This was all the easier for him on account of his indifference towards all the nationalities of his vast realm, even towards the Germans, although to the end of his life he felt himself to be a German prince. As in the earlier part of his reign, so in the last decade, the separate nationalities were favoured or neglected, but always played off one against the other. The meaning of *viribus unitis* for Francis Joseph was to use all in the interests of the dynasty. But national consciousness had grown so strong that this policy had no success. The concessions which he granted in the years just before the war to the Slav peoples increased their self-confidence, and led them to make ever greater demands, the non-fulfilment of which caused a weakening of their sentiment for the dynasty. As the differences between the national parties represented in the Austrian Parliament became in the course of years so great that there was no prospect of effective coöperation, Francis Joseph ignored parliamentary activity from 1914 onwards. Experience of the World War led the old Emperor to recognize that he had done the Austrian-Germans an injustice; but isolated attempts to alter the trend of affairs had no lasting effect, and in the end he let things take their course. When he died, severe inroads had been made on the affection of the Austrian peoples; what remained was only just sufficient to disguise the disappearance of loyalty to the dynasty.

As years went on the Emperor became more and more lonely. His son had committed suicide in 1889, his wife had been murdered in 1898; of his brothers only the youngest was still alive, and he resided at a distance and in the strictest seclusion. There had never been any cordial relationship with the heir to the throne, Francis Ferdinand; and with the years, especially after Francis Ferdinand had married Countess Sophie Chotek, the estrangement between the two men increased, so that personal intercourse became rare. Among the remaining members of the Imperial House Francis Joseph only cared to frequent the circles of his two daughters, Gisela and Marie Valerie, and their children. He was bound by ties of true friendship to Katherina Schratt, formerly an actress at the Burgtheater, and in her society he spent his sparingly measured hours of recreation. The summer he usually spent at the watering place of Ischl, and there he devoted himself to the chase, the only pleasure for which he cared passionately to the end of his life.

The Emperor had long enjoyed excellent health. It was not until he had passed his 75th year that disease of the respiratory organs began. In 1911 this became so serious that a catastrophe was feared. All the preparations for Francis Ferdinand's accession were made. But the old Emperor recovered; and his physical as well as his mental energy improved from year to year, so that he was able in the first two years of the World War to transact fully all the business of government. It was only in the year 1916 that his faculties began to fail. He died peacefully of a fresh attack of his old malady on Nov. 21 1916.

Francis Joseph was not one of those of whom contemporaries, especially those at a distance, form any definite impression. The reserve which he observed even towards the great majority of his advisers made it more difficult to penetrate his real nature. He had a deep sense of his exalted position as a ruler. To the end of his days he remained profoundly convinced that the Empire over which he ruled was *his* empire, and the peoples *his* peoples. This conception of the majesty of the office bestowed on him by God found expression in his bearing. He always maintained a regal attitude. He showed kindliness and winning courtesy to everyone. Nothing was farther from him than posing, and no one ever heard him utter sonorous phrases; but he avoided any kind of intimacy even in his intercourse with members of the Imperial House, and, even with them, knew how to maintain his distance. His intellectual gifts were not remarkable, but he possessed sound common-sense and wit. He had a strikingly good memory for persons and events. As a ruler he was a model of the sense of duty. From early morning to evening he attended to business with clock-like regularity, and dealt with all the documents laid before him with the greatest punctuality. This industry and his exact memory made him one of the best authorities in all Government affairs. He sometimes startled his ministers by his intimate knowledge of the details of the business in hand, and occasionally embarrassed them. But he went no further than the details, and lacked the power of surveying the whole. He also lacked, especially in his later years, the ability to take the initiative in important questions, to form independent resolutions and to carry them to their logical conclusions. In an ever-increasing degree he left the decision to his responsible ministers. He was not without skill in the choice of his advisers, but had an instinctive dislike for men whom he felt to be his intellectual superiors. He also disliked people of proud and upright character, and even within the family circle he preferred those who were more subservient. He was essentially cold in tempera-

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***These figures indicate the volume and page number of the previous article.**

ment, with great self-control increased by practice. Among the European rulers he enjoyed, during the last decades of his reign, great respect, which he owed to his age, experience, personal amiability, blameless conduct, and above all the fact that his word could always be relied upon. He was a faithful son of the Catholic Church, and looked up with reverence to the Holy Father; but, quite in the spirit of the traditions of his House, he guarded the rights of the dynasty and of the State with the utmost tenacity, even against the Pope. He took no interest in the arts and sciences, being in this respect more of a Lorrainer than a Habsburg; but whenever he expressed an opinion on these subjects, he showed a decided aversion from the modern tendencies.

It is not yet possible to give a complete picture of Francis Joseph's character, as the necessary references are not available. Up to 1921 practically none of his correspondence had been published. For the period up to 1908 there is the elaborate publication *Francis Joseph I.*, by different authors. His biography has been written by R. P. Mahaffy, *Francis Joseph* (1908); Baron Eugen d'Albon, *Vom Kaiser* (1909); Smolle, *Unser Kaiser* (1908). A successful attempt to draw a sketch of the Emperor, based on information from ministers, generals, and other officials who were in close touch with him, was made by H. Friedjung under the title "Kaiser Franz Josef I." in *Historische Aufsätze* (1919, pp. 493 *seq.*). The numerous popular publications which appeared soon after the death of Francis Joseph are of no historical value. The same is true of *Kaiser Franz Josef und sein Hof, Erinnerungen und Schilderungen aus den nachgelassenen Papieren eines persönlichen Ratgebers*, published and translated by L. Schneider (1919). (A. F. Pr.)

FRASER, ALEXANDER CAMPBELL (1819–1914), Scottish philosopher (*see* 11.38), died at Edinburgh Dec. 2 1914.

FRAZER, SIR JAMES GEORGE (1854–), British anthropologist, was born at Glasgow, Jan. 1 1854. Educated at Helensburgh, Glasgow University and Trinity College, Cambridge, he was elected fellow of his college in 1879 and was called to the bar. In 1907 he was elected professor of social anthropology at Liverpool. His principal work, *The Golden Bough*, first published in 1890 (2nd ed. 1900) and reissued with enlargements in 12 vols. under seven titles between 1907 and 1915, was an elaborate study of the Greek cults, their origins and their place in the comparative history of religion. He also published *Pausanias and other Greek sketches* (1900) and *Sir Roger de Coverley and other literary pieces* (1920). His views on the connexion between magic and mythology are explained in 19.133 and 17.305; those on folklore are described in 10.601.

FREDERICK, ARCHDUKE OF AUSTRIA, DUKE OF TESCHEN (1856–), Austro-Hungarian field-marshal, was born at Gross-Seelowitz, Moravia, June 4 1856. Like most of the princes of the ruling house he adopted a military career, and served creditably for many years as commandant of the V. (Pressburg) Corps. Subsequently commander-in-chief of the Austrian Landwehr and army inspector, he became, after the murder of the heir to the throne, Archduke Francis Ferdinand, inspector-general at the head of the common Austro-Hungarian army. Archduke Frederick was possessed of a considerable fortune, and was one of the greatest landowners in the monarchy; the Albertina Collection was among his inherited possessions. In the World War he was—from the dynastic point of view—as grandson of the victor of Aspern, Archduke Charles, and as nephew of the victor of Custozza, Archduke Albert, the predestined head of the armed forces of Austria-Hungary. He thought it his duty to accept this heavy responsibility, but, modestly estimating his own powers, left the actual exercise of the command to his chief-of-staff, Conrad von Hötzendorf. In the performance of ceremonial duties, and as mediator for the settlement of the conflicting demands of the military, civil and allied elements, his services were undeniable. In the spring of 1917 Emperor Charles himself took over the supreme command; the Archduke, although the Emperor's representative, no longer appeared in the foreground. He married, in 1878, Princess Isabella of Croy-Dülmen, and of this marriage there were eight daughters and one son, who served as an officer in the World War.

FREDERICQ, PAUL (1850–1920), Belgian historian, was born at Ghent, Aug. 12 1850, and was educated at the university of Liége, where he became professor of history, later (1883) occupying the same position at Ghent. His chief works were *Essai sur le rôle politique et social des ducs de Bourgogne dans les Pays-Bas* (1875) and *Corpus documentorum Inquisitionis hereticae pravitatis Neerlandical* (1889–1906, 5 vols.), and many shorter studies, principally on the religious history of the 16th century and the history of the Flemish literature. He was a strong supporter of the Flemish movement, of which he wrote a history, *Schets eener Geschiedenis der Vlaamsche Bewegnig* (1906–9). On the invasion of Belgium by the Germans he was active in encouraging the patriotic feelings of his countrymen and urging every sort of moral resistance to the enemy, being in consequence deported to Germany (March 16 1916), in company with Prof. H. Pirenne. He was interned successively at Gütersloh, Jena and Bürgel. He returned to Belgium after the Armistice and was appointed rector of Ghent University. His imprisonment, however, had seriously weakened his health, and he died March 23 1920. He was a member of the Academie Royale de Belgique, the Commission Royale d'Histoire and the Academie des Pays-Bas, and his influence on the teaching of history in Belgium was profound. He was converted to Protestantism in his youth, and his tendencies in religion, as in politics, were liberal.

See Ch. Nyrop, *L'Arrestation des professeurs belges et l'Université de Gand* (Paris, 1917; also translated into English and Danish); V. Fris, *Les deux historiens nationaux exilés pour leur patriotisme* (1919). (H. P.)

FRÉMIET, EMMANUEL (1824–1910), French sculptor (*see* 11.96), died Sept. 11 1910.

FRENCH, JOHN DENTON PINKSTONE FRENCH, EARL (1852–), British field-marshal, was born Sept. 28 1852. The son of a naval officer, he entered the Royal Navy, in which he served as cadet and midshipman from 1866 to 1870. Joining the militia he passed from this into the army in 1874 and was gazetted to the 19th Hussars. He married Eleanora, daughter of R. W. Selby Lowndes in 1880. He served in the Nile expedition in 1884–5, and commanded his regiment from 1889 to 1893. After two years on the War Office staff he commanded a cavalry brigade from 1897 to 1899, and on the mobilization of the expeditionary force for S. Africa in the latter year he was chosen to command the Cavalry Division and was promoted major-general. Pending the assembly of this, he served in Natal, where he commanded the troops on the field at Elandslaagte and took part in the early combats near Ladysmith, but he proceeded to Cape Colony just before the place was invested. After a few weeks in charge of the force at Colesberg, he led the cavalry during Lord Roberts' advance from Cape Colony, relieved Kimberley, cut off the retreat of Cronje's army, and occupied Bloemfontein. During the subsequent advance into the Transvaal he was in command of the left wing, and at a later stage of the victorious campaign he played a prominent part in the move from Pretoria to Komati Poort. For these services he was given the K.C.B. During most of the second phase of the struggle he was in command of the forces operating against the enemy in Cape Colony, and he was on the conclusion of hostilities promoted lieutenant-general and was given the K.C.M.G.

He commanded at Aldershot from 1902 to 1907, in which year he was promoted general, and he then became inspector-general of the Forces for five years. He was appointed chief of the Imperial General Staff in 1912 and was promoted field-marshal in 1913. In April 1914 he vacated the post of C.I.G.S., owing to military troubles in Ireland in connexion with Ulster, but four months later he was chosen to take charge of the Expeditionary Force on the outbreak of the World War, and he commanded the British army on the western front from the outset of the struggle until the end of 1915. The chief events in France while he was in command were the retreat from Mons under circumstances of great difficulty; the battle of the Marne and subsequent advance to the Aisne; the transfer of the Expeditionary Force to Flanders; the desperate fighting in the autumn, generally called the First Battle of Ypres; the successful Neuve Chapelle offensive undertaken in March 1915; the Second Battle of Ypres in April 1915;

the abortive operations near Festubert embarked on a few days later; and the important victory won in Sept. in the region of Loos. During the seventeen months that the field-marshal led the British troops in the field, these rose, excluding cavalry, from an original total of five divisions at the front to a total of 34 divisions; these he had organized as three armies. His forces up till the last three months suffered greatly from a lack of artillery ammunition, except during the opening weeks of the campaign; this hampered his operations to an extent not experienced by his successor. He resigned in Dec., Sir D. Haig taking his place, and he returned to England, to be raised to the peerage as Viscount French of Ypres and High Lake in recognition of his great services. He then became commander-in-chief in the United Kingdom, and he held that appointment until May 1918, when he was selected to be Lord-Lieutenant of Ireland. This position he occupied under most trying conditions until early in 1921, the political state of the country growing worse and worse. On resigning he was rewarded with an earldom.

At the end of the war, Lord French published his personal narrative under the title, "*1914*."

FRENCH EQUATORIAL AFRICA (*Afrique Equatoriale Française;* or *A.E.F.*), formerly FRENCH CONGO (*see* 11.99), is an immense region stretching from the mouth of the Congo to Tripoli, from the Atlantic to Egypt, covering an area of about 870,000 sq. miles. It is therefore more than four times the size of France. The coast is but little developed and is as a rule flat and sandy. There are few good ports. At a short distance from the Atlantic the country rises to a plateau between 2,300 and 2,700 ft. high, in which lies the vast depression of the closed basin of the Chad. The chief characteristic of the colony is its magnificent river system. It has the Congo for a distance of 370 m. of its course of 2,500 m., its great tributaries (the Sanga or Sangha and Ubangi), the Ogowe (801 m.), and the huge expanse of Lake Chad, which receives the water of the whole of the Schari and Logone valleys. In natural characteristics there are two clearly distinct zones—forest and brush. Tropical forest with luxuriant vegetation and intense animal life covers the Gabun and the valleys of the Sanga and Ubangi; brush reigns up to and beyond Lake Chad. The climate is extremely humid and painfully hot.

Estimates of the population range from 6 to 10 millions. Sleeping sickness is very prevalent. There are many different races and varied types among the natives, but two main groups can be recognized. There are the sedentary people of the forest zone who are very savage and occasionally cannibal, but can adapt themselves to agriculture, and the Nomad tribes of the brush country who are warlike herdsmen influenced by Islam.

A.E.F. is a colony of special growth. Its frontiers were laid down by diplomacy before the country had been explored. The main steps in French occupation of Equatorial Africa were:—(I.) Foundation of French Congo (1842–82), and the great exploration expeditions of de Brazza. (II.) The Berlin Conference and the General Act of 1889 which established international understanding with regard to freedom of navigation and trade in basins and mouths of the Congo and the Niger, and as to the formalities to be observed in order to make the fresh occupations of Africa effective. (III.) The period of political and diplomatic action over the Congo between 1889 and 1909, when a number of Boundary Conventions were signed. (IV.) French expansion towards the Upper Nile, which gave rise to the Fashoda incident (1898) and a declaration in 1899 in which the eastern limits of the French zone of influence in West Africa were laid down. (V.) French expansion in the Chad. The work of the great explorers Crampel, Maistre, Gentil and Maj. Lamy brought about the realization of the ambitious plan of linking up, through Lake Chad, the oases of Algeria and the shores of the Ubangi.

In 1911, following upon the Agadir incident, A.E.F. enabled France to compensate Germany for the rights she ceded to France in Morocco. The colony then lost nearly 100,000 sq. m. of territory, which was joined on to German Cameroon. This was restored by the Treaty of Versailles.

Administration.—A.E.F. is an amalgamation of four different colonies under a governor-general. This post was created by decree June 26 1908, and a further decree Jan. 15 1910 gave definite form to the new administration.

The Government General of French Equatorial Africa consists of the following colonies:—

Gabun (cap. Libreville) 104,000 sq. m. Middle Congo (cap. Brazzaville) 89,000 sq. m. Ubangi-Schari (cap. Bangi) 193,000 sq. m. Chad (March 17 1920) 482,000 sq. m.

The supreme administrative head is the governor-general who resides at Brazzaville. The different colonies preserve their administrative and financial autonomy and are governed by lieutenant-governors with the exception of the Chad, which has either a civil or a military administrator. A government council assists the governor-general, who has his delegates in Paris at the Office Colonial and at the Supreme Colonial Council.

Colonization.—The policy pursued with regard to colonization of this vast country has not been very successful. Big concessions have been given to large colonizing companies for the economic development of large tracts of country. Of 40 concessionary companies only very few have proved successful. The only benefit derived from this system has been that river transport has been organized and the resources of the country have been made known. The great drawback in A.E.F. is lack of transport. The rivers provide practically the only means of communication, and the execution of the plan of railway construction is urgently desirable. A bill authorizing a loan of 171,000,000 francs for the construction and improvement of all methods of communication was approved in 1920.

Products.—Natural produce is varied. Rubber is the chief vegetable resource. It has so far been found impossible to establish practical rubber plantations, and the rubber output of the colony is wild. Rubber exports, naturally, suffered from the world crisis. Exports in 1913 were 1,600 tons, 1914 600 tons, 1915 1,400 tons, 1917 3,000 tons, 1920 2,140 tons worth 14,156,000 francs. The quality is undeniably good, but there is no great demand for this type of rubber on the French market.

The oil palm is the next important resource. It is very widely distributed but was but little exploited before the war. The export of kernels has been greatly encouraged by the administration and has attracted European firms, thanks to which the export figure for 1920 was nearly 7,000 tons of the value of over 4,000,000 francs. Tobacco and cotton grow wild in the colony. Cocoa and coffee cultivation is on the increase and is attracting attention from European firms. Of all the French colonies A.E.F. is the most richly wooded, 54,000 sq. m. being covered by dense forest, in which the presence of mahogany and rosewood, of tulip and walnut, show the diversity of this almost inexhaustible source of wealth. Before long the annual log production will amount to 450,000 tons. In 1921 the figure was 150,000 tons. Exports in 1920 amounted to 66,000 tons of a value of 6,238,000 francs. The possibility of producing wood-pulp on a large scale has to be borne in mind.

So many elephants have been killed that there are large stocks of ivory in the country. Exports of ivory in 1920 amounted to 93,636 kgm., worth 4,700,000 francs.

The export of whale-oil has been recently started. There are large herds of sheep and cattle in the brush country of the northern districts, which will become of increasing value as it is opened up.

There would seem to be a mining future before the country. But few companies have been floated and the underground wealth is still but little known. Copper exists with a yield of 45%, and mines are in some places already being worked, but in a rudimentary fashion, on a belt of about 60 m. in the middle Congo. Railways alone can bring about the proper development of this district, which is 190 m. from the coast.

General Trade reached its top pre-war figure in 1913 with 57,846,000 francs. It fell to just over 22,000,000 francs in 1915 and has since slowly picked up. In 1920 the total was 49,801,000 francs, a figure partly due to inflated prices. There are signs, however, of a return to the normal progress in trade. Imports accounted for over 18,000,000 francs of this sum. (G. A.; M. R.*)

FRENCH LITERATURE (1910–21).—The period just preceding the World War was one of considerable activity in French literature. Never had thought taken on more varied aspects. Romanticism, classicism, naturalism were all living and thriving side by side with other theories, not to speak of aberrations and follies. A literary critic had counted no fewer than 55 literary "schools," groups or coteries, chiefly made up of young writers, but including not a few who had already won their laurels. Indeed, the tendency had for some time been the breaking-up into groups, each with its particular dogmas and formulas. There was a profusion of ideas; there were even a little confusion and anarchy. The dominant note was a youthful optimism. Men of genius were discovered on all sides; a new and great era was supposed to be opening up for France, which had successfully weathered some tremendous storms and had again taken her place amongst the leading nations of the world. Never had so many people been writing, and never had literary form been so widely discussed; rarely, too, had the average literary man cut so prominent a figure in the public eye or had his theories so widely proclaimed and discussed. They were to point out the way to new destinies. There had been a great regeneration of nationalism (a "renaissance of French pride," as one writer put it), while a religious revival was also in the air, and side by side with these facts a hundred more or less significant "isms" and scores of leading and general ideas battled in the intellectual arena. French authors mostly develop in harmony with the thought of their times in a manner not usual with Anglo-Saxon writers. The renewed interest in English literature, which has been a notable feature of post-war letters, had also already begun, but the authors now claiming attention are of another school.

The period 1910–20 was marked by a burst of very varied talent and the more or less complete disappearance of literary schools. The most significant of all the new movements was the nationalist one—the love of the land and of the dead, the cult of energy and heroism. At the head of this was Maurice Barrès (b. 1864), whose influence on youth before the World War had its sequel in the great rôle he played during the struggle. Through his individualism and his *nostalgie*, Barrès is the heir of the great Romantics, though a disciplined Romantic; in the preponderance of thought over imagination which we meet with in him, in the purity and nobility of his prose, he is attached to the purest classical traditions. A spectator of all the political turmoils, from the Panama scandals and the Dreyfus case to the World War, which have shaken France and the French, Barrès in a series of interesting works of high quality did his best to interpret and explain them for his contemporaries, and this he continued in his *L'Âme Française pendant la Guerre* and subsequently in *La Génie du Rhin*, in which, with a tumultuous enthusiasm reminiscent of Michelet, he celebrates the great river which is not the river of any one country. It was a great completion of Barrès's work during the war, beginning with *Colette Baudoche*.

New members of the French Academy include M. Joseph Bédier (b. 1864), the historian and critic of the origins of French literature, whose romances, founded on certain of the old sagas, such as *Le Roman de Tristan et Iseult* and *Perceval, ou le Saint-Graal*, contain some of the finest writing produced of late in France. During the war he was at the front as historian, one of the results being his work *L'Effort Français*. René Boylesve (b. 1867), the *mondain* novelist, has been called a writer of pretty stories—stories which he loves to tell and tells charmingly. He has two styles—the novel of provincial life, in which he is a sort of "little Flaubert," and his sentimental and psychological novels, which are not devoid of licentiousness. He likes to imagine love-nests and 18th-century parks, with labyrinths and statues, as settings to gallantry. On the other hand, he has a great respect for tradition, and he orders and organizes the movement of his novels, keeping affairs of the heart and affairs of the mind rigorously apart. The reticence of his novels of provincial life make up in a way for the libertinage of the others. Henry Bordeaux (b. 1870), another new Academician, who published a number of war books (*Le Fort de Vaux, La Bataille devant Souville*, appreciations of the lives of young heroes, such as Guynemer, the aviator, etc.), is in his novels a painter of the torments of the heart, who has given a distinguished place in literature to Savoy. In his *Pays Natal* he proclaims his wish to restore to the French provinces the original beauty and intellectual vigour which they have lost, and to restore also the spirit of the family, for "a man only preserves his terrestrial existence and greatness through his origin and his hopes." *La Peur de Vivre* shows the beauty of action, of life accepted with all its duties and responsibilities—the nobility of sorrow and the beauty of sacrifice.

If the new men in the Academy—as out of it—were mostly highly prolific, the "old hands" were comparatively silent. Only some small volumes issued from the pen of the veteran Anatole France (*see* 10.775), who, disgusted with the German intellectuals' espousal of the causes of the war, in spite of his age offered himself as a volunteer to the Government "to carry a gun." In one of these, *Le Petit Pierre*, he goes back again to reminiscences of his boyhood. Paul Bourget (*see* 4.331) published *Le Sens de la Mort*, besides *Anomalies*, a volume of short stories of scientific or psychopathological bent, and *Ecuyère*, a dramatic story, in his early manner, though it differs from much of Bourget's work in showing an aristocrat with an ignoble soul in contrast to others of humbler birth.

It was Paul Bourget who made the notable declaration that during war-time the writer should stick to his writing—that he would accomplish more good in so doing than if, in some burst of enthusiasm, he changed from thought to activity. This, in effect, was the reply made to Anatole France by the French Government. Indeed, the *littérateur* played an important part in France during the war, not only in keeping up the *moral* of combatants and civilians, but in proposing ideas, offering counsel, suggesting projects. The writer's imagination often came to the aid of the soldier's science. Paul Adam (b. 1852) was prolific in suggestions to the high army authorities, and was, long before the fact, responsible for putting forward ideas that were subsequently adopted. Men like Maurice Donnay, Richepin (b. 1849), Barrès busied themselves in keeping the civil population hopeful and consoled. Numbers of these writers were at the head of "war works," and Maurice Donnay (*see* 8.417), the author of *Lysistrata* and *Éducation de Prince*, besides producing a number of works of more or less fugitive interest, in a delightfully humorous one-act comedy showed how the needy "poilus," before returning to the front after their "permissions," were provided by society ladies with socks and shirts and "spoiled" by elderly gentlemen with pipes and pipe-lighters.

Marcel Prévost (*see* 22.312) turned from graceful writing on femininity to more serious (or at any rate more topical) subjects —*Mon cher Tommy* and *La Nuit Finira*. M. Prévost founded after the war a new literary review on the style of *La Revue de Paris*, called *La Revue de France*. Edmond Rostand (*see* 23.754), whose death occurred in 1918, published *Le Vol de la Marseillaise* during the war; *La Dernière Nuit de Don Juan*, in which the brilliant versification met with in *Cyrano* and *Chantecler* is unimpaired, though, as in those works, somewhat disfigured by *calembours* and tricks of phraseology, was published posthumously. One distinguished writer laid down his pen entirely all through the war to take up more active work—Eugène Brieux, who devoted great organizing ability to the care of the blind.

The Academy, as a direct consequence of the war, opened its doors to a number of men not purely or not even at all devoted to the cult of letters. Georges Clemenceau had been indeed the author of a number of works of fiction—*Le Grand Pan, Le Voile de Bonheur*, etc.; Marshal Foch was known as a good military writer; and from Marshal Lyautey, the governor-general of Morocco, came a valuable work on Morocco, published about the same time as his election.

Among the older men outside the Academy, Henri Duvernois, the author of *Gisèle*, a very fine *conteur*, kept up the tradition of the Maupassant school; and Abel Hermant (b. 1862) joined to the classical purity and elegance of his French a gift of humour, satire and irony, in his novels and his *chroniques* of Parisian life.

Claude Farrère (b. 1876), like Pierre Loti (b. 1850), a naval officer and also a Turcophil, had, unlike the Academician, embraced the Mussulman faith, yet in spite of this in his novels he is particularly interested in modernism and the cosmopolitan society of oriental capitals. His work is of the most varied character, and the period under review saw from his pen *Bêtes et Gens qui s'aimèrent, La Dernière Déesse* and *Les Condamnés à Mort*, a novel of "anticipation" *à la* H. G. Wells.

The death of Paul Adam (*see* 1.172) in 1920 removed one of the most remarkable, supple and prolific of French writers. At first a violent impressionist and naturalist, he became in turns mystic and sociologist, and set himself especially to writing novels founded on the ideas of the time. His work is so copious that it has been said to resemble overgrown vegetation; Remy de Gourmont described him as a "magnificent spectacle." The thought is fatigued in trying to follow him, and his style is crabbed and often incorrect. But as a whole his work gives an impression of immense power, his metaphors convey great and teeming ideas. In his later manifestation a symbolist, delighting in esoteric significances, he became a disciple of ruthless individualism, preaching the doctrine of force and energy—his ideal of the strong man armed. His latest works written just before his death—*Reims dévastée* and *Le Lion d'Arras*—called forth by the destruction of the war, are magnificent tapestries of life and colour—teeming with both—and breathe an ardent passion for the spirit that built up the French cities.

A singularly individual writer is Marcel Proust, a Prix Goncourt winner, translator of some of Ruskin's works, author of *Du Côté de chez Swan*, *À l'Ombre des Jeunes Filles en fleur*, and other works showing psychological analysis pushed to the extreme. His writings are much discussed in France; and he has many admirers abroad—England and Holland particularly.

Among the men who might be said to be "in the running" in 1921 for academic honours, Marcel Boulenger (b. 1873) is one of the most notable classic writers and stylists of the day, preserving as he does the traditions of style of the 18th century, with all the subtlety of analysis of Stendhal. Among his recent works are *La Cour*, a novel of the General Headquarters Staff, *La Belle et la Bête*, *Marguérite*. Edmond Jaloux (b. 1878) is the author of a number of novels (*Fumées dans la Campagne*, *Au-dessus de la Ville*, *L'Incertaine*, *La Fin d'un Beau Jour*) which place him in a high rank among psychological romanticists, chiefly with a Parisian setting. The brothers Jean and Jérôme Tharaud, who before 1914 had, in *La Tragédie de Ravaillac*, tried with brilliant success a new style of history treated with the methods of romance, and in *La Fête Arabe* added one more to the growing number of works dealing with the native population of France's north African colonies, have produced, among other works, *À l'Ombre de la Croix*, and *Les Grands Seigneurs de l'Atlas*, dealing with phases of Moroccan life. Of the two sons of Edmond Rostand who inherited the literary gifts of their father and mother, two works have issued from the pen of Maurice—*Le Page de la Vie*, poems, and *Le Cercueil de Cristal*, which shows eminent qualities of fancy and observation. His elder brother Jean, whose bent took a scientific and sociological turn, is the author of a pamphlet of very advanced thought against wealth.

J. H. Rosny *aîné* (*see* 23.739), member of the Goncourt Academy, and one of the most prolific of writers, has produced *Le Film Géant*, and other works in which this versatile bookman tries that rare form of romance in French literature, the novel that deals with scientific wonders. *Les Pures et les Impures* is a study of female life since the war, while *Torches et Lumignons* is a series of impressions of his contemporaries and Parisian life generally. Another highly prolific writer, Paul Margueritte (*see* 17.706), who died in 1919, has been called the "Thomas Hardy of the modern French novel," and certainly he was greatly influenced by English literature. *Jouir* and *Le Sceptre d'Or* were among his last works. Pierre Veber (b. 1869), a novelist and dramatist of vigorous talent, has produced *L'Homme qui vendit son Âme au Diable*, a curious sort of modern Faust who succeeds in outwitting his Satanic Majesty—or rather falls in love with a Parisian work-girl who does so—and *La Vue de Personnages obscurs*.

Louis Bertrand (b. 1866), a disciple of Zola and Flaubert, represents a curious phase of modern France in professing to disdain literature and prefer activity. A native of Lorraine, he has lived a great many years in north Africa, and nearly all his books are studies of the Mediterranean and the countries round it. His recent works continue this tendency, and apart from one or two novels the scenes of which are laid on the French Mediterranean coast, in Spain (*L'Infante* and *Le Rival de Don Juan*), or Attica (*Bains de Phalère*), he teaches the French the joys of limitless horizons such as they find in their colonies, and he revels in the virile joys of abundance and prosperity, the panoply of form and colour. "To perform a pompous act," he says, "is to touch closely for an instant life and poetry, and, in a temporary exaltation, proclaim oneself superior to one's surroundings and to others—to participate in the glory of the world." His *Pepète le Bien-Aimé* is a naturalistic romance of African life, curiously contrastable with his *St. Augustin* of before the war.

The romance of adventure has, as a matter of fact, for some years past been highly popular in France, and some of the best young writers have devoted themselves to this *genre*. Most of them have come strongly under the influence of R. L. Stevenson, Conrad, and other English writers of the same school, most of whose works are translated. Pierre Benoit's *Atlantide*, which was awarded the literary prize of the French Academy, attracted exceptional attention on account of the charge levelled against the author of having plagiarized Sir Rider Haggard's *She*. *Koenigsmark*, *Pour Don Carlos* are others of this writer's romances. *Le Lac Salé* is a romance of Mormonism, while the scene of *La Chaussée des Géants* (The Giant's Causeway) is laid in Ireland—one of the indications of the way in which life outside their own frontiers has come to interest the best French writers. Among the most prominent of the younger writers of adventure stories, besides Benoit and Farrére, may be mentioned Pierre MacOrlan (b. 1883) (*Le Chant de l'Equipage*, etc.), René Bizet (b. 1887) (*La Sirène hurle*), Louis Chadourne (*Le Maître du Navire*), Cyril Berger, Edmond Cazal, Maurice Renard, all of whose work shows strong inspiration from the English and the fascination of seafaring life and adventure over sea and land.

Quite a number of writers also have turned for inspiration to the lowest ranks of society—the Paris *apache* and the dregs of the humanity of big cities, and some remarkable studies of character and low humour are the result, such as *Cri-Cri* by Cyril Berger, *Grain d'Cochon*, by Maurice Dekobra (b. 1885), *La Négresse du Sacré Cœur* by André Salmon, and several works by Francis Carco, one of the choicest of French humorists.

René Benjamin (b. 1883) may also be called a humorist, but he is more—he was in 1921 the leading satirist in France and a master of fierce irony. The author of a fine war-book, *Gaspard*, a masterpiece of French humour, he has also produced a series of satires on the administration of justice, on the great educational institutions, on society during the war (*Sous le Ciel de France*) and since (*Amadou*, *Bolcheviste*). His *Major Pipe* is a series of impressions of contact with the English armies in France—a vein that was also successfully tried by Maurois in *Le Silence du Colonel Bramble*. Among the authors whose inspiration was actually called forth by the war, two or three men stand out preëminently from among masses of war literature, and these chiefly on account of their unflinching realism. *Le Feu*, by Henri Barbusse (b. 1875), not only leapt into fame with startling suddenness, but it had a greater success than any other war "romance" in any country, and has given rise to a number of imitators. Barbusse continued his vigorous study of sociological problems in *Clarté* and other works. *Les Croix de Bois*, by Roland Dorgélès, more measured in tone than the work of Barbusse, is perhaps the finest of all the books called forth by the war. Side by side with him must be placed Georges Duhamel, who was already known as a critic. He was actively engaged during the war as a doctor, and a book of his called *Civilisation*, published under a pseudonym, immediately attracted attention through its fierce realism and its critical spirit. In this work and in *La Vie des Martyrs* he expresses, as he says, "the life and feelings of those Frenchmen my brothers who have in such numbers consented to die without foregoing to express what was so near to their hearts—those Frenchmen the greatness of whose soul, whose indomitable intelligence and touching *naïveté* are too little known to the world." Raconteur, critic, humorist and dramatist, there is also a mystical strain in Duhamel, who at times reminds one of Maeterlinck, but a more vigorous and more French Maeterlinck. One of his plays—a short one-act fancy—shows us a small group of average Parisian bourgeois who suddenly have the idea of taking a country-house together, discuss their plans for an hour, and finally all come to loggerheads and separate through a criticism of small details, which wrecks the entire scheme. *Le G.Q.G.*, by Jean de Pierrefeu, which has also had a notable success, is a kind of chronicle of the General Headquarters Staff.

Romain Rolland's (b. 1866) much-criticised anti-militarist work, published during the war, *Au-dessus de la Mêlée*, comes more under the head of politics than of literature. Rolland has written the history of a free conscience during the war—the history, as one of his critics puts it, of "a poor devil of an anarchist, who thrills with hope when he hears at a distance in the forest the axes of those heroic woodcutters Lenin and Trotzky." In his *Colas Breugnon*, which was written before the war, but did not appear until after it, Rolland tried a new style of literature for him, mirthful, Gallic and indeed almost Rabelaisian ("a reaction," he says, "against the constraint of 10 years spent in the flesh of 'Jean Christophe,' which, first made to my measure, ended by becoming too small for me").

Madame Alfred Valette (Rachilde) (b. 1862), one of the most prominent of women novelists (she has more than 30 novels or plays to her credit), possesses passion, keenness of observation and a vigorous style. *Dans le Puits, ou la Vie intérieure*, however, is not a novel and contains no intrigue, but is a sort of "journal intime," without much sequence, kept by the authoress during the years 1915–7 (Maurice Donnay and other writers did the same thing). Cast in the form of a series of conversations with a mysterious personage, Rachilde's book is a remarkable effort of self-revelation without hypocrisy or convention. The revelation of the whole thought, it gives, as its title indicates, a true sensation of the interior life surrounded by an atmosphere of nightmare, "such as was lived during the years of agony and suspense and butchery when one felt humanity descending into bottomless abysses."

Among the 419 French writers killed at the war whose work had already attracted attention, and who belonged to one or another of the leading literary groups, may be particularly mentioned Louis Pergaud, a "Prix Goncourt," author of *De Goupil à Margot*, who in his novels showed himself to be a keen student and observer of animals and with a great taste for natural history. Alan-Fournier, a very young author, in his single work, *Le Grand Meaulnes*, wrote perhaps the finest French adventure book of recent years. It is full of the hopes, romance, friendships and secrets of youth, its fancy and free untamed spirit tinged with melancholy and the timidity of woodland things. Others thus struck down before they had accomplished much were Louis Codet, also quite young, a very fine meridional story writer in the style of Daudet (*La Fortune de Bécot*, *César Caperau*, etc.); Paul Acker (b. 1874), author of *Le Désir de Vivre* and other novels; Lt.-Col. Driant (b. 1855), the hero of Verdun, who had written some striking novels of "anticipation" on the forms of future warfare; the brothers Ernest and Michel Psichari; Charles Müller, a brilliant critic and romanticist; André Lafon, poet and novelist, who had gained the Grand Prix for literature of the French Academy; André du Fresnois, poet, novelist and critic; Lucien Bonneff, the author of popular works on the theories of socialism; Émile Nolly, a writer of novels on colonial life (chiefly of Annam); Charles d'Olonne, an explorer besides being a man of letters; Claude Casimir-Périer, son of a former president of the republic, the author of works on the mercantile marine and maritime questions. A number of remarkable poets also disappeared in the great struggle, among them Pierre Fons, a "laureate" of the Academy, Robert d'Humières, Guillaume Apollinaire, Lionel des Rieux.

The best remembered of all those who fell before the enemy is Charles Peguy, who died an heroic death in the first few months of the war. The poet of *Jeanne d'Arc*, and Grand Prix of the Academy, he was a leader in the school of Barrès and a disciple of the fervent nationalism which had such an extraordinary effect on the young men of France. The founder and director of the famous *Cahiers de la Quinzaine*, which saw the birth of numbers of remarkable works, he came of peasant stock and joined to a profound love of democracy a sort of national-religious mysticism (like the Christian socialist patriotism of the men of 1848). He dedicated his *Jeanne d'Arc* "To all those who have learned the remedy (to the universal evil); to all those who have lived their human life; to all those who have died from their moral life for the establishment of the Universal Socialist Republic." Later works of his were *L'Appel aux Armes*, *Le Voyage du Centurion*, etc.

Léon Daudet's (b. 1868) name (he is also of the "Goncourts") is one of those most on people's lips, and naturally so when we remember his tremendous production on political, national and other subjects during the war (to say nothing of his polemical writings as editor of the *Action Française*, and his vigorous trenchant style. Up to 1921 his latest incursion into pure literature was entitled *L'Amour est un Songe*. But Léon Daudet is one of the most picturesque figures of modern France, and his *Memoirs* will be a valuable addition to the history of the epoch.

Several notable women writers had in 1921 recently passed away, the most picturesque among them perhaps being Judith Gautier (1850–1919), the gifted daughter of a man of genius and the one-time wife of another, Catulle Mendès. Most of her novels and stories had their scenes laid in China or Japan, being reminiscences of the teaching of her former professor, the Chinaman whom her father found wandering in the streets of Paris and took home with him. Madame Daniel-Lesueur (1850–1921), starting as a poet with great talent and the translator of Byron, wrote a larger number of novels showing great powers of observation and vivacity, though in her latter years she had risen little above the feuilleton type.

Among the names of prominent women writers may be cited the Comtesse de Noailles, who was awarded the French Academy prize for literature (10,000 francs) in 1921, Marcelle Tinayre (b. 1872), Colette Yver (b. 1874), Jeanne Landre, Lucie Delarue-Mardrus (b. 1880), Marie-Anne de Bovet. "Colette" followed up her success in *Vagabonde* with *Chéri*, which depicts exactly the same sort of society and with an equally remarkable talent, and another work showing her exceptional love and understanding of animals. Marguérite Audoux, the seamstress authoress of *Marie-Claire*, subsequently followed this work up with a sequel called *L'Atelier de Marie-Claire*, though the second work cannot be said to possess the same qualities as the one which led Octave Mirbeau to find a publisher for her. In general it may be said of French women writers, as of those of other countries, that their treatment of many subjects is bolder and more outspoken than that of the men.

Two women writers notably have got their inspiration from the East, where both of them were born—Miriam Harry, a gifted writer, the child of French parents settled in Palestine, and Elissa Rhais (authoress of *Saada la Marocaine* and *Le Café-Chantant*), a Mohammedan lady from Algeria, whose mother, she tells us, used to relate to her interminable stories in the manner of the *Arabian Nights*.

A feature of French literature worth noting is the long list of "regionalist" writers, who lay the scenes of their romances in and depict the life of particular parts of the provinces with which they are most familiar. Thus we find Henry Bordeaux devoting himself especially to the Dauphiné, while Paul Bourget is the special mouthpiece of the Auvergne, as Maurice Barrès is of Lorraine. J.-H. Rosny *jeune* (*see* 23.739) places a good many of his scenes in the Landes, while there are several novelists who devote themselves to Provence, including Edmond Jaloux and E. Henriot. Writers on the Basque country include Pierre Loti, Paul Faure (b. 1876) and others. Madame Lucie Delarue-Mardrus is the writer for Normandy, Marc Elder and André Savignon (who gained the Prix Goncourt for his *Filles de la Pluie*) for the Ocean (Ushant and the Isles). Pierre Guitet-Vauquelin (b. 1882) is the special writer for the Central Pyrenees and Corsica, and there are others who make a specialty of the Bas-Languedoc, Anjou, Brittany, etc. Indo-China finds interpreters in Pierre Mille (b. 1864), Loti, Farrère, while the list of romanticists for Algeria, Morocco and French Africa is a long one.

Among the poets of 1921 a leading place was taken by Fernand Divoire (b. 1883), the symbolist, who had since the war published a volume entitled *Ames*, with a decided Shakespearean inspiration. Divoire is a champion of the most advanced schools, including "cubism"; he is also particularly interested in the technique and art of the dance, and has written on the art of Isadora Duncan. Henry Bataille (b. 1872), the prolific and popular dramatist, published *La Divine Tragédie* and other poems during the war. Paul Valery is a poet who enjoys a remarkable reputation abroad. Paul Fort (b. 1870), the so-called "Prince of Poets," author of a seemingly interminable series of *Ballades Françaises*, continued to produce his remarkable personal, Puck-like, capricious and prolific muse. Some of his admirers have compared him to Walt Whitman. There is truly something of Whitman in him, but it is perhaps more true to say of him that when he is least like himself he is imitating Paul Fort. "I make all lyres vibrate," he says. "The human soul is my religion. I am a poet—solely a poet. In other words, a dreamer, a conscious creator. Or again, and above all, a creating God, a dreaming God." *Spirituel*, picturesque, solemn or comic, he has always a wonderful command of phraseology and of the *vers libre*, and above all, he is essentially French. "Paul Fort is a mask," one writer says of him, "and under that mask is the familiar daemon of the land of France." Jules Romain, of the group or "chapel" of the *Nouvelle Revue Française*, and founder of the style of "Unanisme," or the absolute expression of reality in verse, has produced *Le Voyage des Amants in vers libre*. Maurice Magre (b. 1877), author of *La Montée aux Enfers*, who is also a dramatist, began his career as a poet of social inspiration, but turned Baudelairian. Francis Carco, the humorist, is a poet of a very sensitive muse.

French criticism suffered severely in the loss of the two veteran critics Jules Lemaître (*see* 16.408) and Émile Faguet (*see* 10.125). Jules Lemaître (1853–1914) was the man of an epoch, and he disappeared when that epoch finished. Poet, dramatist, novelist and critic, he rendered the most service in this last capacity. An admirer and disciple of Flaubert, he was imbued with the particular modernism and fantasy of that master. In the little notebooks he filled at the time with all sorts of impressions, bold, brilliant and often tumultuous, is found the nucleus of all his afterwork. His volumes of criticisms on his "Contemporaries," who included the Parnassians and the Symbolists, and all the leading figures of the middle of the last century, are particularly valuable. A keen analyst, ironical, sceptical and ingenious, mingling the finesse of a metaphysical moralist with the fantasy of a dilettante, and unable to accept the finality of any judgments ("One must not worry too much about the future," was one of his sayings), his work is marked by an intense personality and by novel opinions on old subjects. The inventor of the impressionistic method of criticism, if he severely flagellated some of his contemporaries, he succeeded in making criticism a living and enduring thing. Émile Faguet (1847–1919), by the variety of his encyclopaedic knowledge and his independent views (sometimes over-independent), had in his latter years, without abandoning the study of letters, devoted himself more especially to the study of contemporary sociology in its various forms. Thus among his last works were two volumes on *Le Culte de l'Incompétence* and a continuation *Et l'Horreur de la Responsabilité*. Criticism was in 1921 represented by Paul Souday, the well-known literary critic of the *Temps*, Fernand Vandérem (b. 1864), Adolphe Brisson (b. 1860), editor of *Les Annales Politiques*, René Doumic (*see* 8.450), of the French Academy, and Camille Mauclair (b. 1872).

History is chiefly represented by Gabriel Hanotaux (*see* 12.923), the author of a voluminous *History of France*, Ernest Lavisse (*see* 16.294), Aulard (*see* 2.916) and Lenôtre (b. 1857), the author of brilliant works on 18th-century characters and the Napoleonic era.

The drama had a serious setback in France during the war, when old favourites for the amusement of the "*permissionaires*" had it all their own way. The most prolific and most popular dramatist in 1921 was Henry Bataille, who, though several of his pieces have been slightly suggested by the war, has given it as his opinion that the war can have and should have no durable effect on art. Within a short couple of years several of his highly literary pieces had been produced—notably, *Tendresse*, *Les Sœurs d'Amour*, and *L'Homme à la Rose*. Sacha Guitry (b. 1885), a phenomenon in himself, has latterly been represented by his studies of those two great Frenchmen, *Béranger* and *Pasteur*, and by his lighter pieces, *Je t'aime*, *Le Comédien*, and *Le Grand Duc*. Among other notable playwrights who have been particularly prominent may be mentioned De Curel (*see* 7.637), with his "*pièces à thèse*" (*L'Âme en Folie*, etc.), Maurice Magre (*La Mort Enchaînée*, *Arlequin*, a fairy comedy), Carco, the versatile humorist with his study of apaches and low life generally (*Mon Homme*), Lucien Descaves (b. 1861), *L'As du Cœur*, one of the best of a series of post-war plays dealing with the problem of the returned combatant, Lenormand, André le Lorde (b. 1871) (of the Grand Guignol), Zamacois, Fauchois (*Beethoven*, etc.), St. Georges de Bouhelier, Bernstein (b. 1876), M. Hennequin, and that indefatigable writer of farces, Henry de Gorsse (b. 1868), who had several thousand pieces, written, alone or in collaboration, to his credit.

It must be added that great influence had of late been exerted on the drama and letters by the Théâtre du Vieux-Colombier, which, under the direction of J. Copeau, had become a veritable nursing home of ideas and was *par excellence* the leading classical international theatre. (S. S.)

FRENCH WEST AFRICA (*l'Afrique Occidentale Française*, or *A.O.F.; see* 11.205).—By 1921 France had formed out of all her West African possessions an administrative whole constituting a vast country six times larger than France, and its riches were being continuously developed. The settlements thus linked together are separated one from another on the Atlantic seaboard by intervening foreign possessions but become merged in the depth of the continent. They cover an area stretching south of Morocco and Algeria to the Chad and Congo of nearly 1½ million sq. m., with a pop. of about 11 millions. The colonies thus grouped are:—

Senegal (cap. St. Louis) 76,000 sq. m., pop. 1,250,000. Upper Senegal-Niger (cap. Woulouba) and Upper Volta (cap. Ouaga Dougou) together 315,000 sq. m., pop. 5,645,000.

Guinea (cap. Konakry) 107,000 sq. m., pop. 1,809,000. Ivory Coast (cap. Bingerville) 83,000 sq. m., pop. 1,300,000.

Dahomey (cap. Porto Novo) 41,300 sq. m., pop. 225,000. Mauretania, between the Rio de Oro and Senegal, 100,000 sq. m., pop. 225,000.

Niger Territory (cap. Zinder) 714,000 sq. m., pop. 225,000.

Along the whole coast south of the Rio de Oro to the bend of the Niger there is only one port worthy of the name, Dakar, which has modern equipment. With the exception of Dakar and Konakry on the Guinea coast there are only river ports such as St. Louis on the Senegal. Two vast rivers flow through French West Africa; they have annual floods but are not everywhere navigable and their mouths are obstructed by cataracts and barrages. They are the Senegal (1,060 m.) and the Niger (over 2,500 m.), the latter of which forms an immense curve up to Timbuktu. On the Ivory Coast and in Dahomey lagoons run parallel with and a short distance from the sea. They are navigable by specially constructed boats. The physical configuration of the country has made its penetration arduous. The Saharan desert on the north, dense equatorial forests on the south and an unfriendly sea-coast for long shut out the explorers. Climate changes according to the distance from the coast. In the south rains are heavy and steady. The natives represent many different branches of the black race, Sudanese, Mandingoes, Bambaras, Ouslops and Ashanti. A governor-general, residing at Dakar, is at the head of the administration, and the colonies under him, which preserve their administrative and financial autonomy, are governed by lieutenant-governors.

The railways (1,860 m.) are being greatly developed. Existing lines in 1921 were Dakar, St. Louis, Thies–Kayes, Kayes–Niger.

Oil products, textile and fibre are the chief exports. Nuts are the great resource of Senegal. The total oil exports of 1919 amounted to 230,260 tons, of which nuts formed the bulk. They are shipped shelled and unshelled. Shelling economizes about 50% in freight. Oil made from these ground-nuts has conquered the market. Cakes made with this oil are being increasingly used in the feeding of cattle. The oil palm which is found in Guinea, and especially in the Lower Ivory Coast and Dahomey, is very productive. The covering of the palm-nut yielded 36,000 tons, of which 35,000 tons were exported in 1919. The kernel oil produced in 1919 amounted to 102,000 tons, of which 98,538 tons were exported.

The production of textile and fibrous material is not great, but there are considerable possibilities. The natives have always grown cotton, and successful attempts to grow cotton industrially have been made in Senegal, Upper Senegal, the Niger, Ivory Coast and Dahomey. In the Sudan and Senegal irrigation is necessary, and according to experts the valley of the Niger is as good as that of the Nile in this respect. A great irrigation scheme was being prepared in 1921. Timber resources are vast. The forest of the Ivory Coast, which covers two-thirds of the colony, measures 70,000 square miles. Mahogany exports in 1919 were 35,000 tons. Proper working of the forest will give vast quantities of wood, 30% of which is suitable for furniture. The general trade amounted in 1919 to 630,260,000 fr. (300,433,000 imports), showing a considerable falling off from the 1918 figures, which were 853,060,000 fr. (575,271,000 imports). There were signs, however, that in 1920 there would be a great improvement.

FRENCH WEST INDIES.—Martinique and Guadeloupe (*see* 17.801 and 12.645), belonging to France, form one of the small West Indian colonies in the Atlantic Ocean.

Martinique.—The total pop. was 193,087 inhabitants who, with the exception of the immigrants, are all classed under the general denomination of Creoles. Fort de France, the capital of the colony, has 27,000 inhabitants, and is the only large place in the island since the destruction of St. Pierre in 1902. The produce of Martinique consists principally of sugar-cane and its derivatives. The trade of the colony in 1919 amounted to 247,375,000 fr., of which 74,670,000 were imports and 172,705,000 were exports. The trade figures for 1918 were 105 million fr., this being 25 million fr. more than the average for the five years 1913–7. As in the case of Guadeloupe, France and her colonies account for only about one-third of the imports, while they absorb about nine-tenths of the exports.

Guadeloupe.—The pop. of Guadeloupe and the outlying islands is 190,503. About nine-tenths consists of Creoles; it comprises whites, half-breeds and blacks, between whom there is considerable friction. Guadeloupe has two large towns: Pointe-à-Pitre, a busy place (22,664 inhabitants), and Basse-Terre, the capital (8,184 inhabitants). The trade of Guadeloupe and its dependencies in 1918 amounted to 90,766,879 fr., of which 39,696,000 fr. were imports and 51,070,824 were exports. This total represents an increase of 33,500,000 fr. on the average for the five years 1913–7. About one-fourth of the imports came from France, while almost the whole of the exports went to the mother-country.

FRENSSEN, GUSTAV (1863–), German author, was born at Barlt Oct. 19 1863, and was educated at the universities of Tübingen, Berlin and Kiel. He took orders and from 1892 to 1902 was pastor at Hemme, taking his degree as doctor of theology at Heidelberg in 1903. But he had already for some years been known as a writer of novels, and in 1902, a year after his great success with *Jörn Uhl* (1901), he gave up his pastorate and devoted all his time to literature. His work in fiction includes *Die Sandgräfin* (1895, 3rd ed. 1902); *Die drei Getreuen* (1898); *Hilligenlei* (1905); *Peter Moor's Fahrt nach Süd-West* (1906); *Klaus Henrich Baas* (1909) and *Die Brüder* (1918). He also published sermons (*Dorfpredigten*, 1899–1902), and two plays, *Das Heimatsfest* (1903) and *Sönke Erichsen* (1912).

See H. M. Elster, *Gustav Frenssen, sein Leben und sein Schaffen* (1912); also studies by E. Muesebeck (1908) and T. Rehtwisch (1902); and *Gustav Frenssen: Hilligenlei als Kunstwerk und als Tendenzschrift* (1906).

FREUD, SIGMUND (1856–), Austrian physician and psycho-analyst, was born on May 6 1856 at Freiberg in Moravia, and studied medicine and psychology at Vienna, being strongly influenced by Brücke in the latter subject. He took his doctor's degree in 1881, became a member of the teaching faculty in 1885, extraordinary professor in 1902 and ordinary professor in 1919. After working in Paris under Charcot in 1885–6, he devoted himself, under his influence and in coöperation with the Viennese physician, Josef Breuer, to the study of nerve cases. The results of their joint investigations were published in 1895 as *Studien über Hysterie*, of which several editions have appeared, expounding a new treatment, the so-called *catharsis*. This consisted in putting the patient in a hypnotic state, and the examination by the physician, while under this condition, of the forgotten original circumstances under which the symptoms first appeared. Subsequently Freud pursued a path of his own, and developed a special technique, abandoning hypnosis in favour of the so-called "psycho-analytic" method, under which the pathogenic material of which the patient was unconscious was revealed by means of free association and by the interpretation of dreams, etc. The technique and the results of this research work are explained in Freud's most important works: *Die Traumdeutung* (6th ed. 1921), *Psychopathologie des Alltags* (7th ed. 1920), *Drei Abhandlungen zur Sexualtheorie* (4th ed. 1920). Freud's smaller works were collected in four volumes under the title, *Kleinere Beiträge zur Neurosenlehre.* Freud also published two general sketches of his theory: a shorter one, *Fünf Vorlesungen über Psychoanalyse* (delivered at Worcester, Mass., in 1909), and a comprehensive one in *Vorlesungen zur Einführung in die Pyschoanalyse.* These medical-psychological studies yielded surprising results in relation to other subjects, and in the possibilities of their adaptation in other branches of knowledge, *e.g.* mythology and the history of religion, civilization and literature. The principal works in this connexion are *Totem und Tabu* (2nd ed. 1920), *Der Witz* (3rd ed. 1921), *Eine Kindheitserinnerung: Leonardo da Vinci* (1916), *Jenseits des Lustprinzips* (1920), *Massenpsychologie und Ich-analyse* (1921). Freud's works have been translated into English in collected form. He was given an honorary degree by Clark University, Worcester, Mass.

FRICK, HENRY CLAY (1849–1919), American manufacturer and philanthropist, was born at West Overton, O., June 17

1849. As a boy he was a clerk for his grandfather who was a distiller and flour merchant; but he early became interested in the coke business. In 1871 he organized the firm of Frick & Co., which ultimately acquired large coal deposits and ran 12,000 coke ovens. He was chairman of the board of Carnegie Bros., from 1889 to 1892, and in the latter year, during the Homestead strike, was shot and stabbed by Alexander Berkman, an anarchist. He was a director of the Pennsylvania, the Santa Fé, and other railways, and of the U.S. Steel Corporation. He died in New York Dec. 2 1919.

To his family and friends he left $25,000,000, estimated at the time to be one-sixth of his estate. To his daughter he left about $6,500,000 to be expended in educational and charitable work. To the city of Pittsburgh he left land for a park (its value being estimated at $500,000), together with endowment of $2,000,000. His New York mansion, with its collection of paintings, bronzes, and enamels, he bequeathed to the city on the death of his wife; and he added an endowment of $15,000,000 for the support of this "Frick Art Collection." He divided his residuary estate into 100 equal parts, each of a tentative value of $500,000. One share was left to many Pennsylvania hospitals and charitable homes, three shares to the Lying-in Hospital (New York), ten shares to the Mercy Hospital (Pittsburgh), ten shares to the Frick Educational Fund, ten shares to the Massachusetts Institute of Technology, ten shares to Harvard University and thirty shares to Princeton University. The value of his New York mansion and its art collection was estimated, in 1920, to be $50,000,000. Among the chief treasures are the Fragonard panels, purchased from the Morgan collection in 1915 for $1,250,000, Bellini's "St. Francis in the Desert" (costing $250,000), Velasquez's "Philip IV." (costing $400,000), Van Dyck's "Paola Adorno" (costing $400,000), Rembrandt's "Portrait of Himself," Gainsborough's "The Mall" (costing $300,000), and the same artist's "The Hon. Anna Duncan" (costing $400,000). Other paintings are fine examples of Titian, Vermeer, Frans Hals, Ruysdael, Cuyp, Rubens, El Greco, Goya, Sir Thomas Lawrence, Millet, Raeburn, Reynolds, Romney and Turner.

FRIEDRICH, JOHANN (1836–1917), German theologian (*see* 11.216), died in 1917.

FROHMAN, CHARLES (1860–1915), American theatrical manager, was born at Sandusky, O., June 17 1860. At the age of twelve he started to work at night in the office of the *New York Tribune*, attending school by day. In 1874 he began work for the *Daily Graphic* and at night sold tickets at Hooley's theatre, Brooklyn. In 1877 he took charge of the Chicago Comedy Co., with John Dillon as star in *Our Boys*. He next joined William Haverly and his Mastodon Minstrels as manager, touring the United States and Europe. Then for a time he was associated with his brother Daniel in managing the Madison Square theatre, New York. In 1888 he presented Bronson Howard's *Shenandoah* in a revised form, which was a great success. In 1890 he organized the Charles Frohman Stock Co. On Jan. 25 1893 he opened his Empire theatre, New York, with *The Girl I Left Behind Me*, and here he presented many of his stars. Other New York theatres with which he was at various times connected were the Criterion, Garrick, Knickerbocker, Lyceum, and Savoy. He was an adept in developing talent. Among his successful players were Maude Adams, Ethel Barrymore, Blanche Bates, Billie Burke, William Gillette, and Otis Skinner. During 1905–6 he presented E. H. Sothern and Julia Marlowe in Shakespearean plays. Sir James Barrie's plays were favourites with him, and he produced many of Henry Arthur Jones's and Pinero's. He was one of the organizers of the syndicate which for several years controlled the American theatres. Beginning with 1897 he presented many plays in London, leasing at different times such houses as the Duke of York's, Globe, Comedy, Vaudeville and Adelphi. He perished when the "Lusitania" was sunk by a German submarine May 7 1915.

FRONTIERS, BATTLES OF THE.—The generic name of "battles of the frontiers" covers the whole of the actions fought at the opening of the World War in Aug. 1914 on or near the French frontiers. They are described separately below.

(1.) Early Operations in Upper Alsace

First Entry of the French into Mulhouse.—In 1914 the Upper Vosges formed a wall between the French Lorraine and the plain of Alsace, taken from France in 1871. On the other hand, to the S. of this wall, the large open gap between the Vosges and the Swiss Jura presented an easy crossing from the Rhine valley into the Mediterranean basin. This gap, a historic gate of the Gauls, was defended on the French side by the fortress of Belfort which gave it its name. A little E. of the fortress the Franco-German frontier separated the area of Belfort from that of Upper Alsace which has Mulhouse as the centre and is commonly called Sundgau.

In the critical days at the end of July 1914, the French Government, wishing to avoid all chance of premature collisions, directed its covering troops to hold themselves at a distance of at least 10 km. back from the frontier, a precaution which served only to deplete of French troops the heights of the Upper Vosges, of which the Germans took possession without firing a shot, and to confine the troops of Belfort within their fortifications while the enemy made repeated incursions into French territory.

Mobilization had only just been ordered when Gen. Bonneau, who was in command of the French troops from Gérardmer to the Swiss frontier, received instructions to take the offensive, and to advance on Mulhouse with the 8th Cavalry Div., the VII. Corps (14th and 41st Divs.) and a brigade of infantry from the garrison of Belfort attached to the 14th Division. The object of this offensive was, it seems, to destroy the Rhine bridges, and to mask Neubrisach; but without doubt the High Command counted much on the political effect that the immediate arrival of the French would produce.

However that may be, the offensive began on the morning of Friday, Aug. 7th, and its start was promising. During the day, on the right Altkirch was captured after hand-to-hand fighting by a brigade of the 14th Div. and a brigade of dragoons; in the centre, the two other brigades of the 14th Div. occupied, after an advance-guard action, the line Aspach–Burnhaupt–Ammertzwiller; on the left, the 41st Div., which had descended the Thur valley, reached Thann and threw out an advance guard towards Cernay.

The next day, while one of its brigades stationed itself at Altkirch, the VII. Corps continued its march forward without resistance. The 41st Div. thus advanced to Lutterbach, and the 14th Div. reached Mulhouse, which it entered at about 6 P.M., with bands playing and flags unfurled, having been preceded by a strong advance guard which pushed beyond the town towards Madenheim and Rixheim.

This unresisted advance was so abnormal that it filled Gen. Curé, commanding the 14th Div. already warned by uncertain rumors, with fears which were soon confirmed by more definite information. The general learned that large German forces had been observed both in the directions of Mülheim and towards Neubrisach, that the Harth Forest swarmed with *Pickelhaubes*, and that the German advance guards had been seen in the Ile Napoleon at a distance of a few kilometres from Mulhouse. Not wishing to run the risk of being caught in a trap, he decided to withdraw his troops from the town, taking advantage of the night to establish them on the heights. The evacuation commenced at 2 A.M., eight hours after the entry into Mulhouse, and on Sunday (Aug. 9), at the break of day, one of his brigades was concentrated with the corps artillery on the plateau of Riedisheim, and the other to the S. of Dornach.

The apprehensions of the commander of the 14th Div. were only too well justified. The German plan of concentration provided for the formation of an army under Gen. von Heeringen between Strassburg and Colmar. Two of the corps belonging to it, the XIV. and XV., were already mobilized and had practically finished their concentration on Aug. 7 when the Germans first heard of the audacious French advance. The smallness of the numbers opposing them caused the Germans no anxiety. They therefore made no attempt at resistance, but utilizing their roads and railways to the full assembled superior forces behind the Harth and Nonnenbruch forests. Thus on the morning of the 9th an armoured train of eight trucks, on which the French artillery fired unsuccessfully, went to and fro between Mülheim and the Ile Napoleon, bringing up infantry units on each trip. In a few hours hostile columns advanced from all directions, and by about 5 P.M. the VII. French Corps was violently attacked all along the line by the superior forces of the XIV. and XV. German Corps. It held its ground till nightfall, and counter-attacking drove back the enemy on Rixheim and the Ile Napoleon, but was eventually forced to break off the action under cover of darkness to avoid envelopment. The artillery got away in good order, and despite the difficulty of disengaging the infantry in the darkness and in the enclosed country the withdrawal westwards was successfully effected without interference from the enemy. On the 10th order was established in the units of the VII. Corps, which on the morrow took up a position on the frontier behind the St. Nicholas.

If the French general staff had acted very imprudently by taking such an early offensive in the Sundgau that it could not keep it up, the German general staff showed singular indecision in not profiting by their superior numbers to follow up and overwhelm the French corps, as early as Aug. 10, and to attack Belfort during the confusion following its defeat. It held strictly to its plan of operations, and, having prepared a massed attack on Luxemburg and Belgium, provided for a strict defensive between Switzerland and the Donon. The XIV. and XV. Corps rejoined the army of von Heeringen on the 10th, and the defense of Upper Alsace was given over to Gen. von Gaede, who received for that purpose the command of four brigades of Landwehr. The organization of this detachment took time, and when the Landwehr at length undertook a tardy pursuit they had lost touch with the VII. Corps. Instead of marching towards the W. they advanced to the S., in the hope, doubtless, of being able to force the defile which formed the easiest approach to Belfort. But they had been forestalled in this direction by the garrison of Belfort (57th Div., Gen. Bernard), which on Aug. 13 checked their advance before Montreux-Vieux. Having lost during the day 1,800 to 2,000 men, the Germans suspended their counter-offensive, and fell back rapidly towards the E., abandoning arms, equipment, and munitions.

The Operations of the Army of Alsace.—As early as Aug. 10, however, Gen. Joffre, wishing to react against the effects of the repulse of Mulhouse, had decided to form an Alsatian army in the vicinity of Belfort under the command of Gen. Pau, which was to renew the advance in greater strength. It had also the mission of covering the right flank of the I. Army, which under the orders of Gen. Dubail, was to operate in the direction of the Donon, and the Bruche valley.

The Army of Alsace comprised the 8th Cavalry Div., five detachments of Chasseurs Alpins, the VII. Army Corps, the 44th Infantry Div. consisting of the troops from Africa, the 58th, 63rd and 66th Reserve Divs. from the centre and the S. of France, and the 57th Reserve Div. with two heavy batteries detached from the Belfort garrison.

Before all these formations had arrived the army took the offensive on the left; and the five battalions of Chasseurs crossing the passes of Bussang and Schlucht, which the Germans had abandoned at the beginning of August, descended towards Thann, Cernay and Colmar. The main body of the army advanced on the 16th, the advance being methodically executed with the idea first of cutting off the enemy's retreat to the N., then driving him back beyond Mulhouse, and either hemming him in against the Swiss frontier or forcing him back to the other side of the Rhine.

Disconcerted by a counter-offensive which they had not expected so soon, and by the superior numbers of their adversaries, the Germans under von Gaede fell back rapidly everywhere, offering little resistance. In three days all the territory to the S. of the Vosges was cleared, and at 10 A.M. on the 19th the main body of the Army of Alsace attacked the enemy forces concentrated before Mulhouse, their right at Lutterbach and Pfastatt, their centre at Dornach, their left towards Brunstatt. Fighting continued during the afternoon, being particularly severe around Dornach. The eventual capture of this village by the French decided the day, and the defeated Germans fell back towards the Harth and the Rhine, leaving behind them 24 guns and 1,000 prisoners. At 4 P.M., for the second time in a fortnight, the victorious French entered Mulhouse. They were again warmly greeted by their brethren of Alsace, who were inspired by this rapid return to hope that this time they were definitely freed from the yoke of the oppressor. In the joy of triumph they refrained from further advance, and the conquered Germans were able to fall back unmolested when a vigorous pursuit might have turned their defeat into an irreparable rout.

A second battle, without any definite connexion with that of Dornach, took place on the same day, Aug. 19, some distance to the S. of Mulhouse. The 44th Div., which covered the right flank of the Army of Alsace, was attacked, between Leumschwiller and Tagsdorff, by a German division which had been brought over from the other side of the Rhine. This division was beaten off and obliged to beat a hasty retreat; but the French division, which had paid dearly for its victory, had to be withdrawn in order to refit. On the 21st it was relieved by the 57th Div. which occupied Altkirch with advance posts on the right bank. The 14th Bde. of Dragoons, supported by two battalions at Hirsengen and Hirtzbach, extended the line to the right and completed the screen covering the Army of Alsace.

Fortune for the moment seemed to smile upon the French, but suddenly the situation underwent a change, and their hopes were dashed to the ground by the disasters of Sarrebourg, Morhauge and Charleroi. The withdrawal of the XI. Army had an immediate repercussion on the situation of the I. Army, which had to conform to the retreat of its left-hand neighbour. The Army of Alsace was in its turn affected by the general withdrawal, and by orders from G.H.Q. was broken up in order that its various elements might be allotted to other formations.

The 44th Div. was the first to leave on Aug. 22 to rejoin the I. Army. On Aug. 24 the 57th Div. was again placed at the disposal of the governor of Belfort, and had to abandon its position at Altkirch and fall back first to Dannemarie, and thence to the line Montreux-Vieux–Foursemagne–Fontaine. On the 25th Mulhouse was evacuated, and the VII. Corps together with the 63rd Div. was entrained in order to form the nucleus of the VI. Army, of which Gen. Maunoury was to take command. On the 26th, the 66th Div. was sent to Montbéliard with the 14th Bde. of Dragoons. The 58th Div. fell back to the Upper Thur valley, one of its brigades being left to occupy the mouth of the defile at Thann.

The Chasseurs battalions and the 8th Dragoon Bde. marched by Münster road to the crest of the Vosges. The bridges of Illfurth and of Aspach were destroyed, the canal sluices between the Rhône and the Rhine were blown up, and the two large viaducts on either side of Dannemarie station were cut. The disbandment of the Army of Alsace thus left the Sundgau once more clear of French troops, and abandoned to the mercy of the Germans. At the same time Belfort was left exposed and open to hostile attack.

Renewed Offensive of the Belfort Garrison.—The rôle assigned to Belfort in the French defensive scheme was to support the right wing of the armies resting on the Swiss frontier, and to command the gap by which the enemy might endeavour to penetrate between the Vosges and the Jura, in order to gain a decisive advantage by taking the French armies in reverse. It was a vitally important rôle, since if the Germans once secured the gap they might penetrate into the heart of France by Besançon and Dijon.

A vast amount of work had been done in the last 40 years in constructing, on the basis of the small fortress of 1870, the great stronghold of 1914. Much, however, remained to be completed. The work necessitated by the invention of armour-piercing shells dragged on endlessly, hindered by the want of funds and by manufacturing delays in the workshops, to which must be added the alterations caused by the progress of armament leading to a constant modification of the plans. The result was thus a miscellaneous array of old works and new forts with others still in the course of construction.

The forts Roppe, Bessancourt, Vesélois, Fourgerais, and Bois D'Oye were splendid modern or modernized works. On the other hand, the construction of the forts of Giromagny and Salbert had not even been begun; and La Chaux and Mont-

Vaudois, the reconstruction of which had just been undertaken, were half demolished and transformed into enormous building yards so that they were quite incapable for the moment of playing any part in the defence. As in all the French fortresses, there was not enough heavy artillery; the guns were good, but their mountings were out of date; and as these could only be fired from platforms which took a long time to erect, they had not the necessary mobility; the 1,000 rounds apiece which was allowed them was totally insufficient, and the method of firing, as then practised, did not allow them to make full use of their range. Altogether, the defence of Belfort in 1914 presented grave deficiencies, and the command had no illusions as to its inconveniences or dangers, but there existed no means of remedying them save by hasty makeshifts and by special alertness. Nevertheless, confidence reigned in the fortress, everyone there knowing that will, energy, and moral courage are the first essentials for the defence of a besieged fortress.

Despite this confidence, the days which passed between July 26 and Aug. 2 1914 appeared painfully long to the Belfort garrison, helpless as it was in face of the German raids, owing to the order to remain at a distance of 10 km. from the frontier, which prevented them from taking even elementary measures of precaution. As elsewhere, mobilization at Belfort was only commenced on the morning of Sunday Aug. 2, and it was extremely complicated, involving as it did the mobilization of both reservists and territorials and their incorporation into their units, requisitioning, transport, supply of provisions, and placing of the fortress in a state of defence.

The mobilization had been well prepared and was carried out with singular regularity; but the fact of troops being diverted from Belfort for the operations which were immediately undertaken in Alsace rendered difficult the normal organization of the garrison. This was to have been composed of an actual brigade of infantry with five battalions of the 57th Res. Div. (12 battalions of infantry, three groups of field artillery, and a company of engineers, and two squadrons of dragoons), 19 battalions of territorial infantry, 15,000 artillery, and 3,000 sappers, together with detachments of custom-house officers, foresters, telegraphic and postal operators, hospital orderlies, clerks, and depot personnel of the various arms, altogether about 75,000 men. As a matter of fact, a half-mobilized brigade of the 57th Div. was called away as early as the 6th, to take part in the first offensive on Mulhouse, then the other brigade of the division was sent forward when barely completed, and it was to the 57th Div., thus formed in the face of the enemy, under the command of Gen. Bernard, that there fell the honour of checking the Germans at Montreux on Aug. 13, after the retreat of the VII. Corps. Without a moment's respite the division then took part in the operations of the Army of Alsace, and it was only on the 26th, after this army was broken up, that it returned to the vicinity of Foursemagne under the cannon of Belfort. While the reserve division was thus engaged, the active brigade took part in front of the fortress at Félon and Lagrange. The rest of the garrison had been assembled, and as soon as its various units were formed they were set to work, in conjunction with all the men from 15 to 60 years of age not subject to military service, to push on with the works laid down in the scheme of defence.

The completion of this task was necessarily impeded by the fighting in which a part of the garrison was engaged during August; but thanks to the willingness of all the workers, the enormous undertaking was achieved by the time that the Army of Alsace was dissolved. The armament of the forts had been completed, numerous batteries had been constructed and armed, and munition depots had been organized. Centres of resistance, united by continuous lines of trenches, which were again covered by accessory defences, had been erected around Roppe fort, the fort and the village of Bessancourt, Fort Meroux, the spur of Oye Wood, the work of the Bambois, and Salbert hill. Finally the organization of the principal zone of defence had been strengthened by large inundations on part of the front.

In front of this zone other works had been undertaken with a view to strengthening the fortress, and towards Frais, Chèvremont and Bourogne. The works of Mont Vaudois were pushed forward, and in the fortress of Chaux itself, the dismantling of which had left the road from Montreux to Montbéliard open to attack, the parapets were rebuilt, concrete shelters constructed and every device utilized which could render the dilapidated work capable of effective action.

All this might have been reassuring, if the experience of a few weeks of warfare had not confirmed the insufficiency of French heavy artillery material, and the power of the German heavy artillery which had crushed the resistance of Liége, Namur and Longwy. On Aug. 25, there could be no possible doubt that if the enemy could approach near enough to Belfort to establish his guns 8 km. from the forts, the heart of the place would be bombarded and the forts themselves smashed before the artillery of the defence could fire a shot. Under the circumstances, at the very moment that the generalissimo was recommending a defensive based on the fortresses, it was manifestly unwise to uncover the most useful of them all by rapidly evacuating the Sundgau and breaking up the Army of Alsace instead of using a part of it to prepare, occupy, and defend strong defensive positions at important points. G.H.Q. might have need elsewhere of the VII. Corps, the 44th and 63rd Divs. and part of the cavalry, but it did not remove either the 57th Div. or the 58th or the 66th Divs., or the 14th Dragoon Bde., so that these formations together were in effective strength superior to the enemy, who had left in front of the Army of Alsace only Ersatz and Landwehr troops.

Instead of these troops being withdrawn, and dispersed over the area of Montbéliard–Foursemagne–Wesserling, they might well have been ordered to stand fast in the Sundgau. Even if Mulhouse appeared to be too distant, or too exposed a position to hold, a judicious use of field fortifications would at least have enabled them to cover Thann, and to establish between Altkirch and Heidwiller a strongly fortified centre, from which it would have been possible to control the road to Basle, the valley of the Ille, the railway and the canal, while the 14th Dragoon Bde. watched all the country in the direction of Ferrette, the Harth, Mulhouse and the Nonnenbruch.

Nothing of this kind was done, and von Gaede was thus able to reoccupy the Sundgau at his leisure. It was now to be feared —the bad news coming in from all sides appeared to justify all manner of fears—that the Germans would make a vigorous attack on Belfort, in order to destroy the pivot of the extensive withdrawal of the Anglo-French troops, which was now being carried out along the whole Swiss frontier to Belgium.

Under these conditions, knowing he had only his own resources to count upon for the defence of the gap, Gen. Thévenet, governor of Belfort, decided not to await the enemy's attack, but at once to assume the offensive, based on the fortress, so as to clear the immediate outskirts of the place and to maintain the initiative. His original plan was to push forward the active brigade and the 57th Res. Div. in front of the fortress, to carry out offensive reconnaissances on an increasing scale, to gain ground by infiltration, to organize the positions gained, and thus to establish, little by little, an effective barrier across the gap. To his mind, the advance should be sufficient to place Belfort beyond the range of the enemy's artillery, and to reduce the line to be held as much as possible by establishing it at the point where the Swiss frontier salient of Porrentuy reduced to a minimum breadth the practicable part of the gap—30 km.—between the Vosges and Switzerland. While this brigade and division were advancing, the governor proposed to employ the rest of the garrison on completing the defences of the fortress and the extension of its perimeter. He also proposed, while making the territorials coöperate with the available civilian labour in constructing these works, to carry on with their training so that they could be employed on the front when the occasion arose. This plan was immediately put into operation. The offensive reconnaissances in front of the fortress began as from Aug. 28 and from that date were pursued without interruption.

The 57th Div., moving forward from its position between Montreux and Fontaine, performed the rôle assigned to it with remarkable energy. Its first reconnaissances were carried out by detachments of cavalry, patrols of infantry, and numerous squads of cyclists mounted on bicycles bought from the local shops, who pushed forward in every direction and drove back the small enemy detachments encountered by them. After Sept. 2 these reconnaissances were extended. Small columns consisting of one or two battalions, one or two sections of artillery, a few cavalrymen, and cyclists, repulsed the enemy in a series of engagements which were practically without exception successful. They appeared simultaneously in the direction of Falckwiller, Waldighoffen, Überkumen, Burnhaupt, Gildwiller, Sternemberg, Heimsprung, thus giving the illusion of a force very superior to that which the fortress of Belfort was in fact able to furnish. Thus covered, the 57th Div. was able to advance from village to village, organizing the localities as it occupied them, and on Sept. 10 the advance guards were on the line Ballersdorff–Gommersdorff–Tranbach beyond Dannemarie.

The active brigade had also carried out reconnaissances well in advance of its front Félon–Lagrange; on Sept. 6 it established its connexion with Thann, the most advanced point held by the 58th Div., which, since the break-up of the army of Alsace, had been bottled up in the Thur valley by the Germans, holding Cernay and the Nonnenbruch forest. On the 9th it advanced to the heights of the left bank of the Doller; its artillery broke up an attack of the 55th Brigade of Landwehr against Vieux-Thann, and at the close of the day it occupied Michelbach, Aspach-le-bas, and the important position of Kalberg, thus holding the highroad to Cernay, commanding the Nonnenbruch and overlooking the plain in the direction of Mulhouse.

After a day spent in massing strong forces at Cernay and in the Nonnenbruch, von Gaede on the 11th carried out a new demonstration against Thann, preceded by a bombardment, and directed a very violent, heavy attack against the positions held by the Belfort brigade. Despite serious losses, the latter held its ground; but its commander, feeling his position to be too exposed, and fearing to be cut off from the fortress, fell back under cover of darkness and regained his cantonments behind La Chapelle sous Rougemont.

It was not long before the advance of the 58th Div. on his right allowed him to push his advance guards forward to the Soultzbach, from Mortzwiller to Dieffmatten, while on his left Massevaux was held by a detachment which was supported in its turn by a Territorial battalion occupying the Ballon of Alsace, and the upper valley of the Doller.

On Sept. 18, wishing to put an end to the raids which the enemy patrols were still carrying out on his right, the governor of Belfort occupied Chavannate, Suarce, Lepuy and Réchézy with strong posts of custom-house officers, who from that day assured the safety of these villages.

On this same day, Sept. 18, the H.Q. of the 57th Div., whose daily reconnaissances had been carried on uninterruptedly in advance of its front, was transferred from Foussemagne to Dannemarie. This transfer was, from the point of view of the garrison of Belfort, the affirmation of their possession of this place, and it was completed on the day following the Marne victory, with the express intention of marking out a new permanent line of defence; it thus made a great impression in France, as also in Alsace, and had all the importance of a victory. It was indeed a considerable success, for the occupation of Dannemarie had been carried out with such precision and solidity that it had now to become definite. From Sept. 18 1914 onwards, the tricolor flag never ceased to fly over the little Alsatian town thus reconquered. (F. T.)

(2.) The First Battles in Lorraine

The first plan of the French High Command, as shown in the General Instruction No. 1, of Aug. 8, was of a purely offensive nature; it was a question of seeking a battle, with all forces concentrated, with the right of the army resting on the Rhine. In Lorraine there were two French armies, the I. and II.; the I. Army was to move against the German Army of Saarburg (the VII.) and endeavour to throw it back in the direction of Strassburg and Lower Alsace. One isolated corps (the VII.) was to make a diversion to the E. of the Vosges; the II. Army, throwing out a flank guard to face Metz, was to take the offensive in the general direction of Saarbrück, on the front Delme–Château Salins–Dieuze, keeping touch with the I. Army in the region of the lakes. It was to leave its two left corps at the disposal of the generalissimo, in the area Bermécourt–Rozières en Haye (W. of the Moselle), with a view to their possible employment in the north.

In front of the I. and II. Armies were the VI. and VII. German Armies, the VI. (Prince Rupprecht of Bavaria) consisting at first of the I., II. and III. Bavarian, and I. Bavarian Reserve Corps and the XXI. Corps, together with two independent divisions and three cavalry divisions; the VII. (Gen. von Heeringen) of the XIV. and XV. Active and XIV. Reserve Corps and the 30th Reserve Division. Both armies were at first to remain on the defensive.

The extreme rapidity of the German invasion of Belgium, and the importance of this theatre, from the first moment induced the French High Command to hurry on the operations in Alsace and Lorraine in order to disengage the Belgian front. By Aug. 13 the VIII. and XIII. Corps were on the Meurthe, the XIII. in the triangle Baccarat–Raon l'Etape–Bazient, the VIII. in that of Fraimbois–Vathimenil–Gerbéviller. Gen. Dubail, commanding the I. Army, counted in addition on the coöperation of the two right corps of the II. Army[1] and on that of the XXI. Corps, descending from the Vosges on his right. On Aug. 16 the II. Cavalry Corps, with a division from the I. Army and two from the II., came under his orders.

It must be noted that the concentration, though completed as far as concerns the fighting troops, was to be entirely finished only on Aug. 18. However, the XIII. and VIII. Corps, commenced their movement on Aug. 14; the next day they entered Cirey and Blamont, driving back the I. Bavarian Corps, which, menaced with envelopment, retired on Saarburg. By the evening of Aug. 17 the two French corps had reached the line Vasperviller–Aspach–St. Georges, and the XXI. Corps was in line with them towards the Vosges. The II. Cavalry Corps had been ordered to lead the advance on Aug. 18 towards Saarburg, which fell into its hands after some fighting. The XXI. Corps pushed its advance guards north-eastwards to Walscheid; the XIII. held the heights N. and E. of Saarburg; the VIII. Corps, marching on Heming, seized the crossings over the Marne–Rhine canal and entered Saarburg. The II. Cavalry Corps bivouacked in the Diane Capelle area, in touch with the II. Army, which had reached the front Bisping–Château Salins on the left of the first. The Germans held strongly fortified positions facing the I. and II. Armies on a front of 37 m. from near Dommenheim to Biberkirch.

Both Gen. Dubail and his troops appeared full of confidence, as also did Gen. Joffre. It was decided that the I. Army should attack with its left N.W. of Saarburg, reposing its right and centre in view of the possibility of a German counter-attack in the Vosges, of which there were certain indications. The II. Cavalry Corps was to be directed on Saar Union and to operate to the S. of the Saar.

On Aug. 19 the left of the attack (VIII. Corps) commenced before daybreak, gained ground to the N.W. of Saarburg, despite the strength of the enemy's positions, and repulsed a counter-attack from the direction of Dolving. On Aug. 20 the advance was resumed, and early in the morning it became evident that the VIII. Corps would be unable to open the way for the II. Cavalry Corps. The 15th Div. could neither cross the Saar nor maintain its hold on Gosselming; counter-attacked from the N. it fell back on Kepprich and the wood to the E., then to the Marne–Rhine canal, after suffering severely from the fire of the German heavy artillery.

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[1] The I. Army comprised at the beginning of hostilities the VIII., XIII., XXI., and XIV. Corps, the 12th, 13th, 22nd, 28th and 30th groups of Alpine Chasseurs, and the 71st Reserve Division. The XIV. Corps, the Alpine groups and the 71st Div. remained at first in the Vosges or at Epinal.

In the centre and on the right the French fared better. On Aug. 19 the XXI. Corps had extended its front to the S.E. of Saarburg, in the direction of Plaine de Valsch-Walscheid, without encountering any resistance; the XIII. Corps, which was in army reserve, had not yet been engaged. Next day the XXI. Corps, violently assailed by the XIV. German Corps, inflicted on it a serious defeat near Walscheid; the XIII. Corps, coming at last into line, attacked N.E. of Saarburg, disengaging the 16th Div. (VIII. Corps), which held the town till nightfall. Gen. Dubail's intention was to entrench himself astride the Saar on the front Kerprich–Soldatenkopf, and thence to resume a methodical advance foot by foot. But the defeat of the II. Army induced Gen. Joffre to order, on the evening of Aug. 20, the withdrawal of both armies. On the morning of Aug. 21 Gen. Dubail ordered the I. Army to retire slowly as far as Blamont. The withdrawal was carried out at first without serious difficulty, but was soon accelerated by the rapidity of the II. Army's retreat and by various untoward and costly incidents. On the evening of Aug. 22 the army, which had been joined by the XIV. Corps and 71st Reserve Div. from the Vosges, held a line from N. of Moudon forest to the Bonhomme pass; on the evening of Aug. 23 it had fallen back a good deal further, and, pivoting on its right, had thrown back its left to Damas aux Bois. At this point Gen. Dubail gave orders to stop the retreat and prepare for the resumption of the offensive. After this series of unfortunate movements the weariness of the French troops was extreme, and the infantry had suffered heavy loss—indeed in the VIII. Corps it exceeded 50% of the total strength.

The parallel offensive of the II. Army had been even less fortunate. Its mission was twofold: at all costs it was to protect Nancy, mainly because of the moral effect of the loss of that city; it was also to prolong the attack of the I. Army to the W., on the front Dieuze–Château Salins, with a flank guard facing Metz. The army, under Gen. de Castelnau, at first comprised the XVIII., IX., XX., XV., and XVI. Corps, three reserve divisions (59th, 68th and 70th) and two cavalry divisions. But in view of the necessity of parrying the German advance in Belgium by reinforcing the V. French Army, on the left of the line, the XVIII. Corps was sent north-westwards, on Aug. 13, to form Gen. Lanrezac's left. In the middle of the offensive, however, the greater part of the IX. Corps was sent off to reënforce the IV. Army. The two cavalry divisions were later incorporated into the II. Cavalry Corps and placed under the orders of the I. Army.

On Aug. 13, on the eve of the Lorraine offensive, the IX. Corps held the northern front of the Grand Couronné de Nancy,[1] with outposts on the Seille; the 70th Reserve Div. was towards Amance; the XX. Corps in the area Hueville–Laneuveville–Nancy, with forward troops on the Loutre Noire; the XV. Corps at Héraucourt, Drouville–Lerres–Courbessaux; the XIV. Corps at Lunéville–Xermaménil; the 59th and 68th Reserve Divs. in second line at Laxose and Vendoeuvre, and four Chasseurs battalions at St. Nicholas.

The generalissimo having prescribed that the I. and II. Armies should take the offensive, Gen. de Castelnau ordered the XVI. and XV. and the greater part of the XX. Corps to advance on Aug. 14 on Avricourt, the XX. Corps covering the northern front with the rest of its forces. On the evening of Aug. 14 the army held a line between Vuvrecourt and Goudrexon, facing N.E.; only the XV. Corps had met with serious resistance and been held up at Moncourt. Next day the situation of this corps, after the losses it had suffered, still checked further progress; the XVI. Corps advanced to Igney–Avricourt, the XX. to Bexange-la-Petite, Xanrey, and the northern edge of the Bezange la Grande forest; the IX. from its position on the Grand Couronné sent out detachments to Nomény, Bénicourt and Clemery. On Aug. 16 the German withdrawal continued, and the French followed rapidly; the XVI. Corps reached Mondange–Réchicourt–La Garde; the XV. Donnelay–Maremont; the XX. Vic–Moyenvic, the hills N. and N.W. of Donnelay; the IX. retaining its position.

On Aug. 17 the right of the II. Army was to swing up to the N.W., with the object of reaching the line Delme–Château Salins–Dieuze, the first objective fixed by Gen. Joffre. The XVI. Corps pushed forward without difficulty to the region Angviller–Bisping–Guerdemange; the XV. reached the Seille and occupied Marsal without resistance but failed to effect the passage of that river with its main body; the XX. Corps entered Château Salins and pushed reconnaissances northwards. The absence of the cavalry divisions was much felt at this time. Despite heavy night fighting at Rorbach, in which a fraction of the XVI. Corps was engaged, it was believed that the enemy was merely fighting rear-guard actions and that his main bodies were retiring, the I. Bavarian Corps on Saarburg, the XXI. and the left of the II. Bavarian Corps on Morhange.

Aug. 18 was to be given up to the crossing to the right bank of the Seille, but from the early morning the XVI. Corps encountered important hostile forces at the exits from the woods. On its right, the II. Cavalry Corps (I. Army) was not in position to support it, being itself held up at Dolving and Gosselming S. of the Saar. To the left the German heavy artillery pinned the XV. Corps to its ground on the Seille between Marsal and Zommange, preventing it even from occupying Dieuze. The XVI. Corps, being too far forward, was compelled to fall back on Angviller; only the XX. Corps advanced to the N. of Morville les Vic and Château Salins.

In spite of the departure of the IX. Corps, ordered on Aug. 18, to the IV. Army area, Gen. de Castelnau ordered on Aug. 19 that the offensive should be continued with the utmost energy, both to conform with the instructions of the generalissimo to hold fast as many as possible of the enemy in Lorraine, and in order to disengage the I. Army, now menaced by strong hostile forces from the direction of Phalsburg and Obersteigen. The XVI. Corps, while still continuing to cover the II. Army to the eastwards on the canal of Houillères, was to debouch from the region of the lakes to the N. of Loudrefing. The XV., operating to the E. of the Bride and Koeking forests, was to march on Bensdorf, and the XX. Corps, to the W. of these forests, on Morhange.

In order not to risk being taken in the flank by an attack from Metz, the II. Army was ordered for the moment not to cross the line of the Lower Albe below Bening Virming and Morhange. Thus the offensive of the right and not that of the left was limited, though the contrary was more natural.

On the morning of Aug. 19 the French right was checked by the enemy. As regards the XVI. Corps, the 31st Div. could not debouch to the N. of the Salines canal and had to be relieved by the 32nd; the XV. Corps captured Zommange and Vergaville, but could get no farther; only the XX. Corps made a considerable advance, reaching the northern edge of Château Salins forest, occupying Oron and pushing a brigade well forward on Morhange. The 68th Reserve Div., which had relieved the IX. Corps in its positions, covered the left flank of the XX. Corps very insufficiently at Fresnes en Saulnois–La Neuveville. The 70th Div., in the Seille around Manhoué, and the 59th on the Grand Couronné from Leyr to Ste. Geneviève, assured the immediate protection of Nancy. The enemy's intentions were still obscure.

In these circumstances Gen. de Castelnau deemed it advisable to clear the passages for the XVI. Corps over the Salines canal as soon as possible, and ordered that corps and the XV. to carry out a united attack on Aug. 20 against the line Cutting–Domnom–Bassing, and to drive back the enemy as far as the Saarburg–Bensdorf railway. The XX. Corps consolidated its positions taken the previous day, and prepared either to continue its advance to the N. or to the N.E., or to face any possible attacks coming from Metz.

On the morning of Aug. 20 mist delayed the offensive of the XV. and XVI. Corps, which were in fact later violently attacked themselves and checked and even forced back. The XX. Corps had received from its commander, Gen. Foch, orders inspired, it would seem, rather by the doctrine of the resolute offensive then in favour in the French Army than by the orders of Gen. de Castelnau; they laid down that the heights of Baronville and Morhange, reached the previous evening, should be secured and that the right should then endeavour to disengage the XV. Corps and facilitate its attack.

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[1] A group of steeply sloping hills forming a semicircle around Nancy, on the E. bank of the Moselle.

On Aug. 20 the 11th Div. attacked the front Morhange–Racrange, in conjunction with the XV. Corps; to the left, the 39th Div. the line Brehain–Baronville. About 6:30 A.M. Gen. de Castelnau stopped this offensive, which he considered inopportune, and ordered that the right of the XX. Corps should support the XV., while the left should hold and fortify the position then held by it and should even prepare a second position farther south. But these arrangements were upset by the enemy taking the offensive; the left of the XX. Corps (39th Div.), heavily assailed, had to retire on Château Salins, involving the withdrawal of the right (11th Div.), which fell back on Lidrequin, and of the 68th Reserve Div., which withdrew from Lenoncourt to its position of Aug. 19. The situation of the II. Army became so perilous that at 4 P.M. Gen. de Castelnau ordered the retreat. The corps were moved away that night, with the intention of re-forming their most sorely tried units farther south; rear guards facing N.E. from Maizières to Fresnes en Saulnois were to cover the withdrawal.

These movements were carried out that evening and night, and during Aug. 21, under the protection of the XX. Corps and the 68th Reserve Div., which had orders to hold on to Château Salins as long as possible and to fall back thence on St. Nicolas. The remainder of the army reached the area Dombasle–Lunéville, and were there reënforced by two reserve divisions, the 64th and 74th; the 73rd Reserve Div., forming part of the mobile garrison of Toul, moved to the N.W. of Nancy, and the II. Cavalry Corps (less the 6th Cavalry Div. which was left under the orders of Gen. Dubail) was on Aug. 22 transferred from the I. to the II. Army and was ordered to cover the latter's right. The enemy at first followed slowly, but soon violently attacked the XVI. Corps at Crion and Lionviller, and forced it back over Lunéville, whence it went back to reform in the Xermaménil area. Finally, while the XX. Corps was waging a series of successful actions in the heights of Flainval, before retiring on St. Nicolas, the remainder established themselves on the W. bank of the Meurthe, the XVI. Corps holding the hills of Belchamps, the 74th Reserve Div. astride the Lunéville–Bayon road, the XV. Corps at Haussonville and Ferrières, and the 64th Reserve Div. in the Sappais plateau. The Grand Couronné was still held by the 18th Div. (IX. Corps), the dispatch of which to the S. had been delayed, and by the 59th and 68th Reserve Divisions. The offensive of the II. Army, as well as that of the I., had thus been a complete failure. Various factors contributed to this result, the most important being the French inferiority in material and the insufficient preparation of the attacks.

Meanwhile the I. Army also had stopped its retreat. On Aug. 23 Gen. Dubail laid down that its mission henceforward would be to forbid any new hostile advance and refit so as to be in a condition to resume the offensive in the near future; it was also to support the II. Army, which was being heavily attacked, on its left. This was the object of a three weeks' battle, the first act of which was to take place on the Mortagne. On Aug. 23 Gen. Dubail ordered the VIII. Corps, supported on its left by the cavalry division, to operate against the flank of the Germans then attacking the right of the II. Army. The VIII. and XIII. Corps, forming the I. Army's left wing, were holding the line Damas aux Bois–Anglemont.

On Aug. 24 the II. Army was attacked on the front Haussonville–Borville. The VIII. Corps was directed to take the offensive in the direction of Venezey–Moriviller, while the XIII. Corps, covering its right, moved to the vicinity of Ménarmont, ready to face N. or E. according to circumstances. These movements, carried out on Aug. 24 and 25, were of considerable assistance to the II. Army, before which the enemy fell back on Aug. 26 to the north-east. Next day the VIII. Corps reached the Mortagne, but from Aug. 28 to Aug. 30 it could do no more than repulse the enemy's attacks, without itself getting forward. On Aug. 30 and 31 the Germans, entrenched to the E. of the river, on the heights of Domptail, held up the French advance, but were themselves unable to make any progress. The utility of the VIII. and XIII. Corps' action was all the greater, as at this time the II. Army was being heavily assailed, first in the direction from Lunéville to Charmes, and then in the Grand Couronné. It appears, indeed, to have been the Germans' first intention to advance with the VI. Army along this former line, and with the VII. by Raon l'Etape and Rambervillers on Charmes, their common effort being directed to forcing what is usually known as "the gap of Charmes." The I. Army was further weakened by the departure from its position on the right of the XIII. Corps, and of the XXI. Corps, which left to join the IV. Army in Champagne, arriving there in time to take part in the last days of the battle of the Marne.

From Sept. 5 to 7 the VIII. and XIII. Corps merely maintained their positions. On Sept. 6 the German VII. Army, which faced the French I. Army, was dissolved by order of the supreme command. Two of its corps joined the VI. Army, now left alone in Lorraine; the staff and one corps were sent W. to reënforce the German right wing, heavily engaged with Maunoury (French VI. Army) on the Ourcq. On Sept. 7, as the enemy in front of the VIII. and XIII. Corps seemed to be weakening, an attempt was made to resume the French offensive; and on Sept. 9 the VIII. Corps was ordered to capture St. Pierremont and Magnières by a night attack; the XIII. Corps and a provisional corps formed of troops already on the army front, and put into line in place of the XXI. Corps, were also to attack farther to the east.

The operation thus projected was a success only on the right and in the centre; the VIII. Corps attack failed. At this moment the I. Army was still further and more seriously weakened by the arrival of orders for the transfer of the XIII. Corps elsewhere. While it was being transported to the W. of the Oise, where it was to prolong the left of the VI. Army, the I. Army consolidated its recent gains. On Sept. 12 the VIII. Corps attacked towards Domptail and Azerailles, and the 71st Reserve Div., which had replaced the XIII. Corps, towards Baccarat, and the provisional corps towards Raon l'Etape. By the evening the I. Army had reached the Meurthe; unfortunately the pursuit was stopped by another transfer, this time of the VIII. Corps on Sept. 13 to St. Mihiel on the Meuse, where another German offensive was being prepared. The left wing of the army (71st Reserve Div. and provisional corps) took up position along the Meurthe from Raon l'Etape to Azerailles. The fighting known as the battle of the Meurthe now came to an end.

Meanwhile the XXI. and XIV. Corps, on the right of the I. Army astride the Meurthe, had also attempted to carry out the mission assigned to them by Gen. Dubail, to stop the enemy's advance, and prepare for a resumption of the offensive. Their first efforts met with little success; in fact, up to Aug. 27 they had lost ground; and the 44th Div., which was being brought up from the Vosges to reënforce the I. Army's left, had to stop and support them (Aug. 25). On Aug. 26 the right of the XIV. Corps was driven back in the Ban de Sapt; next day, the enemy entered Ste. Dié, and the withdrawal of the 58th Reserve Div. from Anozel pass uncovered the eastern flank of the XIV. Corps, which fell back from Nompatelize and then from La Bourgonce (Aug. 29). The Germans endeavoured to cut off the corps from the Vosges and menace the I. Army's right flank; and successful though costly counter-attacks by the XIV. Corps on Aug. 30 recovered both Nompatelize and La Bourgonce. On Aug. 31 and Sept. 1 its right maintained itself at Anozel; on Sept. 3 the corps held a line thence to Rougiville and the N. edge of the forest of Mortagne, but its situation remained anxious up to and including Sept. 6. Not till Sept. 7, when the army had consolidated its line in the Vosges, could the XIV. Corps make a little progress; it then accentuated its offensive, reoccupied Ste. Dié on Sept. 11 and reached the Meurthe along its whole front, as the VIII. Corps, the 71st Reserve Div. and the provisional corps had done. By this time the "Vosges group" had got into definite touch with the right of the XIV. Corps from the Bonhomme pass. The I. Army had been successful in fixing important enemy forces on its own front, and in bringing considerable relief to the rest of the French line, despite the fact that many men had been withdrawn from it to reënforce those armies to whom decisive rôles had been assigned.

The II. Army also had passed no less difficult days. On the morning of Aug. 21, after the defeat of Morhanges, Gen. Joffre wired, "The II. Army will endeavour to reconstitute and hold fast on the Grand Couronné and on the Meurthe and the Moselle." Gen. de Castelnau decided therefore to maintain at all costs the Grand Couronné and the line held by the XV. and XVI. Corps and the 64th and 74th Reserve Divs., while holding the rest of the army ready for a counter offensive in the area of Lenoncourt. But the situation rapidly changed, and it fell to Gen. de Castelnau's lot to prepare, not a counter-attack but an attack.

Early on Aug. 24 it was reported that at least two hostile corps were moving southwards, exposing their right flank to the II. Army. Gen. de Castelnau, seizing his opportunity, ordered an advance in the direction of Serres by one division of the XX. Corps and the available troops of the reserve divisions holding the Grand Couronné. The XVI. and XV. Corps, the 64th and 74th Reserve Divs. and the rest of the XX. Corps, were to contain the enemy in front, the II. Cavalry Corps covering their right. The VIII. Corps on the left of the I. Army was requested to coöperate by advancing on the front Rozelieures–Vennezey, in a direction almost at right angles to the II. Army front. Thus ensued the battle of Aug. 25.

Gen. de Castelnau's objective was Arracourt–Einville, which appeared to be the enemy's line of communication from the north. The main attack was to be supported on the right by the XVI. and one division of the XV. Corps, in concert with the VIII. Corps. But it soon became clear that the last-named formation would not be able to debouch to the N. of Essey and St. Boingt, and it became necessary to make the action of the II. Army more prompt and more intense. The II. Cavalry Corps, the XVI. and one division of the XV. Corps, were pushed forward, driving the enemy back to the E. of Rozelieures; at nightfall the XVI. Corps was in possession of this village and the XV. of Lamath and Blainville, while the main body of the II. Cavalry Corps was moving on Deinvillers. On the French left, progress, rapid at first, had been checked by a strong counter-attack on Flainval; by evening, however, the XX. Corps held the heights of Sommerville, Flainval and Hudiviller with its 11th Div. and its 39th Div. remaining in the region of St. Nicolas. To the N., portions of the IX. Corps and the 68th Reserve Div. held the eastern edges of the forest of Champenois.

After the battle of Aug. 25 Gen. de Castelnau proposed to seize the passages over the Meurthe S. of Lunéville, and then to advance on the Einville–Arracourt road by attacking between the Meurthe and the Sanon and by seizing the heights of Serres. The fatigue of the troops, who had been marching and fighting continuously since Aug. 14, was the first cause of difficulty; and since the left centre and right of the I. Army were violently attacked one after the other, the II. Army had to manœuvre by its right, while refusing its left, and the offensive on Serres could not be carried out with the necessary vigour.

However, in the course of Aug. 21 the II. Army made some progress. The XVI. Corps reached Remenoville and the XV. occupied Mont sur Meurthe, but could get no farther. The XX. Corps got as far as the line Friscati (N.W. of Lunéville)–Deuxville–Maixe, prolonged to the left by the 70th Reserve Div. which held Drouville. To the N. the 18th Div. (IX. Corps) maintained its positions in the area Courbessaux–Reméréville–Champenois.

On Aug. 27 the XVI. and XV. Corps, to which the 74th and 64th Reserve Divs. were attached, fought a series of successful actions at Xermaménil and Blainville. The rest of the army remained halted. On Aug. 28 its right undertook a general offensive, with the idea of reaching the Meurthe, but the XVI. Corps and the 74th Div. after capturing Gerbéviller were held up and finally driven out of the town and back to the Mortagne. The XV. Corps was checked at the St. Mansey wood, between the Mortagne and the Meurthe, and did not push its left towards Vitrimont forest, while the XX. Corps made little headway N. of the Meurthe.

On Aug. 29 the XVI. Corps retook Gerbéviller, but was then checked all day in frontal fighting, which also delayed the advance of the XV. Corps on the Meurthe. Aviation reports stated that the enemy was preparing a second line of defence, facing the French left, and was evacuating the first line, which seemed to indicate that he was growing weaker. Gen. de Castelnau therefore decided to attack on Aug. 30 between the Sanon and the Nancy–Château Salins railway, and to take and consolidate the Serres heights. However, in view of the violent hostile attacks against the I. Army, the plan had once more to be modified, and again the II. Army was driven to manœuvre by its right in conjunction with the I. Army. On Aug. 30 the principal action took place around the clearing of Fraimbois, S. of Lunéville, between the Meurthe and the Mortagne. The XVI. Corps and 74th Reserve Div., despite their losses, failed to take Fraimbois, but to the N. the XX. Corps occupied the signal of Frascati. On Aug. 31 the enemy's attacks on Rehainviller (S.W. of Lunéville) were repulsed, and the French consolidated their positions.

It was not till Sept. 1 that Gen. de Castelnau could resume the manœuvre originally planned for Aug. 30; he ordered that on this date the army should attack between the Meurthe and the Sanon, and take and hold the heights N. of Lunéville. The XX. Corps was only partially successful in reaching its objective, and on the rest of the front the positions were unchanged.

The situation of the II. Army had by this time considerably changed. Gen. Joffre intended eventually to resume the offensive on the centre and left of the Allied armies, but did not believe that the opportunity would come as it actually did; he therefore deemed it necessary to withdraw troops to the fullest extent from his right-wing armies, which were not called on to play a decisive part in this manœuvre. On Sept. 1 orders were issued for the westward move of a cavalry division and a Chasseur brigade; on Sept. 2 the 18th Div. (IX. Corps) and the XV. Corps were also sent off. In view of this additional weakening the II. Army seemed condemned to the defensive.

Moreover, at this moment, the fighting before Nancy necessitated new and great efforts on the part of that army. On Sept. 4 the enemy's activity became more intense on the Meurthe and in the Serres area, and towards evening they opened a bombardment on all the front between Vitrimont forest and Courbessaux. Emperor William II. had arrived from Metz with the intention of making a triumphal entry into Nancy in a few days' time. The Germans possessed an immensely powerful heavy artillery and did not hesitate to employ it to the fullest possible extent; on the night of Sept. 5–6, in eight hours, over 3,000 shells fell on the hill of Amance in an area of little over 1,000 sq. yards.

By Sept. 5 both Gen. Joffre and the commander of the II. Army had appreciated to the full the seriousness of the situation. For a time they hesitated as to whether they should withdraw the army's left to the strong positions of the forest of Haye and the heights of Sappais and Belchamps S.W. of Nancy, or hold the line in front of the city at all costs. This hesitation seems to have lasted right up till Sept. 7; fortunately the second plan was adopted and carried out.

During the battle of Nancy, the French right, the XVI. Corps, the 74th Reserve Div., the XV. Corps and the 64th Reserve Div., fighting in the area Rehainviller–Xermaménil–Gerbéviller, maintained their positions practically intact from Sept. 6 to 11. In the centre and on the left, however, the fighting was extremely fierce, and the French line swayed to and fro, from the Sanon to the northern edge of Champenois forest.

On Sept. 5 the enemy seized Maixe and Reméréville, but lost the latter place again in the evening, and failed to dislodge the French from the eastern edge of Champenois forest. On Sept. 6 the 39th Div. (XX. Corps) attacked and reoccupied

Crévic and the wood of the same name. Next day a German force advancing from Pont à Mousson violently assaulted the N. front of the Grand Couronné; the commanding village of Ste. Geneviève was for a time evacuated, but was reoccupied by the French on Sept. 8, 2,000 enemy dead being counted on the ground. On Sept. 7 also another attack was delivered on the eastern front in the direction of Mont d'Amance and Laneuvellotte, and the 68th Reserve Div. fell back into the defile of La Bouzule between the two ridges in Champenoux forest. The French line was forced back to its western edge, and had also to be withdrawn from the forward positions to the S., towards Courbessaux and Drouville.

The German attacks continued in the night of Sept. 7–8, and on Sept. 8, but on neither occasion did they meet with any success. Violent fighting occurred on Sept. 9 on the western border of Champenois forest, but the French maintained their positions. To the S., in order to relieve the pressure on the 59th and 68th Reserve Divs., the XX. Corps undertook an offensive in the direction of Drouville and Courbessaux; some ground was gained, including Crévic wood, which had previously been lost, and the French line was pushed forward to the centre of St. Paul forest. Gen. de Castelnau ordered a vigorous offensive on Sept. 10, by the 59th and 68th Reserve Divs., in Champenoux forest and on the Bouzule, by the XX. Corps on Reméréville, and by the XVI. Corps towards Lunéville; although the results achieved were incomplete, the enemy's resistance appeared to be weakening all along the line, and on Sept. 11 the French succeeded in retaking the eastern edges of Champenoux forest, St. Paul forest and Haraucourt wood. Next day it was learnt that the Germans were retiring, abandoning large quantities of arms and ammunition at Lunéville; the left of the I. Army was advancing northwards without encountering any resistance. The II. Army began the pursuit on its front, occupying Fraimbois, Lunéville, Drouville, Courbessaux, Reméréville, Nomény, and Pont à Mousson; the cavalry pushed forward to Einville, Serres and Morville.

On Sept. 13 the French occupied the heights of Crion and Sionviller, and those to the N. of Serres, together with the wood to the W. of Sornéville. The I. Army's left was at Vathiménil, and the line of the Meurthe had thus been definitely and completely secured, never again to be lost. Meanwhile another German offensive was in preparation W. of Nancy, in the Woevres and on the Meuse, and the II. Army had to dispatch in this direction to meet it, first the 2nd Cavalry Div., then the 73rd Reserve Div. from Toul, and finally, on Sept. 13, the XX. Corps. This new development brought to an end the pursuit which had been begun after the battle of Nancy, and in a few days the II. Army was broken up, to be reconstituted anew on the left of the French VI. Army during the "race to the sea."

Thus, after a difficult beginning, with a defeat resulting from an inopportune offensive, the I. and II. Armies had been successful at first in checking the enemy's progress, and then in driving him back practically as far as the former French frontier. Their rôle, in itself no easy one, had been rendered even more difficult owing to the constant weakening of their effectives by the removal of their best elements to other parts of the front. During the battle of the Marne they formed the unshakable pivot of the centre and left of the Allied armies, and freed them from all anxiety as to their right flank. If, thanks to the memorable initiative of Gen. Galliéni, Gen. Joffre succeeded in carrying out on the Marne and on the Ourcq the manœuvre which caused the enemy's retirement to the Aisne and completely ruined his original plan of campaign, it was because of the efforts and sacrifices of the I. and II. Armies. By holding fast on the Meurthe and before Nancy, three hostile corps and numerous reserve formations, the II. Army had fulfilled, as had the I. at the foot of the Vosges, a task indispensable to the strategic reëstablishment of the whole of the Allied forces. The price had unhappily been a great one. Between Aug. 24 and Sept. 12 the 74th Reserve Div. (to take only one example) lost 140 officers and over 5,000 other ranks, practically a third of its effective strength, and the casualties in other units had been even heavier. (B. E. P.)

(3.) BATTLE OF THE ARDENNES

Directly the large concentration transports, which were at their height from Aug. 8–14, began, the III. French Army was formed in the region of Verdun under the protection of the VI. Army Corps, which took up protective duties on July 31 1914. Gen. Ruffey, with Gen. Grossetti as his chief-of-staff, was in command. On Aug. 14 that army consisted of the IV. Corps, to the E. of Damvilliers; the V. Corps, to the W. of Etain; the VI. Corps in the Woevre to the E. of Fresnes-en-Woevre, Vigneulles and St. Baussant. A group of reserve divisions, commanded by Gen. Pol Durand, was then under the orders of Gen. Ruffey, but they were not all completely disembarked by that date (Aug. 14). The 7th Cav. Div. (Gen. Gillain), attached to the III. Army, covered the right wing of that army towards Metz.

The IV. French Army was at first designed to form a general reserve in the hands of the general-in-chief; and, with a force of three army corps and one cavalry division, was grouped in the region between Vitry-le-François and Ste. Menehould. But on hearing of the German attack on Liége Gen. Joffre decided to send the IV. Army in the first line, to the left of the III. Army, in the region of Stenay (Aug. 8 1914). The II. Corps, which protected the V. Army to the E. of Stenay, as did the VI. Corps to the E. of Verdun, remained on the spot, while the V. Army (Gen. Lanrezac) returned farther to the N.E., first in the region of Vouziers–Auberton, and then towards Charleroi.

Directly it entered the lines the IV. Army—commanded by Gen. de Langle de Cary, with Gen. Maistre as chief-of-staff—was considerably reënforced. The II. Army Corps was the first to join it, followed by the XI. and IX. Corps, and the 52nd and 60th Reserve Divisions. In the Ardennes the 4th and 9th Cav. Divs. were at its disposal. This IV. Army was, on Aug. 22 1914, by far the strongest of all the French armies.

According to Plan 17, which regulated the concentration operations, there would be little more than protective corps on the frontier until Aug. 8. Between Aug. 8 and 14 the concentration transports, working with their maximum efficiency, were to bring all the army corps stationed in the interior to the concentration zone of their armies. It was not before Aug. 15 or 16, therefore, that Gen. Joffre would have all his resources at command. But the general-in-chief was determined to keep to the defensive, even a yielding defensive, which would be willing to lose ground until the concentration of all the French forces had been effected. Owing to this decision the protective corps formed a rigid cordon, with only very small detachments—rifle and cavalry battalions—ahead of it.

On the other side the Germans were proceeding in the same way. They were determined to fight with extreme violence everything that opposed the bringing into position of their armies, but would make no efforts to thwart the enemy's concentration, or even to know how the French High Command organized its distribution of forces.

It is not surprising, therefore, that the first great battle was the "battle of the two blind men." Neither belligerent knew exactly where the encounter would take place, nor what forces they would have to fight. On Aug. 10 1914, when the IV. Army Corps had only just joined the lines, to the left of the IV. Army, a German mixed brigade, starting westwards at a venture from Thionville, had the mad idea to attack at Mangiennes, the spot where the junction of the III. and IV. Armies was taking place. Without thinking, it engaged *à fond*. Then it was that Gen. Cordonnier came and took this brigade in reverse, after it had already been roughly handled in the frontal attack, and destroyed it. The Germans did not try to avenge their defeat; they made no further attempt against the protective troops of the III. and IV. Armies. The Germans were absorbed in the deployment of their armies: the V., to the W. of Thionville as far as Tintigny; the IV., from Tintigny to Dinant; the III., from Dinant towards Charleroi; the II., on the Sambre; the I., towards Mons, in accordance with a plan mathematically determined in the pre-war period.

The French, bringing into play the variant which placed their IV. Army between the III. and V. Armies, formed up ladderwise. If the III. and IV. Armies faced eastwards, the VI.

Corps served to form the highest rung, while the lowest was occupied by the IX. Corps. If they faced N., the lowest step would be the VI. and V. Corps, then the IV., then the II.; such would be the following steps, each rising higher and higher.

When Gen. Joffre launched his rigid formation brutally to the N., the German deployment was not yet effected; thus it was that the German III. Army, entangled behind the IV. Army, did not appear upon the battlefields of the Ardennes; it was a wasted force. The offensive, which drew such criticism against the French general-in-chief, thus produced this happy result, that a battle was brought about at a time when the enemy could not avail themselves of all their resources.

The battle of the Ardennes was to take place between the French III. and IV. Armies on the one side, and the V. Army, commanded by the German Crown Prince, the IV. German Army, under the Duke of Württemberg, and the III. German Army, under Gen. von Hausen, on the other; but the German III. Army was not destined to fire a single gun, either against Gen. de Langle de Cary's troops, or against those of Gen. Lanrezac; its cavalry alone took part in the Dinant skirmish.

On Aug. 16 1914 Gen. Ruffey's army moved slightly northwards. The IV. Corps advanced to Jametz, the VI. Corps pushed forward as far as Etain, the V. Corps took up its position between these two localities. As this army left the Hauts-de-Meuse region it was replaced by the reserve divisions of Gen. Pol Durand. Fresh reserve divisions arrived shortly, and on Aug. 19 they formed the Lorraine army, under Gen. Maunoury. The mission of the Lorraine army—which consisted of the reserve division groups of Gens. Pol Durand and Beaudenom de Lamaze and the mobile reserve divisions of Toul and of Verdun—was to invest Metz, should the III. Army be victorious near Longwy; its defensive mission was to stop any German troops attempting to force the Hauts-de-Meuse.

The Lorraine army was not under Gen. Ruffey, but it covered the rear of the IV. Army. No army, when fighting is carried on in the same theatre of war, is truly independent; each must communicate with and help its neighbour as far as possible. This solidarity was not to be found to a desirable degree between the III. Army and the Lorraine army; but if one realizes that, in spite of its small population, France managed in Aug. 1914 to face the Germans with forces nearly equal to those of the Kaiser's army, it is easy to understand that the French reserve divisions were composed of elderly men, slow to acclimatize to war, and that their *cadres* and staffs needed considerable time to acquire the desirable manœuvring qualities.

On Aug. 20 1914 the French III. and IV. Armies faced N.; they were ordered to keep in touch with each other on the axis Marville–Virton–Etalle, during the advance northward. They formed a strict whole, and yet there was no army group commander to impart unity to this ensemble.

To the right of the bloc was the VI. Corps, whose direction of attack was the neighbourhood of Audun-le-Roman and Longwy. This army corps, commanded by Gen. Sarrail, consisted of three divisions, and was to advance in échelon and to the rear of the V. Corps with two divisions, while the third was to be a flank guard, facing the fortified region Metz–Thionville.

The Lorraine army, as has been said, prolonged the flank guard of the III. Army through the Woevre to Toul; in the E., it was in touch with the II. Army (Gen. Castelnau). Thus in proportion as one advanced farther W. the initial dispositions gained ground towards the north. At the extreme left the IX. Corps was disembarking near Mézières–Sedan; taken away from the French II. Army it retained only one of its divisions, the J. B. Dumas Div., which, even before all its troops had been able to join it, was to launch advanced guards between the Semoy and the Lesse. A Moroccan division was soon to reënforce the IX. Corps. Gen. Lanrezac was obsessed by fears for his right flank, whereas his real danger lay in front and on his left flank. By a spirit of *camaraderie* for the commander of the V. Army, Gen. de Langle de Cary sent advanced guards, disposed somewhat at random, to occupy Gedinne, Houdremont and Bièvre; the 60th Res. Div. was ordered to hold the crossings of the Semoy, from below Bohan to its confluence with the Meuse at Monthermé, while the 52nd Res. Div. was to keep watch on the Meuse as far as Revin, where the operation zone of the V. Army began. The 4th and 9th Cav. Divs., forming one cavalry corps, reconnoitred in front of the IX. and XI. Army Corps, to the left of the IV. Army; and the 7th Cav. Div. reconnoitred to the right of the III. Army. On Aug. 22, on the extensive front from Bertris to about Audun-le-Roman, there was only the cavalry of the French army corps.

In the night of Aug. 20–21 the whole French system moved forward; the day's march was long for all; for some it was a forced march. The only instructions given by the French High Command were "to attack the enemy wherever they were encountered"; and as the marching directions were prolonged very far northwards in the orders many unit commanders supposed the enemy to be far in the north. Although, here and there, they came violently into touch with the enemy, as for instance the 9th Cav. Div. at Neufchâteau, that was not enough to raise the alarm; and the following day, in the night of the 21st to 22nd, the same illusions caused the same imprudences to be repeated. The advance was all the more unhesitating in that it was expected that the enemy would be caught manœuvring. The Germans were not ready; von Kluck's great enveloping movement was only in a fair way of being carried out; von Hausen's army had not yet disengaged from the right of the Duke of Württemberg's army. Hence the sole task of the German army was to remain in readiness behind the trenches it had dug for itself.

One of the belligerents was waiting along a large battle-line extending from the Moselle, near Thionville, to the Meuse near Dinant. The other was advancing in countless columns, along all the roads leading from S. to N. between the Moselle and the Meuse. Engagements might be expected between cavalrymen everywhere, then between advanced guards and outposts; neither side would be surprised. Division battles would take place side by side with one another, thus forming one great battle without any break on the front, since the III. and IV. Armies were contiguous. The IV. Army was to push ahead; the III. Army "to cover the right flank of the IV. Army against forces which might still be in the Luxemburg region."

On Aug. 21 the higher formation vanguards of the IV. Army were on the Semoy, and between Semoy and Lesse on the left; but the vanguards of the II. Corps were farther S., at Meix-devant–Virton, the cavalry regiment only being at Bellefontaine. On the evening of that same day the III. Army reached Virton with the IV. Corps, Tellancourt with the V.; as for the VI. Corps, although its most advanced division was at Beuzeville, its 40th Div. (Gen. Hache) occupied Monaville in the rear, facing Briey, forming a flank guard to the 54th and 67th Res. Divs., disposed in échelon relatively to the 40th Division. The IV. Army had been engaged in action, and reported strong enemy forces to be in the Neufchâteau region; the III. Army declared it had seen no other enemy than a few small detachments, whereas the whole army of the Crown Prince of Germany was within its reach.

The orders for Aug. 22 were as follows: The IV. Army was to advance northwards and the III. Army was to cover the right of the IV. Army and face any attack from the N. and the E. Two of Gen. Pol Durand's reserve divisions were to occupy Spincourt and Monaville, by 8 o'clock on the 22nd, and be ready to counter-attack "everything that debouched from Briey."

Directly it debouched from Virton, the left division of the IV. Corps was driven sharply back to the S. of the Basse-Vire. Thus, as early as the morning of the 22nd, the III. Army failed in its mission to cover the right flank of the IV. Army; it knew nothing of the enemy, and its cavalry division remained inert. Badly commanded, it did nothing on that day, and neither its army commander nor the commander of the VI. Corps brought it into action. The V. Corps neglected to put itself in touch with the IV., and stormed the enemy positions without making use of guns to support the infantry. This soon led to a panic, and Gen. Grossetti was obliged to take the place of the army corps commander to restore order in this large unit where whole regiments retreated without fighting. The left division of the VI. Corps, while attempting to cross the Chiers at Cons-Lagrandville, was soon drawn into the retreating movement of the V. Corps. The centre division, which knew nothing of the enemy, engaged badly and was unable to progress farther than Ville-au-Montoir. The right division, stationed on the Fillières–Mercy-le-Haut front, facing Audun-le-Roman, and badly served by the reconnaissance service of the 7th Cav. Div., which forgot it was not alone, was attacked towards noon by the three divisions of the German XVI. Corps. But Gen. Hache, an able tactician, was there, and although both the cavalry division and the reserve division which should have protected his right and rear abandoned their post, he managed to make head against forces three times stronger than his own.

A lack of coöperation and of understanding had made itself felt between the Ruffey and Maunoury armies, due perhaps to a faulty transmission of orders. By the evening of the 22nd the III. Army had retreated on the Virton–Spincourt front.

In the IV. Army, the leading division of the II. Corps, warned by the corps cavalry regiment which had spent the night in a state of readiness near Bellefontaine in touch with the German positions and had identified their forces, deployed and got into touch with the enemy by its patrols. It expected its artillery to debouch N. of the woods. At about 9 A.M. the enemy attacked the French advanced guards, whose artillery had not yet appeared; but thanks to the woods and the preparations for defence of the village of Bellefontaine these first attacks were not successful. After 10 o'clock the advanced guard was reënforced by two groups of 75-mm. guns, and from that time was mistress of the situation; attacked at nightfall by a whole German army corps, it had lost no ground whatever at the end of the day; it had fought "like a lion."

Owing to the reverse of the IV. Corps at Virton, a gap had formed between the IV. and III. Armies at Villers-la-Loue. But fortunately, on the preceding day, Gen. de Langle had withdrawn the 3rd Div. from the front and disposed it in second line, behind his right. A division of the IV. Army, actuated by Gen. Gérard, the commander of the II. Corps, was thus at hand to ensure the *liaison* between the two armies. This saved the day. On Aug. 22 the II. Corps took part in two battles, separated by the large forest of Virton, at Bellefontaine and at Villers-la-Loue; both battles resulted in the defeat of the V. and VI. German Army Corps, and prisoners belonging to five different German divisions were taken. On the left of the II. Corps the Colonial Corps advanced on Rossignol in two columns; one mixed brigade on the left and one division on the right. The Ravenez Div., in column without advanced guard or flank guard, was crushed under the German projectiles to which it served as an extensive target. Its commander collected some remnants of his troops and rushed upon the enemy, gun in hand. He was killed, and "all was lost, save honour."

It is difficult, in that forest district, to make the most of a success; the Germans did not pursue their attack; so, by the evening, the Colonial Corps still held the Semoy and its outlet N. of Florenville. An army reserve colonial division arrived in the night to form the connecting link between the II. Corps and the XII. The XVII. Corps also had let itself be surprised, so that the XII. Corps, flanked on the right by the Colonials and on the left by the XVII. Corps, was in a critical position. Farther westward, the XI. Corps attacked Offagne without success, and the IX. gained ground on the left, being kept informed by the cavalry corps. In sum, there were tactical reverses nearly everywhere; nevertheless, the general commanding gave orders to resume the attack next day (Aug. 23).

It was now a recognized fact that, contrary to Joffre's belief, there was no gap in the Ardennes; the Duke of Württemberg's corps were being identified one by one, as well as those of the Crown Prince's right wing; and, near the extreme left, the IV. Army was in touch with cavalry of the German III. Army.

On Aug. 22 the French III. Army had given way badly in the centre and on the right; and the IV. Army had lost its offensive power. On Aug. 23 the attacks contemplated had to be given up and a retreat was made, during which the XII. Corps suffered a severe reverse.

Meanwhile the I. Army at Sarrebourg, the II. at Morhange, the V. at Charleroi, suffered tactical reverses at least as great as those experienced by the III. and IV. Armies, between Longwy and Dinant. The tactical instruction of the French army, badly given owing to a lack of training camps, and for various other reasons, was the real cause of the reverses at the beginning of the campaign. If, in addition to this, one notes the splendid conduct of the I. Corps of the V. Army, the II. Corps of the IV. Army, the VI. Corps of the III. Army, the XX. Corps of the II. Army; if, in contrast, it is stated that at Dinant the Boutegourd Res. Div. was seized by panic and announced the presence of a German army whereas there was only some cavalry supported by a few infantrymen; that to the left of the IV. Army two reserve divisions were doing nothing, and to the right of the III. Army were others which were of no help to the 40th Active Div., one begins to realize that the frontier army corps, which included hardly any reservists, the I., II., VI., and XX., were splendid; that the army corps stationed in the interior had much to learn and were receiving hard lessons; finally, that the reserve divisions were as yet useless. An army requires an acclimatization more or less long in proportion as it contains inexperienced and older men. A still more important deduction may be made: since the lesson was needed to teach the French army the same lesson would have resulted in defeat anywhere else. The French army was bound to lose the first battle, whether it took place in plain or forest, in the offensive or in the defensive. Joffre's strategy could not make up for the tactical insufficiency of Joffre's army. The German armies beyond the Moselle and the Meuse were effecting their strategic deployment. The first ready were to wait for the entire completion of the plan established by the Berlin staff. A battle accepted before all the armies were placed would be a strategic reverse. The much-criticised French offensive inflicted this reverse upon German strategy. The German III. Army was not at the battle; the German I. Army only arrived after Lanrezac had escaped, and although the English army was in great danger, on Aug. 23, it was nevertheless able to avoid the destruction reckoned on by the enemy. The German V. and IV. Armies, obliged to wait until the deployment of the *ensemble* was completed, merely engaged a defensive battle, to which, it is true, fierce counter-attacks were added; but the counter-offensive which the Crown Prince of Germany and the Duke of Württemberg ought to have led, and which might have had incalculable consequences, was not forthcoming.

Joffre, Ruffey, de Langle de Cary, had a powerful influence over their subordinates. There were blunders of appreciation on their part in this "battle of the two blind men," but a determination to manœuvre. This determination to manœuvre was to be found again at the Marne, and this time Joffre's eyes were opened. The German commanders kept to their book knowledge, merely carrying out what was written; they allowed their troops to act; their troops, not they, won the battle. The lesson of Charleroi instructed the French army; time, and subsequent battles, accustomed the active and reserve units to war. At the Marne German tactical superiority existed no longer; Joffre's strategy defeated the strategy of the German Supreme Command.

The French general-in-chief was still blind on the morning of Aug. 23; during that day he received the reports; on the evening of Aug. 24 "the veil was torn"; he saw his strategic mistakes, saw into the enemy's game, and understood the causes of most of the tactical reverses met with. He determined to carry the centre of gravity of his forces westwards; to recall to the minds of all that the true French fighting doctrine is based on protection and the coöperation of arms; to take their command from those chiefs who gave way. These were the results of the battle of the Ardennes, results unfortunately obtained at far too high a price. The Germans learnt nothing at the battle of the Ardennes. Their self-confidence was increased. At the battle of the Ardennes, we may say, there were two blind men: at the battle of the Marne, Joffre had been operated on for cataract, while the Kaiser had allowed the film on his eyes to grow thicker.

Battle of the Meuse.—By the evening of Aug. 23 1914 the intention of the French general-in-chief had not met with success at any point. Gen. Ruffey showed a desire to take up the offensive, but his troops were unfit for it. The III. Army, while retreating, had turned round the left of the IV. Corps. The latter was firmly supported by the right of the II. Army Corps, which had not given way. The point of touch between the armies was at Mont-Quintin, to the N.E. of Montmédy. The V. Corps needed to recover its strength and the 40th Div. of the VI. Corps was in a bad condition after its efforts of the previous day. The Colonial Div., which had formed Gen. de Langle de Cary's army reserve, had been pushed on by him to the first line, and was ordered to resume the attack by pivoting round the II. Corps, which was to wait until the Ruffey army was enabled by an advance northward to cover its right flank. But the IV. Army was not in a condition to attack; on the left the J. B. Dumas Div. of the IX. Corps, which was fresh, pushed forward, but found itself in a difficult position, since on its right the XI. Corps remained in the rear. During that day the XII. Corps, both its flanks uncovered owing to its neighbours having given way, had a serious check.

Generally speaking, on the evening of the 23rd, the front of the IV. Army was marked by a straight line drawn from Monthermé to Mont-Quintin, near Virton, and facing north-eastwards; the front of the III. Army, by a straight line extending from Mont-Quintin to Nouillon-Pont-Spincourt through Marville. Gen. de Langle de Cary was ready to make any sacrifice to prevent the right flank of the V. Army from being uncovered; Gen. Lanrezac, on the other hand, had retreated on his own authority and without warning his neighbours.

On the 24th the IV. Army was astride the Meuse, its front being marked by Revin, Mézières, Donchery, Douzy, St. Walfroy and Avioth; at Mont-Quintin it was in touch with the III. Army. There was some fighting during the day in different parts of the front of the IV. Army. On the left wing, the IX. Corps, which had been joined by the Moroccan Div., moved from the Semoy to Mézières without being followed by an enemy on whom it had inflicted a severe lesson. On the morning of the 25th the II. Army Corps sent patrols from Avioth to Lahagne, near Bellefontaine, to bring back wounded men who had been left there because unfit to be moved. One of the patrols (Lt. Benoît, of the 18th Chasseur Battalion) killed a German staff commander on whom were found the orders given to the German IV. Army for the forcing of the Chiers and Meuse crossings, on Aug. 26 and 27.

In the IV. Army, a patrol (Sergt. Ronchon of the 3rd Hussars) attacked a German motor-car and seized orders which showed that the German 33rd Res. Div. was to attack from Metz towards Etain. A trap was set for that division, not without great difficulty, owing to the lack of coördination between the staffs of the III. Army, the Lorraine army, and that of the general-in-chief. All the energy of Col. Tanant, staff sub-chief of the III. Army, was required to organize a manœuvre. If, however, the German 33rd Res. Div. managed to escape on account of these difficulties and because the reserve troops were slow to move, they did not do so without confusion and considerable losses. Thus, the French IV. and III. Armies had not lost all material and moral value, as was believed in the German camp. As soon as the ground was in their favour they would be able to resist the enemy.

During Aug. 24 the Colonial Corps had had to repulse violent attacks at St. Walfroy, and the V. Army Corps had beaten a somewhat hasty retreat. On the 25th the right of the IV. Army retired between Chiers and Meuse; the same day the IV. Corps experienced so serious a check at Marville that its chief, Gen. Boëlle, who was in close touch with Gen. Gérard, asked him to undertake to bring back his corps artillery regiment to him. This detail shows how intimate was the coöperation between the III. and IV. Armies.

The right of the III. Army, badly covered by the cavalry division, whose chief was, moreover, relieved of his command, was left in the air by the suppression of the Lorraine army (night of Aug. 25–26). Gen Maunoury, indeed, received orders to leave the defence of the Hauts-de-Meuse to Gen. Pol Durand and to return their respective forces to Verdun and Toul. Gen. Maunoury himself, with his staff, with Gen. Beaudenom de Lamaze and the 55th and 56th Res. Divs., was to proceed to Montdidier. It is well known that this was how the VI. Army was formed; their attack on the Ourcq, in concert with the English army and the French V. Army, brought about the rout of the German right at the Marne.

In the morning of Aug. 26 the right of the IV. Army and the III. Army crossed to the left bank of the Meuse. Dun (IV. Corps) was the point of junction between the IV. and III. Armies on the morning of the 26th. By the evening of that day the III. Army was almost entirely on the left bank of the Meuse, facing eastwards; the IV. Corps to the N., the W. and the S. of Dun; the V. Corps in the Montfaucon region, the VI. Corps to the S. of Montfaucon and the N. of Verdun (H.Q. at Esnes). The 7th Cav. Div. was sent to Dombasle, between Verdun and Clermont, as though the army commander feared the enemy might turn Verdun by the S. and take the III. Army in reverse. The 42nd Div. had remained as an advanced guard on the right bank of the Meuse; on the afternoon of Aug. 27 it received orders to cross to the left bank; on the 28th it passed into the army reserve at Varennes. This division was, moreover, to be taken from the VI. Corps and allotted to the army detachment under the command of Gen. Foch.

The III. Army did not come in contact with the enemy on the 26th and 27th. But the 7th Inf. Div. was summoned towards Beauclair, to the W. of Stenay, and placed at the disposal of the II. Corps, while the front of the 8th Div. was extended nearly as far as the road from Stenay to Beauclair. Thus the German V. Army was not in pursuit; it was slowly advancing towards the Meuse, its left at Ornes alarming the governor of Verdun who asked the IV. Army for assistance. The centre passed through Damvillers; the right caused uneasiness towards Stenay.

On the evening of the 25th the orders to the IV. Army ran: "To-morrow the IV. Army will establish itself on the left bank of the Meuse in order to resist." On the evening of the 26th the orders were as follows: "From to-morrow the IV. Army will engage the decisive battle on the Meuse." These last instructions were enthusiastically received by the troops. The II. Corps was to defend the left bank of the Meuse, from Stenay to Luzy. The Colonial Corps, on its left, was to defend the crossing in the neighbourhood of Inor, leaving one division as an army reserve at Vaux-en-Dieulet. The XII. Corps was to hold the crossings of the Meuse in the Joncq region, the XVII. Corps facing Mouzon. The XII. Corps, reënforced by the 52nd and 60th Res. Divs., was to prevent the crossing of the Meuse between Remilly and Mézières. By the evening of Aug. 24 the 4th Cav. Div. had been given back to the V. Army. The mission of the 9th Cav. Div. (Gen. de l'Espée) was to ensure the communications, in conjunction with the IX. Corps.

On the evening of Aug. 25 the IX. Army Corps (Gen. Dubois) received the special mission of covering the Signy-l'Abbaye region and forming the connexion between the IV. and V. Armies. The situation, indeed, was becoming serious on the left of the IV. Army. The Saxon III. Army, of whose existence the French army had long remained ignorant, had shown signs of its presence since the 24th. The French V. Army, thanks to its retreat, no longer risked being taken in reverse; but as a large space unoccupied by troops existed between the IV. and V. Armies, it was to be feared that the German III. Army might penetrate there in order to act against the wing of one or other of the two French armies, according to its inclination. Gen. Dubois found himself thrust into the space, with the 9th Cav. Div. to assist him. His position was unique all through the campaign, and it was owing to the suppleness of his manœuvring that Gen. Dubois succeeded in performing the difficult mission with which he had been entrusted. On the evening of Aug. 25, he placed one of his divisions at Renwez (10 km. N.W. of Mézières), facing the Meuse and the N.; and the other division farther eastward towards Rocroi in the N. and Signy-l'Abbaye in the south. He thus completely covered the left flank of the IV. Army.

At the very moment when Gen. de Langle de Cary gave orders to engage the decisive battle on the Meuse (Aug. 26, 2 P.M.), the right of the German IV. Army forced the crossing of the Meuse at Donchery; the French V. Army had given ground on the Serre, thus completely uncovering the left of the French IV. Army, and important enemy forces were reported in the Rocroi region (von Hausen army).

The commander of the IV. Army ordered Gen. Dubois to proceed, on the 27th, to the Signy-l'Abbaye–Launois region in order to cover the left flank of the IV. Army.

Already by the morning of the 27th, as the fog lifted, the Germans, who had been allowed to cross the Meuse freely between Stenay and Inor, passed to the attack. Gen. Gérard had given orders to throw back into the Meuse all enemies who sought to debouch therefrom. A division of the German VI. Corps was therefore allowed to emerge from Luzy and Cesse; then, after being taken under the fire of the batteries, it was counter-attacked by a Colonial regiment and two rifle battalions and thrown into the Meuse. In this part of the battlefield the Germans experienced nothing but reverses, their attacks being always badly supported by their artillery, which contented itself with throwing large projectiles at random.

The Colonial Corps engaged fierce battles with the German troops that had crossed the Meuse at Pouilly; Gen. Leblois' division was beginning to retreat when the arrival of reserves from the II. Corps reëstablished his position. The XII. Corps, weakened by the losses sustained during the previous engagements, seemed, at one moment, to have imperilled its situation; it managed nevertheless to maintain its position. The XVII. Corps had deprived itself of one of its divisions, according to the orders of the commander of the IV. Army, to relieve the XI. Corps. It now comprised only the 33rd Div., some of the artillery of which had been lost at the battle of the Ardennes; fortunately the whole German effort was directed to the battle of La Marfée, and the XVII. Corps was able to remain on its positions.

The XI. Corps, established on the evening of the 25th in the woods of La Marfée, was attacked there early on the 26th by the enemy forces which had crossed the Meuse at Donchery on the one hand and at Remilly on the other. After fighting all day the XI. Corps and the 60th Res. Div. were obliged to retire somewhat. On the same day, the 52nd Res. Div., threatened by the XII. Saxon Corps on its left, concentrated to the W. of Mézières and took up its positions between the 60th Div. and the IX. Corps. On the 27th the fighting continued. The enemy, surprised in dense masses, was crushed by the 75-mm. guns and thrown back in disorder on Noyers, leaving the flag of the 68th Prussian Regt. (VIII. Corps, 16th Div.) in the hands of the 137th French Infantry. On the right, then, the XI. Corps won a great success; but on the left, the battle long remained doubtful. In the evening an imprudent move, similar to that of Noyers, was made by the Germans at La Marfée, and after heavy losses they were driven back towards the Meuse. On the same day, under a slight pressure from the enemy, the IX. Corps and the 52nd Res. Div. came and occupied the positions fixed by the orders.

The French IV. Army considered itself victorious, and Gen. de Langle sought leave from H.Q. to continue the battle and take the offensive. "We see no objection," was the answer, "to your keeping your positions to-morrow, Aug. 28, in order to assert our success and to prove that our falling back is merely strategic; but on Aug. 29 everybody must be in retreat."

On the evening of Aug. 25 the German III. Army was in the region of Fumay; on the 26th in the neighbourhood of Rocroi; during the night of the 27th–28th it came in touch by its right with the IX. Corps in the Signy-l'Abbaye region, and, by its left with Mézières, in touch with the IV. Army. The VIII. Corps and the VII. Res. Corps of the German IV. Army were fighting S. of Donchery and Sedan. More to the left the XVIII. Corps had crossed the Meuse at Remilly, the XVIII. Res. at Mouzon, and the VI. Corps at Luzy-Cesse, in touch with the V. Army.

On the 28th nothing took place between Stenay and Inor; there was some slight action near Joncq, but with no result. In the XII. French Corps there was some hesitation; in the XVII. Corps nothing of importance took place, except a few falsely interpreted orders which made void some slightly successful results.

In the XI. Corps the successes of the previous day were continued. At about 6 P.M. a finely conducted charge drove the enemy from all the positions they had previously conquered and for which they had paid heavily. But evening was drawing near and, in order to conform with the orders of the general-in-chief, though much to their distress, Gen. de Langle de Cary and his troops were obliged to retire.

The battle of the Meuse was ended; and Gen. de Langle, in general order No. 27, on the evening of Aug. 28, said: "The Army inflicted heavy losses upon the enemy, yesterday and to-day. It returns to the Aisne line, in accordance with orders received, to prepare for the offensive in a new direction."

While the IV. Army was fighting, the III. Army remained practically inactive opposite the German V. Army, which showed no particular dash.

Battles of Signy-l'Abbaye.—On the left of the French IV. Army Gen. Dubois was fighting on the same day (Aug. 28) at Signy-l'Abbaye against troops as numerous as they were badly commanded. A German Army (XII. Active Corps, XII. Res. Corps and XIX. Active Corps), of which the French staff knew only the XII. Active Corps, was advancing towards Rethel, in the gap between the IV. and V. Armies. On the 28th, at 3 A.M., the outposts of the Moroccan Div. (Gen. Humbert) were attacked; the Zouave Regt., threatened with envelopment, escaped towards the S.E., after three hours' fighting, leaving the road to Signy-l'Abbaye open to the enemy, who entered, at 11 A.M., after a slight engagement. This German advance to the S., towards Rethel, threatened the communications between the IX. Corps and the troops in the rear, and cut off those between the French IV. and V. Armies. Gen. Dubois then gave the Humbert Div., which was very flexibly quartered in the region N. of Launois (6 km. S.E. of Signy-l'Abbaye), orders to attack Signy-l'Abbaye. A fierce battle was engaged midway, at Dommery, which was taken, lost and retaken. The fighting front spread northward, both sides being reënforced. At nightfall nothing was decided, but the enemy's advance to the S. was checked. The commander of the 17th Div. (J. B. Dumas) could hear the guns from La Marfée, and claimed leave to hasten in that direction. The 9th Cav. Div. gave the support of its guns to the Moroccan Div., but would have done better to interpose between Signy-l'Abbaye and Rethel. A French infantry and *cuirassier* detachment took up position at Novion-Pornin, thus cutting off the road to Rethel. But although the enemy were unable to enter Novion-Pornin they remained in touch, and the following morning entered the town without resistance, its defenders having withdrawn to join their respective corps. Thus, on the morning of the 29th, the road to Rethel was in the hands of the enemy; the IV. Army was retreating; the IX. Corps was still under orders to cover the left of the IV. Army and to remain in touch with the V. Army. But the enemy had now interposed between the IX. Corps and the V. Army. The commander of the IV. Army, who was not yet informed of the battle of Signy-l'Abbaye, gave orders, on the evening of Aug. 28, to maintain the positions: in the Poix-Terron region on the 29th, and before Rethel on the 30th. Gen. Dubois decided to interpose between Signy-l'Abbaye and Rethel. He sent the 9th Cav. Div. to the S. of the forest of Signy; gave orders to the J. B. Dumas Div. to advance on and capture Novion-Pornin; to the Moroccan Div. to act as a screen in front of the J. B. Dumas Div. while this movement from the N.E. to the S.W. was being effected, then to stop the fighting and take up position E. of that division.

By the evening, not without fighting or without difficulty, and in spite of a whole German Army to oppose the proposed manœuvre, Gen. Dubois was in front of Rethel, at the spot where the situation made his presence necessary. On the same day he was to pass under the command of Gen. Foch, commander of an army in formation, the IX. Army. The French army, on the evening of Aug. 29, was no longer the French army of Aug. 22; it was soon to become the army of the Marne. (V.L.E.C.)

(4.) BATTLE OF CHARLEROI

On Aug. 21, 22, and 23 1914 the French V. Army fought the battle of Charleroi, E. and W. of that place, in the angle formed by the rivers Sambre and Meuse.

By Aug. 20 1914 the forward movement of the German right-wing armies into Belgium, and the failure of the offensive of the French I. and II. Armies, had caused a modification in Gen. Joffre's original plan of campaign; and the plan of operations, after being adapted each day to the general situation, finally took a definitely new shape. Broadly speaking the intention now was to make the principal attack through Luxemburg and Belgian Luxemburg with the object of threatening the communications of such German forces as had crossed the Meuse between Namur and the Dutch frontier. This duty devolved primarily on the III. and IV. Armies of the French. In the S. the I. and II. Armies were to make a secondary offensive between Metz and the Vosges to hold the enemy, who might otherwise be able to take in flank the French advancing through Luxemburg; and the French V. Army and the British army were to act upon the offensive, though this offensive would depend almost entirely on success by the III. and IV. Armies to their right. The offensive of those armies, however, collapsed, and this had an immediate effect upon the French V. and British Armies in the zone Charleroi–Mons, for they were then left in an isolated state some 40 m. to the N. of the remainder of the French battle-front. It has been said that "the battle of Charleroi was lost before it was fought"; and though this statement may be demurred to, the peculiar situation of the V. Army must be borne in mind in studying the battle.

On the evening of Aug. 20 1914 the situation of the V. Army was as follows: Of the I. Corps (reënforced by the 8th Infantry Brigade) the main body was W. of Dinant, with detachments on the Meuse from Revin to Namur, and on the Sambre from Namur to Floreffe; the 51st Reserve Div. attached to the corps was about Rocroi en route for Dinant. The X. Corps (reënforced by the 37th Div.) had its main body in the area Fosses–Philippeville, with detachments along the Sambre from Ham to Tamines. The III. Corps (reënforced by the 38th Div.) had its main body in the area Gerpinnes–Joumioux–Gourdinnes, with detachments on the Sambre from Rosalies to Marchiennes. The cavalry corps of Gen. Sordet was behind the Brussels–Charleroi canal, with detachments holding the passages from Gosselies to Seneffe. The head of the XVIII. Corps—which had been transferred from the II. Army—had reached Beaumont in its march to Thuin. The 53rd and 69th Reserve Divs. of Gen. Valabregue were in the area Vervins–Hirson. Army headquarters were at Signy-le-Petit. The V. Army was commanded by Gen. Charles Louis Lanrezac, an officer with an extremely high reputation in France. On April 10 1914 he had been made a member of the Conseil Supérieur de la Guerre.

Throughout the 20th the French cavalry had been in contact with that of the Germans. North of the Sambre this contact had been gained by the cavalry of the I., X. and III. Corps, while the cavalry corps of Gen. Sordet was in touch with German mounted troops on the line Charleroi–Nivelles. It was on this day that there arrived from G.H.Q. the orders for Gen. Joffre's new offensive. The orders were to the effect that all information pointed to the intention of the Germans to carry out an outflanking movement in the north. The French III. and IV. Armies had been ordered to march against the line Neufchâteau–Arlon. As for the V. Army, its task was to pivot on Namur and the Meuse, and to seek out the main enemy mass in the north. On the left of the V. Army the British army would advance towards Soignies in the direction of Nivelles.

Gen. Lanrezac considered that it was not possible to carry out the order, so far as it affected his V. Army, at once. To begin with, the I. Corps, to be made available, must await relief by the 51st Reserve Div., marching up from Rocroi to Dinant, and this relief could not be effected until the evening of the 22nd. The XVIII. Corps on the left might, it is true, be up by the afternoon of the 21st; but even with this reënforcement Gen. Lanrezac considered it imperative to wait until the I. Corps —his best troops—should be available. Then it had to be borne in mind that the British had not yet come up on the left, and that the action of the V. Army would also depend upon the success of the French IV. Army on the right. Gen. Lanrezac therefore confined himself for the moment, while awaiting the opportunity of assuming the offensive, to issuing orders for the occupation of a defensive position by the X. and III. Corps S. of the Sambre.

On the side of the Germans a combined attack had been arranged in which the II. and III. Armies were simultaneously to attack the French V. Army, from the N. and E. respectively. This operation had been ordered on Aug. 20 by Supreme Headquarters, who had directed that the I. and II. Armies were to close up to the line reached on that day, and that an offensive against the enemy W. of Namur was to be carried out in coöperation with an attack by the III. Army against the line of the Meuse between Meuse and Givet, details being left for decision by the Army headquarters concerned. It was stated that at least three French corps were between Namur and Givet, and that more enemy columns were advancing northwards between Namur and Maubeuge. As regards the British the German Intelligence Department was woefully at fault, for it was stated that "a disembarkation of the British forces at Boulogne and the neighbourhood must be taken into account. It is the opinion here, however, that a landing on a large scale has not yet taken place." At the time two-thirds of the British force was within 30 m. of Gen. von Bülow—a striking testimony to the celerity and secrecy with which the transport of the British army to the continent had been accomplished.

During the day the Germans attacked the French detachments on the Sambre. Tamines and Rosalies were taken, and early in the afternoon some of the Prussian Guards crossed the river at Auvelais and held it against French counter-attacks. Farther W. the cavalry of Gen. Sordet was also attacked about half-past three in the afternoon, and it was found necessary to send an infantry brigade to its support. Thus Charleroi was threatened from both E. and W., and during the night shells fell upon the railway station in the town. The events of the day had resulted in dislocating Gen. Lanrezac's preparations for the offensive, and at 12:30 P.M. he wrote to Gen. Joffre as follows: "I consider it dangerous to let the V. Army cross the Sambre during the 22nd minus on the one hand the I. Corps, which must hold the Meuse until the IV. Army has made sufficient progress N. of Semoy, and minus on the other hand the English who on the 22nd will not be able to get farther than Mons." During the evening a reply came from Gen. Joffre to say that Gen. Lanrezac could choose his own time for the offensive, and he accordingly decided that it would be launched on the 23rd.

Early on the 22nd fighting was resumed all along the French front on the Sambre. The X. Corps was forced back, and during the afternoon the road from Fosse to St. Gerard was crowded with artillery, infantry and transport moving southward, which was probably the disquieting incident witnessed by Sir John French in his visit to the zone of the V. Army on this day. Fosse was occupied by the Germans about 8 P.M. Farther W. the III. Corps had likewise to give ground. Severe fighting took place early in the afternoon round Chatelet, and both divisions had to retire, the 5th towards Tarcienne and the 6th to Nalinnes. By one o'clock the III. Corps had definitely to renounce its grip on the southern outskirts of Charleroi. The city had witnessed fighting of extraordinary severity, and according to some accounts it was lost and won five times before the Germans were permanently masters of it. In the narrow streets between the Sambre and the canal the carnage was almost indescribable, and in places the dead and wounded blocked the way to those who were still unscathed. Here and there the bodies of the slain formed ramparts from which sharpshooters kept up a murderous fire; and the Germans as they pressed on marched on a veritable *chaussée* of corpses. A

French survivor has left on record a vivid description of the scene in the town. "In the narrow streets the Germans pushed on in close order, and the French guns made such havoc in their ranks that the air was full of flying arms and heads and legs, of boots and helmets and swords and guns, that it did not seem to be real—it looked like some burlesque. Even one of the gunners turned sick at the sight and turned to his commander saying, 'For the love of God, Colonel, shall I go on?' And the Colonel, with folded arms, replied, 'Fire away.'"

As for the XVIII. Corps, it came upon the field, but was S. of the Sambre between Thuin and Malines instead of being, as Gen. Lanrezac had hoped, on the Mons–Charleroi road in touch with the British. The Cavalry Corps of Gen. Sordet had fallen back during the night to Solre, and in the afternoon was sent to guard the crossings from Jeumont to Thuin, and also to hold the cross-roads at Merbes Ste. Marie on the far side of the river. The night march following on long and arduous work in Belgium had been fatiguing to the horses, and the cavalry corps was in need of rest. Gen. Joffre had prescribed that it was to move to the British left, but Gen. Lanrezac considered that it was not in a fit state to move until the evening of the 23rd. It was not, however, until the 26th that it arrived on the outer flank of the British in the battle of Le Cateau.

To Gen. Lanrezac on the evening of the 22nd the situation of the V. Army seemed grave, but by no means desperate. Only two of his corps, the X. and III., had been engaged, and if these had suffered heavily they had also made the enemy pay the price. Withdrawn to more open terrain, where their artillery could render better support, they could re-form and, so he hoped, in their turn take the offensive. Further, the I. Corps was intact and now becoming available on the right, as was also the case with the XVIII. Corps on the other flank; and the reserve divisions of Gen. Valabregue were coming up to support it. And as for the British, they were now arriving in position on the left round Mons. In one way Gen. Lanrezac was much more fortunate than he knew. Gen. von Bülow had attacked prematurely by forcing the Sambre on the 22nd instead of waiting for the attack of the III. Army against the Namur–Givet section of the Meuse to take effect, and the retirement of the V. Army during the 22nd had seriously discounted the German chances of enveloping it.

The chief interest in the battle of Charleroi is bound up with the narrative of the operations of Aug. 23, the day on which the British forces were engaged in the battle of Mons on the left of Gen. Lanrezac's army. Particulars of the battle were long shrouded in mystery, and the phrase *"L'énigme de Charleroi"* even came into current use.

On the morning of Aug. 23 the situation of the French V. Army was as follows: The I. Corps had one division echelonned from Sart St. Laurent to Lesves; the main body were assembling in the area Ermerton-sur-Biert–Anthée; three battalions were detached to Namur; the 51st Reserve Div. was holding the Meuse from Hermeton to Yvoir; all bridges had been destroyed except those at Dinant and Hastière. The X. Corps had its right on the high ground S. of Fosse and Vitrivel, left at Scry. The III. Corps (reënforced by a brigade from the XVIII. Corps) was deployed on the line Gerpinnes–Nalines–Claquedent. The XVIII. Corps was on the line Ham-sur-Heure–Thuin, with detachments on the Sambre as far as Merbes-le-Château. The cavalry corps of Gen. Sordet was holding the passages of the Sambre from the left of the XVIII. Corps to Maubeuge. The 53rd and 69th Reserve Divs. (Gen. Valabregue) were about Solre le Château.

Gen. Lanrezac's orders were to the effect that the X., III., and XVIII. Corps should hold on to their positions; the I. Corps should form up on the right of the X., and, if possible, act against the left flank of the Germans attacking the corps. The reserve divisions of Gen. Valabregue were to relieve the cavalry corps of Gen. Sordet, which was to make for Maubeuge with the object of emerging eventually on the left flank of the British army.

On the German side the orders of Gen. von Bülow were briefly as follows:—The attack was to be continued on the 23rd on the following frontages: the VII. Corps, left of the line Thuin–Boussu–Cerfontaine, was to cover the right of the II. Army from Maubeuge and to reconnoitre in the direction of Avesnes; the X. Reserve Corps was to attack E. of the line Charleroi-Philippeville; the X. Corps was to attack E. of line Tamines–Mette–Rosee; the Guard Corps was to attack on the left of the X.; the line Fontaine–Valmont–Mettet was to be crossed at 8 A.M.

In his published account of the battle Gen. Lanrezac divides it into two distinct phases, the first from daybreak until 4 P.M., and the second from that hour until nightfall. In the first phase the course of the battle was as follows: The right wing of the X. Corps was driven back, and it re-formed between Scry and St. Gerard; the I. Corps deployed on the high ground round St. Gerard with its right about Sart-St. Laurent. This operation was completed about midday, and the I. Corps was then well placed to act against the flank of the Guard Corps, which was then attacking the X. Corps sharply. Gen. Franchet d'Espérey, commanding the I. Corps, instantly resolved to seize the opportunity and to attack *au fond*. His artillery prepared the way by an intense fire, and the Germans, apparently taken by surprise, suspended their attack to deal with this new danger. It was now about one o'clock, and Gen. Franchet d'Espérey was about to launch his infantry when disquieting news reached him from his right rear. The 51st Reserve Div., which had relieved the I. Corps on the Meuse, had failed in its task, and had allowed troops of the German III. Army to cross the river. The report went on to say that the reserve battalions had fallen back in disorder and that a detachment of the enemy had occupied Onhaye behind the V. Army. Gen. Franchet d'Espérey had no alternative but to suspend his attack and to send a division and a brigade to deal with the peril behind. Emboldened by the enforced inaction of the French the Guard Corps again pressed on, its artillery maintaining a very severe fire. The French X. Corps and the fraction left of the I. Corps resisted energetically, with the result that in this portion of the field but little ground was lost, and connexion was still maintained with the fortress of Namur.

While such was the state of affairs on the right wing, little was, in this first phase, taking place on the left wing. But after four o'clock a change for the worse set in in that portion of the field. The left wing of the III. Corps was taken by surprise and driven back by a sharp attack, with the result that the whole III. Corps fell back in confusion to the line Chastres–Morialme, while the XVIII. Corps, with its right now uncovered by the retirement of the III. Corps, was forced to withdraw to the stream which runs from Thuilles to Thuin. The reserve divisions of Gen. Valabregue, however, had come up to Bousignies and Thirimont. On the right wing, in this second phase of the battle, the X. Corps had been forced to admit a loss of ground, but it was only slight, and when night fell the corps was holding the line Graux–Mettet–Wagnée. As for the I. Corps the portion left at St. Gerard was holding its ground.

Reference has been made to the danger which was threatening the right rear of the V. Army by a German advance across the Meuse. The attack in this quarter was being carried out by the German III. Army in which the XII. Corps had been ordered to force the passage of the river at Houx and Dinant. To the right the XII. Reserve Corps had been directed to seize Yvoir, while on the left the XIX. Corps was ascending the river on the right bank towards Givet and Fumay.

During the 23rd, as already related, Gen. Franchet d'Espérey had been called upon to deal with the presence of a detachment of the III. Army which had forced its way over the river. A brigade was directed upon Anthée, and to it was attached the provisional cavalry brigade from the X. Corps. On arrival at Anthée, about 6 P.M., the cavalry proceeded to reconnoitre in the direction of Dinant, as well as the villages of Onhaye and Leune. Some sharp fighting took place, and about 10 P.M. the French infantry carried Onhaye with the bayonet. It appears that this attack by the French came upon the Germans somewhat by surprise, and the units of the III. on the right bank of the Meuse were in consequence retained there for the moment.

In addition to the above-mentioned French detachment the 2nd Div. had been sent from the I. Corps. That division moved upon Morville but was not engaged.

At the end of Aug. 23 Gen. Lanrezac weighed in his mind the various happenings of the day, and quickly came to the conclusion that immediate retreat was called for on the part of the V. Army. The chief causes of his decision are given by himself as follows: In the first place he had learnt definitely that the offensive of the IV. Army had failed and that the beaten troops were falling back to the Meuse with the left of the army on Mézières. The line of the river between that place and Givet was guarded by but a few battalions of reserve troops, whose efficiency Gen. Lanrezac had reason to suspect. The rear of the V. Army was thus threatened once again. In the second place Namur had fallen, and this incident undoubtedly made a profound difference to the strategic situation; in addition the roads on the right flank of the V. Army, already encumbered with thousands of civilian refugees, would be further blocked by the retreating Belgian troops from the fortress. Thirdly, the British army was checked, and *l'on peut prévoir qu'elle va être obligée de retrograder.* It is perhaps a sufficient refutation to this statement to say that half the British army had not been engaged at all, that the other half had held off the Germans without serious difficulty, that the total British losses were less than 2,000, while a moderate estimate of the casualties inflicted on the Germans would be more than twice that number, and that when night fell the universal opinion among the British rank and file was that they had won a victory. Gen. Lanrezac, however, issued orders for the V. Army to retire on the 24th to the line Givet–Philippeville–Beaumont–Maubeuge. Amongst the officers of his own staff the decision does not seem to have been well received; and Gen. Lanrezac relates that "*quelques officiers de mon état-major loin de reconnaître ma clairvoyance me taxent de pusillanimité; pour eux je ne suis 'qu'un catastrophard' dont il faut se debarrasser au plus vite.*"

On the 24th the retreat began before daybreak, and the line Givet–Maubeuge was reached without incident other than the action of rear guards, who easily held off the advanced guards of the German II. Army. The right flank was covered by the 2nd Div. of the I. Corps, which fell back slowly from position to position without any interference by the enemy, and at nightfall it bivouacked immediately N.W. of Givet. (F. E. W.*)

(5.) MONS AND LE CATEAU

The battles of Mons and Le Cateau were fought by the British on Aug. 23 and 26 1914 respectively, against the extreme right wing of the Germans during the advance of the latter through Belgium and northern France.

When England declared war on Germany during the night of Aug. 4–5 her forces available to take the field consisted of a cavalry division, six infantry divisions, and some battalions of line-of-communication troops, the whole forming the Expeditionary Force for service overseas. The Government decided to retain two divisions temporarily in the United Kingdom and to transport the rest of the Expeditionary Force to France. The first ships sailed on Aug. 9, and, thanks to the perfection of the arrangements for mobilization and transportation, the operation was completed without a hitch by Aug. 18. Sir John French, the British commander-in-chief, had reached his headquarters at Le Cateau on the previous day; and his army consisted of the I. Corps (1st and 2nd Divs.), Lt.-Gen. Sir Douglas Haig; II. Corps (3rd and 5th Divs.), Lt.-Gen. Sir Horace Smith-Dorrien; and the cavalry division under Maj.-Gen. Allenby. Concentration was completed by the 20th S. of Maubeuge, and the post assigned to the British was on the left of the French V. Army, preparatory to an advance N. of the Sambre towards Soignies.

The two following days were spent in moving forward to positions about Mons which were reached on the 22nd; and on Aug. 23 the position of the Allied forces in the N.W. of France was as follows: From Valenciennes by Lille to Dunkirk were some French territorial divisions, of which one, the 84th, was at Condé. Working from left to right, then came along the canal the British 19th Bde., made up of battalions of line-of-communication troops. Then came the 5th Div., while next on the right was the 3rd Div., holding a salient round Mons as far S.E. as Villers St. Ghislain. The line was continued by the British I. Corps farther south-eastwards to Peissant. The cavalry division was in rear of the British left, except the 5th Cav. Bde., which was posted in advance of the right flank. The French V. Army, farther to the right, was now in rear of the line held by the British.

The British position was thus in shape somewhat that of a broad arrow, with the two army corps practically at right angles to one another and facing, generally speaking, E. and N. respectively. As matters turned out the German attack was directed almost entirely against the II. Corps, and here on the left the situation was favourable to the British, for the canal made a valuable defensive line, while the terrain on the farther side held numerous difficulties for the attackers. Muddy ditches and barbed-wire fences impeded their movement, although on the other hand groups of trees and bushes gave useful cover from view and were of service for the enemy's machine-guns. South of the canal the crests of the high ground afforded the British useful sites for artillery, but the slag heaps of the numerous mines limited observation to some extent. The line of the canal, however, had one very disadvantageous feature: after running from Condé to Mons in a mathematically straight line, it forms a loop round Mons, thus constituting a marked salient. Such a position might easily be found to be untenable, and Sir Horace Smith-Dorrien had prepared another and more defensible line in rear running through Frameries–Paturages–Wasmes–Boussu. During the 22nd Sir John French had visited the area of the French V. Army on his right, and had been somewhat disconcerted to meet columns of infantry and artillery moving south. As the left of the V. Army, formed by some reserve divisions, was drawn back, and the centre and right were in process of retiring, Sir John French considered that his own position on the Mons canal might quickly become very precarious. He accordingly informed Gen. Lanrezac that he would hold his position for 24 hours, but that the retirement of the V. Army might require a withdrawal of the British, after that time, to the Maubeuge position.

On the German side the battle of Charleroi (*see* above) was not producing all the effect hoped for by the Germans. The German plan had been that the II. Army was to attack S. across the Sambre, while the III. Army was to coöperate by attacking W. across the Meuse, towards Mettet, sending a strong force across the Meuse by Dinant towards Rocroi to bar the French line of retreat. As for the extreme right army of the Germans (the I. under Gen. von Kluck, who was temporarily subordinated to Gen. von Bülow) during the 23rd, it was, generally speaking, to conform to this offensive movement. Gen. von Bülow had, however, made the mistake of attacking prematurely with his II. Army; the combined movement with the III. Army was unsuccessful, and consequently the trend of the fighting drifted westwards to where the advanced guards of the I. Army were coming into contact with the British on the Mons–Condé canal.

When day broke on Aug. 23 Gen. von Kluck had three active corps and Gen. von Bülow one (the VII.), or about 150,000 men and 600 guns, within striking distance of the British force of some 75,000 men and 300 guns. Further, Gen. von Bülow had been for two days successfully engaged against the French V. Army, which had been pushed back some way S. of the Sambre. Not only, therefore, was the British army heavily outnumbered, but it was becoming isolated. The great advantages which the Germans possessed in this respect were, however, neutralized by their lack of accurate information. By the 20th it had not been definitely ascertained that the British Expeditionary Force had completed its landing, and its line of advance, when landed was expected to be towards Lille. Not only at the time, but for several days after the battle of Mons, it was believed that the British were based on Calais and the ports near it, instead of upon Le Havre and Rouen.

On the evening of Aug. 22 the German I. Army had halted E. of the line Mignault–Laugrenée (IX. Corps), Chaussee Notre

PLATE V.

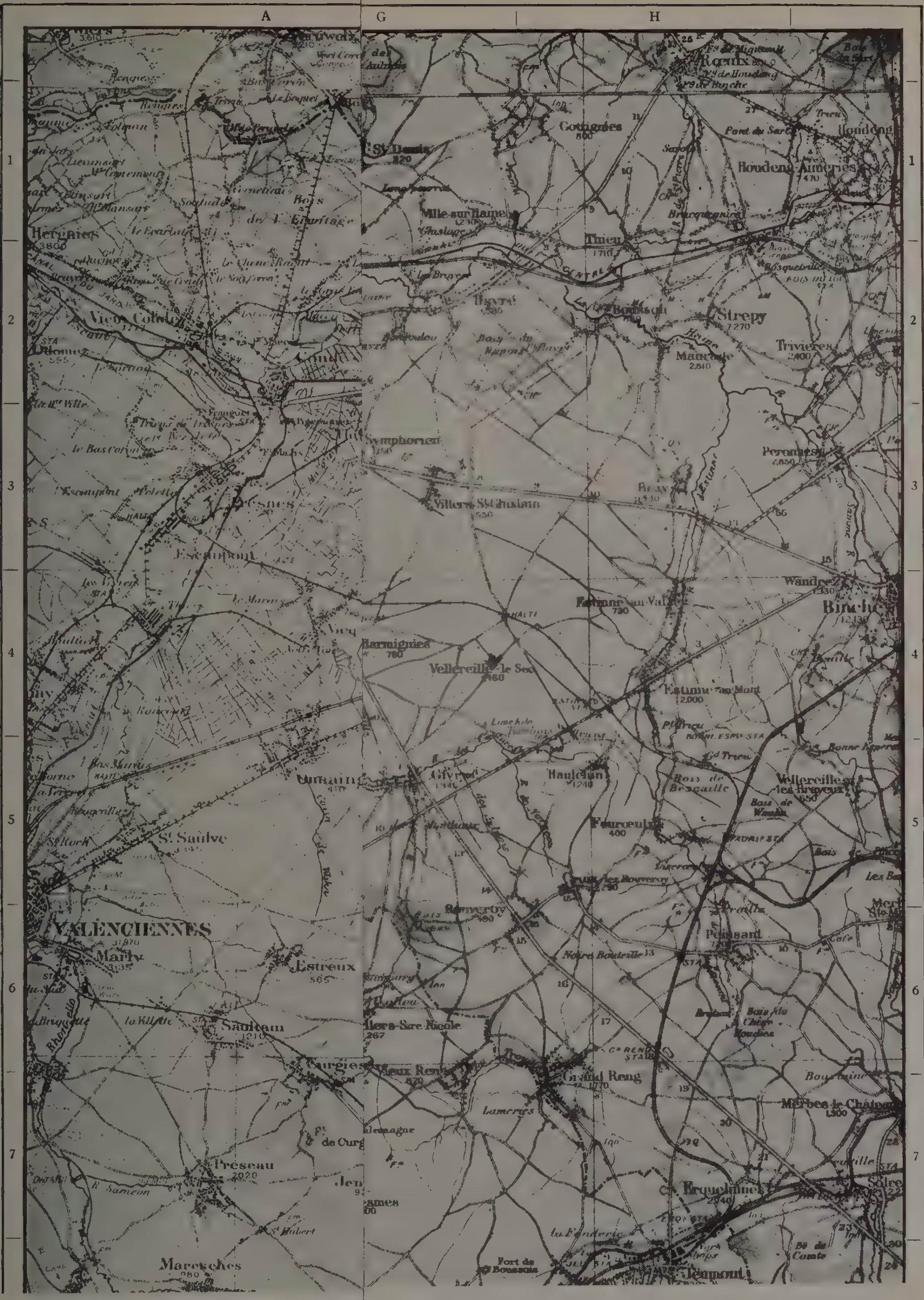
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Bois de l'Ermitage
Vieux Condé
Havré
Boussu
Strepy
Maurage
Trivieres
Symphorien
Peronnes
Villers St. Ghislain
Bray
Fresnes
Escaupont
Estinne-au-Val
Wandre
Binche
Harmignies
Vellereille-le-Sec
Estinne-au-Mont
Givry
Haulchin
Vellereille-les-Brayeux
Quarouble
St. Saulve
Fauroeulx
Croix-lez-Rouveroy
Rouveroy
Peissant
VALENCIENNES
Marly
Estreux
Saultain
Villers-Sire-Nicole
Curgies
Vieux Reng
Grand Reng
Mairieux
Merbes-le-Château
Préseau
Erquelinnes
Jeumont
Marpent
Maresches
Fort de Boussois
Solre

Dame de Louvignies–Thoricourt (III. Corps), Silly–Ollignies (IV. Corps), Niove (II. Corps). The III. Reserve Corps had been detached towards Antwerp, while the IV. Reserve Corps had just arrived at Brussels. Army headquarters were at Hal. The II. Cav. Corps under Gen. von der Marwitz was W. of Ath. Gen. von Kluck's task for the 23rd was to continue the advance of his I. Army into the area N.W. of Maubeuge, and he issued orders in which the destination of his various corps were to be as follows: The II. Corps was to be at La Hemaide, the IV. Corps at Basecles and Strambuges, and the III. Corps at St. Ghislain and Jemappes. The high ground on the S. side of the canal to be occupied. The IX. Corps was to cover the movement on the Maubeuge side. The IV. Reserve Corps to follow in rear as second line. The heads of the IV., III. and IX. Corps were to cross the line Ath–Roeulx at 8:30 A.M.

The German I. Army was thus to march in a south-easterly direction. The British II. Corps on the Mons canal was facing north. Consequently the left of the army of Gen. von Kluck must collide with the II. Corps in the neighbourhood of Mons. As a matter of fact the German commander was in ignorance of the position of the British force; in the orders referred to above there is no mention of the fact that it was along the Mons canal, and, indeed, the German cavalry had reported the ground clear for 50 miles. The march of the I. Army, on the 23rd, was therefore shrouded in the fog of war, and quite early in the day delay was caused by a report that Tournai was held by British troops. These were actually two French territorial battalions, but, under the impression that they were British, orders were sent to the IV., III. and IX. Corps to halt on the Leuze–Mons–Binche road in view of the possibility that it might be necessary to make a wheel to the right so as to envelop Tournai. Later reports showed that the British were in strength on the canal, and that the troops at Tournai, now known to be French, had retired towards Lille. The advance of the German I. Army was therefore resumed. But the orders for this resumption of the march were late in reaching the III. and IV. Corps, with results that reacted on the German chances in the battle.

The left column of Gen. von Kluck's army was the 17th Div. of the IX. Corps, and its march was directed towards St. Symphorien and Villers St. Ghislain. On the British side the I. Corps was on the line generally Harmignies–Peissant, and as it faced a gap between the German I. and II. Armies its share in the battle of Mons was destined to be very small. It was shelled by German artillery, covered in its advance by the 16th Dragoons, but the British casualties were slight, only about 100, and these were chiefly in two batteries upon which the German fire was concentrated. Of active fighting there was none save for some spirited minor actions between the British divisional cavalry and cyclists on the one hand and German patrols on the other. The bulk of the day's fighting fell upon the salient formed by the canal loop round Mons. So soon as Gen. von Kluck had grasped the real state of affairs—namely, that the British were not at Tournai but along the Mons–Condé canal—his plan appears to have been to envelop both the British flanks while bombarding the front heavily with his guns. The envelopment of the British left did not succeed, owing chiefly to the delay referred to above.

The battle opened in earnest about 10:30 A.M. with a bombardment by some batteries of the German IX. Corps which came into action on a ridge to the N. of Orbourg, and from that time onward the guns were gradually extended westwards as battery after battery, first of the IX. and then of the III. Corps, came into action. At 1 P.M. the Germans had established a great superiority of artillery against the front of the British II. Corps. The actual loop of the canal was held by the 4th Royal Fusiliers and the 4th Middlesex Regt., the former being responsible for the bridge at Nimy while the right of the latter regiment held the crossing at Orbourg. At both these places the fighting was very severe, but the British musketry proved a terrible surprise to the Germans, who came on in masses which it was impossible to miss, and the British guns, though outnumbered by the German artillery, gave most effective support. Finally, however, the Germans were able through their superiority in numbers to make a converging attack against the salient from the N. and E., and the British were gradually forced back E. and S.E. of Mons. But the Germans were cautious about pushing into the town, and it was not until after 7 o'clock that the 84th Regt. of the 18th Div. of the IX. Corps entered Mons, where it was thrown for a time into confusion by heavy fire. The British 3rd Div. fell back to a line running E. and W. through Nouvelles.

West of Mons the left division of the German III. Corps attacked the left of the British 3rd Div.; and still farther W. along the canal the right division of the III. Corps, and later towards evening, the advanced guards of the IV. Corps, attacked the 5th Div. of the British. The retirement of the 3rd Div. from the salient round Mons inevitably led to a slight withdrawal of the 5th Div., and by nightfall the II. Corps was on a line which showed an average retirement of some three miles from the canal.

During the late afternoon and evening Sir John French had been receiving disquieting news as to the situation of the French V. Army on his right. At 11:30 P.M. a telegram arrived confirming the reports, to the following effect: Namur had fallen during the day; the French V. Army had been heavily attacked, and was falling back to the line Givet–Philippeville–Maubeuge; Hastière had been captured by the Germans; the Meuse was falling rapidly and had added to the difficulty of defence. In these circumstances Sir John French decided to retreat to a previously reconnoitred line from Jerlain eastwards to Maubeuge, and orders were issued accordingly in the small hours of the 24th. The withdrawal was effected without serious loss, and for a moment Sir John French thought of taking advantage of the fortifications of Maubeuge; but recollections of the fatal attraction of Metz for Bazaine induced him to pass the fortress, and orders were issued at 3 P.M. on the 24th for the retreat to be continued to the line Le Cateau–Cambrai. After Bavai the retreat was handicapped by an incident of terrain, for the Forêt de Mormâl compelled the British army to march in two separated portions, the I. Corps E. of the forest and the II. on the west. In the latter corps a crossing of routes had taken place, with the result that the 3rd Div. had changed places with the 5th and was now on the outer flank. Towards nightfall on the 24th the pressure of the enemy became greater on the British left, but the British cavalry division performed excellent service in keeping the enemy at bay, and early on the 25th the retreat was continued, again covered skilfully by the mounted troops. During the night the detrainment of the 4th Div. from England was almost completed, and it moved to its position towards Cambrai.

Meanwhile reports which had been coming in during the day (25th) showed that the French were retiring all along the line, and Sir John French had now to come to a momentous decision. Was he to stand and fight on the line to which the British were now retiring (Le Cateau–Cambrai), or ought he to continue the retreat at daybreak on the 26th? After long and anxious deliberation the commander-in-chief came to the conclusion that the retreat should be continued, and orders to that effect were accordingly issued. The order was complied with by the I. Corps. That corps had been delayed in starting on the 25th, and had only been able to reach the neighbourhood of Landrecies. When darkness fell the Germans sent forward advanced troops in motors and lorries through the Forêt de Mormâl, and this culminated in a violent attack on Landrecies, which was, however, beaten off, chiefly by the 4th Guards Brigade. Sir Douglas Haig then proceeded to carry out the orders of the commander-in-chief, and the retirement of the I. Corps was continued in the direction of Guise. In the II. Corps, however, shortly after midnight Sir Horace Smith-Dorrien came to the conclusion that, in view of the fact that many of his troops had only just come in after over 20 hours of heavy and continuous work, and that the enemy were close along his front, it was out of the question to continue his retirement at dawn. He therefore issued orders to fight on the ridge just S. of the Le Cateau–Cambrai road.

When dawn broke on the 26th Smith-Dorrien's force was disposed as follows from right to left: The greater part of the cavalry was between Le Cateau and the Sambre; later it moved to the left flank to get in touch with the French I. Cav. Corps of

Gen. Sordet, which all through the 25th was moving in rear of the battlefield to protect the British left. Then came the 5th Div., which held the front from the southern outskirts of Le Cateau to Troisvilles, with the 19th Bde. in support. The 3rd Div. held the centre as far as Caudry, and on the left lay the 4th Div., part of which had moved forward N. of the Cambrai–Le Cateau road the day before to protect the retirement of the II. Corps, but the left of which was now about Esnes. Thence to Cambrai was a gap filled by the 4th Cav. Bde., and later by Gen. Sordet's cavalry corps. The French 84th Territorial Div. was retiring slowly through Cambrai.

The German force on the heels of the British II. Corps was the I. Army, whose commander, Gen. von Kluck, at one time or another before, during, and after the battle was the victim of faulty conclusions. He believed that the whole of the British Expeditionary Force was opposite him; he diagnosed that it was holding a position running N. and S., whereas the line of the II. Corps was almost due E. and W., and he was sure that it was either retreating or about to retreat in a westerly direction. His plan was similar to that which had been tried at Mons, a frontal attack mainly with artillery followed by enveloping movements against both flanks. The II. Corps was to march through Cambrai and the IV. Reserve Corps to Catherieres, thus enveloping the British left. The IV. Corps was to make the attack on the British front from the W. of Le Cateau to Caudry. The III. Corps was to march W. of the Sambre on Le Cateau in order to envelop the British right. The II. Cav. Corps under Gen. von der Marwitz was to pin the British left until the German infantry should arrive upon the field.

Soon after daybreak the British were engaged upon both flanks. On the right some troops of the German IV. Corps entered Le Cateau and some confused fighting ensued, while on the left the 4th Div. became engaged with the II. Cav. Corps of the enemy. Here the 4th Div., after defending an advanced position for some time, fell back slowly to a second line and brought the enemy advance to an abrupt standstill. These events were but preliminaries, and the battle of Le Cateau proper opened with a heavy bombardment, which grew in intensity as the artillery of four German corps came into action. The British artillery made a spirited reply, though heavily outmatched in numbers and weight of metal, and dealt severely with attempts of the German infantry to push forward. These attempts were, however, practically limited to the ground near Le Cateau on the British right, and to the village of Caudry, which now formed a salient in the centre of the line. Throughout the forenoon constant infantry attacks varied by bouts of heavy shelling were made against the latter village, from which about noon the defenders were forced out by artillery fire; but a counter-attack at once regained part of it and the German infantry advance was held up.

It was now about 1 P.M. and the line of the II. Corps was still everywhere intact in spite of the superior numbers arrayed against it. But on the right the situation was becoming grave, for the 5th Div. with its right flank uncovered by the retirement of the I. Corps was being threatened by more and more German columns converging upon the field. Sir Horace Smith-Dorrien realized that the moment had come when at all costs the fight must be broken off if his force was to be saved. He was now faced with one of the most difficult operations of war—that of extricating tired troops from contact with an enemy largely superior in force. Orders were, however, sent to break off the fight and to continue the retirement of the previous days, and the operation was very neatly accomplished with entire success, difficult though it was. Against the exposed flank of the 5th Div. the Germans were now vigorously pressing, and this to some extent precipitated matters, for before the orders for retreat had reached all concerned, the British right had given way before overwhelming superiority of numbers. But the Germans failed to exploit this success, and the withdrawal of the II. Corps, thanks largely to the devotion of the British artillery and to the arrival of Gen. Sordet's cavalry corps on the left, which held off the German enveloping movement in that quarter, was effected with less difficulty than had been expected. Sir Horace Smith-Dorrien successfully withdrew his columns, and marched them swiftly to the Somme at and near Ham, and by the 28th had got the II. Corps safely across the river.

The losses of the British had been severe, and 38 guns had been taken by the enemy. The men were exhausted after the severity of the marching and fighting of the first stage of the war, and a vigorous pursuit by the Germans might have meant disaster for the British II. Corps. The retreat, however, was practically unmolested, for Gen. von Kluck hurried S.W. instead of S., and thus missed a chance not likely often to occur in war.

(F. E. W.*)

FROST, ROBERT (1875–   ), American writer, was born in San Francisco, March 26 1875. His father was a New Englander and his mother was born in Edinburgh. In 1885 he moved with his parents to Lawrence, Mass., studied in the public schools, and entered Dartmouth College in 1892, remaining there one year. During 1897–9 he was a student at Harvard. During 1905–11 he taught English in the Pinkerton Academy, Derry, N.H., and then for a year taught psychology at the N.H. Normal School at Plymouth. In 1912 he went to England, where he remained three years and published his first two volumes of verse. On his return to America he retired to a farm at Derry and gave much time to active farming. During 1916–20 he was professor of English at Amherst College. His poems portray in realistic fashion every-day country life in New England. Some of the work of his first volume had been denied publication for 20 years, and some of the second for 10 years. He was the author of *A Boy's Will* (1913); *North of Boston* (1914); *Mountain Interval* (1916) and *A Way Out*, a play (1917).

FRY, SIR EDWARD (1827–1918), English judge (*see* 11.270), died at Failand, near Bristol, Oct. 19 1918.

FRYATT, CHARLES (1872–1916), British sea-captain, was born at Parkeston, near Harwich, Essex, Dec. 2 1872. He entered the service of the Great Eastern Railway Co., and in 1904 became chief officer in their service of vessels plying between Harwich and Rotterdam, in 1913 becoming captain. He continued to navigate his ship, the " Brussels, " to Rotterdam and back for the first two years of the World War. At the end of July 1916 it was announced that the " Brussels " had been captured and the captain himself arrested and tried by court-martial on a charge of having attempted on March 28 1916 to ram the German submarine U33 near the Maas lightship. The German authorities stated that Captain Fryatt had confessed during his examination that he had acted under orders from the Admiralty, but the trial was suspiciously hurried and secret, an application for postponement being refused, and no intervention on the part of neutrals was allowed. The captain was condemned to death and shot at Bruges July 28 1916. Half an hour after the execution had been carried out a telegram arrived from the army headquarters at Berlin ordering the sentence to be postponed. The news of the execution aroused great indignation in England, and on two occasions it was stated by Mr. Asquith in the House of Commons that due reparation would be exacted for this and similar murders. Ample provision was made for Captain Fryatt's family, his widow being awarded a pension of £100 a year over and above the amount to which she was already entitled under the Government compensation scheme, while the Great Eastern Railway Co. also gave Mrs. Fryatt an annuity of £250 a year for life. The captain's body was on July 7 1919 brought from Belgium to England. A memorial service was held at St. Paul's on July 8, and the body was buried at Dovercourt church, near Harwich.

FUEL (*see* 11.274).—Civilization on its physical side is based on fuel. Of all the powers of nature which have been turned by man to his use and convenience, fire stands out with a distinction which is unique. The kindling of the first fire of dried leaves and branches by our prehistoric ancestors marked the beginning of the transfer of this mighty power from the gods to man, and new possibilities of prodigious import were opened up. With fire at his command, a new dividing line was established between man and the lower animals, and a higher and more social standard of living became possible. The horrors and dangers of the darkness of night were greatly mitigated, social instincts were aroused through the nightly gathering round this new source of light and warmth, while imagination and thought were stimulated. The charred stick supplied the budding artist with his first pencil, while the glowing embers were the laboratory furnace in which the coming chemists and metallurgists made their first observations of the effects of heat on rocks and stones. Fire, first automatically and then deliberately, became the test to which all materials were submitted. The arts of the craftsman were based on these observations. The smelting of metals, the bending of wood, the singeing of skins, the melting of gums and the boiling of water started a whole train of new possibilities, each step in discovery opening the way to new adventures. It is no exaggeration to say that the practice of observation and experiment, on which the physical science of to-day is founded, had its origin in the first fire kindled by man. In the management of the wood fire the first lessons in the properties of fuel were learned. The flaming stage, followed by the steady and more concentrated heat of the glowing embers, naturally led to the collection of more massive embers by the control of the earlier stages of combustion, thus leading up to charcoal burning, by which the worker in metals was supplied with an ideal fuel for his operations. Thus the carbonization of raw fuel as a means of raising the availability of its potential therms had its origin in the far past.

It is unnecessary here to follow through the ages the romantic history of the association of fuel with civilization. Enough has been said to justify the opening remark that civilization on its physical side is based on fuel. This interrelation developed new features during and after the World War of 1914–8, and the future production and use of fuel in England and other countries has become closely associated with social ideals which involve the raising of the standard of living among the mining class.

Fuel Resources of the World

Before considering in detail some of the fuel problems of the immediate future, it may be well to pass in review the fuel position of the world in 1921, as it was disclosed by the most recent figures of production.

Coal and Lignite.—According to the estimate of the United States Geological Survey in 1920 the total world output of coal, including 143 million tons of brown coal and lignite, amounted to 1,300 million metric tons (*see* Coal). This is within 3% of the maximum output, which was reached in 1913 and 1918. Of this total output, the United States produced 45%, Great Britain and the British Empire 22%, Germany 19%, while other countries ranged from 2½% downwards. One of the most significant features of this survey is the remarkably rapid development in the winning and use of brown coal and lignite on the continent of Europe and particularly in Germany. The output of brown coal and lignite in Germany in 1919 had reached 93·8 million tons, but this was overtopped in 1920 by an output of 111·6 million tons, out of a total output of 140·7 million tons on the continent of Europe that year. The output of ordinary coal in Germany for 1920 was 140·8 million tons.

The brown coal industry in Germany is of old standing, and its rapid development in recent years is based on sound knowledge and experience. Though in its natural state a less concentrated fuel than bituminous or anthracitic coal, brown coal has many points in its favour. The chief of these is the low cost at which it can be won as compared with ordinary coal. Where extensive deposits of great thickness occur, these can be worked opencast and excavated by machinery. The winning of brown coal is thus on an altogether different basis from ordinary coal-mining with its deep and costly underground roads and workings which involve heavy costs for timbering, pumping and ventilation. The manual labour required is much smaller in amount for a given output, and is of a less highly specialized type, while the special dangers and uncertainties of coal-mining are practically absent. The capital charges, being mainly on surface roads and on excavating machinery, are relatively light as compared with the heavy initial and permanent charges involved in the sinking and equipment of shaft or mines. Brown coal, though it contains from 40 to 60% of water, is to-day by far the cheapest source of thermal units. Its further manufacture by drying, briquetting and carbonization can be carried out close to the point of excavation and under conditions favourable to production on a large scale, and therefore at a low cost. The glowing accounts of this development which appeared in the technical press during 1919–21 may have been somewhat exaggerated; but the solid fact remains that in 1920, with a production of 111 million tons of lignite in addition to ordinary coal, Germany had already faced the fuel problem of the future so far as she herself was concerned. According to the extent to which Germany could meet her own requirements for heat and power by the development of lignite, peat and water-power, the output of her coal-mines would be set free for export.

It is not surprising that Germany's example has been followed, not only in Central Europe, but in Victoria (Australia) and in Canada. In Victoria extensive deposits of brown coal exist in Central Gippsland, which are estimated by Mr. H. Herman, the Director of Geological Survey, to contain 30 thousand million tons. The main deposits near Morwell are hundreds of feet in thickness, and lend themselves admirably to opencast working on an enormous scale. Considerable progress has already been made in the development of these deposits; and since the commencement of operations in 1916, 400,000 tons of brown coal had been mined and sold by 1921. When the excavating methods become more perfectly organized, it is expected that the coal will be produced at the mines at 2s. 3d. per ton. It contains from 40 to 50% of water, so that in heat value two tons is equal to about one ton of ordinary coal. A 50,000-kilowatt generating station was in 1921 being installed at Morwell for the transmission of current to Melbourne. It was intended to establish a plant at the mines for briquetting and carbonizing, so that fuels of higher availability might be produced from the raw coal. In 1920 a sample of this coal was received in England, and experiments on its carbonization were carried out at the Government Fuel Research Station. In the Dominion of Canada experiments were in progress in 1921 on the briquetting and carbonization of the brown coals of Manitoba and Saskatchewan. These experiments were being carried out under the auspices of the Dominion and of the Province of Saskatchewan.

Oil and Oil Shales.—Of oil (*see* Petroleum), next to coal the chief natural source of fuel, the world's output for 1920 was about 97 million tons, of which the United States produced 64·8%, Mexico 23·3, Russia 3·5, the Dutch East Indies 2·5, India 1·2, Rumania 1·1, and Persia 1·0. The oil output amounted to 7% of the fuel output of the world, reckoned in tons. If reckoned in potential therms, the figure would be raised to 10 per cent. As the United States has extensive oil interests in Mexico, it may be taken that in 1920 she controlled 75 to 80% of the total output of the world. It is therefore significant that, in official quarters, grave anxiety has been expressed as to the probable exhaustion of these resources in view of the rapid development in the use of motor spirit for road transport and of fuel oil for transport by sea. The following extract from a statement by Mr. J. O. Lewis, Chief Petroleum Technologist to the United States Bureau of Mines, expresses clearly the American view:—

> "The United States Geological Survey during 1910–20 has made several estimates of the quantity of oil left in our oil fields. The most recent estimate, that of David White, indicates that about 40% of the oil had been brought to the surface, and that the 60% remaining underground would last barely 20 years at the present rate of consumption. As the period in which an oil field can be made to yield its oil is not wholly within the control of man, the domestic production will undoubtedly be spread over a much longer period than estimated; but, on the other hand, the peak of production will be passed long before 20 years, and thereafter production will be at a declining rate. Of course, such estimates are by no means infallible, as many obscure factors are involved. However, this statement represents the opinion of the agency best qualified to make such an estimate, and is indicative of a condition which, were there no other solution to the problem, would be highly unsatisfactory, and would be viewed by the automotive industry with the greatest concern. For, even were the estimate unduly pessimistic, and the actual reserve double, the condition would be unsatisfactory.
>
> "The preceding statement refers only to the oil from oil wells in the United States. Fortunately there are enormous undeveloped

> resources in the rest of the world. The petroleum resources of this country have been developed and depleted in a ratio far beyond that of other countries, so that although we are producing to-day two-thirds of the world's production, the opportunities elsewhere for increasing production are much greater than in the United States. Geologists and those well-informed on foreign resources believe that in all probability the world contains enormous reserves of oil that can be obtained upon demand. Although to obtain oil from these reserves may not be as satisfactory as to obtain it within the confines of the United States, the outlook tends to assure the future of the internal combustion engine.
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> "Fortunately oil may be obtained from other sources than oil fields. In various parts of the United States, particularly in Colorado, Wyoming and Utah, are enormous bodies of oil shales from which oil may be obtained by destructive distillation, as benzol is obtained from coal. The United States Geological Survey has estimated the quantity of oil locked up in the richer shales of the three States mentioned as perhaps ten times the amount of the oil reserve in the oil fields. In Scotland the retorting of oil from oil shales has been on a commercial basis for more than 50 years, and antedates the oil industry in the United States. Commercial and semi-commercial experiments are being made in order to determine whether the oil shales of the Western States can be mined and retorted profitably in competition with petroleum from oil fields. This problem has not yet been solved, but these shales constitute a latent reserve that protects the future needs of the country for motor fuel as far as these needs can be foreseen. However, oil cannot be obtained from the shales on a large scale without heavy investments and the development of the industry must be spread over many years. Also, when the time comes, the consumer will probably have to pay more for his gasoline."

The oil shales not only of the United States, but of the whole world, await development as a source of oil fuel. The commercial possibilities of this development depend almost entirely on the relative cost of production and the selling price of natural oil and shale oil. In comparing the cost of production of natural oil from wells and of oil produced by distillation from shale, long experience has shown that in any field which is considered worthy of commercial development the cost of the oil at the wells should not exceed one penny per gallon, or 25s. per ton. In favourable cases it is only a fraction of this amount. In the shale field the shale has to be mined and transported to the retorts in which it is distilled, and the earthy residue, which amounts to from 15 to 17 cwt. for each ton distilled, has to be handled and disposed of. Labour and fuel have to be supplied for the retorting process and the retorts have to be kept in repair. With selected shales a yield of 30 to 40 gal. of crude oil per ton of shale may be obtained. The mining and retorting costs will amount to at least 10s. per ton, without capital and general charges, or 3d. per gallon for the crude oil as compared with the above figure of one penny per gallon at the wells. It is clear that the initial cost of crude oil obtained from shale puts it quite out of court in competition with natural oil, except in situations so far from oil wells that the extra cost is compensated for by that of transport of natural oil. It is clear that, in times of plenty, the natural oil can, if necessary, be sold at a price of one penny per gallon, which will at least pay the cost of production; the shale oil works on the other hand would have to sell at a loss, or to shut down and disband the large staff of skilled workers required for the prosecution of the industry.

The history of the oil industry during the period 1870–1920 shows a succession of waves of over-production and low selling prices, as new oil fields have been developed. The effect of these periods of plenty and of low prices has on the whole been to develop consumption of oil as a fuel; but their effect on the shale industry of Scotland has been to make the profitable running of the industry so speculative that it has never been possible to develop it on a really large scale, though ample supplies of shale are known to exist there. With natural oil, cost of production *per se* has very little to do with the fixing of the selling price, but with shale oil cost of production is the vital consideration. The best hope for the development of the shale-oil resources of the world appears to depend on a continuance of the interest recently shown in the United States in this question as being of vital importance to the industrial welfare of that country. Great natural resources in oil shales have been proved to exist; it only remains to develop systems of mining and retorting on the best modern lines, by which shale oil can be placed on the market at a minimum cost. Though in the opinion of experts in Great Britain this can never approach the actual cost of production of natural oils in existing fields, shale is thereby not necessarily excluded as one of the more important sources of oil fuel. First cost is only one among the conditions which will determine this development.

The production of oil by the carbonization of bituminous coal is also receiving much attention in the United States, as well as in Great Britain and Germany. This problem involves economic questions which do not arise in connexion with oil shales. Chief among these is the fact that, while in the distillation of shale about 70% of the shale distilled is a valueless earthy residue, 60 to 70% of the bituminous coal is retained after carbonization as a smokeless fuel of a higher value for domestic purposes than the original coal.

Peat.—The scarcity of fuel in the United Kingdom during the World War led to considerable pressure upon the British Government for the establishment of a serious inquiry into the possible development of peat. The matter was considered by the Advisory Council of the Department of Scientific and Industrial Research, resulting in the institution of the Fuel Research Board, by whom an Irish Peat Inquiry Committee was appointed. The history of this inquiry has been dealt with in the published reports of the Fuel Research Board.[1] As the subject was recognized as one of world-wide importance, Prof. Pierce Purcell was appointed Peat Investigation Officer to the Fuel Research Board in 1919, and through him close touch was maintained with the principal peat developments in Europe and America. In the summer of 1920 Prof. Purcell visited Canada and the United States, and investigated the work of the Peat Committee of the Canadian Government at the Alfred Bog, near Ottawa. In the following summer he visited some of the more important peat stations in Germany, Denmark and Sweden.

In Germany the Wiesmoor peat station has been in operation since 1910. The peat is dredged, macerated and spread on the surface of the bog to dry. By stacking under cover, the moisture of the peat blocks can be reduced to 25% solely by air-drying. For steam-raising purposes two tons of air-dried peat are equal to about one ton of coal. At Wiesmoor eight water-tube boilers are fired with peat. The average fuel consumption is stated to be from 2·7 to 3 kilos of partially dried peat sods per kilowatt hour, and the cost of the peat is taken at five marks per ton. A scheme was stated to be on foot for the establishment of a line of peat generating stations from Königsberg on the east to Wiesmoor. The promoters of this scheme appear to have ignored the fundamental difficulty which applies to the winning of peat in quantities sufficient to meet the day-by-day requirements of any large central station. When it is realized that the peat deposit in a good bog 20 ft. deep is only the equivalent of a 12 or 14-in. seam of coal, it will be evident that even an output of 1,000 tons a day of air-dried peat involves the laying out and development of an enormous surface. At the Zehlonbruck station, near Königsberg, it was proposed to use 920,000 tons per annum, or about 2,500 tons per day. Prof. Purcell states that to win mechanically 900,000 tons of air-dried peat in one season at least 4,500 men, women and children would be required, and the area over which the spreading and drying operations would extend could not be less than 9,000 ac., or say 15 sq. miles. He suggests that, in dealing with any production over 60,000 to 80,000 tons per annum from any single district, the difficulty would increase as the square of the production; and he considers that it is only by the development of these smaller units that progress will be made. There was evidence in 1921 that a steady development on these lines was in progress in Germany.

In Canada and in Ireland the application to local conditions of mechanical cutting or dredging, maceration, air-drying and harvesting has been studied with encouraging results. In the summer of 1920 peat was cut, macerated, spread on the bog at Turraun in Ireland, air-dried and harvested there, and a hundred tons of this air-dried peat were sent to H.M. Fuel Research

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[1] Reports of the Fuel Research Board for the years 1918–9, and on the winning, preparation and use of peat in Ireland; reports and documents.

Station, where some interesting experiments were carried out on its use for boiler firing and for carbonization. The peat, when it reached the station, contained about 27% of moisture. After having been kept under cover for some months the moisture was reduced to about 17 per cent. This peat is in the form of hard blocks of various lengths, up to about 10 in. with a cross section of something like 2 by 2 inches. Its density is rather under 1, or about twice that of the ordinary hand-cut sods made on the same bog. The blocks can be cut and sawn like hard wood, and they stand transport with very little breaking up into "smalls." In this respect they contrast very favourably with the ordinary hand-cut sods, which break down seriously in transport by rail or road. Steam-raising trials have shown that this material is an excellent boiler fuel, and that it lends itself admirably to carbonization, either in vertical retorts at temperatures between 750° and 850°C. or in steel retorts at 550° to 600°C.

It is evident that maceration of the freshly cut or dredged peat is well worth the small expenditure of power which it entails. When spread on the surface of the bog it dries much more quickly than ordinary cut peat, while in drying a shrinkage occurs which almost doubles the density of the dried product and so produces a fuel which can be stored, transported and used under much more favourable conditions than the ordinary air-dried sods.

Alcohol.—In view of the threatened shortage of petrol in England in 1918, Mr. Walter Long appointed a committee to consider the possibilities of alcohol as a motor fuel (*see* ALCOHOL). The report of this committee was considered by the Privy Council Committee for Scientific and Industrial Research, and it was recommended that the Fuel Research Board should be charged with the duty of investigating the technical and economic problems which are involved. As a first step to this end Sir Frederick Nathan was appointed Power Alcohol Investigation Officer. A preliminary survey was published in July 1920.[1]

For the complete replacement of imported petrol by alcohol it was estimated that 250 million gallons of 95% alcohol would be required. To produce this from grain (barley), potatoes or mangolds, the following quantities would be necessary:—

	Tons		Acres		Raw Material	
	Required for 250 million gallons	United Kingdom Production 1919	Required for 250 million gallons	Under Crop in 1919	Average Price per ton 1919	Cost per gallon of Alcohol
					£ s. d.	s. d.
Grain (barley)	4,170,000	1,288,035	5,593,293	1,870,087	21 4 0	6 0
Potatoes	12,500,000	6,312,000	2,118,644	1,218,774	8 10 6	8 6
Mangolds	25,000,000	7,769,000	1,282,513	471,759	1 10 0	3 0

These figures were not encouraging, and generally it may be stated that the production of alcohol in any considerable quantities from vegetable materials grown in the United Kingdom is not economically possible, owing to (1) insufficient acreage; (2) the high cost of cultivation and harvesting; (3) the high cost of manufacture; and (4) the fact that the most suitable raw materials are also important food-stuffs. There was for these reasons no prospect in England of replacing any considerable quantity of petrol by home-produced alcohol. Moreover, it was unthinkable that land, for even a fraction of the quantity of the raw materials in the foregoing table, could be used for such a purpose when, for food itself, a week-end supply only was assured from the home production. It was, however, considered desirable to make a further study of the growth of mangolds and of Jerusalem artichokes for this purpose, and experiments were in progress during 1919–21. From these it appeared that it might be possible to grow artichokes for the supply of a limited quantity of alcohol for special purposes, such as aviation. An examination of the artichoke stems indicated that it might be possible to convert them by a simple treatment to paper pulp. Should this prove to be the case, both products would be cheapened.

Investigations as to the possibilities of producing alcohol in the British Empire overseas indicate that, in the sugar-growing countries, molasses, from which alcohol might be obtained, is undoubtedly wasted, but that the wasted quantities are comparatively small, and in most cases would be insufficient, if so utilized, to meet even local requirements for alcohol. Alcohol might be made from suitable crops grown specially for the purpose in those British dominions and colonies where labour is available, and used to supplement or take the place of supplies from other sources. Some such course may be specially desirable where petrol is dear and difficult to obtain, for instance in the E. African protectorates and W. African colonies, which are very dependent on motor transport for their development.

The use of cellulosic materials was not yet possible in 1921, because although research work was in hand to find a process that could be employed on a commercial scale in those regions where such materials exist in sufficient abundance, it had not so far led to any definite results. Where, however, materials capable of easy hydrolysis exist, as for instance is the case with waste rice straw, the large-scale experiments in Burma, under the auspices of the Burma Oil Co., appear to indicate that the joint production of alcohol and paper should be a commercial possibility.

Until alcohol can be made from waste materials which can be collected and treated at small cost, it does not seem likely that British Empire-produced alcohol can be imported into the United Kingdom on any considerable scale; it is improbable that it will be produced cheaply enough, or in sufficient quantities, for export, even by those overseas portions of the Empire which may produce it in this way for local consumption.

USES OF COAL AS FUEL

Since coal is likely to remain the chief source of fuel for the world at large, the problems of its winning, preparation and use still occupy the foreground in all serious consideration of the subject. We know that in 1913 the output of coal of the mines of the United Kingdom was approximately 287 million tons, of which 98 million tons were exported. Out of the 189 million tons consumed at home, 35 million tons represented the domestic use, and the remainder was taken for industries as follows:—

	Million Tons
Railways	15·0
Coasting Steamers	2·5
Factories	60·0
Mines	20·5
Iron and Steel	31·0
Other Metals	1·3
Brickwork, Potteries, Glass and Chemicals	5·8
Gasworks	18·0

The uses of coal as fuel may be classed under three main heads:—(1) production of heat and light for domestic purposes; (2) production of heat for industrial purposes; (3) production of power for industrial purposes and for transport. Reclassifying the above figures under these three heads, we find that the consumption was as follows:—

(1.) *HEAT and LIGHT for domestic purposes.*

	Million Tons
Directly burnt as coal	35
One-third of the total used by gas undertakings . .	6
One-half of the total used by electrical undertakings . .	3
	44

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[1] "Fuel for Motor Transport": an Interim Memorandum by the Fuel Research Board.

	Million Tons
(2.) *HEAT for industrial purposes.*	
Iron, steel and other metals	32
Bricks, pottery, glass, cements	6
Paper, textiles, food-stuffs, fertilizers, chemicals, as steam	20
	58
(3.) *POWER for transport and industrial purposes.*	
Railways and coasting steamers	17
Mines	18
Factories	52
	87

Coal used in the raw state.	Million Tons	
Domestic heating	35	
Steam raising for heat	20	
Steam raising for power	60	
Transport, railways, steamers	17	
Brickworks, potteries, cement, glass, chemicals, soap, etc.	9	141
Coal carbonized and gasified.		
Gas undertakings	18	
Iron, steel and other metals	30	48
		189

These figures show that 141 million tons, or three-fourths of the coal used in the United Kingdom, was burned in the raw state; that 35 million tons, or nearly one-fifth of the total consumption was used in the raw state for domestic heating; and that 97 million tons, or one-half of the total consumption was used in the raw state for steam raising. Before considering the technical and economic problems which are involved in the replacement of raw coal as a fuel by the products of its carbonization, gas, petrol, oils and coke, we shall review the position of these great outlets for raw coal, domestic heating and steam raising.

Domestic Heating.—The domestic use of coal in the raw state affects the widest range of consumers in most civilized communities. In Great Britain the consumption per head of the population is in the neighbourhood of one ton per annum. In Ireland peat is still the chief domestic fuel, about six million tons of air-dried peat being consumed per annum. In no other country but Great Britain does the consumption of raw coal for domestic purposes reach the high figure of one ton per head per annum. The ample supplies and the low price of bituminous coal for centuries prior to the World War have established the open room fire and the kitchen range on a popular foundation in Great Britain from which it is difficult to displace them. The British climate has had much to do with the popularity of the open room fire, the radiation from which can be so readily modified to meet the rapid changes of humidity and temperature which are liable to occur almost from day to day during the year. Only during exceptional winters, when really low temperatures have continued for weeks at a time, has the open fire broken down as a means of maintaining English homes at a habitable temperature. The work of Dr. Margaret Fishenden on open fires has definitely shown that, under reasonable conditions of firing, 20% of the total potential heat of the raw coal is radiated into the room, and that a further 20 to 30% is given up to the fabric of the building before the waste products of combustion leave the chimney. Smoke and soot are, however, an unduly heavy price to pay for the transient cheerfulness of the flaming coals in a well-stoked fire, especially when we remember that over long periods the ordinary fire is only smouldering and dreary-looking. The coal-fired kitchen range, unlike the open room fire, has few if any sentimental associations and its replacement by gas-cookers and coke-fired water-heaters is only a matter of time.

In northern and central Europe, and in the United States and Canada, where really low winter temperatures prevail, close stoves and central heating systems are universally used, and the smoky combustion of bituminous coals has never gained a footing. In the United States and Canada anthracitic coals for domestic purposes are regarded as a necessity, and the Governments of these countries give every encouragement to schemes for the conversion of bituminous coals into smokeless fuel so as to avoid the transport from great distances of anthracitic coals. On the social side of civilization it is no exaggeration to say that the cheap and plentiful supplies of bituminous coal in Great Britain have not been an unmixed blessing. Even on the industrial side this is true, for it has led to the formation of habits of reckless extravagance in the use of fuel, which are so deeply rooted among workmen and manufacturers that it will take many years of high fuel prices to eradicate them. The gas undertakings of the United Kingdom have, however, done much to popularize the use of gas and coke for the replacement of raw coal for domestic use; and there is every prospect that a considerable proportion of the raw coal burned for domestic use will be displaced by the developments in the production of town gas on newer and more economical lines, and by the increased use of gas-works coke for domestic heating.

Steam Raising.—The fact that one-half of the coal used in Great Britain is consumed in raising steam for heating purposes and for power production, places the problems of fuel efficiency in this connexion in the forefront from an economic point of view. On the theoretical side these problems lend themselves to simple and direct treatment.

Steam-boiler efficiency depends first on the perfect combustion of the fuel, second on the utilization of the radiant heat of combustion, and third on the utilization of the sensible heat of the gaseous products of combustion before they are dismissed to the chimney. The heat for the conversion of water into steam has to pass through steel plates or tubes, and the rate at which this transference takes place is determined by the different temperature of the two sides of the plate or tube. The lower the temperature on the water side and the higher the temperature on the furnace side, the greater will be the amount of heat which is passed into the water, and the higher will be the evaporative efficiency of that portion of the boiler. Direct radiation from the burning fuel is by far the most effective means of maintaining the temperature on the furnace side of the plates and therefore of obtaining the highest evaporative efficiency per sq. ft. of metal surface. On the water side of the plate or tube the temperature can be kept down only by the maintenance of a very rapid circulation of the water over the metal surface. With adequate water circulation sufficient heat for the evaporation of 60 to 80 lb. of water per sq. ft. per hour can be safely passed through the metal. With inadequate circulation the metal may be raised to a destructive temperature, and the boiler may be ruined. In the ideal boiler the maximum proportion of the radiant heat of combustion ought to be absorbed by metal surfaces provided with ample water circulation on their inner side. The utilization of the sensible heat of the products of combustion involves the transfer of the heat of the gases to the metal by convection; the molecules of gas must actually come in contact with the metal surface. Rapid circulation is required in order to obtain this, and high velocity of the gases must be maintained. The work of Nicholson on this subject has received considerable attention during recent years and has to some extent been applied to boiler design. The importance of the direct absorption of the radiant heat of combustion is not as yet so generally recognized, but is likely to lead to important results in boiler design. The theoretical knowledge as to the utilization of the heat of combustion in boilers is still somewhat in advance of even the best engineering practice in steam-boiler construction. Unfortunately average practice still lags far behind the best knowledge on the subject.

Coal as ordinarily burned suffers from the disadvantage that it is not a homogeneous fuel like gas, oil or coke, but is in effect a mixture of these three forms of fuel. The only way in which coal can be made to approximate to a homogeneous fuel is by pulverizing it so that its particles are so fine that, when mixed with air, they at once ignite and burn like a jet of gas or a spray of oil. The degree of fineness required to produce this effect involves grinding till 80% of the coal will pass through a screen of 200 meshes to the square inch. For metallurgical and other high temperature purposes the advantages which result from pulverization may more than compensate for the cost of grinding and for the heavy initial cost of the grinding and distribution plant, but for steam raising it is still an open question whether the gain in the efficiency of combustion is sufficient to compensate for the greatly increased cost which is involved. In the best steam-raising practice the disadvantage due to the non-homogeneity of raw coal as a fuel has been met by the design and working of the boilers, while by the use of automatic stoking and ash removal, the boiler house charges under these heads have been greatly reduced. In comparing the best practice on these lines with the most recent experiences in connexion with pulverized fuel in America it is still doubtful whether the latter can be justified on the score of expense.

The valuable papers of Mr. D. Brownlie[1] throw a much needed light upon the use of coal for steam raising. His analysis of the statistics which he has collected shows that the amount of coal used for steam generation in Great Britain for heat and power production is from 75 to 100 million tons per annum, or about one-half of the whole coal consumption. His conclusions as to the comparative efficiency of the numerous boiler plants he personally examined during seven or eight years, and the extension of these conclusions to cover the whole steam-raising practice of the United Kingdom, supply material on which some broad generalizations may be based. He divides the boiler installations of the United Kingdom into three classes—bad, average and highly efficient. Of the total number he classes: 10% as bad, 85% as average and 5% as highly efficient. As regards the efficiencies of each class, with water-tube boilers the bad give 61%, the average give 69%, and the highly efficient give 82%, while with Lancashire boilers the bad give 49%, the average give 60% and the highly efficient give 79%.

If we take the minimum figure of 75 million tons as the amount of coal annually used for steam raising in Great Britain, it is clear that the scope for economy is enormous; for even a moderate increase of efficiency of 10% over all would result in a saving of 7½ million tons per annum. Mr. Brownlie's own experience of the savings to be effected by a reorganization of plants leads him to take a much higher saving as a possibility. In the case of the colliery steam boiler plants, the average efficiency of which he places at 51%, he estimates that the coal bill for all the British colliery plants is 18½ million tons, and that the efficiency might easily be raised by 10 to 15%, while by the systematic use of colliery waste a further saving of salable coal would be realized. These facts and figures are well worth careful study of all who are seriously interested in fuel economy. They show the enormous possibilities existing for fuel economy, apart from any new revolutionary discoveries.

Before we leave the subject of steam raising, the use of gas, oil and coke for this purpose may be referred to.

Gas.—A considerable amount of experience has been accumulated on the use of gas for steam raising. This experience covers a wide range of gases from blast-furnace gas of about 100 B.Th.U. per cub. ft. to coke-oven gas of over 500 B.Th.U. With the lowest grade gas the thermal efficiency in ordinary practice has generally been of a low order, but with proper care in boiler setting and firing there is no reason why a thermal efficiency of 80% should not be reached, even with low grade gas. The evaporative efficiency per sq. ft. of heating surface however is low, and in ordinary blast-furnace practice it is found that when coal-firing is replaced by gas, a larger number of boilers is required for the evaporation of the same amount of water.

With coke-oven gas there is no reason why the highest thermal efficiency—as well as a high evaporation efficiency per sq. ft. of heating surface—should not be obtained. From an economic point of view, however, the use of high-grade gas for steam raising can only be justified when it is a waste product for which there is no other outlet. As fuel for steam raising, the availability of the therms in coke-oven gas is only from 10 to 15% higher than that of the therms in the form of raw coal, or, with coal at 25s. per ton, about 1·2d. per therm; but for distribution as town gas its value is from 2·5d. to 3d. per therm, while for use in internal combustion engines its value would be at least as high. For a possible gain in thermal efficiency of from 10 to 15%, it will obviously not pay to produce gas as a fuel for steam raising, except under very special conditions.

Oil.—As fuel for land boilers, oil is definitely superior to coal in many respects. Chief among these are the ease with which it can be transported, stored and handled, its flexibility as a fuel, and the high efficiency with which it can be burned. These advantages would probably justify a price of 50 to 100% higher than that of coal. As fuel for the ships of the navy, all the above advantages over coal are emphasized, and in addition to these are the greatly enlarged range of action and the possibility of oil bunkering while at sea. As fuel for the ships of the mercantile marine its advantages are now so fully recognized that the only limits to its extended use are the uncertainty as to future supplies and as to its price. In 1914 there were on Lloyd's Register 364 steamers of 1,310,000 tons fitted for burning oil fuel, whereas in 1921 the total was 2,536 vessels of 12,797,000 tons. The following comparison shows the division of motor-power in the two years:—

	Percentage of total gross tonnage	
	1914	*1921*
Sail power only	7·95	5·05
Oil etc. in internal combustion engines	0·47	2·00
Oil fuel for boilers	2·62	20·65
Coal	88·96	72·30
	100·00	100·00

It will be seen that only 72% of the tonnage of the British merchant marine in 1921 required coal, while in 1914 the figure was 89%.

Coke.—Much useful work has in recent years been done by the London Coke Committee on the use of coke and coke breeze for steam raising. This has led to the development of the "Sandwich" system of firing with a mixture of coke and bituminous slack. This system, which is in operation in London, Manchester and elsewhere, consists of feeding from a divided hopper on to the chain-grate stoker, coal slack and coke in superimposed layers, the coal being uppermost. With a natural draught of only ·25 in. the coke layer may be from 5 to 6 in. in thickness. This layer prevents the percolation and consequent loss of coal dust through the grate. The coke layer being relatively porous permits the passage of air required for the combustion of the coal under favourable conditions, so that little or no smoke is produced. When coke alone is used on a chain grate it is difficult to maintain a sufficiently high temperature to ensure its ignition near the front of the grate. Under the Sandwich system the ignition temperature is maintained well to the front of the grate by the flame produced from the layer of slack. Each fuel therefore helps the more efficient combustion of the other. When coke is used by itself for steam raising, special provision has to be made to secure that its ignition takes place as near the front of the grate as possible. If this is secure, advantage can be taken of the high radiating efficiency of the bed of incandescent coke by the provision of ample water-cooled surfaces for the direct absorption of the radiant heat.

Direct combustion of coal is likely to maintain a leading place in steam raising for many years to come; and there is no direction in which the scope for increased economy and efficiency is so obvious and so extensive. By the closer association of steam electric-generating stations with gas-works and coke-ovens the use of the products of carbonization, gas, oils, tar and coke, may supplement the use of raw coal to some extent and may lead to higher efficiency and economy of fuel, but this form of association must be carefully thought out in each particular case. Certain general principles which affect this form of association can be laid down, but the purely local and individual condition must always determine the application of these general principles. Their merely superficial adoption will only lead to disappointment and loss. This aspect of fuel economy is referred to below in connexion with carbonization and gasification as a means of sorting out the elements of raw coal into fuels of higher availability and convenience, but it may be said at once that up to 1921 no case had been made out for the general replacement, by fuels of higher availability, of raw coal used for steam raising. There is every reason therefore for the concentration of skill and enterprise on the general application of the well-established principles which govern the most efficient use of raw coal for steam raising. In Great Britain alone it is certain that tens of millions of tons of coal per annum might be saved in this way.

Apart from steam raising the direct combustion of raw coal in industry does not bulk very large in the general fuel bill. In the metallurgical industries coke and gas are the more important fuels, though considerable quantities of raw coal are still used in steel-making. In pottery and brick-making raw coal is still the chief fuel, but movements have been set on foot which may lead to the more extensive use of gas. In the Portland cement industry raw coal is likely to remain the fuel, as it can be used in pulverized form in rotary cement kilns with high efficiency.

POWER PRODUCTION BY INTERNAL COMBUSTION ENGINES

While by far the larger proportion of the power requirements of the world is at present supplied by steam boilers and engines, the production of power by the direct combustion of fuel in internal combustion engines has taken an increasingly important place (*see* Internal Combustion Engines). In 1900 great hopes were entertained that gas-engine units of large size would be used for the generation of electricity at central stations. Great difficulties have however been experienced in maintaining gas-engine cylinders of large size, and the tendency for some years previous to 1920 was to keep down the size of the individual cylinders and to multiply the number of cylinders running on one shaft. Under these conditions the size of the unit engine is necessarily limited to 1,000–2,000 horse-power. Even with units of this size the cost of maintenance may be high, and considerable stand-by plant has to be kept in reserve. Sir Dugald Clerk has estimated that, in Great Britain, more than half a million B.H.P. per annum was derived in 1920–1 from gas-engines combined with suction and other gas producers. The Diesel type of oil-engine also made great progress during 1910–20 on land as well as on sea.

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[1] *Engineering*, July 12 and 19 1918; July 25 and Aug. 1 1919; Dec. 10 and 17 1920.

The internal combustion engine made the most remarkable developments after 1910 in its application to motor vehicles and to aeroplanes. The fuel required for this purpose must conform to certain definite requirements, the most fundamental of which is that it must be an inflammable liquid which can be depended on to vaporize on mixture with air at a sufficiently low temperature to ensure that the mixture can be fired in the cylinders of the engine by an electric spark. Petrol or gasoline is the most widely used fuel for this purpose. It is a mixture of the more volatile hydrocarbons which are obtained in the fractional distillation of natural petroleum. It is also obtained from natural gas by compression or cooling, or by oil-stripping.

The enormously increased demands during recent years led to the adoption of cracking processes, by which during distillation the heavier and less volatile fractions of the crude oil are partially broken up into hydrocarbons of a volatility which brings them within the range covered by the motor-spirit requirements. It is estimated that the development of cracking methods in the United States has added 10% to the yield of petrol obtained from the crude oil; while other improvements in collection and refining have added a further 5 to 6%. In 1909 the yield was 10·7%, while in 1918 it had risen to 26·1%. Thus fully one-fourth of the crude oil refined in the United States is being put on the market as petrol. The petrol imported into Great Britain in 1920 was about 250 million gal., or 830,000 tons.

The only sources of motor fuel in Great Britain are shale oil-works, gas-works and coke-ovens. From the shale oil-works about four million gallons of petrol per annum might be obtained, and from gas- and coke-works about 20 million gallons of benzol, though in 1921 the output was much less. Benzol is an excellent motor fuel for land purposes, alone or mixed with petrol.

Carbonization and Gasification

In connexion with the fuel problems of coal in their wider aspects, the operations of carbonization and gasification can be most conveniently considered as *processes for the sorting out of the constituents of coal into fuels of various degrees of availability and usefulness.* Though the hydrocarbons and their derivatives which occur in, or are derived from, coal by destructive distillation must continue to have a deep interest and an economic significance from the chemical point of view, they are relatively insignificant when the use and disposal of hundreds of millions of tons as fuel are being considered. While this is the only safe attitude for the fuel expert to take, it should be clearly understood that this in no way excludes the due consideration of chemical and by-products questions when these arise as a necessary part of the fuel problem.

Coke-Ovens.—So long as the blast furnace remains the instrument for the conversion of iron ore into pig iron, the coke-oven must continue to supply the necessary fuel in the form of hard coke. The "sorting-out process" at the coke-ovens is necessarily coloured by the fact that its primary object is the production of the right kind of coke. So much is this the case that the beehive oven, in which coke is the only product obtained, has only been partially displaced by the recovery oven, in which the by-products, tar, benzol and ammonia, are saved. In the iron and steel industry to-day the most advanced opinion is in favour of the concentration of coke-ovens, blast furnaces, steel furnaces and rolling-mills on one site, so that the whole of the potential heat of the coal may be pooled and used in a closed cycle for the production of heat and power. Mr. Talbot has estimated that in this way the fuel required for the production of one ton of finished steel would be reduced from 45 to 35 cwt. As any general replacement of existing works, under the financial conditions prevalent in 1921, was likely to involve a prohibitive capital cost, a more general use of coke-oven gas for the purposes of town supply was not to be hoped for.

Carbonization in Gas-Works.—In gas-works the sorting-out process is influenced by the fact that the primary purpose is to supply potential light, heat and power in the form of gas. In the British gas industry the fuel problems of the future acquired a new interest after the publication of the report of the Fuel Research Board on the results of their inquiry into the subject of gas standards. The results of this inquiry led to the adoption by the Board of Trade of a new method of charging the consumer for the gas which passes through his meter. The volume of this gas was still measured and recorded, but the consumer no longer paid on thousands of cub. ft. but on the product of the multiplication of the number of cub. ft. passed by the standard calorific value of the gas per cub. foot. The unit of charge was made the "therm," the name adopted for 100,000 British thermal units. Under this system it is now possible to give to the gas undertakings a wide latitude in the selection of the standard of calorific value which they adopt, and therefore a much wider choice of the methods by which gas is manufactured. In the report it was stated that the great gain for the gas undertakings under the new system would be that no undue legislative restrictions would limit them in their development of the most economical production of thermal units in the form of gas. It was pointed out that there was still great scope for this development; as, according to present practice, only from 21 to 24% of the total potential thermal units of the coal was being sold in the form of gas.

To increase this percentage two known methods are available, both depending on the production of water-gas by one or other of the reactions between steam and carbon at a high temperature. The first of these methods is the old-established one in which a portion of the coke produced in the retorts is transferred to a separate producer, in which it is raised to bright incandescence by an air-blast and then subjected to the action of a current of steam. The thermal efficiency of this operation ranges from 45 to 55% according to the method of blowing-up and steaming adopted. The second method has recently been developed in connexion with vertical retorts. In this case the water-gas reactions are carried out in the lower part of the column of red-hot coke in the retort itself, by passing through it a current of steam. The volume of gas produced is much increased, though its calorific value is reduced by the addition of water gas to the hydrocarbon gas resulting from the carbonization of coal.

During 1919–21 continuous experiments were carried out at H.M. Fuel Research Station on the use of steam in vertical retorts with various types of coal. It was proved that, by the use of a moderate percentage of steam, a much larger proportion of the thermal value of the coal can be converted into the fuels of higher availability and value, gas and tar. In the case of a S. Yorkshire coal of good quality the following results were obtained: At a working temperature of 126°C. and with 21% of steam, the gains per ton of coal were 22 therms in the form of gas, 34 lb. of tar, and 6 lb. of ammonium sulphate. While without steam only 23% of the potential heat of the coal was obtained in the form of gas, with steam 33% was obtained. The extra heat which had to be supplied to the retorts in order to produce these results was ten therms per ton of coal carbonized, or 3·3% of the thermal value of the coal. The gas obtained amounted to 22,580 cub. ft. per ton, with a calorific value of 460 B.Th.U. per cub. foot. Both thermally and economically these results are superior to those which would have resulted from the production of an equivalent amount of water-gas in separate producers. The independent production of water-gas will always be regarded by gas engineers as an invaluable means by which exceptional demands on the gas supply can be met at short notice.

Low-Temperature Carbonization.—For many years inventors have been endeavouring to develop a practical process for the production of a solid smokeless fuel for domestic purposes by the carbonization of selected coals at 550° to 600° C. The resulting coke is entirely free from smoke-producing hydrocarbons, though it still contains 10 to 12% of volatile combustible matter, which burns with a very slightly luminous, perfectly smokeless flame. When the coke is kindled it becomes enveloped by these flames, which quickly raise the surface to incandescence. Undoubtedly if this smokeless solid fuel could be produced at a cost permitting of its being sold at little more than the price of the coal which it would replace, it would lead to a complete revolution in domestic heating.

The problem really has two distinct sides—the technical and the economic. On the economic side the data for a final solution will only be obtained after the technical solution has been reached. In other words, until a fair-sized industrial plant has been worked continuously over a long period, making and disposing of all the products of carbonization under steady market conditions, no one can say whether or not the business will be a profitable one.

On the engineering side an efficient and not too costly apparatus must be designed and constructed in the working of which manual labour, fuel consumption and maintenance costs are all reduced to a minimum. In these respects—as well as in its output capacity on a given ground area—the apparatus must stand comparison with gas retorts and oil-shale retorts of the most modern types. Only when this ideal has been realized practically can the future of low-temperature carbonization as a business proposition be put to the test of continuous working on a large scale under the labour and market conditions of the day.

From the experience gained in 1919–21 at H.M. Fuel Research Station, with a considerable variety of coals, the yields and quality of the gas, oils and coke produced under definite conditions were ascertained; but this knowledge is only the first step in the inquiry. For, until the cost of producing these, and the markets in which they are to be disposed of, are known with equal certainty, no economic balance sheet of any real value can be arrived at. Low-temperature carbonization can only be established on a sound commercial basis with low operating costs and a very moderate margin of profit. Prior to 1914 the shale oil industry in Scotland was distilling three million tons of shale per annum. The entire cost of the carbonizing operation, for labour, maintenance and fuel, was 1s. 6d. per ton, and the margin of profit on which fair dividends were paid was 2s. 6d. per ton. Unless the costs and profit margins of low-temperature carbonization can be reduced to the modern equivalents of these figures, the prospects of its development on a large scale are not hopeful.

If low-temperature carbonization is proved to be a feasible operation commercially, it would find its first and most natural application in Great Britain to the 35 million tons of coal used for domestic purposes. Were this coal all carbonized, it would produce about two million tons of fuel oil for the navy, or considerably more than the peace requirements, though considerably less than the war requirements. The motor spirit produced would amount to about 100 million gallons.

CONCLUSIONS

From this review it appears that coal is likely to remain for a long time the world's chief source of fuel. Its more efficient use may be secured:—(1) by more careful sorting and preparation at the mine; (2) by the improvement of boiler and furnace firing on well-known lines; (3) by the sorting out of its combustible constituents into fuels of higher availability or convenience by preliminary carbonization carried out either at high or at low temperatures. The development of oil shales as a source of liquid fuels was still in 1921 only in its initial stages, but it had evidently a great future before it. The problems of the utilization of peat, which cover a wide range both technically and economically, are mainly of local importance, and are not likely to affect the fuel supplies of the world to any great extent. The production of alcohol on a really large scale as a motor fuel of high availability bristles with economic and technical difficulties, and it was still in 1921 too early to pronounce an opinion on the possibilities of the future. Most, if not all, of these problems on their technical side are probably capable of solution by the skill and application of the industrial pioneers of the world; but the most difficult of the fuel problems of the future, as viewed in 1921, were those into which industrial and economic factors—the relations between capital and labour, and the cost of production —so largely entered. (G. T. B.)

FURNESS, CHRISTOPHER FURNESS, 1ST BARON (1852–1912), English shipbuilder and iron-master, was born April 23 1852, the son of a provision merchant, and entered the family business in 1870. By making a corner in food-stuffs, whilst the French fleet was blockading the mouth of the Elbe, he made a profit of over £50,000 for his firm out of the provisioning of ships. In 1877 he left the business and inaugurated the Furness line of steamships, and in 1891 he amalgamated with Withy & Co., iron and steel shipbuilders, founding the great shipbuilding firm of Furness, Withy & Co. at Hartlepool. In 1898, with others, he acquired extensive iron and steel works and founded the S. Durham Steel & Iron Co. He had an interest in many other concerns, and was chief proprietor of a Liberal paper, the *North Mail*. In 1908 he established a profit-sharing scheme for his workmen, but in 1910 its continuance was put to the vote and rejected by a majority. In 1891 he was elected Liberal member for the Hartlepools, but in 1895 he lost the seat, winning it again in 1900. In 1906 he was returned unopposed, and in Jan. 1910 he was elected but unseated on petition. A month later he was raised to the peerage; he had been knighted in 1895. He died at Grantley Hall, near Ripon, Nov. 10 1912.

His nephew, SIR STEPHEN WILSON FURNESS, 1ST BART. (1872–1914), who, after his uncle's death became chairman of the shipbuilding firm and iron and steel works founded by him, as well as of many other undertakings, was born May 26 1872. He sat in the House of Commons for the Hartlepools from 1910, and was made a baronet in 1913. He died at Broadstairs Sept. 2 1914.

FURNESS, HORACE HOWARD (1833–1912), American Shakespearean scholar (*see* 11.362), died at Wallingford, Pa., Aug. 13 1912. His *Variorum* edition of *Cymbeline* was ready for the printer and appeared in 1913.

FURSE, DAME KATHARINE (1875–), founder of the English V.A.D. force, was born at Bristol Nov. 23 1875, the daughter of the poet and critic John Addington Symonds (*see* 26.286). In 1900 she married the painter Charles Wellington Furse (*see* 11.365), who died prematurely in 1904. On the outbreak of war in 1914 Mrs. Furse realized that the existing number of nurses would prove totally inadequate to deal with the enormous amount of work which might be expected, and in Sept. 1914 she proceeded to France with a number of assistants, these forming the nucleus of the V.A.D. force (Voluntary Aid Detachment). In Jan. 1915 she returned to England, and the V.A.D. work was then officially recognized as a department of the Red Cross organization. Mrs. Furse resigned her position in 1917, and the same year became director of the W.R.N.S. She received the order of the Royal Red Cross in 1916, and the G.B.E. in 1917.

GAIRDNER, JAMES (1828–1912), English historian (*see* 11.390*), died at Pinner, Middlesex, Nov. 4 1912. A third volume of his *Lollardy and the Reformation in England* appeared in 1911.

GALLIÉNI, JOSEPH SIMON (1849–1916), French general and statesman (*see* 11.418), was appointed military governor of Paris, Aug. 26 1914, and at once took energetic steps for the defence of the capital. Eleventh-hour efforts were made to construct trench defence work and to create modern forts around the capital. On Sept. 3 he issued the following order: "To the Army of Paris and the Population of Paris. The Members of the Government of the Republic have left Paris in order to give a new impulse to national defence. I have been ordered to defend Paris against the invader. This order I shall fulfil to the end." General Galliéni was enabled, owing to information received from his aeroplanes, to hurry out reinforcements to Gen. Maunoury's Army (VI.) during a critical period in the battle of the Ourcq. The Paris taxicabs were requisitioned to transport them. He was appointed Minister of War in the Briand Cabinet at the end of Oct. 1915. His period of office was made notable by endeavours to create unity of command, and by changes in the position of Gen. Joffre. He resigned for reasons of ill-health on March 16 1916, and died at Versailles, after undergoing two operations, on May 27. His body was given a State funeral, and lay for a time under the dome of the Invalides. He lies buried at St. Raphael.

GALLON, TOM (1866–1914), British novelist and dramatist, was born in London Dec. 5 1866. He was first a clerk in a city office and then usher in a large private school, but, owing to ill-health, he had to give up routine work, and took to literature as a means of livelihood. He wrote a number of novels in which plot and incident predominate, amongst them *The Kingdom of Hate* (1899); *A Rogue in Love* (1900); and *The Charity Ghost* (1902). He then turned to the writing of plays, collaborating with Albert Chevalier in *Memory's Garden* (1902) and publishing some plays on his own account, *The Christmas Party* (1904); *The Devil's World* (1910) and *The Great Gay Road* (1911). He died in London Nov. 1 1914.

GALSWORTHY, JOHN (1867–), English novelist and playwright, was born at Coombe, Surrey, Aug. 14 1867. He was educated at Harrow and New College, Oxford, and was called to the bar in 1890, but devoted himself mainly to literature. His earliest novel, *Jocelyn*, appeared in 1898; but he first attracted general attention with *The Island Pharisees* (1904) and *The Man of Property* (1906). These were followed by *The Country House* (1907); *Fraternity* (1908); *The Patrician* (1911); *The Dark Flower* (1913); *The Freelands* (1915); *Saint's Progress* (1919); *In Chancery* (1920); *To Let* (1921); in addition to essays and short stories. Meanwhile he had also made a considerable reputation as a writer of realistic drama with a strong emotional appeal, notably *The Silver Box* (1906); *Joy* (1907); *Strife* (1909) and *Justice* (1910). His later plays include *The Pigeon* (1912); *The Eldest Son* (1912); *The Fugitive* (1913) and *The Skin Game* (1920).

See Sheila Kaye-Smith, *John Galsworthy* (1916).

GALTON, SIR FRANCIS (1822–1911), English anthropologist (*see* 11.427), died at Haslemere Jan. 17 1911.

GAMBIA (*see* 11.437).—The area, reckoning the colony and protectorate together, is 4,132 square miles. At the 1911 census the pop. was 146,101. St. Mary's Isle, at the mouth of the Gambia, on which is Bathurst, the capital, had 7,700 inhabitants (compared with 8,807 in 1901). European residents numbered 186 in 1911 and 112 in 1918. Estimates made in 1920 put the total pop. as high as 240,000.

The cultivation of the ground-nut, the chief occupation of the people, proves so lucrative that the efforts of the administration to widen the basis of prosperity meet with little success, though since 1913 there has been an increased production of food crops, African koos (millet) and rice, for home consumption. The land is all hand-worked, attempts to induce the farmers to adopt modern methods having failed. Up to 1915 the ground-nuts were nearly all purchased by French firms at Bathurst and sent to Marseilles. France in 1914 took 78% of the total crop. Changed conditions created by the World War and the establishment of large oil mills in England led to a diversion of the trade, and in 1916, for the first time for 58 years, Britain received a larger proportion of the crop than was shipped to France. In 1919 Great Britain took 91·44% of the total crop. In that year France took only 2·59%.

Trade in ivory, wax and rubber, formerly considerable, had by 1915 sunk to negligible proportions; besides ground-nuts the chief exports are palm kernels and hides. The restriction of shipping during and after the war caused a contraction of trade; nevertheless the value of exports in the period 1909–19 (excluding specie) rose from £351,000 to £1,229,000. They had dropped to £430,000 in 1915. The rapid recovery was due to increased prices rather than increased production. In 1909 the export of ground-nuts was 53,600 tons, valued at £323,000; in 1918 the export was 56,400 tons and the value £800,000. The most striking contrast was shown in 1914–5. In 1914 the export of ground-nuts was 66,000 tons, fetching £650,000; in 1915 the export was 96,000 tons, but the value fell to £400,000. In 1919 the export was 70,000 tons valued at £1,154,000.

In the period 1909–19 the value of imports, also excluding specie, rose from £258,000 to £1,179,000. In 1915 they had fallen to £302,000. The chief imports are cotton goods, kola-nuts, rice and hardware. Most of the imports come from the United Kingdom but up to 1914 France had a considerable share in the trade (27% in 1913) and Germany a smaller part (10% in 1913). In 1919 France and French possessions supplied only 8% of imports; the United Kingdom over 57%; British possessions 14%; the United States 19%. The American export is mainly rice, sugar and fuel oils. The United States imports rose from £12,000 in 1915 to £235,000 in 1919. America had in that time captured as large a share of the Gambia trade as Germany had had before the World War. It was entirely one-sided, as there were no exports from the Gambia to the United States. The bulk of the imports from British possessions was represented by kola-nuts from Sierra Leone,—valued at £157,000 in 1919.

Shipping is mainly in British hands. Total tonnage rose from 495,000 in 1909 to 625,000 in 1913. In that year British tonnage was 371,000, French 76,000, German 60,000, Greek 33,000. A great restriction followed and in 1918 the total tonnage was only 282,000. Of this total 262,000 tons were British. In 1919 the tonnage entering and clearing at Bathurst was 441,000. Of this 354,000 tons were British, 40,000 American and 19,000 French.

An import duty on kola-nuts and an export duty on ground-nuts are the chief sources of revenue, which rose from £72,000 in 1909 to £180,000 in 1919. In the same period expenditure increased from £56,000 to £143,000. There is no public debt. Education remains in the hands of various Christian missions, except for a Mohammedan school at Bathurst, which is maintained by the Government. For the whole of its length in the protectorate the Gambia is navigable and forms a sufficient means of communication, few places in the protectorate being more than 10 m. from the river. There are neither railways nor inland telegraphs, but there is cable connexion with Europe and other parts of W. Africa, and in 1915 the Admiralty erected a wireless station at Cape St. Mary. By going to Dakar, 90 m. from Bathurst, the passage to Europe by the French packet can be made in eight days.

Since the pacification of the protectorate by Sir George Denton (governor 1901–11) in 1901, the country has been peaceful. The ground-nut industry is entirely in the hands of the natives, who also own large herds of cattle—the symbol of wealth. In 1917 plague carried off fully 75% of the cattle, but as the country was overstocked, many of the cattle being kept simply for show, the effect was not as serious as might have been thought. Much of the petty trade is in the hands of Syrians. In Sept. 1911 Sir H. L. Galway became governor, his tenure of office witnessing a great development of commerce. In April 1914 he was succeeded by Mr. (afterwards Sir) E. J. Cameron, under whose guidance the economic crisis caused by the war (restriction of shipping and consequently of food supplies, with violent fluctuations in the price of ground-nuts) were successfully overcome. During the war the natives gave many proofs of their loyalty to Great Britain, and the Gambia Co. of the West African frontier force served with distinction both in Cameroon and German E. Africa. At the end of 1920 Sir E. J. Cameron retired and was succeeded as governor by Capt. C. H. Armitage, the commissioner of the Northern Territories of the Gold Coast.

**** These figures indicate the volume and page number of the previous article.***

See H. F. Reeve, *The Gambia* (London 1912), an excellent monograph by a retired official; Sir G. Denton, "Twenty-three Years in Lagos and the Gambia," *Jnl. African Soc.*, vol. xi. (1912); *The Gambia* (a British Foreign Office handbook, 1920) and the Annual Reports issued by the Colonial Office, London. Full statistics are given in the Blue Book issued yearly at Bathurst. (F. R. C.)

GANDHI, MOHANDAS KARAMCHAND (1869–), Indian political leader, a member of the *bania*, or trading and money-lending caste, was born at Porbandar, in Western India, where his father was for twenty-five years Dewan, or chief minister, of the State. He proceeded to England in 1888 and was called to the bar at the Inner Temple. After practising for eighteen months at Rajkot in Kathiawar, he went to South Africa in 1893. Here he placed himself at the head of the Indian community and organized a campaign of "passive resistance" against various measures of anti-Asiatic legislation. As a result of the inevitable collision with the authorities which ensued he underwent a term of imprisonment. At that time he held that it would be a calamity to sever the connexion between England and India, and during the Boer War he volunteered for service with a corps of Indian stretcher-bearers. In Dec. 1914 he returned to India and in 1916 opened an *asram*, or retreat, at Ahmedabad in the Bombay Presidency. During the lifetime of G. K. Gokhale he remained under his moderating influence; but after his death in Feb. 1915, he became wholly obsessed by the teachings of Tolstoy, to which he had been attached in early life and which he now grafted upon those of the Bhagavadgita. Tolstoy's "letter to a Hindu" (written on Dec. 14 1908) was not actually addressed to him, but it contains all the essential features of the "non-coöperation" agitation which was initiated by him after the passing of the Rowlatt Act in the autumn of 1918, and which was one of the prime factors in the Punjab disturbances of April 1919. The object of *Satyagraha*, or "civil disobedience," which inculcates abstinence from all forms of active association with British rule and an attitude of hostility towards Western civilization in general, is to compel the grant of "swaraj," or full self-government. In Aug. 1920 Mr. Gandhi announced that success would be attained in a year, provided that an "indissoluble union" was brought about between Hindus and Mohammedans and a "conscious voluntary effort" was made by the masses in the matter of treating the "untouchable" castes as "blood brothers" (*Freedom's Battle*, 1921). In neither direction was appreciable progress achieved, although Mr. Gandhi, in order to "buy the friendship" of the Mussulmans "at a critical time in their history" (*ibid.*), identified himself with the extreme wing of the Khilafat movement, which demanded the restoration of the Turkish Empire to the *status quo ante bellum*. Complete failure meanwhile attended a systematic attempt to wreck the first elections held in the autumn of 1920 under the Montagu-Chelmsford reform scheme. Mr. Gandhi's austere asceticism earned for him the title of "Mahatma" and a reputation for the possession of supernatural powers. His own sincerity, it may be noted, was not impugned, but his visionary gospel of "soul force" as opposed to brute force was brought into discredit by the violent and unscrupulous methods adopted by his followers and by the strong anti-British flavour which their propaganda assumed.

See J. J. Doke, *M. K. Gandhi: an Indian patriot in S. Africa* (1909); *Freedom's Battle* (speeches: Madras, 1921). (H. E. A. C.)

GARDNER, PERCY (1846–), English classical archaeologist (*see* 11.462), published subsequently to 1911 *Principles of Greek Art* (1913); *The Ephesian Gospel* (1915); *History of Ancient Courage* (1918); and *Evolution in Christian Ethics* (1918).

His brother, ERNEST ARTHUR GARDNER (1862–), became during the World War a lieutenant-commander, R.N.V.R., worked in the historical section of the British Foreign Office, and was awarded the gold cross of the Greek Order of the Redeemer in 1918.

GARFIELD, HARRY AUGUSTUS (1863–), American educator, son of James A. Garfield, 20th president of the U.S., was born at Hiram, O., Oct. 11 1863. After graduating from Williams College in 1885, he taught for a year in St. Paul's school, Concord. N.H., and from 1888 to 1903 practised law in Cleveland. He was professor of contracts in the Law school of Western Reserve University from 1891 to 1897; helped to organize, in 1896, the municipal association of Cleveland; and served as president of the Cleveland chamber of commerce, 1908–9. He was professor of politics at Princeton University from 1903 to 1908 and in the latter year became president of Williams College. In Aug. 1917 he was appointed Federal fuel administrator by President Wilson. His duty was to conserve the coal supply and keep the price within reasonable bounds. Local committees were appointed throughout the country to study local conditions and their reports formed the basis for the prices fixed in different localities. The ensuing winter was unusually severe, and serious shortage of coal threatened. This led to his issuing his "idle Mondays" order in Jan. 1918, closing non-essential industries for five consecutive days beginning Jan. 18 and on every Monday thereafter up to March 25. This roused a storm of protest from many manufacturers; and the U.S. Senate voted a resolution, requesting postponement, but this reached him after the order had been signed. On Feb. 14, however, the order was suspended and priority for certain shipments substituted. He disapproved of the method of settling the coal strike in Dec. 1919 and resigned his office, resuming that of president of Williams College.

GARIBALDI, GIUSEPPE (1879–), Italian general, eldest son of Gen. Ricciotti Garibaldi and grandson of the Liberator, was born at Melbourne July 29 1879. He fought under his father in the Greco-Turkish War in 1897, and also served in the South African War. In 1904 he went to Venezuela and fought in the insurrection against President Castro. He was imprisoned and condemned to death, but escaped. In 1905 he was employed in London in making arrangements for the settlement of Italian colonists in Australia. From 1907 to 1909 he worked in the Panama Canal Zone under Goethals, whence he went to Mexico and joined Madero, acting as the latter's chief-of-staff. In 1912 he joined the Greek army to fight in the Balkan wars, and reached the rank of brigadier. In 1914 on the outbreak of the World War he raised an Italian Legion of 14,000 men to fight on the side of France, and his six brothers accompanied him as officers. The Legion fought in the Argonne, and had 6,000 casualties, among the killed being two of the Garibaldi brothers. Giuseppe was made lieutenant-colonel, and subsequently colonel, in the Foreign Legion. In 1915 Garibaldi returned to Italy with his legionaries, and on Italy's entry into the war he and his brothers enlisted as volunteers. They were soon afterwards commissioned, Giuseppe being given command of a battalion. He served with the 4th Army until the spring of 1918, and distinguished himself in command of a regiment, a group of mountain troops and a brigade, and reached the rank of colonel-brigadier. He returned to the French front in March 1918 in command of the famous Brigata Alpi, which formed part of the Italian II. Corps. In June Garibaldi was promoted to brigadier-general, the only Italian officer of reserve to reach this rank. After the Armistice he commanded the Italian 8th Div. in Belgium. He retired from his command in June 1919 and gave up his commission in Feb. of the following year, returning to the business life which had been so often interrupted by these episodes of adventure.

GARLAND, HAMLIN (1860–), American writer, was born at West Salem, Wis., Sept. 16 1860. His father, a farmer, migrated to Iowa, where the boy grew up. He graduated from the Cedar Valley Seminary, Osage, at the age of 21, and taught for a year in Illinois. In 1883 he took up a claim in Dakota; but the following year went to Boston, where he read diligently in the public library and turned to story writing. In 1887 he revisited the scenes of his boyhood, and the drudgery of farm life in the Middle West furnished him with abundant material for his realistic tales. His works include *Main Travelled Roads* (1891); *Prairie Folks* (1892); *A Member of the Third House* (1892); *A Spoil of Office* (1892); *Rose of Dutcher's Cooley* (1895); *Boy Life on the Prairie* (1899); *Her Mountain Lover* (1901); *The Captain of the Gray Horse Troop* (1902); *The Long Trail* (1907); *Money Magic* (1907); *Cavanagh* (1909); *Other Main Travelled Roads* (1910); *Victor Olnee's Discipline* (1911); *The Forester's*

Daughter (1914); *A Son of the Middle Border* (1917) and *A Daughter of the Middle Border* (1921). He was made a member of the American Academy of Arts and Letters in 1918.

GARSTIN, SIR WILLIAM EDMUND (1849–), British engineer, was born in India Jan. 29 1849. Educated at Cheltenham College and King's College, London, he in 1872 entered the Indian Public Works Department. In 1885 he was transferred to Egypt, and in 1892 became Inspector-General of Irrigation in Egypt and Under-Secretary of State for Public Works. He was created K.C.M.G. in 1897 and G.C.M.G. in 1902, and in 1907 was appointed British Government director of the Suez Canal Company. During the World War he was engaged on Red Cross work in England, and was in 1918 created G.B.E.

GARVICE, CHARLES (1851–1920), British novelist, was born in London Aug. 24 1851. He was privately educated and began writing early, acting as correspondent for various English and American papers. He produced a volume of poems, *Eve and Other Verses* (1873), and two plays, *The Fisherman's Daughter* and *A Life's Mistake*. It is, however, as a remarkably prolific novelist that he is best known. His first popular successes were made in America, as a writer of serials. Both there and in Great Britain he wrote literally for the million, reproducing again and again the same types and situations, and had the largest circulation on record, as well as a wide circle of correspondents attracted by his books. When told by a friend that his stories were unlikely to live, he pointed to the readers on the seashore with the apt remark, "They are all reading my latest." Amongst his long list of novels may be mentioned: *Just a Girl* (1898); *In Wolf's Clothing* (1908) and *In Cupid's Chains* (1903). He died at Richmond, Surrey, March 1 1920.

GARVIN, JAMES LOUIS (1868–), British journalist, was born at Birkenhead, Ches., April 12 1868, of Irish parentage. When quite young he started journalistic work for the *Newcastle Chronicle* at Newcastle-on-Tyne, and he became a practised leader-writer during his connexion with the staff of that paper from 1891 to 1899. He also contributed to the *Eastern Morning News* at an early period when it was under the editorship of J. A. Spender; and even before 1899, when he joined the editorial staff of the *Daily Telegraph* in London, he had made himself known in well-informed journalistic circles as a brilliant publicist by his contributions to reviews and otherwise, and particularly by numerous articles on foreign affairs as well as domestic politics, mostly under pseudonyms, in the *Fortnightly Review* from 1895 onwards. He became editor of the weekly *Outlook* from 1905 to 1912, and of the evening *Pall Mall Gazette* from 1912 to 1915; and in 1908 he had also become editor of the Sunday *Observer*, which he converted into a great organ of opinion with a much-increased circulation, his association with the *Observer* having in 1921 been maintained continuously during that period. An ardent Imperialist, and intimate supporter of Joseph Chamberlain from the time when the latter became Colonial Secretary in 1895, Mr. Garvin's championship of the Tariff Reform movement in politics was the most powerful in London journalism from 1903 onwards. Deep in the inspiration of Mr. Chamberlain's policy and in the Unionist councils, his influence in this respect was felt throughout the political world, and he contributed largely, by his journalistic work and also by lectures and speeches, to the intellectual side of the policy of the Unionist party, especially as represented by Imperialism and Tariff Reform. In this connexion he published volumes on *Imperial Reciprocity* (1903) and *Tariff or Budget* (1909), and a striking article dealing with the "principles of constructive economics" in the volume of *Compatriot Club Lectures* (1906). With Mr. L. C. M. Amery and others he was one of the founders and chief supporters of the Compatriots' Club, which was started in 1903 to provide intellectual backing for the Tariff Reform policy. After the World War, in the course of which his only son, a young man of brilliant promise, was killed at the front, he published *The Economic Foundations of Peace* (1919), an elaborate plea for reasonable views of reconstruction. In 1920 he was selected to write the official biography of Joseph Chamberlain.

GARY, ELBERT HENRY (1846–), American business man, was born near Wheaton, Ill., Oct. 8 1846. He attended Wheaton College and then after studying law for a time in an office he continued his legal studies at the university of Chicago (LL.B. 1867). In 1871 he began practice in Chicago where he became a noted corporation lawyer. In 1874 he organized the Gary-Wheaton Bank, of which he was president. He was elected judge of Du Page co. in 1882 and again in 1886; was three times elected president of the town of Wheaton and on its becoming a city (1892) served as its first mayor for two terms. He was president of the Chicago Bar Association 1893–4. He early saw the advantages of combination in business and in 1891 was one of the organizers of the Consolidated Steel & Wire Co. In 1898 upon the organization of the Federal Steel Corp., with a capital stock of $200,000,000, he became its head and retired from legal practice. This company was merged in the U.S. Steel Corp. in 1901 and he was elected chairman of the board of directors and of the finance committee. The town of Gary, Ind., laid out in 1906 as a model home for steel workmen, was named in his honour. In 1914 he was made chairman of the committee appointed by Mayor Mitchel, of New York, to study the question of unemployment and its relief. When America entered the World War (1917) he was appointed chairman of the committee on steel of the Council of National Defense. Through his own connexion with a business essential for munitions of war he exerted great influence in bringing about coöperation between the Government and industry. He was interested in strengthening the friendship between America and Japan. In 1919 he was invited by President Wilson to attend the Industrial Conference in Washington, and took a prominent part in it as a firm upholder of the "open shop," of which he was always a strong advocate.

GASES, ELECTRICAL PROPERTIES OF (*see* 6.864 for ELECTRIC CONDUCTION THROUGH GASES).—The electrical properties of gases vary greatly with the conditions to which the gas is exposed. A gas in its normal condition is a non-conductor of electricity even though it is the vapour of a good conductor like mercury. On the other hand, when it is exposed to such influences as Röntgen rays, intense electrical forces or the radiation from radioactive substances, it becomes a conductor of electricity. Radioactive radiations are so wide-spread and so difficult to eliminate that it has not been found possible to obtain gases which do not show traces of conductivity under tests as delicate as some of those now at our command. This residual conductivity is, however, so small that we may here leave it out of account.

The most important electrical property of a gas in a normal state is its specific inductive capacity. The significance of this property is best illustrated from the relation $K-1/4\pi=\mathrm{NM}$, between the specific inductive capacity K, N the number of molecules per unit volume, and M the electrostatic moment which a molecule acquires under unit electric force. As we know N, we can if we know the value of K deduce the value of M, and this will tell us a good deal about the shape and size of the molecule. For example, if we regard the molecules as solid conducting spheres, $\mathrm{M}=r^3$ where r is the radius of the sphere. Thus, on this hypothesis we can find the radius of the molecule, if we know the value of K, and though the hypothesis itself does not throw much light on the structure of the atom, it is probable that the radius of a conducting sphere which would produce the same electrical moment would be of the same order of magnitude as the linear dimensions of the molecule: the radii of metallic spheres which would give the specific inductive capacities possessed by hydrogen, nitrogen, oxygen and chlorine, are respectively $1\cdot19\times10^{-8}$, $1\cdot60\times10^{-8}$, $1\cdot48\times10^{-8}$, $2\cdot04\times10^{-8}$ centimetres. On the more probable hypothesis that the atoms and molecules consist of electrons arranged in equilibrium round centres of positive electricity, the electric force will displace the electrons relatively to the positive centres and thus cause the molecule to have a finite electrical moment. The more rigidly the electrons are connected to the positive charge, the smaller will be this moment and the smaller the specific inductive capacity of the gas.

The values of $K-1$ for the elements belonging to the same family are connected by a remarkably simple and interesting relation, which was discovered by Mr. Cuthbertson (*Phil. Trans.* A.207, p. 135). It is shown in the following table, where the numbers under the symbols denoting the elements are the values of $\frac{1}{2}(K-1)\times 10^6$:—

			He
			$144\times\frac{1}{4}$
N	O	F	Ne
297	270	192	137
P	S	Cl	Ar.
1197	1101	768	568
$=299\times 4$	$=275\times 4$	$=192\times 4$	$=142\times 4$
As	Se	Br	Kr.
1550	1565	1125	850
$=258\times 6$	$=261\times 6$	$=187\times 6$	$=142\times 6$
	Te	I	X
	2495	1920	1378
	$=249\times 10$	$=192\times 10$	$=138\times 10$

Thus the values of $K-1$ for successive elements of the same family—(N.P.As): (O,S,Se,Te): (F.Cl.Br.I): (Ne,Ar,Kr,X)—are in all cases very nearly in the proportion 1, 4, 6, 10. In the simple theory, where the molecules are regarded as conductors, this would indicate that the volumes of the molecules of the successive elements in the same family are in the proportion 1, 4, 6, 10, for each of these types of elements. On the theory which regards the atom as built up of electrons arranged round positive centres, the configuration of the outer layer of electrons for different members of the same family would be similar, and it is easy to show that for similar configurations of electrons the value of $K-1$ would be proportional to the cube of the linear dimensions, *i.e.* to the volume enclosed by the outer layer of electrons; so that again on this theory Cuthbertson's result shows that volumes of successive elements in the same family are in the same ratio whether the family be that of the inert gases, the halogens, or the oxygen or nitrogen groups.

Another example of the information as to the nature of the molecule afforded by determinations of the specific inductive capacity is that, while the specific inductive capacity of many gases, *e.g.* H_2, N_2, O_2, CO, CO_2, Cl_2, is equal (as Maxwell's Electromagnetic Theory of Light suggests) to the square of the refractive index, there are, as Bädeker (*Zeitschrift Physik. Chem.* 36, p. 305) has shown, others, such as NH_3, HCl, SO_2, the vapours of water and the alcohols, whose specific inductive capacity is far in excess of the value given by this rule, and moreover the specific inductive capacity of these gases diminishes much more rapidly as the temperature increases than that of gases of the first type. The difference can be accounted for by supposing that the molecules of gases of the first type have no electrical moment when they are free from the action of an external electrical force, while those of the second type have an intrinsic electrical moment apart from that which may be produced by the external force. When there is no electrical field, the collisions between the molecules will cause the axes of electrical moments of the different molecules to be uniformly distributed, so that the average effect will be zero. An electric force will tend to drag the axes of the different molecules into alignment, and the assemblage of molecules will have a finite electrical moment which will be a measure of the specific inductive capacity. Inasmuch as the collisions between the molecules tend to knock their axes out of line and diminish the specific inductive capacity, the latter will diminish as the temperature and with it the vigour of the encounters increases. The substances which have an intrinsic electrical moment have exceptionally active chemical properties and are good solvents, dissociating the salts dissolved in them.

If the distribution of electrons in a molecule were not symmetrical about three axes at right angles to each other, the specific inductive capacity of a single molecule would vary with the direction of the electric force, but as the molecules in a gas are orientated in equal numbers in all directions we should not detect this by direct measurements of the specific inductive capacity. We can however detect this effect in another way; for if the molecules have different specific inductive capacities in different directions the light scattered by the molecules at right angles to the incident unpolarized light will not be plane polarized as it would be if the molecule were symmetrical (J. J. Thomson, *Phil. Mag.* 40, p. 393), and if the incident light is plane polarized the scattered light will not vanish in any direction. Strutt (*Proc. Roy. Soc.* 98A. 57) has measured the departure from plane polarization for different gases with the result shown in the following table:—

Argon	0·46 %
Hydrogen	3·83 %
Nitrogen	4·06 %
Air	5·00 %
Oxygen	9·40 %
Carbon dioxide	11·70 %
Nitrous oxide	15·40 %

This shows that the molecule of argon is very symmetrical, while the nitrogen molecule is more symmetrical than the oxygen; and this again more symmetrical than that of CO_2.

Ionized Gases.—Gases may in various ways be put into a state in which they conduct electricity on an altogether different scale from the normal gas. They acquire this conductivity when Röntgen rays or the rays from radioactive substances pass through them, or when they are traversed by cathode or positive rays. Ultra-violet light of very short wave length can impart this property to a gas, while gases recently driven from flames or from near arcs or sparks or bubbled through certain liquids or passed slowly over phosphorus also possess this property.

The conductivity of gases possesses interesting characteristics. In the first place it persists for some time after the agent which made the gas a conductor has ceased to act; it always however diminishes after the agent is removed, in some cases very rapidly, and finally disappears. The conducting gas loses its conductivity if it is sucked through glass-wool, or made to bubble through water. The conductivity may also be removed by making the gas traverse a strong electric field so that a current of electricity passes through it. The removal of the conductivity by filtering the gas through glass-wool or water shows that the conductivity is due to something mixed with the gas which can be removed by filtration, while the removal of the conductivity by the electrical field shows that this something is charged with electricity and moves under the action of the electric force. Since the gas when in the conducting state shows as a whole no charge of electricity, the charges mixed with the gas must be both positive and negative. We conclude that the conductivity of the gas is due to the presence of electrified particles; some of these particles are positively, others negatively, electrified. These electrified particles are called ions, and the process ionization.

The passage of electricity through a conducting gas does not follow the same laws as the flow through metals and liquid electrolytes; in these the current is proportional to the electromotive force, while for gases the relation is represented by a graph like fig. 1, where the ordinates are proportional to the current and the abscissæ to the electromotive forces. We see that when the electromotive force is small, the current is proportional to the electromotive force, as in the case of metallic conduction; as the electromotive force increases, the current after a time does not increase nearly so rapidly, and a stage is reached where the current remains constant in spite of the increase in the electromotive force. There is a further stage, which we shall consider later, where the current again increases with the electromotive force, and does so much more rapidly than at any previous stage. The

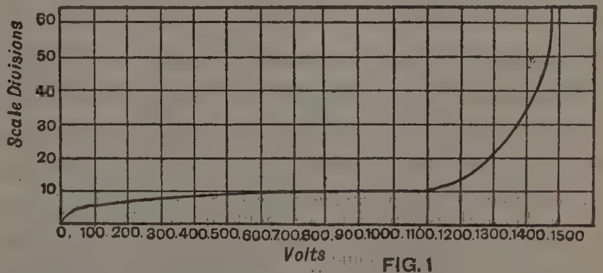

FIG. 1

current in the stage when it does not depend upon the electromotive force is said to be saturated. The reason for this saturation is that the passage of a current of electricity through the gas involves the removal of a number of ions proportional to the quantity of electricity passing through the gas. Thus the gas is losing ions at a rate proportional to the current; it cannot go on losing more ions than are produced, so that the current cannot increase beyond a critical value which is proportional to the rate of production of ions. This sometimes produces a state of things which seems anomalous to those accustomed to look at conduction of electricity exclusively from the point of Ohm's law. For example, when gases are exposed to Röntgen rays, the number of ions produced per second is proportional to the volume of the gas, so that, if two parallel plates are immersed in such a gas and a current sent from one to the other, when the distance between the plates is increased the number of ions available for carrying the current and therefore the saturation current will be increased also. Thus apparent "resistance" will diminish as the length of the gaseous conductor is increased.

The Nature of the Ions.—The question arises, what is the nature of the particles which carry the charges of electricity? Are they the atoms or molecules of the gas, or, for the negative charges, electrons? Information on these points is afforded by measuring the velocity of the ions under given electric forces.

It follows from the kinetic theory of gases that the velocity V of an ion due to an electric force X is given by the equation:—

$$V = X\frac{e}{m}\cdot\frac{\lambda}{v} \quad . \quad . \quad . \quad . \quad \text{(i)}$$

Here λ is the mean free path of the ion through the surrounding molecules, v the average velocity of the ion due to its thermal agitation, this velocity depending only on the mass of the ion and the temperature of the gas, and m is the mass of the ion and e the electric charge carried by it. If we calculate by this formula the velocity of an ion in hydrogen, assuming that the mass of the ion and its free path are the same as those for a molecule of hydrogen, we find that it would be 26 cm/sec. for an electric force of a volt per cm.; the value found by experiment is 6·7 cm/sec. for the positive and 7·9 cm/sec. for the negative ion. The assumption that both λ and m are the same for the ion as for the molecule is therefore wrong. It is clear that if, as we have every reason to believe, the normal hydrogen molecule is made up of positively and negatively electrified parts, the ion in virtue of its charge, even if its mass is the same as that of the hydrogen molecule, will exert a greater force upon a neighbouring molecule than would an uncharged molecule, and this increase in the force implies a diminution in the free path, and therefore by equation (i) a diminution in V. That a part of the discrepancy between the results given by the equation and those found by experiment is due to this cause cannot be questioned; the point which is still doubtful is whether the attraction due to the charge on the ion may not cause some of the hydrogen molecules to cling to it, forming a cluster of molecules with a greater mass and smaller free path than a single molecule. It would follow from the general principles of thermodynamics that, if the work required to separate a neutral molecule of hydrogen from a positive charge in its near neighbourhood were comparable with the average energy of translation of the molecules at the temperature of the gas, some such clusters would be formed, and that, if the work of separation were large compared with the energy of agitation, practically all the ions would consist of such clusters. This work would be greater for molecules which, like those of ammonia, or the vapours of water and alcohol, have a finite electrical moment, than for those which, like the molecules of hydrogen, oxygen and nitrogen, have no such moment, so that it is quite possible that, though there may be no clustering with these very permanent gases, there may be some when gases of the other type are present. This differentiation seems borne out by experiment, for no clear indications of clustering seem to have been found for the permanent gases. Since clustering is analogous to chemical combination, we should expect the mobilities, if they depended upon clusters, to have very large temperature coefficients. The mobilities of some of the permanent gases at constant density have been measured by Erikson over a considerable range of temperature, and though there is a considerable temperature effect it is not nearly so large as we should expect if it depended on chemical combination. Again, since clustering is a process of condensation, it would be favoured by an increase in pressure; thus a decrease in pressure would be accompanied by a simplification of the ion, and would increase its mean free path beyond the natural increase due to the diminution in the number of molecules with which the ion comes into collision. If there were no change in the character of the ion with the pressure, the mobility would vary inversely as the pressure; if the character of the ion changes, the mobility at low pressures will be greater than that given by this law. Now experiments show that for the positive ion the mobility is, very accurately, inversely proportional to the pressure over a wide range of pressures; this again is inconsistent with the existence of clusters. On the other hand, it is found that the addition of small quantities of gases which, like the vapours of water and alcohol, have a finite electrical moment produce a marked diminution in the mobility; this effect is more pronounced for the negative than for the positive ion, but as Zeleny has shown it exists for both ions. This effect is readily explained by supposing the water molecules to cluster round the ion. It would seem in accordance with the evidence to conclude that, though there is no evidence of clustering for the permanent gases, it does occur when certain easily condensible gases are present.

The behaviour of negative ions is in many respects quite different from that of the positive ones. In the first place the mobility of the negative ions is for the permanent gases greater than that of the positive; thus, for example, in dry hydrogen the velocities of the negative and positive ions, when the electric force is one volt per cm., are 7·95 and 6·7 respectively, and for air 1·87 and 1·36. The difference is less for moist gases than for dry, while for complex vapours which have comparatively small mobilities Wellisch found that there was very little difference between the mobilities of the positive and negative ions.

For the permanent gases the ratio of the mobilities of the negative and positive ions varies but little with the pressure, until the pressure is reduced below that represented by about 10 cm. of mercury. For lower pressures than this, the mobility of the negative ion increases, as Langevin showed, more rapidly than that of the positive; at the pressure of a mm. or so the mobility of the negative ion in air may be three or four times that of the positive.

An even more interesting result was discovered by Franck and Hertz, who, when they experimented with very carefully purified nitrogen or argon, found that the mobility of the negative ion was more than 100 times that of the positive. The mobilities in these gases are extremely sensitive to traces of oxygen, and a fraction of 1 % of oxygen added to the pure gas will reduce the mobility of the negative ion to less than one-tenth of its maximum value. The enormous mobility of the negative ion in nitrogen and argon as compared with that of the positive shows that in them the negative electricity must be carried by electrons and not by atoms or molecules, while the effect of introducing traces of oxygen shows that these electrons readily attach themselves to the molecules of oxygen though they are unable to adhere to molecules of nitrogen or argon. The same effect has also been observed in helium and hydrogen.

These properties of the negative ion are of great importance in connexion with the mechanism of ionization in gases and the structure of atoms and molecules. In the first place, they furnish strong evidence in support of the view that the first stage in the ionization of a gas is the ejection of an electron from the molecule of the gas rather than the separation of the molecule into atoms of which some are charged with positive and others with negative electricity. On this view the negative ion begins its career as an electron and not as an atom, while the positive ion from the beginning is of molecular dimensions. As an electron has much greater mobility than a molecule the mobility of the negative ion will at first be much greater than that of the positive. In some gases, such as oxygen, the electron soon gets attached to a molecule, and its mass and mobility become comparable with those of the positive one. The mobility we measure is the average mobility of the negative ion during its life; part of the time its mobility, being that of an electron, is very much larger than that of the positive ion, while in the other part the two mobilities will be much the same. The excess of mobility of the negative over the positive ion will depend upon the fraction of its life which the negative ion spends as a free electron—a fraction which would tend to increase as the pressure of the gas diminished.

To calculate the mobility of an electron as compared with that of a molecule, we must make some assumption as to the effect of the charge on the mean free path of an electron. We saw that there were some grounds for supposing that, in the case of the positive ions, the mean free path was determined rather by the charge of the ion than by the dimensions of the molecule carrying the charge. Since the magnitude of the charge on the electron is the same as that on the positive ion, we might expect, if this were the case, that the mean free path of an electron would be much the same as that of an ion, so that in equation (i) it would be the factor mv which would differentiate the mobility of the ion from that of the electron. If the electron is in thermal equilibrium with the surrounding gas, mv^2 will be the same for the ion and the electron, and thus the mobility will be inversely proportional to the square root of the mass; as the mass of the hydrogen molecule is $3{\cdot}6\times10^3$ times that of the electron, the mobility of the electron in hydrogen should be 60 times that of the positive ion; in nitrogen the mobility of the electron would be about 220 times that of the positive ion. If the positive ion were a cluster of molecules instead of a single molecule, the mobility of the electron as compared with that of the positive electron would be much larger than the preceding figures would indicate.

The difference between the behaviour of the electron in nitrogen or argon and in oxygen is of great importance in connexion with the structure of the atom and molecule, for it indicates that, while a molecule of oxygen can accommodate another electron in addition to those already present, the molecules of nitrogen and argon are unable to do so. It is instructive therefore to consider the results in connexion with the power of the atoms and molecules of the different elements to acquire a negative charge obtained by the study of the positive rays. These show that, while the atoms of hydrogen, carbon, oxygen, fluorine or chlorine readily acquire a negative charge, those of helium, nitrogen, neon, and argon do not; and again that, while it is very exceptional for a molecule whether of a compound or an elementary gas to acquire a negative charge, the molecule of oxygen is able to do so. We see that this result is in accordance with the behaviour of the carrier of the negative charge in an ionized gas. Since the atoms in the positive rays show so much greater affinity for the electrons than the molecules, it follows that if the agent producing ionization were to dissociate some of the molecules of the gas into neutral atoms (and to do this would require the expenditure of much less energy than to ionize the gas), these atoms would be much more effective traps for the electrons than the undissociated molecules. Loeb has shown that even in oxygen an electron collides on the average with about 50,000 molecules of oxygen before it is captured; thus if the oxygen *atom* could capture an electron at the first encounter, if only one molecule in 50,000 were dissociated into atoms, the effect of the atoms would be as efficacious as that of the molecules in capturing the electrons. When this dissociation takes place the abnormal velocity of the negative ion will only occur in gases like nitrogen and the inert gases whose *atoms* cannot receive an electron.

Recombination of the Ions.—Even when the ions are not removed from a gas by sending a current of electricity through it, their number will not increase indefinitely with the time of exposure of the gas to the ionizing agent. This is due to the recombination which takes place between the positive and negative ions; these ions as they move about in the gas sometimes come into collision with each other, and by forming electrically neutral systems cease to act as ions. The gas will reach a steady state with regard to ionization when the number of ions which disappear in one second as the result of the collisions is equal to the number produced in the same time by the ionizing agent.

If there are n ions of either kind per cub. cm., the number of collisions between the positive and negative ions in one second in a cub. cm. of the gas will be proportional to n^2; hence the number of ions of either sign which are lost by recombination in one second will be represented by αn^2 when α is called the coefficient of recombination. If the ionizing agent produces q ions per cub. cm. per second, then—

$$\frac{dn}{dt}=q-\alpha n^2.$$

The solution of this equation, if we reckon t from the instant the ionizing agent begins to act, so that $n=0$ when $t=0$, and where $K^2=q/\alpha$, is—

$$n=K(\epsilon^{2K\alpha t}-1)/(\epsilon^{2K\alpha t}+1)$$

We see that, when the gas reaches a steady state, $n=K=\sqrt{q/\alpha}$, and that the gas will not approximate to this state until t is large compared with $\frac{1}{2}K\alpha$, *i.e.* to $\frac{1}{2}n_0\alpha$ where n_0 is the value of n in the steady state. Thus when the ionization is very weak it may take a considerable time for the gas to reach a steady state.

When the ionizing agent is removed, the ions do not disappear at once, but decay at the rate given by the equation—

$$\frac{dn}{dt}=q-\alpha n^2.$$

The solution of this, where t is the time which has elapsed since the removal of the ionizing agents, and n_0 the number of ions when $t=0$, is—

$$n=n_0/(1+n_0\alpha t).$$

Thus the number of ions will be reduced to one-half their initial value after a time $1/\alpha n_0$. We may therefore take $1/\alpha n$ as the measure of the life of an ion when there are n ions per cub. centimetre. The values of α/e, where e is the charge on an ion, have been measured by various experimenters, and for different methods of ionization the results are given in the following table:—

Values of α/e for various gases at atmospheric pressure and ordinary temperature.

	Townsend	McClung	Langevin	Thirkill	Hendren	Retschinsky	Rumelin	
Gas	Röntgen rays	Röntgen rays	Röntgen rays	Röntgen rays	α rays	α rays	α rays	β rays
Air	3420	3380	3200	3580	3300	4200	4240	5820
CO_2	3520	3490	3400	3500	..	..	..	..
H_2	3020	2940	..	..	..	..	..	..
O_2	3380	..	..	..	..	..	..	..
SO_2	..	..	..	3000	..	..	..	..
N_2O	..	..	..	2960	..	..	..	..
CO	..	..	..	1780	..	..	..	..

The results as ascribed to Thirkill were obtained by extrapolation from experiment made at lower pressures. Since e, in electrostatic measure, is $4\cdot8\times10^{-10}$, the value of α for air is about $1\cdot6\times10^{-6}$, so that, when there are n positive and n negative ions per cub. cm., the number of ions which recombine per second is—

$$1\cdot6\times10^{-6}n^2.$$

This shows very markedly the influence of the electric charge in increasing the number of collisions between the particles, for the number of collisions in a second between $2n$, uncharged molecules in a cub. cm. of air is only—

$$4\times10^{-10}n^2,$$

which is only about 1/4,000 of the number of recombinations between the same number of ions.

It is a very remarkable fact, and one which has not yet received a satisfactory explanation, that the values of α for gases of such different molecular weights as H_2, O_2, CO_2, SO_2 should be so nearly equal, while the value of α for CO is only about one-half of that for the other gases.

For pressures less than one atmosphere Thirkill has shown that α diminishes as the pressure p diminishes, and that the relation between α and p is a linear one. Langevin showed that α for air attained a maximum value at a pressure about two atmospheres, and that at higher pressures it diminished somewhat rapidly as the pressure increased.

When the density is constant the value of α diminishes as the temperature increases. The connexion between α and the absolute temperature T seems to be expressed with fair accuracy by the equation—

$$\alpha=c\mathrm{T}^{-n}.$$

According to Erikson, n is equal to 2·3, 2·42, 2·35 for hydrogen, air and CO_2 respectively, while Phillips' experiments gave $n=2$.

Large Ions.—The ions we have been considering are those produced in dust-free gases by Röntgen or cathode rays. In some cases, however, ions with very much lower mobilities are to be found in gases. Thus Langevin found in air from the top of the Eiffel Tower two types of ions, one consisting of ions of the kind we have been considering, with a mobility of about 1·5 cm/sec., the other of ions with a mobility of 1/3,000 cm/sec. Ions with mobilities of the same order as this second type may be produced by bubbling air through water, by passing air over phosphorus, or by drawing air from the neighbourhood of flames. They are probably charged particles of dust of various kinds, held in suspension in gas which is exposed to some kind of ionizing agent which gives a supply of ions of the first type; these settle on the particles of dust and form the slow ions. The number of these slow ions when the gas is in a steady state will only depend on the number of dust particles in the gas, and will not be affected by the strength of the ionizing agent. This follows from the principle that in the steady state the number of dust particles which acquire a positive charge must equal the number which lose such a charge. A positively electrified dust particle might lose its charge by meeting and coalescing with a negative small ion or by coalescing with a negatively electrified dust particle. These dust particles are, however, so sluggish in their movements that, unless the dust particles are enormously more numerous than the small ions, we may neglect the second source of loss in comparison with the first.

Thus if U is the number of uncharged dust particles in a cub. cm. of the gas, P and N the number of those with positive and negative charges respectively, and p, n the number of positive and negative small ions, the number of dust particles which acquire per second a positive charge will be $\alpha\mathrm{U}p$ and the number losing such a charge by coalescing with a negative ion $\beta\mathrm{P}n$, where α and β are constants; hence for equilibrium—

$$\alpha\mathrm{U}p=\beta\mathrm{P}n.$$

Similarly by considering the negatively charged particles we get—

$$\alpha'\mathrm{U}n=\beta'\mathrm{N}p.$$

Hence we see that the proportion between the charged and uncharged particles of dust depends only upon the ratio of p to n, and not upon the absolute magnitude of either of these quantities. Thus, though it would take much longer to reach the steady state with a feeble source of ionization than with a strong one, when that state was reached there would be as much dust electrified in one case as in the other. De Broglie estimates that in this state about one-tenth of the particles would be electrified.

Relation between the Potential Difference and the Current through an Ionized Gas.—We shall take the case of two infinite parallel metal plates maintained at different potentials and immersed in an ionized gas; the line at right angles to these plates we shall take as the axis of x, it being evidently parallel to the direction of the electric force X. Let n_1, n_2 be respectively the number of positive and negative ions at the place fixed by the coördinate x; u_1 and u_2 the velocities of these ions. The volume density of the electrification in the gas, if it is entirely due to the ions, is $(n_1-n_2)e$ when e is the charge on an ion, hence—

$$\frac{dX}{dx}=4\pi(n_1-n_2)e \quad . \quad . \quad . \quad (1).$$

If ι is the current through unit area of the gas—

$$\iota=e(n_1u_1+n_2u_2) \quad . \quad . \quad . \quad (2).$$

Hence from (1) and (2) we have—

$$n_1e=\frac{\iota}{u_1+u_2}+\frac{1}{4\pi}\frac{u_2}{u_1+u_2}\frac{dX}{dx} \quad . \quad . \quad . \quad (3),$$

$$n_2e=\frac{\iota}{u_1+u_2}-\frac{1}{4\pi}\frac{u_1}{u_1+u_2}\frac{dX}{dx} \quad . \quad . \quad . \quad (4).$$

When things are in a steady state, neglecting any loss of ions by diffusion we have—

$$\frac{d}{dx}(n_1u_2)=q-\alpha n_1n_2 \quad . \quad . \quad . \quad (5),$$

$$-\frac{d}{dx}(n_2u_2)=q-\alpha n_1n_2 \quad . \quad . \quad . \quad (6),$$

where q is the number of ions produced per second in a cub. cm. of gas, and α is the coefficient of recombination; if K_1, K_2 are the mobilities of the positive and negative ions respectively, then—

$$u_1=K_1X, \quad u_2=K_2X.$$

From equations (1), (5) and (6) we get—

$$\frac{d^2X^2}{dx^2}=8\pi e(q-\alpha n_1n_2)\left(\frac{1}{K_1}+\frac{1}{K_2}\right),$$

and, substituting the values of n_1 and n_2, we get—

$$\frac{d^2X}{dx^2}=8\pi e\left(\frac{1}{K_1}+\frac{1}{K_2}\right)\left\{q-\frac{\alpha}{e^2X^2(K_1+K_2)^2}\left(\iota+\frac{K_2}{8\pi}\frac{dX^2}{dx}\right)\right.$$
$$\left.\left(\iota-\frac{K_1}{8\pi}\frac{dX^2}{dx}\right)\right\} \quad . \quad . \quad . \quad (7).$$

No general solution of this equation has been obtained, but when ι is small compared with the saturation current qle, an approximate solution is represented by the graph in fig. 2.

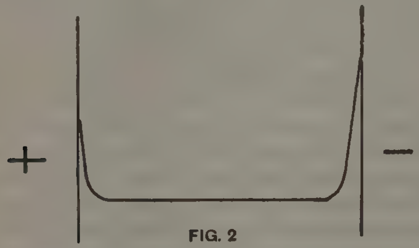

FIG. 2

The force is practically constant, and equal to—

$$\left(\frac{\alpha}{q}\right)^{\frac{1}{2}}\frac{\iota}{e(K_1+K_2)},$$

except close to the electrode, where it increases; and as the mobility of the negative ion is greater than that of the positive the increase in the force will be greater at the cathode than at the anode. As the potential difference between the electrodes increases, and the current approaches more nearly the saturation value, the flat part of the graph diminishes, and the graph for X takes the form given in fig. 3. When the potential difference is so large that the current is nearly saturated, X is very approximately constant from one electrode to another.

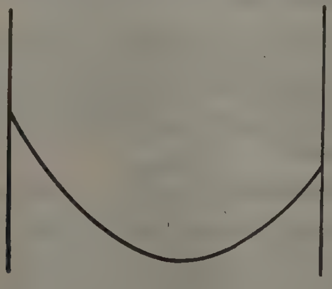

FIG. 3

In one extremely important case, that in which the negative ions are electrons and have a mobility which may be regarded as infinite in comparison with that of the positive ions, equation (7) admits of integration: for by putting $K_1/K_2=0$ in equation (8) it becomes—

$$\frac{dX^2}{dx}+\frac{8\pi e^2K_2qX^2}{\alpha\iota}=\frac{8\pi\iota}{K_2} \quad . \quad . \quad . \quad (8).$$

If, as is more convenient in this case, x is the distance from the cathode, instead of from the anode, as we have hitherto assumed, the solution of this equation is—

$$X^2=\frac{\alpha\iota^2}{qK_2^2e^2}+C\epsilon\frac{-8\pi e^2K_2qx}{\alpha\iota} \quad . \quad . \quad . \quad (9).$$

The second term on the right-hand side diminishes very rapidly as x increases and soon gets negligible, so that we see that the electric force will be constant except in the immediate neighbourhood of the cathode. To find the value close to the cathode we must find the value of C in equation (9). We have from equation (7)—

$$\left[\frac{1}{8\pi e}\frac{dX^2}{dx}\frac{K_1K_2}{(K_1+K_2)}\right]_0^{x_1}=\int_0^{x_1}(q-\alpha n_1n_2)dx \quad . \quad . \quad . \quad (10).$$

The right-hand side of this equation is the excess of ionization over recombination in the region between the cathode and x; it must therefore be equal to the excess of number of the negative ions passing through the gas at x; it must therefore be equal to $(\iota-\iota_0)/e$ where ι_0 is the amount of negative electricity emitted by unit area of the cathode in unit time. Putting this value for the right-hand side of equation (10) we find approximately, since K_1 is small compared with K_2,—

$$C=\frac{\alpha\iota(\iota-\iota_0)}{qK_1K_2}\frac{K_1+K_2}{K_2}=\frac{\alpha\iota(\iota-\iota_0)}{qK_1K_2}.$$

Substituting this value for C, we find—

$$X^2=\frac{\alpha\iota^2}{qK_2^2e^2}\left(1+\frac{K_2}{K_1}\frac{\iota-\iota_0}{\iota}\epsilon\frac{-8\pi e^2K_2qx}{\alpha\iota}\right) \quad . \quad . \quad . \quad (11).$$

This distribution of force is represented by the graph in fig. 4; the force at some distance from the cathode is equal to—

$$\frac{\iota}{Ke}\left(\frac{\alpha}{q}\right)^{\frac{1}{2}},$$

and is thus proportional to the current; the force at the cathode itself is $\left\{K_2(\iota-\iota_0)/K_1\iota\right\}^{\frac{1}{2}}$ times greater than this. The fall of potential between the electrodes is made up of two parts, one arising from the constant force; as this force is proportional to ι, this part of the potential fall will be proportional to ιl when l is the distance between the electrodes, and may be represented by $A\iota l$ when A is a constant; the other part of the potential fall is that which occurs close to the cathode. We find from equation (11) that this is proportional to ι^2 and does not depend upon l. Thus, if V is the potential difference between the electrodes when A and B are constants—

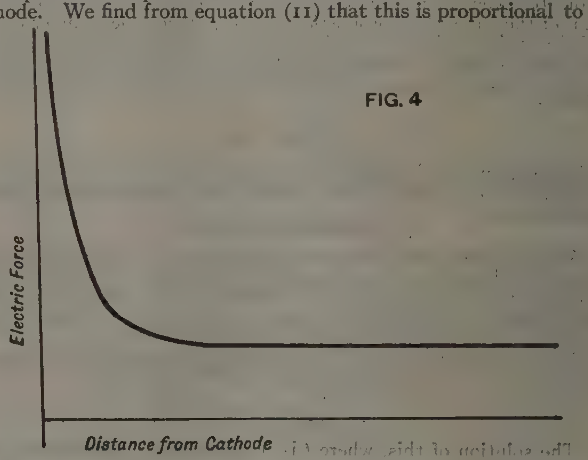

FIG. 4

$$V=A\iota l+B\iota^2 \quad . \quad . \quad . \quad (12).$$

H. A. Wilson has shown that an equation of this type represents the relation between the current and potential difference for conduction through flames. In many cases the drop of potential at the cathode is much greater than the fall in the rest of the circuit; when this is so we see that the current is proportional to the square root of the potential difference. The value of B increases with the pressure and decreases with the amount of the ionization.

Current from Hot Wires.—A case of great importance from its industrial application in hot wire valves is one where all the ions are negative and are emitted from the cathode. Metal wires raised to incandescence emit electrons, and if they are used as cathodes can transmit across a vacuum or gas at a low pressure very considerable currents. No currents will pass if they are used as anodes.

Take the hot cathode as the origin from which x is measured; let V be the potential at the point x, n the density of the negative ions at this point, and ι the current through unit area. If a is the velocity of the negative ion, we have

$$nue=\iota \text{ and } \frac{d^2V}{dx^2}=4\pi ne.$$

There are two cases to be considered; the first is when the hot wire is surrounded by gas of sufficient density to make the velocity of the ions proportional to the electric force; the second is when the hot wire is surrounded by a vacuum, and the motion of the ions is not affected by the gas.

In the first case $u=K_2\frac{dV}{dx}$, when K_2 is the mobility of the negative ion, and the equation $nue=\iota$ is equivalent to—

$$\frac{K_2}{4\pi}\frac{dV}{dx}\frac{d^2V}{dx^2}=\iota \quad . \quad . \quad . \quad (13).$$

The solution of this is—

$$\left(\frac{dV}{dx}\right)^2=\frac{8\pi\iota}{K_2}x+C.$$

Therefore if V is the difference of potential between the anode and cathode, and l the distance between them,—

$$V=\frac{K}{12\pi\iota}\left[\left(\frac{8\pi\iota l}{K}+C\right)^{\frac{3}{2}}-C^{\frac{3}{2}}\right] \quad . \quad . \quad . \quad (14).$$

If u_0 is the velocity of the negative ions at the cathode, $\iota=neu_0$; hence

$$\frac{\iota}{I-\iota}=\frac{\sqrt{6\pi u_0}}{c} \quad . \quad . \quad . \quad (15).$$

So that, unless ι is small compared with I, u_0 will be comparable with c; in this case, however, the velocity of the ion is no longer proportional to the electric force so that equation (13) no longer holds. Again, when the current approaches saturation, $\iota/(I-c)$ is large, and therefore by (15) u_0 will be large compared with c. For the negative ion to acquire a velocity of this magnitude the electric field would have to be so strong that sparks would pass through the gas unless the pressure were very low. Thus saturation currents from hot bodies are only obtainable at very low pressures.

Since $u_0=K\sqrt{C}$,

$$C=\frac{c^2}{6\pi K^2}\frac{\iota^2}{(I-\iota)^2}$$

Comparing this with the value of $8\pi\iota l/K$ we find, by substituting the values of K and c, that if the current is far from saturation, C will be negligible compared with $8\pi\iota l/K$, unless lI, when l is measured in centimetres and I in milliamperes, is small compared with unity. When C can be neglected, equation (12) gives—

$$\iota=\frac{9K}{32\pi}\frac{V^2}{l^3} \quad . \quad . \quad . \quad (16).$$

Thus the current is proportional to the square of the potential difference. A remarkable thing about this expression is that for these very small currents the intensity of the current is independent of the temperature of the wire, although, of course, the range of currents over which this formula is applicable is wider the higher the temperature of the wire.

When the hot body is in a vacuum, we have, if the ions have no initial velocity,—

$$\tfrac{1}{2}mu^2=Ve,$$

where m is the mass and e the charge on an ion; hence the equation $nue=\iota$ is equivalent to—

$$\frac{d^2V}{dx^2}V^{\frac{1}{2}}=4\pi\iota\sqrt{m/2e} \quad . \quad . \quad . \quad (17),$$

a solution of which is

$$V=(9\pi\iota)^{\frac{2}{3}}(m/2e)^{\frac{1}{3}}x^{\frac{4}{3}} \quad . \quad . \quad . \quad (18).$$

Hence, if V is the potential difference and l the distance between the electrodes—

$$\iota=\frac{1}{9\pi l^2}\left(\frac{2e}{m}\right)^{\frac{1}{2}}V^{\frac{3}{2}}.$$

We see from this equation that the electric force vanishes at the cathode, and that the density of the negative electrification is proportional to $x^{-\frac{2}{3}}$; thus it is infinite close to the cathode and diminishes as the distance from the anode diminishes. The total quantity of electricity between the anode and cathode is proportional to $l\iota^2$. We see again that for a given potential difference the current does not depend on the temperature of the hot wire; this law only holds when the currents are less than the maximum currents which can pass between the electrodes. When the current approaches this value, the current instead of increasing as $V^{\frac{3}{2}}$ becomes independent of V and the negative electricity between the electrodes diminishes as V increases. Langmuir, who has made a very complete investigation of the currents from hot wires, finds that the expression (7) represents, with considerable accuracy, the relation between the current and potential over a wide range in the values of the currents. The curves in fig. 5 given by him represent the relation between the current and potential for wires at different temperatures. They illustrate the point that a colder wire, until it is approaching the stage of saturation, gives as large a current as a hotter one, though the hotter one, of course, has a wider range of currents.

Ionization by Collision.—The curve representing the relation between the currents through a gas ionized (say) by Röntgen rays and the difference of potential between the electrodes is found to be of the form already shown in fig. 1, where the ordinates represent the currents and the abscissæ the potential difference. The flat part represents the state of saturation when the potential difference is large enough to send all the ions produced by the rays to the electrode before they can recombine. When the potential difference is still further increased we see that a stage is reached when the current begins to increase with great rapidity with the potential difference, and reaches values much greater than could be attained by the ions produced by the Röntgen rays. Thus in addition to the ions produced by the rays there must be other ions, and some other source of ionization associated with the strong electric fields. Now the processes going on in a gas while it is conveying an electric current are:—(1) the ionization of the gas by the external agent—in this an electron is liberated from the molecule and the residue forms a positive ion; (2) the electron and the positive ion acquire energy under the action of the electric forces; (3) in many gases the electron finally unites with an uncharged molecule to form a negative ion. As the most noticeable change in the conditions when the intensity of the electric field increases is in the energy of the electrons and ions, it is natural to look to these as the source of the additional ionization. We have moreover direct experimental evidence that rapidly moving electrons and ions are able to ionize a gas through which they are passing. Hot wires and metals exposed to ultra-violet light yield a supply of electrons which when they leave the metal have very little energy; by applying suitable electric fields these electrons can be endowed with definite amounts of energy and can then be sent through a gas from which all extraneous ionizing agencies are shielded off. When this is done it is found that, when the energy of the electrons exceeds a certain critical value, depending upon the nature of the gas, the gas is ionized by the electrons, but no ionization occurs when the energy of the electron falls below this limit. It is convenient to measure the energy of the electron in terms of the difference of electrical potential through which the electron has to fall in order to acquire this energy. The potential difference which would give to the electron the energy at which it begins to ionize the gas is called the ionizing potential. The values of the ionizing potential have been found for several gases, as will be seen from the following table. There is, however, considerable discrepancy between the results obtained by different observers.

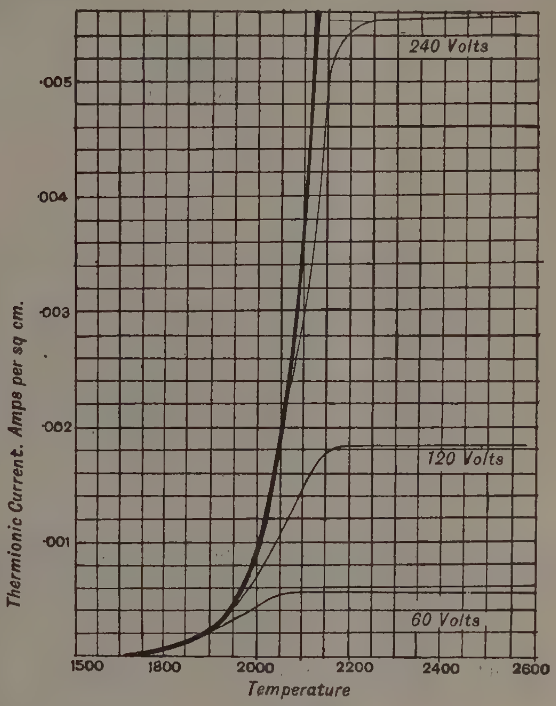

FIG. 5

Ionizing Potentials.

Gas	Stead & Gosling	Franck & Hertz	Davis & Goucher	Horton & Davis	Tate & Foote	Hughes & Dixon
H_2	15	11	11 and 15			10·2
He	20·8	20·5		25·6		
O_2		9				9·2
N_2	17·2	7·5	17			7·7
CO	15					7·2
Arg.	12·5	12		15		
Ne				16·7 & 20 & 22·8		
Hg	10·8					10·2
Cd					8·9	
Na					5·1	
K					4·1	
Zn					9·5	

The most obvious view to take of this ionization by moving electrons is that the moving electron comes so near to an electron in a molecule of the gas that the latter receives from the collision enough energy to enable it to escape from the molecule and start as a free electron. If the electrons repel each other with forces varying inversely as the square of the distance between them, and if T is the energy of the moving electron, and d the length of the perpendicular from the electron in the molecule on the initial direction of motion of the moving electron, then the energy communicated to the electron in the molecule by its collision with the moving electron is equal to $\dfrac{\mathrm{T}}{1+\dfrac{d^2}{e^4}\mathrm{T}^2}$, where e is the charge of electricity on an electron. This is on the supposition that the electron is moving so rapidly that the time while it is in close proximity to the electron in the molecule is small compared with the time of vibration of that electron; if this time is comparable with the duration of the collision, the energy taken from the moving electron will be considerably less, and it will become vanishingly small when the duration of the collision is large compared with the time of vibration. The energy given to the electron in the molecule does not increase indefinitely with that of the moving molecule, for it vanishes when T is infinite as well as when T is zero; it has the maximum value when $\mathrm{T}=e^2/d$. In order that the electron in the molecule should receive an amount of energy Q,—

$$\mathrm{Q}=\frac{\mathrm{T}}{1+\dfrac{d^2}{e^4}\mathrm{T}^2},\text{ or } d^2=\frac{e^4(\mathrm{T/Q}-1)}{\mathrm{T}^2}.$$

If Q is the ionizing potential, d^2 must be less than the value given by this expression. If n is the number of *electrons* in unit volume of the gas, and if the spheres with radius d described round the different electrons do not overlap, the probability that the moving electrons should come within this distance of one of them, when moving through a distance Δx, is $n\pi d^2\Delta x$, or

$$\frac{n\pi e^4(\mathrm{T/Q}-1)}{\mathrm{T}^2}.$$

The coefficient of Δx is the number of ions made per unit path by a moving electron with energy T. The maximum is when $\mathrm{T}=2\mathrm{Q}$.

Experiments on ionization by moving electrons have been made by Kössel (*Ann. der Phys.* 37, p. 406) and by Mayer (*ibid.* 45, p. 1), who found that the maximum ionization per unit path occurred when the energy of the moving electron was in the neighbourhood of 200 volts. Mayer's results are 125 for hydrogen, 130 for air, and 140 for carbon dioxide. These numbers are much greater than twice the potential at which the ionization begins, as this potential is of the order of 11 volts. It must be remembered, however, that, though there may be some electrons in the atom which can be ejected by 11 volt electrons, there may be other electrons of different types which require more energy for their expulsion, so that, as the energy of the moving electrons increases beyond the energy required to liberate these electrons, fresh sources of detachable electrons will be trapped, and these may more than counterbalance the falling off in the ionization of the more easily detached electrons. Again, some of the electrons ejected by the primary electrons may have enough energy to ionize on their own account; the total ionization may thus be increased by ionization due to the secondary electrons, and also by radiation excited by the impact of the primary electrons against the molecules of the gas.

When, as in the case of cathode rays in highly exhausted tubes or in that of the β rays from radioactive substances, T is very large compared with Q, the number of ions produced per unit path is $n\pi e^4/\mathrm{QT}$, and so varies inversely as the energy of the moving electrons. The experiments of Glasson on ionization by cathode rays, and of Durack on that by β particles, seem to be in accordance with this result. If we measure the number of ions produced per centimetre in a gas at known pressure, for which we know the value of Q, we could determine n, the number of electrons in unit volume; as the pressure gives us the number of molecules, we could deduce in this way the number of electrons in each molecule.

Ionization by Moving Ions.—When the moving systems are ions instead of electrons, the collision between them and the electrons are collisions between masses of very different magnitudes, and in consequence a very much smaller fraction of the energy of the moving body is transferred to the electron than when the colliding bodies have equal masses.

The amount of energy transferred to the electron when the moving body has a mass M is equal to:—

$$\frac{4\mathrm{M}_1\mathrm{M}_2}{(\mathrm{M}_1+\mathrm{M}_2)^2}=\frac{\mathrm{T}}{1+\dfrac{4d^2\mathrm{T}^2}{e^2\mathrm{E}^2}\left(\dfrac{\mathrm{M}_2}{\mathrm{M}_1+\mathrm{M}_2}\right)^2},$$

when M_2 is the mass of the electron and E the charge on the moving body. When, as in the case of the collision between an ion and an electron, M_2 is very small compared with M_1, this becomes

$$\frac{4\mathrm{M}_2}{\mathrm{M}_1}\cdot\frac{\mathrm{T}}{1+\dfrac{4d^2\mathrm{T}^2}{e^2\mathrm{E}^2}\dfrac{\mathrm{M}_2{}^2}{\mathrm{M}_1{}^2}}$$

Thus, if Q is the ionizing potential, the minimum value of T, which will communicate this energy to the electron, is $\dfrac{1}{4}\dfrac{\mathrm{M}_1}{\mathrm{M}_2}\mathrm{Q}$.

For the smallest possible ion, an atom of hydrogen, $\mathrm{M}_1/\mathrm{M}_2=1{,}700$, so that the minimum energy that will enable an ion to ionize a gas by knocking out an electron from a molecule is equal to 425Q. Q for many gases is about 10 volts; thus a positive ion must have at least energy represented by 4,250 volts to ionize the gas. With more massive ions the energy required for ionization would be still greater.

An ion with a mass equal to that of a molecule of oxygen would not ionize unless its energy were greater than 136,000 volts. Thus if any ionization by ions takes place in discharge tubes it must be due to ions of the lighter elements hydrogen or helium.

If the ion came into collision with the ion of the atom instead of with one of its electrons, it could, since its mass is comparable with that of the ion, give up to this a large fraction of its energy, a very much larger fraction than it is able to give to an electron. Inasmuch as it requires less work to dissociate a molecule into neutral atoms than to dissociate it into positively and negatively electrified ions, the result of such a collision is more likely to be the production of neutral atoms than of electrified ions.

An ion is, however, a much more complex thing than the simple charge of electricity which has in the preceding considerations been taken to represent the forces it exerts; and it may be that some strongly electronegative ions have such a strong attraction for an electron that when they pass through the molecule of a more electropositive element they are able to capture one of its electrons and carry it away with them. This type of ionization would differ from the ordinary type, inasmuch as in it the electron is never free; it produces negative ions, the other negative electrons.

It is evident from the preceding considerations that except in very intense fields it must be the electrons and not the ions which produce ionization by collision. Let us consider what are the chances of an electron acquiring sufficient energy in a uniform electric field; if the electron moved freely under the electric force X for a distance l it would acquire Xel units of energy. The electron in its course through the gas will come into collision with other bodies; its path will be deflected, possibly reversed, and in moving against the electric field it may lose all the energy it had previously acquired. Thus a collision of this type will destroy any ionizing power given to the electron by the electric force before the collision.

Let λ be the average distance passed over by an electron between two collisions; then the chance of an electron moving through a distance l without a collision is $\epsilon^{-\frac{l}{\lambda}}$; but if it moves through a distance l it will acquire energy $=\mathrm{T}=\mathrm{X}el$, hence the chance of an electron acquiring energy equal or greater than T is $\epsilon^{-\frac{\mathrm{T}}{\mathrm{X}e\lambda}}$, and the chance that it should acquire energy between T and T$+d$T is $\dfrac{d}{d\mathrm{T}}\left(\epsilon^{-\frac{\mathrm{T}}{\mathrm{X}e\lambda}}\right)d\mathrm{T}$. If it possess this amount of energy the chance that it makes one ion per centimetre of path is $n\pi\dfrac{e^4}{\mathrm{T}^2}(\mathrm{T/Q}-1)$; hence the chance that an electron should make one pair of ions per centimetre of path is:—

$$n\pi e^4\int_0^\infty\frac{d}{d\mathrm{T}}\left(\epsilon^{-\frac{\mathrm{T}}{\mathrm{X}e\lambda}}\right)(\mathrm{T/Q}-1)\frac{d\mathrm{T}}{\mathrm{T}^2}.$$

This may be written—:

$$n\pi e^4 \epsilon^{-\frac{Q}{Xe\lambda}} 1/Q\, F\left(\frac{Xe\lambda}{Q}\right),$$

where $F\left(\frac{Xe\lambda}{Q}\right)=\int_0^\infty \frac{\epsilon^{-x}\cdot x\cdot \frac{Xe\lambda}{Q}}{\left(x\cdot\frac{Xe\lambda}{Q}+1\right)^2}dx.$

Thus if α is the chance that an electron may produce one electron per unit path, since λ for the same gas is inversely proportioned to the pressure p, α will be of the form $nf\left(\frac{X}{p}\right)$: and since n is proportional to the number of molecules per unit volume, α may be written as $pf\left(\frac{X}{p}\right)$. When the spheres described round the electrons with radius d do not overlap, n will also be proportional to the number of electrons in the molecule. The greatest value of d is $e^2/2Q$; hence if D, the distance between two electrons, is greater than $e^2/2Q$, there can be no overlapping; if D is less than this quantity there may be overlapping; since the value of d diminishes as the kinetic energy of the electron increases, n for very fast electrons will be proportional to the number of electrons in the molecule.

Some of the electrons will by adhesion to a neutral molecule become negative ions. Let the chance of an electron doing so while passing over 1 centimetre be γp. If N be the number of electrons per c.c. at a place fixed by the coördinate x, then $\frac{dN}{dt}+\frac{d}{dx}(NU)=$ rate of increase of number of ions per c.c., where U is the velocity of the electron parallel to x.

The number of electrons passing through the unit of area in unit time is NU. The new electrons produced by the passage of them through the unit volume is $NU\alpha$, while $NU\gamma p$ will disappear; hence:—

$$\frac{dN}{dt}+\frac{d}{dx}(NU)=NU(\alpha-\gamma p)+q \quad \cdot \quad \cdot \quad \cdot \quad (19),$$

where q is the ionization due to external sources; when things are in a steady state $dN/dt=0$, and the solution of the equation, when the electric field may be taken as constant from one electrode to another, is:—

$$NU=C\epsilon^{(\alpha-\gamma p)x}-\frac{q}{\alpha-\gamma p}.$$

Most of the experiments on this subject have been made without external ionization; a supply of electrons has been obtained from the cathode, either by raising it to incandescence or by exposing it to ultra-violet light. In such cases $q=0$, and

$$NU=\iota_0\epsilon^{(\alpha-\gamma p)x} \quad \cdot \quad \cdot \quad \cdot \quad (20),$$

where ι_0 is the number of electrons emitted in unit time from the cathode. Townsend, and Townsend and Kirkby have determined the value of $\alpha-\gamma p$ for various gases and over a considerable range of pressure. A series of these values for air are given in the following table:—

X = volts per cm.	Pressure (mm.)				
	·17	·38	1·10	2·1	4·1
20	·24	..	..	..	..
40	·65	·34	..	..	..
80	1·35	1·3	·45	·13	..
120	1·8	2·0	1·1	·42	·13
160	2·1	2·8	2·0	·9	·28
200	..	3·4	2·8	1·6	·5
240	2·45	3·8	4·0	2·35	·99
320	2·7	4·5	5·5	4·0	2·1
400	..	5·0	6·8	6·0	3·6
480	3·15	5·4	8·0	7·8	5·3
560	..	5·8	9·3	9·4	7·1
640	3·25	6·2	10·6	10·8	8·9

It will be seen that, when X is given, the increase in the number of electrons reaches a maximum for a particular pressure. From general reasoning this must be so, for if $p=0$ there will be no collisions to make fresh electrons, and if p is infinite the free path of the electrons will be so small that they cannot acquire sufficient energy to ionize the gas. Since α is of the form $pf\left(\frac{X}{p}\right)$, and γ does not depend upon p, $\alpha-\gamma p$ will be a maximum when

$$f\left(\frac{X}{p}\right)-\gamma-pf^1\left(\frac{X}{p}\right)\cdot\ \frac{X}{p^2}=0,$$

or when $f\left(\frac{X}{p}\right)-\gamma=f^1\left(\frac{X}{p}\right)\frac{X}{p}$. This equation determines X/p; hence the critical pressure will be proportional to the electric force.

At this critical pressure $Xe\lambda$ bears to Q a ratio which depends upon the way in which the chance of an electron ionizing by a collision depends upon the energy of the electron. If, for example, the chance were independent of this energy, provided the energy were greater than Q, the maximum current would be when $Xe\lambda=Q$; this relation would not hold for other and more probable laws connecting ionizing power with the energy, but we should expect that for any such law the ratio of $Xe\lambda$ to Q would neither be very large nor very small.

Since the electrons cannot begin to ionize until their energy is equal to Q, and to attain this energy they must pass through a distance Q/Xe, it is clear that we ought in such an equation as (19) to write $x-Q/Xe$ in place of x. If V is the potential difference between the plates, $X=V/d$, so that $x-Q/Xe=x-dQ/V$ if Q is measured in volts. Thus in finding the current between two electrodes we must, if we use equation (19), write $d\left(1-\frac{Q}{V}\right)$ instead of d. Partz (*Verh. d. Deutsch. Phys. Gesell.* xiv, p. 60) has shown that theory and experiment agree better by this change.

Spark Discharge.—The production of ions by moving electrons will not by itself explain why a current of electricity can be maintained through a gas by an electric field when all other sources of ionization are excluded. The electrons are continually being driven towards the anode, and unless there is some source of supply near the cathode the ionization and therefore the current will rapidly come to an end. One way in which the electrons could be supplied by the action of the electric field would be by the positive ions which strike against the cathode communicating so much energy to the anode that it is raised to incandescence. Since an incandescent metal gives out large quantities of electrons there will be a continuous supply of electrons from the cathode, which will ionize the gas and produce fresh positive ions to strike against the cathode and keep it hot. This is what happens in the arc discharge when the cathode is kept in a state of incandescence by the discharge. In this case there is a large amount of energy put into the arc. There are, however, other forms of continuous discharge where the cathode does not become incandescent, so that there must be other ways in which the supply of electrons is maintained. From what we know about ions there are several ways in which this might occur.

It has been found by experiment—(Füchtbauer, *Ann. der Phys.* 23, p. 301 (1907); Saxen, *Ann. der Phys.* 38, p. 319 (1912); Baerwald, *Ann. der Phys.* 41, p. 643 (1913); 42, p. 1207 (1913)—that electrons are emitted from metals when these are bombarded by high-speed positive ions even though the metal is not raised to incandescence. According to Baerwald the emissions of electrons from metals bombarded by positive hydrogen atoms does not become appreciable until these have an amount of energy exceeding that represented by 900 volts. We know too that, when the electric discharge passes through a gas, radiation capable of ionizing a gas through which it passes, or of ejecting electrons from a metal on which it falls, is an accompaniment of the discharge. Again positive ions ionize a gas through which they pass. This was shown by McClelland, who found that the relation between the potential difference and the current from a hot wire anode surrounded by gas at low pressure was represented by a curve like that shown in fig. 6.

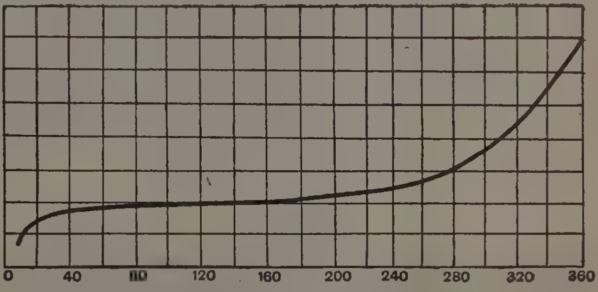

FIG. 6

The hot wire furnishes positive ions as well as negative ones, and the curve shows that fresh ions are formed when the potential difference is greater than about 200 volts. This is a much greater potential difference than that needed to produce ionization by electrons, but it is smaller than would be expected by the considerations given above. As it requires less work to eject an electron from a metal than from a molecule, we should expect that if 200 volts ions could eject electrons from a gas through which they pass they would be able to do so from a metal against which they strike, but from Baerwald's experiments much more energy than 200 volts is required for this purpose. In McClelland's experiments the ionization might have been into positive and negative ions rather than into positive ions and electrons; before the negative ions could be efficient for ionization by collision they would have to undergo further dissociation into electrons and uncharged molecules. Curves similar to that in fig. 6 have also been obtained by O. W. Richardson. Pawlow (*Proc. Roy. Soc.* A. 90, p. 398) and also Franck and E. v. Bahr (*Verh. d. Deutsch. Phys. Ges.* xvi, p. 57, 1914) came to the conclusion from their experiments, that ionization was produced by positive ions even when their energy did not exceed a few volts; indeed they could not get any evidence of a minimum to the ionizing voltage. Horton and Davies (*Proc. Roy. Soc.* 95, p. 333) could not detect any ionization in a gas by positive helium ions when the energy was due to 200 volts. They ascribe the ionization observed by Pawlow and Bahr and Franck to photo-electric effects; they consider, however, that positive helium ions can liberate electrons from a metal against which they strike if their energy exceeds 20 volts. Baerwald considers that it requires an energy measured by 900 volts before positive ions can liberate electrons from metals.

There are thus at least four methods by which the supply of electrons near the cathode necessary to maintain the discharge can be obtained. The gas near the cathode may be ionized by positive ions or by radiation, or the cathode itself may emit electrons under the impact of positive ions or by the incidence of radiation.

When the gas is at a low pressure the appearance of the discharge has well-marked characteristics which may throw light on the method by which the electrons are produced and the place from which they start. The discharge near the cathode is represented in fig. 7; near the cathode we have a velvety glow, then a space comparatively dark called the cathode dark space; this joins on to a brightly luminous region called the negative glow; passing through this region, and making themselves evident by the luminosity they excite when they strike against the glass wall of the vessel in which the gas is contained, are the cathode rays. These have been shown to be electrons moving with high velocity. These electrons have been liberated by the action of the electric field and have acquired their velocity under the action of that field. The velocity of the cathode rays has been measured, and it has been found that practically all of them have the same velocity. This shows that they must have all fallen through the same potential. They would do this if they all started from the cathode itself, but if they had originated by the ionization of the gas in the dark space in front of the cathode, some would have started from one place and some from another, and they would have acquired different velocities. This is strong evidence in favour of the cathode itself being the primary source of the electrons which maintain the discharge. When a supply of electrons is produced by processes taking place at the cathode, ionization by collisions of electrons with the molecules of the gas is sufficient to maintain the discharge through the interval between the negative glow and the anode. This interval, as will be seen from fig. 7, is made up of a short part next the negative glow in which there is comparatively little light, called the Faraday dark space, and then a long uniform portion reaching right up to the anode. Unless the pressure is very low or the spark very short this position, which is called the positive column, forms by far the larger part of the discharge. The discharge here will be maintained if the rate at which electrons are produced by collision is equal to the number lost by recombination. When this is the case, equation (19) gives $\alpha = \gamma p$, or, since α is of the form $pf\left(\frac{Q}{Xe\lambda}\right)$,

FIG. 7

$$f\left(\frac{Q}{Xe\lambda}\right) = \gamma,$$

thus $Xe\lambda = cQ$, where c is a quantity which does not depend upon the pressure or strength of the field; as λ is inversely proportioned to the pressure, this equation is equivalent to $X = c_1 p$, when c_1 is a quantity which will depend on the nature of the gas and possibly on the intensity of the current. If l is the length of the positive column the difference in potential between the anode and the end of the positive column next the cathode is lX, *i.e.* lc_1p.

Between the cathode itself and the negative glow there is a fall of potential, called the cathode potential fall, which, when the current carried by the discharge is not large, is independent of the current and the pressure of the gas; it depends upon the nature of the gas and the material of which the electrodes are made. If V_0 is the cathode fall, then (neglecting the change in potential in the negative glow and the Faraday dark space, which has been found by experiments to be very small) V, the potential difference between the anode and cathode will be given by the equation

$$V = V_0 + c_1 lp \quad . \quad . \quad . \quad (21).$$

It is assumed that the length of the spark is greater than that of the dark space D: at pressures comparable with that of the atmosphere, D is a very small fraction of a millimetre, but at the low pressures which can easily be obtained in highly exhausted vessels D may be several centimetres. It is to be noticed that V is a linear function of lp, and lp is proportional to the mass of gas between the electrodes; hence as long as the mass of gas between the electrodes remains unaltered the potential difference required to maintain the spark will be constant. This law, which was discovered by Paschen in 1889 as the result of a long series of experiments, is known as "Paschen's law." It has been found to be in agreement with the very numerous investigations which have been made on the potential difference required to produce a discharge in an approximately uniform electric field such as that which exists between two slightly curved electrodes.

The relation (21) does not give any indication of the relation between the potential difference and the spark length when the latter is exceedingly small. When the spark length falls below a critical value which is inversely proportional to the pressure, and which in air at atmospheric pressure is about ·01 mm., the spark potential increases rapidly as the spark length diminishes; this was first observed by Peace. A simple way of demonstrating it is to use slightly curved electrodes and to observe the path of the spark as these are brought closer together. Until the electrodes get very close together the spark passes along the shortest line between them, but as they approach each other a stage is reached where the spark no longer passes along the shortest line but goes to one side, taking a longer path, showing that it is easier to produce a long spark than a short one. The relation between the potential difference and the spark length for several gases has been determined by Carr, who finds that Paschen's law that the potential difference depends only on pd is also true for very short sparks; Paschen's own experiments were made with sparks considerably longer than the critical value. Fig. 8 represents Carr's results for the relation between V and pl. The results of Carr and Strutt's experiment for the minimum spark potential, and the value of pl, at which it occurs, are given in the following table:—

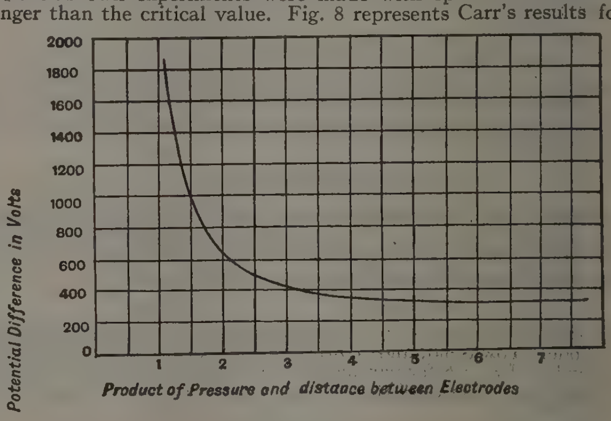

FIG. 8

Gas.	Minimum Spark Potential in volts.	pl.
Air	341 S	5·7
Nitrogen	251 S	6·7
Oxygen	455 C	
Hydrogen	302–308 S 278 C	14·4 ..
Carbonic acid	419 C	5·1
Sulphur dioxide	457 C	3·3
Nitrous oxide	418 C	5
Sulphuretted hydrogen	414 C	6
Acetylene	468 C	..
Helium	261 S	35

The curves are very flat in the neighbourhood of the minima, so that the critical values of pl may be subject to considerable errors. Strutt found that even very small traces of impurity produced very large increases in the values of the minimum spark potential in nitrogen and helium; these are gases where, as we have seen, such traces produce large diminutions in the mobility of the negative ion. The existence of a minimum for the spark potential and a critical spark length follow from the view that the spark is maintained by the emission of electrons from the cathode owing to its bombardment by positive ions. For if ι_0 be the number of cathode rays emitted from unit area of the cathode per second, at a distance x from the cathode $\iota_0 \epsilon^{\alpha x}$ electrons will stream through unit area per second and will produce per second $\iota_0\alpha\epsilon^{\alpha x}$ positive ions per c.c. These positive ions will proceed up to the cathode, and a certain percentage will react and bombard it. Let the chance of the ion reaching the cathode with undiminished energy be $\epsilon^{-\beta x}$; then the energy with which it strikes the cathode is Ve, when V is the potential at x, so that the energy in the ions striking unit area of the cathode per second is $\iota_0\int_0^l \alpha\epsilon^{\alpha x}\epsilon^{-\beta x}Ve\,dx$. The rate of emission ι_0 will be proportional to this energy, so that,

$$\iota_0=K\iota_0\int_0^l \alpha\epsilon^{-(\beta-\alpha)x}Ve\,dx \quad . \quad . \quad . \quad (22).$$

when K is a quantity that may depend on the material of which the cathode is made and on the kind of positive ions which strike against it, but will not depend on the pressure of the gas. If W be the potential difference between the anode and cathode, and l the distance by which they are separated, V may be written in the form $Wf(x/e)$, where $f(0)=0$ and $f(1)=1$. Putting $x/l=y$, equation (7) gives

$$1=KW\alpha le\int_0^1\epsilon^{-(\beta-x)ly}f(y)dy \quad . \quad . \quad . \quad (23).$$

Now both α and β are proportional to the pressure p of the gas, so that l and p only occur in the combination lp; thus in the most general case W the spark potential will be a function of lp; this is Paschen's law, which has been shown by Carr to hold, down to very low pressures and spark lengths. When lp is very small (23) reduces to

$$W=\frac{1}{K\alpha le}\;\frac{1}{\int_0^1 f(y)dy}.$$

Thus the potential required to produce very short sparks varies inversely as the length of the spark, so that to produce an infinitely small spark would require an infinitely large potential. The rapid increase in the spark potential as the spark length diminishes is shown by the curve in fig. 8. The spark potential will also be infinite when l is infinite so for some intermediate spark length the potential must be a minimum. We see from the form of equation (23) that if W_0 is the minimum potential, $KW_0\alpha/(\beta-\alpha)$ is a constant, depending only on the form of the function f, and also that, if L is the spark length when the potential is a minimum, $L(\beta-\alpha)$ is another constant depending also on the form of the function; if $f(y)=y$ we get $L=\frac{1\cdot 8}{\beta-\alpha}$, thus the critical spark length will depend upon the gas, but not upon the material of which the cathode is made: the minimum potential W_0 is equal in this case to $(\beta-\alpha)2\cdot 2/Ke\alpha$ or $W_0=\frac{1\cdot 2}{L\cdot Ke\alpha}$. Now $1/Ke$ is the potential difference, u, through which a positive ion must fall to get enough energy to liberate one electron from the cathode, and αL is the number of electrons produced when an electron passes over the critical spark length. If this number is n, $W_0=\frac{1\cdot 2u}{n}$. We may summarize the argument as follows: if p_1 is the chance of a positive ion liberating an electron from the cathode, p_2, the chance of that electron making an ion in the space d, then the probability that the original positive ion will be replaced by a new one is p_1p_2, and if the process is to be regenerative p_1p_2 must be unity.

Since K may depend on the metal against which the ion strikes as well as upon the ion itself, the minimum potential might depend upon the material of which the cathode is made. Baerwald found, however, that for many of the ordinary metals there was not much difference in the numbers of electrons they emitted when bombarded by positive ions, so that with all such metals for cathodes the critical spark should be the same. There is very considerable evidence that the minimum potential required to produce a spark is equal to the cathode fall of potential when the length of discharge is much greater than the critical spark length, and Mey has shown that the cathode fall of potential is appreciably less when the cathode is made of Al, Mg, Na or K, than when it is made of Pt, Hg, Cu or Ag.

The mechanism we have hitherto considered involves the ionization of the gas between the electrodes, and no spark could pass across a vacuum. There are, however, other methods by which a discharge might pass across a vacuum. For suppose there was a stray electron between two parallel electrodes in a vacuum; then under the action of the electric field it would be driven against the anode; by the impact Röntgen radiation would be generated, which would fall on the cathode and if it were intense enough to liberate one electron from the cathode the original electron would be replaced and the passage of negative electricity from the cathode to the anode would be repeated. From these considerations it is probable that even the highest vacuum would not act as a perfect insulator for the very intense fields.

The linear relation $V=V_0+c_1lp$ has been obtained on the assumption that the direction of the electric force was the same in all parts of the field; this is only true when the dimensions of the electrodes are large compared with the distance between them. The potential difference required to produce a spark of a particular length depends upon the size of the electrodes between which the spark passes, and is not a linear function of lp, where p is the pressure and l the spark length, unless l is small compared with the linear dimensions of the electrodes. If these are spheres, the spark potential will depend upon their radii, and for small spheres may be considerably less than for large ones. Thus, for example, the spark potential in air for a five centimetre spark is 26,000 volts for electrodes ·5 cm. in diameter, and 105,000 volts when the diameter of the electrodes is 5 centimetres.

In this connexion it may be noted that, if the electric field is sufficiently intense at any place to produce there a local supply of ions, these may redistribute themselves between the electrodes, and by their electrostatic action produce a change in the distribution of the electric force more favourable to the passage of the spark than that prior to the production of the ions. To illustrate this, take the very simple case when the electrodes are two parallel plates: if there are any ions available these may distribute themselves so that the force between the plates is no longer uniform. Thus let us suppose that there are enough positive ions to congregate round the cathode in sufficient numbers to produce within the distance of the "critical spark length" or thickness of the cathode dark space a difference of potential equal to the minimum spark potential. This would ensure that from close to the cathode there was a continual emission of electrons, and even though the electric field from this place to the anode was too feeble to give an electron enough energy to ionize the gas, the electrons coming from the cathode would be able to carry a small current, though this part of the discharge might not be luminous. The ions here would be all of one sign, so that the electric force will increase up to the anode. If the current is gradually increased, the place where the electric force will just rise to the value necessary to make the electrons ionize will be close to the anode. When this occurs a supply of positive ions will start from the anode and move towards the cathode, accompanied by luminosity close to the anode and very faint luminosity through the rest of the tube. The introduction of the positive ions into the region between the anode and cathode will diminish the retarding effect of the negative space charge which existed in this region, so that the current will increase. This increase in current will again increase the ionization at the anode, and thus the supply of positive ions. In this way there might be a supply of electrons coming from the cathode, and of positive ions from close to the anode, which will maintain the current in spite of the fact that between these places there was a region where the electric force was below that required to produce ionization by collision, and the potential difference between the electrodes less than that calculated on the supposition that the electric force was uniform from one to the other. We should expect from these considerations that, if the electric force at any point were intense enough to produce ionization by collision, some discharge would take place.

Russell (*Phil. Mag.* 6. xi., p. 237) states that the results of the different experiments made on the potential difference required to produce sparks of various lengths between spherical electrodes of various radii are in good agreement with the rule that the discharge takes place in air at atmospheric pressure if the electric force at any point in the field before discharge begins is as great as 37,000 volts per centimetre. This value agrees well with that required to make electrons produce in air at atmospheric pressure other ions by collisions.

The curious lag observed by Warburg between the application of the potential difference and the passage of the spark, which may amount in extreme cases to several seconds, *e.g.* when the applied potential is only a very little greater than that required to produce the spark, is naturally explained as the time necessary for the ions to distribute themselves so as to produce the distribution of potential required for the discharge.

The discharge of electricity from points affords a good illustration of the preceding considerations. Suppose that the electrodes are a needle point and a plane. When the discharge first begins the only place where any light is to be seen is close to the point; the current between the electrodes is very small; as the potential difference increases a stage is reached where light begins to appear close to the points, the space between the point and plate being quite dark. This stage is marked by a large increase in the current. With further increase in current the luminosity extends into the gas and ultimately stretches from one electrode to another.

The potential required to start the discharge is less where the point is negative than where it is positive. This is what might be expected, for to maintain the discharge from the negative point there must be (1) ionization of the gas by the outgoing electrons, and (2) liberation of electrons by the incoming positive ions, while when the point is positive there must be (1) ionization of the gas by outgoing positive ions, and (2) liberation of positive ions by the impact of incoming electrons; as the process is not the same as for the negative point we should expect that there would be a difference between the potentials. It is not only the potential difference which is affected but the type of discharge. This can be shown by allowing the point discharge to pass in the neighbourhood of a photographic plate. Beautiful figures are found on developing the plate, and the character of these is different according as the point is positive or negative. Figures 9 and 10 represent discharges from positive and negative points respectively.

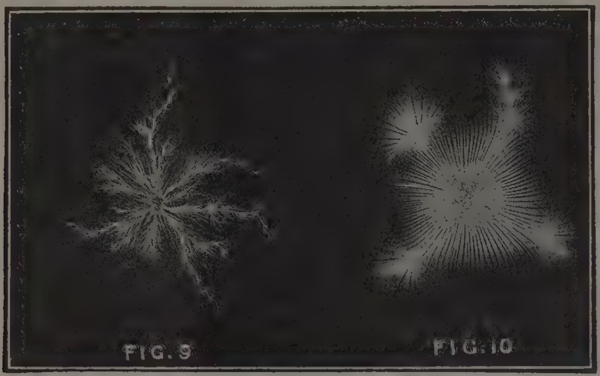
FIG. 9 FIG. 10

The discharge from a negative point is in some gases very much influenced by the purity of the gas; thus Warburg found that the discharge from a negative point in nitrogen increased about fifty times by removing the last trace of oxygen from the nitrogen, though this had little or no effect upon the discharge from a positive point. This can be accounted for by the discovery of Franck and Hertz that in very pure nitrogen the electron does not become a negative ion and has a very high mobility. This is true for the inert gases as well as for nitrogen, and Pryzibram has shown that the difference between the discharges from positive and negative points is exceptionally large in these gases.

Electrical Wind.—The electrified ions starting from the point in a point discharge sets the gas in the neighbourhood of the point in motion producing a current of air, called the "electrical wind." The momentum gained by the air is lost by the point, so that there is a backward force acting on the point, which has often been measured. This force, as well as the electrical wind, is smaller when the point is negative than when it is positive; this difference is especially marked at pressures low enough to make the negative ion have an abnormally large mobility.

Relation between Potential Difference and Current.—The potential difference required to maintain a discharge will depend upon the current passing in the discharge. The relation between the current and potential difference for discharge through gases is often a very complicated one. We should expect that this would be so, for in the spark discharge, for example, the potential difference is made up of the cathode fall of potential (this increases with the current) and a uniform force along the rest of the discharge, and this force in many cases diminishes as the current increases. Thus whether increases of current produce an increase or decrease in the potential difference will depend on the relative contributions of these two parts.

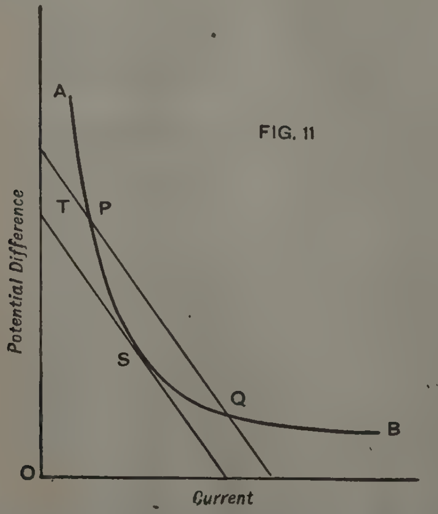

FIG. 11

A curve of which the ordinates are the potential difference between the electrodes and the abscissæ the current through the gas is called the "characteristic curve" for the discharge. Suppose that the current sent through a gas by a battery of cells of electromotive force E_0 is required. If R is the resistance of the curves connecting the battery with the electrodes in the gas, then $E_0-R\iota$ is the potential difference between the electrodes in the gas, and one relation between this potential V and the current is represented by the straight line $V=E_0-R\iota$. The other relation is that represented by the characteristic curve; the values of the current through the gas and the potential difference between the electrodes will be determined by the points of intersection of this straight line and the characteristic curve. Unless the straight line cuts the curve there can be no discharge through the gas; on the other hand, the straight line may cut the characteristic curve in more than one point, indicating that there is more than one type of discharge. Some of these types may, however, be unstable and thus impossible to realize. Thus, for example, if the current is increased by $\delta\iota$ the difference of potential given by the battery between the electrodes is diminished by $R\delta\iota$; if V is the potential difference between the electrodes required to send a current ι through the gas, then, when the current is increased by $\delta\iota$, the increase in the potential required is $\frac{dV}{d\iota}\delta\iota$; thus unless $\frac{dV}{d\iota}\delta\iota$ is less than $-R\delta\iota$, or $-\left(\frac{dV}{d\iota}+R\right)\delta\iota$ be positive, the diminished potential supplied by the battery will not be sufficient to maintain the increase in the current, this increase will stop, the current will return to its original value, and the discharge will be stable; thus if $R+\frac{dV}{d\iota}$ is positive the discharge will be stable. If, however, $R+\frac{dV}{d\iota}$ is negative the fall in potential required to maintain the increased current is so great that, in spite of the diminution of the potential difference supplied by the battery, the residue is great enough to maintain the increased current, the increase in the current will continue, and the discharge will be unstable. Thus the condition for stability is that $R+\frac{dV}{d\iota}$ should be positive, a result first given by Kaufman. This result is equivalent to the condition that for stability the straight line must, at the point where it cuts the characteristic curve, fall more steeply than the tangent to the curve at that point. Thus if APQB is the characteristic curve, and if the straight line cuts it at PQ, the type of discharge represented by P is unstable, and that by Q stable. Keeping the electromotive force of the battery constant and increasing the resistance will make the straight line steeper, and Q will move to the left and the current through the tube will decrease; when the line gets so steep that it touches the curve at S, the minimum value of the current consistent with the maintenance of this type of discharge by the electromotive force supplied by the battery will be reached, and any further diminution of the current will result in the extinction of this type of discharge. It is a well-known fact that the existence of most types of luminous discharges requires the current to be above a certain critical value which depends upon the external force. The electric arc is perhaps the most familiar example of this; as the characteristic curve for the arc discharge is a rectangular hyperbola represented by the equation $V=a+\frac{b}{\iota}$. We can easily show that if the external electric force is E, the maximum resistance which can be introduced into the circuit without extinguishing the arc is $(E-a)^2/4b$, and the smallest current compatible with the existence of the arc $2b/(E-a)$. For any stable type of discharge we see that an increase in the external electromotive force will result in an increase of current; at a point corresponding to an unstable condition it produces a diminution.

Structure of the Discharge.—The structure of the discharge at atmospheric pressure is on so fine a scale that its details can only be made out with difficulty; as the pressure is reduced the scale gets larger and larger, until, when the pressure is reduced to that due to a millimetre or so of mercury, the details of the structure become very conspicuous. The appearance of the discharge at such a pressure is shown in fig. 12, and we see that it is built up of several constituents of very different types. We have already

FIG. 12

when considering the spark discharge given a general description of some of them; there are, however, some features which require further discussion.

Starting from the cathode we find a thin layer of luminous gas, the colour of which depends on the kind of gas through which the discharge is passing. In most gases the light appears to reach right up to the cathode, but in helium Aston has shown it is separated from it by an exceedingly thin dark space. This luminous layer is sometimes called "Goldstein's first layer"; next to this we have a region where there is comparatively little luminosity called "Crookes' dark space," the boundary of this space being approximately the surface traced out by normals to the surface of the cathode of constant length. The thickness of the dark space, which is of the order of the critical spark length, depends upon the pressure of the gas, varying approximately as the reciprocal of the pressure for air; at the pressure of 1 mm. of mercury the thickness of the dark space is about 2 mm., so that at atmospheric pressure the thickness would not be much more than about 1/400 of a millimetre. If the pressure remains constant and the current through the tube is increased, the thickness of the dark space remains unaltered until the current is large enough to cover the whole of the cathode with the luminous glow; after this stage is reached any further increase in the current causes a diminution in the thickness of the dark space. Starting from the boundary of the dark space there is a brightly luminous region called "the negative glow." The function of the parts of the discharge from the cathode to the negative glow is to produce the supply of electrons from the neighbourhood of the cathode necessary to keep the discharge going. The dimensions of this part of the discharge are independent of the distance between the cathode and anode; at very low pressures this part may occupy a length of several centimetres, but at atmospheric pressure they are crowded into a very small fraction of a millimetre and as far as length goes occupy a negligible portion of the sparks at such pressures. The Crookes' dark space, though it appears dark in contrast to the negative glow, is not devoid of luminosity; indeed Seeliger, who has made a spectroscopic examination of the dark space, finds that there are some lines, such as the Balmer series lines, which are almost as bright in the dark space as in the negative glow. But many lines are much stronger in the negative glow than in the dark space.

Beyond the negative glow there is another comparatively dark region called the "Faraday dark space"; the length of this is very variable even when the pressure is constant, as it is sensitive to any change in current. Beyond this and reaching right up to the anode is a luminous column, called the positive column. The luminosity in some cases is fairly uniform in intensity, but when the pressure and current are between certain limits this column may exhibit remarkable alternations of dark and bright spaces called striations, such as are shown in fig. 13. Under some circumstances a dark space round the anode has been detected by several observers.

FIG. 13

When the distance between the electrodes is considerable and the pressure not very low, the positive column forms by far the greater part of the discharge; thus at atmospheric pressures all but a fraction of a millimetre of the discharge next the cathode will consist of the positive column.

Distribution of the Electric Force along the Discharge.—The electric force is very large indeed in the part of the dark space next the cathode, but diminishes rapidly towards the negative glow. In the negative glow itself it is smaller than in any other part of the discharge; passing the negative glow, the electric force increases in the Faraday dark space, until the positive column is reached. When the positive column is of uniform luminosity the electric force in the column is constant until quite close to the anode, when there is an abrupt change of potential of about 20 volts, called the anode fall of potential. When the positive column is striated, the alternations of luminosity in the positive column are accompanied by alternations in the intensity of the electric force, the maxima of the electric force occurring at the bright parts of the striæ, the minima at the dark. From the equation $\frac{dX}{dx}=4\pi\rho$, where X is the electric force in the direction of x and ρ the density of the electrification, we see that there is an excess of positive electricity in the cathode dark space and of negative in the Faraday dark space; in a uniform positive column there is no appreciable excess of electricity of one sign over that of the opposite, while in the striated positive column there is an excess of negative electricity on the cathode side of a bright part of a striation and of positive on the anode side.

Cathode Fall of Potential.—Until the glow next the cathode covers the whole of the electrode the difference of potential between the cathode and the negative glow is constant, depending on the gas and the material of which the cathode is made, but being independent of the pressure of the gas and the strength of the current. This constant difference of potential is called the "cathode fall of potential," and there is evidence to show that it is equal to the minimum potential that can produce a spark through the gas. Its value, as determined by Mey for different gases and different electrodes, is given in the following table, which includes also Matthies' results for Cl_2, Br_2, I_2:—

Gas	Pt	Hg	Ag	Cu	Sc	In	Al	Mg	Na	Na-K	K
O_2	369	..	..	..	..	..	..	..	..	..	..
H_2	300	..	295	280	230	213	190	168	185	169	172
N_2	232	226	..	..	..	..	..	207	178	125	170
He	226	..	..	..	..	..	..	..	80	78·5	69
Arg	167	..	..	..	..	..	100	..	..	..	..
Cl	295	..	..	..	..	..	..	..	..	..	..
Br	355	..	..	..	..	..	..	..	..	..	..
I	377	..	..	..	..	..	..	..	..	..	..

When the current is so large that the luminous glow completely covers the cathode, the potential difference between the cathode and the negative glow increases as the current increases, while the thickness of the dark space diminishes. Mr. Aston, as the result of experiments made with very large parallel plate electrodes, found the following relations between V the cathode fall of potential, ι the intensity of the current, D the thickness of the dark space, and p the pressure of the gas—

$$D=\frac{A}{p}+\frac{B}{\sqrt{\iota}}$$

$$V=E+\frac{F\sqrt{\iota}}{p}.$$

These relations are empirical, and must not be taken to imply that the dark space would increase indefinitely if the current were diminished without limit. Aston also found that the thickness of the dark space as well as the cathode fall of potential depended upon the material of which the cathode is made. If the space round the cathode is restricted so that the dark space has not room to develop (for example, if the cathode is placed in a narrow tube), then, as soon as the dark space reaches the walls of the tube, the cathode fall begins to increase, and increases very rapidly as the pressure diminishes and the thickness of the free dark space exceeds more and more the space available round the cathode. This is due to the same cause as that which makes the spark potential increase rapidly when the spark length falls below the critical value. This result is utilized to make "electric valves," *i.e.* tubes through which a current will only pass in one direction. For if electrodes are put in a tube which is narrow at one end and very wide at the other, the development of the negative glow will be restricted when the cathode is at the narrow, but not when it is at the wide end of the tube: a discharge through the bulb will pass much more easily when the wide end is cathode than when it is anode, so that even if the electrodes are made alternately positive and negative the discharge through the tube will only be in one direction.

A very important question in connexion with the cathode fall of potential is whether the fall is continuous throughout the dark space or whether an appreciable fraction of it occurs abruptly at the surface of the cathode: Aston, who measured the distribution of potential near a very large flat cathode, came to the conclusion that there was no abrupt fall at the cathode. Westphal, on the other hand, found in his experiments an abrupt fall of potential quite close to the cathode amounting to 20% or more of the total cathode fall. The question is important in connexion with the mechanism of the discharge, for if the fall is so abrupt that it occurs within molecular distances the electric force on the surface of the cathode might be so great that the electrons would be drawn out of the cathode without the necessity for the bombardment by positive ions. It is interesting in this connexion to notice that Skinner has shown that the anode "fall of potential" occurs quite abruptly, as far as can be tested by experiment; this, again, if the fall took place in molecular distances might be sufficient to drag positive ions out of the anode itself. By using a cathode heated to incandescence, and therefore emitting a plentiful supply of electrons, we can reduce the cathode fall of potential to a small fraction of its normal value; we cannot, however, with a luminous discharge get rid of the anode fall; thus in the arc discharge the anode fall of potential is greater than the cathode fall. Matthies has shown that, in chlorine, bromine and iodine, the anode fall of potential may rise to hundreds of volts, that in air or hydrogen being only about 18 volts. Reichenheim and Gehrke utilized this fact to get positive ions of sodium and potassium projected with great velocity. They made the anode of a mixture of the halogen salts of these metals and graphite, and worked at a very low pressure; under the action of the discharge the halogens were liberated from the anode, and the large anode fall they produced was sufficient to project sodium and potassium ions from the anode with great velocity; this stream of positive ions constitutes what is known as "anode rays."

The electric force in the positive column is a linear function of the pressure; it depends slightly on the diameter of the tube through which the discharge is passing; it also depends on the current through the tube; in most cases, though not invariably, an increase of current produces a decrease in the electric force. The condition determining the electric force in the positive column is that it should give to an electron during its free path the amount of energy that will enable the electrons to produce by collisions as many ions per second as are lost during the same time by recombination.

Striated Discharge.—The form of discharge when the positive column is striated is so beautiful and remarkable that it has attracted a great deal of attention. To get this type of discharge the current and pressure must be within certain limits. The striations are developed more readily in mixtures of gases than in a pure gas; in fact some physicists have advanced the view that they could not be obtained in an absolutely pure gas. There is no doubt, however, about their occurrence in gases in which great attention has been paid to purification. Nerbeck could not get them in pure nitrogen or pure helium, though they were conspicuous as soon as a trace of impurity was admitted. Nitrogen and helium are gases in which, when pure, the carrier of negative electricity is always an electron; in these gases the electron does not join on to a molecule and become a negative ion. Spottiswoode found that, in some cases when the positive column showed no signs of striation when observed in the usual way, striations moving rapidly down the tube could be seen when the discharge was observed after reflection in a rapidly rotating mirror. Aston and Kikuchi, who have studied this effect in neon and helium, are of opinion that the striations are moving in these gases with the velocity of sound; it must be remembered, however, that the velocity of sound in many gases is of the same order as the velocity of a positive ion under the electric forces in the positive column, so that this result does not necessarily prove that the moving striations are analogous to sound waves.

The distance between the striations increases as the pressure diminishes (in hydrogen the distance is inversely proportional to the square root of the pressure); it depends upon the size of the tube: the striations are nearer together in narrow tubes than they are in wide. The distance between the striations also depends upon the current. When several gases are in the tube, spectroscopic observation of the bright parts of the different striations shows that we may have one set of striations corresponding to one gas, another to another and so on. Thus Crookes observed in a tube containing hydrogen three sets of striations, one set red, another blue and a third grey; the spectroscope showed that the first was due to hydrogen, the second to mercury vapour and the third to hydrocarbons. The striations are often curved with their concavities turned to the anode.

To get a general idea of the causes which might give rise to stratification, let us consider a case where the current is carried entirely by electrons, the positive ions being regarded as immovable in comparison with the electrons. Let us imagine a stream of electrons coming from the negative glow; the electric force in this region is exceedingly small, so that these electrons will have very little energy and will be unable to ionize the gas; the electrification in this part of the tube will be that due to the electrons and thus will be negative, so that the electric force will increase as we approach the anode; as the electric force increases the energy of the electron increases, and the electron will acquire enough energy to enable it to ionize the gas and produce positive ions and electrons; the increase in the number of ions will check the rate of increase in the electric force. The connexion between the ionization and this rate of increase is in the case we are considering represented by a very simple equation. For if n and m represent respectively the number of negative and positive ions per unit volume, X the electric force, and x the distance from the cathode

$$\frac{dX}{dx}=4\pi(n-m)e \qquad (24).$$

If the current ι is carried, as we have supposed, by the electrons, $neu=\iota$, where u is the velocity of the electron, and if we neglect the current carried by the positive ions, then when things have reached a steady state the number of positive ions produced in any region per second must equal the number which disappear owing to recombination. Hence, if q is the rate of ionization, α the coefficient of recombination, $q=\alpha mn$ or $m=q/\alpha n$. Hence we see that (24) is equivalent to—

$$\frac{dX}{dx}=\frac{4\pi\iota}{eu}-\frac{4\pi qeu}{\alpha\iota} \qquad (25).$$

Thus as long as q vanishes, dX/dx is positive, but as soon as q becomes finite the rate of increase will be retarded; as X increases q increases, and when $e^2qu^2=\alpha\iota^2$, dX/dx will vanish; but though X reaches its greatest value at this point, the values of u and q, which depend on the energy acquired by the electron, will continue to increase beyond it. For the energy acquired by an electron depends on $\int Xdx$, taken over a distance measured by the free path of the electron; at low pressures this may be a centimetre or more, and the place where $\int Xdx$ is a maximum will be beyond that where X is a maximum by a length of this order. Thus after X has reached its maximum u and q will increase and dX/dx will become negative, so that X will diminish; the diminution in X will ultimately produce a diminution in $\int Xdx$ and also in u and q; the rate of decrease will slow down; X will attain a minimum, and begin to increase again when similar changes will be repeated. Thus the curve which represents the relation between X and x will resemble fig. 14, giving alternate maxima and minima for the value of x. Thus $\int Xdx$, the energy acquired by an electron, will vary periodically along the path of the discharge. There are two values of this energy which are of special importance in connexion with discharge through gases, one the ionizing potential we have already referred to, the other, sometimes called the "radiation potential," is the energy which the electron must possess to make the gas luminous. The radiation potential is less than the ionizing potential, and electrons with energy between these potentials will make the gas luminous but will not ionize it. Thus the molecules of the gas will give out light but will not be charged. When the energy of the gas exceeds the ionizing potential the luminous molecules are or have been charged. If the variations in the energy along the line of discharge are large enough to make it sink below the radiation potential, then along the discharge we shall have:—(1) places where the energy is below the radiation potential,—these will be dark; (2) places where the potential is between the radiation potential and the ionizing potential,—the molecules here will be luminous and uncharged and will, therefore, not move under the electric field; (3) places where the molecules are luminous and charged,—these molecules will move down the tube towards the cathode with the velocity which the positive ion acquires under the electric field. This velocity, when the pressure is low and the field several volts a centimetre, as it is in the positive column, may be many thousand centimetres per second. Place (1) corresponds to the dark parts of the striations, (2) to the stationary luminous parts, while (3) is the origin of the striations moving down the tube observed by Wulner, Spottiswoode, Aston and Kikuchi.

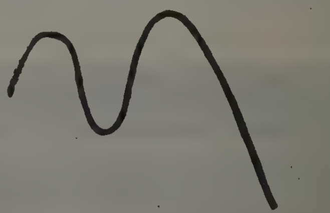

FIG. 14

Cathode Rays.—In 1859 Plücker observed on the glass of a highly exhausted tube in the neighbourhood of the cathode a bright greenish yellow phosphorescence, which changed its position when a magnet was brought near to it. About 10 years afterwards Hittorf showed that a solid body placed between a pointed electrode and the walls of the tube cast a well-defined shadow of such a shape as to show that the agent producing the phosphorescence travels in straight lines at right angles to the surface of the cathode. The name "cathode rays" for the cause of the phosphorescence was introduced by Goldstein, who made many important investigations on their properties. The opinion held by Goldstein and generally in Germany was that cathode rays were waves in the ether. Varley and Crookes advanced the view that they were electrified molecules shot off at right angles to the cathode. The discovery by Hertz that the cathode rays could pass through thin layers of gold leaf was difficult to reconcile with this view. The evidence in favour of the cathode rays being electrified particles was much increased by Perrin's discovery that when a pencil of the rays entered the opening in a Faraday cylinder they gave a negative charge to the cylinder. One difficulty which had been urged against the rays being negatively electrified, viz. that, though they were deflected by a magnetic force, an electric force produced no effect upon their path—was removed by J. J. Thomson, who showed that the absence of deflection was due to the gas in the tube acting as a screen and protecting the particles from the electric force. As the gas in the vacuum tube is a conductor of electricity the rays move inside a conductor of electricity, and so will not be affected by an external electrified body. Thomson showed that when the vacuum was very high, so that there was but little gas in the tube, the cathode rays were deflected by an electric and magnetic field, and that the direction of the deflection indicated a negative charge on the particles. The measurement of the deflection by known electric and magnetic forces led to a determination of the mass of the particles which carried the charge, and showed that these particles were not atoms or molecules but something with a mass not one-thousandth part of the mass of the lightest atom known, that of hydrogen.

The deflection due to electric and magnetic forces can be calculated as follows. Suppose that the particles are travelling horizontally between two parallel horizontal metal plates A, B, maintained at a constant difference of potential, there will be a vertical electric force F acting between the plates, and if the axis of y is vertical the equation of motion of the electrified particle when it is between the plates is

$$m\frac{d^2y}{dt^2}=\mathrm{F}e.$$

If y and $\frac{dy}{dt}$ are both zero when the particle enters the region between the plates, then, when it leaves this region, after a time—

$$y=\frac{1}{2}\frac{\mathrm{F}e}{m}t^2 \text{ and } \frac{dy}{dt}=\frac{\mathrm{F}e}{m}t.$$

Since the electric force is at right angles to the direction of motion of the particles, v the velocity of the particles will not alter, and if the deflection is small, $t=l/v$ where l is the length of the plates. Thus—

$$y=\frac{1}{2}\frac{\mathrm{F}e}{m}\frac{l^2}{v^2} \text{ and } \frac{dy}{dv}=\frac{\mathrm{F}e}{m}\frac{l}{v}.$$

Suppose the particles strike a photographic plate or a screen covered with a phosphorescent substance at a distance L from the end of the plates, the y displacement at this plate produced by the electric force is given by the expression—

$$y=\frac{1}{2}\frac{\mathrm{F}e}{m}\frac{l^2}{v^2}+\frac{\mathrm{F}e}{m}\frac{l\mathrm{L}}{v^2}=\frac{\mathrm{F}el}{mv^2}\left(\frac{l}{2}+\mathrm{L}\right).$$

Magnetic Deflection of the Rays.—If the rays go through a uniform magnetic field of length l and strength H, then if the magnetic force is vertical the force acting on the moving particles will be Hev, and will be at right angles to the magnetic force and also to the direction of motion of the rays; *i.e.* it will be at right angles to the plane of the paper; if z is the displacement of the particle in this direction—

$$m\frac{d^2z}{dt^2}=\mathrm{H}ev.$$

From this we see that the value of z at the screen is given by

$$z=\frac{\mathrm{H}el}{mv}\left(\frac{l}{2}+\mathrm{L}\right).$$

Hence
$$\frac{l}{m}=\frac{z^2}{y}\frac{\mathrm{F}}{\mathrm{H}^2l\left(\frac{l}{2}+\mathrm{L}\right)} \qquad (26),$$

and
$$v=\frac{z}{y}\frac{\mathrm{F}}{\mathrm{H}} \qquad (27).$$

Thus the measurements of y and z, the electric and magnetic deflections, give the values of e/m and v.

The expressions for y and z have been obtained on the supposition that the electric and magnetic fields acted one at a time and not simultaneously. If, however, y and z are small, their values will not to a first approximation be altered if the electric and magnetic deflections occur simultaneously. Thus by making the cathode rays pass through superposed electric and magnetic fields, e/m and v can be got with one exposure by measuring y and z on the screen or photographic plate.

Since from the above equation (26) z^2/y is constant as long as e/m is constant, we see that all the particles of the same kind, whatever their velocity, would strike the screen or plate on a parabola, and that if the rays were a mixture of particles of different kinds each kind of particles would trace out a different parabola. Since z/y only depends upon v, all the particles moving with the same velocity will strike the screen or plate in a straight line.

The determination of e/m for the cathode rays led to results of fundamental and far-reaching importance, for it was found that all the cathode rays had the same value for e/m, and that moreover while for a charged atom of hydrogen in liquid electrolytes e/m was equal to 10^4, when e was measured in electromagnetic units, the value of e/m for the particles in the cathode rays was considerably more than one thousand times this value. Thus if e were the same for the particle as for the hydrogen atom (and we shall see later that this is the case), the mass of the cathode particle is only $\frac{1}{1800}$ of that of an atom of hydrogen, the smallest mass which hitherto had been recognized. Again it was found that whatever metal might be used for the cathode, or whatever might be the gas in the discharge tube, the value of e/m was unaltered. As those particles must have come either from the electrode or the gas, it follows that the particles of the cathode rays are a constituent of the atoms of all the chemical elements. These particles are called "electrons."

After the electrons had once been detected in the cathode rays, they were soon detected under many other conditions and found to be of very wide-spread occurrence. Thus, for example, it was found that streams of electrons are given out by incandescent metals, the rate of emission increasing very rapidly with the temperature. This has received a very important industrial application in what are known as "hot wire valves," at which a current from a hot cathode passes through a vessel in which the vacuum is so perfect that the gas takes no part in the discharge; the current, in some cases amounting to several amperes, is carried entirely by electrons. Lenard found that they were emitted by metals exposed to ultra-violet light. They are emitted when Röntgen rays strike against matter, and by radio-active substances. The speed of the electrons ejected either by ultra-violet light or by Röntgen rays does not depend upon the intensity of the radiation but only upon the wave length. The energy acquired by the electrons is = hn where n is the frequency of the radiation and h Planck's constant.

Since the cathode rays are deflected by electric and magnetic forces proportionally to the magnitude of these forces, we can use the deflection of the rays as a measure for electric and magnetic forces. As these rays have practically no inertia they are especially adapted to measure very rapidly alternating forces which could not be detected by any index having an appreciable mass. The cathode ray oscillograph, an instrument by which electric and magnetic forces are measured by the deflection of cathode rays, has already been used in many investigations, and is a very important aid to research. Another property of cathode rays is that when they strike against matter they generate Röntgen rays, the hardness of the latter increasing with the speed of the former.

Positive Rays.—Goldstein discovered in 1886 that, if the cathode on a highly exhausted tube was perforated, bundles of a luminous discharge streamed through the aperture into the space behind the cathode. The colour of this discharge depends upon the gas in the tube; thus in hydrogen it is rose colour; in air, yellowish. The colour of the light due to these rays is not the same as that produced when cathode rays pass through the gas. In some gases the difference is very striking: thus in neon the light due to the cathode rays is pale blue, while the discharge which streams through the cathode is a gorgeous red. Goldstein called the rays which stream through the hole in the cathode *Kanalstrahlen;* but as they have been proved to consist of positively charged particles it seems more natural to call them "positive rays." These rays produce phosphorescence when they strike against glass and many other substances, though the phosphorescence is generally of a different colour from that produced by cathode rays. They also affect a photographic plate. It was at first thought that the positive rays were not deflected by a magnet, as magnetic forces which produced large deflections of cathode rays had no appreciable effect upon positive ones. Wien showed, however, by using very strong magnetic fields, that they could be deflected, and that the direction of the deflection indicated that they carried a charge of positive electricity; they can also be deflected by electric forces.

By measuring the deflection provided by electric and magnetic fields we can determine the value of e/m for the particles which constitute the rays. The result is of great interest. Instead of, as in the cathode rays, e/m having the same value for all the carriers, we find that e/m has many different values separated by finite intervals; and instead of e/m being equal to $1{\cdot}78 \times 10^7$, as in the cathode rays, we find the greatest value of e/m is 10^4, which is the same as its value for a charged hydrogen atom. The values found for e/m depend on the gases in the discharge tube; the outstanding result is that all these values of m correspond to masses of atoms or molecules of the chemical elements or compounds. Thus while the determination of e/m for the cathode rays shows that in a gas at a very low pressure the carriers of the negative electricity are all of the one type, being electrons whose mass is exceedingly small compared with that of any atom, the determination of e/m for the positive rays shows that the carriers of the positive electricity are of many different types; and that all these types correspond to atoms or molecules of the chemical elements or compounds. It has already been shown that if charged particles, after passing through electric and magnetic fields, are received on a screen or photographic plate, all particles, for which e/m is the same, strike the plate on a parabola, and that for each different value of e/m there is a separate parabola.

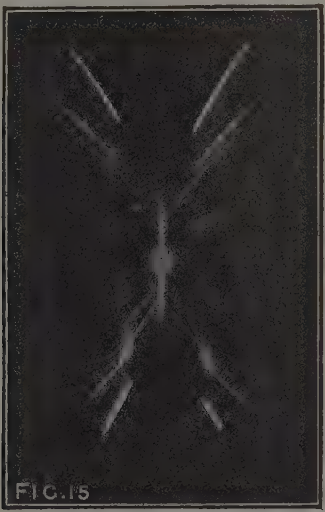
FIG. 15

These parabolas are shown in fig. 15, which is a reproduction of a photograph made by allowing the positive rays in a tube containing gases liberated by heating a certain mineral to strike against a photographic plate; taken from the top downwards they correspond respectively to the atom of hydrogen, the molecule of hydrogen, the atom of helium, the atom of carbon with two charges, the atom of nitrogen with two charges, the atom of oxygen with two charges, the atom of carbon with one charge, the atom of nitrogen, the atom of oxygen, the molecule of water, the molecule of CO and that of N_2 (these form one parabola), the molecule of oxygen, the molecule of CO_2 and the atom of mercury. We find that many of the atoms can carry more than one charge, for when we find a parabola corresponding to one value of e/m we frequently find another corresponding to twice this value; thus carbon, nitrogen, and oxygen occur very frequently with two charges, other atoms such as argon with two and three charges, while mercury atoms have been detected with 1, 2, 3, 4, 5, 6, 7 charges. It is significant that the atom of hydrogen never occurs with more than one charge. Multiple charges generally occur on atoms but not on molecules; there are, however, some molecules such as CO on which double charges have been found. Some of the positive particles, after passing through the hole in the cathode, lose their positive charge and become uncharged, and some of these neutral particles acquire a negative charge; thus mixed with the positively electrified particles there are some negatively electrified ones. This power of acquiring a negative charge is confined to certain atoms; thus while the atoms of hydrogen, carbon, oxygen, fluorine occur with a negative charge, the atoms of nitrogen, helium, argon and neon do not. It is exceptional for a molecule to acquire a negative charge, the molecules of oxygen and carbon, however, can do so. The equation of a parabola formed by a particle on the photographic plate has already been given—

$$z^2 = \frac{e}{m} y C$$

where z is measured parallel to the displacement due to the magnetic field and y to that due to the electrostatic. C is a quantity which depends on the strength of the electric and magnetic fields and on the position of the photographic plate. If, as in fig. 16, we draw a line parallel to the axis of z, the intercept made by a parabola on this line will be proportional to $(e/m)^{\frac{1}{2}}$; thus, if the top parabola is due to the atom of hydrogen, the next to the molecule of hydrogen, the third to the atom of helium and the fourth to that of oxygen, the intercepts AH, AH_2, AO are in the proportion of $1, 1/\sqrt{2}, 1/4$. Thus by comparing the intercept made by any parabola X with that made by the parabola due to the hydrogen atom we can find the molecular weight of the substance producing the parabola X.

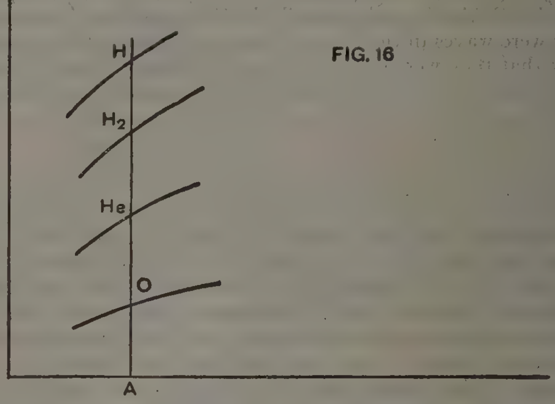

FIG. 16

Positive Rays as a Method of Chemical Analysis.—Since from the measurement of the positive ray photographs we can determine the molecular weight of the gases in the discharge tube, we can analyze a gas by putting a small quantity of it in a discharge tube and taking a photograph of the positive rays. It is thus a method of chemical analysis, and its application has already led to the detection of several new substances. In fact, though it has only recently been introduced, more substances have been discovered by this method than have ever been discovered by spectrum analysis. The method has many advantages. In the first place only a very minute quantity of the gas is required; a small fraction of a cubic centimetre of gas at atmospheric pressure is all that is required to fill the discharge tube at the pressure at which the positive rays are produced. Again, the method is very sensitive, as it will detect the presence of a gas which only forms a small percentage of the gas in the tube. The method not only detects the presence of the gas, but at the same time determines its molecular weight. It indicates, if the gas is an element, whether it is monatomic or diatomic; for if it is diatomic it will give rise to two parabolas, one due to the atom, the other to the molecule. The absence of double or negative charges will suggest that it is a compound and not an elementary gas. The only ambiguity is that it does not distinguish between two substances of the same molecular weight; thus CO_2, and N_2O give the same parabolas, as also do CO and N_2: we can often, however, remove this ambiguity by putting substances in the tube which would absorb one gas and not the other, and testing whether or not this has removed the parabola.

Use of Positive Rays to Determine Atomic Weight.—The measurement of the parabolas give, as we have seen, the atomic weight of the elements producing them; they can therefore be used to determine the atomic weight of elements which can be introduced in a gaseous state into the discharge tube. This method has the great advantage that the presence of impurities does not affect the result. Mr. Aston has lately, by the use of a positive-ray method for determining atomic weights, found the very important fact that, if oxygen is taken as 16, the atomic weights of the elements with the exception of hydrogen are represented by whole numbers. Thus in working with chlorine he found no substance with an atomic weight of 35·4, but two substances with atomic weight of 35 and 37 respectively; he regards these substances as identical in chemical properties and inseparable by chemical reactions, and ordinary chlorine as a mixture of about 3 parts of (35^2) and one part of (37^1). Mr. Aston, by the method of positive ray analysis, has discovered isotopes of boron, silicon, bromine, krypton, xenon and mercury.

The Charge of Electricity Carried by Gaseous Ions and Electrons.—The deflection of cathode and positive rays by electric and magnetic forces supplies a method for finding the value of e/m; for the determination of e, the charge on an ion, other methods have to be employed. One such method used by J. J. Thomson is based on the important investigations of C. T. R. Wilson on the effect of ions on the deposition of clouds and fogs from supersaturated air. If dust-free air saturated with water vapour is suddenly cooled by expansion, no cloud or fog is deposited unless the supersaturation due to the cooling is very large. C. T. R. Wilson found that if ions are present in the gas they act as nuclei round which drops of water are deposited with a supersaturation much below that required for gas free from ions. A beautiful application of this is the detection of the path of an α particle from a radioactive substance. The α particle produces by collision ions all along its path; if the damp gas through which the particle is passing is suddenly cooled by expansion, drops of water will deposit on the ions and thus mark out the path of the particle. One of Mr. Wilson's photographs of such a path is shown in fig. 17. Mr. Wilson found that less supersaturation is required to deposit water on negative than on positive ions. This result can be applied to find the number of ions in a moist gas, for if the gas is suddenly expanded by an amount sufficient to deposit drops on ions, but not sufficient to produce condensation in their absence, then each ion may be made the centre of a drop, and the problem of counting the ions is reduced to that of counting the drops.

FIG. 17

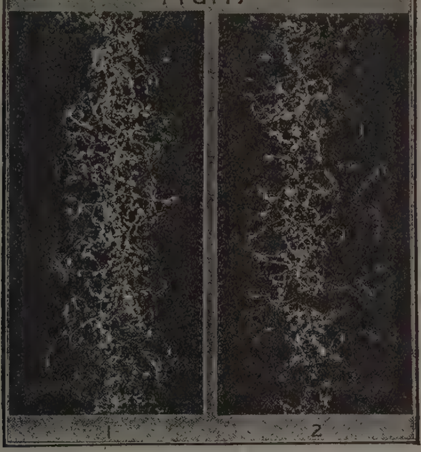

We can calculate the amount of water that will be deposited by any given expansion of the air; hence, since we know the volume of the water we can determine the number of drops if we know the volume of a single drop. Observation of the rate at which a drop falls under gravity will give the size of the drop, for Stokes long ago showed that the velocity of a rain drop falling under gravity is given by the equation $v=\frac{2}{9}g\frac{a^2\rho}{\mu}$; when v is the velocity of the drop, a its radius, μ the viscosity of the gas, g the acceleration due to gravity, and ρ is the density of the gas. It has been found that, with the exceedingly fine drops formed round ions where the radius of the drop is comparable with the free path of the molecules of the gas, the velocity is greater than that given by the above, equal in the proportion of $\left(1+\frac{C}{pa}\right)t_0 1$, when C is a constant, and p the pressure. But though this correction makes the relation between a and v a little more complicated, it still enables us to determine a when v is known. Thus the radius, and therefore the volume, of the drop can be determined, and from this, as we have seen, we can deduce the number of ions.

Let n be this number per unit volume; then if a current of electricity is sent through the gas by an electric force X, the current passing through unit area will be neU when U is the mean velocity of the positive and negative ions under the force X. We know that it is proportional to the force and for a force of one volt per centimetre is 1·5 cm./sec.; and hence when X is known U is known, the current neU can be measured, and hence ne deduced; as n has been found by the drops, the value of e can be determined immediately. This was the method used by J. J. Thomson; a simpler method used afterwards by H. A. Wilson was to get drops round the negative ions alone by using an expansion that would deposit moisture on negative but not on positive ions. He then showed the rate of fall of these drops, first under gravity alone, and then under a vertical electrical force X, acting on the drop in the same direction as gravity. Thus, when the electric field is acting, the force on the drop is

$$\mathrm{X}e+\frac{4}{3}\pi\rho a^3g,$$

and when it is off the force is only $\frac{4}{3}\pi\rho a^3g$. Thus, if v_1, v are respectively the velocities of the drop when the field is on and off,—

$$\frac{\mathrm{X}e+\frac{4}{3}\pi\rho a^3g}{\frac{4}{3}\pi\rho a^3g}=\frac{v_1}{v}$$

$$\text{or } \mathrm{X}e=\frac{4}{3}\pi\rho a^3g\frac{(v_1-v)}{v}.$$

From v, the rate of fall when the field is off, we can calculate as before the radius of the drop, and from the preceding equation we can determine e. Millikau, who has made most extensive and accurate investigations on the value of e, used a modification of the preceding method. Instead of producing water drops by expansion on the ions, he obtained, by means of a sprayer, minute drops of oil; he observed the motion of one of these under an electric field in a gas which was subject to some ionizing agent, and from time to time an ion would strike against the drop and alter the charge; this would alter the velocity, and from the alteration of the velocity he could by a formula similar to that just given calculate the charge communicated to the drop by the ion. The value obtained for e by this method is, in electrostatic units,—

$$e=4{\cdot}77\times10^{-10}.$$

From the value of e we can obtain Avogadro's constant, the number of molecules in a cubic centimetre of gas at 0c and 760 mm. pressure. For Townsend has shown that $Ne=\mathrm{P}\frac{u}{\mathrm{XD}}$ where P is the pressure when the number of molecules is N, u the velocity of the ion when the force is X, and D the coefficient of diffusion of the ion into the gas. Townsend measured D, and found that the value of Ne determined by this equation was, within the limit of errors of experiment, equal to NE as determined by experiments on the quantities of hydrogen liberated by electrolysis. E is here the charge carried by an atom of hydrogen in the electrolysis of liquids. Thus the charge on the gaseous ion is equal to that on the liquid ion. Since one coulomb deposits 1·11827 milligrams of silver, and the atomic weight of silver is 108 and the density of hydrogen $8{\cdot}987\times10^{-5}$ at 0c, $\mathrm{NE}=1{\cdot}290\times10^{10}$, and as $e=4{\cdot}77\times10^{-10}$, $\mathrm{N}=2{\cdot}7\times10^{19}$. The number of molecules in a gramme molecule of any substance is $6{\cdot}06\times10^{23}$.

Thus the study of the electrical property of gases has given the most accurate values available of two of the most important constants connected with the constitution of matter. By studying electrified atoms and molecules, we have been able to determine their masses and their properties with an accuracy far beyond that attainable by any method which can be used when they are in the normal state. (J. J. T.)

GASQUET, FRANCIS AIDAN (1846–), Roman Catholic cardinal and historian, was born in London Oct. 5 1846. He was educated at Downside College, Bath, afterwards becoming superior of the Downside Benedictine monastery (1878–1884). He was created cardinal in 1914. He has produced various works on mediaeval church history and liturgies, among them being *Henry VIII. and the English Monasteries* (1888–9); *A Short History of the Catholic Church in England* (1903); *Parish Life in Mediaeval England* (1906) and *The Bosworth Psalter* (1908).

GAUL, GILBERT WILLIAM (1855–1919), American painter (*see* 11.532), died in New York Dec. 21 1919. He was awarded a gold medal at the Appalachian Exposition, Knoxville, in 1910.

GAUTSCH-FRANKENTHURN, PAUL, FREIHERR VON (1851–1918), Austrian prime minister, was born at Vienna Feb. 26 1851. He was director of the Theresa academy from 1881 to 1885, and Minister of Education from 1885 to 1893 and from 1895 to 1897. He was three times prime minister: first from

1897 to 1898, when he revoked the language ordinances made by Badeni; again from 1904 to 1906, when he prepared the way for universal suffrage; and for the last time from June to Oct. 1911. He died on April 30 1918.

GEDDES, SIR AUCKLAND CAMPBELL (1879–), British man of science, administrator, and diplomatist, was the son of Auckland Campbell Geddes of Edinburgh and the younger brother of Sir Eric Geddes, and was educated at George Watson's College, Edinburgh, and Edinburgh University. He studied medicine, qualified as a practitioner, was at the London hospital for a time, and later studied at Freiburg. He was a demonstrator and professor of anatomy first at Edinburgh, then at the Royal College of Surgeons, Dublin, and afterwards at McGill University, Montreal. He had also military experience, first in the South African War, and afterwards in the World War from 1914–6, becoming eventually a brigadier-general in the Territorial Force. At the outbreak of war he was still at McGill University; but in 1916 he was brought into the War Office as Director of Recruiting. The remarkable efficiency of his work in this capacity caused him to be appointed to succeed Mr. Neville Chamberlain in Aug. 1917 as Minister of National Service. This was one of the new ministries instituted by Mr. Lloyd George, with a view to the more energetic prosecution of the war. The great problem was to utilize the man-power and woman-power of the country to the best advantage. Sir Auckland Geddes outlined his policy in speeches at Edinburgh on Oct. 3, at Nottingham on Oct. 9, at Plymouth on Nov. 12, and at the Aldwych Club on Nov. 14. Instead of following Mr. Chamberlain's plan of building up a great department, he proposed to utilize existing machinery as far as possible. He contemplated a system of industrial coöperation, and determined to carry out the necessary transference of labour by means of labour's own organizations. More men were wanted for the shipyards, the production of steel, the making of aerodromes, and the production of aircraft and aero engines. To get them he proposed to use the employment exchanges, the trade unions, and the employers' federations. He appealed for volunteers for seasonable occupations like haymaking and harvest, and said that the waste of power in domestics, chauffeurs, and gardeners must stop. He made a special appeal to young, healthy, middle-class femininity. He instituted four grades of physical fitness. He said that the need of men and women for the army must be obtained by a drastic comb-out of individuals. He condemned extravagance on luxury, such as women's clothes. His department made a card index of the whole of the army at home, so as to get back into civil life men unfit for active service but fit for industrial occupations. His object was to ensure the maximum effort of the country for the following spring, when the strain would be the greatest.

A seat in Parliament was found for Sir Auckland at Basingstoke, and unlike some of the eminent practical men whom Mr. Lloyd George introduced from the outside into his administration, Sir Auckland had little difficulty in accommodating himself to parliamentary life. He introduced in Jan. 1918, and carried through Parliament in Feb., a bill the chief object of which was to call up from civil employment a number of young men who had hitherto been exempt from military service. He secured the coöperation of the trade unions in general, and even eventually of the Amalgamated Society of Engineers, which had hitherto proved recalcitrant. It was largely due to his efforts that the man-power and woman-power of the whole country was so completely thrown into the prosecution of the war as to make the victory of 1918 possible. In Nov. he became President of the Local Government Board and Minister of Reconstruction, and in the following May President of the Board of Trade. In this latter capacity he began the removal of the barriers to British trade which the war had necessarily set up, and he had to deal with the difficulties which immediately arose in the coal industry. He pointed out that the shortening of the working-day and the slackness of production had resulted in a deficiency of nearly 50 millions of money, that England could not get back to her industrial position before the war, unless the work of the country was done, and it was not being done. He had to increase the price of coal by 6s. a ton in the summer; but in Nov., as the result of a conference with the Labour party, he announced that the British consumers ought to profit by the profits on export coal, and reduced the price of domestic coal by 10s. In 1919 an opportunity was afforded him to return to academical life by his selection to succeed Sir W. Peterson as principal of McGill University. He accepted the appointment, subject to its not being operative until he could be spared from his work at the Board of Trade on account of the coal crisis in England. But the delay so caused prevented his taking up the appointment, and in the spring of 1920 the Government prevailed on him to accept the post of British Ambassador at Washington, Gen. Sir Arthur Currie being made principal of McGill in his stead. It was thought that his combination of academical and intellectual interests with military and administrative experience, together with his knowledge of, and affection for, Canada, gave him peculiar qualifications for the Washington Embassy. He had, moreover, married in 1906 an American wife, Isabella Gamble, daughter of W. A. Ross of New York, by whom he had four sons and one daughter. He was made a K.C.B. in 1917.

GEDDES, SIR ERIC CAMPBELL (1875–), British man of business and politician, born in India Sept. 26 1875, was the son of Auckland Campbell Geddes of Edinburgh and the elder brother of Sir Auckland Campbell Geddes. He was educated at Oxford Military College and Merchiston Castle school, Edinburgh. He gained business experience lumbering in the southern states of America, and he afterwards was connected with railways—first the Baltimore & Ohio system in the United States, and then the Rohilkund and Kumaon in India. Returning to England, he joined the North-Eastern Railway Co., under Sir George Gibb, and, having succeeded him in 1906, was himself the general manager of this line when the World War broke out in 1914. He was one of the business men whom Mr. Lloyd George, on becoming Minister of Munitions, enlisted in Government employ. He became deputy director-general of munitions supply 1915–6, and his powers of administration so impressed the ministers charged with the conduct of the war that, when in 1916 the question of communications behind the lines of the British army in France became urgent, and Sir Douglas Haig asked for the help of an expert, he was appointed, though a civilian, director-general of military railways and inspector-general of transportation, with the rank of hon. major-general. Under him, and with the assistance of the expert railway managers whose services were enlisted, the British lines of communication in the latter part of the war were brought into a high state of efficiency. He was knighted in 1916 and in 1917 he was created K.C.B. and G.B.E., being transferred to the Admiralty in May of that year as controller, with the honorary rank of vice-admiral, in order to develop and utilize the whole of the shipbuilding resources of the country and concentrate them under one authority. So highly did Mr. Lloyd George value his work that when Sir Edward Carson resigned the office of First Lord of the Admiralty a couple of months later, the Prime Minister selected Sir Eric Geddes, in spite of his having no parliamentary experience, to succeed him. A seat in the House of Commons was provided for the new minister at Cambridge (town). He held office at a time when the unrestricted German submarine warfare was levying a heavy toll on the British mercantile marine. He informed the House of Commons in March 1918 that the monthly output of British shipbuilding yards would have to be nearly doubled before the monthly rate of sinking was made good; and he appointed Lord Pirrie, the great Belfast shipbuilder, as controller-general of merchant shipbuilding. In Oct. he went at the head of a naval mission to the United States. After the Armistice Mr. Lloyd George availed himself of Sir Eric's powers as an organizer by appointing him to coördinate Government departments in regard to demobilization. His success in these varied tasks was rewarded in Jan. 1919 by the G.C.B. The Prime Minister's programme for the election of Dec. 1918 included "the development and control . . . of the railways and the means of communication," and "a systematic improvement in the transport facilities of the agricultural areas." For the purpose of carrying out this policy, Sir Eric left the Admiralty when the ministry was reconstructed in Jan. 1919 in order to organize and preside over a new Ministry of Transport. Until the bill constituting it was passed in the summer, he held Cabinet office without portfolio. The measure, which was opposed in both Houses as tending unduly to nationalization, gave the minister control of railways, roads, canals and docks. The constitution of the new ministry subsequently aroused severe criticism on account of its extravagant scale when in 1920–1 all eyes were fixed on the need for economy; and in view of the contemplated handing back of the railways from State control to the companies in the autumn of 1921, it became understood that its future was very doubtful, and that Sir Eric himself had no desire to continue in public life after that event. A bill for regrouping the railways was introduced by him in the spring of 1921. Sir Eric Geddes married in 1900 Gwendolen, daughter of the Rev. A. Stokes, and had three sons.

GEIKIE, JAMES (1839–1915), Scottish geologist (*see* 11.553), died at Edinburgh March 1 1915.

GENETICS.—This term was proposed at the third conference on hybridization 1906 to denote the study of heredity and variation. In that sense it has been generally adopted, and by extension is understood to include the physiology of reproduction and the art of breeding. Though such inquiries have been pursued from the earliest times, the development of a special branch of science relating to them is recent. The primary incentive was the hope that by applying accurate methods of observation and experiment to the course of heredity and variation a more precise knowledge of evolutionary processes might be acquired. Modern theories of evolution are based on the assumption that species have arisen by descent with modification, and that the constancy and diversity which living things manifest in their reproduction provide a sufficient basis for that conception. It is significant that as a result of the preliminary work done under the new inspiration attention has been largely diverted from these more philosophical aims. Beliefs current among naturalists, especially as to the nature and incidence of variability, were at once found to be widely incorrect. The scope and character of these discoveries are referred to below. Their immediate consequence has been that the development of evolutionary theory is tacitly suspended or postponed, and activity is concentrated on the exploration of genetical physiology, the theoretical evaluation of the knowledge thus gained being relegated to the future.

In these researches several methods of investigation are available. Modern genetics began with an attempt to observe empirically the course of contemporary variation from type; but though observations of this class have proved valuable in a preliminary survey, and have often been of use as indicating material for more prolonged investigation, the main advances have been accomplished by either (1) experimental breeding or (2) cytology. Important sidelights on genetical problems have also been obtained through the study of developmental mechanics (*Entwicklungsmechanik*) by experimental methods.

(1) *Experimental Breeding.*—The great stimulus to this method of research was given by the rediscovery in 1900 of Mendel's paper (*see* 18.115). Heredity, long regarded as a fortuitous and seemingly lawless phenomenon, was proved to follow regular principles which could in great measure be ascertained by experiments properly planned. A vast field was at once thrown open for investigation. Mendel's success was made possible by his genius for simplification. Working with peas he made crosses between distinct varieties and watched the descent of their numerous characteristics, fixing his attention on each separately, and disregarding other differences. He then found that numerous distinctive features behaved in descent as if they were transmitted as units. These determining elements or units are referred to as *factors* or "genes" (a term especially used by American writers, the equivalent of Johannsen's *Genen*). The differences determined by these factors can commonly be shown to be treated in heredity as pairs of alternatives or opposites, such as tall and short, coloured and colourless, hairy and smooth, each germ-cell being usually pure in respect of one or other of the contrasted characteristics. This is the principle of *allelomorphism*, and the members of such pairs are called *allelomorphs*. The zygote, formed by two germ-cells united in fertilization, may be made up of two germ-cells alike in respect of any given pair, in which case it is said to be *homozygous* in that respect, or it may be a *heterozygote* if the uniting pair of cells are unlike. Before the germ-cells of the heterozygote are formed a process of *segregation* occurs, and there is a dissociation between the opposing elements introduced at fertilization, such that the resulting germ-cells are again in normal cases pure in regard to each allelomorph.

After the rediscovery of Mendel's work, progress was rapid, and it was soon found that similar principles of descent apply to a great range of characteristics by which living things are distinguished. The number of forms of life studied is now very large, and includes most of the kinds of plants and animals which are readily amenable to experiment or observation. Man is evidently no exception, and we already know that certain features of human coloration, especially of hair and eyes, and several congenital abnormalities are transmitted according to the Mendelian scheme, some being dominant, others recessive.

Scarcely any satisfactory opportunities for studying the genetics of the lower plants (ferns, mosses, Algae, etc.) have yet occurred, but one example has been described in a unicellular Alga (Pascher). Of the features by which animals and plants are distinguished most have now been shown to be dependent on segregable elements. Reservation must be made in regard to differences which are simply quantitative, for there is a good deal of evidence suggesting that the elements by which size and weight are determined do not often form themselves into simple allelomorphic pairs. A similar doubt exists in regard to numerical or meristic distinctions.

Differences in instinct and other characters dependent on nervous mechanism are not, as such, distinct in their genetical behaviour, and some have been proved to depend on segregable factors or elements. In several breeds of fowls the hens are devoid of maternal instincts, and do not sit on eggs. This characteristic is recessive to the normal instinct, and segregation takes place in regard to it. The same is true of the pacing habit in horses as opposed to the trotting habit. The "waltzing" habit of certain Japanese mice is recessive to the normal, segregates from it and breeds true when it reappears. This example is interesting, since the abnormality is almost certainly a consequence of deformity in the semicircular canals of the ear.

As to the descent of the normal mental attributes of man little is known with accuracy, but several abnormalities of the nervous system are known to follow modes of descent which prove them to be subject to segregation. Feeble-mindedness is a recessive condition which breeds true. Paralysis agitans is also a recessive. Hereditary chorea descends as a dominant; colour-blindness and a form of night-blindness may also be termed recessive (*see* Sex). In heterozygous combination with the normal there is segregation, but the descent of these conditions is complicated by sex.

It will readily be understood that though the determining factors may be transmitted as units, the distinguishing characters of animals and plants must be often due to the association of many independent units. Of these some produce their effects separately; but not rarely, though independently transmitted, two or more unit-factors may be complementary to each other and combine to produce a joint effect, or "compound character" as it is sometimes called. Such complementary factors if separately present in the organism without their complement need not manifest their presence at all, and it is then only by breeding tests that their existence can be demonstrated.

Organisms may now be represented as aggregates of units which confer upon them their various attributes. The degree to which an organism may be thus resolved is as yet undetermined, but there is presumably a limit to the process, and it is natural to suppose that the detachable elements are implanted on a *basis* which for a given type is irreducible.

Reversion.—Conceptions, formerly vague, now acquire an exact meaning. For example, reversion or "throwing-back" to an ancestral form, previously regarded as a mere caprice of nature, can at once be perceived to be due to one of two definite causes which operate with regularity. The reversion is either (*a*) the reappearance of a recessive characteristic, or (*b*) it is the consequence of the reunion of complementary factors which, though both present together in the ancestor, had been separated by variation and transmitted in distinct strains. For example, when a red-haired child is born to dark-haired parents the fact proves that the two parents are heterozygous in respect of the recessive red, which reappears when two germ-cells carrying it unite in fertilization. Moreover, if the statistics of a considerable number of such families of children were collected and added together it would be found that the proportion of red-haired was approximately a quarter of the whole. The mere fact that one or both of the parents traces descent from a red-haired ancestor is not the *cause* of the reversion—for if either of the parents were homozygous in dark hair the red would not have reappeared.

The reversion to an actual or supposed ancestral form consequent on the meeting of complementary factors is less common in the ordinary practice of breeders, but is frequently seen in experimental crossing. When two white orchids crossed together give a coloured flower in F_1, or when a rose-combed fowl bred with a pea-combed bird gives chickens with the walnut comb of the Malay fowl, the production of the unexpected colour or structure is due to complementary action of two independent factors. But the old interpretation of the phenomenon as a consequence of such an ancestor having occurred in the pedigree is illogical and misleading. In the case of the walnut comb, for instance, it is quite possible that either or both of the parent breeds never had a Malay ancestor. The production of a new form by the meeting of complements should be regarded, like the properties of a chemical compound, simply as the empirical consequence of a certain combination of units, without reference to the previous history of those units.

Purity of Type.—Of greater importance, both theoretical and practical, is the fact that it is now possible to assign a precise meaning to this expression. To the pre-Mendelian evolutionist purity was always a matter of degree, which might be gradually and, as it were, asymptotically approached in successive generations of selection, but never actually attained. The practical breeder also has always regarded purity as a property necessarily dependent on a long course of selection. Purity is now seen to be the condition of the animal or plant which is formed by the union of gametes bearing identical units. In respect of any allelomorphic pair purity may thus be conferred, though in respect of other pairs of units the same organism may be impure, *i.e.* heterozygous, or, in ordinary parlance, cross-bred. This is the central fact of Mendelism, and on it Genetics is based.

The question of purity must therefore be considered separately for each pair of units. A thoroughbred horse, for example, may be pure in a number of characteristics which go to the making of the breed, but it may be impure in, say, colour. A chestnut horse, however, of whatever parentage, is pure-bred in colour, since that colour is the lowest of the series of horse colours, and chestnuts bred together give chestnuts only. By selection the likelihood of producing purity is increased, but, as will subsequently appear, no amount of selection can ensure purity. On the other hand, purity in respect of any character may be attained at once in any mating by which gametes of similar factorial composition happen to be brought together in fertilization. From this proposition the corollary follows that the combination of two strains pure in any given respect will give a family uniform as regards the character considered, and the uniformity of such cross-bred families, especially when one of the parents contains few dominant factors, is in practice one of the simplest and most convincing tests of purity.

Genetic Analysis.—By the institution of a series of crosses with varieties and study of the composition of the succeeding generations an *analysis* of the factorial constitution of a given type can be made. The numerical proportions or ratios in which the several combinations of characters are represented, the number of these terms in the series, and their respective genetical powers of transmission furnish the data from which the nature and number of the factors comprising the parental type may be determined. In the earlier article on Mendelism (*see* 18.115) some of the simpler ratios and their significance are explained, but examples of a much higher order of complexity are often encountered. The unravelling of these complications has led to some important discoveries. The many ways in which it may come to pass that two or more terms in a series of factorial combinations may be indistinguishable from each other cannot be enumerated here, but a knowledge of some of the more significant causes of disturbance of what may be called the normal ratios (9:3:3:1; 9:3:4; 27:9:9:9:3:3:3:1, etc.) is essential to a proper comprehension of Genetics.

Cumulative Factors.—From certain crosses (especially of cereals) into which only one pair of differences had apparently been introduced it was observed (Nilsson-Ehle; East) that the recessives reappearing in F_2 were only 1:15 instead of the usual 1:3. Investigation proved that from the dominant side *two* factors with identical functions, though belonging to distinct pairs, had been introduced. Consequently, among the dominants in F_2 were some containing both these factors and others having one only. Various results suggest that this multiplication, or better, *accumulation*, of similar factors is a phenomenon of common occurrence, and that the process may be extended in special cases.

Inhibiting and Lethal Factors.—Many factors act by producing a negative result, inhibiting the development of some character, the determining elements of which are present though their action is not perceptible or largely diminished. Of these the most easily demonstrable operate by inhibiting the formation of colour. The white pigment of the coats of animals and the feathers of birds, or of flowers, for example, is commonly due to the absence of the elements necessary for the formation of colour, but both in animals and in plants varieties have been found which are white, or nearly so, not through absence of pigment, but through the presence of factors which, in some way not yet defined, inhibit the production of the coloured pigments. From some matings a mixture of white individuals may be obtained, which to the eye look alike, or nearly so, though they represent various factorial terms and are genetically dissimilar. The process of inhibition may be carried much further, and there are well-established instances in which the animal or the plant cannot live if it is homozygous (containing two "doses," in popular terms) for a given factor. The classical instance of such *lethal* factors, as Morgan has called them, was met with in the breeding of yellow mice (Cuénot; F. M. Durham). Mice with yellow coats, bred together, give a majority of yellows, but always throw a proportion of some other colour—for example, chocolate or black. Since in mice yellow is a dominant, it is clearly caused by a factor which the gametes can carry. But the union of two gametes, both carrying this factor, does not give rise to a viable animal. It was suggested that two such gametes could not unite in fertilization, but later work has practically proved that these fertilizations occur and that the resulting embryo perishes at an early stage (Ibsen). The physiological action of the yellow factor in causing death is not known. In plants the "golden"-leaved varieties are comparable. They cannot breed true, but throw 2 yellow: 1 green. The purely yellow term is missing, and is clearly not viable (Baur). The suggestion has been made that the yellow factor acts not merely negatively by diluting the amount of chlorophyll, but by inhibiting its formation, probably producing a body with this specific power. This is the more likely since golden varieties in dull weather turn almost a full green, whereas in sunlight they bleach to a full yellow, the fact indicating that the production of the inhibiting body is promoted by sunlight. Two doses of this factor kill the plant altogether, probably during embryonic life.

Linkage.—At an early stage in these inquiries it was observed that factorial units belonging to separate allelomorphic pairs are not always distributed independently among the gametes of a heterozygote, but that some combinations occur regularly with a greater frequency than others. The next step was the discovery that this *linkage* depends on the association of the linked factors in the parent from which the heterozygote was formed. For example, if a form *AB* is crossed with *ab* the normal expectation is that the double heterozygote *AaBb* will form gametes *AB*, *Ab*, *aB*, *ab* in equal numbers; but if there is linkage between *A* and *B*, then the parental combinations *AB* and *ab* will be more frequently represented in the gametic series than the other, or "cross-over" combinations, *Ab* and *aB*. But if the original cross were in the form *Ab* x *aB*, then the most frequent gametes will be *Ab* and *aB*, the cross-overs, *AB* and *ab* being the rarer. This observation forms the starting-point from which modern genetical theory has been very largely developed. The terminology followed above is that introduced by T. H. Morgan, to whom progress has been especially due. It is sometimes convenient to distinguish the case in which the two dominants (*AB* x *ab*) are introduced together by the parent as *coupling*, and the converse (*Ab* x *aB*) as *repulsion*, but the physiological process is now recognized as being clearly the same in both cases, and there is no difference in the numerical proportions in which the parental combinations respectively reappear. It should be observed that the factors thus linked have plainly no connexion with each other as regards the effects which they produce in the zygote, but may concern the most dissimilar characters. For instance, in the example first observed the linkage was that between the factor which makes the flower of the sweet pea blue or purple (as distinguished from red) and that which makes the pollen grains long (as distinguished from round). According as the proportion of cross-overs is small or large the linkage is more or less complete. If both parental and cross-over terms are equally common there is no linkage. The most satisfactory test of the linkage-ratio is obviously provided by breeding the double heterozygote (*Aa-Bb*) with the double recessive (*aabb*), and this mating should be carried out reciprocally since it is known that in plants (*e.g.*, *Primula sinensis*) the male and female sides of the same plant may show different degrees of linkage (R. P. Gregory), and that in animals (*e.g.*, *Drosophila* and the silkworm) crossing-over may be entirely absent in one sex though occurring in the other.

Allelomorphism: Multiple Allelomorphs.—Apart from linkage, segregation is always a separation of units affecting the same character, and from a very large range of observations it is possible to represent the distinction between the allelomorphic pair as one in which a *positive* element separates from a *negative.* In other words, allelomorphism may commonly be conceived as a difference which consists in the *presence* of something on the one side and its *absence* on the other. This conception is applicable whenever there is definitely pronounced dominance. It is natural that the characteristic which possesses dominance should be looked upon as due to the positive or present element, the recessive being the consequence of its absence. Nevertheless there is as yet no strict proof that this representation is physiologically correct. For since we know that many factors may operate by inhibition it is always possible to *invert* the conventional representation and, by putting negative for positive, to make a factorial scheme which equally agrees with the observed results. Conventionally, for instance, the tall pea is represented as either *TT* (homozygous) or *Tt* (heterozygous), the dwarf being *tt*, from which the positive element *T* tallness is absent. But we cannot positively declare that the dwarfs may not be *TT* homozygous in the presence of an inhibitor *T*, whereas the tall plants might be either *Tt* heterozygous or *tt* homozygous in respect of the absence of this inhibitor. The significance of this alternative mode of representation will be apparent when the application of factorial systems to evolutionary theory is attempted (*see* MENDELISM). But when the heterozygote is intermediate between the two homozygous forms the "presence-and-absence" method of representation cannot be applied with any confidence. From the existence of such cases and from certain other considerations it has been urged, especially by American geneticists, that the method of representation by presence-and-absence is incorrect, and that a negative allelomorph should be treated as a real entity. There is no valid means of deciding this question as yet. The probability is perhaps that the absence should always be regarded as relative only. As a mode of symbolic expression the representation of the two allelomorphs as differing quantitatively is often convenient, though certainly not universally applicable.

Allelomorphism is, as the term implies, a relation between two alternatives, and in any one zygote there can be no more than two. Nevertheless there are instances in which the same unit-factor enters into heterozygous combination with various alternatives in different zygotes, and each of these may thus be in allelomorphic relation with it. Alternatives composing such a group of possibilities have been termed by Morgan *multiple allelomorphs*, and this expression is commonly adopted. Its use, however, makes the application of the term "multiple" to "factors" in a totally different sense a probable source of confusion, and for this reason the word *cumulative* or some equivalent is there to be preferred, as suggested above. The distinctions which together make up a set of multiple allelomorphs may commonly be recognized as a series of *quantitative* differences, the character affected being throughout the series the same. One of the most familiar illustrations is provided by the degree of albinism in rabbits. The fully albino form is white with pink eyes, but there is a variety called Himalayan, which, though born white with pink eyes, acquires some chocolate pigment in certain parts. Himalayan is dominant to albino but recessive to the ordinary coloured types. If a coloured type is bred with Himalayan the heterozygotes so raised cannot, when interbred, throw albinos, nor can heterozygotes raised from coloured × albino throw Himalayans, even though the albino used as their parent had itself been extracted from Himalayans. The degree of albinism put in by the parents comes out in F_2 and in the same degree. Hence it is not possible from similar parents to breed all three kinds, but, on the other hand, each family can contain at most two of them.

This phenomenon can be interpreted in either of two ways. The Himalayan pattern may be regarded simply as a quantitative diminution or fraction of the sum total of colour needed to make the self-coloured type. The real albino is thus produced by the absence of the whole unit needed for colour, and the Himalayan by the absence of part of this total. It is then obvious that the heterozygote, coloured × albino, could never produce a Himalayan unless the colour-complex broke up again *de novo.* But on the analogy of the behaviour of other colour patterns the self and the Himalayan might be conceived as each consisting of two units: one for colour and one a factor determining its pattern, intensity or distribution. If there were a very close linkage between each "pattern" factor and colour the observed facts could then be represented; but by continued breeding the supporters of this view would expect the missing cross-over eventually to appear as either a Himalayan associated with recessive albinos or an albino associated with recessive Himalayan. On the ground of simplicity the former view seems preferable. The significance of these two alternatives will presently appear.

More complex illustrations of these possibilities have been described by Nabours in certain grasshoppers (*Paratettix*). The species studied presents a long series of colour forms, and experimental breeding showed that with certain exceptions all the pure forms behaved as if allelomorphic to each other. In other words, whichever two pure forms *A* and *B* were crossed together, the F_1 generation was *AB* giving in F_2 a family approximating to 1*AA*:2*AB*:1*BB*. The whole series of colours is thus often described as a vast set of multiple allelomorphs. Nevertheless there are curious features in that case which raise a doubt whether this account is really correct. Many of the distinctions are plainly *quantitative* degrees in development of some one type of coloration which are, as might be expected, allelomorphic to each other (*cf.* the Himalayan rabbit); but among the elements comprising the total coloration of these grasshoppers there are several in which both the pigments and the positions they occupy are so distinct that the characters cannot easily be represented as determined by factors allelomorphic to each other. Only by a very loose application of the term colour can the distinctions be said to apply to the same character. Hence, in this hitherto generally accepted illustration it seems probable that, in so far as the distinctions are actually quantitative differences in one respect, true allelomorphism may be recognized, but that the appearance of an allelomorphism between factors of differing scope is more probably spurious, and referable to close linkage (*cf.* Haldane). No decision on this question can yet be made with any confidence.

Allelomorphic Complexes.—Among recent extensions of genetical theory none is more remarkable than the discovery that large and apparently miscellaneous groups of characters are sometimes governed by elements capable of segregating collectively as a single complex. Nevertheless, in the case of sex, we have long been familiar with one example. Since the distinction between the two sexes in many animals is known to behave in segregation as if it depended on a single Mendelian factor, we have to recognize that a number of distinctions of all kinds, structural and functional, may be treated in segregation as factorially single. In the special case of sex we know further that particular genetic elements may be detached from the complex (*e.g.* the elements governing spur and broodiness in fowls, the beard in man, etc.), though the possible limits of such disintegration are unknown.

Renner's experiments have shown that the inheritance of the protean variations of several Oenotheras is largely effected by the transmission of similar complexes. Each of these large composite factors or groups of factors (in so far as they prove to be divisible) may govern many characters of form, colour, habit, etc., and the whole group is transmitted as a single heritable entity. Similar discoveries will probably be made in regard to other forms. The details are beyond the scope of this article, but it may be remarked that these complexes in Oenothera supply one of the most striking illustrations of the phenomenon which may be called *unilaterality* (*see* "Somatic Segregation," *infra*) or the relegation of a factor or factors exclusively to one sex-side of a plant. For instance, whereas *Oenothera Lamarckiana*, the species which provided de Vries with his most celebrated but unsound evidence of mutation, can be proved to be a permanently heterozygous form having two complexes equally distributed in segregation to both the male and the female gametes, the species *biennis* and many more, though similarly heterozygotes of two complexes, in segregation pass the whole of the one complex into the male gametes and the whole of the other into the female gametes. The question whether the apparently simple factors which commonly behave as Mendelian units are capable of further resolution is of much theoretical importance in its bearing on the problem of the nature of variation. Such a complex factor as that which determines sex may evidently break up into simpler components, but for various reasons some geneticists incline to the belief that factors in general are permanent and irresoluble. Whenever a series in F_2, derived from two clearly distinct and true-breeding types, consists of a number of intergrading forms it is possible to interpret this result as due to the operation of a multitude of *originally* distinct factors, or to the fractionation of some one or more of them. Not very rarely in such series an extreme parental type fails to reappear at all (*e.g.* the many-feathered tail of the fantail pigeon [Staples-Brown], or the long glumes of Polish wheat) from crosses with ordinary types. It is difficult to interpret the absence of the extremes simply as an indication of their statistical infrequency. The recent production of an innumerable series of colour-forms, as in the sweet pea, is almost certainly due to the fractionation of the colour-complex. Until systematic crossing was undertaken, the extremes existed but the intergrades did not. So also in *Drosophila*, of which the normal eye is red, a profusion of intergrades ranging to the white eye, which was discovered first, has now appeared. Though "mutation" is involved, the essential change is probably the disintegration or fractionation of the originally integral complex.

(2) *Cytological Interpretations of Genetic Phenomena.*—Soon after the rediscovery of Mendelian analysis the plausible suggestion was made that the behaviour of the chromosome in the course of the maturation divisions was consistent with what might be expected if they were actually the bearers of segregable factors. Since, however, the number of segregating factors in many forms far exceeds the number of chromosomes possessed by those forms, it is clear that if the chromosomes are the carriers of factors they must be capable of carrying many. The discovery of linkage, and especially of the fact that linkage was determined by the parental associations of the factors, pointed in the same direction, for, as hinted (by Punnett) in the earlier article on Mendelism (*see* 18.118), linkage or "gametic coupling," as it was then called, might not unreasonably be supposed to be based on chromosomal association. The first development of this conception was made by T. H. Morgan, whose investigations, relating mainly to the fruit-fly *Drosophila*, have inaugurated a new phase in the development of genetical theory. This insect is a subject unusually favourable for experiment inasmuch as it offers a profusion of variations or "mutations," and reproduces itself with great rapidity under laboratory conditions.

The work began with the observation that the eyes, normally red, may be white, and that this variation is sex-linked, behaving genetically precisely as colour-blindness does in man. The white-eyed male mated with normal females produces offspring all normal. Of these the sons cannot transmit the abnormality at all, whereas the daughters mated with normal males transmit the white eye to half their sons. White-eyed females can only be produced as daughters of white-eyed fathers and all the sons of such females are white-eyed. Supposing the male to possess an X-chromosome, this system of descent would be represented if it were assumed that in the normal the X-chromosome carried the dominant factor for red eye (*see* SEX). The linkage with sex is thus found to be an expression of the association of the two determining factors for sex and red eye in the same chromosome.

Numerous other sex-linked characters were soon after discovered, to which the same considerations apply, all collectively composing one linkage-group. The other factors identified in *Drosophila*, amounting to more than a hundred, can all be represented as grouped in three separate linkage-systems which, with the sex-linked group, make *four;* and since from cytological observations the haploid number of chromosomes in this animal is also 4, the inference is drawn that the factors composing each linkage-group are borne in one chromosome. Developing this conception, Morgan suggests that the factors are arranged in the chromosomes as beads on a string, each having a position normally fixed in relation to the rest. Crossing-over is thus represented as the consequence of an exchange of material between homologous pairs of chromosomes in synapsis (*see* CYTOLOGY). The pairs of chromosomes which then conjugate are with much probability regarded as respectively of maternal and paternal origin. The conjugating pairs seem to twist round each other, and occasionally there is (especially in Amphibia) an appearance of anastomosis between them which is regarded as providing for an exchange of material between the homologous pairs, and thus for the formation of cross-overs. According as the linkage between two factors is more or less complete it is supposed that the distance between the position of the two factors in the chromosome is smaller or greater, and in proportion as factors are placed close together the probability of their being separated in the process of twisting and anastomosis is regarded as diminished. The proportion of cross-overs is thus taken as a measure of the position of two factors in the chromosome. If A, B, and C are three factors in one linkage group, and the closeness of the linkages between A and B and between B and C respectively be determined experimentally, then from these two the linkage between A and C can be calculated, and the result of the calculation is commonly found to agree with the value found experimentally for that linkage. In this way the relative "loci" of numerous factors have been determined with fair consistency, and the fact that this can be done forms a strong argument for the belief that in some way at least the factors must be disposed in linear systems. That these systems are actually arranged along the lines of the chromosomes is as yet a matter of inference. Attention must be called to the curious fact that in *Drosophila* crossing-over never occurs in the males in any of the 4 linkage-systems. As in every example of sex-linkage studied, the linkage with the sex-factor is always complete; but all the other factors are liable to crossing-over in the female, though among the male gametes the original parental combinations reappear unchanged. Conversely Tanaka, examining linkages in the silkworm, observed that a pair of linked factors show crossing-over in the male but not in the female, and the two facts together suggest some limitation of crossing-over to the sex which is homozygous in sex, the female in Diptera, the male in Lepidoptera. The development of the idea here outlined has become the subject of very active research and is described in a copious but somewhat esoteric literature which can be followed only with difficulty by those not personally engaged in the work. That the outcome of these researches has led to a valuable codification of genetic principles is not in dispute; but until the main thesis, that the number of independent factors or of linkage-systems is never greater than the haploid number of chromosomes, has been shown to hold generally for animals and plants, this account of the nature of linkage, though probable, cannot be regarded as proved. The defect of the theory at the present time is that it rests on many subordinate hypotheses which are not all capable of independent verification. The position of the factors, for example, is believed to be liable to changes due to the action of other factors, the effects of age and miscellaneous influences difficult to distinguish. Errors of cell-division, long regarded as the most probable source of variation, may also cause disturbance. In two very remarkable instances it has been found possible to connect a disturbance in the normal course of heredity with a visible cytological irregularity—called by Bridges "non-disjunction." In a certain family he observed that a sex-linked character failed to follow its normal distribution to the sexes, and he was able to find that in this family the sex-chromosomes showed corresponding irregularities. More recently (1921) he obtained similar evidence in regard to the fourth chromosome and the group of genes attributed to it. Thus a definite association between particular chromosomes and the transferable factors must certainly exist.

Giant-forms.—The interrelation of genetical and cytological phenomena is further illustrated by the behaviour of "Giant-forms." This name is applied to certain varieties (chiefly of plants) in which the haploid and diploid numbers of chromosomes are double those of normal forms. R. P. Gregory bred such varieties of *Primula sinensis*, and found that in respect of various allelomorphs they might be quadripartite and not merely bipartite as the normals are. A plant, for example, might be *DRRR* in colour or leaf-shape, and, in consequence of the extra recessive elements, not distinguishable from the ordinary recessive, though in fact capable of throwing a small proportion of dominants. Since recent cytological studies have shown that series of allied forms may contain various multiples of the lowest haploid number (*Chrysanthemum*, for instance, having 9, 18, 27, 36 or 45), various extensions on these lines may be expected.

Somatic Segregation.—In the genetics of plants a number of phenomena have been encountered which are difficult to reconcile with the view, otherwise not unacceptable, that the distribution of the factors occurs exclusively in the maturation processes of the germ-cells. Apart from certain special conditions, best known in variegated plants (which are sometimes irregular mosaics and sometimes consist of an outer "skin" and an inner "core," dissimilar in their genetical potentialities), there are many plants in which the distribution of factors must have been laid down before the formation of germ-cells. E. R. Saunders's results proved that in certain stocks (*Matthiola*) the pollen all carried doubleness though the ovules were mixed in character, single and double. C. Pellew showed that in the hermaphrodite *Campanula carpatica "pelviformis"* the pollen bore exclusively femaleness and preponderantly white flower-colour (the plant being heterozygous for blue). The pollen of *Begonia Davisii* (a wild species with single flowers) carries doubleness exclusively, and several similar examples are known, in all of which the segregation of characters must precede the maturation of the germ-cells. Thus, while it is not in question that segregation depends on some cell-division, and very possibly on a differentiation of the chromosomes, there is evidence that the cell-division in which this differentiation occurs must at least sometimes precede germ-formation. As mentioned, in *Oenothera* this "unilateral" distribution is exceptionally frequent.

Bearing on Evolutionary Theory.—This aspect of genetics can only be briefly treated here (*see also under* MENDELISM). Genetic analysis has shown that the appearance of variability as a contemporary and widespread phenomenon is largely illusory. On studying a variable species critically it is found that the various forms cannot all produce each other as was formerly assumed, but that they stand in a regular descending order, being terms in a series of combinations of definite factors. Such series are no evidence of contemporary variability. Many of the terms can be separated in the homozygous condition, and thereafter may breed perfectly true. Even such an appearance of variability as that seen in polymorphic species is frequently not above suspicion of being the consequence of a cross, more or less remote. Contemporary variation certainly may occur; but of the contemporary origination of new species, or of the occurrence of genetic changes which can be colourably interpreted as likely to lead to the production of incipient species in a strict sense, no indication has been found. That the forms of life have been evolved from dissimilar precedent forms we know from the geological record, but as to the process by which this evolution has come to pass we are still in ignorance. All that can be said with any confidence is that variation most commonly arises as an error of cell-division, and that conceivably new species have so arisen.

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(W. Bn.)

GENOA (*see* 11.597), the chief port of Italy and capital of the province of Genoa. Pop. (Dec. 1918) of the municipal area of about 12 sq. m. (*comune*) 272,221, or, with suburbs (*circondario*), 577,449. The latter figure includes the now contiguous industrial quarter of San Pier d'Arena on the west and a growing residential quarter beyond the Torente Bisagno on the south-east to which the Via Venti Settembre gives direct access. Before the World War there was a marked activity in house-building, but the only buildings of note recently erected are the imposing Banca d'Italia in the Via Dante and the Hotel Miramare above the principal station. The improvement of the Piazza de Ferrari, the central square, was begun in 1913: blocks of houses adjoining the 6th-century church of S. Ambrogio were demolished and the area opened up. The historic Palazzo San Giorgio underwent complete restoration and transformation between 1890 and 1914 and became the headquarters of the Harbour Board (*Consorzio*). A fine new sea-front, the Corso d'Italia, adds considerably to the attractiveness of the new residential quarter.

The birth-rate in 1913 was 20·6 and the death-rate 17·64; 23·25% of the latter were children below the age of five and 11·8% of these died before the age of one year. Mortality was due mainly to pulmonary diseases, heart affections and infantile diarrhoea. The meteorological station (alt. 147 ft.) records the highest mean annual rainfall of the twelve Italian stations of which statistics are available—52 inches. The average number of rain-days is 117. The mean annual temperature is 59·6° F. with a mean of 72·6° in summer and 48·1° in winter and an absolute maximum and minimum of 98·4° and 16·7° respectively. During 1916–8 eighteen earthquake movements were recorded.

The total value of the trade in 1916 was 4,581 million lire, or 39% of that of all Italy. The following table shows the fluctuations of trade in tonnage.

	Imports.	Exports.	Total.
1910–1913 (average)	6,210,000	1,230,000	7,440,000
1914	5,930,000	1,080,000	7,010,000
1915	6,560,000	900,000	7,460,000
1916	6,870,000	840,000	7,710,000
1917	5,090,000	430,000	5,520,000
1918	4,530,000	300,000	4,830,000
1919	5,210,000	430,000	5,640,000

The marked drop in imports which began in 1917 was due mainly to the great decrease in coal—590,000 tons in 1917 as against a previous yearly average of 3,140,000 tons. About 6,600 vessels (exclusive of sailing craft) of an aggregate tonnage of 6,700,000 entered and cleared in 1919, compared with an average of 12,000 vessels of 14,340,000 tonnage during 1911–3. The British share in shipping in 1913 was 1,260 vessels of 2,900,000 tons. The passenger traffic of Genoa (including emigration) had normally amounted to about half a million annually, but it fell to 45,000 in 1916. Emigration decreased from 42,000 in 1914 to 1,500 in 1918.

The port has warehouse and shed capacity for 300,000 tons of general merchandise in addition to coal and cereals. A daily average of 1,000 trucks can be loaded and unloaded. The doubling of the railway track to Pisa and the development of the marshalling station at San Pier d'Arena and of the Genova Brignole station, 3 km. east of the principal station, on the main line to Pisa and Spezia, have aided the improvement of port facilities; also the extension of electric power to the main line towards Turin, and to Savona and beyond on the line along the coast. The power for the latter is supplied by plant of 80,000 H.P. at Cuneo. The new Vittorio Emanuele basin, equipped with up-to-date plant, was nearing completion in 1920 and the construction of the larger basin of San Pier d'Arena had been begun. Shipbuilding (merchant) is increasing in importance; seven steam vessels of 6,900 total tonnage, nine of 7,570 tons and ten of 28,650 tons were built in 1916, 1917 and 1918 respectively.

Woollen factories have been established; the manufacture of felt and straw hats is increasingly important and there is a considerable motor-car industry. The construction of an underground electric railway $6\frac{1}{2}$ m. in length, with 14 stations, connecting San Pier d'Arena with Quarto, $2\frac{1}{2}$ m. east of Genoa, was proceeding in 1920.

GEODESY (*see* 11.607 and 8.801).—The term "Figure of the Earth" is sometimes used to denote the form of the sea-level surface or geoid, and sometimes to denote that spheroid of revolution, or three-axial ellipsoid, which most nearly fits the geoid. It is best to confine its use to the latter sense, so that a "determination of the figure of the earth" means the derivation from the results of observation of the lengths of the axes.

The values obtained by J. F. Hayford in 1909 (1) were:—

Equatorial radius of the earth	6,378,388 ± 18 metres.
Reciprocal of flattening	297·0 ± 0·5
Polar semi-diameter	6,356,909 metres.

These figures define a spheroid which certainly fits the northern geoidal hemisphere very closely. Helmert (2), examining Hayford's figures, arrived at somewhat larger probable errors, namely ± 35 metres and ± 0·8, but even so the uncertainty is small.

In the southern hemisphere, however, there have hitherto (1921) been no determinations of importance; and the extension of the African arc, which now stretches from Port Elizabeth to near the northern boundary of Rhodesia, and its ultimate connexion with the Egyptian triangulation are much to be desired.

In 1915 Helmert (3) deduced a value of the flattening from numerous gravity observations and found 1/296·7 ± 0·6. This agrees very closely with Hayford's value and is an important corroboration. The advantage over previous determinations of the figure of the earth enjoyed by his solution lies in the fact that the results of the astronomical observations have been corrected by computing the attraction of all the topography up to a great distance from each station under the assumption of isostatic compensation (*see* below). This procedure undoubtedly frees the astronomical results from a large proportion of the effects of local attraction and so brings the local vertical into much better agreement with the normal to the spheroid than if the correction had not been applied. This solution of Hayford's is in fact so satisfactory that it may almost be said that the problem has been solved.

Geodesy now turns its attention to finding the actual form of the geoid, that is to say, the level or equipotential surface of the earth which corresponds in ocean areas with mean sea level.

This form will be defined with reference to a spheroid of revolution, and it is not a matter of much importance what spheroid is chosen as the figure of reference so long as it fits the actual geoid reasonably well. Whatever spheroid is selected, careful measurements will reveal the fact that the geoid is slightly irregular with regard to it. The spheroid may be assumed tangential to the geoid at any one point; the two surfaces will not usually be coincident elsewhere. The inclination between the normal to the geoid and the normal to the spheroid is called the deflection of the plumb-line.

The relation of the geoid to the spheroid and the necessity for making the assumption that they are tangential to one another at some arbitrarily chosen point have not always been kept clearly in mind. The idea has been held that the deflection of the plumb-line was everywhere something real and measurable, if the means of measuring it could be found; whereas in reality the spheroid of reference has no existence in nature, and in order to fix this imaginary surface with reference to the real geoidal surface it is necessary to assume that at some particular point the two surfaces touch each other or are parallel. It is not necessary to assume that the origin of the survey is the point at which the surfaces are parallel; we may assume that there is a deflection of the plumb-line there, or not, just as we please. Once the deflection at the origin, the height of the latter above the spheroid, and the axes of this spheroid have been selected, deflections at other points may be derived. If this is done at sufficient points the separation of the geoid from the spheroid can be deduced, and, as the form of the spheroid is known by assumption, that of the geoid also becomes known. The determination of the plumb-line deflections is made by means of a combination of results derived from observations to terrestrial and astronomical objects. If the deflections are found to vary smoothly, so that it appears justifiable to derive intermediate values by interpolation, it becomes possible to integrate the separation of geoid and spheroid due to them, and so arrive at the separation at any point in the area dealt with.

In regions where the deflection is large it is generally also irregular and then interpolation between ordinary triangulation stations may prove inadequate, and it may be necessary to fix additional intermediate stations by triangulation and to make the necessary astronomical observations at these.

An alternative method of measuring the separation of geoid and spheroid may be based on the measurement of vertical angles between triangulation stations, combined with spirit levelling. To do this it is necessary that the plumb-line deflections at the stations shall have been determined. The ray from one station to another is curved in a vertical plane by atmospheric refraction. If this (5) refraction is known it is a simple matter to compute the height of the observed station (whose distance is known) above the horizontal plane through the observing station. It is, however, necessary to find the height with respect to some general datum surface. As the form of the geoid, that is to say the mean sea-level surface, is still unknown, and is in fact one of the objects of the measurement, it is impossible to make a formula applicable to it, and it is necessary to have recourse to some assumed reference figure, and the obvious figure is the spheroid which has already been used in connexion with the deflections of the plumb-line. The vertical angles corrected for refraction can be reduced to the spheroidal vertical by applying the component of the plumb-line deflection, and then it is quite straightforward to compute the height of the observed point above the spheroid. By means of spirit levelling it is possible to find the geoidal height of the station observed, for spirit levelling with its short rays intimately follows the geoidal level surface. Both spheroidal and geoidal heights of the observed points are thus obtained and the difference between them is the separation of geoid and spheroid.

It has not generally been pointed out that the triangulated heights and spirit-levelled heights are not strictly the same thing. Triangulated heights have very rarely been properly reduced, taking account of plumb-line deflections and refraction, and so have not meant anything very precise, but they are certainly not geoidal heights. Geoidal heights have many practical uses and are what would generally be required by engineers, but from the geodesist's point of view they do not mean much until the form of the geoid, to which they refer, has been determined.

Isostasy.—The theory of isostasy postulates that the apparent excesses of matter in the earth's crust, consisting of continents and mountains, and the apparent deficiencies, corresponding to oceans, are compensated by underlying variations of density, mountains being compensated by a low density and oceans by a high density in the material below them. These variations of density constitute the isostatic compensation of the topographical features.

In 1909 Mr. Hayford of the U.S. Coast and Geodetic Survey published his work on the figure of the earth and isostasy (8); he suggested the idea of isostatic compensation being complete at a depth small in comparison with the earth's radius; that is to say, he supposed that all those arrangements of crustal density required to make good the deficiency of height in a column under the sea, or to balance the excess of height in one under a mountain, would be found in a crust of moderate thickness, and that all matter at a greater depth was either homogeneous or arranged in homogeneous layers. He also assumed, partly from considerations of convenience, that the excess or defect of matter was distributed uniformly from sea level to that depth, which he named the "depth of compensation." Computing the attraction of the visible topographical features upon those stations of the U.S. Triangulation at which the deflection of the plumb-line had been determined, and trying the effect of isostatic compensation complete at various depths, he arrived at the conclusion that the most probable depth of compensation is 122 kilometres. Using this depth and calculating the deflections that the visible topography and its compensation would produce, he finds that the average residual, that is the difference between the observed and the calculated deflection, is only one-tenth of what it was before the correction for compensation was applied. From this he concludes that in the U.S.A. the existence of a close approximation to isostatic equilibrium is proved, and that this equilibrium is complete at a depth which does not differ very greatly from 122 kilometres.

Hayford's hypothesis was subsequently applied to the pendulum stations of the U.S. C. and G.S. (9) and the results obtained were in good accord with those deduced from the deflections of the plumb-line. The hypothesis was also applied to the deflections and pendulum observations in India but the results did not appear to be so favourable. In a further discussion of the American results Mr. W. Bowie (10) endeavours to trace a connexion between the gravity residuals and the geology of the regions surrounding the stations, and has a certain measure of success. He points out, however, that if there is, for instance, a surface sheet of dense rock of wide extent, compensated by lightness in the deeper crust, the pendulum will not be able to reveal the fact, for the attraction of an extensive disc on a point above its centre is independent of the height of the point so long as the height is small in comparison with the radius of the disc, so that the effect of the excess of matter in the dense sheet of rock immediately under the station will be *exactly* counterbalanced by the negative effect of the corresponding deficient density in the lower strata of the crust. If the dense sheet were of small extent the pendulum would reveal its presence, for its closeness to the pendulum would make its effect more potent than that of the more deeply situated deficiency which compensates it, and gravity would therefore be greater than if the whole were homogeneous. Sir Sidney Burrard (11) applies the idea of allowing for geological peculiarities to India, where the Gangetic plain is an example of an area covered by alluvium of low density which probably extends downward to a considerable depth. He also shows that the distribution of crustal density required to account for the low values of gravity found at stations of the Gangetic plain will go some way, at least, towards explaining the high values of gravity found at stations along the margin of the alluvium. The excess of density required in the deeper parts of the crust, to make good the lightness of the alluvium, will from its position exert a positive attraction on a pendulum off the alluvium on either side, more than sufficient to counteract the negative effect of the lightness of the alluvium itself, for the latter will be nearly in the same horizontal plane as the pendulum and therefore unable to produce any appreciable downward pull, so that there will remain a somewhat greater attraction on stations off the alluvium than if the whole had been homogeneous. These considerations tend to remove the discrepancies between the results of observation and those of calculation in the Gangetic and Sub-Himalayan region and Sir Sidney Burrard concludes that the Gangetic trough is isostatically compensated.

The depth of compensation is not a quantity which should be regarded as definitely determined. Mr. Bowie finds a good deal of evidence for a smaller depth of about 96 kilometres. In average country the effect on the computed deflections, or values of gravity, of changes in the assumed depth are so small that the evaluation of the depth cannot be very precise.

Base-Line Measurements.—The system introduced by E. Jäderin of Stockholm, of measuring with stretched wires, may be said to have superseded the older methods and it is improbable that any kind of bar will again be used for this purpose. It is now recognized, moreover, that nothing is gained by measuring a short base with extreme accuracy as this accuracy is lost in the process of connecting the base with a side of the primary triangulation. The best course is to measure a side of the primary triangulation itself, but it is not often that this can be done, though the use of stretched wires instead of bars makes it possible to carry base measurements over much more uneven ground than of old. Jäderin's original plan was to use two wires having different coefficients of expansion and from the difference between their lengths, as disclosed in the process of measuring, to deduce their temperature. In the United States, where tapes are generally used, uncertainty as to the temperature was much reduced by the expedient of making the measurements by night. The discovery of "Invar" by C. E. Guillaume almost entirely removed the need for these special precautions. A wire of the thickness generally used, namely 1·65 mm., is not much heated by the rays of the sun and the error made in assuming that its temperature is the same as that of the air is not large. The average coefficient of expansion of invar is about 4×10^{-7} per 1° C., so that an error of $2\frac{1}{2}°$ C. in the adopted temperature of the wire would produce an error in the measurement of only 1/1,000,000. The methods of making measurements with invar wires have been closely studied by Benoit and Guillaume (12) and their procedure may be confidently followed.

For the standardization of the wires at the observatory, before and after the measurement of the base, different methods of laying out a length of 24 metres, which is the usual length of the wires, have been employed. An apparatus designed by Sir David Gill for the trigonometrical survey of India is fully described in *Engineering* 1915.

The ultimate standard of length which was supplied with this apparatus is a nickel bar of H section one metre long. Standards for ordinary use are H bars of invar one metre and four metres in length. Invar has been observed to undergo a secular change in length which continues for many years. This constituted a serious drawback, but according to a recent investigation by Guillaume the instability is due to the presence of carbon which gradually forms cementite, Fe_3C, with the iron. The addition of chromium, which has a greater affinity for carbon than iron has, prevents this, and an invar with tenfold increased stability has been produced.

Triangulation.—For measuring horizontal angles the use of theodolites with horizontal circles of more than 12 in. diameter is now unusual. For primary triangulation the use of opaque signals has now been almost entirely abandoned. Luminous signals, *i.e.* heliotropes by day and lamps by night, are universally employed and there is a tendency to regard the night as the best time for observing horizontal angles, though for vertical angles it is necessary to choose the time at which refraction is most steady, namely from about 1 to 3 P.M.: at this time of day refraction is also a minimum.

In countries where continuous sunshine is rare the night is no doubt preferable to the day, but where sunshine can be counted on the best results for horizontal angles, that is to say those least influenced by lateral refraction, are probably to be obtained from a combination of day and night measures.

Control of Triangulation.—As triangulation extends from its initial base errors are generated and controls are required to prevent these errors from accumulating unduly. These are provided by the measurement of additional bases and by introducing Laplace points at suitable intervals along the triangulation. At Laplace point, where the azimuth is observed astronomically, and the longitude determined by telegraph, a check is introduced on the triangulated azimuth precisely similar to that given by an extra base on the triangulated length of the side. The question to be decided is the proper interval at which bases and Laplace points should be introduced. When the error in length of side generated in the triangulation is probably two or three times as great as that of a base it will be desirable to introduce a check base. The formulae of de Graaff Hunter (14) give the means of calculating the probable error accumulated in the triangulation.

In the first place a quantity $M=(1+f)m\sqrt{\frac{18}{l}}$ for each series of the triangulation under discussion is to be computed. This quantity measures the precision of the series and enters into the determination of the probable error. In it $m=\sqrt{\Sigma\Delta^2/3n}$ is Ferrero's error of mean square of a single observed angle, f is a factor ranging from 0 to 1/6 depending on the type of figures of which the series consists, and l is the average length of side in miles.

Then P.E. in seconds of azimuth of terminal side of a series

$$=1''\cdot575\sqrt{\Sigma M^2S}$$

P.E. in 7th place of log. of terminal side of a series

$$=33\cdot2\sqrt{\Sigma M^2S}$$

in which S is the length of the series in units of 100 miles. The summation is for different series for which values of M differ. If one straight series only is considered the above quantities become:

$$1''\cdot575M\sqrt{L}$$

$$33\cdot2M\sqrt{L}$$

where L is the length of the series in units of 100 miles. It may be pointed out that there is no symbolic difference between azimuth error expressed in radians and error in Napierian log. side, and with these units the same description applies to one or other.

If we take $1/10^6$ as the probable error of a measured base it will be desirable to introduce a check base as soon as the probable error of the length of a side of the triangulation amounts to three times this quantity; this stage is reached when

$$33\cdot2M\sqrt{L}=3\times10^7\times\log.\ (1+10^{-6}).$$

In first-rate triangulation the value of M will be about 0·2, using this value L = 384 m.

If ΔA = astronomic—geodetic azimuth, Laplace's equation becomes

$$\Delta A.\text{cosec}\ \lambda_0—\Delta A\ \text{cosec}\ \lambda=(L-L_0)-15T$$

where $(L-L_0)$ is the computed longitude difference and T is the difference between the local times at the two ends of the triangulation.

This equation serves to determine ΔA whence the true geodetic azimuth follows. The P.E. of an azimuth observation, δA, may be estimated at about $0''\cdot2$ in high-class work, that of T at about $0^s\cdot03$, or $\delta L=0''\cdot45$, hence in latitude 45° the P.E. in azimuth determined from a Laplace equation is $\sqrt{(\delta A^2{}_0+\delta A^2+\delta L^2\sin^2\lambda)}=0''\cdot4$, which in radians is roughly 2×10^{-6}. This is twice as large as the value which was adopted as the P.E. of a base and shows that the precision of azimuth and longitude observations must be increased if they are to be brought up to the standard already reached in base-line measurements; that is to say, it indicates that in the case of triangulation in which M is as small as 0·2 it would not be justifiable to attempt to control the azimuths by means of frequent Laplace points unless the observations at the latter can be improved.

Determinations of Height.—The precision of spirit levelling is so great as to justify the recognition of the lack of parallelism of the various level surfaces, each of which is approximately spheroidal. It is nowadays customary in levelling of high precision to apply to the observed differences of height the correction (15) (16) for the convergence of these surfaces, that is to say the orthometric correction, and to publish the orthometric heights.

As regards differences of height found by triangulation much improvement is called for. Refraction has always been a source of great uncertainty, and it has perhaps been looked on as more intractable than it really is. Further research is required. Few field observations provide suitable material for investigating the question, owing to lack of information as regards (*a*) plumb-line deflection, without which it is impossible to reduce the observations to the reference spheroid, and (*b*) rate of change of the density of the air with height, on which the refraction depends. A consideration (5) of the ordinary physical laws leads to a formula which represents very well the refraction usually met with, when these are not burdened with error due to neglect of plumb-line deflection.

Observed vertical angles are referred to the local geoidal vertical; when reciprocal observations have been made at two points A and A_2, if E_1, ω_1, δ_1 are respectively the angle of elevation, the refraction and the deflection at A_1 towards A_2 and with changed suffixes for A_2, then

$$E_1+\delta_1-\omega_1+E_2+\delta_2-\omega_2+c=0$$

where c is the angle between the verticals at A_1 and A_2. It has been customary to neglect δ_1 and δ_2 and to assume $\omega_1=\omega_2=\Omega$, whence the equation becomes

$$\Omega=E_1+E_2+c=0.$$

As $\delta_1+\delta_2$ may easily exceed the error of observation and as ω_1 and ω_2 are appreciably different, values of refraction so deduced are of little value. There is no reason why this state should continue. Properly reduced vertical angles will give good values of heights above the selected spheroid and the differences of these heights from the heights obtained by spirit levelling will reveal the separation of the geoid from this spheroid.

Astronomical Latitudes.—For the observation of latitude the Zenith telescope and the Tallcott-Horrebow method seemed to have superseded all others (*see* 11.610), but the prismatic astrolabe and the method of equal altitudes have advantages for special purposes which entitle them to consideration. This instrument, which was invented by MM. Claude & Driencourt (17), determines the time and the latitude simultaneously, thus doing the work of the Zenith telescope and the transit instrument at the same time. Those who have used the astrolabe claim that a set of observations (18), which can be made with an instrument of small size in two hours, suffices to determine the time within one-tenth of a second, and the latitude within one second of arc. It is probable, however, that the time observation is liable to be considerably affected by the personal equation of the observer.

The principle of the prismatic astrolabe is that of equal altitudes. The axis of the telescope is horizontal. In front of the object glass an equilateral prism is mounted with its edges horizontal and the face next the object glass vertical; below, and slightly in front of the prism, there is a bath of mercury. The rays of light from a star at altitude 60° strike the upper face of the prism perpendicularly and are reflected from the opposite face into the telescope; the rays which fall on the mercury are reflected upwards, strike the lower face of the prism at right angles, are then reflected from the opposite face and enter the telescope parallel to the rays which reached the prism direct; thus two images of the star are formed in the telescope which approach each other as the star approaches the altitude of 60° and then separate again. The observation consists of noting the time at which the images pass each other. Each observation of this kind gives a locus, analogous to a "Sumner" line in navigation, on which the zenith of the station of observation must lie. Three such observations to suitably situated stars should, if everything were perfect, result in three concurrent lines, but will in general produce three lines forming a triangle and care must be used in deciding on the true position of the zenith, which will not necessarily be inside the triangle. If four stars are observed the case is clearer and it is advisable therefore to observe four stars as a minimum; of these one should be in each quadrant of the heavens; that is to say, one to the N.E., one to the S.E., one to the S.W., and one to the N.W. of the station at the moment of crossing the circle of 60° altitude. When the observations have been made the chronometer error and the latitude of the place can be deduced from them by means of a simple graphical construction which gives results as accurate as the precision of the observations allows. If certain preliminary computations have been performed beforehand the graphical method can be carried out very quickly and the results obtained in a few minutes after the completion of the observation.

Longitudes.—The development of wireless telegraphy (*see* SURVEYING) has removed the chief difficulty of determining the longitude and there is now no reason why astronomical longitudes should not be used as freely as astronomical latitudes.

The time signals emitted by the Eiffel tower in Paris are of an accuracy superior to that of any ordinary determination of local time, and they have been picked up without much difficulty (1921) by means of a portable apparatus at a place as far from Paris as Dehra Dun, India, to which the distance along a great circle is about 60°. The "Scientific time signals" are sent out from Paris at 23·00 G.M.T. (civil). After certain warning signals, 300 dots are sent at equal intervals, the whole occupying about 293 seconds. These are heard in a telephone in which the clock-beats are also produced. It is only necessary to note the time at which there is a coincidence between a dot and a clock-beat. The precise time of the first and last of the 300 dots is also signalled and a simple computation connects the clock with G.M.T. With good hearing conditions there seems little room for personal equation in this part of the observation. In the determination of the local time there is less certainty; unexplained differences of 0·1 and even 0·2 occur.

Thus in the Paris–Washington arc, 1913–4, the values obtained by the interchange of the American observers were:—

$$\overset{h}{5}-\overset{m}{17}-\overset{s}{36}\cdot549\pm\cdot0051 \text{ and } \overset{h}{5}-\overset{m}{17}-\overset{s}{36}\cdot758\pm\cdot0027$$

A similar difference was obtained when the French observers were exchanged. Two separate determinations of the Greenwich–Paris arc gave $\overset{m}{9}-\overset{s}{20}\cdot977$ and $\overset{m}{9}-\overset{s}{20}\cdot910$. These differences have been the subject of discussion (19), and are receiving a good deal of attention; it is to be hoped that the source of error will be discovered and that longitudes correct to 0·01 sec. will be obtained.

Longitude determinations are required in order to provide Laplace points for the control of the triangulation and also for the investigation of the deflection of the plumb-line. The use of wireless telegraphy will greatly facilitate the former because in the past it has often been difficult to find a place where it was possible to get a connexion with the telegraph wires and also to make satisfactory azimuth observations. By the multiplication of longitude stations knowledge of the deflection of the plumb-line in the prime vertical will be much improved, especially in low latitudes where the effect of such a deflection on the azimuth is so small that the comparison of observed and computed azimuths is incapable of giving trustworthy results.

Gravity.—A very important addition to the half-seconds pendulum apparatus designed by Col. R. von Sterneck (*see* 8.809) of the Austrian survey is the means of measuring and correcting for the movement set up in the stand by the swinging pendulum. This movement is named by German observers "das Mitschwingen"; in the Coast and Geodetic Survey of the United States it is called "the flexure." Probably the best English word to describe it is "the sway."

Two methods of measuring it are in use. The C. and G.S. measure the actual to-and-fro movement of the top of the stand by means of an interferometer (20). The effects of different amounts of movement on the pendulum's time of oscillation are found by experiment and an empirical formula is used for reducing this time to what it would have been if the stand had been perfectly rigid. The movement is expressed as a fraction of the width of one of the bands or fringes in the interference grating. Using monochromatic sodium light it was found that a movement of 0·1 fringe corresponded to a correction of $17^s\cdot8\times10^{-7}$ in the time of vibration of the half-seconds pendulum. A movement of 0·1 fringe means a linear displacement of the pendulum support of $0\cdot029\mu$.

The other method introduced by Prof. Schumann (20a) of the Prussian Geodetic Institute is as follows: Two pendulums of equal period are suspended on the stand, with their knife-edges parallel to each other and in the same horizontal plane. Of these one is set swinging, the other being at rest, and the rate at which the latter acquires an oscillation, from the swaying of the stand induced by the swinging of the former, is a measure of the rigidity of the stand and affords the means of computing a correction to the time of oscillation. With this method the probable error of the correction derived from four observations, two taken before and two after a series of pendulum swings, is about $0^s\cdot5\times10^{-7}$. The amount of the correction where circumstances are favourable may be expected to be about $40^s\times10^{-7}$.

The absence of means of determining the correction for sway was perhaps the principal source of uncertainty in the results of the older series of pendulum observations and the methods which have been described formed an important advance.

Numerous observations with pendulums for the determination of the force of gravity have been made of recent years in various parts of the world and the effect of applying the theory of isostasy to the computation of the normal value has been extensively tried in America and in India. By normal value is here meant that value which is arrived at by the use of the formula which gives the force of gravity at sea-level in any latitude and the application to that value of the correction for the height of the station above sea-level, and for the attraction of the topography of the whole earth with its isostatic compensation.

The formula deduced by Helmert from the discussion of a large number of observations in different parts of the world was

$$\gamma_0=978\cdot030\,(1+0\cdot005302\sin^2\phi-0\cdot000007\sin^2 2\phi)$$

(*see* 8.801).

For the area of the United States it was found that an equatorial value of 978·039 (9) agreed better with the observed results, and in India the value of 978·041 (21) was found the best.

In 1915 Helmert (3) deduced a formula from the 3,000 stations which had been reduced to the Potsdam system by Borrass in 1912, in which he supposes the equator to be an ellipse so that the longitude L as well as the latitude ϕ has to be taken into account. The formula is:—

$$\gamma=978\cdot052\left\{(1+\underset{\pm7}{0\cdot005285}\sin^2\phi-0\cdot000007\sin^2 2\phi+\underset{\pm4}{0\cdot000018}\cos^2\phi\ \cos2(L+\underset{\pm6}{17^\circ})\right\}$$

This formula is applicable to continental stations situated at least 100 km. from the edge of the continental shelf, that is from the 110-fathom (200-metre) line.

It is assumed that the semi-axes of the equatorial ellipse differ by 230 metres and that the major axis lies in 17° W. longitude. Clarke (4) in 1878 deduced an elliptical equator in which the semi-axes differed by 465 metres, the major axis lying in 8°15′ W. longitude.

The advantage of using an elliptical equator seems rather questionable; it would appear preferable to regard inequalities of the equatorial radius as deviations of the geoid from the spheroid of reference rather than as fulfilments of a mathematical law, but it is of interest to know that the geoid presents such an irregularity.

For measuring the force of gravity at sea various kinds of apparatus have been tried. The underlying idea is to balance the weight of a column of mercury against a pressure, which is either constant or measurable, and which is independent of gravity.

Hecker used the pressure of the atmosphere as in an ordinary barometer and measured it by means of boiling-point thermometers. Duffield has tried an aneroid in place of the boiling-point thermometer and more lately has balanced the mercury against a constant mass of air, the whole apparatus being closed. The success so far attained is not very great but the last-mentioned device seems capable of improvement and may prove a satisfactory instrument.

The variation of gravity on land has been studied by Baron Roland Eötvös (23) (24) (25) with an instrument of quite a different kind, namely, the Gravity Torsion Balance. This instrument does not measure the force of gravity but the rate of change in the force of gravity at any point and the direction in which that rate is greatest.

The force of gravity γ, in latitude ϕ, is given by the formula $\gamma=978\cdot00(1+0\cdot00531\ \sin^2\phi)$ C.G.S., hence the change in γ corresponding to a change of 1″ in latitude in latitude 45° is $25\cdot2\times10^{-8}$, and the length of 1″ of meridian in latitude 45 being about 3,100 cm. the change in 1 cm. is $8 \cdot 1 \times 10^{-9}$. Along the parallel there is no change. These are the normal values. The Torsion balance determines the actual rates of change at the point of observation and the direction in which this rate is a maximum. Eötvös calls this maximum rate the "Gravity Gradient," Gr(g). The instrument consists of a light horizontal tubular beam 40 cm. long suspended from its centre by a fine platinum wire about 50 cm. long; at each end of the beam there is a weight of 28 gr., the one inserted in the tube and the other hanging from it by a thread about 60 cm. long. The whole is enclosed in a case so constructed as to protect the interior as far as possible from inequalities of temperature. The case is capable of being rotated on a vertical axis into different azimuths, and it is by measuring in each of a series of positions the amount of torsion of the suspending wire that is required to balance the small forces acting on the beam and tending to cause it to take up a position coinciding with the direction of Gr(g), that the direction and magnitude of Gr(g) are determined.

The quantities which the Eötvös balance is capable of measuring are almost incredibly small, 1×10^{-9} C.G.S. being rather larger than the average of the differences which it is able to detect. The data furnished by this instrument afford the means of tracing the form of the geoid and, after the effects of the visible topography have been allowed for, of detecting the presence of subterranean irregularities of density. A large number of observations with this instrument have been made in Germany since 1917 under the direction of the Prussian Geodetic Institute, chiefly with the object of studying its applicability to geological research; that is to say, for the location of masses of abnormal density.

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(G. P. L.-C.; J. DE G. H.)

GEOGRAPHY (*see* 11.619).—The application of geography to matters connected with the World War and the peace settlements took two main directions. The first was concerned with all those special naval and military studies and operations of which the results are expressed principally on maps (*see* MAP). The other showed geography in what may be termed its encyclopaedic aspect, in which, to a prefatory description of a territory in its topographical and (so far as appropriate) its geological, botanical, and other scientific aspects, there must be appended a discussion of its social, political, and economic conditions, its communications, history, and so forth: in short, an account of the activities of its inhabitants in whatever direction. For example, much work of this general character was executed by British intelligence organizations such as the geographical section of the Naval Intelligence Department and the historical section of the Foreign Office, the French *Service Géographique de l'Armée*, and others. Most of this work was carried out by organizations created *ad hoc*; much of it was of permanent value apart from its immediate military and political uses; and, generally speaking, it indicated many desirable directions for geographical research and the collection of data, which might have been placed on a permanent footing but for restrictions imposed by financial considerations after the war.

Expressed in the broadest terms, the keynote of geographical study on this side is the relation of man to his geographical environment. A natural corollary is to view the world first in natural regions, as defined by physical conditions of climate, relief, vegetation, etc.; afterwards to correlate ethnographic, linguistic and political divisions with these. The study and definition of natural regions, at any rate on broad lines, is specially associated in Britain with the name of Andrew John Herbertson, professor of geography in Oxford University. This division of the earth into natural regions, and the influence of the conditions of each upon its inhabitants, is obviously capable of application not only on broad simple lines to the world generally, but locally and minutely in special areas. In this last direction there is an almost infinite field for research: it is necessary at all times that its practical application should be kept in view, and trivialities, on the one hand, and too bold generalizations, on the other, avoided.

This relationship between man and his environment as prescribed by natural regions has thus become a leading motive of geography, in research and as an educational subject, in Britain and in Europe, especially among French and German geographers, and elsewhere through the local and individual work of such investigators as Prof. J. Cvijić in the Balkan area. In the United States, too, this view of geography has taken firm hold, though here it did so later, as at first the modern development of geographical study tended rather towards the physiographical side (land forms) alone. In the wider field such workers as Ellen C. Semple, Prof. R. de C. Ward, W. L. G. Joerg, Prof. I. Bowman, and others, turned their attention to many parts of the world, but especially, perhaps, to their own country, and a proposal was made to the Association of American Geographers that, by way of a basis, a map dividing the United States into physiographical provinces should be prepared with the collaboration of all American geographers and institutions interested.

Distributional surveys, whether physical or ethnographical or economic, or of whatever sort, are in fact the chief requirement of this branch of geography, though the prospect of their being put in hand on international or even national lines is remote. In certain special directions international action has been taken, as for example the expression of the need, and the laying down of certain general principles, for a series of international aeronautical maps, which was voiced in the convention for aerial navigation signed by about 30 States in Paris in Oct. 1919. But a proposal for an International Geographical Union, which arose out of the formation of the International Research Council in 1918 by national academies of the principal Allied Powers, was not welcomed with unanimity, although one was formed for geodesy and geophysics. It was not only as regards geography among the sciences, however, that doubt was expressed as to the present possibility of working international unions, in view of the preoccupation of workers with the reorganization of their individual work at home. Such work is largely concerned with the establishment of geography as an educational subject (see below). As a special example apart from this, mention may be made of the work undertaken in 1919 and following years by a permanent British committee representing the Admiralty, the War, Foreign, Colonial, India, and Post Offices, the Boards of Trade and Agriculture, and the Royal Geographical Society, which was charged with the preparation of lists of standard spellings of geographical names, the divergent systems or lack of system characteristic of maps and geographical works hitherto having been found to be a real inconvenience in geographical investigations during the war.

Education.—The position of geography in the British educational system came periodically under discussion before the war, and had been materially strengthened in some directions, but not in all. The war, for obvious reasons, broadened interest in this subject, and its consideration was actively resumed in and after 1917. Broadly speaking, it may be stated that the position of geography was consolidated as an elementary educational subject, and that its appeal was widened as a university subject, as evidenced by the establishment of honours courses in geography and the endowment of professorships (*e.g.* Cambridge University geographical tripos, 1919; chair of geography and anthropology, University College, Aberystwyth, 1918). Geography had become widely studied as a subject for the school certificate examination, although complete agreement had not been reached as to its exact scope for this purpose: for example, while one syllabus began with the study of the distribution of land and water, another went farther back, to demand some knowledge of the position of the earth as a planet, and its movements. The subject is recognized as valuable, not only for its own sake as teaching something about the world, but as a pointer to special directions of study, such as geodesy, surveying and military topography, and as an essential adjunct to such subjects as history and economics, and certain aspects of biology. It was in regard to these special applications, and particularly so far as they are appropriate to advanced courses in schools, that the position of geography in education remained weak: a subject so elastic in comparison with other school subjects must necessarily be difficult to define by means of a syllabus, and it did not find wholly satisfactory expression in advanced text-books. Regarding geography thus, as a species of pivot for the study of other subjects, we may be in danger of assuming that so long as these other subjects are viewed and taught with a proper conception of the place of geography in them, the teaching of geography itself is of no consequence. But the geographical view and teaching can hardly be ensured if they be left dependent upon teachers and students of kindred branches of learning, as indeed has been sufficiently demonstrated by the position of geography in education down to quite recent years.

Exploration.—Even though virgin areas of the earth's surface be now few, explorers have still many fields in which to labour at the filling-in of details. Meanwhile in the Arctic and Antarctic regions, especially the latter, there are still large areas unknown, despite the work of important expeditions (*see* Polar Regions). In Africa plenty of geographical knowledge remains to be acquired. Here and in the tropical islands of the Malay Archipelago, especially New Guinea, where at many points development by white men is only in an early stage, exploration may be regarded as almost within the routine duties of European administrators, and is more or less constantly in progress.

The other principal fields for exploration are Canada and Alaska, and certain parts of South America and Asia. As regards Canada and Alaska, in addition to the investigation of the Arctic coast lands, reference may be made to Mr. Howard Palmer's study (1910) of the orography of Mt. Sir Sandford and its vicinity in the Selkirk range, B.C., to Dr. J. Norman Collie who was travelling north of the Yellowhead Pass in 1911, and to other investigators who extended the detailed knowledge of the Canadian Rockies in various directions. The research committee of the National Geographic Society granted $5,000 for the continuation in 1911 of the glacial investigations in Alaska by Prof. R. S. Tarr and Prof. L. Martin, who led the Alaskan expedition of the Society in 1909–10 in the region of Yakut Bay, Prince William Sound, and the lower course of the Copper river. The demarcation of the Alaska–Canada boundary, running for 600 m. along the meridian 141° W., occupied commissions under Messrs. T. D. Craig (Canada) and T. Riggs (United States) from 1907 to 1914, when about 200 permanent boundary marks were erected. In connexion with exploration reference may be conveniently made to the investigation of natural resources, on which subject the Canadian Commission of Conservation has issued a valuable series of reports (down to 1920), dealing with water-power in British Columbia, power (including water, coal and natural gas) in Alberta, etc.

In South America, Major Fawcett in 1910 undertook further exploration in Bolivia, in the valley of the Heath and adjacent territories. Following upon earlier reports by this officer, work on the demarcation of the Brazil–Bolivia boundary was proceeded with in 1911–2. In Jan. 1911 Col. A. J. Woodroffe led a party of British officers lent to the Peruvian Government for the demarcation of the frontier with Bolivia, and the work was carried on in 1912–3. The Yale Corporation sent an expedition to Peru in 1911, under the direction of Prof. Hiram Bingham, with Prof. Isaiah Bowman as geographer and geologist, and Mr. K. Hendrikson as topographer. It was divided into three parties, to carry out archaeological, topographical, and geological explorations, and had three fields of operations—the Urubamba river and its affluents, a trans-Andean section from the head of navigation on the Urubamba to the Pacific, and the vicinity of Mt. Coropuna (the estimated height of which was reduced to 21,700 ft.) and Lake Parinacochas. Notes on the human and economic geography of the region were collected by Bowman, who followed up this work by making another journey in 1913, when he made similar studies in the Andes of north-west Argentina, the Titicaca-Poopo basin, and the desert of Atacama. Prof. W. Sievers in 1909–10 placed the true source of the Marañon (upper Amazon) in the glacier of Mt. San Lorenzo. In 1912–3 Dr. Hamilton Rice was at work in the north-west of the Amazon basin, S.E. of Bogotá, Colombia, and in the same years Dr. Koch-Grünberg made a second expedition in northern Brazil, about the headwaters of the Branco and the Orinoco and the connecting waterway of the Cassiquiare.

Among recent journeys in central Asia may be mentioned that of Mr. D. Carruthers, whose party, in 19 months' work (1910–1), covered much ground in the upper Yenisei region, Mongolia and Dzungaria. In the same years the French traveller Dr. Legendre carried out important exploration in western China, especially in the valley of the Yalung between 28° and 30° N. In India, Sir M. A. Stein investigated (1911–2) numerous sites of archaeological interest in the course of an exploratory journey on the north-west frontier, and in 1913–5 extended his researches in the Lop-nor, Turfan, and other areas, including the Pamirs. The punitive expedition (1912) against the Abors in the north-east added considerably to topographical knowledge in spite of extreme difficulties of transport, heavy forests, and misty and wet weather. One party explored the River Dihong as far as Shimong for the first time, and carried mapping above that point; another surveyed the Padam Abor country; others, again, broke new ground in the Galong Abor country and in the valley of the Subansiri. Considerable corrections were found necessary in existing maps. In 1913 the Indian and Russian triangulations were connected, after an arduous piece of survey through the difficult country from Gilgit up the Hunza gorge and over the Kilik pass. Maj. P. M. Sykes continued his journeys in Persia, and in particular studied the problems connected with the ancient territory of Parthia. Dr. A. Musil in 1910 made further explorations in northern Arabia, in the region adjacent to the Hejaz railway. He claimed to have accurately identified for the first time the Mount Sinai of the Bible. The extensive surveys carried out in Mesopotamia during the war may fairly be mentioned in connexion with exploration; the information previously available, both cartographical and verbal, concerning this country was found on critical examination to be unreliable in many directions. The surveys executed in 1914–8 covered nearly all southern Mesopotamia, with adjacent parts of Persia and Arabia.

In 1920–1 an expedition having for its objects the ascent of Mt. Everest, and (as ancillary thereto) the scientific study of the territory surrounding the mountain, was organized by the Royal Geographical Society and the Alpine Club. The consent of the Dalai Lama of Tibet was secured, and arrangements were made to despatch a reconnaissance expedition during the summer of 1921 so as to determine the best direction for attempting the ascent, which should be undertaken in 1922. Col. C. Howard Bury was appointed chief of the expedition, and Mr. H. Raeburn as leader of the reconnaissance. (O. J. R. H.)

GEOLOGY.—Progress in scientific geology during 1910–21 is here discussed in four sections: (1) cosmic, (2) dynamical, (3) structural and (4) stratigraphical.

I. COSMIC GEOLOGY

Cosmic geology (*see* 11.648) deals with three main groups of problems: (1) the early history of the earth as inferred from its composition and structure, and from analogy to other heavenly bodies; (2) the physical conditions which by their influence on climate have controlled the origin and evolution of life on the earth; (3) the plan of the earth or distribution of continents and oceans as determined by the upheaval and sinking of the surface and by the formation of the valley systems due to dislocations of the earth's crust. On all these questions scientific opinion had become more definitely crystallized by 1921, through the further discussions during the previous decade.

The Origin of the Earth.—The origin of the earth may be learned either from study of its composition and structure or from cosmogony and its analogy to the stars. Only a small proportion of the earth's materials are available for direct observation, but indirect methods have demonstrated three facts about the inaccessible interior. It is hot, heavy, and consists of zones having very different physical properties. That the interior of the earth has a high temperature is shown by hot springs, by the warmth of deep mines, by the molten condition of the lavas that are raised to the surface through volcanoes, and by the evidence that all deep-seated rocks have been either melted or re-crystallized under great heat. The temperature below the surface rises at a rate which is known as the geothermic gradient. The average rise has been often estimated as about 1° F. for every 53 ft. of descent. The high temperature of some Queensland hot springs would, unless their water came from a much greater depth than the layers reached by the wells, indicate a gradient more than twice as fast. On the Rand goldfield, on the other hand, the rate may be five times as slow, for at the Village Deep mine it is only 1° F. for every 253·9 ft. of descent. The rate of increase is naturally quickest near active volcanoes, and it varies in accordance with the geological history of an area and the composition and thermal conductivity of the rocks. The famous observations at the Rose Bridge colliery at Wigan showed that the geothermic gradient varied from 1° F. for 33 ft. to 57·7 ft.; in the upper part the rate was 1° F. for every 57·7 ft., in the lowest part the average was 1° for 48·2 ft. A persistent increase of 1° F. for 50 ft. would amount to approximately 100° per m.; so the temperature would be at 2,000° F. at the depth of 20 m., and at 100 m. deep would be of solar intensity. It is, however, probable that the material of the deeper parts of the earth is a better conductor of heat than the rocks of the crust; so the geothermic gradient may become more gradual in depth and below perhaps 40 m. the temperature may be almost uniform, and 2,000° F. may be the highest temperature within the earth.

The second certain fact about the inner earth is that its material is much heavier than the rocks of the crust. The average specific gravity of the crust is about 2·5, whereas that of the earth as a whole is about 5·7. The heaviness of the internal material may be due either to its condensation by pressure or to its composition largely of heavy metals. That the latter explanation is correct is indicated by the evidence of meteorites, of radioactivity, and of earthquakes. Meteorites are fragments of heavenly bodies which fall on to the earth from outer space; they show that not only do the extra-terrestrial bodies consist of the same chemical elements as the earth, but these elements compose the same compounds and mineral species, which are grouped into the same kinds of rocks. Meteorites are divided into two groups: (1) stony meteorites or aerolites, which are composed of such minerals as olivine and bronzite, that are found in the rocks of the earth's crust,[1] and (2) iron meteorites or siderites, which consist mainly of an alloy of iron and nickel.

That the earth includes a great central mass of metallic material similar to that of the iron meteorites is indicated by its high specific gravity, which is explained by the earth consisting of a heavy core, the barysphere, surrounded by a lighter stony shell, the lithosphere.[2] The specific gravity of the ordinary iron meteorites is about 7·75, so that the earth's specific gravity of 5·7 indicates that the metallic exceed the stony constituents.

The comparative thinness of the lithosphere is also indicated by radioactivity. The earth is radioactive to an extent that can be explained by the limitation of its radioactive minerals to a shell of about 40 m. thick. Among the few materials that are not radioactive are the iron meteorites. Hence the radioactive phenomena of the earth are consistent with its structure as a stony shell of about 40 m. thick surrounding a core of nickel-iron.

This conclusion was first suggested from the propagation of earthquake waves. The late Prof. Milne was thereby led to the conclusion that the earth consists of a rocky shell about 40 m. thick, and of a denser, more rigid core, composed of a material which he called "geite," and which he regarded as mainly composed of nickel-iron, like the iron meteorites. Later study of the distribution of earthquake waves by Dr. R. D. Oldham has shown that within the barysphere is an inner core, which occupies about a fifth of the earth's diameter and does not transmit earthquake waves. This centrosphere in that respect behaves like a gas.

Various lines of evidence therefore together indicate that the earth probably consists of a centrosphere which may be gaseous; of an intermediate layer, the barysphere, which forms the bulk of the earth and consists mainly of nickel-iron; and of an outer shell, the lithosphere, which is probably about 40 m. thick, and forms the rocky crust of the earth. This structure would be the natural result from the condensation of a swarm of small heavenly bodies with the average composition of the meteorites. How the swarming may have happened we have to inquire from cosmogony, which presents two rival hypotheses: the nebular theory attributes the earth to a cloud of white-hot gas, and the meteoritic theory to a swarm of cold meteorites.

According to the nebular theory of Laplace the solar system was originally a cloud of incandescent gas that extended beyond the orbit of its outermost planet; as this mass cooled and contracted the matter collected into rings, like those around Saturn or of the Ring Nebula in Lyra. All the matter in each ring was gradually collected into a planet and its satellites, which continued to revolve around the sun along the circle occupied by the ring from which they were formed. As the outer zone of the nebula cooled first the central mass has remained the hottest, and thus the sun is nearest to the condition of the original nebula. This theory brought into one logical and consistent scheme so much observational material that it was almost at once accepted, and for a century and a half dominated speculations on the history of the solar system and interpretation of the heavenly bodies. Further observation by improved telescopes discovered important facts consistent with the theory. The nebulae include bright compact clots indicating local concentrations of material, and also empty spaces, such as the Eyes in the Owl Nebula. Many nebulae rotate, for the rays of the spiral nebulae are bent backward; nebula M 101 is estimated to rotate once in 85,000 years. Further coincidence with the requirements of Laplace's theory is that the nebulae are not spherical but disc-shaped; that in Andromeda, being seen obliquely, appears elliptical, and that in

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[1] The elements proved by Sir William Crookes (*Phil. Trans.*, 1918, vol. 217A, pp. 427–30) in the stony meteorites include iron, chromium, magnesium, nickel, silicon, sodium, manganese, potassium, aluminium, and calcium, in addition to oxygen, hydrogen, and carbon; so that they consist of the elements which form the bulk of the earth's crust. The proportions of the four chief constituents of many stony meteorites are so similar that Sir William Crookes (*ibid.* p. 426) suggested the possibility of their all having been derived from the disruption of one planet intermediate between Mars and Jupiter, while he suggests that the nickel-iron meteorites were of a different origin or derived from the core of the same planet.

[2] The mineral species found in aerolites are characteristic of the basic rocks; but the existence of acid meteoritic material has been claimed, from the obsidianites found chiefly in Australia. These obsidian buttons have forms found also in fused flue-dust; their microscopic structure suggests that they are due to the fusion of dust by lightning during dust storms, and that they are aerial fulgurites.

Berenice's Hair, seen edgewise, appears as a line with a thickened centre. Laplace's theory explained why, with a few insignificant and intelligible exceptions, all the bodies of the solar system travel round the sun in the same direction and nearly in the same plane, for it represents them all as having been part of one lens-shaped mass.

The spectroscope added striking support to the nebular hypothesis by Huggins' discovery in 1864 that the nebula in Draco consists of incandescent gas; while later proof of the solidity of the material in spiral nebulae is consistent with their representing a later stage than that of the nebula in Draco. Such nebulae would include white-hot particles, though the average of the mass would be cold. The spectroscope also revealed the fact that the different heavenly bodies consist of similar materials. Most of the terrestrial elements are known in the sun, in which hydrogen, calcium, iron, carbon, and sodium are especially conspicuous. It is true that the only material yet recognized by the spectroscope in some nebulae is the light gas, nebulium, and that the solar corona consists mainly of coronium; both these elements are unknown on earth. Despite such exceptions the spectroscope has demonstrated the uniformity of material throughout the solar system and the general unity of matter.

Laplace's theory was therefore regarded as firmly established by astronomical observation finding so many agreements with its requirements. Weighty mathematical and physical considerations, however, tell against it. A cloud of white-hot gas as tenuous as a nebula and surrounded by the intense cold of outer space should cool almost instantaneously. The luminosity of the nebulae is one of their still mysterious properties. "We have no knowledge," says Hale (*Stellar Evolution*, 1908, p. 206), "why they glow with a steady and unchanging light, since there is no direct evidence that this light is produced either by heat or by electrical excitation."

The objections to the nebular theory which have carried the greatest weight are those founded on the distribution of energy in the solar system. Jupiter possesses only 1/1000 of the total mass of that system, yet possesses 95% of the total energy of rotation. The mathematical objections are regarded by Chamberlin, Moulton and See as absolutely fatal to the theory, while Jeans remarks (*Problems of Cosmogony*, 1919, p. 274), "it seems probable, although by no means certain, that we must abandon the Nebular Hypothesis of Laplace." According to Hale (*op. cit.* 1908, p. 186) it must be reconstructed or abandoned.

The chief rival to the nebular theory is the meteoritic theory, which regards the various stellar systems as formed, not by the cooling of clouds of incandescent gas, but by the aggregation of innumerable small meteorites. The meteorites coming together are heated by collision and pressure until they are fused into a solid mass. The meteoritic theory has three chief forms. The first, due to Sir Norman Lockyer, trusted to the infinite numbers of meteorites in space to provide ample material for the star systems. The numbers are indeed infinite. Any observer may see about seven per hour on any moonless, cloudless night, and from this number it is calculated that from 10 to 15 million enter the earth's atmosphere every day. It has been calculated that they occur through space on an average of 200 m. apart. Most of those which fall on the earth are minute, and they are pulverized by friction with the atmosphere into dust, the quantity of which is relatively so small that it would take aeons for the earth to add one cubit to its diameter by this process. The earth may, however, have formerly received more of this material, as it is travelling along a path which has now been swept clear of meteorites; it is chiefly those that are travelling on irregular paths through space which fall upon the earth, though Sir Norman Lockyer recognized that many meteorites travel round the sun on regular orbits like minute planets. The objection that the number of meteorites is too small and gravity too weak to collect them into swarms led to a second form of the hypothesis—the planetesimal theory of Chamberlin (*Geology*, vol. ii., p. 4, 1906). He assigned the chief constituents of the planets to meteorites which are moving in orbits around a common centre. He described them as "infinitesimal planetoids or planetesimals." The theory in this form had the attraction that it explained the segregation of the meteorites, but in his later statement of it (*Origin of the Earth*, 1916) the planetesimals are relatively unimportant and the planets are attributed to clots formed in rays shot out from a star which has been disrupted by the close approach of another star. The constituents of these clots revolve around a secondary centre and are minute satellites, not planetesimals. If a star be thus disrupted two antipodal rays would be projected from it, and during its rotation the ends of the rays would lag behind as in spiral nebulae; the segregation of the material in the rays into clots would produce the planets.

A third form of the meteoritic theory, that of T. J. J. See, represents space as originally crowded with meteoritic dust which has gradually collected around larger bodies and thus slowly built up star systems.

All varieties of the meteorite theory agree in assigning the origin of the earth to an aggregation of cold meteorites which have been welded into a solid body by collision and pressure. This theory seems to offer the most probable explanation of the origin of the earth, but the form that is most likely to gain acceptance is uncertain. As Mr. Jeans remarks (*op. cit.* p. 288), "the time for arriving at conclusions in Cosmogony is not yet come." The evidence available, however, justifies the conclusions that the world is an iron projectile, hardened, like those of modern artillery, by nickel, and whirling through space; that it was probably due to a swarm of meteorites, which fused into a compact mass; and that during its consolidation the metals settled downward into the core, the barysphere, while the lighter stony materials floated like a slag to the surface and there solidified the lithosphere or crust of the earth.

The Origin of Life on the Earth.—The physical conditions on the early earth also bear on the problems connected with the origin of life on it, which has been explained as introduced from some other world. The conditions on the earth were probably as favourable to the independent generation of life as any we can assume elsewhere. The formation of living from dead matter by processes still in operation has been claimed as probable by Sir E. A. Schafer in his presidential address to the British Association (1912); but it more probably happened in the early days of the earth under the special atmospheric and climatic conditions which prevailed in primeval times.

Living matter consists mainly of compounds of carbon, many of which have been made artificially. The carbohydrates can be made by inorganic processes and also altered into the more complex amino acids, which are the physical basis of living tissues. A carbonaceous jelly which has many of the properties of living matter can be made artificially, and would probably have been formed naturally under the conditions prevailing when the earth was young. The vitalization of this inorganic material would have resulted from the formation of a catalytic agent concentrated in a small spot or nucleus, which would control the subdivision of the growing mass of jelly when its size became too large to be stable. Chemical research on the carbon compounds has shown that there is no insuperable difficulty in the production of organic materials from non-living matter, without the intervention of a living organism. The process by which the non-nuclear carbonaceous jelly was developed into the primitive organism Protobion, as it has been called (Gregory, *Making of the Earth*, 1912, p. 231), by the development of a nucleus which acts catalytically probably through some phosphoric constituent, is the gap still left in explaining the origin of life. The environment on the muddy shores of the primeval sea, when the atmosphere was richer, warmer and moister than that of the present day, and changes of temperature were slight, would have been especially suitable for this momentous development.

Geological History in Relation to Cosmic Theories.—Life once established would probably have developed steadily since the earth's surface comparatively soon reached an average temperature and climatic conditions which have persisted throughout later geological times, though there may have been rhythmic minor oscillations. The geological history of the earth is better concordant with the meteoritic than with the nebular hypothesis. On the latter would be expected a series of progressive changes throughout geological time, the climate becoming colder as the sun and interior of the earth cooled, volcanic activity diminishing as the crust thickened and the surface of the fluid rock material lay deeper, earth movements losing vigour though generally following the same lines, and the oblateness of the earth increasing as the equatorial bulge enlarged under the unceasing influence of rotation. It has also been held that the age of the earth must be comparatively short owing to the limited heat supply in the solar system.

Calculations as to the age of the earth based upon the rate of the loss of heat from the sun led to the belief that its duration must be relatively short, and the estimates have varied from possibly as little as 13 million years to perhaps as long as 100 million years. The recognition of other sources of heat, such as atomic disintegration, has, however, released geology from the short mathematical limits on the age of the earth.

In a paper by Prof. H. N. Russell, read before the Royal Society, March 10 1921, the estimated age of the earth was given between 2,000 million and 8,000 million years. Geologists and cosmogonists now assume practically as great an age for the earth and the solar system as they find convenient, and 1,000 million years is a moderate minimum.

The progressive changes that would appear to be the natural consequence of the nebular theory are not indicated by geological evidence. Instead of a steady advance throughout the ages there have been rhythmic oscillations about a general average. Thus the climate of the earth as a whole has been of about the same order throughout geological time; the oldest sandstone in the British Is., the Torridon sandstone, was formed under desert conditions, and the size of its grains and the position of wind-polished surfaces on the pebbles show that the wind was of the same power and had the same prevalent direction as at present. The evidence of some of the oldest rocks shows that in the earliest geological times glacial conditions prevailed in parts of Canada, Spitsbergen, and North Siberia, while a little later (in the Cambrian period), central China was glaciated and ice floes floated in the seas of Australia up to the tropics. The climate of the world in the earliest geological periods was therefore no warmer than that of to-day. In Carboniferous times prolific vegetation grew the materials for the world's chief coal-fields, but at the same time glaciers existed in central India, south-eastern Brazil, South Africa and Australia.

Similarly, volcanic action shows no steady decline in power; periods of world-wide volcanic activity due to violent disturbances of the crust have alternated with periods of general volcanic rest.

The shape of the earth has doubtless throughout geological time been approximately an oblate spheroid, but it has been deformed to an irregular geoid by the hard crust sinking in places to follow the shrinkage of the internal mass. The excess of crust was most readily disposed of by subsidences on four surfaces producing the oceanic basins, while raised areas antipodal to the depressions formed the continental masses. The major subsidences have thus produced periodically a tetrahedral deformation, which was corrected, whenever sufficiently developed to render the crust unstable, by spheroidal recovery accompanied by relatively quick and tumultuous earth movements. These major subsidences and uplifts have been accompanied by the buckling of belts of the earth's crust into the great fold mountain chains; these movements happened at four main periods of mountain formation, represented by the Grampian folding of north-western Europe in the pre-Cambrian; the Caledonian movements at the end of the Silurian; the Hercynian, which at the end of the Carboniferous produced the older east-to-west mountain chains from Asia across Europe to North America; and the Alpine-Himalayan and west American mountain systems in the middle of the Cainozoic. Each of these great periods of earth movement was followed by intense climatic disturbance with local glaciations, and rapid biological evolution. Temporary changes in the environment were intensified by rearrangement of ocean and continent due to crustal movements across the older geographical structures.

Earth movements have not only determined the major elevations and depressions of the crust, but also the secondary depressions, such as sunklands, due to the subsidence of areas along peripheral faulting, rift valleys due to sinking of bands of country between parallel faults, and fiords due to formation of valleys along intersecting fractures when broad areas of hard rock have been raised in dome-shaped uplifts (Gregory, *Origin of Fiords*, 1913). The one change on the earth that has been apparently progressive has been the restriction in space of violent crustal movements. The Eozoic rocks, those of the older pre-Cambrian times, are steeply tilted in all parts of the world. Later rocks are often nearly horizontal, and steep tilting in them is confined to belts connected with mountain-forming movements; for with the growing strength and thickness of the crust the movements necessary for its accommodation to the reduced size of the earth have been concentrated along narrow bands.

The probable future changes in the nature of earth movements may be inferred from the study of the moon, which of all heavenly bodies is perhaps of most interest to the geologist, as, owing to its proximity, it is the one of which we have fairly precise information as to its topography. The map of the visible side of the moon is indeed more complete than that of the earth. The topography of the moon, like that of the earth, includes wide sunken areas, the "maria" which correspond to oceanic basins, long narrow mountain chains which are composed of parallel ranges, and volcanic craters, some of which are apparently still active. The most characteristic features of lunar topography are numerous ring-shaped mountains named vulcanoids; they surround circular or polygonal depressions and may correspond to volcanic caldrons, but are much larger than those on earth. They were first regarded as volcanic craters, but their intimate structure shows that they are composed of concentric ridges and neither of radial lava flows nor piled rings of volcanic ash. They have also been interpreted as impact rings raised by the fall of colossal meteorites; a theory which, however, does not account for their distribution. The moon differs from the earth by the mountain chains being relatively fewer and more fragmentary. The moon probably had a similar early history to that of the earth, but passed through the early stages more quickly because as a smaller body it cooled faster and acquired a thicker and less easily folded crust. It has apparently no shell resting upon a plastic layer, by sliding over which it can accommodate itself to changes of shape rendered necessary by the contraction of the interior. Owing to the absence of this frictionless layer and occurrence of the tremendous monthly changes in temperature the vertical movements on the lunar crust are more important than the horizontal. The chief younger lunar mountains are due to the vulcanoid subsidences, not to the crumpling of narrow belts. The ridges on the moon which appear to be fold mountains are old and broken, for it has reached a stage in which their formation has either ceased or is dormant. The moon moreover, as it rotates on its axis only monthly instead of daily, is less flattened at the poles, and has not the folds parallel to the equator which are so important in the earth's geography.

The moulding of the moon's surface by denudation must be very different from that on the earth: the moon having practically no atmosphere and no surface waters, its rocks are not subject to ordinary decay and wear, but, owing to the absence of an atmosphere and its day lasting for a terrestrial fortnight, it undergoes violent changes of temperature which must shatter the rocks and cause the fragments, by their lengthening and contraction at every change from day to night, to creep down even gentle slopes. The level areas on the moon are therefore probably covered by a sea of talus which spreads over them like the flow of the stone rivers of the Falkland Is., but is effective on gentler gradients.

The aspect of the moon indicates the probable future of the earth when, by continued cooling of the interior, the crust has become much thicker and more rigid. Its condition forecasts the state of the earth at some future time when its relief will be due almost entirely to vertical movements as the crumpling of belts of the crust will have ceased, and when horsts and sunklands due to faulting and valleys due to subsidence instead of to erosion will be the dominant features in the topography. (J. W. G.)

II. DYNAMICAL GEOLOGY

Volcanoes (*see* 28.178, 11.657).—The most important later advance in our knowledge of the processes of volcanic activity is in the study of the gaseous emanations of volcanoes. These have been somewhat elaborately investigated in regard to Kilauea. Water vapour was found even in the gases most directly collected from the central lava column, associated with permanent gases, consisting mainly of carbon dioxide and monoxide, sulphur dioxide, nitrogen and hydrogen, with some free sulphur, chlorine, fluorine and perhaps ammonia. This group of gases, associated together at a temperature of 1000° C., cannot be in equilibrium; the hydrogen could not exist, except temporarily, in presence of the dioxides of carbon and sulphur, nor the free sulphur in the presence of carbon dioxide; chemical reactions would take place, all of which are accompanied by the evolution of heat. Other reactions, between the gases and the protoxide of iron in the lava, equally give rise to the evolution of heat, and in this is found an explanation of Brun's experience that when obsidian is raised to the temperature at which gases are freely evolved nothing can stop its expansion into pumice, the accession of heat from within, owing to chemical reaction, assisting the rapid expansion of the gas by a weakening of the containing walls of the cavities. It may be added that these chemical reactions also afford an explanation of the long distances to which some lava flows have been known to travel, the preservation of sufficient fluidity being due, not merely to the protective effect of a poorly conducting shell of solidified lava, but to the continued accession of heat.

At the time of its appearance much attention was attracted to A. Brun's theory, that the volcanic exhalation was essentially anhydrous. Subsequent investigations, especially on Kilauea, have not borne out his contention in detail, and the theory has been generally rejected, at any rate in English countries; yet there is a probability that it may not be far from the truth, so far as paroxysmal eruptions are concerned. The generally accepted opinion, that the propulsive agency in these is predominantly steam, seems to be due to the resemblance in form between the cloud formed over a volcano in eruption, and clouds of condensed water vapour, formed in the upper air; to the presence of water vapour in the fumaroles on the sides of volcanoes, and in the emanations from lava flows; and to the occurrence of heavy rainfall in connexion with violent eruptions. The last-named is, however, by no means an invariable accompaniment, and may be readily explained by the induced uprush of air which, in a humid atmosphere, would give rise to heavy rainfall; and as regards the first, the resemblance is equally great to the clouds of smoke issuing from a furnace. Nor can dependence be placed on resemblances, for clouds may be caused by other vapours than that of water, and one formed of such vapour, mixed with the impalpable dust of an eruption, may be indistinguishable in appearance from the ordinary aqueous clouds of the atmosphere.

Direct observation is ordinarily impossible in a violent eruption, but, in 1911, G. Ponte was able to collect gas issuing from a lateral outflow of lava, derived directly from the column of lava in the central neck of the volcano, then in violent eruption. Analysis of the gas showed it to be composed mainly of carbon dioxide, with some nitrogen, sulphurous acid, sulphuretted hydrogen, nitrogen-carbon monoxide and methane but no water vapour. This observation is confirmatory of Brun's contention, and, even as regards Kilauea, there are some general considerations bearing on the question. Water is one of the end products of the reactions between magmatic gases which have been referred to above; the eruptions of Kilauea are of a quiescent type, in which many of these reactions have taken place before the gases escape, and observations show that the percentage of water vapour is less in those collected most directly from the lava as it ascends from the central pipe, dropping to only 4% in the collection made most directly from the issuing lava. In more violent eruptions, where the gases issue more nearly in the composition with which they are released from the magma, the proportion may well be less than this, and even drop to nothing. Brun's observation that the fumaroles nearest the crater of Vesuvius, having temperatures of 400° C. or more, yield very small amounts of water vapour, has been confirmed by Perret on Vesuvius and Ponte on Etna, but the most pertinent fact is, probably, the presence of chlorides of iron, magnesium and aluminium in the ashes of the cone, and within the crater, after violent eruptions of Vesuvius. Being deliquescent these minerals could not have crystallized in the presence of saturated steam, and equally could not have been formed in the presence of superheated steam, as they would then have been decomposed with the formation of oxides, at temperatures even below 500° C., much lower than that of the escaping gases of the eruption. There is, therefore, reason to suppose that water vapour, as such, may be absent from, or form a trivial proportion of, the gases issuing from the vent of a volcano in violent eruption; it would be formed, after issue, as the result of reactions between the components of the highly heated ascending column of gases, and by union of hydrogen with the oxygen of the atmosphere. This supposition is, moreover, in keeping with the modern trend of conjecture regarding the nature of the fluidity of the magma, according to which the effect formerly ascribed to water is now frequently attributed to hydrogen, either free or in combination with other elements than oxygen.

Earthquakes (*see* 8.817, 11.659).—Not much has been added in more recent years to our knowledge of the character and effects of earthquakes. The ultimate cause is still very incompletely understood, but it has become clear that *faults*, of structural geology, are much less directly connected with earthquakes than was formerly supposed. It still remains established that the vast majority of earthquakes are caused by the shock resulting from dislocation of the solid material of the earth's crust, due to fracture consequent on a state of strain, but the detailed examination of the Californian earthquake showed that this strain was radically different in character, and the result of some quite different cause, from that which produced the San Andreas fault, along which visible displacements took place. The earthquake was not, in fact, an incident in the growth of the fault, nor the fault the cause of the earthquake; the real connexion of the two being that the fault produced a plane of weakness, along which relief of the growing strain took place, and so controlled the local distribution of the intensity of disturbances. It is probable that detailed investigation would yield a similar result in the case of other earthquakes, where a visible connexion between the violence of the earthquake and the existence of structural faults has been observed, for another result of the examination of the Californian earthquake was to show that the fracturing of the crust, to which the felt earthquake was due, was but the secondary result of a more deep-seated disturbance or bathyseism, and that this bathyseism, the exact character and depth of which are still unknown, gave rise to the long-distance records commonly attributed to the earthquake proper (*see* SEISMOLOGY). Though, as has been said, nothing is known of the character of the bathyseism, it may be connected in some way with the changes of volume consequent on a redistribution of the chemical elements composing the material in the interior of the earth, which are referred to in the section dealing with the origin of mountain ranges; according to the ingenious speculations of Mr. W. H. Goodchild it is probable that some of these changes may take place with great, even explosive, rapidity, and so might easily give rise directly or indirectly to both the earthquake proper and the long-distance record.

The study of the periodicity of earthquakes has given some curious and interesting results. According to the tabulation of 20 years' record of the Italian seismological service there is, in Italy, a well-marked diurnal periodicity, giving a well-marked maximum frequency at about two hours after midnight, and a period of low frequency extending from about 9 A.M. to 5 P.M. with a minimum at about two hours after midday, the maximum frequency being almost twice as great as the minimum and the number of earthquakes occurring during the 12 hours of the night being very close to half as many again as the number recorded during the 12 hours of the day. The subject has been elaborately investigated and the periodicity shown to be a real one, not to be accounted for by any imperfection of the record. Though certainly real, the particular form of periodicity applies only to Italy, other regions differing in this respect, and no satisfactory explanation has been offered. It is evidently not due to tidal stresses set up by the attraction of the sun, for the periodicity completely disappears when the record is tabulated by lunar instead of solar time; there is, however, another peculiarity of frequency which does seem attributable to this cause. In any record of sufficient extent to be usable, it has been found that the relative proportion of day shocks to night shocks is slightly greater during summer, and slightly smaller during winter, than the general average for the whole year. The variation from the mean is small, not exceeding 6% in the most extreme case which has been investigated, and is generally less; it can only be detected when a large number of records are investigated, but as the same relation has been found repeated in the only two cases where the record has been discussed in terms of lunar hours and declination, it may be accepted as real, and very probably connected with the different distribution of the tide-producing stresses during the day and night, according to the varying declination of the sun and moon. Whether this conclusion be accepted or not, the very smallness of the effect shows that earthquakes are uninfluenced, except possibly, and very insignificantly, as to the actual time of occurrence, by any cause exterior to the earth; they are a purely terrestrial phenomenon, due to actions which take place within the outer crust of the earth and, therefore, the study of them is distinctly a branch of geology.

Origin of Mountains (*see* 11.659).—The problem of the origin of mountain ranges, and incidentally of the major inequalities of the surface of the earth, stands in a very different position from that which it held in 1910. At that time it was recognized that in some of the elevated tracts of the earth there was no obvious connexion between geological structure and orography, but in other cases, of which the Alps were a type, it had been observed that there was very intense disturbance and compression of the rocks, that the strike of the folds, into which the rocks had been thrown, agreed with the general direction of the range; and in these cases, regarded as "true" mountain ranges, it was believed that the surface elevation was due to a thickening of the crust consequent on the compression indicated by the disturbance of the rocks.

Even in the Alps there were difficulties: the compression is not simply towards the principal crest of the range, but large blocks of strata had been thrust from the southern limit of the range to near the northern, and though it was possible to explain this by a gradual southward migration of the central axis of compression many difficulties arise in the course of such explanation. Another point, which could not easily be met, is the want of a relation between the degree of compression and the height of the mountains. The Himalayas, also regarded as a true mountain range of Alpine type, are about twice as high as the Alps, but the amount of compression of the rocks is, if anything, distinctly less. In the course of the decade 1910–20 other ranges were studied; the Andes are now known to exhibit much less compression of the strata than the Alps, less in fact than many lowland regions which give no indication of having ever formed lofty mountains; but the most striking case of want of accord between the geological structure of rocks and the relief of the surface is in the region of the Pamirs. Here, between the plains of Russian Turkestan, on the W., and of Chinese Turkestan, on the E., and between the upper waters of the Jaxartes and Oxus, on the N. and S., is a great mountain mass, in which the general course of the ranges and river valleys, as of the trend lines of the geological structure, is between S.W.-N.E. and W.S.W.-E.N.E. From the low hills on the west the general level of the surface rises to the high plateau of the Pamirs, and eastward of these comes a well-defined mountain range, the Mustagh Ata range, with peaks ranging to over 25,000 ft., running nearly N. to S. along the edge of the plains of Chinese Turkestan. So well marked and definite is this range that the late Prof. Suess, in his great work on *The Face of the Earth*, concluded that it must be structural, and that the trend-lines of structure as seen to the westward must bend round to follow the course of the mountain ranges. The earlier observations of Dr. F. Stoliczka, and the recent explorations of Sir Henry Hayden, have alike shown that this is not so, and that the general strike on the Pamirs is continued across the range to the plains of Chinese Turkestan.

In both of these mountain regions, the Andes and the Pamirs, and especially in the latter, large parts of the surface show the rounded outlines and moderate slopes of a lowland topography which has been subject to a prolonged period of subaerial denudation, the mountainous character, where present, being due to quite recent erosion by streams and rivers. In other words, the indications in both regions are that the present elevation is due to a simple uplift, quite independent of, and of later date than, the compression which is evidenced by the surface rocks. In parts of the central Himalayas there is evidence leading to a similar conclusion, and most of the difficulties in reconciling the structure with the larger features of the surface relief of the Alps would disappear if it were accepted.

Meanwhile, an entirely different line of research had led to a similar result. It has long been known that the apparent excess of matter in the visible prominence of mountain ranges was compensated by a diminished density, and consequent deficiency of matter, in the crust beneath them. The elaborate studies of Messrs. Hayford and Bowie, Becker and others, have shown that the principle is of wider extent, and that whatever the relative height of the surface may be the amount of matter under any region is approximately equal, the greater volume indicated by greater surface elevation being compensated by a lesser average density. To this general principle the word *isostasy* is now generally applied, though the term was originally intended to indicate the process by which the result was brought about. The geological application of this conclusion, derived from geodetic observation, has been elaborately investigated by the late Prof. J. Barrell, who concluded that the strength of the earth's crust as a whole was about double that of good granite as we know it, that the thickness through which this strength continues is about 30 m., and that below it there is a rapid transition to material not much more resistant to change of shape than lead. He also calculated that the average departure from exact balance of surface relief and compensation, in the continental region of N. America, is equivalent to a load of average rock reaching a maximum thickness of about 1,600 ft., and thinning out to nothing at the ends of a length of about 200 m.; for a greater length the maximum load would be correspondingly less, and greater for a shorter length. This does not indicate the maximum possible departure from exact isostasy, for even within the American region he finds evidence of about double (in the Pacific islands quadruple) that shown by the figures quoted.

The bearing of the recorded geodetic observations on the origin of the Himalayas and Pamirs, the largest and loftiest mountain region of the world, has been investigated by R. D. Oldham. He found that the excesses and deficits of matter indicated by observation were ranged in alternate bands, following the general course of the major surface relief; that the outer hills of the mountains bordering on the lowland plains showed an excess of matter; that farther in towards the centre of the hills this was followed by a zone of deficiency of matter, and that (though observations are wanting here) the most central portion is either in equilibrium or may show some excess of matter. The widths of these zones, the amount of the departure from exact equilibrium, and the distribution are very much the same as those which would result if a crust of the strength found by Prof. Barrell were uplifted by expansion of the material underlying, or possibly composing, its lower portion. Such an expansion of the underlying material, being necessarily accompanied by decrease in density, would not only account for the compensation of the elevated region, but assumes a prominent position as the primary phenomenon, and direct cause, to which the elevation of the mountain mass was due. This idea is not new, but while the only explanation of the changes of density was variation in temperature, the cause was, quantitatively, inadequate. Of late years, however, a new aspect has been given to the problem by Dr. L. L. Fermor, who has shown that a magma of the same chemical composition may solidify in more than one form of mineral complex, and that the density, and solid volumes, of these aggregates may vary by 20 to 30 per cent. To the two different forms of solidification he applied the terms plutonic or infraplutonic, and pointed out that the transition from one to the other form of mineral combination of the same chemical elements would depend on the balance between pressure and temperature; so that a small change in either might result in a passage from one mode, or mineral combination, to another of the same norm, or magma, and that this passage would be accompanied by a very considerable change in bulk, which, again, would result in uplift or sinking of the surface level. As the variations in underground density revealed by geodetic measurements are not greater than those provided for by Dr. Fermor's supposition, it is evident that we have here at least one cause which would at the same time account for the major inequalities of surface level, and for what is known to geodesists as compensation.

We have, then, an agreement between two independent lines of research, one pointing to the conclusion that the greater inequalities of surface level are the result of underground changes in density, the other indicating with a high degree of probability that such changes do occur. It must, however, be added that a detailed study of published geodetic measurements suggests that this explanation is not quite complete, and that, as suggested by Dutton, the surface transference of material from regions of denudation to areas of deposition is accompanied by a corresponding underground transfer in the reverse direction; yet the effect of any such transfer is subsidiary and trivial in comparison with that of the changes of density to which the predominant proportion of the changes of surface level appear to be due.

This explanation is in accord with the fact that the larger features of the surface forms of the earth, such as the distinction between continental and oceanic areas, cannot be fully accounted for in terms of surface tectonics alone. It does not touch the importance of these tectonics in determining the secondary irregularities of surface; the well-established connexion of these with geological structure of the surface rocks, on the one hand, and the processes of denudation and deposition, on the other, is unaffected, and it still remains possible that, within limits, hills and ranges may be directly due to compression of the rocks composing them. These limits cannot be defined with precision, but, so far as figures available go, they may be put at the extreme figures of a breadth of 150 to 200 m. and a height of 2,000 to 3,000 ft.; for a narrow base the height might be increased, for a greater width it would be less. These figures, though necessarily vague, give an idea of the limit of magnitude which can be allowed for surface inequalities resulting from superficial tectonics alone. For the larger features—the lofty mountain ranges, the deeps of the ocean, the extensive elevated plateaus and the broad distinctions between ocean and continent—we must look to causes and changes operating in the more deeply seated portions of the crust, or in the material underlying it.

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III. STRUCTURAL GEOLOGY

Isostasy.—During recent years, the consideration of the structure of the outer layers of the earth's crust, and of the relation between areas of elevation and depression, has been greatly influenced by the doctrine of *isostasy*. It has been felt that the larger inequalities cannot be supported by the rigidity of the crust. They may, however, when once they have been established, be maintained on a yielding crust by transference of load. The processes of denudation carry material from the uplands to the lowlands, and ultimately to the ocean basins, thereby lightening the upraised regions and increasing the weight on those already relatively low. The down-bent areas thus become further depressed, while mountains and continents rise as a consequence of their own decay. C. E. Dutton, who invented the word in 1889, has defined it as "the tendency to maintain mountain profiles in equilibrium" (ἴσος, equal, + στάσις, condition).

A simple case of isostatic response to change of load was suggested by T. F. Jamieson in 1865 (*Quart. Journ. Geol. Soc.*, vol. 21, p. 178), when he explained the raised beaches of northern Europe as due to the depression of the region by the weight of ice in the Glacial epoch, followed by an upward swing of the crust when the burden was removed by melting. Jamieson's view has been extended by N. O. Holst (1914), who points out that the subsequent rise may foster a second though minor glaciation, followed by renewed submergence; the final melting brought the various beaches to their present elevations above the sea. It will be seen that the theory of isostatic response allows of irregularity of bulging, and is altogether more satisfactory than one which seeks to account for raised beaches by a general change in volume of the sea. The matter is carried further by those who trace a movement of elevation contemporaneous with the northern depression in regions S. of the loaded area. Ph. Négris (1910) thus accounts for the uplift of the floor of the Pliocene sea in the Mediterranean basin, whereby shelly beds were carried to heights of 1,750 metres above the present level of the Aegean. H. Munthe (Internat. Geol. Congress, 1910, *Excursions en Suède, No. 25*) suggests a similar bulging for the periphery of the glaciated area of northern Europe, and a subsequent falling back as the northern region rose. Isostatic recovery, as W. A. Johnston points out in Canada, may be concealed in certain places by the flooding of valleys with water previously locked up as ice. R. A. Daly believes that, after a general lowering of sea-level, due to a removal of water in a solid form towards the poles, a general rise of the sea took place in warmer times over the whole area of the Pacific Ocean. Fluctuations of the water-level, as well as permanent warping, involving imperfections of return to the original crustal relations, must clearly be allowed for in connecting raised beaches with isostasy.

J. H. Pratt (*see* 11.654) in 1855 laid the foundation in India for a generalization that has been widely accepted as an explanation of the support of mountains. He pointed out that observations on the deflection of the pendulum from the vertical indicate a defect of mass in the Himalaya range and an excess of mass towards the Indian Ocean, and he concluded that highlands were upheld by differences of density in the crust. Detailed work is still in progress; but numerous observations with the seconds pendulum, and by comparison of points and mercury barometers at sea, already serve to indicate a general "positive anomaly" of gravity—that is, an excess of attraction in the oceanic areas. The "negative anomalies" associated with high plateaus and mountain-chains are compensated by positive anomalies in adjacent plains or under adjacent seas. It is held that denser rocks, such as basaltic magmas, have accumulated beneath the oceans, while mountains are typically formed of less dense material. They may thus be compared with floating bodies; they are supported by the pressure of denser masses which they have in part displaced. At a certain depth below the less dense earth-block under an elevated area, and below the denser earth-block under an adjacent area depressed below sea-level, a region of *compensation* must exist, where the two blocks balance one another. If of equal area, these two blocks above this "depth of compensation" will contain the same mass. To geologists, who realize the complexities of intrusion, and the interlocking of various types of rock in the outer layers of the crust, the conception of columns of uniform density stretching down from the surface to the depths may seem too much like a purely mathematical expression; but the theory of isostatic compensation is shown by Jos. Barrell (*Am. Journ. Sci.*, vol. 48, pp. 281–338) to relate to broad areas rather than to local irregularities of the surface, and it is probable that the balance is attained much more nearly under continents than under isolated mountains. J. F. Hayford, of the U.S. Geodetic Survey, has reviewed (1909–12) the relations of topography to gravity throughout the United States, with results extremely favourable to the isostatic theory. H. S. Washington (*Journ. Franklin Inst.*, 1920, vol. 190, p. 812) supports Hayford's conclusions by an estimate of the average densities of the rocks underlying the areas of elevation and depression, including a consideration of the igneous rocks of oceanic islands and continental regions over the whole globe. G. Costanzi (1910) has correlated surface-relief throughout Europe with anomalies of gravity. E. Suess, in the concluding volume of his *Antlitz der Erde*, seriously doubts if the known range of density in rocks is sufficient to account for the maintenance of the major features of relief. His most important argument is drawn from the Indian Ocean, the floor of which represents sunken continental land. Suess points out that here O. Hecker, from his marine traverses, indicates a region of strong positive anomaly.

Albert Heim (translation in *Proc. Liverpool Geol. Soc.*, vol. 13, 1920) shows how gravity determinations in Switzerland are related to the form of the Alpine chain, positive anomalies occurring only near the Lago Maggiore and under the Black Forest. He explains the latter case by the presence of a *gravity anticlinal*, in which the denser matter of Suess's "Sima" layer is brought nearer than usual to the surface. The explanation of gravity-anomalies in the Himalayas and the "Gangetic trough" has been the subject of much discussion by Sir S. Burrard, H. H. Hayden and R. D. Oldham.

Great mountain-chains, as was long felt to be the case, evidently bulge both upwards and downwards, and send down crumpled and lighter matter from the upper crust that displaces the denser matter of the depths. This process is aided by the presence of a yielding but not necessarily molten layer, Barrell's asthenosphere, below the depth of compensation, which lies some 80 to 100 m. (say 128 to 160 km.) below the general surface of the geoid. Barrell remarks that "the density of the crust is presumably irregular in depth as well as in distribution, but it is seen to be essentially a phenomenon of the outer fiftieth of the earth's radius."

Isostasy is not put forward as a cause of mountain-building. The relative importance of successive overfolds and of vertical upheaval in establishing these features of relief is still a matter of discussion, and geologists will probably incline more and more to the view of O. Ampferer (1906) that sliding movements in the *Untergrund*, Barrell's asthenosphere, are responsible for drag and crumpling at the surface. Melting of lower layers and consequent vertical foundering may promote extensive movements in a lateral direction. At the surface the final overlapping of recumbent folds may be largely gravitational, a feature emphasized by Hans Schardt. A renewed appreciation of the importance of vertical uplift and vertical foundering leads us back to conceptions of mountain-structure that were prevalent in the early 19th century. Ampferer has even pointed out the influence of notches cut by subaerial denudation on folding that may subsequently affect the surface.

In considering folding in connexion with rock-flow, C. K. Leith (*Structural Geology*, 1914) applies the term *competent* to rocks that resist crumpling, and *incompetent* to those that yield contortions. A competent mass under increase of pressure may of course become incompetent. The flow of incompetent rocks between competent layers obviously produces considerable changes in their relations at the surfaces of contact, and complications of this kind may be expected in any overfolded series. Where faults result from overfolding, E. B. Bailey (1910) styles them *fold-faults* or *slides.*

The recognition of overfolding of the Alpine type in other areas has been accompanied by some criticism, and H. Schardt, himself an honoured pioneer, uttered a word of warning in 1906 when he humorously described P. Termier as afflicted with *Ultra-nappismus.* E. B. Bailey (*Quart. Journ. Geol. Soc.*, vol. 66, 1910) recognized a system of recumbent folding as responsible for many features of the schistose masses in the S.W. Scottish highlands and in 1920 he described two successive *nappes* as resulting from overfolding from N.W. to S.E. L. Gentil (1918) traces three *nappes* in the structure of the coastal range of Algeria and Tunisia. In this he is strongly supported by Termier, but is opposed by J. Savornin (1920). V. Uhlig, O. Ampferer, and others have studied overfolding in detail in the Hohe Tauern and Wetterstein districts of the eastern Alps, where much attention has been given to lateral shifting across the main folds from E. to W. Maria Ogilvie Gordon (1909) indicates folds and thrusts in explanation of the relations of the dolomite masses to underlying strata in the well-known Langkofel region of Tirol. P. Termier and G. Friedel trace outlying blocks, *klippes*, the German *klippen*, separated by denudation from former overfolds of the western Alps, in the southern part of the Rhône vale and even on the flanks of the Cevennes. These outliers include a block of Urgonian strata resting on Oligocene beds and 3,700 metres long. It is held that the Gard coal-field has been affected by the Alpine crumpling, and Termier recognizes older overfolded structures of Armorican (late Carboniferous) age in the eastern border of the central *massif* of France. On the other hand, linear mountain masses may record movements that are mainly vertical. H. E. Gregory (*Am. Journ. Sci.*, vol. 41, 1916) thus treats the Andes as an uplifted plateau of marine and continental sediments, penetrated by igneous intrusions. The erosion-surface here has little regard for geological structure. This is borne out by J. A. Douglas (*Quart. Journ. Geol. Soc.*, vol. 76, 1920), who finds no overfolding in Bolivia and Peru and treats the range as a product of vertical upthrust between two resisting crust-masses. Even more recently, T. O. Bosworth records intense block-faulting as characteristic of the Cainozoic region of Peru, and a considerable Andean uplift, accompanied by a subsidence of the sea-floor, is recorded at the opening of Quaternary times. The upraised coastal band is "part of the crust-belt of the great fault." Five miles out at sea, a fault-scarp 2,000 ft. in height leads down abruptly to the depths of the Pacific. E. H. L. Schwarz points out similar features as bounding the E. coast of S. Africa, where Cainozoic shore-deposits have been elevated to a height of 1,350 ft.

Fracturing.—The study of structural geology has shown in recent years a marked return towards the recognition of lines of fracture, and founderings on a large scale, as influencing existing topographic features. The power of subaerial denudation has been justly emphasized by W. M. Davis in his development of the Huttonian cycle of erosion and his indication of traces of peneplains, where the eye is now likely to be diverted by later features of sculptural relief. But these later and secondary features, the walls of outstanding blocks and the courses of rivers across the rejuvenated country, are again and again associated with rectilinear and regularly intersecting fracture-systems. The tracing of rift-valleys, better styled trough-valleys, from the Jordan region to Nyasaland, and on a minor scale in the post-Oligocene groove of the Rhine from Basel to Mainz, has led to a general attempt to correlate faults and river-courses. The cliff-walls of elongated lakes in Finland are very probably due to late Cainozoic fracturing, and fault-scarps in the hard gneissic rocks guide the modern rivers on their way. J. W. Gregory in his book on *The Origin of Fiords* (1913) has collected much evidence to connect straight river-courses with more or less rectangular fracture-systems. E. B. Bailey shows the influence of downward-reaching "shatter-belts" on the valleys eroded in the region of Glencoe; and E. de Margerie gives a tectonic significance to the narrow *cluses* of the Juras, which unite the valleys of longitudinal and apparently *subsequent* streams. On the other hand, some of the surfaces cited by Gregory are connected with rock-folding and denudation rather than with faulting. J. Ball (*Geol. Mag.* 1910) points out that recent landslides have simulated fault-scarps in the Nile valley and the Gulf of Suez; both these depressions are grooves of normal erosion and not troughs. W. F. Hume (*ibid.*) regards the Nile valley as on the whole connected with the erosion of the softer Cretaceous strata in its southern part, and of Middle Eocene strata in the north. It is, however, a structural feature in that these beds, like the carboniferous limestone in the Armorican folds of south Ireland, have been eroded along the course of a synclinal. Ball states that the Gulf of Suez is guided by an eroded anticline.

One of the most powerful influences in the correlation of surface-features and crustal structure has been the completion by E. Suess of the third volume of *Das Antlitz der Erde* in 1909; the annotated and "extra illustrated" French edition was published under the care of E. de Margerie in 1918. In this volume the Armorican mountain systems of Europe are regarded as offshoots of those of Asia, under the general name of Altaids. The spread of the ranges in huge southward ripplings towards India, and their finger-like ramifications in the European region, are shown, as well as their posthumous influence on the directions of the Cainozoic chains, or "Alpids."

To E. Suess we also owe the observation of "caldron-subsidences" in many portions of the globe, from crater-like depressions, such as those traceable in lunar topography, to broad plains, the gathering-ground of detritus from upstanding mountain-rings. It is true that the recognition of overfolded sheet-structure in the Carpathian ring has disposed of the conception that the differential elevation of the ring and the Hungarian basin is mainly due to faulting; but there remain many lowlands in which foundering has caused the depression, and no doubt the most striking instances are concealed beneath the oceans. The Tyrrhenian and Aegean sinkings occurred almost in human times, and speculation may still be allowed to revive the ancient tradition of Atlantis. A belief in the comparative rapidity of such movements is fostered by the evidence of Fossiliferous strata on the flanks of the marine depressions and on residual isles. The down-sinking occurred during a part of one geological epoch; and the same is remarkably true for the upheaval and lateral flow of folded mountain-chains.

The well-known Rieskessel, the plain round Nördlingen in southern Bavaria, presents all the character of a caldron-subsidence, with a core of shattered granite, and abundant upwellings of lavas on the marginal ring (*see* section in Suess, *La Face de la Terre*, vol. 3, p. 1,507). C. T. Clough, E. B. Bailey, and H. O. Maufe, in describing the "caldron-subsidences of Glencoe" (*Quart. Journ. Geol. Soc.*, vol. 65, 1909), show how foundering took place within a ring-fault, up which a "fault-intrusion" occurred, probably as a forerunner of the granite that afterwards came into the district. This intrusive rock gathered into itself the fragmental matter accumulated along the fault-plane. The mechanics of such subsidences, and the substitution of igneous matter for the foundered core, are here clearly discussed. A striking upwelling of syenite along a ring 16 m. in diameter has been mapped by W. A. Humphrey (1914) in the Pilansberg in Transvaal.

Coral Reefs.—The question of the evidence afforded by coral reefs as to regions of subsidence has been advanced by the large number of instances where barrier reefs and atolls have been shown to stand on the marginal areas of submarine platforms. The depth of the lagoons enclosed by coral rings appears to agree closely with the depth of the platform outside them. The platforms may in places be composed, as W. M. Davis suggests in the case of Queensland, of wave-planed coral rock of unknown thickness, and E. C. Andrews (1916) and W. C. Foye (1917) regard the reefs of Fiji as thickened during local subsidence. But Foye finds no proof of general subsidence during coral-growth in the Pacific; block-faulting has more probably occurred. T. W. Vaughan (*Bull. 103, U.S. National Museum*, 1919) discusses the whole question of the growth of reefs on platforms; the reefs have in some cases been thickened as Darwin suggested; but tectonic interest has now been shifted to the platforms. If these are of Pliocene age, they should represent an epoch of elevation and wave-erosion, and a subsequent enlargement of the oceans by subsidence. If, as R. A. Daly urges, they are Pleistocene, his "glacial control" theory may account for their origin at a time when the sea was lowered by withdrawal of water to form ice at the poles. But it is doubtful if the whole of the existing reefs are of post-Glacial age, and attention is thus redrawn to evidence of crust-movement in the platforms.

The economic importance of structural geology has been specially emphasized by numerous surveys of oil-bearing districts, and the entry of oil into anticlines and domes has been interestingly correlated in the United States with the earth pressures that caused the folding. (G. A. J. C.)

IV. STRATIGRAPHICAL GEOLOGY

The study of comparative stratigraphy has been greatly facilitated by the publication of the *Handbuch der regionalen Geologie*, under the editorship of G. Steinmann and O. Wilckens, the first part of which, on Denmark, appeared in 1910. Written by specialists in various countries, the descriptions and bibliographies are brought fully up to date. The section on the British Isles, by 14 British geologists, was issued, as a triumph of scientific coöperation, at Heidelberg during the World War in 1917. E. Haug's *Traité de Géologie* (1908–11), with its wealth of coördinated detail, has furnished an important work of general reference. Attention has been given, especially in the United States, to "diastrophic" episodes, epochs of apparently world-wide earth-disturbance, and the old theories of "revolutions of the globe" have been recalled by the tendency to connect diastrophism with marked changes of fauna. Many geologists have felt that the boundaries set to geological periods may be quite justly drawn at epochs of crust-movement, which promoted rapid modifications in life-forms to suit altered conditions of existence. The continuity, however, of marine Carboniferous and Permian systems in some countries, and the break caused by the Armorican folding in Europe, serve as an example of the difficulty of calling in diastrophism as a general aid in classification. C. D. Walcott (1910) explains the abrupt appearance of the Cambrian fauna by suggesting that the marine basins of pre-Algonkian time, in which earlier faunas may be recorded, have never been elevated to form part of the land-surface. The few traces of Algonkian fossils represent lakes, or merely brief communications with oceanic waters. Walcott proposes the term *Lipalian* for the epoch when the unknown primordial fauna was adjusting itself to shore-conditions. The Lower Cambrian fauna had thus attained a high degree of differentiation when the Olenellus-beds were deposited by encroachments of the sea across the continents. In nomenclature, the adoption of the name *Silurian* by the British Geological Survey in the restricted sense has been accompanied by a general change in the same direction, while Lapworth's Ordovician has also become international. E. O. Ulrich (1911) has proposed in the United States to cut off an *Ozarkian* system from the top of the Cambrian and a *Canadian* system from the base of the Ordovician, restricting the term Ordovician to beds above the Beekmantown stage of the Champlain valley and Maryland. C. Schuchert, in his last pronouncement (1915), adopts these terms as lower subdivisions of his Ordovician system.

The frequent revision of the names of local subdivisions may be illustrated by A. W. Grabau's classification in 1909:—

Siluric	Upper	Monroan
	Middle	Salinan
	Lower	Niagaran
Ordovicic	Upper	Trentonian
	Middle	Chazyan
	Lower	Beekmantownian

Walcott (1912) proposed *St. Croixan* for the Upper Cambrian and *Wacauban* for the Lower, thereby replacing *Saratogan* and *Georgian*. The correlation of the Cambrian and Ordovician strata throughout the United States is shown in a detailed table in a volume issued by the Maryland Geological Survey in 1919.

Pleistocene deposits, especially in relation to evidences of the antiquity of man, have attracted considerable research, and the publication of W. B. Wright's *Quaternary Ice Age* (1914) has provided a philosophic summary of recent glacial observations. The most marked advance has been the general acceptance of views in which James Geikie was one of the foremost pioneers. Widely spread deposits of boulder-clay and plains of outwash gravel are no longer attributed to the agency of floating ice, but are recognized as the unmeltable residues of glaciers of the Greenland or "continental" type, the lower layers of which may consist of 50% of material gathered from the ground in their advance. A glacial epoch is now regarded as due to a cooling of the atmosphere round all the earth, and evidence of the spread of ice in Permian times, even in tropical lands, continues to accumulate as new areas are explored. T. G. Halle (1914) has described the Permo-Carboniferous glacial beds of the Falkland Is., and proposes the name *Lafonian* for the series marked by the ancient "tillite" and by Glossopteris.

Regional Stratigraphy.—Among the additions to knowledge of the stratigraphy of various lands, the following may be selected as those of most importance.

In the *British Isles* the former prevalence of the Upper Cretaceous sea has received general recognition. Its deposits were easily removed by denudation; but the discovery of chalk and flints in considerable abundance off the W. coast of Ireland (*Geol. Surv. Ireland*, Mem. on rocks dredged from the Atlantic, 1910) and the tracing of the probable Cenomanian sea-floor across Anglesey and Snowdonia by E. Greenly (*Geol. Surv. Gt. Britain*, Geology of Anglesey, 1919) support and even amplify the view put forward by A. Jukes-Browne in the 3rd edition of his *Building of the British Isles.* Interesting Cretaceous relics are also recorded from the Isle of Arran. The revised official memoirs and maps of the South Wales coal-field and of the Edinburgh and Glasgow districts are welcome from both a scientific and an industrial point of view. In Ayrshire, shales of Millstone Grit age have been found to be rich in aluminium hydroxide, and thus to indicate a climate in Britain in Carboniferous times capable of "laterising" the surface. The Yorks. coal-field has been traced eastward and on into Notts. under its Permian Mesozoic cover, and it is estimated (W. Gibson, *Geol. Surv. Memoir*, 1913) that 5,000 ft. of Upper Carboniferous strata were removed from the area N.E. of Leeds before the Permian strata were laid down. The Bovey Tracey lignite beds have been investigated by C. and E. Reed (1910), and are held, in agreement with Heer, to be of Upper Oligocene age. The interbasaltic plant-beds of the county of Antrim are probably Oligocene rather than Eocene. The laterites and bauxites associated with them have been described in a recent memoir of the Geological Survey of Ireland, and subsequent work W. of Lough Neagh indicates that the "Lough Neagh Clays," now proved to be 1,100 ft. in thickness, may have, after all, to be removed from the Pliocene and included in the interbasaltic series. The earlier Pleistocene gravels of the S. of England have been correlated with phases of the glacial epoch, and have received renewed attention from the discussions on eoliths and from the discovery of *Eoanthropus Dawsoni* at Piltdown, N. of Lewes, in 1911–2. S. H. Warren's eolithic flints from beneath the Lower Eocene in Essex (*Quart. Journ. Geol. Soc.*, 1921, vol. 66, p. 238) dealt a sudden blow at many examples relied on.

On the borderlands of *Holland, Belgium*, and *Germany* considerable coal-fields have been traced by means of borings, several of which were carried by the Netherlands Government to a depth of over 1,000 metres in N. Limburg. Borings for lignite in Oligocene strata N. of Mulhouse in Alsace led to the discovery of important deposits of sylvine, which were developed for agricultural purposes in 1909, and will now supply France with an important mineral asset.

Under the auspices of the Geologische Reichsanstalt (now Staatsanstalt) of Vienna, considerable additions have been made to our knowledge of the Cretaceous as well as the older strata of *Bohemia*. The "red gneiss" of the Sudetic and Eisengebirge regions, formerly regarded as an Archaean floor, has been shown to be intrusive and of Upper Devonian or Carboniferous age. O. Ampferer and W. Hammer have published a detailed geological section of the *Eastern Alps* from Algau to the Lago di Garda (*Jahrbuch Geol. Reichs.*, vol. 61), and regard the features seen at the surface as dependent on much that is unseen below, the upper folds being the crests of masses that have sunk deeply in the crust. The *Dalmatian and Yugoslavic lands* have received much attention. The stratigraphy of *Macedonia* and southern *Serbia* has been investigated by J. Cvijić (*Petermanns Geogr. Mitt.*), and work in *Greece* may now be linked across the Aegean with that of German authors. A. Philippson (1910) finds that the W. of *Asia Minor* has been much affected by late Cainozoic faulting, to which the E. and W. ridges and the plains of the Hermus and Maeander may be attributed.

In *Russia*, J. Samojlov (*C. R. Congrès géol. internat.*, 1913) has found that the phosphorite deposits which occur over a very wide area range from Portland to Senonian horizons. The occurrence of phosphatic limestone in the Upper Cretaceous of Bohemia (J. Woldrich, *Jahrbuch Geol. Reichs.*, 1917) connects these deposits with those of Belgium. This, with the Egyptian beds above the Nubian sandstone, seems to indicate special conditions in the Cretaceous seas, perhaps connected with the evolution of bony fishes. Curiously enough, the phosphatic nodules of Silurian age in Podolia have become washed into Cretaceous strata, whence they are exploited. F. Oswald has issued (Dulau & Co., 1914) his general geological map of the Caucasus, and has described the post-Sarmatian folding on the S. flank of the chain. Upper Miocene fractures allowed of the volcanic outpourings.

For *India*, reference has been lightened by an index and bibliography of "Indian geological terminology" (*Mem. Geol. Surv. India*, vol 43, pt. 1, 1913). G. E. Pilgrim has correlated the Cainozoic river-deposits with those of Europe, as follows:—

U. Siwalik	Middle to top of Pliocene
M. Siwalik	Pontian to Placentian
L. Siwalik	Tortonian and Sarmatian
Murree Beds	Burdigalian to Tortonian
Gaj Beds	Lower Burdigalian or Upper Aquitanian.

In Mysore, W. F. Smeeth (1912) finds that the Kolar Schists are penetrated by what was once regarded as a fundamental gneiss. The latter has, by undermining older masses, substituted a new foundation to the country. The existence in Pliocene (Siwalik) times of a great river, the "Indobrahm" of E. H. Pascoe (1920), running S. of the Himalayas from Assam to the Bay of Bengal, may now be regarded as established. Earth-movement in the W. probably determined the present separation of the Brahmaputra and Indus basins. M. Blanckenhorn and a number of colleagues have elaborately investigated the Pithecanthropus beds of Java (Leipzig, 1911), and regard them as formed in a pluvial period of early Pleistocene times.

In *Egypt*, H. J. L. Beadnell has shown that the Nubian sandstone (Cretaceous) was deposited on crystalline rocks and penetrated by granite, probably of Eocene age, when the mountains E. of the Nile were elevated. In *Nigeria* J. D. Falconer (1911) states that the earliest unaltered sediments are Upper Cretaceous, with an underlying series of schists and quartzites and granitised gneisses. The volcanic rocks are connected with Middle Eocene and late Pliocene earth-movements. Similar conditions (C. Guillemain, *K. preuss. geol. Landesanstalt*, 1909) seem to have prevailed in Cameroon. The beds with giant dinosaurs discovered in what is now the *Tanganyika* colony can be correlated by their marine zones, and C. Schuchert places the lower horizon as early Jurassic and the upper horizons as Jurassic to Cretaceous. Dinosaurs, probably Cretaceous, are recorded from Bushmanland in the W. of the Cape Province, S. Africa. In *Uganda*, F. Oswald (1914) finds Dinotherium in Burdigalian beds. The Karroo "system" has been traced into the S. of *Nyasaland* by A. R. Andrew and T. E. G. Bailey, and into *N. Rhodesia* by A. J. C. Molyneux. A. Holmes compares the intrusive gneisses of *Mozambique* (*Quart. Journ. Geol. Soc.*, vol. 74, 1919) with the "Laurentian" of Canada. In *South Africa*, A. W. Rogers has transferred the Nieuwerust beds to the base of the Nama system, and beneath the Malmesbury series (*see* 5.229). In *South West Africa*, P. A. Wagner, in a comprehensive memoir (*Geol. Surv. S. Africa*, Mem. 7, 1916) recognizes Dwyka, Ecca, and Stormberg beds, and compares the older rocks also with those of the provinces to the east.

A notable summary of *North American stratigraphy* is given by Bailey Willis (*U.S. Geol. Surv.*, Prof. Paper 71, 1912), accompanied by a coloured map on the scale of 1:5,000,000. A. C. Lawson has returned to Rainy Lake in the W. of Ontario (*Can. Geol. Surv.*, Mem. 40, 1913), and notes that, while the "Laurentian" gneiss penetrates the Coutchiching and Keewatin series, a second gneiss cuts the Seine (Huronian) sediments. For this he proposes the name *Algoman.* The work of the Canadian Survey on intrusion, absorption, and reconstruction of rocks in the Haliburton and Bancroft areas of Ontario, and its bearing on the origin of amphibolites, has attracted much attention, and is supported by P. P. Sustschinsky (1914) by examples from S.W. Finland. In the United States the influence of massive algal growths (Cryptozoön, etc.) in building ancient limestones has been emphasized; Cryptozoön, on the other hand, has been compared by O. Holtedahl (1921) with mineral structures in the Permian limestone of Durham. The work of C. D. Walcott has greatly extended our knowledge of the Cambrian strata of the north-west. N. L. Britten and C. P. Berkey have reported (1919) on the geology of *Porto Rico*, where beds from Eocene to Miocene rest on a volcanic series probably of Cretaceous age. J. C. Branner (*Bull. Soc. Geol. America*, vol. 30, ed. 2, 1920) summarizes the geology of *Brazil*, with a map of the same scale as for N. America.

The State Geological Survey of *Western Australia* has published a geological map of the state (1918) on the scale of about 1:3,000,000. The most productive quartz reefs of the gold-fields are metasomatic replacements of schists along shear-planes. Lastly, the stratigraphy of *New Zealand* promises to be much elucidated by the careful revision of all known fossils by the Geological Survey, especially in regard to a delimitation of the Mesozoic and Cainozoic systems.

(G. A. J. C.)

GEORGE V. (1865–   ), King of Great Britain and Ireland (*see* 11.745), succeeded to the British throne on the death of his father King Edward VII., May 6 1910. By the Regency Act 1910 (a temporary constitutional necessity in view of the fact that his eldest son, Prince Edward, was then not 16) his consort Queen Mary was at once nominated to become regent in the event of a demise of the Crown while the heir to the throne was under age. A new Civil List for the Crown, fixed at £470,000 a year, was approved by Parliament in 1910. An important change in the King's accession declaration was also embodied in an Act of that year, to the satisfaction of his Roman Catholic subjects, the following short and simple formula being substituted for the old "no popery" manifesto which had long been resented by them:—

> "I do solemnly and sincerely in the presence of God profess, testify and declare, that I am a faithful Protestant, and that I will, according to the true intent of the enactments which secure the Protestant succession to the Throne of my Realm, uphold and maintain the said enactments to the best of my power according to law."

The coronation at Westminster Abbey on June 22 1911 was attended by representatives from all parts of the Empire and other countries, and, in order to complete the public assumption of royal authority throughout the United Kingdom, the King and Queen, with the Prince of Wales (as Prince Edward was created on June 23 1910) and Princess Mary, made State visits to Ireland, Wales and Scotland during July. There followed later in the year an important extension of the whole principle of the recognition of Imperial sovereignty in the visit made by their Majesties to India, and the coronation ceremonies at the ancient capital of Delhi (Dec. 12 1911). They left England on Nov. 11 and did not return till Feb. 5 1912.

From the very first, King George and Queen Mary showed in all their actions their earnest desire to use their royal position in the most public-spirited manner. At the death of so active, popular and influential a sovereign as King Edward VII., in the midst of grave parliamentary difficulties, and conditions of social-economic unrest and industrial conflict, the country was fortunate in the fact that so much had already been done to establish the Throne in the hearts of the people as a central and unifying national and Imperial force, distinct and aloof from sectional interests of party or class. Under King George, the Sailor-King,—whose exhortation "Wake up, England!" in the speech he had made in 1901 at the Guildhall, when returning from his colonial tour as Duke of York, had never been forgotten—a further strengthening of this conception of the functions of the Throne was steadily pursued. King George and Queen Mary, assisted by other members of the royal family, devoted themselves on every available occasion, public or private, to the task of making the influence of the court a pure, useful and kindly one in the life of the country. It may briefly be noted that in the summer of 1912, for the first time, State visits were paid to a London music-hall (the Palace) and to Henley Regatta, while the King also went to Lord's on the occasion of the test-match between Australian and South African cricketers, and had the teams presented to him. But the King and Queen were not content with lending themselves, constantly though unostentatiously, to the scenic side of royalty: they mingled graciously and sympathetically with different classes of society, and were ever active in accepting new opportunities of service. Thus Queen Mary, after a royal visit to the Dowlais steel works at Merthyr (June 27 1912), took tea with a Welsh miner's wife, and during a tour through the industrial districts of Yorks. King George went down the Elsecar colliery (July 9 1912), and showed himself no less handy in wielding a pick than in bringing down grouse on a Scottish moor. Such incidents, which naturally attracted attention early in the reign, became too familiar with the public in later years to need chronicling in detail. The personal tastes both of King George and Queen Mary were known to lie in characteristically British domestic directions, while the King's well-known hobby of stamp-collecting[1] and his long-standing reputation as one of the best shots in the country, were typical links with popular interests of one sort or another. Facilities were wisely extended to the press to give contemporary publicity to the royal doings. Enhanced confidence resulted in the British Throne and its occupants, whose happy domestic relations were, moreover, universally appreciated.[2]

The political history of the period from 1910 onwards is dealt with in the article ENGLISH HISTORY (*see* also BRITISH EMPIRE). With a less popular sovereign on the throne, the development of the domestic political crisis which was obviously impending when King Edward died might have created more embarrassment than actually was produced in the public mind, as regards the functioning of the Crown in relation to parliamentary government. It was generally felt, indeed, that Mr. Asquith's use of the royal prerogative in 1911, however justifiable on political grounds, in securing the King's assent to the creation of enough new peers, if necessary, for overcoming the resistance of the House of Lords to the Parliament bill, involved a more uncomfortably violent disclosure of the domination of the parliamentary executive than had ever before been regarded as *convenable* in the working of English party government. But the responsibility for the use of the royal prerogative for such a purpose was, by common consent, put upon the Government; and the political bearing of the incident on the constitutional position of the Crown was effectively minimized in the controversy between the parties. On the other hand, the value of the influence of the Crown as standing above and outside domestic party politics, continued to be emphasized, alike by such incidents as the Buckingham Palace conference in 1914 on the Irish deadlock, though unhappily abortive; by the increased momentum given throughout the British Empire to the progress of its conception as an Imperial Commonwealth of self-governing nations with a common sovereign; and by the events of the World War, during which the King and the royal family in various ways consolidated their hold on the loyal affections of the British people.

From the opening of the World War in Aug. 1914 the King and Queen, jointly and severally, set themselves to make the royal influence an encouragement to every form of national activity in aid of the fighting forces. The nation found in the Throne, from the moment when war started, the embodiment of its will-to-victory and of its patriotic devotion. Queen Mary herself gave a lead to the war work of women, details of which are given elsewhere (*see* WOMEN'S WAR WORK), in many notable directions. King George's own messages to the nation, during the war years and afterwards, were admirably conceived for initiating or supporting the special efforts required from the public from time to time in the organization of the home front—notably his messages appealing for voluntary national service (Oct. 23 1915), compulsory military service (May 25 1916), strengthening of the volunteer forces against the risk of invasion (Jan. 27 1917), general economy in food (May 2 1917), the observance of a special day of prayer on Sunday Jan. 6 1918 (Nov. 7 1917), and those on the victory itself (Nov. 19 1918), on the need for subscriptions to the Victory Loan (June 12 1919), on the signing of the Peace Treaty (June 28 1919), appealing for support to the "King's National Roll" of employers who would take discharged soldiers into their employ (Aug. 18 1919), for the League of Nations (Oct. 13 1919), and for the celebration of the first anniversary of Armistice Day, by two minutes' silence on the 11th hour of the 11th day of the 11th month of the year (Nov. 6 1919). A collection of the King's numerous speeches and replies to addresses, and his constant messages to the Dominions and India, to the army and the navy, or in such special connexions as the repatriation of prisoners of war or the success of *The Times'* Red Cross fund, would make a bulky volume, and were always full of inspiration and good cheer for those who received them. The King and Queen regularly went in state to prorogue and open Parliament in successive sessions, and on frequent occasions royal visits were paid during the war to important factories and workshops at the munitions centres throughout the country, as well as to shipbuilding yards, hospitals and other institutions engaged in war-work of one kind or another. The King's inspections of provincial industrial establishments included visits to Glasgow and the Clyde (May 1915), Coventry and Birmingham (July 1915), Leeds and Sheffield (Sept. 1915), Nottingham (Dec. 1916), Liverpool, Manchester, Barrow and Gretna (May 1917), Newcastle-on-Tyne, Hull and Rosyth (June 1917), Glasgow for a third time (Sept. 1917), Bristol for a second time (Nov. 1917), Bradford, Huddersfield and Leeds (May 1918).

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[1] From his midshipman days on the "Bacchante," the King had been a keen stamp-collector, his uncle the Duke of Edinburgh having even then been hon. president of the Philatelic Society, London, and being succeeded in that position by King George (while Duke of York) in 1896. The royal collection is the completest in existence, and in 1920 the King, in a message to the Junior Philatelic Society, assured its members of his "unabated interest in stamp-collecting."

[2] It is now purely a curious episode in the history of scandalmongering that, at the time when King George came to the Throne, a story was current in various quarters that he had been secretly married before his marriage with the Queen, and that this earlier wife was alive, though for dynastic purposes the union was ignored. In 1893 this cruel allegation had been privately contradicted, at Queen Victoria's desire, by confidants of the royal family such as Sir Theodore Martin and Canon Dalton, in letters to various people of influence and newspaper editors (including the present writer); but it was revived, to the King's natural annoyance, and with the danger of public misconception and ill-feeling if it were not finally disproved, in 1910. It was hoped that the public contradictions authoritatively given by the Dean of Norwich (Dr. Russell Wakefield) in a speech in July 1910, by Mr. W. T. Stead in the *Review of Reviews* for that month, and by Sir Arthur Bigge (afterwards Lord Stamfordham) in *Reynolds' Newspaper* (Oct. 30 1910) would put an end to it; but it was repeated in a definite way by a certain Edward Mylius in Nov. and Dec. 1910 in a "republican" paper called the *Liberator*, published in Paris and circulated in England under the auspices of the Indian revolutionary Krishnavarma. In this the writer declared that the King, when a midshipman, had in 1890 married at Malta a daughter of Admiral Sir Michael Culme-Seymour; that his subsequent marriage in 1893 was therefore bigamous and shameful, and the Church, by conniving at it, had been guilty of subordinating its own principles to reasons of State. Copies of the *Liberator* were seized by the police, and Mylius was arrested and on Feb. 1 1911 tried for criminal libel before the Lord Chief Justice and a special jury. Evidence was given by Sir M. Culme-Seymour and others absolutely contradicting the whole fabrication. The admiral had no daughter whom the King could have married in 1890; one of his daughters died unmarried in 1895 without ever knowing the King, the other (Mrs. Napier) had not met him between 1879 and 1898; the King was not at Malta between 1888 and 1901; the Maltese registers were produced, and contained no record of any such marriage. Mylius refused to give evidence, his claim that the King ought to appear as a witness to be cross-examined by him being overruled; and the jury promptly found him guilty. He was sentenced to the maximum penalty of a year's imprisonment; and the attorney-general then read a statement signed by the King that he had never been married to anyone but the Queen and that he would have attended in person to give evidence if the law officers of the Crown had not insisted that it would be unconstitutional for him to do so. The whole affair caused naturally a great sensation, but the effect was excellent, and the straightforward action taken by the King—for it was known that the Government doubted the expediency of bringing the matter into court—confirmed public opinion as to the character of the new occupant of the throne. He had insisted on having the truth told, and was not prepared to forgo his rights as a man simply because, as a king, he was above the law.

The exposure of this malicious libel may indeed be said to have put an end, once for all, to all forms of personal aspersion on the King's private character; for, coincidently, no less absurd stories had been current that he drank too much,—a charge which was utter nonsense to all his personal friends and acquaintances, who knew him ever to have been the most abstemious of men. Still, in spite of its gross absurdity, the charge was made, and had been publicly denounced as unfounded by the Dean of Norwich in the speech already referred to in July 1910. After the Mylius case this calumny, too, sank into the oblivion it merited.

The King was also constantly inspecting the forces at home, visiting the various camps, and holding investitures for conferring honours and decorations—indeed the total number of war decorations personally conferred by him from the outbreak of war up to the end of 1919 reached the colossal figure of 50,669. Moreover, periodical visits were made by the King to the Grand Fleet (July 8–10 1915; June 18 1916; June 27 1917; and July 23 1918), and to the battle-front in France (Nov. 29–Dec. 5 1914; Oct. 21–Nov. 1 1915; Aug. 7–Aug. 15 1916; July 3–July 14 1917; March 28–30 and Aug. 5–13 1918). It was during his visit to the front in 1915 that, on Oct. 28, King George met with a somewhat serious accident, which laid him up for some weeks, through his horse rearing and falling backwards on him, being startled by the sudden cheering of a regiment whom he was inspecting; but after being safely brought back home he made a good recovery from his injuries. On the 1917 visit Queen Mary accompanied the King to France, and returned with him, but made a separate tour while there. Finally, after the Armistice, the King made another visit to Paris and to the battle-fields, Nov. 27–Dec. 10 1918, and had an enthusiastic reception in the French capital (Nov. 28–30). On each of his last two French visits a distance of about 800 m. was covered by motor-car.

In other directions during the war period, the King's desire to set an example of patriotic self-abnegation was illustrated by two specially notable actions—his announcement on March 30 1915 that the serving of alcoholic liquor for his own use and that of the royal family and household would be suspended (as from April 6), in order to assist in the movement for increased temperance and economy in wartime, and his spontaneous gift, on March 31 1916, of £100,000 to the Exchequer out of the Privy Purse, to be used as the Government might decide in relief of war expenditure. The long record of royal attendances at notable ceremonies included such occasions as the funeral services at St. Paul's for Lord Roberts (Nov. 19 1914) and Lord Kitchener (June 13 1916), the commemoration service there on the entry of the United States into the war (April 20 1917), the Albert Hall commemoration of the first Seven Divisions (Dec. 15 1917), the thanksgiving at St. Paul's on Their Majesties' silver wedding (July 6 1918), the presentation to the King at Buckingham Palace by the special Japanese mission of the sword and badge of a Japanese field-marshal (Oct. 29 1918), the U.S. navy and army baseball match at Stamford Bridge (July 4 1918), the Drury Lane matinee of the Shakespeare tercentenary celebration (May 2 1916), and Their Majesties' visit to the Bank of England and the Stock Exchange (Dec. 18 1917). On the occasion of Their Majesties' silver wedding, the King and Queen were received at the Guildhall (July 6 1918) and were presented with a cheque for £53,000, subscribed by the citizens of London, to be devoted to charities by Their Majesties' wish, together with a silver tankard once owned by Charles II.

On July 17 1917 it was announced that King George V. had abandoned all German titles for himself and his family. At the same time a proclamation was issued to the effect that henceforth the royal house of Great Britain and Ireland would be known, not as the house of Saxe-Coburg-Gotha, but as the house of Windsor. It had previously been announced (June 20 1917) that the King had decided that those princes of his family who were British subjects but bore German titles should relinquish those titles in favour of British names. The following peerages were consequently conferred:—The Duke of Teck and Prince Alexander of Teck, brothers of Queen Mary, adopted the surname of Cambridge, in allusion to their descent from the Duke of Cambridge, seventh son of George III., and became respectively Marquess of Cambridge and Earl of Athlone; Prince Louis of Battenberg (*see* 3.531), brother of Queen Victoria's son-in-law Prince Henry of Battenberg, adopted the surname of Mountbatten, and became Marquess of Milford Haven, his eldest son assuming the courtesy title of Earl of Medina; while the sons of Princess Henry of Battenberg, youngest daughter of Queen Victoria, also adopted the surname of Mountbatten, the eldest, Prince Alexander, receiving the title of Marquess of Carisbrooke. Princess Henry of Battenberg herself resumed the style of Princess Beatrice.

With the return of peace it was possible for the more normal activities of court life to be resumed on the lines already familiar before the war, but in the long list of later royal functions some stand out typically as worthy of record for their special appeal to contemporary public interest. Immediately after the Armistice in 1918, the King and Queen on successive days made popular progresses through different sections of London, and received general ovations, in carriage drives through the city (Nov. 11), to a special thanksgiving at St. Paul's (Nov. 12), through the East End (Nov. 13), the south (Nov. 14), the north (Nov. 15), the north-west (Nov. 18) and the south-west (Nov. 22). On Dec. 27 a great banquet was given in honour of President Wilson at Buckingham Palace, where he and Mrs. Wilson were staying with the King and Queen. During 1919, mention may also be made of Their Majesties' visit (March 4) to Westminster school, to witness the "tossing of the pancake" on Shrove Tuesday; the King's presentation of a cup to the New Zealand Rugby football team at Twickenham after their match against a French army team (April 19); Their Majesties' presence at the thanksgiving at St. Paul's on the signing of the Peace Treaty (July 6), and at the river procession (sea services commemoration) on the Thames (Aug. 4); the King's banquets at Buckingham Palace to the Shah of Persia (Oct. 31), to the President of the French Republic (Nov. 10), and to the Prince of Wales on his return from his world tour (Dec. 1); and the King's visit to the Oxford and Cambridge Rugby football match (Dec. 9). As time went on the King's long-standing interest in sport was indeed regularly shown by his presence at the chief popular events, whether at race meetings, football or cricket; and public appreciation of this royal interest in sport was enhanced by the way in which the Prince of Wales and the Duke of York (as the King's second son, Prince Albert, was created in 1920) were also taking an active part in it on their own account. On no such occasion was popular enthusiasm shown more emphatically than in the reception given to the King and the Duke of York at Stamford Bridge on April 23 1921, when the King presented the Football Association's cup to the Tottenham Hotspur team on its victory over the Wolverhampton Wanderers in the final tie. On June 21–2 1921, the King and Queen visited Belfast, going and returning by sea, in order that His Majesty might inaugurate the new Northern Irish Parliament under Sir James Craig's premiership. In Dec. the engagement of Princess Mary to Viscount Lascelles, son of the Earl of Harewood, was a happy event in the Royal Family. (H. CH.)

GEORGE I. (1845–1913), King of Greece (*see* 11.746), had all but completed the 50th year of his reign and was about to celebrate his jubilee (if we may believe his friend and biographer, Capt. Christmas) by abdicating the throne in favour of the Crown Prince Constantine, when he was shot down by a half-crazed Greek, named Schinas, at Salonika on March 18 1913. His assassination was at first attributed to Bulgarian instigation but after the first few days Greek public opinion dismissed this suspicion. On the other hand the crime has sometimes been attributed to Austrian and German intrigue—Austrian for political, German for dynastic reasons. This suspicion is quite unproved, although a certain atmosphere of mystery that covered the examination and the subsequent "suicide" of the assassin helped to make it popular.

It had been characteristic of King George's political acumen that in 1909 he promptly recognized Venizelos' rare ability and gave him his wholehearted support, overlooking the fact that only four years before Venizelos had practically driven the King's second son, Prince George, out of Crete, and came to Greece in 1910 with the avowed readiness to force the King himself to abdicate, if he persisted in his life-long policy of *laisser faire.* And the King's discernment was rapidly and amply justified. Internal politics played only a secondary part in King George's, as in King Otho's, reign. The Panhellenic, or "Great," idea, *i.e.* the hope of uniting all the Greek lands of the Ottoman Empire with the Greek Kingdom, had absorbed the thoughts and resources of the Greek people, ever since the recognition of the independence of Greece. King George, warned by Otho's example, and being of a totally different temperament, as well as of a far superior acumen, consistently strove, throughout his long reign, to restrain the patriotic exuberance of his subjects on the one hand, while endeavouring, on the other, to use his great personal influence and family connexions abroad in favour of the aspirations of the Greek people. As the brother-in-law of Edward VII. of England, and of Alexander III. of Russia, the uncle of Tsar Nicholas II., the friend of Francis Joseph and of Gladstone, De Freycinet and many other British and French statesmen of his day, he had the ear of those upon whose decisions European politics depended; and while he was not always able to win them to his point of view, nor to spare Greece humiliations like the blockade of 1886 or cruel disappointments like the successive phases of the Cretan question, yet it is beyond doubt that his personal influence obtained for Greece, from the Great Powers, the maximum of friendly consideration consistent with their own interests and policies. It has been said more than once that at the time of his accession to the Greek throne he was made to undertake a secret engagement toward the Powers to act as a check upon the Panhellenic agitation; and in order to strengthen his hands in this undertaking Great Britain ceded the Ionian Islands to Greece in 1864. Only once did King George depart from his pacific policy—in Feb. 1897, when he approved of Col. Vassos' expedition to Crete. In a proclamation to the nation he declared that "his patience was at an end," and that, since the Great Powers persisted in dallying with the Cretan question, he felt that the moment had come for Greece to settle it by herself. Even in Oct. 1912, when Greece, in alliance with the other Balkan states, was preparing to declare war against Turkey, King George came hurrying home from Denmark, very much opposed to this venture. Venizelos went to meet the Royal yacht at Corinth, and the vessel was kept at quarter-speed for four hours between Corinth and Piraeus while Venizelos argued and wrestled with the King to win him over to his point of view. Finally the King, still unconvinced, observed that in obedience to the constitutional principle he had no choice but to consent.

King George's violent death was thus fraught with momentous consequences for Greece and for Europe. Greece lost a sagacious sovereign, and the Anglo-French Entente a devoted friend. He was succeeded by his eldest son, as Constantine I.

See Capt. Walter Christmas, *King George of Greece* (1914).

GEORGE, SIR ERNEST (1839–), English architect, was born in London June 13 1839. He began his career in the office of S. Hewitt, and at 19 became a student at the Royal Academy, where in the following year he was awarded the gold medal in architecture. He started professional practice in 1861, in conjunction with T. Vaughan, and with him carried out his earliest large commission—Rowsdon, Devonshire. On his partner's death in 1871 he was joined by Harold Peto, and subsequently by Alfred Yeates. During his connexion with the former of these many of his important works were done. They were almost wholly domestic, his public buildings being inconsiderable in number, and his church work confined to a few small churches, two of them in the Engadine. Amongst the houses for which he was responsible are Buchan Hill, Sussex; Stoodleigh Court, Tiverton; Motcombe, Dorset; Rawdon House, Herts; additions to Welbeck Abbey; Crathorne Hall, Berks, a villa at Antibes, and very many others. To this short list of a few only of his country houses may be added the many town residences with which he almost formed new quarters of London, such as those in Mount Street, in Collingham Gardens, and in parts of Chelsea, and an elaborately finished house in Berkeley Square. Amongst his commercial buildings are the Royal Exchange buildings, London, the (late) Albemarle hotel, and the interesting Venetian design for Sotheran's bookshop in Piccadilly. Before he ceased to take an active part in work his last design was for a great palace for the Maharajah Holkar of Indore.

George was also a most diligent painter and water-colour artist, and the influence of his sketching work not only in England but especially in Belgium, Holland and France makes itself evident in his picturesque design. He published volumes of his etchings on the Loire, and on the Mosel and in Belgium, Venice, etc., and was a constant exhibitor of his water-colour drawings at various galleries. In 1896 he was awarded the gold medal of the Royal Institute of British Architects. In 1910 he was elected an associate of the Royal Academy, and full member in 1917, and received a knighthood in 1911.

GEORGIA, the former province of Russia (*see* 11.758), in 1917, in consequence of the collapse of the Russian Empire, recovered an independent position, first as part of the Federal Republic of Trans-Caucasia, and then, alone, as the republic of Georgia.

As a republic Georgia comprised the two old Russian "governments" of Tiflis and Kutais, and the "districts" of Batum and Artvin, and was contained by the range of the Caucasus Mountains in the north, the Black Sea and the Turkish frontier in the west, and the borders of the sister republics of Erivan and Azerbäijän in the south and east. As a whole the country lacks geographical unity. Only on the north and west are its frontiers natural ones; in the south and east they had not yet been determined in 1921, except in part. The eastern half of Georgia, containing the old Russian "government" of Tiflis, occupies the upper basin of the Kura, a river entering the Caspian Sea; the western half, comprising Kutais, Batum and Artvin, is drained by various smaller streams flowing to the Black Sea. Much of the country where not mountainous is very fertile; forests cover a considerable area, and the mineral wealth is great, particularly in manganese, copper and coal.

Area and Population.—The area of the republic is about 28,000 sq.m., but in addition are some 4,500 sq.m. in dispute with the adjoining republics of Erivan and Azerbäijän. The territory of the republic contained, by the Russian census of 1916, a pop. of 2,770,000, comprising 1,620,000 Georgians, 233,000 Russians and other Europeans, 425,000 Armenians, 249,000 Moslems, and 244,000 other elements. Territory in dispute had a pop. of about 240,000, of whom Georgians numbered perhaps 9,000, Russians and other Europeans 8,000, Armenians 50,000, Moslems 160,000, and other elements 14–15,000.

Railway Communication.—Possession of a coast line on the Black Sea has greatly affected the course of recent Georgian history. Owing to the configuration of sea and land in western Asia the Georgian port of Batum is the natural port not only for Georgia, Erivan and Azerbäijän but for wide regions of Central Asia. Railroad development, determined by this geographical fact, has therefore made Batum the gateway for a large part of the continent of Asia. It is in the power of Georgia to keep the gate closed or open, or to exact tolls; in fact it is in her power to penalize or favour her inland neighbours as expediency or need, friendship or hostility may move her. And the military importance of Batum is not less than the political and economic. The port is in rail communication with Erivan, with Erzerum in Asia Minor, with Tabriz in northern Persia, with Russia and with Baku in Azerbäijän; from Baku all the coast line of the Caspian Sea lies open; from Baku to Krasnovodsk is a few hours' steaming, and at Krasnovodsk begins a line of railway which runs to the Afghan frontier and the Pamirs. Whether Georgia be a weak power or a strong it cannot avoid the great influence exerted by Batum.

The Georgian People.—The Georgian people so placed are, as a race, the most advanced in civilization of any in Trans-Caucasia, or indeed in Asia. They have a further advantage over their neighbours in possessing a cherished tradition of comparatively recent independence. Towards the close of the 18th century a Georgian kingdom made a treaty of close alliance with Russia, whereby in return for support against the Ottoman the great northern Power guaranteed Georgian internal independence. Within 20 years, however, the terms of the treaty were violated and Georgia was incorporated as a Russian province. Although the lot of the country in these conditions was not unsatisfactory, the breach of faith was never forgotten and served to keep alive the memory of past nationhood; Georgian national consciousness therefore centres more in the State than in the race, though elsewhere in Trans-Caucasia racial consciousness predominates. Due perhaps to this wider outlook and tradition is the distinct capacity for self-government which the Georgian people showed during the early period of independence. While professing and practising an advanced form of socialism in political and economic affairs, they displayed no want of patriotic zeal, and were opposed to Bolshevism. Indeed, the resistance this small people had shown up to 1921 to intense Bolshevik propaganda and efforts at corruption was remarkable.

Recent History.—For the first 18 months of the World War Georgia's part was that of any Russian province; that need for independent action might arise was not so much as suspected. But in the spring of 1917 distinct signs became visible in Trans-Caucasia that a serious upheaval was fast approaching in Russia; and that an opportunity might present itself for Georgians and Armenians to obtain their independence and perhaps the independence of all Trans-Caucasia. It was recognized further that a Russian collapse would leave the Trans-Caucasian provinces open to Turkish invasion unless the people were prepared to take care of themselves. From this point events in Russia moved fast. In April the Provisional Government, established after the abdication of the Tsar, declared for the self-determination of peoples, and the conclusion of a permanent peace without indemnities. In June occurred the mutiny of the Russian Black Sea fleet at Sevastopol; and in the same month the Russian armies in Asia Minor, putting Bolshevik theories into practice, left their positions and voluntarily retired behind the pre-war Russo-Turkish frontier. Here for a time they were held together by the great personal influence of the Grand Duke Nicholas, the commander-in-chief. Russia became a republic on Sept. 15; the time had come for Trans-Caucasia to dispose of its own destinies.

Preparations had already been made in this direction. Unity of purpose existed to some extent among Georgians and Armenians, but less so on the part of the Tartars of Azerbäijän; propaganda, however, was undertaken to bring them into line with their neighbours. Representatives of the three peoples were elected in Aug. and met in Tiflis in Sept. as the "Council of the Trans-Caucasian Peoples." There, on Sept. 17, they proclaimed the Federal Republic of Trans-Caucasia.

In these events Georgian leaders, chiefly ex-members of the Russian Duma, bore a leading part; the policy followed also had a Georgian origin. Georgia, in fact, as the most advanced, populous and wealthy division of Trans-Caucasia, appeared to dominate the Federal Republic. Jealousy between the states existed from the first, but instead of diminishing it became more and more acute. Each state had its own particular aspirations to pursue; its own special difficulties to surmount; its own susceptibilities to consult; each stood out for its own point of view and seemed unable to understand the outlook of the others. Georgia desired complete independence; Erivan was under reactionary Russian influence and sought to retain some degree of Russian support; Azerbäijän with its Moslem population had leanings towards Turkey and Pan-Islamism. Both Erivan and Azerbäijän were agreed that the Federal Republic masked a Georgian ambition to incorporate them in a Georgian State. Only on one point were all the states in harmony, and that was to resist Bolshevism.

After Lenin and Trotsky had established themselves in power in Russia—Nov. 17 1917—the Russian armies in Trans-Caucasia dispersed into an armed rabble, fighting for trains to return home, and left the frontier open to Turkish invasion. The Federal Government now endeavoured to organize a force to hold the Turkish front. The old Georgian army, sent to Russia's western campaigns in 1914, were now returning, but the men had absorbed Bolshevik principles, and refused to fight anywhere except on Georgian territory, nor even then unless their committees approved. Eventually a considerable force of Georgians, Armenians, Russian volunteers and Assyrians were got together and prevented or delayed a Turkish advance for a time.

The Petrograd Government, who had not surrendered hope of retaining the Trans-Caucasian provinces, sent a chief commissary for the Caucasus to Tiflis in Jan. 1918. But he wielded no real power and was soon ejected. He then retired to Baku, and with the help of some 10,000 Armenian revolutionaries established a Bolshevik Government there, supported further by Bolshevik naval forces on the Caspian. This Russo-Armenian combination expelled and massacred the Moslem Tartars of Baku, and thus did much to estrange the Mahommedan population of Trans-Caucasia from any alliance or common action with Georgian or Armenian Christians.

On March 3 1918 Russia and Germany signed the Treaty of Brest Litovsk, which contained provisions affecting Trans-Caucasia. It awarded certain Armenian districts and the Georgian province and part of Batum to Turkey; and Turkish forces immediately advanced to occupy these areas. Batum fell into Turkish hands on April 15; on April 23 the Federal Republic, unable to offer any military resistance, began peace negotiations, and at the same time made a formal declaration of independence. But Georgia, Erivan and Azerbäijän were now alienated from one another beyond hope of agreement. Each had no other purpose than to preserve its own interests. The Azerbäijän representatives had already withdrawn from the Federal Council, and retired to Elizabetopol, where they established a form of government for their own country. On May 26 1918 the Federal Government of Trans-Caucasia was dissolved, and Georgia, Azerbäijän and Erivan became separate republics.

In this isolated situation Georgia accepted German assistance. German troops were already in Odessa and Sevastopol; German delegates came to Batum to negotiate peace between Turkey and Georgia; and Georgia and Germany concluded an agreement under which German financial and military support were to be extended to the Georgian Republic. The Turkish occupation of Batum could not be terminated; but Germany undertook that Georgian rights in the port should be safeguarded, and that Georgian neutrality should not be infringed. German troops were admitted to Georgia, and so long as Germany remained in Trans-Caucasia she executed the terms of her agreement with exactness, even though to the disadvantage of her Turkish ally.

The two armistices—between the Allied Powers and Turkey on Oct. 30 1918 and between the Allied Powers and Germany on Nov. 11—which ended the war changed the whole position in Trans-Caucasia. They provided for the immediate evacuation of this region by Turkish and German troops, and their replacement, for the time being, by Allied troops. In execution of these provisions a British garrison was placed in Batum on Dec. 27, and a British occupation of Trans-Caucasia was carried out to ensure the evacuation by Turks and Germans.

During the British occupation Georgian administration—which proved to be efficient—was left undisturbed except in the matter of railways. These it was found necessary to put under a British Board of Railway Control at Tiflis, owing to their international importance, and to the increasing efforts of the Georgian Government to use them for exerting political pressure.

In Georgia, as in the other Trans-Caucasian republics, disputes upon frontiers and territorial claims became acute as soon as Russian control had ceased. One such dispute with regard to the district of Borchalinsk led to Georgia declaring war on Erivan in Jan. 1919. After long negotiations with the British general commanding in Trans-Caucasia serious hostilities were averted, and a neutral zone established; but the matter showed that unless the whole country were controlled by a dominant power there would be no settlement of such disputes except by warfare between the three republics.

At the Paris Peace Conference which opened on Jan. 18 1919 Georgian interests were represented by a delegation. For some time it seemed that the Conference would include Trans-Caucasia within the scope of its settlements; but gradually this good intention disappeared. Various ideas were considered, such as placing the whole area under a mandatory Power; but no Power willing to undertake such an onerous and thankless task could be found. The question of Batum, in particular, received much attention. The international importance of the position was realized, and a scheme embodied in a draft of the Treaty of Sèvres making the port and district a free state under the League of Nations, and giving Erivan and Azerbäijän definite rights in the port and of access by rail. But this apparently reasonable proposal was also abandoned on further consideration. The future of Trans-Caucasia, in fact, was dominated too much by Russia for any practical settlement to be attempted. Nothing would be permanent to which Russia was not a party, and for the time being no definite Russia capable of expressing herself existed. Yet whenever a reconstituted Russia emerged she would hold Trans-Caucasia in the hollow of her hand, and any settlement against her interests would be worse than wasted effort. The Peace Conference confined itself to granting *de facto* recognition to the three republics; to preventing war between them; and to embodying in the Treaty of Sèvres a provision for the settlement of the frontiers of Erivan, with Georgia and Azerbäijän. Few will hold that wisely it could have done more.

The British occupation of Trans-Caucasia continued until the end of Aug. 1919, and then, with the exception of a small garrison left in Batum, the troops were withdrawn, their mission fulfilled.

During the same year the situation in Georgia was not a little complicated by the intrigues and hostility attending Gen. Denikin's movement against Bolshevik Russia. As early as Jan. 1919 Gen. Denikin, whose headquarters were at Ekaterinodar in Cis-Caucasia, had collected nearly 200,000 men. At first he met with remarkable success. In the early autumn, indeed, it looked as if he might destroy Bolshevik rule. His armies were successful; his navies controlled the Black Sea and the Caspian; he had unlimited supplies. Throughout he viewed with extreme disfavour the independence of the Trans-Caucasian provinces, and did what he could to promote disunion and hostilities between them. He had an understanding of some kind with the Armenians of Erivan whom he encouraged and supported against Georgia, regarding that republic as the chief danger to future Russian supremacy in Trans-Caucasia. He seemed to fear that Georgia, accessible from the sea, might pass under British control and be made the foundation of a united Trans-Caucasian state, rich in oil and minerals and powerful enough, with British support, to maintain its position permanently. Towards Georgia, therefore, his policy became one of almost active hostility. He refused to recognize her flag at sea, fired on her shipping, and attacked her frontier guards. The collapse of Gen. Denikin's operations in the autumn of 1919 was the end of a reactionary movement entirely incompatible with Georgian independence.

But, Denikin out of the way, Bolshevik Russia began to push her designs in Trans-Caucasia. Propaganda and corruption on a lavish scale prepared the ground. It was not until April 1920 that active military measures were taken; but in that month the XI. Soviet Army from Cis-Caucasia moved on Baku, occupied the city without fighting, overthrew the republic of Azerbäijän, and set up a Soviet Republic. Established there, Russian troops advanced along the railway towards Georgia, intending the capture of Tiflis, but were repulsed at the frontier and found it necessary to suspend their operations. Having the Polish campaign on her hands at this time Russia was unable to press her efforts in Trans-Caucasia. She was content to wait. She signed a treaty of peace with Georgia on May 7—a provision of which recognized the district and port of Batum as Georgian territory.

The Supreme Council having abandoned the idea of creating a free state at Batum, no sufficient reason existed for retaining a British garrison there; transfer to Georgia became desirable, and was carried out on July 7 1920. An agreement, however, was made with Georgia by which she granted Erivan and Azerbäijän the same port and railway rights they would have enjoyed had Batum been under the rule of a Free State, and Erivan a special concession for a direct line of railway to the port.

The Batum area was peopled chiefly by Ajarians, a warlike Mahommedan tribe with Turkish sympathies, whose readiness in arms had previously caused Georgia considerable difficulty. These stout hillmen were now won over by giving them a form of autonomy under Georgian sovereignty.

In the summer of 1920 Georgia was able to regard her position with satisfaction and some degree of hopefulness for the future. In two years of independence she had made great national progress. Her territory was untouched by war; her internal affairs were tranquil, her Government and administration effective for her needs; her population was prosperous, and the large proportion opposed to the theories of Bolshevism, notwithstanding propaganda and the presence in Tiflis of a loud-voiced Bolshevik mission, prodigal of gold. Externally, however, her outlook was not so bright. Bolshevik Russia and Nationalist Turkey were in league, pursuing common aims, and, in effect, seeking a common frontier in Trans-Caucasia. Georgia did not stand geographically in the way of Russo-Turkish approach, but she could not fail to be affected by disaster to her Armenian neighbour who did. The difficult question for Georgia was that of support for Erivan in the event of a Russo-Turkish attack. It was complicated further by Turkey not having renounced her claims to Batum.

At the end of Sept. these matters reached a crisis. A Turkish army invaded Erivan; a Bolshevik army threatened Erivan and Georgia along the railway line leading from Baku to Tiflis. In spite of Armenian resistance, which met at first with some success Turkish troops overran Erivan; Bolshevik risings broke out in the capital and other towns, and Erivan became a Soviet Republic nominally allied with Russia. Georgia had hesitated when the danger first became evident; her people had strong instincts against military operations outside their own territory; they could not realize that their best line of defence lay not in Georgia but in Erivan; they felt, too, that resistance would have slight prospect of success. If aggression were directed against their own country they would, they believed, fare better by a policy which avoided desperate resistance than by a policy of resistance to the uttermost. They had faith in the turnings of the wheels of time.

A Bolshevik invasion of Georgia followed immediately; and simultaneously, in the usual Bolshevik way, risings proclaiming Soviet rule occurred in Tiflis and various Georgian towns. No serious resistance was attempted. The Turks reoccupied Batum; Georgia became a Soviet Republic dependent on Russia; and thus, in fact, if not at once in form, Russia had reëstablished herself in Trans-Caucasia by 1921. And she took care that her vital Trans-Caucasian seaport should not remain in Turkish hands. She insisted that it must belong to the Soviet Republic of Georgia; and the Turk gave way. (W. J. C.*)

GEORGIA, U.S.A. (*see* 11.751*).—The pop. of Georgia in 1920 was 2,895,832 as against 2,609,121 in 1910, an increase of 11%. For the preceding decade the rate of increase was 17·7%. During 1910–20 negroes increased from 1,431,802 to 1,689,114, but relatively they decreased from 45·1% of the total pop. to 41·7%. The urban pop. was 25·1% as compared with 20·6% in 1910. The density of pop. in 1920 was 49·3 per sq. m., as against 44·4 in 1910. The census of 1920 revealed an important movement of population from the mountain counties of the northern portion of the state and from central Georgia to south-central

***These figures indicate the volume and page number of the previous article.**

and south-eastern Georgia. This shifting of population was due to the presence of large areas of undeveloped and fertile land in the southern half of the state. The highest density of population, however, was still to be found in the northern half.

The following are the cities of over 25,000 inhabitants with their pop. in 1920 and 1910 and rate of increase in the decade:—

	1920	1910	Percentage Increase
Atlanta	200,616	154,839	29·6
Augusta	52,548	41,040	28·0
Columbus	31,125	20,554	51·4
Macon	52,995	40,665	30·3
Savannah	83,252	65,064	28·0

Agriculture.—The coming of the boll weevil and the outbreak of the World War coincided. Although scarcely perceptible in 1914, by 1916 the boll weevil had spread over the coastal plain of Georgia, and in the following years covered the entire state. The growing of long-staple cotton was abandoned and the production of the short staple was sharply curtailed, falling from 2,718,037 bales in 1914, the largest crop in the history of the state, to an average of 30 % less in the four years following. This situation gave a powerful impetus to diversified farming, the movement being aided by the high prices of food-stuffs due to the World War. The production of corn jumped from 39,000,000 bus. in 1919 to 69,000,000 in 1920; Irish potatoes from 886,000 bus. to 1,628,000; sweet potatoes from 7,426,000 bus. to 13,000,000; peanuts from 2,559,000 bus. to 7,616,000; tobacco from 1,485,000 lb. to 16,000,000. Hogs increased in number from 1,945,000 in 1910 to 3,040,000 in 1919, and a number of packing plants were established. Agricultural lands advanced in price about 100 %, and agricultural wages about 80 %. The depression of 1920 had a very serious effect. The sudden and drastic deflation in the prices of agricultural products caused a practical moratorium of debts and led to many failures.

Education.—In 1910 the total enrolment in the public schools was 555,794; in 1920, 723,077; the state appropriation for elementary schools in 1910 was $2,237,000; in 1920, $4,000,000; there was raised by local taxation in 1910, $1,307,000; in 1920, $5,693,205. The total amount spent for educational purposes in 1910 was $5,400,000; in 1920, $15,540,781. This last sum included all funds from all sources. Important legislation was put upon the statute books during the period 1910–20 looking toward the modernizing of the educational system. A constitutional clause limiting the taxing power of the counties to taxation for elementary schools only was removed (1910), thus legalizing county taxation for high schools. The State Board of Education, which had been composed of state-house officials, was made into a professional board (1911), and a uniform text-book law passed, the duty of choosing the books being placed upon the board. Compulsory education dates from 1916. The law, as amended by the new School Code of 1919, was a good one, requiring attendance through the seventh grade and allowing no exemptions except of a temporary character. Provision was made for attendance officers. A training school for negro teachers was authorized in 1917. Long strides forward resulted from the Federal Smith-Lever Act of 1914, accepted by Georgia the same year, providing for extension work in agriculture and home economics, and the Federal Smith-Hughes Act of 1917, accepted the same year, for the teaching of vocational subjects in the schools. In 1919 the policy was adopted of setting apart one-half of the total income of the state for the schools. In the same year a constitutional amendment was adopted, by which the counties were required to levy local taxation of not less than one mill nor more than five mills for the support of elementary schools as a supplement to the state appropriation. An additional five mills may be voted in districts having independent school systems. To encourage the consolidation of small schools, the Legislature appropriated $100,000 from which the state offered to pay a bonus of $500 to any county which combined small schools into larger ones; and where a four-year high school was provided an additional bonus of $1,000 was authorized. An illiteracy commission was established (1919) to make a study of adult illiteracy, and in 1920 local taxation for the support of schools for adult illiterates was authorized. Noteworthy progress was being made in the eradication of illiteracy. White illiteracy declined from 7·8 % to 5·4 %; negro from 36·5 % to 29·1 %. Physical education was required (1920) in all schools supported by the state. During the 15 years after 1905 the number of four-year high schools increased from seven to 204. The progress of the elementary and high schools was far more noteworthy than that of the higher educational institutions. The latter enjoyed large increases in attendance, but very small additions to their equipment and appropriations for maintenance. The total state appropriations for higher institutions, including the academies for the deaf and blind, were, in 1910, $436,500; in 1920, $991,671.

Government.—The decade 1910–20 in Georgia was characterized by noteworthy legislation designed to further social progress and economic improvement. A training school for girls was established (1913), a similar school for boys having already been in operation for several years. The standard of medical education was materially raised (1913); only four-year medical colleges were recognized and the requirements for entrance were increased. A new Board of Health was established (1914) to exercise control over the county boards of health. Provision was made for paid sanitary commissioners in all sanitary districts which consist of one or more counties. A Vital Statistics law of 1914 provided for the registration of births and deaths and for the publication of statistics. Juvenile courts were established in 72 towns and cities as the result of legislation in 1915 and later. The employment of children under 14 years of age was prohibited (1914), and factory inspectors were provided in 1916. A Training School for Mental Defectives was established (1919); a Community Service Commission (1919) exercises supervision over similar county and city bodies; and a State Board of Public Welfare (1919) was set up, charged primarily with the duty of inspecting all institutions maintained by the state for the dependent, defective, delinquent, and criminal classes. An Act of 1920 provided for rehabilitation of persons disabled in industry or otherwise. This measure included assent to the Federal Vocational Act and pledged the state to equal appropriations made by the United States. A State Board of Vocational Education, created by an Act of 1917, was charged with the administration of the rehabilitation training.

In the field of economics and industry a Department of Commerce and Labor was created (1911) in which was later (1917) included a free employment bureau. The Department of Insurance dates from 1912. The State Highway Department (1916) was reconstituted in 1919 in order to bring the state system into harmony with national legislation providing aid in the construction of rural post roads. The Georgia law contemplates a state-wide system of paved highways, with a total of 4,800 m., to connect all county seats. Funds arising from the issue of motor licences (amounting in 1920 to $1,900,000) were set aside for this purpose. A Bureau of Markets (1917) was created to gather and disseminate information of value to producers and consumers of agricultural products. To further the erection of modern warehouses for the weighing, grading and storage of lint cotton, a Warehouse Commission was authorized in 1918. A new banking code, modelled on the National Bank Act, corrected many defects in the old banking system and provided for adequate inspection. An Employers' Liability Act (1920) set aside the common law defences of contributory negligence and negligence of fellow-employees and provided for compensation for industrial accidents, and a commission was created to administer the Act. A Legislative Reference Library was established in 1914, and a State Department of Archives and History in 1918.

Finances.—The assessed value of the taxable property of Georgia in 1910 was $766,000,000; in 1920, $1,181,473,000, an increase of 50 %. The yield of taxes in 1920 was $10,820,500. The principal source of revenue was the discredited general property tax. It was estimated that about 75 % of the taxable property of Georgia escaped taxation. In 1913 a Tax Equalization Act was passed with the purpose of removing inequalities as between counties and as between individuals. A Tax Commission was created the same year. Improvement resulted, but the root of the evil was not touched. An able Special Tax Commission was appointed in 1918. It recommended the classification of property for taxation purposes, but the Legislature had failed to act on the report up to the summer of 1921. The bonded indebtedness of Georgia was reduced from $6,944,000 in 1910 to $5,818,000 in 1920. The estimated value of the Western & Atlantic Railway, state-owned, was $20,000,000, or three and one-half times as much as the bonded debt.

History.—In politics Georgia continued throughout the period 1910–20 solidly Democratic both in state and national affairs. The most interesting political contests were those growing out of World War issues. U.S. Senator Hardwick stood for reelection in 1918. He had not supported the administration in a way acceptable to President Wilson. The President threw his support to Hardwick's opponent, William J. Harris, who was elected. By the time of the elections of 1920 a considerable reaction in sentiment had occurred. Hardwick entered the race for governor and defeated two administration candidates. Thomas E. Watson, a former Populist leader and an uncompromising opponent of President Wilson and his war policies, was elected U.S. senator over Hoke Smith and Dorsey.

The total number of soldiers furnished by the state during the World War was 86,973. Of these 20,132 voluntarily enlisted; 66,841 were taken into the service through the selective draft. The amounts subscribed to the Liberty and Victory Loans totalled $179,866,850.00. The names and dates of the governors were: Hoke Smith, 1911–2 (shortly after his inauguration Smith was elected by the Legislature to succeed J. M. Terrell as U.S. senator); Joseph M. Brown, 1912–3 (elected at a special election to fill Smith's unexpired term); John M. Slaton, 1913–5; Nathaniel E. Harris, 1915–7; Hugh M. Dorsey, 1917–21; Thomas W. Hardwick, 1921– . (R. P. B.)

GERARD, JAMES WATSON (1867–); American lawyer and diplomat, was born at Geneseo, N.Y., Aug. 25 1867. He was educated at Columbia University (A.B. 1890; A.M. 1891) and at the New York Law School (LL.B. 1892). He was admitted to the bar in 1892 and began to practise in New York City. The same year he became a member of the New York National Guard, rose to captain, and served through the Spanish-American War (1898) on the staff of Gen. McKoskry Butt. From 1900 to 1904 he was quartermaster, with the rank of major, of the 1st Brigade of the New York National Guard. In 1908 he became associate justice of the Supreme Court of New York and served until 1913, when he resigned on being appointed ambassador to Germany. At the outbreak of the World War in 1914 he assumed the care of British interests in Germany, later visiting the camps where British prisoners were confined and doing much to alleviate their condition. His responsibilities were further increased by the fact that German interests in France, Great Britain, and Russia were placed in the care of the American embassies in those countries, the American embassy in Berlin thus becoming a sort of clearing house. From first-hand knowledge he was able to settle the question, much disputed among the Germans themselves, as to the official attitude of the German Government toward the violation of Belgian neutrality. At the request of von Jagow, after the fall of Liége, he served as intermediary for offering the Belgians peace and indemnity if they would grant passage of German troops through their country. On Aug. 10 1914 the Kaiser placed in his hands a telegram addressed personally to President Wilson declaring that Belgian neutrality "had to be violated by Germany on strategical grounds." At the request of a high German official this telegram was not made public as the Kaiser had wished, but was sent privately to the President. After the sinking of the "Lusitania" with many Americans on board, on May 7 1915, the American ambassador's position became more difficult, and finally, on Feb. 3 1917, diplomatic relations were broken off by America and he was recalled. He was detained for a time because of wild rumours that the German ambassador in America was being mistreated and German ships had been confiscated; but this being disproved he was allowed to depart. While in Germany in 1914 he was Democratic nominee in New York for the U.S. Senate, but without success. On his return to America in 1917 he again entered the practice of law in New York City. In 1917 he published *My Four Years in Germany* and in 1918 *Face to Face with Kaiserism*. For his services to England he was decorated with the G.C.B.

GÉRAULT-RICHARD, ALFRED LÉON (1860–1911), French journalist and politician (*see* 11.766), died Dec. 6 1911.

GERMAN EAST AFRICA (*see* 11.771).—This protectorate was conquered in 1916–7 by British and Belgian forces, and German sovereignty over it was renounced in the Treaty of Versailles. The six years immediately preceding the outbreak of the World War had been a period of much administrative and commercial activity in the protectorate, the principal achievement being the completion of the railway from the Indian Ocean to Lake Tanganyika.

According to official returns the native inhabitants in 1913 numbered 7,659,898. Europeans numbered 5,336 (compared with 1,954 in 1908), of whom 4,107 were German, 411 British (including about 300 Dutch South Africans) and 336 Greeks. Coloured persons other than natives numbered 14,898, of whom the majority were British Indians. Of the natives some 185,000 were domestic slaves. The Reichstag early in 1914 passed a resolution desiring that slavery should cease by Jan. 1 1920. To this policy of fixing a date for the emancipation of the slaves both the governor (Dr. Schnee) and the Imperial Colonial Secretary (Dr. Solf) were opposed. About 300,000 natives professed Islam; adherents of the various Christian missions numbered over 200,000. The principal towns were the seaports of Dar es Salaam and Tanga—which had in 1913 about 900 and 300 white inhabitants respectively—Tabora, on the central plateau, and Ujiji-Kigoma, on Lake Tanganyika.

The high price of Ceará rubber on the European markets led to a great increase in the number of plantations, especially in the hinterland of Tanga, where British capital was largely interested. In 1910 rubber took first place in the exports of the protectorate. Other industries much developed were sisal and coffee growing, while cotton was also cultivated on a larger scale. The increased productivity was reflected in the trade returns. In the five years 1908–12 the value of exports rose from £543,000 to £1,570,000, and that of imports from £1,289,000 to £2,515,000. A good deal of the exports passed over the Uganda railway, but Tanga, as receiving the produce of the Usambara Highlands—where lived the majority of the Europeans—handled the largest proportion.

About 54% of the trade was with Germany; India, adjoining regions of Africa, and the United Kingdom took nearly all the rest of the trade. About 90% of the shipping was in German hands. Labour on the plantations was obtained through licensed recruiters; during 1911–3 the administration introduced regulations with the object both of ensuring sufficient labour for the planter and of proper treatment of the natives engaged. Most of the natives employed in the Usambara Highlands came from distant parts of the protectorate; about 25% of them renewed their original contracts.

Much energy was shown in developing communications. The Northern or Usambara railway, with its sea terminus at Tanga, had reached New Moshi, a distance of 218 m., by 1912. The Central or Tanganyika railway, 787 m. in length, was completed in Feb. 1914. Like the Usambara line it is of metre gauge. Kigoma, a good natural harbour near Ujiji, was chosen as the lake terminus. The Government bought nearly nine-tenths of the shares of the company owning the railway. The line, running from E. to W. through the centre of the country, and supplemented by a steamboat service on Tanganyika—with over 400 m. of navigable water—afforded a very large area of east-central Africa easy access to the sea. From Tabora, through which the Tanganyika line passed, surveys were completed for a railway N. to the Kagera river on the Urundi-Ruanda border. The building of this line was begun in 1914, but construction was stopped in 1916.

Wireless telegraphic stations were opened at Mwanza and Bukoba, on Victoria Nyanza, in 1911; a high-power station at Dar es Salaam was completed in 1913 and another was erected at Tabora in 1914.

The administration was in the hands of a governor who had the aid of a council consisting of three official and 15 unofficial members elected in three districts—five for Dar es Salaam and hinterland, five for Tanga and hinterland and five for the rest of the protectorate. This council had, however, advisory powers only. Education was partly undertaken by the Government, but that of natives was largely in the hands of missionary societies, prominent among them being the Church Missionary Society and the Universities Mission.

Revenue increased from £702,000 in 1910 to £966,000 in 1912; the chief sources of revenue were customs and a hut or poll tax of three rupees per annum on all adult male natives. The expenses of the civil administration were met from local receipts; an imperial subsidy was received for military expenses, the grant in 1913 being £180,000. The budget of 1914–5, the last framed by the German authorities, balanced revenue and expenditure for the civil administration at £1,023,000, with £165,000 subsidy for military expenses.

History.—The result of the adoption—at the instance of Herr B. Dernburg (then Colonial Secretary) after his visit to the protectorate in 1907—of a policy based avowedly on a study of British colonial methods is seen in the progress recorded above, not least in the increase in the European population. The demarcation of the N.W. frontier in 1910 settled a long and troublesome controversy with the Belgians and British and placed almost the whole of the important sultanate of Ruanda in German territory. In Ruanda a military administration was established; the authority of the sultan was impaired, not broken.

In July 1912 Dr. Albert Schnee, an official who had served in London and in New Guinea, assumed the governorship in succession to Baron von Rechenberg. Dr. Schnee was a man of energy and it was in part due to his efforts that the Dar es Salaam railway was completed two years before scheduled time. In 1913 Dr. Schnee started a vigorous anti-Moslem campaign, apparently regarding Islam as a danger to the country. He sent a circular to all military stations asking for a report on what could be done by means of Government servants and Government teachers to counteract effectively the spread of Islamic propaganda. "Do you consider it possible," the circular added, "to make a regulation prohibiting Islam altogether? . . . The encouragement of pig-breeding among natives is recommended as an effective means of stopping the spread of Islam. Please consider this point also." And Dr. Schnee, by administrative orders, considerably harassed the important Moslem community at Dar es Salaam. This anti-Moslem attitude was dropped at the outbreak of the World War and a violently pro-Islam attitude substituted. By Dr. Schnee's authority a proclamation was widely distributed inciting the Moslems to a holy war against the British. Schnee also later on permitted the deliberately degrading treatment of British civilians interned at Tabora to continue until, in July 1916, he realized that that place would fall into the hands of the Belgians.

Early in 1914 Lt.-Col. von Lettow Vorbeck arrived at Dar es Salaam and took over the command of the protectorate military forces. He had just completed a tour of the country when the war broke out. Up to March 1916 the civil administration continued with little alteration, and Dr. Schnee was tenacious of his authority up to the time when in Nov. 1917 he was compelled to flee from the protectorate.

Apart from the military operations the last years of German rule in East Africa—1914–7—were remarkable for the manner in which the Germans, cut off by the British blockade from outside supplies, were able to provide for their necessities. They had indeed adventitious aid. An exhibition was to have been opened at Dar es Salaam on Aug. 12 1914 to celebrate the completion of the Tanganyika railway, and for the use of the many visitors expected large quantities of European foods had been imported. In 1914 too the natives had large stocks of corn and cattle, and the country itself furnished milk and eggs. The abundance of wild honey largely made up for the lack of sugar, and rhinoceros fat was much esteemed. But all this apart, the Germans showed much resource. They manufactured whiskey and benzine, soap, tea, chocolate, biscuits, cigars and cigarettes, paper, calico, boots and quinine.

The British and Belgians established their own administrative machinery in the regions they respectively occupied, but by a decision of the Supreme Council in May 1919 the whole of German East Africa was assigned to Great Britain as mandatory. Nevertheless, in virtue of an agreement reached in Sept. 1919 nearly the whole of the provinces of Urundi and Ruanda were added to Belgian Congo. The British-governed area—over nine-tenths of the whole protectorate—was renamed Tanganyika Territory (*see* TANGANYIKA TERRITORY).

See a valuable report by Vice-Consul Norman King, Annual Series, No. 5171, published by the British Foreign Office, 1913; *A Handbook of East Africa*, prepared for the British Admiralty, 1916; A. F. Calvert, *German East Africa* (London 1917); Gen. Smuts, "East Africa," *Geog. Jnl.* vol. li. (1918); and the authorities cited under EAST AFRICA: *Military Operations*. (F. R. C.)

GERMAN LITERATURE (*see* 11.783).—Between 1910 and 1921 German literature, as shown in philosophy, poetry, drama and the novel, displayed various interesting reflections of the movements of ideas.

I. Philosophy.—The World War and the Revolution, which alike took the most unpolitical nation of Europe by surprise, were preceded by many premonitory signs, by many preparatory intellectual conflicts, waged in the sphere of ideas, of philosophy, literature and art and not touching in their immediate implications the domain of actual facts. Long before the European catastrophe there began in Germany an intellectual reaction against the materialist view of things with its promise of power and enjoyment. Sciences which had come to be prosecuted solely on technical and specialized lines began to strive for a return to philosophy, the primal mother of them all; for there was a general longing to venerate once more something that was absolute and beyond experimental investigation, and to establish a new value for the life of the soul. The one-sided explanation of the universe given by the natural sciences and by the materialism compendiously and popularly set forth in Ernst Haeckel's *Weltraetsel* was disposed of from three quarters—by the Vitalists or philosophers of the vital principle, whose forerunner was Nietzsche, by the Marburg school of philosophers, which revived Kant's transcendental idealism and by the so-called Baden school, which issued from Windelband's "systematics." The Vitalists by the mere fact of their descent from Nietzsche were a kind of romantic school. That great rhapsodist, who was far more of a poet and an artist than an abstract thinker, bequeathed to his successors an idea which has often been misrepresented, the idea of the superman, the lofty ethical ideal of the tragicman, who in spite of his sufferings affirms life by virtue of his intellectual power which emanates from the unconscious and ever exhausts itself in the pursuit of the objects of consciousness. Halfway between Nietzsche and the French Vitalist, Bergson, stands the keen-witted analyst Georg Simmel, although he after all "turns to the idea" and seeks above biological conceptions a metaphysical value higher than life itself (*Der Konflikt der modernen Kultur; Lebensanschauung*). Wilhelm Dilthey, one of the most gifted representatives of the historical method, tries to find a bridge between the newer Vitalism and the idealism of classic German philosophy. The living conception of the world of history has for him become the totality in which individual values compensate one another and form a unity of life. Karl Joel seeks this unity beyond the limits of the biological principle in a wider conception of the "organic" (*Seele und Welt*).

Eduard Spranger lays stress upon the subjective nature of every philosophy (*Weltanschauung*) as a creative synthesis of the imagination; the philosopher always arrives at a point where he believes in himself and in nothing else. Max Scheler, a pupil of Husserl, is the spirited representative of a new attitude in his *Philosophie des Lebens*. Philosophy, he argues, must not think in general conceptions; it must avoid relations with natural science or with mathematics, neither of which can supply any direct subjective experiences; it should confine itself to history, regarding it as the autobiography of the human soul. With Oswald Spengler's *Untergang des Abendlandes*, a fascinatingly written book, this vitalistic view is further extended. Spengler represents universal history as a morphology which shows the great civilizations arising upon one another to flourish and decay. They have as little comprehension of each other as have the vegetations of different climates and have therefore produced neither a common nor an absolute value. Fritz Mauthner maintains a cooler scepticism than the elegiac exponent of our decline. According to his *Beiträge zu einer Kritik der Sprache*, men cease to understand one another as soon as they begin to speak. In his *Atheismus im Abendlande* this nihilist nevertheless acknowledges the necessity of "a mysticism without God" in the sense of Buddhism. The marriage of the Oriental with the European soul is celebrated by Count Hermann Keyserling in his *Reisetagebuch eines Philosophen*, which, like Spengler's book, became the mode. An artist and an enthusiast rather than a philosopher, Keyserling aims at awakening the divinely creative element in the human soul, and attempts the conquest of selfishness, including the self-seeking of races and nations. Encouraged by the example of Rabindranath Tagore, he founded a "School of Wisdom" at Darmstadt (1920).

Leopold Ziegler gives the question of the significance of the future of western man a deeper bearing in his *Gestaltwandel der Götter*. Gods are for him not merely Zeus or Jahwe but also the conceptions by which we are swayed, endless space and time, the law of causation or that of the conservation of energy. Ziegler makes a penetrating analysis of the religious spirit of Europe, the forces which sustain our intellectual and social life, and then shows himself to be an equally able master of synthesis in his rôle as a prophet of the mystery which invokes Buddha and Nietzsche, the mystery by which we make ourselves divine without God, the mystery ever renewed, of guilt incurred and expiated, of sacrifice and regeneration, of creation and redemption.

Compared with these individual confessions the tendencies of Mme. Blavatsky and Mrs. Annie Besant's occultism and theosophy are more superficial; but it may be mentioned that they have been distilled into an esoteric doctrine by Rudolph Steiner in his Anthroposophical Society. Steiner likewise invoked the idea of development as set forth by Goethe, who used to make short work of prophets of the occultist type such as ordinary people, particularly women, have sometimes been very ready to accept. It is noteworthy in this connexion that long before the World War the very popular travelling preacher, Johannes Müller, started under the motto, "Save thy Soul," a successful campaign against materialism and intellectualism.

As at the time of the *éclaircissement* in the 18th century, philosophy went down among the people in order to act directly as a guide to the will and to teach men how to live. Abstract philosophy naturally maintains its attitude of reserve; the problems of the theory of knowledge which are its province are not suitable for engaging the public directly in the debate. But the philosophy of the universities against which Schopenhauer inveighed is no longer content with historical retrospects; it has once more begun to think. It was precisely materialism and positivism that gave life to the type of thought which succeeded German classical philosophy, and which now in turn cannot rest content with the narrow biological conception of the universe held by the new Vitalists. It has once more unfurled the old Kantian banner, with the legend: God, freedom, immortality. Paul Natorp, the head of the Marburg school, no longer confined himself to pure theory but devoted himself with ideal enthusiasm to questions of education, proving a powerful antagonist to the "profoundly uncultured dogmatism and absolutism" of the mere empiricists. Ernst Cassirer, a pupil of Hermann Cohen, the founder of this school, has written a biography of Kant which takes an equally high place as a scientific treatise and as a narrative. His excellent essay, *Freiheit und Form*, is born of the spirit of Kant, Fichte and Schiller. In *Idee und Gestalt* he succeeds, like Dilthey, in once more bringing what is essential in literary phenomena under broader philosophic points of view. Besides the school of Marburg, the Baden school manifested considerable productivity; it was founded on the traditions of Kant, Fichte and Hegel, by Wilhelm Windelband, who besides his great achievements in the sphere of history, once more displayed the *Willen zum System* (the will to frame a philosophic system). His successor, Heinrich Rickert, who was in 1921 the most powerful German philosopher in the proper sense of the term, defends the universality of his science with great success against the Vitalists who followed Nietzsche and were now allied with Bergson and with the American William James. Only the first volume of his chief work, *System der Philosophie*, had appeared up to 1921; his brilliant polemical work against the *Philosophie des Lebens* is of general interest. In opposition to the Vitalists, who conceive of thought as producing itself without concepts (*unbegreifflich*) as a pure fact from the elemental event of life, Rickert insists on the necessity of seeking a system. Without mastery of the contents of thought by means of concepts there is a theoretical chaos; life does not think; it is we who think about life, which is neither the only nor the final value but only the prior condition.

While Rickert combats the absence of reflection in the Vitalists and the Intuitionists, Rudolf Eucken attacks the mechanization involved in positivism and pure psychology. Eucken's popularity was founded upon his earlier writings, *Die Grundbegriffe der Gegenwart* and *Die Lebensanschauungen der grossen Denker*. The mild humanity of his nature and the suave emotion which characterizes his method of presentation spread the devoted community of his disciples as far as America and Japan. In Germany his lead was taken up by Ernst Tröltsch, who began by being a theological writer (*Der Protestantismus; Die Sociallehren der christlichen Kirchen und Gruppen*). Tröltsch demands of the inner motive power of the Christian idea that it should put itself in gear with the actual situation of the world. Christian ethics can only persist as social ethics. The idea of the Kingdom of God does not render the world valueless; what is beyond is the power of what is here.

Philosophy has once more leavened all the mental sciences; and, especially after Rickert's constructive criticism, the historical materialism of Lamprecht's German History is no longer conceivable. Political economists, too, like Werner Sombart, and the two Heidelberg brothers, Max and Alfred Weber, are governed no longer by mere technical or commercial points of view. The Webers, especially Max, a courageous and warm-hearted ethical leader of democracy, tried to impart ideal impulses to German policy during the war and the revolution.

It is a significant fact that one of the greatest German industrialists, Walther Rathenau, who in 1921 became Minister of Reconstruction, protested against the mechanization of life under capitalism and imperialism. In his eloquent writings he calls upon the educated youth of Germany so to act as to renounce and abandon materialism, and to be masters who serve (*Zur Kritik der Zeit; Zur Mechanik des Geistes; Von Kommenden Dingen*).

II. Poetry.—The literature of the years 1910–21 followed the same path as philosophy, although it was not always conscious of having had the same spiritual origin. Literature, by adopting the label of Expressionism, brought itself into line with the general tendency of an international development from which it, no doubt, received impulses, but on which, in view of the plentiful crop of new and talented writers, it was not dependent. Expressionism, like philosophy, was awaiting in 1921 a final battle against Naturalism and its legacy, Impressionism and Symbolism; the movement signified a declaration of independence by the creative mind, regarded as subject, against the power of reality, the insurrection of the intelligence against nature. The Expressionist poet does not want to detach his work of art, as an organic creation with an individual character, from life, but, like the Vitalist philosopher, wishes to continue to influence life by it. A poem is a free act of the mind, an independent manifestation of the will. The ego of the poet is the only world possible for him. The Expressionist rejects all traditions, all constraint of the past; he looks solely to the future and works at evolving a new race of men as part of the mystical-religious mission.

In 1910 German lyric poetry could show three poets of a representative character, Stefan George, Rainer Maria Rilke and Richard Dehmel. Stefan George, the strictest representative of the principle of "art for art's sake"—art raised above life to the position of eternal form—founded in profane literature a kind of cult in which the sanctity of form alone is worshipped and is handed down like ancient hierophantic rites. With his own chief work, *Der siebente Ring*, however, he had apparently exhausted the possibilities of this school of the sublime. Those of his disciples who did not completely surrender themselves to an esoteric service under the dictatorship of their master were the best able to survive. Among those with most individuality and robustness, Rudolph Alexander Schröder, whose productivity is small, published a fine volume of poems, *Elysium*, in which, by the frequent employment of ancient classical metres, he aspired to the calmness and clearness of Goethe. His German Odes, which sing the land of Dürer, Beethoven and Bach, the suffering heart of Europe, revive the Hellenism of Hölderlin, which is characteristically German in sentiment.

Rudolph Borchardt, who never entirely belonged to George's circle and who chivalrously gave the master notice in order to conduct a more spirited campaign against his disciples, attained as a lyrist, in spite of his marvellous tricks of style, no greater reputation than that of being an eclectic of taste. His essays, however, in his collected works show him to be the master of a prose which promises to endure by virtue of its monumental power of expression. Like the romantic school at the beginning of the 19th century, and indeed like every movement which is solely governed by aesthetics, this movement culminates in a very exquisite critical treatment of literature, in the semi-productive activities of literary transmission and translation.

Friedrich Gundolf, whose lyric vein was soon exhausted, wrote a book on Goethe in which he sets up his own conception of that poet as an alternative to that of Houston Stewart Chamberlain, and, after having revised the old translation by Tieck and Schlegel, published his *Shakespeare und der deutsche Geist*. The lyric fountain of the gifted Hugo von Hofmannsthal seemed to have run dry; he was content to be the librettist of Richard Strauss. Yet in the melodious tenderness of his *Prosaische Schriften* there is still an echo of the lyric temperament which is his essential endowment. The special "Viennese note" which was said to characterize his youth is now discovered in Peter Altenberg, who is far more detached as regards environment or tradition, who has never, like some of his contemporaries, written a line of poetry, and has never worn the garb of a past which was the creation of his own enthusiasm. *Was der Tag mir zuträgt; Wie ich es sehe*—these titles of his first books convey the characteristics of all he has produced. This creator of numberless lyric sketches in prose is altogether identified with the present; he is the poet of the street and of the Vienna café, of all the little, unremembered meetings with anybody whomsoever, above all with himself; in short a self-revealer of a naïveté which is ready to face inspection at every moment; and in this surrender to the moment it is he who perfects Impressionism.

The mystic lyric strain of Rainer Maria Rilke could produce no school in the strict sense of the term. His peculiarly personal talent, so delicate and yet so hardy, is due to an aristocratic refinement of the nervous system, to an extreme sensibility which seems to employ almost supernatural organs of perception and vibrates like an Aeolian harp at the faintest breath (*Buch der Bilder; Stundenbuch; Neue Gedichte*).

A single plaintive cord inspired and still vibrates in the poems left by Georg Trakl, a poet who was an Austrian officer, and who, in a state of mental derangement, took his own life during the war. Apart from these, Rilke's lyric strain has found affinities only among women writers. The insatiable longing of erotic mysticism sustains the sensuous and super-sensuous poetry of Else Lasker-Schüler, who exorcised the wretchedness of her Berlin Bohemian life by the conception of an imaginary biblical East redolent of myrrh and pomegranate. She is the wistful child of nature, who dances like Salome, serves like Ruth, and is ever and again waiting with the Song of Songs for the advent of the bridegroom (*Gesichte; Mein Wunder*).

The lyric verse of Princess Mechthild Lichnowsky, governed as it is by stricter methods of construction as regards form, must likewise be described as essentially religious. In the main, the religious element has become spiritualized; it no longer devotes itself to legend and mythology. Alfred Mombert calls himself a "spirit of ethereal piety" (*einen aetherfrommen Geist*). His too incorporeal and shadowless song is an ecstatic soaring above the world to the stars (*Der Sonne-Geist; Aeon*). The more robust Theodor Däubler, who has a great following outside Germany as well as in it, sings, in the great pathetic rhapsody of his *Nordlicht*, the man born of the light, the Aryan whom the North perfects. Mombert and Däubler are forerunners of the Expressionists; their bearing is hierophantic.

The real Expressionists who aim at ethical activism present themselves as a numerous party notwithstanding their individual differences. They are united in one task at which they all seem to labour simultaneously. Tireless conspirators and literary sappers, they receive their orders from the future and acknowledge no master in even the most recent past; although Richard Dehmel is really the giant who carries their world on his mighty shoulders. It was only at rare intervals that Dehmel was a pure lyric poet, for he insisted too systematically upon symbolical significance; but it was he who developed modern German lyric poetry out of Naturalism, who once more gave it warmth, intellectual vigour, significance and dignity. The full tones of social grievance and arraignment were being sounded in 1921 by the talented Franz Werfel; but he is also a man of a metaphysical cast who in suffering and acting seeks deliverance from the ego. His poetry rolls on like a never-ceasing flood which tears hills and rocks along with it. Werfel represents love in the guise of wrath—even of wrath against himself—and as instinct with a moral power which warrants a somewhat persistent expression of strong feeling (*Wir sind; Gerichtstag; Spiegelmensch*). Akin to him in moral sentiment are Georg Heym, Kurt Heyneke, Alfred Wolffenstein and Paul Zech. They are all denizens of the great city; they sing the proletariat, the factory, suffering, vice, crime, and also the horrors of war, which many of these revolutionary spirits had anticipated by presentiment. A method of greater artistry is followed by Ernst Stadler, an Alsatian who fell in the war. His volume of poems, *Der Anbruch*, shows a choice type of technical skill and a passion for nobility of form. Another victim of the war, a man of riper years, was Max Dauthendey, who died of homesickness on the island of Java—a quiet South German, who, after hesitating shyly on the brink, was hurled into literature by the eagerness of Dehmel. Dauthendey still maintained the old link with nature that is found in the fairy tale, the pantheistic kinship with all that grows on the earth, with the sense of wonder that inspires earlier German lyric poetry (*Das Lusamgärtlein; Die ewige Hochzeit*). Like Dauthendey, Oskar Lörke is a lyric poet whose verse is free from all "tendency" and who is entirely absorbed in his own moods, abandoning himself completely to the spirit of the moment.

It was by something of an accident that Ernst Lissauer acquired the reputation of a ferocious poet by his *Hassgesang auf England* ("The Hymn of Hate"). His later volume of poems, *Der inwendige Weg*, manifests a great depth of intense feeling and a strength which is derived from the earth but attains the form which fashions thought.

A great deal of recent German verse, particularly that which was written during the war and the revolution, is dispersed in magazines. A small volume, *Arbeiterdichtung*, contains a collection of the finest and most popular poems in which men of the people like Karl Bröger, Max Barthels and Heinrich Lersch rallied to their country in her hour of need.

III. The Drama.—The German declines to regard his theatre as a matter of convention; he asks from the stage a comprehensive conception of life and from the dramatist a highly personal confession of that which is in him. The German stage has submitted to all impulses that had any significance, whether they came from Tolstoi, Ibsen, Maeterlinck, Strindberg or Bernard Shaw. It has thus become at once the battlefield and the home of all the greatest innovators. The development from Naturalism through Symbolism to Expressionism kept the stage in a constant ferment which was attended by the passionate interest of the public and by a very alert criticism. Leading managers, like Otto Brahm, Max Reinhardt, Leopold Fessner and many others, courageously adopted those tendencies which in their general aspects represent the transition from reality to idealism, from nature to style, and which, naturally, have also influenced the actor's art in the sense of the new tasks which they set him. Gerhart Hauptmann, Germany's greatest imaginative writer, experienced during 1910–21 a proud renaissance of his earlier works; it was recognized late in the day that those works of his which had been described as naturalistic were not confined to the "art of *milieu*," and that they retained the freshness of youth by virtue of their essential form. During these years Hauptmann showed himself to be occupied with a transformation of the gods, with the clarification of ethical ideas from their mythological representations. Far away from his Silesian home and from German soil, he found the subject of his new plays, *Der weisse Heiland* and *Inipodhi*, in Mexican history and in the collision between Christianity and paganism during the epoch of the conquistadores. His brother, Carl Hauptmann, who was a man of high intellect but without the same poetic power of fashioning his work, followed a parallel path to Symbolism and to the literary drama (*Stildrama*). Hermann Sudermann, whom short-sighted critics used to place on a level with Gerhart Hauptmann, now merely satisfies the daily demands of the stage by his technical ability.

Gerhart Hauptmann's naturalist successors, the North Germans, Max Halbe, Georg Hirschfeld, Otto Erich Hartleben, and the South Germans, Ludwig Thoma and Josef Ruederer, had either died or fallen silent. Moreover Thoma's literary importance rested less upon his popular comedies than upon his excellent satires, written, partly in Bavarian dialect, against reaction in Church and State (*Lausbubengeschichten; Peter Schlemihl; Briefe eines bayrischen Abgeordneten*). His dramatic campaigns against clericalism were continued by Heinrich Lautensack who died young (*Das Gelübde; Die Pfarrhauskomödie*). August Stramm, who was killed in the war, made a hopeless attempt to let mere atmosphere instead of the spoken word influence the audience; he thus effected a *reductio ad absurdum* of Naturalism and brought it almost to the verge of Expressionism.

The Suabian Hermann Essig attempted to give Naturalism a substratum of the fairy-tale element, but he lacked the dialectical energy which inevitably turns modern drama into an intellectual process. Fairy tales, legends and especially Bible stories were frequently employed. The Rhinelander, Wilhelm Schmidt of Bonn, held the stage for some time by presenting unpretentious dramatic versions of the story of the Prodigal Son and the mediaeval legend of the *Graf von Gleichen*.

Austrian dramatic art, which had still been flourishing in the year 1900, fled into past phases of civilization, especially the rococo and renaissance periods, and dallied with dreams and raptures in clever masquerades. Hugo von Hofmannsthal never recovered the seductive charm of his youth after his play about Casanova, *Der Abenteurer und die Sängerin*, while Arthur Schnitzler, the leading representative of Viennese literature properly so called, succeeded in achieving dramatic concentration only in his one-act plays, in which there is a kind of chemical fusion between the man of the world's sceptical analysis of souls and a rare delicacy of dialogue. Hermann Bahr, who only writes poetry as a secondary occupation, mainly devoted himself to writing brilliant essays on artistic and literary subjects.

Richard Beer-Hofmann, who can claim kindred with both the last-mentioned playwrights, created in *Jaákobs Traum* an essentially lyric drama with a Zionist tendency. His earliest play, *Der Graf von Charolais*, is of interest for English readers in that it is founded upon Massinger's *The Fatal Dowry*. The Viennese Anton Wildgans had begun in his early play *Armut* to give Naturalism a literary style of its own. Other attempts at reform had already proceeded from the school of Stefan George, out of which a dramatic branch arose, little as that hierophantic master occupied himself with the profane structures of the stages.

Carl Vollmöller took a subject from the Middle Ages in his *Catherina Gräfin von Armagnac*, gave it a form something like the ballad and arranged it as if it were in strophes. From the later accretions to the Tristan legend Ernst Hardt derived his technically ingenious drama *Tantris der Narr*, which won both the Schiller Prize and a lasting success on the stage. The culmination of the romantic drama was achieved by Eduard Stucken with two mystery plays, the grail-cycle *Gawan* and *Lanwal*, which lulled the German public, but only very transiently, in an atmosphere of incense. All these endeavours were directed against the supremacy of Gerhart Hauptmann, who was, from a one-sided point of view, regarded as a mere Naturalist. Paul Ernst, excellent as an essayist, trifled with experiments in an archaic style; Hermann Burte, Wilhelm von Scholz, Eberhard König, Kurt Geucke indulged in sentimental flourishes of trumpets which sounded particularly patriotic in ears that were not too sensitive; but none of these could drown the calm poetic power of Gerhart Hauptmann's voice.

Herbert Eulenberg was regarded as a hope—by many as the fulfilment of a hope; he was an absolute romanticist who turned his face away from commonplace reality, a singer of quixotic passions, who let the hot ferment of the blood course like a ceaseless melody through his lyric dramas (*Alles um Geld; Alles um Liebe; Belinde*). His personages are all poets and visionaries, bewitchers or bewitched; but the morbid beauty of his plays soon began to fade because it did not clothe any real bones and sinews of dramatic structure.

All these exponents of a new style, all these neo-romanticists, were displaced by Frank Wedekind, once he had won his way to recognition. Especially after the censorship, which had been very hostile to him, had been abolished by the revolution, he dominated simultaneously with August Strindberg the repertory of the German stage. Compared with Hauptmann's more passive or more vegetative nature, the productivity of which seems almost unconscious, Wedekind is a real fighter, a fanatic, a satanist, who exhibits with unparalleled audacity the conflict between society and the relentlessness of sexual passion. Wedekind has not designedly sought a style, because in this instance the man is the style, because he habitually speaks with his own peculiar accent of cynicism through all his personages. His world is like a circus or a theatre of marionettes, and the most natural behaviour for his characters is the grotesque. Next to the enduring work of his youth, *Frühlings Erwachen*, his plays *Erdgeist* and *Die Büchse der Pandora* and *Francisca* have had the greatest vogue, and that not least because of the audacity of the subjects with which they deal. A rival to Wedekind arose in Carl Sternheim, who, with the intention of becoming a German Molière, attacked the *bourgeoisie* in all its exhibitions of moral and social hypocrisy. His reliance upon the keenness of his dialectics makes him the sworn enemy of all naturalistic portrayal of situations. Sternheim invented for his own use a "telegraphic style" of extraordinary precision, the most laconic kind of dialogue possible (or sometimes impossible) within the limits of German grammar, a method by which every figure in the play caricatures itself. His chief plays, *Die Hose*, *Bürger Schippel*, *Der Snob* and "*1913*," are an unbroken series of invectives against the German *bourgeoisie*. In them the storm of war and revolution already seems to be discharging its lightnings. Sternheim's satire had been exhausted by 1921, because his method of comedy lacked the fructifying elements of love and warmth. His Impressionism, carried as it is to the extreme point, could only have Expressionism as its sequel.

The real battle for the new art, which at the same time meant an entirely new view of life, was opened in 1912 by Reinhardt Sorge's *Bettler*, shortly followed by Walter Hasenclever's *Sohn* and by Paul Kornfeld's *Verführung*. In these plays, the last vestiges of Naturalism have vanished; the *milieu* exercises no constraint; there is no longer any psychological control; even the law of causation, with which a dramatist can hardly dispense, appears to be eliminated. The new generation declares war against everything which exists. Sons kill their fathers without hesitation in the name of life, which is the sole standard of value and which wins its right to every kind of fulfilment. In *Menschen* and *Jenseits* Hasenclever almost becomes an occultist; youth declares ecstasy to be its normal condition. Under the influence of war and revolution, frequently in anticipation of them, this kind of work, inspired by spiritual aspirations and by intense emotion, includes socialist and pacifist ideas amongst those which it absorbs. This school of drama likewise attracts a kind of talent which, with a stronger inclination than its own for plastic art, originates in an older tradition. Reinhardt Göring has written a fine drama in *Seeschlacht*. The virile power of his band of six sailors, who during the battle of Jutland work and die in the turret of a battleship, substitutes concentrated lyric force for dramatic effect. Fritz von Unruh, a playwright of great talent, took the subject of his *Prinz Louis Ferdinand* from Prussian history. In his tragedy *Ein Geschlecht* all the horrors of violence have found expression. Pacificism, communism, ethical utopianism, have laid hold of this new form of dramatic art in the persons of many of its young exponents. The *motif* of humanity suffering in the mass and conducted by the poet-apostle towards a less guilty future runs through all these plays. Politically Ernst Toller and Paul Zech are extremists; H. J. Rehfisch, Hans Johst, and the sympathetic Rolf Lauckner, rather seek to mediate.

This whole development, both in its ethical and in its formal aspects, is reflected in the many-sided work of Georg Kaiser, which elastically adapts itself to every varying mood of the times. His is a talent which is spasmodic and always surprising, but which lacks the tenacity of a development governed by the will of its possessor. His dramatic method is constantly becoming more incorporeal; it resembles a crystal in which he ever finds new facets to polish. Kaiser's chief characteristic is a tempestuous speed of action, which finds its most natural expression in *Von Morgen bis Mitternacht*, the tragedy, raised to symbolic significance, of a criminal hounded to death by his vain pursuit of enjoyment. *Koralle* and *Gas* represent the end or the suicide of the industrial and capitalist age. Kaiser's nature is coldly artistic rather than ethical. The tyranny of Expressionism has seized him and carried him away. It is in the nature of this school that, being intelligence transmuted into will, its supreme object is not to produce works of art about life, but by means of art to increase the potentialities of life itself. The era of Expressionism was not yet quite over in 1921, but its cycle would be completed if the truth were once more recognized that no art can begin by designedly ignoring nature, least of all dramatic art, the business of which is and remains the portrayal of men and women.

IV. The Novel.—The novel in Germany during the period 1910–21 started with an imposing inheritance from the past, an inheritance for which it had to thank talented women as regards the greater part of its productivity. Clara Viebig represented Naturalism, Helene Böhlau a soulful realism. Erica von Handel-Mazzetti gave literary form to Catholic tradition, and Ricarda Huch proved herself to be a great romanticist, distinguished alike by the colour which pervades her visions and by the exquisite art of her style. The delicate talent of Count Eduard Keyserling has a temperamental element that is almost feminine; it always reverts to the atmosphere of his Baltic homeland and to the decadent race of the last scions of aristocratic houses (*Abendliche Häuser; Fürstinnen; Wellen*). The German homeland school (a counterpart of the "Kailyard school" in Britain) was for a time the vehicle of a propaganda directed against literary centres in the great cities, but satisfied no one except the critics who had sworn allegiance to it. The Hamburg pastor Gustav Frenssen, who wrote the successful story of the peasant farmer *Jörn Uhl*, left as his successors in North Germany only the sensitive Tim Kröger and the more self-confident Hermann Löns. If the conception of an art of the homeland be applicable to Berlin, the elegiac sceptic Georg Hermann would deserve mention. With adaptive sympathy he turned to account in his *Jettchen Gebert* the popularity of the "Biedermeyer period" (1830 or thereabouts) and the characteristics of the Berlin Jewish *milieu*. Old Vienna supplies a better background than the younger capital of the German Reich. Arthur Schnitzler, in his novel *Der Weg ins Freie*, has brought out the tragic element in the life of the Jews of to-day with special reference to Austrian conditions. In his masterpiece, *Casanovas letztes Abenteuer*, he fashions the elegy of the advent of old age. More important and more fruitful than the self-conscious homeland school is that peculiar spirit and intimate life of a countryside which German literature has not only described in detail but has also warmed and fructified. In particular those quiet nooks of Suabia which are the homes of so many writers have produced an art of imaginative narrative characterized by tranquil contemplation. Emil Strauss's more important works belong to the preceding decade. Hermann Hesse experienced a second youth as a result of his familiarity with Dostoievsky and also under oriental influences (*Peter Camenzind; Klingsors letzter Sommer; Demian*).

The German Swiss, who are the nearest kinsmen of the Suabians, point to the increasing but not unchallenged fame of their veteran epic poet, Carl Spitteler. The tradition of their greatest imaginative writer, Gottfried Keller, is continued by Jacob Schaffner, who was originally a working shoemaker. If he had had greater power of concentration he might have become a master in his art. His best novel, though somewhat long drawn out, is *Konrad Pilater*, a genial, wise, and peculiarly German book, instinct with cosmopolitan sympathy. Albert Steffen, in his *Bestimmung der Roheit*, plunged deeply into mysticism; this novel is a kind of modern life of a saint, a dream of the expiation of the guilt of mankind by the divine power of the soul. The great religious novel of the period, *Emanuel Quint, der Narr in Christo*, was written by Gerhart Hauptmann. He used a legend of his Silesian homeland in order to tell the story of a vagabond who thinks himself Christ come back to earth. He collects like a chronicler the contradictory reports about this remarkable case, for which there was no psychological explanation. This enables him to describe in a masterly fashion the religious atmosphere in which Messianic expectations and ecstatic visions are possible.

Hauptmann's Silesian countryman, Hermann Stehr, sets out by plunging his narrative art into the depths of mysticism; he is a visionary, with special organs of perception which find their way equally well in the fourth dimension (*Geschichten aus dem Mandelhaus; Der Heiligenhof*).

With somewhat rash enthusiasm Jacob Wassermann in his *Christian Wahnschaffe* sends out a scion of the modern plutocracy among the people, in order that, like a new St. Francis of Assisi, he may take upon himself all the sorrow and guilt of humanity. Wassermann exhibits a more trustworthy artistic instinct in his earlier novels, *Die Geschichte der jungen Renate Fuchs*, *Caspar Hauser*, and in two excellent collections of stories, *Der goldene Spiegel* and *Drei Schwestern*. His Franconian countryman, Bernhard Kellermann, whose talent is characterized by flexibility, accommodated himself, after the sensational success of his *Tunnel*, to the contemporary demand for thrilling situations with the verisimilitude of everyday life. Gustav Meyrinck acquired his sway over the public mainly by his fanciful novels *Der Golem* and *Das grüne Gesicht*. Meyrinck made occultism and satanism popular; he is a most enterprising manager in respect of his stage settings and the skilful tricks by which he blends daylight with dreams and the sensuous with the supersensuous.

The place of the novel which educates or develops was taken by the romantic variety which preceded the expressionist type. Thomas Mann, who so successfully told the tale of the *Buddenbrooks*, approximated to this type with his novel *Königliche Hoheit*, somewhat of a fairy tale in its story of the marriage of an impoverished German prince with an intellectual dollar-princess. A far more powerful performance is his *Der Tod in Venedig*, the story of a writer who comes to a tragic end as the result of an abnormal but platonic passion. A very symptomatic episode of the years of the war was the keen literary feud between Thomas Mann, who is rooted in the German tradition, and his brother, Heinrich Mann, who, as a writer, looks for his inspiration to the south and, as a politician, to the western democracies. His great cycle of novels, *Die Göttinnen*, shows the influence of D'Annunzio; the one which exhibits the greatest technical skill is *Die kleine Stadt* with its Italian climate, and its lifelike presentation of men of the south. His satirical study, *Der Untertan*, attacking the epoch of William II., has laid its justification open to challenge by the coarsening effect of its bad taste. Heinrich Mann's extreme sensualism is a stage preceding Expressionism, which, if it were consistently employed, would inevitably destroy the art of story-telling, since, without the reproduction of the circumstantial element and without connected representations of reality, that art must lose its substance. The natural consequence was that the novel recurred to past epochs of history or resorted to strange and remote scenes in order to get the desired distance from its subject. Alfred Döblin gave his *Wallenstein* the highly coloured background of the Thirty Years' War, and Max Brod laid the action of *Tycho Brahes Weg zu Gott* in approximately the same epoch of human progress.

Eduard Stucken, displaying as much knowledge as inventive ingenuity, dealt in *Die weissen Götter* with the conquest of Mexico by Ferdinand Cortez and the reciprocal infliction of religious cruelties entailed by the collision of two civilizations. Casimir Edschmid, the theoretical champion of Expressionism, likewise delights in his somewhat violent novels in the sanguinary orgies of the age of the conquistadores. The more pacific Norbert Jaques takes a refuge in a melancholy Robinson Crusoe story, *Piraths Insel*, and in the tranquillity of the South Seas.

Narrative fiction in Germany frequently mingles with the feuilleton, the essay, the description of travel. Waldemar Bonsels, a writer of versatile talent, owes his early fame to his book of travel, *Indienfahrt*, and to his *Menschenwege*, frank confessions of a vagabond. Alfons Paquet in his sketches, *Li oder der ferne Osten*, shows his penetrating knowledge of East Asia, while in his Parisian novel, *Kamerad Flemming*, he appears as a socialist with international sympathies. He is an emissary of that element in the German people which seeks its brethren throughout the whole world. At the head of this school of writers, who think in European rather than in national terms, is the Alsatian René Schickele, a journalist of merit, a lyrist, a writer of tales, a dramatist, and a man of uncommon intellectual elasticity. He regards Expressionism in an aspect transcending its literary significance and displaying it as above all an ethical movement, a manifestation of the will—the good-will—which by the fraternization of the creative minds of all nations would prepare the way for universal peace. (A. E.)

GERMAN SOUTH-WEST AFRICA (*see* 11.886).—This protectorate was conquered in 1915 by South African forces under Gen. Botha, and German sovereignty over it was renounced in the Treaty of Versailles. The last ten years of German rule were notable in the economic sphere for the development of the mineral resources of the country, the increasing output of copper from the Otavi and Tsumeb mines, and the exploitation of the diamond-fields in the Lüderitz Bay district.

Diamonds were first discovered in 1908 and led to an influx of Europeans, the number of whites in the country in 1913 being 14,816, of whom 12,292 were German and 1,650 *Kolonialengländer* (mostly Dutch S. Africans). In 1915 the Germans numbered 15,298. The administration, which discouraged the settlement of non-German whites, was bureaucratic, expensive and unpopular. It spent, however, considerable sums on public works, and made efforts to promote stock-raising (for which large areas of the country are specially suited), agriculture, market-gardening and forestry. Between 1908 and 1912 a north-to-south railway, 315 m. long, was built across the central plateau and connected the lines running from Swakopmund to Windhuk and from Lüderitz Bay to Keetmanshoop. A railway (62 m.) was also built along the coast south from Lüderitz Bay to serve the diamond-fields. This was not a state line.

Fully half the capital invested in mining, land and exploration companies was, in 1913, British. In that year the mineral production was valued at £3,406,000, the whole of this trade having sprung up since 1906, when the copper mines were first worked. Diamonds were the chief export, being valued at £2,890,000. The output of diamonds increased from 483,266 carats in 1909 to 1,470,000 in 1913; up to Aug. 1914 the total value of the diamonds exported was £9,250,000. The yield of copper in 1913 was 50,000 tons, valued at £390,000. Apart from minerals, exports—mainly animal products—were practically stationary in the period 1903–13. The total exports increased from £1,103,000 in 1909 (the first year of diamond exports) to £3,515,000 in 1913; in the same period imports averaged about £2,000,000 yearly.

Revenue and expenditure were divided into ordinary and extraordinary, the latter category including military and certain public works charges. Ordinary revenue for the period 1910–4 was about £850,000 a year and was in excess of ordinary expenditure. The extraordinary expenditure was met by grants from the Imperial Government, which in 1903–14 averaged £1,490,000 per annum.

History.—The protectorate had a special value for Germany as being her only overseas possession where colonization by whites on a large scale was possible, and also as being a base in South Africa, both for political and economic purposes. Germany had cultivated close relations with the Transvaal Republic, and since the annexation of the Boer republics by Britain German agents had not ceased to maintain relations of a dubious character with certain sections of the Boers. Dr. T. Seitz, who was appointed governor of S.W. Africa in 1910, records that in 1911 he was in touch with "politicians of Dutch descent." In 1912 the German Government believed that the assurances given it by certain Dutch South Africans would ensure, at the least, the neutrality of South Africa in the event of an Anglo-German conflict. Dr. Seitz says that he was not so sure; he had evidence of "the mistrust by the Boers of the German race and the German character," and thought that the S.W. protectorate was threatened with as much danger from the Union of South Africa as from England herself. Seitz however continued negotiations with the Boer opponents of the British connexion. He proposed common action with them, and when the World War broke out he issued a proclamation that the Germans made war "not on the Boer people as such, but on the English and their adherents." (*See* SOUTH AFRICA: *History.*)

The opposition of a section of the South African Dutch to the operations against the Germans did not prevent the invasion and conquest of the protectorate by Gen. Botha (see *infra*), the long narrow strip of the protectorate extending E. to the Zambezi (the "Caprivi Finger") being cleared of the Germans by Rhodesian forces. Dr. Seitz states that the negotiations opened with Gen. Botha in May 1915 were merely to gain time, as he believed then that the German successes in Russia would bring a speedy peace. But the surrender two months later was a military necessity.

From July 1915 onwards the protectorate was governed by the Union of South Africa, martial law, in a mild form, being maintained until Jan. 1921. On May 7 1919 the Supreme Council had decided that the country should be assigned to the Union of South Africa under the mandatory system "C," set forth in the Covenant of the League of Nations; that is, it might be administered as an integral part of the territory of the mandatory. The terms of the mandate were approved by the Council of the League at Geneva on Dec. 17 1920. The territory was renamed the South-West Protectorate; its progress is described under SOUTH AFRICA, § *South-West Protectorate.*

See Dr. Seitz, *Südafrika im Weltkriege* (Berlin 1920); T. Tönnesen, "The South-West Africa Protectorate," *Geog. Journ.*, vol. xlix. (1917).

(F. R. C.)

MILITARY OPERATIONS 1914–5

For some time before the year 1914 the close proximity of the German Protectorate of South-West Africa, sharing a common frontier on its southern and eastern borders with the Union of South Africa, had been recognized by the Union Government of South Africa as an important factor in its military arrangements. The sudden outbreak of war in Aug. 1914 at once converted a hypothetical situation for which tentative measures had been devised into a problem calling for immediate action.

On Aug. 6 1914 the Union Government undertook to assume all military obligations resting upon the British regular garrison in South Africa and to replace that force by Union troops. This offer was accepted by the Imperial Government, and the imperial military forces in South Africa became available elsewhere. On Aug. 10 the Union Government further undertook to send a military expedition of its own against German South-West Africa, and the seaports of that territory and the wireless installation at Windhuk were indicated by the British Government as the original objectives of the enterprise.

The position of South Africa on the ocean line of communication between Europe and Asia, and the necessity for denying friendly harbours and long-range communication to the enemy naval squadron under Adml. von Spee in the South Atlantic were obvious and imperative reasons for early action on the lines suggested. This decision of the Union Government, however, produced strong opposition on the part of a portion of the Dutch population of South Africa, and the antagonism to the proposed expedition culminated in open rebellion in Oct. 1914. Though the opposition to the Government was numerically insignificant—only some 11,500 rebels took up arms—the sporadic nature of the outbreak and the extent of the territory in which it occurred necessitated the employment of 30,000 troops (of which two-thirds were of Dutch descent) for its suppression, and delayed all offensive action across the border for four months.

Before the rebellion started the following preliminary movements had been carried out by Union troops for the prosecution of the campaign in South-West Africa. On Sept. 18 1914 a force, under Col. P. S. Beves, had been landed without opposition at Lüderitzbucht. On Aug. 31 a mixed force, under Brig.-Gen. H. T. Lukin, some 2,500 strong and including the regular mounted troops of the Union (the South African Mounted Riflemen), had begun to disembark at Port Nolloth, and, extending inland, was eventually disposed along the western portion of Union territory immediately adjoining the southern enemy border, with headquarters at Steinkopf. Farther eastward this line of observation was continued by another mixed force of approximately 1,000 rifles under Lt.-Col. Maritz with headquarters at Upington, and upon Maritz's desertion with the greater portion of his command to the enemy on Sept. 9 Col. Brits with another force took over the task which had been so shamefully abandoned. Col. Brits, called away to the Union, was soon replaced by Col. van Deventer, who, on the recall of Lukin's force on Oct. 23 to the Union, assumed sole command in the locality. Until the end of the rebellion, which was closed by the surrender of Kemp with his own and Maritz's rebel forces at Upington on Feb. 3 1915, the activities of all the forces first employed, with one exception, did not involve anything beyond outpost and reconnaissance work. A more ambitious undertaking ended in the capture of a strong advanced detachment of the South African Mounted Riflemen with two guns at Sandfontein, in enemy territory, on Sept. 26.

The beginning of Feb. 1915 then may be taken as the time of the actual commencement of offensive action by the Union forces in and against German South-West Africa. The circumstances attending the problem which confronted the South African military commanders may be briefly summarized as follows: The greater portion of what was formerly German South-West Africa—of which the area is 322,350 sq. m., or rather more than half as great again as that of the German Empire in Europe—is a high plateau 3,500 ft. above sea level. From the coast and the border adjoining Union territory, until the gradual ascent to the plateau begins, a barren waterless tract 40 to 100 m. broad in the first case and 200 in the second formed a serious obstacle to the advance of the South African forces. Water is extremely scarce throughout the country, and is almost entirely below the surface. The water-holes were well known and at long intervals, and an advance was thus restricted to several well-defined lines. The country is very sandy and often rough, and presented formidable difficulties for every kind of transport. The climate is in the main very dry and healthful for man and beast, though the semi-tropical conditions of the N. cause the usual malaria and other diseases in the wet season. Cattle at the time of the campaign were plentiful, but all other supplies, including fodder of any kind, were scanty. The theatre of operations, badly watered, difficult to move in, devoid of adequate supplies, and protected against an advance from the Union side or the coast by a desolate belt of desert, was a powerful aid to a protracted defence by a commander falling back upon his magazines. A railway of 3 ft. 6 in. gauge ran from Lüderitzbucht to Keetmanshoop in the S., and thence N. to Windhuk, and from there westward to Karibib, with an extension to the southern portion of the Protectorate at Kalkfontein branching from the Lüderitzbucht–Keetmanshoop section at Seeheim: a total length of broad-gauge line of 800 miles. From Swakopmund, the northern port, a 2 ft. gauge railway ran to Karibib, and thence northward to Tsumeb and Grootfontein, with a total length of 420 miles. Much damage was done by the enemy to these lines and their bridges and culverts, and the Union engineers repaired 1,040 m. of railway and laid 340 m. of new line during the campaign.

The enemy regular forces consisted of approximately 140 officers and 2,000 other ranks (artillery and mounted riflemen), while about 7,000 European males of military age, of whom many had military training, were also available. An efficient camel corps proved of value, and several hundred South African rebels were also at the enemy's disposal. His one aeroplane was active until its collapse, and, with the arrival of some Union aeroplanes towards the end of the campaign, the South African troops had such advantage as was to be derived from command of the air. Of military equipment and *matériel* the German commander had abundance, and he enjoyed a substantial numerical advantage in respect of artillery.

The Union expeditionary base was formed at Cape Town, and from that place the Royal Navy conveyed, escorted and disembarked the whole of the forces and their supplies, which proceeded from South Africa to Lüderitzbucht, Walvis (Walfish) Bay and Swakopmund without the loss of a vessel or a life. Naval armoured cars also served during the operations.

Gen. Louis Botha, who, on the outbreak of the rebellion, had assumed supreme command of the forces of the Union decided personally to direct the operations in the N., and on Dec. 25 1914 the advance units of his force reached Walvis Bay under the command of Col. P. C. B. Skinner, who, on Jan. 13 1915, occupied and retained the port and town of Swakopmund. Gen. Botha reached Swakopmund, having visited the central force at Lüderitzbucht, on Feb. 11. On this date the position was as follows: The northern force—of which the greater proportion of the combatant troops was mounted, though a strong infantry force was included—occupied Walvis Bay and Swakopmund; the enemy, here controlled mainly by their chief command, holding an outpost line immediately outside the latter place. The central force, considerably augmented since its arrival in Sept. of the previous year, and now under the command of Brig.-Gen. Sir Duncan McKenzie, was at Lüderitzbucht on the coast, with its most advanced detachments at Tshaukaib, 40 m. inland, in touch with the enemy under Maj. von Bauzus on the railway line to Keetmanshoop. On the southern border, based on Upington, and organized in four, and later five, columns was the southern force, commanded by Brig.-Gen. J. Van Deventer. To this force, which was mounted, was opposed the enemy under Maj. Ritter. The eastern force, considerably smaller than the rest—it consisted of four mounted regiments with two 12-pounder guns—which was to advance on enemy territory westwards from Kuruman along the Kuruman and Molopo rivers, was in process of mobilization under Col. C. A. L. Berrange. Enemy detachments were on their eastern border at Rietfontein and Hasuur. To the Union forces heavy and field artillery were allotted as the supply available and the nature of the various tasks suggested.

To clear his immediate front and gain power of reconnaissance was Gen. Botha's first concern, and on Feb. 23 an advance in force from Swakopmund cleared the country beyond for a distance of 20 m., and Rössing on the railway and Husab on the Swakop river were permanently secured. The formation of forward supply depots was now undertaken, and, after much labour and with considerable difficulty, a longer advance was carried out terminating in successful engagements on March 18 at Riet and Pforte, in the Swakop valley, where the enemy were heavily defeated and retired with a loss of 37 killed and wounded, and 2 field guns and 9 officers and 275 other ranks captured. The Swakop river was thus secured for a distance of 60 m., and a garrison was placed at Riet. Railhead was pushed to Arandis, 30 m. from Swakopmund. The bulk of the forces were withdrawn, in view of the supply difficulty, to Swakopmund, and preparations for a similar advance were again undertaken.

The Swakop river route, recently visited by an unexpected and most welcome flood, had been selected for the main advance on Karibib and Windhuk. After a visit by the commander-in-chief to Gen. McKenzie, a second advance under Gen. Botha was made from Swakopmund and Riet on April 26, with the result that Karibib, the junction of the northern railway, was occupied on May 5 as the outcome of an advance from the Swakop river aided by a wide turning movement to the right by mounted troops, detached under Gen. Myburgh, by way of Otyimbingwe and Wilhelmstal. A determined enemy attack on the railhead at Trekkoppies on April 26 was beaten off by the garrison under Col. Skinner. The enemy opposite Gen. Botha, having withdrawn to the N. to avoid envelopment, Windhuk was occupied without opposition on May 12. The majority of the enemy European women and children were left to the care of the victors at Karibib and Windhuk.

In the meantime the central force had occupied the strong position of Aus on March 30 without fighting. The enemy, evidently apprehensive of the trend of events in the N., had retired. After some preparation Gen. McKenzie pushed strong mounted reconnaissances in the direction of Bethany (Bethanien), towards the Keetmanshoop–Windhuk railway, and, as a result of fine marching and vigorous action, engaged the only strong body of the enemy remaining in the S. at Gibeon station on April 26, the day of the second advance by Gen. Botha from Swakopmund. The enemy was roughly handled and escaped with loss and difficulty. The withdrawal of this southern enemy detachment had been prompted by the activity of the southern and eastern forces of the Union troops.

The eastern force, having set out from Kuruman on March 6, engaged the enemy successfully at Rietfontein and Hasuur, and on April 20 joined hands at Kabus with a portion of the southern force. The advance of this eastern force had only been possible as a consequence of well-planned water arrangements.

The columns of the southern force, in their advance from the southern border, defeated the enemy at Nabas on March 8, at Platbeen on March 27, and again at Kabus on April 20, when touch with the eastern force was established. These final operations in the S. were carried out under Gen. Smuts.

With the fall of the capital the whole of the country S. of it fell into the hands of the Union forces, and the enemy retired to the N. retaining no town of importance and controlling less than 200 m. of narrow-gauge railway. A conference as to terms between Gen. Botha and Gov. Seitz at Giftkuppe on May 21 proved abortive, and the final stage of the campaign against the enemy, now wholly concentrated in the N., was begun.

A large reduction of forces, reorganization, and settlement of the occupied territory were completed by June 17, and on the 18th Gen. Botha started on his final advance from Karibib. An infantry brigade, accompanied by two mounted brigades, moved in the centre under the personal direction of the commander-in-chief, while strong mounted forces operated to the E. and W. commanded by Gens. Myburgh and Brits respectively. The enemy, constantly outflanked, retired rapidly, and on June 27 Brits was detached to make a wide and rapid detour through unknown country to the N.W. with orders to reach Namutoni before the enemy and head the latter off. Myburgh was instructed to press the enemy in towards the main advance and to swing in towards Tsumeb.

Each of these movements, though communication ceased from the time of separation from the main advance, was carried out almost to the moment, and the enemy, defeated on July 1 at Otavifontein by the leading mounted brigade of the centre, forestalled at Namutoni by Gen. Brits, and having lost Tsumeb to Gen. Myburgh, surrendered to Gen. Botha on July 9 1915.

The campaign had been won with little loss of life—127 Union soldiers were killed in the rebellion and in German South-West Africa—but it will repay study as an instance of the overcoming of difficulties in climate and terrain, and for the experience which it afforded of the value of fertility of resource and power of adaptation.

Some of the difficulties which were surmounted seemed almost impossible to deal with, and the methods adopted in connexion with water supply are worthy of the closest attention. Some magnificent marching was a striking feature of all the operations. Brits's force on the final advance marched 340 m. in 20 days; McKenzie's mounted troops covered 200 m. in 12 days; while the infantry brigade in the centre on the final northern advance in 16 days marched 230 miles. Finally, the operations indicate clearly the extraordinary mobility of mounted riflemen, who are good horsemen and horsemasters, and whose frugal habits tend enormously to simplify the difficult problem of supply in a barren country, when they are directed by a master hand. (J. J. C.)

GERMANY (*see* 11.804).—The bounds of the pre-war German Empire, as constituted, since its foundation on Jan. 18 1871, out of the states of the earlier North-German Confederation and the S. German states, together with Alsace-Lorraine (annexed to Germany by virtue of the Treaty of Frankfort), were materially changed in the reconstitution of the new German Reich after the World War of 1914–8. By the Treaty of Versailles in 1919 (ratified on Jan. 10 1920) Alsace and Lorraine were restored to France; in the E. the Poles, who had been made independent, had large stretches of German territory assigned to them; in the N., after a plebiscite, parts of the Prussian province of Schleswig-Holstein went to Denmark; moreover, the town of Danzig with its outlying districts and the district round Memel were separated from Germany. In the S. a small strip of territory, the little district of Hultschin, was assigned to Czechoslovakia. In the W., Germany lost the territories of Eupen and Malmédy to Belgium. By the territory ceded to Poland, Germany was now split into two parts—one W. of the Polish frontier, and the other E. of the so-called old Poland, with the Polish corridors to the Baltic, and consisting mainly of the province of E. Prussia. By the

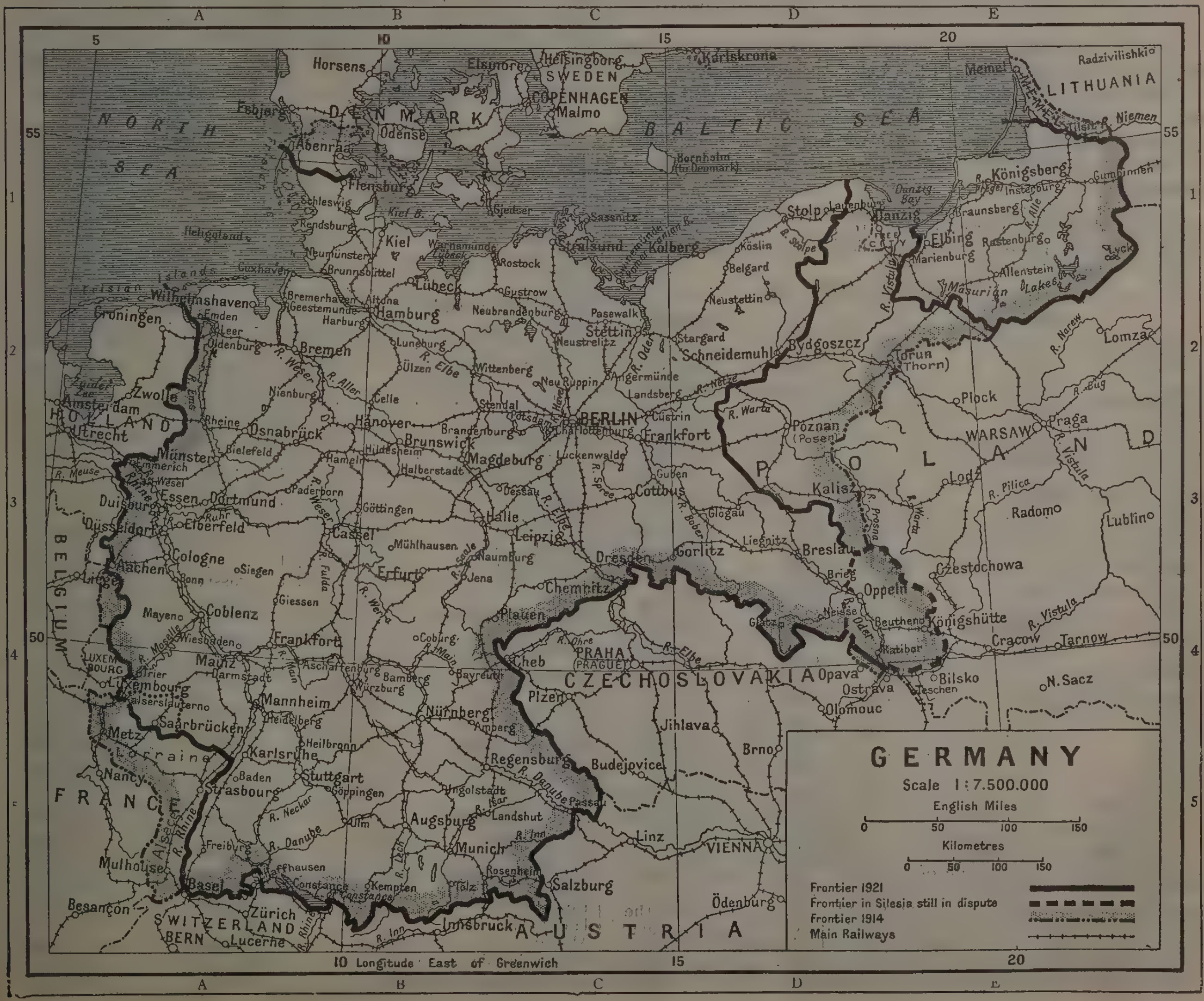
GERMANY
Scale 1:7.500.000
English Miles
0 50 100 150
Kilometres
0 50 100 150
Frontier 1921
Frontier in Silesia still in dispute
Frontier 1914
Main Railways
10 Longitude East of Greenwich
NORTH SEA
BALTIC SEA
DENMARK
SWEDEN
LITHUANIA
POLAND
CZECHOSLOVAKIA
AUSTRIA
SWITZERLAND
FRANCE
BELGIUM
HOLLAND
LUXEMBOURG
BERLIN
Hamburg
Bremen
Hanover
Cologne
Frankfort
Munich
Dresden
Leipzig
Breslau
Königsberg
Danzig
Stettin
Nürnberg
Stuttgart
Strasbourg
Metz
Memel
WARSAW
VIENNA
PRAHA (PRAGUE)
COPENHAGEN

surrender of territory in the N., Germany's northern limit was restricted to 55° 18′ N. The restoration of Alsace and Lorraine to France, however, only shifted the western frontier eastwards to an inconsiderable extent.

By the territorial alterations effected under the Treaty of Versailles, the extent of the German coast line, which previously amounted to not quite one-third of the entire frontier-line of the country, was diminished by the territories assigned to Denmark and Poland and by the districts apportioned to the free town of Danzig and the Memel district. In addition, the important seaports of Danzig and Memel were lost to Germany. As regards the frontiers dividing one country from another, the most important differences are that, in the W., since the separation of Alsace and Lorraine, the Rhine has become, to a great extent, the frontier-line between France and Germany, and that in the E., owing to the formation of the state of Poland and the establishment of the independence of the so-called border states, there is no longer any direct connexion between Germany and Russia. In the W., Germany is bounded by Holland, Belgium, Luxemburg and France; in the S., by Switzerland, Austria and Czechoslovakia; the eastern frontier is formed by Poland.

The extent of the reconstituted German Reich within these borders amounts to 473,314·9 sq. km., as compared with the 540,857·5 sq. km. of the German Empire before the conclusion of the Treaty of Versailles. The number of large towns (of over 25,000 inhabitants) had been diminished by 10, namely Strassburg, Metz, Mülhausen, Danzig, Posen, Bromberg, Thorn, Graudenz, Hohensalza and Gnesen. The number of inhabitants of the ceded territories, according to the census of Dec. 1910, was 5,579,912.

Of the self-contained river basins formerly belonging to the Empire (Rhine, Ems, Weser, Elbe, Oder, Vistula, Pregel, Memel and Danube), the basins of the Vistula and Memel, as well as the Rhine, were affected by the Treaty of Versailles. The Vistula was completely cut off from the waterways of the German Reich, and practically nothing but the mouth of the Memel remained in its possession.

Population.—The pop. of the German Empire, which was 41,058,792 in 1871, had increased in 1910 to 64,925,993. Table I shows the distribution of area and population at the census of Dec. 1 1910, among the 26 states:—

TABLE I.—*States of the Empire, 1910.*

State	Area (sq. km.)	Population
Prussia	348,779	40,165,219
Bavaria	75,870	6,887,291
Saxony	14,992	4,806,661
Württemberg	19,507	2,437,574
Baden	15,070	2,142,833
Hesse	7,688	1,282,051
Mecklenburg-Schwerin	13,126	639,958
Saxe-Weimar	3,610	417,149
Mecklenburg-Strelitz	2,929	106,442
Oldenburg	6,429	483,042
Brunswick	3,672	494,339
Saxe-Meiningen	2,468	278,762
Saxe-Altenburg	1,323	216,128
Saxe-Coburg-Gotha	1,976	257,177
Anhalt	2,299	331,128
Schwarzburg-Sondershausen	862	89,917
Schwarzburg-Rudolstadt	941	100,702
Waldeck	1,121	61,707
Reuss (elder line)	316	72,769
Reuss (younger line)	826	152,752
Schaumburg-Lippe	340	46,652
Lippe	1,215	150,937
Lübeck	297	116,599
Bremen	256	299,526
Hamburg	414	1,014,664
Alsace-Lorraine	14,521	1,874,014
German Empire	540,857	64,925,993

In the middle of 1914 the pop. was estimated at 67,790,000. The war, however, broke this tale of progress. The number of males killed in the war during 1914–8 is estimated at 1,800,000. A decrease in the birth-rate became more and more marked from the first quarter of 1915 onwards; and the death-rate of the civil population, notably in 1918–9 in consequence of the influenza pandemic, attained an alarming figure. By the loss of territory under the Peace Treaty a pop. of nearly 6 millions was separated from Germany. The result was that, in the census of Oct. 8 1919, the pop. of the reconstituted German Reich was shown to be 60,837,579. Of these, 28,982,137 were male and 31,855,442 female. The abnormal discrepancy in the relative numbers of the sexes (1,000 men to 1,099 women) was due to the war. In 1910 there had been only 1,026 women to 1,000 men.

Under the new constitution of the German Reich, the German Republic was composed of 18 territories (*Länder*). The distribution of the population over these territories at the end of 1920, according to the 1919 census, is shown in Table II.

TABLE II.—*Population by Territories, 1920.*

Territory	Male	Female	Total	Per sq. km.
Prussia	18,017,360	19,647,653	37,665,013	127
Bavaria	3,394,270	3,746,063	7,140,333	93
Saxony	2,168,065	2,495,233	4,663,298	311
Württemberg	1,195,144	1,323,629	2,518,773	129
Baden	1,051,405	1,157,098	2,208,503	146
Thuringia	712,474	795,551	1,508,025	128
Hesse	616,521	674,467	1,290,988	168
Hamburg	493,260	557,099	1,050,359	2,534
Mecklenburg-Schwerin	317,400	339,930	657,330	50
Oldenburg	250,623	267,142	517,765	80
Brunswick	226,400	254,199	480,599	131
Anhalt	157,710	173,548	331,258	144
Bremen	148,466	162,800	311,266	1,214
Lippe	71,117	83,201	154,318	127
Lübeck	57,539	63,029	120,568	405
Mecklenburg-Strelitz	51,170	55,224	106,394	36
Waldeck	31,065	35,367	66,432	59
Schaumburg-Lippe	22,148	24,209	46,357	136
German Reich	28,982,137	31,855,442	60,837,579	128

In the same area which showed, in 1920, a pop. of 60,837,579 there had been, in 1910, one of 59,346,081. The increase, therefore, amounted to 2·5 %; but as regards males there was a decrease of 1 %. During this period the growth of the population as a whole was greatest in the towns and the industrial districts. Apart from the three cities of Hamburg, Bremen and Lübeck, and their territories, Saxony was in 1920 the most densely populated territory. The next

TABLE III.—*Principal Cities, 1920.*

Town	Territory	Population
Berlin	Prussia	1,902,509
Hamburg	Hamburg	985,779
Cologne	Prussia	633,904
Munich	Bavaria	630,711
Leipzig	Saxony	604,380
Dresden	Saxony	529,326
Breslau	Prussia	528,260
Essen	Prussia	439,257
Frankfort-on-Main	Prussia	433,002
Düsseldorf	Prussia	407,338
Nürnberg	Bavaria	352,675
Charlottenburg	Prussia	322,766
Hanover	Prussia	310,431
Stuttgart	Württemberg	309,197
Chemnitz	Saxony	303,775
Dortmund	Prussia	295,026
Magdeburg	Prussia	285,856
Berlin-Neukölln	Prussia	262,127
Königsberg	Prussia	260,895
Bremen	Bremen	257,923
Duisburg	Prussia	244,302
Stettin	Prussia	232,726
Mannheim	Baden	229,576
Kiel	Prussia	205,330
Halle	Prussia	182,326
Berlin-Schöneberg	Prussia	175,092
Altona	Prussia	168,729
Gelsenkirchen	Prussia	168,557
Cassel	Prussia	162,391
Elberfeld	Prussia	157,218
Barmen	Prussia	156,326
Augsburg	Bavaria	154,555
Aix-la-Chapelle	Prussia	145,748
Berlin-Lichtenberg	Prussia	144,643
Bochum	Prussia	142,760
Brunswick	Brunswick	139,539
Berlin-Wilmersdorf	Prussia	139,406
Karlsruhe	Baden	135,952
Erfurt	Prussia	129,646
Mülheim-on-Ruhr	Prussia	127,027
Crefeld	Prussia	124,325
Lübeck	Lübeck	113,071
Hamborn	Prussia	110,102
Mainz	Prussia	107,930
Plauen im Vogtland	Saxony	104,918
Münster in Westphalia	Prussia	100,452

were Hesse and Baden. The least densely populated were the agricultural territories (or *Länder*) Mecklenburg, Waldeck, Oldenburg and Bavaria. Of the Prussian provinces, those of the Rhineland, Westphalia and Upper Silesia, which are mainly industrial, were the most densely populated, whilst the least densely populated were the agricultural provinces of W. Prussia, Posen, Pomerania and E. Prussia.

Corresponding to this development, there was a continuous movement between 1910 and 1920 towards the increase of the urban population. According to the 1910 census 20,374,127 (34·3%) of the total pop. were residing in towns of over 20,000 inhabitants. In 1919 this number had increased to 21,345,289 (35%).

In Table III a list is given of the principal cities of over 100,000 inhabitants according to the 1919 census.

The growth of individual German towns has varied greatly. Table IV gives index-numbers for the increase shown by the pop. in 1920, if that of 1871 is taken at 100.

TABLE IV.—*Growth of Town Population 1920 (1871 pop. = 100).*

Berlin	230	Bremen	311
Hamburg	412	Duisburg	800
Cologne	490	Stettin	305
Munich	371	Mannheim	579
Leipzig	565	Kiel	646
Dresden	299	Halle	346
Breslau	254	Berlin-Schöneberg	3,844
Essen	852	Altona	227
Frankfort-on-Main	475	Gelsenkirchen	2,154
Düsseldorf	587	Cassel	350
Nürnberg	424	Elberfeld	220
Charlottenburg	1,653	Barmen	210
Hanover	354	Aix-la-Chapelle	196
Stuttgart	337	Bochum	673
Chemnitz	445	Brunswick	241
Dortmund	664	Karlsruhe	371
Magdeburg	338	Crefeld	217
Berlin-Neukölln	3,226	Plauen im Vogtland	449
Königsberg	232		

The figures in Table IV, however, do not adequately represent the concentration of population in the towns which took place during 1910–20. In order to form an accurate judgment of the development of the large towns and the trend towards urban life, the influence of a large town on the communities within its immediate neighbourhood must be considered. These neighbouring communities show a considerably higher rate of increase as compared with communities farther removed from the town.

It was not yet possible in 1921 to ascertain whether the trend towards the large towns was being modified by the altered conditions arising out of the World War. There were signs that this was the case. The pop. of Berlin (2,071,257 in 1910; 1,902,509 in 1920) had decreased since 1910, although not to any great extent. This retrogression, however, was likely to cease when it once more became possible for German industries to make adequate provision for their workmen. The trend towards urban life is largely identical with the trend towards the workshop. This was especially evident during the war years 1914–8; internal migration assumed enormous proportions, and was directed away from those places where the conditions of war had restricted production towards the centres of increased production arising out of direct or indirect war requirements. After the signature of the Armistice there was a wide-spread retrograde movement, still governed by prospects of production and therefore of wage-earning. At the same time rural districts experienced a not inconsiderable increase in population, and this applies above all to the great coal-mining districts of Germany, the Ruhr region, Upper Silesia and the lignite district in central Germany.

Emigration from Germany overseas had been steadily decreasing after 1891; and it was almost entirely stopped during the war. Between 1871 and 1880 the overseas emigrants had numbered 625,968; between 1881 and 1890, 1,342,423; 1891 to 1900, 529,875; and 1901 to 1910, 279,645. For later years the official figures were: 1911, 22,690; 1912, 18,545; 1913, 25,843; 1914, 11,803; 1915, 528; 1916, 326; 1917, 9; 1918, none; 1919, 3,144; 1920, 8,458.

As regards foreign immigration into Germany, no recent detailed statistics were available in 1921. But the census returns showed that on Dec. 1 1910 there were 1,259,873 foreigners in Germany. More than one-half of these were Austro-Hungarians. Holland was represented by 144,175, Russia by 137,697, Italy by 104,204, England by 8,319, France by 19,140, Switzerland by 68,257, Denmark by 26,233, Belgium by 13,455, and the United States by 17,572. In 1920 the number of foreigners in Germany was very considerable, but precise figures were wanting. The number of immigrant Russians and so-called Eastern Jews and Galicians was particularly great. The number of Germans outside Germany greatly increased after the war. In the ceded territories there were (according to the census of 1910) 3,217,053 inhabitants speaking German as their mother-tongue. These must be reckoned among the Germans resident abroad in 1920. The number of Germans abroad before the war was estimated at over 30 millions. Of these only a comparatively small proportion returned to Germany after 1918. Outside Germany itself, in 1920, the countries to be reckoned more especially as German-speaking were Austria, parts of Switzerland and Belgium, Luxemburg, Liechtenstein, and stretches of country in Czechoslovakia and in Hungary.

The inhabitants within the boundaries of the German Republic speaking other languages than German as their mother-tongue are not numerous. At the census of 1910 the question of the mother-tongue was not raised in all the states throughout the Empire. Apart from the territories of Prussia and Saxony, where the mother-tongue was ascertained, there are hardly any but German-speaking inhabitants. In Prussia in 1910 it was estimated that 3,500,621 inhabitants (8·7% of the population) spoke Polish as their mother-tongue; that 141,510 (4%) spoke Danish; that 64,766 (0·2%) spoke Wendish, and that 790,733 (2·0%) had some other mother-tongue that was not German. In Saxony the census of 1910 showed that 24,009 inhabitants (0·5%) spoke Wendish, and 35,083 (0·7%) spoke other foreign languages as their mother-tongue.

Religion.—Of the pop. of Germany, 61·6% were, according to the census of 1910, adherents of the Protestant, or, as it is designated in Germany, the Evangelical faith; 33·7% adherents of the Roman Catholic faith; 0·44% belonged to other Christian sects, and 0·95% were Jews. Since the census of 1890 the number of Protestant Christians had been on the decrease, and that of Roman Catholics on the increase. This was to be attributed, on the one hand, to extensive immigration from Catholic countries, and, on the other, to the fact that the Roman Catholic population increased more rapidly than the Protestant, the creed of the former having a direct influence on the birth-rate, while, in addition, the Catholic section of the population contained an immensely larger proportion of the more prolific labouring classes than the Protestant. According to the census of occupations taken in 1907, there were 680 Catholic to 1,000 Protestant wage-earning workers, but to every 1,000 Protestant salaried employees or persons engaged in occupations on their own account, there were only 527 Catholics.

Table V shows the distribution by religion within the new frontiers of Germany after the Treaty of Versailles, on the figures of the 1910 census.

TABLE V.—*Distribution of Religions.*

Territories (1920)	Protestants (1910)	Roman Catholics (1910)	Jews (1910)	Others (1910)
Prussia	23,420,842	12,341,123	378,819	318,537
Bavaria	2,014,876	4,865,373	55,394	26,466
Saxony	4,520,835	236,052	17,587	32,187
Württemberg	1,671,183	739,995	11,982	14,414
Baden	826,364	1,271,015	25,896	19,558
Thuringia	1,456,075	43,102	3,820	7,541
Hesse	848,004	397,549	24,063	12,435
Hamburg	929,758	51,036	19,472	14,398
Mecklenburg-Schwerin	615,511	21,043	1,413	1,991
Brunswick	464,175	25,888	1,757	2,519
Oldenburg	371,650	107,508	1,525	2,359
Anhalt	315,262	12,755	1,383	1,728
Bremen	259,688	22,233	1,843	15,762
Lippe	143,961	5,936	780	260
Lübeck	111,543	3,968	623	465
Mecklenburg-Strelitz	101,513	4,255	254	420
Waldeck	57,817	2,858	590	442
Schaumburg-Lippe	44,385	715	230	1,322
German Reich	38,173,442	20,152,404	547,431	472,804

At the census of 1919 the question of religion was not raised. According to the new constitution of the German Reich, no one is obliged to disclose his religious belief, unless rights or duties depend upon it, or there is a legally authorized interrogation.

Households.—The distribution of the population into households in 1910 was as follows:—Family households, 13,238,237 (with 61,765,065 members); single persons' households, 1,045,143; institutions, 63,312 (with 2,115,785 members). The size of family households had steadily diminished during successive decades, from 4·70 in 1871 to 4·60 in 1900 and 4·53 in 1910. There were 6,978,324 inhabited buildings in 1910, an increase of 65,703 in the decade. With the exception of the year 1913, there was great activity in building during the years 1911–4, but during the war it gradually came to almost a complete standstill. After 1919 building gradually revived, under the stimulus of the need for providing houses for the enormous number of immigrants and newly married couples; but, for the most part, it was limited to the erection of barracks, emergency dwelling-houses and small back-garden houses. This work was chiefly carried out by public enterprise. The need for new houses had not been by any means met by 1921. The number of those in search of dwellings was continually on the increase. In 1918, in order to form an estimate of the number of empty houses available and of the extent of the housing need, a housing census for the whole Reich was taken. It covered 3,782 communities, mostly the largest ones, and comprised 9,176,137 houses inhabited by 32,330,668 persons, or 55·5% of the total civil population of Germany. By this census it was ascertained that only in the smallest portion of the region under examination were there more than 3% empty houses available. The shortage which arose after the signing of the

Armistice, due to the great number of immigrants and of persons expelled from foreign states, and to the high marriage-rate, could only be met in an approximate degree by the extensive adoption of a system of house rationing and compulsory billeting.

Vital Statistics.—The great increase in the population of the German Empire up to the beginning of the 20th century was mainly due to a high birth-rate. Between 1870 and 1900 the birth-rate maintained a level of 36–9 per 1,000 of the average population during that period. An average of 1,800,000 children were born alive annually. The average surplus of births over deaths amounted approximately to 600,000 annually. The comparative lowness of the birth surplus, if the high level of the birth-rate be taken into consideration, was due to the rather unsatisfactory death-rate. During the three decades 1870–1900 the death-rate fluctuated between 21·7 and 31·0 per 1,000 of the average population. From 1900 onwards the birth-rate was steadily on the decrease, and in 1914 it was only 26·8 per 1,000 of the average population. Simultaneously, however, the death-rate declined, not only owing to a lower death-rate among adults, but also because of a considerable decrease in infant mortality. The death-rate as a whole declined from 23·2 per 1,000 in 1900 to 15·8 in 1913, and infant mortality from 207 per 1,000 infants born alive to 151. In spite of the declining birth-rate, therefore, the surplus of births over deaths remained at the same level as heretofore. The birth surplus did not entirely cease until a few years before the outbreak of the World War. During the war the birth-rate and the rate of mortality were greatly affected by war conditions. From the middle of 1915 the birth-rate dropped rapidly and reached its lowest point in 1917, namely 13·9 per 1,000 of the population. In this year only 912,109 children were born alive. The rate of mortality rose during the same period. This was due, on the one hand, to the heavy losses by casualties, and, on the other, to the high rate of mortality among civilians, whose health had been greatly weakened by the blockade. The highest death-rate was in 1918, when, partly owing to the influenza pandemic, it rose to 24·7. After the Armistice the birth-rate began to recover, and from the middle of 1919 it rose with great rapidity, 1,512,162 children being born alive in 1920 (26·3 per 1,000 of the pop.), with a surplus of 623,367 births over deaths in that year, the death-rate having sunk practically to the pre-war level. Infant mortality, which in 1913 was 151 per 1,000 born alive, was 164 in 1914, 154 in 1915, 136 in 1916, 150 in 1917, 154 in 1918, 121 in 1919, and 131 in 1920.

For every 1,000 female infants born alive the number of male infants was 1,053 in the year 1910, 1,055 in 1915, and 1,080 in 1919. The reasons for this rise in the proportion of male infants have not been fully ascertained; it may probably be attributed to the decrease in the number of infants born dead. The rate of stillbirths (number born dead per 100 births) had declined from 3·1 in 1900 to 2·99 in 1919, though it rose again to 3·2 in 1920. In the case of stillborn infants, the proportion of the sexes is approximately 100 females to 127 males. A decline in the rate of stillbirths would therefore result in increasing the proportion of male infants born alive.

During the three decades 1871–1900, approximately 90% of the infants born alive were legitimate and 10% illegitimate. The proportion of illegitimate births has been almost continuously on the increase since 1903. During the war the increase was especially marked. The cause of this increase is to be traced, not so much to a rise in the number of illegitimate births as to the comparatively larger decrease in the number of legitimate births. The number of illegitimate infants to every 1,000 infants born was 91 in 1910, 98 in 1914, 112 in 1915, 115 in 1917, 131 in 1918, and 112 in 1919.

In 1910 the marriage-rate was 7·7 per 1,000 of the population. During the war, the number of marriages decreased materially (4·1 in 1915 and 1916, 4·7 in 1917, 5·4 in 1918), but there was a great increase afterwards (13·9 in 1919, 14·8 in 1920). The number was particularly great in the second quarter of 1920.

Divorces have increased both absolutely and relatively. In 1910 there were 23·3 divorces per 100,000 inhabitants; in 1914 the number had risen to 26·2, and in 1919 it had reached 36·2.

Occupations.—Table VI shows the division of the population in 1920 according to occupations, on a basis corresponding to that of the census of occupations taken in 1907.

TABLE VI.—*Occupation in 1920.*

	Total population	Persons whose emolument is derived from their chief occupation	Members of their families and their domestic servants
A. Agriculture and forestry	15,271,767	8,671,666	6,600,101
B. Industry and mining .	24,833,853	10,600,512	14,233,341
C. Commerce and traffic; hotel-keeping	7,730,501	3,256,063	4,474,438
D. Hired labour, various kinds; personal service	723,292	435,633	287,659
E. Public service; professions	3,051,149	1,523,424	1,527,725
A–E.	51,610,562	24,487,298	27,123,264
F. Unemployed . . .	4,764,028	3,141,916	1,622,112
A–F. Total population .	56,374,590	27,629,214	28,745,376

As compared with the Germany of 1907, the agricultural side had in 1920 been somewhat reduced and the industrial enlarged.

Agriculture.—In 1913 an inquiry was held as to the way in which the cultivation of the land was distributed. Table VII gives an application of its results to the territories of the Reich as constituted after the war.

By the cession of territory under the Peace Treaty Germany forfeited 14·8% of its arable land and 24% of its vineyards. About one-quarter of the total land of the newly constituted Reich is forest; approximately one-half of the total forest land consists of privately owned forests and the other half, for the most part, of state and communal forests. Two-thirds of the woods consist of conifers. The pine tree is the most common of these; not more than one-third of these coniferous woods consists of trees other than pines. Of this third the larger proportion is formed of fir trees. Of deciduous trees, beeches are the most numerous. One-fifth of the timber is oak. N. Germany is not so rich in forests as central and S. Germany. All the smaller mountain ranges, such as the Black Forest range, the Thuringian and Oden ranges, are wooded. To the N. there is a small stretch of land along the Baltic covered with oaks and beeches. There are practically no forests in the N.W.; in that region wide stretches of peat-moor predominate.

According to the harvest statistics for Nov. 1920 the chief products of the arable land were cultivated over the following areas (in hectares):—wheat, 1,381,274; rye, 4,325,247; spelt and winter spelt, 158,802; summer barley, 1,198,462; oats, 3,243,672; potatoes, 2,459,872; grass, clover and lucerne, 7,703,535; sugar-beet, 326,974.

TABLE VII.—*Cultivation (in 1,000 hectares).*

Territories	Land under tillage and gardens	Meadow-land	Pasturage	Fruit Farms	Vine-yards	Forests and Woods	Houses and farmyards, waste land and shores, roads, waterways
Prussia	14,440·1	2,844·8	1,689·4	14·7	20·2	7,461·7	3,194·8
Bavaria*	3,002·3	1,323·8	247·2	3·5	21·3	2,494·3	493·5
Saxony	841·7	174·1	8·4	0·6	0·3	377·6	91·3
Württemberg	846·9	295·2	48·8	22·3	18·9	604·8	114·0
Baden	561·2	213·5	41·0	0·5	15·0	588·9	87·0
Thuringia†	606·6	121·1	13·7	2·7	0·1	408·8	79·1
Hesse	365·5	93·7	7·9	3·3	14·4	242·0	42·0
Mecklenburg-Schwerin	743·5	116·4	66·8	0·1	..	246·0	143·4
Mecklenburg-Strelitz	138·6	21·7	9·7	..	..	64·5	58·4
Oldenburg	191·1	95·0	120·9	0·2	..	66·8	168·9
Brunswick	187·3	33·1	6·8	0·4	..	110·2	27·5
Anhalt	137·1	16·9	2·2	0·5	..	58·5	14·7
Waldeck	47·5	9·0	6·2	..	..	43·2	6·2
Schaumburg-Lippe	16·8	4·3	1·1	..	..	6·7	5·1
Lippe	64·7	6·8	11·7	0·1	..	33·0	5·2
Lübeck	15·8	2·4	2·0	..	..	4·2	5·5
Bremen	6·2	7·9	5·8	..	..	..	5·4
Hamburg	17·1	3·9	5·9	..	..	1·6	14·0
German Reich	22,230·9	5,382·6	2,295·6	48·9	91·2	12,812·8	4,556·0

* Excluding Coburg. † Including Coburg.

Rye is cultivated principally in the N. and E., while the cultivation of wheat is more extensive in the W. and S.

During the war years agricultural production was greatly reduced, and even in 1920 it had not nearly regained the level of 1913. The cause was the dearth of labour, which was most acute on the large properties, and also, to a great extent, the lack of manures, especially artificial manures. The decrease in production was, on the whole, most marked where large properties predominated.

The average quantities (in tons) produced per hectare throughout the Reich were in 1920 as follows:—wheat 1·63 (average of 1909–13, 2·15); rye 1·15 (1·82); barley 1·50 (2·08); oats 1·50 (1·98); potatoes 11·48 (13·71); clover and lucerne 5·16 (4·71); grass 4·31 (4·28). The crops throughout the Reich amounted in 1920 (in tons) to:—wheat, 2,255,055; winter spelt, 178,864; rye, 4,971,800; summer barley, 1,799,713; oats, 4,870,126; potatoes, 28,248,765; sugar-beet, 7,964,024; clover and lucerne, 11,419,406; grass, 23,656,436.

The yield of grain and fodder is quite inadequate for the requirements of the population of the German Reich, and Germany is compelled to import the larger proportion of both from overseas. Even the sugar-beet crop of 1920 was insufficient for the requirements of the country, in contrast to the years before the war when Germany was able to export large quantities. During the years 1913 to 1920 the production of raw sugar was as follows (in 1,000 *doppelzentner; a doppelzentner* or double hundredweight being 220 lb. or 100 kgm.):—1913, 27,159; 1914, 25,101; 1915, 15,153; 1916, 15,579; 1917, 15,411; 1918, 13,277; 1919, 7,890; 1920, 10,633.

The cultivation of *hops* extended during the years before the outbreak of war over approximately 27,000 hectares. The greater part of this, 65 to 70%, was carried on in Bavaria, and 25 to 30% in Alsace-Lorraine and Württemberg. During the war, the cultivation of hops declined very considerably. In 1919 only 8,030 hectares were under cultivation, but in 1920 the area rose again to 11,595 hectares, the crop that year amounting to 60,253 *doppelzentners* (see above). Owing to the restrictions placed on brewing, the demand for hops during the war was, of course, small.

In 1914 the number of breweries within the area in which beer was dutiable (that is, exclusive of Bavaria, Württemberg and Baden) was 3,602, with an output of 34,213,000 hectolitres; and in 1918 there were 2,192, with an output of 10,422,000 hectolitres. From 1919 onwards the three territories already named were included in the area in which beer was subject to duty. Within this area there were, in 1913, 23,229 breweries with an annual output of some 70 million hectolitres of beer. In 1919 only 11,477 breweries were at work. In 1920 the output of beer amounted to 23·3 million hectolitres.

The output of spirits amounted, up to 1914, to about 3·5 million hectolitres annually. From 1914 to 1918 there was an average annual output of 2·3 million hectolitres; and in 1919–20 the output dropped to 0·6 million hectolitres. In 1913–4 there were 53,448 distilleries at work, and in 1918–9 only 30,577.

The area under tobacco cultivation was 14,162 hectares in 1913 with a crop of 258,339 *doppelzentners.* In 1920 (partly in consequence of the loss of territory through the Peace Treaty), the area was 12,927 hectares, the crop in 1919 having fallen off to 205,836 *doppelzentners.* Tobacco is mainly grown in the territories of Baden and Bavaria (1920, 7,238 hectares). The principal plantations in the E. are to be found in the provinces of Brandenburg, Pomerania and E. and W. Prussia.

In 1920 the area under vine-culture in Germany amounted to 72,661 hectares, as compared with 120,207 hectares in 1906, but this diminution includes the loss of the Alsace-Lorraine vineyards to Germany. The output of must had fluctuated enormously from year to year. In 1904 it amounted to 3,118,000 hectolitres, as compared with 695,000 hectolitres in 1910. In 1920 the output amounted to 2,440,000 hectolitres.

Live Stock.—On Dec. 1 1913 it was reckoned that there were, within the territory of the late empire, 21 million head of cattle, 5·5 million sheep, 25·7 million pigs and 3·5 million goats. During the war live stock was seriously affected by the curtailment of fodder supplies, and was greatly reduced both in numbers and in weight per head. According to the census of live stock in the reconstituted area of Germany in Dec. 1920, as compared with the same territory in 1913, the figures were: horses, 3,581,380 (3,821,000 in 1913); cattle, 16,789,844 (18,648,271); sheep 6,139,299 (4,991,959); pigs, 14,149,462 (22,775,120); goats, 4,451,463 (3,256,853); and poultry, 60,751,686. Thus the figures for 1920 had fallen far short of those for 1913; but they cannot be viewed in their true light unless account is taken of the comparative weights of animals slaughtered. These were as follows (in kgm.) for the year 1919–20, as compared with pre-war averages:—oxen, 155 (250); calves, 31 (40); sheep, 17 (22); pigs, 75 (85). These figures show that the reduction in weight of animals slaughtered was considerable under each heading.

The distribution of live stock throughout the different territories is very uneven. Prussia, in consequence of its great extent, has the largest number. Horse-breeding is particularly flourishing in E. Prussia (breeding farm at Trakehnen), Schleswig-Holstein, Mecklenburg, Oldenburg, Hanover, Saxony (breeding farm at Graditz), and in Württemberg and Bavaria. Bavaria is richest in cattle; in this territory the pastures on the mountains (Alpenrevier, Algäu) are particularly favourable to cattle-rearing. But cattle-rearing is also carried on throughout the meadowlands of the hills and valleys of Württemberg, Thuringia and Hesse. It also forms the principal means of livelihood in the marshy lands on the Baltic, in Schleswig-Holstein, Pomerania and Mecklenburg. Pig-breeding is most extensively practised in Central Germany, but it also flourishes in Saxony, Westphalia and on the Lower Rhine. Sheep-breeding, which had been steadily on the decrease before the war, developed enormously in the later years. It is especially active in the northern parts of Germany in the less fertile and productive districts and in those containing large private properties. The development of sheep-breeding has been due to the shortage of wool in Germany and also to the lack of agricultural labour. But in spite of the increase in sheep-breeding, the production of wool falls far short of Germany's requirements. Goats and rabbits are especially numerous in Saxony, where there was great shortage of food during the war. Necessity forced the inhabitants of this territory to make up the deficiency in food supplies to some extent by keeping small stock.

The comparatively small quantity of live stock in Germany is totally inadequate for the supply of the population with meat and milk. During the war the people suffered very greatly from this shortage. The only means of securing to every individual a small share of meat and milk was by rationing the supply.

Fisheries.—The inland waters of Germany are fairly well stocked with fish. The fisheries on Lake Constance yielded 297 tons of fish in 1920, as compared with 390 tons in 1913. The sea fisheries in 1920 provided a larger yield than in any year before the war, and it was anticipated that, within the next few years, it would have increased to such an extent that Germany would no longer require to import fish from other countries. In 1920, 196,487 tons were caught in the North Sea and the Baltic, as compared with 183,900 tons caught during the most favourable year before the war, 1913.

Mineral Resources.—Germany, before the war, was the richest country on the European continent in iron ore, potassium and coal. In the last full year before the war, 1913, the raw mineral output amounted to 323,672,400 tons, with a value of 2,674·6 million marks. Table VIII shows the details.

TABLE VIII.—*Mineral Products, 1913.*

	Quantity in 1,000 tons	Value in 1,000 marks	Persons employed
Pit coal	190,109·4	2,135,978	654,017
Brown coal	87,233·1	191,920	58,958
Iron ore	28,607·9	115,718	42,296
Lead, silver and zinc ores	2,884·8	50,295	21,282
Arsenic ore	25·8	292	13,292
Copper ore	947·8	32,028	—
Sulphur ore	268·6	2,173	821
Wolfram ore	15·8	181	148
Tin, cobalt, nickel and bismuth ores	34·3	568	585
Mineral oil	121·0	8,514	964
Asphalt	105·5	792	215
Graphite	12·1	266	313
Salt	13,306·3	135,825	39,269
Total	323,672·4	2,674,550	832,160

During the war the output of minerals increased very considerably. Pit coal, iron ore and asphalt were the only products showing a considerable decline, the output of iron ore and coal being lowest in 1915. By the Treaty of Versailles, the German Reich lost valuable mineral resources. The annexation by France of Alsace-Lorraine in particular deprived Germany of its most productive sources of iron ore. In 1913, 74% of the total output of iron ore in Germany came from Alsace-Lorraine. The German political revolution of Nov. 1918, moreover, seriously affected output, since the introduction of the 8-hour day and the 7-hour shift in mines resulted in a great falling-off of production. This was accentuated by the diminished efficiency of labour owing to malnutrition resulting from the blockade during the war. A further economic loss to Germany arose out of the decision of the Peace Treaty to deprive the country for 15 years of all products from the Saar district. Hence, the total output in 1919 amounted to no more than 228,844,100 tons with a value of 77,314 million paper marks; the number of persons employed being 870,112.

The chief metals produced mainly from ores in 1913 were: iron, 16,763,800 tons, valued at 1,087,923,000 marks; lead, 188,000 tons, valued at 77,692,000 marks; copper, 53,800 tons, valued at 67,579,000 marks; bronze and brass, 3,000 tons, valued at 3,888,000 marks; raw and refined zinc, 278,800 tons, valued at 124,403,000 marks; tin, 12,000 tons, valued at 48,353,000 marks; nickel, 5,200 tons, valued at 15,509,000 marks. The output of these metals had been greatly diminished in the reconstituted Germany of 1919–20. The output from the smelting furnaces alone had been reduced by 23% (as compared with 1913). In 1919 the production in Germany was as follows: iron, 5,791,400 tons; lead, 57,600 tons; copper, 38,400 tons; raw and refined zinc, 97,400 tons; tin, 100 tons; nickel, 500 tons.

Coal and Lignite.—The coal output of Germany attained great dimensions in the 20th century. In 1860 the pit-coal production amounted to 12·3 million tons and the brown-coal (lignite) production to 4·4 million tons; the output had increased in 1900 to 109·3 million tons of coal and 40·5 million tons of lignite, and in 1913 the output was 190·1 million tons of pit coal (valued at 2,136,000,000 marks) and 67·6 million tons of brown coal (valued at 191,900,000 marks). Owing to loss of territory, the introduction of the 8-hour day and the reduced working capacity of the miners, only 140,757,000 tons of pit coal were produced in 1920, in spite of the fact that the number of workers in every coal-mining district had increased considerably. (The number increased in the Ruhr district, for instance, from 390,647 at the close of 1913 to 542,598 in May 1921; in Upper Silesia from 123,349 at the close of 1913 to 189,300 in Jan. 1921.) The output of brown coal (lignite), on the other hand (*see* FUEL), was increased, amounting in 1920 to 11,634,000 tons.

The most important mining districts for pit coal were the Ruhr district (114,487,000 tons in 1913; 84,986,000 tons in 1920) and Upper Silesia (43,435,000 tons in 1913; 31,686,000 tons in 1920). The next in importance was the Saar district (13,217,000 tons in 1913; 9,410,000 in 1920), of whose output, however, Germany was deprived under the Peace Treaty.

Coal is also produced, although in much smaller quantities, in Saxony, Lower Silesia, in the neighbourhood of Aix-la-Chapelle, and in the Wealden district near Hanover.

The most important brown-coal (lignite) mining districts are situated to the right and left of the Elbe, namely, the Thuringia-Saxony district, the districts of Lower and Upper Lausitz and the Brunswick-Magdeburg district. The brown-coal mining district on the Lower Rhine, near Cologne, is also very extensive. Small deposits are also to be found in Westerwald, Upper and Lower Hesse, and in Upper Bavaria. More than one-third of the total output is obtained from the Thuringia-Saxony district.

The development of the coke and briquette production corresponds to that of the coal output; of recent years coke production has declined, but the production of brown-coal briquettes has considerably increased, as shown more particularly in the year 1920. In 1913, 34,630,000 tons of coke and 21,977,000 tons of brown-coal briquettes were produced; in 1920 the production was 25,177,000 tons of coke and 24,282,000 tons of brown-coal briquettes.

Graphite is only obtained in Lower Bavaria. In 1919 the output amounted to 30,525 tons, representing a value of 5,480,942 marks.

Asphalt quarries are found in Prussia in the province of Hanover, and in Brunswick. The output in 1919 amounted to 12,554 tons with a value of 273,395 marks.

Petroleum.—The principal mineral-oil fields of Germany are in the Hanoverian lowlands between the Weser mountains and the Teutoburg forest. The large oil-field in Lower Alsace passed, with the cession of Alsace and Lorraine, into French possession. The production of mineral oil in 1913 amounted to 121,000 tons, with a value of 8·5 million marks; in 1919 it was 37,442 tons.

Iron Ore.—The presence of large quantities of iron ore in Germany was the main cause of the steady expansion of the heavy goods industry and a fruitful source of the increasing wealth of the country. Within the German customs area (including the Grand Duchy of Luxemburg) the output in 1910 was 28,710,000 tons, valued at 106,800,000 marks; and in 1913, excluding Luxemburg, it amounted to 28,607,900 tons, falling, however, in 1915 to 17,709,600 tons. In 1919 the output was further diminished to 6,156,049 tons with a value of 218,327,000 paper marks. By far the greater proportion of the total ore output, about 75 %, used to consist of minette, and by the cession of the minette districts of Alsace-Lorraine Germany lost the whole of her minette production. The most productive ore districts still remaining in the possession of the German Republic are in the Siegerland-Wieda sparry iron ore district, the district of Peine and Salzgitter, the Nassau-Upper Hessian district and the Vogelsberg district.

Before the war Germany ranked second to the United States in the iron production of the world. In 1910, the production was 14,794,000 tons. In 1913 the output of pig iron in Germany, exclusive of Luxemburg, amounted to 16,763,809 tons; owing to the war it fell in 1915 to 10,154,700 and in 1919 to 5,791,433 tons.

Lead and Zinc.—The principal lead and zinc mines are situated in Upper Silesia and near Aix-la-Chapelle. Smaller deposits are worked in the Upper Harz, within the Hildesheim administrative area, in the Erz mountains near Freiberg and in the Black Forest. The output for several years before the war was maintained at practically the same level. In 1913 it amounted to 2,884,758 tons. From that time up to 1915 there was a sharp decline; in 1918, however, the output again reached 2,812,700 tons. In 1919 the output in Upper Silesia and the Rhineland fell to 1,703,413 tons.

In 1913 the production of lead amounted to 205,400 tons and that of zinc to 278,800; in 1919 it fell to 57,580 tons and 97,397 tons, respectively. The principal lead-smelting works are in Saxony, in the Harz and within the areas of Aix-la-Chapelle and Cologne; the largest number of zinc-smelting works are in Upper Silesia, where the output of zinc in 1913 amounted to 60 % of the German output.

Copper.—In 1913 the output of copper ore amounted to 947,757 tons and 53,852 tons of copper was produced. The ore was chiefly obtained from the Harz, and from the districts of Mansfeld, Lower Silesia and Saxony. Smaller quantities were obtained from the Rhine district and in the neighbourhood of Stadtberg. In 1919 616,809 tons of copper ore were obtained and 38,370 tons of copper manufactured, but mostly not from ore.

Of *tin* the output in 1913 was 12,048 tons. The output in 1919 amounted to 83 tons.

Salt.—The territories of Saxony and Anhalt are the richest in salt; here are the great rock-salt pits of Stassfurt and Leopoldshall. In 1913 there were 153 salt mines under exploitation, besides 72 salt pits. The principal salt pits are in the Saxony-Thuringia district. Out of a total output of 13,306,300 tons in 1913, rock-salt represented 1,349,581 tons and potassic crude salt 11,956,528 tons. According to statements of the *Kalisyndikat* (Potash Syndicate), 7·8 million tons of potassic salt were produced in 1919, and 11·4 million tons in 1920. The total output for 1913 was valued at 135·8 million marks. In the salt works 675,903 tons of refined salt and 8,986 tons of other salts were produced; in 1919 the total production was 296,854 tons.

Industry.—Thanks to the great mineral resources of the country, to the energy of the people, and to the organized application of science to industry, Germany had been able to extend her industrial activities enormously in the generation before the war.

Table IX gives the statistics for industrial occupations and the persons employed in them, according to the census of industry in 1907, adjusted to the population represented in the restricted territory of 1919–20.

TABLE IX.—*Industrial Occupations.*

Industrial Groups	No. of principal works	No. of secondary works	No. of persons employed	No. of labourers among these
Landscape and market gardening . .	32,325	1,802	113,166	65,248
Live-stock rearing and fisheries . .	15,359	7,650	29,424	10,843
Mining and smelting	4,989	747	813,956	772,776
Stones and earth .	44,532	4,476	721,280	649,652
Metal manufactures .	141,776	12,886	900,432	707,758
Machines and instruments .	87,777	12,971	1,072,317	870,595
Chemical industry .	9,926	547	165,604	128,868
Illuminants, soaps, etc.	5,745	982	88,415	67,352
Textiles . . .	129,619	22,948	1,005,450	785,982
Paper .	19,182	1,376	223,702	186,779
Leather .	47,028	3,965	198,571	136,462
Timber and carving-materials .	189,611	32,108	719,222	492,310
Foodstuffs and luxuries .	288,768	47,801	1,160,506	715,471
Clothing . .	640,459	45,718	1,230,046	506,409
Cleaning . . .	117,382	11,574	239,991	108,554
Building . .	194,574	22,405	1,454,919	1,183,293
Photography . .	18,008	1,199	201,384	161,951
Industrial art . .	11,776	585	29,143	15,499
Commerce .	789,227	230,531	1,944,189	680,428
Insurance .	22,847	34,037	66,447	4,530
Traffic and transport	83,044	23,466	387,108	263,448
Hotel-keeping and liquor trade . .	303,033	41,215	749,240	269,971
Music, theatres, exhibitions . .	23,742	9,426	83,866	19,223

The census of 1907 showed that the number of persons industrially employed had constantly increased, since the corresponding census in 1882 and 1895, in a higher ratio than the number of industrial concerns, so that the size of these concerns had increased from one census to the other. In 1882 the average number of persons engaged in the principal works was estimated at 2·5, 1895 at 3·2 and in 1907 at 4·2. The number of industrially employed persons increased also more rapidly in proportion than the total population. While the pop. as a whole increased by 14·5 % between 1882 and 1907, the industrial pop. increased within the same period by 39·9 %. A steadily augmenting proportion of the German pop. had thus found employment in industrial work. From 1895 to 1907 the industries connected with foodstuffs and luxuries and with machinery, instruments and apparatus, showed the greatest development of all in this respect. The increase in the number of persons employed in these industries and in the building trade amounted to over half a million in each branch. In the machinery, instrument and apparatus-making industry, the increase amounted to 92·3 %, and in the building trade to 49·6 %. The number of textile works decreased by 87,399, or 35·2 %, but the number of persons employed in them increased by 95,023, or 9·6 %. While a marked decrease took place in the number of works engaged in the metal manufactures, wooden and carved goods and in the clothing industry, the number of persons employed in these branches of industry increased as follows: in the metal industry by 46·5 %, in the timber and carved goods industry by 28·8 % and in the clothing industry by 6·5 %. In 1907 the building trade employed the greatest number of persons; next came the clothing industry, the foodstuffs and luxuries industries, the manufacture of machinery, instruments and apparatus and the textile industry. As a result of the war this grouping underwent a considerable alteration. In 1921 conditions were such that the building trade had undoubtedly forfeited its leading position. The mining and smelting industry probably assumed that place; this industry employed only 813,956 persons in 1907, but must certainly have given occupation to considerably more than a million persons at the end of 1921. Similarly, the extent of the textile industry greatly diminished. During the war and afterwards this industry suffered particularly severely from the lack of raw materials, so that many factories were forced to close down. This shortage had not yet been made good in 1921. The clothing industry had also certainly suffered. On the other hand, the number of persons employed in the metal and chemical industries, in the production of wooden and carved goods, and in the paper industry, was proportionately far greater in 1921 than in 1907. It was impossible, however, in 1921 to obtain definite statistics. There had been no new industrial census, and the various branches of industry were in such a state of flux that it might happen that an industry was at an absolute standstill one day, so that persons engaged in it were forced to enter another, while the next day this same industry had become a refuge for large numbers of unemployed.

An approximate idea, however, of the decline in production may be derived from the exports of Germany in 1920, as compared with those of 1913, in different categories of products of the iron industry (Table X).

TABLE X.—*Exports of Iron Goods.*

Class of goods	Export 1913 (in cwt.)	Export 1920 (in cwt.)	Decrease (−)or Increase(+) per cent
Ornamental castings and other fine castings, non-malleable, fireplaces, ovens, etc.	811,409	675,004	−16·8
Parts of machines of non-malleable cast iron. Parts of engines, ships, etc.	578,873	71,195	−87·7
Tin—raw, annealed, worked, dressed, polished, cut, etc.	6,651,324	2,478,807	−62·7
Wire—rolled or drawn in the rough or finished product	4,626,586	839,079	−81·9
Tramway and railway rails, railway sleepers, fishplates, chairs, plate screws, etc.	6,574,144	1,520,159	−76·9
Railway axles, wheels, spokes, mountings of railway carriages, etc.	1,255,342	368,796	−70·6
Bridges and component parts of bridges. Iron building materials of wrought iron	1,098,710	435,886	−60·3
Locomotive and traction engine boilers and funnels of worked iron, combined parts of the same, etc.	288,658	308,340	+ 6·8
Ploughs (excluding traction power ploughs), ploughshares, harrows, etc.	375,515	163,918	−56·3
Heavy forks for hay, dung, turnips, coke, stones, etc.	24,430	13,335	−45·4
Scythes, sickles, knives, straw-cutters, picks	38,312	27,806	−27·4
Pieces for cross-saws, hand-saws	40,264	32,727	−18·7
Files, rasps	27,672	18,611	−32·7
All classes of rough cutlery with the exception of rough knives and shears	58,295	53,446	− 8·3
Scales (for weighing) except automatic scales and scales of precision, flat-irons, etc.	68,377	105,298	+54·0
Wire ropes and cords, barbed wire, plaited wire, wire netting, wire clamps, etc.	468,231	226,858	−51·5
Pins, cut nails (tacks, brads, drawing pins)	661,466	305,802	−53·8
House and kitchen equipment. Cooking-utensils made of sheet iron and several parts of these	320,891	207,590	−35·3
Building, furnishing appurtenances, doors, furniture (chains, and similar component parts of furniture, doors, ventilators, etc.)	226,020	147,418	−34·8

In contradistinction to the iron industry, the German textile industry rests only partially on indigenous production. Germany's dependence in her textile industries on foreign markets for raw materials became very apparent during the World War, when resort had to be made to substitutes to a large extent. The manufacture of cloths made of nettles, and particularly of paper, was developed. The former was, however, very expensive, and the latter produced wares which, though fairly durable, were on the whole very uncomfortable to wear. Both branches greatly diminished in importance when the import of raw materials once more became possible. How severely the cotton industry was still suffering in 1920 is best shown by the fact that the total imports of raw cotton in the first 10 months of 1920 amounted to only 1,070,543 double-cwt. compared with 4,223,071 during the same period in 1913. To meet this deficiency, 92,487 double-cwt. of prepared, bleached, dyed, printed and woven calico and embroideries had to be imported as against an export of 272,279 double cwt. in the same period of the year 1913.

The German chemical industry increased enormously during the war years. Germany's severance from the world's markets (especially from the supply of nitrate) compelled her to provide her own materials. Enormous works sprang up in Upper Silesia and particularly in Thuringia for the artificial production of nitrogen.

Before the war, Germany possessed almost a world monopoly in the production of aniline dyes. In 1907 24 establishments employing 9,071 people were engaged in this industry. In 1920, however, the export of dyes and dyestuffs was only 40% of the pre-war amounts.

Labour Market, Wages, Prices.—German production had received a tremendous blow through the war and the political revolution of Nov. 1918. In a still higher degree than for the output of raw materials does this hold good for the manufacture of finished articles. The diminution there was due not merely to the cessions of territory, the introduction of the 8-hour day and the diminished working capacity of labour, but also to the increased difficulty of obtaining raw materials and of finding markets. The result of these conditions in the first years after the Armistice was a vast amount of unemployment. The statistics compiled with regard to unemployment and applications for work give only an incomplete picture of the situation. The greater part of the unemployment was not total but partial. The number of workers affected by short-time represents many times the number of the totally unemployed. According to the demobilization commissioner's figures, on Jan. 15 1920 there were 454,775 heads of households in receipt of relief, and 379,071 receiving supplementary grants; and on June 1 1921 the corresponding figures were 357,850 and 384,003. At the different trade unions 26,144 persons reported themselves at the end of Nov. 1918 as out of work; at the beginning of 1920, 129,972; and at the beginning of 1921, 225,581. At the end of Nov. 1918, 264 applications were made at the labour exchanges for every 100 vacant situations for male workers; in May 1921 the figure was still high, 204. To relieve the distress of the unemployed masses the system of doles was introduced by ordinance in Nov. 1918.

The difficulties of the labour situation were only affected in a comparatively small measure by the question of wages. It is true that the political revolution of Nov. 1918 was accompanied by a demand for higher wages; but the rise was only rarely out of proportion to the increase in the cost of living. What was specially notable in the wage movement was the approximation to a uniform level in the cost of the wages of workers who were formerly paid on different scales. This levelling arose from the fact that the wages of the lowest-paid classes rose comparatively far higher than those of the classes which were formerly highly paid. For instance, in the mining industry of the Ruhr the wages of the actual miners (who were occupied below ground) did not rise quite 900%, while the wages of young male workers rose by almost 1,500%. A similar development took place in all occupations and in all social strata. Among commercial salaried employees, for instance, between 1913 and 1921, salaries rose 500% for men over the age of 30; for men under 20 they rose by 790%; for females over 30 years of age salaries rose by 830%, and for females under 20 by 970%.

Generally speaking, however, it may be said that, in the summer of 1921, except in a very few strata at each end of the social scale, the standard of living was very much below that of 1913.

The rise in wages was largely governed by the cost of living. If the average cost of normal rations for a family of five persons in 1913 be represented by 100, the following index figures emerge for 1920 and 1921:—

Feb. 1920	635	Dec. 1920	934
March 1920	747	Jan. 1921	944
April 1920	648	Feb. 1921	901
May 1920	868	March 1921	901
June 1920	845	April 1921	894
July 1920	856	May 1921	880
Aug. 1920	790	June 1921	896
Sept. 1920	779	July 1921	963
Oct. 1920	843	Aug. 1921	1,045
Nov. 1920	882		

In connexion with these figures it must be borne in mind that the prices of certain classes of goods, on which the index figures are based, were kept down by means of considerable subsidies from the Reich. For what are called "free goods," *i.e.* uncontrolled commodities, the rise in prices was much greater and more sudden. This may partly be observed in the index of wholesale prices which the Statistical Office of the Reich issued subsequently to Jan. 1921. The index figures for the prices of these articles were as follows (100 being taken to represent the index figure of 1913):—

Jan. 1920	1,243	March 1920	1,694
Feb. 1920	1,670	April 1920	1,556

May 1920	1,502	Jan. 1921	1,436
June 1920	1,377	Feb. 1921	1,372
July 1920	1,363	March 1921	1,334
Aug. 1920	1,446	April 1921	1,323
Sept. 1920	1,495	May 1921	1,306
Oct. 1920	1,462	June 1921	1,365
Nov. 1920	1,506	July 1921	1,425
Dec. 1920	1,437		

This index, however, is also influenced by statutory prices. In free commerce prices rose in some instances fifty- and sixty-fold. The situation, of course, was always subject to the course of depreciation in the value of the mark, German prices tending to rise as the value of the mark abroad fell and vice versa.

Commerce.—In 1902 an entirely new tariff law was adopted and came into force in 1906, when certain commercial treaties expired. By the Treaty of Versailles, however, some of the fundamental principles of the German customs tariff system were interfered with. Goods from regions formerly German are now duty-free or enjoy preferential treatment. Germany's freedom to conclude commercial treaties is restricted by the provision that most favoured treatment granted to any country by Germany is automatically extended to the Allied and Associated Powers. As a general rule, however, the German arrangements which were in force before the World War remained valid.

In accordance with the industrial development of Germany and the necessity of exporting on a large scale, and thanks to the diligent activities of German merchants and engineers, German foreign trade underwent an immense expansion up to the year 1914. In "special trade," inclusive of bullion, German imports had risen (in millions of marks) from 9,130 in 1910 to 11,206 in 1913, and exports from 7,644 to 10,198. But on the outbreak of the World War German foreign trade collapsed. The complete severance from the world market caused by the blockade confined Germany to an extremely limited coastal trade with the northern neutral countries. For 1919 the imports were valued officially at 32,376 million marks, and the exports at 10,057 millions; but these amounts cannot be compared with the statistics for former years, since the values they give are in depreciated paper marks. Only by reducing paper marks to gold marks can comparable amounts be obtained. This applies in a still greater measure to the values given for the year 1920. The exports for the year 1920 figured out at about 69·3 milliards of paper marks. No figures were issued for imports. To form an idea of the extent of Germany's foreign trade in 1920 as compared with that before the war a closer examination must be made of the different kinds of goods and the quantities imported and exported.

Imports.—Germany, a country with a population much too large in proportion to its agricultural production, and with industries also too extensive by comparison with its natural resources, has, as a natural consequence of this situation, an import trade which consists principally of food-stuffs, raw materials and half-manufactured goods. In 1913, of the total value of the imports 45·2% was raw materials, 10·7% half-manufactured goods, and 26·3% food-stuffs and luxuries. The total value of the above amounted to 9,572·3 million marks. The import of finished goods was only 10·7% of the total imports and amounted in value to 1,246·1 million marks. In 1920 there had been no fundamental change in the relative proportions of these imports. The figures for food-stuffs are somewhat more prominent, while for finished goods they are rather less. Table XI shows the imports and exports of the principal food-stuffs for 1913 and 1920 respectively.

TABLE XI.—*Imports and Exports of Food* (*in double-cwt.*).

	1913		1920 (Jan.–Oct.)	
	Import	Export	Import	Export
Wheat	25,459,586	5,383,130	5,914,801	21,037
Rye	3,525,339	9,344,634	4,041,258	12,848
Rye and wheatmeal	188,687	4,198,571	781,013	282,852
Potatoes	3,820,496	3,324,725	7,308,092	573,961
Fresh vegetables	3,089,812	532,104	1,985,014	310,273
Fruit and tropical fruits	10,025,799	303,327	2,022,319	52,185
Wine	1,303,367	208,342	865,493	—
Canned delicacies	71,556	81,779	1,207,446	21,371
Rice	4,775,998	1,843,536	1,270,256	10,010
Beans, peas, lentils	2,119,870	120,295	1,765,431	46,376
Barley and oats	37,432,455	6,677,568	774,486	51,018
Maize	9,186,553	346	4,089,317	11
Beef, veal, pork, mutton, goats' flesh	549,325	16,605	1,390,352	1,017
Bacon	16,498	366	816,508	54
Lard	1,073,869	169	1,234,132	—
Milk	771,982	167,733	292,114	14,504
Butter	542,394	2,732	78,141	1,946
Cheese	262,646	7,270	228,357	784
Oil and vegetable fats	483,918	242,575	852,326	10,041·35
Margarine and artificial fats	989	533,013	640,670	12,370
Sugar	27,670	11,262,170	982,948	68,259
Fish, fresh,	1,685,057	170,238		
smoked, salted (bar.)	1,298,119	5,521	4,836,728	23,353
Tobacco	813,998	4,339	834,566	3,342

It is noteworthy that the import of grain (flour being reckoned in the corresponding quantities of grain) in 1920 almost exactly corresponded to the quantity required in 1913, taking into account the diminution of territory in 1920; and further that the import of potatoes, pulse, sugar, meat and fats had risen enormously.

Table XII shows the imports and exports of raw materials.

TABLE XII.—*Imports and Exports of Raw Materials* (*in double-cwt.*).

	1913		1920	
	Import	Export	Import	Export
Mineral oils	12,943,547	334,604	4,201,901	73,279
Iron manganese	160,151,493	27,772,847	64,504,207	1,605,200
Copper ore	275,950	252,211	1,083,114	29,038
Pyrites and pyritic ores	10,257,321	282,141	4,785,097	26,641
Raw iron	1,243,161	7,829,108	979,994	1,259,216
Copper	2,253,920	72,037	595,217	63,455
Aluminium	153,225	27,032	78,221	28,639
Lead	837,810	413,694	173,066	87,577
Tin	142,606	64,374	45,362	2,261
Zinc	559,642	1,052,435	5,268	278,776
Cotton	5,211,280	525,834	1,498,793	6,753
Flax	932,223	432,069	17,435	3,827
Hemp	616,966	89,434	161,775	380
Jute	1,620,634	78,216	505,217	8,603
Wool	1,992,713	168,641	524,890	5,518
Silk	43,039	7,730	12,187	1,997
Hides	2,765,744	824,724	601,819	19,081
Rubber	237,806	46,012	127,910	1,289
China clay	3,031,063	420,576	1,311,016	312,125
Rough wood	12,848,734	668,801	648,764	367,982
Coal	105,400,694	345,984,084	2,629,370	73,049,823
Lignite	69,870,647	603,451	23,406,957	722,993

In the import of raw materials a great diminution is apparent in the figures for 1920.

Exports.—The fact that the expansion of Germany's exports before the war was due, not to the possession of raw materials so much as to industrial enterprise and labour, is of decisive importance in estimating the effects of her defeat and of the Peace of Versailles. If the 132 milliards of gold marks which were demanded from Germany by way of reparations were to be paid, this could only be done by increased achievements on the part of German labour in the creation of goods for export. Among German exports in 1913 the value of metal goods (machinery, etc.) stood first, at more than 3 milliard marks, or, roughly, three-tenths of the total. In 1920 they represented three-eighths. The imports in this class in 1913 amounted only to 830 million marks, leaving a large credit balance. The next highest group of exports in point of value is that of the products of agriculture and forestry, and other animal and vegetable products, food-stuffs, etc., to the total of 1,728·2 million marks. It is counterbalanced, however, by imports of the same categories to the value of 7 milliards of gold marks. Only the products known as those of the "secondary agricultural industries" show a balance in favour of exports, particularly flour of all kinds, pearl barley, corn flour, groundnut oil, palm-kernel oil, coconut oil, potato starch, stiff rubber, beet-root sugar, beer and mineral waters. In the third highest group of exports, that of manufactured animal and vegetable fibres and goods made of these, to the total value of 1,560·6 million marks in 1913, there was a considerable excess of exports over imports, more than 700 million marks in all. In these exports woollen and cotton goods took the first place. The export of woollen and cotton goods alone amounted to almost one milliard marks in value. The situation was equally favourable in other groups: chemical and pharmaceutical products; dyes and dyeing materials; leather and leather goods; furriers' goods; catgut goods; paper and pasteboard, and goods made therefrom; rubber goods, etc. It is only in the large group of mineral raw materials and mineral oils that an export of 869·8 million marks in 1913 was set off by a larger amount of imports, 1,087·3 million marks.

In 1920 the proportions of the different groups had considerably altered. The second place was no longer occupied by the products of agriculture and forestry, but by chemical products, dyes and dyestuffs. These are followed by textiles and mineral raw materials. Next come agricultural and forestry products, and the other groups. The exports of the most important goods in 1913 and 1920 (Jan.–Oct.) are compared in Table XIII.

Before the war, the share of the different countries in Germany's foreign trade was proportionate to their supplies of goods and raw material and to their demand for finished goods. Russia took the first place for imports into Germany from European countries. German exports to Russia were correspondingly large. Great Britain, Austria and France were the next most important sources of imports. Then a long way after came Belgium, Holland and Italy; and at the bottom of the list Sweden, Switzerland, Spain and

Denmark. Among non-European countries as sources of imports the United States was the chief factor, with British India, the Dutch Indies, Australia, Brazil and Chile well represented.

TABLE XIII.—*Principal Exports (in 1,000 double-cwt.).*

	1913	1920
Sugar-beet seeds	296·5	150·5
Hops	64·9	98·1
Products of forestry	7,885·2	10,188·7
Wood for building	3,938·4	8,521·7
Earths and stones	41,784·8	27,730·2
Coal and anthracite	345,984·1	73,049·8
Coke	64,329·9	9,814·0
Chemical products	49,032·6	26,324·6
Salt, brine, etc.	4,321·1	12,533·2
Rough salt	11,248·1	3,291·7
Mineral manure (potash, etc.)	4,608·7	4,952·3
Sulphuric magnesia, chloride of potassium	5,859·4	1,583·7
Dyes and dyestuffs	2,620·0	1,015·4
Aniline dyes, etc.	642·9	142·1
Alizarin, etc.	110·4	33·3
Indigo, etc.	336·1	66·7
Fibrous textiles	4,264·3	782·7
Silk	137·1	33·7
Wool	755·2	121·7
Cotton	1,330·4	143·5
Leather	251·6	43·2
Leather goods	115·2	31·8
Furriers' goods	34·5	10·3
Rubber goods	197·1	31·1
Wooden goods	790·0	1,050·3
Paper and paper goods	5,426·1	262·8
Books, pictures and paintings	243·0	118·7
Stone and mineral goods	1,881·0	3,184·1
Pottery	7,787·5	3,843·8
Glass and glass goods	2,458·1	1,184·3
Base metals and goods therefrom	68,519·4	18,478·8
Iron and iron alloys	65,024·9	17,506·0
Aluminium and aluminium alloys	83·7	84·1
Machinery	5,956·7	3,976·7
Electrotechnical goods	1,338·5	671·4
Vehicles	1,089·9	2,078·0
Watches	85·7	60·1
Musical instruments	285·9	463·0

In 1920 there were no imports from Russia. The European States which had been belligerents were sending very little; and the largest importing countries were the United States, Argentina, and the European neutrals. In the import of iron ore, Lorraine and Luxemburg began to play a considerable part.

As regards German exports, on an average for the years 1910–3, Great Britain took 14 % of the total, Austria 11·2 %, Russia 7·9 %, United States 7·7 %, Holland 6·7 %, Switzerland 5·8 %, Belgium 5·3 %, Italy 4·2 %, Argentina 2·9 %, Denmark 2·8 %, Sweden 2·3 %, Brazil 1·9 %, and Norway 1·6 %. According to a calculation for the first eight months of 1920, the proportionate shares of the different countries in Germany's total export trade that year were as follows:—Holland 21·2 %, Switzerland 9·2 %, Sweden 7·1 %, Norway 3·0 %, Denmark 6·1 %, Finland 1·7 %, Spain 2·7 %, Austria, Hungary and the "succession states" 7·8 %, Balkans and Turkey 1·1 %, Russia and Poland 2·5 %, Great Britain 6·4 %, France 3·0 %, Belgium 3·0 %, other European States 5·1 %, America 7·2 %, and other non-European countries 10·0 %. It will be observed that the United States, and in a less degree Italy, maintained somewhat similar places in the proportion taken of German exports in 1920, to those occupied in 1913. More than half the total export (51 %) went to European countries that had been neutral in the war. If the larger European States are regarded under three groups (Neutral States, Entente States, Eastern and South-eastern Europe), the distribution of German exports in the first eight months of 1913 and 1920 respectively (Jan.–Aug.) will be seen in Table XIV in millions of marks (*i.e.* gold marks in 1913, and only depreciated paper marks in 1920).

TABLE XIV.—*German Exports to Europe.*

	German exports		Percentage of total German exports	
	1920	1913	1920	1913
Holland, Scandinavia, Switzerland and Spain	20,714	1,430	50·9 %	21·2 %
Great Britain, France, Belgium and Italy	6,291	2,115	15·4 %	31·4 %
Russia, Austria-Hungary, Balkans and Turkey	4,615	1,532	11·3 %	22·8 %

Railways.—In 1913 the full-gauge German railway lines had attained an extent of 57,481 kilometres. The lines were the property of the several states. On April 1 1920, in accordance with the inter-state convention of April 30 1920, the German State railways were transferred to the Reich. By the cession of territory under the Treaty of Versailles about 7,000 km. of the former German railway system passed to other countries, 1,436 km. of the railways of the Saar coming under French administration. At the end of 1921 the total length of the German railways may be reckoned at 53,797 kilometres. The amount of rolling stock (without that of Alsace and Lorraine) was as follows:—locomotives (1913) 28,111, (1920) 30,000; passenger carriages and luggage vans (1913) 79,034, (1920) 60,000; goods wagons (1913) 631,323, (1920) 546,800. Before the war, the railways were a considerable source of income for the states. In 1918 there was for the first time a deficit, which increased in 1919, and in the financial year 1920 amounted to 16·4 milliard paper marks. The cause of this deficit lay first and foremost in the increased cost of working materials, partly also in the increased wages and numbers of the railway officials, and also in the impossibility of raising the rates for passenger and goods traffic in proportion. A large increase of rates, intended to lower the total deficit, came into force on June 1 1921. For 1920 the total receipts were 14·9 milliard (paper) marks and the expenses 31·3 milliards. The railway staff numbered 740,505 in 1913 and 1,044,379 in 1920.

Postal Service.—Before the war years, the imperial postal administration did not include the states of Bavaria and Württemberg, which had their own separate services. It was only in 1919, with the foundation of the German Republic, that the postal system as a whole became an affair of the Reich. The German Post Office staff (for the whole area of the Reich) numbered 334,064 in 1913 and 476,563 at the end of 1920.

International telegraphic communication by means of deep-sea cables does not belong to the postal system properly so called. At the beginning of the war, in 1914, Germany possessed 112 deep-sea cables with a length of 43,500 km., of which 5,474 km. were the property of the State. By the Peace Treaty of Versailles, Germany was deprived of all her cables, except about 6,500 km., which consisted for the most part of the end sections of the former great cable lines. As Germany's means of communication with the world was thus severed, her wireless system became of most vital importance to her. By means of her wireless stations Germany can now communicate with the whole world. The largest is at Nauen.

Shipping.—The German mercantile marine grew from 4,658 vessels of 4,430,227 tons in 1910 to 4,935 vessels of 5,238,937 tons in 1914. Of the 4,935 ships (including a tonnage of 4,694,190 steam ships), 3,968 were merchant vessels proper and 621 fishing vessels. The personnel of the German merchant service amounted to 83,898 officers and seamen. The demand for ships was supplied almost entirely from the German shipyards. In 1913 there was launched from the German yards a total registered tonnage of 465,000. The war made a sharp break in this development. On the one hand, there was no need for new shipping, as Germany's foreign trade was interrupted by the blockade; on the other hand, the shipyards had for the most part to be transformed for war purposes. Launches of new ships dropped to 199,000 tons in 1915, 38,000 tons in 1917, and 16,000 tons in 1918. In 1919 shipbuilding was practically at a standstill, only 12,000 tons being launched. The Peace Treaty of Versailles, with its stipulations as to the surrender of German tonnage, dealt German shipping a deadly blow. Of the more than 5,000,000 registered tons in 1914, in the middle of 1920 there only remained to Germany 419,000 registered tons, the rest having all had to be handed over. Germany was also bound by the Treaty to build each year 200,000 registered tons for the Entente.

Only a short time before the outbreak of war the great plans embodied in the Prussian Waterways Law of April 1 1905 had been realized—the Berlin–Stettin ship canal, the Rhine–Hanover canal, the enlargement of the Bromberg canal, etc.

The central idea of future German policy as regards the waterways lay in 1921 in establishing connexions between the different natural river channels, the courses of which, with the exception of that of the Danube, generally speaking run from S. to N. The most important schemes for intercommunication are the Lake of Constance and Danube canal, the Main–Danube canal, the Neckar–Danube canal, these last forming the so-called Rhine–Danube canal scheme. There are, moreover, the North Seaports canal, the Central (Mittelland) canal to connect Hanover and the Elbe, and the Elbe–Oder canal. Finally there are numerous plans for communication in the regions of the Oder, the Netze, the Weichsel and the Pregel, extending as far as the river Memel. Of these projects the Central canal and the canalization of the Upper Main, the Neckar and the Danube below Regensburg had been already approved. The execution of the plans for waterways is, however, extremely difficult. The reason for this is partly the internationalization of certain rivers, partly the lack of capital. An extension of the waterways according to the general scheme will only be possible in combination with the construction of great electrical works which could use the water-power and make the waterways pay. The prospect of this, however, is not very great in view of the slightness of the fall on most of the German rivers.

Education.—The school system in Germany is very highly developed. The number of illiterates is therefore very small, the few that exist being mainly foreigners who have come to Germany for work. The whole educational system is divided into general-school training, technical-school training, and training in higher institutes such as universities and technical colleges. For general-school training the institutions are the national schools (*Volksschulen*), intermediate schools (*Mittelschulen*) and higher schools (*Realschulen, Real-Gymnasien, Gymnasien*). Up to 1921 the regular and periodical collection of school statistics had not been resumed. The last general statistics on the subject were compiled in 1911. At that date there were in Germany (old boundaries) 66,037 national schools, 1,249 intermediate schools, and 2,515 higher schools. In the public national schools there were 148,217 male and 39,268 female teachers, in the middle schools 6,278 male and 5,787 female teachers; and in the higher establishments the numbers engaged in teaching were 35,339, of whom 21,998 had enjoyed a university education.

In 1921 there were 23 universities, 11 technical colleges, 7 lycées, 3 veterinary colleges, 4 agricultural colleges, 3 academies of forestry, 2 academies of mining, 4 commercial colleges, 18 colleges for communal administration, art, industrial art, etc., and 11 of music.

The total number of male students in German universities (with the exception of Königsberg for which the figures could not be obtained) was in the winter half-year 1913–4 55,614, and, besides these, 7,848 persons were allowed to attend lectures. During the war years the numbers at first fell, but soon rose again; and after the end of the war, in the winter half of 1918–9, they reached the figure of 67,644. The highest point in the winter half of 1919–20 was 79,213 students. In addition 7,794 persons were admitted to lectures. In part this enormous rise is the result of an accumulation due to the impossibility of completing studies in the war years. In the summer half of 1920 there was thus a setback, the male students being only 76,392. In the winter half, 1920–1, there was a further fall.

Female students in the winter half 1913–4 numbered 3,649, and in addition 1,510 were admitted to lectures. In the summer half of 1920 the number of female students was 7,750, and 2,857 were admitted to lectures.

The technical colleges after the end of the war boasted an ever-increasing attendance. In the summer of 1913 there were only 11,705 male and 62 female students at these colleges. The numbers had risen in the summer term of 1920 to 20,505 male and 258 female students, and the attendance was still increasing. The study of architecture was less popular than formerly, while on the other hand there was an increasing rush to study machine-making and engineering, electricity, chemistry and mining and metallurgy.

(W. Gr.)

German Finance, 1910–21

The period from about 1895 up to the outbreak of the World War in 1914 had been one of growing economic prosperity for Germany. From time to time the advance had been interrupted by intervals of depression, but they were short-lived, and when they passed the progress continued. Between 1907 and 1913, for instance, German coal production rose from 143 million tons to 191 million tons, or roughly by one-third; the production of lignite from 62½ to 87 million tons, or two-fifths; of pig iron from 13 to 19·3 million tons, or nearly one-half. Germany's imports increased in this period by 2 milliards (thousand millions) of marks [1] (£100,000,000) and German exports by well over 3 milliards of marks (£150,000,000), the total foreign trade of Germany increasing from 15½ milliards (£775,000,000) to 20·7 milliards of marks (£1,035,000,000).

German imperial finance reflected economic progress only to a small extent in its budget. Confederation had left the Empire itself in a weak position financially by reserving the most important sources of taxation for the individual component states. The governing theory was that direct taxes appertained to the states, while the Empire must rely on indirect taxation. In spite of the general financial and economic prosperity, the imperial debt had risen in 1910 to 5,016 millions of marks (having been 1,240 millions in 1890, 2,201 millions in 1895, 2,418 millions in 1900, and 3,323 millions in 1905). German statesmanship had been slow to adapt the needs of the imperial budget to the changing conditions. In 1909, however, an important fiscal reform was introduced. New sources of revenue to a total amount of about 500 millions of marks were tapped; the long-continued period of recurring deficits seemed at an end, and the hope of surplus income appeared justified. The additional expenditure on armaments, necessitated by the army estimates of 1912 and the naval estimates of 1913, amounting to about 185 million marks, was covered by increases in the customs duties and new property taxes were introduced. It was proposed to cover the extraordinary expenditure, estimated at about one milliard of marks, by a single "defence tax," levied as a capital-tax on properties of 10,000 marks up to 15,000 marks at 0·15%, increasing to 1·5% on amounts of over 5 millions, and as an income-tax, starting with 1% on incomes of 5,000 to 10,000 marks and increased to 8% on incomes of more than 500,000 marks. This "defence tax," levied in 1914–5, brought in 976·9 millions of marks; but, as events turned out, it was merely swallowed up in the exigencies of war expenditure.

The imperial budgets for 1910–3, for total revenue and expenditure ordinary and extraordinary, showed the following figures, in thousands of marks:—1910, revenue 2,943,419, expenditure 3,024,260; 1911, revenue 3,057,592, expenditure 2,897,403; 1912, revenue 2,915,384, expenditure 2,893,337; 1913, revenue 3,698,829, expenditure 3,698,829. There was a deficit in 1910 of 80,841,500 marks, and in 1911 and 1912 there were surpluses of 160,188,800 and 22,046,400 marks respectively.

War Finance.—The pre-war "defence tax" was not an organic reform. It had provided the power to attack income and property as a source of imperial revenue, but only once. The Empire thus entered the war with an undeveloped system of taxation—without, indeed, any large current revenue from taxation which (like an income-tax) could easily be increased in proportion with the enormous requirements of the war. To introduce it during the war would not have been an easy matter, and the view prevalent in Government circles was not in favour of such a course. They counted on a war of short duration, and did not wish to exacerbate the feelings of the population, greatly distressed as it was through sacrifice of blood and life in the field as well as through the blockade, by imposing heavy burdens of taxation. They did not wish to interfere with the right of the individual states to obtain their own revenue from direct taxation, and desired to make as little alteration as possible in the existing arrangements. Therefore, the decision arrived at was that the cost of the war should be met not out of taxation, but by the issue of loans; only the interest on the loans issued was to be debited to the current budget and covered by income. The current budget itself was artificially assisted by taking out of it, at first in part and later in full, the largest items, *i.e.* the current expenses for the army and navy, and debiting them as extraordinary expenses of the war. In the course of the war, other expenses too, only indirectly connected with the war, such as bonuses to civil servants to compensate for the rise in prices, were debited to the war fund. On the other hand the revenue, which it was at first quite impossible to estimate, was simply included in the price of peace, although the most important part of it, for instance the customs revenue, suffered an immediate and very sharp reduction through the blockade and the resulting reduction in imports, as well as the suspension of customs duty on corn, grains and other articles of pressing need, which took place immediately on the outbreak of the war. It was a system which at first seemed to lighten the burden, but afterwards made it only heavier, and which, the longer the war continued, was found less and less adequate.

The German system of war economics was directed by the enormous demands of modern war on men and material on the one side and by the blockade on the other side. Strict economy was to be observed in all that was necessary for the war, especially in raw material required for war purposes and the not less important labour, while distribution was to be organized in such a manner that everybody received at least a share of the necessaries of life. To increase production to the utmost for the requirements of the war, and to make the whole of the economic system subservient to its satisfaction, was from the first the ruling idea. This transference of all economic activity to the needs of the war provided at the same time the financial means of carrying on the war. As the German people were increasingly, if not totally, cut off from foreign supplies, they were more and more dependent on home produce, and the profits of the war expenditure remained for the most part at home. The continuance of the regular savings system, combined with the retrenchment necessitated by the lack of opportunity for spending, liberated funds for investment in the war loans. In this process, however, the stocks of industry and commerce were drawn upon without being replaced; buildings, works and plant were used more fully, without attention being possible to necessary repairs; the agricultural land was farmed without its being invigorated by proper manuring; and finally the holdings of foreign paper and securities were liquidated as far as possible by transference to neutral countries in order to gain the means of paying for obtainable imports. Thus there went on a continuous using-up of the national capital, which was spent by the Government, and became for the private possessor paper mortgage bonds of the Empire.

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[1] Up to the outbreak of war, the German mark was practically equal to the English shilling (*see* Exchange, Foreign). Its subsequent depreciation in value makes it impossible to convert the later figures for paper marks, as given in this article, into their real money value. Only where gold marks are referred to, the pre-war parity with sterling holds good.—(Ed. *E. B.*)

At the outbreak of the war, loan-banks (*Darlehnskassen*) for making advances of money were established, which granted loans at a low rate of interest against pledged securities and goods. At the same time, in order to safeguard the gold reserves of the Reichsbank, its obligation to redeem its notes in gold was suspended. The indirect, proportionate "covering guarantees" of the Reichsbank were also abolished, *i.e.* the provision in the Bank Law that the Reichsbank had to pay 5% per annum to the Treasury on the amount by which the bank-note issue at any time exceeded the cash reserve *plus* a sum of 550,000,000 marks, or, on the quarterly balance, 750,000,000 marks. The Reichsbank was thus enabled to issue any quantity of bank-notes without increasing the discount rate. This, on the other hand, led to a constantly increasing deterioration of the proportion between the bank-note issue and the means of covering it. Still, the creation of the offices for advancing money (*Darlehnskassen*) and the abolition of the restriction on the note issue enabled Germany to dispense with a legal moratorium. A kind of substitute for a moratorium was furnished by the regulation empowering the law courts to grant delays, so that they could allow payments of cash and of mortgages to be deferred in cases of necessity. Men who were away at the front were in particular protected from proceedings for the enforcement of judgments. Lastly, debtors unable to meet their obligations were saved from bankruptcy and the consequent wasteful realization of their assets by a law (Aug. 8 1914) which enabled them to apply for an official control of their businesses (*Geschäftsaufsichtsgesetz*). According to this law the debtor could request the bankruptcy court to appoint a trustee to exercise supervision over business assets and their disposal, thus avoiding the personal disabilities and the effects as to property which are the normal consequences of public bankruptcy.

These were, on general lines, the sources whence the subscriptions to the war issues were derived. The Empire made the funds necessary for the war available at the issuing bank by discounting Treasury bills, and then appropriated in regular intervals the accumulated cash of the population ready for investment, by issuing war loans and funding the floating debt.

This system of war finance only succeeded completely up to the autumn of 1916. The first four war loans, with their subscriptions of 4,460 millions (autumn 1914), 9,060 millions (spring 1915), 12,101 millions (autumn 1915) and 10,712 millions (spring 1916), brought in sufficient to cover the Treasury bills issued up to that time. Up to the autumn of 1915 there was even a considerable surplus, which helped to finance the carrying-on of the war for the succeeding months. But from the autumn of 1916 this condition of affairs was altered. The war loans issued regularly every half-year continued to produce large amounts: 10,562 millions in the autumn of 1916; 13,112 millions and 12,626 millions in 1917; 15,001 and 10,443 millions in 1918. But the Treasury bills put into circulation regularly increased to a greater extent: in the autumn of 1916, 2 milliards remained uncovered; in the autumn of 1917 the amount had risen to 14½ milliards; in the autumn of 1918 to 39 milliards; and in Nov. 1918 when the Armistice was concluded, besides the 98 milliards in war loans there were already in circulation 50 milliards in Treasury bills as floating debt of the Empire, this total being subsequently still further increased.

The reason for this state of affairs was the enormous increase in the cost of the war and the continued rise in prices. The average cost of the war per month was estimated for the first year of the war at 1·7 milliards of marks, in the second year 2 milliards, in the third year 3 milliards, in the fourth year 3·8 milliards, and in the last year 4·4 milliards of marks. In the extraordinary budgets of the five years 1914–8, the general war expenses were as follows:—1914, 6,935·7 millions of marks; 1915, 23,908·9; 1916, 24,739·3; 1917, 42,188·4; 1918, 33,928·4. In the same years the total indebtedness of the Empire rose by 11·3, 22·1, 30·3, 36·3 and 50·9 milliards; to this must be added 13·5 milliards in obligations undertaken towards Germany's allies. The full amounts of the actual costs of the war, however, are not shown in these figures. Very considerable sums, as the accounts got more and more in arrears, only became due a considerable time after the war was over. These amounts and the cost of demobilization, reaching additional milliards, burdened for the most part the budgets of the years following.

The enormous increase of the State debt naturally resulted in a proportionate increase in the yearly expenses for interest. Where in 1913 the management and interest of the debt swallowed 147 millions, 375·6 millions were required in 1914, 1,248·1 millions in 1915, 2,518·5 millions in 1916, 4,248 millions in 1917 and as much as 6,430·9 millions of marks in 1918. At the same time important sections of the revenue declined. Customs, yielding in 1913 a revenue of 679·3 million marks, provided in 1914–8 only 560·8, 359·9, 348·3, 232·7 and 133 millions, the decline being plain evidence of the growing effect of the blockade. In the same way the profitable enterprises of the Empire (posts and telegraphs and railways—at that time still not including the lines belonging to the individual states) suffered under the influence of the war, and instead of being sources of revenue became burdens; in 1913 they showed a surplus of 140·9 million marks, but in 1914–8 they required subventions of 53·6, 42·2, 50·5, 139·8 and 596·5 million marks. The revenue from spirits dwindled considerably. It became therefore more and more a pressing necessity to find funds for the war, not only by the issue of war loans, but through taxation. In the summer of 1916 the tobacco duty, the stamp duty on freight notes, and postal and telegraph charges were raised, but the resulting improvement in returns was meagre and insufficient even to cover the interest on the debt. In 1917 came a coal-tax and duties on passenger and goods traffic, and in 1918 a number of taxes were increased and new taxes introduced—an increased bourse-tax, a turnover-tax, stamp-tax on bills, taxes on sparkling wines, beer, tea and coffee and mineral waters, etc., while the tax on spirits was extended into a monopoly. There came also increases in the direct taxes in the individual states, whose finances under the influence of the war were also suffering severely.

The most important new source of taxation, however, was the taxation of war profits. It started with the law of June 21 1916, which covered not only the profits gained on war products but any and all profit gained during the war from whatever source, *i.e.* the difference between the taxable property of end 1916 and end 1913, and which took from the property remaining intact a supplementary duty, in so far as the taxable property did not show a reduction of more than 10%. This supplementary duty was one per mille, and the duty on the increase 5% on the first 10,000 marks, rising to 50% on increases over 1,100,000. Then came a tax on the surplus profits of companies, beginning with 10% on a surplus profit of 2% on the capital up to 30% on a surplus profit of 15% on the capital, and further progressive super-taxes based on the total rentability of the companies. In 1917 an advance of 20% was claimed on this war-tax of 1916, and in 1918 this was further extended. The Imperial Government proposed, besides the existing charges, a single war-tax on income, which would hit people with an income of 20,000 marks at the rate of 3 to 20%. This was shelved through the traditional objection of the states, which were still disposed to combat the annexation of the revenue from direct taxation by the Empire. Instead, the surplus income per head, that is the difference between the peace-time income and the war-time income, where such difference exceeded 3,000 marks, was made the subject of a tax calculated at 5% on the first 10,000 marks of the taxable surplus income, up to 50% if the difference in income amounted to over 201,000 marks. Then came the property-tax beginning with one per mille on the first 200,000 marks, rising to 5 per mille on a fortune of over 2 million marks. Thirdly, came a considerable increase of the tax on companies: it was based on a fixed rate of 80% on the surplus profit, which obtained a reduction of 10 to 50% only when the surplus profit did not exceed a very moderate amount or where it did not exceed a very moderate return on the capital. The final extension of the war-profit tax took place in 1919. It again hit the individual with a tax on the surplus income, commencing with 5% and rising to 70% on a surplus income of only 400,000 marks. The war-tax on companies was also repeated. More particularly a tax was levied on total increase of fortune between Dec. 31 1913 and July 30 1919 and that at an extraordinarily high rate. Exemption from the tax was allowed only up to an increase of 5,000 marks, from which amount the tax began with 10%, increasing to such an extent that an increase in fortune of 376,000 marks was taken in full and in no case could the taxpayer keep more than 172,000 marks of the increase. All that individuals gained during the war and the first period of transition over an increase of 172,000 marks was claimed by the State under this last extension.

The revenue from the war-tax of 1919 was estimated at 12 milliards, when it became law. In the years of the war the defence-tax, war-profits tax of 1916, and surplus-income tax of 1918 brought in the following amounts:—637·4 millions in 1914, 307·8 millions in 1915, 65·1 millions in 1916, 4,853·1 millions in 1917, 2,410·3 millions in 1918, and 1,136·4 million marks in 1919. The total yield of the defence-tax was 976·9 million marks; of the 1916 war-tax, with its increases, 5,777·1 millions; and of the 1918 war-tax 2,686·2 millions, a total of 9·4 milliards of marks.

Notwithstanding these considerable amounts, and the increased revenue obtained through other forms of taxation, the German war budget was a most unfavourable one. The appended table gives the total revenue and expenditure of the Empire for the years 1914 to 1918, and, as already stated, a great part of the actual war costs are not included in the expenditure, as it only appears in the accounts for the years following:—

Revenue and Expenditure 1914–8
(*in millions of marks*).

	Revenue	Expenditure
1914	2,350·8	8,653·8
1915	1,735·2	25,708·4
1916	2,029·4	27,740·9
1917	7,830·3	52,015·4
1918	6,795·0	44,030·7

The war was financed, almost entirely, by an enormous increase in indebtedness, at first through issues of loans, and later, in ever-growing measure, through increasing the floating debt. The taxes and levies introduced during the war were barely sufficient to meet the current requirements, greatly increased through the interest on the debt as well as through decrease of revenue from peace-time sources. As far as the property and income-tax is concerned these were not permanent sources of income but were only available once, and terminated as soon as their result was obtained. But the expenses remained, and necessitated imperatively the replacement of the single levies through regular sources of revenue.

After the War.—It was in this desperate situation financially that the war came to an end. The collapse which followed it, together with the crushing conditions of the Armistice and the Peace Treaty, disorganized the whole economic and financial life of the country. The effect of the war appeared after the defeat with frightful clearness. Of the German population 1,700,000 were killed, 1,500,000 injured and thus had their capacity to gain a livelihood impaired. And the civil population, through the physical and moral strain of the war, showed a greatly increased mortality; more especially, countless children and old people were victims of the privations imposed by the blockade. The increased mortality of the civil population in 1914–9 is estimated at 800,000 souls. A still heavier blow was the fall in births through the separation of the sexes in consequence of the war. For the period of six years this reduction amounted to 3,700,000. Besides actual losses in numbers, there was also exhaustion of those who remained alive and the destruction of the means of productivity.

Superficial critics have been apt to observe that Germany itself was saved from the ravages of the war, since it was fought, with the exception of a short incursion of the Russians in East Prussia, outside its frontiers. Herein lies a fallacy. The German industrial works were not indeed destroyed, but the greater part of the machinery and plant was used up to the utmost by war production without there being a possibility of seeing to repairs and renewals. Similarly, the agricultural areas were exhausted. Industry and commerce had lost the materials that were used up in the war; cattle had gone from the stalls; transport undertakings were crippled to an incredible extent. At the end of March 1920 only 45·9% of the existing locomotives were usable, whereas at the end of July 1914 the number under repair was only 19·1%. Germany in the late autumn of 1918 was not only in a state of military defeat and political chaos; financially and economically it was at its last gasp. What was needed was help from abroad, through importation of foodstuffs and raw materials, which alone could facilitate a transition from war to peace conditions. A complete change in the direction of its productive energies was required. During the years of war production was solely for war requirements, the Government being the sole big buyer, always eager for goods; when the demand for war requirements stopped suddenly it was necessary again to produce for peace requirements, and to find a market for them. First and foremost there was the task of again taking into the labour market the millions of people released from the army and of finding places for them in agricultural and industrial undertakings, in the works and factories and offices. Elaborate plans for this demobilization of the army had already been made during the war. They were, as so many other schemes, rendered useless by the destructive conditions of the Armistice. The periods fixed for the return and release of the army were too short, and all organization in that direction collapsed. The enormous supplies taken for the army, the value of which was estimated at several milliards of gold marks, and the return of which was imperative for the use and nourishment of the people during the first part of the period of transition, could not be stored in the given time. Moreover, Germany had to deliver up to the Allies 5,000 engines and 150,000 wagons, and the transport crisis already threatened was thereby rendered complete. In accordance with the supplementary conditions of March 1919 Germany had to hand over the biggest part of its commercial shipping, and this again greatly increased the difficulties of distribution. Worse still, the blockade still continued for months, and thus there was the severest restriction of imports of necessary provisions and raw materials, for which also only inadequate means of payment were available. Terrible were the results of these regulations. Not only was the political and social crisis rendered more acute, but the German economic position was disordered to such an extent that repeatedly a total collapse seemed unavoidable. The result was the loss of hundreds of thousands of lives among the civilian population, whose weakened condition was unable to withstand the continued privations. According to an estimate based on 375 German towns of 15,000 inhabitants and over, as against 140 deaths per 10,000 in 1913 there were 175 deaths in 1919 and 158 in 1920. The mortality from tuberculosis alone was increased from 15·7 in 1917 to 27·1 in 1919, and in 1920 it was still as high as 18·4. That was not all. With the Armistice began the Allied occupation of the left bank of the Rhine and the bridgeheads on the right bank. A difficult economic situation was thus produced, which again became peculiarly acute in the spring of 1921 through the London "sanctions," for Germany lost control of her most important customs frontier; the "hole in the west" was torn open, and a flood of foreign goods, to the value of milliards of marks, poured without regulation or control into the starved country, aching for commodities of all descriptions. Whilst the German population was without the means to satisfy its requirements in absolute necessaries, the country was flooded with foreign articles of luxury. Although masses were facing starvation, the carrying-out of the conditions, first of the Armistice and later of the Peace Treaty, permitted the classes which had profiteered out of the war and the revolution to satisfy their vulgar greed.

The Peace Treaty of Versailles, as adopted by the Allies in May 1919, and imposed on Germany by the threat of renewing the war, completed the work of economic ruin. Germany lost with its territories a total population of 5·3 million souls. With Alsace-Lorraine, moreover, Germany lost nearly three-quarters of its capacity for iron production; out of pre-war deposits of iron ore valued at 2·3 milliards of marks in Germany and Luxemburg (which had a customs treaty with Germany), there remained a value of only 0·403 milliard within the new German frontiers. Germany also lost with Alsace-Lorraine 26% of its potash. It lost with the transfer of the Saar valley to France roughly 9% of its pit-coal production, and was also obliged to agree to deliver to the Allies large quantities of coal, fixed in Oct. 1920 in Spa at 2 million tons per month. It was threatened with the loss of Upper Silesia, which had produced 23% of German pit-coal, 80% of zinc and 61% of raw zinc. Germany lost, moreover, almost all its commercial shipping, all overseas cables, its colonies,—in fact all the bases of its commerce abroad. Germany lost in the N. and the E. of its empire large agricultural districts which had formerly furnished about 25% of its supply of grain and potatoes, and 10 to 12% of its cattle. And while the Peace Treaty thus raised for Germany the crucial question whether it would be at all possible in future to supply a population now amounting to 61 million souls with nourishment and occupation on German soil—whether indeed within its new frontiers it was not really a case, from the economic point of view, of "20 million souls too many"—the country also found itself burdened with external financial obligations of unexampled magnitude by way of reparation payments to the Allies.

The Depreciation of the Mark.—The first effect of the defeat, —the internal collapse, and the terms of the Armistice and the Peace Treaty,—was the almost total breaking-down of the German currency system. The depreciation of the mark abroad had pursued a progressive course already during the war. In consequence of the blockade, and of increasing demands for war requirements in industrial production, German exports had declined much more quickly than the imports; and since the cover formerly available for excess of imports, arising from shipping charges, freights, etc., failed entirely and foreign investments were largely unrealizable, it was almost impossible to obtain credit abroad, which in normal times would have covered the deficit. By the end of the second year of the war (summer of 1916) the exchange in Switzerland, for instance, had fallen from a normal rate of 123·46 francs per 100 marks to 95·60 francs, showing a loss in exchange of 22·60%. Though depreciation still went on, in Oct. 1918 the Swiss rate was still as much as 71·50 francs and the loss in exchange not more than 42·10%. But after the end of the war the fall became steeper. The Swiss exchange was 62½ francs per 100 marks at the end of Nov. 1918, and the rate descended month by month to 35½ francs at the end of May 1919, and then, after a brief reaction, to 26 francs at the end of Sept. 1919, 11·50 francs on Dec. 31 1919, and 6·15 francs (equal to a loss of 95%) at the end of Feb. 1920. From this point there was again a reaction in the summer of 1920, and on May 31 1920 the Swiss rate was 14·75 francs, but in the autumn of 1920 the depreciation recommenced, and towards the end of June 1921, the Swiss exchange for 100 marks was 8·10 francs. (*See* EXCHANGES, FOREIGN, for the German exchange.)

German currency depreciation during the war, as well as afterwards, was one of the factors which restricted the possibility of getting help from foreign capital. And though the value of money in Germany itself declined much more slowly than the mark exchange abroad, another result was that foreign purchasers were able to buy whatever was obtainable in Germany, stocks of goods and merchandise, town property, securities, plant and machinery, up to complete industrial enterprises, at catastrophically low prices. Another consequence was an enormous increase in German indebtedness towards foreign countries. The German mark note became the gambling counter of the world. The German notes went abroad in milliards at ever-falling rates in payment for imported goods, to be bought up by big and little speculators, down to the hotel porter and the domestic servant who hoped to profit by any rise in exchange. Enormous foreign holdings of mark notes resulted also from credits given by banks in marks, also with an eye on an improvement in the exchange. Only in this way was it possible for Germany to pay for its large excess of imports over exports, which marked the destruction of Germany's economic position in these years of greatly reduced production at home. The price was a foreign indebtedness, the yearly burden of which in interest charges was estimated at the end of 1920 by competent judges at one milliard gold marks and by some critics at an even larger figure.

Apart from all other difficulties attending economic reconstruction after the war, every attempt of Germany to reach a real internal consolidation was hampered by the monetary instability. On the one hand it raised prices, and on the other it depreciated the value of property and income. While, towards the end of the war and just after, wages had often been increased beyond the rise in prices, so that a moderate increase in real wages resulted to the worker, it was not possible to continue this for any length of time in view of the unhappy state of production. Much less was it possible for people enjoying fixed incomes, officials, civil servants, and brain-workers, to increase their income in proportion with the reduction of money value, and they sank lower and lower in the social scale. The worst sufferers were people relying on incomes from rents. Every reduction in the value of money amounted to a favouring of the debtor at the expense of the creditor. Those who had invested their capital in Government securities, mortgages, etc., at fixed rates of interest, were helpless against the reduction in money value, which reduced their capital as well as the interest to a fraction of its former amount. Producers themselves might be able, through the rise in prices, to obtain some compensation for the reduction in the value of money. But any such compensation could only be reached by a very small part of the population. No doubt, as in all periods of economic revolution, some lucky people found the means of enriching themselves to an extraordinary extent. But the high profits nominally realized by many German companies, if the amount were reduced to the actual value of money, represented not only no advantage, but a loss if compared with pre-war times. The large middle class was hit particularly hard. This class, the main repository of national culture, was in danger of being swallowed by the proletariat.

Such a situation was bound to influence the State finances to a deplorable extent. Whatever services were required had to be paid for at a nominally higher rate. It was necessary too to spend enormous sums on subsidies for reducing the price of necessaries to the public, for keeping down the cost of transport, and for the relief of the unemployed. On the other hand, uneconomic State finance was itself a factor in the decline of money values. The State had to cover its financial requirements in default of taxation by further issues of paper money, increasing from week to week and month to month.[1] It was itself the producer of the artificial purchasing-power which brought in its train the continued rise in prices. The bank-note press, in substitution for the taxation machine, created a continually growing inflation. It was the uninterrupted use of the printing-press, as a means of meeting the expenditure, that characterized State finance in the first years after the collapse.

Taxation Reform, 1919–20.—The National Assembly of the new German Republic had to face the task of laying the foundations of a new financial system and re-creating it out of chaos. The old privileges of the separate states of the Empire, in depriving the central Government of the benefit of the most important sources of tax-revenues, had to go. The German Reich now had

[1] On Jan. 1 1919, the regular note issue amounted to 22,188 million paper marks (as against 11,467 millions a year earlier) and the loan-bank note issue to 10,109 millions (6,264 millions in 1918). On Jan. 1 1922 the total was about 120,000 millions.

to bear by far the largest part of the costs of the war, the interest on the war debts, the war pensions and compensations, the whole of the burdens of the Peace Treaty, etc.; these swelled the budget expenditure to such an extent that the requirements of the individual states were left far behind. The great sources of direct taxation had now to be made free for obtaining revenue for the Reich. Events had made compulsory a strong centralization in German finance. By an order of the Finance Department of the Reich on Sept. 10 1919, the management of all fiscal levies was handed over to the central Government. A further order, of Dec. 13 1919, provided for the formal right of taxation. A decisive step was taken in the National Taxation Law of March 22 1920, which fixed on a new basis the position of the three great receivers of taxes, the Reich, the individual states, and the subordinate local Governments towards each other. Whereas the pre-war rule was that the use of certain sources of taxation by the individual states forbade the Imperial Government to use such sources, the new regulations reversed the position, ruling that the use of certain sources of taxation by the Reich forbade the collection of similar taxes by the individual states and local communities unless expressly empowered to collect a supplementary levy. Counties and municipalities kept their most important independent tax sources—the taxes on landed property and industrial activities. They were obliged to levy an amusement-tax, and were entitled to tax the lowest incomes which escaped the general income-tax. In principle they became pensioners of the State, receiving of the revenue from Reich taxation two-thirds, of the companies-tax also two-thirds, of the inheritance-tax one-fifth, of the tax on acquistion of landed property one-half, and of the turnover-tax 15% (*i.e.* 10% for the counties and 5% for the municipalities). This was a most important step in the direction of laying a sound basis for Reich finance.

In the place of the various tax departments of the individual states there had to be created the gigantic machinery of a central Finance Department for the entire Reich. It could not come into existence without much early trouble and failure. The new department was at first quite unable to carry out the regulations, and only slowly and gradually came the introduction and collection of new taxes. And another difficulty followed quickly in consequence of the new regulations for financial management. The unification of the railways in Germany had been, like the unification of taxation, an old demand, but one which could not be carried out in times of peace, when the railways were a valuable source of revenue to the states, more especially to Prussia. Now it was accomplished, and the Reich, which previously had managed only the railways of Alsace-Lorraine, from April 1 1920 took over all the railways. But the railways, instead of bringing in a profit, now found themselves with a deficit. From the moment, however, that the Reich had taken over the important sources of tax revenue, it was obliged to take over the railways as well, since the individual states were not able to carry their losses, and these losses now fell on the Treasury of the Reich.

With this basic change in organization came now the extension of the field of taxation. Between Sept. 1919 and March 1920 a system of new taxes for the whole Reich was created. The taxation of income was carried out in three different ways.

First comes the unified tax on income, which came into force on April 1 1920. The rate of taxation is as follows:—

Amount of Income	*Rate per cent*
For part or the whole of the first 24,000 marks	10
For every additional (whole or part) 6,000 "	20
" " " " " " 5,000 "	25
" " " " " " 5,000 "	30
" " " " " " 5,000 "	35
" " " " " " 5,000 "	40
" " " " " " 70,000 "	45
" " " " " " 80,000 "	50
" " " " " " 200,000 "	55
" all further amounts	60

Thus, 60% of any income exceeding 400,000 marks (now paper marks) has to be handed over as tax to the Treasury. On an income of 30,000 marks the tax is 3,600 marks; on 50,000 marks it is 10,000 marks; on 200,000 marks it is 81,600 marks; and on 1,000,000 marks it is 551,600 marks.

A reduction in these rates is allowed only in so far as an existence minimum and the numbers in the family are taken into consideration. This is arranged so that, for every person subject to pay tax and for each member of his household not independently taxed, the taxable amount of income is reduced by 120 marks, provided the dutiable income does not exceed 60,000 marks, and by 60 marks where the income is between 60,000 and 100,000 marks. A married man subject to the tax, with four children and an income of 24,000 marks, will, for instance, obtain a reduction of 720 marks. Taxation of those who receive salaries or wages is assured by making the employer answerable for retaining from the salary or wage a proportionate amount in advance and paying it over to the tax collector.

To this income-tax, affecting the total income of the subject, is added, as super-tax, a levy on income from investments, in distinction from earned income, *i.e.* from dividends on shares, etc., interest on loans and mortgages of all kinds, interest on advances of any description, especially on deposits in banks and savings banks, rents, etc., and discounts on bills, including Treasury bills. The tax is 10% on the whole return on the capital. An exception is made only in the case of small investors over 60 years of age or incapacitated from work. These have the tax on returns from capital included in their income-tax, as follows: on an income of not more than 5,000 marks, the whole amount; up to 6,000 marks 90%, the rate being reduced with every further 1,000 marks by 10%. On incomes of over 14,000 marks this relief terminates.

The third form of taxing incomes is the companies-tax, which operates as a super-tax on enterprises carried on by companies, including foundations, institutions and other societies for the management of property. This tax is 10% generally, on the total dutiable income. For societies working for gain (companies with shares, societies with limited liability, etc.) there is, in addition, a special tax on the distributed profit, calculated on the proportion of the distributed amounts to the capital, so that where the profit is only 4% on the capital the tax is 2% on the distributed amounts, rising by 1% up to 10% of the distributed amounts if the profit on the capital is 6, 8, 10, 12, 14, 16, 18% and over. The first 3% of profit on the capital is tax-free.

The total taxation on income, from the three forms of levy, works out as follows: Income from shares, for instance, is taxed under each of the three forms. The company itself has to pay on its income in proportion to its own liability; then the distributed profit is reduced by the 10% tax on return from capital; and finally the shareholder has to pay income-tax on his dividends.

Taxation on property (capital) was also imposed in three forms. First of all came the war-tax (*Kriegssteuer*) on property increase, which hits any increase of over 5,000 marks in the value of property during the war and immediately after the war (difference in property between June 30 1919 and Dec. 31 1913), nobody keeping a larger increase than 172,000 marks. The following table (in marks) indicates its working:—

Increase in Property	*Amount of Tax*
10,000	1,000
15,000	1,750
20,000	2,500
25,000	3,500
30,000	4,500
35,000	6,000
40,000	7,500
50,000	10,500
100,000	30,500
150,000	55,500
200,000	83,000
300,000	148,000
400,000	233,000
500,000	333,000
800,000	633,000
1,000,000	833,000
2,000,000	1,833,000
4,000,000	3,833,000
5,000,000	4,833,000
10,000,000	9,833,000

Through this war-tax increase in property is for the greater part annexed. But secondly, a further tax levied for the "need of the Reich" (*Reichsnotopfer*) makes a deep inroad on unincreased property, as calculated on Dec. 31 1919. This affects companies, especially companies with shares, and other societies for gain, on their net property, that is without the paid-in capital and without reserve funds intended for general utility or benevolent objects, at a rate of 10%. It also applies to the property of individuals, leaving only a property of 5,000 marks tax-free, though in the case of married couples this is increased to 10,000 marks tax-free, and, for those who have children, a further amount of 5,000 marks tax-free is allowed for the second and each additional child. Consideration is also extended in the case of proprietors of industrial enterprises who are liable to be hampered by the depletion of capital, the capital employed in the business being calculated not to the full amount but only up to 80% of its value.

The rate for individuals is as follows:—

First 50,000 marks (in full or in part)	10%	Next 200,000 marks	35%
Next 50,000 marks	12	" 500,000 "	40
" 100,000 "	15	" 500,000 "	45
" 200,000 "	20	" 1,000,000 "	50
" 200,000 "	25	" 2,000,000 "	55
" 200,000 "	30	" 2,000,000 "	60
		All further amounts	65

This works out as set forth in the following table:—

Taxable property	Amount of tax	Taxable property	Amount of tax
1,000 marks	100 marks	350,000 marks	56,000 marks
5,000 "	500 "	400,000 "	66,000 "
10,000 "	1,000 "	450,000 "	78,510 "
15,000 "	1,500 "	500,000 "	91,000 "
20,000 "	2,000 "	550,000 "	103,500 "
25,000 "	2,500 "	600,000 "	116,000 "
30,000 "	3,000 "	650,000 "	131,000 "
35,000 "	3,500 "	700,000 "	146,000 "
40,000 "	4,000 "	750,000 "	161,000 "
45,000 "	4,500 "	800,000 "	176,000 "
50,000 "	5,000 "	850,000 "	193,500 "
55,000 "	5,600 "	900,000 "	211,000 "
60,000 "	6,200 "	950,000 "	228,500 "
65,000 "	6,800 "	1,000,000 "	246,000 "
70,000 "	7,400 "	1,500,000 "	446,000 "
75,000 "	8,000 "	2,000,000 "	671,000 "
80,000 "	8,600 "	2,500,000 "	921,000 "
85,000 "	9,200 "	3,000,000 "	1,171,000 "
90,000 "	9,800 "	3,500,000 "	1,446,000 "
95,000 "	10,400 "	4,000,000 "	1,721,000 "
100,000 "	11,000 "	5,000,000 "	2,271,000 "
150,000 "	18,500 "	6,000,000 "	2,871,000 "
200,000 "	26,000 "	7,000,000 "	3,471,000 "
250,000 "	36,000 "	8,000,000 "	4,121,000 "
300,000 "	46,000 "	For each additional 1,000 marks 650 marks more	

The tax has to be paid in cash or in war loan, but may be paid in yearly part payments, the unpaid amount being charged 5%, and it must be paid off within 26 years. If real property is given as security, where the payment is secured by entry in the official register 46 years are allowed for payment.

The third form of property-tax, inheritance duty, consists of a considerable extension of the former inheritance- and gift-tax, with the addition of a succession-tax after the pattern of the English estate duty. Inheritance- and gift-tax are calculated under six classes, according to the relationship of the beneficiary:

Class 1—Wife or husband and children, including illegitimate children recognized by the father.

Class 2—Descendants of the children.

Class 3—Parents, brothers and sisters.

Class 4—Grandparents, descendants of first degree of brothers and sisters, parents-in-law, step parents, children-in-law, step children and adopted children.

Class 5—Descendants of second degree of brothers and sisters, brothers and sisters of the parents, brothers- and sisters-in-law.

Class 6—Other beneficiaries (except as regards communities, churches, benevolent and utilitarian societies, foundations, etc., in which case the rate is always 10%).

The following are the rates of the tax per cent for the different classes, an allowance, however, being made for 5,000 marks being tax-free for the first five classes, and 500 marks for the sixth class:—

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
For first 20,000 marks taxable part or full	4	5	6	8	10	15
For following 30,000 marks	5	6	8	10	12	20
50,000 "	6	8	10	12	15	25
50,000 "	8	10	12	15	20	30
50,000 "	10	12	15	20	25	35
100,000 "	12	15	20	25	30	40
200,000 "	15	20	25	30	35	45
250,000 "	20	25	30	35	40	50
250,000 "	25	30	35	40	45	55
500,000 "	30	35	40	45	50	60
All further amounts	35	40	45	50	60	70

The highest rates apply where the taxable benefit exceeds one and a half million marks. The tax increases by 1% of the amount; that is, if the already existing property of the beneficiary is 100,000 marks but not over 200,000, for each 10,000 marks; where the existing fortune exceeds 200,000, for each 20,000 marks. The increase must not exceed 100% of the tax. The total of the inheritance duty must not exceed 90% of the benefit. For a legacy arising before April 1 1935 the tax is reduced 1% for each year down to April 1 1925, and for each earlier year 2%. Reduction down to March 31 1921 is therefore 20%.

The succession duty (estate duty) is calculated solely on the property which has been left, without reference to relationship or number of beneficiaries; it applies to landed property, business capital, and personal property in so far as it exceeds 50,000 marks. The tax does not apply to gifts between living persons. The rate of tax is, for the first 200,000 marks (part or whole), 1%; for the following 300,000, 2%; for the following 500,000, 3%; for the following 1,000,000, 4%; and for further amounts 5%. If the value does not exceed 200,000 marks the first 20,000 marks are tax-free.

It is necessary to consider the effect of all these taxes together on property and income, to obtain a clear idea of what the burdens mean. At the Brussels Conference of 1920, the German Government submitted to the British delegates a statement which gives examples in explanation:—

Example No. 1.—A private individual with property worth on June 30 1919 100 million marks, showing an increase of 25 millions, dies in 1920 and leaves his property to two nephews in equal shares. One nephew has no property, the other has property stated at one million marks. Taxation on the 100 millions is as follows:—

(1) War-tax on increase	24,828,000 marks
(2) "Need of Reich" levy, on balance of 75,172,000 marks	47,779,550 "
(3) Succession duty on property (27,392,450 marks)	1,332,622 "
(4) Inheritance duty to be paid by nephew who has no property	5,032,245 "
(5) Inheritance-tax to be paid by nephew who has property of 1,000,000	7,548,367 "
Total taxation	86,520,784 marks

There remains, of the original property of 100,000,000, only 13,479,216.

Example No. 2.—A private individual has property worth 10,000,000 marks of which 4,000,000 are from shares in a company for gain, which could have paid in 1920 a dividend of 20%, if it had not been obliged to pay companies-tax. The rest is landed property, returning 5%. There is no increase in property. Without taxes this person would have an income of 1,100,000 marks per annum. The "Need of Reich" levy exacts 5,417,750 marks, leaving 4,582,250 marks. The untaxed income on this would be 800,000 marks from dividends and 29,112 marks from rents, or 829,112 marks. This is reduced by 160,000 marks for companies-tax, 64,000 marks for return on capital, and 315,160 marks for income-tax, leaving an income of 289,952 marks.

Example No. 3.—A private individual has property worth 1,000,000 marks; no war profit. Property rented out brings 5%. One-third of the "Need of Reich" levy (244,250 marks), 82,250 marks, is paid, leaving a balance of 162,000 marks, on which there is 6½% interest to pay. On the remaining property, 917,750 marks, the income is 45,887 marks. Out of this there is to be deducted:—6½% on 162,000, 10,530 marks; return on capital-tax, 4,588 marks: income-tax, 7,272 marks; or 22,390 marks in all, leaving the remaining income at 22,497 marks. This person, who before the war, after deduction of tax, had an income of about 45,000 marks (or say £2,250), had thus, in 1920, after deduction of taxes an income not merely reduced by half, but, in view of the depreciation of money, no better than that of an ordinary working-man.

The work of tax reform under the young German Republic was not exhausted by this extension of direct taxation. There was added a great extension of indirect and transport taxation. Its most important item was the tax on turnover. At first it consisted in a stamp duty of one per mille, rising in the last year of war to five per mille, but by the National Assembly's regulation of Dec. 24 1919, which came into force on Jan. 1 1920, it was fixed at 1½%. This turnover-tax is applied also to articles of luxury, specially mentioned, at a rate ten times increased, namely 15%. Further it includes a restaurant-tax, advertisement-tax, cloakroom-tax, etc., etc., and covers certain kinds of service such as letting-out furnished rooms, taking in advertisements, holding in trust money, securities, valuables and furs, letting riding horses on hire, the rate of tax being 10%. It is to be noted that the normal rate of 1½% does not represent the total amount, which really is very much higher on the average, and in the case of semi-manufactured and manufactured goods it has to be paid as many times as the commodity changes hands. The tax is therefore a real tax on consumption in the largest sense. Similarly, the coal-tax is collected at 20% on the value at the pit-head, and rises in proportion with the selling-rates. Various single taxes on tobacco, matches, playing-cards and sales of real property were also to be added, as well as repeated increases in the charges for letters, telegrams, postal-orders, trunk-telephone messages and railway rates.

A gigantic increase of the burden of taxation on the whole of German national economy was the result of these reforms, though even then they were not sufficient to balance the budget of the Reich.

Development of Reich Finance, 1919–21.—The most significant feature of the financial position in these first years after the war was the rapid increase in the national debt. The figures each year were as follows, in milliards of marks:—

	Funded debt (Treasury bonds and interest-bearing Treasury notes)	Floating debt (Treasury notes without interest)	Total
March 31 1918	71·9	33·3	105·2
March 31 1919	92·4	63·7	156·1
March 31 1920	92·0	91·5	183·5
March 31 1921	78·3	176·6	244·9

The reduction shown in the funded debt in 1921 arises from cancellation by means of collection of war-tax and "Reich need" levy, and by the sale of army property. Against this the increase in floating debt in 1921 includes a part of the purchase price paid by the Reich on taking over the railways from the individual states, whilst, on the other hand, a number of other obligations are not included. If these are taken into consideration, and the Reich and the individual states are taken together, there appears for Oct. 1 1920 a total debt of 294·8 milliards of marks, compared with 22 milliards on March 31 1914. The large increase of debt was the result of slow returns from the new taxation, the depreciation of money which continually caused a greater expenditure on goods and services and repeatedly upset the budget estimates, the subsidies given on necessaries in order to adjust prices to the depreciation of money, the large rise in the interest charge on the debt, the deficits on the railways and post-office, and finally the beginning of large payments under the provisions of the Peace Treaty.

In the regular budget for 1919 a revenue was shown of 12,753 million marks and expenditure of 15,087 millions (of which 8,389 millions was for debt alone). The deficit was covered for the most part through returns from the taxes on war profits. Not so the extraordinary budget, which showed a revenue of 4,154 millions of marks and an expenditure of 39,779 millions. The deficit of 35,625 millions had to be covered by loans. Very large items of arrears in war expenditure were included here, and it seemed justifiable to hope that, with the closing of such expenditure, the deficit would be reduced. But the opposite came to pass. The estimate for 1920, in which for the first time larger returns from the new taxes were included, forecast in the ordinary budget a revenue and expenditure of 39,891 millions, or more than three times the revenue estimated for the previous year; and under the expenditure 12,693 millions was included for the service of the Reich debt, 3,967 millions for pensions and 9,405 millions for the states and local governments as their share in the new Reich taxes. The extraordinary expenditure was estimated at 52,579 millions, of which 3,955 millions was for the paying-off of the old army and 41,440 millions for the execution of the Peace Treaty, while losses on the postal, telegraph and railway management were put down at 19,221 millions, so that there remained to be covered by loans a total of about 70 milliards, besides 3½ milliards representing deficits in the individual states. Unfortunately the event did not contradict these unfavourable estimates. The revenues from direct taxation, transport duty, customs, tax on consumption and other levies, brought in 46·10 milliards, or an excess of 37·70 milliards compared with the previous year and even an excess of 6·10 milliards over the estimate, largely as a result of the "Reich need" levy, by which 9·33 milliards was collected (the estimate having been 3½ milliards). From the new income-tax 9·59 milliards was received (estimated at 12 milliards), from the new tax on return of capital 909 millions (estimated 1,300 millions), from the newly extended tax on turnover 4·2 milliards (estimated 3·65 milliards). The coal-tax brought in 4·67 milliards, an increase of 3·32 milliards over the previous year; the new tobacco duty brought 1·76 milliards. But the total net revenue accruing to the Reich after deduction of the costs of collection and the amounts transferred to the states and local governments was only 27·7 milliards and the net expenditure was 73·7 milliards, in addition to 10·4 milliards for interest on debt and 18·2 milliards for subventions and for cost of management of railways and post-office. There resulted a deficit of 74·9 milliards which again could be covered only by an increase in the floating debt.

This disastrous picture was repeated in the 1921 budget. On March 26 the provisional estimate, passed in the Reichstag, provided for an expenditure of 46,945 millions in the ordinary budget and 43,667 millions in the extraordinary budget. Three months later a supplementary estimate entirely upset these figures. Expenditure in the ordinary budget was now put at 48,459 millions, the estimated deficit of 4,250 millions on the revenue side requiring to be covered by fresh tax proposals. The expenditure in the extraordinary budget was placed at 59,680 millions, against which there was an estimated revenue of 10,500 millions (of which 7,800 millions would come from the "Reich need" levy). The subventions for post-office and railways were estimated at 18,383 millions. Here was a deficit, in round figures, of 50 milliards of marks, apart from one of 4¼ milliards on the ordinary budget. No allowance is included here for the reparation payments to the Allies.

As in the accounts for 1920, the liabilities under the Peace Treaty made a considerable showing by themselves in the budget for 1921, the estimate being 26½ milliards. The delivery of live animals involved three milliards; the costs of the settlement department for the liquidation of the pre-war debts between German subjects and those of former enemy countries were provisionally placed at two milliards; for reparation deliveries, apart from shipping, cables and cattle, 8,630 millions. The cost of Allied troops of occupation on the Rhine was put down at 7,266 millions, further augmented by 757 millions for the cost of land and buildings for their use, together with further incidental expenses. For the Rhineland Commission itself 109 millions was estimated, besides 1,220 millions for economic help for the occupied territory, to which the states and local governments had to contribute. Finally there came the reparation demand, which put before Germany economically and financially a problem of tragic magnitude.

The Reparation Demand.—According to article 233 of the Versailles Peace Treaty the Reparation Commission fixed on

May 5 1921 the amount of the war indemnity to be furnished by Germany and arranged the scheme of payments. By a renewed threat of an ultimatum the Government of the German Republic was forced on May 10 1921 to declare that they were "resolved to comply with the obligations placed on them by the Reparation Commission without reserve and without conditions." The total burden to be borne by the people of Germany was fixed at 132 milliards of gold marks, to be reduced, on the one hand, by the sums already paid on account of reparations and such sums as were to be credited to Germany according to the Peace Treaty or by decision of the Reparations Commission, but to be increased, on the other hand, by the taking-over by Germany of Belgium's debt to the Allies. Germany was required to deliver bonds in three series, of which the first two, in amounts of 12 to 38 milliards of gold marks, were to be issued at latest by July 1 and Nov. 1 1921 respectively, while the last series of 82 milliards subject to the above-mentioned modifications was also to be issued and delivered by Nov. 1 1921, but was only to be put into circulation by the Reparations Commission so far as their bonds were secured by the German annual payments. The interest on the bonds was to be 5%, the yearly sinking-fund 1%. For this purpose Germany had to provide a fixed annuity of two milliards of gold marks, besides a variable annuity corresponding to 26% of the annual value of German exports, or a proportionate sum to be fixed by further agreements. According to the existing position shown by the amount of German exports this meant an annual payment of 3 to 3¼ milliards of gold marks, added to which were the other burdens of the Peace Treaty, the cost of the occupation, payment for liquidation of foreign claims, and similar charges. On the basis of the current value of German money, this meant a yearly burden of about 60 milliards of paper marks.

The financial prospects for Germany in 1921, on these calculations, might be regarded, from a German point of view, as apparently only too clear. If the 1921 estimates placed the total budget expenditure at about 108 milliards, with a revenue deficit of about 54 milliards, both these amounts would be increased (until means to cover the deficit had been found) by 50–60 milliards. And with this it could not be expected that the highest point had been reached. If the depreciation of German money went still further, as it must do if Germany was forced by financial necessity to decrease the subventions for the cheapening of means of existence, and, in order to reduce the budget deficit, increased the postal and railway charges as well as the price of coal, the expenses of the Reich for official salaries, wages of labour and other requirements must grow automatically, and for this further cover must be found. A further increase of the floating debt, by resorting to the help of the printing-press in the issue of bank-notes, could only lead to a catastrophe. Only one alternative was visible, and that was to open up new sources of revenue for the Reich. But that would mean, in view of the concurrent financial requirements of the states and local governments, that year by year an amount of perhaps 200 milliards of marks would have to be drawn forcibly into the Treasury through the power of the Government from the hands of private earners of income and possessors of property. It remained to be seen whether any Government, and particularly one so weakened by national disorganization, could exercise such power.

Apart from the internal financial difficulty, there was also the economic problem: how Germany was to make payments abroad in such immense amounts annually. Germany in 1921 had not only a financial but also an economic deficit. Its imports had exceeded exports annually since the end of the war by several milliards of gold marks. Only by increasing foreign indebtedness and by transferring abroad considerable parts of the property of the German population had it been possible hitherto to cover this economic deficit, and an enormous additional economic burden had already resulted from the liability for interest on this debt. This method of adding to the foreign debt and financing the operation by transference of the substance of the people's wealth might be pursued still further in order to meet the demand for reparation payments. But its limits were bound to be relatively narrow. For permanent use there could only be one really practical means of payment, by obtaining a favourable trade balance in an excess of exports over imports. Germany must strive to restrict internal consumption still further, and, to increase production, it must reduce imports and increase exports to the utmost. It was a strange piece of irony, and a contradictory policy difficult for Germany to understand, that the very Powers which were imposing the demand for reparations were at the same time hampering and restricting German production by economically closing up the Rhineland through the "sanctions" resorted to in 1921, instead of furthering such power of production and allowing it to develop. If they wilfully stimulated the imports of luxuries into Germany through the "hole in the west," although the stoppage of such imports would help to provide reparation money for them by economies on the part of German consumers; if they sought to render German exportation more difficult by stringent customs regulations, in spite of the fact that an increase in German exports was the obvious economic method of complying with the reparation demand—in spite, indeed, of the fact that, through the export index, according to which 26% of the value of the current German export trade was to be taken as the amount of the variable annuity, any increase in exports would mean a rise in the yearly amount payable—the position would then become self-contradictory, and, for Germany, more and more hopeless.

Even without such embarrassments it remained to be seen how, on the one hand, Germany could attain the necessary increase in production in the short time contemplated, and whether, on the other hand, international commerce would be able to adjust itself economically to an acceptance of Germany's increased supply of goods and services, while at the same time producers elsewhere had to deny themselves a market in Germany owing to its being without means to buy.[1]

It must be sufficient here to indicate these problems, which faced all parties in 1921. The German Government had in May–July declared its fixed will to overcome them and to fulfil to the utmost the obligations that had been undertaken. It was engaged in perfecting its powers for doing so. A new period of German financial and economic management had been entered upon; and a new period of world economics had also begun, —to what end a later generation would have to discover.

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[1] It should be observed that in the middle of Aug. 1921 it was calculated by the *Frankfurter Zeitung* that the wholesale prices of commodities had risen 16-fold in Germany since 1914. Consequently a commodity which had cost 20 marks (then equal to £1) before the war had come to cost 320 marks, which, as it happened, was also in mid-Aug. 1921 just about the value of £1 in the exchange market. That is to say, £1 sterling would buy in Germany just about the same amount of commodities at wholesale prices in mid-Aug. 1921 as before the war, in spite of the 16-fold rise. On the other hand, in England during the same period the rise in wholesale prices represented an addition of 80%, so that in mid-Aug. 1921 it cost there about £1 16s. to buy the same amount of commodities wholesale which could have been bought for £1 before the war. Consequently, in respect of this difference at all events, German manufacturers and traders were in a position of advantage over British in being able to underbid them in the sale of goods. To equalize wholesale prices of commodities in German and English currencies in mid-Aug. 1921, either the German prices would have had to show a 29-fold, and not a 16-fold, increase as compared with the pre-war level, or else the mark exchange would have had to stand at 180, instead of 320, marks to the £1; or, correspondingly, English prices would have to be lowered. The mark, however, actually depreciated still further in Sept. and Oct. 1921, reaching on Oct. 17 an exchange of 750 to the £1. The explanation of the relatively low prices (in sterling) of German commodities at this time was presumably to be found in the higher productivity of the German workman and his lower standard of living, though the situation was also being affected by the difference in the economic conditions generally. German wages, though increased nominally about 8-fold as compared with the pre-war standard, were now much lower than British. But the fact here noted with regard to the relationship between prices and currency in the international market was in 1921 some set-off to the mischief done to Germany by the depreciation of the mark. The low German exchange was, in itself, an advantage to Germany in respect of her export trade in competition with England in the international market, so far as the German capacity for exporting goods at all could be made effective, since it lowered the cost of German goods to the foreign purchaser. English manufacturers in the summer of 1921 were in fact complaining that they were undersold. On the other hand, the depreciation of the mark was a severe handicap to Germany in buying anything abroad, including the materials required for producing goods for sale in the international market. (Ed. *E. B.*)

(A. F.*)

The Republican Constitution

1. From the Old Reich[1] *to the New.*—The German constitution which arose out of the Prussian and German victories of 1866 and 1870 had culminated in three supreme organs—the Emperor (*Kaiser*), the Federal Council (*Bundesrat*), and the Reichstag (National Representative Assembly). Bismarck, by taking over into his constitution the democratic Parliament of the Frankfort *Paulskirche* (*see* 11.866) of 1848, linked that constitution with the democratic and national movement for unity which had continued to live in the mind of the German people since the Wars of Liberation against Napoleon, but which had not been able of its own strength to carry through the political transformation of Germany in accordance with its own ideas. Although Bismarck diverted this popular tendency into the paths of his own policy, he had not realized its aims. The Reichstag was linked up with the idea of 1848, but in the Federal Council the organ of the old Federation of Sovereigns survived. And this representation of the " Federated Governments " (*die Verbündeten Regierungen*) was, according to the terms of the constitution, endowed with greater plenitude of power than the representation of the people, the Reichstag. The status and the construction of the Federal Council prevented the emergence of an independent and politically responsible Government, and thus obstructed evolution towards the parliamentary system. On the other hand this situation made the dynasties and governments of the individual states feel their subordination to the hegemony of Prussia less keenly; they were able to regard this subordination as the inevitable premium which they had to pay for mutual insurance under the Prussian protection. Prussian hegemony in the federally organized Empire was the natural consequence of the fact that Prussia embraced in population and territory four-sevenths of the whole Empire, and that she possessed the strongest military and administrative organization. The constitution of the Empire gave outward expression to this fact by making the king of Prussia the German emperor. But the real basis of the political power of Prussia in the Empire, as in its other aspects, lay not in the emperor's prerogatives but in the position of the Prussian Crown. The old public law of Germany always regarded its conception of monarchy as realized solely in territorial sovereignty. It remained, therefore, in this instance an open question and a matter of controversy whether the German emperor could be correctly described as monarch of the Empire and whether imperial Germany could be described as a monarchy. The political unification of Germany had not in fact been accomplished as in Italy, through the supersession of the territorial sovereignties by a national monarchy. On the contrary, the old Federation of Sovereigns (*Fürstenbund*) had, after the expulsion of Austria, been more firmly compacted under the leadership of that member of the Federation which was now the strongest—Prussia; and it had been popularized and modernized by the addition of the Reichstag elected by the democratic suffrages of the whole nation.

No doubt, in the course of those succeeding decades which brought an apparently assured position of power to the Empire in its external aspects, together with a splendid growth of economic prosperity, there arose a natural tendency towards development in the sense of the modern national State. Under the influence of this tendency the centre of gravity of public life was more and more altered in favour of the Empire; the political influence of the Reichstag and the independence of the Government of the Empire were more and more strengthened. Nevertheless, this development never reached the point of giving distinct form and substance to the powers and responsibilities of a national Government. The extension of the political mentality of the people did not keep pace with that of its economic and social capacities; its political evolution could not overcome the tenacious resistance of the old powers and the obstruction of the old order of things. There remained an unsolved and apparently insoluble discord between the development that was necessary and the political dynamic forces that had been inherited, a conflict which was one of the deeper contributing causes of Germany's national disaster.

The military and political catastrophe with which the World War ended threatened likewise the internal political existence of the German people with a terrible twofold peril. Bitter disappointment and despair brought the complete dissolution of the national commonwealth appallingly near by producing the criminal delusion that single portions and fragments of a shattered Empire might be able to bear the dreadful consequences of defeat better than the nation as a whole in firm political unity. And at the same time the desperately bitter feeling of large sections of the people directed itself, in view of the collapse of all the old authorities, against the foundations of any and every order of the state and of society, which these sections, following the example of their neighbour, Russia, dreamed that they could overthrow by means of a world revolution and the dictatorship of the proletariat. The only salvation from these two deadly perils, which menaced the political and social existence of the German people and indeed of all Europe, was to be found, if anywhere, in the conception of a national democracy. This idea had lived through generations in the soul of the German people; it had survived failures and defeats, and it had only been relegated to the background by the successes of Bismarck's policy. What was now needed was to revive with resolute determination this idea of national German democracy. Not as a federation of sovereigns, nor as a federation of separate states (now without sovereigns) under Prussian hegemony, could the German Reich continue; it could only be perpetuated as a national commonwealth, the outward political expression of German national unity, by virtue of the sense of a common nationality and by democratic self-determination. The fundamental idea of German national democracy had therefore to be " *grossdeutsch* "[2] (greater German). The " *kleindeutsch* " (smaller German) imperial Reich had been built upon dynastic foundations, and had therefore been compelled to exclude the Germans of the Habsburg Monarchy from the empire of the Hohenzollerns. But once the empire of the Habsburgs had been shattered to pieces in the name of the principle of nationality, the national and democratic German Republic would necessarily have been abjuring that very principle and the idea on which it was itself based, if it had not kept the door open for the Austrian Germans to enter and unite with their common stock. And, further, as the democratic idea of national unity was the only thing that could be effectively opposed to national disintegration, so it was only with the idea of complete democratic equality of rights for all members of the nation that the destructive attempts to set up a lawless class despotism of the proletariat could be successfully encountered.

It was for Germany a piece of good fortune in the midst of bad that social democracy, which, after the collapse of the old authorities, had come to the top, should at this critical juncture have taken its stand upon the platform of political democracy and gradual social reform. The Social Democratic " Commissaries of the People "[3] promulgated the Electoral Law of Nov. 30 1918, which was drafted at their request by the Democratic Secretary of State for the Interior, Dr. Preuss. In accordance with the terms of that law a Constituent National Assembly (*Deutsche Verfassungsgebende Nationalversammlung*) was elected by all German men and women over 20 years of age, and the definitive decision with regard to the future constitution of Germany was entrusted to this democratic National Assembly. It met on Feb. 6 1919 at Weimar. The Secretary of State, now become Minister of the Interior, laid before it a draft of the new constitution of the Reich, which, it is true, had been strongly modified in a Particularist sense by the representatives of the Governments of the individual states in the States Committee. These modifications were, however, for the most part eliminated by the National Assembly and its Committee on the Constitution. On July 31 1919 the National Assembly adopted the new constitution of the Reich by 262 votes, cast by the Majority Socialists, the Centre (Catholics) and the Democrats, against a minority of 75, composed of the two parties of the Right and the party of the extreme Left. This Constitution of Weimar was promulgated by the president of the Reich on Aug. 11 1919, and thus came into force. The fact that the young German Republic had to pass under the terms of the Peace of Versailles simultaneously with the establishment of its constitution prejudicially affected the chances of the latter's becoming familiar to the popular mind, and compromised the new order of the State in a way that was fraught with mischief.

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[1] The words " *Deutsches Reich* " were, before the revolution of Nov. 1918, invariably translated " German Empire." But the word " Reich " has, for historical reasons, been retained by the German Republican Commonwealth as its official territorial and political designation. " Reich " is an old Germanic word found in various forms in Early and Middle English, and surviving in composition in the English word " bishop*ric*."—(Ed. *E. B.*)

[2] The idea of Greater Germany, *i.e.* of Germany including German Austria, had been opposed since 1848 to the idea of " *kleindeutsch*," *i.e.* Germany, excluding Austria, which was adopted and carried out by Bismarck.

[3] The first Provisional Government by six " Commissaries of the People (*Volksbeauftragte*)" set up under Ebert and Haase after the revolution of Nov. 1918.

2. Democracy and Reichstag.—While the old constitution was headed by the statement of the fact that it had originated in a federation of sovereigns under the leadership of the King of Prussia, the new constitution is prefaced in deliberate contrast by the declaration of the national and democratic conception which guided its construction:—

> The German nation, united in its peoples (*Stämme*) and inspired by the determination to renew and to establish its Reich in freedom and justice, to promote peace at home and abroad, and to further social progress, has given itself this Constitution."

If Germany had possessed a national monarchy, there might perhaps, even after terrible defeat, have been a possibility of preserving it. But it was quite impossible, after the collapse of the 22 dynasties and their Prussian head, to entertain the idea of restoring monarchy. The maintenance of the political unity of the German people was only practicable in the form of a democratic republic. The new constitution, nevertheless, retained the designation of "Reich" for the national commonwealth, in spite of the danger of misapprehension which might arise from the connexion existing between the words *Reich* (Empire) and *Kaiser* (Emperor) in the French and English languages. In the soul of the German people the idea of its unity has for centuries been so intimately identified with the name "*Deutsches Reich*" that there could really be no thought of abolishing that designation at a moment when Germany's whole destiny depended upon the vivifying power of the national sense of unity. The German democratic republic is a Reich without an emperor and without sovereigns. This is expressed by the first article of the new constitution as follows:—

> The German Reich is a Republic. The powers of the State proceed from the people.

Linking itself with the traditions of the old German democracy which inspired the movement of 1848, yet at the same time clinging to the memory of the economic expansion of Germany during the last decades, Article 3 enacts:—

> The colours of the Reich are black, red and gold. The flag of the mercantile marine is black, white and red[1] with the colours of the Reich in the top inside corner.

While the constitution of the Reich is designed to realize at home the democratic State based on law, it takes its stand in its external aspects with deliberate emphasis upon the basis of international law, for Article 4 says:—

> The universally recognized rules of international law are accounted as binding constituent parts of the law of the German Reich.

The democratic principle is carried out by the constitution of the Reich in a twofold shape; first in the forms of representative democracy, the highest organs of the German Republic—the Reichstag and the Reichspräsident—being elected by the most extensive democratic franchise; secondly, in an institution of direct democracy—the referendum, which has been introduced alongside of the other and, according to the circumstances of the occasion, is exercised as the vote of the people (*Volksabstimmung*), the initiative or demand of the people (*Volksbegehren*) and the decision of the people (*Volksentscheid*).

The suffrage for the Reichstag was universal, equal and direct under the constitution of the Empire; the new constitution (Art. 22) has reduced the age for the exercise of the suffrage from 25 to 20; while for the "passive franchise," *i.e.* eligibility for the Reichstag, the lowest age limit of 25 has been retained in the Electoral Law of April 27 1920. The vote and likewise eligibility have been conferred upon women entirely on the same footing as upon men. The system of election by majority in single constituencies has been replaced by the proportional system with *scrutin de liste*. Finally, the election must take place on a Sunday or public holiday. These changes correspond to the demands which the Social Democrats had long ago put forward in regard to these points in their political programme.

There is the same franchise for the election of the president of the Reich as for the referendum. According to the Electoral Law now in force, which, however, will probably one day be altered, the whole territory of the Reich is divided into 35 electoral districts, each of which elects a large number of deputies on the system of strictly separate and closed lists. Thus the list is elected, not the single deputy. To every list as many seats are allotted as the number of times by which the number of votes cast for that list is divisible by 60,000. On this basis the candidates are elected in the order in which their names appear on their list. The total number of Reichstag deputies is accordingly not a fixed number; it is determined by the number of votes recorded at the election. The 35 electoral districts are combined into 17 groups of districts, and within the limits of each of these groups the parties may associate their lists in order to secure that remainders of votes under 60,000 may be reckoned conjointly. The further votes which still remain after this process throughout the whole Reich are credited to what is called the "*Reichsliste*" of the party for which they are cast, and a deputy is elected for every 60,000 of these remainder votes. A remainder which exceeds 30,000 votes is counted as 60,000. It follows that out of all the votes cast for any party throughout the whole Reich 30,000 at the utmost can be lost as regards their effect upon the result of the elections. In consequence of the extent of the suffrage, which is as wide as it can possibly be, 60% of the whole population of Germany now possess the franchise. The census of 1919 showed the population of Germany to be about 60,000,000. There are therefore close upon 37,000,000 persons in the German Reich who enjoy the franchise.

The old Reichstag itself used to decide disputed elections; but the decision was frequently long delayed, often indeed until the very end of a legislative period; and its impartiality was once and again doubtful. In point of fact, such decisions bore essentially the character of the exercise of a judicial function for which Parliament, swayed by political parties, is little fitted. Yet so long as a Parliament has not become absolutely sure of its power in the State, it is wont to watch over this right as over all its other prerogatives with jealous vigilance. Under the new order in Germany the Reichstag is now strong enough to dispense with this judicial function. For the investigation of disputed elections the new constitution of the Reich (Art. 31) transfers the decision to a court composed of judges and of members of the Reichstag. The mixed composition of the court was adopted in order that the deciding body might continue to have the benefit of expert parliamentary knowledge.

The Reichstag is elected for four years. The duration of the legislative period is a natural subject of conflict between democratic and parliamentary tendencies. Democratic tendencies are in favour of enabling the people, the electorate, to make its voice heard as frequently and as directly as possible, and it therefore urged that the duration of the representative assembly should be brief. On the other hand the efficiency of parliamentary government depends upon allowing an adequate period to elapse between the travail and the after-pangs of a general election for Parliament to have time for quiet political work. The four-year legislative period adopted in the constitution of the Reich represents a compromise between the old legislative period of five years and the demands for a two or three years' period. From the point of view of reasonable parliamentary democracy a period of four years does not seem too long, especially as there is the referendum; and, moreover, the president of the Reich can, by dissolving the Reichstag, appeal from the elected to the electors. It is true that he can do this only once on account of the same matter (Art. 25). This limitation was introduced in order to prevent any attempt by an autocratic president and a complaisant Government to weary the people by repeated dissolutions and thus impose their will.

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[1] The colours of the Hohenzollern Empire.

The date of the meeting of the Reichstag is not subject to the pleasure of the Government; it has the right to convoke itself. The first meeting of a newly elected Reichstag must take place at latest on the thirtieth day after the elections; otherwise it must assemble every year on the first Wednesday of November, unless its president, on the demand of the president of the Reich or of two-thirds of the deputies, convokes it earlier. The Reichstag itself determines the close of its session and the date of its reassembling (Art. 23, 24). In other respects, too, the Reichstag enjoys the fullest rights of parliamentary autonomy, which its president, elected by itself, officially safeguards. Its proceedings are public; it is only on a proposal backed by 50 members and on a resolution supported by a two-thirds majority that the publicity of the proceedings can be suspended (Art. 29). The press cannot be called to account so long as it gives accurate reports of the Reichstag's public proceedings (Art. 30). The parliamentary immunity of the deputies is secured in the most consistent fashion. This does not merely embrace inviolability of privilege for their votes and speeches in the House and their exemption from arrest or legal proceedings without the consent of the House; they have also the right to refuse to give evidence regarding persons or facts with which they become acquainted in their quality of deputies (Art. 36–38).

3. The Reichstag and the President.—According to the old constitution the assent of the Reichstag was, no doubt, required for laws, taxes and the budget; but its influence was decisive only in a negative sense; it could prevent things from being done, but it had no power of creative political action. Upon the composition of the Government and, therefore, upon the general tendency of its policy, the Reichstag had no constitutional influence. The political direction lay quite definitely with the federated governments represented in the Federal Council (*Bundesrat*), with the Prussian Crown at their head. The new constitution of the German Republic puts the Reichstag at the centre of the life of the State by establishing the parliamentary system of government on the broadest democratic foundations. This in no way signifies unlimited autocratic sovereignty of Parliament. On the contrary, the principle of the constitutional state, established on the basis of law, requires the co-existence of several supreme organs of the State between which parliamentary government forms the elastic link; and it requires the control of independent courts which can determine the legality of all private and public acts. In a parliamentary monarchy the hereditary crown is coördinate with the Houses of Parliament. In a republic an elected head of the State is substituted. If he is elected by Parliament his position is not coördinate with, but rather subordinate to, Parliament; he has no authority of equal standing with that of Parliament; and he is therefore unable in critical situations to supply any counterpoise to excessive manifestations of the one-sided domination of party. In a democracy the only element of equal standing and equal weight with the Parliament is a head of the State who is likewise elected by the whole people.

Accordingly, in the democratic German Republic the President of the Reich is elected by the whole German people.[1] He is elected for seven years. Every German who has completed his thirty-fifth year is eligible. A woman may be elected (Art. 41, 43, 109). The special Electoral Law of May 4 1920 enacts that all electors for the Reichstag have a vote for the president; that the suffrage is direct and secret; and that an absolute majority on the first ballot is decisive. Should there, however, be no absolute majority on the first ballot, then the result is decided in the second ballot by relative majority. The President of the Reich is thus as much a direct representative of the people as is the Reichstag; he is not dependent upon the Reichstag either for his original election or for his reëlection. It is true that the constitution gives the resolutions of the Reichstag the greater decisive force; but, in the case of the Reichstag, the representation of the people is distributed among more than 400 deputies, while in the case of the President of the Reich it is concentrated in a single person. The position of this "plebiscitary" president may present many of the features of a tribune of the people, but the danger of degeneration into Caesarism or Bonapartism is meant to be counteracted by the strict practice of the system of parliamentary government, which makes every act of the President absolutely and without exception conditional upon the coöperation and countersignature of the Ministry of the Reich, which, again, is dependent upon the Reichstag.

Unquestionably as a democratic republic was in the circumstances the only possible form of state for Germany, it might nevertheless have been open to serious doubt whether the parliamentary system of government was suitable for that country. This system, it is maintained, cannot with any prospect of success be imposed by rigid legal statutes. It is rather the organic product of a long political development, which can only be created by tradition, political training and by the self-control of political parties, without which parliamentary party government cannot politically subsist. This kind of tradition and the selection of steady leaders, which depends upon it and is indispensable for parliamentary government, are most naturally created where there is a development that has started from aristocratic parliamentarism, has progressively widened its bases, and, finally, through the plutocratic parliamentarism of the middle classes, leads to perfect democracy. In Germany historical development did not supply these favourable conditions. The political progress of that country lagged far behind its economic and social evolution. And now, by means of the new constitution, the parliamentary system and the most complete democratization, which had become inevitable, were simultaneously introduced, and that at a time when there was an entire lack of any leadership traditional and acknowledged by the free play of custom; at a moment, too, when the external situation was the most unfortunate conceivable; and when a very powerful social movement was asserting itself in the country. This is so; and yet what was necessary had also to be rendered possible in the midst of this decisive crisis of the destinies of the German people. For a people of 60 millions the organization of a pure, direct democracy could not be entertained. Suggestions were made from many quarters that, on the model of the American constitution, the executive power should be wholly entrusted to the president elected by the people, with a ministry dependent solely upon him and not upon Parliament. But this dualistic system, which lays excessive stress upon the separation of powers, has exhibited great imperfections when confronted with the demands of modern political life. The absence of a system of parliamentary government is, perhaps, the most serious defect in the otherwise admirable edifice of the American constitution. And Germany's own experiences of the unbridged dualism of Government and Parliament under the old régime offered no inducement to reëstablish it in a republican form. In spite of all the objections which have been mentioned, the new constitution had therefore to decide in favour of the parliamentary system in the confident hope that the practice of this system would itself gradually produce the political conditions requisite for its success. This is the explanation of the circumstance that the constitution contains many express rules for the conduct of the parliamentary system, which in other countries is founded upon custom and convention, not upon written laws.

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[1] President Ebert was, however, elected by the National Constituent Assembly at Weimar. He was really provisional president, a definitive election not being considered expedient until the definitive extent of the German Reich had been decided, *e.g.* by the destiny of Upper Silesia.

> The Chancellor and, upon his suggestion, the Ministers of the Reich are appointed and dismissed by the President of the Reich. (Art. 53.)

In selecting the persons whom he might appoint, the President of the Reich is thus legally free, and is not confined, for instance, to the members of the Reichstag for his choice. But this is subject to precise conditions:—

> The Chancellor and Ministers of the Reich require for the exercise of their office to possess the confidence of the Reichstag. Any and each of them must resign if the Reichstag by an express vote withdraws its confidence from him. (Art. 54.)
>
> The Chancellor lays down the guiding lines of policy and bears the responsibility for them to the Reichstag. Within these lines every Minister of the Reich conducts the affairs of the department which has been entrusted to him independently and on his own responsibility to the Reichstag. (Art. 56.)

The President of the Reich can, therefore, only appoint a Government which is able to obtain the support of a majority of the Reichstag; and only so long as it commands such support can it remain in power. The Chancellor and the Ministers form a Cabinet (*Kollegium*), at the head of which the Chancellor of the Reich corresponds to the English Prime Minister.

The President of the Reich has in regard to foreign and internal affairs all the prerogatives which usually belong to the constitutional head of a State; but the declaration of war and the conclusion of peace are effected by legislation of the Reichstag; and political treaties concerned with matters which form the subjects of legislation require the approval of the Reichstag (Art. 45):—

> All ordinances and dispositions of the President of the Reich, including those relating to the armed forces, require for their validity the counter-signature of the Chancellor or of the competent Minister of the Reich. By the counter-signature responsibility is assumed. (Art. 50.)

This likewise applies to the dissolution of the Reichstag and to the institution by the President of the Reich of a referendum of the people upon decisions of the Reichstag. If the Ministry, supported by a majority of the Reichstag, refuses its counter-signature to these acts, the President of the Reich can appoint another Ministry, and can, with the counter-signature of this Ministry, dissolve the Reichstag. The people finally decide the matter by the general election.

The constitution draws a sharp distinction between political and legal responsibility; the latter signifies responsibility for the lawfulness, the former for the expediency and the success, of the acts of the Government. Political responsibility is not a legal question which could be decided by a court of justice by means of legal proceedings in accordance with statute law; it involves a judgment regarding political values, which is materially influenced by the party point of view. Political responsibility is, therefore, enforced by a vote of no confidence on the part of the Reichstag, entailing the resignation of the Ministry or of a minister, but involving no judgment at law. As a general rule the political responsibility of the Ministry covers the President of the Reich. It is only for the exceptional case of an intolerable conflict between the President of the Reich and the Reichstag that, as the counterpart of the President's prerogative of dissolution, the Reichstag is similarly given the faculty of appealing from the elected to the electors. The Reichstag by a resolution, which must be carried by a two-thirds majority, can submit to the people a proposal for the deposition of the President. If this proposal be rejected by the popular vote, its rejection is taken to be equivalent to the re-election of the President for a fresh term of seven years, and it at the same time entails the dissolution of the Reichstag (Art. 43). Legal responsibility on the other hand is the same for the President of the Reich as for the Chancellor and the Ministers. On the proposal of at least 100 of its members the Reichstag can by a two-thirds majority impeach President, Chancellor or Ministers for having culpably violated the constitution or a law of the Reich. Judgment is given after regular proceedings at law by the Court for State Affairs (*Staatsgerichtshof*) for the German Reich, invested with the independence of a Supreme Court of Judicature (Art. 59).

4. The Reich and the Territories.[1]—Although the new constitution of the Reich did not originate, like the old one, in a federation of the separate states but in the national and democratic unity of the people, it has not abolished the existence of the separate states. Notwithstanding the more compact organization of the national commonwealth and a considerable extension of its competence, the smaller commonwealths continue, although they are no longer called "States" (*Staaten*) but "Territories" (*Länder*). Whether the German Republic should now be called a federation of States (*Bundesstaat*) with strong national central authority, or a unified State (*Einheitsstaat*) with strong territorial decentralization, is hardly more than a theoretical controversy about terminology. A great obstacle in the way of genuine federal organization and at the same time of consistent political and administrative decentralization is the manner in which territory is distributed among the different German countries. This distribution arose out of the accidents of the dynastic policy of the former reigning houses. It is in many instances a patchwork of fragments of territory which have no real connexion with each other; and above all there is a vast disparity in the size of the territories. Prussia alone embraces in territorial extent and population four-sevenths of the whole Reich; it is therefore by one-third as large again as all the other territories put together and some hundred of times larger than the smallest of them. Corresponding with this proportion was the position of hegemony which Prussia enjoyed under the old constitution of the Reich, but which has now been completely abolished in constitutional law. Yet this has not solved the difficulty of treating as equals territories which are actually so unequal, whether federative organization or the decentralization of the functions of the Reich be the question at issue. The necessity of giving the new constitution a proper basis by a territorial rearrangement of the component parts of the Reich has certainly been acknowledged; but under the pressure of perils without and within this right idea could not for the present be carried out. The 25 territories were therefore provisionally taken over in their old extent; and the constitution of the Reich merely prescribes the procedure by which a rearrangement may be effected at some future date. Meanwhile seven of the smallest territories have spontaneously combined to form the single new territory of Thüringen (Thuringia).

Within the organization of the Reich the individual territories are not represented, like the separate states of the American Union or like the Swiss cantons, by a separate House of Parliament, but only by a non-parliamentary body (*Kollegium*), the Council of the Reich (*Reichsrat*). The Reichstag consists of a single House. In the American Senate and in the Swiss Council of Estates (*Ständerat*) there are two representatives of each separate state, elected by that state but representing the political opinion of their party. Not so in the Reichsrat. That body is composed of members of the Governments of the different territories or of substitutes appointed by them, who speak and vote in the name of those Governments. In view of the vast disparity in the size of the different German territories it is impossible that each of them should have the same number of votes. Each territory has at least one vote and the larger territories several votes, in the main according to population. No territory, however, may have more than two-fifths of all the votes. Without this limitation Prussia alone would command a majority in the Reichsrat, so that the representation of the other territories would have no significance. Moreover, in future, half of the Prussian votes are to be assigned to the provinces of Prussia, which thus for the first time will obtain direct representation in the Reich on the same footing as the other territories. At present there are 65 votes in the Council of the Reich; of these Prussia has 26, of which 13 are to be assigned to her 13 provinces, including Berlin as a province.

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[1] The different countries and cities federated in the German Empire (*Reich*) of 1871–1918 were called States (*Bundesstaaten*). In the constitution of the new republican Reich they (*e.g.* Bavaria, Württemberg, Saxony, etc.) are designated Territories (*Länder*), but also in their political aspects Free States (*e.g. Freistaat Sachsen, Bayern*, etc.).

In composition and external aspect the Reichsrat is undeniably the successor of the old Federal Council (*Bundesrat*); but its real character and its constitutional position are essentially different. The Federal Council was the real seat of the authority of the Government and of the Prussian hegemony. Its President, the Imperial Chancellor, was at the same time Prussian Minister-President, and it was this that gave him real power; the direction of the Empire was very intimately connected with the Government of the Prussian State. In legislation the Federal Council had constitutional equal rights with the Reichstag, and as it likewise was in possession of the powers of Government, it actually predominated over the Reichstag. The Imperial Chancellor could not introduce any measure into the Reichstag without the assent of the Federal Council; and no measure or resolution passed by the Reichstag could come into force if the Federal Council did not agree to it. This position of the Federal Council had been the barrier against progress in the parliamentary system in imperial Germany, for it rendered impossible a Government really responsible to the Reichstag. In all these aspects the position of the Federal Council has now been so transformed that the path has been cleared in the German Republic for parliamentarism. The Reichsrat is presided over by a member of the Government of the Reich; but that Government is now entirely independent of the Prussian Government, and it is also independent of the Council of the Reich. It is not the Council but the Ministry of the Reich which conducts the Government and administration and issues general ordinances. Only in so far as the execution of the laws of the Reich falls within the competence of the authorities of the territories is the assent of the Reichsrat required for this purpose. For the rest, the Ministers of the Reich have to keep the Council informed regarding the conduct of the affairs of the Reich and to consult its committees in matters of importance. The Government of the Reich lays its bills in the first instance before the Reichsrat. If the Council rejects them, this does not bar the way to the Reichstag; the Government can introduce its bill together with an exposition of the dissentient views of the Council. The Council has the right to enter an objection to bills passed by the Reichstag; in that case the bill goes back to the Reichstag. If the Reichstag maintains its vote by a two-thirds majority the objection of the Council falls to the ground, unless the President of the Reich ordains that there shall be a popular referendum on the subject. If, however, the Reichstag only votes by a simple majority against the objection of the Council the bill is dropped, unless the President of the Reich institutes a referendum on the matter. The Reichsrat has thus a suspensory veto; the real seat of legislation is the Reichstag.

Neither the President nor the Government of the Reich possesses the right of veto on legislation; they must dispatch the laws which have been constitutionally enacted and must promulgate them within a month's time in the official Law Gazette of the Reich (*Reichsgesetzblatt*). The President can, however, submit a law passed by the Reichstag to the referendum within the month's period. Moreover, the promulgation of a law must be postponed for two months, if one-third of the members of the Reichstag demand this, and if the law has not been declared urgent by the Reichstag and the Reichsrat. If promulgation is postponed the law must be submitted to a referendum, if one-twentieth of the total electorate request it. The initiative in legislation is also admissible by way of the referendum; this is designated the popular demand (*Volksbegehren*). The popular demand must be based upon a fully drafted bill, the submission of which must have been demanded by one-tenth of the electorate. If such a demand has been brought forward the Governnent lays the bill, accompanied by an expression of its own opinion, before the Reichstag; if the Reichstag does not pass the bill without any alteration the final decision must be taken by a referendum. On the budget, on taxation bills and on votes for salaries the President alone can institute a referendum. Bills and resolutions passed by the Reichstag can be annulled by the referendum only if the majority of the whole electorate has participated in the popular vote. If it is a case of an alteration of the constitution for which a popular demand has been advanced, the assent of the majority of the whole electorate is requisite for the validity of the popular decision. For the rest, decisions of the Reichstag for alterations in the constitution can only be effected if two-thirds of the legally qualified members are present and if at least two-thirds of those present vote. Similarly in the Reichsrat laws for altering the constitution require a two-thirds majority. If the Reichstag has voted an alteration of the constitution to which the Reichsrat objects, the President of the Reich may only promulgate the alteration if the Reichsrat does not within a period of two weeks demand a referendum on the subject.

The referendum has hitherto been tried on a comparatively small scale only, as in Switzerland and in individual American states. On so large a scale and with a mass of some 37 millions of voters it will now, under the new constitution of the German Reich, be tried for the first time. This is an experiment which cannot be made without some misgivings; there are circumstances in which it might seriously complicate legislative procedure. In view of the situation in Germany, however, this modification of pure parliamentarism in favour of the direct intervention of democracy was necessary. The hope may be entertained that it will have the effect of promoting the political education of the masses; the precautions which have just been enumerated will at any rate militate against its abuse.

5. *Fundamental Rights.*—In the distribution of tasks between the Reich and the territories the new constitution like the old defines only the competence of the Reich, and tacitly leaves everything else to the competence of the territories. But the sphere of this competence of the Reich is materially broadened and more strictly outlined as compared with the old arrangements. The constitution of the Reich prescribes for all the German territories the republican form of government and popular representation based, like the Reichstag, upon equality of franchise; upon this representation the Government of the territory must lean. The same suffrage is also prescribed for the communal representative bodies.

In respect of legislation the competence of the Reich *ipso facto* excludes the competence of the territories for a variety of subjects, in particular for foreign relations, questions of citizenship[1] or nationality, freedom of migration within the Reich, emigration and immigration, extradition; similarly for the organization of the national forces and for coinage, customs, commerce, posts and telegraphs. For a very large number of other subjects the legislation of the Reich is also competent, but the territories also retain their competence as regards these subjects until the Reich exercises its prerogative. Besides this, the Reich can, in case of need, enact uniform laws dealing with public welfare and for the preservation of public order and security; and it can lay down principles for dealing with religious societies, schools, the legal status of officials, land laws, etc. In the matter of taxation the competence of the legislation of the Reich is almost unlimited. The law of the Reich prevails over the law of the territory—that is to say, territorial laws which contradict laws of the Reich are of no effect. In case of dispute the decision of the Supreme Court (*Reichsgericht*) may be invoked.

In administration, too, the direct competence of the Reich extends to the most important spheres, embracing foreign policy, military forces and navy, communications, especially posts, telegraphs, railways, inland navigation and waterways, customs and, for the most part, taxation as well. For the rest the laws of the Reich are executed by the administration of the territories, so far as these laws do not otherwise provide. Over this part of the activity of the authorities of the territories, however, the Reich exercises supervision, and it can give these authorities general directions. In cases of difference a Supreme Court decides. If a territory does not fulfil the duties incumbent upon it according to the constitution or the laws of the Reich, the President of the Reich, with the aid of armed forces, can make it do so. Similarly, if in any part of the Reich public security and order are seriously disturbed or imperiled, the President can adopt the measures necessary for their restoration, and he can at the same time suspend certain of the fundamental rights. He must without delay inform the Reichstag of all these measures, and, if the Reichstag so demands, he must revoke them. In the spirit of the State based upon law the constitution of the Reich contemplates at all points the decision of disputed questions of justice by independent courts. It sets up the leading principles for securing this independence and for the judges' tenure of their office for life. It prohibits emergency courts, enacts the abolition of military jurisdiction and, on the other hand, secures the existence of courts of administration for the protection of the individual against ordinances of the administrative authorities. A Supreme Court of Administration (*Reichsverwaltungsgericht*) is to be established by a special law.

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[1] A German is both a citizen of the Reich and of the German territory or state (*e.g.* Prussia or Bavaria) to which he belongs.

In addition to the part which specially deals with organization and is entitled "Construction and Duties of the Reich"—in fact the whole scheme of government—the constitution sets up as its second part a declaration of rights entitled "Fundamental Rights and Duties of Germans." These rights embrace partly statute rights which are directly applicable, but, for the most part, the declaration lays down guiding lines for a programme of legislation for the Reich and the separate territories. These, in a multitude of diverse provisions, have reference to the individual, life in communities, religion and religious societies, education and schools, and economic life. In contradistinction to earlier declarations of the rights of man and of the citizen they lay stress, not merely upon the preservation of individual liberty, but above all upon the obligations and the solidarity of society. Of special importance from the point of view of organization is Art. 165, which declares that the workers and salaried employees and their organizations are to be brought into coöperation on an equal footing with the employers in the arrangement of social and economic life. The declaration prescribes the formation of workers' industrial factory councils, of district economic councils, and of an Economic Council of the Reich (*Reichswirtschaftsrat*). Before the last-mentioned Council social and economic bills of fundamental importance must be laid by the Government of the Reich for its opinion. The Council can also itself propose such measures and can have them advocated by one of its members before the Reichstag. The constitution does not, however, give the Economic Council of the Reich a decisive vote; the Council is, therefore, not an actual organ of legislation.

6. The Constitution of the Free State of Prussia.—From the collapse of Nov. 1918 there did not emerge a common Revolutionary Government for the Reich and Prussia. Accordingly in Jan. 1919, eight days after the elections for the German National Assembly, a separate Prussian Constituent Assembly was likewise elected. After many difficulties and obstacles had been overcome this Assembly completed on Nov. 30 1920 the republican constitution of Prussia.

For Prussia the revolution had infinitely greater significance than for any other German state. In view of the distinctively monarchic structure of the old Prussian State the transition to a republic was in itself something that bore the aspect of a prodigy. This change at the same time brought with it the complete alteration of the position of Prussia in the Reich, a position which had hitherto been characterized by the imperial dignity (*Kaisertum*) attaching to the Prussian Crown. And not only was this hegemony, the close connexion of the Prussian Government with that of the Reich, abolished; important rights and instruments of power, as, in particular, military organization and railways, passed from Prussia to the Reich. Finally this brought about a further change in the other direction in the relationship between Prussia and her own provinces, which had till then been held together by the compact centralization of monarchy.

The contents of the Prussian constitution are determined and influenced in a far-reaching and decisive way by the new constitution of the Reich. The republican form of government, the basis of the suffrage for the election of the Landtag (the Prussian Diet or Legislative Assembly), and a Government supported by the confidence of the representatives of the people, were prescribed for the constitution of this territory by the law of the Reich. The new Prussian constitution merely carries out these instructions. But, in its close connexion with the constitution of the Reich, it designedly goes considerably further; for the majority of the Prussian Constituent Assembly desired to strengthen as much as possible the unity of the Reich. But for the sake of this object they had to deviate in one important particular from the pattern of the constitution of the Reich. If they had set up a president of the Prussian State in addition to the President of the Reich, friction of the most serious character would have been inevitable. The Prussian Republic has, therefore, no president. The Diet (*Landtag*) is elected on the same franchise as the Reichstag and, like it, for four years. It elects, without debate and by an absolute majority,[1] the Minister-President, who then appoints the rest of the Ministers. The Minister-President and the Ministry of the state hold a position as regards each other and as regards the Diet analogous to that of the Chancellor and the Ministers of the Reich as regards the Reichstag. Their political and legal responsibilities are regulated in the same way as in the Reich. The Staatsrat (State Council) holds a position in accordance with the Prussian constitution similar to that of the Reichsrat in the Reich.

So long as a new territorial arrangement of the territories (states) which compose the Reich cannot be carried out, the attempt is being made to diminish the difficulties arising from the disproportionate size of Prussia in comparison with the Reich by increasing the independence of the Prussian provinces by means of thoroughgoing decentralization and enabling them to enter upon direct relations with the Reich. This at the same time meets the popular desire in many districts of Prussia, which are hardly inferior in extent, in population and in cultural and economic importance, to any of the non-Prussian German territories, and are, indeed, superior to most of them in these respects. In the sense of this policy the constitution of the Reich has conferred half the Prussian votes in the Reichsrat to the Prussian provinces. In the same spirit the Prussian constitution prescribes a great extension of provincial autonomy, and has created the Staatsrat (State Council) to represent the provinces in the legislation and administration of the state. The Staatsrat is no more intended to be a second chamber than the Reichsrat; the Parliament consists of one House. But, as the Prussian provinces have no independent Governments of their own, the Staatsrat cannot, like the Reichsrat, be composed of the members of Governments. Its members are elected by the different provincial Diets, which, again, are the products of equal suffrage like the Reichstag and the Landtag. The procedure is that the members of the Staatsrat are elected on the proportional system immediately after every general election for the provincial Diets. They give their votes in the Staatsrat without instructions in accordance with their own unfettered convictions. Every province sends up at least three representatives and an additional one for every half-million inhabitants. All men and women who are citizens of the Reich, have completed their twenty-fifth year, and have been domiciled in the province for one year, are eligible. In the legislation of Prussia the Staatsrat plays a part analogous to that of the Reichsrat in the legislation of the Reich. If it raises objection to decisions of the Diet the objection can be set aside by a repetition of the vote of the Diet by a two-thirds majority or by a referendum which the Diet can institute. The assent of the Staatsrat is requisite if the Diet wishes to vote expenditure exceeding the amount which has been proposed or approved by the Ministry. A referendum is not admissible in this instance. In the administration the Staatsrat coöperates by giving its opinion on the general ordinances which are to be issued by the Ministry. The President of the Staatsrat, elected by itself, is entitled to coöperate in the dissolution of the Diet, which, in the absence of a President of the State, is decided upon by a body (*Kollegium*) composed of the Minister-President, the President of the Diet and the President of the Staatsrat. The Landtag can also be dissolved by its own vote or by popular demand. For the rest the referendum, the popular demand and the popular decision are admissible in a form similar to, though somewhat more restricted than, that which is prescribed for the Reich.

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[1] A candidate, in order to be elected, must have received one more than half of the number of votes cast.

It is only by a gradual and tranquil development that the immense transformations in every sphere of the State, which find expression in the constitution of the Reich and Prussia, can establish themselves and take firm root in the mind of the people, in which, naturally, traditions and memories of the past were still not obliterated in 1921. (H. P.*)

Administration

The business of the German Reich is conducted by the Ministries of the Reich, consisting of departmental ministers and ministers without portfolio. The departmental Ministries are as follows: Foreign Affairs, Interior, Finances of the Reich, National Defence (*Reichswehr*), Justice, National Economy (*Reichswirtschaft*), Labour, Post Offices and Communications, Treasury, Food, Reconstruction.

In Prussia affairs are conducted by the Ministry of State, composed of Ministries of the Interior, Justice, Finance, Public Welfare, Commerce and Industry, Agriculture, Domains and Forests, Education and Public Worship (*Kultus-Ministerium*).

The Territory and Free State of Prussia is now divided into ten provinces: Brandenburg, Pomerania, Lower Silesia, Upper Silesia, Saxony, Schleswig-Holstein, Hanover, Westphalia, Rhein Province, Hesse-Nassau. The municipality of Greater Berlin, created by the law of April 27 1920, also ranks as a province, as does the border region (*Grenzmark*) of Posen and West Prussia, being the remainder of the two former Prussian provinces bearing those names which was left to Prussia by the Treaty of Versailles. A Prussian province is at once a Regional State Authority (*Staatsteil*) and a self-governing local authority.

According to the new Prussian constitution (Art. 72), the provinces are to be administered by their own administrative organs in accordance with the terms of an Autonomy Law which is to be enacted. This administration is concerned with (i.) matters falling within the administrative competency of the provinces, having been either assigned to them by legislation or voluntarily taken over by them; (ii.) delegated affairs, *i.e.* affairs of State which have been transferred to the provinces.

The State authorities of the provinces are the Chief President (*Oberregierungspräsident*) and the Provincial Council; the local authorities are the *Landeshauptmann* (in some regions known as the *Landesdirektor*), the Provincial Diet and the Provincial Delegation (*Provinzialausschuss*). The provinces are divided as territorial parts of the State into districts (*Regierungsbezirke*), at the head of which is the district president. The districts are divided into sub-districts (*Kreise*), which are of two kinds, urban and rural sub-districts (*Stadt- und Landkreise*). These form part of the State Government like the provinces, and are also independent, self-governing units. The constitutions of local government units, *i.e.* the provinces, the urban and the rural sub-districts, are determined by provincial and local statutes, which differ for different parts of the country. The electoral system, on the other hand, has been made uniform for the organs of local government by a law of Dec. 3 1920. The suffrage is the same as for the Reichstag, with proportional representation.

In the sub-districts the organs of administration are the *Landrat*, the *Kreistag* and the sub-district delegation (*Kreisausschuss*). A town with a population of more than 25,000 inhabitants may separate from the rural sub-districts to which it would otherwise belong and form an independent urban sub-district. Rural sub-districts are divided into communes (*Gemeinden*), which again are either urban or rural communes. The pre-war statutes as to the administration of urban and rural communes are still in force. The organs of State administration under the *Landrat* are the *Amtsvorsteher* (sub-district officials); the organs of the communal administration are the *Gemeindevorsteher* (communal officials). The larger landed estates constitute *Gutsbezirke*, the administrative organs of which are the *Gutsvorsteher*. In the towns there is a council of aldermen (burgomaster and aldermen) at the head of the administration, and there is likewise a council of elected municipal deputies. All these administrative organs are being reformed on uniform and modern lines. Greater Berlin has, by the law of April 27 1920, been made into a single urban community, consisting of 8 urban communes, 59 rural communes and 27 manorial communes (*Gutsbezirke*). This permanent organization replaced the union of Greater Berlin, which had been provisionally effected for certain special purposes.

The status of officials as regards the Reich is based on Art. 128–131 of the constitution. They are appointed for life except in cases where the contrary is provided by statute. In Prussia their position is regulated by the Prussian constitution (Art. 77–79). Every official of the Reich has to take an oath of fidelity to the constitution of the Reich, and every Prussian official to the constitutions of the Reich and of Prussia. The scale of salaries has been revised for the Reich by the laws of April 30 and Dec. 17 1920, for Prussia by the law of May 7 1920. According to the law of the Reich of Dec. 21 1920, the remunerations and allowances paid by the individual states, the local authorities or by other public corporations to their officials and the teachers in their schools must not be higher than the salaries paid to the officials of the Reich who occupy corresponding positions (*Beamtensperrgesetz*). In Prussia a maximum age limit has been introduced by the law of Dec. 15 1920. For officials directly employed by the State and for national-school teachers it is 65; for judges, teachers in universities and higher technical colleges, 68.

Socialization.—According to the new constitution of the Reich (Art. 156) the Reich may convert into property of the community all enterprises which are suitable for socialization. The Reich may associate itself, the individual states or the communes, with the administration of such enterprises, and it may out of separate industrial undertakings form self-governing coöperative bodies. The Socialization Law of March 23 1919 had been promulgated before the constitution was enacted. According to this law the Reich had the power (i.) to socialize all suitable enterprises, especially those occupied with the extraction of minerals and with the exploitation of natural sources of power;[1] (ii.) in case of urgent necessity to regulate by means of administration in the public interest the production and distribution of economic products. A Socialization Commission was set up whose business it is to make proposals for laws for carrying out the Socialization Law.

The rules for the working of the Statute of March 23 1919 dealing with the coal industry were promulgated Aug. 20 1919. At the head of the coal administration is the Coal Council of the Reich (*Reichskohlenrat*), under which is the Coal Association (*Reichskohlenverband*). The latter supervises the main lines laid down by the Coal Council for dealing with the whole industry in fuel. Germany is divided into 11 mining districts; all the collieries of each district are united into a syndicate. Similarly all gas-works in the district are united in one Gas Coke Syndicate. The Chancellor, and, under him, the coal commissaries of the Reich, exercise supervision over distribution of all the coal which is produced in Germany.

The potash industry is regulated by the law of the Reich of April 24 1919. The chief control is in the hands of the Potash Council. This body is competent to give its assent to the conclusion of syndicate contracts and to business regulations for the potash industry. It may forbid the opening of new potash-fields and may close down existing works. It fixes the price at which potash may be sold in Germany and also the average wage to be paid in the industry. Wage bureaux of first and second instance have been instituted for the latter purposes. All producers of potash are united in one obligatory syndicate, which has the sole right to sell and to import potash products. The potash control office supervises the execution of the instructions of the Potash Council of the Reich. It fixes the extent to which each of the potash-works is to participate in the general production. An application for revision of its decisions may be made to the Potash Board of Appeal.

Socialization of electricity has been initiated by the law of Dec. 31 1919. Associations are to be formed for the production and distribution of electrical power in all districts where there are electrical works. In the case of larger works the Reich has the right to take them over.

Settlement and Housing.—By the Settlement Law of Aug. 8 1919 the individual states are obliged to establish settlement associations in the public interest for the creation of small independent settlements. These associations have the right of preëmption for all properties over 25 hectares in extent unless they pass into the possession of a husband or wife or near relations of the owner. In settlement districts where more than 10% of the agricultural land is in properties exceeding 100 hectares in extent the properties form a land supply association with coöperative rights. This association has to place at the disposal of a settlement association lands for settlement up to one-third of the agricultural area as it existed in 1907 on the properties concerned.

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[1] A great development of water-power was in progress in 1921, especially in Bavaria.

According to the Small Holdings Law of May 10 1920 the Reich, the individual states and the communes may assign small holdings for the erection of dwelling-houses and for cultivation by a small holder. The holding may not be partitioned or mortgaged without permission of the authority which has assigned it. The assigning authority has the first right to purchase, except where property passes to a husband or wife or near relation of the owner, and it also has a claim to the reversion of the holding if the small holder manages the place badly or does not properly look after it.

The housing difficulty has since 1918 necessitated measures of compulsion. In accordance with the proclamation of Sept. 9 1920 the communes may prohibit the demolition of buildings and the use of living-rooms for purposes other than habitation; they may also demand the notification of rooms which are not in use. In districts where there is an actual housing crisis the commune can also be empowered to issue further regulations for such purposes as sequestration of houses and rooms for compulsory billeting. Profiteering by house agencies is forbidden and is punishable. For increases of rent a certain percentage in addition to the peace-time rent of July 1 1914 may be fixed as a maximum.

Courts of Law.—The principal courts of justice in their order from the lowest to the highest are: the Local Courts (*Amtsgerichte*), Provincial Courts (*Landgerichte*), Superior Provincial Courts (*Oberlandesgerichte*) and the *Reichsgericht* at Leipzig. The Reichsgericht is the only court which is maintained by the Reich; all the others are courts of the individual states. The judgments of the courts are issued in accordance with the new constitution of the Reich, under the heading "In the Name of the People."[1] All the courts act as civil courts, as criminal courts and as courts having jurisdiction in non-contentious matters.

The Amtsgerichte are, according to the Statute of March 11 1921, declared to be competent in all actions involving values up to 3,000 marks, and as regards some classes of actions (such as claims for maintenance, purchase of cattle, suits relating to rents and transport, etc.) without regard to the value of the object. The *Amtsrichter* sits as sole judge. An appeal from his judgment to the Landgericht may be made, but only when the value of the object is more than 300 marks.

The Landgericht sits in divisions consisting of 3 judges in civil actions and of 5 judges in the case of the more important criminal trials. In the more important districts the Landgericht has also a commercial division with one professional judge and two lay judges taken from the commercial classes. From a judgment of a civil or commercial division an appeal lies to the Oberlandesgericht, sitting in senates of which each is composed of 5 judges. From the judgment of this court there is again an appeal on pure questions of law to the Reichsgericht, sitting in senates of which each is composed of 7 judges; such appeals only lie where the value of the object exceeds 4,000 marks, or in special classes of action (*e.g.* matrimonial suits, claims against the State, etc.).

Minor criminal cases are tried by the courts of first instance, *Schöffengerichte*, which are presided over by the Amtsrichter and are composed of him and two lay judges. From the judgment of the Amtsgericht an appeal lies to a *Strafkammer* (Criminal Division of the Landgericht), and on points of pure law there is a further appeal to a criminal division of the Oberlandesgericht, in which 5 professional judges sit. Criminal cases of medium gravity are tried before a Strafkammer of the Landgericht as a court of first instance. An appeal lies from its judgment, not on questions of fact but only on the ground of misapplication of the law, in most cases to the Reichsgericht at Leipzig, but in some classes of cases this appeal goes to the Oberlandesgericht.

The gravest crimes are tried before a court composed of 3 judges sitting with a jury; the jury consists, as in England, of 12 persons. There is an appeal to the Reichsgericht against the judgment of a court sitting with a jury, but only on the ground of faulty procedure.

The Reichsgericht at Leipzig, in addition to being the court of revision in civil and criminal matters, is also competent, as a court of first and final instance, for the trial of cases of high treason, ordinary treason and military crimes. In order to obviate the extradition of the Germans accused of war crimes (as provided for in Art. 228 *seq.* of the Treaty of Versailles), the Reichsgericht was declared by a Law of Dec. 18 1919 to be competent for the trial of war crimes and offences.

Amtsgerichte, Landgerichte, Oberlandesgerichte and the Reichsgericht are designated as regular (*Ordentliche*) courts. There are, in addition, special courts (*Sondergerichte*); for example, industrial and commercial courts for disputes between employers and employed. In these there is a permanent president with assessors consisting of employers and employed in equal numbers. There are courts dealing with profiteering (Ordinance of Nov. 27 1919). There is further the *Reichswirtschaftgericht* (Ordinance of May 11 1920), or economic court of the Reich for dealing with certain kinds of disputes arising out of the war and the conclusion of peace. Other special courts are the extraordinary tribunals with expedited procedure, such as those which the President of the Reich, acting by virtue of emergency powers conferred on him in Art. 48 of the constitution, set up to deal with cases arising out of the communist disorders. These courts are presided over by 3 professional judges; there is no appeal.

Legislation for Carrying Out the Treaty of Versailles.—The Peace of Versailles was signed on June 28 1919, and accepted by the Reichstag by the Law of July 16 1919. According to the concluding article of the Treaty it was to come into force so soon as Germany and the three leading Powers had ratified it, and a "First Protocol" regarding the deposition of the Acts of Ratification had been drawn up. This was done on Jan. 10 1920. That day is, therefore, to be regarded as the day of the conclusion of peace for Germany in her relations with those States which had at once signed this protocol.

Germany had previously promulgated two laws of Aug. 31 1919; a law for the execution of the Treaty of Peace, and an Expropriation Law for the purposes of the Peace Treaty. According to the former, the settlement of claims and debts arising from transactions entered upon before the war between Germans and enemy nationals could as a rule be effected only by means of official investigation and through clearing offices (Treaty of Peace, Art. 72, 296); but where an enemy Power had not, according to Art. 296*e*, given notice to Germany, within a month's time after its ratification of the Treaty, of its intention to adopt the clearing-office system, direct negotiations were permitted. On April 24 1920 a statute was formed setting up a central clearing office of the Reich in Berlin, with 15 branch offices in the more important towns.

Up to May 1 1920 the following States had declared their participation in the clearing-house system: Great Britain, France, Italy, Belgium, Siam, Haiti. The following States had so far decided for direct negotiations: Brazil, Japan, Bolivia, Guatemala, Peru, Poland, Czechoslovakia, Uruguay, the British Union of South Africa and the British Protectorate of Egypt, Yugoslavia, Cuba, Portugal, Liberia, Rumania, Honduras, Nicaragua, Panama.

The law for executing the Treaty further authorized the Government of the Reich to requisition, subject to compensation, the service of agricultural, forest, industrial and mercantile enterprises, for the purpose of fulfilling the obligations arising out of the Treaty.

The Expropriation Law of Aug. 31 1919 empowered the Reich to confiscate and expropriate provisionally by summary order without legal procedure objects which were to be transferred to the Entente.

For the execution of the Peace Treaty a special commissariat of the Reich for works of reconstruction was instituted in the Ministry for Reconstruction, and also a commission for restoring machines and material to the enemy. According to the Law of the Reich of May 3 1920 information must be given to the authorities regarding all property rights and interests of German nationals in the territories of the Entente States.

Compensation for services and supplies to the enemy forces in occupied regions was provided for by the Law of March 2 1920.

Military and Naval System.—By the new constitution of the Reich, and under pressure of the Treaty of Peace, the military system of the German Reich was completely transformed. According to Art. 173 of the Treaty of Versailles universal service was abolished in Germany, and the German army might be recruited and vacancies filled solely by voluntary enlistment. According to Art. 160 and 183 of the Treaty, the whole peace strength of the German army might not exceed 100,000 men, while that of the naval forces was limited to 15,000 men—in both cases including officers. In execution of these provisions the Law "for the abolition of universal service and for the regulation of the obligation to serve for a long period" was promulgated on Aug. 21 1920. A provisional *Reichswehr* (army of the Reich and navy of the Reich) had at first been created by the laws of March 6 and April 16 1919; the Reichswehr Law of March 23 1921 was issued, and according to this law the armed force of the German Republic is the Reichswehr.

Those who enter the army or navy as soldiers or sailors undertake the obligation of serving for 12 years. After that period, unless three months' notice to leave is given, the contract is prolonged for an additional year. During the period of service either party may dissolve the contract on special grounds. Every member of the army or navy can be promoted to the highest posts in accordance with capacities and services.

The career of an officer is intended to be for life. A candidate, before he is appointed to the position, has to contract a written obligation to serve uninterruptedly for 25 years. This contract, however, like that of the men, can be annulled on special grounds before it expires. The electoral rights of officers and men as citizens remain in abeyance during their period of service (Electoral Law of the Reich of May 27 1920, §2).

Provision is made by law for soldiers who have left the service and for the surviving dependents of soldiers and sailors. Provision for those officers of the former German army and those non-commissioned officers under contract to serve for a long period (*Kapitulanten*), who were not taken over into the new army of the Reich, was made by the Officers' Compensation Law and the Non-commissioned Officers' (under contract) Law, both promulgated on Sept. 13 1919. Officers of the different reserves, the men, and the military officials (*i.e.* those belonging to the Reserve, the *Landwehr* and the *Landsturm*) were released from all military obligation by an ordinance of the President of the Reich and the Reichswehr Ministry dated Jan. 21 1920. The settlement of the amount of pension or provision to which they might be able to lay claim was reserved.

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[1] In the monarchical states the heading was "In the name of the King" or of the Grand Duke, Duke or other Sovereign.

In accordance with the new constitution of the Reich (Art. 105) the former Military Courts of Honour were abolished, as was the whole system of military jurisdiction, apart from penal proceedings in time of war and on warships in commission. Apart from these courts-martial on land in time of war and in general on sea, criminal cases against members of the army and navy can be tried by the civil courts.

A law of the Reich of May 12 1920 deals with provision for former members of the German forces on land and sea, and with surviving dependents of such in cases where injury or death was incurred in the service. This law applies to claims for pensions or payments arising out of the war. The provision which is made, apart from medical treatment and social aid by means of gratuitous training in a trade or occupation, usually consists in a pension (*Rente*), the amount of which is regulated in accordance with the disability of the recipient to pursue his calling, and in accordance with the nature of his occupation, the numbers of his family and the place of his residence. The pension for surviving dependents in case of the death of a member of the army or navy in consequence of injuries received on service takes the form of a pension for widows, orphans and parents. Persons who are entitled to receive support may obtain instead of a pension a capital sum for the purchase of land, or for the economic amelioration of land which is their property.

In execution of Art. 173 *seq.* of the Treaty of Versailles the disarmament of the German population was undertaken in accordance with the Disarmament Law of Aug. 7 1920,[1] under the direction of a commissary of the Reich with an advisory council of 15 members chosen by the Reichstag. By the Law of the Reich for executing Art. 177 and 178 of the Peace Treaty participation in unauthorized military associations was made punishable by a fine not exceeding 50,000 marks, or by incarceration in a fortress or imprisonment for a period not exceeding 3 months.

According to Art. 228 of the Treaty of Peace the Powers of the Entente were entitled to bring before their military courts Germans who were accused of offences against the law and customs of war, and the German Government had undertaken to extradite all Germans demanded by the Entente and described as war criminals—an undertaking which was contrary to an express prohibition in the German penal code. The Entente ultimately intimated its assent to the arrangement that the German nationals whom it accused of these offences should be tried by German courts.

For the purpose of carrying out this arrangement a special law was promulgated on Dec. 18 1919 (amended March 24 1920 and May 12 1921). This law declared the Reichsgericht at Leipzig to be competent for trying and judging, as a court of sole instance, cases of crimes or offences against enemy nationals or enemy property committed by Germans at home or abroad up to June 28 1919, and punishable according to the law of the place where they were committed. Amnesties, proscription by lapse of time or the pronouncement of judgment at a previous trial formed, according to these laws, no bar to a new prosecution. Proceedings were to be instituted by the *Oberreichsanwalt* (chief public prosecutor) before the Supreme Court of the Reich; but even when that court found no ground for an indictment, the public prosecutor could demand that the decision should be given in open court after pleadings as to whether the proceedings were to be stayed or continued.

Railways.—During the war the Reichstag proposed that preparations should be made for bringing all German railways of any importance into the possession of the Empire. The Governments of the separate states resisted this scheme; they endeavoured by mutual arrangements (the so-called Heidelberg programme) to remove the chief causes of complaint arising out of the coexistence of so many railway systems. When the constitution of the new republican Reich was under consideration the unification of the railway system was assumed to be the aim in view. Art. 89 of the constitution of Aug. 11 1919 enacts that "it is the business of the Reich to acquire possession of the railways which subserve general traffic and to administer them as a unified system of communications." According to Art. 171 the railways of the German states were to be transferred to the possession of the Reich by April 1 1921 at latest. This transfer was actually effected on April 1 1920. In accordance with the treaty of March 31 1920, between the Government of the Reich on the one part and the states which owned the state railways—Prussia, Bavaria, Saxony, Württemberg, Baden, Hesse, Mecklenburg-Schwerin, Oldenburg—on the other, the railways of the states which were parties to it passed as a whole, with everything connected with them and all rights and obligations involved, into the possession of the Reich. The Reich indemnifies each state in one of two ways according to the option of the particular state. It either hands over the amount of capital invested in the railways of the state calculated on March 31 1920, or it pays the amount calculated to be the average between that amount and the capital value computed on the basis of the returns for the financial years 1909–13. In addition, the states are compensated in all cases for deficits which arose between April 1 1914 and March 31 1920, during the war and the period of the revolution. The total indemnification will burden the Reich with some 40 milliard marks. The Reich thus took over (according to the situation on March 31 1919) the following kilometric extent of state railways including narrow-gauge lines: Prussia and Hesse, 40,312; Bavaria, 8,545; Saxony, 3,367; Württemberg, 2,153; Baden, 1,859; Mecklenburg-Schwerin, 1,095; Oldenburg, 673 km. The total number of persons employed on the German state railways in 1920 was 1,030,000, including some 365,000 officials.

The Treaty of Versailles inflicted a heavy blow upon the German railway system; according to Art. 67 the German state railways of Alsace-Lorraine passed into the possession of France without any payment, whereas when Germany took possession of Alsace-Lorraine under the Peace of Frankfort (1871) the then French railway lines in those provinces were paid for by the German Empire with a sum of 250,000,000 francs. According to Art. 40 of the Treaty, Germany had further to renounce all her rights with regard to the working of railways in Luxemburg (the Wilhelm-Luxemburg railway). According to Art. 256 the state railways in the ceded portions of German territory passed into the possession of the states which acquired these territories; these states have, however, to pay the value of the railways as ascertained by the Reparations Commissions.

The whole organization of the railway system is under the Ministry of Communications. Subject to that Ministry the rights hitherto exercised by the Prussian Ministry of Public Works, the Prusso-Hessian central office, and the railway central office in Berlin, as well as the Bavarian central office in Munich, were maintained. The authorities for regional administration are the regional railway officials of management (*Eisenbahndirektionen*), and, subject to them, for local administration the offices for traffic, construction, machines and workshops.

Postal, Telegraph and Telephone System.—The unification of the whole German postal system, and its transference to the Reich, was effected by the terms of the new constitution of the Reich of Aug. 11 1919. Art. 88 provides that the posts and telegraphs, together with the telephone system, are exclusively the concern of the Reich. According to Art. 170 the posts and telegraphs administrations of Bavaria and Württemberg were to pass to the Reich on April 1 1921 at latest. The transfer, however, took place on April 1 1920, in accordance with a law of the Reich and treaties which had been previously concluded. Bavaria received an indemnification of 620,000,000 marks and Württemberg 250,000,000 marks.

The secrecy of the posts, telegraphs and telephone is safeguarded by Art. 117 of the new constitution of the Reich. The German post-office, in addition to conveying letters and parcels, conducts business in the nature of banking, such as the issue of postal orders, the collection of the price of goods on delivery or by means of postal mandates, and all payments resulting from the national insurance schemes (excepting sick pay). The post-office also performs the functions of a public recording official. It procures acceptances of bills, serves process in civil and criminal cases, collects and protests bills and cheques in case of dishonour; but its functions respecting bills and cheques do not extend to sums above 1,000 marks. Certain franking privileges which had previously existed were abolished by a law of April 29 1920. Postal tariffs have in many respects been increased by a law of March 22 1921. The postal cheque system is based upon the Postal Cheque Law of March 22 1921 and the postal cheque regulations of April 7 1921. In 1918 there were 300,562 persons who used postal cheques to the amount of 1·2 milliard marks. The whole turnover of the post-office amounted to 151 milliard marks, of which 115·5 milliards were paid without the use of currency. The administration of the telegraphs and telephone is under the supreme control of the Ministry of Posts for the Reich, subject to whom are 45 higher post directories for district administration, and under the latter are post-offices of the first, second and third class, railway post-offices and postal agencies.

Waterways.—According to Art. 97 of the new constitution it is the business of the Reich to take over into its own possession and administration the waterways which subserve general traffic. The waterways and sea-marks were transferred to the Reich on April 1 1921 in accordance with Art. 171 of the constitution. The keenly debated scheme for a Prussian central canal for establishing a connexion by water between the Vistula, the Elbe, the Weser and the Rhine, has been extended by laws of Dec. 4 1920 and Jan. 14 1921, sanctioning further expenditure of 436,000,000 and 740,000,000 marks (Weser and Elbe canal). The administration of the waterways by the Reich is conducted through the section for waterways in the Ministry of Communications.

By Art. 331 of the Treaty of Versailles the sovereignty of the State over the five great rivers—the Rhine, the Elbe, the Oder, the Memel and the Danube—which flow through German territory, has been considerably restricted. They are "internationalized."

Air Traffic.—By an order of the Council of the Commissaries of the People of Nov. 26 1918, an air-traffic office of the Reich was instituted in connexion with the Ministry of the Interior until a law should be issued for the regulation of air traffic. An ordinance for the provisional regulation of air traffic was issued on April 30 1920;

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[1] Another law was passed in March 1921 for the disarmament and dissolution of forces like the Bavarian *Einwohnerwehr* and *Orgesch* (*Organisation Escherich*), the object of which was to organize various voluntary service formations throughout the country.

dirigible aircraft travelling outside the boundaries of an aircraft station without a licence for themselves and their pilots from the Office of the Reich for Air and Motor Craft may be declared confiscated by the Reich. (E. H.)

The Post-War Army

In the chaos which followed the signing of the Armistice of Nov. 11 1918, the 228 divisions which then constituted the German army as known during the World War (*see* Army) either demobilized themselves or placed their services at the disposal of the more popular officers. In this way, the German Government was able to raise troops to oppose the Poles and to put down the Spartacist rising in Jan. 1919. The forces raised at first consisted of the following two categories:—(i.) In the E., volunteer formations were raised for "*Grenzschutz Ost*" (frontier guard E.) in addition to the retention with the colours of the 4 youngest classes. (ii.) In the interior, the 1918 class and men of old army units who had no civil employment were combined into so-called *Sicherheitstruppen* formed from the old army units. In addition certain volunteer units of pronounced republican tendency were raised in Berlin.

The forces named under (ii.) proved so untrustworthy that the Government had to fall back on volunteer formations, which were raised during Jan. and Feb. 1919 by the personal exertions of well-known officers of the old army. These volunteer formations, differing largely in military value, organization, methods of pay and recruiting, could only be regarded as a stop-gap, and in March the *Reichswehrminister* Noske obtained the consent of the National Assembly to the formation of a provisional *Reichswehr*, with linked *Volkswehr* units to be raised from the existing volunteer formations in the interior. The scheme for this new provisional army was promulgated in army orders of April 4, and was put into execution throughout the interior of Germany during April and May. The original scheme provided for 6 brigades on the higher and 12 on the lower establishment, giving a total of 177,000 men of the Reichswehr and linked Volkswehr in the interior; the main body of this force was organized from the volunteer formations stationed around Berlin under Gen. von Lüttwitz and formed the Lüttwitz Group.

The Sicherheitstruppen in the interior were disbanded or absorbed into the Reichswehr, and the remaining men of the younger classes were demobilized. Pay and organization of the various volunteer units and formations were regularized; gradually the scattered volunteer units and formations were transformed into Reichswehr brigades, and the former system of independent recruiting by units or commanders was transferred to the territorial army-corps districts.

The troops of Grenzschutz Ost, who were commanded by Hindenburg, were at first not affected by this new reorganization, but from mid-May 1919 the volunteer formations in Grenzschutz Ost were gradually absorbed into the Reichswehr. All men of the younger classes retained compulsorily in Grenzschutz Ost were discharged by July 31 1919. By Sept. 1919 the German Reichswehr consisted of 43 mixed Reichswehr brigades. In addition, there were still some volunteer formations in the eastern provinces. The total strength was then about 320,000 men. After the ratification of the Peace Treaty on Jan. 10 1920, the period allowed for the reduction of the Reichswehr to 200,000 men was 3 months. Up to the time of the Spa Conference (June 21 1920), however, the German army still considerably exceeded this figure. By the terms of the agreement at Spa, Germany was obliged to reduce the Reichswehr to 150,000 men by Oct. 1 1920 and to 100,000 men by Jan. 1 1921.

Although the German forces were reduced to the figures laid down in the Peace Treaty, with a few minor exceptions, by Jan. 1 1921, it was not until March 23 1921 that the law known as "*Wehrgesetz*" was promulgated by the Federal President, abolishing universal military service in Germany and definitely fixing the establishment of the new German army. By the terms of the new German Military Law the defence force (*Wehrmacht*) of the German Republic is the Reichswehr. It consists of the *Reichsheer* and the *Reichsmarine*, which are composed of, and recruited from, volunteer soldiers and non-combatant military *Beamten* (officials).

The army (Reichsheer) consists of 100,000 men, including 4,000 officers and military officials of officer's rank. In addition to these there are 300 medical and 200 veterinary officers. The Federal President is the commander-in-chief of the Reichsheer. The administration of the Reichsheer is exercised by the parliamentary *Reichswehrminister*, assisted by the Reichswehr Ministry. The total number of officers employed in the Reichswehr Ministry in accordance with the Treaty of Versailles must not exceed 300. Under the Reichswehrminister the executive military command is exercised by a general, who is chief of the army command (*Chef der Heeresleitung*), a title for which there is no British equivalent,[1] and the military administration is carried out by the chief of the army command, corresponding practically to the quartermaster-general of the British army system. The quartermaster-general ranks as Under-Secretary of State. The executive military command is carried out through two *Gruppen Kommandos* (Command Staffs) who are directly responsible to the chief of the army command. The administrative services of the divisions, however, are under the control of the Q.M.G. Each State of the German Federation may choose a *Landeskommandant* from amongst the commanders available in the State. The Landeskommandant is then confirmed in his position by the Federal President and is directly under the Reichswehrminister. The principal mission of the Landeskommandant is liaison between the Federal States and the Reichswehr Ministry. The German Reich is subdivided into 7 divisional districts. Each divisional district comprises 2 or more of the former army-corps districts. Each infantry division is commanded by a general officer, assisted by the commander of the infantry (*Inf. Führer*) and by the commander of the artillery (*Art. Führer*) and their staffs.

The composition of each infantry division is as follows:—headquarters; infantry H.Q. and 3 regiments of infantry; artillery H.Q. and one regiment of artillery; and, as divisional troops, one squadron of cavalry, one battalion of pioneers, one signal detachment (2 companies), one mechanical transport detachment (3 companies), one horse-transport detachment (4 companies), and one medical.

There are 3 infantry regiments in each division. Infantry regiments are numbered from 1 to 21, and are each composed of 3 battalions, one trench-mortar company, one depot battalion. The battalion has 3 infantry companies and one machine-gun company.

There is one artillery regiment in each division. Artillery regiments are numbered from 1 to 7, and consist each of 3 groups (of 3 batteries each). The pioneer battalion is composed of 2 pioneer companies, one pontoon detachment and one searchlight section.

Each cavalry division is commanded by a general officer, assisted by a divisional staff; the composition of the cavalry division is 6 cavalry regiments and one horse-artillery group (3 batteries). The cavalry regiment consists of 4 squadrons and one depot squadron. Cavalry regiments are numbered 1 to 18.

The divisional troops in each branch are numbered from 1 to 7 according to the division to which they belong.

Armaments and Equipment.—According to the conditions of the Treaty of Versailles and subsequent decisions by the Commission of Control in Berlin, the following scale of arms was authorized for the Reichsheer: Rifles (1898 pattern), 156,080; carbines, 18,000; short pistols, 50,000; machine-guns (light), 1,418; machine-guns (heavy), 828; field guns, 7·7-cm., 204; light field howitzers, 10·5-cm., 84. An arsenal reserve of 4% on the above figures was allowed by the Peace Treaty.

Military Schools.—According to the Treaty of Versailles the Reichsheer is allowed to maintain one military school per arm. These schools were in 1921 located as follows:—Infantry, Munich; Cavalry, Hanover; Artillery, Jüterbog; Pioneers, Munich; Farriers, Hanover. Physical training and sports receive special attention and encouragement in the Reichsheer.

The uniform of the Reichsheer is the standard field-grey uniform. The tunic is universal; breeches are worn by the infantry with ankle boots and puttees, and by mounted troops with knee boots. The head-dress is, for field service, a steel helmet or a grey field-service cap with cloth cockade and soft peak; otherwise a stiff service cap with cockade of the Reich surrounded by a wreath of oak leaves, above which is placed a cockade of the state to which the unit belongs. (The helmet and shako of the imperial army have been abolished.) The colour of the piping on the collar of the tunic and on the cap and the colour of the piping and of the numerals on the shoulder strap denote the arm to which the individual belongs:—infantry, white; cavalry, yellow; artillery, red; pioneers, black; signal troops, brown; trains, light blue. The former badges of rank of the imperial army, worn on the shoulder straps, have been restored to the officers of the Reichsheer, but the latter are now of dull and silver lace for junior officers, of intertwined gold and silver for field officers, and of gold lace for general officers. (X.)

The Navy

The German navy law of 1900 proposed that the navy should consist of:—(1) the battle fleet, composed of 2 fleet flagships, 4 squadrons of 8 battleships each, 5 armoured cruisers, 24 light cruisers; (2) ships for foreign waters, comprising 3 armoured cruisers, 10 light cruisers; (3) and, as reserve ships, 4 battleships, 3 armoured cruisers, 4 light cruisers. Torpedo-boats and vessels for special purposes were to be added to the establishment year by year as necessity should arise. The Reichstag passed the law, except for the omission of the ships for foreign waters. During the succeeding years, in compliance with this programme, new ships were constructed, obsolete types replaced, dockyards, harbours and coast defences built, the Kiel canal widened and deepened, the personnel increased, the organization of the higher commands extended, etc. The Navy Law was afterwards supplemented as regards particular points, to meet the requirements of new developments. In 1906 the 6 armoured cruisers which had been cut out were reinstated, and, following the example of England, battleships and armoured cruisers were transformed into dreadnoughts and battle cruisers; the number of torpedo-boats was also increased. The North Sea naval bases—Wilhelmshaven, Heligoland, Cuxhaven—were strongly fortified, and submarine construction was energetically carried out. In 1912 a fifth squadron was established, the number of battleships raised by 3 to 41, the reserve ships being incorporated and the maintenance of a reserve abandoned; the number of light cruisers was raised from 38 to 40.

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[1] The term "general staff," under the conditions of the Peace Treaty, is abolished. Practically, the chief of the army command exercises the functions of the former chief of the general staff.

The naval budget increased from £21,700,000 in 1910 to £28,800,000 in 1914; and during these years the personnel of the navy increased from 57,070 to 79,070.

In the article Ship and Shipbuilding an account is given of the new warships built for Germany in these years. (*See also* Naval History of the War.) At the outbreak of the World War the fleet included 15 first-class battleships, 5 first-class battle cruisers, 22 older battleships, 7 older armoured cruisers, 29 light cruisers, 100 torpedo-boats, 14 mine-layers, 106 mine-sweepers, 27 submarines, 3 naval airships, 6 seaplanes and 6 aeroplanes. By Nov. 1918 it included 19 first-class battleships, 6 first-class battle cruisers, 5 older battleships, 2 older armoured cruisers, 18 light cruisers, 188 torpedo-boats, 6 mine-layers, 394 mine-sweepers, 3 seaplane-carriers, 206 submarines, 9 airships, 879 seaplanes, and 360 aeroplanes.

The losses during the war comprised one battle cruiser ("Lützow"), one older battleship ("Pommern"), 6 older large cruisers ("Scharnhorst," "Gneisenau," "Blücher," "Prinz Adalbert," "Yorck," "Friedrich Karl"), 18 light cruisers ("Magdeburg," "Ariadne," "Mainz," "Köln," "Hela," "Königsberg," "Emden," "Leipzig," "Nürnberg," "Dresden," "Undine," "Bremen," "Wiesbaden," "Elbing," "Rostock," "Frauenlob," "Breslau," "Karlsruhe"), 98 torpedo-boats, 3 mine-layers, 71 mine-sweepers, 55 airships, 194 submarines, and 128 other vessels.

After the War.—Under the revolution the inner organization of the navy was severely strained but not destroyed. Order was gradually restored. The authority vested in heads of staff and administration was revived as the Government grew stronger and the liquidation of the war could be begun. The surrender of the ships composing the High Seas Fleet took place on Nov. 21 1918. In the interest of historical truth it must be recorded that the German crews, who had received the news of the surrender with shouts of joy, proceeded with the ships to the Firth of Forth in the firm belief that it was a question only of a temporary internment and not of the complete surrender of the fleet. The German officers acted from a strict sense of duty and under the same conviction. It is only fair to say that it was when it became known to them that in this expectation they had been deceived, that the officers and crews sank their ships in Scapa Flow on June 21 1919.

Side by side with the fulfilment of the Peace Treaty went the reëstablishment of discipline. In particular the 2 naval brigades, formed from volunteers, and a few cruisers and torpedo-boats set an example of military obedience and loyalty to duty. From the example set by them grew the restoration of the *moral* and organization of the navy, which was seriously but transiently disturbed once more by the Kapp "Putsch" on March 13 1920.

In 1921 the navy was organized as follows: The control of the navy was, like the control of the army, incorporated in the Ministry of the Defence of the Reich (*Reichswehrministerium*) in Berlin and was subordinated to the political minister at the head of that department. It includes the functions of the former Admiralty staff, Naval Cabinet and Admiralty, and therefore embraces the command and the administrative authorities. Subject to the head of the control of the navy are:—the Navy Command Department (including the defence department, for organization, training, and welfare, and the fleet department, for military dispositions, developments in fighting material, strategic and tactical questions); the General Navy Department (including the dockyards section, construction department, armament section, nautical section, and water transport section); and the Navy Administrative Office (naval stores, accounts, pay). In addition there are the central department, the financial department, and the medical department; and further, for both army and navy, the legal department and the intelligence department.

The naval forces were:—Baltic Station: the battleships "Hanover," "Hessen," and "Schleswig-Holstein"; the cruisers "Medusa," "Thetis," and "Berlin." North Sea Station: the battleships "Braunschweig," "Elsass," and "Schlesien"; the cruisers "Hamburg," "Arcona," and "Amazone"; together with two flotillas of torpedo-boats (each of 6 larger and 6 smaller boats), and 4 gun-boats ("Drache," "Hai," "Fuchs," "Delphin"). Also there were several mine-sweeping flotillas. It was intended to replace obsolete ships, and a vote for the construction of a new cruiser was passed in 1920–1. The naval dockyard in Kiel had been made over to a private company, the navy retaining only the smaller portion of it as an arsenal. The Wilhelmshaven dockyard was greatly diminished in extent. In that part which was given up there is now a fishing harbour. The shipbuilding yards are used for merchant vessels and steam trawlers.

In accordance with the peace terms the naval personnel numbers 15,000, of whom 1,500 are officers. Compulsory service is abolished. Every volunteer agrees to serve 12 years, and every officer to serve 25 years, or until the age of 45.

The legal basis of the navy is embodied in the Law of April 16 1919 and the National Defence Law of March 19 1921. To these must be added the Pay Law and the Pensions Law. The estimates are fixed annually; for 1921 they were for 652,000,000 marks.

Reform of the School System

Under the Empire, education had been regulated by the separate states and was left outside the imperial jurisdiction. But the new republican constitution of the Reich laid down in its section on first principles those which should regulate education in the different territories. A positive step was thus taken in the direction of the movement first started about 1848, and supported by German educationists, particularly at the teachers' conference at Dortmund in 1908, by the Social Democrats at their party congress at Mannheim in 1906, and in the debates of the Reichstag from 1912 to 1914, for introducing imperial legislation based on one universal and secular school system. An Imperial Schools Commission or Board had been in existence since 1871, but its functions were of a very limited character.

During the discussions of the committee for drafting the new constitution it was especially the Social Democrats, the Independents and the Democrats, but also the Catholic Centre party and the *Volkspartei* (formerly the National Liberals), who worked for a new organization of the schools system directly under the Reich. The movement encountered various hindrances: the signing of the treaty; the withdrawal of the Democrats from the Government; the first educational compromise between the Catholic Centre and the Social Democrats which gave local option to individual parishes to choose between denominational, bidenominational, and secular schools; and the final educational compromise of July 31 1919, whereby bidenominational (Catholic and Protestant) schools became the norm, purely denominational and secular schools being, however, expressly recognized by law as exceptions to the rule. But in spite of these hindrances a number of principles were accepted and laid down in section 4 (Arts. 142-50) of the constitution which came into force on Aug. 11 1919. These principles were that educational institutions should be public, that teachers should be uniformly trained, that there should be State inspection, and that there should be a standard type of school, the concessions for private schools being limited, while private schools for preparing pupils for the national schools should be abolished. It was also laid down that there should be instruction in citizenship, handicrafts and religion.

The application of these constitutional principles took place not through any grand general law of the Reich but by means of measures of a transitional character or measures dealing with parts of the subject, but all based upon the main plan. The first step was the law of the Reich dated April 28 1920, dealing with elementary schools and abolishing preparatory schools (Art. 146, 1). The elementary school, which is compulsory for everyone, covers the first four years' work of the preparatory school (*Vorschule*). The date for the final abolition of public preparatory schools was fixed for the financial year 1924–5, that of private preparatory schools for the year 1929–30. The Ministry of the Interior explained that the passing of this measure before the expert opinion of the National Teachers' Conference had been heard was due to the pressing necessity for settling the question of the elementary schools with all speed. It was only in March 1921 that the Prussian Ministry of Education could issue instructions for the carrying-out of the law, and for the curriculum of the elementary schools in Prussia.

Further, in order to give effect to the educational compromise, a bill for carrying out Art. 146, 2, of the constitution was laid before the Reichstag. It sets up as the standard type a more comprehensive school than the bidenominational type (*Simultanschule*) hitherto recognized as the standard. It recognizes Protestant and Catholic schools, purely secular schools, and also schools based on some particular philosophic conception or doctrine (*Weltanschauungsschule*), such as positivism, in order to give every class of opinion its rights. There was sharp contention about the definition of this comprehensive standard school (*Gemeinschaftsschule*). The non-Socialist Democrats regarded it as a further development of the existing bidenominational school; the parties of the Right and the Catholic Centre as the continuation of the older bidenominational schools, which were on a Christian basis, and of former denominational schools; the Socialist parties of the Left conceived it as a frankly secular school.

Beyond the scope of these school laws is the law on the Religious Education of Children (July 4 1921), regulating the religious education of children of mixed marriages. It was voted unanimously. Finally, a bill was introduced to deal with special aspects of the welfare of the young and in particular with the education of abnormal children, of those who are subject to prejudicial moral surroundings, and of orphans, etc. Radical changes in the relations between parents and the school were effected by the Prussian ordinance of Nov. 5 1919 on the formation of Parents' Advisory Councils in connexion with schools.

(F. B.*)

SOCIAL AND INDUSTRIAL LEGISLATION

I. *The Pre-War Period, 1911 to 1914.*—Workmen's insurance against sickness, old age and invalidity, which had been introduced by Prince Bismarck in the years 1884–9, and had been extended by repeated amendment laws, underwent, after lengthy preparation and debate, a reform which was finally completed in the system of insurance for the Reich of July 19 1911. Fundamentally the law remained the same, but the ranks of the insured were extended. The interrelation between the different forms of insurance and their administrations were more clearly defined, and in addition provision was made for the widows and orphans of insured persons. Miners were not included, as they retained their old insurance system under the mutual system of the *Knappschaft* (Miners' Association).

The law of Dec. 20 1911 introduced special insurance for salaried employees in commerce, industry and shipping; for persons employed in theatres and orchestras; for teachers, tutors and governesses; it gave medical treatment and an allowance during invalidity and also to all insured persons over 65 years of age. The means were supplied by contributions from employers and employed, without subvention from the State. The free mutual-aid societies, which existed side by side with the legalized State insurance system, were placed under the control of the State department which supervised private insurance.

As regards the protection of workers, one of the darker sides of the economic life of the people was touched by an attempt to regulate home industries by the law of Dec. 20 1911, which came into force on April 1 1912. It included registration of workers employed in home crafts, the introduction of wages books, public exhibition of wages tables, regulations for the protection of children and young persons, prophylactic hygienic measures, and the establishment of committees with equal representation of employers and employed for the regulation of conditions of work, but without the right to fix a legally binding minimum wage.

A limitation and modification of the law, prohibiting assistants from taking employment in works of a similar character to those which they left, was brought about by the Act of July 10 1914. The duration of this "prohibition of unfair competition," as the law was called, was limited to 2 years, an important matter for minors and for assistants receiving low salaries. During the period of the prohibition the employer had to pay compensation for unemployment.

In contrast to these advances in social insurance and the protection of workers, the legal rights of labour were not only neglected during these years but actually diminished. This was not the result of actual legislation, but was brought about through the administration of justice and by the police. The trade unions, contrary to the Associations Law of 1908, were treated as political unions, and this greatly hampered their activity. The cry for the limitation of the right of combination (the prohibition of picketing and protection of blacklegs) grew steadily louder. A legal regulation of the wages contracts and the methods of settling disputes was expressly rejected by the Government. A halt was called in the whole course of social political legislation. Slackness in matters of social policy was succeeded by frank reaction. The outbreak of the World War at once created a new atmosphere affecting opinion and practice rather than legislative activity.

II. *The War Period, 1914 to Nov. 1918.*—The necessities of war-time, which demanded that substitutes should be found for the workingmen who were called to the colours, entailed a temporary suspension (Aug. 4 1914) of the regulations for the protection of women and young workers (10-hour day, night rest, prohibition of unsuitable employment); but official warnings to be careful in these matters were repeatedly issued (Dec. 11 1916 and Aug. 11 1917). The prohibition of night work in bakeries (Jan. 15 1915) and of the use of white lead for painting (Oct. 25 1915), as well as ordinances concerning 7-o'clock closing for shops and the raising of the amount of wages exempted from sequestration for debt (Dec. 13 1917), also remained in force throughout the period of the war. The policy adopted in regard to wages by the military authorities was of especial importance in that it insisted on sufficient payment for army contracts carried out by home industries, and in some districts even made a minimum wage legally obligatory.

In order to maintain workers' insurance during the war, the Federal Council decreed by an ordinance of Aug. 4 1914 that the necessary measures should be taken for this purpose especially in regard to the sickness-fund organization. In the course of the next few years several reforms of lasting value were carried out:—Maternity benefit (*Wochenhilfe*) was provided (Dec. 3 1914), giving monetary aid during and after childbirth, and while the child was being nursed by the mother; the age at which an old-age pension became payable was lowered from 70 to 65 (1916); illnesses commonly contracted in particular industries were included in the accidents insurance scheme (Oct. 12 1917); repeated increases were made in the benefits from sickness and disablement insurance and insurance in the interests of survivors, and the wages at which insurance became compulsory were scaled up.

The labour exchanges were made more uniform, and surveys of the whole labour market were published at short intervals, vacancies being grouped locally; but in spite of petitions from trade unions and resolutions of the Reichstag (1915) there was no thoroughgoing legislative systematization in the matter of unemployment.

In Feb. 1918 the Government laid a bill before the Reichstag, concerning the establishment of Labour Chambers (*Arbeitskämmern*) in which employers and employed were to be associated on the basis of different trades for joint discussion of their affairs, but owing to sharp differences of opinion it was not passed.

On the other hand, the trade unions at last had their rights acknowledged. They were no longer persecuted by the police and the administration of justice on the plea that they were "political"; the authorities recognized their assistance in public work as indispensable, and the consequences of this acknowledgment found expression in legislation. The Associations Law was altered (Aug. 1916) in so far as trade unions were expressly exempted from the restrictions imposed upon political unions, and the prohibition of the use of foreign languages in meetings was abolished (April 1917). The law of May 22 1918 suspended Art. 153 of the body of regulations affecting industrial occupations (*Gewerbeordnung*), which had for 50 years placed under special and vindictive legal provisions workers who had been guilty of offences during strikes and lockouts.

The most important act of social legislation during the war was the law concerning war-work (*Vaterländischer Hilfsdienst*) of Dec. 6 1916. It obliged every male between the ages of 17 and 60—who was not serving in the army—to work at war industries, at agriculture, in hospitals or in the work of securing food supplies for the nation. In order to settle disputes arising from this compulsory labour—as, for instance, whether an industry fell under the head of war-work, whether the worker was capable of complying with the regulations, or whether he might change his place of work—conciliation boards were established, composed half of employers and half of employees, under official guidance. They had the right of giving arbitral decisions. With the object also of cultivating good relations between employers, workers and salaried employees, workers' boards were compulsorily established in the various industries. The execution of the law rested with the Minister of War, with whom a committee of the Reichstag was associated for this purpose. The last act of social legislation during the war was the establishment of a Ministry of Labour for the Empire, with a leading trade unionist as Minister (Oct. 4 1918). This dealt with matters of social policy which had previously appertained to the Department of the Secretary of State for the Interior, or the Department of National Economy.

III. *After the Revolution.*—After the Armistice supreme authority passed into the hands of the Commissaries of the People. One of their first edicts (Nov. 12 1918) contained important acts of industrial legislation; the right of forming associations and holding meetings was freed from all restriction; the law concerning war-work was suspended, except that the conciliation boards remained; the regulations concerning domestic servants were repealed, as were also the special laws which bore hardly upon agricultural labourers. The provisions for the protection of workers, which had been suspended at the outbreak of the war, were again put into force. Apart from these ordinances, which had the effect of laws, it was announced that the 8-hour day for workers would come into force by Jan. 1 1919, at the latest.

On Nov. 18 1918, the Commissaries of the People, by official decree, gave the status of law to an agreement which had been concluded by the great employers' unions and the trade unions. This agreement covered the following points:—Recognition of the trade unions as the elected representatives of the workers; free right of association; no support to "yellow" unions; reëmployment of ex-service workers; supply of raw materials and placing of orders; equal distribution of work; regulation of terms of labour by collective agreements (wages contracts); establishment of workers' boards, conciliation boards and boards of arbitration; introduction of an 8-hour day; and the establishment of a central committee to carry out these measures.

On this basis the ordinance for the regulation of hours of work for industrial workers (Nov. 23 1918) was framed, which fixed the length of the working day in all industrial concerns. The same was done for the transport services by the ordinances for railways and the post (Nov. 24 1918), and for salaried employees (March 18 1919), as well as for bakeries (Nov. 23 1918), in the case of which night-work between the hours of 10 P.M. and 6 A.M. was forbidden. Finally a provisional ordinance of Jan. 24 1919 fixed the hours of work for agricultural labourers at 8, 10 and 11 hours during 3 periods of 4 months respectively, overtime being permissible. In April 1919 the miners in the Ruhr district were granted a 7-hour day, including the time spent in descent and ascent. The hours of Sunday rest in commercial establishments, shops and offices were extended (Feb. 5 1919). All these regulations, as was expressly stated, were only intended as provisional measures, especially for the period of demobilization.

Demobilization in its social, political and economic aspects, and the regulation of the labour market, demanded a special organization, in view of the vastness of the task of finding work for the millions who were returning from the fronts, and the change from the economics of war to those of peace-time. As early as Nov. 12 1918 a Government office for demobilization was established. Among its numerous ordinances and measures the following were of particular importance for the legal rights of labour: Regulation for the engagement and dismissal of workers and salaried employees (Feb. 12 1920); for making places free for workers (April 25 1920); for remedying the scarcity of labour in agriculture (March 16 1919); for the enforced employment of seriously injured ex-service men (April 4 1920); for the stricter regulation of distribution of work (Dec. 9 1918); for the carrying-out of measures of relief for the unemployed, partly by means of monetary support, partly by finding work through the collective efforts of the Reich, the state and the commune. The Government office for demobilization was abolished on April 26 1919. Its duties were taken up by the respective ministries of the Reich; and the demobilization commissioners and committees were, for the most part, abolished in April 1921.

The legal position of labour underwent an important development in three directions during the period of transition, by means of the ordinance of Dec. 23 1919, which was subsequently endowed with the force of law. The wages contract was declared to be universally binding. All concerns with 50 or more employees must institute workers' committees for the safeguarding of workers' rights. The war-time conciliation boards were regularized and firmly established. The committees for the different occupations, which had been contemplated in the Home Employments Law of 1911, but had not yet been put in force, were called into being on Jan. 13 1919 and given extended powers. In the beginning of May 1919 an expert committee was formed in the Ministry of Labour in order to frame a uniform system of labour law. The decisive turn in labour legislation, however, was taken by the Factory Councils Law (*Betriebsrätegesetz*) of Feb. 4 1920, which entrusted the representatives of the employees, who now replaced the former workers' committees, with the task of upholding the common economic interests of workers and salaried employees in their relations with the employers. This law is described fully in the separate section below.

IV. *International Labour Laws.*—Germany, which for 30 years had striven both officially and by the efforts of independent organizations after an international coördination of legislation in the matters of social policy, declared in the constitution of the Reich of Aug. 11 1919:—

> "The Reich advocates a regulation by agreement between different states of the legal position of workers, so as to win, for working classes of mankind, a universal minimum of social rights."

Without being a member of the League of Nations, Germany was admitted to the International Labour Organization by decision of the General Conference of Washington (Oct. 31 1919); she had two seats in the Administrative Council of the International Labour Office, and took part in the annual conferences.

The main principles for the development of German labour legislation are laid down in the constitution of the Reich. The economic life of the nation must be ordered in accordance with social justice and must aim at securing for all an existence worthy of human beings. Within these limits the economic liberty of the individual is to be assured (Art. 151). Labour is under the special protection of the State; the Reich will frame a uniform body of labour laws (Art. 157). The right of association for the purpose of guarding and improving the economic and industrial conditions of work is guaranteed to everyone and to all occupations. All agreements and measures which aim at restricting or diminishing these liberties are illegal (Art. 159). For the maintenance of health and ability to work, for the protection of motherhood and for securing provision for the economic consequences of old age, ill-health and the accidents of life, the Reich has created a comprehensive system of insurance, in which the insured persons play a decisive part (Art. 161). Without any infringement of his personal liberty, it is the moral duty of every German to employ his intellectual and physical powers in such a manner as is demanded by the welfare of the whole community. Every German shall be given the opportunity of earning his living by economically productive work (Art. 163). Workers and salaried employees have the right to coöperate on equal terms with the employers in regulating the conditions of wages and work, as well as in the entire economic development of the means of production. The organizations of both parties and the agreements effected by them are recognized (Art. 161, 1).

Besides the industrial councils, an Economic Council of the Reich was established in June 1920 as an advisory body; regional economic councils were in preparation in 1921, and a thoroughgoing reform of the whole system of social insurance was being undertaken. A Government Labour Exchange Department for the Reich supervises and regulates the labour market. The *Reichsarbeitsblatt* (Labour Gazette of the Reich) reports all that goes on in connexion with labour legislation. (E. F.*).

THE FACTORY COUNCILS LAW

The idea of securing representation for workers in the conduct of the establishments in which they work is not new. It was bound to arise from the special character of modern great industrial enterprises, in which the majority of the employees have a common interest in their position as regards their employer. The idea of such representation was confronted by obstacles such as a claim of the employer to authority and his determination to be "master in his own house," and, on the other hand, the legal conception that contract alone determined the relations between the two parties, so that the employer had only to do with the individual employee. The instances in which the employer voluntarily recognized the right of his workers as a body were rare; exceptions, such as were made by philanthropic employers like Abbe and Freese,—the former at the well-known Karl Zeiss works at Jena,—were very rarely imitated. There were extremely few cases before the World War in which a collective wages tariff was set up. It is true that wages-tariff contracts had succeeded in finding a foothold in workshops (*Handwerksbetriebe*) and industrial establishments of medium size, and that the extension of the principle of collective-wages contracts was being vigorously advocated among the working classes. The great German employers of industry, however, declined to have any dealing with the workmen's organizations. It was for this reason that the method of wages-tariff contracts was comparatively seldom the means of establishing representation of workers in the concerns in which they worked. Legislation continued to avoid the subject. It is true that the industrial regulations for the German Empire recognized committees of workers; but these were not obligatory and they had no decisive rights or functions. The one exception was the mining industry. In this instance, after fierce struggles, the introduction of obligatory committees of workers had been secured, particularly in Prussia. The rights of these committees were no doubt extremely limited. Nevertheless, an instrument for negotiations had been constructed for the miners, and with it at least opportunity for the regular exchange of views had been secured.

The war undermined in Germany the old conception of the position of the "masters." The desire to preserve social peace during the war became, as in all countries, a national anxiety. The employers were accordingly urged to conclude wages-tariff contracts. These contracts set up representation of the workers for the separate industrial establishments; a representation which, it is true, was invested with only limited rights. But more than anything else it was the War Emergency Law for securing Auxiliary Service (*Hilfsdienstgesetz*), imposing upon all able-bodied men the legal duty to work, which promoted the conception of the establishment by legislation of representative bodies of workers. The employee, according to the terms of the Hilfsdienstgesetz, could no longer exchange his employment for another without a special certificate (*Abkehrschein*). There had thus been instituted an obligation to continue to work in a particular establishment, or in other words a legal restriction of liberty for which some counterbalancing advantage had to be secured for the other party. If the employee was chained to the establishment in which he worked, it was only right that he should obtain influence upon the conduct of that establishment. The Hilfsdienstgesetz accordingly set up, in the form of obligatory workers' and salaried employees' committees, organs of the employees in each industrial establishment, and these representative bodies had above all the right, in disputes where all the workers were involved, to appeal to the services of a Board of Settlement, thus making the matters in dispute between the employers and employed more or less matters of public interest.

Such was the situation with which the so-called "Councils Movement," following upon the Revolution, was confronted. There were several tendencies which converged in that movement. In the first stage, when in all the larger towns great placards were exhibited bearing the words "All power to the Workmen's and Soldiers' Councils," the Councils Movement appeared to be merely an imitation of what had taken place in Russia. But it was an elemental impulse which drove the masses into the streets. It was an instinctive revolt against the mechanical apparatus of the authority in control of industrial establishments. The old authority of the State had collapsed. The idea of liberty seemed to know no bounds. What could appear more natural to the masses, whose powers of endurance had been totally exhausted by war and privations, than to demand the control of the establishments in which they worked? This instinctive movement, regarded historically, was a relapse into the earliest stages of the development of socialism. Just as the masses had formerly attempted in blind despair to destroy the machines to which they attributed their distress, so now they directed their attacks against the great citadels of the factories, which they regarded as the source of the merciless exploitation of their minds and bodies. If it be further borne in mind that Germany at that time was in the trough of the sea and that there seemed no glimmer of hope that she could again recover in the ordinary way, it will be understood why this movement possessed such a mighty force and why it actually threatened to swallow Germany up. The newly established State was confronted with the task of adopting the legitimate and practical demands of the movement and giving them form and shape. The outcome of this policy is embodied in Art. 165 of the constitution of the Reich, which was framed after great strikes and as the issue of bitter conflicts and prolonged debates at the Congresses of the Councils in Berlin. The text of Art. 165 is as follows:—

> "Workers and salaried employees are entitled to coöperate on equal terms with the employers in the settlement of the conditions of wages and work, and also in the whole economic development of the processes of production. The organizations of the parties on both sides and their mutual agreements shall be recognized.
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> "For the furtherance of their social and economic interests workers and salaried employees shall have legal representation by means of Industrial or Factory Workers' Councils (*Betriebsarbeiterräte*), and also by District Industrial Councils (*Bezirksarbeiterräte*) distributed according to industrial regions, and by an Industrial Council for the whole Reich (*Reichsarbeiteramt*).
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> "With the object of fulfilling the whole of their economic tasks and of coöperating in the execution of the Socialization Laws, the District Workers' Councils and the Workers' Council of the Reich shall meet the representatives of the employers and of any other interested sections of the population through the medium of District Economic Councils and the Economic Council of the Reich. These District Economic Councils and the Economic Council of the Reich shall be so constituted that all the leading industrial occupations are represented in them in accordance with their respective economic and social importance.
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> "Social or economic bills of fundamental importance shall be laid by the Government before the Economic Council of the Reich for its opinion before being tabled in the Reichstag. The Economic Council of the Reich shall itself have the right to propose the introduction of bills of this nature. Should the Government not agree to a bill proposed by the Economic Council, the bill must nevertheless be submitted to the Reichstag. The Economic Council of the Reich may have the proposed bill submitted to the Reichstag by a member of the Council.
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> "Powers of control and administration may be conferred upon the Workers' and the Economic Councils in the spheres assigned to them.
>
> "The development of the Workers' and Economic Councils and the functions to be assigned to them, as well as their relations with other self-administering bodies occupied with questions of social policy, fall exclusively within the province of the Reich."

Article 165 of the constitution of the Reich, containing the general programme for prospective German legislation concerning the Councils, is based upon four main principles.

The first principle is the idea of a separate economic constitution within the State, side by side with the political constitution. Within the last 30 or 40 years the powers of the State have been enormously increased; it has been increasingly empowered to intervene in social and, more particularly, in economic matters and to regulate them. In the present generation this tendency will be strengthened, for the idea of "economic freedom" is receding and every kind of economic activity is being subjected more and more to the tendencies of organization. The idea is steadily gaining ground that the economic activities of a people form one great organism, and that for this reason a general economic administration is necessary in order to put production on a rational basis and to promote social justice. But how can the State perform the tasks of general industrial administration, seeing that it is overwhelmed by other duties? The methods of the State are political methods, but the management of economic enterprises requires special technical knowledge and business methods. The idea of a general management of economic enterprises is therefore inseparable from the idea of a special economic constitution with independent machinery to enable it, on behalf of the State, to fulfil these general economic functions. The machinery of a separate economic constitution of this nature is to consist of the Councils referred to in Art. 165 of the constitution of the Reich.

The second principle is the ideal of an economic democracy. Up to the present time economic enterprise has been the private affair of the persons engaged in it. They were the creators of the industries and to them alone the products of labour belonged. They alone were responsible for what took place in the economy of the enterprise; the employees were not regarded as coöperating with them, but merely as their assistants who could act only in accordance with the wishes of those conducting the business. They received their wages; the method of conducting the business was no concern of theirs. They had no voice in framing the regulations affecting relations between employer and employed; they had nothing to do with the way in which the enterprise was conducted. "Industry," "commerce," and "agriculture" were alike represented, not by employers and employees, but solely by employers. Economic democracy, however, calls upon the employee to join in determining not only the conditions on which labour is hired but also questions concerning the management of the business. Such questions are to be regarded as the concern both of employer and of employed. The employee must not only concern himself with his own particular task, but he must also consider the object of all labour, which is to provide the whole community with economic products. Hitherto Germans have been living in a period of economic autocracy; now a constitution had to be framed which should give the employee the right of coöperating in the sphere of business management and social welfare. This was implied in the first paragraph of Art. 165, by which the workers and salaried employees are entitled to "coöperate on equal terms with the employers in regulating conditions of work and wages and also in the whole economic development of productive capacity."

The third principle is the construction of a system of representation of labour in accordance with the principles of association and of community of interests. Social life is comprised in two manifestations of the human will. In the one man is opposed to man, group to group, interest to interest. The struggle for existence is the essence of it. In the other, connexions are formed between individuals and between groups, which are subordinated to a higher unity in order to achieve a common object. In this manifestation the guiding principle is that of mutual aid. If this two-fold object of the forms of social life be applied to the organization of labour, the legislator finds himself confronted by two distinct tasks. On the one side he must institute organs of representation by means of which labour may look after its own special interests in the face of interests which conflict with them. On the other hand he must institute for labour such means of representation as may enable it to coöperate with, and to have a saying in, the decisions of other organizations for their mutual benefit. It will be seen, therefore, that, according to Art. 165 of the constitution of the Reich, two kinds of councils have to be instituted. In the one kind the workers and salaried employees obtain, "for the protection of their social and economic interests, legal representation on Industrial Factory Councils and also on Regional Workers' Councils and in a Workers' Council for the whole Reich." In the other kind the District Workers' Councils and the State Workers' Council, "in order to fulfil their economic tasks as a whole and to coöperate in the execution of socialization laws, shall meet the employers' representatives and delegates from other sections of the people concerned in District Economic Councils and in an Economic Council for the whole Reich. These District Economic Councils and the Economic Council for the Reich shall be so constituted that all the leading groups of trades are represented on them in accordance with their economic and social importance."

The fourth principle is concerned with the future relations of these councils with other forms of organization by which employers and employed have hitherto managed their mutual affairs. Economic and social life is not organized by the State alone; it organizes itself in various forms. One of the most important is the collective-wages tariff. Since the end of the war another form of self-determination has arisen, that of *joint labour organizations*, in the shape of unions of employees' and employers' associations (*Arbeitsgemeinschaften*) for the purpose of dealing with questions connected with particular trades which affect both parties, more particularly economic questions. There are joint organizations of this kind for industry, commerce and agriculture. Collective-wages contracts and joint labour organizations constitute the voluntary bodies for self-administration in the constitution, which was the object of the legislation in regard to councils. The councils legislation does not aim at suppressing the activities of this social self-determination, but at maintaining it, and at linking it up with the economic structure as a whole. This is the meaning of the second sub-section in Sect. 1 of Art. 165 of the constitution of the Reich by which the organizations of both parties and the agreements between them are "recognized," and of the final sentence of this article in which the adjustment of the relations between the statutory councils and these social autonomous bodies is regarded as the business of the Reich.

Up to the autumn of 1921 the Factory Councils Law of Feb. 4 1920 (*Reichsgesetzblatt*, p. 147) had been the only piece of legislation enacted to carry out Art. 165 of the constitution; the Economic Council of the Reich had been instituted provisionally; its functions had not yet been defined in detail. Arrangements for the formation of the District Economic Councils were still proceeding; they were bound up with more extensive plans for administrative organizations, in particular with the question of the formation of so-called industrial provinces. The main lines of the Factory Councils Law are as follows:

Factory councils are to be established in all factories employing as a rule a minimum of 20 workers. These councils deal with the conjoint economic interests of the employees (wage-earning workers and salaried employees) in their relations with the employer, and are to assist him in carrying out the objects of the industrial enterprise in which they are engaged. For the protection of the particular economic interests of the workers and salaried employees in their relations with the employer, separate workers' councils and salaried employees' councils shall be established in all factories where factory councils exist in which workers and salaried employees are represented. Public officials and candidates for official posts are not regarded as employees. Home workers who, in the main, work for the same factory and do not themselves employ others have a special council in those factories where a minimum of 20 home workers are employed. The establishment of special industrial councils for those who are employed in maritime and inland navigation is contemplated. By the term "factories" (*Betriebe*) is understood all factories, businesses, and managements both publicly and privately owned—that is to say, not households, but State and communal factories, in so far as workers and salaried employees not officials are employed. The factory council consists of at least 3 and at most of 30 members, according to the size of the factory. Those members of the factory council who, as workers and salaried employees, are also members of the workers' or the salaried employees' council are chosen by direct and secret vote on the system of proportional representation; they are elected for a period of one year, and are eligible for reëlection.

All male and female workers over 18 years of age who enjoy full civil rights have the right to vote. Electors over 24 years of age who are citizens of the Reich, who have passed the stage of apprenticeship, and who on the day of election have been employed in the factory or business for at least 6 months, and have been engaged in that particular branch of industry or occupation for at least 3 years, are eligible for election. The members of the factory council and their representatives are to fulfil the duties of their office without payment and as honorary officials. In factories where, as a rule, less than 20, but more than 5, workers having the right to vote are employed, of whom at least 3 are eligible for election, a factory steward (*Obmann*) must be elected. Apart from a few details the factory steward has the same rights as the factory council or the workers' and salaried employees' councils.

The factory council is the organ of the whole of the workers in a factory, but it is also an official body (*Amt*).

As an organ of the workers the factory council safeguards their collective interests and also the interests of individual workers. The interests of the workers collectively are concerned with matters connected with labour and factory management. These two subjects must be carefully distinguished. In so far as the factory council is concerned with matters affecting conditions of labour, it only represents a considerable advance along the lines on which the wage-earners' and salaried employees' committees under the old legalized system had already started. In so far as it deals with questions affecting the business management of the factory it is taking the first step in a new development, the essential principle of which lies in the fact that the worker is henceforth to have a direct interest, not only in matters connected with his work but also in matters connected with the management of the factory, and that the workers collectively are to be entitled to exercise influence requisite for this purpose. The interests of individual members of the whole working staff are protected by the factory council more particularly in cases coming under Sect. 34 of the Statute, according to which, in the case of notice of dismissal being given on the part of the employer, the worker, within 5 days after such notice, may enter a protest by appealing to the workers' or salaried employees' council. This council, if there is reason to believe that the notice of dismissal was unwarranted, may then intervene with the employer on behalf of the worker, or, if an agreement is not reached within one week, it may appeal after a further interval of 5 days to the Conciliation Board.

The factory council exercises the functions of a department of the public service (*Amt*) in those cases in which duties appertaining to the State are assigned to it, the State having invoked its assistance. Such duties comprise, above all, the vindication of the legal rights and the protection of the interests of the workers. Thus, the factory council must see that, in matters concerning the work of the factory, the decisions of a Conciliation Board, or of any other body to which by consent differences have been submitted, are carried out, and that the statutory regulations and other measures which have been enacted for the benefit of the workers are observed. The council must also devote its attention to the prevention or removal of conditions in the factory which involve the danger of accident or are prejudicial to health. It must give its assistance to factory inspectors and other officials occupied with these matters, and must offer suggestion, advice, and information. It must also see to it that police regulations in regard to industrial occupations and regulations framed to prevent accidents are carried out; and it must appoint one of its members to be present at inquiries into accidents which may be instituted by the employer or by the factory inspector or other competent authority.

In addition to the exercise of these statutory powers the factory council may, in particular cases, exercise special functions by virtue of a mandate conferred upon it by the persons concerned. Thus, individual workers in a factory may ask the council to act for them. In that case the council acts as the representative of the interested party in the ordinary legal sense of the term. A factory council may also have conferred upon it by a wages contract functions for which the Factory Councils Law did not provide. A way is thus left open for the adaptation of the council to special circumstances and needs. In no case may the statutory powers of this representative body in a factory be withdrawn from it by private agreement between the parties concerned.

The workers' demand for a voice in the management of factories arose in the first place from a vague but intense longing for emancipation from the lifeless mechanism of factory routine. The worker wanted to be in a position to shape the conditions of his or her occupation, a thing which had become impossible in the mechanized system and the division of labour which prevails in factories on a large scale. This longing soon took shape in the demand that the assent of a factory council invested with equal rights should be requisite for all dispositions made by the employers. The law as it now stands has accepted the fundamental idea of this councils movement, but has by no means met the demand in full.

A voice in shaping decisions is only possible where right of acting together with the employer is conferred upon the factory council. The council has this right in regard to the issue of regulations regarding the work, the framing of factory by-laws, the fixing of wages and other conditions of labour. It also has the right of coöperation in laying down the lines to be followed in regard to the engagement of workers, the fixing of penalties and the decisions of the Board of Supervision[1] (*Aufsichtsrat*) to which the factory council has the right to send delegates. It has further the same right to a voice in the case of the dismissal of a member of the representative body of the factory, which can only take place with the consent of the members of that body. The working regulations of the factory must be mutually agreed upon in all factories employing 20 or more workers, whereas formerly these regulations were issued by the authority of the employers alone. Should no agreement be arrived at the matter must be settled by the irrevocable decision of the Conciliation Board. The same applies to the fixing of penalties and the dismissal of members of the representative body of the factory. A voice in the decisions becomes illusory where the representative body of the factory is only able to exercise an influence upon the will of the employer. This influence may be exercised in two ways: in the first place by the workers' right to be heard (*Audienzrecht*), which means that, in certain cases, the representative body has the right to demand that the employer shall listen to what they have to say. In other cases this right may extend still further and enable the representative body to demand that the employer shall enter into negotiations with them, as, for instance, in the case of the engagement of workers and notices of dismissal. Finally, the right to be heard may take the more precise form of a claim to receive information from the employer, so that the latter is obliged to give particulars of anything that occurs which may affect the workers' contracts or their general activities. Similarly, the employer may be required to produce the wages books and the necessary proofs that existing wages contracts have been carried out. He may be required to furnish quarterly a report on the position and progress of the business and on the state of the industry in general; further, on the output of the factory and, more particularly, on the labour likely to be needed for it. The employer must likewise, on demand, produce for inspection a balance sheet and a statement of the profit and loss on the factory. The will of the employers can also be influenced by the right of the factory council to bring the employer before a court. The representative body may, in the case of differences, appeal to the Conciliation Board or to any conciliation or arbitration court which may be agreed upon. This right enjoyed by the representative body implies an obligation on the part of the employer to appear before the Conciliation Board. There is no obligation to negotiate, but a verdict may be pronounced, even if the other party has not appeared or has not negotiated. It is true that the verdict of the Conciliation Board, except in the cases mentioned above (working regulations, etc.), is not binding. The method of arbitration to be observed in the case of engagement of workers and notices of dismissal will be dealt with more particularly below, but it may be remarked here that, in accordance with a legal practice, generally adopted though not unchallenged, the demobilization commissioner is considered to be within his rights in declaring, by means of an administrative order, such arbitral decisions to be of binding force as would otherwise, according to law, not be obligatory.

The right to a voice in decisions affecting the engagement of workers and notices of dismissal requires special consideration. Legislation on this point encountered peculiar difficulties. The working classes pressed for unrestricted coöperation in all decisions concerning engagements and notices of dismissal. Serious strikes, more particularly of salaried employees and above all of bank clerks, occurred in connexion with this question. The employers fought for the maintenance of their absolute freedom as regards the engagement and dismissal of their staffs. The law is based on a compromise between these two demands.

In the first place, as regards the engagement of workers, the employer remains, as hitherto, unrestricted in the choice of his employees. But the Factory Councils Law provides that, as mentioned above, certain main lines for the engagement of workers may be agreed upon and that the employer shall be bound by them. At the same time the employer is not *under any obligation* to agree to such lines of action; so that this provision of the law may be rendered nugatory by him, unless the balance of power is such as to compel him to agree to accept general guiding lines for his action. If certain lines have been agreed upon the employer must observe them. If he deviates from them the representative body of the factory may appeal to the Conciliation Board. The Conciliation Board may issue a binding order that, in case of a departure from the course of action agreed upon, the contract of the employee with the employer shall terminate as soon as the decision has come into force, subject to the observance of the legal term of notice.

Of greater and more far-reaching significance than this coöperation of the workers' representative body in regard to the engagement of workers is the coöperation of this body in cases of dismissal. Sect. 84 of the Factory Councils Law directs that in all industrial establishments having a factory council, the individual worker, in case of dismissal by the employer, has the right to enter a claim within 5 days of the notice of dismissal by appealing to the workers' or salaried employees' council, "(1) if there is ground for the suspicion that the dismissal is due to the worker's sex, to his or her political, military or (religious) denominational activities or to his or her activities as a trade unionist, or to the fact that he or she does not belong to some particular political, religious or industrial association, or to some military society; (2) if notice of dismissal has been given without any reasons being assigned; (3) if the notice has been given because the worker has refused to undertake permanently other work than that for which he or she was originally engaged; (4) if the dismissal appears to be an act of unwarrantable severity not justified by the behaviour of the worker or the conditions in the factory."

When an employee has entered a protest with the workers' or employees' council against his dismissal, the council shall endeavour, if they consider the objection justified, to come to an agreement with the employer by negotiation. Should no agreement be arrived at within one week the council may appeal to the Conciliation Board after a further period of 5 days. The individual worker who has received notice of dismissal enjoys the same right of appeal. Should the Conciliation Board consider the appeal against dismissal to be justified, and should the employer nevertheless refuse to continue to employ the worker in question, the committee shall then impose on the employer the obligation to give him compensation. The compensation shall be proportionate to the total number of years during which the worker has been employed in the factory, and may be reckoned for each year up to a maximum of one-twelfth of the amount of wages earned during the last year of employment. The total, however, must not exceed six-twelfths of that amount. In making this calculation the economic position of the worker and also the financial capacity of the employer must be considered.

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[1] Every limited-liability company in Germany has in addition to the directorate a smaller board of expert business men which exercises control or supervision over the directorate.

The principle of the factory council was not accepted forthwith by the socialist sections of the community and by the trade unions. It is intelligible that the employer, who had been accustomed to autocratic position, would not feel well-disposed towards the institution of factory councils from which he apprehended unwarrantable interference in his affairs. But the fact that the zealous advocacy of factory councils met with opposition from the advanced sections of the labouring classes calls for explanation. The idea of factory councils was connected in Germany, as in other countries, with a wave of syndicalism. At first it seemed as though, by means of the factory councils, industries would be brought under the control of the workers, so that, in this way, industrial property might be transformed into the property of labour. A demand of this sort has always been contrary to the fundamental principles of socialism, according to which the socialization of industry should be effected not by and for separate industrial establishments, but by means of an economic community of the entire nation, which should control all the separate industrial enterprises. The syndicalist demand, moreover, was really contrary to the fundamental principles for which the trade unions had fought. They had always been organized on the basis of whole trades. They were united in a central organization, and their whole system was based on the perception of the fact that the regulation of wages and of conditions of labour depended on the state of the labour market, and that the labour market could be regulated for the benefit of labour only through trades unions on a large scale. The trades unions could not but fear that, if the real representation of labour became concentrated in the factory councils, the methods hitherto employed by the unions would be altogether superseded. And, indeed, the tendencies of the councils movement were in direct conflict with those of the trades unions.

It may now (1921) be asserted that these conflicting tendencies in Germany have been reconciled, although under certain circumstances the old differences might be revived. The view has prevailed that it is the business of the factory councils not only to safeguard the interests of particular factories, but also to be responsible for safeguarding the interests of the whole industrial economy. Moreover, the factory councils, as things have actually developed, have more and more become instruments of the trades-unions movement in the factories, so that the great impulses of the social movement continue, as before, to emanate from the trades unions. They have, in particular, kept a firm control of regulation of conditions of labour. The Factory Councils Law paved the way for this development. The factory council, from its whole structure, is intended to be not merely a representative body for the workers in a particular industrial undertaking. This, it is true, would be the historical development of the factory council from the fundamental ideas of the councils movement as described above. The factory council, however, is also to be conceived as an official institution designed to safeguard the interests of the whole industrial economy. This is expressly laid down in Sect. 68 of the Factory Councils Law, which says: "The factory council in carrying out its functions must endeavour to see that neither party puts forward demands or adopts measures which would be prejudicial to the general interest." As regards the relative position of the trades unions, the Factory Councils Law is carefully framed so that in all cases of dispute the precedence of the trades unions shall be recognized. For this reason the wages contract takes priority of any other agreements between the factory council and the employer. For the same reason the representatives of the trades unions have the right to attend the meetings of the factory council and to take part in the general meetings of the factory workers. More especially, the right of the trades unions to represent the workers in negotiations with the employer is not affected by the right of representation enjoyed by the factory council. This point is determined by Sect. 8 of the Factory Councils Law, which says: "The right of economic associations of workers and salaried employees to represent the interests of their members is not affected by the provisions of this law."

What is the significance of the German factory council in the social movement of labour? That the rights of labour have been extended by the factory council is beyond all doubt. Where factory councils are in existence arbitrary conduct on the part of the employer in regard to matters fundamentally affecting conditions of labour is rendered impossible, and the legal position of the worker in the industry is firmly established. Rights hitherto exercised by the employer without any restriction—such as, for instance, the right to issue factory regulations, to fix penalties and to give notice of dismissal at will—have been limited. The worker's sense of his own personality has thus been raised. But, above all, the worker's sphere of influence has been extended to a province from which he was hitherto excluded. This province is the conduct of the business. It is true that the powers of the factory council in this sphere are not so far-reaching as in the sphere of the regulation of conditions of work. The actual right to a voice in business decisions has nowhere been conceded to the factory council. The employer, however, is obliged to answer questions put to him with regard to these matters; he must discuss them and must lay facts and figures before the council. Nevertheless, in forming an opinion on the right of the workers to a voice in the business conduct of an enterprise, it must be remembered that the precise limits within which the law permits such coöperation are of comparatively small significance. The manner in which the right is exercised by the workers is of far greater importance.

It is no mere coincidence that, since the institution of factory councils, a new educational movement on the part of the labouring classes has developed in Germany. This movement is connected with the fact that new functions have been assigned to the factory councils, functions which can only be performed by those who possess the necessary expert knowledge. So-called "courses of instruction for councils" (*Rätekurse*) are being instituted all over Germany with the object of enabling the working classes to acquire the knowledge and capacity requisite for the fulfilment of their new duties. This educational movement is becoming more and more systematic and conscious of its own significance. At the university of Frankfort-on-Main an "Academy of Labour" has been founded, to the support of which trades unions of all kinds are contributing large sums. The object of the "Academy of Labour" is to produce a new class of leaders for the new tasks of the labour movement by means of a comprehensive scheme of education.

In this intellectual side of social politics to which the Factory Councils Law has given birth there lie the seeds of a highly important development. For social questions are not merely questions of power. The supremacy of capital over labour has not been due solely to the ownership of the instruments of production; it was, above all, based on intellectual capacity for business management and leadership. The labour movement, by striving with purpose and system to obtain the intellectual equipment which is requisite, not only for acquiring the instruments of production, but also for managing them in the way that will be most beneficial to the entire community, is taking a step forward which may be of greater significance to the economic life of the nation than any laws and schemes for socialization. It is an undoubted fact that this intellectual movement, bound up as it is with the new rights of the factory councils and with the general and fundamental principles of the councils movement, is a preliminary step in the socialistic transformation of economic life which is taking place before our eyes, although many of us may not be aware of it, or may not wish to become aware of it.

Bibliography.—Information on the general questions involved is given by Anschütz in *Die Reichsverfassung* (zu Art. 165; 1921); by Sinzheimer in *Das Rätesystem. Eine Einführung in den Rätegedanken* (1920); Proceedings of the Constitution Committee of the National Assembly (1919–20). For particular information concerning the Factory Councils Law the Commentaries on the law should be consulted, especially those of Dersch (1920), Flatow (1921), Feig and Sitzler (1921). (H. Si.)

Political History

From 1910 to Outbreak of World War.—The question of reform in imperial financial system, which in 1909 led to the resignation of Prince Bülow and the appointment of Bethmann Hollweg as Chancellor, continued to exercise a predominant influence in German domestic politics until the Reichstag elections of Jan. 1912. Against the so-called "black and blue *bloc*" (the Catholic Centre and the Conservatives) which had carried the financial reforms through the Reichstag, and of which Bethmann Hollweg was considered to be the representative, the hitherto divided Liberal Left (*Freisinnige Vereinigung*, *Freisinnige* and *Deutsche Volkspartei*) at the beginning of 1910 united to form the Progressive People's party (*Fortschrittliche Volkspartei*), which held its first party congress in March of that year. In the electoral contest of 1912 the question of Prussian suffrage reform played an important part. It was a question which was really of the first importance for the policy of the Empire on account of the predominant position of Prussia. In accordance with an undertaking which had been given in Jan. 1908 by Prince Bülow, as Prussian Minister-President, Bethmann Hollweg introduced a Government bill on Feb. 4 1910 in the Prussian Diet. This bill, however, did not provide, as had been desired in many quarters, for the application of the suffrage of the Reichstag to Prussia; on the contrary it retained the antiquated original electoral districts and the division of the electorate into three classes according to the amount of their income-tax assessments. Certain provisions of the bill were, it is true, intended to effect alterations in the distribution in the three classes of electors, and the direct method of election was to have been substituted for the system of choosing electoral colleges. After various vicissitudes, the bill was rejected by the Diet on May 27 1910. The question nevertheless continued to form a constant subject of public discussion during the ensuing years, and franchise reform constituted one of the chief demands of the parties of the Left, more especially the Social Democrats, after the World War started. The rejection of the suffrage bill led to a change of ministers in Prussia; the chief president of the province of Silesia, Dallwitz (afterwards Statthalter of Alsace-Lorraine), became Minister of the Interior, and Baron von Schorlemer-Lieser Minister of Agriculture, while the chief burgomaster of Magdeburg, Lenze, took over the Ministry of Finance. About the same time the Imperial Secretary for the Colonies, Dernburg, retired, and the under-secretary von Lindequist was appointed in his stead. Dernburg had been attacked for the favour he was alleged to have shown to the great capitalists in the exploitation of the S.W. African diamond fields, yet to him undoubtedly belongs the credit of having been the first to awaken the active interest of the nation in its colonial possessions. Shortly afterwards there was also a change in the secretaryship for Foreign Affairs, Kiderlen-Wächter having been appointed in succession to Baron von Schön, who was sent as ambassador to Paris. The St. Borromeo Encyclical of the Pope against the Reformation, which was felt in Protestant circles to involve great danger for the religious peace of Germany, threatened to cause difficulties in internal politics. A crisis was averted, however, by the Pope's disavowal of any thought of offending the non-Catholic population of Germany or the German Protestant sovereigns.

The person of the Emperor repeatedly became a central subject of discussion in the course of 1910. Excessive importance was attached to an incident of a not very serious character caused by the Conservative deputy Oldenburg-Januschau, in the Reichstag. That deputy declared in a debate on military discipline that the German Emperor must always be in a position to say to a lieutenant: "Take ten men and close the Reichstag." Although this unfortunate utterance did not deserve to be taken so seriously as it was in the press and in several of the German parliaments, it nevertheless showed the complete opposition which eight years before the revolution of 1918 existed in Germany between the different conceptions of the monarch's position. An extraordinary sensation was produced by a speech of the Emperor, who at Königsberg claimed in the following words that he held his office by the grace of God:—

"Here in Königsberg my grandfather set the crown of Prussia on his head in his own right,[1] distinctly asserting once more that it was bestowed upon him solely by the grace of God and not by parliaments, popular assemblies or popular resolutions, and that he thus regarded himself as a chosen instrument of Heaven and as such fulfilled his duties, first as Regent, and afterwards as Sovereign. Regarding myself as the instrument of the Lord, without paying attention to views and opinions of the hour, I go my own way, which is dedicated simply and solely to the well-being of the peaceful development of our country."

The Emperor, it is true, modified this utterance in a speech delivered shortly afterwards at Marienburg, declaring that the cross on the robes of the Teutonic Order, which meant its subjection to the will of Heaven, illustrated what he had said at Königsberg. "As my lamented grandfather and I," he continued, "both represented ourselves as working under the supreme protection and with the supreme permission of our Lord God, I assume the same to be true of every honest Christian whoever he be." Nevertheless an interpellation was moved in the Reichstag in Nov. on the subject of these speeches. There was also in this connexion the additional fact that the Social Democrats at their congress at Magdeburg had laid strong emphasis upon their republicanism. The Socialist party, moreover, succeeded at this congress in composing dissensions which had arisen among them on the question of voting the budget in Prussia, and they were able to maintain the unity of the party. While criticism of the Government on various matters that arose became more and more severe, an understanding with regard to the elections was effected between the National Liberals and the new Progressive People's party. It was about this time, too, that the catchword, "the *bloc* from Bassermann to Bebel," was coined.

The Bethmann Hollweg Government had managed in spite of this opposition to carry two highly important measures. One was the law coördinating the social insurance system of the Empire passed by the Reichstag on May 3 1911. By this law a work of social policy was completed which became a model for many countries. The new law extended the system of sickness and accident insurance, and further developed the insurance of invalids and surviving dependents. It granted a subvention to widows and orphans (*Reliktenversicherung*), the annual amount of which was estimated at 60,000,000 marks. Among the insured were included some 7,000,000 additional workers employed in home industries, in agriculture and in domestic service. A proposed reduction of the pension age from 70 to 65 was not carried at this time on account of the cost, which would have meant a fresh expenditure of 9,000,000 marks per annum; this reform had to wait until after the revolution of Nov. 1918, when various other bills amending the national system of insurance were carried, and the contributions, pensions, etc., were increased in accordance with the depreciation of the currency. A fundamental reconstruction of the insurance laws was contemplated for the year 1922.

Another measure of great significance was the bill for giving a constitution to Alsace-Lorraine, introduced on Sept. 23 1910, and passed, together with a complementary Franchise bill, on May 26 1911. According to this measure, the Emperor had the right to nominate, without consulting the Federal Council, the Statthalter for the Reichsland and 19 members of the First Chamber. The other half of the members took their seats partly *ex officio*, partly as the representatives of the estates of the country. Alsace-Lorraine was given three votes in the Federal Council, and its representatives on that body received their instructions from the Statthalter. In order, however, to prevent a too great preponderance of Prussia in the Federal Council, the provision was added that the three Alsatian votes should not count in cases where a Prussian proposal could not be carried without them. It was evident that, since the Emperor, who was also King of Prussia, appointed the Statthalter, and the Statthalter gave the Alsatian members their instructions, the Alsatian votes in the Federal Council in reality meant Prussian votes. For the Second Chamber of the Reichsland Parliament, universal, equal, direct and secret suffrage was granted, although it continued to be withheld from Prussia; and the anomaly was witnessed of the Prussian Minister-President, Bethmann Hollweg, advocating in the Reichstag, as Imperial Chancellor, this suffrage for Alsace-Lorraine. When the bill was being debated, there was a revival in Conservative circles of the old demand for the incorporation of Alsace-Lorraine with Prussia. The Chancellor met this demand by pointing out that the avowed object of Bismarck's policy was to give the people of Alsace-Lorraine a country of their own, as nearly as possible on an equal footing with the other German states and under the protection of the whole Empire. The constitution came into force on Sept. 1 1911. The first and only elections to a German Parliament of the Reichsland took place on Oct. 22 1911 and resulted in a Clerical majority. There were, nevertheless, in the sequel repeated incidents in Alsace-Lorraine, some of them in the Parliament itself. A good deal of excitement was caused in Nov. 1913 by the so-called Zabern affair, when young Lt. von Forstner—who afterwards fell in the war—employed a local term of abuse, "Wackes," to characterize the Alsatians. The consequence was that German officers were insulted by the population, and, as the civil authorities did not interfere, the regimental commander governing the garrison, Colonel von Reuter, had arrests made on his own responsibility. This incident made a very bad impression among the anti-militarist parties in the Reichstag, and led to excited debates, which were followed on April 1914 by the resignation of the Statthalter, Count Wedel. This had been preceded on Jan. 29 by the retirement of the Secretary of State of the Reichsland, Zorn von Bulach, and also of two under-secretaries. The Prussian Minister of the Interior, von Dallwitz, was appointed Statthalter. It is noteworthy that in the course of the Reichstag debates on this subject a vote of no confidence in the Chancellor was passed for the first time in German parliamentary history. The official view of parliamentary responsibility, which was strongly held by the Emperor, prevented the vote from having any further consequences.

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[1] Only two of the Prussian Kings had been crowned: Frederick I., on Jan. 18 1701, and William I., on Oct. 18 1861. Both crowned themselves at Königsberg, the first because, as Duke, and subsequently King, of Prussia, he could assert in his eastern possessions, which were outside the Holy Roman Empire, his absolute independence of the Emperor, from whom, nevertheless, he had received permission to assume the royal dignity.

On June 18 1911 the German nation celebrated the fortieth anniversary of the foundation of the Empire. In the course of the same year the despatch of the gunboat "Panther" to Agadir caused a highly strained European situation, attended by the greatest excitement in Germany. The so-called "*geste* of Agadir" was at first joyfully greeted by the whole of the parties of the Right, and more particularly by the Pan-German members, as a sign that Germany was determined to assert her position in the world. When, however, the Government appeared to be abandoning German interests in Morocco in exchange for compensations in the French Congo, the Secretary of State, Kiderlen-Wächter, and the minister responsible for the conduct of German policy, the Chancellor Bethmann Hollweg, were subjected to very violent attacks, with which even some of the deputies of the Left associated themselves. In the midst of this excitement the speeches of Mr. Lloyd George and Mr. Asquith in England were regarded as wounding to Germany. When the details of the Franco-German Morocco-Congo Convention, signed on Nov. 4 1911, were published, they had a calming effect upon public sentiment. Only the Pan-German newspapers continued to speak of the "disgrace" of Agadir. The Secretary of State in the Colonial Office, von Lindequist, resigned because he could not approve of the agreement. He was succeeded by Dr. Solf, who had been governor of Samoa. There was a debate in the Reichstag, lasting several days, upon the Morocco negotiations, and the Imperial Chancellor took up an attitude of vigorous opposition to the ideas of the Conservative leader, von Heydebrand. A great sensation was caused by the action of the Crown Prince, who appeared in uniform in the Court Gallery and demonstratively applauded von Heydebrand. This incident led to further parliamentary discussion. In one of the speeches which the Chancellor delivered, he declared that Bismarck's principle never to wage a "preventive" war had continued to guide the Government in the Morocco crisis. For himself he had to bear the responsibility, and it was his duty so to conduct affairs that any war which was avoidable and was not necessitated by Germany's honour should be avoided. In another speech Bethmann Hollweg expressed his regret that von Heydebrand had used language with regard to German relations with Great Britain such as might be useful at an election meeting but was not customary in a Parliament alive to its responsibility. With these proceedings the legislative period of the Reichstag which had been elected in 1907 closed.

On Jan. 12 1912, the new Reichstag elections took place, and resulted, as had been expected, in showing that the "black and blue *bloc*" (Conservatives and Catholic Centre) no longer commanded an effective majority. Although most of the by-elections in the previous year had revealed a strong movement toward the Left, the extent of the success of the Social Democrats proved extraordinary. They were sent back to the Reichstag with 110 deputies, which made them the strongest party in the House. The "black and blue *bloc*" lost 45 seats. This change in the parliamentary situation did not, under the German political system of those days, entail a reconstruction of the Government; its effects, however, were manifested at the election of the president and the vice-presidents of the Reichstag. These, according to parliamentary custom, had to be elected twice over. At the first election the veteran Socialist leader, Bebel, only missed being elected president by 11 votes, while for the first time in German political history a Socialist, Scheidemann, was elected vice-president. At the second election the Progressist (*bourgeois* Democrat) Kampf was elected president, while Scheidemann was defeated by the National Liberal, Dr. Paasche. The times were not ripe for placing Social Democrats in positions which entailed personal relations with the Court. The new Reichstag—the Reichstag which lasted throughout the war and proved to be the last under the old Imperial *régime*—was ultimately swept away together with the Bismarckian constitution by the revolution of Nov. 1918.

In Bavaria, the second largest German Federal state, elections had almost simultaneously taken place for the Diet. Their result was signalized by the appointment of the leader of the Catholic Centre in the Empire, Baron von Hertling (who afterwards became Imperial Chancellor), to the presidency of the Bavarian Ministry. An ordinance issued by this Government, permitting certain limited activities in Bavaria to the Jesuits, who had been expelled from Germany since 1872, led to much discussion, which was also taken up in the Reichstag. In consequence of the decision of the Federal Council, Bavaria withdrew this Jesuit ordinance in Nov. 1912. New army and navy bills, providing for the establishment of two new army corps at Allenstein and Saarbrücken and contemplating the completion of the third squadron of battleships for the fighting line, involved measures for meeting fresh expenditure, in connexion with which the Secretary of State of the Imperial Treasury, Wermuth, resigned. He was succeeded by the under-secretary Kühn, and was elected a few months afterwards to the office of chief burgomaster of Berlin. As a presage of what was afterwards to take place it may be noted here that there was already a Social Democratic majority in the Diet of the smallest of the federated states, Schwarzburg-Rudolstadt.

On Dec. 12 1912, the Prince Regent Leopold of Bavaria died at the age of 92. He had governed in place of the incurably insane King Otto since 1886. He was succeeded as regent by his son Prince Louis (Ludwig), and in the following year (1913) the Hertling Ministry introduced an amendment to the constitution providing that if the king was unable, owing to bodily or mental infirmity, to exercise his office, and if, after a period of 10 years, there was no prospect of his recovery, the regent should declare the throne vacant. The Bavarian Diet agreed on Oct. 30 1913 to this alteration of the constitution, and the regent assumed the Bavarian crown as King Louis (Ludwig) III. In another state of the confederation, Brunswick, the regency which had lasted for many years was also terminated in 1913. The legitimate heir was the Duke of Cumberland, son of the King George of Hanover who had been deposed in consequence of the events of 1866. The Duke of Cumberland had expressly refused in 1884 to renounce his right to succession to the throne of Hanover. By decisions of the Federal Council in 1885 and 1907 he was accordingly debarred from taking up the succession to the ducal throne of Brunswick. It was only the marriage of his sole surviving son, Prince Ernest Augustus, with the daughter of the German Emperor, Princess Victoria Louise, that put an end to these difficulties. The marriage was celebrated at Berlin on May 24 1913 with great splendour, and a large number of European sovereigns and princes were present. Among them were the King and Queen of England and the Tsar of Russia. Prince Ernest Augustus, who had previously entered the Prussian army, had on April 20 addressed a letter to the Imperial Chancellor intimating that his father had transferred to him his rights to Brunswick; further, that his marriage with Princess Victoria Louise and his entrance into the Prussian army would, in his view, justify a reversal of the former decision of the Federal Council concerning the Brunswick succession. On the proposal of Prussia the Federal Council then declared (Oct. 27) that it agreed to the prince's accession to the throne of Brunswick. The young Duke and Duchess of Brunswick were, therefore, able to make their state entry into Brunswick on Nov. 3. The fact nevertheless had a sequel. Attacks were made in the Reichstag on the Federal Council because it had given its consent to the accession of Prince Ernest Augustus without the renunciation of the throne of Hanover by his father, the Duke of Cumberland, which it had demanded in the year 1907. The German Crown Prince in a correspondence with the Imperial Chancellor associated himself with this protest, a proceeding which caused some transient annoyance. Meanwhile, the Hanoverian Guelphs turned the settlement of the Brunswick succession to account by advancing in the most uncompromising manner demands, which since 1866 they had never abandoned, for the reëstablishment of the Guelph kingdom of Hanover.

The Secretary of State for Foreign Affairs, von Kiderlen-Wächter, suddenly died on Jan. 2 1913. He was succeeded by the ambassador in Rome, Gottlieb von Jagow. On Jan. 29 the chief in command of the High Seas Fleet, Adml. von Holtzendorff, was placed on the retired list and was succeeded by Adml. von Ingenohl. The danger of war, which had again overshadowed Europe, and more especially Germany's ally, Austria, in consequence of the Balkan War and the Russo-Austrian tension, caused the German Government to introduce the great Army Bill of 1913, to meet the cost of which a non-recurring war contribution (*Wehrbeitrag*) was to be levied upon the well-to-do sections of the nation. The Imperial Chancellor introduced the bill on April 7 in a great speech, in which he referred to the change in the military and political situation resulting from the issue of the Balkan War. "If ever," he said, "there should be a European conflagration in which Slavs and Germans were opposed, a disadvantage for the Germans would lie in the fact that the place in the balance of power hitherto occupied by European Turkey would now to some extent be occupied by the South Slav states." After alluding to the growth of Pan-Slavic tendencies, to the literature of Chauvinism in France, and to the fact that in Germany, as contrasted with France, the idea of universal service was no longer completely carried out, the Chancellor declared:—"We are not bringing in this bill because we want war, but because we want peace, and because, if war comes, we desire to be the victors." The bill raised the strength of the German army, as from Oct. 1 1913, from 544,271 men to 661,176. It passed the third reading in the Reichstag on June 30 1913. The financial measure accompanying it, defraying the proposed expenditure to the amount of more than one milliard marks by a non-recurring war contribution levied upon personal fortunes, was passed at the same time. The bill for this impost, which in the ensuing years—indeed for the most part in the first year—was paid up without any disturbance of the economic life of Germany, was the work of the Secretary of State for the Treasury, Kühn. The sovereigns of the German Confederation renounced their privilege of exemption from taxation and paid their share of this contribution on behalf of the national defences. As regards the construction of warships, the Secretary of State for the Navy, von Tirpitz, had stated in the Reichstag on Feb. 7 that he had no objection to the proportion of 10 to 16 between the numbers of the German and the English battleships, as proposed by the British First Lord of the Admiralty.

The remarkable progress of the German nation up to 1913-4 was advertised in a striking way by the great celebrations of 1913, the centenary of the War of Liberation, and the twenty-fifth anniversary of the accession of William II. All the German sovereigns assembled to take part in a ceremony in the hall built at Kehlheim to commemorate the national liberation, and in the dedication of the monument erected at Leipzig in memory of the "Battle of the Nations" (*Völkerschlacht*). On the occasion of the *fêtes* celebrating the Kaiser's accession, there were many references to the industrial, economic and financial prosperity which had been achieved. Dr. Helfferich calculated that the national wealth of Germany amounted at that date to something like 300 milliard marks (about £15,000,000,000). The population, according to the census of 1910, was 64,896,881. Nevertheless, Germany had one constitutional weakness which was a flaw in its prosperity. The World War came upon it at a stage of its internal political development when it had not yet succeeded in readjusting the rights and duties of the various factors in the life of the state, in the sense of a compromise, such as the times demanded, between monarchy and parliamentary democracy. In the very centre of this political struggle, which had been going on for many years, stood the question of the suffrage for the Prussian Diet. The Social Democrats, almost exactly one year before the outbreak of the World War, lost on Aug. 13 1913 by the death of August Bebel their veteran leader in the struggle for the democratization of Germany. His successor in the presidency of the party organization was the man who was destined subsequently to be the first president of the Republican Reich, Ebert. (O. B.)

The War Period.—The prosperous development which Germany had experienced for more than 40 years of peace had been both politically and economically a mighty one; and there had arisen in the German people a profound sense of their strength, based in great part upon the absolute confidence which they felt in their military power. This confidence continued to influence popular feeling during the first years of the war. The events which led up to it, the crime of Sarajevo, the Austrian ultimatum to Serbia, the preparations for war in Russia, were followed throughout the country with earnest attention, but until the end of July 1914 there was scarcely any sign of satisfaction among the German people at large at the prospect of war. It was only when it became known that there was no hope of avoiding the conflict that any national enthusiasm for war suddenly broke out and communicated itself to all sections of the people. It found expression in lively demonstrations. Characteristic of the state of public feeling were the words which the Emperor addressed from the balcony of Berlin Castle to the assembled masses below:—"I no longer know any parties among my people; there are only Germans." The necessity of setting aside all party strife was felt from the extreme Right far into those working-class circles which, as belonging to the Social Democratic party, had hitherto been opposed on principle to war. On Aug. 1 1914 the Socialist leaders had issued a manifesto exhorting their followers to persist in their confidence that the future, in spite of everything, belonged to Socialism as the great bond between the nations. Indeed, if the Social Democrats had frankly taken up an attitude of opposition to the war, the masses, even those who belonged to the party, would in their patriotic enthusiasm have declined to follow their lead. The appeal by the Kaiser to his people on Aug. 6, the manifestos of the different German sovereigns, the Emperor's speech from the throne on Aug. 4, and the speech of the Imperial Chancellor Bethmann-Hollweg on the same day, awakened an accordant response from the nation. On Aug. 4 the Social Democrats joined with the rest of the parties in the Reichstag in voting the first war credit of 10 milliard marks. A united front of all parties was established.

And now the events of the war followed each other in rapid succession. The overrunning of Belgium by the German troops and the victory of Hindenburg over the Russians at Allenstein produced a whirlwind of victorious exultation. On Sept. 9 the Socialist leaders published a protest against the anti-German attitude of the International Socialist Bureau, and thus drew a clear line of cleavage between the German Social Democracy and that of enemy countries. On Dec. 2 a second war credit was voted by the Reichstag. In this instance the express assent of the Social Democrats was given, and their then leader, Haase, explained in a long speech the reasons for their attitude. The feeling in Germany was everywhere the same; victory was believed to be certain; even the unfavourable issue of the battle of the Marne, the fall of Tsing-tau and the destruction of the German cruiser flotilla off the Falkland Is. did nothing to impair this conviction. Although the participation of England in the war was keenly felt, the unquestionably great military successes of Germany in 1914 dispelled any apprehensions that the nation might not be strong enough to face its enemies.

The beginning of 1915 brought no alteration in this respect. In March the Social Democrats, by the mouth of their leader, Haase, expressed in the Reichstag the gratitude of the country to the German troops for their valour. At the same time the Government did its best to meet the Social Democrats halfway by fulfilling demands which that party had hitherto preferred in vain. The Secretary of State for the Interior, Dr. Klemens Delbrück, indicated in the Reichstag that new lines of policy were to be adopted; the question must be considered to what extent the great events which were taking place confronted the Empire with the necessity of meeting legitimate desires of the Left. In Aug. the president of the Reichstag, Dr. Kampf, intimated that the Government had abandoned its opposition to the proposal to place the inscription "To the German People" on the place long reserved for it on the Reichstag building.

In May Italy entered the war, an event which had long been foreseen and therefore did not exercise any very depressing influence. In certain circles a feeling nevertheless began to gain ground that, in view of the steady increase in the number of Germany's foes, the prospect of victory was becoming more doubtful. The Government did its best to repress this feeling. On Aug. 19 1915, the Chancellor, Bethmann Hollweg, delivered a speech in the Reichstag directed chiefly against England, and culminating in the prediction that the numbers, the powers, the wealth and the malice of Germany's enemies would be shattered against the iron determination of the German race. Once more the Reichstag, including the Social Democrats, voted a war credit, but this time one Socialist vote, that of Dr. Liebknecht, was recorded against it. Gradually, however, the Social Democrats began to give expression to aspirations for peace. As early as Nov. 1915 the Social Democratic leader, Scheidemann, addressed a question to the Government regarding the possibility of concluding peace. And now for the first time a Socialist group of 18 deputies, under the leadership of the deputy for Leipzig, Geyer, voted against a fresh war credit, although the Socialist Dr. Landsberg still protested in the most emphatic manner against any surrender of German territory. A division in the ranks of Social Democracy began. A sensation was caused by the publication of a peace manifesto issued by the German Social Democratic minority in the Paris newspaper *Humanité*.

This was vigorously repudiated by the Socialist majority. On July 19 Haase, Bernstein and Kautsky published in the *Leipziger Volkszeitung*, under the title "A Necessity of the Hour," a declaration in favour of the early conclusion of peace. The official leaders of the Social Democratic party issued, it is true, a counter-declaration, but in this document it was acknowledged for the first time that the Government must be ready for peace negotiations if a suitable opportunity offered. The chief party organ, *Vorwärts*, which published this counter-declaration, was temporarily suppressed by the Government. Thus there arose between the Social Democrats and the Government a discordancy which gradually extended among the masses. All the non-Socialist parties identified themselves in this instance with the attitude of the Government. Another element in the situation was that in Prussia there was a campaign going on for the reform of the suffrage, demanded by the Social Democrats but somewhat peremptorily refused by the Prussian Ministry. The bombing of Freiburg in Baden by enemy airmen, causing the death of eight persons, and the similar fate of Karlsruhe, where 27 persons were killed and 57 wounded, helped, no doubt, to revive popular feeling against the Entente and against the idea of peace. Nevertheless, a sense of war-weariness became more and more apparent and began to spread even in non-Socialist circles.

This change of feeling was above all due to the increasing difficulties in providing the masses with food. The severance of all communications between Germany and foreign countries prevented the importation of raw materials and foodstuffs of every kind. Although, at first, raw materials, sometimes in large quantities, could be imported through Holland, Switzerland and Sweden, these supplies gradually diminished as scarcity began to be felt in those countries. As far back as the beginning of 1915 the German Government was compelled to adopt measures for securing a supply of food for the whole population. All grain and flour were sequestrated on Feb. 1 1915. A system of bread cards was introduced for a ration of 200 grammes of bread per head of the population. It was further decreed that the bread should be baked with an admixture of substances like potato-flour. On June 29 1915 a Grain Office for the Empire was instituted and took over the whole traffic in grain; and on July 23 a similar department was set up for providing fodder for animals. A prohibition was issued against feeding cattle with rye or wheat. As it was at first impossible to enforce this prohibition by a system of minute surveillance, an order was issued that one-third of all the swine should be slaughtered. The lack of petroleum made itself felt, especially in the rural districts which had no other means of lighting. Illicit traffic in the kinds of goods that were under Government control began to spread, and profiteers raised prices far above real values. The Government was, therefore, compelled to adopt measures for preventing profiteering on the necessities of life. Maximum prices for petroleum were fixed in July 1916, and in Oct. of the same year for butter and potatoes. On May 22 1916 a War Food Office was established, with the former chief president of E. Prussia, von Batocki, at its head. The bread card was supplemented on Oct. 2 by a meat card allowing 250 grammes of meat weekly per head of population.

From Nov. 1 1916 onwards meat might be obtained only on Tuesdays and Fridays. Milk was also rationed, in order to assure a supply for infants and young children. The municipalities and communes made arrangements for supplying food to indigent persons; in the large towns popular kitchens were established which provided a meal at a low cost. The pupils in the schools were instructed to collect remnants of food and kitchen-refuse to supplement the fodder for cattle. The older pupils volunteered to go into the country and bear a hand in the harvest. Materials for clothing gradually began to be scarce. In July 1916 a Clothing Office for the Empire was instituted, and everyone who wanted to buy an article of wearing apparel had to apply to it for a permit; without the production of this purchase certificate no article of wearing apparel could be sold. German scientific experts were meanwhile doing their best to devise substitutes for articles of which there was a scarcity, and these efforts led to many new inventions.

The provision of financial resources for the prosecution of the war and for other public requirements presented a special problem. While Great Britain met her war expenditure in the main by increasing the tax revenue and issuing short-dated loans, Germany adopted from the first the method of issuing long-dated war loans. At the beginning of the war the Secretary of State Kühn was in charge of the finances of the Empire; he resigned in Jan. 1915 and was succeeded by Dr. Helfferich, who at a later date became the leader of the German National party (the Conservative Right). In May 1916 Dr. Helfferich succeeded Dr. Klemens Delbrück as Secretary of State for the Interior, and was himself succeeded in the Department of Finance by Count Rodern, hitherto Secretary of State in Alsace-Lorraine. The method of providing money remained the same throughout the war. The loans were employed not merely for meeting expenditure but also for meeting interest due upon previous loans. The result was a very rapid increase of the public debt, which by 1918 had reached the amount of nearly 102 milliard marks.

Altogether nine war loans were issued. The first (Sept. 1914, issue price 97·5%) produced 4,491,861,000 marks; the second (March 1915, issue price 98·5%) 9,106,394,700; the third (Sept. 1915, issue price 99%) 12,161,630,100 marks; the fourth (March 1916, issue price 95%) 10,767,598,000 marks; the fifth (Oct. 1916, issue price 95%) 10,651,726,200 marks; the sixth (April 1917, issue price 95%) 13,122,000,000 marks; the seventh (Sept. 1917, issue price 95%) 12,626,000,000 marks; the eighth (April 1918, issue price 95%) 15,001,000,000 marks; the ninth (Nov. 1918, issue price 95%) 10,443,000,000 marks. Beginning with the sixth war loan a system of periodical drawings was introduced in order to attract subscriptions. This method of meeting financial necessities was maintained until almost the end of the war, when it became manifest that the increased burden of interest was becoming gigantic. It is true that in 1916 and 1917 new measures of taxation were passed by the Reichstag, but the yield of this taxation was inconsiderable. By 1918 the estimates had grown to over 7¼ milliard marks, or almost 3 milliards more than in the previous year. The necessity of imposing fresh taxation was manifest, and the Reichstag adopted measures for this purpose in April 1916. The new taxes were estimated to produce a revenue of 3,179,000,000 marks. They were as follows:—a monopoly in spirits, to be administered by a Central Spirit Office, to which all the spirit manufactured by the distillers was to be delivered; an increase in the duty on beer; an increase in the duty on wine, amounting to an additional 20% of its value; an increase in the duty on sparkling wine of three marks per bottle; a duty on mineral waters and manufactured non-alcoholic drinks; a duty on coffee of 130 marks per 100 kgm.; a duty on tea of 230 marks, and on cacao and chocolate of 140 marks per 100 kgm.; an increase in the postal and telegraph tariffs; a war duty ranging from 10% to 50% on increased profits of companies; a stamp duty of four-tenths per thousand for ordinary stock, two-tenths on war loan and seven-tenths on foreign stock; further an increase of the duty on bills of exchange and money transactions (*Geldumsätzen*); a duty of 5 per mille on sales; a luxury tax on precious metals, jewels, works of art, antiquities, carpets, furs, pianos, fire-arms and motor vehicles. Simultaneously a law dealing with the evasion of these as well as previous forms of taxation, and imposing severe penalties, was passed. Further, a tax upon excess of income beyond the amount of the last pre-war assessment was enacted, with the object of confiscating a considerable part of war profits. These new measures of taxation did not succeed in putting the finances of the Empire upon a sound basis, as they could no longer be properly administered. After the close of the war, in consequence of the Revolution and the reparation payments imposed upon Germany, the national finances fell more and more into a state of complete disorder.

From the beginning of the year 1916 war-weariness was becoming more and more prevalent among the people, and the attempts of the Government and the press of the Right to fight it were unsuccessful.

A conflict arose between the navy administration and the Government of the Empire regarding the adoption of an intensified form of the U-boat warfare, and this conflict cast its shadow upon the whole of political life and formed the subject of violent debate in the press. In March 1916 the two conservative parties in the Reichstag tabled a resolution to the effect that complete freedom in the use of the U-boat weapon should be reserved in any negotiations with other Powers. Ultimately a compromise was effected in favour of another resolution, which declared:—"Seeing that the U-boat has proved an effective weapon against the British method of waging war with the object of reducing Germany to starvation, the Reichstag expresses its conviction that it is imperative to make such use of the U-boats as will assure the achievement of a peace giving security for the future of Germany." The Social Democrats voted in favour of this resolution with the exception of the Minority group of 18 deputies, to whom it gave the signal for separating themselves from the Social Democratic party in Parliament and forming a separate party under the name of *Sozialdemokratische Arbeitsgemeinschaft*. It was out of this group that at a later date the party of the Independent Socialists sprang.

On April 5 1916 the Imperial Chancellor delivered a speech in the Reichstag describing peace negotiations as out of the question so long as on the British side the object of the war continued to be the destruction of Germany. In describing the objects of Germany the Chancellor said that peace could only be concluded on the basis of the results of the war. Poland therefore could not be handed over again to Russia; the Polish question must be solved conjointly by Germany and Austria. On the German eastern frontier securities must be demanded against any repetition of the Russian attack. Belgium must not become a British vassal state, and must be economically joined up with Germany. In the Reichstag the speech was received with strong demonstrations of approval. It did not, however, succeed in uniting the nation afresh in a vigorous determination to prosecute the war to a successful conclusion. A similar fate attended later speeches which the Chancellor delivered in the Reichstag in Sept. and Nov., and in which, among other things, he said:—"A statesman who hesitated to employ against the enemy any effective instrument of warfare which is really calculated to shorten the war would deserve to be hanged." The dissensions between the Right and Bethmann-Hollweg became more and more acute. He was reproached with watering down the war aims and of having too little backbone when confronted with the pressure of the Left for a democratization of the Government. The Social Democrats on the other hand, and gradually also the *bourgeois* Democrats and the Catholic Centre, demanded from the Chancellor unequivocal assurances that the Imperial Government was prepared to conclude peace on an acceptable basis, and in particular to renounce all annexations and war indemnities. The Chancellor himself was inclined to yield to this pressure, but he encountered vigorous opposition from the Chief Command of the army, where General Ludendorff in particular advocated the principle that Germany could not conclude a peace which did not compensate her in the fullest degree by annexations and indemnities for the sacrifices she had made in the war. The Chief Command even went so far as to try to influence the policy of the Government, and Bethmann-Hollweg was not the kind of man resolutely to repel these endeavours. There gradually arose a situation in which the Chief Command actually acquired a real influence on the policy of the Empire. The result was that the Chancellor found himself in an ambiguous position in dealing with the demand of the Majority of the Reichstag for an unequivocal demonstration of the German desire to make peace. At this stage the Catholic Centre deputy Erzberger became more and more prominent as the champion of the views of the Majority, so that ultimately two strongly contrasted groups were formed, the Minority on the Right which represented the views of the Chief Command, and the Majority, composed of the Catholic Centre, the *bourgeois* Democrats and the Social Democrats, who pressed for an acceptable peace. In addition to these there arose on the extreme Left a small but very active group which put itself in the most uncompromising opposition to the Imperial Government and from 1916 onwards voted against all war credit. The leaders were the deputies Haase (the former president of the Social Democratic party), Dittmann, Geyer and Ledebour. As already mentioned, 18 deputies of this colour seceded on Jan. 12 1916 from the Social Democratic party. The deputies Liebknecht and Ruhle, who were still further to the Left, did not join this new extremist group, because it did not go far enough for them. In Sept. 1916 the Congress of the Social Democratic party of the whole Empire adopted a resolution which, while laying stress on the duty of defence, rejected the idea of a war of conquest and advocated reëstablishment of international relations.

The position of the Chancellor was rendered still more difficult by fresh and much more violent attacks upon him from the Right. He found it necessary to repel these attacks in very strong language in a speech which he delivered in the Reichstag. The worst of these attacks was a pamphlet directed against the Chancellor, which was published under the *nom de guerre* of

"Junius Alter" and had a large circulation. About the same time the director of the E. Prussian Credit Institute, Kapp (destined in 1920 to become celebrated as the perpetrator of the "Kapp *Putsch*"), published a denunciation of Bethmann Hollweg under the title of *Die Nationalen Kreise und der Reichskanzler*. The Chancellor's language in the Reichstag was so vigorous and contemptuous that Kapp sent him a challenge to a duel, which the Chancellor did not accept. There were a number of other similar incidents. Prof. Cossmann of Munich published violent attacks against Prof. Valentin of Freiburg, whom he charged with having obtained by theft material which he had used for an article on the number of vessels which had been sunk by the U-boats. Grand Adml. von Tirpitz intervened in this controversy. On June 28 1916 the Reichstag deputy Liebknecht was condemned to two-and-a-half years' penal servitude for having caused a popular demonstration in the Potsdamerplatz in Berlin, by a violent speech against the prolongation of the war. The constantly increasing influence which the Social Democrats were acquiring was shown by the action of the Government in conceding two of their demands: the prohibition of the use of foreign languages at political meetings was abolished, and the participation of young persons in assemblies arranged by the trade unions was now permitted.

The food situation had become considerably worse in the course of 1916. In Jan. of that year further restrictions had to be imposed upon traffic in winter corn and in groats for fodder. Maximum prices were fixed for artificial manures. Restrictions were placed upon the use of barley for brewing. In the following April the State took possession of coffee, tea and the substitutes (*Ersatz*) for them. Soap was rationed—600 grammes monthly per person. The consumption of meat in restaurants was restricted. In Feb. all materials for clothing and all ready-made clothes were seized by the Government. In Dec. the boot and shoe trade was subjected to the authority of the Department for Wearing Apparel. In April 1917 an order of the Federal Council limited the supply of paper for printing. In consequence of the bad harvest a great part of the milch-cows had to be slaughtered by order. The employment of substitutes (*Ersatzmittel*), the artificial production of albuminous foods, the manufacture of textile fabrics from nettle fibre and so forth, failed to make up for the deficiency in the real articles. On Nov. 25 Gen. Groener was entrusted with the charge of a department for providing for the efficiency of the economic and industrial equipment of Germany. A special law (*das Hilfsdienstgesetz*) enacted that all males between the ages of 17 and 60 should be compelled to work. Field-Marshal von Hindenburg issued an appeal for providing the munition workers with a better supply of food fats, whereupon the agricultural interest started a "Hindenburg Donation" movement for the purpose.

The opposition, which had gradually been gathering strength during 1916, was intensified early in 1917. On Feb. 1, Bethmann Hollweg announced to the Central Committee of the Reichstag the intention to prosecute the unrestricted submarine offensive, and, in view of the attitude of the United States of America, he defended this policy in a further detailed statement at a full session of the Reichstag on Feb. 27. The naval administration laid before the Reichstag certain calculations on the strength of which it was asserted that England would only be able to hold out against the submarine warfare for a few months. The Reichstag did not take up any definite standpoint in regard to the question, although the members of the different parties who spoke did not oppose the submarine warfare. Among the Social Democrats, the Democrats and the Catholic Centre party, however, a feeling was gradually gaining ground that tended more and more to emphasize the necessity for peace, and Bethmann Hollweg was reproached with being under the influence of the Supreme Military Command and with coöperating in the latter's war policy. On May 15 this feeling culminated in an important debate in the Reichstag on the subject of Germany's war aims. In a speech which gave rise to lengthy discussions, the Chancellor summarized these to the effect that a binding statement in detail of Germany's war aims would be injurious to the interests of the nation at that moment; that he would not permit himself to be influenced by any party, but would be guided solely by the consideration of the interests of the whole nation; that if Russia—the Tsar's Government having been overthrown on March 16 by the Russian Revolution—wished to conclude peace with Germany, Germany would make no demands incompatible with the liberty and welfare of the nations. In the course of the debate which followed, Scheidemann, the leader of the Social Democrats, vigorously attacked the war aims of the Pan-Germans, and said that if the Government continued to pursue such aims Germany itself would soon be faced by revolution. The speaker on behalf of the Central party, Dr. Spahn, also voiced the longing of the German people for peace, and emphasized the necessity of sincere coöperation between the Kaiser and his people. The Reichstag was then adjourned until July 6. When it reassembled on that day the strength of the feeling against Bethmann Hollweg had become more ominous than ever. The predictions in regard to the submarine warfare had not been fulfilled. America had entered the war, and the prospects for Germany were constantly becoming more and more gloomy. Deputy Erzberger had constituted himself leader of the opposition against the Chancellor, and on July 6, at a meeting of the Central Committee of the Reichstag, he disputed the possibility of bringing the enemy to terms by means of submarine warfare. Erzberger demanded the immediate initiation of negotiations for peace, on the ground that Germany's military situation would not be so favourable at a later date and that it was still possible to make an offer for peace which would have the prospect of obtaining a result favourable to Germany. The Social Democrats and the Democrats supported Erzberger, the former mainly with the object of demanding guarantees that would safeguard the influence of Parliament on the development of the political situation. Long and continuous conferences between the Chancellor and the party leaders ensued. Hindenburg and Ludendorff came to Berlin in order to intervene, but Bethmann Hollweg succeeded in preventing their being received by the Kaiser. The Crown Prince also came to Berlin and had consultations with members of the Reichstag. The Conservatives declared that they did not consider Bethmann Hollweg to be the right man to conduct German policy at this crisis. The Catholic Centre, the Democrats and the Social Democrats were united in working for his fall; and finally, Dr. Stresemann, who, owing to the severe illness of the leader of the National Liberals, Bassermann, was at the head of that party, declared that the National Liberals also had no further interest in his continuance in office. Bethmann Hollweg, however, did everything in his power to retain his position. He even persuaded the Kaiser to issue a declaration on July 11 in which a promise was made to carry out the franchise reform in Prussia which had long been demanded by the Left, and to conduct the next Prussian general election on the basis of this reform; the declaration entrusted the execution of these measures to the Chancellor.

But this final attempt to regain the support of the Left also failed. On the same day, July 11, the Bavarian minister-president, Count Hertling, was summoned to Berlin, and negotiations were conducted with him regarding his succession to the Chancellorship. Hertling, it is true, declined. Nevertheless, Bethmann Hollweg's day was over. On July 14 he tendered to the Kaiser the resignation of the Cabinet, and that resignation was accepted. Dr. Michaelis, who was at that time commissioner of state at the Food Department of the Empire, and who was regarded as an extremely capable official but had hitherto played no part in political life, was appointed as his successor. Michaelis was in general sympathy with the Conservative party. The press received the news of his appointment with marked reserve, as did also the Reichstag.

The new Chancellor was at once confronted with a difficult situation. The Catholic Centre party, the People's party and the Social Democratic party had agreed among themselves on a resolution in favour of peace, which they brought before the Reichstag on July 19 1917. This resolution proposed that a declaration be issued by the Reichstag to the effect that it desired to bring about a peace by agreement, which should be incompatible with acquisition of territory by force and with political, economic or financial measures of coercion. The declaration further condemned economic blockades and the creation of enmity between nations, and demanded that the "freedom of the seas" should be secured, and that the readiness of Germany to promote the organization of international law should be manifested. So long as the enemy Governments refused to entertain a peace of this kind the German people would resolutely stand together like one man and fight for their right of existence and development. The new Chancellor, Dr. Michaelis, declared, on the subject of this peace resolution, that Germany had only gone to war under compulsion, and that she would not continue to fight a day longer merely for the sake of making conquests by force of arms. He hoped to be able to achieve the aims of Germany within the four corners of the Peace Resolution "as he understood it." The Chancellor further expressed his readiness to appoint men who enjoyed the confidence of the principal parties to leading positions in the Government. His words, "As I understand the resolution," gave rise to lively discussions in the press and contributed to the immediate creation of a hostile feeling against Dr. Michaelis among the parties of the Left. The Chancellor himself modified the effect of his saving clause by stating that, in using it, he had had no intention of putting himself in opposition to the Peace Resolution of the Reichstag. The Resolution was passed by 216 votes against the 126 votes of the Right and the Independent Socialists, who were joined by a few members of the Catholic Centre party. Michaelis arranged for the Kaiser to meet a number of members of the Reichstag. This meeting took place at a social gathering at the official residence of the Secretary of State Helfferich, at which the Kaiser was present. This was doubtless the first occasion on which the Emperor William came into personal contact with the leaders of the Social Democratic party; among those present were Ebert, David and Scheidemann.

On August 5th Michaelis's new Cabinet was formed. Dr. Helfferich became Vice-Chancellor, vacating the Secretaryship of the Interior. A new economic department was detached from the Department of the Interior and entrusted to the burgomaster of Strassburg, Schwander. The chief burgomaster of Cologne, Wallraf, became Secretary of State for the Interior. The chief government president of Pomerania, von Waldow, was placed at the head of the War Food Department, with the Social Democratic trades union leader, August Müller of Hamburg, as his under-secretary. Von Krause became Secretary of State for the Department of Justice, and von Kühlmann, at that time ambassador at Constantinople, became Secretary for Foreign Affairs. The National Liberal deputy Schiffer, was appointed under-secretary of state to the Treasury. Maj.-Gen. Scheuch was made head of the War Ministry in the place of Gröner. Simultaneously with the reconstitution of the Cabinet of the Empire, that of the Prussian Government took place, from which the Ministers von Lobell, Beseler, von Trott zu Solz, von Schorlemer and Lentze, who were opposed to the introduction of universal suffrage, had resigned. The leader of the Catholic Centre, Dr. Spahn, was appointed Minister of Justice; Dr. Schmidt, up to that time ministerial director in the Ministry of Public Worship and Education, became Minister; the Minister of Agriculture was Landeshauptmann von Eisenhart-Rothe; Minister of Finance, Government President Dr. Hergt.

From the first the parties of the Left severely criticized these appointments on the ground that the desired parliamentarization of the Government had not been sufficiently carried out by them. The Social Democrats in particular immediately dissociated themselves in the most vigorous terms from Dr. Michaelis, and he found but few supporters either in the Progressist or the Catholic Centre parties. The adjournment of the Reichstag, however, gave Dr. Michaelis some respite. No actual crisis occurred until Oct. when the Reichstag reassembled. Early in 1917 there had been a case of mutiny in the navy. In the course of an inquiry into this case it had transpired that the mutineers had, previously, had dealings with the deputies Haase and Dittmann, members of the Independent Socialist party, and that these politicians had advised them "to be extremely prudent." Michaelis mentioned the matter in his speech in the Reichstag on Oct. 9, making it the text for a bitter attack on the Independents in the Reichstag, who, he said, had overstepped all permissible bounds because their aims were such as to endanger the existence of the Empire. The Secretary of State for the Navy, von Capelle, seconded the Chancellor's attacks. This parliamentary action against the Independent Socialists, which had not been very skilfully managed by Michaelis, as there existed no definite material for the prosecution of the deputies Haase and Dittmann, created an unfavourable impression among the Right also, as deputies on that side of the House considered that the disclosure of the fact of the mutiny had seriously damaged the prestige of the German navy. Michaelis himself ultimately realized that, under such circumstances as these, he could no longer remain in office, and he resigned.

On Nov. 2 the President of the Bavarian Ministry, Count Hertling, for many years leader of the Catholic Centre in the Reichstag, was appointed as successor. Hertling, who was over 70 years of age, was regarded as a man of diplomatic talent; his long parliamentary experience was in his favour, so that he entered upon his new duties with good prospects of success. He at once discussed the Government programme in detail with the different political parties and agreed to undertake the further development of the parliamentary system. He immediately confirmed this promise by appointing the leader of the Progressist People's party, von Payer, to replace Dr. Helfferich, who had retired as Vice-Chancellor. The leader of the National Liberal party in the Prussian Diet, Professor Dr. Friedberg, was similarly appointed vice-president of the Prussian Ministry. At the end of Nov. the Secretary of State of the Economic Department, Schwander, retired, and the under-secretary, Stein, was appointed in his stead. Hertling further made a number of concessions to the Social Democrats, such as the institution of Chambers of Labour and an extension of the trade-union right of combination to political associations. On Nov. 29 Hertling laid his programme before the Reichstag. He emphasized the fact that Germany's war aims were confined to defending the Fatherland, preserving her territories intact, and maintaining the freedom and independence of her economic existence. He gave proof of his endeavours to obtain peace by referring to the answer given to the Pope on November 19th in reply to his transmission of an alleged overture for peace, a reply in which Germany's readiness to enter upon peace negotiations was expressed. Hertling closed with the exhortation: "Wait, endure and persevere." He managed to avoid any collision with the various political parties, so that he soon gained their confidence, and by the end of 1917 stable conditions had once more been established in the Government of the Empire.

On July 24 1917 there died Ernst Bassermann, for many years the leader of the National Liberal party. On Sept. 2 a number of leading personalities founded the German *Vaterlandspartei*, with Duke Johann Albrecht of Mecklenburg as hon. president and Adml. von Tirpitz in charge of the practical conduct of the party. The programme of this party was to stand above all parties and to unite within itself members of any of them. Its purpose was to strengthen the resolution of the people and to leave nothing undone in order to create the conditions necessary for perseverance to the bitter end. Internal politics were not to be its business: nevertheless it was precisely in this sphere that it was destined soon to exercise a determining influence. It became the centre of all those who attempted to infuse into the people a spirit of victory and to oppose in the most resolute manner all thoughts of a disadvantageous peace. At first certain members of the Social Democratic party had joined the *Vaterlandspartei*; but soon the Social Democrat press opened the most vigorous campaign against it, charging it with wrecking every chance of peace. Then developed a bitter struggle which soon played a large part in the various German Parliaments and in the widest public circles. The *Vaterlandspartei* had large funds at its disposal, conducted far-reaching propaganda, and soon had vast numbers of members. Its activities produced no solid results in political life, but rather had the effect of further embittering internal struggles.

During 1917 food difficulties increased to an almost incalculable extent. Even rye for making bread became scarce. War bread steadily deteriorated in quality through the admixture of substitutes. Gradually a state of insufficient nutrition became prevalent among the entire populace and caused particular suffering to children and the aged. The winter of 1917–8 was popularly called the "swede winter," for lack of potatoes and meat made swedes a chief article of diet. In all the great cities soup-kitchens were established, partly from communal and partly from charitable funds, in order to offer to the poorer classes at least the possibility of obtaining meals which were at all adequate. Popular anger was directed especially against food profiteering, which assumed great dimensions. All legislative attempts to remedy this evil failed, because the cunning of the profiteer found ever new ways and means of evading the meshes of the law. In many places there were food riots, which were also directed against certain parts of the agricultural population, who tried to sell food at the highest possible prices. Regular centres of the profiteering trade arose, in which everything that was wanted could be obtained, though at enormously high prices; while trainloads of food and other necessaries were diverted or even stolen in transit in order to find the articles for this illegal traffic. It was in vain that specially instituted war-profiteering offices strove everywhere to put a stop to this trade; it remained impossible to eradicate it. The whole community of swindlers, too, profited by this state of affairs. The prosecution of a certain Frau Meta Kupfer, which came before the courts at Berlin in July, was a characteristic example. This woman had obtained loans all over the town, for which she often paid 100 per cent or more, alleging that she made enormous profits with these sums in the (illegal) food traffic. In reality she spent the money on a life of luxury, and paid interest out of fresh loans which she raised. She accumulated many millions of marks before the edifice of fraud which she had erected collapsed. The lack of food caused particular suffering to the labouring classes. Following an appeal by Field-Marshal Hindenburg in Sept. for a new economic and military armament of Germany, a "Hindenburg dole" was created in Oct. which was primarily intended for the benefit of soldiers disabled in the war. Maximum prices were fixed for a fresh series of commodities. In the spring of 1917 the consumption of bread had to be reduced to 170 grammes per head per diem, and even this quantity could not in some instances be supplied. All these circumstances materially contributed to create a feeling of longing for the end of the war; and this feeling, at the same time, was directed against the Government, which was considered responsible for such conditions. Strikes also began even among the munition workers. In order to make possible the continued production of munitions, great increases of wages had to be conceded.

At the very beginning of 1918, the fight for peace began with fresh violence. The main question was whether Pres. Wilson's Fourteen Points could form the basis for a peace. On Jan. 25, the Chancellor Count von Hertling announced his attitude to the Fourteen Points in the Main Committee of the Reichstag. He declared himself satisfied with them on the whole, with this restriction, that the peace must satisfy the rightful claims of Austria-Hungary, and secure the inviolability of Turkey. The nation began gradually to split into two parties, of which one rejected any disadvantageous peace, while the other conducted vigorous propaganda for peace even with concessions on the part of Germany. The deputy Erzberger became more and more prominent as the champion of this latter view. He entered into relations with Vienna, where the need for peace was even more urgent. In his endeavours Erzberger worked hand in glove with the Social Democratic party. The conclusion of peace with Russia furnished fresh material for the agitation of the advocates of peace. It was objected that this peace was not of such a nature as to enable Germany to hope for any conciliatory response from her enemies in the West. On Oct. 8, Erzberger laid down, in the Main Committee of the Reichstag, principles for Germany's Eastern policy, which could only betoken a declaration of war against the Hertling Cabinet. The Centre party, far from siding with Erzberger, actually published a declaration to the effect that the Government enjoyed the full confidence of the party; but the difference between Erzberger and Count Hertling was not thereby removed; and Hertling declined to receive Erzberger any longer.

In the spring of 1918, great attention was also aroused by a document published the previous year by the former German ambassador in London, Count Lichnowsky, who asserted in it that the German Government was responsible for the outbreak of war, while Sir Edward Grey on his side had done everything to prevent it. Lichnowsky in this connexion referred to a meeting of the Crown Council at Potsdam on July 5 1914, which was alleged to have been held with the Kaiser presiding, and which, according to Lichnowsky, adopted at that early date the decisions regarding the commencement of the war. The Vice-Chancellor, von Payer, declared on March 10 1918, in the Main Committee of the Reichstag, that these assertions were not in accordance with the facts, and denied that the alleged meeting of the Crown Council referred to had ever taken place. The controversy about this Crown Council was continued after the war. It was asserted again and again that it had taken place, as for instance after the Revolution by the then Bavarian Minister-President Eisner. Persons who were supposed to have been present at the Council, such as the Secretary of State von Jagow, repeatedly asserted, however, that the story of a meeting of the Crown Council on July 5 1914 was a fable (*see* EUROPE, section *War Period*).

As regards internal policy the Hertling Cabinet was the author of a number of new laws complying with some of the Social Democratic demands. Thus on June 8 the Reichstag passed a law for broadening the basis of the Reichstag. By this law the larger municipal and rural constituencies having more than 300,000 electors had a larger number of deputies assigned to them, and these were to be elected on the principle of proportional representation and *scrutin de liste*. On June 6 the salaries of members of the Reichstag were raised from 3,000 marks to 5,000.

In May the president of the Reichstag, Kampf, a member of the Progressive People's party, died. Fehrenbach, a member of the Catholic Centre party, succeeded him. Dr. Scheidemann and Dr. Paasche—Progressist Social Democrat and National Liberal respectively—became vice-presidents. Although the relations between the Chancellor Hertling and the Reichstag remained tolerable, dissatisfaction with several of the members of the Cabinet began to arise in the Reichstag. This applied especially to Kühlmann, the Secretary of State for Foreign Affairs, who was accused by the Left of having made a policy of annexation the guiding principle in concluding peace with Russia. Further, the *Deutsche Tageszeitung*, an organ of the Extreme Right, raised charges regarding Kühlmann's personal conduct during his stay at Bucharest. On June 21 Kühlmann made a very remarkable speech in the Reichstag, in which he stated among other things that an end of the war could no longer be reached by purely military decisions. The Chancellor, Count Hertling, considered it necessary in the next sitting to contradict this assertion by pointing out that there could actually be no question of any diminution of German confidence in victory. Herr von Kühlmann thereupon resigned, July 9. Adml. von Hintze, hitherto German minister at Christiania, was appointed his successor.

Meanwhile the Social Democrats clamoured for further progress in the direction of parliamentary Government. In Sept. they presented a series of minimum demands as the price of their continued support of the Government (demands which were very far-reaching) in internal affairs, and at the same time asked for the restitution of Belgium, liberation of all territories still under occupation, and the abandonment of the treaties of Brest-Litovsk and Bucharest. On Sept. 21 it was reported that Bulgaria had asked for an armistice. The Social Democrats now adopted a still firmer tone against the Government, demanding a true parliamentarism as the condition of their further collaboration.

Count Hertling did not see his way to complying. But the Catholic Centre and the Democrats adopted a similar basis for their demands in the Main Committee of the Reichstag, and on Sept. 30 Count Hertling asked to be relieved of his office.

The parties had already selected his successor, this being the first time a purely parliamentary choice had been made. They chose Prince Max of Baden, heir-apparent to the grand ducal throne of that state, who was considered to be a man of thoroughly democratic principle. His programme was the introduction of a radical parliamentary system, the restriction of the Kaiser's powers, and the acceptance of President Wilson's Fourteen Points. As Prince Max subsequently stated in the *Preussische Jahrbücher*, he did not intend to ask for an armistice, but merely wished to make an appeal to President Wilson in order to explain to him that he accepted his war aims and that Germany was ready to make heavy sacrifices in order to get peace. But Prince Max did not get the chance of putting his aims into practice. He succeeded indeed in making a few alterations, chiefly in regard to the appointment of Secretaries of State taken from the ranks of Parliament and invested with far-reaching powers. The opportunity for any further activities was denied to Prince Max of Baden's Cabinet. At the beginning of Oct. General Headquarters had already demanded that an immediate application should be made for an armistice. Meanwhile naval mutinies began in Kiel and Wilhelmshaven. In Munich the Republic was proclaimed, and the Social Democrats threatened the Imperial Government with action of a very thoroughgoing character. Accordingly Prince Max retired on Nov. 9 1918, having first appointed the Social Democrat Ebert to be his successor, and now the period of revolution began for Germany.

(C. K.*)

The Revolution.—The official birthday of the German Revolution is Nov. 9 1918. Its real beginning lay much further back. The war-years, with the burdens and the hardships which they imposed upon the people, had aroused feelings and had created conditions which in the political as in other spheres were big with the elements of a volcanic outbreak. A wise and skilful government might perhaps have been able to control the whole movement and to divert it into calmer channels, either by meeting the demands of the masses and effecting reforms of the constitution in time, or by fighting the movement with ruthless determination by every means at its command. The Government had neither the resolution nor the strength to adopt either of these courses. It vacillated between concession and resistance, and it drifted with the stream of circumstance into a situation where events simply crushed it out of existence. The last Imperial Chancellor of the old *régime*, Prince Max of Baden, had attempted at the last moment to stem the course of events by concessions. But he only did so when it was too late, and did it in a way which exhibited the characteristics of weakness too patently to have any real influence upon the course of events. It has already been mentioned that Prince Max desired to carry out a programme which would have placed the constitution of the Empire upon a new and far more liberal basis, and which in its broad lines would have embodied the principle of an Imperial Democracy (*Volkskaisertum*). The authoritative posts in his Cabinet were entrusted by Prince Max to Secretaries of State taken from the ranks of Parliament. The appointments were Gröber and Erzberger of the Catholic Centre party, Haussmann of the Progressive party (corresponding to the post-Revolution *bourgeois* Democrats) and Scheidemann of the Social Democracy. The Imperial Home Office was also given to a member of Parliament, the Catholic Centre deputy Trimborn, while the Department of Public Economics (*Wirtschaftsamt*) was given to the Social Democrat Bauer, with the Catholic Centre deputy and prominent trade unionist Giesberts as under-secretary. At the head of the Foreign Office was placed the former Colonial Secretary, Dr. Solf, with the Social Democrat David as under-secretary. The Prussian War Minister, von Stein, was replaced by General Scheuch, who was reputed to have Liberal views. In the speech which Prince Max delivered in the Reichstag on Oct. 5 1918, he set forth a government programme containing a decisive p fession of democracy, and other points asserting as an article faith the right of nationalities to determine their own political destinies. He likewise declared himself in favour of the evacuation of Belgium, and even offered compensation. This declaration of policy was immediately followed, on Oct. 28 1918, by a number of measures intended to make the constitution democratic and curtailing the prerogative of the Emperor. The Secretaries of State, who were members of Parliament, were accorded far-reaching powers. The military authorities were in future to issue instructions only with the assent of the civil administration. For the Imperial Chancellor in the exercise of his office the confidence of the Reichstag was to be requisite. Appointments, transfers, promotions and dismissals of officers could take place only with the counter-signature of the Imperial Chancellor or of the War Minister, whereas they had hitherto been effected by Imperial Cabinet order.[1] The Emperor issued an edict, published on Nov. 2, referring to this democratization of the constitution, and containing the sentence "the office of Kaiser is service for the people." But, as has been pointed out, all these measures were useless, because, before effect could be given to them, they were anticipated by the Revolution and all that it entailed.

The Revolution started in Kiel. A rumour had spread among the sailors that the fleet was at last going to be staked in battle. The result was that the crews hoisted the red flag on the ships and arrested the officers, or even, when they resisted, murdered them. The mutiny spread from Kiel to Travemünde, Hamburg and Wilhelmshaven. On Nov. 8 the Republic was likewise proclaimed at Munich. The Imperial Chancellor, Prince Max, did not know what to do when confronted by these events; his attitude was one of helplessness. The Social Democrats urged him to compel the Emperor to abdicate. Prince Max considered that he must yield to this demand, so he sent plenipotentiaries to Grand Headquarters at Spa, who pressed the Emperor to renounce the throne. The Emperor at first refused; and it has never been definitely ascertained how far there was a misunderstanding about this. What is certain is that, at the moment when Prince Max announced on the morning of Nov. 9 that the Emperor had resolved to renounce the throne and that there had been a corresponding renunciation on the part of the German Crown Prince, no renunciation either by the Emperor or by the Crown Prince was actually in his possession. He may have hoped by proclaiming such a renunciation to be able at least to save the throne for the House of Hohenzollern. But in that case he entirely failed to realize how far matters had already gone. On Nov. 9 the Revolution had already commenced in Berlin. For Prince Max no other course was now open but to retire at once together with his Cabinet. He vanished from Berlin and betook himself to his home in Baden.

Meanwhile the final events were taking place on the western front—the German request for an armistice, the negotiations with Foch, and the agreements which were concluded with him. The Emperor William left the front on Nov. 10 on the advice of those about him, because they believed that they could no more guarantee his personal safety. He betook himself to Holland, where, to begin with, he claimed the hospitality of Count Bentinck at Amerongen Castle. He was followed by the German Crown Prince, who was interned on the island of Wieringen in the Zuyder Zee. On Nov. 28 the Empress left Germany and joined her husband in Holland. The actual abdication of the Emperor did not take place till Nov. 28, the day of the Empress's arrival at Amerongen Castle. The Emperor signed on that day the abdication document which was laid before him by a deputation sent to Amerongen by the new Revolutionary Government. The Crown Prince renounced the succession on Dec. 5.

In the Republican Reich (formerly the German Empire) matters were now *en train.* In all the states of the Confederation the sovereigns had been compelled to abdicate; nowhere had there been any fighting or bloodshed in connexion with these particular events. In Berlin the Revolution wore a theatrical rather than a dramatic aspect. The *bourgeoisie* there as elsewhere had been systematically kept by the Imperial Government in ignorance of ominous symptoms and incidents. The press had not been allowed to make the slightest disclosure of these things. Thus the citizens of Berlin—and the same holds true of the whole Reich—were absolutely taken by surprise when on the afternoon of Nov. 9 motor-lorries suddenly appeared in the streets all over the city, full of armed workmen, mostly youths, carrying red flags. They delivered speeches from the lorries and asserted that the Government had fallen. The only other thing that they did was to tear the black-white-and-red cockades from the caps of officers and soldiers whom they met in the streets, and to cut the epaulettes from the officers' coats. The outward beginning of the Revolution in Berlin was a procession of workmen which made its way into the city from the working-class quarter in the north and started by attempting to storm the barracks situated at the north end of the Friedrichstrasse. The guard fired upon them. Then the command arrived not to fire upon masses of workmen. This command was issued to all the military posts. From whom it came was never definitely ascertained. In these circumstances the only thing that the military could do was to surrender to the insurgents without a blow. In a number of instances sections of the troops joined the insurgents. There was therefore no bloodshed on the day of the Revolution or on the succeeding days. In fact one or two battalions would have sufficed to nip the whole business in the bud. Here and there shooting occurred—at the Castle, for example, where a search was being made for officers reported to be armed, and in the neighbourhood of the Castle; but these incidents rather provided amusement for the revolutionary bands, largely composed of youths.

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[1] The Emperor had three "Cabinets" or offices of his household—a civil, a military and a naval Cabinet, through which and occasionally on whose advice he had directly exercised his military and civil prerogatives. (Ed. *E.B.*)

The Revolution had been systematically prepared by members of the Independent Socialist party. The deputy Ledebour afterwards publicly boasted that he had been working at these preparations since 1916. Barth and Däumig made similar statements. The Independent Socialist Cohn is understood—indeed he subsequently admitted it—to have received large sums of money from Russia for the purposes of the Revolution; they were said to have amounted to about 12½ million marks. Bands of picked men (*Stosstruppen*), lavishly provided with rifles and machine-guns, had everywhere been formed. The "majority" (or governmental) Social Democratic party did not officially participate in these schemes. But when the Revolution began on Nov. 9, they associated themselves with the revolutionaries, and it was perhaps due to them that the Revolution did not take the course which it took in Russia, and that by persistent efforts order was gradually restored. The *bourgeoisie* was absolutely helpless in the days of the Revolution. It took things as they came and did not lift a finger to prevent them. Many sections of this class even thought that the time had come to go over with flying colours into the revolutionary camp of the Social Democracy, in order to participate in the advantages which the Revolution promised to secure for those who professed extreme opinions.

The Social Democrat Scheidemann, who had been in the Cabinet of Prince Max of Baden as a Parliamentary Secretary of State, had announced his resignation on Nov. 8. Prince Max, when he withdrew on Nov. 9, installed the Socialist leader Ebert as Imperial Chancellor. Ebert issued on the same day an appeal "to German citizens," inviting them to coöperate in the new order of things, even if they felt difficulty in doing so; on no account must there be any breakdown in that hour of trial. The Social Democrats then opened negotiations with the Independent Socialists, and a Council of Commissioners of the People (*Volksbeauftragten*) was set up as the supreme revolutionary authority, the two parties each being represented on it by three of their leading men. Ebert, Scheidemann and Landsberg were the three Social Democratic commissioners; Haase, Dittmann and Barth were the three Independents. The bureaucracy, with few exceptions, declared its readiness to continue its work provisionally under the new revolutionary *régime.* All the officials of the ministries, for example, remained at their posts, and tried their best, amid the confusion which at first reigned, to go on with their work upon the old lines.

The Council of Commissioners of the People had first of all to form a new Cabinet. It is noteworthy that this Cabinet consisted almost entirely of non-Socialists (*Bürgerliche*). The Prussian War Minister, Scheuch, and the Secretary of State for the Navy, von Mann, remained at their posts, and so did Dr. Solf at the Foreign Office, and Erzberger as a Parliamentary Secretary of State. The National Liberal deputy, Schiffer, became Finance Secretary, and the Progressist (non-Socialist Democrat) Professor Preuss was made Secretary of State for the Interior. It was only at the Food Department of the Reich that a Social Democrat, the deputy Wurm, was appointed. The first legislative order, which was issued in the form of an "ordinance having the force of law," swept away a number of pre-revolution enactments. Thus it raised the state of siege, abolished the restrictions upon the right of association and public meeting, decreed freedom of the press, proclaimed an amnesty for political offenders, repealed the wartime law which made patriotic auxiliary service obligatory, abrogated the regulations applying to domestic service and the special provisions regarding the obligation of agricultural labourers to work, while it enacted that private property should be protected. Further, it was at this early stage announced that elections would be held for a Constituent National Assembly, and that all men and women who had attained the age of 20 should be entitled to vote. At first, it is true, the new revolutionary Government was unable to evolve order out of the turbulent situation which had arisen with the Revolution. In all the towns and the larger villages Workmen's and Soldiers' Councils were formed and took over the administration, doing as they pleased with the money that was at their disposal, and in many instances issuing absolutely ridiculous and absurd orders. A central authority that could in any way intervene did not exist, so that each Workmen's and Soldiers' Council did as it pleased. Gradually the Berlin Workmen's and Soldiers' Council attempted to introduce a certain degree of order into the situation by assuming the part of the authoritative and supreme body placed over all the Workmen's and Soldiers' Councils of Germany, although it by no means succeeded in getting itself recognized by all the rest of the Councils. There was even a movement in the Berlin Workmen's and Soldiers' Council to get the powers of the Government permanently into its hands and to prevent the elections for a National Assembly. In the other parts of Germany, especially in the south, the most violent opposition arose against this arbitrary action of the Berlin Workmen's and Soldiers' Council. The Social Democratic party likewise published a declaration of its fundamental conviction that a reign of terror by an arbitrary Parliament of Councils was not in accordance with democratic principles such as it considered to be authoritative for the construction of the new Republic. The Soldiers' Councils now dissociated themselves from the Workmen's Councils and turned against them, accusing them of gross mismanagement of the finances and of squandering war material and food. Meanwhile the Berlin Workmen's Council had elected an Executive Board as its supreme authority, and this new body was claiming for itself the management of the whole business of the Reich and representing itself as the body which was entitled to exercise supreme authority and surveillance over the Government.

The constant attacks which were being made by the various Workmen's and Soldiers' Councils upon officers caused the War Minister, Scheuch, to resign office on Dec. 15. Colonel Reinhardt was appointed his successor. The Government now convoked for Dec. 16 a congress of delegates of all the Workmen's and Soldiers' Councils of Germany to meet in Berlin. At this congress there were wild scenes of conflict between the Extremists and the Moderates. The latter, however, were throughout in the majority, so that the Congress conferred executive and legislative powers upon the six Commissioners of the People, fixing the date of the elections for the National Assembly for Jan. 19 1919. The Berlin Executive Board was thus put out of action. It continued, indeed, to make attempts to get into power again, but without success.

Meanwhile the Extremist group on the left wing of the Independent Socialists had seceded and had formed a party of their own called the Spartacus League, the more prominent leaders of which were Dr. Liebknecht, Rosa Luxemburg, and Däumig. This Spartacus League rejected the principle of democracy, and advocated a "dictatorship of the proletariat" in the form of a Soviet Republic on the Russian model. The Russian Bolshevik, Radek, was present at the meeting at which the League was founded, and was welcomed as the representative of Bolshevik Russia. The League at once organized a violent campaign conducted by every conceivable method against the Council of Commissioners of the People, preaching a second revolution against them. Already on Dec. 5 there had been collisions between a mass demonstration of the Spartacists and some military detachments. On Dec. 24 a regular battle began for the possession of the imperial castle, occupied by the Spartacists, and for the neighbouring imperial stables, which they also held. The Government sent troops against the insurgents, who chiefly consisted of former members of the Sailors' Division, formed during the first days of the Revolution in Berlin. The castle and the stables were stormed by the troops after a sanguinary struggle; there were heavy losses on both sides. The sailors were finally compelled to lay down their arms on a promise of immunity from punishment.

The Independent Socialist members of the Council of Commissioners of the People, Barth, Dittmann and Haase, had during the fighting adopted a very ambiguous attitude. After the capitulation of the insurgents they resigned office on the ground that the revolutionary Government ought not to have employed troops against the rebels. Their places in the Council of Commissioners were taken by the Majority Socialists Noske and Wissel, the first-mentioned of whom had done very good service in putting a stop to the naval mutiny at Kiel at the beginning of the Revolution. On Dec. 20 Dr. Solf resigned his post as Secretary of State at the Foreign Office, and was replaced by the minister at Copenhagen, Count von Brockdorff-Rantzau.

In Prussia, too, the Revolution had resulted in upsetting the central organization of that state. On Nov. 12 a Prussian Ministry, composed of Social Democrats and Independent Socialists, was formed. It took the curious form of a kind of dyarchy running through the whole of the departments, one minister being presumably appointed to watch and check the other. The presidency was held conjointly by the Social Democrat Hirsch and the Independent Socialist Ströbel, with equal rights. The Upper House and the Chamber of Deputies were dissolved. The only minister of the old régime who remained in office was the Minister for Railways, Breitenbach, but he retired on Nov. 26 and was succeeded by the ministerial director of that department. The Minister of Justice, Spahn, was replaced by a couple of Socialist lawyers, Rosenfeld and the highly cultured and gifted Wolfgang Heine; the Majority Socialist Dr. Sudekum was made Minister of Finance. The maddest appointment was that which was made to the Ministry of Public Worship and Education, where, alongside of the moderate Majority Socialist Haenisch, the Independent Socialist Adolf Hoffmann was installed, a man known by the nickname "Ten Commandments Hoffmann," because he was fond of introducing in his speeches passages from the Bible, although he had left the Church and did not profess any religion. Hoffmann was not proficient either in speaking or in writing the German language; he could neither open his lips nor take up his pen without perpetrating solecisms and grammatical blunders, to say nothing of the fact that he had not the slightest idea of the administration of schools or churches. His action was in keeping with his qualifications and was absolutely reckless; he never even informed his Majority Socialist colleague Haenisch of the autocratic ordinances which he issued. He straightway abolished the contribution of the State to the expenditure of the Church, and decreed that instruction in history should henceforth only be given from Social Democratic text books. He likewise abolished all religious instruction. There was soon a storm of indignation against Hoffmann in all scholastic circles, so that his colleague Haenisch had to revoke all Hoffmann's decrees. Irritated at this, Hoffmann resigned, after having taken care to draw his salary from the funds of the Ministry for several months in advance. There was a still worse state of things in the former duchy of Brunswick, where the president of the state was a tailor named Merges, while the Minister of Public Worship was a washerwoman.

The year 1919 opened with sanguinary disturbances. The Spartacus League under the leadership of Dr. Liebknecht had made elaborate preparations for a fresh insurrection. In the first days of January, mass demonstrations of the Spartacus League began in Berlin with the participation of large numbers of the Independent Socialists. The Majority Socialists called upon their adherents to assemble for counter-demonstrations in the Wilhelmstrasse and the Wilhelmsplatz, the quarter in which the Government offices were situated. Collisions at once took place in this district, but there was no bloodshed. It was not till Jan. 5 that the real rising commenced. The adherents of the Spartacus League, who were amply provided with rifles and machine-guns, first occupied the so-called "newspaper quarter" of Berlin, in particular the offices of the great non-Socialist journals, and also the great building of the Majority Socialist organ *Vorwärts*. They then tried to force their way into the Wilhelmstrasse. The Government had at its disposal only a small and diminishing number of troops. If the Spartacists had pressed their attack home with greater energy, it would have been easy for them to occupy the Government offices and to expel the Government. They were, however, intimidated by the sight of a handful of soldiers, who had occupied the approaches to the Wilhelmstrasse with machine-guns, and although there were various shooting affrays they did not venture upon any real assault. The Cabinet now entrusted one of its members, Noske, who had taken over the Ministry of National Defence (*Reichswehrministerium*), with the task of procuring troops. Noske, with the assistance of Gen. von Lüttwitz, collected in the western suburbs of Berlin all the troops that were available in the neighbourhood of the capital. Some new formations were also organized; they were mostly recruited from officers of the former German army. With these troops Gen. von Lüttwitz marched into Berlin, and a bloody struggle began, which lasted several days and finally resulted in the defeat of the Spartacists. Some of the newspaper offices had to be besieged for days and even bombarded with artillery, before the Spartacists who were holding them would surrender. There was a great deal of isolated fighting, and frequently there was firing from the roofs of the houses. A warrant for the arrest of Liebknecht and Rosa Luxemburg, who were at the head of the insurrection, was issued. Liebknecht was arrested on Jan. 16 in a Berlin suburb where he was in hiding, and was taken to the Eden hotel, where Gen. von Lüttwitz had established his headquarters. When the prisoner was being transported from the hotel to Moabit prison, he was shot by his military guards as he was making an attempt to escape.[1]

His associate, Rosa Luxemburg, had a similar fate. She, too, was arrested, and was conducted to the Eden hotel. When she was about to be transported thence to prison, she was felled by a soldier with the butt end of his rifle. Seriously injured and unconscious, she was placed in a motor-car, where another soldier shot her through the head. The motor-car rapidly conveyed her body to the neighbouring Landwehr Canal, into which it was flung. Several weeks elapsed before the body was found. Her funeral, like Liebknecht's, was attended by large crowds of their Spartacist followers. The murderer of Rosa Luxemburg was subsequently brought to trial, and was condemned and sentenced to a term of imprisonment. Altogether there were several hundred lives lost in the Spartacist rising of Jan. 1919. In Stuttgart, as also in Bremen, Munich and other towns, there were sanguinary struggles, until the insurrection could be regarded as having been everywhere suppressed.

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[1] The Independent Socialists and the Communists afterwards persisted in maintaining, on the ground of some contradictory medical evidence, that Liebknecht was shot in cold blood.

The elections for the National Assembly had taken place on Jan. 19. They resulted in a Socialist majority. The Majority Socialists won 163 seats, the Independents 22. As against these 185 Socialists there was a non-Socialist (*bürgerlich*) majority of 236, of whom 42 belonged to the German National People's party (the former Conservatives), 21 to the German People's party (formerly the National Liberals), 88 to the Christian People's party (formerly known as the Centre) and 75 to the Democratic party (formerly the Progressists); while 10 non-Socialist deputies did not adhere to any party. The total numbers of the votes recorded for the different parties were 11,509,048 for the Social Democrats, 2,317,290 for the Independent Socialists, 5,980,216 for the Christian People's party, 5,641,825 for the Democrats, 3,121,479 for the German National People's party, and 1,345,838 for the German People's party. It is noteworthy that the non-Socialist parties had all assumed new popular designations. In course of time, however, their old names came again into use, except in the case of the Democrats, whose new designation was more generally convenient.

The National Assembly was convoked to meet, not in Berlin, where constant disturbances were probable, but in Weimar in Thuringia, where it assembled on Feb. 6 1919. The Berlin Spartacists—the party afterwards known under the more comprehensive designation of Communists—made a fresh attempt at the beginning of March to abolish the National Assembly and to set up a Dictatorship of the Councils. It decreed a general strike for the whole of Germany, but the strike attained considerable dimensions only in Berlin. Once more it was the Marine Division which had recourse to acts of violence. It occupied the suburb of Lichtenberg, whence it attempted to force its way into the centre of Berlin. There were again sanguinary struggles in which more than 1,000 persons were killed. Among these were 29 members of the Sailors' Division, whom First Lieut. Marloh caused to be shot, after they had been arrested by the troops, when they had unsuspectingly come to fetch their pay. Proceedings were instituted against Marloh, but he was acquitted. The March rising of the Spartacists was completely quelled. Local risings in different places had the same fate,—at Halle, for example; at Stuttgart and at various other places in Württemberg; at Munich (where on April 7 a Soviet Republic was proclaimed); at Dresden (where on April 12 the Saxon War Minister Neuring, a Social Democrat, was thrown into the Elbe by the mob and perished); at Leipzig, at Hamburg, and so forth. In many of these local risings hundreds of people lost their lives.

The Constituent National Assembly sat at Weimar from Feb. 1919 onwards, meeting in the Weimar theatre, which was specially reconstructed. The Majority Socialist David was almost unanimously elected President. A matter of first concern was to get together a majority upon which a responsible Government could be based. Negotiations between the Majority Socialists and the Independents failed, because the two parties together were not sufficiently numerous to form a majority in the House, while the Independents refused to enter a coalition with any of the non-Socialist parties. The Catholic Centre and the Democrats, on the other hand, were prepared to renew the connexion which had united them with the Social Democrats in the old Reichstag since the date of the "Peace Resolution." Thus there arose a coalition of the Catholic Centre, the Democrats and the Social Democrats, who undertook to form a Cabinet. On Feb. 11 the National Assembly elected the Social Democrat Ebert to the presidency of the Reich by 277 votes against 102. Ebert entrusted the formation of a Cabinet to the Social Democrat Scheidemann, who assumed the office of Minister-President. The Democrat Schiffer was appointed Vice-President of the Ministry. The other members of the Cabinet were Count Brockdorff-Rantzau (Foreign Affairs), Preuss (Interior), Schiffer (Finance)—all these three belonged to the Democratic party—Giesberts (Post Office), Bell (Colonies)—both members of the Catholic Centre—Landsberg (Justice), Noske (National Defence), Bauer (Labour), Wissel (Ministry of Economics), Robert Schmidt (Ministry of Food), all these being Social Democrats. Erzberger, of the Catholic Centre, the Democrat Gothein and the Social Democrat David were members of the Cabinet but without portfolio. Fehrenbach replaced David as President of the National Assembly. The Right, *i.e.* the German National party and the German People's party (formerly Conservatives and National Liberals respectively), at once placed themselves in the most pronounced opposition to the new Cabinet, and on the extreme Left the Independent Socialists did the same. The whole session of the National Assembly at Weimar was characterized by controversies on these lines, which frequently assumed an extremely violent character. This was particularly the case during the debates on the new Constitution, for which Prof. Dr. Preuss had drafted a scheme. There were particularly stormy scenes when the questions of the socialization of industries and the new colours of the Reich were being discussed. A compromise on the second of these questions was proposed by the Catholic Centre and the Social Democrats, and it was finally agreed that the colours of the Reich should be black, red and gold, while the flag of the mercantile marine should be black, white and red, the colours of Imperial Germany, with black, red and gold in the upper canton next the staff. This was carried by 211 votes against 89.

The first grave ordeal which the new Coalition had to undergo was the ratification of the Treaty of Versailles. Up to the end of June the House, with the exception, perhaps, of the extreme Left, was unanimously of the opinion that a peace such as that which had been dictated by Germany's adversaries could not in any circumstances be accepted. The Minister-President Scheidemann declared in the House, amid tremendous applause: "Let the hand which signs this peace wither!" On June 22 the debates on the question of accepting or rejecting the Treaty of Versailles began. Scheidemann's Cabinet, which had committed itself to rejection, had resigned on June 21; it wished to leave the National Assembly perfectly free in its decision. The formation of the new Cabinet was effected under the greatest difficulties; it was finally undertaken by Bauer, who had hitherto been Minister of Labour. The Democratic party, the majority of whom were against signing the Treaty, declined to enter the new Cabinet. The Catholic Centre, too, was at first against accepting the Treaty, and it required great efforts and all the parliamentary diplomacy of Erzberger to bring about a change of opinion in the majority of his party. Finally the Bauer Ministry was formed for the purpose of signing the Treaty; the only parties represented in it were the Social Democrats and the Catholic Centre. Members of it who may be mentioned here were Müller (Foreign Affairs), Noske (National Defence), Erzberger (Finance) and Bell (Colonies)—the last-mentioned being, so to speak, a minister *in partibus*, as Germany no longer had any colonies. Each of the parties in the Assembly made only a short formal statement; the vote resulted in the acceptance of the Treaty of Peace by 237 against 138, while 5 deputies refrained from voting. The majority consisted of the Catholic Centre with the exception of its 13 Bavarian members, the Social Democrats and the Independent Socialists, together with 7 of the Democrats. The resolution adopted was in the following terms: "The National Assembly approves of the attitude of the Government in the question of the signature of the Treaty of Peace." The Government now sent word to Paris that it was prepared to sign the Peace, but that it rejected the passage in the preamble which dictated a confession of Germany's guilty responsibility for starting the war, and further, that it rejected the extradition of the army leaders and of those who were characterized by Germany's enemies as war criminals. The reply having come from Paris that the Peace must be signed unconditionally, the National Assembly gave the Government, on June 23, by the same majority as before, full power to sign even in these circumstances. The signature accordingly took place at Versailles on June 28 by the hands of the German Minister for Foreign Affairs, Hermann Müller, and the Minister for the Colonies, Bell. On July 9 the National Assembly, by 208 votes to 115, gave its assent to the signature.

The most active member of the Bauer Ministry turned out to be the representative of the Catholic Centre, Erzberger, who gradually gave the whole Ministry its characteristic colour. He was always in the forefront when the Opposition had to be met. He replied to the attacks of the Right with still sharper counter-attacks. The question of responsibility for the war took a leading place in these encounters. Erzberger charged the Right and those who had been behind it with having destroyed all chance of concluding peace before it was too late. The Right, on the other hand, reproached Erzberger with having prematurely published the news of the Pope's attempt at mediation in Aug. 1917, with the result that the Vatican was compelled to abandon its efforts, so that the effect of Erzberger's action had really been to prevent peace. Erzberger's chief opponent in these controversies was the former Secretary of State for the Imperial Finances, Dr. Helfferich, who was now a deputy belonging to the German National (Conservative) party. A newspaper feud between Erzberger and Helfferich ensued, and led to an action for libel by Erzberger against Helfferich, the issue of which was delayed until March 1920. These controversies were again and again fought out on every possible occasion in Parliament, and filled columns of the press for many months.

The deliberations on the new Constitution were concluded on July 31 1919, and the final vote was taken upon the project as a whole. The Constitution was carried by 262 votes against 75, the minority consisting of the German National (Conservative) and the German People's (National Liberal) parties. On Aug. 11 the formal signature of the Constitution took place, and on Aug. 21 the Provisional President of the Reich, Ebert, solemnly took the oath of fidelity to the Constitution. According to the terms of the new Constitution (Art. 41) the President of the republican Reich must be elected by the whole of the Germans who possess the franchise; but, as the future extent of German territory had not yet been settled in accordance with the Treaty of Versailles, seeing that plebiscites had still to be taken in various regions, the first President, Ebert, was elected provisionally. The Minister-President Bauer now assumed the title of Chancellor of the Reich in accordance with Art. 52 of the Constitution. The National Assembly then adjourned till Sept., and decided to return to Berlin, where the situation had meanwhile become calmer, so that there was no longer believed to be any danger of interruption by demonstrations.

When Parliament resumed its session in Berlin at the end of Sept. negotiations were at once opened by the Government parties—the Catholic Centre and the Social Democrats—with the non-Socialist Democrats, with a view to the reëntry of the latter into the Coalition. The result was that the Democrats Schiffer and Koch became members of the Cabinet, Schiffer at the Ministry of Justice and Koch at the Ministry of the Interior. Shortly afterwards the Bavarian Democrat Gessler, chief burgomaster of Nürnberg, was appointed to a new office, that of Ministry of Reconstruction. On Oct. 11 the Ministry for the Colonies was abolished, as there were no longer any colonies to administer. The Right now started a campaign in favour of having a general election at an early date for the Reichstag, on the ground that the National Assembly had finished its task by passing the Constitution. This demand was extremely unwelcome to the Left, which did not expect to be successful in new elections and wanted to carry with the existing majority a number of laws in fulfilment of its own legislative programme. Perhaps the most important of these measures was the Factory (or Industrial Councils) bill, which contemplated the formation of councils in factories and other industrial and commercial establishments, giving the workers and salaried employees representative boards as well as a certain influence upon the management of the business in which they were engaged. Another important bill which was ultimately passed was the Socialization Law, laying down in general terms the principle that the whole mining industry should be transferred to the ownership of the State. The controversies on these matters were conducted by the interested parties throughout the country as well as in Parliament. The Factory Bill was not passed until 1920.

Particular difficulties were caused by the necessity of opening up new sources of revenue for the State. The public debt had increased to about 220 milliards of marks; the budget had reached the figure of 15 milliard marks of ordinary expenditure and 41 milliard marks of extraordinary expenditure. On June 28 the Minister of Finance, Erzberger, submitted to the National Assembly a number of minor taxation proposals, the most important of which was the War Contribution bill, which contemplated a levy rising to 50% upon the excess of incomes during the war over peace incomes. Similarly the greater part of capital increases during the war was to be appropriated by taxation, and the taxation of tobacco, sugar, matches, etc., was to be raised. On July 8 Erzberger developed a detailed financial programme in which he announced proposals for the so-called Emergency Contribution for the Reich (*Reichsnotopfer*), contemplating the sequestration of a considerable percentage of all personal fortunes. He advocated at the same time the transference of the administration of all state taxation from the territories (states) to the Reich. On Nov. 27 the National Assembly accepted this principle by passing a bill for regulating contributions by the states to the finances of the Reich. On Nov. 17 1919 the law enacting the Emergency Contribution to the Reich was carried by 238 votes against a minority of 43. On Nov. 7 the leader of the Independent Socialists, Haase, died from wounds which had been inflicted upon him by an insane assassin some days earlier as he was entering the Reichstag building. Other noted parliamentarians who died in the second half of 1919 were the leader of the Catholic Centre Gröber (Sept. 19) and Friedrich Naumann, leader of the Democratic party and author of the celebrated book *Mitteleuropa* (1915). (C. K.*)

—*After the Revolution.*—On Jan. 10 1920 the Treaty of Versailles came into force. On that day the representatives of Germany, von Simson and Lersner, signed the protocol of ratification at the French Ministry for Foreign Affairs in presence of representatives of the principal Allied Powers. America was not represented. From this date the time-limits for the fulfilment of the obligations contemplated by the Treaty and for the plebiscites began to run; and the whole course of German politics in 1920 was dominated by the anxieties over these problems. In a New Year's message the President of the Reich, Ebert, said: "Under the pressure of ruthless coercion a Peace Treaty had to be concluded which threatened to place the honour of our nation, its prosperity and the fruits of its past and future toil, at the mercy of foreigners." On the day of the ratification of the Peace, the Government of the Reich addressed a message of farewell to the "hundreds and thousands of members of the German nation" who were being separated under the Treaty from the Reich. In the occupied Rhineland, at Flensburg, at Malmédy, in the Saar region, in Upper Silesia, in the Memel district, at Bromberg, a foreign sway, which was in some cases to be temporary and in others permanent, came into force in accordance with the terms of the Treaty. In Jan. and Feb. the German prisoners-of-war in France were at last sent home. On Feb. 10 1920 the first of the plebiscites took place, and resulted in the transfer of a strip of territory in northern Schleswig, including Hadersleben, Apenrade and Tondern, to Denmark. The vote in the second Schleswig zone took place on March 14 and resulted in a German majority. A serious economic consequence of the conclusion of peace was that an even greater quantity of luxuries flooded Germany through the customs "gap in the west" (*Loch im Westen*) than had been the case in 1919. The consequence was that the exchange value of the mark continued to fall, so that it constantly became more difficult to import the food-stuffs, textile fabrics and raw materials that were urgently needed. Not until March or April was it possible to get the "gap in the west" partially closed by agreements with the Allied Powers.

The German National Assembly resumed its session on June 30 1920. On the orders of the day was the third reading of the

Factory Councils bill, the provisions of which did not go far enough to satisfy the extreme Left, the Independent Socialists. In consequence of the agitation conducted by that party, a crowd numbering close upon 100,000 persons assembled in the vast square in front of the Reichstag building and ultimately attempted to force their way into the National Assembly. The armed police were compelled to fire upon them, 40 persons being killed and over 100 wounded. The bill was finally passed on Jan. 18. The Taxation bill was then discussed—the income tax for the Reich, a special tax of 10% on incomes from invested capital (*Kapitalertragsteuer*) and the taxation of companies. Erzberger continued to be the leading spokesman of the Government in the advocacy of these proposals. He was at the same time occupying public attention in consequence of the action for libel which he had brought against the Conservative leader and former Secretary of State, Helfferich, who had accused Erzberger of combining with his political activity the advocacy of private commercial interests, and had also charged him with untruthfulness. The trial lasted seven weeks and resulted in the condemnation of Helfferich to a fine of 300 marks for libel or insult (*Beleidigung*), although the court animadverted upon Erzberger's conduct in terms which led his party, the Catholic Centre, to recommend his withdrawal for a time from public life. He had previously resigned the Ministry of Finance. During the trial an attempt had been made on Erzberger's life by a young officer named von Hirschfeld, who succeeded in wounding him.

Immediately after the conclusion of peace the Allied Powers demanded from Holland the extradition of the German Emperor. Holland persisted in declining to comply with this demand, but undertook to subject the ex-Kaiser to strict surveillance. Although the ex-Kaiser now enjoyed little popularity in Germany, the demand for his extradition was regarded as a national humiliation, and this feeling was intensified in the highest degree by the subsequent demand for the extradition of the so-called war criminals, seeing that the original French list contained the names of almost all the military leaders, including Hindenburg, Ludendorff and Tirpitz, and further the former Imperial Chancellor Bethmann Hollweg, several German sovereigns and heirs to German thrones, as well as 895 persons of different military ranks belonging to all classes of the German people. The list, moreover, was very imperfect and inaccurate in its designation of the persons whose extradition was demanded. Some of them were dead. The president of the German Peace Commission in Paris, Baron von Lersner, accordingly declined to receive the list which Millerand handed to him on Feb. 4 1920. The list was then presented in Berlin, and was followed by an exchange of notes and finally by a decision of the Supreme Council on Feb. 14 to the effect that certain alleged war criminals should be tried by the German Supreme Court at Leipzig. A list containing the names of 45 persons was presented to the German Government on May 7 1920. The trials were delayed by the fact that the Allied Powers took a long time to furnish the German public prosecutor with the names and the evidence of the witnesses for which he had asked. Some 15 cases were tried in the summer of 1921, some of them ending with a verdict of guilty and a sentence, others with an acquittal. In the army the excitement over the demand for the extradition of the military leaders was especially strong. Among the soldiers, as among the police, there was a determination to refuse to coöperate in any way in fulfilling this demand. Another cause of discontent was that the members of the small new army remained in complete uncertainty regarding their personal future. According to the Treaty, the German army, which in peace times had numbered about 700,000 men and during war had risen to 12,000,000, had now to be reduced to 100,000. This reduction had to take place within three months of the ratification of the Treaty. At Germany's request, however, the Supreme Council agreed on Feb. 18 1920 to extend the period for reduction to July 10. Until April 10 a strength of 200,000 men was to be permitted. In Spa, in July 1920, it was decided that the new army (*Wehrmacht*) should have a strength of 150,000 until the following Oct., but should be reduced to 100,000 by Jan. 1 1921. This decision was carried out by Germany.

The army reduction originally determined for April 10 was one of the direct causes of the military *Putsch* on March 13. There were two bodies of troops, the Ehrhardt Marine Brigade and the Löwenfeld Brigade, which refused to be disbanded. The political grounds for the insurrection, known as the "Kapp *Putsch*," may be explained as follows. In Jan. 1920 the text of the electoral bill for the first republican Reichstag and for the election of the President of the Reich had been published. It seemed that the date for the general election could not be long delayed. Yet the National Assembly rejected on March 9 a Conservative proposal for the dissolution of the National Assembly on May 1. On the Right the view was held that the mandate of the National Assembly had been fulfilled when it had constructed a new Constitution and concluded peace. It presently became known that the Social Democrats intended to propose that the President of the Reich should be elected by the Reichstag instead of, as the bill provided, by the whole nation. The feeling against the Government and Parliament created by this prospect was utilized by Kapp (*see* KAPP, WOLFGANG) of Königsberg and by Gen. von Lüttwitz, and on the morning of March 13 1920 they seized power in Berlin with the aid of the marine brigades quartered at Döberitz. The Government offices in the Wilhelmstrasse were occupied. Kapp assumed the Chancellorship and Lüttwitz the office of Minister of National Defence, and the constitutional Government was declared to be deposed. A new Government of "order, liberty and action" was described in a proclamation as having been instituted. The National Assembly and the Prussian Constituent Assembly were declared to have been dissolved. A Committee of the Social Democratic party replied by the proclamation of a general strike, an appeal to which the names of the President of the Reich and the Socialist ministers were attached. The Government and the President of the Reich fled to Dresden to prevent civil war and bloodshed. The Kapp movement was, however, confined to parts of north Germany and collapsed in a few days. Kapp and Lüttwitz threw up the game on March 17 and fled. Warrants for their arrest and for that of their leading accomplices on the charge of high treason were issued. Among these accomplices were Col. Bauer (a right-hand man of Ludendorff), Capt. Ehrhardt and the former Berlin prefect of police, von Jagow, who for a few days during the *Putsch* had played the part of Minister of the Interior. The National Assembly met on March 18 in Stuttgart, whither the Government had removed, and denounced the *Putsch* as a monstrous crime against the German nation. In the sequel disciplinary measures were taken, and a number of officers and officials were dismissed. The rank and file of the participators in the movement, however, were let alone. The prosecution of the chief conspirators was ultimately fixed to take place at the end of 1921.

The Kapp enterprise had been started with an incredible degree of political ignorance, and must be regarded as having amounted to an attempt at a monarchist revolution. It may be asserted, however, that none of the parties represented in the Parliament, including the *Deutschnationalen* (Conservative) party, participated in the movement. During the *Putsch* days there were sanguinary collisions in various towns between workmen and those bodies of troops which had declared for Kapp. Nine officers were murdered at Schöneberg, a suburb of Berlin, and a number of persons were shot on the departure of the so-called Baltic Corps at the Brandenburg Gate. In consequence of these events there was a new outbreak of the extreme revolutionary movement. In the Ruhr region in particular there were regular warlike operations by the Red Army, while at the same time the Communist free-lance, Max Hölz, overran the Saxon Vogtland and burned and plundered. A Bolshevist "terror" reigned for some days in the Ruhr region, where the extremists considered the moment to have arrived for setting up a Soviet republic, for which they had long been making preparations. There was a good deal of intimidation and raiding of banks and other commercial establishments, and

Government troops were being attacked and surrounded. The Government, however, hesitated for a time to intervene. In Berlin the general strike was with difficulty brought to a close. After negotiations with the trade unions, which demanded greater influence upon the formation of the Government and the conduct of affairs, a new Cabinet was formed under the presidency of the Social Democratic Minister for Foreign Affairs, Hermann Müller. The Minister of National Defence, Noske, whom the Independent Socialists and also a section of the Majority Socialists made responsible for the revival of the "militarist reaction," had previously resigned and was replaced by the Bavarian Democrat Gessler. Dr. Wirth of the Catholic Centre was appointed Minister of Finance. There were also ministerial changes in Prussia, the Social Democrat Braun becoming Minister-President, and Severing, also a Social Democrat, being appointed to the Ministry of the Interior—a post of the first importance in times of internal disturbance. Severing had come to terms with the Ruhr insurgents on March 25 at Bielefeld, and the Government had undertaken that if the conditions were fulfilled the regular troops (*Reichswehr*) would not be sent into the region. The truce was not maintained, and on April 3 troops marched into the Ruhr region from the north and the east. This action had an unfortunate effect upon the policy of France. The French seized the occasion to occupy Frankfort-on-Main and the Maingau. The Ruhr district formed part of a neutral zone, 50 km. broad, which was to have been denuded of all German troops in accordance with Art. 43 of the Treaty of Versailles. By a special agreement of Aug. 8 1919, however, Germany was permitted to keep a small garrison of regulars within the region. This garrison proved too weak to suppress the insurrection, and the Minister for Foreign Affairs, Hermann Müller, asked for permission to reënforce these troops. France refused. When German troops were nevertheless sent into the Ruhr region in consequence of desperate appeals from part of the population, and when Hermann Müller asked the Allied Powers to give their retrospective assent to these measures, the French Government gave orders to its troops to occupy the Maingau on April 6 as a guarantee. Germany appealed to the League of Nations without result. At a conference of the Supreme Council at San Remo (in April 1920) it was decided—as appeared from a subsequent declaration of Millerand in the French Chamber—that the evacuation of the Maingau should take place so soon as the numbers of the German troops in the Ruhr region were reduced to the figure permitted in the special agreement of 1919. The French evacuation accordingly took place on May 17, but not before six Germans had been killed and over 30 wounded in a collision with a detachment of black troops who were occupying the chief guardhouse at Frankfort.

The Social Democrat Dr. Adolf Köster, a journalist, succeeded Hermann Müller as Minister for Foreign Affairs on April 14. The National Assembly, after voting a bill for transferring to the Reich those railways which had hitherto been the property of the separate German states, and after having voted the sum of one milliard marks as compensation for damage caused during the civil disturbances, closed its session on May 21 1920. On June 6 the elections for the first German republican Reichstag were held and resulted in a distinct disavowal of the Coalition Ministry. The Democratic party suffered most seriously of all, while a great increase of seats was achieved by the Independent Socialists and by the two parties of the Right (the Conservatives and the National Liberals, to call them by their old names). The Democrats were reduced from 74 to 45, the Social Democrats from 163 to 112. On the other hand the *Deutsche Volkspartei* (National Liberals) were increased from 22 to 62, the *Deutschnationale Volkspartei* (Conservative Right) from 42 to 66, and the Independent Socialists (extreme Left) from 22 to 81. In view of these changes, the formation of a new Government presented the greatest difficulty. The President of the Reich had ultimately to entrust the task to the Catholic Centre deputy Fehrenbach, who succeeded in forming a Cabinet on June 26. This Cabinet no longer contained any Social Democrats, but, for the first time since the revolution, representatives of the *Deutsche Volkspartei* (National Liberals) were in the Government. Dr. Simons, who had been director of the legal department of the German Foreign Office but had resigned in 1919 with other members of the German delegation at Versailles, was appointed Minister for Foreign Affairs. He was soon the leading spirit in the new Cabinet, which to some extent fulfilled the demand of the *Deutsche Volkspartei* (National Liberals) for experts in ministerial posts. After the first republican German Reichstag had elected its presidential bureau from the different sections of the House, the Social Democrat Löbe being chosen president, the provisional President of the Reich, Ebert, addressed a communication to the Chancellor on June 25 asking the Reichstag to fix the date for the presidential election. The Cabinet, however, decided that the definitive election of the President of the Reich should not take place until after the plebiscite in Upper Silesia.

The formation of this Government took place under political pressure from abroad. The Supreme Council had determined at San Remo on April 18 1920 to discuss, in immediate conference with the German Government, certain outstanding questions arising out of the Treaty of Peace. At Hythe Mr. Lloyd George and M. Millerand had agreed that this conference was to be postponed until the new German Government had been formed. After a further conference at Boulogne on June 23 had produced three Notes complaining of the lack of goodwill on Germany's part to carry out the Treaty, German ministers sat for the first time at the same table with leading representatives of the Allies at Spa from July 5–16, in order to discuss with them questions connected with the execution of the Treaty. On the German side these negotiations were conducted by Dr. Simons and the Chancellor Fehrenbach, but there were moments when almost the whole Cabinet was at Spa. Under threat of the occupation of the Ruhr district the following points were arranged:—(1) the disarmament of the German army and its reduction to the strength of 150,000 men by Oct. 1 and to the strength of 100,000 men by Jan. 1920; (2) the reduction of the monthly deliveries of coal from 2,400,000 to 2,000,000 tons, with a reservation on behalf of the German share of Upper Silesian coal. In the negotiations on this point considerable impression was created by the appearance of the German coal and iron magnate Hugo Stinnes, accompanied by the miners' leader, Hue, both advocating the same view. The final arrangements for the payment of all the reparations due by Germany were adjourned, pending a further conference at Geneva.

While the Spa conference was still sitting a disagreeable incident took place in Berlin. On July 14, the day of the French national fête, a German workman hauled down the French flag on the embassy in Berlin. On Aug. 26 there was a further incident at Breslau, where a crowd of people who had been excited by the arrival of German fugitives from Upper Silesia forced their way into the Polish and French consulates. The satisfaction which was demanded was given by saluting the French flag and by an apology conveyed by the Minister for Foreign Affairs to the French ambassador.

On July 11 the second of the plebiscites was held on the borders of East and West Prussia and resulted in a distinct German success, some 95% of the inhabitants having voted for remaining German. Soon afterwards East Prussia was threatened by the backwash of the Russo-Polish war, and Germany asked to be permitted to send troops into the region which was still under the administration of the Plebiscite Commission. Both Poles and Bolsheviks were crossing the frontier into East Prussia at this time and were being disarmed and interned. In accordance with the German declaration of neutrality the transit of arms and munitions to Poland was being prevented, and this led in some cases to an excessive display of zeal by the German railway men, some of whom were in sympathy with Soviet Russia, so that regular Allied transports, *e.g.* the troops in Upper Silesia, were here and there held up.

The decision of the Ambassadors' Conference on the East Prussian plebiscite gave Poland only a narrow strip of territory on the right bank of the Vistula. Eupen and Malmédy went by the plebiscite of July 24 to Belgium. In the summer of 1920 ambassadors from the Powers which had been at war with Germany were once more sent to Berlin, the business of their embassies having meanwhile been conducted by *chargés d'affaires*. On July 1 the French Ambassador Laurent, on July 2 the British Ambassador Lord d'Abernon, and on July 31 the Italian Ambassador Martino presented their credentials to the President of the Reich. Germany had, for her part, sent in Jan. 1920 the Catholic Centre deputy, Dr. Mayer, to Paris, the Hamburg senator, Dr. Sthamer, to London, and the former Minister for Foreign Affairs, Dr. Solf, to Tokyo. The newly instituted Papal nunciature to the Reich was taken over by the Papal Nuncio at Munich, Mgr. Pacelli.

The next business of the Reichstag was to give effect to the Spa decisions. On July 30 universal and compulsory military service, which had existed for more than 100 years, was abolished, and also military jurisdiction. On July 31 the law on the disarmament of the civil population was passed. It was carried out in the autumn by Secretary of State Peters, a process which included the surrender and destruction of over 2,000,000 rifles. In this connexion the much-canvassed "Orgesch" (*Organization Escherich*) instituted by the Bavarian Director of Woods and Forests, Escherich, for the protection of the citizens in the event of a renewal of Bolshevist disturbances—an organization characterized by certain extreme reactionary tendencies—was forbidden in Prussia. After the London Conference of May 1921 it had to be dissolved, together with the Bavarian *Einwohnerwehr* (voluntary military organization for citizens' defence).

The movement for the socialization of industry, which had reached its zenith during the period of the revolution, had in course of time become concentrated upon schemes for the socialization of the mining industry. A Socialization Commission had been appointed, and in Sept. 1920 it presented two alternative schemes. The one scheme was for the immediate and complete socialization of the mining industry, with compensation for the mine-owners. The other, of which Walther Rathenau, afterwards Minister for Reconstruction, was the author, contemplated a State monopoly of the wholesale coal trade, with still more ample compensation for the mine-owners. Meanwhile a new and novel kind of parliament had been established (June 30). This was the so-called provisional Economic Council of the Reich (*Reichswirtschaftsrat*), a non-political, purely economic parliament with 326 members. A joint committee of this Economic Council and the Coal Council of the Reich (*Reichskohlenrat*) discussed the two socialization schemes. Its verdict, of which Hugo Stinnes was doubtless the father, was in favour of a proposal that the coal-miners and workmen should participate in the capital and the profits of the industry by means of small shares. The miners, however, rejected this proposal, and in the course of a debate in the Reichstag the Minister for Economics, Dr. Scholz, declared that the question was not yet ripe and could be decided only on economic grounds.

About this time fundamental changes took place in the grouping of the Socialist parties. The Independent Socialists had applied at Moscow to be received into the fold of the Third International, whereupon the Third International had set up 21 conditions of admission, among them the exclusion from the party of all leading members who professed any kind of democracy or were infected with any kind of "social patriotism." At the Independent Socialist party congress held at Halle these conditions were accepted, after a speech by the Russian Bolshevik Zinoviev, on Oct. 16 1920, against a strong minority vote. The minority, the right wing of the Independents under the leadership of Crispien, thereupon separated from the New Communists, whose leaders were Däumig and Stöcker. The latter united in Berlin on Nov. 1 with the Communist party (led by Dr. Levi) and formed the "United Communist party of Germany, Section of the Third International." In the preceding spring a still more extreme group, the Communist Workers' party, had seceded from Dr. Levi's organization.[1] This group eschewed all participation in elections or parliamentary work. The Majority Socialists (*i.e.* the governmental or moderate Socialist party) renewed in Aug. 1920 at Geneva their adhesion to the Second (the Amsterdam-London) International, and, in the presence of their foreign associates, made confession of their own and Germany's responsibility for the German war policy.

The United Communist party instigated in March 1921 in central Germany, in the region between Halle and Eisleben, an insurrection, the chief object of which doubtless was to demonstrate their revolutionary character to their masters at Moscow. The Chief President of the Prussian province of Saxony, Hörsing, had had recourse to the services of the armed police (*Schutzpolizei*) in consequence of the intolerable situation in several great factories, where thefts, intimidation and strikes were the order of the day. The *Rote Fahne*, the organ of the K.P.D. (the Communist party of Germany), thereupon called a general strike and exhorted the whole of the workmen to take up arms. Many of the workmen of central Germany accordingly rose. What might be called the military conduct of the insurrection was assumed by the locksmith Max Hölz, who extorted money from "the bourgeoisie" for his Red Army and set their houses on fire. Attempts were made to wreck railway bridges and stations, post-offices and banks. In the great Leuna nitrogen works near Merseburg, the centre of the movement, all authority was for some weeks, on the Russian model, in the hands of the workmen. The Prussian Government, which at that time was predominantly Socialist, considered it politically expedient not to employ the regular army (*Reichswehr*) against the insurgent workmen, but to use only the armed police (*Schutzpolizei*). This police liberated the central region of Germany after hard fighting. The violent agitation conducted by the central committee of the K.P.D. in Berlin had meanwhile succeeded in causing the insurrection to spread to other towns, particularly Hamburg. The movement altogether cost the lives of several thousands of workmen and armed police. Dr. Levi and Klara Zetkin had shortly before this *Putsch* been compelled to retire from the leadership of the central committee of the Communists, in order to make room for people who would blindly obey the orders of Noske. The failure of the insurrection led to further disciplinary measures and splits within the Communist party in the Reichstag and also at the Communist party congress. Hölz was tried and condemned to penal servitude for life. The insurrection had nevertheless proved that by far the greater part of the Socialist working classes were no longer inclined to be driven into hopeless enterprises by irresponsible agitators.

In Prussia the elections for the Diet took place in Feb. 1921. Their result, like that of the elections for the Reichstag six months earlier, was that the old coalition was weakened and that the Social Democrats left the Government. A new Government was formed, after difficult negotiations, by the leader of the Christian trade unions, Stegerwald, a member of the Catholic Centre party; it was composed of Catholic Centre men and Democrats. The Fehrenbach-Simons Government fell in May over the Reparations question. The Allies, after a number of preliminary meetings, had settled at their Paris Conference in Jan. 1921 that the total amount to be paid by Germany should be 226 milliards of gold marks and an *ad valorem* tax of 12% on German exports. The German Minister for Foreign Affairs, Dr. Simons, stated on Feb. 1 in the Reichstag that these proposals did not give the German Government any possible basis for an arrangement. At the Reparations Conference in London (March 1–7) he submitted a German counter-proposal which was summarily rejected by the Allies. A memorandum, which was submitted by German experts, pointed out that the result of accepting the Paris decisions would be to compel the German workman to work 14 hours a day, and German industry and commerce to dump German goods on the markets of the world. The negotiations were finally broken off, and Dr. Simons left with the German delegation. The Allied Powers now imposed their so-called "sanctions." Düsseldorf, Duisburg and Ruhrort were occupied, a customs frontier was set up on the Rhine, and German exports were penalized by a 50% duty. On April 24 1921 Germany, after the President of the United States of America had declined to act as arbitrator, addressed a fresh request to America asking her to mediate in the Reparations question. At the third and last conference in London (May 1–5) the Allies addressed to Germany, in the form of an ultimatum which had to be accepted by May 12, the following demands:—The whole indebtedness of Germany for Reparations was to be 132 milliards of gold marks (£6,600,000,000), of which 50 milliards were to be rapidly paid off; a fixed annual payment of not less than three milliards of gold marks was to be made, consisting of a direct fixed payment of two milliards and a varying impost of 25% or 26% on German exports. The Reichstag accepted the ultimatum on May 10 after debates characterized by exceptional violence. A new Government, composed of Social Democrats, members of the Catholic Centre and Democrats, with Dr. Wirth (hitherto Finance Minister) as Chancellor, was formed, and was prepared to hazard the attempt to fulfil these colossal demands. Dr. Bauer (a former republican Chancellor) took the office of Vice-Chancellor; the Social Democrat Dr. Gradnauer was the new Minister of the Interior; while Dr. Walther Rathenau, managing director of the Allgemeine Elektrizitätsgesellschaft, took the Ministry of Reconstruction. Dr. Rosen, an experienced diplomatist, hitherto German Minister at The Hague, became Minister for Foreign Affairs. The first milliard of gold marks for the year 1921 was punctually paid by Germany by Aug. 31. On Oct. 6 and 7 the Minister for Reconstruction, Rathenau, concluded at Wiesbaden a convention with the French Minister for Reconstruction, Loucheur, regarding German payments in kind for restoring the devastated regions of northern France. The value of the contemplated deliveries of material was not to exceed seven milliards of gold marks up to May 1 1926. Associations of German industrial contractors were to be formed to carry out the deliveries.

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[1] In German books and newspapers the first of these groups was frequently designated by the letters K. P. D. (*Kommunistische Partei Deutschlands*), the second by the letters K. A. P. D. (*Kommunistische Arbeiter-Partei Deutschlands*).

The effect of the gigantic Government purchases of foreign bills for the Reparations payments was a heavy fall in the mark, which assumed a disastrous character in Oct. 1921 in consequence of the recommendations of the Council of the League of Nations regarding the partition of Upper Silesia. Upper Silesia had voted in the plebiscite of March 20 by a two-thirds majority for remaining German. At innumerable public meetings and demonstrations the German people had urged that the region ought to remain in the Reich; the Reichstag had voted a bill at the close of 1920 giving it autonomy. Another Polish insurrection instigated by Korfanty in the spring of 1921 had caused great suffering and damage. In spite of the protests of the whole German nation and of the great majority of Upper Silesians, including a good number of Poles, the portions of the region which were the most important for German commerce and industry, and therefore for the payment of the Reparations, were assigned to Poland in Oct. 1921 by the Allied Council of Ambassadors in accordance with the decision of the Council of the League of Nations. The result was a political crisis in Berlin and the resignation of the Wirth Ministry. But Dr. Wirth was indispensable at this stage, and in a few days he resumed office.

The negotiations between the Government of the Reich and Bavaria regarding the disarmament and the disbandment of the Bavarian *Einwohnerwehr* entailed difficult discussions. Both demands were, however, finally fulfilled by Bavaria. The Bavarian Minister-President, von Kahr, resigned in Sept. 1921 because he found himself unable to agree to the demand of the Government of the Reich that the state of siege in Bavaria should be raised. In Oct. the ex-kings of Württemberg and Bavaria died within a very short time of each other. The assassination of Erzberger on Aug. 26 1921 had caused great indignation and excitement among the parties of the Left and the Catholic Centre, and led to measures being taken by the Government of the Reich against press organs of the Right. The Reichstag after the autumn recess was engaged through the party leaders in negotiations that lasted for weeks in an endeavour to broaden the basis of the Coalition by making it include all the parties from the *Deutsche Volkspartei* (the old National Liberals) on the Right to the Social Democrats on the Left, with a view to securing a more stable basis for the economic life of the country and also in the interest of the Reparations payments, as the National Liberals largely represent industrial capitalism.

While, during the first years of the Revolution, all attempts to introduce any degree of order into the confusion which reigned in Germany seemed almost hopeless, it was nevertheless found possible, in course of time, to bring about a more tolerable state of things in both political and economic life. Until well into the year 1920 insurrections and disturbances, sometimes of a very ominous character, were constantly recurring in different parts of Germany. The insurrectionary movement then began to subside, and unrest became confined to a strike movement, which was, no doubt, very extensive and successively affected all kinds of workers and salaried employees. This movement, however, although it partially undermined the economic life of the country, ceased to constitute a real danger for the State. Events like the rising in central Germany and the earlier sanguinary disturbance in Berlin, in which the then prefect of police, Eichhorn, an Independent Socialist, played a very dubious part, and other dangerous incidents of the kind, were scarcely to be apprehended at the end of 1921. One great reason was that Communism, which was transplanted from Russia at the time of the Revolution, became more and more weakened in Germany. While in the year immediately following the Revolution strike movements bore a thoroughly political character, this was no more the case after the middle of 1920. In 1921 the whole nation was again systematically at work; it was only the constant rise in prices of the necessaries of life that exercised a powerful pressure upon the poorer sections of the population and incited them to frequent demands for higher wages and consequently to strikes. It was found impossible to maintain State control of traffic in the necessities of life. In particular the State could not permanently burden its finances by a standing subvention for the purpose of reducing the retail cost of articles of food. The system of control was therefore gradually replaced by internal free trade. This, it is true, was attended by an increase in food prices, which were further sent up by constant deterioration of the mark exchange to Germany's disadvantage. Not only the working classes, but also, in an especial degree, the officials suffered, and the latter class was reduced to a condition which more and more tended to herd them socially into the ranks of the proletariat. The same applied to intellectual workers and salaried employees. The constant recurrence of strikes with the object of maintaining the standard of living constituted a danger for the economic future of the country, especially as every increase of wages automatically led to an increase in the price of commodities. In the financial situation in which Germany found herself at the end of 1921, and in view of the vast payments which she had to make in consequence of the Reparations imposed upon her, the end of these unsound conditions was not yet in view. The financial demands of the State, too, were constantly increasing taxation. Germany was willing to work, but it was considered that the possibility of economically fruitful work could be secured only if Germany's creditors did not make excessive demands upon her and if they gave her time and means for carrying out those obligations of labour and payment which she had undertaken. (O. B.)

GHENT (*see* 11.919*).—Pop. (1914) 169,473, or, including suburbs (1910), nearly 250,000. The city measures 26 km. in circumference, much space being taken up by nurseries and gardens, Ghent having become a most important horticultural centre, especially for the cultivation of azaleas, rhododendrons, begonias, orchids, etc., under glass. Linen-weaving has greatly developed as a main industry and schools of industry and mechanics have been established. In 1913 1,363 vessels of over one million tonnage entered the port, and transport by smaller river craft represented an equal tonnage.

The original panels of the famous "Worship of the Lamb" by Hubert and Jan van Eyck, which had been dispersed since

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** These figures indicate the volume and page number of the previous article.*

1816, were brought together again in 1920 in pursuance of the terms of the Treaty of Versailles. The cast-iron steeple of the Belfry was removed in 1912. In 1913 a Great International Exhibition was held.

From Oct. 9–11 1914 Ghent was the headquarters of the British 7th Div. of the IV. Army Corps. On Oct. 12 the Germans entered the city and held it until Armistice Day, the Belgian army in following up the German retreat having reached the outskirts on Oct. 24 1918. During the occupation the Germans published the *Vlaamsche Post*, an organ professing Flemish sympathies and advocating the partition of Belgium. Intrigues on the part of the Germans to transform the university of Ghent into a purely Flemish institution (an aim long desired by the Flemish Nationalists) were resisted by the professors, some of whom were deported in consequence. The western suburbs suffered some damage in the final war operations.

See V. Fris, *Histoire de Gand* (1913), and *Bibliographie de l'Histoire de Gand*, 2 vols. (1907–21).

GIBB, SIR GEORGE STEGMANN (1850–), British railway administrator, was born at Aberdeen April 30 1850. He was educated at Aberdeen grammar school and university, and in 1872 entered a solicitor's office as an articled clerk. In 1877 he became assistant in the office of the solicitor to the Great Western Railway, and from 1880 to 1882 practised his profession in London. In 1882 he became solicitor to the North-Eastern Railway, and in 1897 acted as arbitrator for that company on the question of wages before Lord James of Hereford. From 1891 to 1906 he was general manager and from 1906–10 director of the North-Eastern Railway, and in 1906 became managing director of the Underground Electric Railways Co. and chairman of the Metropolitan District Railway. In 1904 he was knighted. He served on the War Office Reorganization Committee in 1901, and the London Traffic Commission in 1903, and from 1910–9 was chairman of the Road Board. In 1915 he was appointed a member of the Committee on Production, and became its chairman in 1918.

GIBBONS, JAMES (1834–1921), American Roman Catholic cardinal (*see* 11.936), celebrated his golden jubilee as a bishop Oct. 20 1918. In 1917 he published *A Retrospect of Fifty Years*. He died in Baltimore March 24 1921.

GIBSON, MARGARET DUNLOP (1843–1920), and LEWIS, AGNES SMITH (1843–), British orientalists, were twin daughters of John Smith, solicitor, of Irvine, Ayrshire. They were born at Irvine Jan. 11 1843 and educated at private schools and by private tuition, principally in classics and oriental and modern languages. In 1883 Margaret married the Rev. James Young Gibson (d. 1886), the translator of Cervantes, and in 1887 Agnes married the Rev. Samuel Savage Lewis, fellow of Corpus Christi College, Cambridge (d. 1891). The two sisters made together several journeys to Syria and Palestine, visiting Sinai six times, and in 1892 they discovered and photographed the Syro-Antiochene, or Sinaitic palimpsest, the most ancient known MS. of the four Gospels in Syriac. Four years later they brought to England the first leaf of the Hebrew *Ecclesiasticus*. In 1897 they founded and endowed the Westminster Theological College at Cambridge. In 1915 both were made gold medallists of the Royal Asiatic Society; they also received honorary degrees from St. Andrew's, Dublin, Halle and Heidelberg universities. They published numerous works on Syriac, and especially Sinaitic, MSS., on Arabic Christian MSS. and other ancient literatures. Mrs. Lewis also, before her marriage, published travel books and stories. In 1892 she wrote a *Memoir* of her husband and late in life published a volume of poems (1917). Mrs. Gibson died at Cambridge Jan. 11 1920.

GILBERT, CASS (1859–), American architect, was born at Zanesville, O., Nov. 24 1859. He was educated in the schools of Zanesville and later of St. Paul, Minn., to which his parents moved in 1868, and at the Massachusetts Institute of Technology. In 1883 he began the practice of architecture in St. Paul but subsequently moved to New York. He is perhaps most widely known as the architect of the Woolworth building in New York, 57 storeys, 760 ft. high, and, excepting the Eiffel Tower in Paris, the tallest structure in the world. Other buildings designed by him include the Minnesota State Capitol, St. Paul; the Endicott building, the Dayton Ave. church, and St. Clement's Episcopal church, in St. Paul; the U.S. Custom House and the Union Club, New York; the Brazer building, and the Suffolk Savings Bank, Boston; Art building and Festival Hall (for the Louisiana Purchase Exposition), and the Central Public Library, St. Louis; Ives Memorial Library, New Haven, Conn.; Public Library, Detroit. He also drew the plans for the university of Minnesota and for the university of Texas. He was appointed by President Roosevelt a member of the Council of the Fine Arts; and by President Taft a member of the National Commission of Fine Arts, and was reappointed by President Wilson. He was a member of the National Jury of Fine Arts at the Chicago Exposition (1893) and a member of the National Jury for Architecture at the Paris Exposition (1900). He was made a member of the National Academy in 1908 and of the American Academy of Arts and Letters in 1914. He was elected president of the American Institute of Architects in 1908, of the Architectural League of New York in 1913, and of the National Institute of Arts and Letters in 1919.

GILBERT, GROVE KARL (1843–1918), American geologist (*see* 12.7), died at Jackson, Mich., May 1 1918. Among his latest writings were *The Transportation of Débris by Running Water* (1914) and *Hydraulic Mining in the Sierra Nevada* (1917).

GILBERT, SIR WILLIAM SCHWENK (1836–1911), English playwright and humorist (*see* 12.9), was drowned at Harrow Weald, Middlesex, May 29 1911 in an effort to save a lady in his own grounds. His play *The Hooligan* was produced on the variety stage a short time before his death.

GILBEY, SIR WALTER, 1ST BART. (1831–1914), English wine merchant (*see* 12.11), died at Elsenham Hall, Essex, Nov. 12 1914.

GILL, SIR DAVID (1843–1914), British astronomer, was born in Aberdeenshire June 12 1843 and educated at the university of Aberdeen. From 1868 to 1873 he was in charge of a private observatory at Aberdeen, and from 1873–6 of Lord Crawford's observatory at Dunecht, organizing from there the expeditions to Mauritius to observe the transit of Venus in 1874 and to Ascension I. to determine the solar parallax by observations of Mars in 1877. He became Astronomer Royal in Cape Colony in 1879 and retained that post till 1902. There he observed the transit of Venus of 1882 and photographed the great comet of that year. He did much to advance stellar photography and its use in cataloguing the stars, and he was responsible for the geodetic surveys of Natal and Cape Colony, British Bechuanaland, German S.-W. Africa and Rhodesia. He was the recipient of many medals and honorary degrees and was created K.C.B. in 1900. In 1907 he was president of the British Association. He died in London Jan. 24 1914.

See *David Gill, Man and Astronomer*, by George Forbes (1916).

GILLETT, FREDERICK HUNTINGTON (1851–), American politician, was born at Westfield, Mass., Oct. 16 1851. He was educated at Amherst (A.B. 1874; A.M. 1877) and at the Harvard Law School (LL.B. 1877). In 1877 he began to practise law in Springfield, Mass. From 1879 to 1882 he was assistant attorney-general of Mass., and in 1890 was elected to the Mass. House of Representatives, serving two terms. In 1893 he was elected U.S. congressman and thereafter repeatedly reëlected to serve through 1923. He was a member of the Appropriations Committee and chairman of the Committee on Civil Service Reform. In 1914 he favoured the Panama Canal Tolls Repeal bill but opposed the administration's Mexican policy. In an address before the Pan-American Commercial Congress, 1919, certain of his remarks about Mexico brought protest to the State Department from the Mexican chargé d'affaires and led the Mexican Government to withdraw its delegates. In May 1919 he superseded Champ Clark (Democrat) as Speaker of the House, and in 1920 was a delegate-at-large to the Republican National Convention.

GINER DE LOS RIOS, FRANCISCO (1840–), Spanish philosopher and lawyer, was born in Ronda (Andalusia) in 1840, of a middle-class family, connected on his mother's side with an illustrious political family. He graduated in Granada, and very early in life came to the university of Madrid as a professor of jurisprudence. He there felt the influence of Prof. Sanz del Rio, Krause's famous disciple. Twice he resigned his chair, together with several of his colleagues, in a brave stand for liberty of thought in the university against a reactionary Government, and twice he was reinstated. He was one of the founders of the Institucion Libre de Enseñanza, an educational institution which did much to improve teaching methods in Spain and, when created, was well in advance of its time, not only for Spain but even for Europe in general. He many times refused election to the Cortes, and in 1873 declined a post in the Government. His greatest influence was personal and direct, for he was a born teacher, a man of refined sensibility, pure in his life as in his ideals.

He published several volumes of essays—literary, educational, philosophical and religious—as well as *Lecciones Sumarias de Psicologia* (1871); *La Idea del Derecho* (trans. from the German of Röder, 1885); *Resumen de Filosofia del Derecho* (1898) and other works. A complete edition of his works was undertaken in 1916.

GINSBURG, CHRISTIAN DAVID (1831–1914), British Hebrew scholar (*see* 12.29), died in London March 7 1914.

GIOLITTI, GIOVANNI (1842–), Italian statesman (*see* 12.31). The elections of 1909 returned a strong Giolittian majority, but the Premier found himself faced with the necessity for renewing the steamship conventions which were about to lapse. The bill presented by his Cabinet on this subject was open to much criticism, having been designed to conciliate conflicting political interests rather than to solve the actual problem. The vigorous attacks of the Opposition, led by Baron Sonnino, induced Giolitti to adjourn the debate until the autumn, when, the Cabinet having been defeated on a point of procedure, he resigned (Dec. 2). But he continued to play an active and in fact dominant part in Parliamentary politics, for the majority of the Chamber and of the Senate being thoroughly Giolittian, the Sonnino Ministry and that of Sig. Luzzatti which succeeded it only remained in power at his discretion. When in March 1911 the latter resigned in consequence of the hostile vote of the Radicals and the resignation of its two Radical members, Giolitti was again called upon to form a Government (March 31). The chief event of his fourth Cabinet was the Libyan War. Personally he was not enthusiastic over the African enterprise, as it introduced new and, to him, unaccustomed and unwelcome values into Italian political life; but he realized that public opinion demanded it and he did not care to run counter to the current. He was criticised by the vestals of constitutional tradition for having declared war without consulting Parliament and for not having summoned it until several months later. His conduct of the Government during the campaign was also severely blamed, as he acted as though the war were merely an affair of internal politics and party combinations. When peace was concluded fresh elections were held on the new franchise law introduced by the Cabinet, which raised the electorate from 3,000,000 to 8,000,000 votes (Oct. 26–Nov. 2 1913); although a Giolittian majority was again returned, his opponents, not only among the Socialists but also among the constitutional parties, were now more numerous, and he felt that opposition to his rule was growing in the country at large even more than in Parliament. The various awkward problems which now faced the Government, and the divisions among its own supporters, induced him to seize the opportunity of a hostile vote by the Radical group to resign (March 10 1914). When the World War broke out his attitude was favourable to the absolute neutrality of Italy, believing that his country's interests lay in not siding with either group of belligerents, and on the eve of Italian intervention he made an attempt, by using his personal hold over the Parliamentary majority, to upset the Salandra Cabinet, but it was frustrated by an uprising of public opinion in favour of war. During the progress of the campaign he kept away from public affairs, although he assumed a Cassandra-like attitude in all his utterances, and his henchmen in the press were frankly "defeatist." He consequently lost his influence over public opinion, and in many quarters was regarded as little better than a traitor. But after the Armistice the unsatisfactory consequences of the peace negotiations, the heavy burden of suffering and loss caused by the war, and, above all, the intolerable internal policy of the Nitti Cabinet, which seemed prepared to hand the country over to the Bolshevist Socialists, brought about the return of Giolitti to the sphere of practical politics once more. When Nitti was forced by the impossibility of governing the country to resign for the third and last time on May 20 1920, the return of Giolitti was the inevitable alternative. He succeeded in forming a Cabinet which comprised a number of non-Giolittians of all parties, but only a few of his own "old guard," so that he won the support of a considerable part of the Chamber, although the Socialists and the Popolari (Catholics) rendered his hold somewhat precarious. His policy during the occupation of the factories by the workmen organized by Bolshevist leaders in Sept. 1920 provoked the indignation not only of the manufacturers but of all the middle-class. But he appears to have acted under the impression that the Socialists were much stronger than they really were, and therefore gave them a free hand with the object of avoiding bloodshed, and also perhaps with that of proving to the workmen that they could not run industry without the capitalists and the technical experts. When he realized the strength of the national reaction, he allowed the patriotic *fascisti* free rein to reëstablish order and practically exercise many functions of Government, while he assumed an attitude of Olympic calm and posed as being *au dessus de la mêlée*, so as to avoid compromising himself with any party. In foreign affairs he succeeded in achieving as satisfactory a solution of the Adriatic problem as was possible under the circumstances. In view of the annexation of new provinces under the peace treaties and of the altered state of public opinion on internal policy, he dissolved the Chamber on April 7 1921, and was confirmed in power by the elections on May 15. But he resigned with his Cabinet at the end of June, being succeeded as Premier by Signor Bonomi.

GIRL SCOUTS: *see* BOY SCOUTS.

GLADDEN, WASHINGTON (1836–1918), American Congregational divine (*see* 12.63), died at Columbus, O., July 2 1918. His latest publications included *The Labor Question* (1911); *Present-Day Theology* (1913) and *Live and Learn* (1913).

GLASGOW (*see* 12.80).—By the Glasgow Municipal Boundaries Act (1912), Glasgow again became in population the second city of the British Empire. The burghs of Govan, Partick and Pollokshaws, and several suburban districts, including Shettleston and Tollcross in Lanarkshire and Cathcart and Newlands in Renfrewshire, were brought within the municipal boundary, increasing the area of the city from 12,975 to 19,183 acres. The pop. of the annexed areas was 226,309 by the 1911 census, and the pop. of the unextended city in 1911 was 784,496. The estimated pop. in 1920 was 1,121,842.

The valuation of the burgh for 1911–2 was £5,977,249, for 1913–4 £7,473,325, and in 1920 £9,200,000. The number of municipal wards was increased in 1912 from 26 to 37, and the membership of the Corporation from 80 to 113—three representatives of each ward and two *ex-officio* members (the Dean of Guild and the Deacon Convener of the Trades). By the Representation of the People Act (1918) the city sends 15 members to the House of Commons, the Parliamentary divisions being Bridgeton, Camlachie, Cathcart, Central, Gorbals, Govan, Hillhead, Kelvingrove, Maryhill, Partick, Pollok., St. Rollox, Shettleston, Springburn and Tradeston. The Act increased the number of voters in Glasgow from 242,000 to 526,000. An extension of the municipal buildings was in progress before the World War, and the memorial stone was laid by the King on July 7 1914. The Mitchell library, the largest of the Glasgow public libraries, was removed in 1911 from Miller St. to a spacious building in North St., erected at a cost of £100,000, and opened on Sept. 28 1911 by Lord Rosebery. The Corporation which, under a series of municipal acts has power to levy an assessment of 3d. per £ for library purposes, established 17 district libraries throughout the city. In 1915 the Corporation purchased for £30,000 the Balloch Castle estate, of which 200 ac. were converted into a public park known as the Loch Lomond Park. Other purchases were the Linn Park (1919) covering 180 ac., and the Ruchazie and Frankfield Park (1920) covering 300 ac. The Newlands Park was given in 1913, the

Glenconner Park in 1914, and the Dawsholm Park in 1920. In 1911, 121 ac. of the grounds of Pollok House were given to the Corporation for use as a public park for a period of ten years. Statues of Lord Kelvin (1913), Lord Roberts (1916) and Thomas Carlyle (1916) have been erected in the Kelvingrove Park.

The increase of population has led to some anxiety about the water supply. An additional supply from Loch Arklet came into use in 1914, but in the same year a bill to secure additional water from Loch Voil and Loch Doine was rejected by a committee of the House of Lords. A Glasgow Water Order was, however, obtained in 1915 giving power to impound the waters of the river Turk in Glenfinlas and to convey the water thus obtained by a tunnel to Loch Katrine. The commencement of the necessary work was delayed by the war, and immediate relief was obtained by a Provisional Order (1919) enabling the Corporation to raise the level of Loch Katrine. In 1919 the Corporation purchased 24,110 ac. in the watershed areas of Loch Katrine and Loch Arklet at a cost of £71,850. The average daily quantity of water sent into the city was in 1920 79,147,673 gallons.

Important developments of the municipal undertakings (gas, electric light and power, tramways and slaughter-houses) were delayed by the war. A Housing Committee of the Corporation reported that a total of 57,000 houses of 3, 4, or 5 rooms was urgently required, and it was hoped to build 7,000 by the summer of 1922; plans and schedules for nearly 4,500 had been prepared, and 300 timber houses had been completed by the end of 1920. The estimated cost of 4,443 permanent houses, including streets and sewers, was £4,763,686. A new justiciary building was opened by Lord Dunedin on July 7 1913.

During the period of voluntary recruiting for service in the World War the total enlistments in the city of Glasgow numbered 178,000 (inclusive of recruits from areas outside the boundaries).

The amount invested in the various forms of War Loan was approximately £83,500,000, and subscriptions for benevolent purposes connected with the war reached a total of £5,000,000.

GLASS, CARTER (1858–), American politician, was born at Lynchburg, Va., Jan. 4 1858. He studied in the schools of his native town; learned the printer's trade, which he followed several years; and became proprietor of the *Daily News* and the *Daily Advance*, the morning and evening papers of Lynchburg. He was elected to the Virginia State Senate for two terms (1899–1903) and was a member of the State Constitutional Convention in 1901. He was elected to the national House of Representatives to fill the unexpired term (1902–3) of P. J. Otey, deceased, and was continuously reëlected thereafter to serve through 1919. As chairman of the House Banking Committee he was active in framing and passing the Federal Reserve Bank Law. In 1918 he resigned from the House to enter the Cabinet of President Wilson as Secretary of the Treasury, succeeding William G. McAdoo. Under his guidance the fifth Liberty Loan was floated in April 1919. In Nov. 1919 he was appointed by Governor Davis of Virginia to serve in the U.S. Senate for the unexpired term (1919–25) of Thomas S. Martin, deceased, and he resigned as Secretary of the Treasury. He was chairman of the Committee on Resolutions at the National Democratic Convention in 1920.

GLASS (*see* 12.86).—During 1910–20, and more especially during the period of the World War, very considerable developments in the glass industry occurred, both in the glass produced and in the varieties of glass manufactured. In the following article attention is, of necessity, given to the British glass industry. In certain respects the art of glass-making has for long been at a very high level in Great Britain. The products of leading manufacturers in the London, Stourbridge and Manchester districts, so far as table-ware, ornamental glassware and coloured glasses for windows are concerned, have, for many years, been of as fine a quality as any obtainable elsewhere. Indeed some of the ornamental glassware made in England has long been unrivalled. There is no need to amplify what has been said in the earlier article on these matters. When the war drew attention to the British position in respect of glass generally, it was in the direction of scientific glassware and special glass for certain industries, that the deficiencies were realized. Glass for scientific purposes may be taken to include optical glass and all glassware used in laboratories.

Laboratory Glass.—To deal with laboratory glassware in the first place. Before the war it may be said that nearly all the glass and glass apparatus used in laboratories throughout the United Kingdom was obtained from abroad. The main kinds of glass required for laboratory purposes may be grouped thus: Soft glass for tubing, and for a number of articles and vessels where the highest resistance to chemical action is not required, glass highly resistant to chemical action; very hard glass for combustion tubing; glass for thermometers.

Soft Glass.—Such a glass must be soft enough to be readily worked in a flame, and must stand prolonged heating without showing the changes in appearance and working qualities generally described as devitrification. Before chemical glassware of foreign origin became practically universal in laboratories, vessels and apparatus in great variety were made from lead glass. Many examples have survived long and continued usage. Their appearance at the present time shows how good this glass was in respect of its general resistance to chemical change, and their survival probably is to be ascribed largely to the property of such glass, when well made, of withstanding changes of temperature. Lead glass for chemical use has certain disadvantages. It may contaminate solutions with lead, and some varieties of it are specially prone to show surface darkening when exposed to solutions of alkaline sulphides. Again, in working lead glass in the flame, the care needed to avoid reduction of the lead with consequent blackening made the introduction of a workable glass free from lead a very welcome change to those who had not mastered the art of working lead glass. Experience has shown that the many advantages claimed for non-lead glass as a material for laboratory apparatus have been proved, and there is no likelihood of a return, nor adequate reason for a return, to lead glass. Common custom has, however, directed the attention of laboratory workers so markedly away from lead glass that it may be worth mentioning here that this glass can be made of such high resistance to the action of water, and of many solutions which also abstract alkali from glass, that in some special cases vessels made from it are only surpassed by silica in resistance to chemical change. As one instance, certain colloidal preparations can be kept far longer in vessels made from a suitable lead glass than is found to be possible with any of the chemical resistance glasses of the non-lead type. The durability of well-made lead glass is a matter of common experience in table glassware, many examples of which have been in constant or occasional use for years, exposed to variable atmospheres and all the processes incidental to cleaning, without showing any noticeable disintegration or discoloration of their surfaces. It is not intended here to advocate the use of lead glass for general scientific other than optical purposes, but only to suggest that it has certain properties which are useful, and which might advantageously be more fully considered than has been the custom in dealing with glasses for laboratory use.

In the early days of the war it was recognized that there would be a serious shortage of laboratory vessels. A simple sodium-calcium-silicate glass was known to be unsuitable since the readiness with which it devitrifies in a flame makes it impossible to produce from it any articles which have to be lamp-blown, and tubing made from it is practically useless to workers in laboratories. The immediate advance made was the addition of alumina, either as such, or preferably in the form of felspar. The use of alumina for retarding devitrification and for rendering a glass workable in the flame was known in Great Britain, and at least three British manufacturers had for some years produced glasses containing various percentages of alumina up to about 10%.

It is unnecessary to go in detail through the stages of development of the so-called soft soda glass, but one or two points may be mentioned. Quite early in the production of this kind of glass it was recognized that a sodium-potassium-calcium-aluminium-silicate type of glass had most satisfactory general properties, that arsenic was not permissible, and that the only constituent other than those indicated which might be added was a small amount of manganese dioxide, to disguise the green colour due to the presence of iron in the material used. The formula given here shows the approximate composition of a batch mixture expressed in percentages of silica and oxides of the metals in the various ingredients of the batch:—SiO_2, 68; Al_2O_3, 4; CaO, 7; K_2O, 6·5; Na_2O, 14·5. Manufacturers vary the proportions somewhat, either to suit their furnaces or through preference for some particular set of proportions, but the formula given is an example of one yielding a good glass, soft enough for flame-working while possessing good durability.

Glass of this type was made in the early part of the war, and would have been continued, as one meeting many scientific and industrial requirements, had it not been for the necessity of conserving supplies of potassium compounds, of which the amounts that could be apportioned for use in glass manufacture were sufficient only for the production of certain optical glasses. Without potassium compounds these optical glasses could not be made having the constants required by the optical industry. Manufacturers of other scientific glassware had, therefore, to search for methods of producing soft workable glasses without employing quantitites of manufactured potassium compounds. To some extent nitre was available and was used. Potash felspar, which for long had been an ingredient in certain glasses, was a convenient form of aluminium compound for introducing alumina. The amounts of this material employed varied between wide limits, and glasses of good working qualities were obtained. Good examples of potash felspar contained about 10% of K_2O. If in the above formula all the alumina be introduced in the form of such felspar, about 2% of K_2O is also introduced into the glass. Glasses having many good qualities were made with enough felspar to yield from 3 to 4% of K_2O in the resulting glass, but the amount of alumina introduced rendered the glass too stiff, and liable also to give a roughened surface if long worked in the blowpipe flame. Such roughening could be removed by heating to a higher temperature, but its occurrence was a decided objection, and, moreover, flame-workers were placed at some disadvantage in respect of the time occupied in the production of blown vessels and apparatus. To remedy these defects varying proportions of borax were employed, and in this way sodium-potassium-calcium-aluminium-boro-silicate glasses of good working qualities and of marked durability were produced, which met many of the requirements of laboratory workers. Some investigators and manufacturers of scientific glassware, however, looked upon these glasses as temporary expedients, and only awaited supplies of potassium compounds to return to the earlier type.

It is not found convenient by glass-makers to have to produce a very great variety of glasses. Unless a glass is generally suitable for the needs of laboratories and of industries where ready and kindly working in a flame, along with good durability, is required of it, the glass fails to fulfil the requirements it may reasonably be expected to meet. For example, the boro-silicate glass referred to possessed many desirable properties, and articles made from it in the flame, and also by blowing into moulds, left little to be desired when the glass was well made and the necessary technical skill had been acquired. It failed, however, when used for X-ray tubes. Good and workable bulbs and tubing could be made from it, but experience showed that X-ray tubes of this glass took longer to exhaust, and that there was a lack of stability in the vacua obtained. Investigation left little doubt that the glass parted with water vapour under electrical bombardment, and the results of numerous experiments proved that borax was an undesirable ingredient in glass intended for X-ray work. A glass of the general type indicated in the formula above is quite suitable for such work, and hence X-ray bulbs and tubing can be made from it in the course of working a pot for a variety of other articles. It may be mentioned here that, unless manganese in small quantity be present in the glass, an X-ray tube in use does not exhibit the green phosphorescence with which workers with X-rays appear to have become accustomed. As manganese dioxide is generally added as a so-called decolorizer, only one type of glass need be made for practically all the scientific purposes and many of the industrial purposes to which a comparatively soft glass is put. Experience so far appears to show that the best type is on the lines of the formula given, and that the presence of notable proportions of the oxides of aluminium and potassium are essential. It is unnecessary to go into details about the form in which each ingredient of the glass is introduced in the batch mixture. Potash felspar has been mentioned as a convenient source of alumina, and part of the alkalies may be usefully added as nitrates. In general, all the materials of the batch mixture should be as pure as can be obtained commercially, so that the composition of the glass may depart as little as possible from that which it is intended to have, and which has been proved to give satisfactory results.

Before proceeding to other types of scientific glassware which were called for during the war, one or two remarks which are relevant for almost all glasses may be made here.

As far as it is possible to obtain and to store them, all the substances for a batch mixture should be free from water. In several instances it has been shown that a glass made from anhydrous materials differs from one calculated to give the same composition finally, but produced from a wet batch, or from one containing an ingredient having a notable proportion of combined water. In addition to some lack of general stability, the glass from a wet batch may show, and in many instances has shown, a greater tendency to devitrification when heated in a flame or by radiation. The amount of water left in a glass may be very small, but it has been shown to be sufficient to affect the behaviour of the glass. The only reservation to the statement that to produce the best glasses the materials should be dry is that the action of water to effect change in glasses either during their production or on subsequently heating them is, if not imperative, at least an advantage in respect of the production of certain coloured glasses and apparently of some opal glasses.

The other remark is about homogeneity. Apart from optical glasses, which must have the same composition throughout, all glasses for laboratory use should be made in such a way as to secure the greatest possible homogeneity. It is a matter of experience that glass which has been kept heated for some time, even after it is apparently "fined" and ready for working, is more resistant to heat changes and is also more generally stable than the same glass less well founded. Attempts to secure the thorough incorporation of all the ingredients by making the glass at a very high temperature were not altogether satisfactory, since there was greater attack of the pot, and, in many cases, too much loss of some of the more volatile constituents. Some glasses require very high temperatures, and problems connected with them led to investigations on materials for pots and furnaces to improve their refractory nature and so to make the production of such glasses possible. The remark about long heating applies to these glasses as well, but the attempt to substitute heating through a relatively short period of time at a very high temperature, for long-founding of glasses which only needed a moderately high temperature, led to uncertainty of composition and failed to secure the homogeneity aimed at. It is perhaps unwise to dogmatize on this matter, having in mind certain exceptions, but as a general rule it may be said that in the present state of our knowledge the long-founding so much insisted upon by many experienced glass manufacturers cannot be dispensed with if the nicest possible refinements of a good glass are to be realized.

Stirring to secure homogeneity is a necessary operation in making optical glass. It is not customary to stir glass for laboratory use, but this is not to say that such glass would not be improved by being stirred if it were economically possible to do so. Although it is outside the range of scientific glasses, the opportunity may be taken here of drawing attention to an instance in which perfect homogeneity in glass does not appear to all eyes as an advantage. The instance is that of coloured glasses used for decorative purposes, such as windows. Some of the charm of old glass seems to be associated with a marked lack of identity of composition, and, therefore, of regularity of optical properties throughout the glass. From a glass-maker's point of view it was an imperfect manufacture, but those who find depth and life in the less perfect production may ask, "Would it be imperfect manufacture to take advantage of the possibilities in a glass-melting to secure a more perfect fitness and suitability for the purposes for which such a glass is designed?" Certainly the control which modern manufacturers have over glass, and the knowledge and experience which they possess, would make it possible to secure a great variety of pleasing results.

The subject of annealing has, in recent years, been given much attention, and several investigations have been carried out. Results of much interest and importance have been obtained, dealing with the conditions for removing strain in glass and with the problem of annealing, both from the theoretical and a practical point of view. Consideration of these results serve to emphasize the importance of thoroughly annealing any glass articles which are required to withstand marked changes of temperature, and of arranging that any vessels, etc., which in the course of production are re-heated locally, shall be re-annealed. Tubing is not customarily annealed as part of the process of manufacture, but for certain purposes, notably with tubes which are to be ground, it is an advantage to anneal them.

"Resistance" Glass.—Laboratory glassware, to deserve this description, must possess great stability, and must part with only minute traces of any of its ingredients when it is exposed to the action of the majority of solutions and liquids used in a chemical laboratory. In the early days of the war the production of such glassware was undertaken by British manufacturers. The chief varieties made can be included in two types: one containing compounds of zinc and the other free from this metal. In neither type is the inclusion of arsenic or antimony considered to be permissible.

The following formulae, illustrative of these two types, give approximate proportions for batch mixtures expressed in percentages of the oxides contained in the various ingredients of a batch:—

(A)		(B)	
SiO_2	66	SiO_2	66
B_2O_3	8	B_2O_3	9
Al_2O_3	9	Al_2O_3	2·5
CaO	5	ZnO	8
MgO	1	MgO	5
Na_2O	8	Na_2O	9·5
K_2O	3		

It is to be understood that adjustments of the proportions given can be made to suit different furnaces and also to fit in with the amount of broken-up glass from previous meltings (cullet), which is incorporated in the batch. The addition of cullet is customary on economical grounds, and also because it is a matter of experience that, with a number of glasses, the desirable properties are more easily realized when notable proportions of cullet are used. Of these two types of resistance glass (A) requires a rather higher temperature in the making and on the whole presents more difficulties than (B). It has also a somewhat higher coefficient of expansion, and on that ground is less liable to withstand sudden changes of temperature. Previous remarks on the influence of long-founding for securing homogeneity and stability apply in a marked manner to such a glass as (A), and this type has been made of very high chemical resistance and of satisfactory behaviour when quickly heated or cooled through a greater range of temperature than it would usually be exposed to in a laboratory. In comparison with glass (B) it is generally more reliable for working in a flame. Several examples of the type (B) tend to show reduction of zinc in a blowpipe flame, but glasses of type (B) can be, and have been, made by British manufacturers, which exhibit none of this reduction even in a very hot flame. The general resistance of glass (B) to chemical action is good, but with hot strong solutions of caustic alkalies it does part with some zinc, and, to a very small extent, this is true of its behaviour with strong acids. Good examples of glass (A) are more resistant in the sense that they are less soluble in such reagents, but the slight action which does occur causes a roughening of the surface of the glass which is noticeable, while in the case of glass (B) the surface is left polished even though the solvent action on it may have been much greater.

Balancing the evidence of the advantages and disadvantages of the two types in their general applications to laboratory work, it is probably fair to give preference, on the whole, to glass of type (B). It is inherently more capable of withstanding sudden changes of temperature, and because it is the easier glass to make, there is less likelihood with vessels made from it of mishaps due to imperfect manufacture of the glass. Whichever class of glass is chosen, all vessels and apparatus made from it need thorough annealing.

Combustion Tubing.—Tubing of very hard glass is essential for many laboratory experiments, and since it is largely used in the analysis of carbon compounds by combustion it has come to be known specially in this connexion, but in tubing of various diameters it is required for a number of other purposes. Most of these preclude the use of any compounds of arsenic or antimony in the composition of batch mixtures for making the glass. Before the introduction of a new type of tubing from Jena, combustions and other operations at high temperature were carried out in a potassium-calcium-silicate glass, the best-known form of which was Kavalier's combustion tubing. The general composition of this glass is indicated by the following percentages to the nearest whole numbers:—SiO_2, 78; CaO, 8; K_2O, 12; Na_2O, 2. Glass of this kind served many useful purposes in laboratories, but it was difficult to use in a blowpipe flame, considerable skill being needed to work it quickly enough to avoid devitrification to an extent sufficient to roughen the surface and bring about a pasty condition which prevented the glass from flowing under heat. The Jena glass which took its place possessed greater plasticity over a longer range of temperature, and was stiff enough to allow of tubing being usable at a temperature at which the older kind tended somewhat suddenly to collapse. During the war very hard glass tubing was much needed, and as the result of experiments on a laboratory scale and in glass works, tubing of a type similar to the Jena combustion tubing was produced fully equal to any obtained before the war. With regard to hardness and suitability for working in the flame it fulfils its purpose most satisfactorily. It differs advantageously in one respect from the pre-war glass, in that it does not show anything like the same tendency to become opal when heated for a long time. The following is the composition for a batch mixture, given as for other glasses in the percentage of oxides: — SiO_2, 68·5; B_2O_3, 5·5; Al_2O_3, 6; CaO, 8; BaO, 6·8; Na_2O, 3·2; K_2O, 2. Remarks made about formulae for batch mixtures of glasses previously mentioned apply to this formula in respect of adjustments for addition of cullet and for some modifications to suit different furnaces. With this glass, however, there is not much latitude allowable if the full hardness of the glass is to be realized and difficulties in manufacture are to be avoided. The glass is one requiring a high temperature for its successful production, and is another example of the need for such glasses calling for investigation of refractories in order to make their production possible.

Thermometer Glass.—The manufacture of thermometers of all kinds has been carried on in Great Britain for many years, and British capillary tubing of high quality and technical perfection has long been available for their production. The tubing has been made both from lead glass and from various other types of glass, and has been in constant demand. An ideal glass for thermometers, in addition to being a good durable and workable glass, must be of such a nature that bulbs blown from it are constant, in that after being heated they rapidly return to their original volume. Thermometers made from such a glass would not show any change in their zero points after use. Jena thermometer tubing has gained a high reputation for close approximation to this ideal, and large quantities of it have been used by British thermometer makers. Mention should be made of the fact that at least one British glass manufacturer produced tubing also near to this ideal some years before the war. During the war very great numbers of thermometers were called for, the greater proportion being for medical purposes, but many also for scientific and industrial use. The production of these drew attention to the subject of glass for thermometers generally. Guided by their own knowledge and experiments, and assisted, in some instances, by other investigations, manufacturers of glass produced tubing to meet the demand, not only in lead glass, for the production of which they were ready and pre-eminent, but also in other varieties of glass having properties closely similar to two Jena glasses of high reputation. One of these can be used for thermometers, capable of standing high temperatures up to about 500° C., and the other is for more general application. The following formulae, given as for other glasses in percentages of oxides and with similar reservations, indicate the nature of batch mixtures for these types of glass:—

High Temperatures		Ordinary Temperatures	
SiO_2	73·5	SiO_2	67·0
B_2O_3	9·7	B_2O_3	2·5
Al_2O_3	5·8	Al_2O_3	2·7
Na_2O	11·0	CaO	6·5
		ZnO	6·7
		Na_2O	14·6

Vessels and Apparatus.—If we turn from the character of the glasses themselves to the vessels and apparatus made from them, scientific glassware may be broadly classified as furnace-made and as lamp-blown. The former is for the most part produced by blowing into moulds molten glass gathered from the furnace on a blowing-iron. When the variety in shapes and sizes of flasks, beakers and other apparatus used in laboratories is considered, it will be realized how great a development had taken place in this direction after the war in a British industry in which, for several years, practically none of this type of apparatus had been made. So also in the lamp-blown apparatus had there been a remarkable extension in development. Before the war, lamp workers for laboratory apparatus were few in number in Great Britain and were chiefly engaged either in making a comparatively small amount of apparatus to special design or in repair work. During the war numbers of workers of both sexes were trained in lamp-blowing generally, and in 1921 those making scientific glassware were producing practically all the varieties of this kind of apparatus needed in laboratories, the best examples comparing favourably with any obtained in the past from abroad. Glass for such apparatus is supplied to the lamp blower in the form of tubing, in the production of which, therefore, there had also been a great development.

The production of scientific glassware arising out of the needs of the war was one of the most noteworthy extensions of glass manufacture in Great Britain. Since so little of this kind of glassware had been made there for such a long time, the manufacturers were not, in the majority of instances, equipped with the knowledge and experience necessary to start at once. The deserved reputation of most of the scientific glassware of foreign origin made it natural at first to attack the problem of its reproduction. It is only justice to foreign manufacturers to acknowledge indebtedness to them for a number of types to work to. At the same time it would be injustice to British manufacturers of glass to give the impression that, among the great number of varieties which they had to make during the war for all kinds of purposes, there were not very many which were produced *de novo*, as the result of the work of a number of investigations outside, as well as inside, the industry, and of ready enterprise on the part of the manufacturers. For several of the glasses needed there were no available data to go upon, and the knowledge and experience required for guidance in the earlier stages of their production had to be gained by research.

The best examples of glasses for scientific purposes, of British manufacture, are now fully equal to any pre-war glass, and some are superior. The glasses already mentioned are the chief ones required for the production of laboratory apparatus, but they do not, by a long way, exhaust the list of glasses called for during the war for special scientific use or for industrial purposes. Examples are here briefly referred to.

For glass for miners' lamps, a glass withstanding rapid changes of temperature exceptionally well was necessary, since the lamp glasses are thick and the flame of the lamp may often touch them. There was an urgent demand for them early in the war. It was successfully met, and such glasses of British make are now produced in large quantities. Another glass on similar lines, but differing somewhat in composition, was prepared for the production of chimneys for incandescent and high-pressure gas illumination, paraffin lamps, etc. In addition to withstanding heat changes well such a glass must be markedly resistant to the chemical action of hot products of combustion. Both these glasses consist chiefly of alkaline boro-silicates having a high percentage of boric anhydride. They need a high temperature for their successful production in a homogeneous state. When well founded their low coefficients of expansion render articles made from them highly resistant to sudden variations in temperature over a long range.

Glass rods for half-watt electric lamps were required, to hold the thicker tungsten wires which support the filament of this metal. They had to be made specially, since no existing glass of British make capable of withstanding heat changes was also sufficiently reliable in respect of not cracking round the sealed-in wires. This glass in most cases involved also the production of special rods to join with it and with the stem of the lamp.

Other glasses were needed which, while making safe joints with ordinary laboratory tubing, etc., would hold platinum, copper, iron or nickel wires. Such glasses are often described as sealing-in enamels. Several of these have been made, and, generally speaking, they are of the type either of a soft glass containing a high percentage of lead, or of one free from lead and containing a notable proportion of a fluoride, such as cryolite. The coefficient of expansion of the glass, in relation to that of the metal wire used, has to be taken into account, but it is not the only factor, as may be just indicated here by the mention of a sealing-in enamel which is successful with platinum and copper but cracks with iron, nickel or tungsten.

Other glasses, and glassware from them, which had to be made during the war will be mentioned very briefly. They were of great importance, but, generally speaking, they were familiar to British manufacturers, and their manufacture did not need the extensive preliminary investigations and trials which the production of most of the foregoing glasses involved.

Bulbs for Making Ordinary Electric Lamps.—Before the war somewhat less than a quarter of our requirements of these was made by British manufacture. A very great extension of this part of the industry during the war was urgent. In 1918 bulbs were being made at the rate of about 1,000,000 per week.

Jars for Preserving Fruit and Meat.—Though numbers of these had long been made in Great Britain, about 80% of the total number used had been obtained from abroad. Great increase in the production of these vessels was required to meet the needs, enhanced as they were by the war. Bottles for a great variety of purposes had always been made by British manufacturers, but not in the great quantities which were required when sources of supplies from abroad were cut off or were inadequate. The extension of this part of the glass industry was very great even on the older lines of manufacture, but the necessity for more economic production led to a review of methods and to the adoption of new machinery.

Glassware for Medical Purposes.—Some of this has for many years been made in Great Britain, but not in sufficient quantities to supply the demand, and much of it was obtained from abroad. The war caused a great increase in the demand, and very large quantities of vials, tubes, syringes, graduated measures, etc., had to be made. Most of these could be produced from glass, and by methods familiar to manufacturers, but some requirements had to be met by investigation and experiment before suitable glass was produced. In connexion with medical glassware, artificial human eyes may be mentioned. For their production there are required opal glasses to suit variations in the tint of the sclerotic; bright clear glass for the lens; black glass for the pupil, and a great variety of coloured glasses for the iris; a clear glass containing fine embedded threads of opal used for imitating the irregularly radiated appearance of the iris, and a red glass for the veins of the eye. Artificial eyes had for many years been made in Great Britain, but many were imported. Most British makers of them are used to working in lead glasses, and many of their products will bear comparison with the best of foreign origin, which, as a rule, are made from glasses free from lead. Experiments for the production of such glasses as the latter furnished the data for their manufacture.

There was considerable increase during the war in the production of coloured glasses, *e.g.* for spectacles to protect the eyes of the great numbers of men working at steel furnaces. Coloured glasses in considerable variety were also wanted for other purposes, but in comparatively small amounts. Some of them needed investigation and a number of experiments before the conditions for their production could be determined.

From what has been stated already it may be gathered that a great advance had to be made in glass manufacture through needs arising out of the war, and sufficient has, perhaps, been said to indicate that the knowledge and experience gained in meeting them had placed the British glass industry in this respect in 1921 in a very different position from that of 1911.

Optical Glass.—Of none of the glasses already mentioned can it be said there was more imperative need for their production than for the variety of glasses required to make the numerous optical instruments used during the war. Early in it there was no doubt that the supplies of optical glass existing in England would soon be exhausted. For about three quarters of a century, Messrs. Chance Brothers of Birmingham had produced optical glass. They were enabled greatly to extend their facilities for production, in order to meet the demands which rapidly arose and were very urgent. The change which was brought about in the production of optical glass in England will be gathered from the following comparative figures. For a year or two before the war, out of the total amount of optical glass used in Great Britain, approximately 60% was imported from Germany, 30% from France, and 10% was of English manufacture. In 1916 81% was English and 19% was obtained from France, while the total quantity supplied by Messrs. Chance Brothers was about 18 times as much as they sent out in 1913 and over three times as much as the total quantity of optical glass from all sources used in Great Britain in that year. About the middle of 1917 the Derby Crown Glass Co., which was formed in the autumn of 1916 for the manufacture of optical glass, was supplying it. Figures for the first quarter of 1918 show that 96% of the optical glass used in Great Britain was made at home, while France supplied only 4% of the British requirements. In that first quarter the output of optical glass made in England was about nine times as much as the total quantity of English manufacture produced in the whole of 1913, and it was being made at the rate of an annual production of more than six times the total quantity of optical glass from all sources used by British optical instrument manufacturers in 1913. This great increase in production was due entirely to the war, since during it very little optical glass was used for purposes other than the manufacture of instruments for the fighting services. The compulsory extension of manufacture called mostly for development in quantity production rather than increase in the number of types manufactured. A few types not hitherto made in England have been produced; but Messrs. Chance Brothers for some years have manufactured a number of glasses having properties similar to several types of Jena optical glass. Both this firm and the Derby Crown Glass Co. have been called upon for glasses having pre-determined optical constants, and the meeting of these demands has involved a considerable amount of investigation and experiment. No completely new type of optical glass has been manufactured; but in some instances the requirements of the optician have necessitated a departure so marked as to constitute an extreme variety very like one.

It is not easy to suggest a strict definition of "type" as applied to optical glass. The two types of earlier days were "flint" and "crown" the former containing lead oxide and the latter calcium oxide along with alkalies and silica. The names are convenient, as their connotations are understood and they have become conventional; but a glass free from lead may be used as the flint, and one containing lead may be employed as the crown, in some optical combinations of lenses. For practically all the optical glasses other than the old flints and crowns the optical industry is indebted in the first instance to the researches and manufacture carried out at Jena. Many substances not used before in the production of glass enter into their composition, and it would seem preferable to restrict the expression types to such glasses as have markedly different chemical compositions. It is not necessary to elaborate this point here. It is mentioned only to indicate a distinction between the comparatively few distinct types of optical glasses which have been made and the large number of varieties of them which are needed to provide for the many differences in optical constants asked for by opticians.

Investigation and experience have enabled the English manufacturers of optical glass to go far in satisfying the demands of the manufacturers of optical instruments of all kinds; but there is still room for much experimental research for glasses and transparent media nearer to the ideals present in the minds of designers of optical systems.

With regard to homogeneity, freedom from colour and durability, optical glasses made in England have reached a high level. During the war, in spite of the fact that production had to be so largely increased, the good qualities of the glass generally were not only maintained, but in many instances of glasses somewhat difficult to make a high quality was reached, at least equal to the very best which was available before the war. With the experience gained in recent years improvements of manufacture are possible which point to a greater percentage of yield of high-quality glass than has hitherto been obtained from any melting. The use of more efficient mechanical means for handling pots of glass, the production of pots more highly resistant to the chemical action of molten glass, increase of the durability of some of the less stable glasses, ready production of large homogeneous masses of glass, and the production of new glasses, are the lines along which future progress may be expected, and are the developments indicated during the great activity in the British optical industry owing to the war.

No attempt can be made here to discuss the compositions of the various glasses which have been produced, or to deal in any detail with the range of optical constants now available. Before leaving the subject, however, the relevancy of the problems connected with optical glass to the production of some other glasses may be mentioned. It is a matter of experience that the numerous researches required for the production of various types of optical glass have a considerable value, not only in arriving at the immediate end in view, but also because the knowledge obtained of the properties of glasses of very varied chemical composition is of the highest importance in pointing the way for designing many glasses for other scientific purposes, and also for certain industrial use. This applies not only to the actual glass, but also to several considerations in respect of furnaces and refractories.

Acknowledgment must be made here of the work organized in England during the war by the Department of Scientific and Industrial Research; of work and investigations carried out by the National Physical Laboratory; of the practical investigations by a committee of the Institute of Chemistry; of the work and investigations undertaken by the glass technology department of the university of Sheffield, and of the guidance and stimulus given by the department of the Ministry of Munitions, which, concerned at first with optical glass only, soon became responsible for supplies of glass and glassware of all descriptions.

Progress in the Use of Machinery.—It is probable that between 1910–21 the greatest advance in the economic production of certain types of glassware was in the direction of the introduction of machinery and minor labour-saving devices in substitution of the older hand methods employed in production. Naturally this substitution was only rendered practicable by concurrent improvements in the means for assuring a continuous supply of molten glass in a suitable condition to permit of the machines being run continuously. It will, therefore, be understood that whereas the common practice in the past has been to found the glass in pots in direct-fired furnaces, there has been a gradual tendency for tanks, some of them being of very large capacity, holding as much as 300 tons of molten glass, to take the place of the older pot furnaces. It is scarcely possible that the pot furnace will entirely disappear from practice, inasmuch as those glasses which are only required in comparatively small quantities or of absolute purity, as in the case of optical glass, certain coloured glasses, and those liable to contamination from furnace gases, will still have to be pot-founded.

The development of machinery in glass manufacture has been by gradual evolution. In general the earlier efforts were directed towards imitating by mechanical means the sequence of the operations performed by the skilled glass worker; and we find, therefore, that skilled labour was not suddenly displaced. The earlier machines were partly automatic or semi-automatic, and required a gatherer, a human link between the furnace and the machine, and also a boy to take and transport the finished article from the machine to the annealing lehr. The human links have now been dispensed with in many American factories; neither the raw materials nor the glass is handled at any stage during the progress of manufacture. Conveyors transfer the raw material from the trucks to the storage bin; automatic weighers discharge the requisite quantity of material from the storage bin to a rotary mixer mounted on a trolley; another conveyor transfers the mixed batch to the batch storage bin in close proximity to the charging end of the tank, for the ready release of the batch down a chute at periodic intervals into the tank.

Although machinery has entered so largely into glassware production, there are still some few operations where man has not been displaced. This is more particularly in evidence in the production of many types of chemical glassware produced by the glass-blower with the aid of a blowpipe, the beautiful specimens of cut table-ware, the handiwork of the craftsman skilled in the use of the grinding wheel and polishing pads, and other ornamental ware.

The types of machines may be conveniently divided into the following groups:—pressing machines for the production of tumblers, meat and jelly jars, bull's-eye lenses, tableware and pavement lights; press and blow machines for all types of bottles, and many kinds of food containers; blow machines for electric lamp bulbs, lamp chimneys and similar articles; rolling machines for plate glass, figured and ribbed glass and reinforced sheet for sheet and window glass, and for drawing tubes and rods.

In addition to the glass-forming machines there are many other types for miscellaneous purposes, including cracking-off machines for severing the fashioned article from the waste glass, employing multiple fine jets of flame which impinge on the line of severance. This line is usually started by a short diamond cut at the predetermined point. Calibrating machines for accurately dividing measuring devices such as thermometers, burettes, pipettes and cylinders; grinding and polishing machines for preparing and finishing the surface of plate glass; machines for forming the stoppers of bottles and for grinding the seating in the neck of the bottle; flowing devices and feeding machines, to take the place of the gatherer and his operation of withdrawing from the pot or tank, by means of a gathering-iron, a sufficient quantity of molten glass to make the article required.

It will be readily appreciated that in common with certain other industries the development of glass manufacture has made remarkable strides on the engineering side. The advance is the more marked, inasmuch as the progress made in other essentials has not been commensurate with mechanical progress.

Press Machines.—No very marked advance has been made in recent years in this type of machine so far as principle of operation is concerned, but there has been constant improvement in detail. It will be appreciated that a very limited number of types of article can be made with a solid mould. Only such as have both an internal and external taper, the diameter being reduced in the direction of the movement of the plunger, are suitable. In all other cases where the ware has external shoulders or ornament, the mould must be hinged. In the semi-automatic and fully automatic machines the movements of the plunger and mould are operated by compressed air. It is in the control valves and mechanism for operating the moulds that improvements have been effected. In the earlier press machines the plunger was directly connected with the piston, resulting in an equal pressure throughout the stroke. The later types in which the power is transmitted through toggles are much more efficient, since a slower motion and increased pressure are obtained as the plunger nears the end of its stroke. This arrangement conforms to what has been found to be the best practice in using the hand-lever press. If too much glass be fed into the mould, less pressure is required to form the article than if there is a comparative shortage of glass when a heavy pull is required on the lever. The toggle machine, therefore, is adapted to compensate for variations in the quantity of glass fed into the mould.

In another type of press machine a series of moulds is arranged on a rotating plate, and by means of air pressure the mould containing the molten glass, when it reaches a point immediately beneath the plunger, is forced upwards to meet the fixed plunger. This type of machine is employed in making deep pressed ware such as tumblers and is usually adapted only to solid moulds. Press machines naturally vary very much in size according to the ware to be produced. Probably the largest of its kind is one operated in America for the production of glass burial caskets, which measure up to 6 ft. 3 in. in length. The machine weighs about 6 tons, and is capable of developing a pressure of about 700 tons.

Press and Blow Machines.—This type of machine is used in greater numbers and of more varied forms than any other class of glass machinery. It is essentially the bottle machine. It may be interesting to note that the first attempt to produce a machine for making bottles was the work of an Englishman, although it is to American skill and enterprise that the successful development of this complex machine is due. A press and blow machine is designed to perform two distinct operations. In the first the neck of the bottle is formed by pressure in what is known as the parison mould, and in the second the body is blown and finished in the blow mould. In general the machine consists of two circular plates, either disposed one above the other and capable of a step by step rotation about a central pillar, or arranged side by side, the second being driven from the first by an intermediate pinion or gearing also by a step by step motion. At regular intervals near the periphery of one plate (the upper one in the first case) are situated the parison moulds for forming the neck, and on the other plate similarly situated are the blow moulds for forming the body. All the necessary movements, including the rotation of the plate, the actuation of the plunger, the automatic opening and closing of the moulds, and the transfer of the blank from the parison mould to the blow mould are performed by air pressure. In certain types of machine the last-mentioned operation is not performed automatically, but by hand.

The sequence of operations in making a bottle on such a machine is as follows. A supply of molten glass is fed into the blank mould, either by one of the various types of automatic feed or by a gatherer using the usual form of punty rod. A blowing head then makes contact with the mould and blows the glass down on to the plunger, thus forming the neck of the bottle. The plunger is withdrawn, and the table advanced to the next position. A puff of air is blown into the orifice, to blow the glass to the full size of the blank mould. Again the table advances, and at the third position the mould opens and the glass blank is transferred to the blow mould situated on the second table. This mould closes round the glass, and the blowing head takes up the correct position to supply the necessary air pressure to blow the bottle to the required shape. The mould again advances and opens at the next position when the finished bottle is removed and transferred to the annealing lehr. Considerable difficulty was experienced in producing satisfactorily small narrow-necked bottles, but within the last few years the difficulties have been overcome and satisfactory results have been obtained on fully automatic and semi-automatic machines. Naturally the speed of production depends on the type of machine and the size of the ware being produced, but the capacity of some of the later types of machine may be gathered from the fact that eight or nine bottles of one quart capacity can be produced in one minute, and smaller even faster.

Blow Machines.—The use of this type of machine is not nearly so common as that of the press and blow machine. They are principally used in the production of electric lamp bulbs, lamp chimneys, tumblers and similar light hollow ware. The main difference and special feature of these machines is that the moulds are coated internally with carbonized material, and the article is rotated in the mould during the period of blowing. It is therefore obvious that ware produced in such a mould must have a smooth regular surface, and any kind of figuring or ornamentation is out of the question. These machines may be semi-automatic, in which case a gatherer is necessary to feed the required quantity of glass to the machine, or they may be fully automatic, in which case the machine sucks up the molten glass from the tank. The former type of machine comprises generally four vertical frames mounted on a cast-iron base frame. A horizontal shaft carrying four circular discs runs in suitable bearings situated at the head of the vertical frames. Mounted loosely on the shaft and close to the discs are four arms, which, by means of suitable cams and tripping devices, can be rotated between a horizontal and vertical position. Each arm is provided with a small air pump at its extremity. On a level with the arm when in the horizontal position is a small disc, which serves the purpose of a marverer. This disc, mounted in a bearing attached to the back of the frame receives its motion from the vertical disc. A suitable mould disposed at the base of each vertical frame is mounted on a horizontal spindle capable of movement through 90°. When in the horizontal position, the mould is submerged in a trough of water situated in the base casting. The moulds are hinged, and the opening and closing movements are effected by a rod at the back.

The sequence of operations in making an electric bulb is as follows:—A gatherer having withdrawn from the pot or tank a mass of glass on his blowpipe secures the latter in contact with a rubber washer, forming part of the air pump at the end of the machine arm when the arm is in a horizontal position. The mass of glass on the end of the blowpipe, which is slowly rotating, comes into contact with the marverer, which is also rotating in the same direction. After a short period a cam comes into operation, causing a slight puff of air to be given to the glass through the blowing iron. The arm now assumes a vertical position with the glass at the bottom, and at the same time the mould takes up a vertical position, and the operator by pulling a lever causes the mould to close over the glass. Whilst the glass still attached to the end of the blowpipe is kept rotating in the mould, a puff of air is admitted through the blowpipe and expands the glass into the desired bulb. The operator then opens the mould, withdraws the blowing iron from the machine, and places it in an adjacent stand, when another operator severs the bulb from the iron with shears; the iron is cleaned off and is again ready for use.

A brief description of the other type of machine, which is fully automatic, is as follows:—The machine rotates by a step by step movement about a vertical axis at the rate of about two revolutions per minute, and is provided with six double arms actuated by cams disposed on a vertical drum. The first operation is the projection of the cantilever head into the furnace, when glass sufficient for two bulbs is sucked up by vacuum into the blank moulds; the cantilever head then withdraws and the glass blanks are released and deposited in cups. The cantilever heads are capable of being rotated about a horizontal axis, and the cups are in their top position when receiving the glass. At this point a rod is forced up into the glass to form a hole for the blowing operation. The machine is rotated to the next position and the head moves into the horizontal plane when the glass blank receives the first puff of air; at the next rotation of the machine the head assumes a vertical position with the partly formed bulb hanging downwards. At this stage either a reciprocating or a swinging motion is imparted to the head in imitation of a hand-worker's movements. The mould is then raised, and closes over the partly formed bulb, and a final puff of air is given. The next rotary movement of the machine opens and lowers away the mould, and the finished bulb is removed by hand. From the time that the glass is fed into the cups of the head until the bulb is blown the glass is kept rotating. Before the mould is again brought into operation it passes through a mixture of soap and water.

Sheet or Window Glass Machinery.—The earlier attempts to manufacture window glass by machinery better illustrate the tendency to imitate the methods which had proved by long practice to be best suited to production by hand. The objective of all the earlier machines was the production of as perfect a cylinder of glass as possible. Patents and improvements related rather to modification of detail than variation of first principles. The general method employed in this type of machine is to bring a ring or circular bait of metal into contact with the molten glass, to raise the bait by mechanical means, and at the same time supply air under a low but increasing pressure into the cylinder of glass so formed.

The following will give in brief the outline of a machine which is being successfully worked at the present time:—A pot or receptacle about 3½ ft. in diameter, and of a depth sufficient to hold the quantity of glass required in making a cylinder is charged by means of a ladle with molten glass taken from a tank furnace. A structure alongside the pot is so arranged as to permit of a bait being raised vertically by means of a motor to the full height of the cylinder to be drawn. The bait, which consists of a short hollow cylinder about 1 ft. in diameter, furnished with an internal lip at its lower end, is lowered into the molten glass contained in the pot, which has been left standing for a short time until the glass has attained the correct drawing temperature. As the bait is lowered the glass flows over the lip and solidifies, thus forming a starting point for the cylinder. An operator standing on a platform well above the pot level starts the motor, which raises the bait, and at the same time air under pressure is admitted through the top of the bait. The cylinder of glass quickly increases in diameter, and the pressure of air is arranged to give the desired dimension. In order to ensure a uniform thickness of wall, both the speed of drawing and the pressure and volume of air are increased to counteract the increased viscosity of the glass due to falling temperature. When the full cylinder, 40 ft. long and weighing about 1,000 lb., has been drawn, it is cracked off from the pot; the lower portion is swung out and the cylinder lowered into a horizontal position; the top portion or cap is cracked off and the remainder is divided into convenient lengths for handling; these are usually about 5 ft. long. The remaining processes of slitting and flattening are similar to those followed in hand-made cylinders.

In a later, and not yet so widely used, type of machine the sheet is drawn directly from the tank and requires no subsequent flattening treatment. The tank is furnished with an extension at the refining end into which the glass flows and cools sufficiently to be drawn. When in a proper condition, an iron bait in the form of a narrow iron plate is lowered into the molten glass, which welds to it. By means of a hand-actuated device the bait is raised; the sheet of glass following it is drawn through a pair of narrow water-cooled rollers arranged at each side of the sheet, which assist in maintaining its width, and then over a hard and highly polished roller situated about 30 in. above the drawing pot. Here the glass assumes a horizontal position. In the neighbourhood of the bending roller, additional heat is applied to the sheet to prevent any possibility of cracking; the sheet of glass then passes over a flattening plate and enters the annealing lehr. At this point a caterpillar drive pulls the sheet along and furnishes the power for the automatic drawing of the sheet. It will be seen, therefore, that the process is continuous so long as a supply of glass is available. By this process sheet-glass can be produced which may be of any predetermined thickness within wide limits, the governing factors being the speed of drawing and the temperature of the glass in the draw pot. The width of the sheet is about 6 ft., and the speed of drawing for the thin variety is about 2 ft. 6 in. per minute. At first there was a tendency for the glass manufactured by this process to be somewhat cordy, probably due to the surface cooling in the drawing chamber, but this has been overcome and the product is now of very good quality.

In the Belgian method of drawing sheet-glass the space above the glass in the tank is divided into two parts by means of a brick curtain which depends from the roof to a short distance below the surface of the glass; by this means the flame and hot gases are restricted to the melting end. Subsidiary ports are provided in the refining end to regulate temperature. In the refining end of the furnace two further similar brick curtains are arranged parallel and comparatively close together; between them floats a *débiteuse*, a hollow vessel made of fireclay or similar refractory material, rectangular in plan and with rectangular ends, but having a section to within a short distance of each end somewhat like an inverted M with the apex of the central angle cut off, thus leaving a long narrow slit giving access from the outside to the inside of the receptacle. This device has a specific gravity slightly less than that of glass; it floats, therefore, in such a position that the narrow central slit is just below the surface of the glass. Above the refining or drawing end of the tank, an erection in the form of a square tower about 13 or 14 ft. high, made of sheet iron lined with refractory material, is provided. On opposite sides of this tower are sets of double resilient rollers disposed vertically, and so arranged that when the sheet of glass is being drawn the edges of the sheet will pass between, and be gripped by, the rollers. The rollers on one side are driven by suitable gearing from an electric motor.

In drawing a sheet of glass a bait consisting of a narrow flat woven iron sheet of a length equal to the length of the slit in the *débiteuse* is lowered within the lips forming the slit. When the glass has welded to the bait the latter is raised, lifting with it a sheet of glass. By means of a water-circulating system the glass is chilled sufficiently to retain its form and then passes up between the rollers. When once gripped by the rollers the upward draw is continuous so long as the motive power is applied to the rollers. The bait is removed when the sheet reaches the top of the tower. The tower is provided with a series of inclined iron diaphragms, the upper part of each of which is flush with the rollers. These diaphragms serve the double purpose of preventing broken glass from falling into the tank, and of preventing the heat from the tank ascending the tower. By this means a rough annealing is performed, since the ascending sheet of glass is subject to a gradually falling temperature. When the sheet reaches the top of the tower it is cut to size and packed.

Plate Glass.—No special innovations have been introduced in recent years in the methods of manufacturing plate glass, with the exception of the means for annealing the plates. In the older method the plates are placed on the floor of a kiln when the latter is at a dull red heat; the opening is then built up and luted with fireclay. The heat is shut off, and the kiln allowed to cool gradually over a long period. Recently, however, a plant has been installed in the United States for annealing the plates in a continuous lehr, and it is claimed that the glass is equally well annealed as in the old process. The time saved is considerable, being five hours as against three days by the kiln method.

After the glass has been melted in a pot, the latter is taken bodily from the furnace, and the glass poured on to the rolling table, about 28 feet x 16 feet. This consists of a large cast-iron bed, usually made up in segments, carefully bolted together so as to give an even smooth surface and cooled by a water circulating system. A large roller extending the full width of the table, and weighing from 5 to 6 tons, is mechanically driven forward and spreads the glass out into a sheet. Guides are provided at each side of the table upon which the roller bears; the height of the guides governs the thickness of the sheet formed. The plate having been rolled is moved forward into the first section of the lehr, which is maintained at a temperature of about 600°C., and then progresses by an intermittent motion through the other sections of the lehr. The floor of the first sections of the lehr is made up of fireclay slabs, and, in the cooler sections, the glass moves forward on wooden slats or battens, the total length of the lehr being about 400 feet. As a fresh plate is rolled about every ten minutes, this fixes the period during which a plate remains in any one section of the lehr. After leaving the lehr the plates are carried by a travelling crane to the grinding and polishing shop.

Tube Drawing Machine.—There are two types of machine, the semi-automatic and the fully automatic. In the semi-automatic machine the mass of glass on the blowing iron is prepared as in the case of drawing by hand. The drawing machine is installed in a tower about 170 ft. high, in the basement of which is a motor-driven winding drum. A steel wire rope connected to the drum runs straight to a fixed pulley at the top of the tower and down again to the blowpipe carriage. The carriage is therefore raised or lowered when the drum is operated. The carriage is provided with means for securing the blowpipe, and also with four rollers which permit it to move freely between vertical guides. The glass having been prepared on the blowing iron, a punty is secured to a socket between the vertical guides; the glass, still on the blowing iron, is lowered on to the upper face of the punty and adheres to it; the blowing iron is then locked in its carriage and the motor started. The speed of the draw governs the size of the tube, which may be regulated by means of a variable speed on the motor. The tube having been drawn, it is parted from the punty, and by means of a band brake gradually lowered and cut up into lengths. Practically any type of tubing can be drawn on this machine, inasmuch as the finished product depends upon the form imposed upon the glass by marvering and blowing prior to being put into the machine.

In the case of the fully automatic machine only tubing having a circular section can be drawn. Glass is ladled from the melting furnace into a specially constructed pot, heated by a system of burners and provided with a baffle extending from the top of the pot down into the glass, and also with an orifice from which the glass flows regularly into a rectangular clay trough. From a small opening in the trough, the size of which can be controlled, the glass flows, in the form of a ribbon, on to a revolving cone. The cone is hollow and made of fireclay, and varies in size according to the tube to be drawn. Longitudinally through the centre of the cone is a steel tube with a nicrome steel cap. This tube is for supplying air to the interior of the glass tube being drawn, and also serves as a means for rotating the cone. The speed of revolution can be governed by the motor. The axis of the cone is inclined so that the apex is depressed. The ribbon of glass from the pot flowing on to the larger diameter of the cone tends to flow by gravity towards the apex, and soon after starting the whole cone is covered with molten glass; the flow continues beyond the end of the cone and maintains its form of a hollow cylinder owing to the air under pressure which is admitted to the central tube. At this stage the glass tube is much larger in diameter than the finished tube, but by the time it has reached a series of pulleys in line the diameter has been reduced to the desired size, and it has cooled sufficiently to retain its form. It continues to pass over the series of pulleys until at about 150 ft. from the pot the tube passes between, and is gripped by, two endless chain belts faced with asbestos sheet pads. As soon as the tube is gripped by the belts a steady pull is maintained. The speed at which the belts travel, combined with the temperature of the glass at the cone, determines the size of the tube. After passing the belts the tube is cut into lengths automatically; they fall into a tray of a rotary conveyor, where they are automatically sorted into separate racks.

Automatic Flowing and Feeding Devices.—Various forms of feeds have been devised for delivering a pre-determined quantity of molten glass from a tank furnace to the glass-forming machine. In all of these it is essential that the supply of glass should be maintained at a constant level, and it follows, therefore, that these devices have been applied either to tank furnaces or subsidiary containers which are constantly replenished.

The most primitive form of feed consisted of a simple overflow from a spout or lip with a stream of glass cut at periodical intervals by means of a pair of blades actuated automatically and water-cooled, and an improvement on this form of feed provides for the substitution of one of the blades by a series of cup-like devices fixed at the ends of radial arms rotating from a common centre, in such a way as to bring the cups in succession under the stream of glass. Each of these cups rotates about its own horizontal axis.

At the moment when a mould has been sufficiently charged the edge of a cup meets the moving blade, scissor fashion, in the line of the stream of glass. The glass now falls into the cup which is gradually rotating about its axis. During this part of the operation a new mould has taken up its correct position, the cup continues to rotate and pours the accumulated glass into the mould, into which the now unimpeded stream of glass also falls. The next following cup again intercepts the stream and so completes the cycle.

In another type of feed a spout is provided at the working end of the furnace. On the under-side of the spout there is a hole capable of being varied in size. A pair of shears automatically cuts off the glass as it flows from the hole, after which a timing device retards the flow of glass. This governs the quantity of glass delivered.

In another type of feed the glass is delivered by a reciprocating paddle working in a specially devised extension to the tank. The mass of glass which is forced over the lip of the receptacle by the paddle is severed by suitably actuated blades. The mass of glass falls on to an inclined chute, water lubricated, and is delivered into the glass-forming machine.

Refractories and Pots.—With the introduction of more efficient pot furnaces and tanks in which higher temperatures were reached it soon became evident that the question of refractories would have to be investigated in order that the pots, tank blocks and furnace parts, would stand up to the increased strain which was being put upon them. During the war a large amount of experimental and practical work was undertaken with a view to improvement in this direction. As a result of some of these investigations a provisional specification was drawn up for the help of users and makers of refractories, and it was hoped by this means to standardize the types of clay, percentage and size of grog, porosity, shrinkage and other factors necessary in production of the refractory articles used.

Evidence would appear to point to the fact that in so far as concerns the majority of types of optical glass, and, if it were an economical proposition, for other glasses also, pots of a porcelain nature or of a composition approximating in relative proportions of alumina and silica to kaolinite have given the most satisfactory results. In connexion with the manufacture of optical glass in America for war purposes it was found as a result of considerable experiment that a pot of the porcelain type was the best suited to their purpose. In other directions considerable experimental work has been devoted to the production of pots by the ordinary casting and by the vacuum casting processes, and also of pots from osmose clay. In each case results of great promise have been obtained.

Furnaces.—There is no doubt that the exigencies of the war in relation to glass production caused British manufacturers to consider very seriously the equipment at their command in respect of its efficiency and quality of output. Although in some instances a reasonably efficient type of furnace had been installed, the general run of furnaces, although satisfying the type of work performed in Great Britain before the war, were unable to attain or maintain the necessary temperatures for producing certain essential kinds of glass for the supply of which the British consumer had previously relied on foreign sources. In factories existing at the outbreak of war the more efficient furnaces were of the regenerative type, but in the recently erected pot furnaces the tendency has been to adopt the recuperative principle. In this type of furnace there are two sets of channels or passages, one for the air supply and the other to carry away the hot products of combustion; the temperature of the air is raised due to interchange of heat by conduction through the common party wall of the channels. As the flow of the secondary air and hot flue gases are constant in direction, there are, therefore, no reversing valves to be operated as is the case in the regenerative type, and it is claimed that the furnace can be maintained at a more even temperature in the former than in the latter.

The recuperative type of furnace is producer-gas-fired. The furnaces, according to the designer, differ in respect of the disposition of their elements; in one type both the producer and recuperators are situated immediately below the furnace, and both the air passages and hot flue gas passages are disposed horizontally, whereas in another type the recuperators are at the sides, and the air passages are vertical whilst the flue gas passages are horizontal. It is claimed for the latter type that glass from a broken pot can be more easily dealt with and is not likely to cause so much damage.

Oil Fired Furnaces.—Oil firing has not been installed to any extent in the glass industry in England and in very few, if any, cases has the furnace been designed specifically for oil fuel. But the coal strike in 1921 and consequent high price and irregular supplies of coal caused attention to be more particularly directed to oil as a fuel, and during the first half of 1921 some optical glass furnaces in England were fired with heavy oil.

From experience gained so far it would appear that better results were obtained with the heavier grades of oil, and that tank furnaces lend themselves more readily to this type of fuel. In the case of pot furnaces the objection is raised that the pots are liable to suffer on account of the irregular heating due to localized combustion.

The prospect of increased consumption of oil as fuel has led naturally to efforts being made to improve the existing types of oil burners in the direction of better efficiency, etc. Several oil burners are now on the market, in some of which atomization is effected by steam under pressure. In others mechanical means and air pressure are utilized. Although more complete atomization is obtained by the former means, yet it appears to be generally admitted that the burner utilizing air pressure with some mechanical means for assisting atomization gives more complete combustion and higher temperatures. The virtue in this method of firing is increased cleanliness and the absence of discolouration or deterioration of the glass, due to the effects of the flame coming into contact with it. Moreover, with oil fuel the temperatures can be more easily controlled.

Annealing.—Prior to the war a very wide gulf separated the methods in use for annealing optical glass from those practised by the makers of other types of glassware. In the former an efficient system of well-lagged electrically heated towers ensured a satisfactory result. In the latter, however, a primitive, straight-through tunnel (usually coke heated) formed the lehr. It was open to the objection that it was exceedingly draughty and the glass was hurried through in all too short a time. During the war, however, when new types of ware had to be produced in which the annealing needed to be above suspicion, close attention was devoted to the subject of improved lehrs. In many of the factories considerable care was exercised to ensure efficiency in this operation. The site was well chosen, the system of heating was considered in relation to the necessity of a variation in the maximum temperature according to the class of ware being annealed, and of a gradual fall in temperature after passing the hottest zone. Precautions were taken to prevent draughts sweeping through the lehr and so defeating the object of the operation. (H. Jn.; S. W. M.)

"GOEBEN" AND "BRESLAU."—The "'Goeben' and 'Breslau' incident" forms an interesting part of the naval history of the World War, since the escape of the German battle-cruiser "Goeben" from Messina on Aug. 6 1914 enabled it to proceed to Constantinople and to exercise a powerful influence on Turkey and the outcome of the war.

When the war broke out the British forces in the Mediterranean under the commander-in-chief Vice-Adml. Sir A. Berkeley Milne consisted of three battle-cruisers: the "Inflexible" (flag.), "Indomitable" and "Indefatigable" (each eight 12-in. guns, 23 knots); the 1st Cruiser Squadron (under Rear-Adml. E. C. Troubridge): "Defence" (four 9·2-in., ten 7·5-in.), "Black Prince," "Duke of Edinburgh," "Warrior" (each six 9·2-in., ten 6-in.); the four light cruisers, "Chatham," "Dublin," "Gloucester," "Weymouth," and the 5th De-

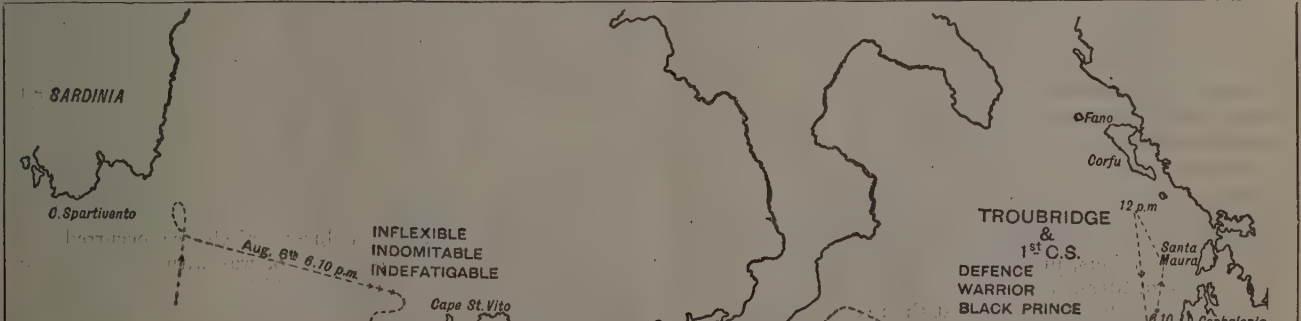

GOEBEN & BRESLAU
Aug. 6th 6.10 p.m.

stroyer Flotilla of 16 destroyers. The French forces under Vice-Adml. Boué de Lapeyrère numbered one Dreadnought (the "Courbet," twelve 12-in.), six "Dantons" (Lord Nelson type), nine older battleships, six armoured cruisers and 24 destroyers. The German forces under Vice-Adml. Souchon consisted of the battle-cruiser "Goeben" (ten 11-in., 26 knots) and the light cruiser "Breslau."

The original British war orders for the Mediterranean were to concentrate at Malta and watch the entrance of the Adriatic; these would have met the circumstances of the case, but they were modified by a series of Admiralty telegrams. The British fleet was at Malta on July 29. On the 30th the Admiral received instructions that his first task was to aid the French in their transport and bring the "Goeben" to action if it attempted to interfere. These instructions were apparently sent without the concurrence or knowledge of the French commander-in-chief, who had not asked for British assistance. On Aug. 1 news came of the "Goeben" and "Breslau" at Brindisi and they proceeded to Messina unknown to the British commander-in-chief. On Aug. 2 about 2:45 P.M. he received orders to shadow the "Goeben," watch the approach to the Adriatic and remain near Malta himself. He accordingly took up his station off Malta and sent Troubridge with the "Indomitable," "Indefatigable," the 1st Cruiser Squadron and four destroyers to watch the entrance to the Adriatic. About 8 P.M. he was told he could get in touch with the French commander-in-chief for combined action, but was unable to establish communication and remained ignorant of the French plans. Early in the morning of Aug. 3 the commander-in-chief, in answer to a question on the subject, was told that he was to maintain his watch on the Adriatic but the "Goeben" was his objective and was to be followed and shadowed wherever she went.

The "Chatham" had looked into Messina on Aug. 3 at 7 A.M. but there was no sign of the "Goeben" there (she had left to bombard the Tunisian coast), and the commander-in-chief accordingly recalled the "Indomitable" and "Indefatigable" on their way to the Adriatic and sent them to the W. to look for the "Goeben." He was very much handicapped by his ignorance of the French dispositions and the Admiralty supplied no information on this point. The Admiralty now became anxious about the Atlantic trade routes and at 8:30 P.M. an order arrived for the "Indomitable" and "Indefatigable" to proceed to Gibraltar at high speed and they went off at 21 knots. The "Goeben" and "Breslau" had been bombarding Philippeville and Bona, and, by a stroke of good luck, the "Indomitable" and "Indefatigable" on their way to Gibraltar ran right into them returning to Messina 40 m. N. of Bona on Aug. 4 at 10:32 A.M. The British battle-cruisers turned to the E. and followed at 11,000 yards. The day was misty, the "Goeben" 3 knots faster, and by 4:35 P.M. she was out of sight. Meanwhile the commander-in-chief had received news of Italian neutrality during the afternoon and an order not to approach within 6 m. of the Italian coast. This was a very exceptional restriction, far in excess of the requirements of international law, and was cancelled on Aug. 6 at 7:46 P.M. after the "Goeben" had escaped. It seems to have arisen from some confusion of ideas regarding the committal of acts of hostility within neutral waters, but its effect was to debar Adml. Milne from the use of Messina Straits and hinder the immediate concentration of any forces stationed at the two entrances.

Meanwhile the "Indomitable" and "Indefatigable" were following E. on the track of the "Goeben" and were between Sardinia and Sicily when at 6:50 P.M. (Aug. 4) they received orders from the commander-in-chief to steer W. and go slow, which meant turning round and abandoning the pursuit. In giving this order the commander-in-chief seems to have been influenced partly by the idea of covering the French transport route, strengthened by the report of a German collier at Majorca, and partly by the Admiralty injunction against approaching the Italian coast. He now decided on the same grounds to establish a patrol to the W. of Sicily, and when hostilities commenced at midnight on Aug. 4 the "Inflexible" was in Malta Channel steering W. to join the "Indomitable" and "Indefatigable" in order to do so. The "Goeben" was just returning to Messina. Troubridge with the 1st Cruiser Squadron was about 60 m. W. of Zante. The "Gloucester" was watching the S. entrance to Messina. The "Goeben" had arrived at Messina early in the morning of the 5th and started coaling, but there were difficulties in her way and the work was slow. News of her arrival only reached London at 6 P.M. and did not reach the British commander-in-chief till 4 A.M. on Aug. 6, though the "Gloucester," on the strength of wireless indications, had reported she must be there. A still more important piece of news never reached the commander-in-chief, namely that the Italian authorities had given her 24 hours to leave the port. During the night of the 5th the commander-in-chief continued to patrol with the "Inflexible" and "Indefatigable" in what is now seen to be an absurd position between Bizerta and Sardinia, while the "Indomitable" was coaling at Bizerta. At 6:10 P.M. on Aug. 6 he was 15 m. off Cape S. Vito (the N.W. point of Sicily; *see* map) when the "Gloucester's" wireless began to sound. The "Goeben" and "Breslau" were leaving Messina to the south.

The commander-in-chief did not display any great haste in following her to the East Mediterranean. He seems to have known very little of the ticklish state of affairs in Turkey, and had merely been told that the Turks were mining the Dardanelles. He proceeded at a moderate speed (15 knots) to Malta, arriving there with the battle-cruisers at noon on Aug. 7 just as the "Goeben" was approaching Cape Matapan. Adml. Souchon had been left at liberty to act as he might see fit and on leaving Messina it was his intention to proceed to the Dardanelles. He made a feint of steering N. till about 11 P.M. but the "Gloucester" followed and signalled his every move. Rear-Adml. Troubridge was off Cephalonia at 6 P.M. on the 6th (*see* map) and, thinking he was making for the Adriatic, steered with the 1st Cruiser Squadron for Fano I., but, concluding at midnight that the first course was a feint, altered course and proceeded S. at full speed. He had already informed the commander-in-chief that he would not risk his squadron in a daylight action with the "Goeben," and had been told by the commander-in-chief that the circumstances would not arise. From the position signalled by the "Gloucester" he found he could not intercept them before daylight, and accordingly abandoned the pursuit and altered course for Zante at 3:50 A.M. Like the commander-in-chief, he saw no immediate danger in the "Goeben's" eastward course. Its vast consequences were beyond their ken. At 4 P.M. Aug. 7 the "Goeben" was off Cape Matapan with the gallant little "Gloucester" (Capt. William A. H. Kelly) still clinging doggedly behind. She had engaged the "Breslau" at 1:35 P.M., but had received orders not to follow beyond Cape Matapan and turned back at 4 P.M. The battle-cruisers were still at Malta, 400 m. behind. There the "Inflexible" and "Indefatigable" coaled and at 12:30 A.M. on the 8th, 12 hours after their arrival, left for the Aegean in chase. There was still time to do something, for difficulties had arisen as to entering Constantinople and the "Goeben" was cruising and coaling in the Aegean all the 8th and 9th. But again an unlucky mischance occurred. The Admiralty sent out a false alarm of war with Austria at noon on the 8th. The commander-in-chief received it at 1:30 P.M., when he was half-way between Malta and Greece, and decided to concentrate with Troubridge off the Adriatic. The telegram was cancelled a couple of hours later, but on being informed that the situation was critical he continued to close Troubridge. At noon on the 9th the "Inflexible" was 40 m. W. of Zante and it was not till 2:50 P.M. that the Admiralty ordered him to resume the chase.

He had lost 24 hours and did not enter the Aegean till 3 A.M. on Aug. 10. At 5:18 A.M. he passed Belo Pulo Light just as the "Goeben," 120 m. to the E., was finishing coaling off Denusa, a small island near Naxos. She had received orders by wireless to proceed to Constantinople and shaped course at 5:45 A.M. for the Dardanelles. It was too late to cut her off, nor had the commander-in-chief information of her whereabouts. All that day he was searching for her in the Aegean. At 5 P.M. the "Goeben" was off Cape Helles, and at 16 minutes past 5 entered the Dardanelles, starting a train of events which exercised a momentous influence on the war. Adml. Milne received the news at noon on Aug. 11 and was ordered to watch the exit. At the beginning of the chapter of accidents lay the unhappy telegram ordering him to protect French transports which did not need protection. (A. C. D.)

GOETHALS, GEORGE WASHINGTON (1858–), American army engineer, was born in Brooklyn, N.Y., June 29 1858. He entered the College of the City of New York in 1876, but at the end of three years went to West Point, where he graduated in 1880, receiving a commission as second lieutenant of engineers. In 1882 he became first lieutenant and was stationed at Cincinnati, where he was engaged in improving the channel of the Ohio river. Later he taught engineering at West Point for several years, but returned to Cincinnati in 1889. Afterwards he was in charge of the construction of the Muscle Shoals Canal on the Tennessee river and of another canal near Chattanooga, Tenn. In 1891 he was made captain. On the outbreak of the Spanish-American War in 1898 he was commissioned lieutenant-colonel of volunteers and appointed chief engineer of the First Army Corps. In 1900 he was commissioned major in the regular army and three years later was engaged in planning fortifications in the neighbourhood of Newport, R.I. He was then made a member of the General Staff in Washington, and in 1905 graduated from the Army War College. In 1907 he was appointed by President Roosevelt a member of the Isthmian Canal Commission, with the rank of lieutenant-colonel, and soon afterwards was made its chairman and chief engineer. Two years later he was promoted colonel. His arrival in Panama marked a new era in the construction of the canal. Hitherto the work had been in charge of high-salaried civilian engineers who dwelt at a distance. The work, as reorganized, was directed by army engineers subject to the control of the President of the United States. Several changes of plan, such as widening the canal, were now inaugurated. Col. Goethals favoured the lock form of canal, chosen by Congress in 1906, instead of the sea-level type. There was considerable opposition to his view but a special commission after inspection gave him support. He took up his abode on the spot, came into close contact with the labourers, won their admiration and confidence, and after seven years' labour brought his task to a successful issue. On May 15 1914 the canal was officially opened to barges, and on Aug. 15 following was declared open to world commerce. Col. Goethals was appointed the first civil governor of the Canal Zone by President Wilson in 1914 and the following year was made major-general. He favoured complete sovereignty of the United States over the Canal Zone. He resigned the governorship in 1916 and was appointed chairman of the board constituted to report on the Adamson Eight-Hour law. In 1917 he was appointed state engineer of New Jersey, but after America's entrance into the World War he was released to serve as manager of the Emergency Fleet Corporation. He had little faith in the plan for a wooden fleet and after three months resigned. Toward the close of 1917 he was appointed acting quartermaster-general, U.S. Army, and his "especially meritorious and conspicuous service" brought him the D.S.M. the following year. In 1918 he was appointed chief of the division of purchase, storage and traffic, and he was also a member of the War Industries Board. At his request he was relieved from active service in March 1919. He subsequently became the head of a business organization engaged in engineering and construction work.

GOKHALE, GOPAL KRISHNA (1866–1915), Indian constitutional leader, was born at Kolhapur in 1866 of a humble Chitpavan Brahman family. Graduating in arts at the Elphinstone College, Bombay, in 1884, he joined as professor of history and political economy the group of teachers at the Fergusson College, Poona, pledged to serve for 20 years on a merely nominal salary. He remained on the staff, finally as principal, until 1902. Becoming actively identified with the National Congress movement, he was for some years the joint secretary and in 1905 president at the Benares session. After two years on the Bombay Legislature, he was elected in 1902 to represent the non-official members thereof in the Viceregal Legislature. His persuasive eloquence, close reasoning, accurate knowledge of the subjects discussed, and instincts of statesmanship won him the Indian leadership, and Lord Curzon recognized his earnest patriotism by nominating him for the C.I.E. (1904). A few months before his death he declined promotion to knighthood of the order. Consulting him freely in reference to his projected constitutional reforms, Lord Morley wrote of him to the Viceroy as appreciating executive responsibility and having an eye for the tactics of common sense (*Recollections*, vol. ii., p. 181). He was fiercely assailed by the extremist section, which never succeeded in his lifetime in capturing the Congress machinery. In 1905 he founded his Servants of India Society, whose members take vows of poverty and lifelong service of their country in a religious spirit. Under the leadership of his successor, Mr. Srinivasa Sastri, the society is exerting a powerful influence in social and economic amelioration. In the enlarged Viceregal Legislature elected in 1910 Gokhale promoted measures for compulsory education on a basis of local option, but did not survive to see this principle introduced from 1918 onwards in most of the provinces. Though his last years were clouded by illness, he was a powerful member of the Indian Public Services Commission 1912–5. His death at Poona Feb. 19 1915 was a severe blow to the constitutional party at a critical moment in India's political history. His last political testament, entrusted on his deathbed to the Aga Khan, was published in Aug. 1917 and outlined plans of reform based on the principle of provincial autonomy, so substantially recognized in the Government of India Act 1919.

Gokhale's speeches down to 1908 were published in Madras and there are many small memoirs, but no authoritative life has been written. (F. H. Br.)

GOLD (*see* 12.192).—The world's production of gold increased rapidly as a result of the Californian and Australian discoveries of 1848 and 1851 from the £5,000,000 or £6,000,000 per annum of 1845–7 to £30,700,000 in 1853, and as these fields showed the decline natural to alluvial gold, the total dropped until it reached £19,600,000 in 1883. From then, and largely as a result of the discovery of the Witwatersrand district of the Transvaal, the output advanced almost annually (except for the Boer War period, 1899–1902) to £96,400,000 in 1915. Subsequently there was a marked decline.

TABLE I.—*Gold Production 1909–20 (in fine oz.).*
(Estimates of the Bureau of the U.S. Mint.)

Year	Africa	Australasia	Canada	India	United States	World
1909	8,271,575	3,435,007	453,865	501,097	4,821,701	21,965,111
1910	8,474,809	3,167,140	493,707	518,502	4,657,017	22,022,180
1911	9,265,672	2,911,410	472,241	534,744	4,687,053	22,348,313
1912	10,248,276	2,636,894	611,885	534,822	4,520,719	22,549,335
1913	10,024,816	2,569,311	802,973	589,109	4,299,784	22,249,596
1914	9,771,597	2,301,162	773,178	550,432	4,572,976	21,240,416
1915	10,538,588	2,369,800	918,056	557,399	4,887,604	22,674,568
1916	10,785,153	1,958,017	930,495	542,115	4,479,051	21,970,788
1917	10,366,972	1,664,011	738,831	523,069	4,051,440	20,289,546
1918	9,532,243	1,490,554	699,681	485,236	3,320,784	18,556,520
1919	9,374,140	1,263,177	767,167	507,260	2,918,628	17,664,910

From Table I it will be seen that Africa and Canada reached their highest in 1916, the United States in 1915, and India in 1913, while Australasia steadily declined during the entire period.

In the period 1848–75 nine-tenths of the output was won from alluvial and one-tenth from quartz reefs or lodes, but by the end of that period the proportion had already changed to two-thirds and one-third. Taking the 1919 output of £75,000,000, about £10,000,000, or 13 %, was obtained from alluvial; about £30,000,000, or 40 %, from lodes; and about £35,000,000, or 47 %, from the quartz conglomerate called "banket," found as a gold producer almost exclusively in the Witwatersrand district. In totals per annum the production from alluvial is about one-third of what it was at its best, and the production from lodes about two-thirds, while the banket output is still only one-eighth below its highest.

The decline in later years was almost general, every producing country of any importance showing a set-back. By reason of its greater steadiness of output the Transvaal, which had 40% of the 1915 world's output to its credit, claimed 49% of the 1920 total, while the British Empire in the same period advanced from 63% to 69%, and foreign countries dropped from 37% to 31%. This is shown by Table II.

TABLE II.—*The Decline in Gold Production after 1915.*
(*In millions of pounds at 84s. 11¾d. per fine oz.*)

Year	Transvaal	The rest of the Empire	British Empire	Foreign Countries	World	Drop as compared with 1915		
						Transvaal	British Empire	World
1915	38·7	22·0	60·7	35·7	96·4	—	—	—
1916	39·5	20·1	59·6	33·9	93·5	—	2 %	3 %
1917	38·3	17·8	56·1	30·2	86·3	1 %	7½ %	10½ %
1918	35·8	15·2	51·0	28·0	79·0	7½ %	16 %	18 %
1919	35·4	14·6	50·0	25·0	75·0	8½ %	17½ %	22 %
1920	34·6	13·4	48·0	22·0	70·0	10½ %	21 %	27½ %
6 yrs. Proportions	222·3 44 %	103·1 21 %	325·4 65 %	174·8 35 %	500·2 100 %			

A decrease of 27½% in the world's production is a serious matter. Its cause is doubtless to be found mainly in the exhaustion of the mines, but it has also been materially contributed to by the exceptionally heavy working costs resulting from conditions produced by the World War. For a long time the gold mines did not, as did practically all other industries, obtain any relief from their increased expenses in a higher price for their product, but from 1919 such of the mines as are in the British Empire (*i.e.* the majority) benefited from the premium on gold, to which reference will be made later. As working costs might, after 1920, be expected to be appreciably ameliorated, the relief should find its effect in a recovery of production, though the output is hardly to be expected to recover to more than about £80,000,000 a year, assuming of course that there are no new discoveries of importance. There has been no such discovery since that of the Witwatersrand in 1886, and this was altogether exceptional by reason of the unique character of the deposits, their extent and their proximity to coal-fields. It is true that the Klondike-Yukon field dates from as recently as 1896, but like other alluvial finds (California in 1848, Victoria, Australia, in 1851, and British Columbia in 1858), it reached its zenith within five years of its discovery, and in its best year contributed only a few million pounds to the world's total.

The earth's surface is rapidly becoming better known, and the more it is overrun the less is it likely that any potential gold-field will be found. It is, moreover, to be noted that the recent rapid growth of the gold output was due not only to new finds but to improved metallurgy, especially the cyanide process of treating tailings, so that while not very long ago only some 60% of gold in the ore was recovered, the proportion has been raised to 90 or 95%.

It has already been pointed out that the Transvaal contributes almost half of the world's present output, and nearly the whole of that colony's production is derived from the banket formation of the Witwatersrand district from a stretch of ground some 55 m. long and usually hardly more than 2 m. wide.

If one splits up this 55 m. by separating off the eastern and more recently developed 10 m., one gets a division into Old and New Rand, one showing distinct signs of decline, while the other has for the present all the symptoms of healthy growth. Thus:—

TABLE III.—*Yield of Old and New Rand compared.*
(*In millions of pounds at 84s. 11¾d. per fine oz.*)

Year	*Old Rand* £	*New Rand* £	*Whole Rand* £
Total to 1907	179,697,000	7,217,000	186,914,000
1908	26,992,000	1,818,000	28,810,000
1909	28,037,000	1,863,000	29,900,000
1910	28,552,000	2,152,000	30,704,000
1911	30,732,000	2,811,000	33,543,000
1912	32,664,000	4,519,000	37,183,000
1913	31,197,000	4,616,000	35,813,000
1914	28,670,000	5,454,000	34,124,000
1915	29,723,000	7,542,000	37,265,000
1916	29,529,000	8,579,000	38,108,000
1917	26,313,000	10,705,000	37,018,000
1918	23,288,000	11,535,000	34,823,000
1919	22,277,000	12,177,000	34,454,000
1920	21,072,000	12,696,000	33,768,000
	538,743,000	93,684,000	632,427,000

Thus the Old Rand's production has dropped 35½% since high-water mark was reached in 1912, while the New Rand has shown an increase every year to date. Moreover, the yield on Old Rand ore has declined from 31s. 9d. per ton in 1908 to 24s. 8d. at the normal price of gold in 1920, and the profit of 13s. 3d. per ton in 1908 would to-day be represented by a loss at that normal price. The New Rand on the contrary has improved its yield and maintained its profit per ton. The result is that the total working profit of the Old Rand, which was £11,224,000 in 1908, is now represented only by the gold premium, while the New Rand has advanced in the same period from £787,000 to nearly £5,000,000 per annum. The latter field, therefore, affords the one instance of real importance of a rapidly increasing output. Incidentally one sees in the above table the result of the efforts put forth to increase the output in the earlier part of the World War, especially noticeable in 1915 and 1916. The fact that so many mines are now being kept going by the gold premium indicates that their production is likely to be severely diminished when the premium disappears. The New Rand is not likely to reach its zenith until about 1930, but the Witwatersrand district as a whole on the present outlook will show a continuance of the fall experienced since 1916, though its life, on a constantly diminishing output, is not likely to end until after 1960.

Gold and Currency.—While the producers of other commodities were able to secure higher prices for their products as the World War went on, and so were able to counteract the rise in working costs, gold-mining companies were not in that happy position. In the Rand district the annual average costs were 17s. 6d., 17s. 10d., 18s. 7d., 19s. 8d., 21s. 11d., 23s. 1d. and 25s. 7d. per ton for the years 1914 to 1920, and the normal value of the gold won was but 26s. 6d., 26s. 3d., 26s. 9d., 27s. 2d., 27s. 11d., 28s. 7d. and 28s. for the same years, so that the margin of profit on that normal value was reduced every year from 9s. per ton in 1914 to 2s. 5d. in 1920. Throughout the war the mines had only one outlet for their gold, owing to the system of prohibitions of import and export, the Bank of England taking it at the normal price of 77s. 9d. per standard ounce. This arrangement was satisfactory so long as costs were not materially higher and so long as the currency received was felt to be worth par. But when it became clear that payment was being made in terms of depreciated paper, and that the Imperial Government was benefiting by selling the production abroad free of depreciation, the mining companies became restive. In their report of Aug. 15 1918, Lord Cunliffe's Committee on Currency and Foreign Exchanges after the war (*see* Cd., 9182) had recognized the position, though British currency was not then openly quoted at a discount:—

> "It is not possible to judge to what extent legal tender currency may in fact be depreciated in terms of bullion. But it is practically certain that there has been some depreciation, and to this extent therefore the gold standard has ceased to be effective."

In July 1918, a committee representing the gold producers of the British Empire approached the British Government and pointed out the rise in working costs, the decrease in output and the fact that the gold was paid for in depreciated currency, and they suggested a special grant in some form during the abnormal times to meet the abnormal conditions. The Gold Production Committee (chairman, Lord Inchcape) was appointed by the Government, reported on Nov. 29 1918, and flatly refused the proposal:—

> "To give more for an ounce of gold than it is worth in currency appears to us out of the question. . . . We are not prepared to recommend any bounty or subsidy for the purpose of stimulating the gold output of the Empire; gold being the standard of value no more can properly be paid for it than its value in currency."

Thus the Committee, three of whose four members had joined in the Currency Committee's report of three months before, completely ignored the undoubted depreciation in the currency and refused to give the mines the premium in paper which that condition of things justified. The gold producers, however, did not abandon their attitude, and the real depreciation of the currency became apparent when the N.Y. exchange, which had been artificially maintained at $4.76½ to the £ throughout the war, was "unpegged" in March 1919, and by the end of July had dropped to $4.35. The first to benefit were the Australian mines, the Australian Government agreeing to remove the embargo on the export of gold for a trial period of three months from Feb. 1919, a period which was subsequently extended from time to time. These mines, in the 16 months to June 1920, produced 1,324,000 fine oz. and sold 1,170,000 fine oz., largely in Shanghai, Hong-Kong and New York, at a net premium of £1,388,319, or 23s. 8d. per oz. Therefore, they secured an average of 108s. 8d. per fine oz. for gold whose "value in currency" was but 85s. On July 24 1919, with the assent of the Imperial Government, the gold producers of the African colonies entered into an agreement with the Bank of England under which they agreed to send all their gold to the Bank of England on condition of their being then allowed to sell it in the open market and receiving a licence to reëxport it at any time within five weeks of its arrival at the Bank. Under this arrangement gold first arrived in Aug. 1919, after which time there was a market for gold in London, but merely for current production and not for stocks already there. From then to the end of the year the price varied from 96s. 8d. to 111s. 5d. per fine oz. and averaged 101s. 10d. as against the normal or Bank price of 84s. 10d., the average premium being 20%. In 1920 the price of gold varied between 127s. 4d. in Feb. and 102s. 10d. in June and averaged 112s. 6d., representing a premium of 32½%. The premium was hardly a premium at all. It merely meant that as long as the United States maintained an open mint, gold could be handed to that mint at the normal price of $20.66 per fine oz., and the resulting dollars could then be realized in London at a price based on the rate of exchange. The gold in fact was sold at gold par, but the resulting British currency obtained for it represented a premium in paper, simply because that paper was depreciated. A recovery of the N.Y. exchange to par would mean the reduction of the London price for gold to the normal 84s. 10d. per fine oz.

The gold of South Africa, Rhodesia and West Africa was sold under this arrangement to buyers all over the world, and at first the East was a heavy purchaser, but whether there was a demand for it or not the mines had always the U.S. mint to fall back upon, and in practice such of the gold as was not bought by others was sent to that mint as a matter of course. And as a matter of course also, the price was always based upon and closely followed the N.Y. exchange, which if it were, for example, $4.00 instead of $4.87, meant a premium in London of 21½% or a price of 103s. per fine oz., and so on.

During the period Aug. 1919 to March 1921, 14,311,000 fine oz. reached London and were sold under the Bank of England agreement already mentioned. Of this 3,928,000 oz. were taken by India and 954,000 oz. by the Straits Settlements, the East thus accounting for 34·1%. South Africa took 1,021,000 oz., or 7·1%, affording the strange spectacle of the South African banks buying sovereigns in London at 25s. 9d. apiece in order to replace sovereigns handed over their counters in the colony at 20s. to be smuggled to the East. South America took 6·8%, other countries 1·6% and the jewellery trade 5·6%, leaving 44·8% to go to the N.Y. mint. In 1919 60% of the output of these mines went to the East and only 10% to New York, but in the six months to March 1921, only 2½% went to India and as much as 96½% to New York, reflecting the temporarily changed conditions of the world, India and the newer countries showing a strong reversal of trade. The gold taken by India was bought by the India Government up to June of 1920 (private importation of gold being prohibited except under licence until that time), and was resold by it at a considerable profit on the bazaars. The price it paid to the producers plus transport, etc., charges averaged about 110s. per oz. and the price of resale on the bazaars was probably between 135s. and 145s., a difference of about £6,000,000. After free importation of gold was permitted the bazaar price approximated to the world (*i.e.* New York) price.

This sale of gold at a considerable premium in currency brings to mind the parallel of 1813 during the Napoleonic wars, when gold commanded 120s. per oz. in paper.

The consumption of gold, or rather the destination of the output, is perhaps best shown in mass figures (Table IV.).

The figures of the last quinquennium were of course markedly affected by the World War. Prior to 1915 the industrial arts and India, with variations attuned to trade cycles, were rapidly increasing their demands, and as soon as normal conditions are restored they are likely to reassert themselves. The recent absorption of China is abnormal and may not persist in the near future, for it is to be expected that that country will, like the India of decades ago, first show a greater appetite for silver. The amount shown as available as money after the demands of these first claimants have been satisfied has been sufficiently large to permit of a marked increase in the world's stock per head, which before the war resulted in a considerable rise in the prices of commodities, but the table hardly reflects the recent considerable decrease in the gold production already referred to, and it is to be expected that in the future the balance available as money will shrink so as to maintain the per-head figure for some time in the near neighbourhood of the 258d. shown for 1919.

TABLE IV.—*Consumption of Gold 1895–1919 in Quinquennia.*
(*In millions of pounds at 84s. 11¾d. per fine oz.*)

	1895–99	1900–4	1905–9	1910–4	1915–9
Industrial consumption of Europe and America	65	79	95	121	90
India's absorption (years to March 31 following)	24	32	50	96	51
Egypt's absorption	8	15	11	4	−1
China's absorption	0	2	2	3	17
	97	128	158	224	157
World's gold production	253	306	431	470	430
Available as money	156	178	273	246	273
Aggregate stock of gold money (excluding India, China and Egypt) at end of period	958	1,136	1,409	1,655	1,927
Aggregate stock of gold money per head of the world's population	151d.	172d.	204d.	229d.	258d.

As a result of the war gold has become largely demonetized partly by being collected by Governments and partly by being hoarded, and most countries have prohibited its export. The result has been that the new production available and a further part of the existing stock has flowed into the State Banks and Treasuries of the world. The following is an attempt to show the position:—

	Dec. 1913 £	*June 1920* £	*Change* £
Held by the U.S. Treasury	266,000,000	445,000,000	179,000,000
Held by State Banks and other Treasuries	749,000,000	1,075,000,000	326,000,000
	1,015,000,000	1,520,000,000	505,000,000
In private banks, in circulation and hoarded	572,000,000	420,000,000	152,000,000
World's stock of gold money (excluding India, China and Egypt)	1,587,000,000	1,940,000,000	353,000,000

Thus the United States had increased its proportion of the world's stock from 17% to 23% (and the whole of the United States from 24½% to 28½%), and State Banks and other Treasuries from 47% to 55½%, while the remainder in private banks, in circulation and hoarded, had dropped from 36% to 21½%.

In the 10 years before the World War the net coinage of gold in Europe and America was about £677,000,000, or £68,000,000 per annum, and of this amount £171,000,000 was issued from the Royal Mint in London, £103,000,000 in Australia, £183,000,000 in the United States and £220,000,000 in other countries. The effect of the war was to reduce the total to probably under £15,000,000 per annum for 1916 to 1919, the United Kingdom and United States coinage tailing off to nil, and the total being mainly contributed to by Australia and Mexico. In the latter country, as a consequence of its disturbed conditions, the note issues were made inconvertible and gold and silver coins disappeared, in accordance with Gresham's law. In due course of time the notes became waste paper, and in 1919 gold and silver were again minted and declared the only legal currency, so that Mexico has returned to a metallic basis. This transition from hard money plus notes to inconvertible notes which rapidly became of little value, and then to hard money again, all took place within the few war years, and in it can be seen the probable programme (when they can afford it) of the more hardly hit Continental countries. In the United Kingdom the policy was to revert to an effective gold standard, and as a preliminary the Currency Committee's recommendation that £150,000,000 of gold should be concentrated in the central institution had already been carried out by 1920. When gold remonetisation occurs there is likely to be a shortage of the metal, and its appearance in actual circulation may be long delayed. It will probably first be used, as far as money is concerned, for international transactions and as a cover for notes. (J. K.)

GOLD COAST, West Africa (*see* 12.203).—In spite of the fact that the Gold Coast forms a British Crown colony (to which Ashanti and the Northern Territories are the adjoining protectorate) it consists (1921) of an agglomeration of small self-contained and mutually independent native states, each of which is under the immediate management of its own tribal organization. This consists of a paramount chief, variously called *Omanehene* by the Akans and by the people who have come under the Akan influence, *Manchi* by the Gas and all kindred peoples, *Konor* by the Krobos and *Fia* by the Ewe-speaking folk in the neighbourhood of and beyond the Volta. These paramount chiefs are in each case chosen for the offices they fill by the tribesmen concerned, the candidates belonging to one or more families from among whose members alone a chief can be selected. The Akans trace descent exclusively through the female line and among them a chief can only be succeeded by the son of a female relative and never by one of his own sons. The non-Akan peoples of the Gold Coast recognize descent through the male line; but with Akans and non-Akans alike, men are selected to fill the office of chief, nominally by popular suffrage, in reality by the principal sub-chiefs, counsellors and elders of the tribe or section of the tribe concerned, care being taken to choose the most suitable of the eligible candidates. All chiefs are liable to "destoolment" at the decree of their people if they fail to give satisfaction. Every paramount chief is the occupant of a stool, which is reputed to be the seat of office of the original founder or leader of the tribe; and in this often fragmentary wooden relic the spirits of his ancestors are believed to abide, and to them, through it, sacrifices are offered, and libations of blood (formerly human, to-day that of fowls or goats) are poured over it on all ceremonial occasions. Each paramount chief is assisted in his office by a number of sub-chiefs of varying rank, whose jurisdiction, until quite recently, was personal rather than territorial. These sub-chiefs, with certain counsellors and elders of the tribe, jointly deliberate with the paramount chief upon all matters of importance. All evidence is given before them in public; but all in authority retire to consider their verdict, which is subsequently announced to the tribesmen by the Linguist, who is the mouthpiece of the paramount chief on all formal occasions. The bulk of the population, no matter what their age, are collectively classed as "young men" and, in spite of the democratic principles upon which the tribal organization is theoretically based, they ordinarily have very little voice in public affairs.

Until the spread of permanent, as opposed to shifting, cultivation was brought about by the extensive planting of cocoa, the territorial limits of the numerous tribal areas were very roughly defined, but as the value of land has appreciated, boundary questions have come into ever greater prominence and have given rise to interminable litigation, the cost of which has well-nigh ruined several of the tribes concerned. The judicial powers of the chiefs of all ranks are defined by the Native Jurisdiction Ordinance, appeals lying to the provincial and supreme courts, and ultimately to the Privy Council.

So far as it is possible to trace local history prior to the incursion of Europeans, it would appear that the Twi- or Tschi-speaking people, who to-day form the predominant native race, and to which the Akan tribes of the colony, and Fantis and the Ashantis alike belong, were expelled from the open country of the upper Volta valley by Arab or Fulani Mahommedan invaders, probably about the 10th or 11th century A.D., and were forced to seek a new home in the tsetse-fly infested forest country, whither their mounted assailants could not follow them. The country which is now Ashanti and the Gold Coast colony appears at that time to have been inhabited by a number of negro tribes possessing a culture far more primitive than that of the Twi-speaking folk, who it is probable were in some instances still in the neolithic stage. The newcomers rapidly overran the forest country, subdued or absorbed the autochthonous inhabitants, and established mutually independent tribal units alike on the coast and in the interior. It is probable that the original invasion of the forest area was undertaken almost simultaneously by a number of separate bands of fugitives; and that, as these communities successively outgrew the food-supply yielded by the lands which they had occupied, further emigrations took place, the section of a tribe separating itself from the rest sometimes electing to form a wholly distinct political unit, and sometimes continuing to recognize an actual allegiance to the tribal organization under which it had once lived, or at any rate a perpetual alliance with it. In many cases, no doubt, the aborigines were exterminated, but in others they survive to this day, the Efutu tribe in the central and the Gwangs and Cherepongs in the eastern province of the colony, for instance, still retaining their identity, their languages and some traces of a distinct tribal organization. In the western parts of the Gold Coast the aborigines appear to have come under Akan influence, but to have avoided actual conquest; while on the eastern side the Akan invaders came into contact with such people as the Gas, the Krobos and the Ewe-speaking people beyond the Volta, all of whom, it is probable, are descendants of invaders who pushed westward into these coastal districts from the neighbourhood of the Niger estuary. In quite recent times one Akan tribe, the Akwamus, established themselves in lands which they still occupy on both banks of the Volta, at a point some 60 m. from its mouth; but with this exception, the Akan or Twi-speaking peoples of Ashanti and the colony form a distinct ethnological wedge sandwiched between different stocks.

Sir William Brandford Griffith was British governor of the Gold Coast from 1886 to 1895, in which year he was succeeded by Sir William Maxwell, Colonial Secretary of the Straits Settlements, who first started the colony upon an upward grade. Under his administration some very important boundary disputes were settled with the French; Kumasi was occupied by an expeditionary force, which met with no resistance, and Prempeh, the Ashanti king, was deported, first to Sierra Leone and subsequently to the Seychelles. On Sir William Maxwell's premature death he was succeeded by Sir Frederick Hodgson, under whose administration a search for the "golden stool"—the throne of the Ashanti kings—caused an extensive rebellion in Ashanti, which led to the final conquest of the country. Sir Matthew Nathan succeeded to the governorship in 1900, and under his administration Sekondi was converted from an insignificant fishing village into an important seaport, and the railway from that place to Kumasi was constructed. In 1904 Sir John Rodger became governor and held the post till his death in 1910. During his term the waterworks both at Accra and Sekondi were inaugurated, though he did not live to see them completed. He was succeeded by Mr. Thorburn, the Colonial Secretary of Southern Nigeria, formerly a member of the Ceylon civil service, who in 1912 was followed by Sir Hugh Clifford, the Colonial Secretary of Ceylon. During his administration, which lasted till July 1919, the railway extension from Mangoase via Koforidua to Tafo was completed, and the whole line from that place to Kumasi was surveyed and demarcated. Numerous public works of importance were constructed, in spite of the World War, *e.g.* the up-to-date railway workshops at Sekondi, with the electrical installation which supplies lighting for the town; the Government offices, general post office and headquarters police barracks at Accra; a very large number of bungalows of modern type which, with the segregation areas in which they are situated, have revolutionized the living conditions of the official population in most of the principal centres alike in the colony and in Ashanti; and some 600 m. of motor-road. Sir Hugh Clifford was succeeded by Brig.-Gen. F. G. Guggisberg in Sept. 1919. By him extensive harbour works at Sekondi were projected and an extension of the railway from Tafo to Kumasi was being made in 1921.

On the outbreak of the World War the adjoining colony of Togoland was invaded by the Gold Coast Regt. under the command of Lt.-Col. Bryant. Lome, the capital, was abandoned without a struggle, the enemy retiring up the Lome–Atakpame railway in the direction of Kamina, the place in the interior where a gigantic wireless installation had been completed in the preceding July. On Aug. 28 the German force, after destroying the wireless installation, was compelled to surrender, their defeat being accomplished by the Gold Coast Regt., which had been joined a few days earlier by a platoon of French native troops. A larger French force arrived at Kamina a few days later. A provisional agreement for the immediate partition of Togoland between Great Britain and France was negotiated by Sir Hugh Clifford and by M. Nouffland, the lieutenant-governor of Dahomey, at Lome on Aug. 30, and was confirmed by their respective Governments. Under it slightly more than half the geographical area of the country was placed under the French, the remainder—which however included Lome, the only port of entry and the terminus of the three railway lines—being administered on behalf of Great Britain by the Government of the Gold Coast, which bore all the charges connected with the conquest and the subsequent occupation of the country. The net revenue derived from customs and from the railway, though collected by the British, was divided equally between them and the French. Under British rule the western districts of Togoland prospered exceedingly, it being calculated that within two years the areas under cultivation exceeded by 33% those which had been tilled in German times. The work of administration was carried on by a handful of British officers, selected for that purpose from the Gold Coast, under Maj. Rew, the officer commanding in Togoland, who exercised both military and civil functions under the guidance of the governor of the Gold Coast. By an agreement concluded in Paris in July 1919, the greater part of the territory hitherto occupied by the British, including Lome, was surrendered to the French, only a few frontier districts remaining under the Gold Coast.

After its conquest of Togoland the Gold Coast Regt., leaving a small force to garrison the occupied territory, took part in the Cameroon campaign and did not return to Kumasi until May 1916. In the following July the bulk of the regiment embarked for East Africa, where it took a distinguished part in the campaign both in German and Portuguese territory, returning to the Gold Coast in Sept. 1918. During this time it was regularly supplied with drafts of men recruited in the Gold Coast and trained at depots established throughout its dependencies, including the occupied area in Togoland, and at the time of the Armistice the regiment had expanded into a brigade, commanded by Brig.-Gen. R. A. de B. Rose.

Since 1890 a great social and economic revolution, which even the war was powerless materially to affect, has been wrought in the Gold Coast, and latterly in Ashanti also, through the spread of cocoa-cultivation. In 1891 a parcel of cocoa weighing 80 lb. and valued at £4 was exported from the Gold Coast. In 1901 cocoa weighing 960 tons and valued at £42,827 was exported; and by 1911 the export had expanded to 35,261 tons, valued at £1,613,448. During the last year before the war 50,554 tons of cocoa were exported, equivalent at that time to about one-third of the total cocoa crop of the world. In spite of the war these figures during the succeeding years were not only maintained, but exceeded, the annual exports of cocoa from 1914 to 1919 being 52,888; 77,278; 72,161; 80,374; 66,343; and 176,176 tons. The decline in 1916 was due to the tightening of the blockade into Germany via Holland, and the recovery in the following year to the opening-up of direct trade with the United States. The serious falling-off in 1918 was due to the shortage of shipping, and a large part of the enormous exports in 1919 consisted of cocoa that should have been shipped during the preceding year. The exports for 1919 were valued at £6,481,569. The cocoa industry has throughout been entirely a native enterprise, Europeans acting only as carriers, purchasers and shippers; and the introduction of this permanent form of cultivation has created private property in real estate, which is not contemplated by local custom, under which all lands are communal. Apart from this, the spread of the cocoa industry has brought great wealth to the African population, which has been utilized by them to improve the character and material of their houses, their clothing, their diet—meat being now consumed in large quantities throughout the country—and generally to raise their standards of comfort. Their increased expenditure upon imported spirits was comparatively trifling; but under an international agreement the importation of such spirits was prohibited, with effect from Feb. 1919. Owing to the very high duties imposed upon these articles the revenue they yielded was large, and the sudden cessation of this source of income was making itself acutely felt in 1921, with the return of more normal trade. Cocoa cultivation, moreover, is such light toil that it disinclines the natives to work their palms or to undertake similar comparatively heavy tasks; and kola-nuts, of which more than 16 million tons were exported during 1919, are the only other export with a steady tendency to increase.

The revenue and expenditure of the Gold Coast and its dependencies and the value of the trade of the country for various periods are shown in the following table:—

Year	Revenue	Expenditure	Imports	Exports
1910	£1,006,633	£ 924,862	£3,439,831	£ 2,697,706
1913	1,301,566	1,230,850	4,952,494	5,427,106
1916	1,835,989	1,465,946	5,999,746	5,816,527
1919	2,601,359	1,781,170	7,946,981	10,814,175

Owing to the shortage of silver, notes having face values of £1, 10s., 2s. and 1s. were introduced in 1918, the shilling notes proving most unpopular among the natives. In 1920 silver coins of the same quality as the new issue in Great Britain were put into circulation, and later in the year token coins, resembling in every way the 3d., 6d. and 1s. pieces issued by the West African Currency Board, which was established in 1912–3, but minted from an alloy, were put upon the market. These were gradually replacing the paper money of low denomination, but were not regarded with much favour by the natives of the Gold Coast.

REFERENCES.—Lady Clifford, *Our Days on the Gold Coast* (1919); *The Red Book of West Africa*, ed. by Allister (1920); Sir Charles Lucas, *The Gold Coast and the War* (1920); W. W. Claridge, *History of the Gold Coast and Ashanti* (1915); Sir Hugh Clifford, *The Gold Coast Regiment in the East African Campaign* (1920). (H. CL.)

GOLDMARK, KARL (1832–1915), Austrian composer (*see* 12.212), whose most successful opera, *Die Königin von Saba*, was produced by the Carl Rosa opera company in Manchester in 1910, died at Vienna Jan. 1 1915.

GOLF: *see* SPORTS AND GAMES.

GOLLANCZ, SIR ISRAEL (1863–), British man of letters, of Jewish family, was born in London July 13 1863. He was educated at the City of London school and afterwards at University College, London, and Christ's College, Cambridge. From 1892 to 1895 he was Quain student and lecturer in English at University College, London, and in 1896 was appointed university lecturer in English at Cambridge, becoming in 1906 university professor of English language and literature at King's College, London. He became secretary of the British Academy on its foundation in 1903. He was general editor of the *Temple Classics* and *King's Library* series and of the *Book of Homage to Shakespeare* which appeared in 1916. His published works include *Cynewulf's Christ* (1892); an edition of Lamb's *Specimens of Elizabethan Dramatists* (1893); *Exeter Book of Anglo-Saxon Poetry* (1895) and *Hamlet in Iceland* (1898).

GOLTZ, COLMAR, BARON VON DER (1843–1916), Prussian general, military writer and organizer of the Turkish army (*see* 12.227). Gen. von der Goltz was made a field-marshal in 1911 and retired in 1913. In Aug. 1914 he was appointed governor-general of Belgium, then occupied by German forces. In Nov. of the same year he was attached to the Turkish headquarters as aide-de-camp-general to the Sultan. In April 1915 he was placed in the chief command of the I. Turkish army in Mesopotamia, and succeeded in investing Gen. Townshend's British forces at Kut-el-Amara on April 19 1916. He died at Bagdad and was said to have been poisoned by the Young Turks. His latest work was *Kriegsgeschichte Deutschlands im 19ten Jahrhundert* (1910–4, 2 vols.).

GOLTZ, KARL, COUNT VON DER (1864–), German lieutenant-general, was born at Brühl June 28 1864. He commanded a division of the *Landwehr* at the battle of the Masurian Lakes in Feb. 1915. In the spring of 1918 he led the Baltic Div. (*Ostsee* Div.) into Finland and was appointed chief-in-command in the Baltic countries in Nov. 1918. In the following year his position became anomalous. He was leading a volunteer army professedly against the Bolshevists, but his recall was demanded by the Allied and Associated Powers. His removal was effected only with great difficulty by the Berlin Government, as he had taken the bit in his teeth. He was suspected of cherishing designs for leading his Baltic volunteers back at some suitable moment into Germany in order to place them as an instrument at the disposal of the royalist and reactionary movement. Sections of them (*Das Baltikum*) actually took part in the military occupation of Berlin which attended the Kapp *coup* in March 1920, and great difficulty was afterwards experienced in disbanding them. Count von der Goltz wrote *Meine Sendung in Finnland und im Baltikum* (1920), describing his experiences in the Baltic countries in 1918–9.

GOLUCHOWSKI, AGENOR, COUNT (1849–1921), Austrian statesman (*see* 12.227), died at Lemberg March 29 1921.

GOMME, SIR GEORGE LAURENCE (1853–1916), English archaeologist, was born in London Dec. 17 1853 and educated at the City of London school. As a boy he entered the service of the Metropolitan Board of Works; but in 1891 he was appointed statistical officer to the London County Council, becoming in 1900 clerk to the Council. He was founder of the Folklore Society and editor successively of the *Antiquary*, the *Archaeological Review* and the *Folklore Journal*, and few men have ever possessed a more profound knowledge of the past and present history of London (*see* 16.957). He married Alice Bertha Merck, authoress of *Traditional Games of Great Britain.* In 1911 he was knighted. He died at Long Crendon, Bucks, Feb. 25 1916.

Amongst his numerous publications were *Primitive Folk-Moots* (1880); *Folklore Relics of Early Village Life* (1883); *The Village Community* (1889); *Folklore as a Historical Science* (1908); etc.

GOMPERS, SAMUEL (1850–), American labour leader (*see* 12.230), was convicted in 1907 and sentenced to 12 months imprisonment for contempt of court in disobeying an injunction restraining him from printing the name of the Buck Stove and Range Co. in the "black list" of *The Federationist* (the organ of the A. F. of L.). He appealed, and after seven years of litigation he won his case, the U.S. Supreme Court deciding in 1914 that action was barred by the statute of limitations. Although in theory opposed to all war, after the outbreak of the World War he resisted any tendency in labour unions to favour peace at any price, and declared himself in favour of voluntary military training. After America's entrance into the World War he was appointed a member of the Advisory Commission of the Council of National Defense in 1917; the same year he was elected president of the American Alliance of Labor and Democracy, which was organized, with the approval of President Wilson, for combating disloyal propaganda among workmen. He represented the A. F. of L. at the Peace Conference in Paris 1918–9, and was appointed chairman of the International Committee on Labour Legislation. He was also chairman of the American labour delegates at the convention of the International Federation of Trades Unions at Amsterdam in 1919. He consistently opposed socialistic movements among the unions and favoured collective bargaining. He opposed compulsory arbitration in labour disputes and urged that labour unions be exempt from the anti-trust law. He urged the ratification of the Peace Treaty. In 1921 he was elected president of the A. F. of L. for the fortieth time.

GOMPERZ, THEODOR (1832–1912), German scholar (*see* 12.230), died at Baden, near Vienna, Aug. 29 1912.

GOODWIN, NAT(HANIEL) CARL (1857–1919), American actor (*see* 12.239), died in New York Jan. 31 1919.

GOODWIN, WILLIAM WATSON (1831–1912), American scholar (*see* 12.240), died in Cambridge, Mass., June 16 1912.

GORE, CHARLES (1853–), English divine (*see* 12.254), was in 1911 translated from the see of Birmingham to that of Oxford. In 1919 he resigned his bishopric and settled in London, where he continued to identify himself with those social and economic tendencies which are known as Christian Socialist. His recent works include *New Theology and Old Religion* (1908); *Orders and Unity* (1910); *The Question of Divorce* (1911) and *The Religion of the Church* (1916).

GORELL, JOHN GORELL BARNES, 1st Baron (1848–1913), English judge, was born at Liverpool May 16 1848, the son of Henry Barnes, a shipowner. He was educated at Peterhouse, Cambridge, where he took his degree in 1868. He began work as a solicitor, but was called to the bar in 1876, becoming Q.C. in 1888. He was well known as an expert in Admiralty cases, and in 1892 was made a judge of the Probate, Divorce and Admiralty division, becoming its president in 1905 on the retirement of Sir Francis Jeune (Lord St. Helier). He was made a privy councillor in 1905, and in 1909 was raised to the peerage. In 1909 he became chairman of the royal commission on divorce. Lord Gorell, who married in 1881 Mary, daughter of Thomas Mitchell, died at Mentone April 22 1913.

He was succeeded by his son, Henry Gorell Barnes (1882–1917), who was born Jan. 21 1882, and educated at Winchester, Trinity College, Oxford, and Harvard. He was called to the bar in 1906, and acted as secretary to his father during the latter's later years on the bench and also during his presidency of the divorce commission. He served during the World War and was awarded the D.S.O. He was killed in action Jan. 16 1917, and was succeeded as 3rd baron by his brother, the Hon. Ronald Gorell Barnes (b. 1884).

See J. E. G. de Montmorency, *John Gorell Barnes, first Lord Gorell* (1920).

GORGAS, WILLIAM CRAWFORD (1854–1920), American army surgeon, was born at Mobile, Ala., Oct. 3 1854. His father was brigadier-general and chief of ordnance in the Confederate army during the Civil War. He was educated at the university of the South, Sewanee, Tenn. (A.B. 1875), and Bellevue Hospital Medical College, New York (M.D. 1879). He was an interne at Bellevue hospital from 1878 to 1880 and in the latter year entered the Medical Corps of the U.S. army. In 1885 he became captain. During the Spanish-American War he served as major (Medical Corps), being sent, after the Santiago expedition, to Havana where he assumed care of yellow-fever patients. From 1898 to 1902, as chief sanitary officer he was in charge of the sanitation measures carried out in Havana. The city was thoroughly cleaned and many experiments were conducted in connexion with the recent discovery that yellow fever was transmitted by the mosquito. Because of his success in eliminating yellow fever at Havana he was made assistant surgeon-general, U.S. army, with the rank of colonel, by a special Act of Congress in 1903. In 1904 he was sent as chief sanitary officer to Panama, where two of the main obstacles to success in building the Canal were yellow fever and malaria. Here again his methods were so efficient that by the close of 1906 he had eliminated yellow fever from the Canal region. Malaria also was eventually brought under control and the Canal Zone converted into a healthful spot. In 1907 he was appointed a member of the Isthmian Canal Commission by President Roosevelt, and the following year was U.S. delegate to the first Pan-American Medical Congress, held at Santiago, Chile. He was president of the American Medical Association 1908–9. In 1913 he was called to the Rand Gold Mines in South Africa to suggest means for combating the frequent epidemics of pneumonia (influenza). This he found was largely due to crowding the labourers together in barracks, and he recommended that they be placed with their families in separate abodes. In 1914 he was made surgeon-general, U.S. army, with the rank of brigadier-general. The same year he was awarded the degree of D.Sc. by the university of Oxford and received the Seaman medal from the American Museum of Safety and a gold medal from the American Medical Association. In 1916 he was made major-general, U.S. army, and in 1918 was retired. He then assumed the permanent directorship of the yellow-fever work of the International Health Board of the Rockefeller Foundation. He went to Central America to make a survey, and under his direction investigation of yellow fever was made at Guayaquil, Ecuador, and in Guatemala. In 1919 he accepted a contract with the Government of Peru to carry out a sanitary programme in that country. He received many marks of recognition at home and abroad. He was awarded the D.S.M. (U.S.), and made Commander of the Legion of Honour (France) and K.C.M.G. (Great Britain). He died in London July 4 1920 and was buried in the Arlington National Cemetery in Washington, D.C.

GÖRGEI, ARTHUR (1818–1916), Hungarian soldier (*see* 12.256), died in May 1916.

GORST, SIR JOHN ELDON (1835–1916), British politician (*see* 12.261), died in London April 4 1916. His son, Sir J. Eldon Gorst, died at Castle Combe, Wilts., July 12 1911.

GOSSE, EDMUND (1849–), English man of letters (*see* 12.268), was the recipient Sept. 21 1919, his 70th birthday, of an address of congratulation signed by a large body of Englishmen of note in art or letters, in recognition of his long and distinguished service to literary criticism. This was followed up by the presentation to him on their behalf of a portrait bust, Nov. 9 1920. His more recent publications include *Portraits and Studies* (1912); *Collected Essays* (1912); *Inter Arma* (1916); *The Life of A. C. Swinburne* (1917); *Three French Moralists* (1918); *Some Diversions of a Man of Letters* (1919).

GOUDY, HENRY (1848–1921), English jurist, was born in the north of Ireland Sept. 16 1848, the son of the Rev. A. P. Goudy, D.D., of Strabane, co. Tyrone. He was educated at the universities of Glasgow, Edinburgh and Königsberg, obtaining thus special advantages for the study of Roman law, in which he became a leading authority. He was called to the Scottish bar and published a work on the Scottish law of bankruptcy in 1886. In 1889 he was appointed professor of civil law at Edinburgh University and in 1893 regius professor of civil law at Oxford which chair he occupied until 1919, being also fellow of All Soul's College in right of his professorship. He was joint author of a *Manual on Local Government in Scotland* (1880), edited Muirhead's *Private Law of Rome* (1898), translated and annotated Jhering's *Jurisprudenz des täglichen Lebens* (1904), and published a short treatise on *Trichotomy in Roman Law* (1910), as well as a lecture on the *Fate of the Roman Law north and south of the Tweed* (1894) and various articles for the *E.B.* He was editor of the *Juridical Review* from its foundation in 1889 until 1893, and he was one of the founders of the Society of Public Teachers of Law and of the Grotius Society, instituted in 1915 during the World War, for the advancement of international law. He died at Bath March 3 1921.

GOUGH, SIR HUBERT DE LA POER (1870–), British general, was born on Aug. 12 1870, son of Gen. Sir C. Gough. He joined the 16th Lancers in 1889 and served in the Tirah campaign. In 1899 he was sent out to South Africa on special service, and he commanded a mounted infantry regiment with distinction for nearly two years, being promoted brevet lieutenant-colonel for his services. He held staff appointments after returning home. Promoted colonel in 1906, he in 1911 became brigadier-general commanding the 3rd Cavalry Brigade at the Curragh, where his attitude with regard to Ulster and the use of the troops in 1914 caused a grave political crisis (*see* ENGLISH HISTORY). He took his brigade to France in Aug. of that year, succeeded to the command of the 2nd Cavalry Div. in Sept., and was promoted major-general for distinguished service in Oct. He was in April 1915 transferred to the 7th Div., and was in July given charge of the 1st Army Corps, a position which he held until the spring of 1916, when he was given command, first of a reserve force, and afterwards of the newly constituted 5th Army; with this he played an important part in the battle of the Somme, and he was given the K.C.B. He was promoted lieutenant-general at the beginning of 1917 and in that year he was for some time in charge of the Flanders offensive. Then, early in 1918, it fell to the lot of his army to be on the right wing, next to the French, and to take over from them a considerable front on both sides of the Oise, for which his forces were inadequate. The brunt of the great German offensive of March fell in the first place on his troops, who were unable to withstand the pressure and fell back with heavy loss in personnel and material. Gough's dispositions under circumstances of the utmost difficulty were appropriate, and responsibility for the disaster did not rest with him; nevertheless he was deprived of his command by the Government and was ordered home. He was afterwards for some months head of the British Mission to the Baltic States in 1919, and he was in that year given the G.C.M.G. On his return, influenced no doubt by his experiences in the Baltic States, Gen. Gough came forward as a prominent advocate of a world-settlement based upon consent and goodwill, and especially as a supporter of such a settlement of the Irish question.

His younger brother, JOHN EDMUND GOUGH (1871–1915), who had joined the army in 1892, was also a distinguished soldier. He served in central Africa in 1896–7 and in the South African War, and in the Somali campaign of 1902–3, where he won the V.C. and was promoted brevet lieutenant-colonel. He reached the rank of colonel in 1906 and commanded the troops in Somaliland from 1908 to 1910. He afterwards held appointments on the staff and he went out to France in 1914 as brigadier-general, general staff, of the 1st Army Corps. When the expeditionary force was divided into two armies, he became head of the general staff of the 1st Army, but shortly afterwards he was severely wounded, and on Feb. 21 1915 he died of his wounds. He was the author of a study of the Fredericksburg and Chancellorsville campaigns (1913) and of several remarkable essays on military subjects.

GOUIN, SIR LOMER (1861–), Canadian statesman, was born at Grondines, Quebec, in 1861 and was educated at Laval and McGill Universities. He was called to the Canadian bar in 1884, and became Q.C. in 1900, being elected Batonnier-General of the Quebec bar in 1910. He was a member of the Quebec Legislature from 1897; and, after holding minor offices, in 1905–20 was Prime Minister and Attorney-General in the province of Quebec. Attempts were made by Sir Robert Borden to get him to join his Coalition Ministry, but these failed, and subsequently Sir Lomer declared his allegiance to the Liberal Opposition. He derived considerable importance from the fact that he was the Quebec representative on the boards of large Canadian financial institutions. He was knighted in 1908, and received the K.C.M.G. in 1913. His first wife (d. 1904) was a daughter of Honoré Mercier, a former Premier of Quebec. On the Liberal victory in Dec. 1921 he was included in the new Cabinet of Mr. Mackenzie King.

GOURAUD, HENRI JOSEPH EUGÈNE (1867–), French general, was born at Paris on Nov. 17 1867. He entered St. Cyr in 1888, and was commissioned to the infantry in 1890. Two years later he was promoted lieutenant. In 1894 he was seconded for duty under the colonial administration; and thereafter he gained much experience of active service in the French Sudan, in which he served almost continuously for two years. In 1904 he was promoted lieutenant-colonel and made commandant of the Chari (Congo) territory. In the same year he was made an Officer of the Legion of Honour—he had already won the cross of Chevalier for distinguished service. In 1907 he was promoted colonel. He next served in Morocco, where he remained until the outbreak of the World War. On Sept. 17 1914 he was promoted temporary general of division, and the following Jan. was appointed commander of the Colonial Army Corps. On Feb. 15 1915 he was made a substantive general of division. In May he replaced D'Amade as commander of the Corps Expéditionnaire d'Orient in the Gallipoli theatre, where he was so badly wounded that his right arm had to be amputated. He was awarded the médaille militaire on July 10 1915. On recovering from his wound he went to Italy in charge of a mission, and then in Dec. 1915 he was appointed to command the IV. Army. A year later he was sent temporarily, as commissioner-general, to Morocco; but he again took command of the IV. Army in June 1917. From 1915 to the summer of 1918 the part of the IV. Army was relatively quiet, save for one moment in the spring of 1917 in which it was drawn into the ambit of Nivelle's offensive on the Aisne. At that time Gouraud was in Morocco. Thus, when on July 15 1918 the Germans launched their last offensive on the Champagne front, Gouraud had had little executive experience as an army commander in battle, and before the "zero" day Pétain had had some difficulty in convincing him of the necessity of a "coil spring" defence. But when the time came Gouraud carried out its principles admirably, and brought the Germans' last effort to a standstill in his battle-zone. The counter-attacks far to the west followed three days later, and the tide was turned for good. In turn the IV. Army, acting in conjunction with the Americans between Meuse and Argonne, assumed the offensive in Sept., and by Nov. 11 it had reached the Meuse between Sedan and Mézières. Gouraud was awarded the Grand Cross of the Legion of Honour on Dec. 28 1918. In Oct. 1919 he became high commissioner in Syria and commander-in-chief in the Levant.

GOW, ANDREW CARRICK (1848–1920), British painter, was born in London June 15 1848. He studied at Heatherley's art school, London, and first exhibited at the Royal Academy in 1869, a picture of his henceforward appearing there every year till his death. He was elected A.R.A. in 1881, and R.A. ten years later. In 1911 he became keeper of the Royal Academy. He died at Burlington House, London, Feb. 1 1920. Gow was best known as a historical painter. His works include "The

Relief of Leyden" (1876); "The Last Days of Edward VI." (1880); "Cromwell at Dunbar" (1886, bought by the Chantrey Fund); "Queen Mary's Farewell to Scotland" (1892) and "The Queen's Diamond Jubilee at St. Paul's" (1897, painted for the Corporation).

GRACE, WILLIAM GILBERT (1848–1915), English cricketer (*see* 12.308), died at Eltham, Kent, Oct. 23 1915. His elder brother EDWARD MILLS GRACE (1841–1911), who was born Nov. 28 1841, died at Thornbury, Glos., May 28 1911.

See Lord Hawke and others, *The Memorial Biography of Dr. W. G. Grace* (1919); *W. G. Grace, Cricketer* (1916); and F. S. A. Cooper, *Edward Mills Grace, Cricketer* (1916).

GRAF, ARTURO (1848–1913), Italian poet and critic (*see* 12.315), published in 1911 *L'Anglomania e l'influsso inglese in Italia nel secolo XVIII*. He died at Turin May 29 1913. *Poesie*, a collection of his best poems, appeared in 1915.

See Sartori Treves, *Arturo Graf, romanziere e poeta* (1904).

GRANTHAM, SIR WILLIAM (1835–1911), English judge, was born at Lewes Oct. 23 1835. He came of an old Sussex family, and inherited property in the county. After a successful career at the bar and in Parliament, where he represented East Surrey in the Conservative interest from 1874–85, he was appointed in 1885 judge of the Queen's Bench division of the High Court. He was never at pains to conceal his own views on politics, and after 1906, when he was on the rota of judges for election petitions, his decisions were sharply criticized as biassed against the Liberal party, notably in the Great Yarmouth case, which led to a motion of censure in the House of Commons in July 1906. But in certain criminal cases he gained considerable credit, and in the Adolf Beck trial he was one of the first to suspect the mistake as to the prisoner's identity (*see* 14.287). He was chairman of the East Sussex quarter sessions, and as a landlord took a practical interest in the housing of the rural labourers. He died in London Nov. 30 1911.

GRANVILLE-BARKER, HARLEY (1877–), English playwright, producer and actor-manager, son of Albert James Barker, of Hereford, and Mary E. Bozzi-Granville, was born in London Nov. 25 1877. Educated privately, at the age of 13 he was sent to the Theatre Royal, Margate, then a stock company's theatre and a dramatic school. A year later he made his first stage appearance at Harrogate in Wilks's *Ben the Bos'un*, and he first appeared in London at the Comedy theatre the following year in *The Poet and the Puppets*. After playing in a diversity of dramas he became interested in the work of the Stage Society and especially in the plays of G. Bernard Shaw. In 1904 he joined J. E. Vedrenne in the management of the Court theatre, London, and there produced and acted in many of these plays, as well as in those of St. John Hankin, John Galsworthy, Ibsen, Masefield and his own play, *The Voysey Inheritance* (1905). His later play, *Waste*, forbidden public performance by the Censor, was played by the Stage Society in 1907, as was also *The Marrying of Ann Leete* (1901). *The Madras House* was produced by the Frohman repertory company at the Duke of York's theatre in 1910. In 1913–4 he produced Shakespearean dramas in an original manner at the Savoy theatre. He wrote *Souls on Fifth*, a fantastic story, and *The Red Cross in France*, both in 1916, published a volume of three short plays (1917), and a play, *The Harlequinade*, with D. C. Calthrop (1918). In 1921 he was appointed public lecturer on the art of the theatre by the university of Liverpool. He married first (1906) LILLAH MCCARTHY, herself a distinguished actress in Shaw's plays and in English versions of Greek drama. She made a special success as Ann Whitefield in Shaw's *Man and Superman* and Jennifer in his *The Doctor's Dilemma*. She was also Jocasta in Reinhardt's production of *Oedipus Rex* at Covent Garden in 1912, and Nan in Masefield's play of that name, as well as playing the name part in his translation of Jensen's *The Witch*, both first produced at the Court theatre in 1911 and repeated at the Savoy theatre in 1913. Miss McCarthy obtained a divorce in 1917, and in 1920 she married Prof. Frederick W. Keeble (b. 1870), of Oxford. Granville-Barker in 1918 married Helen Gates Huntingdon of New York.

GREECE (*see* 12.425).—Old Greece had up to 1912 an area of about 25,014 sq. miles. The Balkan wars of 1912–3 added to the kingdom New Greece, consisting of Macedonia, Epirus, Crete and a number of islands in the Aegean extending over 16,919 sq. m., making the area of the country 41,933 sq. m. in all, in 1914. After the World War, Greece, with the consent of the Allied and Associated Powers, occupied part of Western Thrace and of the vilayet of Aidin in Asia Minor and retained all the islands for the time being. According to the Treaty of Sèvres (Aug. 10 1920) Greece was to receive practically the whole of European Turkey W. of the Chatalja lines, and the Dodecanese islands were ceded by Italy when the treaty was signed. The war between Greece and Turkey left the situation as regards Asia Minor still uncertain during 1921.

The numerous changes make it impossible to present statistical returns in comparative form, but the available official figures are given in the tables. Table 1 shows the population at the dates given, for the departments as in 1914.

TABLE 1. POPULATION

Department, 1914	Area in sq. kms.	Census of 1907 or 1913	Census of 1920 (uncorrected)
Attica and Boeotia	5,997·6	407,063 (1907)	581,829
Salonika	15,023·6	506,571 (1913)	398,240
Achaia and Elis	5,507·1	254,728 (1907)	271,672
Larissa	8,073·2	197,808 (1907)	239,528
Messenia	3,267·9	218,514 (1907)	226,066
Florina	3,310·8	142,336 (1913)	200,866
Aetolia-Acarnania	7,671·6	188,597 (1907)	195,571
Trikkala	5,823·9	183,489 (1907)	186,476
Kozani	6,376	206,307 (1913)	175,577
Janina (Yannina)	6,732·4	214,621 (1913)	167,644
Drama	5,727·2	204,404 (1913)	161,890
Argolis and Corinthia	5,221·8	153,172 (1907)	158,528
Arcadia	4,257·9	162,324 (1907)	155,833
Lesbos (Mytilene)	2,175	182,167 (1913)	146,852
Laconia	4,114·8	148,628 (1907)	137,456
Euboea	4,093·2	116,903 (1907)	127,876
Corfu	635·6	140,757 (1907)	123,371
Cyclades	2,629	130,378 (1907)	120,292
Phthiotis and Phocis	6,133·3	174,574 (1907)	119,215
Heraclion (Crete)	2,563·2	110,015 (1913)	118,101
Serres	3,851·6	135,284 (1913)	113,620
Canea (Crete)	1,800	97,141 (1913)	97,175
Pella (Macedonia)	(This prefecture was formerly included in that of Salonika)		94,117
Rethymno (Crete)	1,876·8	66,384 (1913)	68,715
Samos	491	68,946 (1913)	65,756
Cephalonia	1,180·4	71,235 (1907)	64,775
Chios	858	73,230 (1913)	61,873
Lasithion (Crete)	2,948·8	62,611 (1913)	61,158
Arta	1,793	41,280 (1907)	52,578
Preveza	1,591·6	30,997 (1913)	45,632
Zante	409·5	42,502 (1907)	39,098
Totals	122,135·8	4,732,966	4,776,380

Table 2 shows the annexed provinces, and the departments formed with population in 1920. It should be noted that in 1921 Thrace was being administered under a governor-general at Adrianople, and Ionia (subject to military operations in progress) under a high commissioner at Smyrna.

TABLE 2. NEW TERRITORY ACQUIRED AFTER THE WORLD WAR

Province	Area in sq. kilometres	Department	Population 1920
Thrace	34,984	Adrianople	145,490
		Kirk-Kilisse	134,359
		Gallipoli	53,568
		Rodosto	143,801
		Enos	92,050
		Rhodope	100,429
Dodecanese (with Tenedos and Imbros)	1,459		121,800
Northern Epirus	4,921		200,000
Ionia	17,500	Aivali	66,000
		Sanjak of Smyrna	754,000
		Magnesia-(Manisa) Kassaba	140,000

It will be seen that, altogether, the New Greece had an area of 180,999.8 sq. km., and a pop. of 6,727,877. Table 3 shows the principal towns of Greece (including Thrace and Ionia).

TABLE 3. PRINCIPAL TOWNS

Athens	(1920)	300,462	Trikkala	(1907)	18,995
Salonika	(1915)	158,139	Larissa	(1907)	18,939
Piraeus	(1920)	130,082	Mytilene	(1915)	18,705
Adrianople	(1911)	65,454	Kalamata	(1907)	18,510
Patras	(1920)	46,500	Chios	(1915)	18,000
Corfu	(1907)	30,585	Yannina	(1915)	17,331
Candia	(1915)	25,185	Zante	(1907)	15,035
Canea	(1915)	24,399	*Ionia:—*		
Volo	(1907)	23,563	Smyrna	(1915)	225,000
Kavalla	(1915)	23,378	Manisa	(1915)	35,000
Syra	(1907)	21,342	Aivali	(1915)	25,000
Serres	(1915)	19,468	Kassaba	(1915)	23,000

In 1921 there were 219,000 Greeks in the island of Cyprus; and it was estimated that there were about 800,000 in Asia Minor outside Ionia (Pontus and Anatolia), 225,000 in other Balkan states, 150,000 in southern Russia, and 100,000 in Egypt; besides the Greek colonists, many of them naturalized in foreign countries, who were estimated to amount to 20,000 in western Europe, 6,000 in India, Africa, etc., and 250,000 in the United States of America.

Emigration to the United States continued unabated after 1910. In 1914 45,881 emigrants from Greece entered the United States, and from 1915–20 the annual average was 26,500, or nearly 45,000, if all emigrants of Greek origin (from Egypt, Turkey and the Caucasus) are included. Between 1910 and 1920 the number of repatriated emigrants was about 6,000 a year. The number of Greek emigrants permanently established in N. America is said to approximate 500,000. Their remittances home were said in 1917 to amount to nearly £2,000,000 annually.

Finance.—Between 1898 and the end of 1913 new loans raised the Public Debt to 1,216,480,000 drachmae. In every succeeding year this was further increased, and on May 1 1921, the total Public Debt amounted to 6,208,264,000 drachmae. This vast growth was due to the successive deficits in the budget since the Balkan wars (which cost approximately 682,523,000 drachmae); to the preparations for entering the World War (1914–6), 570,000,000; to the war itself (war expenses Oct. 1916-Dec. 1918, 760,000,000, not including the value of war material supplied by the Allies); finally and especially to the war in Asia Minor, which up to Aug. 1921 must already have cost nearly 3,000,000,000 drachmae. Table 4 shows the revenue and expenditure 1910–20, deficits being due almost entirely to extraordinary war expenditure.

TABLE 4. REVENUE AND EXPENDITURE

	Revenue	Expenditure
	Drachmae	Drachmae
1910	129,500,000	140,500,000
1911	137,800,000	175,700,000
1912	127,200,000	207,900,000
1913	122,200,000	423,800,000
1914	221,000,000	555,000,000
1915	232,000,000	477,000,000
1916	230,000,000	363,000,000
1917	263,000,000	440,000,000
1918	288,000,000	824,000,000
1919–20 (Budget)	469,690,000	1,554,357,000
1920–1 (Budget)	597,011,000	2,005,304,000

The bank-notes in circulation increased from 310,604,185 dr. in 1914 to 1,856,173,000 in Nov. 1920, and approximately to 2,500,000,000 in May 1921. Table 5 shows the yield of taxes in millions of drachmae.

TABLE 5. TAXATION RECEIPTS

	1911	1912	1916	1917	1918
Direct	23·5	24	50·4	49·9	50·8
Indirect	62	56	89·2	68·1	95·2
Monopolies	13·2	13	18·4	18·4	20·9

The deposits in the banks of the country, on Sept. 10 1918, were 1,162,312,912 dr., of which 607,845,414 were at the National Bank of Greece and 184,445,821 at the Ionian Bank.

Trade.—Table 6 shows (in francs) the value of imports and exports, 1914–20.

TABLE 6. IMPORTS AND EXPORTS

	Imports	Exports	Total
1914	318,846,472	178,564,362	497,410,834
1915	289,390,294	218,356,354	507,746,648
1916	399,438,840	154,841,815	554,280,655
1917	223,075,496	112,626,577	335,702,073
1918	733,907,099	296,860,251	1,030,767,350
1919	1,608,323,928	726,533,168	2,334,857,096
1920	2,131,038,321	664,112,647	2,795,150,968

Shipping.—The merchant shipping of Greece in 1920 comprised a tonnage of 298,903, with 228 steamers and 1,048 sailing vessels. Of these, three were transatlantic liners of a total tonnage of 11,085 tons, and 23 others, between 2,000 and 5,000 tons, of a total tonnage of 59,282 tons. To this list should be added 54 steamers and eight sailing vessels bought in 1919 but not yet registered, representing a tonnage of 68,572 and 1,947 respectively. Greek river boats and tugs in foreign waters raised the total of the Greek merchant navy in 1920 to 1,697 vessels of 464,635 tons. These figures do not include about 10,000 vessels of less than 30 tons, registering altogether about 83,000 tons. The Greek merchant fleet suffered very severely during the war. Greece lost 299 ships of 718,000 tons, thus losing 64·6 % of her pre-war tonnage.

Communications.—The total length of Greek railways in 1919 was 2,307·5 km., including the important section 88 km. in length from Papoula to Platy, by which the line from Piraeus to Demerli (the Greco-Turkish frontier of 1912) was joined up to the line from Belgrade to Salonika, thus putting Athens in direct railway connexion with W. Europe; this line was completed in 1916. To this total must be added a further section, nearly 700 km. in length, of the line from Salonika to Constantinople. The section from Salonika to the Greco-Bulgarian frontier of 1913, 340 km. in length, was acquired by convention of March 16 1919; the new section extends from the Greco-Bulgarian frontier of 1913 to the new Greco-Turkish frontier defined by the Treaty of Sèvres.

The construction of various new lines of about 970 km. (103 km. in old Greece, 863 in Epirus, Crete, etc.) was in 1921 under consideration; and the concession for a new line from Kavalla to Drama had already been obtained by a French company.

There are in Old Greece 3,286 km. of main roads, constructed before 1892, and 2,300 km. constructed between 1892 and 1920. In Crete, Macedonia and Epirus there are 2,538 km. New roads of 3,775 km. in length were projected, and about 600 km. were actually under construction in Nov. 1920.

Though commercial aviation had not yet been established in Greece in 1921, it should be noted that Athens is the natural centre of Mediterranean communications, and is situated at an almost exactly equal distance from Corfu, from the Greco-Serbian frontier, from Kavalla, from Gallipoli, from the Greco-Turkish frontier east of Smyrna and from the eastern shores of Crete.

Agriculture.—In 1918 the area under cultivation (within the frontiers of 1914) was given as 1,415,633 hectares, and produced 18,927,226 metric quintals (of 100 kg.) of various crops, of a total value of 1,591,526,024 drachmae. In 1920 the annual production, in quintals of the chief crops, was given as follows:—wheat 3,318,709, maize 2,320,723, must 1,816,793, barley 1,529,651, olive oil 1,410,918, currants 995,500, oats 579,953, rye 333,914, tobacco 310,864.

The progress of agriculture has been delayed by the small size of the holdings in most parts of the country; but this obstacle has been to some extent overcome by the law of 1915 on agricultural coöperative associations. In 1918 there were already 730 of these associations in existence with a membership of 27,051; more than half of these were loan associations to which the National Bank was authorized to advance up to 25,000,000 drachmae. Greece however still depends on foreign imports for her cereals. The average annual consumption per head is 180 okes (one oke = 2·832 lb. avoir.) while the average home production is 126 okes. The annexation of Thrace and (provisionally) of Ionia should remedy this defect. Meanwhile in other parts of the country, where estates are too large, as in Thessaly, and the *métayer* system prevails (the cultivator paying to the proprietor one-third or one-half of the gross produce), these estates are being broken up by the application of Law 1,072 on expropriation drafted by M. Michalakopoulos, in the Government of Venizelos. An agricultural bank to cover Crete, Macedonia and the islands, was being established in 1921, and agricultural instruction seriously organized. The agricultural population of Old Greece (1911) constituted 61 % of the total population, and it is estimated that this proportion was raised to 65 % by the annexation of Macedonia. The use of chemical manures is rapidly growing: in 1910 only 611,780 kg. were used, while the figure had risen in 1914 to 6,592,785 kilogrammes.

Forests.—The area under forests in 1914 was 1,600,000 hectares, half in Old Greece and the rest in the provinces acquired in 1913. They were valued at 320,000,000 drachmae, and the gross revenue estimated at 38,000,000 (19,300,000 in Old Greece).

Fisheries.—The annual produce of Greek fisheries was estimated in 1920 at 28,700,000 okes, of which 23,700,000 were the produce of State waters. In 1918 the yield was valued at 1,544,120 drachmae. In Sept. 1919 there were 1,941 fishing vessels registered at 84 ports, with total crews of 7,689 men.

Manufactures.—In 1920 there were 2,211 factories employing 36,124 workpeople, with plants valued at 260,518,437 dr. and an output at 871,494,508 drachmae. Of these 2,211 factories, 1,870 used power (40,000 H.P. in all), 570 steam, 283 oil, 383 electricity, 308 gas and 326 water-power. Water-power is used in flour-mills and macaroni factories (1,662 H.P.), oil refineries (202 H.P.), chemical industries (1,095 H.P.), textile industries (3,288 H.P.), tanneries (10 H.P.) and wood-work (15 H.P.). The development of water-power, in which Macedonia is remarkably rich, is expected to be of great importance in the future. The lake of Ostrovo alone, with the river Voda, is said to be capable of giving a force of 34,000 H.P. besides the rivers Vardar (4,000 H.P.), Vistritsa (3,000 H.P.) and

Struma (3,500 H.P.), and the falls of Niausta (4,000 H.P.) and Verria (Kara Feria) (2,000 H.P.).

Mines.—The output of iron fell (in thousands of metric tons) from 377 in 1912 to 68 in 1918, of lead from 175 to 18, of zinc from 40 to 4½. On the other hand the production of lignite rose from 20 in 1914 to 214. The gross output of the mines fell from 806 to 408 thousand metric tons. In 1918 the output of gross ores sold was valued at 20,920,000 fr., of roasted and dressed ores at 5,124,000 fr., the output of quarries at 7,715,000 fr.; and the net profits (for Old Greece only) amounted to 5,533,000 fr.; 8,350 men were employed and 852 women, including 4,424 underground workers (all men). There were 65 accidents. The enterprises that made the largest net profits in 1918 were the Société financière de Grèce (lignite) with 2,425,592 dr.; the Compagnie français des Mines de Laurium (various) 776,945 dr.; L. Depian, N. Raphael (magnesite) 676,883 dr.; Apostolides Brothers (chrome) 304,998 dr.; and the Anglo-Greek Magnesite Co., Ltd., 260,728 drachmae.

Labour.—Greece only became conscious of a labour question within comparatively recent years. In 1917 and 1918 a certain amount of unrest was met by the Government with temporary measures. In 1919 the Government succeeded in settling in a friendly manner more than 200 strikes. Labour conditions at the ports have been improved by the organization of the workers in coöperative associations dispensing with the intervention of contractors. At the Piraeus alone three such associations handled in 1919 work estimated to exceed 10,000,000 drachmae. In 1920 the discontent was less pronounced; but the working population, except to some extent at the Piraeus, voted against the Government of M. Venizelos at the elections, as a protest against the suspension of popular liberties during the war. (On June 18 1921 the leaders of the Communist party, MM. Demetratos and Siderès, with two others were arrested and imprisoned for printing and publishing certain Tolstoyan pamphlets.) At the end of 1918 there were 918 coöperative associations of various sorts, with 45,070 members; 820 of these associations were agricultural, with 32,648 members.

Greece was the first state to ratify the resolutions of the International Labour Conference held at Washington after the war (with regard to the 8-hour day, unemployment, employment of women and children, etc.). In 1911 a department of labour and social welfare had already been established at the Ministry of National Economy; in 1912 an inspectorate of labour and in 1915 a Superior Council of Labour. The employment of women and children was elaborately regulated in 1913 by legislation which was extended in 1915 to the new provinces. A series of laws provided for the health and security of workmen, especially in mines, bakeries and printing shops. A law of 1914 regulated compensation for accidents; another dealt with wage disputes (1911); and a law of 1918 secured for workmen in private employment that they should keep their places when called up for military service. Further legislation established special relief funds for miners and regulated the hours of labour; sea labourers also have their own pension fund. The employment of children under 12 years of age is forbidden, and the maximum day of six hours is fixed for children between 12 and 14 years of age. The employment of women and children in mines and quarries is forbidden; and a compulsory leave of eight weeks is accorded to women workers during maternity. Women workers (employed in currant packing and mills) organized themselves as a union and on Sept. 27 1920 demanded a uniform wage of 10 drachmae.

TABLE 7. AVERAGE PRICES IN DRACHMAE OF CHIEF COMMODITIES, 1914–20

	1914	1915	1916	1917	1918	1919	1920
Wheat (100 kilos.)	32·11	49·82	71·76	175·94	133·06	105·2	111·54
Flour (100 kilos.)	38·90	55·77	67·32				
Bread (the kilo.) . .	·38	·51	·60	·76	·99	·88	·98
Potatoes	·23	·30	·50	·96	1·19	·96	·81
Beef	1·41	1·55	1·97	3·45	5·71	5·50	5·91
Fish (fine)	2·57	2·76	3·64	5·69	8·00	6·89	7·06
Butter (cow)	3·92	3·99	5·32	9·04	14·76	13·76	14·14
Butter (sheep)	4·13	4·23	5·12	9·35	14·84	13·40	14·40
Oil	1·18	1·38	1·60	2·27	3·81	4·19	5·66
Milk	·51	·54	·70	1·05	1·51	1·35	1·47
Cheese	1·61	1·67	2·26	3·35	5·02	4·43	4·81
Olives	·69	·76	·97	1·36	1·83	1·98	2·57
Coffee	2·68	2·81	3·10	4·34	5·26	5·14	5·38
Sugar	·85	1·10	1·65	2·58	2·84	2·67	4·19
Rice	·76	·93	1·18	1·89	1·96	2·15	3·15
Charcoal (the metric quintal)	16·12	15·50	21·57	30·18	45·75	50·26	50·58

Cost of Living.—From Table 7 it will be noted that oil, olives and charcoal rose in price without intermission in 1914–20 to an extent of between 300 and 400%. Bread, beef, fish, butter, milk and cheese, after attaining their maximum prices in 1918 (from 300 to 380% above those of 1914) fell in 1919 only to rise again in 1920, beef rising 420%. Wheat attained its maximum price in 1917, and potatoes in 1918. In June 1920 prices were between three and four times greater than those of the pre-war period; and in June 1921 the cost of living was estimated to have been five times what it was in 1914. This increase after the war was mainly due to the fall in the foreign exchange value of the drachma.

Economic Conditions.—In 1910–12 there was a marked economic improvement throughout the country largely due to good harvests, better relations with neighbouring states and the stability of the exchange (drachma at par), due to reforms in the administration, and resulting in extension of trade, increased railway traffic and development of the merchant navy. This general improvement was interrupted by the war period, which began in Greece in 1912 and continued practically without intermission up to 1921. Greece suffered very severely from the Allied blockade of 1916–7 and the prolonged mobilization; but the many large fortunes accumulated during the war period by Greek ship-owners enabled the country to begin a quick recovery in 1919. Already in 1918 the annual returns of the wealth of the country were estimated at more than 1,600 million drachmae (agriculture 628; forests 38; industry 825; minerals 49; merchant navy 60 millions). The national capital was at the same time valued at nearly 3 milliards of drachmae (capital value of agricultural productions, 1,756,000,000; of forests, 320,000,000; of industrial enterprises, 341,000,000; of mining enterprises, 69,000,000; of merchant navy, 218,000,000; total 2,704,000,000). This is manifestly a very incomplete inventory; and, if the potential wealth of Thrace and Ionia be taken into consideration, it is clear that, with a progressive administration capable of ensuring peace at home and abroad, the country might expect a period of great prosperity. Unfortunately, the recovery begun in 1919 was again interrupted at the end of 1920 by the revolutionary restoration of King Constantine, resulting in the "economic blockade," the suspension of credits in the Allied countries and the consequent interruption of trade. There were large issues of paper money, and the drachma fell rapidly to 60 and finally (May 1921) to 100, after which the Government, by restricting all transactions to a syndicate or "consortium" of leading banks, artificially fixed the rate of exchange at between 60 and 70 drachmae to the pound sterling.

POLITICAL HISTORY, 1910–21

First Venizelos Ministry.—In Jan. 1910 the Military League, embarrassed at the completeness of their success, had called Venizelos from Crete as their political adviser, and Venizelos, immediately assuming the effective leadership, had by the end of March arranged for the dissolution of the revolutionary league on the convocation of a National Assembly, which should conciliate the necessary reforms with the usual procedure of constitutional government. When the National Assembly met on Sept. 21, Venizelos, who having himself been elected a member had in deference to the protests of Turkey resigned his position in Crete, again took the less revolutionary course, and insisted that it must be only a revisionary and not a constituent body. The dispute led to the resignation of the premier Dragoumis, and on Oct. 18 King George asked Venizelos, who had won the enthusiastic support of the Athenian populace, to succeed him in the Government. The old party leaders, more alarmed by the rise of a new and popular man than by the proposals of the revolutionary officers, now combined to leave him without a quorum; thereupon Venizelos dissolved the Assembly and appealed to the people. New elections were held (Dec. 11), and, without the help of any party organization he was returned with a tremendous majority, winning 300 seats against 64 retained by his opponents.

The second revisionary National Assembly met on Jan. 22 1911, and inaugurated a period of energetic reform. The administration was freed from corruption, partly by the hard work of Venizelos, and partly through the fact that his electoral triumph had shattered the old party machinery in the provinces. By the beginning of June the Assembly had settled the following revisions of the constitution: foreign officers were made eligible for service of State, and accordingly foreign missions were at once summoned to Athens to reorganize the services—English officers for the navy, Italians for the gendarmerie and French for the army, in which the Crown Prince was reinstated as Inspector-General. Elementary education was to be free and compulsory. The official language was declared to be that of the constitution, without prejudice however to literature, while, after a violent recrudescence of the agitation "to defend the purity of the language" under the leadership of a certain Professor Mistriotes, who finally had to be suppressed by the

Government, the translation of the Scriptures was forbidden without the consent of the Church. Expropriation was defined, thus enabling Venizelos to settle (April 2) on a basis of voluntary sale an agitation among the peasant cultivators of Thessaly against speculative landlords who had bought up the estates of Turkish feudal beys after the annexation of 1881. No soldiers, mayors or other public servants were to be eligible for the Chamber, the quorum of which was to be one-third of the total number of deputies. The Council of State (instituted in 1864 and abolished in the following year) was revived; and security of tenure was enjoined for judges and other public officials (in order to put an end to the "spoils" system, which however was still prevalent in 1921). In March diplomatic relations, suspended since 1905, were resumed with Rumania; and better relations of the Christian communities in Macedonia, where their "disarmament" had been carried out with great severity since 1910 by Shevket Torgut Pasha, led to an Easter visit of 300 Bulgarian students to Athens, and enabled Venizelos to put forward in April the first suggestions of a defensive alliance against Turkey—which on Sept. 29 became involved in war with Italy.

On Jan. 3 1912 the National Assembly was dissolved, and at the elections for an ordinary Chamber on March 25 Venizelos won 150 seats out of 181. To this Chamber 69 members were elected by a Cretan revolutionary assembly, which, assuming the government of the island on the outbreak of Turkey's war with Italy, had already tried to send a number of deputies to the National Assembly; these had been arrested by the international forces (Dec. 15 1911) and detained at Suda Bay till the dissolution. Of the 69 Cretans elected to the new Chamber 19 were arrested by H.M.S. "Minerva" and detained at Suda (April 28–June 6 1912); others made their way to Athens and attempted to take their seats on June 1. Venizelos however, by troops and persuasion, succeeded in excluding them from the opening sitting and then adjourned the Chamber, thus avoiding an inopportune and premature provocation of Turkey.

Meanwhile more definite and official approaches had been made to Bulgarian friendship. The Crown Prince had visited Sofia on Feb. 2 for the coming of age of Prince Boris. The Serbo-Bulgarian Treaty of Alliance had been signed at Sofia on March 13. On May 29 a secret treaty of alliance between Greece and Bulgaria was signed at Sofia, by which the two Powers bound themselves to act together "with all their armed forces" for the defence and preservation of equal rights and privileges for their nationals in the Turkish Empire. A special clause however declared that the stipulations of the Treaty should not be binding in case of an outbreak of war between Greece and Turkey in consequence of the admission of Cretan deputies to the Greek Chamber. The military convention annexed to this Treaty was not signed till Oct. 5. During the summer the condition of the Macedonian races had become desperate. A revolt had broken out in Albania; the Turkish troops had mutinied at Monastir; and bombs thrown at Kochana had succeeded in provoking them to massacre. On Sept. 30 the Balkan States, beginning to mobilize, made an united *démarche* at Constantinople, in the nature of an ultimatum, demanding immediate reforms in Macedonia. On Oct. 8 1912, the Powers, who with the exception of Russia had remained unaware of the new grouping in the Balkans, addressed to Sofia, Belgrade and Athens a severe warning, promising that they themselves, "relying on Article 23 of the Treaty of Berlin, would take in hand the restoration of administrative reforms in European Turkey, in the interest of the populations concerned, on the understanding that such reforms should not infringe the sovereignty of the Ottoman Empire." But on the same day King Nicolas of Montenegro declared war against Turkey. On Oct. 14 the Greek Chamber met, and the Cretan deputies were admitted, an act which denoted the formal annexation of the island, to which the ex-premier S. Dragoumes was sent as governor.

Balkan War.—Turkey declared war on the following day against Bulgaria, Serbia and Montenegro, but not against Greece, who was offered the island of Crete and the long-refused permission for the construction of the railway between Salonika and the Thessalian frontier which should connect Athens with Europe, if she would remain neutral. The offer is said to have tempted King George. But Venizelos, who before making the arrangement with Bulgaria had done all that was possible to arrive at a friendly settlement with the Turks, actually offering to pay a small tribute and acknowledge Turkish sovereignty over Crete if the Porte would recognize the right of the Cretan deputies to sit in the Greek Chamber, realized that it was now of supreme importance that Greece should not be left out of the new grouping; and he proved his country's loyalty to the Balkan Alliance by declaring war against Turkey (Oct. 18).

The Greek forces immediately crossed the frontier, and on Oct. 22 sharply defeated the Turkish army, which made a first serious attempt to resist the invasion at Sarandoporon. After occupying southern Macedonia the Crown Prince, who was in command, intended to march towards Monastir, but was diverted by urgent instructions from the Government that for political reasons the primary objective of his army must be Salonika. He accordingly wheeled his forces towards the north-east and fought another two days' battle at Yenitsa. Three days later, on Nov. 8, the feast of its patron saint Demetrius, the town of Salonika, after negotiations inaugurated by the foreign consuls, surrendered to him with the whole Turkish garrison of 30,000 men. Four days afterwards the Greek army again turned westward in order to clear western Macedonia of the Turkish forces which had been threatening their left flank, and on Nov. 20 at Florina they joined hands with the Serbians who had now taken Monastir. The successes of the army gave the Greek people a new self-confidence. But a delicate situation arose when, two days after the occupation of Salonika, a Bulgarian army, after a forced march over the mountains, entered the town, claimed a sort of condominium, displaying an increasing hostility towards the Greek authorities. Meanwhile the Bulgarians had swept through Thrace and invaded Adrianople but had been held up by the lines of Chatalja. By the end of the month the Turks, holding nothing in Europe, outside those lines, but the fortified towns of Adrianople, Scutari and Yannina, signed an armistice (Dec. 3) with Bulgaria, Serbia and Montenegro, but not with the Greeks, who were thus enabled to maintain the blockade of the Dardanelles and to transfer their major activity to Epirus, where an army under General Sapundzakes had driven the Turks into Yannina.

The Greeks took part, however, in the conference which met in London on Dec. 16, when the Balkan allies met the Turks and demanded the surrender of all that they held, together with the fortresses invested. Under pressure of a note from the Powers the Grand Council at Constantinople (Jan. 22 1913) had finally decided to accept these terms, when the extreme Nationalists under Enver Bey expelled the Grand Vizier Kiamil Pasha and murdered Nazim Pasha, the commander-in-chief. Hostilities were resumed on Feb. 3. The Greek army in Epirus, now heavily reinforced and under the immediate command of the Crown Prince, carried Yannina by storm (March 6); and 12 days later the victor acceded to the throne as King Constantine, his father having been assassinated at Salonika.

Bulgarians and Serbians stormed Adrianople at the end of the month, and on April 22 Scutari surrendered to Montenegro. Negotiations between the belligerents were reopened in London on May 20, and by the Treaty of London (May 30) Turkey ceded collectively to the Balkan allies all her European territory west of a line drawn from Enos on the Aegean to Midia on the Black Sea, leaving the questions of Albania and the Aegean islands (except Crete, which was at last to be definitely annexed to Greece) to be settled by the Powers. Unlike Bulgaria's treaty with Serbia, the Greco-Bulgarian Treaty contained no territorial provisions. A friendly division of the surrendered territory, however, could probably have been arranged between the three allies, had not England been induced, with the object of setting up an independent kingdom of Albania, to support the Austrian proposal to exclude Serbia from the Adriatic. This unexpected exclusion caused Serbia to reconsider the provisional partition of Macedonia arranged in the treaty with Bulgaria;

while Bulgaria adopted such a threatening and aggressive attitude to both her allies that, on June 2, Greeks and Serbians signed a defensive alliance, intended primarily to prevent Bulgarian hegemony in the Balkans, but clearly drafted so as to be binding in case of attack by any third power. Bulgaria, hoping to rush Salonika and anticipate the result of further negotiation or arbitration, attacked the Greek and Serbian lines on June 29, but was heavily defeated at Kilkish (July 4) and compelled to retire fighting towards the Bulgarian frontier. Seeing the Bulgarians punished, Rumania intervened to claim territorial concessions in the Dobruja. On July 20 the Turks reoccupied Adrianople. Neither the Powers nor the two surviving partners of the Balkan Alliance protested against this violation at Bulgaria's expense of the Treaty of London.

Peace of Bucharest.—The Rumanian intervention brought the belligerents to terms, and peace was signed at Bucharest on Aug. 10. The frontier of Greek Macedonia was carried eastwards as far as the river Mesta (Kara Su), thus excluding Bulgaria from the coveted Aegean port of Kavalla, and northwards as far as Florina and Doiran. Venizelos had no hope of mitigating Bulgarian enmity and restoring the shattered alliance by any further concessions, and was driven to base his policy on a balance of power, hoping to immobilize Bulgarian ambitions by the standing threat of the alliance with Serbia and the new friendship with Rumania.

Northern Epirus.—The Greek frontier in Northern Epirus depended on the delimitation by the conference of the Powers in London of the new principality of Albania, and the decision of the international commission appointed for this purpose was subject to Italy's refusal to allow Greece to hold any of the Adriatic littoral north of Corfu. When the decision of this commission was promulgated (Florence, March 1914), Greece obediently withdrew her troops to the south of the new frontier, but the inhabitants of the evacuated district, which included Chimara, Argyrokastro, and Koritsa, were so thoroughly Greek in sentiment that they immediately proclaimed a provisional government, and finally obtained from the Albanian Government, subject to the international commission of control, certain rights of autonomy with which they were provisionally satisfied (Corfu, May 17 1914). In Oct. 1914, after the departure from Albania of Prince William of Wied, Greece was authorized by the Entente with the consent of Italy to reoccupy this district of northern Epirus with her troops in order to preserve order, on the express understanding that the question should be finally settled by the Peace Congress. Greek forces were obliged to hand over these districts to Italian occupation in 1916, but were authorized to reoccupy them after the war (Dec. 1919). The Italians accordingly evacuated Epirus and French troops the Koritsa district in April and May 1920. Subsequently Chimara and other of the disputed districts were restored by the Greek authorities to Albania (June 1 1921), who appealed to the League of Nations against the frontier claimed by Greece. The Council of the League of Nations, however, relying on the declaration of the Powers in 1914 decided June 28 1921 that only the Supreme Council of the Allies (then represented by the Ambassadors' Conference in Paris) was competent to determine the Albanian frontiers.

The Dodecanese.—Greece also awaited the decision of the Powers with regard to the islands of the Aegean; and in the solution of this question it happened again that Italy was the Power responsible for checking Greek aspirations. Italy had occupied during her Tripolitan war with Turkey the twelve islands of the southern Sporades, known as the Dodecanese, all of which, except Rhodes and Kos, were barren rocks inhabited by Greek sponge fishers, and by the Treaty of Lausanne (Oct. 18 1912) had retained them only as security for the evacuation of Tripoli by the Turkish troops. During the Balkan War the Italian occupation had naturally protected these islands from attack by the Greek fleet which had successfully seized from Turkey all the other islands of the Aegean. Sir Edward Grey declared on Aug. 12 1913 that "Italy had never allowed England for one moment to doubt that it was her intention to complete that part of the Treaty of Lausanne with regard to these islands and retire from these islands when Turkey had completed her part; England had complete confidence in her good faith." On Feb. 13 1914 the Powers recognized Greek sovereignty over all the islands seized by the Greeks during the war, with the exception of Tenedos and Imbros, which were supposed to command the entrance to the Dardanelles; but still the Italians gave no sign that their occupation of the Dodecanese was either conditional or temporary. It remained for Venizelos after the World War to negotiate with Signor Tittoni an agreement (July 29 1919) by which all the outstanding questions between Italy and Greece were compromised, and all the islands were to revert to Greece, with the exception of Rhodes, the cession of which was to be dependent on the result of a plebiscite to be held within 15 years of England's cession of Cyprus; and Venizelos refused to sign the Treaty of Sèvres in Aug. 1920 until the official and obligatory character of this agreement had been recognized by the Supreme Council. The islands of Tenedos and Imbros together with the island of Lemnos were occupied during the World War by the British fleet; and the British forces under Gen. Finlayson handed the three islands over to the Greek authorities in accordance with the Treaty of Sèvres on June 25 1921.

The decision of the Powers after the Peace of Bucharest, assigning to Greece sovereignty over the Aegean islands, was not recognized by the Turks, who commenced a boycott of Greek shipping and an organized persecution of Greeks in Asia Minor. Fortified by the opportunity of buying two battleships which would have secured for their fleet the supremacy of the Aegean, Turkey plainly threatened to reopen the war. In June 1914 the situation was indeed so alarming that Venizelos appealed for Serbian support. The Serbs in their reply did not hesitate to recognize the obligations of the Greco-Serbian alliance; and after pointing out that their immediate participation in a third war was for obvious military and financial reasons extremely undesirable, if not impossible, they proceeded to address a strongly worded protest to the Grand Vizier at Constantinople, with the result that he felt that they were quite prepared to declare war in defence of Greek interests. They also requested the other Powers to use all possible pressure to restrain Turkish provocation. They showed such goodwill in the exercise of these diplomatic measures that on June 22 1914, M. Streit, then Foreign Minister in the Government of Venizelos and subsequently King Constantine's private adviser, telegraphed to Belgrade "the lively gratitude of the Greek Government for the Serbian *démarche* at Constantinople on the subject of the persecution of the Greeks in Turkey, a *démarche* which has proved once again the solidarity of our alliance and the bonds of affection which unite the two peoples." Meanwhile Venizelos, having sounded the other Powers and learned that, owing to Germany's refusal to take part, there was no chance of a naval demonstration by the Great Powers in order to compel the Turks to respect the decision of the London conference with reference to the Aegean islands, succeeded (July 8 1914) in buying for immediate delivery two American battleships, which deprived the Turks of any chance of challenging the superiority of the Greek fleet. Turkey at last consented to negotiate,[1] and Venizelos was on his way to meet the Grand Vizier at a neutral capital, when at Munich he learnt of the outbreak of the World War. There also he received the question from the Serbian premier as to the attitude Greece would adopt in view of the Austrian invasion. Venizelos declared at once (Aug. 2) that "with regard to the war with Austria he must await fuller information and consultation with his colleagues in the Government before he could determine the answer to be given; but that with regard to the possibility of a Bulgarian attack the place of Greece would be at the side of her Serbian ally in order to keep their common enemy at a respectful distance, and ensure the maintenance of the Treaty of Bucharest." This declaration was officially renewed on his return to Athens.

The World War.—On Aug. 4 1914 Germany informed Greece both officially and by private telegram from the Kaiser to King Constantine that she had concluded alliances with Turkey and Bulgaria, and invited Greece to join the Germanic powers in a united campaign against a Slav domination in the Balkans. This invitation was declined by King Constantine in terms of warm personal friendship. Venizelos, on behalf of the Greek Government (Aug. 8), supplemented the King's rather regretful reference to the impossibility of Greek coöperation with Germany owing to the Mediterranean supremacy of the British and French fleets, by suggesting the renewal of a Balkan federation *to include Bulgaria* for the maintenance of neutrality. The hostile attitude of Turkey, however, now once more strengthened by the entry into the Dardanelles of the German cruisers "Goeben" and "Breslau," gave little hope of preventing the war from spreading in the Near East; and on Aug. 23 Venizelos officially declared with full authority that "Greece, not merely in consciousness of her indebtedness to the great guaranteeing Powers, but from a clear perception of her vital interests as a nation, understood that her place was at the side of the Powers of the Entente; and that whereas in the war that was being waged it was not possible for her to take a military part, since she could not, owing to the danger from Bulgaria, reinforce the Serbians, much less send an expeditionary force to France, nevertheless she thought it her duty to declare to the Powers of the Entente that, if Turkey went to war against them, she placed all her forces naval and military at their disposal for the war against Turkey, always presupposing that she was to be guaranteed against the Bulgarian danger."[1] The results of this voluntary declaration, made at a time when the Germans were advancing triumphantly towards Paris, won an assurance from the British Government that the Turkish fleet would not be allowed to leave the Dardanelles, the consent of the three Powers and of Italy to the provisional reoccupation of northern Epirus by the Greek army, and a cordial telegram from King George V. of England to King Constantine. But shortly afterwards Admiral Mark Kerr, instructed by the British Admiralty to concert plans with the Greek staff for a possible occupation of Gallipoli, was surprised to be told by King Constantine that he had no intention in any circumstances of declaring war against Turkey unless Turkey first attacked Greece. Venizelos in a memorandum to the King (Sept. 7) explained the reasons for forestalling an inevitable Turkish attack, Turkey in her persecutions of the Greek element in Asia Minor "having long been waging a war which had never been declared"; he protested against the King's excessive fear of offending Germany; and finally offered to resign. He was induced to remain in office, but insisted on the resignation from the Government (Sept. 28) of M. Streit, Minister for Foreign Affairs, who was understood to have advised the King without the knowledge of his colleagues; Streit indeed continued to be the private political counsellor at the Palace. A month later Turkey entered the war.

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[1] These negotiations were subsequently resumed, and resulted (Nov. 14 1914) in an agreement known as the Treaty of Athens.

In Jan. 1915 England on behalf of the Allies once more invited Greek assistance, not against Turkey but for the relief of Serbia, by a well-meaning attempt to reconstitute the nascent Balkan federation of 1912. Serbia, in the hope of eventually reaching the Adriatic, was to secure Bulgarian coöperation by certain concessions in Macedonia; and if Greece would facilitate these concessions the three Powers would gladly acknowledge "the right of Greece to very considerable compensations on the coast of Asia Minor" (Jan. 24 1915). Venizelos, whose own policy had always tended whenever possible towards a Balkan federation, explained to King Constantine in a memorandum of Jan. 11 the necessity of securing the coöperation not only of Rumania but of Bulgaria as well, and declared that in exchange for Bulgaria's active coöperation in a war which must result in "the creation of a real Magna Graecia" he would not hesitate to sacrifice Kavalla (the port in western Macedonia chiefly coveted by Bulgaria); and in a third memorandum (Jan. 17) he defined the territory in Asia Minor—"a province of 125,000 sq. km. as large as and no less rich than the whole kingdom of Greece and containing 800,000 Greek inhabitants"—which might be secured in exchange for the 2,000 sq. km. of the Kavalla district, the population of which need not necessarily be lost to Greece. These negotiations were frustrated primarily by the attitude of Bulgaria.

On Feb. 19, at the time of the preliminary attack by the British fleet on the Dardanelles, Venizelos, realizing that a landing force would be required, took up again the question of Greek coöperation. By a fourth memorandum (unpublished) he believed that he had succeeded in gaining the King's assent to the mobilization of one army corps to join in the Allied attack on Turkey, but he was checked by the immediate resignation of Col. John Metaxas, chief of the general staff. He therefore called a Crown Council of former premiers, under the presidency of the King (March 5), at which his proposal was favourably received by the leaders of all parties, including the ex-premiers Ralli and Dragoumes. At the suggestion of the ex-premier Theotokes a second Crown Council was held (March 6) in order to hear the reasons for the continued opposition of the general staff. At this meeting Venizelos, influenced by information from Constantinople (Feb. 29) that the Turks were already preparing to evacuate their still unfortified capital, attempted to meet the arguments of the general staff (against the denudation of the frontier of troops which might be required in view of the possibility of a Bulgarian attack), by proposing that not an army corps but only one division should be sent to the Dardanelles. This proposal was unanimously adopted by the Crown Council and even the ex-premier Theotokes, who never wavered in his personal preference for neutrality, advised the King that it was his duty to follow the advice of the Government of Venizelos without further hesitation. Nevertheless, King Constantine refused, demanded the resignation of Venizelos (March 6), and dissolved the Chamber (April 10).

Venizelos in Conflict with the King.—A new Government was formed on March 10 by D. Gounares, who declared that the basis of Greek policy in loyalty to Serbia would remain unaffected by the change of Government; and in the following month, when Bulgarian "irregulars" raided the Nish-Salonika railway, associated Greece with the Serbian protest at Sofia. The Minister for Foreign Affairs, Zografos, "honestly adopted all that was possible of the Liberal policy, the foundation of which was a very benevolent neutrality towards the Entente with a firm determination never to allow a Bulgarian attack on Serbia"; he continued for some weeks to negotiate with the Governments of the Entente, who on April 11 specifically offered the vilayet of Smyrna, but his sincere proposals were overtaken by the extravagant stipulations attached to them by the general staff. In the following month further offers of Greek coöperation were made through less formal channels, such as the suggestion (May 2) that Greece would lend the assistance of her fleet if guaranteed against Bulgarian attack. But the French Government, to which at this period most of these offers were addressed, replied that all proposals of assistance must be unconditional. Other offers were left unanswered by the French and British Governments, which were convinced of the insincerity of these proposals; not only because the Government of Gounares had taken office on the specific programme of maintaining Greek neutrality, and was believed to be putting forward these suggestions (as ex-President Poincaré subsequently stated on Dec. 9 1920) as a manœuvre directed against the Liberal party on the eve of the elections; but also because the real government of the country had been taken over by the King, who from this time forward assumed the right of negotiating directly with foreign Powers either through their ministers in Athens or through his brothers, one of whom would be sent from time to time on a tour of the western courts.

King Constantine was at the beginning of the war honestly neutral, but his mind was overwhelmingly impressed by German military prestige, and influenced by the German training of some of the most capable officers of the general staff. He was convinced by sentiment and environment, in spite of the logic of Venizelos, that Germany was going to win. The German press propaganda, well organized under Baron Schenck, was meanwhile very active, and as Germany had nothing to hope for from Greece beyond her neutrality, it directed all its efforts not only to strengthen the politicians opposed to Venizelos but also to popularize the King's own person and policy. At the elections which were finally held on June 13 the voters were definitely told that a vote cast against Venizelos, against the Liberal party, meant a vote for their King and a vote for peace. It is therefore somewhat remarkable that although Venizelos himself took no part in the elections, his party, with a programme of intervention, won a majority of 58 seats in a house of 310. (In Old Greece alone they won 123 seats out of 184, but lost heavily in Macedonia.)

In spite of this result Gounares remained in office. As the King had fallen ill, Gounares insisted that this precluded him from considering any change of policy that might be necessitated by a change of Government; and the interval was used by the German propaganda which had now obtained a firm hold on a certain section of the press, in conjunction with the counsellors of German sentiment within the palace, to wean public opinion from the ideas of confidence in Venizelos and loyalty to Serbia. In July an agreement was signed between Turkey and Bulgaria, an agreement which was declared by *The Times* correspondent in the Balkans (July 15) to be "of no political importance." The Greek press, less credulous, perceived the danger, and on Aug. 2 Gounares officially declared that "a Bulgarian attack on Serbia could not leave us indifferent, and the Turco-Bulgarian agreement will only strengthen the bonds between Greece and Serbia." Yet it is significant that on July 30 the Greek minister at Bucharest was informed by his English colleague that Germany had formally promised Bulgaria that Greek neutrality was definitely assured even in face of a Bulgarian attack on Serbia.

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[1] The exact terms of this declaration have never been published; the text is taken from a speech of Venizelos in Aug. 1917.

At last on Aug. 23 Venizelos was recalled to office. He had to face a strong opposition, composed of jealous party leaders, great provincial families, and local politicians whose positions had been endangered by the reforms of 1910–1; and this opposition of personal hostility to Venizelos was cleverly utilized by the German propaganda, which had only to identify the policy of loyalty to Serbia and to the protecting Powers with the figure of Venizelos in order to make this mixed opposition into a compact body of opinion working in effect if not in intention for Germany. The first act of Venizelos on taking office was to inform Serbia as well as Germany and the protecting Powers that his policy was to preserve Serbia from Bulgarian attack, and his dispatch to the German Government expressed the hope that Germany "would not fail to exercise all her influence in order to restrain Bulgaria from attacking Serbia, and would thus ensure the preservation of peace on the Greek frontiers." Germany and Bulgaria, however, had received information from other quarters to a very different effect. Bulgaria mobilized on Sept. 23, and three days later the Bulgarian premier publicly reassured his followers on the subject of Greek and Rumanian neutrality. Venizelos accordingly ordered a counter-mobilization, and was then reminded at the Palace that, as the King did not want to fight Germany, this must be regarded only as a "precautionary measure"; he agreed, and, having received an assurance from Sofia that Bulgaria had no intention of attacking either Greece or Serbia, explained in the Chamber (Sept. 29) that in spite of Bulgaria's declared intention of maintaining an "armed neutrality" the situation was grave, and suggested that it might be easily improved by a simultaneous demobilization. At this time the opposition press began to develop for the first time the suggestion, which proceeded from the general staff, that Serbia was not in a position to carry out her obligation, under the military convention annexed to the Greco-Serbian Treaty, to put 150,000 men into the field for the operations against Bulgaria. And Venizelos, in the course of his discussions with the King, who at this time disputed neither the validity of the Greco-Serbian Treaty nor the authority of his prime minister as head of a constitutionally elected Government, but could only repeat that he did not want to fight Germany, was authorized to meet the arguments of the general staff by asking France and England to supply in place of Serbia the 150,000 bayonets stipulated by the military convention. The King subsequently changed his mind, but the invitation had already been sent. On Oct. 2 a note from the French Minister announced the arrival at Salonika of the first French troops "in order to assist Serbia," France and England assuming "that Greece . . . will not oppose measures taken in the interests of Serbia who is her ally." At this the King pointed out that the troops must not land until Bulgaria attacked Serbia; for the Treaty would not come into force until Bulgaria declared war, and until that moment the landing of foreign troops would be a violation of Greek neutrality; and Venizelos accordingly himself formally protested against the disembarkation, which would, however, it was understood, be facilitated in every possible manner. On Oct. 4 Venizelos explained in the Greek Chamber his intention of respecting the Greco-Serbian Treaty and using the Greek army to protect the Serbian flank: "Greece has no immediate quarrel with Germany and Austria; but if in the course of events in the Balkan peninsula she should find herself faced by other Powers, she will act as her honour demands. Such is the policy of the present Government. I would add that it has been approved by the Greek nation at the recent elections." In the debate that followed M. Gounares declared for the first time his view that the Treaty with Serbia was only applicable to a purely Balkan war. Venizelos received the confidence of the Chamber by a majority of 46. On the following morning he was dismissed from office by the King, who entrusted the formation of a Government to M. Zaimes.

M. Zaimes announced a policy of "armed neutrality," and in replying on Oct. 11 to a Serbian appeal for assistance (which England supported with the offer to cede Cyprus, an offer withdrawn on Oct. 22), he developed the argument that the Treaty had a "purely Balkan character," and applied only to a "war between one of the Allied States and a single other Power." He added the remarkable sophism that "even in the course of the European War, Greece was ready to face the Bulgarian danger. . . ." But Greece anticipated a Bulgarian attack undertaken separately even though in conjunction with other hostilities directed against Serbia. The hypothesis of a combined attack with other Powers was outside the question. The Venizelist majority in the Chamber continued to support the new Government, on the understanding that Greek neutrality, as announced by M. Zaimes, was not less "benevolent" than before, until Nov. 3 when an incident produced by Gen. Giannakitsas, the Minister for War, provoked Venizelos to defeat the Government by 33 votes. On the following day Gen. Giannakitsas was given an appointment at court. The King dismissed the Chamber (Nov. 6), and a Government was formed by M. Skouloudes, a wealthy old man of good repute but weak character, who elaborated the now usual declaration (Nov. 9) of "*very* benevolent neutrality" towards the Entente.

The elections for the new Chamber were held on Dec. 19. Venizelos and the Liberal party decided to abstain from the polls, as a protest against what they regarded as an unconstitutional use of the King's authority in this second dissolution of the Chamber. The Liberals had the barren satisfaction of noting that only 230,000 votes were polled as against 720,000 recorded in the previous June. M. Skouloudes, now wholly under the influence of the Palace and the general staff, soon found that the practice of "*very* benevolent neutrality" was less easy than the profession. He was driven to admit that there were only two sorts of neutrality, voluntary and involuntary. In April he refused permission for the use of Greek railways for the transport of the Serbian army overland from Corfu to Salonika; and the manner of his refusal gave further offence to France.

On May 23 he received from the German minister a notification that Fort Rupel, a key position of great importance in the passes entering eastern Macedonia, would shortly be occupied as a "purely defensive" measure and without prejudice to Greek sovereignty. Two days later the fortress and its contents were duly surrendered by the Greek garrison to German and Bulgarian troops. M. Skouloudes possibly argued that if he was to remain neutral he could not refuse to Germany facilities which he had granted to the Allied forces at Salonika. Unfortunately he denied all knowledge of the incident when questioned in the Chamber on June 6, and his attitude was the beginning of a period of almost open hostility between the Greek Government and the Allies. "By adopting a passive attitude in face of an invasion which might weaken the position of the Allies, Greece appeared to be abandoning her policy of benevolent neutrality,"—telegraphed the Greek *chargé d'affaires* from Paris. The incident led to violent attacks on King Constantine; he was as violently defended by the German propaganda and by his own supporters in Athens; and now, embittered by these attacks, it must be assumed that he began definitely to desire a German victory.

On June 3 Gen. Sarrail proclaimed martial law at Salonika. On June 21 the Allied ministers presented a note, drafted a the British Legation, in which they demanded in the name of the three guaranteeing Powers (*Puissances garanties*) the demobilization of the army, a general election, the formation of a non-political or "business" ministry to carry out these changes, and the replacement of certain police officials who were supposed to be in close relations with the German propaganda. M. Skouloudes resigned, and M. Zaimes again took office (June 23) in order to accept performance of the note. Demobilization was at last begun on June 29. The army had been kept mobilized at great expense to the State for nine months, and as the Government had had no intention of entering the war, the only reason for keeping it on a war footing had been in order to increase the political power of the general staff. In order to continue this influence the demobilized men were now organized into "leagues of reservists" pledged to impose what was now definitely known as the King's policy in opposition to that of the Liberal party, and to form in practice centres of German propaganda and of active hostility to the Allies. In July and Aug. the Bulgarians advanced, and occupied almost the whole of eastern Macedonia, including the port of Kavalla, the Greek garrison of which, amounting to 8,000 men, was instructed to surrender to the invaders (Aug. 28) and was subsequently deported and interned at Görlitz in Germany. The Bulgarian invasion of Macedonia greatly embittered the feelings of the Entente Powers and of Greek Liberals against King Constantine; and when the invasion extended to western Macedonia it also led to the abandonment (very unfortunately) of the proposed election, the Liberals not caring to insist on carrying through an election without the Macedonian constituencies. The Chamber was not dissolved but adjourned (June 29), and was recalled on Nov. 13.

The evident sincerity of M. Zaimes, however, produced a temporary improvement of the relations between the Allies and the Greek Government. Venizelos promised to give his unconditional support to any government that would follow a policy of intervention; and King Constantine, in order to calm the popular excitement produced by Rumania's decision to enter the war and by the Bulgarian invasion of Macedonia, let it be known that he had authorized M. Zaimes to reopen negotiations with the Entente. On the eve of Rumania's declaration of war (Aug. 27) Venizelos at a mass meeting of his supporters made a final appeal to the Government and to the King to take this opportunity of associating Greece with the Allies before it was too late. King Constantine refused to receive a deputation elected by this meeting. On Sept. 1 a revolutionary movement was started by some of Venizelos's most prominent supporters at Salonika (P. Argyropoulos and Col. Zymbrakakes), who established a Committee of National Defence with the object of reënforcing the Allies with such troops as they could gather and helping them to drive the Bulgarians from Greek soil. On Sept. 2 a further Entente note, supported by the presence of the Allied fleet at the Piraeus, demanded the control of the posts and telegraphs and the expulsion of certain enemy agents who under the protection of the Palace were thought to be endangering the plans of the Allied forces at Salonika; and on Sept. 11 Zaimes resigned, finding it impossible, owing to the action of the Palace, honestly to satisfy the Allies by stopping the hostile tendencies in the capital.

A new Government was not formed till Sept. 16, when M. Kalogeropoulos took office but was not recognized by the Allied ministers, whom he was unable to satisfy as to his capacity to restore a more tranquil atmosphere. On Sept. 25 Venizelos left Athens, and, being joined in Crete by Admiral Kountouriotes and Gen. Dankles, proclaimed a revolutionary movement, intended not to displace the throne and the central Government but to force their hands by concentrating and displaying the strength of the Liberal and interventionist parties. This triumvirate, after gathering supporters by a tour of the Aegean islands (Samos, Mytilene and Chios), landed two days later at Salonika and, absorbing the Committee of National Defence, organized a Provisional Government which took on all the functions of a sovereign administration in alliance with the Allied forces, raised a Greek "Army of National Defence," and a month later declared war against Germany and Bulgaria. It was not, however, officially recognized by the Allied Powers. "Whenever we find part of the Greek community which is in fact under the Government of M. Venizelos," said Lord Robert Cecil after an Allied conference at Boulogne (Oct. 20), "where the majority of the population recognize him as their Government we recognize it as *de facto* the ruler of that portion of Greece." This cautious attitude contributed to the prestige still enjoyed by King Constantine at Athens, and enabled his League of Reservists to terrorize the ordinary population throughout the country. The report was spread that Venizelists were fomenting a revolution in Athens, and it was suggested that anyone who favoured the Allies was a dangerous rebel. On Oct. 10 a new government had been formed by Prof. S. Lambros, who obeyed the Palace and the general staff.

On Nov. 19, at 48 hours' notice, the French Adml. Dartige du Fournet, in command of the Allied fleet, expelled from Athens the ministers of the enemy Powers. Gen. Sarrail, who had just reoccupied Monastir, being now seriously alarmed about the safety of his left flank owing to the continual communications which were said to be passing between the Palace at Athens and the headquarters of the Central Powers, and owing to the appearance of Greek irregular bands in the neutral zone which had been established in Macedonia between the spheres of the Athens and Salonika Governments. On Nov. 24 the Admiral demanded the surrender of a considerable part of the Greek army's artillery;[1] this demand was the result of a private interview between the King and a French deputy, M. Bénazet, who had visited Athens at the end of Oct. and understood that the King would willingly comply. Two days later some detachments of French troops were landed, followed on Dec. 1, the day on which the time limit accorded by the Admiral expired, by 2,500 French and British marines, the Admiral being confident that no resistance would be offered and that only a show of force was needed. The troops were approaching Athens when they were attacked with machine-gun fire by Greek troops posted in prepared positions. Many were killed and wounded, and the remainder were escorted as prisoners back to their ships, while the Admiral himself was a prisoner in the Zappeion gardens, which he had made his headquarters, until the Allied fleet dropped a few shells in the gardens of the Palace. The French and British ministers retired to their warships and for two days the capital was given over to the excesses of the troops and reservists, who, excited by reports of a Venizelist plot to dethrone the King, hunted down as rebels and traitors all prominent citizens suspected of Venizelist tendencies. On Dec. 7 the Allied fleet began a close blockade of the Greek coasts. A week later a note from the Three Powers and Italy demanded reparation, and the withdrawal of all troops and arms to the Peloponnesus; and on Dec. 19 England officially recognized the "Provisional Government of National Defence," and sent Lord Granville to Salonika as British envoy. On Dec. 31 a further note from the Protecting Powers demanded a reduction of armed forces, the transfer of all armament to the Peloponnesus, the cessation of Reservists' meetings and of the arming of civilians, the re-establishment of the control officers (who had been expelled from the telegraphs, etc., on Dec. 1), the release of political prisoners, and apologies; and on Jan. 8, after an Allied Conference at Rome, a further note gave the Royal Government a week for the acceptance of these demands, but assured it that the Provisional Government of Salonika should not be permitted to extend its power or threaten the capital.

On Jan. 16 the Government accepted these terms, and by way of apology the flags of the Allies were formally saluted by Greek troops at the Zappeion. The blockade was, however, maintained, as King Constantine and his Queen were holding out in expectation of a German offensive in Macedonia, and, while organizing Greek irregulars in the Thessalian neutral zone, were sending frantic wireless messages to Berlin, one of which, for example, addressed to the German Emperor, prayed "that God grant you very soon a glorious victory over all your infamous enemies." Once more, however, the tension died down; King Constantine probably realized that the prospects of a German offensive on a large scale in Macedonia were very remote; his confidence must have been shaken by America's entry into the war (April); and, although the Russian revolution in March had deprived him of some diplomatic support, there were still influences abroad which enabled him to reopen relations of "friendly neutrality" when the French and British ministers returned to their legations in March. At the end of the month one or two of the Venizelist newspapers, whose presses had all been broken up in Dec. by the Royalist mob, ventured to reappear. On the other hand the replacement of the French Government of M. Briand by that of M. Ribot probably disposed France for a more drastic policy. The King's less truculent attitude, reflected in the reappearance of M. Zaimes as prime minister (May 3), was now confronted by more firmness in the councils of the Allies.

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[1] Eighteen field batteries, 6 mountain batteries, 4,000 rifles, 140 machine-guns, with ammunition, etc.

Deposition of Constantine.—At the end of May the Allies were at last agreed that the professed neutrality of King Constantine was not genuine enough to be respected. On June 6 M. Jonnart, a French senator, arrived in Greece as commissioner of the Three Powers, and, after conferences at Salonika, returned to Salamis and on June 11 presented the Greek Government with a note which demanded the abdication of King Constantine, "who would himself choose, in accord with the Protecting Powers, a successor among his heirs." The Greek Government, required to give an answer within 24 hours, was also informed that the Crown Prince would be excluded from the succession (on account of his German sentiments) and that the King, after his departure and subject to his good behaviour, would be guaranteed a pension of £20,000. On the following morning (June 12) M. Zaimes informed the High Commissioner that the King, "anxious as always for the welfare of Greece, had decided to leave the country together with the Prince Royal, and had chosen as his successor Prince Alexander" (his second son, born Aug. 1 1893); and the same night King Constantine left Athens and made his way to Switzerland, with his family and suite, which included his chief political adviser, M. Streit. General Dousmanes and other officers of the general staff, with M. Gounares and other politicians notorious for their German sentiments, were deported to Corsica; and with them M. Ion Dragoumes, a brilliant and rising writer, diplomatist and politician, who while not hostile to the Allies was regarded as dangerous owing to the extravagance of his hatred of Venizelos.

On June 26 Venizelos himself returned to Athens and with the members of his Government, after the resignation of M. Zaimes, took the oath of allegiance to King Alexander. French troops had been landed in Athens on M. Jonnart's arrival, and had also advanced into Thessaly to secure the harvest. Venizelos had repeatedly asked the Allies to suspend the neutral zone and allow the Salonika Government to advance into Thessaly and also to march against the Athenian Government, which could have offered very little resistance; for at the time the Salonika Government had raised an army of 60,000 men, "well organized in three divisions, with a fourth division, that of the Cyclades and Ionian islands, ready for immediate equipment." The Allies had refused the request, not wishing to permit any outbreak of civil war, however brief. They quite naturally preferred to effect the purgation of the Athenian state without bloodshed; but the presence of French troops in Athens during the month of June exposed Venizelos to the charge of having been restored to power by "foreign bayonets."

Greece in the War.—On June 29 the reunited Greek Government declared war against the Central Powers. The Chamber of June 13 1915, which King Constantine had dissolved on Nov. 6 1915, was recalled, and in a great speech (Aug. 26 1917) Venizelos explained to the legally elected representatives of the Greek people the causes of his policy from the beginning of the war and of two conflicts with King Constantine. Of 198 deputies present 188 voted for the resolution of plenary confidence in the Government. Yet the passions aroused by these conflicts and by the respective propagandas were not easily stilled. A large number of officers who refused to disavow their allegiance to King Constantine were cashiered, and many civil servants who refused to acknowledge the authority of the new Government were also removed. Of the civil servants all but about 400 (out of a civil service amounting to some 30,000 persons) had been reinstated at their own request by May 1920, in spite of the difficulties created by the duplication of staff effected by the Salonika administration; and of these 400 many remained unemployed, not for political reasons but on account of their official incompetence. But the reinstatement of officers was less easy owing to questions of seniority involved, and the Loyalist officers remained as an element of irreconcilable discontent to be exploited by a sedulous propaganda conducted by the ex-King Constantine from his exile in Switzerland. Several mutinies occurred during the mobilization of the army, which were quickly suppressed; but the shooting of the ringleaders, inevitable in a state of war, left a painful impression. In Nov. 1917 Venizelos visited Paris and London, where he was entertained at the Mansion House, and secured supplies of food, all stocks having been exhausted during the Allied blockade, as well as munitions and equipment for the Greek army. By April 1918 the mobilization was complete. The Greek forces, which were successfully tested in a preliminary action at Skra di Legen (May 30), amounted in July to 10 divisions, about 250,000 men, and gave the Allies for the first time a definite superiority on the Macedonian front. The Allies were thus enabled to plan in Aug. the great offensive which was opened in the following month and culminated, after the Greek troops had distinguished themselves with the British at the storming of the Doiran heights (Sept. 22), in the capitulation of Bulgaria (Sept. 30).

After the War.—Venizelos arrived in Paris at the end of the year and soon became one of the leading figures at the Peace Conference, which opened in Jan. 1919. The Greek delegation signed before the Supreme Council of the Allies the Greek claims for the annexation of northern Epirus, Thrace, Smyrna with a large portion of the western littoral of Asia Minor, and the Dodecanese; and for the internationalization of Constantinople. Meanwhile Greek troops had taken part in the unfortunate French expedition to south Russia, and the Greek army and fleet had been represented in the Allied occupation of Constantinople. But the number of statistical factors involved, the tendency of the Council of Ten, not less than that of the subsequent Supreme Council of Four, to postpone difficult problems, and the conflicting ambitions and policies of the Great Powers in the Near East, combined to keep the future of Greece in suspense for two years after the conclusion of hostilities. As affecting Bulgaria the Greek claims were settled by the Treaty of Neuilly, to which was annexed a Greco-Bulgarian convention for the protection of racial minorities, etc. (Nov. 27 1919), by which Bulgaria was cut off from the Aegean. But the Turkish problem in which all the Powers were interested remained to be dealt with in the following year. The armistice concluded with Turkey (Oct. 30 1918) had unfortunately made very incomplete provision for the disarmament of the Turkish forces, and it was partly in order to restore order in Asia Minor and protect the Christian populations that Venizelos, after a first presentation of his Turkish argument, obtained an authorization for Greek troops to occupy Smyrna (May 14 1919). Unfortunately, owing to the defective arrangements of the Greek authorities, the landing was followed by a disturbance in which the Greek troops and local population got out of hand and about 20 Turks were shot down in the streets. The Greek Government immediately set up a court-martial which passed severe sentences on 48 Greeks (three of whom were executed), 13 Turks, 12 Armenians and one Jew involved in the riots. Subsequently an Inter-Allied Commission of British, French, American and Italian officers was sent out to investigate, but its report was never published as by an oversight the decision of the Supreme Council, that a Greek officer should be present at the investigations, had been ignored. In Sept. leading British residents of Smyrna testified to the admirable impartiality of the new Greek commissioner M. Sterghiades. But the suppression of this report, as well as similar incidents said to have occurred at the end of June at Aidin, where the Turks had burned the Greek quarter and murdered many of the inhabitants, gave rise in ensuing discussions of the Turkish solution to very severe criticisms of Greek capacity for ruling a mixed population. When the Supreme Council met in London in Feb. 1920 the presentation of the Greek case was opposed by a strong Moslem propaganda, while the Turkish irregular armed forces in Asia Minor, retreating beyond the limits set by the Supreme Council to the Greek army of occupation, were developed by Mustafa Kemal Pasha into a Turkish Nationalist movement definitely hostile to the Allies; and after the Supreme Council had announced (Feb. 21) their decision to allow the Sultan to remain in Constantinople, where he would be more amenable to Allied persuasion, the Turkish authorities professed to be unable to control Kemal, who declared his independence and established an Anatolian Government at Angora.

At a further conference at San Remo the Allies completed the draft of the treaty and handed it to the Turkish delegates (May 11), and at the beginning of July at another conference at Spa Venizelos received from the Supreme Council a mandate for the Greek army to restore order in the whole north-western district of Asia Minor, beyond the frontiers of the Smyrna district, as well as in Thrace, where similar disorders had arisen. The Greek army occupied Thrace and entered Adrianople on July 25. "Venizelos expressed the opinion," said Mr. Lloyd George in the House of Commons (July 21), "that he would be able to clear up the whole neighbourhood between Smyrna and the Dardanelles in 15 days. . . . The Greek troops, well organized and admirably led . . . did so in 10 days."

Treaty of Sèvres.—The business-like way in which the Greek army carried out this mandate was held to justify the terms of the Treaty of Sèvres, finally signed on Aug. 19, by which the whole of Turkish Thrace from Adrianople up to Chatalja and Derkos, within 20 m. of Constantinople, including Gallipoli and the northern shore of the sea of Marmora (subject to an International Commission which was to control the zone of the Straits), was definitely ceded to Greece; together with the islands of Tenedos and Imbros and all the Aegean islands already in Greek occupation; the Smyrna district with its hinterland was placed under Greek administration, with provision for the exhibition of a nominal symbol of Turkish sovereignty, and subject to the rule of a local parliament, elected by proportional representation, on the demand of which after five years the territory might be definitely incorporated in the Greek kingdom; while Rhodes and the other islands of the Dodecanese were ceded to Italy, but transferred to Greece by a Greco-Italian convention signed on the same day and incorporating the terms of the Venizelos-Tittoni agreement.

After thus concluding his diplomatic labours Venizelos was leaving Paris (Aug. 12 1920) when an attempt to assassinate him was made by two ex-officers of the Greek navy (Tserepes and Kyriakos). The crime was reasonably suspected to have been instigated by King Constantine's propaganda; it was extolled as a glorious tyrannicide by the Royalist press. When the news reached Athens the mob broke loose and looted the houses of many anti-Venizelist politicians, with the connivance of the police, who were also responsible for the brutal murder, after his precautionary arrest, of M. Ion Dragoumes; and although Venizelos telegraphed his horror at the crime he failed, after his return to Athens, publicly to censure the Government for their negligence.

Fall of Venizelos.—During his absence from the country Venizelos had left as vice-president of the Council his Minister of the Interior, M. Repoules. With the growing pressure of public affairs, however, Venizelos had become separated from any healthy contact with the community at home. Often, too, he was unfortunate in his choice of administrative subordinates. A mendacious propaganda was kept up by King Constantine's agents that the people were being persecuted and oppressed; and their attempts to stir up seditions and conspiracies made it impossible to relax any of the stringent measures of censorship which gave colour to the tale. Venizelos had attempted in May to repeal some of the provisions of martial law, retaining only those measures strictly necessitated by the state of war in Asia Minor, but had quickly been obliged to revoke the concession. Meanwhile, the country districts suffered even more severely than the towns under the burden of mobilization, from which they had known little release since 1912. When Venizelos returned to Greece, and presented to the Chamber (Sept. 7) the three treaties with Turkey, Bulgaria and Italy, he was, indeed, unanimously thanked as the saviour of his country, and was able to announce that on the imminent dissolution of the Chamber all restrictions of civil liberty would be abolished, so that the elections in the autumn should be held under constitutional conditions. He only made the condition that the return of King Constantine should not become an issue. The opposition, whose strength Venizelos unduly neglected, consisted of a coalition of prominent politicians united only by their hatred of himself. The situation was changed by the death of King Alexander, from the bite of a monkey, on Oct. 25. At a special session (Oct. 28) of the Chamber dissolved on Sept. 23, the Government advised the election as regent of Adml. Kountouriotes and the offer of the crown to Prince Paul, Constantine's third son, whom they regarded as the only constitutional successor. Prince Paul replied that "the Throne does not belong to me; it belongs to my august father King Constantine and, constitutionally my eldest brother is his successor. Neither of them has ever renounced his rights. . . . I would only ascend the Throne if the Hellenic people were to decide that it did not want the return of my august father, and were to exclude the Crown Prince George from his right of succession"; and then it became clear that the restoration of Constantine must be the real issue at the general election fixed for Nov. 14. The Opposition jumped at the heaven-sent election cry, while Venizelos was content to announce that if defeated he would retire from public life. The result came as a surprise to both parties. Only 120 Liberals were elected as against 246 members of the Opposition (and four Independents); and although the result failed to represent the real strength of the Venizelists in the country (it was calculated that proportional representation would have returned 200 Venizelists) and they still remained the larger single party in the Chamber, it was impossible to minimize the catastrophic nature of their downfall. Venizelos immediately resigned, and with many of his ministers and officials left the country, and a Government was formed by the aged Demetrius Ralli, which entrusted the regency to the Dowager Queen Olga (who had come to Athens for the funeral).

Return of Constantine.—On Dec. 5 a plebiscite was held on the question of the return of King Constantine, from which the Liberals decided to abstain, announcing that they were content loyally to abide by the result of the election. The British, French and Italian Governments issued a proclamation reminding the Greek people that the actions of King Constantine had been hostile to the Allies and "reserving to themselves complete liberty in dealing with the situation" if he were recalled. Nevertheless, 999,954 votes out of 1,013,724 were said to have been cast in favour of the King's return. King Constantine, with his Queen and retainers, returned triumphantly to Athens on Dec. 19 and was received with enthusiasm. The Allied Powers refused, however, to recognize him, and withdrew the financial assistance which Greece had been receiving. The withdrawal of Allied support was serious. Mustafa Kemal's Anatolian movement was still gaining in strength; he had established a Nationalist "Parliament" at Angora which entirely repudiated the Treaty of Sèvres, and had also established communications with Russia; thus vitalized, he was threatening the French occupation in Cilicia and endangering the whole Allied arrangement in the Levant. Accordingly a strong section of Allied opinion, especially in France, seeking a quick and economic settlement, thought that Kemal should be pacified by negotiation and by concessions in Asia Minor; and that the restoration of King Constantine was an excellent pretext for revising the whole treaty (which, though signed, had not been ratified) in Turkey's favour and at the expense of Greece.

Accordingly a conference of the three Powers (England, France and Italy) met in London on Feb. 21 1921, and was attended by two Turkish delegations from Constantinople and Angora, while Greece was represented by M. Kalogeropoulos, who had become prime minister on Feb. 7. The two Turkish delegations coalesced with dignity, the Constantinople delegate retiring to bed and leaving the Turkish case in the hands of the Nationalist delegate from Angora. M. Kalogeropoulos, on the other hand, violently rejected semi-official attempts to persuade him to coöperate in defending the treaty with M. Venizelos, who had come to London in order to plead in his private capacity against the penalization of the Greek people. The Supreme Council first proposed that an Inter-Allied Commission of Inquiry should be sent out to investigate the racial and other problems involved in the questions of Thrace and Smyrna. This proposal having been rejected by Greece, the Conference (March 12) submitted to the delegates its own proposals for modifying the treaty. These, while leaving the Greeks undisturbed in Thrace, strengthened the Turkish position in Constantinople and made certain financial concessions to the Turks; while for Smyrna they proposed a complicated régime of which the principal provisions were the following: the vilayet of Smyrna was to remain under Turkish sovereignty; a Greek garrison would remain in Smyrna, but elsewhere order was to be maintained by a gendarmerie under Allied officers and recruited in proportion to the numbers and distribution of the population in each district as reported by an Inter-Allied Commission; the same proportional arrangement would apply to the administration; and a Christian governor would be appointed by the League of Nations with an elective assembly and council. No definite replies to these proposed modifications of the treaty were received from either party; but on March 24 the Greeks opened an offensive against the Nationalist position, and before the end of the month had seized the important railway junctions of Afiun Kara Hissar and Eskishehr on the line to Angora. North-west of Eskishehr, however, they were heavily defeated (April 2), and after losing 4,000 killed and wounded were compelled to retreat all along the line to their old positions. The reverse was not surprising, as on the eve of the offensive the Government had removed from their commands all the higher officers of Venizelist sentiments and replaced them by Royalists. On April 7 Gounares, who had visited London and Paris during the last days of the Conference, became prime minister. At the same time the centenary of the independence of the Greek kingdom was rather gloomily celebrated (April 7) and was marked by the canonization of the Patriarch Gregory V.

The new Chamber, which had met on Feb. 1 and declared itself a national constituent assembly, was a very representative collection of all the reactionary elements which had been swept out of Greek politics in 1910; indeed, some of the most prominent figures in it had not been heard of since 1897. After voting a large increase in the King's civil list as well as all the arrears of the pension promised him in 1917 it spent most of its time in denouncing such traces as were left of the Venizelist "tyranny," including the introduction into the national schools of the popular or demotic language. M. Gounares had on his programme many ambitious proposals for the revision of the constitution—providing for women's votes; for an industrial council of not more than 200 representatives of legally organized trades to advise the Legislature on social and economic questions and draw up bills for submission to the Government and Chamber; for a plebiscite to be held under certain conditions on the demand of king, Chamber or a fixed number of citizens; for a "service" Government of permanent civil servants, etc., to carry out elections after a dissolution, etc. He was also said to be contemplating decentralization in local government in the direction of provincial (monarchical) autonomy. But at the end of May the National Assembly was still discussing generous proposals for the compensation of all those who had suffered for political reasons since 1917. The Treasury was empty; but the spirits of the populace, who had begun to get uneasy at the continual postponement of the new offensive, the depreciation of the exchange and the rise in the cost of living, were maintained by a mendacious propaganda, one of the favourite legends of which was that England was secretly helping King Constantine in his war against Turkey with supplies of money, and munitions, and even with army and fleet. On May 20 the British, French and Italian High Commissioners in Constantinople proclaimed the strict neutrality during the Greco-Turkish "state of war" of all districts in their military occupation (*i.e.* the "Zone of the Straits"). But some colour was lent to these Athenian rumours at the beginning of June when British relations with the Nationalists of Angora were severely strained; and on June 11 (anniversary of the fall of Constantinople and death of Constantine Palaeologus in 1453) King Constantine left for the Smyrna front amid a frenzy of hysterical flattery, hailed by the Government press as emperor designate of Constantinople and as commander of the Anglo-Greek forces in the Near East.

Soon afterwards the Powers made another attempt to tranquillize Asia Minor before the Greek offensive should open. On June 21 the ministers of the three Powers handed the Greek Government a note in which they offered their "friendly services to prevent the reopening of hostilities in the Near East and to secure an honourable and lasting peace." Four days later the Greek Government, after consultations with the King at Smyrna, replied that Greece, while thanking "her great Allies" for their offer of mediation, could not postpone the offensive as by imposing the terms of the Treaty of Sèvres she was only continuing the task undertaken in conjunction with "her great Allies" during the war, and that the Turkish question could only be solved by force of arms. On June 28 the Greek forces evacuated Nikomeeia (Izmid), and the offensive finally opened on July 19. After a few days the Greek army had again seized Eskishehr and Afiun Kara Hissar as well as Kutahia. A month later they had reached Sivri Hissar, within 60 m. of Angora, but a check came at the end of August, and in September both sides had fought themselves to a standstill.

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(J. N. M.*)

GREELY, ADOLPHUS WASHINGTON (1844–), American soldier, was born at Newburyport, Mass., March 27 1844. He graduated from the Newburyport high school in 1860 and on the outbreak of the Civil War entered the army as a private, rising to major of volunteers. In 1867 he was appointed second lieutenant in the regular army and the following year became associated with the Signal Service. In 1873 he became first lieutenant. In 1881 he was chosen by President Garfield to establish in Lady Franklin Bay one of the 13 circumpolar stations recommended by the International Geographical Congress held in Hamburg in 1879. Setting out in the summer of 1881 with a party of 25, he penetrated farther north than had any previous explorer, reaching 83° 24′ N. and 42° 45′ W. in 1882. Two relief expeditions failed to reach his party, which returned south to Cape Sabine in dire straits. Only seven were alive when finally rescued in the summer of 1884 by a third expedition under Capt. Winfield Scott Schley. Lt. Greely received medals from the Royal Geographical Society and the French Geographic Society. In 1886 he was made captain and in 1887 was given an unusual promotion to brigadier-general, being appointed chief signal officer U.S.A. by President Cleveland. From 1898 to 1902 he supervised the construction of telegraph lines in Cuba, Porto Rico and China, and of a very elaborate system in the Philippine Islands. He was likewise in charge of constructing means of communication in Alaska. In 1904 he was made a member of the board to regulate wireless telegraphy in the United States, and the following year appointed to the board to report on coast defences. At the time of the San Francisco earthquake in 1906, as commander of the Pacific Division, he was in charge of relieving the sufferers. In 1908 he was retired by operation of law. In 1911 he represented the United States in London at the coronation of King George V. He wrote *Three Years of Arctic Service* (1886); *Handbook of Arctic Discoveries* (1897) and *Handbook of Alaska* (1909).

GREGORY, AUGUSTA, Lady (1852–), Irish folklorist, playwright and author, was born March 5 1852, the youngest daughter of Dudley Persse of Roxborough, co. Galway. She married in 1881 Sir William Gregory, a well-known Irish M.P. and ex-governor of Ceylon (d. 1892), whose autobiography she afterwards edited in 1894. A prolific writer upon Irish subjects, she produced many plays, essays, volumes of folklore, and popularized versions of ancient sagas and romances concerning the early Irish heroes. She always lived in close *rapport* with the people, and identified herself with their sufferings and aspirations, as in *The Jail Gate*, the *Rising of the Moon*, and other plays. It was she who chiefly popularized the Anglo-Irish dialect of English as spoken in the west, which had been first employed in the *Love Songs of Connacht*. She translated for the Abbey theatre several of Molière's plays into this dialect under the title of *The Kiltartan Molière* (1910). Hence this form of idiom has by some been christened "Kiltartanese" after the name of her district in Galway. She made Cuchulain—the greatest hero of pre-christian Ireland—known to thousands through her re-telling of the ancient tales, which she wove with great restraint and ability into a consistent whole. She did the same for Finn MacCumhail and other heroes of the old sagas. Her work as playwright, and director, in association with W. B. Yeats, of the Abbey theatre, was enormously fruitful. Over a hundred new plays had been produced there by 1921, and scores of actors had been developed and trained. This theatre was opened in 1904, and she told its story in her volume *Our Irish Theatre* (1913). Her only son, a distinguished airman and artist, was killed in the World War; and Sir Hugh Lane, whose life she wrote (1920), was her nephew.

Lady Gregory's chief works are:—*Cuchulain of Muirthemne* (1902); *Poets and Dreamers* (1903); *Gods and Fighting Men* (1904); *A Book of Saints and Wonders* (1907); *Seven Short Plays* (1909); *The Kiltartan History Book* (1909); *The Kiltartan Molière* (1910); *The Image* (1910); *Irish Folk History Plays* (1912); *New Comedies* (1913); *Our Irish Theatre* (1913); *The Kiltartan Wonder Book*; *The Golden Apple* (1916); *The Kiltartan Poetry Book* (1919); *The Dragon* (1920); *Visions and Beliefs in the West of Ireland* (1920); *Hugh Lane's Life and Achievement* (1921).

GREGORY, ROBERT (1819–1911), English divine, was born at Nottingham Feb. 9 1819. He was first intended for business, but subsequently went to Corpus Christi College, Oxford, and was ordained in 1843. In 1851 he became curate of Lambeth parish church, and from 1853–73 was rector of St. Mary's, Lambeth, becoming a canon of St. Paul's in 1868. In 1890 he became dean of St. Paul's. A member of the first London School Board, he was a champion of church schools and of religious education. He died in London Aug. 2 1911.

GRENADES (*see* 12.578).—The revival of the hand grenade in the Russo-Japanese War of 1904–5 resulted in new designs for weapons of this class being worked out in several countries, not only for hand grenades with a time fuze, but also for percussion grenades and for grenades fired from a rifle. In the World War the advent of trench warfare on the largest possible scale produced a sudden demand for grenades in enormous quantities and as pre-war and war-time designs were successively exposed to the test of active service conditions, while at the same time the needs of quantity production constantly imposed checks of another kind, grenade design passed through a rapid evolution from 1914 up to 1917 after which warfare became more open and the rifle and light machine-gun asserted themselves as the prime infantry weapons. It is proposed here to indicate the course of this evolution by describing representative patterns of grenade employed successively in the British and other armies.

During the course of the war, both hand and rifle grenades (especially the latter) were used as containers for gas and smoke compositions, as well as for illuminating and light-signalling purposes. These special grenades, as grenades, presented fewer problems of design than the explosive grenade, and the safety and ignition devices employed with them were simple adaptations of those used with the explosive grenade. They do not, therefore, require special treatment in the present connexion, and the following account will deal with the explosive grenade only.

Hand Grenades.—Perhaps the dominating characteristic of trench warfare as practised in 1914 and 1915 was the inability of the deeply entrenched infantry on each side to inflict damage upon the other otherwise than by high angle fire. Within the infantry arm itself, this high angle fire could at first be provided only by hand grenades. But as no one had foreseen the use of this weapon by infantry on a large scale, the available patterns in Great Britain and elsewhere (designed for use by skilled sappers in siege warfare) were of a somewhat complicated design. Thus, at the outbreak of the World War, the only grenade available in the British service was the "No. 1," evolved after the Russo-Japanese War, and the only immediate means of supplementing it was a stock of "Hale's" grenades which had been manufactured for the Mexican Government. These two, in very small quantities, formed the only armoury of the bomber in the early days of 1915, and soon the troops in the field began to improvise grenades out of jam tins and other receptacles, using any explosive and any form of igniter which was at hand. At the same time other types were worked out by the engineer branch of the War Office, and both then and afterwards countless inventors set to work to produce weapons of this class and submitted them to the military authorities, who sifted them, tested the more promising both on the experimental ground and in the trenches, and finally, where the advantages of a proposed new design outweighed the very serious drawbacks attendant upon manufacturing a new type and training the army to its use—considerations which ruled out many designs that were intrinsically very good—it was adopted as a service store. So far as concerns British grenades, only service stores will be dealt with in this article.

Thus, towards the end of 1915 or the spring of 1916 the types in use and in prospect were very numerous, and most of them were open to objections, either in point of safety to the user, or of trustworthiness in trench conditions, or of manufacture.

Considering them collectively, these grenades may be classified in two ways: according to their effect and according to their method of explosion. As regards the former, a distinction arose between those designed for concussion effect and those designed for fragmentation. From the same dual need of localized effect and of distributed effect which produced the two main classes of artillery shell, came "concussion" grenades which contained a maximum of explosive, contained in the thinnest possible case, and "fragmentation" grenades with heavy iron cases, provided only with the explosive necessary to impart wounding energy to the fragments, and having the iron prepared for the desired fragmentation by criss-cross weakening grooves. Each of these had the defects of its qualities; thus, the concussion grenade was only effective within a narrow radius from the point of burst, and the fragmentation grenade was liable when used in the open to kill the thrower himself with splinters coming back. Examples of each class will be found below, and it should be added that special grenades such as those used for smoke, for light and for gas, were in the intermediate position, having thin walls, so as to contain a maximum of composition and a small explosive charge sufficient merely to open the casing.

The second basis of classification, which from the designer's point of view was the more important, was the method of bursting the charge. In all grenades filled with H.E.[1] as in all shell so filled, a small charge of sensitive explosive is required to detonate the relatively inert main charge. This element is contained in a copper tube called a detonator and it is in the means of igniting this detonator and the safeties provided against its premature action that the whole art of grenade design resides. Many of the risks, indeed, only became evident as the result of active service experience—for instance, the risk that a man would be shot after putting the safety device out of action but before he could throw the grenade.

At the outset, the standard patterns of hand grenade had percussion ignition—that is, they were arranged to explode on contact with the ground or the target. Such grenades were "armed" and dangerous as they lay in the bomber's hand ready for throwing, since, whereas in an artillery shell or a rifle grenade the shock of discharge is available as a force for arming the ignition, in a hand grenade this has to be done by the bomber himself. They were, further, intrinsically more sensitive than artillery fuzes in that they had to act at very low striking velocities and even on soft ground. A very little experience of existing types, therefore, sufficed to turn the current of opinion in favour of time grenades, not because of any special utility and function such as those possessed by the time fuze of artillery but purely because a delay between ignition and explosion was the best practical form of safety. Five seconds was as a rule adopted as a standard interval, and this gave time in case of accident to throw the grenade to a safe distance, or to take cover or lie down. Later, in perfected designs, the percussion grenades came to the fore again, but only towards the end of the war, and these new types were never actually used by the British army in the field.

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[1] Certain German grenades were filled wholly or in part with black powder and needed no detonator.

Apart from the question of safety, the percussion grenade—at least in all patterns previous to those embodying an all-ways fuze—had to be designed so as to fall on its nose. The usual method of ensuring this was by an air-drag in the form of streamers, attached to the tail or handle. Time grenades would of course act whatever the position in which they fell.

With percussion grenades the ignition device was simply armed by, or before, the act of throwing, but in all time grenades of course positive ignition was necessary. Many ignition devices were used and many others proposed; in general, they may be classified as friction lighters and striker-and-cap combinations. In either case, the actual ignition was done by the bomber. In many designs he ignited the grenade before throwing it. In some a cord, attached to his wrist and to the grenade, suddenly tightens when the grenade has travelled to the end of its tether (a few feet) and the parting jerk fires the ignition device. In others, which are the best known and most successful, ignition takes place automatically as (or shortly after) the grenade leaves his hand.

The charge employed in grenades naturally varies according to the intention of the design. In fragmentation grenades, as above mentioned, it is kept small (in the Mills grenade described below it is $2\frac{1}{2}$–3 oz. only, in a total weight of 1 lb. 8 oz.), whereas in concussion grenades—notably in the heavy tin-cased concussion grenades used in the earlier days of the war for wire cutting and demolition effect—it is at a maximum (3 lb. 9 oz. out of a total weight of 5 lb. in the Russian "obstacle" grenade). The permitted weights of hand grenades have also varied considerably. In 1915 heavy grenades intended to be thrown by trench engines (*see* BOMBTHROWERS) were in frequent use, but these were superseded by trench mortar bombs, just as their throwing engines were displaced by light trench mortars. The special grenades used with certain explosive-propellant throwers were also frequently of this heavy class. But for the hand grenade an upper limit was fixed when the ranges required on service and the throwing powers of the average bomber had been ascertained by experience. This limit was about 2 lb. in Germany and $1\frac{1}{2}$ lb. in Great Britain and France. To qualify as a bomber, a British soldier was required to pitch half of his ($1\frac{1}{2}$ lb.) bombs into a trench target measuring 10 ft. longitudinally and 4 ft. laterally at a range of 30 yd., but specially expert men were capable of much longer throws. Another consideration limiting the size of hand grenades was that of ammunition supply in the very difficult conditions of trench fighting.

These two requirements, range and supply in the trenches, combined from 1916 onward to bring into use a much lighter form of grenade, colloquially called the "egg," which weighed only 11–12 oz. and could be thrown 50 yd. by an average bomber. At the same time the grenade of the $1\frac{1}{2}$ lb. class began to be adapted for firing from a rifle, and thus to take the place of the rifle grenade, though it also remained in use as a hand grenade to the close of the war.

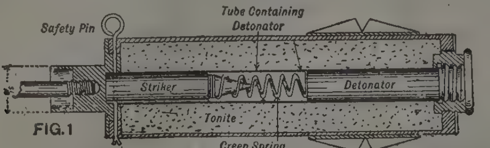

FIG. 1

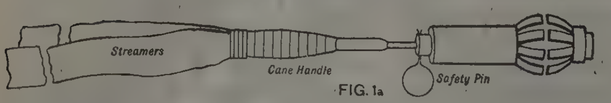

FIG. 1a

A representative percussison grenade of the earlier type is the British "No. 2" or Mexican Hale (figs. 1 and 1a). Though light (1 lb.) it is of the fragmenting class, for while the casing itself is thin, it is surrounded by a heavy iron collar prepared by grooves for fragmentation. The streamers and the presence of this collar well up on the head ensure a nose-first fall. In the interior is a central tube, the upper portion of which takes the detonator, the middle a creepspring and the lower a pellet with pointed striker. The pellet is held firmly by a safety-pin which is only withdrawn at the last moment. When thrown, the parts retain their relative positions, but on impact inertia causes the striker pellet to fly forward, overcoming the creepspring, and its needle pierces the detonator and the grenade is exploded. It will be noted that, once the safety-pin is removed, the only safety device operating consists of a creepspring which is necessarily kept very weak.

An ingeniously designed French grenade which was much used in 1915, but later shared the fate of all percussion grenades, is shown in figs. 2 and 2a. It is pear-shaped and fragmenting but weighs hardly more than 1 lb. complete. Essentially its ignition arrangements consist in a lever with a weighted cord, a striker and a creepspring. Until the moment before throwing, the lever 7 is held in place by a string, which the bomber breaks with his left hand while firmly gripping the lever with his right. When the grenade is thrown, the lever flies up under the impulse of the spring 9 and the striker 5 is now held off the cap only by the creepspring 6. The lever 7 with the weighted cord 11 act as an air-drag to ensure nose-first impact. The head of the lever 10 is pivoted eccentrically and its underside is formed to a curve which gives an initial leverage against the action of the spring 9, and therefore acts as a safety device.

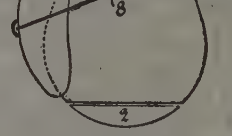

FIG. 2

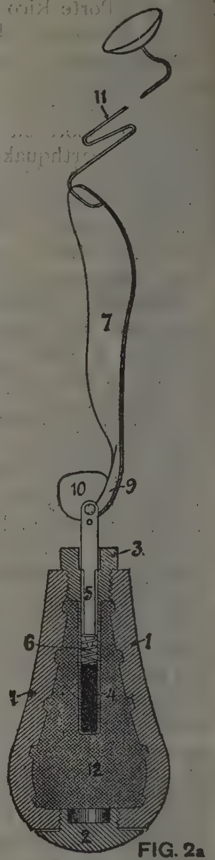

FIG. 2a

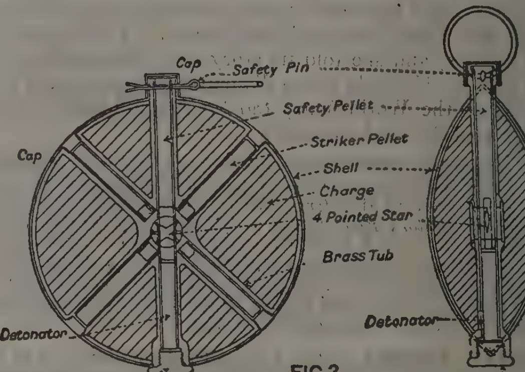

FIG. 3

The German "disc" percussion grenade (fig. 3) is designed so as to act in any position of fall. It has internally six radial channels, of which four are provided with striker pellets carrying caps, one contains the detonator, and the sixth has a safety pellet. In the centre is a fixed star, offering four striker points to the four striker pellets. These points are masked by arms or prongs on the safety pellet until the latter falls out of the grenade during flight and leaves them exposed. Then, whichever portion of the disc edge strikes the ground, the opposite striker pellet sets forward, dashing its cap on to the corresponding point of the star and so firing the detonator. A disc percussion grenade was also used with the Minucciani bombthrower described under BOMBTHROWERS.

It will be noted that in both these cases the ignition arrangements constitute what is called in artillery language a "graze fuze," that is, the active element (the striker pellet) sets forward when the motion of the body of the grenade is checked on impact or graze. In other patterns, on the contrary, the ignition is of the "direct action" class, the pellet projecting from the head of the grenade and being forced back on to the detonator when the object is struck. To ensure this action, in the case of grenades, the outer end of the pellet is usually formed with a large disc or mushroom head which augments the surface of impact and therefore the resistance which tends to drive in the pellet.

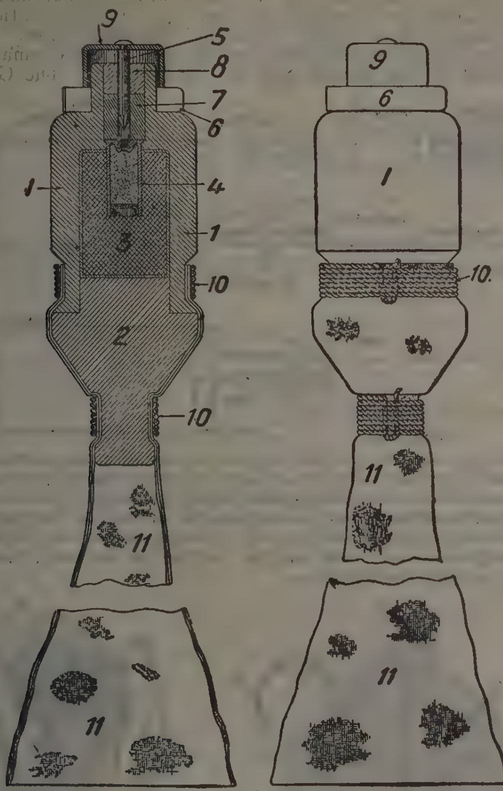

FIG. 4

A simple grenade of this kind is the "Japanese" grenade as employed by the Russian army in the World War (fig. 4). This is a heavy-bodied fragmentation grenade with a hood bound on by cord wrapping instead of streamers. It will be seen from the drawing that when the safety ring 6 is removed nothing holds the striker 5 away from the detonator cap except the tightness of fit of the striker rod in the india-rubber block 8. On impact the mushroom head 9 forces the striker in and the grenade is fired. This was a rather light grenade weighing about 1 lb. 4 oz. and ranged, in expert hands, to about 45 yards. It could not be used in the open, as fragments came back as far as 200 yards. It had no handle, being grasped by the body.

Time grenades, as already explained, possess the advantages of intrinsic safety and of being able to act in any position of fall, though in other respects inferior to percussion. The types described below have been selected (*a*) to show the variety of ignition devices employed and (*b*) to indicate the evolution of design generally during the war period.

The type of grenade shown in figs. 5 and 5a is a Russian pre-war design, based no doubt on Port Arthur experience. The model shown was brought out in 1914 to replace an earlier and heavier engine of similar design.

Between the detonator and the cap is a column of slow-burning composition 21 connected to the cap 19 by strands of quickmatch 25. As in almost all patterns of grenade, the detonator element is transported separately. In this case the parts which render the grenade "live" are assembled in a U-shaped body 18 which is dropped into position with the cap over the striker 6 and the detonator 22 in a cavity in the exploder 23, and clipped there by the fastener 20. The action is as follows: the bomber grips the handle, pressing on the lever 12, and thus by means of the sear *a* cocking the striker-spring 8 and striker 6. His fingers encircle the safety-ring 15 (which has hitherto held the lever) in such a way that in throwing the grenade the ring will remain in his hand. He then withdraws the safety-pin 11 which limits the forward movement of the striker. When he throws the grenade, the spring 14 forces out the lever 12 and the striker 6, released from the sear *a*, flies forward under the influence of its spring and fires the cap. This, through a flash along the quickmatch 25, starts the slow-burning composition which in due course fires the detonator, exploder, and main charge. Though primarily a thin-walled "concussion" grenade, this pattern has the casing lined with metal rings 17 prepared for fragmentation.[1] It will be noticed that the handle portion as well as the body proper is filled with explosive. Carrying nearly 1 lb. of H.E., this was a very formidable concussion grenade, serviceable and not too difficult to manufacture (in spite of its apparent complexity), and could safely be used in fighting in the open.

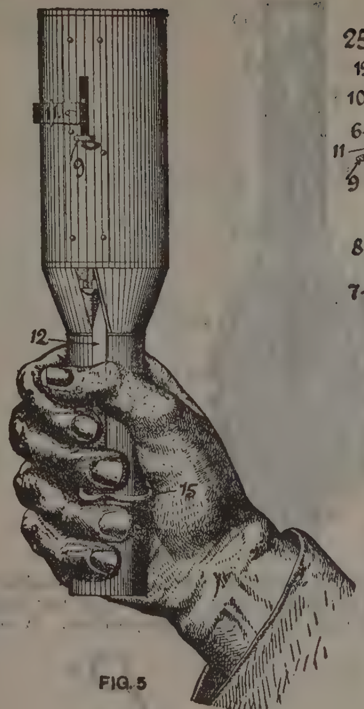

FIG. 5

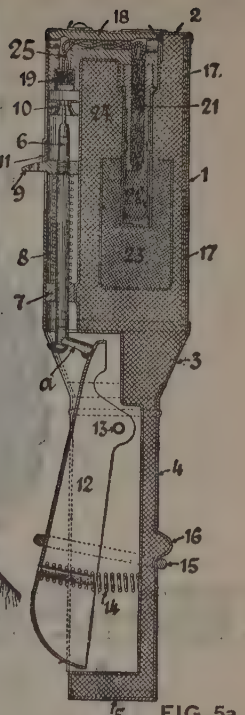

FIG. 5a

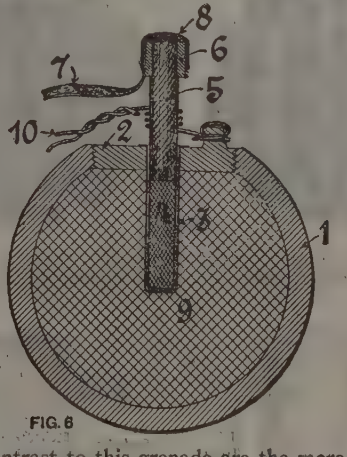

FIG. 6

In marked contrast to this grenade are the more or less improvised time grenades of 1915 of which the British "cricket ball," the French "F1" and some German specimens may be taken as representatives. The British "cricket ball" (fig. 6) and its variant the "lemon" was a plain iron, spherical or ovoid shell into which was screwed a plate carrying a detonator sleeve. In preparing for action the detonator was placed in the sleeve and secured by wire. Crimped into the mouth of the detonator was a 5-seconds length of Bickford safety fuze, the other end of which was prepared with a patch of composition such as is used for safety matches. The protective cap 8 being pulled off, the grenade was ignited by rubbing the head against a strip of matchbox composition (tied on the bomber's sleeve), and thrown. The weight of this grenade in its cricket-ball form was 1½ lb.

The French "defensive" (*i.e.* fragmenting) grenade "F1" weighed 1¼ lb. As shown in fig. 7 it was ignited by a blow. The cover 10 being removed, a sharp blow on the cardboard inner tube 4 (carrying the cap) forced the cap down on the striker, igniting the time-fuze length 8.

The German 2-lb. ball grenade (fig. 8), unlike most, was powder-filled and, as it could therefore be fired by a flash, needed no sensi-

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[1] The earlier (2½-lb.) pattern had a large amount of "langridge" (*i.e.* small pieces of metal) packed round the explosive charge.

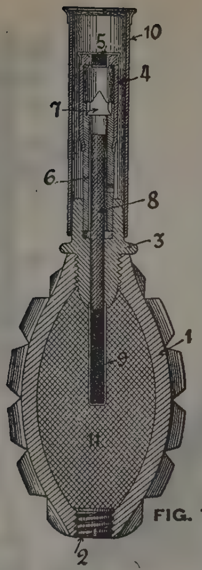
10
5
4
7
6
8
3
1
9
11
2

FIG. 7

tive detonator. Its ignition arrangement was somewhat similar to the familiar friction tube of artillery, viz. a roughened bar which was inserted in a tube coated with match composition. A cord attached to the bomber's wrist, tightening when the bomb reached the end of its tether, jerked out this roughened bar and so effected ignition.

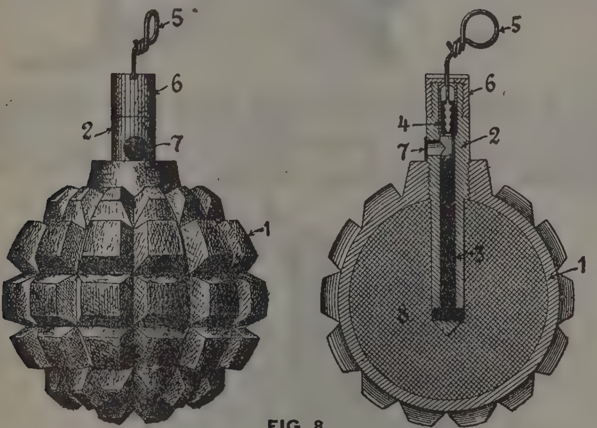
5
6
2
7
1
5
6
4
2
7
3
1
8

FIG. 8

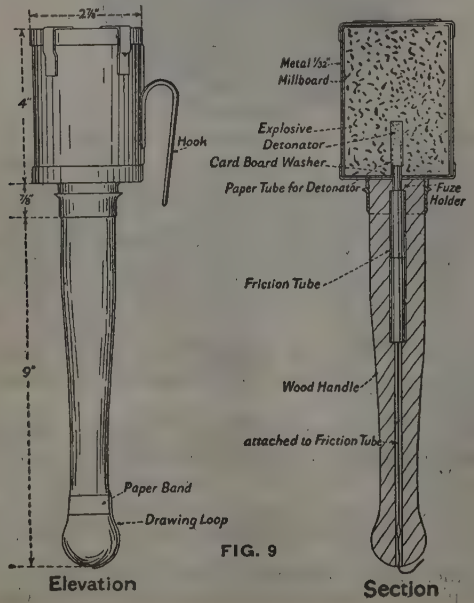
2⅞"
4"
Hook
⅞"
9"
Paper Band
Drawing Loop
Metal 1/32"
Millboard
Explosive
Detonator
Card Board Washer
Paper Tube for Detonator
Fuze Holder
Friction Tube
Wood Handle
attached to Friction Tube

Elevation FIG. 9 Section

The German H.E. cylindrical grenade (fig. 9) had also a friction-tube igniter, but the bomber fired this by a pull on the attached wire before throwing. This was essentially a concussion or "offensive" grenade and remained in use throughout the war. It was provided with a handle and with a hook whereby to attach it to the waistbelt. In another type of cylindrical handled grenade, part of the H.E. charge was replaced by langridge [1] and the ignition was by a spring striker as in the "hairbrush" described below.

Another form of handled time grenade used by the Germans and then copied by the British was the "hairbrush." The German pattern (figs. 10 and 10a) had a spring igniter of a simple character. In a tube (fig. 10a) inserted in the rear end of the detonator and time-fuze tube was a striker, striker spring and cap. A collar on the striker rod kept the spring in compression so long as the tail end of the rod was held by the safety-pin. As soon as this was withdrawn the spring reasserted itself and the striker flew forward, firing the cap and igniting the time fuze.

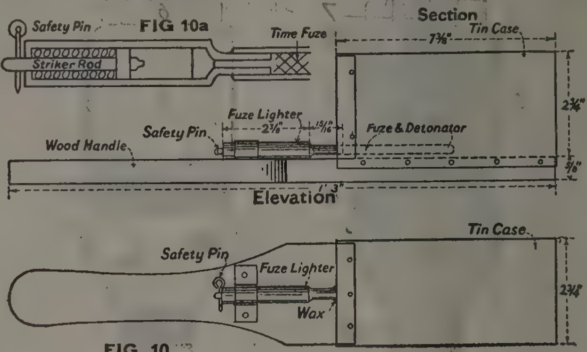
Safety Pin
FIG 10a
Time Fuze
Striker Rod
Section
Tin Case
7⅜"
2¾"
Fuze Lighter
Safety Pin
2⅛"
15/16"
Fuze & Detonator
Wood Handle
⅜"
1' 3"
Elevation
Tin Case
Safety Pin
Fuze Lighter
Wax
2¾"

FIG. 10

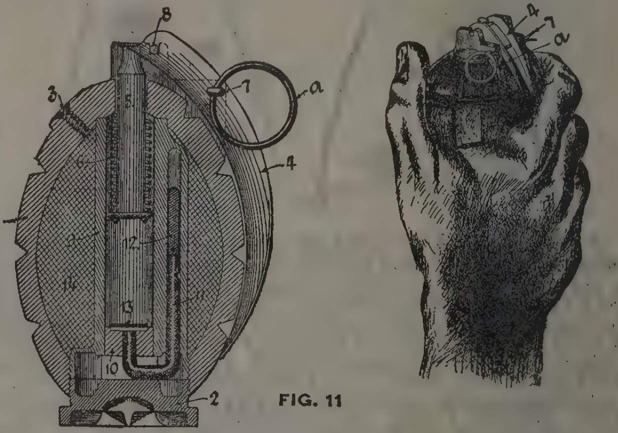
8
3
5
6
7
a
4
1
9
12
14
11
13
10
2
4
7
a

FIG. 11

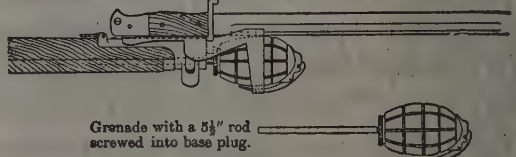

Grenade with a 5½" rod screwed into base plug.

FIG. 11a

Neater in design, more trustworthy in action, and far more popular with the troops than other British types, the *Mills grenade* requires a more extended description (fig. 11). If the number supplied, and the steadiness with which the type maintained its hold on opinion be a test, this grenade was the most important of all those used in the World War.

As its name implies, it was patented by Mr. William Mills, of Birmingham, but the idea was of Belgian origin; although it is fair to add that the original Belgian design differed very considerably from that which is now so familiar as the "Mills" grenade.

The No. 5 grenade, which was the first of several British service patterns of the Mills type, consisted of a barrel-shaped iron casting, fitted internally with an aluminium tube known as the "centre piece." Adjoining the centre tube, and communicating with it at the bottom end of the grenade was a cylindrical chamber for the reception of the detonator to which was attached a 5-second fuze, terminating in a rim-fire percussion cap, which was inserted in the end of the central tube. The lower end of the grenade was closed with a screwed plug, known as the "base plug," made in aluminium, brass, or a soft alloy, and which secured in position the detonating apparatus, and also formed a firm base to receive the shock of the striker when released from the lever. The high-explosive filling was introduced through an opening situated near the top of the grenade, closed with a brass screw, which, after filling, was carefully cemented into position. The cap was fired by means of a steel plunger, known as the "striker" which was operated by a powerful spring. The striker was held off the plug by means of an external lever provided close to one end, with small trunnions which rested in seatings formed on the head of the grenade. The shorter end of the lever was forked, the prongs of the fork engaging the projecting head of the striker. Thus, while the long end of the lever (which was bent to conform to the outer shape of the grenade) continued to be held in the thrower's hand or to be pinned down by the safety-pin the spring remained compressed and unable to drive the striker down on to the cap, but as soon as the lever was freed, the spring asserted itself, forcing the lever up (and out of its seatings) and the striker fired the cap. Modifications of the No. 5 were made later from time to time with the object of increasing its safety and efficiency, but its main features remained unaltered.

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[1] Some of the grenades improvised in the field by the British army were also partly filled with langridge or so-called "shrapnel."

Originally the "Mills" grenade was intended purely and simply as a hand grenade, but it was found that its usefulness could be materially increased if means were adopted for projecting it from a rifle. This idea was considered and ultimately accomplished by substituting for the aluminium base plug one of steel, to the centre of which was attached a short steel rod 5½ in. long. The rod, when inserted in the barrel of a rifle, enabled the grenade to be projected by the firing of a 35 gr. cordite blank cartridge, later replaced by the 43 gr. blank cartridge used for firing all rodded grenades.

In order to hold the lever in its correct position in relation to the grenade, and secure the striker until the moment of discharge from the rifle, a special appliance, known as a "rifle cup," was designed to fit on to the barrel of the rifle, and was secured to the barrel by the bayonet. The rifle cup consisted substantially of a flat steel ring slightly larger in diameter than the grenade, and projecting beyond the barrel of the rifle about 2½ in., the ring being fixed concentrically with the rifle barrel. It will thus be seen that at whatever angle in relation to the horizontal plane, the grenade was inserted in the rifle cup, the lever was prevented from rising and thus releasing the striker until the grenade had been discharged, although the safety-pin had been previously withdrawn, leaving the lever otherwise free to act (fig. 11a).

This device had the effect of increasing the range of the grenade by about 50 yards. In this form the grenade was known by the description of "No. 23 Mark I" and perhaps attained its maximum of usefulness. Later developments of the Mills as a rifle grenade are dealt with below.

The "egg" class of hand grenades, alluded to earlier in this article, embody no novel technical devices and, therefore, need not be further described here. (C. F. A.)

Rifle Grenades.—The desire to obtain increased range in a convenient way had already before the World War broke out led to the design of rifle grenades, which were, essentially, percussion grenades fitted with a steel tail-rod that was inserted in the bore of the service rifle and propelled by the force of a blank cartridge. In these rifle grenades, two forces became available to the designer which were not so in the case of hand grenades, viz. high velocity and therefore the possibility of causing and utilizing rotation, and the shock of discharge. Both these forces greatly facilitated the design of percussion grenades, as also did the fact that (given a suitable charge and conditions of firing) the tail rod ensured a nose-first fall. The development of the rodded rifle grenade in the war period was therefore steadier and more consistent than that of hand grenades.

For most of the patterns used by the British army in the war, the original "No. 3" or "Hale's rifle grenade" (fig. 12) may be taken as representative in point of principle. It was a fragmentation grenade, as were all explosive rifle grenades, since the range eliminated danger from blowing back of fragments.

To the lower end of the body was fitted a base-piece of brass, which was bored out to receive a striker-rod and its needle. The outside of this base-piece was machined to receive a wind-vane, the boss of which held in position two safety bolts situated in the base-piece and preventing forward movement of the striker rod. Below the boss of the vane was a sleeve-like safety socket securing the boss above mentioned against premature rotation, so machined and slit that it clipped over the lower portion of the base-piece, this also being suitably machined. Into the lower end of the base-piece was screwed a steel rod, 10 in. long and of the calibre of the rifle, viz. ·303 in. (In this and certain of the patterns which succeeded it a clip was fitted to the base-piece which was sprung over the muzzle of the rifle in order to secure the grenade in position.)

The grenade body itself was traversed by a central tube, in the forward portion of which was secured the detonator in its sleeve, the middle portion containing a creepspring and the lower the point of the striker rod.

When the rifle was fired (a special 43 gr. blank cartridge was used) the safety socket set back, releasing the wind-vane which presently, under the action of the air, began to revolve and so to unscrew itself; in turn, this released the safety bolts which flew out, and thenceforward nothing but a light creepspring kept the detonator off the needle, which flew forward on graze and exploded the detonator and the bursting charge.

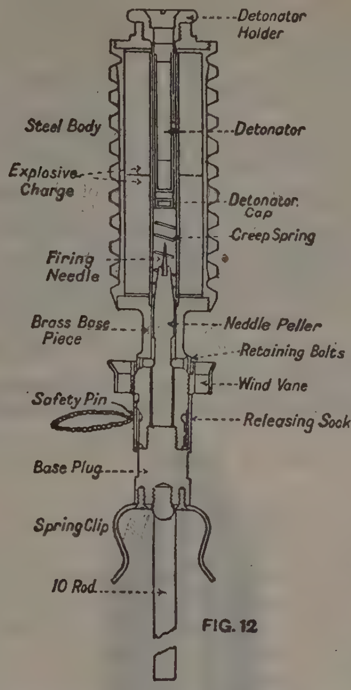

FIG. 12

While the general principle of this grenade was maintained without change, certain defects of detail and other reasons for modification soon appeared. Thus, the difficulty of so much machining in a store which was required urgently and in enormous numbers, and the difficulty of keeping the wind-vane and its screw clean in trench conditions, led to the design of the vaneless "No. 20" in which the safety socket alone controlled the safety bolts, and considerations of manufacture, especially of filling conditions, led to further modifications in the types No. 24 and No. 35. These need not be dealt with in detail here. It should be mentioned, however, that the substitution of a service-rifle cartridge case (with its cap) for special detonator holders brought about a marked improvement in the direction of simplicity of manufacture.

Another British rifle grenade, known as the "Newton Pippin" or No. 22, was an improvised design by Capt. H. Newton, which was manufactured in the workshops of the army in the field. Its ignition arrangements were of the direct-action type, the mushroom-headed striker being forced back on impact. Other features of the grenade were the use of the service cartridge case as a detonator holder (a practice which, as has just been remarked, became general); the length of the rod (15 in.); and the provision of a gas-check on the end of the rod, a device used fairly frequently in other armies but not accepted in regulation British grenades. Ordinarily, the rod of the grenade does not seal the bore of the rifle, as it does not enter the grooves, and a proportion of the propellant force of the gas is therefore lost by escape round the rod. A gas-check, expanding into the grooves and then sealing them, obviates this, though of course the higher efficiency is obtained at the cost of an increased strain on the rifle.

Two other British types of rodded rifle grenade may be mentioned—the Sangster and the Steuart, distinguished by the numbers 25 and 39. In the former, which was of the direct-action class, a wind-vane attached to the striker screwed it down in flight until it left the screw thread and became sensitive. Owing to the careful design of the body and the use of a 15-in. rod, very long ranges were obtained with this grenade, but it was never adopted as a standard pattern owing to the same considerations of difficulty in manufacture and of service rough usage as those which had militated against earlier vaned patterns. The characteristic of the Steuart pattern was a safety device consisting in a sleeve which was slit across in manufacture so as to leave only a narrow web of metal; this sleeve was placed on the striker rod in such a way as to hold it firmly till the shock of discharge occurred, when the rod set back and a shearing blade fixed to it cut through the remaining metal of the sleeve. The striker rod was thus freed. The Steuart was a direct-action grenade. Experience had proved that, in spite of the relatively low velocity of rifle grenades, the conditions of grenade practice were similar to those of artillery in that graze fuzes, having a slight delay inherent in their design, were liable to act only after the projectile had more or less buried itself. It is preferable, therefore, that the ignition arrangements of a rifle grenade should resemble in principle the artillery "instantaneous" fuze so as to ensure a burst above ground.

In the rodded rifle grenades used by foreign armies, the same general arrangements are, as a rule, found, and a catalogue of the minor variations which are found would be of no interest to the non-technical reader. As France (and America) did not employ rodded rifle grenades at all in the World War, interest centres practically on German and Russian designs. These are not numerous. Both direct-action and graze types are found, and a gas-check is almost invariably fitted to the rod. A tin saucer is sometimes fitted to graze types to prevent the grenade from burying itself in soft ground. Both German types, model 1913 and model 1914, are complicated, especially the latter, which is organized with all the elaboration characteristic of German artillery fuzes of the period. Russian types are usually simpler, and reflect the lessons of active service experience in demanding little or no expertness in the user. Whereas elsewhere it is the almost invariable practice to keep the detonator element separate in transport, and to assemble it in the field, Russian rifle grenades have the detonators (which are rather exploder-gaines than detonators in the British sense of the word) buried in the interior of the body. The usual length of rod was 15½ in., which in a long rifle gives the same length of propellant chamber as a 10-in. rod in the short rifle.

One Russian type, however, merits a full description as it has several unique features. This is the Mgebrov, illustrated in fig. 13.

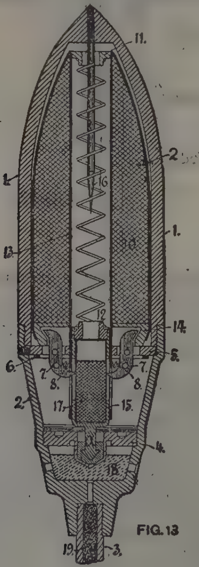

FIG. 13

Against its complexity and evident difficulty of manufacture must be set the positive and "fool-proof" character of its safeties which are such that the bomber is not even called upon to withdraw a safety-pin.

The outer casing 1 is thick (for fragmentation) and inside this outer casing is a separate thin-walled explosive container 2 which is capable of a slight forward movement. The bottom of this container is formed with an incurving lip 14, and it is traversed from end to end by a central tube 13, longer than itself. In this central tube are an extended spring and the pellet containing cap and detonator 12, 15, 17. The spring is attached to the top socket of the tube and to the cap-holder of the pellet. The striker-rod with its needle 16 (which is fixed to the outer shell and not to the container) projects into this central tube. The tendency of the spring therefore is to pull the cap on to the needle. The premature occurrence of this is prevented by two sets of safety devices in which reside, as usual, the ingenuity and the complication of the design.

Under the base of the detonator pellet is formed a detent *a* consisting of a short stem with a barbed end. This end is buried in a block of fusible alloy, which is itself in a cup that is nearly surrounded by thermit 18. The thermit chamber has holes to provide air for combustion and communicates by a channel with the hollow tail-rod 3, which is filled with powder composition 19. All these elements are rigidly attached to the outer case and tail-rod and the detonator pellet is therefore solidly fixed both during transport and when fired. Moreover, the spring in the central tube tends to bind the unattached explosive container to its supporting platform 6, thus avoiding any shock due to set-back on discharge.

On firing, the flash ignites the powder in the tail-rod which burns through to the thermit chamber and ignites the thermit. This instantly develops so high a temperature that the fusible alloy in its cup melts away, freeing the barb of the detent *a* and therefore the detonator pellet. This takes place after four seconds, and the detonator pellet is now gently pulled forward by the spring. Thereupon the second set of safeties comes into play. This consists in two pivoted catches 7, the lower ends of which bear (through slots in the central tube) on the sides of the detonator pellet, and are held there by small springs 8. The pivots of these catches lie in the rigid platform 6 which supports the explosive container, and their upper ends engage in the annular lip 14 formed on its underside.

On graze, the explosive container sets forward, and its under-lip actuates the two catches so that their lower ends no longer bite on the detonator pellet; this latter is then quite free and, under the combined influence of inertia and of its contracting spring, moves violently forward in the central tube, dashes its cap on to the needle and explodes the grenade.

To complete this survey of rodded rifle grenades it remains to mention the British Nos. 44 and 45 anti-tank grenades. These, having often to be fired almost at point blank, had short rods (8 in.) and a calico vane to ensure front contact. Unlike all the types above described, they were designed purely for concussion, having tin bodies and a maximum explosive content. The ignition was of the graze-fuze type. These engines gave a very efficient shattering effect on the hard steel of British tanks and seriously bulged the mild steel of German tanks, besides producing marked shock effects.

(C. E. W. B.; C. F. A.)

Discharger-Cup Grenades.—It has already been mentioned that the French army never adopted the rodded rifle grenade. The objections to the rod are indeed serious, quite apart from the fact that it is awkward to handle and requires careful treatment. The rifle tends to bulge and eventually to split in the barrel, especially with the shorter rods, since the propellant gases impinge upon the end of the rod at high velocity and set up wave pressure at the point of contact. This is true, however accurately straight the rods may be. If they are not so, they buckle in the bore and the barrel bursts, probably with fatal results to the firer; in this case it is obviously the longer rod which is the more dangerous. Further, the general strain of firing rodded grenades shakes the rifle to pieces after some time, especially with long-rodded grenades in which heavy recoil is accepted for the sake of obtaining high muzzle velocity and ranging power.

In the latter part of the World War, therefore, we find a general tendency to discard rodded grenades in favour of the discharger-cup or tromblon. In Great Britain this tendency began to show itself after the fitting of the muzzle attachment above described for the Mills grenade. This was not a true discharger-cup since the grenade was rodded and the cup was merely intended to hold down the Mills lever before firing, but its success established the principle that hand and rifle grenades should be as nearly as possible interchangeable, and this requirement was bound in the long run to lead to the discharger-cup in some form.

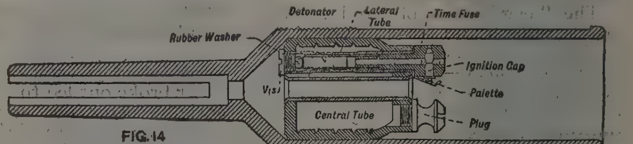

FIG. 14

The pioneers in developing the discharger-cup were the French, whose Viven-Bessières or "V.B." grenade (fig. 14) became as famous in war as the Mills hand grenade. This was a cylindrical fragmentation grenade with a hollow passage through its middle. The ignition arrangement was peculiar. The detonator and time composition were mounted in a tube parallel and adjacent to the central passage, and at the head of this tube, at right angles to its axis, was a small cap-cartridge. A flat spring called the palette, carrying a pointed striker, was mounted in such a way as to protrude into the central passage. The space in the grenade cylinder not taken up by the central passage and the detonator and fuze tube was of course filled with explosive. To the muzzle of the rifle was attached, by a sleeve, the "tromblon" (an old word for blunderbuss) or discharger-cup which was cylindrical for the greater part of its length and coned for the rest. When the grenade was placed in this, the axis of the central passage was in line with the axis of the bore of the rifle. An ordinary bulleted service cartridge was employed.

When the rifle was fired, the bullet, on leaving the muzzle, passed through the central passage of the grenade giving a sharp inward blow to the palette and thus firing the cap. At the same time the expanding gases from the bore filled the conical space in the cup and propelled the grenade.

This combination of cup and grenade proved very serviceable, its chief defect being shortness of range (180 metres) as compared with the rodded grenade. For longer ranges a different discharger was employed known as the D.R. In this, the cup (called a "mandrin") was externally cylindrical and internally coned (fig. 15), and the grenade had a sleeve with external vanes (*cf.* the grenades of the German *Granatwerfer* described under BOMBTHROWERS). A blank cartridge was employed. The sleeve of the grenade was slid over the outside of the cup as far down as the regulating pin allowed it to go, the function of this pin being to regulate the volume of the gas expansion chamber and therefore the range. The body of the grenade was arranged for fragmentation and it had a direct-action ignition system. The maximum range was nearly 400 yards.

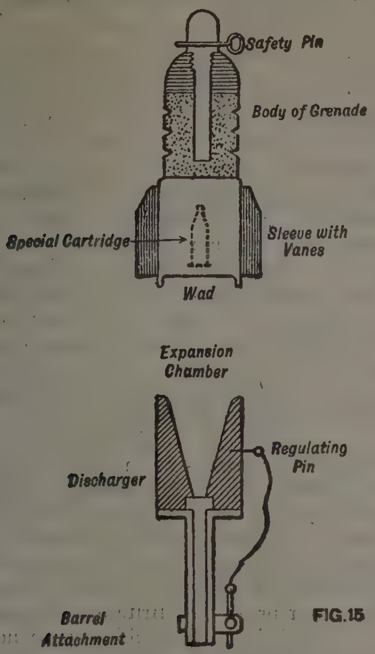

FIG. 15

The German discharger-cup grenade, introduced in 1918 to replace rodded grenades, was in all but details a copy of the French V.B. It ranged to 150 metres. The ignition arrangement was simpler than in the French archetype.

The Russians also used a discharger-cup grenade in addition to their rodded rifle grenades. The grenade for this fuze had an adjustable time ring. (C. F. A.)

The Grenade of the Future.—In Great Britain, a reconsideration of grenade problems in the middle of 1917 led to several modifications in the Mills grenade as such (the new pattern being designated No. 36) and in particular to the design of a discharger-cup for it. The rod was abandoned, and replaced by a steel disc 2½ in. in diameter attached to the base plug. This fitted accurately into the cylindrical portion of the cup, and the whole of the escaping propellant gas was therefore usefully employed. This cup was used on active service in the last months of the war.

Meantime, research had again been directed to the percussion hand grenade. Various types had been tried but, owing chiefly to the fact that the Mills had become thoroughly familiar and was trusted by the army, none was actually adopted.

The fusion of hand and rifle grenades, however, was not imminent, and amongst the conditions laid down for the "grenade of the future" were that it was to be (1) a percussion grenade, but one that would act in any position of impact or fall without the necessity of any form of air-drag; (2) capable of use either as a hand grenade or as a rifle grenade; (3) safe (*a*) during the first 10 yd. of flight and (*b*) if dropped or accidentally knocked prior to throwing, but sensitive beyond 10 yd., even should it fall in soft mud; capable also of being picked up and thrown away when lying on the ground with all safeties removed; (4) weatherproof and mudproof; (5) simple to manufacture, to assemble in the field, and to use.

The last two conditions are obvious necessities in a service grenade required in vast quantities. The other three, however, involve technical questions of design and are largely interdependent. Thus, requirement (1) might be met by rotating the grenade by grooves in the discharger-cup and ridges on the grenade or *vice versa* (thus ensuring nose-first impact) were it not for requirement (2), and in requirement (3) the significance to the designer of the 10-yd. frontier between "safe" and "sensitive" is different according as a hand-throw or an explosive propulsion is in prospect. A discussion of these requirements in detail, the technical elements available for meeting them, and the experimental patterns which have been evolved in accordance with this schedule of conditions lies outside the scope of this article. It must suffice to say that the problem thus set is one of great difficulty, but that, with the harvest of experience gained in grenade design during the war period, it is by no means insoluble. One or two questions of a general character should, however, be mentioned in conclusion.

The range and weight of the grenade of the future will depend undoubtedly on the final interpretation of the lessons of the war. The tendency to increase range will be checked at some upper limit fixed by the capacity of the infantryman's standard weapon to endure the strain. Beyond that limit a special weapon will be required, and this will either compete with or fuze with the light trench mortar, but in either case its projectile will cease to be a grenade in the ordinary acceptation of the term. On the other hand the lower limit of weight of projectile remains fixed by the necessity of producing adequate effect on explosion. Under existing conditions it may be stated, as a *rough* indication, that the lower limit of weight compatible with effect is hardly, if at all, below 1 lb., and that 300–350 yd. represents the upper limit of weight for 1¼–1½-lb. bombs fired from a discharger-cup fitted to the ordinary rifle.

Another question of importance is the means used for varying the range. As a hand-thrown weapon of course the grenade is brought on to its target by the skilled eye and hand of the thrower, but as a rifle grenade it requires mechanical adjustment. During the war, special rifle-grenade stands were designed, into which the rifle was clamped, but such devices may be considered as proper to trench warfare only, and the problem of the present day is to find a means of varying the trajectory of the grenade which is adaptable to the individual rifle. Two solutions have offered themselves. One is varying the pressure of the propellant gas by varying the position of the grenade in the cup, as in the French D.R. grenade and mandrin, the discharger-cup used in the last months of the war for the Mills grenade, and other types. Opinion is divided on the merits of this method, which, though attractive in other respects, is open to criticism because it does not legislate for wind—a specially important factor in shooting with a large object of low velocity such as the grenade, and also because such an adjustment may easily be forgotten or mis-set in battle conditions. The alternative is to provide a simple form of clinometer or elevation indicator on the rifle. (C. E. W. B.)

GRETNA (*see* 12.583*).—A new association was given to the village of Gretna in 1915, when the Ministry of Munitions purchased a site for the erection of a large propellants factory and for houses to accommodate munition workers. The strip of land taken for the purpose was roughly 9 m. long by 1 m. broad, and extended from the village of Dornock on the west to Longtown on the east. The factory was erected to make the explosive known as cordite R.D.B., which had been recently invented by the Research Department and was made without the use of acetone, of which supplies were short.

An area of 7,715 ac. of lightly farmed arable and pasture land was taken under the Defence of the Realm Act in July 1915, and was subsequently increased by 1,399 additional ac. in order that the factory might convert into cordite both its own nitro-cellulose and also that produced by a factory at Queensferry. One factory was divided into separate areas for the successive processes of manufacture, and materials were carried by an elaborate system of specially constructed railway lines. The full output of 800 tons of cordite per week was attained in the beginning of 1917, and the total amount of cordite produced was 56,876 tons. The maximum number of construction and operating workers employed together was 24,700, but the number of operating workers had been reduced by the date of the Armistice from 20,000 to 11,000. The proportion of female to male labour was about seven to three. For the accommodation of this large staff, factory townships were erected; the two largest of these were Gretna, with an area of 431 ac., and Eastriggs, near Dornock, with an area of 173 ac. The total number of dwellings erected included 670 timber huts, 54 timber hostels, 310 brick or stone houses, and 134 brick hostels, accommodation being provided for 13,485 persons. The villages contained shops, halls, cinemas, recreation grounds, schools and churches, and excellent supplies of water (from the river Esk) and of electric power were provided, both for industrial and for domestic use. Surplus land was cultivated and provided large supplies of oats, potatoes, garden produce and hay. The townships were administered by a town manager who controlled housing and public services, and the factory was made a special police area. The health of the factory was very satisfactory; the total number of deaths was 145. When the factory was gradually closed down after the Armistice many of the workers were allowed to remain in the houses, though they had to find employment elsewhere or in the repair of railway wagons, which was introduced to relieve unemployment in the area. At the end of 1920 there were still some 600 operatives employed in the maintenance of the buildings or in some other work connected with the factory; but, after considerable hesitation, it was decided not to retain it for national purposes and it was offered for sale in the autumn of 1921.

GREY, ALBERT HENRY GEORGE GREY, 4TH EARL (1851–1917), British statesman, was the son of Gen. Charles Grey, Queen Victoria's private secretary, and grandson of the 2nd Earl, the Whig Prime Minister who passed the Reform bill of 1832. Born Nov. 20 1851, he was educated at Harrow and at Trinity College, Cambridge, where he graduated with a first-class in the law and history tripos, 1873. As his uncle the 3rd Earl had no children, Albert Grey was the heir-presumptive to the earldom, and he endeavoured to win a seat in Parliament as a Liberal, when a by-election occurred in S. Northumberland in the spring of 1878. It was at first announced that he had been returned by two votes; but a scrutiny eventually seated his Conservative opponent, who became afterwards Mr. Justice Ridley. However, he won the seat by a large majority at the General Election in 1880 and, after the Reform bill of 1884 had altered the constituency, sat for Tyneside for a few months in 1885–6. The Liberalism which he displayed as a member of Parliament and developed greatly in a crowded after-life was unlike the conventional Radicalism of the period. He was an enthusiastic social reformer, and a passionate imperialist. It was inevitable that he should follow Hartington rather than Gladstone over Irish Home Rule. He was one of the 93 dissentient Liberals who by voting against the Liberal Government decided the fate of the Home Rule bill of 1886.

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* *These figures indicate the volume and page number of the previous article.*

Standing as a Liberal Unionist, he lost his seat at the General Election of that year, and did not reappear in Parliament till he succeeded his uncle in the earldom in 1894. The interval had been largely filled with travel—chiefly along the byways of the British Empire. He was in S. Africa when his uncle died, and his knowledge of, and interest in, that country led to his appointment in 1895, after the Jameson raid, as administrator of Rhodesia in succession to Dr. Jameson. His difficulties were great. The settlers were still few and scattered, and were regarded with jealousy and mistrust by their neighbours, the Transvaal Boers. In 1896 there came the second Matabele War, only brought to a close by Cecil Rhodes's personal intervention. Racial, administrative, and economic problems of an intricate kind pressed upon him and were not always wisely decided; and it says much for his personal charm that he carried away with him on his retirement the warm affection of the Rhodesians. He had become himself a close friend and ardent admirer of Cecil Rhodes; and it was natural that on returning to England he should join the board of the Chartered Co. in 1899, a directorship which he held until he went to Canada. He visited Lord Milner in S. Africa after the Boer War; and returned once more in 1912 to unveil the Rhodes memorial on Table Mountain.

Canada, however, where he went as governor-general in 1904, was the part of the British Empire to hold the first place in his affections. He was no stranger there, but had visited the dominion twice already, being a brother-in-law of his predecessor, Lord Minto. His enthusiasm for the land and the people, his idealistic outlook, his bright but simple manner, his utter lack of conventionality and stiffness, his fondness for travelling and nature and sport captivated the Canadian heart. He formed a firm and cordial friendship with the Prime Minister, Sir Wilfrid Laurier; but that did not prevent him from welcoming and winning the attachment of Sir Wilfrid's successor, Sir Robert Borden. Similarly he was able to celebrate worthily, in the presence of the then Prince of Wales, the acquisition by Quebec of the Plains of Abraham for public purposes, without hurting the susceptibilities of the French-Canadians. His term of office was twice prolonged; but Canada was loth to see him go in Oct. 1911, even though his successor was to be the Duke of Connaught.

Never much of a party man, he was still less so after his return to public life in England. He devoted himself to the causes which appealed to him. Of these, the federation of the Empire was the first, and he would only contemplate Irish Home Rule as part of a Federal scheme. State liquor control was another of his pet ideas; and he helped greatly towards licensing reform by the institution of the Public House Trust, in which he took a leading part. He worked hard also for Proportional Representation. Perhaps the good of agriculture came next in his affections to the claims of empire; and he forwarded all promising schemes for its betterment and organization. He died at Howick, after a serious operation, on Aug. 29, 1917.

Lord Grey married Alice, daughter of Robert Stayner Holford, and had, besides daughters, a son who succeeded him in the earldom and who married the daughter of the 2nd Earl of Selborne. (G. E. B.)

GREY OF FALLODON, EDWARD GREY, 1st VISCOUNT (1862–), British statesman (*see* 12.588), had given public notification, in a speech in the City of London in Oct. 1905, that if, as seemed probable, the Liberal party regained power in the near future, they would maintain the national foreign policy pursued by Mr. Balfour and Lord Lansdowne. He mentioned as the three cardinal points of British policy: (1) friendship with the United States; (2) the alliance with Japan; and (3) the Entente with France; all three were matters, he said, of cordial congratulation. Could British relations with Russia and Germany be improved? As to Russia, he held that the roots of estrangement lay solely in the past, and that it should be the business of both Governments to encourage the growth of mutual confidence. As to Germany, it must be a condition of any improvement in relations between her and Britain that the relations of Germany with France on all matters coming under the Anglo-French Entente should be fair and good also.

The programme thus laid down in advance was faithfully observed by Sir Edward Grey (as he then was) during a tenure of the Foreign Office which lasted exactly 11 years, from Dec. 1905 to Dec. 1916. He had great hesitation originally in accepting office under Sir Henry Campbell-Bannerman; but after a short interval of negotiations he was included in the new Liberal Cabinet. In office the relations of the two men were cordial, and the Prime Minister gave his Foreign Secretary steady backing. It was needed at the very outset. During the general election of 1906, as Sir Edward told the House of Commons in his famous speech on Aug. 3 1914, Germany was pressing France about Morocco, and he was asked by France if, should a Franco-German war break out, Britain would give her assistance in arms. He replied that he could promise nothing which would not be fully endorsed by public opinion, but that, if war were forced on France through the Entente respecting Morocco, British public opinion would rally to her support. The French Government then suggested conversations between naval and military experts. After consulting the Prime Minister, the Chancellor of the Exchequer and the War Secretary, he agreed, on the understanding that such conversations should in no way bind the British Government. The Algeciras Conference on Morocco followed in the spring of 1906, and the constant support which, on his instructions, the British representatives accorded to the French helped to produce a satisfactory result, and to strengthen the Anglo-French Entente. He had also in this first year to take a firm attitude towards Turkey, who was making difficulties about the delimitation of the Turco-Egyptian frontier. In 1907 he forwarded Anglo-American friendship by sending a distinguished public man, Mr. (afterwards Lord) Bryce, to Washington as British ambassador; and, it may be added, he succeeded, during Mr. Bryce's term, in settling the outstanding questions of difference between England and America. He concluded an agreement in 1907 with Spain, which pledged both Powers to maintain the *status quo* in the waters adjacent to southern Spain and north-western Africa, and which incidentally involved Spanish recognition for the first time of the British position and rights at Gibraltar. In that year he also fulfilled his hope of coming to an understanding with Russia. He concluded a convention with her about Persia, in which both Governments recited their desire to maintain the integrity of that country, but stated that in certain parts of it Russia and Britain had special interests. Accordingly Britain recognized Russia's rights and interests in the northern zone and Russia recognized British rights and interests in the southern zone, the central zone being treated as neutral ground. Sir E. Grey asserted, and the Russians did not deny, the special rights of Britain in the Persian Gulf. Other questions which pressed on him in these early years of his foreign secretaryship were the state of Macedonia and of the Congo. He disappointed the humanitarians by declining to pose as a knight-errant. His prudence led him to be chary of burning words, but to promote international action to benefit Macedonia, and to forward the transference of the Congo State from King Leopold to Belgium.

In 1908—the year in which Mr. Asquith, an intimate friend of Sir E. Grey, became Prime Minister—the European situation was considerably modified by several striking events. First came the Young Turk revolution, which Sir E. Grey, no wiser than the rest of the western world, welcomed as a most beneficent change. Then, in October, came, almost simultaneously, the assertion by Prince Ferdinand of the independence of Bulgaria and his assumption of the title of king or tsar, and the annexation by Austria-Hungary of Bosnia and Herzegovina, which she had administered under the Treaty of Berlin. These strokes of policy moved the indignation of both the Russian people and the Russian Government; but the German Emperor announced that he would stand by his Austrian ally in "shining armour"; and Sir E. Grey, though he protested against the infraction of the public law of Europe, was naturally unable to promise Russia anything more than diplomatic support. The action of the Central Powers must have confirmed him in the view that it was from them that came the principal danger to European peace; but he kept on friendly terms with them, and resisted all suggestions that the Anglo-French Entente and the Anglo-Russian agreement constituted in any sense a hostile encirclement of Germany. On the other hand he emphatically declared in Parliament that, if Germany persisted in her naval preparations, Britain could not give up the competition.

The labours of the Foreign Office, coupled with membership of the House of Commons, left Sir Edward little leisure for forwarding the domestic policy of the Government. But he made two or three speeches in 1909 on behalf of Mr. Lloyd George's famous budget, maintaining that it was not revolution that Britain had to dread, but undue slowness to move with the times. He also took his share in the campaign against the House of Lords, but protested that he was in favour of a two-chamber system, with the Commons' predominant, and declared the Parliament Act, after its passing, to be a cumbrous and not a final measure. He showed himself a convinced supporter of Irish Home Rule, but was forward in the autumn of 1913 to obtain an agreed settlement, suggesting "Home Rule within Home Rule" as the proper method of meeting Ulster's fears. He was a strong advocate of woman suffrage; and he defended the Declaration of London as conforming the British naval code to that which the United States and the continent of Europe would agree to enforce in war.

Meanwhile British relations with Germany were his main preoccupation. Germany gave dramatic notice of her dissatisfaction with the spread of French arms and influence in Morocco by despatching, at the beginning of July 1911, the gunboat "Panther" to the N.W. African coast at Agadir, to protect, it was alleged, German interests (a step which perhaps hastened the action of Italy, later in the year, in seizing Tripoli before her German ally could develop an interest in it). In view of this further attempt to test, and if possible loosen, the Entente, the British Foreign Office issued a warning, through the mouth of Mr. Lloyd George speaking at the Mansion House, that Britain intended at all hazards to maintain her place among the Great Powers. The warning sufficed to make Germany lower her tone, and Sir E. Grey helped forward a reasonable agreement between her and France. In November he explained to Parliament that the foreign policy of the Government was a continuance of Lord Lansdowne's, and had got rid of the constant trouble with France and Russia; that British friendship with these Powers afforded a guarantee that neither would pursue an aggressive or provocative policy towards Germany, while the strength of Germany was a guarantee that no country would pick a quarrel with her; but that, when a nation had the biggest army and was increasing its already big navy, it was natural that other Powers should be apprehensive. On this occasion, as always, the Opposition, represented now by Mr. Bonar Law, supported Sir Edward; but many Radicals and Labour men, as throughout his tenure of office, were full of suspicions, disliking any agreement with autocratically governed Russia, and anxious for better relations with Germany at almost any cost. But public opinion in general supported Sir Edward, and was pleased when in the following year his memorable services to his country as Foreign Minister in difficult times were marked by the very unusual distinction, for a commoner, of the Order of the Garter.

In the beginning of 1912 he was a party to sending Lord Haldane on an informal mission to Berlin to reassure the Emperor and his Government as to the pacific intentions of Britain and to probe the intentions of Germany. The Cabinet formally notified the German Government that Britain would neither make, nor join in, any unprovoked attack on Germany. But nothing would content the German Government but an absolute pledge by Britain of neutrality if Germany were engaged in war—a pledge which Sir E. Grey naturally could not give. Largely in consequence of this ominous rebuff, he exchanged letters on Nov. 22 1912 with the French ambassador, agreeing that, if either Britain or France had grave reason to expect an attack by a third Power or a menace to the general peace, both Governments would consult whether they should coöperate and what measures they should take in common. Still he found himself able to work in general harmony with the German Government in the efforts made by the Powers, in conference in London, to bring a settled peace to the Balkans. In those regions, in the years 1912 and 1913, a Balkan League of Bulgaria, Serbia and Greece had, first of all, severely defeated Turkey, and had then split up, Bulgaria's treachery in turning on Serbia and Greece, in order to obtain the largest share of the booty, being overcome, after barbarous fighting on the part of Bulgarians, Serbians and Greeks alike, by the final intervention of Rumania. He joined the other Powers in creating an independent Albania, under a German prince; and seems to have had his suspicions lulled for the time by the apparent reasonableness of German diplomacy and by the straightforward attitude of the new German ambassador in London, Prince Lichnowsky, who was not, it subsequently appeared, in the confidence of his own Government.

Accordingly he was taken aback by the unyielding attitude of Germany in the negotiations arising out of the Austro-Serbian dispute. As soon as he heard of the Austrian ultimatum delivered at Belgrade on July 23 1914, he realized at once that Russia could not allow Serbia to be crushed, and exerted himself in the most strenuous fashion to save Europe from the threatened catastrophe of a war in which four Great Powers at least, Austria, Russia, Germany and France, would be involved. In conjunction with Russia he urged upon Austria the extension of the alarmingly short time-limit of 48 hours, and he pleaded unavailingly with Germany to do the same. Next he proposed that England, France, Germany and Italy should work together at Vienna and St. Petersburg for conciliation—a proposal to which Germany had no objection, but which produced no result. Thirdly, in conjunction with France and Russia, he advised Serbia to go as far as possible to meet Austria; and in fact, Serbia accepted almost the whole of the Austrian demands; but Austria would be content with nothing less than complete submission, and on the expiry of the time-limit declared war on Serbia. Sir Edward proposed a conference in London between himself and the French, German and Italian ambassadors, to discuss the best means of a settlement. Germany boggled at the conference, but accepted in principle mediation between Austria and Russia by the four Powers; and he asked her to suggest any other form of mediation than the proposed conference. At this point, on July 29, Germany, declaring war to be inevitable if Russia attacked Austria, endeavoured to purchase the neutrality of England by undertaking, if England remained neutral, to make no territorial acquisitions at the expense of France—an undertaking which did not extend to the French colonies—and by promising to respect Belgian integrity, after the war, if Belgium had not sided against Germany. Sir E. Grey next day absolutely refused to make any bargain of the sort at the expense of France and Belgium. But, in a final effort for peace, he offered, if through the coöperation of Germany with England the peace of Europe should be preserved, to endeavour to promote some arrangement, to which Germany would be a party, by which she and her allies could be assured against any aggression or hostile policy on the part of France, Russia or Great Britain. This suggestion met with no response. In view of the apparent threat to Belgium, Sir Edward asked France and Germany whether they were prepared to respect Belgian neutrality provided it was not violated, and he asked

Belgium whether she would remain neutral. France and Belgium both replied affirmatively, while Germany temporized. Hopeful negotiations which had been begun directly between Russia and Austria were wrecked by a German ultimatum to Russia to countermand her mobilization; and on Saturday Aug. 1 Germany declared war on France.

The moment for decision had come for Great Britain. Russia had asked her to declare herself against Germany and so give the German General Staff pause; France had asked her to coöperate, as Germany was about to invade French territory. The Cabinet had hitherto been divided, a strong section pressing for the preservation of neutrality, and so Sir Edward had been unable to reply favourably to either Russia or France. But now Germany had declared war on France, and was apparently about to disregard the neutrality of Belgium. The Opposition, through Mr. Bonar Law, tendered support for active measures to aid France and Russia; and Sir Edward with a Cabinet rallying, with slight exceptions, to his view, was able to make an appeal in the House of Commons on Aug. 3 for the support of public and parliamentary opinion to a policy of action. Unconditional neutrality, he said, was precluded by the commitment to France and the consideration of Belgium. The forces of the Crown were never more efficient; the Government had striven for peace till the last moment; and the country when it realized the situation would support them. The speech finally decided a wavering public opinion; with the exception of some Radicals and extremist Labour men, all parties, including the Irish Nationalists, accepted the necessity of war. Sir Edward demanded next day that Germany should respect the neutrality of Belgium, and on the German refusal, England went to war.

Great Britain found herself at once associated, in the war against the Central Powers, with France, Russia, Belgium and Serbia, to whom Japan, in virtue of her relations to Great Britain, was added in the course of August. One of Sir Edward's first tasks was to turn this association into an alliance, which should bind its members to fight in common and make peace in common. In the course of the negotiations for this purpose, both with the Powers who were fighting Germany from the beginning and with those who, like Italy and smaller Powers, joined afterwards in the struggle, he did not hesitate to guarantee the support of Great Britain for the attainment of long-cherished national objects, provided that these did not conflict with the aims of liberation and self-development common to the Allies—the most striking case being the promise, after Turkey entered the war on the side of the Central Powers, that Russia should have Constantinople.

Much of Sir Edward's time and attention during the first half of the war was occupied by difficult questions arising out of the blockade of Germany and the consequent interference with the trade of neutrals. Public opinion in Great Britain constantly complained that the blockade was not enforced with sufficient strictness, that the policy enunciated of preventing goods from either entering or leaving Germany was very far from being realized in fact; while the United States, as the principal neutral, harassed the British Government by repeated notes, denouncing the methods of the British navy, in the search of neutral ships and in the seizure of goods, as unnecessarily prejudicial to American trade and contrary to international law. He was perhaps more successful in his answers to the Americans than in his justification to the British public; and a large body of opinion in America accepted his explanations as reasonable. He pointed out, as was indeed notorious, that American exports to neutral countries adjacent to Germany had enormously increased since the war began; that there was a serious danger lest these countries might become in consequence bases of supplies and arsenals for the enemy on an unprecedented scale; that there were neutral ports in the neighbourhood of Germany that were neutral only in name and really did a thriving trade in contraband; and that Britain was only exercising the right claimed by the United States in their Civil War of expanding the practices of international law to meet emergencies not hitherto contemplated. He further demonstrated that the assertion of the United States that the immense modern ships could be adequately searched at sea, at a period when submarine warfare was being vigorously prosecuted, and that it was unjustifiable to take them into port for the purpose, could not be seriously maintained. He claimed also that the British practice caused the least discomfort to neutrals; and contrasted with it the German practice of sinking ships, regardless of human life.

The tenure of the Foreign Office by a statesman so high-minded, sincere and experienced as Sir Edward Grey was everywhere regarded as such a valuable asset for Great Britain that it appeared only natural and fitting for Mr. Asquith, when contemplating the formation of a Coalition Government in May 1915, to lay down, as one of the essential conditions, that there should be no change in the office of Foreign Secretary. No one could refute with such authority the intermittent assertions of the German Chancellor that it was England and not Germany that was responsible both for the origin and for the continuance of the war. Sir Edward pointed out, in a letter to the press on Aug. 25 1915, that the reason why the Anglo-German negotiations of 1912 broke down was that Germany wished to retain her freedom to wage war while binding Britain to absolute neutrality. What she was really fighting for now was supremacy and tribute. When the pacifists called for negotiations in May 1916, he showed that when the Germans professed a readiness for peace it was only for a peace on the basis that Germany had won and the Allies were beaten; but the Allies were not beaten, and the first step towards peace would be taken when Germany began to recognize that fact. In Oct. 1916 he laid it down that, as the war was forced by Germany on Europe, it was the Allies who must have guarantees for the future. The peace must ensure that Europe should be free from Prussian militarism.

Credit must be given to Sir Edward for facilitating, in the early summer of 1915, the entry of Italy—till May 3 a member of the Triple Alliance—into the war against the Central Powers. It was, however, a grave disappointment to him that he was unable to prevent Bulgaria, in the autumn of 1915, from taking the field against the Allies. He had worked for a Balkan agreement founded on mutual concessions, but naturally Greece and Serbia would not make concessions unless Bulgaria joined the Allies; and Bulgaria was seduced by the promise of the Central Powers, who had not to consider the feelings of her neighbours. He warned Bulgaria that, if she joined the enemy, Britain would give her own friends in the Balkans all the support in her power in conjunction with her Allies, without reserve and without qualification. In fulfilment of this promise Allied troops were sent to Salonika, and he offered Cyprus to Greece in order to induce her to carry out her treaty obligations and go to Serbia's aid against Bulgaria. But on this issue King Constantine won the support of his people against M. Venizelos; and Serbia was crushed before help could reach her.

Sir Edward made strenuous efforts, with a certain measure of success, on behalf of British prisoners in Germany and British civilians interned at Ruhleben. The course of the war compelled him, in July 1916, after long hesitation, to abandon that Declaration of London in regard to naval warfare which he had strongly supported in peace-time. He took part, it may be added, in the first tentative experiments to obtain full coöperation of all the Allies in war, by attending Allied Conferences in Paris in Nov. 1915 and March 1916.

In July 1916 an affection of the eyes, which had been giving him increasing trouble, made it advisable that he should have as much relief from work as possible, and he accepted a peerage. It was announced that he had been created an earl—a rank which his public services thoroughly warranted. But he wished to keep his own name, and yet not to enter into any competition with the head of his family, his cousin Earl Grey. Accordingly at his own request he was gazetted a viscount and not an earl—Viscount Grey of Fallodon. When a few months later, in December, his friend and chief Mr. Asquith was succeeded in the premiership by Mr. Lloyd George, failing eyesight and political comradeship both united to determine him to bring his tenure of the Foreign Office to a close. He had served for a longer consecutive period than any predecessor, exceeding by a year the 10 years' tenure of Grenville (1791–1801), Pitt's colleague in the first war against republican France, and of Castlereagh (1812–22), the Foreign Secretary under whom Waterloo was won and the Treaty of Vienna signed. In his official methods he carried out his own precept—that foreign policy required not striking effects nor bold strokes but careful steering. An ardent lover of peace, he had been driven, through no fault of his, to lead Great Britain into the World War; he left a tradition in his office of steady work, a resolute will, and a clear head, and of that straightforwardness, sportsmanship, and courtesy which distinguish the best type of English gentleman.

After his resignation Viscount Grey took no part in public life for more than a couple of years. Happily, rest and quiet worked a decided improvement in his eyesight, and in the autumn of 1919 he felt himself well enough to comply with the wish of Mr. Lloyd George's Government that, pending the appointment of a permanent ambassador after Sir Cecil Spring-Rice's premature death, he should go on a mission to Washington to deal with questions arising out of the peace. He only remained there three months; while his sympathetic personality made numerous friends for himself and for his country, the quarrel in progress between the Senate and President Wilson over the Treaty of Versailles hampered him seriously in fulfilling the charge entrusted to him. His public appearances in England in the years immediately following the war were very few; but he showed a keen interest in the League of Nations; and he took a leading part at the foundation, in July 1920, of a British Institute of International Affairs in order to promote among Englishmen international thinking.

He published in 1899 a book on *Fly-Fishing*, his favourite recreation. In 1885 he married Dorothy, daughter of Shellcross F. Widdrington, of Newton Hall, Northumberland. She was killed in a carriage accident in 1906; there were no children of the marriage. (G. E. B.)

GRIERSON, SIR JAMES MONCRIEFF (1859–1914), British general, was born Jan. 27 1859 and joined the Royal Artillery in 1877. Noted from the outset as an exceptionally keen student of his profession, he served on the staff in the Egyptian Expedition of 1882 and the Suakin Expedition of 1885, and again, having in the meantime passed through the Staff College, in the Hazara Expedition of 1888 (for the latter campaign he was in 1895 promoted brevet lieutenant-colonel). From 1896 to 1900 he was military attaché at Berlin. As a colonel he was with Lord Roberts during the advance from Bloemfontein into the Transvaal; but he was then transferred to China to act as British military representative on the staff of Field-Marshal Count Waldersee, commander-in-chief of the Allied forces against the Boxers. For his services he was given the C.B.

In 1904 he was appointed Director of Military Operations and promoted major-general, and he held command of the 1st Div. at Aldershot from 1906–10. Promoted lieutenant-general in 1910 and made a K.C.B. in 1911, he was in 1912 put in charge of the Eastern Command. On the outbreak of the World War Sir J. Grierson was selected for the command of the II. Army Corps. He proceeded to France, but died suddenly on Aug. 17 while his troops were still assembling in the area of operations. A good linguist and unusually well acquainted with most of the European armies, Grierson had taken full advantage of his varied military experience, and had shown himself well fitted for high command in the field.

GRIFFITH, SIR SAMUEL WALKER (1845–1920), Australian lawyer and statesman, was born at Merthyr Tydvil June 21 1845, the son of the Rev. Edward Griffith, afterwards of Brisbane. He was educated at the university of Sydney, graduating in 1863 and winning a travelling fellowship two years later. In 1867 he was called to the Queensland bar, and was also called in New South Wales and Victoria. He became Q.C. in 1876. He entered the Legislative Assembly of Queensland (1872), was Attorney-General 1874–8 and again 1890–3, was Minister for Public Instruction 1876–9 and 1883–4 and for Public Works 1878–9, and was Premier of Queensland from 1883–8 and again from 1890–3. From 1893 to 1903 he was Chief Justice of Queensland and from 1899 to 1903 also Lieutenant-Governor. In 1903 he became the first Chief Justice of the Australian Commonwealth and held that office until 1919. He was the chief bulwark of the Conservative cause in Australia and his cold, clear intellect, never deflected by passion and rarely by sympathy, has left a deep stamp on Australian national life. His early draft of a constitution for the Federation was rejected because it was not "popular" enough, but its one essential check remained in the later "popular" constitution—that of a High Court with supreme power over the Executive and the Legislature. He published *The Queensland Criminal Code*, as well as a translation of Dante's *Divina Commedia* (1912). He died at Brisbane Aug. 9 1920.

GROENER, WILHELM (1867–), German general, was born Nov. 22 1867 at Ludwigsburg, Württemberg. In 1912 he was a sectional chief of the railway section of the German army with the rank of lieutenant-colonel. During mobilization in 1914 he was at the head of the German field railway service. In 1915 he was promoted to the rank of major-general, and from May 27 1916 to Aug. 1917 he was at the head of the War Office and a member of the directorate of the War Food Supply Office. He subsequently returned to the front as divisional commander and leader of an army corps, and in 1918 was chief of staff of the army group under the command of Linsingen and afterwards of Eichhorn. From Nov. 1918 to Sept. 1919 he was the successor of Ludendorff in the position of quartermaster-general. He retired as a protest against the signature of the Treaty of Versailles. During his tenure of office at the Ministry of War Gen. Groener was instrumental in maintaining, in spite of strikes and other difficulties, the coöperation of the German trade unions in securing a steady supply of munitions.

GROSSMITH, GEORGE (1847–1912), English comedian (*see* 12.619), died at Folkestone March 1 1912.

His son, George Grossmith (1874–), English comedian and third of the name, who made his first appearance at the Shaftesbury theatre in an operetta by his father, became a well-known figure in musical comedy, especially at the Gaiety theatre, London. He was the author, or part author, of many musical plays, songs and revues, and took a leading part in popularizing revue in London. Together with Edward Laurillard he became lessee and manager of several London theatres. During the World War he served as lieutenant in the R.N.V.R.

GROSSMITH, WEEDON (1853–1919), English comedian, brother of the second George Grossmith, was born in London June 9 1853. He was educated as a painter and exhibited at the Academy and the Grosvenor Gallery; but in 1885 he joined Rosina Vokes's theatrical company and went on tour in the provinces and in America. He first appeared in London at the Gaiety theatre in 1887 as Woodcock in *Woodcock's Little Game;* but his earliest notable success was made in *A Pantomime Rehearsal.* He played with Irving at the Lyceum theatre, with Tree at the Haymarket and with Mrs. John Wood at the Court theatre. In 1894 he entered into management on his own account at Terry's theatre and produced a play of his own, *The Night of the Party.* His gift of quiet humour brought him much success, and among his best impersonations may be mentioned Archibald Bennick in *The New Boy*, Jimmy Jinks in *Baby Mine*, the Earl of Tweenwayes in *The Amazons*, "Boney" in *The Misleading Lady* and the Judge in *Stopping the Breach*, this being the last rôle he ever played (1917). In 1913 he published his autobiography, *From Studio to Stage.* He married Miss May Palfrey, who was also an actress. He died in London June 14 1919.

GRUNDY, SYDNEY (1848–1914), English dramatist (*see* 12.640), died in London July 4 1914. His last play, *A Fearful Joy*, was published in 1908.

GUAM (*see* 12.648).—The population of the island on July 1 1920 was 14,724, of whom the natives numbered 13,698; foreign-born, 548; personnel of the naval station, 478. In shape the island, which has an estimated area of 225 sq. m., bears a resemblance to the sole of a human foot. Apra harbour, with proper improvements, could easily shelter a large fleet. Distances from Apra are approximately: Yap, 458 m.; Manila, 1,506 m.; Yokohama, 1,353 m.; Sydney, 3,067 m.; Honolulu, 3,337 m.; San Francisco (direct), 5,053 m.; Panama, 7,988 m. The mean average temperature is 81° F., with a mean maximum of 88° F. and a mean minimum of 72° F., but the heat is minimized, especially during the hottest months, by a constant breeze. The chief products are copra (the only export), maize or Indian corn (introduced from Mexico many years ago and the chief food crop), rice, taro, yams and sweet potatoes, breadfruit, plantains and bananas.

Education is in charge of a naval officer, who is assisted by a superintendent and district superintendent, as well as by 13 teachers furnished by the Federal Government. In 1920 there were 1,894 pupils of school age, 345 pupils over school age, an average daily attendance of 1,769; total number of teachers and substitutes 67, and of schools 14. The total cost of the schools to the island Government (exclusive of cost of upkeep and of four Guam Government students in the United States) was $14,500. Congress makes no appropriation directly for education purposes, but the naval station meets a part of the expenses. Instruction is in English. Considerable advance has been made in health and sanitation work. Guam has no private physicians, and the navy furnishes all medical assistance through a corps of eight medical officers, two dental surgeons, three pharmacists, eight navy nurses, and 30 hospital corps men. The disfiguring disease *gangosa* is being stamped out and its effects are no longer seen except among persons over thirty. All lepers have been sent to the island of Culion, the Philippine leper colony. Intestinal parasites, tuberculosis, and various skin diseases form the greatest menace to health, while hookworms abound. The work inaugurated by the Rockefeller Institute has resulted in an improvement of sanitary conditions.

Congress has never legislated for Guam. The governor, who is also the commandant of the naval station, combines in himself all functions of government, even some judicial authority, for an appeal lies to him in almost all cases. Most of the other Government officials belong to the naval station. The law in effect is the old Spanish law as changed by the Acts of the governor. The laws are in a chaotic state and badly in need of revision. There is no legislature, but for several years there has been a so-called congress with only advisory powers. The police department is wholly native with the exception of the chief and assistant chief, who are marines. The Insular Patrol, formed of marines, has certain constabulary duties, acts as fire wardens, and aids and advises the natives in their farming and in other ways. Of the able-bodied male natives between 16 and 60, numbering approximately 3,000, some 600 are employed by the Federal or island Government, while about 400 are employed in various town occupations, leaving about 2,000 for agricultural work. An effort is being made to introduce modern agricultural methods, so that the island may become self-sustaining. Since 1916 an effort has been made to exterminate the pest of rats, and about 1,750,000 of these rodents were destroyed in 29 months. The Commercial Cable Company has a cable station with connexions to Manila, Yokohama, Midway, and Yap. In Nov. 1917 the Navy Department opened a high-power radio station. Imports for 1920 were valued at $408,263.88, and exports at $34,132.94. The United States furnished $313,212.65 of the imports and took $15,148.59 of the exports. In 1920 imported foodstuffs were valued at $147,870.74. Government receipts in 1920, $155,209.06; and expenditures, $137,205.60.

In 1914 the German raider "Cormoran" was interned in Apra harbour, and after the United States declared war on Germany was blown up by the crew. The latter were captured and interned in camps in the United States, being the first German prisoners taken by U.S. troops. All the able-bodied young men in Guam enlisted in the militia formed for the protection of the island. In July 1918 a disastrous typhoon struck the island, and in three hours destroyed all the crops and ruined many of the coconut trees. Aid was rendered by the American Red Cross. Since 1899 there have been 22 governors and acting governors, all naval officers.

See William Edwin Saffron, *Guam* (1912); L. M. Cox and others: *The Island of Guam* (U.S. Government Printing Office, 1917); Guam Agricultural Experiment Station (annual reports beginning with that for the year, 1910–1); Annual Report, Governor of Guam, 1920; *Census of Guam* (U.S. Government Printing Office, 1921).

(J. A. Ro.)

GUATEMALA (*see* 12.661).—Manuel Estrada Cabrera's last election as president occurred in 1917, when he was chosen to succeed himself for the period ending in 1923. He controlled the republic for 22 years through a military dictatorship which depended upon the dense ignorance of the masses and the bitter factional strife among the upper classes. He maintained his sway by a standing army, a police force, and a secret service which suppressed and persecuted opposition. The revolt which unseated him began in 1920 with the press, which severely criticized his monetary and administrative systems. The Government seemed impotent to repair the damage caused by the 1917 earthquake, and the press attacked the Government for its inadequacy. Bishop Piñol began to lead the people to think on social and political topics. Then the Unionist party arose, at first composed of less than a dozen intellectuals and business men, who organized in Guatemala City in Dec. 1919. Its policy was to effect by quiet means and legally a change in the system of government. Soon the party was supported by many thousands. The demand grew for the elimination of Estrada Cabrera, for strict observance of the constitution, and for restoration of popular political rights. The National Assembly took up the movement, which the President tried to check by force. Many were imprisoned, and reforms in elections and exercise of civic rights were denied. The reformers abstained from the use of weapons, but they increased in numbers and influence until finally Estrada Cabrera took refuge at his country home and determined to shell the capital. The army went over to the opposition, and the President resigned in April 1920 in favour of Carlos Herrera, the *primer designado*, or vice-president. The Congress confirmed Herrera in the executive power. At the subsequent election he had two opponents, but was overwhelmingly elected for the term expiring March 1923. President Herrera, a member of a prominent family, was then about 55 years of age. He had travelled widely in Europe and the United States, and had been in 1915 a member of the Pan-American Financial Congress. He controlled an agricultural estate of over a million acres, half of which was utilized, and employing modern methods and machinery. With his brothers, he was interested in banking and commerce. His governmental aims were said to include the reduplication in Guatemala of the democratic institutions of the United States. His administration welcomed foreign capital, favoured immigration, and assisted in the development of all natural resources. The Herrera Government was promptly recognized by the leading Powers of America and Europe. It interested itself in repairing the earthquake damages, in erecting government buildings, hospitals, a national theatre, a national institute, and other needed work. The Unionist party of Guatemala favoured the Central American Union, the pact for which was signed at San José de Costa Rica Jan. 20 1921. The Union was declared on Oct. 10 1921, and was composed of Guatemala, Honduras and Salvador, Nicaragua refused to sign the pact. Costa Rica signed but this action was later rejected by the National Assembly. On Dec. 6 1921 a revolutionary *coup d'état* overthrew Herrera and his Government; and the former president surrendered his powers to a Provisional Government headed by General Lima and General Orellana.

During the early period of the World War there was a great influx of German emissaries from Mexico, who attempted to keep Guatemala from joining the Allies. In spite of their activities the republic broke off diplomatic relations with Germany April 27 1917, and this action was considered subsequently by Estrada Cabrera to be tantamount to a declaration of war. The territorial waters, ports, and railways of the country were offered to the United States for war uses in the common defence, Peace was declared with Germany Oct. 3 1919.

Economic and Social Conditions.—The estimated pop. in 1912 was 2,119,000; in 1914 the estimate was 2,003,579, but in that year the births were said to number 76,551 and the deaths 40,878, leaving a surplus of 35,673. The estimates for the total pop. 1912 and the total pop. for 1914 are therefore probably not exact. The foreign pop. in 1912 was estimated at 12,000. The total expenditures for education in 1916 were £34,074. In 1917 there were 1,942 government schools with 54,479 pupils in attendance. The Government established the Universidad Estrada Cabrera, opened Sept. 15 1918. For 1918–9 the national revenues amounted to 110,937,325 paper dollars and the expenditures to 77,666,023 paper dollars. In Dec. 1918 the total external debt with interest was £2,301,563. The internal debt in Dec. 1916 was 135,799,843 paper dollars and 1,091,702 gold dollars. The British claims were adjusted in 1913 after a warship had been sent to Guatemalan waters, and an appeal by Guatemala had been made to the United States for assistance.

The largest crop was coffee. There were 1,500 plantations, covering 96,000,000 sq. yd. and containing 450,000,000 coffee-trees. In

1918 the crop amounted to 110,000,000 lb. of which between 50% and 60% was German-owned. In 1918 coffee exports were worth $8,562,715. Sugar ranked second in importance. In 1918 there were produced 42,000,000 pounds. In 1916 the banana and plantain crop was 9,351,485 bunches; and 6,110,900 quintals of corn were produced. The cattle production in 1915 amounted to 1,470,200 head of all varieties. The total imports in 1918 were worth £1,326,800, and the exports £2,263,800. By far the greater part of the commerce was with the United States. The British trade showed in 1919 £292,521 exports from Guatemala and £396,182 imports. This was a marked increase over the trade of the war period. In the same year 601 vessels entered Guatemalan ports, 175 being American and 129 British. In Dec. 1915 the State took over all the ore lands in the country, ordaining that they might be exploited only under leasehold.

The International railway of Central America, incorporated in 1912, was a consolidation of the Guatemala railway (195 m.), the Guatemala Central (139 m.), the Occidental railway (51 m.), and the Ocos railway (22 miles). The main lines at the close of 1920 ran from Puerto Barrios on the Caribbean to Guatemala City, 194·5 m., and thence to San José de Guatemala on the Pacific, 74 miles. A Salvadorean division 40 m. long was separately operated. In 1914 the International railway bought a 60-m. line from Santa María to Las Cruces and continued it 45 m. to Ayutla on the Mexican border. Through service began Oct. 1 1916. A line was also projected from Santa María to Santa Ana in Salvador. The plan was to provide continuous service from Vera Cruz, Mexico, to Panama along the western portion of Central America. Telegraph lines in 1917 amounted to 4,337 m., and telephone lines to 531 miles.

The Banco Nacional Privilegiado, established April 11 1918, made agricultural loans, and assisted in rehabilitating earthquake-destroyed areas and transacted commercial business. Its capital was owned by the Government and by native and foreign capitalists. There were four other established banks, antedating 1910, whose paper money in circulation in 1916 was 183,000,000 paper pesos. (H. I. P.)

GUBERNATIS, ANGELO DE, COUNT (1840–1913), Italian man of letters (*see* 12.667), published in his later years a series of lectures on Italian poetry (1907), and a *Dictionnaire internationale des écrivains du monde latin* (1905–6). He died at Rome Feb. 26 1913.

GUCHKOV, ALEXANDER (1862–), Russian politician, was born in Moscow in 1862. His father was a factory owner of some means, whose family came from a stock of Old Believers, who had acknowledged the authority of the Russian Orthodox Church while keeping the ancient ritual for which their forefathers had endured persecution since the days of Patriarch Nikon. Guchkov's mother was French. He studied history and humanities at the university of Moscow, and, after having gone through his military training in a grenadier regiment, left for Germany where he read political economy in Berlin under Prof. Schmoller. Academic studies were, however, not suited to his active and adventurous character. He gave them up and started travelling. He rode alone on horseback through Mongolia to western Siberia, and narrowly escaped being slaughtered by a mob. During the Boer War 1899–1902 he volunteered for service against the English and joined Gen. Smuts's commando. He was shot in the leg, picked up by the English, and successfully treated, although he remained slightly lame. He was elected by the Moscow municipal Duma to be a member of the executive (Uprava), and took active part in the self-government of the city. During the Russo-Japanese War he served in the Red Cross and in the Municipal Union for the organization of hospitals; he was left to take care of the Russian wounded after the battle of Moukden, and showed much dignity and efficiency in the performance of his arduous duties. When the first Russian revolutionary movement developed in 1905 he took part in the meetings of Zemstvo representatives, but did not join the Cadets, whom he considered to be too doctrinaire and cosmopolitan. Together with D. Shipov, E. Trubetzkoy and N. Lvov, he founded the Octobrist party, in the hope that the Tsar's Government would recognize the necessity of great reforms and work with the moderate Liberals of the Zemstvos while safeguarding the monarchical principle. Stolypin was for some time in sympathy with that programme, and even contemplated the formation of a Ministry strengthened by leaders of public opinion, of whom Guchkov, Count Heyden and N. Lvov would have been prominent members. When this project came to grief, Guchkov continued to support Stolypin. In the third Duma, elected on a restricted franchise, the Octobrists assumed the leading rôle. After Khomiakov's resignation in 1910 Guchkov was elected speaker. He attacked with patriotic eloquence the "irresponsible influences" at Court and the shortcomings of the Ministry of War in preparing for the inevitable conflict with Germany. As Stolypin became more and more violent and reactionary, the Octobrists lost their standing ground, and Guchkov eventually resigned the presidentship of the Duma. In the elections to the fourth Duma he failed to secure a seat. He came again into prominence, however, during the World War. He was put in charge of the Red Cross organization on the German front, and it fell to him to search for the corpse of the unfortunate Samsonov. When the campaign of 1915 had disclosed the incredible inefficiency and corruption of the Russian War Office, Guchkov threw his whole energy into the work of refitting the army on the technical side. He was one of the principal workers and leaders of the mixed committees for the defence of the country, formed with the help of the Zemstvos and towns. He was not content with laying the blame at the door of the effete War Office, but deplored the apathetic way in which the Tsar passed the time at headquarters, without any clear political plan, holding on supinely to formalism and routine, yielding to the spasmodic interference of the Empress.

When the March Revolution of 1917 broke out Guchkov was called in to take charge of the Ministry of War. Together with Shulguin, he submitted the Act of Abdication for signature to Nicholas II. He was powerless against the mounting flood of desertion and demoralization in the army, and he was the first of the ministers to resign in despair. In the "emigration" he found himself without proper place and influence. He would have liked to organize a big move against the Bolsheviks from the west, but such a move could not be made while the Entente Powers were resolved to keep Germany out, and while they sympathized with all the new organizations hostile to Russia—Esthonia, Latvia and Poland. Later he took refuge in Paris, where he pleaded for a national reunion of all parties against the Red tyrants. (P. Vi.)

GUERRINI, OLINDO (1845–1916), Italian poet (*see* 12.672), died at Bologna Oct. 21 1916.

GUIANA.—(For BRITISH GUIANA *see* WEST INDIES, vol. 32.)

DUTCH GUIANA (*see* 12.680). The pop. of Dutch Guiana, excluding the Indians and negroes of the interior, was in 1910, 86,233; in 1918, 92,284; and on Dec. 31 1919, 109,810, including Dutch, British, Hindus, Javanese and Chinese; 1,109 were Europeans. In 1910 the pop. of Paramaribo, the chief city, was 35,346; in 1919 it was 36,038.

The country grants full religious liberty and in 1918 there were 24,624 Moravian Brethren, 20,850 Hindus, 19,698 Roman Catholics, 12,489 Mohammedans, 9,733 Reformed and Lutherans and 847 Jews. In 1910 there were 25 public schools with 2,889 pupils and 38 private schools with 6,016 pupils; in 1918 there were 30 public schools with 3,806 pupils and 43 private schools with 6,724 pupils. The chief agricultural products are sugar, rice, cacao, maize, coffee and bananas. Of these sugar is the most important. Rum and molasses are produced in large quantities. The following table shows production:—

	1910	1918
Sugar	26,433,220 lb.	26,588,509 lb.
Rice	4,386,140 lb.	8,260,560 lb.
Cacao	3,702,600 lb.	4,152,940 lb.
Maize	2,911,260 lb.	4,121,920 lb.
Coffee	445,060 lb.	4,076,600 lb.
Bananas . . .	462,200 bunches	733,800 bunches
Rum	210,779 gal.	294,805 gal.
Molasses . . .	43,356 gal.	3,709 gal.

In 1910 the gold production was 18,745 oz.; in 1917, 25,869 ounces. In 1910 the production of balata, a species of gutta-percha, was 1,495,342 lb.; in 1917 it was 1,952,643 pounds. The country's exports and imports were valued as follows:—

	1910	1917
Exports	£692,700	£732,216
Imports	614,121	632,442

In 1910 there entered 240 vessels of 210,998 tons and cleared 243 vessels of 215,391 tons. In 1917 there entered 133 vessels of 182,788 tons and cleared 133 vessels of 185,562 tons. The local revenues are not sufficient to meet expenditures, and the Dutch Government makes up the annual deficit by subventions.

	1910	1920	1921 (est.)
Expenditures . .	£555,899	£425,040	£691,067
Local revenues . .	479,786	296,753	261,560
Subvention . . .	76,113	128,287	174,125

In 1920 there was only one railway, extending from Paramaribo to Macami, about 90 m. in length. At that time, in addition to papers published in Dutch, there was an English weekly, *The New Paramaribo Times*. The Dutch force in the country averages some 250 officers and men.

French Guiana (*see* 12.681). The pop. of French Guiana, excluding Indians and negroes, was, in 1911, 49,009; in 1918 it was only 26,325. In addition the country has many convicts deported from France; those in 1918 in the penal settlement numbered about 9,000. Cayenne, the chief city, had, in 1911, 13,527 inhabitants; in 1919 the population was 13,609. The prevailing religion was Roman Catholic.

In 1910 there were 24 primary schools with 2,230 pupils; in 1918 there were the same number of primary schools but with 2,003 pupils. In the latter year there were also in the penal settlement 4 schools with 163 pupils. The country produced few agricultural products, the total cultivated area being in 1919 only about 8,800 acres. Sugar, coffee, cacao, maize, potatoes and bananas were produced in small quantities. Rosewood extract and balata were among the exports. The most important industry was gold-mining, for which concessions are granted by the Government. In 1910 there were produced 123,168 oz., and in 1918, 80,477 ounces. Of exports France takes the largest part, averaging 66%, Switzerland 30%, Great Britain 2%, and the United States 1%. Of imports France and her colonies send about 70%, Great Britain and her colonies 17%, and the United States 7%. Of exports gold averages 90%. The value of exports and imports was as follows:—

	1910	1918
Exports	11,567,168 fr.	15,321,697 fr.
Imports	12,213,420 fr.	15,308,526 fr.

The local revenues do not as a rule equal expenditures and the home country makes up the deficit. In 1911 France's expenditure on the colony was 6,497,394 fr., including 5,884,000 fr. for the penal settlement. In 1920 the chief towns were connected by telephone and telegraph line between Cayenne and the Maroni, and the Compagnie Française des Cables Télégraphiques owned lines to Paramaribo, the Antilles and Pará. In 1920, besides small railway lines to the gold-mines, there was a line from St. Laurent du Maroni to St. Jean. In 1919 the French military force in the country consisted of 150 officers and men.

GUILD SOCIALISM, the name given to a school of socialist thought which originated in England early in the 20th century, and has since spread to other parts of the world, particularly to the English-speaking countries—the United States, Australia, New Zealand and South Africa—and to Japan. As its name implies, it had, in the minds of those who originated it, a definite relation to the forms of industrial organization which existed throughout the mediaeval world, and it was an attempt to apply to the solution of modern industrial problems certain of the principles which were in active operation in the economic organization of mediaeval society. This does not mean that Guild Socialism is an attempt to restore the mediaeval guild system, or that it has any necessary relation to the restoration of a system of hand craft in place of the modern system of machine production. In harking back to the mediaeval organization of industry, Guild Socialists for the most part have in mind not the forms of production which prevailed in the Middle Ages, but the mediaeval principle of industrial self-government.

The origin of the Guild Socialist movement is to be found in *The Restoration of the Gild System* (1906), a book written by A. J. Penty, the well-known architect and craftsman, and in an article published at about the same time in the *Contemporary Review* by A. R. Orage, editor of the *New Age*, which was, during the following decade, very closely associated with the guild propaganda. In both these articles Guild Socialism appeared in an essentially preliminary form, and the emphasis was laid, far more than by the more recent guild writers, on an actual restoration of the mediaeval system. Mr. A. J. Penty, who has perhaps the best claim to be regarded as the originator of the modern guild movement in this form, took the craftsman's point of view and set himself in direct hostility to the modern systems of large-scale production and trading.

From 1906 to 1912 the guild idea developed gradually and almost unnoticed in the columns of the *New Age*; but during this period a gradual transformation of the theory was taking place, and the emphasis was coming to lie, not upon the return to craft organization or the restoration of a system closely similar to that of the Middle Ages, but upon the utilization of the modern trade-union and working-class movement as the basis for a system of industrial self-government, directly related to modern conditions and to large-scale production. During this stage the propaganda for the "restoration of the gild system" was developing into the propaganda of *National* Guilds, the emphasis on the word "National" indicating the necessity for a different kind of guild system corresponding to the "National Economy" of modern times.

This transition was made definite, and the first attempt to expound the new guild theory as a complete system of socialism began to be made in the *New Age* in 1912, when a series of articles, subsequently reprinted in the volume, *National Guilds*, which was written by S. G. Hobson, and edited by A. R. Orage, was published week by week. It was with the publication of these articles that the guild theory first became a definite force in the British socialist movement.

While this process of theoretical development was going on the situation in the British industrial world was rapidly changing. The earlier years of the 20th century were years of comparative industrial tranquillity, during which the main attention of the working-class movement was concentrated on political questions and on the building-up of the Labour party. From 1909 and 1910 onwards, however, a big wave of industrial unrest passed over the country. Big strikes broke out in a number of the most important industries, and a great stimulus was given to the movement for wider industrial combination. This industrial ferment also served to arouse a corresponding ferment in the realm of ideas. New socialist theories, based mainly on the working-class industrial organizations, sprang rapidly into prominence, and in particular the "Industrial Unionist" ideas, which had entered Great Britain from America a few years earlier, and the syndicalist ideas derived from contemporary developments in the French labour movement, gained for a time a large number of adherents and excited vigorous controversy. It was in the midst of this controversy and of this industrial ferment that the guild idea developed from a "Utopian" plan for the restoration of mediaeval conditions into the outline of a practical policy of industrial self-government, appealing particularly to the British organized working-class movement. The transition, however, was not fully completed with the publication of the "National Guilds" series of articles in the *New Age*; for the influence of the *New Age*, although it was during these years steadily growing, reached only a comparatively narrow circle of intellectuals in the middle and working classes. It was when a group of the younger men took up, from 1913 onwards, the wider dissemination of these ideas, particularly through the then newly founded Labour paper, the *Daily Herald*, that the movement began to exercise an influence over larger circles. This wide appeal, moreover, also resulted to some extent in a transformation of the Guild Socialist theory itself. The theory became steadily less Utopian and remote; and its advocates applied themselves more and more to a study of actual, pressing trade-union problems, and to the working-out of proposals for the "next steps" to be taken.

Up to this point the guild movement had remained entirely unorganized, save for the small degree of cohesion secured through the medium of the *New Age*. It was in 1914 that the idea of creating an organization for the propaganda and study of Guild Socialism in England first took shape at a private conference of the younger Guild Socialists. This led, at Easter 1915, to the formation of the National Guilds League, which immediately set on foot an active propaganda in the working-class and professional movement. There is no doubt that this propaganda was largely helped by the conditions of war-time industry. Workshop problems were constantly arising owing to the operation of dilution and to war-time changes in the methods and forms of production. This situation served to awaken a critical spirit in the workers, and made them more ready to listen to plans for a change in the industrial system.

It is legitimate to say that by 1921 the guild propaganda, while it had not made any direct appeal to the larger masses of the workers in Great Britain or other countries, had come to exercise a powerful influence over a steadily growing number of the younger local and national leaders of the Labour movement and in the professions. This influence could be seen in the changing policies and programmes both of trade unions and professional associations and of socialist societies. For example, the Miners' Federation, which before the war advocated a measure of nationalization of the mines which would have placed them under direct State administration, laid before the Coal Industry Commission, in 1919, a scheme which was in substance an adoption of the Guild Socialist proposals for industrial self-government. Similar influences have been at work in other industries, notably in the post-office, on the railways and in the building industry. The influence of the Guild Socialist propaganda has also been considerable in the professions, and especially in the teaching world; while in the sphere of socialist organization the policy and programme of the Independent Labour party, the Labour party and other organizations have been largely changed so as to incorporate the idea of control of industry by the workers more or less on the lines advocated by the Guild Socialists.

The National Guilds League, which is the only organization directly representing the Guild Socialist movement in Great Britain, defines its objects in the following terms: "The abolition of the Wage System, and the establishment by the workers of Self-Government in Industry through a democratic system of National Guilds, working in conjunction with other democratic functional organizations in the community." An examination of this definition will serve to indicate clearly the main ideas upon which Guild Socialism is based.

The central idea, undoubtedly, is that of self-government in industry. The guild propaganda is above all connected with the advocacy of a change in the system of industrial administration which would result in placing the power and responsibility of administration in the hands of the workers engaged in each particular industry or service. Guild Socialists have always stressed the point that by "workers" they mean not simply the manual workers engaged in industry, but the whole necessary personnel. Indeed, the oft-used phrase "workers by hand and brain" seems to have been coined by the Guild Socialists, and was used by them from the beginning of their propaganda. They have stressed, moreover, not only the need for common action by all the workers "by hand and brain," but also the need for the recognition, in any form of democratic industrial organization, of vital functional differences between one grade of workers and another. The democracy which they have advocated has been not the government of industry by indiscriminate mass voting, but a system in which power and responsibility would be definitely related to the particular function which each individual or group of individuals is called upon to fulfil in the service of the community.

The central idea of Guild Socialism is thus the idea of functional democracy, or, in other words, the application of democratic principles to the organization of all forms of industry and public service. This advocacy is closely combined in Guild Socialist propaganda with a critique of the current conceptions of democracy. Guildsmen are fond of pointing out that the present forms of democratic organization, which may be called, for short, "parliamentary democracy based on universal suffrage," are not in reality democracy at all, and do not in fact provide for the direction of the affairs of the community by the positive wills of its members. They urge that it is useless to look for effective democracy in the political sphere as long as the principle on which industry, which so largely dominates men's lives in modern communities, is organized is the principle of autocracy, or, at best, of fundamental class divisions. In this aspect their teaching may be regarded as a precise application of the Marxian "materialist conception of history" to the criticism of modern parliamentary democracy. If industry is democratically organized, they hold that real democracy in the political sphere will follow almost as a matter of course; but, as long as men, in their daily work, are compelled to submit to external dictation and have no recognized voice in the ordering of their service, these class conditions, they hold, will inevitably reproduce themselves in the political sphere. Guildsmen say that "economic power precedes political power."

The central object, then, of the Guild Socialists is to establish democracy in the sphere of industry, and thereby to secure that it shall be applied throughout the whole sphere of social organization. In advocating such a change they recognize that their hope of success rests on relating their ideal definitely to actual movements existing within the world of capitalism, but capable of being so transformed as to supplant capitalism and replace it in the organization of industries and services. They have therefore always based their propaganda directly upon the organizations which the manual and professional workers have created for the purpose of protecting their interests and improving their position under the wage system, and they have sought to persuade these organizations to accept the principle of industrial self-government, and to work for the realization of it by endeavouring, in proportion as their power increases, to extend their actual control over capitalist industrialism. Mention has been made above of the transformation which has taken place in the programmes of many trade unions and other working-class bodies, largely under the influence of Guild Socialist ideas. The members of these bodies, from regarding the purpose for which their organizations are built up as limited to the protection of their members' interests under the wage system in face of those by whom they are employed or the securing of useful legislation, are gradually broadening their conception of the function of these organizations so as to include the assumption of direct "control" and responsibility for the organization of industry. Nor is this influence manifest only in the changing programmes of the working-class organizations, but also in their positive policy and action. It was particularly plain in the "shop stewards' movement" in the British engineering and kindred industries, which, during the war, endeavoured to establish in the workshops a wider measure of direct trade-union "control of industry." It is also manifest in the widening of the range of industrial disputes, and in the putting forward by the unions of claims which involve the recognition of their right to interfere and negotiate on behalf of their members in connexion with questions of "discipline" and "management." It appears further in demands that foremen and supervisory workers should be members of the trade unions, and even that they should be appointed by, and responsible to, those who have to work under them.

The most remarkable outcome of the guild propaganda, and also the only important practical experiment which the Guild Socialists have so far been able to make, is to be found in England in the Building Guild movement. Towards the end of 1919 a movement arose, largely fostered by the local branch of the National Guilds League, among the building operatives in the Manchester area, for the formation of a guild which would be prepared directly to undertake work, especially on behalf of the public authorities, in the sphere of house-building. A local Building Guild organization, governed by representatives from the local management committees of the various building-trade unions, was set up in the Manchester area, and the movement spread very rapidly throughout the country, so that during the following year something like a hundred local Building Guild committees, linked up in a central organization, were brought into being. These guild organizations proceeded to make tenders to the local authorities for the carrying-out of the housing schemes which were then being brought forward in most parts of the country, and after some difficulty the Ministry of Health was induced to sanction a limited number of contracts on an experimental basis. In March 1921 work was already proceeding on about 20 such contracts.

Some of the difficulties which arose in the starting of the Building Guild movement serve to illustrate very clearly certain of the fundamental principles underlying the Guild Socialist movement. When the Building Guilds first tendered for contracts they were asked by the local authorities and by the Ministry of Health, as a private contractor would have been asked, what "financial guarantees" they were willing and able to give. They replied that they would give no financial guarantee, even if they were in a position to do so, since their intention was not to produce for profit, but to produce for the public absolutely at cost price. There is in the constitution of the Building Guilds not only no provision for capital or for interest or profits, but a definite clause which prohibits the distribution, under any circumstances, of any form of dividend or bonus or profit to the workers. This is one of the features which clearly differentiate the Building Guild movement from the movement for "Coöperative Production" with which it is sometimes confused. In their refusal to give financial guarantees the Building Guilds stressed the fact that they were in a position, as a private contractor was not, to give a "labour guarantee," *i.e.* a guarantee that they could and would supply all the labour, including technical and supervising ability, necessary for the execution of the job. Stress has been laid, throughout the guild propaganda, on the idea that the power of the workers is based on their possession of a "monopoly of labour," and the Building Guild movement itself is based on this monopoly, largely possessed by the trade unions which control the Building Guilds.

In the second place, difficulties arose because the Building Guilds firmly insisted that all workers employed by them must have security against unemployment, and must receive full-time wages irrespective of bad-weather conditions, which so often cause an interruption of building work, of sickness, and of the other factors which serve to make the wages of the worker, especially in the building industry, vary so largely from week to week, and thus throw him into a position of permanent insecurity. This condition was accepted in the contracts actually signed by the Building Guilds and endorsed by the Ministry of Health; but considerable trouble subsequently arose over it in consequence of the opposition of the building-trade employers, who regarded it as "preferential treatment."

This point is very important, and is fundamental to the whole guild theory. In the statement of objects of the National Guilds League quoted above, it will be noticed that the Guild Socialists set out first of all to secure the "Abolition of the Wage System." A part of what they mean by this is that the conditions under which the workers at present receive wages involve permanent insecurity and are therefore degrading, and such as to place the worker at the mercy of the "governing class in industry." Guildsmen, therefore, have always made the principle of "continuous pay," or, as it is sometimes called, "industrial maintenance," a fundamental part of their propaganda. They have insisted that all those who are willing to do service for the community have a right to continuous pay in return for that willingness to serve, and that the maintenance of the "reserve of labour" is a necessary and legitimate charge upon the various industries, and forms a real part of their costs of production. This principle of "industrial maintenance" has undoubtedly been one of the most favourably received and influential aspects of the Guild Socialist policy.

Guildsmen thus claim the recognition, not only of the principle that the responsibility for industrial administration should be placed in the workers' hands, but also of the principle of economic security for every worker in the widest sense. They recognize fully that this involves changes far more fundamental than any mere alteration of the machinery of industrial administration. They are not simply Guildsmen: they are also Socialists. They are in agreement with other schools of socialist thought in holding that it is necessary to transfer the means of production and distribution and exchange from private hands to some form of communal ownership. They are, however, strongly hostile to the older schools of collectivism or "State" Socialism, which contemplate the nationalization of industry in a sense which would involve its direct administration, after transference to public ownership, by the governmental organization of the political State. Guildsmen have always laid great stress in their propaganda on the evils of bureaucracy and political control in industry; and their system of direct workers' control is put forward as an alternative to State administration.

This, however, does not mean that they hold that the entire control of the various industries and services ought to pass into the hands of the workers organized as producers. They have always contemplated the exercise of direct producers' control over administration in close conjunction with a control over policy in which the representatives of the organized citizen-consumers would have an effective voice. This is what they mean when they say that self-government in industry will be exercised through guilds "working in conjunction with other democratic functional organizations in the community."

Guildsmen differ in their conception of the precise changes which are required in order to give effect to this principle. They are united in recognizing that the working-class coöperative movement is destined to play an important part as the representative of the organized domestic consumers in the society to which they look forward. But there is much difference of opinion amongst them concerning the character and rôle of the State. The majority in the National Guilds League has taken a view concerning the State which is closely similar to that of the Marxians. They regard the State as a form of capitalistic organization—"an Executive Committee for administering the affairs of the whole capitalist class"—and they look forward to its supersession "by forms of organization created by and directly expressing the will of the workers themselves. It (the N.G.L.) holds, however, that the exact form of organization required in any country cannot be determined in advance of the situation which calls it into being." There is a minority, however, in the Guild Socialist movement which holds that the State is capable of adaptation to the function of acting as the political representative of the community in a state of society in which economic organization is based on the Guild Socialist principle of industrial self-government.

The Guild Socialist theory concerning the precise forms of socialist organization which would replace the present machinery of industry and the capitalist State is still in the making, or rather, to some extent, in the unmaking. Different Guild Socialist writers have put forward different views on this question; and on the whole the recent tendency of the Guild Socialist movement has been towards the abandonment of any attempt to define at all precisely the structure of the future society, and towards a concentration rather upon the principles and policies which are to guide the transition to it, preserving only in general outline a common conception of the character of the future organization. The movement has undoubtedly been influenced, as it has been sharply divided, by events in Russia from 1917 onwards. The National Guilds League in England has affirmed its "solidarity with the Russian Soviet Republic," but has refused to commit itself as an organization to Communist principles, or to declare for the adoption, in Great Britain, of methods similar to those which the Communists have applied in Russia. It is important to point out that the Guild Socialists and their organization, the National Guilds League, must not be regarded as a party or group at all parallel to other socialist organizations such as the Independent Labour party or the Communist party. Guild Socialists in many cases belong to, and work within, one or other of the socialist parties; and they are held together not so much by a common attitude on the question of socialist political policy, as by a common belief as to the principles which must guide the making of the new society—principles which are compatible with varying views as to the policy which it may be necessary to pursue in the political field. Differences on this question of method have not prevented the guildsmen from working together in their endeavour to promote in the trade-union world, and to a less extent in the coöperative movement, a policy designed to strengthen the demand for workers' control, and to bring about substantial encroachments by the workers on the capitalist control of industry, even while the capitalist system as a whole remains in being. Mention has been made before of the development of the Building Guild organization. Side by side with this practical object-lesson, guildsmen have worked out policies for adoption in those industries in which it is not possible at present to establish guild organizations in rivalry with the existing capitalist system. They have supported, in the case of the railways, the mines and certain other industries, demands for nationalization, always, however, coupling their support with the demand that nationalization must be accompanied by a large measure of democratic control over administration. At the same time they have pressed, in industry generally, the policy known as "encroaching control." "Encroaching control" means the attempt by the trade unions, while not at once overthrowing capitalism or dispossessing the present owners of the means of production, to transfer into the hands of the organized workers as many as possible of the functions of control which are at present exercised by employers or their representatives. The two outstanding forms of this propaganda of "encroaching control" are to be found: (*a*) in the demand put forward by the guildsmen for the election of foremen and supervisors by the rank-and-file workers; and (*b*) in the policy known as "collective contract."

(*a*) Guildsmen are never weary of urging that in place of the present system, under which the foremen and industrial supervisors are appointed by the employers, usually from the ranks of the manual workers, the workers, through their trade unions, should take into their hands the right to appoint their own foremen and supervisors. This demand has not at present been conceded save in an insignificant number of instances; but the trade unions have taken certain steps towards it by securing, in numerous instances, the dismissal of foremen to whom their members have taken objection. The carrying-through of this policy of democratic election of foremen is closely bound up with the policy of "collective contract."

(*b*) By "collective contract" is meant a scheme capable of assuming a number of different forms, under which the whole of the workers in a particular shop, factory or department would make with their employer a single agreement as to their terms of service, the amount and character of their output, and the payment for it. Instead of the present system, under which the employer engages and pays each worker individually, and appoints his own representatives to exercise discipline in the workshop, the trade unions themselves, under this system, would make a contract with the employer to supply the necessary labour, including workshop supervision, and to carry out the work required, and would thus control engagements and dismissals as well as workshop discipline. The employer, instead of paying each worker individually, would pay to the union, or to the works committee on its behalf, a lump sum, which the workers would then distribute amongst themselves in such a way as they might agree upon. By this arrangement, it is contended, the employer would be directly excluded from a certain sphere in which he now exercises control. The workers would thus not only get a valuable lesson and experience in the work of controlling industry, but would also greatly strengthen their position for a subsequent further assumption of power, which would involve the winning of industrial control over a wider area, including commercial as well as purely productive operations. This system, too, has not yet been adopted anywhere in full, but certain approximations to it have been made.

The guildsmen stress, in the whole of their propaganda, the need for an appeal to a new motive in industry if men are to be persuaded to put out their best efforts, and to do their best work in the service of the community. They claim that in the past, since the coming of large-scale industry, production has been secured mainly by the operation of two motives—fear (of unemployment and starvation) and greed (for higher remuneration secured, *e.g.* by "payment by results"). They contend that these two motives are showing themselves more and more inadequate to secure the continuance of production, and that this is shown both by the increasing frequency and severity of industrial disputes, and by the diminished willingness on the part of the workers to do their best. They maintain that a different spirit can be made to prevail in industry only if two conditions are satisfied. The first of these conditions is that the worker must have a sense that, in putting his best into his work, he is serving, not the private interest of any individual, but the whole community, and that his work is being directed to that end which will most conduce to the common benefit; the second condition is that the responsibility for doing his best must be placed upon the worker himself, and that he must be given freedom, in the form of self-government, in the organization of his work. These two ideas are often put together in the phrase "free communal service," which is regarded by guildsmen as the condition of the creation of reasonable industrial order. It is recognized that such an order would make higher demands upon the will and good-will of the mass of the people than the capitalist system; but guildsmen contend that, if the right appeal is made and the above conditions satisfied, the workers will rise to the occasion and will be prepared to do their best in the service of the public, because they will feel that they "count," and that the responsibility for the good conduct of industry rests directly upon them. Guild Socialists always insist that the power which goes with responsibility must be diffused to the widest possible extent among the whole mass of the people, and that this is the necessary condition of democratic efficiency and healthy social organization.

REFERENCES.—There is a large and growing literature dealing with Guild Socialism. See *National Guilds*, by S. G. Hobson; *Guild Socialism Re-stated*, by G. D. H. Cole; *The Meaning of National Guilds*, by M. B. Reckitt and C. E. Bechhofer; *Old Worlds for New*, by A. J. Penty; *Self-Government in Industry*, by G. D. H. Cole; other works by Hobson, Cole and Penty; and the various publications of the National Guilds League (39 Cursitor St., London, E. C. 4). For hostile criticism see *Guild Socialism*, by G. C. Field; *Our Social Heritage*, by Graham Wallas; and *The Case for Capitalism*, by Hartley Withers. For the social theory of Guild Socialism see *Social Theory*, by G. D. H. Cole; *Authority, Liberty and Function*, by Ramiro de Maeztu; *The Sickness of an Acquisitive Society*, by R. H. Tawney; and *Roads to Freedom*, by Bertrand Russell. For its industrial policy see *Chaos and Order in Industry*, by G. D. H. Cole; *The Nationalization of the Mines*, by Frank Hodges, and the evidence volumes of the Coal Industry Commission, 1919 (evidence of Cole, Straker, Slesser, and others). The National Guilds League publishes a monthly journal, *The Guildsman*, in which questions of Guild Socialist and trade-union policy are regularly dealt with, and news given of the movement in various countries. (G. D. H. C.)

GUILLAUMAT, MARIE LOUIS ADOLPHE (1863–), French general, was born at Bancqneuf (Charente Inférieure) on Jan. 4 1863. He entered the École de St. Cyr on Oct. 31 1882 and was appointed a sub-lieutenant of infantry on Oct. 1 1884. Four years later he was promoted lieutenant. In Nov. 1893 he became a captain and was transferred to the 147th infantry regiment. In 1903 he was appointed professor of military history at St. Cyr, and later became lecturer on infantry tactics at the École de Guerre. He was promoted lieutenant-colonel in 1907 and colonel in 1910. In Jan. 1913 he became director of infantry at the Ministry of War, and on Oct. 8 of the same year was made a general of brigade, continuing to hold his appointment. On June 14 1914 he became *chef de cabinet* when M. Messimy was War Minister, but on the outbreak of the World War he was placed at the disposal of General Joffre. On Sept. 2 1914 he was given command of the 33rd Division, becoming, in the following Dec., a temporary general of division. On Feb. 25 1915 he took part in the defence of Verdun, in the operations attending the German offensive of Feb. 1916, and in the French (Somme) offensive of the same year. He was confirmed in his rank as a general of division on Dec. 23 1915. In Dec. 1916 he took over command of the II. Army from General Nivelle when that officer was appointed commander-in-chief. Twelve months later (Dec. 14 1917) he succeeded General Sarrail as commander-in-chief in Salonika. In this capacity he had the difficult task of restoring the *moral* of a heterogeneous force that had become disorganized through inaction, and of reconciling the divergent military interests of the Allies in this theatre. He drew up the offensive plan which Franchet d'Espérey afterwards carried out so brilliantly, but in June 1918 was suddenly brought back to

Paris to act as military governor when the German summer offensives threatened to reproduce the conditions of the Marne. When the tide turned he actively supported the proposed Salonika advance by pressing its advantages on the War Council, and it was with his aid that Franchet d'Espérey obtained authority to advance. In Oct. 1918 he was given command of the V. Army. He was awarded the Grand Cross of the Legion of Honour on July 10 1918 and the médaille militaire on Oct. 3 1918. On Jan. 30 1920 he was appointed to the Superior War Council.

GUISE, BATTLE OF.—The name of the battle of Guise is given to the battle fought by the French V. Army on Aug. 29 1914, during the first Allied retreat, with the object of delaying the advancing Germans so as to take pressure off the British and to gain time for the debouchment of the newly formed French VI. Army.

By Aug. 25 the succession of battles fought in Lorraine, the Ardennes and on the Sambre had produced an atmosphere of optimism at German general headquarters. The Supreme Command was, however, led astray by the magic of imagination and mistook the shadow of victory for the reality, although it is true that the Germans were somewhat in advance of their timetable. Gen. von Moltke considered that the great decisive battle in the W. had been fought and ended in Germany's favour, and that the moment had arrived when forces might safely be sent to the eastern front. It was decided to send two corps from France to reinforce the VIII. Army in East Prussia. Gen. von Moltke's first intention had been to take these reinforcements from his left wing, but both the VI. and VII. Armies reported that they were opposed by superior numbers, and it was therefore decided to send two corps from the right. Accordingly the XI. and Guard Reserve Corps and a cavalry division received orders early on the 26th to proceed to the eastern front.

The bracing atmosphere of optimism breathed by Supreme Headquarters in their peaceful hotel at Coblentz, some 200 m. from the battlefield, had at least one rarefied "pocket" in the front line. On Aug. 26 Gen. von Bülow, the commander of the II. Army, was bewailing the fact that the III. Army on his left was not conforming to the south-westerly wheel of the II. Army, and that there was an awkward gap between the two. Further, on the 27th, the I. Army (which since Aug. 20 had been under Gen. von Bülow's orders) was suddenly removed from the control of the II. Army by order of the Supreme Command, thereby making the coöperation of the three right-wing armies still more difficult. On the side of the Allies, neither far behind the fighting nor in the front line was there any optimism, and indeed there was little to suggest a roseate view of the situation. Failure had dogged their early efforts, and the whole left and centre were being forced back. This circumstance, however, was not without its advantages, for it ensured that the Allied commanders-in-chief were in far closer touch with their forces than was the case on the German side. Far from attempting to deal with the situation from a couple of hundred m. in rear, Gen. Joffre and Field-Marshal Sir John French were on Aug. 26 deliberating within sound of the guns, and with the assistance of the French army commander most nearly concerned. The meeting took place in the billiard room of the house at St. Quentin which was serving as the headquarters of the British commander-in-chief. The moment was one of particular anxiety for Sir John French, for while awaiting the arrival of Gen. Joffre and Gen. Lanrezac—the commander of the French V. Army—the British field-marshal received the news that his II. Corps had not been able to comply with his orders to fall back from the line Cambrai–Le Cateau, and was now committed, and alone, to a battle. Staff officers were sent to Gen. Smith-Dorrien with peremptory orders to break off the fight and to resume the retreat forthwith. It was now nearly eleven o'clock, and shortly afterwards Gen. Joffre arrived with his chief-of-staff. He was followed by the commander of the French V. Army, and a discussion of the situation immediately began.

During the night which had preceded the conference Gen. Joffre had issued a new directive, to the effect that, the offensive which he had projected having proved incapable of realization, "further operations would be carried out with a view to forming a mass of manœuvre on the left flank to carry out an offensive." This mass of manœuvre was to be made up of the French IV. and V. Armies and the British, plus a new army—the VI.—to be made up of units moved by rail from other sectors, chiefly from the right. In theory these orders formed the basis of the discussions at the conference, though, as it happened, the rapid march of events had prevented orders being thoroughly assimilated by some of the recipients. Nothing very definite indeed seems to have been decided at the meeting beyond the understanding that the retreat was to be continued as slowly and deliberately as possible, until the Allies should find themselves in a favourable position to make a firm stand and take the offensive. Immediately after the conference Sir John French set out to ascertain the fate of his II. Corps, and, having learnt of the hard fighting which it had experienced at Le Cateau (*see* FRONTIERS, BATTLES OF: Sec. 5), he issued orders for the British army to fall back to the line La Fère–Noyon, and during the evening shifted his headquarters to the latter town.

From the evidence of his own published account it is clear that Sir John French felt strongly on two matters. The first was the action of the French V. Army on his right. He considered that the British had been placed in a position of isolation both at Mons and immediately afterwards "by the very sudden change of plan and headlong retirement of the V. Army." He had indeed pointed this out to Gen. Joffre, in the presence of Gen. Lanrezac, at the conference at St. Quentin. The other factor on which he had formed decided views was "the shattered condition of the troops which had fought at Le Cateau." In a further interview between the two commanders-in-chief on Aug. 27 Gen. Joffre showed himself most sympathetic and "understanding" in reference to the special position of the British, and promised that the French V. Army would be directed to take energetic action to take the pressure off it.

It was now the forenoon of the 27th, and the French V. Army, in accordance with Gen. Joffre's directive of the 25th, was retiring over the Oise above Guise; and orders had actually been drafted for the continuance of the retirement next day to the line Montcornet–Marles–Ribemont. Shortly before one o'clock on the 27th, however, an officer arrived from French general headquarters with verbal instructions to the effect that Gen. Lanrezac was at once to attack towards St. Quentin with vigour, "sans s'occuper des Anglais." As the V. Army was retiring almost due S., and in several columns, it would necessarily take some time to effect the change of front required for the offensive ordered, and this was pointed out to the envoy. The envoy made an irritating innuendo; a discussion of rather a tart nature ensued; Gen. Lanrezac's exasperation triumphed over his prudence, and he expressed himself rather freely on what he considered the indifferent work of French general headquarters.

Nightfall of the 27th found the French V. Army behind the Oise and Thon, with its left below Guise and its right about Rumigny, facing north-east. Before the offensive against St. Quentin could be carried out it was necessary to transfer the bulk of the army below Guise and to establish it opposite its objective; that is to say, facing west. This preliminary movement, which would entail a flank march within range of the enemy, and was further complicated by a change of front of more than a right angle, was undoubtedly a most delicate operation. A further difficulty was added by the fact that the Oise would give only a limited protection to the movement, inasmuch as it was not a serious obstacle above Guise. Again, the more the V. Army closed in to its left the wider would become the gap between it and the IV. Army on its right. These factors ruled out of court any prospect of an offensive before the 29th.

On the 28th the headquarters of the V. Army were at Marle, and there about noon Gen. Joffre came to see Gen. Lanrezac. The latter described to his chief the dispositions he was making, pointing out at the same time the exposed situation in which his right flank would find itself while his main body was committed to the offensive against St. Quentin. These observations do not appear to have been taken in good part by the commander-in-chief, who became very angry. He peremptorily ordered the V. Army commander to proceed with the offensive against St. Quentin; and *menaça le général Lanrezac de lui enlever son commandement.*

Before discussing the battle of Guise from the tactical point of view it is necessary to have a clear idea of the position of the forces engaged on either side. On the evening of the 27th the front of the V. Army from right to left was generally on the line Rumigny–Etreaupont–Guise–Origny St. Benoite. The main body, consisting of the I., X., III. and XVIII. Corps (in this order from right to left), lay between Aubenton and Guise, covered on the right by the reserve division of Gen. Bouttegourd and the cavalry of Gen. Abonneau, the latter being between Rumigny and Rozoy. On the left were two reserve divisions under Gen. Valabrègue holding the passages over the Oise at Guise and below that town. To bring about the transfer of strength to the left, and to effect the change of front required for the offensive ordered, orders were given for the following movements to take place on the 28th. Gen. Valabrègue was to close to his left and hold the left bank of the Oise S. of Moy. The III. and XVIII. Corps, each reënforced by an African div., were to take post along the Oise between Origny St. Benoite and Moy. The I. Corps was to move to Sains and form the army reserve. The X. Corps was to take post along the Oise E. of Guise. The cavalry of Gen. Abonneau, to which was to be attached the reserve division of Gen. Bouttegourd, was still to operate on the right. On the left of the French V. Army the British were, throughout the 28th, continuing their retirement, and by the evening of that day were on the line La Fère–Noyon, with a gap between the I. Corps on the right and the II. on the left.

To turn now to the Germans, the two armies likely to come into collision with the French V. Army were the I. and II., of which the former under Gen. von Kluck was on the right. After the battle of Le Cateau that army, by the evening of the 26th, was on the line Hermies–Crèvecœur–Caudry–Busigny, and by the evening of the following day it was, generally speaking, on the front Combles–Estrées. Unlike Gen. von Bülow, the commander of the I. Army was being affected by the heady atmosphere of optimism. The victory of Le Cateau obviously required following up, but a more grandiose scheme was selected, and Gen. von Kluck's one idea now seems to have been to march S.W. until he should overlap the Allied left. Accordingly on the 28th his army switched off from the pursuit of the British II. Corps, moved in the direction generally of Peronne, and by evening was in possession of the passages over the Somme between Feuillières and St. Christ. Thence he moved still S.W., becoming involved in fighting with French forces of Gens. d'Amade, Maunoury and Sordet, missing his chance of "eating up" the British II. Corps, and incidentally vanishing from the picture so far as the battle of Guise is concerned.

As for the German II. Army, on the evening of the 27th it was on the line St. Souplet–Wassigny–Etreux–Laschelle–Buironfosse–La Capelle, with its corps (working from right to left) disposed as follows:—VII. (less 13th Div.), X. Reserve, X. and Guard. During the day the order which had put the I. Army under the orders of the commander of the II. was cancelled by Supreme Headquarters, and Gen. von Bülow was beginning to feel somewhat isolated. On his right Gen. von Kluck had begun his eccentric march, while on the left the III. Army was being sucked eastwards to assist the IV. which was in difficulties. In these circumstances Gen. von Bülow at first determined to throw forward his right so as to keep touch with the I. Army, while keeping his left in position; but early on the 28th more favourable news from the III. Army on his left led him to order the X. and Guard Corps to cross the Oise. On this day Gen. Lanrezac was making a flank march behind that river, and changing front from north-east to west. Thus the French V. Army, from being in a position to get in its blow against St. Quentin, was likely to have its own right flank attacked by the II. Army of the Germans.

Gen. Lanrezac's orders for the attack on St. Quentin on the 29th were to the effect that while the X. Corps and Gen. Abonneau's cavalry should maintain their position, the main body (III. and XVIII. Corps) was to cross the Oise below Guise and march on St. Quentin, left in front, with orders to attack the enemy wherever found. Liaison officers brought the welcome intelligence that the British I. Corps would coöperate, and accordingly Gen. Lanrezac added a paragraph to his orders to the effect that the British I. Corps would debouch from Laon at 5 A.M. and move against St. Quentin. About 2 A.M. on the 29th, however, a telephone message was received to the effect that such coöperation was impossible, and accordingly Gen. Lanrezac ordered the reserve divisions of Gen. Valabrègue to flank the left of the XVIII. Corps.

At daybreak on the 29th the main body of the V. Army began to cross the Oise above and below Origny. For a time all went well, but at nine o'clock a telegram from the X. Corps announced the fact that it had been heavily attacked by German troops from the line Guise–Englaucourt; in other words, by the German X. and Reserve Corps. The message went on to say that the left of the X. Corps was holding its own but that the right had been compelled to give ground. Gen. Lanrezac had again to modify his plan and to issue new orders, of which the tenor was as follows. The objective was still to be St. Quentin, but first of all the enemy attacking the X. Corps was to be thrown back over the Oise. The left flank was still to be protected by the reserve divisions of Gen. Valabrègue. The XVIII. Corps was to continue its advance towards St. Quentin but was to avoid serious engagements with superior forces. The III. Corps was to maintain its advanced troops W. of the Oise, so as to facilitate the eventual crossing of the river and the connexion with the XVIII. Corps on its left. The main body of the corps was, however, now to face N. and attack Guise. The X. Corps was to attack on the right of the III. Corps. The I. Corps now in reserve about Sains was to be ready to assist the X. Corps. The right flank was still to be protected by Gen. Abonneau's cavalry division.

It was, however, impossible to carry out this new plan, for by the time the orders had reached the various commanders the X. Corps had been driven back too far to allow of an attack upon St. Quentin. Gen. Lanrezac accordingly decided to renounce definitely all idea of attacking that place and to confine his efforts to dealing with the Germans who were harassing the X. Corps. To this end he issued the following order shortly before 11 A.M.:—

> In view of the large number of Germans who have appeared E. of Guise the project of attacking St. Quentin is now renounced. It is now a question of defeating the enemy E. of Guise, and of either destroying him or at any rate of driving him back across the Oise. The XVIII. Corps and the Reserve Divisions of Gen. Valabrègue will mask St. Quentin, while the main body (III., X. and I. Corps) will make a determined attack to the north. Gen. Abonneau will leave a mixed detachment to maintain connexion with the IV. Army on the right and will then move the main bodies of his own cavalry division and of Gen. Bouttegourd's Reserve Division to Vervins ready to act against the enemy's left flank which has crossed the Oise W. of the Vervins–Avesnes road.

Gen. Joffre was present when the above instructions were drawn up, and gave them his tacit approval.

The French V. Army was now committed to two separate operations, in both of which the fighting was destined to be severe, for Gen. von Bülow had by now received definite orders from Supreme Headquarters to advance on Paris via the line Laon–La Fère. To take the fighting E. of Guise first, on the side of the Germans the Guard and X. Corps were facing the 51st Reserve Div., the X. and I. Corps and the 4th Div. of Cavalry, to which were subsequently added the bulk of the III. Corps. The German Guard Corps was operating from the line Etreaupont–Flavigny; the X. from Flavigny to Macquigny by Guise.

The morning of the 29th was ushered in by a thick mist which limited visibility for some time to three or four yards. The French X. Corps had been ordered to take Audigny, and accordingly the 20th Div. on the left moved forward against that village, while the 19th Div. followed in support on the right. The advanced guard of the 20th Div. entered Audigny, but was almost immediately attacked on its right flank, and after some stubborn fighting the French effort to hold Audigny broke down; the fighting drifted back to the neighbourhood of Sains, and it was the intelligence of this set-back which led Gen. Lanrezac to give up the attack upon St. Quentin. The German Guard Corps was endeavouring to outflank the right of the X. Corps, and by three o'clock in the afternoon the situation for the French was distinctly unfavourable. Relief, however, was afforded partly by the action of Gen. Abonneau on the right, and still more by the intervention of the I. Corps, which came into action on the left and in front of the X. Corps and eventually got into touch with the III. Corps on the left and with Gen. Abonneau on the right. The situation of the French was now sensibly relieved as a result of the orders issued by Gen. Lanrezac about 11 A.M., and about five o'clock the general offensive prescribed therein took place along the 18 m. from Origny-Vervins towards Guise. Success crowned the efforts of the French. Bertaignemont, Clanlieu, Pusieux, Richaumont and Colonfay were retaken, and the Germans were driven back towards the Oise, although on their left they still held out stubbornly. During the night the two German corps fell back across the river.

This success was, however, neutralized by the events between the Oise and St. Quentin, where the situation took an unfavourable turn for the French. The reserve divisions of Gen. Valabrègue occupied Urviller, but were in turn attacked and forced to fall back behind the Oise. The leading units of the XVIII. Corps had meanwhile reached the neighbourhood of St. Quentin, but as its left was uncovered by the retirement of the reserve divisions Gen. de Las Latrie deemed it advisable to make preparations for a withdrawal of the XVIII. Corps to the Oise, an operation which was carried out by evening.

When morning broke on the 30th Gen. Lanrezac was under no illusions as to his position. The British army had been compelled to rest throughout the 29th on the line Noyon–La Fère, and was not likely to assume the offensive on the 30th; while on the right it was probable that the French IV. Army was again in retreat. If, therefore, the V. Army should remain during the 30th in the region Vervins–Guise–Ribemont it might find itself isolated with its flanks uncovered, and also forced to face simultaneously north, west and east. Gen. Lanrezac was prepared to take the risk, but in the evening of the 30th a telephonic message (apparently in confirmation of a written order which had gone astray) arrived directing the V. Army to fall back. The commander of the V. Army therefore issued orders for his troops to gain during what was left of the 30th the high ground N. of the lower Serre and Souche. This was carried out and by the 31st the V. Army was disposed in a great semicircle round Laon.

It is admitted that the French V. Army ably carried out its task of delaying the Germans; and Sir John French, writing of the battle later, said: "On the 29th (August) a very brilliant and successful attack by the French V. Army at Guise heavily defeated three German corps and threw them back with severe loss. This had a great effect in assisting the retreat, for it not only enabled the V. Army to hold its own for some time on the Oise, between Guise and La Fère, but it considerably relieved hostile pressure on the British and on the French troops on our left." Gen. Lanrezac, however, was apparently not in favour with French general headquarters, and within a few days he was relieved of his command. (F. E. W.*)

GUITRY, LUCIEN GERMAIN (1860–), French actor (*see* 12.705). In 1920 he came to London, with his son Sacha, and made an immense success in *Pasteur*, playing himself the eminent scientist, and in his son's play *Mon Père avait Raison*.

SACHA GUITRY (1885–), also a distinguished actor, was born at Petrograd. He was the author of a number of brilliant modern comedies, of which *Tel Père Tel Fils* (1909); *Nono* (1910); *Le Veilleur de Nuit* (1911); *La Prise de Berg-op-Zoom* (1912) are other examples. He married Yvonne Printemps, herself an actress of distinction. JEAN GUITRY, another son of Lucien Guitry, and a promising actor in modern comedies, was killed in a motor accident near Deauville Sept. 11 1920.

GÜNTHER, ALBERT CHARLES LEWIS GOTTHILF (1830–1914), German biologist, was born in Württemberg Oct. 3 1830 and educated at Tübingen, Berlin and Bonn universities. He entered the British Museum in 1856 and became keeper of the zoölogical department in 1875, holding that post for 20 years. He made a special study of fishes and reptiles, and published various works on the subject, as well as contributing a section of the article *Ichthyology* to the *E.B.* He received the gold medal of the Royal Society in 1878 and of the Linnean Society in 1904. He died at Kew Feb. 1 1914.

GURKO, VASILI (1864–), Russian general, was born in 1864. He was educated in the Corps of Pages, and in 1885 was given a commission in the Grodno Hussar Regiment. On finishing his course at the Academy of the General Staff, he was appointed a general staff officer. During the S. African War of 1899–1902 he was one of the foreign military attachés on the Boer side. In the war with Japan 1904–5 he commanded a cavalry brigade and also served on the general staff. He distinguished himself and was promoted to the rank of general. Later he presided over the military-historic commission which in 1911 published "An account of the Russo-Japanese War" in seven volumes. In 1911 he was the chief of the 1st Cavalry div., with which in Aug. 1914 he advanced into Eastern Prussia. In 1915 he was the commander of the VI. Corps. His pronounced gifts and energy ensured his promotion. In 1916 he was commander of an army, and at the end of 1916, during Gen. Alexeiev's illness, he fulfilled the duties of chief of staff to the supreme commander-in-chief. Later, after the revolution, he was deprived of his appointment as commander-in-chief by Kerensky, owing both to his objections to risking an offensive with the army in its then condition of ferment and to his outspoken opinions as to the causes of this condition. Gurko was imprisoned, released, imprisoned again and finally sent out of Russia by way of Archangel, with his wife, who at once volunteered for service with the French Red Cross. She was killed in action at a dressing-station on the front on March 23 1918. General Gurko published his war memories (English edition) in 1918.

GUSTAVUS V. (1858–), King of Sweden (*see* 12.738), succeeded his father on the throne in Dec. 1907. As Crown Prince he had interested himself greatly in sport and music, and he continued as King to patronize them. When the World War broke out in 1914 and neutral countries were impelled to take counsel together, King Gustavus took the statesmanlike action of inviting the kings of Norway and Denmark to a meeting at Malmö, and on a later occasion he himself journeyed to Christiania where he had once sat as regent. During the war he exerted himself personally to ensure the maintenance of a policy of honourable neutrality. His eldest son, the Crown Prince Gustavus Adolphus (b. 1882), also devoted much time and energy to sport, and interested himself in archaeology. The Crown Princess Margaret (b. 1882), a daughter of the Duke of Connaught, died on May 1 1920; she had won the love of the Swedish people, and when she died a fund of nearly 1,500,000 kronor was quickly subscribed to consecrate her memory. King Gustavus's brother, Prince Karl (b. 1861), was president of the Swedish Red Cross; and another brother, Prince Eugene, became known as a painter of much distinction.

GUTHRIE, CHARLES JOHN GUTHRIE, BARON (1849–1920), Scottish lawyer, was born at Edinburgh April 4 1849, the son of the Rev. Thomas Guthrie, editor of the *Sunday Magazine*. He was educated at Edinburgh Academy and University, and in 1875 was admitted to the Faculty of Advocates. He was from 1881 to 1900 legal adviser to the Church of Scotland, and in 1897 became a Q.C. In 1907 he was appointed a judge of the court of session and created a life peer. Lord Guthrie was a member of the royal commissions on historical monuments in Scotland (1908) and on divorce (1909), and was chairman of the houseletting commission (1906–7). From 1910 to 1919 he was president of the Boys' Brigade of Great Britain and Ireland, and was a member of various antiquarian societies. He had been in youth a friend of Robert Louis Stevenson, and published in 1914 an appreciation of "Cummy," Stevenson's nurse. His other works include *John Knox and his House* (1898), and an edition of Knox's *History of the Reformation in Scotland* (1898), besides contributions to the memoir of his father, Thomas Guthrie (1875). He died at Edinburgh April 28 1920.

GWALIOR, SIR MAHDO RAO SINDHIA, Maharaja of (1876–), was born Oct. 20 1876, and succeeded his father, Sir Jayaji Rao Sindhia, in 1886 (*see* 12.748–9). He threw himself with the utmost keenness into the supervision of every detail of State management, endowing Gwalior with an excellent system of light railways, carrying out irrigation projects, husbanding the revenues and raising the standards of administration by unceasing vigilance. A great sportsman, on his visits to England for the coronations of 1902 and 1911 he delighted spectators at Hurlingham and elsewhere by his prowess in polo matches and other mounted sports. To his profound disappointment serious ill-health when the World War broke out prevented his service at the front; but he bent all his energies to helping the Allied cause. His two regiments and transport corps fought with distinction in France, East Africa, Egypt and Mesopotamia. A boundless and inventive generosity found scope in his constant presentation of munitions of war and princely donations to various relief funds. He took the main part in purchasing, equipping and maintaining the hospital ship "Loyalty," which carried 15,000 war patients; and provided a convalescent home at Nairobi in East Africa—to mention only a few of his gifts. He actively combated false and discouraging reports in India regarding the war. A lieutenant-general in the British army, and hon. colonel of 1st Duke of York's Own Lancers (Skinner's Horse), he was hon. A.D.C. to King George V., had the Grand Crosses of the Victorian Order, the Star of India and the British Empire; his permanent dynastic salute was raised to the maximum of 21 guns; and Oxford and Cambridge conferred upon him their hon. doctorates in law. King George V. also honoured him by becoming sponsor to his heir, George Jivaji Rao (b. 1916).

GWATKIN, HENRY MELVILL (1844–1916), English theological scholar, was born at Barrow-on-Soar, Leics., July 30 1844, the youngest son of the Rev. R. Gwatkin, formerly tutor at St. John's College, Cambridge. He was educated at Shrewsbury and St. John's College, Cambridge, where he graduated in theology in 1868, taking the Carus prize for Greek in 1865 and 1869, and the Tyrwhitt Hebrew prize in 1870. In 1868 he became a fellow of St. John's, and in 1874 theological lecturer. He succeeded Creighton as Dixie professor of ecclesiastical history at Cambridge (1891) and in 1903 gave the Gifford lectures at Edinburgh. He died at Cambridge Nov. 14 1916.

His chief works were *Studies of Arianism* (1882); *The Knowledge of God* (1906, the published version of his Gifford lectures) and *Early Church History* (1909).

HAAG, CARL (1820–1915), British painter (*see* 12.780*), died at Rother Thurm, Oberwesel, Jan. 17 1915.

HAASE, FRIEDRICH (1827–1911), German actor (*see* 12.782), died in Berlin March 17 1911.

HAASE, HUGO (1863–1919), German Independent Socialist leader, and one of the commission of six who conducted the Government of the German Reich in the name of the people immediately after the revolution of Nov. 1918, was born in 1863 at Allenstein in East Prussia. At the outbreak of the World War he was parliamentary leader of the Social Democratic party in the Reichstag, but in 1916 he seceded with the Independent Socialists, who refused to vote the estimate and war credits, and became their leader. In this capacity he exercised a moderating influence upon the extreme section of the Independents, who at a later date (1920) joined the Communists. Haase died on Nov. 7 1919 from wounds received in an attempt upon his life while he was entering the Reichstag building.

HACKER, ARTHUR (1858–1919), English painter, was born in London Sept. 25 1858, the son of Edward Hacker, a line engraver. He became a student at the Royal Academy schools in 1876, and from 1880–1 worked at the *atelier* Bonnat, Paris, subsequently travelling widely both in Europe and in North Africa. The best known of his paintings are "Her Daughter's Legacy," "The Mother," and "The Cloud," while his "Annunciation" (1892) was bought by the Chantrey trustees. He became A.R.A. in 1894 and R.A. in 1910. Hacker also became well known as a portrait painter. He died in London Nov. 12 1919.

HADFIELD, SIR ROBERT ABBOTT, 1st Bart. (1859–), British metallurgist, was born at Sheffield Nov. 29 1859, and was educated at Sheffield collegiate school. At an early age he interested himself in metallurgy, and in particular carried out much research on the manufacture of steel. In 1883 he patented his process for the production of manganese steel (*see* 14.809), the first important known substance to combine great hardness with great malleability. From this time he became famous as the inventor or improver of various metallurgical processes. He was the inventor of low hysteresis steel, and also produced the "Era" steel for use in armour-plating, besides many special alloys. He became a member of many scientific committees, and was president of the Sheffield Metallurgical Society (1894–5), of the Iron and Steel Institute (1905–7), and of the Society of British Gas Industries (1917–8), besides being master cutler of Sheffield from 1899 to 1900. In 1908 he was knighted, and the following year became F.R.S. Sir Robert Hadfield received many honours from scientific and learned societies, including the Howard prize (1908), the Bessemer gold medal (1904), the Elliott Cresson gold medal (1910) and the John Fritz medal (1921) from various American societies. He was created a baronet in 1917.

HADLEY, ARTHUR TWINING (1856–), American economist and educationist, was elected a director of the New York, New Haven & Hartford railway in 1913. In 1914 he lectured at the university of Oxford on "Institutions of the United States." In 1915 he evoked considerable discussion in America by declaring that young men who looked forward to a political career should have private means so as to avoid pecuniary temptations. In 1915 he endorsed college military camps and favoured counting military training for a degree. In 1920 he resigned as president of Yale University. The same year he was elected a director of the Atchison, Topeka & Santa Fé railway.

HADOW, SIR WILLIAM HENRY (1859–), English scholar and musician, was born at Ebrington, Glos., Dec. 27 1859. He was educated at Malvern and Worcester College, Oxford, and after taking his degree remained at Oxford as a tutor and fellow of his college. In 1909 he became principal of Armstrong College, Newcastle, retaining this post until 1919, when he became vice-chancellor of Sheffield University. He was in 1918 appointed assistant director of education for the troops by the War Office, and also worked for the Y.M.C.A. He was knighted in 1918. Sir Henry Hadow is well known as a great authority on the history of music, and also composed many songs and pianoforte pieces, besides the incidental music to Robert Bridges' *Demeter* (1905). He published *Studies in Modern Music* (1894 and 1895); *Sonata Form* (1896); *A Croatian Composer* (1897); a valuable tract on Haydn and the source of many of his melodies and the section *The Viennese Period* (1904) in the *Oxford History of Music*, of which he was the editor.

HAECKEL, ERNST HEINRICH (1834–1919), German biologist (*see* 12.803), died at Jena Aug. 8 1919.

HAGENBECK, CARL (1844–1913), German wild-animal collector (*see* 12.814), died at Hamburg April 14 1913.

HAGGARD, SIR HENRY RIDER (1856–), English novelist (*see* 12.816), was knighted in 1912. In the same year he was appointed a member of the royal commission to inquire into the natural resources and the improvement of the trade of the British Empire. He took a keen interest in the after-war settlement of ex-service men, and in 1916 visited the overseas dominions in that connexion. He was created K.B.E. in 1919. Among his later novels are *Child of Storm* (1913); *The Ivory Child* (1916); *Love Eternal* (1918); *The Ancient Allan* (1920).

HAIG, DOUGLAS HAIG, 1st Earl (1861–), British field-marshal, was born at Edinburgh on June 19 1861, son of John Haig of Cameronbridge, Fife. He was educated at Clifton and Brasenose College, Oxford, and in 1885 joined the 7th Hussars. He was promoted captain in 1891, afterwards passed through the Staff College, and was employed with the Egyptian army in 1898 during the Nile campaign, for which he was given a brevet majority. On the outbreak of hostilities in S. Africa in 1899, he went out to Natal on the staff and was present during the opening engagements near Ladysmith. He was afterwards chief staff officer of the cavalry division during Lord Roberts' victorious advance from Cape Colony through the Orange Free State into the Transvaal, and was promoted brevet lieutenant-colonel for his services. In the later phases of the struggle he was in command of a column and later was controlling groups of columns; at the close of the war he was appointed A.D.C. to the King, promoted brevet-colonel, and given the C.B.

Col. Haig subsequently commanded the 17th Lancers for a year, after which he went out to India as inspector-general of cavalry; this appointment he held until 1906, having been promoted major-general in 1905, in which year he married the Hon. Dorothy Vivian, daughter of the 3rd Lord Vivian. From 1906–9 he was a director in the War Office, and during this time he was intimately concerned in the development of the general staff and the improvements effected in the organization of the army, which were set on foot while Lord Haldane was Secretary of State. In 1907 he published a volume of *Cavalry Studies.* His next appointment was that of chief of the general staff in India, which he held for three years, being promoted lieutenant-general in 1910. In 1912 he was brought home to take the command in Aldershot, and in 1913 he was made a K.C.B.

On the mobilization of the Expeditionary Force in 1914, Sir D. Haig took the field as commander of the I. Army Corps, which he led during the Mons, Marne and Aisne operations, and the first battle of Ypres; he was promoted full general in November for his services. On the division of the B.E.F. into two armies at the beginning of 1915, he was placed at the head of the first. On the front of his army during 1915 there took place the battles of Neuve Chapelle, Festubert and Loos, and at the end of the year he succeeded Sir J. French in the chief command. He had been made a G.C.B. in the autumn.

The campaigns and battles of the British army in France under Sir Douglas Haig's command are dealt with elsewhere, and here it is sufficient to recall the names of the Somme, of Arras and the Hindenburg Line, of Messines and Ypres, of Cambrai, and finally the great disasters and greater triumphs of 1918. The culminating moment of all his work came on Sept.

***These figures indicate the volume and page number of the previous article.**

28 1918, when, in conjunction with the American attack on the Meuse-Argonne front and the Belgian King's offensive from the Ypres-Yser lines, the British army broke through the Hindenburg Line between Cambrai and St. Quentin. It was after the success of Haig's attack on this front that the German military command made up its mind to yield, and its results were gleaned in a steady and triumphant advance along the whole British front up to the day of the Armistice.

For his great services he was raised to the peerage as Earl Haig of Bemersyde, and was given a grant of £100,000. The Order of Merit was also conferred upon him. He was appointed commander-in-chief in Great Britain after returning from the Continent, but he held the position for only a few months, as it was then abolished. Thereafter he devoted himself primarily to furthering the cause of the ex-soldier.

HAINISCH, MICHAEL (1856–), Austrian official and writer, president of the Austrian Federal Republic from Dec. 8 1921, was born Aug. 15 1856. He was originally a lawyer and an official of the Treasury and of the Education Department, but retired to his estates in Lower Austria and Styria, where he carried on model farming, became a leader of the Austrian branch of the Fabian movement, and one of the founders of the Central People's Library. Holding aloof from political parties, he was chosen Federal president because of his personal authority, although he was not a member of Parliament, nor a candidate for the presidency. He was a fertile author of works on sociology and politics: *Zukunft der Oesterreicher* (1892); *Zur Wahlreform* (1895); *Kampf ums Dasein und Sozialpolitik* (1899); *Heimarbeit* (1906); *Fleischnot und Alpine Landwirtschaft*. Once a Radical Socialist, he became with advancing years a Conservative Agrarian. During the World War he introduced grain monopoly.

HAITI (*see* 12.824).—The all-important event in Haitian affairs in the ten years 1910–20 was the military intervention on the part of the United States, developing into a close political and fiscal protectorate. The first half of the decade was marked by constant revolutionary turmoil and by rapid political disintegration. In July 1911 President Simon was overthrown and on Aug. 14 1911 Cincinnatus Leconte, one of the foremost men of Haiti, became president. A year later (the night of Aug. 8 1912) the presidential palace was blown up and Leconte and a number of his followers killed. The National Assembly at once elected Tancrede Auguste, a prominent planter; he died the year after, and on May 4 1913 Senator Michel Oreste was elected to the presidency. December 1913 ushered in a period of political turbulence, and three military presidents assumed office in quick succession: Oreste Zamor, on Feb. 8 1914; Davilmar Theodore, on Nov. 7 1914; and Vilbrun Guillaume Sam, on March 4 1915. The last named, after withstanding the attacks of his opponents for several months, was compelled to seek refuge in the French legation in the night of July 26 1915, while two hundred political prisoners in the gaol of Port au Prince were massacred by order of one of his followers. At the funeral of the victims a party of mourners invaded the French legation, dragged out the ex-president, handing him over to the mob for death, and killed the ex-gaoler. Two hours later a U.S. cruiser arrived at Port au Prince and landed marines. U.S. forces occupied the country, disarmed the natives, and restored order:—and on Sept. 3 1915 Rear-Adml. Caperton, in command, declared martial law. Although U.S. naval officers assumed charge of most administrative functions, the Haitian governmental organization remained intact. On Aug. 12 1915 Sudre Dartiguenave was chosen by the Haitian Congress as president, and a treaty having been accepted by the Haitian Government, the U.S. Senate advised ratification Feb. 28 1916. Ratifications were exchanged at Washington May 3 1916, and the treaty was proclaimed on the same date. Modelled upon the American-Domingo Convention of 1907 (*see* 24.194), this instrument was designed to secure political stability and economic development in Haitian affairs by a political and fiscal protectorate, to remain in force for a period of 20 years. By its terms the president of Haiti appointed on the nomination of the president of the United States: (*a*) a general receiver of customs to take charge of the customs houses; (*b*) a financial adviser to be attached to the ministry of finance; (*c*) American officers to organize and command a Haitian constabulary (*gendarmerie*) which was to replace the Haitian armed forces, such officers to be later succeeded by qualified Haitians; (*d*) engineers to supervise public works and sanitation. Haiti agreed not to increase the public debt and not to modify the customs duties without the consent of the United States; the United States undertook to intervene when necessary for the preservation of Haitian independence and the maintenance of a stable and effective Government. The treaty provisions were promptly put into effect, and determined entirely the subsequent course of events.

Attention necessarily centred upon the establishment of civil order, and this was fully accomplished through an efficient native *gendarmerie*. Several hundred miles of much-needed roads had been constructed by 1921, and progress had been made in town sanitation. Fraud was eliminated from the customs houses, and dishonesty from national finances. On the other hand, friction grew out of the uncoördinated division of authority between the Haitian Government, the treaty officials and the military occupation. The nominal continuation of constitutional Government, superseded however in authority and operation by the military occupation, caused native irritation greater than complete military occupation for a probationary term might have been expected to develop. Charges that wide-spread atrocities were tolerated by American officials were made in 1920, but upon minute investigation resolved themselves into specific instances promptly corrected.

The future of Haiti presented in 1921 the gravest problem of American influence in the Caribbean. Early termination of military occupation was, in the opinion of those in responsible charge, certain to result in reversion to old conditions. On the other hand, public sentiment in the United States did not view with satisfaction the definitive abandonment of the one great opportunity left the negro race to demonstrate, even after repeated trial, an ultimate capacity for self-government. Until 1921 the establishment of civil order had engaged the best energies of the American officials. With this accomplished, opportunity seemed to be afforded for rendering the further offices contemplated by the treaty in a way conducive to the ultimate assumption of civil authority by the Haitian Government, subject only to those reservations as to political stability and fiscal solvency in force in other areas within the range of American influence in the Caribbean.

There has never been any reliable census of the population. The estimates vary from 1,500,000 to 2,500,000; the one most commonly accepted in 1920 was 2,000,000. Foreign trade for the year ending Sept. 30 1920 amounted to $46,388,443, of which $18,990,032 were exports and $27,398,411 were imports. Exports to the United States for this period were $9,903,881; to France, $6,531,252; to the United Kingdom, $318,120. Imports from the United States were $22,773,762; from France, $1,451,700; from the United Kingdom, $2,286,614. The chief articles of export for 1920 and their values were: cacao, crude, $606,801; coffee, $10,533,376; logwood and logwood extracts, $2,868,411; cotton, raw, $2,294,864; hides of cattle, $73,266; goatskins, $280,840; honey, $131,235; sugar, raw, $897,197; lignum-vitae, $114,923.

See "Reports and Inquiries regarding Conditions in Haiti" in *Annual Report of the Secretary of the Navy* (Washington 1920), Appendix C. For an extreme criticism of the American Occupation, see "Self-Determining Haiti," James Weldon Johnson, in the *Nation* (N.Y.), Aug. 28, Sept. 4 and 11 1920. (J. H. Ho.)

HALDANE, RICHARD BURDON HALDANE, 1st Visct. (1856–), British statesman, philosopher and lawyer (*see* 12.831), was raised to the peerage in March 1911, while still Secretary of State for War; and he was appointed at the same time, on account of his eminence in the legal profession, a member of the Judicial Committee of the Privy Council. That eminence was further recognized, in June 1912, by his elevation to the woolsack in succession to Lord Loreburn. His six and a half years' tenure of the secretaryship for war had resulted in the fashioning of a small expeditionary force always ready for war, and in the creation of a territorial army, which was far more efficient than the old Volunteers. During his three years' occupancy of the Lord Chancellorship Lord Haldane presided over the highest court of appeal with dignity and efficiency. He did an unusual thing, as Chancellor, by leaving the country and putting the great seal in commission in the autumn of 1913, in order to go to Canada and address the Bar Association at Montreal.

In the years before the World War, he had come mainly before the public as the strong opponent of Lord Roberts' campaign for compulsory service, which would divert, he considered, money and attention from the navy, Britain's chief defence;

and as the apostle of better relations with Germany, a country which he knew well, which he regarded as his "spiritual home," and where he had many friends. While still Secretary of State, he made a mysterious journey to Berlin in Feb. 1912, at the direct invitation, it was said, of the Kaiser, whom he had entertained at lunch on his visit to England in the previous year. In Berlin he had conversations with William II. himself, and with the Chancellor and other ministers. Mr. Asquith at Cardiff, in the October after the war began, revealed the negotiations which passed with Germany in the year 1912—presumably at this visit. The British Cabinet formally assured the German Government that Britain would neither make, nor join in, any unprovoked attack on Germany. But the German Government asked Britain for an absolute pledge of neutrality if Germany were engaged in war—a demand which, of course, could not be conceded. After this rebuff Lord Haldane ceased to advocate in public a *rapprochement* with Germany; but he did not abandon his hopes, and the outbreak of war was for him a peculiarly bitter disappointment. He witnessed with legitimate satisfaction the smoothness and promptitude with which the expeditionary force he had done so much to equip was put in the field in France; but he regretted that Lord Kitchener preferred to create a new army rather than expand the Territorials. He sat on the War Council which Mr. Asquith created in Nov. 1914. But his association with the conduct of the war soon ended. The prejudice which his German affinities had raised against him in the public mind caused him to be left out of the first Coalition Ministry in 1915, and he did not return to office. His services to statesmanship and philosophy were recognized, on his retirement, by the bestowal of the Order of Merit.

After 1915 Lord Haldane ceased to take a prominent part in politics. So far as he intervened in them at all, he appeared to be moving from his old Liberal position and inclining rather to the Labour platform; so much so that it was currently reported that, if Labour formed a Ministry, he would be ready to hold the chancellorship in it. But he mainly occupied himself with his judicial duties as an ex-Chancellor, with the promotion of schemes for the improvement of national education, and above all with his philosophic studies. He published a comprehensive philosophical work, *The Reign of Relativity*, in 1921, on a subject which had occupied him for over 40 years; and he has told the world that the work was projected "on the day of my release from office as Lord Chancellor in 1915." It was natural that, when Prof. Einstein came to England in June 1921 to lecture on his revolutionary theory of relativity, he should be Lord Haldane's guest and lecture under Lord Haldane's chairmanship. Lord Haldane was chancellor of Bristol University, had held the rectorship of Edinburgh University, and been the recipient of many honorary degrees. (G. E. B.)

HALE, GEORGE ELLERY (1868–), American astronomer, was born at Chicago, Ill., June 29 1868. He studied at the Harvard College Observatory and the Massachusetts Institute of Technology (B.S. 1890). He was director of the Kenwood Astrophysical Observatory, in Chicago, from 1890 to 1896. From 1892 to 1905 he was at the university of Chicago as associate professor of astrophysics, as professor (from 1897), and as director of the Yerkes Observatory (after 1895). In 1904 he became director of the Mount Wilson Solar Observatory (Cal.) of the Carnegie Institution of Washington. He invented the spectroheliograph first used in 1892 for photographing solar prominences and won an international reputation for his solar and stellar spectroscopic work. He was awarded the Janssen medal by the Paris Academy of Sciences in 1894, the Rumford medal by the American Academy in 1902, the Draper medal in 1903, a gold medal by the Royal Astronomical Society in 1904, the Bruce medal by the Astronomical Society of the Pacific in 1916, and the Janssen medal by the Astronomical Society of France in 1917. From 1892 to 1895 he was an editor of *Astronomy and Astrophysics* and thereafter of *The Astrophysical Journal.* He was the author of *The Study of Stellar Evolution* (1908) and *Ten Years' Work of a Mountain Observatory* (1915), besides numerous papers in the *Contributions* from the Mount Wilson Observatory and other scientific publications. He was a member of many learned societies at home and abroad.

HALES, JOHN WESLEY (1836–1914), British man of letters, was born at Ashby de la Zouch, Leics., Oct. 5 1836 and was educated at Louth grammar school, Glasgow high school, Durham grammar school, Glasgow University and Christ's College, Cambridge, which elected him to a fellowship. He was for some time an assistant master at Marlborough College under Dr. Bradley, as well as examiner at King's College, London, and the universities of Wales, New Zealand and Cambridge, and from 1889–93 Clark lecturer on English literature at Trinity College, Cambridge. Until 1903, when he retired, he was professor of English literature at King's College, London. He was general editor of Bell's *Handbooks of English Literature*, as well as editor of handbooks on *The Longer English Poems* (1872) and *Milton's Areopagitica* (1874), and co-editor of *Percy's Folio MS.* (1867–8). He wrote the introduction to Snell's *Age of Chaucer* and Seccombe and Allen's *Age of Shakespeare*, and contributed to the *Dict. of National Biography.* He died in London May 19 1914.

HALIFAX, CHARLES LINDLEY WOOD, 2ND VISCOUNT (1839–), was born in London June 7 1839, and educated at Eton and Christ Church, Oxford. From 1862 to 1870 he was groom of the bedchamber to the Prince of Wales, and in 1885 succeeded his father in the title. In 1886 he became an ecclesiastical commissioner. He was well known as a strong High churchman, and for many years acted as president of the English Church Union.

HALIFAX, capital of Nova Scotia, Canada (*see* 12.843).—The pop. in 1918 was 63,000. The public buildings and many of the houses built of stone show a considerable taste in architecture. Much of this stone was brought from the dismantled homes and fortifications of Louisburg. About one-tenth of the city area was devastated by the explosion on Dec. 6 1917 of a French steamer, carrying 3,000 tons of T.N.T., on colliding with a Norwegian steamer on its way with a cargo of relief to Belgium. The reconstruction of a "Greater Halifax" was in 1921 being carried out on modern lines of town-planning.

During the World War Halifax and Sydney were the only two points of departure from which clearances were allowed by the British Admiralty for Imperial and Allied shipping. On the west side of the outside harbour the Federal Government had in progress the great work known as "the Halifax Ocean Terminals," of which several units are in operation. Within the pier head line 62 ac. will contain 27 berths prepared to accommodate ships up to 1,200 ft. in length. The depth at the piers at low water is 47 feet. The landing quays connect with the terminal passage station of the Canadian National railways. Grain elevators and conveyor systems will meet the needs of expanding commerce. Halifax claims to have the lowest port charges on the Atlantic coast. The principal exports are lumber, wood-pulp, fish, apples and flour; the imports sugar, tea, molasses and W. Indian fruits. In 1918 the imports were valued at $14,760,000 and the exports at $127,642,512. The entering and clearing tonnage rose from 3,111,535 tons in 1912 to 15,836,554 in 1919. The industrial establishments include the "Halifax Shipyards," iron foundries, a sugar refinery, rope and cordage works, cotton, chocolate, skate and furniture factories. Besides being the Atlantic terminus of the Canadian National railways, Halifax is the chief winter port of Canada, and is connected by steamship lines with Great Britain, Europe, Africa, South America, the West Indies, the United States, and by Panama Canal with the Pacific.

HALLE, WILMA MARIA FRANCISCA, LADY (MADAME NORMAN-NERUDA) (1839–1911), Anglo-German musician (*see* 12.853), died at Berlin April 15 1911.

HALSBURY, HARDINGE STANLEY GIFFARD, 1ST EARL OF (1823–1921), English lawyer and politician (*see* 12.867), died in London Dec. 11 1921. He was prominent as the leader of the "die-hard" section of the Conservative peers during the debates on the Parliament Act of 1911 (*see* ENGLISH HISTORY). The year of his birth, earlier given as 1825, was subsequently found to have been wrongly put two years too late, since the records of Merton College, Oxford, showed him to have been born on Sept. 3 1823.

HAMBURG, Germany (*see* 12.871).—Pop., according to the census of 1919, 1,050,359; in 1910, 1,014,664. The commerce, industry and shipping of Hamburg had constantly been increasing up to the outbreak of the World War, as was particularly manifested by the development of the Hamburg-Amerika line. That shipping company increased its capital in the year 1912 by 25 million marks (pre-war=£1,250,000), in order to deal with the constantly growing traffic. On April 3 1913 the Hamburg-Amerika line launched the s.s. "Vaterland," which was the greatest passenger steamship in the world. Again on Nov. 8 1913 it raised its capital from 150 to 180 million marks (£9,000,000). In its business controversies with the North German Lloyd, the Hamburg-Amerika line pursued the path of developing as rapidly as possible into the greatest German shipping company. Simultaneously the intellectual and commercial life of Hamburg were greatly quickened. In Jan. 1912 the elevated and underground railway was opened. In April 1911 the Hamburg Senate proposed the appointment of a committee of the *Bürgerschaft* (the representative assembly of the citizens) to consider the question of a university. A bill for the foundation of a university with three faculties was adopted by the Senate in Dec. 1912, but in Oct. 1913 was rejected by a majority of 80 against 73 by the *Bürgerschaft.*

The prosperous development of Hamburg was suddenly interrupted by the war. The 250th anniversary of the Chamber of Commerce was commemorated on Jan. 19 1915 under the shadow of economic decline. On April 18 1917 the *Bürgerschaft* had appointed a commission with a view to bringing about a reform of the class franchise which had hitherto existed in the Hanseatic cities (Hamburg, Bremen and Lübeck). A measure of electoral reform for Hamburg was adopted on June 11 1917. The city and territory nevertheless had as severe an experience of the revolutionary movement as any region in Germany. The Council of Workmen and Soldiers which had been set up in the first days of Nov. 1918 assumed complete political power on Nov. 13. The Council wanted to form a state of Great Hamburg by adding portions of Prussian territory. The region of Cuxhaven belonging to Hamburg declared its independence on Jan. 11 1919 under Spartacist (Communist) leadership. The republic of Cuxhaven, however, only lasted four days; it was overthrown on Jan. 15 by the officials, the state employees and the schoolmasters of Hamburg. At the end of Jan. and at the beginning of Feb. 1919, Communist disturbances broke out in the city itself; they were due in part to the occupation of Bremen by troops of the German *Reich.* For a brief period the Communist working classes of Hamburg remained under arms, but were ultimately disarmed by the soldiers who had remained faithful to the Government of the *Reich.*

In those days of revolutionary tempest the university of Hamburg was founded on March 28 1918; a very democratic constitution was conferred upon it on Jan. 28 1921 by the law of the *Reich* dealing with the governing bodies of higher institutes of learning and scientific teaching (*Hochschulbehördengesetz*).

An election for the Hamburg *Bürgerschaft* took place on March 16 1919, when 81 Majority (moderate) Socialists, 13 Independent (extreme) Socialists, 33 Democrats, 14 members of the German People's party (old National Liberals), 13 representatives of the Economic League (lower middle class, tradesmen, etc.), and six members of the German National party (the old Conservatives) and the Catholic Centre were elected. The new constitution of Hamburg was adopted on Dec. 29 1920 by 95 votes against a minority of 40, consisting of the whole of the Right and the Communists.

This new constitution, which was adopted in a similar form in the other two Hanseatic cities (Bremen and Lübeck), reduced the Senate to the level of a democratic and parliamentary Government. The power which formerly emanated from the Senate now proceeds from the *Bürgerschaft.* The Senate is no longer elected for life, but is chosen on parliamentary grounds by the *Bürgerschaft.* The principle of a referendum was introduced into the constitution. The franchise is no longer confined to citizens of Hamburg, but is extended to all citizens of the *Reich* who may be present in Hamburg on the day of the election.

In accordance with provisions of the constitution of the *Reich* the new constitution of Hamburg shows itself to be an absolutely democratic, parliamentary system of Government. The *Bürgerschaft* (representative assembly) consists of 160 members elected on the proportional system. The right to vote for the *Bürgerschaft* is acquired at the age of 20, the right to be elected to it at the age of 25; at the age of 30 any citizen is eligible for the Senate. In execution of the provisions of the constitution of the *Reich* a Labour council and an Economic council were formed for the representation of economic interests. Attempts to form a unified economic representation of the people failed. A feature of the old system of so-called "deputations" was retained for Hamburg in the shape of the Finance Deputation for dealing with finances of the city state.

(O. Kr.)

HAMILTON, SIR IAN STANDISH MONTEITH (1853–), British general, was born at Corfu on Jan. 16 1853. He was educated at Wellington College and in Germany, and joined the army in 1872. He served with the 92nd Highlanders in the Afghan War and the Boer War of 1881, and was severely wounded on Majuba Hill, one arm being permanently disabled. He was then for several years intermittently on the staff of Sir F. (Lord) Roberts. He served in the Nile Expedition of 1884–5, for which he was promoted brevet major, and in Burma in 1886–7, for which he was promoted brevet lieutenant-colonel. In 1887 he married Jean, daughter of Sir John Muir, Bart. Promoted colonel in 1891, he was on the staff of the Chitral Relief Force in 1895, for his services in which he received the C.B., and he then became deputy quartermaster-general in India. He commanded a brigade on the North-West Frontier in 1897, and was afterwards commandant of the school of musketry, Hythe, for a year. On the outbreak of the South African War in 1899 he went to Natal on the staff. He commanded a brigade at the early engagements around Ladysmith and during its siege, and was promoted major-general; after its relief he commanded a mounted infantry division during Lord Roberts' advance from Bloemfontein to Pretoria and into the eastern Transvaal, for which he was made a K.C.B. He returned home early in 1901 to become military secretary at the War Office, but towards the end of the year went back to South Africa nominally as chief of the staff to Lord Kitchener, although in reality he was employed chiefly as the commander-in-chief's deputy to control particular groups of operations from time to time during the closing stages of the struggle. He was promoted lieutenant-general for his services.

He was afterwards again military secretary and then quartermaster-general at the War Office, and in 1904 he went out to the Far East to accompany the Japanese armies in the field. His diary and impressions of the Manchurian campaigns he published under the title *A Staff Officer's Scrap Book* (2 vols., 1906–7), a book which by reason of the interest of its subject, the charm of the author's style, and the combination of war experience and of imagination which inspired his judgments and criticisms, at once took rank in Europe as a modern military classic. On his return he had charge of the Southern Command until 1909, being promoted general in 1907, and he was afterwards adjutant-general at the War Office for a year. He took a prominent part on behalf of the voluntary service system during the early years of the Territorial Force and the campaign in favour of compulsory service led by Lord Roberts, and in the course of this controversy he published a book under the title *Compulsory Service* (1910), which he wrote at the request of Lord Haldane. In 1910 he was created G.C.B., and appointed commander-in-chief in the Mediterranean and inspector-general of the Overseas Forces, in which capacity he visited and inspected the newly organized forces of the Australian Commonwealth in 1913. On the outbreak of war in 1914 he served for some months as commander-in-chief of the Home Defence Army in England. Then, in March 1915, he was selected to take charge of the Mediterranean Expeditionary Force, which was intended to coöperate in opening a way into the Black Sea (*see* DARDANELLES CAMPAIGN). The naval effort to force the Dardanelles having failed, he found himself obliged to undertake operations in the Gallipoli Peninsula, and although his army was very ill-equipped for the task, he succeeded in landing it in the face of the enemy; but in spite of this good beginning he was speedily brought to a standstill. Having, after considerable delay, received substantial reënforcements, he made a great effort in Aug. to improve his position, but the operations failed to accomplish what was intended, and a situation of stalemate arose. The Government consulted him in Oct. as to the expediency and feasibility of withdrawing from the peninsula, and on his pronouncing himself strongly opposed to such a policy he was replaced by Sir C. Monro and returned home. He was given the G.C.M.G. for his services. He was appointed lieutenant of the Tower of London in 1919, but retired from the army at the end of the year.

In 1920, after the issue of the report of the Dardanelles Commission, he published his own story of the campaign under the title of *Gallipoli Diary* (2 vols., 1920).

HAMILTON, Ontario, Canada (*see* 12.891), had in 1919 a pop. of 108,143. Hamilton's geographical position gives it excellent shipping facilities, and the city is on the direct line of main railways from Buffalo and Niagara Falls to Detroit and Port Huron; Buffalo and Niagara Falls to Montreal, and Detroit and Port Huron to Montreal. Hamilton has been called "the city of five hundred diversified industries," and has the largest plough works and implement works in the British Empire. Besides its Anglican and Roman Catholic cathedrals, the city has 83 churches, 33 banks, 51 schools (public, private and technical), five hospitals and three public libraries.

HAMMANN, OTTO (1852–), German journalist and Foreign Office official, born Jan. 23 1852 at Blankenhain. He was engaged in journalism from 1877 to 1893 and was appointed, in 1894, Director of the Press Section of the German Foreign Office, a post which he continued to hold until 1916. Hammann was the trusted adviser of Prince Bülow, who always kept an attentive eye upon public opinion as reflected or created in the press. He had personally played a leading part in the defensive campaign of the Imperial Chancellor, Count Caprivi, and the Foreign Secretary, Baron Marshall von Bieberstein, in the early 'nineties, against the Bismarckian *fronde*. His business was to inspire the German and, as far as possible, the foreign press in a sense favourable to German policy and above all to obtain full and accurate information with regard to the personality and circumstances of journalists. His position enabled him to acquire a great deal of exclusive information with regard to the more secret ways of German policy and he embodied a considerable portion of what he knew in the three volumes of reminiscences which he published after the Revolution, *Der neue Kurs, Erinnerungen* (1918); *Zur Vorgeschichte des Weltkriegs* and *Um den Kaiser, Erinnerungen aus den Jahren 1906–1909* (1919).

HAMMARSKJÖLD, HJALMAR (1862–), Swedish statesman, was born in 1862, and educated at Upsala University, where he became professor of civil law. He gradually established his reputation as a jurist, and took a prominent part in national politics. In 1901 he joined von Otter's Ministry, and was Minister of Justice till it resigned in 1902. In the latter year he was elected president of the Göta High Court. In 1905 he joined Lundeberg's Government, formed after the dissolution of the union with Norway, as Minister of Education. He was one of Sweden's four representatives in the negotiations with Norway at Karlstad. After the resignation of the Lundeberg Government he became, in Nov. 1905, Swedish Minister in Copenhagen, and in 1907 governor (*landshöfding*) of the province (*län*) of Upsala. He had often acted meanwhile as expert in constitutional law on behalf both of Sweden and of other countries. He was Swedish delegate at the international conference in Paris with regard to literary copyright in 1896, and at the Hague conferences in regard to private international law in 1900 and 1904. From 1904 he was Swedish member of the Hague International Board of Arbitration, and in 1907 he was Sweden's leading delegate to the Hague Peace Conference. In 1908 he was appointed member of the Board of Arbitration in regard to the question of the sea boundary between Sweden and Norway, and in the same year he acted as president of the Franco-German Board of Arbitration in regard to the Casablanca affair. He was chairman of the Swedish committee for drafting the Swedish-German treaty of commerce in 1910–1; Swedish delegate at the Spitzbergen conferences of 1910 and 1912; in 1909 juridical adviser in the Swedish-Norwegian Board of Arbitration in regard to the right of Swedish Laplanders to graze their reindeer in Norway; and in 1913 president of the Franco-Italian Board of Arbitration for the solution of certain freight disputes. In Feb. 1914 he succeeded Staaff as prime minister, retaining this post during the World War until 1917.

HANKOW, China (*see* 12.919).—At the mouth of the Han river a great commercial entrepôt is provided for China by the three large cities, Hankow, Hanyang and Wuchang, at the point where the Han flows into the Yangtsze. Prior to the commencement of disorder in 1911 the development of railway communications in the interior of China had largely increased the wealth and importance of this great distributing centre. Hankow, on the N. bank of the Yangtsze, is the terminus of the completed Peking-Hankow trunk line, and Wuchang, on the S. bank, the terminus of the line, in process of construction, from Canton. But during the turmoil of the revolution, and on more than one occasion thereafter, Hankow suffered materially because of its strategical importance to the contending factions. On Nov. 1 1911 two-thirds of the city was destroyed by fire as the result of a bombardment by the imperialists; nevertheless, the population of the three cities united was reckoned by the Maritime Customs in 1916 at 1,321,280 and in 1920 at about 1,500,000.

The black-tea trade, Hankow's staple industry in former days, declined steadily between 1915 and 1920, partly because of the competition of Indian and Ceylon teas, but chiefly because of the elimination of the Russian buyer—the total amount of black leaf shipped abroad from China in 1919 being 288,398 piculs, as against 771,141 piculs in 1915. But in other directions the trade of the port expanded steadily, in spite of political excursions and alarms; its net value in 1919 was 200 million taels, as against 170 millions in 1917. The industrial development of the district, increasingly active after the conclusion of the World War, was reflected in a large demand for machinery and plant for new factories. In 1919 Hankow-milled yarn was selling at a higher price than yarn imported from Japan. The export trade in wood-oil and sesamum-seed, of which Hankow is the chief centre, increased very rapidly.

The number of residents in the British Concession recorded by the census of 1920 included 163 British and 341 Japanese out of a total of 678. The German Concession, like that at Tientsin, was taken over by the Chinese authorities after China's declaration of war on the side of the Allies; early in 1920 it was understood that Japan was negotiating with the Chinese Government to acquire it by purchase.

(J. O. P. B.)

HANN, JULIUS VON (1839–1921), Austrian meteorologist, was born at Linz, Upper Austria, March 23 1839, and was educated at the *Gymnasium* of Kremünster and afterwards at Vienna. From 1865 to 1868 he was master at the *Oberrealschule* at Linz, and in 1865 was appointed editor of the *Zeitschrift für Meteorologie*. In 1877 he became director of the *Meteorologische Zentralanstalt* and professor of meteorology at the university of Vienna. In 1897 he was appointed professor at Graz, but in 1900 returned to Vienna as professor of cosmical physics. His meteorological researches were of the greatest value and importance (*see* 18.266, 286). His published works include *Allgemeine Erdkunde* (with F. von Hochstetter and A. Pokorny, 1872; 5th ed. 1896); *Handbuch der Klimatologie* (1883; latest ed. 1908); and *Lehrbuch der Meteorologie* (1901; latest ed. 1914), besides numerous meteorological papers contributed to the *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften* in Vienna. Dr. Hann was in 1912 made a foreign knight of the Prussian *Ordre Pour le Mérite*. He celebrated the jubilee of his doctorate in 1918, and died at Vienna Oct. 1 1921.

HANOTAUX, ALBERT AUGUSTE GABRIEL (1853–), French statesman and historian (*see* 12.923), was active during the World War as historian and propagandist, producing *Histoire de la Guerre de 1914* (9 vols., 1914); *Le Traité de Versailles* (1919) and *Histoire de la Nation française* (17 vols., 1920). He was employed on more than one semi-official mission abroad, notably to the Vatican, and in 1921 was the third French delegate on the League of Nations.

HARA, TAKASHI (1856–1921), Japanese statesman, was born at Morioka in Feb. 1856. His early studies were made at the now defunct Law College of the Department of Justice, but he abandoned the law, before graduating, in favour of journalism, joining the staff of the *Hochi Shimbun*, an important Tokyo daily newspaper. He acted as special correspondent in Korea in 1882, when the late Marquess Inouye was envoy to that country, and subsequently entered the diplomatic service as a junior official in the Foreign Office. He was then appointed consul at Tientsin and in 1886 became secretary and chargé d'affaires in Paris. When the late Marquess Inouye was appointed Minister of Agriculture and Commerce Mr. Hara became his personal secretary. In 1892 he was appointed director of the commercial bureau at the Foreign Office and was promoted in 1895 to Vice-Minister of the Department. He was sent as minister to Korea from 1896–7, when he again turned to newspaper control and became chief editor of the *Osaka Mainichi*. Still deeply interested in politics he was one of the right-hand men of the late Prince Hirobumi Ito, when the latter organized the Seiyu-Kai (Liberal) party in Aug. 1900, and subsequently became its leading spirit. From the end of 1900 to May 1901 he filled the chair of the Minister of Communications in the Ito Ministry. Reverting once again to journalism he then became the chief editor of the *Osaka Shimpo*, and was elected a member of the House of Representatives for his native city in 1902, being reëlected at each subsequent election. In 1906, he definitely abandoned his journalistic career in favour of affairs of State and was appointed Minister for Home Affairs in the first Saionji Ministry. On the fall of this Cabinet in 1908 he spent two years visiting Europe and America. Returning to Japan he accepted the portfolio of the Minister for Home Affairs in the second Saionji administration, which was in office from 1911 to 1912. During the short period of the Katsura administration Mr. Hara held no office, but returned to his former position at the Ministry for Home Affairs for the third time under the Yamamoto administration of 1913 to early in 1914. When this Cabinet resigned, owing to the rejection of the Budget by the House of Peers, Mr. Hara retired for a time from active politics, though still retaining his leadership of the Seiyu-Kai. The Terauchi administration, which was generally considered to be conservative, came to an end in the autumn of 1918, and Mr. Hara was invited to form a Cabinet which might appreciate the growing desires and aspirations of the people of Japan towards liberalism. On Sept. 29 1918 Mr. Hara, the first commoner to become prime minister of Japan, formed an administration based, for the first time in the history of Japanese political development, on strictly parliamentary principles. He was assassinated on Nov. 4 1921 in Tokyo.

HARCOURT, LEWIS VERNON HARCOURT, 1st Viscount (1863–), British politician, was born in London Feb. 1 1863, the eldest surviving son of Sir William Harcourt (*see* 12.939). He was educated at Eton and afterwards travelled widely, becoming well known for his interest in art. In 1899 he married the only daughter of Walter H. Burns, of New York. In 1904 he was elected as Liberal member for the Rossendale division of Lancs., retaining the seat until 1917, and on the formation of Sir Henry Campbell-Bannerman's Government (1905) became First Commissioner of Works. In 1910 he became Secretary of State for the Colonies in the Asquith Cabinet, but on the formation of the Coalition Government in 1915 again became First Commissioner of Works. In 1916 he was raised to the peerage. He was appointed a trustee of the Wallace Collection, British Museum, London Museum and National Portrait Gallery.

HARDIE, JAMES KEIR (1856–1915), British Labour politician, was born at Newarthill in Lanarkshire Aug. 15 1856. His father, a ship's carpenter, was frequently out of work owing to illness and the decline of his trade, and his mother had to go out to work soon after her son was born. Being unable to send him to school she taught him reading herself, and when only six years old he had to earn money as a message boy. A year or two later he began work in the mines and earned his living underground for 16 years, often working 12 and 14 hours a day. At 22 years he was acting as local miners' secretary. After victimization in consequence of a strike he obtained work at Cumnock, Ayrshire, and was shortly afterwards elected secretary of the Ayrshire Miners' Association. Advanced Radical ideas attracted him, and before he was 25 years old he was to the fore in political meetings. He helped Henry George in his land agitation and was a staunch co-worker with Robert Smillie in the miners' movement. At the Trade Union Congress in 1887 he attacked the secretary, Mr. Broadbent, for supporting capitalist candidates at elections, thus starting the campaign for Independent Labour representation which he brought into prominence in 1888 by contesting Mid-Lanark as an Independent Labour candidate. From this time on he worked unceasingly for an independent political party for the workers. At the general election of 1892 he was elected for S. West Ham and appeared at Westminster as the first Labour member. In 1893 he presided over the first conference of the Independent Labour party and the following year was elected chairman of the party, an office to which he was reëlected annually until 1899. In 1895 he had lost his seat in Parliament, but in 1900 he was elected for Merthyr Tydfil. In the great strike in the South Wales coal-field in 1898 he addressed, together with Robert Smillie, huge meetings of miners, and in the general election of 1906 he was reëlected to Parliament for Merthyr Tydfil. In addition to his work for the Labour and Socialist movement at home he was one of the most ardent pioneers of international socialism, and visited many countries in his endeavour to bring together the workers of different lands. The collapse of the International on the outbreak of the World War was a great sorrow to him, and is thought to have hastened his death, which took place in 1915 when he had only just completed his fifty-ninth year.

HARDING, WARREN GAMALIEL (1865–), 29th President of the United States, was born at Corsica (then Blooming Grove), Morrow co., Ohio, Nov. 2 1865, son of George Tyron Harding, a farmer and country doctor, and Phebe Elizabeth Dickerson. He studied in the common schools, and from 14 to 17 at the Ohio Central College at Iberia. He taught in a country school for a year, read law for a short time, worked in a newspaper office, and in 1884 became editor and proprietor of the *Marion Star*. On July 8 1891 he married Florence Kling. Having attracted the notice of Senator Joseph B. Foraker (*see* 10.628), he was encouraged to enter state politics, and was early recognized as an effective speaker. He served two terms in the Ohio Senate (1900–4), and during the second was influential in securing Senator Foraker's reëlection to the U.S. Senate. From 1904 to 1906 he was lieutenant-governor of Ohio, but in 1910, when nominated for governor by the Republicans, was defeated by a plurality of 100,000. In the campaign of 1912 his paper supported President Taft. In 1914 he defeated Foraker in the Republican primaries as candidate for the U.S. Senate, and was elected with a majority of 100,000 for the term of 1915–21; but his friendship with Foraker remained unabated. In 1916 he was delegate-at-large from Ohio to the Republican National Convention, of which he was chosen permanent chairman. In the Senate he was regarded as a "safe" man, who could be relied upon to support orthodox Republican policies. In 1915 he urged "preparedness" for naval defence. In 1916 he voted against the confirmation of Louis D. Brandeis as associate justice of the U.S. Supreme Court. In 1917 he gave his support to the declaration of war against Germany, and also to all the war measures, including the Selective Draft and Espionage bills. He favoured the death penalty for spies, but after the war advocated amnesty for political prisoners. He opposed the suggested Federal control of food and fuel. He favoured the Prohibition Amendment, and voted for the Volstead Act, enforcing war-time prohibition, over the President's veto. He favoured the anti-strike clause of the Cummins Railway bill, and voted for return of the lines to their owners within a year after the end of the war. He was for exempting American shipping from Panama Canal tolls and also supported woman suffrage. He was opposed to the Covenant of the League of Nations, holding that "either the Covenant involves a surrender of national sovereignty and submits our future destiny to the League, or it is an empty thing, big in name, and will ultimately disappoint all of humanity that hinge its hopes upon it." He voted for the Lodge reservations and also for the Reed reservation that the United States alone should judge whether matters of direct interest to it should be brought before the League; and finally he voted against ratification of the Treaty as submitted by President Wilson. He maintained that Americans should show chief concern for America, and opposed all tendencies toward internationalism. He supported the Knox resolution declaring that war with Germany was ended.

At the Republican National Convention in 1920 he was not at first among the prominent candidates for president. On the first ballot he received 65½ votes (493 being necessary for choice), 39 of these being from his own state. On the eighth ballot he received 133½ votes, on the ninth 374½ votes, and on the tenth he secured the nomination with 692⅕ votes, the result being due largely to the support of certain influential U.S. Senators, delegates to the convention, who hoped that as president he would be amenable to the Senate. He did not "stump" the country, but conducted his campaign from the "front porch" of his own home. Mr. Harding based his campaign chiefly upon criticism of the Wilson administration, denouncing especially the excessive power that, as he maintained, had been exercised by the executive as a result of war centralization; he demanded as speedy as possible a return to normal conditions, political and industrial. While opposing the Covenant of the League of Nations, he gave to many of his supporters the impression that he desired an "association of nations" which, without the characteristics of a super-state (such as he believed the League to be), might safeguard peace. But he retained the political support of many who were opposed, like Senators Borah and Johnson, to any sort of international association. In the November elections he won an overwhelming victory over James M. Cox, the Democratic nominee, also from Ohio; he carried, generally by immense majorities, all the northern states and all but one of the states on the border between North and South, and he cut down materially the Democratic majorities in the South. The electoral vote was 404 for Harding against 127 for Cox. The popular vote was 16,138,000 for Harding against 9,142,000 for Cox. In Ohio the popular vote was 1,182,000 for Harding against 780,000 for Cox. The sweeping character of his victory was due less to his own personal strength or to the weakness of Cox than to the national reaction against the Democratic party and the popular feeling against President Wilson. Mr. Harding resigned from the U.S. Senate in Dec. 1920, and was inaugurated March 4 1921, the sixth President to come from Ohio.

The promise frequently made by Republican campaign leaders that Mr. Harding would surround himself with advisers of capacity and experience, seemed to be fulfilled by his choice of Cabinet members. The outstanding names were those of Charles E. Hughes and Herbert C. Hoover, who became Secretary of State and of Commerce respectively. The distinguished career of the former and the widespread confidence in his ability and political integrity had marked him for the most important position in the Cabinet; and there had been a general demand that the new administration should utilize the organizing ability displayed by Hoover in many fields. Various elements in the Republican party, nevertheless, had stoutly opposed their appointment, so that the President's choice showed that he was prepared to exert his independence of party managers and to insist upon administrative efficiency. The choice of Andrew W. Mellon, a wealthy banker and ironmaster of Pittsburgh, as Secretary of the Treasury, was welcomed by men of business; and though that of Will H. Hays to be Postmaster-General was in the nature of payment of a political debt to the man who had been the successful manager of the Republican campaign, it was early justified by his efficient administration of the postal service. Mr. Harding's inaugural address, and his first message to Congress, delivered in person on April 12, voiced his desire to return to "normalcy," as he expressed it. Retrenchment in expenditure formed a major item in his programme, together with a prompt and thorough revision of taxation. He advocated the adoption of a national budget system, and, Congress having passed a budget bill similar to that vetoed by Mr. Wilson in 1920, he approved it on June 10 1921; it provided for a Budget Bureau in the Treasury Department and the appointment of a director of the budget, the first being Charles G. Dawes, formerly general purchasing agent of the American Expeditionary Force. President Harding's first budget was presented Dec. 5 1921. The President was insistent upon the need of repealing the excess profits taxes and reducing transportation taxes and income surtaxes. The need of financial retrenchment led to his opposing the proposal that war veterans should receive a cash bonus. In this matter, as in others, he proved his ability at this early stage to resist political pressure. As regards the tariff he advocated, as a temporary stop-gap, the passing of the emergency tariff, which had been vetoed by President Wilson, but which with slight alteration was approved by Mr. Harding on May 27 1921. He urged the need of adopting a permanent tariff policy, and on Dec. 5 1921 suggested a "flexible tariff" which might provide for the adjustment of rates to meet unusual and changing conditions. Such adjustments might be made, in his opinion, by the executive on the advice of the Tariff Commission. Mr. Harding's interest in agricultural problems was keen; in his first message he asked special protection for agricultural interests, and in his second he declared that something more than protection must be given the farmers, advocating warmly the encouragement of coöperative marketing plans. As regards domestic legislation, the President, in general, assumed the rôle of moderator. He disclaimed any desire to enlarge the powers and responsibilities of the executive, which, he declared, were already too large; and he aimed at close coöperation with Congress. In marked contrast to his predecessor, he left administrative responsibility to the members of his Cabinet. Foreign policy was largely determined by Hughes, financial by Mellon, and the problem of unemployment was thrown upon Hoover. The President, however, frequently played an active rôle in the conferences necessary to secure general agreement, as on Aug. 9 1921 when an accord was reached between the Treasury and the Representatives on the taxation plan.

The foreign policy of the administration at first seemed likely to emphasize independence of action, in contradistinction to that of President Wilson; the threatened war between Panama and Costa Rica was prevented by a sharp note from Secretary Hughes; the claims of the Japanese to a mandate over Yap were stoutly denied; the administration refused to follow Great Britain in resuming trade relations with Soviet Russia. President Harding made plain in his first message that the United States would not enter the League of Nations. But he expressed himself warmly in favour of active coöperation with other nations of the world, and by accepting the invitation to participate in inter-Allied councils indicated that he would avoid a policy of isolation. In rejecting the League Covenant, he said "we make no surrender of our hope and aim for an association to promote peace, in which we would most heartily join." The President advocated a declaration of peace with Germany by resolution, and the immediate negotiation of a treaty. This policy was adopted by Congress, which agreed upon a joint peace resolution, signed by him on July 2. On Aug. 25 1921, a treaty with Germany was signed, embodying the President's plan of including most of the stipulations of the Versailles Treaty, but repudiating adherence by the United States to any clause referring to the League of Nations. This treaty and similar pacts with Austria and Hungary were ratified by the Senate, Oct. 18 1921.

The most important step taken by President Harding during the first year of his administration was the calling of an international conference on the limitation of armaments. On May 25 1921 the Senate had adopted an amendment of Senator Borah to the Navy bill, authorizing and inviting the President to call such a conference. Mr. Harding's preliminary invitations to the principal naval Powers (Great Britain, Japan, France and Italy) were sent July 10, and formal invitations Aug. 11. He made clear his belief that the question was closely connected with the problems of the Pacific and Far East, and invitations were also sent accordingly to China and to the smaller European powers with Far-Eastern interests—Holland, Belgium and Portugal. The invitations were accepted, and the conference assembled at Washington on Nov. 12. President Harding avoided the example set by his predecessor, and did not himself participate as a delegate. He displayed his political tact in the choice of the American delegation, which was led by Secretary Hughes and included, besides Elihu Root, two members of the Senate, Lodge and Underwood, the Republican and Democratic leaders respectively. The policy drafted by the President and Mr. Hughes was direct and vigorous. They refused to permit the vital problem of limitation of armaments to be side-tracked, and surprised the conference by proposing a ten-year naval holiday and a drastic scrapping of tonnage by the three chief naval Powers. The President made it clear that he regarded the conference merely as a step in securing international understanding and good will; he advocated the convening of succeeding conferences as a possible means of securing an international association for the promotion of peace, and he approved the principle of substituting an understanding between the United States, Great Britain, France and Japan regarding Far-Eastern problems, for the existing Anglo-Japanese Treaty. (*See* WASHINGTON CONFERENCE.)

The initiative taken by President Harding in calling the conference, and the extent of its success, intensified the feeling which had been steadily growing during the first session of his administration, that he possessed qualities peculiarly adapted to the political conditions of the moment. He had faced difficult problems with independence and yet he had been able to inaugurate something of an "era of good feeling." His "gospel of understanding" had proved effective both in domestic and foreign politics. (C. SEY.)

HARDINGE OF PENSHURST, CHARLES HARDINGE, 1ST BARON (1858–), British diplomat, was born in London June 20 1858, second son of the 2nd Viscount Hardinge. He was educated at Eton and Trinity College, Cambridge, and in 1880 entered the diplomatic service. He became secretary of legation at Teheran in 1896, and in 1898 went to St. Petersburg as secretary of embassy. In 1903 he returned to England and became Assistant Under-Secretary for Foreign Affairs, becoming later (1906–10) Permanent Under-Secretary. In the latter capacity he accompanied King Edward VII. on his foreign visits. He was created K.C.M.G. in 1904 and G.C.M.G. in 1905. From 1904 to 1906 Sir Charles Hardinge was ambassador to Russia, and in 1910 was appointed Viceroy of India and raised to the peerage. On Dec. 22 1912, a bomb was thrown at him as he entered the city of Delhi in state, seriously wounding him, besides killing an attendant. It fell to Lord Hardinge's lot to welcome King George V. and Queen Mary on their historic visit to India in the winter of 1911–2. Lord Hardinge returned to England in 1916 and was reappointed to the post of Permanent Under-Secretary of Foreign Affairs, retiring in 1918. In Nov. 1920 he succeeded Lord Derby as ambassador in Paris.

Lord Hardinge married in 1890 the Hon. Winifred Selina Sturt, daughter of the 1st Baron Alington. Lady Hardinge did much during her husband's period as Viceroy of India to further the medical training of Indian women. She escaped unhurt when her husband was wounded at Delhi, but the resulting shock to her nerves did much to hasten her death in London July 11 1914.

HARDY, THOMAS (1840–) English novelist (*see* 12.946); in more recent years received increasing recognition, not only as the premier living English novelist but as a poet. His poetical play *The Dynasts*, recounting in dramatic form the epic of England's struggle against Napoleon with an accompaniment of philosophic comment after the manner of the Greek tragedians, was produced at the Kingsway theatre, London, in the early months of the World War, and again at Oxford in 1920. He published *Satires of Circumstance* (1914); *Selected Poems* (1916); *Moments of Vision* (1917); and his *Collected Poems* appeared in 1919. His first wife died in 1912, and in 1914 he married Florence Emily, daughter of Edward Dugdale, herself a writer of children's books and articles in periodicals. Both on his 70th and on his 80th birthdays he received tributes of respect and admiration from literary and public men throughout the English-speaking world.

HARE, SIR JOHN (1844–1921) English actor (*see* 12.948), played the Judge in Barrie's *The Adored One* at the Duke of York's theatre in 1913, and made his latest appearance on the stage in a revival of Grundy's *A Pair of Spectacles* at Wyndham's theatre in 1917. He died in London Dec. 28 1921.

HARLAN, JOHN MARSHALL (1833–1911), American jurist (*see* 12.954), died in Washington, D.C., Oct. 14 1911, after a service on the Supreme Court of just short of 34 years.

HARPIGNIES, HENRI (1819–1916) French painter (*see* 13.15), of whose drawings there was an exhibition in London in March 1910, died in Burgundy Aug. 23 1916.

HARRIGAN, EDWARD (1845–1911), American actor (*see* 13.17), died in Brooklyn, N.Y., June 6 1911.

HARRISON, FREDERIC (1831–), English jurist and historian (*see* 13.23), published his *Autobiography* in 1911. Other more recent volumes from him were *Among my Books* (1912); *The Positive Evolution of Religion* (1912); *The German Peril* (1915); *On Society* (1918) and *Obiter Dicta* (1919). The last was a collection of vigorous comments on politics and literature contributed by him to the *Fortnightly Review* throughout the closing year of the World War. These comments, though then in his 90th year, he resumed as *Novissima Verba* throughout 1920.

One of his sons, AUSTIN HARRISON (b. March 27 1873), became editor of *The English Review* in 1910. He was the author of *The Pan-Germanic Doctrine* (1904) and other works on Germany's foreign policy.

HART, SIR ROBERT, BART. (1835–1911), Anglo-Chinese statesman (*see* 13.30), left China in July 1907 after 45 years of service as inspector-general of the Imperial Maritime Customs. A year before his feelings had been hurt and his authority diminished in the eyes of the customs service, by the action of the Chinese Government in appointing high Chinese officials to be "administrators" of the service, with control over the inspector-general and his staff; and although the Peking authorities made partial amends for the discourtesy thus shown him, by declining his resignation and by increasing his titular rank while on leave of absence, the remaining years of his life were undoubtedly affected by recollection of the lack of appreciation thus displayed by those whom he had served so long and so loyally. After 50 years of residence at Peking and complete absorption in Chinese affairs, a life of enforced leisure in England had a depressing effect upon his spirits and his health. The book which he wrote, after the Boxer rising, in 1901, remains his only published work; he declined to write his memoirs, and by his will left instructions to his executors which apparently preclude all hope of his voluminous diaries being used for biographical or historical purposes. Despite the disappointments of his later career, Sir Robert Hart left a name in China whose greatness will endure; his life's work stands out against the confused background of Chinese affairs as that of one who combined the qualities of an administrator with something of the poetic temperament and the mind of a speculative philosopher, a figure as picturesque in its way as that of Gordon or Cecil Rhodes. The multifarious activities of his career were reflected by the large number of honours and decorations conferred upon him by European sovereigns, rulers and learned societies; at the time of his death, he was the possessor of 13 grand crosses. By imperial edicts every high honour in the gift of the Chinese throne had been bestowed upon him, including the Double Dragon and the Peacock's Feather. He was a junior guardian of the heir-apparent, and his ancestors had been retrospectively ennobled for three generations. He died at Great Marlow on Sept. 20 1911. (J. O. P. B.)

HARTLEY, SIR CHARLES AUGUSTUS (1825–1915), English engineer (*see* 13.35), died in London Feb. 20 1915.

HARTLEY, JONATHAN SCOTT (1845–1912), American sculptor (*see* 13.35), died in New York City Dec. 6 1912. Among his last exhibits were "Young Hopi Stick Thrower" (1911) and "The Cradle of Pan" (1912).

HARVARD UNIVERSITY (*see* 13.38).—The history of Harvard University, after 1909, when Abbott Lawrence Lowell succeeded Charles William Eliot as president, continued to be one of change and growth to meet new needs and opportunities.

Buildings.—Three residence halls for freshmen—Gore, Standish and Smith—accommodating about 450 men, built near the Charles river at a cost of approximately $2,500,000, were opened in 1914; and in 1919–20 a number of other dormitories, originally erected by private enterprise, were purchased by the university, thus largely increasing the residence halls under its control. Two new chemical laboratories, the Walcott Gibbs and the Thomas Jefferson Coolidge, Jun., Memorial, were opened in 1913–4, and proved a welcome addition to the university's equipment for teaching and research; and in the following year an addition to the Peabody Museum was first occupied, thus completing the university's museum buildings as originally planned by Louis Agassiz in 1859. A building for the music department and the Cruft high-tension laboratory were also opened in 1914–5. In 1915 the Widener Library was first available. This building was erected by his mother, in memory of Harry Elkins Widener, of the class of 1907, who lost his life in the "Titanic"; it is probably the most successful as it is the largest of college library buildings. The Germanic Museum, intended to exhibit the evidences of Germanic civilization in the widest sense, was completed and opened in 1921. Improvements have been made in athletic fields, gymnasia, etc.

Endowments.—The period under consideration was the most remarkable in the history of the university for the rapid increase of funds. In spite of the World War, graduates and friends gave approximately $17,000,000 in the decade from 1909 to 1919. Approximately $5,000,000 of this was for buildings and immediate use; $12,000,000 for permanent endowment. With the close of the war the alumni revived a project, started before the war but suspended, to secure additional endowment, and organized in the summer of 1919 a committee of graduates for the purpose. Up to June 30 something over $13,780,000 had been subscribed, of which over $8,500,000 had at that time been paid into the treasury. The total productive endowment of Harvard University then approximated $48,000,000.

The College.—In 1910–1 a new plan of admission to Harvard College was put into operation, which endeavours to test the intellectual condition of the applicant for admission and to establish a closer coöperation with preparatory and high school authorities; experience has shown that the plan in fact does secure closer articulation, especially with public schools, and that it provides the college with a better grade of student. In 1920 over 40% of the freshmen class entered from public schools. In its essential features the "new plan" has been adopted by at least six other important colleges. The free elective system, which furnished little or no direction to a student's choice of studies, was modified in 1910 so as to require each student to choose enough courses in some one field of knowledge to enable him actually to gain considerable knowledge of that subject; and also to distribute a certain number of courses among other fundamental subjects, so that a more systematic and well-rounded education might be secured. At the same time the "degree with distinction" was established for high attainment in general, coupled with distinguished success in the subject to which the student has given most attention. Ordinarily the candidate is obliged to pass a special examination near the end of his senior year to obtain this degree. Beginning with 1916 general final examinations on the student's field of concentration were introduced in the departments of history, government and economics for all students, whether candidates for distinction or not, and this plan is about to be extended to most departments. Experience has shown that such an examination for the degree encourages the student to think of his chief subject as a whole, and to read independently in his field; it gives an opportunity to test the student's capacity at the end of his course; and it has resulted in increased interest on the part of the students, and in a higher grade of scholarship.

Engineering School.—In 1915–6, after the Massachusetts Institute of Technology had decided to move from Boston to Cambridge, all instruction in engineering was virtually transferred to it under a coöperative agreement entered upon between the Institute and Harvard. Since there was some doubt, however, as to whether such coöperation was allowed under the terms of the large Gordon McKay bequest which was given to Harvard University to further applied science, application was made by the university authorities to the Supreme Court of Massachusetts for a judgment in the matter. The decision of the Court in 1917 made it necessary to abandon the coöperative plan, and Harvard University again established a school of Engineering Sciences, which, in spite of conditions caused by the war, made a successful beginning, and in 1920–1 had 24 instructors and 214 students.

The Graduate Schools.—The period under review has also been marked by constant developments in the graduate schools of the university.

The Graduate School of Arts and Sciences had steadily grown in numbers until checked by the war, and by 1920 was rapidly recovering its losses. The students in this school mostly prepare for careers as teachers and scholars; and in spite of the economic disadvantages under which the profession of teaching labours, it is impossible to meet all the requests coming to the school for teachers and research workers. The preparation which the Graduate School of Business Administration is giving young men for the scientific management of business has won wide appreciation and is causing large resort to the school—442 in 1920–1. In the Law School a postgraduate year of study has been established, leading to the degree of S.J.D., which is intended especially for men who wish to prepare themselves for teaching law and for research in jurisprudence. In 1919–21 the number both of faculty and students largely increased. In the Medical School new departments of pharmacology, of tropical medicine and industrial medicine have been established. Affiliation with hospitals, many of which are now grouped near the school, and changes in the faculty have secured the largest and strongest organization for teaching of medicine and for medical research in the United States. New degrees of Master of Theological Science (S.T.M.) and Doctor of Theology (Th.D.) have been established for those who wish to continue their studies after obtaining the ordinary degree, and the ordinary degree itself (S.T.B.) is now given on the basis of a general examination at the end of the student's three-year course.

University Extension.—Since 1909 Harvard University has united with Boston University, Boston College, the Massachusetts Institute of Technology, Simmons College, Tufts College, Wellesley College, and the Museum of Fine Arts in offering courses in university extension. These courses are given ordinarily in Boston to a considerable number of students each winter (1,785 in 1920–1).

World War Services.—Ten thousand Harvard graduates and students entered the army or navy of the United States during the conflict; of these 70% received commissions. No complete records exist of those who engaged in non-military service, but it may safely be said that over half the Harvard men of every age took an active part during the war. The Roll of Honour contains 372 names of men who gave their lives.

Preparation for the possible entrance of the United States into the war began early at the university, and large numbers of students and graduates attended the successive Plattsburg camps. Beginning with 1915, courses in military training were given regularly in the college. In Feb. 1916 the Harvard regiment was formed by undergraduates and trained by regular and volunteer officers; the next year the Reserve Officers' Training Corps came into existence, and early in 1917 President Lowell, through the French embassy, arranged for the visit of six wounded French officers to train the students. In the summer of 1917 the Government sent a picked group of 550 newly commissioned officers to study under these French officers at Harvard. After the United States entered the war intensive military training was begun and the academic work of the year correspondingly abbreviated. Large numbers of the teaching force entered the service both abroad and in the United States, while the student body quickly shrank to those who either because under age or physically defective were unfit for military service. During the autumn of 1918, when the Government established the Students' Army Training Corps at the university, training was furnished for the army, the navy and the marine corps to some 1,989 students. The equipment of the university in electrical engineering led to the establishment in May 1917 of a Radio school, which, originally planned for a few hundred, rapidly grew until it contained about 5,000 men. Special quarters were erected on open ground and the Cambridge Common was occupied by temporary dormitories. The university also provided quarters for the Officer Material school, which trained ensigns for the navy. As early as 1915 the generosity of a group of graduates made it possible to send out the first Harvard medical unit to assist the Allies. Successive units followed, until in 1917 a Harvard unit under Dr. Hugh Cabot joined the English forces for the duration of the war.

The number of students in 1920–1 was as follows:—

College	2,532
Graduate School of Arts and Sciences	532
Special students	77
Engineering School	214
Graduate School of Business Administration	442
Architecture	66
Bussey Institution	15
Divinity School	53
Law School	944
Graduate School of Education	121
Medical School	439
Dental School	232
Summer schools of 1920	2,077
School of Public Health	31
(330 deducted for duplication)	
Total	7,445

In 1908–9 the corresponding total was 5,250. The number of officers of instruction and administration in 1920–1 was 891; in 1908–9, 743. The total number of volumes and pamphlets in the university library in 1920 was over 2,000,000. The number of students at Radcliffe College (for women) in 1920–1 was 652. (C. H. M.)

HARVEY, GEORGE (1864–), American editor and diplomat, was born at Peacham, Vt., Feb. 16 1864, and was educated at the Peacham academy. At the age of 18 he became a reporter on the *Springfield* (Mass.) *Republican* and later on the New York *World*. In 1885 he was appointed by Gov. Green of New Jersey as aide-de-camp on his staff, and was reappointed by Gov. Abbett. The latter also made him insurance commissioner of New Jersey in 1890. During 1891–4 he was managing editor of the New York *World*. Then for several years he was engaged in the construction of electric railways and in 1898 organized a syndicate which secured possession of the lines in Havana, Cuba. The following year he purchased *The North American Review*, which he thereafter edited for several years. During 1900–15 he was president of the publishing house of Harper & Bros., and during 1902–13 was editor of *Harper's Weekly*. In 1903 he purchased the *Metropolitan Magazine*. He was said to have been the first to suggest (in 1906) Woodrow Wilson, then president of Princeton, as a presidential possibility. In the campaign of 1912 he gave Wilson strong support; but after the latter's nomination an estrangement developed, due, as it was generally understood, to the fact that Wilson intimated that his cause was being jeopardized by Harvey's officiousness. In 1916 Harvey urged the election of Charles E. Hughes, the Republican candidate for president. He was strongly opposed to the League of Nations on the ground that it involved the yielding of national sovereignty. In 1918 he established *The North American Review's War Weekly*, later called *Harvey's Weekly*, which bitterly denounced the Wilson administration. He was present at the Republican National Convention of 1920, but not as a delegate, and was influential in the nomination of Senator Harding. In 1921 he was appointed ambassador to England by President Harding.

He was the author of *The Power of Tolerance, and Other Speeches* (1911).

HARVEY, SIR JOHN MARTIN (1867–), English actor, was born at Wyvenhoe in Essex June 22 1867, and was educated at King's College school, London. He was intended for a naval architect, but took to the stage, and appeared first in 1881 at the age of fourteen in a boy's part at the Court theatre, London. Next year he was engaged by Irving at the Lyceum and remained in his company for fourteen years, playing minor parts in London but leading parts during summer tours. In 1898 he played Pelleas in Maeterlinck's *Pelleas and Melisande*, and in 1899 he entered into management with *The Only Way*, an adaptation of Dickens's *Tale of Two Cities*, in which he scored a great success. Other successes were in *A Cigarette-Maker's Romance* and *The Breed of the Treshams*. In later years he was active in promoting the production of Shakespearean plays, both in London and in the provinces, playing the leading parts himself, and he was the King in Reinhardt's production of *Œdipus Rex* at Covent Garden Jan. 1912. He married Angelita Helena de Silva, herself an actress and exponent of Shakespearean heroines. He was knighted Jan. 1 1921. During the World War Sir John Martin Harvey delivered a large number of recruiting lectures on Sunday evenings in leading theatres throughout the United Kingdom, beginning in Sept. 1914. By collections made there and elsewhere, by himself and Lady Harvey, he raised sums for the British Red Cross, and for wounded soldiers, nurses and other sufferers by the war,—amounting in all to about £25,000.

HAUCK, ALBERT (1845–), German theologian, was born at Hassertrüdingen, M.-Franken, Dec. 9 1845, and was educated at the gymnasium at Ansbach and later (1864–8) at the universities of Erlangen and Berlin. He took orders, and from 1875–8 was pastor at Frankenheim. In 1882 he became professor of theology at Erlangen, and in 1889 proceeded to Leipzig, where he was professor until 1898, and then for a year rector of the university. His published work includes *Tertullian's Leben und Schreiben* (1877) and the *Kirchengeschichte Deutschlands* (5 vols., 1887–1911).

HAUPTMANN, GERHART (1862–), German dramatist (*see* 13.68), hardly added to his reputation as a dramatist after 1909. He produced *Kaiser Karls Geisel* (1908); *Griselda* (1909); *Die Ratten* (1910), the latter in his earlier realistic manner; *Gabriel Schillings Flucht* (1912); *Der Bogen des Odysseus* (1914) and *Winterballade* (1917). His novels include *Emanuel Quint* (1911), *Atlantis* (1912) and *Der Ketzer von Soana* (1918). A complete edition of Hauptmann's works was published in Berlin in six volumes (1912).

See C. Holl, *Gerhart Hauptmann*, etc., (1913); W. Bonsels, *Das junge Deutschland und der grosse Krieg, aus Anlass des Briefwechsels Romain Rollands mit G. Hauptmann über den Krieg und die Kultur* (1914); A. Esprey, *G. Hauptmann und wir Deutschen* (1916); P. A. W. Gaude, *Das Odysseusthema bei Hauptmann* (1916); J. H. Marschan, *Das Mitleid bei G. Hauptmann* (with bibliography, 1919).

His elder brother, CARL HAUPTMANN (1858–1921), also an author, was born at Ober-Salzbrunn, Silesia, May 11 1858. He was educated at the Realschule, Breslau, and at the university of Jena, where he studied physical science and philosophy under Haeckel. He was afterwards a pupil of Avenarius and Forel at Zürich, and his first published work, *Die Metaphysik in der modernen Physiologie* (1893), shows their influence. He returned to Silesia about 1890 and devoted himself thenceforward to literature, publishing a very large number of dramas, poems, novels and tales of peasant life in the Riesengebirge. Amongst his novels may be mentioned *Mathilde* (1902) and *Einhart der Lächler* (1907), and amongst his dramas *Ephraim Breite* (1898), *Die Bergschmiede* (1901) and *Napoleon* (in two parts, 1906). He died in Berlin Feb. 3 1921.

See *Carl Hauptmann*, by Hans Heinrich Borcherdt (1911).

HAVANA, Cuba (*see* 13.76).—The pop. of Havana, according to the census of 1919, was 360,517, an increase of more than 20% over that of 12 years earlier. During the 10 years previous to 1918, 295,320 immigrants reached Cuba through the port of Havana. Within recent years the city has undergone a radical change. Modern pavements, scientific sanitation and 20th-century discipline of every sort have helped to make it a thriving, healthful, vigorous city in keeping with its commercial and industrial importance. Motor-cars swarm the streets, which are greatly congested, especially in the older section where they are very narrow. This condition will be relieved, it is hoped, by the construction of a subway, plans for which were prepared early in 1921. The estimated cost was about $10,000,000.

The police corps of Havana was said to be one of the most efficient organizations of the republic. The fire department was also well organized and the most modern fire-fighting apparatus had been recently installed. In keeping with the general prosperity of the island, a great deal of building went on in Havana of fine private residences, luxurious club-houses and modern hotels, the last to care for the large number of American tourists. The most noteworthy public building completed in recent years was the new presidential palace, built at a cost of nearly $5,000,000, and opened Jan. 31 1920. Situated most impressively on the Avenida de las Palmas, it is said to be one of the handsomest palaces built in modern times. Among the noteworthy developments in educational lines was the establishment in Havana in 1920 of a Spanish-American branch of the College of Business Administration of Boston University. The university of Havana had nearly 1,600 students in 1919, an increase of about 170% over the enrolment 12 years before.

Havana is the chief centre of trade for the island and nearly all important commercial companies and banks have their main offices located there. More merchandise enters and leaves this port than any other on the western hemisphere except New York. At almost any time there can be seen in the harbour ships that represent nearly the entire world. About 75% of the imports of Cuba are handled here, though a considerably smaller proportion of the exports, which are shipped from the many lesser ports near various producing centres. In 1919 the total customs receipts for the island were $44,403,323, of which $33,733,915 were collected at Havana. In 1920 the receipts at Havana reached the record sum of $52,700,597, in comparison with $17,922,092 ten years before. Japan in 1919 established a direct line of steamships between Yokohama and Havana via the Panama Canal.

The All American Cables, Inc., obtained four permits in 1920 to land cables on the Cuban coast, two of which were to enter Havana, one from the United States and the other from Mexico or the Central American coast. A telephone cable between Havana and Key West has been completed, making possible telephone communication between Cuba and any part of the United States. Early tests proved conversation between New York and Havana to be as easy as between New York and Washington. Early in 1921 port conditions (*see* CUBA) were materially improved. (W. R. MA.)

HAVERFIELD (BALGUY), **EVELINA** (1867–1920), English war hospital worker, daughter of the 3rd Baron Abinger, was born Aug. 9 1867. She married Maj. Haverfield, R.A., in 1887, and *en secondes noces* Gen. Balguy in 1899. A keen sportswoman, she collected abandoned troop horses on the veldt during the Boer War and nursed them back to good condition. She was among the first London women-suffragists to be sentenced to imprisonment and organized a branch of the Women's Social and Political Union. She was one of the original members of the Women's Emergency Corps in Aug. 1914, founded and organized the Women's Volunteer Reserve, and was commandant-in-chief of the Women's Reserve Ambulance (Green Cross Corps). In April 1915 she went to Serbia as administrator of the Scottish Women's hospital unit at Valjevo, and remained with Dr. Elsie Inglis working for the Serbs as prisoners of the enemy from Nov. to Feb. 1916. In Aug. 1916 she went to Russia in charge of the transport column of Dr. Inglis's unit. On her return in Nov. 1917 she organized a comforts fund for the Serbian army, which became a fund for disabled men and their dependents after the Armistice. In Aug. 1919 she went to Serbia as hon. sec. of this fund and as commissioner for the Serbian Red Cross Society in Great Britain. At her instigation her friends at home raised another fund for Serbian children, with which she established an orphanage at Baiyna Bachta, on the borders of Bosnia, and there she succumbed to pneumonia brought on by fatigue and exposure March 21 1920. She received the Order of St. Sava, classes IV. and V., St. George's medal for bravery under fire, and a Russian medal, class II., for meritorious service. The Order of the White Eagle was posthumously bestowed.

HAVERFIELD, FRANCIS JOHN (1860–1919), English historian and archaeologist, was born at Shipston-on-Stour Nov. 8 1860. He was educated at Winchester and New College, Oxford, and after some years as a schoolmaster was appointed tutor of Christ Church, Oxford, in 1891, and official student in 1893. He became a great authority on the history and antiquities of Roman Britain and was entrusted by Mommsen with the editing of the British section of the *Corpus Inscriptionum* (*see* 18.683). In 1907 he was elected Camden professor of ancient history at Oxford. He was a fellow of the British Academy and a member of the Royal Commission on Ancient Monuments, England; he was also first president of the Society for the Promotion of Roman Studies. He died at Oxford Sept. 1 1919. Amongst his publications were *The Romanization of Roman Britain* (3rd ed. 1915); *Ancient Town Planning* (1913) and many monographs on Roman history.

HAWAII (*see* 13.83).—In 1920 the pop., exclusive of military and naval forces, was 255,912, an increase of 64,003, or 33·4%, over that of 1910. It was distributed by race as follows: Hawaiian, 23,723; part-Hawaiian, 18,027; Portuguese, 27,002; Porto Rican, 5,602; Spanish, 2,430; other Caucasian, mostly American, 19,708; Japanese, 109,274; Chinese, 23,507; Filipino, 21,031; Korean, 4,950; Negro, 348; all others, 310. The distribution by islands was as follows: Oahu, 123,496; Hawaii, 64,895; Maui, 36,080; Kauai, 29,247; Molokai, 1,784; Niihau, 191; Lanai, 185; Midway, 31; Kahoolawe, 3. The pop. of Honolulu, the capital, was 83,327, an increase of 59·7% over that of 1910. That of the second city in size, Hilo, was 10,431.

Males numbered 151,146, or 59·1%, and females 104,766, or 40·9%, the corresponding percentages in 1910 being 64·1 and 35·9. The excess of males is chiefly among adults, but since the cessation of Japanese, Chinese and Korean labour immigration there has been a constant tendency towards normal sex and age ratios. The Hawaiians continue to decrease, but at a diminishing rate. The decrease for 1910–20 was 2,318, or 8·9%, as compared with a decrease of 3,746, or 12·58%, for 1900–10. The part-Hawaiians, however, are increasing more rapidly than the Hawaiians are decreasing. Their increase for the last decade was 5,521, or 44·15%, and for the preceding decade, 4,658, or 59·35%. The death-rate of Hawaiians and the birth-rate of part-Hawaiians are the greatest among all races. The Hawaiians apparently are destined to disappear through intermarriage with other races rather than by deaths. They intermarry chiefly with Caucasians and Chinese. Each of these crosses, especially the latter, produces a good stock. The Japanese and Koreans are the extremists in preserving racial solidarity.

Immigration has been occasioned chiefly by the rapid growth of industries since 1875. Much of it has been of assisted Latin and Oriental unskilled labourers. Many of these, under improved conditions, become sooner or later skilled labourers, and their children, with the advantages of education, seldom engage as unskilled labourers. Hence the constant need of replenishing the supply. The last immigration assisted by the Government was in 1906–12, and consisted of 5,288 Spanish, 4,962 Portuguese and 2,056 Russians. Since then the only assisted immigration has been of Filipinos, introduced by the sugar producers. The number of these in the territory increased from 2,318 in 1910 to 21,031 in 1920. The increase in population, apart from this assisted Filipino immigration and a small but steady unassisted Anglo-Saxon immigration, is now mainly through births. There has been some emigration of Portuguese, Spanish, Filipinos, Russians and Japanese to California.

Chinese immigration, restricted previously, has been prohibited since 1898; the Chinese decreased from 25,762 in 1900 to 21,674 in 1910, but increased to 23,507 in 1920, indicating that this race has now established itself on a basis of natural increase, notwithstanding the abnormally small number of Chinese women and the tendency of Chinese men to intermarry with Hawaiian women. Japanese arrivals have exceeded departures since the "gentlemen's agreement" of 1907 between the United States and Japan, but the arrivals have been in large part women unknown to their future husbands, the so-called "picture brides," and not only has the largest increase in any race in recent years been of Japanese through births, but this race now constitutes by far the largest element in the population. Their increase in 1910–20 was 29,599, or 37·15%, as compared with 18,559, or 30·37%, for the preceding decade. For the year ended June 30 1920 Japanese births numbered 4,963, and deaths 1,596, as compared with 5,202 births and 2,968 deaths for all other races. The rapid increase in the number of Japanese who are native born and therefore American citizens presents the most important problem for the future. Comparatively few of these have yet arrived at voting age. The increase in Portuguese was 4,701 for the last decade and 6,628 for the preceding decade. The increase in Caucasians other than Latins, and exclusive of military and naval forces, was 4,841 for 1910–20 and 4,290 for 1900–10. These were mainly Americans, but with a considerable British element, and in 1921 they constituted the dominant element in the social and industrial life of Hawaii.

Industries and Commerce.—The remarkable prosperity which Hawaii enjoyed previous to 1910 continued during the decade 1910–20. The number of banks increased from 11 in 1910 to 26 in 1920, and their deposits from $13,324,305.54 to $52,783,114.04. The assessed value of taxable property increased from $150,268,467 to $287,006,792; exports increased from $47,029,631 to $145,831,074, and imports from $26,152,435 to $68,876,094. Trade is chiefly with the mainland of the United States, $142,246,003 of the exports, and $59,261,621 of the imports in 1920; while $3,585,071 of the exports and $9,614,473 of the imports were with foreign countries. The exports named in order of value comprised sugar, $118,998,848, canned pineapples, $18,869,449, fruits and nuts, coffee, molasses, hides, canned fish, rice, honey, wood, sisal and tallow. The imports from the United States comprised a wide range of articles while those from foreign countries were in large part food supplies from Japan, bags from India and nitrates from Chile. The sugar industry continues to be by far the largest. It grew rapidly until 1911, but since then comparatively little land has been available for further expansion. The largest crop, that of the crop year ending Sept. 30, 1915, amounted to 646,445 short tons. This industry is conducted mostly on a large scale by corporations, which own the mills and raise on land owned or leased by them most of the cane they grind. The capital stock is widely distributed. The yield per acre is larger than in any other country, about five tons of sugar per acre on the average, the irrigated land yielding about 70% more per acre than the unirrigated. On some fields a new variety of cane is yielding 12½ tons of sugar per acre. About half the acreage is irrigated by conduits from mountain streams, storage reservoirs and pumping from artesian and surface wells. The most recently constructed large irrigated project, completed in 1916, consists of about 25 m. of concrete-lined tunnels and ditches and steel pipe 6 ft. in diameter, the longest tunnel extending 2·76 m., for conducting water from the rainy windward to the arid leeward side of the island of Oahu. The employees, of many nationalities, on the sugar plantations number about 45,000. These, besides receiving house, fuel, water and medical attendance free, are paid a monthly basic wage and a bonus which varies with the price of sugar. In 1920 the minimum monthly basic wage—that is, for the lowest class of labour—was $20, and the bonus, extraordinarily large, was 276% of the wages. For 1921 the minimum monthly basic wage was $30. Much has been done to improve the living conditions of employees by replacing tenements with cottages and garden space, providing hospitals, entertainment halls and motion-pictures, playgrounds, kindergartens, social-service workers, and by improving sanitary conditions generally.

The canned pineapple industry has had a remarkable growth. It is an industry of the present century. During the first decade the pack increased from practically nothing to 544,968 cases per year, while during the second decade it increased to 5,978,064 cases, or 143,473,536 two-pound cans, valued at approximately $31,000,000, for 1920. One of the factories is the largest fruit cannery in the world and has attained a maximum output of 777,371 cans in a day. About 46,000 ac. of land are devoted to this industry.

While Hawaii exports and imports more of what it produces and consumes than most other countries, there is nevertheless considerable farming for subsistence, and several industries, such as the livestock and fishing industries, figure largely in local trade. Much has been done since 1895 to promote homesteading of public lands, but with small success. During 1910–20 2,650 homesteads were taken up, covering an area of about 55,000 ac., at prices aggregating about $1,500,000, which was probably about a third of the actual value. The most striking feature in Hawaii's industries as well as that which has contributed most to their success, is the extent to which science is applied, not only by the individual industrial concerns but also through such more general agencies as the sugar planters' association's experiment station, the university of Hawaii, the territorial bureau of agriculture and forestry and the U.S. experiment station.

Although Hawaii is essentially an agricultural country, the principal agricultural industries are such as require much manufacturing, not only directly, as in sugar, rice and coffee in mills and fruit and fish in canneries, but also indirectly, as in iron and fertilizer works and can factories of large size. The ironworks, while doing much work of other kinds, such as marine-engine and drydock work, have specialized in sugar-milling machinery to such an extent and with such proficiency that they receive orders from many countries and have established branch offices or works in several other countries. The principal can factory has a capacity of 100,000 cans an hour. There are many other kinds of manufacturing but on a small scale. Strikes have seldom occurred in Hawaii, but in 1909 and again in 1920 about 7,000 Japanese labourers struck, unsuccessfully, on the sugar plantations of the island of Oahu. Unionism has obtained little foothold. There is a growing tendency toward welfare legislation affecting labour. In 1913 a Compulsory Workmen's Compensation Act was passed and a public utilities commission was created. The railways were already under the Interstate Commerce Commission, and in 1920 by Act of Congress the telephone, telegraph and wireless utilities were brought under it.

Communications.—The rapid growth of commerce on the Pacific, due to general causes as well as to the opening of the Panama Canal, called for the formulation and execution of a comprehensive plan, involving an expenditure of many millions of dollars, for the development of shipping facilities at this commercial cross-roads. To this end much has been accomplished since 1905 by the Federal and territorial Governments and private enterprise. Among other things, the harbours at Hilo on the island of Hawaii and at Kahului on the island of Maui have been developed by the construction of breakwaters and wharves and by dredging, and similar work is in progress at Nawiliwili, on the island of Kaui. At Honolulu the harbour was deepened and widened, and in 1921 was being extended at one end, while near the other end a smaller harbour is being made for small vessels. At Honolulu there were in 1920 two floating drydocks, two automatic coal-handling plants and the oil-storage tanks of three companies, connected with the wharves by pipe lines and electrical freight-handling apparatus. Practically all the new wharves are of concrete. From 1910 to 1920 the arrivals and departures of deep-sea vessels, mainly steamships, but exclusive of numerous naval vessels, army transports and coal-bunker vessels, increased from 864 to 1,069, and their tonnage from 2,601,676 to 5,430,976. A fleet of 12 steamers is engaged exclusively in inter-island traffic. There are approximately 350 m. of steam railways on the four principal islands, besides about 625 m. of private railways on sugar plantations. Road construction has proceeded rapidly for some years. Much of it is of concrete. Hawaii was the first country to establish wireless communication for commercial purposes. Besides a cable there are four powerful wireless plants for trans-oceanic communication, and smaller stations for communication between the islands and with ships at sea. The five larger islands are well covered with efficient telephone systems.

Administration.—In 1913 the territorial Legislature provided for open direct primaries in territorial and county elections. In 1918 Congress authorized the territorial Legislature to provide for woman suffrage, but before the Legislature acted this was brought about in 1920 by the 19th Amendment to the Federal Constitution. At the ensuing election many women failed to register. The total registration was 26,366, of whom 17,084 were men and 9,282 women. By races the registered voters comprised 11,219 Hawaiians, 3,460 part-Hawaiians, 5,336 Americans, 3,091 Portuguese, 1,142 Chinese, 658 Japanese and 1,460 others, largely British. The first territorial Legislature was controlled by the Home Rule party, whose slogan was "Hawaii for the Hawaiians," but since then the voters have been divided mainly, and in late years entirely, between the Republican and Democratic parties, with the Republicans in the majority.

Finance.—The bonded debt of the territory was in 1920 $12,374,000, bearing rates of interest from 3½ to 4½ %. Most of this has been incurred during 1910–20 for public improvements, chiefly wharves, roads, school-houses, and public buildings. Much current revenue also is expended on public improvements. The counties have no bonded debt except that the city and county of Honolulu issued small amounts of district improvement bonds payable in instalments by assessments on the property benefited, but $3,756,747.39 of the territorial bonded debt has been incurred for county improvements, for which the counties reimburse the territory in interest and sinking funds. The total revenue of the territory and counties for the year ended June 30 1920 was $9,902,032.25 of which $4,845,416.29 went to the territory and $5,056,618.96 to the counties, as compared with $2,621,758.01 and $1,394,693.29 respectively for 1910.

Education.—The recent changes include the introduction of kindergartens in the public-school system, the enlargement of the college of agriculture and mechanic arts into a university, to which has been transferred the aquarium and the marine biological laboratory connected therewith, the establishment of a trade school and schools for the physically defective and the feeble-minded, the multiplication of high schools and the extension of physical education, music, industrial training and home-making in the primary and secondary schools. Medical inspection of school children is regularly made, and a dental infirmary for them has been provided for by private gift. Between 1905 and 1920 many large concrete school buildings were erected. Public-school buildings furnish community centres, and they and their grounds are used in evenings by private organizations for educational moving-pictures, mass singing, short talks and other special features. Perhaps the most striking feature in Hawaiian education is the diversity of races and racial mixtures, sometimes 40 to 50 in a single school, and the absence of racial feeling. The number of pupils increased from 25,537 in 1910 to 45,701 in 1920, of whom 38,295 were in the public schools and 7,406 in private schools. Noteworthy, too, is the increase of Japanese pupils in the public schools from 6,393 in 1910 to 17,541 in 1920. For some years the Japanese have maintained through the territory so-called Japanese language schools, which their children attended before or after the public-school hours, and at which were taught not only the Japanese language but also Japanese history, institutions, ideals and loyalty in spite of the fact that most of these children were American citizens by birth. In 1920 the problem was settled by the passage of a law, acceptable to the Japanese, subjecting all such schools to the supervision of the department of public instruction, limiting them to one hour in the afternoon, six days a week, and requiring the teachers to pass satisfactory tests in the English language, American history and institutions and the ideals of democracy, and to use only such text-books and give only such courses as should be approved by the department. In 1912 a territorial library was opened in a handsome building in Honolulu's civic centre. It now has nearly 50,000 volumes, a trained corps of librarians, and 232 stations throughout the territory which it supplies through "travelling libraries."

Charities.—Of all the departments of the territorial Government, none, except that of education, is of wider scope or expends more out of current revenues than that of public health. An unusual feature is the employment or subsidizing of physicians, so that all, however indigent or remote from centres of population, may have proper medical attendance. The principal territorial institution under this department is the leper settlement on the island of Molokai, with its auxiliary the leper hospital in Honolulu. Formerly emphasis was laid on isolation, with the result that the inmates of these institutions were regarded as outcasts and, although at one time they numbered over 1,200, it was so difficult to enforce the law that many remained at large and little progress was made in the eradication of the disease. In 1909 the policy was changed so as to lay emphasis on treatment, with the result that the lepers freely surrendered themselves, and the number of inmates, which at first increased, was reduced to 662 by 1920, and there were comparatively few lepers at large.

History.—During 1910–20 Hawaii grew in importance as the commercial cross-roads of the Pacific, as the military and naval outpost of the Pacific coast of the United States, which has called for an expenditure of vast sums on the great naval station at Pearl Harbor and the numerous forts and military posts on Oahu I., and as the friendly meeting place of East and West. In 1917 there was incorporated in Hawaii as the Pan-Pacific Union what had for some years previously been known as the Hands-around-the-Pacific Club, the objects of which were not only to cultivate further the spirit of interracial brotherhood which had already become a notable feature in Hawaii, but also to foster a similar spirit among all the peoples of the Pacific and promote coöperation among them for their common welfare. In 1920 it inaugurated a series of Pan-Pacific conferences to be held at Honolulu, the first of which was a scientific conference held in Aug. 1920, and the second of which, an educational conference, was set for Aug. 1921. While Hawaii was called on heavily and responded beyond her quota for men and money for the World War, she continued to enjoy great prosperity owing to the demand for her products. In 1909 President Roosevelt, in order to prevent poaching by Japanese feather exploiters, set aside as a bird reservation the chain of small islands extending for 1,200 m. to the N.W. of the larger islands, excepting Midway I., on which there is a cable station. This is the largest and most populous bird colony in the world.

In 1916 Congress reserved as a national park the active volcanoes, Kilauea and Mauna Loa, on the island of Hawaii, and the great extinct crater, Haleakala, on the island of Maui, with their surrounding regions. The healthy climate and beautiful scenery are attracting tourists in numbers beyond the capacity of steamships to bring them and are making the tourist business one of great importance. In 1920 the centenary of the arrival of the missionaries was celebrated on a grand scale, reviewing a century of what has been called a great history in miniature. The governors of Hawaii between 1907 and 1921 were:—W. F. Frear, 1907–13; L. E. Pinkham, 1913–8; and C. J. McCarthy, 1918.

Authorities.—Consult, in addition to the list in 13.93, *Preliminary Catalogue of Hawaiiana*, (the most complete bibliography, 1916); *The Centennial Book 1820–1920*, (by 16 authors, 1920); H. H. Gowen, *The Napoleon of the Pacific* (1919); O. H. and A. E. C. Gulick, *The Pilgrims of Hawaii* (1918); W. R. Castle, Jr., *Hawaii Past and Present* (1916); N. B. Emerson, *Unwritten Literature of Hawaii* (1909); C. W. Baldwin, *Geography of the Hawaiian Islands* (1908); W. A. Bryan, *Natural History of Hawaii* (with bibliography, 1915); W. T. Brigham, *The Volcanoes of Kilauea and Maunaloa* (1909); J. F. Rock, *The Indigenous Trees of the Hawaiian Islands* (1913); *The Ornamental Trees of Hawaii* (1917); D. S. Jordan and B. W. Evermann, *The Aquatic Resources of the Hawaiian Islands* (3 vols., 1905); *A Survey of Education in Hawaii*, made under the direction of the U.S. Commissioner of Education (1920); Reports of the U.S. Commissioner of Labor on Hawaii (1901–3–6–11–16); *Men of Hawaii*, compiled by *Honolulu Star-Bulletin*, Ltd. (1917, revised edition in prep. 1921); miscellaneous publications of Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History. For current history and statistics, see particularly annual reports of the governor of Hawaii and Thrum's *Hawaiian Annual*. (W. F. F.)

HAY, IAN, pen name of John Hay Beith (1876–), British novelist, was born at Rusholme, nr. Manchester, April 17 1876, and was educated at Fettes College, Edinburgh, and St. John's College, Cambridge. At the outbreak of the World War he joined the Argyll and Sutherland Highlanders, 10th Service Batt., was mentioned in despatches and decorated with the M.C. He published amongst other novels *Pip* (1907) and *A Man's Man* (1909); but he is best known as the author of *The First Hundred Thousand* (1915), a humorous sketch of military life in the early days of recruiting, and its sequel *The Last Million* (1918). In 1917 he published *Carrying On*, and in 1919 his novel *Happy Go Lucky* (1913) was dramatized as *Tilly of Bloomsbury* and produced by Arthur Bourchier at the Apollo theatre, London. *A Safety Match* (1911) was also dramatized and produced by Arthur Bourchier at the Strand theatre in Jan. 1921.

HAYASHI, TADASU, Count (1850–1913), Japanese statesman (*see* 13.109). In the second Saionji Cabinet (1911–2) he held office *ad interim* as Foreign Minister during the absence of Visct. Uchida in Washington, and also held the portfolio of the Ministry of Communications. Owing to having contracted diabetes, from Dec. 1912 he lived in strict retirement at his villa at Hayama. In the following June he fractured his thigh as the result of being thrown out of a 'rikisha, and amputation was found necessary. He failed to rally completely from the operation and died on July 10 1913. He was buried in the Foreign Office corner of the Aoyama cemetery. In his death Japan lost an eminent diplomat, a genuine scholar and a man of strong opinions.

HAZLITT, WILLIAM CAREW (1834–1913), British bibliographer (*see* 13.120), died at Richmond, Sur., Sept. 8 1913.

HEALTH MINISTRY.—The Ministry of Health in Great Britain was created by the Act of 1919. This had as its principal object the concentration of the main health services of the country in a single department under a Minister of Health responsible to Parliament. The Act in the form in which it received the royal assent established a Minister of Health for England and Wales with a parliamentary under-secretary. Wales was given a Board of Health separately constituted but responsible directly to the minister. A Scottish Act was subsequently passed, setting up a Scottish Board of Health; this is entirely a separate organization and its chairman and parliamentary head is the Secretary for Scotland, who has a Scottish Under-Secretary for Health. The main Act also designated the Chief Secretary for Ireland as Minister for Health in Ireland. He is assisted by an Irish Public Health Council but its functions are purely advisory and its members are nearly all nominated directly by the Chief Secretary. It is important therefore to note that the health administrations of England and Wales, Scotland, and Ireland respectively, are quite independent, are under three distinct ministers, and that if any United Kingdom health legislation is desired it must be sanctioned by three distinct Government offices. Nurses' registration, indeed, was carried in 1920 in the passage of three identical Acts; and the Medical Research Committee (a United Kingdom body) had to be withdrawn completely from the sphere of the Health Ministries and placed under a committee of the Privy Council. In practice the Ministry of Health and the Scottish Board of Health perform almost identical functions and have proceeded on similar lines. Conditions in Ireland are so different that no comparison is possible.

The Ministry of Health came into being on July 1 1919 and assumed from that date the whole of the powers and duties of the Local Government Board and of the English and Welsh insurance commissioners, save for their powers over the Medical Research Committee. The powers of the Privy Council relating to midwives were immediately vested in the new ministry. On Oct. 1 it took over, as provided by the Act, the powers of the Board of Education with respect to the health of mothers and young children, and of the Home Office in relation to infant life protection under the Children Act. On Dec. 1 the ministry further assumed responsibility for the duties of the Board of Education regarding the medical inspection and treatment of children and young persons. Arrangements had however been made to enable certain of these latter duties to be carried out by the Board of Education on behalf of the Minister of Health.

In May 1920 the ministry took over from the Home Office the administration of the Anatomy Acts and of certain powers and duties in relation to lunacy and mental deficiency. The 1919 Act also prescribes that there shall be transferred to the Ministry of Health "all or any of the powers and duties of the Minister of Pensions with respect to the health of disabled officers and men after they have left the service," and the date was to be not later than three years after the termination of the World War (*see* Pensions Ministry). Many powers inherited from the Local Government Board, but inappropriate to the new body, have been transferred to other departments, ranging from the Board of Education to the Electricity Commissioners and the Ministry of Transport.

The activities of the new ministry fall into five main sub-divisions:—(1) public health, (2) local administration and taxation, (3) housing and town-planning, (4) administration of the Poor Law and the Old Age Pensions Acts, (5) national health insurance.

It will be seen that these arise naturally by inheritance from the parent bodies. Indeed, Dr. Addison, the then President of the Local Government Board and Minister Designate of Health, was careful to point out when introducing the bill that no new medical treatment was provided for any person by the bill, nor did it affect the functions of any local authority of any kind. There is, however, one interesting innovation in connexion with the actual machinery of the Act itself. Section iv. provides that consultative councils shall be established for the purpose of providing advice and assistance to the minister. They have the power of making recommendations to the minister on their own initiative and their reports are to be published if possible. Already several of these councils have been set up (*e.g.* medical and allied subjects, insurance, and Welsh affairs), and a report by the first-named, outlining extensive changes in health organization, was published in 1920.

The organization and administration of public health in England on systematic and vigorous principles dates from the Royal Sanitary Commission of 1869. As a result of the commission's report the Local Government Board was set up in 1871. In 1872 the great Public Health Act was passed which for the first time organized all England into sanitary districts, imposed on every sanitary authority the obligation of appointing both a medical officer of health and an inspector of nuisances, and established the principle of a grant-in-aid towards their salaries. Sanitary law was further amended and codified by the Act of 1875 whose 343 sections still determine in many fields the health administration of the country. This vigorous health policy produced almost unhoped for results. The group of typhus, typhoid, scarlet fever, smallpox, cholera, diphtheria, measles and whooping-cough—the "fevers"—caused in the decade 1861–70 713,000 deaths out of a population for England and Wales numbering roughly 22,000,000. In the years 1910–9 the population had risen to some 33,000,000, but the deaths from this group sank to 252,000, and of these measles and whooping-cough accounted for 169,000.

The position was reviewed by a Royal Commission from 1905–9.

It was found that confusion had once again crept in and that the numerous groups of Acts which had to be administered by the various local authorities—county councils, district councils, parish councils, boards of guardians—stood in urgent need of simplification. The commissioners presented a majority and a minority report, both urging reorganization, while the minority (Webb) report also proposed the abolition of the boards of guardians. In 1917 the Maclean Committee presented conclusions, subsequently adopted by the Government, practically embodying the minority report.

Meanwhile in the combat with disease progress has continued. New ground has been broken in the case of tuberculosis, venereal disease, and child welfare. Tuberculosis was brought much into public notice during the Insurance Act campaign in 1911, and though the results from sanatorium treatment have not fulfilled the earlier hopes as to cure of actual sufferers, yet the mortality statistics have been most encouraging. The death-rate per 100,000 from tuberculosis (all forms) has diminished from 139·7 in the quinquennium 1910–4 to 125·8 in 1919 and 112·8 in 1920, by far the lowest figure ever recorded in Britain. Though this fall undoubtedly owes something to the effects of the great influenza pandemic of 1918–9 which swept away many cases which would ultimately have swelled the tuberculosis mortality, there are factors which give hope that here we have a proportion of permanent gain.

Venereal disease was the subject of the report of a Royal Commission in 1916 and has since been officially recognized as an infectious disease presenting a community as well as a personal aspect. A beginning has consequently been made with clinics and propaganda work throughout the country, treatment being free and the cost shared between local and central authorities (75 % central, 25 % local). Child-welfare grants-in-aid (50 % of the total expenditure) increased from £12,000 in 1914–5 to £4,000,000 in 1919–20. Concurrently, though not necessarily because of this expenditure, infant mortality fell from an average of 110 in the years 1911–5 to the unprecedentedly low levels of 89 per 1,000 in 1919 and 80 per 1,000 in 1920. The general death-rate (all causes) in 1920 was 12·4 per 1,000, being the lowest on record.

Local administration and local loans call for little comment. Local finance, heavily strained by the rise in prices, has also had a large burden to bear in the cost of social reform; thus in the year 1920 a sum of £5,266,000 was borrowed for the sole purpose of settling ex-service men on the land. Local finance has also shown an unexpected buoyancy in the raising of large sums for the housing programmes by 6 % housing bonds.

Housing, previous to 1918 a very minor province of the Local Government Board, expanded so vastly as to form almost a ministry in itself. House-building, seriously depressed since 1911, had been entirely stopped during the World War. The complete hold-up, during more than five years, of the natural overflow of the population in emigration much more than balanced war losses. The combination of these two factors caused a congestion so great that it was determined at the end of the World War that local authorities should forthwith initiate and carry out large housing schemes, with supervision and financial assistance from the State. These proposals were made law in 1919 [Housing and Town Planning Act, Acquisition of Land Act, Housing (Additional Powers) Act.] These Acts make it obligatory on every local authority to provide for the housing of the working classes within its area, and they guarantee that the exchequer will bear any deficit on a housing scheme over and above the produce of a rate of 1d. per pound. The Additional Powers Act also provides that a subsidy may be paid to private individuals who have completed a house "suitable for the working classes" to the satisfaction of the ministry before a specified date.

By July 31 1920 10,748 schemes had been submitted by 1,679 local authorities and 149 public utility societies; 5,211 applications had been received for the approval of house plans covering 246,159 houses; tenders had been approved for 135,572 houses and building had commenced on 30,618. Meanwhile a subsidy had been sanctioned for 17,593 houses to be erected by private enterprise, and 1,000 more had received the grant on actual completion. A very rough preliminary survey by the local authorities of the number of houses eventually required had given an estimated need of 800,000 houses but this was almost certainly too high. In July 1921 the Cabinet decided that only the 176,000 houses already contracted for could be completed owing to the grave financial position of the country and the enormous cost of the scheme.

A review of the administration of the Poor Law and the Old Age Pensions Act shows a great falling-off in the number of adults in receipt of domiciliary relief and a small decrease in the numbers receiving institutional relief after 1910 (when old age pensions were granted). The war period reveals a further striking decrease in all groups in receipt of relief (726,060 in Jan. 1915; 549,672 in July 1919). Old age pensions were raised from the 5s. per week originally granted in 1910 to 10s. per week by the Act of 1919, which also provides that out-door relief shall no longer disqualify for the receipt of pension. Pensions payable on March 26 1920 numbered 957,915, of whom 620,343 were women. Of these totals about 95 % were in receipt of the maximum pension of 10s. Unemployed relief, administered by the Local Government Board under the Unemployed Workmen Act of 1905 was transferred to the Ministry of Labour.

The changes in national health insurance in consequence of the amalgamation with the Local Government Board were mainly administrative. The joint committee was reconstituted and in 1921 consisted of the Minister of Health (chairman), the Secretary for Scotland, the Chief Secretary for Ireland and a fourth member having special experience of national health insurance in Wales. The Medical Research Committee constituted under the Insurance Act of 1911 was transferred to a committee of the Privy Council under the name of the Medical Research Council. Its funds are now derived from a direct parliamentary grant instead of from a levy of 1d. per head per annum for each insured person.

The first full audit of the approved societies took place in 1920. It was anticipated in 1921 that its final completion would show that the surplus of all the approved societies amounted to £7,000,000. Much of this of course was due to the war modifications of approved societies risks, but the increasing health of the nation must also be taken into account.

The Scottish Board of Health is completely independent of the English ministry though proceeding on similar lines. The board derives directly from the board of supervision for relief of the poor, set up in 1845, to which public health was added by the Act of 1867, transformed in 1874 into the Local Government Board for Scotland and so in 1919 by reorganization with the insurance commission into its present form. A feature differing widely from anything in England, however, is the Highlands and Islands Medical Service Board. This was set up by Act of Parliament in 1913 and is subsidized directly by the exchequer. It approximates to a State medical service and was only provided on account of a strong report in 1912 (Dewar Committee) showing that while the various health services in these areas were inadequate no amelioration could be expected from local resources which were completely exhausted. (W. E. El.)

HEALY, TIMOTHY MICHAEL (1855–), Irish lawyer and politician, was born at Bantry, Cork, May 17 1855. He was educated at the Christian Brothers' school, Fermoy, and in 1884 was called to the Irish bar, becoming a Q.C. in 1899. He entered Parliament in 1880 as Nationalist member for Wexford, and held that seat until 1883, afterwards sitting for Co. Monaghan (1883–5), South Londonderry (1885–6), and North Longford (1887–92). Mr. Healy seconded the vote of confidence in Parnell moved by Justin M'Carthy when the Irish leader was attacked (1890), and was an energetic member of the Nationalist party. He was called to the English bar in 1903, and became a K.C. in 1910. From 1892 to 1910 he sat for North Louth, and in 1910 successfully contested North-East Cork, but lost his seat in 1918. He came forward with Mr. William O'Brien as a strong opponent of the 1909 budget.

He published *Loyalty plus Murder* (1884); *A Word for Ireland* (1886); *Stolen Waters* (1913) and *The Great Fraud of Ulster* (1917).

HEARST, WILLIAM RANDOLPH (1863–), American newspaper proprietor, was born in San Francisco, Cal., April 29 1863. He entered Harvard in 1882 but left after three years without finishing his course. As the only child of George F. Hearst (1820–1891), U.S. senator from California (1886–91), a mining man of great wealth, he had the use of ample capital at the outset of his career. In 1886 he became proprietor of the *San Francisco Examiner*, the first of a long chain of papers to come under his control. In 1895 he bought the New York *Journal* and the following year founded the *Evening Journal*, the morning paper being known after 1902 as the *New York American*. Other papers founded by him were the *Chicago American* (1900); *The Chicago Examiner* (1902); the *Los Angeles Examiner* (1902); *The Boston American* (1904), and the *Atlanta Georgian* (1906). He also purchased the *Boston Advertiser* (1917); the *Chicago Herald* (1918), thereafter combined with the *Examiner* as the *Herald and Examiner*: the *Washington Times* (1919); and the Milwaukee *Wisconsin News* (1919). He was likewise proprietor of the *Cosmopolitan Magazine*; *Good-Housekeeping Magazine*; *Harper's Bazar*; *Hearst's Magazine*; *Motor Magazine*; and *Motor-Boating Magazine*. His papers were sensational in form and contents and had an enormous popular circulation. They upheld the cause of the people against the moneyed interests, but the charge was often brought that they appealed to the baser passions. They were America's chief representatives of "yellow journalism" (*see* 19.569). In 1916 they were barred from circulation in Canada "because of garbled despatches" concerning the World War. After America's entrance into the war they were frequently charged with disloyalty and in many towns attempts were made to suppress them. From 1903 to 1907 Mr. Hearst was representative in Congress from New York, and in 1904 had support as presidential candidate at the National Democratic Convention. In 1905 he was Democratic candidate for mayor of New York on the Municipal Ownership ticket, and four years later on the Independence League ticket; in 1906 he was candidate for governor of New York on the Democratic and Independence League tickets, in every instance being defeated. He strongly opposed the League of Nations.

HEART AND LUNG SURGERY.—In recent years notable advances have been made in the surgery of the heart and lung.

1. HEART.—It has been proved experimentally and verified by actual experience of operations in man that the heart may be safely handled, incised, and sutured; and cardiac surgery, thought to be impossible 30 years ago, had by 1921 achieved many striking successes. Operation on the pericardium and heart is undertaken (1) for the relief of pericardial effusion, serous, purulent or haemorrhagic; (2) for releasing pericardial adhesions; (3) for injuries and the removal of foreign bodies; (4) for the reanimation of a heart which has ceased to beat. (5) It has been proposed and attempted for the relief of certain valvular lesions, and for (6) tumours of the heart.

Pericardial effusion.—When it is decided to evacuate the contents of the pericardium it should be exposed and a sufficient incision made in it; paracentesis of the pericardium is uncertain and dangerous; as an operation it should be abandoned, though the cautious use of an exploring needle for diagnostic purposes may occasionally be desirable. Especially when the effusion is purulent every endeavour should be made to avoid opening a healthy pleura. The extent to which the pericardium is overlapped by the pleura varies considerably, but, according to Voinitch, there is invariably a triangular area of safety at the inner end of the 6th and 7th left costal cartilages. Pericardial effusion by no means always displaces the reflection of the pleura, but the surgeon can generally recognize the pleura and push it aside.

The lower the opening in the pericardium the better the drainage. Mintz (*Zentralblatt für Chir.*, 1904, p. 59) opened the pericardium in a case of suppurative pericarditis after resecting the 5th costal cartilage, and at once decided to drain it from below. He made an incision along the lower border of the 7th cartilage, separated the attachments of the abdominal muscles and of the diaphragm and continued blunt dissection until he reached the pericardium, which he then incised on a probe introduced through the upper wound. In the operation he subsequently advised the patient is placed with the chest somewhat raised; the surgeon, standing on the right, makes an incision along the lower border of the left 7th costal cartilage extending 7 or 8 cm. outwards from the costo-ziphoid angle. The abdominal muscles are disinserted and the cartilage divided at each end of the wound, the diaphragm is next disinserted and the cartilage and skin retracted upwards. The prolongation of the internal mammary artery is seen and tied or displaced. The anterior inferior angle of the pleura is identified and avoided, and, nearer the median line, the pericardium is defined and incised.

In the operation recommended by Voinitch the left 6th and 7th cartilages and the adjoining edge of the sternum are resected.

Delorme and Mignon (*Rev. de Chi.*, 1895) give the following directions for opening the pericardium:—(1) Make a vertical incision 1 cm. external to the left border of the sternum from the lower border of the 7th to the upper border of the 4th costal cartilage. (2) Dissect off soft parts from ribs and cartilages for 1 cm. towards middle line and for two fingers breadth outwards. (3) Disarticulate and resect a piece of 5th and of 6th cartilage. (4) Carry the incision through intercostal muscles and perichondrium down to triangularis sterni. (5) With a director worked parallel to posterior surface of sternum detach insertions of triangularis sterni, introduce finger and completely detach soft parts from posterior surface of sternum, seek the pericardium just above the insertion of the cartilages into the sternum and separate it with the finger from the cellular tissue which covers it, then, when its opaque surface is clearly exposed and its transverse fibres recognized, continue the separation through the whole extent of the wound. Thus the pleura and the internal mammary artery are displaced outwards and are not seen. (6) Pick up the pericardium with forceps and incise it. These methods or some modification of them are those recommended for the surgical treatment of pericardial effusion, but they are not suitable as the first stage of operation on the heart itself.

Cardiolysis.—Intra-pericardial separation of adhesions (endopericardial cardiolysis) has been suggested, but its possible utility is not apparent. Extra-pericardial cardiolysis in which adhesions between the pericardium and the mediastinal tissues are separated is more likely to be useful. It has been proposed to introduce a graft of fat or of fascia lata to prevent fresh adhesions.

Pericardial thoracolysis, in which adhesions between the pericardium and the chest wall are separated and portions of ribs or costal cartilages excised, is an operation designed to free the heart from the rigid chest wall in front and to relieve an enlarging heart from compression in a too confined space. Good results have been obtained. The first operations of this kind were done in 1902 by Peterson and Simon at the suggestion of Brauer. Thorburn of Manchester (*Brit. Med. Journ.*, 1910, vol. i., p. 10) discusses the question and gives a table of 15 cases collected from literature. He relates one case done by himself and refers to two other operations by Stabb at the suggestion of Alexr. Morrison.

Heart Wounds.—The course and symptoms of heart wounds vary considerably. Instantaneous death may result from a quite small wound, and extensive injuries may be brought for treatment. Under war conditions most cases die on the field of battle with the symptoms so long ago described by Celsus (V. 26. 8.): "When the heart is wounded much blood is poured out, the pulse fails, pallor becomes extreme, the body is bedewed with cold and ill-smelling sweat, the extremities become chilled and speedy death ensues."

When seen the diagnosis may be obvious, or difficult and uncertain. The symptoms may be severe and the injury to the heart *nil;* thus Tuffier remarks, "the case in which the diagnosis of wound of the heart seemed to us the most obvious and the most clearly demonstrated by the situation of the wound and the grave condition of the patient was that of a woman in whom the revolver bullet had not even penetrated the thorax." This was probably an instance of contusion of the heart and analogous to the phenomenon of arterial paralysis. When the initial symptoms have subsided and the external haemorrhage has ceased the diagnosis is based upon the history of the case, the situation of the external wound and the signs of haemo-pericardium or haemothorax, or of a foreign body.

The classical signs of pericardial effusion are: the cardiac impulse and sounds are feeble or imperceptible and the area of cardiac dullness is enlarged; sometimes abnormal (pericardial) sounds can be heard, of these that known as the mill-wheel sound (*bruit de moulin*) has been much discussed; it is chiefly associated with air and fluid in the pericardium, and was for a time thought to be pathognomic. It is thus described in a work by Stokes published in 1854: "They were not the rasping sounds of indurated lymph, or the leather creak of Collin, nor those proceeding from pericarditis with valvular murmur, but a mixture of the various attrition murmurs with a large crepitating and gurgling sound, while to all these phenomena was added a distinct metallic character."

Sudden distension of the pericardium with blood is a great surgical emergency. The auricles are compressed and signs of venous obstruction appear; there is great dyspnoea with cyanosis. The respiration is laboured and shallow and the pulse small, rapid and of low tension. It is urgent freely to open the pericardium and to decompress the heart.

In purulent pericarditis the upper segments of both recti may be rigid, and there may be a narrow band of oedema round the front and left side of the trunk about the level of the 5th interspace. The present writer has seen this band of oedema and has known suppurative pericarditis to be mistaken for inflammation below the diaphragm. Absence of diaphragmatic movement suggests pus in contact with the diaphragm. In pericarditis with effusion the right lobe of the liver is low; in dilatation of the heart the right lobe of the liver is not depressed. Many observers have found a small area of dullness in the left back just internal to the angle of the scapula, a purulent pericardial effusion has been tapped from the back in mistake for an empyema. The early diagnosis of purulent pericarditis is greatly assisted by X-ray examination and by the blood-count. These should never be omitted.

Bullets and other foreign bodies may lodge in the pericardium or in the heart muscle or in one of the cavities, in which it may become fixed or remain freely movable. Sometimes few or no symptoms are observed, and their presence is only demonstrated by radiography; sometimes they cause more or less frequent and severe attacks of pain and syncope, and give rise to abnormal sounds. Only by radiography can an accurate diagnosis be made.

The story of the wanderings of bullets and other foreign bodies in the vascular system of man is very remarkable. A bullet may perforate the heart or aorta without causing fatal haemorrhage.

A bullet may enter the hepatic vein or vena cava and pass on into the right ventricle, or enter a pulmonary vein and lodge in the left ventricle. Or it may enter the inferior vena cava and be carried by gravity against the blood current and be arrested in an iliac vein, or again a bullet may be expelled from the left ventricle into the aorta and travel with the blood current and be arrested in an artery, or from the right ventricle may be ejected into the pulmonary artery. In several cases during the World War the course of the projectile has been followed by radiography, and removed by operation from the vessel in which it became arrested.

Operations for injury and the removal of foreign bodies.—The operation must be so planned that free access to the heart is obtained and that any required operation on it can be carried out. We have to consider (*a*) the exposure of the heart; (*b*) the surgical manipulation of the heart; (*c*) the control of haemorrhage; (*d*) drainage of the pericardium.

The chief methods of opening the chest for exposure of the heart which have been successfully utilized are as follows:—

1. The various forms of flap operation of which the Delorme-Mignon-Kocher operation may be taken as a type: a vertical incision is made down the middle of the sternum from the level of the

3rd to that of the 5th cartilage; the upper end of the incision is then continued towards the left along the line of the 3rd cartilage and the lower end of the vertical incision is carried downwards and towards the left along the line of the 6th cartilage. The musculo-cutaneous flap is raised and turned outwards, the 4th, 5th, and 6th cartilages are removed, the internal mammary vessels are tied and divided (which is best done after removal of the 6th cartilage), triangularis sterni is cut through and displaced, the pleural edge being carefully avoided, and the pleura displaced by gauze pressure.

2. The Duval-Barasty operation. This operation opens both thorax and abdomen but does not divide ribs; it gives free exposure of the heart without opening the pleura but demands good vitality in the patient and seems unsuitable for possibly septic cases. It was used in several successful cases by French surgeons in the World War. It is thus carried out:—(1) Make a median incision from the level of the 3rd cartilage to the mid-point between xiphoid and umbilicus. (2) Separate the attachments of the muscles to the xiphoid and insinuate two fingers of the left hand behind the sternum, so as to protect the pericardium and the anterior margins of the pleura. (3) Divide the sternum transversely opposite the 3rd cartilage, and below the section split the gladiolus and xiphoid longitudinally. (4) Open the peritoneum along the line of the median incision in the upper abdomen. Open the pericardium in the middle line then divide the diaphragm between the two halves of the xiphoid cartilage, one blade of the scissors being within the pericardium and one in the abdominal cavity. While this cut is being made the heart must be gently lifted out of the way. The diaphragm is divided as far back as the coronary ligament. (5) The halves of the sternum can now be widely separated and "the whole contents of the pericardium are an open book to the surgeon. We have by this operation removed a bullet from the intra-pericardial portion of the vena cava inferior." (*Bull. et Mém. de la Soc. de Chi.*, Paris, June 1918.) (6) At the close of the operation the reconstitution of the divided structures is perfect. The incisions in the diaphragm and pericardium are sutured. The sections of the sternum fall together and do not require suture.

3. The Spangaro operation. Spangaro makes a long incision in an intercostal space, generally the 4th, and then divides or disarticulates the 4th and 5th costal cartilages at their union with the sternum, and in some cases the 3rd and 6th cartilages may also be divided. The 4th and 5th ribs are then forcibly drawn apart by a rib-spreader and a fine view is obtained.

4. The method of Duval as modified by Moynihan. "An incision is made exactly in the line of a rib following its curve from the edge of the sternum for about five inches outwards, down to the pectoralis major muscle a pair of forceps is pushed through the muscle until it touches the rib, the blades are opened and the muscle is split, and the separation carried from end to end of the incision. All bleeding vessels are ligated. The rib and costal cartilage are cleared. Two incisions are made through the periosteum close to the upper and lower edges of the rib, and from them the periosteum is stripped upwards and downwards and from the posterior surface. The periosteum which lies between the two incisions is left attached to the rib throughout the operation. As soon as the periosteum is freed from the posterior surface for half an inch the periosteal elevator of Doyen is slipped round the rib and pushed backwards towards the axilla and forwards to and along the costal cartilage until a length of about 5 in. is cleared. Here and there a little help may be needed with the knife or scissors to make the way easy for the instrument. The costal cartilage is now divided by two incisions meeting at a point, this allows the divided ends to dovetail together when the operation is nearing completion. When the cartilage is divided a gauze strip is passed underneath the rib, which is lifted gently upwards and outwards. In young patients the elasticity and suppleness of the rib are remarkable. It is quite easy to raise the bone out of the way throughout the operation and then to replace it.

"When the rib is elevated the periosteum is seen as a thickening of the pleura exposed in the wound. Through periosteum and pleura a small incision is made with the result that in the absence of adhesions air slowly enters the pleural cavity and the lung begins to collapse. The incision in the pleura is then lengthened always along the line of the periosteum, until there is room for the hand to pass through it. The rib-spreader is then introduced" (Sir B. Moynihan, *Brit. Journ. of Surgery*, vol. vii., 457). At the conclusion of the operation the rib is replaced and fixed by a suture.

5. Tuffier's method. Transverse sterno-thoracotomy. Transverse incision in the 4th intercostal space, prolonged over the sternum to the right side, opening the intercostal space, division of the sternum by Lister's forceps, retraction of the divided sternum to the maximum.

In many cases of injury to the heart the pleura has also been wounded, and in these the Spangaro or Duval operation has the advantage that the pleura and lung can also be examined. The dangers of pneumo-thorax on one side seem to have been exaggerated, and experience has shown that a differential pressure apparatus formerly considered essential is not necessary.

The danger of opening the pleura is not respiratory difficulty but infection. Moynihan lays stress on the patient being deeply anaesthetized before the pleura is opened, and on the opening in the pleura being made small at first so that the lung may slowly collapse.

6. The method of Petit de la Villéon. This operation is carried out under the guidance of the X rays; a small incision is made in an intercostal space and a special forceps thrust through it and pushed on closed until its shadow on the screen touches that of the foreign body; the forceps are then opened, the foreign body grasped, mobilized and pulled out. The method was elaborated by its author for removing foreign bodies from the lung, and has been applied by him to 15 cases of foreign body in the wall of the heart.

Manipulation of the heart.—The pericardium having been widely opened the heart may be safely palpated and grasped in the gloved hand; it feels like a live fish, and it may be steadied and drawn forwards and upwards by a fixation suture passed through the apex.

The specially dangerous regions of the heart are:—

(1) The coronary arteries between their origin from the aorta and their bifurcation. A wound or ligature in this situation is fatal; the heart becomes arrested in diastole from the failure of its own nutrition. Domenici, from experiments on dogs, concluded that the prognosis is more favourable when both artery and vein are ligatured than when the artery alone is tied (*Policlinico Romana*, 1916, p. 155). Sir G. H. Makins made the same observation respecting the femoral artery and vein. A branch of the coronary artery may be tied without ill effects.

(2) The inter-auricular septum and the cardiac ganglia and nerve plexuses which are found chiefly at the base of the right auricle and along the auriculo-ventricular groove. Krönecker and Schurey (quoted from Tuffier) have described a ganglion centre at the level of the auriculo-ventricular septum near the left border of the heart, a wound of which causes immediate arrest of the heart.

(3) The bundle of His. Carrel and Tuffier say "the starting point of the cardiac contractions is at the opening of the vena cava at the base of the right auricle, the fibres of the auriculo-ventricular bundle of His, which transmit the auricular excitation to the ventricles, traverse the inter-auricular septum, then the inter-ventricular septum and bifurcate and anastomose with the ventricular fibres." A sudden lesion of the bundle of His produces irregularity of contraction and dissociation of function of the two sides of the heart. A case published by Keith and Miller (*Lancet* 1906. II. 1429), in which the commencement and upper half of the main auriculo-ventricular bundle was destroyed by a gumma and the coronary arteries were partially obliterated, shows that the normal mechanism of the heart may be profoundly changed without a great disturbance of function, provided that these changes are not brought about too suddenly. The bundle of His is fully described by Keith and Flack (*Lancet* 1906. II. 359).

The control of haemorrhage.—Free haemorrhage from a wound in the heart is a great and imposing emergency; the heart, relieved from compression by the incision in the pericardium, contracts tumultuously, the field is obscured by the escaping blood, the blood-pressure is rapidly falling and death is imminent. Rapid, precise, and correct action can alone save life. The surgeon, just as in a case of ruptured spleen or of ruptured tubal gestation he plunges his hand into the abdomen through a mass of blood and seizes the bleeding vessel, so he must now plunge his hand into the pericardium, grasp the heart and by digital compression control the bleeding, and proceed to suture the wound. Suture is the method by which haemorrhage from the heart is permanently controlled, though ligature has been used in a wound of an auricular appendage. The vena cava may be compressed digitally or with suitable forceps as an aid in the arrest of haemorrhage.

When an incision is to be made into an unwounded heart, the sutures should be placed, and the loops drawn out of the way before the incision is made; tightening the sutures arrests the bleeding.

In experimental work on the heart the effect of compression of the great vessels has been tried. Carrel and Tuffier found that the entire vascular pedicle could be compressed for 45 seconds, the pulmonary artery for 10 minutes, the aorta for 6 minutes, the two venae cavae for 3½ minutes, which could be prolonged to 10 minutes if an oxygenated solution were injected into the carotids; compression of the four pulmonary veins was rapidly fatal; but isolated compression of one pulmonary vein was of no gravity. The times would probably not apply to the human heart; Trendelenburg found that the aorta and pulmonary artery must not be obstructed for more than a minute and a half.

Drainage of the pericardium.—In clean wounds this is unnecessary and even harmful; in infective pericarditis efficient drainage is a necessity, but is by no means easy to carry out. As fluid collects in the pericardium it accumulates mainly in the two postero-lateral pouches of the pericardium on each side of the partition formed by the projection of the two venae cavae and the right auricle, and in the dome-shaped space above, the heart is pushed forwards, approaching the chest wall more closely as the tension of the fluid increases, and the pouches formed by the reflexion of the pericardium on to the great vessels become distended. The chief of these recesses is that described by French anatomists as the *cul-de-sac* of Haller, in English works as the oblique sinus, and by Prof. Keith as the bursa of the left auricle. It is situated behind the left auricle and extends upwards between the right and left pulmonary veins and arteries to the upper border of the left auricle and towards the right as far as the superior vena cava. It is 4 to 5 cm. in depth and behind it is the oesophagus. The lower end is widely open below at the level of the groove on the posterior surface of the heart between the left auricle and ventricle. The right border of the opening is on a lower level than the left and reaches as far downwards as the inferior vena cava. The opening faces downwards, forwards, and to the left.

In a distended pericardium the apex of the heart is carried forwards and the contents of the oblique sinus can escape, but with the emptying of the pericardium the ventricles and apex drop backwards and downwards and shut off the oblique sinus from the rest of the pericardial cavity so that it cannot drain through an anterior incision in the pericardium.

Failure to drain this recess properly was, in the writer's opinion, a cardinal factor in the fatal termination of a case of his own.

A left postero-lateral incision would drain this space, and can be made when the trans-pleural route is adopted. Rubber tissue is the best drainage material. The pericardium differs from the pleura and peritoneum in that it cannot be completely inspected and cleansed even if the apex and ventricles are pulled forward so as to expose the mouth of the oblique sinus; this is a cause of difficulty in deciding for or against drainage.

Reanimation of an arrested heart.—An epigastric incision is the quickest route though the trans-costal route has been used.

The heart is reached through an incision in the diaphragm, grasped directly near the apex by the thumb and forefinger and the ventricles compressed rhythmically 30–40 times a minute. Some surgeons have massaged the heart from the abdomen without incising the diaphragm.

Speed is an essential factor; massage must be commenced without any delay. The circulation has, indeed, been restored after a considerable interval, but recovery is not possible unless the organs are in a condition to benefit from the influx of blood; the nervous system suffers irreparable damage from cessation of circulation in about 15 minutes. The heart muscle retains its power of contraction a long time; according to Kuliabko (quoted from L. Wrede *Arch. f. kl. Chi.* Bd. 101 (1913) S. 835) contraction can be induced in the isolated human heart by passing through it a stream of warm oxygenated fluid even 24 hours after death.

Intra-cardiac injection of excitant substances such as strophanthin, adrenalin, and caffeine has been used either alone or in conjunction with massage, as also injection of saline solution or defibrinated blood, either intravenously or into the heart; with a view to rapid restoration of circulation through the coronary arteries injection through the carotid towards the heart has been suggested. Pieri reported 76 cases of heart massage. In 19 success was complete and permanent, in 16 partial and temporary, and in 41 failure was complete. In the successful cases the interval between cessation of the heart's action and the start of massage was from 2 to 15 minutes (*Revista Ospedalera*, April 15 1913, vol. iii., No. 7).

Wrede, in order to decide whether massage of the heart effected an artificial circulation of the blood and not a mere to and fro movement in which the pressure in veins and arteries was equal, injected colouring matter into the external jugular vein after death and then massaged the heart. He found the colouring matter had penetrated into the vessels of the portal circulation, and this he considered proved that capillary resistance had been overcome, but that it was conceivable that it was in the reverse direction.

Proposed operations for certain valvular lesions.—Sir Lauder Brunton (*Lancet*, 1902), witnessing the autopsy on a young girl who had died from uncomplicated mitral obstruction was led to reflect on the possibility of surgical relief in similar cases, and made experiments bearing on the subject. Carrel and Tuffier pursued the enquiry further (*Presse Médicale* mars 1914) and concluded that pure mitral stenosis, certain forms of stenosis of the aortic orifice and of the pulmonary artery, might derive benefit from surgical intervention. Schepelman (*Arch. f. kl. chi.*, 1912, vol. 97) suggested that congenital tricuspid stenosis might be amenable to operation.

The following operations were experimentally performed by Carrel and Tuffier:—Internal valvulotomy, external valvulotomy, auriculo-ventricular anastomosis, arterio-ventricular anastomosis, section of the mitral valve indirectly through the carotid artery after the manner of an internal urethrotomy, resection of valves. They effected derivation of the blood current by means of a piece of vein with the formation of an artificial valve. An ingenious method which they term "patching" was tried: a square piece of vein is sutured along three sides of its sides over the site of the arterial opening it is desired to enlarge, a small knife is insinuated beneath the patch at the unsewn edge, the vessel beneath incised, and the suture of the patch completed.

The only reference to operations for valvular disease in man which the writer has seen is by Tuffier, who mentions two cases (*Fifth Congress of Int. Soc. of Surgery*, Brussels, July 1920):—"I observed, in a young man, a grave and rapidly progressive aortic stenosis. On the repeated request of his physician I decided to explore it. The vibration was intense: I reached the stenosis and very easily carried out a gradual dilutation by slowly introducing the little finger into the strictured ring, the vibrations under the finger being intense; I abstained from trying to divide the stricture as I did not consider experimental enquiry sufficiently advanced. I did not expect to attain any result. The patient was well in a few days; he improved temporarily and is still alive. I saw him three months ago."

Doyen attempted cardiotomy on a patient believed to be suffering from mitral stenosis; at the operation an inter-ventricular communication was found and the patient died in a few minutes.

Tumours of the heart and paracardiac tumours.—A primary tumour of the heart has not yet been diagnosed during life, and the symptoms to which they give rise having been referred to valvular lesions or to angina pectoris, but some forms of benign tumour are anatomically operable. Certain paracardiac tumours, mediastinal dermoids among others, adhere intimately to the pericardium and cause cardiac embarrassment.

Tuffier has successfully operated on one such case. Removal of the 2nd and 3rd costal cartilages disclosed a dermoid cyst as large as two fists filled with sebaceous matter, it was totally adherent and within it the aorta, the auricle and ventricle could be seen beating, and formed part of the wall without the interposition of the pericardium, part of the wall was calcareous and constricted the left half of the vascular pedicle. The cyst was drained, and six months later the calcified portion of its wall was broken up piecemeal. The patient recovered. Clerc and Duval (*Bull. et Mém. de la Soc. de Chi.* vol. xlvii., 1921, p. 200) published a successful case in which a dermoid cyst was completely removed from the mediastinum; the pleura was closed without drainage. On the second day after operation 500 c.c. of sterile fluid were removed by aspiration, after which there was no further complication.

Literature and statistics.—The paper by Fisher in *Langenbecks Archiv.*, vol. ix., (1868) and the article by Matas in Keen's *Surgery* (1909) give a full account of the subject and its literature as known at the respective dates; by contrasting them the great advance of knowledge will be evident. In Sir Charles Ballance's Bradshaw Lecture, 1919, a table is given of 152 cases of operation on the heart and pericardium subsequent to 1912 (with references) collected from literature; of these 104 recovered and 48 died, showing a mortality of 31·57 %. In 1920 Tuffier, in a paper at the Fifth Int. Cong. of Surgery at Brussels, referred to 305 cases with a mortality of 49·6 %. Statistics give some idea of the amount of work that has been done, but so many different conditions are present and the probability that many unsuccessful cases are not recorded is so great, that they are not reliable in estimating the risks of operation. In the *Lancet* of May 7 1921 a case is quoted from the *Journal of the American Med. Assn.* of Feb. 19 1921 in which E. M. Freeze successfully sutured a wound of both ventricles.

II. LUNGS AND PLEURAE.—It was until recently believed that opening the pleural cavity without the aid of differential pressure might be fatal, and that incision or even handling of the lung would cause severe haemorrhage; these fears long retarded the progress of intra-thoracic surgery. Experience has shown that an open pneumothorax on one side is without grave danger, that the once-dreaded pulmonary collapse is an assistance rather than otherwise to the surgeon, and that bleeding from the lung is readily arrested by suture. The scope of intra-pleural surgery has been considerably extended, not so much by any new discovery as by the application of the general principles of surgery.

Operations on the lung and pleura are now undertaken (*a*) for injuries, (*b*) for certain diseases. The pleural cavity is opened and the lung exposed by resection of a rib or ribs or by rib-spreading with, or sometimes without, division of one or more ribs or cartilages. Osteo-plastic flaps are mostly abandoned.

Injuries.—The experience of the World War has shown that the ideal treatment of a wound (gunshot or other) is mechanical cleansing, removal of all foreign bodies and devitalized tissue, and repair by suture. This should be the aim of the surgeon in dealing with wounds of the lung, and the complete operation for this condition would be excision of the parietal wound, removal of all blood and clots from the pleura, exposure of the lung, removal of any foreign body, cleansing and repair of the pulmonary wound and closure of the thorax.

Operation for retained projectiles in the lung is fully described and discussed in a paper by Sir B. Moynihan in the *Brit. Journ. of Surgery*, April 1920. He recommends the open method of Duval and the separation of all adhesions, however dense, as the first step of the intra-pleural operation. Duval's lung forceps are used for fixing the lung and bringing the area of incision to the surface. The specially dangerous region is the root of the lung "the number of vessels is great and their size formidable. A wound of the root of the lung should be inflicted with extreme caution, for if a vessel is wounded it is exceedingly difficult to arrest the haemorrhage. It is almost impossible to secure the vessel and to ligate it in the ordinary manner. If a suture is passed round the vessel it is likely that other vessels will be wounded by it. For this reason many of the French surgeons advise plugging the wound with gauze, which is left in position for two or three days. The root of the lung is almost immobile. The operator must go down to it; he cannot bring the parts nearer to him. All the steps of the operation can, and should, be visible to the surgeon—nothing need be done in the dark; but the remoteness and the immobility render all manipulations much more difficult than they are elsewhere. All technical procedures at the root of the lung are made easier if the parts near the hilum are fixed by the special light forceps of Duval. They not only withdraw the lung from the path of the surgeon, but give a stable field in which to work." Another point emphasized by Moynihan is the "mimicry of a projectile by the hard rounded but irregular condition of a bronchus." Most foreign bodies which have entered a bronchus by the mouth can now be removed with the aid of the bronchoscope, the recently perfected instrument for viewing the bronchus, and unless they have caused abscess would rarely call for the trans-pleural operation.

Disease.—Operations on the lung and pleura for disease have for their object:—(1) The removal of morbid products from the lung by incision and drainage or by excision of portions of lung. (2) The induction of collapse of the lung for the arrest of haemoptysis or to give it rest and assist in recovery from tuberculous disease or to allow a cavity to close. (3) The removal of morbid products from the pleura and the separation of adhesions.

1. Incision of lung and drainage have been carried out (*a*) for hydatid cyst of lung; the cyst is incised, its contents evacuated, and the adventitious cyst wall left in place, either marsupialised and drained or sutured; (*b*) for gangrene and abscess of lung; (*c*) for tuberculous cavities.

Excision of portions of lung for tuberculosis has been done; in one case with survival for seven years. But Tuffier and Martin wrote in 1910:—"Pneumotomy for tuberculous cavities has now fallen into disfavour, as likewise pneumectomy for early tuberculosis."

2. Collapse of lung is induced either by opening the pleura and admitting air, by injecting nitrogen, or by incising the chest wall down to the pleura, with or without resection of rib, detaching the parietal pleura and plugging the resulting cavity with gauze so as to bring about an extra-pleural pneumo-thorax.

3. Fluid is removed from the pleura by aspiration or by incision. Aspiration is employed for serous effusions and for haemothorax. Incision with excision of a portion of one or more ribs is current for acute empyema; some cases have been cured by aspiration only.

Recent experience seems to show that a wider opening into the pleural cavity than that usually made is desirable in empyema, so that the cavity can be inspected, the hand introduced, and all adhesions separated and false membranes and lymph removed. This is the only sure way to detect an inter-lobar abscess, and to secure expansion of the lung.

Immediate suture, after complete evacuation of the pus, has been carried out, but unless done very early does not seem likely to succeed. It has been suggested the pus should be removed as completely as possible by aspiration, and then 20-60 c.c. of a 2% solution of formalin in glycerine injected into the pleura. Chronic empyema in which the lung fails to expand and a persistent sinus has resulted has until recently been dealt with by extensive thoracotomy such as Estlander's operation with the object of making the chest contract down to the level of the contracted lung; the more recent operation has for its object the expansion of the lung. A free opening is made in the chest by the method of Duval or some analagous method, and the false membranes, often of considerable density, which bind down the lung are stripped off, and the pleural cavity closed.

Of the various intra-thoracic operations that have been suggested and tried, some will doubtless be abandoned while others will be developed and pass into current surgical practice. The war demanded new methods of diagnosis and treatment, and these were evolved and perfected amid stress and strain.

It was found that the chest cavity hitherto treated with undue deference could be opened and its contents inspected, palpated and dealt with as readily and as safely as the contents of the abdomen. This knowledge, won at the cost of so much suffering, has now to be applied to civil surgery, and when this is done even more successful results may be expected. Mr. G. E. Gask, in his Lettsomian lectures for 1921 gave an able exposition of the surgery of the lung and pleura as influenced by the experience of the World War; these lectures have been published in the *Transactions of the Medical Society of London*. (C. A. B.)

HEART DISEASES (*see* 13.132).—The study of disease of the heart entered on a new phase in the second decade of the 20th century as a result of the researches of the Scottish physician, Sir James Mackenzie (b. 1853). His work, which first made a public appearance in 1902 with his *Study of the Pulse*, and later was embodied in *Diseases of the Heart* (1908) and *Principles of Diagnosis in Heart Affections* (1916), followed three lines. In the first place there were new observations on the rhythm of the heart itself; secondly there were observations and conclusions regarding the meaning of heart failure and its recognition; finally the importance of the early signs of disease as opposed to its later manifestations was emphasized.

Mackenzie showed that by making tracings from the neck as well as from the wrist it was possible to obtain information regarding the activity of all the chambers of the heart. The neck tracings gave a wave when the auricles contracted. This was caused by a reflux of blood up the jugular veins; following this came the ordinary pulse beat in the carotid artery, which lies close to the jugular vein and so can be recorded by the same tambour. Thereafter a third wave in the vein indicated the muscular tightening-up of the organ at full systole.

The three waves were named respectively *a* (auricular), (carotid) and *v* (ventricular). Normally the *a* wave occurs $^{1}/_{5}$ sec. before the *c* wave. The tracing which shows these waves is a continuous line and thus it is difficult to determine in the first instance which wave is which. This difficulty can be overcome by putting an ordinary pulse tracing on the same piece of paper. The carotid pulse occurs $^{1}/_{10}$ sec. before the radial pulse. Thus the wave occurring in the composite tracing $^{1}/_{10}$ sec. before any beat in the wrist pulse tracing is the *c* wave. It is then easy to determine the other waves.

This work led to the differentiation of cardiac irregularities—a subject which had been shrouded in mystery. It was much facilitated by the discovery of the string galvanometer or "electrocardiograph." This instrument depends for its working on the oscillations of a special string between the poles of a magnet. Currents are set up when the heart beats, separate currents for auricles and ventricles, and these cause the string to move. Its movements are photographed onto a moving plate in such a way that a line tracing is produced. The nomenclature of electrocardiograms differs from that of pulse tracings in that the *a* wave is called the *p* wave, the *c* wave the *r* and the *v* wave the *t* wave. (It must be noted, however, that the tracings are produced in entirely different ways and therefore there is no real comparison between these waves.) There are several "leads" to the electrocardiograph—*i.e.* the patient may have a hand and a foot in the salt pails which constitute its terminals or he may have both hands.

The electrocardiograph confirmed Mackenzie's findings and enabled them to be extended. In this work Thomas Lewis, who had assisted Mackenzie, played a great part and was able to clear up some points which had not been fully understood. Thus the discovery of the fact that in a certain irregularity of the heart the auricles of that organ are no longer beating is due to Lewis. He named the condition "auricular fibrillation."

The following types of irregularity are described by Mackenzie:—

Youthful Irregularity.—The pulse varies with the breathing. It is quickened by inspiration and slowed by expiration. When the breath is held the irregularity disappears. This condition is occasioned by the vagus nerve which exercises a slowing influence on the heart. It is common in young persons and is of no evil significance.

Extra Systoles.—These are the popular "missed beats." They are not, however, missed beats at all, but beats which occur out of their normal time. The so-called "auricular extra systoles" are produced by the whole heart, both auricles and ventricles taking part; the "ventricular extra systoles" are produced by the ventricles only, the auricles beating at their normal time. These beats occur too soon and so the heart is not fully charged with blood. In consequence, the beat may not be discernible at the wrist. The heart pauses after the beat to recover itself. There is then a big beat. Extra systoles in the absence of signs of cardiac failure may be ignored.

Paroxysmal Tachycardia: Auricular Flutter.—In this condition a period of abnormal rhythm suddenly occurs. The pulse rushes off and the patient is pulled up and feels a soft fluttering in his chest. A tracing shows that the auricles are beating more rapidly than the ventricles, only a few of the beats being followed by ventricular contractions. The auricles may achieve very great speed, even 200 beats a minute. The condition, as a rule, ends suddenly.

Auricular Fibrillation.—In this condition the patient suddenly becomes very unwell. His feet may swell and his liver dilate. He becomes breathless on exertion and may have much cyanosis. The pulse is often rapid and is always markedly irregular. There are small and big beats but no two beats are of the same length. Moreover the irregularity does not disappear on exertion as does that caused by extra systoles—a useful means of distinguishing the conditions. The cause of the trouble is a fibrillation of the auricles which are no longer contracting. In tracings the *a* wave and in electrocardiographs the *p* wave is absent. The condition points as a rule to grave cardial mischief; it frequently occurs in mitral stenosis —narrowing of the orifice of the mitral valve. In this disease a rough murmur is heard just before systole of the heart and is caused by the rush of blood through the narrowed orifice under the compulsion of the contracting auricles. When, however, auricular fibrillation begins this compulsion is removed and then the pre-systolic murmur is no longer heard. A curious point, too, is that patients who have suffered from attacks of angina pectoris before auricular fibrillation began seldom so suffer after its appearance. The condition is amenable to treatment. Mackenzie advises that digitalis is the drug for auricular fibrillation and that it must be exhibited in large doses, 15 minims four times a day, until the pulse slows down. Thereafter the drug must be stopped or, rather, given in small doses sufficient to maintain the slowing. The results of this treatment in favourable cases are remarkable.

Heart Block.—Stanley Kent and the junior His showed that there exists in the heart a neuro-muscular mechanism whereby stimuli pass from a node of tissue situated on the sinus venosus (and so known as the sino-auricular node), where they arise, to the auricles and ventricles. The means of their passage is the auriculo-ventricular bundle, a strand of fibres of neuro-muscular type which bifurcates and supplies a branch to each ventricle. In cases of disease this bundle may be affected and so the passage of stimuli be prevented. Thus the auricles and ventricles will be dissociated from each other.

Partial Heart Block occurs when the dissociation is not complete. In this condition only alternate stimuli may pass ("2–1 block,") or only every third stimulus. The patient is apt to suffer fainting attacks and also a condition known as the Stoke Adams syndrome. This occurs when a period of more than 18 seconds elapses before a stimulus passes. It is characterized by a convulsion, by stertorous breathing and by the bringing-up of frothy expectoration. As the disease causing the block advances the dissociation becomes more complete and then, curiously enough, the ventricle takes on its own rhythm and beats regularly at about 40 to 50 beats per minute. The fainting attacks now pass away.

Complete Block.—Auricle and ventricle beat separately without relation to one another. The ventricular rate is slow (40 to 50). The auricular may be fast or normal. The patient may go on for a long time with this dissociated rhythm.

Block is not always caused by disease of the bundle. Certain infections and certain drugs may cause it temporarily. Treatment is not of much avail, but if the condition is diagnosed much may be done to prevent ill-effects from exercising their full force.

The main cardiac arrhythmies was elucidated by Mackenzie, Lewis and others. This work has now been accepted throughout the whole medical world. Lewis has pursued further the electrocardiographic study of arrhythmia and has recently suggested differentiation between "homologous" and "heterogenous" rhythms. A type of the former is the youthful irregularity; of the latter the extra systole auricular flutter and auricular fibrillation.

Not less momentous than the researches on cardiac irregularities was Mackenzie's contribution to the subject of *heart failure.* He pointed out that the study of valvular disease had been largely a study of sounds heard through the stethoscope. It was the habit of the profession to relate an abnormal sound to a supposed gross abnormality of structure—*e.g.* a broken valve and to make a prognosis on this supposition. This method led to many mistakes and even to abuses, for time had shown that patients with murmurs of various kinds might yet be well able to carry on active lives and even to live to old age without any symptoms of distress. It seemed therefore to be necessary to discover some more sure ground of diagnosis than that existing.

Mackenzie asked himself the question: "What is it that I am afraid of when I examine the patient?" The answer evidently was: "Heart failure." Thus a new direction was given to the assessment of the significance of cardiac symptoms. These symptoms were no longer to be accepted and read in terms of the post-mortem room. They were to be put to the test of their relationship with failure of cardiac power, that is to say of the myocardium or heart muscle.

The effect of this re-statement was an increased interest in such subjective symptoms as breathlessness and pain. These symptoms, it was remarked, vexed the patient as a rule when he attempted exertion, at which times one or other might make its appearance. The breathlessness seemed to be due to an excitation of the respiratory centre by lack of oxygen—weak circulation; the origin of the pain was more obscure. Mackenzie, however, called attention to the fact that in cardiac pain there is present as a rule an area of tenderness or hyperalgesia on the left side of the chest, below or surrounding the nipple. This is clearly a "referred" tenderness and corresponds to similar areas found in the skin of the abdomen in cases of visceral disturbance, *e.g.* gall-stone colic or appendicitis. The view was therefore formulated that the cardiac pain represented an effort of the heart to deal with large quantities of blood, that organ being incompletely prepared for its task. Thus the pain pointed to a weakness of the heart muscle.

The upshot of this work was a system of relating such findings as a murmur to the general state of the patient. Thus, if a murmur was heard and it was found that the individual was also breathless or suffered from marked pain and that these subjective symptoms were increasing, a tendency to myocardial exhaustion might be inferred. If on the other hand the murmur was unaccompanied by symptoms its presence was not to be regarded as of so serious a character. This applied specially to systolic murmurs occurring at the moment of the cardiac beat and replacing the first sound. It applied also, however, to the two murmurs which are generally regarded as betokening organic disease, the presystolic murmur of mitral stenosis and the diastolic murmur of aortic disease.

In connexion with the presystolic murmur Mackenzie pointed out that when auricular fibrillation occurred this sign disappeared, leaving however a mid-diastolic murmur, which is also frequently found in mitral stenosis. The disappearance of the murmur is occasioned by the failure of the auricle to beat. In the case of aortic disease the accompanying hypertrophy of the heart is an important additional sign of muscle damage, even though the cause of the hypertrophy is by no means clearly understood.

Evidently the value of this method of determining the degree and progressive character of heart failure must lack in value without some system of correction and test. Mackenzie early apprehended this difficulty and set himself to supply the want. He conceived that in the last issue the proof of the danger or otherwise of a symptom is the after-life of its possessor. Consequently while still a young man he undertook the laborious task of following up a large number of patients during a long period of years.

The test was continued for some 20 years and its results then published in a series of books and monographs. A great many symptoms had been recorded in the first instance and their after-histories were therefore, when revised collectively, a commentary on the prognosis of heart affections of a unique kind, both as respects content and value. It was found that certain symptoms which had an evil reputation had not at all interfered with healthy life—an example is the systolic murmur met with in toxic persons; these murmurs are very frequent and the irritable type of hearts in which they appear is also a commonplace of the consulting-room. Mackenzie named the general condition "X-disease," because its exact nature was doubtful.

Another dreaded symptom which proved more or less without harm was the missed beat or extra systole. Another, the so-called *caput medusae* or group of injected venules seen on the margin of the ribs of many persons. Still another was the tendency to occasional palpitation or heavy beating of the heart after an acute illness.

On the other hand it was found that persons suffering from auricular fibrillation, attacks of true anginous pain (angina pectoris), from the curious cardiac rhythm known as *pulsus alternans* because every alternate beat is smaller, and from various forms of dyspnoea, tended to succumb at more or less early periods. In some cases, for example auricular fibrillation, much could be accomplished by proper treatment (digitalis); in others, for example *pulsus alternans*, little or nothing could be achieved.

This body of evidence is now at the disposal of the medical profession and constitutes a contribution of enormous value.

Another aspect of the cardiological problem, which was brought into prominence by the war, is the so-called "nervous or irritable heart." Attention was first called to this condition in 1915, when it was found by the British army medical authorities that a very large number of soldiers were being sent to hospital and being invalided out of the service on account of heart disease. The extent of the mischief was so great that it was rightly concluded that some inquiry was called for and application was made to the Medical Research Committee to take the matter in hand. Sir James Mackenzie, Dr. Thomas Lewis, Capt. Thomas Cotton and Dr. R. M. Wilson were appointed to study the cases. At a later date a committee consisting of Sir Clifford Allbutt, professor of medicine at Cambridge, the late Sir Wm. Osler, professor of medicine at Oxford, and Sir James Mackenzie was constituted, and a separate hospital, Mount Vernon, Hampstead, was set apart for soldiers with heart complaints. This hospital had on its staff, in addition to the above mentioned, Dr. Thomas Parkinson of the London hospital, Professor Francis Fraser now at St. Bartholomew's hospital, Professor Meakins now of Edinburgh University, Dr. Nigel Drury and others. A very prolonged and careful research was carried out.

The symptoms of the condition were found to be breathlessness on exertion, pain over the praecordium, exhaustion and giddiness and fainting In addition palpitation was often complained of, as also were headache, lassitude, coldness of the extremities and irritability of temper. The signs, as opposed to symptoms, were increased heart rate, raised blood pressure in patients up and about, diffusion of the apex beat and irregularity of the heart's action. The temperature was frequently raised to 99·5° F. or to 100° F., such elevations being of a fleeting character. Respiration rate was also raised on exertion and tremor was the rule.

Lewis, who directed the research, gave to this picture the name of "Effort Syndrome" and wrote of it in an early publication:—"A generalization which has been shown to approximate to the truth in respect of the exaggerated rise of heart rate, blood pressure and leucocyte count in response to exercise is that the rise in patient and control are identical, if the exercise is sufficient to produce in patient and control the same degree of respiratory distress."

In short these patients responded to stimuli in an excessive manner. The first method of dealing with them was an attempt to sort them out by means of graduated exercises and for this purpose an instructor was obtained. It was soon found that capacity varied a good deal but that it could be increased in certain instances by a judicious use of the exercises. It was soon discovered that the predominant etiological factor in the clinical histories of the cases was infection of one kind or another. In 558 patients the history of onset was definitely dated from rheumatic fever or chorea in 68 instances (or 12%), from dysentery in 14 instances, from typhoid fever and diarrhoea in 14 instances, from pneumonia, pleurisy and bronchitis in 25 instances, from pyrexia of unknown origin (trench fever in all probability) in 28, and from miscellaneous infections such as diphtheria, scarlet fever, syphilis and pus infections in 30 instances. In all these the first symptoms of the malady were definitely noticed during convalescence from the disease in question. The percentage covered is thus 33. But this by no means exhausts the importance of infection, for of the 376 cases which remain there was a history of rheumatic fever in 57 cases, of repeated joint pains in 8 cases, and of pleurisy, pneumonia, syphilis and other maladies in many more. Moreover, any intercurrent infection always had the effect of greatly increasing the severity of the symptoms. Further work in other hospitals has only increased the tendency to regard this malady as an extra-cardial one and to assign its cause to infection or, in a few instances, to gastro-intestinal troubles, shock and so on.

That irritable heart or "nervous heart" is found in civilian practice is certain, and that it constitutes a large proportion of so-called heart disease cases is equally beyond doubt. That it is not heart disease at all is becoming increasingly evident. Indeed the vital and even revolutionary part of this work lies in the fact that symptoms which have been associated with one kind of mechanism of origin are now seen to be capable of production by another kind of mechanism. In other words, breathlessness on exertion and cardiac pain may occur in the absence of any damage to the heart.

Thus it became necessary to re-investigate these symptoms. Numerous attempts have been and are being made. At one period, about 1919, a chemical theory held first place in interest. It was suggested that breathlessness was due to a lack of "buffer" salts in the blood. The idea was that the blood contains various salts and notably acid phosphate of soda, which are capable of absorbing either an excess of acid or of alkali. Thus the action of the buffer salt is comparable to that of a sponge. It was suggested that these cases of nervous heart were deficient in buffer salts and so lacked the means of preventing alterations in blood quality. This view was supported by a great deal of very delicate work but it has scarcely found general acceptance. An alternative view has recently been suggested to the effect that the blood lacks oxygen. It is pointed out that a general condition of venous stasis exists and that on this account a smaller quantity of blood passes through the lungs in a given time. The oxygen intake is lowered. In consequence during effort there is no great reserve of oxygen for use in the muscles and so more rapid and forcible breathing is rendered necessary in order to increase the supply. The stimulus here is not an excess of waste products but a lack of oxygen. Curiously enough there appears to be some ground for supposing that oxygen want is not in any sense synonymous with excess of carbonic acid gas. In the absence of sufficient oxygen the blood does not become less but rather tends to become more alkaline. This subject, however, is at present being further investigated. The researches of Haldane of Oxford and Barcroft of Cambridge must be mentioned in connexion with it.

The oxygen want is probably secondary to a nervous disturbance whereby the circulation is upset. In fact the evidence available at present points to an effect of the toxins of disease on the nervous system, and more especially on the involuntary nervous system. This system regulates the action of the heart and also the tone of the circulation. The smaller arteries are under its control and recent work, following that of Roy, suggests that even the capillaries may be supplied with nerves. It is, moreover, related in an intimate way to certain of the ductless glands and notably the supra-renals which produce adrenalin. The work of Gaskell has furnished a new conception of this system and it is now possible to recognize two main branches—the true sympathetic, the action of which on the heart is accelerator, and the vago-sacral sympathetic or parasympathetic, the action of which on the heart is inhibitor. It can easily be seen that any disturbance of the relationship existing between these branches of the involuntary nervous system must react not only on the efficiency of the heart and of its responses to calls for increased effort but on the integrity of the whole circulatory tree. In point of fact the tendency to stasis or stagnation in many "nervous heart" cases is explicable only in terms of this nervous system.

In the same manner the origin of "cardiac" pain in these cases is probably to be related to the nervous system. How exactly the pain arises still remains in dispute. Enough that the pain is often excited by effort and tends to diminish if effort is abandoned. The fact that it usually disappears if the auricles of the heart begin to fibrillate has suggested to some workers that distention of those chambers by blood may act as the exciting cause.

The fact of immediate importance is that breathlessness, pain, palpitation, giddiness, exhaustion and the other symptoms of this series cannot be taken as of themselves indicating heart failure. They may all be present and yet the heart may be active and sound. Cardiologists have thus been compelled to reconsider the evidence on which a grave prognosis may be founded and have come to appreciate the great difficulties which beset their paths. Indeed the tendency has become apparent to regard serious heart mischief in a patient showing symptoms of the kind mentioned as the exception rather than the rule.

Nevertheless certain guides are available which should enable a reasonable opinion to be formed. If for example a patient has been suffering from a degree of limitation of the field of effort for a considerable period and if this degree is not exceeded it can be inferred that, whatever injurious agent is present, whether it be organic disease or a poison, the mischief is stationary. There is no "failure" in the true significance of that term. If moreover a sharp restriction of the field of effort is accompanied by signs of febrile illness and if the restriction is removed as the fever subsides a grave view need not be taken. But if a marked restriction occurs without evident cause this points in all probability to a weakening of the heart muscle. Again if dilation of the organ takes place and is progressive, or if auricular fibrillation supervenes, heart failure may be confidently diagnosed. In the last issue heart failure would seem to be always a muscle problem. The ultimate importance of extra-cardial factors is thus their influence on the burden which the heart is called upon to support. The heavier that burden and the weaker the organ (*e.g.* on account of organic disease) the earlier may failure be expected to show itself.

Heart Flutter.—The most recent contribution to the study of heart disease is that of Dr. Thomas Lewis on the nature of auricular flutter and auricular fibrillation. Lewis followed the experiments of Mayer in 1908 and of Mines in 1913. These workers used the contractile bell of the jellyfish and later rings of muscle cut from the ventricles of turtles and the auricles of teleostean fishes. The experiments were repeated in 1914 by Mines and Garvey on rings of muscle cut from the ventricles of the dog.

The experiments were as follow: If a ring of muscle was stimulated at a given point in its circumference by means of a single shock, a wave of excitation is set up. This wave develops two "crests"; one goes round the ring in one direction, the other in the other direction. Necessarily they meet at a point. The whole ring has now become involved by the wave and has passed into a state of excitation. It has become "refractory," that is to say that for the moment it is no longer excitable by further shocks.

When therefore the waves of excitation meet one another on the circumference of the ring, movement is brought to an end. In Lewis's words: "like two waves of flame, two waves of excitation meeting do not override: each crest forms an impassable barrier."

The ring of muscle remains in this state of excitation (which is nearly though not quite synchronous with the state of contraction) for a period and then recovers. It recovers in the order in which it has become involved, that is to say it begins to be "responsive" again at the spot where the primary shock was applied. The responsiveness travels round the ring in two waves just as the excitability did. When the crests of these second waves meet the ring has returned to its original condition. It is wholly responsive.

Lewis uses the analogy of a prairie fire which can spread only in those directions in which unburnt grass awaits it. If, therefore, for any reason a portion of the ring of muscle happens to be "refractory" or in a state of excitability when a fresh shock is given only one wave of excitability may be able to travel. The fire, so to speak, is stopped by a patch of outburnt grass. Recovery of this refractory area may, however, have taken place before the new wave gets round to it. In that case the wave will continue to circulate, for when it returns to its starting point that starting point will have recovered its responsiveness. It is, indeed, as if the grass had grown again on the face of the prairie by the time the fire got back to it.

This curious condition of affairs is spoken of as a "circus movement" and it is in these circus movements that this investigator believes he has discovered the secret of auricular flutter and auricular fibrillation. For some reason the normal wave of excitability which should pass over the muscle of the heart is replaced by a wave travelling in a circle over the surface of the auricle. This wave follows, it would appear, the same circular path which it has mapped out for itself and then returns again to its starting point. Here it meets muscle which has so far recovered as to be responsive once more, and thus the wave keeps on travelling round and round. Subsidiary waves are sent out, like tributary tongues of fire, over the muscular surface and the auricle beats at the rapid rate which is characteristic of the clinical condition.

Lewis has been able to induce fluttering of the auricles experimentally in dogs and has been able to prove that this is the same condition as that encountered in the human subject. "Flutter," he declares, "consists essentially of a continuously circulating wave." The path taken by this wave is not always the same for each animal. In the dog an artificial flutter may last for hours; in man flutter may last not hours but years. A "single wave continuously circulating for seven years," Lewis pointed out, "may seem to be a remarkable conclusion; nevertheless, it is one we are now bound to accept."

It is evident that the permanence or impermanence of this circulating wave of excitability depends on the fact that the crest of the wave always finds recovered and so responsive muscular tissue in front of it—to revert to the analogy, the advancing crest of the fire always finds new-grown grass to burn. There is thus present, in auricular flutter, a "gap" of recovered or responsive muscle between the refractory or excited portions and the crest of the oncoming wave of excitability. This gap moves round and round the ring just as the wave of excitability does. The grass in fact grows up as quick as it is burnt down—there is always a patch of it for the flames. Upon the continued presence and integrity of this gap the permanence of the flutter depends. So long as the gap is there the wave will circulate; so long as there is grass the fire will burn. But if the gap could be closed the flutter would—must—stop at once.

The same description applies to fibrillation except that the circus movement here is less well defined in its quality and the wave motion more diffuse. It will be seen that the experimental work has led to the door of the sick-room, so to speak, and that Lewis's view of the "gap" is probably justified: "it is a gap which will command the attention of many workers in the near future, for upon our power to influence its length, our success in treating flutter and the closely allied condition, fibrillation, will very largely depend."

(R. M. Wi.)

HEAT (*see* 13.135).—Progress in the science of heat on the experimental side during 1910–21 was necessarily slow, because time and opportunity were lacking during the World War for the laborious work which solid progress entails. Some valuable researches, for which provision was made before the war, were subsequently brought to a successful conclusion, but many of the minor details, which taken in the aggregate constitute a considerable addition to knowledge, had not been made available by 1921 in a digested form suitable for reference. Speculative theories, on the other hand, which require no apparatus or elaborate preparation, have flourished the more abundantly in the absence of effective checks and exact verification. The summary of recent works, given below, is arranged for convenience as far as possible in the order of the earlier articles connected with heat, in the 11th ed. of the *E.B.*, as enumerated in 13.157, and references to them are made where necessary.

International Notation.—The symbolic notation here adopted is based on that recommended by the International Commission for the Unification of Physico-Chemical Symbols at their meeting at Brussels in 1913, as extended by a special Committee of the Physical Society of London under the presidency of Sir J. J. Thomson. Fortunately their recommendations coincide in the main with the notation employed in the 11th ed. of the *E.B.*, but a few changes have been made for the sake of uniformity, as indicated in the following list.

Alphabetic Index of Symbols.

$A = 1/J$, Reciprocal of mechanical equivalent of heat.
a, Numerical factor for reducing PV to heat units.
B, Constant of integration in expressions for E and H.
b, Covolume in characteristic equation of gas.
C, Cooling-effect of Joule and Thomson (*see* 27.901).
c, Coaggregation volume in gas-equation.
E, Intrinsic energy.
G, Gibbs' function, $T\Phi - H$.
H, Total heat of vapour, $E + aPV$.
h, Total heat of liquid.
J, Joule's equivalent.
K, k, Thermal Conductivity, and Diffusivity.
L, Latent heat.
M, Mass.
m, Molecular weight or mass-flow.
N, Number of atoms or molecules.
n, Index in formula for c.
P, Pressure generally.
p, Saturation-pressure.
Q, Quantity of heat energy.
R, Gas-constant in $PV = RT$.
S, Specific heat of vapour; s, of liquid.
T, Absolute temperature; t, from 0°C.
U, Velocity of motion.
V, Specific volume of vapour; v, of liquid.
W, Work.
X, Cross-section of pipe or nozzle.
Φ, Entropy of vapour; ϕ, of liquid.
β, Radiation constant in $\beta\nu/T$.
γ, Ratio of specific heats of gas.
Λ, Velocity of light, 3×10^{10} cms/sec.
λ, Wave-length; ν, frequency.
η, Viscosity of gas.

CALORIMETRY

Units of Heat.—One of the most fundamental points in the measurement of heat is the relation between the practical units corresponding to the various methods discussed in the earlier article (*see* 5.60), in which the most important experimental evidence then available was described and reviewed. Some of the conclusions reached have since been contested, but additional experimental evidence has been obtained which seems to confirm the views previously maintained.

The experiments of Rowland by the mechanical method, agreeing closely with those of Joule when reduced to the scale of the gas thermometer, showed that the gram-calorie at 20°C. (defined as the quantity of heat required to raise the temperature of 1 gram of water at 20°C. under atmospheric pressure by 1°C. on the scale of the hydrogen thermometer) was equivalent to 4·180 joules of mechanical energy. Those of Reynolds and Moorby between 0° and 100°C. gave the equivalent of the gram-calorie as 4·1832 joules for the mean of the whole range, showing that the mean calorie was nearly the same as the calorie at 20°C., in contradiction to the results of earlier experimentalists who had obtained much higher values for the mean calorie. The best of the previous results by the method of mixtures for the variation of the specific heat of water between 0° and 100°C. were those of Lüdin (*see* 5.64, fig. 6), which gave a somewhat improbable curve for the variation, indicating a value 4·206 joules for the equivalent of the mean calorie, if the calorie at 20°C. was equivalent to 4·180. Most of the older results for the mean calorie, *e.g.* those of Dieterici (*Wied. Ann.*, 33, p. 417, 1888), giving 4·244 by an electrical method with an ice-calorimeter, were much higher than Lüdin's. On the other hand, the continuous electrical method (*see* 5.65), in which platinum thermometers were employed in place of mercury thermometers, while agreeing very closely with Rowland's results from 5° to 30°C., gave a much slower rate of increase than Lüdin's for the specific heat between 40° and 100°C., and a value 4·186 joules for the mean calorie, confirming Reynolds and Moorby.

The later experiments of Dieterici, by the method of the ice-calorimeter employing a 10 times smaller current with a coil of higher resistance in order to reduce the uncertain errors of the electrical measurement, gave an equivalent 4·192 joules for the mean calorie. He also redetermined the constant of the ice-calorimeter, using water at 100°C. sealed in thin bulbs of quartz-glass, and obtained a value 15·491 milligrams of mercury per mean calorie, appreciably higher than the value 15·44 previously employed. This has since been confirmed by E. Griffiths (*Proc. Phys. Soc.*, 26, p. 1, 1913) who found the value 15·486 for a mean calorie of 4·184 joules. Owing to the smallness of the quantities of heat available for measurement at low temperatures, the ice-calorimeter is unsuitable for investigating the variation of specific heat in the neighbourhood of the freezing-point, but the observations of Dieterici at temperatures above 100°C. by the same method gave a rate of increase of the specific heat of water slightly exceeding that found by Regnault, which could not be reconciled with Lüdin's curve showing a maximum of specific heat at 87°C. On the other hand, Messrs. W. R. and W. E. Bousfield (*Phil. Trans.*, A, 211, pp. 199–251, 1911) succeeded in reproducing Lüdin's results with remarkable fidelity by a most ingenious method of electric heating with a vacuum-jacket calorimeter. The heating-coil consisted of a long spiral of small-bore glass tubing filled with mercury, the expansion of which in a capillary tube was made to indicate the actual temperature of the mercury at any time when traversed by the electric current. The observers were thus enabled to avoid the source of error due to the superheating of the conductor above the temperature of the calorimeter. The uncertainty of heat-loss by evaporation from the surface of the water was minimized by protecting the surface with a cover in the form of a metal box maintained as nearly as possible at the same temperature as the water during an experiment. The rise of temperature over predetermined ranges, 0°–13°, 13°–27°, etc. was observed with suitable mercury thermometers of limited scale, standardized at the National Physical Laboratory. The corresponding quantities of electrical energy supplied, when corrected for external heat-loss and for the thermal capacity of the calorimeter, gave the increase of total heat of water, or the mean specific heat over each range. By adding the increments of total heat for each range, the *variation* of the total heat h, or the small difference $h-t$, could be obtained at each of the points of observation, as in the following table:—

Temperature C.	13°	27°	40°	55°	73°	80°	100°
Bousfield	0·058	0·058	0·059	0·124	0·242	0·306	
Lüdin	0·057	0·059	0·064	0·119	0·285	0·371	0·633
Formula (1)	0·070	0·072	0·054	0·038	0·046	0·062	0·159
Dieterici	0·010	0·011	0·013	0·031	0·090	0·128	0·303

Bousfield's observations did not extend beyond 80°, owing to the difficulty of excessive evaporation with an open calorimeter. According to his curves, the corresponding values of the specific heat appear to be approaching a maximum at 80°C., a little lower than that shown by Lüdin's curve. The value of the specific heat at 80°C., according to Lüdin's formula, is 1·0184 in terms of the specific heat at 20°C. taken as unity, and exceeds the value given by the continuous electric method by 1·55%. This looks alarming at first sight, but the method of comparison in terms of the actual specific heat, though commonly adopted, is really unfair, because the quantity actually observed in Lüdin's method is the total heat, which shows a difference of only 0·31 calorie according to the above table at 80°C. Dieterici's observations at 100°C., where they were most reliable, differ by only 0·14% from the continuous electrical method, and he does not claim an order of accuracy greater than 0·1% for the ice-calorimeter.

According to Bousfield's experiments, the absolute value of the mechanical equivalent of the calorie at 20°C. is 4·1752 joules. He attributes the discrepancy between this value and the value 4·180 given by the continuous electric method to the uncertainty in the electromotive force of the Clark standard cell, the value of which was commonly taken in 1900 as being 1·4342 volts at 15°C., which has since proved to be erroneous. Thus Wolff and Waters (U.S.A. Bureau of Standards, vol. 4, p. 64, 1907) found the value 1·4333 for Clark cells of the type employed in the continuous electric method, which would exactly account for the discrepancy. It should be observed, however, that the electromotive force of the actual cells employed was determined at the time with a specially designed electrodynamometer (*Phil. Trans.*, A, 1902, p. 81), and was found to be 1·4334 volts at 15°C., which was used in place of the legal value 1·4342 volts in deducing the absolute value 4·180 joules for the equivalent of the calorie at 20°C. The same electrodynamometer was employed 15 years later by Prof. Norman Shaw (*Phil. Trans.*, A, 1914, vol. 214, pp. 147–198) without any modification, in determining the electromotive force of the Weston cell. In the course of this work he verified the constants of the coils and the theory of the instrument with a very high order of accuracy, so that there can be little doubt that the value 1·4334 found for the Clark cells at 15°C. was substantially correct.

Continuous Mixture Method.—Since the number of separate determinations of the specific heat of water at points between 50° and 100°C. by the continuous electric method was only 12, and since these were made under conditions of exceptional difficulty, and differed most widely from the values found by Lüdin and Bousfield, it was felt to be desirable to confirm the variation in this region by an entirely independent method of equal accuracy. The continuous mixture method (Bakerian Lecture, *Phil. Trans.*, A, 1912, vol. 212, pp. 1–32) was devised for this purpose, and consisted in passing a steady current of water, initially at 100°C., through an interchanger, in which it gave up a large part of its heat to a current of cold water initially at 25°C., emerging at a temperature in the neighbourhood of 70°C., without having actually mixed with the cold current. The same current was then cooled to an accurately regulated temperature in the neighbourhood of 25°C., and reëntered the interchanger as the cold current. The point of the method is that the circulation is continuous, so that the water equivalent of the interchanger is not required, and that the hot and cold currents are *the same*, so that the quantity of the current divides out of the equation (except in the small term representing the external heat-loss) and need not be determined with an accuracy greater than 1%, since the external heat-loss can easily be reduced to a small fraction of 1% of the heat-exchange between the currents. The actual temperatures t_1 and t_2 of the hot current on entering and leaving the interchanger, and those of the cold current, t_3 and t_4, were observed with platinum thermometers to 0·001°C. If s' is the mean specific heat of the hot current between t_1 and t_2, and s'' that of the cold current between t_3 and t_4, we have the equation,

$$s'\,(t_1-t_2)=s''\,(t_4-t_3)+\mathrm{X}/\mathrm{M},$$

where X is the external heat-loss in gram-calories per second, and M the value of the water current in grams per second. The heat-loss was determined, as in the continuous electric method, by varying the flow M while keeping the temperatures the same. In a large number of trials it was found that the ratio of s' to s'' agreed with the value 1·0050 given by the continuous electric method, but disagreed materially with the value given by Lüdin's formula. It was concluded that the discrepancy from Lüdin's formula was probably to be attributed to the unavoidable errors of his method, due to losses by evaporation at temperatures above 50°, and to the uncertainties of zero and stem-exposure which cannot be eliminated in the employment of mercury thermometers.

Formulae for the Specific Heat of Water.—It is usual to employ an empirical formula of the type, $s=1+at+bt^2+ct^3+\text{etc.}$, which is familiar and convenient for the application of the method of least squares to the results of observation. The formulae most often quoted for water are those of Lüdin and Dieterici, which are as follows in terms of the calorie at 20°C.:—

$$\text{Dieterici,}\quad s=1{\cdot}0013-0{\cdot}0104(t/100)+0{\cdot}0208(t/100)^2,$$

$$\text{Lüdin,}\quad s=1-\underset{\pm 0\cdot 00025}{0{\cdot}07668(t/100)}+\underset{\pm 0\cdot 040}{0{\cdot}196(t/100)^2}-\underset{\pm 0\cdot 030}{0{\cdot}116\,(t/100)^3};$$

The probable errors of the coefficients, as given by Lüdin, are shown in the line below his formula. The formula of Dieterici represents his observations satisfactorily from 50° to 300°C., but does not apply to the variation near the freezing point, which cannot be represented satisfactorily by this type of formula without an additional term. The formula of Lüdin is fairly accurate between 0° and 25°, but appears to give results about 1% too high between 60° and 90°C. It is also inconvenient in practice, because the coefficients are large and of opposite signs, giving the small variation required as a difference between relatively large terms. In the preliminary reduction of the results of the continuous electric method (*B. A. Rep.*, 1899) it appeared that a formula of this type would be unsuitable, and the observations were accordingly represented by three simple formulae for different ranges of temperature between 0° and 200°C., as given in the previous article (*see* 5.66). These have since been combined into a single equivalent formula, which is more convenient for several purposes.

$$s=0{\cdot}98536+0{\cdot}504/(t+20)+0{\cdot}0084(t/100)+0{\cdot}009(t/100)^2 \quad \ldots\ldots \quad (1)$$

The value of the constant is adjusted to make $s=1$ when $t=20°$. The other terms are small and positive, and can be calculated with sufficient accuracy for all possible purposes by means of a 10-in. slide rule. This formula agrees very closely with the table previously given, but represents a later and more accurate reduction. It is of no theoretical significance, and cannot safely be extrapolated much above 100°C., but still agrees very closely with Regnault's observations at 160°C. Above 100°C. it is better to use the thermodynamical formula (*see* 27.903) suggested by McF. Gray, which agrees very closely with experiment from 40° to 100°C., but does not represent the increase of specific heat with fall of temperature near the freezing point. Gray's formula was re-defined by Callendar as representing the change of total heat of water under saturation pressure, and then agrees very closely with the observations of Dieterici at high temperatures, when corrected to give the change of total heat in place of the intrinsic energy. It has a simple theoretical foundation, and greatly simplifies the thermodynamical relations between liquid and vapour. There is good reason to believe (Callendar, *Properties of Steam*, pp. 160, 196) that it continues to hold satisfactorily right up to the critical point, where the specific heat becomes infinite.

By experiments on the supercooled liquid, Prof. H. T. Barnes has shown that the increase of specific heat with fall of temperature continues to follow the same curve above and below the freezing point. By very accurate experiments on mercury, using the continuous electric method, he has shown that a diminution of the specific heat with rise of temperature occurs as in the case of water, but persists up to a minimum at 140°C. It appears probable that a similar phenomenon would be found for all liquids at low vapour pressures, but it is masked in the case of volatile liquids by the opposite effect of the vapour-molecules, as represented by the thermodynamical formula. The diminution of the specific heat of water was attributed by H. A. Rowland to the presence of a small proportion of solid molecules in the liquid near the freezing point. The rapid increase of the specific heat of a solid as the fusing-point is approached may similarly be attributed to the presence of a small but rapidly increasing proportion of liquid molecules in the solid. The proportion required in either case, to explain the diminution of hardness and rigidity of the solid, or the anomalous expansion of water near the freezing point, is small, but cannot be calculated with certainty on account of our imperfect knowledge of molecular forces and dimensions. Such a theory would be difficult to verify in any case by experiment for the liquid and solid molecules. On the other hand, the latent heat of the vapour-molecules in the liquid, according to the thermodynamical formula, is simply that of a volume of saturated vapour, equal to that of the liquid, and easily calculated.

Specific Heat of Gases and Vapours.—The continuous electric method was first applied in the case of steam (*see* 27.901) and gave results near 100° corroborating Regnault's value at higher temperatures. The same method was applied to air and CO_2 by W. F. G. Swann (*Phil. Trans.*, A, 1910, vol. 210, p. 199), who found results from 2 to 5% higher than those of Regnault. Swann's formula has since been verified by Holborn and Jakob (*Zeit. Ver. Deut., Ing.*, 58, p. 1429, 1914) and it is now generally recognized that this method is the most accurate for the determination of the specific heat of any fluid at constant pressure. Swann's values for air at 20° and 100°C. were closely consistent with those of Joly at constant volume (*see* 5.67), and gave a ratio of specific heats very nearly equal to 1·40, as required by the kinetic theory for a diatomic gas. They also showed a very small increase with temperature at the rate of only one-half of 1% for 100°C. His values for CO_2 verified with improved accuracy the rapid increase with temperature found by Regnault and Wiedemann for this gas, which amounted to 12% for 100°. This increase of specific heat was not accounted for on the kinetic theory, which required that all the degrees of freedom of a gas molecule should be equally excited, and should contribute constant terms to the specific heat. The apparent discrepancy was explained (*B. A. Rep.*, 1908, p. 340) by supposing that a natural frequency of the gas-molecule would be excited by radiation in direct proportion to the intensity of the corresponding frequency at each temperature. It was shown that a natural frequency having a wave-length of the order of 15 microns would be competent to produce the observed effect in the case of CO_2, contributing, when fully excited, a term R to the specific heat. An attempt was accordingly made to investigate the relation between the variation of the specific heat of gases and the absorption and emission bands in their infra-red spectra. Some qualitative agreement was found, but it was very difficult to make quantitative measurements of the kind required, or to frame a consistent theory. For instance, there is a strong band at 4·4–4·5 microns both in the emission and absorption spectra of steam. This band corresponds to the maximum ordinate of the wave-length spectrum of full radiation at a temperature $T = 647°$C., which is the critical point of water, and appears to be closely related to other properties of steam, such as the latent heat and the cooling-effect, and the variation of the specific heat with pressure. There is no doubt that the properties of any substance must be intimately related to the natural frequencies of the molecules, but the form of the relation cannot be predicted with certainty; the experiments were interrupted by the war, and the quantitative measurements, up to 1921, had not been sufficiently exact to distinguish between many possible hypotheses.

The experiments of A. Eucken (*Sitz. Akad., Berlin*, 33.1, p. 141, 1912) on the specific heat of hydrogen at low temperatures were very instructive in this connexion. The gas was electrically heated at various temperatures in a thin steel vessel under considerable pressure at constant volume. The specific heat was found to diminish from nearly $5R/2$ at ordinary temperatures to nearly $3R/2$ at $T = 60°$, after which it remained practically constant down to $T = 35°$. The fall could be approximately represented by a formula of the Einstein type, $Rf(z)$, as explained in the next section, with a value $\beta\nu = 430$, corresponding to a wave-length of about 32 microns. The experiments were undoubtedly of considerable difficulty, owing to the large thermal capacity of the steel vessel, and its rapid diminution with fall of temperature, but there seems no reason to doubt the substantial accuracy of the result. In the kinetic theory of the specific heat of a diatomic gas, the term $3R/2$ is attributed to the three degrees of freedom of translation, and the term R to the two of rotation, the energy of which must be exactly proportional to that of translation, if the effect is produced by collisions. The late Lord Rayleigh was never satisfied with this explanation, which evidently must be revised if Eucken is correct.

Specific Heat of Solids at Low Temperatures.—The early experiments of Sir J. Dewar, Sir W. A. Tilden, and others, had shown that solids at low temperatures deviated from Dulong and Petit's law of the constancy of atomic heat in the same way as carbon, boron, and silicon, at ordinary temperatures, but they failed to show the full extent of the deviation, or to indicate a probable explanation. A great impetus to research in this direction was given by the suggestion of A. Einstein (*Ann. Phys.*, 22, p. 180, 1907) that the atom of a solid might be regarded as an electric resonator with three degrees of freedom possessing a particular frequency, independent of the temperature, and capable of responding to the same frequency of radiation. Adopting Planck's theory and radiation formula, he showed that the specific heat at constant volume should approach the limit $3R = 5{\cdot}94$ calories per gram-atom at high temperatures, as required by Dulong and Petit's law, but that the variation at low temperatures should be given by the expression—

$$s = 3Rz^2e^z/(e^z - 1)^2 = 3Rf(z) \quad . \quad . \quad . \quad (2)$$

where $z = \beta\nu/T = \beta\Lambda/T$, as in Planck's formula. The symbol ν denotes the natural frequency of the atoms, and λ the corresponding wave-length in cm. such that $\nu\lambda = \Lambda = 3 \times 10^{10}$, the velocity of light. The constant, $\beta\Lambda = 1{\cdot}460$, is Wien's constant of radiation. Taking H. F. Weber's observations on the variation of the specific heat of the diamond, extending from $T = 222°$ to $1258°$, Einstein showed that they agreed qualitatively with this formula, if we could assume the diamond atoms to possess a single frequency corresponding to the wave-length 11 microns. Taking the substances, $CaFl_2$, NaCl, KCl, $CaCO_3$, and SiO_2, for which the optical frequencies in the infra-red were known, he showed that the frequencies agreed in order of magnitude with those required by his formula, but that the observed wave-lengths were somewhat shorter than those calculated from the specific heats. This could be attributed to the fact that most of the substances showed more than one frequency, and that the frequencies were not strictly monochromatic, as indicated by the width of the corresponding absorption bands. In any case there were other effects, such as work of expansion, included in the specific heats as ordinarily measured, and it might be doubted whether the optical frequencies corresponded exactly with the thermal vibrations of the atoms.

An important series of experimental measurements, extending down to the temperature of liquid hydrogen, was made by W. Nernst, F. A. Lindemann, and their collaborators (*Sitz. Akad., Berlin*, p. 494, 1911), on a number of metals and other solids, including those for which the optical frequencies were known. They found, as already indicated, that Einstein's formula gave too low values for the specific heats at low temperatures, if the optical frequencies were assumed in calculating the value of $f(z)$, and that much better agreement could be obtained by taking the mean of $f(z)$ for the optical frequency, and a similar term, $f(z/2)$ at half the optical frequency:—

$$s = 3R[f(z) + f(z/2)]\,/2 = 3R\,f''(z) \quad . \quad . \quad . \quad (3)$$

The same function, $f''(z)$, of z was assumed to apply to other substances, such as the metals, but the appropriate values of z were selected to fit the observations on the specific heats. Some substances, such as SiO_2 (in the forms of quartz and quartz-glass) and benzine, C_6H_6, which gave a different type of curve, were represented by formulae with two or three different values of z, each value of $f''(z)$ being multiplied by a fractional coefficient representing the proportion in which the corresponding molecule was supposed to be present. But such cases could not be regarded as a verification of the theory, because it would obviously be possible to represent almost any type of variation in this way. Einstein objected that even the simplest of these formulae, namely (3), was too empirical to be satisfactory from a theoretical standpoint; that a cubical crystal, such as KCl, or NaCl, could not have two different frequencies; and that there was no evidence in either case of an optical frequency with half the experimental value, since, according to Rubens, the crystals became again transparent before this frequency was reached, and had a value of the refractive index which was nearly normal. He also indicated two other objections to the "quantum" theory on which Planck's formula was based. (1) According to the quantum theory it did not follow, as required by the classical mechanics, that the oscillator with three degrees of freedom would have three times the energy of a linear oscillator. (2) It was very difficult to conceive the distribution of energy among the oscillators at low temperatures required by the theory. Thus for the diamond at $T = 73°$ only one molecule in 100 millions would possess a single quantum of energy, all the rest would be absolutely quiescent. It was physically impossible to conceive such a distribution of energy, which moreover would make the thermal conductivity of the diamond at such temperatures entirely negligible, whereas, according to Eucken, it was nearly as great as that of copper at ordinary temperatures. For these reasons Einstein preferred to rely mainly on the expression for the energy of an electric oscillator in equilibrium with radiation as deduced from Maxwell's equations, and to regard Planck's formula for the distribution of energy in full radiation simply as representing the results of experiment, without reference to the special hypothesis of quanta, which was subsequently invented to provide a theoretical explanation of the formula, but leads to serious difficulties in many directions.

Debye's Theory of Specific Heat of Solids.—The theory now most commonly accepted is that of P. Debye (*Ann. Phys.*, 39, p. 789, 1912), who attributes the heat energy to mechanical or acoustic vibrations of the solid with all possible frequencies up to a certain limit ν_m. According to a theorem attributed to the late Lord Rayleigh (*Sound*, i., p. 129, 1877) the number of possible degrees of freedom of a system of N discontinuous mass-points will be 3N. According to another theorem by the same author (*Phil. Mag.*, 49, p. 539, 1900), the number of possible frequencies in a given volume of a *continuous* medium between the limits ν and $\nu + d\nu$ may be represented by $C'\nu^2d\nu$, where C' is a constant depending on the volume and the velocity of propagation. The total number of possible frequencies from 0 up to a limit ν_m is $C'\nu_m{}^3/3$. If we equate this to 3N, we find $C' = 9N/\nu^3{}_m$. Adopting Planck's expression for the energy of an electric oscillator with one degree of freedom as applying to each possible frequency of the N atoms in a gram-atom, we obtain the energy $(RT/N)z/(e^z - 1)$ for each frequency. Multiplying this by the number of frequencies between ν and $\nu + d\nu$, namely $(9N/\nu^3{}_m)\nu^2d\nu$, and integrating from 0 to ν_m, we obtain the energy of a gram-atom at T, from which the specific heat at constant volume is obtained by differentiation with regard to T. Unfortunately the integral cannot be expressed in finite terms and is too complicated to reproduce here. It is evident, however, that it will be a function of z_m, or $\beta\nu_m/T$, or T_m/T, where $T_m = \beta\nu_m$. Thus the *form* of the curve representing the variation of the specific heat (which depends on a single parameter T_m or ν_m) is the same for all substances on Debye's theory, if the temperature scale is altered for each in proportion to ν_m. This point has been very carefully tested by E. H. Griffiths and E. Griffiths (*Phil. Trans.*, A, 214, pp. 319–357) for the metals Al, Ag, Cd, Cu, Fe, Na, Pb, Zn. Their results indicate qualitative agreement with the theory, but show characteristic differences, greatly exceeding the limit of experimental error, which may possibly be attributed to other effects not included in the simple theory. Thus the curve for Fe differs from that for Cu by nearly 20% between corresponding temperatures, which may be attributed to the magnetic properties of Fe. The curve for Na shows a rapid rise towards the melting point, reaching an excess of 25% above 3R, followed by a diminution of specific heat for the liquid, as in the case of water and mercury. Many simple compounds, such as NaCl, show curves of a very similar type to the metals, which has been used as an argument that the specific heat must be attributed entirely to the atoms, and that the free electrons supposed to exist in metals cannot make any appreciable contribution. Thus if there were two free electrons per atom, as required by some theories, the electrons alone would account for the whole specific heat according to the kinetic theory at ordinary temperatures; and it would be necessary to suppose that the number of free electrons diminished to zero at low temperatures, which would make it difficult to account for the enormous increase in electric conductivity of pure metals demonstrated by Kamerlingh Onnes in the neighbourhood of the absolute zero.

One of the commonest objections to Debye's theory is the arbitrary nature of the assumption of an abrupt limit of frequency ν_m. This assumption is made on account of its simplicity, but is highly improbable from a physical standpoint, though it might be expected to give results of the right order of magnitude. W. Sutherland (*Phil. Mag.*, 20, p. 657, 1910) had previously shown that the wave-length of the elastic vibrations of solids was of the same order of magnitude as the distance between the atoms for frequencies corresponding to the optical frequencies in the infra-red, so far as these were known. If the forces holding the atoms in place in a crystal lattice are electromagnetic, as commonly assumed, we should expect that the energy would be shared between matter and aether, and that the natural frequencies of the optical and mechanical vibrations would be the same. The wave-length and velocity of the natural frequency as measured outside the crystal would be reduced inside the crystal in the same proportion as the ratio of the velocity of light to that of an elastic vibration, or of the wave-length outside the crystal to the lattice constant, *i.e.* in the case of rocksalt, NaCl, about in the ratio 2×10^5 to 1. Since the energy in the cube of the wave-length remains constant, the energy-density of the external radiation of the natural frequency would be increased in the cube of this ratio, and would be of the right order of magnitude to explain the specific heat of the solid on the usual theory of resonance, as applied by Einstein. We have seen, however, that the assumption of Planck's radiation formula gives too low a value for the specific heat at low temperatures on Einstein's theory. If on the other hand we interpret Lord Rayleigh's formula, namely $C'Te^{-z}\nu^2 d\nu$, as representing the partial *pressure* $pd\nu$ of radiation between the limits of frequency ν and $\nu + d\nu$, the latent heat of emission or absorption of radiation per unit volume between the same limits, according to Carnot's principle, is represented by the expression,

$$T(dp/dT) = C'T\nu^2(1+z)e^{-z}, \quad . \quad . \quad . \quad (4)$$

and the total heat of a gram-atom of solid in equilibrium with radiation having this distribution of energy is given by,

$$H = 3RT(1+z)e^{-z}, \quad . \quad . \quad . \quad (5).$$

The specific heat as ordinarily measured, when the external pressure is small as compared with internal pressure, will be simply,

$$s = 3R(1+z+z^2)e^{-z}, \quad . \quad . \quad . \quad (6).$$

This expression, unlike that similarly deduced from Planck's formula, gives good agreement with the observed value of the specific heat in the case of rocksalt, when the optical frequency corresponding to 51 microns is assumed, at a temperature corresponding to the maximum of the frequency curve, where $z = 2{\cdot}732$, $T = 100°$, and $s = 8{\cdot}67$ (doubled for a gram-molecule of NaCl). We should expect to get good agreement at this point, in spite of the fact that the actual vibrations in a solid cannot be strictly monochromatic (as Einstein pointed out) but extend for a distance of an octave or more on either side of the maximum, as indicated by the absorption spectrum. The effect of this is to reduce the steepness of the monochromatic curve, bringing it into good agreement with observation at high and low temperatures, without materially affecting the agreement at the mean point corresponding to the maximum of the frequency curve. If we assume the value $\lambda_m T = 0{\cdot}290$ for the wave-length λ_m (corresponding to the maximum ordinate of the wave-length spectrum of full radiation at T), in deducing the appropriate value of Wien's constant βA in formula (4), the maximum ordinate comes out the same as in Planck's formula, provided that the same value of the Stefan-Boltzmann constant σ is assumed in the fourth power law σT^4 for the total radiation. The two curves also agree so closely throughout their whole extent that it would be very difficult to decide between them by experiments on radiation. We should therefore be justified, according to Einstein's reasoning, in applying formula (4) in the deduction of the specific heat of a solid, especially when we find that the result gives such good qualitative agreement with the optical frequencies.

An obvious objection to Debye's theory in the case of transparent substances, such as quartz and rocksalt, is that, if the atoms have all possible frequencies below a certain limit, they ought to be completely opaque in this region, and to become suddenly transparent when the limit ν_m is surpassed. Experiment shows, however, that quartz, for instance, which begins to be opaque about four microns, and has optical frequencies corresponding to 9 and 21 microns approximately, and possibly one lower, becomes almost perfectly transparent below 100 microns. The variation of its specific heat is of an entirely different type to that given by Debye's theory but corresponds closely, according to formula (4), with its optical frequencies. Ice and benzol, which are also hexagonal, show a variation of specific heat similar to quartz, according to Sir J. Dewar. The corresponding optical frequencies have not yet been observed, but it appears that water must have some frequencies below 100 microns to account for its remarkable opacity to long wave-lengths, and the variation of its specific heat. We should naturally expect that the torsional vibrations of an elastic solid, which are of the same kind as those of light, would be excited by radiation, and would be intimately connected with the optical frequencies. It is quite possible, however, that the compressional vibrations, which are of a different type, and propagated with a different velocity (that of sound), would continue to exist at low temperatures without affecting the transparency. These acoustic vibrations, though not capable of being excited directly by radiation, would be necessarily excited by the impacts of the molecules of the surrounding gas, with a distribution of energy corresponding to the Maxwellian law, and might be expected to provide a term in the specific heat of a somewhat similar character to the Debye term for compressional waves at low temperatures. It is noteworthy that Nernst and Lindemann in their latest reductions have found it necessary to retain the original Einstein term $f(z)$ for transparent substances in their formula (3), but have replaced the hypothetical term $f(z/2)$ by a term of the Debye type. The appropriate frequencies are calculated in most cases by Lindemann's semi-empirical formula from the molecular weight m, the atomic volume V, and the temperature of fusion T_f, but with different values of the constants for the two terms, as follows:—

$$\nu_e = 2{\cdot}12 \times 10^{12}\ (T_f/m)^{1/2}\ V^{-1/3},$$
$$\nu_m = 3{\cdot}08 \times 10^{12}\ (T_f/m)^{1/2} V^{-1/3}, \quad (7)$$

of which the first gives the optical frequency of Einstein and the second that of Debye. The cube root of the atomic volume is proportional to the lattice constant, and the elastic constants of a solid must be closely related to the temperature of fusion. Nernst and Lindemann assign equal importance to the two terms, but we should naturally expect from elastic theory, as given by Debye and other previous writers, that the numerical coefficients should have different values, and should be proportional to $1/u'^3$, for the compressional waves, where u is the velocity of sound, and $2/u'^3$ for the torsional waves, where u' is the velocity of light *in the solid* for the particular optical frequency considered. This may not fit so well with Planck's radiation formula for the Einstein term, but appears to give better agreement with experiment if formula (4) is substituted for Planck's. The appropriate frequencies cannot be calculated from the elastic constants for a discontinuous medium without introducing arbitrary hypotheses, which are unsatisfactory, because the effect of the hypothesis selected is most important at the point where the discontinuity commences, and it is difficult to avoid selecting an hypothesis to give the desired result. There is the further difficulty that the values of the elastic constants are somewhat uncertain, and liable to vary with temperature, and to depend on the particular specimen tested, especially with metals.

Sir J. Dewar (*Proc. R. S.*, 1913, A, 89, pp. 158–169) has measured the mean specific heats of the elements between the boiling points of hydrogen and nitrogen by means of his liquid hydrogen calorimeter. The results for the specific heats, when plotted against the atomic weights, give a curve showing a most remarkable coincidence with the well-known curve of atomic volume as a periodic function of the atomic weight. In other words, the specific heat is nearly proportional to the atomic volume, or to the cube of the lattice constant, for similar substances, at this low temperature, corresponding to a mean about T = 50°. The relation does not pretend to be exact, though it is a fair approximation over the range 20° to 80°, but it illustrates the point that the atomic volume is the most important factor in determining the frequencies.

In the case of the metals, which are opaque to all frequencies below a certain limit, we should expect the possible frequencies to extend over a considerable range, and to be grouped about a mean in a similar way to the velocities of gas molecules on the kinetic theory. But there are many possible alternatives to the somewhat arbitrary hypothesis of Debye. We might suppose, for instance, that of N molecules in a gram-molecule, the number possessing the frequencies between the limits ν and $\nu + d\nu$ was represented by an expression of the type,

$$(N/2)\ e^{-x}\ x^2 dx \quad . \quad . \quad . \quad (8)$$

in which $x = \nu/\nu_0 = \beta\nu/T_0 = \theta z$, where z denotes $\beta\nu/T$, and $\theta = T/T_0$. Multiplying this by expression (6) divided by N for the specific heat of a single molecule of frequency ν, at a temperature T, and integrating the product from 0 to ∞, we obtain for the specific heat of a gram-molecule,

$$s = 3R(\theta^3/(1+\theta)^3)(1+3/(1+\theta)+12/(1+\theta)^2) \quad . \quad . \quad . \quad (9).$$

This is much simpler than Debye's expression, but gives a very similar curve. The *mean* frequency, $\nu_m = 3\nu_0$, is nearly the same as Debye's limiting frequency. More accurately, Debye's characteristic temperature corresponds to $2{\cdot}91T_0$, in place of $3T_0$, on account of the difference in the values of the constant β, which are in the ratio 4·9651/4·8284 in Planck's and Rayleigh's formulae for radiation. If Debye's scale is multiplied by 2·91, his curve agrees very closely with (9) from $\theta = 0{\cdot}6$ to $\theta = 1{\cdot}0$. Below $\theta = 0{\cdot}6$, (9) agrees better with the Nernst-Lindemann curve (3), except that (9) tends to vary as T^3 at very low temperatures, instead of vanishing exponentially. Above $\theta = 1$, the curve (9) lies above Debye's by a quantity corresponding to the difference of the specific heats at constant pressure and volume. This is to be expected, because (9) represents the rate of change of total heat, which is the same as that of intrinsic energy for all practical purposes under the condition of small external pressure and negligible expansion. Thus in the case of water under atmospheric pressure, the increase of total heat between 0° and 100° C. is 100 cals. C., and exceeds that of intrinsic energy between the same limits by only 0·001 cal. C., which is 100 times smaller than the limit of accuracy of observation; whereas the change of total heat *at constant volume* between the same limits in the case of water exceeds that of intrinsic energy by 21 cals., approximately; but the correction from constant volume to constant pressure is very uncertain, even in the best known cases. It therefore appears to be more logical to employ a formula giving the specific heat at constant pressure directly, in place of applying an uncertain correction. It should be observed, however, that (9) assumes the mean frequency ν_m to be independent of T, as in Debye's formula, which may be a good approximation in many cases, but cannot be exactly true if the molecule changes its state. Curve (9) reaches $s=3R$ a little above $\theta=2$, and attains a maximum 3·195 R at $\theta=4$, after which it falls with comparative rapidity to 3·048 R at $\theta=5$, tending to a limit 3R at $\theta=\infty$. The fall is of the right order of magnitude to explain the diminution of specific heat in the case of water, mercury and sodium. The distribution postulated in (8) appears to apply fairly to most of the metals, but it fails notably for many other substances. Such cases might be treated empirically by modifying the distribution, or assuming special frequencies, but such hypotheses would be of little value unless their physical meaning could be interpreted with reference to other properties of the substances.

CONDUCTION OF HEAT

In 1910 the very attractive theories of P. Drude and H. A. Lorentz were still commonly maintained, and were continually being applied to the explanation of electrical and thermal effects. According to their views a metal contained a number of free electrons moving in all directions with velocities corresponding to those of gas-molecules on the kinetic theory. Drude showed that this assumption led to an approximately correct value of the ratio of the thermal to the electric conductivity in the case of pure metals, and Lorentz showed that it accounted for the long wave radiation from hot bodies. There were numerous other applications of the theory which appeared to correspond in a remarkable manner with experimental facts, but there were also serious difficulties which appeared to render the adoption of such a theory premature.

The fluid state of scientific opinion on the subject in 1911 is well illustrated by the views expressed about that time by J. H. Jeans, one of the leading exponents of mathematical physics. In the report of the Solvay Congress, 1911, *On the Theory of Radiation and Quanta* (Gauthier Villars, Paris, 1912), assuming that there were two free electrons per atom of the metal, Jeans took the view that the specific heat of metals was entirely due to the movement of free electrons and not at all to the movements of the atoms, "a hypothesis which accords well with our knowledge of the internal movements of solids." On the other hand, in his report on the quantum theory (*Phys. Soc.*, London, 1914), he adopted the theory of Debye (according to which the specific heat was entirely due to the movements of the atoms) as probably "destined to be final," and concluded that the free electrons do not contribute sensibly to the specific heat. Sir J. J. Thomson, *Corpuscular Theory of Matter* (Constable, 1907), had already pointed out that the number of free electrons required to explain thermal and electric conductivity was too large to reconcile with the facts of specific heat on the assumption that the electrons possessed the same energy of agitation as gas-molecules at the same temperature, and had proposed an alternative theory (*loc. cit.*, p. 86) previously suggested in his *Applications of Dynamics to Physics and Chemistry* (1888). According to this view, the metallic atoms, owing to their close proximity in the solid state, were capable, under the influence of an electric field, of forming Grotthus chains, along which they could exchange electrons. There were no free electrons in the sense contemplated by Drude and Lorentz, with velocities depending on the temperature and contributing to the specific heat, but the thermal agitation of the atoms tended to break up the chains, so that their number and length varied with the electric field in the manner required to explain the relation between electric and thermal conductivity and many other effects. In a later paper (*Proc. Phys. Soc.*, 27, p. 527, 1915), the same theory was applied to explain the striking phenomena of superconductivity discovered by Kamerlingh Onnes, who found that at very low temperatures, in perfectly pure metals, a current once started might continue for days instead of stopping almost instantaneously on the cessation of the exciting field. According to J. J. Thomson's theory, it would naturally follow that, below a certain point, the thermal agitation would be insufficient to break up the chains when once they were formed, which would explain why it is that the electric resistance of most pure metals tends to vanish (apart from impurities) at a temperature *above* the absolute zero. A working hypothesis of this kind is very useful to the experimentalist as affording a mental picture of the physical conditions, and may help to explain the remaining difficulties with regard to the specific heats.

Conductivity of Gases.—Prof. Knudsen, who has made so many admirable contributions to the kinetic theory of gases on the experimental side, drew special attention (*Solvay Report*, p. 133) to the data for the thermal conductivity of gases, as being more scarce and discordant, owing to experimental difficulties, than determinations of other properties, and as requiring attentive examination for the elucidation of the law of action between molecules. The hot-wire method of T. Andrews (*Phil. Trans.*, 1840) offers special facilities for relative measurements, such as the comparison of conductivities of different gases, or of the same gas at different temperatures, and has frequently been applied with this object in recent years. It has also been improved by introducing the usual compensation for end-effects, and employing more accurate methods of electrical measurement. But it remains liable to the difficulties depending on the small dimensions of the wire, and the uncertainty of the corrections for convection and radiation. For these reasons the parallel plate method, adopted by E. O. Hercus and T. H. Laby (*Proc. R. S.*, A, 95, p. 190, 1918) for measuring the *absolute* conductivity of air, deserves special mention, owing to the great care with which the method was applied, and the complete elimination of convection effects. They also give a very complete reduction of previous results for different gases with the view of testing the value of the numerical coefficient f in the relation, $k=f\eta s$, between the conductivity k, the viscosity η, and the specific heat s at constant volume. According to the theoretical investigations of S. Chapman (*Phil. Trans.*, A, 211, p. 433, 1911) the value of the coefficient f should be 2·5 for a gas constituted of spherically symmetrical molecules, which agrees with Maxwell's theory based on the inverse fifth-power law of force, and also with experiment for monatomic molecules. Unfortunately the variation of viscosity with temperature does not satisfy the fifth-power law, which requires that the viscosity should be directly proportional to T. The conclusion is that monatomic gases may have spherically symmetrical molecules, but that the law of force is different. Theory gives no clear indication with regard to the appropriate value of f for other types of molecules. Experiment gives approximately a linear relation, $f=2{\cdot}816\gamma-2{\cdot}2$, between f and the ratio of the specific heats. This gives $f=7/4$ for diatomic gases, which show fair agreement with each other. The experimental values for polyatomic gases are much less certain, and suggest the need of further investigation. The paper gives fairly complete references.

THERMODYNAMICS

Since the general principles of thermodynamics have not undergone any material change for the last 50 years, it will readily be understood that such progress as there is to record relates chiefly to matters of expression or convention, and to the practical application of the principles to engineering problems. The evolution of the steam turbine and the internal-combustion engine, along thermodynamical lines, has illustrated the importance of an exact and consistent theory of the conditions limiting the efficiency, and of an accurate experimental study of the properties of the working fluid in either case. Thus the improvement of the internal-combustion engine has depended greatly on the extension of the thermodynamical efficiency of the cycle by using higher compression-ratios, which has necessitated careful attention to the reduction of heat-losses, to the properties of various fuels in respect of detonation, and to the specific heats of the products of combustion at high temperatures. The displacement of the reciprocating engine by the turbine for large power units has similarly depended on the possibility of improving the economy by utilizing high vacua. The high speed of the turbine has directed special attention to the importance of losses due to friction and supersaturation, which depend on the rapidity of expansion. The turbine realizes the ideal condition of steady flow with an exactitude unattainable by the reciprocating engine. This has made it worth while for engineers to adopt the thermodynamical definition of total heat first proposed by Callendar in the 10th ed. of the *E.B.*, in place of Regnault's definition, which had sufficed for many years, but continually gave rise to minor difficulties and complications when applied to the turbine. In the article cited, and as repeated in the 11th ed. (*see* 26.811), the total heat was defined as the thermodynamic function E+PV, and was denoted by the special symbol F in order to distinguish it from Regnault's total heat H, representing the quantity of heat added to the fluid under the condition of constant pressure equal to that of vaporization. By general convention, the symbol H has now been defined as representing E+PV, a property of the substance depending only on the state, and the symbol Q has been allocated to any quantity of heat added under special conditions.

Equations of Steady Flow.—These depend on the law of conservation of mass, and on the law of conservation of energy, of which they afford some of the simplest possible illustrations. If a fluid is flowing steadily at a constant rate M (mass per second) through a circuit (pipe or nozzle) of variable cross-section X, at a point where the mean volume is V per unit mass, and the mean velocity U units of length per second, we have $MV=kUX$, where the constant k is unity in any consistent system of units, *e.g.* if U, X, and V are measured in ft., sq. ft. and cub. ft. respectively. It is common practice, however, to measure X in sq. in., which must be reduced to sq. ft. by putting $k=1/144$; and similarly for other arbitrary systems. If we consider any two points (1 and 2) of a circuit for which M and X are known, the relation $MV=kUX$ makes it possible to determine either U or V at each point if the other is known. A second relation is obtained from the conservation of energy. Suppose for example that the points 1 and 2 represent the admission and exhaust of a turbine. When the flow is steady, for each unit mass entering at 1, unit mass must leave at 2. Unit mass entering at 1 carries with it its intrinsic energy E_1 and its kinetic energy $U^2_1/2g$, in addition to which work P_1V_1 is done by the pressure P_1 in forcing the volume V_1 into the turbine. Reducing these to heat units by the appropriate numerical factors, a and J, we have for the total energy entering the turbine with each unit mass of fluid, $E_1+aP_1V_1+U^2_1/2Jg=H_1+U^2_1/2Jg$, where H_1 is the initial value of the total heat, which is always tabulated in heat units per unit mass. Similarly the total energy carried out per unit mass at 2 is $H_2+U^2_2/2Jg$. Since the total quantity of energy existing in the turbine remains constant when the conditions are steady, the excess of the energy carried in over that carried out must be equal to the external work W/J done by the turbine together with the external heat-loss Q_x, both expressed in thermal units per unit mass passing through the turbine. We thus obtain the general equation representing the conservation of energy,

$$\text{Heat-Drop, } H_1-H_2=W/J+Q_x+(U^2_2-U^2_1)/2Jg, \quad . \quad . \quad . \quad (10).$$

The reduction factors, a, J, g, can be omitted for absolute or C.G.S. units, but it is better to retain them explicitly, because the various quantities can seldom or never be measured in absolute units in practical work, and the retention of the symbols saves much trouble and many mistakes.

In this equation, as applied to a turbine, the term W/J, representing the external work, is the most important on the right-hand side. The external heat-loss Q_x, and the leaving-loss, depending on the kinetic energy wasted in the exhaust, can be reduced to small corrections, which are readily applied. The external work is the equivalent of the corrected heat-drop, which can be calculated if the initial and final states of the steam are known. The equation takes exact account of any work wasted in internal friction, which does not appear explicitly in the equation because it affects both sides equally. The same equation can be applied to a reciprocating engine, or to any appliance admitting of steady flow.

Joule and Thomson (*Phil. Trans.*, 1854–62; *Proc. R. S.*, 1856) were the first to employ the function E+PV, in their experiments on the flow through a porous plug or orifice. They discussed the various terms in the equation with great precision, but did not apply it to a steam engine, which was first done by Hirn and Rankine, though the equation is commonly attributed to Zeuner. In an ideal throttling experiment, such as that designed by Joule and Thomson, the equation shows that the total heat remains constant, $H_1=H_2$, provided that $U_1=U_2$ and that W and Q are negligible. The lines of constant total heat on the PT diagram can be determined by observing the initial and final values of P and T in a sufficient number of throttling experiments. It is then possible to deduce the actual values of H under any conditions by measuring the specific heat and latent heat at any one pressure, preferably atmospheric for most fluids.

In applying the equation to the discharge through an orifice Joule and Thomson showed that the kinetic energy generated was equivalent to the drop of E+PV, or H, which follows immediately from equation (10) if W and Q are negligible. In the usual case, starting from rest, U^2_1 is negligible as compared with U^2_2, so that U_2 is given by the simple relation,

$$U_2=(2Jg)^{1/2}\ (H_1-H_2)^{1/2}, \quad . \quad . \quad . \quad (11).$$

For given conditions, V_2 is known in terms of H_2 and P_2, so that the discharge M/X per unit area can be deduced by applying the relation $M/X=kU/V$. Joule and Thomson showed that the discharge would reach a maximum in the case of air under adiabatic conditions when the final pressure after passing the orifice was 0·52 of the initial pressure, a result which had previously been deduced in a similar way by de St. Venant and Wantzel (*Comptes Rendus*, 1839) from Poisson's equation for the adiabatic, namely $PV^{1·4}=\text{constant}$. They also showed that the velocity of the discharge under this condition was simply related to the velocity of sound in the air at the original temperature and pressure, but they failed to interpret the relation. Osborne Reynolds (*Phil. Mag.*, 1886, p. 194), using the same equations for a perfect gas, showed that the velocity at the throat or minimum area of the stream was *the same* as that of sound in the gas under the same conditions, so that, when this velocity was reached, no further lowering of pressure beyond the throat could possibly increase the discharge. The same result is easily shown to apply to any fluid, either liquid or gas, in the absence of friction. The condition that M is to be a maximum for a given value of X gives $d(M/X)=0$, whence $dU/dV=U/V$. Eliminating dU/dV by differentiating (11), we obtain, for isentropic flow (Φ const.)

$$U^2=-JgV(dH/dV)_\phi=aJgV^2(dP/dV)_\phi, \quad . \quad . \quad . \quad (12)$$

which is the expression for the velocity of sound. This equation also gives the maximum discharge by substituting M/X for kU/V.

In steady-flow calorimetry the drop of H between given initial and final states can be deduced from equation (10) by observing the quantity of heat Q_x which must be abstracted, under conditions such that W and U^2 are negligible. The pressure is usually constant, but if there is a large drop of pressure between the initial and final states, as in Regnault's experiments on the total heat of water, the difficulty is avoided, without changing H_1, by using a throttle, which is precisely what Regnault did, though he was unable, owing to the defective state of thermodynamics at that time (1847), to appreciate the exact effect of this proceeding. The same method can be applied for measuring the total heat of steam in any state, including the latent heat. In all cases of steady flow the quantity measured is the change of total heat, which is the most important property to determine for steam engines or refrigerating machines working on any modifications of the Rankine cycle. On the other hand the intrinsic energy E is the property required for the constant volume cycle of the internal-combustion type.

A very simple and instructive illustration of the equation of steady flow is that of the temperature gradient in a fluid under gravity. If a current of air is flowing steadily upwards at a moderate speed, the external heat-loss Q_x and the change of kinetic energy are negligible, and the drop of total heat is equivalent to the work done against gravity, giving W/J = 1 calorie C. for each 1,400 ft. of ascent. This would evidently be the same for any fluid whatever. In the case of dry air the specific heat is nearly independent of the temperature and pressure, and the change of H is equal to $S(t_1-t_2)$, where $S=0·241$ is the specific heat at constant pressure. The drop of temperature will therefore be 1/0·241 = 4·15°C. in 1,400 ft.; or the temperature gradient, 0·296°C. per 100 ft. This result is evidently quite independent of the initial temperature, or pressure, or height, so long as we can afford to neglect the small variations of S and g. In an ascending column of *damp* air, condensation sets in with formation of cloud as soon as the temperature falls below the dew point. The drop of H remains 1 calorie per 1,400 ft., but the temperature gradient is greatly reduced by the liberation of the latent heat of the vapour. On the other hand, in a descending current, as in the ventilating shaft of a mine, the temperature increases with depth at the rate of nearly 3°C. per 1,000 ft., which, however, is usually much less than the natural gradient of underground temperature (due to outflow of heat through the earth's crust), which sometimes exceeds 10°C. in 1,000 ft. In this case there will be no condensation, but the air may be cooled by evaporation, if the mine is kept wet to reduce dust, as is usually the case.

According to equation (10) the rate of increase of temperature with depth, denoted by dt/dx, is equal to 1/JS, and is uniform in adiabatic flow if S is constant. The *pressure* gradient, dp/dx, in gravitational units, is equal to the density 1/V, or p/JRT, if R is expressed like S in calories per 1°. Dividing by dt/dx, we have $dp/dt=Sp/RT$, giving the adiabatic equation, which is commonly assumed as the starting point to find the temperature gradient. But the reverse order is more instructive as showing why the temperature gradient dt/dx is uniform.

Properties of Radiation.—The flow of heat by radiation from one body to another at a lower temperature is the commonest case of steady flow. Owing to the high velocity of radiation and the absence of thermal capacity in the circuit, the steady state is established in a small fraction of a second, if the temperatures of source and sink are constant. The quantity measured in a radiation experiment is not the energy E of the radiation, as is frequently assumed, but the total heat E+PV, which is the same in the case of radiation as the latent heat of emission, namely VT(dP/dT), for a volume V, according to Carnot's principle. This is universally admitted in the deduction of the fourth-power law (*see* 13.155), which follows from the fact that the pressure of full radiation is one third of the energy-density, so that the latent heat of emission per unit volume is four times the pressure. The quantity directly measured in experiments on full radiation is the quantity of heat emitted per sq. cm. per second from a black-body or perfect radiator at a temperature T, and is denoted by σT^4, where σ is the Stefan-Boltzmann constant of full radiation. By the geometrical conditions of the problem, the quantity σT^4 is $\Lambda/4$ times the latent heat per unit volume, or $\Lambda/3$ times the energy-density in an isothermal enclosure at T, where Λ is the velocity of light. The qualitative verification of the fourth-power law requires only a receiver capable of giving correct relative values of the radiation received, and is now generally accepted as satisfactory; but the absolute measurement of the value of the constant σ is a much more difficult problem, which has frequently been attacked in recent years without obtaining so high a degree of concordance as is desirable in so fundamental a research. The value $5\cdot32\times10^{-5}$ ergs per sq. cm. per second, found by F. Kurlbaum in 1898 (*see* 13.155), was accepted for several years, though it rested on a somewhat doubtful value of the absorption coefficient of the bolometer. Moreover, the assumption that the radiant energy measured was equivalent to the electric energy required to produce the same rise of temperature in the bolometer, was rendered somewhat uncertain by conduction effects at the ends of the strips. A similar bolometer, with the end-effects compensated, as employed in the solar eclipse of 1905, gave the somewhat higher value $5\cdot60\times10^{-5}$. Kurlbaum (1912) gave the corrected result $5\cdot45\times10^{-5}$. F. Paschen and W. Gerlach, by a modification of Ångström's method (*Ann. Phys.*, 38, p. 41, 1912), found the value $5\cdot80\times10^{-5}$, which was confirmed by G. A. Shakespear (*Proc. R. S.*, A, 86, p. 180, 1912), and by H. B. Keene (*Proc. R. S.*, A, 88, p. 49, 1913), who found $5\cdot67\times10^{-5}$, and $5\cdot89\times10^{-5}$, respectively. W. Coblentz (*U.S.A. Bur.* 12, p. 553, 1916), by a method similar to that of Paschen and Gerlach, found the value $5\cdot72\times10^{-5}$, which is a fair mean of the previous results. One of the most promising methods is that of the radio-balance (*Proc. Phys. Soc.*, 23, pp. 1–34, 1910), in which radiation received through a measured aperture is completely absorbed in a small copper cup, and is compensated by the Peltier cooling-effect due to a current through a thermojunction. Unfortunately, these experiments were interrupted by the war, and the final reductions have not yet been completed. There seems to be little doubt that Kurlbaum's original value was too low, but there are many pitfalls in such difficult experiments, and most of the methods adopted are liable to some objections.

It is generally admitted that the distribution of energy in the spectrum may be represented within the limits of experimental error by Planck's formula (*see* 13.156), namely,

$$E\,d\lambda = C'\lambda^{-5}d\lambda/(e^{c'/\lambda T}-1), \quad . \quad . \quad . \quad (13).$$

If this formula is integrated from 0 to ∞, and equated to σT^4, assuming that it represents the distribution of energy in the spectrum as observed experimentally, we find for the constant C', in terms of c' and σ, $C' = 15\sigma(c'/\pi)^4$. The value of the distribution constant c' is most readily deduced from the wave-length λ_m corresponding to the maximum ordinate of the energy curve at T, since by Wien's law the product $\lambda_m T$ is the same for all temperatures. According to Planck's formula the maximum occurs at the point $\lambda_m T = c'/4\cdot9651$. Planck took $\lambda_m T = 0\cdot294$, and $\sigma = 5\cdot30\times10^{-5}$, giving $C' = 3\cdot735\times10^{-5}$, and $c' = 1\cdot460$. But if $\lambda_m T = 0\cdot289$, and $\sigma = 5\cdot72\times10^{-5}$, then $C' = 3\cdot708\times10^{-5}$ and $c' = 1\cdot435$, according to the latest values of $\lambda_m T$ and σ. A comparatively small error in c', which is raised to the fourth power, suffices to neutralize the error in σ. The weak point of the method is that the position of the maximum of an experimental curve cannot be fixed with any certainty when the curve (as in this case) is far from symmetrical on either side of the maximum.

It is too commonly assumed that Planck's radiation formula, in spite of the weighty objections that have been repeatedly urged against it, is so firmly founded in theory and experiment, that no other formula is worth considering in comparison with it. It is also frequently asserted that no formula based on the "classical" mechanics can possibly satisfy the required conditions. The argument is somewhat as follows. The number of possible vibrations per unit volume of a continuous medium possessing the properties of the aether, between the limits λ and $\lambda + d\lambda$ of wave-length, should be represented by $8\pi\lambda^{-4}d\lambda$, according to Lord Rayleigh's method of calculation (*Phil. Mag.*, 49, p. 539, 1900), if the length of path between each reflection is restricted to an integral multiple of half a wave-length. If the different frequencies are regarded as separate inconvertible entities, like the molecules of different gases, between which the energy must be equally divided, the whole of the energy would accumulate in the infinitely short waves, which is absurd and contradicts experiment. It would be more natural, however, from a physical standpoint to regard Lord Rayleigh's formula

$$(8\pi RT/N)e^{-c''/\lambda T}\lambda^{-4}d\lambda \quad . \quad . \quad . \quad (14)$$

as corresponding to the partition of energy among a number of *similar* molecules, according to Maxwell's law, which is universally admitted in the kinetic theory of gases, as resulting from the steady state produced by collisions. The steady distribution of energy of radiation in equilibrium with matter arises in a similar manner from the Doppler effect, by which the energy of a group of waves is changed in the same proportion as the frequency at each encounter with a moving obstacle. The frequency, or the reciprocal of the wave-length, corresponds to the energy, and occurs in much the same way in Rayleigh's formula, as the square of the velocity, or the kinetic energy, in Maxwell's law. On this view, Lord Rayleigh's formula evidently represents the distribution of pressure-energy between the different wave-lengths about a mean value RT/N, which, according to the law of equipartition, should be the same as the pressure-energy of a single gas-molecule at the same temperature.

If we take Rayleigh's formula as representing the pressure distribution in full radiation, the expression for the latent heat of absorption L as measured experimentally (corresponding to (4) above, but expressed in terms of the wave-length λ in the normal spectrum) may be written

$$L\,d\lambda = C''(T + c''/\lambda)\lambda^{-4}e^{-c''/\lambda T}d\lambda, \quad . \quad . \quad (15).$$

Integrating from 0 to ∞ we find $C'' = \sigma c''^3/8$. The maximum of this curve occurs at the point where $c''/\lambda T = 2 + 2\sqrt{2}$, whence $c'' = 4\cdot8284\lambda$. The absolute value of the maximum ordinate comes out $0\cdot65754(\sigma T^4/\lambda_m)$. The value of the same ordinate, calculated in the same way for Planck's formula (13), but with $c' = 4\cdot9651\lambda_m T$ comes out $0\cdot65755(\sigma T^4/\lambda_m)$. It is a curious and significant fact that the maxima should be so exactly the same when the same values of the experimental data are assumed for both curves. The total areas of the two curves are the same, and they agree so closely throughout their whole extent that it would be practically impossible to distinguish between them with certainty by experiments on the distribution of heat in the spectrum. The greatest difference amounts to about 1% of the maximum ordinate, and occurs near the point $\lambda = \lambda_m/2$ on the short wave-length side, where the curve is very steep. This difference becomes quite appreciable in the specific heats, when the curves are differentiated, and seems to lead to better agreement with experiment than Planck's formula as explained above.

The most serious difficulty from an experimental standpoint in applying Planck's formula, is that the latent heat of emission per unit volume is always tacitly assumed (following Planck) to be the same as the energy-density, without taking any account of the pressure, whereas the existence of the radiation pressure is universally admitted as the basis of the deduction of the fourth-power law. The work done by the pressure, if it exists, cannot consistently be neglected in experimental measurements of radiation in steady flow. This is one of the most fundamental points in practical thermodynamics, but had not up to 1921 received sufficient attention from the mathematicians who had worked so elaborately on the theory.

VAPORIZATION

A good deal of attention has been devoted in recent years to the study of the properties of vapours employed in heat engines and refrigerating machines. The importance of the thermodynamical aspect of the problem has been widely recognized by engineers as the only sure guide to improvements in efficiency, and it has been realized that equations employed to represent the properties of the working fluid must be exactly consistent with the laws of thermodynamics, if it is desired to avoid discrepancies in the results of calculations by different methods. The principal properties of vapours were discussed from this point of view in the earlier article (*see* 27.897). The theory there given still holds good, but it will be of interest to discuss some of the evidence which has since accumulated on the experimental side. The case of steam, for which the experimental data are more accurate than for any other substance, will be taken, as being far the most important to engineers, and as illustrating the properties of vapours at moderate pressures. At high pressures, on the other hand, in the neighbourhood of the critical point, the data for steam are almost entire deficient, owing to the difficulty of the experiments, and the impracticability of using steam as a working fluid under these conditions. In the critical region the properties of carbonic acid have been most widely studied on account of its use for refrigeration.

Properties of Steam.—The equations for steam, first proposed by Callendar in the 10th ed. of the *E.B.* (1902), were founded on experimental measurements, (1) of the specific heats, s and S, of water and steam by the continuous electric method, (2) of the Joule-Thomson cooling-effect C with a differential throttling calorimeter, and (3) on the adiabatic index γ for dry steam with a very sensitive platinum thermometer. These experiments, when taken in conjunction with the laws of thermodynamics, sufficed to determine all the required properties with a fair degree of accuracy at moderate pressures.

The experiments on the specific heat of water extended from 0° to 100°C., and, when taken in conjunction with those of Regnault at higher temperatures, showed that the total heat h under saturation pressure could be represented, with sufficient accuracy for the purpose, by the thermodynamic formula

$$h = st + avT(dp/dT), = st + vL/(V_s - v), \quad . \quad . \quad . \quad (16)$$

in which the constant $s=0{\cdot}99666$ is chosen to make h at 100°C. = 100 cals. C., or 180 B.Th.U. per lb. at 212°F., reckoned from 32°F. The symbol a is the factor for reducing any product of dimensions pv to heat units. When p is in lb. per sq. in. and v in cub. ft. per lb., the reciprocal $1/a$ (which it is most convenient to use with a slide rule) has the value 9·722 on the Centigrade scale, and 5·401 on the Fahrenheit scale of temperature. V_s and v are the volumes of the dry saturated vapour and the liquid respectively, and dp/dT is rate of increase of saturation pressure p with temperature. When taken in conjunction with Clapeyron's equation for the latent heat, formula (16) gives a very useful relation between the total heat H and the volume V for *wet* saturated steam in any state,

$$H-st=aVT(dp/dT)=pV/\pi, \quad . \quad . \quad . \quad (17).$$

The factor $\pi=p/aT(dp/dT)$, which varies slowly and is independent of the wetness, has been tabulated, as affording the most expeditious and accurate method of calculating either H or V when the other is known. The relation between H and V when p is given is that most commonly required in practical work. The same formula leads to a simple expression for the entropy Φ,

$$\Phi=s\log_e(T/T_0)+aV(dp/dT), \quad . \quad . \quad . \quad (18)$$

which applies to wet steam of volume V, and also to the liquid if v is substituted for V. T_0 represents the freezing point, 273·1°C. or 491·6°F.

Values ranging from 0·305 at 0°C. to 0·665 at 160°C. had been proposed by various writers in 1900 for the specific heat of steam, but the direct measurements by the continuous electric method at atmospheric pressure from 100° to 160°C. gave results but slightly exceeding those of Regnault over the range 124° to 224°C., and showed that the limiting value S_0 at zero pressure was probably nearly constant and equal to 0·477. This was confirmed by L. Holborn and H. Henning (*Ann. Phys.*, 18, p. 739, 1905) in a qualitative manner by comparison with air over the range 110° to 820°C.

The experiments on the cooling-effect C, when combined with those of the specific heat S, showed that the product SC was a function of the temperature only, and gave the simple expression for the total heat,

$$H=S_0T-SCP+B \quad . \quad . \quad . \quad (19)$$

for dry steam at any pressure P. The values for dry *saturated* steam, given by putting the saturation pressure p in this expression, while differing materially from Regnault's formula, gave good agreement with the experiments (*see* 27.902) of Dieterici at 0°C., and of Griffiths at 30° and 40°C., when the constant B was reduced from Joly's observations at 100°C. with the aid of the experiments on the specific heat of water. This formula was closely confirmed by the observations of H. Henning (*Ann. Phys.*, 21, p. 849, 1906) on the latent heat between 30° and 100°C. His later observations (*Ann. Phys.*, 29, p. 441, 1909) also gave good agreement with the same curve at 180°C., but showed a discontinuity at 120°C., which may be attributed to inevitable experimental errors in such difficult work. At higher temperatures, up to 260°C., equation (19) received theoretical confirmation from the formula for the latent heat proposed by M. Thiesen, namely, $L=L_1(t_c-t)^{\frac{1}{3}}$, based on the vanishing of the latent heat at the critical temperature t_c. As first applied by Thiesen himself (*Ann. Phys.*, 9, p. 80, 1902) to the case of steam, with 365°C. for the critical temperature, this formula gave results which were much too low for the latent heat. It was shown, however, by Traube and Teichner (*Ann. Phys.*, 13, p. 620, 1904) that the true value of t_c was 374°C., which brought Thiesen's formula into agreement with (19) to less than 1 in 1,000 all the way from 0° to 260°C., when the constants were properly determined from the known values at 0°, 100°, 180° and 374°, giving the result,

$$\log L=1{\cdot}9638+0{\cdot}3151\log(374-t) \quad . \quad . \quad . \quad (20)$$

in the logarithmic form as required for practical calculations. The importance of this formula arises from the fact that direct determinations of H_s (for dry saturated steam) become exceedingly difficult and uncertain at temperatures above 180°C., owing to errors from leakage and wetness, and that a formula of this type has been verified for many other substances in the critical region, so that it affords the best guide to the probable variation of H_s between 200° and 374°C.

The throttling experiments showed that there must be a considerable variation of S with pressure, corresponding to the variation of SC with temperature. But the experiments on the adiabatic expansion of dry steam showed that the index $n+1$ in the equation $P/T^{n+1}=$ constant, was very nearly constant and equal to 13/3 over a wide range of P and T. Since $S_0/R=13/3$, it followed that the total heat of dry steam must be expressible in the form,

$$H=(13a/3)P(V-b)+abP+B \quad . \quad . \quad . \quad (21)$$

giving the convenient expression for the volume of dry steam,

$$V=(3/13a)(H-B)/P+10b/13 \quad . \quad . \quad . \quad (22).$$

It also followed that the coaggregation volume $c=c_0\ (T_0/T)^n$ in the equation

$$V-b=RT/aP-c, \quad . \quad . \quad . \quad (23)$$

must vary with temperature according to the index n 10/3, giving for the variation of S and C, in terms of c, the formulae,

$$SC=a(n+1)c-ab \quad . \quad . \quad . \quad (24)$$

$$S=S_0+an(n+1)cP/T, \quad . \quad . \quad . \quad (25).$$

It was obvious that these could not apply accurately at high pressures in the critical region, but they afford ample accuracy for all purposes in the pressures required in steam-engine practice.

The Munich experiments (*Forsch. Ver. Deut. Ing.*, 21, 1905) by O. Knoblauch, R. Linde and K. Klebe, on the volume of steam, proved to be quite inconsistent with the well-known equation of Zeuner, then commonly accepted, but showed the most remarkable agreement up to 180°C. with formula (23) deduced from the throttling experiments. Unfortunately Linde introduced an additional factor of the form $(1+kP)$ in the expression for the coaggregation volume c, to represent the apparent curvature of the isothermals, and the probable deviations at higher pressures. His equation has often been adopted (*e.g.* in the tables of Marks and Davis) and frequently imitated, but it is of the wrong type to represent the critical conditions, and leads to impossible results at comparatively low temperatures within the range of steam-engine practice. Thus it would make the value of H_s a maximum at 207°C., which should not occur till near 280°C., and it gives a value 47 B.Th.U. lower than the Thiesen formula (20) at 500°F. (260°C.), both of which results are quite impossible. Moreover, it cannot be reconciled with observations on the specific heat and the cooling-effect.

The variation of S with pressure given by (25), as predicted by the experiments on C, was qualitatively confirmed by the experiments of O. Knoblauch and M. Jakob (*Forsch. Ver. Deut. Ing.*, 36, p. 109, 1906) extending to 8 atmospheres. But their extrapolation to higher pressures was clearly impossible, and was conclusively disproved by the experiments of C. Thomas (*Amer. Soc. Mech. Eng.*, 29, p. 1,021, 1907), extending to 34 atmospheres, which confirmed the variation given by (25) as closely as could be desired up to 500 lb. and 350°C. According to Knoblauch and Jakob, the specific heat S_0 at zero pressure increased no less than 14% between 100° and 400°C. This was reduced to 4% by the later experiments of O. Knoblauch and H. Mollier (*Forsch. Ver. Deut. Ing.*, 109, p. 79, 1911). G. A. Goodenough (*Steam Tables*, 1915) from the same observations deduces a *diminution* of 1%, and R. C. H. Heck (*Amer. Soc. Mech. Eng.*, 1921) an increase of 2% over the same range. This variation is evidently much too small and uncertain to be worth considering in any equations for steam-engine work, though it becomes quite important for the internal-combustion engine at 2000°C.

The integration of Clapeyron's equation for the saturation pressure (*see* 27.903) afforded a means of testing the theory by comparison with Regnault's observations, which showed satisfactory agreement. The observations of L. Holborn and H. Henning (*Ann. Phys.*, 26, p. 833, 1908), extending to 200°C. with platinum thermometers, showed improved agreement at 200°C. and also at low temperatures. The theoretical equation was not originally intended for use at temperatures above 200°C., but the experiments of L. Holborn and A. Baumann (*Ann. Phys.*, 31, p. 945, 1910) at higher temperatures showed that it could not be so much as 1°C. in error at 260°C. This would make an error of only 1 in 4,000 in the value of H_s, which is quite beyond the limits of experimental accuracy. A great deal has been made of the uncertainty of V_s as deduced from T and dp/dt by Clapeyron's equation, which greatly exaggerates the possible error. This equation cannot be used in practical tests, in which it is always necessary to deduce the values of V_s from those of H_s and p by (22), so that no uncertainty of this kind can arise, provided that the values of H_s are correct, as shown by equation (20), and that the equations are consistent with the adiabatic assumed. Owing to the continuity of the adiabatic on the HP diagram, the exact point at which the steam crosses the saturation line is of little importance. The state of the steam beyond this point may be either wet or supersaturated, which may make a considerable difference in V, but does not materially affect the result for given values of H and P. Errors may arise in academic problems if only t is given and the wetness is assumed, but the state of the steam cannot be determined in practice without measuring H, preferably by throttling, and P is the easiest quantity to observe, and is always known. If P is given, and the state of the steam is known, the error in V cannot exceed ¼ of 1% even at 650 lb. pressure, if the values of H_s are correct. If the variation of H is directly determined by the throttling method, the values of H_s cannot be far wrong. But if the values of H_s are deduced from those of V_s through Clapeyron's equation for L, as is frequently done, by assuming an arbitrary empirical formula for dp/dt in conjunction with an improbable type of equation for V, it is almost inevitable that material errors should arise from the thermodynamic inconsistencies involved in such a circuitous process. It is most essential for practical purposes that the equations should be as simple as possible and exactly consistent with the laws of thermodynamics. To be of any use, the tables must agree precisely with the expression employed for the adiabatic heatdrop and the discharge through a nozzle. With such limitations it would evidently be impossible to include the critical state in any consistent system of equations without intolerable complexity, but ample accuracy can be secured for the ordinary range of steam-engine practice.

Adiabatic Heatdrop.—The change of total heat H in frictionless adiabatic expansion or compression is frequently of considerable interest as representing the work done by or on the fluid in the ideal case, when there is no internal friction, and when no heat is supplied or lost externally. If the laws of thermodynamics are summarized in the form,

$$dQ = \mathrm{T}d\Phi = d\mathrm{H} - a\mathrm{V}d\mathrm{P} \quad . \quad . \quad (26)$$

in which dQ represents heat supplied per unit mass by friction or otherwise, we observe that, in the case of isentropic flow, for which $d\Phi = 0$, the change of H is equal to the integral of $a\mathrm{V}d\mathrm{P}$ along the adiabatic, which is readily obtained by substituting for V in terms of H and P from (22) or (17), for any given initial state and final pressure. We may also obtain the general expression for Φ from those for H and V by integrating $d\Phi = d\mathrm{H}/\mathrm{T} - (a\mathrm{V}/\mathrm{T})d\mathrm{P}$. These expressions may be put in a variety of forms according to the purpose for which they are required. One of the most useful for dry steam is,

$$\mathrm{DH}\phi = (\mathrm{H}' - \mathrm{H}'')\phi = (\mathrm{H}' - \mathrm{B} - ab\mathrm{P}')(1 - \mathrm{T}''/\mathrm{T}') + ab(\mathrm{P}' - \mathrm{P}'') \quad . \quad . \quad (27)$$

in which H′, P′, T′, and H″, P″, T″, represent the initial and final states. An exact expression for the adiabatic heatdrop $\mathrm{DH}\phi$, in the case of wet saturated steam, is readily obtained in terms of H′ and T′, T″. But in practice it is usually more convenient to tabulate H and ϕ, and the Gibbs' function $\mathrm{G} = \mathrm{T}\phi - \mathrm{H}$, which has the advantage of being a simple function of the temperature only, and is independent of the wetness for a mixture of water and steam in any proportions. From the definition of G, if ϕ is constant and equal to its initial value ϕ'', we obtain immediately the convenient expressions,

$$\mathrm{DH}\phi = (\mathrm{T}' - \mathrm{T}'')\Phi' - \mathrm{G}' + \mathrm{G}'' = \mathrm{H}' - \mathrm{H}''_s + \mathrm{T}''(\Phi_s'' - \Phi'), \quad (28).$$

The first expression is general, and is readily applied if G′ and G″ are tabulated. The second is obtained by substituting for G′ and G″ in terms of H and ϕ, but is applicable only if the final state is saturated, so that H''_s and ϕ''_s are the tabulated values for dry saturated steam.

Effects of Supersaturation.—For the general theory of the behaviour of a vapour when cooled below the saturation temperature without condensation *see* 27.898–9. The state of supersaturation is very common, in rapid expansion, and has proved to be of some practical importance, as affecting the discharge through a nozzle, and the efficiency of a turbine. It appears that steam usually follows the dry adiabatic, $\mathrm{P}/\mathrm{T}^{13/3} = \text{constant}$, for some distance below the saturation point. The drop of temperature is about three times as rapid as along the wet adiabatic, and the volume is smaller than that of saturated steam at the same P and H. The heatdrop, and the velocity generated, are also smaller, for a given pressure drop, than in the case of steam which is assumed to remain in the equilibrium state of saturation throughout the expansion. If the initial steam is dry saturated, it usually remains dry for some distance beyond the throat of a nozzle, so that the discharge, as given by equation (12), is obtained from the dry adiabatic, by substituting $(d\mathrm{P}/d\mathrm{V})\phi = 1{\cdot}3\mathrm{P}/\mathrm{V}$ at the throat, which leads to values about 5% larger than those given by the equations for wet steam. This is confirmed by experiment, and is represented by the numerical formula for the discharge M/X_t in lb. per second per sq. in. of throat, when P′ is in lb./sq. in. and V′ in cub. ft./lb. in the initial state,

$$\mathrm{M}/\mathrm{X}_t = 0{\cdot}3155(\mathrm{P}'/\mathrm{V}')^{\frac{1}{2}}, \quad \mathrm{P}_t/\mathrm{P}' = 0{\cdot}545, \quad . \quad . \quad . \quad (29)$$

in which the small quantity b is neglected as being usually beyond the limits of possible accuracy of measurement.

The defect of heatdrop on reaching the throat is about 5%. If the steam continued to follow the dry adiabatic to low pressures, the defect of heatdrop would often reach 20%, which would be very serious. But soon after passing the throat, the coaggregated molecules begin to act as condensation nuclei, according to Kelvin's equation (*see* 27.899). When this limit is reached, the condensation takes the form of a very thick fog of exceedingly fine particles, and is extremely rapid, owing to the enormous number of nuclei available, about 10^{22} per lb. of steam. If the expansion is relatively slow, the steam is transformed into the saturated state, and remains nearly saturated for the rest of the expansion. But if the expansion is very rapid, as in an expanding nozzle at a velocity of 3 or 4000 ft./sec., the steam will remain near the supersaturation limit with a loss of heatdrop amounting to nearly 8% at low pressures, involving a corresponding loss of efficiency. According to Wilson's experiments at low pressures (*see* 27.899), the supersaturation limit is reached when the pressure is about 8 times the normal saturation pressure corresponding to the actual temperature of the steam. The equivalent wetness of the steam at this point, when transformed to the saturated state at the same P and H, would be about 3%. This appears to be confirmed by turbine tests at these pressures, but Wilson's experiments do not afford any direct evidence with regard to the limit at which condensation starts at higher pressures. It appears on theoretical grounds that the pressure ratio corresponding to the supersaturation limit should not be so high as 8 at high pressures, which would require an excessive increase in the drop of temperature and in the equivalent wetness of the steam at high pressures.

There is some evidence that the equivalent wetness at the supersaturation limit is the same, namely 3%, at high as at low pressures. This would permit a very simple method of calculation, but more experimental tests are required to decide the point. The effect of initial superheat in improving the efficiency of a turbine cannot be satisfactorily explained on the older theory that the steam is in the equilibrium state of saturation throughout the expansion, but is a necessary consequence of the phenomenon of supersaturation. The loss due to supersaturation may be entirely eliminated if the superheat is sufficient to prevent supersaturation. In any case the loss will be greatly reduced by superheat, and the results of calculation appear to indicate that the improvement of efficiency may be exactly accounted for in this way. This point has been very fully discussed by H. M. Martin, in "A New Theory of the Steam Turbine" (*Engineering*, vol. 106, 1918); and also by Callendar, *Properties of Steam*, pp. 305–12.

Properties of Carbonic Acid.—The critical point of CO_2, commonly known as carbonic acid, being at a temperature a little above 31°C., the most convenient point of the scale for accurate regulation, offers special facilities for investigating the critical phenomena. These were first elucidated by T. Andrews (*Phil. Trans.*, 1869), whose investigations formed the starting point for the theories of J. Thomson, J. D. Van der Waals, J. C. Maxwell and R. Clausius. The method employed by Andrews in measuring the volume and pressure of the liquid and vapour at various temperatures reached the highest point of refinement in the researches of E. H. Amagat (*Ann. Chim. Phys.*, 29, p. 136, 1893), whose tables of the properties of CO_2 from 0° to 250°C. have generally been accepted as the standard. For practical use in refrigeration the properties are also required at temperatures down to −50°C. The saturation pressures below 0°C. have since been determined by Kuenen and Robson (*Phil. Mag.*, 3, p. 154, 1902), using platinum thermometers. They also determined the vapour pressures of the solid, which follow a curve cutting that of the liquid at a sharp angle at the melting point, which is at −56·2°C., where the common vapour pressure is 5·2 atmospheres. It is found that the vapour pressures of the liquid can be represented with a fair degree of accuracy, sufficient for most practical purposes, by the simple empirical formula,

$$\log p = 1{\cdot}5363 + 3{\cdot}157t/\mathrm{T}, \text{ (atmospheres)} \quad . \quad . \quad (30)$$

from −50°C. to the critical point, but (30) gives results which are probably about 2% too high at −50°C. The values of the latent heat above 0°C. can be deduced from Amagat's tables of p, V, and v, by means of Clapeyron's equation. They are most important below 0°C. for refrigeration purposes, and have since been directly measured by C. F. Jenkin and D. R. Pye (*Phil. Trans.*, A, 213, p. 67, 1914), who also determined the variation of the total heats, H and h, of the liquid and vapour, by experiments on the specific heat S, and the cooling-effect C, over the range −30° to +30°. Their observations of the latent heat are well represented by a formula of the Thiesen type,

$$\log \mathrm{L} = 1{\cdot}1463 + 0{\cdot}4018 \log (31{\cdot}5 - t), \quad . \quad . \quad . \quad (31)$$

and those of the total heat of the liquid under saturation pressure by a formula of the same type as that employed in the case of water, namely

$$h - av\mathrm{T}dp/dt = \mathrm{H} - a\mathrm{VT}dp/dt = 0{\cdot}42t - 6{\cdot}53, \quad . \quad . \quad . \quad (32)$$

in which the constant 0·42 represents the limiting value of the specific heat of the liquid at low pressures, and the constant 6·53 the value of the term $av\mathrm{T}dp/dt$ at 0°C., from which both H and h are supposed to be reckoned. It is quite possible that the specific heat of the liquid at zero pressure may vary in the same way as that of the vapour with temperature, giving a constant value for $\mathrm{S}_o - s_o$, in place of a constant value for s_o. This would simplify the equation of saturation pressure, but the observations so far made do not extend over a sufficient range to decide the point. The advantage of these formulae for the total heat is that they fit most simply with Clapeyron's equation, and give a natural approach to the critical point, where both dh/dt and $d\mathrm{H}/d\mathrm{T}$ become infinite, but with opposite signs.

Equations for the Volume.—The equation first proposed for CO_2 was that of W. J. M. Rankine (*Phil. Trans.*, 1854, p. 337), representing Regnault's experiments on the deviations from the laws of gases at moderate pressures. Rankine's equation may be put in the convenient form,

$$a\mathrm{P}/\mathrm{RT} = 1/\mathrm{V} - c/\mathrm{V}^2 \quad . \quad . \quad (33).$$

The symbol a represents the usual factor for reducing PV to cals. C. The value of R in cals./deg. is 0·0451 for CO_2. The coaggregation volume c was found by Rankine to vary as $1/\mathrm{T}^2$, with a value 3·53 c.c./gm. at 0°C. This equation also represented the observations of Joule and Thomson on the cooling-effect at moderate pressures, but it becomes unsatisfactory at high pressures, and fails near the critical point, giving imaginary values of V when P exceeds $\mathrm{RT}/4ac$. This difficulty is removed most simply by introducing the covolume b in the first term on the right, thus,

$$a\mathrm{P}/\mathrm{RT} = 1/(\mathrm{V} - b) - c/\mathrm{V}^2, \quad . \quad . \quad . \quad (34)$$

which transforms the equation into a cubic of the same type as that subsequently proposed by J. D. Van der Waals in his essay on the *Continuity of the Liquid and Gaseous States* (1873), except that c according to Van der Waals' equation would vary inversely as T (in place of T^2) which would not suit the properties of CO_2. If the values of b and c in (34) are determined from the condition that the cubic in V must have three equal roots at the critical point, we obtain the relations,

$$\mathrm{RT}_c/ap_c = 8\mathrm{V}_c/3 = 8b^b = 64C_c/27 \quad . \quad . \quad . \quad (35)$$

in which the suffix (c) indicates the values of T, p, and V, at the critical point. Taking the values, $p_c=72{\cdot}9$ atmos. $=1071$ lb./sq.in., at $T_c=304{\cdot}6°$ we find,

$b=0{\cdot}0156$ cub.ft./lb. $=0{\cdot}974$ cc./gm., $V_c=2{\cdot}92$ c.c./gm.
$c_c=0{\cdot}05265$ " " " $=3{\cdot}287$ "
$C_c=0{\cdot}0655$ " " " $=4{\cdot}090$ "

With these values of the constants, equation (34) represents the observations of Jenkin and Pye on H, S, and C, very satisfactorily, but the theoretical expressions, applying to any equation of the Van der Waals' type, are somewhat complicated and inconvenient for practical use, namely,

$$H=S_m t+B-3cRT/V+bRT/(V-b), \quad . \quad . \quad . \quad (36)$$

$$SC=a[3c-bV^2/(V-b)^2]/[V^2/(V-b)^2-2c/V] \quad . \quad . \quad (37)$$

$$S=S_o+3cR/V+bR/(V-b)+[R/(V-b)+cR/V^2]SC/a \quad . \quad . \quad . \quad (38).$$

It will be observed that the value of the critical volume V_c is too large to reconcile with the observed value 2·15 c.c./gm. given by Amagat. The value of b is also larger than the observed volume of the liquid at −50°C., and the equation does not represent the latent heat or the saturation pressures at all satisfactorily.

Equation of Saturation Pressure.—Maxwell was the first to show how the saturation pressure could be calculated at any temperature from the continuous isothermal of James Thomson (*see* 27.898), as represented by Van der Waals' equation. According to Carnot's principle, that no work can be obtained from heat at constant temperature, the integral of PdV along the continuous isothermal represented by the equation (34), must be equal to the external work of vaporization $p(V-v)$ between the limits V and v; and the latent heat of vaporization must be equal to the integral of $aT(dP/dT)_v dV$, between the same limits, at constant T. Applying these conditions to Van der Waals' equation, in which c varies as $1/T$, we obtain,

$$ap(V-v)/RT=\log_e(V-b)-\log_e(v-b)+c/V-c/v \quad . \quad . \quad . \quad (39)$$

$$L/RT=\log_e(V-b)-\log_e(v-b), \quad . \quad . \quad . \quad (40).$$

These give the increase of p between 0° and 30°C. only half the observed value, and the calculated value of p at −50°C. is more than twice too large. The calculated value of L at 0°C. is less than half the observed value, showing that Van der Waals' theory required serious modification.

The equation of Clausius (*Phil. Mag.*, 13, p. 132, 1882) for CO_2 is still most commonly quoted. He reverted to Rankine's assumption for the variation of c, but introduced an additional empirical constant b'' in the denominator of the term representing the effect of coaggregation on the density,

$$aP/RT=1/(V-b')-c/(V+b'')^2, \quad . \quad . \quad . \quad (41).$$

This has the effect of reducing the value of V for any given values of P and T by the constant quantity b'', but makes no difference to any of the other properties in terms of P and T. The values of c and b as deduced from P_c and T_c remain unaltered, but $b'=b-b''$. Clausius selected b'' to make the volume of the liquid agree with observation at 20°C., but the slope of the curve is unaltered, and the calculated value of v by (41) is 26% too small at −50°C., whereas by (34) it is 40% too large. The calculated values of p and L at the same point by either equation are 34% too small for p, and 37% too large for L, if Maxwell's theorem is employed. But it is unjustifiable to apply Maxwell's theorem to an equation which represents the properties of the liquid so badly, and it may be doubted whether the theorem is strictly applicable to an unstable transformation, such as that required by the James Thomson isothermal. It is always possible to choose the variation of c to fit the saturation pressures, but this is purely empirical, and fails in other respects.

Since the application of Maxwell's theorem is doubtful and difficult in any case, it seems preferable for practical purposes to calculate the saturation pressures, as in the case of steam (*see* 27.903), by combining an equation of the type (32) for the liquid with a suitable expression for V. This method, as applied by Callendar (*Properties of Steam*, p. 186), seems capable of giving very accurate values of p, without upsetting the agreement with H and V, or introducing intolerable complications in the theoretical expressions, such as have frequently been proposed by mathematicians. It may fairly be regarded as confirming the correctness of the principles applied in the case of steam, and the exact definition of formula (32) for the total heat of the liquid, on which the result mainly depends.

Critical Relations.—The critical point is most conveniently defined, especially in the case of transcendental equations, by the conditions,

$$(dP/dV)_t=0, \text{ and } (d^2P/dV^2)_t=0 \quad . \quad . \quad . \quad (42)$$

which imply that the isothermal elasticity becomes zero of the second order, vanishing without change of sign at the critical point. Applying these conditions to the equation of Dieterici (*Ann. Phys.*, 5, p. 51, 1901)—

$$aP(V-b)=RTe^{-c/v}, \quad . \quad . \quad . \quad (43)$$

we obtain,

$$V_c=2b=c_c/2, \quad RT/ap_c=e^2b=3{\cdot}695V_c$$

showing that it gives a value of the ratio of the critical volume to the ideal volume agreeing better with experiment than that found from Van der Waals' equation in (35). There are, however, many other conditions to be satisfied which limit the possible choice of equations. The general expressions for S and SC, which are as follows:—

$$SC=(dH/dP)_t=-(dH/dV)_t/dP/dV)_t, \quad . \quad . \quad . \quad (44)$$

$$S=(dH/dT)_p=(dH/dT)_v+SC(dP/dT)v, \quad . \quad . \quad . \quad (45)$$

show that SC and S become infinite of the second order at the critical point, but that C remains finite and becomes equal to the reciprocal of the pressure coefficient $(dP/dT)_v$ to the second order of small quantities.

Similarly, if we take the Joule-Thomson equation,

$$SC=aT(dV/dT)_p-aV \quad . \quad . \quad . \quad (46)$$

and divide by $S=aT(dV/dT)_p(dP/dT)\phi$ we obtain,

$$C_H=(dT/dP)\phi-aV/S \quad . \quad . \quad . \quad (47)$$

which shows that the cooling-effect CH at constant H becomes equal to the cooling-effect $C\phi$ in adiabatic expansion when aV/S becomes zero of the second order at the critical point. The three cooling-effects, C_H, C_v, and $C\phi$ which are the reciprocals of the pressure coefficients, and are most easily measured for any substance, or deduced from any assumed type of characteristic equation, remain finite and become equal, to the second order of small quantities, at the critical point.

Again, if we take the general expression for the latent heat according to Maxwell's theorem, we see that the latent heat is equal to the product of $aT(V-v)$ by the mean value of $(dP/dT)_v$ between V and v. Comparing this with Clapeyron's equation, $L=aT(dp/dt)(V-v)$, we observe that $(dP/dT)_v$ must become equal to dp/dt, to the first order of small quantities, at the critical point, which affords a useful test of any type of equation, because the coefficient dp/dt is readily observed.

These simple conditions, which seem to have been overlooked, are fatal to most of the equations which have been proposed. For instance, the equation of Clausius for CO_2 requires $(dP/dT)_v$ to be equal to $7P/T$ at the critical point. But the observations of Amagat show that $dp/dt=6{\cdot}5p/T$ at this point, so that we should expect to find some difficulty in reconciling the equation of Clausius with the saturation pressures, as already indicated. The equation of Dieterici (43) gives a very satisfactory representation of the cooling-effect, to which it has often been applied, provided that the quantity c is assumed to vary as $1/T^{3/2}$. But this gives a value only $4P/T$ for the coefficient $(dP/dT)_v$ at the critical point in place of $6{\cdot}5P/T$, so that it would be quite impossible to represent the saturation pressures consistently. Most of the equations which have been proposed are modifications of the cubic type of Van der Waals, but are too complicated and empirical to serve as a satisfactory basis for the physical interpretation of the phenomena of the critical state. There is an almost infinite variety of possible types if transcendental functions are introduced. Many of these will be difficult to manipulate, but, in spite of the complexity of the conditions to be satisfied, we need not despair of arriving ultimately, by a process of elimination, at some form which is in reasonable agreement with experiment and at the same time sufficiently simple to be intelligible.

REFERENCES.—In addition to works cited in the earlier articles, the following may be recommended. On the practical side, Sir J. A. Ewing's *Mechanical Production of Cold* and *Thermodynamics for Engineers* (1920); on the theoretical side, H. S. Carslaw, *Fourier's Series and Integrals* and J. H. Jeans, *Dynamical Theory of Gases*. For experimental details it is always necessary to refer to the original papers, but *Physical and Chemical Constants* by G. W. C. Kaye and T. H. Laby (1921) gives a very handy and up-to-date summary of numerical results. (H. L. C.)

HEATON, SIR JOHN HENNIKER, 1ST BART. (1848–1914), English postal reformer, was born at Rochester, in Kent, May 18 1848, the son of Lt.-Col. Heaton. He was educated at Kent House grammar school and King's College, London. In 1864 he went to Australia and became a landowner and newspaper proprietor in New South Wales. He returned to England and entered the House of Commons as M.P. for Canterbury in 1885, retaining the seat until 1910. All his energies were devoted to postal reform. He advocated penny postage throughout the British Empire, and lived to see it achieved and extended to the United States. He also promoted cheaper oceanic telegraphy, and many other postal reforms. He died at Geneva Sept. 8 1914.

See *Life and Letters of Sir John Henniker Heaton, Bart.*, by his daughter, Mrs. Adrian Porter (1916).

HEDIN, SVEN ANDERS (1865–), Swedish geographer and explorer, was born at Stockholm Feb. 19 1865. He was educated at Stockholm and Upsala universities, and afterwards studied in Germany at Berlin and Halle. In 1885–6 he made a year's journey through Persia and Mesopotamia, and in 1890 was attached to the special embassy sent by King Oscar of Sweden to the Shah of Persia. The same year he visited Khorasan and Turkestan. Sven Hedin is, however, best known for his explorations in Tibet, which place him in the first rank of modern

Asiatic explorers. In 1893 he started from Orenburg, on the Ural river, with the intention of crossing the Asiatic continent to Pekin. His journey traversed a large area of unexplored country (*see* 16.991; 26.925). In two other expeditions (1899–1902, 1906–8) he added considerably to our knowledge of the country and thoroughly explored the sources of the Sutlej and Brahmaputra or Tsanpo (*see* 26.925). Many honours were conferred upon him as a result of his discoveries. Besides receiving medals from various geographical societies, he was specially honoured by the King of Sweden, and he was awarded an hon. K.C.I.E. by the Indian Government.

During the World War Sven Hedin was a prominent supporter of the German cause, and his book *With the German Armies in the West* (1915) gives an account of his experiences as a guest of the German army. Among his publications are *Journey Through Persia and Mesopotamia* (1887); *Journey Through Khorasan and Turkestan* (1892); *Through Asia* (1898); *Central Asia and Tibet* (1903); *Adventures in Tibet* (1904); *Scientific Results of a Journey in Central Asia 1899–1902* (6 vols. 1904–7); *Transhimalaya* (1909; vol. iii., 1913); *Overland to India* (1910); *From Pole to Pole* (1911); *Bagdad, Babylon, Nineve* (1917); *Southern Tibet* (1917); *Eine Routenaufnahme durch Ost* (1918–9).

HEERINGEN, JOSIAS VON (1850–), German general, was born March 9 1850 at Kassel. After having been in command of the II. Army Corps at Stettin he was appointed Minister of War in 1909, and retired from this position in 1913, after he had successfully piloted the last great Army bill through the Reichstag. On the outbreak of the World War he was Inspector-General of the Second Army Inspection, but was at once placed in command of the VII. Army, which was then in Lorraine and after Sept. 1914 was on the Aisne. In 1917 he was appointed to the command of the coast defences, and was placed on the retired list in Nov. 1918.

HEIJERMANS, HERMANN (1864–), Dutch writer (*see* 13.212). His recent plays include *Schakels* (1904); *Allerzielen* (1906); *De Groote Vlucht* (1908); *Ahasverus* (1912) and *Eva Bonheur* (1919). *Op Hoop van Zegen* had by 1921 been acted over 500 times. He lived for a few years in Berlin, but returned to Holland in 1912 in order to manage a society of players, and devoted himself to that work.

HEINEMANN, WILLIAM (1863–1920), British publisher, was born May 18 1863 at Surbiton and educated at home. He spent his early years in the study of music until, realizing that he could not hope to be in the front rank of musicians, he started a publishing business. Amongst his earliest publications were Whistler's *Gentle Art of Making Enemies* (1890) and *Heinemann's International Library*, edited by Edmund Gosse. In 1897 he opened the series of *Short Histories of the Literatures of the World* with Gilbert Murray's *Ancient Greek Literature*. Heinemann's most conspicuous service to literature probably lies in his introduction to the English reading public of such foreign writers as Maeterlinck, Ibsen, Björnson, Tolstoi, Couperus and Valera. He also published three plays by his own pen—*The First Step* (1895); *Summer Moths* (1898) and *War* (1901). Since 1913 he had been president of the National Booksellers' Society. He died suddenly in London Oct. 5 1920.

HEJAZ RAILWAY (*see* 13.218).—The system comprises the Damascus-Medina line (1,320 km.) and a line from Der'a to the coast at Haifa (161 km.).

In 1900 Sultan 'Abdul Hamid II., urged by his favourite 'Izzet Pasha, decided to build a railway from Damascus to Medina and Mecca. The ostensible reason was to provide a cheap and easy means for Moslems to perform the prescribed pilgrimage to the holy places of their Faith, but the Sultan also hoped that the line would strengthen his temporal authority. The military aspect of the enterprise was carefully ignored when, in May 1900, the Sultan, as Khalif, invited the Faithful to contribute towards the expenses of building the "Pilgrim Railway," and subscribed £50,000. An *irade* was issued (May 1900) granting 10% of one month's pay of all officials and soldiers of the Ottoman Empire to the Fund, imposing special stamp duties, and appropriating the proceeds of the sale of the skins of animals sacrificed at Moslem ceremonies for the same purpose. In all, about £1,000,000 was raised in cash or kind by voluntary subscriptions throughout the Moslem world, the levies on officials and soldiers produced some £250,000 and, up to Sept. 1 1907, £2,250,000 had been spent. After that date, the construction of the railway was entirely in Turkish hands.

A High Commission under Marshal Kiazim Pasha was appointed to superintend construction; Hajji Mukhtar Bey began the survey, and, after Jan. 1901, the German engineer-in-chief, Meissner Pasha, took active control of the work. At first Austrian and Italian contractors were employed, but Ottoman railway troops were also used, and for the later stages of the line from El 'Ala to Medina only Moslems were allowed to work. In all, some 7,000 soldiers were employed, besides Italian, Montenegrin and Greek labourers, and Syrian-Christian muleteers and followers. The cost per mile of construction worked out at about £3,000. Meissner Pasha began to work from Der'a near Mezeirib, the terminus of a French railway from Damascus, for which an offer of £280,000 was refused by its proprietors. A British company which built a few km. of track inland from Haifa was bought out for £46,250.

Running almost due S. from Damascus, the main line enters the Yarmuk basin and skirts the western edge of the Hauran. South of Der'a it takes much the same course as the old Hajj road along the desert plateau about 65 km. E. of the Jordan, ascending gradually to Ma'an, where it turns S.S.E. About 40 km. farther it reaches its highest point (1,180 metres) and begins to descend the steep escarpment of Batn el Ghul and follows the long N.S. depression between the main Arabian watershed and the 'Aweiridh range. After ascending a saddle the line descends into Wadi Hamdh basin, within which it continues to Medina. The Haifa sector runs roughly W. from Der'a down the Yarmuk valley, crosses the Jordan at Jisr el Mujami', turns S. to Beisan, and then N.W. across the plain of Esdraelon.

The chief stations are:—

	Height in metres (approx.)	Km. from Damascus (approx.)	Section opened Sept. 1
(1) *Main Line*			
Damascus . . .	696	—	1903
'Ezra	589	91	
Der'a	529	123	
Zerqa	618	203	1902
'Amman . . .	738	222	1903
Qatrane . . .	783	326	
Qal'at 'Anaze . .	1,051	423	1904
Ma'an	1,074	459	
Mudawara . . .	732	572	1906
Dhat el Hajj	691	610	
Jebuk	775	692	1907
Mu'adhdham	1,005	830	
Medain Salih	820	958	
El 'Ala	676	993	
Hadiya	400	1,144	1908
Medina	700	1,320	
(2) *Der'a–Haifa sector*			
Mezeirib	462	135	1901
Semakh	189	197	1905
Jisr el Mujami'	246	208	
(Jordan Bridge)			
Beisan	121	225	1904
'Afule	62	248	
Haifa	1	284	

The line is laid in most part on steel sleepers with ballast of broken lava and basalt. Curves being sharp in places—often not more than 125 metres radius—derailments are frequent. Speed nowhere exceeds 25 km. per hr., and, in the southern sector, the maximum obtainable with safety is $14\frac{1}{2}$ km. The fuel used in normal times was a mixture of Turkish Eregli and Cardiff coal imported at Haifa, but during the World War this was replaced by wood from the palm groves of Damascus and Medina and the oak forests of El Hishe to which latter the Turks built a short branch line from Qal'at 'Anaze. The water supply at main stations is from elevated tanks fed by steam—or windmill—pumps, and, at certain places, is so highly mineralized as seriously to affect the tubing of locomotives. The main repairing shops are at Qadim station, Damascus, with smaller shops at Der'a, Ma'an and Tebuk. Before the World War three through trains left Damascus weekly, with numerous specials during the pilgrim season, and the journey took $5\frac{1}{2}$ days. In 1911, receipts were £T. 214,000 and, in 1912, 48,000 pilgrims were carried.

After the outbreak of the revolt (1916) the railway was repeatedly damaged by organized parties of Arab forces, the most serious attack being that in the spring of 1918 when a long sector S. of Ma'an was so completely destroyed as to be beyond repair during the war. Even in peace times the line was constantly subject to raids by Bedouin, who broke telegraph lines, displaced rails and did much damage to stations; as late as March 1921 organized attacks continued and bridges in the northern sector were destroyed. Control of the Hejaz railway enabled the

Turks to hold Medina until Jan. 1919. The prolongation of the line to Mecca was prevented by the opposition of the Harb tribes, which were inspired by the Grand Sherif of Mecca and by the cessation of subscriptions.

See Auler Pasha, *Die Hedschasbahn,* 1906; Angus Hamilton, *The Hejaz Railway in Problems of the Near East,* 1909. (H. P.-G.)

HELFFERICH, KARL (1872–), German financier and politician, was born July 22 1872 at Neustadt-on-the-Havel. In 1901 he was appointed to a professorship of political science in Berlin. In 1906 he went to Constantinople as manager of the Anatolian railway, which was financed by the Deutsche Bank, and in 1908 he returned to Berlin to take up the chairmanship of the directorate of that great bank. In 1913 he was the chief German delegate at the international financial conference held in Paris for the settlement of Balkan financial affairs after the Balkan wars. In 1915 he was appointed Secretary of State for the Imperial Treasury and carried the votes for the second, third and fourth war loans through the Reichstag. His financial policy was based upon the principle of defraying the cost of the war by borrowing rather than by fresh taxation. He counted upon a final German victory and upon imposing very heavy indemnities upon the Allies. He, therefore, became identified with the policy of Hindenburg and Ludendorff, and considered that no sacrifice of men and money was too great if Germany could hold out until the Allied and Associated Powers were sufficiently exhausted to be willing to accept a "German peace." After a period of scepticism regarding the prospects of the U-boat warfare, he became the most vigorous political advocate of the unrestricted submarine campaign, and was one of those who expected it to reduce Great Britain to impotence in six months' time. In June 1916 he exchanged the Treasury for the Imperial Home Office, and, as Secretary of State for that department, acted as vice-chancellor or representative of the head of the Imperial Government. On the assassination of Count Mirbach at Moscow, Helfferich was appointed in June 1918 as his successor in the diplomatic representation of Germany at the headquarters of the Russian Soviet Republic. Owing to the conditions of insecurity which prevailed under the Bolshevik Government, Helfferich was never able to occupy his post. He returned to Berlin in order to conduct the economic and industrial demobilization of Germany after the Armistice. He remained the irreconcilable adversary of the new republican *régime*, and, in particular, directed his denunciations against the democratic Catholic leader, Erzberger, with whom he had a celebrated lawsuit in 1920. In the Reichstag he led the Conservative and monarchist right, known as the *Deutsch-Nationalen.* He was the author of *Deutschlands Wohlstand, 1888–1913* (1913) and of *Der Weltkrieg* (three vols., 1919).

HELIGOLAND BIGHT.—The naval battle known as that of Heligoland Bight was fought in the Bight on Aug. 28 1914.

The original plan of the British operations included only the forces in the southern part of the North Sea, and took the form of a sweep to be carried out in the Bight by Commodore (T) and his Harwich flotillas, in conjunction with six submarines of Commodore (S), supported by the "Invincible" and "New Zealand" from the Humber and Cruiser Force (C). Three submarines were to be posted off Heligoland to attack any cruisers coming out, and three to the W. to entice enemy destroyers to come out. The Harwich flotillas were to come down from the N. of Heligoland, then turning W. sweep on a 9-mile front towards Terschelling, cutting off any craft patrolling to the W. of Heligoland. The operation was arranged for Aug. 28 and the operation orders went out on Aug. 25. When Adml. Jellicoe heard of it the next day, he proposed to send Vice-Adml. Beatty with the Battle Cruiser Squadron and the 1st Light Cruiser Squadron to coöperate. This was approved about midnight on Aug. 26, but there was no time to send a full draft of the operation orders N. and Vice-Adml. Beatty, when he sailed from Scapa at 5:20 A.M. on Aug. 27, had only a rough outline of the proposed operation and the rendezvous of the Humber battle-cruisers. He was still in the dark as to the positions and intended movements of the submarines. This by itself would not have been a serious handicap, but unfortunately information of Beatty's coöperation was not sent out to Commodore (S) (Comm. Roger Keyes) and Commodore (T) (Comm. Reginald Tyrwhitt) till 1:10 P.M. on Aug. 27, by which time they had both sailed, and as the message was not signalled to them, they did not know that Beatty was taking part in the operations till they had actually begun.

By Aug. 27 the British forces were all on their way to the Bight, organized as follows:—

Sweeping Force.—"Arethusa," l.c., 2 6-in., 6 4-in., 27 knots; "Fearless," l.c., 10 4-in., 26 knots.

3rd Flotilla:—1st Div.: "Lookout" (Comm. A. B. S. Dutton), "Leonidas," "Legion," "Lennox"; 2nd Div.: "Lark" (Comm. R. Rowley-Conwy), "Lance," "Linnet," "Landrail"; 3rd Div.: "Laforey" (Comm. G. R. Edwards), "Lawford," "Louis," "Lydiard"; 4th Div.: "Laurel" (Comm. F. F. Rose), "Liberty," "Lysander," "Laertes."

1st Flotilla:—1st Div.: "Acheron" (Comm. Brien Money), "Attack," "Hind," "Archer"; 2nd Div.: "Ariel" (Comm. Dashwood Moir), "Lucifer," "Llewellyn"; 3rd Div.: "Ferret" (Comm. G. Mackworth), "Forester," "Druid," "Defender"; 5th Div.: "Goshawk" (Comm. Hon. Herbert Meade), "Lizard," "Lapwing," "Phoenix."

Submarines.—Off Heligoland: E 4 (Lt.-Comm. Leir), E 5, E 9. To W. of Heligoland: E 6 (Lt.-Comm. C. P. Talbot), E 7 (Lt.-Comm. Feilmann), E 8, "Lurcher" Commodore (S), and "Firedrake."

Supporting Force.—1st B.C.S. (Vice-Adml. Sir David Beatty):—"Lion" (flag), Capt. Alfred Chatfield, b.c., 8 13·5-in.; "Queen Mary," Capt. W. R. Hall, b.c., 8 13·5-in.; "Princess Royal," Capt. Osmond de B. Brock, b.c., 8 13·5-in.

1st L.C.S. (Comm. W. E. Goodenough):—"Southampton" (flag), Comm. E. Astley-Rushton, l.c., 8 6-in.; "Birmingham," Capt. Arthur A. Duff., l.c., 9 6-in.; "Falmouth," Capt. John D. Edwards, l.c., 8 6-in.; "Liverpool," Capt. Ed. Reeves, 2 6-in., 10 4-in.; "Nottingham," Capt. Chas. B. Miller, l.c., 9 6-in.; "Lowestoft," Capt. T. W. Kennedy, l.c., 9 6-in.

Cruiser Force K (Rear-Adml. Sir Archibald G. Moore):—"Invincible" (flag), Capt. Chas. M. de Bartolome, b.c., 8 12-in.; "New Zealand," Capt. Lionel Halsey, b.c., 8 12-in.; attended by 1st Flotilla, 4th Div., "Badger" (Comm. Chas. Fremantle), "Beaver," "Jackal," "Sandfly."

In Reserve.—Cruiser Force K (Rear-Adml. Arthur Christian):—"Euryalus" (flag), Capt. Eustace La T. Leatham; "Bacchante," Rear-Adml. H. H. Campbell, Capt. Hon. Algernon Boyle; "Cressy," Capt. Robert Johnson; "Hogue," Capt. Wilmot S. Nicholson; "Aboukir," Capt. John E. Drummond; all a.c., 2 9·2-in., 12 6-in.; and "Amethyst," Capt. Bertram Thesiger, 12 4-in.

It was light at 4 A.M. Comm. Tyrwhitt had met Comm. Goodenough and the 1st L.C.S. at daybreak, and at first mistook him for the enemy, but his challenge was answered and the cruisers recognized in time to prevent an accident. By 5 A.M. the sun was rising, and the forces were in position some 60 m. N. of Heligoland. The flotillas went off at 20 knots, the "Arethusa" and 3rd flotilla ahead, with the "Fearless" and 1st flotilla 2 m. astern. They were in cruising order, with divisions in line ahead disposed abeam, half a mile apart. Eight m. behind came the 1st L.C.S. with its six light cruisers in three divisions, 2 m. apart. The 1st B.C.S. was some 30 m. to the westward. On reaching a point about 12 m. W. of Heligoland, as he should do about 8 A.M., it was Tyrwhitt's intention to turn W. and sweep down the Bight, while the cruiser squadrons supported his movements.

Let us glance now at the German dispositions. Though their strategical policy was largely based on the idea of the British fleet invading the Bight, the actual attack came as a complete surprise. Posted round Heligoland in a semicircle they had two lines of patrols, an outer line of nine destroyers of the 1st flotilla 25 m. from the fortress, and an inner line of older vessels of the 3rd Minesweeping Div. 13 m. from it. These were supported by another torpedo flotilla (the 5th) at Heligoland, three cruisers on outpost duty and a battleship in the mouth of the Jade.

Their detailed disposition was as follows:—Outpost, Outer Line: 1st Flotilla, G 193, G 196, G 194, V 187, V 188, V 190, V 191, G 197, V 189. Outpost, Inner Line: 3rd Minesweeping Div. D 8, T 25, T 29, T 31, T 33, T 34, T 35, T 36, T 37 (?), T 40 (?), T 71 (?).

Cruisers in support: "Stettin" (10 4·1-in., 23 knots), off Heligoland, with Chief of 2nd U. Flotilla; "Frauenlob" (10 4·1-in., 19 knots), off the Jade; "Hela" (4 15½-pdr., 16 knots), N.E. of Heligoland. Battleship in support: "Heligoland" (12 12-in.), Jade river, inside outer bar. T.B. in support: 5th Flotilla in Heligoland; Submarines U5, U16, U25 and three others in Heligoland; U24, U 28 off Heligoland. In Wilhelmshaven Roads:—Cruisers: "Ariadne" (1900, 2,660 tons, 10 4·1-in., 19 knots); "Kolberg" (12 4·1-in., 25 knots); Battle

Cruisers: "Seydlitz" (10 11-in., 25½ knots, port engine disabled, under repair); 1st S.G., "Moltke" (10 11-in., 25½ knots); "Von der Tann" (8 11-in., 25½ knots); "Blücher" (12 8·2-in., 23½ knots). Battleships: 1st Squadron, "Ostfriesland," "Oldenburg" and "Thüringen" (relieved "Helgoland" about 8:30 A.M.); 3rd Squadron, "Prinz Reg. Luitpold," "Kaiser," "Kaiserin," "König Albert."

In Wilhelmshaven:—"Cöln" (Rear-Adml. Leberecht Maas, Flotilla Admiral; 1909, 4,350 tons, 12 4·1-in., 24½ knots, coaling); "Strassburg" (12 4·1-in., 26 knots); "Stralsund" (12 4·1-in., 26 knots); "Rostock" (2nd Leader, Flotillas), 12 4·1-in., 26 knots; "Hamburg" (Chief of 1st U. Flotilla), in dock.

In the Elbe:—2nd Squadron (Deutschlands).

At Brunsbüttel:—"Danzig," "München" (10 4·1-in., 20 knots).

Off the Ems:—"Mainz" (1909, 4,350 tons, 12 4·1-in., 25 knots).

The movements of all the heavy German ships were governed by one dominant consideration—the time of low water on the outer Jade bar. This fell at 9:33 A.M., and though there is not a word of the tide in any operation orders or despatches, it could hardly have occurred more fortunately for the British attack, for it meant that between 7 A.M. and noon no German battle cruiser or battleship could put to sea, a striking instance of the serious handicap imposed on the Germans by their river harbours.

The first signal of anything unusual came in at 5:26 A.M. The British submarine E 7 had fired a torpedo at G 194 about 4:45 A.M. and on the report reaching the "Seydlitz" about 5:26, Rear-Adml. Maas, the German Flotilla Admiral, was ordered to send out the 5th Flotilla to look for the submarine, and they left Heligoland for this purpose at 6:45 A.M. Such was the situation just before the British forces came on the scene. The sea was smooth, with a light wind from N.W., the sky overcast and weather dull. At 6:53 A.M. the "Arethusa" struck the outer patrol line, and, seeing G 194 on the port bow about 3½ m. away, sent her flying towards Heligoland with the 4th Div. of the 1st Flotilla ("Laurel," "Liberty," "Lysander" and "Laertes") in chase. G 196, the next German boat on patrol to the N., sighted the British cruisers and reported them at 7:6, but the report from G 194 did not get through till about 7:30 A.M. V 187, the German flotilla leader's boat, to the S. of G 194, had also sighted two destroyers, possibly the "Lurcher" and "Firedrake," and two cruisers on a S.E. course, and sent in a report of them. The "Laurel's" division drew away to E., and at 7:26 Comm. Tyrwhitt turned to port to support them. The "Fearless," 2 m. astern of him, followed suit. A few minutes later the German 5th Flotilla was sighted coming up from Heligoland, and turned back hotly pursued. Between 7:45 and 8 A.M. it became clear to the German Admiral of Scouting Forces that a considerable force of British destroyers had penetrated the Bight and at 7:47 the "Stettin" and "Frauenlob" were ordered to proceed in support. The "Stettin" had already weighed at 7:32 and by 7:58 was under way, though she had not raised steam in all boilers. Orders were also issued to the "Cöln" and "Strassburg" to support, to the "Kolberg" to get steam up, and to the "Stralsund" to proceed to the Roads. The German 5th Flotilla was being slowly overtaken and was crying for cruiser help (7:45).

The chief of the German 2nd S/M Flotilla, on board the "Stettin," ordered U 25 to take up a position at the N. end of the Heligoland–Weser line; the remainder of the German submarines, U 5, U 16, U 24, U 28, as they became available, were sent towards the Jade to guard the entrance of the river. The alarm had gone in Heligoland and the 8-in. guns were manned at 7:30 A.M.; by 7:50 A.M. the whole fortress was standing to. The pursuit was rapidly approaching the island, and the British flotillas were gradually overhauling the rear destroyers of the German 5th Flotilla. S 13 and V 1 were falling behind; the latter's range had fallen to 3,900 yd., and at 7:50 a 4-in. shot penetrated her stokehold, reducing her speed to 20 knots; another shot got home on the starboard side, damaging the steering connexions, and the British destroyers were gradually drawing closer when the "Stettin" arrived on the scene at 7:58 A.M. and opened fire at 9,200 yards. At 8:5 A.M. the "Fearless" was sighted, and the "Stettin," breaking off the action, retired behind Heligoland to get steam up for full speed, while the "Fearless" turned to W.¼S. at 8:12. The brief respite, however, had enabled the German 5th Flotilla to get clear, and they were now streaming down towards Heligoland, though some of the 3rd Minesweeping Div., which had formed the inner patrol line, were not so fortunate. They came under a heavy fire from the "Arethusa," and D 8 was hit by a 6-in. shot which killed the captain, lieutenant and doctor and disabled a score of men. T 33 too was brought to a standstill, but at 8:8 A.M. the "Frauenlob," which had left the Jade on hearing the guns, suddenly arrived on the scene from the S., and engaged the "Arethusa" on a S.W. course. The range fell from 6,000 to 4,000 yd., and the "Arethusa," which had only commissioned the previous day, suffered severely. Lt. Eric Westmacott, the signal officer, was killed by the commodore's side. Only the forecastle 6-in. gun remained in action, and one officer and 8 men were killed. The "Frauenlob" did not go unscathed. She received about 10 hits and five dead and 32 wounded. About 8:25 the "Arethusa" turned to W.¼S., and the "Frauenlob" turned to S. and broke off the action.

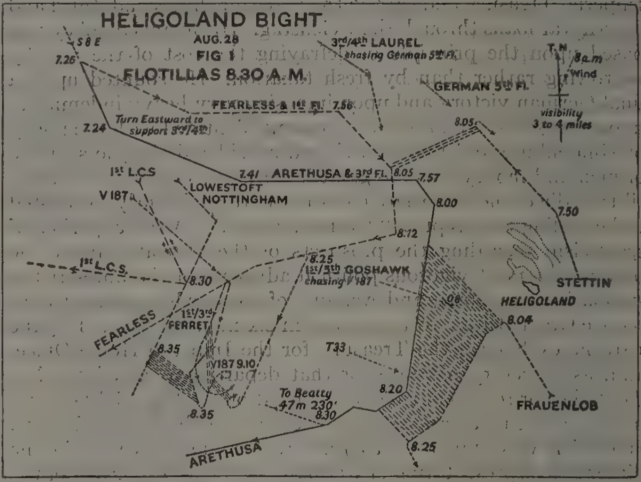

The approach to Heligoland and the engagements with the "Stettin" and "Frauenlob" may be called the first phase of the action. By 8:30 A.M. it was over and both the flotillas were proceeding to the W., the "Fearless" some 6 m. to the N. of the "Arethusa." Goodenough's light cruisers were about 12 m. to the W. and had also turned W. at 8:30. Beatty's battle cruisers were about 45 m. off to the north-west. The original plan had miscarried. The German patrols, instead of being swept to the W., had broken back and had all reached home with one exception. As the "Fearless" made to the W., she sighted V 187 at 8:15. This was the German flotilla leader's boat, and the 5th Div. of the British 1st Flotilla went off in chase. V 187 ran to the S.W., hoping to make the Jade and Ems, when at 8:45 the "Lowestoft" and "Nottingham," which had been detached by Comm. Goodenough to support the flotillas, suddenly emerged to the N.W. and opened a heavy fire at 4,300 yd., hitting her for the first time. The captain turned to the N. to break past the pursuing destroyers. He had passed them and was about to turn to the E. when the 3rd Div. of the 1st Flotilla came down on him from the north. He was now enveloped in a heavy fire from three sides. One shot put the foremost gun out of action, another penetrated the stokehold, another struck the bridge. The boat was brought to a standstill, and was sunk by the "Goshawk," "Phoenix" and "Ferret" at 9:10 A.M. The "Defender" had lowered boats to rescue the survivors, but the "Stettin," which had now got steam up, sighting V 187's smoke, reappeared on the scene, too late to help her but in time to scatter the destroyers, though she received one or two hits in doing so. The "Defender," in the hurry and scurry, had to leave her boats behind, but E 4 (Lt.-Comm. Leir), after making an unsuccessful attack on the "Stettin," waited till she was out of the way, then suddenly emerged, rescued the "Defender's" men, took an officer and a couple of V 187's men "as a sample," gave the remainder a compass to find their way to Heligoland, then submerged as suddenly as she came.

At 8:55 the "Fearless," making W., had sighted the "Are thusa," and both flotillas were now 12 to 15 m. W. of Heligoland steering W.¼S. To Commodore (S), who did not know of the presence of Goodenough's cruisers, the situation appeared confused. He had sighted Goodenough's light cruisers at 7:45 and reported them as the enemy, leading Goodenough to look for an enemy where there was none, and now about 9:40 A.M., seeing Goodenough coming up behind him, he reported he was being chased by four enemy cruisers. Tyrwhitt, getting the signal, turned boldly round at 9:42 A.M. to help him, and proceeded E. again. At 10 A.M., however, the mist lifted for a time and Comm. Keyes recognized Goodenough's cruisers. But he now became concerned for his submarines. The "Southampton" had already attempted to ram E6, and Goodenough, after seeing Keyes, sent a signal to Beatty and withdrew to the W., leaving the field clear for the submarines. The "Arethusa," after proceeding to the E. for 8 m. with the "Fearless" and flotillas, stopped and proceeded to repair damages. A lull of half an hour now ensued in the operations. The "Arethusa" had stopped and Goodenough's cruisers had withdrawn.

By this time the Germans were beginning to appreciate the situation. At 8:20 A.M. the German C.-in-C., Adml. von Ingenohl, had taken over the command from Rear-Adml. Hipper, the Admiral of Scouting Forces, and had ordered the battle cruisers to raise steam and be prepared to go out as soon as the bar would permit. The German light cruisers, eager to attack, had pushed out one by one as soon as they could get up steam. The "Strassburg" had passed the Outer Jade at 9:34 A.M., the "Cöln" (Rear-Adml. Maas) at 10 A.M., the "Ariadne" (ordered out at 10:33) at 10:50, the "Stralsund" at 11:20, the "Kolberg" at noon. They now began to appear on the scene. At 10:40 the "Arethusa" had got under way again, and was making to the W. when the "Strassburg," which had been making strenuous efforts to get in touch with the "Stettin," was sighted to the S.E., coming up on a N.N.W. course. Fire was opened and the flotillas turned to attack, but the "Strassburg," evidently unwilling to close, went off to the N. and disappeared in the mist. At 11:5 the "Cöln" appeared to the S.E., and they turned to engage her, but after a few salvoes she passed on. At 11:16 the "Strassburg" reappeared to the N., and, steering a westerly course, opened a heavy fire at about 8,650 yd. The "Lookout," with the 1st Div. followed by the 2nd Div., went off to attack her at 11:35 A.M. Two of their torpedoes crossed her path, and, driven off by the flotillas, she disappeared in the mist.

The flotillas rejoined the "Arethusa" and continued their course to the westward. When the "Cöln" appeared Tyrwhitt had asked for support, and when the "Strassburg" came in sight the second time, Capt. Blunt, foreseeing a concentration of German light cruisers, sent an urgent signal for assistance.

Beatty meanwhile had been steaming round a position about 54° 28′ N., 6° 20′ E. The situation was obscure to him, but at 10 A.M. he made a general signal to all ships giving his position 54° 26′ N., 6° 14′ E., and adding: "Remaining here," so that they might know where to find him.

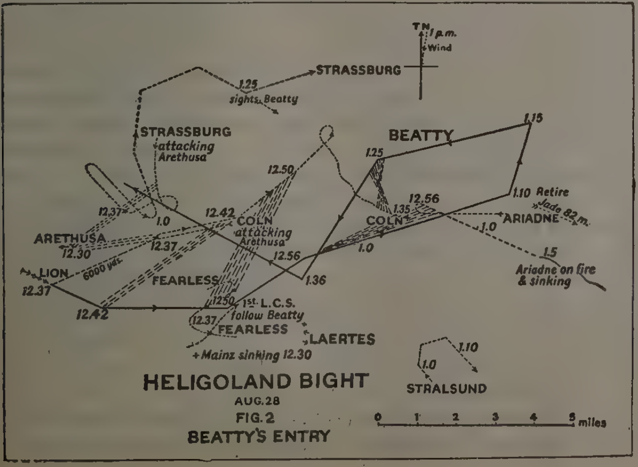

HELIGOLAND BIGHT
AUG. 28
FIG. 2
BEATTY'S ENTRY

The final and decisive phase of the action was now about to begin. Between 11 and 11:30 Beatty received three calls for assistance. At 11:20 he had ordered Goodenough to go to Tyrwhitt's assistance. Then came Capt. Blunt's signal couched in urgent terms, and Beatty decided to take his whole force into the Bight. The "Arethusa" was some 40 m. away, and at 11:24 he formed his battle cruisers in single line ahead, and, working up to full speed, proceeded to E.S.E., to throw his whole force into the issue of the day.

Meanwhile the "Mainz" had left the Ems shortly after 9 A.M. and was making at full speed to the E. to cut off the British destroyers and to get in touch with the "Strassburg" and "Stettin." At 11:30 she was sighted almost right ahead by the 2nd, 3rd and 5th Divs. of the British 1st Flotilla as they came W., with the "Fearless" and "Arethusa" some miles behind them. The "Mainz" turned to the N. and chased the destroyers to the N., bringing them under a heavy fire. But at 11:50 the situation suddenly changed. Out of the mist, on the port bow of the 1st Flotilla, there appeared four light cruisers steaming S.S.E. at high speed. These were Goodenough's cruisers coming down from the N.N.W. in support. For a few minutes the destroyers were doubtful whether they were friend or foe, then they recognized them as British and turned gleefully to join them. The "Mainz" recognized them too, and, turning sharply round, fled to the southward. The 1st L.C.S. opened fire, but the range was over 7,000 yd. and the "Mainz" drew away, reporting that she was being chased by a battle cruiser. The signal was received at 12:5 P.M. and the "Moltke" and "Von der Tann" were ordered to proceed, with the German 8th Flotilla to screen them. At 12:8 P.M. the "Mainz," running S.E., sighted the "Fearless" and 3rd Flotilla. She swung round to S. and the 1st and 2nd Divs. of the British 3rd Flotilla turned to N. and the 4th Div. to S. to engage her.

A shot, possibly from the "Fearless," damaged the "Mainz's" rudder and brought her port engine to a stop. She now concentrated on the 4th Division. The "Laurel" was hit by her first salvo; the fourth detonated a number of lyddite shells and blew away the after-funnel, and the "Laurel," with her captain severely wounded, crawled away, hidden by the steam and smoke pouring out of her funnel. The "Liberty" ran into the zone of fire, and had her mast shot away and her captain, Lt.-Comm. Nigel Barthelot, killed. The "Laertes" was hit four times by a single salvo at 4,000 yd. and was stopped dead. But a torpedo fired by the 4th Div. had hit the "Mainz" on the port side amidships. Goodenough's cruisers were closing rapidly and, opening a deadly fire, they reduced her quickly to a wreck. At 12:25 they ceased fire, and at 1:8 the "Mainz" settled by the bows and sank.

The position was still far from clear. The flotillas were scattered. Two German cruisers, the "Strassburg" and "Cöln," had appeared to the N.E. and opened a heavy fire, and the German forces seemed to be concentrating to the northward. But in a few minutes everything was changed. Out of the mist there emerged Beatty's four great battle cruisers steaming at high speed. They swept past the sinking "Mainz," and on to the N.E., Goodenough with his cruisers following in their wake. The German cruisers saw them and fled, but it was too late. At 12:37 the "Cöln" appeared on the port bow, and the "Lion" opened fire at 3,800 yards. The "Cöln" steered desperately to the N.E., but was hit by a heavy shell and her engines disabled. She gained a brief respite, for the "Ariadne" was sighted by the "Lion" trying to cross her bows on a S.E. course in a despairing effort to escape. Her end came quickly. She was hit by the first two salvoes and disappeared in the mist to the S.E., on fire and sinking. Beatty now decided to withdraw, and at 1:10 P.M. made the signal to retire.

The "Lion" circled round to the N. and sighted the "Cöln" again at 1:25 P.M. steering slowly to the S.W. The admiral had fallen, her captain was seriously wounded. The "Lion" sent a 13·5-in. shell into her; she listed to port and sank with her flag flying, at 1:35. By this time both the "Stettin" and "Strassburg" had reported the presence of battle cruisers, and at 1:50 the German light cruisers were ordered to fall back on the "Moltke" and "Von der Tann." At 2 P.M. the German battle cruisers passed the bar of the Outer Jade. The German 1st and 3rd Squadrons were now getting up steam, and the German battle cruisers were ordered not to advance against the British squadron (2:41 P.M.) but to wait for the "Seydlitz" 25 m. W. of Heligoland. By 3:50 the three battle cruisers had reached that position, and had been joined by the "Strassburg," "Kolberg" and "Stralsund." There were no signs of the enemy. The squadron turned back before reaching the position where the "Cöln" went down, and no survivors were found that day. A single stoker was picked up by a torpedo-boat on Aug. 30. Four others had managed to get hold of a battered dinghy, but he alone survived.

For the British it remained only to get home. Adml. Campbell's cruisers met the "Lurcher," with the "Mainz's" crew on board, escorting the "Laurel" and "Liberty," at 4:30 P.M., and the "Laurel" was taken in tow by the "Amethyst." The "Arethusa" struggled on at 6 knots till 7 P.M., then had to signal for assistance, and at 9:30 P.M. was taken in tow by the "Hogue" and reached home safely.

Mist, uncertainty arising from the appearance of British light cruisers, and the speed of the enemy's light cruisers militated against the success of the British submarines. E 7 had begun the day by firing a torpedo at G 194, had sighted the 1st L.C.S. at 10 A.M. and recognized them as British; she had seen the "Danzig" later at 12:40, and at 1:15 had sighted Beatty's battle cruisers, which passed over her—this probably gave rise to the report of an attack on the "Queen Mary." E 4 had fired a torpedo at the "Stettin," picked up the "Defender's" men and seen the "Ariadne" going W. at 12:10 P.M. E 6 had been attacked by the "Southampton" at 9:30, had watched the action between the "Mainz" and the flotillas, and had prepared to attack a four-funnelled cruiser at 1:45, only to recognize it just in time as the "Liverpool."

The German submarines had all been held back off Heligoland by the chief of the 2nd Submarine Flotilla, and the reports of attacks by them on the British were fictitious. When, at noon, it was clear that battle cruisers had entered the Bight, the German submarines were ordered by the chief of the 1st Submarine Flotilla to attack the enemy in the vicinity of Heligoland, but as the enemy was 35 m. off and it would have taken them at least four hours to reach him, the order was ineffective.

The engagement was a severe blow to the German fleet. They had lost three light cruisers and one destroyer, and their casualties were 63 officers and 649 men killed, 20 officers and 361 men wounded, 9 officers and 140 men prisoners, a total of 1,242, against the British 35 killed and some 40 wounded. The Germans had at first expected the British fleet to enter the Bight, but as days passed without a sign of it they became less circumspect and Beatty caught them off their guard. In these circumstances they had only two courses before them—either to keep everything back or send everything out. As it was, the light cruisers had proceeded independently and had fallen victims to greatly superior forces. The exposure of the patrols to sudden attack entailed one of two policies—to keep heavy ships continuously on patrol and tie them to the defence of the rivers, or to lay minefields to cover the approaches. The latter policy was adopted and mines began to be laid to the W. of Heligoland in September 1914. The engagement had a further effect, for it confirmed the Kaiser in his determination to limit the German fleet to a strictly defensive policy. When Beatty swooped down on the Bight he drove a great wedge into German naval policy. Von Tirpitz, whose son had been taken prisoner in the "Mainz," wearied himself with plaints, but all in vain. For the British nation and navy the victory came, too, at an opportune time. The irresistible advance of the German army was being viewed with something like dismay. The news of a naval victory in the very gates of the enemy lightened the gloom and gave the nation faith that the navy was equal to its gigantic task. It gave the navy, too, confidence in its leaders. They knew that where they were Beatty also would be. Many a day was to pass before, on another misty day, also in the mouth of another river, Beatty was to look on a very different scene, but the first naval laurels of the war were gained in the Bight, and this naval action ranks as one of the most important of the World War. (A. C. D.)

HELMET (*see* 13.247).—The World War again demonstrated the truth of the old saying that "in war it is the unexpected that happens." In view of the developments which had taken place in the science of gunnery, and the destructive effects of modern gun and rifle fire, it would hardly have been anticipated that the world would again witness the spectacle of soldiers in helmets throwing hand grenades and bombs at an enemy only a few yards distant—in fact, a return of the grenadiers in helmets. Against modern rifle-fire, helmets are of no use; and except for ornamental purposes they had long been abandoned. But the World War brought them again into use.

It was not until the war was well advanced, and the armies on the western front had been engaged in trench warfare for some considerable time, that it was realized that a great number of head wounds caused by shrapnel bullets, fragments of shell, etc., travelling at relatively low velocities, might have been prevented by very slight protection. Even then an immense amount of research and experimental work had to be carried out before an efficient helmet was produced, and an immense amount of prejudice had to be overcome before the soldier realized its value and could be induced to wear it. Helmets were first introduced into the French army, and they eventually formed an essential part of the equipment of every soldier.

The problem to be solved in the manufacture of a helmet is very different to that of the ordinary bullet-proof plate which is designed to stop direct rifle-fire. The governing factor is weight, and as it is impossible to attempt to stop direct rifle-fire owing to the excessive weight of metal which this would necessitate, efforts must be confined to securing defence against shrapnel bullets and fragments travelling at low velocities. A hard steel is out of the question, as it would break up under impact. On the other hand a soft steel would be too easily perforated. The properties which the metal must possess are those of extreme toughness and ductility, so that the resistance offered to the impact may be gradual and distributed over as large an area as possible. The effect can perhaps be best described by comparing it with the action of a loosely hung net in stopping a cricket ball or a golf ball. The one material which possesses these requirements to a high degree is manganese steel. This steel can be rolled into thin sheets from which the helmets are pressed, and in this form its ductility is remarkable. The thickness of the metal is only 20 B.W.G. or ·036 of an inch, and this is required to withstand the impact of a shrapnel bullet (forty-one to the pound) travelling at a velocity of 750 ft. per second. Under actual test they resisted this attack at 900 ft. per second.

A comparison of the British helmet with the French and German is of interest. The French helmet weighed slightly less than the British—23¼ oz. as against 25½ oz.— but was only made of mild steel and could be easily perforated by shrapnel bullets at as low a velocity as 350 ft. per second. It must be remembered, however, that the French were the first to realize the value of helmets, and at once issued two million of them manufactured from the only material available to the army. Arrangements were subsequently made for these helmets to be replaced by manganese-steel helmets, but in the meantime the Armistice was signed and they were never delivered. The German helmet was made of nickel-chrome steel and weighed as much as 37 oz., or nearly 12 oz. more than the British. It was easily perforated by shrapnel at low velocities, and in addition suffered from the fatal defect of cracking and breaking under impact. The helmets supplied to the U.S. troops at the beginning of the war were exact copies of the British types. The model of 1917, of manganese steel, ·036 in. to ·040 in. thick, weighs, complete with lining and chin strap, 36 ounces. (E. F. L.)

HEMY, CHARLES NAPIER (1841–1917), British painter (*see* 13.265), died at Falmouth Sept. 30 1917.

HENDERSON, ARTHUR (1863–   ), British Labour politician, was born in Glasgow of working-class parents Sept. 15

1863; but his work and interests subsequently lay at Newcastle (where he served an apprenticeship as moulder at Robert Stephenson & Co.'s works), and in the county of Durham. He gradually became prominent in connexion with his own trade union and in the trade-union movement generally. After a while he took a leading part in local affairs, and was for some years a member of the Newcastle city council, and Darlington borough council. He was mayor 1903; and was made a magistrate for the county of Durham. He entered Parliament for Barnard Castle as a Labour member, at a by-election in 1903. When the Labour party were first returned to Parliament in force, in 1906, he soon made his mark as one of their leaders. In 1907 he took a prominent part in advocating the ending, rather than the mending, of the House of Lords; and in 1908 he was elected chairman of the party, a post which he held for two years and to which he was reëlected in the autumn of 1914 when the then chairman, Mr. Ramsay Macdonald, had to resign owing to his pacifist views. As chairman, at the opening of the new session in that autumn, Mr. Henderson promised the full support of organized labour in maintaining the "splendid unity" of the nation.

When Mr. Asquith formed the first Coalition Ministry in 1915, he included Mr. Henderson in the Cabinet as President of the Board of Education, and also adviser of the Government on Labour questions arising out of the World War. Indeed his functions as Labour adviser so occupied his time and attention, that it was thought desirable to relieve him in Aug. 1916 of the Board of Education, and give him the practical sinecure of Paymaster-General, so that he might be free to devote himself to the more congenial part of his work. Throughout the Ministry Mr. Henderson showed himself resolved on a strenuous prosecution of the war. He warmly advocated both the Munitions bill and the Registration bill, and had no hesitation in taking the further step of compulsory service, asserting, on the first Military Service bill, that the choice was between compulsion and defeat, and on the second bill, that the first had brought in more men than was expected and, therefore, that there was every reason to anticipate the success of the second. He followed up this action by strongly urging the Labour party to rally in Dec. 1916 to Mr. Lloyd George, and by accepting himself the position of an original member of the War Cabinet of four without portfolio. In consequence of his prominence as a labour protagonist of the war, his life was threatened, along with the Prime Minister's, by the conspiracy of a Derby family of anarchists, who were duly convicted, and sentenced to considerable terms of penal servitude, in March 1917.

After the revolution in Russia in the spring of 1917 Mr. Henderson visited that country on behalf of the British Government. He found there, as he subsequently explained, the most confused ideas current as to the aims of the Allies in the war, and deliberate perversions circulated by enemy agents. The then Provisional Government at Petrograd favoured an international Labour and Socialist Conference, which was being promoted by the International Socialist Bureau and was to meet at Stockholm. They pressed Mr. Henderson to use his influence with British Labour to attend this Conference; and he, believing the Conference to be inevitable, came to the conclusion that, provided it were merely consultative, it would be better that British representatives should go, rather than permit Russian representatives to meet German representatives alone. He returned with these ideas to England, and, being still secretary of the Labour party as well as a member of the War Cabinet, used his influence as secretary to promote British Labour participation in the Conference. But though the majority of Labour men were apparently in his favour, public opinion in other classes was strongly against any conference with Germans in the midst of war. The Sailors' and Firemen's Union refused to carry the delegates. Mr. Henderson visited Paris in the company of Mr. Ramsay Macdonald to discuss the situation with Labour over there, but found that neither French, nor Belgian, nor Italian, nor American Labour was disposed to join. Moreover, all Mr. Henderson's Labour colleagues in the Government opposed his views; and on Mr. Lloyd George expressing the surprise of the rest of the War Cabinet at his action and their dissent from his policy he resigned and was succeeded by Mr. George Barnes.

The attitude of Labour internationalism was maintained by Mr. Henderson out of office, and he warmly espoused the Labour policy of the latter part of 1918, to take the Labour men out of the Government and appeal for support on a Labour platform, in conjunction with the pacifist wing of the party. This policy cost Mr. Henderson his seat in Parliament at the General Election of Dec. 1918. He was defeated by a candidate of the National Democratic party in East Ham, and none of the Pacifist Labour men with whom he had made common cause found their way into Parliament. He himself returned to the House of Commons at a by-election for Widnes in Sept. 1919. He strongly promoted the League of Nations in the early part of that year; he attended the International Socialist Conference at Berne; and in Dec. 1920 he paid an informal visit to Ireland in the hope of promoting peace. (G. E. B.)

HENDERSON, SIR DAVID (1862–1921), British general, was born on Aug. 11 1862. He served in the Nile Expedition of 1898, and in the defence of Ladysmith and the subsequent advance into the Transvaal 1899–1900. In the later phases of the S. African War he was chief of the Intelligence Department, and on its conclusion he was promoted brevet lieutenant-colonel and received the D.S.O. He afterwards held many staff appointments at home, was promoted colonel in 1905, and became director of military training in 1912. In the meantime he had taken up the study and practice of aviation, and in the following year he was appointed the first director of military aeronautics. On the outbreak of the World War he went to France in command of the Royal Flying Corps, while retaining the position of director at the War Office, and he was promoted major-general for distinguished service within a few weeks. But, finding it impossible to combine the duties, he gave up his command at the front early in 1915, and thenceforward devoted himself to the development and expansion of the military flying service. He was promoted lieutenant-general at the beginning of 1917, and at the end of that year he joined the Air Ministry on its creation, as chief of the general staff; but he resigned this position in the following April. In May 1919 he became director-general of the League of Red Cross Societies. He was created K.C.B. in 1914, and K.C.V.O. in 1919. He died at Geneva Aug. 17 1921.

HENRY, EDWARD LAMSON (1841–1919), American painter (*see* 13.299), died at Ellenville, N.Y., May 9 1919.

HENRY, O. (1862–1910), American short-story writer, was born at Greensboro, N.C., Sept. 11 1862. His real name was William Sydney Porter, and he came from an old southern family. Until 15 years of age he attended a school directed by his maternal aunt in Greensboro and then entered his uncle's drugstore as a clerk. From early years he was a constant reader, and he secured a wide knowledge of the English classics. He has recorded that his favourite books were Lane's translation of *The Arabian Nights* and Burton's *Anatomy of Melancholy*, and that he was a devoted admirer of Tennyson. The close confinement as drug-clerk impaired his health, and in 1882 he was sent to a friend's ranch in Texas, where he remained two years. In 1884 he went to Austin, Tex., where he lived ten years, first as a book-keeper in a real estate office, then as an employee in the General Land Office and from 1891 as teller in the First National Bank of Austin. In 1894 he purchased Brann's *Iconoclast*, a weekly, which after a short time he renamed *The Rolling Stone*. This paper he converted into a ten-page weekly, he alone furnishing most of the matter and the illustrations. Even as a young boy he had been locally famous for his cartoons. After a year the paper "rolled away," to use his own words, and in 1895 he became a reporter on the Houston *Daily Post*. In 1896 he was charged with having embezzled money while teller in the Austin bank some years before. He fled to Honduras, and thereafter visited several South American countries. In 1897 he returned to Austin and the following year was convicted and sentenced to serve four years in the Ohio penitentiary. Later his innocence seemed to have been established, and it was generally agreed that had he originally stood trial he would have been acquitted. He entered prison

April 25 1898 and was released July 24 1901. It was probably while in prison that he first adopted the pen name of O. Henry. Many of his stories, written there, were mailed to New Orleans and thence redirected to the publishers. In 1902 he settled in New York, and sent forth a constant stream of stories, which became extraordinarily popular. They are characterized by a gorgeousness of imagination, recalling *The Arabian Nights* so familiar to him; but the constant striving for effect and the excessive use of slang led many to see in them a degeneration into "literary vaudeville." He is perhaps at his best when describing the endlessly varied types presented by the mass of humanity in New York City. He died in New York June 5 1910.

His own natural reticence concerning his life gave rise to many myths. His stories were issued under the following titles:—*Cabbages and Kings* (1905); *The Four Million* (1906); *The Trimmed Lamp* (1907); *Heart of the West* (1907); *The Gentle Grafter* (1908); *The Voice of the City* (1908); *Roads of Destiny* (1909); *Options* (1909); *Whirligigs* (1910); *Strictly Business* (1910); *The Two Women* (1910); *Let Me Feel Your Pulse* (1910, his last completed story); *Sixes and Sevens* (1911); *Rolling Stones* (1912) and *Waifs and Strays* (1917).

See C. Alphonso Smith, *O. Henry* (1916).

HENRY, VICTOR (1850–1907), French philologist (*see* 13.301), died at Sceaux, near Paris, Feb. 1907.

HENSCHEL, SIR GEORGE (1850–), English musician (*see* 13.302), from 1905–8 taught at the Institute of Musical Art, N.Y. He was knighted in 1914. A Mass in eight parts *a cappella* was first sung in 1916. In 1907 he published *Personal Recollections of Brahms* and 12 years later *Musings and Memories of a Musician.* Henschel's very highly developed sense of interpretation and style made him an ideal concert singer, while he was no less distinguished as accompanist.

HENSON, HERBERT HENSLEY (1863–), English divine, was born in London Nov. 8 1863. As an unattached student at Oxford he graduated with a first class in modern history in 1884, and was elected a fellow of All Souls College. He was ordained in 1887, and after being head of Oxford House at Bethnal Green for a year he was given the living of Barking, Essex. He was incumbent of St. Mary's hospital, Ilford, 1895–1900, canon of Westminster and rector of St. Margaret's 1900–12, and dean of Durham 1912–8, when he was promoted to the bishopric of Hereford in succession to Dr. Percival. He had become B.D. in 1898 and successively hon. D.D. of Glasgow, Durham and Oxford, and was for some time hon. professor of modern history at Durham University. Owing to his pronounced liberal opinions in theology, notably as to the Virgin birth, and to his insistence on the validity of Nonconformist orders, highly objectionable to the Anglo-Catholic school in the Church, his elevation to the bench of bishops aroused much controversy, and a number of the clergy of the diocese united in a public protest. The election, however, went forward in face of opposition, which soon subsided. In 1920, he was translated to the bishopric of Durham.

Amongst his published works may be mentioned *Light and Leaven* (1897); *Cui bono, an open letter to Lord Halifax* (1899); *War-time Sermons* (1915) and *Christian Liberty* (1918).

HERBERTSON, ANDREW JOHN (1865–1915), British geographer, was born at Galashiels Oct. 11 1865, and educated at Galashiels Academy and Edinburgh Institution. He served for some time with a firm of surveyors in Edinburgh, but later entered Edinburgh University, where he was engaged in research work under Prof. Tait. He subsequently carried out investigations on hygrometry at the Ben Nevis observatory. In 1894 he was appointed lecturer in Geography at Owens College, Manchester; in 1896 lecturer at the Heriot-Watt College, Edinburgh, and in 1899 assistant to the reader in geography at Oxford. He became reader in geography in 1905 and in 1910 received the title of professor. The same year he was president of the geographical section of the British Association. He edited, with Dr. Buchan, the volume on meteorology for *Bartholomew's Physical Atlas* (1899) and, with O. J. R. Howarth, a *Survey of the British Empire* (1914). His paper on *Climatic Regions of the Globe* attracted much attention, and his numerous text-books on geographical subjects and the leading part he took in the foundation and development of the Geographical Association enabled him to exert a powerful influence on the improvement of the teaching of geography. He died at Chinnor, near Oxford, July 31 1915.

HERKOMER, SIR HUBERT VON (1849–1914), British painter (*see* 13.364), died at Budleigh Salterton, Devon, March 31 1914.

HERMANT, ABEL (1862–), French author and dramatist, was born in Paris, Feb. 3 1862. He was educated in Paris, and afterwards entered the literary profession, being in 1902 made president of the Société des Gens de Lettres.

His works include *Monsieur Rabosson* (1884); *Amour de Tête* (1890) and *Le Frisson de Paris* (1895), besides various amusing dialogues, such as *Scènes de la Vie des Cours et des Ambassades, comprenant La Carrière, Le Sceptre et Le Char de l'Etat* (1900). His plays include *La Meute* (1896); *Sylvie, ou la Curieuse d'Amour* (1900); *La Belle Madame Héber* (1905); *Les Jacobines* (1907) and *La Semaine Folle* (1913). He produced a series of novels, *Mémoires pour servir à l'histoire de la Société*, including *Coeurs privilégés* (1903); *La Confession d'un homme d'aujourd'hui* (1904); *Les Affranchis* (1908); *Histoire d'un Fils de Roi* (1911) and *L'Aube ardente* (1919). He also published various books on the war, including *Heures de guerre de la famille Valadier* (1915) and *Histoires de mon ami Jean* (1917).

HERRICK, ROBERT (1868–), American author, was born in Cambridge, Mass., April 26 1868. He was educated at the Cambridge Latin school and at Harvard University (A.B. 1890). He was appointed instructor in rhetoric at the Massachusetts Institute of Technology in 1890 and three years later accepted a similar position at the university of Chicago. At the latter place, passing through the various stages of promotion, he became professor of English in 1905. His novels and short stories deal with the complicated problems of modern life in realistic fashion. They include *The Man Who Wins* (1895); *Literary Love Letters and Other Stories* (1897); *Love's Dilemmas* (1898); *The Gospel of Freedom* (1898); *The Web of Life* (1900); *The Real World* (1901); *Their Child* (1903); *The Common Lot* (1904); *The Memoirs of an American Citizen* (1905); *The Master of the Inn* (1908); *Together* (1908); *A Life for a Life* (1910); *The Healer* (1911); *One Woman's Life* (1913); *His Great Adventure* (1913); *Clark's Field* (1914); *The World Decision* (1916) and *The Conscript Mother* (1916). He was also the author of *Composition and Rhetoric* (1899, with L. T. Damon). He was made a member of the National Institute of Arts and Letters.

HERTLING, GEORG, Count von (1843–1919), German statesman, was born Aug. 31 1843 at Darmstadt. In 1882 he became professor of philosophy in the university of Munich, and during his tenure of this chair he published books on Aristotle (1871) and on Albertus Magnus (1880). From 1875 to 1890, and again from 1893 to 1912, he was a member of the Reichstag, and after 1909 led for a time the Centre (Catholic) party in that Assembly. The Regent of Bavaria made him in 1891 a life member of the Upper House of the Bavarian Diet. In 1912 he was appointed Bavarian Minister-President and Minister for Foreign Affairs. King Ludwig III. elevated him to the rank of Count. He had been urged by the Emperor to accept the Chancellorship when Bethmann Hollweg resigned in July 1917, but declined on the ground that he saw no prospect of being able to work in harmony with the higher military command. When Michaelis was got rid of in Oct. 1917 he yielded to pressure which was put upon him, and, although 74 years of age and in a precarious state of health, assumed the burden of the Chancellorship, which he sustained for the ensuing 12 months. The encroachments of the military authorities, particularly Ludendorff, upon the political conduct of the empire became even more serious during Hertling's Chancellorship than they had been during that of Bethmann Hollweg. Hertling's son, an officer who was attached to him as aide-de-camp, has, in a book possessing both political interest and real literary merit, *Ein Jahr in der Reichskanzlei* (1919), given an account of the difficulties which the Chancellor experienced in his dealings with the Emperor and with Ludendorff. It fell to Hertling's lot, moreover, to endeavour to persuade the reactionary Prussian Chamber and the Prussian Herrenhaus to pass the bill which, in fulfilment of the Emperor's belated proclamations, had been introduced for the equalization of the Prussian franchise. In this he failed, although upon one occasion he had gone so far as to warn the Upper House that the question was one which concerned "the existence of the dynasty."

Indeed, two "Chancellor" crises within four months had done much to undermine the whole system of Imperial and Prussian semi-absolutism, and to shake the confidence of the masses in the possibility of a successful issue of the war. The failure of the spring and summer offensives of 1918 destroyed Hertling's hope that he might eventually be able to negotiate with the Allied and Associated Powers on anything like equal terms. Feeling among the masses and also in large sections of the army was giving cause for great anxiety. The necessity for the introduction of real parliamentary government, against which, in accordance with the conservative principles of a lifetime, he struggled, became paramount. His health too was broken. His resignation was accepted on Sept. 30 1918. He died on Jan. 4 1919 at his country home at Ruhpolding in Upper Bavaria. He left reminiscences which were published in 1919 under the title of *Erinnerungen aus meinem Leben*.

HERTZOG, JAMES BARRY MUNNIK (1866–), Dutch South African politician, was born at Wellington, Cape Colony, in 1866, and was educated at the Victoria College, Stellenbosch, going afterwards to Amsterdam University. Returning to South Africa he settled in the Orange Free State, where he was called to the bar and was appointed a judge in 1895. During the South African War of 1899–1902 Hertzog served as a Boer general, though without conspicuous personal distinction in the field. Nevertheless he emerged from the war as one of the recognized leaders of the Free State Dutch, and took a leading part in the consultations of the Dutch leaders which preceded the Peace of Vereeniging. He resisted the policy of making an end of the war, and held out to the end against the moderate counsels of Transvaal leaders such as Gen. Botha and Gen. Smuts. This difference was smoothed over later, but the memory of it persisted and had a potent influence on the course of South African history. When responsible government was granted to the Orange River Colony in 1907 Hertzog became Attorney-General and Minister for Education with Abraham Fischer as Prime Minister. As Minister of Education he pursued with determination a policy of placing Dutch side by side with English as the medium of education, a policy sound enough in view of the racial circumstances of the country, but demanding the utmost skill and tact in its administration. Hertzog showed none of the gifts of the skilled administrator, and as his methods revealed themselves resentment and suspicion grew among the English-speaking people of the colony and from them spread throughout South Africa. The circumstances of the time were difficult enough in themselves, but the contrast between the methods of the Botha Government in the Transvaal as to education and those of the Fischer Government in the Orange River Colony was for all to see. The complications of Hertzog's administration of the Education Department culminated in the summary dismissal by him of Mr. Fraser, an English-speaking inspector in the service of the Department. Hertzog justified this summary action in Parliament and before his constituents by making public accusations against the *bona fides* of Mr. Fraser, who brought a libel action against him, in which the verdict went heavily against Hertzog. Meanwhile the Union movement grew throughout South Africa. Hertzog was one of the representatives of the Orange River Colony on the National Convention which drafted the Union Act, and took office under Gen. Botha as the first Minister of Justice of the Union of South Africa in 1910. During the meetings of the Convention it had seemed that he was ready to obliterate the racial hatreds of the war, but his conduct as Minister of Justice soon showed that the old spirit of bitterness was still strong in him. He was a thorn in the side of the Botha Ministry, and at the end of 1912 the differences between him and his more moderate colleagues in the Cabinet became so plain that the patience of the Prime Minister could ignore them no longer. In Dec. 1912 Gen. Botha resigned, and taking office again, reconstructed his Ministry, leaving Hertzog out. This was the critical point in a long feud between Hertzog on one side and Botha and Smuts on the other. When the World War broke out, Hertzog, who by then had formed the Nationalist party in the South African Parliament and was in steady opposition to the Botha Ministry, resisted the coöperation of the Prime Minister and Smuts with Great Britain in the war. When, at the end of 1914, some of the Dutch-speaking people went into open rebellion, Hertzog hesitated and attempted to compromise, never bringing himself to utter any straight condemnation of rebellion. This course he and the Nationalists maintained throughout the war, drifting ultimately into a formal claim for a republic in South Africa. In two general elections during 1920, when Gen. Smuts had become Prime Minister after the death of Gen. Botha, Hertzog maintained the Parliamentary strength of the Nationalist party, having refused reunion with the party led by Gen. Smuts on the ground that the claim could not be abandoned.

HERVIEU, PAUL (1857–1915), French dramatist and novelist (*see* 13.405), produced his last play, *Le Destin est Maître*, in 1914. He died suddenly in Paris Oct. 25 1915.

See A. Binet, *Portrait psychologique de Paul Hervieu* (1914); H. Burckhardt, *Studien zu Paul Hervieu* (1917).

HEWLETT, MAURICE HENRY (1861–), British man of letters (*see* 13.417). Later novels include *Brazenhead the Great* (1911); *Mrs. Lancelot* (1912); *Bendish* (1913); *A Lover's Tale* (1915); *Love and Lucy* (1916) and *Mainwaring* (1921). In verse he also published *Helen Redeemed and Other Poems* (1913); *The Village Wife's Lament* (1918); *Flowers in the Grass* (1920), as well as various translations and imitations of the Norwegian sagas, notably *Thorgils of Treadholt* (1917). His son, Flight-Comm. FRANCIS ESMÉ THEODORE HEWLETT (b. 1891), gained distinction in the R.N.A.S. during the World War, being one of the small force which set out to reconnoitre and photograph Cuxhaven on Christmas Day 1914. His seaplane was forced to descend, and he was picked up only after a week of buffeting with the sea. Throughout 1917 he was with the flying squadrons at Dunkirk, taking daily flights in all weathers to and from Dover. During 1918 he was at Mudros and thence made a flight to bomb Constantinople.

HEYSE, PAUL JOHANN LUDWIG (1830–1914), German novelist, dramatist and poet (*see* 13.438), received the Nobel prize for literature in 1910. His later works include *Novellen vom Garda See* (1902); *Gegen den Strom* (1907); *Helldunkles Leben* (1909); *Italienische Volksmärchen* (1914) and *Letzte Novellen* (1914). He died at Munich April 2 1914.

Several volumes of his letters have appeared (1916, 1917, 1919); see also H. Raff, *Paul Heyse* (1910).

HIBBEN, JOHN GRIER (1861–), American educator, was born at Peoria, Ill., April 19 1861. He graduated from Princeton University in 1882; was a student at Princeton Theological Seminary from 1883 to 1886; and later studied at Berlin. In 1887 he was ordained a minister in the Presbyterian Church and was a pastor for four years at Chambersburg, Pa. In 1891 he returned to Princeton where he taught logic as an instructor (receiving the degree of Ph.D. in 1893), assistant professor, and from 1907 professor. In 1912 he succeeded Woodrow Wilson as president.

His works include *Inductive Logic* (1896); *The Problems of Philosophy* (1898); *Hegel's Logic* (1902); *Deductive Logic* (1905); *The Philosophy of the Enlightenment* (1910, contributed to the *Epochs* mentioned below); *A Defence of Prejudice and Other Essays* (1911) and *The Higher Patriotism* (1915). He edited *Epochs of Philosophy*, a series of twelve volumes written by distinguished scholars of America, Canada and Great Britain.

HICHENS, ROBERT SMYTHE (1864–), English novelist, was born at Speldhurst, Kent, Nov. 14 1864. He was educated at Tunbridge Wells and Clifton College, and then became a student at the Royal College of Music, London, with a view to adopting music as a profession. He was, however, diverted to journalism and later to fiction. During his musical period he published some lyrics and short stories, besides a novel, *The Coastguard's Secret*, at the age of seventeen. But he first attracted serious attention with *The Green Carnation* (1894) and *An Imaginative Man* (1895). He followed these by some novels of London society such as *The Londoners* (1897) and *The Woman with the Fan* (1904); but his principal work in fiction was a series of novels with an Eastern setting, beginning with *The Garden of Allah* (1905) and including *The Call of the Blood* (1906) and *Bella Donna* (1909). He also published certain travel sketches in

The Holy Land (1910) and *The Near East* (1913), as well as tales of the supernatural, of which *The Dweller on the Threshold* (1911) is the best example. Of his dramatized novels *Bella Donna*, produced at the St. James's theatre, London, in 1911–2, and *The Garden of Allah*, produced first in New York and (1920) at Drury Lane theatre, London, were the most successful.

HIGGINSON, HENRY LEE (1834–1919), American banker, was born in New York City Nov. 18 1834. At the age of 17 he entered Harvard College but before finishing his course entered the banking house of S. & E. Austin, of Boston. He later went to Vienna for a year, where he studied music. On the outbreak of the Civil War he was commissioned second lieutenant of volunteers and was soon promoted to first lieutenant. Later he was made captain and transferred to the volunteer cavalry, being promoted major in 1862 and two years later brevetted lieutenant-colonel. In 1863 he was severely wounded at Aldie, Va., and in the following year was honourably discharged, after serving for a time on the staff of Maj.-Gen. Barlow. In 1868 he joined the banking firm of Lee, Higginson & Co., of Boston, with whom he remained until his death. His interest in music led to his founding the Boston Symphony Orchestra in 1881. A long line of distinguished directors placed this organization in the first rank. It was a stimulating source of musical education in America and won full recognition abroad. In 1891 as a memorial to certain friends who died in the Civil War, he presented Soldiers' Field to Harvard University. In these extensive athletic grounds the Stadium was built. In 1899 he erected the Harvard Union as a general meeting-place for all undergraduates. He was a trustee of numerous institutions, including the New England Conservatory of Music, and was for many years a fellow of Harvard University. He died in Boston, Mass., Nov. 14 1919.

See Bliss Perry, *The Life and Letters of Henry Lee Higginson* (1921).

HIGGINSON, THOMAS WENTWORTH (1823–1911), American author (*see* 13.455), died in Cambridge, Mass., May 9 1911.

See *T. W. Higginson: The Story of His Life* (1914), by M. T. Higginson (his wife).

HILDEBRANDSSON, HUGO HILDEBRAND (1838–), Swedish meteorologist, was born at Stockholm Aug. 19 1838, and was educated at the Stockholm gymnasium and the university of Upsala, where he took his doctor's degree in 1858, becoming doctor of physics in 1866. In 1878 he was appointed first professor of meteorology at Upsala and director of the meteorological observatory there, retaining these posts until 1906. He was a prominent member of the International Meteorological Committee, and for some years served as its secretary, while he also sat on the Nobel Committee for Physics, in 1900 obtaining the Nobel prize. In 1880 he was elected an hon. fellow of the Royal Meteorological Society of London, which in 1920 awarded him the Symons gold medal, being also a member of many foreign scientific societies.

As a meteorologist Hildebrandsson is remarkable for his researches into the subject of cloud, and in 1880 was requested by the International Meteorological Committee to prepare the *International Cloud Atlas*, a work carried out in conjunction with Léon Teisserenc de Bort. Many further observations were subsequently incorporated in *Les bases de la météorologie dynamique* (1907), in which Teisserenc de Bort again collaborated. His papers on centres of action of the atmosphere mark a great advance in seasonal forecasts.

HILL, DAVID JAYNE (1850–), American diplomat and publicist, was born at Plainfield, N.J., June 19 1850. After graduating in 1874 from the university of Lewisburg, Pa. (later known as Bucknell University), he taught there first as instructor in Greek and Latin and from 1877 as professor of rhetoric. In 1879 he was elected president of Bucknell and in 1888 of the university of Rochester. In 1896 he resigned and went abroad to study public law. He returned in 1898 on being appointed Assistant Secretary of State by President McKinley. While in Washington he was also professor of European diplomacy in the School of Comparative Jurisprudence and Diplomacy. In 1903 he was appointed ambassador to Switzerland and in 1905 was transferred to Holland, where he remained two years. He was a delegate to the Second Peace Conference at The Hague in 1907. From 1908 to 1911 he was ambassador to Germany, resigning in the latter year. In 1914 he was an unsuccessful candidate for the Republican nomination for the U.S. Senate to succeed Elihu Root. In 1920 he was made a member of the American Academy of Arts and Letters.

His best known work is his *History of Diplomacy in the International Development of Europe*, embracing *A Struggle for Universal Empire* (1905); *The Establishment of Territorial Sovereignty* (1906) and *The Diplomacy of the Age of Absolutism* (1914). His other numerous writings include a *Life of Washington Irving* (1877); a *Life of William Cullen Bryant* (1878); *The Science of Rhetoric* (1878); *The Elements of Psychology* (1886); *The Social Influence of Christianity* (1888); *Principles and Fallacies of Socialism* (1888); *Genetic Philosophy* (1893); *The Conception and Realization of Neutrality* (1902); *World Organization as Affected by the Nature of the Modern State* (1911, being lectures delivered at Columbia University); *The People's Government* (1915); *Americanism—What It Is* (1916); *The Rebuilding of Europe* (1917); *Impressions of the Kaiser* (1918); *Present Problems in Foreign Policy* (1919) and *American World Policies* (1920).

HILL, JAMES J(EROME) (1838–1916), American railway capitalist (*see* 13.464), died at St. Paul, Minn., May 29 1916. He resigned the chairmanship of the board of directors of the Great Northern railway in 1912. He had long thought that the farmers and millers of the north-west needed a large financial institution near at hand to which they could easily turn for aid. Accordingly in 1913 he secured control of the First and the Second National Banks of St. Paul and merged them, thereby increasing local facilities for loans. On the outbreak of the World War he was deeply interested in the cause of the Allies, and exerted all his influence in behalf of the Anglo-French loan of 1915. On learning in the same year that friends had raised $125,000 for establishing as a tribute to him a chair of transportation at Harvard he added a like amount. During his latter years he gave much attention to developing the Hill Reference library, in St. Paul, to which he contributed liberally. He was the owner of a remarkable collection of modern French paintings, including fine examples of Puvis de Chavannes, Corot, Delacroix, Millet and others. He was the author of *Highways of Progress* (1910). He left no will, and his estate, when appraised, amounted to less than $60,000,000, only about one-fourth in railroad securities.

HILL, OCTAVIA (1838–1912), English philanthropic worker (*see* 13.465), died in London Aug. 13 1912.

HINDENBURG, PAUL VON (1847–), German soldier, chief of the great general staff during the World War, was born on Oct. 2 1847 at Posen. His full family name was von Beneckendorf und Hindenburg. His promotion was slow; from 1877 to 1884 he served on the general staff, but he was 47 years of age when he became colonel, and 49 when he attained a military position of higher importance as chief of the general staff of the VIII. Army Corps. In 1904, when he was 57, he was appointed to the command of the IV. Army Corps, and in 1911 was placed on the retired list, at the instance, it is said, of the Emperor William II. (who had criticized manœuvres of his corps). While in command of this Eastern Corps he had thoroughly studied the strategy, and above all the geography, of a possible war with Russia, a fact which was widely known in the German army, but to which the German Emperor does not appear, at the time, to have attached importance. When, at the outbreak of the World War, East Prussia was overrun by the armies of Rennenkampf, military opinion turned to Hindenburg, and he was recalled from his retirement at Hanover, and appointed to the command of the VIII. Army with Ludendorff as his chief of staff. In Aug. and Sept. he won the victories of Tannenberg and the Masurian Lakes, which were decisive for the deliverance of East Prussia and for the prospects of any Russian advance into Germany, upon which sections of opinion in the Entente countries were reckoning. In the summer of 1915 he planned and executed a German advance against Riga, Dünaburg and Molodetschno. In acknowledgment of his victories he had meanwhile been advanced, on Aug. 27 1914, to the rank of colonel-general (*Generaloberst*), and, on Nov. 27 of the same year, to that of field-marshal. He had further been appointed, in Nov. 1914, chief in command over the armies of the East, a command which was extended at the beginning of Aug. 1916 so as to embrace sections of the Austrian front. Finally, on Aug. 29 1916, he was made chief of the general staff of the army in succession to Falkenhayn. In this capacity he controlled the whole conduct of the operations in the East and West, with Ludendorff in the position of quartermaster-general as his adviser and executive officer. His achievements and failures during this period belong to the military history of the war, but it may be mentioned here that his identification with Ludendorff was so close in everything he did that the credit or discredit is rightly attached to the younger soldier, who was in the full vigour of his faculties and powers of initiative. The German people, which was unable to personify, as in 1870–71, the spirit of the war and of its patriotic aspirations in an emperor, a crown prince or a chancellor, centred its hopes and its enthusiasms upon Hindenburg, its deliverer from the tremendous Russian menace. Justice and the facts of the case soon compelled it to associate Ludendorff inseparably with the fame of its hero, but Hindenburg remained during the war the national figure-head. A wooden statue of him was erected in the Königsplatz in Berlin, and patriotic persons of all classes paid sums of money towards war charities for the privilege of driving a nail into this effigy.

Hindenburg entirely associated himself with Ludendorff in urging upon the German Government, in Sept. and Oct. 1918, the necessity of seeking an armistice. When the Armistice had been arranged the urgent question arose of leading the partially disorganized German armies of the West home and disbanding them. It was to the unequalled prestige and authority of Hindenburg that the provisional Republican Government, the Commission of the six Delegates of the People, looked to cope with this gigantic task. And it must be acknowledged that the magnanimity and the patriotic devotion of the man were even more strikingly displayed in this emergency than in his greatest military achievements. He addressed to the army an appeal in which he announced that an Armistice on very hard terms had been signed. He paid a tribute to the services of the army which had kept the enemy far from Germany's frontiers and thus saved the country from the horrors and devastation of war. He maintained that they "issued from the struggle proud and with heads erect." And he concluded:—

"The terms of the Armistice oblige us to execute a rapid march home—in present circumstances a difficult task which demands self-control and the most faithful fulfilment of duty by every single one of you, a hard test for the spirit and the internal cohesion of the Army. In battle your Field-Marshal-General never left you in the lurch. And I rely upon you now as before."

In other aspects these post-war services of Hindenburg had certain grave and prejudicial effects. The rôle which was assigned to him and to other soldiers (Ludendorff being carefully excluded as too dangerous a political schemer) demonstrated that the German Republic was at first unable to dispense with the services of royalist officers, just as it was unable for a long time to replace royalist officials by republicans. The Kapp *coup d'état* of March 1920 was facilitated by the fact that many of these officers and officials were in a position to make their influence felt against the republic. There was at one time, in 1920, some talk of putting up Hindenburg as a candidate for the presidency of the Reich, if it had then become vacant. During the first half of 1919 Hindenburg held the chief command of the forces for defending the Eastern frontier (*Grenzschutz Ost*), which had headquarters at Kolberg on the Baltic. He retired from active service on July 3 1919, and subsequently lived at Hanover as a private citizen. Unlike Ludendorff, he kept himself clear of the political conflicts of the day. A chivalrous, almost a quixotic action, was his offer, on the morrow of his retirement, to place himself at the disposal of the Allied and Associated Powers as a substitute for the ex-Emperor, if it had been decided by the Allies that William II. should actually be prosecuted. In 1920 he published his recollections under the title of *Aus meinem Leben.*

HINES, WALKER DOWNER (1870–), American railway official, was born at Russelville, Ky., Feb. 2 1870. He was educated at Ogden College (B.S. 1888) and the university of Virginia (B.L. 1893). From 1893 to 1904 he was with the Louisville & Nashville railway as assistant attorney, assistant chief attorney and, after 1901, as first vice-president. He practised law in Louisville, Ky., 1904–6 and in New York City 1906–16. In 1906 he became general counsel for the Atchison, Topeka & Santa Fé railway, serving in this capacity for 12 years. He was also chairman of the executive committee after 1908 and chairman of the board of directors from 1916. In Feb. 1918, when the U.S. Government assumed control of the railways as a war measure, he was appointed assistant director-general, and in Jan. of the following year succeeded William G. McAdoo as director-general. He resigned the directorship in May 1920, intending to resume the practice of law in New York City, but was appointed by President Wilson to act as arbitrator in the distribution of German inland shipping under the Peace Treaty. He was specially versed in questions of interstate commerce and wrote many articles on federal regulation of railways.

HINTZE, PAUL VON (1864–), German admiral and diplomatist, was born at Schwedt-on-the-Oder Feb. 13 1864. He entered the navy and was from 1903–6 naval attaché for the Scandinavian states with his headquarters in St. Petersburg. He was supposed to have won the confidence of the Tsar Nicholas II. and was appointed in 1908 military plenipotentiary at the Russian Court. There is evidence, however, that the Tsar had become suspicious of his activities, and that he had, perhaps through his agents, been somewhat too observant in the interests of Germany. His adventures as a diplomatist during the World War awakened popular interest. He was recalled from his post in Mexico at the end of 1914 in order to be sent to Pekin, a journey which he managed to effect in spite of the vigilance of the naval forces of the Allied Powers. Transferred to Christiania in 1915 he again succeeded in eluding the vigilance of the Allies and in reaching his new post. From July 9 to Oct. 3 1918 he was Secretary of State for Foreign Affairs in succession to Kühlmann and was privy to the exchange of views between the Higher Command and the Chancellor in Aug. and again at the end of Sept. which led to the German demand for an armistice. Tirpitz, who entertained a high opinion of him, expressed in his book *Erinnerungen* (1919) the opinion that war with Russia might have been averted in 1914 if the Emperor had sent Hintze on a special mission to the Tsar.

HITCHCOCK, GEORGE (1850–1913), American painter (*see* 13.533), died on the Island of Marken, Holland, Aug. 2 1913.

HITCHCOCK, GILBERT MONELL (1859–), American politician, was born at Omaha, Neb., Sept. 18 1859. His father, Phineas W. Hitchcock, was U.S. senator from Nebraska 1871–77. He was educated at Omaha, Baden-Baden (Germany), and the law school of the university of Michigan (LL.B. 1881). He was admitted to the bar in 1881 and practised law in Omaha for four years. In 1885 he founded the Omaha *Evening World* and four years later bought the Omaha *Morning Herald*, combining the two papers into the *World-Herald*. He was representative in Congress 1903–5 and 1907–11. He was elected U.S. senator for the term 1911–7 and reëlected to serve through 1923. Soon after the outbreak of the World War in 1914 he introduced an unsuccessful bill to prevent war loans to the warring countries as well as the buying and selling of their securities. The same year he introduced another unsuccessful bill to embargo the shipment of ammunition and arms for use against countries with which America was at peace. After the sinking of the "Lusitania" in 1915 he believed that action on the part of America should be limited to a demand for reparation. In 1917, however, he urged support of the resolution for a declaration of war against Germany and in 1918 became chairman of the Senate Committee on Foreign Relations. When the President submitted to the Senate the Treaty of Versailles, Senator Hitchcock not only led the administration forces by virtue of his office, but also gave strong support to the League of Nations, arguing that it threatened neither the Monroe Doctrine nor U.S. sovereignty.

HOCKING, SILAS KITTO (1850–), English novelist, was born at St. Stephen's, Corn., March 24 1850 and educated at the local grammar school. He was ordained as a Free Church minister in 1870 but resigned his pastorate in 1896. Both he and his younger brother, Joseph Hocking (b. Nov. 7 1860), who had a similar upbringing for the Nonconformist ministry, became prolific writers of widely read novels with a distinct religious note. Among those of Silas Hocking were *Alec Green* (1878); *Who Shall Judge?* (1910); *His Own Accuser* (1917) and *Watchers in the Dawn* (1920). Among those of Joseph Hocking were *Jabez Easterbrook* (1891); *Zillah* (1892); *The Scarlet Woman* (1899); *Tommy and the Maid of Athens* (1917) and *The Pomp of Yesterday* (1918).

HODGE, JOHN (1855–   ), British Labour politician, was born at Muirkirk, Ayrshire, Oct. 29 1855. He was educated at the Motherwell Ironworks school, and also at the Hutchesontown grammar school, Glasgow, afterwards becoming a metal worker. He was for many years active in the local politics of Glasgow and western Scotland, and formed the British Steel Smelters' Mill, Iron, Tinplate and Kindred Trades Association for the betterment of the workers' conditions, becoming its secretary. He unsuccessfully contested Gower (1900) and Preston (1903) but in 1906 was returned as Labour member for the Gorton division of Lancashire. In the House he spoke frequently on industrial questions, and was an earnest advocate of the establishment of conciliation boards for the prevention of trade disputes. When Mr. Arthur Henderson entered the Coalition Government in 1915, Mr. Hodge became acting chairman of the Labour party, and in 1916 himself entered the Government as Minister for Labour. In 1917 he became Minister of Pensions, but resigned this office in 1919.

HODGKIN, THOMAS (1831–1913), British historian (*see* 13.557), died at Falmouth March 2 1913.

HODGSON, SHADWORTH HOLLOWAY (1832–1912), English philosopher, was born at Boston, Lincs., Dec. 25 1832. Educated at Rugby and Corpus Christi College, Oxford, he devoted himself from 1858 onwards entirely to the study of philosophy. He helped to found the Aristotelian Society of London in 1880, and was its first president. His published works include *Time and Space* (1870); *The Philosophy of Reflection* (1878) and a complete exposition of his philosophy in *The Metaphysic of Experience* (1898). For an account of his views, *see* 18.251. He died in London June 13 1912.

HOGARTH, DAVID GEORGE (1862–   ), British classical archaeologist, was born at Barton-on-Humber May 23 1862. Educated at Winchester and Magdalen College, Oxford, he became first Craven travelling fellow in 1886. Together with Sir William Ramsay he made journeys of exploration in Asia Minor between 1887 and 1894. He has conducted numerous excavations, notably Paphos (1888), Dêr-el-Bahari (1894), Naukratis (1899 and 1903), Knossos (1900), Ephesus (1904–5), Assiut (1906–7) and Carchemish (1911). He was director of the British School at Athens from 1897 to 1900, and was appointed keeper of the Ashmolean museum at Oxford in 1909. He is a fellow of the British Academy and a Founder's gold medallist of the Royal Geographical Society (1917). During the World War (as Commander R.N.V.R.) he directed the Arab intelligence bureau at Cairo under the British Admiralty (1915–9), went to Arabia on a special mission in 1916, accompanied the British army to Palestine in 1918, and was British commissioner (Middle East Commission) at the Paris Peace Conference in 1919.

Amongst his publications are *Devia Cypria* (1890); *A Wandering Scholar in the Levant* (1896); *Philip and Alexander of Macedon* (1897); *The Nearer East* (1902); *The Penetration of Arabia* (1904); *Accidents of an Antiquary's Life* (1910); *The Balkans* (1915); *Hittite Seals* (1920) and many archaeological reports.

HOLBROOKE, JOSEF CHARLES (1878–   ), English musical composer, was born at Croydon July 5 1878, his father being an able pianist, his Scottish mother a professional singer. He spent his early years in travelling around the country with his father and various entertainers. But on his father obtaining an engagement as pianist at Collins's music-hall in Islington, and a little later at the Bedford music-hall, the family settled in London, where Josef became a chorister at St. Ann's, Soho; he also attended the church school. During this period he was taught both the violin and the piano, so that when, in 1893, he entered the Royal Academy of Music he was already well trained as pianist and musician with a good knowledge of the classics. Holbrooke's somewhat fitful career at the R.A.M. was ended in 1896, he having accumulated many medals and prizes and one or two scholarships. On leaving the R.A.M. he became conductor and pianist to a touring company, which was unsuccessful, and he then returned to London and took pupils. A turning point in his career came through the characteristic generosity of Sir (then Mr.) August Manns, who played Holbrooke's symphonic poem, *The Raven*, at a Saturday concert at the Crystal Palace on March 3 1900. From about that time compositions flowed unceasingly from his prolific pen. *Queen Mab* and a Byronic poem appeared in 1904 and 1906; *The Bells* in 1907; *Homage to Poe* in 1908; *Apollo and the Seaman* (symphonic music to Herbert Trench's poem) 1908. The opera of *Children of Don* was given at the London Opera House in 1911; *Dylan* at Drury Lane two years later; *Bronwen* completed, and *The Wizard* produced, during Holbrooke's visit to the United States at Chicago, in 1915. The opera-ballet, *The Enchanted Garden*, dates from 1915. Besides a great mass of music for orchestra Holbrooke wrote concertos for pianoforte ("The Song of Gwyn ap Nudd") and violin, some five quartets, a horn trio, three quintets, four sextets, and dramatic scenes for voice with orchestra.

See George Lowe, *Josef Holbrooke and his Work* (1920).

HOLDEN, SIR EDWARD HOPKINSON, 1st Bart. (1848–1919), English banker, was born May 11 1848 at Tottington, Lancs., and spent his early years at the neighbouring village of Summerseat, where he was educated. He entered a business establishment at an early age, but later obtained a junior clerkship in the Manchester and County Bank at a salary of £30 a year. Here he remained for 14 years, and at the end of that time became a bank accountant as a result of answering an advertisement in the *Economist*. During this period he also studied law and political economy at Owens College in company with his wife. In 1881 he went to Birmingham as accountant of the Birmingham and Midland Bank, and here his rise was extraordinarily rapid. In a comparatively short space of time he rose to be general manager, and this led later to his occupying the double position of managing director (1898) and eventually chairman (1908). He devoted himself with great energy and much success to developing the amalgamating policy of his bank, which ultimately developed into the London Joint City and Midland Bank. For the history of the amalgamations leading to that result, *see* Banks and Banking. From about 1898 he interested himself largely in international banking, with the result that he became as great an expert on foreign exchange questions as on home finance. He was the first of the larger London joint-stock bankers to open a foreign exchange department. In 1906 he was elected Liberal member for the Heywood division of Lancs., and in 1909 a baronetcy was conferred upon him. In 1915 he went with Lord Reading to the United States on behalf of the Government and arranged there the Anglo-French loan. He died July 23 1919.

Holden was in many ways a typical "Lancashire lad"; he was always a shrewd business man, with a pugnacious disposition, a firm friend to his friends, a hot fighter against opponents, but with unusual vision and with a remarkable *flair* for banking operations. As chairman of the London City and Midland Bank, which, under him and through his exertions, became the greatest of the English joint-stock institutions, he was for many years the most powerful figure among the clearing bankers, and his interests were bound up with the progressive success of the bank with which he was identified. He was a man of great activity of mind, keen to spot the opportunities and tendencies in contemporary finance, and assiduous in mastering its problems. During the World War he did valuable work in this respect, the extent of which cannot well be over emphasized. His annual addresses to the shareholders of his bank were a succession of educational manifestoes, packed with information and instruction. Before the war he had taken the lead in advocating a larger gold reserve, and himself started the accumulation of a larger independent gold-holding by his bank. In this and various other ways he was a pioneer in a number of improvements in British banking during his time, and his death deprived the City of London of one of its most vigorous characters. (H. Ch.)

HOLLAND, HENRY SCOTT (1847–1918), English divine, was born near Ledbury, Hereford, Jan. 27 1847. He was educated at Eton and Balliol College, Oxford, where he took a first class in *Literae Humaniores* (1870). In 1872 he was ordained, becoming the same year a tutor at Christ Church. He became well known not only as a tutor but also as an eloquent preacher. In 1882 he was senior proctor of the university, and the same year was made a canon of Truro and examining chaplain to its bishop. He was appointed a canon of St. Paul's in 1884, and in 1886 precentor. He refused the offer of the see of Norwich in 1893, but in 1910 was appointed regius professor of divinity at Oxford. He died at Oxford March 17 1918.

See *Life*, by Stephen Paget (1921).

HOLLAND (*see* 13.587).—According to the preliminary returns of the census of Dec. 31 1920, the pop. numbered 6,841,155, as compared with 2,613,487 in 1830 and 5,858,175 in 1909. The average rate of increase per year rose from 0·91% in 1830–40 to 1·42% in 1910–20. The proportion of females to males shows a diminution from 1,045 per 1,000 in 1830 to 1,014 in 1920. Four towns have each more than 100,000 inhabitants, viz.: Amsterdam 677,645 (566,131 in 1909); Rotterdam 510,538 (417,989 in 1909); The Hague 353,286 (271,280 in 1909); and Utrecht 140,189 (119,006 in 1909). Those with more than 50,000 but less than 100,000 in 1920 were Tilburg, Arnhem, Nymegen, Dordrecht, Leiden, Haarlem, Groningen and Maastricht. The number of towns with a pop. between 20,000 and 50,000 was rapidly increasing in 1920 and the birth-rate diminished from 31·6 per 1,000 in 1900 to 28·6 in 1910, and 24·2 in 1919, but the death-rate also receded from 17·9 per 1,000 in 1900 to 13·6 in 1910, and 13·2 in 1919; in 1918 the death-rate was abnormally high (17·1 per 1,000) as a result of shortage of food and the influenza epidemic. There was a slight increase in the number of illegitimate births during the war in consequence of the mobilization. The war also occasioned some reduction in the marriage-rate from 1914 to 1918, followed by a reaction in 1919 above the average. Divorce was on the increase (0·83 per 1,000 marriages in 1910; 1·35 in 1919).

Religion.—According to the latest reliable data, fully 56% of the pop. belonged to Protestant churches, fully 35% were Roman Catholic and nearly 2% Jewish. Religious conviction continued to exercise in the Netherlands an overwhelming influence, determining not only the formation of political parties (the Roman Catholic and the Protestant parties), but making itself felt in every sphere of social life—education, labour organization, the coöperative movement, care of the poor, etc. In every activity, Catholic and Protestant organizations are found side by side with others.

The number of persons declining to recognize any particular confession was continually increasing. In the various decade censuses from 1869 to 1909 the figures were:—6,461; 12,253; 66,085; 115,179; 290,960, this last (1909) representing 5% of the pop. Since then the number has indubitably increased very considerably.

Dikes.—The continually recurring difficulties in the maintenance of sea-dikes led to the adoption of barrages of ferro-concrete on a system invented by an engineer named De Muralt. The oldest of these constructions are the "spykerglooiing" (peg slopes) built with slabs of ferro-concrete fastened with pegs of the same material. These were followed by the "trapjesglooiingen," *i.e.* step slopes; as the name implies they are constructed in terraces of somewhat larger dimensions, the object being to break the waves impinging on the gradually sloping front of the dike; they are chiefly found in the islands of Zeeland where they have given great satisfaction.

Notwithstanding all efforts, the Netherlands have repeatedly suffered from floods caused, as a rule, by a combination of unfavourable circumstances such as exceptional pressure of water in the rivers coupled with adverse storms of wind. In the inundation of Jan. 13 and 14 1916 the Zuider Zee dikes gave way and a great part of the province of N. Holland (the Waterland) was flooded and a number of river polders submerged.

Drainage.—During the period 1910–20 electricity replaced steam at many of the pumping stations. The largest was the Electra "boezemgemaal" (main pumping station) constructed in the province of Groningen in the year 1920. This station, which drains an area of 232,274 ac., was equipped with three wood screw-pumps, each driven by a 550 H.P. motor and capable of raising 1,000 cub. metres of water per minute. The station had spare space for two further pumping installations if required. Nevertheless the steam pumps had not yielded altogether to the electric competitor. Indeed, for the draining of the province of Friesland, the year 1920 saw the erection of a steam installation which was the largest in Europe and surpassed in capacity even the Nile pumping station at Khatatba. It comprised eight centrifugal pumps each driven by four tandem compound engines and raising 500 cub. metres per minute.

Waterways.—It is well known that traffic in Holland largely takes place by water. The prosperity of her ports is intimately dependent upon good water communication with the European hinterland, which makes the Rhine of the greatest importance to Dutch trade.

In 1913 fully 97,000 ships passed Lobith. They represented a tonnage of 52,000,000 tons and carried cargoes totalling 37,000,000 tons. About 25% of the ships were trading with Belgium and 75% with Holland. 75% of the entire goods traffic between Germany and Holland went via Lobith.

The international status of the Rhine is of the greatest importance to Holland. Till the outbreak of the World War, Rhine navigation was determined by the Treaty of Mannheim of Oct. 17 1868: according to which a central Rhine navigation committee at Mannheim exercised control over the maintenance of the river's navigability. Thanks to this international coöperation, the Rhine was always kept navigable for ships of 2,000 tons (the type chiefly employed) and for barges up to even 3,600 tons, though the working of these did not prove practicable.

In the Rhine navigation commission, the riparian states (Baden, Bavaria, Hesse, Prussia, Alsace-Lorraine and Holland) were each represented and each had one vote. By the Treaty of Versailles, however, France, taking the place of Alsace-Lorraine, became once more a riparian state. Moreover, the Rhine was internationalized, and the United Kingdom, Belgium, Italy and Switzerland each received seats on the Rhine commission. The votes were distributed as follows:—France was given four votes and the permanent presidency, the German contiguous states four votes together, and the remaining states two votes each. Holland, which controls the mouths of the Rhine and possesses such preponderant interests in this river, was thus placed on the same footing as non-contiguous states. The Dutch Government protested against this arrangement, with the result that, in the beginning of 1921, a supplementary protocol was added, according Holland three votes.

Holland watches with great interest the further development of the Rhine navigation settlement as well as the French plans for the improvement of the water communication with the French hinterland and the Rhone, the regulation of the German Upper Rhine between Strassburg and Basle, and the Swiss idea of constructing a canal from the Rhine to the Lake of Geneva with a navigable branch to the Rhone.

Holland continued the improvement of the Rhine waterway within its own territory. New works were decided upon in 1909. The Waal about St. Andries was narrowed to 260 metres, increasing to 350 metres at Gorinchem; and the curved reaches were reduced. In eight years, nearly £2,000,000 were expended on the work. The Lower Rhine, the Lek and the Geldrian Yssel were improved; the Yssel was made navigable for ships of 1,500 tons and the Lower Rhine for ships of 2,000 tons. Between 1851 and 1918, about £3,300,000 were devoted to these rivers, being about one-quarter of the sum (£14,900,000) spent on all river works in Holland. About £7,600,000 were expended on the Rotterdam waterway and the diversion of the Maas estuary.

A second international water problem arose during the negotiations with Belgium over the abolition of the treaties of 1839. Holland could not admit that new waterways between Antwerp and the Rhine are necessary for the prosperity of that port, believing that the canal through S. Beveland (opened in 1866) which carried the traffic between Antwerp and the Rhine—sufficed for the highest demands. This canal is 6·50 metres deep and navigable for ships of 2,000 tons. On either side—at Hansweert and Wemeldinge—there were two locks, while a third lock was completed at Hansweert in 1915, giving passage to tugs of 2,000 tons, and a similar large third lock was being constructed at Wemeldinge in 1921. Nevertheless Holland was willing not to oppose the Belgian desires for other communication with the Rhine and declared itself prepared, in principle, to coöperate in the formation of a canal from Antwerp direct to the Hollandisch Diep and of another from Antwerp to the Rhine across the Meuse in Dutch Limburg. In her turn, Holland needs the help of Belgium in rendering navigable the Meuse below Liége.

The Meuse is the only international river which is not navigable in its lower reaches, this being due to the extensive tapping of the river for Belgium's water supply. Plans for the canalization of the Meuse in Holland have been ready for many years; but since it is a frontier river from Maastricht to Maasbracht, this great work cannot be undertaken without the collaboration of Belgium. Meanwhile, however, Holland has undertaken works to render the Meuse navigable between Maasbracht and Grave, and the construction of a canal from Mook to Nymegen (from Meuse to Rhine) to provide direct passage between Limburg and the N. of the country.

But the vigorous development of the coal-mines in S. Limburg made further provisions necessary. Maasbracht lies too far from the mines. In 1920, therefore, it was resolved to delay the canalization of the Meuse between the Belgian frontier and Maasbracht, and to dig a lateral canal, suitable for 2,000-ton ships, from Maasbracht to Borne, where a loading harbour was to be formed. It was also intended to construct a canal for 1,000-ton ships starting from Borne and connecting with the Liége-Maastricht canal by means of a lock just S. of Maastricht. When the canal being constructed in

1921 from Wessem to Nederweert (10·9 m.) is completed the coal district will obtain better communication via S. Willemsvaart with the N. Brabant industry; this canal will also provide better connexion with S. Holland and Zeeland. In Brabant, a canal for 500-ton ships was completed in 1915 connecting Tilburg, Dongen, Oosterhout and—by a branch—Breda with the Amer and hence with the Hollandsch Diep. The continuation of the canal to the E. of Tilburg towards the S. Willemsvaart was in course of execution in 1921: this Wilhelmina canal will have a length of 42·5 miles.

The waterways from the large ports of Rotterdam and Amsterdam are continually being improved. The New Waterway, which joins Rotterdam with the North Sea, was given a depth of 10·5 metres at ordinary high-water or 9 metres at low-water; and in 1921 it was being deepened to 11·5 metres and it was intended to increase the depth subsequently to 12·5 metres and widen the navigable channel and reduce the reaches. An improvement of the Noordgeul and the Oude Maas was also in progress whereby the current will be improved and the port of Dordrecht made accessible to ships with a draught of eight metres.

Amsterdam communicates with the sea via Ymuiden. At this port there are three locks for ships of 200 metres length, 24 metres width and 92 metres draught. A fourth, 400 metres long, 50 metres wide and 15 metres deep, was under construction in 1921. This width is one and a half times that of the locks of the Panama Canal, which are also 3·3 metres shallower. The outer harbour at Ymuiden was being enlarged and deepened. A scheme for the improvement of Amsterdam's communication with the Rhine was being prepared. In the E. of the country a canal system over 73 m. in length, decided upon in 1919, is to run from Almelo via Hengelo and Enschede to the Upper Rhine. In this way good water communication will be obtained from these important industrial districts to the great rivers and thus also to Rotterdam.

Railways and Tramways.—In railway affairs in the Netherlands there is an increasing tendency towards concentration.

In 1917, after a period of sharp competition, the "Hollandsche Spoorweg Maatschappij" (Holland Railway Co.) and the "Maatschappij tot Exploitatie van Staatsspoorwegen" (State Railways' Co.) which dominated the entire railway system, came to an understanding for furthering their common interests.

The movement in favour of nationalization of railways has grown stronger and stronger, and the fresh agreements concluded between the State and the two companies in 1921 accorded a complete preponderance to the State. By these agreements, the capital of the companies was augmented from £3,375,000 to £7,500,000, the State providing the increase and thus becoming the chief shareholder, with a majority of votes in the Board of Directors.

The railway system was extended between 1900 and 1920 by about 379 miles. Its total length in 1919 was 2,381 m., of which 1,228 m. were double-tracked; the combined length of railways with limited speed possibilities and of the tramways was 1,843 m., 161 m. being double-tracked.

In 1913 the line Eindhoven-Weert was added to the great railway lines. It has a length of only 18 m., but constitutes a great improvement in the communication between the provinces of Holland and Utrecht on the one hand, and Limburg on the other; since its opening, the trains run via Boxtel, Eindhoven, Weert and Roermond to Maastricht and the rapidly developing mine districts. In 1907–8 a local, electrically worked line was laid from Rotterdam to The Hague and Scheveningen (20¼ m.). Of great significance is the local railway which relieved the isolation of the prosperous agricultural and market-gardening districts around Haarlemmermeer, joining such places as Hoofddorp, Aalsmeer, Uithoorn, Alphen and Oudshoorn to Leiden, Haarlem, Amsterdam and the main line from Amsterdam to Utrecht (by Nieuwersluis). Its total length is about 74 miles. Among other extensions in progress in 1921 were local railways and tramways in S. Limburg and Dutch Flanders.

In principle it has been decided to electrify some of the main lines. At the same time it is intended to relieve the main lines of the local traffic by the construction of new tramways and the electrification of old ones. For example, the steam tramways from The Hague to Leiden and from Leiden to Haarlem were to be electrified. Between Rotterdam and The Hague and between Haarlem and Amsterdam, electric traffic lines were already in existence. Various steam tramways had already been electrified or were being converted.

The State usually subsidizes the construction or improvement of local means of communication, provided both the communes and the provinces concerned manifest sufficient financial interest.

On the Netherland railways there were in use, in 1919, 1,363 locomotives, 4,823 passenger carriages and 29,734 goods wagons. The number of passengers carried increased from 46,221,001 in 1910 to 76,361,000 in 1916. The shrinkage of traffic possibilities by reason of the coal dearth and the raising of tariffs caused passenger traffics to recede to 64,326,000 in 1917, 60,613,000 in 1918, and 60,248,000 in 1919. The goods traffic reached its maximum, 20,183,000 tons, in 1913; it fell to 13,819,000 tons in 1919.

On Dec. 31, 1918 the tramways owned 567 locomotives, 3,028 passenger cars and 3,479 goods trucks. Traffic had been continually rising; it totalled in 1918 296,140,000 persons. The goods traffic likewise continued to increase, the amount carried in 1918 being 2,298,775,000 tons.

In 1908 Amsterdam mean time (20 minutes fast on Greenwich mean time) was adopted on the railways and in the post-offices.

Post, Telegraphs and Telephone.—The post-offices in 1919 numbered 1,702, (1910, 1,494). The number of letters and post cards delivered per head of the pop. was 60·4 (1910,46). In 1920 there were 1,421 telegraph offices (1911, 1,048).

The telegraph lines covered 5,137 m. (1911, 4,677), the total length of the wires being 29,417 m. (1911, 22,302).

The telephone system had been gradually brought under State control. Good progress had been made with the replacement of overhead wires by underground cables between the chief commercial centres, the Pupin system being used.

The radio installations at Scheveningen and at the State navigation stations handled 10,500 telegrams in 1910 and 20,900 in 1919.

During the war, the need for direct wireless communication with the Dutch East Indies was keenly felt. This communication was nearly complete in 1921. Near Bandoeng (Java) a temporary station had been erected, while in Holland the receiving station at Sambeek was also ready; the sending station at Kootwyk, some 31 m. distant, has six steel towers 700 ft. high.

A few small stations for wireless telegraphy and telephony were placed at the service of aerial traffic and the meteorological office.

Moreover, radiography is employed to relieve the long telegraph wires and cables on land. The chief telegraph office at Rotterdam has wireless communication with Germany. It was expected that a similar service between Amsterdam and England would be opened.

Aerial Communications.—In 1921 a daily aerial service for passengers, post and goods was instituted between Amsterdam-Rotterdam-London, Amsterdam-Rotterdam-Brussels-Paris and Rotterdam, Amsterdam-Bremen-Hamburg.

Agriculture and Market Gardening.—In the years immediately preceding the World War, Dutch agriculture and market gardening had devoted increasing attention to the export trade. Situated between such characteristically industrial countries as England, Belgium and Germany, where the general prosperity of the people enabled them to purchase products whose value is not chiefly determined by the area of soil necessary for their cultivation but rather by the labour required, Holland was in a position to carry on intensive agriculture and market gardening with the certainty of finding ample market for the lucrative sale of her output.

Corn-growing gradually dwindled, and remained of some importance only in the province of Groningen (where the strawboard industry made straw a valuable by-product) and in the sandy districts of Drenthe, Overyssel, Gelderland, N. Brabant and Limburg, where the rye grown was used in combination with enormous quantities of foreign fodder for the maintenance of live stock which, in comparison with the size of the farms, was exceptionally numerous and provided meat, dairy products and eggs for the export trade.

The reduction of corn-growing was coupled with an expansion of potato and beet cultivation; while a comparatively important place was occupied by various products such as rape seed, mustard seed, flax, canary seed and caraway seed. In the fen districts of Groningen, Drenthe and Overyssel potatoes were grown for the potato flour factories. Although the area of grass-land did not greatly increase, the quantity of live stock was continually added to. Large imports of foreign fodder made it possible to increase the number of cattle, this fodder being used even in the pasture districts of Utrecht, Friesland, N. Holland and S. Holland. Foreign grain and oil-cake were converted into meat and dairy produce to be exported, in their turn, to the industrial countries already mentioned.

Much care was bestowed upon the breeding of good cattle, whereby Holland came to possess magnificent stocks. As a consequence Dutch cattle were much sought after for breeding purposes both in Europe and in oversea countries.

Owing to its favourable geographical position, Holland was able to place its vegetables on the markets of neighbouring countries in a fresh condition, and the climate and soil being specially suitable for the cultivation of vegetables, it is natural that market gardening assumed extensive proportions. The country became more and more the vegetable garden of the industrial districts. Certain market gardening centres devoted themselves to the cultivation of bulbs, fruit trees, ornamental shrubs and table flowers, all of which were exported to countries near and distant.

This orientation of agriculture and market gardening placed Holland in a very difficult position during the war. For the feeding of its people and its cattle it was dependent upon foreign supplies which, especially after 1916, were largely cut off. Numerous Government regulations of a very irksome character for the agriculturist and market gardener became necessary in order to direct the production of food-stuffs requisite for the support of the Dutch population as well as of the many interned and the charitably entertained Belgian refugees. These measures included the obligation to convert grass-land into arable soil and to limit various crops not primarily essential as human food. Notwithstanding these measures, distress became acute, and the World War ended only just in time to prevent a general famine.

After the close of the war it became possible gradually to restore to agriculture the free exercise of its functions. Every effort was made to raise the diminished cattle stocks to their old level and to give them in other respects their pre-war position.

The State gives assistance on a large scale by well-organized instruction in agriculture, market gardening and cattle breeding, by the advice of State agricultural, horticultural and dairy experts, by the experimental Government stations, etc. Useful work is also performed by various organizations, such as the Royal Netherland Agricultural Committee, the Netherland Heath Society (reclamation of waste land), the Netherland Market Gardening Council and the Netherland Cattle Herdbook; while the coöperative movement is continually extending its influence among the farmers and in the dairy works. The quality of the dairy produce stands under strict control and can be guaranteed by Government stamps under which butter with not less than 80% of fat and not more than 16% of moisture, cheese with minima of 45%, 40%, 30% and 20% of fat may be sold.

Of the whole surface of Holland, being 3,263,541 hectares (1 h.a. = 2·47 ac.), in 1919 2,461,112 h.a. were in cultivation, viz.: arable land 908,622 h.a., pastures and meadows 1,207,743 h.a., gardens 59,796 h.a. (market gardens 24,327 h.a. and under seed cultivation 817 h.a.), orchards 25,698 h.a., arboriculture 2,718 h.a., floriculture 591 h.a., bulb-growing 4,889 h.a. and woods 249,055 h.a.

Small and medium-sized concerns are preponderant in Holland, more than half cover 1 to 5 h.a. each, about 20% 5 to 10 h.a., 14% 10 to 20 h.a. and 11% 20 to 50 h.a. Cultivation is very intensive.

Trade and Shipping.—Holland occupies a prominent place in international trade and shipping, thanks to its favourable geographical position, its well-equipped ports, its rich colonies and the commercial abilities of its inhabitants. About 18% of the bread-winners are engaged in trade and transport, against 27% in agriculture, etc., and 34·5% in industry. But this situation, so favourable in normal times, was a source of serious disadvantage during the World War. It was essential to the Allies to cut off, as far as possible, the influx of supplies to Germany. The consequent blockade of Germany caused the collapse of the Dutch import and transit trade; while the dangers arising out of the sea-mines and the submarine warfare first hampered and finally arrested altogether Dutch navigation and oversea export. Furthermore, overland trade with Belgium, France, Switzerland and Italy was absolutely paralyzed. The result was that Holland, both as regarded the export of its surplus output (particularly perishable agricultural and dairy products) and also the importation of indispensable commodities (coal, iron, etc.), became more than ever dependent upon the Central European countries, the only ones with which unimpeded traffic was possible. This traffic was controlled by the Nederlands Overseas Trust (N.O.T.)—a trade association created for the purpose and therefore dissolved after the war. Managed by leading business men, the N.O.T. kept in regular contact with the Dutch Government as well as with the blockading Powers, and, by undertaking the supervision of oversea imports so as to prevent their reëxportation to the Central Powers, it enabled the Allies to allow into the Netherlands from abroad such articles as the country required.

The unrestricted U-boat warfare, the tightening of the blockade and, finally, the requisitioning of a great portion of the Netherland mercantile marine by the United States in 1918 produced a complete dislocation of Dutch trade, which, in its effects, outbalanced the profits accumulated in the early days of the war by reason of the high prices which the Central countries had been prepared to pay for Holland's surplus of agricultural and dairy produce. In 1917 trade with Germany showed a balance of about £2,670,000 in favour of Holland, but in 1918 there was an adverse balance of over £15,000,000; trade with England in 1917 amounted to £26,500,000, but was reduced by the obstacles at sea in 1918 to £6,625,000.

After the war Dutch trade remained utterly dislocated. Germany, who had been one of Holland's best customers, appeared to have lost her purchasing capacity; Russia had vanished from the market. The rest of the world continued to suffer from the war's aftermath. In Holland, notwithstanding the appearance of a class of *nouveaux riches*, there proved to be a general impoverishment.

To obtain, therefore, an idea of the development of Dutch trade, it is necessary to revert to pre-war years. War-time and post-time data reflect only abnormal conditions.

In 1913 the imports totalled 66,488,516 metric tons (1910, 47,580,053) and the exports 45,033,122 (1910, 35,529,824). The imports consisted mainly of colonial produce (tobacco, coffee, tea, tin, hides, spices, cocoa, copra, etc.), raw materials (ores, coal, timber, cotton, wool, etc.), bread-stuffs, feeding-stuffs and manufactured articles.

Holland exported principally agricultural and horticultural produce (potatoes, vegetables, flower bulbs, seeds, fruits), horses, cattle, meat, fish and shell fish, butter, cheese, condensed milk, margarine, sugar, jams, potato flour, cotton and woollen piece-goods, shoes, electric lamps, strawboard, gin, beer and other alcoholic beverages, cocoa and chocolate, tobacco and cigars, glassware, paper, vegetable oils and oil cakes, etc. Imports by sea amounted in 1913 to 26,020,444 and exports by sea to 10,090,387 metric tons. Imports and exports by rivers and canals at the eastern and southern frontiers totalled in the same year 53,146,224 metric tons (imports 23,856,170 and exports 29,290,054). These figures illustrate the transport capacity of the Dutch river fleet. Imports by railway amounted in 1913 to 10,611,902 and exports to 5,652,681 metric tons.

Seaports.—Geographical conditions predestine Holland to a large transit trade, which in 1913 reached a total of 2,488,957 metric tons. The rivers Rhine, Meuse (Maas) and Scheldt, the principal trade routes of Western and Central Europe, having their estuaries on Dutch territory, the Dutch ports Rotterdam and Amsterdam form the gateways to a large part of Europe. Both ports are connected with the North Sea, the former by the New Waterway from Rotterdam to the Hook of Holland, the latter by the North Sea canal from Amsterdam to Ymuiden. Whereas the New Waterway is an open channel, the North Sea canal is provided with locks. The expenditure for the construction of the North Sea canal amounted in the years 1865–83 to 51,000,000 guilders; from 1883 till 1913 a further amount of 19,000,000 guilders was spent.

There is considerable difference in the position of Amsterdam and Rotterdam in international commerce. While Amsterdam disposes of a large portion of the foreign merchandize it receives directly, Rotterdam owes its importance to the fact that it is largely a transit-port. The length of the quays at Rotterdam now reaches the impressive figure of 30 miles. Loading and unloading are effected by means of the most modern appliances: electric cranes, pneumatic grain elevators, coaltips, etc. The total area of the harbours is about 6,000,000 sq.yds., not including the area of the New Meuse, which itself forms a large anchorage. The following figures relating to 1913 give an idea of the extent of the Rotterdam sea-borne traffic: tonnage of out-going ships 13,796,691 and of in-going ships 13,748,784, together 27,525,475 tons. In 1918 this figure had receded to 2,577,321 tons, but rose again in 1919 to about 6,500,000 tons and, in 1920, despite a two months' harbour strike, to 8,000,000 tons.

Rotterdam possesses the considerable advantage of being situated at the mouth of two such important rivers as the Rhine and the Meuse. In normal years the number of river vessels calling at Rotterdam is enormous. It is quite a common thing to see Rhine cargo-boats having a tonnage of 3,000 cub. metres. The following figures show the development of the shipping traffic on the Rhine and its division among Rotterdam, the rest of the Netherlands and Belgium.

Rhine shipping traffic ex-Germany in cub. metres:—

	With Rotterdam	With the rest of Holland	With Belgium
1910	17,663,521	3,936,174	7,727,219
1913	22,764,241	5,177,136	9,073,140

In like manner the smaller inland navigation and local shipping increased by leaps and bounds, so that including the Rhine shipping there were in 1913 140,469 vessels entering the port of Rotterdam, aggregating about 30,500,000 cub. metres capacity. For 1920 these figures were: 142,124 vessels and 26,613,225 tons.

Amsterdam is the principal centre for the home trade and for the world's trade in colonial produce. The public sales of tobacco, tin, coffee and spices are visited by numerous foreign buyers.

Amsterdam is also a large importer of Peruvian bark and capoc, and possesses important local industries, its diamond cutting enjoying a world-wide repute. The Amsterdam Exchange occupies a leading position in the world's money market.

The harbours of Amsterdam have a quay length of seven m., the water area accessible to ocean vessels covers 2,600,000 sq. yards. Its timber docks which next to those of London are the largest in Europe, have an area of 375 ac., the petroleum harbour comprises 70 ac., and the surrounding property, with tank capacity for 155,000 bar., measures another 30 ac. The harbour traffic of Amsterdam in 1913 totalled 4,347,000 tons, the returns fell greatly during the war, but reapproached pre-war figures in 1920; in the first quarter of 1921 the harbour movements reached 1,588,388 tons.

Of the minor ports Zaandam in the immediate neighbourhood of Amsterdam is a well-known centre of the timber trade. Harlingen on the Frisian coast has an extensive export to England of cattle, meat, dairy produce, potatoes and eggs; Delfzijl is near the German frontier and Flushing has the mail service to England.

As a centre of great shipping enterprises Holland ranks very high. The great Dutch steamship companies maintain services to almost every important port in the world.

In 1920, by the coöperation of 11 of the largest companies, the "Vereenigde Nederlandsche Scheepvaart Maatschappij" was founded, with a capital of £16,700,000, its object being the creation or continuation of lines to the East Indies, Australia and Africa.

The total tonnage of the Dutch mercantile marine (excluding steamships and motor-vessels of less than 500 tons and sailing ships) amounted on Jan. 1 1921 to 1,863,688 gross register tons.

Ship Building and Ship Repairing.—During and after the war, ship building made great progress in the Netherlands. On Dec. 31 1901, Dutch yards had, under construction and on order, only 33,700 gross register tons; on Dec. 31 1914, the figure had risen to 185,000. In 1915 there was a leap to 406,045 tons, and on Dec. 31 1918, the figure was 477,850.

Peace gave a startling impulse to the industry; on Dec. 31 1919, the total had risen to 740,675 gross register tons, but fell again to 561,035 by Dec. 31 1920. Although the Netherlands mercantile marine increased to 375,475 tons in 1920, the high ship-building returns of 1920 were chiefly due to foreign orders, since a considerable portion of the increase in the Dutch merchant fleet came from abroad. Dutch ship building gave employment to 25,000–30,000 workmen in 1921. The principal yards were at Amsterdam, on the Maas from Vlaardingen to Dordrecht, and at Flushing.

Remarkable progress has also been made in the ship-repairing industry, which was formerly of no great significance. Rotterdam had 12 dry docks with a total lifting capacity of 97,000 tons, the largest being for 15,600 tons. At Schiedam, Wilton's Factory had a floating dock of 46,500 tons. Amsterdam had four dry docks with a lifting power of 3,000, 4,000, 7,500 and 16,500 tons.

Industries.—During the World War, Holland was, by the measures of the belligerents, largely thrown on its own economic resources. Industry adapted itself as far as possible to the new circumstances by paying greater attention to home requirements. It devoted itself to the production of a number of articles previously obtained almost exclusively from abroad, such as: porcelain insulators, motor cylinders, drawn wire, fire extinguishers, kid gloves, clothiers' machinery, asbestos plates, press buttons, electric pocket lamps, wax images, sewing cotton, laboratory glass, incandescent lamp globes, toys, office requisites (writing cases and carbon paper), chloride of lime, sulphur chlorate, aniline colours, saccharine, bromides, chlorate of potash, synthetic scents, iodine compounds, narcotic ether, siliceous varnish, artificial horn (galalith), rubber articles, felt, flying machines, typewriters, etc. Various industries are rapidly extending, especially ship-building, the manufacture of implements and tools, glow lamps, margarine, cigarettes, etc.

An indication of industrial development is to be found in the number of boilers in use for factory plant and in the area of their heating surface. The number of boilers in use at the close of the years 1911, 1916 and 1918 were 7,455, 7,779, 7,973 respectively; the heating surface, in sq. metres, being 347,876, 431,077 and 467,158. The application of electric energy is continually on the increase.

Data concerning the number of workmen in the various industries, provided by the Inspector of Labour, show that in factories of more than 25 workmen, the number employed was 339,150 on Feb. 1 1920, as against 313,944 on May 1 1914, exclusive of the sugar factories which work from April 30 till Jan. 31 and employ about 10,000. The metal trade, together with machine building and ship building, occupied the largest number of workmen. Next in order followed the textile trade; the earthenware and glass industry; the clothiers; tobacco and cigars; timber, cork and strawboards; the chemical trades; printing works; the diamond industry; paper-making; leather and rubber industries.

Mining.—The Netherlands coal-mining industry showed a curious growth. The necessity in war-time of supplying requirements out of home resources led to vigorous productivity, with the result that the output was more than trebled (1,280,000 tons in 1910, increased to 3,940,000 tons in 1920). Above all, the State mines (Wilhelmina, Emma and Hendrik) attained great prosperity in those years. The production is estimated to be 6,000,000 tons in 1925 and probably 7,500,000 tons in 1930.

During the war, the lignite fields of Limburg, which previously were unable to compete with the German industry, were opened up. They produced in 1917 42,442 tons, in 1918 1,425,617; in 1919 1,881,962 and in 1920 1,395,851 tons. The ampler supplies of coal after the close of the war caused the output of lignite to fall off, and it was expected that the decline would become further accentuated, as the exploitation is only remunerative at high prices.

In what measure the Limburg mines rendered Holland independent of foreign countries is clearly reflected in the following figures:—

IMPORTS, EXPORTS AND CONSUMPTION OF COAL IN THE NETHERLANDS IN 1,000 TONS

Imports[1]		Exports[1]	Excess Imports	Limburg Output[3]	Available for Consumption
1910	14,789	8,515	6,274	1,280	7,532
1911	16,378	9,824	6,554	1,463	8,017
1912	18,250	10,980	7,270	1,717	8,987
1913	20,466	12,382	8,084	1,837	9,921
1914	16,315	8,999	7,316	1,890	9,206
1915	9,881	2,594	7,287	2,250	9,537
1916	8,431	2,208	6,223	2,563	8,786
1917	3,044	—[2]	3,044	3,007	6,051
1918	1,486	—[2]	1,486	3,806	5,292
1919	3,615	—[2]	3,615	3,939	7,554
1920	3,327	31[2]	3,296	4,339	7,635

That the consumption was so much lower in 1919 and 1920 than in 1913 is to be explained by the decrease of bunkering, the reduction of demand in the gasworks, and the depressed condition of certain industries as an aftermath of the war.

The productive coal district of South Limburg covers an area of about 96·5 sq. miles. Experts assess the depth at 8,200 feet. The deposits are to be regarded as an offshoot from the Belgian Limburg beds. In North Limburg there is a second coal region the exploitation of which has been decided upon; it is a continuation of the Westphalian coal-field. In Gelderland coal is also found.

Salt.—The difficulty of obtaining sufficient salt during the war led to the exploitation of the salt beds in the E. of Gelderland close to the German frontier. The State Mineral Exploration Service instituted in 1903 had discovered salt deposits near Winterswyk with an estimated rock-salt content of 22,000,000,000 tons, and others near Buurse with apparently 2,000,000,000 tons.

In 1919 the output was 5,244 tons, in the last month of that year 2,000 tons, being one-sixth of the whole consumption in the country.

Fisheries.—In 1919 more than 27,000 persons earned their entire livelihood by fishing, while a very large number exercised the craft as a subsidiary occupation or were employed in such callings as sail making, working in net factories, rope walks, cooper's workshops, fish-smoking sheds, tanneries, basket works, etc. In that year the number of vessels engaged in fishing was 6,239, of which 302 were propelled by steam, and 216 were motor-boats, the total capacity being 450,970 cub. metres. High-sea and coastal fishing produced roughly 251,036,000 kg. of fish including shell fish and molluscs; the value was £5,606,216. The river catches (salmon, etc.) weighed 119,000 kg. and was sold for £54,133; no returns are obtainable concerning other freshwater fish.

In 1913 the high-sea and coastal fisheries produced 203,833,000 kg., the value being £2,243,283. Thus the proceeds have increased since the war, but the working expenses have risen to such an extent that the profits of the business are much less favourable. Above all, the collapse of the German exchange has had a very detrimental effect, Germany having been one of the principal purchasers prior to the war. The export of herrings, of fresh fish (trawl fish) and of anchovies suffered extremely.

The Act of Oct. 6 1908, which came into force on July 1 1911, contained regulations regarding all the fisheries, instituting also a Fisheries Board. A decree of 1912 founded a State Institute for Fishery Investigation. There is an Inspection of the Fisheries, charged with the supervision of the fisheries and the carrying out of the regulations. Several towns maintain fishery schools, all endowed by State and Province.

Constitution and Government.—The Constitution of 1815 which had already been revised in 1840, 1848, 1884 and 1887, again underwent important changes in 1917, especially with regard to the franchise and education. The number of Ministries in 1921 was 11, viz.: Foreign Affairs; Justice; Home Affairs; Education, Arts and Sciences (since 1918); Marine; Finances; War; Public Works; Agriculture, Trade and Industry (since 1908); Labour (since 1918) and Colonies. Public Works included the whole system of transport, Labour and public health.

The States-General consisted of a Second Chamber (Deputies) and a First Chamber (Senate). The Second Chamber consists of 100 members chosen, since 1917, for a period of four years according to proportional representation, by secret, general and single male franchise, while after 1919 the law made use of the powers granted by the revised Constitution of 1917 to extend the franchise to women.

The franchise is granted at the age of 25, and since 1917 the constitution has made voting compulsory. Membership of the Second Chamber, a position which may not be held under the age of 30 years, has attached to it a yearly indemnity of £250, while travelling is free for members. Retired members enjoy a pension of £8 6s. 8d. for every year of service to a maximum of £166 13s. 4d.

The First Chamber consists of 50 members, chosen by the Provincial States for the term of nine years. Every three years a third of the number resigns. They are chosen by absolute majority of votes, each province sending a quotum according to population.

The conditions for eligibility are the same as for the Second Chamber. The members have the right of free travelling, while those who do not live in The Hague where the States-General meet, receive the sum of £1 13s. 4d. per day for expenses.

The Provincial States and the Municipal Councils are elected for four years under the same franchise conditions as the Second Chamber. The salary of the Burgomaster varies from £41 13s. 4d. to £1,666 13s. 4d. (Amsterdam).

Worthy of special mention also are the "Waterschappen," "Veenschappen" and "Veenpolders" (bodies charged with the survey of dikes, peat land, etc.), elected by those interested in the maintenance of the dikes, the draining of polders, etc. They have power to make regulations in their own interests, according to legal rules, but are also subject to the control of the Provincial States.

Since the introduction of general female suffrage the number of electors for the Second Chamber totals 3,250,247 or 97·6% of the inhabitants over 25 years of age. In 1917, that is prior to the introduction of universal suffrage, the total was 1,079,475, being 70·8% of the male population above 25 years of age, or about 35% of the total inhabitants above 25 years. (Proposals for a new general revision of the constitution were introduced on March 22 1921.)

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[1] General imports and exports until 1917; both coal, coke and coal and lignite briquettes are included in the figures.

[2] We have not reckoned the bunker coal, which is mentioned under exports in the Trade statistics since 1917, as exports.

[3] Including lignite calculated as coal.

Finance.—Holland, it is true, was not directly involved in the war, nevertheless, the four years' mobilization, the equipment of army and navy, the provision of daily necessaries and the care of refugees during the war, as well as the measures on behalf of the demobilized and the unemployed and those required to meet the housing shortage and the rise of salaries after the war, caused such heavy expenditure that the Dutch finances became greatly over-burdened. The "War" expenses alone amounted to £165,000,000, of which a portion was at once met by taxation. The national debt showed an increase from £96,355,000 in 1913 to £216,604,000 in 1921; it had thus been more than doubled during the war. For the amortization of the "War" debt special taxation was voted for the formation of a loan fund, whereby it would be possible to pay off this special debt in from 22 to 25 years. From 1915 to 1919 £24,107,737 was paid into the loan fund.

The burdens imposed upon the people were therefore very heavy, particularly as the communes, upon which, in Holland, an important share of the administrative task devolves, also had to make heavy disbursements in connexion with the war. The consequence was that the direct taxes of the realm, the provinces and the communes grew from £1 9s. 5d. per head of the population in 1913 to £5 16s. 5d. in 1918–9. After then, taxation was noticeably increased, while the above figures take no account of the rise in excise, indirect taxes and various tariffs. The direct and the indirect taxes of the realm, and the excises, grew from £2·25 per head of the population in 1913 to £7·9 in 1919. The War Profits Tax produced by Nov. 1 1920 £50,000,000. The total national revenue, which in 1913 amounted to £18,851,888, increased to £56,187,634 in 1919, and in 1921 was estimated at £46,012,609. The total national expenditure, £19,893,955 in 1913 and £74,054,597 in 1919, was estimated for 1921 at £69,273,810.

The ratio of metal to the note issue of the Netherlands Bank remained very favourable throughout the war.

	Notes issued	Gold coin and bullion in £	Total metal stocks in £
1910	£23,296,000	10,904,500	13,233,000
1919	£85,264,500	52,906,000	53,609,000
June 1921 . . .	£84,415,703	50,488,597	51,541,553

According to the latest estimates in 1921 the direct taxation of the realm *per capita* of the population amounted to fl.40·50, and indirect taxation to fl.35. Local rates amounted to fl.40, provincial rates to fl.3, total fl.118·50 (£9 17s. 6d.). The entire pop. of the Netherlands, therefore, on a total taxable revenue of 2,000,000,000 guilders, pays fl.830,000,000 in taxes, *i.e.* more than 40%.

National Defence.—The Dutch army is in the main a Militia army. Of the 60,000 men at disposal 23,000 are annually selected by lot for the first period of service which lasts six months for infantry but longer for cavalry, engineers, etc.

These men, who are liable to service from their 20th till their 31st year, form, in the event of mobilization, an immediately available army of over 200,000. By calling up older levies and drilling those previously exempted an army of 400,000 men was obtained in the period from 1914–9, while a reserve was also at disposal. These forces constitute a field army of four divisions of three brigades each, the brigade comprising two regiments of infantry, one regiment of artillery and one of cavalry; besides these there are the auxiliaries, the garrisons of the lines, coast guards, frontier guards, etc.

Holland was prepared for mobilization as early as July 28 1914; mobilization started on Aug. 1, and by Aug. 4 it was complete.

The army is officered by about 2,000 professional commissioned and 5,000 professional non-commissioned officers, supplemented, during mobilization, by about treble that number of reserve officers and non-commissioned men.

The army in the Dutch East Indies (Java, etc.) is absolutely independent of the home forces. It consists of voluntary regulars to the number of about 36,000 men, to which, in recent years, a small addition of conscripts has been made.

The navy in 1921 comprised 5 ironclads, 2 armoured cruisers, 1 protected cruiser, 3 armoured gun-boats, 4 gun-boats, 16 mine layers, 4 mine sweepers, 8 destroyers, 11 torpedo boats, 24 submarines and a large number of small coastal vessels. It does service both in the home waters and in the Indies. It is equipped with volunteers, supplemented by an annual contingent of 800 to 1,000 conscripts.

In the 1921 budget, the army figured with almost £6,250,000 and the navy with more than £4,350,000, being about £1 11s. 0d. per head of the population.

Labour Legislation.—Although Holland began somewhat late and hesitatingly with its labour legislation, that legislation assumed such a development during the ten years following 1910 that in 1921 it occupied a leading place. The first effort to remove social evils by legislation dates from 1873, in which year the employment of children under 12 years of age was prohibited. But a parliamentary enquiry in 1887 showed that the Act had not had much effect. Investigations led to the Act of 1889, which was repeatedly extended till, in 1919, a highly important change was achieved by an Act applicable to factories and workshops, bakeries, shops, offices, pharmacies, coffee houses, hotels and hospitals (but not to agriculture, horticulture, arboriculture, mining or household work) which introduced, in principle, the 8-hour day and the 45-hour week. Holland thus took the leading place and even went beyond the requirements of the Washington Conference of 1919: except in the occupations mentioned above, these regulations have been gradually introduced. In bakeries, all work is prohibited on Sunday and from 8 P.M. till 6 A.M. As a general rule, work must cease on Saturday at 1 P.M. All work is forbidden for children under 14 years of age, and in general, Sunday employment and night work for persons between 14 and 18 years.

In cases prejudicial to health, morals or life, any particular work may be forbidden by royal decree to young persons and women. Women are not permitted to work for at least two weeks before and six weeks after childbirth.

Special Acts provide for safety in factories (1895), the prohibition of white phosphor in match works (1901), labour in caissons (1905), stone cutting (1911) and harbour work (1914).

Workmen's Insurance.—Workmen's insurance in Holland began with the Accident Act of 1901. This Act was applicable only to factories and workshops with power machinery, but was extended to all cases in 1919. Only agriculture, horticulture, arboriculture, sea fisheries and navigation were excepted. For the last, a temporary regulation was adopted in 1919 as continuation of a regulation made in 1915 for war accidents at sea. The accident premiums are paid by the employers. Mutual accident insurance in agriculture and arboriculture has existed since 1909.

In 1913 a compulsory sickness and old age insurance bill was passed, and regulations immediately came into force whereby workmen 70 years old at that date were granted a pension of two francs per week (married couples together three francs); in 1919 these sums were increased to three francs and five francs and the age limit was lowered to 65. The Act itself, however, was not promulgated owing to the continued conflict between the advocates of State pensions (Liberals, Radicals and Socialists) and the advocates of compulsory old-age insurance with payment of premium by the insured (the clerical parties). This conflict ended in the retention of compulsory insurance with payment of the entire premium by the employer. The age limit is 65 years. Children under 14 years may receive an orphan dole and widows absolutely invalided or not less than 60 years old receive an annuity. For persons not performing hired service but whose economic position is similar to that of workmen, opportunity was given to insure voluntarily against old age, the State undertaking the costs of administration.

Council of Labour.—In 1919 a High Council of Labour was appointed composed, partly, of representatives of the employers and the employed, partly of officials, and partly of persons who had made a special study of social and economic questions or of social legislation. This body, of which the Labour Minister is president, was to advise the various departments concerning Labour affairs.

Housing.—Owing to circumstances due to the war, the housing problem in the Netherlands also became extremely pressing. Before the war, thanks to the housing law of 1901, the slum dwellings in the great centres of population were being cleared away and the system of cash advances to building societies introduced by this law rendered possible the construction on a large scale of houses for the working and lower middle classes.

The stagnation in building during the years of war owing to a shortage of labour caused by the long duration of the mobilization, and the want of materials, changed the favourable situation existing before the hostilities into one of great need. Legislative measures proved necessary to prevent as far as possible the inflation of house rents, and Acts were passed in 1917, 1918, 1920 and 1921; also the construction of houses by private individuals was encouraged as much as possible by the State by means of loans and premiums. The shortage of houses was greatest and reckoned at 57,550 at the end of 1919, and it was estimated that this number had been reduced to 52,500 on Jan. 1 1921.

Public Health.—State supervision of public health was provided for in the Health Act of 1919. The Government is advised by the Health Council. There are health committees in all communes of more than 18,000 souls and in unions of smaller communes aggregating more than 40,000 souls.

Protection of Children.—The Compulsory Education Act gave authority to the communes to provide food and clothing for needy children. In various large towns the authorities proceeded to the installation of school baths, and physicians and nurses were appointed; dental treatment was also arranged for.

Poor Relief.—The Act of April 27 1912 achieved with regard to Poor Relief an urgently necessary coöperation by instituting joint Poor Councils in which the various public and private charitable institutions are represented. One general Poor Commission, established in The Hague, advises both the Government and the Poor Councils. The principle of the Poor Relief is that precedence is taken by Church or other special institutions and that only afterwards civil relief, exercised by the community, comes into action.

The Church and special institutions may be subsidised by the authorities. The number of charitable institutions amounted in 1917 to 6,880, nearly 60% of which belonged to the churches. In 1917 about £3,500,000 were spent for charitable purposes.

Labour Movements.—The comparatively slight importance of the

Dutch industry in the first half of the 19th century prevented the rise of a strong labour movement. It is not until the 'seventies that one finds the beginning of a real trade organization, and even then the movement developed very slowly, largely because of divisions among the workers. Attempts to combine all workers in one trade, without distinction of political or religious faith and afterwards to organize the various trade unions into one central body, failed. As soon as socialistic tendencies appeared in the labour movement, the denominational workers broke away. The consequence was that five central organizations were established: (1) the Dutch Labour Secretariat, founded in 1893, the members of which are revolutionary—socialistic or anarchistically inclined; (2) the Dutch Trade Federation, of 1905, which is under social democratic influence; (3) the (Protestant) Christian National Trade Federation, founded in 1908; (4) the Roman Catholic Trade Organization Bureau, formed in 1909; and (5) the Dutch Federation of Neutral Trade Unions, founded in 1912 with the aim of uniting the workers of the various political or religious creeds; but which has really become an organization of those who, politically, are liberal or radical. It combined in 1919 with the Central Committee of Neutral Trade Unions as the General Dutch Trade Federation.

The following figures show the development and importance of these various central bodies. The Dutch Labour Secretariat had in 1895, 15,728 members; in 1900, 12,444; in March 1903 (great railway strike), 17,602; in Dec. 1908, 8,000; in 1910, 3,454. Then ensued a reorganization and the adoption of more moderate tactics and in 1915, the membership was 9,242; in 1918, 23,068; in April 1920, 50,140. Again a decline followed; in Jan. 1921 the membership was 36,038. The Dutch Trade Federation had a membership on Jan. 1 1906, of 18,900; Jan. 1 1912, 52,235; Jan. 1 1915, 87,611; April 1 1919, 207,512; April 1920, 262,116. Later the figures declined to 225,367 in Jan. 1921. The Christian National Trade Federation had on Jan. 1 1910, 6,580 members gradually amounting to 76,488 on Jan. 1 1921. The Roman Catholic Trade Organization Bureau Oct. 1 1909, had 9,356 members, rising steadily to 158,222 in Oct. 1920. The General Dutch Trade Federation, after the fusion, had about 48,000 members rising to 51,913 in Jan. 1921.

In Jan. 1921, therefore, these five great labour bodies included 550,000 workers. Outside these there were still a number of smaller organizations but the tendency towards centralization was becoming continually stronger: in 1913, 53·66; in 1918, 77·87; in 1920, 87·53 % of all organized workers had joined these greater organizations and the percentage was still rising.

In the meantime there remained a considerable number of workers who were not organized at all, but a zealous propaganda from various sides unceasingly brought new organizations into existence.

Two factors contributing to the growth and the centralization of the Labour Movement were the collective workers' contracts and the unemployment insurance. With regard to the former, there already existed in 1920, 935 of these agreements which embraced about 22,500 undertakings (1911; 1,100) and over 273,600 workmen (1911; 2,300). From the Catholic side there is a tendency to go still further, aiming at a system of trade councils which would unite the organized employers with the organized workmen.

Insurance against unemployment was steadily extending. While in 1911 only 504 organizations possessed an unemployment fund, this number had risen in 1920 to 4,535. There was an especially large increase after the Government, under the stress of circumstances due to the war, decided to subsidize the unemployment funds by adding 100% to the workmen's own contributions while leaving the management of the funds to the workers, although it exercised a certain measure of control. The number of workpeople insured against unemployment, which in 1911 was only 43,601 and in 1914 was 70,481, had risen in 1920 to 397,900.

Coöperation.—Consumers' coöperation is, in the Netherlands, chiefly concentrated in the Dutch Coöperative Union, the Union of Dutch Workers' Coöperations and the Union of Roman Catholic Coöperative Societies, together including about 380 societies with 200,000 members. During the last few years before 1921 a great extension took place in the Coöperative Wholesale Society, "De Handelskamer," which originally acted as a commission agent, but gradually established its own warehouses, and continually brought more of its own wares, with its own special mark, into the market. It possessed also its own soap factory, a factory for wooden shoes, a corn-mill, etc. It embraced in 1917 about 270 societies with about 170,000 members. The return was then—in the difficult years of the war—10,000,000 guilders, but afterwards somewhat decreased.

Agricultural coöperation is much more strongly developed. The Dutch Farmers' Union, established in 1896, is the central organization of the farmers' unions existing in every province, embracing nearly 1,700 local societies with about 200,000 members. In 1913 the various farmers' unions bought coöperatively to the value of over £3,000,000, that is, on an average, about 57 guilders per acre. Soon after there arose a need of centralization in purchasing, and the Central bureau for the purchase of agricultural necessaries was established at Enschede.

In market gardening also, coöperation progressed quickly. The Dutch Market Gardening Council included in 1918 351 societies with 65,700 members.

Coöperation in dairy produce is of great importance. In 1879 the first butter factory was established and in 1886 the opposition of the farmers to the machine-made butter industry in Friesland had so far decreased that the first coöperative butter factory could be established at Warga. Twenty years later there existed 749 coöperative factories (304 of which worked with hand-power) against 226 non-coöperative factories, and 175 coöperative cheese factories against 97 non-coöperative. Again ten years later the industry proved more concentrated, and the figures for butter were 602 (115 with hand-power) and 282; for cheese 236 and 101. The coöperative dairy produce factories, at first provincially organized, combined in the Federative Dutch Dairy Union, which also founded a Central Sale department. In 1917 nearly 10,000,000 kg. of butter were sold directly through this department; the associated factories produced in that year over 1,370,000,000 kg. Through their strict control the dairy produce coöperative factories have had a very favourable influence on the quality of the product.

In the Netherlands agricultural credit is regulated on an entirely coöperative basis through three central bodies, viz. the Coöperative Raiffeisenbank at Utrecht, the Coöperative Central Farmers' Loan Bank at Eindhoven and the Coöperative Central Agricultural and Market Gardening Bank at Alkmaar, which together include over 1,000 local banks with over 92,000 members. Besides these three great organizations there are also a large number of smaller coöperative banks for agriculture and market gardening and for the middle classes. With the exception of the dairy produce business productive coöperation has had little success.

Education.—The conflict over the schools, which had dominated the political life of the Netherlands for almost three-quarters of a century, closed in 1917 with the complete victory of the church parties. The Constitution of 1848 had granted the right to give private instruction, but had made public undenominational instruction exclusively "an object of the permanent care" of the Government. Accordingly, the public funds provided for undenominational education. The advocates of denominational education had to pay for that education with their own means, while helping, as tax payers, to support schools which they did not want for their children and which they regarded as pernicious in principle. The undenominational school, with its obligation to respect in its curriculum the religious convictions of everyone, was considered by the parties of the Left suitable for children of every confession. Gradually, however, these parties also coöperated in granting higher and higher subsidies to private schools. There was also a desire to end the conflict in order to devote more energy to the improvement of education generally. In 1917 a modification in the constitution prescribed that education generally, *i.e.* not merely public instruction, was to be an object of the uninterrupted care of the Government. By this change denominational schools were accorded the same rights as the undenominational. As a result a financial arrangement was made in 1919 which benefited them in equal degree.

On the basis of the new article in the fundamental code a new Elementary Education Act came into force in Jan. 1 1921. But whether the "school war" is ended for good and all was open to question. Rather the scene of war was changed: it was transferred to the commune. It was expected that many "public" schools, especially in smaller places, would disappear, and that the number of small private denominational schools would be augmented and the cost of elementary education consequently increased, thereby impeding the improvement of education. Denominational education of a secondary character and as preparatory to advanced study, though it was not yet placed on an equal footing with "public" instruction of the same character as had been done in the case of elementary education, received nevertheless public assistance.

As a whole, Dutch education in all branches stands on a high plane. Compulsory elementary schooling, which was introduced in 1901 (6–12 years), was in 1921 increased to seven consecutive years of instruction (6–13). To this two years may be added. After the sixth year, too, there is considerable opportunity for extended elementary education which lasts three years and may comprise modern languages and mathematics. Preparation for advanced technical and commercial instruction is given in the higher middle-class schools and commercial schools, while the "gymnasia" (grammar schools) prepare for the universities. In addition there is extensive technical or trade instruction.

The care of education, which had previously been entrusted to the Ministry of the Interior, was transferred in 1919 to a special Department of Education, Arts and Sciences. As adviser to the minister a Council of Education was appointed.

The growth of primary education is shown in the following figures. The children attending "public" schools numbered in 1875 386,293; in 1919 575,369; those in private schools numbered in 1875 123,400, and in 1919 432,197. In the latter year there were 3,401 "public" and 2,439 private schools. The results are shown by the percentage of illiterates, which has fallen to 0·2–0·4 per cent.

Between the years 1910 and 1918 the number of higher middle-class schools for boys rose from 85 to 111 and for girls from 16 to 28. The number of boys attending increased from 10,844 to 15,497 and of girls from 4,097 to 7,587. Numerous communes also have commercial schools. In 1910 there were 30 public and 35 private gymnasia, the corresponding figures for 1918 being 34 and 41. The pupils increased in number from 5,373 to 7,552.

There are five humanistic universities; three are State institutions, namely at Leiden, Utrecht, Groningen; while one is municipal and one private, both at Amsterdam. The students numbered in 1909–10 3,945 (671 women), and in 1918–9 5,396 (1,263 women). Besides these universities, there are other institutions which, requiring similar entrance qualifications, are empowered to grant degrees. One is the State technical university (Hoogeschool) at Delft, conferring the degree of "Doctor Ir." (engineering), and admitting in 1909–10 1,121 students (57 women), and in 1918–9 1,866 (123 women); another is the private university of commerce founded at Rotterdam in 1913, conferring the degree of Doctor of Com. and attended in 1918 by 556 (28 women) students. In 1912 the State agricultural school at Wageningen was converted into a State higher agricultural, horticultural and arboricultural school, and in 1918 into an agricultural university (Dr. Agr.), its students then numbering 222. In 1912 a secondary agricultural school was founded at Groningen and a secondary school of colonial agriculture at Deventer. In addition there are 21 State agricultural and horticultural winter schools and a State dairy school at Bolsward. The State veterinary school at Utrecht was raised in 1918 to the status of a university. In addition there are schools of navigation (at Amsterdam and elsewhere), secondary technical schools, academies of plastic art, training schools for teachers, a large number of housekeeping and training schools for girls and institutes for deaf mutes, for the blind and for backward children.

Besides large amounts provided privately the net expenditure on education from the public exchequers (State, provincial and communal), after deduction of revenues, totalled in 1910 over £3,550,000 and in 1917 nearly £5,580,000. Since "public" and private education have been given equal claims to State support and teachers' salaries have been improved, the total estimated expenses for 1921 were not less than £12,500,000.

Literature.—Literary development in Holland was marked by a change about the year 1900 after the violent individualism of "the men of the 'eighties." Dogged subjectivity, the principle of "Art for Art's sake," was abandoned, and even under the men of the 'eighties this development attained completion (Gorter, van Eeden). The lyric and naturalistic epic concentrated in the figure of Marcellus Emants (b. 1848); under the influence of French naturalism, French philosophy and of Ibsen especially he became the delineator of degeneration and of the tragedy of heredity (*Waan*, *Liefdeleven*). This modern realism, with a typically Dutch tint, is to be found in Herman Robbers (*Roman van een Gezin*), Ina Boudier Bakker (*Armoede*), Top Naeff (*Voor de Poort*), de Meester (*Geertje*), Heyermans (*Diamantstad*), and Querido (*Menschenwee*, *De Jordaan*). Beside it there flourishes a modern romanticism: Arthur van Schendel (*Een Zwerver Verdwaald*), van Moerkerken (*De Bevryden*), Adr. van Oordt (*Warhold*), greatly under the influence of the realism of about 1890.

Louis Couperus abandoned his neurotic *milieu* of The Hague (*Eline Vere*) and turned to the semi-historical and highly imaginative (*Een berg van Licht*, *Antiek Tourisme*, *Iskander*). Many modern poets with socialistic ideals aim at an art for the community (Adama van Scheltema, Henr. Roland Holst), while P. C. Boutens (*Carmina*, *Praeludiën*) under the influence of the classics and philosophers produces intellectual lyrics. Among the younger lyric poets are Aert van der Leeuw, P. N. van Eyck, Geerten Gossaert and J. C. Bloem. The poet-singer J. H. Speenhoff deserves special mention.

In the theatre great progress has been made in this period: Heyermans (*Ghetto*, *Op Hoop van Zegen*), Mrs. Simons-Mees (*De Veroveraar*), Schürmann (*De Violiers*). As producers, Royaards (Vondel, Shakespeare, Goethe) and Verkade (English Society plays) are well known. The best known actor is Louis Bouwmeester, who, as Shylock, has had great success in London as well as in Paris, Berlin and Vienna.

Dutch critics are Albert Verwey (*De Richting der Hedendaagsche Poezie*), Carel Scharten (*Krachten der Toekomst*), Joh. de Meester, Is. Querido and van Eeden (*Studien*).

Painting.—The Hague school has been coming to a close in a number of disciples who miss the great powers and great personality of the Marises (James and William), of Mauve and Weissenbruch. Joseph Israëls died in 1911. Breitner (1857–), who, although he lived in Amsterdam, may still be regarded as one of the Hague school, had done his best work. Matthew Maris, one of the finest and most subtle Dutch artists of the 19th century, died in 1917. Antagonistic to the Hague school were the pupils of Allebé, the Amsterdammer. Among them one finds such well-known portrait painters as Veth and Haverman, a landscape painter like Voerman, a painter-*littérateur* like Van Looy, painters of fish, Dysselhof, Witsen, etc. Bauer, the great etcher and painter of the East, occupies a place of his own. He is a Romanticist with the technique of the Hague school, just as Isaac Israëls in his painting is more nearly related to the French school, as Manet, etc.

The first revolutionary in Holland was Vincent van Gogh (1853–90). He went to France and was affected by the modern masters of that time. Judging him by his best known work he must, without doubt, be considered one of the greatest Passionates that Holland ever possessed. His influence on some of the younger painters is still apparent. After him come two such contrasting masters, Toorop and Van Konynenburg. Toorop (1858–) is an admirable portrait painter, a symbolic draughtsman, rich in imagination, a creator of religious subjects (since he became a Catholic in 1905).

Van Konynenburg (1868–) has long been an opponent of the Dutch impressionism (the Marises, etc.). He has become, like Toorop, chiefly a figure painter; one of the most psychological portraits of our time, that of Boutens, is his work.

Jan Sluyters (1881–), called by some the Breitner among the younger men, especially with reference to such work as "The Negro," is a naturalistic limner of excellent child portraits, a painter of still life and of landscapes with figures. Leo Gestel (1881–) is more refined. Cubist in his landscapes (soft in colour) of Majorca, with melancholy in his sunflowers, he is in his later studies of flowers what might be called normal decorative. Sluyters and Gestel are both Amsterdammers. With them may be mentioned Matt. Wiegman. Schelfhout tends towards the archaic in his dry-points. Roland Holst is full of good taste, the painter, after Derkinderen, of mural paintings; Alma is developing also in that direction.

Thorn Prikker (1868–) has always stood apart. He has the most sensitive feeling for line of any Dutch artist.

Architecture.—It is to the credit of Dr. P. J. H. Cuypers (1827–1921), a pupil of Viollet-le-Duc, that, aided by his friend Jhr. Victor de Stuers (1843–1916)—himself a great art connoisseur and patron—he succeeded in arousing general interest in art and, more especially, in architecture and decoration. Cuypers, inspired both by the Gothic and by the Netherland style of the 16th century, built the State museum at Amsterdam and many churches, in which he was frequently assisted and followed by Joseph Cuypers, Bleys and others. The Dutch 17th century Renaissance served as a model to architects such as Gosschalk, Springer, Van Arkel, Van der Steur, etc. Jan Stuyt, De Basel and Leliman turned their attention more to the 18th century. A fresh trend in architecture had emanated from H. P. Berlage, who stresses simplicity and severity of line and the use of brick as a specially suitable material for Holland.

HISTORY.—The war period brought a solution of some very important questions in Holland. After the resignation of the Liberal Cabinet of De Meester in 1908, the Government passed into the hands of the "Right" (clerical) Cabinet of Heemskerk (1908–13), which, thanks to the gifted minister Talma, succeeded in passing an act for compulsory insurance. The Heemskerk Cabinet, in the person of its vigorous Minister for War, Mr. Colyn, was able to carry out a reorganization of the army which made it possible for Holland to mobilize very rapidly in 1914 and to strengthen its forces very considerably during the war. The building of a fortress near Flushing aroused at first some dissatisfaction in Belgium, France and England, owing to fear of German influence; but it appeared that Holland aimed merely at an energetic maintenance of its neutrality on the Western Scheldt in the event of war. The World War showed that Holland's neutrality benefited the Allies by preventing the German invaders in Belgium from using the Western Scheldt for submarine warfare.

In 1913 the Heemskerk Cabinet made way for that of Cort van der Linden, which came into power after the refusal of the Social Democrats to accept seats in the Cabinet and the consequent refusal of the Liberal parties to take upon themselves any responsibility. The State Councillor and professor emeritus, Cort van der Linden, had been Minister for Justice in 1897–1901. This highly respected Liberal formed an "extra-parliamentary" Cabinet, that is, a Cabinet desiring not to be regarded as a mandatory of the Liberal-Socialist majority, though taking over the programme of these parties victorious in the voting. In this way the new Cabinet achieved a revision of the Constitution in 1917. Herein it succeeded in solving the school question which had dominated political life for half a century. The talented minister Lely, who for the third time was at the head of the Department of Public Works (1891–4, 1897–1901, and 1913–8), saw his life's work crowned with success in that the States-General resolved to barrage the Zuider Zee.

To a large extent the success of the Cabinet was due to the party truce brought about by the war. Otherwise the war gave rise to great difficulties. The geographical position of Holland caused the belligerents on either side to desire that she should not get entangled in the war. In order to protect vigorously her neutrality, Holland herself increased her army to 500,000 men, well trained and equipped as efficiently as possible. Repeated diplomatic differences of increasing poignancy were as repeatedly settled to the satisfaction of all parties by Jonkheer Loudon, the Minister for Foreign Affairs, who inspired great confidence both at home and abroad. Nevertheless, Holland suffered greatly from the blockade and the U-boat warfare.

The neutral position of Holland made it possible for her to assist very largely in mitigating distress in the belligerent countries, by sending thither ambulances and aiding in the Relief Work in Belgium and Northern France, and in a special degree, by welcoming the destitute Belgian refugees, who, to the number of over a million, fled to Holland after the fall of Antwerp. Gradually most of these returned home, but even in 1917 and 1918 between 30,000 and 40,000 were still supported by the Dutch Government.

In Sept. 1918 there came a fresh influx of refugees, numbering about 40,000, chiefly from Northern France, as a result of the evacuation caused by the retreat of the German army. On all these refugees the Dutch Government expended certainly some £5,000,000 sterling. To this are to be added many millions provided by private means. The exchanged British and German prisoners-of-war were also hospitably received. After the fall of Antwerp, too, 30,000 Belgian and some hundreds of British soldiers were interned in Holland. The number of German interned also assumed big proportions, no fewer than 10,000 deserters crossing the frontier. Finally, numbers of military and civil interned managed to escape from Germany into Holland, whither no fewer than 4,000 Russians fled.

Meantime, the elections of 1918 had produced a majority of the Right, which, though weak (51 to 49), enabled the Roman Catholic leader, Dr. Nolens, to form a Cabinet, inasmuch as the Liberals were split into eight groups by the new system of proportional representation and the Socialists had gained seats as a result of general suffrage. Since Dr. Nolens considered it undesirable that he, as a priest, should take a seat in the Cabinet, Jhr. Ruys de Beerenbrouck acted as leader. It was the first time in Holland that a Government accepted responsibility under Catholic leadership.

This Government soon found itself faced with great general dissatisfaction as an outcome of the wartime distress. On the conclusion of the Armistice the desire for demobilization was so great that a serious mutiny broke out. The Social Democratic leader, Mr. Troelstra, announced a revolution in Parliament and demanded the resignation of the Government. But he was not supported either by his own party or by the workmen's organizations. There was a strong revival of patriotism, attachment to the reigning house and feeling for social order. Everywhere civil guards were formed. The army was demobilized and measures were adopted for the benefit of the men. Besides this social reforms were promised. The danger of revolution soon began to disappear. Moreover, an improvement in the supply of victuals was noticeable. The Government had acquired the prestige requisite to introducing important measures into the Second Chamber even with a wavering majority. These included old age and invalidity insurance (Talma Act, 1919), the eight-hour day and 45-hour week, and the Primary Education Act. The Roman Catholic influence was evidenced, *e.g.* by the restoration of a permanent envoy to the Pope; this representation had lapsed in 1870 but had been reinstituted during the war, though only as a temporary measure with the object of coöperating in a possible effort at peace. Meantime, the peace negotiations at Versailles had raised fresh international difficulties for Holland, which gave Jhr. van Karnebeek, the Minister for Foreign Affairs, an opportunity of demonstrating that he pursued a circumspect but persistent policy.

In the early hours of Nov. 10 1918 the Government at The Hague had been surprised by the arrival of the German ex-Kaiser, who sought refuge in Holland. In accordance with ancient Dutch tradition concerning political refugees, the fallen monarch, and, afterwards, the ex-Crown Prince, were accorded the rights of asylum in Holland. When, in 1920, the Allies demanded the person of the ex-Kaiser, compliance was refused. The ex-Kaiser had his residence appointed in the village of Doorn, that of the ex-Crown Prince being in the Isle of Wieringen. They were allowed to remain in Holland on condition of refraining from all political activity.

Other difficulties arose out of Belgium's desire for a revision of the 1839 Treaties. Holland declared herself prepared to discuss the question at Paris on the basis of equality. This took place. It appeared that Belgium demanded the sovereignty (afterwards softened into "*maîtrise*") over the Western Scheldt and its dependencies, as well as over the canal and railway Ghent–Terneuzen, together with the right to use the Scheldt for defensive purposes in war time—further a *régime* in South Limburg which should guarantee her security, to which end it raised objections to Maastricht remaining Dutch. Moreover, Belgium asked for a canal running direct from Antwerp across Dutch Limburg to the Rhine and another from Antwerp to Hollandsch Diep.

Concurrently, various Belgian journals and the Comité de Politique Nationale demanded that the Western Scheldt, though it had been Dutch since the Middle Ages, Zeeland Flanders (which had been Dutch since 1648), and Limburg (which had been Dutch for the same time; Maastricht even since 1632), should all fall to Belgium. A storm of indignation was aroused in Holland, and the districts in question gave unambiguous expression of their attachment to Holland. The Dutch Government declined to discuss the question of territorial cessions, but declared themselves willing to coöperate in the construction of the canals, though they denied the necessity. They demonstrated moreover that, during the invasion by the German armies, it would have been disadvantageous to the Allies if Dutch Limburg had been Belgian and that the Western Scheldt would have been used as a submarine basis but for the Dutch character of the river. The Supreme Council decided that the revision of the Treaties of 1839 should be entrusted to a commission composed of representatives of the United Kingdom, the United States, France, Italy, Japan, Belgium and Holland; but the proposals of this commission should, in no case, contain suggestions for a transfer of territorial sovereignty or the establishment of international servitudes; moreover, Belgium and Holland were to endeavour to come to an understanding concerning the waterways. In the subsequent negotiations between these two countries agreement was reached on the administration and maintenance of the Western Scheldt, on the Antwerp–Hollandsch Diep canal, the Antwerp–Meuse–Rhine canal and the administration of the Ghent–Terneuzen canal. Agreement was reached, but a satisfactory settlement was prevented when, at the close of the negotiations, Belgium expressed the desire to discuss the question of the Wielingen, which constitutes the estuary of the Western Scheldt and over which Holland had exercised rights of sovereignty since mediaeval times. Holland proposed to settle the matter either by arbitration or by dividing the Wielingen along the middle of the channel, so that Belgium would obtain permanent free access to Zeebrugge and the adjoining North Sea ports, while Holland retained her free access to the Western Scheldt. Nor had Holland any objection to retaining the existing situation, which had never given rise to any difficulties. But Belgium demanded a solution according to her own wishes and broke off negotiations May 1920.

Holland joined the League of Nations in 1920, after having participated in the Labour Conference at Washington in 1919 and in the Seamen's Conference at Genoa in 1920. She was also represented at the assembly of the League of Nations at Geneva in Nov.–Dec. 1920. The Permanent Court of International Justice, in pursuance of the resolution of the League of Nations, was domiciled at The Hague.

In June 1921 the Cabinet of Ruys de Beerenbrouck saw their proposals for the reform of the army rejected, and tendered their resignation.

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(P. G.*; A. E. M.)

HOLROYD, SIR CHARLES (1861–1917), English painter-etcher (*see* 13.618*), died at Weybridge Nov. 17 1917. Many important additions were made to the National Gallery during his period as director, the chief of these being the Rokeby "Venus" by Velasquez. He also arranged for the transference of a large portion of the Turner bequest to the Tate Gallery.

HOLTZMANN, HEINRICH JULIUS (1832–1910), German theologian (*see* 13.620), died at Strassburg Aug. 6 1910.

HONDURAS (*see* 13.649).—Miguel R. Dávila, president of the republic of Honduras in 1909, was secure in his position only so long as President Zelaya of Nicaragua, whose creature he was, retained control. When Zelaya fell, Manuel Bonilla, the former president, who had fled from Honduras when Amalpa was surrendered in 1907, invaded the country from the north coast in 1910, quickly winning decisive victories. At a peace conference brought about by the United States the presidential power was confided provisionally to Dr. Francisco Bertrand. In the elections which followed Bonilla was successful by a nearly unanimous vote. He ruled until his death in 1913, when Dr. Bertrand, the vice-president, succeeded him. Bertrand was elected to the presidency in 1915. A Liberal revolution in 1919 was due to the claim by opponents of the Government that the election, then approaching, could not be fairly held. Vice-President Membreño and Gen. López Gutiérrez rose in arms against Dr. Bertrand. In Sept. the latter resigned and fled the country. Gen. Gutiérrez assumed dictatorial control, though Francisco Bogran was titular head of the Provisional Government. In the Oct. elections Gutiérrez defeated Membreño overwhelmingly. Deputies to the Congress and judges of the Supreme Court were then chosen.

The return of German property seized during the World War, in which Honduras joined by breaking relations with Germany May 17 1917 and by declaration of war on July 19 1918, was a difficult problem for the new Government, as was also the oft-recurring plan for the union of Central America. The Liberal party in power in 1920 declared itself to be ruling the country constitutionally, and to be labouring for the national development. The Government announced a policy of controlling foreign investments, which were large and important, by securing larger returns to the country from future concessions. Honduran representatives participated in the conference looking toward a unitary rather than a federal Central American union, and in Jan. 1921 signed the pact at San José de Costa Rica which provided for the combination *régime*. The new union was proclaimed Oct. 10 1921, and was composed of Honduras, Guatemala and Salvador. A new boundary agreement with Guatemala was arranged in Washington in 1919 through the good offices of the U.S. Department of State.

Economic and Social Conditions.—The pop. in 1914 was estimated at 562,000 and in 1916 at 605,997. Education showed slight advances during 1910–20. In 1913 there were 916 primary schools with an average attendance of 25,917 pupils. In 1918 there were 965 primary schools with 1,197 teachers, and 93,004 children of school age, of whom 33,127 were in attendance. In 1919 expenditures on education amounted to 384,980 pesos (nominally about £40,000), 63,406 pesos being furnished by the state and 321,574 by the municipalities. The national expenditures for 1916–7 were estimated at £421,261, with revenues the same. In 1919–20 the figure for each was £459,872. The external national debt was estimated on Dec. 31 1914 at £25,871,222, and on Dec. 31 1919 at £27,261,317. No interest had been paid on the debt since 1872. The Government took over the partly built railway contemplated under the original loan, and slightly extended it. On April 17 1920 the National railway, 53 m. long, was delivered by the Government to the Compañía Agrícola de Sula as security for a loan of $1,000,000 to be used in reconstruction of the road. There are over 400 m. of fruit company railways on the north coast and 150 m. of poor automobile roads.

The Banco de Honduras and the Banco Atlantida are the active financial institutions, and in 1920 had paper to the value of $110,000 in circulation. In 1919 the exchange value of pesos and dollars was fixed at two for one, and U.S. currency was made legal tender at that rate. It is practically the only circulating medium. In July 1920 an American economist, A. N. Young, was employed to draw up a financial programme looking toward settlement of the debt, establishment of a national bank, determination of limits for the budget, fixation of a gold monetary system, and general economic reforms. The banana crop in 1920 amounted to 9,631,568 bunches, worth $2,872,475. Sugar, coco-nuts, silver bullion, concentrates, and hides were the other chief exports. Coffee production increases, while rubber decreases. The coffee exportation in 1919–20 was 1,091,977 lb., worth $216,918. Sugar and alcohol were new exports. Tobacco was raised in El Paraiso and Copan provinces, the crop being about 1,750,000 pounds. Indigo culture was reviving, and the Government subsidized henequin production. Cattle-raising was carried on by over 1,500 ranches, which devoted 150,400 ac. to grazing. Cattle exports fell off from 21,911 head in 1913–4 to 6,482 in 1919–20. During the period 1910–20 imports exceeded exports owing to investments of American capital in machinery, etc.

The following table gives the imports and exports for recent years:

Years	Imports	Exports	Total Trade
1910–1	$3,560,939	$2,908,391	$6,469,330
1915–6	4,452,109	4,190,565	8,642,674
1918–9	6,931,376	5,997,741	12,929,117
1919–20	12,860,762	6,944,725	19,805,487

(H. I. P.)

HOOD, HORACE LAMBERT ALEXANDER (1870–1916), British naval officer, was born in London Oct. 2 1870, the third son of the 4th Viscount Hood and a lineal descendant of the 1st viscount, Adml. Sir Samuel Hood, captor of Corsica in 1793 (*see* 13.665). He entered the navy in 1883, won many prizes, and was promoted lieutenant in 1890. He saw service on the Nile (1897–8), being in consequence promoted commander. In 1903 he was promoted captain and served in the Somaliland expedition (1903–4), being awarded the D.S.O. (1904). He commanded a small squadron of battle cruisers in the battle of Jutland (May 31 1916) and went down on his flagship "Invincible."

HOOKER, SIR JOSEPH DALTON (1817–1911), English botanist (*see* 13.671), died at Sunningdale, Berks., Dec. 10 1911.

HOOPER, HORACE EVERETT (1859–1922), publisher of the *Encyclopaedia Britannica*, was born in Worcester, Mass., Dec. 8 1859. He was of English descent, his father's family having settled in New England about 1650, while his mother was a descendant of John Leverett, governor of Massachusetts 1672–1679. Having been educated in the public schools of Worcester and of Washington, D.C., he started in business in early life at Denver, Colo., but a few years later removed to Chicago where with others he organized the Western Book & Stationery Company with book stores in a number of the large western cities. In 1895 he moved to New York and joined a company for the sale of *The Century Dictionary*, and his success in this enterprise led to wider fields. In 1897 he went to London and arranged with A. & C. Black, publishers of the *Encyclopaedia Britannica*, for a reprint of the 9th Edition of that work, and with *The Times* for its sale through that paper. Later he purchased the copyright. By reducing the price and by providing for payments in small monthly instalments the sale of the work was revolutionized, 70,000 sets being sold in the next five years. The success of this enterprise led Mr. Hooper to have prepared, in 1902, a large supplement in 11 volumes (under the editorship of Sir Donald Mackenzie Wallace, President Arthur T. Hadley of Yale, and Mr. Hugh Chisholm) which, added to the volumes of the 9th Edition, formed the 10th Edition. For this also there was a large sale. His next enterprise was *The Historians' History of the World*, 1904, a work in 25 volumes. Meanwhile Mr. Hooper's relation with *The Times* grew more close. He took an intimate part in the business management, and it was at his suggestion and under his personal direction that *The Times Book Club* was formed. In 1908 when the proprietorship of *The Times* passed into the late Lord Northcliffe's hands, Mr. Hooper's connection with that paper came to an end.

In 1903 Mr. Hooper entered upon a larger enterprise than any yet attempted, the preparation of an entirely new edition, the 11th, of the *Encyclopaedia Britannica*, under the editorship of Mr. Hugh Chisholm. This was published in the closing months of 1910 and the first of 1911 under an arrangement with the Cambridge University Press. Hitherto all large works of reference had been issued volume by volume over a period of years. By his energy and the liberal expenditure of money, Mr. Hooper arranged that the 11th Edition of the *Encyclopaedia*

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* *These figures indicate the volume and page number of the previous article.*

Britannica should all be published at the same time, thus greatly enhancing the usefulness of the work. Of this edition 75,000 sets were sold in the next few years, the use of India paper being one factor in its success. In 1915 Mr. Hooper published the work in a smaller and cheaper form known as the Handy Volume Issue, the contents being identical with the original issue. In this form nearly 200,000 sets were sold within a few years. The last enterprise in which Mr. Hooper was engaged was the publication in 1922 of Three New Volumes of the *Encyclopaedia Britannica*, which supplemented the 11th Edition, and with the 29 volumes of that Edition made the 12th Edition.

Mr. Hooper's success in publishing and distributing so widely the important works mentioned above lay partly in the originality, boldness and brilliance of his operations, but chiefly in his faith in the intelligence and ambition of the great masses of the people. He believed in the educational value of good books, and that the people would order such books and use them if the matter were properly placed before them. The ideals he set before himself were the maintenance in the *Encyclopaedia Britannica* of the highest standard of scholarship and the placing of the work as an educational aid in the greatest number of homes. Many professional educators of note have done less than he toward popular enlightenment. For a number of years Mr. Hooper lived in England. He was a strong believer in the unity of the English-speaking peoples, and exerted his influence toward the removal of causes of friction between England and America and the establishment of cordial feeling and a mutual understanding. He died at Bedford Hills, N.Y., June 13, 1922.

HOOVER, HERBERT CLARK (1874–), American mining engineer and public official, was born of Quaker parentage on a farm at West Branch, Ia., Aug. 10 1874. He was left an orphan at an early age, his mother dying in 1880 and his father four years later. When 14 years old he ran away from a relative's farm in Oregon and went to Portland where he worked in a real-estate office. When Leland Stanford, Jr., University was opened in 1891 he entered with the first class and specialized in geology and engineering, supporting himself by working at various jobs in free hours. On graduating in 1895 he worked for a time at a California mine to get experience. Then he went to San Francisco and secured employment in the office of a mining engineer. In 1897 he went to Australia as mining engineer for an English syndicate and developed successful mines. In 1899, when a Department of Mines was created by the Chinese Government, he was appointed Director-General of Mines. Before departing for the Orient, he married Miss Lou Henry, a fellow student at college, daughter of a banker at Monterey, Cal. In China he made extensive surveys which, however, were interrupted by the Boxer outbreak; and he, together with his wife were among those besieged at Tientsin. After his return to America he had other offers from abroad, and thereafter was engaged in mining development throughout the world. From 1902 to 1908 he was a partner in the firm of Bewick, Moreing & Co., London, for whom he had gone to Australia in 1897. Later he was connected with several mining companies, with offices in London, and there he was when the World War broke out in 1914.

At that time thousands of Americans in Europe found their funds shut off, and Mr. Hoover headed a committee in London to give all possible assistance to those in England. The sudden invasion of Belgium by the Germans rendered a large part of the Belgian civilian population destitute, and on Oct. 22 1914 the Commission for Relief in Belgium was organized and Mr. Hoover appointed chairman. All his energies were now directed to securing food and vessels for its transportation and to directing its distribution in Belgium. This involved constant contact with officials of the warring countries, especially those of Germany, but he soon showed that the work was entirely neutral. Later the Commission's activities were extended to devastated northern France. After America's entrance into the World War the work had to be carried on by neutrals, but Mr. Hoover remained chairman of the Commission. Some idea of the business efficiency of the C.R.B., as it was familiarly called, may be gained from the fact that although almost $1,000,000,000 was expended on food and transportation, only about one-half of one per cent was required for overhead expenses. In Aug. 1917 he was appointed Federal Food Administrator. Already as chairman of the food section of the Council of National Defense he had begun to marshal all the agencies for economizing, especially on those foods which the Allies needed. He reached every American household by enlisting the services of the women. He instituted wheatless days and meatless days, and urged the avoidance of all waste. After the Armistice, 1918, his services were extended to the destitute populations of central Europe. Storehouses of food were established at various centres and a system of food-drafts was devised whereby relatives and friends could send relief where it was needed. In 1920 Mr. Hoover was mentioned as a possible candidate for president. He himself declared that he did not desire nomination, but later agreed to take the Republican nomination if it should be offered him. The party machine, however, did not give him any support. It was declared that he had long lived in England, and in only one case (1896) had he been able to vote for a presidential candidate. Throughout he kept up his work of relief, and at the beginning of 1921 was collecting funds as chairman of the European Relief Council, for the starving children of central Europe. In March he entered the Cabinet of President Harding as Secretary of Commerce, stipulating that he be allowed to carry out his European relief work, already begun. In the autumn of 1921 he undertook the general supervision of relief work in Russia, first having exacted, as a condition, the release of all American prisoners held by the Soviet authorities.

He was the author of *Principles of Mining* (1909). In 1912, in collaboration with his wife, he published as a sumptuous folio, an English translation of Agricola's *De Re Metallica*. This Latin treatise on mining and metallurgy had remained the standard text-book for almost 200 years after its appearance; the translation was a memorial to a pioneer contributor to the knowledge of a great profession.

(G. C. S.)

HOPE-HAWKINS, SIR ANTHONY (1863–), English novelist (*see* 13.682), was knighted in 1918. His later novels include *A Young Man's Year* (1915); *Captain Dieppe* (1918); *Beaumaroy Home from the Wars* (1919) and *Lucinda* (1920).

HORNE, CHARLES SYLVESTER (1865–1914), English Nonconformist divine, was born at Cuckfield, Sus., April 15 1865. He was educated at Newport grammar school and Glasgow University, and subsequently studied theology at Mansfield College, Oxford, becoming minister of Kensington Congregational chapel in 1889. In 1892 he married the daughter of Lord Cozens-Hardy, afterwards Master of the Rolls. He was chairman of the London Congregational Union in 1902, and in 1903 became minister of Whitefield's chapel, Tottenham Court Road. In 1910 he was elected Liberal M.P. for Ipswich. He died suddenly, May 1 1914. See *Life*, by W. B. Selbie (1920).

HORNE, HENRY SINCLAIR HORNE, 1st Baron (1861–), British general, was born Feb. 1 1861. He joined the Royal Artillery in 1880 and served on the staff throughout the South African War, taking part in Lord Roberts' advance from Cape Colony through the Orange Free State into the Transvaal and in various later operations, for which he was made a brevet lieutenant-colonel. He was promoted colonel in 1906, and from 1910–2 was staff officer for artillery at Aldershot; he then became inspector of artillery, and in Aug. 1914 he went to France in command of the artillery of the I. Army Corps.

He was promoted major-general for distinguished service in Oct. 1914, and in the following Jan. was given charge of the 2nd Division, which position he filled until Nov., when he went out to the Near East with Lord Kitchener. At the end of the year he was given charge of the XV. Army Corps in Egypt and he took this to France in April 1916 and commanded it during the opening phases of the battle of the Somme. His method of employing his guns during these operations attracted much attention and was signally successful, as was recognized by his being given the K.C.B. and by his being chosen in Sept. to succeed Sir C. Monro as leader of the I. Army. He was promoted lieutenant-general at the beginning of 1917, and his troops achieved very marked success during the fighting that took place about Arras and Lens in the spring. They took no part in the Flanders offensive later in the year, but when the enemy in March and April 1918 made his great effort they repulsed all attacks that were made upon their front. Then, when the Allies' counter-offensive developed in the late summer, their part in the final victories was conspicuous. For his services he was at the beginning of 1919 advanced to the rank of full general and on the final distribution of honours he was raised to the peerage as Baron Horne of Stirkoke and received a grant of £30,000.

HORNE, SIR ROBERT STEVENSON (1871–), British politician, was born at Slamannan Manse, Stirlingshire, Feb. 28 1871. He was educated at George Watson's College, Edinburgh, and at the university of Glasgow, where in 1893 he took first-class honours in philosophy. In 1895 he became lecturer in philosophy in the University College of North Wales, and from 1896 to 1900 was examiner in philosophy at Aberdeen University. In 1896 he was called to the Scottish bar. In 1910 he became a K.C., and stood unsuccessfully as Conservative candidate for Stirlingshire in both the general elections of that year. He joined the Royal Engineers on the outbreak of war, and in 1917 became assistant inspector-general of transportation. The same year he was made director of the Admiralty department of materials and priority. In 1918 he was elected for the Hillhead division of Glasgow, and became director of the Admiralty labour department, being also made third civil lord of the Admiralty and created K.B.E. In 1919 he became Minister of Labour. He presided over the National Industrial Conference of Feb. and April 1919. In 1920 he became president of the Board of Trade, and received the G.B.E. In 1921 he was appointed Chancellor of the Exchequer in succession to Mr. Austen Chamberlain.

HORSLEY, SIR VICTOR ALEXANDER HADEN (1857–1916), English surgeon, was born at Kensington April 14 1857, the son of the painter John Callcott Horsley. He was educated at Cranbrook school, and afterwards studied medicine at University College hospital, where he took his degrees in medicine and surgery in 1878 and 1880. He soon won a reputation as a gifted and successful surgeon, and on the brain in particular he did work of extraordinary brilliance. In 1886 he became surgeon to the National Hospital for Paralysis and Epilepsy, from 1884 to 1890 was superintendent of the Brown Institute at Lambeth, in 1885 secretary to the Royal Commission on Hydrophobia, and from 1891 to 1893 Fullerian professor at the Royal Institution. From 1893 to 1896 he was professor of pathology at University College, in 1902 he was knighted, and in 1906 became emeritus professor of surgery at University College hospital. In March 1916 he volunteered for service in Mesopotamia. He was sent up country, and died of heat stroke at Amara July 16 1916. Sir Victor Horsley was keenly interested in social questions, an ardent advocate of temperance and a strong supporter of woman suffrage. He unsuccessfully contested the university of London as a Liberal in Dec. 1910, and in 1912 came forward as candidate for Market Harborough. Here, however, he received no official support, and retired. He received honours and awards from many universities and scientific societies, and was first chairman of the representative meeting of the British Medical Association.

See *Life* by Stephen Paget (1920).

HORTHY DE NAGYBANYA, NIKOLAUS (1868–), Regent of Hungary in 1920–1, formerly an Austro-Hungarian naval officer, was born on June 18 1868 of a Hungarian family of Calvinist gentry. During the World War he distinguished himself, as captain of the battleship "Novara," by raids on the Italians in the Adriatic. He was adjutant to the Emperor-King Charles, and as Admiral and Commander of the Fleet he surrendered, at the Imperial command, the Austro-Hungarian fleet to the Jugoslavs when Austria collapsed. During the rule of the Soviet in Budapest he organized in Szeged the counter-revolutionary troops, at whose head he marched to Budapest after the fall of the Soviet republic on Nov. 16 1919, and took over the supreme military command in Hungary. As the exercise of the royal power by King Charles IV. was interrupted during the revolutions and on account of foreign complications, Adml. Horthy was, under Article 1 of the law of Jan. 1 1920, elected regent on March 1 1920. This highest position in Hungary he was to occupy indefinitely until otherwise directed by the National Assembly (*see* HUNGARY).

HORTON, ROBERT FORMAN (1855–), British Nonconformist divine (*see* 13.783), published his *Autobiography* in 1917.

HOSPITALS (*see* 13.791).—GREAT BRITAIN.—During 1910–20, and especially late in that decade, the problem of voluntary hospitals became gradually more acute. Considerable confusion had arisen in the minds of many people by 1921 as to the relative value of the various remedies that had periodically been suggested. Some of these suggested remedies had not received general approval because they failed to meet the situation as a whole; some were obviously devised to meet the pressing needs of an individual hospital heedless of the effect on other similar institutions, while other so-called cures were but attempts to remove some individual symptom. In other words, treatment has often been prescribed prior to the diagnosis of the disease. In order adequately to appreciate in broad outline the hospital problem as it presented itself in 1921 in Great Britain, it is necessary to consider its various aspects.

The Principle of Management.—There are three ways in which British general hospitals can be managed: they may be (*a*) controlled by the State; (*b*) controlled by the local municipality (county or borough councils); or (*c*) continued on the so-called voluntary basis, as at present.

The advocates of a State hospital service occasionally cite the excellent attainments of the military hospitals during the World War in support of their argument; but it should be pointed out that, although such hospitals were State institutions in so far as they were staffed and financed by the State, their success was in no small measure contributed to by the great volume of voluntary aid supplied in the form of personal service at the central hospitals as well as in the auxiliary institutions, which proved such a valuable adjunct to the military hospital system. The question of municipal control of the general hospitals of the country was discussed in Parliament and in the public press in 1920 in connexion with the Miscellaneous Provisions of Health Bill introduced by the Minister of Health, with the result that it soon became apparent how widespread was the opposition to the possibility of any such contingency. The opposition appeared to crystallize round the idea that the general hospitals would thus be brought into close proximity to, and therefore likely to be influenced by, the fluctuating tides of local politics. With possibly a preponderating vote for Labour in one area, and in another the controlling vote in favour of a policy for the reduction of local rates, the obvious result would be a disparity in the amount of hospital provision and in efficiency of management even greater than exists at present throughout the country. In the bill referred to, as originally introduced, the Minister of Health asked Parliament for powers to enable the county and borough councils (1) to supply and maintain hospitals, including out-patients' departments for the treatment of illnesses; (2) to contribute on such terms and conditions as the Minister may approve to any voluntary hospital or similar institution within their area. The Minister of Health repeatedly announced his desire to maintain the voluntary hospitals on their existing basis, but in asking for such wide powers in his bill he roused the opposition of many who read more into the bill than the minister really intended.

Although the bill never reached the Statute Book, it will doubtless be regarded by the hospital historian as having been the means of the voluntary hospital system making a real step forward, for out of the discussion on the bill came the establishment of the committee presided over by Visct. Cave, a body appointed by the Minister of Health "to consider the present financial position of voluntary hospitals and to make recommendations as to any action which should be taken to assist them." The appointment of this committee met with widespread approval, for all genuinely interested in British hospitals realize that the first essential step prior to any legislation is to investigate the evidence from the country as a whole and thus ascertain the existing "facts" from which to evolve some solution of the present problem. The Cave Committee was appointed on Jan. 25

1921, and on March 9 an interim report was published which contains the following important announcement:—

> "The evidence already received has convinced us that it is desirable in the public interest to maintain the voluntary system of hospital management."

Such an important pronouncement by a body of independent investigators could hardly fail to exercise considerable influence in stabilizing public opinion and to encourage that large body who by their voluntary contributions have hitherto been the mainstay of a hospital system which is regarded as unique in the history of charitable institutions. The Cave Committee recommended that a State grant of £1,000,000 should be made in relief of hospital finance, but in June 1921 the Government decided to make this only £500,000, the condition being that further voluntary effort should be made in order to keep the hospitals on an independent basis.

Hospital Finance.—Whoever seeks to investigate this aspect of the British hospital problem as a whole quickly encounters difficulties which may well appear almost insuperable. King Edward's Hospital Fund for London makes it conditional for any hospital applying for a grant that the uniform system of accounts be used, with the result that it is a comparatively simple problem to obtain a clear statement of the finances of any individual hospital, or of the group as a whole, in the London area which comes under the supervision of the King's Fund. But there is no supervising authority for the hospitals outside London, with the result that in the provinces, in Scotland and in Ireland the voluntary hospitals adopt a bewildering variety of forms for presentation of their financial accounts. This lack of uniformity makes it exceedingly difficult to ascertain the real financial position of many individual hospitals, and almost impossible to institute a reliable basis of comparison for the hospitals in the aggregate. Owing to the absence of a uniform system of hospital accounting, the annual hospital report is of little value for comparative purposes. The annual report as at present constituted is a production for "home consumption," that is, for the individual hospital committee, and is useful in comparing the costs of one year with another, but is of comparatively little value for the purposes of an inter-hospital comparison, and unless hospitals are in a position to compare themselves with similar institutions, they are apt to remain isolated units without the privilege of learning from the good points of their neighbours.

A reform urgently needed, not only for the provincial hospitals but also for those under the supervision of the King's Fund, is some simplified system for showing a hospital's financial situation, so that the subscribing public might readily understand the position of the institution they are asked to support. It is no longer enough for a hospital secretary to publish the bald statement on the front page of the annual report that such and such a sum of money is urgently needed to keep the hospital going. A hospital financial statement should set forth the total amount of money received during the year from all sources, from individual sources, and details of what has been done with the money received.

Prior to and during the World War the voluntary hospitals as a general rule experienced no great difficulty in obtaining financial support sufficient to meet their expenditure. Voluntary subscriptions and donations constituted the major portion of the receipts. Certainly during the years 1915–8 inclusive, when so many hospital beds were occupied by patients paid for on a capitation basis by the State, the majority of hospitals were able to show an ever-expanding income. But when this financial prop was removed during 1919 hospitals were caught unprepared.

When the military patients disappeared their places were speedily taken by non-paying patients. Hospitals had recourse to their old pre-war method of raising money, namely the spasmodic public appeal, only to find that such methods no longer possessed the necessary power of earlier days. The result was that hospital secretaries appealed through the public press for the support necessary to stave off the threatening financial disaster. But during this period, while so many were declaring their helplessness, several hospital secretaries took stock of the new conditions, realizing, amongst other facts, that the possession of money, as a result of the war, was more widespread amongst the community. They appreciated the fact that their hospital patients were drawn from a class of the community who were now, and had been during the war, in receipt of much higher wages than formerly, and to these employees in factories and workshops the hospital secretaries appealed for weekly contributions and organized the necessary machinery for collection. This source of revenue has proved most profitable to many hospitals, but unfortunately there are some hospital secretaries who appear reluctant to explore this source of wealth that is so ready to their hand.

In 1919, a period before workmen's contributions had been generally adopted by the hospitals, it was found that, out of 600 hospitals (in the provinces) investigated, 374 showed contributions from employees amounting in the aggregate to £518,043, or approximately 20% of their ordinary income.

Again, many hospitals realized that there were those amongst their in-patients who were no longer content to place a small coin in the hospital poor-box in gratitude for the services received, but who now desired to pay a more substantial contribution towards their expenses, so that in 1921 the majority of the hospitals had in operation one of three possible methods by which patients' payments are made:—(*a*) Many hospitals had adopted the almoner system, that is, specially appointed hospital employees who approach the individual patient who comes to hospital, explain the needs of the hospital, and invite the patient to contribute according to his ability. (*b*) A few hospitals had adopted the less popular plan of instituting a fixed daily or weekly levy from their patients on account of maintenance. (*c*) Comparatively few hospitals in 1921 were without the reserve of a small number of beds for patients who desired to pay the cost of their maintenance. Many of the small or cottage hospitals in the provinces had instituted the system of paying-patients some years before, but there were still some of the larger type of hospitals that had made no such arrangements. The London hospitals were quickly adopting some system of patients' payments, as shown by the following figures. In 1913 the amount obtained from payments made by or for patients was £78,000. In 1919 it was £124,000—an increase in the six years of £46,000—whereas in 1920 the total from this one source reached £230,000; and if patients' donations are included the total reached was £260,000—an increase of £182,000 in the seven-year period. In the provinces in 1919, 600 hospitals with 33,514 available beds showed a total ordinary income, including un-earmarked legacies, of £3,486,098. Payments made by or on behalf of patients amounted to £803,741, or 23% of the total ordinary income. It has to be pointed out that these figures being for 1919 include some figures that may be regarded as non-recurrent—namely, capitation payments for the military patients who were then remaining in hospital. The question of "paying-patients" in voluntary hospitals was repeatedly urged by that great hospital authority the late Sir Henry Burdett, who pleaded with the hospitals to adopt the principle not only as a relief to hospital finance but as broadening the basis of usefulness to the community.

The following figures, supplied by the Cleveland Hospitals Survey are from three large American general hospitals and show the ratio of paying to non-paying patients:—

	Percentage of Total Admissions.		
	Hospital I.	Hospital II.	Hospital III.
Patients paying full cost of maintenance	41·9	27·9	30·5
Patients paying part cost of maintenance	20·8	40·9	49·3
Patients paying nothing towards maintenance	30·1	15·5	20·2
Patients unclassified	7·2	15·7	0·0
	100	100	100

Of the various other possible sources of hospital income in England there is one that calls for special comment—namely, payment on behalf of National Insurance patients. The section of the National Insurance Act dealing with medical benefit does not make provision for the payment of hospital treatment. The operation of the Act has thrown an unexpected volume of work upon the voluntary hospitals, both in the in-patient and out-patient departments. This fact, with all the expense involved to the hospitals, was rather obscured during the six years of the war period because of the necessary pressure in making provision for the treatment of military patients and also because hospitals were in receipt of enhanced incomes from the War Office; but after these conditions had disappeared the hospitals realized the great pressure that the operation of this Act placed on their finances. Medical men who act as panel practitioners continued to recommend their panel patients to the hospitals in increasing numbers and for these the hospitals received no direct payment. Hospitals had some claim for financial consideration for the treatment of patients under the National Insurance Act. Such payment should not take the form of a capitation rate, as such rates would inevitably tend to rise and have the effect of drying up income from voluntary sources and also probably in time necessitate some degree of State control over the hospitals on behalf of the approved societies. Any payment for insured patients might rather take the form of block grants to hospitals, administered through a central hospitals board, after careful assessment of the general work of the hospitals, especially in regard to the standard of service and also of the efficiency of administration.

In discussing the disposal of the accumulated surplus, estimated at approximately £7,000,000, Lord Cave's Committee in their interim report made the following statement:—

> "We are strongly of opinion that, in the interests both of the hospitals and of the societies, the schemes to be approved should provide for the application of a substantial part of the disposable surplus in providing a contribution towards the cost of the maintenance of members in hospitals."

Hospital Expenditure.—Too often the superficial view is taken that what is known as "the hospital problem" is merely a consideration of finding the additional income that is required. On the contrary, another aspect of the problem of equal if not greater importance is the question of hospital expenditure. In times past, when hospitals received from the subscribing public whatever income they chose to appeal for, there was not that incentive to exercise scientific check and control over expenditure that became urgent when income was so much more difficult to collect. This subject of hospital expenditure is pregnant with great possibilities for economy, provided there could be established the necessary supervising authority to carry out the investigations and the consequent recommendations. Intimate knowledge of both military and civil hospitals reveals one point of marked difference between the two types, greatly to the financial advantage of the former, namely—a coördinating authority. In the British military hospitals a system of comparative "returns" was instituted by the army medical department dealing with such items of expenditure as food, drugs and surgical dressings, laundry, personnel, etc. These "returns" were of two kinds: (*a*) intra-hospital, comparing ward with ward; and (*b*) inter-hospital, comparing individual hospitals with each other. The circulation of these "returns" exercised a silent pressure which resulted in an enormous reduction in expenditure. The good points of any one hospital were soon brought out in the circulating returns and became apparent for other hospitals to emulate. No such inter-hospital comparison existed amongst the voluntary hospitals: each hospital was an isolated unit, with little regard to any other hospital and learning few of the good points from its neighbours. It would be almost futile to set up any basis for stabilizing the financial position of hospitals without the necessary corollary of establishing some system of coördination. Hospitals themselves admit the necessity for something of the kind to be established, but so long as the spirit of individualism prevails there can be small prospect of any system of coördination being set up from within the hospitals themselves. It must be instituted by some body outside the hospitals having the power to render monetary assistance to the hospital. In the absence of coördination amongst the hospitals it is a fair deduction to say that the money subscribed by the public is not put to its best use, for there is not only considerable overlapping on the part of the hospitals in purchasing commodities—hospitals competing against one another in the same market, sometimes in the same town—but there is also overlapping of hospital accommodation.

In some parts of England there are more hospital beds than are required, while in other areas there are large waiting lists of patients which the hospitals are not overtaking. No one in 1921 had any authority to exercise influence over the hospitals so as to come to some arrangement by which the smaller hospitals might bring relief to the big hospitals by taking over some of the patients who suffer from less severe ailments. The large general hospitals are necessarily expensive institutions because of the special equipment and staff required, and when these hospitals become full and waiting lists develop, the hospital committees usually begin to think of means to extend their accommodation, or, in other words, *to enlarge the inlet* into the hospital; whereas a more practicable policy would be to evacuate their patients more rapidly into auxiliary institutions, such as the cottage hospitals in the surrounding country—in other words *to enlarge their exit*. Further, there is urgent need for some scientific scheme of training for hospital administrators. The standard of administration in 1921 varied within wide limits in the voluntary hospitals. The only experience some of the existing administrators had had was in office under the superintendence of their predecessor, and therefore they were apt to be content to attain to the standards of the past. Hospital administration has become an increasingly complex science, due partly to the ever-increasing specialization of the various departments. It is widely recognized that a carefully selected course of training is required for a woman to become an efficient almoner; so also the hospital treasurer has to be scientifically trained in the various branches of accountancy. But for the more responsible office of hospital administrator no special standard of training seems to be expected, nor is special training available.

A hospital is much more complex than most business organizations of equivalent size. Its peculiarity is the inclusion of a number of different professions, each highly specialized, which must work together and which must be kept in effective working relations. The basis of a hospital is its medical staff, but in addition to this medical element is the business administration represented by the superintendent and his administrative assistants. The nurses form another highly specialized and well-organized group. Social service (hospital almoners) represent still another and different type of work in the hospital; and there are, finally, the housekeeping, mechanical and clerical groups, who maintain the essential daily routine of the hospital. It should be added that while the emphasis of the work of most superintendents is on the business side, the superintendent ought to interpret, develop and represent all phases of a hospital's activity. Hospital personnel thus includes such widely varying elements and draws them into such intimate relationship that the successful organization and administration of a modern hospital is a difficult matter requiring special training and skill.

In America this problem of the training and equipment of hospital administrators has also been experienced, and a committee has been established, under the auspices of the Rockefeller Foundation, to report upon "the need and practicability of inaugurating a course of training for hospital executives."

Available Bed Accommodation.—"Hospitals represent, or ought to represent, the organization of medical services upon a scientific basis, bringing to bear upon the needs of the individual patient the maximum resources in equipment and skill that 20th-century medical science can muster. To promote a better understanding of hospitals by the community is to promote at the same time their better and more discriminating utilization and their more effective and generous support." This quotation from the Cleveland Hospitals Survey briefly expresses the ideal service that hospitals offer to the community. The British public have become educated during recent years to appreciate the valuable medical and surgical services now provided in general and special hospitals, hence the ever-increasing demands made by patients seeking to avail themselves of the best that medical science can give. These scientific developments within the hospitals, on the one hand, and the appreciation of them by the public on the other, disclosed a situation that called for investigation and reform—namely, the failure of hospital accommodation to keep pace with the demands. At the beginning of the 20th century the generally accepted hospital bed rate was one bed per 1,000 population, but that ratio was no longer maintained in 1921, for, as in the case of general housing of the people so with the housing of the sick in hospital, the supply of hospital accommodation had fallen in arrears in many districts since the time at which the hospitals were erected. The number of hospitals that can show "waiting" lists of patients seeking admission is too large for this aspect of the hospital problem to be ignored. Many hospitals have of recent years become so accustomed to the waiting-list problem that we are liable to overlook the fact that such lists imply a considerable amount of preventable human suffering, especially in the case of patients with haemorrhoids and hernia, and yet these diseases are responsible for the majority of the names on a waiting list. Further, some hospitals keep no record of the number of cases that have been refused admission owing to lack of accommodation. A hospital committee of management ought to be furnished each month by its superintendent or officer in charge with a statement showing the number, sex and age of each applicant for hospital accommodation that was refused admission and the reasons for the rejection. Such a procedure would educate those responsible for the good government of the voluntary hospitals to appreciate to what extent their institution was meeting the needs of the community.

But it is not only in regard to accommodation for patients in hospital that consideration is required, but also in regard to the accommodation for staff. With the reduction of nurses' hours on duty and consequently the increased number who have to be employed to overtake the work of the hospital, many hospitals have found their accommodation for staff inadequate. This was in 1921 one of the most pressing problems before many hospitals.

Hospital accommodation, whether for patients or staff, is obviously closely dependent on finance, and the financial position of these hospitals in 1921 was such as to put hospital extension entirely out of the question. In the London group of hospitals these financial difficulties regarding capital expenditure on increased accommodation were being experienced, as elsewhere. In the interim report by the Policy Committee of King Edward's Hospital Fund for London, dated April 12 1921, referring to increase of hospital accommodation, the following statement occurs:—

"In spite of the large sums already subscribed by the public, it is evident that the financial problem of making provision for even the most urgent development of hospital accommodation is a serious one; and the possibility of saving capital expenditure by making use of any existing buildings, whether at present under voluntary management or not, requires the fullest consideration, including, for example, the question of homes of recovery and the question of unused beds in Poor-Law infirmaries."

Hospital Standards.—No investigation of the hospital problem would be complete without some reference to the question of hospital standards. Any reference to standardization in connexion with hospital work is apt to convey, to those who are satisfied with a superficial view, the suggestion that this implies interference with initiative and the substitution of mechanical limitations.

On the contrary, some voluntary hospitals fail to function to their highest capacity because of the absence of definitely accepted standards. When a minimum standard of efficiency is defined, below which no hospital should be allowed to fall, there is no implication that any hospital should rest content on this minimum line; but the public have a right to expect that some accepted standard is maintained. Necessity exists for a generally accepted hospital standard in regard to two subjects—namely, hospital accounting and the training and equipping of hospital superintendents. In respect of the former some standard of uniformity is required before hospitals can be adequately compared with one another. This does not necessarily imply interference in any individual hospital with the system of book-keeping that may have been evolved to meet local requirements, but in addition to that the hospital should, for the purpose of an inter-hospital comparison, conform to some uniform system of accounts. Again, it has been pointed out how essential it is that some standard of efficiency in training should be expected from any applicant for the post of hospital administrator.

Nurses' Training.—Another hospital service that requires a minimum standard to be fixed is that of nursing, both as regards training of the individual nurse and also the ratio of nursing personnel to hospital beds. A general hospital with a minimum of 50 beds may be sanctioned as an authorized school of training for nurses with permission to grant to the successful candidate a certificate of proficiency. It is well known that the standard of hospital training of a nurse varies widely in different hospitals, depending very largely on the requirements of the individual matron. In some hospitals the standard required of the nurse is very high; it may be even too high, calling for the comment from competent judges that a nurse's training should be restricted to nursing matters and not trespass into the domain of the medical man; while in other hospitals the standard of training is very much lower. Both sets of nurses "qualify" and issue from their respective training schools into the service of the public, each possessing her certificate of proficiency. The public have no means of judging as to the quality of the training of the nurses they seek to employ beyond the general label that "she is a certificated nurse."

The probationer nurses receive technical lectures from the matron and her senior assistants and from members of the junior medical staff of the hospital. Unfortunately there are too many hospitals to-day where the same individuals who give the tuition constitute the examining body, whereas in the larger hospitals one or more "external" examiners are appointed to share in the examination of the candidates. It is surely obvious that in such an important profession as nursing there might have been evolved ere this some definite minimum standard of proficiency applicable to all training schools. Again, it is not suggested that hospitals be asked to conform to some rigid mould of training, but in the interest of nurses themselves, and especially of the general public, some minimum standard should be fixed below which no hospital should fall.

A parallel illustration might be quoted in the final examination of the medical student, for it was only after the General Medical Council instituted a system of inspection of the various "final" examinations held throughout the country that something approaching a minimum standard of proficiency was adopted. Further, in regard to the ratio of nurses to beds, hospitals show a considerable range of difference, even after making due allowance for the variety in architectural structure of the buildings. The absence of any standard in this connexion makes it very difficult to institute a comparison between similar hospitals and renders of little value the figure quoted by hospitals as being the "cost per bed," for it is obvious that if one hospital employs more staff than its neighbours, the cost of provisions consumed by them but attributed to the patients will be higher, and so also with salaries and wages.

In conclusion, it may be stated that there is practically no department in a general hospital where some basis could not be arrived at for instituting standards of efficiency. Such standards would be of considerable value to the hospitals themselves and also to the general public, both in regard to economical administration and in the general service to the community; but owing to the want of knowledge of each other, hospitals at present lack the information that would be of so great value in the establishment of standards. This knowledge would readily be forthcoming under a system of hospital coördination, and the institution of some such system seems the most essential step towards a solution of the present-day hospital problem. (N. B.)

UNITED STATES

The hospitals of the United States in the years 1910–21 grew in number and made progress in the acquirement of national characteristics and fixed economic and social importance. In 1921 there were in the United States 7,667 hospitals maintaining 695,698 beds; in addition 24,394 beds were used for hospital purposes in homes for aged and in similar institutions. Table I. presents an analysis of these hospitals.

TABLE I.

U.S. Hospitals.

- Public: supported by taxation.
  - Federal, State, County, Municipal.
- Private: supported by earnings, endowments and contributions.
  - Proprietary, for profit.
    - Small hospitals for patients of one proprietor—a physician or surgeon.
    - Larger institutions for patients of a group of owners.
  - Voluntary Corporations not for profit.
    - Church
      - Catholic.
      - Protestant.
    - Non-Sectarian. (Covering the larger endowed general hospitals, including those connected with universities.)
  - Hospitals for special groups maintained by
    - Fraternal Orders.
    - Large Industrial Plants.

The proprietary hospitals show a much larger proportion of the total number of hospitals than of the total number of hospital beds, as most proprietary institutions have less than thirty beds. Larger proprietary institutions are divided into two classes. Some are jointly owned by two or more physicians or surgeons who combine to gain the increased facilities and efficiency obtained by pooling the volume of their professional business. Others are controlled by specialists corresponding to the departments of a general hospital—including X-ray and all forms of laboratory work. This was a recent development and the number of such hospitals was in 1921 few, but they showed great efficiency. The numbers will increase and in 1921 there was evidence that the basic idea—commonly called "group practice" —was bettering the professional service in other hospitals.

The hospitals in 1921 were classified by capacity as follows:

Bed Capacity	Hospitals	Percentage
Under 25	3,110	40·56
25 to 49	1,859	24·24
50 to 99	1,263	16·47
100 to 199	781	10·19
200 to 499	405	5·28
500 to 999	116	1·52
1,000 and over	133	1·74
	7,667	100·00

In discussing the number of active hospital beds (exclusive of convalescent and allied institutions and hospitals for nervous or mental diseases) needed by a given population, the figures for

TABLE II.—*Hospitals and Active Hospital Beds by States, and Ratio of Beds to Population.*

States	Hospitals	Beds	Ratio of Beds to Pop.
Alabama	84	4,214	1 to 557
Arkansas	58	3,147	1 to 556
Arizona	66	2,285	1 to 146
California	409	27,384	1 to 125
Colorado	109	8,629	1 to 108
Connecticut	71	6,466	1 to 213
Delaware	16	1,005	1 to 221
District of Columbia	28	5,160	1 to 84
Florida	61	2,436	1 to 397
Georgia	88	4,263	1 to 679
Idaho	57	1,738	1 to 238
Illinois	304	29,215	1 to 222
Indiana	148	8,902	1 to 329
Iowa	193	8,321	1 to 289
Kansas	122	4,950	1 to 357
Kentucky	87	5,134	1 to 471
Louisiana	53	5,553	1 to 324
Maine	56	2,477	1 to 310
Maryland	70	9,319	1 to 156
Massachusetts	298	23,314	1 to 165
Michigan	206	16,384	1 to 224
Minnesota	212	11,903	1 to 200
Mississippi	50	2,017	1 to 887
Missouri	149	12,476	1 to 273
Montana	99	4,238	1 to 129
Nebraska	100	4,894	1 to 265
Nevada	27	734	1 to 105
New Hampshire	52	1,994	1 to 222
New Jersey	127	12,121	1 to 260
New Mexico	54	3,939	1 to 91
New York	537	66,274	1 to 157
North Carolina	112	5,641	1 to 453
North Dakota	67	2,476	1 to 261
Ohio	280	19,059	1 to 302
Oklahoma	99	3,292	1 to 616
Oregon	98	4,127	1 to 190
Pennsylvania	378	38,962	1 to 224
Rhode Island	32	3,291	1 to 184
South Carolina	57	3,640	1 to 463
South Dakota	70	2,892	1 to 220
Tennessee	86	7,452	1 to 314
Texas	225	12,300	1 to 379
Utah	46	1,965	1 to 229
Vermont	31	1,083	1 to 325
Virginia	106	7,553	1 to 305
Washington	162	8,384	1 to 162
West Virginia	74	3,636	1 to 402
Wisconsin	95	11,106	1 to 237
Wyoming	42	2,520	1 to 77
Outlying Possessions	131	13,902	1 to 758

Boston and for Massachusetts usually are cited as standard for a city and a state, New York's requirements being considered exceptional. Boston has one bed for each 110 inhabitants and Massachusetts one for each 165, and these never seem too many—indeed, scarcely enough. But the Boston hospitals admittedly draw some patients from other states.

Students of public health and welfare have agreed that any city must have at least one active bed for each 200 of population to meet its obvious obligations and that any state should have one bed for from 200 to 300 depending on the density of the rural population and its proportion to the urban population.

Table II. on the previous page shows conditions in 1921, convalescent and allied institutions and all hospitals for the nervous or insane being excluded.

Classification.—Two-thirds of the hospitals in the United States in 1921 were classified as general, one-third as special, *i.e.* confining their work to tuberculosis, general contagious, mental and nervous diseases, maternity, etc. Nearly all limited their admissions to acute cases, with the result that the lack of provision for chronic cases was the prominent defect.

Finances.—The rapid increase in operating costs following the outbreak of the World War was a serious problem to American hospitals. Nearly all hospitals in 1921 admitted three classes of patients: (*a*) those paying full cost of their care; (*b*) those paying part of the cost in definite charges; (*c*) those paying nothing. "Pay" hospitals adjusted themselves to the new conditions by increasing their charges; "part pay" hospitals were generally able to obtain larger rates from patients during the war. Until deflation began there were fewer free patients than before the World War. This circumstance, the increase of (and the payment received from the Federal Government for) soldier patients, enabled the hospitals to meet their increased costs.

Answers to a general questionnaire in 1921 showed the actual investment in buildings and original equipment to average $4,714 per bed, no allowance being made for subsequent increases in values of land or buildings. On this basis the first cost of building and equipping the American hospitals had been $3,279,520,372. Annual maintenance cost for 1920 was $791 per bed. This figure, applied to the entire field, shows a total annual operating cost of $550,287,118. The above figures were compiled by the *Modern Hospital* with the aid of various agencies and organizations.

Equipment.—During 1910–20 there was a marked change in the equipment of the average hospital. The previous development in clinical and pathological laboratory facilities and work continued and expanded. An institution in 1921 had little claim to rating as a hospital unless it had a working X-ray equipment and was prepared to carry out any pathological and clinical laboratory work, including serological examinations, at least to the extent of the Wasserman test. To do this many institutions were compelled to make working arrangements with private firms or with other institutions, but the essential aim—that of making the service available to the patients in the hospitals—was secured. The average mechanical equipment also was much improved.

Medical Education in Hospitals.—The Council on Medical Education and Hospitals of the American Medical Association was in 1921 making a real contribution to the professional work of hospitals, as well as developing the fifth or intern year of medical education, by establishing a routine inspection of the hospitals' facilities and personnel for the instruction of the interns. Lists of approved hospitals were published and were of great service, as there were more positions for interns than new graduates in medicine, and a hospital was forced to comply with the requirements for admission to the approved list in order to obtain interns.

New Hospitals.—There was a distinct movement in the decade 1910–20 to make hospital service available to everyone. State legislation enabling rural counties with small populations to combine for the support of one hospital, and encouraging average counties without hospitals to erect and support one, was responsible for the larger part of the increase. Such county hospitals have their work supplemented through private endowment or gift and admit the private patients of the physicians in the county. The need for free service in some counties is very small. The hospital is often in type a community institution quite different from the county hospital in a large county having many private hospitals. In these large counties the county hospital provides largely for free or chronic patients and often acts as a department of public service for the poor.

Organization.—The American Hospital Association has both institutional members (hospitals) and personnel members, such as hospital trustees, persons on the medical staff, superintendents and department heads. State associations similarly organized were being formed rapidly in 1921 as state sections of the American Hospital Association. There was also a Catholic Hospital Association. There were many National associations of the nurses, social workers and dietitians. These were all united in the American Conference on Hospital Service, formed to deal with questions larger than those of any one of the associations. (A. R. W.)

HOUGHTON, WILLIAM STANLEY (1881–1913), English playwright, was born at Manchester Feb. 1881, and was educated at the Manchester grammar school. He became a cotton-broker, but employed his leisure in dramatic criticism for the *Manchester Guardian* and in the writing of plays. *The Dear Departed* was produced by Miss Horniman in Manchester in 1908 and afterwards in London. With *Hindle Wakes* (1912) he leapt into fame. It had a long run in London and later in the same year *The Younger Generation* (written and played in Manchester in 1910) was successfully produced at the Haymarket theatre, London, with *Trust the People* the following year at the Garrick and *The Perfect Cure* at the Apollo. His early death in Manchester Dec. 10 1913 cut short a career of much promise.

HOURS OF LABOUR.—The decade following 1910 witnessed a rapid advance and extension in the already widespread movement in favour of the reduction of the hours of labour. This was mainly due, apart from general trade-union pressure, firstly to the repercussions of the World War and of experience of industry under war conditions, and, secondly, to the international recognition of the principle of the 8-hour day in the Treaty of Peace of Versailles as one of the "principles . . . well fitted to guide the policy of the League of Nations."

Until the outbreak of the World War the movement in favour of the reduction of hours, and particularly in favour of the 8-hour day, had gone forward but only slowly and spasmodically. International conferences of workers passed the ordinary resolutions demanding the 8-hour day, as did the International Socialist Conference of 1910, the International Textile Workers' Conference in 1911 and the eighth Congress of Trade Union Secretaries in 1913. In 1912 the International Association for Labour Legislation asked for a 56-hour week for glass-workers, an 8-hour day for the iron and steel trades, for workers in paper and pulp mills and in the manufacture of chemicals. In the following year the Miners' International Congress demanded the day of eight hours "bank to bank." The official delegates of the Berne Conference in 1913 contented themselves with a proposal to limit the hours of child workers to 10 daily—a proposal which the International Association for Labour Legislation adopted in 1918, with the suggestion that part of the working day should be devoted to trade education. The Berne Conference further suggested a 10-hour day for women workers.

The comparatively moderate nature of the majority of these pre-war proposals—and indeed of certain later ones, such as that of the Congress of Inter-Allied Trade Unions at Leeds in 1916, which asked for the 10-hour day, and that of the International Trade Union Congress held at Berne in 1917, which demanded that the daily maximum should be gradually reduced to 8 hours—would hardly have prepared the student of these matters for the very striking advances which became operative in the chief industrial countries between the Armistice and 1921. The advance is also to be noted in recent expressions of trade union opinion, in the movement for the 7- and even for the 6-hour day in coal-mining, and in such pronouncements as that of so influential an employer as Lord Leverhulme in England, who in 1918 himself advocated the 6-hour day on economic grounds.

The outbreak of war had been followed in all the belligerent countries by the suspension of all limitations upon the hours of labour worked in industries of importance in the conduct of the war, whether these limitations arose from agreements with the trade unions, from legislation or from custom. In all cases the general course of events was the same. After some difficulty, varying in degree with the imminence of the threat to national safety and with the strength of trade unionism, the workers consented, were persuaded by tempting rates of wages, or were coerced to lengthen the working day. In all cases, after the experience of a period of excessively long hours, it was found that the returns from overtaxed labour rapidly diminished, and in all cases limitations were sooner or later re-imposed, not, however, reducing hours to the pre-war standards, but calculated to yield the highest return in output from the personnel available.

War experience would thus seem to have effectively killed the long-lived notion that output in industry varies directly with the number of hours worked. The argument in favour of the shorter working day was indeed formidably (and perhaps unexpectedly in certain quarters) strengthened by the scientific investigation of hours in relation to output, which was undertaken, by Great Britain and America in particular, in the height of the desperate struggle to produce adequate supplies of munitions of war. The results of the British investigations, published in the various reports of the Health of Munition Workers Committee (appointed by the Ministry of Munitions in Sept. 1915) and of the British Association for the Advancement of Science, were of the highest scientific value, and these, corroborated by the evidence of American, French and German experience, and themselves corroborating much of the argument of certain investigators whose work had been done before the war, undoubtedly were an important factor in determining the attitude of mind which is reflected in the above quoted "principle" enshrined in the Treaty of Peace.

War experience did, in point of fact, supply the scientific basis which the general propaganda, carried on for so long by the organizations of workers in all industrial countries in favour of the reduction of hours, had lacked. Such scientific data as existed had been provided or interpreted for the most part by writers on so-called "scientific management" who were concerned primarily with questions of output. Governmental investigations had to consider output *in relation to the labour available*, and were led inevitably to considerations of the health of workers and even of their satisfaction or dissatisfaction. In other words, whilst previous investigations were, rightly or wrongly, suspected by workers generally to be directed by motives which, if not hostile, tended at least to a certain neglect of the workers' side of the case, the war investigations were much more widely accepted as being a fair attempt at an adequate study of the question of hours in relation not only to output but also to the effect on the worker.

It need only be added here that the general result of those investigations was that a reduction of hours was not incompatible with an increase in output, arising from the improved health of the worker and his increased capacity for effort during the shorter hours worked.

The war, however, was responsible for another and perhaps even more effective factor in the eventual restriction of hours. The repercussions of the successive Russian revolutions were everywhere felt and everywhere dreaded. It became a commonplace of polemic on the subject of improved conditions of labour that such improved conditions (including the reduction of the hours of labour) were the alternative to Bolshevism. Thus scientific experience, fear of revolutionary movements and the normal liberalism of the nations successful in the war were united in support of a general reduction in the hours of labour at the moment of relief and optimism which succeeded, in the later months of 1918, the long and oppressive years of warfare.

The results of this combination are to be found in the rapid extension of legal restrictions upon the hours of labour which took place in many of the belligerent countries immediately upon (or even before) the Armistice of Nov. 1918, and in the inclusion in the treaties of peace of the "Labour Part" (Part XIII. in the Treaty of Versailles) which creates machinery for international legislation upon labour conditions, and which recognizes the 8-hour day as an end to be pursued by international action.

In the middle of 1921 signs were indeed not lacking that a characteristic of the next few years might be a reaction in this connexion. Hopes of rapid recovery to the economic position of pre-war days had been disappointed, and there was a manifest tendency to place part of the blame for this upon the reduced hours of labour. It can only be noted here that this reaction seemed likely to result in a check to the movement for a further reduction in hours of labour.

NATIONAL MEASURES

National legislation for the limitation of the hours of labour has taken various forms. In some cases, *e.g.* France, Spain, Portugal, acts or decrees have prescribed a *general* limitation for all workers, or for all workers in large groups of occupations such as "industry," or "commerce," whilst the detailed application has been left to be elaborated by administrative decrees or orders. Usually these decrees are issued after consultation with the organized workers and employers concerned, and they appear to result in a considerable elasticity in the application of the law. In other cases (*e.g.* Netherlands, Czechoslovakia, Belgium) the act itself is made to apply to a detailed list of industries, and the exceptions are usually indicated. Again, as in the case of Great Britain (Coal Mines Act) a special Act may regulate the hours worked in a particular industry.

Another group of legislative measures deals with the hours of labour of specified classes of workers, women and children and men, engaged in hazardous occupations. In Great Britain the Factory Acts have attempted to regulate the hours of women and children, who were regarded as being less favourably situated for "free bargaining" than men, but it was not until 1908 that legal restrictions were placed upon the working hours of the latter, and then only in the case of a single industry, coal-mining, which was of a peculiarly difficult and laborious nature.

A third type of legislation secures the aim of limiting hours of labour by indirect means. In the Commonwealth of Australia, for example, and in its constituent states, the Arbitration Laws provide for the settlement of disputes in labour matters (including disputes about the hours of labour) by a process of arbitration and the legal enforcement of arbitration awards. Again, in the case of Germany and some other countries, collective agreements arrived at voluntarily between employers and workers' organizations may under certain conditions be given the force of law.

There remains to be noted the huge mass of collective agreement upon hours of labour which, though not always possessing the force of law, does in fact regulate hours very successfully in many countries. This is notably the method adopted for most industries in Great Britain, but the practice is common even in countries where legislative limits are enforced. In these cases the collective agreement is usually an advance, from the workers' point of view, upon the provisions of the existing legislation.

The analysis, given later, of the position in 1921 in the more important industrial countries of the world will illustrate these methods of limitation.

(*a*) *Exceptions of a General Nature.*—All national legislation on the subject of hours provides for exceptions of a general nature, affecting the whole field of application of the legislation, as well as for exceptions in particular cases.

To provide for the former class of exceptions, which may be classified as those arising from national necessity, clauses are usually inserted which give the administration power to suspend or relax temporarily the regulations normally in force. In the case of the draft International Convention (see later) it is provided that "the operation of the provisions of this Convention may be suspended in any country by the Government in the event of war or other emergency endangering the national safety" (Article 14). From national legislation the following may be cited:—"Extension of the working hours shall be permitted in cases of urgent public necessity, mobilization, fire, flood, landslips, explosion, grave disaster, in all cases of *force majeure* . . . " (Portugal; Decree of May 7 1919, limiting the hours of work in commercial and industrial establishments).

"His Majesty may, in the event of war, or of imminent national danger, or great emergency . . . by order in Council suspend the operation of this Act to such extent and for such period as may be named in the Order either as respects all coal mines or any class of coal mines" (Great Britain: Coal Mines Regulation Act, 1908).

(*b*) *Exceptions in Particular Cases.*—Experience of the working of national legislation has proved that *a priori* arguments against the possibility of a universal application of the 8-hour day—or even of a uniform day of greater length—were largely justified, and much elasticity has been conceded in the administration of hours of labour acts. Both national and international legislation has been obliged to provide for certain exceptions in particular cases, which may be classified as those which arise (1) from considerations of the *worker* himself or herself, (2) from the *size of the industrial undertaking*, (3) from the *nature of the work*, (4) from the *situation of the country concerned* with regard to climatic conditions, character of population, or other factor rendering it abnormal from an industrial point of view, and (5) from *exceptional circumstances.*

(1) In the first class may be placed those exceptions which are

provided for domestic industries and small establishments where only members of the same family are employed. The fact that exception is made for such cases is due to a recognition of the great difficulty of supervising the application of any regulations. So far, international labour legislation has admitted exceptional treatment for these classes of workers. It is generally considered, both in national and international legislation, that certain persons, even in factories where a minimum day is legally enforced, should be exempt from its provisions because of their relations to the employer. Managers and persons holding posts of responsibility or of confidence are generally thus exempt, and in some national legislation sons or other close relatives of the employer are similarly excluded from the application of the regulations. Again, in all countries which have adopted legislation on hours of labour, women and young persons are exceptionally treated.

(2) As to the *size of the industrial undertaking*, different standards have been adopted. Whilst in Sweden concerns employing not more than four workers are exempt from the application of the Eight-hour Act of 1919 (save where such concerns are situated in towns with a population of over 1,500), in Japan 15 is the number of employees requisite to bring an undertaking within the scope of the Factory Act, and in India it was 20 until 1921, when the number was reduced to ten. Here again the great difficulty is that of the inspection and supervision of small isolated concerns, but a complicating factor lies in their frequent close connexion with agriculture, which results in their sharing to some degree in the seasonal character of the latter. This reason appears to have been influential in deciding the attitude of the Swiss Government towards the International Convention on the 8-hour day and the 48-hour week.

(3) The third class of exceptions, it has been stated, are connected with the *nature of the work*. The case which appears to have presented most difficulty in national legislation is the *continuous process*. In many industries (*e.g.* iron and steel, paper, glass, gold-refining, etc.) processes are employed which take long periods for their completion, and which cannot be intermitted without damage to or total loss of the material operated upon. In such cases work is organized in shifts, frequently 3 shifts of 8 hours each per day, but also frequently 2 shifts of 12 hours. Whilst the former plan achieves the 8-hour day, it does not of itself achieve the 48-hour week (for work is continued through 7 days per week). A certain elasticity is required to facilitate changes of shift, which frequently results in a week of more than 48 hours alternating with a week or possibly two weeks of less than 48. In other cases the process, whilst not being continuous in the strict sense of the word, is yet longer than the normal working day of 8 hours. The arrangement of shifts for such cases presents further difficulties for which exceptions must be provided.

The International Convention on hours permits a 56-hour week in "those processes which are required by reason of the nature of the process to be carried on continuously by a succession of shifts."

The opposite case is where the work is of so *intermittent a nature* that it is felt that a longer day may be worked without injury to the worker. It is difficult to define exactly what is meant by this "intermittence." The work of a gatekeeper or watchman who has no other duties may be instanced, but there are border-line cases which are treated differently in different legislations. Is a railway porter's or a signalman's work intermittent? Obviously generalization is impossible. The Washington meeting of the International Labour Conference tried to meet such cases by permitting the legislative authorities to allow permanent exceptions where the work is "essentially intermittent," but insisting at the same time, first, that regulations, to be drawn up after consultation with the organizations of workers and employers concerned, should fix the maximum number of additional hours to be permitted, and, second, that the check of compulsory overtime pay at a rate of at least "time and a quarter" should be imposed to guard against any further overstepping of the bounds thus extended.

For national legislation the Netherlands Hours of Work and Dangerous Trades Act (Nov. 1 1919) may be quoted:—"Men who do no other work than that of watching may do such work during 10 hours a day and 60 hours a week. . . . ." Section 25 (2b).

The Swiss Hours of Work on Railways Act similarly provides, in section 3 (2), "In the case of certain employments, specified in the Supplementary Regulations, which consist mainly in being in attendance at a given place, the average hours of work may be extended to nine hours." The Czechoslovakian law (Eight-Hours Act of 1918) makes similar extensions for "persons engaged in irregular service such as the supervision and watching of houses and undertakings, and looking after animals."

Seasonal industries form a further category under this heading. Both national and international legislation permit extension of the working day in industries engaged upon material susceptible of rapid deterioration, or material which is available at certain seasons only and which must be treated immediately. Similarly, industries dependent upon weather conditions are usually allowed considerable elasticity in the daily or weekly total of working hours. The Swedish Eight-hour Act (Oct. 17 1919) provides, *e.g.* that "if working hours are dependent in a material degree upon the seasons or the weather, or if they are of varying length by reason of these or any other conditions, the Labour Council may, to such extent as may be found necessary, authorize a system of working hours differing from that established in §4 (*i.e.* the 8 and 48 rule), provided that the aggregate working hours over a period not exceeding four weeks shall not in any case be more than the number of hours corresponding to 48 hours per week." This device of averaging the weekly hours over a period is fairly common, and has been adopted in international legislation. Article 5 of the Washington Draft Convention lays down that in exceptional cases where the ordinary rule cannot be applied, a Government may give the force of law to agreements between workers' and employers' organizations which permit an extension of the daily limit, provided that "the average number of hours worked per week, over the number of weeks covered by any such agreement, shall not exceed 48."

In the regulation of hours of labour in commerce, similar exceptions are frequently provided for hotels and restaurants at certain periods of the year. International legislation has so far not dealt with commerce, but with regard to seasonal industries similar proposals are made in the Washington Draft Convention to those outlined above in the case of "intermittent" work.

Exceptions are usually provided in connexion with what is known as "*preparatory and complementary*" work. There is frequently the necessity of the earlier attendance in factories of a certain number of the personnel whose work must be done before the general work can commence; there are others, similarly, who must continue after the conclusion of the general work. Cases in point are the engineers and other workers in the engine-room of a factory. In some national legislation, and in international legislation, exceptional provision is made for such workers; limitations are, however, usually laid down, as in the case of the Netherlands Hours of Work and Dangerous Trades Act of Nov. 1 1919, section 25 (2 a), which provides that "men and women who have to prepare workrooms, tools and appliances before the commencement of the day's work or who have to attend to them at the conclusion of the same may do such work . . . . during not more than 10 hours a day, provided that women do not work more than 51 hours and men not more than 57 hours in a week. . . . ."

(4) The fourth class of exceptions arises in international legislation, where it has been found necessary, in order to attempt a rough equation between countries dissimilarly situated with regard to climate, character of population or other industrial factor, to permit a longer working day in the one than in the other. Thus in the Washington Convention, a 57-hour (60 hours in the raw silk industry) week is permitted for Japan, and a 60-hour week for British India, and elasticity is provided in the application of the Convention to "colonies, protectorates and possessions not fully self-governing" for "such modifications as may be necessary to adapt its provisions to local conditions."

(5) The circumstances which, under national and international legislation, permit of the temporary suspension of the general application of the limitation of hours have already been treated. Some national legislations consider that the danger to an industry arising from the pressure of foreign competition is a sufficient warrant for the relaxation of rules in its particular case. Thus the Swiss Factory Act allows "a weekly duration of work of 52 hours if urgent reasons justify this measure, and so long as these urgent reasons hold good, particularly if . . . . an industry runs the risk of being unable to withstand competition on account of the duration of work time in other countries" (Section 41). And an Article in the Swedish Act seems to have in view the same (among other) circumstances: "If the application of this Act involves such difficulties in the case of any particular work or undertaking as to jeopardize the continuance of the same, the King may . . . authorize an exemption from the application of this Act such as the circumstances may require."

PRINCIPAL COUNTRIES

UNITED KINGDOM.—The 8-hour day was established in the mining of coal, stratified ironstone, shale and fireclay by the Coal Mines Regulation Act of 1908, and the amending Act of 1919 further reduced the daily hours of underground workers, with certain exceptions, to seven. Article 1 of the Act provided for a future reduction in certain eventualities to six hours daily. Other legislative restrictions of hours are to be found in the Factory and Workshop Consolidation Act of 1901, the Shops Act of 1912, and the Employment and Closing Order Act of the same year. A bill was introduced in Aug. 1919 for the establishment of the 8-hour day in industry, and clauses were proposed to be added extending its scope to cover also maritime employment and agriculture, but it went no further in 1921.

In the United Kingdom legislation has played a comparatively unimportant part in the restriction of hours except in the cases of women and children. Before the war a large number of collective agreements had been made, and after the war these were widely extended. The spheres now (1921) covered by agreements reducing the working week to 48 hours or less are best indicated by an enumeration of the cases in which a longer week is still worked.

In agriculture the normal weekly hours are 48 in winter and 50 in summer. These figures, however, do not in all probability indicate the number of hours actually worked. They are fixed under the Corn Production Act, and their principal value from the workers' point of view lies in the fact that hours worked in excess of 48 or 50 are paid for at overtime rates.

In constructional engineering an agreement has fixed the summer week at 49½ hours, the winter week at 44 (this arrangement does not infringe the rule of an average 48-hour week).

In the linen industry of North Ireland workers in the bleaching and dyeing branches work, by agreement, 49½ hours per week.

A 50-hour week is the rule in one or two smaller industries, such as the manufacture of picture-frame moulding, and type-founding. In the latter case, the workers agreed to work two hours per week (in addition to the normal 48) without pay, in return for which they enjoy an annual holiday on full pay.

In the rest of British industry the rule is the 48-hour week or less. On the railways the normal weekly limit is, by an agreement of Feb. 1 1919, fixed at 48 hours (47 hours in the railway workshops). The daily hours, however, may exceed eight, provided that the weekly total does not exceed 48. The 44-hour week is worked in the building industry generally, in some quarrying, as at Aberdeen, in the manufacture of thread (though not universally), in glove-making (women) and tie-making, by dock workers (except at Belfast where the hours are 46), in the manufacture of envelopes, office and other furniture (again not universally), in bakeries in Scotland, in the textile warehouses of London and the wholesale warehouses of Manchester, and in most concerns in the cocoa and chocolate industry. Apart from a few very exceptional cases (*e.g.* glass-blowing, where the hours are from 35 to 37 per week) and the kaolin quarries of Cornwall and Devon (42 hours per week), practically every other British industry of importance enough to be organized has a weekly limit lying between 44 and 48 hours.

AUSTRALIA.—The position as regards hours of labour is determined in Australia by (1) Factory and Shop Acts, (2) Early Closing Acts, (3) decisions of arbitration courts and boards, including those of the Federal Arbitration Court, (4) direct legislation such as the Mines Act of the various states, and (5) collective agreements. The 8-hour day (or less) and the 48-hour week (or less) are practically universal in industry and commerce.

The Factory Acts date from 1900 in Queensland (amended several times subsequently), 1904 in Western Australia (amended 1912), 1907 in South Australia (amended 1908, 1910 and 1915), 1910 and 1911 in Tasmania, 1912 in New South Wales and 1915 in Victoria. The principal Early Closing Acts are those of 1899, 1900, 1906, 1910 and 1915 in New South Wales, of 1911 and 1912 in South Australia, of 1902, 1904 (two Acts), 1911 and 1912 (a consolidating Act) in Western Australia, and of 1911 and 1913 in Tasmania. In addition to these New South Wales has an Eight-hours Act of 1916, amended 1920, and Acts of 1910 and 1916 relating to the Saturday half-holiday and Sunday rest. Each state has mining legislation regulating hours amongst other conditions of labour in mines. Generally speaking these provide that no underground worker and no surface worker whose duties are laborious or responsible shall work more than eight hours per day, and Sunday labour is prohibited.

Arbitration courts and boards were first created in 1912 in New South Wales, Queensland, South Australia and Western Australia. The Acts establishing them have been in some cases frequently amended, and the courts now figure very prominently in the regulation of hours and in the settlement of disputes. For example, in New South Wales the Industrial Arbitration Act of 1912 directs the Court and the Boards of Arbitration that their awards must, in the case of all industries other than the coal and metalliferous mining industries, provide for working hours not longer than (1) 8 hours per day on 6 consecutive days, (2) 48 hours per week, or 96 hours in 14 consecutive days. Again, in Nov. 1920 a decision of the Federal Arbitration Board awarded the 44-hour week to a large group of industries. In New South Wales the Eight-hour (Amendment) Act of 1920 established a special court to inquire into the working hours in any industry and to consider the possible economic effects on that industry of a reduction to 44 hours per week. On April 11 1921 this court reported in favour of the 44-hour week for a large number of groups of workers, including most of those employed in the building trades, in the manufacture of food and of furniture, in the iron trades and in printing. The decisions of the court were given effect by proclamations on April 16, and they came into force on May 1 1921, with the exception of that referring to the iron trade, which became effective from May 22. Again, in Victoria, decisions of the Arbitration Commission, issued on June 19 1916 fixed limits to the working day in practically all industries, usually but not universally at eight hours.

NEW ZEALAND.—The Factory Act of 1901, consolidated in 1908 and amended in 1910, fixed the working hours of men at 8¾ per day and 48 per week, of women and boys at 8¼ per day and 45 per week. Since then hours in most industries have been reduced to 8 per day and 48 or less per week by agreement or by awards of the Court of Arbitration. The 44-hour week is now the rule for brewers, bricklayers, electrical workers, employees in the manufacture of furniture, plasterers, stonemasons, tailoresses, wharf-labourers and some others. Bootmakers have a 45-hour week and typographers 42. In coal-mining a 5-day week is worked alternately with a 6-day week (8 hours daily "bank to bank") and in gold-mining the 44-hour week is the rule. In some cases the working day has been reduced to 7 (*e.g.* biograph operators) or 7½ (trackmen employed on tramways).

An amendment to the Shops and Offices Act which came into force on Jan. 1 1920 reduced the weekly total of working hours for shop assistants from 52 to 48, and permitted a maximum overtime of 100 hours per annum (not more than three hours in any one day).

CANADA.—Both collective agreements and legislation have been used in the limitation of the working day in Canada, with the result that the 48-hour week is the rule in mining, on railways, in the public utility services, the building industry, the manufacture of chemicals, tobacco, food-stuffs, paper and printing, textiles, in the oil industry, in shipbuilding, carriage building and in the metal trades (with some exceptions). Telegraphists secured the 8-hour day in 1920. British Columbia and Manitoba have legislated on the hours of women workers, and Nova Scotia on those of young persons, in each case imposing the 8 and 48 rule; in the Yukon Territory and Manitoba the same limit has been fixed by law for state employees. Alberta and British Columbia have enacted the 8-hour day in coal-mines and for furnace workers, British Columbia in metalliferous mines, and Ontario in all mining industries. The weekly hours of women workers in restaurants in Manitoba are limited to 48 by administrative order. In the other industries above mentioned the 8 and 48 limits have been secured by collective agreements.

Hours worked on Canadian railways appear to be governed largely by the practice in the United States, where the McAdoo Award gave the 8-hour day. The same rule applies to the electric tramways of British Columbia.

SOUTH AFRICA.—The hours of labour in factories are governed by the Factory Act (No. 25 of 1918) which laid down limits of 9½ hours daily and 50 hours weekly for adults, and a 45-hour week for young persons under 16 years of age. The Mines and Works Act (No. 12 of 1911) provides an 8-hour day and a 48-hour week for underground workers in gold-mines.

In addition to these legal limitations, hours are regulated by a number of collective agreements, particularly in the skilled trades. The surface workers in gold-mines and underground and other workers in coal and other mines have secured the 48-hour week by agreement. Certain categories of factory workers—the more highly skilled—have also been able to secure the 48-hour week though their working hours are legally restricted by the Factory Act.

FRANCE.—The 8-hour day in France began with certain employees of the State in 1901, and by 1914 it had been extended to about a third of the workers employed by the State. An inquiry made in 1906 showed that certain establishments in the chemical industries, in printing, textiles, metals and glass had adopted it, but in all only some 15,000 workers were concerned. In subsequent years the substitution of the 3- for the 2-shift system gave the 8-hour day to others, notably to furnace workers (1911), and to those engaged in the manufacture of artificial silk and aluminium. During the war the 8-hour shift was adopted in many munition establishments.

The Eight-hour Act of April 23 1919 laid down that "the effective working time of workpeople or employees of either sex and of any age shall not exceed 8 hours per day or 48 hours per week, or an equivalent limitation based upon a period of time other than the week, in industrial and commercial establishments or in business premises of any kind connected with them, whatever their nature, whether public or private, secular or religious, even where they are of a technical educational or religious nature." The application of the law was to be by administrative decrees. A considerable number of these, applying the Act usually to certain industries, have been issued. The one of Dec. 12 1919 in reference to the textile industries will serve as a type. It provides for the limitation of the working hours to a maximum of 8 per working day in each week, but allows the weekly total of 48 hours to be so distributed as to permit of a shorter working day on Saturdays. To achieve this, a maximum of 9 hours per day may be worked. In the bleaching, dyeing and finishing branches of the industry it is possible (since a short working day is uneconomic in these processes) to distribute the 48 hours over 5 days only, with a maximum of 10 hours per day. The decree goes on to make minute provision for the extension of hours to make up for lost time due to slackness of trade (for which a maximum of 100 additional hours per year may be worked), for exceptional pressure of work (maximum 150 additional hours), for the provision of rest periods and for the keeping of registers of the hours worked. Altogether some 30 groups of trades or categories of workers have been covered by similar orders, including the more important French industries (leather and skins, books, boots and slippers, clothing, building, metal trades, hats, electricity, carriage and coach building, saddlery, etc.) and some commercial undertakings (hotels and cafés in Paris, hairdressers' shops, etc.).

In addition to this legislative regulation, a number of other trades have secured the 8-hour day by collective agreement, some of them—the clothing workers, builders, textile workers in the north, and others—before the application of the Act to their particular industry.

France is one of the few countries which has applied the 8-hour day to seamen. This was done by a decree of Feb. 24 1920.

ITALY.—A decree of May 15 1919 instituted the 8-hour day for workers on railways, trams and in inland waterways, and a second of June 15 1919 did the same for the State railways. Generally, however, reductions in hours of labour have been secured by collective agreements, which now cover practically every important industry, including transport and mining; for example, since April 1919 miners have worked a 7-hour day for the most part. The larger number of these collective agreements date from early in 1919. In their application the emphasis would appear to be upon the 48-hour week rather than the 8-hour day; as in France the working day is frequently extended by an hour or half-an-hour in order to permit of a shorter working day on Saturday. Most of the agreements limit the permissible number of hours which may be worked daily in excess of eight, usually to two.

GERMANY.—Regulations issued on Nov. 23 1918 respecting the hours of work of industrial workers, including those employed in transport, established the general 8-hour day. These were followed up rapidly by a series of amending orders regulating exceptional cases, and on Jan. 24 1919 by an order relating to a provisional Agricultural Labour Act, which was to give legal force to an agreement, concluded between agricultural employers and employees, regulating conditions in agriculture and prescribing an 8-hour daily average during four months of the year, a 10-hour average during four months, and an 11-hour average over the remaining four months. On the same date as that of the general order mentioned above, hours in baking and confectionery establishments were limited also to 8 daily.

The hours thus determined by legislation have, in certain cases, been still further reduced by agreement. For example, an agreement concluded between employers and workers on Jan. 22 1919 established the 8-hour day with a 6-hour Saturday for workers in the textile industry. This agreement was abandoned by the employers early in 1921, however, and new agreements have for the most part reëstablished the week of 48 hours.

The hours of work in mines were fixed by the regulations of Nov. 23 1918 at seven daily for underground workers, but later, in view of the economic position, the miners agreed to work an additional shift (seven hours) per week.

AUSTRIA.—The Act of Dec. 19 1918 (reënacted Dec. 17 1919 with some changes) provided that "the hours of work in industrial undertakings carried on as factories shall not exceed 8 hours in 24, not including breaks in work." The Act further limited the working hours of women and young persons to 44 in the week. Instructions issued on Feb. 12 1919 regulated the application of the Act in continuous industries, railways and other special cases.

An Act of April 3 1919 made similar provision for employees in bakeries, and working hours in mines were regulated by the Act of July 28 1919, which again established the 8-hour day, with possibilities of further reduction in particularly unhealthy places.

The 8-hour day was, however, established much earlier in some Austrian industries (*e.g.* lithography since 1914) by agreement, and has been extended to branches of industry not covered by the above Acts, *e.g.* woodworkers, by the same method. On March 1 1921 a 10-hour day in agriculture was instituted by collective agreement.

RUMANIA.—An administrative regulation of July 1 1919 instituted the 8-hour day in the national printing offices. The rule was extended to the State match and tobacco factories, railways and other State enterprises. Collective agreements secured the same end in the metal, carpentry and printing trades in Bucharest during the early months of 1919, and in the petroleum industry in Nov. of the same year. In one province (Ardeal) a Decree of May 21 1919 prescribed the 8-hour day in industry, mines and quarries, and in commercial establishments generally.

SPAIN.—Legislation on the 8-hour day in Spain commenced with the Royal Decree of March 11 1902, which applied to the employees of the Ministry of Finance. After the war, the same working day was extended by further decrees to building workers (March 15 1919), and to workers generally (April 3 1919—to come into force from Oct. 1 1919).

Regulations issued Oct. 9 1919 determined the hours to be worked at sea. The engine-room hands work an 8-hour day and 48-hour week at sea and in port; the hours of deck-hands vary with the size and nature of the vessel and its position. In the tropics the limit is 8 hours per day; elsewhere 10 or exceptionally 12.

Miners' hours were fixed by an Act of Dec. 27 1910 at 10 daily for surface workers and 9 for underground workers. The above-mentioned decree of April 3 1919 extended the 8-hour day to both categories. Subsequently, by an order of Oct. 10 1919, the hours of underground workers were reduced to 7, the reason given being that this was necessary in order that the surface workers should not be compelled to work more than eight.

Finally, an Eight-Hour Day Order of Jan. 15 1920 applied the Decree of April 3 1919 to workers generally, and specified the permissible exceptions. The only class of workers excepted by name from the application of this order are domestic servants, but a second order of the same date specifies many other classes, including agricultural workers engaged in the care of livestock, and hotel and restaurant waiters. In a large number of trades the 8 and 48 rule had been secured by collective agreement before the coming into force of the above royal decree and orders.

BELGIUM.—An Act passed on June 8 1921 established the 8 and 48 rule in industry generally, but from the end of 1919 it had been almost universally adopted, usually by agreement, as in diamond-cutting, bootmaking and the manufacture of musical instruments (June 2 1919), in quarries (April 17 1919), coal-mines (Dec. 1 1919): on Jan. 1 1920 furnace workers secured the 8-hour day, and on Jan. 1 1921 it was extended to bookbinders also. Most, though not all other industries were already covered before these dates, so that the Act recently passed made little actual difference in the situation beyond the change from agreement to legislation. The Act of June 8 provided further that the same or similar regulations should come into force within one year for commercial workers, including employees in retail shops, hotels, restaurants and public houses. A 7-hour day is already observed in some commercial establishments, particularly in Antwerp, but the working of overtime is fairly general.

NETHERLANDS.—An Act providing for the regulation of hours of labour and for the prohibition in certain cases of work in dangerous trades was adopted on Nov. 1 1919, and was put into force from Oct. 24 1920. Broadly speaking, the Act provided that the limit of hours of work in factories and workshops should be 8 in the day and 45 in the week; for outdoor employees of hotels, shops, offices, etc., 10 in the day and 55 in the week (with the possibility of a reduction in these hours by administrative regulations); for office workers indoors, 8 in the day and 45 in the week; for shop and pharmacy workers indoors 10 in the day and 55 in the week; for young persons employed in cafés and hotels, 9 hours in the day, and so forth. This is the most detailed and comprehensive hours-of-labour act in existence. A noteworthy feature is the 45-hour limit for the week's work. In establishing this, however, the Act did no more than sanction legislatively or re-affirm what had been already achieved in a large number of industries by collective agreement and by earlier legislation. In practice the 45-hour week means that the worker has Saturday afternoon free and that the "English week-end" is firmly established in the Netherlands. Since the passing of the Act collective agreements have tended to make the 8 and 45 rule even more general than does the Act itself.

The Act had not up to 1921 been applied to navigation, but by agreements barge and boatmen have secured a 10-hour day, and the engine-room staff on seagoing vessels the 8-hour day; the tendency is for collective agreements for maritime workers generally to be based on the 8-hour day and the "English week-end."

DENMARK.—The Factory Act of April 29 1913 was amended by an Act of Feb. 12 1919, which introduced the 8-hour day in undertakings working continuously day and night, for workers engaged on continuous processes. By decree the 8-hour day was subsequently extended to the State railways, posts and telegraphs and customs offices. The municipal authorities of Copenhagen and certain other of the larger towns have granted the same hours to their employees generally.

For the most part, however, reductions of hours in Denmark have been secured rather by the method of collective agreement than by legislation. One such agreement made on May 17 1919, and covering over 150,000 workers in several industries, established the 8 and 48 rule.

A Commission on Working Hours was appointed on Feb. 28 1919. Its report proposed the adoption of the 8 and 48 rule.

SWEDEN.—The Act of Oct. 17 1919 relating to the limitation of working hours, applies to "every undertaking, industrial or otherwise, in which more than four workers are ordinarily employed on account of an employer and also to every such undertaking carried on in any town or borough or municipality the population of which . . . exceeds 1,500, although the number of workers employed therein may be less than four." The Act imposes the 8 and 48 rule. A second Act regulates the hours during which work may be done in bakeries; generally speaking, it prohibits night and Sunday work.

An Act of Oct. 24 1919 limits the hours of seamen. The permitted hours vary with the size of the vessel and the nature and extent of its voyages. For engineers, greasers and trimmers on vessels carrying not less than 3 men of these categories the hours must not exceed 16 in 2 days, and similarly for firemen on vessels with engines of more than 250 H.P. engaged in ocean or North Sea trade, and on vessels of 600 H.P. or over in more restricted trade. For other seamen the 9-hour day is the general rule, though exceptions are permitted (up to 24 hours in two days) provided the weekly total does not exceed 63. On a vessel lying in port the limit is 8 hours daily (7 in the tropics).

NORWAY.—The Norwegian legislature adopted in Aug. 1918 an Act limiting the weekly hours of labour in industry to 48, with a daily maximum of 8½. Most industrial establishments, including mines, are covered by it, with the exception of those in which the number of employees is less than 5 and in which no motive power (of greater strength than 1 H.P.) is used.

An Act of July 11 1919 restricted the hours of seamen (deck-hands and engine-room staff) to 8 hours daily (7 in the tropics), and limited the hours during which the stewards, cooks and other workers on board might be employed. Exceptions were admitted for small vessels, fishing vessels, and sailing vessels doing coasting voyages in the limits of Norwegian waters.

SWITZERLAND.—The principal Act regulating the hours of labour in Switzerland is the Factories Act of June 18 1914, which was amended by an Act of June 17 1919. The latter Act reduced the weekly hours to 48, providing at the same time for a working day longer than 8 hours in cases where a short Saturday is worked. Extensions to 52 hours are permissible if the Federal Council considers them warranted by "urgent necessity."

Hours of work on railways and other services connected with transport and communications (*i.e.* the Federal railways, postal, telegraph and telephone services, and transport and communication undertakings licensed by the State) are fixed by an Act of March 6 1920 at 8 per day averaged over 14 working days. This Act was the object of a referendum and was approved by a large majority.

In the Canton of Basle (Town) a local Act of April 8 1920 applies the 48-hour week in a general way to all employees in the public services and in private undertakings. For bakers and confectioners, gardeners, hairdressers, shop assistants and some others a weekly maximum of 51 hours is determined; for caretakers, messengers, cab-drivers, hotel employees and home workers it is 60 hours, and for chemists' assistants, theatre employees and "persons who work in the houses of private customers" 54. Domestic servants and agricultural workers are to be guaranteed an uninterrupted rest period of 9 hours in every 24. Other provisions regulate the working hours of young persons and children.

The 48-hour week has been very widely adopted in Switzerland, by virtue of the Act of 1919 and of numerous collective agreements which have regulated its application. Certain industries, *e.g.* lace-making and home-weaving, still, however, work longer hours, in the first case 52 (in 1914 it was 60), and in the latter, it is alleged, 10 to 12 hours per day.

For the building trades a scheme drawn up by a Special Commission appointed by the Federal Department of Public Economy was accepted in 1921. Under it the weekly hours will be 50 during the period March to Sept., 44½ in Oct. and Nov., and 39 otherwise.

GREECE.—A regulation issued on Feb. 14 1911 established the 8-hour day for underground workers in mines. By collective agreements the same rule holds in certain industries, especially in and near Athens and the Piraeus, and in State industries. Workers covered by these agreements include gasworkers, dockers, workers in the manufacture of macaroni, flour-millers, coopers, carpenters and ship cleaners. Greece was the first country to ratify the Washington international Draft Convention.

JAPAN.—Some limitation of working hours (the 12-hour day) was secured by the Japanese Factory Act of 1911, but the 8-hour day has only recently begun to be adopted. Since the war, however, this daily limit has been introduced in the shipbuilding industry and in the metal trades; it would appear, however, that the American plan of determining a "basic" 8-hour day has been adopted, rather than an actual limitation of hours. In some of the important glass works of Osaka, and in certain establishments in Tokyo, Kobe and Osaka, the 8-hour day is worked. Telephone workers in the central offices work a 7- or 8-hour day.

SOUTH AMERICA.—Either by national law or by agreement the 8-hour day for industry prevails generally in Argentina, Brazil, Chile, Peru, Ecuador and Uruguay. (H. A. G.*)

UNITED STATES.—In the United States regulations of hours worked in industry are made by state or Federal legislation or by agreement between employer and trade union. When trade unions fix the length of the working day, they mean the *basic* workday, with a higher rate of pay for overtime. The theory of the basic workday is that extra pay for overtime acts as a tax on the employer to induce him to introduce a shorter actual workday. In the week ending Dec. 13 1919, for the entire state of New York, 35·76% of telephone operators worked from 3 to 6 hours overtime, 35·02% worked 6 to 9 hours overtime.

According to the census of 1910, of the 6,615,046 wage-earners enumerated in manufacturing enterprises, 7·9% worked 48 hours or less a week, 30·6% worked 54 hours or less, 60·7% worked more than 54 hours but not more than 60 hours, and 8% worked more than 60 hours. The census shows that 114,118 or 1·7% worked where the prevailing hours were more than 72 a week. These figures, which do not include agriculture, building, mining, domestic and personal service, show the number of hours normally worked by the majority of workers in the establishments enumerated. Of the 86 principal manufacturing industries employing more than 10,000 wage-earners in 1909, 20 employed over 10% of their workers more than 60 hours a week.

Among railway employees continuous service for long hours has been very common. Records of the Interstate Commerce Commission show that during the year ending June 30 1913, 261,332 railway men were reported as on duty for periods exceeding the legal limit of 16 hours, and that over 33,000 of them worked more than 21 hours continuously. In 1914, of the 7,000,000 wage-earners enumerated in manufacture in the United States, 11·8% worked 48 hours a week or less, 51% worked 54 hours or less a week, 43·1% worked more than 54 hours but not more than 60 hours, and 5·8% worked more than 60 hours. The number working more than 72 hours was 0·8%. The number working the 8-hour day or less was 833,330, chiefly in the building trades.

The year 1915 was marked by an active movement toward the 8-hour day. Strikes for the basic 8-hour day started among the machinists in the war-boom town of Bridgeport, Conn., where they put the factories of the city practically on an 8-hour basis, and spread over the entire state and then into other states, especially Pennsylvania, New York, Ohio, Illinois and Massachusetts, and into other trades—munition industries, automobile factories, paper mills, musical instrument factories and garment trades. Over 200 firms, chiefly located in the eastern states, and among them the largest of their kind, granted the 8-hour day to their employees in 1915. Thirty thousand machinists in munition plants in Connecticut alone gained the 8-hour day. On Jan. 1 1915, about 7,000 members of the International Association of Machinists had the 8-hour day: by Jan. 1 1916, 60,000 had it. Of wage-earners in manufactures in the industries and localities studied by the Bureau of Labour Statistics in 1917, 171,978 gained the 8-hour day in 1915; 342,138 in 1916; 537,587 in the first 6 months of 1917. This leads to the conclusion that there were in the United States in June 1917, at least 1,885,033 wage-earners enjoying the 8-hour day. Probably in each case the basic 8-hour day is meant. The Anthracite Mine agreement of May 1916 established the basic 8-hour day with *pro rata* overtime pay for 6 days a week for all employees in the anthracite mines in place of the 9-hour day established by the 1902 agreement. The new agreement affected approximately 100,000 of the 181,899 workers reported in the anthracite mines in 1914, since the miners proper and their underground labourers, who together constitute about 40% of the total working force, were already working an 8-hour day schedule, and about 8,000 other employees were compelled by the nature of their duties to continue working 9 hours a day. In this case the basic 8 hours do not include the time going to and from employment, even on the premises of the mine; drivers must take their mules from the stables to the working place before the 8 hours begin, pay for such services to be included in the day rates.

What did more than anything else to bring the 8-hour movement to the attention of the general American public was the threatened strike of the railroad brotherhoods in the summer of 1916. As early as 1907 three of the brotherhoods in the western territory had demanded an 8-hour day, but they had abandoned this in favour of an increase in wages. In 1915 at the national conventions of the brotherhoods the question of the 8-hour day came up. Each convention instructed the executive officers to demand a basic 8-hour day, with pay at the rate of time-and-a-half for overtime. In Jan. 1916 the strike ballot was submitted to the vote of the men. In Feb., it was officially announced that 90% had voted in favour. The railroads were notified, and a reply requested. The two sides entered into negotiations, but in June the railroads refused the demands of the employees, and asked for arbitration under the Newlands Act or by the Interstate Commerce Commission. The brotherhoods rejected this, and voted to strike on Sept. 2. The country was frightened; it was at a time of crisis in international relations. The result was the President's message to Congress and the passage of the "Adamson Law."

The Adamson Law granted the basic 8-hour day to the members of the four railroad brotherhoods, at a rate of pay for the 8 hours equal to that previously for 10, and *pro rata* for overtime up to the legal 16 hours. The Act also provided for a commission to investigate the results of the change. The report of this commission was published in 1918. It shows that the greatest reduction in hours was among yard crews, 11,000 of whom were placed on 8-hour shifts between March and Oct. 1917. Passenger trainmen who were already often working 8 hours or less were little affected, while freight crews continued to have runs from 11 to 13 hours. In 1919 a general order of the Railroad Administration gave to the freight service the 8-hour day or 100-m. run as a basis with time-and-a-half pay for overtime.

After the entrance of the United States into the World War in April 1917 the number of employees working an 8-hour schedule was greatly increased because of the automatic regulation of the hours of labour on Government contract work by the Federal 8-hour law. By a series of executive orders the 8-hour day on Government ship-building, munitions, and construction work was suspended during the war emergency, and the basic 8-hour day with time-and-a-half pay for overtime was substituted. The influence of this on public opinion led to the introduction of the basic 8-hour day in private industries. About 25,000 boot and shoe workers secured the 50-hour week during 1917, about 11,000 cigar-makers gained the 8-hour day. About 10,000 fur workers reduced their hours from 53 to 49 a week by strikes: in New York City about 5,000 of them secured an agreement establishing the basic 8-hour day. The United States Bureau of Labor Statistics reported in 1917 that the number of workers having the 8-hour day had increased 27% since 1914. Of the union scales in the metal trades in 1914, 28% provided for the 8-hour day, and 49% for the 54-hour week; in 1917, 41% provided for an 8-hour day, 32% for a 54-hour week.

In 1918, 50,000 lumbermen of the western states, 100,000 employees of the meat-packing industry, and about 336,000 shipyard employees and 270,000 employees of the merchant marine worked the basic 8-hour day with extra overtime pay, due largely to rulings of such Governmental boards as the Shipbuilding Labour Adjustment Board and the National War Labor Board, the general policy of which was to grant the basic 8-hour day, with time-and-a-half for overtime and double pay for Sundays and holidays. Shipbuilding employees of the Delaware river and Baltimore district were granted a basic 44-hour week with overtime pay up to a maximum of 60 hours. A decision of the War Labor Board introduced the actual 8-hour day, except in emergencies, in the foundries of Wheeling, W.Va. The reason given was that longer hours shorten the workers' lives, injure their health, and in the long run decrease production. In this case overtime was to be permitted only by the vote of a joint committee of employers and employees. For the railway shops, on the other hand, an agreement was made between the union and the Railroad Administration for all shops working single shifts of less than 70 hours a week to increase their hours on a 7-day basis, to meet the emergency of the war. On the day following the signing of the Armistice, the heads of the three chief production departments of the Government, War, Navy, and the Shipping Board, decided to issue an order for immediate discontinuance of overtime and Sunday work on all Government construction and in all establishments owned or controlled by the Government which were producing war supplies. An order of the Railroad Administration a week later provided that, wherever practicable, the hours which had been increased to meet emergencies in railway shops should be reduced to nine. Four awards of the War Labor Board in Oct. refused to permit overtime pay for Sunday work unless the employee had worked 48 hours in the preceding week.

The movement for the 8-hour day continued after the Armistice, until there was in 1921 scarcely a trade or industry in which many of the employees were not working the basic 8-hour day. Many of these work overtime. The Bureau of Labor Statistics in 1919 received reports of 1,640 agreements between trade unions and employers providing for the 48-hour week, and 315 providing for the 44-hour week. On Oct. 1 1918 the U.S. Steel Corporation granted the basic 8-hour day with time-and-a-half pay for overtime to the employees in its mines and industrial establishments, more than 250,000 men. A year later, the treasurer testified before the U.S. Senate Committee that of 60,000 employees of this corporation and its subsidiary companies, 26·8% actually worked 72 hours or more a week, 38·7% worked 60 hours or more, and only 34·2% worked less than 60 hours a week. Most of these men work 7 days each week, 82 men work a continuous 24 hours once in each month, and 344 men work a continuous 18 hours every alternate week; these are all in blast furnace departments. However, some 20 American steel plants were in 1921 running on a 3-shift schedule; the employees affected have been willing to make concessions in the matter of wages, in order to obtain the shorter hours.

The year 1919 was marked by the introduction of the 44-hour week in the clothing industry, the result of strikes and peaceful agreements. The Postal Telegraph Co. reduced the hours of its employees to 8 a day. It indeed seemed that the 8-hour day was the "established policy of the country," as the President's personal mediation commission had stated. Twenty-seven unions, with a membership of 15,350, chiefly in the railway shops and building trades of Boston and Seattle, had a basic 40-hour week. In 1919 the International Typographical Union obtained the 44-hour week in book and job offices by negotiation with the employers; 12 years before, this Union together with the bookbinders and the pressmen, had spent $11,000,000 to win the 48-hour week.

Investigations made in 1920 showed that one-half the employees of hotels and about one-third of the men and one-fourth of the women working in restaurants were employed 7 days a week. Except for cooks the hours were very irregular, often split into shifts, and falling at different times day after day. The average hours on duty varied from 8 to 10 every 24. The basic work week in the Central Atlantic coast district for 40% of the unskilled labourers was over 54 hours, for 30% more than 44 but not more than 48 hours, for 18% it was 44 hours or less. Of skilled trades in the same district, 75% worked 44 hours or less a week; of clerical workers 12% worked 39 hours or less, 53% worked 39¼ to 42 hours inclusive, 33% worked 42½ to 45 hours inclusive. There are no data for hours of agricultural labour for the United States as a whole. The length of the workday varies with the kind of farming and with the season. Studies made on Iowa farms (1909 to 1918) show that the average hours per weekday of the proprietor increased from 10·4 to 11·95, while those of the hired labourer decreased from 12·4 to 11·46. In Wisconsin in 1916 the average farm workday was 10·8 hours in winter and 12·5 in summer.

Hours of Work in U.S. in 1919.
(From investigations of U.S. Bureau of Labor Statistics.)

Industry	Aver. Hours Actually Worked per Day		Aver. Hours Actually Worked per Week		Aver. Full-Time Work Week	
	Men	Women	Men	Women	Men	Women
Lumber	7·2	..	43·2	..	59·1	..
Millwork	8·1	8·1	48·6	48·6	52·8	54·7
Furniture	8·5	8·1	51·0	48·6	55·2	54·9
Bricks	7·8	..	46·8	..	55·1	..
Chemicals	8·4	7·4	50·4	44·4	56·8	52·6
Glass	7·8	7·2	46·8	43·2	53·7	51·9
Leather	8·1	6·9	48·6	41·4	53·0	52·1
Paper	8·7	8·0	52·2	48·0	51·4	51·7
Pulp	8·5	..	51·0	..	51·4	..
Automobiles	8·2	7·8	49·2	46·8	50·6	49·3
Cars	8·1	..	48·6	..	53·8	..
Electrical Apparatus	8·0	7·7	48·0	46·2	50·6	50·2
Foundries	8·2	7·1	49·2	42·6	53·8	50·4
Machinery	8·2	7·1	49·2	42·6	51·7	52·9
Machine Tool	8·6	7·7	51·6	46·2	53·9	51·6
Typewriter	8·6	7·8	51·6	46·8	52·6	51·6
Pottery	7·1	6·8	42·6	40·8	53·6	50·9
Rubber	8·2	7·8	49·2	46·8	51·1	51·9
Boot and Shoe	7·4	7·2	44·4	43·2	48·4	48·8
Hosiery and Underwear[1]	6·8 to 9·8	5·9 to 9·1	40·8 to 58·7	34·2 to 63·1	47·8 to 59·8	48·0 to 60·0
Silk[1]	7·3 to 9·5	7·3 to 9·1	40·8 to 57·0	42·3 to 54·5	50·0 to 55·	50·0 to 55·
Men's Clothing[1]	5·9 to 9·5	6·6 to 8·6	35·6 to 56·9	39·4 to 51·6	45·2 to 53·8	45·5 to 50·1
Cigars[1]	6·1 to 8·5	5·7 to 9·0	34·9 to 51·6	33·9 to 55·1	No data	No data
Paper Boxes	8·3	7·5	49·9	45·0	51·2	50·0
Women's Clothing	8·1	7·4	48·5	44·0	48·5	48·1
Confectionery	8·4	7·3	50·4	43·8	54·4	50·1
Overalls	7·1	6·7	42·6	40·2	46·1	46·0

The annual convention of the American Federation of Labor in 1920 accepted the report of the committee on the shorter workday in favour of the 44-hour week, 8 hours for 5 days of the week, 4 hours on Saturday, except in certain industries where the hours should be still shorter, "that there may be no unemployment in that field."

Six states and the Federal Government have passed laws requiring that certain wage-earners be given one day's rest in seven. The Federal law applies only to post-office employees. Most of the laws limiting hours for women prevent Sunday work by fixing a weekly as well as a daily limit, but some specify only the daily limit, and Arizona makes the weekly limit 7 times the daily limit. Virginia requires that all state employees who work 7 days must be relieved for at least two Sundays in each calendar month. The 7-day week increases absenteeism, especially on Monday. Much of the present-day continuous operation of industry involves 7-day labour. In Minnesota in 1909, 98,558 men, or approximately 14% of the gainfully employed males in that state, were working every day in the week. In New York in 1910, out of 335,000 union members in a number of specified industries, more than 10% worked 7 days in the week. Many establishments which operate continuously, such as iron and steel plants, paper mills, glass and chemical works, combine the 12-hour day with the 7-day week, and in not a few cases require their employees to alternate weekly or fortnightly between day and night shifts, working 24 hours without rest when the change is made. Telephone operators in New York State receive 150% pay for the first Sunday on duty each month, and 200% pay for additional Sundays: the amount of Sunday work varies with the locality from every other Sunday to one in every fifteen.

While more than a dozen states have made Saturday afternoon a legal holiday, few, if any, have made effective provision for the enforcement of this or other laws fixing legal holidays. The extension of the Saturday half-holiday during recent years has been due to the initiative of the employer or to trade-union activity. The short workday on Saturday is more often found in summer than in winter, and more often among clerical and mercantile than among industrial workers. In 1914 the Consumers' League induced most of the large stores in New York City to close all day Saturday during July and August. In the summer of 1920, 25 of the largest department stores in the city closed all day on Saturday during July and Aug., and nearly as many for half the day. This was found actually to pay, as the number of shoppers in summer was small on Saturdays. In smaller communities stores closed Wednesday or Thursday. This movement of a regular weekday holiday in summer seems to be growing. In Hudson river towns in the summer of 1920, factories employing less than 50 people were found to shut down on Saturday at 12 or 1 o'clock. In the building trades and clothing industry the 44-hour week is prevalent. Twenty-five per cent of the telephone operators in New York State have the 44-hour week.

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[1] Varies greatly with locality. No general averages attempted.

The best known studies in the United States are reported in Goldmark's *Fatigue and Efficiency*, which is the collection of material used in preparing the brief for the shorter workday for women, in the famous case of Bunting *v.* Oregon, 37 Sup. Ct. 435, 1917, and in *U.S. Public Health Service Bulletin, No. 106*. Other references on hours of labour are the series of bulletins on the subject published by the U.S. Bureau of Labor Statistics, reports appearing in the *Monthly Labor Reviews* of the Bureau and reports of the National Industrial Conference Board. (J. R. Co.)

INTERNATIONAL ACTION

Demands for international agreement or legislation on the standardizing of the hours of labour have been frequent since 1890, when the International Conference on Labour in Factories and Mines—the Conference summoned officially by the then German Emperor—suggested a general adoption of the 8-hour day in mines. The need for uniformity in hours in order to remove at least one awkward cause of friction in international relations was voiced in 1893 at Zurich by the Metal Workers' Congress, and again in 1904 at Amsterdam. In 1894 it was the turn of the Tobacco Workers; in 1905 of the International Conference of Trade Union Secretaries. At Geneva in 1906, and again at Zurich in 1912 the International Association for Labour Legislation emphasized the same point. In 1916 the General Federation of Trade Unions of Great Britain, and in 1918 the United States Socialist party adopted resolutions on the subject. Steps were taken in the same direction by the Scandinavian and Inter-Allied Conferences of 1918.

This movement culminated in the inclusion of the international labour agreement (*see* INTERNATIONAL LABOUR) in the Peace Treaty of Versailles. The Labour part of the Treaty was drafted by an International Commission on Labour Legislation, appointed by the Peace Conference on Jan. 31 1919. Its chairman, Samuel Gompers, of the American Federation of Labor, submitted a declaration of the aims of labour, which included the following clause:—

> "It shall be declared that the workday in industry and commerce shall not exceed eight hours per day except in case of extraordinary emergency, such as danger to life or property."

Various national delegations proposed amendments in the terms, but finally certain "principles" were adopted by the Commission, including the following:—

> "The adoption of an eight hours' day or a forty-eight hours' week as the standard to be aimed at where it has not already been attained."

The Peace Conference approved of these general principles in its plenary sitting of April 28 1919. An International Organizing Committee, representative of the United States, Great Britain, France, Italy, Japan, Belgium and Switzerland, appointed to prepare for the first session of the International Labour Conference created by the Labour part of the Treaty, placed first upon the Agenda for that Conference the question: "Application of principle of the eight hours' day and of the forty-eight hours' week."

Working Hours in Industry.—On May 10 1919 the Organizing Committee issued to the Governments of all the States which were named in the Annexe to the Covenant of the League of Nations a questionnaire, the object of which was, firstly, to secure information as to how far the 8-hour day was already observed, whether as a result of legal enactment, collective agreement, or custom; and as to the immediate intentions (if any) of the various Governments in the matter; and secondly, to elicit by categorical questions the attitude of the Governments towards the proposed limitation of the working day to 8 hours and the working week to 48.

Thirty-five Governments replied to the questionnaire. To the categorical question: "Is the Government prepared to adopt the limit of eight hours a day exclusive of rest-time?" not one Government returned a definitely negative reply. The Government of Siam did not contemplate legislative action "in the present circumstances." In the United States and Canada the distribution of legislative power between the central and state or provincial authorities made a direct reply difficult if not impossible. The Japanese Government doubted the possibility of the immediate application in Japan of the 8-hour day, in view of the relatively unadvanced state of most of her industries and the inexperience of her workers. Similar considerations were argued by India and by Greece. Every other State replying to the questionnaire indicated its readiness to adopt the 8 and 48-hour limits. Many of them indicated that these limits (or lower ones, as in the case of Poland, which had a 46-hour week) were already enforced within their territories.

The list of these States comprised every Power of industrial importance, with the exception of Russia, Finland and the ex-enemy States, and included Argentina, Belgium, Czechoslovakia, Denmark, Ecuador, France, Great Britain, Guatemala, the Netherlands, New Zealand, Nicaragua, Norway, Poland, Portugal, Panama, Peru, Rumania, Serbia, Spain, Sweden, Switzerland and Uruguay, in addition to those mentioned above.

Of the States which were not consulted or which did not reply, it was known at the time that Finland, Germany, German-Austria and Russia had already taken action by law.

This evidence pointed clearly to the possibility of the successful conclusion of an International Convention on the subject; and the Organizing Committee proceeded at once to the drafting of a project to be submitted for the consideration of the Conference. The basis of this project was the adoption of the 48-hour week rather than the 8-hour day, the Committee giving as its reason for this, that "it allows more elasticity in the arrangement of the hours of work, and it facilitates the adoption of a half-holiday, or even a whole holiday, on Saturday or some other day of the week, by enabling a longer period than 8 hours to be worked on other days. Secondly, it helps to secure the weekly rest-day, whereas the principle of an 8-hour day by itself does not." The greater part of the project was concerned with the limitations within which exceptions to the general rule should be permitted. It was clearly undesirable to leave unlimited scope for exceptions. "The mere affirmation of the principle of a 48-hour week, while leaving a wide discretion to each State to allow such exceptions as it considers desirable in the circumstances of its country, would not, so it seems to the Committee, fulfil the purpose for which the International Labour Organization has been created." Since one of the motives of such a convention, as indeed of all international labour legislation, is the removal so far as possible of such sources of international friction as those which arise from the competition of "cheap" labour, or of labour suffering under relatively disadvantageous conditions, the Committee was obviously adopting the proper attitude in this respect.

The discussions of the International Labour Conference, which met at Washington in Oct.–Nov. 1919, turned for the most part on the permissible exceptions. To the general principle little or no opposition was offered. The Organizing Committee's project was, after some preliminary discussion, referred to a Commission of the Conference, and a Special Countries Commission was entrusted with the task of considering the application of this and other projects to tropical lands and countries displaying unusual conditions.

The Commission on Hours amended the draft in several particulars, and clauses were added to meet the special cases of Japan (a 57-hour week); British India (a 60-hour week, with a clause indicating that further limitation of hours is to be considered at a future session of the Conference); China, Persia and Siam (consideration at a future session); Greece (postponement of the date at which the provisions of the Convention should come into operation for two years in the case of certain industries, three years in the case of others); and Rumania (postponement for three years).

The Organizing Committee's omission of a provision for the establishment of the 8-hour day was not upheld by the Conference, which approved, in the final draft, the wording:—

> "The working hours of persons employed in any public or private industrial undertaking or in any branch thereof . . . shall not

exceed eight in the day and forty-eight in the week with the exceptions hereinafter provided for."

The draft Convention came before the Conference for its final vote on Nov. 28 1919 and secured the two-thirds majority which is necessary for the formal adoption of a draft Convention.

The authentic text of the draft Convention was communicated to the Governments of all States Members of the International Labour Organization by the Secretary-General of the League of Nations on Jan. 15 1920.

Since a large number of the industrial States had already adopted, by legal enactment, or otherwise, the 8-hour day, it might have been expected that the ratification of the draft Convention would be rapid and practically universal. But this was not the case. Up to Aug. 1921 two countries only, Greece and Rumania, had ratified. Some countries (*e.g.* Great Britain and Switzerland) had definitely declined to ratify.

In the first place, certain difficulties arose as to the interpretation of those articles of the Treaty which govern the action to be taken by States in connection with the draft Convention. Article 405 of the Treaty of Peace provided that " Each of the members undertakes that it will, within the period of one year at most from the closing of the session of the Conference, or if it is impossible owing to exceptional circumstances to do so within the period of one year, then at the earliest practicable moment, and in no case later than eighteen months from the closing of the session of the Conference, bring the recommendation or draft Convention before the authority or authorities within whose competence the matter lies, for the enactment of legislation or other action." The wording of the last sentence has given rise to certain hesitation, but the bulk of the States members have construed " the authority or authorities within whose competence the matter lies " to mean their respective Parliaments, and have submitted the draft Convention together with the Governmental proposals for action upon it, to those bodies. In Great Britain the difficulty arose from the fact that Article 405 provides also that draft Conventions be submitted " for ratification by the Members." It was contended that the ratifying authority in Great Britain is the Crown, and that the Government was therefore under no obligation to submit a draft Convention for the consideration of Parliament unless legislative action in pursuance of the provisions of the draft Convention was contemplated.

Secondly, difficulties arose in connexion with the actual procedure of ratification. The Treaty provides an apparently simple formula:—

> " In the case of a draft Convention the Member will, if it obtains the consent of the authority or authorities within whose competence the matter lies, communicate the formal ratification of the Convention to the Secretary-General. . . ."

But this procedure was, in certain cases, found to fit awkwardly into the complicated framework of the older diplomatic practice. France considered it necessary to sign with Belgium a convention embodying the terms of the draft Convention on hours, and to add a protocol which was left open for the signature of other States. France and Belgium may thus in some sort be said to have ratified the Hours Convention, though they did not complete the procedure laid down in the Treaty. But the act of France and Belgium led to some misgiving on the part of other states members of the organization, who naturally asked whether these two countries would consider themselves bound not only in respect of one another and of any other countries which might adhere to the Franco-Belgian convention by signing the open protocol, but also in respect of other States which might ratify the Washington Convention by the procedure indicated.

Thirdly, the exceptions provided for in the text of the Hours Convention did not appear to meet the circumstances of all countries. Thus, Switzerland, which had adopted the 8-hour day on its railways and in certain branches of industry, and which, in its reply to the Organizing Committee's questionnaire, stated that " The Government prefers the 48-hour week system and is prepared to adopt this limit in factories," declared itself unable to ratify the Hours Convention, principally on the ground that it considered its application to the small trades and undertakings of the rural and mountain districts to be undesirable. Again, Sweden, whose Government was " prepared to adopt both limitations (*i.e.*, the 8-hour day and 48-hour week) at the same time," was faced by similar difficulties. The British Government was " prepared to adopt the limit of 48 hours a week exclusive of rest-time." In Great Britain the 8-hour day and 48-hour week (or less) are all but universal. Yet the Minister of Labour declared that the Government was unable to ratify because of existing collective agreements governing the working of the railways, which permit overtime in certain cases which are not provided for in the Convention. The same or similar circumstances delayed or prevented ratification by Denmark, Holland, Norway and possibly other States.

Other factors making for non-ratification were the disturbed economic state of post-war Europe, and a reaction both in Government circles and in public opinion, as to the wisdom of shorter hours of labour in view of the need for greater production. The failure of the Russian revolutionaries to establish a satisfactory social system, the crushing of the attempts of their sympathizers in Hungary and Germany, and the failure of great strike movements in France, Great Britain and elsewhere, had moderated the fears of revolutionary action which were a factor in the creation of the International Labour Organization in 1919.

Working Hours at Sea.—The Washington Draft Convention was applicable to " industrial undertakings " which were defined partly by enumeration and partly by exclusion. The line of demarcation between industry on the one hand and commerce and agriculture on the other was left to be drawn by the individual States, and the whole question of the application of the 8 and 48 rule to maritime and inland navigation was deferred for the consideration of a special meeting of the Conference. The preparations for this meeting were made by the International Labour Office. Questionnaires were sent to the States members of the International Labour Organization, in order to establish the existing position with regard to the hours of labour worked at sea and on inland waterways, and to elicit the views of the Governments as to the establishment in these spheres of the 8 and 48 rule.

The principal maritime countries replied unanimously in favour of international regulation of the hours of labour on board ship, but in most cases with considerable caution with regard to the 8 and 48 rule, which is clearly more difficult of application under sea conditions. On the whole, however, the evidence was again in favour of the possibility of the conclusion of a Convention upon the subject, and the International Labour Office, basing its work upon the replies of the Governments to its questionnaire, elaborated a draft for submission to the Conference.

The second meeting of the Conference took place at Genoa, June 15–July 10 1920. The delegates attending it, whether representing Governments, employers' organizations or workers' associations, were predominantly men experienced in maritime administration or practice. But the result was indecisive. The draft prepared by the International Labour Office was referred as at Washington, to a special commission, and after being amended it was submitted to the full Conference, which approved it by a vote of 48 to 25; the two-thirds majority necessary for formal adoption thus was not attained, though by a very narrow margin.

The questions of the hours of labour in the fishing industry and in inland navigation were dealt with separately by the Conference. In both cases a recommendation was agreed upon, by the terms of which the States members were urged to adopt legislation limiting in the direction of the 8-hour day and 48-hour week the duration of the labour concerned. (H. A. G.*)

HOUSE, EDWARD MANDELL (1858–), American politician, was born at Houston, Tex., July 26 1858. He was educated at the Hopkins grammar school, New Haven, Conn., and at Cornell University (A.B. 1877). He returned to Texas, where he became interested in politics. He never sought office, but as a trusted adviser he became influential in the Democratic party. He became a friend of President Wilson, with whose political ideals he sympathized, and after the outbreak of the World War in 1914 visited the belligerent countries as the President's personal representative, conferring with the leading diplomats informally and advising American ambassadors of the President's attitude on various questions. He himself repeatedly declared that he was not a peace envoy. In 1915 and in 1916 he was again in Europe observing conditions and from time to time making confidential reports to the President. This method of approaching foreign Governments through private personal contact instead of stereotyped diplomatic formality brought some criticism upon the President, many believing that the powers of the recognized head of the State Department were being infringed upon. In 1917 he was elected a director of the Fort Worth (Tex.) *Record*. After America's entrance into the World War in 1917 Col. House was appointed to gather information which the U.S. peace representatives would need when the terms of peace should ultimately be discussed. He represented the United States at the Inter-Allied Conference in Paris, Nov. 1917. In Dec. of the same year he represented the United States in the Supreme War Council at Versailles. In 1918 he was delegated by the President to act for the United States in negotiating the Armistice and was a member of the American Peace Commission. He took a prominent part in drafting the Peace Treaty in 1919. In 1920 he joined the staff of the Philadelphia *Public Ledger*, and visited Europe as a correspondent of that paper.

HOUSING (*see* 13.814).—Subsequently to 1910 the housing problem greatly increased in difficulty. At that time it was largely a problem of the poorer classes, of slums, of congestion in cities and large industrial centres, and the like. In 1921 it reached even to the middle classes. There was a world shortage of houses. In addition the slum difficulties remained, and a great many houses had fallen into serious disrepair since 1914 owing to the World War.

There were no reliable statistics up to June 1921 on the shortage, though better information was likely to become available as the result of the taking of the 1921 census in England and elsewhere. However, there was no doubt on the general question. Almost every responsible Government of the world was confronted with a grave housing problem. There was abundant evidence of the crying need for houses which prevailed not in Europe alone, but in the remoter continents. A shortage of houses existed simultaneously in towns as far from each other as Paris, Cape Town, Bagdad, Melbourne and Bombay.

Such expedients as the compulsory registration of empty rooms, the erection of wooden hutments, and the conversion of large dwellings into small ones had been introduced, whilst in Germany the unpopular measures of rationing house room, and of billeting the civilian population in private houses, had been urged upon local authorities by the Government.

In several countries laws had been passed for the purpose of making grants of money from public funds towards building costs; of extending the power of local authorities in the matter of housing; of securing the observance of proper standards in the building of small dwellings; and of remedying the evil housing conditions prevailing in so many large and prosperous towns. Legislation had also been passed for the restraint of rent profiteering, to which the shortage of houses had given encouragement, whilst in France, the United States, Germany and Norway, special rent committees had been formed whose duty it was to reconcile, as far as possible, the claims of landlords and tenants.

In carrying out legislative measures and housing schemes misunderstandings had tended to arise between the authorities and the public, because progress was slow at a time when speed appeared to be the main essential to those actually in need of houses. In most countries, however, after the war an endeavour was being made to increase the number of houses and to secure a higher standard of housing for the future than has prevailed in the past.

Undoubtedly the World War was the chief cause of the universal house shortage in the countries affected by it. During the war house-building almost ceased; even the loss caused by a number of houses passing out of use each year was not met, and, in addition, populations increased despite the war. In northern France, in Belgium, and in the war-devastated portions of the world generally there was also a special loss of houses. But the war was not the only cause. Even before the war there was a growing shortage of small houses, and probably special measures would have been necessary to cope with it. The cause of this pre-war shortage has been variously estimated, but finance had much to do with it. There was a difficulty in building small houses where they were needed, at a suitable rent—suitable, that is, to the pockets of the tenants. That was one of several difficulties which still confronted private enterprise in 1921, but whereas it caused a slowing down in pre-war years it afterwards produced very nearly a cessation.

Some of the results of the shortage are familiar, including overcrowding, and all that it means. Again, the shortage formed one cause of social unrest. Further, slums cannot be cleared until their occupants can be re-housed. The problem of overcrowding is, however, not identical with that of the shortage of houses. Some families live in one or two rooms because of poverty and the like. There are no recent national statistics about overcrowding, the latest available in 1921 for the United Kingdom being those derived from the 1911 census returns, showing that 9% of the population of England and Wales were living more than two persons per room. The percentage was over 30 in Sunderland, Newcastle, and neighbouring towns, and in London was 17·7 per cent. It may here be added that there has been a growing recognition on the part of large employers of labour that they have an interest, if not indeed a responsibility, in the housing of their workers; and in several instances employers have helped to supply the need. In areas where new works are erected there is an influx of workers often resulting in overcrowding. Much information on this subject is given in "Housing by Employers in the United States," *Bulletin of the U.S. Bureau of Labor Statistics, No. 263*.

The housing problem has become especially difficult in several areas by the lack of suitable building sites, involving the problem of cheap and quick transport. Most people like to live within easy reach of their work, and if more houses cannot be built near (for instance) collieries in Wales and offices and works in London, there must either be overcrowding, or a good tram, bus, or train service to the areas where houses can be built. In the case of some works and offices there is an alternative, namely to move them from the crowded city centres to satellite towns, and this alternative has had attention. To overcome the difficulties of housing in the populous and prosperous South Wales coal-fields, it has been suggested by a committee of investigation that dormitory towns be built by the Government in a cleaner atmosphere with surroundings giving a less confined outlook, though still within easy reach of the collieries by train.

But the solution offered by dormitory towns, though probably the only one possible in South Wales, is not complete. The garden city, or satellite town, is better. The promoters of garden cities insist that works and offices should be moved to such cities, and thus that the people can have suitable work without travel. Much useful information on this subject is published in England by the Garden Cities and Town-Planning Association, 3, Gray's Inn Place, W.C. 1; and the International Garden Cities and Town-Planning Association with which it is allied held an important conference in London in 1920, attended by a large number of foreign delegates, and presided over by the veteran president and pioneer of the movement, Mr. Ebenezer Howard.

UNITED KINGDOM.—A good indication of the housing problem is to be found in the legislation in force in the United Kingdom. The first of the Acts is the Housing of the Working Classes Act, 1890. It repealed a large number of previous Acts, going back to 1851, but had their main objective, namely, the removal of unhealthy housing conditions. It had little concern with the provision of new houses, and the powers in that regard which it conferred on local authorities were adoptive only. This may be taken as evidence that the shortage of houses was not then a problem requiring serious action by the State. Even in the Act of 1909 (the Housing, Town-Planning, etc., Act, 1909) the powers with regard to the provision of houses by local authorities were left optional. It was not until the Housing, Town-Planning, etc., Act, 1919, was passed that they became duties.

The 1890 Act contained somewhat elaborate provisions enabling local authorities to remove unhealthy housing conditions. There were powers to enable the authorities to compel landlords to repair houses; houses could be closed until made fit, or demolished; small groups of unfit houses and large areas could be acquired for improvement (mainly demolition) purposes; and there were many cognate powers and provisions.

In 1894, 1900 and 1903 short Acts were passed amending the 1890 Act chiefly in matters of administrative detail.

In 1909 the subject of "town-planning" had come to the front, and a large and interesting part of the Act passed in that year was devoted thereto.

Another important new provision was that prohibiting the erection of back-to-back houses. The following extract from a summary of the report for 1918 of the medical officer of health of Birmingham is typical of a mass of evidence on the subject of such houses:—

> "In 1913 there were 43,366 back-to-back houses in Birmingham housing 200,000. In six wards, all in the central area, from 51 to 76% of the houses were of this kind. During the period 1914–8 four of these wards had a general death-rate of more than 19 per 1,000; five an infant mortality greater than 134 per 1,000 births; three a measles death-rate above 0·56; five a death-rate from pneumonia and bronchitis above 3·63; five a phthisis death-rate above 1·63; and five a mortality rate of over 29 per 1,000 births for deaths at ages under two from diarrhoea and enteritis. As a contrast we may take King's Norton with less than 8% of back-to-back houses. The death-rate here from all causes is less than 10·9, the infant mortality less than 78, the measles mortality less than 0·15, the bronchitis and pneumonia rate below 1·62, the phthisis rate below 0·89, the diarrhoea and enteritis figure below 9. Some of the inhabitants may be shiftless and criminal, unfit to thrive in any environment, but it is impossible to imagine a rising generation of young people being able to improve in health or self-respect, even if the best of educational facilities are provided, when everything they come in contact with is sullied by dirtiness and squalor."

The 1909 Act also amended in some detail the 1890 Act, and brought it into closer touch with the conditions and the problem as then existing. But it contained nothing to indicate that there was a general shortage requiring action beyond the power of private enterprise. There were local shortages and congestion. Certain local authorities might want to build, but, excluding the rural problem, mainly by way of re-housing poor persons to be removed from unfit dwellings. However, by 1911 a general shortage was threatening. Private enterprise had supplied 95% of the houses built, and continued to do so up to 1915, but the output was slackening.

The following statistics on the subject are interesting:—

New Houses Built.

	England and Wales		Scotland	
	Houses under £20 rental	Houses of rental £20–£41	Houses under £20 rental	Houses of rental £20–£41
1904–5	99,905	25,026	12,933	2,129
1911–2	44,821	14,300	1,429	1,546
1912–3	45,632	13,926	2,491	1,784

The year 1904–5 was one of high-water mark in building, and on the assumption that in England and Wales 100,000 new houses are required each year, it will be seen that there was under-building from 1911, and that there was every indication of a new problem before 1914. In 1904–5 the annual value of the 99,905 houses under £20 rental was roughly £13 each, and of the 25,026 houses at £20–£41 rental it was roughly £28. The corresponding figures for Scotland were £12. 10s. and £28. It is difficult to compare these figures with those for the houses being built in 1921, as the quality, it is contended, had been improved; but if an economic rent were charged for the latter it would be at least three times as great as the rent of pre-war houses.

Further evidence that the output by private enterprise was slackening before the war is to be found in the *48th Annual Report* of the Local Government Board for 1918–9:—

Number of Houses proposed to be erected by Local Authorities.

Year ended	
March 31 1911	464
March 31 1912	1,021
March 31 1913	1,880
March 31 1914	3,291
March 31 1915	4,408

The number of local authorities concerned in these efforts was 181 in the year ending March 31 1915. This, however, is but one-tenth of the local authorities, and it should be remembered that much of the housing proposed was connected with slum clearances and the serious lack of houses in rural areas. On the latter point the report of the Local Government Board for 1912–3 shows that loans had been sanctioned to district councils for housing in 42 villages, in 21 of which there would be a deficit to be met by the ratepayer. The shortage caused by the war thus came at an unfortunate moment, and even in 1917 it was clear that extraordinary measures would have to be taken as soon as possible after the cessation of hostilities.

It should be mentioned that, following the outbreak of war, the Housing Act, 1914, and the Housing (No. 2) Act, 1914, were passed. These, however, were of limited application and had little general effect.

In July 1917 the Government took the first steps towards meeting the after-war housing problem, and issued a letter to the 1,806 local authorities (borough, urban and rural district councils) in England and Wales asking for a return as to housing conditions and needs. There were 1,660 replies indicating an immediate need for some 400,000 working-class dwellings. A similar letter to the 311 Scottish local authorities resulted in returns showing a need for 109,000 houses. The Royal Commission upon Housing in Scotland estimated in 1916 that 121,000 houses were needed to remove overcrowding and to remedy uninhabitability of houses at that date. They estimated that if the standard were raised very moderately no less than 236,000 houses would be at once required. In Aug. 1921 a departmental committee supported these conclusions, and pointed out that in Glasgow there were 12,000 houses which had been condemned by the medical officer of health as unfit for human habitation, but which, owing to the housing shortage, were still occupied. In the House of Commons on April 14 1921 it was stated that the number of houses estimated to be required in Ireland was 53,033.

The Government then announced the financial assistance it would grant to local authorities providing houses, it being evident that private enterprise could not meet the demand. Negotiations followed on the subject of this financial assistance, but there was nothing accomplished of a very settled character at the date of the Armistice. On Nov. 14 1918 the Government issued a further letter, but the replies indicated meagre possibilities of an early start. In Feb. 1919 the Government made its final offer, to the effect, broadly, that it would bear the annual loss in excess of a penny rate, subject to the conditions laid down. That there would be a deficit was clearly recognized by all. There was a scarcity of building materials and of labour, and it was certain that the cost of each would be high. To set off against this high cost there would be only the rent receivable, and the tenants could not pay the rent necessary to prevent a deficit. The local authorities accepted this offer and the Government introduced the Housing, Town-Planning, etc., Act, 1919. The chief provisions of this Act were: to make it the duty of every local authority to survey the housing needs of their district, and to prepare and carry out a housing scheme to meet the needs and to provide for action on the default of a local authority; to give financial assistance to local authorities, and to public utility societies; to facilitate dealing with slum areas; in conjunction with the Acquisition of Land (Assessment of Compensation) Act, 1919, to facilitate and cheapen compulsory acquisition of land; to simplify the procedure of town-planning and to make it compulsory on towns with over 20,000 inhabitants.

This was a very heavy programme, involving an almost incredible amount of hard work. The subject bristled with difficulties, and the strength of the Ministry of Health (which was given charge of the scheme) was taxed to the uttermost. The local authorities' surveys showed an estimated need of new houses in England and Wales of over 800,000. This was a decided over-estimate, and revisions reduced the number considerably in a very large number of cases.

But though the Act was no doubt well conceived, progress in building was slow, and the Housing (Additional Powers) Act, 1919, was passed. The chief purposes of this Act were: to provide a subsidy, amounting in the aggregate to £15,000,000, to private persons building small houses; to check luxury building; to prevent the demolition of dwelling houses; to enable local authorities to issue housing bonds; to facilitate the acquisition of land for the purpose of garden cities or town-planning schemes.

The subsidy was at first £160 for the largest type of house permitted and £140 for the smallest, but the heavy increase in the cost of house building soon resulted in the increase of the subsidy by £100 per house. The subsidy, originally offered for 12 months only, was subsequently extended by the Housing Act, 1921, but withdrawn in July 1921. The results to May 1 1921 were announced in the House of Commons on May 12 1921:—

Houses under approved tenders	176,000
Houses under signed contracts	160,000
Houses commenced	102,000
Houses practically completed	45,000
(The latter two items include "subsidy" houses.)	
Average loss to the State on each house built by local authorities	£60 per annum
Tenders for average-sized house:—	
July 1919	£650
Aug. 1920	£950
May 1921	£855

Early in 1921 the Government reviewed its housing programme, and on July 14 the following statement was made in Parliament by the Minister of Health:—

"The number of houses built, building and contained in approved tenders under the housing scheme for local authorities and public utility societies is now about 176,000. Under the scheme of subsidy to private builders the number of houses built or to be built is estimated at about 23,000. The annual cost to the State under the local authorities and public utility societies' schemes is about £10,000,000 per annum, and the amount required for the payment of subsidies to private builders is about £5,000,000.

"In view of the immense difficulties confronting the nation during and after the war the Government think that they have no reason to be dissatisfied with the scale of their contribution to the housing problem—a contribution, notwithstanding the grave embarrassments of the war, without precedent in our history. The Government is, under its housing scheme, performing, at great cost, a work of supreme national importance which private enterprise could not carry out. At the present time the houses which are being built or are to be built under the Government Housing Scheme will utilize all available labour for at least twelve months, including a considerable number of ex-service men to be absorbed in the industry. By the end of twelve months conditions may have changed very greatly, prices may be stabilized, and the considerations upon which Government action should be based may be fundamentally altered. Reconsideration is, moreover, imperative when regard is paid to the present financial condition of the country.

"The Government have accordingly decided that, for the time being at any rate, the following limitation must be placed on housing expenditure. The number of houses to be constructed by local authorities and public utility societies with Government assistance under the present scheme will be limited to 176,000, that being the number built, building, or for which tenders have been approved, and assistance will not be given under the scheme in respect of any houses in excess of that number. It would appear that on a final examination of the present approved tenders some adjustments will be possible to meet cases of hardship without exceeding this total.

"All expenditure in connexion with the housing schemes which has already been incurred by local authorities with the approval of the Ministry of Health will rank for financial assistance under the present scheme, which limits the liability of local authorities to the produce of a penny rate, and where work undertaken by local authorities with the approval of the Ministry of Health cannot for reasons outside the control of the authorities be completed by July 1922, the time for completion will be extended as may be necessary.

"As regards the scheme of subsidy to private builders, the powers taken under the recent Act will be exercised to the extent of making payment in full for houses completed within the four months after the expiration of the previous Act, *i.e.* by April 23 last, and additional houses will be subsidized only if begun before July 1, under a certificate or the promise by a local authority of a certificate. There will be cases in which commitments have been entered into, although construction has not actually been begun, in anticipation of the continuance of the subsidy. In order to meet these cases I shall, in the exercise of my discretion, pay subsidy where commitments have been entered into, if work is started within six weeks.

"The Government recognize the urgent necessity of making what improvements are possible under present financial circumstances in slum areas. To this end they are prepared to provide an annual contribution not exceeding £200,000 towards the deficiency on local authorities' accounts for the improvement of slum areas. This annual contribution will continue for the whole term of such loans as may have to be raised by local authorities.

"It is the intention of the Government to keep the housing problem closely under review. They fully recognize the importance of that problem from the point of view of the health and social conditions of the people, but it is impossible to incur greater commitments than our finances will allow."

On the same date the figures for Scotland were given as follows: houses built, building or contained in approved tenders, by local authorities and public utility societies, 21,749; private builders' subsidy houses, 2,220; Government assistance to be limited to a total of 24,500 houses; annual charge for local authorities' houses, £1,087,450; total cost of private builders' subsidy, £550,000. The figures for Ireland were not given.

Town planning, though dealt with in the Acts above mentioned, is not exclusively a housing subject. Its object is to put a check on indiscriminate development. The policy of planning ahead enables a local authority to check the crowding of houses together, and to avoid the repetition of the haphazard development of the past, with its bequest of road widenings and other improvements rendered exorbitant in cost through the demolition of misplaced property. In the preparation of town-planning schemes attention can also profitably be given to the claims of industry. The schemes in existence in 1921, in so far as they prescribed restrictions as to the character of buildings, were chiefly concerned to preserve the amenities and healthful conditions of residential districts. But town planning should be of at least as great a value to industry. In America the art of "zoning" is practised as much with a view to the suitability of sites and convenience of transport for industrial undertakings as for the protection of house property.

The following table shows the number of town-planning schemes in contemplation, in course of preparation, or in actual operation, on March 1 1921:—

Position of scheme	No. of schemes	No. of L. As. submitting schemes	Acreage covered by schemes
1. Schemes finally approved (incl. one amending scheme)	7	5	10,329
2. Schemes submitted and not yet approved	9	8	23,216
3. Schemes authorized under Act of 1909 to be prepared but not yet submitted	155	101	275,051
4. Resolutions under Act of 1919 deciding to prepare schemes—			
(I.) Not requiring approval	42	39	151,283 (approx.)
(II.) Approved	18	15	77,232 (approx.)
5. Resolutions awaiting approval	7	7	46,153 (approx.)
Totals	238	154 (net)	583,264

Thus 154 local authorities were engaged in preparing 238 town-planning schemes covering over 583,000 acres.

On the subject of the advantages which might be anticipated from town-planning schemes and improved transport facilities, the Registrar-General of Births, Deaths and Marriages had a significant paragraph in his report for 1918. He gives two tables of the county boroughs arranged in order of low infant mortality rate, and says that, as might be expected, the highest places in both tables are occupied for the most part by residential towns, "but the position of East Ham (a working-class area in the east of London), seventh for the mortality of the first twelve months and thirteenth for that of the first four weeks, out of the whole 82 county boroughs, shows what results may be attained in a working-class community. The conditions here of course differ materially from those of the more common case where the areas of industry and residence coincide; and the habitually low rates returned by this and neighbouring residential working-class suburbs of London are of good omen for the success which may be achieved elsewhere by improvements in town planning and transport."

Another part of the Housing, Town Planning, etc., Act, 1919, amended and brought into line with modern conditions the Small Dwellings Acquisition Act, 1899, enabling local authorities to lend money so that occupiers may become owners.

Other Acts bearing on housing are the Land Settlement (Facilities) Act, 1919, and the Acquisition of Land (Assessment of Compensation) Act, 1919. The former deals with the powers of county councils in connexion with the settlement of soldiers on the land and the provision of the necessary houses. The latter simplifies the machinery for the assessment of compensation for land taken compulsorily for housing. Of other Acts affecting housing the chief are the Public Health Acts; but one which has a powerful temporary influence was the Increase of Rent, etc., (Restrictions) Act, 1920, which restricted the rent to be charged by landlords for houses (built before April 2 1919) of the type of which there was a shortage, to that charged at the outbreak of war, plus percentage increases of, generally, 40%. People paying such rent and increases could not be evicted except in special circumstances. This Act would expire on June 24 1923.

The above summary of the Acts shows their broad effects in England and Wales. The legislation affecting Scotland and Ireland is almost identical, with, however, special provision for crofters in Scotland.

The position in England and Wales up to July 1921 was briefly as follows: There were roughly between 7,000,000 and 8,000,000 residential houses. The average life of a house is not more than 100 years, and it was urged that from 70,000 to 80,000 new houses were needed on that head every year. Further, there is the growth of population, estimated by the Registrar-Géneral of Births, Deaths and Marriages as calling for 140,000 new houses during the decade 1910–20. (Population growth had been checked during the war.) But the houses required had not been provided during the war, and only a part was provided for some years previously. The result was a shortage variously estimated as being from 500,000 to 800,000. Of this number the State was helping local authorities to provide up to 176,000, at a cost to the State estimated at £10,000,000 per annum. (In addition the State was finding £5,000,000 in a lump sum as a subsidy to private builders.) This annual loss would vary in accordance with the cost of building and the rents which could be secured for the houses. On June 1 1920 the average officially approved rent on the new houses was 12s. 3d. per week, exclusive of rates: 1·5% were under 6s. and 1·5% over 20s. The lower rents were charged in rural districts. Generally the rents payable cover from one-third to one-half of the cost of providing the houses.

Public financial assistance to housing schemes is not a new principle. Up to 1914 52,000 cottages had been built by Irish local authorities at a cost of £8,500,000, and there was an annual loss thereon. In Liverpool people displaced from slums had been re-housed by the local authority at less than an economic rent, and in several county villages the local authorities had provided cottages on which there was a loss.

On March 1 1921 there were 108,168 men, of whom 54,479 were skilled, employed on the housing schemes of local authorities and public utility societies; but 10,686 additional skilled men were required for the work actually in hand, while a considerably larger number could have been employed on schemes for which official approval had been given.

The Government had made several attempts to increase the supply of labour, and steps had been taken to meet other difficulties arising, particularly that of the heavy cost of building. Many new building materials had been tested.

Canada.—The progress of housing in Canada has not been rapid, in spite of the fact that the Federal Government in March 1919 voted a credit loan of £5,000,000 for general housing purposes. The money was to be distributed in proportion to population, a grant being made to the Government of each province for the municipalities on condition that they submitted suitable housing schemes. But the plan met with opposition from some local authorities, who refused to work under the Federal scheme. The impression, too, prevailed among the working population that the restrictions and guarantees demanded by the Federal and provincial Governments made it impossible for workmen to acquire a loan. The grant allocated to the province of Ontario amounted to about £1,800,000, but it was expected that the provincial Government would be compelled to finance housing to the extent of £3,000,000. Sixty-six of the municipalities had by Sept. 1919 agreed to work under the scheme, 21 of which had already begun building, but the largest municipality, Toronto, had refused to coöperate, as it preferred to finance its own housing schemes. The city council of Halifax (Nova Scotia) rejected the Federal scheme, objecting that it was impracticable and would impose too heavy a burden of debt on the city. The work of rebuilding the area of Halifax, which was destroyed in 1917, went forward steadily under the auspices of the Halifax Relief Commission. The municipal authorities of Winnipeg had agreed to accept the Federal grant, and it was estimated that they would have 200 houses completed by the spring of 1921. Much dissatisfaction prevailed in Winnipeg with regard to high rents, and a Tenants' Protective Association was formed as a means of redress. A building society was created in connexion with the association.

Australia.—The large cities of Australia suffer from a very pronounced shortage of houses, and one of the causes is said to be the growing tendency of the country inhabitants to drift towards the towns. One writer states that the population of several leading rural centres in Victoria is distinctly on the down-grade, whilst figures published in Sydney show that the number of persons engaged in rural pursuits in New South Wales steadily diminished from 154,000 in 1912 to 142,000 in 1917. The war is said to be only partially responsible for this alarming wastage of country population. The housing of returned soldiers and of their dependents in Australia is carried out by the Repatriation Department, which drew up a housing scheme based on the War Service Homes Act of Dec. 1918. The Government made a grant of £20,000,000, and out of this fund the housing commissioner was empowered to acquire private or crown lands, upon which dwellings to the value of £700 each were to be erected. The applicants eligible under the Act are enabled to acquire houses on easy terms, one condition being that they do not own a house elsewhere, either in the Commonwealth or outside it. The Federal Housing Commissioner has invested in land on behalf of the Repatriation Department, but the building of houses has been retarded by the great scarcity of building materials.

The question of housing the civilian population of Australia is left to the Governments of the different states. New South Wales has been the most active, probably because the shortage there is more acute than in the other states. A housing department was created and a minister appointed. The sum of £500,000 was allocated from state funds for building purposes, and the minister promoted schemes for the extension of suburbs outside Sydney and Newcastle, where housing conditions were especially bad. There is no indication of a like activity on the part of the other state Governments in dealing with housing, except in Queensland. In spite of the house famine prevailing in Melbourne the question of housing had not advanced much by 1921 in the state of Victoria.

New Zealand.—Housing conditions in the larger towns of New Zealand, particularly in Wellington and Christchurch, are in an unsatisfactory state. It is said that Wellington had been suffering for years from failure of private building enterprise, and had reached the stage in 1921 when State or municipal intervention was imperative on account of the shortage and overcrowding which prevail. The position was not much better at Christchurch, where about 1,000 new houses were needed.

The efforts of the New Zealand Government in the direction of practical housing were confined to authorizing the Labour Department to build 200 dwellings in Wellington. Certain clauses of the Public Health Amendment Act of Dec. 1918 were aimed at the prevention of overcrowding and the demolition of unhealthy buildings, but they could hardly produce much effect as long as the shortage of accommodation continued.

The Parliamentary Committee on Industry presented its report in Aug. 1919, and the following were some of its recommendations: That a national Housing Department be set up, which should formulate a comprehensive scheme of house construction; that £2,000,000 be allocated towards the scheme; that the houses be available, by preference, for men with incomes below £300 a year, with an additional allowance of £25 per child in cases where there are more than three children; and that local authorities be empowered to engage in housing schemes.

South Africa.—The cost of living, together with the high rents and the prevailing shortage of houses, has caused much discontent in South Africa. The Government was urged to take steps to deal with the control of rents, to finance building undertakings, and to take steps to clear slum areas, as it was felt that the question had assumed national proportions requiring the intervention of the State. Not much had been accomplished by the Government up to 1921 towards solving the question. Some legislation had been passed, notably the South African Health Act, by which the duty of supervising housing conditions in urban areas and of enforcing the observance of proper building standards by local authorities is vested in the Department of Public Health. Another measure was passed in June 1919 to enable the town council of Durban to borrow money for housing purposes and to build and erect its own houses. A housing commissioner was appointed in Sept. 1919 to investigate conditions in several municipal areas and to report whether it would be advisable to give financial or other assistance to local authorities for providing houses for people of limited means. Matters were specially unsatisfactory in Johannesburg, where it was necessary to provide temporary accommodation in tents for persons who had no houses. A few of the large municipalities of South Africa have adopted the plan of building houses for their employees. The authorities of Cape Town built a garden village in the suburbs for this purpose, and Port Elizabeth had a similar scheme in view.

India.—The outstanding feature with regard to housing in India is the question of high rents, which had entailed considerable hardships on the inhabitants of the large towns. In some of the provinces temporary legislation against rent profiteering has been carried out. Although the question of rents most engages public attention, there is also a serious shortage of housing. The shortage of accommodation in Bombay, for instance, was estimated in 1920 at 49,000 permanent dwellings. The population of this city was over a million; and the large majority of the population lived in one-room tenements. The squalor of the slums of Poona, Surat, and Ahmadabad has been the subject of comment. Town-planning on a large scale has been carried out at Delhi, where a suburban area of 800 ac. has been acquired by the Government. This district has been laid out on simple lines, with wide streets, and building sites have been leased for long periods.

France.—The principal sufferers from the housing shortage in France are the inhabitants of the larger towns. In Paris the position is especially unsatisfactory; overcrowding prevails extensively, and conditions from the point of view of health are said to be deplorable. Housing conditions in the seaports may be exemplified by the case of Marseilles, where ruinous houses, condemned as unfit for human habitation, whose demolition had already been begun before the war, were again in 1920 in occupation. Commercial firms found great difficulty in obtaining labour in the locality owing to the shortage of accommodation for workmen.

There was not much evidence in 1921 of the building of dwellings either by public authorities or by building organizations. In Sept. 1919 the "Cheap Dwellings Bureau" of the Department of the Seine was engaged on plans for the erection of several garden suburbs outside the city of Paris, but the high cost of labour, the difficulties of transport and other obstacles to building retarded the progress of these developments very appreciably.

The Government passed some legislation, with a view to suppressing rent speculation, by which a certain rent limit is fixed, due allowance being made for increase from natural causes (building costs and so on). A decree was also issued to the effect that in towns of more than 10,000 inhabitants the owners of boarding or lodging houses must exhibit on their premises notices stating the number of rooms they have to let, and the rents which they ask for them. Notifications containing the same information must also be forwarded to the municipal housing office, should such an office exist in the locality. This legislation is due to the extraordinary demand for hotel and boarding-house accommodation, which had been increasing in proportion to the decrease in dwelling-house accommodation; in Paris the number of persons living in such buildings in 1910 was 129,622, but by 1918 it had increased to 287,156.

Italy.—The attempts to meet the housing shortage in Italy have taken the form, in the northern towns, of the institution of coöperative societies and building clubs. In the central and southern districts the movement met with less success, as private individuals and coöperative societies were unwilling to invest their money in the building trade, and wished to be guaranteed by the State against any risk of loss. The building operations which had been inaugurated throughout Italy up to 1921 were expected to cost about £10,000,000; the Minister of Industry made an annual State grant of £400,000, and was prepared to increase it if the inhabitants and the coöperative societies showed the requisite activity. The Italian Government passed some legislation dealing with taxes on building. The houses built before April 1924 would be exempt from building and supertaxes for six years, and for four years after the builders would be required to pay half only of such taxes. If the building of these houses was begun before Jan. 5 1920 and finished before the end of 1921 they were to be exempt from all taxes and supertaxes for the whole of the succeeding 10 years.

In order to facilitate the building of workmen's dwellings in Rome the Government issued a decree dealing with State loans, by the provision of which the Treasury might advance sums up to the amount of £1,600,000 to the Ministry of Industry, Commerce, and Labour, which would make loans to building societies through the medium of the Bank of Loans and Deposits, the loans being guaranteed by the State. Supplementary advances up to the amount of £400,000 would be made for roads and public services constructed by the municipality in connexion with the building schemes. The allocating of the grant was to be decided by a committee, presided over by the Minister for Industry, and composed of representatives of building institutions, the Bank of Loans and Deposits, and the municipality of Rome. The committee would exercise supervisory powers over the projected building schemes.

Germany.—The difficulties of the situation were increased after the cessation of the war, and the shortage of houses was in 1921 greater than ever. The shortage had increased by reason of the demobilization of the army and the large influx of persons returning from abroad and from Poland. The office of Housing Commissioner for Prussia lapsed in Sept. 1919, when the administrative work of housing was vested in the Home Colonization Department of the Ministry for Social Welfare. An order issued by the Department in 1921 countermanded an earlier order respecting the entry of new residents into towns already full. The original order granted permission to some municipalities to veto this right of entry, but as the shortage increased numerous rural and other urban authorities clamoured for similar powers. In view of the economic disturbance that might ensue if the practice became widespread the Ministry withdrew the concession altogether. The rationing of house-room and the billeting of civilians in private houses was enforced in a number of towns, whilst supervision was exercised by the Housing Registration Offices over the letting or selling of houses.

The position of affairs in the large towns may be illustrated by the situation in Munich, where towards the end of 1919 the director of the Housing Office stated that matters were going from bad to worse, and that applications for houses to the number of 7,917 had been made at the local House Registration Office, the total number of empty houses available being twenty-three.

A considerable number of Home Colonization Associations were formed all over the country for the purpose of diverting the urban population to rural settlement areas, and in one mining district in central Germany a Home Building Association was formed, whose members intended to build houses for each other when their eight-hour day's work was ended.

Norway.—The shortage of small dwellings in Norway was estimated at a total of 18,000 at the beginning of 1919. The housing problem was said to be largely a financial one, as there was a great need of a well-organized credit system in Norway. There were a few credit institutions, the most important being the "Workmen's Holdings and Dwellings Bank," whose powers were extended by the passing of a law in July 1919 which increased the powers to grant loans and allowed the local authorities to assume responsibility for larger sums than hitherto. In addition, an agreement was concluded between the Small Holdings and Dwellings Bank and the Norwegian Shipping Owners' League, whereby the latter placed a loan of £562,500 at the bank's disposal in order that it might once again be in the position to issue loans. A Housing Council, which was appointed in 1916, reported to the Government in 1919. One of the first practical results was the granting in Nov. 1919 of a loan to the Council of £562,500 out of Government funds, to be used for the building of dwellings of not more than five rooms.

Sweden.—The decrease in building activity in Sweden resulted in acute distress as regards certain localities and certain classes of the community. The shortage of dwellings evoked clamorous demands, especially on the part of the extreme socialists, for the rationing of housing accommodation and other measures of State intervention. The Swedish Social Board, however, maintained that such measures would encroach on the privacy of domestic life, and would probably not result in any real improvement. The Board deliberated on the report presented by a special committee of experts appointed by the Government to investigate the conditions of housing in Sweden, and the main conclusion which it derived from the report was that the State should, in the first place, provide dwellings for Government employees. It proposed that a State grant of £5,600,000 per annum should be made during the next few years, and that £4,000,000 should be devoted to this purpose. The chief means recommended for obtaining the funds was a new Government lottery bond loan. A loan of this kind to the amount of £5,600,000 was floated in £2 bonds towards the end of 1919, and was a great success.

Holland.—A law was passed by the Government in 1918 dealing with measures to be adopted by the State and local authorities to relieve the distress caused by the shortage of houses. The law empowered the Government to order the local authorities to prepare statistics as to housing, and to promote building schemes with a view to providing temporary huts as well as more permanent dwellings. The State was to advance, in the form of loans, 90% of the cost of building, the amount thus allocated, in 1918, being over £1,000,000.

The total shortage of houses in Holland was estimated in 1920 at 60,000. The need was very great in Amsterdam, where about 15,000 houses were required; in order to cope with the situation adequately it would be necessary for the municipal authorities to build 6,000 houses per annum for five years. For the whole country 49,000 required to be erected each year during the same period. A scheme was prepared by which 10,000 houses were to be built by the Amsterdam municipal authority and 18,000 by the building societies.

Switzerland.—The housing shortage is acute in Switzerland, especially in Geneva and Berne. In the case of Berne a special decree was issued by the Federal Government, authorizing the local authorities to allow the tenants to remain in the houses which they occupied if they had no hope of obtaining other accommodation. Matters were better at Zürich, owing to the farseeing policy adopted by the local authorities during 1910–20. The Swiss Government made a credit vote of £400,000 to be allotted to the local authorities in whose districts the shortage was most urgent. Grants might be made to private individuals and to societies which were prepared to undertake building operations, provided that the Cantons showed willingness to take their share by advancing similar amounts.

Authorities.—Sir Kingsley Wood, M.P., *The Law and Practice with regard to Housing in England and Wales;* Raymond Unwin, *Town Planning in Practice*, 6th ed.; C. B. Purdom, *The Garden*

City; W. G. Savage, *Rural Housing;* J. Nolen and others, *Houses for Workers; Housing by Employers in the United States*, Bulletin of the United States Bureau of Labor Statistics, No. 263; *Report of the United States Housing Corporation*, issued by the U.S. Department of Labor; *State Housing Manual*, and *Annual Report of the Commission of Immigration and Housing* (California); R. Reiss, *The House I Want;* J. Robertson, M.D., *Housing and the Public Health; Houses of the Working Classes in London 1855–1912* (a Report of the London County Council); *Housing* (a monthly journal issued by the Ministry of Health); *The First Annual Report of the Ministry of Health 1919–20; Part II. Housing and Town Planning* (Cmd. 917), and various other official publications particulars of which may be obtained from H.M. Stationery Office or the Ministry of Health.

Note.—A useful short catalogue of books on housing, etc., is issued by the Garden Cities and Town Planning Association, 3, Gray's Inn Place, W.C. 1. (K. W.; T. A. R.)

UNITED STATES.—The housing conditions prevalent in the United States do not differ materially from those of European countries, although, being new, the country suffers somewhat less from survivals of antiquated forms of architecture and obsolete forms of sanitation. On the other hand, the general use of wood in house and apartment construction renders the fire risk greater than that of European cities. It can be safely stated that every one of the European housing problems is reproduced in the United States to some extent. Reports of investigating commissions for American cities show congestion, poor planning, poor lighting, inadequate ventilation, overcrowding of rooms, and wretched conditions of sanitation and of general maintenance. These undesirable conditions of sanitation and maintenance are reproduced also in the poorer agricultural regions.

Since 1910 there has been a notable increase of interest in the housing problem in the United States. The establishment of the National Housing Association in that year, and the efficient publicity conducted by its secretary, Mr. Lawrence Veiller, led to the establishment of temporary or permanent housing associations or commissions in virtually every important city. Fairly extensive housing investigations have been conducted in more than 60 cities. Among the more recent investigations of this character the surveys of urban and rural housing conditions of California by the State Commission of Immigration and Housing are notable. The report of the Housing Commission of Michigan published in 1916 may be mentioned as another admirable example of a survey by state authorities. Many local investigations by private agencies have also been made during this period.

Among the best of the reports of these studies are:—*The Housing Problem in Chicago*, edited by Sophonisba Breckinridge and Edith Abbott of the School of Civics and Philanthropy (1910–2); *The Houses of Providence, R.I.*, by John Ihlder (1916); *Housing Conditions in the City of St. Paul*, prepared by Dr. Carol Aronovici for the Amherst H. Wilder Charity (1917); *Housing Problems in Minneapolis*, by the Civic and Commerce Association (1914); *The Housing Report*, made to the City Plan Commission of Newark, N.J., by James Ford (1913); the annual reports of the Philadelphia Housing Commission; and *A Study of the Housing and Social Conditions in Philadelphia*, prepared by Dr. Frank A. Craig for the Henry Phipps Institute (1915).

Legislation.—The modern period in American housing legislation dates from the enactment of the Tenement Housing Act for New York City in 1901. Mr. Lawrence Veiller, who is largely responsible for the framing and passage of that law, published in 1914 *A Model Housing Law* (revised edition 1920), which has served as a model for legislation in many American cities during the past ten years. The housing legislation of Columbus, O.; Duluth, Minn.; and Grand Rapids, Mich., for example, is very closely modelled upon this book. Housing laws have been passed during 1910–20 in California, Connecticut, Indiana, Iowa, Kentucky, Massachusetts, Michigan, Minnesota and Pennsylvania. In most instances such legislation applies only to cities of a specified minimum size. In a few cases, however, the law is universal in its application. The legislation of Massachusetts is permissive in its character, but when adopted by any town or city it has the force of state law, and cannot be repealed or changed without the consent of the state Legislature. The enforcement of state legislation in New Jersey is centralized in a state board of tenement-house supervision, under a law passed in 1904. The annual reports of that board show efficiency in administration and considerable accomplishment in the control of housing conditions, in spite of the small appropriations made to the board. In other states the power of enforcement is either largely or wholly decentralized, with the minor exception of the laws of Pennsylvania, which centralize certain powers over sanitation and maintenance of old buildings. The most striking example of vigorous and effective enforcement of tenement-house legislation has been offered by the Tenement-house Department of New York City. The Tenement-house Act of 1901 lodged with that department exceptional powers and established heavy penalties for violations of the law. The appropriations to the department have been relatively large and its administration has been unusually competent.

Agencies of Improved Construction.—Most of the houses for the use of wage-earners in America are designed and erected by building contractors. Such houses are built to rent or sell for profit. The interests of the investors are considered before those of the occupants. Restrictive legislation is always necessary to govern the conditions of structure, sanitation and maintenance in such properties. In general, shrewd investors have found increasingly that tenement-house property does not pay as well as other forms of investment; hence such properties tend to be sold to recent immigrants who are eager to possess real estate but fail to appreciate the weight of the carrying charges of rapidly deteriorating residential property. In some cities, notably Philadelphia, row houses are still constructed in large numbers by operative builders to be sold in units to occupants. Nevertheless, home ownership, which would be facilitated by devices of this sort, is becoming less general in America from decade to decade. The population is increasingly living in rented houses or apartments, and housing conditions are determined by the owners and builders of these properties except in so far as legislation may protect the tenants. Attempts to improve upon prevailing house types have been made by other agencies of house construction, by philanthropic or limited-dividend housing companies, by employers of labour or industrial firms, by coöperative housing associations, or by departments of the state and national Governments.

Limited-dividend Companies.—Construction of model tenements has continued in New York City under the direction of the City and Suburban Homes Co., a corporation which in 1920 had a capital of $6,000,000 divided into shares of $10 each. Dividends amounting to 4¼ % were paid on the invested capital. More than 13,000 persons were housed by this corporation. The construction of tenement houses has been improved in many ways by this company. Open stairways, roof gardens, central-heating systems and large courts are a few of its contributions to tenement-house construction. Its buildings invariably improved upon prevailing local standards in lighting, ventilation, fireproofing and general maintenance. The tendency of improved housing is, however, increasingly in the direction of residential decentralization, so that the construction of attractive homes for individual families has largely superseded the building of model tenements. Such homes are detached, semi-detached, grouped in units of from three to six families per building, or in rows. American village and suburban housing has borrowed its standards largely from the English garden-city and garden-suburb movement, though some concessions to local architectural practices are almost invariably made. Recent examples of suburban housing by limited-dividend companies are offered in the dwellings constructed by Schmidlapp in Cincinnati, the Improved Housing Association in New Haven, Conn., the Philadelphia Model Housing Co., the Billerica Garden Suburb, Lowell, Mass., and in the work of the Boston Dwelling House Co. near Forest Hills, Mass.

Many American chambers of commerce have established limited-dividend companies which have erected buildings of a suburban type. Among the better examples of such work during the past ten years are the buildings constructed by the Albany Home Building Co. at Albany, N.Y., the Bridgeport Housing Co. at Bridgeport, Conn., the Civic Building Co. at Flint, Mich., and the Williamsport Improvement Co. at Williamsport, Pa.

Industrial Housing.—Employers of labour and industrial corporations have constructed garden villages in virtually every state in the course of the past ten years. Probably the greatest actual contribution to improved construction of cottage dwellings up to the year 1918 was made by agencies of this class. Very pleasing industrial villages have, for example, been erected and operated by the Goodyear Tire & Rubber Co. at Goodyear Heights, Akron, O.; by the Norton Co. at Indian Hill, Worcester, Mass.; by the Mount Union Refractories Co. at Kistler, Pa.; by the Viscose Co. at Marcus Hook, Pa.; and by the Lehigh Valley Coal & Navigation Co. at Hauto, Pa. Practically all improved housing undertaken since the termination of the World War was fostered by industrial corporations or by chambers of commerce. These agencies alone can afford to invest considerable sums of money without expectation of an immediate return at the market rate of interest. In the long run industrial agencies presumably profit from their housing ventures through the better health and increased contentment of their employees, which increases their output, and reduces friction.

Coöperative Housing.—British experience in the formation of coöperative tenant societies has been closely watched by many Americans who are interested in the improvement of housing conditions. For several years a committee on new industrial towns, with headquarters in New York City, has issued pamphlets urging the establishment of coöperative garden suburbs and of garden cities.

As yet, their recommendations have not been adopted in any instance. The state of Wisconsin has passed an Act which is designed to promote coöperative housing in that state, but so far no association has been formed. Nevertheless, during the past decade many coöperative apartment houses have been constructed for the well-to-do and the movement has extended as a protest against rent profiteering. Among immigrant populations the Finns have coöperatively purchased a number of boarding-houses in several cities and are engaged in operating them. In New York City they have purchased tenement houses as well. In Greater New York the Queensboro Corp. has recently built several apartment houses for sale to coöperative organizations of their tenants. But this movement is still in its infancy and will probably lag far behind that of Great Britain, because of America's relative lack of experience in economic coöperation in all its forms.

Governmental Housing—The most pronounced difference between the housing policies of Europe and those of American states and cities lies in the fact that American cities and states do not under any circumstances build houses for wage-earners. No American city has yet engaged in house construction, and it probably would be unconstitutional in most American states for cities to undertake such construction if they so desired. One American state, Massachusetts, has built houses with state money. An appropriation of only $50,000 was made for this purpose and a small tract of land was purchased in the city of Lowell, where 12 houses were constructed as a demonstration of methods of improved economical house construction. The houses so constructed have been sold on easy terms to their occupants, but the state Legislature has not been convinced of the utility of promoting further experiments.

The Massachusetts Homestead Commission, which was charged with the construction of these houses, has been eliminated, its functions being taken by the state department of public welfare.

The need of providing for the rapid manufacture of munitions and for the construction of ships forced the Federal Government, shortly after America's entrance into the World War, to arrange for the housing of the workmen engaged in war industries. In some instances the population could be housed in existing dwellings, but in more than a hundred communities it was found that manufacturing of materials needed for war purposes would be retarded unless houses were immediately constructed. There were three branches of the Federal Government which were engaged in house construction in the year 1918. The War Department built villages of temporary construction at the remote places where it had powder plants, bag-loading plants, etc. The Emergency Fleet Corp. built permanent villages for workmen engaged in construction for the U.S. Shipping Board. The land was provided by the ship-building companies, but the houses were planned, built and financed by the Federal Government through the housing and transportation division of the Emergency Fleet Corp. in 27 different towns and housed more than 9,000 families. The U.S. Housing Corp. which received appropriations from Congress amounting to $100,000,000, planned 128 communities for more than 25,000 families, in addition to housing accommodation for approximately 25,000 single labourers, and actually completed after the Armistice houses for more than 6,000 families and 8,000 single workers. Both the Housing Corp. and the Emergency Fleet Corp. built permanent houses, applying with considerable care and skill the principles of town-planning and of improved construction in virtually all of their projects. They convincingly demonstrated the value of village and suburban planning, and their experiments in the designing and construction of houses have had and will continue to have a pronounced influence upon subsequent housing undertakings of America. These houses in almost all instances are now being sold on relatively easy terms of amortization to their occupants. They are being occupied by skilled labourers and persons of relatively small means who are engaged in commercial pursuits. They have in no sense solved the problem of housing for the unskilled labourer, but are of great value as an indication of modes of planning and construction for families having an income of from $2,000 to $3,000.

Housing Finance.—The relative costliness of housing by the Federal Government combined with the pronounced distaste which the American people have for centralization of power has resulted in a strong reaction against the continuance of house construction by Government. There is, however, in the United States a sentiment for elimination of taxation of mortgages, a movement for tax exemption for new buildings and a movement for governmental aid in the financing of local housing undertakings. The chief American device for financing of individual house construction or construction of houses in small groups is the building and loan society. There were in the United States on June 30 1920 approximately 7,788 building and loan associations, with a membership of over 4,280,000 persons and total assets amounting to over $2,100,000,000. The funds are used almost exclusively for the construction or acquisition of house property. The state of North Dakota finances home building by the issue and sale of state bonds repayable with interest not to exceed 6%. One bill before Congress in 1921 would provide for the issue of Federal bonds which would nearly double the assets available to these associations for housing purposes. Other suggested measures present recommendations for credit legislation similar to that of Canada, providing for central funds, low interest charges, easy terms of amortization, experimentation, and advice in the matter of housing.

Several American states have established housing commissions since the war to handle questions of rent profiteering or other special problems. The housing committee of the N.Y. State Legislature has conducted an extensive investigation into profiteering and collusion in building construction which is to be followed by indictments for such malpractices as can be reached by law. Rent-profiteering commissions in many cities and states have succeeded in diminishing flagrant evictions and profiteering in rentals and have in thousands of instances succeeded in effecting conciliation or compromise between landlord and tenant. The necessity of increasing rentals in order to make a reasonable return upon invested capital and to encourage new construction has, however, not been appreciated by all such commissions.

At the beginning of the year 1921 the situation in the United States was as follows:—Building prices during and following the war had increased more than 100%; rentals during the same period increased by about 25%. The shrewd investor, seeing that he could make no profit in building houses to rent, invested his money in other enterprises. Very few houses had been built for sale because of anticipation of a fall in building costs. Late in the year 1920 building prices began to decline. As the decline had not yet stopped at the beginning of 1921 building had not yet recommenced. The actual shortage of housing in America is not measurable. There has always been a shortage of housing of good quality, but it is calculated by the U.S. Chamber of Commerce that if house-building had continued at the rate of construction which was normal in the pre-war years there would have been 1,200,000 more houses or apartments in the United States in 1921 than there were. Many years of conditions favouring building construction were needed to make up for a housing shortage of this magnitude.

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HOUSSAYE, HENRY (1848–1911), French historian (*see* 13.828) died in Paris Sept. 23 1911. The fifty-fifth edition of his *Waterloo* appeared in 1906, and after his death were published *Jêna et la Campagne de 1806* (1912), and *La Patrie Guerrière* (1913).

See L. Sonolet, *Henry Houssaye* (1905).

HOUSTON, DAVID FRANKLIN (1866–), American public official, was born at Monroe, N.C., Feb. 17 1866. He graduated from South Carolina College in 1887 and the following year was tutor there in ancient languages. From 1888 to 1891 he was superintendent of schools at Spartanburg, S.C., and from 1891 to 1894 was a student in the Harvard Graduate School (A.M. 1892). From 1894 to 1902 he was at the university of Texas as adjunct professor of political science, professor (after 1900), and dean of the faculty (after 1899). He was president of the Agricultural and Mechanical College of Texas from 1902 to 1905 and then returned to the university of Texas as president. Three years later he was elected chancellor of Washington University, St. Louis, but resigned in 1916. In 1913 he was appointed Secretary of Agriculture by President Wilson and in 1920 was transferred to the secretaryship of the Treasury. He was a member, generally *ex officio*, of the Federal Council of National Defense, the National Forest Reservation Committee, the Federal Reserve Banks organization committee, and chairman of the Federal Board for Vocational Education. He favoured woman suffrage but was opposed to raising a loan for a soldiers' bonus. He was the author of *A Critical Study of Nullification in South Carolina* (1896).

HOWELLS, WILLIAM DEAN (1837–1920), American novelist (*see* 13.839), died in New York May 11 1920. In 1915 he received the gold medal of the National Institute of Arts and Letters for his work in fiction. To within a short time before his death he continued to contribute to the "Editor's Easy Chair" of *Harper's Monthly.* His later works included *My Mark Twain* (1910); *Imaginary Interviews* (1910); *Parting Friends: A Farce* (1911); *Familiar Spanish Travels* (1913); *New Leaf Mills: a Chronicle* (1913); *The Seen and Unseen at Stratford-on-Avon: a Fantasy* (1914); *The Daughter of the Storage and Other Things in Prose and Verse* (1916); *The Leatherwood God* (1916) and *Years of My Youth* (1916). In 1920 he edited with an introduction *The Great Modern American Stories.* He left unfinished *Years of My Middle Life.*

HUERTA, VICTORIANO (1854–1916), Mexican general and dictator, was born in Colotlán, Jalisco, Dec. 23 1854. He began his military career as a boy, graduating from Chapultepec Military College in 1876, and immediately serving in the successful revolt of Porfirio Díaz against President Lerdo. He was then eight years on the Military Map Commission, from 1890 to 1900 was a member of the General Staff, and later fought Indian campaigns in Sonora and Yucatan. Díaz made him a brigadier-general. When the latter fell, Huerta escorted him to Vera Cruz, then joined Madero, and conducted campaigns against Zapata in 1911 and Pascual Orozco in 1912. From Feb. 9 to 18 1913 he commanded the Madero forces when the Díaz revolutionary forces were besieged in the arsenal at Mexico City and when several thousand non-combatants were shot by the ill-directed gunfire of Huerta's men. On Feb. 18 he betrayed Madero, forcing him and the vice-president Pino Suárez (who were later murdered) to resign and obliging Congress to ratify his usurpation of power. He was recognized as president by the foreign embassies, but President Wilson refused him recognition and insisted upon his elimination. In Oct. 1913 he was characterized as a murderer by a member of the Mexican Congress, who immediately disappeared. The deputies remonstrated, whereupon Huerta arrested 110 of them and seized the legislative and judicial powers. In April 1914 came the Tampico incident, when two American sailors were arrested and removed from a U.S. boat for a trifling cause. Huerta's refusal to make adequate apology brought about the occupation of Vera Cruz by U.S. troops. His resignation was forced on July 15 1914. He went first to Spain, then came to New York in April 1915. In July he was arrested in Texas, charged with instigating invasion of Mexico. He was taken ill after his arrest, and was released from custody just before his death at El Paso on Jan. 13 1916. He was a man of great will power, remarkable physique and native astuteness, but possessed no training in statecraft or great ability as a soldier. (H. I. P.)

HUGGINS, MARGARET LINDSAY, Lady (1848–1915), English astronomer, was born in Dublin Aug. 14 1848, the daughter of John Murray, a Dublin solicitor, and married Sir William Huggins in 1875. From childhood she had been interested in astronomy and entered with enthusiasm into her husband's work (*see* 13.857). She published lives of *G. P. Maggini* and of *Agnes and Ellen Clerke*, as well as various scientific papers, both alone and in collaboration with her husband, whom she survived for nearly five years, dying in London March 24 1915.

HUGHES, ARTHUR (1832–1915), English painter, was born in London Jan. 27 1832. In 1846 he entered the art school at Somerset House, his first master being Alfred Stevens, and later entered the Royal Academy schools. Here he met Millais and Holman Hunt, and became one of the pre-Raphaelite group of painters. His first picture, "Musidora," was hung at the Royal Academy when he was only 17, and henceforth he contributed almost annually not only to the Royal Academy but later also to the Grosvenor and New Gallery exhibitions. He also became widely known as an illustrator of books, his work in *Good Words for the Young* (1869) attracting much attention. With Morris, Rossetti and Burne-Jones he was responsible for the decorations of the hall of the Union Society at Oxford, which have now perished. He died at Kew Green Dec. 22 1915.

HUGHES, CHARLES EVANS (1862–), American statesman, was born at Glen Falls, N.Y., April 11 1862. He graduated from Brown University in 1881. He then studied law at Columbia (LL.B. 1884). He was admitted to the bar in 1884 and for seven years practised in New York City. From 1891 to 1893 he was professor of law at Cornell and then resumed practice in New York City, serving at the same time for several years as lecturer in the New York Law school. In 1905 he was counsel for a commission appointed by the New York Legislature to investigate the cost of gas, and in the same and the following year was counsel for a legislative committee for investigating life-insurance companies. This investigation revealed many irregularities in the management of the companies and led to the passage by the Legislature of New York and of other states of remedial legislation. The same year he was nominated by the Republicans for mayor of New York City but declined to run. In 1906 he was elected governor of New York State, defeating William Randolph Hearst, and was reëlected in 1908. He resigned in Oct. 1910 after being appointed associate justice of the U.S. Supreme Court by President Taft. In 1916 he resigned from the Supreme Court on being nominated for the presidency by the Republicans, but was narrowly defeated by President Woodrow Wilson, who had been renominated by the Democrats. Hughes's election was considered assured when the campaign began; but though he "stumped" the country widely he disappointed the people because he took no definite position on any of the specific questions involving the stand of America in the World War and especially as regards the sinking of the "Lusitania." The result of the election was doubtful until a full count had been made, and eventually hinged upon Minnesota and California, normally Republican states. Hughes carried Minnesota by a few hundred votes but lost California by a few thousand. The electoral vote was 276 for Wilson against 255 for Hughes. The popular vote was 9,116,000 for Wilson against 8,547,000 for Hughes. The following year he again entered upon the practice of law in New York City. In 1917 he was appointed chairman of the Draft Appeals Board of New York City by Governor Whitman, and the following year was special assistant to the U.S. Attorney-General, in charge of the investigation of alleged waste and delay in the construction of aircraft. He was president of the New York State Bar Association in 1917–8 and of the Legal Aid Society 1917–9. He was opposed to Article X. of the League of Nations Covenant and urged special recognition of the Monroe Doctrine. He was the leader of the New York Bar Assn. in its opposition to the expulsion of the Socialists from the N.Y. State Legislature in 1920. In 1921 he entered the Cabinet of President Harding as Secretary of State. He was one of the four U.S. delegates to the Conference on Limitation of Armament, held in Washington, D.C., Nov. 1921, and was elected permanent chairman (*see* Washington Conference).

HUGHES, RUPERT (1872–), American writer, was born at Lancaster, Mo., Jan. 31 1872. He was educated at Western Reserve University (A.B. 1892; A.M. 1894) and Yale (A.M. 1899). He was assistant editor of *Godey's Magazine*, *Current Literature* and *The Criterion*. He served on the Mexican border in 1916 with the rank of captain; in 1918 was promoted major, and after honourable discharge in 1919 was appointed major in the reserve corps. His works include *The Lakerim Club* (1898); *The Dozen From Lakerim* (1899); *Contemporary American Composers* (1900); *The Musical Guide* (1903); *Excuse Me!* (1911); *The Amiable Crimes of Dirk Memling* (1913); *The Thirteenth Commandment* (1916); *Long Ever Ago* (1919) and *What's the World Coming To?* (1920). Among his plays are *The Wooden Wedding* (1902); *Tommy Rot* (1902); *The Richest Girl in the World* (1906) and *Uncle Zab* (1913).

HUGHES, SIR SAMUEL (1853–1921), Canadian soldier and politician, was born at Darlington, Ont., Jan. 8 1853. His father was an Irishman and his mother of Scotch-Irish and Huguenot descent. From the age of 13 he belonged to the Canadian volunteer militia, with which he saw service in 1870 at the time of the Fenian raids. In 1873 he was gazetted to the 45th regiment. Educated at Toronto University, he became a lecturer in English at the Toronto Collegiate Institute and held that post until 1885, when he gave up teaching for journalism, being editor and proprietor of the *Lindsay Warder* from 1885 to 1897. In 1892 he was elected to the Dominion Parliament, but in 1899 he interrupted his political career to serve in the South African War, where he commanded a mixed force of English and colonial scouts in western Cape Colony. The year 1911 saw him in England, where he attended the coronation of George V. On his return to Canada he became Minister of Militia and Defence, and in that capacity was responsible for the creation of the Overseas force which in 1914 came over to take its share in the World War. In 1915 he was created K.C.B. and promoted major-general. But, in spite of his strong personality, he was not easy to work with, and difficulties with Sir Robert Borden led to his sudden resignation of office in Nov. 1916. His health subsequently failed. In July 1921 he announced his intention of retiring from Parliament, and he died Aug. 24 1921.

HUGHES, SPENCER LEIGH (1858–1920), British journalist, was born at Trowbridge April 21 1858 and educated at Woodhouse Grove school near Leeds. For ten years he worked with an engineering firm near Ipswich, but joined the staff of the *Morning Leader* at its beginning, and for many years contributed the "Sub Rosa" column, which consisted of short witty paragraphs on current topics written from a Liberal standpoint. He was also connected from 1891 onwards with *The Star*. He was one of the cleverest after-dinner speakers of his time, and published a book on *The Art of Public Speaking* (1913), as well as *The English Character* (1912); *Things that Don't Count* (1916); *Press, Platform and Parliament* (1918), to a great extent autobiographical, and other essays, tales and sketches. After failures at Jarrow in 1907 and Bermondsey in 1910, he was elected to Parliament as a Liberal for Stockport (1910). He died after a long period of ill-health in London Feb. 22 1920.

HUGHES, WILLIAM MORRIS (1864–), Australian statesman, was born in Wales Sept. 25 1864. He was educated at Llandudno grammar school and St. Stephen's Church of England school, Westminster, where he was trained as an elementary schoolmaster; but at the age of 20 he preferred to emigrate to Australia and to make his living as he could until he succeeded in entering political life as a member of the Labour party. This he achieved ten years later, being elected to the N.S.W. Legislature for one of the divisions of Sydney in 1894. He was also admitted to the N.S.W. bar. Though delicate in health and in later life handicapped by deafness, he showed from the first marked ability and fighting force. He organized the Maritime unions, became general secretary of the Wharf Labourers' Union and of the Waterside Workers' Federation, and president of the Carters' Union, and was reëlected to the Legislature at each successive election until he resigned upon his election for W. Sydney to the first Federal Parliament (1901). He first took office in 1904 as Minister for External Affairs. In 1907 he was a delegate to the Imperial Navigation Conference. The following year he was Attorney-General in Mr. Deakin's administration (1908–9) and held the same office under Mr. Fisher (1910–3), and again in his first War Cabinet (1914–6). On Mr. Fisher's resignation of the premiership in 1915 Mr. Hughes succeeded him and continued to hold office up to 1921.

He met, however, with considerable opposition, especially from the Labour party, who resented his advocacy of conscription (twice rejected on a referendum) and in 1917 refused to re-elect him as their leader. His own attitude towards the World War was vigorous and patriotic. He made a recruiting tour in 1915 through Great Britain, where he won a popularity perhaps greater than he enjoyed at home, and pledged himself to introduce conscription in Australia, though he failed to carry it. On his return to Australia in 1916 he was obliged to reconstruct his Cabinet and to effect a coalition with Mr. Cook, leaving out most of his previous colleagues of the Labour party. In Jan. 1918 he again formed a new Cabinet. As a member of the Imperial War Cabinet he was often in Europe. On his journey to Great Britain he made a speech in New York, May 31 1918, advocating the application of the Monroe doctrine to the South Pacific islands in the interests of Australia, and at the Paris Peace Conference of 1919, where he was the Australian representative, he objected to any authority over ex-German territory in these islands being granted to the League of Nations. In 1915 he was sworn of the Privy Council and in 1919 he became K.C. He published *The Case for Labour* and other pamphlets, and a collection of his speeches in Great Britain appeared in 1918. (*See further* AUSTRALIA.)

See Douglas Sladen, *From Boundary Rider to Prime Minister* (1916).

HULL, England (*see* 13.870).—Pop. (1911) 277,991, showing an increase during the decade of 37,732. The King George Dock situated E. of Alexandra Dock, with 53 ac. of water-space, is the largest on the N.E. coast and was opened in 1914. Both docks provide accommodation for the largest class of vessels and are equipped with graving docks, coal appliances, grain silos and warehouses, wool and transport sheds and the most modern appliances for general overseas trade; and they are directly served by railway at Alexandra Dock Station. An important addition to the facilities for the coal export trade was made in 1910 by the installation of coaling beds at the Victoria Dock; this method of shipping coal (the appliance for which has a capacity of 600 tons per hr.) had not previously been employed in England. Eastward of King George Dock is the Salt End deep-water jetty equipment for dealing with a large and growing oil import trade. The total water-area of Hull docks had reached 240 ac. in 1921, with a quayage of 13 miles.

During the World War there was a very large development of the seed-crushing industry at Hull for oils of various kinds including that of the soya bean; very extensive mills were established by the British Oil and Cake Mills, Ltd., with a view to the development of the food supply and to taking advantage of the seed-oil trade diverted from certain continental countries. Castor oil, in particular, and lubricating oils for the use of Allied aircraft, were largely produced.

An art gallery was opened in 1910 by Mr. T. R. Ferens, M.P., who largely contributed to its erection and upkeep, and also presented 12 almshouses to the town in 1911 as a memorial to King Edward VII., and a playing field near the East Park. A new Guildhall has been built and a new museum designed to illustrate the shipping and fishing industries. A Municipal Training College for teachers, providing accommodation for 153 resident students, built at a total cost of £51,972, was opened in Sept. 1913 and the Newland high school for girls, with accommodation for 500 day scholars, was opened on May 20 1920; both buildings are erected on part of a site of 50 ac. N.W. of the town, purchased by the city council for £9,090 in 1908. In 1921 steps were being taken to transform the restored Old Grammar school, a fine example of 16th-century architecture, into a Museum and War Memorial so as to ensure its preservation; and the restoration of Holy Trinity church was completed. Among street improvements, the prolongation of Spring Bank west for a distance of $\frac{3}{4}$ m. in the direction of Willerby was the most important.

Hull suffered severely from Zeppelin raids. In that of June 6 1915, much damage was caused to commercial buildings and, on March 6 1916, in a raid by two Zeppelins, widespread havoc was done to house property and shops. Before a third raid in Aug. 1916, anti-aircraft defence had been organized and, though there were various subsequent attacks, they were mostly of the "tip-and-run" character and much less damage was done.

HUMBERT, GEORGES LOUIS (1862–), French general, was born at Gazeran (Seine et Oise) on April 8 1862. He joined the ranks of the 20th regiment of Chasseurs in April 1880, and did not enter the military academy of St. Cyr until Oct. 1881. He was first commissioned (in Oct. 1883) in the 102nd infantry regiment. Two years later he was promoted lieutenant and was transferred to a native (Tonkin) unit, with which he first saw active service. He became a captain in June 1889, and shortly afterwards was again on active service in Madagascar. He was promoted lieutenant-colonel in Dec. 1902 and colonel (of the 96th infantry regiment) in June 1907. Five years later (March 1912) he was made a general of brigade, and in 1913 was sent to Morocco. On the outbreak of the World War he was given command of the 1st Moroccan division, which he held during the battle of the Marne. In Sept. 1914 he was made a temporary general of division. On Oct. 27 following he was confirmed in his rank and given command of the XXXII. Army Corps. On July 22 1915 he took over the III. Army—a command which he held continuously for four years, except for a small break Oct. 15 1918 to Oct. 23 1918—when he commanded the VII. Army. In Oct. 1919 he was appointed governor of Strassburg and commandant of the Alsace territory, and in the Jan. following was made a member of the Superior War Council. He was appointed a Grand Officer of the Legion of Honour on July 10 1918.

HUME, ALLAN OCTAVIAN (1829–1912), English ornithologist and Indian administrator, son of Joseph Hume (*see* 13.884), was born June 6 1829 and educated at Haileybury and London University. Entering the Indian civil service in 1849, he became collector of Etwah, and rendered distinguished service during the Mutiny and later against Firoz Shah. Between 1867 and 1871 he carried out the negotiations with the Rajput chiefs for opening road and railway communications through the great belt of mountain and jungle which formerly cut India in two. He was made secretary to the Indian Government in the Home Department and afterwards in the Revenue and Agricultural departments, but returned to the North-West Provinces as member of the Revenue Board in 1879. In 1882 he retired from the service, and devoted himself to furthering the aspirations of native Indians. The Indian National Congress (*see* 14.417), which held its first session at Bombay in 1885, owes its existence to his exertions. He was the author of several works on ornithology, and presented his collections of bird skins and eggs to the British Museum. He died at Norwood July 31 1912.

See Sir W. Wedderburn, Bart., *Allan Octavian Hume, C.B.: Father of the Indian National Congress* (1913); and *Allan O. Hume: a Sketch of his Life and Services to India* (1912).

HUMPERDINCK, ENGELBERT (1854–1921), German musical composer (*see* 13.891), produced in 1897 the opera *Königskinder*, which, with some later additions, became very popular. Another opera, *Die Heirat wider Willen*, appeared at Berlin in 1905, and in 1912 Humperdinck produced the incidental music for the English production of *The Miracle*, himself coming to England to superintend the rehearsals. His last opera, *Die Marketenderin*, was played at Cologne in 1914. He died at Neu Strelitz Sept. 27 1921.

HUNGARY (*see* 13.894).—In consequence of the World War, Hungary was in 1921 only a remnant of what had been a thousand-year-old realm, large tracts of pre-war Hungary having been allotted on June 4 1920 by the Treaty of Versailles (Trianon) to its neighbours, Czechoslovakia, Rumania, Yugoslavia and Austria. The area of the old Hungarian state was 109,216 sq. m., of which only 35,184 sq. m. now remained to it. In the late summer of 1921 the boundaries of the State had not been definitely settled. The districts assigned by the Peace Treaty to Czechoslovakia, Rumania and Yugoslavia had already passed into their possession, and the county (*comitatus*) of Baranya, with the town of Pécs, which had been left to Hungary, had—with the exception of a few villages—been evacuated by the Yugoslavs, but the Burgenland (German Western Hungary), which had been assigned to Austria, was only in course of being handed over, a break-down in the arrangements occurring in August and September. The new boundaries are: on the N. the Danube E. of Pozsony (Pressburg), then the Ipoly (Eipel), whence it runs, regardless of natural features, partly between hills and mountains and partly across the Alföld (the central Hungarian plain); on the E. and S. along the Alföld the only part of the old southern frontier surviving being at its western end along the course of the Drava. The western frontier was shifted further E. at Hungary's expense.

Population.—Hungary had in 1910 a pop. of 20,886,487 of whom 9,945,000 were Hungarian and the remainder Rumanian, German, Serbian, Slovakian, Ruthenian, and Croatian; in 1920 the pop. was 7,481,951 of whom 6,612,000 were Hungarians, the remaining Hungarians having come under the rule of neighbouring States—Czechoslovakia with 1,084,000 Hungarian inhabitants, Rumania with 1,705,000, Yugoslavia with 458,000, and Austria with 80,000. In 1921 the pop. in Hungary was 88·4 % Hungarian; 7 % (521,344) German; 2·2 % (165,886) Slovakian; it included also 41,000 Croatians, 48,000 Rumanians, and 22,000 Serbians. According to religion 4,700,000 (63 %) were Roman Catholic, 1,597,000 (21·3 %) Calvinistic, 463,000 (6·2 %) Lutheran, 466,000 (6·2 %) Jewish. Approximately 29·8 % of the pop. dwelt in towns of over 10,000 inhabitants, while 70·2 % dwelt in villages. The proportion of men to women was as 1,000 to 1,015. The birth-rate was high, but so also was the death-rate, which in 1910 was 23·6 per thousand. In 1919, out of 410,000, 63,000 died of tuberculosis, which is especially prevalent in the Alföld. During the World War Hungary lost over 600,000 men in the field; moreover from April 1915 to 1918 the number of deaths exceeded the number of births. In 1919 births exceeded deaths by 15,350. Emigration, the result partly of the exhaustion of the mines and the decline in handicrafts, due to the growth of industry in Austria, and partly of the rise in food prices, caused a serious drain on the population. That it was not due to persecution alone is shown by the fact that out of 790,068 emigrants in 1905–13, 577,001 belonged to the territory which Hungary lost by the Peace Treaty; thus the number of emigrants was considerable even in those parts of pre-war Hungary where there could be no question of Nationalist oppression. The main stream of emigrants was to the United States, and a certain proportion of these returned, the number between 1905 and 1913 being 213,542. After the conclusion of the war the emigrants rendered great services by sending over food and money.

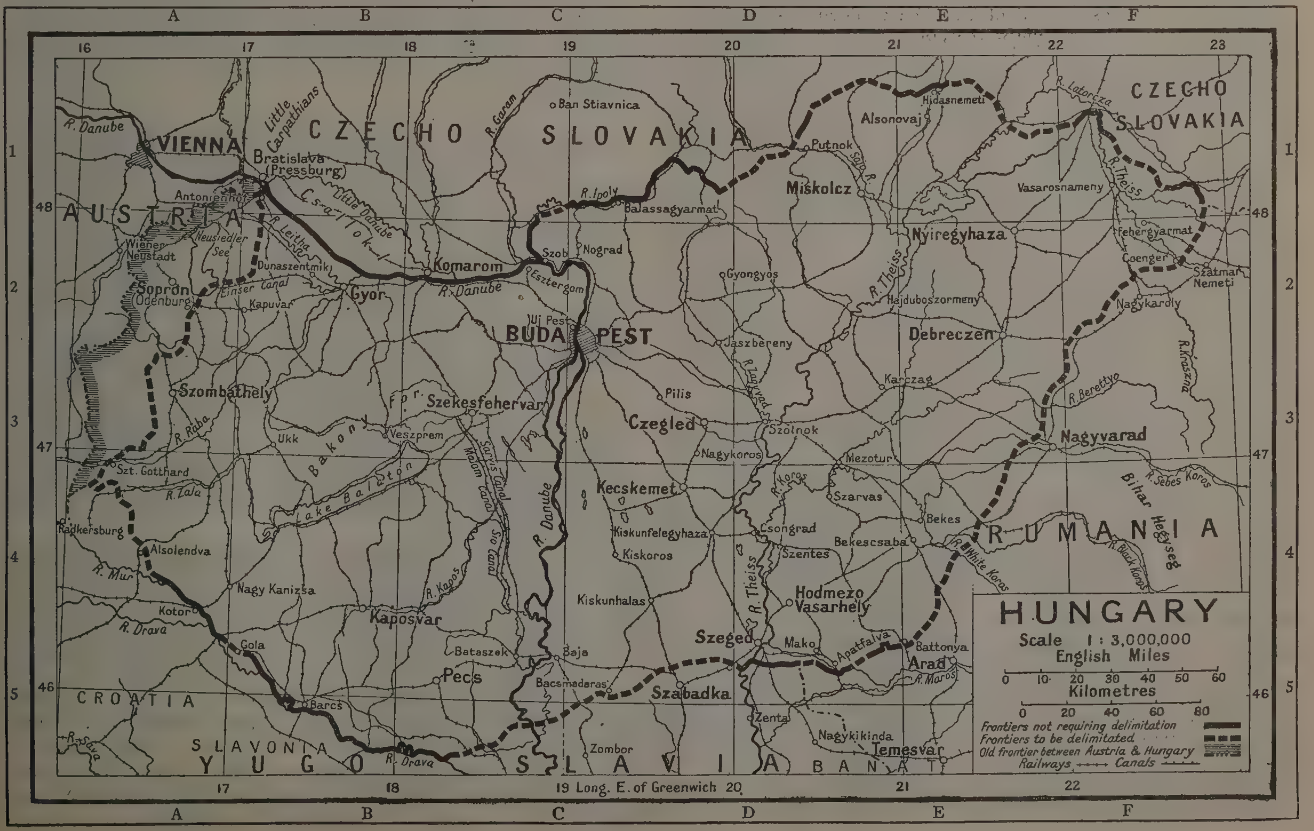
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R. Danube
VIENNA
Little Carpathians
Bratislava (Pressburg)
C Z E C H O   S L O V A K I A
R. Garan
Ban Stiavnica
Hidasnemeti
Alsonovaj
Putnok
Sajo R.
R. Latorcza
CZECHO SLOVAKIA
Antonienhof
A U S T R I A
Csallókoz
Little Danube
R. Leitha
R. Ipoly
Balassagyarmat
Miskolcz
R. Theiss
Vasarosnameny
Wiener Neustadt
Neusiedler See
Dunaszentmiki
Komarom
Szob
Nograd
Esztergom
Gyongyos
Nyiregyhaza
Fehergyarmat
Coenger
Szatmar Nemeti
Sopron (Odenburg)
Einser Canal
Kapuvar
Gyor
R. Danube
Uj Pest
BUDA PEST
R. Theiss
Hajduboszormeny
Debreczen
Nagykaroly
Jaszbereny
R. Zagyva
R. Krasna
Szombathely
F. Pr.
Szekesfehervar
Pilis
Karczag
R. Berettyo
R. Raba
Ukk
Bakony
Veszprem
Czegled
Szolnok
Nagyvarad
Szt. Gotthard
R. Zala
Lake Balaton
Sarviz Canal
Malom Canal
Nagykoros
Mezotur
R. Koros
R. Sebes Koros
Bihar Hegyseg
Kecskemet
Szarvas
Bekes
Radkersburg
Alsolendva
R. Mur
Kiskunfelegyhaza
Kiskoros
R. Danube
Sio Canal
R. Kapos
Csongrad
Szentes
Bekescsaba
R. White Koros
R. Black Koros
R U M A N I A
Nagy Kanizsa
Kiskunhalas
Hodmezo Vasarhely
Kotor
R. Drava
Kaposvar
R. Theiss
Gola
Bataszek
Baja
Szeged
Mako
Apatfalva
Battonya
Arad
R. Maros
Pecs
Bacsmadaras
Szabadka
C R O A T I A
Barcs
Zenta
Nagykikinda
Temesvar
R. Save
S L A V O N I A
Zombor
Y U G O S L A V I A
R. Drava
B A N A T
19 Long. E. of Greenwich 20
HUNGARY
Scale 1 : 3,000,000
English Miles
0 10 20 30 40 50 60
Kilometres
0 20 40 60 80
Frontiers not requiring delimitation
Frontiers to be delimitated
Old frontier between Austria & Hungary
Railways
Canals

The following large towns were ceded to neighbouring States—Pozsony (Pressburg), Komárom, Kassa (Kaschau), Kolozsvár (Klausenburg), Arad, Temesvár, Szabadka (Theresiopel), Nagyvárad (Grosswardein), and Sopron (Ödenburg). In addition to the capital Budapest, Hungary in 1921 still included among its chief towns Békéscsaba (pop. 42,600), Esztergom (17,881), Debreczen (92,729), Györ (44,300), Hódmezö-Vásárhely (62,445), Kalocsa (11,738), Kecskemét (66,834), Kiskünféledyháza (34,924), Makó (34,918), Mezötúr (25,835), Miskolcz (51,459), Mohács (17,092), Nagy Kanizsa (26,524), Nyiregyháza (38,198), Pécs (49,822), Szeged (118,328), Székesfehérvár (36,625), Szombathely (30,947), Tokaj (5,105), Vácz (18,952); the figures being those of 1910.

Agriculture.—Hungary is preëminently an agricultural country; and in 1921 was still one of the principal wheat-growing regions of Europe. The Peace Treaty had, however, reduced the national area by much fertile soil. The comparative figures for the distribution of cultivation in 1913 and 1920 are as follows (in 1,000 ac.):—arable land (1913) 31,716 (1920) 13,598; gardens (1913) 941 (1920) 236; meadows (1913) 6,470 (1920) 1,627; vineyards (1913) 776 (1920) 530; pastures (1913) 8,183 (1920) 2,497; forests (1913) 17,977 (1920) 2,581; reedplots (1913) 125 (1920) 67.

Corn is the principal crop. The corresponding figures are (in tons):—wheat (1913) 4,028 (1920) 1,958; corn (1913) 1,221 (1920) 789; barley (1913) 1,484 (1920) 700; hay (1913) 1,236 (1920) 432; maize (1913) 4,136 (1920) 1,478; potatoes (1913) 5,074 (1920) 1,907.

The most famous wine-producing districts, Tokay-Hegyalja, Balaton and Eger, have been left to Hungary. Whereas pre-war Hungary produced annually 71,346,000 gal. the output in new Hungary was reduced to 43,524,800 gal. Only 114,000 (41 %) out of 284,000 ac. remained for the cultivation of sugar beet; only 82 % out of 71,000 ac. to tobacco growing; only 21,000 (26 %) out of 80,000 ac. to the cultivation of cabbage. Hungary retained 54 % of its oak forests, 42 % of its beech woods, and only 4 % of its coniferous trees, so that it became necessary to import timber.

As regards live stock there were 6,184,000 cattle in 1913, and 2,148,000 in 1920; swine had fallen from 7,311,000 to 3,729,000; horses from 1,597,000 to 746,000; sheep from 6,577,000 to 1,817,000. The proportion of animals to the population was thus much smaller in the new Hungary than it was formerly; whereas in pre-war times there were 33·9 cattle to every 100 inhabitants, in 1920 28·7; sheep were formerly 42·2, now 32·2; swine formerly 35·1, now 44·4; horses formerly 11·0, now 12·0.

This impoverishment was all the more important in that 56 % of the total population in 1920 was employed in agriculture. Pre-war Hungary exported, besides grain, a considerable amount of live stock; in 1913, 347,318 head of cattle; 46,567 horses; 893,192 pigs; 6,300,000 live fowl as well as 30·8 million lb. of slaughtered fowl; 77·9 million lb. of eggs; 61·5 million lb. of lard and bacon.

Minerals.—In consequence of the Peace Treaty Hungary has lost the greater part of its mines. Salt, opal, gold, silver, copper, lead and bauxite mines were entirely lost and only the iron-mines, which in pre-war times formed a quarter of Hungary's mining wealth, remained. Natural gas was discovered in Transylvania in 1912, and the supply appears to be almost unlimited, but the World War put a stop to the equipment of boring stations. These gas-fields passed into the possession of Rumania. Natural gas has been found in several places on the Alföld and in Transdanubia.

The annual pre-war production of the salt-mines was 245,500 tons, so that on their loss it became necessary to import salt to meet the home demand (98,000 tons). The petroleum output had been 6,400 tons. Of a former output of 1,178,000 tons of iron ore 196,000 tons were left as the produce of post-war Hungary; of 383,000 tons of iron, only 118,000 tons. Out of a former output of 1,077,000 tons of coal, one of only 786,000 tons (72·8 %) was left; and as this was chiefly obtained from the mines at Pécs which had in 1921 been for two years under the Yugoslav administration, the pre-war demand for imported coal was intensified. In 1914, 3,728,850 tons of pit coal were imported. The pre-war production of lignite was 7,846,000 tons, and 5,500,000 tons were produced in 1920.

Industry.—Hungary in 1921 had 2,029 factories (before the war, 4,241), with machines of 398,929 H.P. (before the war, 798,049) and 219,725 workers (before the war 445,792). The annual pre-war production was valued at 3,396,091,000 kronen (at pre-war rate of exchange). In 1921, on the basis of full work at the factories, the corresponding figures should have been 1,887,930,000 kr. but this figure was not attainable, since the coal supply was insufficient, and raw materials (which were chiefly derived before the war from the districts now ceded) could only be obtained by importation. If the production of post-war Hungary could be raised to peace-time level, the food industry would have an output estimated (at pre-war exchange) at 945,306,000 kr. (57 % of the former figure, 1,650,283,000), the iron and metal industry 252,388,000 kr. (50 % of the former 501,763,000), machine-making 250,680,000 kr. (82·1 % of the former 305,446,000), leather industry 44,975,000 kr. (57·6 % of the former 78,139,000), clothes manufacture 24,127,000 kr. (74 % of the former 32,320,000), paper industry 10,690,000 kr. (21 % of the former 49,542,000), timber industry 41,295,000 kr. (22·2 % of the former 186,268,000), textile industries 78,712,000 kr. (40·8 % of the former 192,977,000), chemical industry 126,029,000 kr. (54·7 % of the former 230,564,000), etc.

Commerce.—Pre-war Hungary had a favourable trade balance; in 1913 the exports were valued at 79·4 million pounds sterling, and imports at 86·4 million pounds sterling. No proper figures for 1920–1 can be given here, since the neighbouring States were still boycotting Hungary, and trade was therefore entirely abnormal.

Communications—The total length of railway lines in 1921 amounted to 8,320 km. (formerly there were 19,723); the rolling-stock comprised 1,549 engines (formerly 4,949); 2,284 passenger carriages (formerly 8,718); 749 luggage vans (formerly 3,537); and 18,010 goods trucks (formerly 105,837). By the Peace Treaty Hungary lost its entire coast-line, and at the same time the whole of its mercantile marine, which amounted in 1914 to 412 sailing vessels (tonnage 1,837) and 137 steamers (tonnage 147,906). Inland shipping is greatly impeded by the fact that the Peace Treaty cut across the navigable rivers. The Treaty pronounced the Danube to be an international waterway, and Danube shipping is administered by an international commission.

The passengers carried by rail in 1913 numbered 166,100,000. Goods traffic amounted to 87 million tons, and the income derived from traffic to £24,500,000. As the express engines in post-war Hungary had to be driven by imported coal, the express service was very limited and fares extremely high.

Banking.—As the great banks of pre-war Hungary were chiefly seated at Budapest, the loss in this respect was not very great. Of 1,788 banks and savings banks, with capital of 2,164·4 million kr. (pre-war rate), Hungary retained 673, with a capital of 1,515·6 million kr. (*i.e.* 37·7 % of the institutions, but 70·1 % of the share capital). The share capital of the industrial joint-stock companies, formerly 1,059·3 million kr., amounted in 1921 to 828·5 million kr. (78·2 %). But owing to the terrible depreciation of the currency these sums had lost greatly in value on the world market. Between 1919–21 the value of the Hungarian krone fluctuated between 1 and 3 Swiss centimes, compared with a former value of 120.

Finance.—The first budget of reconstituted Hungary (1919–21) showed an estimate of 8·4 milliard kr. ordinary and 11·8 milliards extraordinary expenditure, as against 8·8 milliards ordinary and 1·7 extraordinary revenue; thus there was a deficit of 9·7 milliards, and this was increased by the loss of former sources of revenue (*e.g.* the State railways), on account of the surrender of rich districts. The National Debt in 1921 amounted to 61·4 milliard kr., of which 8 milliards dated back to the pre-war period, 32·7 to the years of war and 20·7 to the post-war period. The Peace Treaty declared that Hungary should be liable to pay indemnity and make reparation, but without naming a definite sum. The establishment of an independent State bank, simultaneously with the separation from the Austro-Hungarian bank, had already been begun in 1921.

Education.—Of the former 16,929 elementary schools 6,402 remained in post-war Hungary; of 2,229 kindergartens 828; of 532 "secondary schools" (*Bürgerschulen*) 237; of 187 *Gymnasien* 85; of 34 *Realschulen* 15. The universities of Budapest and Debreczen were left to Hungary, as also the polytechnic of Budapest; the university of Pozsony was taken over by the Czechs, that of Kolozsvar by the Rumanians. (J. S.*)

Social Conditions.—Up to quite recent times, the members of the Hungarian aristocracy, who were also known as "oligarchs," had continued to exercise an important influence on the destinies of their country. It has become the fashion to put the blame on them for everything that went wrong, but from an unprejudiced point of view such an accusation is unjust. The Hungarian aristocracy was ever loyal and ready to make sacrifices for the good of the nation. Many illustrious names are to be found in their ranks—mention need only be made of Szechényi, Batthyány and Andrássy. This aristocracy, distinguished by talent and culture, considered it the highest honour to serve their country whether in politics or in war, and the only just reproach that can be brought against them is that of having resisted too long the introduction of new elements into the constitution. For the most part, however, this attitude was due to tradition and to a fear that the politically untrained masses might prove a source of danger to the nation.

In this respect there was little difference between them and the upper middle classes, who played an important part in the history of Hungary, and had given to the country such notable men as the poet and politician Kölcsey, Louis Kossuth and Francis Deák. In the days of the Diet there were in Hungary 20 commoners to one nobleman; in 1816 the saying was, "He is not a Hungarian nobleman; what then is he to be?" As there was no real *bourgeoisie* in Hungary, it was replaced by the lower nobility, to which was applied the English term "gentry." Possessing a cosmopolitan education enhanced by foreign travel they produced the best minds in the political and intellectual world. It is Hungary's misfortune that this rank of society, which was so important to the national culture and politics, especially in the second half of the 19th century, should have fallen into decay, due largely to the growth of extravagance and love of pleasure, and to a reluctance to learn, which was in marked contrast to the earlier days. The chief cause of this decadence was, indeed, the deterioration in their own standard of life. They suffered severely from the abrogation of the *urbarium* (dues paid by the peasants to their landlords), and from the fact that the method of indemnification at the time of the absolute government (during the 'fifties of the last century) was not one calculated to benefit the Hungarian nobleman in possession. To this must be added that the agrarian crisis of the last decades of the 19th century greatly impaired the smaller estates. The weakness of the lesser landowners rendered them incapable of absorbing the new Hungarian elements, so that they forfeited their intellectual leadership without achieving importance in the industrial sphere, where they had never played any part. Latterly the majority of the gentry, after being driven from their mismanaged estates, which had hitherto been the basis of their existence, found themselves almost entirely dependent on the public services; though deprived of landed possessions they remained proudly conscious of their class, and this prevented them from seeking a means of livelihood in other spheres. The Hungarian nobleman had always considered it beneath his dignity, exactly as in feudal Hungary before 1848, to occupy himself with commerce and industry; and as late as the 'seventies of the last century no girl belonging to the better classes would have been seen in Kolozvár (Klausenburg) walking in the streets, arm in arm with a mere business man. Exclusiveness and a domineering temper were the characteristics of the gentry, who were perhaps even prouder than the aristocracy, and in former days even avoided connexion with them by marriage. They did not desire to become baron, count or prince: good birth was of more value in their eyes than the most dazzling title.

When we come to the plain citizen class, it must be noted that they had never played so important a part historically in Hungary as in England, France, Germany and Italy. Characteristically enough, before 1848 all the towns of Hungary had together only two votes in the Diet. Pozsony (Pressburg), as the town where the coronation took place and the Diet met, occupied an outstanding position. At other times lonely and deserted, the tide of social life there ran high whenever the Diet assembled. The other towns, especially of western and upper Hungary, where German education was in the ascendant, had no influence on the intellectual progress of Hungary. The German population of the towns maintained a close intercourse with the Hungarian, from whom they borrowed new ideas, often absorbing at the same time their nationality and language. Many a leader of the Hungarian Liberal movement sprang from what were originally German middle-class families, and in the same way German cities became Hungarian. On the other hand the Saxons, who had settled in Transylvania and possessed autonomous institutions hallowed by tradition, which gave them political privileges, clung to their German nationality and acquired their education at German universities.

With the exception of the Transylvanian Saxon towns, which resembled those of mediaeval Germany, the Hungarian towns were for a long time merely large villages. Even in the early 'sixties of last century Pest was small, but little developed and badly paved. In those days a citizen of Pest who made a journey to Paris was an object of curiosity. In Debreczen, the "pearl of the Alföld" (the Hungarian central plain), when the season was wet, it was necessary to lay planks across the streets in order to make communication possible. No vehicle could pass along the roads without sinking halfway up the wheels in mud. It was not till after the *Ausgleich* with Austria of 1867 that a sudden development took place throughout the country. This is shown by a comparison of the increase in population of the different towns. In 1781 Pest had a pop. of 52,944; in 1869 it had 254,500, and in 1910 as many as 880,371 inhabitants. Pozsony (Pressburg), with a pop. of 26,898 in 1781, in 1910 had 78,223 inhabitants. Debreczen, with 20,153 in 1781, had 92,729 in 1910. The census of 1920 will have shown still higher figures, since the flow of population from the country to the towns had increased enormously, hand in hand with the development of industry, commerce and the means of communication. Those who knew Budapest, the capital, before the *Ausgleich* as a little town, found it just before the World War a stately European city of enormous dimensions. Within two or three decades everything there had undergone a change. Old-fashioned streets and indeed whole quarters were demolished to make room for broad thoroughfares and imposing buildings. Between 1870 and 1910 the number of houses increased from 9,351 to 19,637. Endeavours were made to remedy the lack of public gardens. A number of bridges, among them the grandiose and daringly conceived Elizabeth Bridge, and the world-famed suspension bridge, unite Pest with Ofen which is beautifully situated on the opposite bank. It was in the full swing of this great development that Budapest was struck down by Bolshevist rule and the Rumanian occupation.

As regards the working-classes, the origins of socialism in Hungary can be traced back to the year 1868. About this time the "Working-man's Paper" (*Munkások ujsága*), edited by Kunsági, made its appearance. This paper, which was of short duration, was succeeded by others, such as "The Golden Trumpet" (*Arany Trombita*) edited by Táncsics and the "Weekly Labour Chronicle" (*Munkás heti krónika*) edited from 1876–81 by Léon Frankel, who was at the head of the Ministry of Works at the time of the Paris Commune. This was followed in 1880 by the "Voice of the People" (*Rêpszava*), founded by Viktor Külföldy, which became the most powerful organ of the Hungarian Social Democratic party which from the outset was closely connected with international social democracy. Labour in Hungary had a centralized organization, with its headquarters at Budapest, whence the whole movement received its impetus. However, a split occurred in 1897 when Várkonyi founded the Independent Socialist party, and another in 1900 when Mezöfi began to lead the Reorganized Socialist party. Among these three parties the most successful were the Social Democrats, who organized an agricultural strike in 1897, with the result that the extraordinarily low wages—of often only 25 *heller* per day—were doubled and even trebled. After several Acts had been passed for the protection of labour, for instance that of 1891, the law of 1898 was passed, which aimed at the prevention of self-help and was called "the Law of Slaves" by the Socialists, since it made strikes illegal and compelled men to work at the point of the bayonet. But this did not suppress the movement. Its chief cause lay in the unequal division of land. A large part was owned by the rich landowners as estates—many possessing as much as 20,000 *Joch* (about 28,400 ac.)—whereas another part—known as Mortmain—was in the hands of the Church. As such conditions made it impossible for the proletariat to buy land of its own, and industry was not as yet developed enough to provide food and means of livelihood for the poor, many were forced to emigrate. It has been calculated that within 10 years more than 1½ millions left their own country in order to win for themselves across the Atlantic a new home and a more hopeful existence. Those who were left behind swelled the ranks of Social Democracy, which split up and formed several camps. All were organized and led by different leaders. But a common cry bound them together, to win the franchise, from which they were excluded. Their aim was to enter Parliament by this means and there to give weight to and defend their interests through their own representatives.

The earliest legislation dealing with electoral law in Hungary is to be found in Article 5 of the law of 1848. It was not until 1874 that the subject was again introduced, and Article 30 of that year was in reality a retrograde step, in that it imposed higher property and taxation qualifications than had been demanded in the ordinance of 1848. In spite of the notable increase in the population, the number of those entitled to vote was not greater than it had been in 1848—namely 700,000 to 800,000. Another period of inactivity followed. After the Electoral League had for some time been agitating for universal franchise the Delegate Vázsonyi introduced a motion by which a committee of 35 members should be set up to draft a law for the introduction of universal suffrage, to regulate the elections and to collect the necessary statistics. The importance of this proposal lay in the fact that it introduced the question of universal suffrage for the first time into the Hungarian Parliament, and from that time onwards till the outbreak of the revolution (Oct. 1918) it was always present on the Order of the Day. It was brought forward on behalf of the Government by Joseph Kristóffy (b. 1857), Minister of the Interior in the Fejerváry Cabinet, on July 28 1905, on the occasion of an address to a labour deputation. Kristóffy's electoral system gave the vote to 2,691,000 electors. This enfranchised all males over 24 years of age who were able to read and write. After Kristóffy each new Government had to bring forward a new programme of franchise reform. On April 10 1906, Alexander Wekerle, Minister-President of the Coalition Cabinet, declared himself in favour of universal suffrage, in agreement with the speech from the throne. On Nov. 12 Count Andrássy, as Minister of the Interior in this Cabinet, brought forward a plural voting law, which gave two to three votes according to an educational qualification. The party led by Justh, the radical wing of the Independence party who were opposed to the principle of plurality, left this party, and thus brought about the failure of Andrássy's scheme.

The Government of Count Khuen-Hédervâry, which followed, completed the statistical preparations for a new electoral law. This was moved by Khuen's successor, Minister-President Ladislaus von Lukacs, but only carried by Stephen Tisza's Ministry, as the so-called "Lukacs-Tisza Electoral Law of 1913." It gave the vote to 1,627,000 electors, but was destined not to satisfy the supporters of radical reform. The secret ballot was restricted to a certain proportion of the electoral districts. Tisza himself recognized its weaknesses and the necessity of revision. In particular the industrial classes seemed at a disadvantage, since he had intended to widen their franchise considerably. Accordingly Tisza determined to remedy this when the new list of electors was compiled. When, however, Stephen Rakovszky, a member of the Catholic People's party, proposed to give the vote to all soldiers on active service by means of a supplementary amendment to the Electoral Law, Tisza protested most firmly against such a demand. He held that the franchise must not be regarded in the light of a reward, and that to accept Rakovszky's proposal would mean universal suffrage, which he regarded as inadmissible. Accordingly Rakovszky's motion was lost. On April 28 1917, however, the young King Charles announced in an autograph letter an extension of the franchise in consideration for the sacrifices made by the population during the war. Tisza however interpreted the royal letter in a manner which, according to the Opposition, was not in agreement with its contents and sense. Tisza would not yield, since in his opinion a radical franchise policy which outstripped the development of educational and economic policy would be a serious danger to the country and the dynasty alike. The Cabinet fell. In announcing his programme in Parliament on June 21 1917, Tisza's successor, Count Maurice Esterházy, declared electoral reform to be the chief plank in his platform, and said that he had undertaken to extend the franchise in the sense of the royal letter of April 28 and for the reasons given in this, keeping in mind at the same time the exigencies of the Hungarian State. When Tisza proposed, as a compromise, that for the time being only industrial workers should receive the vote, Count Apponyi refused, on behalf of the Government, to consider this. Vázsonyi, as Minister of Justice, strongly attacked Tisza, whose electoral reform of 1913 he described as a sham and denied that a democratic franchise would prove a danger to State or dynasty. Wekerle, Esterházy's successor, in putting forward his programme on Sept. 12 1917 also insisted on suffrage reform as the fundamental basis on which his Government would stand or fall. On Dec. 21 Dr. Vászonyi, the Minister in charge of the Electoral Law, put forward before the House of Deputies the scheme announced by the Ministry on its formation. It provided, *inter alia*, that the franchise should be exercised by every Hungarian citizen, 24 years of age and over, who could read and write; by all who had received the military medal for courage or the military cross founded by King Charles (*Karl-Truppen-Kreuz*); by all who paid taxes amounting to at least 10 kr.; by all who had been on active service or attained the rank of non-commissioned officer, irrespective of length of service; or who followed a trade. Moreover all women were entitled to vote who were over 24 years of age; who were of Hungarian citizenship; who had passed through four forms of a secondary school, or attained a similar degree of education; whose husbands fell during the war or succumbed to their wounds, if there was a child; or who had for two years been members of a scientific, literary or artistic society. But the revolution of Oct. 1918 and Bolshevism revolutionized everything and imposed by force the rule of one class—the proletariat—on all ranks of society.

A sketch of social conditions in Hungary would be by no means complete, nor could its development be properly understood without some knowledge of the activity of the "Sociological Society" (*Tarsadalomtudományi Társaság*). It had a deep influence on the development of the ideas of the young generation of "Intellectuals." Its founders were followers of Prof. Julius Pikler's opinions on the solution of theoretical as well as of practical problems. The journal "The Twentieth Century" (*Huszadik század*) served as the organ of this society for the scientific discussion of social problems, and its columns were open to the free discussion of every question. It was the rallying point of from four to five thousand enthusiasts. At the same time the Galileo Club (*Galilei Kör*) was the centre for the contest which a section of the Budapest University students carried on against the Catholic congregationist unions. This club gradually developed into a students' Socialist organization, in which the Jewish element predominated. As a result of the distress caused by the war, which was severely felt by these young men, who were for the most part without means, anti-military and syndicalist doctrines spread in their ranks, and a few weeks before the outbreak of the Oct. Revolution of 1918 the police authorities found it necessary to suspend this club and arrest many of its members. The twenty-year-old "Intellectuals" of the communism which followed had all belonged to the Galileo Club, and, having nothing to lose and everything to gain, were prepared to go to any extremes.

The Jewish question has become important in Hungary. In 1785 there were 75,089 Jews in Hungary; in 1840, 241,632 (an increase largely due to immigrations from Galicia); in 1880, 730,342; and in 1910 as many as 932,458. This growth must be ascribed to their great wealth. Only half a century earlier than 1921 they were to be found in small towns and villages where they lived the isolated life of the ghetto. In time, as they grew rich through trade, the ghetto became too small for them. As they owned no land they were not tied to the soil, and streamed to larger cities, where they found more opportunities of making money and adding to their wealth. Above all Budapest, as the centre of commerce and industry and the seat of the banks, had a strong attraction for them. Three distinct classes of Jews grew up: the Orthodox, who wished to remain Jews with all the habits and customs of the ghetto; those who in most respects had relinquished their position of religious isolation and strove after assimilation, in opinions and culture, with the genuine Hungarian element, in so far as they had not already been so assimilated; and thirdly the cosmopolitan Jews, the revolutionaries, who were the enemies of national feeling and represented materialistic internationalism. It was the part played by this third class of Jews—not the action of those who had become partizans of Hungarian nationalism—which has made the Jewish question acute in Hungary. As Hungary has no true middle class, they exercised great influence on the intellectual life of the country, and without them its economic life, which was preponderantly in their hands, would have been condemned to stagnation.

Language and Nationality.—It has become customary to regard Hungary as the battleground of the nationalities inhabiting it, in opposition to the Hungarian nation. In contrast to the majority of western European states Hungary has suffered from the lack of uniformity of language. The existence of a population speaking different tongues was due to several causes. The wars of the Magyars against invading enemies, which were continued through many centuries, caused heavy losses which could only be made up by the immigration of foreign settlers, who poured in in vast, ever-renewed numbers; and the admixture of languages due to this cause was increased by the Rascians, Serbs and a number of Wallachians, who fled from the Turks into Hungary, where they were hospitably received. There was no possibility of any fusion of these alien elements with the national Magyar stock, and the Magyar race showed no desire for such assimilation, regarding the matter with complete indifference. Indeed, so far from the Hungarians making any attempt to Magyarize their country, they were themselves in danger of Germanization, first under Joseph II. (1780–90) and later, after the national uprising of 1848–9, under the *régime* of the minister Bach. This danger was averted by the war of 1866 and the *Ausgleich* with Austria that followed. By the law of 1868 all citizens of the State domiciled in Hungary constituted, in the political sense, the indivisible, uniform Hungarian nation, of which all were members with equal rights, regardless of their nationality. Before the World War the Magyars numbered 10 millions in the whole of the kingdom of Hungary, constituting the majority of the population and therefore, in accordance with the Law of Nationalities of 1868, Hungarian (Magyar) was established as the official language for all, just as Latin had been in the days of the old Diet. When the elder Count Julius Andrássy was Minister-President, and under his immediate successors, who clung closely to this law, there was no Nationalist party and therefore no Nationalist question. The latter did not arise till after 1875, when Koloman Tisza, and still more Baron Bânffy, deviated from the Law of Nationalities and initiated a more chauvinistic Hungarian policy. This was, doubtless, a political mistake. Equally impolitic was the attempt in 1907 of Francis Kossuth, the Minister of Commerce, to make Hungarian the official language of the Croatian railways, and the action in 1909 of Count Apponyi, Minister of Education, in ordering the Magyar tongue to be used for religious instruction in the Ruman State schools. None of these efforts succeeded, and their only result was to create bad blood and to rouse complaints of oppression and persecution which found a sympathetic hearing abroad.

In spite of these specific grievances, which in any case were much exaggerated, all citizens of the Hungarian State, whatever their race or language, were guaranteed the full exercise of all their civic rights. Under the agreement of 1868 Croatia enjoyed full autonomy, with Croatian as its official language. It was to all intents and purposes independent, limited only, in the same way as Hungary, through the common army and common representation in the Delegations. The nationalities speaking languages other than Magyar had the right to build and maintain schools, and themselves to determine the language of instruction subject to the State language finding its proper place in the curriculum. In the school year 1912–3 there were 447 German, 377 Slovak, 2,233 Rumanian, 59 Ruthenian, 270 Croatian or Serbian elementary schools (not counting those in Croatia and Slavonia), which together made up one-fifth of all the elementary schools in Hungary. These Nationalist schools received a State subvention of nearly 14 million kronen. The prelates, both of the Greek-Uniate and the Greek Non-uniate confessions—metropolitans, archbishops and bishops—had by the end of the 17th and the beginning of the 18th century a seat in the Hungarian Upper House, as, for example, the Metropolitan of Karlowitz, the Rumanian Archbishop of Balázsfalva (Blasendorf) and the Rumanian Bishop of Nagyvárad (Grosswardein). On the other hand the prelates of the Protestant Church, which was wholly Magyar, only entered the Upper House 120 years later.

The nationalities had full freedom in the domain of the Church. At ecclesiastical functions, Rumanian was spoken exclusively in 3,322 parishes, Slovak in 1,029, German in 937 and other foreign languages in 832. It is significant, too, that between 1908–13 the Rumanians in Transylvania were able to acquire land to a value of 60 million kr. at the expense of the Hungarian population. The monetary institutions of the foreign nationalities were equally flourishing. A contrast is marked by the fact that the "Rumanian League of Culture" in Bucharest on March 28 1914 referred to the Rumanians in Transylvania as "oppressed brothers beyond the Carpathians," whose only hope, according to a resolution of 1913, lay in revolution. In Rumania, however, the domiciled Hungarians were permitted neither education nor religious service in their own tongue. The intercourse between Magyars and Slovaks furnishes an example of complete harmony. While the latter became Germans in Silesia and Czechs in Moravia, they were enabled to preserve their nationality intact in Hungary. The famous Cardinal Peter Pázmán (1570–1637), the father of Hungarian prose, saw to it that, as early as the 17th century, they could hear sermons in their own tongue at the church of Nagysombât (Tirmau). This harmony was not disturbed till it was pretended that the Hungarian Slovaks were lineal descendants of Svatopluk (d. 894); and a Slovak Protestant clergyman, who was entirely ignorant of history from the 10th to the 13th century, declared in 1821: "We, the Slovaks, are the heirs of this land, and the Hungarians mere foreigners." It can truly be said that the Magyars of pre-war Hungary knew of no national or religious differences, and, just as in 1848 the Magyar, German, Slovak and Rumanian serfs were all liberated at the same time and given the full exercise of political privileges, so after 1867 there was complete equality and freedom in religion and language. But the principle of State unity was strictly maintained, though efforts to undermine it were made in Croatia and the southern Slavonic districts, where the formation of a separate uniform Slav State was aimed at. This aspiration found its first expression in the Fiume resolution of 1906 which proclaimed the realization of the union of the Croats, Serbs and Southern Slavs. In 1916 the union of Croatia, Slavonia and Dalmatia with Bosnia and Herzegovina was demanded. Inspired by the idea of nationality which had developed during the 19th century some of the Rumans in Hungary also wished for union with the kingdom of Rumania. So long as the monarchy existed in its entirety such agitations had, of course, to be conducted in secret. The Slovaks rejected all the blandishments of the Czechs.

Many notable Hungarian politicians were in favour of an extremely liberal treatment of the non-Magyar population of Hungary. But, like Baron Joseph Eötvös, they dismissed the idea of national divisions by purely ethnographical districts, on the ground that this must lead to the dissolution of the State. On the other hand Hungarian politicians did not wish the other nationalities to feel themselves stepchildren on the soil of Hungary. In conformity with their whole trend of thought, it was their ambition that their nation, through its ethical and political hegemony, should prove the centre of attraction to the subject nationalities. But they always maintained, as Count Stephen Tisza declared on Jan. 24 1917, that in districts where different races and nationalities were intermingled it was impossible for each individual race to form a national State. That race must be in the ascendent, and give the impress of its character to the State, which preponderated in numbers and culture.

Economics.—Hungary, with its area of 324,851 sq. km. and pop. of 20,886,000 (according to the 1910 census), is economically one of nature's most favoured lands. As a patriotic Hungarian poet has said: "Were the earth God's hat, then Hungary would be the wreath that decked it." It is above all an agricultural country; it possesses valuable forest land and rich plains irrigated by great rivers, where the harvests are usually plentiful. A great step in the development of agriculture had been taken, when in 1848 the peasant became the free owner of his land. Under the influence of the defeat of 1849 the effects of this advance were lost, and progress remained at a standstill until after the *Ausgleich* with Austria in 1867, when a new period of economic prosperity set in. Among every 100 industrial workers 69 were employed in agriculture, which was conducted principally on extensive estates. Forestry occupies an important place, in that 27·2% of the area of the country is forest land, Hungary thus being very rich in timber. In 1879 the Forest Law was passed against indiscriminate exploitation of the forests, and from that time onwards it formed the basis of Hungarian forest policy. Thus a stop was put to the enormous waste of timber.

The most important use to which the land was put was corn-growing. Up to about 1881–91 the three-field system was customary; to-day it is no longer used and corn is grown intensively. Wheat is the chief product; from 1870–5 the average crop was 13,500,000 quarters, in 1912 it was already 50,250,000 qr.; the maize harvests in 1870–5 amounted to 12,169,000 qr., in 1912 to 52,325,000 qr. Oats and rye produce the smallest crop on account of the climate. The total value of cereals was estimated in 1878 at 1,408,000,000 kr., in 1912 at 3,055,000,000 kr. Wine is one of the most famous products, and above all Tokay.

Next in importance comes live-stock raising. In 1857 horses numbered 2,095,000, in 1911, 2,352,000; cattle in 1857, 5,647,000, in 1911, 7,319,000; swine in 1857, 4,505,000, in 1911, 7,580,000.

Hungary has been renowned for centuries for its mining and smelting; but after the opening-up of mines in America and Australia the importance of the gold-, silver- and copper-mining industries declined, while that of the coal-mines and iron-works proportionately increased. While in 1893 46,134 workers were employed in mining, before the war as many as 76,767 were so employed. The total proceeds from mining and smelting amounted to 53,000,000 kr. in 1864, and to 160,000,000 kr. in 1911. Salt is a State monopoly.

Though Hungary is essentially an agricultural country, it could, before the collapse of 1918, look back upon considerable industrial prosperity, although it never had the resources which would have made it an industrial State of any economic importance. After 1889 the Government did much to promote and encourage industry. Between 1890 and 1902, 537 undertakings received State aid. The distinguished Minister of Commerce, Gabriel de Baross (1848–92), brought about the systematic participation of home industries in State and army contracts. This policy was further developed by Joseph Szterényi, who after 1898 was the leader of the movement for the promotion of industry.

The most important group of Hungarian industries is that of food production, and here the mills have played the most important part. The first large steam mill was set up at the instigation of Count Stephen Széchenyi in 1839. There were in Hungary 147 steam mills in 1863; 492 in 1873; 1,908 in 1906 and later 2,040; water-power mills numbered 16,590. Second in importance is the sugar industry, which steadily developed after 1888, the number of factories rising from 21 to 28 during 1905–15. In 1913 1,701,675 *doppelzentners* of cane sugar were exported to Great Britain. After sugar come the iron and metal industries, which are among the oldest.

Commerce.—In 1890 the number of merchants in Hungary was 140,000; in 1910 they numbered 190,000, of whom 128,000 dealt in cattle, timber, mining and agricultural produce, and 62,000 in manufactures. In 1901, of the total national revenue 409 million kr. were derived from commerce, while in 1913 this had risen to 722 million kr. An idea of the general development of Hungary is given by its budget, which in 1868 amounted to 242 million kr., and in 1912 had risen to 1,856 million kr.

Communications.—The development of industry and commerce influenced the organization of communications. The first Railway Law was passed in Hungary in 1836. At the end of 1866 the network of railways covered 2,160 km., and there were only private railways. State management was not introduced till after 1867, when it had become evident that the private railway system ran counter to the economic interests of the nation. The period from 1876–91 saw nationalization, which was chiefly brought about by the minister Baross, who also introduced the epoch-making zone tariff. In 1912 the total length of railway lines was 21,910 kilometres.

In connexion with shipping it must be noticed that, whereas the river system of the Danube, of which most of the Hungarian rivers form a part, belongs to the Black Sea, a considerable part of Hungarian trade goes by way of the Adriatic, which is in nowise connected with the Danube system. The result is that there is little connexion between river and sea traffic, and this has its disadvantages. Steamers plied on the Danube between Vienna and Pest for the first time in 1825. Large sums were spent by the Hungarian Government on regulating river navigation. Special mention must be made of the navigation works on the lower Danube. The regulation of the Danube at the Iron Gates was of great value to the grain trade, since it used to be dependent on the favourable level of the water. In 1911 the waterways in Hungary navigable by steamers were 3,502·7 km. in length, of which 1,001·2 km. were on the Danube. In 1911 the tonnage of ships entering and leaving Budapest amounted to more than 25 million *meterzentners*. It had been planned to elaborate the commercial harbour of Budapest. In order to cope with the merchant traffic, freight ships maintained by the I.K.K. privileged Danube Steam Navigation Co. and the Royal Hungarian River and Sea Navigation Joint Stock Co. ply systematically on the Danube and its tributaries.

Hungary had a very short coast-line, on which the only notable port was Fiume, which, however, is not situated on the mouth of a great, navigable river such as would encourage mercantile traffic. Nevertheless Fiume was, and is, of great importance to Hungary in that it makes direct intercourse with international commerce possible. Between 1871 and 1911 the Hungarian Government spent about 51,500,000 kr. on improvements of the harbour of Fiume. Mention must be made of the Royal Hungarian Sea Navigation Co. Adria and also of the Hungarian Levant Sea Navigation Co. The Hungarian-Croatian Steam Navigation Co. was under contract with the Hungarian State.

The postal service of Hungary carried an average of 44 million letters between 1868–70, a number which had increased to 1,052 millions in 1912. Telegrams numbered 1,200,000 in 1868–70, and 13,980,000 in 1912. Hungary is in possession of an extensive local and interurban telephone system. The longest interurban lines are Budapest–Berlin (950 km.) and Budapest–Bucharest (896 km.).

Education.—The highest authority for public education is the Royal Hungarian Ministry for Culture and Education; State, Church and denominational schools are all under its control. The total number of elementary schools, Croatian excepted, amounted before the revolution to 16,861. The great poet and philosopher Baron Joseph Eötvös, Hungarian Minister of Education after the *Ausgleich* of 1867, made elementary education compulsory by the Elementary Schools Law of 1868. The number of illiterates was nevertheless great, especially in the districts inhabited by Rumans, Slovaks, Ruthenes, Serbs and Croats. The Minister of Education, Albert von Berzeviczy, laid down in 1905 a new curriculum for the Hungarian elementary schools. Special attention was paid by the State to the training of teachers. The *Bürgerschule* is a modern institution, especially designed for the children of the lower middle classes, who receive there a general and practical education. The fifth and sixth forms were recently adapted for agricultural tuition. These schools were attended by 43,000 boys and 57,000 girls, and these for the most part become the pupils of the intermediate technical schools. There are also girls' high-schools which also serve as teachers' seminaries. In 1910–11 there were 35 such schools, numbering 6,318 pupils and 434 male and female teachers. The higher secondary schools (*Gymnasien* and *Realschulen*) were critically affected by the passage of the Higher Secondary School Law of 1883, under the Minister of Education, August de Trefort, who had done much for the schools and Hungarian education in general. Only teachers with State diplomas are allowed to teach in these schools. In the *Gymnasien* Latin is taught from the first and Greek from the fifth form. There are 188 *Gymnasien* and only 34 *Realschulen;* accordingly the number of pupils in the former average 65,000, and in the latter 11,000. The cause of this is the preponderance of law students in Hungary. Those intending to teach in *Gymnasien* and *Realschulen* receive their training at special training colleges. The ranks of the teachers in the higher secondary schools are reinforced from the Eötvös College—an institution similar to the École Normale Supérieure at Paris—to which only the best pupils are admitted after careful selection. There they receive board and lodging, some paying the whole cost, some half and others nothing. Mention must here be made of the Board of Education founded in 1871 and reorganized in 1896, which deals specially with educational reform.

To the two existing universities of Budapest and Kolozsvár (Klausenburg in Transylvania) were added in 1914 the universities of Pozsony (Pressburg) and Debreczen. Besides these Hungary possesses one polytechnical institute in Budapest, 10 schools of law and 44 theological academies, and one Jewish rabbinical seminary. The greatest number of students—7,808—attended the university of Budapest in the winter session 1912–3. A change which was introduced in 1896 by the former Minister of Education, Baron Julius de Wlassic (b. 1852), opened the university to some extent to women. Accordingly, as they could not attend the university without having obtained the leaving certificate of the higher secondary schools, the Hungarian Women's National Educational Union founded a girls' *Gymnasium* of eight forms, which was followed by two others.

Mention should also be made of the technical schools. Hungary had 7 higher and 52 lower agricultural schools. In 1913 there were 4 commercial colleges and 54 higher commercial schools as well as 58 special commercial courses for women.

HISTORY (1910–1921)

The "Coalition" which, under Wekerle's leadership, had taken over the Government in April 1906 was made up of elements too heterogeneous to enable it to satisfy the excessive hopes and expectations to which its advent to power had given rise. It fell to pieces owing to quarrels about the establishment of an independent Hungarian Bank, to take the place of the common Austro-Hungarian Bank, and to the refusal of the Crown to make further concessions to Magyar national sentiment in the matter of the army. After manifold negotiations Francis Joseph, as King of Hungary, on Jan. 11 1910 appointed Count Khuen-Hédervâry Minister-President.

Khuen-Hédervâry Cabinet.—On Feb. 14 Count Julius Andrâssy, whom Count Khuen had vainly attempted to win over to his side, dissolved the Constitutional party of which he had hitherto been the leader and declared that he would not actively oppose the Government. On the following day 24 members of the Constitutional party joined the supporters of the Government. Under the leadership of Count Stephen Tisza, on Feb. 19 1910, the National Party of Work (*Nemzeti munkapart*) was formed as the direct successor of the Liberal party established in 1875 by Coloman Tisza. There followed scenes of extraordinary violence provoked by the Opposition in Parliament, which was dissolved before its time by a speech from the throne on March 22. In the general election that followed in June Count Khuen-Héderváry was surprisingly successful; for of the 413 members returned 255 belonged to the party of the Government. The parties of Justh and Francis Kossuth were wiped out—the parties which aimed at bringing the army under parliamentary authority, which were working for the separation of Hungary from Austria, and whose programme included the establishment of an independent Hungarian Bank. Fresh life was put into the party of 1867 which for decades had determined the fate of Hungary.

The speech from the throne, with which the new Parliament was opened on July 25, proclaimed as one of the most urgent tasks it would have to face the reform of the franchise in such a way as to safeguard the uniform national character and the democratic development of the State. In the debate on the address the prime minister defended himself against the charge that he was pursuing a policy of abnegation, and that he was attempting to restore the disturbed harmony between the King and the nation by the surrender of all national aims. At the same time he announced that it would be necessary to increase the Hungarian army in proportion to those of the Great Powers. In Nov. the civil code was finally adopted. On Dec. 1 the Minister of Finance laid before Parliament a convention for the extension of the privilege of the Bank, which lapsed on Dec. 31 1910, and on the resumption of payment in specie. On Dec. 13 Parliament adopted by a large majority the provisional budget, up to April 1 1911. In general it can be said of the year 1910 that it was for Hungary a year of gradual internal consolidation. That the project of raising in March a loan of 560,000,000 kr. in Paris broke down was due to political reasons, since there was an objection there to lending money to a member of the Triple Alliance. But, after the signature of the commercial treaty with Serbia on Jan. 10 1911, a loan floated on the German money market (Jan. 13) met with immense success. It may be reckoned as a result of the promises made in the speech from the throne in 1910 that on May 2, at Bonyhad, a general meeting of the Hungarian Peasants' League, which was attended by 6,000 small cultivators from 181 communes, passed a resolution pledging support to any political movement aiming at securing universal, equal and secret suffrage.

After several days of obstruction Parliament began to debate the question of the reform of the defence force, which was met by the party of Kossuth and Justh and by the People's party by obstructive tactics carried to an extreme of technical perfection. This obstruction, which lasted for several months, led on Nov. 3 to the resignation of the president of the House of Deputies, Albert von Berzeviczy, who had been severely criticized for his mild interpretation of the rules of the House, the vice-president, Navay, being elected in his stead. On Nov. 8 the Opposition, under Count Julius Andrássy, declared itself ready to discuss the budget for 1912, to drop its technical obstruction of the Defence bill, and to debate it on two days a week during the discussion of the budget. The estimated expenditure under the budget for 1912 was increased from 1,706,544,999 kr. to 1,852,747,661 kr., the latter sum being the estimated receipts.

The effect of the alliance with Germany was illustrated during the year 1911 by the introduction of the German language as a compulsory subject in the teachers' training colleges, a rule which came into effect on Sept. 1. In view of the outbreak of the war between Turkey and Italy, Count Apponyi, on Oct. 11, interpellated the prime minister as to the attitude of Austria-Hungary, urging the duty of the neutral Powers to offer their mediation under the Hague conventions of 1899 and 1907; and at the meeting of the Hungarian Delegation on Dec. 29 he proposed that Hungarian public opinion should make it clear that the preservation of peace was the loadstar of Hungary's policy, and should declare itself, from this point of view, unalterably attached to the tried principles of Hungary's traditional foreign policy. The internal situation, however, gave little promise of peace. The hostile attitude of Croatia had, so early as Feb. 1911, given rise to stormy scenes in the Hungarian Parliament. On Feb. 6 the deputy Polonyi accused Dr. Tomačić, the Ban of Croatia, of making unconstitutional statements to the Croatian Diet as part of a deliberate policy. At Agram, from Aug. 12 to 16, there was held a great Pan-Slav gymnastic festival, which was attended by over 5,000 members of *Sokols* from Austria-Hungary, Serbia, Bulgaria, Russia and America. On Nov. 7 the Croatian Diet was dissolved by royal rescript, on the ground that it had not fulfilled the expectations with which it had been summoned, and that no further fruitful activity was to be expected of it. The Hungarian press fulminated against the administrative methods of the Ban, whom it accused of introducing into Croatia a reign of terror prejudicial to the good name of Hungary. At the new elections to the Diet 67 members were returned by the five groups of the Opposition, 27 by the party attached to the Government. The anti-Magyar party of the Right increased its representation from 14 to 25.

The Army Question.—At the outset of the year 1912 it seemed as though a peaceful atmosphere would prevail in Parliament. On Jan. 22 Count Apponyi announced the conditions on which the Kossuth party would sever its connexion with the Opposition, viz. (1) settlement of the question of flags and military emblems in accordance with the rights of Hungary as a State; (2) expunging from the military penal code of all regulations connected with the use of the German language; (3) redrafting of the individual paragraphs of the Defence bill; (4) an interpretation of Article 18 of the law of 1888 concerning the calling-up of the reserves and special reserves (*Ersatz-Reservisten*). In view of the perilous situation in the Balkans, Count Andrássy urgently appealed to the majority of the House and to the Opposition not to drive matters in connexion with the Defence bill to extremes and urged the Government to accept Apponyi's four points. Of these the most contentious was the article of the law of 1888, to which par. 43 of the Defence bill referred. The Kossuth party demanded pledges from the Crown that, in the event of its again finding itself, as in 1905, faced with a hostile majority in Parliament, it would not have recourse to a prorogation and to the expedient of meeting the refusal to vote the quota of recruits by calling the reserves and special reserves to the colours. The Opposition saw in Article 18 of the law of 1888 a handle for the Crown to nullify the right of Parliament to vote the annual quota of recruits, and for this reason wished to introduce into the new Defence bill specific provisions making such a course impossible. The prime minister took up the position that in this matter the Government and the Opposition were of one opinion, and it was therefore decided that the Party of Work should propose a resolution calculated to placate the Kossuth party. But this was not the opinion of the heir to the throne, the Archduke Francis Ferdinand, nor of the Austro-Hungarian Minister of War, Ritter von Auffenberg, who saw in this an infringement of the rights of the Crown. The King-Emperor himself shared this view, and the situation became so strained that a crisis involving the whole State was expected. Francis Joseph, in an interview with Count Khuen-Héderváry, declared that he would rather abdicate than submit to the proposed resolution. The only way to avoid the disastrous shock which the carrying-out of this resolve would infallibly have caused seemed to the prime minister to be that he himself should resign. On March 7, accordingly, he handed in his resignation, which was not, however, accepted. On March 30 Francis Joseph addressed to him an autograph letter, in which he expressed his deep regret at the differences of opinion which existed as to the rights of the Crown. It was far from his intention to dispute the constitutional powers of the nation, of which the right to vote the quota of recruits was one. But he, too, as

King of Hungary, had firmly to maintain the sovereign rights assigned to him by Article 18 of the Defence Law of 1888, which empowered him, in case of necessity, to summon to the colours and to dismiss the reserves and special reserves. He earnestly exhorted the nation to make this double task easier for him, in order to clear the way for those constitutional labours which depended for their fruition upon a good understanding between the King and the nation. Count Khuen-Hédervåry accepted the King's view of the resolution which had been projected with his consent, and agreed to remain in office.

Lukacs Ministry.—Peace, however, was not restored. The Justh party, which represented the extreme wing of the Opposition, insisted that the crisis could only be definitely closed if the Defence bill were shelved and electoral reform given the first place on the parliamentary programme. As Khuen-Hédervåry no longer commanded a following sufficient to enable him to carry the Defence bill, with its considerable increase in the number of recruits, he was forced to resign on April 16 1912. He was succeeded by Ladislaus von Lukacs, hitherto Minister of Finance, who had said that, if everything else failed, force must be met by force. In a stormy session, on May 22, Count Stephen Tisza was elected president of the House of Deputies in succession to Navay—a symptom of the decidedly bellicose temper of the majority. The new president lost no time in doing what had been expected of him. With the fearlessness and iron energy characteristic of him he succeeded on June 4 in carrying the Defence bill through the House, amid scenes of violent uproar. At his orders the police entered the House and removed the deputies of the Opposition. Members who had been suspended, but defiantly attended the House, Tisza ordered to be thrown out by the police. The deputy Julius Kovacs, who for breaches of order had been suspended for 30 sittings, entered the House on June 7 with the cry "There is still one member of the Opposition," fired at Count Tisza, but without wounding him, and then shot himself. The Count remained utterly unmoved, and continued the session as though nothing had happened. But the House could only debate under armed protection; it was frequently prorogued; and in these circumstances little could be done to restore wholesome conditions.

In Croatia, too, the year 1912 was one of disorder. The newly elected Diet met on Feb. 7 only to be immediately dissolved. The newly nominated Ban, Eduard von Cuvay, tried to suppress the disorders in Agram with an iron hand. In April the constitution was suspended; and several unsuccessful attempts were made during the year to assassinate Cuvay, who had been armed with the powers of a commissioner of the Crown.

The year 1912 witnessed the death of two notable Hungarians, the aged Gen. Görgey, who died on Dec. 17, and Count Albin Czaky, one of the creators of the political reform of the Church, who died on Dec. 15. At the close of the year the Government introduced into Parliament the projected Franchise bill, for which urgency had so long been pleaded.

When, after several days' interval, the Hungarian House of Deputies again met under police protection, Zoltan Désy, a former secretary of state and now a deputy, brought an action for libel against the prime minister Lukacs. The Budapest court acquitted Désy of the charge of slander brought against him by Lukacs, on the ground that he had proved that Lukacs in 1910, in connexion with the conclusion of agreements with the Hungarian Bank and Joint Stock Co., had accepted more than 3,000,000 kr., not indeed for himself but for party purposes, which was contrary to good morals. This was a sentence of condemnation on the Lukacs Cabinet; and on June 5 Tisza was appointed prime minister.

Tisza Ministry.—With the same unbending will with which, as president of Parliament, he had conducted the business of the House, Tisza now conducted the affairs of the nation in the face of unceasing protests on the part of the Opposition. He saw a further means of strengthening his system of government in securing State control of the administration of the counties (*comitatus*), which had hitherto been in the hands of elected officials; for if these were nominated, they would be entirely dependent upon the Government. This attempt at monopoly by the Government party was met with violent protests on the part of the Opposition, which was still further embittered by the consciousness that the King no longer stood as ruler above parties. As for Tisza, he set no limits to his will when he believed that the interests of the State demanded that it should prevail. Believing as he did that peace would be imperilled if the opinion gained ground abroad that the military power of the Dual Monarchy was broken, he carried a motion through the House of Deputies on Jan. 28, raising the contingent of recruits by 31,300 men, of whom 13,676 were to be drawn from Hungary. While the Government succeeded in raising a loan in London, the first for several years on the English market, Tisza tried to come to an accommodation with the Hungarian Rumans in the matter of their national claims. He declared publicly that the system hitherto pursued of enforcing Magyar only as the language of teaching in the schools had been mistaken, and that more attention must therefore be paid to the demand for instruction in the mother tongue. The Rumanian National Committee, however, refused to agree to Tisza's proposals. The refusal was, indeed, couched in conciliatory terms which left the door to future negotiations open. The door was slammed as the result of a bomb-explosion in the episcopal palace of Debreczen on Feb. 3, which raised a storm in Parliament and in the press. The outrage—which happily was unsuccessful—was directed against the life of the Greek-Uniat Bishop Miklossy, who in the controversy as to the use of Rumanian or Magyar in the liturgy had declared in favour of Magyar. For this outrage the Rumanians were blamed, and at the same time the opinion gained ground that the originators of this unsuccessful attempt at murder were tools of Slav agitation. In any case, the discussions as to those responsible for the crime caused bitter feeling between the Hungarians and Rumanians. On March 28 there was a hostile demonstration of the "Rumanian Culture League" at Bucharest against Hungary, and at the same time the Rumanians of Transylvania were celebrated there as "our oppressed brethren beyond the Carpathians," which led to sharp rejoinders in the press.

Hungary and the World War.—Into the midst of these squabbles, and just as Tisza was accusing the Opposition of publicly proclaiming their support of the Triple Alliance and at the same time playing into the hands of its enemies, there came suddenly, on June 28 1914, the news of the murder of the Archduke Francis Ferdinand and his wife at Sarajevo. In Hungary the death of the Archduke was felt as a relief. His dislike of the Magyars was well known, and also his objection to the system of Dualism. In truth, his aim had been nothing less than the overthrow of the form of the State as constituted by law. In the political systems which he from time to time favoured—whether Trialism or a Federalism—he had assigned an important political rôle to the nationalities living in Hungary, and always in an anti-Magyar sense. Exactly a month after the Sarajevo crime Austria-Hungary declared war on Serbia (July 28), and the Hungarian Parliament was prorogued for an indefinite period. When it met again, on Nov. 30, its attitude was that of an unexpressed vote of confidence, and, after the storm and stress of the last years, gave the impression of "a magnificent symphony"—to quote the *Budapesti Hirlap*.

It was only now, during the war, that a series of grievances, which had raised the most violent disturbances in Parliament, were settled in the sense of the Opposition. A decree of the Minister of the Interior, issued on Nov. 7 1914, authorized the wearing of the colours and emblems of the various nationalities, provided these were not identical with those of foreign countries and that the idea of the Hungarian State was also symbolized. The Government published the correspondence of Tisza with the Metropolitan of Hermannstadt in Transylvania, in which a reform of the National Schools Law was promised in order to meet the wishes of the non-Magyar inhabitants of the kingdom in the matter of the denominational schools. It was also decided to legalize the use of the mother tongue in direct intercourse with State officials. Finally, a prospect was held out of a reform of the franchise with a view to putting the representation of the Rumanians on a just basis. On April 19 1915 Parliament, which would have come to an end on the following July 15, passed a bill extending its life for another year. In Oct. the question of the coat-of-arms and flag of the Dual Monarchy, the settling of which had been blocked by the Archduke Francis Ferdinand, and which for decades had been the worry and distraction of every Government in turn, was at last arranged. For all matters of common concern a coat-of-arms was devised which actually symbolized the constitutional relations of the two halves of the Dual Monarchy. The quartering on the same shield of the arms of Hungary and Austria proclaimed their essential independence, and the name of Austrian Empire was now officially adopted by the cis-Leithan half of the monarchy in place of the style "the Territories represented in the *Reichsrat.*" The escutcheon of the House of Habsburg surmounting the two shields, on the other hand, symbolized the fact that the two states were united, this being still further emphasized by the motto *indivisibiliter ac inseparabiliter*, borrowed from the Pragmatic Sanction. In the same spirit the question of the flag was settled. The old black-and-yellow flag of the common army was replaced by an ensign in which white alternated with black and yellow, with red, white and green "flames," and which was further ornamented with the new arms of the common State surmounted by the Imperial crown and the crown of St. Stephen.

A settlement thus seemed to have been effected of all the quarrels which had weakened the monarchy, whether arising out of the internal affairs of Hungary or her relations with Austria. When on Sept. 2 1916 the Hungarian and Croatian municipalities took the oath of allegiance to the Emperor-King at the palace of Schönbrunn, the Ban of Croatia, Baron Skerlecz, said that this was the day of victory for all the fundamental principles on which the structure of the monarchy rested; and the speeches delivered on this occasion, both by Hungarian and Austrian representatives, gave eloquent expression to the deep sense of essential unity which had been called forth by the danger to the monarchy arising out of the war. In the internal affairs of Hungary, too, the Opposition wished to secure "concentration" by means of a Coalition Ministry, hoping in this way to avoid a repetition of what it conceived to be mistakes in Hungarian foreign policy. On May 20 1915 Count Apponyi proposed that a Coalition Government should be formed of members of the Opposition and of the actual Cabinet; that the prime minister should be a member of this Government, but that at its head should be placed a statesman whose neutrality should be guaranteed by the fact that he had taken no part in recent party contests. But Tisza was by no means disposed to submit himself to the headsman. He believed himself to be indispensable at the head of affairs in Hungary at a time when the failure to prevent Italy entering the war on the side of the Entente was ascribed to the inexcusable blundering of the Austro-Hungarian Foreign Office. He declared that he could with a clear conscience accept responsibility for whatever influence had been exercised by the Hungarian Government upon foreign affairs. And so the idea of a Coalition came to nothing.

Two months later, on Nov. 21 1916, the long reign of Francis Joseph came to an end. Ever since his coronation, on June 8 1868, as King of Hungary he had never ceased to feel and act as the constitutional ruler of the country, and he had faithfully adhered to the spirit of the *Ausgleich* of 1867. The gratitude of the nation was expressed in a resolution passed by Parliament on Jan. 22 1917 to erect a fitting memorial to him in Budapest. The collapse of the monarchy in ruins prevented this resolution from being carried out.

Accession of Charles IV.—Francis Joseph's successor, who assumed the style of Charles I. as Emperor of Austria and Charles IV. as King of Hungary, was crowned, together with his consort, on Dec. 30 1916, after he had, in accordance with the constitution, signed the "inaugural diploma" guaranteeing the rights of the nation. This ceremony, which under the Hungarian constitution was the indispensable condition precedent to the exercise by the King of any of his powers, was heralded by violent scenes in Parliament. The kings of Hungary were crowned by the primate and by a "vice-palatine" elected *ad hoc* by the Parliament. Count Tisza was ambitious of fulfilling the latter function and was duly elected by the parliamentary majority, while the opposition, under Andrássy's leadership, put forward the Archduke Joseph. To have thus put himself into opposition to the Archduke, who was not only popular but reverenced as a prince of the Hungarian royal house, was a mistake on the part of Tisza. It gave his opponents an opportunity of impressing upon the young sovereign that Tisza's violence would not always be content with shoving an Archduke aside. Equally strong was the impression made upon the royal couple, whose opinions were strongly clerical, by the suggestion that Tisza's behaviour was characteristic of the arrogance of this Calvinist, who presumed to crown the Apostolic King. As constitutional monarch Charles had to confirm the election of Tisza as vice-palatine, but it can safely be affirmed that this episode still more firmly rooted the dislike with which, as a Calvinist, he was already regarded at court.

At this time the negotiations for the economic *Ausgleich* between Austria and Hungary once more reached an acute stage. According to Article 25 of the treaty these negotiations for a new agreement, to cover the period from Jan. 1 1918, should have begun not later than the commencement of 1915, but it was not till Sept. 26 1915 that the two Governments took the matter in hand. As there was also a possibility of a tariff arrangement with Germany, wide support was given in 1917 to the idea of concluding an *Ausgleich* between the two halves of the monarchy which should cover a considerable period, say 20 or 25 years. It was thought that this would give a strong basis for the negotiations with the German Empire, and that it would save Austria-Hungary from the violent quarrels about the *Ausgleich*, which recurred every 10 years, and often produced abroad the false impression that the monarchy was falling to pieces. There never was a new *Ausgleich*, however, the last being that of 1907.

The Opposition in Parliament shared the strong dislike of the court for Count Tisza. On Feb. 26 1917 his motion for bestowing extraordinary powers on the Government for the duration of the war was opposed by Count Julius Andrássy, who saw in this an attempt on the part of the Cabinet to subject the whole country to the discipline of a single party, and denounced the imperialism of the Party of Work, which was extending even to Austria, where great bitterness was being aroused owing to the refusal of Hungary to supply food-stuffs. The interests of Hungary, Andrássy insisted, demanded a strong Austria alongside of a strong Hungary. In spite of this opposition, however, extraordinary powers were voted to the Government on March 23 by a majority of 93 to 63. On April 13 Tisza delivered a bitter attack on the Opposition, whose demand for a Coalition Government he denounced as a mere party cry, and whose object he declared to be not "concentration" but disorganization. On the following day the breach was complete. Tisza attempted to strengthen his Cabinet by inviting two members of Andrássy's Constitutional party to join it, but after consultation with their leaders they refused. Neither this attempt, nor an autograph letter of April 28 in which the King assured him of his confidence, could avert his fall—distrust of him at court was too deep-rooted. The immediate cause of his fall was the demand of King Charles that every holder of the military cross named after him (*Karl-Truppen-Kreuz*), *i.e.* every soldier who had actually served at the front, should be given the vote. On Tisza's refusal to agree to a policy in contradiction with that outlined in the autograph letter of April 28, he received his dismissal (May 23 1917).

Esterhazy and Wekerle Cabinets.—The proper thing to have done now would have been to have entrusted the formation of a Government to Count Andrássy, as the most conspicuous member of an Opposition which rested on the principles of 1867. Charles, however, thought it advisable to employ young blood in inaugurating the policy which he believed to be necessary in view of the tendencies of the times, and on June 15 he placed the young Count Maurice Esterhazy at the head of the Ministry. The Count had the reputation of being a very intelligent, gifted magnate, but it was felt that to fit him for such a position it would have been necessary that he should have at least won his spurs as a politician. Tisza was now leader of the Opposition, and he was at the head of a blindly devoted majority. The strongest member of the Esterhazy Government was Dr. William Vazsonyi, a former lawyer who represented the Socialist party in the Cabinet and was appointed Minister of Justice. To him was entrusted the task of bringing before the House proposals for electoral reform in accordance with the new spirit of the times. He had scarcely drafted the bill before every sub-section of it became the object of unworthy chaffering. Even Count Michael Karolyi, who had posed as one of the most zealous champions of far-reaching democratic ideas, is said to have expressed his willingness to oppose the enfranchisement of illiterates in return for the appointment of a member of his party as Secretary of State in the Ministry of Justice. When it was obvious that the members of the Government were in violent disagreement among themselves, and Esterhazy's health broke down under the strain, it became necessary to find another prime minister. On the advice of Count Czernin, the Austro-Hungarian Minister for Foreign Affairs, Alexander Wekerle was appointed on Aug. 20. He had held the office several times before, was distinguished for his financial ability, and, in spite of his mistakes in the past, had the reputation of possessing one of the wisest heads in Hungary. But the task imposed upon him was beyond his powers. The situation had been rendered more difficult by the failure of the State to provide Austria-Hungary with bread-stuffs by taking over the rich harvest of 1917, with the result that forestallers and war profiteers had hastened to buy it up and withdraw it from the market. Wekerle soon tendered his resignation; but, on the failure of the Minister of Finance, Szterenyi, to form a new Cabinet, he consented to remain in office. The members of the Cabinet who had urged the immediate settlement of the franchise question—Apponyi, Esterhazy, Bela Földes and Vazsonyi—now retired.

The End of the Monarchy.—The whole political life of Hungary was sick, owing, on the one hand, to the opposition of Tisza to the radical reform of the franchise projected by Vazsonyi, and, on the other hand, to the ambition of Count Karolyi, who wished to get into office at any cost. The latter was not particularly gifted, and was more of an intriguer than a statesman; but he had been thrust into the foreground by the Opposition, which used this popularity-hunting aristocrat as a battering-ram to break down obstacles that stood in the way of their plans, and the part he was called on to play had turned his head. He really believed that his destiny was to shape the fate of Hungary, and his whole soul was intent on becoming Minister-President. Karolyi did not disguise his opinion that in politics all means are legitimate, if they lead to power. While assuring the King of his fidelity, he maintained secret relations with the Radical, and even with Bolshevist, elements. Impatient at the postponement of his ambitious hopes, he declared openly that he would keep no bounds, which agreed with his announcement in Parliament on Oct. 18 1918 that he intended henceforth to substitute deeds for words. At the same time he made skilful use of a means which gained him great popularity, viz., his supposed intimate relations with the Entente Powers, by means of which he promised to procure for the country the peace for which it earnestly longed. It was indeed this war-weariness which accounted for the amazing influence which Karolyi actually exercised, the secret of which was that he was believed to be the one man who could bring peace to Hungary. But Karolyi overestimated both his own abilities and his influence with the Entente. Because he had formerly always taken up in Parliament an attitude of hostility to the Triple Alliance, he believed that he had only to hold out his hand to the Entente Powers and these would at once grant Hungary favourable terms of peace. In view of the danger threatening from Karolyi and the Radicals, Tisza—the "granite head" as Prince Ludwig Windischgrätz called him—at last showed himself not indisposed to make concessions in the matter of franchise reform. He was even prepared to come to terms with his old antagonist Andrássy, to propose him for the office of Foreign Minister, and to support him. Into the midst of this confusion fell like a bombshell the young Emperor-King's manifesto of Oct. 16, which proclaimed the liquidation of the monarchy and its transformation into a Federal state. It was the most unfortunate of all Charles's actions. The immediate and logical result of the manifesto, which destroyed dualism, was that Hungary declared that she had recovered her rights as a separate state and that henceforth she would be bound to Austria solely by the personal union of the Crown.

Meanwhile the power of social democracy had grown ever greater and greater. Nothing had been done to satisfy its burning desire for universal and secret suffrage, and it was therefore in the highest degree discontented. Among wide classes of the population the failure to carry out the oft-repeated promise of an extension of the franchise, especially in the case of the soldiers, had shattered all confidence in the King and the Government. The ground was thus prepared for the most Radical party cries to take root and flourish. All authority was undermined, and its place was taken by a deep-rooted hatred of the governing classes who had hitherto directed the destinies of the country. At this crisis, which called for a strong guiding brain and hand, the throne was occupied by a sovereign who, though quite well-meaning, was too inexperienced and too weak to do the right thing. The representatives of the power of the State showed themselves no less weak; it was as though everyone had conspired to paralyse all the organs of the State and to destroy its order. As is always the case at the outbreak of revolutions, men who had hitherto avoided the light now rose to the surface from the lower depths. An atmosphere had been created in which it was possible for such Catilinarian figures as Count Michael Karolyi and his fellows to flourish. The revolutionary spirit had received rich nourishment from Béla Kun, who had returned from captivity in Russia, liberally provided with Bolshevist money, and employed himself in spreading the doctrines of Lenin and Trotsky in the barracks and among the troops at the front. In the same spirit, on Oct. 25 1918, and on Karolyi's suggestion, a National Council was organized.

Karolyi in Power.—It now became fatally clear that everyone was agreed that the King had no choice but to appoint Karolyi Minister-President in succession to Wekerle, who had resigned. Even Tisza advised this course. Thus the helm of the State was to be put into the hands of the man who based his policy on the world-revolution which was to enforce peace. It was not, however, as yet clear that a violent revolution would be successful. On the night of Oct. 29–30 Oskar Jaszi, the principal mob leader, told his comrade Kunfi that they would probably both be hanged on the morrow; for they feared that Field-Marshal Lukachich would lead his troops against them and make an end once for all of revolutionary nonsense. But when, towards the morning of the 30th, the general had not put in an appearance, they regained courage. In the half-light of dawn bands of soldiers, seduced by the revolutionary propaganda, began to concentrate in the region about the Hotel Astoria, carrying red and national flags, and shouting "Long live Karolyi! Long live the Revolution!" Soon the tidings spread abroad that Karolyi had been appointed Minister-President. When Jaszi stepped out on to the balcony of the Hotel Astoria and announced the King's decision to the assembled crowds, he was met with cries of "The King? Who is the King now? It is not the King who nominated Karolyi. He is Minister-President by the will of the Revolution. Long live the Republic!" It was a victory for the mob, and its immediate effect was to make the position of Andrássy, the newly appointed Foreign Minister in Vienna, impossible. Karolyi at once ordered the withdrawal of the Hungarian troops from the front, in conformity with Lenin's prescription making the dissolution of the army the essential condition precedent to the social revolution. This sealed the fate of Hungary, which was thus rendered absolutely defenceless.

The first victim of the new régime was Count Tisza, who was murdered on the morning of Oct. 31. His all too stubborn resistance to the extension of the franchise had earned him the hatred of the people. It was also universally believed at that time that it was to his advice that the beginning of the war was principally due, though it has since been proved, from official sources, that, on the contrary, Tisza was the only one of the ministers present at the fateful council who spoke against the declaration of war on Serbia, a fact which he was too proud to announce publicly during his lifetime.

Karolyi had triumphed over even his strongest opponents, but he was not destined to enjoy his triumph long. Now that he had seized the reins of government it was soon abundantly clear that he had none of the qualities enabling him to fill the part to which his morbid ambition had led him to aspire, and that, where he thought to push, he was himself pushed. When the reins of government slipped from his feeble hands, he played them into those of the Bolshevists, who, emancipated from all ties of country, indulged in an orgy of plunder and murder, plunging Hungary into a misery deeper than any she had suffered from the war. (E. v. W.)

The People's Republic.—The forces by which the monarchy and the constitution were overthrown, and which after their overthrow controlled the situation, were represented by three groups, of which only one had previously been represented in Parliament—that led by Karolyi. These groups were (1) the Social Democratic party, which in 1919 had 215,022 associate members; (2) the Bourgeois-Radical party of Oskar Jaszi (b. 1885), the members of which were mainly Jewish intellectuals; (3) the party of Independence, under Count Karolyi, which had great support among the undiluted Magyars of the Alföld (the great central Hungarian plain) because it upheld the Kossuth tradition of separation from Austria. It was the representatives of these three groups who, under Karolyi's leadership, had constituted the National Council on Oct. 26. On the 29th the Diet at Agram declared the independence of Croatia, and on the 30th the National Assembly of German-Austria proclaimed the Republic at Vienna. On the night of Oct. 30 occurred the revolution in Budapest. Workmen's and soldiers' councils on the Russian model had already been formed; but, though the revolution was the work of the mob, it undoubtedly had wide support among the middle classes and the peasants, while the murder of Count Tisza removed the only man strong enough to have arrested its course.

After Wekerle's retirement the Archduke Joseph, as the King's representative, had nominated a new Ministry consisting of members of the three revolutionary groups, with Karolyi at their head. These men at first took the oath of allegiance; but as early as Nov. 1 they asked permission to rescind it; the King's permission was given, and the Karolyi Cabinet constituted itself as a People's Government, and took a fresh oath of allegiance to the National Council. To the further wish expressed by the Government, that King Charles should abdicate, he made no reply; but on Nov. 13 he issued from Eckartsau a proclamation announcing his withdrawal from all affairs of State, and his recognition in advance of any form of government which the Hungarians might decide upon.

On Nov. 16 the National Council proclaimed Hungary a People's Republic, dissolved the two Houses of Parliament, and handed over power to Karolyi and a committee of the National Council, pending the convocation of a National Constituent Assembly, which, however, never met. On Jan. 11 Karolyi was elected by the National Council provisional President of the Republic and he himself appointed Dionys Berinkey (b. 1871) Minister-President. The new Government did not recognize the armistice concluded by the Italian Gen. Diaz with the Higher Command of the dissolving Austro-Hungarian army; and, in the hope that as a pacifist and a consistent opponent of war he would obtain better terms for Hungary, Karolyi proceeded to Belgrade, where he concluded with Gen. Franchet d'Espérey, the commander-in-chief of the Entente troops in the Balkans, a fresh armistice. He had already deliberately destroyed the Hungarian army; the new armistice established a line of demarcation which gave over large portions of Hungary and Transylvania to Rumanian and Serbian occupation.

In order to avoid the threatened partition Karolyi and Oskar Jaszi, the Minister of Nationalities, began negotiations for the transformation of Hungary into a pacifist confederation. They had not proceeded far, however, before the country was invaded by Rumanian and Czech troops, who occupied two-thirds of it, even beyond the lines of demarcation. A few of the Hungarian troops which had arrived in good order from the front wished to offer resistance; but this Karolyi would not allow. The military mission of the Entente in Budapest took cognizance of this further occupation, but paid no attention to the protests of the Hungarians.

The failure of the Government in its dealings with the Entente roused bitter feeling among the people, who had hoped that the new men would be able to save the thousand-year-old Magyar State, and this discontent was rendered more acute by the anti-national attitude of the two Government parties, the Social Democrats and the Bourgeois-Radicals. In consequence of the disbandment of the army, there was only one organized force in the country, that of the Socialist trade unions, the leaders of which now desired to assert their new-won power. They thwarted all attempts to form a new National army, and the fall of two War Ministers was caused by parades of Socialist soldiers' councils. As the Social Democrats and the Jaszi Radicals were also agitating against the influence of the Church, so dominant in Hungary, and in favour of non-religious ethics, the reaction developed on nationalist and religious principles. The Szekler soldiers, who had been driven from Transylvania by the Rumanians, the league of "awakening Hungarians," and the officers' associations greatly stimulated the resentment felt against the pacifist and Radical-Socialist Administration. This resentment assumed an anti-Semitic character hitherto unknown in Hungary, the reason being that the leaders of the Social Democrats and Bourgeois-Radicals were, almost without exception, of Jewish origin. This was also the case with the most prominent members of the Government of the Republic—Oskar Jaszi; Siegmund Kunfi, the Minister of Education (b. 1889); William Boehm, the Minister of War; and Joseph Pogany (b. 1886), the president of the Soldiers' Council. These were the men who had made it impossible to resist the invasion of Hungary by force of arms.

The Government attempted to win over the peasants by a radical scheme of land reform, a People's Law (18 of the year 1919) decreeing the breaking-up and distribution of all estates of 500 *Joch* (about 900 acres) and over; but this law was never carried out. The anti-national programme of the Social Democrats, who were alone effectively organized, caused divisions in both the other Government groups.

The Communists under Béla Kun.—The Social Democratic party, which alone was organized, by its anti-nationalist demands caused divisions in both the other Government parties. A portion of the Karolyi Independence party went over to the Opposition, and the Jaszi Radicals abandoned, as useless, all attempt at participation in the approaching elections to the National Assembly, which was to be summoned in order to decide all questions definitely. In the vehement election campaign the Social Democrats fought, on one side against the Nationalist bourgeois or peasants, and, on the other side, against the new Communist party. This latter was founded on Nov. 24 1918 by some returned prisoners-of-war from Russia, among whom the most conspicuous was Béla Kun, who had been trained at Moscow in the schools for Bolshevist propaganda and had returned to Hungary to prepare the Communist revolution. Between Jan. and March 1919 the Communists succeeded in stirring up several riots and insurrections among disabled and discharged soldiers and among the unemployed. Their efforts were directed against the Social Democrats, and especially against the minister Kunfi and the trade-union leader Jacob Weltner; and when on Feb. 20 Béla Kun with his Communists stormed the Social Democratic publication office, he was arrested and roughly treated by the police. Since, however, a counter-revolution on national lines was gaining strength in the country, and, on the other hand, the workmen's and soldiers' councils were becoming daily more radical under the influence of the Communist agitation, the leaders of the Social Democrats decided to seek escape from this situation by a fusion of the two Labour parties and the proclamation of the "dictatorship of the proletariat" on the Bolshevist model. In accordance with the compact signed (March 4 1919) by the Socialist minister Kunfi and the Communist leader Béla Kun in the latter's prison, both groups united to form the Hungarian Socialist party, abandoned democratic principles, and took over the government of the country in alliance with Soviet Russia. The People's Government resigned, and President Karolyi surrendered his powers to the new Hungarian Soviet Government.

Period of Soviet Government.—According to the Constitutional Law (Soviet Ordinance No. XXVI.), which was borrowed from Russian Bolshevism, the object of Soviet dominion in Hungary was "the destruction of capitalistic production and society and the creation of social (communistic) production and society by securing the dominion of the workers over the exploiters by means of the dictatorship of the proletariat." The dictatorship, according to this regulation, was to be exercised through the workmen's, soldiers' and peasants' councils (soviets). Only "workers" were allowed to vote for the local soviets; traders, the clergy, monks and nuns, and all who lived on rents or the interest on investments were disfranchised. Deputies from the local soviets constituted the central soviet, which was to choose the People's Commissaries, in whom all actual power was vested. The 16 People's Commissaries to whom Karolyi had transferred his powers on March 21 were subsequently confirmed in their authority by the central soviet. A stonemason named Alexander Garbai (b. 1879) became President of the Republic, but the actual ruler was Béla Kun, "People's Commissary" for foreign affairs, who was in direct contact with Lenin in Russia. As candidates for the local soviets had to be chosen from the official list, power was permanently secured to the People's Commissaries. The old administrative system was in principle abolished. At the head of the more important offices were placed "political commissaries," appointed by the People's Commissaries and armed with dictatorial power. The officers of the law were removed from their posts and the courts done away with; the new "revolutionary tribunals" were composed entirely of workmen. Workmen also supervised education.

In making the compact with Béla Kun the Social Democrats had, indeed, abandoned democratic principles, but they failed to understand the methods of the new dictatorship and to the last their attitude towards it was purely passive. The only active agents of the dictatorship were the true Communists who in the whole country numbered only some 15,000, mostly unemployed, and Budapest soldiers won over by Béla Kun with money and promises. In order to maintain its power this minority had to imitate the methods of Bolshevist Russia by a system of terror and propaganda in the towns and countryside in the interests of the dictatorship. Terror was proclaimed as an instrument of government in the official declarations and proclamations of the Communists. It took the form of the enlistment of a Communist army, of the quartering of Communists on middle-class families, of the arrest of "hostages" (in Budapest only)—some 400-odd distinguished citizens, politicians and writers, of whom some were bestially murdered—and, finally, of the organization of special "terror troops" whose function was to terrorize the people. The "terror troop" known as "Lenin's ruffians," which acted as guard to the strongly fortified house in which the People's Commissaries lived and worked, arrested, tortured and executed people on their own authority. For the provinces a special terror troop was created, under the leadership of the People's Commissary Tibor Szamuelly, which was empowered to inflict the death penalty without any formalities whatever.

In the interests of the propaganda an attempt was made to suppress all expressions of national and religious life, and to spread the Communist conception of the world which had been imported from Russia by means of posters, pamphlets, brochures, processions, meetings and education. With the exception of three official Communist journals, all newspapers were suppressed, and the writers were placed in a Government office where they could only work under State supervision and censorship. The right of public meeting was abolished, except for Communistic objects. A propaganda abroad was instituted in order to spread Bolshevism in the countries bordering on Hungary; schools of propaganda for the training of agitators were established, and an "international red army" consisting of Russian and Italian prisoners-of-war was created. The principal object of all this was the erection of Soviet Government in Austria. For this purpose the Communist party in Vienna was provided with money; and when a demonstration organized by this party with a view to the proclamation of the Soviet régime resulted in nothing but futile bloodshed, Béla Kun deposed the leader of the party and replaced him by a Hungarian Communist. On this particular work of propaganda the diplomatic mission of Soviet Hungary in Vienna spent 60,000,000 kronen.

The schools served the Soviet Government chiefly by way of propaganda; and with this in view all religion and authority were excluded. In the middle schools the pupils themselves elected Pupils' Councils whose function was to control the activities of the teachers. All mention of the nation or of religion in the lessons was forbidden, and, instead of the national heroes, Marx, Engels and Lenin were glorified, together with Spartacus and Catiline, their forerunners in the task of liberating the working-classes. It was sought to spread the doctrines of historical materialism; the university was reorganized and deprived of its autonomy, and, as the highest educational establishment, an "Institute for Research into Historical Materialism" was founded. In boys' and girls' schools the pupils received enlightening instruction in the processes of generation, birth, etc., with disastrous results to juvenile morality.

A complete revolution was brought about in the economic organization of the country. Certain occupations were entirely prohibited, such as judges and lawyers generally, bank officials, trade employees, workers in gold, confectioners, cooks, hotel employees, paper-hangers, sign-writers, hatters, bookbinders and barbers. All private property was declared to be the property of the State; business houses were closed and their wares sold by official agents for the benefit of the State. The most valuable furniture, carpets, pianos, pictures and libraries were collected from private houses and taken to Government stores. Trade became a State monopoly. Manufactories were taken over by councils of workmen connected with the particular industry; manufacturers, engineers and officials were placed under the orders of these councils, or driven away. The distribution of raw materials to the factories was managed by a Government office. Industries declined through want of capital, and the diminution of output owing to payment by time was so great that presently the workmen themselves were anxious to return to the piece-work system. Cost prices advanced by leaps and bounds. In March 1919 the cost price of cast iron was 50·80 kr. per 100 kgm.; in April 2,700 kronen. The output of the Salgo-Tarján mines fell by more than 50% under the Soviets. The small manufacturers and homeworkers, who were regarded as exploiters, were refused raw material and their businesses were closed. In the agricultural districts, all landed property was taken over by the State, the large estates were placed under the management of workmen, but the Government allowed the peasants to retain holdings up to 100 *Joch* (about 180 acres) as private property.

Counter-Revolutionary Movements.—A few weeks only had passed under this régime before the Soviet Government had to fight for its life both at home and in its relations with foreign Powers. Nobody but the small Communist minority was satisfied with its decrees. It found opponents alike in the trades unions, which the Communists wished to destroy because of their democratic past; the terrorized middle classes, traders and industrialists, who were without bread to eat; and the clergy, who were persecuted by the Soviets which attacked Christianity and the Church after the Russian model and were only prevented from closing all places of worship by the wrath of the people. In the schools and among the country folk the commissaries preached atheism, free love and the advantages of communal kitchens. In consequence of the industrial crisis, the Soviets were unable to supply the peasants with any implements, while the Soviet currency, which in violation of the charter of the State Bank was turned out by the printing press in immense quantities, was now worthless. The peasants therefore refused to supply any produce, and the towns, and especially Budapest, suffered from want of food. Isolated uprisings of the peasantry were bloodily suppressed by Szamuelly's "terror troops." Since most of the ruling politicians and People's Commissaries (Béla Kun, Szamuelly, Commandants Pogany and Böhm, and Finance Commissary Eugene Varga) belonged to the younger generation of Jews, anti-Communist feeling in the country assumed more and more the character of anti-Semitism. In May 1919, the politicians, officers and officials who had fled from the terror to the districts in Rumanian occupation formed a counter-revolutionary Government under Count Julius Karolyi (b. May 7 1871), which, establishing itself at Szeged, proceeded, under the direction of the former Vice-Adml. Nicholas Horthy, to recruit and organize a "National army" against the Communists.

Downfall of the Soviet Government.—The Soviet Government viewed Hungary as Lenin's outpost, which was to be held until Communism had been victorious in the neighbouring countries also. Béla Kun, therefore, attempted to open negotiations for peace with the Allies and was prepared to abandon Hungary's territorial claims if thereby he could secure the continuance of Soviet rule and gain greater opportunities for propaganda. On the other hand, the Soviet Government created a "Red army" "for the liberation of the Proletariat." As Béla Kun failed to come to an agreement with Gen. Smuts, the delegate of the Supreme Council in Paris, Rumanian troops on April 10 1919 took the offensive against Soviet Hungary, defeated the Red army and occupied the line of the Theiss. After this disaster, the Soviet Government reorganized the Red army. The system of soldiers' councils and civil commissaries with the army was abolished; and the authority of professional officers and discipline were restored; the use of national emblems was permitted and appeals to patriotism were used in order to excite the soldiers against the invading enemy. The Serbs and Rumanians having refused a fresh offer made to them by Béla Kun, the latter determined to anticipate their now inevitable offensive by ordering an attack on the Czechs. The soldiers, fired by patriotic enthusiasm, defeated the Czechs and occupied the greater part of northern Hungary. But when, on the categorical demand of Clemenceau (June 8), Béla Kun gave back the reconquered territories to the Czechs, in the hope thereby of saving the Soviet Government, the *moral* of the troops was completely broken. The growth of national anti-revolutionary feeling and the boycotting of the capital by the peasantry, which led to starvation among the workmen, drove the Soviet Government to make a last desperate attack on the Rumanians in order to secure the harvest of the Theiss district.

But the Red troops scattered at the first attack; the Rumanians crossed the Theiss, and advanced on Budapest without meeting any resistance. The Soviet Government resigned on Aug. 1. Its Communist members, including Béla Kun, went to Vienna, where they were allowed the right of asylum by the Austrian Government. Later, some of them left for Russia. Szamuelly, the leader of the "terror troops," shot himself during his flight.

Hungary after Bolshevism, 1919.—In view of the Communist breakdown, the Socialist organizations now reasserted the principles of democracy, severed their connexion with the Communists, and, under the presidency of Julius Peidl, formed a purely Social-Democratic Ministry. But the influence of the Social Democrats had been so weakened by their coöperation with the Bolshevists that the new Ministry could only survive for five days. On Aug. 6 a group of citizens and officers demanded its resignation, and it obeyed.

The representatives of the Entente in Budapest put the government of the country into the hands of the popular Archduke Joseph, who formed a Ministry of members of the counter-revolutionary middle class, under the premiership of Stephen Friedrich (b. July 1 1883).

The Rumanian Occupation.—After the disbandment of the Red army Rumanian troops occupied Budapest and the whole of what remained of Hungary, with the exception of the western border counties, in spite of the prohibition of the Entente representative in Budapest. As a result, political activity in the country was crippled, and the reëstablishment of order after the Bolshevik experiment retarded. The Rumanians were several times ordered to evacuate the country by Clemenceau, in the name of the Supreme Council, but they declared that they wished first to take revenge on Hungary for the plundering of Rumania by the German troops during the war. They took grain, fodder, cattle, 1,151 locomotives, 40,950 railway carriages, all the post-office motor-cars from Budapest, 4,000 telephone installations from the Budapest central exchange, the telephones and typewriting machines from the Government offices and schools, beds and bed linen from hotels and prisons, and scientific apparatus from the schools. Machinery was removed from factories; the iron beams of the Cyör cannon works were torn from the walls and carried off—the journey to Rumania in open trucks entirely destroyed them. It was only as the result of an ultimatum from the Supreme Council that the Rumanians at last withdrew from Budapest (Nov. 11) and from the line of the Theiss (Feb. 1920).

New Governments, 1920.—After the fall of Bolshevist rule and the Rumanian occupation, Hungary was only able slowly to regain order in her internal affairs. The neighbouring countries hostile to the Habsburgs (Czechs, Yugoslavs, Rumanians) would not tolerate the regency of the Archduke Joseph. By an order of the Entente, accordingly, the Archduke, together with the prime minister whom he had appointed, resigned office, and the political parties appointed the Christian Socialist Karl Huzzár (b. Sept. 10 1882) president, pending the meeting of the National Assembly. Order was maintained during the Rumanian occupation by a civil police force, and, after the Rumanian withdrawal, by the national army under Horthy. The effects of the Bolshevist dictatorship had now produced a strong reaction. During the dictatorship, the extermination of the *bourgeoisie* and the shooting of whole villages of peasants had been spoken of at meetings and in the official press as normal Government measures, the result being that both citizens and peasants only slowly became again accustomed to a system based on orderly justice. During the masterless days after the fall of Bolshevism, there were in the country districts many cases of lynch law exercised upon the Communists. The successive Governments of Huzzár, Simonyi-Semadam (b. March 28 1864), Count Paul Teleki (b. Nov. 11 1879, formerly professor of geography), which held office from June 19 1920 to April 15 1921, took great pains to restore the authority of the law, and in order to restrain unlawful acts of vengeance they several times proclaimed martial law, and broke up by force of arms certain civil and military organizations.

The relations of the political parties were quite changed as a result of Bolshevism. In the place of former parties, differentiated by their ideas of the State, new ones sprang up which, in opposition to the anti-national and anti-religious tendencies of Bolshevism, formulated a National-Christian programme intended to make impossible any repetition of the Communist times. At the elections in Jan. 1920, which for the first time in Hungary were conducted on the basis of universal and secret suffrage, with the exception of six Democrats, only members of the *Bourgeois* Christian Nationalist and Peasant Farmers' parties were elected to the National Assembly. Socialist ideas had forfeited all sympathy among the rural population and the citizens of the towns on account of their association with Bolshevism. The trades unions found their political activities obstructed; whereupon, on June 20 1920, the International Federation of Trades Unions at Amsterdam declared a boycott of Hungary. Hungary replied with a boycott of Austria, where the Labour men of the Socialist Left were vigorously applying to Hungary the boycott ordered by the international conference, and cut off Austria's food and coal supplies. The result was that the original boycott was withdrawn, although no advantages had been secured by the Hungarian Socialists. One consequence of the Bolshevist rule was the still more intense development of anti-Semitic feeling. Since leaders of the Communists were chiefly recruited among the younger Jewish intellectual circles, the National Assembly, in order to prevent the creation of a Jewish intellectual proletariat, in Sept. 1920 proclaimed the "Numerus Clausus" for the universities. Under this clause, Jews could only be admitted to the universities in proportion to their percentage of the population. By the desire of the Small Farmers' party, a bill was passed, on the lines of the English Small Holdings Act, making it possible for every agricultural labourer to acquire a holding up to 10 *Joch*.

As a consequence of the annexation of parts of the old Hungary by the new states, what remained of the country was filled with fugitives, mostly officials, teachers, etc., who had been driven out by Czechs, Rumanians and southern Slavs. All economic and cultural intercourse between the rump of Hungary and the territories now occupied by the new states continued to be interrupted even after the collapse of Bolshevism.

Huzzár's Government was, on Dec. 2 1919, invited to the Peace Conference in Paris by the Entente. The Hungarian delegation, headed by Count Albert Apponyi, was forced to sign the Treaty of Trianon (June 4 1920), without being given any opportunity of discussing the conditions imposed by the Entente, under which more than two-thirds of the old Hungary was divided among the neighbouring states.

Adml. Horthy as "Regent."—After experience of the Karolyi and the Soviet republics, the traditional monarchist feeling became evident in Hungary; but as the neighbouring states, members of the "Little Entente," Czechoslovakia, Yugoslavia and Rumania, and also Italy, saw in the occupation of the throne of Hungary by a member of the House of Habsburg a danger to themselves, and threatened to treat such an event as a *casus belli*, the National Assembly postponed all decision as to the form of the State, leaving the question of the sovereign undecided, and on March 1 1920 entrusted the commander-in-chief, Adml. Horthy, with supreme power as regent.

The recovery of the State from the effects of Bolshevist rule proceeded slowly. At Easter 1920 the Finance Minister of the Teleki Government, Roland Hegedüs (b. June 24 1872), established the machinery for the paper currency. The national revenue had been made in March 1921 to balance expenditure; and the Foreign Minister, Gustav Gratz (b. 1875), began to negotiate for resumption of economic relations with the new States built out of the ruins of the Habsburg Monarchy.

When at Easter 1921 King Charles, without awaiting the decision of the National Assembly as to the exercise of the royal power, suddenly appeared in Hungary and wished to take over the powers of the regent, the latter refused to hand them over, since to have done so would have been contrary to the law under which he held the regency. The King was forced, therefore, again to leave the country, amid the loud protests of the "Little Entente" against his enterprise. His subsequent attempt, in Oct. 1921, at a *coup d'état* was even more disastrous to him; and he was then interned at Madeira under Allied surveillance. The Teleki Government was replaced on April 15 1921 by the Christian-National-Agrarian Ministry of Count Stephen Bethlen.

See Memoirs of Count J. Andrássy (*Diplomacy and World War*, Hung. and Germ., 1920); Prince Ludwig Windischgrätz, *Vom roten zum schwarzen Prinzen* (1920); Oskar Jászi, *Magyar Kálvária, Magyar Feltámadás* (1920); *The Ordinances of the Soviet Republic* (Hung., 5 vols., 1919). On the Soviet period there are several journalistic works, as well as the publications of certain People's Commissaries, issued after the fall of the Soviet régime, as apologies and for purposes of further propaganda, of which may be mentioned Eugen Varga, *Die wirtschaftspolitischen Probleme der proletarischen Diktatur* (1920); Béla Szántó, *A Magyarországi proletariatus osztályharcza és diktaturája* (1920); and *Dokumente der Einheit, die Vorgeschichte des Zusammenschlusses der Social-Demokraten und Kommunisten* (1919); Alexander Szana, *Die bolschevistische Wirtschaftspolitik in Ungarn*.

Reports by workmen on the economic conditions will be found in the Social-Democratic weekly, *Világosság* (Vienna, 1920). A comprehensive account based on documentary evidence is given in *A bolsevizmus Magyarországon* (*Bolshevism in Hungary*) edited by Gustav Gratz (1921). (J. S.*)

HUNGARIAN LITERATURE

In 1908 a parting of the ways between the younger and the older generations in Hungarian letters was definitely marked when some of the younger poets published the new songs of the new time in two volumes under the title *The Coming Day*, and founded the periodical *West* which, enlarging itself by the adoption of a political programme, was made their organ of progress. The most complete expression of the new revolutionary spirit found itself in lyrical poetry, which attained its full maturity in the poems of Andreas Ady (1877–1919).

Ady's lyrics display a Hungarian language rooted in the remote past and awaken the old tones of the peasant-crusader (*curuczok*) poetry of the 16th century and of the Protestant Bible, but transfused with a new idiom personal to himself. His language is submerged in the twilight depths of the soul, battles against the narrowness of middle-class morality, and revels in sensual love. His outlook on life attracted him towards the Socialist and Pacifist schools of thought, and he thus became the representative of those Social-Democratic phrase-mongers who, in the autumn of 1918, led Hungary along the path of destruction. His poems were published in 9 vols.:—*New Poems, Blood and Gold, By the Chariot of Elijah, Ye Must Love Me, Elusive Life, Self-love, Who Saw Me, From the Poems of Primeval Secrets, At the Head of the Dead.* Ady's novels display a naturalism subjectively experienced, as in *Thus May It Also Happen, Pale People, The Cleopatra with Ten Millions, On a New Path.* He also published polemical works in favour of his political views. An appreciation of him was written by John Horváth in *Ády and the Newest Hungarian Lyrical Poetry.*

Beside Ady the most important of the writers connected with the periodical *West* was Michael Babits, whose poems express with great perfection of form and moving effect the self-destructive suffering of civilized man in the 20th century. He wrote *Leaves from the Wreath of Iris*, and *The Valley of Unrest.* Desider Kosztolanyi (b. 1885) interpreted the romance and melancholy of Budapest in *The Laments of the Poor Child*, and *Poppy*. Among others may be mentioned Arpad Toth (b. 1886), Gabriel Olah, Ernö Szep, Julius Juhasz, Béla Halasz, and Renée Erdös—the last-named a lady whose muse, pagan and erotic at first, was converted later into Catholic and penitent. At the beginning of the World War an enthusiastic welcome was given to the patriotic poems of Geiza Gyoni (d. 1917), which were written at the front and sent home from Siberia. These poems, modern in style, were published under the titles *On Polish Fields*, and *Letters from the Hill of Calvary*. To the radical school of thought belonged also Joseph Kiss (b. 1843), who, following the tradition of Arany, wrote pacifist war-songs and several beautiful ballads, his lyrics having an oriental charm. The new poetry had many champions among critics and essayists, notably Aladár Schöpflin and Ludwig von Harvany.

In prose fiction and the drama modernism was less strongly marked, though the new philosophy of life differed from that of the earlier generation. The most important novelist of this period was Siegmund Móricz (b. 1879), who wrote *Gold in the Muck, Behind the Devil, The Torch.* Margaret Kaffka (1880–1918) gives in her novels, *e.g. Maria's Apprenticeship* and *Colours and Years*, sketches of contemporary politics. Francis Molnár (b. 1878) describes in his novel *Andor* the wasted life of a decadent young man. Mention may also be made of Michael Suranyi's novels, *The Peacock from Trianon* and *The Holy Mountain*.

On the Hungarian stage modern ideas and traditional convention were in sharp competition. To the latter belong *The Nurse* and *The School-mistress* of Alexander Bródy (b. 1863), together with his war drama, *Lyon Lea*, centring round the life of the Galician Jews. Desider Szomory wrote tragedies on themes taken from the history of the House of Habsburg, *Maria Theresa* and *Joseph II.*, and in *Bella, Hermelin* and *Matuska* he dramatized the sexual life of the modern woman. Francis Molnár, the novelist already mentioned, became a popular and successful writer of drawing-room drama, with a great mastery of stage routine and technique. His best-known plays are *The Guards Officer, The Devil, The Wolf, The Carnival, The Swan* and *Liliom*, a picture of apache life. Among his successful rivals in the same genre are Melchior Lengyel, with his *The Prophet* and *Typhoon*, and Louis Brió, author of *The Tsaritsa*. Among the younger of the dramatists is G. Drégely, author of *The Well-fitting Dress Suit*.

As representatives of the older generation of conservative poets may be mentioned Joseph Levay (1825–1918), Alexander Endrödy (1850–1920), Andrew Kozma (b. 1861), author of *Hungarian Sym-*

phonies. Koloman Mikszáth, the greatest Hungarian novelist after Jókai, died in 1910; his *The Black City* did not appear until 1911, and his *Posthumous Works* were issued subsequently. Among the effective romance writers of the old school was Francis Herczeg (b. 1863), who wrote numerous novels, and also appeared as a playwright in *Blue Fox* and *The Black Horseman.* Noteworthy also was Geiza Gardonyi (b. 1863), who draws his homely themes from the life of the villages and small towns, but who also seeks inspiration in Hungarian heroic legend and in the faith of mediaeval cloisters. Gardonyi is one of the most sympathetic of contemporary Hungarian writers; as in his tales *The Longhaired Peril* and *'Tis Far Till Then* (1913); Stephen Tömörkény wrote genre word-pictures, such as *People in the Service of the Country* (1916); as also did the novelist Cäcilie Tormay (b. 1876), *e.g. The Old House.* In light literature Julius Pekar did some good work, and also as a political writer in support of national ideals. Noteworthy also are the popular writers Koloman Catho and Alfred von Drasche-Lazar.

The conservative literary school was supported by a host of competent critics. Eugen Rakosi (b. 1842) opposed the modern literature of decadence with all the force of his burning enthusiasm, as in his *For the Hungarian Idea.* Zoltán Ambrus (b. 1861) was an esteemed dramatic critic. G. Vojnovich (b. 1877), E. Császár (b. 1878) and L. Kéky were also critics of conservative tendencies.

After the revolution of Oct. 30 1918, the political current brought to the surface a mass of pacifist, defeatist and cosmopolitan literature. Under the presidency of Ady and Siegmund Móricz, the progressives founded their own Academy which they named after the national romantic poet, Vörösmarty. With the end of the World War signs of futurism and expressionism had already appeared. The new writers of the social world-revolution rejected all poetical form. Their ideals were cosmic universalism and the collective solidarity of international mankind. But only one of them possessed any real merit—the iron-worker Louis Kaszak, who had developed from naturalism into the poet of the proletariat in his *Book of new Poets.* The periodical *To-day* became the semi-official organ of Communist literature. It must be added that Communism in Hungary, as in Russia, suppressed the free publication of books and appointed the People's Commissariat as sole publisher with the unrestricted right of censorship. The book market was now flooded with works of Communist propaganda. The theatres, turned into State institutions, were forced to perform plays with a Communist moral. No composition of any permanent value was produced by the Commune. After its fall Desider Szabo took the lead of the new literary movement. In his poems he laments in vigorous language the Szeklers of Transylvania, now separated from their mother country, as in his *The Village Torn Away* (1919). In addition to Szabo, a poet writing under the pseudonym of "Vegvari" protested in the poem *Help!* against the dismemberment of Hungary.

Journalism, finally, has developed greatly in Hungary since the 'seventies and, since it employs a number of literary men, deserves mention here. Numerous periodicals are in the habit of publishing feuilletons, short stories and serial novels.

History.—The centre of Hungarian historical research, as of the other sciences, is the Hungarian Academy of Science, of which Albert von Berzeviczy (b. 1853) was president in 1921. Robbed of its revenues under the Bolshevik régime, vigorous efforts were made to reëstablish it after the restoration of order.

In historical writing and research great activity has been displayed in Hungary since 1910. Vol. xii. of Arpad Karolyi's *Acts of the Hungarian Parliament* contains fresh material of great importance for the study of the religious wars of the 16th century in Hungary. Desider Czánki published a further instalment of his *Historical Geography of Hungary during the period of the Hunyadi;* Lukinich his *Transylvania's territorial transformations;* and Julius Nagy *Codex diplomaticus Andagevienslis;* Samuel Gergely, *Codex Comitum Teleki;* Francis Döry, *Codex Comitum Zichy.* Other works of original research are:—William Fraknoi (b. 1843), *Critical Studies relating to the History of the Triple Alliance,* and *The place of Hungary in the World War;* Árpád Karolyi, *The Döbling literary remains of Count Stephen Széchenyi;* Eduard von Wertheimer (b. 1848), *Count Julius Andrássy, his life and times* and *Friedenskongresse und Friedensschlüsse;* Viktor Concha (b. 1846), *The Friendship of Baron Eötvös and Montalambert;* Heinrich Marczali (b. 1856), *Ungarische Verfassungsgeschichte;* Julius Szekfü (b. 1883), *The Hungarian State,* and *Three Generations, the History of a declining Age;* Balint Homan, *The financial History of Hungary from 1000–1325;* Ladislaus von Szabó, *History of the countly family of Széchenyi;* Baron Gabriel Szalay, *Letters of Ladislaus von Szalay;* Stephen Cserey, *The Law of Succession to the Hungarian throne;* Alexander Domanowszky (b. 1877), *The Succession to the throne in the time of the Arpads.*

Philosophy.—In the domain of philosophy Karl Böhm (d. 1911) was very productive. After his death appeared (1912) the 4th volume of his principal work *Man and his World,* in which he sought further to develop the subjective idealism of Fichte. Bernhard Alexander (b. 1850) published *Essays in the field of Modern Philosophy;* Julius Kornis (b. 1885), *Causality and the reign of law in Philosophy;* Eugen Posch, *The Phenomena of our Soul and their Nature;* Cecil Bognár, *Causality and the reign of Law in Physics;* Akusius Pauler (b. 1876) published *An Introduction to Philosophy,* which reached a 2nd edition as early as 1921.

Jurisprudence.—Among writers on scientific jurisprudence the following deserve special mention: Alexander Plosz (b. 1846), *Law of civil procedure;* Alexander Raffay, *Hungarian Private Law;* Joseph Illes (b. 1871), *Introduction to the history of Hungarian Law;* Gustav Szászy-Schwarz, *New Directions in Private Law;* Ernst Wittmann, *Methods of peaceful settlement of international disputes* and *Past and present of the right of the self-determination of nationalities;* Géza Magyary (b. 1864), *Civil procedure* and *Procedure in International Arbitration;* Paul Angyal (b. 1873), *Hungarian criminal procedure;* Julius Dertö, *The principle of objective damages for injury;* John Karacsonyi (b. 1858), *The territorial historical law of the Hungarian Nation;* Stephen Ereky, *Studies in historical Jurisprudence and in administration;* Felix Somló (d. 1920), *The foundations of Jurisprudence,* one of the most important works, which defines in a new way the ideas of law and of the State; Francis Finkey (b. 1870), *Manual of Hungarian criminal law procedure;* Wolfgang Heller, *Principles of Political Economy* (1920).

(B. Z.)

HUNTER, SIR ROBERT (1844–1913), English lawyer and philanthropist, was born Oct. 27 1844. Educated at the university of London, he qualified as a solicitor in 1867, and in 1882 became solicitor to the General Post Office. He devoted much of his time and energy to safeguarding the rights of the public in regard to open spaces and the preservation of rights of way, and was one of the principal promoters of the Commons Preservation Society founded in 1865. In 1868 he became its hon. solicitor, and successfully conducted suits for preserving Wimbledon and Wandsworth Commons and recovering a portion, wrongfully enclosed, of Epping Forest. Ashdown Forest, Hampstead Heath, Hindhead and the New Forest were also safeguarded by him. He was made K.C.B. in 1911, and died at Haslemere Nov. 6 1913, after a strenuous life of public service.

HUSEIN IBN 'ALI (1856–), Emir or Sherif of Mecca and first King of the Hejaz, came of the 'Abadila clan of the Ashraf (*see* 2.262) and was grandson of the first 'Abadila Emir, who died in 1858. He was born at Constantinople, but at the age of eight was taken to Mecca, where he followed a course of Moslem studies. He began his official career by assisting successive Sherifs, 'Abdulla and Husein (his uncles), in administration; but on the death of the latter in 1884 he acted in opposition to the succeeding Sherif 'Aun er Rafiq—a favourite of 'Abdul Hamid and Emir from 1882 to 1905—and was eventually (1895) sent to Constantinople. He became a member of the Imperial Ottoman Council. On the death of Sherif 'Ali, successor of 'Aun, Husein's uncle, 'Abdulla, was nominated to the Sherifate by the Porte, but he died on his way to Mecca and Husein was appointed in 1908 in his place. He at first showed a semblance of zeal on behalf of the suzerain Turks, but in reality desired the emancipation of the emirate of Mecca. He openly pursued an anti-Turkish policy from about 1913, and by 1916, seconded by able sons, had become the *de facto* power in the Hejaz, with wide influence outside. In June 1916, after the success of the Arab revolt against the Turks under his leadership, he assumed the title of "Sultan of Arabia," but later in the year, with the approval of the Allies, he was proclaimed "King of the Hejaz," a title indicating more accurately the extent of his territorial rule. In Aug. 1916 he issued a proclamation to the Moslem world justifying his claim to independence. King Husein showed considerable zeal for administrative reform in the Hejaz, notably in the public works, health, postal and telegraphic, and customs departments. He was present at a banquet which he gave to the representatives of the foreign Powers at Jidda, Feb. 1919, to celebrate the victorious conclusion of the war, and in other ways showed himself not averse to intercourse with non-Moslem Europeans. His four sons were the Emirs 'Ali, 'Abdulla, Faisal and Zeid (*see* ARABIA).

HUTCHINSON, SIR JONATHAN (1828–1913), English surgeon (*see* 14.13), died at Haslemere June 23 1913.

HUTIER, OSKAR VON (1857–), Prussian general, was born Aug. 27 1857 at Erfurt. In command of the 1st Div. of the Prussian Guards he played a prominent part in the battles which attended the German advance in Aug. 1914. In 1915 he was placed in command of the XXI. Army Corps, and in Jan. 1917 of the Army Group (*Armeeabteilung*) D. On April 27 he took over the command of the VIII. Army with part of which he occupied Riga. In Dec. 1917 he was transferred to the command of the XVIII. Army on the western front, and in the following March bore a highly important part in the attack on the British positions between Cambrai and St. Quentin, in which his army formed the left flank of the German advance.

HUTTON, ARTHUR WOLLASTON (1848–1912), English divine and author, was born at Spridlington, Lincs., Sept. 5 1848. A scholar of Exeter College, Oxford, he took orders in the Church of England in 1872, but under Newman's influence became a Roman Catholic, and from 1876–83 was a member of the Edgbaston Oratorian community. He changed his views, however, renounced Roman Catholicism, and became known as an agnostic and free-thinker. For some years he was librarian at the National Liberal Club in London, but in 1898 he was readmitted to the English Church, and from 1903 to his death he was rector of Bow Church, London. His absolute sincerity and great intellectual ability were recognized by all. He was the author of a *Life of Manning* (1892). He died at Blackheath March 25 1912.

HYDE, DOUGLAS (1860–), Irish scholar and writer, known in Ireland as the *Craoibhín Aoibhinn* (*i.e.* "delightful little branch," an allegorical name for Ireland, in folk-song), was born in 1860, the youngest son of the Rev. Arthur Hyde, of Frenchpark, co. Roscommon, and nearest living representative of the Castle Hyde family of co. Cork. He was educated at Trinity College, Dublin, where he won the highest honours, and afterwards spent a year in Canada in the State University of New Brunswick. Coming back to Ireland he helped to found in 1893 the Gaelic League or *Connradh na Gaedhilge*, and became its first president, a position to which he was annually reëlected until 1915, when he resigned. He was also first president of the National Literary Society, a post which he resigned on the foundation of the Gaelic League. As president of the elder society he had already in 1892 foreshadowed the ideals of the League in a lecture entitled "The necessity for de-anglicizing the Irish nation," not, he explained "as a protest against imitating what is best in the English people, for that would be absurd, but rather to show the folly of neglecting what is Irish, and hastening to adopt, pell-mell and indiscriminately, everything that is English, simply because it *is* English." For some years Dr. Hyde's work for "Irish Ireland" made little progress; but in 1899 an attack upon the Irish language, before a Vice-regal Committee to inquire into intermediate education, gave him his chance. He produced letters which he had procured from all the leading Celtic scholars in Europe as to the value of the language and literature, and the publication of these letters and his own evidence saved the language on the Intermediate Board, and attracted a great deal of attention throughout Ireland. Towards the beginning of the century the first *Oireachtas* was held in Dublin; it was the equivalent of the Welsh Eisteddfod, and became an annual event, and from this time forward the movement (which had now added to its aims a new clause—the support of Irish industries) began to go forward of its own momentum. In 1905 Dr. Hyde set out on a tour through America to collect money for the League, and returned after seven months with £11,000. On his return he was presented with the freedom of Dublin, Cork, and other cities. He was also appointed on a Royal Commission to inquire into Irish university education, including Trinity College, an institution which had been excluded from the purview of former commissions. The result of this commission was the foundation of the National University of Ireland, with three colleges (Dublin, Cork and Galway), and the Queen's University, Belfast. It was probably owing to Dr. Hyde's influence with his fellow commissioners that Trinity College, following their recommendations, established a moderatorship and gold medal in Celtic studies. He himself became professor of modern Irish in University College, Dublin.

Dr. Hyde was the first to collect the *Love Songs of Connacht*, which he published in 1894, and which he translated into verse and also into the sort of English prose afterwards adopted by Lady Gregory and by Synge. He was also the first to collect Irish folk-lore in the original; and his many volumes, some in Irish and some with English or French translations, will always be of value to the folklorist. He was also almost the first to turn to short plays in Irish as a method of popularizing the language. The first of these, *The Twisting of the Rope*, was produced in the Gaiety theatre, Dublin, in 1901, the author himself acting the principal rôle. His *Literary History of Ireland* (1899) had gone through seven impressions by 1921.

HYDERABAD, SIR MIR OSMAN ALI KHAN, 7TH NIZAM OF (1886–), was born April 6 1886 and succeeded his father, Sir Mir Mahbub Ali Khan, on his death on Aug. 29 1911. His education had been under an English tutor, Sir Brian Egerton, and a nobleman of the state, of scholarly attainments, Imad ul Mulk (Saiyid Husain Bilgrami). Soon after accession he abandoned the traditional system of governing through a Diwan, and for five years was his own prime minister. In 1919 he constituted an executive council, with Sir Ali Ima, a former law member of the Government of India, as president, and with eight other members, each in charge of one or more departments. This was the beginning of various constitutional reforms, including the transformation of the nominated legislature into a mainly elective body. The great services of India's premier prince in the World War maintained the fine traditions of his predecessors as the faithful allies of Britain. When Turkey joined the Central Powers the Nizam issued a proclamation enjoining on his subjects, and impressing on his Moslem co-religionists throughout India, the duty of firm and steadfast devotion to the British cause. When the Khalifat agitation respecting the peace terms with Turkey arose among the Mahommedans he prohibited anti-British propaganda in his dominions. The large body of imperial service troops maintained by the Nizam was employed at full strength throughout the war in the Eastern theatres, and he actively coöperated in recruiting work. In addition to many gifts of money, the Nizam spontaneously bore the cost of the maintenance in the field of a cavalry regiment, 20th Deccan Horse, of which he was hon. colonel, at a cost of Rs.153 lakhs. The war expenses of the State amounted to over three-fifths of the annual income. His Highness, already a G.C.S.I., was awarded the G.B.E., was promoted to hon. lieutenant-general in the British army, and in 1918 King George V. conferred upon him the new and special title of Exalted Highness. Two features of his progressive rule must be selected for mention. To obviate possibility of repetition of the devastating floods which in 1908 caused great loss of life and property in the city of Hyderabad, and to provide adequate water supply, a great dam enclosing a lake was built across the river Musi; many fine new public buildings were erected, and the amenities of the city greatly improved. The establishment there of the Osmania University represented the first serious attempt in India to impart higher instruction through the principal vernacular, Urdu, displacing English, which was taught only as a language. (F. H. BR.)

HYNDMAN, HENRY MAYERS (1842–1921), English socialist and author, was born in London, March 7 1842, the son of John Beckles Hyndman, a barrister and founder of the Hyndman Trust for church building. He was educated privately and at Trinity College, Cambridge, afterwards becoming a war correspondent for the *Pall Mall Gazette* during the Austro-Prussian War of 1866. He had inherited wealth and he travelled extensively, using his pen always in defence of free institutions. In 1881 he founded the Social Democratic Federation in Great Britain and for many years was its chairman. During the 'eighties he was a prominent member of the Irish Land League and of the Land League of Great Britain. He took part in the unemployed demonstrations of 1887 and was put on trial for his share in the Trafalgar Square riot, but was acquitted. He opposed the South African War, took a prominent part in organizing the Second International in 1900, and from that date onwards was also active, both as speaker and writer, in advocating the grant of free institutions to India. But for some years before, as well as after, the outbreak of the World War, he uttered frequent warnings against the "German Menace." He published many works on socialism, land nationalization and kindred subjects, as well as *Records of an Adventurous Life* (1911), *Further Reminiscences* (1912), and *The Future of Democracy* (1915). He died in London Nov. 22 1921.

IBÁÑEZ, VICENTE BLASCO (1867–), Spanish novelist, was born at Valencia in 1867. His earliest works, such as *Flor de Mayo* (1895), are pictures of provincial life in Valencia, but he later developed a realistic and minute style, reminiscent of Zola. His work is remarkable for its keen observation and power of description, and has become widely popular in England and France. His novels include *Sonnica la Cortesana* (1901; Eng. trans., *Sonnica*, 1915); *La Catédral* (1903; Eng. trans., *The Shadow of the Cathedral*, 1909); *Sangre y Arena*, a study of the career of a bull-fighter (1908; Eng. trans., *Blood and Sand*, 1913); *Los Cuatro Jinetes del Apocalipsis* (1916; Eng. trans., *The Four Horsemen of the Apocalypse*, 1918); and *Mare Nostrum* (1918; Eng. trans., *Our Sea*, 1920).

See E. Zamacois, *Mis Contemporáneos: V. Blasco Ibáñez* (1910).

IBN SA'UD (*see* 2.267 and 28.245), the name of the Wahabite dynasty of Dar'iya and Riyadh (Nejd). 'Abd el 'Aziz ibn Sa'ud, the ruling emir, about 54 years of age in 1921, succeeded to the throne in 1902. The Ibn Sa'ud dynasty suffered eclipse at the hands of Ibn Rashid, emir of Hail (Jebel Shammar) from the middle of the eighties of the last century. The rightful emir, 'Abdurrahman ibn Faisal, and his son 'Abd el 'Aziz ibn Sa'ud were in exile at Kuwait, such power in Nejd as remained to the Sa'ud dynasty being wielded by an uncle, as mediatized ruler, until his murder by Ibn Rashid's order in 1902. In March 1902, with the help of Mubarak, sheikh of Kuwait, 'Abd el 'Aziz—his father stepping aside—regained Riyadh by a *coup d'état* against Ibn Rashid, who called in the Turks to aid him. Nevertheless, owing to the anarchy prevailing in Hail at the time, and with the help of the people of Nejd (who were traditionally attached to the house of Ibn Sa'ud), 'Abd el 'Aziz eventually succeeded in restoring and establishing the supremacy of the kingdom of Riyadh. Early in 1913 he extended his rule to El Hasa, driving out the Turks who had garrisoned the district since 1871. On the entry of Turkey into the World War, though the attitude of 'Abd el 'Aziz was at first uncertain, he eventually concluded a treaty with Great Britain on lines similar to those in force with the Persian Gulf states and, thereafter, proved an unswerving ally. He restored the chief towns in Nejd, rendered the roads more or less safe from raiders, encouraged cultivation, and increased the material prosperity of his dominions generally. His son, Turki, acted as his able lieutenant in the outlying districts (*see* ARABIA).

ICELAND (*see* 14.227*).—Since the beginning of the 20th century there has been considerable development in the affairs of Iceland, and especially in its political position, in respect of which an exceedingly important change has taken place. Instead of being as formerly (in accordance with the Danish Act of Jan. 2 1871) regarded as a territory with a wide measure of home rule, forming " an inseparable part of the state of Denmark," Iceland, since 1918, has been recognized as a separate kingdom, with unlimited sovereignty, in personal union with Denmark. According to the Act of Union (Nov. 30 1918), passed both by the Icelandic and the Danish Parliament, and in Iceland confirmed by a plebiscite, there are no real joint affairs; Denmark, however, provisionally till 1940, takes charge of the foreign affairs of Iceland as its mandatory in concert with a deputy appointed by the Icelandic Government. For the same period Danish citizens resident in Iceland and Icelandic citizens resident in Denmark enjoy in every respect equal rights with the citizens born and residing in each of these two states; they also have equal rights of fishing within the territorial waters of both states without regard to their place of residence. Other affairs of common import to the two states, such as communications, trade, the customs, navigation, mail services, telegraphs, etc., are to be arranged by agreement or treaty between the Governments of Iceland and Denmark. Iceland has issued a declaration of perpetual neutrality and of having no military or naval flag. On the other hand, Iceland, since 1915, has had its own merchant flag; this shows a white Greek cross, inside of which is another in red on a blue ground. Also, in 1918, it acquired national arms of its own, bearing the four guardian spirits of the country as described in Snorri Sturlason's *Heimskringla*, viz., a dragon, a vulture, a bull and a giant. As to diplomatic representation, Iceland has had, since 1920, a legation in Copenhagen, and is moreover entitled to establish legations or consulates at places where none have been appointed by Denmark; Icelandic attachés may also be appointed at existing Danish legations, which normally act on behalf of both Denmark and Iceland. In Iceland Denmark has a legation; Norway a consul-general and six vice-consuls; Sweden has four vice-consuls and has besides resolved to appoint either a legation or a consul-general; Great Britain a consul and four vice-consuls; France a consul and five vice-consuls; Holland two vice-consuls and Germany a consul; Russia, Belgium and Italy one vice-consul each.

According to the new constitution (1920) the king shares the legislative power with the Parliament, the *Althing*, an assembly of 42 members, of whom 36 are elected for a period of four years in separate electoral districts, where every man and woman (including servants) is entitled to vote at the age of 25; the remaining 6 (formerly nominated by the king) are elected for a period of eight years by proportional election in the whole country regarded as one constituency; in this case, however, the electoral right is limited to voters who have attained the age of 35. The Althing meets every year and sits in two divisions, the Upper and the Lower House; but in case of dissension it can assemble as a joint Parliament, in which disagreements are decided by qualified (in financial affairs by simple) majority. The Upper House consists of 14 members, the 6 members elected by the whole country and 8 elected by the other representatives out of their own body. The Lower House consists of the remaining 28 members. The Cabinet consists of three ministers, a premier and two secretaries of state, who in every respect (not only, as formerly, for the maintenance of the constitution) are responsible as well to the king as to the Althing. There is (since 1904) no governor-general, although the prime minister to some extent also acts as such, but every legislative act passed by the Althing, as well as many administrative measures, the more important appointments, etc., must be sent to the king in Copenhagen to be confirmed and signed by him; an Icelandic private secretary (not connected with the above-mentioned legation) is appointed for his assistance in such affairs. In the organization of the judicial power an important change has also taken place: appeals to the Danish supreme court in Copenhagen can no longer be made, Iceland having (since 1920) its own supreme court, consisting of five members; in consequence of this the former superior court in Reykjavik has been abolished, and appeals from the sheriff courts lie directly to the supreme court. Iceland also has its own university in Reykjavik (since 1911), consisting of four faculties: divinity, law, medicine and philosophy (including philology and history). Not only the Danish but also the French and the German Governments have appointed lecturers of their own to give lectures on their respective languages and literatures in the university of Iceland; and a similar step was contemplated in 1921 on the part of the United States. Among other improvements in education, the establishment of a teachers' seminary and of several other schools may be mentioned.

In almost every other respect Iceland in this period made constant and rapid progress. The total pop. increased from 78,000 in 1901 to 95,000 in 1921, about 43 % living in towns and trading stations. There were in 1921 seven towns with chartered privileges, with a total pop. of 30,000, and 34 trading stations with from 100 to 1,000 inhabitants each. The pop. of Reykjavik, the capital, increased from 6,700 in 1901 to 18,000 in 1921. The financial budget of the Icelandic State had for the financial period of 1918–9 advanced to 27 million krónur (£1,500,000) from only 1½ million krónur in 1904–5, and deposits in the savings banks to 40 million krónur from only 2 million in 1900. Commercial transactions (import and export) had in 1918 advanced to a value of 78 million krónur from only 15 mil-

These figures indicate the volume and page number of the previous article.

lion in 1900. The fishing trade had been considerably improved by the introduction of new methods (especially steam trawlers and motor cutters), and the export of fish products had in 1915 increased to 67,000 tons from 28,000 in 1900. The cultivation of the soil is also constantly improving, though in a smaller degree, and dairy farming after the Danish method has been introduced, by which the production of butter has been greatly improved. Some woollen factories have been established, but capital is lacking to provide as many as are needed. In its innumerable waterfalls (the greatest and most accessible estimated to represent about 4 million horse-power) Iceland is in possession of almost inexhaustible motive-power, and it was to be expected that considerable industries might grow up in Iceland in the near future, both Danish and Norwegian companies with extensive capital having already petitioned the Althing for concessions to utilize some of the greater falls. Up to 1921, however, the water-power had only been used to produce electric light in some of the towns. Communications are constantly developing, and driving roads have been made in almost every district; bridges have also been constructed over most of the rivers (while a scheme for the construction of a railway was under consideration in 1921). A telegraph cable to Shetland was opened in 1906 and telegraph and telephone lines inland have been extended practically throughout the whole country. In 1917 a wireless telegraph station was erected in Reykjavik. The lighthouse system is yearly improving, and at Reykjavik a modern harbour with quays and cranes has been built. In 1914 Iceland acquired its own steamship company, which in 1921 controlled six mail steamers. A lunatic asylum and a sanatorium for tuberculosis (at the cost of the State), together with some minor infirmaries, have been established. From 1912 onwards there came into force a system of complete prohibition of the import and making of any liquor containing more than 2¼ % of alcohol, with the exception of medical requirements and denaturalized spirits for industrial use.

See *Dansk-Islandsk Forbundslov* (1918); *Stjórnarskrá konungsríkisins Ísland* (1920); *Statistique de l'Islande*, Nos. 1–25; *Starfsskrá Íslands* (1917); Valtýr Gudmundsson, *Island am Beginn des 20. Jahrhunderts* (1904); P. Herrmann, *Island, das Land und das Volk* (1914.) (V. G.)

IDAHO (*see* 14.276).—In 1920 the pop. was 431,866 as against 325,594 in 1910, an increase of 106,272, or 32·6 %. The rural pop. in 1920 numbered 312,829, or 72·4 % of the total, and the urban 119,037, or 27·6 %, both increasing at nearly the same rate. The average number of inhabitants per sq. m. increased from 3·9 in 1910 to 5·2 in 1920. Boise, the capital and the largest city, had in 1920 a pop. of 21,393 (17,358 in 1910). The pop. of the other chief towns was as follows: Pocatello, 15,001; Twin Falls, 8,324; Idaho Falls, 8,064, and Nampa, 7,621.

Agriculture continued after 1910 to be the principal source of wealth, despite rapid developments in mining and the lumber industry. The most significant growth came in the portions of the state south of Salmon river. In northern Idaho, although the value of farm crops showed an increase in 1910–20, the total acreage remained about the same. The following table indicates the extent of agricultural development at the last three census periods:—

	1900	1910	1920
Number of farms	17,471	30,807	42,106
Acreage (improved)	1,413,118	2,778,740	4,511,680
Average acreage (total)	183·4	171·5	198·9
Value of farm property	$67,000,000	$305,000,000	$716,000,000

In 1920 15·7 % of the land area of the state was in farms and 53·9 % of the farm land was improved. Nearly two-fifths of all farms were in the group containing between 100 and 174 ac., but this group was declining in favour of larger and smaller holdings. The average value of land and buildings per farm was $13,811 as compared with $7,955 in 1910. The number of mortgaged farms nearly doubled in the 10 years. Tenant farming was not a serious problem, for nearly 63 % of all farms were operated by their owners. There were 41,598 white farmers and only 508 coloured farmers. Of the former, 35,284 were native born. The value of all crops for Idaho in 1919 was $126,459,766 as compared with $32,880,915 in 1909. Although the total value of cereals in 1919 ($43,118,428) showed an increase over 1909 ($16,026,676), it was not so marked as the increase in the value of hay and forage crops (1919, $50,807,437; 1909, $12,101,239). In the same decade the value of the potato crop increased 755·5 % and of the sugar-beet crop 236 %. With the increased acreage there came a decline in the average yield per acre of such crops as oats, wheat, barley and potatoes. Horticulture was important in the fertile valleys of the N. as well as in the irrigated districts of the S. and E. The production of strawberries in 1919 was 494,818 qt.; apples, 3,648,640 bus.; peaches, 279,101 bus.; plums and prunes, 485,325 bushels. Although Idaho is still important as a stock-growing state, the growth of this industry has not kept pace with the development in crop raising. The table in opposite column indicates comparative gains during the decade ending 1920.

Construction of large-scale irrigation projects received a set-back during the World War. About half the farms in the state were under irrigation in 1920. In 1909 the total acreage actually under irrigation was 1,430,000, though existing projects were capable of putting water on a total of 2,388,000 acres. In 1920 over 2,000,000 ac. were under irrigation. Incidental to irrigation has been the construction of a number of drainage projects costing (1920) $1,706,462, and providing drainage for 55,732 ac., less than one-tenth of 1 % of the area of the state.

	1910	1920
No. of horses	189,322	293,123
No. of cattle	404,518	714,903
No. of sheep	1,012,431	1,654,771
Production of milk (gal.)	30,981,341	52,365,498
Production of wool (lb.)	16,377,265	17,860,962

Mining.—Mining continues to rank second in economic importance. The following table shows the value of the mineral production in alternate years since 1910:—

	Gold	Silver	Lead	Copper	Zinc
1910	$1,018,000	$4,268,000	$10,761,000	$ 753,000	$ 33,000
1912	1,432,000	5,011,000	13,233,000	1,224,000	1,127,000
1914	1,286,000	7,412,000	13,426,000	2,166,000	685,000
1916	1,061,000	8,013,000	25,111,000	12,633,000	2,190,000
1918	750,000	8,709,000	22,368,000	1,278,000	4,212,000
1920	459,000	8,379,000	22,292,000	491,000	1,785,000

The total value of the mineral production in 1920 was $33,557,708. Lead is first in importance. The most important lead mines are in the Coeur d'Alene district of the Panhandle, including the Hercules, the Tamarack and Custer, Hecla, and Bunker Hill and Sullivan mines. The mines of central Idaho are again becoming important after the lapse of half a century, and successful developments of lead-silver and lead-zinc ores have been made in Lemhi and Custer counties in the east-central part of the state. The extraction of silver is in most sections of the state incidental to lead mining. The most striking developments in the years just preceding 1921 were in the mining of zinc. The Interstate-Callahan mine in the Coeur d'Alene is probably the third largest producer of zinc ore in the United States. Other properties in the same region have shown good yields in the past few years. Some zinc also is produced in central Idaho. The copper resources of the state, while widely distributed, are only in the first stages of exploitation, due largely to the inaccessibility of the best ores. The largest copper-producing area is in Custer county, though some development has been made in Lemhi, Shoshone and Adams counties. The Seven Devils range in Adams county is one of the most extensively mineralized copper belts in the west. Gold is produced in northern and central Idaho partly by milling quartz ores and partly by dredging. One concern, operating in central Idaho, has produced by dredging as much metal-bearing material in a year as all the lode mines in the state combined. The latter are chiefly found in the Coeur d'Alene. Tungsten in increasing amounts is being mined, chiefly in Lemhi county, which contains a more complete variety of precious, useful, and rare minerals than any other county in the state. In south-eastern Idaho are great quantities of phosphate rock, of which 30,000 tons were mined in 1920. Low-grade coal is being developed in small quantities near the Wyoming line, and there has been some prospecting for oil.

Manufactures.—Although Idaho is by no means a manufacturing state, there has been a marked growth during the past decade both in the number of establishments and in the value of their products. The following are the chief industries, in order of importance: lumber, flour and grist mills, car and railroad shops, printing and publishing. Over 98 % of the employees are males over 15 years of age; 71 % of the establishments are owned by individuals or firms and 27 % by corporations. The total value of all manufactured goods in 1914 amounted to $28,453,000. Of this 47·7 % was represented by lumber products. The cuts are chiefly of soft woods, 40 % being white pine. Idaho contains the largest body of standing white pine in the world.

Government.—The Legislature of 1919 completely reorganized the state civil administration in so far as the limitations imposed by the state constitution permitted. The Administrative Consolidation Act abolished some 46 boards, commissions and offices. The resulting changes gave Idaho a consolidated form of state government, or, as it is locally called, a cabinet or "commission" form of government, with the governor at the head, assisted by nine departmental "commissioners." These nine departments are: Agriculture; Commerce and Industry; Finance; Immigration, Labor and Statistics; Law Enforcement; Public Investment; Public Welfare; Public Works; Reclamation. Each commissioner, salary $3,600, is appointed by the governor and, except "those under the constitution who are appointed for specific terms," may be removed by him at his discretion. The Act further provides that in certain departments designated officers shall be appointed by the governor, but these are comparatively few in number, and on the whole the organization within each department is under the control of the commissioner. This consolidated form of government concentrates authority in the hands of the governor to a marked degree. The law provides a budget system for the state, to be prepared by the Commissioner of Finance.

There were in 1920 45 counties in the state. During the 1921 session of the Legislature an effort was made to secure favourable action on a resolution to divide the state and to permit the creation out of northern Idaho, with eastern Washington and possibly part of western Montana, of a new state of Lincoln, should Congress permit the admission of the same to the Union. There was considerable agitation for this step.

Education.—In 1917–8 there were 131,845 pupils enrolled in the common schools of the state, as compared with 62,728 in 1905–6. The school buildings were rapidly increasing in number and in quality. In 1918 there were 1,703 school-houses valued at $9,591,609. The law permits the formation of consolidated school districts, of which there were 17 in 1918. The state university comprised in 1920 four colleges: Letters and Sciences, Agriculture, Engineering, and Law; and three schools: Forestry, Mines, and Education. The total enrolment was over a thousand. In 1917–8 the state normal school at Lewiston had an enrolment of 507; the state normal school at Albion, 403; the technical institute at Pocatello, 563.

Finance.—The total state tax levy for 1919 amounted to $3,795,059 on an assessed valuation of $486,759,104. The total expenditures in the same year for cost of government amounted to $3,405,929. The *Financial Statistics of States*, issued by the U.S. Census Bureau, gave a total net debt at the end of 1919 of $2,403,218. The outstanding bonds and interest-bearing warrants carried interest at 4·5, 5 and 6%.

History.—In the World War Idaho furnished 19,016 men, representing 26 to 30% of the total number of men examined for military service. Men from Idaho made part of the 41st National Guard Division and the 91st National Army Division. The 41st landed in France in Dec. 1917 and the 91st in July 1918. The 91st, though it spent but 14 days in active sectors, gained a total of 34 km., or 4·35% of the total ground gained against the enemy. There were 1,390 battle deaths in the 91st and 5,106 wounded. Idaho over-subscribed each of its Liberty Loan quotas. The governors of the state were: James H. Brady, Republican, 1909-11; James H. Hawley, Democrat, 1911-3; John M. Haines, Republican, 1913–5; Moses Alexander, Democrat, 1915–9; D. W. Davis, Republican, 1919–

Bibliography.—For the early history and exploration of Idaho, see Dale, *The Ashley-Smith Explorations and the Discovery of a Central Route to the Pacific, 1822–1829*. There are several histories of Idaho: Brosnan, *History of the State of Idaho* (1918); Hailey, *History of Idaho* (1910); McConnell, *Early History of Idaho* (1913). Of the state publications the biennial reports of the Commissioner of Finance, the Board of Education and the Mine Inspector are among the most important. On mining developments the bulletins issued by the state School of Mines (Bureau of Mines) are also valuable. (H. C. D.)

IDRISI (Seyyid Mohammed el Idrisi), Arab chief, b. 1876 at Sabia, was a grandson of Seyyid Ahmed el Idrisi, a native of Fez, who was head of a religious fraternity or *tariqa* at Mecca and who acquired land at Sabia, settled there and died in 1837. The descendants of Seyyid Ahmed appear to have increased in wealth and influence and to have gradually supplanted the ruling sherifial family of Abu 'Arish. Seyyid Mohammed was educated partly at El Azhar University and partly by the Senussi at Kufra, and subsequently resided for a time in the Sudan, at Argo. On his return to Asir, his one ambition was to render that district independent of the Turk. By able administration he gradually expanded his political power to include Mikhlaf el Yemen and a large part of the Tihama, with control over several tribes outside these limits. He threw in his lot with the Allies in the World War, and was the inexorable foe of the Imam of Yemen (*see* Arabia).

ILKESTON, BALTHAZAR WALTER FOSTER, 1st Baron (1840–1913), British physician and politician, was born at Cambridge July 17 1840. He was educated at Drogheda and Trinity College, Dublin, where he studied medicine. He afterwards (1860) became medical tutor and professor of practical anatomy at Queen's College, Birmingham, was professor of anatomy there 1864–5, and professor of materia medica at Sydenham College, Birmingham, from 1865 to 1868. In the latter year the two colleges amalgamated, and he then became professor of medicine, and in 1892 was appointed emeritus professor of medicine. In 1886 he was knighted. In 1885 he had successfully contested Chester as a Liberal, but lost the seat in 1886; in 1887, however, he was elected for the Ilkeston division of Derby, which he retained until 1910. From 1892 to 1895 he was parliamentary secretary to the Local Government Board, and in 1906 was sworn of the Privy Council. The same year he received the gold medal of the British Medical Association. He was made a peer in 1910, and died in London Jan. 31 1913.

He published various medical works, including *The Use of the Sphygmograph in Heart Diseases* (1866); *Method and Medicine* (1870); *Clinical Medicine* (1874); *Political Powerlessness of the Medical Profession* (1883) and *Public Aspects of Medicine* (1890).

ILLINOIS (*see* 14.304).—The pop. by the 1920 census was 6,485,280, as compared with 5,638,591 in 1910 and 4,821,550 in 1900. The rate of increase 1910–20 was 15%, as against 14·9% for the whole United States and as against 16·9% for the state in the preceding decade. The increase of 1910–20 was urban, rural pop. continuing to decline. In 1900 the percentage of urban pop. in towns and cities of 2,500 or over was 54·3%; in 1910 61·7%; in 1920 67·9%; 35·2% of the total pop. in 1900, 38·8% in 1910, and 41·7% in 1920 was in Chicago. In 1920 52·5% of the state's pop. was in cities greater than 25,000. Population in villages of less than 2,500 declined from 12·6% in 1900 to 12% in 1910 and 10·5% in 1920. Purely rural pop. fell from 33·2% in 1900 to 26·4% in 1910 and 21·6% in 1920. The rapid growth of towns of 25,000 to 100,000 is significant, their gain in the decade being 29·2%.

Population of Cities of over 25,000.

City	Population 1920	Population 1910	Increase per cent
Aurora	36,397	29,807	22·1
Bloomington	28,725	25,768	11·5
Chicago	2,701,705	2,185,283	23·6
Cicero town	44,995	14,557	209·1
Danville	33,776	27,871	21·2
Decatur	43,818	31,140	40·7
East St. Louis	66,767	58,547	14·0
Elgin	27,454	25,976	5·7
Evanston	37,234	24,978	49·1
Joliet	38,442	34,670	10·9
Moline	30,734	24,199	27·0
Oak Park village	39,858	19,444	105·0
Peoria	76,121	66,950	13·7
Quincy	35,978	36,587	−1·7
Rock Island	35,177	24,335	44·6
Rockford	65,651	45,401	44·6
Springfield	59,183	51,678	14·5

Agriculture.—While the census of manufactures of 1914 showed Illinois to be an industrial rather than an agricultural state, the value added to her manufactured products by manufacture making a total of $907,139,412 as against a value for agricultural products of $586,517,053 for 1910, there has been no absolute decline in her agriculture. True, the population gainfully engaged in agriculture fell from 32% of all employed in 1890 to 19% in 1910; but the average annual value of field crops grew from $129,890,293 for 1895–9 to $518,227,210 for 1915–7. One cause, other than higher prices, for this increase, in the face of a decreased number of farm labourers, appears in the increased efficiency and utilization of farm machinery; from 1890 to 1910, in spite of price reductions, the value of implements on farms increased from $34,456,938 to $73,724,074. The machine replaced the man. The cereals are still Illinois' main crop, and maize is the leading cereal. The crop of 1917, 418,000,000 bus., grown on 11,000,000 ac., was the largest. In 1918 and 1919 crop and acreage decreased, the 1919 crop being 301,000,000 bus. grown on 8,600,000 ac. That Illinois in these last two years ranked second to Iowa for the first time since 1890 was due to her turning her efforts to war-time wheat production. First in the Union in wheat production in 1889, she had fallen in 1900 to 14th place, but from a product of 30,850,000 bus. grown on 1,650,000 ac. in 1917, she rose to 60,991,000 bus. grown on 2,774,000 ac. in 1918, and in 1919 to 65,675,000 bus. grown on 4,184,000 ac., an achievement which placed her second only to Kansas. In oats her production declined steadily from the high-water mark of 1900, 164,909,129 bus., until the outbreak of the World War. In 1917 she produced 239,200,000 bus., which had fallen off by 1919 to 123,060,000 bus. from an acreage slightly larger than that of 1900. Since 1917 Illinois has been second only to Iowa in the production of this crop. In 1919 she ranked 8th in the production of barley and rye, producing 3·45% of the barley and 4·66% of the rye grown in the United States. In live stock Illinois, Jan. 1 1920, with 1,060,000 milch cows, ranked 7th among the states; and in other cattle, numbering 1,290,000, ranked 13th. On the same date she ranked 18th in number of sheep, with 1,010,000 of the 48,615,000 in the United States. In swine she ranked second only to Iowa, having 5,323,000, a little over 7% of the total for the nation. In total value of cattle, sheep, and hogs on farms Jan. 1 1920, $294,000,000, she fell below Iowa, Texas and Wisconsin only. In value of the 1,422,000 horses and 147,000 mules on her farms on Jan. 1 1920 she was second only to Texas.

Manufactures.—In value of manufactures Illinois since 1893 has ranked third, being exceeded only by New York and Pennsylvania. In 1914 the total value of her manufactured products was $2,247,322,819 and the value added by manufacture $907,139,412. Manufactures employed 506,943 wage-earners, working in 18,388 establishments. There were 124 distinct industries reporting products yearly in excess of $1,000,000 each. The 25 exceeding $20,000,000 ranged as follows:—

Manufactured Products, Illinois, 1914

	Number of Establishments	Average Number of Wage-earners	Value of Products	Value Added by Manufacture
Slaughtering and meat-packing	98	31,627	$489,230,324	$77,215,741
Foundry and machine-shop products	1,371	55,261	141,328,624	80,722,363
Printing and publishing	2,722	32,838	112,833,427	79,555,812
Clothing, men's, including shirts	604	35,119	89,144,448	47,833,982
Agricultural implements	73	19,556	65,337,663	32,460,102
Iron and steel, steel-works and rolling-mills	25	15,408	64,995,121	25,057,057
Cars, steam-railway, not including operations of railway companies	23	18,000	61,315,638	20,886,871
Liquors, distilled	7	855	51,596,022	42,989,814
Flour-mill and grist-mill products	406	2,398	49,493,224	6,652,317
Electrical machinery, apparatus and supplies	142	16,483	45,667,456	26,288,292
Bread and other bakery products	2,278	10,404	45,250,060	21,611,189
Lumber and timber products	618	14,870	42,064,008	17,939,874
Cars and general shop construction and repairs by steam-railway companies	94	28,682	41,496,130	23,177,666
Liquors, malt	89	5,749	39,435,995	29,029,583
Furniture and refrigerators	283	13,766	32,999,567	17,286,793
Gas, illuminating and heating	75	3,890	28,170,560	20,135,071
Tobacco manufactures	1,622	7,653	26,036,729	15,982,887
Iron and steel, blast furnaces	5	1,450	25,861,528	4,067,381
Copper, tin and sheet-iron products	508	7,445	24,815,389	10,990,536
Paints and varnishes	72	2,110	24,488,449	9,011,951
Confectionery	147	5,009	22,138,559	10,043,926
Coffee and spice, roasting and grinding	34	1,193	22,044,588	4,950,998
Butter, cheese and condensed milk	267	1,755	21,792,220	3,556,588
Soap	27	2,144	21,420,035	6,167,142
Clothing, women's	241	8,113	20,750,550	9,531,354

In four of these industries—slaughtering, agricultural implements, distilled liquors and railway cars—Illinois in 1914 ranked first among the states. In the relative importance of the industries in Illinois there have undoubtedly been great changes since 1914. War-time demands had far-reaching effects; and prohibition greatly curtailed the output of distilled liquors, firms engaged in their manufacture often turning to some related line such as the production of alcohol for industrial purposes. The tendency in manufacturing is toward large-scale production and corporate ownership. In 1914 the 32·6% of manufacturing establishments that were corporations produced 90% of all manufactured products. Of the 18,388 establishments in the state in the same year, the 336 producing $1,000,000 or over turned out 59·7% of products. Of the mergers during the boom period 1902–3 those in harvesting machinery and iron and steel have endured; but the National Packing Co., made up of three great Chicago packing-houses, was dissolved in 1912. Chicago, with its tributary manufacturing suburbs of Maywood, Harvey, Cicero, Blue Island, Chicago Heights, and in Indiana Hammond and Gary, is the greatest manufacturing centre of the state. A lesser manufacturing centre has grown up in the net of railways that centres at St. Louis in the cities of Alton, Belleville, East St. Louis, Collinsville, Granite City and Edwardsville. A third centre is formed by Moline and Rock Island with Davenport, Ia. Peoria and Joliet were second and third to Chicago in value of products in 1914. Of manufactures at these various points, those of Chicago, as might be supposed, are completely diversified. The same is usually true of the smaller cities, though a few are noted for special products. Thus Rockford is best known for its furniture manufactures, Elgin and Springfield for watches, Moline for automobiles and farm implements, Kewanee for boilers and steam tools, Peoria for distilled products, and Aurora for railway repair, and foundry and machine-shop products.

Minerals.—In mining and allied interests Illinois occupies an important position. Her petroleum production in 1917 was 15,776,860 bar., valued at $31,300,000. In this field she was 5th, being exceeded by Oklahoma, California, Kansas and Texas. In coal production, with 86,000,000 tons valued at $162,281,822, she was exceeded only by Pennsylvania and West Virginia.

Communications.—For transportation Illinois mainly relies on its steam railways. With 12,140 m. of main line she was in 1914 second only to Texas. For over 30 years little new main line has been built. The important extension has been in double-tracking and improvement of the right-of-way and terminals. The field of passenger and light freight and coal transport since 1900 has been invaded by electric lines, which by 1916 operated 2,415 m. of main track. The Illinois Traction System operates a ramification of electric lines crossing the state from Danville to East St. Louis and radiating through central Illinois; on certain runs it operates sleeping and parlour cars. Illinois' most important water transportation system is that of the Great Lakes. Receipts of grain at Chicago by lake have steadily declined of late years, though the lakes are still the usual route for shipment of wheat to eastern points. Flour shipments by lake are comparatively insignificant, an important fact in view of the increasing quantity of grain milled at Chicago. Iron ore still comes to Chicago and South Chicago by boat. Other water transportation in Illinois is comparatively insignificant. Trade on the Ohio is small; on the Mississippi negligible. The Hennepin canal, completed in 1907 to connect the Illinois and the Rock rivers, is unused. The Illinois and Michigan canal, though exercising a restraining effect on freight rates, has steadily declined in usefulness for the last 30 years and has not paid expenses of operation and maintenance for more than 40 years. The Chicago sanitary and ship canal, opened in 1900 as far as Lockport, has had a little more traffic. The improvement of Illinois roads has of late years engaged attention. A state highway commission was created in 1905 to investigate the subject, various laws facilitating local road improvement were passed, and in 1914 state appropriations for hard roads were made from the proceeds of automobile licence fees. Actual construction was begun in 1914. Road-building has continued, certain counties, such as Vermilion and Cook, making bond issues and constructing hard-road systems of their own. Acts of Congress of 1916 and 1919, apportioning Federal aid in behalf of roads, allotted to Illinois $3,300,000 and $8,700,000 respectively. The question of issuing $60,000,000 in bonds based on automobile licence fees for the construction of 4,800 m. of hard roads was submitted to the voters of the state in Nov. 1918 and approved by them, and work has begun on Federal aid and bond issue.

Banking.—The northern part of Illinois lies in the 7th Federal Reserve District and the southern part in the 8th, with headquarters respectively at Chicago and St. Louis. In 1919 there were 472 national banks in Illinois with aggregate capital of $79,415,000, surplus of $57,632,000 and total assets of $1,587,634,000; $845,925,000 of this was located in Chicago, where one bank had a capital of $21,000,000 and another $10,000,000. Side by side with the national banks was a system of state banks created by the Act of 1887 and operating under the supervision of the auditor of public accounts. The minimum capital required was $25,000 in towns of less than 5,000 inhabitants and $50,000 in larger ones. In 1920 there were 1,018 state banks with total capital of $116,879,205 and total resources of $1,861,466,834.23. Besides these there have been many private banks under no supervision. Their number has been uncertain, but in 1915 there were at least 586. Failures in this class have been frequent, and Acts passed in 1917 and 1919, and ratified by popular vote in the elections of 1918 and 1920, require all such banks to cease business or submit to state supervision.

Government.—Despite the difficulty of changing the organic law, in the period 1910–20 there were far-reaching changes in the organization of the machinery for government. Under the constitution of 1870 an amendment must be initiated by two-thirds of both Houses in the General Assembly and approved by a majority of all persons voting at the next election, a provision that in 1916 caused the loss of an amendment increasing the General Assembly's taxing powers because it received a majority only of those voting on the question. Further, in a session an amendment to but one article can be proposed and no two amendments to any article can be offered within four years. Revision of the constitution by amendment therefore proved too difficult, and in 1917 the General Assembly voted to submit to the people the question of a constitutional convention, which was approved at the election of Nov. 1918. Accordingly in 1919 an Act was passed for a convention to meet Jan. 6 1920. Difficulties arose between the delegates from Chicago and those from the southern part of the state over proposals to limit Chicago's representation in the General Assembly, and in Dec. 1920 the convention adjourned with its work unfinished to meet in Sept. 1921. Important changes in the state's system of appointments were effected. First in time was the extension by the Act of 1911 of the civil service system, established six years before in the state charitable institutions, to the greater part of the state's employees. Civil service now covers all state appointees except those appointed by the governor and confirmed by the Senate, the scientific and academic staff of the university of Illinois and the normal schools, and a few others, such as special attorneys appointed by the attorney-general. All examinations are competitive, though for some scientific posts "unassembled examinations" are given which consist of questions as to training and experience. By an amendment of 1917 all appointees may be removed by the appointing authority, but are allowed an appeal to the State Civil Service Commission on allegation that the removal is due to race, politics or religion. Reorganization of governmental machinery had begun in 1909 with the abolition of separate boards for the various state charitable institutions and the establishment of one central board of control possessing also certain powers over private charitable institutions. In addition to this board a supervisory state charities commission was created. There remained, however, more than a hundred state boards, bureaus and offices, paid and unpaid, created to execute various acts and to supervise various state institutions; the result was disorder and waste. A reorganization recommended by an efficiency and economy committee in 1914 was in great part adopted in the State Consolidation Act of 1917. This Act necessarily left untouched the constitutional offices, secretary of state, auditor of public accounts, treasurer, attorney-general, and superintendent of public instruction, but set up in addition to them nine departments—Finance, Agriculture, Labor, Mines and Minerals, Public Works and Buildings, Public Welfare, Public Health, Trade and Commerce, Registration and Education. The heads of these various departments, who are appointed by the governor and Senate, have acted as a Cabinet for the governor.

Suffrage and Elections.—The most important development since 1910 has been the complete enfranchisement of women. Initiated by the Act of 1891, which allowed women to vote in elections of school trustees, it was continued by the Act of 1909, making women eligible to all offices under the school law of the state. In 1913 the General Assembly extended to women the franchise for presidential electors, members of the board of equalization, for all state offices not already open to them by the constitution and for offices in cities, villages and towns. Enfranchisement was completed by the Federal constitutional amendment of 1920. In legislation as to primaries the state has had difficulty in procuring constitutional laws. Acts of 1905, 1906 and 1908 were invalidated by the Supreme Court. An Act passed in 1912 stood the test, but a further Act passed in 1919 was declared unconstitutional.

Public Finance.—For the biennium 1916–8, the last for which statistics are available, the total revenue of the state in respect of the General Revenue Fund was $41,856,721. Of this the general property tax supplied $27,532,790, the 7% of Illinois Central Railroad earnings $3,775,240, the inheritance tax $3,848,174, subventions by the Federal Government $330,215; the balance was the proceeds of fees, fines, receipts from state institutions, etc. In addition to the General Revenue Fund the receipts of the state in respect of certain other special funds amounted to $19,912,132. Of these the receipts for the state school fund were $7,911,653, the proceeds of the special mill tax for the university of Illinois $4,847,202, the receipts from automobile licence fees used for hard roads $4,353,090, and receipts to be applied toward registered bonds guaranteed by the state $1,897,400. Expenditures for the biennium 1916–8 based on both groups of funds were $47,919,125; when classified by state departments the largest were those for registration and education, $15,409,692, which included disbursements for the university of Illinois and the state school fund. The expenditure of $14,831,833 for public welfare included expenditures on the charitable and penal institutions of the state. The other large totals were: state officers, $4,217,448; public works, $3,083,850; administration, $2,462,031; registered bond fund, $2,062,823; military, $1,704,207; trade and commerce, $1,198,713; agriculture, $1,023,285.

Education.—In 1918 there were enrolled in the elementary schools of Illinois 490,762 boys and 478,185 girls; in the state high schools 50,107 boys and 62,450 girls. The total number of teachers was 34,597. The estimated value of school property was $154,619,859, of which $10,553,848 represented equipment, furniture, etc. Total funds available were some $68,000,000, and expenditures in school districts some $52,000,000, of which $1,294,537 was spent on administration, $29,001,198 for instruction, $5,961,635 for operating plant, $8,745,373 for new buildings and equipment, $3,236,889 for repairs, etc. Teachers' salaries were low. In 1918 over one-half the elementary-school teachers were paid between $300 and $700. Such conditions result in unsatisfactory professional standards: 1,015 teachers in 1918 had attended no school above elementary; 1,787 had attended, but not graduated from, a high school; 9,631 were high-school graduates. Even with such meagre qualifications, there was a serious shortage of teachers in the state. The most significant development in recent years has been in high-school education. Acts of 1913 and 1915 directed the payment by local school authorities of tuition for children who wish to attend high school elsewhere when there was none in their district. In 1917 an Act was passed making easier the establishment of country high schools and laying a tax on the community for the payment of tuition to other high-school districts in which the community's children attended high school. An adverse decision of the state Supreme Court caused the reënactment of the measure in different form in 1919. As a result of this legislation the numbers of high schools, students and teachers have doubled since 1906:—

	High Schools	Students	Teachers
1906	438	52,394	2,057
1918	840	112,257	5,476

There has been a corresponding increase in the enrolment in the universities and colleges of the state, notably in the university of Illinois, the capstone of the state's educational system. The university enrolment between 1910 and 1920 rose from 5,217 to 9,208. Appropriations have failed to follow this increase, with the result that, with an annual revenue of $3,967,848.20 as against $2,002,038.23 in 1910, the university found itself badly crippled. In spite of this it performs an ever-increasing variety of services to the state. Not only in its colleges and graduate schools does it train teachers, chemists, and engineers for the benefit of the state, but its special schools of agronomy, animal husbandry and dairy husbandry co-operate with the farmers of the state in solving their problems. Its schools of ceramics, civil, electrical, mechanical, mining, municipal, sanitary and railway engineering and architecture devote themselves to the study of the state's problems. By various research bureaus and surveys, such as the State Geological Survey, it conducts research for the benefit of the state. Of the other two large universities of the state, the university of Chicago in 1919–20 had a total enrolment of 10,880, with a faculty, exclusive of assistants, of 328. Its total assets exceeded $50,000,000; its library included 900,000 books and pamphlets (*see* CHICAGO, UNIVERSITY OF). Northwestern University, located in Evanston and Chicago, had a total registration in 1920–1 of 7,389, and a faculty of 389, exclusive of assistants. Its libraries included over 300,000 books and pamphlets. Its annual expenditure was $1,398,084.

History.—In 1912, as a result of the Progressive secession, the Republican party for the first time in 16 years lost control of the state, the Democratic presidential electors winning by a vote of 405,038, as against 386,478 for the Progressives and 253,593 for the Republicans. The Democratic state ticket headed by Edward F. Dunne was elected by a somewhat larger plurality over Gov. C. S. Deneen, Republican, and Frank H. Funk, Progressive. The Democrats, however, did not control the General Assembly on joint ballot and had to compromise with the Republicans on the election of one Democratic senator, James Hamilton Lewis, and one Republican, Lawrence Y. Sherman, the latter to fill an unexpired term to 1915. By 1914 the normal Republican majority in the state reasserted itself, the popular vote for senator in that year being L. Y. Sherman, Republican, 390,661; Roger Sullivan, Democrat, 373,403; Raymond Robins, Progressive, 203,027. Wilson lost the state in the presidential election of 1916 by 160,000 votes, Frank O. Lowden, Republican, being elected governor over Edward F. Dunne. In spite of the appeal for the support of the Wilson administration on patriotic grounds, but five Democratic congressmen were elected in 1918, and Medill McCormick, Republican, beat J. H. Lewis, Democrat, for senator by 53,024 votes. In 1920, after an extremely bitter primary fight in the Republican party, Len Small was nominated for the governorship over John J. Oglesby, Small running on a platform opposing the action of the Public

Utilities Commission in allowing increase of rates by public utilities, and advocating increased taxation of wealth. In the election Republican state and national tickets swept the state by overwhelming majorities, though Lewis, the Democratic candidate for governor, ran ahead of his presidential ticket.

The governors of Illinois after 1905 were: Chas. S. Deneen, 1905–13; Edward F. Dunne, 1913–7; Frank O. Lowden, 1917–21; Len Small, 1921– .

World-War Activities.—Under the vigorous leadership of Gov. Lowden, Illinois supplied 188,010 drafted men and 163,143 volunteers, a total of 351,153, to the armed forces. The 33rd Division, made up of Illinois National Guard units, saw service in France both on the British front and in the Meuse-Argonne offensive. The 149th Field Artillery, originally the 1st Illinois Artillery, was in the 42nd Division and took part in many engagements; the 13th, or Railway, Engineers and several other Illinois units also saw service in France. One divisional cantonment, Camp Grant at Rockford; the great naval recruit training depot at Great Lakes, Lake Bluff; Fort Sheridan, near Chicago, utilized first as an officers' training camp, then as a hospital; Chanute and Scott aviation fields at Rantoul and Belleville, together with various other camps and training centres, were located in the state.

The organization of the state for participation in the war was the work in great measure of the state Council of Defense, created by Act of the General Assembly, and representing capital, labour and other interests. Over 110,000 volunteer workers affiliated themselves with this body. Under its direction the agriculture of the state was turned with unexampled success to the production of wheat, barley and rye. The manufactures of the state also were reorganized for war purposes. Citizens of the state subscribed $1,586,227,500 to Liberty Loans, exceeding the state's quota by 28%, and gave more than $50,000,000 to war relief agencies. The universities and colleges of the state organized students' army training corps, gave their students to the officers' training camps and their specialists to all phases of Government activity, from experts' work at the Peace Conference to chemical experiment and railway operation.

See, in addition to the books listed in 14.311, *Centennial History of Illinois* (5 vols., published by the state 1918–20) and later volumes of the *Illinois Historical Collections.* (T. C. P.)

ILLUMINATING ENGINEERING.—The formation of the Illuminating Engineering Society in England in 1909 gave a great stimulus there to the study of illumination. A body with similar aims had existed in the United States since 1906. Illuminating engineering societies have also been formed in Germany (1912) and in Japan (1918). These bodies include in their programme the study of illuminants, the influence of light on the eye, the measurement of light and illumination, and practical applications of light. A notable step has been the formation, on the proposal of the British Illuminating Engineering Society, of the International Illumination Commission, with national committees in all the chief countries. Work was in abeyance during the World War but has since been resumed. Agreement on a common unit of light (the "International Candle") has been attained in Great Britain, France and the United States. In Germany the Hefner candle (equal to 0·9 "international" candle) is still used.

Researches have led to a more accurate knowledge of the influence of humidity and barometric pressure on the 10-c.p. Pentane standard (*see* Trotter, Haldane and Butterfield, *Int. Phot. Comm.*, 1911; C. C. Paterson, Phys. Soc. Lond., June 1909; Crittenden and Taylor, *Trans. Illum. Eng. Soc. U.S.A.*, 1913; Takatsu and Tanaka, Electrot. Laby. of Dept. of Communications, Tokyo, 1917). Meantime the search for an absolute standard of light continues. Recent work by N. A. Allen (Phys. Soc. Lond., 1920), indicating under favourable conditions the maintenance of a constant current-density in the crater of the carbon arc, suggests the possibility of an arc-standard. At the Reichsanstalt in Charlottenburg experiments on the use of a dark hollow space, forming a "black body," maintained at a constant temperature, have been conducted (Müller, *Licht und Lampe*, April 21 1921). Many instruments for measuring illumination, including forms suitable for direct measurement of brightness, are now available. Some recent types, intended for rapid and approximate work, enable values of illumination to be read off directly by the inspection of a series of slots of graded brightness without manipulation to obtain balance. An instrument of this type was used to determine the illuminating power of parachute lights, flares, etc., during the World War; and other special apparatus for studying the decay of brightness of radium self-luminous material has been developed (Trotter, *Illum. Eng.*, Nov. 1919). Daylight illumination has also been studied by apparatus relating illumination at any point in the room to the unrestricted illumination from the sky-hemisphere. The "daylight-factor" thus determined may be of the order of 0·25% in schools, and this has been suggested as a standard minimum of access of daylight (*Illum. Eng.*, Jan., Feb., July 1914).

Greater experience has been gained of the practical operation of the integrating sphere photometer for measuring mean spherical candle-power or total flux of light in lumens. It is now recognized that, in view of the great variations in mode of distribution of light from modern illuminants, comparisons should be made in terms of total light emitted, or average candle-power, and not candle-power in one direction only. Accordingly the integrating sphere has assumed greater importance. Various methods of applying this apparatus to determine absolute coefficients of reflection of surfaces have been evolved (A. H. Taylor, *Sci. Paper*, Bureau of Standards, 1920; *Trans. Ill. Eng. Soc. U.S.A.*, Dec. 1920). These researches assign to magnesium carbonate the high coefficient of reflection of 99%, and this has been proposed as a standard photometric surface.

Attention has also been devoted to physiological aspects of illumination, such as the avoidance of glare from bright unshaded lights in the range of vision, the effect of infra-red and ultra-violet rays, etc. Problems involved in the lighting of shops, schools, streets, factories, theatres, etc., have been discussed and in some cases recommendations issued by joint committees. Thus a joint committee representing the Illuminating Engineering Society, the Institutions of Gas and Electrical Engineers and the Institution of County and Municipal Engineers prepared a draft standard specification for street lighting, streets being classified in order of importance and appropriate minimum values of horizontal illumination specified in each class (*see* Trotter, *Illum. Eng.*, May, June 1913). Reports of joint committees on school and library lighting (*Illum. Eng.*, July 1913) and eyestrain in cinema theatres (June 1920) have also been issued.

There has been a growing recognition of the importance of adequate illumination in factories in the interests of health, safety and efficiency. In England, the Departmental (Home Office) Committee on Lighting in Factories and Workshops issued an interim report in 1915 (Blue Book Cd. 8000), recommending that there should be statutory power "requiring adequate and suitable lighting in general terms in every part of a factory and workshop. . . ." The report contained full data on industrial lighting and results of upwards of 4,000 measurements of illumination in factories, and ranks as one of the most important official documents on this subject. In subsequent years industrial lighting codes have been adopted by six of the American states. It has been suggested that ultimately an international code may be developed.

During the World War the Illuminating Engineering Society exerted its influence in favour of judicious lighting economies and scientific methods of darkening streets. An increase in street accidents was attributed partly to inequalities of lighting prevailing in the streets of London (*Illum. Eng.*, Jan. 1917, p. 38). War conditions imposed a check on the development of spectacular lighting in England, but novel forms of illuminated signs, particularly those of the pictorial variety, have since been developed (E. C. Leachman, *Illum. Eng.*, March 1921). The lighting of the Panama-Pacific Exposition, opened at San Francisco in 1915 (*Gen. Electric. Review U.S.A.*, June 1915), was regarded as marking a new era in spectacular lighting, many striking colour effects being devised.

Additional information on illuminating engineering may be derived from the following works:—

The Art of Illumination, by L. Bell (1912); *Lichttechnik*, by L.

Bloch, issued by the German I.E.S. (1921); *Elementary Principles of Illumination and Artificial Lighting*, by A. Blok (1914); *Factory Lighting*, by C. E. Clewell (1913); *Practical Illumination*, by J. Eck (1914); *Modern Illuminants and Illuminating Engineering*, by L. Gaster and J. S. Dow (1920); *Praktische Photometrie*, by E. Liebenthal (1907); *Colour and its Applications*, by M. Luckiesh (1915); *Light and Shade and their Applications*, by M. Luckiesh (1916); *Artificial Light: its Influence upon Civilization*, by M. Luckiesh (1921); *Illumination: its Distribution and Measurement*, by A. P. Trotter (1911); *Elements of Illuminating Engineering*, by A. P. Trotter (1921); *Illuminating Engineering Practice*, a series of lectures delivered at the university of Pennsylvania, reprinted in 1916.

Also *The Illuminating Engineer*, the official organ of the Illuminating Engineering Society in London, and the *Transactions* of the Illuminating Engineering Society, U.S.A. (New York).

(See also LIGHTING, ELECTRIC.) (J. S. D.)

IMMINGHAM, a capacious deep-water dock situated on the Lincolnshire shore of the Humber estuary; 9 m. S.S.E. of Hull and 5 m. N.N.W. of Grimsby, England. Constructed by the Great Central Railway Co., the dock in 1921 comprised a square basin and two long arms (including a graving dock) running parallel to each other on the western side, of a total area of 45 ac., with 5,400 ft. of quayage; the depth, ranging from 30–35 ft., is sufficient for practically any vessel afloat. The dock is specially designed and equipped for dealing with the coal, timber, grain and wool trades. Construction was begun in 1906 and the official opening by the King took place on July 22 1912.

The area of the dock property, 2½ m. in length and 1 m. in greatest depth, is just over 1,000 ac. with a river frontage of 1½ miles. Railway sidings extend to 172 m. and have a capacity for 16,850 waggons carrying upwards of 174,000 tons of coal. The particular site of Immingham was chosen because the deep-water channel of the Humber, which lower down runs midway between the shores, here makes an inward sweep and leads right to the dock gates, thus obviating much initial dredging, providing ingress and egress at any state of the tide, and rendering the towage of the vessels unnecessary. The entrance lock, 840 ft. in length and 90 ft. broad, has a depth ranging from 47 ft. at high water to 27 ft. 6 in. at low water of spring tides, and is furnished with three sets of gates. Long jetties spring out on either side of the entrance, curving round about midway in order to run parallel to the river, thus forming a huge funnel-shaped entrance; the eastern jetty forms a landing-stage for passenger traffic and the western is designed for the shipment of bunker and cargo coal. Eight hydraulic hoists, of the most up-to-date pattern, are capable of shipping 5,600 tons of coal per hour.

There is an immense granary and a wool warehouse with capacity for 40,000 bales. A new town is springing up near-by—the original village of Immingham lies a little inland. The Grimsby electric tramways have been extended to Immingham and, in addition, a light railway runs between the two places.

IMMUNITY, in pathology (*see* 3.175).—During the year 1920 a very interesting contribution to the study of immunity was published by Dr. Besredka of the Pasteur Institute in Paris. The importance of this contribution lay in the fact that a cellular basis as opposed to a blood basis for immunity was suggested. Besredka in the course of experiments with dysentery bacilli found that the bacilli, whether injected into a vein or under the skin or given by the mouth, always made their way to those areas of the alimentary canal in which dysentery lesions are commonly found. Moreover, damage was confined to these regions.

One of the claims advanced for artificial immunization, *e.g.* by vaccines, is that by raising the resistance of the system to a particular microörganism any attempt by that microörganism to invade the body will be localized. In the Paris experiments, however, localization took place of itself. Thus it would seem that the dysentery organism was able to exercise its malign influence only when in contact with a highly specialized form or type of tissue. No matter where the bacilli entered the system the result was the same. There was no effect, or but little effect, until the tissues of the bowel were reached. The effect was then the one usually associated with an attack of dysentery.

This series of experiments suggested what may be called a tissue affinity for particular microörganisms. Thus, a bacillus *x* being postulated, it would be possible to describe any particular tissue as *x*-sensitive or *x*-resistant. This idea naturally led to the formulation of another question. If reaction is located in special tissues, is immunity also located in these tissues? In order to answer it Besredka gave injections of killed dysentery bacilli (Shiga's) to a number of rabbits. In those rabbits which had a single ingestion of dead bacilli the agglutinin, after 18 days, reached a maximum of 1–200, and after a month it fell to the normal 1–50. A second ingestion was followed by no further effect. The blood showed no trace of agglutinins.

The specific agglutinin formed in the blood in response to an infective agent is of the character of an antidote, using that word in its widest sense. Thus it appeared that the "protection" afforded by ingestion of dysentery bacilli by rabbits was of a very short-lived character, and further that the renewal of the ingestion, so far from increasing the small quantity of agglutinins, was followed a month afterwards by their complete disappearance. Nor did the serum of these rabbits contain any preventive anti-body, for when injected into mice which were afterwards inoculated peritoneally with fatal doses of dysentery bacilli it had no more preventive power than normal serum.

Thus it appeared that after one ingestion of these organisms the intestines of the animal refused to absorb any further quantity. This in a measure pointed to the development of a localized power of resistance. It was resolved to test the matter further by seeing how these rabbits, which carried in their blood neither agglutinin, preventive anti-body nor apparently any other anti-body, behaved when a fatal dose of dysenteric virus was injected into their veins.

The resulting experiments showed that both the rabbits which had had a single injection of killed bacilli (and had a small amount of anti-body in their blood) and those which had had two ingestions (and had no anti-bodies in their blood) behaved in the same way on receiving the intravenous injections of living bacilli. They were solidly protected and showed no ill effects, while, on the contrary, control animals all died within 24 hours.

This seemed to increase the evidence in favour of a localization not only of sensibility but also of resistance or of reaction. Indeed, the possibility presented itself of a double protection—that of the blood and that of the tissues. Besredka believes that the tissue immunity is established in the intestine at the site of the lesions following the first ingestion. The first ingestion does not meet with the localized resistance which it serves to establish and so a part of the antigen reaches the blood and there gives rise to anti-bodies—the agglutinins. When, however, this break in the wall is closed up, a solid immunity is established and the "intestinal barrier" becomes unbreakable. If the ingestion is repeated no more antigen can gain access to the circulating blood and so no further formation of anti-body takes place.

Besredka thus believes that, so far at any rate as dysentery, typhoid and paratyphoid are concerned, animals have only a single means of acquiring active immunity, and no matter which mode of vaccination is adopted—oral, subcutaneous or intravenous—the resulting active immunity is invariably local, that is to say, intestinal. Vaccination is thus only efficacious when the vaccine reaches the intestinal tract, whether it comes by a vein, through the skin or through the mouth. Nor is any object served by producing general reactions and blood resistances. Indeed the method to be preferred is that of oral administration, for it reaches the required positions with minimum loss of time and with maximum security.

In another series of experiments this investigator found that the natural immunity of rabbits to Paratyphoid B. infection could be broken down if a preliminary course of ox-bile had been administered to the animals. The suggestion was that the ox-bile served to break down the localized tissue resistance, for if the bacilli (Paratyphosus B.) were injected intravenously a fatal result also followed. In this case the bacilli were found not in the blood but in the bowel wall, where they would normally have been localized. Thus there are ways (bile) of breaking down a natural localized immunity.

These researches appear to be of a revolutionary character. It is as yet too early to express final opinions on them, but they open up a wide vista of possibilities which will be explored by many workers in this field of medicine.

See "Immunity to the Enteric Fevers," Aug. 28 1920, *British Medical Journal*. (R. M. Wi.)

INCHCAPE, JAMES LYLE MACKAY, 1st BARON (1852–), British shipowner and banker, was born at Arbroath, Forfarshire, Sept. 11 1852, and educated there and at Elgin. In 1874 he was sent to India in connexion with his father's merchant business, which had branches in Bombay, Calcutta and Karachi. In India he had a distinguished career, being member of the Legislative Council of the viceroy from 1891 to 1893 and member of the Council of India from 1897 to 1911. He was created K.C.I.E. in 1894. In 1902 Sir James Mackay negotiated a commercial treaty with China which was signed at Shanghai Sept. 5 (*see* 6.207); he was then created G.C.M.G. He served on most of the Government commissions of inquiry into Indian administration, besides that appointed to investigate the question of the gold standard of Mexico, and in England he sat on the committee of inquiry into the Board of Trade and Local Government administration 1903–4, and Government workshops 1905–7. In 1911 he was raised to the peerage as Baron Inchcape, of Strathnaver. In 1912 he was appointed chairman of a royal commission to inquire into the natural resources and improvement of Imperial trade. Before the World War broke out, Lord Inchcape was already one of the most prominent figures in the British business world, being chairman of the P. & O. Steamship Company after having been chairman of the British India line which was amalgamated with it, and a director (and acting chairman) of the National Provincial Bank, with which the Union of London and Smith's Bank was subsequently amalgamated. As a representative of the shipping industry he took a leading part in all its affairs during the war, and in assisting the Government to sell its surplus ships after the war to private owners.

INCOME TAX (*see* 14.356).—I. United Kingdom. The income tax position in 1910 was briefly this. The rate of the tax was 1s. 2d. in the £, and the exemption limit was £160. Earned income paid at 9d. in the £ if the total income did not exceed £2,000, at 1s. if the total income did not exceed £3,000. Earned income over the £3,000 limit, and all "unearned" income, paid at 1s. 2d. in the pound. Graduation was effected partly by a series of abatements (of £160, £150, £120, and £70 for individuals whose total incomes did not exceed £400, £500, £600, and £700 respectively) and partly by the recently introduced super-tax, which was an additional duty or income tax, centrally administered, and charged by direct assessment on the recipients of incomes exceeding £5,000. Super-tax was charged in those cases at 6d. in the £ on every pound by which the income exceeded £3,000.

It will be seen that in 1910 the principle of graduation, which, after a long struggle, had at last been definitely adopted into the income tax system, was very imperfectly applied. There were abrupt "jumps" in the effective rate immediately above the various abatement limits, but between £701 (where the abatements ceased to apply) and £5,000 (where the super-tax began) there was no graduation at all. The total yield of the tax for 1910 was £38,344,767, and the yield for each penny of the rate was £2,738,912. Super-tax produced £2,702,892 from 11,713 super-tax payers.

From this position there was no considerable change until the Finance Act of 1914 increased the rate to 1s. 3d. and made an attempt at a more complete graduation. The rate on earned income rose by five steps instead of three to the maximum rate, which was reached above £2,500; unearned incomes (graduated now for the first time) went by three steps to the maximum rate, which was charged on incomes above £500. The super-tax limit was reduced from £5,000 to £3,000, and the super-tax, instead of being charged at a uniform flat rate of 6d., was charged, on the income in excess of £2,500, at seven rates rising from 5d. to 1s. 4d. in the £ on successive "slices" of income. The children allowance was increased to £20.

The Finance Act of 1914 which made these changes—very characteristic of the natural development of the tax—was passed on July 31 1914. Next week the World War broke out.

War Developments.—Owing to war requirements the rate of tax rose rapidly. The second Finance Act of 1914 increased it to 1s. 8d.; the first Finance Act of 1915 to 2s. 6d., the second to 3s.; in 1916 it rose to 5s. and in 1918 to 6s. in the pound. In 1918 also the super-tax limit was put down from £3,000 to £2,500 (on the income in excess of £2,000) with a new scale of charges running up to 4s. 6d. in the pound.

But in addition to mere increases in the rate of tax the war was responsible for many other changes and developments. In 1915 the exemption limit was reduced to £130, and the "abatements" allowed to persons whose total income did not exceed £700 were reduced. This lowering of the exemption limit—which was an attempt to spread the cost of the war down the scale of incomes at the same time as the excess profits duty was laid upon the larger incomes—brought an immense number of new taxpayers under the purview of the Inland Revenue Department; and these new taxpayers were not only very numerous, but they were largely of the weekly wage earning class, a class wholly unaccustomed to the payment of any annual tax, or indeed to annual payments of any kind. To have legislated to make them pay income tax in one sum on their whole year's income would have been to invite failure. It was therefore decided to assess quarterly and to collect tax quarterly from weekly wage earners employed by way of manual labour; and presently it was arranged that payment might be made in these cases by the purchase of income tax stamps to be stuck on a card and ultimately handed in to the collector.

The war and the high rates of tax also rendered necessary the provision of special reliefs for persons whose profits were adversely affected by the war; the granting of specially low rates of tax to soldiers and sailors; payment of tax in two half-yearly instalments; a further increase of the children allowance, and the grant, for the first time, of an allowance for a wife, in order that the heavy burden of taxation should be more fairly distributed between the bachelor and the family man.

"Double" Income Tax.—The rapid increase of taxation both in the United Kingdom and in the British Overseas Dominions brought into new prominence a grievance which, though long felt to be annoying and inequitable, had not hitherto been a very severe hardship. It arose from the fact that, owing to the income tax being imposed in the United Kingdom on all the income of a British resident irrespective of the country of its origin, income which arose in a Dominion and was taxed there was again taxed in this country in the hands of the resident recipient. With high rates of tax in both countries this hardship was suddenly and enormously magnified, and in 1916 an attempt was made to deal with it. Where the same income was assessed both in the United Kingdom and in a British possession relief was to be granted (as a maximum) so as to bring the United Kingdom rate charged on that income down to 3s. 6d. As the rate in force was then 5s. in the £, the maximum relief was 1s. 6d. When the rate was increased to 6s. in 1918 this provision was still continued, the effect being to increase the maximum relief to 2s. 6d. in the pound. The relief was granted at the expense of the British Exchequer. This attempt to remedy the double income tax grievance was admittedly only a temporary expedient, made without prejudice to the ultimate settlement between the Exchequers concerned, and it was coupled with an undertaking that the whole matter should be fully gone into after the war.

Non-deduction at Source.—The war was responsible also for a striking departure from the great principle of deduction of tax "at the source," which since 1803 has been the characteristic feature of the collection of the tax. The necessity for attracting foreign money led to the issue early in 1917 of the 5% War Loan, 1929–47, subject to the condition that the interest on the loan should be paid in full without deduction of tax. Recipients of interest who were ordinarily resident in the United Kingdom were to be liable to direct assessment on the interest, but the interest paid to holders who were not ordinarily resident in the United Kingdom was altogether exempt from tax. The same course was followed in some other war issues, but the Treasury reverted after the war to the old method.

Farmers.—The rise in the price of commodities consequent upon the war drew attention to the income tax position of farmers. Under Schedule B of the Income Tax Acts, farmers had always been assessed not upon their actual ascertained profits but upon a conventional amount based on the rent or annual value of their farms. From 1896 to 1915 the Schedule B assessment, intended to represent the profit of the occupation of land, was fixed at one-third of the rent. Under war conditions this position rapidly became so favourable to the farmers that a change had to be made. In 1915 the Schedule B assessment for farmers was fixed at the full rent instead of one-third of the rent, and in 1918 it was raised to twice the rent. Seeing, however, that a farmer can always elect to be assessed under Schedule D on his actual average profits, and can, moreover, have his Schedule B assessment adjusted if his profits prove to be less than the conventional basis of twice his rent, he is still in a favoured position in spite of the six-fold increase in his Schedule B basis.

The Royal Commission, 1919.—Even before the war there had been many evidences of a desire for a general and searching inquiry into the income tax. Its administrative machinery was very old, and parts of it were in practice obsolete; the main features of the tax dated from a time when the conditions of business life were widely different from modern conditions; and the law on the subject could only be collected piecemeal and with much labour from half a hundred statutes. The Government had before the war promised to appoint a commission with full powers of inquiry, and this commission was on the point of being set up when war began. Postponement was inevitable. But in the meantime a very salutary work was undertaken by way of preliminary. This was the task of consolidating the existing income tax law into one comprehensive statute, a step very necessary to be taken before any thorough survey of the income tax position could be made by a commission consisting in the main of laymen.

As the result of much labour, first on the part of a departmental committee and then of a joint select committee of the House of Lords and the House of Commons, the Income Tax Act, 1918, was passed on Aug. 8 1918, with effect as from April 6 1919. It did not alter the law. It was merely a consolidating measure. The fact that the whole of 13 Acts and parts of 39 others were repealed by the 1918 Act is sufficient proof that the time was ripe for consolidation.

The long-expected and long-promised inquiry into the tax came within a few months of the cesssation of hostilities. A Royal Commission of 23 members, under the chairmanship of Lord Colwyn, was appointed by Royal Warrant dated April 4 1919. The terms of reference were widely drawn:—"To inquire into the income tax (including super-tax) of the United Kingdom in all its aspects, including the scope, rates and incidence of the tax; allowances and reliefs; administration, assessment, appeal and collection; and prevention of evasion; and to report what alterations of law and practice are necessary or desirable and what effect they would have on rates of tax, if it were necessary to maintain the total yield." The Royal Commission held 50 sessions, examined 187 witnesses (including 21 official witnesses), and issued a long and comprehensive report (Cmd. 615) on March 11 1920. They also published in two volumes a verbatim report of the minutes of evidence, running to 1,383 pages, and a further volume containing 71 appendices to the minutes of evidence, and an index to the whole. These three volumes contain an enormous mass of information on the subject and are indispensable to the serious student. Among the appendices are a short history of the tax, an exposition of the existing income tax system, historical memoranda on various aspects of the tax, notes on the position in the Dominions and foreign countries, and much interesting statistical information.

The report, which was signed by all the commissioners—the reservations being few and comparatively unimportant—ranged over the whole field of the tax. There was no minority report.

The recommendations of the Royal Commission were very numerous, detailed and far-reaching; only the more important need be summarized here.

In Part I. of the report, dealing with "the scope of the tax," they recommended that certain classes of non-recurring or "casual" profits, which are now outside the charging words of Schedule D, should be made assessable (paragraph 91); and that British subjects residing abroad should no longer be deprived of the allowances and reliefs granted to residents (paragraph 65). They also proposed a modification of the relief in respect of "double income tax." On this question of "double taxation within the Empire" a sub-committee of the Royal Commission had conferred with representatives of the Dominions and of India who had come to this country for the purpose, and the report of that sub-committee was accepted by the whole commission. The principle underlying their recommendation was that where income tax is charged on the same income both in the United Kingdom and in a Dominion the total relief to be given should be equivalent to the tax at the lower of the two rates of tax imposed. The recommendation was in the following terms:—

"Firstly, that in respect of income taxed both in the United Kingdom and in a Dominion, in substitution for the existing partial reliefs there should be deducted from the appropriate rate of the United Kingdom income tax (including super-tax) the whole of the rate of the Dominion income tax charged in respect of the same income, subject to the limitation that in no case should the maximum rate of relief given by the United Kingdom exceed one-half of the rate of the United Kingdom income tax (including super-tax) to which the individual taxpayer might be liable; and

"Secondly, that any further relief necessary in order to confer on the taxpayer relief amounting in all to the lower of the two taxes (United Kingdom and Dominion), should be given by the Dominion concerned." (Paragraph 70.)

In Parts II. and III., which dealt with "Rates and Incidence of the Tax," and "Allowances and Reliefs," an entirely new system of differentiation and graduation was proposed. Differentiation in favour of earned income, instead of being effected by a special series of rates of tax, was to be made by deducting one-tenth of the earned income (paragraph 111), in order to arrive at the "assessable income"—a new term—subject to a maximum deduction of £200. The old system of graduation by means of a series of abatements was to be superseded by a new plan. From the "assessable income" various personal and other allowances were to be made—for the taxpayer himself, his wife, children and dependants—and the balance was to be called the "taxable income." The first £225 of this "taxable income" was to be charged at half the standard rate, and the remainder at the full rate (paragraph 139). Further graduation in the higher ranges of income was to be by way of super-tax on the old lines. The new "personal allowance" was to be £135 for the unmarried taxpayer and £225 for the married couple (equal to £150 and £250 respectively in terms of "earned" income). This, in effect, was a raising of the old "exemption limit" and a considerable increase in the "wife allowance," but the new "personal allowances" were to be given to all taxpayers, without regard to the amount of their total income. The allowances in respect of children and other dependants were also to be allowed irrespective of the size of the taxpayer's income—a notable change (paragraph 270). The incomes of husband and wife were still to be aggregated for income tax purposes (paragraph 260); the spouses were to be allowed (as before) to make separate returns and to pay tax separately if they wished, but this was not to alter the total amount to be paid, which was still to be fixed by reference to the amount of the combined incomes.

The effect of this new system of graduation was to produce a smooth and gradual rise in the effective rate of tax as the income increased. The old line of graduation proceeded by a series of steps, the rise in some parts of the scale being much steeper than in others; the new plan (as shown by the graphs appended to the report) produced a line which rose smoothly and evenly instead of by a succession of jerks.

The commissioners expressed their strong conviction that the principle of "taxation at the source," a principle which underlies the whole scheme of the income tax in this country, must on no account be abandoned (paragraph 154). They recommended an allowance, subject to a good many qualifications, for certain wasting assets (paragraph 200).

When they came to deal with the administrative machinery of the tax, in Part IV. of the report, the Royal Commission had much to say that was of interest. The machinery provisions in the Act of 1842, when Peel reimposed the tax, were taken from the Act of 1806, which in its turn followed earlier models, and, as the commission said, looked back for its origin to the old Subsidy Acts (paragraph 331).

However well adapted to the social and commercial conditions of 1806 those provisions may have been, it was inevitable that they should be found wanting when examined in 1920. The Royal Commission found that the smooth working by the machine was "rendered possible only by considerable deviations from the scheme of administration originally conceived by the founders of the tax" (paragraph 331), and that "an attempt by the General Commissioners to carry out the Income Tax Acts literally would result in a breakdown of the machinery" (paragraph 342). They found that the position in the scheme originally allotted to the Crown's representative (the inspector of taxes) had gradually grown in importance with the development of the tax, and they reported that "without this gradual devolution to the inspector the machinery of the tax would have been found to be hopelessly inadequate" (paragraph 331). Most of their recommendations on this aspect of their subject were, as they themselves stated, "directed towards recognizing and giving legal sanction to those practical developments in the working of the tax which have so largely contributed to its success." They include (*a*) the abolition of the office of assessor (paragraph 386), (*b*) the transfer of certain clerical work from the clerk to the local commissioners to the inspector (paragraph 369), (*c*) the granting to the inspector of the power to make assessments in certain cases. The fundamental feature of the existing system—the right of the taxpayer to appeal against any assessment to the general commissioners, a local and unpaid body—was approved by the Royal Commission, but they made various suggestions as to the personnel and the tenure of office both of those commissioners and of the additional commissioners (another local unpaid body by whom assessments under Schedule D are made).

Part V. dealt with "assessment, appeal and collection" and covered a great variety of subjects. Among other things the commission proposed a rearrangement of the contents of the five categories or "schedules" into which incomes are divided for income tax purposes. Certain properties (such as railways, mines, gasworks, docks, etc.) were to be transferred from Schedule A to Schedule D which is the schedule under which profits of trade are charged; farmers' profits were to be transferred from Schedule B to Schedule D; and all incomes from employments were to be assessed under Schedule E which now includes certain classes of employments only. To the new Schedule D as so reconstituted a new basis of assessment was to be applied. The existing basis for Schedule D assessments is, generally speaking, the average of the profits of the three preceding years; but some classes of income are assessed under Schedule D on other bases. The incomes proposed to be transferred to Schedule D are also assessed on a variety of bases. The Royal Commission recommended that all this assortment of bases should be swept away, and that all the incomes to be assessed under the newly constituted Schedule D should be charged on the one uniform basis of the income of the preceding year.

Recommendations were also made with regard to the income tax liability of coöperative societies, but to these proposals there were several reservations (printed at the end of the report) on the part of some of the commissioners.

Part VI. was confined to the question of evasion of the tax and to the suggestion of possible preventive measures. The commission were satisfied that a good deal of evasion existed and they made many proposals for dealing with it, mainly in the direction of giving the assessing authorities more power to call for accounts and information from the taxpayer, including (with certain safeguards) the power to have access to original books of account.

Growth of the Tax.—The accompanying tables will give some idea of the growth of the tax from the year 1911–2 onwards. In drawing inferences from the figures given it is always necessary to bear in mind not only the alterations in the rate of tax but also the effect of the various legislative changes made during the years in question.

Income Tax (Excluding Supertax).

	Actual income liable to Tax before deduction of personal or family allowances and reliefs	Income on which Tax was received	Net produce of Tax	Normal rate of Tax		Produce of each penny of the normal rate of Tax
	Million £	Million £	Million £	s.	d.	£
1911–2	866	720	39	1	2	2,830,830
1912–3	907	755	41	1	2	2,969,591
1913–4	951	791	43	1	2	3,108,810
1914–5	985	814	63	1	8	3,169,614
1915–6	1050	873	118	3	0	3,299,034
1916–7	1373	981	201	5	0	3,360,612
1917–8	1631	1083	220	5	0	3,668,133
1918–9	2072	1287	303	6	0	4,217,088
1919–2	Not available	Not available	330*	6	0	4,580,000*
1920–1	do.	do.	350*	6	0	4,860,000*

* These figures are only estimates. For 1921–2 the estimated produce of each penny was £5,000,000.

Super-Tax

Amount of assessments, and number of persons charged, years 1911–2 to 1916–7; estimated income, yield, and numbers of persons chargeable for 1917–8, 1918–9 and 1919–20.

	Total income (including the first portion of income on which no super-tax is payable)	Yield of the super-tax	Number of persons chargeable	Incomes chargeable
	Million £	£		
1911–2	150	2,842,177	12,253	exceeding £5,000
1912–3	158	2,995,877	12,887	do.
1913–4	176	3,349,757	13,937	do.
1914–5	242	11,253,473	29,996	exceeding £3000
1915–6	231	19,621,262	29,299	do.
1916–7	261	21,697,019	31,985	do.
1917–8	296	25,500,000	35,250	do.
1918–9	350	40,000,000	48,000	exceeding £2,500
1919–20	410	46,000,000	56,000	do.

For 1920–1 and 1921–2 super-tax was charged on incomes exceeding £2,000; the estimated Exchequer receipt for 1920–1 was £55,281,000, and the number of persons chargeable was estimated at 81,000.

In the Finance Act of 1920 effect was given to some of the recommendations of the Royal Commission. Their suggestions were so numerous that they could only be carried into law by instalments, and the Finance Act, 1920, represented the first instalment. The new plan of differentiation, graduation and allowances was adopted in its entirety, and the relief proposed for double taxation within the Empire was also passed into law. At the same time the super-tax limit was brought down so as to include all incomes exceeding £2,000, and the super-tax rates increased, in close conformity with the suggestions of the commission.

A further instalment of the recommendations, dealing with the basis for assessment under Schedule D and with the machinery of administration, were embodied in a Revenue bill which was introduced in 1921 but was dropped for the session.

The Finance bill of 1921 contained no important income tax changes. The standard rate for 1921 remained at 6s. in the £, and the super-tax rates, on successive slices of income, were as they were fixed in 1920, viz:—

	s.	d.
On the first £2,000 of the income	Nil	
" next £ 500 (to £2,500)	1	6
" " £ 500 (to £3,000)	2	0
" " £1,000 (to £4,000)	2	6
" " £1,000 (to £5,000)	3	0
" " £1,000 (to £6,000)	3	6
" " £1,000 (to £7,000)	4	0
" " £1,000 (to £8,000)	4	6
" " £12,000 (to £20,000)	5	0
" " £10,000 (to £30,000)	5	6
" remainder (above £30,000)	6	0

The effective rates of income tax (combined with super-tax) on selected incomes are shown in the following table:—

Actual total Income	Single Persons				Married Couples without children				Married Couples entitled to allowance for 3 children			
	If Income all "Earned" Income		If Income all "Investment" Income		If Income all "Earned" Income		If Income all "Investment" Income		If Income all "Earned" Income		If Income all "Investment" Income	
£	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
200		8		11½	Nil		Nil		Nil		Nil	
300	1	4	1	8		5½		9	Nil		Nil	
400	1	8	2	3½	1	0	1	4		4		7½
600	2	11	3	6½	2	0½	2	7½	1	1½	1	8½
800	3	6½	4	1½	2	10½	3	5½	2	2½	2	9½
1,000	3	11	4	6	3	4½	3	11½	2	10	3	5
2,000	4	8	5	3	4	4½	5	0	4	1½	4	8½
3,000	5	8	6	1	5	6	5	11	5	4	5	9
4,000	6	5	6	8	6	3	6	7	6	1	6	5
5,000	6	11	7	2	6	10	7	1	6	8	6	11
6,000	7	4	7	7	7	3	7	5	7	2	7	4
8,000	8	1	8	3	8	0	8	2	7	11	8	1
10,000	8	8	8	9	8	7	8	9	8	7	8	8
25,000	10	2	10	3	10	2	10	2	10	1	10	2
50,000	11	0	11	1	11	0	11	1	11	0	11	0
100,000	11	6	11	6	11	6	11	6	11	6	11	6

On incomes above £100,000 the effective rate continued to progress, approximating to 12s. in the £ on the highest incomes.

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(H. M. Sa.)

II. UNITED STATES

Although taxes on gains and profits derived from personal ability as distinguished from property—the so-called "faculty taxes"—were employed in the American colonies before the middle of the 17th century, no successful use of the general income tax was made in the United States until the Civil War; and the income taxes then adopted were soon thereafter repealed or fell into practical disuse. The demand for effective income taxation, however, showed great vitality. It kept moribund income-tax laws on the statute books in several states, led to abortive experiment with the tax, particularly in the "forties" and "nineties," and finally in 1909 resulted in the adoption of a Federal excise tax "with respect to the carrying on or doing business" by corporations, equivalent to 1% of the annual net income over and above $5,000. This proved to be in substance an effective income tax.

In 1911 (after the adoption of an empowering amendment to its constitution in 1908), the state of Wisconsin passed a general income-tax law applicable to individuals, partnerships and corporations; and the practical success of this tax encouraged other states to adopt similar laws or to vitalize the administration of unsuccessful income taxes already on the statute books. The following states now use the modern income tax:—Wisconsin, Massachusetts, Connecticut (corporations only), New York, Oklahoma (personal incomes only), West Virginia (corporations only), Missouri, Virginia, Delaware (personal incomes only), North Dakota, North Carolina, and Montana (corporations only). On Feb. 25 1913 the foundation for the Federal system of income taxation was laid by the ratification of the Sixteenth Amendment, which provided as follows:—

FEDERAL INCOME TAX

	1913	1916	1917	1918	1919
Personal Income Tax.					
Total number of returns	357,598	437,036	3,472,890	4,425,114	5,332,760
Total net income	$3,900,000,000	$6,298,577,620	$13,652,383,207	$15,924,639,355	$19,859,491,448
Total tax yield	$28,253,535	$173,386,694	$691,492,954	$1,127,721,835	$1,269,630,104
Average tax per individual	$79.01	$396.60	$199.11	$254.85	$238.08
Average rate of tax:—					
Incomes $1,000– 2,000	—	—	0·66 %	1·19 %	0·87 %
" $5,000– 10,000	—	·61 %	2·41 %	4·34 %	3·10 %
" $25,000– 50,000	—	1·41 %	7·34 %	13·32 %	12·13 %
" $100,000–150,000	—	3·48 %	13·92 %	33·68 %	33·12 %
"$1,000,000 and over	—	11·09 %	35·65 %	64·65 %	—
General average rate	1 %	2·75 %	5·06 %	7·08 %	6·39 %
Normal rate $4,000 and under	1 %	2 %	4 %	6 %	4 %
Normal rate over $4,000	6 %	2 %	4 %	12 %	8 %
Maximum surtax	—	13 %	63 %	65 %	65 %
Incomes under $5,000:—					
Per cent. of total returns	—	36·59 %	87·56 %	89·17 %	—
Per cent. of total net income	—	9·91 %	48·66 %	59·00 %	—
Per cent. of total tax	—	1·14 %	10·58 %	12·84 %	—
Incomes over $100,000:—					
Per cent. of total returns	—	1·54 %	0·56 %	0·33 %	—
Per cent. of total net income	—	29·47 %	17·96 %	10·49 %	—
Per cent. of total tax	—	73·11 %	65·83 %	54·73 %	—
Per cent. of total tax returned in:—					
New York	44·32 %	44·96 %	36·96 %	31·41 %	31·49 %
Pennsylvania	11·24 %	10·15 %	11·53 %	12·22 %	10·10 %
Illinois	7·34 %	6·31 %	7·02 %	7·50 %	7·83 %
Massachusetts	5·33 %	6·28 %	6·47 %	7·21 %	6·82 %
Per cent. number of returns to population	0·37 %	0·43 %	3·40 %	4·27 %	5·03 %
War profits and excess profits tax returned by individuals	—	—	$101,249,781	—	—
Returned by partnerships	—	—	$103,887,984	—	—
Personal exemptions:—					
To individual	$3,000	$3,000	$1,000	$1,000	$1,000
To head of family	$4,000	$4,000	$2,000	$2,000	$2,000
For each dependent	—	—	$200	$200	$200
Corporation Taxes.					
Total number of returns	316,909	341,253	351,426	317,579	330,000*
Returns showing taxable income	188,866	206,984	232,079	202,061	—
Returns showing no taxable income	128,043	134,269	119,347	115,518	—
Total net income	$4,714,000,000	$8,765,900,000	$10,730,400,000	$8,400,000,000	$9,100,000,000*
Income tax yield	$43,127,740	$171,805,150	$503,698,029	$653,198,483	—
War profits and excess profits tax yield	—	—	$1,638,747,740	$2,505,565,939	—
Total tax yield	$43,127,740	$171,805,150	$2,142,445,769	$3,158,764,422	$2,050,000,000*
Grand total—Income and profits taxes, individuals and corporations	$71,381,275	$345,191,844	$2,921,583,203	$4,286,486,257	$3,319,630,104*

*Estimated.

The Congress shall have power to lay and collect taxes on incomes, from whatever source derived, without apportionment among the several states, and without regard to any census or enumeration.

The development of the Federal income tax in the Acts of Aug. 5 1909, Oct. 3 1913, Sept. 8 1916, Oct. 3 1917, and Feb. 24 1919, is suggested statistically in the appended tabular statement.

The most important characteristic of the Federal income tax is its striking productivity, the elasticity of which is illustrated by the increase of the Federal taxes based on income from $345,191,844 for 1916 to $2,921,583,203 for 1917 and to $4,286,486,257 for 1918. These enormous sums (now collected from taxpayers in four quarterly instalments each year) have been raised without causing bankruptcy or widespread distress to taxpayers. As appears in the table, the personal exemptions granted by the Federal law are high compared with the similar exemptions allowed in other countries, and only a small proportion of the population is directly affected by the tax. A large proportion of the tax is collected in the industrial or urban states, and is thus marked by some unfortunate class and sectional characteristics. Compared with the similar taxes of other countries, the rates on small and moderate incomes are low: while the rates on the larger incomes are comparatively high, probably the highest collected in any important country.

From the technical standpoint, the striking characteristics of the Federal tax are: its taxation of gains from the occasional sale of capital assets (the constitutionality of which was affirmed March 28 1921 by the U. S. Supreme Court in *Merchants' Loan and Trust Co.* v. *Smietanka*); its failure, largely because of constitutional limitations, to reach interest on municipal bonds and other tax-free securities; the relatively small and decreasing use of "stoppage-at-source" (whereby the normal tax is withheld and paid direct to the Government by payers out of the payments due to corresponding payees); the full credit accorded for income and profits taxes paid to any foreign country on income derived from sources therein; the complexity of the law arising largely from the "cushions" or relief provisions (such as the deduction for amortization and the allowance for depletion on the basis of discovery value in the case of mines and oil wells discovered by the taxpayer) designed to protect the taxpayer against hardship; the great centralization in the administration of the tax; and the delay in the audit and inspection of the larger and more important returns due principally to the complexity of the law and the centralization of the administration. The structure of the tax creates some difficulties. Individuals pay a "split-normal" tax of 4 and 8 % (see table) and surtaxes rising from 1 to 65 %, while corporations pay 10 % (on income in excess of the specific exemption of $2,000), and excess profits tax. This plan is unsatisfactory and the excess profits tax, it was believed, would be repealed at the close of 1921. The other principal defects of the tax—the excessive rates of surtax; the demoralizing influence of tax-exempt income; the complexity of the tax; the delay in audit; and the over-centralization of administration—were generally acknowledged even by the friends of the tax, and legislative efforts to correct these failings were (1921) being made.

In the states, the adoption of income taxes was hastened by the unsatisfactory operation of the personal property tax, particularly on intangible personal property, and the so-called corporation franchise taxes. The income tax is being used (1921) to replace these taxes. The newer state income taxes are generally administered by state or central authority. There is an increasing tendency to compute the tax on the basis of the Federal return, and an effort is made by apportionment devices to exempt, in whole or in part, business or corporation income derived from property located and business transacted without the state. Jurisdictional questions and multiple taxation thus constitute fundamental problems. The Wisconsin tax is progressive on both individuals and corporations, rising (with surtaxes for soldiers' and educational bonus) to 13·2 % on individual incomes in excess of $12,000 and on corporation incomes in excess of $7,000. The Massachusetts tax varies in rate for different classes of income, being 1½ % on annuities and income from salaries and trade or business, 3 % on the excess of gains over losses sustained from the purchase and sale of securities and intangible personal property, and 6½ % on interest and dividends. The corporation tax in Massachusetts is at the rate of 2½ %. In New York the personal tax rises from 1 % on income not exceeding $10,000 to 3 % on income in excess of $50,000, and the corporation tax is at the rate of 4½ %. While the rates at which the state taxes are imposed are thus not immoderate, they create when added to the Federal tax a serious burden. The newer state laws, while centrally administered, provide for the return of a substantial portion of the tax to the county or local governments.

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(T. S. A.)

INDIA (*see* 14.375).—The sixth decennial census of India (British India and the native states) was taken on March 18 1921. The provisional figures gave a total pop. of 319,075,132, of which 247,138,396 is the pop. of British India and 71,936,736 that of the native states. The corresponding figures of the decennial census of 1911 were: British India 243,933,178 and native states 71,223,218. The rate of increase in the decade ending 1921 is thus only 1·2%, a notable drop in comparison with the advance of the pop. in the immediately preceding decade, but nearly identical with the results of the 1901 census. The growth of the Indian pop. in the last 40 years had been singularly uneven. The percentages of increase in the several decennial periods were as follow:—9·6% in 1881–91; 1·4% in 1891–1901; 6·4% in 1901–11; 1·2% in 1911–21.

Vital Conditions.—These remarkable variations are, as might be expected, mainly due to the character of the agricultural seasons and the absence or presence of great epidemics of disease. The decade of 1881–91 was one of recovery from the great drought which devastated the Madras and Bombay Presidencies in 1876–8. The seasons were generally good and food was cheap and abundant. The next decade (1891–1901) was marked by one of the worst visitations of drought and famine, extending over the years 1896 and 1897, that India has known. It affected a population of nearly 70 millions, and was especially intense in the United Provinces, Bihar, the Central Provinces, Madras and Bombay. In the spring of 1897 4,000,000 people were receiving relief and the mortality, despite the efforts of the State to alleviate distress, was great. In 1896 bubonic plague appeared in Bombay, to which port it had probably been brought by infected rats in grain ships from China, and from thence it spread in an epidemic form into nearly every part of India. Under the ravages of plague and famine the population actually decreased in the decade in several provinces and native states, and the rate of advance for the whole of India was only 1·4%. In the next decade (1901–11) conditions were better. But a serious failure of the monsoon rains occurred in Upper India in 1908, and many parts of the country were devastated by plague. The growth of the population was curiously uneven in the different provinces and native states. The Central Provinces and Berar recorded an increase of 18%, the native states attached to those provinces an increase of nearly 30%, and the important state of Hyderabad one of 20%. These high figures represent the filling-up of famine losses in some of the less populous regions of India. In the more thickly populated provinces of Madras, Bombay and Bengal the increase ranged from 5% to 8%, while in the United Provinces and the Punjab the pop. actually declined. The very moderate rate of increase (6·4% in the decade) returned for India as a whole represented the mean of widely different provincial rates and concealed the recuperative power which the Indian population exhibited in those parts of the country where conditions were favourable.

The decade 1911–21 showed the lowest figure of increase since the decennial census was instituted in 1871. Up to 1917 the seasons were normally good and the public health not unsatisfactory. Notwithstanding the World War and its economic effect in raising prices and restricting the supply of necessary imports, the country was generally prosperous. A comparison of the yearly birth-rates with the corresponding death-rates showed an increasing population. But in 1918 a double calamity befell India. The monsoon rains failed over the greater part of the country. The losses of crops were estimated at 20 million tons or one-fourth of the average production. Food grains, milk and other nourishing food were at famine prices. The Government met the situation by importing wheat from Australia and rice from Burma, by a rigorous control over existing food stocks and by various relief measures. But distress was general and acute. On the top of this disaster a virulent form of influenza spread throughout India. Within the space of four or five months the epidemic was responsible for five million deaths in British India and a million in native states. The death rate of 1918 in British India exceeded 62 per mille or nearly double the birth-rate, as against a normal death-rate of about 30 per mille. In several provinces it was markedly higher. The United Provinces returned a death-rate of 83 per mille, the Punjab 88 per mille and the Bombay Presidency 93 per mille. Thus the decade which had opened prosperously closed on a people impoverished by scarcity and decimated by disease. The facts are reflected in the census returns.

Several provinces and a number of native states show an actual decrease of population. The pop. declined 2·6% in the United Provinces of Agra and Oudh, 1·6% in Bombay, 1·4% in Bihar and Orissa. The pop. of the United Provinces in 1921 was actually less by several millions than it was in 1891. The conditions of life in this densely populated tract give cause for anxiety. In the Central Provinces and Berar, which in 1901–11 had shown an increase of 18%, the pop. was practically stationary. The important state of Hyderabad, in which the pop. had increased by 20% in 1901–11, recorded a loss of 6·9% and the Rajputana states a loss of 6·4%. To this depressing record a few favoured tracts are exceptions. The pop. of the Travancore state, in the extreme south of the peninsula, increased by nearly 17%, and this on the top of an increase of 16% in the preceding decade. The pop. of Burma, a province which is happily exempt from the droughts and epidemics that afflict the Indian continent and in which the standard of living is considerably higher, continues to expand. In 1901–11 it increased by 15·5%, and in 1911–21 by 9%.

In brief, India is prodigal of human life and prodigal of death to a degree unknown in Western countries. The population nearly everywhere presses close on the limits of bare subsistence. It is largely dependent on the chances of the harvests and the vicissitudes of the seasons. It is peculiarly helpless by reason of its ignorance of natural laws and adherence to hurtful traditions and observances: and it is an easy victim of many diseases which science elsewhere has extirpated or set bounds to. A persistently high birth-rate is constantly kept in check or even nullified by an excessive death-rate. A stationary population is not in itself an evil. But in India it is attained by a profuse expenditure of human life and at the cost of much suffering and misery. In the sphere of social and sanitary reform an immense task and a great opportunity lie before the reformed governments of India.

The statistics of education, occupations, religions and castes were not available for the decade 1911–21 up to Aug. 1921. The census of 1911 had shown that the reforming sect of the Arya Somaj in Northern India grew from 92,419 to 243,514; Sikhs increased from 2,155,339 to 3,014,466; and Christians from 2,923,241 to 3,876,196.

POLITICAL HISTORY, 1910–21

The Morley-Minto Era.—Nov. 1910 saw the close of the Morley-Minto era. Lord Minto then completed the fifth year of his viceroyalty and was succeeded by Lord Hardinge of Penshurst. About the same time Lord Morley exchanged the India Office for the less exacting duties of Lord President of the Council. His successor was the Marquess of Crewe. Many circumstances combined to make the period the opening of a new chapter in the political development of India. The advent of the Radical party to power in England in the autumn of 1905 quickened ambitions and aspirations for a larger measure of self-government that had been steadily gathering force among Indian politicians. They believed that Parliament, as constituted by the result of the recent general election, would not be indifferent to Indian grievances. In Lord Morley they saw the veteran champion of Liberalism and expected much of him. His position was difficult. He refused to undo the "partition" of Bengal. He recognized the difficulties of the Indian Government, but was convinced that a moderate measure of political advance was overdue. He was accused by some of having "shelved the principles of a lifetime," and by others of undermining the foundations of British rule in India. In the considered judgment of the Montagu-Chelmsford report the reforms he effected "constituted a real and important advance." They were "essentially of an evolutionary character"—a natural extension of the previously existing system, a change of degree and not of kind. Lord Morley, in his *Recollections* (1917), has given us interesting glimpses of his relations with the Viceroy, Lord Minto. Though widely different in temperament, training and political outlook, they appear to have worked together in essential harmony.

Lord Minto testified that on large questions of policy they rarely differed, though he thought that at times the Secretary of State interfered unnecessarily with the Indian Government in matters of actual administration, and reduced its authority to that of a mere agent. Lord Morley, undoubtedly, held and acted on the view that the executive in India is a derivative government, responsible not only as to policy but as to administrative acts to Parliament, and as such subordinate in all respects to the Secretary of State. The doctrine was beyond dispute, but may be applied too rigidly. Lord Minto, however, frankly acknowledged that his Government had the unfailing and effective support of the minister whenever its measures were challenged.

Political "Unrest."—Lord Minto went to India believing that what the country most needed was a respite from reforms, and proposed, as he expressed it, " to give the horse a rest in his gallop." But it was soon patent to him that the state of India was beyond an anodyne of the kind. He found widespread " unrest " among the educated classes, which took various forms. Of open organized disaffection there was little except in the dismembered province of Bengal and the newly created province of Eastern Bengal and Assam, where a very bitter agitation, accompanied by the boycott of British goods and frequent disturbances of the peace in which Mahommedans were mostly the sufferers, had been started by Hindu politicians with the object of obtaining a reversal of the partition. The movement kindled the flame of Bengal nationality and became invested with the religious sanctions of Hinduism. The " motherland " of Bengal, it was said, had been desecrated by foreign hands and Kāli, its tutelary goddess, cried for vengeance. Among an excitable and impressionable people crude notions of self-rule and political freedom easily " yoked themselves," as Lord Morley wrote to Lord Minto, " to deep invisible roots of alien race, creed and inviolable caste." The movement caught up students and teachers in schools and colleges and the poorer members of the professional classes. As it gathered strength and was fed by a rancorous press, among the publications of which the *Yugantar* (*New Era*) newspaper was the most notorious until its suppression in 1908, it led not a few of its misguided proselytes into the downward path of anarchical crime. Within two years of Lord Minto's arrival in India secret societies, radiating from Calcutta and Dacca and composed chiefly of young men belonging to respectable families, sprang up in many districts of the two provinces, having for their object the deliverance of India from the foreign yoke. This they sought to compass by assassination and terrorism. The art of bomb-making was imported from Europe. Revolutionary literature and the use of pistols and explosives were sedulously studied. Funds were obtained by gang robberies, usually committed at night and accompanied by murder and violence. In Oct. 1907 an attempt was made to blow up the train in which the lieutenant-governor of Bengal was travelling, in Dec. the district magistrate of Dacca was shot, in April 1908 two English ladies were killed in their carriage by a bomb intended for the district magistrate of Muzaffarpur. Police discoveries followed which made it clear that the Government was faced with a formidable revolutionary conspiracy, organized by obscure fanatics but directed by subtler brains, challenging the very existence of British rule and unamenable to political concessions. An anarchical movement of this kind was really alien to the Indian character. But the mass of the population was inert and terrified, and the moderate section of the politically minded classes was overborne by extremists, who, while dissociating themselves from the " physical force " party, extenuated their acts and laid the blame on the " partition " policy.

But the course which disaffection was to run in the two Bengals and its reactions elsewhere were unsuspected when Lord Minto examined the situation in 1906. The " unrest " which he found existing in other parts of India was of a kind which, notwithstanding disquieting features, was in the main not revolutionary or unconstitutional, and might yield to sympathetic treatment. English books and newspapers had familiarized the educated classes with the political ideas of advanced Western communities. They had become conscious of their strength and the power of the press and platform. The annual meetings of the National Congress, now in its twenty-first year, voiced the advanced views of the more ardent politicians. With increasing boldness the Congress leaders inveighed against the Government as a jealous bureaucracy, oppressive in policy, deaf to outside opinion and bent on excluding Indians from high administrative office. They dwelt on the poverty and stagnation of India and contrasted it with the brilliant progress made by Japan. What the National Congress said once a year, extremist Indian newspapers said daily. In the partition of Bengal, in the Universities Act and in other measures of Lord Curzon's administration they saw so many insidious attempts to crush their ambitions. Discontent and distrust were in the air. England, it was said, had come to the end of her liberating mission and India had nothing to hope for. Lord Minto took the view that novel forces and aspirations were at work that were natural and just, which the ruling power should not only meet but assist. " A change," he said, " is passing over the land and we cannot afford to dally." In the summer of 1906 he invited his executive council in a Minute to consider the question of political reform or, as he described it, " the possibility of the development of administrative machinery in accordance with new conditions." A tentative project of reform was drawn up in 1907, and with the approval of the Secretary of State in Council was published in England and India. In 1908 the Government of India reviewed it in the light of opinions received from various sources and submitted revised proposals to the Secretary of State. A bill, embodying them as finally settled, so far as they required parliamentary authority, was presented to Parliament by Lord Morley in Feb. 1909 and, after debates in both Houses, was passed with little amendment in May of that year and became law as the Indian Councils Act 1909.

The Morley-Minto Constitution.—The main object of the Act was to enlarge the Legislative Councils and make them more fully representative, introduce the elective principle, give greater powers of discussion and of obtaining information from the executive. Its provisions were wide and general, all details and some important matters of principle being left to rules to be made by the authorities in India. The Act fixed for each Council the maximum number of " additional " members (*i.e.* those other than the members of the executive councils), the number varying from 60 in the Imperial Legislative Council to 30 in the smaller provinces. The proportion of elected and nominated members in each Council, the formation of the electoral bodies, the qualifications of the electors and of persons eligible for election, the procedure of the Councils as regards debate, the moving and effect of resolutions and the asking of questions were left to rules. The actual constitution and powers of the Councils must therefore be sought in the rules. In each Council the nominated members comprised: (1) a substantial *bloc* of officials, the *bloc* in the Imperial Legislative Council being large enough to secure, together with the members of the executive council, an absolute majority; (2) non-officials nominated to represent classes or interests which would otherwise be unrepresented or inadequately represented. In all the Councils, with the exception of that of Bengal, the nominated members exceeded in number the elected members. The number of the latter in any province was too few to admit of any system of territorial constituencies and direct voting. Special constituencies therefore were formed, such as universities, chambers of commerce, groups of municipalities and district boards, the object being to obtain as far as possible a fair representation of the different classes and interests in the country. Special arrangements were also made for the representation of Mahommedans as a separate class or community. The Councils were empowered to discuss and move resolutions on the annual budget and in like manner to raise discussions by resolution on matters of general public interest. But they did not vote the budget and resolutions operated only as recommendations which were not binding on the Government. The Councils had no direct control over the executive, though they could inform and influence it. Lord Morley emphatically said that India was not ripe for parliamentary institutions and that he would be no party to creating them. The Act also increased the number of members of the executive councils of Madras and Bombay from two to a maximum of four, thereby providing a seat for an Indian or two Indian members; it also authorized the creation of an executive council in any province having a lieutenant-governor. The policy of associating Indians with the executive government, thus affirmed as regards the provinces, had already been given effect to as regards the Government of India by the appointment of Mr. (afterwards Lord) Sinha to the Governor-General's executive council. Lord Morley had also placed two Indians on his own council. Of these reforms as a whole it may be said that they gave to India the beginnings of representative institutions and opened to Indians the highest offices of the State.

While the reforms were slowly maturing, increasing disorders in Bengal and the spread of disaffection in other parts of India gave cause for anxiety and made the prospect of an early appeasement doubtful. In the spring of 1907 the enactment of an unpopular law led to a violent anti-British movement in the Punjab. There were seditious meetings in the large cities, serious riots took place, endangering the lives of Europeans, in Lahore and Rawalpindi and attempts were made to tamper with the native army. In Bombay the irreconcilable extremist, Bal Gangadhar Tilak, a Brahmin of the notoriously disaffected Chitpavan sect, passionately advocated *swarāj*, or complete political independence, and in his newspapers, the *Kesari* and the *Mahratta,* denounced the foreigner and foreign rule. When the Muzaffarpur murders took place, the *Kesari*, in a casuistical argument, apologized for and condoned the use of the bomb in Bengal as the latest effective remedy against tyranny. For these articles Tilak was prosecuted and sentenced by the Bombay High Court to six years' imprisonment. Meanwhile another Chitpavan Brahmin established in London a hostel for Indians under the name of the India House, which became the centre of revolutionary plots in the Bombay Presidency. The extent of its machinations became known in the course of the proceedings pursuant to the assassination of Sir W. Curzon Wyllie at the Imperial Institute in London in June 1909 and of Mr. Jackson, the district magistrate of Nasik, in the Bombay Presidency. During this period the extremists sought to commit the National Congress to a rejection of the proposed reforms and to a programme of complete Home Rule, and might possibly have succeeded but for Tilak's conviction and imprisonment. Notwithstanding these unpropitious signs the Indian Government did not waver in their resolve to proceed with the reforms. "I am determined," said Lord Minto in his Legislative Council, "that no anarchical crimes will for an instant deter me from endeavouring to meet as best I can the political aspirations of honest reformers." In giving this assurance to the moderates his Government asked for and obtained increased powers to combat seditious incentives in the press and at public meetings and anarchical crime. In 1907 and 1908 laws were passed for prohibiting in proclaimed areas public meetings of a seditious character, for preventing the publication by the press of matter inciting to murder and other offences, for penalizing the manufacture and use of explosives and conspiracies connected with them, for establishing a special procedure and special tribunals for the trial of crimes of an anarchical nature and for making associations for certain objects unlawful (the Prevention of Seditious Meetings Act, 1907; the Newspapers' Incitement to Offences Act, 1908; the Explosive Substances Act, 1908; the Criminal Law Amendment Act, 1908).

Tranquillizing Effect of the Reforms.—These measures, together with the better appreciation by the educated classes of the substantial nature of the proposed reforms, sensibly improved the situation. Mr. Gokhale, the leader of the moderate section of the nationalist party, a Brahmin of great intellectual capacity, high ideals and selfless devotion, effectively appealed to his countrymen to accept the reforms and, by making the best of them, to prove their fitness for larger political liberties. The King-Emperor's message to the princes and people of India, delivered on Nov. 2 1908, the jubilee of the late Queen Victoria's proclamation, had also a tranquillizing effect. The elections to the new Legislative Councils were conducted in a spirit of goodwill, and the discussions in the opening sessions in Jan. 1910 were marked by moderation and good sense. Though murders of public servants, gang robberies and other acts of terrorism still continued in Bengal and Eastern Bengal, Lord Minto in leaving India in Oct. 1910 was able to declare that the reforms had greatly cleared the air and that a happier feeling was abroad. Except for a serious failure of the monsoon in the autumn of 1908 and consequent losses of crops and cattle over a large area, the country generally was prosperous in Lord Minto's viceroyalty. Irrigation advanced rapidly in the arid tracts of the southwestern Punjab and the wealth of the colonists attracted there from the populous districts of the province became proverbial. The ravages of plague continued unabated and in 1907 the recorded deaths (1,315,000) from the disease reached a maximum. An advisory committee constituted from the Royal Society and the Lister Institute explored the causation of plague and in the light of their researches the Government of India revised the administrative methods of dealing with it. The problem of plague was a part of the larger problem raised by the insanitary conditions of India, especially of the towns. To this increasing attention began to be directed, and steps were taken in Lord Minto's administration to establish a service of medical officers of health in the municipalities and to assist those bodies to carry out sanitary improvements. Among the cities so assisted may be mentioned Rangoon. An important Act establishing an Improvement Trust, to deal with the insanitary and congested areas of Calcutta, was enacted by the Bengal Legislature.

Political Policy of Lord Minto.—A new direction to the relations of the British Indian Government with the native states of India was given by Lord Minto. For some time past there had been signs that some of the ruling chiefs resented the control exercised over them and their states by the suzerain power and suspected it of a wish to increase that control. How far the discontent was justifiable is a matter of opinion. What is clear is that the growth of political ideas, increased contact with Europe and greater consciousness of their privileged position, had tended to make the princes discontented with a relationship which they had formerly accepted without hesitation. Lord Minto took occasion of a state visit to the Maharana of Udaipur to make a declaration of policy (Nov. 8 1909). Taking as his text the guarantee given to the feudatory princes and ruling chiefs in Queen Victoria's proclamation of 1858 and of King Edward VII.'s message of Nov. 1 1908, Lord Minto said that his Government proposed to follow a policy of greater sympathy and elasticity. They would not aim at enforcing uniformity or administrative efficiency and would not press British methods of administration upon the states, but preferred that reforms should emanate from the durbars and be in harmony with the traditions of the states. "The foundation-stone," he said, "of the whole system is the recognition of identity of interests between the Imperial Government and the durbars and the minimum of interference with the latter in their own affairs." The declaration and the spirit in which it was acted upon were very welcome to the ruling princes. Zealous political officers, when faced as they sometimes are with wrongdoing and oppression, may at times be inclined to regret the emphasis laid on non-interference. But it was an essential part of the policy of mutual trust and coöperation. The war vindicated its soundness.

Relations with Afghanistan continued good during Lord Minto's administration. The Amir maintained silence about the provisions of the Anglo-Russian Convention of 1907 affecting Afghanistan, and it was decided not to press him on the matter. He showed his confidence in Lord Minto by accepting the latter's invitation to pay him a friendly visit. He was received in state at Agra on Jan. 9 1908, and afterwards visited some of the principal cities of India. The Viceroy considerately abstained from discussing matters of business during the Amir's sojourn in India. The Amir was delighted with the kindness shown him and let it be known that his friendship with the British Government had been immensely strengthened. As regards the independent tribes on the N.W. frontier the only important event was the sending of two punitive expeditions against the Mohmands and the Zakka Khels in the spring of 1910. Operations were over in less than a month.

Lord Kitchener's Army Administration.—The present military system of India, as regards the organization and administration of the army, is largely due to the changes effected by Lord Kitchener in Lord Minto's viceroyalty (*see* also the section on *Army* below). With the disappearance of the military department and military member of council, the administration of military affairs in the Government of India and the executive command of the army were united in the person of the commander-in-chief. As an exception to this unification, certain branches of army supply were at first made a separate department and placed under a supply member of council. But after three years' experience of the new system Lord Minto obtained the Secretary of State's assent to bringing supply under the commander-in-chief and making the latter supreme over all branches of the army. Briefly stated, Lord Kitchener's scheme was to provide a field army of sufficient strength to meet the maximum danger to which India was likely to be exposed, to distribute the troops composing the field army and those assigned for internal defence into self-contained divisional commands, and to give to the divisional commanders powers and responsibilities that hitherto had been exercised by army headquarters. As subsidiary measures the defences of the N.W. frontier were strengthened, and military equipment and the pay and conditions of service of the Indian army improved. The increase of military expenditure which the scheme involved was viewed with increasing disfavour by Indian nationalists. Lord Hardinge's Government, threatened with the loss of the opium revenue and anxious to find money for education and other civil needs, came to the conclusion that the Anglo-Japanese alliance and improved relations with Russia justified a reëxamination of the military requirements of India. The Secretary of State agreed to refer the question to a committee presided over by Field-Marshal Lord Nicholson. The committee were not unanimous and presented a majority and minority report. Before action was taken on these reports war with Germany and Austria broke out.

Lord Hardinge as Viceroy.—In the spring of 1910 the appointment of Lord Kitchener to succeed Lord Minto as Viceroy seemed probable. Lord Morley records in his *Recollections* (vol. ii., page 333) the objections he felt to the appointment of a soldier, and was prepared to carry them to the point of resignation. His view prevailed. Fate reserved Lord Kitchener for greater tasks and the choice fell on Sir Charles Hardinge, permanent Under-Secretary for Foreign Affairs and formerly ambassador at St. Petersburg. On his elevation to the peerage he took the title of Lord Hardinge of Penshurst. Lord Hardinge's long viceroyalty (Nov. 1910—March 1916) was strenuous and eventful. The earlier years were marked by the visit of King George V. and the Queen to India, the selection of Delhi as the site of the future capital of the Indian Empire, the revision of the "partition" of Bengal and the nefarious attempt of anarchists to compass the deaths of the Viceroy and his wife on the occasion of their state entry into Delhi. The closing years saw India in the throes of the World War. Lord Hardinge, like his predecessor, had an hereditary connexion with India, as his grandfather, the 1st Viscount Hardinge, was Governor-General (1844–8) in the stirring times of the first Sikh War. The goodwill of Indians toward the new Viceroy deepened as they saw his genuine liking for their country; his zeal, carried on one occasion to the point of an indiscretion, to obtain redress of the grievances of Indians residing in other parts of the Empire; and his endeavours to associate their political leaders to the fullest extent possible with the work of government under the reformed Councils scheme. His diplomatic and Foreign Office experience and knowledge of the politics and conditions of the East enabled him to handle dexterously and effectively the external affairs of India and to enter into the difficulties and apprehensions of Indian Mahommedans. He cordially pursued the policy of friendship and coöperation with the ruling chiefs of native states that Lord Minto had inaugurated. Events outside India were beginning to attract the attention of Indians as in no former time. The Mahommedans watched with disquietude the Italo-Turkish War, the revolution in Turkey and the Balkan wars, while Indian politicians and the durbars of native states noted the signs of coming trouble in Europe and speculated as to the results of a catastrophic war. It was an advantage that at this juncture the head of the Indian Government was exceptionally qualified to interpret these world commotions to the Indian public and to explain the attitude of the British Government. Lord Hardinge's addresses to his Legislative Council and to deputations and his speeches on occasions of ceremonial visits to native states, removed misconceptions and inspired confidence. When the World War came in 1914 the popularity of his administration and the personal influence and friendship which he had acquired with the ruling princes had much to do with the magnificent response of India to the call of the Empire.

Working of the Morley-Minto Reforms.—Lord Minto's prediction that the conciliatory measures associated with the reform of the Councils, coupled with the preventive measures which his Government had taken, had cleared the political atmosphere proved correct. On Jan. 5 1911 an important deputation from the Indian National Congress presented an address to the new Viceroy in which they expressed deep and heartfelt loyalty to the Crown and appreciation of the reforms, which "had given the Indian people a larger opportunity than they had before of being associated with the Government in the administration of the country," and which "had done much to bring about a better understanding between the Government and the people." The hope subjoined to these expressions of goodwill that "the regulations in connexion with the Councils which had evoked criticism will be modified in the light of experience" had reference to the provisions for communal and class representation and indirect voting, to which the advanced nationalist party had taken objection on the publication of the regulations. They had set their hopes on large territorial constituencies based strictly on numbers, and were disappointed with a constitution which in these and other respects fell short of their political ideals, and which gave special protection to the Mahommedan community, the landowning classes and other important interests. But as the enlarged Legislative Councils settled down to their work, even the advanced party found in the new powers a healthy outlet for their energies. Social and economic measures, such as compulsory education, alteration in the Hindu law of marriage and the Mahommedan law of property, the encouragement of indigenous industries, the prohibition of emigration beyond seas under indenture to labour, were brought forward in the form of resolutions or bills. Acts of the executive government or its officers were made the subject of questions or debate. The annual financial statement of the Imperial Government or local government, as the case might be, was closely scrutinized and criticized and gave openings for discussion ranging over the whole field of imperial or provincial finance. As already said, the Councils might influence but had no direct control over the Government. They could not turn the executive out of office or refuse supplies. Later on this and other limitations became a serious grievance, but at first they were little dwelt upon. The Governments, Imperial and provincial, showed themselves anxious to adapt their policy and measures as far as possible to popular needs as expressed by the elected members, to show deference to Council resolutions having public feeling behind them, to investigate and remedy alleged grievances and abuses, and when legislating to rely less on voting power than on argument in debate, coupled with concessions on points of detail or secondary importance. As consultative and critical bodies the reformed Councils exercised a real and growing influence and were an educative force. They formed, directed and developed public opinion in political matters. They acted as a restraint upon the autocratic tendencies of the executive and made it more responsive to popular demands, and they strengthened its hands when it had to sustain Indian interests against the interests of Great Britain or of the self-governing Dominions.

The temper of the Legislative Council was tested in the first session by the proposal of Lord Hardinge's Government to place permanently on the statute-book the Prevention of Seditious Meetings Act, which had been enacted in 1907 at the time of the Punjab disturbances as a temporary measure. Mr. Gokhale and three other leading nationalists were opposed to the retention of the Act on the ground that the general situation was no longer such as to justify so exceptional a measure. But the majority of the non-official members were content to accept Lord Hardinge's assurance that the lapse of the Act would endanger the public tranquillity, and his promise that it would never be applied to any part of India unless a clear necessity arose. In the same session the announcement that the King-Emperor and Queen-Empress would visit India in the winter was received with great enthusiasm.

The King's Visit.—The royal visit was a complete success. The presence of the King-Emperor and his consort in India touched the imagination of the people. The Delhi ceremonies drew vast crowds eager to see and salute the sovereign. When a visit to Calcutta followed, the welcome given by the populace of that city was even more enthusiastic and unrestrained. On Dec. 12 1911, in a great arena outside Delhi specially prepared for the occasion, the King held a coronation durbar at which he received in person the homage of the great officers of state and the ruling princes and chiefs of the Indian Empire. Largesse and "boons" of various kinds were granted and an announcement made of great political moment. The seat of the Government of India was to be transferred from Calcutta to Delhi; Eastern Bengal reunited to Bengal and the enlarged province given a Governor in Council; Bihar, Orissa and Chota Nagpur, tracts which are loosely connected with Bengal proper, made a Lieutenant-Governorship in Council; and Assam formed into a Chief Commissionership. The secret had been well kept and the surprise was complete. The scheme, though open to obvious objections, was ingenious and cleverly balanced. A reasoned exposition of its object is contained in a despatch, dated Aug. 25 1911, from the Government of India to the Secretary of State, submitting the proposed changes for the home Government's approval in advance of the King's visit. In the foreground was placed the desirability of removing the Government of India from Calcutta, where its presence diminished the dignity and responsibility of the local Government, and where it unavoidably was subject to Calcutta opinion to the exclusion of that of other parts of India. The removal of the Government of India to a capital of its own would, it was urged, facilitate the growth of local government in India on sound and safe lines. India was envisaged as consisting in the not remote future of a number of administrations, autonomous in all provincial affairs, with the Government of India above them all, but with its functions ordinarily restricted to matters of Imperial concern. It was essential to this evolution that the central Government should not be associated with any local Government, but should have a separate and independent capital. The withdrawal from Calcutta of the Government of India would also, it was urged, make a second long-desired object possible. Calcutta could be made the seat of a Governor-in-Council and placed on an equality with the two other presidential capitals. As to the third change proposed—the modification of the "partition"—the despatch laid stress on the unforeseen bitterness of feeling, "widespread and unyielding," which the partition had created, and on certain real disadvantages to which it had subjected the Bengalis in both provinces into which the old province had been divided. In each province the Bengalis were in a minority. "As matters now stand, the Bengalis can never exercise in either province that influence to which they consider themselves entitled by reason of their numbers, wealth and culture." The scheme met Bengali sentiment on that point. But the triumph of the agitators against the "partition" was not unmixed. Bengali pride had to reconcile itself to the loss of prestige consequent on the withdrawal of the supreme Government from Calcutta, and to the recognition of Dacca, the old Mahommedan capital of Eastern Bengal, as the second capital of the reunited province. The last provision, it was hoped, would tend to reconcile the Mahommedans of Eastern Bengal to the changes. But they and their coreligionists in other parts of India regarded the revision of the "partition" as a Hindu victory and a blow to their community. The suspicion and resentment thus engendered augmented the unrest which events in Europe were exciting among them. Such was the scheme and its objects. In the months following the Delhi durbar it ran the gauntlet of criticism in England and in India. Strong objection was taken by its critics to the undoing of the "partition," "the settled fact" which Lord Morley had refused to disturb. Objections equally strong were taken to the removal of the Government of India from direct contact with the largest and most powerful European community in India and the segregation of its officials from the outside world. The authority of Parliament, it was also said, had been flouted. The King's ministers had suffered a royal announcement to be made of changes of the highest moment before Parliament was allowed to discuss them. There was force in the contention. Parliament was confronted with a *fait accompli,* and the circumstances were such as to prevent it from enforcing, if it wished, the responsibility of ministers. Time alone will test the wisdom of these changes, autocratically conceived and dramatically carried out. The building of the new capital has been thrown back by the war, and the cost will largely exceed the estimated sum of four millions sterling. New Delhi, it is urged by opponents of the scheme, will be merely the cold-weather headquarters of an official hierarchy, an imposing mass of buildings untenanted for climatic reasons during eight months of the year; while the Government of India, rotating between it and Simla, will live perpetually in a bureaucratic atmosphere. On the other hand the drawbacks of Calcutta were many, and recent constitutional changes have emphasized the desirability of removing the supreme Government from immediate contact with the internal administration of Bengal. The presidential Government of reunited Bengal is an undoubted success, the bitterness of feeling engendered by the "partition" has disappeared, and the interests of the Mahommedan population of the Eastern districts receive a just measure of attention from the local government. The province of Bihar and Orissa is the weak feature of the scheme. The artificial union of two blocks of territory lying geographically apart and without linguistic or racial affinities can never be a convenient administrative unit, and may eventually give place to a better arrangement.

Lord Hardinge's Internal Administration.—The period from the conclusion of the royal visit to the outbreak of the World War was one of administrative progress and constitutional advance, not however without incidents and movements of serious import. The finances were satisfactory. The reformed Legislative Councils were working well. The relations of the non-official members with the Government were cordial and helpful. Much attention was given in the provincial Councils, as also in the Imperial Legislative Council, to matters of education, public health and local self-government, and interest was stimulated by the considerable grants for these purposes which the central Government was able to make from imperial revenues to local governments. In closing the budget debate in his Council in March 1912, Lord Hardinge defined the duty of his Government, as he conceived it, to be "to turn all our energies to the uplifting of our people. Only by the spread of knowledge and by the resolute struggle against disease and death can India rise among the nations." The beginning of a sustained advance in popular education was made at the Delhi coronation durbar, at which a recurring grant of 50 lakhs (£333,000) to local governments for the purpose was announced. (Here and elsewhere the conversion of rupees into sterling has been made on the basis of Rs. 15 = £1. *See* note under *Finance* below.) This was followed in succeeding years by larger grants. From 1911 to 1915 non-recurring grants amounting to 3¼ millions sterling and recurring grants of £826,000 were made to the provinces. The total annual expenditure on education rose during the period by nearly 3 millions sterling, and the number of boys and girls at school or college by one million and a half. This expansion was numerically greatest in the primary schools. A wide educational policy was laid down, embracing the universities and secondary and technical schools and colleges. Research and post-graduate instruction were promoted in the universities. The existing universities, which were of the affiliating and examining type, had become unwieldy. They served vast areas and required to be supplemented by resident universities, in which teaching would predominate over examinations, and an academic atmosphere would be created. The universities now established at Dacca, Patna, Rangoon and Lucknow are of this type. The Benares Hindu University, the creation of which was largely due to the energy and capacity of Mrs. Annie Besant, is on similar lines, though sectarian in character. The Moslem University at Aligarh is also of this type. With the problem of university reform the organization and condition of the affiliated colleges and of the secondary schools which feed the latter were intimately connected. Their improvement formed part of Lord Hardinge's educational programme, but the subject was full of difficulty and in most provinces reform was delayed by the war. With regard to technical education mention may be made of the establishment of a well-equipped medical college at Lucknow, raising the number of medical colleges in India to five, of schools of tropical medicine in Calcutta and Bombay and of an institute of science at Bangalore. In the domain of public health Lord Hardinge's Government similarly encouraged progress in the provinces by imperial grants. Non-recurring grants to the amount of £2,700,000 and recurring grants of £368,000 were made. A great impetus was thus given to sanitary measures. The capital grants rendered practicable the execution of sanitary measures which a few years before seemed beyond the limits of financial responsibility.

In several other cases the action of Lord Hardinge's Government faithfully reflected the views and sentiments of Indians and had the strong support of the Legislative Council. Regrets and some resentment were expressed by that body when proposals made by the Government of India for the establishment of a High Court in the Punjab and an Executive Council in the United Provinces failed to obtain the sanction of the home authorities. The appointment of a royal commission to inquire into and report on the public services of India with a view to increasing the proportion of Indians in the higher offices met aspirations expressed in a resolution moved in the Legislative Council and was warmly approved. Another popular measure was the establishment of a Legislative Council in the Central Provinces. But much greater feeling was provoked by the position of indentured labour in the Colonies to which it was permitted and by the treatment of Indian residents in South Africa and Canada. The first trouble arose over the refusal of the Natal Government to accept Indian immigrants as permanent citizens of the Union after the expiration of their indentures. As no redress was obtained the Government of India in 1911 prohibited for the future indentured emigration to Natal. In the following year the grievances of the Indians domiciled in the Union against the Union Government came to a head. The Immigrants' Regulation Act of the Union Government was considered by them to deprive them of rights guaranteed under an agreement. The Indian settlers resorted to "passive resistance." The situation was aggravated by strikes and riots among Indian labourers in Natal. Intense feeling was aroused in India by reports of the treatment of passive resisters by the magistrates and the rough handling of strikers and rioters by the police. Lord Hardinge in a speech delivered in Madras (Nov. 24 1913) expressed evident sympathy with the passive resisters in their struggle against "invidious and unjust laws," referred to allegations that the movement had been dealt with by measures that would not be tolerated in any civilized country, and pressed for an inquiry in South Africa by a strong and independent committee on which Indian interests should be fully represented. The Union Government resented the Viceroy's language, which admittedly was not very discreet. But the calculated indiscretion served its purpose. A Commission of Inquiry was appointed, but objection was raised to its composition by the Indians in South Africa. Eventually, after a period of tension, the Union Government agreed to the deputation of a distinguished Indian civilian to represent Indian grievances before the Commission. A satisfactory solution was at length reached and embodied by the Union Government in its Indian Relief Act, 1914. This closed the passive resistance struggle. The controversy had been followed in India with passionate interest. In the action they took Lord Hardinge's Government had the warm approval of the educated classes. With regard to Canada the grievances of Indians were less easy of settlement. Indians resented the refusal of the Canadian authorities to admit them as settlers and contrasted it with the more liberal treatment accorded to Japanese under an arrangement with the Japanese Government. In the face of Canadian feeling on the subject Lord Hardinge considered that the only course which was likely to conciliate Indian public opinion and secure a lasting settlement with the Dominion Government was a policy of reciprocity, which could be made effective without direct retaliation and would not raise questions of the personal status of Indians in Canada. Some progress has been made towards an agreement on these lines.

Attempt on Lord Hardinge's Life.—In the period immediately preceding the World War the only exception to the general tranquillity of the country was the persistence and extension of the revolutionary movement in Bengal and the growing unrest of the Mahommedan community. In Bengal the revolutionary societies which had been quiescent for a time again became active towards the close of 1912. On Dec. 23 1912, as the Viceroy was making a state entry into Delhi, a bomb was thrown and exploded in the *howdah* of the elephant on which he and Lady Hardinge were riding, severely wounding him and killing an attendant. The assailants were never brought to justice, but there is little doubt that they were connected with the revolutionary movement in Bengal which had extended to the Punjab. The organization of the revolutionary societies, their interconnexion and propaganda methods, their success in corrupting the educated youth of the country, are minutely described in the report of the Sedition Committee (1918) over which Mr. Justice Rowlatt presided. By 1912 the movement had largely lost its religious and national motive and had become definitely terroristic, anti-British and predatory. It sought to demoralize the police by violent crime, often committed in crowded thoroughfares and open daylight, to overawe the public, and ultimately to subvert the Government. Recruits were attracted by the boldness of the conspirators, their practical immunity from capture and punishment, and the booty which they acquired by midnight robberies in force. By the end of 1913 the ordinary forces of law and order had been definitely beaten. The Bengal Government found itself in a very dangerous position, but still hesitated to resort to extra-judicial methods. Matters grew worse in the following year, when war broke out. To complete the narrative it may here be mentioned that German agents in America and the Dutch East Indies, getting into touch with Indian anarchists abroad, arranged to support a general rising in India by supplying arms and money. Some ships were fitted out for the purpose in 1915 and arrangements for the landing of the arms were made with the revolutionary leaders in Bengal. Fortunately the undertaking miscarried; the ships failed to arrive; the Indian authorities got on the track of the scheme; the chief conspirators were hunted down; and a vigorous use of the power of internment given by the Defence of India Act broke up the revolutionary gangs and restored order in the presidency.

Mahommedan Discontents.—The outbreak of war between Italy and Turkey in 1911 followed by the Balkan War in 1912 excited the feelings of Indian Mahommedans, always sensitive to events affecting their co-religionists in other countries. Turkish reverses aggravated the situation and created the impression that the interests of Christendom and Islam were in serious conflict. The tension was increased by the intemperate language of a section of the Mahommedan press, by meetings to express sympathy with Turkey and by collection of funds for sending medical relief to the Turkish forces. The local governments found it necessary to enforce the Press Act and other restrictions. A state of alarm and irritation in the Indo-Mahommedan community invariably leads to bad relations with other communities. Any insignificant local incident may then be the occasion of unbridled widespread agitation and possibly disturbances of the peace. In 1913 the removal by the Cawnpore municipal board of a building claimed by the Mahommedans to belong to a mosque was taken by them as an insult to their faith and led to a serious riot (Aug. 3 1913). This was followed by bitter press attacks on the Government for its anti-Mahommedan policy. Lord Hardinge, to allay an agitation which was growing serious, made an earnest appeal in his Legislative Council (Sept. 17 1913) to Indian Mahommedans to cultivate sanity of judgment and self-restraint and to rely on the good-will of the British Government towards Turkey, and himself visiting Cawnpore brought about a settlement over the heads of the local authorities. This exceptional step may be held to have justified itself by the appeasement that followed. The restoration of peace in the Balkans further relaxed the tension. From then onwards until the World War the state of Mahommedan feeling in India gave little cause for anxiety.

The World War: India's Effort.—On the outbreak of the World War in Aug. 1914 Lord Hardinge's administration entered upon the third stage. He had won great popularity. The country as a whole was exceedingly quiet. Relations with Afghanistan and the frontier tribes were good. The magnificent response made by India to the needs of the Empire is a matter of world history. "Nothing has moved me more," ran the King-Emperor's message delivered by the Viceroy to the Legislative Council on Sept. 8 1914, "than the passionate devotion to my throne expressed both by my Indian and English subjects and by feudatory princes and chiefs of India, and their prodigal offers of their lives and their resources in the cause of the realm." On the motion of an Indian member the Council unanimously affirmed their unswerving loyalty, promised unflinching support to the British Government, and offered on behalf of the people of India to share in the cost of the war. The Council reflected the general attitude of the country. In the hour of stress the deep-rootedness of the British connexion and its indispensability to the safety of India were clearly realized. All thinking Indians saw that in this matter British and Indian interests were identical. The political leaders instinctively suspended their controversies with the Government and gave it their support. The martial classes eagerly responded to the call to arms. From the rulers of native states lavish offers of help poured in. They were recounted in the Viceroy's telegram to the Secretary of State, dated Sept. 7 1914, which was read in both Houses of Parliament and circulated throughout the Empire. As a wonderful demonstration of loyalty and generosity, its effect on popular feeling was immense.

With this confidence and enthusiasm were mingled some alarm and bewilderment. Trade came to a standstill. There were runs on the banks, withdrawals of deposits, encashment of currency notes and hoarding of coin. Timid Marwari traders of Calcutta closed their businesses and fled to Rajputana. In the remoter districts rumours of the collapse of the British *raj* disturbed the countryside. The Mahommedan peasantry in the Jhang district and in adjoining districts of the south-western Punjab raided and burnt the houses of Hindus and moneylenders, and military force was required to restore order. In Bengal the revolutionary societies redoubled their criminal activities. In San Francisco and Vancouver an Indian revolution was openly preached to the Sikhs settled there, and numbers of them were incited to return to the Punjab to take part in a general rising. Their designs were detected, their plots to seize arsenals and tamper with the troops were frustrated, and a formidable conspiracy was broken up by a vigilant local government having behind it the goodwill and help of the rural population. But for some months the Punjab was disturbed by murders, dacoities, and robberies and the reckless use of arms and explosives.

In India as a whole the situation was so satisfactory that the Indian Government was able to denude itself freely of its military resources to meet the insatiable demands of the home Government for troops and war material. Most of the British troops, the flower of the Indian army, the best of the artillery, and large quantities of ammunition were despatched to France and other theatres of war. In Sept. 1914 a force of 70,000 men was sent to France. By the end of 1915 India's contribution amounted to nearly 80,000 British and 210,000 Indian officers and men. At one time the original British garrison was reduced to only 15,000 men. These were gradually supplemented by territorial and garrison troops from home, but throughout the war the British element in the army in India was dangerously below the defensive needs of the country. The expeditionary forces sent from India to France, Gallipoli, Egypt and East Africa passed on arrival to the control of the home Government, and the responsibility of the Indian Government for them was thereupon confined to replacing losses by fresh drafts and providing supplies.

Mesopotamian Expedition.—It was otherwise with the expedition sent to Mesopotamia. Until the spring of 1916 the home Government, though it initiated the expedition and directed the policy, left the control and management to the Government of India. In the judgment of the Mesopotamia Commission, this division of responsibility was unfortunate. The expedition at first had a very limited objective. It was sent to occupy Basra in the event of Turkey declaring war. Its scope was gradually enlarged and the strength of the force increased until by Sept. 1915 a series of successes brought it within striking distance of Bagdad. The circumstances in which Sir John Nixon sought and obtained permission to advance on Bagdad, the failure of the attack on the Turkish position at Ctesiphon, the disastrous retreat on Kut el Amara, and the capitulation of the besieged British force on April 29 1916 are narrated in the report of the Mesopotamian Commission. The report reflected severely on the Indian authorities and on the organization and equipment of the army in India, on the Secretary of State and his advisers and on the Cabinet. But by the time the report was published (May 17 1917) Lord Hardinge was no longer Viceroy, the early defects of the expedition had been repaired, a series of defeats inflicted on the Turks, and Bagdad captured by Sir Stanley Maude. The inquiry had therefore no effect and was barren of results.

The entrance of Turkey into the war placed Indian Mahommedans in a difficult position; but along with the rest of India they loyally rallied to the side of the Crown. Against a few prominent agitators only was it necessary to take action. The premier Mahommedan prince, the Nizam of Hyderabad, and the Begum of Bhopal, in addresses to their co-religionists, effectively stated the British case and exposed the falsity of the pretexts by which Enver Bey and his associates sought to justify the entrance of Turkey into the war. These addresses, and a declaration by the Government of India as to its attitude towards Islam in general and the Holy Places in particular, served greatly to maintain tranquillity.

War Measures of Indian Government.—Among the many other important matters arising out of the war during Lord Hardinge's Government the following may be noted:—

(1) *Recruitment.*—The pre-war recruitment for the Indian army, which is on a voluntary basis, was about 15,000 men a year. In order to meet the needs of the armies in the field and to keep the units in India up to strength it had to be increased eightfold. The task proved one of increasing difficulty, and required the closest coöperation between the military and civil authorities and the loyal support of the landowning classes. The races and castes from which serviceable recruits could be drawn were an insignificant minority of the vast population. Before long the Punjab, which furnished 50% of the fighting forces, showed signs of over-recruiting. (2) *Supply of Stores and Munitions.*—India served as the basis of supplies for the Mesopotamian force and for Indian troops employed elsewhere. It also furnished to the Allies essential materials of which they stood in need. The low development of Indian industries made State assistance and supervision, and in some cases control necessary. At a later stage Lord Chelmsford set up a central Munitions Board with branches in all provinces. It effected great economies and did much to encourage the manufacture of supplies that formerly could only be obtained from abroad. (3) *Regulation of Prices and Control of Export.*—Measures were taken to moderate the high prices of food grains, which were causing much distress and discontent among the poorer classes, and to prevent hoarding and profiteering. The Government obtained powers by Ordinance to take possession of stocks unreasonably withheld from the market. Private exports of wheat were prohibited, but the Government arranged to purchase for the United Kingdom considerable quantities

within limits of price. Later on the same system of control over export and prices was applied to the Burma rice crop. Control over exports generally was also exercised to prevent goods from going to the enemy. (4) *Internal Security.*—The statutory power which the governor-general has to legislate in an emergency by Ordinance was freely exercised to secure the safety of the realm. Of these Ordinances the more important were the Indian Naval and Military News Ordinance; the Foreigners Ordinance; the Ingress into India Ordinance; the Commercial Intercourse with Enemies Ordinance; the Articles of Commerce Ordinance. The duration of an Ordinance is limited by statute to a period of six months, but the Indian Legislature passed an Act in 1915 to keep these and other specified Ordinances in force during the continuance of the war and for six months after. The Indian Legislature in March 1915 also enacted the Defence of India Act, giving the Government very wide rule-making powers for the purpose of securing the public safety and the defence of British India. It also enabled the Government to provide in any notified districts for the trial of certain classes of heinous crime by a special tribunal of three commissioners. It may be mentioned that many of its provisions were reënacted in a modified form by the Rowlatt Act of 1919 (the Anarchical and Revolutionary Crimes Act 1919).

Retirement of Lord Hardinge.—In Nov. 1915 Lord Hardinge completed his fifth year as Viceroy, but at the request of the home Government remained in office until the following April. In a farewell speech to his Legislative Council he said that, with a reservation as to Bengal, “ the internal situation of India could hardly be more favourable.” Heads of provinces had informed him that never in their experience “ had the relations between the Government and the people been closer or of greater confidence.” He expressed his wish to see “ the early realization of the just and legitimate aspirations of India,” but, with an obvious reference to the Home Rule movement which Mrs. Annie Besant (the head of the Theosophical Society in India) had started in Madras, and to the advocacy of “ self-government on colonial lines ” by Indian nationalists, he besought his hearers not to be led astray by impracticable ideals, but to look facts squarely in the face and to realize that in the Dominions self-government had been the slow product of steady and patient evolution.

Lord Chelmsford's Administration.—Lord Chelmsford, the new Viceroy, assumed office on April 4 1916. Lord Hardinge, in referring to his successor, had characterized him as a man of “ noble ideals and generous sympathy.” He was in his forty-eighth year. He had been an active member of the London School Board and the London County Council, and had made acquaintance with constitutional problems as governor of Queensland and then of New South Wales. At the time of his selection he was serving with his territorial battalion in India. His administration covered one of the most difficult and momentous periods of British-Indian history, whether as regards the pressure of world events, the complexity of the forces acting in and upon India, the difficult and dangerous situations that arose, the number and magnitude of the problems demanding solution and the gravity of the issue they have raised. With the prolongation of the war India had lost its first enthusiasm and its first alarm. Its remoteness induced a sense of security and obscured the vital issues that were still in balance. High prices, scarcity of imported commodities and unaccustomed restrictions on trading and travel fretted the masses. Among the educated classes national aspirations were quickened by the increasing share taken by India in the war, by the generous recognition of its services and admiration of its resources accorded by other members of the Empire, by the association of representatives of India on terms of equality with the ministers of Dominion Governments in the Imperial War Conference, and by the knowledge that the constitutional relations of the component parts of the Empire would be readjusted after the war. Politicians became apprehensive lest the claims of India might go by default unless asserted promptly.

“ Home Rule ” Movement.—In the first year of Lord Chelmsford's administration the political peace enjoyed by his predecessor came to an end. In the early part of the year Mrs. Besant succeeded in getting her scheme of Home Rule considered by leading members of the National Congress and the Moslem League. She continued to advocate it with great energy among students and schoolboys in Madras, established a Home Rule League, celebrated a “ Home Rule ” day, and declaimed in her paper *New India* against the Government. Mr. Tilak, who had been released from prison in 1914, was equally active in Bombay. In Oct., 19 elected Indian members of the Imperial Legislative Council submitted a memorandum on proposed reforms to the Government of India. They described the Morley-Minto reforms as having created Legislative Councils which were mere advisory bodies without any effective control over the Government, Imperial or provincial. They propounded a scheme which, while retaining irremovable executives responsible to Parliament and the Secretary of State, would have subjected them in legislation, finance and administration to the orders of a legislative body, in which elected members would be predominant. These proposals were adopted in substance a few months later by the National Congress and the Moslem League. In the Montagu-Chelmsford report they were subjected to close examination and pronounced impracticable and wrong in theory. A legislature and an executive deriving their authority from and responsible to different authorities must come to a deadlock which could not be resolved, as it would be under a genuine parliamentary system, by a change of Government. From this adverse judgment the authors of the Montagu-Chelmsford Report advanced to their own solution of the problem—the division of the administration into two halves, one an official executive responsible to the British Parliament and the Secretary of State, and the other an executive of ministers responsible to the Legislature. The Congress-League scheme has from its very defects an historical value in the evolution of the present Indian constitution.

To return to the course of events. At meetings held at Lucknow in Dec. 1916 the National Congress and the Moslem League, as the result of lengthy negotiations, agreed upon a scheme of reforms based on the proposals of the 19 members, and resolved to put it before the public, through the agency of the Home Rule League, as the irreducible minimum with which the national party would be content. The scheme became known as the Congress-League scheme. By this time the nationalist party led by Mrs. Besant and Mr. Tilak had become dominant in the Congress. The Moslem League, originally founded for the protection of Moslem interests against Hindu ascendency, had similarly fallen under the influence of the “ young ” Mahommedans, who made Home Rule their objective and joined forces with the Congress on the condition that in certain provinces in which the Mahommedans were in a minority they were guaranteed a proportion of seats in the future Legislative Councils in excess of the number they could hope otherwise to win. Effect was given to this compact, henceforth known as the “ Lucknow Compact,” in the Congress-League scheme. Following the Lucknow conferences an energetic Home Rule campaign was opened in all provinces. Mrs. Besant's activities in Madras caused the Madras Government in June 1917 to require her and her lieutenants to abstain from attending public meetings and making speeches, to leave Madras city and to take up their residence in one of several specified areas. This order made a great sensation throughout India. Protest meetings were held to procure its withdrawal. It was thought to be the forerunner of a general policy of repression, and added fuel to the agitation for Home Rule. The stir in the nationalist camp was quickened by the knowledge that the views of Lord Chelmsford's Government on political reforms had for some time past been before the home authorities. Other incidents deepened the feeling of uneasiness among Indian politicians. The belated publication of the report of the Royal Commission which, with Lord Islington as president, had since 1913 been inquiring into the Indian public services with a view to the admission of Indians in larger numbers, did not mend matters. Its recommendations were pronounced unsatisfactory and inadequate. A frank declaration of policy by the British Government as to the future political development of India became increasingly necessary.

The fault of delay did not rest with the Indian Government. From the moment of his assumption of office Lord Chelmsford had been impressed with the urgency of the matter. A preliminary and informal examination of the changes possible and prudent had been made by Lord Hardinge. Lord Chelmsford took up the inquiry from the point where his predecessor had left it. At the close of 1916 his Government submitted to the Secretary of State a considered scheme of reforms, and asked for an authoritative declaration of policy. Was the goal for the Indian peoples to be responsible government? If so, by what stages and steps should it be reached? The questions raised were large and delicate. The Cabinet was preoccupied by the war. In July 1917 the Secretary of State, Mr. Austen Chamberlain, resigned on the report of the Mesopotamian Commission.

Declaration of Aug. 20 1917.—It fell to his successor, Mr. Montagu, to announce on Aug. 20 1917, in the House of Commons, the policy of the Government with regard to India. "The policy of H.M. Government," he said, "is that of increasing the association of Indians in every branch of the administration and the gradual development of self-governing institutions with a view to the progressive realization of responsible government in India as an integral part of the British Empire." After stating that the Government had decided that substantial steps in this direction should be taken as soon as possible, and that he was going to India to examine the matter in conjunction with the Viceroy, he ended with an important caution:—"Progress in this policy can only be achieved by successive stages. The British Government and the Government of India, on whom the responsibility lies for the welfare and advancement of the Indian peoples, must be the judges of the time and measure of each advance, and they must be guided by the coöperation received from those upon whom new opportunities of service will thus be conferred and by the extent to which it is found that confidence can be reposed on their sense of responsibility."

This announcement, though its qualifying words were not liked by the extreme nationalists, somewhat cleared the air in India, and Mrs. Besant's release had a further tranquillizing effect. In the Mahommedan camp there were signs of discord. Conservative Mahommedans did not like the Lucknow Compact with the Hindu leaders. Mahommedan feelings were stirred by the reverses suffered by Turkey and the growing power of the Sherif of Mecca. In Sept. the Hindu population attacked their Mahommedan neighbours in the Shahabad and Gaya districts of Bihar over the cow-killing question, and bloody and destructive riots occurred before order was restored by force.

The Montagu-Chelmsford Report.—In the course of the winter Mr. Montagu visited India. The results of his mission were embodied in a joint report by himself and the Viceroy, drawn up before he left India, and bearing date April 22 1918. The report is a lengthy and able document, written in an attractive and picturesque style. It described the existing administrative system and led up to the conclusion that the political development of the provinces was stifled by the rigid control which the central Government was compelled to exercise in discharge of its responsibility to Parliament. In the course of 10 years the national consciousness and the desire for political power had grown with unexpected rapidity, and the Morley-Minto constitution no longer satisfied Indian opinion. The report then described the social and political conditions of the different sections of the Indian population, with the object of showing that responsible government could not be introduced at once over the whole field of administration; and examined and pronounced impossible the Congress-League scheme of reforms. In the second part of the report the authors set out their own proposals. These, in brief, were that the provinces should be the domain in which the earlier steps towards the progressive realization of responsible government should be taken, and that the only possible plan was to divide the functions of provincial governments into those that might be made over to popular control and those which for the present must remain in official hands. This novel and ingenious plan of a dual Government has received the name of "dyarchy." The Montagu-Chelmsford scheme of reforms and the action which was taken on it by Parliament are described below (*see* under *Administration*).

War Conference of 1918: India's Increased Effort.—The Montagu-Chelmsford report was nearing completion at Simla when the Viceroy's attention was recalled to the pressing realities of the war. In the Near East, German troops had penetrated the Caucasus and Turks were invading Persia. With the collapse of Russia a road to Afghanistan and thence to India seemed possible. In a telegram (April 2 1918) which reflected the anxieties of the western front though it referred to what was happening in the East, the Prime Minister made a strong appeal to the Government and people of India to redouble their efforts and prevent German tyranny from "spreading to the East and engulfing the world." Lord Chelmsford's response was to convene a war conference at Delhi, to which many ruling princes and representatives of all provinces of every shade of opinion were invited. There he earnestly besought all classes to suspend political strife, to concert measures for gathering up the whole man-power and resources of the country, and to accept cheerfully the necessary sacrifices. The conference heartily and loyally responded to the appeal and agreed upon a programme of measures of no small value. The better organization of recruiting and materials of war was entrusted to boards. A scheme of territorial recruitment was mapped out whereby each province would furnish its quota of men. The ruling princes, who, as always, were preëminently helpful and practical, undertook to furnish larger contingents and to open their dominions to British recruiting parties. The conference was followed by similar conferences in all the provinces. These did much to rekindle public interest in the war and to enlist popular support to the exertions of the Government. In the five months preceding the Armistice 200,000 men were recruited, and had the war gone on this number would have been greatly increased. In the spring of 1917 the Legislative Council had accepted the Government's proposal to make a free gift of £100,000,000 to the home Government towards the expenses of the war. This was in addition to the obligation which the Indian Government had undertaken, to bear the normal charges of all troops on the Indian establishment sent overseas. In the Sept. session of 1918 the Legislative Council, by a large majority of the non-official members, to whom the decision was left, agreed to make a further contribution. It was to take the form of paying for a certain number of Indian troops employed outside India by the British Government, along with certain pensionary charges. Assuming that the war would last till 1920 the aggregate charge was estimated at £45,000,000. Actually, however, on account of the earlier ending of the war and the heavy cost to India of the subsequent Afghan War, the contribution was reduced to less than one-third of that sum.

In appraising the contributions and the sacrifices made by India to the common cause of the Empire, several factors which distinguish that country from the self-governing Dominions should be remembered. The first is the poverty of the general mass of the population, dependent on a precarious and primitive agriculture, without the stay of large industries, with little accumulated capital, unversed in modern ways of banking and investment, and wedded to the ancient habit of hoarding. Secondly, the fiduciary relation of the Government to the governed, making it reluctant to impose sacrifices on a dependent population, and ever conscious of the difficulty of finding revenue to meet the elementary needs of a civilized administration. Thirdly, the necessities of self-defence owing to untranquil borders and liability to invasion. During the war the life of the late Amir of Afghanistan alone averted this danger. Its imminence and gravity were proved by the Afghan War and the rising of the independent tribes which followed on the murder of Amir Habibulla in Feb. 1919. All these circumstances considered, the part borne by India in the war and the sacrifices made by her people for the common cause were by no means despicable. They are represented by an addition of over 230 crores to her rupee debt, the sending overseas of 800,000 combatants and 400,000 non-combatants, and the furnishing of food-stuffs and other supplies at the cost of much privation among the poorer classes. If the agriculturists as a body and some other sections of the community made money out of the war, the urban classes and the multitude of persons on small salaries and fixed incomes suffered greatly from the dearness and scarcity of food and clothing. Privation undoubtedly intensified the severity of an epidemic of influenza in the autumn and winter of 1919 from which 5,000,000 persons died. It was also a potent cause of the labour unrest, strikes, and labour unions that were a marked feature of industrial India during 1919 and 1920, and that reacted on the political situation in 1921.

Reception of Montagu-Chelmsford Report in India.—The Armistice in Nov. 1918 was the signal for general rejoicings in India, but ushered in a season of political strife and agitation which has proved very unfavourable for the peaceful introduction of the new constitution. The Montagu-Chelmsford report had been published in the previous July. Its publication widened the breach between the moderates and the extremists. The moderates, while affecting regret that the scheme did not go far enough, accepted it as a generous attempt to establish responsible institutions. The extremists rejected it as utterly inadequate to satisfy the claims and expectations of the country. In the Sept. session of the Legislative Council the report was referred for consideration to a committee of the non-official members and was approved by them, with certain qualifications, as affording a satisfactory basis for the constitutional development of India. Encouraged by this report, the moderate party held a special conference in Nov. at Bombay and accepted the general principle of the Montagu-Chelmsford scheme while urging that it should be enlarged in certain ways. On the other hand the National Congress, which had now become the organ of the extreme national party, wholly condemned the scheme at the Dec. meeting, demanded full provincial autonomy at once and asserted India's right to self-determination. Unhappily another controversy now arose which was fated to overshadow and prejudice the constitutional question by the passions which it kindled and the bitterness which it imported into the relations of the people to the Government.

The Rowlatt Bill.—The report of the Sedition Committee over which Mr. Justice Rowlatt presided had been before the public for some months and the intention of the Government of India to legislate in accordance with the committee's recommendations had been announced, without exciting much heat. In fact the impressive evidence which the report presented as to the existence of a revolutionary and anarchical conspiracy in Bengal and elsewhere and the ineffectiveness of the ordinary criminal law to deal with it, secured at first a favourable reception for the committee's proposals. But on the bills being published in Jan. 1919 a violent campaign was started against the report and its proposals by the nationalist press and nationalist politicians. The object of the principal bill was to reënact in substance the extra-judicial procedure for dealing with anarchical and revolutionary crime with which the Defence of India Act had equipped the executive and by means of which the Government of Bengal had at last got the upper hand of a very dangerous conspiracy. Its provisions were not to be put into force in any place unless the Governor-General in Council was satisfied of the existence there of anarchical and revolutionary movements and of the public safety being endangered by the prevalence of crime of that nature. The bill, however, was represented as an attack upon the popular liberties, an attempt to invent crimes, a monstrous engine of tyranny and oppression, the forerunner of a policy of reaction and an unmerited slur upon the loyalty and law-abidingness of the Indian people. The extremists made it the occasion of a trial of strength with the autocratic power. Even the moderates disliked it and thought its introduction inopportune and unnecessary. A whirlwind of excitement swept through the cities of upper India, a strange medley of ignorance and alarm, of political unrest and domestic discontents, of conscious exaggeration and mendacity. It was an epidemic of unreason, such as destroyed Walpole's Excise bill. Walpole stayed his hand because he saw that it would lead to bloodshed.

It is easy to be wise after the event, but had the Government of India realized the intensity of the opposition and foreseen the tragedy of Amritsar it is at least possible that they would have thought it prudent to bend, like Walpole, to the storm. In the Legislative Council the bill met with most determined opposition from extremists and moderates alike. The Government in vain made concessions—one being to limit the duration of the measure to three years—and only passed it by the official majority.

While the bills were before the Legislative Assembly Mr. M. K. Gandhi, a well-known social and religious reformer, revered in the Bombay Presidency as an ascetic and holy man, initiated a passive resistance movement. *Satyagraha*, as he termed it, meant insistence on truth and a reliance on soul-force. He deprecated violence while preaching disobedience to the laws. The distinction, however obvious to a mystic of his temperament, was disregarded, as he afterwards regretfully acknowledged, by his followers. The nationalists took the movement in hand and organized branch societies in the larger towns of Bombay and northern India. On the Rowlatt bill receiving the Viceroy's assent Mr. Gandhi announced a day of general mourning and cessation of business. On March 30 a *hartal*, or closure of shops, took place at Delhi, the mob came into collision with the police and deaths occurred. A wave of excitement passed over the Punjab. Disturbances marked by grievous excesses broke out in Lahore, Amritsar and other centres when news came that Mr. Gandhi had been forbidden to enter the province and sent back to Bombay under arrest. Between April 10 and 15 mobs were in possession of these and other towns in the central Punjab. Disorder assumed the character of open rebellion, definitely anti-Government and anti-British, communications were cut and the civil authority was only maintained by military force. Martial law was proclaimed in Amritsar on April 14, was extended subsequently to other districts, and was not finally withdrawn from every part of the province until June, although order was generally restored by the end of April. But the situation remained critical owing to the Afghan War, and it was thought prudent to run no risks.

The Amritsar "Tragedy."—On April 13 "the tragedy of Amritsar" occurred. In that city banks and other buildings had been pillaged and burnt and Europeans murdered. The civil officers, finding themselves powerless to cope with the mobs in possession of the city, called upon the military to restore order. Brig.-Gen. Dyer, the officer commanding, deemed it necessary in the course of his operations to disperse forcibly an unlawful assembly held in the Jallianwala Bagh. Nearly 400 persons were killed by the fire of his troops and probably thrice that number wounded. His action aroused intense indignation among Indians of all shades of political opinion and became the subject of most bitter controversy. Other incidents, such as injudicious orders and degrading punishments awarded by officers administering martial law, the general severity with which martial law was administered, the heavy sentences passed by the summary courts on persons convicted by them, the confinement for extended periods of journalists and politicians suspected of having instigated the disturbances, the exclusion from appearing in the courts of counsel from other provinces, formed materials for an impassioned attack by the nationalist party on the policy and conduct of the Punjab Government and its head, Sir Michael O'Dwyer, and was not allayed by the appointment towards the end of the year of the Hunter Committee to inquire into the disturbances connected with the Rowlatt legislation.

The Punjab was not the only province in which the *Satyagraha* movement led to disturbances. In Bombay the news of Mr. Gandhi's arrest at Delhi was the occasion of an immediate outbreak of disorder in Ahmadabad, the capital of Guzerat, and in neighbouring towns. The military had to be called in, but not before numerous acts of incendiarism and violence and some loss of life had occurred. The disturbances terminated on the arrival of Mr. Gandhi, who expressed great sorrow at the excesses of his followers and was allowed to address an enormous meeting and upbraid the people for their violence.

The Afghan War, 1919.—Distorted reports of the disturbed state of the Punjab and of the nature of the Rowlatt Act found their way to Afghanistan and led the new Amir, Amanulla, to conclude that an invasion of India might prove a solution of his domestic differences. The murder of his father, the Amir Habibulla, on Feb. 20 1919 had brought him to the throne. But his succession was disliked by powerful factions. An invasion of India might increase his popularity with the army and the anti-British party and would appeal to the religious fanaticism of his Mahommedan subjects, deeply stirred as it was by the humiliation and defeat of Turkey and by the British conquest of Mesopotamia. His plan was to start with an anti-British propaganda in India, to incite the independent tribes to rise and to follow up their raiding parties with his Afghan regular forces. His designs miscarried. The frontier tribes were slow to move. Aggressive movements of his troops in the Khyber were countered by the rapid mobilization of the army in India early in May, the occupation of the Afghan advanced base at Dacca and the bombing by aeroplanes of Kabul and Jalalabad. By the middle of May the Afghans asked for a cessation of hostilities and threw out feelers for peace. Dilatory negotiations followed before the Amir could bring himself to ask for terms. In June he reluctantly accepted the conditions of armistice offered to him. In July his representatives attended a conference at Rawalpindi and on Aug. 8 a treaty of peace was signed. The terms proposed were lenient as the object was to reëstablish friendly relations with Afghanistan. The Amir lost his subsidy and the privilege of importing arms through India. Another article expressed the willingness of the British Government to resume friendly relations with Afghanistan, if in the next six months the Afghans proved by their conduct that they were sincerely anxious to regain its friendship. A concession to which the Afghan delegates attached much importance was conveyed in a separate letter, which officially recognized the freedom of Afghanistan from foreign control. Doubts have been expressed as to the wisdom of this concession. But control over the foreign policy of Afghanistan has always been nominal rather than real, and the withdrawal of the subsidy in itself implied the rescission of the reciprocal obligation. The policy embodied in the treaty has been slow of fruition. After many delays the Amir sent delegates to India in 1920 to discuss the basis of a permanent friendly agreement, and as a sequel to these discussions a British envoy proceeded to Kabul to confer with the Afghan Government. The progress of Bolshevism in the countries to the N. of Afghanistan and the overthrow of the state of Bokhara may have disposed the Amir to seek a renewal of friendship with the British power, but in 1921 nothing was settled.

Waziristan Expedition.—The Rawalpindi treaty did not end the troubles on the frontier. The independent tribes of Wazirs and Mahsuds, who occupy a large block of country S. of the Khyber line between Afghanistan and the British districts to the E., had risen in May at the instigation of the Afghans, raided the adjoining British districts and achieved some temporary successes over the tribal militia and levies by whom the border is policed. As their raids showed no abatement, the Indian Government determined to undertake the permanent pacification of the country. It was a serious undertaking, as the tribes could place some 30,000 well-armed men in the field, of whom a number had served in the Indian army. A strong force was assembled on the frontier in Oct. and an ultimatum given to the tribes. They were required to make reparation for damages, to surrender arms in specified amounts, and were informed that the Government intended to make military roads through their country and occupy certain positions. The Wazirs in the Tochi Valley were soon subdued, but the Mahsuds held out and fought with dogged obstinacy and great skill. There were two considerable encounters (on Dec. 21 1919 and Jan. 14 1920) in which the British casualties were heavy. In the end the Mahsuds accepted the terms imposed upon them and operations closed on May 7 1920. This frontier campaign is officially described as one of "unparalleled hard fighting and severity. The enemy fought with a determination and courage which have rarely, if ever, been met with by our troops in similar operations." They were well armed, and many retired regular soldiers and deserters from the Indian army and tribal militia were present in their ranks. It was later found necessary to occupy the central portion of the Mahsud country while road-making, one of the most pacifying influences, was in progress.

Army Inquiry.—The Indian Government suffered both in purse and in military reputation from the Afghan War. That war and the Waziristan campaign cost the Indian taxpayer £15,000,000. The hurried mobilization of a large army on the frontier at the beginning of the hot weather and the carrying out of operations in an inhospitable country during the hottest months of the year severely strained the war-worn military machine and revealed defects in its working. The hardships experienced by the troops and the shortcomings of the supply and medical departments provided material for press attacks on the Indian military system and a repetition of the Mesopotamian breakdown was freely predicted. An inquiry into the organization and administration of the army in India was overdue, and in the autumn of 1919 the Secretary of State appointed a committee, with Lord Esher as chairman, to undertake it. The committee visited India in the winter and reported in the following May. Their recommendations covered much ground, from the relations of the High Command in India to the War Office and the India Office, the duties and position of the commander-in-chief in the Government of India, the administration of the army in India as part of the armed forces of the Empire, to the pay and pensions of officers and men of the Indian army. Some of these recommendations raised large questions of policy. Others involved a considerable increase in the Indian military budget. The report was unfavourably viewed in India. It was thought to harbour a design to increase the control of the War Office over the military forces of India and to place them at the disposal of the home Government. The Legislative Council expressed these apprehensions in a series of resolutions which the Government of India undertook to lay before the Secretary of State. The Government of India also undertook to effect all possible economies in military expenditure.

The Non-Coöperation Movement.—In Dec. 1919 the scheme of constitutional reform became law by the passing of the Government of India (Amendment) Act. Its importance was signalized by the King's proclamation of Dec. 23, which dwelt in eloquent and arresting language on the political advancement conferred upon the Indian peoples, authorized the Viceroy to extend the royal clemency to political offenders in the fullest measure compatible with the public safety, and announced that the Prince of Wales would visit India to inaugurate the new constitutions. Unfortunately, the effect of these gracious words was marred by the excitement and racial feeling generated by the sittings in the Punjab of Lord Hunter's Committee which was then inquiring into the disturbances of the preceding April. The National Congress met at Amritsar and passed resolutions denouncing the Government's action in the Punjab, demanding the recall of Lord Chelmsford and condemning the reform scheme as disappointing and unsatisfactory. This hostility towards the administration and rejection of the reforms by the extreme section of the nationalists developed in the ensuing months into a definite "non-coöperation" movement, organized by Mr. Gandhi. Mr. Gandhi had already identified himself with the grievances of the Indian Mahommedan community with regard to the terms imposed on Turkey by the Allies and the question of the Khalifat. In connexion with the "Anti-Peace Celebrations" Committee organized by the Moslem leaders he announced a *hartal* and days of mourning and exhorted his Hindu followers to support the Mahommedan claim that Turkey should be reinstated in the position it held before the war. The campaign was viewed with indifference by the vast majority of Hindus, but fell in with the nationalist policy of uniting the two communities against the Government. In the summer of 1920 the movement was strengthened by two events. The publication of the Hunter Committee's report, and of the correspondence between the Government of India and the Secretary of State regarding its findings, and the subsequent debates in Parliament renewed the bitterness and indignation which the Amritsar proceedings had aroused in India. About the same time the terms of the Sèvres Treaty became known to Indian Mahommedans and added flame to the Khalifat agitation. In Aug. Mr. Gandhi proclaimed in a letter to the Viceroy his adoption of non-coöperation as a remedy against a Government for which he retained "neither respect nor affection" on account of its "unscrupulous, immoral and unjust" action in the matter of the Khalifat and its failure to punish adequately the officials responsible for "the wanton cruelty and inhumanity" with which the disorders in the Punjab were suppressed. The end of this strange and illogical movement was not yet in sight in the middle of 1921. Its effects had been greatest with the student class and with the extremists of the national party. Students temporarily deserted the colleges but returned after a few days' reflection. Attempts made by Mr. Gandhi and his Mahommedan associates to capture the Hindu University at Benares and the Aligarh College failed. Lawyers did not discontinue practising in the courts, and very few persons resigned their government posts or relinquished their titles and decorations. Nationalist politicians held aloof from the elections to the new Legislative Councils only to find that the moderates were installed in power. There was no dearth of candidates at the elections held at the end of 1920, and notwithstanding the efforts of the non-coöperators the number of voters was creditably large. But while the movement had not drawn to itself the middle and upper classes it would seem to have loosened authority to some extent and relaxed the sense of law and order among the masses. In some provinces the tenants were urged to withhold rent from the landlords in anticipation of the advent of *swarāj* or national self-government outside the Empire, and agrarian disturbances in consequence resulted.

In Jan. 1921 the Duke of Connaught visited India in place of the Prince of Wales and inaugurated the new constitutions. The speeches delivered by him in opening the Legislative Assembly, the Council of State and the Chamber of Princes at Delhi, and the Legislative Councils of Madras, Bengal and Bombay made a deep impression. His earnest appeal, as an old friend of India, to all parties, British and Indian, "to bury along with the dead past the mistakes and misunderstandings of the past," struck a note which has found response in the proceedings of the new Legislatures and in the Indian press.

End of Lord Chelmsford's Viceroyalty.—On April 2 1921 Lord Chelmsford made over the office of viceroy to his successor Lord Reading. No viceroy had been more tried by circumstances beyond his control, and no viceroy had shown more steadfast courage, patience or devotion to the highest ideals of his great office. The era will be a landmark in the history of modern India. It saw India started on the road to self-government and admitted on equal terms to a partnership in the British Empire.

ADMINISTRATION

The Government of India Act 1919 made great changes in the political structure and life of India. On Aug. 20 1917 the British Government announced in Parliament that their policy was that of the increasing association of Indians in every branch of the administration and the gradual development of self-governing institutions with a view to the progressive realization of responsible government in India as an integral part of the British Empire. Mr. Montagu, the Secretary of State for India, visited India in the ensuing winter and in association with the Viceroy, Lord Chelmsford, made investigations as to the reforms necessary to give effect to this policy. Their recommendations were embodied in a joint report on Indian constitutional reforms. The Morley-Minto reforms had enlarged the Legislative Councils, had introduced into them the elective element, and had given them greater powers of influencing the executive government in matters of legislation and administration. But the executive Governments, Imperial and provincial, still remained Governments of officials, responsible as such to Parliament and the Secretary of State, and not amenable to popular control in India. The annual estimates of revenue and expenditure were discussed in the Legislatures, but were not voted. An official majority in the Imperial Legislative Council secured the passage of taxation laws that might be required. Though in practice the provincial Governments enjoyed a large measure of independence, they were in theory subject in all respects to the orders of the Government of India, and their revenues and expenditure were an integral part of the general revenues and expenditure of India and, as such, controlled in amount and allocation by the Government of India. The system was highly centralized and could not be otherwise, since the central Government was responsible to the home authorities for everything that was done in India. An advance on the lines laid down in the declaration of Aug. 20 1919 involved a break with the past and a new departure.

The Montagu-Chelmsford Report.—The authors of the Montagu-Chelmsford report proposed that responsible government should be conferred on India by progressive stages, together with a substantial step towards its immediate realization. By responsible government they meant government by ministers primarily amenable to an elected assembly and in a secondary degree to an electorate. They recognized that India was not yet fit for responsible government in its completeness, that an electorate had to be created and that the experience of its representatives would be small. They proposed therefore to confine the first stage of the advance to the major provinces, and in these provinces to set up a dual form of government, generally known as "dyarchy."

The administration was to be divided into two parts, "reserved" subjects and "transferred" subjects. The former would be administered by the governor and his executive council, and the latter would be transferred to ministers chosen by the governor from amongst the elected members of the Legislative Council. In this way Indian ministers would be trained in the practice of responsible government. The two halves of the Government would deliberate together, but each half would be separately responsible for legislative and administrative action in its own field. The governor would be the connecting link between the two. He would assist and guide the ministers, but ordinarily would not direct action to be taken against their advice. The provincial Legislative Councils would be enlarged and given substantial elected majorities. Provincial finance would be separated entirely from Imperial finance. The provincial Governments were to have complete control over their own revenues and expenditure, after making each a fixed contribution to the central Government. They would enjoy a much greater measure of independence of the central Government in administrative matters, and their domain of action would be definitely marked out by a formal separation of functions or subjects appertaining to the central Government from those appertaining to provincial Governments. It was not proposed to introduce "dyarchy" into the Government of India. It was thought essential to retain the Governor-General in Council's responsibility to Parliament in the whole field of the central Government. There would be no "ministry" working side by side of the executive council, and no separation of central subjects into "reserved" and "transferred." The Imperial Legislative Council, however, would be replaced by a bicameral Legislature, consisting of a Legislative Assembly, in which there would be a substantial elected majority, and a Council of State in which the Government would have an official majority. Bills would require the assent of both Chambers, except that a bill certified by the Governor-General in Council to be essential to the interests of peace and order or good government which the Legislative Assembly refused to pass might be enacted by the Council of State alone. In the provinces the governors would be given a somewhat similar safeguard (in the form of a grand committee) against the refusal of the Legislative Council to pass essential legislation.

The Montagu-Chelmsford report left the question of the distribution of subjects into "central" and "provincial" and the subdivision of "provincial" subjects into "reserved" and "transferred" subjects to be separately worked out, as also the question of electorates and the franchise. Two committees, known as the Functions Committee and the Franchise Committee, were appointed by the Secretary of State to make the necessary inquiries in India. They submitted their recommendations early in 1919. The views of the Government of India and of the local Governments on the proposals of the Montagu-Chelmsford report and of the two committees were also obtained. A third committee inquired into the constitution and functions of the India Office and of the Secretary of State's Council. Various political associations in India sent delegates to England to place their views before Parliament.

Joint Select Committee on the Bill.—In July 1919 a bill embodying the Montagu-Chelmsford scheme, modified in the light of subsequent inquiries and information, was introduced into the House of Commons, read a second time and referred to a Joint Select Committee of both Houses presided over by Lord Selborne, which was appointed to consider it in the light of the criticisms and suggestions received after the publication of the Montagu-Chelmsford report. The committee examined nearly 70 witnesses of all shades of opinion and made important changes in the bill. These are explained in their report. They dealt at length with the political and administrative problems involved in the bill, made recommendations on a number of important matters which are left in the Act to be dealt with by rules, and indicated the principles by which the authorities entrusted with the working of this novel and intricate system of government should be guided. Their report is a most valuable constitutional document and is indispensable to a study of the Act. The bill passed both Houses substantially as amended by the committee, and received the Royal Assent on Dec. 23 1919.

In their preliminary remarks on the bill the Joint Select Committee expressed themselves satisfied that the plan of the bill interpreted the declaration of Aug. 20 with scrupulous accuracy and that it was the best way of giving effect to the policy of the British Government. They approved the plan of a dual government or "dyarchy" for the provinces, but refused to adopt the proposal pressed upon them by Indian witnesses that it should be extended to the central Government. They considered it essential that, during this first stage of a measured progress towards responsible government, the central Government, except so far as it might be released from responsibility as regards subjects transferred to "ministers" in the provinces, should remain in undisturbed responsibility to Parliament and fully equipped with the necessary powers to discharge that responsibility. They also considered it essential that in the provinces, while the "ministers" should be given the fullest opportunity of managing the field of government entrusted to their care, the provincial governor in council, as regards the field of government in which Parliament continued to hold him responsible, should remain equipped with the sure and certain power of fulfilling that responsibility. They regarded it of the highest importance that the governor should foster the habit of free consultation between the two halves of his Government. But this should not confuse the duties or obscure the separate responsibility of each half. Neither should control or interfere with the other. Each should be given under the Act and rules adequate power to fulfil its respective charge.

The Joint Committee accepted with some alterations the proposals of the Functions Committee for the distribution of functions or subjects between the central Government and the provincial governments. The line of demarcation was sufficiently obvious as regards the great majority of subjects. The army and navy, foreign affairs, currency and coinage, the public debt of India, the civil and criminal codes, customs, income tax and other sources of all-India revenues, posts and telegraphs, are subjects which clearly appertain to the central Government. Administration of law and justice, police, prisons, local self-government, medical administration, public health and sanitation are the natural functions of a provincial Government. But there are border-line subjects and cases of overlapping for which provision had to be made. It was also necessary in respect of some subjects provincially administered for the central Government to retain an over-riding power of legislation. The subdivision of the corpus of provincial subjects into "reserve" and "transferred" involved the question of the extent to which the provincial administration should at the outset be made over to non-official control, and gave room for considerable diversity of opinion. Broadly speaking, subjects appertaining to law and order, police, the administration of justice, the ports, factory Acts, the provincial revenues, are retained by the official half of the provincial Government, while local self-government, public health and sanitation, the liquor and drugs excise, education (with minor reservations), and other similar social services are transferred to "ministers."

The Joint Committee closely considered the much-debated question of the allocation of the provincial revenues between the two halves of the Government. Was each to have its own sources of revenue which it would develop and extend? Or were the provincial revenues to form a common fund from which each side of the Government would help itself? The first method, known as that of separate purses, would tend to keep the two parts of the Government apart. The second or "joint-purse" method might generate frictions and disputes. The Government of India advocated the former. There was a strong body of opinion in support of the latter. The Joint Committee decided in favour of the "joint-purse." They were hopeful that the matter could be readily solved by the exercise of common sense and reasonable give and take, and that the governor would ordinarily be able to propose an allocation acceptable to both sides. If he failed to secure an agreement, he should be empowered to refer the matter for decision to such authority as the Government of India might appoint.

The committee gave much consideration to the constitution of the electorates and made a number of recommendations. The most important of these touched the vexed question of the separate representation of special classes and interests. The Montagu-Chelmsford report reluctantly conceded it to the Mahommedan community and the Sikhs, and refused it to other classes. The Franchise Committee proposed its extension to Europeans and Anglo-Indians in certain provinces and to native Christians in Madras. The Joint Select Committee further extended it to the non-Brahmins in Madras and the Mahrattas in Bombay. They also recommended increased representation by means of nomination for the depressed classes and special provision for the representation of landholders and of Europeans in Bengal. The electoral system is largely coloured by the principle of separate representation of classes and interests.

The Joint Committee dealt as follows with the difficult question of the relations of the provincial governor towards his Legislative Council when it reduces or withholds supply asked for, or refuses to pass laws proposed by his Government. As regards supply the committee considered that the governor should have power to restore the provision made in the estimates for a "reserved" subject, on his certifying that the amount asked for was essential to the proper administration of the subject. With regard to legislation the committee rejected the expedient of referring a bill relating to a "reserved" subject which the Legislative Council had refused to pass to a Grand Committee, and recommended that the governor should have power to pass the bill on his sole authority on certifying that it was essential for the discharge of his responsibility. An Act so made was to be reserved for the King's assent.

With regard to the clauses of the bill relating to the Government of India the Joint Committee transformed the Council of State from a chamber in which the Government would have had an official majority into a real second chamber, having a majority of members returned by some method of election. They proposed that the governor-general should be empowered to pass on his sole responsibility Acts which the Legislature had refused to enact, on his certifying that the law was essential for the safety, tranquillity or interests of British India. They recommended that the Legislative Assembly should be elected directly by suitable constituencies, and not by the indirect method proposed by the Franchise Committee; that the Indian budget (certain charges being excepted) should be submitted to its vote, but that the Governor-General in Council should have power to restore any demand which the Legislative Assembly had refused, on certifying that it was essential to the discharge of his responsibilities. This power was meant to be real and to be used if and when necessary, since no measure of responsible government was to be introduced into the central administration. The committee considered that the governor-general should not be a member of, though he should have the right of addressing, either Chamber. He should appoint the president of the Legislative Assembly during the first four years, after which time the Chamber would elect its own president. The governor-general should also appoint the president of the Council of State from among its members. The first president should be qualified by experience in the House of Commons and knowledge of parliamentary procedure, precedents and conventions. Minor changes were made in the composition of the executive council. The limit on the number of its members was removed. Three members must be public servants, or ex-public servants, having not less than ten years' experience in the service of the Crown in India, one member should have definite legal qualifications, and not less than three members should be Indians.

With regard to the India Office the Joint Committee accepted the recommendation of Lord Crewe's committee that there should be a high commissioner for India, to be paid out of Indian revenues, who would perform for India functions of agency, as distinguished from administrative and political functions, analogous to those performed by the high commissioners of the self-governing Dominions. They agreed that all charges of the India Office, not being "agency" charges, should be paid out of money to be provided by Parliament. They were not in favour of the abolition of the Council of India, differing in this respect from the Crewe committee. But they recommended the introduction of more Indians into it, and the shortening of the period of the service upon it so as to ensure a continuous flow of fresh experience from India. The period has been reduced from seven to five years.

The Joint Committee made a highly important pronouncement on a question of great practical moment. Under the new constitution, notwithstanding the creation of an Indian Legislature deriving its authority from a large electorate, with a large elected majority and with enlarged powers, the responsibility of the Governor-General in Council to Parliament will remain statutorily unimpaired. This responsibility is enforced through the Secretary of State for India. In the past Secretaries of State have not hesitated to require the governor-general to carry out a policy approved by Parliament, or by powerful interests in Parliament, in opposition to the views of the Indian Government and of the Indian people. Especially has this been the case in tariff questions, where the Indian Government has sought to impose customs duties on cotton piece-goods and other imports in which the British manufacturer is interested. Is intervention of this kind to continue, or, in view of altered circumstances, should it be restricted by statute or convention? The committee considered that no statutory change could be made, but that it should be an understood rule that only in exceptional cases should the Secretary of State intervene in matters of purely Indian interest, where the Indian Government and the Legislature of India were in agreement. In the particular case of fiscal policy they recommended that the Government of India should have liberty to devise those tariff arrangements which seemed best fitted to India's needs as an integral part of the British Empire. India should have the same liberty as Canada, South Africa, and Australia. The Secretary of State's intervention, when it does take place, "should be limited to safeguarding the international obligations of the Empire or any fiscal arrangements within the Empire to which H.M. Government is a party." If future Parliaments abide by the convention which the Joint Committee have suggested and do not force the hands of the Secretary of State, a potent cause of friction and misunderstanding between India and England will be removed.

A similar rule should, the committee considered, regulate the relations of the Government of India to provincial Governments so far as reserved subjects are concerned. Where the provincial Government and Legislature are in agreement, their view should ordinarily be allowed to prevail. Over transferred subjects the control of the governor-general should be restricted within the narrowest possible limits.

Lastly, the committee recommended that during the next ten years no changes of substance should be made in the constitution. At the end of that period the working of the constitution should be examined by a statutory commission. They suggested the appointment of a financial commission to advise as to the principle on which contributions from the provincial Governments to the central Government should be adjusted. They attached the greatest importance to the formation in each province of a strong department of finance which would serve both sides of the Government alike. They ended a notable report by an emphatic repudiation of the suggestion that the proposed constitutional changes implied any condemnation of the present system of Government in India.

Government of India Act, 1919.—The bill on which the Joint Committee reported became law as The Government of India Act, 1919. It takes the form of amendments of the Government of India Act, and has been so drafted as to admit of being textually incorporated into the principal Act. Its provisions are best studied in the Act of 1915 as now amended. As is usual with statutes relating to India, it left a great deal of the new constitution to be worked out by rules. In indicating in their report the lines which the rules should follow, and subsequently when rules had been made by the Government of India and had been laid before Parliament by the Secretary of State in examining and reporting on them, the Joint Select Committee have largely controlled the ultimate form of the new constitution.

"Dyarchy."—The distinctive feature of the new constitutional system is the introduction of dual government or "dyarchy" into the major provinces. But preparatory to that two other steps required to be taken. In the three provinces known as Presidencies the form of government was that of a governor in council. The new system necessitated that the provinces known as the United Provinces, the Punjab, Bihar and Orissa, the Central Provinces, and Assam, which had hitherto been governed by lieutenant-governors or chief commissioners, should be raised to the position of "Governor's Provinces" and given each a governor in council.

In making this change the Act altered in one particular the composition of provincial executive councils. The maximum number of members is retained at four, but only one member (instead of two) must have been in the service of the Crown. Burma, the remaining major province, was left a lieutenant-governorship until a constitution adapted to its special needs could be devised. In the next place it was necessary to secure to the provinces a larger measure of independence of the central Government and a more assured field of action. Though in practice they enjoyed considerable freedom in the management of their domestic affairs, the Government of India, in virtue of their statutory right of control and intervention and concurrent powers of legislation, were always able, and were frequently compelled by their responsibility to the home authorities, to exercise powers both executive and legislative that cut across the considered action of the local Government. The same was the case with regard to provincial finance. The local Governments in practice were assigned by the central Government a very considerable share of the general revenues of India, but the main sources of the provincial income were not under their sole control and they were in theory little more than collecting and disbursing agents of the Government of India. They could not raise loans for provincial objects or impose additional taxation. The Act of 1919 does not in express terms enlarge the autonomy of provincial Governments, but it gives ample power to make statutory rules to that end and indicates the matters for which any such rules should make provision. This power has been exercised. The functions of the provincial Governments have been demarcated from those of the central Government by means of classified lists of "central" and provincial subjects. Some account of the contents of these lists has already been given.

The provincial Governments have been allotted their own sources of revenue, the principle on which the allocation has been made being that revenues accruing in respect to subjects provincially administered go to the provincial Governments. Receipts on account of land revenue, stamps, excise, forests, belong to this category. The central Government by this arrangement loses the share of these revenues which it hitherto received, with the result that the revenues accruing in respect of subjects (such as customs, income tax, salt, opium) which it itself administers are insufficient for its requirements. The provinces are therefore required to contribute annually fixed sums to the central Government, amounting in the aggregate to 983 lakhs (about £6,500,000). It is hoped that in time the central Government may be able to reduce, and possibly to remit altogether, these contributions. The provincial Governments are required to bank with the central Government. In cases of emergency a provincial Government may be required by the central Government, with the sanction of and on conditions approved by the Secretary of State, to pay to the central Government a contribution in excess of the prescribed amount. The central Government has also power in an emergency to require a provincial Government to reduce temporarily its drawings on its balances. Each province is also required to maintain a famine fund of a prescribed amount. Subject to these exceptions and to the obtaining the sanction of the Secretary of State to certain classes of expenditure, the provincial Governments may expend their revenues and balances as they think fit. They may also raise loans for certain specified purposes and on prescribed conditions on the security of provincial revenues. With regard to taxation certain taxes are scheduled which a provincial Legislative Council may impose by law without the previous sanction of the central Government.

Constitution of Provincial Governments.—The field of provincial autonomy having thus been demarcated and enlarged, the Act proceeds to introduce responsible government in an elementary and tentative form into the administration. It provides for the appointment by the governor of ministers, who must not be officials and who must be elected members of the Legislative Councils, to administer "transferred" subjects and to hold office during his pleasure; and it directs that ordinarily the governor shall be guided by their advice. The Act leaves it to rules to determine what "provincial" subjects shall be transferred to the administration of the governor acting with ministers, to regulate the extent and conditions of such transfer and to provide for the allocation of revenues or moneys for the purpose of such administration. Under this rule-making power an elaborate division of the functions of provincial Government into "reserved" subjects, which are administered by the governor in his executive council, and "transferred" subjects which are administered by the governor acting with ministers, has been made. Mention has been already made of the subjects placed respectively into the two categories. Law and order, administration of justice, police, are, as might be expected, among the reserved subjects. Of the subjects transferred to unofficial control education is perhaps the most critical. The rules with regard to the allocation of provincial revenues and balances as between reserved and transferred services adopt the "joint purse" plan recommended by the joint committees. Other rules create in each provincial Government a finance department and assign to it duties analogous to those discharged by the Treasury in England. It is controlled by a member of the executive council. It is responsible for seeing that proper financial rules are framed and suitable accounts kept; it prepares the estimates, examines and reports on all proposals for the increase or reduction of taxation, lays the audit and appropriation reports before the public accounts committee, and generally acts as the financial conscience of the administration.

A minister holds office during the pleasure of the governor. In administering his department he is responsible to and should command the support of the Legislative Council. If he should fail to command it, he may see fit to resign, or the governor may replace him. The salary of a minister is the same as that of a member of the executive council, unless a smaller salary is fixed by vote of the Legislative Council. The number of ministers is at the discretion of the governor, but will probably vary from two to four. The ministers will be encouraged to act together as a ministry and also, as far as possible, in consultation and harmony with the official half of the Government, that is, the executive council. But each half is solely responsible for decisions on the subjects administered by it. The orders and proceedings of each part of the Government run in the name of the Government but also indicate from which part they emanate. In the Legislative Council one part of the Government is not bound to support the other by speech or vote, but should not oppose.

Provincial Legislative Councils.—The new Legislative Councils are more than double the size of the late Councils and have a much larger majority of elected members. The method of election is direct, and the electorates are many times larger than the old electorates. The vote has been given to about five millions of the adult male population. On account of the necessity for providing for the separate representation of different communities, classes and interests, the formation of constituencies and allotment of seats to the several communal or class groups has been a complicated and difficult business. The Act leaves these and other matters connected with the franchise to be settled by statutory rules. It merely prescribes the minimum strength of each Council and the proportions of official to elected members. Not more than 20% of the members may be officials, and at least 70% must be elected. The rules fix the strengths of the several Councils as follow:—Madras 127 members, Bombay 111, Bengal 139, United Provinces 123, Punjab 93, Bihar and Orissa 103, Assam 53. In all the Councils the seats allotted to electorates exceed the prescribed minimum of 70 per cent. The Bengal Council for instance consists of 113 elected members, 20 officials and 6 non-officials nominated to represent special interests. A further analysis of the composition of the Bengal Council will show the extent to which the electorates are formed on a communal, class, or special interests basis. Of the 113 elected members 46 are returned by non-Mahommedan electorates, 39 by Mahommedan, 5 by European, 1 by an Anglo-Indian electorate, 5 by landholders, 1 by the university, and 15 by chambers of commerce and trade associations. The constituencies with few exceptions are territorial, the Mahommedan and the non-Mahommedan electors in each electoral area being placed on separate rolls and reckoned as separate constituencies. The franchise is based on a property qualification varying from province to province, such as the payment of a prescribed minimum of land revenue, or of income tax, or of municipal taxes; but in all provinces pensioned or discharged officers and men of the Indian army are entitled to a vote irrespective of the amount of their income or property. The rules further provide for the return of election expenses, and for the appointment by the governor of commissioners for the trial of election petitions, and define what shall be deemed to be corrupt practices. These provisions have been supplemented by an Act (The Indian Elections Offences Act, 1920) of the Indian Legislature. The governor is no longer a member and *ex-officio* president of the Legislative Council. But he is entitled to address it and for the first four years appoints the president. Thereafter the Council will elect the president from among its members. It elects from the outset the deputy-president. With regard to legislation the restrictions which debarred provincial Legislative Councils under the Morley-Minto scheme from making laws on certain subjects, except with the previous sanction of the Government of India, have in a measure been relaxed. But a fact of more consequence is that in the new Councils the elected members are in a great majority and that ministers, responsible to them, will initiate legislation. A large advance has been made in the matter of budget procedure. Under the Morley-Minto system the Legislative Councils could only pass resolutions that were not binding on the Government. Now the proposals of the local Government for the appropriation of provincial revenues and other moneys are submitted to the vote of the Legislative Council in the form of a demand for grants, and the Council may refuse its assent to a demand or reduce the amount. To this power there are important limitations designed to strengthen the hands of the executive. Certain heads of expenditure are not submitted to the Legislative Council, on the analogy of the Consolidated Fund, and power is given to the governor to restore grants asked for in respect of reserved subjects which have been refused, and to authorize expenditure in an emergency.

Duties and Powers of Governors of Provinces.—The powers of the governor with regard to bills are important and somewhat intricate. He may stop proceedings on a bill by certifying that it affects the safety or tranquillity of his province or of another province. He may withhold his assent from a bill, or return the bill to the Council for reconsideration. Certain bills he is required by rule to reserve for the consideration of the governor-general, and others, as specified in the rules, he may so reserve. He may pass on his own responsibility a bill which the Legislative Council has refused to pass, if it relates to a reserved subject and he certifies that it is essential to the discharge of his responsibility. In accordance with the recommendation of the Joint Select Committee a bill so passed is subject to disallowance by His Majesty in Council. The governor of a province is thus the pivot on which the whole system of dual government turns. As Governor in Council he is the head of the official Government, and as such responsible together with his executive council to the Secretary of State and Parliament, and subject to the authority of the Government of India. In administering reserved subjects he and his executive council have to live on terms with a Legislative Council in which elected members are in a large majority, and to deliberate with ministers who reflect the dominant views of that body. In acting with the ministers his duty is to assist them in their administration of transferred subjects and advise them with regard to their relations with the Legislative Council. He has to have regard to these relations and to the wishes of the people as expressed by their representatives in deciding whether to accept or dissent from a minister's advice. Further, the Instrument of Instructions which he receives on appointment, while requiring him to act in all things so that the people may soonest be fitted for self-government, specially charges him to see that the safety and tranquillity of the province are maintained and religious and racial conflicts prevented; that minorities and depressed classes are not oppressed or their interests overlooked; that no one is deprived of rights and privileges hitherto enjoyed; that members of the public service are safeguarded in the legitimate exercise of their functions and justly treated; and that no monopolies or special privileges against the common interest shall be established. The governor's responsibility extends over the whole field of provincial government.

Constitution of Central Government.—The decision that no measure of responsible government should be introduced into the central administration left only the question of the changes to be made in the structure and powers of the Indian Legislature. The Act of 1919 has substituted for the single Chamber known as the Imperial Legislative Council a bicameral Legislature consisting of a Council of State and a Legislative Assembly. The old Chamber consisted of 68 members of whom 36 were officials. Of the 32 non-official members some were nominated and others were elected by very restricted electorates and indirect methods of voting. The new Legislative Assembly consists of 144 members of whom 103 are elected. Of the 41 nominated members 26 are officials. The Upper Chamber or Council of State consists of 60 members of whom 33 are elected, and 27 nominated. Not more than 20 of the nominated members may be officials. The executive Government is therefore not assured of a majority in either Chamber and it has been necessary to provide safeguards to enable it to pass essential legislation and to obtain supplies.

The Act leaves to statutory rules the apportionment of the elective seats of each Chamber among the provinces, the formation of constituencies, the qualifications of the electors and the like. Rules have been made on these subjects. The apportionment of seats is arranged with regard to the relative size and importance of the several provinces. To the province of Bengal 17 seats in the Legislative Assembly and 6 seats in the Council of State have been allotted. Smaller provinces have a smaller representation. The Punjab and Assam, for instance, are given 12 and 5 seats respectively in the Legislative Assembly and 3 and 2 seats in the Council of State. The method of election to both Chambers is direct. The constituencies have been formed on the communal and special interests' lines adopted in creating electorates for the Provincial Legislative Councils, though they are necessarily larger in area and the property qualification of voters is substantially higher. The province of Bengal for instance is divided into communal and special electorates which return 6 non-Mahommedan and 6 Mahommedan members, 3 Europeans, 1 representative of the landholders and 1 representative of Indian trade, to the Legislative Assembly. The province also returns to the Council of State 3 non-Mahommedans, 2 Mahommedans and 1 European by means of electorates which are similarly constituted, but which are very extensive in area and based on a restricted franchise.

The governor-general is not a member of, but may address, either Chamber. The members of his Executive Council are appointed members of one or other Chamber as the governor-general sees fit, but may speak in either Chamber. The governor-general nominates the president of the Upper Chamber, as also for the first four years after the constitution of the Chamber the president of the Legislative Assembly. After that period the Lower Chamber will elect its own president. The normal lifetime of the Council of State is five years and of the Legislative Assembly three years, but either Chamber, or both simultaneously, may be dissolved at any time by the governor-general.

The Indian Legislature.—The powers of the Indian Legislature may now be considered. As regards the asking of questions and the moving and discussing of resolutions concerning matters of general public interest the two Chambers of the Indian Legislature have substantially the same powers as their predecessor, the Imperial Legislative Council, and are subject to the same restrictions. But two minor enlargements may be mentioned. A supplementary question may be asked by any member of the Chamber; and a motion for adjournment of the business of the Chamber for the purpose of discussing a matter of urgent public importance may be moved with the consent of the president. A resolution if passed, has, as before, effect only as a recommendation to the Governor-General in Council. But the political effect may now well be greater in view of the altered character of the Legislature. With regard to legislation the Indian Legislature is debarred, as its predecessor was, from legislating on certain specified subjects except with the previous sanction of the governor-general. To the creation of a second chamber and the possibility that the Government may be placed in a minority in either chamber are due certain provisions in the Act of 1919 which are not in the former Act. If the Chambers fail to agree to a bill within a period of six months from its passage by one Chamber the governor-general may refer it to a joint sitting of both Chambers. He may stop proceedings on a bill or prevent its introduction by certifying that it affects the safety or tranquillity of the country. He may pass a bill on his own responsibility which the Legislature has refused to pass, on certifying that its passage is essential for the safety, tranquillity or interests of British India or any part thereof. Any such Act is laid before Parliament and has no effect until it has received His Majesty's assent. The budget procedure prescribed by the Act of 1919 is novel and is an extension of the financial powers hitherto enjoyed by the Legislature. The Indian Councils Act of 1909 authorized the making of rules permitting the discussion in the Legislative Council of the annual financial statement. Under these rules resolutions might be moved and adopted concerning entries in the statement, but no vote was taken on the estimates and resolutions operated merely as recommendations. The Act of 1919 requires that the proposals of the Governor-General in Council for the appropriation of revenue or moneys (certain specified heads of expenditure excepted) shall be submitted to the vote of the Legislative Assembly in the form of demands for grants. The Legislative Assembly may assent or refuse its assent to any demand or may reduce the amount referred to in any demand by a reduction of the whole grant. But this formidable power is subject to limitations. The governor-general may restore a demand which the Legislative Assembly has refused to grant, by declaring that it is essential to the discharge of his responsibilities. Further the excepted heads of expenditure which are not submitted to the vote of the assembly include such important items as political and military charges and the salaries and pensions of certain classes of public servants, and constitute a large part of the budget. Of this arrangement, as also of the power given to the governor-general to pass a law which the Legislature has refused to accept, it is sufficient to say that they are solutions recommended by the Joint Select Committee of the dilemma raised by the coëxistence of an irremovable executive and elected Legislature, deriving their respective authority from different sources. They are not a final adjustment of forces but an expedient devised for a transitory stage of political development. The Act makes some minor changes in the number and in the tenure of office of members of the Secretary of State's Council and in the procedure of the India Office, but leaves the functions and constitution of the Council unaltered. A long-standing grievance is remedied by a provision placing the salary of the Secretary of State on the estimates and by an arrangement with the Treasury whereby the expenses of the Council of India and the India Office other than "agency" charges will henceforth be borne by the British Exchequer. By "agency" is meant work such as the purchase of stores, the engagement of persons for service in India, the payment of pay and pensions of Indian officers, in which the India Office acts as the agent of the Indian Government.

High Commissioner for India.—The Act authorizes the appointment of a high commissioner for India who will take over the agency business of the India Office with the necessary establishment, and transact it in direct communication with, and at the charge of, the Government of India. When this transfer has taken place the functions of the India Office will be purely administrative, and confined to those which strictly arise out of the duties of supervision, direction and control placed by Parliament upon the Secretary of State in Indian affairs.

Restriction of Secretary of State's Powers.—As a corollary to the introduction of the elements of responsible government into Indian administration the Act empowers the Secretary of State in Council to divest himself by rule, to such extent as he may specify, of his statutory powers of supervision and control over Indian affairs, and thereby, to like extent, of his responsibility to Parliament. In exercise of this power he has made a statutory rule which has the effect of releasing the administration of "transferred" subjects from his supervision and control, except in certain specified circumstances, such as, where Imperial interests or the interests of the Government of India are affected. Ordinarily he will not interfere, and will not be expected by Parliament to interfere, in subjects administered by members. This may be illustrated by a concrete instance. The administration of the liquor and drugs excise is a transferred subject. In the past the Secretary of State has constantly been called upon to intervene in respect of the district or provincial management of liquor shops and correct alleged abuses. In future his reply will be that the administration of this subject rests with the ministers responsible to the provincial Legislative Council, and that he is by rule precluded from interfering, unless it can be shown that the matter falls under one or other of the specified exceptions. A considerable area of Indian administration has in this way now been removed from the purview of Parliament. The rule-making power conferred by the Act extends in terms to central and provincial subjects as well as to transferred subjects. But the anxiety of Parliament to limit the exercise of the power to transferred subjects is shown by the provision that no rule applying to subjects other than transferred may be made until the draft has been approved by resolution of both Houses of Parliament. This is in consonance with the opinion of the Joint Select Committee that any relaxation of parliamentary control over that part of Indian administration which is still retained by the Governor-General in Council and the official Government in the provinces should come about by the growth of a convention and is not a suitable subject of rules.

Position of Public Services.—Two or three other matters dealt with in the Act of 1919 may be briefly noticed. The transfer of a considerable portion of Indian administration to ministers responsible to a Legislature, for the most part elected, necessarily affects the position of the public services and might, in the absence of statutory safeguards, injuriously affect their rights and privileges. The Act contains provisions securing to civil servants appointed by the Secretary of State (to which category the European services belong) protection against wrongful treatment or dismissal, and the enjoyment of pensionary rights granted to them on their appointment. The Act also establishes a Public Service Commission, with a chairman appointed by the Secretary of State in Council, to superintend the recruitment and to control the public services in India, creates the office of auditor-general and sets up a financial authority with adequate powers in each province.

Statutory Commission.—Lastly, the Act provides for the appointment of a Statutory Commission at the expiration of ten years to inquire into the working of the system of government, the growth of education, and the development of representative institutions in British India, and to report as to whether and to what extent it is desirable to establish the principle of responsible government, or to extend, modify or restrict the degree of responsible government then existing therein, including the question whether the establishment of second chambers in the local Legislatures is or is not desirable.

This provision sufficiently indicates the transitional and evolutionary character of the new constitutions set up in India. The progressive realization of responsible government has been declared the aim of British policy in India. If, as was announced, this policy can be carried out only by successive stages, and if the British Government and the Indian Government must be the judges of the time and measure of each advance, inquiry by a commission is a necessary measure. The undertaking given in the Act that inquiry shall be made ten years hence should disarm suspicions as to the intentions of Parliament and the British Government, and give assurance to honest workers in India. Impatient idealists may think the interval too long and may seek to abridge it. But the present advance means a long stride in an unmapped and difficult country, and ten years is as nothing in the growth of a nation. The interval will give opportunity for observation and testing such as were denied to the Morley-Minto reforms. The latter after barely four years' working were engulfed in the war and the inrush of new ideas. It will also give time for elementary education to become more general and for the electorates to comprehend the meaning and consequences of representative and responsible government.

Subsidiary Administrative Reforms.—The constitutional changes sanctioned by Parliament are to be supplemented in two directions by administrative measures which the Government of India has undertaken. They propose in the first place to revivify local self-government. Excluding the great presidency corporations, which are a class by themselves, Indian municipalities are largely under official guidance and control. The nominated element in the boards is large, and the chairman is often one of the district officials. "With the best intentions," say the authors of the Montagu-Chelmsford report, "the presence of an official element on the boards has been prolonged beyond the point at which it would have afforded very necessary help, up to a point at which it has impeded the growth of initiative and practice." It is proposed to increase the elective element, to widen the municipal franchise, to replace official chairmen by elected chairmen, to give the boards greater financial and administrative powers, and to substitute control from without for control from within. The same policy is to be applied to the rural boards which even more than the municipalities are Government agencies. It is hoped in this way to make local affairs a training-ground for political work and to bring home to the people the realities and responsibilities of local self-government. In the second place the reconstitution of the public services is contemplated. They are to be "Indianized" in general accordance with the recommendations of the Royal Commission on the Public Services of India, as amplified by the Montagu-Chelmsford report. For the civil service of India, which is the administrative service of the country, the proportion of Indians has been fixed at 33 %, rising by 1½ % annually for a period of ten years to a maximum of 48 per cent. In the Indian educational service the proportion of Indians will be even larger. Some of the services which hitherto have contained a more or less considerable number of Europeans will in future be recruited entirely in India. Along with this change in the composition of the public services of India, their position and functions will undergo a change in consequence of the establishment of ministerial government in the provinces. Hitherto the greater services, and especially the civil service of India, have in practice had the administration in their hands and held the places involving superior control. They have formulated policy while being the executants of it. Under a system of responsible government this position will gradually change. They will be the executive agents of ministers who in their turn will be accountable to the Legislative Councils and the electorates. The authors of the Montagu-Chelmsford report have not overlooked the consequences of this change both as regards the recruitment and fortunes of the European members of the services and as regards the efficiency of the administration. But they take a sanguine view. They believe that to make the Indian people self-governing the presence of the English officer will be found indispensable, and while forbearing to forecast the future organization and disposition of the services, they consider that the English official will continue to play a large and useful part in the administration of the country.

Constitution for Burma.—The authors of the reforms scheme excluded Burma from the scope of their proposals and left the problem of its political evolution for separate and future consideration. They remarked that Burma was not India. Its peoples belonged to another race in another stage of development, its problems were altogether different, and it was impossible to say how far their proposals would be applicable to Burma until the Government and the people of that province had had an opportunity of considering them (Montagu-Chelmsford report, para. 198).

Acting on this suggestion the Government of Burma drew up and published for public discussion a tentative scheme of constitutional reform. After some delay due to this procedure the local government submitted to the Government of India in June 1919 its matured proposals, with a lengthy statement of its reasons for not recommending the application to Burma of the distinctive features of the constitution about to be given to India proper. Briefly speaking, the country was at present unfit for responsible government. The Burmans were politically a generation behind the people of India. They had not undergone the training in public affairs which had fallen to the lot of the latter. Municipal and local self-government in Burma were in their infancy. The elective principle was unfamiliar to the people. Comparatively few Burmans had an advanced knowledge of the English language and very few had attained to high office in the public service. The Indian constitution applied to Burma would result in an inexperienced electorate, a Legislative Chamber unequal to the responsibilities thrust upon it, and ministers with no administrative knowledge. The Burma Government therefore advocated a transitory scheme by which the people might be trained for the exercise of larger powers.

Instead of a dual Government, consisting of an official executive council and ministers drawn from and responsible to the Legislative Council, the Burma Government proposed that the head of the province, remaining autocratic, should be assisted in the administration by boards. Each board would consist of a non-official president nominated by the governor, to be chosen from the Legislative Assembly, and one or more official members. The boards would refer to the governor for decision cases in which the members were not agreed and cases of major or special importance. The boards would not be responsible in any respect to the Legislative Council. The methods of legislation would be similar to those in the provinces of India, but resolutions on the budget would be only recommendations to the governor. There would be no transferred subjects, no ministers and no responsibility to the Legislature.

The Government of India agreed with the Government of Burma as to the impossibility of imposing on Burma a constitution on the Indian model and as to the necessity for an intermediate period of preparation and training. In March 1920 they laid these views before the Secretary of State and asked for sanction to the scheme, which they said would give to Burma at least as great an advance as the disparity between it and India in political conditions warranted. In one important particular they modified, with the consent of the Burma Government, the original scheme, substituting for the proposed system of boards an executive council of three officials and three non-officials. The Executive Council would work in committees of two, so that the non-official Burman would have an official as his colleague and mentor. An appeal was to lie from a committee to the full council in case of a difference of opinion.

The decision of the Secretary of State was not announced until Nov. 1920. While this leisurely constitution-making was in progress, indifference in Burma had given place to a vigorous political agitation to secure for the province at least as ample a measure of responsible government as India was about to receive. In India "dyarchy" was in act of being established and the magnitude of the advance it implied was now realized. The Burman's pride was touched to the quick by the idea that it was proposed to put him on a lower plane than the Indians. He began to regard as an insult to his country and race the reform scheme which in 1919 Conservatives and Moderates had been disposed to accept. The rising feeling in Burma was patent to the Secretary of State when he refused to adopt the Government of India's proposals and informed them that His Majesty's Government had decided to apply the Act of 1919 to Burma. He based this decision on the ground that the Morley-Minto "training," which in substance was the same as the Indian Government's scheme, had proved "fallacious in India as a means of fitting Indians to exercise responsibility." He wished to avoid creating in Burma the situation which now threatened to prejudice success of reforms in India, and thought it better "to train Burmans in exercise of real responsibility rather than in criticism." The Government of India was perturbed by this decision. They replied that the immediate application of the Act of 1919 to Burma would be fraught with grave risks for which they could not accept responsibility, and urged that if it was decided to legislate, Parliament should be made acquainted with their views.

In March 1921 a bill to apply the Act of 1919 to Burma was introduced in the House of Lords. The debate on the second reading was adjourned until the House was in possession of the latest correspondence on the subject between the India Office and the Government of India. In the meantime the Secretary of State referred the whole correspondence to the Standing Joint Committee on Indian Affairs and asked them to advise him as to the form of constitution which should in their opinion be introduced in Burma. On the merits respectively of the Government of India's scheme and that of the Secretary of State the committee were divided. But they were at one in the conclusion that matters having gone thus far, Burma must be granted the same constitution as India. They had less difficulty in reaching this conclusion insomuch as the Burma Government, confronted with an agitation that had grown in intensity and strength since the intention of the home authorities had become known, telegraphed that the time had passed for pressing any scheme for an intermediate period of "training," and that the only course open was to extend "dyarchy" to Burma as soon as possible. The Government of India expressed similar views. Any scheme falling short of that adopted for provinces in India would, they said, no longer meet the aspirations of moderate Burmans. The acceptance of the bill was necessary.

In spite of the report of the Standing Joint Committee, and these strong expressions of opinion from Indian authorities hitherto opposed to the bill, it was found impossible by the Government to find time in 1921 for passing the Burma bill. It was decided, therefore, in August merely to proceed by notifying, under section 58a (1) of the Government of India Act, that it applied to Burma. It was then only necessary to settle the provisions of the franchise, determine the constituencies, divide the sphere of government into "transferred" and "reserved" subjects, and frame regulations on ancillary matters. It was hoped that the first elections to the Legislative Council would take place in 1922.

EDUCATION

The census of 1911 showed that only 11·4% of the male pop. and 1·1% of the female pop. of British India were literate, according to a very modest standard of literacy. That is, under 6% of the pop. could read and write. The number of persons, male and female, returned as having an elementary knowledge of English was under a million and a half in a pop. (British India only) of 240 millions. Corresponding figures of the 1921 census were not available up to Aug. 1921, but it was believed that they would show a substantial advance. During the 10 years ending 1918 the number of persons undergoing instruction in colleges and schools increased by 50 per cent. In 1909 the number of students undergoing university education in arts and vocational colleges was 25,000, and in 1918 63,000; in secondary schools 800,000 in 1908 and 1,200,000 in 1918; in primary schools 4,420,000 in 1909 and 6,000,000 in 1918. These figures are for colleges and schools classed as public institutions. Adding to them students attending special schools and private secondary and primary schools, the total number of persons under instruction was approximately 6,000,000 in 1909 and 8,000,000 in 1919. The increase would have been greater but for the deadly influenza epidemic which swept India in the latter year and carried off five millions of the pop., and which for some time would necessarily leave its mark on educational statistics.

Considerable as was the progress shown by the figures, the fact remained that only 5% of the male pop. and 1% of the female pop., or 3% of the whole pop., was undergoing instruction. If primary education were as general as in England, the percentage of males under instruction would be 15 instead of five. For India to approximate to the English standard (a standard which is possible only under a compulsory system), primary schools and teachers for three times the number of boys who were being taught would be necessary. This gives some idea of the magnitude of the task with which the educational reformer in India is faced. While primary education is thus so greatly in defect, the proportion of the population receiving university and secondary education compares well with the position in the most advanced Western countries. From the days of the East India Co. the demand of the middle class for education of this type as a means of livelihood has been insistent and increasing. It has been supplied by the State to the limit of its means on very cheap terms, to the comparative neglect of the agricultural and labouring classes who, where they were not actively hostile to the school-master, were well content to do without him. "While the lower classes," it is officially stated, "are largely illiterate, the middle class, which is the class that mainly patronizes higher institutions, is, numerically speaking, educated to a pitch equal to that attained in countries whose social and economic conditions are more highly developed." In Bengal the proportion of the educated classes who are taking full-time university courses is said to be almost 10 times as great as in England. But much of this so-called collegiate education is really school work of an indifferent kind. The danger of this top-heavy system is now fully realized. The local Governments, with the assistance of liberal grants from the revenues of the central Government, have lately adopted considered schemes for extending and improving primary schools and are laying the foundations of systematic advance. In several provinces arrangements have been made to double the number of places in the primary schools within the next few years. Public opinion in India was not ripe in 1921 for any general scheme of compulsory education. As a first step, municipal boards and other local bodies had been given by law in most provinces permissive powers to enforce the principle within their respective areas, but no great eagerness to make use of them had been shown.

During 1910–20 expenditure upon education in India had doubled. In 1919 it amounted to £8,500,000. Of this £3,600,000 came from general revenues, £1,100,000 from local funds, £1,500,000 from endowments and missionary enterprise, and £2,000,000 from fees. The charge upon general revenues was roughly 3½d. per head of the population. The local Governments may be expected to increase their educational budgets now that their finances have been improved under the new constitution and the department of education has been transferred to a minister responsible to the provincial Legislative Assembly. But the revenues of the provinces are not very elastic, the claims upon them are many, and fresh taxation in India raises many problems. Secondary and university education equally with primary education is in urgent need of a larger allocation of funds than is likely to be forthcoming in any province.

With the publication (1919) of the report of the Calcutta University Commission, higher education in India entered upon a new phase. The Commission was presided over by Sir Michael Sadler. It consisted of seven members, of whom four came direct from England and two were Indians. Its report condemned in emphatic and impressive language the whole system of secondary and university education, as it existed in Bengal, and, subject to qualifications, in other parts of India.

"The university system of Bengal," said the report, "is fundamentally defective in almost every respect." The system is based on an external examining university and a multitude of affiliated colleges, scattered throughout the country. The Calcutta University attempts to deal with 26,000 students. The numbers are beyond the capacity of a single university organization. The university is loaded with administrative functions which it cannot adequately perform. It rests on the assumption that the passing of examinations is the only thing of value in a university training. The examination standards are low and tend to lower themselves to the capacity of the weakest colleges. The scattered affiliated colleges are for the most part meagrely staffed and equipped; the teachers are gravely underpaid; the methods of instruction are mechanical; the conditions under which many of the students live are bad for their health, morals and work. The secondary or high schools which feed the colleges are even more defective, not only as regards teaching but in discipline, social life and healthy surroundings. Many are private-venture schools, managed for the gain of the proprietors at the lowest limit of efficiency. To pass their pupils into the university through the matriculation examination is their one aim. "The high-school training (dominated almost entirely by the matriculation examination), while it fails to fit most of the boys for the university, fails also in fitting them for anything else." With students entering the university so badly prepared, the teaching in the "intermediate classes" (that is during the two years between matriculation and the intermediate examination) is essentially school and not university work. The Commission would remove these classes from the university to "intermediate" colleges which, together with the high schools, would be placed under a Board of Secondary and Intermediate Education, independent of the university. The "intermediate" colleges would form the uppermost stage of a reformed and self-contained system of secondary education. Their curriculum would be of a varied kind and would lead up to appropriate examinations, conducted not by the university but by the Board, qualifying for entrance to the university, but also having an independent value as a certificate of general education. Students would enter the university at the stage at present represented by the intermediate examination and at a later age. The university would disencumber itself of two-thirds of the present unwieldy host of 26,000 students, and be set free for its proper duties.

The Commission rightly placed a radical reform of secondary education in the forefront of its proposals. As to the university, it would reconstitute it as a teaching university with a multi-collegiate organization, and give it a new constitution. It looked forward to the best of the affiliated colleges becoming in course of time independent universities. In the meantime, it would establish a teaching university at Dacca. Effect was given to this last recommendation, but the rest of the programme, involving an annual expenditure of £500,000 and a non-recurrent expenditure of an equal amount, remained in abeyance in 1921 owing to the financial difficulties of the Bengal Government. Other provinces accepted the principles of the report and proposed to apply them. The laws passed in the United Provinces for establishing teaching and residential universities at Lucknow and Aligarh (the Moslem University) bear unmistakable marks of the recommendations of the Commission.

THE INDIAN ARMY

The army in India is composed of British regular troops, which form part of the British army transferred for a period of service to the Indian establishment, and of the Indian army. The latter consists of Indian troops, raised in India by the Indian Government, and commanded by Indian officers (native officers as they are called) holding the viceroy's commission, and by British officers holding the king's commission. Under recent arrangements a certain number of king's commissions in the Indian army are now given to Indians; in some cases in recognition of distinguished service in the Indian army and by way of promotion, and in others to young men of good education on condition of their undergoing training in England at the Royal Military College, Sandhurst. The numerical proportion in which the two component parts of the army in India should stand to each other was fixed in the first instance in 1858, when the Crown assumed responsibility for the government and defence of India. It was further considered in 1893, when the rapid advance of Russia in Central Asia gave rise to anxiety for the security of India. The ratio of one British soldier to 2·5 Indian soldiers was then definitely adopted and has since been adhered to as the permanent basis of the army in India, though liable in emergencies, as in the World War, when India was for a time almost denuded of British troops, to be departed from. The proportion is struck on the regular forces, including the imperial service troops maintained by native states. No account is taken, on the one hand, of the Auxiliary Force, which is recruited on a voluntary system from the European and Eurasian community, or, on the other hand, of the reserves of the Indian army, the Indian territorial force, the armed police or the armies of the native states.

The British troops are necessarily the most costly part of the army in India, and both on this account and from a sense of national pride Indian critics of military expenditure have pressed for a reduction in the British element. Up to 1921 the Indian Government and its military advisers, though committed generally to reducing army charges that have doubled since 1914, had not admitted that the British garrison could be safely reduced. In a debate in the Legislative Assembly in March 1921 the commander-in-chief (Lord Rawlinson) made out a strong case for not altering the proportion of British to Indian soldiers while the requirements of internal and external defence were unchanged.

In 1914, when the World War broke out, the regular forces in India comprised 75,575 British soldiers, including 2,689 commissioned officers; 159,861 Indian army troops, including 2,771 British commissioned officers and 341 British warrant and non-commissioned officers; and 21,069 Imperial service troops. The reserves of the Indian army numbered 36,000 odd. Many of these were found during the war to be unfit for active service. The Volunteer force consisted of some 38,000 Europeans and Eurasians. During the World War the Indian army was greatly enlarged, as demands were made upon it by the Home Government for service abroad. In the last year of the World War the Government of India undertook to raise an additional half-million combatant recruits, and no doubt the full number would have been raised had the Armistice not intervened. All charges were borne by the Home Government, but the heavy task of recruiting, training, equipping and despatching the new armies fell on the Indian administration. Demobilization commenced in the beginning of 1919, but was interrupted by the Afghan War and the subsequent campaign against the tribes in Waziristan. At the end of 1920 the Indian troops serving in India mustered 226,000 men, or some 70,000 above pre-war strength. The British troops on the same date were only 65,390 men, or some 14,000 below pre-war strength.

The Kitchener Reforms.—Lord Kitchener, in the course of his prolonged tenure of the post of commander-in-chief in India, set to himself the task of reconstituting the army in India as regards organization and administration, improving its military efficiency, distributing it territorially to the best advantage, and giving it the mobility and power of rapid concentration which modern warfare requires. Though able men before him had done much to make the Indian army an efficient instrument of war, Lord Kitchener brought to bear upon the problem new ideas and methods. He had this advantage over his predecessors that he enjoyed a prestige and authority that enabled him to override opposition and obtain the concurrence of the home and Indian authorities to a large, and, in many respects, a contentious, scheme of reconstruction. The abolition of the military department and the military member of council, and the subsequent suppression of a separate department of supply, made him eventually the sole military adviser of the viceroy, and concentrated in the person of the commander-in-chief all executive and administrative authority in military affairs. In reorganizing the army he made the defence of the north-west frontier against the possible advance of Russia through Afghanistan his primary concern. The organization of the troops which he found existing dated from the Mutiny. It failed, he considered, to distinguish sufficiently between the requirements of internal security and those of offensive warfare. It did not ear-mark troops for these two distinct purposes and train and equip them accordingly, but left the selection and mobilization of an active army in the event of war to the last moment. He aimed, therefore, at creating out of the forces at his disposal (some 230,000 men in all) a field army, capable of being immediately mobilized, of the strength which he considered would be required to defend India against a Russian advance through Afghanistan, until help could be obtained from England. He proposed to mark off this army from the troops allotted for internal defence, to distribute it conveniently by divisions (each division comprising some 13,500 combatants of all arms) in homogeneous military areas, and to train it in war formations under the general officers who would command in the field. He broke up the four army commands which he found existing and replaced them by nine "divisional" commands. In each divisional command he proposed to place a self-contained division of the field army together with the necessary complement of garrison troops that would be left behind for internal defence in the event of mobilization. Fully mobilized his field army would absorb some 120,000 combatant troops, or more than half the total strength of the army in India. Adequate transport and supplies were to be provided and every arrangement made to enable each division of the field army, thoroughly trained and fully equipped, to pass rapidly into a state of war, when required, without confusion and dislocation.

It was a large scheme, involving many subsidiary reforms, such as enlarged staffs, extensive regrouping of troops and building of barracks, better training and equipment, increased pay and allowances for the native ranks of the Indian army.

These measures were in process of being carried out, when Lord Kitchener left India in 1909 after seven years' tenure of the office of commander-in-chief. Though planned with the greatest economy, and though it was curtailed and altered in order to reduce expense, the scheme necessarily increased the army charges, which rose from £16,000,000 in 1901 to £20,500,000 in 1910. Financial difficulties then beset the Indian Government. Fears of Russian aggression had subsided and a halt in military expenditure was thought advisable. When the World War broke out, the reorganization so far completed fell considerably short of Lord Kitchener's original scheme, though representing a great advance on what it had superseded. In the meantime much greater progress had been made in the United Kingdom in the organization, training and equipment of the British army. The expeditionary forces despatched from India were found in the earlier stages of the World War to be inferior in these respects to British troops. Then came the Mesopotamian breakdown, the inquiry of the Mesopotamian Committee set up by Act of Parliament, and the grave indictment of the Indian military system, as regards both administration and organization, contained in the Committee's report. The system was described as cumbrous, slow-moving and overcentralized in the last degree. The new commander-in-chief (Sir Charles Monro) effected some improvement, but the Afghan War of 1919, followed by the Waziristan campaign, led to renewed complaints against Indian army administration.

Under Lord Chelmsford's viceroyalty, the appointment of a Committee, with Lord Esher as chairman, to inquire into the organization and administration of the army in India, was deemed necessary. In the judgment of this Committee, which reported in 1920, the existing military system, as regards both organization and administration, was defective in many respects. Their recommendations would, if acted on, modify considerably the Kitchener scheme. Effect had already been given by 1921 to one such recommendation involving an extensive measure of delegation and decentralization. The nine divisional commands created by Lord Kitchener were replaced by smaller territorial units, and these were grouped into four army commands, the commanders of which would dispose of much work hitherto dealt with by the commander-in-chief and army headquarters. The more important proposals of the Committee regarding the functions of the military forces of India in any scheme of Empire defence, the authority to be exercised over their organization and administration by the British War Office, and the position and duties of the commander-in-chief were in 1921 still before the Indian Government and the Cabinet. As they stood, the proposals were not acceptable to Indian nationalists, who saw in them a design to subordinate the Indian army to the necessities of the Empire and to encroach on the independence of India.

FINANCE

The Indian revenues are largely dependent on the seasonal rains. If the monsoon is bad, and the crops fail, land revenue is remitted or its collection postponed, railway traffics decline, the agricultural population consumes less, the customs and excise receipts fall off, and heavy expenditure is incurred in the relief of distress. Good and bad seasons occur in cycles. Lord Minto entered upon his administration in a good cycle. In 1905–6 there was a surplus of £2,000,000,[1] although the salt duty had been reduced, certain land cesses remitted and special grants made to local Governments from Imperial revenues. It may here be explained that the budget of the Government of India included also the transactions of the local Governments, the revenues enjoyed by the latter being mainly derived from sources of income which are shared between the Imperial or central Government and themselves. A grant from "Imperial revenues" to "provincial revenues" meant that the central Government from its surplus made a gift to the local Governments. In 1906–7 further remissions of land cesses and additional grants to local Governments were made and a surplus of £1,500,000 secured. In 1907–8 in expectation of continued prosperity the salt duty was reduced to the low rate of R.1 per maund (82 pounds), and the opium revenue precautionally written down in view of an agreement with the Chinese Government, under which the export of Indian opium to China would be progressively diminished until in the space of ten years it would altogether cease. But adverse times now set in. In the autumn of 1907 the rains failed over a great part of India. Conditions continued unfavourable throughout 1908 and the first half of 1909. In the year ending March 31 1909, the deficit exceeded £3,500,000. In 1909–10 equilibrium was only attained by the enforcement of severe economies. In 1910, the last year of Lord Minto's administration, additional taxation amounting to over £1,000,000 a year was imposed. The seasons again became favourable and Lord Hardinge succeeded to a full treasury.

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[1] The conversion of rupees into sterling throughout this article has been made on the basis of Rs. 15 = £1. This was the ratio, as fixed by Act of the Indian Legislature, up to Sept. 1920. It was effectively maintained in the exchanges, and was the accepted notation of the Indian Government in its financial and other returns. The ratio has now been altered to R.1 = $^1/_{10}$ of the gold contained in a sovereign by the Indian Coinage Act, 1920, in accordance with the recommendation of the Indian Exchange and Currency Committee. But the new ratio failed to become effective, and no steps to stabilize it had been taken up to the middle of 1921. In the latest Indian returns the notation is in lakhs and crores of rupees. If and when a 2s. rupee becomes effective, a lakh will = £10,000 and a crore = £1,000,000.

The four years 1910–4 were years of financial prosperity. There was a large expansion of ordinary revenues, and also large windfalls under opium, due to the high prices which the Chinese were prepared to pay during the last few years of the trade. The accounts showed an "Imperial" surplus of nearly £4,000,000 in 1910–1, of equal amount in 1911–2, of over £3,000,000 in 1912–3 and of £2,330,000 in 1913–4. But the surpluses were really larger, as in the revised estimates of each year special grants for education and public health were made to local Governments, aggregating over £6,000,000 in the four years. The wisdom of special grants or "doles" from the surplus revenues of the central Government to the local Governments for expenditure on specific objects has been questioned, as encouraging extravagance and undermining the financial responsibility of local Governments. But they were a natural feature of the interlocking of provincial and Imperial revenues which then existed and of the control exercised by the Government of India over the whole field of provincial administration. Under a centralized system they were probably the most effectual instrument for promoting the active policy in public health and education that Lord Hardinge had at heart, and fell in with the ideas of the Indian members of the Imperial Legislative Council.

With the outbreak of the war in 1914 Indian finance entered on a difficult and anxious period. At first direct expenditure on the war was small, being limited to bearing the normal cost of troops belonging to the Indian establishment who were employed out of India in the different theatres of war.

The pre-war budget for military services was about £20,000,000 a year. This figure slowly rose to £25,000,000 in 1916–7 and £29,000,000 in 1917–8. In 1917 the financial position was sufficiently strong to justify the Indian Government, with the warm assent of the Legislative Council, in making a contribution of £100,000,000 to the home Government towards the cost of the war. In Sept. 1918, in the belief that the end of the war was distant and the needs of the home Government great, the Legislative Council, by a large majority of the non-official members to whom the decision was left, approved the Indian Government's proposal to make a further contribution. The Indian Government proposed to bear the cost of additional troops raised in India and of certain pensionary charges, the whole estimated at a sum of £45,000,000. Later estimates reduced the amount to £31,700,000. In 1920 the Legislative Council reconsidered the matter and recommended that the cost of the Afghan war should be deducted. The Government of India acquiesced, and the actual contribution was reduced to a sum of about £14,000,000. During the first two years of the war it was judged politically advisable to maintain the pre-war standard of taxation and incur a deficit of £3,000,000. In 1916–7, additional taxation, estimated to yield £3,000,000, was imposed. The income tax and salt duty were raised, duties imposed on exports of jute and tea, and the import tariff, save as regards the important item of cotton piece goods, was revised. By that time public confidence had revived, trade was active—especially in the export of produce required for war purposes—and agriculture prosperous. The railway earnings were large, all other sources of revenue yielded well, and a surplus of £7,500,000 resulted. In 1917–8, in order to meet the interest charges and sinking fund of the £100,000,000 contributed to the British Government, further additional taxation estimated to yield £6,000,000 was levied. A super-tax on incomes was imposed, the export tax on jute was increased, and a small surcharge placed on railway goods traffic. The import duty on cotton piece goods was also raised from 3½% to 7%, the excess duty on local cotton manufactures being maintained at the lower rate. The latter measure evoked strong protests from Lancashire and led to an important debate in the House of Commons, resulting in an undertaking that the matter would be reexamined hereafter in connexion with the general fiscal policy of the British Empire. Though the war continued, such was the activity of trade and the general prosperity of the country that a surplus of £8,000,000 was achieved.

The budget of 1918–9 was framed to produce a modest surplus. During the year the expenditure was increased by £13,000,000 credited to the home Government as the first instalment of the additional war contribution. The receipts, however, under most revenue heads were good, and the deficit of the year was under £4,000,000. In order to balance the estimates of revenue and expenditure of 1919–20 an excess profits duty, estimated to produce £6,000,000, was imposed for one year only. The budget of 1919–20, however, was completely upset by war with Afghanistan and other unexpected military charges, and the accounts of the year showed a deficit of £15,750,000. The budget estimates of 1920–1 were made on a basis that has since been found fallacious and were much too sanguine. It was assumed that the "boom" in trade and a high rate of exchange would continue, and that the gain from exchange or, in other words, diminution of the home charges would be large. The balance of trade from being highly favourable to India became adverse and the rupee exchange dropped during the year from 2s. 6d. to 1s. 4d. The military expenditure was underestimated. Sufficient account was not taken of the increased working charges of the railways and the consequent diminution of net receipts. The general rise in the cost of the civil departments on account of revisions of salaries necessitated by high prices was not foreseen. This was frankly admitted by the finance member in his financial statement introductory to the budget of the current year (1921–2).

The budget of 1921–2 marked a new era in Indian finance. It was the first budget under the new constitution submitted to the votes of the Legislative Assembly. It is confined to the revenues and expenditure of the central Government only, as provincial finances have now been entirely separated off and made over to the local Governments. It is expressed in rupees and not in sterling. The sterling pound of Rs.15 has disappeared and the proposed new ratio of 2s. to the rupee has failed to become effective. Crores of rupees take the place of millions of pounds. But whereas the crore was formerly the equivalent of £666,000 it is now assumed to be, but at present is not, the equivalent of £1,000,000. Expressed in the new notation there was in 1920–1 a deficit of 11 crores instead of an anticipated surplus of 2 crores. The budget of 1921–2 recognized that the expenditure from various causes had definitely outgrown the revenue, and provided 19 crores of additional revenue by enhancement of the customs import duties, a surcharge on railway goods traffic, higher postal rates, and regrading of the income tax and supertax. The revenues and expenditure of the central Government in 1921–2 are estimated at 130 crores (£130,000,000 on the basis of a 2s. rupee). The military charges absorb 66 crores or more than one-half of the total income. They are more than double the pre-war figure. The cost of the British garrison and the pay and pensions of the Indian army have greatly increased and the standard of equipment is higher and more expensive. Military expenditure is one of the budget heads which are not submitted to the vote of the Legislative Assembly. But the subject has been raised in other ways in that body and is one about which there is a difference of view between the executive Government and the Legislature. To the Indian nationalist whose thoughts are concentrated on internal progress and who imperfectly appreciates the existence of external dangers, the cost of defence seems excessive. The possibility of material economies largely depends on the strength and composition of the forces to be maintained. The Government of India, while not pledging themselves to immediate reductions, have undertaken to make a searching inquiry into military expenditure.

Military expenditure apart, the features of the financial situation which gave cause for anxiety were the large amount of floating and short-term debt; the inflated note circulation and the heavy capital requirements of the railways and irrigation. In comparison with other countries the indebtedness of India due to the war is not oppressively great. Before the war India was in the happy position of having no "ordinary" debt, as opposed to debt incurred for capital expenditure on railways and canals, the interest on which was borne by those undertakings. During the war and up to the end of 1920–1 some 230 crores of fresh rupee debt (including floating debt) had been incurred, representing an annual charge of over 12 crores on account of interest. Against this burden, considerable as it is, may be set the impulse given by the war to industrial development, the productiveness during the war of all existing industries, and the rapid accumulation of capital.

Currency.—At the outbreak of the World War the Indian currency system had, for a "managed" system, reached a position of considerable strength. The legal currency is the rupee, the ratio of which to the sovereign was, until altered in 1920 on the recommendation of the Indian Currency Commission of 1919, fixed at 15 rupees to the sovereign. There is no free coinage of silver. The Indian Government purchases silver and coins rupees to meet the requirements of the country. The profit, which was considerable when the price of silver ranged from 23 pence to 30 pence the ounce, is placed to the gold standard reserve and invested in sterling securities in London, forming a reserve to be used to maintain the exchange value of the rupee. The gold standard reserve amounted to £23,500,000 in 1914. On March 31 1920, it was represented by securities of the estimated value of £36,300,000. The import of gold in the form of sovereigns or bullion was unrestricted, and sovereigns circulated at the legal ratio. A favourable balance of trade over a series of years encouraged the import of gold, and £70,000,000 had passed into circulation between 1900 and 1914. In 1914 the gold held by the Indian Government in England and India together amounted to £23,000,000. The exchange value of the rupee had become stabilized in close approximation to the legal ratio, any upward movement being checked by imports of gold and any downward movement being met by the Government of India selling drafts on its reserves in London. It may be mentioned that the policy and measures adopted by the Indian Government to maintain the exchange value of the rupee received the approval of the Royal Commission on Indian Finance and Currency which was appointed in 1913.

With the war the Indian currency system entered on a new phase. India was called upon to supply the British Government and the Allies with immense quantities of raw materials, manufactured goods and food-stuffs for war purposes, and also to provide funds in India and in countries where Indian troops were fighting. The Indian Government had therefore to disburse rupee currency to very large amounts. The home Government repaid its debts by credits in London, but the Indian Government required money in India and the difficulty was to remit specie. Gold was unobtainable. Silver was scarce in the London and American markets. The Indian Government was therefore compelled to increase the note issue without a corresponding increase of rupees held against the notes. The security for such issues was provided by investment in British Treasury bills on behalf of the paper currency reserve of moneys lying at credit of the Indian Government in the Bank of England. The notes were convertible and their encashment drained away the reserve stock of rupees. The time drew near when either inconvertibility must be declared or silver obtained in large quantities for coinage. In April 1918 inconvertibility was all but reached when help came from the American Government. The circumstances in which the relief of India was achieved at the last moment through the sympathy, statesmanship and driving force of President Wilson were graphically described in a speech made to the English-speaking Union on Feb. 12 1921 by Lord Reading, who was at Washington at the time as special ambassador and on whom it fell to put the serious position of India, and the gravity of the consequences likely to result from suspension of metallic payments, before the American Government. Congress was prevailed on to pass the Pittman Act as an emergency measure. The Act enabled the Government to borrow from the Treasury the greater part of the dollar reserve of 375 million oz. held as security for silver certificates. The American Government as soon as it obtained this authority allowed the Indian Government to purchase 200 million oz. of silver dollars on very reasonable terms and accelerated the despatch of the metal to India. The news of the transaction reaching India in advance sensibly alleviated the situation and gave the Indian Government a welcome respite. From July 1918 onwards American silver began to arrive in large quantities and was coined into rupees. For some months the new money went out of the reserves as fast as it was coined, but by Dec. 1918 the convertibility of the note issue was secured. Between March 1915 and March 1919 nearly 120 crores of rupees (£80,000,000, converting the rupee at 1s. 4d.) were added to the circulation. The active circulation of notes in the same period rose from 60 crores to 150 crores. The rupees held against the note issue in the paper currency reserve in March 1919 amounted to 28 crores, the balance being covered by investments in British and Indian Government securities and by gold. This great expansion of metallic and paper currency in India has been accompanied by a general rise in prices and wages.

The price of silver in the London market rose with the demand for it, and with the gradual decline in the dollar exchange value of the pound sterling, from the pre-war level of 26 pence the oz. to 55 pence in Sept. 1917. From that time onwards it varied from a minimum of 45 pence to a maximum of 89 pence in Feb. 1920. This was followed at intervals by corresponding rises in the sterling exchange value of the rupee from the pre-war standard of 1s. 4d. to 1s. 8d. in May 1919 and 2s. 4d. in the following December. So great a departure from the Indian currency system based on the ratio of 15 rupees to the pound sterling gave rise to great difficulties. The Indian Government could no longer buy silver for coinage except at a heavy loss. The withdrawal of rupees for clandestine export by bullion dealers and speculators, or their melting down, became a profitable though illegal operation. The conversion into bullion of the rupee, when valued at one-fifteenth of the pound sterling, was profitable as soon as the price of silver touched 43 pence the ounce. Thus embarrassed, and in the belief that a higher price level for silver had come to stay, the Indian Government recommended and the Secretary of State agreed that the question of Indian exchange and currency should be referred to a strong committee sitting in London. The committee after a prolonged inquiry reported early in 1920. It recommended that the rupee should be correlated to gold, and not to sterling which by that time had depreciated in relation to gold and had no certain value, and that it should be given a new statutory ratio equivalent to one-tenth of the gold contained in a sovereign. This would give the rupee the equivalence of 2s. when the pound sterling returned to parity with the sovereign. The committee were of opinion that the price of silver expressed in pence would remain at a point that would make the retention of a 1s. 4d. rupee impossible unless the coin itself was diminished in weight or fineness. This alternative they rejected. In fixing the ratio at one-tenth of a gold sovereign they looked to the eventual return of the pound sterling to parity with gold. They thought that, having regard to the higher price levels of the world, India would still be able to maintain a favourable trade balance with a 2s. rupee, and that any consequent readjustment of rupee prices of Indian export staples would be to the advantage of the Indian consumer by acting as a drag on internal prices. The Indian Government accepted the committee's recommendations, which tallied with their own views. They announced their intention of legislating to establish the new ratio between the rupee and the sovereign, and for some months they endeavoured to maintain the exchange value of the rupee at that level by selling drafts on their resources in London to the amount of over £50,000,000. But economic forces proved too strong. Persons having money in India hastened to remit it to England now that the rupee commanded 2s. 6d. or upwards of sterling. At the same time the export trade of India fell off. In common with other countries whose exports consist of raw materials India found the demand for its produce suddenly dry up. The favourable trade balance, on which the stability of the rupee exchange at the old rate of 1s. 4d. depended, gave place during the second half of 1920 to a large adverse trade balance which had to be liquidated by bills on London. Exchange persistently dropped from 2s. 6d. the rupee, which in the first months of 1920 roughly represented the parity of one-tenth of a gold sovereign, to below 1s. 4d. in the early part of 1921, and the price of silver receded to 32 pence the ounce. In Sept. 1920 the Indian Coinage Act established the new ratio. The Indian Government, while stoutly maintaining that the policy was right, acknowledged that their efforts to support exchange and make the new ratio effective had proved both costly and abortive.

In 1920 the Indian Government took an important step to put its note issue on a better footing. Before the war the amount of notes that the Paper Currency Office might issue on the basis of securities of the British and Indian Governments was restricted to 14 crores. During the war the fiduciary issue was extended by a series of emergency Acts to 120 crores. The Indian Paper Currency Amendment Act, 1920, embodies a new and more elastic principle. It allows notes to be issued without limit, provided that at least 50% are covered by metallic holdings. Of the securities for the fiduciary portion 20 crores may be rupee securities. The balance must be securities of the United Kingdom of no longer maturity than 12 months. The metallic holdings may be either in gold or silver, but the gold, with the exception of 5 crores, must be held in India, not in England. This location of the gold reserves gives effect to Indian opinion on the subject. A novel and useful provision is that notes to the amount of 5 crores may be issued against bills of exchange of a durance not exceeding 90 days. The Act contains also transitory provisions intended to bridge the interval within which these important changes are to be brought into effect. Taken in conjunction with the amalgamation of the three Presidency banks into an Imperial Bank of India (*see* BANKS AND BANKING) this measure should secure a large expansion of the note issue under safe conditions.

AGRICULTURE

As two-thirds of the population of India live on agriculture, the prosperity of the country turns on the annual harvests to an extent unknown in western Europe. Irrigation in many parts of India protects an increasingly large area from the vicissitudes of the seasons; but speaking generally Indian agriculture is in the main dependent on the monsoon rains. An intense and widespread drought afflicted the greater part of India in 1896 and taxed all the resources of the administration to cope with the resulting distress. In 1900 and again in 1908 the monsoon failed badly over very considerable areas, causing great destruction of crops and cattle. From the latter date until the autumn of 1918 the country as a whole enjoyed a ten-year cycle of good rains and satisfactory harvests.

Until the outbreak of the World War the foreign demand for Indian produce—wheat, cotton, oil-seeds, jute, rice—was very active. Under this demand prices rose rapidly in India, to the gain of the agriculturist but to the detriment of the urban and labouring classes, and the result was provocative of much unrest and discontent. Indian politicians are inclined to look suspiciously on the export of grain, and to regard it as a "drain" on the food of the people. But over a series of years the net export of food grains has averaged less than 2% of the estimated total outturn. The effect therefore of the "drain" in normal years may easily be exaggerated. That the foreign demand has stimulated Indian agriculture and that the Indian peasant has benefited would seem beyond doubt. The irrigation colonies of the Punjab, where virgin soil yielded phenomenal crops of wheat during the decade, prospered exceedingly. Agricultural land fetched from £30 to £40 the acre and market sites along the railway from £200 to £300 the acre. The colonists absorbed vast quantities of specie,—especially sovereigns,—built spacious towns and substantial dwellings and indulged in a standard of living that from the Indian standpoint was luxurious.

The war introduced new factors. At first the foreign demand ceased. But soon the Allies turned to India for supplies for war purposes, and by 1916 their needs became so great that the Indian Government was obliged to undertake control of internal prices and restrict the volume and regulate the direction of export trade. Money poured into India for purchase of wheat, rice, jute and other commodities. In the interest alike of the Indian consumer and of the British Government and its Allies, it was essential to see that the country was not denuded of supplies, that prices were not forced up to extravagant heights, and that whatever surplus was available was utilized for war purposes, and did not find its way to the enemy or to neutrals. The need for caution was proved by what occurred in 1918. In 1917 there was a record wheat crop. In 1918 the monsoon failed and the harvests of all food grains were bad. A moderate estimate placed the deficiency of the year's harvests at 20 million tons or about one-fourth of the average yield. The control exercised by the Indian Government prevented extreme shortage, though it was necessary in 1919 to import 200,000 tons of wheat from Australia, and to divert to India a large part of the surplus rice crop of Burma. Generally speaking the war has enriched the Indian agriculturist and given a stimulus to agricultural improvements.

During the ten years preceding the war the agricultural departments in India were reorganized and strengthened. Each province has now a staff of experts. Much valuable work has been undertaken, though the difficulty of improving the methods employed by the mass of the cultivators is great. The departments have been successful in introducing improved seed and distributing it over large areas. Strains of wheat bred at the Central Research Institute at Pusa are said to yield an increased profit of £1 an acre. Long-stapled varieties of cotton have been introduced into Madras and the canal colonies of the Punjab. The improvement of jute, sugar cane, indigo and rubber has also been taken in hand. In recent years the growth of the coöperative movement has been notable. In 1909 the number of coöperative societies was under 2,000 with 180,000 members, with an aggregate share capital of £91,000 and loans and deposits of £380,000. In 1918 there were 24,395 societies with a membership of over one million, a share capital of £1,403,000, loans and deposits of £6,500,000 and a reserve of £727,000. The number of societies has since increased to over 32,000. The district societies are grouped round central societies, of which there are over seven hundred. These collect loanable capital and finance the affiliated societies. Nine-tenths of the societies are agricultural. The public confidence in the movement is increasing, as the proportion of loans and deposits from non-members has nearly doubled in four years and represents more than 30% of the total capital. In Madras the movement is extending rapidly among the depressed classes. In the Punjab figures available for 140 societies which have been in existence for ten years show that 28% of the members are now entirely free from debt, that over £100,000 of debt has been paid off, and that on the average 10 years of coöperation reduces the debts of a member by half. In all provinces coöperation is reported to diminish extravagance and litigation. Some societies have by-laws prohibiting certain specified forms of ceremonial extravagance. In Burma the principle of coöperation has taken firm hold of the people and the movement there is carried on by an almost entirely indigenous direction. In many parts of India the societies are working in close conjunction with the agricultural department. There are societies for the purchase of concentrated manures and agricultural implements; others for the sale of cotton The coöperative movement in India is still in its infancy; it has had its ups and downs, its failures and mistakes; it affects but an infinitesimal fraction of the population. But it seems to have the elements of vitality, and to be the most hopeful road to freeing the petty cultivator and landholder from indebtedness and to improving his crops.

Irrigation.—Up to the end of 1918–9 the total outlay on the great irrigation canals that are classified as productive works and charged to capital account was £38,000,000. In that year the total receipts from these works, including land revenue due to irrigation, amounted to about £4,900,000 and the total expenses, including interest, to £2,600,000, leaving a net return of £2,300,000 or 6% on the capital invested. There are also certain protective works of considerable magnitude, constructed for the protection of precarious tracts, the cost of which, amounting to about £7,000,000, has been charged not to capital but to the general revenues, as they are not directly remunerative. And there are also "minor" works, which in the aggregate have a substantial protective value. The three descriptions of canals irrigated some 25,000,000 ac. in 1918–9, and the area continues to increase rapidly with the development of irrigation on the recently constructed canals in the Punjab. It is in the western region of that province, where vast tracts of fertile land have for centuries lain waste from want of rainfall and where the great rivers which have given to the province its name are fed in the driest months by the melting snows of the Himalayas, that the greatest advances have been made and the most striking results achieved. The first of these desert canals, the Lower Chenab canal, is easily the most productive work in India. It irrigates 2,500,000 ac. and returns over 40% on the original outlay. The Lower Jhelum canal is of the same character, though the area it commands is less. It irrigates 800,000 ac. and gives a return of 20 per cent. The triple-canal scheme, the last link of which—the Upper Jhelum canal—was completed in 1915, is in magnitude, daring conception, and engineering difficulties the greatest irrigation work in India. As its name implies it consists of a series of canals. The first canal conveys the surplus water of the Jhelum river, a river which receives from the Wular Lake in Kashmir an unfailing supply of water in excess of local requirements, to the Chenab river. Another canal utilizes the upper waters of the Chenab, thus reinforced from the Jhelum, to irrigate a large tract between that river and the Ravi, and discharges itself into the latter river, which in its turn is enabled to feed a third irrigation canal. The combined system will eventually irrigate 1,750,000 ac. and return a net revenue of over 7% on a capital outlay of £6,000,000. Three other projects of the first magnitude are under consideration in the Punjab, and one of equal size and difficulty—the Sukkur barrage scheme—in Sind. Including these, schemes are under consideration or projected in the different provinces which are estimated to cost £40,000,000, irrigate 10,000,000 ac. and yield a return of about 7 per cent. The bearing of this development of canal irrigation in mitigating the effect of drought and increasing the food supply of India is obvious. It provides a surplus production for export in normal years and a reserve of food for the country in years of deficient harvests; and it gives an outlet for the population of older and more fully settled districts.

MANUFACTURES

The conditions of employment in Indian factories are regulated by the Indian Factory Act of 1912, which marked a decided advance upon the former law, although very inadequate if judged by modern ideas of factory legislation. It established a 12-hour day for men, a 10-hour day for women, and a 6-hour day for children in textile factories; prohibited night-work, and limited the use of mechanical or electrical power in the factory to 12 hours during any one day. India was represented at the International Labour Conference held at Washington in 1919, and the Indian Government is taking steps to bring its factory law into greater conformity with the principles approved by the conference. It is proposed to raise the minimum age-limit for child labour from 9 years to 12 years and the upper age-limit from 14 to 15 years; to establish a 60-hour week for all classes of factories; to give longer intervals of rest and make more stringent provision for the weekly holiday.

In the years immediately preceding the war the cotton mills, mostly in the Bombay Presidency, passed through a long period of depression, though the number of spindles and looms increased. Jute mills, which are concentrated at Calcutta and are mostly in English hands, enjoyed almost unbroken prosperity at the expense of Dundee. The Tata Iron and Steel Works and the Bengal Iron and Steel Co. managed to hold their own against strong competition from overseas. The provision of electrical energy for the numerous industries of Bombay city was taken in hand by another Tata company, with a capital of more than a million sterling raised entirely in India.

The war gave a notable stimulus to Indian industries and aroused great public interest in the industrial development of the country. The scarcity and dearness of foreign goods threw the country on its own resources, enabling existing industries to make abnormal profits and encouraging the growth of new industries. The production of cotton piece goods doubled and the export in 1917–8 was 86% over the pre-war average. The number of looms increased from 69,700 in 1908 to 106,000 in 1918. The value of manufactured jute exports was £35,000,000 in 1917–8 against £13,500,000 in the pre-war quinquennium. The Tata Iron and Steel Works and the Bengal Iron and Steel Co. produced 781,000 tons of steel and iron in 1918–9 against 305,000 tons in 1913–4, and their equipment has been greatly enlarged. The demand for tanned hides has led to an increase in the number of leather factories from 29 in 1908 to 322 in 1918. The number of rice mills increased in the same period from 202 employing 21,000 persons to 544 employing 46,000 persons. The production of woollen mills trebled and the capital invested increased sevenfold. These are some instances of the impetus which the circumstances of the war gave to Indian manufactures. It was reinforced by the establishment in 1917 of a munitions board for supplying stores to armies in the field and developing industries in India. The profits made during the war had encouraged the promotion of many new industrial ventures, some of them possibly not very well conceived. During 1919–20, 906 companies were floated with an aggregate capital of £183,000,000. Another indication of the rapid growth of capital in India and of the profits made from industries and agriculture during the war is to be found in the success which has attended the large issues of Government loans. As an outcome of the munitions board the Government of India at the close of the war appointed an industrial commission to take stock of the industrial state of the country and to consider in what ways the Government might best assist its development. As the result of an exhaustive survey the commission were impressed with the backwardness of India, its ill-equipment as regards fundamental industries, and the poor provision made for technical and scientific training. Their recommendations cover much ground, from the active participation of the State in industrial development, the establishment of an All-India scientific service with full laboratory equipment and investigating staffs, the grant of State aid to private enterprises, to improving the general conditions of labour in India and increasing its efficiency. To give effect to the policy recommended by the commission a Minister of Industries has now been added to the executive council of the Governor-General. Another important step has been taken in the amalgamation of the three Presidency banks into an Imperial Bank of India under conditions that will make for greatly increased banking facilities in the interior of the country.

COMMERCE

During the ten years preceding the war the sea-borne trade of India greatly increased. For the five years ending 1908–9 imports of private merchandise averaged £75,000,000 a year and exports £108,000,000; the corresponding figures for the five years ending 1913–4 were imports £97,000,000 and exports £146,000,000. These figures exclude treasure. The balance which they show in favour of India averaged £49,000,000 a year in the latter quinquennium, or £52,000,000 including reëxports of foreign merchandise. Net imports of treasure during 1909–14 averaged over £25,000,000 a year, of which nearly £19,000,000 was in sovereigns or gold bullion. The figures reflect a series of good harvests, an active demand on other countries for Indian produce, and rising world prices. Of the gold imported, a portion found its way into the paper currency reserve, a portion no doubt was hoarded or used for jewellery, and a considerable portion passed into circulation. In some districts sovereigns became common. Sixty-three per cent of the imports of private merchandise came from the United Kingdom. Cotton piece goods represented one-third of the imports, and of this trade the United Kingdom had nearly a monopoly, 98 % of the white and grey goods and 93·5 % of the coloured goods coming from it. Other large items in the imports were iron and steel, in which trade the United Kingdom's share was 60 %; sugar, chiefly from Java and Mauritius; railway plant and rolling stock and iron and steel, chiefly from the United Kingdom. Of the exports 25 % went to the United Kingdom, 10 % to Germany, 7·5 % to Japan and the United States respectively, and 6·6 % to France.

The war at first brought the Indian overseas trade to a standstill. Exports to Central Europe, which had hitherto been a good customer of India's raw materials, ceased. The invasion of Belgium and the military preoccupations of Marseilles upset the oil-seed and groundnut trade. A great shortage of shipping arose. Indian importing houses closed their commitments in the United Kingdom for piece goods and other manufactures. But before long India began to adapt itself to war conditions. Jute cloth for sand bags, hides for army boots, raw wool and tea were exported in enormous quantities. Heavy shipments of wheat were made on Government account. Japan was a large buyer of Indian raw cotton, to be returned to India in the form of piece goods. In 1915–6 the export trade of India did extremely well, and better still in the following years. In 1918–9 the gross exports and imports of private merchandise exceeded the highest pre-war figures, being £169,000,000 and £113,000,000 respectively. This increase of value, however, was largely due to abnormally high prices, and was not accompanied by a corresponding increase in the volume of trade. The war also affected the distribution of this overseas trade. On account of shipping difficulties and the inability of English manufacturers to produce goods the United Kingdom lost part of its pre-war share of the import trade, and Japan and the United States gained at its expense. In 1918–9 the United Kingdom's share of India's imports had declined from the pre-war 64 % to 46 %, while the shares of Japan and the United States had increased from 2 % and 3 % respectively to 20 % and 10 %. Japan flooded India with cotton piece goods and with miscellaneous articles which formerly had been supplied by Germany and Austria. The United States supplied iron and steel work, railway material, motor cars and cycles, and machinery. The post-war course of Indian trade has been erratic. During the year ending March 1920 it was very active. The imports and exports of 1919–20 exceeded in value all previous records, and the balance of trade in favour of India was phenomenally large. Imports amounted to £132,000,000 and exports to £218,000,000. The exports of raw cotton and raw and manufactured jute, tea, oil-seeds and hides were notably large. In the import trade the United Kingdom recovered some of the ground which it had lost during the war, and its share rose from 46 % in 1918–9 to 51 %, the improvement being most marked under the heads of cotton piece goods, iron and steel, railway materials and mill work. Imports from Japan declined and the share of that country of India's imports fell to 9 per cent. In 1920–1 the trading prosperity of India experienced a serious setback. The foreign demand for Indian produce fell off and values declined in consequence of the severe industrial depression prevailing in the United States, Japan and the United Kingdom. The power of India's customers to purchase her produce was severely restricted, the export trade came to a standstill, and stocks of many of her commodities, such as hides and tea, accumulated. The import market became seriously overstocked. Encouraged by the high exchange value of the rupee during the winter of 1919–20 and by the great demand of the Indian population for cotton piece goods and other foreign commodities the importing houses placed large orders in the United Kingdom and America. Delays occurred in the execution of these orders, and when the goods reached India the Indian public was in no mood to buy, while the fall in the exchange value of the rupee from 2s. 7d. to 1s. 4d. placed importers who had not taken the precaution of "covering" exchange in serious difficulties. As a result of these untoward events the unprecedented balance of trade in favour of India in 1919–20 was replaced in 1920–1 by an adverse balance. There is, however, nothing inherently wrong in India's commercial position. A country which is a large producer of important raw commodities, such as wheat and other food grains, jute, cotton, oil-seeds and hides, for which in normal years there is a world-wide demand, should be among the first to feel the effect of restoration of credit and industrial revival in the suffering nations of Europe.

RAILWAYS

From 1908–9, in which year there was a net loss to the State on the railway account in consequence of the failure of the monsoon, up to the outbreak of the war, the railways fully participated in the prosperity which a series of good harvests produced. The goods and passenger traffic, the gross and net earnings, and the gain to the State steadily increased. There was a setback in the first year of the war, followed by a great expansion of traffic and earnings. The net profit to the State, after meeting interest, annuity, sinking fund and working charges, was £4,000,000 in 1915–6, £7,500,000 in 1916–7, £10,000,000 in 1917–8, and £11,000,000 in 1918–9. Since 1918–9 increased working charges, due to higher wages, greater cost of fuel and heavy outlay on renewals have seriously eaten into the net profit of the State from the railways. The war placed a great strain on the Indian railway system, which, in addition to discharging India's own requirements, had to supply personnel and materials for the construction and working of military railways in Mesopotamia and other theatres of war. The constant movement of troops, and conveyance of supplies, munitions and stores for despatch overseas, caused a great increase of traffic. Ordinary passenger traffic and other civil needs had to give way to essential military requirements, and a central control department had to be created. The railways deteriorated in equipment owing to the scarcity of materials and rolling-stock. Since the war ceased, endeavours have been made to make good these arrears and bring the lines up to the pre-war standard. The 1919–20 budget provided £17,700,000 for capital expenditure, and a still larger sum was provided in 1920–1.

During the ten years ending 1918–9 the open mileage increased from 31,490 to 36,616. But for the war, and the necessity for applying after the war all available capital to the equipment of open lines, the increase would have been greater. The number of passengers carried on all Indian railways increased from 329,000,000 to 472,000,000, and the total weight of goods carried increased from 61,000,000 to 99,000,000 tons. The total capital outlay incurred by the Government up to the end of 1918–9 in the purchase and construction of State lines amounted to £370,000,000. The net traffic earnings represent a return of about 5½ % on this capital.

The most important line of recent construction is that through Rajputana from Muttra to Kotah, affording communication between northern India and Bombay on the broad-gauge of the Bombay and Baroda system. The bridge across the Ganges at Sara in Bengal is a fine engineering work. It was opened in 1915 and carries the traffic from N. of the river, which was formerly ferried over, without trans-shipment to Calcutta.

The inadequacy of the railways to carry the increasing traffic and the scanty accommodation provided for third-class passengers have been the subject of much complaint. The substitution of State for company management, as working leases fall in, is favoured by Indians, chiefly on the ground that under State management their interests are more likely to be consulted and more openings made for them in the higher ranks of the railway service. Management by companies domiciled in India, on the boards of which Indians should be represented, has also been advocated. The matter came to a head in 1919 when, under the terms of the lease of the East Indian railway to an English company, the State might have terminated the contract and taken over the management. In deciding to allow the lease to run for a further term of five years the Secretary of State announced his intention of referring the general question of the future management of Indian railways to a committee. The committee (with Sir William Acworth as chairman) was appointed in Oct. 1920 and reported in 1921.

AUTHORITIES.—Among books bearing on the period the following may be mentioned:—Valentine Chirol, *Indian Unrest* (1910); Lovat Fraser, *India Under Curzon and After* (1912); Chailley, *Administrative Problems of British India* (1910); J. Ramsay Macdonald, *The Government of India* (1919); Gilchrist, *Indian Nationality* (1920); H.H. the Aga Khan, *India in Transition* (1918); Sir Verney Lovett, *History of the Indian Nationalist Movement* (1920); Lord Meston, *India at the Cross Ways* (1920); L. Curtis, *Dyarchy* (1920). For constitutional history see Ilbert, *Government of India* (1915); and for general history Vincent Smith, *The Oxford History of India* (1919). Lord Morley's *Indian Speeches* (1909) and his *Recollections* (1917) are useful for the Minto period. The collected Indian speeches of Lord Minto and those of Lord Hardinge have also been consulted. The annual review or year-book of Indian affairs (*Statement Exhibiting the Moral and Material Progress and Condition of India*) which the Government of India prepare for submission to Parliament is in its revised form a most useful State paper. The present series started from the year 1918. The Montagu-Chelmsford report on *Indian Constitutional Reforms* (1918) was published as a Parliamentary paper, as also was the subsequent correspondence regarding it between the Secretary of State and the Government of India. Other Parliamentary papers of special importance are the *Proceedings and Report of the Joint Select Committee on the Government of India Bill* (1919); the further correspondence regarding *Constitutional Reform in Burma* (1921); the *Report of the Hunter Committee on Disturbances in the Punjab* (1920), and of the Esher Committee on *The Army in India* (1920). For finance the *Report of the Indian Currency Committee* (1920) and the *Financial Statement and Budget* of the Government of India for 1920–1 and for 1921–2 should be consulted. With regard to education the *Report of the Calcutta University Commission* (Calcutta, 1919) is a document of the first importance. (T. W. Ho.)

INDIANA (*see* 14.421).—The pop. in 1920 was 2,930,390, an increase of 229,514, or 8·5 %, over the 2,700,876 of 1910, as against an increase of 7·3 % in the preceding decade. From ninth in rank among the states in 1910 Indiana fell to eleventh in 1920. Of the 92 counties in the state 28 show increases and 64 show decreases. The density in 1920 was 81·3 to the sq. m.; in 1910, 74·9. The urban pop. (in places of over 2,500) was 50·6 % of the whole in 1920 as against 42·4 % in 1910.

The ten cities of Indiana with a pop. of 30,000 or more were:—

	1920	1910	Increase per cent
Indianapolis	314,194	233,650	34·5
Fort Wayne	86,549	63,933	35·4
Evansville	85,264	69,647	22·4
South Bend	70,983	53,684	32·2
Terre Haute	66,083	58,157	13·6
Gary	55,378	16,802	229·6
Muncie	36,524	24,005	52·2
Hammond	36,004	20,925	72·1
East Chicago	35,967	19,098	88·3
Kokomo	30,067	17,010	76·8

The cities making the largest percentage of gain were in the northern part of the state, especially those near Chicago, like Gary, East Chicago and South Bend.

Agriculture.—During the decade 1910–20 the number of farms decreased from 215,485 to 205,126, or 4·8%. During the same period the acreage per farm increased from 98·8 ac. to 102·7; the value per acre from $84.94 to $144.44. The value of all crops rose from $196,869,691 in 1909 to $497,229,719 in 1919. The Indian-corn crop in 1909 was 195,496,433 bus., valued at $98,437,988, from 4,901,054 ac.; in 1919, 158,603,938 bus., valued at $229,975,713, from 4,457,400 acres. The oat crop in 1909 from 1,667,818 ac. was 50,607,913 bus., valued at $18,928,706; in 1919, from 1,718,748 ac., 52,529,723 bus., valued at $42,023,780. The winter wheat crop in 1909 from 2,080,879 ac. was 33,901,949 bus., valued at $33,559,918; in 1919, from 2,759,757 ac., 44,796,296 bus., valued at $97,207,962. The total value of domestic animals in 1920 was $244,164,616. The number of cattle reported was 1,546,095, valued at $94,529,884; of horses 717,233, valued at $66,703,216; of sheep 643,889, valued at $7,628,968; and of swine 3,757,135, valued at $63,095,220.

Mineral Products.—Instead of ranking fifth among the states in natural gas and sixth in petroleum, as in 1906, Indiana was in 1921 thirteenth in natural gas and twelfth in petroleum. The state still ranked sixth in coal, with greatly increased yearly output, valued at $70,384,000, the coal being bituminous. Indiana in 1921 was producing 27,000,000 tons of coal annually, with an annual rate of increase of 500,000 tons.

The large stone quarries of Monroe and Lawrence counties produce 70% of the limestone used in the United States for building. Indiana is the first state in this product; fifth in value of all stone sold. Indiana oölitic limestone is used in nearly every state and in foreign countries. The value of the limestone quarried in 1916 was $4,657,000, as compared with $2,553,502 in 1902. Indiana has valuable clays, shales, and kaolin, and is sixth among the states in ceramic production. Drainage tiles, encaustic tiles, fire-proofing, terra-cotta, sewer pipe and stove linings are other important clay products. Pottery products include earthenware, stoneware, white granite, semi-porcelain, sanitary ware and porcelain electrical ware. In 1916 and 1918 Indiana was the second state in the production of Portland cement, valued in 1918 at $12,525,000 as against $1,347,000 in 1903.

Finance.—The total true value of taxable property in the state, according to the tax levy of 1919, was $5,749,258,800, an increase since 1907 of nearly $5,000,000,000. This increase came partly by growth in wealth but largely by increased rate of assessment. The total taxes in 1919 for state, township and municipal purposes amounted to a little over $75,615,000, of which $21,205,434 was for tuition and special school funds. The assessed valuation was chiefly on real estate and improvements ($3,727,112,673); steam and electric railways ($660,794,291); telegraphs and telephones ($45,229,449); and express companies ($3,207,473). The debt of the state was less than $1,000,000.

Education.—In 1920 Indiana ranked third among the states in percentage of school children in attendance, the rate of attendance, however, being only 73%. The average annual expenditure per child attending school in 1918 was $53, the state ranking 28th in this respect. The average annual expenditure per person of school age (6 to 21 years) was $39. The salaries for teachers materially increased in the three years 1918–21. In 1921 the state increased the tax levy for common-school support as well as for the support of the higher educational institutions, and provision for teachers' pensions was enacted. There was a tax levy of five cents on each $100 of taxable property for the support of the three higher educational institutions of the state, producing about $2,750,000, and a levy of a fraction of a cent for vocational education producing yearly about $115,000. Nearly $50,000,000 is spent annually in Indiana for purposes of education, from local and general levies, counting from the primary grades to the universities.

Constitution and Government.—During the decade 1910–20 there was much discussion over amending the constitution of the state, a difficult undertaking under the provisions of the constitution of 1851. In 1914 a conference was held at the state university to consider whether a constitutional convention should be called. Out of this conference grew an organization of voters, the Constitutional Convention League, whose purpose it was to bring about such a convention. Under the influence of this League, while the Legislature refused to call a constitutional convention, it agreed to submit to the voters by referendum in 1916 the question whether such a convention should be held. The proposal was voted down by a large majority, partly because of the expense involved, partly from fear of radical innovations. The vote for the convention was, however, so large that the Legislature decided to submit to the people for a vote in Sept. 1921 13 proposed amendments.

These amendments provided: (1) that the term of office or salary of any officer fixed by law shall not be increased during the term for which such officer is elected; (2) that all county officers shall be elected for a four-year term and that the surveyor be eliminated from the elective list; (3) that prosecuting attorneys shall be elected for four years; (4) that negroes may be admitted to the state militia; (5) that the General Assembly may have power to classify the several counties, townships, cities and towns of the state and to enact laws prescribing a uniform method of registration; (6) that the General Assembly may provide by law for the qualifications of persons admitted to the practice of law (this amendment, pending for nearly 40 years, would do away with the extraordinary provision in the constitution that "every person of good moral character, being a voter, shall be entitled to practise law . . . in all courts of justice"); (7) that the Legislature may levy an income tax, providing for reasonable exemptions; (8) that the governor may veto specific items in appropriation bills, and that any such bill or item may be passed over his veto under the rules affecting ordinary bills; (9) that the state superintendent of public instruction shall be appointive; (10) that all elective state officers created by the General Assembly shall hold their offices for only four years (except judges), none to be eligible for more than four years in any period of eight years; (11) that the General Assembly shall provide by law for a system of taxation, the purpose being to give plenary taxing power to the Assembly, and to enable it to classify property for taxation, and to eliminate the requirement of a "uniform general property tax"; (12) that senators and representatives shall be apportioned every six years among the several counties according to the votes cast at the last preceding election; (13) that aliens shall be fully naturalized before voting (hitherto aliens could vote in Indiana after taking out their first papers, if they had been in Indiana six months and in the United States one year).

All the amendments were rejected, although the last-named received a majority of the votes cast.

Indiana furnished 121,000 men to the U.S. army during the World War and 5,516 men for the U.S. navy. In proportion to population, the state furnished more volunteers (25,148) than any other. The number that died was 3,354 men and 15 nurses. A "Gold Star" volume in commemoration of these men and women has been published by the state. A total of 317 men from Indiana received citations for extraordinary bravery performed while in line of duty. The people of the state bought a total of $451,000,000 worth of Government bonds in the five Liberty Loan drives in Indiana; the sale of war savings stamps and thrift stamps totalled $47,000,000, making a grand total of $498,000,000. This means that Indiana bought for every man, woman and child in the state an average of $166 worth of bonds; or for every family of five an average of $1,000 worth of bonds. Indiana was well organized for war. There was a state Council of Defence, and, in every county, a county Council of Defence. Food production was encouraged. Over 500,000 war gardens were planted. The corn acreage of the state was increased by 600,000 ac. over 1916, and 524,000 more acres of wheat were sown in 1917 than the year before. The production of hogs and of all food products was greatly increased, in coöperation with the U.S. Food Administration. The food production in Indiana increased by 25% during the war-time years 1917 and 1918.

Since 1909 the governors of the state have been as follows: Thomas R. Marshall (Dem.), 1909–13; Samuel Moffet Ralston (Dem.), 1913–7; James Putnam Goodrich (Rep.), 1917–21; Warren T. McCray (Rep.), 1921–

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(J. A. W.)

INDIANS, NORTH AMERICAN (*see* 14.452*).—In the region N. of Mexico, to which this article is confined, the Indians are no longer warlike nor do they resist to any extent efforts for their civilization. The United States Government assumes that health, education and industry are essential to the Indian's self-support and citizenship. The settled policy is, therefore, to hasten his advancement in these particulars and meanwhile to protect his personal and property rights. Under the administration of the Bureau of Indian Affairs there are provided health supervisors, school and agency physicians, field matrons, nurses, travelling dentists and hospitals for all forms of disease, but with special reference to the care of infants and expectant mothers, and the treatment of tuberculosis and trachoma. For education, the Government conducts 184 day schools, 61 reservation and 29 non-reservation boarding schools with an attendance of over 25,000 pupils, and provides courses of study combining academic and industrial training adapted to Indian needs and temperament. The aim is to prepare girls to become good housewives and mothers in their home communities and to fit boys for practical farming, or to give them such elementary knowledge and practice in mechanics as will lead to skilled workmanship. At seven of the larger schools vocational training extends through the tenth grade and at one of them is a thorough commercial course. In 1920 these advanced schools enrolled 5,300 students; their graduates readily found remunerative employment in agriculture, the trades and business pursuits. In all Federal schools prominence is given to hygiene, to moral conduct, to religious culture and to the practice of thrift. State public schools in 1920 were accessible to and enrolled more than 30,000 Indian children. Over 5,000 are cared for in mission and private schools.

To promote reservation industries there were maintained, in 1920, eight demonstration and four experimentation farms, and several hundred farmers, stockmen and assistants living near Indian communities were employed for purposes of oversight and instruction in modern methods of agriculture and the breeding and handling of live stock. Loans were made to energetic Indians from tribal or Government funds as initial capital for beginning their self-support. Special attention was given to the reclamation of arid and semi-arid Indian lands, resulting in the irrigation of about 350,000 ac., with nearly a million more under project. The annual increase in crop values was nearly equal to the cost of the investment. Tribal herds of sheep and cattle were maintained on a number of reservations with financial profit, but chiefly to encourage individual ownership and enterprise in live stock. The affairs of the Alaskan Indians were supervised by the U.S. Bureau of Education. Sixty-seven schools were conducted, with a field force of 6 superintendents, 9 physicians, 13 nurses and 133 teachers. Five hospitals were maintained and native girls were taught nursing. The work was carried on in 67 villages scattered along the coast and on the great rivers. Imperfect transportation and adverse climatic conditions rendered the service very difficult, but progress was substantial.

In Canada the Department of Indian Affairs has administrative charge of all Indians and Eskimos. There were in 1911 103,661 Indians and 4,600 Eskimos in Canada, a total of 108,261; in 1919 105,998 Indians and 3,296 Eskimos, a total of 109,294. The Spanish influenza affected the increase for 1920, and the approximate figures for that year were 105,800 Indians and 3,200 Eskimos, a total of 109,000. The Indians and Eskimos are located on reserves in different parts of the Dominion, and the Department of Indian Affairs directs through its 114 agencies the activities for their education and health, and the development of agriculture and other pursuits among them. The less civilized groups are stationary in population, but the more progressive show an appreciable gain in number and physical standards. The educational work comprises 247 day, 58 boarding and 16 industrial schools. The staff of an agency, which may control from one to 30 bands, usually includes, besides the agent, a medical officer, clerk, farm instructor, field matron, stockman, constable, etc., whose work is supervised by inspectors. The Indian population is chiefly W. of Lake Superior. In the vast region E. of the Rocky Mountains, where the aboriginal title was extinguished, the Government promised gifts in cash and lands and aid in education and agriculture. Food was supplied for a time, following the disappearance of the buffalo, but is now practically discontinued, as farming, stock-raising and, in the more remote districts, hunting and fishing furnish means of livelihood. In British Columbia no cession of the Indian title was sought or obtained, but adequate reserves have been set apart, many of which are suitable for stock-raising and to some extent farming and horticulture, and the same assistance in education and agriculture is given as in the Prairie provinces. In the older regions of the provinces of Ontario and Quebec the Indians are entering more and more into the life of the country as farmers, artisans, teachers and lumbermen, with some few as surveyors and physicians, and are increasingly becoming citizens. Enfranchisement, however, which establishes full citizenship, is extended with great discretion, since, if prematurely conferred, the Indians concerned cannot hold their own with white men.

Under the policies outlined the N. American Indians in the United States and the Dominion made unusual progress during the decade 1910–20. Their population at its close was greater than at any time in the preceding half-century. They depend less upon "medicine men" and more upon medical science and sanitation. As compared with earlier periods, they are giving more attention to permanent homes; are less nomadic and superstitious. Their women are better house-keepers, and infant mortality is decreasing. The day of paint and feathers and blanket garb is passing. Nearly two-thirds of their number wear citizens' clothing. The younger, school-trained element is creating a new leadership manifested in changing habits, customs, industrial pursuits and social life. Marriage by tribal custom is giving way to legal rites, and crime is diminishing. In the United States approximately three-fourths of the Indian children of suitable age and health are enrolled in some school, Federal, state or mission. There has been a steady increase in the number of Indians who speak, as well as of those who read and write, English, and a friendly Indian sentiment towards the schools generally prevails. Substantial advancement is noticeable in agricultural operations and stock-raising, the use of modern machinery and methods, in the large additions to individual funds, and the increasing citizenship through the acquirement of fee title to lands, as well as in the lively interest the Indians now show in exhibits of their industrial products at fairs, where they compete with one another and with the whites.

The acceptance by the Indians of the principles of government and civilization was proved by their conduct in the World War. In the United States the number of Indians in military service was more than 10,000, three-fourths of whom enlisted. In Canada the number exceeded 4,000, all volunteers, as they were exempted from the operation of the Military Service Act. The percentage of Indians of military age in the war was probably equal to that of the whites and their proportion of volunteers even greater. They were mingled almost entirely with white organizations and were highly commended by their officers for their intelligence, courage, discipline and efficiency. The Indians ineligible for war duty were equally patriotic. They were active in Red Cross and other relief work, and responded to emergency demands for all productive labour. In the United States they subscribed $25,000,000 for Liberty Bonds, and purchased upwards of $2,000,000 in War Savings Stamps.

INDIANS IN THE UNITED STATES EXCLUSIVE OF ALASKA

Population and Citizenship.

	1911	1920
Population	322,715	336,337
Received allotments of land	164,215	175,433
Received patent in fee to land	76,033	119,800
Received trust patents to land	88,182	55,633
Citizens	179,830	184,968

Educational and Vital Conditions.

	1911	1920
Children eligible for school	63,411	82,856
Children in Federal schools	23,647	25,396
Children in public schools (State)	11,000	30,858
Children in mission and private schools	4,750	5,546
Total children in all schools	39,397	61,800
Capacity of all schools	43,015	62,298
Could speak English	121,431	173,193
Could read and write English	79,843	126,331
Church-going Indians	104,529	146,176
Missionary workers among the Indians	472	627
Hospitals and sanatoria maintained	50	85
Capacity of hospitals and sanatoria	1,268	2,190
Patients treated	8,408	16,954
Given medical examination	42,645	67,053
Wearing citizens' clothing	238,410	296,841
Families living in permanent homes	46,379	64,195
Arrested for drunkenness	2,057	568
Deputies employed for liquor suppression	154	42
Marriages by tribal custom	606	237
Marriages by legal procedure	1,177	1,636

These figures indicate the volume and page number of the previous article.

Industrial Activities and Resources.

	1911	1920
Indians engaged in farming	24,489	49,962
Number of acres cultivated	383,025	890,700
Value of crops raised	$1,951,752	$11,927,366
Irrigated acreage cultivated	454,485	607,044
Indians benefited by irrigation	27,145	37,030
Crops on irrigated lands	$3,008,338	$15,773,349
Home buildings, furniture, and farm implements	$10,029,184	$30,657,763
Individual funds in bank	$10,735,723	$38,035,476
Value of live stock sold	$900,000	$4,080,375
Value of all live stock	$19,471,209	$35,158,731
Value of timber cut	$1,398,166	$2,060,559
Income from land sales and individual leases	$8,402,669	$11,686,726
Engaged in native industries	21,235	26,949
Employed by private parties	3,204	13,079
Employed in Indian Service (regular and irregular)	8,577	12,244
Value of products from native industries	$847,456	$1,869,907
Earnings from private parties	$591,672	$2,654,008
Earnings from Indian Service	$1,269,958	$1,586,141
Income from minerals, chiefly oil, gas and coal	$1,406,001	$23,838,382
Total value of individual and tribal property	$523,134,254	$751,725,329
Total income of Indians	$21,092,923	$72,696,431
Total revenue to Indians from minerals for decade ended June 30 1920		$83,796,622

INDIANS IN CANADA

Property Values.

	1911	1920
Land in reserves	$29,421,972.50	$51,535,245.00
Public buildings, prop. of bands	932,052.00	1,245,800.00
Private fencing, buildings, implements, etc.	5,412,035.35	8,103,160.00
Live stock and poultry	2,587,841.80	4,443,970.00
General and household effects	2,012,708.40	2,586,902.00
Total value of real and personal property	$40,366,610.05	$67,915,077.00

Sources and Value of Income.

	1911	1920
Farm products, including hay	$1,459,962.46	$3,462,147.00
Beef sold or used for food	236,753.36	450,415.00
Received from land rentals and timber	66,072.12	154,446.00
Wages earned	1,540,021.10	2,521,618.00
Earned by fishing, hunting and trapping	1,511,053.85	1,863,886.00
Earned from other industries	852,944.63	1,714,988.00
Annuities paid and interest in Indian Trust fund	(not reported)	621,341.85
Total	$5,666,807.52	$10,788,841.85
Average per capita value, real and personal property	—	$674.43
Average per capita income	—	107.13

(C. Se.)

INDO-CHINA, FRENCH (*see* 14.490).—The French Indo-Chinese Union comprises the following areas:—

Cochin-China, pop. (1921)	3,795,613	capital Saigon (83,000 inhabitants)
Tongking "	6,100,000	capital Hanoi (120,000)
Annam "	4,800,000	" Hué
Cambodia "	1,500,000	" Pnom-Penh
Laos "	500,000	" Luang-Prabang

Kwangchow Wan Territory, 150,000 inhabitants.

There were in 1914 1,273 m. of railway open and 154 m. under construction, less than half of the minimum required to satisfy the essential needs of the colony. The deficiency was made up by regular services in every part of the country having navigable waterways. In 1918 there entered Indo-Chinese ports 2,219 vessels, with a tonnage of 2,376,347; there left 2,087 vessels, with a tonnage of 2,222,935,—a total of 4,600,000 tons.

The wealth of Indo-China springs chiefly from rice. The crop is annual in Cambodia, Cochin-China, and the southern part of Annam, and bi-annual in Tongking and the northern part of Annam. The rice-fields covered about 4,700,000 hectares in 1920, in which year the crop amounted to 4,500,000 tons. Indo-China is, after Burma, the second rice-exporting country of the world; in 1918 she exported 1,600,000 tons and in 1919 966,865 tons, valued at 567,678,000 francs. Export is chiefly to China, Japan, and the Philippines, but shipments to Europe, and especially France, were increasing. The sugar-cane is found in almost all parts of Indo-China, especially in Annam, and production showed considerable development. The exportation of sugar has doubled since 1913, and amounted to 7,718 tons, of a value of 9,202,000 fr., in 1919. The coconut-palm is common everywhere save in Tongking. Cotton flourishes in Cambodia, and plantations in other parts of the country are satisfactory. The forests, not yet fully explored, are immense, covering the major part of the mountainous regions, and including a singularly large number of species of trees.

Indo-China is rich in coal, which makes it exceptional among French colonies. The principal deposits are in Tongking, in the immediate neighbourhood of the Bay of Along (region of Honghai). The total production, including lignite, which is found in numerous beds, was in 1918 636,000 tons.

There is much iron, mainly haematite, but it is not exploited. On the other hand, the zinc of Tongking is being more and more developed (production: 33,438 tons in 1913). The most important industries of the country are those derived from rice—rice-mills, and distilleries preparing a spirit largely consumed by the Annamites.

The general commerce of Indo-China attained in 1919 the figure of 1,841,966,000 fr., of which 791,073,000 fr. were imports and 1,050,893,000 were exports. France, by reason of difficulties in marine transport, stood for little in these exports, the greater part of which went to Hong-Kong and Singapore, and some to China and Great Britain. The figures for general commerce in 1918 were only 817,687,000 fr. total, of which 363,383,000 fr. were imports and 454,304,000 exports; but the fluctuations in the value of money must be allowed for. In any case, the figures for 1918 represented an increase of 14,132,000 fr. over the previous year, and a surplus of 148,132,000 over the average for the five years 1913–7. In 1913, the last normal year before the war, the general commerce amounted to 650,591,000 francs. (M. R.*)

INDUSTRIAL COUNCILS (United Kingdom).—The formation of joint industrial councils (or, as they are commonly called, "Whitley Councils") has been one of the most important sequels of wartime developments in the attempt to adjust the relations of employers and employees in the organization of British industry. These joint industrial councils are bodies representing, usually in equal numbers, the organized employers and employees in the particular industries concerned; and they are the outcome of the recommendation made for this purpose by a committee (which became a sub-committee of the Reconstruction Committee) appointed in 1916 by Mr. Asquith, as Prime Minister, and presided over by Mr. J. H. Whitley, M.P. (then Chairman of Committees in the House of Commons), the reference being:—

1. To make and consider suggestions for securing a permanent improvement in the relations between employers and workmen;
2. To recommend means for securing that industrial conditions affecting the relations between employers and workmen shall be systematically reviewed by those concerned, with a view to improving conditions in the future.

The Whitley Committee was composed of well-known representatives of trade unions and employers' associations experienced in collective negotiations, with certain public men and women not directly associated with the interests of employers or employed. One of the most important developments in the improvement of industrial relations before the World War had been the establishment of voluntary conciliation boards or machinery for the settlement of labour disputes, and, in the course of a considerable number of years, such bodies or machinery had been established in most of the well-organized trades in the United Kingdom. Along with the great body of collective regulations established over a long period of years, this machinery was practically for the time being set aside by war conditions, which at the same time produced a remarkable growth in trade-union organization, and necessitated much consultation between the Government and representative bodies of employers and trade-unionists, who were also often associated in official boards of control, such as the Cotton Control Board.

When the Whitley Committee was appointed it was widely recognized that a permanent solution of the "Capital and Labour" question was one of the most important of the social and industrial problems of the post-war reconstruction, with a view to which first the Reconstruction Committee and later the Ministry of Reconstruction were formed. The origins of a few of the councils may be carried back, however, to a time before the appointment of the Whitley Committee, or even, in idea at least, to before the outbreak of war; and these origins are to be found in the desire of certain groups of individuals, with knowledge or experience of industrial disputes, to create some new form of joint organization which would unite the employers and employees in an industry in coöperation for common ends. Thus, the conception of a building-trades parliament may be traced back to 1914. Again, a national painters' and decorators' joint council was formed in the winter of 1916–7, before the publication of the first Whitley report. Before also the Whitley Committee reported, the activities initiated by certain private individuals interested in industrial matters, leading up to the formation of the Pottery Joint Industrial Council (the first of the officially recognized Whitley Councils), had been in progress for some time.

Here it may be noted that the name "Industrial Council" has been applied to other bodies which must not be confused with the joint industrial councils set up through the Whitley report, though they have certain connexions with these councils. Further reference to these bodies is made at the end of this article.

The Whitley Committee presented an interim report on joint standing industrial councils in March 1917 (Cd. 8606). In this report they recommended that, so far as the main industries of the country, in which there existed representative organizations of employers and employees, were concerned, the best way to deal with the first point in the terms of reference was to settle the second point, and for this latter they proposed the institution of joint standing industrial councils. The proposed councils were to be joint, so as to bring employers and workpeople together; standing, to ensure the regular discussion of matters of common interest; and industrial—that is, formed on an "industrial" rather than a trade or craft basis. In order to secure the realization of what may be considered the fundamental idea of "continuous coöperation in the promotion of industry" the committee recommended that, in addition to national joint industrial councils covering complete national industries, there should be formed also district councils and works committees. It was contemplated that the machinery should be decentralized, the district councils dealing with district matters within the limits laid down by a national council for the industry, and the works committees dealing in the same way with questions peculiar to the individual workshop or not of general concern. A fundamental condition affecting the formation of the councils was that the members should be chosen exclusively from the trade unions of the workpeople and the associations of the employers; this first report had reference only to well-organized industry, and the scheme outlined was not considered applicable where organization was weak or non-existent. Following its circulation to all the principal trade unions and employers' associations, the report was adopted by the Government in Oct. 1917 as part of its industrial policy. At the same time the Government decided to recognize the industrial councils as standing consultative committees for their industries.

The Minister of Labour was charged with the duty of providing the industries with assistance in the formation of councils, and the first joint industrial council to be officially recognized was that formed in the pottery industry in Jan. 1918. The following list includes all the councils which had been officially recognized up to the end of Jan. 1921, at which time, however, 11 of the councils listed had more or less definitely broken down (these being marked by an asterisk). The operations of several others were intermittent, a principal reason for the failures being lack of adequate organization.

Asbestos manufacture
*Bread-baking (England and Wales)
Bread-baking (Scotland)
Bedsteads, metallic
Bobbin and shuttle manufacture
Boot and shoe manufacture
Building trades
Cable-making, electrical
Carpets
Cement
Chemicals, heavy
China clay
Civil service (administrative and legal departments)
Coir mat and matting
Cooperage
*Elastic webbing
Electrical contracting
Electricity supply
*Entertainments
Flour-milling
*Furniture
Gas mantles
Gas undertakings
Glass
Gloves
*Gold, silver and horological trades
Government industrial establishments
Heating and domestic engineering
Hosiery (English)
Hosiery (Scottish)
Insurance committees (National Health)
*Leather goods, made-up
Local authorities' non-trading services (manual workers)
Local authorities' non-trading services (manual workers) (Scotland)
Local authorities (administrative, technical and clerical)
Local authorities (administrative, technical and clerical) (Scotland)
Lock, latch and key
Match manufacture
*Music trades
Needles, fish-hooks and fishing-tackle
*Packing-case making
Paint, colour and varnish
Paper-making
Pottery
Printing
Process engraving
Quarrying
*Road transport
Rubber manufacture
*Sawmilling
Seed-crushing and oil-refining
Silk
Soap and candles
Spelter
Surgical instruments
Tin-mining
Tramways
*Vehicle-building
Wall-paper making
Waterworks undertakings
Welsh plate and sheet
Wire, iron and steel
Wool (and allied) textile (England and Wales)
Woollen and worsted (Scottish)
Wrought hollow-ware

In the formation of nearly all these 65 councils a main part was taken by the Ministry of Labour, which arranged conferences and carried through the often difficult and prolonged work of negotiation between the various associations of employers or workpeople concerned. Of the 65, 20 were formed in 1918, 30 in 1919, and the remainder during the next 13 months.

On Oct. 18 1918 the Whitley Committee presented a second report on joint industrial councils (Cd. 9002). This recommended, for trades where organization was very weak or non-existent, an adaptation and expansion of the system of trade boards, working under an amended Trade Boards Act, and, in trades in which organization was considerable but not yet general, a system of joint councils with some Government assistance which might be dispensed with as the industries advanced to the stage of organization contemplated in the first report for joint standing industrial councils. The second, unlike the first report, was not completely adopted by the Government. In June 1918 a joint memorandum on the proposals contained in the second report was issued by the Minister of Labour and the Minister of Reconstruction. This memorandum emphasized the desirability of separating as completely as possible the trade board and the joint industrial council forms of organization, so as to develop the voluntary bodies only where the degree of organization warranted them, and the trade boards only where lack of organization made the statutory regulation of wages necessary.

In the meantime, for the purpose of consultation on questions of industrial reconstruction, it had been agreed by the Minister of Reconstruction, the Minister of Labour and the President of the Board of Trade that representative joint bodies should be formed on a less restricted basis than was contemplated in the first Whitley report. These interim industrial reconstruction committees, as the joint bodies were called, were begun to be established by the Ministry of Reconstruction in the beginning of 1918. They differed from joint industrial councils in that they were not intended to be permanent, and in that they were often formed in industries which had insufficient organization for joint industrial councils. They resembled joint industrial councils in being purely voluntary bodies and in the fact that their members were representatives of organizations of employers and workpeople. The formation of these interim committees did not violate the agreement as to policy contained in the joint memorandum referred to above, since the committees were formed primarily for special and temporary purposes, and were not meant to be permanent. It was contemplated that in some industries joint industrial councils would develop out of the interim committees as organization improved and, where organization remained weak, the existence of such a committee or any other voluntary body could not prejudice the power of the Minister of Labour to establish a trade board. A considerable number of such interim committees were formed. Several of these became joint industrial councils, some continued to operate as interim committees, while others had by 1921 ceased to exist, and in a number of the industries affected trade boards have since been formed.

The joint industrial councils have, for the most part, been formed on fairly uniform lines. A council is usually formed of equal numbers of members from the employers' associations and from the trade unions connected with the industry. The normal rule as to the appointment of officers is that there should be a chairman and vice-chairman and two secretaries: if the chairman is a member of the employers' side the vice-chairman is chosen from the trade-union side and *vice versa*, and a change in the side from which the chairman is chosen is made each second year. The secretaries are chosen usually one from each side. The two-sided character of the council is reflected in the rule commonly adopted in regard to voting: that no resolution shall be regarded as carried unless approved by a majority of the members present on either side. Usually in practice this means that decisions have to be arrived at by agreement. The councils generally have adopted not only uniform procedure but also a somewhat uniform statement of functions. The general object of a joint industrial council is often drafted in terms which indicate that it exists, to quote the final report of the Whitley Committee (Cd. 9153), to deal with all "matters affecting the welfare of the industry in which employers and employed are concerned," and to care for "the progressive improvement of the industry as an integral part of the national prosperity." In addition to such general statement of its functions, the constitution of a council usually includes, as more specific objects, the consideration of questions falling under such heads as the following: (*a*) wages, hours, working conditions, regulation of employment, machinery for settlement of differences; (*b*) improvement of health conditions in the industry, supervision of entry into and training for the industry; (*c*) extension of organization in the industry; (*d*) collection of statistics and information, encouragement of research and of invention, inquiry into special problems of the industry and publication of reports; (*e*) the formation of district councils and works committees; (*f*) the representation of the opinions of the industry to the Government and (*g*) coöperation with other councils in matters of common interest. In idea, therefore, the joint industrial councils are differentiated from the pre-war conciliation boards, which were usually confined, by their constitutions, to questions of wage bargaining and the like. The number of members on a council varies from as much as 130 in the building trades council (which is exceptional also in several other respects) to 13 on the wall-paper manufacture council. Other councils range between this latter figure and 70 in the printing trades council, about 30 being a common membership. A few councils are differentiated from the others in that they do not concern themselves with negotiations on wages or hours of work or with the settlement of disputes; the sub-title (building trades parliament) of the council of the building industry is meant to indicate the *deliberative*, as contrasted with the negotiatory, purposes for which this council was established. The conception of such trades parliament for the industry goes back to 1914.

The most important of the great national industries, which have attained the highest degree of organization,—*e.g.* coal-mining, iron and steel manufacture, cotton manufacture, engineering and iron founding,—had not adopted the Whitley scheme up to the early part of 1921. The industries in which councils have been formed vary from such national industries as those of building, printing, and wool manufacture to such small and localized industries as the manufacture of bedsteads, locks and latches, needles and fish-hooks. A large proportion of the industries are local in character, and it may be doubted whether some are more than sections of the industrial units for each of which the Whitley Committee meant a national industrial council to be formed. (The Whitley report did not, however, clearly define what it meant by an "industry.") Again, the trade or craft rather than the industrial basis has been adopted in one or two instances. The coopering joint industrial council is an example of this, the organization on both sides following craft lines and being on one side that of the skilled coopers and on the other side that of the employers of such coopers, whether or not master-coopers. The failure to form councils representative of industries rather than trades or crafts would appear to go further than this in so far that the interests represented on several of the councils are only the employers and the trade unions representing considerable sections of more or less homogeneous labour, but not all the occupations in the industry. This failure to realize the completely representative character of an industry is of interest from more than one point of view. It relates the councils to the well-established forms of pre-war conciliation machinery which have developed generally on a craft or occupational basis. It is important also from the point of view of those wider functions of a character other than wage bargaining which the councils have been expected to undertake. For this purpose it would appear to be necessary to have a body more completely representative than a joint industrial council usually is of all the interests in an industry. The constitution of a joint industrial council commonly allows for the coöptation of expert members, and the building council has recently in this way made an addition of representatives of the associations of architects and architects' assistants. This, however, is as yet unusual. Though various associations of managerial workers and technical experts have shown a desire to be represented on the councils there has been practically no development in this direction by either direct representation or coöptation.

The Whitley scheme has been extended to services which are not ordinarily included under the term "industry." A joint industrial council has been formed for the local authorities (administrative, technical and clerical staffs), covering on the employees' side various grades of workers up to and including the higher officials, such as town clerks. For the civil service there is an elaborate scheme embracing all grades of civil servants in the administrative and legal departments. Various attempts, most of them unsuccessful up to the present, have been made by organizations of bank officers, insurance clerks, and other "black-coated" workers, to obtain the formation of councils for their professions. This extension of Whitley council machinery to services and professions outside the industrial sphere is a natural accompaniment of the growth of organization among non-manual workers, other results of which are to be seen in the establishment of various other forms of conciliation.

The formation of district councils as subsidiary bodies to national councils appears to have been effectively carried out on the lines proposed in the Whitley report only in a very few industries; a considerable number of the effective district councils are connected with the national councils which deal with services under the control of local authorities. The Whitley report further recommended works committees as part of the machinery, and the establishment of such committees as well as district councils has been systematically encouraged and assisted by the Ministry of Labour as part of the development of the Whitley scheme. Works committees were the subject of a separate report of the Committee on Relations between Employers and Employed (Cd. 9085), and at the request of that committee the Ministry of Labour made an inquiry into existing works committees in the winter of 1917–8 (Ministry of Labour Industrial Report No. 2). The number of works committees in existence throughout the country is small in relation to the number of industrial establishments of suitable size. Several of the joint industrial councils—*e.g.* those for the pottery and the iron and steel wire industries—have taken active steps to have such committees established in the works which were considered suitable, but little progress appears to have been made in some of the other industries which possess Whitley councils.

By far the largest bulk of the work done by the joint industrial councils has taken the form of the settlement of the rates of wages, hours of work, and similar questions. Agreements on such questions, some of them national agreements, have been arranged on the majority of the councils, and the formation of the councils has meant the introduction for the first time into some of the industries of systematic methods of collective bargaining.

Some councils have made reports on education as affecting their industries, and others have dealt with such questions as conditions of safety in the works. The pottery council has conducted an inquiry into average earnings, costs and profits upon turnover. A report of the majority of a sub-committee of the building council, not adopted by the council, contained proposals for a radical alteration in the economic basis of the industry.

Other Bodies.—The name "Industrial Council" has been applied in two important instances to bodies other than Whitley councils. In Oct. 1911, following upon the transport and other strikes of that year, an addition was made by the Government to the official machinery applicable by the Board of Trade to the working of the Conciliation Act of 1896. This took the form of an Industrial Council which consisted of 13 representatives of employers and the same number of representatives of workers, invited by the President of the Board of Trade to serve on the council with, as chairman, Sir George (afterwards Lord) Askwith who, at the same time, was appointed Chief Industrial Commissioner. This Industrial Council of 1911 was formed as a permanent body for inquiring into trade disputes and for taking action, without compulsory powers, by way of conciliation; that is, it was to be a national conciliation board. In this capacity the council came to very little, and subsequent action has proceeded along different lines. The council's principal achievement was an inquiry into the subject of industrial agreements made at the request of the Government, the report on which was issued in 1913 (Cd. 6952). This contained a recommendation that, in certain conditions, the operation of a collective industrial agreement should be capable of extension by law so as to apply compulsorily not only to the signatories but also to a minority in the industry which had not been a party to the agreement. This recommendation, to which considerable objection has been taken, anticipated one of a similar nature contained in paragraph 21 of the first Whitley report.

The second important instance of the use of the name "Industrial Council," otherwise than in connexion with Whitley councils, is more recent. As a result of a great industrial conference convened by the Government in Feb. 1919 a report (Cmd. 501, 1920), dealing with a variety of industrial problems, was prepared. This included a proposal for the formation of a National Industrial Council, or what may be described as an advisory "Parliament" of industry. The proposals as to the membership and objects of the council followed the lines adopted in the Whitley councils; but the National Industrial Council, consisting of 400 members fully representative of and duly accredited by the employers' associations and the trade unions, was to speak for industry as a whole and on matters of general interest to all industry. It was pointed out that the council was to supplement and not to supersede any of the existing machinery; the general definition of its objects reads: "to secure the largest possible measure of joint action between the representative organizations of employers and workpeople and to be the normal channel through which the opinions and experience of industry will be sought by the Government on all questions affecting industry as a whole." At the beginning of Jan. 1922 the council had not yet been formed.

Bibliography.—See *Reports of the Committee on Relations between Employers and Employed* (The Whitley Reports), Cd. 8606, 9002, 9085, 9099 and 9153; the *Industrial Reports*, Nos. 1 to 4, of the Ministry of Labour; *Reconstruction Pamphlets*, No. 18, Ministry of Reconstruction; *Joint Industrial Councils Bulletin*, Nos. 1, 2 and 3, Ministry of Labour.

Report of the National Provisional Joint Committee on the Application of the Whitley Report to the Administrative Departments of the Civil Service (Cmd. 198); American Bureau of Labour Statistics: Bulletin No. 255, *Joint Industrial Councils in Great Britain; La politique de paix sociale en Angleterre*, by Elié Halévy, in *Revue d'Économie Politique*, No. 4, 1919; "The Industrial Outlook" in *Round Table*, Dec. 1918; *Recommendations on the Whitley Report* put forward by the Federation of British Industries, 1917; *National Guilds or Whitley Councils?* (National Guilds League) 1918; *The Industrial Council for the Building Industry* (Garton Foundation, 1919); *Industrial Councils and their Possibilities*, by T. B. Johnston, in *Industrial Administration* (1920); *Works Committees and Industrial Councils*, by the Rt. Hon. J. H. Whitley, M.P., in *Labour and Industry* (1920); *Workshop Committees*, by C. G. Renold (Report of British Association, 1918); *The History of Trade Unionism* (1920 ed.) by Sidney and Beatrice Webb; *The Labour Year Book* for 1919; *Report of Provisional Joint Committee of Industrial Conference* (Cmd. 501, 1920). (R. Wi.)

INDUSTRIAL MANAGEMENT: *see* SCIENTIFIC MANAGEMENT.

INDUSTRIAL MEDICINE.—The subject of health in relation to work is a wider one than is covered by present-day legislation, wider probably than ever can be covered by statute and regulation. The State is interested in the prevention and treatment of disease; but industry is directly concerned with the preservation of health, whereby contentment may be attained and unrest abolished, whereby greater productivity may result as regards both quality and quantity of output and increased earning power, whereby less waste may occur from labour turnover or from lost time due to sickness and injury. In fact, industry as represented by both capital and labour requires a maximum of human efficiency and activity, and a minimum of over-fatigue and ill-health.

Appreciation of the position as regards industrial health was forced to the front during the World War owing to labour scarcity, and since then by the high cost of labour. While in Great Britain the welfare movement (*see* Welfare Work) has been developing to deal with one side of the problem, in the U.S.A. the tendency has rather been towards the more purely medical side, and there have come into existence factory medical officers entrusted with examining all candidates for work, reëxamining periodically those employed, organizing First Aid for sickness and accidents, and establishing home visitation of the sick. An industrial medical service is thus coming into existence which is still working out its own salvation, neither aided nor impeded by any central authority. Later this American health service will have many lessons to teach. Although industrial medical service is slower in growth in Great Britain, the need has been recognized there for knowledge as to the conditions which make for maximum health and activity—knowledge which must form the foundation of any future industrial health service. Industry has in the past owed much to British physiologists, such as Dr. J. S. Haldane for knowledge upon respiration and the effect of warm humid atmospheres, and Dr. Leonard Hill with relation to the science of ventilation. During the World War, in England, the Health of Munition Workers' Committee set on foot pioneer work which was supplemented by investigation initiated by the Home Office into the subject of industrial fatigue. On completion of the war the work so started was entrusted to a special body, the Industrial Fatigue Research Board, with the following terms of reference:—"to consider and investigate the relation of hours of labour and of other conditions of employment, including methods of work, to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers." This board is now part of the organization of the Medical Research Council.

Certain information has been acquired through these various sources, which may be briefly summarized as follows:—(i.) A maximum of health is needed for a maximum of efficiency. (ii.) Evidence points to maximum efficiency being attained when output of the individual increases steadily but gradually hour by hour during the day, and day by day throughout the week, rather than when maximum output occurs early in the day or in the week. (iii.) Temperature exerts an important influence upon activity; the optimum for heavy physical work is at two or three degrees above or below a mean of 55° F., and the optimum for light sedentary work similarly varies about a mean of 65° F., but in no case should an even monotonous temperature be maintained. (iv.) Ventilation is possibly more important than temperature, not, under normal circumstances, for providing fresh air to breathe, but to stimulate the skin by varied currents of air and to save expenditure of energy by preventing visible perspiration. (v.) The expenditure of physical energy requires, in order to maintain maximum efficiency and avoid over-fatigue, the interpolation of rest pauses which, in proportion to the amount of energy expended, need to be of longer or shorter duration and in the case of heavy physical labour may need to be of longer duration than the period of activity. (vi.) Food suitable in quantity and in quality is required to supply the worker with energy; it must also contain a sufficient amount of vitamines which must be increased in quantity, simultaneously with the supply of food, for workers doing heavy work. Provision should be made for supplying food on factory premises, and care should be taken that the menu is varied. (vii.) Monotony should be avoided, not necessarily monotony such as is associated with repetition processes, but monotony in temperature, in ventilation, in long spells without rest pauses, and in food supply. (viii.) Considerable increase in output (and by hypothesis in health) may result from shortening hours of labour, especially if rest pauses had not already been scientifically introduced in order to prevent fatigue; but this result cannot be expected to follow where the machine sets the pace and the human element is at a minimum. (ix.) Good lighting, whether artificial or natural (but artificial cannot be as good as natural and is always expensive) improves health and output. Window-cleaning and attention to gas mantles and electric light bulbs are economic propositions. (x.) Change of occupation, apart from all these matters concerning environmental conditions and hours of labour, has a serious effect upon health; during the first weeks and months at new work while for lack of experience output is low in quantity and quality, the incidence of industrial accidents and sickness is unusually high. (xi.) Research has revealed that workers tend to drift from one place of employment to another to an extraordinary extent, and that a labour turnover of 100% per year is rather below the average. This drift, which has been estimated to cost industry £80,000,000 a year, can be largely reduced by personal supervision of workers. (xii.) Working clothes suited to each process are important, in order to permit adaptability of the body temperature and avoid perspiration. (xiii.) A clean skin is of special value to workers to enable them to react to ventilation and avoid septic wounds.

Much more remains to be found out from industry about human efficiency and human health. Already sufficient has been done to demonstrate the existence of a new science aimed primarily at preserving health, and incidentally at greatly increasing industrial capacity. The keystone to the position is that the influence of occupation upon a community cannot be appreciated unless from the first its value for establishing and maintaining health is accepted. Work represents the katabolic side of metabolism and is as necessary to life as is rest, the anabolic side. The study of human activity and its maintenance is the study of health. An important Anglo-American publication, *The Journal of Industrial Hygiene*, is devoted to the subject.

Medical Service.—Knowledge is useless unless it receives practical application, and the employment of doctors by industrial establishments is the means to this end. The work to be done varies with the number of employees, but a personnel of 2,500 at an engineering factory provide ample work for a whole-time medical officer if he is entrusted with such duties as examining each applicant for work; caring for the health of those employed by periodical re-examination as required; supervising ambulance and first-aid work; visiting absentees whether injured or sick; controlling the hygienic conditions of workshops, canteens, sanitary conveniences, lavatories and washing accommodation; advising as to faulty posture at work, accident prevention, suitable working clothes, and as to how to fit the worker to the work; keeping personal records of health; and, most important of all, conducting investigations into these records. For smaller establishments a plan has been promoted by a number combining to employ a medical man, remunerating him on a capitation basis of those employed. The expense involved in a factory medical service has always been found to be a good investment, since the loss incurred from labour turnover, from lost time, from accident compensation, and from many other causes, is diminished to an extent which is far in excess of the outlay.

Industrial Diseases.—Description of every form of disease which may be influenced by occupation would be description of every ill to which the flesh is heir. A résumé, nevertheless, may indicate how study of the incidence of morbidity and mortality in different occupations throws light on some of the difficult problems connected with the aetiology of disease. The multifarious forms of occupation, particularly those of manual workers, provide opportunities for studying the effect of different influences upon the human organism. Even if data did not exist to prove the point, reason would lead one to expect great variety in the morbidity and mortality experienced by agricultural labourers, coal-miners, textile operatives, bootmakers, chemical workers, shop-keepers, boiler-makers, stonemasons, fishermen, clerks, furnacemen, engineers and many others. Careful inspection of existing data reveals not only that marked differences do exist, but that they are differences in kind as well as differences in bulk—that is to say a high occupational mortality may be, and indeed usually is, due to an excessive death-rate from one or a few causes, rather than to a high death-rate from all causes. Thus chimney-sweeps suffer excessively from cancer, stone-masons from diseases of the lungs, coal-miners from accidents, and printers from phthisis, without necessarily experiencing any increased mortality from all other disease. Further inspection discloses not only an increased incidence of diseases such as are experienced by the general community, but also the occurrence of certain diseases peculiar to certain industries, what are known as diseases of occupation, for example, poisoning from lead, mercury or phosphorus, tubercular silicosis and miners' nystagmus. This latter group has, like all other things which are strange and unusual, drawn more attention than has the influence of occupation in increasing the prevalence of more common forms of disease. Nevertheless the influence of occupation upon the common forms of disease is far more important. Instances are chosen in what follows to illustrate the importance of industrial medicine. Each disease mentioned hereafter is only referred to as an illustration of how obscure problems may be illuminated and how principles underlying the causation and prevention of disease may be disclosed by study of occupational morbidity and mortality.

Accidents.—Objection may possibly be raised to including accidents among diseases, but careful inquiry into the incidence of industrial accidents has revealed that we succumb to accidents much as we succumb to those forms of ill-health commonly attributed to infection. In other words the incidence of accidents obeys epidemiological laws. Accidents are found to occur with greater frequency with advancing years, just as does cancer. The risk of accidents is greater in some industries, such as mining, than in others; just as tuberculosis is more prevalent in slums. Accidents due to different causes, say falls of roof in coal-mines, cause similar death-rates from year to year, and a similar proportion of total accidents; just as pneumonia year by year causes similar death-rates, and forms a similar proportion of total deaths. Accidents to different parts of the body, say to the eye, form year by year the same proportion of accidents to all parts; just as tuberculosis of the peritoneum forms the same proportion of tuberculosis of all regions. Accident-occurrence is affected by hygienic conditions—fatigue, psychical influences, ventilation, lighting, and temperature—in the same way as are general illness and disease. Accidents in any community are distributed not according to pure chance, but according to varying individual susceptibility; just as certain diseases run in families, due to "inherited predisposition." Workers newly exposed to risk sustain a high proportion of accidents, which diminishes with length of employment; just as lead poisoning claims most of its victims among new workers, or as South African natives succumb to pneumonia when first introduced to civilized communities.

Study of industrial accidents on the above lines indicates that the origin of the vast majority lies in the physiological and psychological state of the worker and his reaction to his environment; that the origin of other forms of morbidity and mortality is in the long run similar, and that the most promising way of attacking the incidence of accidents and of disease is through interesting the community individually in the need for maintaining personal health and resisting power, rather than by encouraging implicit reliance upon protective guards, whether they take the form of fencing machinery to prevent accidents, or using so-called disinfectants to prevent infection.

Action directed to this end is known as the Safety First movement with which the general community is acquainted. In the industrial world steps are being taken to interest the workers by forming in factories accident committees representative of all classes employed. Each accident as it occurs is investigated and reported upon by the committee, and in this way the members, who only serve for short periods of about six months, become acquainted with the principles of accident prevention. The prevalence of accidents where such committees exist has been reduced to an extent as satisfactory as it is surprising. The lesson to be learnt from a study of industrial accidents is that the general health of the community depends upon each individual understanding that his own health is largely in his own hands and that he owes to himself and to the community the duty of maintaining it.

Phthisis.—The occurrence of disease in general may be held to depend on a chain of three links. The first represents a latent capacity to be affected—what is known as hereditary predisposition—which is present in varying degrees in different individuals; so long as this capacity is latent exposure to risk has no effect. The second represents activation of this capacity or sensitization of the individual; exposure to risk now is followed by disease. The third represents risk; which in the case of phthisis is exposure to infection by the tubercle bacillus. Occupations tend to select individuals according to their latent capacity, inasmuch as industries calling for strenuous exertion, such as mining, metal-smelting, and agriculture, call for those physically fit, while indoor and sedentary occupations, such as tailoring and printing, tend to be followed by more weakly individuals. There is, however, no evidence that these weakly individuals are especially weakly so far as phthisis is concerned, and they might be expected to suffer in equal excess from all causes of death. But the incidence of phthisis suggests that certain occupations sensitize workers to the normal risk from infection, while others increase the risk; and study of the occurrence of phthisis in industry is found to support the general view of disease here stated, although difficulty may occur in any particular industry in determining whether the second or third link is the more important.

Study of the distribution of phthisis according to sex and occupation is of great interest in this connexion. Distribution according to sex is important because males as a class are employed away from their houses so much more than females that they may be held to represent the influence of occupation. Distribution according to occupation indicates what influences are favourable, what unfavourable. Phthisis is an index disease, that is to say its incidence rises and falls with the general death-rate for all causes, but more rapidly. Thus, while the mortality from phthisis among males in the past 50 years has fallen 50%, the general mortality has fallen only 25%. Consideration of phthisis for this reason is of especial value. If the mortality from the disease among males during the period 1851–60 be taken at a comparative figure of 100, then that of females was 106 at that date; in 1901–10 the comparative figure for males had fallen to 50, and that of females to 35. These data show that females are as liable to phthisis as are males: indeed up to the age of 15 years they continue to experience a heavier mortality than males; and that whatever influences have contributed to the fall which has taken place, they have clearly not been so powerful in relation to males.

The distribution of phthisis from the age of 15 years and upwards, *i.e.* the period of industrial life, discloses that the disease is more prevalent in urban than in rural districts, and that it attacks males more than females. This increased incidence among males is less marked in rural districts than in urban districts. Since housing conditions are the same for the two sexes, these figures point to the occupation of the male exerting a powerful influence. War-time experience showed that industrial occupation can exert such an influence, for in Great Britain the mortality from phthisis among females rose during 1915, 1916, 1917, and 1918, in proportion to their employment in the munitions industry. It rose most for towns, like Birmingham, Coventry, Manchester, Newcastle, and Sheffield, much affected by war industries; less in towns less affected, like Ipswich, Norwich, Stoke-on-Trent, York, and Worcester; and did not rise or even fall in unaffected towns, like Bournemouth, Brighton, Oxford, and Great Yarmouth. Since the war, women in industry have given place to men, and their mortality from phthisis has fallen again, even below pre-war figures.

When the data for phthisis mortality according to occupation are closely examined, four broad groups can be distinguished. One in which the phthisis mortality is below normal; this group includes agriculture and coal-mining, industries in which opportunity for infection through close personal contact is at a minimum. A second in which the phthisis mortality is above normal, but is the only cause of mortality which is high; this group includes printers, tailors, and boot-makers, who work sufficiently close together to enable infection to pass from person to person (and in rooms where the atmospheric conditions are physiologically adverse). A third in which a high mortality from phthisis is associated with a high mortality from other respiratory diseases; this group includes sandstone-masons, tin-miners, grinders of metal, and others exposed to the inhalation of fine particles of silica. Silica-dust when inhaled appears to possess the power (not yet fully understood) of sensitizing the lung tissue to attacks of tuberculosis. And a fourth in which high mortality from phthisis is associated with a high mortality from all other causes of death; this group includes general labourers and publicans. The publican owes his high general mortality to the power possessed by alcohol of sensitizing the general capacity for succumbing to disease. The general labourer who belongs to the poorest trade of the industrial world is an instance of the claim (mainly supported by evidence other than occupational) that phthisis is a *pestis pauperum.* A possible explanation of this claim is forthcoming from recent investigations into food, which have revealed that the energy contained in food cannot be exploited unless certain food accessory factors (vitamines) are present; vitamines occur most plentifully in expensive forms of food, such as butter, meat and fresh vegetables. These forms of food, especially in the form of animal fats like cod-liver oil, have long been accepted to be of value in relation to phthisis. Further, the supply of vitamines is required to be increased if the output of energy is to be increased. Poverty connotes a low standard of food supply. Industry calls for expenditure of physical energy, which must be obtained from food. The combination of low wages, with a call for expenditure of physical energy, such as is found in the general labouring class, should be, and indeed is, found to be associated with a high mortality rate due to phthisis and to other causes of death as well.

Discovery of a high mortality from phthisis combined, or not combined, with a high mortality from other respiratory diseases alone or from all other causes of death, enables the industry in which it occurs to be placed in its proper group, when the prevalent factor influencing the mortality is indicated. The method of procedure may be seen from the data embodied in the table at foot of page.

Statistical investigation may also provide further evidence. Reference to the age distribution of any phthisis death-rate brings out that the disease is more prevalent at different ages in different groups, as may be seen from the diagram. The median age at death from phthisis for shoe-makers lies between 38 and 39 years of age, which is the same as that for occupied and retired males. And their curve, although at a higher level throughout life, closely resembles that for occupied and retired males. The conclusion follows that if increased infection is the paramount influence determining the influence of phthisis among shoe-makers, it is also the main influence affecting its incidence among occupied and retired males.

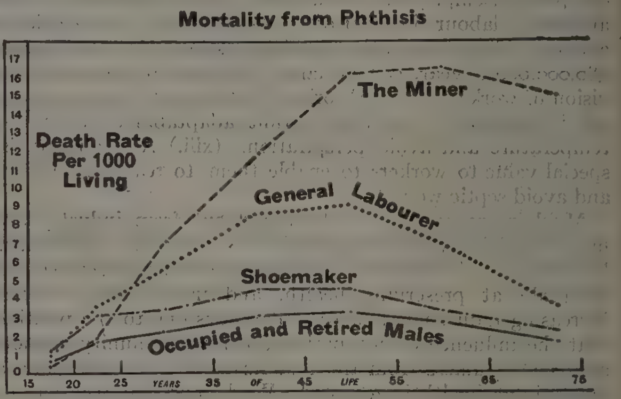

The curve for the general labourer is different in shape; it diverges from the standard continuously up to the age of 50, and although the difference remains considerable in later years it does not maintain the position attained in middle life. The median age at death from phthisis for this group lies between 40 and 41 years of age. Here, apparently, the influence which leads to the increased mortality takes some years exerting its full effect. In the case of the tin-miner the median age at death lies between 43 and 44 years of age, and the curve shows in early adult life in an exaggerated form the same tendency to diverge from the standard. Apparently, the adverse influence once established maintains its power throughout life.

Investigation of phthisis in industry indicates that the disease is to be combated in the general community by maintaining a general resistance against disease, especially through a food supply sufficient for energy needs, by preventing infection from individual to individual through avoiding over-crowding, and in special industries by ensuring the absence of harmful silica-dust.

Injury or trauma, of which pulmonary silicosis may be taken as an example, has long been recognized to sensitize to tuberculosis, whether of bones in childhood or of the lungs in adult life. Tuberculosis here resembles miners' nystagmus, pneumonia and delirium tremens, all of which may be precipitated by an accident. But silicosis further provides a reverse influence; for if a patient who appears to be only slightly affected with silicosis becomes infected with tubercle, the silicotic condition may advance rapidly, almost as though it were precipitated by the infection. The similarity between such a precipitation and the formation of tophi in gout is significant.

The only form of phthisis legally recognized to have a definite industrial origin is tubercular silicosis in which the disease is predisposed to by, or super-imposed upon, a condition of pulmonary silicosis caused by inhaling silica-dust.

COMPARATIVE MORTALITY OF CERTAIN CLASSES AGED 15 YEARS AND UPWARDS, 1900–20

Cause of Death	Standard	Group 1. Low General Mortality		Group 2. Phthisis alone in Excess	Group 3. Phthisis & Respiratory Diseases in Excess	Group 4. High General Mortality	
	(Occupied & Retired Males)	(Agricultural Class)	(Coal-miner)	(Shoe-maker)	(Tin-miner)	(Publican Inn Servant)	(Dock Labourer)
Influenza	100	100	88	67	104	*171*	79
Alcoholism & Liver Diseases	100	47	51	77	28	*670*	*167*
Cancer	100	74	78	103	101	110	*112*
Phthisis	100	45	48	*145*	*436*	*173*	*165*
Other Lung Diseases	100	49	*111*	84	*419*	*148*	*206*
Nervous Diseases	100	60	84	101	84	*178*	109
Circulatory Diseases	100	66	92	100	105	*144*	*129*
Bright's Disease	100	51	66	86	*143*	*243*	*117*
Accident	100	69	*208*	38	92	88	*180*
Suicide	100	89	58	100	32	*216*	63

Dermatitis.—The occurrence of skin affections in occupations is widespread; they cause much pain and sickness but only rarely mortality. Investigation here has, therefore, perforce to be based on other data than mortality statistics. The conditions associated with any form of dermatitis have to be inquired into until the specific cause is isolated. An instance will indicate the method used which is the same that led to discovery that silica alone among dusts possesses the specific property of predisposing to fibroid phthisis. Women employed in curing herring had long been known to suffer from erythema and painful indolent ulcers on their hands and on their arms, which had been ascribed to many causes, such as the condition of fish. The salt brine, however, with which the herring are cured fell under suspicion; then investigation in another industry in which brine is used for curing sausage-skins disclosed the presence among the workers of similar skin troubles; finally they were also found affecting men employed in brine mines. Clearly the salt brine was the cause. Workers handling potassium bichromate suffer in the same way, and those exposed to inhaling the dust of this compound suffer also from ulceration and perforation of the nasal septum. Next, workers inhaling fine salt dust were found with perforation of the nasal septum; and other substances such as copper arsenite, water glass, arsenious acid, lime, and solutions of acid, were found to cause the same troubles. Search for a characteristic common to all these compounds determined that all substances possessing hygroscopic properties could cause these forms of dermatitis, and that the pathological condition was due to the substance, after gaining access to the cutaneous tissue through some slight abrasion, abstracting fluid and so causing local necrosis. Acting on this theory, in some cases mere dilution of solutions used has abolished the trouble, while in other cases provision of opportunity for thorough soaking the skin after exposure has been equally efficient.

A further instance is also instructive. Certain workers employed in making roll tobacco were found suffering from dermatitis of the hands and forearms. These workers alone among tobacco operatives apply olive oil to the leaf. Other operatives much exposed to the oil were also found to suffer, and investigation established that exposure to the oil was the causative influence. Similar dermatitis also occurs among washerwomen, among workers exposed to alkalis, among mechanics exposed to cooling and lubricating mixtures used in engineering shops, and workmen exposed to turpentine, petroleum and other spirits. Here search for a common characteristic suggested that all substances with a lipoid affinity, *i.e.* capable of dissolving the natural fats, palmitin and stearin, from the skin could cause dermatitis by leaving the cuticle dry and liable to crack when infection from without can take place. Remedies by anointing the skin with lanolin and castor oil in order to replace the fat, and by adding antiseptics to the fluid used in order to guard against infection have proved their value and so support the theory.

Another group of skin affections which includes occupational warts is of considerable interest because of the light it throws upon the origin of epitheliomata. Workers who handle pitch, a distillation product of gas tar, and others who mix pitch with coal-dust in the manufacture of briquettes, suffer from warts which appear on the exposed parts of the skin, and also on the genitals. These warts show a special tendency to become epitheliomatous with the formation of "pitch" cancer. Shale oil workers coming in contact with crude paraffin, a product obtained by distillation, similarly suffer from warts and "paraffin" cancer; but workers manipulating refined paraffin do not suffer. Chimney-sweeps have long been noted for their high death-rate from scrotal cancer which originates from exposure to soot, a distillation product of coal. Cancer of the lips and buccal cavity is nearly confined to males who by smoking expose these parts to the distillation product of tobacco. The evidence here summarized suggests that certain products obtained by distilling vegetable substances can sensitize the skin to cancer.

Evidence from the dye industry suggests that the products in question may possibly be benzene compounds. Workers in this industry exposed to certain amino-benzene compounds, particularly benzidine and naphthylamine (compounds which, when they gain access to the body, are excreted by the kidneys), have been found to develop malignant tumours of the bladder. The new growths which occur on the skin in the tar cases, and in the bladder in the dye-workers, have certain features in common: at first there is a simple hyperplasia; the exact moment when malignancy supervenes is a matter of doubt; and metastasis is the exception. Possibly we have in these benzene compounds instances of substances which, by modifying tissue growth, possess the power of preparing the way for, if not directly causing, malignant changes. Much more research work on the lines here indicated waits to be done, for there are numerous other forms of industrial dermatitis, but the above instances should suffice to show how underlying principles of general utility come to light through investigations conducted in industry.

Miners' Nystagmus.—This disease, chosen as an example of a trade neurosis, is one the incidence of which increases with length of employment. It takes on an average 20 years to develop; hence, it lays aside the miner when his skill is at its zenith and he is too old to change his occupation. The complaint is a distressing one which causes much morbidity, but no mortality, and in recent years has increased in prevalence.

The leading symptom is an uncontrollable wheel-like but irregular rotation of the eyeball with the pupil as the hub of the wheel; the sufferer sees the external world constantly moving and rocking before him. At the same time there are marked photophobia, rapid movements of the upper eyelid, and severe headache, which are accompanied by symptoms of general neurasthenia. The condition frequently appears to lie "latent" and to develop suddenly after an injury (especially if to the eyes) or other depressing influence, such as an attack of influenza; this tendency to be precipitated by trauma is even more pronounced than in the case of delirium tremens.

Formerly the disease was mistakenly ascribed to the posture of the coal-getter as he lay on his side holing the coal which necessitated unusual eye movements. Now, thanks to the work of Dr. T. L. Llewellyn, the condition is definitely known to be due to working in dim illumination. It occurs nearly exclusively among coal-getters and hardly at all among the men who convey the coal to the pit shaft or do other work on underground roads. It occurs with equal frequency among men standing at a 6-ft. seam, or kneeling at a 20-in. seam. The frequency of its occurrence varies with the amount of light provided; the less the light, the more the disease; it prevails especially in mines where oil safety lamps, which give a low illuminating power, are used, and is hardly known where naked lights are used, which give twice or three times the illumination.

The two factors which, acting together, sensitize the ocular nerve tracks to the disorganized movements characteristic of the disease, are poor illumination together with need for focussing vision; over 70 % of those affected are found to possess errors of refraction.

The condition improves if the worker gives up underground work, but tends to recur if he resumes it.

Two means of prevention are urgently needed: first, medical examination of all boys who desire to become miners in order to eliminate those with errors of refraction; secondly, introduction of more powerful safety lamps. Electric safety lamps are now available, and where introduced, the prevalence has rapidly diminished.

Lead Poisoning.—This disease affords an excellent instance of control guided by previous investigation and research, opportunities for which were provided by notification of the cases. Lead poisoning of industrial origin was made notifiable in 1895. Distribution of cases by industry and numbers employed then showed that exposure in manipulating metallic lead or moist lead salts was almost a negligible factor in causing the disease; and that the governing risk was exposure to dust of lead salts soluble in the body fluids. Animal experiments proved that a dose of lead-dust when inhaled was a hundred times more toxic than when administered in food. Clearly preventive measures based, according to previous theories, on personal cleanliness, but which neglected the danger from inhalation of dust and fumes, could not be expected to stop the disease. In Great Britain Dr. T. M. Legge of the Home Office, to whom credit is due for recognizing the particularly toxic nature of lead-dust when inhaled, concentrated attention upon preventing the generation of dust and fumes or upon removing them, if generated, from the atmosphere of work-places. This principle underlies a series of regulations applied to industries in which lead compounds are used, *e.g.* the manufacture of electric accumulators and of white lead, vitreous enameling, file-cutting, smelting of materials containing lead, the manufacture of paints and of pottery, tinning of hollow-ware, and heading of yarn. The result of action on these lines has been remarkable; 1,058 cases of lead poisoning were notified in Great Britain in 1900. Since 1900 industries have expanded so that many more persons are now exposed to risk; and in 1906 lead poisoning was made a compensation disease, a factor which temporarily increased the notifications and tends to maintain them. Yet in 1918 the cases notified had fallen to 144 and in 1919 to 206.

Plumbism may be divided into two groups of cases: one, which occurs in the early weeks and months of employment, is characterized by such symptoms as acute colic and encephalopathy; the second, which occurs after years of exposure, is characterized by nerve paralysis and chronic nephritis. The first group contains the vast majority of cases, and its disappearance in later years points to some degree to immunity having been acquired through continued exposure to subminimal toxic doses. Lead poisoning in this respect presents aspects of disease of which industry supplies other instances; some exhibiting a prevalence which diminishes with length of exposure to risk, some one which increases with exposure to risk.

General Considerations.—Mill fever, which affects most operatives on entering the cotton or flax industry, and certain forms of dermatitis, *e.g.* eczema and conjunctivitis due to contact with tetryl, and skin irritation from slag wool, provide examples of troubles which rapidly disappear with continued employment and do not reappear. On the other hand miners' nystagmus, Duyputren's contraction, pitch and paraffin cancer, bronchitis and pneumonia due to dust, cotton strippers' asthma, pulmonary silicosis, glass-blowers' cataract, phosphorus necrosis, and such trade neuroses as writers' cramp and telegraphists' cramp, are conditions which steadily increase in numbers with length of employment.

Other diseases resemble plumbism in presenting both early and late manifestations. Thus reference has already been made to the high incidence of accidents during early weeks and months of employment; with advancing years as bodily activity declines, *i.e.* as the person becomes more sensitized to risk, the tendency to accidents again arises. Tri-nitro-toluene (T.N.T.) during the war caused toxic jaundice among munition workers, but hardly any cases occurred among those who had been employed over six months; it also caused aplastic anaemia, a condition which was rarer and only appeared among those who had been employed for a considerable period. Phthisis also presents some similarities, for there is evidence that exposure to a subminimal dose may result in increased resistance; possibly the tendency for the curves representing the phthisis mortality of boot-makers and general labourers to fall towards that of the standard after middle life indicates some degree of acquired immunity; on the other hand tuberculosis among those sensitized by inhaling silica-dust shows no signs of falling off in later years, and may be held to be analogous to the late group of plumbism cases, the aplastic anaemia cases, and accidents in late life.

There are, however, trade diseases which appear to have no relation to the period of employment. The incidence of these depends directly on exposure to risk; among these diseases are anthrax, caisson disease, and gassing from carbon monoxide, nitrous fumes, and arseniuretted, sulphuretted or phosphoretted hydrogen. These diseases, however, are rare, and their causation and prevention is comparatively well understood.

The lesson which emerges is that although the human body often possesses a capacity which requires no sensitization to succumb when exposed to certain unusual risks, it also possesses a capacity for defending itself against risk if the exposure is long continued. On the other hand certain influences such as alcohol, over-fatigue, lead, dietetic insufficiency, or silica-dust, can gradually sensitize the body, even to the extent of breaking down an acquired immunity, so that it finally succumbs where it formerly resisted. The methods by which immunity is acquired (as against such a thing as tetryl) and by which it is lost through sensitization (as by inhaling silica) both probably await biochemical research to explain their meaning. The problems associated with occurrence of trade neuroses, on the other hand, call primarily for physiological investigation into the normal mechanism of coördinated and balanced nervous control.

Industrial medicine, in which the absence of a disease in any group of workers may go far to explain its causation in another allied group, provides unique opportunities for studying the normal physiological elasticity of health and the way in which it may be overstrained and give place to disease.

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INDUSTRIAL WORKERS OF THE WORLD, THE.—A union of wage-earners in the United States, organized in 1905, with a membership in 1920 of about 100,000, commonly spoken of as the I.W.W. (For a discussion of the I.W.W. *see* TRADE UNIONS.)

INFANTILE MORTALITY.—Since 1910, the social importance of measures for reducing the rate of infantile mortality, which means the number of deaths under one year of age per thousand births, still-births being excluded from both figures, has come into increased prominence. The problem involved, however, presented special difficulty early in 1921 to anyone who sought to deal with it authoritatively, since the World War had upset all calculations and statistics. In some cases, as in all the central European countries, the infantile death-rate had increased to a really appalling extent. One competent observer, for example, during a prolonged stay in Vienna, did not notice one "toddler" in the streets. On the other hand, there was, according to the British Registrar-General's reports for 1919, an apparent fall in infantile death-rate. No contemporary figures were yet available from the central European countries. Moreover, during the war, so great had been the pressure of work in all the countries involved that the statistical returns required, from which to draw conclusions of any lasting value, were perforce allowed to lapse.

A great deal of interesting information is to be found in Professor Starling's *Report on Food Conditions in Germany with Memoranda on Agricultural Conditions and Statistics*, published in 1919 (Cd. 280). The great outstanding difference between Great Britain and Germany in this respect was that of distribution. In England the control of distribution was facilitated by the fact that 80% of the grain and 45% of meat and all the oil-seeds consumed in the country were imported, and therefore could be controlled by the administration from the moment of their arrival. In Germany the whole of the supplies were produced in the country and had to be obtained from the large and small farmers. Thus a highly complicated and very difficult method of collection and distribution had to be followed, and grievous mistakes were made. Much more hoarding took place in Germany than in England, and the producers were far better fed than were the non-producers. The food shortage therefore was mainly experienced by the inhabitants of large towns and industrial areas. These observations are borne out by such books as *An English Wife's Life in Berlin during the War* by Princess Blücher. Moreover the German authorities felt themselves obliged to attempt to ration strictly the whole food of the population, and no such system as this can succeed without mass feeding. No two individuals are alike; one will need more food than the other. In England rationing was wisely confined to certain articles, such as meat, fats and sugar,—leaving bread, the chief food of the poor, unrationed, so that each individual could obtain of this as much as he required.

In Germany, in common with the other belligerent countries, as a result of the absence of the adult male population, the birth-rate went down. In addition to this cause the diminished fertility of the population owing to chronic underfeeding of both sexes must be taken into account. The birth-rate in Germany dropped from 27·5 per 1,000 in 1913 to 15·83 in 1916, and 14·29 in 1917, so that the number of births at the last date was well below the number of deaths, and in 1918 the deaths per 1,000 were 16·30 as compared with births 9·45, or a surplus of deaths per 1,000 of 7·35. In spite of the condition of malnutrition of the mothers, the children were normal when born, a state of things borne out by observations everywhere. Their further development was of course hampered by the lack of nourishment of their mothers, as well as by the defective supply of cows' milk. The pre-war milk consumed by Berlin was 1,250,000 litres, which during the war diminished to 225,000 litres, an amount totally inadequate to the necessities of the babies. How large a share the question of distribution had in the increase of infantile mortality in Germany was shown by the statement issued by the Belgian Relief Commission. Owing to the uniform feeding there was very little evidence of serious malnutrition among the inhabitants of Belgium, and the mortality among the children during the years of German occupation was less than before the war. It is highly gratifying to know that infantile mortality was steadily dropping throughout the world during 1900–20. It is true that the birth-rate was also dropping. The time was not yet ripe in 1921 to attempt to estimate the total loss of births caused by the war.

UNITED KINGDOM

The births registered in the United Kingdom during the years 1910–4 were 4,411,823 as against 3,623,579 during an equal period of time 1915–9, a difference of 788,244. But the numbers born were already decreasing before the war notwithstanding the increase of population, so the whole diminution should not fairly be attributed to this cause. Also there has been a great recent rebound of fertility, not yet at an end in 1921, which may be regarded as a partial offset. The British birth-rate during 1919 went up in all districts except Wales, where, contrary to the usual experience, it went down. The increased rate was specially marked in London.

The British death-rate among male infants is always steadily higher than is that among female ones, and this rate has apparently been rising, though there was a curious drop in 1918. Taking the years 1911–19, 120 male to 100 female babies died, and this rate steadily increased till 1919 when it reached 124, having dropped in 1918 however to 114. The infant deaths registered for the year 1919, according to the latest figures available, were 12·2% of all deaths at all ages. The total number who died were 61,715. This proportion has fallen very rapidly of late years, not only because of fewer deaths, but also of fewer births. The percentage of infantile deaths of the total number as recently as 1901–10 was 22·6.

The rate of infantile mortality resulting from these deaths during 1919 was 89 per 1,000 births, or 15·2% below the average of the previous 10 years. It was the lowest rate that had yet occurred in the United Kingdom, the nearest to it being 95 in 1912.

As to the causes for this decreased rate, opinions seem to vary according to the view point of the person expressing the opinion. For example, the Board of Education officials were inclined to attribute it to the greater educational advantages enjoyed by the mothers through the establishment of their infant welfare centres. Improved sanitation is considered by others to have had great effect. Others again consider that the national campaign against venereal disease had probably had a considerable share in it; others the lessened employment of women in factories, and yet others the weakened strength of alcoholic beverages. Practically all these suggestions, as anything more than simply contributory to causation, are discounted by the fact of 1912 being so much lower than the years preceding and following it up to 1919.

The mortality rate in the case of illegitimate is very considerably higher than in the case of legitimate babies. In London during 1919 the total deaths of legitimate babies in 1,000 births was 77; in the case of illegitimate babies the total number was 233. This was the case in every area in the United Kingdom as the following table shows:—

Infantile deaths from all causes in proportion to 1,000 births.

	All Infants	Legitimate	Illegitimate
London	85·30	76·57	232·91
County Boroughs	98·62	92·56	195·27
Other Urban Districts	85·69	81·88	153·61
Rural Districts	80·46	76·57	136·16
All Urban Districts	91·25	85·48	182·68

This higher rate of mortality is maintained in practically every cause of death, the exceptions being that in London and other urban districts fewer deaths from whooping-cough occurred in the illegitimate babies, and in country districts fewer from tuberculous meningitis.

If we take the three main reasons for infantile death-rate, viz.: diarrhoea and enteritis, syphilis, and premature birth, we find:—

Deaths from diarrhoea and enteritis, proportion per 1,000 births.

	All Infants	Legitimate	Illegitimate
London		12·49	52·96
County Boroughs		8·96	28·55
Other Urban Districts		6·51	18·89
Rural Districts		4·74	9·91
All Urban Districts		8·46	27·82

Deaths from syphilis.

	All Infants	Legitimate	Illegitimate
London	2·10	1·18	17·58
County Boroughs	2·56	1·84	14·03
Other Urban Districts	1·37	0·91	8·42
Rural Districts	0·86	0·48	5·41
All Urban Districts	1·99	1·35	12·12

The infantile mortality from syphilis in 1919 was still higher than before 1917, when it underwent a sudden and considerable increase, though it was still not so high (at 1·76) as in 1917, when it reached 2·03 per 1,000 births.

Taking birth conditions generally in 1919, *i.e.* injury at birth, congenital malformations, premature birth and atrophy debe, and marasmus, we find:—

	Legitimate	Illegitimate
London	7·86	20·51
County Boroughs	9·28	17·47
Other Urban Districts	8·77	14·75
Rural Districts	8·57	14·64
All Urban Districts	8·85	16·74

The rates for illegitimate children followed the same lines roughly as the legitimate ones, viz.: the death-rate increased from south to north, being generally lowest in the residential towns of the south, and highest in the industrial towns of the north. For infants of both sexes jointly the mortality varied during 1919 from 108 deaths per 1,000 births in the county boroughs of the north to 64 in the rural districts of the south. In rural districts, however, it is quite common for infant mortality during the first four weeks of life to be higher than the urban mortality. This is of course because environment conditions other than those of birth itself have not had time to tell. This increased rural mortality is very rare after the first month of life. The birth risk in the rural districts of the north was certainly at its maximum, for much the highest rate for the first day was returned by those areas. There was a similar rural excess during 1919 in Wales, though not in other parts of England, so that if defective midwifery in remote districts is the cause, it does not seem to apply to the Midlands and the south of England. In 1917, on the other hand, first-day mortality was in excess in all the rural districts with the excess still greatest in the north.

Two former causes of infantile deaths that have been tending to disappear altogether, are rickets and tuberculous meningitis. Indeed the marked fall in the mortality of age period 0–5, which necessarily includes mortality of children under one year, from tuberculosis generally, is very noticeable, and was greatly accelerated during 1919. Formerly it was the highest at any age, but it is now exceeded by most of the adult life periods.

Infectious Diseases.—The infectious diseases which influence the infantile death-rate are measles, scarlet fever and whooping-cough. With regard to measles, the death-rate of 1919 was by far the lowest ever recorded. It was much the greatest in the north of England, and since 1912 it has been noted as being the greatest in the large towns. Thus Cumberland, Durham, Northumberland and the North Riding, all in the north, showed the highest mortality, and in spite of the low mortality-rate in the country generally, Middlesbrough and Rotherham remained very high. The total deaths from measles in children under one year in 1919 was 650, or 1·05 % of the infantile deaths.

In the case of scarlet fever, the same high mortality occurs in the north in all areas whether country or town, compared with the south and with Wales; Birkenhead, Bootle, St. Helens and Liverpool head the list as they did in the previous year. The total deaths from scarlet fever in infants under one year for 1919 was 32, or ·051 % of all infantile deaths.

The death-rate from whooping-cough was the lowest ever recorded. There was a marked excess in the case of females, which is constant. The proportion of infantile deaths to the total number of deaths from whooping-cough naturally fell with the diminished birth-rate, but it is a curious fact that it was higher in rural districts than in small towns, and in small towns than in county boroughs. The cause of this persistent characteristic it was impossible at present to discover. It was not shared by measles, which was the only other infectious disease causing infantile mortality to any marked extent. The total number of deaths from whooping-cough under one year was 1,054, or 1·7 % of all infantile deaths.

Enteritis and Diarrhoea.—Diarrhoea as a cause of death is gradually disappearing from the British returns. This is also the case with tubercle and convulsions. The mortality ascribed to tubercle in 1919 was less than one-third, and convulsions less than one-half of that so returned 14 years earlier. In the case of these two latter diseases it is probably very largely one of nomenclature, whereas in that of diarrhoea it presumably represents in the main an actual decrease of mortality. During 1919 there was a lower infant mortality from diarrhoea and enteritis than ever before, except in 1912, when there were remarkably favourable weather conditions, even better than those in 1919. In 1911, a year with an almost tropical summer, the infantile deaths from these causes were 31,900 compared with 6,039 in 1919, the total infantile deaths being 114,600 and 61,715 respectively.

Syphilis shows a steady decrease compared with the startling rise in 1917, but it had not yet in 1919 attained its pre-war level as a cause of infantile mortality. As in the two previous years, mortality from syphilis was in considerable increase in the north.

Developmental and Wasting Diseases, notwithstanding an increase in 1919 in the first month, showed in that year the mortality of 10·3 per 1,000 births, the lowest ever recorded for England and Wales. By far the most important increase was that due to premature birth. This accounted for 59 % of the total increase of mortality during the first four weeks of life. Injury at birth also showed a considerable rise, which increase was entirely confined to male infants, whose mortality had risen from 1·11 to 1·34, whereas that of females had remained stationary at 0·85. As the British Registrar-General says: "It looks as if the infants born during 1919 were for some reason exceptionally susceptible to death within the month." This cause of infant mortality was, like so many others, excessive in the north of England, and mainly in the rural districts where it caused a mortality of 1·91 as compared with 1·11 for the country at large. Rural mortality from birth injury was high, and as the health and general condition of the mothers is likely to be better than in towns, it looks as if defective midwifery might be at least a contributory cause. As higher mortality is attributed to premature birth in the north as a whole than elsewhere, the facts of the greater industrial employment of married women in the north might be pointed to as a cause, but mortality from this cause declined during the early part of the war, reaching a minimum in 1916, and increased after the war together with the increased employment of women. Speaking generally, it looks as if a baby born north of the Wash had less chance of surviving than if it were born in the south.

"*Overlying.*"—This cause of infant mortality deserves separate mention. It was very much lower in 1919 than it had ever been before, being 0·76 per 1,000 births, or less than half of what it was a few years before the war. But Dr. W. A. Brend throws some doubt on this as a genuine cause of death. See *Health and the State*, 1917, as well as *Inquiry into the Statistics of Deaths from Violence*, 1915, in which he shows that there is no connexion between overcrowding and deaths from overlying, and that the seasonal variation follows that of bronchitis and pneumonia, being considerably higher in the first and fourth quarters of the year than in the second and third. This is borne out by the figures furnished by the Medical Officers of Health for Liverpool and Birmingham for 1919 and 1920. Thus in Liverpool in 1919 there were 18 deaths from this cause in the first and fourth quarters, and 7 in the second and third; and in 1920, 17 and 6 respectively. In Birmingham in 1919, the figures were 23 for the first and fourth quarters, and 10 for the second and third; in 1920 they were 16 and 11 respectively. The fact of expert pathologists very rarely finding overlying a cause of death, but some other quite different cause, such as pneumonia, lends some support to Dr. Brend's contention.

Housing is a most important condition of infant mortality. Where there is most overcrowding, there is the highest death-rate. Of all children who die in Glasgow before they complete their fifth year, 30% die in houses of one room, and not 2% in houses of five rooms and upwards.

Vital Statistics of Large Towns:—London.—We find that the London infant mortality rate in 1919 was 85 compared with 108 in 1918. The birth-rate was 18·2 compared with 16 in 1918.

The following table published in the report of the Medical Officer of Health for London shows very clearly one great cause of lessened infantile mortality in cool summers and mild winters:—

	1911	1912	1913	1914	1915	1916	1917	1918	1919
1st quarter	108	95	116	96	111	92	115	125	118
2nd "	89	82	81	79	93	73	85	90	70
3rd "	203	81	105	127	113	82	88	85	72
4th "	113	103	115	109	126	103	114	117	76

The high figure in the first quarter of 1919 was due to influenza. The third quarter was the lowest ever recorded and may usefully be compared with the third quarter of 1911 when the heat in the latter part of the summer was almost tropical. The factor which mainly contributed to the low death-rate was the remarkably small number of deaths from measles and whooping-cough, which were 55 and 72 respectively as compared with 276 and 498 for 1918. Diarrhoea however showed an increase, there being 1,217 deaths, as compared with 970 in 1918, which was due to a period of high temperature late in the summer.

The number of deaths of nurse infants during 1919 was only 51 as compared with 103 in 1918. Foster-mothers were encouraged to take their children to infant welfare centres, and visitors followed up to see if the advice given had been carried out.

It is interesting to study the incidence of infant mortality in the different boroughs of the County of London. For example, the highest rates in 1919 were in Kensington, Shoreditch and the City of London with 102, 106 and 115 respectively. The lowest three were Lewisham with 62, Wandsworth with 72 and Battersea with 74, the rest varying from 81–99 per 1,000 births.

The deaths from enteritis and diarrhoea were greatest in Kensington, Hammersmith and Bethnal Green with 30·5, 29·8 and 26·5 respectively, and lowest in Lewisham, Woolwich and the City of London with 5·6, 6·6 and 7·2 respectively. The highest birth-rate was in Poplar with 24·7 per 1,000 of population, and lowest in the City of London with 9·6. These two districts had very nearly the same infantile death-rate, 14·5 and 14·3 respectively.

Birmingham.—The infantile mortality-rate in 1919 was 84, and in 1920 even lower, viz.: 83. This diminution is most striking in the poorer parts of the city. Thus St. Mary's Ward, which for many years held the record for a high infantile mortality, had a mortality of 103, or a drop of 80 as compared with the rate for the years 1912–18 of 183.

An interesting table showing the total infantile mortality rate and the rate with diarrhoea and enteritis taken out is given below. It is really put in to show that the diminution is not due only to cool summers, but it is a very striking evidence of that atmospheric effect as a contributory cause. Thus in 1911 there was a mortality rate of 47 per 1,000 from this cause, and in 1912 a rate of 9 only—this was a year with a very cool summer. It is true that this rate was exceeded every year since, though it never approached 1911, till 1919 when we have a further drop to eight.

	Total mortality rate	Infant mortality less diarrhoea and enteritis	Deaths from diarrhoea and enteritis per 1,000
1911	150	103	47
1912	111	102	9
1913	129	100	29
1914	122	100	22
1915	118	95	23
1916	104	90	14
1917	101	89	12
1918	99	84	15
1919	84	76	8

There can be little doubt that after the appalling rate of 1911 all varieties of infant welfare work were pushed forward and were subsequently beginning to tell, but it seems impossible to doubt that the absence of tropical heat must certainly be given credit for part of it. It remained to be seen what would happen in the event of great summer heat occurring again. The illegitimate death-rate was 177 compared with 84 amongst the total births, *i.e.* over a double rate, very much the same as is shown in most other tables. An analysis of the figures of total deaths in infants under one year shows the effect of the colder parts of the year.

In 1919 during the 1st quarter of the year 554 infants died.
" " " " 2nd " " " " 291 " "
" " " " 3rd " " " " 315 " "
" " " " 4th " " " " 470 " "
1,630

Liverpool had in 1919 a considerably higher birth-rate than the average of the great towns, being 23·9 per 1,000 of population compared with 19, and at the end of 1919 the birth-rate was going up. The infantile death-rate varied from 136 to 81, giving an average for the city of 110. Examination of the figures for the first 20 years of the century shows in common with all other figures examined in other places a marked drop in 1912, with a slight rise in 1913, 1914, and 1915, and a distinct fall for 1916, 1917, and with a slight rise for 1918, and a still lower rate (by far the lowest on record) for 1919.

The statement is made, and is often borne out, that a high birth-rate means a high infant mortality rate. This is not so in certain districts of Liverpool. For example, in the Everton district there were 3,240 births with a death-rate per 1,000 births of 109, whereas in the Exchange district, with 922 births, the death-rate was 127. On inquiry we find that the Everton district is the most densely populated district of the city, containing 176 persons to the acre, but the inhabitants are of the respectable artisan type, such as railwaymen, carters, painters, etc. The houses, although small and closely aggregated, generally contain six rooms with a small backyard, and are of a better type than those found in Exchange district, which is one of the oldest districts in the city, and is closely populated mostly with persons of the labouring class. The men are employed to a great extent about the docks and many of the women are hawkers and such like. Nearly 40% of all infant deaths takes place within the first four weeks.

There has been a marked decrease in drunkenness among women, due in part to restricted hours, but probably also to the weaker nature of the beverage, as well as to better wages which mean better food and improved conditions generally. No woman is noted as having died from excessive drinking in 1919, whereas 50 died in 1914, and 38 in 1915.

Speaking generally, it is the experience of the United Kingdom that infant mortality, though steadily going down, was in 1921 still far too high, but there was probably an irreducible minimum which might be taken as somewhere about 30 per 1,000 births, and might be regarded as accidental and to a large extent unavoidable. In Liverpool, for example, the deaths noted in 1919 under congenital malformation were 56 out of a total number of births of 2,055, or a death-rate of 27 per 1,000.

The lines on which we may expect further diminution are many, and cannot be regarded as due to any one cause, or group of causes, such as sanitary improvements or climatic conditions. The quickening of late years of the public conscience upon the subject, as well as the increased value put on all infant life owing to the immense loss of life during the war, have a very large share in the diminution of infant mortality.

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UNITED STATES

Although accurate statistics of infant mortality in the United States were lacking until recent years, practical interest in the subject was shown as early as 1893, when Nathan Straus established infant milk stations in New York City for the purpose of providing pasteurized milk for infants. After that time there were sporadic efforts in various parts of the country to protect infants. Municipal or state effort was unknown until 1908, when the City of New York established the Bureau of Child Hygiene. On April 9 1912 the U.S. Government established the Children's Bureau under the U.S. Department of Labor, one of whose functions was to investigate matters relating to infants' welfare. Between that time and the end of 1921 35 states established bureaus or divisions of child hygiene, and such municipal organizations for the same purpose became common. In addition to these Governmental enterprises, private and semi-private organizations did excellent work in many communities.

In order to conform to the practice of other countries, it would be necessary to use as a standard the annual number of deaths of infants under one year of age per thousand living births occurring in the same area. But birth registration in the United States has been noticeably lax. The area of state birth registration, originating 1915, was at the end of 1919:

States Included in the U.S. Birth Registration Area, 1919.

State	Year Admitted	State	Year Admitted
Connecticut	1915	Indiana	1917
Maine	1915	Kansas	1917
Massachusetts	1915	Kentucky	1917
Michigan	1915	North Carolina	1917
Minnesota	1915	Ohio	1917
New Hampshire	1915	Utah	1917
New York	1915	Virginia	1917
Pennsylvania	1915	Washington	1917
Rhode Island[1]	1915	Wisconsin	1917
Vermont	1915	California	1919
District of Columbia[2]	1915	Oregon	1919
Maryland	1916	South Carolina	1919

The pop. in the birth registration area for 1915 was 31% of the total estimated pop. of the United States. In 1919 this had increased to about 58%. During a slightly longer period of time, 149 cities were included in the registration area.

The standard accepted by the U.S. Census Bureau is based upon what is known as the Model Law, and its requirements are:

1. Registration of births within 10 days.
2. Use of standard birth certificates.
3. Checks on registration, chiefly by (a) tracing records of deaths of infants under one year of age to see whether birth was recorded, and (b) tracing records of births reported in newspapers.
4. The work of an efficient state registrar possessing full power and responsibility to enforce the law, in direct connexion with local registrars.
5. Prompt monthly returns of the original certificates from the local registrars to the state registrar, with report of "no births" or "no deaths" where such is the case, and official statement of completeness of registration or report of delinquents.
6. Enforcement of penalties for non-compliance.

It was reported in 1921 that no state had obtained complete registration of births. The statistics in the area, however, were generally assumed to be approximately correct. It is evident, therefore, that infant mortality statistics in the United States, up to the end of 1921, were based entirely upon births reported in the registration area and that the total mortality must be estimated. It was believed, however, that the infant death rates in the states having unsatisfactory registration of births do not differ essentially from those recorded in the birth registration area.

Infant Mortality in the United States and Some Foreign Countries or Provinces (per 1,000 living births).

Chile (1919)	306	Denmark (1919)	92
Hungary (1915)	264	England and Wales (1919)	89
Spain (1918)	183	Ireland (1919)	88
Japan (1917)	173	Switzerland (1918)	88
Germany (1918)	154	United States (birth registration area, 1919)	87
Italy (1915)	147	Netherlands (1919)	84
Quebec (1917)	138	Sweden (1915)	76
France (1919, 77 departments)	119	Australia (1919)	69
Finland (1917)	118	Norway (1917)	54
Scotland (1919)	102	New Zealand (1919)	45
Uruguay (1919)	101		
Ontario (1918)	99		

Note: The figures given are the latest available. It is possible that the relative position of the United States would vary if all the statistics were for 1919.

There was a steady and persistent decline in the rates in the birth registration area during 1916–21 with the exception of the year 1918, when there was an increase over the preceding year, due very largely to an epidemic of influenza. The further reduction of the infant death-rate to 87 during the year 1919 supports the belief that the factors which had to do with the general reduction of the rate were exercising a cumulative and progressive effect.

Infant Mortality Rates, U.S. Birth Registration Area, 1915–9.

	Deaths per 1,000 births				
	1919	1918	1917	1916	1915
Registration area (total)	87	101	94	101	100
Whites	83	97	91	99	99
Negroes	131	161	151	185	181

The rate for 1919 showed that of every 12 infants born alive, one died before reaching the age of one year.

Infant Mortality Rates, U.S. Birth Registration Area, 1915–9, by Cities and Rural Communities.

	Deaths per 1,000 births				
	1919	1918	1917	1916	1915
Cities in the registration area (total)	89	108	100	104	103
Whites	86	105	96	102	102
Negroes	148	197	185	177	181
Rural part of the registration area (total)	84	94	88	97	94
Whites	80	90	84	95	94
Negroes	123	143	134	203	182

Study of the infant death-rates in the registration area shows high rates for negroes in both cities and rural communities. This racial characteristic affects the rates in the various states.

Rates in the States of the Birth Registration Area, 1919.

	Total	Urban	Rural
All States	87	89	84
California	70	64	79
Connecticut	86	86	87
Indiana	79	88	74
Kansas	70	88	65
Kentucky	82	105	78
Maine	91	89	91
Maryland	105	98	115
Massachusetts	88	90	82
Michigan	90	97	82
Minnesota	67	68	66
New Hampshire	93	101	85
New York	84	85	77
North Carolina	84	124	82
Ohio	90	94	85
Oregon	63	69	59
Pennsylvania	100	99	101
South Carolina	113	139	111
Utah	71	74	69
Vermont	85	121	79
Virginia	91	106	87
Washington	63	59	67
Wisconsin	80	94	71
District of Columbia	85	85	—

As will be seen, the rates vary from 63 in Oregon and Washington to 113 in South Carolina (for 1919).

Rates by Sex in the Birth Registration Area, 1919.

	1919	1918
Males	95·8	110·9
Females	77·0	90·4

The statistics of U.S. birth registration area show that the ratio of sex to infant mortality in that country is about the same as that in other countries. In all years reported, the death-rate of male infants is appreciably higher than the death-rate of female infants. This applies to both cities and rural communities, in 1919 the city rate for males being 98·7 as against a rural rate of 92·9; the city rate for females being 79·3 as against a rural rate of 74·7.

Rates for 10 Largest Cities of the United States 1914–20.

	1914	1915	1916	1917	1918	1919	1920
New York	94·6	98·1	93·1	88·8	91·7	81·6	85·4
St. Louis[3]	103·3	82·1	89·4	79·7	94·5	75·2	76·5
Boston	103·7	103·0	104·9	98·9	114·9	96·8	100·8
Pittsburgh	115·2	107·7	113·8	116·2	122·5	115·3	110·8
Cleveland	116·4	110·6	107·0	104·9	95·4	90·8	86·0
Philadelphia	117·6	106·2	101·0	110·0	126·0	89·8	88·6
Buffalo	121·5	108·2	113·9	103·7	121·5	109·8	101·0
Detroit	122·4	104·3	112·8	103·6	100·7	96·8	104·2
Chicago[3]	132·7	102·5	111·9	106·4	104·3	91·0	85·5
Baltimore	154·6	119·8	118·2	119·3	147·8	97·0	104·2

As the above table shows, New York City has had the lowest rate of any of the 10 largest cities of the United States in the years 1914–20 inclusive, except for St. Louis in 1915, 1916, 1917 and 1919. St. Louis is not in the birth registration area because its birth registration reports are not accepted by the U.S. Census Bureau.

Rates in American Cities.—Philip Van Ingen states that a report from 432 or 87·8% of the cities of the birth registration area, with a population of 30,063,288 or 95·2% of the total urban population of this area, shows the infant mortality rates for the five years 1915–20, grouped according to population, to be as follows:

Population	1916	1917	1918	1919	1920
Over 250,000	98·8	95·4	102·3	87·0	88·6
100,000 to 250,000	103·1	100·8	111·8	91·0	92·2
50,000 to 100,000	105·3	98·8	103·3	89·0	92·3
25,000 to 50,000	103·8	99·9	107·9	91·0	90·3
10,000 to 25,000	105·8	100·8	114·1	94·7	91·5
All cities in area	101·4	97·6	105·7	89·1	90·2

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[1] Dropped from registration area in 1919.

[2] Included in registration states.

[3] Not in birth registration area.

Causes of Infant Mortality in the United States.—It is probable that the variety of race groups in the United States has had a marked effect upon infant mortality. Statistical studies on this point are not readily available but the report of Dr. W. H. Guilfoy of New York City is worthy of mention. Dr. Guilfoy shows that out of every thousand infants born of mothers of Russian-Polish or Austro-Hungarian nationality, over 920 survive the first year of life; of Italian mothers 897; of native mothers 894; of German mothers 885; of Irish mothers 881. Other significant results of this analysis show that the nationality of the mother seems to be a predominant factor in deaths from congenital diseases under one year of age per 10,000 births reported. This rate in children born of Italian mothers was 295, of Russian mothers 320, Austro-Hungarian mothers 284 and native-born mothers 544. This clearly indicates that measures for the reduction of infant mortality in the United States in the future must take into consideration the high death-rate from congenital causes of infants of native-born parentage. The effect of nationality upon deaths by infectious diseases is shown in the fact that children of Italian mothers present the highest mortality in the group, with a rate of 58; children of Irish mothers rank next with a rate of 57; children of native-born mothers 38; children of Austro-Hungarian mothers 36. In respiratory diseases, race seems again to play an important part. The death-rate of infants of Italian mothers from acute respiratory diseases is more than three and one-half times that of children of German mothers, almost three times that of children of Russian, Austro-Hungarian and Irish mothers, and a little more than double that of native-born mothers. In diarrhoeal diseases, the racial aspect is shown as follows: The death-rate of infants of English mothers is 91 per 10,000 births, children of native-born mothers 80, children of Irish mothers 72, children of Italian mothers 70, children of Austro-Hungarian mothers 52, and children of Russian mothers 30.

The influence of race, as shown by these figures for New York City, would seem to indicate that the highest death-rate from congenital causes in infancy is among children of native-born mothers, the highest among infants from infectious diseases among children of Italian mothers, the highest rate from respiratory diseases among children of Italian mothers, and the highest rate from diarrhoeal diseases among children of English and native-born mothers.

Figures for the United States Registration area for 1919 are of interest in this connexion:

Rates Classified According to Country of Birth of Mother, 1919.

Total rate	86·6
United States	77·7
Austria, including Austrian Poland	112·6
Hungary	89·3
Canada	99·1
Denmark, Norway and Sweden	66·8
England, Scotland and Wales	73·2
Ireland	87·4
Germany, including German Poland	78·1
Italy	87·7
Poland	124·4
Russia	73·6
Other foreign countries	104·8
Negroes (United States)	134·3

Age Groups as Factors in Infant Mortality.—The well-known fact that people are susceptible to their environment in inverse proportion to their age is graphically demonstrated in the case of the infant death-rate by examination of age subdivisions of the first year of life. It is evident that the new-born infant is extremely susceptible to its environmental conditions and that intrauterine factors have an effect in making the infant mortality rate unusually high during the first few days or first month of life. It must be remembered that the intrauterine infant's environment is its mother and that anything that affects her health inevitably reacts upon the infant.

Rates in the U.S. Registration Area 1919 by Subdivisions of First Year.

United States (total)	87·0
Under one day	15·1
One day	4·3
Two days	3·3
Three to six days	6·0
One week	5·5
Two weeks	3·5
Three weeks but under one month	2·8
One month	6·5
Two months	5·9
Three to five months	13·7
Six to eight months	10·3
Nine to eleven months	7·9

Sanitation and Environment.—Statistics regarding the effect of sanitation and environmental conditions on the infant death-rate are difficult, when not impossible, to obtain. Clinical and practical experience must be drawn upon to prove that lack of proper sanitation and poor hygiene cause infant deaths. It is generally accepted by child hygienists that the main factors in high rates are poverty and ignorance. The more definite causes of infant mortality due to lack of sanitation may be classified as those of social, economic and general environment. Although the direct relation of sanitation to the infant death-rate cannot be proved statistically, it has been proved many times by the marked fall in the infant death-rate when sanitary conditions in a community have shown improvement. The sanitary conditions affecting the infant death-rate may be classified from another point of view as decent housing, proper standard of living, opportunities for recreation and fresh air, clean water supply and clean milk supply.

Studies made by the Children's Bureau at Washington show that the infant death-rate is definitely affected by overcrowding, and that the number of people living in a room can be shown to have a direct statistical relation to the rate. Overcrowding has a direct relation to the economic condition of the family and is reflected in its general standard of living. Such factors, therefore, are not easily separated, but statistical studies have shown uncleanliness, overcrowding, lack of ventilation and lack of decent hygiene in the home are directly responsible for many infant deaths. In the same way, poverty can be shown to be allied to the rate by the fact that the rate bears a close and regular relation to the amount of wages received by the family. In the Johnstown report of the Children's Bureau, U.S. Department of Labor, definite figures are given in this regard. The results of that investigation showed that when the father earned less than $521 per year, the infant death-rate was 255·7; where the father earned more than $1,200, the infant death rate was 84. But wages must be considered again in relation to social and sanitary factors, as a decent standard of living may be maintained on a low wage-rate while a high wage-rate does not necessarily include conformity to hygienic requirements.

Poverty reacts upon infant mortality in still another direction. Insufficient earning capacity of the father usually forces the mother into industry. Statistics relating to the health of mothers who are industrially employed during their child-bearing life or during the period of pregnancy would seem to indicate that employment of these women, in itself, has no deleterious effect upon the infant. More detailed studies and more careful analysis of the studies already made would seem to indicate that the high rate in towns where women are industrially employed to any great extent is due not so much to the effect of the mother's industry upon the child, as to the conditions of poverty in the family that have forced the mother into industrial pursuits. In order to show conclusively that employment of women is a factor of importance in increasing the infant mortality rate, a further study should be made as to the effects of certain types of industry upon pregnant women. Probably one of the most harmful results of the employment of women, so far as infant mortality rates are concerned, is the fact that returning to the industry too soon after confinement is not only harmful to the health of the mother in relation to future pregnancies, but reacts disastrously upon the infant in that the latter usually is deprived of breast feeding.

Type of Feeding.—It has long been recognized that infant death-rates from diarrhoeal diseases are very markedly affected by the feeding employed. It has been proved beyond doubt that the infant death-rate from diarrhoeal diseases can be much reduced by the wider use of breast feeding and by the provision of safe, clean milk for use in artificial feeding. The relation of breast and artificial feeding to infant mortality is graphically shown in certain studies made in New York City. One such study, covering deaths of 1,065 infants from diarrhoeal diseases, showed that 17% of those who died had been breast-fed exclusively, while 83% had been artificially fed, either with cows' milk or some form of prepared infant food. In order to determine the extent of breast feeding among well children, a further study was made covering about 4,000 children between 3 and 12 months of age. In this study it was found that 79% of the babies were breast-fed exclusively while the remaining 21% were fed with bottled milk, or bottled milk and breast feeding combined. The experience of the Bureau of Child Hygiene of the Department of Health of the City of New York has shown that about 80% of the tenement population of that city nurse their babies exclusively, and that four-fifths of the high death-rates of infants from diarrhoeal diseases occur in that group of the infant population that is not breast-fed.

Milk.—Reduction of the infant death-rates in the various communities of the United States has followed very closely the improvement of the milk supply and the tendency towards general pasteurization of milk. The use of raw milk which has not been sufficiently protected in its production, transportation and in its care in the home is undoubtedly one of the most important factors in the causation of high death-rates from diarrhoeal diseases which occur so commonly among artificially fed infants. For these reasons any efforts which are directed towards obtaining a safer supply of milk for children may be classed as measures for the reduction of infant mortality.

Congenital Diseases.—Under the group classified as "congenital diseases" in the following table have been listed all deaths of infants from prematurity, feeble vitality and accidents of labor. This group, furnishing as it does over one-third of the total deaths during the first year of life, is of immense importance. Some cities, notably Boston and New York, have demonstrated that by the employment of public health nurses for the supervision of women during their period of pregnancy; the observance by these women of all matters pertaining to timely hygiene; proper supervision and care in confinement, including adequate obstetrical and nursing care and provision for nursing supervision of the infant during the first month of life, it is possible to reduce the infant death-rate from congenital causes in the first month of life at least one-half, and, in many instances, two-thirds. Such results seem to show that the present high rates from congenital causes are unnecessary.

Percentage for Various Disease Groups, U.S. Birth Registration Area, 1919.

	Total	Rural	Urban
Infectious diseases	2·8	2·9	2·4
Respiratory diseases	14·8	13·5	16·2
Diarrhoeal diseases	18·2	15·7	20·5
Congenital diseases	42·7	41·6	44·0
All other causes	21·5	26·3	16·9
	100·0	100·0	100·0

Diarrhoeal Diseases.—The causes of infant mortality from diarrhoeal diseases already have been incidentally discussed. They may be summed up, however, as wrong methods of feeding, lack of hygiene, depressed vitality due to heat and lack of observance of the ordinary methods of hygienic care during infancy.

Respiratory Diseases.—The infant death-rate from respiratory diseases is largely the result of broncho-pneumonia, secondary to measles or whooping-cough. The effect of influenza upon the infant death-rate in the United States has been marked. The results, however, have been due not so much to infant deaths from influenza as to the fact that the mother has died from the disease and the infant, owing to deprivation of breast feeding, has been unable to resist the disease. Experience in public health work has seemed to show that the occurrence of respiratory diseases, in common with the occurrence of contagious diseases in infancy, is due very largely to improper methods of living and is closely allied to lack of ventilation of living-rooms and overcrowding of families.

Contagious Diseases.—This group furnishes only a small proportion of the total infant death-rate. Deaths in this classification are mainly those due to measles and whooping-cough, both of which must be considered as extremely dangerous diseases in infancy.

National Maternity and Infant Welfare Law.—Reference has been made to the efforts of the Children's Bureau of the Department of Labor, Washington, and the various state and other bureaus of child hygiene to reduce the infant death-rates of certain localities. The 67th Congress of the United States passed a bill "to promote the welfare and hygiene of maternity and infancy." This bill, signed by the President, was to be operative during five years. It provides that each state shall receive $10,000 outright, an additional $5,000 provided it appropriates an equal sum, and thereafter a *pro rata* share of approximately $1,000,000, based upon the population of the various states, provided, however, that the state in question raises an amount equal to this additional appropriation. The money thus given is to be used for the purposes stated in the bill, that is, promotion of maternity and infant welfare work. The general central administration of the act is to be carried out by the committee, composed of the surgeon-general of the U.S. Public Health Service, the U.S. Commissioner of Education and the chief of the Children's Bureau of the U.S. Department of Labor, the chief of the Children's Bureau being the executive officer. The purpose of this bill is to reduce the maternity and infant death-rates by helping the states to establish work of their own for the purpose.

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INFANTRY (*see* 14.517).—To appreciate the lessons learned from the experience of infantry in the World War in relation to the past as well as to the future, it is necessary to emphasize one particular aspect of infantry evolution—the gradual decrease in size of the unit which one man can command. It is desirable also to visualize what "command" really implies. A corporal is said to "command" the squad of recruits which he is training on a barrack square; he does it by shouting words of command to them. Marshal Foch also "commanded" the Allied armies in western Europe in 1918; he did it, however, without raising his voice above its usual pitch. Between the Marshal and the corporal were a host of intermediate commanders of every sort, kind and description, but we are concerned here mainly with infantry commanders and especially with those in the junior ranks. For theirs is the hardest task in a battle, and it is upon them that success depends. "The wisest plans, the most thorough preparations, the most brilliant guidance avail nothing unless the fight is won by the fighters—by the platoons." The minds of superior officers therefore are devoted—especially in peace-time—to hard thinking on the problem of what they can possibly do or invent to make junior infantry commanders superior to the adversaries whom they are likely to meet in action. A general's command implies much forethought as well as some experience in its holder, and thus his "command" again has a different meaning. He is a trainer, and it is with respect to this part of "command" that we shall chiefly be concerned.

If we turn to the past for a moment, we find that the Greeks invented and trained their phalanx and the Romans their legion, and with these two systems the infantry arm dominated the known world for several centuries. Each of these tactical formations was based upon a most precise drill, executed almost daily by junior commanders. Moreover this drill was in each case suited to the age and the *esprit de corps* of the period. In battle the voice of the infantry superior could be heard and was instantly obeyed, both in the phalanx and the legion. Then ensued the Dark Ages and comparative chaos, which was dominated by feudal horse soldiers, until archery made infantry again supreme. Precise drill was at the root of the success of the archers, and fire orders were strictly enforced. If we take Crécy (1346) as an example, we find that Edward III. initiated fire orders himself, though he left the command of the front-line to his son, the youthful Prince of Wales in charge of the archers. A careful survey of the ground at Crécy from the commanding position of its windmill, in which King Edward was posted, enables one to see why it was possible for him to issue fire orders and instructions to the archers posted below him. They were only a few hundred yards from him, but he could see better than they could when the crowd of French cavaliers would offer the best target to the British longbowmen. These bowmen had under several reigns been disciplined and drilled with precision in the use of their weapons, and that is why they defeated the gallant but undisciplined mob of horsemen who attacked them without method at Crécy. It is also obvious that the diminutive size of that battle-field enabled the commander-in-chief, posted behind his reserve, to initiate fire orders and see their effect—in fact, he performed duties which now appertain to platoon commanders. Moreover, the size of the whole battle-field corresponded with a sector allotted to one battalion, or at most to two, in 1918. Thus the process of devolution of the physical command occupied some five centuries, chiefly because it took all that time to alter infantry armament from bows to Lewis guns; partly also because each generation of professional soldiers clung with punctilious tenacity to the admirable drill of a previous age. Similar tenacity is visible to-day, but changes are in the air. Frederick the Great (1740) attained parade-ground precision even during the shock of encounter, and won his battles by means of remorseless drill, stepping to music and machine-like fire tactics with inaccurate muskets. Such is the force of tradition in any army that in 1914, German companies in Flanders were trying to copy Frederick's tactics with the aid of song instead of a band to inspire their *Parademarsch* within close range of British infantry. But their opponent's rifles were accurate in 1914.

Frederick, however, did not teach one system on the barrack square and then practise a totally different one on active service; but that is what the British infantry did before the S. African War (1899) and what some soldiers would like it to do again. Their line of reasoning is that, as every war alters tactical formations, it is not of much avail to learn in peace-time tactics which will assuredly be discarded in the next war.

British Infantry in 1913.—In Oct. 1913 the British infantry underwent a drastic change, in spite of much opposition. The old "Eight Company" system was abolished, and the continental system was adopted of dividing the battalion into four companies, each 200 strong. This change gave a peace strength of about 100 men per company actually available for training. This admirable reform, which fortunately was accomplished on the verge of the World War, was effected by amalgamating two of the old companies to form one of the new and enlarged companies. Each company was then commanded by a major or captain, with a captain as second-in-command. Subaltern officers became the responsible and effective commanders of the four platoons into which the new companies were divided, and four of the sergeants who originally commanded sections of the old companies became platoon-sergeants and hence second-in-command. Thus one notable result of the change was to allot the responsibility of an executive rôle to the subaltern in place of the senior non-commissioned officer. The change rested on sound psychology, because the latter has generally proved less capable of initiative, though excellent as an adviser on account of his length of experience, and admirable as an executor of a definite order. The eight colour-sergeants of the old companies were allotted to the four new companies with the titles of company-sergeant-major and company-quartermaster-sergeant, the former for tactical, the latter for administrative duties.

The organization of a battalion at the beginning of the war was as follows:—Headquarters, machine-gun section (two guns), four companies. For purposes of administration the personnel of battalion headquarters—other than the battalion commander a lieutenant-colonel, the senior major, adjutant and quartermaster and the machine-gun section were unfortunately distributed to companies and platoons as supernumerary to their establishments. They should have been kept at battalion headquarters. A company consisted of company headquarters and four platoons, numbered from 1 to 12 throughout the battalion. A platoon was composed of four sections. A section was commanded by a non-commissioned officer and was the normal fire unit. Four battalions, from various regiments, were grouped to form a brigade. In the British army the regiment is simply a unit of sentiment and the spring from which *esprit de corps* arises. It is based on a fixed regimental depot which is the common link of battalions scattered over the British Empire. The four-company battalion marked a stepping-stone in the history of the British infantry, because the platoon became the "tactical" unit instead of the company. As a logical consequence the fire unit (section) decreased in size and became the command of a junior N.C.O.—a corporal or lance-corporal.

At first this change seemed incomprehensible to the lay mind because it was contrary to the idea that in modern war the improvement of communications tends to centralization and control by the higher authorities. But the extent of the modern battle-field and the increase and improvement of mechanical weapons tend to isolate and break up infantry units more than formerly. A further consequence of the change was that British infantry organization became based on a four-unit system from the brigade down to the platoon. This uniform distribution of units in multiples of four proved to be handier than the French and the German distribution in multiples of three. By the end of 1918 the four-unit system was pronounced to be the best, whether for tactics or administration or reliefs or daily routine—but especially for tactical handling in the field. One reason for this is that "odd" numbers destroy the even distribution of duties. In fact the French and German distribution was a three-cornered organization in more senses than one.

The outstanding defect of British pre-war preparations lay in the allotment of only two machine-guns to each battalion and none to a brigade. Another defect which soon became apparent was that the enhanced responsibilities of the company and platoon commanders were not accompanied as they should have been with increased disciplinary powers.

Other Armies, 1914.—In the German, French and U.S. armies the regiment consisted of three battalions, and was a tactical as well as an administrative unit. In Germany it was commanded by a colonel with a lieutenant-colonel as his second-in-command. The battalion, commanded by a major, was divided into four companies, each commanded by a captain. The company was divided into three sections (*Züge*) each under a subaltern who had as his understudy or second-in-command, either a sergeant-major, a "vice-sergeant-major" or a "sword-knot ensign" (aspirant-officer). On mobilization for war one additional officer was allotted to each company. Prior to mobilization every infantry regiment and Jäger battalion was provided with a machine-gun company of six guns, plus one spare. The French company was organized into four sections, commanded in war by three subalterns and one adjutant (superior company sergeant-major). The sections were grouped in pairs to constitute *pelotons* (platoons) under the senior of the two section leaders. In peace there were only two subalterns on the establishment for the four sections. Machine-gun sections were allotted to battalions as in the British army. In the United States the company was composed of three officers and 150 rifles, divided into two sections, each of three squads. In the World War, however, the U.S. infantry regiment was modelled on the continental form, having also a regimental machine-gun company, a headquarters company and a supply company.

Thus before the World War the infantry battalion was in almost every country about 1,000 rifles strong, allotted to four companies each commanded by a mounted officer. But the British battalion was the weakest in fighting strength, because its First Line Transport and other services were deducted from its 1,000 rifles, whereas the regimental systems of continental infantry provided these services from a separate regimental establishment. The subalterns were dismounted officers, whose commands varied as follows:—British 50 men, German 80 men, French 50 men, United States 75 men. But in the British infantry a large proportion of the 50 men borne on the strength of every platoon were absent on other duties. For instance, they were signallers, or machine-gunners, or bandsmen, or transport drivers, or pioneers—they were in fact everything except fighting infantrymen and these should have been struck off the rolls of the fighting platoons. The British Treasury, however, ordained otherwise, and thus made training and fighting difficult and sometimes impossible for the platoon commander.

Changes during 1914–8.—During the war the basic organization of the infantry of the belligerent powers was not materially altered. The changes were chiefly in the direction of additional weapons and a multiplication of kit, which reduced the infantry soldier to a beast of burden laden under a weight which destroyed his mobility. In 1915 the British infantry as compared with the German suffered from a paucity of heavy machine-guns, and was slow to increase its machine-gun strength. At first an increase was made (up to four per battalion), and when manufacturers increased their output these were formed into machine-gun companies. They were gradually divorced from the infantry and formed into a machine-gun corps, firstly as brigade machine-gun companies and finally as divisional battalions. By the time this had been accomplished, the lighter Lewis gun had made its appearance, and had been allotted definitely to infantry units. The first issue (not long before the battle of Loos, 1915) was only two or four guns per battalion, but by the end of Nov. 1915, when brigade machine-gun companies had been formed, the establishment of Lewis guns was beginning to increase. The tendency at first was to use this weapon like a heavy machine-gun and consequently as a battalion weapon, but when its characteristics were better understood it took its rightful place, first as a company weapon in 1916 and finally as a platoon weapon in Feb. 1917. Battalions were issued with 16 guns, *i.e.* one per platoon, but were so satisfied with this weapon that demands were submitted for a further supply. By March 1 1918 16 more guns for platoons and 4 for anti-aircraft work became available, making a total of 36 per battalion. We then find the platoon composed of four sections, two of which were armed with one Lewis gun each. The allotment of an automatic weapon on such a scale marked an important step in the tactics of infantry. One of these new weapons, handled by only two men, could deliver a stream of bullets equal in number to, and more accurately aimed than, what could formerly be projected by 25 soldiers with rifles. Obviously the number of men required in the forefront of the battle could now be reduced without affecting the volume of fire. This meant fewer casualties and bigger reserves for the arm without which battles cannot be won. Consequently, the maximum number of soldiers in every section was reduced to one leader and six men, making a total for all ranks of a platoon only 31 actually taken into action. The change was dictated by the shortage of man-power, which threatened to deplete the ranks of the infantry. Any numbers over the 31 were to be left out of every battle as reënforcements, but few platoons ever numbered more than 20 men actually available after 1916.

The Germans were faced with the man-power problem before any of the other belligerents, and they also appreciated the value of the light machine-gun. In March 1917 they issued three to every company, and afterwards raised this allotment to six by giving two guns to each platoon. Finally, each German battalion consisted of a heavy machine-gun company of 12 guns, and three infantry companies armed with six light machine-guns each, without counting the special machine-gun companies allotted to divisions in every battle. This tremendous increase of automatic weapons had an inevitable effect on infantry formations. The costly attacks on narrow frontages were abandoned. The successive lines or waves of men gave place to open formations. The four sections of a platoon were gradually separated from one another and compelled to manœuvre and fight under their own leaders. When platoons were too weak to man four sections, they fought with only two, one of which was armed with a Lewis gun. The frontages allotted to attacking platoons were increased, and in some of the great battles of 1918 we find platoons attacking on frontages of 200 and even 300 yd. with very small effectives. Fire-power was at last understood.

In addition to the Lewis gun, rifle grenade, and hand grenade, the Stokes light mortar proved to be a most useful infantry weapon. Although it did not form an integral part of battalions, the brigade light-mortar batteries drew their personnel entirely from the infantry, and the mortars were allotted to battalions during operations. The light mortar was the nearest approach to an infantry gun in the British army, and though not an ideal weapon, rendered great help to battalions in reducing enemy machine-guns and strong points. The German mortars in the summer of 1918 were distributed as follows. Each regiment had a regimental "*minenwerfer*" company, organized in three sections, each with three light *minenwerfer* and in addition two or three medium *minenwerfer*. The important part played by these weapons in battle tended to prove that infantry, when scientifically armed, can become independent of other arms, and is capable of fighting its own local battle either with or without artillery support and tanks. To fulfil this rôle, however, it needs to be more highly and scientifically trained than before the World War. The importance of training the commanders of companies, platoons, and sections cannot be over-emphasized, and it was the shortage of these trained officers and non-commissioned officers which caused so much deterioration after the battle of Ypres in 1917.

Organization in 1919.—On Nov. 11 1918, the date of the Armistice, the British infantry battalion was organized in battalion headquarters and four companies, each company consisting of company headquarters and four platoons. Each platoon consisted of headquarters and four sections, two of which were armed with one Lewis gun each. Certain riflemen in the sections carried rifle and hand grenades. The platoon was the largest unit composed of men whose sole duty is to fight, and the war established it as the "tactical unit" of infantry. The section is, however, the fire unit upon which infantry organization is built. It consists of a leader and six men, a number which experience has proved the largest that can be directly controlled in action by one commander. It is therefore the "fire-unit" of the infantry. Thus the British subaltern officer's command in battle became 28 fighting men as compared with 50 in 1914—but it should be remembered that the two Lewis guns and the rifle grenade and hand grenade increased the fire-power of the platoon out of all proportion to the number of its men.

Meanwhile the German organization had undergone no fundamental change, though its battalions had decreased considerably in size. Previous to the offensive of March 21 1918, the German High Command had fixed the total establishment of an infantry battalion at 980 men including the machine-gun company. This establishment was reduced on July 1 1918 to 880 men (750 men for the four companies and 130 men for the machine-gun company). In the autumn of 1918 the strength of a normal German infantry battalion was estimated at 20 officers and 650 other ranks, including the machine-gun company, but, as a matter of fact, many German battalions mustered less than 300 men all told at the end of the war. Each battalion consisted of four companies and a machine-gun company. Companies were numbered 1 to 12 throughout the regiment; machine-gun companies were numbered 1, 2 and 3. A company was organized in three platoons, numbered 1, 2, 3 in each company. Each platoon (*Zug*) was divided into four sections commanded by corporals (*Unteroffizier*), numbered 1 to 12 throughout the company. The smallest subdivision was the section (*Gruppe*) under a lance-corporal, but many of the subdivisions became nominal under defeat in 1918.

Post-war Organization.—The basic structure of the post-war British battalion has remained that of the battalion of 1918, viz.: an organization of companies, platoons and sections on the four-unit system which has successfully passed the test of war and should remain unaltered, though administration is likely to be simplified. The peace strength will probably be 28 officers and 700 other ranks at home, the war strength over 1,000. The chief innovation will be the introduction of a fifth subdivision of the battalion, viz.: the headquarters wing. The interior organization of the four companies will be as in 1918 except that a separate company headquarters will contain both some fighting and the administrative portions of the company, namely, men who do not belong to or fight in platoons (*e.g.* company sergeant-major and company quartermaster-sergeant, company signallers and cooks). These will be borne on the strength of company headquarters and will free the platoons of the incubus of mere paper men. It is around the headquarters wing that the chief interest lies. This unit is the outcome of experience, for during the World War almost every experienced battalion commander formed a unit which was commonly called a headquarters company. It was unauthorized officially, but proved itself to be indispensable. This so-called headquarters company contained the personnel of the battalion necessary for fighting and administrative efficiency—that is to say, all who do not actually take part in an action as members of companies. For example, battalion signallers, police, pioneers, cooks and grooms cannot be classified as men whose duty is solely fighting. The inclusion of these specialists, or "employed men" as they were called, on the strength of platoons gave the higher authorities an erroneous impression of what the actual fighting strength of a battalion was. For example, a platoon might contain 18 fighting men under the old conditions and in addition 12 "employed men." Its total strength was therefore 30 men on paper, but it only took 18 into battle and merely encumbered its pay-books with the 12 men who were otherwise employed. The headquarters wing, so called to distinguish it from a fighting company, will be approximately 200 strong, subdivided into four groups for administration. In particular, it is of interest to note that in the headquarters wing will be included, as an integral part of the battalion, the machine-gun platoon (eight heavy machine-guns) and the Stokes light-mortar section (probably two, possibly four mortars). Although these are composed of men whose duty is fighting, it would be incorrect to include them in the platoons, as they neither fight as part of them nor are trained by the platoon commander. It will be observed that the battalion in 1921 was armed with seven different kinds of weapons (not to mention smoke and gas) as compared with two in 1914:—viz. the rifle and bayonet, the rifle grenade, the hand grenade, the Lewis gun, the Vickers gun, the light mortar, the revolver for Lewis gunners. In addition it is likely that it will be necessary also to arm infantry battalions with some form of light gun, primarily for defence against tanks. The question of accompanying artillery is dealt with elsewhere (*see* ARTILLERY). There will then be self-contained battalions which must be skilfully trained in the use of the numerous weapons with which they will be armed. The crux of the infantry problem will be how to train the infantry soldier, equipped as he will be with these complex weapons.

The need for skilled officers and trained non-commissioned officers is thus greater than ever it was, and the ideal would be to have in each battalion 64 section commanders, each capable of leading and training their sections in the use of the weapons with which they are armed. The 16 platoon commanders and their seconds-in-command will have to be experts in teaching the uses of all platoon weapons and in the tactical handling of the sections in the use of ground. The achievement of this ideal should leave company and battalion commanders free to think out and practise with their units the best methods of coöperating the platoon weapons with the battalion weapons (the machine-gun and the light mortar) and of coördinating these with the other arms (artillery, tanks and aircraft).

Under peace-time conditions this ideal may remain a dream owing to the scarcity of men with whom to carry out any form of training. Also the battalions serving in peace-time at home suffer under the additional burden of completing the elementary training of all recruits, because these are only partially exercised at the regimental depots which they join on enlistment. The civilian is apt to think that a battalion 700 strong has 700 men with which to train itself for war, but in practice it is fortunate if it can muster a single company at a time for training owing to the demands made for drafts and peace duties. Another great hindrance to British training is involved in the fact that the commanders of home battalions are compelled to furnish from their units, and send abroad every year, all the drafts which are required by their linked battalions serving overseas. But, as if these hindrances were insufficient, an even greater difficulty is caused by what are commonly known as "employments." These are of two kinds: (*a*) "employments" carried out by the battalion in peace and war, and (*b*) "employments" carried out by the battalion in peace only. The latter may be servants to staff and departmental officers, gardeners, men employed in regimental institutes, or at brigade, divisional or command headquarters, grooms of officers outside the battalion, etc. These are the type of employments which eat the heart and soul out of every company commander, and which militate against his efficient training for war. Two remedies at least are obvious, but like all transparent truths are slow to be adopted. In the first place the need is for some form of "employment company" to be established in peace, as it had been in the war, to relieve battalions of such servitude. In the second place, the regimental depots might be so reorganized as to turn out recruits fit to take their places in their sections and platoons, and capable of taking part in company training, whether at home or abroad, directly they join any battalion. Without these two indispensable reforms the problem of training the British infantry for a future war is likely to continue unsolved.

Before proceeding to describe what infantry does, it may be useful to emphasize one outstanding difference between British and continental European organizations, namely, the absence from the British service of any regimental personnel. British brigades are composed of four single battalions which lack regimental unity of *moral* and tradition, as well as the habit of working together in peace-time. Nor are the brigades even permanently constituted as are the continental regiments. There are compensating advantages, due to garrisons scattered over an empire with the valuable experience of service overseas. But all the facts do not seem to have been taken into consideration by those who framed peace and war establishments after 1871, or they would surely have compensated battalion commanders for the first line transport and other services which depleted their ranks. Indeed, from whatever angle British battalions are viewed in detail, they appear to exist only on sufferance; and constantly an endeavour becomes visible—to make one man count as two. When this calculation has been successfully achieved it is found that training has invariably been sacrificed. The band however always remains.

The Rôle of Infantry.—The question is sometimes, "What is the use of Infantry? Is it not butchery to expose men on foot to the mechanical horrors of the battle-field of to-day?" A soothsayer occasionally declares: "There is no place left in battle for a man as a fighting entity—his rôle is that of a machine tender." But man, on foot, is still more universally mobile than any machine. In his agility still rests the key to unlock the fastnesses—which no machine yet invented can enter—wherein his fellow man can hide himself. The more destructive weapons become the more does man seek impregnable shelter in which he can escape the missiles of death-dealing machines. But where man has entered, there also man can follow to seek him out, and until the assailant possesses a mechanical octopus he must himself go in to dislodge his adversary. The appliances manufactured by inventive genius only help to break down the barriers to this final act of combat. Man in war cannot be beaten until he owns himself beaten. Experience of all war proves this truth. So long as war persists as an instrument of policy the objects of that policy cannot be attained until the opponent admits defeat. Total extermination, even if it were possible, would recoil on the victor in the close-knit organization of the world's society, and might involve his own moral and commercial ruin. Moreover it is unnecessary. In all war, man, immediately he realizes that his opponent is permanently superior, and directly he has no further hope of victory, yields. To this history bears witness.

Therefore victory produces a moral rather than a material result. To conquer one has to make the enemy feel the force of a superiority which shakes his faith in his own power to win. This demoralization is achieved by a concrete manifestation. Military history testifies that the infliction of casualties does not produce it as a certainty. The survivor alone retains the power to admit defeat, and must therefore be made to feel the superiority of his opponent. The concrete proof of this to him lies in being driven back—not a few yards only, for his *moral* will survive that—but in being hurled back in confusion. The demoralization which begets a conviction of inferiority also comes from the break-up of organization. When the parts do not function hope vanishes.

Now, the greater the progress in weapons, the more far-reaching is their range of destruction. But this greater range brings with it its own counterpoise. The man on the battle-field feels that it is no use to run. Speed of foot will not outstrip the velocity of the projectile, and, as there is little hope of safety in flight, he stands his ground in desperation and seeks to hide from the missiles. He becomes fatalistic, resigned to death. Terror of the machine has overstepped its aim. In such mental state man is no longer guided by his instinct of self-preservation. Temporarily he is akin to an animal confronted by some inhuman threat which it does not understand. It remains motionless, petrified, awaiting its doom, until it perceives some living agency behind the threat. Then only are its senses restored and its instinct of self-preservation revived. It flees. So with men on the battle-field. The sense of defeat, of inferiority, can only be achieved by an agency which is tangible and human. Man needs something from which to run—some tangible oncoming danger from which escape is possible. The hostile infantry supplies it in human form. Even in panics, when no real enemy is present, the images created by hallucination are those of human pursuers.

It is the infantry, and the infantry alone, which can bring about retreat or surrender in the open field and so place the coping stone—victory—on the edifice of battle. A great artillery bombardment will drive the enemy to ground, but even where great concentration of shell-fire is achieved, it cannot dislodge him. He is safer in his dug-out than in flight. The tank is tangible, it is true, and therefore less petrifying, but man can avoid it or hide from it more easily than from infantry. Moreover it is less agile, more cumbersome, more limited in its modes of action than the foot-soldier. There are types of obstacles which it cannot yet surmount, ground which will not bear its weight, or which is too rough or steep to cross. Cavalry, like infantry, is a human arm, but it affords too easy a target, is too quickly stopped by rifle or machine-gun fire, and is less mobile on rugged and broken ground. Its superior speed is insufficient compensation for these drawbacks except against broken and flying infantry. Thus we see that infantry is the sole decisive arm in battle, that its power is based on human rather than on material factors, and that its tactics spring from moral elements of which the chief is fear.

If therefore we wish to understand the action of infantry we must analyse and understand *fear*, in order that we may exploit it in our enemy and remedy it in our own infantry. The exceptional man may not feel fear, but the majority of men do. Their nervous self-control alone stands between them and yielding to fear. How to cause this collapse of our enemy's nervous control and strengthen that of our own men offers a wide field of investigation to future trainers of all arms, but especially of infantry. This nervous control by which the weakness of human flesh is subdued may be upset in two principal ways. It may be worn thin by continued strain or it may be shattered in a single instant by a shock. Usually it gives way under a combination of these two influences. The nerve control can be worn away imperceptibly by the anxiety, the suspense of waiting for an enemy's blow, or by the noise and effect of shell-fire, or by the loss of sleep which renovates the tired will. Then, without warning, the shock of a surprise snaps the fine-drawn thread of our will to resist. Stubborn resistance may then change in a moment to panic flight, and its frequency will depend on inherited racial temperament.

Destruction of the Enemy's Moral.—To wear down the enemy's nerve control is the rôle of the commander, of the artillery, of bombing aeroplanes. When opposing armies are in close contact the infantry shares in the process by raids and false attacks. In the battle, the part of the infantry is to snap, not wear down, the enemy's control over his fear. The fracture is effected by the enemy's sudden realization that he is powerless to ward off his assailant's blow. To accomplish this we must pass a sufficient, though not necessarily a larger, proportion of men through the curtain of his fire, to a point so close to him that they can assault, or offer the threat of an assault which he realizes he is powerless to prevent. The key to this assault is fire at short range, to pave a way for the onslaught. Hence formations which avoid loss by taking advantage of cover and conserve the will to close with the enemy are necessary. Surprise, the simpler, more certain and less costly method, is effected by assault from an unexpected direction against an unguarded spot at an unexpected moment. The key to infantry success is therefore movement, or, in military language, manœuvre. Fear, above all, is caused by uncertainty and apprehension of the unknown, which breaks down the will to resist and gives to the assault in flank or rear its supreme value. Thus at close quarters mere numbers are not the deciding factor, and assaults are better launched by platoons than by battalions.

Strengthening of our own Moral.—What are the factors which enable the average man to fight down fear? First, undoubtedly, comes confidence—confidence in his superiority to the enemy, based on his own skill in handling his weapons; faith in his leader's skill and judgment, combined with devotion to him as a man; trust in and comradeship with his fellows—the assurance that he will be backed up, that his efforts will not be in vain. Secondly, *esprit de corps*—which is allied to confidence. Thirdly, discipline—the power of association to overrule instinct. Lastly, action to minimize reflection on the dangers to be faced.

If a man is engaged upon some definite act or task, his mind is occupied. Hence the advantage of attack over defence. Movement helps to drown fear. So in the attack the moral factor indicates that we should not check the rate of advance in order to obtain uniformity or well-dressed lines. Every time a man stops he offers an opportunity for fear to assert itself. Let him push on to close with the enemy as quickly as he is able, stopping only to regain breath. As soon as he sees an enemy at close range, let him open fire. Not before. Under modern conditions of armament, with the overhead fire of machine-guns and artillery superposed on the fire of the defenders of trenches, attacking infantry has a harder task than in Frederick the Great's day. To demand of it, therefore, a slow advance in line is to strain the nerves unduly. It indicates the presence of leaders whose teachings are based on mechanics, not human nature. Thus movement is the safety valve of fear. We should force the pace of the attack, for the sooner the man closes with his enemy the less chance he has to be apprehensive of what awaits him. But we cannot force the pace if we stop to fire at long ranges. Discipline no longer implies an unthinking obedience. The discipline which dominated fear by inspiring a greater and nearer terror is not advisable now that fire units are widely scattered in battle. Even if still attainable it would not be effective under conditions wherein men must disperse if they are to survive and victory depends on the skill and initiative of subordinate leaders. The mechanical discipline of the past is an anachronism in battle. The need is for intelligent discipline—a discipline compared by the late Col. G. F. R. Henderson to that of "a pack of well-trained hounds, running in no order, but without a straggler, each making good use of its instinct and following the same object with the same relentless perseverance." Infantry discipline should be based on that pride and self-esteem which comes from *esprit de corps*. Man does not dare to show himself a coward under the eyes of the leader he knows, the comrades with whom he shares his duty and recreation. This discipline is based on the confidence that unity gives strength.

Confidence is born of training—the training of each individual, the training of the leader, the training of the unit. These successive trainings forge the infantry weapon and make it fit to act its decisive part on the battle-field. Moreover these various trainings of human beings symbolize the truth that man is still the master of the machine. But no greater error is current to-day than that infantry is the most easily trained arm. None needs more care, more skill, if it is adequately to play its part. For it is the least mechanical and by far the most human arm in existence. Yet experience of the World War indicates that of all the arms and services, infantry, the backbone, was the least trained. This defect was due not so much to the reason that less care, less research and thought were devoted to it—though these factors counted—but to the reason that it is the most difficult arm to train, because it possesses so few concrete elements. It is concerned with tactics and ground, not with material and stable equations. To train infantry is to exercise an art, whereas to train gunners is to apply a science; the one requires an artist, the other a calculator. The man in the ranks of the artillery, the tank corps, the air service, is often a mechanic—executing a concrete task in a definite manner. Initiative is the province of the officer, but even he, in the subordinate ranks of other arms, is concerned with producing a material effect. The infantryman's use of material—his weapons—is only a means to an end not an end in itself. He himself survives the scientific developments of countless wars because his human value remains unchanged. Even in the employment of his weapons he is guided by variable factors and conditions. But the use of his variety of weapons is only complementary to the use he makes of tactics and ground before he gets to grips with his enemy. The variety of elements with which he has to deal has led as a rule to each different unit being trained—too often mistrained—according to the whims and prejudices of its temporary commander, who is apt to confine himself to such parts of the subject as he himself knows best. Hence a tendency towards over-emphasis of such matters as drill, musketry, bayonet fighting, which can be easily mastered by the intellect of the average officer. Hence also the neglect of tactical training, which demands thought and is difficult to learn and teach because it deals with moral and variable factors and requires a modicum of imagination.

Minor Tactics and Fire Tactics.—Right tactics are above all the source of the man's conviction of superiority. The tactics of infantry must be based on human nature and not on mechanics or geometrical perfection. Yet it is almost incredible how in the past the complex of showy evolutions deduced from the parade-ground have persisted on the battle-field. It is a truism to say that a revolution has been wrought in infantry tactics by the inventions which mechanical science has brought to bear on war. But it is no less true that the consequences of this revolution take years to understand. This lesson may be summarized in the phrase—"the power of manœuvre." It needs a complete reorientation of military thought and fresh views before we begin to extract right methods from the melting pot of war. Yet that infantry which soonest learns its lesson will be supreme.

A mastery of elementary tactics is essential if infantry is to attain its goal in battle and justify its claim to be the decisive arm. It must be permeated by the best doctrine which the last war can teach, and its junior commanders must no longer be subjected to the whims or prejudices of whoever happens to be in temporary command. Moreover the doctrine should be adopted by authority, and be expressed in language so simple and by metaphors and illustrations so clear, that it can be as readily grasped by subalterns and corporals as by general officers. Its manual of instructions should be as intelligible to the Australian bushman as it is to the staff college graduate.

In 1806–15 the British were capable of a sustained effort in the theory of tactics as originated by Sir John Moore, and there is reason to believe that British infantry could to-day be trained to as high a pitch of comparative excellence—but not without a definite doctrine of minor tactics and some evidence of leadership to inspire its wholesale adoption. This quality of leadership in peace-time needs the special ingredients of spirit, intelligence and human sympathy together with sufficient character and determination to carry conviction to the mass. Just as Sir John French inspired a new doctrine of peace training at Aldershot after the S. African War, so now could a leader develop the experiences of the last war and reduce fire tactics to simple exercises for platoon and company commanders. Such a doctrine would probably be based on the little group of six men following a corporal whom it knows because he has trained it. In the hurly-burly of modern war, these little groups retain cohesion because men will follow a leader whom they see close to them, whose voice they can hear and whose presence is familiar. These groups (named sections), trained by higher leaders whom they trust, will forget themselves and accept any risks in battle if they are convinced by habit that their effort will not be in vain, that their successes will be immediately supported. A fire unit which forms part of a trained team will sink itself unhesitatingly if it knows that the rest of the team will not leave it in the lurch or allow it to bear the brunt alone: that, when it has spent itself to make an opening, others will relieve it of the burden.

Therefore infantry should be distributed in depth, not in lines. Every man should be able to see near at hand *behind* him a body of troops ready to back up his movements. Better still, let this body be trained to support him by diverting the enemy's fire to another direction. A mere reënforcement may fail to inspire him with an access of confidence, for it is probable that some infection of discouragement might communicate itself to those who merely add to his numbers in a hot corner.

For decades the infantries of all countries attempted to produce tactics adequate to the new weapons at their disposal by multiplying the lines which were so successfully used by their forerunners in the days of the musket—with its short range and slow rate of fire—and the case shot and solid shot of the artillery. They moved shoulder to shoulder with intervals. The idea of manœuvre was absent. Even down to the closing stages of the World War the action of infantry units in battle—as distinct from a skirmish or an affair of outposts—was confined to frontal attacks. Manœuvre was the weapon of the higher commanders only. A division or a brigade moved as a body; hence it was its commander alone who had the power of striking an enemy force at two or more different angles concurrently. We have already seen how slowly the idea of decentralized fire orders developed. It was the same with decentralized power of manœuvre.

When in the middle of the 18th century armies began to be distributed in separated columns, the lead of the French under De Broglie brought about a revolution in strategy and tactics. The limbs of the army—its columns—moved independently though animated by a common plan. Intervals sufficient to be penetrated were left between them; and therefore their commanders gained facilities for manœuvre. But since the middle of the 17th century the smaller infantry units had continued to move and fight in bodies presenting a continuous front. Indeed down even to the last stages of the war of 1914–8 the rule of a continuous front held good. Exceptions occurred in frontier skirmishes or on account of accidental or enforced disorder inside a defender's position. One corps of an army might attack an enemy in front while another might turn his flank, but for the infantry units of each corps attack, as likewise in defence, the manœuvre was usually frontal. In any large action each of the infantry units was necessarily allotted only a fraction of the frontage of the force of which it formed a part. This narrow sector was at first hedged in on either side by neighbouring units of a corresponding size. How then was it possible for attack or defence on the part of infantry units to be aught but straight to their front? How can they possibly manœuvre if they have no space to move in? And how can they be expected to move to a flank if they possess no intervals and no flanks? But at last a change became imperative, through losses due to the range and deadliness of missile weapons. These have enforced a wide dispersion of small combatant units on the battlefield and intervals between adjoining units. These intervals are usually 100 yd. between each leading section. The lesson was stubbornly resisted until the toll of loss could no longer be burked by authority. Similarly in each succeeding war after the middle of the 19th century such lessons were emphatically impressed on the imagination of nations, and towards the end of each war wider intervals between the men were accepted. Thus extended order—in which bodies of infantry moved to the attack deployed in successive waves or lines, with intervals of several yards between each man and his neighbours—was the outcome of the S. African War of 1899–1902. But, as the years of peace rolled on and recollection of the effects of fire faded, the pendulum swung back and the intervals between men were reduced. More especially was this so on the continent of Europe, where tacticians clung to Napoleon's tactics rather than attempt the more difficult task of adapting the spirit of his principles to conditions imposed by accurate firearms.

The Continuous Line.—Thus it came to pass that, in spite of the fire effect produced by scattered Boers sitting on distant *kopjes* in S. Africa (1899), and in spite of Japanese losses in assaults at Port Arthur and elsewhere in Manchuria (1904), European tacticians failed to shake off certain notions about continuous lines and storming masses. They fully appreciated the importance of putting what they called "weight" into the decisive attack, but failed to realize that the weight or forcefulness of an attack no longer increases in proportion to the number of infantrymen thrown into it. In S. Africa wide and premature extensions were adopted to minimize losses on the flat veldt, but such extensions did not lead to any idea of manœuvre. On the contrary, the unmanageable thin lines, one behind the other, were incapable of any intelligent manœuvre—as was discovered in peace training after the S. African War. But even then the idea of a manœuvre to a flank by a small body was not grasped, or at any rate it was not taught as a definite doctrine. Skirmishing lines in extended order made rushes and utilized ground; they fired in small bodies and opened at long ranges; at the decisive points they were gradually thickened up into a crowd. These crowds surged forward at a given signal and assaulted to their front. But the infantry soldier was so near his neighbour in these sham battles that he had scarcely sufficient space to load and fire his rifle without hitting one of his friends; the units became so mixed together in the process of thickening up that neither the corporal nor the subaltern could exercise control over his own men or any unit; often he could not find them during the decisive stage of the battle. Fortunately the "cease fire" soon sounded and reorganization took place; but in 1914–8 there was no cease fire and no umpires, and the warring infantries were slow to learn. This was no doubt inevitable, and is a sufficient reason to try to gather now the best experiences from 1918.

Moreover, it was not realized so clearly as it might have been that it enhances the *moral* of the defenders to see waves of the enemy crumpling up under the fire of the new weapons which invention has introduced. The greater the visible effect of fire on the attacking infantry the firmer grows the defender's faith in himself, whilst a conviction of the impregnability of the defence is intensified in the mind of the attacker. Close ranks do not even make for greater fire effect. The moral influence of fire is produced by that which has physical effect, and the experience of 1914 demonstrated that cool, deliberate shooting by individuals produced this material effect. Volleys from dense waves—

infected by the contagion of excitement—are so ineffectual that they heighten the defenders' *moral*, particularly when he sees his own machine-guns being more accurately employed.

The British army suffered less than others from reactions towards greater density of formations, because on the one hand it thought in terms of limited numbers whilst on the other it was constantly engaged in small wars and expeditions. Its members had less occasion for the effects of fire to fade from their memories. Nevertheless even in the British army during intervals of peace denser formations were adopted. The national bane was that of lines themselves, rather than of dense ones in particular. It was hardly till the middle of the World War that it was realized how slow of movement were the dense waves. Lines require long pauses to restore their dressing unless they are to dissolve in disorder. Moreover, every infantry unit was trained to wait for its neighbour and avoid an exposed flank! Consequently the pace of the line became the pace of its slowest unit. The rolling barrage was often lost merely because one unit detained all the rest. But at last, instead of lines, platoons were utilized in depth, each part under the thumb of its own leader. Some control was thus retained, some cover turned to account and the section pressed forward without waiting to keep pace with others. Above all, it outflanked. It is to human nature, however, that the chief credit for introducing this power of manœuvre should be ascribed. The effects of fire enforced dispersion and wide intervals between men, but it was poor human nature, feeling lonely and leaderless as a single peg in a long row, which instinctively sought companions and a leader and grouped itself with comrades under the nearest N.C.O. This it has always done, because it is human nature so to do—whenever the unnatural mechanism of ranked lines breaks down under aimed fire.

The value of personal example which subdues fear is applicable only to a handful of men who feel the direct influence of a leader. They sense that they are under his eye and known to him personally, and that any wavering will be remembered against them. Thus the group, if it is to have value, must be limited to some half-dozen men. In the turmoil of modern war small groups, not big ones, will keep together. Then each man yields to the leader's power of sweeping him on. Moreover each little group needs to form part of a team, to feel itself supported on its flanks and behind by similar groups acting in unison. Hence the importance of the platoon—the tactical unit of battle to-day. For in battle men need some rock to which to hold fast—the artilleryman has his gun, the aviator his aeroplane, infantry its platoon commander.

Human nature conquered the line formation before its breaking up was officially sanctioned. Tradition held fast to her pre-war habit, but the need for a control which could not be obtained with the extended line helped to breach the ramparts of orthodoxy. The group attained its final and complete recognition after its success against the German "pill-box" defence, in the dreary wastes of the Ypres salient in the autumn of 1917. Also the Germans in their 1918 offensive deliberately trained their infantry in similar groups with orders to penetrate everywhere by infiltration. British dispersion, enforced by new weapons and human nature, rendered penetration possible by attacking infantry groups—termed "sections" in the British army—between the posts or machine-gun "nests" of the defenders. By exploiting every initial penetration by sections and platoons, the commander on the spot attacked in front and flank simultaneously such posts of the enemy as opposed him in his own sector. This newly acquired power of manœuvre restored to infantry the master-key of victory, and retains for it still the rôle of "Queen of Battles" which the old stereotyped tactics were rapidly losing.

Infantry action in battle no longer resembles a wasteful bludgeon-fight or an incursion of the camp followers of other arms. It engages in a test of skill, a manœuvre combat in which is fulfilled the principle of surprise by striking from an unexpected direction against an unguarded spot—namely, the flank exposed by infiltration into the crevices of the defensive position. Its training should therefore be correspondingly perfected, on the basis of a doctrine of fire tactics founded upon penetration and manœuvre as exemplified in 1918.

The Principles of Manœuvre.—The outstanding lesson gained from the new-won possession of infantry units—the power of manœuvre—is that correct tactics can now be based on the fundamental principles which govern the action of other independent bodies which manœuvre. The platoon is no longer fixed in a segment of the machine of battle, but is an independent moving part fighting its own small action. The principles upon which it fights may be compared to those which actuate a single individual engaged in a free fight with another man. As a personal combat is understood by all, whereas war is intelligible only to a few, let us for a moment examine the simplest form of fighting, promising that, owing to the concealment of the enemy and the "fog of war," the fight which typifies the infantry fire-fight is that between two men in the dark, wherein a man can only locate his enemy and find his way to his vital spot by actually touching and feeling him. In the first place a man in the dark must seek his enemy. To do this he will stretch out one arm to grope for him, keeping it supple and ready to guard himself from surprise. This may be termed the principle of the "protective formation." When his outstretched arm touches his enemy, he would rapidly feel his way to a vulnerable spot such as the latter's throat. This is the principle of "reconnaissance." The man would then seize his enemy firmly by the throat, holding him at arm's length so that the latter could neither strike back effectively nor wriggle away to avoid or parry a blow. This is the principle of "fixing." Then while his enemy's attention is absorbed by the menacing hand at his throat, with his other fist the man strikes his opponent from an unexpected direction in an unguarded spot, delivering out of the dark a knock-out blow. This illustrates the principle of "decisive manœuvre." Before his enemy can recover, the man follows up his advantage by rendering him powerless. This is the principle of immediate "exploitation" of success. To adopt for fire tactics these simple principles may prove a sure guide to local victory.

Protective Formation.—Owing to the dispersion and concealment necessitated by the deadliness of modern weapons, attacking infantry can only locate the enemy posts immediately in their path by actual attack—touching and feeling them as did the man in the dark. Like him therefore, the infantry unit moves during the "approach march" and attacks with a portion—the outstretched arm—pushed ahead in the direction of the enemy. This portion is usually termed the advanced guard or forward body. The remainder of the unit, termed the main body or support, follows close behind, ready to manœuvre, and by its mere presence protecting the flanks of the forward body. Hence if we speak of it as the "manœuvre body" its functions explain themselves. To diminish the possibilities of surprise and loss from hostile fire, the platoon or company moves in a formation resembling a diamond or square, of which its sections form the points. The fire or fighting sections no longer move in an extended line. Instead each advances in the form of an arrowhead or in open file or single file with the section commander at the head, so that he may control and lead amid the noise and confusion of battle. To do this correctly he must be trained in peace-time or he will lose his platoon.

Reconnaissance.—Reconnaissance is carried out by moving with scouts ahead, but within touch, in order, like the man in the dark, to touch and feel the enemy. It is their rôle to discover the best approach, to give timely warning of the enemy's nearness and to prevent the unit coming under surprise fire. All this may be done even in a set-piece attack behind a rolling barrage.

Fixing.—The forward infantry press on unceasingly in order to find and penetrate any weak spots in his defence and to advance to the objectives assigned to them. If the forward body of a platoon is checked by an enemy post, it fixes it firmly by fire so that the enemy's attention is absorbed "by a menacing hand at his throat" whilst the manœuvre body works round his flank to deliver a surprise blow. This act of fixing can best be achieved by a combination of fire with movement. There must be the threat of the forward spring in order to fix the enemy's attention. Fire alone, from the hastily chosen halting places of an attacker, cannot be relied on to absorb the whole attention of a defender behind carefully selected cover. Unless each forward infantry section is imbued with a determination to press forward, the posts of the defence may be able to bring cross-fire on groups which have penetrated the position. But there is still a further means by which the enemy can be fixed. The last war has added a useful weapon to the infantry armament—smoke. This new element gives the user the conditions of day but imposes on his adversary the conditions of night. Mist or fog has often been a decisive but accidental factor in battle, but with the introduction of artificial fog which can be projected at the will of the user, the enemy's view is impeded whilst his own movements take place in daylight. In attack, the forward sections may fix the enemy posts more effectively by firing smoke to windward of them, than by rifles or Lewis guns. Thus smoke helps small local assaults.

Decisive Manœuvre.—The manœuvre body of an infantry company follows close behind its forward platoons and remains under the hand of the captain. If and when the whole of a forward platoon is held up by the fire of an enemy centre of resistance, the captain uses his manœuvre body to turn a flank. To achieve this he might have to quit his allotted sector and follow in the wake of a more successful unit on his flank. Passing through the gap he turns and assaults an exposed flank of the centre of resistance. Such a blow has the moral effect—coming as a surprise and threatening the line of retreat—which is the key to victory. But if the defenders of the post turn to meet this flanking attack, the forward body should rush in and assault them from the front. Such combinations are simple if peace training is staged on the basic principle of "fixing and manœuvre" as the key formula of fire tactics. This combination of fixing and manœuvre is the bed-rock principle of every street fight. Watch a couple of small boys tackling a bigger one. What happens? One of the small boys rushes straight at the big boy, and when his attention is fixed the other runs in from behind and delivers a blow. The first small boy puts all his energy into this effort, for he knows instinctively that if he fails the opponent will beat them each separately. But if the big boy attacks one of the small ones, the other in like manner rushes in from behind. Thus "fixing" and "decisive manœuvre" should become a formula engraved on the mind of every infantry corporal and subaltern, and he should also be trained to act upon it instinctively. It has won general acceptance since the end of the war, and concerns above all the tactics of the platoon, which is the smallest unit which can fix and manœuvre without waiting for orders from a superior. Hence the paramount importance of training platoon commanders to act without hesitation when leading an attack. Hence also the desirability of rewriting the training manuals with some regard for the principles which govern every fight and of discarding fire tactics invented only for parade purposes. Fortunately, there is reason to believe that the post-war training manual of the British infantry will fulfil this condition.

Exploitation.—The principle of exploitation is fulfilled by maintaining an unrelenting pressure on the enemy until his retreat spreads and gains in momentum. This is done by fresh units coming on behind the original front.

Defence.—From our glance at the street fight between the three urchins we realized that defence resembled the attack halted. Any infantry unit is capable on account of its open formation of offering immediate resistance to hostile attack or counter-attack. It only remains for it to consolidate the ground on which it has halted, so as to gain the most cover and the best field of fire. The adjustment and entrenchment of its posts to this end depend on the time available for surveying the ground, digging in, and erecting entanglements. The battle principles which have been discussed as regards the attack are also applicable to the defence. Its protective formation is similar to that for the attack. The posts of the defence are distributed in depth and so disposed that they mutually support each other by fire. Reconnaissance in defence is carried out by patrols who watch approaches, or if in contact with the enemy go out at night or in foggy weather to discover his dispositions and movements. In defence, fixing is carried out by the fire of the forward bodies from their previously sited posts. Their rôle is to break up the enemy's organized attack. If the attacker makes a gap or effects a lodgment into the position of any forward bodies, the manœuvre bodies counter-attack to throw him out. Should the attack break through the forward positions on a broad front, the manœuvre bodies take him in flank by fire. Just as manœuvre is superior to frontal attacks, so is defence-fire which enfilades from a flank the more damaging to the attackers' *moral*. In this as in all cases the training and determination of the better infantry wins the day, but the great advantage possessed by the defence—almost its only advantage—is that its action can be thought out beforehand. Its manœuvre bodies can be placed on a flank in readiness for action, and can be practised on the actual ground to counter-attack from favourable positions with auxiliary arms to help them.

Picture of an Infantry Battle.—Who is there with experience of big attacks embracing miles of country in France, that has not seen the most resolute infantry suddenly assailed by a burst of surprise-fire from the flank or rear? Its self-forgetting determination grows uncertain; it ceases to move and looks furtively for cover. If the surprise-fire continues from invisible shooters, the men become irresolute and nervous. The will to advance is gone. If the threat of a counter-assault from a flank should immediately follow they look to their rear and break or dribble away. Unless their own commander coming on from behind can throw in an opportune reserve to counter the counter-attack and restore the local situation, the attack is stopped. That is how, so often in France, one German machine-gun nest—just one little group inspired by the will to resist, nourished in the principle of surprise—would hold up the attack of a company and sometimes of a whole battalion. It is thus we learn to visualize the infantry unit—battalion, company or platoon—in the battle of to-day. It possesses the power of offensive movement and yet is protected by its open formations. Its articulation into interdependent moving bodies, capable of manœuvre, is the main infantry feature developed by the World War. The illimitable extension of fronts, brought about by the vast numbers which nations in arms put into the field, forced the military leaders to seek and discover a solution to the deadlock—and they found it at last by the gift of the power of manœuvre to infantry units down to the platoon. By 1918 we had travelled far from the fire tactics of King Edward at the battle of Crécy (1346), where he was posted on top of a windmill and was practically the fire-unit commander of his army. This revolutionary idea began to emerge in the Flanders attacks of 1917, but was still only in its chrysalis stage when the war terminated in 1918. It still lacks a clear, simple working formula which can be understood by lance-corporals and practised in their daily exercises.

Let us for a moment try to picture the infantry fight of to-day in a European campaign between nations in arms, the description being invented merely to emphasize the salient points.

A battalion is advancing towards the fighting front, which is gradually receding eastwards. It is a hot summer morning. The division attacked soon after dawn, and the advance has been going well. To the trained ears of those in command posts behind the front its success is audible because the noises of battle are rolling ever farther away. The shell-fire dies down spasmodically—part of the guns are being pushed forward to back up the infantry progress—then flares up again and swells the volume of sound. The eye also notes that the line of observant kite balloons on the enemy's side is moving back—occasionally one collapses in flames, destroyed by the intrepid pilot of an aeroplane, or is hastily hauled down to avoid destruction. Our own kite balloons are moving forward behind our advance.

The brigade of which the battalion forms part is in support, and is moving up to "leapfrog" through one of the leading brigades and carry the advance a further stage. The battalion we are watching is one of the forward battalions of this brigade, and is still in column of fours on a road. Already long-range shells are bursting near and on the road ahead. To avoid loss, the battalion opens out first into company columns, resembling an open square; then as the shells grow more frequent into platoon columns off the road. Suddenly a flight of enemy bombing aeroplanes are seen like rapidly approaching specks in the distance. Each platoon promptly deploys into little section groups, moving on under control, and yet so scattered and irregular and offering so small a target that the bombs bury themselves harmlessly in the ground. Futile cascades of earth and stones fly in all directions. Other low-flying aeroplanes follow up the bombing attack by diving at the infantry and firing sharp bursts of bullets from machine-guns. The scattered groups crouch and open fire—the aeroplanes disperse—all save one which, caught by a burst of Lewis gun-fire, crumples up, and with the unforgettable thud that only a crashed aeroplane begets, strikes the ground in a tattered moil of canvas, steel and wood. The infantry move on, their apprehensions of the coming battle lulled by the excitement of the moment—their *moral* heightened by their lack of casualties and the summary retribution which has overtaken one assailant. The rapid unmistakable chatter of machine-gun fire is heard over the rise beyond; the drifting patches of smoke from bursting shells which cover the position gained by the infantry ahead are warnings of the imminence of the call to play an active part in the battle. The deployed battalion is halted under cover of a rise, whilst its leaders survey the ground ahead, and the orders are issued—two companies will lead the advance, a third will follow in support for manœuvre and the fourth company will be retained as a reserve under the hand of the battalion commander. He tells the captains that, as far as is known, the enemy has not had time to organize his back defences and is holding improvised positions which the air service has not been able to locate definitely. He points out a low ridge 2,000 yd. ahead, and informs them that the battalion's rôle is to seize and hold this ridge and consolidate a position on its further slope.

The frontage allotted to the battalion is about 1,200 yd. as marked on the map at the start, and an equal sector of the distant ridge is to be consolidated. There will be no rolling barrage from our artillery—it would only hamper movement—but forward guns will engage centres of enemy resistance. A section of tanks will coöperate with the battalion, and the protective barrage now assisting the brigade in front will lift at 8 A.M. Then advance begins, and the battalion, deployed with 600 yd. of frontage allotted to each leading company, passes through the forward troops—busy as ants digging in and strengthening the position they have gained. Once clear, the section groups shake out into little arrowheads or worms which push forward at a quick walking pace over broken ground; 100 to 200 yd. separates each front-line section. The shell-fire is heavy, but, thanks to the scattered and irregular formations, losses are slight. The air is clamorous with noise, the senses are afflicted by the sight and vibration of bursting shells, but the sections of six men each (sometimes flinging themselves down as a shell bursts over close, then leaping up and pressing on) are too wide apart, too well able to take advantage of cover, too closely knit by the kinship of the section with the corporal whom they follow, to feel the strain. They are too busy moving over broken ground to think of anything but to keep together and go straight to their objectives. The forward companies at last come under heavy machine-gun and rifle fire from the enemy's new position, a system of posts sited to cover each other by fire.

The little groups then worm their way forward, making short rushes from cover to cover, crawling even when the fire is hot and ground too open, but always working nearer. At one or two points groups find covered approaches, perhaps a ditch, a hollow, the bed of a rivulet, by which they penetrate between the enemy's posts. The platoon commander moves with his manœuvre sections to back them up—then when the post is fixed by fire or blinded by smoke its flank is rounded and the defenders turn too late. Drab-clad forms rush in upon them from behind and hands are put up. That moral force which rules battles makes the actual shock a myth, and the nerve-stricken defender, overcome by the powerful moral weapon, surprise—not outfought but out-manœuvred—surrenders or is bayonetted. In other instances the forward sections lose heavily or lack the vital will to close with the enemy; the section leader is unduly cautious; he hopes and waits for his neighbour to find a soft spot, and thus the enemy confronting him are able to keep watch on their flanks and greet the outflanking section with a hail which crumples it up. A tank comes to the rescue, but there is much delay before the post is conquered. Yet in some places quickly, in others tardily, some sections and platoons push deeply into the vitals of the enemy's position. The company commander presses on in the wake of his more successful platoon, and pushes forward his manœuvre platoon diagonally into any soft spot found on his wide front. Thus a success is immediately exploited. The sections are always pushing forward, seizing the fleeting chances given by a shell bursting near an enemy post to rush closer, by smoke to push round a flank, by the fire of a neighbouring section to dash to the next scrap of cover—ever onward because they know that speed of advance is the way to victory and safety. Every man's agility must therefore be unencumbered by articles of kit, and must be stimulated by two thoughts: one is that the turn of his own company to be the leading and therefore the most combative unit only occurs once during eight battles engaged in by his brigade, and therefore every man is " all out " for the company; the second is that no less than ten companies of his own brigade are coming along behind and will not leave him in the lurch.

No dense targets are here, no close-packed uncontrollable waves—each forward group under its own leader, fighting its way to the goal, following an irregular course dictated by the cover to be found, helping its neighbour by fire and smoke, inspired by a common impulse: its guiding star the knowledge that it can and must push straight for the objective. The company and higher commanders retain control of the fight by the use they make of their manœuvre bodies. The accompanying tanks may be hit or delayed by obstacles, but the infantry, by the use in combination of its own weapons and its power to manœuvre, can still fight its way forward. The help of the other arms—artillery, tanks or aircraft—is treated as providing opportunities to be seized, not to be waited for and counted upon to clear the ground of enemies.

Here a company is held up by a counter-attack and the situation looks serious; some men waver; their section leaders are down. But the understudies take charge; their little groups, now shrunk to half their strength but still effective fighters, lie down and open fire. The counter-attack pauses; a diversion comes; the battalion commander, who has followed in the wake of the other forward company, turns inward through the gap, throws in his manœuvre company or a portion of it against the flank of the counter-attack. Surprise again. The enemy, caught by fire from two directions, faced with the threat of assault, waver and break. Their demoralization is infectious. Posts which had held out stubbornly give way; the tide of defeat sets in; everywhere enemies are seen trickling backwards. Pressing close on their heels the whole battalion makes its way towards another position of resistance. Here it beats vainly at first against the dam of the defence, seeking a crack through which it may infiltrate; it succeeds, at first by driblets and then in increasing volume, till suddenly the whole dam is swept away. This means victory, exhilarating victory. The reserve company, the last, is put in, if it has not been previously employed. Some posts and machine-gun nests have still to be overthrown, but the goal is reached; the ridge is gained and the battalion halts on its further slope. The groups are dispersed over the ground; they begin digging in whilst the artillery put down a protective barrage ahead, until still another brigade passes through our weary but triumphant infantry to carry the advance farther. The battalion continues consolidating the ground won, ready to cover the battalion which has passed through, should it be driven back by a counter-stroke.

Such is a rapid sketch, designed merely to illustrate salient points in the tactics taught in 1918 in France.

Future Development.—A question naturally arises as to the probable direction which the development of infantry will take under conditions caused by new inventions, particularly mechanical ones. In what way must we improve and reform our infantry methods in order to lighten the infantryman's burden in view of the probability that he may have to wear a gas mask in every future attack? The question may be considered under two heads: firstly, means to increase mobility; secondly, tactical doctrine.

Mobility.—Almost every mechanical advance means a step towards greater mobility. Every arm and branch of the service is becoming more mobile—or else decaying—under the influence of the petrol era. In the transport of an army the horse has already given way to the road motor, and this in turn promises to yield to a cross-country tractor with caterpillar tracks. The heavy artillery is already motor-drawn, and the lighter field artillery will probably follow suit before many years have passed. A further possibility is that the latter may disappear altogether, and the field-gun be either accommodated permanently in an armoured tank, or carried in one in such a way that it can be quickly mounted on the ground. Mobility is the foundation stone of the value of infantry. Its unique position has always rested upon the fact that it is more *universally* mobile than other arms. But on the normal field of battle, if it is to maintain its unrivalled position as the "handyman" of war, its mobility must keep pace in proportion with that of the other arms. To give it increased mobility two problems must be solved. Firstly, means must be devised for bringing infantry to the scene of its action more quickly and with less fatigue than by the use of its legs. Napoleon declared that he won his victories by his soldiers' legs: that is, by their marching powers, endurance and mobility. This was true so long as the foot-soldier's only competitor was the horse, but the manœuvring power of armies now rests on the speed of railways and petrol engines. In the second place, infantry equipment must be lightened. The soldier must not again be treated as a beast of burden—other means than piling loads on the soldier's back must be devised.

Transportation.—Whilst it is no longer true to say with Napoleon that "marches are war," because of the development of mechanical transport, yet truer than ever is the completion of his sentence that "aptitude for war is aptitude for movement." This problem has been approached in the past by the introduction of mounted riflemen and cyclists. The former were handicapped by the necessity of leaving a considerable proportion of their strength to look after the horses. Cyclists suffered from the defect of being tied to the roads and the lack of means to bring on their mounts after an action on foot. Therefore, in order to gain the maximum effect from available infantry, it will be necessary to move them from point to point and from resting-place to within range of the enemy by mechanical transport.

Equipment.—If infantry is to possess an adequate agility, its weapons and ammunition must be lightened to an appreciable extent or they must be carried for him. In fact, the infantryman of the future must be regarded as an athlete. Every article which he does not need in the combat itself must be discarded or carried for him on accompanying transport. It is likely that a lightened form of the present web equipment will be worn in order to support his cartridge pouches, smoke bombs and side-arms. Leather as a material is too much affected by exposure to rain. The ideal to be aimed at in the design of the equipment is that no straps should hinder the freedom of the wearer's chest. The bandolier is inconvenient and uncomfortable; nor should any great quantity of ammunition be carried. In the British army it is probable that puttees will be retained. They are more flexible, less rigidly binding, less hot than leggings, whilst they give greater protection from weather and abrasions than do stockings. This argument also applies to boots rather than shoes—which do not support the ankle—but a lighter pattern might be supplied.

Tactical Methods.—Infantry to-day has at last shaken itself free from the morass of methods based on theories of mechanics rather than of human nature, and has got its feet firmly placed on bed-rock principles of fighting. But in the attack particularly there remains a problem unsolved. The infantry unit has learned how to deal with any centre of enemy resistance which it encounters in a way which is true to human nature. But in a large-scale battle each infantry unit is only an interdependent and subordinate working part of a vast machine. The need is to devise a method by which its action can be fitted in and dovetailed with the movements of the neighbouring units and of the machine as a whole. Coöperation between units of the same arm—even more than between the different arms—is the keystone of modern war. These minor units are the moving parts of the car—which is the whole force. The car itself, under the control of its driver, the general commanding, may alter its direction, vary its speed, change its gears, but the actual moving parts within it execute their share on a definite system comprising a certain limited number of cycles of movement which are almost uniform. The essential requirement for the smooth running of the car to its journey's end—victory—is that each moving part should fulfil its rôle in harmony with the others. But the path to victory is a winding one, the car has to round steep corners, and a differential is needed which will compensate the movement of the respective wheels without friction, lest a sideslip ensue. In battle, now that the defence is distributed in depth, it is rarely possible to tell beforehand at what points and moments the different units will encounter the organized resistance of the enemy. The attackers of to-day are faced with the problem of breaking through successive positions, each composed of an irregular series of posts, extending back in layers to a depth of several miles. It is reasonably certain that some units will encounter fewer posts and less resistance in their path than others. A system is therefore needed which will ensure that the progress and momentum of the attack as a whole is not lost, nor friction developed between the moving parts, when delays occur to overcome obstacles in the path of certain sub-units. The minor cycle of the sub-unit must be reconciled with the greater cycle of the superior unit, and with that of the whole force.

A method by which this combination may be achieved has been put forward under the title "expanding torrent." It is based on the fact that where, as in the British army, a unit consists of four parts or sub-units, its forward body will be formed of two of these. Let us take the example of a company. It will happen that one forward platoon is advancing whilst the other forward platoon is checked or delayed in clearing an enemy post. If the platoon which can advance waits for its neighbour, the pressure on the enemy will be relaxed and the chance of exploiting success lost. If it is allowed to go on, tactical unity may be lost and its flanks will be exposed to counter-attack. Hence it is suggested that the commander of the company should follow automatically in the wake of his platoon, which is making progress, and after passing through the gap will push forward one of his manœuvre platoons to take over the frontage of the delayed platoon and lead the advance in its place. At the same time he might use his other manœuvre platoon to assist by a flank attack the originally held-up one to overcome its enemy. The moral effect of being outflanked however is often sufficient. Directly the enemy post has been cleared, the company commander reorganizes and pushes ahead without delay.

The method is equally applicable to the battalion and to higher commanders and is described colloquially as exploiting and enlarging the soft spot by automatic action resembling an expanding torrent. The advantages claimed for it, besides that of maintaining the momentum and breadth of the advance, are:—firstly, that the leading infantry will be automatically composed of those who are freshest and are best supplied with ammunition, because they are those which have encountered least opposition; secondly, that it will no longer be necessary to fix definite topographical objectives for each small infantry unit, for to limit the advance of unexhausted units which can make progress is a violation of economy of force and the exploitation of success; thirdly, that the coördination and control of the advance will rest with the superior commander rather than depend on coöperation between the platoons themselves. The driver will keep control of his car, instead of losing it as in the past.

Wanted: a Battle Drill.—A further development in tactical methods which has been mooted is a controllable system of movement on the battle-field. At present armies retain drill movements for the parade-ground and throw them aside when they go on active service. As human nature in battle retains only that which has become instinctive habit, it is scarcely surprising that in movements of crisis one has seen men advancing, against the deadly fire of machine-guns in close-packed lines. But if drill were brought up to date on the lines of open order and the group, it is probable that moments and even hours of priceless value would be saved, during the approach at any rate. But even during the actual attack, there might well be occasions when an ingrained method of control could be used to quicken the manœuvre of deployed units and direct them to take advantage of local situations. Voice control would be out of the question, but if signals were few and simple, visual control might be used, particularly if a clearer means of signalling than the hand were devised. Let anyone with experience of war ask himself if there were not moments in his recollection when he might, had his men been drilled in such a system, have saved precious minutes, an opportunity which never returned, by the use of a signal instead of the slow method of sending a message by runner. The old close order was under control, but modern fire made it impossible. With extended order the battle degenerated into the chaotic movements of an uncontrolled mob. An ingrained system of battle drill, in which intervals and distances were purposely exaggerated, would enable sub-units to be manœuvred, to be opened or closed in "concertina" fashion according to the ground and local circumstances. Such a system might go far to combine the flexibility of the old with the invulnerability of the modern formation.

In defence the probable development of the new power of manœuvre would seem to indicate that in future the infantry will be so disposed as to encourage the attacking enemy to penetrate into channels in which he can be raked by flanking fire. The posts would be sited to support each other by raking fire, rather than to fire direct to a flank. They might even be écheloned backwards along the natural avenues of approach to form gradually contracting funnels raked by fire, with preconcerted signals to bring down a hail of artillery projectiles at the best moment.

It seems improbable that in the future we shall see the extensive and elaborate field fortifications of 1914–8. The new mobility brought in by the tank, the caterpillar tractor, the aeroplane, would appear to prevent the possibility of the long-drawn stagnation which produced the labyrinthine entrenchments in the World War. The infantryman will be trained for future war to dig temporary cover, not mausoleums of mud.

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(F. I. M.)

INFLATION.—As with most economic terms in popular use, analysis shows that "inflation" has different meanings with varying contexts. It is sometimes used as equivalent to a general rise in prices, but a general rise in prices may be due to causes primarily associated with commodities, *e.g.* scarcity. Even if the term is confined to money (metallic and representative) it is possible that a general rise of prices may take place which although due to monetary causes cannot properly be described as due to inflation. In former times a frequent cause of a rise in prices was the debasement of metallic money. Debasement does not of necessity mean depreciation, and the depreciation need not be in exact proportion to the debasement. Much of the reasoning of Thorold Rogers, in his great work on the *History of Agriculture and Prices*, on the debasement of the English currency by Henry VIII. was vitiated by the failure to recognize that debasement of money in general only acts on prices in so far as the debasement leads to an increase in quantity. Such an increase in the quantity of money consequent on debasement is not usually called inflation, though clearly analogous.

A general rise in prices may also take place through an increase in the metal or metals available for money although there is no debasement of the coinage. The rise in prices in the 16th century so far as due to the new silver, and in the 19th century the rise due to the new gold in two periods, can hardly be described as caused by inflation. The gold standard implies that values are measured in terms of a certain weight of gold of a certain fineness in any country in which the gold standard is effectively maintained. In different countries values on the gold standard are compared by the amount of fine gold in the standard coins. Very great discoveries of gold, or even the artificial production of gold, would not of necessity mean any departure from the maintenance of the gold standard. Prices might rise indefinitely and the value of gold relatively to things in general fall indefinitely, but it would seem a misuse of language to speak of the "inflation" of gold. Such an increase of gold may and probably will cause an increase in prices, but in neither case is the increase of gold properly called inflation.

In the interpretation of popular terms there is, of course, no decisive test, as the usage varies; but by the application of the historical method the origins of the different meanings may be traced, and the search for the meanings will, as Sidgwick showed, throw light on the corresponding facts.

Before the World War the term "inflation" was in general applied to paper money. The paper money was thought to be inflated when the amount was greater than if the paper were strictly convertible or definitely related to the metallic standard. From this point of view inflation would now mean an abandonment of the gold standard, together with a consequential increase in the quantity of the currency in which prices are expressed. This is the interpretation given to inflation by Francis A. Walker. "A permanent excess of the circulating money of a country over that country's distributive share of the money of the commercial world, is called inflation" (*Political Economy*, 1887). His subsequent treatment shows that Walker had in view an excess of paper money consequent on partial or complete inconvertibility.

In theory it is possible to control an inconvertible paper currency in such a way that there should be neither specific nor general depreciation as compared with gold. But experience shows that, in general, when notes have been made inconvertible they have been subjected to over-issue, with consequent depreciation, specific or general, or both. Over-issue in this sense is another name for inflation.

It seems best, however, to distinguish between the fact of over-issue and the consequent depreciation. Over-issue might take place with inconvertibility, but the depreciation, whether specific or general, might be delayed. The annulment of the restraints imposed by the gold standard allows inflation to take place, but the degree of the depreciation (if any) depends on the quantity of the new paper money (with the credit based on it) and the demand for it.

In the natural course of the progress of a nation, with the increase of population and trade, a greater amount of money is required for cash transactions. With the gold standard in effective working order the additional money required might be obtained by the expansion of convertible notes and of the various forms of bankers' credit, without any departure from the effectiveness of the gold standard. Such was the case in the United Kingdom from the definite establishment of the gold standard with the resumption of cash payments (1821) to the outbreak of the World War in 1914. There was also, it is true, an increase in the amount of gold in circulation and held in reserve, but only sufficient to secure the absolute convertibility of the notes and other forms of credit.

In the same way in periods of speculation and of trade activity there is, no doubt, an abnormal demand for currency and credit, and both are extended until the limitations imposed by the gold standard are reached. If these limits are overstepped there is a monetary crisis. We speak of cycles of expansion and of depression of trade (in the widest sense), but it is only when the expansion of the "money" used exceeds certain limits that it can be properly called inflation. There may be a legitimate expansion to meet the legitimate expansion of trade.

We are well advised under modern conditions to confine the term "inflation" to such *abnormal* increases of currency and credit as transcend the limits imposed by the gold standard. Over long periods there may be a normal increase of money and of money-substitutes, and there may also be normal increases from time to time for short periods according to the activity of trade or exchange in the widest sense. Such increases of currency and of credit would not properly be called inflation.

The term "inflation" as applied to paper money may be compared with the debasement of standard coins. Debasement is in general a symptom of disease or disorder of the monetary system. It is a departure from the standard (or specific depreciation); and if, as usually happens, it is associated with an increase in the quantity of the money after a point it must lead to general depreciation of the currency. If not associated with an increase of quantity the debasement would be simply equivalent to the institution of a seigniorage. In the same way inconvertible notes may be regarded as coins with a seigniorage of 100% (Walker); in other words the amount of fine metal supposed to be attached to the paper is nil. Nothing is left of the standard coin but the name. In this case the value of the paper is determined by its quantity related to the effective demand for it.

It is clear from the foregoing discussion of the meaning of the term that "inflation" is closely associated with other monetary expressions and is sometimes loosely used as equivalent to one or more of them. We speak of inflated values (or prices) of commodities, as for example in comparing present foreign trade returns with the pre-war figures. In periods of financial speculation it is usual to speak of the inflation of securities. Prof. W. R. Scott, in his *History of Joint Stock Companies*, constantly uses the term inflation in describing the rise in the prices of shares in the period of the South Sea Bubble (1720). It may, perhaps, be said that values of securities are inflated when they bear no proper relation to their earning capacity or to their exchange value under normal conditions.

The term "inflation" is also commonly associated with depreciation, and the terms are loosely used as synonymous. Here, however, it is necessary to distinguish between the different meanings of depreciation. A currency might be *specifically* depreciated as regards gold (the standard) simply through discredit, although there was no abnormal increase of quantity. The terms depreciation and appreciation are often applied to gold itself. Gold was said to be depreciated in the third quarter of the 19th century through the gold discoveries, and appreciated in the last quarter through the falling-off in production. But it would be straining the use of words to speak of the inflation and deflation of gold in these periods. During the World War and afterwards there was a great rise in world prices (measured in gold) and in the United States there was a vast increase of the amount of gold for monetary uses. In the United States there was no specific depreciation of paper money relatively to the gold. Gold there had no premium.

The rise in American prices in terms of gold is partly accounted for by the expulsion of gold from Europe by the floods of inconvertible paper. The question arises whether it is correct to speak of this increase in the American gold currency as inflation. There has been, no doubt, an abnormal increase of gold currency as compared with pre-war periods, but there has been no abandonment of the gold standard. Coincidentally, however, with this great influx of gold the passing of the Federal Reserve Act enabled a given amount of gold to support a larger amount of credit, and this extension of credit facilities may be regarded as equivalent to a partial abandonment of the gold standard as compared with pre-war conditions.

At this point the general question arises as to variations in the meaning of convertibility and inconvertibility. There have been in the past all kinds and degrees of suspended and deferred convertibility. The beginnings in Europe of the gold-exchange standard (so well described by Mr. J. M. Keynes in *Indian Currency and Finance*, ch. 2) show also the beginnings of inconvertibility. These incipient gold-exchange standards prepared the way for the ready acceptance of inconvertible paper on the outbreak of the World War (see "Essay on the Abandonment of the Gold Standard," by Prof. J. S. Nicholson, in *War Finance*, p. 34). In the same way the Federal Reserve Act may be said to have prepared the way for an inflation of credit (see E. W. Kemmerer, *High Prices and Deflation*).

In the preceding account of inflation it was implied that under modern conditions the term was only properly applied to cases in which the abnormal increase of money was due to inconvertibility or to the abandonment of the gold standard. The application, however, of the idea of continuity to convertibility and inconvertibility shows that the term inflation may be extended so as to cover the expansion of credit and currency which has taken place in the United States. And in practice most writers speak of inflation in that country as being only less in degree as compared with Europe.

In the United Kingdom during the war the transition from convertible to inconvertible paper was made by such gradual and concealed steps, both in law and in practice, that it is hardly possible to say when the virtual abandonment of the gold standard was officially recognized,—if indeed it ever was.[1] It was only after the war when the foreign exchanges had been decontrolled and when war demands and war scarcities no longer seemed sufficient to account for the great rise in prices, that the abnormal increase of paper money consequent on the abandonment of the gold standard came to be regarded as one of the principal contributory causes of the rise in prices, and it began also to be acknowledged that the currency had been inflated.

In the United Kingdom the great use of cheques and bankers' credits concealed the progress of the inflation as regards the notes. It was commonly said that the increase in the notes was not sufficient to explain the increase in the prices, and that only sufficient notes were issued to provide the small charge for the governmental credits. In this way we arrive at the position that the inflation in the United Kingdom was *primarily* an inflation of credit and not of currency. In other countries, *e.g.* Russia, Austria, France and Germany, the enormous issue of inconvertible notes had the usual effects in a more direct manner. The case of the United Kingdom, however, is not so different when analyzed as at first sight may appear. Before the war, when the gold standard was effectively maintained, the necessity of securing the absolute convertibility of all forms of credit, and of keeping London a free market for gold, imposed rigid limits (after a point) on the expansion of credit. If in the war the bankers had not been able to provide notes for the cheques presented (for funds for wages and other cash transactions) the whole system of credit expansion would have broken down. The notes took the place of gold for all internal payments, and for many foreign payments borrowing was resorted to.

Once the notes had effectively taken the place of gold in the United Kingdom, that is to say when gold was no longer used by the public as money for cash purposes, the principle of convertibility was maintained as regards all the other forms of credit and "representative" money. There was never after the first week of the war any hint of a banking crisis. No one repudiated the notes, and the whole monetary system was worked with the greatest smoothness. The only difference was that the ultimate convertibility into gold, if required and as and when required, was no longer recognized in practice. But this one exception was fatal to the stability of the monetary system. In normal times before the war the action of the gold standard was so effective and so quiet that even bankers and those engaged in high finance took it for granted, just as a perfectly healthy man takes for granted the circulation of the blood and the other vital processes. To the present generation the real working of the gold standard was only revealed when the abandonment had been effected. This abandonment gave to the monetary system the power of indefinite expansion, and the necessities of the State in the war and its extravagances after the war made the potential expansion an actuality.

The real meaning of the gold standard and the dangers of abandonment or relaxation were admirably expressed in his own day by Ricardo. Ricardo was all his life engaged in high finance, and in monetary affairs was the leading practical authority. Although he is commonly regarded as the founder of abstract economics, always at the back of his mind was the practical working of the principles which he propounded. He lived through the period of the bank restriction when the notes of the Bank of England were made inconvertible, and he had this experience to test his reasonings. Two sentences bring out very clearly Ricardo's conception of a standard and of the limitations imposed by a standard on the expansion (or inflation) of paper money. "In the present state of the law [he is referring to the bank restriction on the conversion of paper into gold] the bank directors have the power of increasing or reducing the circulation in any degree they think proper: a power which should neither be entrusted to the State nor to anybody in it" (Ricardo's works, McCulloch's edition, p. 406). The second text is: "The only use of a standard is to regulate the quantity, and by the quantity the value of the currency—and without a standard it would be exposed to all the fluctuations to which the ignorance or the interests of the issuers might subject it."

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[1] At no time during the war would it have been definitely admitted by the governor of the Bank of England that the gold standard had been "abandoned" (Ed. *E.B.*).

In other words the use of a standard is to provide safeguards against the dangers of inflation. The best and most effective safeguard is convertibility. All the forms of currency and of bankers' credit ought to be convertible into one another and into gold without let or hindrance. Such convertibility is only guaranteed when the principle of limitation is applied in each case in a way effective according to the circumstances of the case. In some parts of the system the limitation is applied in a very rigid manner, as for example with the token coins. The essence of "Gresham's law" in the case of token coins is that only by limitation can the nominal value be kept up. In the United Kingdom it used to be thought that to support this limitation effectively the legal tender ought also to be limited. Experience (as observed by Prof. Cannan) has shown that the limitation may be secured in other ways. In the case of bank-notes, whether issued by the State or by banks with delegated powers, the principle of limitation has been applied in different ways. In the United Kingdom before the war the limitation of the issues of bank-notes was far more stringent than in any other country. The Bank Act of 1844 came to be known as the cast-iron system. The essence of it was that, after a point, no notes could be issued unless in exchange for an equivalent amount of gold. In normal times there was no elasticity. In times of crisis elasticity was provided by the suspension of the Act. Other countries had other methods of regulating the issues of their paper money. When Jevons wrote his book on *Money* in 1875 he was able to describe in his Chapter XIV. on "Methods of Regulating Paper Currency" no less than 14 different methods, and since that time other important varieties have been introduced. In these different systems the elasticity in normal and in abnormal times varies, but it is only in the case of inconvertible notes that the principle of limitation by reference to the metallic standard is abandoned altogether, and even in that case there is in general some kind of hope deferred that some time or other the link with gold will be restored.

During the World War, in all the belligerent countries except the United States and Japan, the connexion of the notes with gold, that is to say the effective convertibility, was abandoned in practice. No other effective method of limitation was discovered or applied. Instead of limitation there was expansion, in order to make the Government loans effective in monetary purchasing power. The greater the expenditure by the State, so much greater became the volume of the forms of purchasing power, and the issues of notes had to conform to other increases if recurrent banking crises were to be avoided.

Historical Examples.—Before the World War there were three notable outstanding cases of inflation in connexion with issues of inconvertible paper. They throw light on the processes and consequences of the inflation after 1914.

The assignats of the French Revolution long formed the classical example in the text-books of the dangers of inconvertible paper. The issues began on what appeared to be, having regard to the circumstance of the time, a reasonable basis. The confiscated lands were more than sufficient in estimated value to meet the deficits of former years and to provide a surplus for the immediate budgets. In Dec. 1789 the Assembly issued assignats of 1,000 livres (£40) each, bearing interest at 5%, to be accepted from purchasers of the nationalized lands. These notes were part of the floating debt, and were, to begin with, not legal tender. It may be observed that the first notes of the Bank of England (1694) were for high denominations and bore interest. In the course of time the interest on the assignats was abolished, the denomination was lowered, the notes were made legal tender as currency, and any pretence of "representing" lands or any other assets was abandoned. In brief, all effective limitation ceased, and the depreciation both specific and general became excessive. In spite of severe penalties against dealings in specie, culminating at last in the death penalty, in the course of time the notes were refused, and by 1796 had become practically worthless. Attempts had been made to substitute other notes mandats or promises of mandats, but there was no effective withdrawal and no real limitation, and the mandats followed the lead of the assignats. In Feb. 1797 all the paper money was demonetized, the mandats being receivable for taxes or land purchase at 1% of their face-value.

The refusal of the paper money began in the French provinces and the circulation was most effective and prolonged in Paris. The analogy with Bolshevist Russia is instructive. There the refusal of the paper money began with the peasants. It is indeed remarkable that the leaders of the Russian Revolution took no warning from the example of revolutionary France. In fact, they advanced more rapidly to monetary destruction. And in Russia there do not seem to have been any of the compensating temporary advantages of inflation. "It is worthy of remark," says a recent writer (R. G. Hawtrey), "that so long as the Paris workmen were ordinarily paid in assignats there were no complaints of unemployment; the high prices attributed to the knavery of speculators were the principal grievance." In Russia unemployment increased with the inflation.

The next great example of inconvertible paper and inflation is furnished by the Bank Restriction in England which began in the year in which inconvertible paper was abandoned in France (1797). The contrast with France is remarkable, and, to begin with, confirms on the positive side the effectiveness of the fact of limitation even when the actual practice is not based on any reasoned principle. The notes of the Bank of England, though inconvertible, were not made legal tender until 1812. They were at first simply debts due by the Bank of England which the bank was not allowed to pay in legal currency. But the notes were accepted by the Government in payment of taxes, and also by the bankers and merchants under a formal agreement amongst themselves. In 1811 Lord King demanded payment of his rents in coin (not paper), and an Act was passed forbidding any differentiation between coin and paper—that is, making illegal the quotation of two prices. Full legal tender was only granted to the notes the next year (1812).

The specific depreciation of the Bank of England notes began in 1800. At this time (and practically up to 1873) gold and silver were ranked equally as precious metals, and the variations in the ratio of their values never departed widely from 15½ to 1. From 1797 to 1818 at Hamburg the highest ratio is 16·25 in 1813 and the lowest 15·04 in 1814. The maximum specific depreciation of the notes in 1813 compared with gold was 136·4; and with silver 134·7 (see table in Hawtrey's *Currency and Credit*, p. 269). By 1816 the specific depreciation relative to the precious metals had practically disappeared. As measured by the exchange on Hamburg the depreciation reached a maximum in 1811 and was about par by 1816.

It is more difficult to estimate the general depreciation as compared with commodities. In 1801 the index number of prices, calculated by Jevons, based on a standard taken as 100 in 1782, had risen from 110 in 1797 to 153 in 1801, after which there was a fluctuating fall followed by a rise to the maximum of 164 in 1810. It is impossible to say how much of this general rise in prices is to be attributed to the inconvertible paper and how much to causes primarily affecting demand and supply of the commodities taken as the basis of the index numbers. The great argument of Tooke (*History of Prices*) was intended to show, by examining the actual records of the circulation and of prices, that the influence of the currency was of little importance compared with demand and supply. Tooke's general argument was weakened by the fact that he laid the chief stress on commodities which were largely affected by the course of the seasons. The modern view from Jevons onwards is that the general rise in prices was in part due to the issues of the inconvertible notes. A reference to the figures shows (Hawtrey, p. 269) that there is no exact connexion between the specific depreciation of the paper and its general depreciation as measured by general prices. Two questions arose in this period on which there was a prolonged controversy which has been revived *mutatis mutandis* by the World War. It was maintained by some that there was no specific depreciation of notes but only an appreciation of gold owing to the exceptional demands for it in connexion with the war. Now, it is argued, there is depreciation of gold. The other allied question was whether the specific depreciation of the notes was the exact measure of the fall in their purchasing power (or general depreciation). Another point of interest in this period was the influence of economic opinion on economic action. The celebrated Report of the Bullion Committee in England (1810)[1] put the case for the resumption of specie payments and a return to convertibility in the strongest way. The principles of the report were due to the influence of Ricardo, although he was not a member of the committee. Later economists have in general approved of the report, both as explaining the facts and as suggesting the only adequate remedy. But the resolutions founded on the report were not only rejected by the House of Commons at the time (1811), but in opposition to them resolutions were carried by Vansittart which it is now agreed were "abundantly foolish." The answers given by the governor and directors of the Bank of England before the committee were described by Bagehot as "almost classical by the nonsense." By some recent economists, however, the policy of the report has been condemned, notably by Prof. Foxwell, in the introduction to the *History of the Bank of England* by Prof. Andréades. It is also now generally admitted that the questions involved in the report are more complex than the framers of the report considered. It is noteworthy that the principles of the report were eventually adopted and became the foundation of the Bank Act of 1844. It is remarkable that Lord Cunliffe's Committee on Currency and Foreign Exchanges, in their "first interim" report (1918), strongly approved of the practical return to the principles of 1844.

The third great historical example of inflation of inconvertible paper is furnished by the American Civil War. The period (1862–79) used to be called by American economists "the inflationist period." In about a year, owing to the stress of the war, 450,000,000 dollars of "greenbacks" were issued, and in the next two years other 200,000,000 dollars of interest-bearing, legal-tender notes were added. In the last year of the Civil War the paper had suffered a specific depreciation as compared with gold of 50%, and there had also been a great rise in prices, partly at least due to the inflation of the currency. In this case the inflation was primarily an inflation of currency and not of credit. At the close of the war steps were taken to reduce the paper money, and the interest-bearing notes were cancelled. The reduction of the greenbacks, however, was made gradual —a monthly maximum of withdrawals being enforced in 1866. From this time onwards to the final restoration of specie payments in 1879 there was a contest between the inflationists and the supporters of "hard" money. The main argument of the inflationists rested on the hardships that follow on a contraction of the currency and consequent fall in prices. For a time the inflationists were successful, and in 1874 a bill was passed through both Houses of Congress actually increasing the paper issues by about 400,000,000 dollars. This bill was vetoed by President Grant and prepared the way for the Resumption Act of 1875, which provided for the resumption of specie payments in 1879. After this year the advocates of what was called "soft" money turned their attention to the coinage of silver.

The American experience after the Civil War is of special interest as applied to the case of the United Kingdom after the World War. The same arguments were advanced in 1920–1 as regards the hardships and the dangers of any deflation and the relative advantages of rising or at least stable prices. The less extreme supporters of inflation, like their American predecessors, thought that there should be no actual contraction, and that trade and production should be allowed to overtake the extra supplies of money and in that way bring about a gradual restoration to the normal. In the United States, after the Civil War, the actual resumption of specie payments was delayed for 14 years. Although the American inflation at that time was, to begin with, specially an inflation (or abnormal increase) of inconvertible paper, after the Civil War credit influences not only in the United States but in other countries had considerable influence on the extent of the depreciation of the paper. In the first months of the peace the gold value of 100 paper dollars was 70. But although the paper was reduced in three years by over 15% the effect on the specific depreciation was insignificant, 100 paper dollars being worth only 71·6 in gold. After 1869 for three years there was a great rise in the gold value of the paper to 89·5 in 1871, in spite of an absence of contraction. After 1871 there was another reaction followed by another and more marked revival. This want of conformity between contraction and appreciation of the paper (in terms of gold) is explained by Mr. Hawtrey (*op. cit.*, p. 309) as due to the variations in the value of gold consequent on credit movements in Europe. In 1866 there was the Overend and Gurney banking crisis in England. In 1871–3 there was the boom in trade following on the Franco-German War. This boom was accompanied in the United States by an excess of imports, due to the advance of European capital for railway construction.

Enough has been said to show that the relation of the quantity of paper money, even when inconvertible, to changes in specific or general depreciation is by no means simple. Nor is such a result opposed to the "quantity theory" of money in its extended modern form. The value of paper money in terms of gold depends partly on causes affecting the paper (not only its quantity but its credit or discredit), and partly on causes affecting the gold itself—not only the supply available for monetary purposes but the various elements of demand both for monetary and non-monetary purposes. The premium on gold is accounted for by various causes, and it is not the exact measure of the fall in purchasing power of the paper as regards commodities.

This brief survey of the three notable cases of inflation before 1914 shows very clearly that the inflation of the World War period was due to similar causes acting with varying force. The precise effect of the increase in the quantity of the inconvertible paper cannot be isolated. The main point is the abandonment of the effective working of convertibility through which the gold standard makes operative the principle of limitation. But even when convertibility is maintained apparently and by law in the most effective manner, as for example under the Bank Act of 1844, it is quite possible that for the time being *de facto* convertibility may be restrained, and there may be an inflation of paper money and of the credit that rests on paper money for cash payments. The old question as to the possibility of the over-issue of convertible notes has been answered in the affirmative by the practical legislators of every country. In other words every country has imposed special restrictions on the issues of notes. But in the course of monetary progress the over-issue of convertible notes has become of relatively small importance as compared with the over-expansion of credit, at all events in highly developed countries. The connexion of credit with the gold standard is not only through the note issues. In the United Kingdom the cheque has for long been the most important form of currency or means of payment. It is possible that even wages might be paid by means of cheques (a beginning has been made by Messrs. Lever), though still forms of legal tender would be necessary for other kinds of cash payments.

Once, however, convertibility has been definitely abandoned as regards the notes, then one of the great restraints on the increase of credit also has been abandoned. It is one thing for banks to provide the gold necessary to meet an internal drain, and quite another to get the notes required in exchange for some form of bankers' credit. It is one thing to keep a free market for gold, and quite another for the government of a country to meet the foreign demands for payment by borrowing abroad instead of sending gold. It is one thing to control the movements of gold by changes in the rate of interest, and quite another to let the movements of gold depend on the governmental regulations regarding import and export.

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[1] Reprint, edited by Prof. Cannan, *The Paper Pound* (1919).

The World War Period.—In tracing the progress of inflation during the World War, the case of the United Kingdom is the most instructive and important. It is also the most difficult, because the abandonment of the gold standard which opened the way for inflation was not definitely announced or admitted, and was only realized some time after the fact had been accomplished in practice. The first authoritative recognition that the gold standard was no longer operative in the United Kingdom was that made in the first report of the Cunliffe Committee issued Aug. 1918. It begins with an account of the currency system which had been effectively maintained in the United Kingdom before the war, and it points out that "under these arrangements the country was provided with a complete and effective gold standard." But the report goes on to state: "The course of the war has, however, brought influences into play in consequence of which the gold standard has ceased to be effective." The main steps in this practical abandonment are also well stated in the report. On the outbreak of war it was considered necessary by the Government not merely to give permission for a suspension of the Act of 1844, as had been done on some earlier occasions, but also to empower the Treasury to issue its own currency notes for £1 and 10s. as legal tender throughout the United Kingdom. It may be noted that before the war only Bank of England notes were legal tender (not the notes of other banks), and Bank of England notes were not legal tender by the bank itself. In the bank restriction (*see* above) full legal tender was only conferred on the notes in 1812, *i.e.* 15 years after the beginning of the restriction.

Under the powers given by the Currency and Bank Notes Act of 1914, the Treasury undertook to issue the new notes through the Bank of England to bankers, as and when required, up to a maximum not exceeding for any bank 20% of its liabilities on current and deposit accounts. The amount of notes issued to each bank was to be treated as an advance bearing interest at the current bank rate. Later on, certificates of larger denominations were issued to banks in lieu of notes, to save trouble, and it became the practice for the banks to pay for the notes in other forms of bankers' credit. In this way the principle of limitation as applied to the notes was practically abandoned. What ought to have been barriers to expansion became elastic bands that yielded at the slightest pressure. The reserves were adjusted to the liabilities and not the liabilities to the real reserves. In place of a limited amount of gold that could only be increased by being attracted from other countries, the real banking reserve was now a mass of notes which could be increased on the demand of the banks themselves. It must be said in justification of these very elastic provisions regarding the notes that it was never anticipated that the demand for internal currency would have necessitated extensive recourse to these provisions. At the beginning of Aug. 1914 an extended bank holiday was sufficient to restore confidence in the currency situation. The danger, as events showed, lay in another direction. The banks were made so secure that they imposed no restraints on the demands of the Government. The inflation was made possible by the issues of the notes—but the real inflation began with the expansion of credit. The credits created by the Bank of England in favour of its depositors, under the arrangements by which the bank undertook to discount approved bills of exchange, and other measures taken at the same time for the protection of credit, caused a large increase in the deposits of the bank. At the same time the needs of the Government for funds to finance the war in excess of what was raised by taxation and by real borrowing from the public made it necessary for the bank to create credits in favour of the Government in the shape of Ways and Means advances. The consequence was that the total amount of the deposits of the bank increased from about £56,000,000 in July 1914 to £273,000,000 in July 1915. The balances created by these operations passed, by means of payments to contractors and others, to the Joint Stock banks, and caused an increase in their deposits, which were also expanded by credits created in connexion with the various war loans. The consequence was that the total deposits of the banks of the United Kingdom other than the Bank of England increased from £1,070,681,000 in Dec. 31 1913 to £1,742,902,000 in Dec. 31 1917. This process of credit inflation is correctly described in the Cunliffe report (*note*, p. 4.): "Before the war these processes if continued compelled the Bank of England to raise its rate of discount, but the unlimited issue of currency notes has now removed this check upon the expansion of credit."

The great increase in bank deposits represented a corresponding increase in purchasing power, which in conjunction with other causes (*e.g.* war demands, war obstructions, war scarcities, etc.) caused a rise in prices. The rise of prices in its turn brought about a demand for legal-tender currency for cash payments of all kinds (wages, transport, retail trade, etc.). The war contractors and others had to break up their large credits into smaller credits, and these again were transmuted into legal tenders. "The unlimited issue of currency notes in exchange for credits at the Bank of England is at once a consequence and an essential condition of the methods which the Government found necessary to adopt in order to meet this war expenditure." On June 30 1914 the fiduciary issue of the Bank of England was under £19,000,000, but by July 10 1918 there had been added £230,412,000 in Treasury currency notes not covered by gold.

Compared with the mass of purchasing power indicated by the growth of deposits, and still more effectively by the increase in the clearing-house returns, the increase of notes may seem of relatively small importance. The importance of the currency notes lies not in their mass compared with other forms of purchasing power but in their function as taking the place of gold. Before the war the Bank of England, with a smaller gold reserve than those of other great European banks, supported a far greater mass of credit. Under certain conditions the movement of a few millions of gold was sufficient to threaten a crisis. Severe precautionary measures were taken to prevent the depletion of the ultimate metallic reserves. The quantity of gold was small, but it was necessary. Before the war, periodical warnings were given that the gold reserves were inadequate to bear the possible strain. By substituting currency notes for gold (and by amassing credits abroad), the quantity of gold held by the central bank became of relatively little importance.

The currency notes, as explained above, were never definitely made inconvertible. It was even provided that when they were presented at the Bank of England gold could be demanded. But since it was against the law to make any use of gold money except as currency—*i.e.* it could lawfully be neither melted down nor exported—the presentation of currency notes for conversion in this way at the bank could only lead to unpleasant questions and possibly incriminating answers. The convertibility was, in fact, only nominal or indefinitely suspended.

The legal prohibition of the melting of gold coin, the control both of the exportation and the importation of gold, and the consequent limitation of dealings in gold, severed the link that formerly existed between the values of coined and uncoined gold. Under normal conditions the market price of gold could only differ from the mint price of £3 17s. 10½d. by very small amounts, negligible so far as any premium on gold was concerned. Practically, in London before the war, gold coin and gold bullion were convertible to any extent at very short notice. The actual records of the price of gold in London show the stability of the price within these very narrow variations. Since there was never the least hesitation among the public in accepting the currency notes, the gold coins previously in public use were gradually withdrawn from circulation by gentle persuasion and the voluntary action of the banks (not by compulsion). Under these conditions it was not possible to discover if there was in fact any specific depreciation of the notes relatively to gold within the country. Spasmodic cases occurred of sovereigns being bought at a premium in 1916, and both buyers and sellers were prosecuted, but at the time the cases were considered as of no practical importance, and it was generally believed that the notes were not depreciated as regards gold. In a paper read by Prof. Foxwell to the Institute of Actuaries March 26 1917 he stated that he was not aware of any depreciation of this kind in Great Britain, though he had been on the look-out for it incessantly. The police-court cases noted above must have escaped his vigilance, but it is quite clear that there was no recognized depreciation in the sense of a premium on gold in terms of the notes during the war.

A specific depreciation of British currency might have been evidenced by the course of the foreign exchanges, especially with countries such as the United States which had preserved the gold standard effectively. But the course of the foreign exchanges is influenced especially in war-time by other factors, and we cannot at once argue from a fall in the American exchange to a depreciation of British currency. In Sept. 1915 there was a considerable fall in the sterling exchange on New York, but after that time the exchanges were controlled and an artificial stability at 4·76½ dollars to the pound sterling was maintained until the control was taken off after the war (1919). It may be observed that the test which the framers of the Bullion Report (1810) thought of the most importance was not applicable owing to the artificial control. It may be added that this artificial control necessitated the incurring of large indebtedness to the United States by England. After the control of the exchanges was taken off there could be no question that the pound sterling depreciated in terms of the dollar, and this old method of estimating the depreciation was revived.

To the great mass of the people of a country, the specific depreciation of the currency, whether measured by the price of bullion or by the course of the foreign exchanges, is of little interest except in so far as it may be a sign of general depreciation or a fall in the purchasing power of the actual currency. The point was well put in a speech by Mr. Reginald McKenna to the shareholders in the London Joint City and Midland Bank on Jan. 29 1921. In discussing the variations in the meaning of inflation he said that one idea runs through all the meanings, namely that inflation is always associated with rising prices. As already explained, a general rise in prices is not in itself inflation, but it is, as experience shows, always associated with it in the sense of abnormal issues of inconvertible paper.

In considering the effects of the inflation (or abnormal issues) of inconvertible paper on general prices two questions must be carefully distinguished:—(1) What is the effect in the country of issue; and (2) what is the effect indirectly on general world prices measured in terms of gold (the old standard).

Under normal conditions, when convertibility of all the forms of currency and credit is effective in the great commercial countries (as before the World War), the level of prices in any one country depends partly on causes operating in that country, *e.g.* tariffs, demand and supply, and partly on the relation of that country to the rest of the commercial world. When the link between gold and paper is broken in any one country, after a point the local issues become of predominant importance. Russia furnishes an example in an extreme form.

In the United Kingdom during the war there can be little doubt that a rise of prices followed on the issues of the currency notes, as shown by Prof. J. S. Nicholson in a paper to the Royal Statistical Society June 1917 (republished in *War Finance*). It was not implied that the rise was simply caused by throwing the new paper into circulation (as in the case of issues of notes in countries where credit is relatively little developed), but account had to be taken of the effect of the issues on the abandonment of the restraining influence of the gold standard. In the paper referred to it was shown that every kind of currency and of credit had expanded. There had been, for example, a very great increase in the silver and bronze coins put into circulation, and on the other side a great expansion of the use of cheques. Within the country the principle of convertibility had been maintained, and the relative amounts of legal tenders of the various kinds and of bankers' credits had increased more or less in like proportions (not exactly for reasons given in Nicholson's *War Finance*, p. 92). As already explained, once the gold standard was abandoned the notes took over the function of gold in restraining or not restraining advances of credit. A comparison with the United States shows also that the rise in general prices began sooner and advanced more rapidly in Britain than in America.

In other countries roughly the local rise was proportionate to the expansion of the local currencies (and bank credits). The differences are best seen and most exaggerated in Russia and Austria-Hungary, but also in France and Germany.

Broadly speaking during the war (and after the war up to the middle of 1920) general prices in most countries were related to the inflation of their respective currencies and the credits based on them. Prices in particular countries were determined to a greater extent by local causes on account of the restrictions placed on international trade in consequence of the war. Account must be also taken of the efforts of governments to maintain control over prices of important commodities, which, though by no means completely successful and in general undertaken too late, had on the whole considerable effect. That is to say, the level would have been higher but for the control. Local prices were also to some extent kept down by the government of the country concerned buying in the foreign markets instead of allowing unfettered competition. This attempt to establish a buyers' monopoly amongst the allied belligerents was applied too late, and was not very effective as against the great trusts which established sellers' monopolies. Still, no doubt, this part of governmental control also affected the price levels of particular countries. The general result was in accordance with former experience—namely that governmental control is a feeble remedy against a rise of prices consequent on the abandonment of the standard. The fundamental difficulty is that a government can only attempt control in its own country in so far as in combination with other buyers it may establish some kind of buyers' monoply. In other words, world prices still govern world markets, and the local prices have to be adjusted to the world levels. This consideration leads up to the effects of inflation (in the sense of abnormal issues of inconvertible paper and the consequential expansion of other representative money) in particular countries on world prices. In dealing with this second question it must be observed that in the past this influence had to be considered in estimating changes in world prices (or the purchasing power of gold).

The substitution of paper for gold (or the precious metals when there was *de facto* a link between gold and silver) liberates a certain quantity of the gold which can be used for monetary purposes in other countries. In the American Civil War the displacement of metallic money, no doubt, had some influence in raising the general level of prices in European countries. In the World War the vast accumulation of gold in the United States tended, no doubt, both directly and indirectly to raise prices in that country and in that way to affect world prices measured in terms of gold. Similar effects were observed in Japan[1] whilst in Sweden precautions were taken against this depreciation of gold. The indirect effect of this influence was far greater in the World War than on any previous occasion owing to the vast area affected by the issues of inconvertible paper and the importance of the countries concerned. It is obvious from the experience of the United States that the mere preservation of convertibility and the effective maintenance of the gold standard are not sufficient to prevent a general rise in prices as measured in the gold standard. Gold prices in the sense of "world prices" depend broadly on the quantity of the gold in use for monetary purposes and on the work to be done by it. In the course of the war, paper was largely substituted for gold, and so far as trade was concerned there was less work to be done by the gold. The general effect then of the World War was analogous to that of great discoveries of gold. Such a result was not in itself a necessary consequence of the World War and of the issues of inconvertible paper. It was quite possible as pointed out by Prof. J. S. Nicholson (in a paper of date Aug. 3 1914—republished in *War Finance*, Part II. ch. 1), that the destruction of credit would more than counterbalance the influences making for a rise in prices. In fact, however, instead of any destruction of credit there was a universal expansion. All governments financed their war needs by loans. The United Kingdom alone of European countries met any considerable part of its war expenses by taxation. In France and Germany the great issues of inconvertible notes directly raised prices, and prices were also raised by the expansion of governmental credits exercised in purchasing power. The notes displaced gold, and the gold was used for monetary purposes in other parts of the world, notably the United States and Japan. In other countries the notes took the place of gold as reserves in the banks, and the reserves were much more easily replenished and increased than was possible with gold. In that way, indirectly as well as directly, the issues of the notes tended to raise general prices. All the world over, in spite of the war, indeed in a sense in consequence of the war, there was a great expansion of credit. But this expansion of credit was only made possible by a corresponding expansion of inconvertible notes.

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[1] In Japan in 1914 the balance of bank-notes issued over the amount withdrawn was 385,000,000 yen against gold coin and bullion of 218,000,000 yen. In 1919 the balance of bank-notes was 1,555,000,000 yen against 951,000,000 yen of gold coin and bullion. In Dec. 1920 the ratio of gold to notes in Japan was 85·6, the highest of any of the 17 principal countries.

It is stated in the official *Financial and Economic Annual* of Japan for 1920 that in order to make up for the deficiency of subsidiary silver coins caused by the war a large number of paper notes of small denominations were issued of an aggregate value of nearly £20,000,000. Elsewhere the demand for silver for coinage raised the price greatly (maximum 89d. per oz. in 1919). In England the standard of fineness was lowered.

The evils consequent on inflation which had been exemplified in former historical cases were observed in the World War and in the boom that followed up to the end of 1920. Any general rise in prices, from whatever causes arising, brings difficulties of readjustments, and these difficulties are increased when the main causes are connected with paper money. The reason is that the changes consequent on excessive issues of paper, especially if accompanied by excessive expansion of credits, are much more rapid and intense than when the changes are due to increases in the metal or metals used for standard money. A general rise in prices gives at first a relative advantage to traders and employers of labour, as compared with consumers in general and the receivers of wages and salaries. During the World War wages in industries bearing on the war rose far more rapidly than had been the case in former experiences of inflation. At first the idea prevailed in the United Kingdom that the war would be of short duration, and throughout the dangers of defeat were so appalling that monetary considerations seemed relatively of no importance. No effective restraints were put on inflation. The workers soon learned that they had only to ask in order to have. The employers added any rise of wages to the cost, and to the cost as so determined added on again the usual or unusual percentage of profit. In war contracts the general rule seemed to be to calculate the contractors' profit as a percentage of cost, and with rising nominal cost profits rose automatically. When the enormous rise in profits was observed, an attempt was made to catch the excess above the pre-war normal by the excess profits duty. But under the inflationist conditions that prevailed the imposition of this tax led again in many cases to a further rise in prices. The profit-makers were also imbued with the old belief that any tax that could be evaded ought to be evaded, at any rate by all lawful means. It seemed better business to increase expenses of various kinds (*e.g.* by provision for bonuses, for depreciation, etc.) rather than increase profits if two-thirds had to be surrendered to the State. The "profiteering" that arose out of the war was not due entirely to inflation, but it was magnified by the inflation. In many cases, however, the extra profit earned in the war was no more than fair economic remuneration for the services rendered, and in some cases the war profit was low compared with what might have been reasonably expected. In the modern industrial State enterprise cannot be made a matter of routine, and the so-called unearned increment is a necessary and cheap stimulus. In the war the need for speed and quick adjustments was overwhelming. If inflation and excess profits were requisite for the sake of speed, they may indeed be considered as evils but as necessary evils.

It was only after the war when the danger to the national existence had passed away that those who had suffered from the maladjustments of inflation began to complain. Industrial unrest became rampant in every country. The rise in nominal wages in the best of cases had not much exceeded the rise in the cost of living and in some cases it had fallen below. The rise in prices came to be greater in the conventional necessaries of the various classes than in the necessaries commonly so-called. The middle classes suffered far more than the lower wage-earners. A large part of them passed into the ranks of the new poor. It is the middle classes who provide normally the greater part of the brain power of the country in education and the professions and in the advancement of the arts and sciences. During the war they also had provided the greater part of the brain power for the armies and navies. It was galling to the new poor to observe that in the redistribution consequent on the rise in prices their position had been changed for the worse for the advancement of all kinds of "profiteers." Industrial unrest amongst the manual working classes spread to the brain-working classes. By the beginning of 1921 the new poor had been driven, partly by need and partly by disgust, to rebel against the high prices. There were new poor in all countries. A general crisis arose from the side of demand. The effect on wholesale prices was soon apparent in the fall in the index numbers. But for long there was only a partial readjustment in retail prices. In spite of the buyers' boycott retail prices moved but little. This was mainly due to the absence of *bona-fide* competition. The absence of competition spells the growth of monopoly.

During the war there was in the United Kingdom a great growth of trusts. The report of the Committee on Trusts tried to show that little of the rise in prices was to be attributed to the trusts, and that from the governmental standpoint in carrying on the war the trusts had been useful. It had been found more easy to bargain with a combine than with a number of separate bodies. This view of the trusts also found favour with people of socialist leanings, who thought that the growth of the trusts would be indirectly favourable to the socialistic ideal. When the trusts came to own the business of the nation, it would be time for the nation to own the trusts. Whether these favourable opinions of the growth of trusts were sound or not during the period of the actual war, the popular belief is that the fall in wholesale prices after 1920 was prevented from spreading down to the ordinary consumers largely by the influence of the great combines. No official information is, indeed, available to test this belief. In all times there has been a natural dislike of monopolies. This dislike, however, is largely founded on the belief that monopolies mean high prices. The growth of the trusts has been accompanied by a considerable dilution of capital and by a great rise in the rate of interest. The boom after the war was marked by excessive issues of new companies which were largely amalgamations. These amalgamations involved the payment of high interest to the constituent companies. New capital was attracted to provide the connective tissue for these constituent companies, and this again could only be attracted by high interest. The post-war boom was marked by a great increase of interest on industrial preferences and debentures. Here again was a reason for keeping up prices.

Deflation.—The question how prices were to fall when interest had to be higher leads to a consideration of deflation. Deflation, as the name implies, is the reverse of inflation. With this meaning it must involve the restoration of the effective working of the gold standard. An essential part of this process in the United Kingdom must be the actual convertibility of the currency notes. With this object in view Lord Cunliffe's Committee in their Final Report (Dec. 1919) recommended in England that the fiduciary issue of one year should not be exceeded in the next. Under this provision, which was accepted by the Government, the maximum fiduciary issue (*i.e.* the amount of Treasury notes in circulation not covered by gold) for 1920 was fixed at £320,600,000, and that for 1921 at £317,555,200. In the redemption account of the currency notes the amount of gold held remained at £28,500,000 from Dec. 1915 to 1921, but the gold had been supplemented by the addition of £19,450,000 Bank of England notes (up to Dec. 1920), these notes still being regarded as "as good as gold," owing to their being convertible into gold at the bank. The ratio of the gold holding (plus the Bank of England notes) to the currency notes rose from 8·3% in June 1919 to 14·5% in June 1921. In June 1920 the bank rate was raised to 7%, and this high rate was maintained with the view of limiting the expansion of credit. Consequent on the depression that followed the post-war boom the rate was lowered to 6% in June 1921, and to 5½% in July 1921. The high rate must have had some effect in checking speculation and bringing it to an end sooner than otherwise would have been the case. It had little or no effect, however, on the governmental borrowings, and from June 1920 to June 1921 the floating debt actually increased by some £79,000,000. The root cause of the inflation, as already explained, was the governmental expenditure of borrowed (or artificially created) money. It is plain that a high rate for money is not by itself sufficient to check governmental extravagance. Public resentment at the heavy taxation involved by the waste of public money began to be effective at the same time as the resentment against high prices led to a falling-off in demand.

It must be remembered that in case of need—and the Government of the day is the judge of the need—governmental borrowing would be resorted to. In case of need also the amount of currency notes requisite for the smooth working of the credit system must be provided. In case of a financial crisis the banks would always expect the restrictions on the fiduciary issues to be abandoned if necessary. Again, the increase of the reserve against the currency notes cannot of itself insure convertibility. The convertibility could only be effective when the foreign exchanges, especially with the United States, had been restored to the normal. It is not only the notes but all the other forms of credit which must be convertible into gold in case of need if the gold standard is to be effectively reëstablished.

Just as the consequences of inflation (*e.g.* the rise in prices and in nominal wages) must be distinguished from the inflation itself, so also with deflation. The great fall in the index numbers of wholesale prices (United Kingdom) after the spring of 1920 cannot be ascribed to deflation, because in fact there was no deflation in the sense of monetary contraction. The *Economist* index number for March 1920 was 325 (compared with 100 for July 1914), and in Dec. 1920 was 231, whilst from Dec. 1919 to Dec. 1920 the notes in Great Britain had risen from £464,900,000 to £509,859,000. During the same year the bank clearings had risen from £28,000,000,000 to £39,000,000,000. In the same way the bank deposits increased during the year. The banking number of the *Economist* on May 21 1921 showed that the rate of increase of deposits (other than in the Bank of England) was 5·7% in 1920 as compared with 18½% in 1919 and 16½% in 1918. The actual increase in 1920 over 1919 was £136,000,000 in bank deposits (other than those of Bank of England), £12,000,000 in currency notes and £41,000,000 in Bank of England note circulation. In 1921, however, up to end of April currency notes declined £30,000,000 and Bank of England notes £4,000,000 and the deposits of 9 joint-stock banks declined by about £120,000,000.

The want of correspondence between the index numbers of wholesale prices in the United Kingdom and the amount of money (notes and bankers' money) has been cited by some writers as destructive to the "quantity theory" of money. The quantity theory, however, in its modern extended form does not imply that immediately on every increase or decrease of money there must be a proportionate fall in prices. In either case there must be some lag. Even with great gold discoveries it takes time before the effect becomes marked, and similarly as regards a fall in the amount. The opponents of the quantity theory, who assert that the money in use (including notes and bankers' credits) must be adjusted or follow on the movements in prices, are in a worse case. How comes it that when prices have fallen so greatly there has not been a corresponding contraction of "money"? The truth is that the element of time must always be considered. An abnormal increase of money takes time for its full effects to be realized. Similarly any contraction will take time to operate. After a period of inflation when prices begin to fall there will be for a time an apparent abundance of money. An illustration may be taken from what occurred in the great fall in prices from 1873 to 1896. At the depth of the depression of prices there was apparently a superabundance of gold at the great banking centres, and the rates of discount were never so low. Yet the general fall in prices was ascribed to the fall in the production of gold and the greater demand for it for monetary uses consequent on the destandardization of silver.

Not only must time be taken account of, but the survey must be extended to world prices, especially with the restoration of international communications. Prices in the United States after the war had a dominating influence on world prices. In the United States convertibility between the various money forms was maintained during and after the war. The Federal Reserve Act, however, made it possible for a certain amount of gold to support a larger superstructure of credit. At the same time, through the influx of gold from Europe, the gold foundation was also greatly increased. The consequence was that from 1913 to 1919, whilst the physical volume of business (in the United States) increased approximately 9·6%, the monetary circulation increased 71%, and bank deposits 120%. At the same time the percentage of actual cash reserves held against deposits declined from 11·7 in 1913 to 6·6 in 1919. Through the concentration of gold a greater power of expansion was given to the credit within the country, whilst the complete abandonment of the gold standard in Europe took away the restraining effect of a possible foreign drain. In this way, in spite of convertibility being maintained in the United States, the gold standard had not the same limiting effect as before the war. This loosening of the restraints of the gold standard is in fact equivalent to a form of inflation, and American economists (*e.g.* Prof. Kemmerer) speak of American inflation during the war.

It follows from these considerations that the process of deflation must be slow. It seemed probable in 1921 that for a considerable time the fall in prices would continue in the United Kingdom to precede the process of deflation.

Similar reasoning applies to wages and employment. With the great fall in prices money wages must fall, because in the last resort wages are paid out of the price of the product when there is a definite product, whilst wages that are given for services that perish in the act are proportioned to the corresponding disutilities involved as compared with the work of the product-makers. If the fall in prices in the United Kingdom is not due to deflation in the sense of monetary contraction, the fall in wages cannot be ascribed to that cause. When the fall in wages is not readily adjusted to the fall in prices there must be an increase of unemployment. But this unemployment cannot be ascribed to deflation.

The process of deflation must begin with a stoppage of inflation, and the effective prevention of the outbreak of renewed inflation. The essential condition is the stoppage of governmental expenditure that depends on borrowed money or the creation of artificial credits. In other words, the gold standard must be effectively restored.

The assumption that a fall in prices must of necessity be accompanied by a fall in real wages and in employment is not confirmed by the experience of the last quarter of the 19th century. Real wages increased during the great fall in prices, and complaints began to be made of the fall in real wages when prices began to move upwards. The charts constructed by Mr. Kitchin (*Times Financial and Commercial Review*, 1921) show that there is no close correspondence between movements in employment and movements in prices under ordinary normal conditions. The great and rapid increase in unemployment in the United Kingdom in 1921 might be partly ascribed to the stoppage of the progress of inflation and the check to speculation.

The fall in prices and in employment may also be partly ascribed to the repudiation of contracts by foreign merchants when they were seen to be unprofitable. This facile repudiation of bargains is symptomatic of the laxity of moral fibre that follows on inflation. This weakening of business *moral* makes it more difficult for governments to meet the obligations of public indebtedness. There has been a revival of old ideas on lessening the burden of public debts by disguised repudiation. It is said that the debts were incurred in depreciated money and therefore ought to be redeemed in depreciated money. It is proposed to stabilize the present level of purchasing power by changing the unit of value. How far such partial repudiation is necessary or desirable for any particular country (*e.g.* Germany) must be decided by the particular country. Even before the war, the very moderate proposals for international bimetallism were not found to be practicable.

The essential facts of the situation are that the United States and Japan have effectively kept to the gold standard, *qua* freedom from specific depreciation, and the departure by the United Kingdom as compared with the United States has not been so great as to make the return to the gold standard impracticable. It seems then that world prices will be reckoned on the gold standard, and the national prices of other countries will in the course of time be adjusted to the specific depreciation of their currencies in terms of gold. International trade in the last resort must be carried on in terms of commodities and services. A country cannot for an indefinite period have a stimulus to its export trade simply through the specific depreciation of its currency. So long as the specific depreciation (*e.g.* of the German mark) is greater than the general depreciation as regards purchasing power of labour and other things within the country itself, so long excess profits are earned on exports. But such a condition is obviously unstable. The general theory was explained by Prof. J. S. Nicholson in a paper (Jan. 1888) on the "Causes of Movements of General Prices," republished in the *Money and Monetary Problems*. The argument was primarily applied to the case of gold and silver, and the consequences of the great depreciation of silver relatively to gold, but it was shown that, *mutatis mutandis*, the same reasoning applied to gold and paper. The silver-standard countries found it desirable to adopt a gold or gold-exchange standard, and by analogy the paper-standard countries at present may be expected in time to revert more or less completely to the gold standard.

The gradual return to the gold standard will no doubt be accompanied by a general fall in prices. The fall, which was very rapid in 1920, slackened by the middle of 1921 but seemed likely to be resumed. One obstacle to the continued fall in wholesale prices and the spread of the fall to retail prices was the action of combination in restraint of competition. It is this reliance on combination to keep up prices which is the great obstacle to the policy of ensuring *de facto* deflation by increasing the amount of goods so as to use the superabundant money. When the world is suffering from the exhaustion of the World War and when production ought to be increased as much as possible to restore the pre-war standards of material comfort, it is paradoxical that limitation of production should be anywhere in favour. It might seem to Labour that limitation of hours or of days is a remedy for unemployment (the "lump of labour" theory), and it is possible that in some cases Labour and Capital could combine to insist on monopoly prices. The great obstacle, however, to the success of any such policy of artificial limitation to keep up prices is the difficulty of making all the combines world-wide in their reach.

LITERATURE.—There is already a large literature dealing with inflation and its consequences during and after the World War. No doubt, as after the Napoleonic period, there will be prolonged controversy on the best methods to be adopted in restoring economic and financial equilibrium. The Report of the Committee on Currency and Exchange, which was unanimously adopted by the delegates of the 39 nations present at the International Financial Conference at Brussels (Oct. 1920), confirmed the opinions expressed in the report of the Cunliffe Committee, which was drawn up with special reference to the United Kingdom. The Brussels report may be divided into four sections. The first deals with the meaning, causes and progress of the inflation in the World War, and points to the necessity of stopping the growth of inflation by the limitation of governmental expenditure to revenue and the limitation of the creation of credit to *bona fide* economic needs. The second section calls for increased production. In this connexion the abandonment of governmental control is advocated, but no reference is made to the dangers of limitation of production by the great combines. The third section recommends the return to the gold standard, but the opinion is given that it is useless to attempt to fix the ratio of existing fiduciary currencies to their nominal value. In the fourth section it is stated that deflation must be gradual and that no useful purpose could be served by any attempt to establish an international currency or unit of account to impose artificial control on exchange operations. Supplementary volumes give details affecting various countries of the evidence on which the Report is based.

In the *Financial and Commercial Review* for 1920, issued by the Swiss Banking Corporation, convenient tables are given on p. 5 of the index numbers of the principal countries of wholesale and retail prices (England, France, the United States, Italy, Japan and Germany), and on p. 13 of the gold reserves and paper circulation of 17 principal countries for 1914, 1918, 1919 and 1920.

The following are useful works of reference:—*The Paper Pound of 1797–1821*, a reprint of the Bullion Report of 1910 with introduction by Edwin Cannan (1919); J. S. Nicholson, *Inflation* (1919); R. G. Hawtrey, *Currency and Credit* (1919); E. W. Kemmerer, *High Prices and Deflation* (1920); the four Reports of Section F of the British Association on *Currency and Credit in the War*, edited by Prof. Kirckaldy, 1916–20, have been collated and brought down to the middle of 1921 in one volume entitled *British Finance, 1914–1921*, by Mr. A. H. Gibson; Irving Fisher, *Stabilising the Dollar* (1920); J. S. Nicholson, *War Finance* (2nd. ed. 1918); J. M. Keynes, *Economic Consequences of the Peace* (1920). The work by Yves-Guyot and A. Raffalovich, *Inflation and Deflation* (1921), gives in short compass a very valuable account of former periods of inflation beginning with John Law, and also gives in a short form the leading facts of the actual progress of inflation in the various countries in the World War. The writers reassert the classical opinions on the evils of inflation and advocate as rapid deflation as possible. H. S. Foxwell, *Papers on Current Finance* (1919), criticizes the generally accepted theories of inflation. *The Review of Economic Statistics*, issued monthly by the Harvard Committee on Economic Research, gives not only a general analysis of business conditions with probable forecasts (somewhat on the analogy of meteorological observations and deductions) but provides in a convenient form the statistics of changes in production and in financial conditions. (J. S. N.)

INFLUENZA (*see* 14.552).—Under the conditions of existence that prevail in the civilized communities of to-day, the human respiratory tract must necessarily encounter a large variety of pathogenic bacteria and a great deal of irritating particulate matter. Such exposure is inevitable in factories, schools, trains, 'buses and, indeed, in all forms of social intercourse within confined spaces. Under these circumstances it is not to be wondered at that acute catarrhal affections of the respiratory mucous membranes, accompanied by pyrexia, should be common. To such affections the name "influenza" is frequently applied; and it is this loose employment of the word that is responsible for much of the confusion that exists in statistical records.

The explosive pandemic of influenza that burst upon the world in 1918 was something quite different from the sporadic pyrexial catarrhs above referred to, although the individual clinical picture, when uncomplicated, was much the same. In the absence of exact knowledge of the causative agent and in view of the fact that the individual clinical picture is such as may follow many different bacterial invasions, it is impossible, at present, to formulate a completely satisfactory definition. Here the term "influenza" will be used to imply "a pandemic outburst of disease characterized, clinically, by a rapid course, catarrh of the respiratory tract, pyrexia, and some degree of prostration; and, epidemiologically, by a tendency to occur in several successive waves at short intervals of time." This provisional definition is applicable to the visitation of 1918–9, to the outbreaks in 1890–1, in 1847–8, and perhaps to those in 1831–3–7, in 1803, and to other outbreaks of respiratory catarrh more remote in time and about the distribution of which less is known. It is *not* applicable to the sporadic cases or even the localized epidemics of respiratory catarrh to which the name influenza has been so often applied, especially in the years following fairly closely upon pandemic outbursts. In the years 1908, 1909, and 1915, for instance, unusually large numbers of deaths were returned in London under the heading of "influenza." For the average Londoner, however, there was no influenza in these years; but the average Londoner and, indeed, the average inhabitant of Europe, Asia, Africa, and America, is quite alive to the fact that influenza prevailed in 1918–9. Statistical records of influenza mortality are apt to be very misleading as medical men often apply this name to fatal respiratory diseases of indeterminate symptomatology. When the real influenza comes, the public is at once aware of the fact because nearly everyone either gets infected or sees friends or relations infected within a very short space of time.

The Influenza Pandemic of 1918–9.—This pandemic swept over the world in three successive waves, the first appearing quite suddenly in May and June 1918, the second starting at the end of Sept. or early in Oct. and waning in Dec., and the third wave, less uniform in character, appeared early in March 1919.

First Wave.—This outbreak, attributed by France to Spain, by Spain to France and by America to eastern Europe, seems to have appeared almost simultaneously amongst the nations of the "Entente" arrayed against the enemy on the western front, and amongst all those communities in intimate touch with them. In the armies of the Entente in France, Belgium, and Italy; in the military camps in England and America; in the civilian populations of England, France, Italy, Spain, and Portugal; in transports at sea; in the closely linked theatres of war of Salonika and Egypt, and in Gibraltar, Malta, and India itself, the outbreak of influenza showed the explosive character that is only possible for a highly invasive infection assisted by conditions of swift inter-communication, such as obtain in modern war.

The invisible barriers of hostility or neutral exclusion seem to have imposed a slight check on its spread so that this first wave made its appearance a little later amongst the Central Powers and their neighbours. It was not until early in July that it attained its full proportions in Germany, Austria, Norway, Sweden and Denmark, Holland and Switzerland. In several large areas of the world's surface, this first wave seems to have been absent or so slight as to have escaped record. In the South American republics, in Bermuda, the British West Indies, the Azores and in the islands on the Pacific, the summer of 1918 seems to have passed without an influenzal outbreak. The same appears to be true of Australia and New Zealand, though cases are said to have appeared in the latter in Aug., the harbingers, perhaps, of the autumn, rather than the first manifestations of the summer, wave.

This first wave passed rapidly, so that a "frequency curve" by weeks, in which the incidence in the worst week is taken as 100%, shows a steep ascent to a maximum, followed by an equally steep and almost symmetrical fall, the whole episode passing within about five or six weeks. So benign was the type that many cases among soldiers at the battle-front escaped record, as the men never "reported sick" but merely rested for a day or so in their units, and this was fortunate as the army hospitals were soon overcrowded. The death-rate was inconsiderable, but there was an ominous tendency to a higher mortality amongst the later cases, just before the wave came to an end, seeming to suggest an increase in virulence. The clinical picture cannot be better summed up than in the words of a consultant physician in France who, describing the first batch of cases, exclaimed "it is like a mild attack of measles without a rash." Respiratory catarrh, congested conjunctivæ, headache, lassitude, pyrexia of short duration, a feeling of prostration with the return of temperature to normal, and then a rapid recovery of health; such was the course in the vast majority of the cases during the first wave. Complications were almost unknown during this outbreak; but a few cases developed broncho-pneumonia or hæmorrhagic œdema of the lungs towards the end of the wave, and it was these cases that sent up the case-mortality. In all these characters, the first wave closely resembled the outbreak of 1890. In one respect it showed an interesting difference. Whereas in 1890 the death-rate was greatest amongst the middle-aged and elderly, in 1918 the chief sufferers were amongst the "young adult" groups.

Second Wave.—Towards the end of Sept., or early in Oct., the second wave suddenly gathered force and swept over the world; the crowning tragedy of so many tragic years. Soldiers, miraculously spared in battle and for whom hope was now dawning with the promise of victory; youths at school or college, to whom the future might look to fill the gaps of war in years of peace: these were the harvest chosen for the scythe of the Angel of Death. For the character of the pandemic had changed and the benign attacks of the summer now gave place to the terrible scourge of the autumn outbreak. Geographically, this wave was almost universally felt, and it seemed to mount up simultaneously throughout the world. St. Helena is said to have escaped, Mauritius, too, had a reprieve; and it appears to be true that the quarantine measures applied by Australia were successful for the moment, but throughout Europe, America, Asia and Africa, this fatal pandemic held undisputed sway.

The upward curve of morbidity was almost precisely similar to that of the summer and the maximum was reached as quickly as in the previous wave, but the fall was much slower and less regular. The outstanding difference between the two waves was the marked tendency to pulmonary complications and the high death-rate of the second. The singularly uniform syndrome of the summer epidemic gave place, in the autumn, to several varieties of clinical picture depending on varying combinations of several factors, amongst which might be reckoned the virulence of the microbic invader, the resistance of the patient, the nature of the bacterial flora of his respiratory tract, and environmental conditions such as occupation, wages and housing. As a rule, the attack was ushered in by the catarrhal and pyrexial symptoms noted in May and June. In many cases, especially where circumstances permitted of immediate rest and treatment, the disease took a favourable course towards recovery, although prostration was nearly always a more marked feature than in the summer. In others, the story was different. The early pyrexial catarrh was sometimes followed by intense toxaemia leading so rapidly to a fatal issue that there was no time for pulmonary complications to develop. But in a very large number of cases the lungs became severely affected and the patient passed into a state of anoxaemia recalling that produced by exposure to the "pulmonary irritants" of gas warfare. But there was a formidable difference between the two conditions. While the "phosgene" patient had to deal with a sterile exudate, evoked by a chemical irritant and capable of rapid absorption if vitality was maintained, the lungs of the influenza patient were charged with an exudate evoked by a living virus which had already overcome tissue resistance and could offer to "secondary invaders" conditions of symbiosis favourable to their growth. Here lay the danger. The virus of influenza could open, as it were, the door to the *streptococci*, *pneumococci*, *staphylococci* and other organisms normally held within safe numerical limits upon the respiratory mucous membranes.

Those who wish to be fully informed of the clinical features of this phase of the disease cannot do better than turn to the admirable account of it given by Dr. Herbert French in the "Report on the Pandemic of Influenza, 1918–9," published by the British Ministry of Health in 1920. The appearance of the patient was often very characteristic. Lying quietly in bed without any of the agonized and restless dyspnœa of the "chlorine-gassed" case, he might seem to the superficial observer to be not very ill. But a closer examination would note the dull cyanosis of the lips and ears, the livid pallor of the face, the rapid shallow respiration; while the pulse, though sometimes good, was often "running" and feeble, indicative of toxic action on the heart muscle. In such a case wisdom lay in sparing the patient the fatigue of a comprehensive examination of the chest. The mere effort of sitting forward or turning over, to allow of stethoscopic investigation of the bases of the lungs, was sometimes enough to turn the scale against the sufferer. Where, however, an examination was carried out, it frequently afforded but little information beyond the fact that there was a marked diminution of the breath sounds and a loss of the vesicular quality of respiration. The *post-mortem* appearances, while tending to have certain basal characters in common, varied considerably with the nature of the "secondary invaders" and other factors. In nearly all cases, there was a hæmorrhagic tendency not often seen in other acute lung affections, and this sometimes amounted to a hæmorrhagic œdema involving the greater part of both lungs. "Wet lungs," "dripping lungs," were expressions frequently heard in the *post-mortem* room. Areas suggesting hæmorrhagic infarcts with their bases extending under the pleura were often noticed. The cut surface of the lungs showed, as a rule, peri-bronchiolitis and patches of broncho-pneumonia with a general state of œdema throughout the parenchyma of the lung; or a whole lobe might give the appearances of red or, in older cases, grey hepatization. (For a detailed account of these appearances, together with their morbid histology, see the article by Maj. Tytler, C.A.M.C., in "Special Report Series No. 36" of the Medical Research Council, 1919.)

Third Wave.—The third wave had no distinctive characters. It tended to resemble the first wave rather than the second, though pulmonary complications and fatal cases were fairly numerous.

Etiology.—As to the causative organism of influenza we remain, after the greatest pandemic in history, still in doubt. This is no reproach to the science of bacteriology. A moment's reflection will show that research, to give conclusive results, must be carried out during the outbreak at a moment when the "pandemic" character gives the stamp of certainty to the diagnosis and the infectivity of the cases is at its height. But so swift is the passage of the wave that it is over by the time that the necessary workers, equipment and accommodation for investigation have been provided. Before 1918 few doubted that the *Bacillus* *influenzæ* (Pfeiffer) was the cause of the disease. The year 1920 found expert opinion sharply divided into two schools, one upholding the etiological significance of Pfeiffer's bacillus, the other maintaining that the evidence pointed rather to an invisible "filter-passing" virus as the causative agent. This question is ably discussed by Sir Frederick Andrewes, F.R.S., in the Report of the British Ministry of Health (1920) above referred to.

Recent research has proved that there are several serologically distinct organisms included under the heading of *Bacillus influenzæ* and that these vary in virulence for experimental animals. It seems beyond question that pathological changes resembling those of human influenza may be produced by the inoculation of some of these strains. The same, however, can be claimed for filtrates of body fluids, exudates and secretions from human influenza cases, and also for "Nogouchi" cultures from these. The liability of laboratory animals to lung injuries during experimental manipulation introduces a source of error that is very difficult to exclude, and that is equally operative in experiments with Pfeiffer's bacillus and with "filtrates." No final answer can be hoped for until a future outbreak finds us prepared to start our investigations *before* the crest of the wave, though much spade-work can and should be done in non-epidemic periods to narrow down the field of inquiry. One thing is certain: that, with adequate technique, Pfeiffer's bacillus can be isolated from almost every case of influenza. A rôle of vast importance in the production or accentuation of pulmonary complications is played by "secondary invaders," the bacterial flora of the normal respiratory tract, a potentially pathogenic group well calculated to exploit the tissue injuries induced by the influenzal virus. These bacteria were found to vary in different areas; but certain of them, notably the *streptococcus mucosus*, the *streptococcus hæmolyticus*, the *pneumococcus* and the *staphylococcus*, were almost universal. Rarer types were *meningococci*, *pneumo-bacilli*, *pyocyaneus* and others. The vast numbers of these organisms that sometimes invaded the injured lung tissues must be seen to be believed. It was common to find them in the blood-stream as "terminal infections" and they were cultivable from the heart-blood after death.

Epidemiology.—In the absence of final knowledge as to the causative agent, many points of fundamental importance still remain obscure. Was the pandemic of 1918–9 a sudden awakening to virulence of some germ already widely distributed in western Europe or was it a "new arrival" operating in "virgin soil"? In spite of the weighty arguments for the former view set forth in the Report of the Ministry of Health, we incline to the latter. But the question arises: "Where could such a germ come from?" It seems justifiable to assume that previous pandemics were due to the same agent. No doubt, somewhere, from one pandemic to another, some human individual or chain of individuals carries on the virus until the time shall be ripe for a fresh outbreak.

It is to be noted that the first wave coincided with the arrival of the first large drafts of American troops in Europe. These young contingents, gathered from the remotest ends of a vast continent, meeting for the first time with the dwellers of far cities or countries, each group harmlessly infested with its familiar bacterial commensals but unprotected against those carried by its new neighbours, these freshly improvised troops must have brought into common circulation pathogenic strains that had long remained dormant in isolated and relatively immunized communities. The crowded troopships afforded just the incubation places that would permit of the maturation of such an infection; and Europe, with its crowded concentration areas and billets offered an unequalled opportunity for its spread. The last influenzal pandemic had occurred just 28 years before. There might be a few scattered "carriers" and perhaps some residual immunity among the middle-aged and the elderly; but the adolescents and the young adults would, in 1918, be "virgin soil." It was just these lower age-groups that suffered most.

How, then, explain the second wave with its greater severity? —and the third? Surely, if immunity played a part, these waves would have been much less extensive, much more benign, and confined to those persons who had previously escaped. These are good, but not final, arguments. It is at least possible that the passage of the first wave might leave behind it a virus of exalted virulence, many "carriers" and many "allergic" subjects whose behaviour to reinfection might betray the phenomena of hypersensitiveness of the respiratory surfaces and a tendency to inflammatory exudates on contact with the air-borne virus. Under such conditions a fresh outbreak would be specially likely to arise in the fall of the year, a period of rapid fluctuations of temperature when the chill evenings drive men into the warmth and close contact of crowded dug-outs, shelters and billets.

Such a theory, while presenting many difficulties, has many points in its favour as well. We find it impossible to believe that the so-called "influenza" to which deaths were attributed every year between 1892 and 1918 was the same disease as the fulminating pandemic that followed. Apart from the extreme contrast in invasive power, a glance at the diagrams of Dr. T. H. C. Stevenson, illustrating the distribution of "influenza" mortality by age-groups (Proceedings of the Royal Society of Medicine, Jan. 1919), will suffice to emphasize the essential differences between, let us say, the graphs for 1917 and 1918, the one showing a preponderating death-rate amongst the old, the other, amongst the young. Such differences can hardly leap into existence within a few months. The known facts of increase and diminution of bacterial virulence lend no support to the idea that such a vast alteration is probable or even possible in so short a time.

Acquired Immunity.—Many observers have brought forward evidence indicating that morbidity and mortality were less marked, in the second wave, amongst those who had been attacked in the first. The evidence bearing upon this point has been thoroughly analyzed in the Report of the Ministry of Health, chap. vi. (1918–9). After a careful examination of the facts and figures at their disposal, the authors state that "these data show a considerable immunizing power in the summer attacks and we conclude, although with natural hesitation, that it is probable, on the average, that an appreciable degree of active immunity was attained by those who passed through an attack in its first and mildest manifestations."

This is not a very positive expression of opinion but all who study the figures will agree that the authors show a wise reticence. The evidences for immunity are of varying efficiency in different places, and the populations of many areas show no tendency at all to acquired resistance to infection as judged by a comparison between the behaviour of those attacked and those missed by the first wave when confronted by the second.

We believe these data to be unsound as a basis for comparison. It is highly probable that many persons were infected during the summer and yet failed to show appreciable illness. The vast difference that may exist between the numbers *infected* and the numbers *affected* by a bacterial invasion can be judged from what we know of the meningococcus and the diphtheria bacillus. And yet these non-pathogenic infections may confer active immunity as we know from the "Schick Reaction" in the case of diphtheria and from many other examples as well. It is very likely that the mere fact of a previous "attack" is a fallacious guide in classifying populations for inquiry as to their relative immunities. After all, the best evidence of the acquisition of immunity is to be found in the phenomena of natural recovery of the individual and of the disappearance of pandemic waves from the community. The fact that these groups of pandemics are separated by long and fairly regular intervals, as a rule about 20 years, is not without significance in this connexion, since at least this period might be necessary to reduce the residual immunity from the last pandemic to an ineffective level.

Artificial Immunity.—No vaccine can be entirely satisfactory unless it is known to contain the virus or germ of the disease in question. The vaccine issued by the War Office and afterwards by the Ministry of Health was confessedly of a provisional nature since the causative agent was still uncertain. Its formula was as follows:—

	Per cub. cm. of vaccine
Bacilli influenzæ (Pfeiffer)	400,000,000
Pneumococci	200,000,000
Streptococci	60,000,000

Unless Pfeiffer's bacillus be accepted as the causative agent, this vaccine must be described as consisting entirely of the "secondary invaders." As such, its issue was entirely justifiable and its effects were such as might be expected: satisfactory in diminishing complications and mortality but practically *nil* in preventing the disease.

Vaccine, then, cannot, as a prophylactic, help us much at present; nor can we, in the light of recent experience, hope for great results from general measures of hygiene. We have just passed through "one of the great sicknesses of history, a plague which within a few months has destroyed more lives than were directly sacrificed in four years of a destructive war." Lacking exact knowledge, we are vulnerable, and our watchword must be "Research." (S. L. C.)

INGE, WILLIAM RALPH (1860–), British divine, was born June 6 1860 at Crayke, Yorks., the son of William Inge, sometime provost of Worcester College, Oxford. He was educated at Eton, and at King's College, Cambridge, and won numerous honours and prizes during his university career. From 1884 to 1888 he held an undermastership at Eton, and during the last two years of that time was fellow of King's College, Cambridge. From 1889 to 1904 he was fellow of Hertford College, Oxford, Bampton lecturer in 1889, and Paddock lecturer in New York in 1906. From 1905 to 1907 he was vicar of All Saints', Ennismore Gardens, until his appointment as Lady Margaret professor of divinity at Cambridge. In 1911 he became dean of St. Paul's, where his sermons attracted great attention owing to their original power, their caustic criticism of the tendencies of modern life, and a somewhat pessimistic tone which earned for him the sobriquet of "the gloomy dean."

Among his numerous historical and theological works may be mentioned *Society in Rome under the Caesars* (1886); *Christian*

Mysticism (1899); *Types of Christian Saintliness* (1915); *Philosophy of Plotinus* (1918); *Outspoken Essays* (1919), and school-books.

INGLIS, ELSIE MAUD (1864–1917), British physician and surgeon, was born at Naini Tal, India, Aug. 16 1864, one of the nine children of John Forbes David Inglis, of the East India Co., and Harriet Thompson. After a childhood spent in India and Australia, the family settled in Edinburgh in 1878. She pursued her studies at the school of medicine for women in Edinburgh and at St. Margaret's College, Glasgow, graduating M.B.C.M., and took up private practice in Edinburgh in 1895. She was instrumental in establishing a second school of medicine for women in Edinburgh and doubling the accommodation of the Edinburgh Bruntsfield hospital and dispensary for women and children. In 1901 she raised money to open the hospice in the Edinburgh High Street as a hospital for women, with the double purpose of benefiting the poor and providing greater facilities for the training of women doctors. Single-handed she developed an indoor and district maternity service and trained her nurses herself. In 1906 the women's suffrage societies of Scotland were formed into a federation, of which she became honorary secretary, and for the eight remaining years before the war she was one of the most prominent suffrage workers in Scotland. In Aug. 1914, inspired by her, a special committee of the Scottish federation of women's suffrage societies, aided by the N.U.W.S.S., undertook the organization of the Scottish women's hospitals for foreign service, and raised £449,000. She first went to Serbia in April 1915 to relieve Dr. Soltau at Kragujevatz. In Nov., when Serbia was invaded by Germans, Austrians, and Bulgarians, the Scottish women retreated to Krushevatz, and Dr. Inglis, Mrs. Haverfield and a few others remained behind till Feb. 1916 as prisoners of the enemy to care for the Serbian wounded. In Aug. 1916 she took a unit to the Dobrudja for service with the newly formed Serbian division attached to the Russian army. She died at Newcastle-on-Tyne Nov. 27 1917, the day after her return from Russia with her unit and the Serbian division. The Serbian general headquarters dedicated a fountain to her at Mladanovatz in her lifetime; and she was given the Order of the White Eagle, Class V., and the Order of St. Sava, Class III.

See *Dr. Elsie Inglis*, by Lady Frances Balfour (1920).

INGRAM, ARTHUR FOLEY WINNINGTON (1858–), English divine, was born in Worcs. Jan. 26 1858, and educated at Marlborough College and Keble College, Oxford. His first curacy was at St. Mary's, Shrewsbury, in 1884; in 1885 he became private chaplain to the Bishop of Lichfield and in 1889 head of the Oxford House, Bethnal Green, where he gained much popularity owing to his devoted work among the East End poor. In 1897 he was appointed suffragan bishop of Stepney, which carried with it a canonry in St. Paul's. In 1901, after the death of Dr. Mandell Creighton, he was nominated by the Crown to the see of London. The appointment, which had hitherto been reserved for ecclesiastics of marked ability as scholars or administrators, excited much comment; but it was undoubtedly popular, and this popularity was confirmed when it was realized that the bishop intended to carry on in his new sphere the democratic traditions of his East End activities. As a preacher he proved very successful with simple people, and during the World War he threw himself into the work of providing religious instruction for the fighting men, visiting both the French front and the Grand Fleet.

INLAND WATER TRANSPORT.—Before the development of the great railway systems in the 19th century, warfare in western and central Europe depended very largely for its prosecution upon the aid of inland water transport. Even the creation of a good road-network in the late 18th century did not dispense armies from the necessity of using water lines for their heaviest stores, notably siege artillery and its ammunition, while in America, and generally in the less well-developed countries, water routes remained of first-class importance for supply services until railways became available. The part played by the Mississippi in 1862–3 was quite as important as that played by the Scheldt in Marlborough's campaigns or the Niemen and Vilui in 1812.

In western Europe the rapid development of good roads and railways naturally tended to put inland water transport into the background, though in most campaigns it was employed to some extent as an auxiliary and for certain special services for which it was peculiarly suited,—such as the transport of wounded to a base or home, or that of siege guns of unusual weight. But the course of events in the World War, and especially the advent of trench warfare, which demanded enormous quantities of what would formerly have been called siege stores, soon imposed as a necessity the organization of inland water transport on a very large scale. The following account deals with the British I.W.T. organization during the war.[1]

Personnel of the British I.W.T. service were employed at home, in France and Belgium, in Italy, in the Macedonian theatre of war, in Egypt, in Mesopotamia, on the Caspian, in East Africa, and in northern Russia, but it was only on the western front, in Egypt and in Mesopotamia that transport on inland waterways was effected on any considerable scale.

Great Britain.—In Dec. 1914 three small establishments—eventually concentrated at Richborough—were formed to supply personnel and material for the I.W.T. service then being constituted for work on the waterways of northern France and Belgium. From Sept. 1916 the growth of Richborough was very rapid; it became the headquarters of the cross-Channel barge service and the scene of numerous other activities. The cross-Channel barge service worked by I.W.T. personnel was instituted to save shipping and to relieve the congestion in French ports. Abroad cargo was being discharged from sea-going vessels to barges for transport to inland depots; if barges capable of passing up the continental canals could be towed across the Channel the demand for ordinary shipping would be reduced, and the pressure on the berth accommodation at the overseas ports lessened. The scheme had other advantages as well; barges, because of their shallow draught, were practically immune from torpedo attack; the loss of a barge from enemy action or any other cause would be less serious than the loss of a ship; the labour of trans-shipment at the overseas ports would be saved.

The dimensions of the type of barge built for the service were governed by the dimensions of the continental canals (*see* under France and Belgium below), but as when crossing the Channel a greater free-board was necessary than when navigating the inland waterways the carrying capacity when crossing the Channel was limited to 180 tons. Towards the end of the war a number of 1,000-ton barges were being brought into use; these could not enter any but the largest inland waterways, but at the overseas ports they could be discharged at berths unsuitable for sea-going ships, and could thus secure most of the advantages which the service was intended to afford.

The service commenced in Dec. 1916, and in May 1917 the returning barges began to be used to convey traffic from France to England. The growth of the traffic is shown in the following table.

Growth of Traffic.

Month	Barges in service		Average tonnage carried per week		Traffic to inland destinations		
	280-ton	1,000-ton	Outwards	Homewards	Percentage of total	Average load per barge in tons	Turn-round in days
Jan. 1917 . .	23	. .	1,904	. .	100	114	12
June 1917 .	105	. .	10,625	2,182	90	154	10
Jan. 1918 .	161	. .	11,930	1,778	83	123	12
June 1918 .	. .	. .	21,972	4,361	69	125	9
Nov. 1918 . .	232	10	11,898	2,013	77	122	15
Dec. 1918 .	245	10	7,688	2,118	73	134	22

The total amount of traffic exported from the institution of the service until the end of Dec. 1918 amounted to 1,415,271 tons, of which 1,083,951 tons, or more than three-quarters, passed through the ports direct to inland destinations. More than half of the total was ammunition; bulky stores like hay, vehicles and air-force material were the next largest consignments. The limitations imposed by bridges over the canals on the height to which barges can be loaded account to some extent for the low average load of barges proceeding inland. The tonnage imported from France during the same period amounted to 200,049 tons. By far the greatest part of this traffic consisted of empty ammunition boxes and cartridge cases for re-use and of guns for repair, but many varieties of salvage were carried as well. Richborough was not the only port used, a small proportion of the traffic being to and from Purfleet and other ports on the Thames and Medway. On the French side the only ports with inland waterway communications were Calais and Dunkirk in the N. and ports on the Seine farther south.

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[1] It should be mentioned that the I.W.T. authorities and their organization became by force of circumstances responsible for a variety of activities not strictly connected with transport over inland waterways. These activities are not dealt with here.

The I.W.T. service in Great Britain also undertook a certain amount of transport over British canals, but the total traffic moved during 1918 only amounted to about 150,000 tons, of which the transport of oil on the Forth and Clyde canal accounted for 130,000.

The towage of craft from home to the various theatres overseas demanded of the I.W.T. directorate careful organization, and involved the solution of many problems; during 1917 nearly 700 shallow-draught river craft were despatched to Mesopotamia alone.

France and Belgium.—The extensive system of waterways in France and Belgium naturally suggested the use of I.W.T. for military purposes, and a beginning was made in Dec. 1914 by the hiring locally of a few barges for loading with supplies. In Jan. 1915 an establishment was sanctioned and some 36 craft of various kinds were ordered. The service eventually undertook much miscellaneous work, but at the outset its main work consisted of the carriage inland of traffic of no great urgency, such as forage, timber, bricks, stone, sleepers, trench material and ammunition, a large proportion of the traffic being received on barge direct off ship. Another branch of its work was the carriage in ambulance barges from the front of seriously wounded patients unable to stand the jolting inseparable from a journey by train. Another development was the provision of water-supply units, each of six barges, equipped with plant for treating water of doubtful or dangerous quality by filtration and chemicals, thus ensuring a supply of potable water at any point on the inland waterways. Each unit was in charge of an expert chemist and was capable of dealing if need be with poisoned water supplies. A number of floating bridges were constructed so that communication could be opened rapidly across any waterway. Provision was also made for the reopening to navigation of waterways previously in enemy hands, a number of lock gates of special design being among the materials provided for use when required.

During the later stages of the war the necessity of relieving the strain on the French railways led to increased activity on the part of the I.W.T. service. In the winter of 1916–7 its construction branch built or enlarged eight large wharves. It also constructed its own workshops and dry-docks for the repair and maintenance of craft. On the German retreat in March 1917 it repaired and reconstructed the banks, locks, sluices, and removed the obstructions, on the recovered portion of the Somme; after the battle of Arras it reopened the river Scarpe to navigation between Arras and Fampoux. Both in 1916 and 1917 a large amount of pumping was done in connexion with strategic inundation and drainage.

Although the whole of the French and Belgian waterways are linked up, the connexions between those in the N.W. and the remainder were in the hands of the enemy throughout the war, and the only means of communication between the canals in the N. and the Somme and the Seine was by sea. During 1918 a regular service of coastal barges was instituted to ply between the northern canals and the Seine. Much work was done for the French and Americans, coastal trips being worked for the former and craft with crews being lent to the latter to ply on the Seine.

The waterways used varied in size from small creeks up to ship canals, but what may be considered the standard canal was 2 metres deep with 3·70 metres head room under bridges, locks 38·84 metres long and 5·20 metres wide. The standard type of barge in use in northern France has a draught laden of 1·80 metres, beam 5 metres and length 38·50 metres; the maximum height above water-level is 3·20 metres, giving a margin of ·50 metre under bridges to allow of slight variations in the water-level in flood time. The carrying capacity is 280 deadweight metric tons, but the space below hatches (being only about 300 cubic metres) governs, in the case of cargoes of light substances, the tonnage that can be transported, the very limited head room available preventing the carriage of cargo above deck. The British fleet included many self-propelled barges; these carried only 130 tons, but saved time at locks by not having to await the passage of the rest of a convoy. Navigation is not practicable in the dark, and may be interrupted by floods, ice, gales, or fog.

Egypt.—Up to the beginning of 1917 such military water transport as was used was controlled by the Royal Army Service Corps. In March of that year an I.W.T. organization was set up of which the principal objects were to relieve the pressure on the railways, to undertake lighterage at the ports of Alexandria and Port Said, and to eliminate competition between Government departments for craft.

The chief waterways operated on were those of the Delta, the Suez Canal, the Ismailia Canal, and the upper Nile, while the bulk of the craft employed were hired locally, only some 50 tugs and barges being obtained by the I.W.T. service from Mesopotamia and England. The principal traffic carried was grain and forage, but a considerable number of passengers were carried as well. Services were run between Cairo and Kantara, Cairo and Alexandria, and Assuan and Cairo. The lighterage work at the ports increased steadily, and by the last quarter of 1918 was greatly in excess of the inland water transport work.

Mesopotamia.—In Sept. 1916 the control of river transport in Mesopotamia, up till then in the hands of the Royal Indian Marine, was transferred to the War Office and an I.W.T. organization was set up. The great length and vital importance of the waterways, their physical conditions, the great distance of the theatre of war from home and the lack of suitable personnel, materials and appliances in the theatre resulted in the growth of the I.W.T. service to a size unequalled in any other theatre, and in a much wider range of activities than was the case elsewhere. The distance from Basra to Bagdad by road is 346 m., by river 498, and up to the beginning of 1917 the waterways provided the only possible means of transport on a large scale. The first railways laid in this theatre commenced to work early in 1917, but up to the close of the campaign there was no through connexion by rail between Basra and Bagdad, and carriage by water was the main form of transport employed on the L. of C.; the railways on the L. of C. eased the extreme pressure on the river transport but did not replace it, never effecting more than one-third of the total transport required.

The physical conditions of the rivers rendered water transport on a large scale very difficult. Both the Tigris and the Euphrates are shallow with tortuous and shifting channels; navigation is liable to interruption by floods, low water, strong winds and fog. In the stretch of the Tigris known as the Narrows, extending over a distance of 15 m., the average width of the river is only about 300 ft., and the depth never exceeds 7 ft. as the river overflows its bank when water-level reaches that height above the bed. Over a length of 29 m. vessels proceeding up-stream have to tie up to the bank to allow descending vessels to pass. The requirements of craft in order of priority were shallow draught, strength and power of towing, accommodation for passengers, fuel and cargo capacity. The larger self-propelled craft were paddle or stern-wheel steamers or motor vessels from 130 to 220 ft. long, beam up to 35 ft., draught from 3 ft. 6 in. to 5 ft., speed 6 to 12 knots, average deadweight load about 100 tons. The largest dumb barges, 170 ft. long and 25 ft. beam, carried 200 tons at 3 ft. draught. The number of cots on ambulance vessels varied from 100 to 200 according to the type of vessel. The general conditions and the trying climate demanded of the I.W.T. service the provision of numerous varieties of special craft, such as refrigerator, ice, cold storage, filtration, water and oil storage barges, hydro-glisseurs for despatch service, motor launches and other vessels. The distance from home, some 6,220 m., rendered the transfer to the theatre of lightly built shallow-draught vessels a matter demanding very careful prearrangement; while the voyage from India across the Indian Ocean, always dangerous, was practically impossible during the monsoon. For the erection of craft sent out in parts, and for the maintenance of the large fleet eventually built up, extensive and well-equipped dockyards and shops had to be provided, together with slipways, wharves, storehouses and camps for the numerous personnel.

The organization of the service underwent various modifications due to changing conditions; the work was eventually divided among 13 branches, viz. craft reërection, marine engineering, dockyards, vessels, buoyage and pilotage, construction, conservancy and reclamation, port traffic, transport, native craft, stores, accounts, personnel. The craft reërection branch assembled and launched craft imported in sections. The marine engineering branch decided what hull and machinery repairs were necessary and controlled engine-room personnel and stores; the vessels branch controlled deck personnel and deck stores and fittings. The dockyards branch fitted out vessels arriving from overseas and carried out the repair and maintenance work called for by the marine engineering branch. The main yards were at or near Basra, but there were subsidiary yards and floating repair shops at the principal I.W.T. depots inland. The buoyage and pilotage branch was responsible for facilitating navigation by making fluvial surveys, compiling of sailing directions, marking channels by buoys and beacons, providing pilots, salving sunken craft and refloating stranded craft. This branch undertook minor dredging work, and during the low-water season employed the process known in India as "bandalling," by which temporary training walls of matting fixed on bamboos are constructed to divert water into the particular channel which it is desired to deepen by scour. Reaches particularly subject to shifting silt banks were examined daily, the channels re-marked when necessary, and the available depth of water notified to the loading points. The work of the construction branch was very extensive, including the construction of wharves, jetties, dockyards, workshops, fuel depots, camps, etc., with a great variety of incidental works, such as pumping stations, power houses, pipe lines and a score of bridges, including the bridge at Amara and the Maude bridge at Bagdad. The conservancy and reclamation branch was responsible for heavy engineering work for the improvement of navigation and for the reclamation of low-lying areas at Basra to provide sites above flood-level for camps and depots; for about a year it was also responsible for irrigation. On the Tigris by means of dams and spurs the depth of water at the Narrows was increased, some dredging was done, and bunds breached by the Turks were repaired. On the Euphrates side about 24 m. of channel was dredged to give communication by water between Basra and Nasiriya. The native craft branch controlled the fleet of vessels hired locally. Some had been hired as early as 1915, but in Jan. 1917 all such craft of over 12 tons' capacity were requisitioned and some 50 of them were converted into motor vessels by the fitting of old motor-car engines. The fleet of native vessels did much useful work, handling at times as much as 30,000 tons a month. From Feb. 1917 to Jan. 1918 the I.W.T. service was responsible for the discharge of ocean steamers to quay or to barge at Basra. All commodities required by the force in the field were carried, the largest quantities consisting of grain, forage and fuel; in addition there was a large traffic personnel and many animals. (A. M. H.)

INOUYE, KAORU, MARQUESS (1835–1915), Japanese statesman (*see* 14.587), died Sept. 1 1915. Although he passed the later years of his life in retirement in his villa in Oiso, a seaside resort near Hakone, he was invariably consulted when matters of moment arose in politics or finance, and his name will go down in his country's history as one of the five Meiji statesmen, namely, Princes Ito and Yamagata, Marquesses Inouye and Matsukata and Count Okuma.

INSURANCE (*see* 14.656*).—Insurance, or assurance, divides itself into several main classes. Although the distinction is not always observed, the word assurance is usually applied to life business and insurance to the acceptance of risks other than that of life. In an ordinary life assurance or endowment assurance contract the policyholder has the knowledge that either he or his dependents are assured of the payment of a sum on the occurrence of an event that must happen. In the various forms of insurance, such as fire insurance, marine insurance, accident insurance or burglary insurance, the policyholder pays a premium in order to be insured against a contingency which, if he is an honest man, he hopes will never occur.

UNITED KINGDOM

During 1910–20 there was a pronounced tendency among British insurance companies to amalgamate. The development of the fusion idea began on a large scale when fire-insurance companies absorbed the marine-insurance companies. There were formerly a large number of offices registered in the United Kingdom transacting only marine insurance. In 1921 there were only one or two which had not been taken under the wing of a fire company; and the large insurance offices transacted all the principal forms of insurance. In normal years they derive the bulk of their profits from fire insurance, but during the war period marine insurance proved exceptionally profitable. The earnings from life insurance are comparatively small, owing to the competition of mutual offices which have no shareholders to consider. Underlying all the fusion schemes of past years seems to have been the idea of connexion. The managements considered that it was essential that they should be able to offer to the assured every form of policy, or otherwise the man who was insured against one risk with a particular office would, sooner or later, be induced to effect other assurances with it or to transfer existing policies to it.

The business of the British insurance offices is world-wide, mainly as far as fire, marine and workmen's compensation insurance are concerned. London is a great school for insurance, and credit for much of the development of the business belongs to the underwriters of Lloyd's. Underwriters acting for themselves, or for a few friends, represented in a syndicate, doubtless feel freer to act than the managers of companies who have to report to boards of directors. In any case Lloyd's underwriters have shown a great deal of enterprise in accepting risks of a novel kind and thus in creating new markets. No ordinary life assurance is transacted at Lloyd's.

Life Assurance.—Life assurance was fundamentally affected by the World War. It will always be to the credit of British life assurance that, in spite of tremendous blows, no office failed to fulfil any contract into which it had entered. All actual sums assured were paid in full. At the same time, the majority of the offices failed to distribute bonuses on participating policies or else allotted bonuses at a reduced rate. The ill-effects of the war fell upon the participating policyholders. Until the war broke out the progress of the offices had been so steady and their success so great that the likelihood of their being unable to distribute profits hardly entered into the minds of most people. Life-assurance agents, basing their calculations on pre-war experience, were quite able to reason that the participating policies, in many cases, represented much better value than the non-participating contracts. The faith of the public in participating policies was rudely shaken by the experience of the war. There was subsequently a reaction, and non-participating policies became the popular form of contract. This change of feeling was really as short-sighted as the previous blind faith in participating policies. The public was thinking of the passing of bonuses during the war, and forgot that the causes responsible for the passing of distributions, such as heavy depreciation of funds and heavy mortality, no longer obtained, and that, with a prospect of appreciation of security values, the outlook for profits was exceptionally favourable.

Much valuable information on the effects of the war on life assurance was contained in the paper read by Mr. H. Brown, Assistant Actuary of the Commercial Union Assurance Co., before the Insurance Institute of London on Dec. 20 1920. Mr. Brown stated that, excluding offices which transacted industrial life business as well as ordinary life business, and those which had started to undertake life assurance since 1914, there were 44 leading British ordinary life offices at the end of 1920. Thirteen of these maintained, or slightly increased, their pre-war bonuses at their first valuation after the outbreak of war; nine reduced their rates of distribution; and 22 (exactly half the total number) either postponed their bonus distributions or passed five years' bonuses altogether.

During the war the tendency to postpone bonuses steadily increased. Forty-two of the 44 offices mentioned were in the habit of making quinquennial valuations. Of those valuing at or about the end of 1914, 2 out of 10 postponed or passed their bonuses. In 1915 the corresponding figures were 3 offices out of 12; in 1916, 3 out of 5; in 1917, 8 out of 8; and in 1918, 6 out of seven. Almost all the offices made arrangements for the payment of interim bonuses on policies which might become claims before the next valuation, although such rates were usually below those of the pre-war period.

The offices which made their valuations for the five years ended 1914 again came to make quinquennial valuations as at the end of 1919. Of six offices which maintained their bonuses in 1914, only two again maintained them. One of these and also the only office valuing quinquennially which maintained its bonus in 1918 were composite companies not keeping separate investments for their life funds, but content to make good the bulk of the depreciation out of the general funds. Apart from these two special cases, only seven ordinary life offices succeeded in maintaining their bonuses, and four of these, which formerly kept exceptionally strong reserves, absorbed part of these reserves in paying bonuses.

A number of highly important offices made their quinquennial valuations as at the end of 1920. The majority of these made no distribution of profits. Depreciation of securities swallowed up sums which would otherwise have been available. One office paid what was regarded as a satisfactory rate of distribution, its power to do so being due to profits from exchange.

An estimate of the war losses during the five years 1914 to 1918 inclusive was made by Mr. Brown as follows:—

(1) Mortality in excess of the pre-war ratio resulted in a loss of about £3,000,000 a year.

(2) Depreciation in excess of the amount provided for just before the war was estimated at £4,000,000 a year.

(3) The reduction in the net rate of interest due to the high income tax resulted in a loss, as compared with the pre-war period, of about £500,000 a year.

The total loss, as compared with the period immediately preceding the war, could therefore be estimated at, roughly, about £7,500,000 a year during the five war years. In the years immediately preceding the war the total divisible profits of the British offices, in respect of ordinary life assurance, amounted to about £6,500,000 a year, of which about £6,000,000 was divided among the policy-holders, and about £500,000 was distributed among the shareholders of the proprietary companies. During the war the normal profits continued, for the most part, to be realized, subject to the deduction of the special war losses enumerated. The special war losses, it will be seen, exceeded the normal profits of the same period, and it may therefore be stated that, down to the end of 1918, the war probably cost the life offices, as a whole, about five years' bonuses. Naturally the experience of individual offices varied. Some offices had a larger proportion of lives of military age on their books, and they were therefore more heavily hit by war mortality than others. Then some companies had a larger proportion than others of their investments in Stock Exchange securities, and they were more severely hit by depreciation of Stock Exchange securities. Besides direct war claims, all life-assurance offices were severely affected by the influenza epidemic which swept over the world in 1918 and 1919 and took a very heavy toll of civilian lives.

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* ***These figures indicate the volume and page number of the previous article.***

A growing tendency on the part of insurance companies to issue policies free from all restrictions meant that in the case of the majority of the offices transacting ordinary business the direct war risk in respect of civilians who joined the fighting forces was automatically assumed by the companies. Some companies doing ordinary business and some transacting industrial life assurance had specifically excluded the war risk. Such offices agreed, however, to waive their rights to extra premiums and assumed the war risks. This for the Prudential Assurance Co., by far the largest British office, meant an enormous liability. In the case of professional soldiers assured before the war, policies were issued subject either to a small extra rate during the currency of the policy, or to extra rates of premium when the policyholders were sent on active service. At first an additional premium of £7 7s.% per annum was charged to cover the war risk, but the rate soon advanced to as much as 20% per annum. Such rates were, in the majority of cases, prohibitive, and probably comparatively little business was done on such terms. It is known that even at these rates the majority of the offices, at any rate, would rather have been without it. They could point to the fact that they had assumed vast liabilities in respect of those who had assured before the war as civilians and then had become fighting men. The fact that all men of military age were liable to service meant that, as regards new business, the life assurance offices could not hope to do more than mark time. Their own staffs were reduced to the absolute minimum. Distinguished actuaries found themselves doing routine clerical work, and, for the most part, the male staffs were replaced by women.

The period of the war was undoubtedly the most exacting through which British life assurance offices have ever passed. In addition to the depreciation of funds, heavy claims, and lack of new business, they were adversely affected by the rise in income-tax. The special position of life-assurance offices as regards interest from investments, which really represents their stock-in-trade, had led to some concession under the Finance Act of 1916. The concession was then made that they should be allowed a refund of taxation in respect of their expenses, so that the tax was paid on the difference between interest and expenses, which was naturally very considerable. This concession reduced the effective rate of tax by about one-sixth, or to about 5s. in the £ on the average on the total interest as at the end of 1920, as compared with the pre-war rate of 1s. 3d. In his paper before the Insurance Institute of London Mr. H. Brown pointed out that in 1914 the pre-war net rate of interest of just over 4% was maintained. In that year the rate of tax was practically unaltered. In the four remaining war years the average net rate realized was 3s. % per annum less than the pre-war rate and was a little below 4% net instead of being rather above that figure. The offices during the war period had the opportunity of investing new funds at comparatively high rates of interest, but this increased rate did not go far to compensate for the enormous depreciation which had to be written off the existing funds. In 1921 there was some recovery in the prices of high-class securities, and this fact gave encouragement to the view that the prospect of earning profits was then brighter than it had been for many years.

After the quiet period of the war the figures of new business in 1919 were the largest ever recorded. These, in turn, were exceeded by the results for 1920. The return of enormous numbers of men to civilian life and the greater appreciation of the value of life assurance were evidently responsible for this development. It was hardly to be expected that the figures for 1921 could be as good.

With life assurance under the heavy cloud of the war, little could be expected in the way of devising new schemes of assurance. One office, the Sun Life Assurance Society, continued to develop assurance without medical examination of the proposer. Until the beginning of 1921 such assurances were issued subject to certain restrictions, the terms in other respects, including the rate of premium, being identical with assurances effected in the ordinary way. These stipulations were that: (1) One-third only of the sum assured was secured if the death of the life assured occurred during the first three months from the commencement of the assurance; and two-thirds if the death occurred within the second three months. After that period the claim was payable in full. If death occurred from accident during the first six months the full sum assured was payable. (2) No assignment was permitted during the first two years from the date of the commencement of the assurance. Early in 1921 the Society announced the removal of these restrictions. It professed itself thoroughly satisfied with its experience in assurances effected without medical examination, and, in fact, strongly encouraged proposals made on such terms.

Two or three offices, notably some with their headquarters in Canada, have been developing assurances providing for the cessation of premiums during incapacity, and for disability weekly payments during such periods. Assurances of this kind would seem to be only in their early stages. The ordinary accident and sickness policy is an annual contract, and a life assurance combining disability benefits would seem to have a good deal in its favour.

A rebate of income tax in respect of life-assurance premiums of half the standard rate, or 3s. in the pound, in 1921, was a very considerable encouragement to the effecting of life assurances in the United Kingdom. This meant that £100 of life assurance could be secured for £85. Rebate at this flat rate was obtainable in respect of all policies effected after June 22 1916. In the case of policies effected before that date the rebate was on a sliding scale, being at the rate of half the standard rate of tax where the total income did not exceed £1,000; three-quarters of the standard rate of tax where the total income exceeded £1,000 but not £2,000; and the whole of the standard rate of tax where the total income exceeded £2,000. The rebate was subject to the provision that the total amount of the premiums to be allowed to any individual taxpayer should not exceed one-sixth of the income, and the amount of the premium in respect of which any allowance was made should not exceed £7 % of the capital sum payable at death, exclusive of any addition by way of bonus.

Industrial Assurance.—Criticism of the industrial life-assurance system in Great Britain led to the appointment in May 1919 of a departmental committee by the Board of Trade to inquire into the business carried on by industrial assurance companies and collecting societies. Over this committee Lord Parmoor presided. The report of the committee (Cmd. 614) was issued as a Parliamentary paper in July 1920.

The magnitude of the interests concerned was shown by the facts that the total amount of premiums received in respect of policies in the industrial branch of the companies and societies in 1918 exceeded £25,000,000, that the number of policies in existence at the end of that year was about 51,000,000 and that the total number of whole-time and spare-time agents and collectors employed was estimated to be about 70,000. The possible *clientèle* was estimated by the committee at about 35,000,000 persons. From the fact that there were 51,000,000 policies in existence at the end of 1918 and that some millions of these were on the lives of children under ten years of age, in whose cases it is unusual for more than one policy to exist, it was evident that a great number of adults were assured under two or more policies.

Criticism can undoubtedly be levelled against the industrial assurance system on the ground of the high level of working costs. On this matter the committee had much to say. They pointed out that the remuneration of the agents is based upon the amount collected, and is frequently a direct percentage of that sum, varying from 25% in the case of the collecting societies to from 15 to 20% in the case of the companies. In addition to this allowance for collecting his renewal premiums, the agent is directly remunerated for the new business he secures. There are various ways of calculating this allowance, but, the committee pointed out, it is always on a generous basis. In some cases the agent takes the whole of the premiums collected during an agreed period following the issue of the policies, *i.e.* the first 12, 14, or 16 weeks. In other instances lapses are set off against new business, and the new business emoluments of the agent are calculated, wholly or partly, on his increase. Thus the Prudential pays ten times the weekly premium on each new policy provided that it is kept in force for 13 weeks, and 18 times the net increase in the weekly debit. The terms of remuneration vary widely in details, but it would appear that, on the general average, the agents of the companies retain about 25% of all the premiums they collect, while those of the large collecting societies may receive as much as 31 per cent. The committee found that about 44% of the total premium income on industrial policies was absorbed by expenses and commission, and also, where companies were concerned, by dividends to shareholders. Thus on every shilling paid in premiums 5¼d. goes in expenses of one sort or another, and only 6¾d. comes back to the assured in benefits. Otherwise stated, of £25,000,000 a year paid in premiums by the insured population, only £14,000,000 come back to them, and £11,000,000 are absorbed in expenses and dividends. The committee stated that they were satisfied that these expenses were too heavy and could be reduced.

Evidence was given before the committee that convenience and economy in collection could be improved by the introduction of the block system, under which an agent is assigned an exclusive area for his operation. This system so far has only been in the experimental stage, but the committee suggested that it should be introduced and extended wherever practicable. It has been put into practice by the Prudential Assurance Co. and has already resulted in a saving of expenses, although the actual effect has been, to a large extent, obscured by the higher scale of wages and the generally increased costs of working brought about by the war.

Lapsing of policies was a matter which received attention from the committee. They pointed out that in the case of one company, the Refuge, whose experience in this matter was held to be in no way exceptional, there were issued in the ten years 1909 to 1918, 9,322,336 policies, while 6,426,313 policies lapsed. Further, it was found that in ten of the offices, including most of the largest, nearly 5,000,000 policies lapsed in 1913, and that nearly 4,000,000 of these had been effected as recently as 1912 or 1913. It was considered probable that the premiums paid on these latter policies amounted to fully £500,000, practically the whole of which would have been absorbed in new business charges, chiefly procuration fees and commissions paid to the agents. Taking all the offices together, it was thought probable that lapses of policies in the year of issue, or in the year following, reached an annual total of 5,000,000. The committee reasoned that this vast figure could only mean that there was a section of the population which was repeatedly induced by the pressure of agents and canvassers to take out policies and discontinued payment immediately that pressure was removed, having lost nearly the whole of whatever premiums it had paid, since the benefit assured at the outset was a mere fraction of the full sum named in the policy. The committee came to the conclusion that, as long as heavy procuration fees were allowed, it would always pay the agents to devote themselves to the ceaseless pursuit of new business among this class of the community, regardless of the value of the policies to the assured or of their being kept up.

It should be noticed that the companies maintain that lapses occurred mostly in the first year or two of assurances before initial expenditure was made good, and that they are thus a source of loss rather than a profit to the companies. Their line of argument seems to be that they have to pay to the agent as fees all the premiums he collects for the first 10 to 20 weeks of the life of the policy, and that if the policy is then dropped the agent has had all the premiums, and there is nothing to help to pay the superintendency and head-office expenses in connexion with the issue of the policy. The offices further contended, in effect, that if the policy lasted a year, the agent had been paid his collecting commission as well as the procuration fee, and, in addition, that they had to pay head-office and branch-office expenses in respect of the issue of the policy, accounting, etc., while they had the risk of the policy becoming a claim, so that even at the end of the year there remained little or nothing out of the premiums paid on the policy. They thus arrived at the conclusion that, on the whole, they lost money by lapses. The committee pointed out, however, that this line of argument seemed to imply that all the expenses relative to new business arose out of the particular policies which the agent succeeded in getting. That is to say he was supposed to earn nothing, and the companies were supposed to incur no expense, in respect of the people whose interest he solicited in vain, the whole of his exertions being regarded as concentrated upon those with whom he succeeded. They doubted whether such an argument was maintainable, and they added that, whoever got the benefit of the premiums paid, whether the companies or their agents, it was certain that the public lost heavily by lapses. The committee recommended that procuration fees should be abolished, and that minimum weekly wages should be substituted based on a fixed collection per week, with a commission on all sums collected above that amount.

The conduct of life assurance by the post-office was also examined. Under the British post-office system life assurance may be effected with Government security at any post-office transacting savings-bank business. Premiums may be paid weekly by means of stamps affixed to premium books handed in quarterly. The average charge for expenses is very low, and the committee held that the terms of assurance ought to be so much better as the result of this than those afforded by the companies that the post-office should be able to issue a large number of policies, in spite of the fact that it neither canvasses nor collects the premiums at the policyholder's door. The number of persons who effect assurances through the post-office is extremely small, and the system as administered by the post-office can, the committee pointed out, only be described as a failure. Apart from the fact that the post-office system was not competitive and provided for no canvass, the committee thought that the system was not operated with sufficient vigour or with due regard to what the public required. The committee found that, although the cost of administration was so small, the sums assured did not compare to marked advantage at any age with those offered by the companies. As one explanation, it was pointed out that the premiums under the post-office plan cease to be payable at 60 years of age, whereas, under the ordinary system, they continue for the whole duration of life or, in certain cases, to the age of 75. Possibly, the committee pointed out, the post-office system was the better one, as official witnesses suggested, but, the committee added, the question was whether the system should offer what the public required or what was thought to be more suitable to the public needs.

In the main, it would seem that the best hope for an improvement of the industrial assurance system lies in a reduction in working expenses. Of this leading managers of companies are doubtless fully aware. During the war period the factors were undoubtedly against them, owing to the rise in the cost of living. In 1910–20 there was a distinct development of industrial assurance on the basis of monthly premiums, and, no doubt, from the practice of this system a substantial reduction of working costs may be expected. The benefits of the system should be developed and the drawbacks overcome.

During the World War the industrial assurance companies in England felt the heavy strain of war mortality claims. They were also adversely affected by the Courts (Emergency Powers) Act, which provided, in effect, that the companies were required to keep in force all policies should the assured be unable, owing to the results of the war, to pay the premiums. There was good reason to believe that the Act was much abused. Practically all those who were not in the fighting forces secured the advantage of the high wages ruling at a time when unemployment practically did not exist. In 1921 the companies under the Act were still required to keep in force a large number of policies on which no premiums had been paid for several years. In addition to receiving no premiums on such policies, they had been called upon to pay claims in respect of many policies of which the holders had been able to benefit by the Act. It was assumed in the summer of 1921 that the Act would shortly be annulled. There seemed a prospect, consequently, that it would come to an end at a time when unemployment was common and there was general financial stringency, so that it would be almost impossible for many policyholders to pay the arrears due, with the result that many policies of long standing would lapse. It was held by some authorities that the Act had been detrimental to the interests not only of the companies but also of the policyholders. The committee recommended, as a way of meeting the difficulties when the Act came to an end, that the policies subject to it should be kept in force for six months after the Act ceased to operate, and that the companies should be required to notify every policyholder to whom the Act applied his right to secure the maintenance of the policy by paying up the arrears, the amount of which should be stated on the notice. Alternatively, that the companies should give the option to the policyholder of maintaining the policy in force for a reduced amount, or in the case of an endowment assurance for an extended period, subject to the cancellation of the arrears, on terms to be approved by the controlling authority.

Fire Insurance.—Fire insurance was much affected by the rise in value during the war period. The rise meant that sums previously insured were quite inadequate and additional insurances were effected. The rise was shown in the estimated cost of the principal fires in the United Kingdom. In 1916 these calculations, according to *The Times*, amounted to £3,300,000; in 1917 to rather over £4,000,000; in 1918 to £5,500,000; in 1919 to £9,462,000, and in 1920 to £9,374,000.

On the whole the British insurance companies emerged from the war period in a far stronger position than when they entered it. After the Armistice there was much activity in the formation of new companies, especially of offices to transact reinsurance. In the pre-war years a very large amount of reinsurance had been placed with German companies which had specialized in this form of business, transacting it at a low working cost. During the war naturally no further business was placed with such companies. The limitation of the reinsurance market led, therefore, to the formation of new offices and to the representation in England of companies registered abroad. So long as values remained on the highest pinnacle all the offices did well, but when trade began seriously to decline in the latter part of 1920 the new companies found that matters developed far less favourably for them. Towards the middle of 1921 absorption schemes were announced for a number of the new companies. Fire managers realized that to conduct a reinsurance business satisfactorily a large capital was needed and only a small rate of profit could be expected.

Before the war, fire-insurance companies had been disturbed, to some extent, by the activities of militant suffragists who set fire to many buildings, including churches. These dangerous activities were to be far exceeded by those of Sinn Feiners after the conclusion of the Armistice with Germany. Immense damage was done to property in Ireland during the course of the campaign of destruction. Insurance companies did not admit responsibility for such damage, special legislation in Ireland providing that the damage could be made good by the local authorities. In the United Kingdom the question of damage of this kind was brought to a head by the destruction of much dock property at Liverpool at the end of Nov. 1920 which was traceable to a Sinn Fein plot. The attitude of the insurance companies generally was that, acting on legal advice, they paid claims under the special riot and civil commotion policies where these had been effected. Where no such special policies existed, or the amount insured under such contracts was insufficient, the loss, or balance of loss, was met under the ordinary fire policies. The insurance companies did not admit liability under such contracts and said that it might be necessary, in order strictly to define the legal position, to take the matter before the Courts.

At the same time, while the insurance companies continued to incorporate in their ordinary fire policies a clause excluding liability for loss or damage caused by riot, civil commotion or military or usurped power, they were prepared, either by the issue of special policies or by the endorsement of existing contracts, to undertake such liabilities, except in the case of Ireland. It is now possible to obtain full protection in respect of the risk of loss or damage by riot, civil commotion, military or usurped power (other than that caused by a foreign enemy), strikers, locked-out workers, or persons taking part in labour disturbances, or malicious persons taking part or acting on behalf of or in connexion with any political organization. In some cases the additional cover is granted for the same rate of premium as that previously charged for riot and civil-commotion risks alone. The risk of fire in respect of private dwelling-houses is included in the ordinary fire policy without extra charge, but, as a rule, a small additional premium is quoted. The wording of the clause giving protection against exceptional risks was, it will be seen, devised with the Irish trouble in mind. It was intended to give complete cover to the assured against risks which were definitely excluded from the ordinary fire policy or might be held, by legal decision, to be so ruled out. A very large number of such special insurances were effected by business men.

Marine Insurance.—In marine insurance the dominant feature of the decade 1910–20 was the demand for war insurance, especially during the period of hostilities. The war cloud was affecting business and was a subject of discussion before the storm broke. In a speech at Copenhagen in 1913, Sir Edward Beauchamp, who was then chairman of Lloyd's, made a stir by indicating what would happen if war with Germany broke out. He then declared that, in any event, British underwriters would stand by their contracts. This statement was considered by some to have gone rather far. Yet British insurance companies transacting business in Germany caused statements of similar effect to be published in German newspapers. The subject had in previous years been discussed in German newspapers, an article, in particular, appearing in the *Neue Hamburgische Börsenhalle* in Aug. 1905, under the title of "English Insurances in the event of a German-English War." Its intention appeared to be that of creating uneasiness in the minds of Germans who had effected insurances in England. Confirmation of the attitude adopted by British underwriters was provided by Section V., Annexe III., Paragraph 16, of the Treaty of Peace, which stated that "where the risk had attached effect shall be given to the contract, notwithstanding the party becoming an enemy, and sums due under the contract, either by way of premiums or in respect of losses, shall be recoverable after the coming into force of the present Treaty."

The ordinary policy covering hulls against the risks of marine perils excluded the risks of war. There was, however, in the years immediately preceding the outbreak of hostilities, a tendency on the part of banks to insist that the risks of capture, seizure, detention, etc., should be included. There was a small number of underwriters in the London market who made a feature of war-risks insurance. They studied the political barometer closely and, as regards rates of premium, set the pace. Other underwriters who were by no means enamoured of war-risk business felt obliged to accept such insurances on similar terms for fear that, if they failed to do so, they would lose the ordinary marine-insurance business. On the whole, the acceptance of such insurances proved profitable.

Reference is made in the article on SHIPPING to the establishment of war-risk schemes by the British Government immediately on the outbreak of war. While these schemes continued in operation and were of immense value, a large amount of war-risk business was transacted in the open market.

Some of the difficulties facing underwriters were indicated in a case which was taken up to the House of Lords and became known as the "Restraint of Princes" case. The facts were, briefly, that a steamer, bound from South America to Hamburg, was stopped off the Lizard on Aug. 9 1914 by a French cruiser and was told to proceed to Falmouth. There her master received orders from the naval officer in authority to proceed to Liverpool to discharge. This he did. The owners of the cargo gave notice of abandonment, which the underwriters declined to accept. The old form of marine-insurance policy included among the risks covered "takings at sea, arrests, restraints and detainments of all Kings, Princes, and People." Mr. Justice Bailhache in the first Court, the Court of Appeal, and the House of Lords decided that a declaration of war involving the abandonment of a voyage was a "restraint of Princes," and entitled the assured to claim a constructive total loss. The underwriters had maintained that actual exertion of force was necessary to constitute "restraint of Princes," and that they insured the safety of the goods and not the success of the venture. They urged that, until the action was brought, there had been no suggestion by merchants that "restraint" meant anything but forcible action, which they themselves understood it to mean. In the case which was heard before the Courts the cargo arrived safe and sound at Liverpool. It was the venture which was not carried out as was expected. After this decision underwriters adopted a practice of modifying what was known as the war-risk clause. This had read:—

> "Warranted free of capture, seizure, and detention, and the consequences thereof or any attempt thereat, piracy excepted, and also from all consequences of hostilities or warlike operations, whether before or after declaration of war."

For the words "and detention" in this clause there were substituted, after consultation with eminent counsel, the words: "arrest, restraint, or detainment." The opinion was afterwards expressed that, had merchants realized what the law on this subject was, as it was afterwards defined, underwriters might easily have been ruined, for a vast number of cargoes might have been abandoned to them. Yet there was another point of view. As events occurred prices of all commodities rose enormously in the United Kingdom. Consequently, had cargoes been abandoned to underwriters, the latter should have been able to dispose of the commodities at a handsome profit. Further, to meet the new situation a clause was inserted in all policies covering war risks which ran as follows:—

> "Warranted free from any claim arising from capture, seizure, arrests, restraints, or detainments by any British Government or their Allies."

This clause was based on one which, soon after the outbreak of war, had been inserted in all insurances against war risks on neutral cargoes in neutral vessels and had read:—

> "Warranted free from any claim arising from capture, seizure, and detention by the British Government or their Allies."

The intention of this clause was that neutrals should not collect from British underwriters moneys for goods or vessels which the British or Allied Governments found it expedient to capture, seize, or detain. In one way and another underwriters were able to assist materially in the conduct of the blockade of Germany. In a striking paper read before the Institute of London Underwriters by Mr. E. L. Jacobs, underwriter of the Alliance Assurance Co., it was pointed out that on a hint that the insurance of certain articles was inexpedient, no insurance was provided. Mr. Jacobs declared that: "No proclamation was necessary. A verbal message sufficed: No insurance, no finance, no shipment. Very simple!" A similar system applied to the insurance of vessels. In the case of these there were black lists. No insurance was available in the United Kingdom in respect of any vessel on such lists.

While the work falling on underwriters and insurance companies was steadily increased, the staffs of the offices were also steadily reduced as more and more men were required for the fighting forces. The difficulties of carrying on business at Lloyd's became immense, and a scheme was introduced which provided for the establishment of a Signing Bureau. An ordinary marine-insurance policy may be underwritten by a large number of syndicates of names, and the signing by hand of the policies by the representatives of all the syndicates was a slow undertaking. A policy might be passing from syndicate to syndicate for many weeks. Objection was raised to any departure from this practice on the ground, *inter alia*, that it was important for the representative of each syndicate personally to see that the terms of the policy were in accordance with the conditions of the insurance as underwritten. In the critical times these difficulties were overcome, and a Signing Bureau was established, which had authority to stamp the policies on account of a large number of individual syndicates and names. As regards despatch, the system had very considerable merits. A policy deposited at the Bureau for stamping was available a very few hours later, completed. Later the system was extended to the settlement of claims, authority being deputed by individual underwriters to the Bureau for that purpose. The practice of stamping the Lloyd's policies on behalf of various syndicates was reflected in the adoption by the insurance companies of issuing a joint policy. Previously each company had issued its own policy and prided itself on doing so. The issue of the joint policy was adopted as an emergency measure, and was not liked by the insurance companies. Most of them agreed to adopt it, but were glad to revert to the individual system later. In order to save paper the size of the policies was reduced during the war, and a standard form of proposal was adopted.

Some underwriters refrained entirely from writing war risks. Nevertheless, it was impossible for them to escape the consequences of the war. Many ships, for instance, became missing. No direct evidence was available as to the loss of the ships, whether through marine or war perils. Vessels were being destroyed promiscuously by the enemy's submarines, and it was clear that, largely owing to this cause, many of the ships became missing. In ordinary times a certain number of vessels set out on voyages and never reach their destination. No trace remains as to the cause of loss. In such cases, after a long interval, the circumstances of the voyage are considered by the committee of Lloyd's. The names of the vessels are then posted in the rooms for inquiry. If nothing, in the meanwhile, is heard of them, the vessels are posted as missing, and settlements are then made by the underwriters in respect of ships and cargo. The position respecting the enormous increase in the number of missing vessels during the war period was considered by a committee representative of shipping ownerships, insurance clubs, Lloyd's, the Liverpool Underwriters' Association, the Association of Underwriters and Insurance Brokers in Glasgow, and the Institute of London Underwriters. As the result of the deliberations, an agreement was drafted providing for arbitration in the event of vessels becoming missing. The underlying idea was that an arbitrator, after hearing such evidence as was possible, could form an opinion as to the probable loss of the vessels, whereas if the question had been taken into court, the proceedings might have been very lengthy, and no better judgment could be expected. In some cases the loss was apportioned by the arbitrator in such proportions among the war-risk and marine-risk underwriters as seemed reasonable.

In the years immediately preceding the war a good deal was heard of over-insurance. Many ships had been built during periods of active trade, and owners found themselves possessed of ships which were worth more to them lost than if still afloat. There was an epidemic of mysterious losses of ships which were, admittedly, over-insured. While suspicions may be formed, the scuttling of ships may be very hard to prove. In order to deal with a difficult situation, which was discussed in a paper read before the Insurance Institute, at the end of 1912, by Mr. Edward F. Nicholls, underwriter to the London Assurance Corp., a clause known as the 15% disbursement clause was prepared, which reads as follows:—

> "Warranted that the amount insured for account of assured and /or their managers on disbursements, commissions, or other p.p.i. or f.i.a. interests, other than those hereinafter mentioned, shall not exceed 15% of the insured value of hull and machinery; but this warranty shall not restrict the assured's right to cover premium reducing freight, chartered freight, or anticipated freight to a reasonable amount; provided always that a breach of this warranty shall not afford underwriters any defence to a claim by mortgagees or other third parties who may have accepted this policy without notice of such breach of warranty."

Underwriters considered that by the use of this clause the risks of under-valuation and over-insurance were eliminated. The risk of total loss is naturally coverable at a lower rate of premium than that of all risks, and any owner who had nefarious designs on his ship would have been tempted to secure a large amount of total-loss insurance at as low a rate as possible. It was held that, by limiting the amount which could be covered for disbursements, etc., to 15%, the inducement to an owner to lose his ship was minimized. The disbursements clause has been maintained throughout since its institution.

Following a period of severe competition and heavy underwriting losses, an agreement was reached among the underwriters of the insurance companies and at Lloyd's on the subject of the conditions on which steamers should be insured for time. This agreement laid down the terms on which vessels should be insured, the conditions being reconsidered from time to time. It was carried on successfully for many years, and then collapsed in June 1921. Agreement on certain important points, such as values, rates of premium and the underwriting lead, could not be reached, and it was decided, while maintaining certain terms which are set out in the Institute Hull Clauses, to give underwriters complete freedom on other important points. This was certainly one of the most important developments in the conduct of marine insurance for many years. It meant that the individual initiative and enterprise of underwriters, which had been curbed by the agreement, were once again given free play. Instead of all owners being treated alike, underwriters were at liberty to discriminate between the good and indifferent ownerships. It seemed to be in the interests of the good owners, while it might possibly be to the disadvantage of those whose record is not so good.

There then set in during the summer of 1921 a period of severe competition, although this was restrained, to some extent, by the withdrawal from the market of a number of offices which had been writing considerable accounts during the period of hectic activity traceable to the war and its effects. As long as there was an immense amount of war-risk insurance to be effected, and values of ships and commodities were inflated, there was sufficient business to feed a much-increased and hungry market. When trade became extremely quiet, some of the newcomers thought that they must continue to secure a large share of the business, and the only way they could do so, in competition with the older and more firmly established offices, was to reduce rates of premium. The cutting of rates went on for some time without apparent evil effects, while the more experienced underwriters refused to accept business on such terms. Early in 1921 claims poured in at a rate which had never been experienced even by the oldest underwriters. There was a cataclysm of claims, both in respect of ships and cargoes. The claims in respect of ships were due, especially, to the fact that while tonnage was in active request, repairs, necessitating the laying-up of ships, were postponed, and also to the fact that the repairing establishments were heavily preoccupied in making good damage done to ships through the submarine warfare and the general stress of working under war conditions. A very large number of ships were unfit to go to sea until the damage they had suffered had been made good, and work on such vessels naturally took priority over repairs which could, by any possibility, be postponed. Incidentally, the cost of repairs was steadily mounting for many years, owing to the rise in wages and in the cost of materials. The following figures show the settlements actually made by a leading insurance company on a large underwriting account of hulls. Taking the premium income written in 1916, the first year's settlements amounted to 13%. By the end of 1917 the settlements had risen to 51%; by the end of 1918 to 72%; by the end of 1919 to 84%; and by the end of 1920 to 93%. These figures were only for actual claim settlements. They show that at the end of the fifth year only 7% of the large premium income remained, from which the working costs had to be deducted.

An extraordinary feature of marine underwriting in recent years has been the extended period over which claims have been made. Before the war it was considered that an account might, for practical purposes, be considered as closed at the end of a third year. There might then be still a few claims unsettled, but not of sufficient magnitude to disturb the main results of the underwriting as then disclosed. After the war no such calculations could be made. The books of the same important insurance company showed that of the 1917 premium income 17 % had been settled in claims alone during the first year. By the end of 1918 the total settlements had risen to 56 %; by the end of 1918 the settlements represented 72 %, and by the end of 1920 89 %. The total showed that for the fifth-year settlements 11 % of the premium income remained. The earlier figures showed that 9 % of the premium income was absorbed in the fifth-year settlements on the 1916 figures, so that if the settlements in the fifth year on the 1917 account were on the same basis, only 2 % of the premium income would remain for expenses. It thus appeared that a substantial loss was inevitable. The figures were extracted from the books of a first-class office, and it is only reasonable to assume that those of other offices which were not in the same favourable position would be still worse.

A further factor responsible for heavy claims in respect of hulls was the loss of a number of steamers under remarkable circumstances. Vessels flying certain foreign flags were especially prominent in this connexion. A large number of steamers foundered near land, with little, if any, loss of life. In some cases the vessels were alleged to have struck drifting mines, especially in the Mediterranean. Some of the vessels were lost shortly before the expiration of policies covering them for far larger values than could be insured again. The epidemic was so notorious that underwriters could not feel justified in paying the claims without full inquiry into the mysterious circumstances of the losses. In this matter Government aid was forthcoming. It was, perhaps, unfortunate that a large number of steamers should be at sea insured for very much larger sums than they could be worth under current market conditions.

If, in connexion with the values of shipping, there seemed to be some weakening of the standard of morality, there was an obvious lowering of the ideals in other forms of commerce. Claims in respect of cargo losses were on an enormous scale, and were attributed in large degree to pilferage of goods throughout the world. Legal decisions have been held that there is a distinction between robbery with force and sneak-thieving, or pilferage. The ordinary marine-insurance policy covers the risk of robbery by force, but the risk of theft and pilferage has usually been specifically excluded. Gradually underwriters were asked to accept it, and they did so in various trades, quoting nominal rates for the risk. Then the evil grew steadily to vast proportions—encouraged, no doubt, by the high value of commodities and a laxity induced by the experience of vast numbers of men in the armies, where it was often a question of every man looking after himself as best he could. All classes of business men became alarmed by the growth of the pilferage evil, and committees were formed in the various ports, led by London, to consider what action was required. The shipping companies, who were called upon to pay a vast number of claims, were naturally active in adopting measures, such as the formation of special police forces and the institution of special systems of tallying the cargo on loading and discharging. The marine underwriters, in order, partly, to bring pressure to bear on the shippers and shipowners, resolved to accept only 75 % of the shipping value of the goods, thus leaving merchants with responsibility for one-fourth of the value. Early in 1921 there was a strong agitation in the London marine-insurance market in favour of refusing to accept the pilferage risk at all, but this did not seem compatible with the functions of marine underwriters in protecting the interest of their clients. Such action as they did take was undoubtedly successful. It had a good deal to do with a decision on the part of the owners of lighters and barges to accept some responsibility, although of limited character, for the safety of goods carried. Until the matter was brought to a head by publicity and the action of shipping managers, merchants and underwriters, the owners of lighters and barges had, under the London Lighterage Clause, refused to accept responsibility for loss of or damage to goods carried, whensoever, wheresoever or howsoever such loss or damage might be caused. The question had many complications. Thus goods might be resold in course of transit at a profit to the original owners. It was pointed out that a settlement by underwriters of not more than 75 % of the shipping value would not be adequate compensation to buyers of the goods at enhanced prices. This matter, in particular, was receiving the careful consideration of underwriters and merchants in the summer of 1921.

Workmen's Compensation for Injuries.—Important recommendations respecting the system of compensation for injuries to workmen in the United Kingdom were made by a departmental committee appointed by the Home Secretary in May 1919, which reported in July 1920. The committee was presided over by Mr. Holman Gregory, K.C., M.P., and included representatives of the workers and of the insurance companies. In the introductory paragraphs to the report (Cmd. 816) the committee pointed out that the system then obtaining, which was based on the Workmen's Compensation Act of 1906, imposed on employers a burden of upwards of £8,000,000 a year, and its cost was an item which every business enterprise had to take into account. The total number of workers within the scope of the Act was calculated to be about 15,000,000, and the negotiation and settlement of the claims of those who belonged to organized labour were an important part of the work of trade-union officials. Sixty-five joint-stock insurance companies did workmen's compensation business with employers having a wage-roll exceeding £600,000,000 a year, and their annual premium income in respect of the workmen's compensation risk was well over £5,000,000. Further, there were about 50 mutual indemnity associations which insured their members against the workmen's compensation risk and paid about £2,000,000 a year in compensation. The majority of employers in several of the most important industries in the country covered their risks by this means.

The committee, after examining the subject thoroughly, found that there were certain defects in the system then obtaining, but were of opinion that these defects could be remedied largely without resort to a State system of insurance, although not without the introduction of a certain measure of State control. They proposed that in future at least 70% of the premium income should be expended in benefits to injured workmen or their dependents, and that the remaining 30% should be available for the management, expenses or profits of the companies and the payment of commission to agents, the latter not to exceed 5% of the premium income in any case. They calculated that there would thus be saved on the then cost to employers a sum of between £1,250,000 and £1,500,000 a year which, under the existing organization would be paid away in expenses of management, commission and profits.

In order to provide against the risk to the workman of uninsured employers proving unable to meet the obligations incurred under the Act, it was proposed that every employer other than the Crown, a local or public authority, a statutory company, or householder in respect of servants not employed by him for the purpose of his trade or business, should be required to insure against the workmen's compensation risk. Employers with an annual wage-roll exceeding £20,000 were to be entitled to claim exemption from compulsory insurance upon compliance with prescribed conditions. Householders were excluded from the provision of compulsory insurance because, as the risk of accidents to domestic servants is small, the premium charged by insurance companies is more or less nominal, and also because it was considered that the cost and difficulty of enforcement would be out of all proportion to the number of persons involved. The committee were informed that a large proportion of householders already insured, and they believed that when the proposed increased liabilities were effective "few would be so unwise as to fail to cover their risk by insurance."

The maximum rates of premium were to be approved or fixed by a Government official who was, for convenience, referred to in the report as the proposed Commissioner. It was proposed to bring within the scope of the Act large new classes of persons. These were:—

(*a*) Persons employed otherwise than by way of manual labour whose remuneration is at a rate not exceeding £350 a year (instead of £250 as under the existing Act).

(*b*) Employment of a casual nature for the purposes of any game or recreation where the persons employed are engaged or paid through a club.

(*c*) Taxi-cab drivers who, on the ground that they are the bailees of their cabs rather than the servants of the cab-owner, were excluded from the original Act.

(*d*) Share fishermen employed in the trawler industry.

(*e*) Share fishermen employed in the herring or other fishery to be brought within the Act by order of the Commissioner, if he was satisfied, after public inquiry, that they ought to be included.

(*f*) All persons ordinarily resident in the United Kingdom who were employed, or were travelling in the course of their employment, in a British ship.

Under the original Act the dependents of a workman killed were entitled, under the Workmen's Compensation Act, to a payment of not less than £150 and of not more than £300. Provision was made by the committee for a substantial increase in benefits. They proposed that, in fatal cases, the benefits for total dependents should be on the following scale:—

(1) Where a widow is left, £250.

(2) Where the person killed leaves a child or children, a weekly allowance of 10s. for the first, 7s. 6d. for the second, and 6s. for every other child. The allowances were to be provided by the payment by the employer into a Central Fund of £500 in every case of a workman dying and leaving a child or children under 15 years of age.

(3) Where other dependents are left, in addition to the benefits mentioned above, a further sum of £500, or where dependents are left, not including widow or children, £250.

The provision for investing money for the children was new. The committee proposed that, in the case of partial dependents, a sum representing the value of the late workman's contributions to the support of the partial dependents should be payable, with a maximum of £250. By the term "support" was meant the provision of the ordinary necessaries of life suitable for persons in their position.

Originally the maximum benefit for total disablement was £1 a week. This sum was raised after Sept. 1917, by two increments, to 35s. a week. The committee proposed that the total payment should be 66⅔% of the average weekly earnings, with a maximum of £3. Since the cash value of an annuity of £3 a week for a man aged 30 might represent £1,500, the liability of employers would become very considerable, and it was this fact evidently which decided the committee to recommend compulsory insurance.

The arrangements for instituting benefits under the Act of 1906 provided that no compensation should be payable for incapacity lasting one week or less; for incapacity lasting more than one but less than two weeks compensation was payable, but only for the days after the first week; for incapacity lasting two weeks or more compensation was payable from the beginning of the incapacity. The committee proposed in future a waiting period of only three days, with no dating back.

Another provision was that any medical and surgical aid necessary, in addition to the medical treatment already available under the National Health Insurance Acts, should be secured for the injured workmen at the cost of the employer under a comprehensive scheme to be worked out by the proposed Commissioner in coöperation with the Ministry of Health.

It was proposed that county court registrars should be appointed to undertake the following duties under the supervision of the registrar:—

(*a*) To give information, free of expense, to injured workmen or their dependents about the benefits provided by the Act and the necessary procedure to protect their rights.

(*b*) To act as mediators between the employer and the injured workman or his dependents on the request of the parties.

(*c*) To be empowered, if both parties agreed, in the event of a dispute as to the workman's condition, to refer the matter to the medical referee, whose certificate should be final.

Power, it was recommended, should be given to the proposed Commissioner to institute inquiries into the practicability of a system of discounts from normal rates in consideration of approved safety devices or provisions, and by agreement with insurance companies and mutual associations to prescribe a practical scheme. The committee was in favour of a substantial increase in the amount of compensation to which priority may be given in the distribution of the assets of a bankrupt employer, and recommended that the amount should be fixed at the full amount of the claim.

The terms of the agreement concluded between the departmental committee on workmen's compensation and the Accident Offices' Association was the subject of some criticism in financial circles. The provision that commission, expenses and profit, if any, should not exceed 30% of the premiums was criticised especially, since it was known that during the previous eight years the average commission paid to agents by a large number of offices had been about 12%, the expenses of management had been about 19%, and the profit about 15%, making a total of about 46%. On the insurance side, however, it was recognized that, even if no committee had been appointed, the companies would have revised their rates of premium in consequence of the favourable effect on the business of the rise in wages during the war period. It was reasoned that the increased benefits recommended by the committee would certainly involve increased rates of premium. Evidently the insurance companies wished to make it quite clear that they had no desire to profit unduly from such developments, and they offered to conduct the business on terms which they hoped would not result in actual loss to them. There was a provision in the agreement that at the end of three yearly periods the rates should be reviewed, so that any deficiency there might be could be taken into account in fixing the premiums for the next triennial period. The insurance companies could well point out that any Government scheme to be inaugurated could not work the system on such favourable terms, and that insurance companies were in a position to do so only because of the efficient organizations which were already in existence.

Legislation was required to give effect to the proposals. This, the Government announced, it would introduce. The time of the Government throughout the first six months of 1921 was, however, much preoccupied with such matters as the coal stoppage, and the necessary legislation was still awaited.

New Extensions of Insurance.—In recent years there has been a great extension in practice of the insurance principle. In some directions this progress received a setback on the outbreak of war, while hostilities gave it an impetus in other directions. As an instance of the development of the principle there may be cited insurance against the risks of bombardment of persons and property in the United Kingdom by the enemy from the sea and air. Underwriters were asked very early in the war to cover such risks. Many insurance companies did not see their way to undertake the business, alleging that they had no data on which to work. But some underwriters and insurance companies did undertake the business and wrote a very large amount of it, to the comfort of the assured and, as events proved, to their own profit. Insurances were issued against the risks of damage to, or death of, individuals and against the risk of damage to property. The demand for insurance of this kind grew to very large proportions, and the market was hardly large enough to deal with the whole of it. Thereupon, with the assistance of leading underwriters, a Government scheme was instituted, use being made of the organizations of all the great insurance companies, which acted as agents for the Government in this matter.

The general insurance department of a composite company includes miscellaneous forms of insurance. Among the chief of these is motor-car insurance. During the war comparatively little was done in this form of business. Many private cars were garaged at specially reduced rates of insurance. In 1919 and 1920, when these cars came into use again, the insurance experience was very unsatisfactory. Costs of repairs were on a high scale, and there was an epidemic of thefts. Profits earned from the business in 1919 were small. For 1920 some of the leading insurance companies reported substantial losses. Early in 1921 rates of premium were advanced.

Unfavourable results also followed the transaction of burglary insurance during the two years immediately following the Armistice. This was due to a general epidemic of lawlessness which pervaded Great Britain, and was seen in the wholesale robberies of goods in course of transit. While the large insurance companies are always ready to transact the main forms of insurance, great credit should be given to the underwriters at Lloyd's, who are willing to consider the issue of policies covering every conceivable risk against which the public may legitimately expect to be insured. In this way insurances are effected against the risks of strikes and their effects, against the risks of changes in taxation imposed in budgets and of the special risks of aviation. Risks of the most diverse character are constantly offered, and those underwriters who have been prepared to accept them are known to have secured satisfactory financial results. Before the war efforts of underwriters were concentrated on forming an Aviation Insurance Association, the idea being that one office should be maintained where risks should be accepted on behalf of a large number of underwriting syndicates and also of two insurance companies. It was recognized that aviation insurance required close study and that one or two underwriters who could give the necessary attention to it could expect to be more successful than those who tried to transact it in addition to many other forms of insurance. The principle was also adopted by many of the leading insurance companies.

Weather insurance was being developed by underwriters at Lloyd's before the war. It was transacted in connexion with the business side of amusements and also in connexion with the spoiling of holidays by wet weather. Naturally little business of the kind was transacted during the war. Yet the importance of the weather upon world affairs was demonstrated again and again during the war. Operations on the western front were frequently affected by the weather, and there is no doubt that the Germans were successful in forecasting it. The battle of Jutland was also affected by "low visibility."

With the resumption of peaceful activities great progress was made with weather insurance. In 1919 the ground was being prepared and a very large amount of data was collected, tabulated and employed respecting the experience in the United Kingdom for many years. In 1920 the volume of business of the kind transacted in the United Kingdom was on a large scale. Insurances were taken out to cover losses due to a falling-off in gate receipts, and to losses of caterers at open-air amusements such as race meetings, cricket matches and regattas. The summer of 1920 in the United Kingdom was wet, and the underwriting experience there was very unfavourable. The business was gradually being extended in foreign fields and the profits which were earned in other countries were believed to have just offset the losses suffered in the United Kingdom. The bulk of the business which had been transacted at Lloyd's was transferred to a leading insurance company, and it was known that the company was satisfied for losses to be on a substantial scale in 1920, because these demonstrated the utility of the business. At one time weather insurance was regarded as a somewhat frivolous form of business, but its importance came gradually to be recognized. It has been realized that there is an immense field open for insurance in connexion with the risk of damage to crops by bad weather. This is a form of business in which large sums of money could easily be lost, and prudent underwriters proceed somewhat carefully with it.

Credit insurance has long been transacted in the United Kingdom by a limited number of underwriters and insurance companies, and in 1920 and in 1921 it was hoped that the principle might be applied to overcome the difficulties caused by the collapse of the credit of some countries especially hard-hit financially by the war. A number of discussions took place between representatives of the Government, banks and insurance companies, but the problem was felt to be beyond the power of the insurance companies generally to solve, and, while the offices showed sympathetic interest in the different schemes discussed, they did not, as a whole, give practical support.

The Insurance Institute movement has developed notably in recent years. It dates back to 1873, when the Insurance Institute of Manchester was formed. The example was quickly followed in other leading centres in the United Kingdom. At the invitation of the council of the Insurance Institute of Manchester the various institutes were asked to send delegates to a meeting held on March 12 1897, at which the decision was taken to form an association to be called the Federation of Insurance Institutes of Great Britain and Ireland. The objects of this federation, as set out in its constitution, were to encourage the study of all subjects bearing on any branch of insurance, to promote the technical education of junior insurance officials, and to do such things as might be deemed desirable to advance the welfare and efficiency of the insurance profession. A scheme of examinations was inaugurated in 1899, which has steadily been developed. The Insurance Clerks' Orphanage was also the outcome of the Institute movement, and has done splendid work amongst the dependents of insurance officials throughout Great Britain. A journal has been published annually since 1898, and the 22 volumes now in print contain papers on all subjects cognate to insurance business. In 1912 the federation received a Charter of Incorporation. The objects of the new Chartered Insurance Institute were set out in 14 clauses, of which the first reads as follows:—

> To provide and maintain a central organization for the promotion of efficiency, progress, and general development among persons employed in insurance business, whether members of the Institute or not, with a view not only to their own advantage, but to rendering the conduct of such business more effective, safe, and scientific, and securing and justifying the confidence of the public and employers by reliable tests and assurances of the competence and trustworthiness of persons engaged in such business.

In June 1921 the membership of the Chartered Insurance Institute approached nine thousand. The membership included that of 30 local institutes in the United Kingdom. In addition, seven institutes in British dominions overseas were affiliated to the Chartered Insurance Institute, namely, those of the Cape of Good Hope, New South Wales, South Australia, Western Australia, Victoria, Toronto and the Transvaal. Primarily, the Chartered Insurance Institute is an examining body, and its present curriculum includes all subjects under the headings of fire, life, accident and marine insurance. For the examinations held in 1921, applications were received from 2,530 candidates, who entered for upwards of 12,000 subjects. Simultaneous examinations were held in 43 different centres throughout the United Kingdom. The council decided in 1921 to extend their operations in this connexion throughout the world. The diplomas of the Institute are sought after, and a fellowship diploma, secured as the result of an examination, may well be regarded as a hall-mark of proficiency in insurance business.

(C. MA.)

UNITED STATES

Insurance in the United States during the years 1910–21 developed along lines of increasing adaptability to the needs of policy-holders and solidified its standing as an essential and reliable financial instrument.

Extent.—In practically all lines of insurance the figures show a remarkable increase in extent and variety of risks carried under insurance contracts. This resulted from the need to provide for hazards not previously covered, from the general expansion of business, from the increasing recognition of the desirability of insurance of all kinds as a means of reducing personal and business risk, and from an increased activity on the part of insurance carriers in providing new forms of coverage. There was also considerable activity in the organization of new companies by interests which had formerly specialized in fire or casualty insurance and thus became enabled to offer coverage in all fields with the exception of life.

Effect of the War.—The World War affected in greater or less measure all forms of insurance. The seriousness of the resulting problems varied in proportion to the intimacy of the connexion between war hazards and particular kinds of insurance. The insurance business as a whole was affected by war inflation and subsequent deflation, leading to increased expenses, increased taxation, depreciation of securities, increase in interest rates, fluctuating property values, and marked changes in the moral hazard. During the period of inflation there was a general tendency to increase the volume of business, with an improvement in the moral hazard, as it was distinctly contrary to the interests of policy-holders to have losses. With the period of deflation, decreasing values and less intensive industrial activity, insurance companies were confronted with a large volume of insurance on depreciating property values. At the same time there was a decreased interest on the part of policy-holders in avoiding losses. In many cases it became profitable to collect insurance rather than to preserve the values insured.

In certain lines the increased volume of business and apparent prosperity of insurers led to the organization of many new companies and the introduction of inexperienced personnel. Subsequent events tested these new organizations and in many cases caused their disappearance.

The extreme depreciation of securities might have caused serious problems for companies which carried large amounts of invested funds over considerable periods of time had not insurance officials applied new standards which took into account the intrinsic worth rather than the market price of the securities.

At the beginning of the war considerable direct insurance and reinsurance was carried by the American branches of alien enemy companies. Even after the entry of the United States into the war these companies were permitted to write business. It soon became evident that their activities must be checked, largely because their operations enabled them to acquire and convey to the enemy vital commercial information. At the end of 1917 these companies ceased writing new business and were taken over by the Alien Property Custodian. This change necessitated a new distribution of insurance in the American market and resulted in an increase in business for American companies and for those of friendly nations.

Coöperation of Insurance Carriers.—The years 1910–21 showed a remarkable increase in the acceptance of the principle of coöperation among insurance carriers. Problems involved in the control of new lines of business, in the meeting of new conditions in old lines, and in general the recognition of common interests by insurance executives all have contributed to the growth of coöperative organizations. These organizations have as their chief purposes education of the public, control of legislation, making of premium rates, adoption of uniform contracts, discouragement of bad practices, provision of reinsurance facilities, suppression of fraud. All this is a part of the growing recognition that the business can no longer proceed along the old individualistic lines.

Governmental Regulation.—During 1910–21 there were also notable advances in the regulation of insurance in the interest of the public. Perhaps the most significant is the growth in importance of the National Convention of Insurance Commissioners, an organization of regulatory officials from the various states in the interest of promoting sound and uniform methods of regulation. Discussions at the meetings of the Convention, and the work of its several committees, each of which deals with some one aspect of the insurance problem, have served to improve the quality of state regulation and to increase the respect with which state departments are regarded by state Legislatures, as well as insurance executives and the public. Among specific accomplishments in the general field of regulation may be mentioned: coöperation in the examination of insurance companies, the uniform valuation of securities for insurance purposes, regulation of the appointment and practices of agents and brokers, prohibition of discriminatory acts, and the adoption of uniform standards of practice.

Insurance Education.—There has been a marked increase of interest in insurance education. Some universities have departments of insurance with classes for college students and for men engaged in the business, and many other colleges and universities have devoted some attention to this subject. The Insurance Institute of America and its constituent societies have developed education among employees of the companies. The Casualty Actuarial Society was organized in 1914 for the purpose of furthering scientific research and education in casualty subjects.

United States Chamber of Commerce.—Recognition of insurance as an independent business activity of major importance was evidenced in the creation of an Insurance Department in the organization of the United States Chamber of Commerce.

Expansion of Operations Abroad.—In 1918 the American Foreign Insurance Association was organized to transact fire, marine and allied branches of insurance in all parts of the world with the exception of North America. The association was in 1921 composed of 16 leading American companies and had an extensive system of branches and agencies.

Life Insurance

Extent.—In 1921 life insurance still held its place as financially the most important type of insurance with assets of 253 companies at the end of 1920, as given in the Insurance Year Book, of nearly $7,400,000,000, a total income during 1920 of nearly $1,800,000,000, and disbursements of over $1,200,000,000. These figures represent a growth of over 100% since 1909 when the same items for 189 companies were, respectively, about $3,500,000,000, $750,000,000, and $500,000,000. Consideration of the reports of companies subject to the jurisdiction of the New York Insurance Department shows that the increase of business during the 10 years was somewhat irregular. The total number of policies in force increased from slightly over 5,750,000 on Dec. 31 1909 to nearly 14,000,000 on Dec. 31 1920; insurance represented by these policies from over $11,000,000,000 to nearly $27,000,000,000. At the same time the size of the average policy increased from $1,930 to $2,055. There were substantial increases in the amount of new business written in each of the years 1910 to 1913 inclusive, a slight decrease in 1914, further increases in 1915 to 1918 inclusive, and an immense increase in 1919 which was exceeded in 1920. The amount of new business written in 1920 was more than five times the amount written in 1910. Practically all this new business represented an increase in the business of old companies. At the beginning of the period there were 35 companies operating in New York and at the end 37. In the whole United States the number of companies operating increased in the same period from 189 to 253, but nearly 85% of the business was carried by companies operating in the state of New York.

It is impossible accurately to assess the importance of each of the various reasons for the immense increase in the life-insurance business. The following are probably the principal causes: (1) Inflation and high prices, making necessary a larger amount of insurance to achieve the same real protection. (2) Increased willingness to pay for insurance out of high wages and profits due to the war. (3) Education in the desirability of life insurance through widespread application of the governmental war-risk scheme. (4) Development of life insurance to cover business risks, inheritance taxes, and other contingencies.

One result of the Armstrong Investigation of 1906 was an attempt to limit the new business which individual companies might write in any one year. The impracticability of the limitations originally imposed soon became evident and modifications in the law caused their almost complete elimination.

The following table from the *Insurance Year Book* presents in detail the record for 1910–20 of new business written and insurance in force for companies reporting to the New York Insurance Department:—

	No. of Companies	New Business Written	No. of Policies in Force Dec. 31	Amount of Insurance in Force Dec. 31	Amount of Average Policy
1910	33	$1,362,589,920	6,049,617	$11,669,698,842	$1,929
1911	34	1,577,846,251	6,621,386	12,802,989,205	1,934
1912	34	1,702,146,572	7,002,352	13,527,321,222	1,932
1913	34	1,840,577,945	7,452,154	14,324,485,296	1,922
1914	35	1,808,730,481	7,851,199	14,931,150,898	1,902
1915	35	1,928,288,981	8,284,281	15,609,722,445	1,884
1916	35	2,362,193,027	8,886,568	16,784,207,636	1,889
1917	35	2,879,338,785	9,502,382	18,422,349,562	1,938
1918	37	2,979,783,022	10,193,211	20,018,199,440	1,963
1919	37	5,213,897,389	11,602,715	23,849,488,761	2,050
1920	37	5,628,778,503	13,199,605	26,839,537,511	2,055

Mortality.—The registration area of the United States showed a decrease in general mortality from 14·7 per thousand to 12·8 per thousand for the years 1910 to 1919 inclusive. Investigations of mortality of insured lives showed a similar trend. This favourable mortality experience was interrupted by the influenza epidemic. It was at its height during the winter of 1918–9, resulting in such an increase of deaths that the mortality of insured lives reached approximately 100% of the American Experience Table, although normally it is expected to reach only about 55 to 75% of that table according to the age of the company. A well-known actuary has said that the net effect on the general body of policy-holders in participating companies was the loss of approximately one year's dividends. Fortunately the epidemic was brought under control and no insurance company was unable to meet its liabilities to policy-holders on account of it. A few small companies were seriously embarrassed and some were forced to reinsure; but the large old-line companies, although they found it necessary to reduce dividends in some cases, were at no time in danger of becoming unable to meet their obligations.

Mutualization.—In the years 1910–21 the Metropolitan Life Insurance Co. and the Home Life Insurance Co. passed from the stock form of organization to the mutual. The Equitable Life Assurance Society and the Prudential Life Insurance Co. practically did so although they were in 1921 still technically stock companies. With these changes the mutual form of organization became the ruling force in life insurance, nearly all of the large companies in 1921 being operated on the mutual plan. A large majority of the smaller companies were stock corporations.

Group Insurance.—Group insurance has as its purpose the insurance of the lives of a group of employees under a blanket contract issued to the employer who becomes responsible for the payment of premiums although he may arrange for contributions from his employees. The New York Insurance Department issued its first approval of a policy of this form in Feb. 1911. On Dec. 31 1920, according to the *Insurance Year Book*, there were nearly 19,000 policies and over $1,500,000,000 of insurance in force under this plan. Although 31 companies had group insurance on their books, 4 of these wrote about 90% of the total business. In its typical form this insurance is written under a yearly renewable term contract at a premium rate based on the age-characteristics of the group at the time of writing the contract and on the desirability of the group as an insurance risk. The individual amounts payable to the beneficiaries of the employees are small, varying from $500 each to a maximum of $5,000. This type of insurance is becoming an accepted form for large industrial corporations.

Disability Clause.—The disability clause commonly added to the insurance contract provides for the assumption by the life insurance company of the risk that the insured might become totally and permanently disabled. In its most complete form it provides for a waiver of premiums during the period of disability, maintaining the amount of insurance unimpaired, and for the payment of an annuity to the policy-holder. In its early form the clause provided for waiver of premiums alone, but it gradually has been liberalized as experience and the demand for protection have developed. A recent development is a provision to the effect that after a policy-holder has been totally disabled for three months it shall be presumed that he is likewise permanently disabled. Another development in liberality is the practice of granting benefits after death which might have been claimed under this clause by the insured during his lifetime.

Tuberculosis, insanity, and accidents account for the majority of cases of permanent and total disability. Mr. Arthur Hunter in a paper delivered before the Actuarial Society of America presented the following figures covering the experience of the New York Life Insurance Co. from 1910 to 1920:—

Cause of Disability	Number of Cases	Per cent of Total Claims
Tuberculosis	730	43·7%
Insanity	334	20
Accident	106	6·3
Paralysis of all forms including infantile	77	4·6
Cancers and tumours	58	3·5
Heart disease	51	3·1
Other causes	314	18·8
Total	1,670	100·0%

Double Indemnity.—The so-called double-indemnity clause which has come into general use in life policies takes two forms: one promising a payment of double the amount of insurance in the event of death from any accidental cause; the other promising double payment if accidental death occurs while the insured is a passenger on a common carrier. A small extra premium is usually charged for this feature. This coverage has developed largely as a selling point and it seems to many to have no logical place in a life-insurance contract.

Mortality Investigations.—In 1916 the Bureau of the Census published an interesting set of mortality tables known as the United States Life Tables, 1910. These were based on the general mortality statistics for the original registration states and showed mortality for males and females, whites and negroes, natives and foreign born, and dwellers in city and country. There were also special tables for the states of Indiana, Massachusetts, Michigan, New Jersey, and New York. The Medico-Actuarial Mortality Investigation was completed and published in 5 volumes. This investigation was undertaken jointly by the Association of Life Insurance Medical Directors and the Actuarial Society of America. To quote Mr. Wendell M. Strong (*American Year Book*, 1913, p. 369): "The present investigation is of even greater scope than the Specialized Investigation and is participated in by 43 companies of the United States and Canada, including practically all of the important companies of both countries . . . the scope of the investigation will be seen from an enumeration of a few of the subjects and classes investigated, such as weight with reference to height and age, causes of death, over-weights, under-weights, large men, small men, married women, unmarried women, family history of tuberculosis, different classes of miners, different classes of employees in the iron business, and different races."

It has long been recognized that the American Experience Table of Mortality is not an accurate statement of insurance experience, particularly as to the younger ages. In 1915 the Actuarial Society of America, at the suggestion of the National Convention of Insurance Commissioners, undertook to prepare a new American table. The result of the work, which was participated in by these two organizations and by the American Institute of Actuaries, was issued in the form of two principal tables: the American Men Table, and the Canadian Men Table, of which the former is the more important. These tables are based on the combined experience of 60 leading insurance companies of the United States and Canada. The results show, for ages below 50, a considerably lower mortality than that indicated by the American Experience Table, while mortality rates above 50 are approximately the same.

Governmental Insurance.—Two states have experimented with state-managed life insurance, each contemplating principally the elimination of the agent's commission. The Massachusetts Savings Bank Insurance scheme, which was started in 1907, showed Oct. 31 1919 total insurance in force of $12,374,000. The Wisconsin State Life Fund, which was started in 1912, showed insurance in force Dec. 31 1919 of $404,000. The most important governmental attempt to furnish life insurance during the period was of course the War Risk Insurance Bureau, described under PENSION.

Industrial Insurance.—Industrial insurance showed a steady growth during the period, as indicated by the following table from the *Insurance Year Book:*—

	No. of Companies	Insurance Written	Insurance in Force (as of Dec. 31)	
			No. of Policies	Amount
1910	22	$ 749,717,264	23,044,162	$3,179,489,541
1915	25	999,079,322	33,370,638	4,431,754,866
1920	20	1,545,989,192	49,178,887	7,121,380,255

Fraternal Insurance.—The development of fraternal insurance, so far as figures are available, is shown in the next table from the *Insurance Year Book:*—

	No. of Orders	Insurance Written	Insurance in Force (as of Dec. 31)	
			No. of Certificates	Amount
1910	497	$1,331,552,713	8,558,093	$9,562,511,910
1911	396	1,200,633,063	10,122,169	9,839,909,282
1912	397	1,023,726,087	9,963,019	9,472,232,473
1913	509	1,065,071,108	8,058,317	9,622,276,590
1914	498	1,079,569,596	7,868,554	9,171,284,227
1915	472	922,890,799	7,695,944	8,694,449,483
1916	523	1,155,784,564	8,674,996	9,162,111,616
1917	533	822,041,734	7,456,551	9,129,974,447
1918	506	834,170,063	8,021,387	8,838,578,765
1919	463	1,327,957,612	10,380,132	9,531,216,614
1920	*238	1,177,970,840	8,439,097	8,879,451,774

*Orders showing 1920 figures.

An improvement in the conditions of fraternal insurance, most important from the point of view of the insured, was brought about by the Mobile Bill and the New York Conference Bill. The former was the result of a meeting of the National Convention of Insurance Commissioners and representatives of the fraternal organizations held in Mobile, Ala., in Sept. 1910. It was enacted into law or adopted by departmental rulings in many states without material amendments and required the societies gradually to improve their condition under state supervision until they should reach a defined standard of solvency. The latter bill which has since been generally adopted is in the nature of an amendment to the Mobile Bill and is an improvement on it in some respects. Through legislative permission the fraternal societies have also acquired the power to write juvenile insurance.

Fire and Marine Insurance

The development of fire and marine insurance during the years 1910–20 is indicated by the appended table from the *Insurance Year Book*.

It must be remembered in considering these figures that the 1920 statements do not reflect completely the process of deflation of business, as the figures for 1921 were not available when this article was written.

It is unfortunate that aggregates are not available separately for fire, marine and allied lines of insurance. The figures here given represent all lines written by companies doing primarily fire and marine business.

Fire and Marine Insurance, 1910–20.

	No. of Insuring Organizations	Net Premiums	Total Income	Paid for Losses	Paid for Expenses	Total Disbursements
1910	624	$ 267,134,029	$ 295,644,715	$125,335,702	$ 95,466,763	$256,681,453
1915	659	433,995,437	474,626,373	226,867,125	159,568,682	416,275,196
1920	926	1,020,241,864	1,102,788,799	461,872,894	378,257,920	907,245,187

Fire Losses and their Prevention.—The annual fire losses in the United States during 1910–20 as compiled from various sources by the Spectator Co. show a fluctuating tendency due probably to their relation to the changing business situation. It will be noted that for the year 1920 there is an unusually high figure.

Fire Losses in the United States, 1910–20.
(From the *Insurance Year Book.*)

	Aggregate Property Losses	No. Fires Causing Loss of $1,000,000 or More
1910	$214,003,300	13
1911	217,004,575	12
1912	206,438,900	8
1913	203,763,550	6
1914	221,439,350	9
1915	172,063,200	10
1916	214,530,995	13
1917	250,753,640	22
1918	290,959,885	21
1919	245,793,128	28
1920	303,147,351	13
	$2,539,897,874	155

During 1910–20 there were 10 fires involving losses of $5,000,000 or more each, 5 of which caused losses of over $10,000,000 each. Certain of these fires were caused in part at least by explosion.

The insurance experience of the 10 years was very favourable as there was only one year, 1914, during which the ratio of insurance losses to premiums exceeded the average ratio of the past 61 years. This ratio touched its high point in 1914 at approximately 60% and its low point in 1919 at approximately 40%. The ratio was rising during 1920 and 1921.

In 1915 the Actuarial Bureau of the National Board of Fire Underwriters was founded in response to a demand for complete classified statistics of fire insurance experience. To 1921 this work had been devoted almost entirely to the classification of losses by states and by causes and a report had been issued on this subject covering the years 1915–19 inclusive. The following table is a condensation of this report:—

	Amount of Losses	Per cent of total
Strictly Preventable Causes . .	$287,759,960	25
Partly Preventable Causes . .	484,753,172	43
Unknown Causes	360,587,544	32
Total	$1,133,100,676	100

Little was done in the development of entirely new fire-prevention devices. There was considerable improvement in the efficiency of operation of devices which were already in use in 1910, and there was a widespread development of education and stimulation of fire prevention. In 1920 the President of the United States issued a proclamation setting aside Oct. 9 as fire-prevention day. Education in fire prevention was extended to the schools and a large amount of literature was distributed. Results from this work had not yet become perceptible during 1921, though future years were confidently expected to show a reduction of losses. During the war important industrial and governmental property was put under the care of fire-prevention engineers. The results furnished abundant evidence of the effectiveness of preventive measures when directed by experts.

Fire Insurance Rating.—Little fundamental progress was made in the development of fire-insurance rating. Modifications of the Universal Mercantile Schedule and the Dean Schedule still were used throughout the country in 1921. The latter had been adopted in new localities, notably in New England and the Middle West, and was used in 29 states. Interesting proposals for improvement of the rating situation were offered in the Experience Grading and Rating Schedule and the L. and L. Schedule, both of which failed to be adopted. The former contemplates a revolutionary change of methods of rating. It is a plan for collecting statistics on fire-insurance experience in such a way that relative hazards may be calculated and premium rates based upon them. The L. and L. Schedule does not differ in principle from the older type.

Several states have passed laws dealing with fire insurance rates, varying all the way from the prohibition of discrimination to the creation of a special rating board for the purpose of making rates. Better opinion seems to favour a type of law which permits the making of rates by insurance carriers acting in concert and subjects the rate-making organization to supervision. Several important reports on investigations dealing primarily with fire insurance were made during the period, resulting in advances in state regulation and in curbing undesirable practices. The most significant of these was the Merritt Report transmitted to the Legislature of New York in 1911. Others were the Illinois Report of 1914, the Pennsylvania Report of 1915, the Missouri Report of 1914, and the North Carolina Report of 1914.

Anti-Compact Laws.—Attempts have been made in certain states to prevent all forms of coöperation between insurance companies in fixing premium rates. In the states of Missouri, South Carolina, and Mississippi such attempts resulted in the virtual withdrawal of the companies. Compromises were effected in the first two states and the objectionable legislation withdrawn; the situation in Mississippi was still unsettled in 1921. Such destructive methods are evidence of a poverty of constructive ability to deal with insurance problems. They cause confusion in business and retard the adoption of more adequate measures.

Underwriting Profit.—The conflict of opinions concerning what constitutes a reasonable underwriting profit for fire insurance companies was resolved in some measure by the agreement between the National Convention of Insurance Commissioners and the National Board of Fire Underwriters. The following points of agreement were reported by the latter body in the Proceedings of its 55th Annual Meeting:

"1. The minimum 'reasonable' underwriting profit is 5% plus 3% additional for conflagrations.

"2. Five years is a minimum term upon which to base a calculation as to underwriting profits.

"3. The difference between earned premiums and incurred losses, plus incurred expenses, represents underwriting profit or loss.

"4. A conflagration is defined as property loss exceeding $1,000,000.

"5. In determining the underwriting experience in any given state the first $1,000,000 of loss shall be charged to the particular state and the balance distributed among all the states (including the one in which it occurred) in proportion to the premium income of each.

"6. That no part of the so-called 'banking' profit shall be included in the underwriting profit."

It is to be noted that the term "underwriting profit" is defined by this agreement as signifying a profit drawn entirely from the operation of the insurance business as such and that there is eliminated from consideration any profits which a fire-insurance carrier may make from invested funds. Dividends to stockholders are in many cases paid from the latter source, insurance profits going entirely to increase surplus.

Revision of Standard Policy.—The old New York Standard Policy which was in use in many parts of the United States was supplanted in New York on Jan. 1 1918 by a new policy form. The new form differed in detail and in arrangement from the old and gave effect to the changes which some 30 years' experiences had shown to be desirable. Substantially the same policy had been enacted in Pennsylvania in 1915. The new policy had been approved by the National Convention of Insurance Commissioners and was in effect in 1921 practically throughout the United States.

Marine Insurance.—The only figures indicating the extent of the marine insurance business in the United States are those which were compiled by Dr. S. S. Huebner of Philadelphia in connexion with an investigation of marine insurance described below. These show that the total net premiums received during the year 1918 by American companies amounted to over $70,000,000 and by foreign companies to over $39,000,000, a total of $109,000,000. Estimated losses paid were respectively $40,000,000 and $24,000,000, a total of $64,000,000. These figures take no account of the large amount of marine insurance which is placed directly with the home offices of foreign companies, of which no record appears in the American reports. It is variously estimated that premiums for this business aggregate 20% to 30% of the total for the United States.

The War and Marine Insurance.—Marine insurance was more intimately connected with the conduct of the World War than was any other line, since it dealt with hazards involved in shipping supplies to Europe. As evidence of the increase of interest in the business during the war, the N. Y. Insurance Department reports that, while there were but 58 organizations authorized to write marine insurance in New York on Jan. 1 1914, there were 109 so authorized on Jan. 1 1918. This total includes new companies organized during the period as well as old companies extending their facilities. So great, however, were the risks incident to war that it was impossible for private initiative to cope with them. Accordingly the Government established the Bureau of War Risk Insurance, which accepted insurance against war hazards. This Bureau was a necessity during the continuance of hostilities; without it American commerce must have almost ceased. Its operations had by 1921 been discontinued so far as they related to marine insurance. New private organizations were attracted into the field by the seemingly large profits, but lack of experience and reckless underwriting caused the disappearance later of some of these organizations and the withdrawal from the marine business of many of the companies primarily interested in fire insurance. Losses which were apparently small during the war period in their final settlement turned out to be alarmingly large. In addition there was an increase in the moral hazard after the war, due to depreciation of values and to the tendency on the part of foreign merchants to refuse to accept shipments of goods whenever a pretext could be found. Congestion of ports in the artificially prosperous times succeeding the Armistice was another cause contributing to increased losses.

During this period, owing largely to the competition of new underwriters, the marine insurance contract was quite generally extended to cover the risk of theft and pilferage. Experience under this coverage has been most unfavourable, as the existence of insurance tended to relieve shippers and carriers of concern for the safety of the cargo. This, with the moral irresponsibility engendered by the war, demonstrated the need of restricting or eliminating the coverage. When accepted it is now frequently provided by indorsement that only 75% of theft or pilferage losses will be paid.

Congressional Investigation.—In 1919 the Committee on the Merchant Marine and Fisheries of the House of Representatives and the U.S. Shipping Board entered upon an investigation of marine insurance in the United States. It early appeared that what the committee regarded as an unduly large share of American marine insurance business was placed directly or indirectly with foreign companies. On the ground that American marine insurance facilities should be developed to a point which would enable American companies to care for the commercial needs of the United States, the committee recommended that combinations of companies be legally authorized, and that the legislative obstructions, including taxation, which hamper companies in their competition with alien interests, should be removed. To provide increased facilities for hull insurance and the survey of losses, three marine insurance syndicates were organized with the approval and encouragement of the Congressional Committee. Syndicate "A," which is a service syndicate for the settlement of losses, operates through the United States Salvage Association, Incorporated. There was likewise introduced a marine-insurance bill for the District of Columbia, designed to serve as a model for enactment in the states.

Marine-Insurance Contract.—In 1917–8–9 the American Hull Underwriters Association adopted certain new forms of marine-insurance contracts which have come into general use, not differing widely from the old forms but adapting them to American conditions.

American Bureau of Shipping.—Increased activity in extending the operations of the American Bureau of Shipping has placed at the disposal of American marine underwriters improved facilities for the classification of risks.

Casualty and Miscellaneous

Workmen's Compensation.—The substitution of the principle of workmen's compensation for that of employer's liability in the United States (*see* LABOUR LEGISLATION) gave rise to an entirely new form of insurance by which insurance carriers assume the obligation of employers to pay compensation to their workmen. Workmen's compensation insurance occupies a peculiar place. The insurance carrier is placed in the position of an administrative unit in a scheme of social welfare. Its duties involve relieving employers of undue risk, insuring the payment of compensation to employees, and assisting in the prevention of industrial accidents. In this form of insurance also there are found the only examples in the United States of the extensive application of state-managed insurance. In 6 states the so-called state funds are given a monopoly of workmen's compensation insurance, in one state there is practically a monopoly, and in 9 states the state fund competes with private carriers. The growth of this type of insurance followed the increasing acceptance of the compensation principle, until in 1920 the carriers collected some $200,000,000 in premiums, more than twice the amount of the entire premiums paid for all kinds of casualty insurance in 1910. It was by far the most important of the lines of insurance written by casualty companies.

Workmen's compensation insurance is written largely by stock-insurance companies, but the organization of state funds, mutuals, and reciprocals has intensified competition for the business. Fortunately competition is in large measure regulated by coöperative action and state regulation, so that it had not the disastrous effects which might otherwise have developed. It undoubtedly improved the service offered to policy-holders.

Regulation of premium rates by the state was from the first an important factor in the compensation business, which is held to be affected with a greater public interest than are most other types of insurance. At first this regulation took the form of approval of rates as to adequacy, with the purpose of requiring carriers to collect sufficient premiums so that there might be no question of their ability to pay claims to injured workmen. Largely through the operation of competition, approval as to adequacy has involved approval as to reasonableness since rates charged in individual cases tend to be the lowest permissible. The measurement of the hazard of workmen's compensation insurance as expressed in terms of rates is peculiarly difficult. In the first instance the carriers had no experience of immediate value. Even after experience was acquired it was difficult to make use of it, because of the great variation in laws and conditions among the states and because of the frequent changes in the laws of each state. Further, each industry and each plant should be rated on its peculiar hazards.

The first rates, which were largely a matter of judgment, were too high. Successive reduction and changes in conditions brought about a rate-level which in 1916 was seen to be too low. The state departments of insurance and the carriers realized the necessity of revising rates and of securing the widest possible basis of experience for the revision. Compensation rates for the entire country were revised in 1917 by the Augmented Standing Committee, a group representing all interests: companies. mutual companies, state funds, and state departments of insurance. The success of this conference led to the formation in 1918 of a continuing coöperative organization, representative of the same general interests. This organization, the National Council on Workmen's Compensation Insurance, conducted another general revision of rates in 1920. These rates, with certain detailed changes, were in effect in 1921. In addition to the national organizations, there were many state rating bureaus which have control over the making and application of rates in their respective states. All but one of these organizations coöperated with the National Council. Where exclusive state funds are in operation each state is, of course, a unit.

The rates of premium developed in the first instance were average rates for each industry. Further account must be taken of the variation from the average of individual plants within the industry. This is accomplished through the application of a system of merit rating, consideration being given in most cases to the loss experience of the individual plant and to the hazards of the plant as determined by inspection of its physical features. Provision is made in compensation acts for the payment of compensation in periodical installments. An insurance loss under a compensation policy may involve payments extending over a considerable length of time. To guarantee the ability of the carrier to make such payments it is necessary that a reserve be set up which shall be equivalent to their probable amount. Such reserves are required by state law, and the rules for their calculation have gradually been improved so that there was in 1921 little question of their adequacy.

Automobile Insurance established itself during the years 1910–21 as a major department of the business. Net premiums received during 1920 were estimated by *The Insurance Field* at $185,000,000. Full coverage under automobile policies involves several hazards, contracts being written to cover the risk of fire, theft, damage to the insured's automobile through collision, liability for damage to the property of others, and liability for personal injury. Fire and theft insurance are written by fire and marine companies, personal liability by casualty companies, while collision and property-damage insurance are written by both. In the West and South there are many specialized automobile insurance companies writing all forms of coverage. Combination contracts are frequently issued by a fire and marine company and a casualty company under a coöperative arrangement. The contract of each company is, however, independent.

The rapid development of this sort of insurance has carried with it serious problems, particularly in the fields of theft and collision where the moral hazard is peculiarly difficult to handle. Rates for these coverages are high, and losses so serious that in 1921 it was apparent that some means must be found to control the hazard. Both casualty companies and fire and marine companies had their separate organizations for discussion and for taking coöperative action on automobile problems. The two organizations coöperate closely in matters of common concern. In this way the contract and rating methods have gradually been developed. It seems probable that the loss problem will receive increasingly effective attention from these same organizations.

Accident and Health Insurance.—Premiums of approximately $92,000,000 were received for accident and health insurance in 1920. This was about three times the premiums of 1910, representing largely an increase in the business of casualty companies, although certain life-insurance companies have developed this field recently. Two new forms of contract appeared which are of particular interest. Accident and health insurance contracts may now be secured without provision for cancellation by the insurance company. Formerly contracts were written only on a one-year basis with provision for cancellation at any time by the insurer, and the bulk of the business was in 1921 still so written. It was the practice of the companies to cancel as soon as there was any evidence of a risk becoming undesirable; consequently, many individuals needing this type of insurance were unable to secure it. The new form insures the continuance of the coverage. Another recent development is group accident and health insurance, similar in its purposes and methods to group life insurance, described in a preceding paragraph. It is being used in many cases as supplemental to the limited coverage provided by workmen's compensation laws which apply only to occupational accidents. Many of the states have enacted standard provisions to be incorporated in policies, some of them compulsory and some optional. These laws have introduced an element of standardization into the contract but the schedules of benefits still remain bewilderingly diverse.

Other Lines.—During the years 1910–20 there were tremendous increases in the business of bonding and of plate glass, burglary and theft, and flywheel insurance. There were considerable increases in steam boiler, title, credit, and live stock, and a decrease in workmen's collective and employer's liability insurance.

Several new types of insurance appeared and attained positions of more or less importance. Among these are strike insurance, covering loss of profit and expenses due to strikes of employees; aviation insurance, covering hazards connected with the use of aeroplanes; weather insurance, covering loss due to interference by rain with public ceremonies, amusements, sales and other events; explosion insurance; crop insurance, covering the failure of crops to reach the marketable stage; riot and civil commotion insurance; and parcel post insurance, covering losses of parcels sent by mail. (R. H. B.)

INTELLIGENCE, MILITARY.—Under this generally accepted designation may be considered the work of obtaining, collating and interpreting information about an enemy or potential enemy, and also the results of that work and the organization which performs it. In practice, "negative" or "defensive" intelligence, that is the countering of an enemy's efforts to obtain intelligence, is also included, as explained below.

(A.) *Intelligence Generally.*—Up to the last few years before the World War the function of military intelligence was in no way separated from staff work in general, nor regarded as a specialty. Information as to actual or potential enemies has of course always been required, obtained and interpreted by Governments and commanders in the field, and individual officers have won great distinction in the wars of the past in obtaining news of vital importance. The employment of spies and the questioning of prisoners date from the earliest times of military history. But such military intelligence was casual and *ad hoc* rather than systematic. Even in Napoleon's day the secret service of his empire was controlled by the Foreign Office in Paris, whose information sometimes took weeks to reach the army in the field. The more immediately useful information furnished by local agents in the theatre of war was indeed organized and paid for within the army, and then, as now, it was the duty of every subordinate commander to collect all possible information and pass it to his superior. But of a regular intelligence service as understood to-day there was no trace in Napoleon's armies. The collection of information was the duty of soldiers generally and the profession of spies habitual or temporary, and its synthesis and interpretation were, in practice, the business of the commander-in-chief himself aided by those of his staff officers whom he chose to employ. Later, we find from time to time "intelligence corps" formed for the obtaining of information, but it still remains part of the functions of a staff—and, when specialized, a general staff—to collate and to interpret this information. Nevertheless, the very organization of such corps or agencies for collecting information implies that it is the business of some one, in charge of the corps or employing the agents, to receive the information that is obtained item by item and to collate it, as well as to direct the efforts of his corps or his agents to those localities where, or to those subjects on which, special information (positive or negative) is wanted by the commander.

In this sense Napoleon was served by an intelligence officer of the first class—Col. Bacler d'Albe, unknown to fame save as a cartographer, but in fact the one assistant who was present when Napoleon arrived at his great decisions in the field. Lying prone on the outspread maps, compasses in hand, with D'Albe at his elbow to inform him either as to topography or as to the enemy's dispositions and order of battle,[1] Napoleon could handle a changing situation day by day with all the certainty that the means of communication of his day allowed. It has recently been remarked that, to a Napoleon, an intelligence staff is more indispensable than the operations staff, and the remark is historically justified by the facts. For an operations staff is the product of a military system—that of Germany—in which the commander-in-chief is a sovereign who may not possess the qualities of command but yet must command, and it has developed because the growing intricacy of operations detail has compelled an increase in the number of workers who collaborate with the normal commander-in-chief. A saying of Foch is illuminating in this connexion. The great French marshal, asked how Napoleon would conduct the western front campaigns, replied: "Were he to return he would say 'you have weapons, numbers, communications, aircraft, transport such as I never possessed. Stand aside, all of you, and I will show you.' But, now as then, he would have taken care to have his Bacler d'Albe at his side."

In so intimate a union between the master of operations and the intelligence officer, it may be assumed without direct evidence that a man whose military judgment was matured by the unique experience of watching Napoleon's brain arrive at conclusions, and following his thoughts so as to be ready to supply the data on which they fed, must have added the function of "interpretation" to those of collection and sifting.

In this word "interpretation" we reach the real *differentia* between the ordinary system of military intelligence work in the past and that developed in the World War.

Napoleon was his own operations staff, and Bacler d'Albe, in his own person also, was the intelligence staff. But while, as above mentioned, the operations work of a Napoleon came, in the middle of the 19th century, to be devolved upon an organ known as the general staff—there was no collateral development on the intelligence side. It is true that within the general staff a branch was usually set apart for intelligence work, and that such organizations of secret agents as existed were controlled by the general staff. Moreover, the study of foreign languages came to be regarded as a valuable element in a staff officer's equipment. But these things did not amount to providing the command (or the operations staff, which is often the command in commission) with the organ which should play Bacler d'Albe to their Napoleon. France, with its "Deuxième Bureau," came probably as near to that ideal as any country, but the Deuxième Bureau was discredited and shaken to its foundations by the Dreyfus affair. Moreover, a new doctrine of the relations between operations and intelligence, to be discussed presently, was set up about 1912, which tended to impair its usefulness still further. In Great Britain the reorganization following upon the Esher report in 1904 provided that the directorate of operations on the general staff should deal, section by section, with intelligence and operations together; thus, the section charged with preparing plans of operations against, say, Turkey was responsible for all intelligence concerning Turkey. In the field organization, both before and during the World War, sufficient officers were allowed on the staff of each formation for one to devote himself principally to intelligence work, and at G.H.Q. there was provided a "brigadier-general intelligence" coequal with a "brigadier-general operations." But any real specialization of function which grew up in the war was due rather to the immense and unforeseen volume and complexity of the information to be handled than to any change of doctrine. If, in the higher staffs, officers were engaged on intelligence work to the exclusion of every other activity, on the lower staffs it was not so. To the very end of the war the theory that, in a division, a G.S.O. 3rd grade (Intelligence) was the understudy of the G.S.O. 2nd grade (Operations) was rigorously maintained, and an "intelligence officer" so called, who was expected to be nearly as familiar with doings on the German side of the wire as an operations staff officer with those on his own side of it, was looked upon as a technical assistant to the general staff rather than as a member of it. The fact that the subjects on which information was required were immensely extended in the war, did not, and quite logically did not, involve any change of doctrine any more than the appointment of a dozen extra foreign correspondents to a newspaper staff affects the distinction between the news-getting and the editorial functions.

But the inclusion of "interpretation" as a function of the intelligence staff—*de facto* if not *de jure*—marks a difference in kind. Once this is admitted and carried to its logical conclusion, certain officers are told off to live, mentally, in the enemy's camp, to form and to convey to the commander working ideas of the opponent's life, mentality and routine, to vivify the specific facts gleaned by them or by others. An epigram current in the British intelligence service during the war admirably sums up the new rôle:—"The intelligence officer's job is to command the enemy's army."

This is what interpretation implies. The facts have to be given not merely a meaning, but their true meaning, or as near an approximation thereto as possible. It is an old, but frequently misleading, maxim of war that a commander should ask himself what he would do if he were in the enemy's place. The real question is: How will the situation strike the enemy, given his organization, upbringing, habits of mind and predispositions? If, for example, in the third week of Aug. 1914 Hindenburg and

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[1] Bacler d'Albe kept a card index of enemy formations and units.

Ludendorff had acted on the supposition that the enemy would do what they in his place would do, Tannenberg would probably never have been fought, or, if fought, would have been merely a battle to gain time. As it was, when pros and cons were practically in equilibrium and the fate of East Prussia depended on the choice made, one thing turned the scale—a conviction derived from intimate knowledge of the Russian army, that in spite of recent reforms and of the evident war-readiness of the enemy, slowness was an inherent character of his leadership. But for this, the decision to leave a mere handful of cavalry in front of Rennenkampf's advancing army, and to concentrate every available rifle and gun against Samsonov, would have been simply trusting to luck, and although luck must always play a part in war, it is the art of command, whether the command be personal or in commission, to reduce this part to a minimum.[1]

To answer the question, then, the commander and his operations assistants must have an intelligence staff which will constantly supply them with a picture of enemy movements, positions and *intentions*. To construct this picture a high degree of military training is necessary, especially in the senior ranks, and the personnel in these ranks must be drawn from the same sources and trained to the same level as similar personnel on the operations staff. But, given this equipment, the intelligence staff officer need have little knowledge of current events and intentions on his own side. The fewer his prepossessions the better.

On this point there has been in the past not a little controversy. In the French command regulations of 1913 it was laid down that the duty of intelligence was to seek for information on the topics and in the directions indicated by the command. In all armies, this principle was accepted so far as cavalry reconnaissance was concerned, the capacities of that arm, and its fragility (exhaustion of horses) made it essential that its activity should be directed to obtaining definite answers to specific questions. The same applies to some extent to information-gathering by other front agencies. And so far as they are concerned the wisdom of the doctrine is unquestionable. In a local tactical situation the presence of enemy forces in certain positions, or their movements in certain directions, can as a rule bear only one meaning. But it is altogether different in the case of groupings and movements of major importance. Here data, even if complete and still more if incomplete, may be wholly misleading unless interpreted by men both qualified in respect of military judgment and also free from preconceived ideas. Instead of placing the intelligence staff in the position of the enemy, with instructions to compile a picture of his grouping and intentions, the doctrine embodied in the French regulations fetters it by compelling it to start from prepossessions. It is to this principally that must be attributed the miscalculations of the French intelligence in Aug. 1914—miscalculations that were nearly fatal to France. It was assumed *a priori* that only first-line troops would be employed by the Germans, and the Deuxième Bureau directed its efforts to identifying the various active army corps as they stood in the strategic deployment. In this it succeeded, but the presence of many duplicate corps of reserves, bearing the same numbers and assembled in the same areas as their parent active corps respectively, passed unnoticed. Thus the strength of the enemy's *troupes de choc* came to be estimated on the eve of battle at 40 divisions, whereas in reality there were 68.

When the intelligence staff is regarded as the mirror of the enemy the risk of such miscalculation is minimized. The mirror may be dark at times, and *a priori* reasoning by the command may then be necessary to supplement the picture, but that is a very different matter from drawing a picture for the intelligence staff to fill in. One argument, and one only, in favour of "coloured" intelligence was and is tempting—the psychological. General Berthelot has admitted that in the information given by French G.H.Q. to subordinate commanders the enemy forces were sometimes deliberately understated so as not to alarm the recipients. Such a proceeding—the risks of which are obvious—is equally conceivable as between an intelligence staff and a command staff. But it is the less likely in proportion as the intelligence staff is allowed to disinterest itself in the events and intentions of its own side. And although it may sometimes be in the general interest that a subordinate's local fears should be overcome by means of a subterfuge, a G.H.Q. must always face the facts. That is the essential quality of its supreme responsibility. Correspondingly, the command is entitled to insist on the facts being presented to it. The intelligence staff need not of course produce at every moment the mass of small items on which its "appreciation" is based, nor should this appreciation be liable to be overruled by a different interpretation of the same evidence on the part of the command (herein its position differs from that of an operations staff). But it cannot expect the "appreciation" to be accepted unless it possesses the confidence of the command, and there is no surer way of forfeiting this than by crying "wolf" too often.[2]

In this modern conception of military intelligence it is evident that the chief of intelligence bears a responsibility that is only less than that of the commander-in-chief or his deputy, the chief of the general staff. The personal rank of the head of the intelligence branch may be high or may be comparatively low, the numerical strength of the organization that he controls may vary from a dozen or two to some thousands—not including "agents" in either case—and the scope of the work may be purely military and local or may cover almost the whole military, political, industrial and economic field as it did in the World War. But whatever his rank, his system and his scope in any particular case, his function is unlike that of any other branch of the staff. He "commands the enemy's army," that is, he interprets to the best of his ability that independent will over which the commander-in-chief exercises no authority.

The collection, sifting and interpretation of data concerning the enemy's resources, movements and intentions constitute what is usually called "offensive" or "positive" intelligence. There is another branch of intelligence work known as "defensive" or "negative" intelligence, but which might more correctly be called counter-intelligence. This consists in preventing the enemy from obtaining, or at least from gathering in, the data for his own offensive intelligence. Within its scope fall, besides the obvious task of detecting spies, preventive measures of various kinds such as the enforcement of discretion within one's own army, and the registration of aliens' movements. In some cases, as in Great Britain, the convenience of having all secret services handled by a single staff has produced the combination of counter-intelligence work with that part of offensive intelligence which operates by secret means. Collectively, this service is known in the British organization as Intelligence B or I(b), in contradistinction to Intelligence A or I(a) which obtains information openly and collates and interprets all "offensive intelligence" material however obtained.

(B.) *Positive Intelligence.*—The gathering, synthesis and interpretation of intelligence in war are all more difficult than in peace. The work of agents in a belligerent country becomes difficult as well as dangerous. A state at war brings into operation all the mechanism of counter-intelligence, and while the mere collection of facts is perhaps easier because of the predominance and priority of military over other elements in the national life, the transmission of these facts to the intelligence office which counts them is exceedingly difficult. In the field of operations, information at once becomes more plentiful than trustworthy, and at the same time has to be synthesized in an atmosphere of hurry and high tension, and interpreted, often without waiting for checks and confirmations, for a commander-in-chief who may well hesitate to stake everything on its accuracy. Nevertheless, during the World War the service of military intelligence reached a level of accuracy and usefulness that it had never reached in any previous war. This success was due (*a*) to the rapidity of modern means of communication, (*b*) to the enormous volume of the data obtained, and (*c*) to the rapid development of aviation. These causes taken together both compelled and justified an elaborate organization of the intelligence service both in War Offices and in field armies.

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[1] As an example of the reverse, the battle of Wörth in 1870 may be quoted. If, in the circumstances described in 28.834, there had been present on the German side any commander or staff officer with an intimate knowledge of the habits of the French army, the battle would never have been fought.

[2] It goes without saying that this confidence can also be forfeited when events show that the enemy's situation has been presented in too unfavourable a light, but the more thoroughly the intelligence staff absorbs the enemy's "atmosphere" the less likely this is to happen, since there are few situations in war in which one side is more confident than the other is anxious; moreover, the less the intelligence staff is exposed to the pressure of its own side's "atmosphere" the less it is likely to make the wish the father of the thought.

In considering the organization it is better to ignore the distinction between War Office and G.H.Q., and to differentiate, instead, between the *central intelligence* system—of which certain branches and representatives live and work at G.H.Q., others in Allied and neutral countries and the rest at the War Office—and the *field intelligence* system. The central intelligence system in all cases carries out all the processes—collection, synthesis, interpretation—in connexion with the enemy's forces, recruiting and losses, internal condition and *moral*, economic condition, armament and equipment. When there are several important theatres of war, it is also the final focus of information, and interpreting authority, for the enemy's order of battle, and organization, distribution of force to the different theatres, inter-theatre movements, general plan of campaign, military *moral*, quality of troops, characteristics of leaders and tactical methods. It is, further, the authority responsible for passing information derived from one theatre to other theatres so far as it concerns them. To it belong all organs of the secret service and the counter-intelligence service—together known in Great Britain as I(b)—whether working in a theatre of war or not. It is an open question whether counter-intelligence (which lives mentally on its own side of the line) and positive intelligence (which lives on the enemy's) should logically form part of the same organization, but it is clear in any case that all branches of intelligence which employ secret means of news-gathering should belong to one system, which is the central.

To field intelligence, on the other hand, belong essentially the study, within the theatre of war, of enemy *plans*, as revealed by his distribution of force, movements, and front and rear works. If the theatre of war is single, some functions normally "central"—such as *moral*, order of battle, tactical methods—may come within its scope. Indeed there may be campaigns in which field intelligence absorbs central intelligence completely. In the past, with imperfect means of *liaison* between home and headquarters, this was often the case even in European campaigns, while as regards warfare in undeveloped countries it is often so still. But in war on the scale of the World War, in which the front and the rear, the soldier and the citizen, the gunner and the scientist, react upon one another incessantly, it was imperative to organize the intelligence service—effectively, if not formally—on the basis of a central system for the whole and a field system for each theatre. This logical distinction does not mean that central intelligence and field intelligence operate in watertight compartments. Each is indispensable to the other in a dozen ways. For instance, at the very least half of the data used by central intelligence in determining the enemy's battle order are obtained by field intelligence, and central intelligence, through interrogations of *rapatriés* and refugees, contributes essential details to the stock of field intelligence.

The Central Intelligence System.—We may now consider the several elements which make up the work of central intelligence.

The enemy's order of battle is the most important of all classes of intelligence. It forms the foundation upon which is based the greater part of intelligence, reasoning and calculation. Once it is established, variations both of organization and of plan can be followed almost day by day. Forming as it does the framework upon which the enemy's units are built up into armies, it is so rigidly respected in practice that from the capture of three soldiers it may be not only possible but safe to deduce the pressure of a division at A. and incidentally its withdrawal from its previous position at B., even though these soldiers remain silent under questioning. To the layreader it may seem a simple and obvious course for the enemy command to delude intelligence by constant changes in the order of battle. So it is. But such changes seriously impair efficiency, and as a rule "the game is not worth the candle." This was preëminently true of the German army in the World War. Except at certain crises, in which the only possible course was to seize a battalion here and a brigade there and fling it into the fight, the German order of battle was built up in perfectly logical sequence from the original 25 army corps of peace-time, and, once built up, was maintained till the summer of 1918.

The strength, recruiting and losses of the enemy are studied minutely by organs of the central intelligence both in the field and at home. The sources are, amongst others, statistical enquiries in the prisoners' camps or cages, captured documents, agents' reports from the interior of the enemy's country and the demographic and industrial statistics collected both in peace and in war. Strength is measured partly by multiplying average unit and divisional strengths found in establishing and maintaining the enemy's "order of battle," partly by watching the calling-up of recruit classes in the enemy's home territory. Field strength in relation to available man-power is estimated by careful work on economic data, on the munitions legislation of the enemy's country, by reading letters from home found on prisoners and generally by synthesizing and interpreting very miscellaneous data. An estimate of losses of course forms an essential ingredient of strength estimates and this is formed by studying published casualty lists, working on captured returns, and "analysing" prisoners. This statistical examination of prisoners (if these are available in large numbers) is very valuable, as it shows the composition of typical units of the enemy, his system of replacing casualties, and his man-power.

In the study of the enemy's general plan of campaign, his allocation of force to different theatres and his inter-theatre movements, the data are obtained both by organs of the central intelligence and by the intelligence systems in the field; they undergo, as they pass to the central system, a process of gradual synthesis and crystallization. Other data of a collateral kind come from the political and economic intelligence systems, which are, or should be, asked to contribute not mere data (*i.e.* items), but considered interpretations of the political or economic situation. In these, the highest levels of intelligence work, only the head of the service and a few of his closest and most responsible assistants are concerned; its importance can scarcely be exaggerated, and the synthesis must be so sound that the interpretation can bear the anxious cross-examination of the command and the Cabinet.

Intelligence work on enemy armament and equipment differs somewhat from other branches in that it deals with concrete objects rather than with estimates and appreciations, and moreover requires the services of technicians, either as permanent members of intelligence or as consultants. In its nature this work belongs to the central system. Enemy material is of interest as indicating (*a*) the scale and principles upon which the opponent is armed, (*b*) new weapons or apparatus, and modifications of old ones, which may be worth copying and in any case have to be reckoned with, (*c*) the state of the enemy's munition industries with regard to raw materials, with as its corollary the appearance of new industrial processes. In each of these cases—as indeed in all intelligence work—the essence of success is continuous collection of and systematic reporting on varied items. Thus, a new shell used by the enemy may be reconstructed from fragments even before an unexploded specimen is obtained. A new pattern of gun though it uses a familiar shell may betray itself by the number and inclination of grooves engraved in the driving band, by a "shelling connexion" established between the battery position and the point of impact and by other methods. Fuzes—even percussion fuzes—have a story to tell to the expert, and cast-iron projectiles, chlorate explosives, paper machine-gun belts, steel cartridge cases, interest the economist who is studying the enemy's industrial condition. But the technical expert often needs the resources of a well-equipped proving ground or laboratory to enable him to carry out his examination, while the economist has to consider the items just enumerated in relation to other data not necessarily concrete, such as the enemy's internal and imported supplies of raw material, his manufacturing equipment and his industrial discoveries. But although it will be seen from the above that command intelligence belongs essentially to the central system, the rôle of the forward intelligence officer in collection of data is of prime importance since he alone can educate the soldier to realize the value of the "souvenir" and even of the unconsidered trifle that seems not worth picking up. It must not be forgotten that it is very largely on such things that armament intelligence has to work, guns and apparatus are not captured every day.

Field Intelligence.—As the scope of field intelligence, in the narrow sense, there remains the study of enemy plans and of the ground within its own theatre of war. To this the central intelligence system contributes all necessary battle order information synthesized and interpreted; topographical information as up to date as possible; the estimate that it has formed of the enemy's strength: the deductions as to the general intentions of the enemy that it has arrived at from studying his military, economic and political and *moral* conditions; and any technical matters of tactical importance, such as the probability of a new gas being used. But with all these aids, the task of field intelligence remains an exceedingly heavy one. It is concerned with the tactical situation of every part of the front, in detail. Trenches, dugouts, machine-gun emplacements, trench-mortar emplacements, battery positions have to be watched day by day for new work or for signs of evacuation. Rear areas have to be studied to discover the creation or abandonment of dumps, sidings, aerodromes and wireless masts and above all for indications of movement. An accurate picture in detail of the enemy's defence system has to be formed and information obtained to amplify or correct that already on the maps, as the basis of any local attack scheme. And, over and above all this, field intelligence provides, by means of its wire organs, much of the battle order and other material upon which central intelligence builds up its appreciations.

The organization of the field intelligence service, during the war period, was improvised, and suffered from the defects of improvisation. Intelligence staffs were never truly separated from operations staffs, and within the intelligence branch itself there were distinctions of status and prospects between "staff officers" proper and "intelligence officers" which were all the more invidious as staff status was given in very numerous cases to officers engaged in administrative work pure and simple. In the case of the French army, intelligence officers were not even given military titles, being styled "interpreters." But apart from questions of status, the tendency to multiply intelligence staffs at every headquarters was wasteful of personnel and energy, led to much duplication of work and also to unnecessary circulation of the raw material of intelligence. In the lower formations the daily intelligence summary, which dealt with its own side's operations as well as with the enemy's, came to be regarded as an internal *communiqué* or local newspaper, instead of being treated as the raw material which in fact it was. Aeroplane photographs too, which require a special expertise to make them practically useful, were distributed broadcast. Intelligence should, of course, issue the results of its work to every branch and person concerned, but the processes by which it reaches these conclusions, and still more the undigested material on which these processes are set to work, are useless and mostly quite uninteresting to the soldier in the line.

The term *Ground Reconnaissance*, formerly confined to reconnaissance of terrain as against reconnaissance of enemy movements, is now used to denote reconnaissance of any kind carried out by troops on the ground as against that carried out by aircraft. Though the advent and perfection of the aeroplane have revolutionized the art of reconnaissance, the necessity for reconnaissance on the ground has not disappeared, for the aeroplane has its limitations and there is much information which can only be obtained by troops working on the ground. An aeroplane photographic reconnaissance will enable a pictorial view of the country to be got in a short space of time, and these photographs, especially if the country has previously been mapped, will be very valuable; but of such details as the configuration of the ground, the practicability of roads, the depth of streams, the penetrability of woods, the aeroplane photograph will give no information at all, or at best information which can be obtained more certainly by reconnaissance on the ground. Before an attack invaluable information may be and is obtained by air reconnaissance of the positions to be assaulted, but it is still necessary for the forward troops to push out patrols to reconnoitre the ground and for personal reconnaissance to be made by those to whom the actual attack is entrusted, though they will be able to reconnoitre the ground to better purpose and with greater safety from the knowledge that has already been obtained by air reconnaissance.

Reconnaissance differs in its methods in open and position warfare, but in both the principles are the same. It has two objects: to prevent the enemy's obtaining information about the belligerent in whose behalf the reconnaissance is made—that is, protective or negative reconnaissance—and the obtaining of specified information about the enemy, which may be called active or positive reconnaissance. In open warfare the first is carried out by the screen either of cavalry or infantry or both which is sent out by the commander to deny the enemy observation of the movements of this main body; in position warfare by the first-trench system, or according to later ideas by the organization of a forward zone masking the "Battle Zone" where the real resistance would be put up. The second object of reconnaissance is brought about by the driving in of the enemy's protective system and so obtaining contact with his main body, or by the employment of patrols and scouting parties, whose object is to obtain timely information with a minimum of deployment. Position warfare involves a state of continual contact, that is, the protective screens of both armies are always facing each other at close quarters. In open warfare, especially when armies are operating over large extents of territory, manœuvre is necessary if the protective screens, to say nothing of the main bodies, are to come into contact with each other.

The objects of ground reconnaissance are varied. It may be purely topographical, that is, it may be concerned with the acquisition of unmapped information about the ground in anticipation of movement over or occupation of that ground. It may be tactical (that is, it will endeavour to discover the positions held by the enemy and the strength and distribution of this defence), or it may be concerned with the obtaining of "identifications" (that is, information about the troops of the enemy in line, either by the capture of prisoners or of documents).

Air Reconnaissance, in spite of certain limitations, has many advantages, however, over ground work. One of the latter is its greater freedom. Machine-guns impede ground reconnaissance much more effectively than A.A. weapons and hostile aircraft impede air reconnaissance. Moreover a greater area of ground can be covered in a shorter space of time. By means of messages dropped at prearranged stations or by wireless, information can be sent back in a minimum of time; and, since the observer in an aeroplane sees the ground as a map and so can easily "pinpoint" what he sees, positions of troops, etc. can be given with a greater accuracy than is possible to the ground observer. In the watching and control of enemy reserves aircraft can perform services which are not possible for any other means of reconnaissance. Contact with the enemy cannot at present be obtained by the use of the aeroplane; but, owing to the fact that the aeroplane can penetrate the protective screen of the enemy and observe the movements of his main forces, a type of contact can be obtained from the air with greater efficiency than from the ground.

The use of the aeroplane camera makes air reconnaissance even more valuable than it would otherwise be. Owing to the height and also the speed of the aeroplane, many details escape the eye of the keenest observer. The use of the camera almost eliminates the personal factor. All that is necessary is that the observer should be able to manipulate the camera and have sufficient knowledge of the map to take the photographs at the correct moment. The image of the ground on the plate is very quickly developed and printed, and studied under favourable conditions away from danger of enemy fire. Aeroplane photographs became more and more important during the World War. Cameras were improved; the men whose task it was to interpret the photographs after they were taken became more and more expert; and the possibilities of their work became more fully realized. At first several difficulties had to be faced, the chief of which were mist and vibration. The mist in the atmosphere rendered the photographs taken so indistinct as to be almost useless. But by the use of filters (that is pieces of tinted glass or celluloid placed next to the camera lens), it was found that photographs could be taken through a mist which the human eye could not pierce. Vibration caused more difficulty. The danger that, through the throbbing of the engine, the camera might be tilted while the photograph was being taken, was finally eliminated by the use of rubber cushions which absorbed the vibration of the aeroplane.

In addition to the important photographic reconnaissance, other types of air reconnaissance were used during the war. Each dawn and dusk, and at other times when conditions made it necessary, reconnaissances were carried out by powerful machines. Their principal duties were to keep close watch of road and rail movements of the enemy. Since these movements mostly took place during the night, dawn and dusk were the times when results were most likely to be obtained. The day-to-day results of the reconnaissance were plotted in "activity maps" which made it possible to gauge the normal movement in any railway line on the battle-front, and so, with the aid of collateral information, to establish conclusions as to significant abnormalities. Another type peculiar to position warfare was the trench reconnaissance. This was carried out by an aeroplane flying low over the trench lines. It had for its object the discovery of the state of the enemy's defences, what portions of the line he was holding, the location of machine-guns and trench mortars, and all those numerous details a knowledge of which was required in carrying out an attack or raid on strongly organized positions.

"Artillery" air reconnaissance was primarily intended to counteract the effects of the enemy's artillery fire on one's own troops. Flying backwards and forwards along the battle-front, the airman watched carefully for the fire of enemy batteries. When a battery opened fire, its position was signalled by wireless, and it was promptly engaged by the counter battery.

One of the chief difficulties with which a commander has to contend during an attack is the difficulty of knowing quickly how far the attack has succeeded and to what distance his troops have penetrated the enemy lines. The aeroplane therefore has a useful function in maintaining contact with attacking troops. In the World War machines carrying out this duty were called "Contact Patrols." They were not intended for fighting purposes, but to determine the position of the attacking troops. In open warfare the aeroplane landed in or near the forward positions and received an account of the situation from the troops themselves. But when this was impossible prearranged signals of various kinds were given by the foremost troops to show their position. A good airman worked without any help from the ground troops. He would fly at a low altitude, sometimes as low as 50 ft., along several miles of front, and place correctly the position of all the forward troops. To determine the position of the enemy and also to discover in what direction counter-attacks were maturing the airman had to rely on his powers of observation. Such work was often very dangerous, since it necessitated flying low over the enemy. Various signals were devised by means of which the aeroplane could inform the infantry of an expected counter-attack. The duty of watching for such threats was sometimes assigned to a separate counter-attack patrol; but more usually it fell to the contact patrol itself. Having obtained his information the pilot's object was to give that information as speedily as possible to those who needed it. He did this as a rule by dropping a message or a marked map at a prearranged station; or he landed at a headquarters and explained the situation in detail to the commander; or he returned to his aerodrome where an officer of the intelligence staff interrogated him and telephoned or telegraphed his information to those whom it concerned.

Detecting Agencies.—Differing from reconnaissance principally in the absence of "contact," but otherwise analogous, are those means of obtaining information which may be called collectively detecting agencies. These are visual or instrumental, and in some cases a combination of the two. Visual observation for intelligence purposes differs from the ordinary watching duties of sentries in that it is an organized service—partly or wholly under intelligence control—for the observation and recording of all enemy activity within the range of vision of the front-line observation post, the tree or belfry behind the line, or the captive balloon in which the observer is stationed. Its records go into the common stock of tactical intelligence material, its work is facilitated by a special equipment of maps, telescopes, etc., and its various elements are so placed and coordinated that the exact location of the enemy activity recorded (*e.g.* digging) can be fixed by intersection. In its most precise form, observation becomes "flash-spotting," that is, the location of an enemy battery position by simultaneous observations of a gun-flash from two, three or more visual posts provided with goniometers and connected electrically with a central where the result of the intersections is plotted. Flares, Véry lights and searchlights to facilitate night observation, are aids to defensive sentries, not to "positive" intelligence.

Detection by instruments (other than the usual flash-spotting in which, after all, the quickness and accuracy of the observer is the main thing) is automatic. Instruments are disposed to receive, transform and transmit impulses from outside, and the human element (except in instruments of the geophone class used in mining) is only introduced at the "central" or exchange station—*i.e.* at the point of synthesis, and not in collection. Such are sound-ranging installations, wireless interception and direction-finding apparatus, and electrical listening-posts. All contribute to the common stock, and each affords collateral checks—called by the French *recoupements* or "intersections"—on the data provided by the rest, or by reconnaissance proper, or from other sources.

Interpretation.—It remains briefly to outline the way in which these means are used to answer the three questions that interest the command at the front: (1) What are the enemy's dispositions, (2) what and where are his defences and other installations, and (3) what are his *intentions?* The third of these questions is really the interpretation of the other two. It depends on military knowledge, on *flair*, and especially on an exact appreciation of what constitutes normal and what abnormal "activity." The first and second questions only concern us here.

Enemy Dispositions in the World War.—The Allied and German armies on the western front faced each other with only a small space of ground between them. Except when an attack was in progress contact was maintained by frequent raids into the enemy lines, by means of which prisoners and documents were captured. The units to which prisoners belonged was revealed by their pay-books and identification discs. German prisoners were, moreover, usually willing to state the units who were occupying the line, as well as the general dispositions for holding it. In trench warfare, then, provided that raids were frequently and successfully carried out, the problem of identifying the troops in line was not difficult.

The problem of the grouping and location of enemy reserves is far harder. It is similar in open and position warfare with the important exception that in open warfare the proportion of undeployed, undisclosed reserves is, on the whole, higher. Even if the intelligence service of an army is able to locate the reserves of the enemy, it does not follow that it will be able infallibly to predict the enemy's intentions or area of attack. The concentration may lie in an area where movement in several directions is equally easy, as in the German concentration on the Mézières transversal in March 1918. But the less an intelligence service knows about the location of the enemy reserves, the more danger is there of a surprise.

For the watching of the enemy reserves there are four chief sources of information: the statements of prisoners and deserters, captured documents and correspondence, agents' reports, and the interception of enemy wireless messages. Much of this information is of an uncertain character and powers of deduction and imagination are necessary to piece together and coördinate the mass of material.

(*a*) When frequent contact is maintained it is easy to discover what new formations have arrived in line and what formations have gone into reserve. Prisoners can sometimes give information about the movements of the unit or formation they have relieved. They may also be able to say what formations they have seen in the journey to the line and what formations were grouped in the area from which they have moved.

(*b*) Captured documents and correspondence are of high value. Even a small attack results in the capture of many documents. The facilities with which maps and documents can now be produced has resulted in the issue of numerous orders, instructions and summaries; as regards maps, the contrast with previous wars is even more marked. In 1870 the Government of National Defence at Bordeaux was only able with difficulty to assemble *one* set of 1/80,000 maps of France for reproduction and issue to staffs, whereas nowadays a single division going into line may receive as much as a ton of maps. One of the most fruitful sources of information is letters written from men of formations in reserve to their comrades in line, which often reveal the location of an unidentified reserve.

(*c*) The work of agents is dealt with in another part of this article. The usefulness of agents in matters of tactical intelligence varies according to the kind of warfare which is being fought. In a war where the opposing armies are manœuvring over a large tract of country and where the front is not fixed, the passing of agents across the lines and their return with the information gained is comparatively easy. On the other hand information becomes out of date far more quickly in manœuvre warfare than in position warfare. On the contrary, when the front is fixed, as in the late war, the passage of agents is more difficult but their information holds good for a longer time.

(*d*) The picking up of enemy wireless messages is also a fruitful source of information. These messages are in cipher,[1] and can sometimes be deciphered quickly enough to yield useful information. But in any case the positions of enemy wireless masts can be discovered by means of direction-finding wireless and valuable deductions can be drawn from their groupings and activity, even if not one of the intercepted messages can be decoded. At one period in the campaign of 1918, a silent battle of which few were aware was fought between wireless intelligence and wireless "Camouflage" so called, in which one side sought, now successfully, now in vain, to mislead the other by varying the positions of masts and the volume of traffic.

Enemy Works and Installations.—Information about the defensive system and the organizations of the enemy is obtained from reconnaissance and to some extent from (*b*) sources, but the most fertile and certain source of information is the aeroplane photograph. Aeroplane photographs are of two types, the oblique and the vertical. Those of the first type are taken from heights of 200 to 1,000 ft. with a tilted camera. Taken at a 1,000 ft. they show the ground as it would appear to an observer from the top of a mountain. Not much detail is visible, but an excellent idea of the general lie of the land is given. Taken at a lower altitude, such details as trench construction, loopholes and machine-gun emplacements, entrances to dugouts, roads, trees and hedges are apparent. The more important type of photograph, however, is the vertical, that is, a photograph taken from directly above, with the camera pointing straight downwards. The appearance of objects on the vertical photograph is stranger, and puzzling to the uninitiated student. All objects are seen from above, so that only their tops and shadows are visible. Everything is seen in plan as on a map and to be able to appreciate a vertical photograph one must, so far as circumstances permit, accustom oneself to see the ground from above, and in any case cultivate a sympathetic understanding of maps as maps.

Vertical photographs may be taken at almost any height. If taken too low the result may be blurred owing to movement, but clear photographs may be obtained from 2,000 to 20,000 ft. The scale of the photograph varies according to the height at which the photograph is taken and the focal length (that is the distance between the lens of the camera and the photographic plate) of the camera used.

Different types of cameras are used according to the scale of photograph required. If a forward trench system is required to be photographed a short focal-length camera (say 8 in. or 10 in.) will be used on a machine flying at a low altitude (say 6,000), so as to get a photograph on a comparatively large scale. On an extensive photographic reconnaissance of an area some miles behind the line, where the object is to get photographs of a large area, not for study in detail, but to discover what constructive work is engaging the enemy, a "wide-angle" type of camera (*i.e.* a camera of short focal length, but, since the photographs are taken at a great height, [15,000 ft. to 18,000 ft.,] on a full plate, show a large area on a small scale) is employed. With this type of camera a larger area can be covered in a short time. If these wide-angle photographs show details of which a more thorough examination is desirable, large-scale photographs can be taken from a height of 15,000 ft. and more with a long focal-length camera (20 in. or even 48 in.) which will show clearly small dumps of material or even the actual barrels of guns.

In working on aeroplane photos there are two stages, the reading of the photo (often called interpretation, though the word is avoided here as having been used in another significance in this article) and its "annotation," that is, the redrawing of its indications in map form for the use of the army generally.

Aeroplane photographs record colours and accidents of the ground (such as bare earth, vegetation, woods, etc.) in terms of light and shade. The ground appears as a simple or complex pattern, in black, grey and white. Though the aeroplane photographic plate is affected by colour, that effect is not so marked as the effect of texture and shadow. For instance, a stretch of dry earth which to the eye appears dark will appear almost white on the photograph. The reason for this is that being smooth it has no texture or contained shadow, and consequently reflects light. Vegetation, on the other hand, which to the eye appears light will photographically be at the dark end of the scale because of its texture and contained shadow. It absorbs rather than reflects light. So when the nature of objects in an aeroplane photograph is to be determined colours must be judged principally in relation to texture. The ground must be visualized vertically not obliquely.

The reading of aeroplane photographs, which necessitates a keen, trained eye, consists in the "spotting" of the numerous details which the photograph contains; its annotation, which is in effect the labelling of the various objects shown, presupposes ability to appreciate these details and their relative importance in the enemy's system of defence and organization. When a detail has been discovered, the examiner of the photograph must decide its probable nature and its rôle and importance in the enemy's system of defence, offence or supply. Details are often very similar in photographs and their nature can only be discovered by considering them in relation to their position and the surrounding details as well as in relation to the current tactical practices of the enemy. The reading and translation of aeroplane photographs indeed is not a solitary science. The interdependence of all branches of intelligence work has already been emphasized and certainly this is no exception. Many details can be seen on photographs and their nature determined from photographs alone; but there is much that will be doubtful and must be reëxamined in the light of prisoners' statements, ground and air observations, captured documents and captured maps. Conversely, the aeroplane photograph may supply missing links in a chain partially established otherwise.

Unlike photographs taken obliquely, which convey something to the merest novice, the vertical photograph must be carefully studied before it reveals its secrets. Only the tops of objects and their shadows are visible and it is only through the latter that the nature of many objects seen on a photograph can be determined. All objects have shadows. On a dull day they may not be apparent to the naked eye, but they always show clearly on a photograph. The first step, therefore, in examining a photograph is to discover from what direction the light is coming, that is, the position of the sun in relation to the photograph. This can always be discovered by examining the shadow cast by some known object such as a house or a tree. By a study of shadow not only can we discover whether an object has height or depth, but we can also get much valuable information about its shape and size. Thorough familiarity with the effects of shadows is in fact an absolute essential to the correct study and easy appreciation of aeroplane photographs.

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[1] In the earlier campaigns of the war, strange to say, messages in clear were sent on several important occasions.

Photographs must be examined systematically, detail by detail, and frequent comparison of photographs taken on different dates made. If a day's photographs are examined alone, many small details will be missed, and it is impossible to follow progress in the construction of enemy works, and to note increase and decrease in the size of enemy's dumps and aerodromes, etc., so important in studying enemy intentions.

Aeroplane photographs are of greatest value in position warfare. In open warfare their use is not so great. Armies advance over areas of so great an extent that it is often impossible to take photographs and get the information from them before the area photographed has ceased to be of interest. Moreover, the defences conducted in open warfare are usually of so simple a nature as not to be visible in photographs. Machine guns are concealed in hedges or in the windows of houses, guns are fired in the open from sunken roads and the edges of woods. Protection is obtained by the utilization of natural cover. Such positions if they were occupied for any time would (unless elaborately camouflaged) betray themselves by the tracks made by men or vehicles approaching them; but if they are only occupied for a short period these tracks do not form. In open warfare therefore much more valuable results are obtained from airmen's reports than from their cameras. It is only when the enemy makes a stand for a few days on a definite line that photographs become valuable. During the first part of the German retreat from the Somme to the Hindenburg position in March 1917 air photographs were of little value. When however the British troops were held up by an outpost line in front of the main Hindenburg position photographs again became of use. On one occasion photographs were taken of a temporary enemy position, the photographs were brought back, developed and printed, and the results delivered by aeroplane to the divisional commander on that front in about an hour and a half. During a retreat in open warfare photographs can be used in watching the pushing forward of the enemy's communications and aerodromes, and during an advance in discovering what demolitions he has carried out.

We must now consider the tactical use of photographs. At the battle of Neuve Chapelle (1915) the maps used for the attack were simply ordinary topographical maps, with the enemy positions roughly marked. If defences are not of an elaborate nature, such a map may be sufficient. But when an attack is being made on a defensive system elaborately organized and several miles in depth, something more exact is necessary.

First of all thick wire entanglements must be faced. When these entanglements consist of several rows, each row from 20 to 50 yd. deep, wire cutters are useless, and gaps must be made either by artillery or tanks. In either case, for the ranging of the guns or for the drawing up of the plans for the tank attack, an accurate map of the wire entanglements is necessary. Numerous trench lines must be captured, dugouts both in the trench lines and in the terrain between the lines must be dealt with, machine-gun emplacements must be captured, and special arrangements must be made beforehand to subdue strong points of resistance, redoubts, fortified woods, farms, quarries, etc.

To make the careful preparations necessary for an attack on such a position, not only the commander, but also his subordinates, must possess an accurate map of the position, which may be, and in the latter part of the war was, so deep that ground observation of its real defensive heart, the "battle zone," is impossible. The information then must come from the air, and moreover, though a competent airman may make valuable observations, the only means of plotting that network of trenches and other defensive organizations on to the map is by means of the aeroplane photograph. This may be defeated in some details by effective camouflage or by the successful use of natural cover, but in general an accurate map of the enemy's defences can be constructed from it—or rather, them, for a particular photo is or should be only one of a series which shows the changing aspect of the ground as man's works are superimposed on it. Besides trenches, wire, and close defence positions of all sorts, the camera attacks the enemy's artillery positions. In some cases innocent ground begins, in succession photos, to show works, tracks and the like, until it becomes so definite that the balloons and the sound-rangers and flash-spotters only confirm what is already certain. On the other hand, photo deductions may be doubtful or even impossible till the battery reveals itself to the other agencies by coming into action. In either case the work of the camera continues in aid of the artillery. Amongst the most important services rendered by the air photograph is that of recording the effects of bombardment upon battery positions, trenches, wire, strong points, dumps and communications.

Photographs are also of value in studying enemy organizations, roads and tracks used by the enemy, billets and positions of reserves, signal communications, *i.e.* buried cables, air telephone lines, light signal stations, railways (normal and light-gauge), unloading stations, ammunition and supply dumps, stations and railway sidings, hospitals and aerodromes.

(C. F. A.; F. C. H.)

(C) *Secret Service and Counter-intelligence.*—The section of military intelligence known in Great Britain as I (b) is charged with two functions somewhat opposed in character, but having this in common, that the methods employed in each are, generally, secret. This factor makes it difficult to submit those functions to public dissection except on general lines; what follows, therefore, is confined within those limits.

Broadly speaking, the duties of Intelligence (B) are:—(1) *Offensive,* in the acquisition of information as to the enemy's military resources, numbers, plans, movements and dispositions, by means other than those employed by I(a), which are identifications by contact; examination of the enemy and other press; scrutiny of captured documents and prisoners; air reconnaissance and photography; sound-ranging and other means. (2) *Defensive,* in the prevention of the acquisition by the enemy of similar information about our own forces. These together make up what may be described as Secret Service; and both involve the use of secret agents and secret methods.

Apart from the close connexion between them, the knowledge and experience of enemy methods gained in either sub-section is so immediately beneficial to the other that the functions of the two sub-sections are complementary and indivisible. They should, therefore, be controlled by one directing brain, especially in the field, where rapidity of action and of the circulation of information is essential. In peace-time at home, where the urgencies and difficulties of active service conditions do not arise, separation is permissible, though not generally desirable.

The offensive sub-section, to which alone the name Secret Service is popularly applied, can only be referred to in general terms. Its duties are similar in peace and war, and are directed towards the collection of information in enemy territory. For this purpose secret agents, or spies, have to be employed. The duties of these agents again differ but little in war and peace; but war increases their importance, and with it their difficulties and dangers. Whether they work as agents *à poste fixe,* like the agents of the notorious Stieber in France before and during the campaign of 1870; or whether they are sent on definite missions, or on general roving commissions, their objective is the same: information about the enemy. This objective is unaltered whether they penetrate into enemy territory through the ports, in the guise of peaceful neutrals armed with all the necessary papers, or whether they get there by other means. In war these other means may include penetrating the enemy lines, either in uniform or *en civil*, during the progress of an action; crossing the enemy lines and landing behind them in an aeroplane, either by the machine coming to the ground or by means of a parachute; crossing similarly in a free balloon; or crossing a frontier guarded by sentries and electrified wire, by evading or killing the sentries, and climbing the wire in insulated boots and gloves. False papers, disguises, secret ink and all the other tricks beloved of the spy novel may form part of their equipment, but normally the less theatrical the spy the less likely he is to attract attention. In practice, the most dangerous and efficient spy is probably the least sensational in his methods; when arrested he invariably has all his papers in order and is the most plausible person alive. Men, women and even children of all grades of society and of all professions, may render services of varying degrees of importance, but all useful to a system of espionage. A spy system in war involves the employment of many thousands of persons: post-boxes, *passeurs*, *contrebandistes* and guides, train watchers, pigeon men, couriers, runners, reliables who will give shelter to agents and escaped prisoners, and notables who are capable of organizing a service. All have their respective parts to play behind the lines in modern war; and that part, far from being ignoble, may be, if actuated by patriotism, as noble, as dangerous and as heroic as any played in the armies in the field.

In spite of all the precautions adopted as the result of experience in the World War, the collecting of information is not the difficulty; that lies in the transmission of information when obtained. Over this subject a veil, unfortunately, must be drawn. Agents may carry pigeons to send back, or portable wireless sets for communication with their employers, and messages have been shot over a neutral frontier by crossbow. The use of directional wireless and ordinary vigilance and common sense soon lead, however, to discovery, and necessitate a change of *venue* for the agent, and the application of fresh methods after a short time. It is only necessary here to say that, contrary to a popular belief, signalling by an agent by any means from, or close behind, the enemy lines is almost impossible, except in open warfare. In trench warfare, even if it were possible, it would be of little use, as any information to be gained there is better obtained by other means. The agent's useful information is gleaned much farther back, and to get it he requires a thorough and careful training. Apart from the control of agents and of the administrative, financial and clerical questions involved in that work, the duties of the chief of this sub-section are to get information by all possible means. Amongst other methods employed in the late war was the dropping of pigeons by automatic release from free balloons. Advantage was taken of the wind's force and direction to regulate their fall in or near any desired neighbourhood, and there they were picked up by the inhabitants. Following the instructions enclosed, the latter often gave rapid and valuable information as to the movements of the enemy.

Another form of activity on which agents may be advantageously employed is sabotage, *i.e.* the destruction in the field of bridges, telegraphs, lock gates and communications, and of munition factories and similar organizations in enemy home territory. The Germans are alleged to have employed these methods, even in neutral countries, where munitions and war material were being manufactured for the Allies. In the field, such work is most advantageously linked up with operations, either just before they begin or whilst they are in progress. If contemplated as a prelude to operations it must always be remembered that they may serve as warning of an offensive. In any event the officer directing such schemes must remember the probable consequences to an allied population in territory occupied by the enemy, on whom punishment will be visited. Sabotage of this sort is naturally easiest in crowded centres, where circulation is difficult to control; and although in war risk to human life, even of non-combatants, must in some cases be a secondary consideration, this fact alone requires that sabotage, if undertaken, should be expected to have definite results.

The duties of the other, the defensive, sub-section are popularly described as *contre-espionnage*. Although the duties, as in the case of Secret Service so called, are the same in peace as in war, the machinery and methods vary considerably according to the conditions under which they are carried out. The varying conditions referred to are: (1) in home territory, in peace and in war; (2) in allied territory; and (3) in enemy or occupied territory. In the two latter cases war conditions only come into consideration.

Of these varying conditions the first provides, perhaps, the easiest problem. The *contre-espionnage* section commands, in peace and in war, all the assistance of trained police throughout home territory; of censorship; of port control; of hotel registration; of the erection of arbitrary barriers such as prohibited areas; and of all the preventive measures which may be the outcome of years of experience in combating enemy espionage under all conditions. Although Intelligence (B) in the field in occupied territory would equally enjoy these powers, and, in addition, the arbitrary powers of the conqueror in the territory of the conquered, and would have the advantage of knowing that the whole population is potentially hostile, the machinery at its disposal to cope with it would be largely improvised and, therefore, at first, not so efficient. In allied territory the difficulties are greater, as it is the ally who, naturally, controls in his own home territory all the real preventive machinery. He is, in addition, possibly susceptible about interference with either his C.E. Organization, or with the native population. Under these conditions *contre-espionnage* is carried on largely on sufferance, and requires the exercise of much discretion and tact.

It is necessary to remember that the object of *contre-espionnage* is, first and foremost, prevention. The catching of spies, interesting though it is, is entirely subsidiary; its principal value lies in disclosing the holes in the preventive net and in directing the attention of the controlling staff towards the proper remedies to be applied. In the zone of the armies the principal value of an efficient *contre-espionnage* system is a moral one. Troops and their commanders must be relieved of their anxieties about enemy activities in their midst; but from what has been written above it will be seen that those anxieties are often based on not very solid grounds, at least in trench warfare. Troops commonly attribute to an enemy secret service of any efficiency powers far beyond the capacity of any S.S. Organization. It is, of course, the effect of the unknown on mass psychology; but the influence on *moral* may be prodigious unless means are taken to check it.

From what has been stated it will be seen that the *contre-espionnage* sub-section falls naturally into two divisions: (i.) the investigation of suspected cases of espionage, and (ii.) the control of the population. It is not possible to enlarge on the methods of investigation employed by a *contre-espionnage* service; although in general they resemble ordinary police detective methods, in details they differ widely from them. They require technical knowledge not usually possessed by ordinary police personnel; and even trained police-detective staffs require special training to be useful in *contre-espionnage*.

In endeavouring to prevent the collection of information by the enemy's agents it is necessary to remember that this may be gained equally (i.) from your own troops and (ii.) from the civil population. The former may sell or convey information deliberately, but it is far more probable that they may convey it to the enemy's agents through their indiscretions. Investigation of treachery requires no difference in treatment, whether it occurs among troops or civilians, and the question need not therefore be further examined. The problem of dealing with leakage of information through indiscretion, however, is a different one, and requires special consideration. "Leakage" may occur in several ways; gossip amongst the troops about impending operations, especially when they are on leave and out of the line; indiscreet conversations and messages on field telephone and buzzer; misuse of code in telegraph and wireless; marking of railway trucks, transport and billets, with inscriptions which give identifications of units; indiscretion in correspondence; careless handling of confidential papers and books; taking orders, codes, books, papers of any kind, even private letters, into the front line; wearing of regimental, brigade or divisional badges and markings, which reveal identifications, and many analogous ways. All these require special treatment. In many cases this demands merely vigilance to see that these things are not done, and that orders are constantly issued to the troops on the subject. Careless conversations on field telephones require "police" listening sets to record them, so that action may be taken against the offenders. Gossip about operations can be dealt with by the punishment of the offenders when caught; otherwise it is best coped with by the deliberate circulation of false rumours by Intelligence (B) through their police and agents. It is therefore one of the essential duties of the I(b) personnel that they should know what is going on amongst the men in their own army; from this it is an easy stage that they should keep the higher command informed of the *moral*, the grievances and the current rumours, not only of their own army, but also of the civil population and of the allied army and even amongst allied official classes. Every case of suspected espionage reported by the troops, even the most obvious cases of spy fever, must be investigated, and the results reported and circulated among the troops.

Finally, Intelligence (B) should advise the operations section of the precautions necessary in connexion with contemplated operations. This implies the closest coöperation with "O"; but it also logically involves the allocation to Intelligence (B) of camouflage, and similar mechanical methods of preventing the acquisition of information by the enemy. This was not the case in the late war; and this omission was, in the writer's opinion, a fault in organization.

The other sub-section of the *contre-espionnage* section is responsible for the control of the civil population. This involves a division of the area occupied by the army into zones for the purpose of the control of circulation, and control of the use of telegraph, telephone and other methods of communication, which might be of use to enemy agents. These restrictions vary in strictness according to their proximity to the fighting front, *e.g.* in the forward or army zone no access would be permitted to civilians of any sort; in the less forward zones civil liberties are less and less interfered with, until in the rearmost zone life may be almost normal for war-time.

The same sub-section is responsible for the drawing up and issue of all necessary regulations; the placing of the necessary port, frontier, railway, road and other controls at points of entry into the various zones. Here would take place the interrogations of persons entering or leaving the zone, the issue and *visa* of passes and the general supervision of civilian traffic. The form of all necessary passes (*laissez-passers*, *sauf-conduits*, protecting certificates, etc.) would be drawn up by the sub-section, in consultation with the provost-marshal's branch, and all arrangements made to fit in with his controls.

Card indexes must be maintained of doubtful persons, as full details as possible being given, to ensure their detention. *Contre-espionnage* summaries and instructions must be issued from time to time, and provision must be made for the rapid circulation of such information to all controls and I(b) personnel. Amongst the other duties of this sub-section are evacuations of undesirables, prostitutes and suspects; supervision, licence and withdrawal of telephonic and telegraphic facilities to civilians, in accordance with military exigencies; interrogation of *rapatriés;* preparations of lists of guides, notables and persons who may be useful in territory occupied by the enemy, in case of an advance; lectures to troops on precautions against leakage of information, even after capture; and all general precautions against espionage where it is a case of dealing with the population in the aggregate, as opposed to the individual.

Both sections must keep adequate and up-to-date records, carefully cross-indexed. In the case of the offensive Secret Service it is undesirable that the names, tasks and whereabouts of agents should be known to anyone but the officer under whom they actually work. Any such records kept must be in safes or strong-boxes.

As regards the machinery employed, both sections require large numbers of intelligence police. Their allocation in the zone of the armies is usually on an army, corps or divisional basis, *i.e.* certain detachments of officers and men (I.P.) are allotted to the headquarters of armies, corps and divisions. On the L. of C., or even in the army zone in the case of prolonged stationary warfare, they are best allotted on an area system, to ports, bases and areas. This has the advantage of acquainting the personnel intimately with the areas, the inhabitants and the special duties called for by special conditions.

One final duty remains to be mentioned—the conveyance of false information to the enemy. This cannot, unfortunately, be dilated upon. It is best undertaken by the head of I(b) himself, in consultation with as few persons as possible. The process, if it is to be usefully employed, involves the complete confidence in him of the higher command and a foreknowledge of their plans and dispositions. It requires, therefore, that he should be above all else a person of solidity and discretion. Apart from other qualifications there is indeed no room for the employment in Intelligence (B) of any person in any grade who does not possess these characteristics. (R. J. D.)

INTERNAL COMBUSTION ENGINES.—It is usual now, as a matter of terminology, to deal comprehensively with gas engines and oil engines under the general description of "internal combustion engines," and the present article gives some account of the new developments that have been made between 1910 and 1921; in the earlier volumes of this work (11th ed.) a full account will be found (under GAS ENGINE, 11.495 *seq.*, and OIL ENGINE, 20.35 *seq.*) of the history of these very important engines up to 1910, together with a statement of the engineering thermodynamics of the subject.

Gas and oil engines in 1921 might conveniently be grouped as follows:—

GROUP 1. LARGE GAS ENGINES

(*a*) Of horizontal, slow-speed, double-acting type, of both 4-stroke and 2-stroke cycles.

(*b*) Of horizontal and vertical medium-speed, single-acting many-cylindered type, usually 4-stroke.

GROUP 2. MEDIUM GAS ENGINES

Usually of horizontal single-acting, 1- or 2-cylindered type, working on the 4-stroke cycle.

GROUP 3. HEAVY OIL ENGINES

(*a*) Of large Diesel design, both 4-stroke and 2-stroke.

(*b*) Of "semi-Diesel" type, both 4-stroke and 2-stroke.

(*c*) Of the low-compression hot-bulb, or Akroyd type, and normal heavy oil engines with vaporizers.

GROUP 4. "LIGHT OIL" ENGINES

Small quick-revolution usually multi-cylindered engines of the 4-stroke Daimler, or 2-stroke Day type; all single-acting, and usually vertical.

GROUP 5. SPECIAL TYPES

(*a*) The Humphrey Pump.

(*b*) The Holzwarth Turbine.

(*c*) The Still Engine.

Group 1 (a). Large Gas Engines.—The period 1910–21 saw a considerable increase in the number of large engines of the slow-running horizontal type. Considerable difficulties were encountered at first with large gas engines as the necessity of providing very complete cylinder cooling arrangements was not clearly realized, and cracked and seized pistons, failures of valves, and ruptured cylinders were not infrequent. These difficulties had by 1921 been completely overcome, and these large engines work with the utmost regularity and freedom from trouble.

The type under discussion—frequently referred to as the "Nürnberg" or "M.A.N." engine, on account of the important part taken in its development by the Maschinenfabrik Augsburg-Nürnberg A.G.—is illustrated in section in fig. 1 and in external appearance in fig. 2.

The engine shown is a 4-stroke, or "Otto" cycle, tandem, double-acting, single-crank, "blowing" engine of M.A.N. type constructed by the Lilleshall Co., Ltd., of Shropshire, England. Rated at 1,200 B.H.P. and running at 90 revolutions per minute on blast furnace gas, it is capable of compressing 26,000 cub. ft. of free air per minute to a pressure of 8 lb. per sq. in. above atmosphere.

Within each of the working cylinders A and B is a piston F 35 in. in diameter and having a stroke of 43½ in.; the pistons are mounted upon a common piston rod which terminates towards the right in

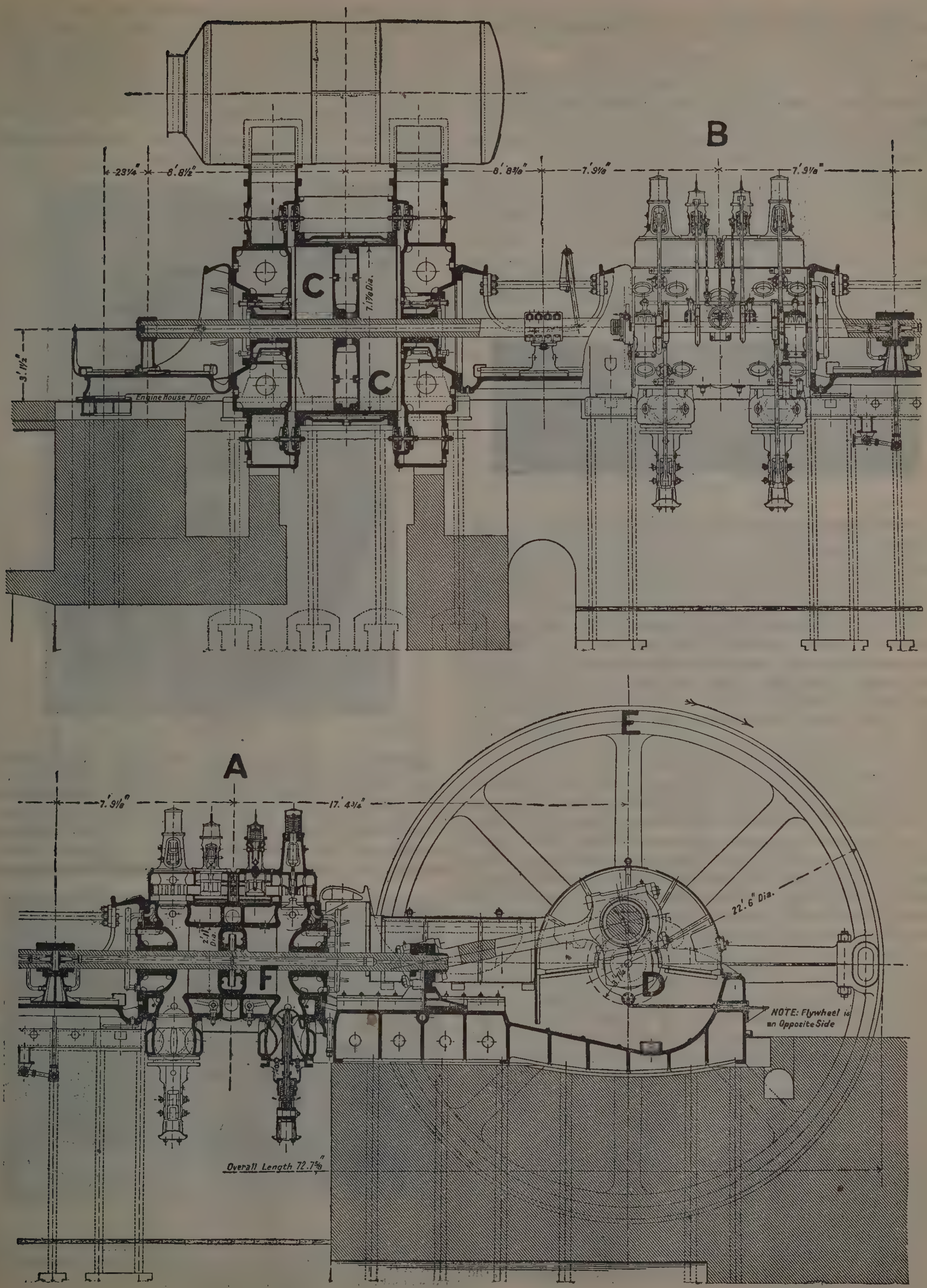
B
23¼"
8' 8½"
8' 8⅜"
7' 9⅛"
7' 9⅛"
C
C
7' 1⅞ Dia.
3' 1½"
Engine House Floor
A
7' 9⅛"
17' 4¾"
E
22' 6" Dia.
2' 11 Dia.
F
D
NOTE: Flywheel is on Opposite Side
Overall Length 72' 7⅝"

FIG. 1.

a crosshead, whereby it is attached to the crankshaft D by means of the usual type of connecting-rod. On the left of the working cylinders is a large double-acting "blowing" cylinder, or air pump, CC, with a bore of 85⅞ in.; this is a conspicuous feature in fig. 2.

The valves are operated by mechanism driven by the crankshaft, and a large fly-wheel E, 22½ ft. in diameter, is provided to ensure a sufficiently uniform motion of the engine. The long piston rod carrying the two working pistons and the air pump piston is borne on four crossheads as shown; the pistons "float" in their respective cylinders, thus minimizing engine friction and wear, as all the weight is carried on these four external crossheads.

It will be observed that the cylinders and cylinder covers are well water-jacketed; the pistons, piston rod, and exhaust valves are also water-cooled. For the cylinders and their covers the cooling water is supplied at a pressure of about 15 lb. per sq. in. above atmosphere; for the pistons, piston rod, and valves, the water pressure necessary is about 55 lb. per sq. in., due to their reciprocating motion. Close to each cylinder is fitted an open water tank into which the various cooling-water pipes discharge in full view of the attendant. Each discharge is fitted with a regulating valve and thermometer, whereby the cooling-water temperature from the several parts of the cylinders, pistons, etc., may be separately adjusted while the engine is running.

FIG. 2.

Special oil pumps are provided for cylinders, stuffing-boxes, and exhaust valves, so that each of these parts is lubricated directly, with provision for separate adjustment. Surplus oil is collected in a sump, filtered, and returned to an oil supply tank above the engine.

Enough has been said to show that in its present form this type of large gas engine is well designed in every detail, and it has proved itself a very safe, economical, and reliable power producer.

The engine illustrated above is installed in the works of the Barrow Haematite Steel Co., and was built by an English engineering firm; the type has, however, made most progress on the European continent. Thus, from 1908 up to the commencement of the World War, the M.A.N. Co. and their licensees had built over 300 of these engines, aggregating 500,000 B.H.P. The M.A.N. Co. had by 1921 installed engines in 22 stations, three of which exceeded 27,000 B.H.P. each, six exceeded 15,000 B.H.P. each, and the remaining thirteen were all over 10,000 B.H.P. in capacity. Messrs. Thyssen & Co. have engined a power station at Bruckhausen which has a capacity of 65,000 horse-power. At the Neunkirchen Works, 14,000 H.P. is provided by *2-stroke* cycle double-acting gas blowing engines. It is stated that 2,000 H.P. per cylinder is obtained from these engines. At Heinitz, Saarbrucken, there is an installation of nine Ehrhardt-Sehmer engines, aggregating about 16,500 horse-power. The Schalke Mining Co. have three Haniel-Lueg twin-tandem engines totalling 12,000 horse-power.

Of American installations may be mentioned: The Indiana Steel Co.'s plant at Gary, Ind., where, in one engine house in units of about 3,700 H.P., is an aggregate of fully 60,000 H.P. supplied by M.A.N. type engines built by the Allis-Chalmers Co. The San Mateo Power Co. have 21,600 H.P. supplied by four 5,400 H.P. horizontal double-acting twin-tandem engines built by the Snow Steam Pump Co.; each engine thus comprises four cylinders; these are 42 in. in diameter, with a piston stroke of 60 in. and the speed is 90 revs. per minute. Thus each working cylinder supplies 1,350 horse-power. At the Carnegie Steel Co.'s Ohio works there are four very large blowing engines of 3,000 H.P. each, capable of dealing jointly with 200,000 cub. ft. of air per minute. An important installation is that (1921) at Kamata, Japan, where four large M.A.N. type engines by the Lilleshall Co., Ltd., operating on Recovery Producer gas, supply electrical energy required to work the railway between Tokio and Yokohama. Each engine is direct-coupled to a 1,500-K.W. alternator the pole-pieces of which are mounted in the rim of the fly-wheel.

An idea of the size of these huge engines may be formed from the following particulars:—

The cylinders are 47¼ in. in diameter and the stroke is 51⅛ in.; at 100 revs. per minute each engine has an output of roundly 2,500 B.H.P. The crank-pin is 23⅝ in. in diameter; the crankshaft at the fly-wheel end is no less than 32¼ in. in diameter; and the fly-wheel is about 22 ft. in diameter and 39·4 in. in rim-width; an illustration of this enormous wheel, which weighs about 100 tons, is given in fig. 3; its great energy of rotation reduces the coefficient of fluctuation of engine-speed at full load to less than 1/250—as required for parallel running with alternators.

Each cylinder, complete, weighs 25 tons, and each complete engine about 400 tons, including the fly-wheel.

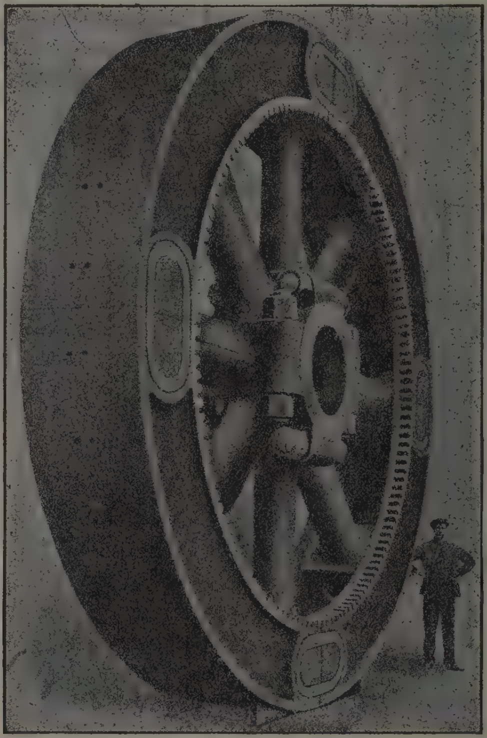
FIG. 3.

Exact data of output during the World War and afterwards are unobtainable, but it is considered that in 1921 there was an aggregate of roundly 2,500,000 H.P. supplied by engines of the large, slow-running, tandem, horizontal, double-acting type.

Group 1 (b).—English designers up to 1921 had not much favoured the large water-cooled-piston double-acting engine, preferring the greater simplicity of the single-acting cylinder with uncooled piston; this led to the development of an important class of vertical and horizontal medium-speed single-acting four-stroke multi-cylindered engines.

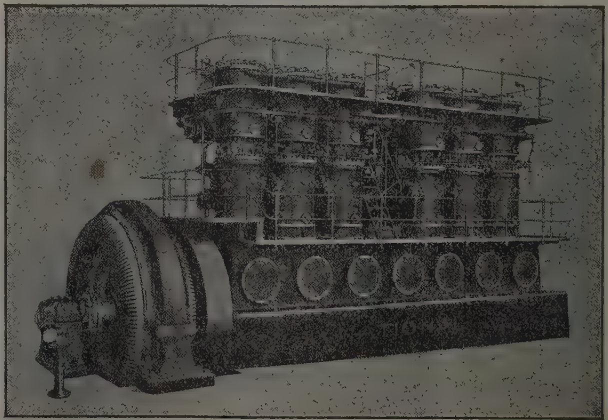
FIG. 4.

The National Gas Engine Co., Ltd., of Ashton-under-Lyne, took a leading position in the development of the vertical type of this class, and in 1910 erected a special factory for their exclusive manufacture.

An illustration of a 1,500 B.H.P. "National" vertical gas engine direct-coupled to an alternating current generator is given in fig. 4, while fig. 5 shows a transverse section through one of the six pairs of cylinders. It will be seen that this 1,500 B.H.P. engine comprises twelve cylinders arranged in six vertical tandem single-acting pairs AA and BB respectively (fig. 5); the pistons EE are rigidly connected together by a stout piston rod, and from the lower piston the six-throw crankshaft D is driven through a connecting-rod CC. The lower part of the upper cylinder AA is closed, and in this air is compressed during the downward stroke of the pistons thus "softening" the running. The engine works on the four-stroke cycle, and the inlet and exhaust valves and gas, air, and exhaust passages are clearly indicated. These engines work on coal gas, Producer gas, coke oven gas or blast furnace gas, and no explosive mixture exists outside the engine itself. The cylinders are well water-jacketed, but the pistons, though not water-cooled, are so designed as to facilitate the conduction of the heat away from their crowns to the surrounding cylinder walls.

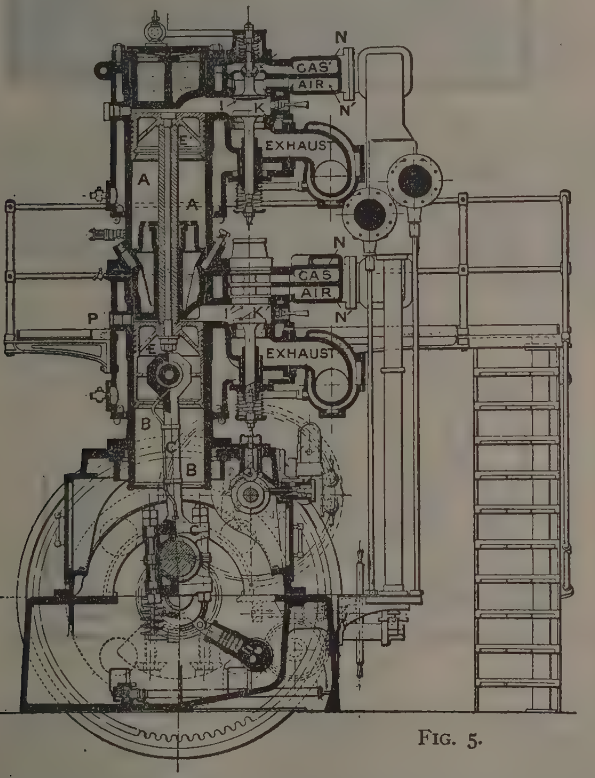

FIG. 5.

Engines of this type are built in a series ranging from a 4-cylinder two-crank design of 300 B.H.P. running at 300 revs. per minute to a 12-cylinder six-crank design of 1,500 B.H.P., 200 revs. per minute.

Many fairly large plants had by 1921 been installed, among which may be mentioned one of 11,500 H.P. at Palmer's Shipbuilding Co., Ltd., Jarrow; one of 11,000 H.P. at the Government Factory, Lanquith; one of 10,500 H.P. at the Partington Steel Co.'s Works, Irlam, near Manchester; and one of 4,500 H.P. for the Midland Coal & Iron Co., Ltd.

As a typical example of the horizontal type of multi-cylindered single-acting large gas engine, the design adopted by the Premier Gas Engine Co., Ltd., of Sandiacre, Notts., is taken. An important installation of this type is that of the Hoffmann Mfg. Co., Ltd., at Chelmsford, which commenced operations in March 1919.[1]

This installation comprises six 500 B.H.P. four-cylinder four-crank horizontal Premier engines running at 190 revs. per minute, each direct-coupled to a 360 K.W.-generator; thus here 3,000 H.P. is produced from 24 cylinders. Gas is supplied by a Lynn pressure producer plant with ammonia recovery. An examination of the results of six months' working in ordinary service showed that the overall thermal efficiency of this plant, *i.e.* the ratio of heat of electrical energy to heat of coal supplied, had the very high value of ·199, *i.e.* 19·9%.

Group 2. Medium-powered Gas Engines.—Included in this group are the very numerous engines principally of the single-cylindered four-stroke horizontal single-acting type using coal gas or Suction Producer gas as fuel, and employed for a great variety of purposes by the smaller class of power consumers. In H.P. they range from 2 or 3 up to (two-cylindered) designs of about 300. Messrs. Crossley Bros., Ltd., of Manchester, produce annually a large number of engines of this type in a series ranging from 3½ H.P. to 260 H.P.; up to the end of 1920 this firm alone had built over 80,000 of these engines.

Many other important firms and companies are also engaged in this industry, among whom may be mentioned Messrs. Brotherhood, Browett-Lindley, The Campbell Co., Davey Paxman & Co., Fielding & Platt, Gardner, Grice, Hindley, The National Co., The Premier Co., Ruston & Hornsby, The Stockport Co., Tangye, The Brit. Westinghouse Co., etc.

A typical combination of Suction Producer and gas engine is illustrated in fig. 6. Through an incandescent zone of anthracite or coke contained in the Producer or "Generator" a mixture of air and steam is drawn by the suction of the engine when at work. This air and steam in passing through the hot zone is decomposed, and issues from the generator as a very hot, smoky mixture consisting mainly of nitrogen, carbon monoxide, carbon dioxide, and hydrogen. A rough average composition by volume is as follows: nitrogen 55%; carbon monoxide 22%; hydrogen 15%; carbon dioxide 6%; miscellaneous hydrocarbons, free oxygen, etc., 2%.

Such a mixture of gases is termed "Producer Gas" and has a (lower) calorific value of 125 to 130 B. Th. U. per cub. ft.; about 200,000 cub. ft. are produced per ton of anthracite consumed.

The hot and smoky gas in the case illustrated passes first through a chamber fitted with a baffle plate, and water-sealed at the bottom; here the grosser impurities are deposited; thence it goes past a 2-way valve which permits its escape through a chimney into the atmosphere when the engine is at rest; when running, however, the gas is drawn by the engine suction through a large cylinder filled with small coke over which a spray of water is constantly played. This is termed the "coke scrubber," and here the gas is cooled and freed from dust and tarry impurities; thence finally it passes into a reservoir, and so to the engine.

The illustration shows in section the normal type of horizontal 4-stroke cycle engine fitted with one or two massive fly-wheels which by their momentum maintain the required degree of uniformity of rotation of the crankshaft.

Vehicle and Marine Applications.—In 1918–21 attention was again given to the problem of propelling motor road vehicles by small producer-gas engines, and a certain measure of success was obtained by Mr. D. J. Smith and others· experiments were in 1921 being continued.[2]

Marine Producer-Gas Engines.—In 1904 Herr Capitaine fitted a tug at Frankfort-on-Main with a 70 H.P. engine and anthracite producer plant. In 1905 Messrs. Thornycroft fitted the launch "Emil Capitaine" with a 60 H.P. engine and producer, and, later, the barge "Duchess" with a similar 30 H.P. plant.

In 1908 Messrs. Beardmore fitted H.M.S. "Rattler," 715 tons displacement, with an experimental 500 H.P. gas engine running at 120 revs. per minute on gas supplied by an anthracite producer. In 1910 the sailing boat "Castell san Nicolan" was fitted with an auxiliary 60 H.P. Gardner anthracite suction power plant.

The principal difficulty encountered with marine suction-gas plants was in obtaining efficient manœuvring power; progress was made, though slowly, and it is of interest to record that the first producer-gas-engined ship crossed the Atlantic in 1919. The largest marine producer plant in 1921 was that of the American vessel "Wilhelmina," and comprised a 350 B.H.P. engine supplied by two suction gas producers.

The Dutch "Van Rennes" producer-gas engines, built in sizes up to a maximum of 200 H.P. have been fitted to a number of small cargo-boats employed in coastal service; these engines are readily reversible, and it is claimed that their fuel consumption is, roundly, 1 lb. of anthracite per H.P. hour.

A good class ocean-going cargo steamer may be taken as of about 8,000 tons dead weight, with steam engines of about 2,000 I.H.P. running at 65 revs. per minute and using 1¾ lb. of coal

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[1] For details see Patchell, *Journ. Inst. of Elec. Engrs.*, June 1920.

[2] Vide *Proc. Inst. Auto. Engrs.*, xiv., 1919-20.

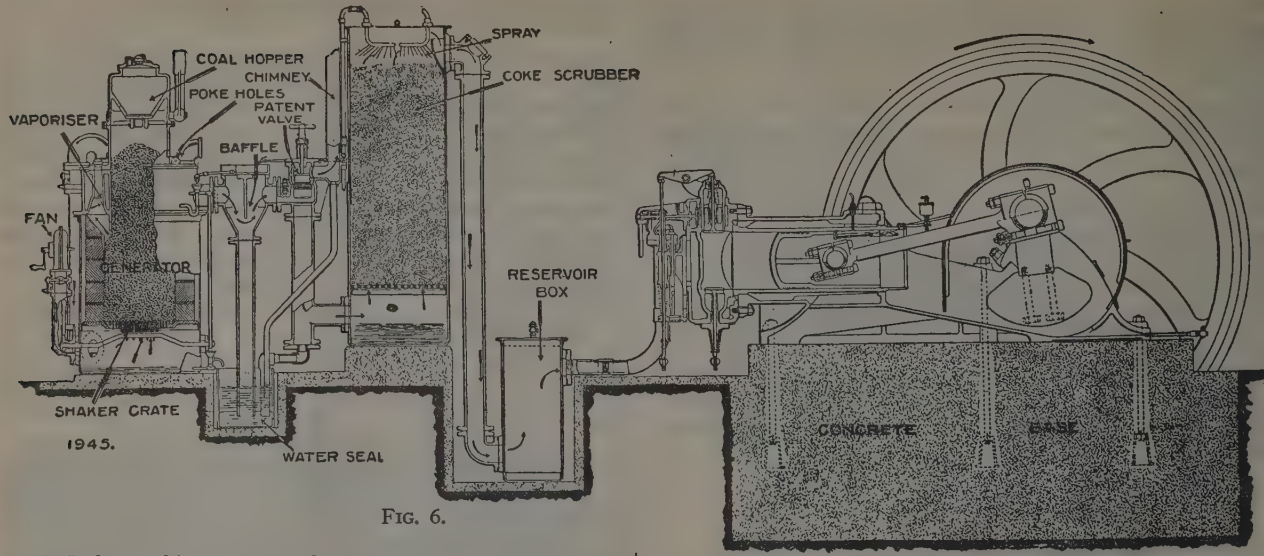

Fig. 6.

per I.H.P. hour; this statement clearly defines the state of development of the marine producer-gas engine in 1921.

Group 3 (a). Diesel Engines.—The Diesel engine has now become established as a reliable prime-mover, having a very low consumption of fuel. A typical illustration is in fig. 7.

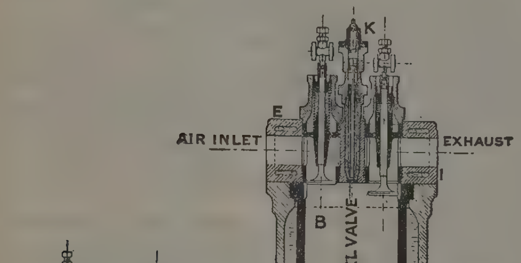

Fig. 7.

Within a very strong water-jacketed cast-iron cylinder BB slides a long, heavy cast-iron piston AA driving a crankshaft C by means of the connecting-rod D. The cylinder head EE is a deep, well water-jacketed casting containing four valves, viz. the air inlet, fuel inlet, exhaust, and air starting valve; the latter is not shown.

On the downward stroke of the piston air only is drawn into the cylinder through the air inlet valve; during the following upward stroke this air is compressed to a pressure of 450 to 500 lb. per sq. in. with accompanying great rise of temperature. At or near the moment of greatest compression, and continued during the first 20° to 30° of crankshaft revolution, the necessary small charge of fuel oil is blown—in the form of a very fine and uniformly diffused mist—into this compressed and heated air. Spontaneous ignition or "explosion" of the mixture instantly takes place, but the fuel supply is so regulated that the pressure is but little, if at all, increased by the explosion, the end aimed at being to cause combustion to take place at as nearly as possible constant pressure; a typical diagram is reproduced in fig. 8.

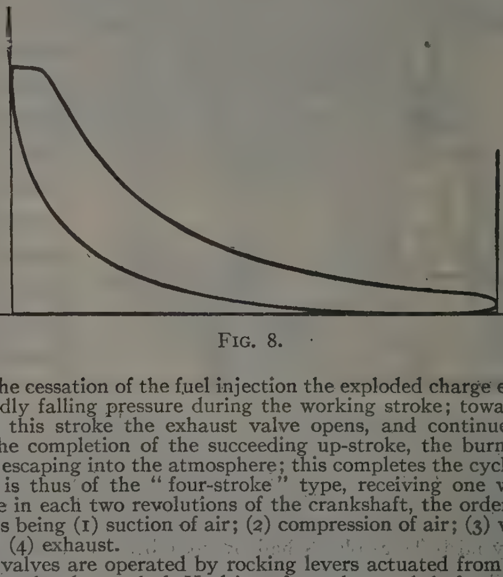

Fig. 8.

On the cessation of the fuel injection the exploded charge expands at rapidly falling pressure during the working stroke; towards the end of this stroke the exhaust valve opens, and continues open until the completion of the succeeding up-stroke, the burnt gases thence escaping into the atmosphere; this completes the cycle. The engine is thus of the "four-stroke" type, receiving one working impulse in each two revolutions of the crankshaft, the order of operations being (1) suction of air; (2) compression of air; (3) working stroke; (4) exhaust.

The valves are operated by rocking levers actuated from a half-speed overhead cam-shaft H, driven from the crankshaft.

Compressed air reservoirs—primarily charged and thenceforward maintained by the engine itself—containing air stored at a pressure of from 750 to 1,000 lb. per sq. in., are used for starting the engine, and providing the air blast for the fuel oil injection into the cylinder.

Many Diesel engines are also built operating upon the 2-stroke cycle, and fig. 9 shows a typical design in section.

Here there is no exhaust valve, but towards the end of the down-stroke the piston over-runs exhaust ports AA formed in the cylinder walls whence the burnt gases escape into the atmosphere. Simultaneously an air pump, operated by the engine, delivers a charge of fresh air at a pressure of 3–5 lb. per sq. in. into the cylinder through an air valve, or valves, in its head. This air hastens the discharge of the burnt gases, and is compressed on the return up-stroke of the piston at or near the end of which the fuel oil is injected, as before, and the working stroke then follows. This type has been largely developed by Carels Bros. of Ghent; it will be noted that every down-stroke is a working stroke, but due to the less perfect scavenging of the exhaust, and to the power absorbed by the air pumps, the power output is found to be only from $1\frac{1}{2}$ to $1\frac{3}{4}$ times that of an equal

4-stroke cycle engine instead of twice as much as would be realized in an ideal case.

A second type of 2-stroke Diesel engine, specially developed by Sulzer Bros. of Winterthur, is valveless excepting for the fuel injection valve and air starting valve. In this type fresh air, at slight pressure, enters through ports on one side of the lower part of the cylinder at the same time that the burnt gases are escaping through ports on the other side, substantially as in the small two-stroke Day-type petrol engine, but without crank-chamber compression, as described later (see fig. 13). The fuel consumption of the 4-stroke cycle Diesel is roundly 0·4 lb. per B.H.P. hour, and of the 2-stroke of either type about 0·45 lb. per B.H.P. hour.

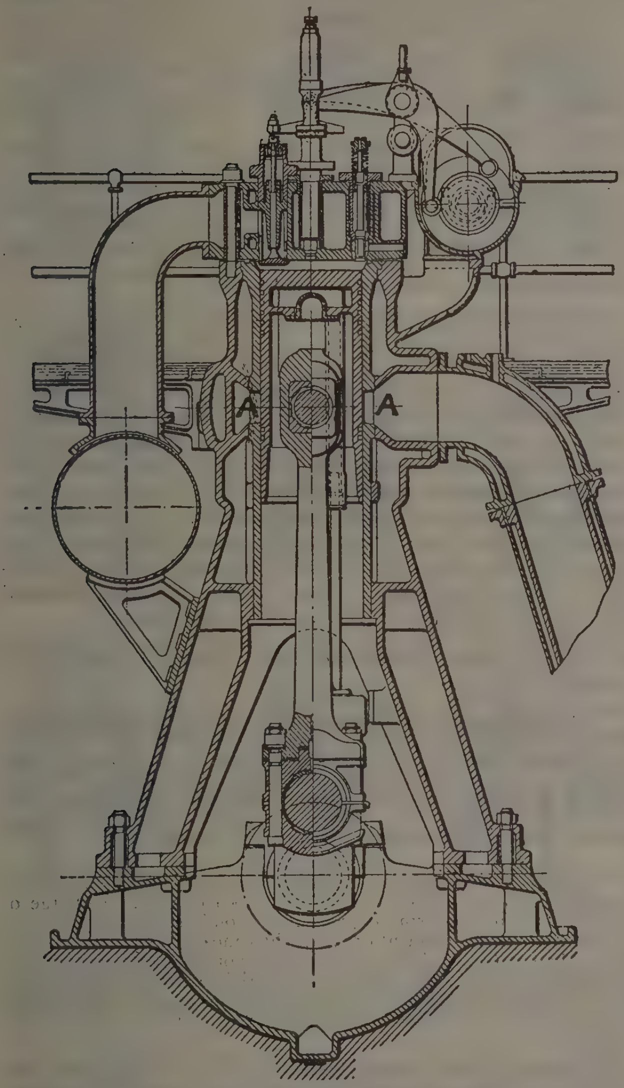

FIG. 9.

Land Installation of Diesel Engines.—Steady progress was made between 1910 and 1921, and at the end of 1920 upwards of 100 plants existed in the United Kingdom of capacity ranging from 50 to 6,000 B.H.P., and aggregating more than 50,000 B.H.P. Outside England more than twenty important installations had by 1921 been erected, or extended, aggregating fully 25,000 B.H.P.; these are spread over the world, being found in Egypt, India, Ceylon, Burma, Malay States, Hong-Kong, S. Africa, Australia and N. and S. America. The principal makers in Great Britain are Mirrlees, Bickerton, & Day; Willans & Robinson; Hick, Hargreaves & Co.; The Brit. Westinghouse Co.; Swan, Hunter & Wigham Richardson; and Thornycroft.

Noteworthy installations are (1) that of the Charing Cross & City Electricity Supply Co., Ltd., London, which includes ten Sulzer Diesel engines aggregating 6,000 B.H.P. Of these, four are of 500 B.H.P. and four of 600 B.H.P. 3-cylinder engines, all running at 150 revs. per minute: the remaining two are 4-cylinder 800 B.H.P. engines running at 150 revs. per minute; this installation was completed in 1912. (2) At the Southend-on-Sea Electricity Works there is a total of 3,900 B.H.P. supplied by two high-speed 6-cylinder Koerting Diesel engines of 450 B.H.P. each, running at 450 revs. per minute, and four 750 B.H.P. 6-cylinder "M.A.N." Diesels running at the same speed; these engines commenced running in 1920. (3) At Letchworth, Herts, the Electricity Supply Station contains six Diesel engines aggregating 1,900 B.H.P.; the first of these commenced work in 1910 and the sixth in 1916. (4) The great majority of Diesel engines are of the inverted vertical type; an interesting exception is that of the plant at Kingston-on-Thames Electric Power Station where are installed one 400 B.H.P. 4-cylinder 4-stroke M.A.N. *horizontal* Diesel engine running at 190 revs. per minute, and one 500 B.H.P. 2-cylinder, 2-stroke M.A.N. *horizontal* Diesel running at 165 revs. per minute; these engines commenced work in 1913. Of large installations outside England may be mentioned that of the Hong-Kong Electric Co. with an aggregate of 3,060 B.H.P. supplied by seven Sulzer Diesel engines; the first of these, two 3-cylinder engines each of 300 B.H.P., started work in 1908, and the last two—of 4-cylinder 540 B.H.P. each—in 1914. An external view of a 500 B.H.P. 4-cylinder, 4-stroke standard Diesel engine is shown in fig. 10.

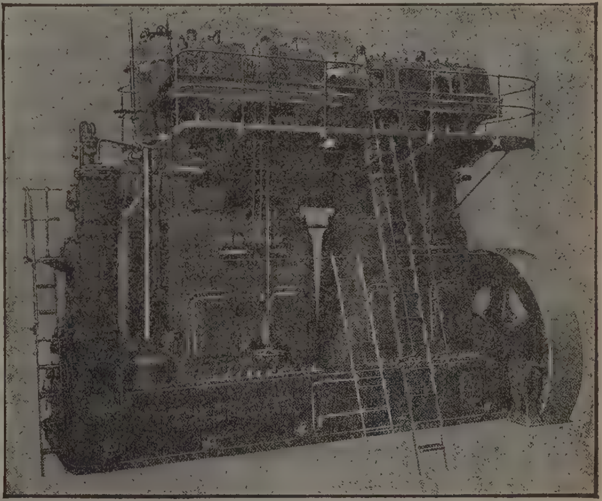

FIG. 10.

Marine Diesel Engines.—Marine Diesel engines differ in no essential respect from the land type. The majority of Diesel-engined vessels existing at the end of 1920 were fitted with 4-stroke cycle crosshead type engines largely on account of the known reliability of the 4-stroke engine in land installations. Two-stroke Diesel engines were at first made with cast-steel cylinder covers which not infrequently failed by cracking; this difficulty has been entirely overcome by making the cylinder covers of a suitable grade of cast iron, and the single-acting 2-stroke engine will probably become the preferred type.

For the very large engines required by war-ships the double-acting 2-stroke design is most suitable, and several had already been built in 1921 though there was not yet an instance of one fitted in a vessel; the cooling problem had not yet been quite satisfactorily solved. The 2-stroke engine possesses the advantages of reduced weight, reduced space occupied, greater simplicity in reversing gear, and lower first cost as compared with the 4-stroke type. Up to the end of 1920 a maximum of 1,800 H.P. had been attained in a single-acting, and 2,750 H.P. in a double-acting 2-stroke Diesel cylinder.

The first ocean-going passenger ship propelled by Diesel engines was the East Asiatic Co.'s 12-knot boat "Selandia," carrying a dead-weight cargo of about 7,400 tons, Copenhagen to Bangkok. There were twin screws each driven at 140 revs.

per minute by an 8-cylindered single-acting 4-stroke Diesel engine of crosshead type, aggregating 2,500 indicated H.P.; the first voyage was made in Feb. 1912. The sister ship "Christian X." was similarly engined. In May 1913 the largest Diesel-engined vessel afloat was the "Siam," built and engined by Burmeister & Wain, at Copenhagen, having a displacement of 13,200 tons; this boat is fitted with two 4-stroke engines aggregating 3,150 I.H.P., twin screws, and attained 12·4 knots on her trial run.

The great success of the geared steam turbine has made it a formidable competitor of the marine Diesel engine; nevertheless, steady progress continues to be made, and it is noteworthy that some of the largest British engineering and shipbuilding companies were in 1921 engaged in Diesel-engined ship production. Thus, during 1920, Messrs. Harland & Wolff launched seven ocean-going Diesel ships, viz. five at Glasgow, one at Greenock, and one at Belfast; while Messrs. Barclay Curle, Doxford & Vickers also built one each—ten in all; and in the United States five or six large oil-tankers with Diesel engines were also built.

In May 1921 there were in hand in Great Britain among others: (1) A large vessel for the Ocean Steamship Co., Liverpool, of 15,000 tons displacement and 13 knots speed; this was to be fitted with two large 8-cylindered Diesel engines by Burmeister & Wain, each developing 3,200 I.H.P.; the daily fuel consumption was estimated not to exceed 20 tons. These engines were of the same type and size as those already fitted in four 14,000-ton "Glen" liners built by Harland & Wolff; (2) two 14,000-ton boats, also by Harland & Wolff, for the Holland-America line, in each of which twin-screw Diesel machinery aggregating 6,400 I.H.P. was to be installed of the same design as those in the Ocean Company's liner; (3) The British India Co.'s vessel "Domala" with engines by the North British Diesel Co.; these were 8-cylinder 4-stroke engines of 26½-in. bore, and 47-in. stroke running at 96 revs. per minute, and giving about 2,350 I.H.P.; this was the first large Diesel-engined passenger liner.

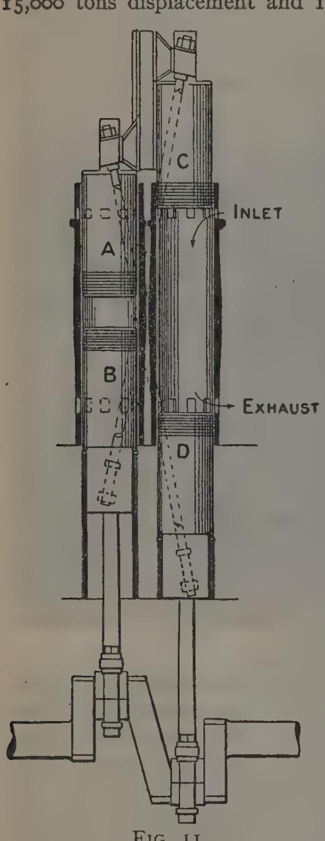

FIG. 11.

Great attention was in 1921 being devoted to improved designs, and some very interesting Diesel engines of special type had recently appeared. Thus Messrs. Doxford had produced a 2-stroke inverted vertical 3,000 H.P. engine of the "Oechelhauser" 2-piston type. Messrs. Cammell Laird have developed the "Fullagar" engine for marine use; this is a modified Oechelhauser made in "units" each comprising two Oechelhauser cylinders placed side by side (fig. 11) with their pistons connected diagonally by long tie-rods as indicated; the obliquity of the rods is small, and the side thrusts are resisted by the cross-heads and guides shown above A and C in the illustration.

The Cammell Laird-Fullagar engine works on the 2-stroke Diesel cycle, the oil fuel being injected between the pistons near the point of maximum compression by a high-pressure air blast; as the inlet and exhaust ports are at opposite ends of the cylinders excellent scavenging is obtained.

This engine is light and low in cost relatively to its power output; it is of high thermodynamic efficiency; and the frame is almost wholly relieved from stress in working. The 1,000 H.P. marine engine comprises two "units," *i.e.* four open-ended tubular cylinders, eight pistons, and a 4-throw crankshaft. The cylinders are 18½ in. in diameter, the stroke of each piston is 25 in., and the engine runs at 110–115 revs. per minute.

Two of these engines had by 1921 been installed in a cargo vessel for Messrs. Brocklebank; trials made in April 1921 were said to have shown the extremely low consumption of only 0·39 lb. of oil per B.H.P. hour. These engines drive their own 3-stage air compressors, scavenging pumps, and circulating water and lubricating oil pumps.

A 4,000 H.P. marine engine of this type was in May 1921 being built by Messrs. Cammell Laird, in a 4-cylinder unit; each cylinder is 26 in. diameter, stroke 42 in., and speed 90 revs. per minute.

Messrs. Swan, Hunter & Wigham Richardson had also recently produced a design of 2-stroke 4-cylinder "Neptune-Diesel" engine of special type.

The F.I.A.T. Co. (Turin) were building large 2-stroke Diesels in sizes up to a 6-cylinder marine type developing 3,200 H.P.

A large number of small multi-cylindered quick-revolution Diesel engines were fitted in submarines during the war by Thornycroft, Vickers, White, etc. This class includes engines having up to 12 cylinders, and run usually at from 400 to 500 revolutions per minute. They are now built in power up to 1,300 B.H.P., frequently with 8 cylinders, of both 4-stroke and 2-stroke type.

Group 3 (b). Semi-Diesel Engines.—Within the period 1910–21 a large group of engines appeared, which it has become usual to term "semi-Diesel" engines. The very high compression pressure of the normal Diesel engine necessitates not only a heavy and costly design but in addition the maintenance of an extremely high pressure in the air reservoirs for supplying the fuel oil blast. Designers have accordingly devoted considerable attention to the problem of producing engines (1) having a lower compression pressure than the Diesel engine, and (2) avoiding the necessity of high pressure air blast reservoirs by injecting the fuel oil into the cylinder by mechanical means through an "atomizer," or spraying device. Great success has been attained with but little sacrifice in fuel consumption efficiency.

In March 1919 the Diesel Engine Users' Association adopted the following useful definitions of Diesel and semi-Diesel engines respectively:—

Diesel Engine.

"A Diesel engine is a prime mover actuated by the gases resulting from the combustion of a liquid or pulverized fuel injected in a fine state of subdivision into the engine cylinder at or about the conclusion of a compression stroke. The heat generated by the compression to a high temperature of the air within the cylinder is the sole means of igniting the charge. The combustion of the charge proceeds at, or approximately at, constant pressure."

Semi-Diesel Engine.

"A semi-Diesel engine is a prime mover actuated by the gases resulting from the combustion of a hydrocarbon oil. A charge of oil is injected in the form of spray into a combustion space open to the cylinder of the engine at or about the time of maximum compression. The heat derived from an uncooled portion of the combustion chamber, together with the heat generated by the compression of the air to a moderate temperature, ignites the charge. The combustion of the charge takes place at, or approximately at, constant volume."

In the semi-Diesel engine definition it will thus be seen that there is no limitation made as to the mode in which the charge of fuel oil is injected, and that the essential features are (1) the practically instantaneous introduction of the fuel oil charge, giving approximately a "constant volume" explosion; and (2) the use of a "hot bulb" for aiding vaporization and ignition, whence these engines are sometimes styled "Hot-bulb Diesels." As the "Hot-bulb" engine was invented by Mr. Stuart Akroyd (1886–90), the "Akroyd-Diesel" would have been a more appropriate name for this class of engine.

Nearly all recent semi-Diesel engines are of the two-stroke type with mechanical or "solid" injection of the fuel oil, *i.e.* no high-pressure air blast; a usual device comprises a small force-pump operated by a quick-acting or "steep" cam which causes the small charge of oil delivered by it to forcibly raise a spring-closed needle valve in the spraying nozzle through from 0·01 to 0·02 of an inch; the charge of oil thus enters the hot-bulb in the form of a well-diffused fine spray. Several recent designs include simple air compressors whose function it is to supply an air jet to improve cylinder scavenging and assist in the cooling of pistons and cylinder walls, thus rendering recourse to the somewhat crude "cylinder water-drip" unnecessary during prolonged full-load running.

An instructive series of diagrammatic sections through nine representative semi-Diesel designs is given in fig. 12[1]; seven of the engines are of the two-stroke type, the "hot-bulb" being shown

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[1] By kind permission of The Diesel Engine Users' Association.

A critical examination of the type will be found in a paper by Mr. J. Richardson read before the Diesel Engine Users' Association on Oct. 25 1918, and reproduced in *Engineering* of the same date.

Messrs. Beardmore were in 1921 building this type of engine up to 600 B.H.P. and were considering a design to give 1,000 B.H.P.

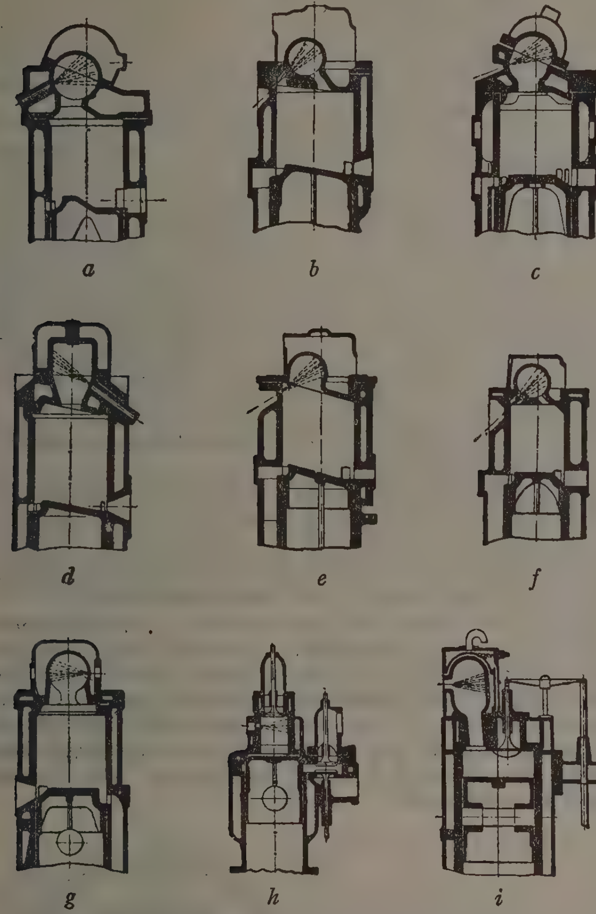

FIG. 12.—*Two-stroke Cycle:*—(*a*) "Beardmore," (*b*) "Bolinders," (*c*) "Petter," (*d*) "Ailsa Craig," (*e*) "Campbell," (*f*) "Kromhout," (*g*) "Robey." *Four-stroke Cycle:*—(*h*) "Cross," (*i*) "Hein."

The Swedish "Bolinders" engine (agents, Messrs. James Pollock & Sons, London) has for years been successfully and largely applied to the propulsion of fishing-boats and coastal craft. As early as Dec. 1911 the small (65-ft.) vessel "Lingueta," fitted with a 30-H.P. Bolinders engine, ran from Weymouth to Pernambuco (Brazil). In 1912, the vessel "Isleford" was fitted with a 4-cylinder 320-B.H.P. Bolinders engine; one of the latest cases (1921) is that of the Duke of Westminster's yacht "Belem," propelled by two 4-cylinder Bolinders engines each of 240 B.H.P. Of this type alone it is stated that over 650,000 B.H.P. had already in 1921 been supplied for various services; and as many other firms build 2-stroke semi-Diesels, the aggregate of this type must reach a very high figure.

The 2-stroke Petter semi-Diesel is also now largely employed in land service.

Semi-Diesel engines are becoming increasingly frequent on account of their simplicity, relatively low cost, and ability to use as fuel, with good economy, most of the heavy petroleum fuel oils varying from 0·8 to 0·9 in specific gravity and 130°F.–250°F. in flash point; the range at present is thus from ordinary kerosene to Texas fuel oil.

Semi-Diesel engines are usually started by compressed air stored in reservoirs at about 200 lb. per sq. in.; prior to starting the hot-bulb is blow-lamp-heated for 10 to 15 minutes.

Group 3 (c). Hornsby-Akroyd, and Normal Heavy Oil Vaporizer-type Engines.—There is no change of any fundamental importance to record regarding this group; mostly of the single-cylindered horizontal type, their use is established in many cases where the requirements call for only comparatively small powers.

Group 4. Quick-revolution "Light Oil" Engines.—This group includes the "Petrol Motors" now universally applied to the propulsion of road vehicles of all types, motor launches, aircraft, and small miscellaneous services.

Invented by Gottlieb Daimler, about 1887, and first applied seriously to road transport by Messrs. Panhard & Levassor, 1890, that modern miracle the "Petrol Motor" had in 1921, in the short space of thirty years, profoundly affected the conditions of civilized life in both peace and war. Distributed now over the whole world it is, *par excellence*, *the* motor for the multitudinous daily wants of humanity where large power is not required, and on land, in the air, on and under water, in agriculture, domestic service, and in the miscellaneous smaller departments of industry it finds universal application. Not the least remarkable of the features of these wonderful little engines is their high thermal efficiency, as much as 28% of the whole heat of the petrol not uncommonly being obtained at full load.

In his presidential address to the Inst. of Auto. Engineers in 1910, Dr. F. W. Lanchester stated that the 4-cylindered and 6-cylindered petrol engine had even then reached a degree of perfection that would have been regarded as impossible of attainment at the commencement of the century; the weight per H.P. developed at full load had been reduced from about 30 lb. to 9 to 12 lb. only (exclusive of fly-wheel); he commented also upon the absence of vibration and efficient silencing of the 1910 engines. Car engines of 1910 were, with few exceptions, of the 4-cylindered vertical type, with bore ranging from 3 to 5 inches, stroke from 3 to 6 inches, and speed, when developing 90% of their maximum power, of from 750 to 1,500 revolutions per minute, the corresponding brake mean effective pressure ranging from 65 to 95 lb. per sq. in. approximately. Compression pressures employed were from about 70 to 120 lb. per sq. in., absolute. Very full details will be found tabulated in the *Proc. Auto. Engineers* for 1910–11, vol. v., pp. 180 *et seq.*

Between 1910 and 1921 the advance made was purely in refinements of detail, with no change in leading principles of action. Six-cylindered engines for road vehicles show a slight increase in number; and in smaller and lower-priced cars, due to post-war cost increases, there has been some tendency observed to the production of two-cylindered horizontal, or "V," car engines, a few of these being of the air-cooled type. The 4-cylindered vertical engine, water-cooled, still largely predominates, as is shown by the following analysis of engines fitted to motor vehicles exhibited at Olympia in the autumn of 1920:—

Engines of Motor Vehicles, 1920.

Number of Cylinders	Number of Engines	Per cent of Engines
2	25	8·3
4	203	67·5
6	59	19·6
8	13	4·3
12	1	0·3
	301	100·0

Of these 301 engines, 292 were water-cooled and only 9 air-cooled.

The provision of detachable heads is a noteworthy improvement in design. In 1910 they were almost unknown; in 1920, of the 301 engines examined, 133 had detachable heads. Valve location has undergone but little change, 227 engines in 1920 having the usual side-by-side arrangement; the overhead valve type showed a small increase, 48 engines being thus arranged. Sixteen engines had sleeve valves, six engines valves on opposite sides of the cylinders,—involving two cam-shafts, and four with the inlet valve vertically over the exhaust. The exceedingly reliable high-tension magneto ignition still predominated, 247 engines being thus fitted; the remainder had either battery ignition or a combination of both H.T. and battery.

The revival of battery ignition is a consequence of the introduction of the very convenient electrical self-starting equipment with which so many vehicles are now supplied;[1] of 262 cars examined in 1920 no fewer than 245 were thus equipped. Recent improvements in H.T. magneto designs enable these machines to "spark" at very much reduced speeds; Messrs. Young & Warren[2] mention a magneto which will spark regularly across a 5·5-mm. air gap at about 60 revs. per minute only, with the timing lever fully advanced.

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[1] For a valuable review see *The Autocar* for Oct. 23 1920.

[2] *Proc. Inst. Auto. Eng.*, 1919–20, p. 374.

With improvements in the H.T. magneto, the recently introduced American "Impulse Starter" may be found to prove a simple, compact, and low-priced solution of the starting problem; briefly, this comprises a spring introduced between the engine and magneto and so arranged that on turning the starting handle the spring is at first wound up, the magneto armature remaining stationary. At an arranged instant the locking device is released, and the armature at once "flicks over" very suddenly, thus producing an intense igniting spark.

Fuels.—Petrol was still in 1921 the principal fuel, though benzol, either alone or mixed with petrol in varying proportions, is now used so far as available; alcohol had not yet come into use, though great efforts were being made to render it generally available. Mixtures of petrol and benzol, or benzol alone, can be used in existing engines usually with no change in adjustment, but with alcohol special designs will become necessary. The cost of petrol to the consumer rose steadily—largely due to the war—from 1910 to 1921. In 1910 the price per gallon in the London district was 9d. and 6d. tax, total 1s. 3d.; in August 1920 it rose to the very high figure of 4s. 3d.; by June 1921 it had fallen to roundly 3s. This great increase, added to the heavy vehicle taxation of £1 per Treasury-rated horse-power (= $0{\cdot}4 \times \text{Bore}^2 \times$ No. of Cyls.) tended to some extent to discourage the use of the private motor vehicle, but this might be regarded as a temporary check only.

The motor-cycles of 1921 may be considered to have nearly attained perfection; swift, comfortable, very economical of fuel, reliable, fitted often with 3-speed gears, "kick" starter, free engine, electric lighting, and many other refinements, they were veritably "cars" in miniature, and continually increased in favour with the motoring public of all ages. In 1920 no fewer than 186,200 licences for motor bicycles were taken out in Great Britain alone.

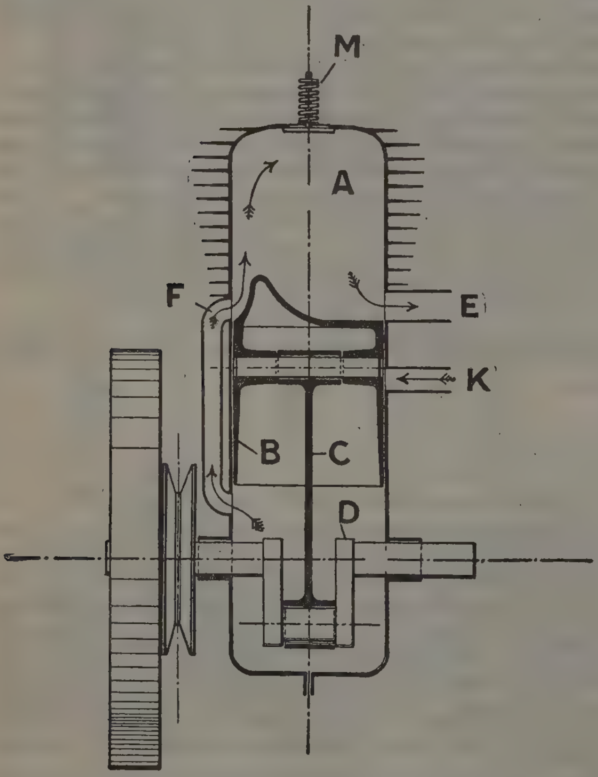

FIG. 13.

A great increase is also observable in that singular, though convenient, makeshift vehicle—the motor-cycle and side-car; this is probably largely attributable to the prevailing high cost of cars. With hardly an exception, motor-cycle engines are all air-cooled; the principal feature of note is the large increase in the number of engines of the 3-port 2-stroke type; the disadvantage of a lower fuel economy than that of the 4-stroke engine is, with many riders, more than compensated for by their great simplicity and low first cost.

A diagrammatic section through one of these very useful little engines is given in fig. 13; it comprises the usual air-cooled cylinder A, piston B, connecting-rod C, and crankshaft D; the piston has a "lumped" crown to deflect upwards the entering stream of fresh mixture as indicated. The crank-chamber is completely enclosed, and to start the engine it is caused to rotate by the driver; the piston rises, producing a partial vacuum in the crank-chamber until its *lower* edge uncovers the port K when an explosive mixture from the carburettor immediately rushes in; on its downward stroke the piston first covers the port K, and thereafter compresses the charge of explosive mixture in the crank-chamber until its *upper* edge uncovers the port F when the mixture, at a slight pressure, immediately passes up the passage shown into the space above the piston. Simultaneously the used gases are discharged through the exhaust port E, which is uncovered by the piston shortly before F. On the following up-stroke the piston first shuts off the ports E and F, and then compresses the charge into the upper portion of the cylinder; at the instant of maximum compression it is exploded by a sparking plug in the usual manner, and the piston is at once driven downwards; near the end of the down-stroke the burnt gases escape through E, at the same time that the next fresh charge is entering through F, and the cycle is then repeated indefinitely. Thus every downward stroke is a working stroke; the engine is valveless; the only moving parts are the piston, connecting-rod, and crankshaft; and the engine will run equally well in whichever direction it may be started,—a feature of value in its application to small motor boats and launches which are readily reversed by slowing down the engine and then suddenly advancing the ignition.

A small compression release valve M is usually fitted in the top of the combustion chamber, which is held open by hand-operated gear to facilitate the operations of starting and stopping. In motor bicycles these engines are commonly run at from 2,000 to 3,000 revs. per minute; they are very reliable, and require no attention beyond the occasional removal of the deposit of oily carbon which forms on the piston crown and walls of the combustion chamber.

Engines for Aircraft.—In principle these are all high-speed petrol engines of the four-stroke or, in rare instances, two-stroke type, characterized by their extreme lightness relatively to their power output. Fig. 14 shows three standard types of engine to scale, each of 75 B.H.P., and enables relative sizes and weights to be readily compared; from this illustration the great engineering achievement embodied in the "Aero Engine" can to some extent be appreciated.

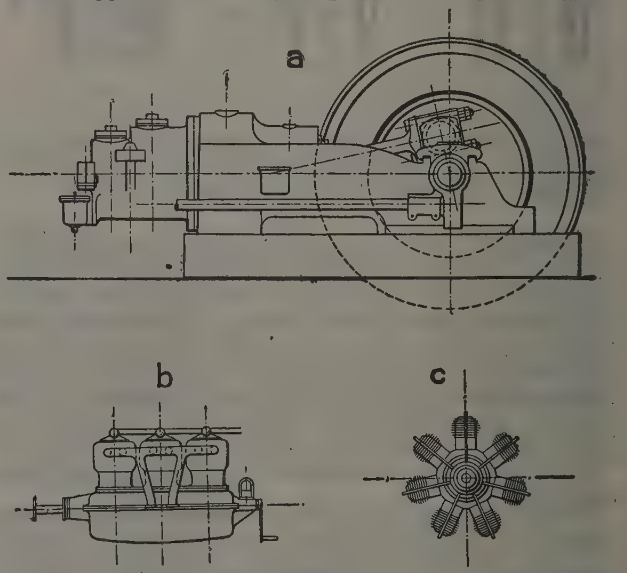

FIG. 14.—(*a*) 75-B.H.P., Single-cylinder Horizontal Engine. 200 R.P.M. Weight 200 lb. per B.H.P. Total 15,000 lb. (*b*) 75-B.H.P., 6-cylinder, Vertical, Water-cooled Aero Engine. 1200 R.P.M. Weight 5½ lb. per B.H.P. Total 410 lb. (*c*) 75-B.H.P., 7-cylinder, Rotary, Air-cooled Aero Engine. 1200 R.P.M. Weight 2¾ lb. per B.H.P. Total 205 lb.

Aero engines are conveniently grouped in five classes, viz., Horizontal Engines, Radial Engines, Diagonal or "V" Engines, Vertical Engines, and Rotary Engines. The horizontal aero engine is now obsolete. A classification of seventy-six aero

Some Data Relating to Typical British Aero Engines in 1919
(From Lord Weir, of Eastwood)

Description of Engine	Bore in inches	Stroke in inches	Compression ratio	Piston speed in ft. per min.	B.H.P.		Revs. per minute			Mean eff. Press. Lb./d.		Weight in lb.			Lb. per normal H.P. hour	
					Normal	Max.	Norm. of engine	Norm. of propeller	Maxm. of engine	Norm.	Max.	Total (dry)	Per H.P. dry	Per H.P. wet	of Petrol	of Oil
Rotary 9-cyl. air-cooled Bentley	5·52	7·08	5·26	1536	230	234	1300	1300	1360	92·0	—	498	2·165	—	·630	·088
Radial 9-cyl. air-cooled A.B.C. "Dragon Fly"	5·5	6·5	4·42	1787	320	350	1650	1650	1750	110·0	—	635	1·980	—	·585	·028
Vertical 6-cyl. water-cooled Siddeley "Puma"	5·72	7·48	5·00	1745	250	266	1400	1400	1500	115·0	123	645	2·58	—	·600	·062
Diagonal, 2 rows of 4 cyls. at 90°, water-cooled Sunbeam "Arab"	4·73	5·12	5·30	1707	212	220	2000	1200	2100	112·0	—	550	2·60	3·24	·486	·039
Diagonal, 2 rows of 6 cyls. at 60°, water-cooled Rolls-Royce "Eagle VIII." . .	4·5	6·5	5·30	1950	359	368	1800	1080	1900	127·2	131·4 at 1500	926	2·58	3·23	·500	·025
Diagonal, 2 rows of 6 cyls. at 60°, water-cooled Galloway "Atlantic"	5·72	7·48	5·40	1872	550	575	1500	1500	1600	126·3	—	1150	2·09	2·74	·504	·045
Diagonal, 2 rows of 6 cyls. at 60°, water-cooled Rolls-Royce "Condor" . .	5·5	7·5	5·10	2187	610	656	1750	970	2000	129·0	129·4	1350	2·21	2·86	·495	·023
Diagonal, 3 rows of 4 cyls. at 60°, water-cooled Napier "Lion" .	5·5	5·125	5·35	1708	450	468	2000	840	2200	122·0	126·0	1318	1·86	2·51	·495	·023

engines in 1910 by Burls[1] showed that 10 were horizontal, 12 radial, 25 diagonal, 24 vertical or "straight" and 5 rotary. With few exceptions the horizontal, diagonal, and vertical engines were water-cooled, the radial mostly air-cooled, and the rotary all air-cooled. Horse-power ranged from 15 to 130, but in aeroplane service from 60 to 120 was usually found. The weight per B.H.P. even in 1910 ranged from slightly under 2 lb. in the "Gnome" type of engine, illustrated in fig. 15, to as much as 7 lb. in water-cooled types in the remaining classes.

In July 1919, Lord Weir of Eastwood[2] gave a table (*see* above) of data relating to current typical British aero engines; it will be seen that vertical, rotary, radial and diagonal designs are all represented, the last-named predominating. The largely increased power of the 1919 engines is noteworthy; in 1910 the practical maximum used was about 130; in Lord Weir's table the maximum is 610 B.H.P. The 1919 engines show also a very satisfactorily low consumption of petrol and lubricating oil.

Considerable reduction has also been effected in the weight per B.H.P. of the water-cooled diagonal-type engines, which range from 3¼ lb. down to only 2½ lb. In the engines of 1910 the average piston speed was, roundly, 1,100 ft. per minute; the average of the eight engines in the above table is roundly 1,800 ft. per minute, a substantial and noteworthy increase.

The power of aero engines is usually stated at ground level; with increase of altitude the power output diminishes owing to the lessened density of the air; if at ground level a full power of 100 H.P. be obtained, at 5,000 ft. elevation this falls to about 82, and at 10,000 ft. to only about 68. To provide for this loss some aircraft engines have been designed for partly throttled running only at ground level, full throttle being only used when working in rarefied air at a suitable altitude; in these engines large compression ratio and forced induction are usually adopted, and full power output is never attempted at the ground level. In other cases a blower is provided to deliver additional air to the cylinders at high altitudes; exhaust-driven turbines of high efficiency have been developed by Rateau for this supercharging; by this means a nearly constant pressure may be maintained in the cylinders at the end of the suction stroke, with consequent constant power output at all heights.

In radial, as in rotary, engines a star-wise arrangement of the cylinders is adopted, all the pistons operating upon one or two cranks only, but the cylinders are stationary and the crankshaft rotates. Designs have appeared including 3, 5, 7, 9, 10 and 14 cylinders, the two last in two planes.

The 9-cylindered air-cooled radial engine of the Cosmos Co. developed 450 H.P. with the extremely low weight of but 1·47 lb. per horse-power; but large radial engines are open to objection on account of the increased head resistance involved in their use. With vertical or "straight" engines, *i.e.* those in which the cylinders are arranged as in the normal motor-car engine, weight per horse-power is found to diminish up to about four cylinders; thereafter, the larger crankshaft and heavier crank-case necessary to provide adequate stiffness tend to cause the weight per horse-power to increase; designers have accordingly associated cylinders together in two or more rows, and the "diagonal" engine with two or more pistons operating on each crank-pin is thus frequently met with in recent high-powered engines.

Weight is also saved and mechanical efficiency increased by operating the valves directly from overhead cam-shafts. Aluminium alloys are also largely used for pistons and cylinders, the latter being fitted with thin steel or cast-iron working barrels.

In their 450-H.P. engine Messrs. Napier have *three* rows each of four cylinders,—twelve in all,—three connecting-rods being attached to each crank-pin; the weight is thus reduced to only 2½ lb. per B.H.P. "wet."

The latest design of this form in 1921 was a sixteen-cylindered 1,000-H.P. aero engine, illustrated in external view in fig. 16 (Plate). In this engine there are *four* rows or "banks," each of four cylinders; the cylinders are separate, each being machined from a solid steel forging, with water-jackets formed of light steel pressings welded on. The vertical angle between the axes of the cylinder rows is 52½°, side angle 90°, and angle at base 127½°; the engine may be regarded as formed of two eight-cylinder 90° diagonal engines placed back-to-back and jointly actuating a "flat four-throw" crank-shaft, with four pistons operating upon each crank-pin. The angular arrangement adopted is considered by the builders to give the most convenient sequence of working impulses. Two exhaust and two inlet valves are provided in each cylinder head, placed at such an angle that the combustion chamber is approximately spherical in form; each row of cylinders has its own overhead half-speed cam-shaft operating the valves through rockers. Four carburettors are fitted, mounted on facings on the front (propeller) end of the crank-case. Ignition is by four high-tension magnetos.

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[1] "Aero Engines," G. A. Burls (Charles Griffin).

[2] *Proc. of N.E. Coast Inst. of Engineers and Shipbuilders.*

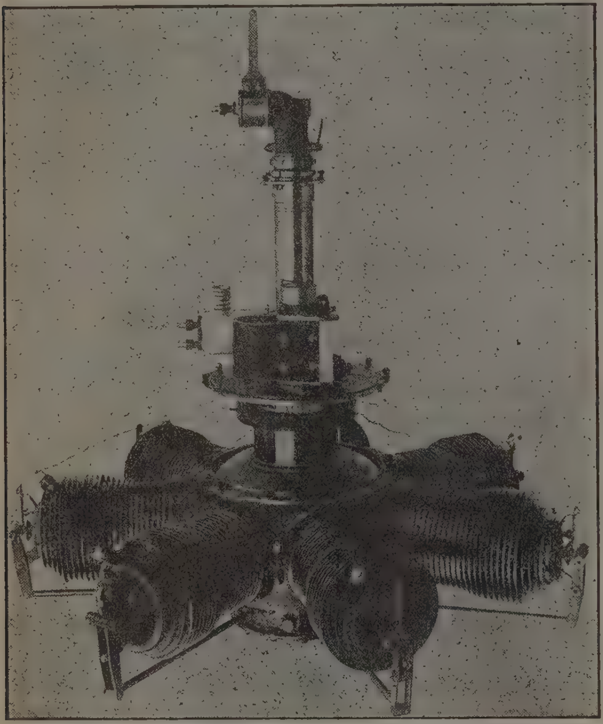

FIG. 15.

The peremptory demands of the war compelled the rapid development of aircraft of all kinds, and aeroplanes driven by two, three, four and even more engines soon became necessary. In 1914 the British depended mainly on the French for aero engines, principally of the "Gnome" and "Renault" types, but towards the close of the war British aero engines in both quality and number surpassed all others. At the end of 1918 the aggregate H.P. of the British aero engines was 7,094,000, and of this huge total 4,143,000 was contributed during 1918 alone.

Progress in the commercial applications of aircraft is slow, but will certainly continue, and increase; its vital importance in warfare renders it essential that adequate encouragement be afforded to enable it to be developed in all directions.

Group 5. Special Types. (*a*) *The Humphrey Pump.*—This is an internal combustion pump, simple in principle, and of high efficiency. Its mode of working will be understood by fig. 17.

It consists essentially of a U-tube AA′A″ containing water, one leg of which, A, is closed; within this closed end a mixture of gas and air is introduced, compressed, and exploded, thus setting the water column in oscillation; the water thus rises in A″, and some is discharged through B into the upper reservoir as indicated. C is a lightly spring-supported inlet valve which opens automatically, admitting a charge of fresh mixture, when the water-column in descending reduces the pressure in A to below that of the atmosphere; on the return oscillation C at once closes, and the fresh charge is compressed in A, and fired by the ignition plug S at the instant of maximum compression; explosion at once occurs, and the water in A is driven rapidly downwards, with corresponding rise in A″ and discharge through B. Towards the end of the working stroke the fall of the water in A causes the resultant pressure upon the suction valve E to become vertically *downwards;* E thereupon opens, admitting a fresh supply of water to the U-tube from the lower reservoir, and simultaneously, by a simple link-work, releases a pawl holding up the exhaust valve D which at once falls by its own weight, permitting the burnt gases to discharge into the atmosphere. The exhaust valve D is placed at the lower end of a short pipe projecting downwards into the combustion chamber as shown, and remains open during the return oscillation of the water-column in A until the water-level reaches and closes it, the pawl then automatically locking it in readiness for the next cycle.

The residual burnt gases are next compressed by the still rising water column in A, which is thus brought to rest. On the succeeding downward oscillation the pressure in A rapidly falls below that of the atmosphere, whereupon the automatic inlet valve C opens and admits a fresh charge; the sequence of operations is then repeated.

The pump as described thus works upon the "4-stroke" cycle, but is also, suitably modified, arranged to work on the 2-stroke cycle; a full account of this very ingenious application will be found in Mr. Humphrey's paper in the *Proc. Inst. Mech. Eng.* for Dec. 1909. It will be noted that, excepting the valves, there are no moving parts, the momentum of the water-column being utilized to charge and compress in the working cylinder, and obtain the fresh supplies of water to be pumped. The four strokes of the cycle, as above described, are all unequal, the working stroke being the longest; this is thermodynamically an advantage.

Mr. Humphrey has produced designs of pumps of this type capable of working with a suction, and for lifts of as much as 300 feet.

A very interesting installation of Humphrey pumps is that at the Chingford reservoir of the Met. Water Board, where are five large pumps, each of which delivers 40,000,000 gallons of water daily into the reservoir from the River Lea. Each pump cylinder is 7 ft. in diameter, and develops from 250 to 300 horsepower. The pumps use gas supplied by anthracite-burning gas-producers, and the consumption per actual pump-horsepower-hour is stated to be about 0·9 lb. of anthracite only.

(*b*) *The Internal Combustion Turbine.*—The exceedingly difficult problem of the internal combustion turbine has continued to receive attention; the chief difficulty encountered has been that of the extremely high temperature (1500–2000°C.) of burning gas in relation to the metals employed in construction.

The late M. Réné Armengaud succeeded in obtaining 300 B.H.P. from a petrol internal combustion turbine of constant-pressure type by reducing flame temperature at efflux to about 400°C. by the addition of large quantities of steam; this may accordingly be equally well regarded as a highly superheated steam turbine. About 3 lb. of petrol were required per B.H.P. hour, which is fully five times as much as is needed by a modern petrol engine of normal type. M. Karovodine has also built a small turbine in which explosions from atmospheric pressure occurring in rapid succession drive a small impulse wheel; this turbine was very small, giving only 1·6 B.H.P. at 10,000 revs. per minute, and the fuel consumption was very high. It is con-

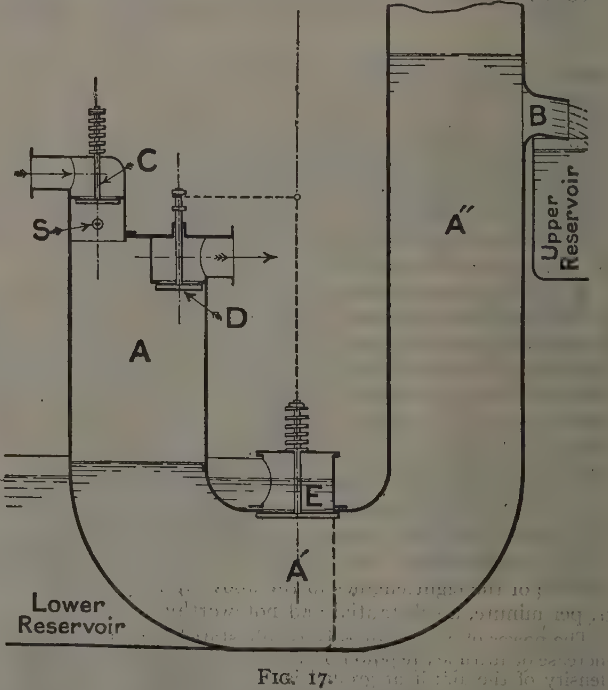

FIG. 17.

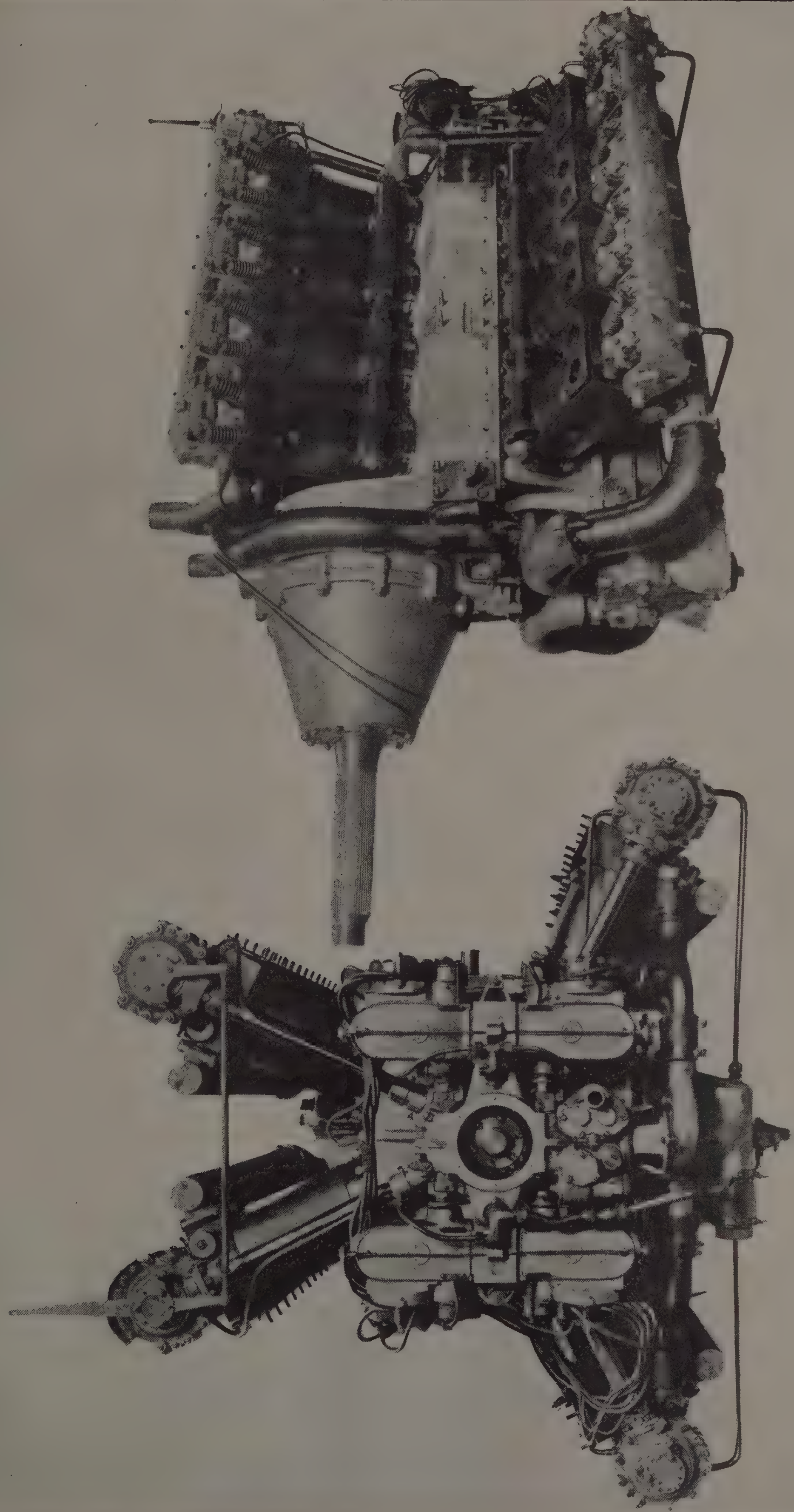

FIG. 16.—END AND SIDE VIEW OF 16-CYLINDERED 1000-H.P. AERO ENGINE.

sidered by many engineers that a combination of the steam and gas turbine will be found to be a satisfactory solution.

Herr Holzwarth has, however, devoted many years to the production of the gas turbine alone, and has made noteworthy progress.[1] The Holzwarth turbine unit comprises a small combustion chamber supplied with a mixture of gas or oil vapour and air by a suitable pump, through mechanically operated inlet valves.

The mixture is delivered under small pressure and ignited by a H.T. magneto. The resulting gases, at high temperature and pressure, then discharge through a spring-controlled flap valve termed the "nozzle valve," and issuing from the nozzle impinge on the vanes of the rotor. Having passed the vanes, the gases enter an exhaust chamber wherein a partial vacuum is maintained by a suitable exhauster. Shortly after ignition the nozzle valve is slowly closed mechanically, sufficient time being allowed for a gust of scavenging air to be passed through the combustion chamber, which is thus cooled and cleared in readiness for the next working charge; this air-gust also cools the nozzle and rotor vanes.

Thus the action is intermittent, and three valves and charging and exhausting pumps are required. In an actual turbine several such units are disposed around a turbine wheel, or "rotor."

Towards the end of 1920 the first gas turbine, using oil fuel, was built in Germany to a definite order by Herr Holzwarth. This turbine is direct-coupled to an alternator, and is stated to develop 500 B.H.P. with an overall thermal efficiency of 26%.

(c) *The "Still" Engine.*—This is a combination of an internal combustion engine and a steam engine. The working cylinder at one end uses a combustible mixture of gas or oil vapour and air, and at the other end of steam produced from the exhaust of the "internal combustion" end of the engine. The quantity of steam generated from the heat of the exhaust is stated to be about 7 lb. per B.H.P. hour at full load.

An experimental "Still" engine tested by Prof. Vernon Boys gave an average mean effective pressure on the 4-stroke internal combustion side of 90 lb. per sq. inch, and from the steam side of 14 lb. per sq. inch; thus the effect was equivalent to that of a normal 4-stroke internal combustion engine giving a mean effective pressure of $90-(2\times14)=118$ lb. per sq. inch, as the "steam" end has a 2-stroke cycle.

A high thermal efficiency is claimed, and it was stated in May 1921[2] that official trials recently carried out on a 350 B.H.P. experimental "Still" engine under Lloyd's inspection had shown such favourable results that Messrs. Scott's Shipbuilding & Engineering Co., the licensees, had decided to standardize designs of 6-cylinder marine sets of 2,000 B.H.P. using oil fuel in the manner of a 2-stroke cycle Diesel engine, with "solid," *i.e.* mechanically sprayed, injection of fuel into the cylinders. These engines would be started and reversed by steam. The development of this combination of internal combustion engine and steam engine was one which in 1921 was being followed by engineers with much interest. (G. A. Bu.)

INTERNATIONAL LABOUR ORGANIZATION.—An important part of the scheme for a League of Nations embodied in the Peace Treaty of Versailles in 1919 involved the creation of a new International Labour Organization. The Labour part of the Treaty (Part XIII.) rested on the principle laid down in its preamble that there can be no social peace which is not based on social justice. It represented the aspiration which moved all classes to carry over into peace the community of sentiment and of action which had held them together during the dark hours of the World War.

Aiming therefore at the promotion of social peace, the International Labour Organization was founded on two main beliefs—the belief that there must be international coöperation in the industrial sphere, if suicidal competition, leading to much human misery, and perhaps to fresh wars, was to be avoided, and the belief that such coöperation must be based on the collaboration between the State, Capital and Labour. The organization was therefore to consist of all the states forming the League of Nations, who were to meet annually in conference and draw up international agreements for regulating and improving industrial conditions. By raising the standard of living and the lot of the worker everywhere, the worst evils of commercial rivalry, and the penalty which it had hitherto imposed on progressive social legislation, could be gradually removed. This could only be done by international agreements having the force of treaties. Under the provisions of Article 405 of the Treaty these agreements are cast in the form of "draft conventions" and "recommendations," which each State is bound to lay before its legislative or other authorities within a maximum period of eighteen months. Special provision is made to meet the case of federal constitutions, such as those of Canada, Australia and the United States, where labour legislation is not within the competence of the federal authority, but is a matter for the individual states or provinces. There were some who took part in the Paris negotiations and who wished to go further. They advocated that the Conference should be vested with the powers of a super-parliament, whose decisions should be immediately binding; but finally the more modest proposal of the British delegation, who put forward the scheme, was adopted, and it was left to the sovereign power in each state to accept or reject the proposals adopted by the conference. The constitution as defined by the Treaty provides therefore that the final decision rests with the government or parliament of each country. Once its approval is given to a draft convention, the formal ratification is conveyed to the secretary-general of the League, and the enforcement of its provisions becomes a treaty obligation.

This procedure is, apart from the imposition of a time-limit, not essentially different from the usual procedure followed by diplomatic conferences before the war, but when the composition of the International Labour Conference is considered, several marked departures from precedent will be observed. In the past governments alone took part in international discussions which were to result in creating international obligations. This meant that the delegates were tied down to carrying out their official instructions, and that mutual concession must be carried to the point where virtual unanimity was reached, if any practical consequences were to follow. The constitution of the International Labour Conference broke away from the diplomatic tradition. It provided for four delegates from each country, two only representing the government, the other two being chosen in agreement with the most representative organizations of employers and of workers in each country. The reason for this innovation is not far to seek. In discussing labour problems it is impossible to ignore the great employers' associations and trade unions, which are primarily interested and which are the controlling factors in modern industry. Once unofficial delegates were admitted, it followed as a necessary corollary that each national delegation could not be expected to act as a whole, but that its members must be free to speak and vote as they pleased. Hence it was no longer possible to look for unanimity, and it was accordingly provided that a draft convention or recommendation must be carried by a two-thirds majority, but that once so carried, its consideration (though not its adoption) became obligatory on the governments, whether their representatives had voted for it or not. By this means international public opinion could exert its influence even in countries which might be unwilling to accept the standards of the majority.

One further point requires brief notice. During the original discussions in Paris there was considerable division of opinion on the question whether the governments should have one vote or two. It was argued from the Labour point of view that the double vote would place the workers in a hopeless minority, and reduce them to impotence against the three votes exercised by the governments and the employers. On the other side, it was pointed out that not only was it probable that the official delegates would be as often on the side of the workers as on that of the employers, but that on the equal voting system the latter would with the assistance of a single government be able to block any proposal. Moreover, unless the majority of the governments accepted a draft convention, there was small likelihood of its being ratified, and this in itself justified their larger voting power. The subsequent experience of the Washington and Genoa conferences may be held to have justified these contentions.

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[1] v. "The Gas Turbine," Holzwarth & Chalkley (Griffin 1913).

[2] v. *The Times* "Engineering Supplement," May 1921.

Supposing then that a convention has been duly ratified by a number of states, what guarantee is there that it will be enforced? Clearly unequal enforcement would largely destroy its value, and would penalise the countries which had acted up to their obligations. To meet this contingency the Treaty provided that where a state failed to carry out its obligations after having its attention drawn to the matter, the governing body of the International Labour Office might, if it saw fit, appoint a commission of inquiry. If the commission's report was unfavourable and the state in question still refused to remove the cause of complaint, the matter could be referred to the Permanent Court of International Justice, who would issue a final judgment and might suggest the adoption of the appropriate economic penalties against the defaulting country. In practice it may be held highly improbable that it would ever be necessary to go to such lengths, but this attempt to provide an effective sanction for international engagements is not without interest.

Washington Conference, 1919.—The first International Labour Conference was held in Washington in Oct. 1919 as fixed by the Treaty. The fact of President Wilson's illness and of the failure of the United States to ratify the Treaty clouded the atmosphere. Moreover, the prevailing industrial strife in America did not make a favourable setting for the first attempt at coöperation between Capital, Labour and the governments on an international scale. Nevertheless, 123 delegates, drawn from 39 countries, assembled: 73 representing governments, 25 the employers and 25 the workers. They were accompanied by about 150 advisers, a good proportion of whom were women. The conference sat for a month and, once it had found its feet, worked with astonishing purpose and enthusiasm. It dispersed with the feeling that its work had not been in vain. Six draft conventions and six recommendations had been adopted by the necessary two-thirds majority, most of them almost unanimously. It must suffice here to enumerate them, calling attention to one or two points of special interest. The first draft convention provided for the 8-hour day and the 48-hour week in industrial undertakings, with a number of modifications and exceptions which are indispensable to meet the special needs of particular industries or particular countries. Particularly notable were the articles dealing with Japan and India, which, though not bringing them up to the western standard at one bound, contain very considerable reductions in the hours of labour hitherto permitted in those countries. Further draft conventions provided for the establishment of employment exchanges and other measures for combating unemployment, for the prohibition of the industrial employment of children under 14, for the assistance of women in industry before and after childbirth, and for the prohibition of the employment of women and young persons at night. In addition, recommendations were adopted dealing with the treatment of emigrants, the establishment of medical inspection of factories, the prevention of anthrax and lead poisoning, etc.

These results of a month's work on the part of such a heterogeneous and polyglot assembly meeting for the first time were certainly noteworthy. They were not reached without a great deal of keen discussion. Employers and workers stated their views with freedom and force, but at the same time with restraint, and not infrequently it was the rôle of the government delegates to construct a bridge between them. But for all the differences of standpoint, mentality, language and interest, which made the conference such a fascinating microcosm, there was a spirit of good-will and a general common-sense, which enabled it to arrive at solid and workmanlike agreements. The foundation was laid for a real system of international labour legislation immeasurably in advance of anything which had been contemplated before the war. The pioneer work of the International Association for Labour Legislation, which succeeded in bringing together an official conference at Berne in 1906, resulting in a convention for the prohibition of the use of white phosphorus in matches, found its consummation at Washington in 1919, when the beginnings were made of a comprehensive international labour code.

The Washington conference completed its work by laying the foundations of the International Labour Office, the other branch of the permanent organization. The conference elected the governing body, which under the Treaty is charged with the control of the office, and which consists of 24 members. Of these 12 are appointed by governments, eight by those of the eight states of chief industrial importance, the remaining four being selected by the government delegates of the conference. There was some contention as to which were the eight chief industrial states, but finally, under protest from India, the following list was accepted:—the United States, Great Britain, France, Italy, Germany,[1] Japan, Belgium and Switzerland. As the first named had not ratified the Treaty, and was therefore not a member of the organization, a fifth place was provisionally thrown open for election, and the following countries were chosen to complete the number:—Spain, Argentina, Canada, Poland and Denmark. In addition to the government members, six employers' and six workers' representatives were chosen by the employers' and workers' groups, which guided their selection by the industrial importance of the organizations which they contained rather than by considerations of nationality. The result was somewhat ill-balanced, as 20 out of the 24 members were from Europe, though the equilibrium would have been better preserved had America been able to fill the three places allotted to her. The conference felt the position to be unsatisfactory and passed a resolution in this sense, which led to the reconsideration of the constitution of the governing body.

When elected, the governing body proceeded to appoint the first director of the International Labour Office in the person of M. Albert Thomas, the French Socialist leader, who had created the French Ministry of Munitions during the war, a man of great energy, capacity and enthusiasm. He quickly set to work, and the office took up its quarters in London in Jan. 1920. Its functions as defined by the Treaty fall into two broad divisions. On the one hand, it carries out all the preparatory and complementary work connected with the conference. It prepares the agenda, presents a report on each item containing all the information available on the subject, it performs the secretarial duties, and conducts all the correspondence arising in connexion with the ratification, interpretation and enforcement of the conventions and recommendations adopted. It also undertakes any inquiries which the conference may order. These may be termed the diplomatic functions of the office, which are performed by one of its main branches known as the "diplomatic division." The other main branch is the "scientific division," which, as its name implies, is engaged in the work of investigation and research. The Treaty imposes upon the office "the collection and distribution of information on all subjects relating to the international adjustment of conditions of industrial life and labour," together with the publication in French and English of "a periodical paper dealing with problems of industry and employment of international interest." It is easy to see how huge a field the office is thus expected to cover. There are few, if any, industrial problems which have not their international bearing. If the war and the economic chaos resulting from it had brought home one truth to the world, it was that economically all the nations are to a greater or lesser degree interdependent. And when the importance of labour as an element in production, whether industrial or agricultural, is considered, it may readily be seen that almost all labour problems have their international aspect. It is unnecessary to insist upon a point which is demonstrated on the one side by the tendency of capital to create amalgamations and working agreements, which take no account of national frontiers, and on the other by the movement of the trade unions in almost every important industry, including agriculture, towards the formation of international federations for the protection of their interests. Neither international strikes nor international collective agreements are outside the realm of practical politics.

Genoa Conference, 1920.—The first big task of the International Labour Office was the preparation of the second annual conference, which was held at Genoa in June 1920. It was exclusively concerned with the conditions of employment at sea. Of all industries the shipping industry is the most essentially international, and of all callings the seaman's has perhaps received the least attention from the social legislator. The Genoa conference was more specialist in character than its predecessor, and its results necessarily less impressive, because they were less universal in their scope. Nevertheless, they are likely to produce considerable practical improvements in the sailor's lot. The conference adopted three draft conventions. The first suppresses the "crimp," who made his living by fleecing the seaman under the pretext of finding him employment. The convention requires the abolition of all private employment agencies carried on for purposes of gain, or where they are allowed to continue temporarily, their supervision by the government. Moreover, each government undertakes to establish free public employment agencies conducted either by the State or by the joint effort of shipowners and seamen. The second convention provides for the payment to seamen of compensation for unemployment in the event of the loss of their vessel. Finally, a third convention prohibits the employment of boys under 14 on board ship. In addition to these conventions, recommendations were adopted in favour of unemployment insurance for seamen, and in favour of the establishment of national maritime codes. This last measure was regarded as the prelude to the drafting of an international code, which would enable sailors of all countries to serve under uniform conditions, under whatever flag they sailed. The International Labour Office was in 1921 engaged in collecting the material on which the joint maritime commission appointed by the conference might begin the work of framing such a code for submission to a future conference. Finally, two further recommendations were passed dealing with the hours of work on fishing vessels and in inland navigation, but on the difficult question of hours of work in seagoing ships, the conference failed to reach agreement. There were long and vigorous debates on this subject, the main point at issue being whether the French system of a 48-hour week with unlimited overtime compensated either by extra wages or by time off in port, or the British Government's proposal of a 56-hour week on deck and 48 in the engine-room, should be adopted. The former failed to obtain the necessary two-thirds majority by a fraction, but as several of the most important seafaring countries were in the minority, including Great Britain, Japan, Norway and Spain, the convention would probably not have been generally applied, had it been actually passed. The sequel, however, showed that legislation is not the only method by which the International Labour Organization can assist in promoting industrial peace.

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[1] Germany and Austria were admitted to the organization at one of the first sittings by 71 votes to 1.

Shortly after the dispersal of the conference the International Seamen's Federation held a congress at which the results were discussed. A good deal of dissatisfaction was expressed at the failure to obtain any reduction of hours, and a resolution in favour of an international seamen's strike was moved. The loss, suffering and dislocation which such a strike would have caused, however short its duration, require no emphasis. An amendment was eventually carried, however, inviting the director of the International Labour Office to intervene with a view to securing a conference with the International Shipowners' Association, at which the matter could be reopened on a purely industrial basis. The shipowners agreed to the meeting which took place at Brussels in Jan. 1921 under the presidency of M. Albert Thomas. Two joint committees were appointed to examine in detail the revision of hours of work in the engine-room and on deck respectively. An excellent spirit was shown on both sides, with the result that it is proposed to make practical experiments on selected ships to test the new system of hours proposed, which may well pave the way to the first international collective agreement. Such an agreement would undoubtedly mark an important landmark in industrial history.

International Labour Office.—As regards the development of the International Labour Office itself, its early months were largely occupied in recruiting and training the staff necessary to carry out its numerous duties. They were gradually drawn together from different countries, and in spite of the variety of language and tradition had at the end of six months attained a degree of unity and cohesion, which enabled the work of the office to reach a very reasonable standard of efficiency and its publication to commence. To the diplomatic and scientific divisions a number of small technical sections were attached, manned by specialists in the problems they were appointed to handle. These sections dealt with unemployment and emigration, agricultural questions, seamen's questions, industrial health, social insurance, including the rehabilitation of men disabled in industry or in war, and coöperation. A further special section was formed to study the social aspects of the Russian revolution in consequence of a decision of the governing body to send a mixed commission of inquiry to ascertain the industrial conditions under the Soviet régime. Owing to the refusal of the Bolshevik Government to admit them, the commission never carried out their mission, but the Russian section which had been formed to prepare the way for their inquiry succeeded in collecting a great deal of first-hand evidence, which had not been previously got together. The section made a scientific analysis of the data thus obtained, and produced the first attempt to give an objective account of the Bolshevik industrial system under the title of "Labour Conditions in Soviet Russia."

Finally a small section was formed to carry out the inquiry into production, which was decided upon by the governing body on the motion of the employers' representatives. The object of this inquiry was to ascertain, if possible, how far the diminution of production was due to the shortening of hours of work, the physical and moral exhaustion produced by the war, or to other causes affecting the output of the individual worker, or how far it was due to deeper economic causes produced by the generally chaotic conditions in which the war had left the machinery for the production and exchange of goods all over the world. To attempt to obtain a clear view of a subject of such complexity was in itself a vast undertaking, but in response to the questionnaire which was sent out in twelve languages to the governments, employers' organizations and the trade unions, a great deal of valuable information about the conditions affecting production in all countries had already been obtained in 1921.

After six months' work in London, the Office was transferred to Switzerland. The Treaty required it to be established at the seat of the League of Nations, and though the secretariat of the League was still in London, the governing body decided for reasons of convenience to transfer the office somewhat earlier to Geneva, which was designated as the future home of the League. Consequently in July 1920, immediately after the close of the Genoa conference, the International Labour Office settled down in its new quarters. After three months' breathing space, it was called upon to take its part in the work of the first assembly of the League. The constitutional relationship between the Labour Organization and the League was generally defined in the Treaty, though some points were not free from ambiguity. The International Labour Office is "part of the organization of the League" and is "entitled to the assistance of the secretary-general in any matter in which it can be given"; but it is not subject to the control of the council of the League, nor is the Labour Organization as a whole in any way dependent upon or subordinated to the assembly, except in the important matter of finance. Unlike the other technical organizations of the League, such as the health or transit organizations, the Labour Organization does not submit its decisions to the council for approval and its agenda are settled not by the council but by its own governing body. Save in the matter of finance, it is an autonomous body attached to the League by ties of common interest rather than by constitutional bonds; in fact, it is a sort of self-governing dominion. The financial link is, however, naturally one of great importance, since money questions are not less vital in international than in national affairs. Hence when the budget of the League was considered by the assembly, the finances of the Labour Organization, which form part of it, also came under review.

As the taxpayer is acutely interested in all public expenditure, it may be interesting to give a rough idea of the cost of the International Labour Office. Its estimates, which were voted by the Assembly for 1921, amounted to 7 million gold francs, which may be taken as approximately equivalent to £350,000. This total is contributed by the 48 States Members of the League, Great Britain as a first-class State paying about £16,000. If these figures are compared with the cost of an average civil department in England, it will be seen that they are exceedingly modest, and it has to be remembered that they include a great many items which do not enter into the estimates of government departments, such as rent, repairs, postage, telegrams, stationery, printing, etc. Again, the conduct of correspondence and publication on a considerable scale in two or more languages more than doubles the effort of the staff, and consequently the cost, which would be entailed if only one language were employed. In order to insure that the utmost economy was being practised, however, and to advise as to the conditions of service, the assembly resolved that a committee of experts should be appointed to inquire into the organization of the secretariat and of the International Labour Office.

At the beginning of 1921 the Office consisted of 95 men and 115 women drawn from 17 different countries. It could deal with every language, except Chinese, in which books bearing upon industrial questions are published. Its library consisted of about 30,000 volumes, mostly purchased from the International Association for Labour Legislation, who had formed at Basle an unique collection of literature on labour and economic questions. The demands made on the office for information by governments and employers' and workers' organizations were growing steadily, and were requiring a constantly widening range of knowledge. A general idea of its work on the scientific side may best be gained by enumerating its publications. Every day it issues a small pamphlet entitled *Daily Intelligence*, which gives information about important events connected with labour and industry, which are not usually available to the reader of the daily press. Every week it issues an *Official Bulletin*, which reports the sittings of the governing body, records the progress of the ratification of the conventions and of the legislation for giving effect to them, and reproduces any important official correspondence. It is, in fact, the official organ of the International Labour Organization. Every month the office publishes the *International Labour Review*, which consists partly of studies prepared in the office dealing with the various subjects which concern it, partly of articles contributed by well-known economists or by leaders of thought in the industrial and trade-union worlds. Apart from these regular publications, all of which appear both in English and French, the office also issues a legislative series containing reprints or translations in English, French and German, of the principal labour laws passed by the parliaments of the world, as well as a number of special studies and reports on questions of current importance, such as the occupation of the factories by the workers in Italy, the history of the miners' strike in Great Britain, the conditions of labour under the short-lived Soviet régime in Hungary and similar topics, which have an interest to the social student everywhere, but about which he finds it difficult to get trustworthy information. In all its publications the aim of the office is to treat the subject-matter with scientific accuracy and complete objectivity, so that they may come to be regarded as really valuable and impartial contributions to social science. In the controversial atmosphere which surrounds so many economic problems to-day, this is not an ideal easily achieved; but if it can be realized, the presentation of the facts upon which future policies must be founded from an international and unprejudiced standpoint will be of real service to honest seekers after truth.

Internationalism.—There is one other task which lies upon the International Labour Organization and which goes to the root of its existence—the creation of an international spirit. Unless that spirit can be born and fostered, neither the League of Nations nor any institution connected with it can hope to survive. It is not a question of paying lip-service to catch-words, of realizing "the brotherhood of man," of reviving in the 20th century the picturesque but shadowy idealism of Rousseau. To create a true international spirit it is necessary to begin practically and prosaically at the bottom instead of presumptuously and poetically at the top. The first and most elementary lesson consists of the inculcation of the fact that there are more links, economic, social and human, which bind nations together than there are divergent interests and antagonistic aims which pull them asunder. It is not an easy lesson to learn. The nationalistic impulse in a people is almost as deep-rooted and instinctive as the egoistic impulse in the individual. But just as men cannot live without working with and for their fellow-men in society, so nations cannot exist without coöperating with other nations. Because, however, the nation, being the larger unit, is more nearly self-sufficient than the individual, national public opinion is slow to realize its dependence on others and is apt to believe its national self-sufficiency far more complete than in the modern world it can possibly be. Internationalism is not the antithesis of nationalism, but its complement. Properly understood, it does not mean the emasculation of the national spirit, which represents the embodiment of the ideals, the traditions and the virtues built up during many generations of common national effort. On the contrary, it means the pooling of the spiritual resources of all nations in order to make their intercourse more fruitful and to bring the society of which they are all members to a higher level of prosperity and civilization. To achieve such a result public opinion needs to possess an international as well as a national consciousness. It must acquire a world point-of-view, a *Weltanschauung*, as a corrective and an enlargement of its national standpoint. Instead of regarding the foreigner with instinctive mistrust, if not with sub-conscious aversion, it will then realize that in most respects he is remarkably similar, that he is grappling with similar problems, faced by similar needs, the victim of similar economic disabilities, which everyone can meet more successfully by working together to find the right solution than by working alone without each other's experience.

Perhaps the principal work of the International Labour Organization is to bring about such collaboration in the industrial field, and so to contribute towards the formation of a practical international spirit. In the present state of economic interdependence which the world has reached, to hunt in isolation for the solution of economic problems, which are in a large measure common to all countries, is hunting deliberately in the dark. When the delegates of the 48 states comprising the League meet at the annual conferences, they not only discover an unsuspected community of ideas and sentiments, but also an astonishing identity in the difficulties which preoccupy them. The labour question, which is largely a psychological question, is essentially the same in Japan as in Great Britain, despite all the variations of mentality, historical evolution and national tradition which go to make up its setting. The mere meeting of the International Labour Conferences does much to promote a sense of common interest and an understanding of the value of coöperation. For its everyday work the International Labour Office attempts to reach the same end by making known to every country what is being thought and done in others through the medium of its publications and of its correspondents. In London, Paris, Washington, Rome and Berlin, regular correspondents are established. Their business is partly to collect first-hand and complete information about the industrial developments in their own country and to keep the office in touch with its government and its great organizations of employers and workers. But an even more important part of their duties is to make known the work of the organization, and so to educate public opinion to see things through international eyes. The value, indeed the indispensability, of such a system of contact for an international organization is shown by the frequent demands which have been received for its extension to other countries. Such a network of international connexions can only be gradually and carefully built up, but it is the surest method of fostering the sense of international community, which is essential to the life of the League of Nations and its allied institutions. Like all other institutions, they are liable to feel the effects of the actions and reactions which affect the current of human progress. The vaulting idealism which marked the close of the World War has given ground before a wave of more materialistic sentiment bred of discouragement and disillusionment, because the new world is as yet apparently no better and certainly less prosperous than the old world we remember before the war. But the ideas embodied in the labour part of the Peace Treaty have already obtained a sufficient hold to justify the belief that their survival and development are as certain as those of any movement can be in an age when all things are in flux and nothing can claim finality. (H. B. B.)

INTERNATIONAL LAW (*see* 14.694*).—The World War led a certain number of "practical" people to the length of declaring international law to be extinct; and, no doubt, in practice during the war the breaches of its principles were more familiar than the cases of its observance. Yet the belligerents never ceased to appeal to it against one another, and to make propagandist capital out of violation of its teachings. In spite, therefore, of there being ground for discouragement, international law has never ceased to be the usage which had grown up as the legitimate practice of civilized mankind, and the violations and deviations only leave it on a more solid foundation of principle than ever. The offences committed by different belligerents against it, moreover, have served to intensify the feeling that safety in the future from international intrigue and hatreds, fomented by leaders of great material interests among ignorant or degenerate masses, lies rather in the diffusion of the spirit of law, its codification, and the creation of agencies for its enforcement against those who disregard it.

1. *General.*—The framers of the treaties of peace evidently felt that public opinion throughout the world demanded something higher than the rule of force, and the preamble sets out among the four purposes of the Covenant of the League of Nations "the firm establishment of the understandings of international law as the actual rule of conduct among governments." The whole preamble reads as follows:—

> "In order to promote international coöperation and to achieve international peace and security, by the acceptance of obligations not to resort to war, by the prescription of open, just and honourable relations between nations, by the firm establishment of the understandings of international law as the actual rule of conduct among governments, and by the maintenance of justice and scrupulous respect for all treaty obligations in the dealings of organized peoples with one another."

In further recognition of the demand of the world for law in the place of force, Article XIV. of the Covenant sets out that the Council of the League of Nations "shall formulate and submit to the members of the League for adoption plans for the establishment of a Permanent Court of International Justice," and that "the Court shall be competent to hear and determine any dispute of an international character which the parties thereto submit to it"; and it goes still further in providing for its obtaining a sort of moral influence over the League itself in that "it may also give an advisory opinion upon any dispute or question referred to it by the Council or by the Assembly."

The framers of the Covenant unfortunately had inserted Article X., which resulted in the United States refusing to join the League.

Yet the article at first sight seemed harmless. It provides that "the members of the League undertake to respect and preserve as against external aggression the territorial integrity and existing political independence of all members of the League," and that "in case of any such aggression or in case of any threat or danger of such aggression the Council shall advise upon the means by which this obligation shall be fulfilled." Closer examination showed that it lent itself to interpretations inconsistent with the objects of a League of Peace. To the undertaking to respect the territorial integrity and existing political independence of the members of the League there could be no objection, but the "obligation", "to preserve them against external aggression" or a "*threat of aggression*" practically constituted the League an agent for defence of the

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These figures indicate the volume and page number of the previous article.

provisions of the Treaty generally, and warranted a potentially offensive attitude on mere suspicion of aggressive purposes—a possible "arming to prevent war." It might bring us back to the old pre-war conditions, based on the profiteering maxim: *Si vis pacem para bellum.*

The notion that usage without sanctions is not law underlay the introduction of Article X. into the Treaty—a notion which is not borne out by either the history of civil law or its practice.

It is seen, in short, that international law is by no means dead. Far from being dead, it is relied upon more than ever to become a substitute for force, and especially for the pre-war theory of the necessity of competition in armaments.

The successful creation of numerous new societies for the study and promotion of the reign of law among nations shows how widespread is the feeling that we need more respect for law and less for solutions dictated at the cannon's mouth.

Moreover, there remain the Wilsonian principles, as accepted by all the belligerent Governments, constituting a sort of new charter for guidance in the reform of public law which in creating the League of Nations and its adjuncts have laid the foundations of new organs for the strengthening and enforcement of law among and between Governments.

A close examination of the 14 points laid down by President Wilson in his address of Jan. 8 1918, reaffirmed in the four of that of July 4 1918, and the five of his address of Sept. 27 1918, reveals several underlying principles which may be considered as constituting a sort of fundamental international programme adopted with one reservation by the Allies in Mr. Lansing's reply to Germany of Nov. 5 1918, and freely accepted by Germany and her allies. These principles may be summed up as follows:—

1. No secret international agreements (1;—also one of the five);
2. Freedom of the sea and its channels (2, 12;—subject to reservations referred to in Mr. Lansing's letter of Nov. 5);
3. Most favoured nation treatment to be generalized (3;—also one of the five);
4. Restriction of armaments (4);
5. Acquiescence of populations in all matters affecting sovereignty over them (5, 6;—also one of the four);
6. Abolition of the "right of conquest" (7, 8, 11;—also among both the four and the five);
7. Access to the sea a right for all States (11, 13);
8. All States as settled by the Treaty of Peace to be guaranteed an equal right to their independence and integrity (14;—also among the four);
9. Racial homogeneity of population to be a ground of adjustment of frontiers (9, 12).

Principle (5) may in some instances conflict with principle (9); (3) may not always tally with (8), and some of them may not be capable of universal application. Nevertheless, they constitute the main lines on which it was promised to European democracy that a resettlement of Europe would be based. (See Barclay, *Collapse and Reconstruction.* Boston, 1919, p. 21, etc.)

A crude, and not always successful, attempt was made in the treaties of peace to carry out these principles. Democracy in the chief countries of the Allied Powers, unfortunately, had not yet had time up to 1921 to grasp their importance. Moreover, their application, to a great extent, has been obscured and perverted by circumstances which arose out of the chaos caused by conflicting claims of ambitious and noisy minorities, and the recasting by an unskilled diplomacy of Western Europe. Nevertheless, the charter exists, and with the spread of democratic influence among Governments its importance for posterity will probably become more distinctly obvious.

The subjects on which the war and its after-effects may be said to have led to differences of view, and which are likely more particularly to be influenced in the development of international law, are neutrality, contraband of war, blockade and prize, the position of armed merchant vessels, the rights and duties of aircraft, and the legal conditions applicable to enemy private property.

2. *Neutrality.*—The old theory of neutrality was that the only restrictions to which a neutral's freedom of action in war was subject were such as would or might constitute assistance or favour, direct or indirect, to either belligerent. Thus neutral ships had to submit to visit and search for contraband of war, and to respect blockade of enemy ports and areas. But they had, in general, the right to carry on intercourse and traffic with either enemy without hindrance, even to supply either side with munitions of war subject only to the belligerent right to capture them if possible.

At the outset of the war, and during the first years of its continuance, there was considerable diplomatic friction between the United States and England, and between the United States and Germany and Austria, respecting the British restraints on American commerce on the one hand, and, on the other, on account of the overwhelming advantage enjoyed by England in respect of war material supplied from the United States.

One of the chief subjects of American complaint was the new practice instituted of bringing neutral vessels into port for search instead of the older practice of visit and search, which interfered as little as possible with the course of their voyage.

The American Secretary of State in a communication of Oct. 21 1915 to the United States ambassador in London protested against the British contention that "modern conditions" justify bringing vessels into port for search, and that the size and seaworthiness of modern carriers of commerce and the difficulty of ascertaining the real transaction in the intricate trade operations of the present day make it impossible to effect an adequate search on the high sea. "It is believed," he wrote, "that commercial transactions of the present time, hampered as they are by censorship of telegraph and postal communication on the part of belligerents, are essentially no more complex and disguised than in the wars of recent years, during which the practice of obtaining evidence in port to determine whether a vessel should be held for prize proceedings was not adopted." The effect of the size and seaworthiness of merchant vessels upon their search at sea, he added, had been submitted to a board of naval experts, who had reported that:—

> "At no period in history has it been considered necessary to remove every package of a ship's cargo to establish the character and nature of her trade or the service on which she is bound, nor is such removal necessary. . . . The facilities for boarding and inspection of modern ships are in fact greater than in former times, and no difference, so far as the necessities of the case are concerned, can be seen between the search of a ship of 1,000 tons and one of 20,000 tons—except possibly a difference in time—for the purpose of establishing fully the character of her cargo and the nature of her service and destination. . . ."

Complaints were also made respecting the detention of neutral vessels on bare suspicion and the methods employed in respect of evidence against them. The U.S. Government pointed out that under the hitherto existing practice when a vessel was brought in for adjudication, courts of prize considered "at the first hearing only the ship's papers and documents, and the goods found on board, together with the written replies of the officers and seamen to standing interrogatories taken under oath, alone and separately, as soon as possible, and without communication with or instruction by counsel, in order to avoid possibility of corruption and fraud." Additional evidence was not allowed to be introduced except upon an order of the court for "further proof," and then only after the cause had been fully heard upon the facts already in evidence or when this evidence furnished a ground for prosecuting the enquiry further. This had been the practice of the U.S. courts during the war of 1812, the American Civil War, and the Spanish-American War, and had been the practice of the British prize courts for over a century. This practice was changed by the British prize court rules adopted by the Order in Council of Aug. 5 1915. Under these new rules there was no longer a "first hearing" on the evidence derived from the ship, and the prize court was no longer precluded from receiving extrinsic evidence for which a suggestion had not been laid in the preparatory evidence. The result was, contended the U.S. Government, that innocent vessels or cargoes were seized and detained on mere suspicion, while efforts were being made to obtain evidence from extraneous sources to justify the detention and the commencement of prize proceedings, and "the effect of this new procedure was to subject traders to risk of loss, delay, and expense so great as practically to destroy much of the export trade of the United States to neutral countries of Europe."

The interest of neutrals is necessarily different from that of belligerents, and their standpoints are influenced accordingly. It is possible that there will be other wars long before there is again one in which the belligerents will form the bulk of the world power. The precedents of the World War are, therefore, subject to the qualification that neutral states, with one exception, were not in a position to assert their rights by force, and that the one great neutral Power in question, which had the power to assert neutral right, came to have an interest which was practically identical with that of one of the parties in the struggle till it became entirely so.

We may, therefore, regard the principles and rules of international law respecting neutrality at the end of the World War as in no essential particular different from those which civilized mankind before the war had come to regard as binding.

3. *The Declaration of London.*—This convention (Feb. 26 1909) had not been ratified at the outbreak of the war by any of the Governments concerned. In the Italo-Turkish War, Turkey and Italy as belligerents had given effect to it as a whole, and Russia as neutral in part.[1] Great Britain had gone the length of giving effect to it by passing an Act through the House of Commons which the House of Lords had thrown out. The U.S. Senate (April 24 1912) "advised and consented" to the ratification of the declaration, but the ratification had not been deposited in London.[2]

The U.S. Government early in the war (Aug. 6 1914) made a suggestion that the belligerent Powers should adopt the declaration in its entirety as a code of international law. Its acceptance by the belligerents, the Secretary of State urged, might prevent the grave misunderstandings between belligerents and neutrals to which different views on the maritime law of war would expose their relations. The German and Austro-Hungarian Governments declared their readiness to give effect to the declaration subject to reciprocity. The British Government declared, however, that it could only observe the provisions of the declaration in so far as this did not conflict with the "efficient conduct" of naval operations. The French Government took the same line as that of Great Britain. The Italian Government in due course followed their example. The U.S. Government, meanwhile (Oct. 22 1914), in view of the little response made to its proposal withdrew it. A British Order in Council of Aug. 20 1914, however, had given effect to the declaration subject to modifications and additions. But the modifications grew with the progress of the war, and with the "manifest developments of naval and military science, the invention of new engines of war, the concentration by the Germanic Power of the whole body of their resources on military ends."[3] In view of these conditions, altogether different from those prevailing in previous naval wars, by Order in Council of July 7 1916 the declaration was finally withdrawn.

4. *Contraband of War, Blockade and Prize.*—International law forbids neutrals to do certain things for the benefit of a belligerent. Among these are the supply of articles of direct or indirect help to him in the prosecution of the war. As Grotius says:—

> "There are still disputes as to what may lawfully be done to those who are not our enemies, nor are willing to be thought so, and yet furnish our enemies with supplies. This is a point which has been sharply contested, both in ancient and modern times, some maintaining the extreme right of war, others the freedom of commerce. In the first place, we must distinguish between the things themselves, for there are some things which are of use only in war, as arms, others which are no use in war, but serve only for pleasure; others which are useful both in war and peace, provisions, ships, and their appurtenances."

Grotius approves of forbidding neutrals to supply the enemy with articles of the first kind, and of permitting traffic in articles of the second kind. As regards the third kind, those which are of use, both in time of war and in time of peace (*usus ancipitis*), he makes a distinction:—

> "For if I cannot protect myself unless I intercept what is sent, necessity will give me a right to intercept it, but under the obligation of restitution, except there be cause to the contrary. But if the supplying of the articles will impede the execution of my design, and he who transports them might have known this fact—as, for instance, if I am besieging a town or blockading a port, and a surrender or a peace is daily expected, he will be liable to me for damages, and his property may be taken to satisfy them. If he has not done the damage, but is only attempting to do it, his property may be detained until he gives security for the future; but if the injustice of my enemy be very clear, and the supplies conveyed to him support him in his unjust war, then shall the party who conveys them to my enemy be not only liable to repair my loss, but he may be treated as a criminal, as one who is rescuing a notorious offender from impending judgment; and for this reason it will be lawful for me to deal with him according to his offence, and for the purpose of punishment I may deprive him of his merchandise" ("*De Jure Belli et Pacis*," lib. iii., c. i., s. 5).

International law at the outbreak of the war still recognized the distinctions laid down by Grotius, the first kind being known as "absolute contraband," and third as "conditional contraband." And, as usual, Governments at the outbreak of war issued lists of absolute and conditional contraband. The Declaration of London (1909), following Grotius' distinctions, adopted a third list of articles, corresponding to his second kind, which are never to be declared contraband. Among them, rather inconsistently, figured "raw cotton," which had been a concession to England. The drafting committee stated, however, that this free list was not exclusive, but merely indicative.

There had been a strong movement on the European continent before the war in favour of abolishing conditional contraband. Moved by the desire to distinguish unmistakably from, so to speak, constructive contraband, and to protect trade against the vexation of uncertainty, many continental jurists had come to argue it away altogether. There were, however, signs of a change of opinion, judging by the discussions on the subject in the Institute of International Law, a body exclusively composed of recognized international jurists. The rules this body adopted in 1896, though they did not represent the unanimous feeling of its members, may be taken as the opinion of a large proportion of them. In any case the majority comprised German, Danish, Italian, Dutch and French specialists. The rules contain a clause which, after declaring conditional contraband abolished, stated that "nevertheless, the belligerent has, at his option and on condition of paying an equitable indemnity, a right of sequestration or preëmption as to articles (objects) which, on their way to a port of the enemy, may serve equally in war or in peace."[4]

Thus, by the established classification goods are divided into three classes:—(1) Goods primarily used for warlike purposes; (2) goods which may be equally used for either warlike or peaceful purposes; (3) goods exclusively used for peaceful purposes.

Under the law of contraband as it stood at the outbreak of war, goods in the first class might be seized if proved to be going to the enemy country; goods in the second class might be seized if proved to be going to the enemy Government or its armed forces; goods in the third class passed free. Attempts of belligerents to enlarge the first class at the expense of the second, and the second at the expense of the third, had only been frustrated at the expense of considerable friction with neutrals.

Under the rules of prize law, as laid down a century ago, goods were not regarded as destined for an enemy country unless they were to be discharged in a port in that country; but the American prize courts in the Civil War found themselves compelled by the then existing conditions of commerce to apply and develop the doctrine of *continuous voyage*, under which goods which could be proved to be ultimately intended for an enemy country were not exempt from seizure on the ground that they were first to be discharged in an intervening neutral port. By British Order of Council of Aug. 20 and Oct. 22 1914, and the corresponding French decrees, the lists of contraband and free goods in the Declaration of London were rejected, and the doctrine of "continuous voyage" was applied not only to absolute contraband, but also to conditional contraband, if such goods were consigned to order, or, if the papers did not show the consignee of the goods, or if they showed a consignee on enemy territory. The situation as regards German trade has been officially recorded to have been as follows;—Direct trade outside the Baltic to German ports had practically ceased. Supplies to Germany were directed to neutral ports, and every effort was made to disguise their real destination. The power the Allies had to deal with the then existing situation was that they had the right to seize articles of absolute contraband if it could be proved that they were destined for the enemy country, although they were to be discharged in a neutral port, and to seize articles of conditional contraband if it could be proved that they were destined for the enemy Government or its armed forces, although they were to be discharged in a neutral port. On the other hand, there was no power to seize articles of conditional contraband if they could not be shown to be destined for the enemy Government or its armed forces, or non-contraband articles, even if they were on their way to a port in Germany, and there was no power to stop German exports.

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[1] See Sir Thomas Barclay, *Turco-Italian War and its Problems* (London 1912, p. 99).

[2] See Garner, *International Law and the World War* (London 1920, vol. i., p. 31).

[3] Note by British Government to neutral Governments.

[4] See Barclay, *Law and Usage of War* (London 1914, p. 24 *et seq.*).

It soon, however, became clear that the restrictions international law placed in the way of inflicting on the enemy to the full the advantage of absolute command of the sea would deprive the Allies of a powerful weapon. This led to the adoption in March 1915 of more extended powers of intercepting German commerce. The Allied Governments decided to stop all goods which could be proved to be going to, or coming from, Germany. This general blockade swept away all distinctions respecting contraband, and the nature of the commodities in question ceased to be of any importance. Once their destination or origin was established, the power to stop them was complete.[1]

The policy adopted in order to enforce the blockade of Germany was as follows:—(1) German exports to overseas countries were almost entirely stopped. Such exceptions as were made were where a refusal to allow the export of the goods would hurt the neutral concerned without inflicting any injury upon Germany. (2) All shipments to neutral countries adjacent to Germany were carefully scrutinized with a view to the detection of a concealed enemy destination. Wherever there was reasonable ground for suspecting such destination, the goods were placed in the Prize Court. Doubtful consignments were detained until satisfactory guarantees were produced. (3) Under agreements in force with bodies of representative merchants in several neutral countries adjacent to Germany, stringent guarantees were exacted from importers, and, so far as possible, all trade between the neutral country and Germany, whether arising overseas or in the neutral country itself, was restricted. (4) By agreements with shipping lines and by a vigorous use of the power to refuse bunker coal, a large proportion of the neutral mercantile marine which carries on trade with Scandinavia and Holland was induced to agree to conditions designed to prevent goods carried in these ships from reaching the enemy. (5) Efforts were made to introduce a system of rationing which would ensure that the neutral countries concerned only imported such quantities of articles as were normally imported for their own consumption.[2]

The result of the blockade was that the export trade of Germany was substantially destroyed. With regard to imports, some of the most important, such as cotton, wool, and rubber, were practically excluded from Germany. Others, like fats and oils and dairy produce, could only be obtained there, if at all, at famine prices, which led to considerable discontent among the population, and food riots in some of the large towns.

This means of bringing an enemy to sue for peace was on a more extended scale only the same in principle as that of the siege of a city and cannot be regarded as a violation of international law. The power of the Allies, as shown by results, to make the blockade effective may be regarded as its justification.

5. *The s.s. "China" Case.*—The s.s. "China" affair was a case of some importance, having led to an examination of the current bearing of the famous "Trent" case, which in its time gave rise to serious friction between Great Britain and the United States. On Feb. 18 1916, the British cruiser "Laurentic" stopped the "China" on the high seas, about 10 m. from the entrance to the Yangtsze-kiang, boarded her with an armed party, and, despite the captain's protest, removed from the vessel 28 Germans, 8 Austrians and 2 Turks, including physicians and merchants, and took them to Hong-Kong, where they were detained as prisoners in the military barracks. The U.S. Government in the note on the subject to the British Government alleged that as none of the men taken from the "China" were incorporated in the armed forces of the enemies of Great Britain, the action of the "Laurentic" must be regarded by it as an unwarranted invasion of America's sovereignty over her vessels on the high seas. The U.S. Government referred to the "Trent" case, and expressed surprise at this exercise of belligerent power on the high seas far removed from the zone of hostile operations. The ambassador was directed to present the matter to the Government of Great Britain at once, and to insist vigorously that if facts were as reported, orders be given for the immediate release of the persons taken from the "China." The British Secretary for Foreign Affairs replied that the latest attempt to define by common agreement the limits within which a belligerent naval power may remove enemy persons from neutral ships on the high seas is represented by Article 47 of the Declaration of London, 1909. This article permitted the arrest of such persons if "embodied in the armed forces of the enemy," without regard to the destination of the ship on which they were found travelling. The commentary on Article 45 of the Declaration contained in the Report of the Drafting Committee of the London Naval Conference states that, on practical grounds "apart from reasons of pure law" it was agreed that the term "embodied in the armed forces of the enemy" should be considered as not including reservists not yet attached to their military units.

At the beginning of the war the British Government had adhered to Articles 45 and 47 of the Declaration of London, as interpreted by the Report of the Drafting Committee. They had taken this step as a matter of convenience, being at liberty, as the declaration was an unratified instrument, to cancel at any time their adherence, provided always that their subsequent action did not conflict with the general principles of international law. When the German authorities began to remove able-bodied persons of military age from the occupied portions of France and Belgium, the British Government felt that they could no longer accept the restrictive interpretation placed for practical reasons on the terms of Article 47 of the Declaration of London by the Report of the Drafting Committee, and that they must arrest all enemy reservists found on board neutral ships on the high seas, no matter where they might be met.

Although the U.S. Government, since their suggestion early in the war that the belligerent Powers should adopt the Declaration of London in its entirety as a code of international naval law, did not find general acceptance, had declared that it no longer considered the declaration as being in force, the Foreign Secretary said he had referred to the bearings of the declaration on this question, because Article 47 represented perhaps the only attempt to arrive at a definition, by common consent of the chief maritime nations of the law in regard to the matter. The attempt, however, was necessarily conditioned by the experience of previous wars, and the definition was reached after weighing the claims and the convenience of neutral shipping against the importance to belligerent powers, as shown by the experience of previous wars, of preventing enemy subjects from proceeding to their destination, and pursuing the hostile purposes for which they were organized.

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[1] See British White Paper, Misc., No. 2 (1916), in which the measures in question are fully set out.

[2] See White Paper, Misc., No. 2 (1916).

It was therefore of the greatest importance for a belligerent power to intercept on the high seas not only mobilized members of the opposing army who might be found travelling on neutral ships, but also "those agents whom the enemy sends to injure his opponent abroad, or whose services he enjoys without having himself commissioned them."

In fact practical considerations from the belligerents' point of view had changed, and the change necessarily implied a modification in the description of enemy subjects whom it is lawful to arrest, supposing such a description can be said to have existed in any binding form.

With regard to the case of the "Trent" the British Government contended that the "China" case was of an entirely different nature from that on which the U.S. Government relied. At the date when the "Trent" case occurred no agreement had been reached as to the claim put forward by certain countries that a belligerent is entitled to remove certain classes of individuals from a neutral ship without bringing the vessels in for adjudication in the Prize Court. Since then a considerable measure of agreement has been reached on this point:—

> "In any case the nature of the persons concerned in the episode of the 'Trent' was entirely different from that of the individuals removed from the 'China.' Messrs. Slidell & Mason were proceeding to Europe, according to their contention, as the diplomatic representatives of a belligerent; at that time the suggestion that the functions of a diplomatic representative should include the organizing of outrages upon the soil of the neutral country to which he was accredited was unheard of, and the removal of the gentlemen in question could only be justified on the ground that their representative character was sufficient to bring them within the classes of persons whose removal from a neutral vessel was justifiable. The distinction between such persons and German agents whose object is to make use of the shelter of a neutral country in order to foment risings in British territory, to fit out ships for the purpose of preying on British commerce, and to organize outrages in the neutral country itself is obvious."[1]

6. *Armed Merchant Ships and the Submarine.*—The subject of the legitimacy of arming merchant ships arose in the course of the war, and the death penalty inflicted on Capt. Fryatt gave a tragic importance to it, which excited British public opinion on a matter which is not so easily disposed of, from the point of view of international law, as the public at the time was led or seemed to suppose.

The British Government, on the outbreak of war, at once (Aug. 4 1914 and Aug. 9 1914) called the attention of the U.S. Government to the distinction between a merchantman commissioned to act as a cruiser and a merchantman merely armed for defence against attack. According to the British rule it was pointed out that "British merchant vessels cannot be converted into men-of-war in any foreign port, for the reason that Great Britain does not admit the right of any Power to do this on the High Seas." This is not perhaps very clearly expressed by the Government communication, which goes on, however, to state that "the duty of a neutral to intern or order the immediate departure of belligerent vessels is limited to actual and potential men-of-war, and, in the opinion of H.M. Government, there can, therefore, be no right on the part of neutral Governments to intern British armed merchant vessels which cannot be converted into men-of-war on the High Seas, nor require them to land their guns before proceeding to sea."

A certain number of British merchant vessels had been armed "as a precautionary measure adopted solely for defence."

Later (Sept. 9 1914) the British Government handed to the U.S. Government a short memorandum in justification of its action in arming merchant ships for defence and of its claim that they should enjoy the status of peaceful trading vessels in neutral ports. This memorandum, which has a certain importance, was as follows:—

> "The German Government have openly entered upon the policy of arming merchant ships as commerce destroyers and even claim the right to carry out the process of arming and equipping such merchant ships in neutral harbours or on the high seas. It is in consequence of this that the British Admiralty have been compelled, in accordance with the practice followed in the great wars of history, to arm a certain number of British merchant ships for self-defence only.
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> "The practice of arming ships in self-defence is very old and has been ordered by Royal proclamation in England from early in the seventeenth century. During the Napoleonic wars the right to arm in self-defence was recognized by British and United States Prize Courts in the cases of the Catherine Elisabeth (British) and the Nereide (United States). The right of a merchant ship of a belligerent to carry arms and resist capture is clearly and definitely laid down in modern times. The right of resistance of merchant vessels is recognized by the United States Naval War Code, by the Italian Code for Mercantile Marine, and by the Russian Prize Regulations. Writers of authority in many European countries also recognize the right. To mention a German authority, it may be stated that the late Dr. Perels, at one time legal adviser to the German Admiralty, quotes with approval Art. 10 of the United States Naval War Code, which states "the prisoners of merchant vessels of an enemy who, in self-defence and in protection of the vessel placed in their charge resist an attack, are entitled to the status of prisoners of war." The Institute of International Law at its meeting in 1913 prepared and adopted a manual of the laws of naval warfare, Article 10 of which expressly declared that private ships are allowed to employ force to defend themselves against the attack of an enemy's ship.
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> "A merchant vessel armed purely for self-defence is therefore entitled under international law to enjoy the status of a peaceful trading ship in neutral ports and His Majesty's Government do not ask for better treatment for British merchant ships in this respect than might be accorded to those of other Powers. They consider that only those merchant ships which are intended for use as cruisers should be treated as ships of war and that the question whether a particular ship carrying an armament is intended for offensive or defensive action must be decided by the simple criterion whether she is engaged in ordinary commerce and embarking cargo and passengers in the ordinary way. If so, there is no rule of international law that would justify such vessel, even if armed being, treated otherwise than as a peaceful trader."

The U.S. Government replied to this memorandum by drawing up some general rules which it declared to be its intention to follow in dealing with cases involving the status of armed merchant vessels visiting American ports. These rules, which very clearly define what constitute armament for self-defence, are likely to become a precedent, and are, therefore, in view of future naval warfare, of considerable value. They were as follows:—

(*a*) A merchant vessel of belligerent nationality may carry an armament and ammunition for the sole purpose of defence without acquiring the character of a ship of war.

(*b*) The presence of an armament and ammunition on board a merchant vessel creates a presumption that the armament is for offensive purposes, but the owners or agents may overcome this presumption by evidence showing that the vessel carries armament solely for defence.

(*c*) Evidence necessary to establish the fact that the armament is solely for defence and will not be used offensively, whether the armament be mounted or stowed below, must be presented in each case independently at an official investigation. The result of the investigation must show conclusively that the armament is not intended for, and will not be used in, offensive operations.

Indications that the armament will not be used offensively are:—

1. That the calibre of the guns carried does not exceed six inches.
2. That the guns and small arms carried are few in number.
3. That no guns are mounted on the forward part of the vessel.
4. That the quantity of ammunition is small.
5. That the vessel is manned by its usual crew, and the officers are the same as those on board before the war was declared.
6. That the vessel intends to and actually does clear for a port lying in its usual trade route, or a port indicating its purposes to continue in the same trade in which it was engaged before war was declared.
7. That the vessel takes on board fuel and supplies sufficient only to carry it to its port of destination, or the same quantity substantially which it has been accustomed to take for a voyage before the war was declared.
8. That the cargo of the vessel consists of articles of commerce unsuited for the use of a ship of war in operations against an enemy.
9. That the vessel carries passengers who are as a whole unfitted to enter the military or naval service of the belligerent whose flag the vessel flies, or of any of its allies, and particularly if the passenger list includes women and children.
10. That the speed of the ship is slow.

(*d*) Port authorities, on the arrival in a port of the United States of an armed vessel of belligerent nationality, claiming to be a merchant vessel, should immediately investigate and report to Washington on the foregoing indications as to the intended use of the armament, in order that it may be determined whether the evidence is sufficient to remove the presumption that the vessel is, and should be treated as, a ship of war. Clearance will not be granted until authorized from Washington, and the master will be so informed upon arrival.

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[1] In Sir E. Grey's letter to Mr. W. H. Page, March 16 1916.

(e) The conversion of a merchant vessel into a ship of war is a question of fact which is to be established by direct or circumstantial evidence of intention to use the vessel as a ship of war. (Dept. of State, Sept. 19 1914.)

The German Government on Oct. 15 1914 communicated by telegram a counter-memorandum to the U.S. Government which stated that it had learnt from "an official notice" in the *Westminster Gazette* (Sept. 21 1914) that the Department of State at Washington had ruled that ships of belligerent nations when equipped with ammunition and armament shall nevertheless be treated, while in American ports, as merchant ships, provided the armament serves for defensive purposes only. "This ruling," the memorandum stated, "wholly fails to comply with the principles of neutrality. The equipment of British merchant vessels with artillery is for the purpose of making armed resistance against German cruisers. Resistance of this sort is contrary to international law, because in a military sense a merchant vessel is not permitted to defend itself against a war vessel. . . . It is a question whether or not ships thus armed should be admitted into ports of a neutral country at all. Such ships, in any event, should not receive any better treatment in neutral ports than a regular warship, and should be subject at least to the rules issued by neutral nations restricting the stay of a warship. If the Government of the United States considers that it fulfils its duty as a neutral nation by confining the admission of armed merchant ships to such ships as are equipped for defensive purposes only, it is pointed out that so far as determining the warlike character of a ship is concerned, the distinction between the defensive and offensive is irrelevant. The destination of a ship for use of any kind in war is conclusive, and restrictions as to the extent of armament afford no guarantee that ships armed for defensive purposes only will not be used for offensive purposes under certain circumstances."

The U.S. Government replied (Nov. 7 1914) in a telegram that it dissented from the views of the German Government as above expressed in regard to the treatment to be accorded armed merchant vessels of belligerent nationality in neutral ports. The practice of a majority of nations and the consensus of opinion by the leading authorities on international law, including many German writers, supported the proposition that merchant vessels may arm for defence without losing their private character and that they may employ such armament against hostile attack without contravening the principles of international law. The purpose of an armament on a merchant vessel was to be determined by various circumstances, among which were the number and position of the guns on the vessel, the quantity of ammunition and fuel, the number and sex of the passengers, the nature of the cargo, etc. Tested by evidence of this character, the question as to whether an armament on a merchant vessel was intended solely for defensive purposes may be readily answered and the neutral Government should regulate its treatment of the vessel in accordance with the intended use of the armament. In permitting a private vessel having a general cargo, a customary amount of fuel, an average crew, and passengers of both sexes on board, and carrying a small armament and a small amount of ammunition, to enjoy the hospitality of an American port as a merchant vessel, the U.S. Government was (it contended) in no way violating its duty as a neutral. Nevertheless, it was not unmindful of the fact that the circumstances of a particular case may be such as to cause embarrassment and possible controversy as to the character of an armed private vessel visiting its ports. Recognizing, therefore, the desirability of avoiding a ground of complaint, the U.S. Government, "as soon as a case arose, while frankly admitting the right of a merchant vessel to carry a defensive armament, expressed its disapprobation of a practice which compelled it to pass an opinion upon a vessel's intended use, which opinion, if proven subsequently to be erroneous, might constitute a ground for a charge of unneutral conduct."

As a result of these representations Secretary Lansing said that no merchant vessels with armaments had visited the ports of the United States since Sept. 10. In fact, from the beginning of the World War only two armed private vessels had entered or cleared from U.S. ports, and as to these vessels their character as merchant vessels had been conclusively established. He expressed the hope that the German Government would also prevent their merchant vessels from entering the ports of the United States carrying armament even for defensive purposes "though they may possess the right to do so by the rules of international law."

The theoretical justification of the German position regarding the status of merchantmen armed solely for defence is that a non-combatant ship carrying arms is not essentially different from a non-combatant person carrying arms. In practice the really important consideration, however, was brought out by the new situation arising out of the weakness of submarine vessels for defence. A comparatively small projectile can destroy a submarine. And is not defence necessarily offence where the merchantman opens fire, though the submarine "may not have committed any hostile act such as firing a gun or torpedo"? (See British instructions of April 1915.) Moreover, may not the merchant vessel, to defend itself effectively, have to round on the pursuer and get to close quarters with him?

These considerations no doubt influenced the U.S. Secretary of State, who on Jan. 18 1916 handed a confidential letter to the British ambassador on the subject, in which he set out that in order to bring submarine warfare within the general rules of international law and the principles of humanity, without destroying its efficiency in the destruction of commerce, he believed that a formula might be found which would appeal to the sense of justice and fairness of all the belligerents.

In pursuance of the object he made the following propositions:—

"1. A non-combatant has a right to traverse the high seas in a merchant vessel entitled to fly a belligerent flag and to rely upon the observance of the rules of international law and principles of humanity if the vessel is approached by a naval vessel of another belligerent.

"2. A merchant vessel of enemy nationality should not be attacked without being ordered to stop.

"3. An enemy merchant vessel, when ordered to do so by a belligerent submarine, should immediately stop.

"4. Such vessel should not be attacked after being ordered to stop, unless it attempts to flee or to resist, and, in case it ceases to flee or resist, the attack should discontinue.

"In the event that it is impossible to place a prize crew on board an enemy merchant vessel, or convoy it into port, the vessel may be sunk, provided the crew and passengers have been removed to a place of safety."

In complying with the foregoing propositions, which, in the Secretary of State's opinion, embodied the principal rules the strict observance of which would insure the life of a non-combatant on a merchant vessel which is intercepted by a submarine, he was not unmindful of the obstacles which would be met by undersea craft as commerce destroyers. Prior to the year 1915, belligerent operations against enemy commerce on the high seas had been conducted with cruisers carrying heavy armaments. Under these conditions international law appeared to permit a merchant vessel to carry an armament for defensive purposes without losing its character as a private commercial vessel. This right was justified by the superior defensive strength of ships of war, and the limitations of armament seemed to be dependent on the fact that it could not be used effectively in offence against enemy naval vessels, while it could defend the merchantmen against the generally inferior armament of piratical ships and privateers. The use of the submarine, however, had changed these relations. Comparison of the defensive strength of a cruiser and a submarine showed that the latter, relying for protection on its power to submerge, is almost defenceless in point of construction. Even a merchant ship carrying a small-calibre gun would be able to use it effectively for offence against a submarine. Moreover, pirates and sea-rovers had been swept from the main trade channels of the seas, and privateering had been abolished. Consequently, the placing of guns on merchantmen at the present day of submarine warfare can be explained only on the ground of a purpose to render merchantmen superior in force to submarines and to prevent warning and visit and search by them. Any armament, therefore, on a merchant vessel would seem to have the character of an offensive armament. If a submarine is required to stop and search a merchant vessel on the high seas, and, in case it is found she is of an enemy character and that conditions necessitate her destruction, to remove to a place of safety all persons on board, it would not seem just or reasonable that the submarine should be compelled, while complying with these requirements, to expose itself to almost certain destruction by the guns on board the merchant vessel. It, therefore, appeared to be a reasonable and reciprocally just arrangement if it could be agreed by the opposing belligerents that submarines should be caused to adhere strictly to the rules of international law in the matter of stopping and searching merchant vessels, determining their belligerent nationality, and removing the crews and passengers to places of safety before sinking the vessels as prizes of war; and that merchant vessels of belligerent nationality should be prohibited and prevented from carrying any armament whatever.

The American statesman added that the U.S. Government was impressed with the reasonableness of the argument that a merchant vessel carrying an armament of any sort, in view of the character of submarine warfare and the defensive weakness of undersea craft, should be held to be an auxiliary cruiser and be so treated by a neutral as well as by a belligerent.

This was a judicious and unbiased statement upon which it is difficult to improve. The advice given was not acted upon. The chief consideration in it was probably just the reason for utilizing it. In the Fryatt case Capt. Fryatt on March 20 1916, as pilot of a British unarmed merchantman, refused to stop on being summoned by a German submarine, and instead, unsuccessfully, tried to ram the submarine. He fell into German hands later on, and was tried as a non-combatant for an act of war against a submarine which was acting within its rights under international law. He was court-martialled and shot.

It is seen from the above summary of the situation that the legal relations between belligerents at sea, which have arisen out of the importation of the submarine into maritime warfare, call for precise regulation, though it is difficult to see the line on which such regulations can extricate the future from the cruelty arising, even unintentionally, from the use of this new instrument of destruction.

7. *Air Warfare.*—"Military aircraft and airmen are bound by the rules that govern belligerents generally. To be distinguishable from spies and possess the rights of prisoners of war, airmen must conform to the provisions of the Hague Regulations, wear the uniform of their country, and act in accordance with the Laws and Usage of War. They are forbidden to drop bombs on *undefended* towns or villages. In case of impending bombardment by an attacking force, it is the duty of the commanding officer to warn the authorities of the place thereof. This applies to all the attacking forces, including aircraft. In sieges and bombardments, precautions are strongly urged by the Hague Regulations to spare historic buildings, hospitals, and charitable institutions; the besieged authorities are recommended to indicate them by visible signs notified to the besiegers. All this affects the besiegers' aircraft as part of the attacking force." The above was written in the autumn of 1914.[1] This is still the law affecting aircraft.

The sense of the word "defended," at the Hague Conference of 1907, gave rise to some discussion in connexion with the special convention there adopted for the regulation of naval bombardments. Article I. of that convention forbids the bombardment by naval forces of "undefended ports, towns, villages, habitations, or buildings," to which Article II. adds the following qualification:—

"Nevertheless, this interdiction does not comprise military works, military or naval establishments, depôts of arms or war material, workshops or installations suitable to be used for the requirements of the enemy's army or fleet, and war vessels in the port. The commander of a naval force may, after summons with a reasonable delay, destroy them by cannon if no other means are possible, and when the local authorities shall not have proceeded to their destruction within the delay fixed."

As lateral damage to "innocent" property may be caused by bombardment, the second paragraph of the same article provides that in case "involuntary damage is occasioned by the bombardment," the commander of the bombarding vessel or vessels "incurs no responsibility."

Then, as there is always the contingency of the bombarding vessel not having time to comply with the prescribed formalities, "military necessity" may be alleged to justify any excesses and barbarity. "If," however, adds a third paragraph of this article, "military necessity requiring immediate action does not admit of delay, it remains understood that the prohibition to bombard the undefended town continues as set out in the first paragraph, and that the commander will take all the desired precautions to occasion the least possible inconvenience to the town." It is left, as may be noticed, to the bombarding commander to inflict, as the French original mildly enjoins, "*le moins d'inconvénients possible.*"

In the above-cited first paragraph of Article II. we get a sort of definition, at any rate, of the alternative of "undefended." The presence anywhere of "military works," "naval establishments," "depots of war materials," "workshops suitable for use by the enemy, army or fleet," "war vessels in port" does not, however, make them "defences," but introduces exceptions which, even in an undefended town, the commander may destroy. In the course of the discussion on the subject at the conference of 1907, the German naval expert, Adml. Siegel, proposed to add "*installations et provisions qui peuvent être utilisées.*" Asked to explain what he meant by "*provisions,*" the Admiral stated that he had more particularly in view depots of coal. He ultimately withdrew his proposal, but he did so only on the ground that "war materials" covered his point, especially as they would include coal. It was pointed out that this view only applied to coal at a seaport. In this he seems to have acquiesced. The same Admiral claimed the right to bombard a railway junction or floating dock as included under the term "*installations*"; this was not disputed. It follows that a bombarding vessel may shell a railway junction and any dock capable of serving as a repairing dock, and, in fact, anything else which can serve the purposes of an army or navy. These provisions do not say or mean that a town ceases to be undefended owing to the presence within its area of things liable to be destroyed. Thus, the question of what constitutes an "undefended town" was left without a precise definition.

As regards naval bombardment, the preamble to the convention relating to bombardment by naval forces states that its object is, as far as possible, to extend to such bombardments the principles of the regulations of 1899 concerning war on land. The words "by any means whatsoever" (Article 25) in the article of these regulations relating to bombardment cover aerial navigation. It may, therefore, be said that the rules set out for bombardment generally apply also to aerial bombardment. Assuming it to be so, to what calamities of war are the inhabitants of a city legally exposed from the air?

They may be summed up as follows:—(1) The air commanders may lawfully attack all undisguised military and naval establishments. (2) They may destroy installations capable of being used for the needs of the military and naval forces, that is, railways facilitating communication between them and wireless stations. (3) They may destroy workshops for the manufacture of materials serviceable for the requirements of army or navy.

Operations by aircraft, in short, are bound by the rules relating to bombardment generally. If carried on by craft belonging to land forces, the Hague Regulations for the conduct of war are binding on them. If carried by craft belonging to naval forces, they are subject to the Hague Convention No. IX.

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[1] See Barclay, *Law and Usage of War* (London 1914).

Unfortunately, it is practically impossible to carry out the regulations except "in spirit." Barrage fire from the ground prevents hostile aircraft from descending near enough to the spot bombarded to distinguish the particular object it is intended to damage or destroy. The same difficulty applies to long-range guns. Thus, a whole town becomes *de facto* exposed to the consequences of there being in its midst, or alongside it, any military store, a garrison, an army staff, or legitimate object of attack.[1]

8. *Private Property.*—It is an unchallenged principle of international law that enemy private property should be respected. This principle was corroborated in the Hague Regulations respecting the Laws and Customs of War on Land of 1899 and 1907, even as regards occupied territory. "Private property," says Article 46 of these regulations, "cannot be confiscated." This principle was violated by all the belligerents, not only during the war but also in the Peace Treaty.

A few months after the outbreak of the war (see Trading with the Enemy Amendment Act of Nov. 27 1914) the Public Trustee in Great Britain was appointed custodian of enemy property. His duty was to hold all property placed in his custody until the end of the war for the benefit of its owner, subject to similar treatment of British property in enemy countries. An Act of Jan. 27 1916 extended these powers to those of "prohibition" and "liquidation." The Public Trustee therefore proceeded to wind up German companies and sell German property by auction, with lavish profusion. In France the first measures taken were also purely for the purpose of preservation. Sequestrators were appointed under the supervision of the judicial authorities. The German treatment of enemy property was at first the most liberal of all, but after the adoption of the British Act of Jan. 27 1916, a German decree of Aug. 29 1916 directed the winding-up of British concerns in Belgium, and, apparently by way of administrative reprisal, the same procedure was extended to enemy property throughout Germany, including Alsace-Lorraine, where forced sales were made with particular hardship, even of the property of German subjects, on the ground of family connexions with France; a violation of principle transcending all the others. The United States followed, more or less, the example of Great Britain.

On the conclusion of the war the Allies were confronted with a sort of dilemma. England and the United States had gone beyond France and had pocketed proceeds of liquidation. France had merely sequestrated the property. The simplest way out was *post hoc* to confiscate all enemy property. Hence provision in the treaties of peace (Article 297 of the Treaty of Versailles) which empowers the Allied and Associated Powers to liquidate all property, rights and interests belonging at the date of their coming into force to German and other enemy nationals or companies controlled by them within their territories, colonies, possessions and protectorates, including territories ceded to them by the Treaty.

Thus, one of the most glaring violations of international law received the consecration of a treaty of peace.

9. *Peace Methods: Mediation.*—Tenders of mediation during the war by the United States (when a neutral), and by the Pope, were declined by the Allies at its outbreak. However, Sir Edward Grey records in a dispatch to Berlin[2] that the German ambassador had said to him it was very desirable that Russia should act as a mediator with regard to Serbia. Four days later, Sir Edward suggested at Berlin that simultaneous and joint action by Germany, Italy, France, and Great Britain at Vienna and St. Petersburg might have a "mediating or moderating influence."[3] Then, on July 28, Austria-Hungary declared war against Serbia. Even in spite of this precipitation, efforts to arrive at an effective mediation were continued by Sir Edward Grey on behalf of Great Britain, and by Herr von Bethmann Hollweg, through the German ambassador in London, on behalf of Germany. It is certain that Great Britain, France and Italy were prepared to offer mediation in conjunction with Germany down to as late as July 29. Germany objected, we then learn from Italy, to the mediation of the four Powers,[4] and on the same date (July 29) the German ambassador assured Sir Edward Grey that the German Chancellor was working in the interest of mediation at Vienna and St. Petersburg.[5] Sir Edward then authorized Sir Edward Goschen to make the following statement at Berlin:—

> "If the peace of Europe can be preserved and the present crisis safely passed, my own endeavour will be to promote some arrangement to which Germany could be a party, by which she could be assured that no aggressive or hostile policy would be pursued against her or her allies by France, Russia and ourselves, jointly or separately. I have desired this and worked for it, as far as I could, through the last Balkan crisis, and Germany having a corresponding object our relations sensibly improved. The idea has hitherto been too Utopian to form the subject of definite proposals, but if this present crisis, so much more acute than any that Europe has gone through for generations, be safely passed, I am hopeful that the relief and reaction which will follow may make possible some more definite *rapprochement* between the Powers than has been possible hitherto."

This was practically a further promise of mediation on the part of Great Britain for assuring the peace of Europe.

That these efforts at mediation broke down seems to have been due to the precipitation of Austria-Hungary in declaring war against Serbia, and her declining to suspend the outbreak of hostilities. The rest follows as a consequence of this precipitation: Russia's precipitation in decreeing a general mobilization, Germany's precipitate espousal of the quarrel of Austria-Hungary, etc., till the bulk of the world found itself at war, and only the United States and Spain, among greater Powers, remained free to offer any mediation at all.[6]

Arbitration received a considerable impetus under the treaties of peace; under Article 13 of the "Covenant of the League of Nations," the provisions of the Hague Peace Conference relating to arbitrable matters are placed within the scope of the League's activities. "In the event of any failure," says the article, "to carry out . . . an award, the Council shall propose what steps should be taken to give effect thereto." The establishment, under Article 14 of the covenant, of a Permanent Court of International Justice, though it will not afford in principle a substitute for arbitration, will, however, probably in practice largely supersede it. Nevertheless, Article 12 of the covenant provides that, if any dispute arises between members of the League, they will submit the matter to arbitration or to enquiry by the Council and they "agree in no case to resort to war," until three months after the award by the arbitrators or the report by the Council. The treaties of peace furthermore provide for the establishment of mixed Arbitral Tribunals to deal with a number of matters specified in the Treaty (see Article 304 of the Treaty of Versailles). These mixed Arbitral Tribunals are composed of three members, one nominated by the late ally and another by the late enemy in question, the third to be chosen by agreement between the two Governments concerned. A number of cases under sections III., IV., V., and VI. of the Treaty of Versailles and corresponding sections of the other treaties were referred to these Tribunals. Article 305 appoints them practically as a final court of appeal from the national courts in cases within their prescribed jurisdiction.

10. *Self-determination and Plebiscite.*—"The settlement of every question, whether of territory or sovereignty, of economic arrangement or of political relationship, upon the basis of the free acceptance of that settlement by the people immediately concerned, and not upon the basis of the material interest or advantage of any other nation or people which may desire a different settlement for the sake of its own exterior influence or mastery." This was one of the four principles laid down by President Wilson in his address of July 4 1918, and accepted by

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[1] See respecting aircraft in time of peace, a subject which is still inchoate, Barclay, *International Law and Practice* (London 1917, p. 59 *et seq.*).

[2] July 20 1914.

[3] Sir Edward Grey to Berlin, July 24 1914.

[4] Sir Edward Grey to Rome, July 29 1914.

[5] Sir Edward Grey to Berlin, July 29 1914.

[6] See Barclay, *New Methods of Adjusting International Disputes and the Future*, p. 7 *et seq.*

the Allies and enemies alike as the peace preliminaries set out in Secretary Lansing's letter of Nov. 5 1918.

In accordance with this principle, the Treaty of Versailles provided for plebiscites in several cases where the population was mixed. This method was prescribed by the Treaty of Versailles for contested areas of Schleswig between Denmark and Germany (Article 109); Allenstein between Germany and Poland (Article 94); Eupen and Malmédy between Belgium and Germany (Article 34); Marienburg between Germany and Poland (Article 96); Saar Basin, between Germany and France (Article 49); and Upper Silesia between Germany and Poland (Article 88). Provisions were made for applying the same method to an area between Poland and Czechoslovakia (Teschen). In all these cases the provisions of the Treaty vary as to methods and period of voting, and in one case at least the construction of the Treaty differs. Thus under Article 88 of the Treaty relating to Upper Silesia that Treaty states that "the inhabitants will be called upon to indicate by a vote whether they wish to be attached to Germany or to Poland." The vote was taken and proved favourable to Germany. The concluding paragraph of the article, however, provides that Germany will renounce in favour of Poland "all rights and title over the portion of Upper Silesia lying beyond the frontier line fixed by the Principal Allied and Associated Powers as the result of plebiscite." This wording was interpreted by Poland to provide for the partition of Upper Silesia, whereas Germany regarded it as relating only to the line of the frontier of Upper Silesia. The wording of Article 6 of the annex, however, speaks of "the territory which is recognized should be German," and Article 5 of "the line which ought to be adopted as the frontier of Germany in Upper Silesia." And the same article provides that "regard will be paid to the wishes of the inhabitants as shown by the vote and to the geographical and economic conditions of the locality." Furthermore, Article 90 provides that "Poland undertakes to permit for a period of 15 years the exportation to Germany of the products of the mines in any part of Upper Silesia transferred to Poland in accordance with the present Treaty." Thus, although the first paragraph of Article 88 seems to imply that Upper Silesia is indivisible, the subsequent provisions of the Treaty do not bear this out. The injunction that regard be paid to "the geographical and economic conditions of the locality" might seem a firmer ground for the German case than any of the above interpretations.

The principle of *self-determination* is essentially an idea pertinent to high political development. To ask an ignorant population—which has never had the benefit of elementary education, cannot read a newspaper, and is necessarily dependent on one who has some education for its intercourse with the outer world—what its "ideals" are, is calculated, however, to turn the notion of self-determination into ridicule. The question how far a population is capable of self-determination was not considered by those who gave effect to the principles in the Treaty of Peace. Yet it was obvious that a population possessing a highly developed social and political intelligence, such as the inhabitants of Schleswig, was in a better position to express an independent wish than an illiterate population like the miners and agricultural hands of Upper Silesia.

11. *Penalties for Violation of the Laws of War.*—The Hague Convention with respect to the laws and customs of war of 1907 provides for the case in which the regulations annexed to the convention should be violated in the following terms (Article 3):—"The belligerent party who shall violate the provisions of the said regulations shall be bound, if the case arises, *to pay an indemnity.* It shall be responsible for all acts done by persons forming part of its armed forces." The words in italics, read in the French original, are *tenue à indemnité*, which may be better construed as meaning to "make amends." This article was an addition made in 1907 to satisfy the then growing public feeling that it was not enough to lay down rules, and that some sanction ought to be available against infringers.

The article confined itself to a statement of the principle and left untouched the question of the authority which is to give it effect. The universal principles of justice, however, exclude the idea that any party to a dispute should be his own judge. This entails the necessary corollary that the determination of the amends to be made shall lie with an independent authority. It was therefore with surprise that jurists learned from the Treaty of Versailles that the Allies had imposed, and that Germany had accepted, provisions in the Treaty which disregarded this principle and laid it down that only violations of the laws and usages of war by Germans should be brought to trial, and that the tribunals before which they should be brought were the military courts of their late enemy.

It is true that the German Government before signing the Treaty protested against provisions forcing Germany "to hand over to her opponents for conviction by a military tribunal any persons accused of having committed acts of violation of the laws and customs of war, even in cases where proceedings have already been instituted against these persons by German courts," on the ground that Article 9 of the German Criminal Code forbids the extradition of German subjects to foreign Governments. The Allied and Associated Powers, "if need be, would thus force upon the German Republic the alteration of an article of law which is the common property of most peoples and which, wherever it is in force, possesses the authority of a constitutionally authorized fundamental law. The refusal of this proposition was a self-evident demand of German honour."

Under the law of nations, it further argued, "only the State as bearer of the international obligation is responsible for acts in violation of the laws and customs of war. If satisfaction is to be given by the punishment of guilty individuals, the injured State itself may not convict; it can only demand the punishment of the State responsible for the guilty person." Germany had never refused and once more declared her readiness to see that violations of international law were punished with the full severity of the law; and that all accusations, from whichever party they came, would be examined impartially. Beyond this, she was prepared to leave the decision of the preliminary question, whether any act committed in the war was to be considered as an offence against the laws and customs of war, to an international tribunal composed of neutrals before which ought to be brought violations of the laws and customs of war committed by subjects of all parties to the Treaty. Germany claimed the same share in the formation of this international tribunal as the Allied and Associated Powers; but she proposed that the powers of the international tribunal be restricted to the settling of questions of international law, punishment to be reserved for the national courts.

These proposals were not agreed to, and the only alteration the German representatives obtained was that the ordinary, not the military, punishments should be inflicted on the guilty.

Articles 228–30 therefore read as follows:—

> "The German Government recognizes the right of the Allied and Associated Powers to bring before military tribunals persons accused of having committed acts of violation of the laws and customs of war. Such persons shall, if found guilty, be sentenced to punishments laid down by law. This provision will apply notwithstanding any proceedings or prosecution before a tribunal in Germany or in the territory of her allies.
>
> The German Government shall hand over to the Allied and Associated Powers, or to such one of them as shall so request, all persons accused of having committed an act of violation of the laws and customs of war, who are specified, either by name or by the rank, office, or employment which they held under the German authorities.
>
> Persons guilty of criminal acts against the nationals of one of the Allied and Associated Powers will be brought before the military tribunals of that Power.
>
> Persons guilty of criminal acts against the nationals of more than one of the Allied and Associated Powers will be brought before military tribunals composed of members of the military tribunals of the Powers concerned.
>
> In every case the accused will be entitled to name his own counsel. The German Government undertakes to furnish all documents and information of every kind, the production of which may be considered necessary to ensure the full knowledge of the incriminating acts, the discovery of offenders and the just appreciation of responsibility."

Thus the Allied and Associated Powers endeavoured to introduce a new principle into the public law of Europe, viz., that the victorious Power has the right to demand the extradition of persons merely accused of violations of the laws and usages of war, without first submitting the presumptive evidence to the national jurisdiction with which, under existing principles and practice, the granting of extradition lies. It does not even profess to grant trial by an independent tribunal—not even a tribunal independent within the national area, but declares that the trial shall take place before "military tribunals." Nor does it distinguish what law is applicable. The guilty are to be "sentenced to punishments provided by law." The word "military," as has been shown, was suppressed. What law? The subjects of any state are bound by the laws of that state, not by laws of a foreign state which may be different from their domestic laws, unless the incriminated acts have been committed within the jurisdiction of the foreign state.

The Report of the Commission of the Allied and Associated Powers on the Enforcement of Penalties recommended the creation of a High Tribunal to be composed of representatives of such Powers exclusively, and that the punishment applicable should be such as "may be imposed for such an offence or offences by any court in any country represented on the High Tribunal or in the country of the convicted person." (Annex 4.)

The Japanese delegates on the commission placed a reservation on record. "A question," they said, "may be raised whether it can be admitted as a principle of the law of nations that a High Tribunal constituted by belligerents can, after a war is over, try an individual belonging to the opposite side, who may be presumed to be guilty of a crime against the laws and customs of war. It may further be asked whether international law recognizes a penal law as applicable to those who are guilty."

In a closely reasoned memorandum of reservations by the American representatives on the commission, Mr. Robert Lansing and Dr. James Brown Scott, it was pointed out that a "judicial tribunal only deals with existing laws," and that "an act could not be a crime in the legal sense of the word unless it were made so by law, and that the commission of an act declared to be a crime by law could not be punished unless the law prescribed the penalty to be inflicted"; and they concluded their memorandum as follows:—"They submit their views, rejected by the Commission, to the Conference, in full confidence that it is only through the administration of law, enacted and known before it is violated, that justice may ultimately prevail internationally, as it does between individuals in civilized nations."

Nevertheless, they submitted a statement of the principles which seemed to them should determine what may be considered inhuman and improper acts of war.

This statement is valuable as a thoughtful *résumé* for future guidance:—

1. Slaying and maiming men in accordance with generally accepted rules of war are from their nature cruel and contrary to the modern conception of humanity.

2. The methods of destruction of life and property in conformity with the accepted rules of war are admitted by civilized nations to be justifiable and no charge of cruelty, inhumanity, or impropriety lies against a party employing such methods.

3. The principle underlying the accepted rules of war is the necessity of exercising physical force to protect national safety or to maintain national rights.

4. Reprehensible cruelty is a matter of degree which cannot be justly determined by a fixed line of distinction, but one which fluctuates in accordance with the facts in each case, but the manifest departure from accepted rules and customs of war imposes upon the one so departing the burden of justifying his conduct as he is *prima facie* guilty of a criminal act.

5. The test of guilt in the perpetration of an act, which would be inhuman or otherwise reprehensible under normal conditions, is the necessity of that act to the protection of national safety or national rights measured chiefly by actual military advantage.

6. The assertion by the perpetrator of an act that it is necessary for military reasons does not exonerate him from guilt if the facts and circumstances present reasonably strong ground for establishing the needlessness of the act or for believing that the assertion is not made in good faith.

7. While an act may be essentially reprehensible and the perpetrator entirely unwarranted in assuming it to be necessary from a military point of view, he must not be condemned as wilfully violating the laws and customs of war or the principles of humanity unless it can be shown that the act was wanton and without reasonable excuse.

8. A wanton act which causes needless suffering (and this includes such causes of suffering as destruction of property, deprivation of necessaries of life, enforced labour, etc.) is cruel and criminal. The full measure of guilt attaches to a party who without adequate reason perpetrates a needless act of cruelty. Such an act is a crime against civilization, which is without palliation.

9. It would appear, therefore, in determining the criminality of an act, that there should be considered the wantonness or malice of the perpetrator, the needlessness of the act from a military point of view, the perpetration of a justifiable act in a needlessly harsh or cruel manner, and the improper motive which inspired it.

When the Powers handed in their list of persons accused and called upon Germany to deliver them up for trial, it became evident that no German Government would be powerful enough to override the refusal of the police and military to act, or of the public to coöperate in the necessary arrests. Maturer consideration of the question led the Powers to agree that it would be better to leave the trial of the accused to the Supreme Court of Germany herself. Trials eventually took place, and certain convictions were rendered and acquittals granted.

It is of the greatest value to mankind that crimes of war should be made punishable after its termination, but circumstances have shown, what was apparent from the first to unprejudiced observers, that the only proper jurisdiction before which they can be brought is one in which the final word would rest with judges accepted by both parties.

The advisory committee of jurists which was created by the Council of the League of Nations, and which sat at The Hague from June 16 to July 24 1920, recommended the institution of a world court competent to try criminals against international public order. Their resolution was for the establishment, by the Council and Assembly of the League of Nations, of a new court called the "High Court of International Justice," with jurisdiction over offences "against international public order and the universal law of nations" which shall be referred to it by the assembly or council. This court to consist of one member for each State, to be selected by the state groups in the panels of the Court of Arbitration, and to have power to determine the rules of procedure, define the crime, fix the penalty and prescribe the means of enforcing the judgment.

12. *Permanent Court of Justice.*—Article 14 of the covenant for the establishment of a League of Nations provides also for the establishment of a "Permanent Court of International Justice." The creation of such a court had been proposed by the United States at the Hague Conference of 1907, and a plan for its constitution and working was appended to the Protocol of the Convention there adopted. Under the article in question, the court is to be competent to hear and determine any dispute "which the parties thereto may submit to it."[1]

Early in 1920 the Council of the League took the question in hand, and a committee of jurists was appointed, which met at The Hague (June 16–July 24 1920) to prepare plans for the establishment of the court. The committee had before it the plan which was in principle approved by the second Hague Conference in 1907, but which had been blocked by inability to frame an acceptable method of choosing 15 judges in a manner satisfactory to small as well as great nations. In addition to this plan, 11 official projects of recent date and a larger number of non-official projects were presented to the committee. The work of the committee was urgent, the Treaty of Versailles in several places having provided for appeals to a court of international justice (cf. Part XII. of the Treaty,

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[1] Article 14 reads as follows: "The Council shall formulate and submit to the members of the League for adoption plans for the establishment of a permanent Court of International Justice. The Court shall be competent to hear and determine any dispute of an international character *which the parties thereto* submit to it. The Court may also give an advisory opinion upon any dispute or question referred to it by the Council or by the Assembly." The French text is different. It reads, instead of as printed in italics, "*que les parties lui soumettront.*" The German translation follows the French text. The word "thereto" in the English text leaves no doubt as to the real meaning.

Articles 336, 337, 386; also in Part XIII., Articles 415–420, 423). The members of the committee unanimously approved of a scheme which was duly laid before the Council of the League. Its essential points are as follows:—

As regards the organization of the court (Articles 1–30) it is to consist of 11 judges and four deputy judges, elected for nine-year terms and eligible for reëlection, their salaries to be determined by the Assembly of the League, upon the proposal of the council. The president or presiding judge, to be chosen by the court itself for a term of three years, shall receive, while holding the office, a special grant to be determined in the same way. The assembly, upon proposal by the council, may increase the number of judges to 15, and of deputy judges to six.

Members of the Hague Court of Arbitration belonging to States that are members of the League shall be invited by the secretary-general of the League to form themselves into national groups for the purpose of nominating by each group not more than two persons, qualified to become judges in the Permanent Court. The nominees may be of any nationality. From the persons thus named the assembly and the council shall each elect judges and deputy judges. Those who receive an absolute majority of votes in each body are elected. Only one candidate may be chosen from any one nationality. The whole body of judges "should represent the main forms of civilization and the principal legal systems of the world."

If, after three election sessions of the council and assembly, one or more seats on the bench remain unfilled, a joint conference committee of those two bodies may name candidates for each vacant seat, and may, by unanimous agreement, present new names.

If all vacancies are not filled by this method, the members of the court itself shall complete their number by selection from among those who have received votes, either in the assembly or in the council. If there should be a tie vote among the judges the eldest judge shall have a casting vote.

During their terms of office the justices may not exercise any political functions, may not act as agent or advocate in any international case, and may not sit in any case in which they have previously taken an active part in any capacity. The members of the court, outside of their own country, shall enjoy the privileges and immunities of diplomatic representatives. They may not be dismissed from office, except by unanimous decision of the other members, formally submitted to the secretary-general of the League.

The court shall appoint its own registrar, who may, if the court please, be the same as the secretary-general of the Court of Arbitration. The court shall hold at least one session a year, meeting at The Hague where the president and registrar shall reside. A quorum of nine judges shall suffice to constitute the court.

The court shall form annually a chamber of three judges who may, when contesting parties demand it, hear and determine cases by summary procedure.

If the court contains a judge of the same nationality as one of the parties to a suit, but not of the other, the latter party may choose one of the deputy judges, if there be one of its nationality, or, if not, one from among those who have been nominated for election to the bench, who may sit as a judge in that case. If the nationality of neither party to a suit is represented among the judges, each side may select a temporary judge, as herein provided.

The expenses of the court shall be met as the Assembly of the League shall provide, upon the proposal of the council.

As regards jurisdiction and competency (Articles 31–36), disputes arising between members of the League of Nations, which cannot be settled by diplomatic means, may be brought before the court by the complainant party, and the court has immediate jurisdiction to hear and determine questions of a legal nature concerning:—

(*a*) The interpretation of a treaty.

(*b*) Any question of international law.

(*c*) The existence of any breach of an international obligation.

(*d*) The nature and extent of reparation for such a breach.

(*e*) The interpretation of a sentence passed by the court.

The court itself shall decide whether any case is included in one or more of these classifications.

The court may accept jurisdiction over disputes of any kind that the parties to the controversy agree to submit to it.

The court shall, in its decision, interpret:—

(*a*) International conventions of any sort, establishing rules recognized by the contestants.

(*b*) International custom, embodying general practice accepted as law.

(*c*) General principles of law recognized by civilized nations.

(*d*) Judicial decisions, and the doctrine of the best-qualified publicists among the various nations.

States not members of the League may bring suit in the court under conditions determined by the Council of the League, in accordance with Article 17 of the covenant.[1]

The council or assembly may refer any international question or dispute to the court for an advisory opinion. If the question so referred does not involve any existing dispute, the court shall consider the matter by means of a special commission of from three to five members; otherwise, the court shall sit as though hearing a case.

As regards procedure (Articles 37–62) the official language of the court is French, but the court may, if the contestants request it, authorize the use of another language.

A State which appeals to the court shall make its application to the registrar, who shall notify the members of the League through the secretary-general. The hearings in court shall be public, unless the court decides otherwise upon a written request of one of the parties, with reasons.

For service of notices upon persons and the procurement of evidence, the court shall apply to the Government of the State whose territory must be entered.

The court may give a decision, even though one party does not appear to defend his case. Decision shall be by majority vote of the judges present. In case of a tie, the president has a casting vote.

The decision shall give the reasons on which it is based and the names of the judges present. If there are dissenting judges, the decision shall record the fact of dissent, without giving the reasons for it. The judgment is final and without appeal. If its meaning or scope is uncertain the court shall construe it upon the request of any party.

The discovery of a new and important fact, if previous ignorance of it were not due to negligence, may be made the ground for an application for revision of judgment, but such application must be made within five years of the date of the first decision.

Before accepting an appeal for revision, the court may require compliance with the terms of the decision. The court may, if it wishes, grant the request of any State to appear in a pending suit as an interested third party.

If in any case the court is construing an international convention to which States, other than contestants, are parties, the registrar shall notify such States, and they have the right to appear in the proceedings. The judgment will then be binding upon them also.

Unless otherwise decided by the court, each party to a suit shall bear his own costs.

This report of the Committee of Jurists was presented to the Council of the League at its eighth session at San Sebastian. The council, Aug. 5, authorized the secretary-general to send a copy of the report to each Government in the League, in order that the project might be carefully studied before the council submitted the recommendations of the committee to the assembly at the meeting in November. The draft scheme worked out by this committee was adopted by the council with some slight modifications. It was subsequently passed, with further modifications, by the assembly at Geneva.

The election of the 11 judges of the court was to be carried out simultaneously by the council and by the assembly, which must agree upon a common list of names in accordance with the system proposed by the Committee of Jurists; the desires of the great Powers and the small Powers would thus be equally respected. On the other hand, the Statute of the Court, in the form in which it was adopted by the assembly at Geneva, does not establish compulsory jurisdiction. The delegates, however, adopted a kind of compromise between the supporters of compulsory jurisdiction and those of voluntary jurisdiction. One of the clauses of the statute enables the contracting States to adopt compulsory jurisdiction for certain classes of disputes.

13. *Mandates.*—A new international institution has been introduced into the domain of law in the creation of "Mandates" under Article 22 of the Covenant of the League of Nations. This article provides that colonies and territories which as a consequence of the war have ceased to be under the sovereignty of the States which formerly governed them, and are inhabited by people not yet able to stand by themselves under the strenuous conditions of the modern world, should be regarded for their well-being and development "a sacred trust of civilization." The best method, says the article, of giving practical effect thereto is that the tutelage of such peoples be entrusted to advanced nations who, by reason of their resources, their experience or their geographical position, can best undertake the responsibility and that this tutelage should be exercised by them as mandatories on behalf of the League.

The character of the mandate, the article continues, must differ according to the stage of the development of the people, the geographical situation of the territory, its economic conditions and other similar circumstances. Thus, certain communities formerly belonging to the Turkish Empire have reached a stage of development where their existence as independent nations can be provisionally recognized, subject to the rendering of administrative advice and assistance by a mandatory until such time as they are able to stand alone. "The wishes of these communities must be a principal consideration in the selection of the mandatory." Other peoples, especially those of Central Africa, are at such a stage that the mandatory must be responsible for the administration of the territory under conditions which will guarantee freedom of conscience or religion, subject only to the maintenance of public order and morals, the prohibition of abuses such as the slave trade, the arms traffic and the liquor traffic, and "the prevention of the establishment of fortifications or military and naval bases and military training of the natives for other than police purposes and the defence of territory," and will also secure equal opportunities for the trade and commerce of other members of the League.

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[1] This article provides that in such an event the non-member of the League shall be invited to accept the obligations of membership for the purposes for the dispute in question upon such conditions as the council deem to be just.

There are territories, says the article, such as S.W. Africa and certain of the S. Pacific Is., which, owing to the sparseness of their population, or their small size, or their remoteness from the centre of civilization, or their geographical contiguity to the territory of the mandatory, and other circumstances, can be best administered under the laws of the mandatory as integral portions of its territory, subject to the safeguards above mentioned in the interests of the indigenous population:—

> "In every case of mandate, the mandatory shall render to the Council an annual report in reference to the territory committed to its charge." "The degree of authority, control, or administration to be exercised by the mandatory shall, if not previously agreed upon by the members of the League, be explicitly defined in each case by the council."

Lastly, a permanent commission was to be constituted to receive and examine the annual reports of the mandatories and to advise the council as to the observance of the mandates.

The preparatory provisions of this article had been largely carried out by 1921. It is seen that there are three kinds of mandates which have to be dealt with (*A*, *B* and *C*).

The mandate territories consist of: In Africa: German East Africa, German S.W. Africa, Cameroon, Togoland. In Asia Minor: Armenia, Mesopotamia, Palestine, Syria. In Australasia: German Samoa and the ex-German islands in the Pacific.

These mandates have been divided up as follows:—

(*A*) Mandates: the non-Turkish portions of the former Ottoman Empire (Armenia, Arabia, etc.).

(*B*) Mandates: German E. Africa, Togoland, Cameroon.

(*C*) Mandates: German S.W. Africa, Nauru, German Samoa, and other ex-German Pacific possessions.

(*A*) Mandates, it has been seen, apply to communities which, although recognized as independent, are under "the administrative advice and assistance of the League." The covenant itself provides that such mandates are to be conferred on certain communities formerly belonging to the Turkish Empire, but it seems to be held in official quarters that (*A*) mandates may be conferred on communities outside the former Turkish Empire, and the situation in 1921 with regard to Armenia and Albania was not greatly different from that with regard to Mesopotamia, Palestine, and Syria.

(*B*) Mandates, applicable solely to Central Africa, do not contemplate the ultimate establishment of an independent government, as in the case of (*A*) mandates; but it follows from the distinction between them and the (*C*) mandates that annexation is excluded. The mandatory's powers and privileges will therefore have to be very clearly defined to insure that the mandatory State will respect all local religious institutions, refrain from raising armed forces except for purposes of police and local defence, and will apply the "open door" to subjects or citizens of the members of the League of Nations.

(*C*) Mandates apply to those territories "which, owing to the sparseness of their population, or their small size, or their remoteness from the centres of civilization or their geographical contiguity to the territory of the mandatory, and other circumstances, can be best administered under the laws of the mandatory as integral portions of its territory."

Although such territories are placed under "full power of administration and legislation" of the mandatory Power or Dominion "as integral portions" of it, even they are not to be fully annexed to it, the mandate being conferred by the principal Allied and Associated Powers upon a Power or Dominion chosen by them jointly and such Power or Dominion being expressly bound, by the terms of its acceptance, to carry out the mandate on behalf of the League of Nations. Moreover, the mandatory is under the obligation to make an annual report to the council, containing full information concerning the measures taken to apply the provisions of his mandate; while "the degree of authority, control, or administration to be exercised by the mandatory shall, if not previously agreed upon by the members of the League, be explicitly defined in such case by the Council." A mandate is thus different from both an annexation and protectorate. In the case of annexation, the annexed territory is merged altogether in the territory of the annexing State, and becomes an integral part of the latter's dominions. As regards protectorates it is inconsistent with the notion of the sovereignty of the protecting State to require it to render an account of its internal administration to a group of Powers. And, in fact, hitherto, States had been reluctant to accept any responsibility for internal government in other States. Even in the case of Turkey, Article 9 of the Treaty of Paris (March 30 1856) specifically stated that in respect of the reforms proposed by Turkey, the Powers should not have the right to interfere either collectively or separately in the internal administration of the Ottoman Empire. The Treaty of Berlin (July 13 1878) did contain a clause (Article 61) in reference to Armenia which provided that the Porte should periodically inform "the Powers" of the measures taken by it to secure the Armenians against the Circassians and Kurds and the Powers undertook to *surveiller l'application* of these measures. But nothing is known to have been done to give effect to the article. We are therefore in the presence of a new departure in the law of nations, in practice if not entirely in theory.

Mandated territories, even in the case of (*C*) mandates, only form part of the sovereign domain of the mandatory Power or Dominion to the extent to which it fulfils certain conditions. If it fails to carry out the requirements imposed on it, it may be deprived of its mandate, which can then be conferred by the League of Nations on another Power or Dominion; and if any dispute regarding mandated territory arises, Articles 12 to 16 of the Covenant provide for arbitration or an inquiry by the Council of the League.

One of the chief objects of the mandate, it has been seen, is to prevent a mandated territory from becoming an annexed territory, or protectorate, or even a sphere of influence, seeing that it is subject to the maintenance of the "open door."

Drafts of mandates had by 1921 been submitted by Great Britain and France. The U.S. Government, however, intervened to prevent final settlement of their terms without its assent, on the ground that, though the United States did not form part of the League of Nations, "the colonies and territories concerned having been ceded by the Peace Treaty to all the Allied and Associated Powers, no distribution of mandates for such colonies and territories can be valid without the formal approval of the United States" (June 1921).

14. *Conclusion.*—The old rules as to contraband and blockade, in so far as regarded as a protection to neutral right, return after the war to their full effect, and England as a neutral will be entitled to regard them as the law provided to safeguard her position as a trading community against undue interference by belligerents. She may suspect danger in the equipping of merchantmen as auxiliary cruisers. She may not be favourable to unmilitarized ships carrying artillery ready for use. She may think that what under a responsible and carefully controlled system may be allowed cannot without jeopardizing the safety of the ocean be accorded to States less sensitive to the public opinion of the world. In short, the practically universal straining of the law in the World War may be found to have left behind it little change in the law itself, and the consequences of the

wild destruction at sea and on land and of the ruthlessness of the methods employed generally have been so disastrous to all concerned that progress in the future is likely to tend to such a reaction as will bring the conduct of war more closely than ever within the restrictions enforced by international law.

The World War was one of general destruction, not confined to combatant forces but directed against every form of non-combatant energy and activity, commerce, industry, innocent and guilty alike, women and children as well as men. A hope is warranted that its hardships may have some effect on the practice of civilized States in the future. At any rate it may produce a reaction in favour of older and more humane practices.

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INTERNATIONAL SCIENCE.—International scientific organizations and conventions may be divided into four groups according to their subjects and methods of procedure. Some are intended to establish uniformity in the standards of measurements, others to advance science by coöperation, and others, again, merely to encourage personal interchange of opinion. The second group, having scientific progress for its direct objective, may be further subdivided into two, according as the coöperation is essential to secure necessary observations in different parts of the world, or is only helpful by promoting coördination and therefore economy of labour.

In the years before the World War, it was customary, for scientific purposes, to form a new international body whenever the need arose—a procedure which was natural and effective so long as each subject could be treated separately without relation to others. The disadvantages of an almost indefinite multiplication of independent bodies dealing with mutually connected subjects had, however, become apparent, and as the World War was nearing its end, efforts were made to organize international coöperation in scientific research on a better basis.

The following list (probably not complete) of the international bodies that were in existence at the outbreak of war in 1914 will give an idea of the range of subjects covered:—

GROUP I.—*Agreements on standards and methods of observation:*—

1. Commission Métrique Internationale, and Bureau International des Poids et Mesures.
2. International Committee of Electrical Units and Standards.
3. International Electro-Technical Committee.
4. International Association for Testing Materials.
5. International Committee on Atomic Weights.
6. Comité International pour la Publication annuelle de Tables de Constantes Physico-chimiques.
7. Commission on Illumination.
8. Conférences Internationales des Ephémérides Astronomiques.
9. International Meteorological Committee.
10. International Solar Union (see also Group II., 7).
11. International Telegraphic Union.
12. Agreements on Radio-telegraphy.
13. Bureau International de l'Heure.

GROUP II.—*Associations formed for the purpose of investigating scientific problems in which coöperation between different nations is considered desirable:*—

1. Geodetic Association.
2. Association of Seismology.
3. Interchange of News concerning Astronomical Occurrences.
4. International Agriculture Institute.
5. International Council for the Exploration of the Sea.
6. Marey Institute.
7. Solar Union (see also Group I., 10).
8. Scientific Sub-Committees of the International Meteorological Committee.
9. International Committee for the Investigation of the Brain.

GROUP III.—*Distribution of work bearing on the same problem for the purpose of economizing time and expenditure:*—

1. Astrographic Chart.
2. Carte Internationale du Monde au Millionième.
3. International Catalogue of Scientific Literature.

GROUP IV.—*Periodic International Congresses serving mainly for friendly interchange of views:*—

1. Mathematics.
2. Chemical Societies.
3. Applied Chemistry.
4. Mining, Metallurgy, Engineering and Economic Geology.
5. Radio-Activity.
6. Botany.
7. Geology.
8. Zoölogy.
9. Entomology.
10. Ornithology.
11. Physiology.
12. Anatomy.
13. Anthropology.
14. Medicine.
15. Hygiene.
16. Cancer Research.
17. Medical Radiology.
18. Geography.

An effort, emanating from Belgium, had been to centralize all international undertakings, and an "Office Central des Institutions Internationales" was established at Brussels. One of the publications of this office, which received no general recognition, gives what purports to be a complete list of all international congresses, unions and associations. Their total number is 279, but many of them were of a social or semi-political or trade character. Among those referring to science the following are not already included in the above list:—

1. Association Internationale des Catholiques pour le Progrès de la Science.
2. Alliance Scientifique Universelle.
3. Office International de Documentation Aéronautique.
4. Commission Permanente du Répertoire Bibliographique International des Sciences Mathématiques.
5. Institut International de Statistique.
6. Comité Maritime International.
7. Comité Juridique International de l'Aviation.
8. Association Internationale d'Agronomie tropicale.
9. Commission Internationale pour l'Enseignement des Sciences Mathématiques.
10. Association Internationale pour Promouvoir l'Étude des Quaternions.
11. Association Internationale des Chimistes des Industries de Cuir.
12. Commission Internationale pour l'Étude de la Question de l'Unification des Méthodes d'Analysis des Denrées alimentaires.
13. Bureau International d'Ethnographie.
14. Association Internationale des Botanistes.
15. Comité Ornithologique International.
16. Association Internationale des Anatomistes.
17. Commission Internationale Permanente de Détermination des Phénomènes psycho-biologiques et socio-biologiques.
18. Office International d'Hygiène Publique.
19. International Sanitary Bureau.
20. Secrétariat International pour l'Unification des Pharmacopées.

21. Association Climatologique Internationale.
22. Association Internationale contre la Tuberculose.
23. Union Internationale des Stations Électriques.
24. Bureau International des Administrations Télégraphiques.
25. Association Internationale Permanente des Congrès de Navigation.
26. Association Scientifique Internationale d'Agronomie Coloniale.
27. Union Internationale des Stations de Recherches Forestières.
28. Union Internationale de Photographie.
29. Institut International de Photographie.
30. Association Internationale des Explorateurs Polaires.
31. Institut Polaire International.
32. Laboratoire International de Physiologie du Mont Rose.

With regard to the origin and aims of some of the most important of these organizations, the following notes may be added.

GROUP I.

1. *The "Bureau International des Poids et Mesures"* was established in 1873 at Sèvres as the outcome of an international commission constituted in 1869 for the construction of metric standards. The existing convention was agreed upon in 1875. Great Britain joined the convention in 1884; the annual contribution now ranges between £200 and £300.

2. *The International Conference on Electrical Units and Standards* which was held in London in 1908 recommended that the various Governments interested should establish a Permanent International Commission for Electrical Standards. The conference requested Lord Rayleigh, then president, to nominate a Scientific Committee of 15 members to formulate a plan of such commission and, in the meantime, to direct such work as would be necessary in connexion with the maintenance and inter-comparison of standards. This committee has done much valuable work, but the intended Permanent Commission never came into being.

3. *The International Electrotechnical Commission* was formed for the purpose of carrying out a resolution of government delegates who met at the International Electrical Congress of St. Louis in 1904. This resolution was to the effect: "That steps should be taken to secure the coöperation of the technical societies of the world by the appointment of a representative commission to consider the question of the standardization of the nomenclature and ratings of electrical apparatus and machinery." The statutes of this commission were finally adopted at a meeting held in London on Oct. 22 1908. They provide for the formation by the Sectional Societies of each country of committees who shall represent that country on the International Commission. The central office is in London. Each Electrotechnical Committee provides funds for its own expenses, and contributes its share to the expenses of the central office. At the last meeting of the commission in Berlin before the war (1913) 24 countries were represented.

4. *International Association for Testing Material.*—Six international congresses were held between 1884 and 1912 with the view of introducing greater uniformity in the methods of testing materials adopted in different countries. At the last two pre-war congresses (Copenhagen, 1909, and New York, 1912) England was represented. The resolutions of the congresses are not binding on anyone, and merely serve to express the opinion of the majority. Nevertheless, the work of this organization has become of considerable importance. After the congress of 1912 a report of the British delegates advocating that the British Government should continue its official support was laid on the table of the House of Commons.[1]

5. *Joint International Committee on Atomic Weights.*—This committee grew out of an organization formed by the leading chemical societies in Europe and America. It was finally constituted in 1901–2, when the business of the committee was entrusted to four men, being representatives of the chemical societies of America, England, France and Germany respectively. The object of this committee was to draw up annual reports on work connected with the determination of atomic weights, to consider the results, and to recommend any changes in the Tables of Atomic Weights which might seem desirable for promoting uniformity in teaching and in the literature of the subject. These reports were published each year until the beginning of the war.

6. *Annual Publication of Tables of Physical and Chemical Constants.*—This is an undertaking with its headquarters at Paris, managed by an International Committee. Special committees have also been instituted in different countries (France, England, Germany, Holland, United States) to assist the work.

7. *International Commission of Illumination.*—The object of this organization, formed by scientific societies in different countries, was "to study and advance by congress and publications the knowledge and practice of the art of illumination, and to secure international agreement on matters of general concern to the science and art of illumination."

8. There were two important "*Conférences Internationales des Ephémérides Astronomiques,*" one in 1896, which established greater uniformity in the adopted constants, such as that of the solar parallax and aberration, and one in 1912, which arranged for collaboration in different countries.

9. *The International Meteorological Conference and Committee.*—Beginning with 1891, the directors of the meteorological institutes and observatories of different countries met periodically in "conference," normally every ten years. The functions of the conference are to propose measures of coöperation likely to prove helpful to the development of meteorology, to bring about uniformity of ideas, and to foster good relations between the workers of different countries. The conference appoints, when it deems necessary, commissions with independent powers to promote the study of special subjects. In addition to the purely meteorological commissions appointed by the conference, there were, at the outbreak of the war, five others concerned respectively with (*a*) Scientific Aeronautics, (*b*) Terrestrial Magnetism, (*c*) Radiations, (*d*) Solar Physics, and (*e*) the Application of Meteorology to Agriculture.

10. *The International Solar Union* was an association of scientific bodies. Of these, three were domiciled in the United States, three in France, two each in Great Britain, Italy, Spain and Germany, one each in Austria, Canada, Holland, Russia, Sweden and Switzerland. Meetings were held every three years, and the business in the meantime was carried out by an Executive Committee of three members only. So far as fundamental measurements are concerned, the Solar Union has, by means of its members working independently in different countries, determined secondary standards of wavelength spread over different parts of the spectrum. It has also, through a number of committees, investigated questions relating to sunspot spectra and solar radiation. In 1913 the union decided to extend its range so as to include the whole of stellar physics.

11. *The "International Telegraphic Union,"* an institution having its "bureau" at Berne, and maintained by subscriptions from the States adhering to the union. Occasional conferences were held which led to "conventions," of which a number are in force. The bureau issues a monthly bulletin—"Le Journal Télégraphique." The union was an official rather than a scientific body, the delegates of the conferences being selected from the clerical staff of the Telegraph Office for Great Britain and its colonies.

13. *Bureau International de l'Heure.*—At an International Conference summoned by the "Bureau des Longitudes" of Paris in 1912, the following resolutions were passed:—

"1. Il est utile de chercher à réaliser l'unification de l'heure.
"2. L'heure universelle sera celle de Greenwich.
"3. Il sera utile de créer une Commission Internationale de l'Heure."

A provisional committee was formed to give effect to the last of these resolutions, and statutes were prepared in which the objects of the International Commission were defined as follows:—"To unify the 'hour' by radio-telegraphic signals or otherwise, whether for the purpose of scientific objects of high precision, or to supply the ordinary needs of navigation, meteorology, seismology, railway traffic, the postal and telegraphic services, public administration, watch-makers, private individuals, etc." An International Bureau was to be established providing for scientific assistants charged with the conduct of special researches. The cost was to be divided between the States forming the union either through their governments or some scientific body. The proposed statutes were submitted to the meeting of the International Association of Academies held in 1913 at St. Petersburg and received their unanimous support. The outbreak of the war prevented further action.

GROUP II.

1. *The International Geodetic Association* was formed by 21 contributing States and has an annual income of nearly £3,000, the subscription for the larger States being £300. According to its convention, which held for 12 years at a time, and was renewable, the Prussian Geodetic Institute at Potsdam was its Central Bureau. Its president, vice-president, and secretary belonged to different countries, and retained their position for the duration of the convention, which lapsed in 1916. Its most useful work dealt with the standardization and comparison of pendulums for gravity measurements. In later years it devoted itself almost entirely to investigations on changes of latitude.

2. *The International Seismological Association* was formed in 1903 on the pattern of the Geodetic Convention, the Imperial Seismological Station at Strassburg being selected as the Central Bureau. France, the United States and Great Britain at first refused to join this association, and the International Association of Academies appointed a committee to suggest such alterations in the proposed convention as would enable these countries to take part in the work. The principal changes proposed and ultimately accepted were: (1) that Strassburg should not necessarily remain the Central Bureau, the selection of its domicile being left to the triennial meetings, (2) that the president should only hold office for three years, (3) that a State may join through one of its scientific societies, and not necessarily through its Government, and (4) that the correspondence between the president and the organizations in each State be carried out through the secretary of the association and not through diplomatic channels as originally provided. The United States joined as soon as these changes were accepted; France

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[1] Cf. Sir James Wolfe-Barry, "Forrest" Lecture of the Institution of Civil Engineers. Appendix v. (1917).

and Great Britain a few years later. The organization then consisted of 20 States, with an annual income of £1,700; the larger States contributing £160 annually. The principal functions of the bureau were to receive and distribute information and to publish systematic lists of earthquakes. Part of the funds was used in paying scientific workers appointed by the association for the purpose of carrying out special researches. The convention lapsed in 1915.

3. *International Commission for the Telegraphic Distribution of Astronomical Information.*—This was to begin with a body consisting of the directors of the principal astronomical observatories in Europe and America, which arranged for the telegraphic distribution of astronomical information. The preliminary arrangements were confirmed by a meeting of astronomers held in Vienna in 1883, when formal statutes for the future conduct of the work were adopted. The headquarters of the organization were at Kiel. The office and working expenses were met by subscriptions from the observatories receiving the information. These were originally fixed at £6 annually, but were subsequently reduced owing to the facilities given by cable companies, which transmit a certain number of messages without charge.

4. *The International Permanent Agricultural Institute.*—This was the outcome of an international meeting held at Rome during 1905 on the invitation of the King of Italy. The institute has its permanent seat at Rome, and its constitution follows lines similar to those of other international conventions. The principal object of the institute is to collect, publish and disseminate statistical information relating to agriculture, to notify new diseases in plants, and to present, if expedient, to the Governments, for their approval, measures for the protection of the common interests of agriculturists. Questions relating to the economic interests of States are excluded.

5. *International Council for the Exploration of the Sea.*—This was constituted in 1902 as a result of discussions held at conferences meeting in Stockholm and Christiania in 1899 and 1901 respectively. It confined itself to questions relating to sea fisheries in N.-European seas, and developed as an economic and political, rather than a scientific, movement. The headquarters were at Copenhagen. The countries originally adhering to the convention were Denmark, Germany, England, Finland, Holland, Norway, Russia, and Sweden. The first convention was made for five years, but annual meetings continued to be held. A number of committees were appointed to deal with different branches of the work. Large sums of money were spent on the work; the total contribution of England amounted to £70,000 (£14,000 annually).

6. *The Marey Institute.*—This institute was founded by M. Marey for the standardization and improvement of instruments used in physiological researches. Its laboratory is at Paris, and its work is controlled by an International Committee. The French Government contributed annually 25,000 fr., and the Swiss Government 1,000 fr. In addition, occasional money contributions were made by the academies of Paris, Leipzig, and St. Petersburg, as well as the Royal Society and the university of London.

7 and 8. *The Solar Union and the Scientific Sub-Committees of the International Meteorological Committee* are entered both under Groups I. and II., because their activity includes to a considerable degree scientific investigation as well as standardization.

Group III.

1. *The International Astrographic Chart.*—The idea of forming a detailed photographic chart of the heavens originated with the late Sir David Gill, but the organization for its practical execution was mainly due to the efforts of Adml. Mouchez, who at the time was director of the Paris observatory. Its programme of work was determined upon at an international conference held in Paris in 1887. The photographs were taken at 18 observatories, of which six were in Great Britain and its colonies, four in France and its colonies, two in Italy, one each in Germany, Finland and Chile. Each country paid the expenses of its own observatories.

2. *Carte Internationale du Monde au Millionième.*—The proposal to issue a map of the world on a uniform plan was initiated at a conference held in London in 1910. In this conference only those countries took part who were represented by ambassadors at the Court of St. James. A second conference, in which other countries also took part, was held at Paris in Dec. 1913. Further details with regard to the construction of the map were settled, and it was resolved that a permanent central office should be established in England for the communication of data, interchange of information, and the publication of an annual report. The headquarters of the office are at the Ordnance Survey, Southampton.

3. *The International Catalogue of Scientific Literature.*—This catalogue, which begins with the year 1901, has its central office in London. Twenty-nine countries (counting the four Australian colonies separately) participate in the work, and most of them have established Regional Bureaux for the preliminary work of preparing the slips which are transmitted to England. The annual expenses before the war were approximately covered by the guarantees of different countries, which took the form of subscriptions for copies of the work, and the independent sales.

Sufficient has now been said to illustrate the variety both in method of work and constitution of the great number of International Unions that had gradually come into existence before the World War. The freedom from tradition and convention with which scientific men interested in a particular subject combined together for a common object had undoubted advantages, as each combination could adopt the constitution best suited to its needs. But there were serious drawbacks. One was the multiplication of bodies. The above list includes five independent organizations dealing with divisions of astronomy. Though they concerned themselves with well-defined branches of the subject, and did not interfere with each other, the great increase in the number of meetings that had to be attended by the same men at different times and in different parts of the world called for some kind of unification. The formation of a more comprehensive body dealing with the whole of astronomy became, for this reason alone, almost inevitable. Then there was the question of funds, which could only be obtained with increasing difficulty, unless some particular Government showed a special and not always altruistic interest in the subject, and attained its object by diplomatic pressure. The International Geodetic Association was brought into existence through diplomatic agencies, and its constitution was vitiated by a not very effective but nevertheless annoying attempt at Government control. It was provided, for instance, that correspondence between the president and the scientific organizations in each State should only be carried out through diplomatic channels, and the association could not itself determine the seat of its Central Bureau. The delegates at the meeting were appointed by the Governments, and often received definite instructions beforehand with regard to their vote. Similar provisions were made originally in the case of the International Association of Seismology, and were abandoned only as a concession to France, England and the United States, who made this a condition of their joining.

It had been hoped at one time that a combination of the leading academies of different countries would help in systematizing international efforts. In the year 1899 a meeting was held at Wiesbaden at which representatives of the principal scientific and literary academies discussed the formation of an *International Association of Academies*, and drafted statutes for such an association. The proceedings at the meeting having been ratified by the bodies concerned, the association was formed and held five meetings at triennial intervals (Paris 1901; London 1904; Vienna 1907; Rome 1910; and St. Petersburg 1913). Twenty-four academies ultimately formed part of the association, though two of them (the Royal Society of Edinburgh and the Finnish Academy of Helsingfors), having only been elected in 1913, never took an active part in the work. The declared object of the association was "to prepare and promote scientific enterprises (travaux scientifiques) of general interest, proposed by one of the Associated Academies, and to facilitate in a general way scientific intercourse between different countries." The attitude of this new body towards other international organizations was discussed at the meeting held at London in 1904 when the following resolution was passed by 19 votes against one:—

> "That the initiation of any new international organization, to be maintained by subventions from the different states, demands careful previous examination into the value and objects of such organization, and that it is desirable that proposals to establish such organizations should be considered by the International Association of Academies before definite action is taken."

This resolution only applied to the initiation of new organizations, as the Association of Academies could not claim to exercise any control over the large number that were already in operation. Nevertheless, it was hoped that it might promote coördination by suggestion and advice.

The Association of Academies included the humanistic as well as the scientific branches of knowledge. It would be easy to point out some valuable undertakings carried out by this body, but the sum total of its effective influence was disappointing. In view of the later period of reconstruction it is necessary to allude to the main source of its weakness. Owing to the limitations of their membership and the great subdivision of our present knowledge, the great academies of the world have lost some of their former authority, which has passed into the hands of specialized societies. While still supreme in questions of general policy, they cannot supply by themselves alone such detailed knowledge as is required in international work.

This then was the position when the World War broke out, and scientific coöperation in peaceful pursuits was inevitably in abeyance. In due course the work of reconstructing it on new lines had to be taken in hand. Informal correspondence between the secretaries of the Royal Society and the Paris Academy of Sciences was interrupted by the death of M. Darboux, a man of great experience and sound judgment combined with a wide and generous outlook. Its resumption after a short interval led to a conference of representatives of the scientific academies in the Allied countries which was held in London on Oct. 11 1918. There were two guiding principles underlying the resolutions arrived at. The first was that no results could be hoped for from any international organization necessitating friendly coöperation and personal intercourse between former belligerents until sufficient time had elapsed for the strong resentment engendered by the initiation and conduct of the war to subside; the second motive was not to lose the favourable opportunity of reconstructing the whole of the international work, by substituting a logical system for the haphazard jumble of conventions and agreements to which its spasmodic historical growth had led. It was the second as much as the first consideration which necessitated a lengthened period for the exclusion of enemy interests which were mainly responsible for the older organizations, some of these having been largely under Government control. For reasons already given, the academies had to recognize that, though they could properly be the organizing authorities, the controlling body in each country would have to be of a more representative character. The main principles were embodied in the following resolutions, which, it will be seen, make special provision for the administrative relations between public services in which coöperation of enemy countries would naturally be resumed after the declaration of peace:—

1. That it is desirable that the nations at war with the Central Powers withdraw from the existing conventions relating to International Scientific Associations in accordance with the statutes or regulations of such conventions respectively, as soon as circumstances permit; and that new associations deemed to be useful to the progress of science and its applications be established without delay by the nations at war with the Central Powers with the eventual coöperation of neutral nations.

2. That certain associations, such as the Metric Convention, depending on diplomatic agreements, be taken into consideration during the peace negotiations.

3. It is not intended that these measures be applied to agreements relating to indispensable administrative relations between public services, such as those regulating navigation, meteorological telegrams, railways, telegraphs, etc.

4. A committee of inquiry be constituted by the conference, the academies of the countries at war with the Central Powers having power to add further members. This committee shall prepare a general scheme of international organizations to meet the requirements of the various branches of scientific and industrial research, including those relating to national defence.

5. Each of the academies represented at the conference shall be invited to initiate the formation of a National Council for the promotion of the researches specified in resolution 4.

6. An International Council, having as nucleus the committee specified in resolution 4, shall be formed by the federation of the National Councils.

7. The conference, being of opinion that all industrial, agricultural and medical progress depends on pure science, draws the attention of the various Governments to the importance of theoretical and disinterested researches, which after the restoration of peace should be supported by large endowments. The conference urges similarly the creation of large laboratories for experimental science, both private and national.

At a further meeting, held at Paris at the end of Nov. 1918, representatives of the following countries were present: Belgium, Brazil, France, Great Britain, Italy, Japan, Poland, Rumania, Serbia and the United States of America. The delegates of Greece and Portugal were prevented from attending. The meeting confirmed the London resolutions and discussed the methods of giving effect to them. A committee of five delegates, representing Belgium, France, Great Britain, Italy and the United States respectively, was appointed to make more definite proposals for the proposed organizations, and the *International Research Council* was finally constituted at a meeting held at Brussels in July 1919. In the meantime the Treaty of Peace with Germany had been drafted. Article 282 of this treaty, as ultimately ratified, runs as follows:—"From the coming into force of the present Treaty, and subject to the provisions thereof, the Multilateral Treaties, Conventions and Agreements of an economic and technical character enumerated below and in the subsequent articles shall alone be applied as between Germany and those of the Allied and Associated Powers party thereto." The list of 26 conventions and agreements which form the exceptions contains only two of the scientific organizations with which we are here concerned, viz. (20), convention of May 20 1875, regarding the unification and improvement of the metric system, and (23) convention of June 7 1905, regarding the creation of an International Agricultural Institute at Rome. It would appear from this that Germany must be considered to have withdrawn from all other scientific organizations, at any rate from those which had received Government support. This view is further confirmed by Article 24 of the Covenant of the League of Nations, according to which:—

> There shall be placed under the direction of the League all international bureaux already established by general treaties if the parties to such treaties consent. All such international bureaux and all commissions for the regulation of matters of international interest hereafter constituted shall be placed under the direction of the League.
>
> In all matters of international interest which are regulated by general conventions but which are not placed under the control of international bureaux or commissions, the Secretariat of the League shall, subject to the consent of the council and if desired by the parties, collect and distribute all relevant information and shall render any other assistance which may be necessary or desirable.
>
> The council may include as part of the expenses of the secretariat the expenses of any bureau or commission which is placed under the direction of the League.

It is a reasonable interpretation of this article that so long as Germany remained excluded from the League of Nations it was not intended to give financial support to international organizations of which Germany formed a part. The way seemed therefore open to reconstruct international scientific work unhampered by the agreements that existed before the war.

A full report of the Proceedings of the Brussels Conference having been published (Harrison & Sons, London), it is only necessary here to outline the general organization that was agreed upon. The objects of the International Research Council, which was now constituted, are defined as follows:—

(1) To coördinate international efforts in the different branches of science and its applications.

(2) To initiate the formation of international associations or unions deemed to be useful to the progress of science in accordance with Article I. of the resolutions adopted at the Conference of London, Oct. 1918 (see page 17 of this report).

(3) To direct international scientific activity in subjects which do not fall within the purview of any existing international associations.

(4) To enter through the proper channels into relation with the Governments of the countries adhering to the International Research Council in order to promote investigations falling within the competence of the Council.

It should be noticed that, once an international association has been formed, it becomes autonomous and is independent of the parent body, subject only to the approval of its statutes and the conditions laid down for admission. The statutes exclude the Central Powers, and lay down a majority of three-quarters for the admission of all but the specified belligerent countries; but so far as countries neutral during the war are concerned, the provision is dealt with by the unanimous invitation extended to them. The following countries had joined the International Research Council by May 1921:—Australia, Belgium, Canada, Denmark, France, Greece, Holland, Italy, Japan, Mexico, Monaco, Norway, Portugal, Serbia, Spain, Sweden, Switzerland, the United States and the United Kingdom.

The statutes remain in force until Dec. 1931, but can be altered at any time with the approval of two-thirds of the adhering countries. Different countries have voting powers according to their contributions, which depend on their population. Self-governing dominions count as independent States.

In addition to the International Research Council, unions were definitely constituted to organize international work in astronomy, geodesy and geophysics and chemistry. In each case the adhering countries constitute National Committees to superintend their part of the work. These National Committees are formed according to the decision of each country, under the responsibility either of its principal academy, or of its National Research Council (where such exists), or of some other national institution or association of institutions, or of its Government.

While the academies of most countries have been satisfied with nominating National Committees on a representative basis for the special purpose of organizing the international work, the United States has established a National Research Council, which is subdivided according to subjects, and which deals with national as well as international activities.

In extensive subjects covering a large range such as astronomy and geophysics, subdivision into groups is necessary, but each union adopts the methods that appear to them to be most effective. While astronomy works through as many as 32 standing committees, the Union of Geodesy and Geophysics has divided itself into six sections, comprising (*a*) geodesy, (*b*) seismology, (*c*) meteorology, (*d*) terrestrial magnetism and electricity, (*e*) physical oceanography, and (*f*) vulcanology.

In addition to the three unions which were actually brought into being at the time, the conference at Brussels formulated proposals for adding unions in the following subjects: mathematics, physics, scientific radio-telegraphy, geology, biological sciences, geography and, finally, bibliography and documentation. The first of these was subsequently constituted at a meeting held in Strassburg, and already counts many countries as adherents. The unions of physics and scientific radio-telegraphy also received substantial support, and it was expected in May 1921 that they would probably be constituted shortly. It seems probable that the international work, which is now established on a sufficiently uniform system to avoid overlapping and waste, while allowing complete liberty of organization within their respective spheres, will in future be carried out as efficiently as is possible in a domain which presents so many inherent difficulties.

In conclusion, and in order to avoid any misunderstanding or misapprehension as regards the general attitude of international science towards research, a declaration of policy which was adopted at the Paris Conference of Nov. 1918 may be quoted:—"The International Research Council recognizes that all great advances in science are initiated by individual efforts, and that it has become increasingly necessary to encourage these efforts. It includes, therefore, within its functions the task of actively encouraging all endeavours to supply the means and freedom necessary to those capable of conducting scientific researches of a high order." (A. S.*)

INTERNATIONAL, THE (*see* 14.693).—After the collapse of the original "International Working Men's Association," known as the First International, there were successive attempts to form a united International of the various socialist and labour movements, the two chief attempts being the Second International, which was formed in 1889 and broke down on the outbreak of the World War in 1914, but was afterwards revived in a mutilated form, and the Third International, which was formed in 1919 on a more exclusively revolutionary basis. In 1921 there was no single International for all the labour and socialist organizations, and the movement as a whole was in flux.

The Second International.—In the period following the collapse of the First International, the national labour and socialist movements grew up separately in each country with only a slight international connexion. For the 13 years between 1876 and 1889 there was no permanent international bond, but only occasional *ad hoc* international conferences of labour. These were summoned by various convening bodies, on one occasion (1888) by the British Trades Union Congress. The list of these intervening conferences is given as follows in the official record of the International Socialist Bureau: 1876, Berne; 1877, Ghent; 1881, Coire; 1883, Paris; 1886, Paris; 1888, London.

In 1889 a new step was taken by the decision of the Paris International Congress to arrange for the periodic holding of International congresses in future. The Paris Congress really consisted of two separately convened conferences, one being Marxian and the other Possibilist or moderate. Subsequent united congresses were held at Brussels in 1891, at Zurich in 1893, and at London in 1896. The starting point of the Second or "New International" is commonly taken as the year 1889.

It was not, however, until 1900, at the Paris Congress of that year, that a definite constitution was set up for the new International. The 1900 Congress established an International Socialist Bureau of representatives from each affiliated national section, together with an executive, a paid secretary, and a central office. The bureau met once a year, or more often in the case of emergency. The central office was stationed at Brussels; and the chairman, secretary and executive, who were entrusted with the task of carrying on the continuous work of the International, were composed of members of the Belgian section.

At the same Congress of Paris in 1900 were laid down the final conditions of membership of the International. By these conditions affiliation was open to—

> (1) All associations which adhere to the essential principles of socialism: socialization of the means of production and exchange; international union and action of the workers; conquest of public powers by the proletariat organized as a class party.
>
> (2) All the constituted organizations which accept the principle of the class struggle and recognize the necessity for political action (legislative and parliamentary), but do not participate directly in the political movement.

Subsequent congresses under the new regulations were held at Amsterdam in 1904, at Stuttgart in 1907, and at Copenhagen in 1910. A special conference was held at Basel in 1912 to protest against the danger of participation by the Great Powers in the Balkan war. The next regular congress was to have been held at Vienna in Aug. 1914, but was abandoned owing to the outbreak of war. The last full congress of the Second International was, in consequence, the Copenhagen Congress of 1910. That congress was attended by 896 delegates representing 23 nationalities. The total number of nationalities affiliated with the bureau at the outbreak of war was 28; and the membership was given as 12 millions.

The pre-war International was a larger organization than had so far been achieved; but its real strength lay in the national sections, and as a whole it lacked effective adhesion or unity. The compromise which gave it birth in the original fusion of the two Paris conferences of 1889 stamped its proceedings throughout. Two leading controversies occupied its attention in the years before the war. One was the question of socialist participation in non-socialist governments. The other was the question of the action of the International in the event of war. On neither of these questions was a clear answer given, although on both elaborate resolutions were passed, couched in revolutionary but vague phraseology. The decision regarding ministerial collaboration by socialists was reached at the Amsterdam Congress of 1904, and laid down that—

> "The Social Democracy can accept no participation in the Government under bourgeois society, this decision being in accordance with the Kautsky resolution passed at the International Congress of Paris in 1900."

This decision would in itself appear definite; but the addition at the end introduces a covert reservation, the terms of the 1900 resolution having sanctioned the exceptional entry of a socialist into the Ministry as a "forced expedient of a temporary and extraordinary character."

The decision on the question of war is even more important for latter-day controversies. The decision was reached at the Stuttgart Congress of 1907 and reaffirmed at the Copenhagen Congress of 1910. It made the following declaration:—

"If war threatens to break out, it is the duty of the working class in the countries concerned and of their parliamentary representatives, with the help of the International Bureau as a means of coördinating their action, to use every effort to prevent war by all the means which seem to them most appropriate, having regard to the sharpness of the class war and to the general political situation.

"Should war none the less break out, their duty is to intervene to bring it promptly to an end and with all their energies to use the political and economic crisis created by the war to rouse the masses of the people from their slumbers and to hasten the fall of capitalist domination."

This decision would again appear definite: but a proposal at the Copenhagen Congress in favour of a general strike in the event of war was referred back by 131 votes to 51, with instructions to the International Bureau to remit it to the national sections for report. The Trade Union International had already refused discussion of the same proposal on the ground that it was a political question falling within the scope of the Socialist International. The subsequent fate of the proposal is worth observing as evidence of the pre-war position. The International Bureau, in accordance with instructions, circularized the national sections in 1910 with a request to report. By 1912 four replies had been received in all, from (1) the Armenian Revolutionary Federation; (2) the Commission of Resolutions of the Seine; (3) the Central Unions and Socialist Party of Denmark; (4) the Socialist Party of Finland. In 1912 the International secretary again circularized the national sections, pointing out the urgency of the subject, as Aug. 1914 (the Vienna Congress) was approaching. This was the position reached before the war.

The International during the War.—The collapse of the International at the outbreak of war in 1914 thus came as more of a surprise to those outside the International than to those acquainted with it. The International, despite its imposing aspirations, was in reality no more than a loose federation of political parties with no strong central authority. In the words of M. Camille Huysmans, the International secretary, describing it as he found it when he took office in 1904, it was "no more than a letter-box and a postal address, a mere medium of communication, without power and without real influence"; and he goes on to describe how efforts to improve this position met with little encouragement.

The outbreak of the war revealed that the national sections were stronger than the International. It is true that in Serbia, the country first affected by invasion, the Socialist party stood by the International and voted against the war credits; but their example was not followed. The most important national sections affected (with the exception of Russia), Britain, France, Belgium and Germany, rallied to the support of what they felt to be a war of national defence. Opposition was expressed only by minorities in each of these countries, consisting of extreme revolutionary socialists or of pacifist socialists.

The effect of the war was, accordingly, to break up the International into two sections, pro-war and anti-war. The International Secretariat was transferred to Holland; and substitute members were taken on to the Executive from the Dutch section. There followed a period of sectional conferences. In Jan. 1915, the neutral socialists met at Copenhagen and issued an appeal to the belligerent socialists to act to stop the war. In Feb. 1915, the Allied socialists met in London and passed a resolution emphasizing the necessity of continuing the war. In April 1915, the Central Powers socialists met at Vienna and passed resolutions dealing chiefly with relations after the war.

All these conferences were held with the knowledge and sanction of the International Executive, which was endeavouring by negotiation to pave the way for a full congress. But in Sept. 1915, the anti-war socialists took matters into their own hands, and held an unofficial socialist conference at Zimmerwald in Switzerland. This conference set up a permanent International Socialist Commission, which was henceforth in tacit, though not at first intended, rivalry with the official bureau. This rivalry became intensified when a second conference was held under the auspices of the commission at Kienthal in April 1916, and the revolutionary section of the anti-war socialists began to play a more dominant part.

The situation was brought to a head by the Russian Revolution of March 1917. An invitation for a full International Socialist Conference to be held at Stockholm was issued by the Petrograd Soviet in conjunction with the Dutch-Scandinavian committee which had been formed to act for the bureau. The invitation was accepted by all the principal sections, including the British Labour party, the French Socialist party, and the German and Austrian socialists. But after a protracted crisis the refusal of passports by the British and French Governments led to the failure of the project. It was at this stage that the Zimmerwaldian Commission held a separate meeting at Stockholm and finally decided on founding a new International.

In March 1918, an Inter-Allied Socialist and Labour Conference was held, which drew up a statement of war aims and communicated it to the socialist parties of the Central Powers. The replies of the latter were received during the summer of 1918, and negotiations were proceeding on these lines when the Armistice came.

The Second International after the War.—Immediately after the Armistice steps were taken for the reconstruction of the International under the auspices of a committee appointed by the Inter-Allied Socialist and Labour Conference of March 1918. This committee, consisting of Messrs. Albert Thomas, Henderson and Vandervelde, acting in conjunction with M. Camille Huysmans, the International secretary, issued invitations for a preliminary International Socialist and Labour Conference to be held at Berne concurrently with the official Peace Conference.

The Berne Conference was held in Feb. 1919, and was attended by delegates from 26 nations. Certain sections of the Left refused to participate, including the Russian Communist party (who had already issued their invitation for a separate conference to inaugurate a new International) and the official parties of Italy, Switzerland, Serbia and Rumania.

The Berne Conference, although not strictly a conference of the old Second International either in origin or composition, made arrangements for the resumption of the International at a full congress to be held the next year, and appointed a Permanent Commission for this purpose. The conference also passed resolutions in favour of a League of Nations based on a just peace, of national self-determination, and of an International Labour Charter. War responsibilities and Bolshevism gave rise to sharp debates. The former subject was remitted to a subsequent congress. On the latter subject a resolution denouncing the dictatorship of the proletariat and declaring democracy the only possible means of achieving socialism received a majority of votes; but the conference decided to postpone a definite decision until it had sent a mission of inquiry to Russia (for which, however, passports were refused).

The Permanent Commission appointed at the Berne Conference met at Amsterdam in April 1919, and at Lucerne in Aug. 1919. It made arrangements for the first full after-war congress to be held at Geneva in Feb. 1920, and drew up a provisional constitution. Difficulties in the way of the Geneva Congress arose owing to the growing strength of the newly founded Third or Communist International and the steady defection of parties and sections from the Second International. In consequence the Geneva Congress was postponed until Aug. 1920.

By the time the Geneva Congress was held in Aug. 1920, the Second International had come to represent in practice the right wing of the International Labour movement, although still in its basis accepting all labour and socialist organizations. Its main strength lay in the British Labour party and the German Majority socialists, together with the parties of certain smaller countries, including Sweden, Denmark, Belgium, Holland and Hungary. The official parties of America, France, Italy, Spain, Austria, Switzerland, Norway, the Balkans, Ukraine and Russia had left it, as had also the German Independent socialists, while of the British socialist organizations only the Fabian Society remained with it.

The Geneva Congress adopted for the first time a regular constitution for the International, and drew up a carefully worded programme on the economic and political side. This programme follows more or less the lines made familiar in England by Fabian socialism, together with the recognition of a large measure of workers' control in industry. The Geneva Congress further recommended that the Secretariat should be transferred to London; and the British section was invited to undertake the task of negotiating with national socialist and labour bodies not represented, in order to secure their adherence. A negotiating commission was accordingly set up in Nov. 1920, consisting of Mr. Arthur Henderson, Mr. J. H. Thomas, Mr. J. Ramsay Macdonald and Mr. H. Gosling.

The Third International.—The decision to found a new revolutionary International, in view of the failure of the old Second International under the test of war, was first definitely framed by the Russian Social Democratic party (Bolshevik) at their congress in 1915, and subsequently adopted, as has been related, by the Zimmerwaldian International Socialist Commission at Stockholm in 1917. In Jan. 1919, the invitation for the first congress of the new International was issued by the Russian Communist party (the name adopted by the Russian Bolsheviks after their revolution of Nov. 1917) together with representatives of other Communist parties. This inaugural congress was held at Moscow in March 1919, and was attended by the Russian Communist party, the Norwegian Labour party, the German Spartacusbund and other smaller parties and groups. The congress wound up the Zimmerwaldian Commission, whose secretary became the secretary of the new International, and appointed an executive to arrange for the next congress, to which was left the drafting of the full constitution and conditions of admission. In the meantime a manifesto was drawn up expounding the general principles of the new Communist International, and inviting the adhesion of the revolutionary movements of the world. A summary of the principles and programme of the Communist International, as expounded in their manifesto, is given in the article on COMMUNISM.

The first congress of the new International had been a hurried meeting with little pretence at a fully representative character. The policy of precipitating its foundation had been deliberately adopted in spite of criticism as a means of crystallizing the situation in the whole International Socialist movement. This object received a considerable degree of fulfilment. Within the next twelvemonth every party had to define its attitude in relation to the new issues, and a great shifting of the centre of gravity began in the whole International movement. Section after section left the Second International, and a slower, but steady, influx passed into the Third International. By the time of the Second Congress in Aug. 1920, accredited representatives attended from parties of varying size in nearly every country.

The Second Congress had to determine the constitution and conditions of admission of the new International. This raised a new problem. The effect of the world-wide movement towards the Third International had been to produce a series of demands for admission from parties which were not fully communist in character. This applied particularly to the applications of the larger parties, the parties of Italy, Germany (the Independent Socialists), France and America. Of these Italy had joined the Third International while retaining a small reformist section within its ranks; France, Germany and America were applying for admission, although all containing anti-communist sections. The danger was that the Communist International would be swamped and become like the old pre-war Second International. Accordingly severe measures were taken to stem the tide, and a series of 21 conditions of membership were drawn up to serve as a test to sift the genuine communists from the "centrists." These measures produced the effect desired. The Italian communists broke away from their connexion with the reformist socialists (who were not themselves numerous, but received support from the majority of the party in the name of unity); the French and German parties came over only after a break with their right-wing minorities; the American communists, who were also in a majority in their party, but were expelled by the official right-wing minority, affiliated separately.

The statutes and 21 conditions of membership reveal the basis and organization of the Third International. The object of the organization is laid down as follows:—

> The new International Association of Workers is established for the purpose of organizing common action between the workers of various countries who are striving towards a single aim; the overthrow of capitalism, the establishment of the dictatorship of the proletariat and of the International Soviet Republic, the complete abolition of classes and the realization of socialism—as the first step to communist society.

In contrast with the pre-war International great stress is laid on international discipline. The World Congress is constituted as the supreme authority of the International, and is given power to confirm or revise the programme and policy of the national sections. In the intervals of the congresses this power is exercised by the International Executive, which has the right to issue obligatory instructions to the component organizations. In further contrast with the pre-war International, great stress is laid on the necessity for illegal work and the preparation for eventual armed conflict.

In addition to the statutes and conditions a series of theses were adopted by the Second Congress, outlining the communist policy and tactics in relation to Parliament, the trade unions, coöperative societies, national and colonial movements, etc. The statutes, conditions and theses, taken together, constitute the official statement of policy of the Communist International, which is held to be binding on all members.

The Vienna International.—While the issues of the Second and Third Internationals were agitating the socialist world, a number of parties which occupied a centre position endeavoured to start a new movement with a view to the reconstruction of the International. These parties had left the Second International, but were not prepared to enter the Third International. In Dec. 1920, a conference was held at Berne which made preparations for an inaugural congress of the new movement at Vienna in Feb. 1921. This congress was attended by the Austrian, Swiss and Hungarian parties, the British Independent Labour party, and the right-wing minorities of the French Socialists and the German Independent Socialists, the Russian Mensheviks and Socialist Revolutionaries, and one or two groups from other countries. An "International Working Union of Socialist Parties" was constituted, open to all parties not affiliated with either the Second or the Third International, and with the object of "unifying the activities of the affiliated parties, arranging common action, and promoting the establishment of an International which will embrace the whole revolutionary working class of the world." A statement on the "Organization and Methods of the Class Struggle" was adopted, which insisted on the probable necessity of expecting the use of violent measures by the capitalist class, but claimed national autonomy for each party to determine its own method of action.

Thus, by the summer of 1921, there were in existence three Internationals claiming the allegiance of the labour and socialist movements of the world.

Bibliography.—No standard history exists of the Socialist International as a whole. The history of the Second International before the war can only be obtained from the *International Socialist Congress Reports*, and the *Bulletin of the International Socialist Bureau.* The International at the outbreak of war is dealt with in A. W. Humphrey's *International Socialism and the War* (1915) and W. E. Walling's *The Socialists and the War* (1915); and the story is carried down to 1917 in R. W. Postgate's *The International during the War* (1918). The International after the war is dealt with in R. Palme Dutt's *The Two Internationals* (1920), which goes up to the spring of 1920. For the Third International see the *Theses and Statutes of the Communist International* (English edition, 1921) and the monthly official journal, *The Communist International.* See also R. W. Postgate's *The Workers' International* (1920), and the articles in the *Labour International Handbook* (1921). (R. P. D.)

INTERSTATE COMMERCE (*see*, 14.711).—Subsequently to 1910 numerous Acts of the United States Congress and decisions of the Supreme Court extended the scope of Federal control over interstate commerce. The regulation of railways was made more complete, and the authority of the United States is now exercised regarding railway rates on traffic within the states when such rates affect interstate commerce. The Anti-Trust Act of 1890 was broadened and strengthened by the decisions of the Supreme Court in the oil and tobacco cases in 1911 and by the Clayton Act of 1913. In the adjustment of labour disputes between employers and employees engaged in interstate commerce the U.S. Government plays a constantly larger rôle.

Railway Regulation.—The Interstate Commerce Commission was given authority by the Hepburn Act of 1906 to establish reasonable maximum railway rates on interstate traffic, but could act only on complaints. By the Mann-Elkins Act of 1910, the Commission was authorized to establish reasonable rates after hearings initiated on its own motion. By this law the Interstate Commerce Act was made to apply also to telegraph and telephone companies. The most important addition to the powers of the Commission by the Act of 1910 was the authority to suspend proposed increases in rates. Rates filed by the carriers were to become effective in 30 days, but the Commission might suspend the increase for 120 days, and, if necessary, for an additional period of not exceeding six months. Another important provision of the Mann-Elkins Act gave renewed vitality to the fourth section, or the long and short haul clause, of the Interstate Commerce Act. Previously a carrier might decide whether this clause applied to any particular route, and, as the law had been interpreted by the courts, the fourth section had practically become a dead letter. By the Mann-Elkins Act no carrier may charge more for the shorter intermediate haul than for a longer haul until he has applied to the Commission and permission has been granted because of special circumstances.

The Panama Canal Act, passed in 1912, contains some important items extending Federal power over interstate commerce. It had long been thought by the public that it was the policy of the railways to secure control of competing carriers by water and force them out of existence. In response to this feeling, Congress, by the Panama Canal Act of 1912, provided that it should be unlawful for any railway company or common carrier, subject to the Interstate Commerce Act, to secure control by stock ownership or otherwise of any common carrier by water operating through the Panama Canal or elsewhere, provided the carrier by water and the railway company did or might compete with each other. The Commission was charged with the duty of deciding the questions of fact as to competition. The drastic nature of the law was somewhat modified by the provision that, if the Commission was of opinion that the public interests would be served and competition would not be prevented or reduced by the continued control by the railway company of a competing carrier by water the Commission might extend the period of control. In enforcing this provision, the Commission has compelled the trunk-line railways to sell the passenger and freight lines which they had efficiently operated upon the Great Lakes. The railways have been permitted to continue to operate steamships coastwise between New England ports. The prohibition of the use of the Panama Canal by vessels owned by a competing railway is absolute. The Panama Canal Act also gave the Commission authority, as regards interstate traffic, to require rail carriers to make physical connexion with the docks of steamship companies and to establish through routes and maximum joint rates. Rail carriers, moreover, that have entered into through arrangements with a carrier by water, operating from a port of the United States to a foreign country, must enter into like arrangements with any or all other lines of steamships operating from the same port. The purpose of this provision was to insure shippers from interior points the benefits of competition by through routes to foreign destinations.

Prior to 1915, it was the practice of railway companies by contracts in bills of lading to fix a maximum value for different articles, and in case of loss or damage the owner could collect only to the amount of the maximum value so fixed. By the Cummins Amendment (1915) to the Interstate Commerce Act carriers were made liable for the actual value of commodities. Subsequently the carriers were, however, permitted to establish a scale of rates varying with different values, provided the Commission approved.

As a result of the steady rise in cost of living after 1910, and of the more effective organization of railway employees, a series of demands was made by railway labour for increased wages. The demands were only partially satisfied by arbitration proceedings, and finally in 1916 the employees of the railways of the country threatened a nation-wide strike on Sept. 1 unless the demand for increased wages and for an eight-hour day was granted. The railway companies were unable to grant the demand and the men refused to arbitrate, although the President of the United States sought settlement by arbitration. The urgency of the situation caused the President to recommend and Congress to enact a law establishing the eight-hour day beginning Jan. 1 1917, and providing that the wages then in force should not be reduced for a period of nine months. In March 1917 this law was upheld by the U.S. Supreme Court.

On March 1 1913 Congress directed the Interstate Commerce Commission to undertake the valuation of railways to enable the Commission to regulate interstate carriers more intelligently and effectively. It is expected that the Commission will complete this work in 1923.

The most important legislation affecting the carriers enacted since the passage of the original Interstate Commerce Law of 1887 is the Transportation Act of 1920, which returned the railways to their owners March 1 (at the end of the 26 months of Government operation), provided for a more comprehensive regulation of carriers by the Commission, and established new principles to be followed in the regulation of rates, revenues and capital expenditures of the carriers. An active propaganda for the purchase of the railways by the Government was carried on during 1919 by the leaders of the railway brotherhoods and unions. The agitation received also the support of socialists and other advocates of the extension of Government functions. The movement, however, did not meet with popular approval, and Congress by a large majority decided in favour of the continuance of private ownership and the return to corporate operation of the railways.

In the Transportation Act of 1920 a new principle of rate-making was incorporated. The Commission, as previously, is the final authority as to rates. But in the future the Commission was to adjust rates with a view to enabling carriers, as a whole, to earn $5\frac{1}{2}$% on the aggregate value of their property devoted to the public service. The Commission might also authorize the carriers to earn one-half of 1% per annum additional, the amount thus earned to be devoted to improvements without capitalizing the amount thus invested. Individual carriers whose net operating revenues exceed 6% were to devote one-half of the excess to building up a company reserve fund until the amount reaches 5%, and are to turn the other half of the excess over to the Government to go into a fund from which it might make advances to the carriers.

The regulation of railway securities by the Commission is authorized by the Transportation Act of 1920, which so amends the laws against combinations as to permit railway companies to consolidate with the Commission's approval. Consolidation or grouping of the railways into a limited number of systems of approximately equal strength is recognized to be an ultimate necessity, and there was some sentiment in favour of making consolidation compulsory by law. That principle, however, was not incorporated in the Act.

One of the most important features of the Transportation Act of 1920 is that providing for the adjustment of disputes as to wages and working conditions of employees. The Act makes it the duty of employers and employees to endeavor by negotiation to settle their differences. If negotiation fails, disputes as to working conditions may be referred to boards of adjustment composed of an equal number of representatives of the employer and employees. These boards may be either local, district or national. The law also provides for the appointment by the President of a Railroad Labour Board made up of nine men, three representing the public, three the railway employees and three the railway companies. Such a Board was appointed by the President in the spring of 1920, and it became active in considering many questions involving wages and working conditions.

Intra-state Rates.—The power of the Federal Government over intra-state rates has been extended by important decisions of the Supreme Court and by the Transportation Act of 1920. In the Minnesota Rate Case (Simpson *et al. vs.* Shepard, 230 U.S. 352), decided in 1913, the Supreme Court upheld the action of the state of Minnesota establishing railway rates within the state, although the facts showed that these intra-state rates affected the rates on interstate traffic and the revenues of the carriers engaged both in interstate and intra-state traffic. Justice Hughes, speaking for the Court, declared that the "state of Minnesota did not transcend the limits of its authority in prescribing the rates here involved, assuming them to be reasonable." But Justice Hughes was careful to point out that "if the situation has become such, by reason of the interblending of the inter- and intra-state operations of interstate carriers, that adequate regulation of their interstate rates cannot be maintained without imposing requirements with respect to their intra-state rates which substantially affect the former, it is for Congress to determine, within the limits of its constitutional authority over interstate commerce and its instruments, the measure of the regulation it should supply." In 1914 the Supreme Court was called on to consider the validity of the order of the Interstate Commerce Commission in its Shreveport decision. The business interests of Shreveport, La., had complained to the Commission that rates within the state of Texas, which had been fixed by the State Commission of Texas, were so much lower than the interstate rates that it was not possible for the merchants of Shreveport to do business in northwestern Texas. The Commission decided that the wide difference between the interstate and intra-state rates constituted an unreasonable discrimination, and the carriers were ordered to correct this, which they did by raising the intra-state to the level of the interstate charges. When the case reached the Supreme Court, the Commission's order was upheld (234 U.S. 342). The principle established by this decision was embodied in the Transportation Act of 1920. The statute provided that when the Interstate Commerce Commission finds that any intra-state rate constitutes an unjust discrimination against interstate or foreign commerce, the Commission may prescribe the maximum or minimum intra-state rate thereafter to be charged. The limitation by the Federal Government of the power of the states over railway charges within their respective territories was not accepted by the states without contest. A test case was pending in the Supreme Court in 1921.

Amendments to the Anti-Trust Act of 1890.—Prior to 1911, the Supreme Court by a series of decisions (*see* 14.711) had defined the scope of the Anti-Trust law of 1890; but while the Act had been sustained, the net effect of the interpretations given to the law had been to limit its effectiveness. However, in the oil and tobacco cases decided in 1911 (221 U.S. 1–106 and 106–193) the Supreme Court adopted a "rule of reason" formulated by Chief Justice White, which gave greater flexibility to the Act and promised to make the law more effective. In a previous decision involving railway combinations, the Supreme Court had interpreted literally the language of the statute, and had not considered whether the combination was reasonable or in harmony with sound public policy. This interpretation had made the statute almost a dead letter as far as regulating combinations. In the oil case, the Supreme Court, speaking through Chief Justice White, said: "It becomes obvious that the criterion to be resorted to in any given case, for the purpose of ascertaining whether violations of the section have been committed, is the rule of reason guided by the established law and by the plain duty to enforce the prohibitions of the Act, and thus the public policy which its restrictions were obviously enacted to subserve." The Court held, in effect, that the purpose of the law was to prevent undue restraint of every kind and that it did not deny to individuals the right to enter into contracts when the right was not improperly exercised.

This interpretation of the Anti-Trust law was unsatisfactory to the extreme opponents of industrial combinations, and it was thought by many that Congress should define combinations and monopolies. In response, the Clayton Act of 1913 was passed, prohibiting, under specified provisions, discriminations in prices and containing numerous other sections intended to make the general provisions of the Anti-Trust Act of 1890 more specific. It is doubtful, however, whether the Clayton Act has really strengthened the Act of 1890. Labour unions and organizations of farmers are exempted from the provisions of the Anti-Trust law. Interlocking directorates of banks are prohibited, and it is made unlawful for a corporation engaged in interstate commerce to acquire control by stock ownership of another corporation engaged in interstate commerce when such acquisition will lessen competition. Carriers engaged in interstate commerce are prohibited, after two years from the passage of the law, from dealing in securities or supplies or from making construction contracts amounting to more than $50,000 with a corporation, firm or partnership having on its board of directors or as one of its officers a person who is at the same time a director or officer of the common carrier. This provision was suspended until after the conclusion of the World War, but was in force in 1921.

The most important decision of the Supreme Court subsequently to 1911 was its finding in the case of the United States against the Steel Corporation, March 1 1920 (251 U.S. 417). By this decision, the largest of all industrial combinations was held not to be a violation of the Sherman Anti-Trust Act. It was not shown that the Steel Corporation had unduly limited competition. The Court decided that it "should consider not what the corporation had power to do or did but what it has power to do and is doing." It reached the conclusion that the public interest would not be served by requiring the dissolution of the Steel Corporation, but that, on the contrary, its dissolution might result in a material disturbance to American foreign trade.

Adjustment of Labour Disputes.—The Erdman Act of 1898 was amended by the Newlands Act of July 15 1913, and more adequate machinery provided for mediation and arbitration of labour disputes. The Erdman Act had provided for voluntary conciliation upon the initiative of the chairman of the Interstate Commerce Commission and the Commissioner of Labor. If conciliation failed, the parties might submit their controversy to arbitration. In that case a board of three men was provided, one arbitrator selected by each side, these to choose the third arbitrator, or, if they failed, the third arbitrator to be chosen by the chairman of the Commission and the Commissioner of Labor. Both the railway companies and their employees objected to submitting their disputes to such a small board, and the Newlands Act therefore provided for a board of five to nine men and also created a board of mediation and conciliation composed of a commissioner and two other designated officials of the Government. A series of important arbitration proceedings was held under the Newlands Act, but by 1916 the railway employees had become dissatisfied with the results of arbitration and made a demand on the carriers for the establishment of an eight-hour day and for a general increase in wages. The carriers resisted and the deadlock was broken by the passage of the Adamson Act in Sept. 1916, establishing the standard eight-hour day in the railway service, and providing for a commission to decide upon wages. There was much popular dissatisfaction with the Adamson Law, which was hurriedly enacted by Congress under the pressure of a threatened labour crisis. The Supreme Court the following spring held the law to be constitutional, and the Adamson Law has definitely established the standard eight-hour day in the railway service (243 U.S. 232). The Newlands Act and the machinery it created have been supplemented and in fact supplanted by the labour provisions of the Transportation Act of 1920. Whether the machinery created by this Act would work satisfactorily had not been fully determined in 1921, but the success of the Board in averting a threatened strike on Nov. 1 of that year gave the Board increased popular support.

For details as to statutes, consult *Barnes' Federal Code* (1919) and the supplement (1921). The most important decisions of the Supreme Court interpreting the power of the Federal Government over intra-state railway rates are Simpson *et al. vs.* Shepard, 230 U.S. 352; Houston East and West Texas Railway Co., and Houston and Shreveport Railway Co. *et al. vs.* United States, 234 U.S. 342. The most recent significant decisions of the Supreme Court interpreting the Anti-Trust Law are Standard Oil Co. *vs.* United States, 221 U.S. 1; United States *vs.* American Tobacco Co., 221 U.S. 106; United States *vs.* U.S. Steel Corporation, 251 U.S. 417, and the Adamson Law Case, Wilson *vs.* New, 243 U.S. 232. (E. R. J.)

INTESTINAL STASIS (*see* 8.263; 19.924; 19.430; 1.33).—In abdominal surgery during recent years some of the principal advances have been due to the increased attention given to the study of *chronic intestinal stasis*, a term which comprises a sequence of changes which affect the entire gastro-intestinal canal. They are in the first instance mechanical in character and are due to the delay in the evacuation of the contents of the intestine. Later the accumulation of material in the large bowel leads to stagnation of the chyme in the small intestines and to its infection by organisms. These germs extend upwards through the ileum, jejunum and duodenum, and foul their contents from which the body obtains its nutrition. The material absorbed from the infected contents of the small intestine contains toxins and perhaps organisms. These may be in a quantity sufficient to escape excretion and alteration by the liver and kidneys. They are carried in the blood-stream and supply the cells of all the tissues of the body with a medium which rapidly produces degenerative changes in them. This infection of the contents of the small intestine by organisms is a matter of the most serious importance in its bearing on the health of the individual.

The Mechanical Changes in the Large Bowel in chronic intestinal stasis usually originate early in the lifetime of the individual. When the napkin of the infant is discarded, the child is educated to expel the faeces only once a day, so that the product of a whole 24 hours' digestion is collected in the distal portion of the large bowel and especially in its pelvic segment. The bulk of faecal matter in these circumstances appears to be greater than this section of the bowel can accommodate without undergoing alterations in form. Changes in the intestine and in its connexion to adjacent structure develop. These vary in character with the vitality of the subject. In one extreme of low vitality the colon elongates and dilates, and consequently loses in expulsive power. The elongation of the pelvic colon affords a serious obstacle to the evacuation of its contents. Infective processes in the mucous membrane also produce a condition of spasmodic obstruction. In the other extreme, in the more vigorous subject, lines of resistance are crystallized as bands or membranes which tend to retain the bowel in position and to oppose its distension and elongation. These bands are generally distributed along the concavity of the large bowel and reach a high state of development at certain definite points. At first they perform a useful function but later, as they contract, they obstruct the lumen of the bowel and tend to shorten life. These deviations from the normal are characteristic of two extreme types of intestinal stasis, within which all varieties and combinations exist.

A matter of great importance is that the cases included in the first group do not get cancer of the large bowel any more than they get carcinoma of the stomach and oesophagus, while those in the second group are very liable to the formation of cancer at any of the points of obstruction produced by the acquired bands or in the situation of the muscle at the junction of the pelvic colon and rectum, or about the *sphincter ani*. Another point is that the consistence of the contents of the large intestine varies greatly throughout its length; while in the caecum and ascending colon it is of a fluid or pasty consistence, in the descending, iliac, and pelvic portions of the colon it is usually firm and may be very hard. Therefore the physical character of the faecal matter is a matter of importance in the consideration of its effects upon and its capacity to pass through any portion of the bowel whose lumen is materially constricted. The explanation of the varying frequency of cancer in the two extreme types is obvious. To exert traumatism at the seat of constriction it is necessary that there should be sufficient thrust produced by the muscular wall of the bowel, and again the mechanical effect of that thrust varies directly with the bulk and consistence of the portion of the intestinal contents which is forced against the partly obstructed segment of bowel, and with the degree of the obstruction.

In the first group the very elongated bowel with its feeble muscular wall, with its inflamed mucous membrane and its very scanty contents, exerts but a slight effect upon the mucous membrane at the junction of elongated loops of colon, the kinking or obstruction by membranes being non-existent in these cases. Instead of developing excessive power by the hypertrophy of the muscle coat of the bowel the proximal colon gives up the struggle readily, dilates and prolapses. In the second group the bowel is not elongated, its wall is hypertrophied, the faecal contents are abundant and bulky, and the obstruction is acute and well defined. In the first group the enfeeblement of the muscle coat of the bowel resulting from the extreme degree of intestinal auto-intoxication eliminates the mechanical factor which in the case of the large bowel is responsible for the formation of cancer, but by causing degenerative changes in the breasts, uterus, ovaries and other organs, it renders them much more liable to cancer.

The ileal effluent is controlled and material is dammed back in the small intestine as the result of overloading of the caecum by its stagnating contents. The distension and dilatation of the caecum produce a twist or obstruction of the terminal ileum, or the ileum is constricted by an appendix which is anchored to the back of the mesentery, forming what is called a "controlling appendix," or by an ileal kink due to the contraction of an acquired ligament or band. The weight of the stagnating contents of the small intestine exerts a drag upon the duodeno-jejunal junction. If, as is frequently the case, this angle is abrupt it is readily blocked, so that the passage of the contents of the duodenum into the jejunum is obstructed and dilatation and inflammatory change take place in the duodenum. The pylorus becomes spastic and the stomach dilates and hypertrophies. Inflammatory changes arise in the mucous membrane about the pylorus over the area in which the contents of the stomach are forcibly impacted and about the centre of the lesser curvature where strain is greatest. Later these infected areas are liable to become cancerous.

Toxic Changes in Chronic Intestinal Stasis.—Carrel has demonstrated that the several tissues of the body can grow and live indefinitely, provided they receive nutriment and are efficiently drained. Any interference with the drainage of effete products or with the supply of suitable nutriment causes the death of the growing tissue.

While most of the changes which take place in the tissues of the body in stasis are due to the effect of the deleterious products circulating in the blood stream, some are consequent upon the extension of infection from the duodenum along the ducts of the liver and pancreas. The latter are evidenced as inflammatory changes in the ducts and tissues of the liver; as gall-stones acting mechanically and producing obstructive symptoms, ulceration and cancer; and as changes in the pancreas which are degenerative, inflammatory and finally cancerous.

The most conspicuous consequences of the effects of intestinal auto-intoxication are:—(1) *Loss of fat.*—This in the woman is a factor of even greater importance than in a man, since she depends on it largely for the beauty of her curves and for the support of her viscera and especially her pelvic organs. (2) *Changes in the skin.*—The skin is stained, especially about the eye-lids, side of the neck, axillae, groins, and about the labia and thighs. This staining is accentuated in areas exposed to friction. The skin becomes wrinkled. Hairs appear on the cheek, upper lip and chin, also over the externs or surfaces of the fore-arm and the legs. The perspiration is pungent and offensive. The breasts become nobbly in their upper and outer segments, cysts are formed later and spread through the whole breast, cancer develops readily in these degenerated organs. (3) The *circulation* is very defective, so that the extremities and ears are cold even in moderately warm weather. The temperature of the body is always subnormal. The heart undergoes many changes due to degeneration of its muscle. The walls of the arteries become atheromatous, impairing the circulation of the blood through the tissues. The changes in the coronary arteries produce the condition called angina pectoris, while the inelasticity and fragility of the cerebral vessels render them liable to rupture in the soft tissues of the brain. (4) The *wasting of the muscles* which occurs early in stasis is responsible for a great variety of symptoms. It affects both the voluntary and the involuntary muscles. Perhaps the earliest evidence of loss of power in the voluntary muscles is afforded by the loss of thoracic respiration, the patient depending for the oxygenation of the blood upon the more reflex and less exacting action of the diaphragm and abdominal muscles. The attitude of rest which is assumed in consequence is very disfiguring. It is interesting to note that this condition of abdominal respiration precedes, and is responsible for, the development of the deformities which are due to the fixation and later the exaggeration of "resting postures," which are thus indirectly due to the auto-intoxication of chronic intestinal stasis. They are "dorsal excurvation," "flat-foot," "lateral curvature," and "knock-knee." (5) The *muscle of the intestine* with its ganglia and mucous membrane degenerate and their function becomes still more defective. (6) The *uterus* falls back and twists or bends, forming the various flexions and versions with which the gynaecologist is so familiar. (7) The *voluntary muscles* waste and become soft and friable. They tear easily when operated on.

Changes in the Nervous System and in the Eyes.—The effect of auto-intoxication upon the brain and nervous system is very striking. Headache, varying in intensity, is a common symptom. Neuralgias are frequent and may involve a great variety of nerves. They may be very intense. Rheumatic pains are constantly complained of. The patient, while sleeping badly, may find it difficult to keep awake during the day. On awakening in the morning the feeling experienced may be that of extreme exhaustion, no benefit having been derived from the night's rest. The most distressing symptom of intestinal auto-intoxication is the mental depression which so frequently accompanies it. It varies in severity from a feeling of incapacity to one which not infrequently leads the sufferer to attempt to terminate an existence which has become intolerable. All efforts at mental concentration are futile, while any physical exertion is followed by a period of complete exhaustion. These patients become introspective, and women especially are liable to become intensely religious.

The term *neurasthenia* is very often applied to this condition of the nervous system. In some degree it is an almost invariable symptom of stasis. The patient loses control, and fits of irritability or of violent passion are not infrequent. Such a person is difficult to live with. Many are supposed to be stupid, dull, inattentive or even imbecile. This feature is more marked in the growing child, who is often at the bottom of the class and may be severely criticized or punished in consequence.

The eyes are always affected. They afford an excellent and very delicate indication of the degree of auto-intoxication and the changes they undergo are of great value to the observer.

Changes in the Kidneys.—The eliminating organ on which, after the liver, most stress is thrown is the kidney. Upon it devolves the strain of getting rid of abnormal toxins and organisms, together with an excessive amount of by-products. The changes which the kidney may undergo are most variable, some being slow and almost imperceptible in their progress, while others are very acute. They include the types of Bright's disease, which probably vary with the nature of the organisms infecting the chyme. The kidney eliminates organisms, such as *bacilli coli* and others, into the urinary tract, through which they may be discharged painlessly and without affording any evidence of their presence.

The removal of fat results in the prolapse of the viscera, and especially of those that are dependent on it for support. The kidneys drop and their functions are impaired in consequence. The outflow of urine is obstructed by the angulation of the ureter at its junction with the pelvis or over a vessel, and hydronephrotic conditions result. The venous flow from the kidney is similarly obstructed, and in consequence the organ becomes gorged with blood and very sensitive. As it lies upon the hard floor formed by the iliac fossa its sensitiveness is increased by every movement, and the pain and distress which ensue are considerable.

Changes in the Thyroid and Ductless Glands.—In stasis the thyroid becomes enlarged at the onset, and later may shrink so much that it cannot be felt by the fingers. It would seem reasonable to argue by analogy from the effect of stasis on the thyroid that the pituitary and adrenal glands behave in a similar manner in their attempt to meet the damage to structure and the drain upon their function that must result from the supply to their cells of blood heavily contaminated with toxic matter. In the case of the adrenal this is supported by the remarkable pigmentation of the skin which develops in stasis, especially in those of the brunette type.

The Importance of Intestinal Auto-intoxication in the Aetiology of Other Diseases.—The depreciation in the vitality of the tissues renders them liable to be invaded and occupied by organisms which would not be able to obtain a foothold except for the lowered resisting power which results from stasis.

In young life the lymphatic tissues of the naso-pharynx are those most susceptible to infection. Later in life the gums about the teeth are constantly exposed to invasion by organisms which probably grow in the food which collects in this situation. This infection is described as pyorrhoea. When it is advanced its products infect the circulation, while the purulent material being swallowed increases the putrefactive and other changes in the gastro-intestinal tract.

Diseases which ensue on account of the lowered vitality of the tissues are: Tubercle, rheumatoid arthritis, Still's disease, Addison's disease, Raynaud's disease, diabetes, exophthalmic goitre, adenoma of the thyroid, ulcerative colitis, microbic cyanosis, asthma, dementia precox, paralysis agitans, disseminated sclerosis, infective endocarditis, and many skin diseases.

This list of diseases might be added to largely, but the number is sufficient to illustrate the view that they are due to infection of the tissues of a toxic subject by organisms or other deleterious matter which could not obtain a foothold in one whose drainage system is efficient. (W. A. LA.)

INVERFORTH, ANDREW WEIR, 1ST BARON (1865–), British ship-owner and administrator, was born at Kirkcaldy April 24 1865. He was educated at Kirkcaldy and afterwards adopted a business career, founding in 1885 the firm of Andrew Weir & Co., ship-owners and merchants, of London and Glasgow. Having made a large fortune in business, in April 1917 Mr. Weir entered Mr. Lloyd George's government as surveyor-general of supply at the War Office, and held this post until Jan. 1919, when he became Minister of Munitions and Supply. The same year he was sworn of the privy council and raised to the peerage, being also awarded the American D.S.M.

IOWA (*see* 14.732).—The pop. of Iowa in 1920 was 2,404,021; in 1910, 2,224,771; an increase of 8·1%, as against a decrease of 0·3% in the preceding decade. In 1915 the native whites of native parentage numbered 1,422,464; those of foreign or mixed parentage 654,855, and the foreign-born whites 264,003. The negro pop. was 16,744. There were in 1920 43·2 inhabitants per sq. m. as against 40 in 1910. In 1920 the urban pop. was 36·4% of the whole.

There were seven cities having a pop. of over 25,000, as follows:

	1920	1910	Increase per cent
Des Moines . .	126,468	86,368	46·4
Sioux City . . .	71,227	47,828	48·9
Davenport . . .	56,727	43,028	31·8
Cedar Rapids . .	45,566	32,811	38·9
Dubuque	39,141	38,494	1·7
Waterloo	36,230	26,693	35·7
Council Bluffs . .	36,162	29,292	23·5

Agriculture.—In 1909 Iowa led all states in crop acreage and was second to Illinois in crop value. In 1919 the aggregate crop acreage in Iowa was 20,420,374, and the value of all crops $890,391,299; two states, Texas and Kansas, outranked Iowa in acreage, Texas alone in crop value. In 1919 Iowa was first among the states in the acreage, production and total value of both corn and oats, and was outranked only by New York in the production of hay. Iowa's corn crop in 1909 was 341,750,460 bus. valued at $167,622,834 from 9,229,378 ac.; in 1919 371,362,393 bus. valued at $501,339,232 from 9,006,733 acres. The oat crop in 1909, from 4,655,154 ac., was 128,198,055 bus. valued at $49,046,888; in 1919 the yield had increased to 187,045,705 bus. valued at $140,284,289 from 5,484,113 acres. In 1920 Iowa led in the value of domestic animals, was surpassed by Texas alone in the number of cattle on farms, and led in the number of horses and swine on farms. The value of domestic animals was $585,889,568 in 1920 as against $393,003,196 in 1910. The number of cattle on Iowa farms in 1920 was approximately 4,567,708 and of horses 1,386,522; while in the number of swine Iowa had increased from 7,545,853 in 1910 to 7,864,304 in 1920 (11% of the whole number for the United States). The number of fowls reported in 1920 was 28,352,515, valued at $27,779,633.

Manufactures, Mining and Transportation.—Meat-packing continued to lead manufacturing industries, the value of products of slaughtering and meat-packing having increased from $59,045,232 in 1909 (U.S. Census) to $221,692,868 in 1919 (*Iowa statistics of Manufactures*, for the year 1919). In 1909 and in 1914 Iowa ranked sixth among the states in the value of this product. The second industry in value in 1919 was that of food preparations, including the production of cereals and breakfast foods. The product in 1909 was valued at approximately $9,795,000, but by 1919 had increased to $80,583,382. The value of foundry and machine-shop products increased from about $14,064,000 in 1909 to $40,632,692 in 1919, and the value of butter, cheese, and condensed milk from approximately $25,850,000 in 1909 (when Iowa ranked third among the states) to $49,201,934 in 1919. The value of the production of buttons in 1909 was $4,000,000; $4,794,422 in 1919. The value of all manufactured products was $259,237,637 in 1909; $698,035,251 in 1919.

The most important mineral product in Iowa is bituminous coal; in 1910 the value was $12,682,106; in 1918 $24,703,237. The value of clay and clay products in 1918 was more than five million dollars. In 1919 cement was valued at $7,798,347, and gypsum products at $2,403,012. The mileage of steam roads was 9,781·65 m. in 1910, and on Dec. 31 1918, according to the 1919 report of the Railroad Commissioner, 9,841·17 miles. The mileage of interurban electric lines, however, had increased from 373·92 m. to 512·13, or about 37%.

Education.—The Federal census of 1910 credited Iowa with the smallest percentage of illiteracy of any state in the Union (1·7%). In 1920, Iowa still maintained her illiteracy had been reduced to 1.1%. State aid became an important factor in the development of public schools in the decade following 1910. Legislation granting such aid to large, centrally located, consolidated schools, replacing small scattered ones, fostered development and stimulated local endeavour. At the close of 1920 there were 430 consolidated districts, including about 25% of the area of the state and taking care of approximately 50,000 pupils. In 1911 state aid was granted by law to high schools organizing normal training courses for the training of rural teachers. In 1918 172 schools in the state were maintaining such courses. In 1917 a state board for vocational education was established to take advantage of the provisions of the Smith-Hughes Act of Congress, offering Federal aid for vocational education. A law, enacted in 1919, provided for part-time schools for the benefit of children between the ages of 14 and 16 working on employment certificates. The establishment of these schools was required where there were 15 eligible pupils in the district; at least eight hours of instruction per week, between the hours of 8 A.M. and 6 P.M., must be given; and the attendance became compulsory. The educational progress of the state is shown in the reports of Dr. Leonard P. Ayres upon surveys made for the Russell Sage Foundation. In 1910 a tabulation of the states on the basis of 10 educational items led to a final relative rating in which Iowa ranked thirtieth. A similar rating in 1918 gave Iowa seventh place.

Legislation.—The only constitutional change made during the decade 1910–20 was an amendment ratified by the people in 1916. It fixed the time of the general election for that year on the same day as the presidential election, the time of election thereafter to be determined by the General Assembly. In 1916 a constitutional amendment extending suffrage to women was submitted to the electors of the state but was defeated. The process of amendment was again under way when the Federal suffrage amendment was adopted in 1920. The vital portions of the "mulct tax" law of 1894 (*see* 14:734) were repealed by the General Assembly in 1915, thus restoring statutory prohibition in Iowa, but a prohibitory amendment to the state constitution was voted down by the electors in Oct. 1917. The constitution of 1857 provided that in 1870 and every ten years thereafter the question, "Shall there be a Convention to revise the Constitution, and amend the same," should be submitted to a vote of the electors of the state, and in case of a favourable vote the General Assembly should provide by law for the election of delegates. In the election of 1920, for the first time, the vote showed a majority in favour of a convention.

The General Assembly in 1913 passed an Employers' Liability and Workmen's Compensation Act, to be administered by an industrial commissioner; and at the same session a Mothers' Pension Act was passed, providing for the granting to widowed and indigent mothers of sums not to exceed $2 per week for each child under 14 years of age. In 1915 the Perkins Law was passed providing that crippled children of poor parents might be sent to the hospital of the medical college of the state university for free treatment. In 1917 an appropriation was made by the General Assembly for the erection and equipment of a hospital at Iowa City for such children. Two years later the General Assembly provided that adults as well might be sent to Iowa City for free medical and surgical treatment. In 1917 the General Assembly established at Iowa City a child-welfare station for the consideration of conditions and measures.

An important development was the farm bureau movement. By 1917 organizations among farmers in the state were numerous, and in that year the General Assembly passed an Act providing that where a farm-improvement association in any county had among its members 200 farmers or farm owners and had raised $500 in annual subscriptions, the county board of supervisors was authorized to contribute $2,500 for the employment of a county agent. A law in 1919 modified the amount and terms of the payment by the county, and made the contribution mandatory. The movement gained rapid headway, county associations being established for the betterment of both social and economic conditions and the improvement of agricultural methods. In 1920 there was a farm bureau in each county and two in Pottawattamie county, 100 in all, with 100 county agents, and a membership of over 100,000. Iowa had become the leading state in the Union in the development of this movement. There was also a considerable growth within the state of a farmers' educational and coöperative union which had over 20,000 members in 1920.

Government and Finances.—The commission plan of government, authorized in 1907 for cities of 25,000 or more inhabitants, was made applicable in 1911 to cities of 7,000 and in 1913 to cities of 2,000 or more inhabitants. By 1920 nine cities had organized under the commission plan: Burlington, Cedar Rapids, Des Moines, Fort Dodge, Keokuk, Marshalltown, Mason City, Ottumwa and Sioux City. In 1915 the General Assembly passed Acts allowing cities to organize their municipal government under either of two city-manager plans. One of these plans—which represents only a slight variation from the mayor-council type—had been adopted by 1920 in a number of the smaller communities. The other plan, patterned closely after that of Dayton, O., had in 1920 been adopted by only two Iowa cities—Dubuque and Webster City.

In 1913 the number of Supreme Court judges was increased from six to seven; the number of district judges increased from 53 in 1910 to 64 in 1920. The General Assembly in 1913 provided that Supreme, District and Superior Court judges should be nominated and elected on a non-partizan ticket, but in 1919 the nomination and election of judges was restored to a party basis.

In the interests of a shorter ballot, in 1913 the State Superintendent of Public Instruction, the clerk of the Supreme Court and the Supreme Court reporter were made appointive officers. In 1917, however, the State Superintendent of Public Instruction was restored to the list of elective officers. In 1911 the office of commerce counsel was created, the incumbent to be appointed by the Board of Railway Commissioners and to serve as expert counsel for that Board. In 1913 the Department of Insurance was created, headed by a commissioner, and in 1917 a State Banking Department was organized and the office of Superintendent of Banking created. In 1915 a State Board of Audit and a State Board of Accountancy were created, and the office of Document Editor was established to relieve the Secretary of State. The road administration was reorganized in 1913 when the General Assembly established a highway commission consisting of the dean of engineering of the State College of Agriculture and Mechanic Arts and two appointive members. Highway legislation in 1919 divided the highways into primary and secondary systems, and arranged for the distribution of Federal and state aid funds for the hard surfacing of primary roads.

The state and local taxes together for the year 1910 amounted to $32,500,045; in 1919 they had increased to $80,495,235. The total income of the state alone from all sources for the year ending June 30 1910 was $4,337,528; for the year to June 30 1920, $20,225,742.

History.—The history of Iowa in the decade 1910-20 was marked by no economic or political changes of great importance. The state remained predominantly agricultural. Although its manufactures increased in importance, it was little disturbed by industrial controversies. The supremacy of the Republican party in politics was not seriously questioned. Owing to a split in the Republican party in 1912, the Democratic candidate for president received the electoral vote of Iowa, but the state returned to the Republican ranks in 1916, and in 1920 cast an overwhelming vote for Harding for president and for Nathan E. Kendall for governor. Throughout the decade U.S. Senator Albert B. Cummins continued to represent the state. The death of Senator Jonathan P. Dolliver in 1910 caused a vacancy which was filled temporarily by the appointment of Lafayette Young. In 1911 William S. Kenyon was chosen to fill the position and was reëlected in 1913 and 1918.

The adjutant-general of the state estimated in 1919 from official sources that nearly 110,000 men from Iowa served in the army, navy and marine corps in the World War. The total amount raised in Liberty and Victory loans in Iowa was $508,935,000. In the Third and Fourth Liberty loan campaigns Iowa was the first state in the Union to exceed its quota. Republican governors were elected or reëlected every two years, incumbents being: Beryl F. Carroll, 1909–13; George W. Clarke, 1913–7; William L. Harding, 1917–21; Nathan E. Kendall, 1921– .

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(J. C. P.)

IRELAND, JOHN (1838–1918), American Roman Catholic prelate (*see* 14.742), died at St. Paul, Minn., Sept. 25 1918. He urged full support when America entered the World War, and in May 1917 delivered a patriotic address in St. Paul before some 50,000 people assembled to bid farewell to a large body of recruits on their departure for training.

IRELAND, JOHN (1879–), English musical composer, was born at Bowdon, Cheshire, Aug. 13 1879, the son of Alexander Ireland, editor and proprietor of the *Manchester Examiner*. He was educated at Dinglewood preparatory school, Colwyn Bay, and Leeds grammar school, and afterwards entered the Royal College of Music. Later he was organist to St. Luke's Church, Chelsea, and obtained the degree of Bachelor of Music at Durham University in 1908. His earliest published work was the *Phantasy* trio for piano and strings (1908), followed by sonatas in D minor and A minor for violin and piano and a second trio in one movement. In 1913 appeared an orchestral work *The Forgotten Rite.* His other works include *Decorations* (1914) and *Rhapsody* (1915) for piano; Four Preludes for pianoforte (1915); a trio in E minor (1917); a piano sonata in E (1919) and a series entitled *London Pieces* (1917–20); together with a vast number of songs and much church music.

IRELAND (*see* 14.742).—On March 31 1911, the pop. of Ireland amounted to 4,390,219. Since the preceding census the pop. had decreased by 1·7%, the smallest decrease on record. In the preceding decade, Leinster had increased its numbers by 0·8%, while Ulster diminished by 0·1%, Munster by 3·8% and Connaught by 5·6%. The urban pop. (1,470,595) continued to grow at the expense of the rural (2,919,624); Dublin and Kildare were the only counties to show an increase in the decade, while the city of Dublin increased 6·4% to 309,272, Rathmines and Rathgar 17·1% to 38,190, Pembroke 13·4% to 29,260, Belfast 10·4% to 385,492, Cork 0·7% to 76,632, Londonderry 2·3% to 40,799, Limerick 0·7% to 38,403, Waterford 2·5% to 27,430, and Galway, alone of the larger towns, decreased 1·3% to 13,249. The agricultural class fell to 780,867, the industrial to 613,397, and the domestic to 170,749, while the professional class rose to 141,134, and the commercial to 111,143; 2,572,929 were classed as indefinite and non-productive.

The 1911 census gives the latest definite figures available up to 1921; but the Registrar-General's annual return of births and deaths combined with the emigration statistics, gave an estimated total pop. of Ireland in 1920 at 4,470,000. Table 1 gives the annual figures.

TABLE 1.—Vital Statistics

Year	Births	Deaths	Marriages	Emigrants
1906	103,536	74,427	22,662	35,344
1907	101,742	77,334	22,509	39,082
1908	102,039	76,891	22,734	23,295
1909	102,759	74,973	22,650	28,676
1910	101,963	74,894	22,112	32,457
1911	101,578	72,475	23,473	30,573
1912	101,035	72,187	23,283	29,344
1913	100,094	74,694	22,266	30,967
1914	98,806	71,345	23,695	20,314
1915	95,583	76,151	24,154	10,659
1916	91,437	71,391	22,245	7,302
1917	86,370	72,724	21,073	2,111
1918	87,304	78,695	22,570	980
1919	89,325	78,612	27,193	2,975
1920	—	—	—	15,531

Religion.—At the census of 1911, Roman Catholics in Ireland numbered 3,238,656 (a decrease of 70,005 in ten years), Protestant Episcopalians 574,489 (5,600 decrease), Presbyterians 439,876 (3,400 decrease), and Methodists 61,806 (200 decrease). Roman Catholics amounted to 83·1% of the pop. in Dublin city, 71% in co. Dublin, 25·4% in Belfast, and 33·1% in N.E. Ulster.

Railways.—The total authorized capital of Irish railways on December 31 1919 was £45,354,724, of which the amount raised, including loans and debenture stock, was £44,240,055. The receipts in that year reached £9,392,599 and the expenditure £7,607,534, leaving a net revenue of £1,785,065. Ordinary passengers numbered 24,581,699, workmen 3,914,400, season-ticket holders 20,016, and 786,672 were carried free on behalf of the Government. The total mileage run was 20,521,942. The total of merchandise carried was 6,028,110 tons, and live stock 3,991,547.

Agriculture.—Table 2 shows the amount of land under the principal crops, and their estimated yield for the year 1920. The number of acres under flax in the year 1919 was 95,610, producing 13,720 tons. The hay crop for the same year was estimated at 4,809,645 tons taken from 2,520,096 acres. The hay crop for 1920 was estimated at 5,547,271 tons.

TABLE 2.—Crops, 1920

	Extent in acres	Estimated Yield, cwts.
Wheat . . .	50,252	751,333
Oats . . .	1,332,050	18,682,309
Barley . . .	206,888	3,225,700
Rye . . .	5,580	67,812
Turnips . . .	276,507	82,149,240
Mangels . . .	77,447	24,910,140
Cabbage . . .	28,409	6,352,260
Potatoes . . .	584,316	39,718,200

Table 3 shows the number and size of holdings in Ireland in 1918.

TABLE 3.—Agricultural Holdings, 1918

Size	Leinst'r	Munst'r	Ulster	Conn't	Ireland
1 ac.	38,809	33,403	33,895	8,717	114,824
5	12,752	9,327	15,964	8,302	46,345
10	10,317	7,983	27,480	18,747	64,527
15	8,162	6,870	24,819	19,411	59,262
30	17,906	20,072	48,496	36,498	122,972
50	13,224	20,486	24,683	14,594	72,987
100	13,132	22,374	15,540	6,629	57,675
200	6,929	9,885	4,123	2,338	23,275
500	2,947	2,897	1,145	1,161	8,150
	657	472	322	517	1,968
Total No. of Holdings	124,835	133,769	196,467	116,914	571,985

The figures in Table 3 are not comparable with those published for years prior to 1910. In many cases farms in Ireland extend into two or more townlands, and in former years that portion of a farm in each townland was enumerated as a separate holding. The total number of holdings published was therefore somewhat too large. A change was made in the method of enumeration in 1910.

Of the holdings in 1918, 372,815 were owned and 199,170 rented. These 571,985 holdings were held by 561,807 separate occupiers.

Agricultural Coöperation.—On March 31 1920 there were, under the auspices of the Irish Agricultural Organization Society, 334 creameries, 101 auxiliary creameries, 371 agricultural societies, 136 credit societies, and 96 other societies. The total membership was 135,669, and the total turnover for the 686 societies for which figures were available was £11,158,583. This is approximately equal in value to £4,463,433 in 1914 in which year the actual turnover was £3,666,724. The total quantity of milk received by the creameries had, however, fallen from 92,300,561 gal. in 1914 to 78,463,271 gal. in 1919.

Land Laws.—Up to March 31 1921 the rents of 383,145 holdings, representing 11,394,275 ac., had been fixed for a first statutory term with an aggregate reduction of 20·7 % on the old rents; 144,133 holdings representing 4,439,026 ac. for a second term with an aggregate reduction of 19·3 %; and 6,123 holdings representing 198,364 ac. for a third term with an aggregate reduction of 9·1 %.

On the same date, under the Land Act of 1903, advances amounting to £63,030,264 had been made to 174,053 tenants for the purchase of their holdings on 6,937 estates; 1,005 estates with 33,066 tenants and a total purchase money of £8,594,952, were still pending; and 3,685 applications for advances amounting to £1,247,127 had been refused. The Estates Commissioners had further purchased 909 estates direct from their owners for £8,483,941, and 17 estates, whose purchase money was estimated at £69,720, were under consideration. The Congested Districts Board had purchased 283 estates for £2,920,197, and four estates estimated at £25,990 were under their consideration.

In 1907 an Evicted Tenants' Act was passed to enable the Estates Commissioners to acquire untenanted land compulsorily for the purpose of providing holdings for tenants who or whose predecessors had been evicted from their holdings since 1878. Over 13,000 persons applied for reinstatement, of whom over 3,500 were reinstated, and the remainder rejected after inquiry into their claims.

The Irish Land Act of 1909 relieved Irish ratepayers of the liability of making good the loss caused by the flotation of stock to finance the 1903 Act at a discount. It substituted a graduated bonus varying inversely with the number of years' purchase of the tenant's holdings for the fixed bonus of the 1903 Act, payment of future purchase agreements in 3 % stock for the cash payment of the previous Act, and offered extra facilities to vendors who were willing to accept 2¾ % stock in total or partial payment of their claims in respect of pending purchase agreements.

Under this Act, up to March 31 1921, advances amounting to £4,870,788 stock were made to 17,375 tenants for the purchase of their holdings on 2,050 estates, and applications from 5,550 tenants for £1,117,016 stock to purchase their holdings on 414 estates remained outstanding. The Estates Commissioners had further purchased 245 estates for £813,481 stock and £92,723 cash, and 83 estates estimated at £398,735 stock and £182,487 cash were under consideration. The Congested Districts Board had purchased 446 estates for £2,154,417 stock and £2,457,046 cash, and had under consideration 214 estates estimated at £1,603,892 stock, and £114,185 cash. On lands purchased by the Estates Commissioners under the Irish Land Acts 1903–9, up to March 31 1921 25,325 tenants had holdings vested in them and were paying annuities on a total purchase money of £7,861,528. On lands purchased by the Congested Districts Board, 9,227 holdings had been vested for a total purchase money of £1,872,515.

In all, under these Acts, a sum of £74,004,992 had been advanced in cash, £10,057,975 in 2¾ % stock, and £7,976,435 in 3 % stock.

In Nov. 1920 a bill was introduced into the House of Commons to complete the operation of land purchase in Ireland. It made provision for fixing an appointed day not less than two and a half years and not more than three years from the passing of the Act. Up to that date landlords would be at liberty to enter into agreements for sale to their tenants as under the Acts of 1903 and 1909. On the appointed day, all tenanted agricultural land, with certain specified exceptions, was to vest in the Congested Districts Board or the Land Commission, according to the area in which it is situated. The land was to be resold to the tenants at a standard price fixed at such a figure that the annuities on it calculated at 5¼ % would give the tenants in each county the same average reduction of their judicial rents (or, on non-judicial holdings, of rents calculated on the same principle as judicial rents) as had been enjoyed by other tenants in the same county who had purchased their holdings under the Act of 1903. The purchase money of all sales was to be paid in 5 % bonds. To this was to be added a sliding-scale bonus, varying inversely with the number of years' purchase of the holdings; and where agreements were made between the passing of the Act and the appointed day, this bonus might be increased by 1 %. Untenanted land in Congested Districts Counties was to vest in the Congested Districts Board at a price fixed by that body subject to a right of appeal to the Judicial Commissioner. This measure did not reach the Statute Book; but it was understood that a bill, substantially identical with it, would be introduced at a later date.

Textiles.—In 1907 (the last statistics available in 1921) the linen industry employed 75,692 operatives. In 1919 the number of spindles was 955,171 and the number of power looms 37,601. There are some twenty hosiery factories and as many tweed mills working in the country; the export of wool in 1919 decreased to 11,595,808 lb. The poplin trade is still practically confined to Dublin, the value of exports for 1920 being estimated at £20,000.

Fisheries.—In 1918 17,502 men were engaged in the fishing industry, the number of vessels in use being 4,717. The total capture of sea fish, excluding salmon, was 760,986 cwt., valued at £993,421. Shellfish was also taken to the value of £64,815; 12,006 persons were engaged in the salmon industry.

Other Industries.—In 1910 the number of gal. of spirits distilled in Ireland was 10,758,965, in 1915 10,249,436, and in 1919 11,076,516. The number of bar. of beer produced in Ireland in 1910 was 3,059,210, in 1915 3,412,520, and in 1919 1,806,046.

There has been little change in the mining industry. In 1918, 30,548 tons of iron ore were taken from the Antrim mines, and 92,001 tons of coal were extracted, valued at the pit mouth at £99,051. In 1917 5 tons of zinc were produced from zinc ore for the first time in Ireland, and in 1918 the production was 18 tons.

The export of biscuits for the 12 months ending Jan. 1921 was 10,990 tons against a pre-war average of 16,466 tons; of butter, 26,441 tons as against 36,110; of cheese, 5,832 tons as against 301; of bacon and ham 37,698 tons as against 55,232; of eggs, 8,986,268 great hundreds as against the pre-war average of 6,358,171 great hundreds; of condensed milk 7,813 tons as against 13,388; of margarine 3,592 as against 3,319; of stout, beer and porter, 376,332 tons against 214,717; of home-made spirits (including industrial spirit) 36,971 tons as against 33,399 tons.

Shipbuilding.—In 1920, 33 vessels were built in Ireland of an aggregate tonnage of 147,695, as compared with the 1919 tonnage of 222,955. Of these, 21 vessels of a tonnage of 116,543, were built at Belfast. The total tonnage in 1911 was 183,390, in 1912 163,481, in 1913 130,899 and in 1914 256,547. In 1915, 1916, and 1917 the tonnages were 38,095, 10,900 and 78,936 respectively, exclusive of Government vessels. In 1918 the total tonnage was 182,356.

Commerce and Shipping.—The most important part of the cross-Channel trade is still the export of cattle and other animals, particulars of which are given in Table 4. In 1918 the number of vessels registered at Irish ports was 809, tonnage 325,491. In the same year the vessels entering and clearing with cargoes in the colonial and foreign trade numbered 212 with a tonnage of about 444,000, and the vessels entering and clearing in the trade between Great Britain and Ireland numbered 30,522, tonnage over 9,350,000.

TABLE 4.—Exports of Animals

Year	Cattle	Sheep	Swine	Total
1909–13*	812,688	708,280	276,525	1,797,493
1919	765,251	507,145	192,540	1,464,936
1920	926,836	591,816	158,877	1,677,529

*Average of five years.

Table 5 shows the value of the direct foreign imports and exports (*i.e.* without transhipment at a port in Great Britain) for the last two pre-war years, and for the two years after the war. Table 6 shows the total trade.

TABLE 5.—Imports and Exports

Year	Imports	Exports
	£	£
1912	17,088,219	1,338,340
1913	17,332,408	2,119,383
1919	26,341,725	1,936,710
1920	42,590,409	1,555,862

TABLE 6.—Total Irish Import and Export Trade

	Imports		Exports	
Year	Value at prices in the year of importation	Value at 1904 prices	Value at prices in the year of exportation	Value at 1904 prices
	1,000£	1,000£	1,000£	1,000£
1904	55,345	55,345	49,815	49,815
1905	57,009	57,095	51,423	50,863
1906	58,794	57,523	56,035	53,445
1907	63,022	59,075	59,190	54,522
1908	60,190	56,829	57,445	53,732
1909	65,155	59,486	60,959	54,792
1910	66,431	59,624	65,896	56,966
1911	67,610	60,322	65,071	56,323
1912	73,953	63,221	67,168	56,708
1913	74,467	62,986	73,877	60,627
1914	74,125	61,176	77,311	63,243
1915	87,257	59,124	84,463	58,372
1916	104,517	56,619	107,171	58,716
1917	119,181	49,785	133,805	56,715
1918	126,016	44,167	152,931	50,569
1919	158,716	50,081	176,032	51,175

The figures for 1919 have been further analyzed as follows:—

	Imports	Exports
	£	£
Farm Produce, Food and Drink Stuffs	55,244,605	93,709,173
Raw Materials	24,433,511	6,776,687
Manufactured Goods	79,037,828	75,545,6[illegible]

Crime.—In non-political crime the latest year for which statistics are available is 1918, when 1,181 persons were committed for trial and 737 convicted, as against 1,414 and 918 respectively in the previous year. Of the 737 convicted, 169 were for offences against the person, 95 for offences against property with violence, 355 for offences against property without violence, 25 for malicious injury to property, 31 for forgery and offences against the currency, and 62 for other offences.

In the courts of summary jurisdiction there has been a notable decline in the number of cases of assault and drunkenness. These numbered 14,624 and 76,860 respectively in 1907, 13,085 and 64,322 in 1910, 12,869 and 59,519 in 1913, 9,397 and 40,488 in 1916, while in 1917 they sank to 7,161 and 24,788, and in 1918 to 6,899 and 13,235.

Amongst political outrages up to May 7 1921 there were 75 courthouses destroyed, 541 police barracks destroyed, 285 police barracks damaged, 3,138 raids for arms, 309 policemen killed, 491 policemen wounded, 102 soldiers killed, and 238 soldiers wounded.

Poor Law.—The number of persons in receipt of indoor and outdoor relief fell steadily from 1906 to 1914, the last year for which total figures have been published. In 1906 562,269 persons were relieved at a total annual cost of £1,070,181, in 1907 557,138 at £1,048,465, in 1909 588,222 at £1,105,328, in 1911 553,796 at £1,022,125, in 1913 499,588 at £1,033,863, and in 1914, 471,563 at £1,032,979.

Education.—In the 1911 census the age of nine years was taken as the datum line for those who could read and write, instead of the age of five years and upwards which had been previously adopted; 88 % could read and write, 3 % could read only, and 9 % could neither read nor write. Approximately 582,446 persons, or 12.2 % of the pop., were returned as being able to speak Irish; of these, 16,873 could speak "Irish only" and 565,573 could speak English and Irish.

In the year 1919, 7,316 boys and 4,803 girls presented themselves for the Intermediate Examination; of these, 3,819 and 2,340 respectively passed. About £42,000 was paid to secondary schools in grants and £6,413 to students in prizes. At the end of 1920, there were about 7,900 national schools in Ireland, the average number of pupils on the rolls being about 700,000. The Government grant for the year ending March 31 1921 was £4,469,811.

During the session 1919–20, 1,403 students attended Trinity College, Dublin; 1,095 attended Queen's University, Belfast; 1,332 attended University College, Dublin; 660 attended University College, Cork, and 270 attended University College, Galway.

TABLE 7.—Revenue

Year	Customs	Excise	Estate Duties Stamps etc.	Prop. and Inc'me Tax	Post Office	Miscellaneous	Total
	1,000£	1,000£	1,000£	1,000£	1,000£	1,000£	1,000£
1907	2,610	5,607	967	999	1,060	156	11,399
1908	2,679	5,579	986	996	1,094	144	11,478
1909	2,611	5,420	1,001	1,019	1,088	147	11,285
1910	2,742	4,487	977	388	1,110	142	9,846
1911	3,103	5,826	1,470	1,825	1,155	139	13,519
1912	3,013	5,668	1,262	1,206	1,207	132	12,489
1913	2,951	5,599	1,324	1,167	1,317	146	12,505
1914	3,006	5,842	1,415	1,162	1,368	140	12,945
1915	3,179	6,360	1,374	1,570	1,379	131	13,995
1916	3,920	8,231	1,399	2,912	1,474	144	18,083
1917	4,340	6,822	1,286	7,048	1,462	137	21,098
1918	4,251	4,291	1,592	9,833	1,545	129	21,646
1919	6,081	7,838	1,818	13,410	1,869	128	31,148

TABLE 8.—Expenditure

Year	Civil Charges	Collection of Taxes	Post Office	Total
1907	£6,226,500	£243,000	£1,209,000	£7,678,500
1908	6,312,000	242,000	1,256,000	7,810,000
1909	7,105,500	250,000	1,312,000	8,667,000
1910	9,077,500	270,000	1,365,000	10,712,000
1911	9,642,000	298,000	1,404,500	11,344,500
1912	9,799,500	269,000	1,465,500	11,533,500
1913	10,279,000	299,000	1,559,000	12,137,000
1914	10,417,000	318,000	1,622,000	12,357,000
1915	10,692,000	319,000	1,645,000	12,656,000
1916	10,603,000	315,000	1,679,000	12,597,000
1917	10,700,000	308,000	1,678,000	12,686,000
1918	11,002,000	317,000	1,683,000	13,002,000[1]
1919	11,312,000	329,000	1,896,000	13,537,000

[1] Exclusive of £8,624,500 on supplementary civil votes.

Finance.—For the last four years for which figures were available in 1921, there was a surplus of income over expenditure to the Imperial Treasury from Ireland of £5,332,000, £11,080,000, £13,863,000, and £15,113,500 respectively. Tables 7 and 8 give details.

The total amount of loans, exclusive of closed services, made by the Commissioners of Public Works up to March 31 1919 was £29,367,575, of which £20,027,511 had been repaid as principal, £12,645,401 as interest, and £472,061 remitted.

On June 30 1920, the amount of the deposits in Irish joint-stock banks was £163,509,000, in Post Office Savings Bank £13,600,000, and in trustee savings banks £3,353,000. By Dec. 31 1920 the amount in joint-stock banks had increased to £182,682,000 and in trustee savings banks to £3,414,000.

The following figures for 1919–20 provide an estimate of the national wealth:—valuation of lands, houses, etc., £16,144,000; value of principal crops, £93,609,000; value of cattle, etc., £85,617,000; paid-up capital and reserve funds of joint-stock banks, £11,547,000; bank deposits £179,868,000; investments in Government stock, £95,063,000; paid-up capital, etc., of railway companies, £44,240,055; paid-up capital of tramway companies, £4,195,000.

The net produce of the income-tax in Ireland in 1919–20 was £5,926,643. (F. C. Mo.)

POLITICAL HISTORY

The year 1910 marked the opening of a new phase in the history of Ireland. Irish political agitation in the past had lost its strength in proportion to the removal of economic grievances. The truth of this was illustrated by the effects of the Fair Rent Act of 1881, and once again by those of the Wyndham Purchase Act of 1903. In the six years between 1903 and 1909 some 217,000 tenants agreed to become purchasers of their holdings on terms advantageous to them and satisfactory to the owners, and during this period Ireland was apparently prosperous and contented. Had land purchase continued without interruption it is possible that the contentment would have continued also. Unfortunately in 1909 it became insistently apparent that the financial basis of the Act had broken down. The Act provided that the cash payable to the owner was to be provided by the issue of a sufficient amount of 2¾% stock, and that, if owing to the stock being at a discount, it became necessary to issue stock in excess of the nominal purchase money, the dividends on the excess stock should be met by the Guarantee Fund, meaning, in the result, the ratepayers in the Irish counties. In 1909 it became clear that the charge for necessary excess stock would bankrupt the county ratepayers, and the Government was compelled to take further action. Accordingly, Mr. Birrell by the Act of 1909 provided that the general taxpayer of the United Kingdom should take over, in relief of the Irish ratepayer, the liability already incurred for excess stock, and that as regards future purchase agreements vendors should be paid in 3% stock of the face value of the purchase money. Unfortunately, this 3% stock immediately fell below par and continued to fall in later years. Owners would not accept their purchase money in depreciated stock, and land purchase practically came to a standstill, while at least one-third of the country remained unsold.

Agrarian and Labour Problems.

It is possible, of course, to exaggerate the social effects of the complete carrying through of the land-purchase policy. It is true that under the Land Acts, and as a result of the Government's housing schemes, the lot of the Irish peasant improved immeasurably; that seemly cottages to a large extent replaced the thatched hovels of an earlier day; and that the occupiers who purchased, paying small annual instalments of purchase money fixed before the outbreak of the World War in 1914, earned subsequently disproportionate profits. But though the old Irish agrarian problem arising out of the landlord system had, since the passing of the Wyndham Act, been largely solved, there grew up in later years another problem due to the rapid increase of the class of "landless men," the sons of the prolific race of small farmers, a problem greatly accentuated by the stoppage of emigration during the war. The lot of the Irish labourers had become worse; for they had now to deal with a generation of close-fisted peasant proprietors in place of the easy-going squires of the old order.

Alongside of these agricultural labourers were the labourers of the towns. Outside Belfast and a few smaller northern towns there are few manufactures in Ireland and little employment in the towns save in transport services, wages being low and unemployment chronic. This want of manufactures and employment has, rightly or wrongly, been attributed in Ireland to the selfish trade policy of England, and it is easy to see how the revolutionary elements fostered by the distress in the cities gained a host of recruits throughout the country.[1]

Home Rule Question, 1910.

Another and even more fateful influence which began to operate in 1910—the reopening of the Home Rule question—was due to the result of the general elections, which by leaving the Unionist and Liberal parties almost equally balanced in the House of Commons made it clear that the Irish Nationalists, under the leadership of Mr. John Redmond, would hold the scales of power at Westminster. Thus Home Rule, kept in the background by the Liberal Government so long as it commanded an unchallenged parliamentary majority, became once more a main plank in the Liberal platform. The immediate effect was to revive the prestige of the Nationalist party, which had suffered some eclipse during the dull years of comparative contentment, and to give fresh impulse to the political agitation in Ireland.

The nature and goal of this agitation were little understood outside Ireland; and, indeed, from the first the issues were obscured by dissensions among the Nationalists themselves. Some years earlier Mr. William Martin Murphy, a leading employer in Dublin, had founded the *Irish Independent* in opposition to the official Nationalist organ, the *Freeman's Journal*. It was largely under his influence that, on the eve of the general election, the unity of the Nationalist party was broken by the secession of Mr. William O'Brien, who accused Mr. Redmond and Mr. John Dillon of "blocking land purchase" and of having sold the Irish vote to the Liberal party, an accusation which was to be repeated later, with fatal force, by the Sinn Feiners.[2]

General Election, 1910.

In the results of the elections in Ireland the effects of the Liberal-Nationalist alliance were significantly apparent: 11 "Independent Nationalists" were returned, among them being Mr. Tim Healy (N. Louth), and in the Protestant north, once the stronghold of Radicalism, only one Liberal, Mr. Redmond Barry, held his seat—in the predominantly Catholic constituency of North Tyrone. Ulster—or, rather, the solid Protestant block of the "six counties"—stood revealed as unalterably opposed to Nationalism. And behind the forces thus arrayed for the coming struggle there remained, sinister and menacing, the great political organizations which Ireland inherited from her troubled past—in Ulster the Orangemen, fiercely Protestant in spirit, who formed the backbone of the Unionist resistance; behind the Nationalists, the United Irish League and the Ancient Order of Hibernians, the latter exclusively Catholic and strong in its affiliation with the same order in the United States; and, last but not least, the Irish Republican Brotherhood, contemptuous of party alliance and constitutional methods.

Religious Cleavage.

Thus, while Home Rule was being debated in England as a mere problem in local self-government, in Ireland the revival of the question emphasized once more the cleavage in the nation, Protestant and Catholic standing ranged against each other, as they had stood since the 16th century, marking "the contrast not only of two creeds, but of two breeds, of two ways of thinking, of two ways of looking at all the most vital interests of men."[3] English politicians were proposing to legislate, in the spirit of the 20th century, for a country which industrially was "just early 19th century" and "in religious matters had not yet emerged from the 17th"; for in 1910, and later, it was still true that "religion is the touchstone by which every Irishman is tested,"[4] and that creed marked the line of cleavage in everything that made for national sentiment. This is the fundamental fact which must be grasped, if the root cause of subsequent troubles is to be understood.

Labour Movement.

Sinn Fein.

There were in 1910, however, other organized forces at work in Ireland, destined to cut across the traditional lines of political and religious cleavage. At this time the labour movement became organized with the foundation of the Irish Transport and General Workers' Union, under the leadership of James Larkin, a fiery demagogue, and James Connolly, who had founded the Irish Socialist Republican party in 1896, and who returned from America in 1910 inspired with a burning resentment at the conditions of life to which Irish working people were too often subjected. This Labour movement, of which the centre was established at Liberty Hall in Dublin, also threw itself into opposition to the official Nationalists, its spokesmen pointing out that influential Nationalist members of the Dublin corporation were responsible for the condition of the city slums by which they profited, and that from the point of view of labour there was nothing to choose between the dominant political parties. Equally opposed to the official Nationalists was another organization, which included among its objects the general improvement of social and industrial conditions in Ireland—the association known as Sinn Fein ("we ourselves"). Sinn Fein was quiescent during the elections, but was none the less active behind the scenes. Its more prominent members, who were recruited mainly from the ranks of the young "intellectuals," scorned the opportunist policy of the official Nationalists; gloried in upholding the tradition of Wolfe Tone and Robert Emmet; and openly aimed at establishing an independent Irish Republic.[5] In 1910 indeed they still advocated none but peaceful methods; but they were already planning the application of the policy advocated by their leader, Mr. Arthur Griffith,[6] namely that of using against "British rule" in Ireland the methods which had been successfully employed by the Magyars against Austrian rule in Hungary; and in their annual congress, held Sept. 29, they proposed making fresh efforts for the withdrawal of the Irish members from Parliament. Their ardent nationalism, based on a somewhat reckless idealization of Ireland's past,[7] present and future, was already a force to be reckoned with, though the politicians continued to ignore it; for it appealed to many of the better elements in the country, less owing to its defiance of "British tyranny," than to its revolt against the dubious methods of the Irish Nationalist organization, with its local "bosses" and rings and its reliance on the support of the publicans and "gombeen men."[1]

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[1] Very large numbers of the agricultural labourers were affiliated to the Irish Transport and General Workers' Union, the headquarters of which in Dublin, Liberty Hall, became the centre of the communist movement in the British Isles, and thus introduced a new factor in Irish political disturbances.

[2] In the *Cork Accent*, the first number of which appeared on Jan. 1 1910, Mr. O'Brien thus stated his mission:—"Ireland is passing through a grave crisis. She is being plundered by the Radical Government (a reference to the Finance Act) and gagged by the 'Molly Maguires' (the Ancient Order of Hibernians). The present Government has carried out Mr. Dillon's wishes, and killed land purchase in Ireland, thus robbing the country of the fruits of thirty years' agitation. It was only a knave would make, or a fool believe, the assertion that Home Rule was to be passed when the Lords' Veto was abolished. Under the rule of the 'Molly Maguires' no Protestant could be admitted into the National movement, be a member of a public board or a public contractor, obtain a position in the gift of a public body, or even get the Catholics' custom in his shop; and that section would either be starved out of existence or out of the country."

On Feb. 11 1910 a public meeting was held at Cork, under the presidency of the Lord Mayor, for the purpose of founding a new Independent Nationalist daily newspaper—the *Cork Free Press*. On this occasion Mr. O'Brien stated that at the elections the candidates "opposed to the despotism of the 'Molly Maguires' had received 45,547 votes, while the candidates of the 'Molly Maguires' only polled 44,865 votes put together."

[3] Dr. Mahaffy, Provost of Trinity, in the Convention of 1917.

[4] "Dogmatism in Irish Life," by Ernest A. Boyd, *Irish Review* (1913), p. 241; *ib.* p. 244.

[5] The Sinn Fein group had originally favoured Irish independence under the Crown, *i.e.* the Constitution of 1783. Republicanism was first openly professed by their organ *Irish Freedom* in 1910.

[6] In "The Regeneration of Hungary" (1904), which originally appeared as a series of articles in the *United Irishman*.

[7] Most national movements have sought inspiration in the belief in a golden age of national civilization, real or imaginary, in the past. It is certainly true of the Irish question that nobody can understand it who does not realize the immense part played in Ireland by historical tradition, true and false. As for the legend of the golden age of Irish civilization destroyed by the English invaders, the truth of this may be tested by readers of the *E. B.* by reading the article IRELAND: *Early History* (14.756) by the late E. C. Quiggin, an eminent Celtic scholar who wrote in a spirit wholly detached and scientific. This may be compared with the article BREHON LAWS by Mr. Lawrence Ginnell, the Nationalist M.P.

Less popular in its appeal, but none the less of considerable political significance, was the enthusiasm of the Sinn Feiners for the revival of the Irish (Gaelic) language and a specifically Irish learning and culture. The Gaelic League, founded in 1893 for the promotion of these objects, was not indeed as yet identified with the Sinn Fein separatist movement; but an important step seemed to have been taken towards the realization of the Sinn Fein ideal when, in Sept. 1910, the Senate of the new National University decided that a knowledge of Gaelic should be required of all candidates for matriculation from 1913 onward.[2]

Land Agitation.

Meanwhile, on the surface of Irish history during 1910 the most conspicuous happenings were connected with the renewed land agitation, the battle of the factions within the Nationalist ranks, and the marshalling of the forces for and against the Union in view of the imminence of a Home Rule bill. The policy of violence for securing the distribution of the land had been deliberately reaffirmed by the United Irish League on Nov. 28 1909, two days after the passing of the Land Act; and since, in pursuit of its policy of conciliation, the Liberal Government had repealed the Arms Act, suspended all "coercive" legislation, and reduced the forces of the Constabulary, it proved quite incapable of coping with an organized campaign of outrage. At the meeting of the League in Dublin, Mr. Denis Johnston, a member of the Directory, said that "the people should make up their minds to put a ring of fire round every land-grabber and grazier in the country[3] and tell them to quit," and under the auspices of the League, throughout the year, cases of boycotting, cattle "driving," cattle maiming, firing into dwelling houses, and the like, continued in various counties. The conditions in this respect were not so bad as in the days of the Land League; but they were bad enough, and they had less excuse.

Nationalist Parties and Home Rule.

Meanwhile the struggle between the rival Nationalist factions was a bitter one, and rioting took place between the champions of Mr. O'Brien and Mr. Redmond.[4] In such circumstances the declared policy of the new "All-for-Ireland League," started by Mr. William O'Brien in Cork City on March 31, seemed like irony. It aimed at "a combination of all the elements of the Irish population in a spirit of mutual tolerance and patriotic good-will," at "guaranteeing the rights of the Protestants, winning the friendship of the British people, and disarming the prejudices of Irish Unionists against Home Rule." It was significant of later developments that, in putting forward this programme, Mr. O'Brien had the support of many well-known Irish Constitutionalists, as well as of many Nationalists.[5]

In general, however, Irish Unionists were less impressed by Mr. O'Brien's conciliatory rhetoric than by the fact that the Redmondite party had been carried to victory on the cry of "Up the Mollies!"[6] The Robert Emmet celebration early in March, conducted simultaneously in New York and Dublin, seemed to emphasize the true aim of the Nationalist movement. In New York aid was invited for the members of Parliament who were "working for independence through legislation."[7] In Dublin a republican orator, Mr. Bulmer Hobson, declared that "they had not in readiness any means to knock down an English dreadnought, but the Germans might do it for them."[8] The impression made by these demonstrations was strengthened as a result of the visit of Irish leaders to America in the autumn, for the purpose of collecting campaign funds. Messrs. Redmond, Devlin and Boyle left Ireland on Sept. 18 for the United States, while Mr. T. P. O'Connor went on a similar mission to Canada. Unionists duly noted the following passage from a speech delivered by Mr. Redmond at the Buffalo Convention:—

> Without freedom, all these great concessions (Land Acts, etc.) are practically valueless, or at any rate such value as they do possess is to be found in the fact that they strengthen the aim of the Irish people to push on to the great goal of national independence. . . . I have come here to-day to America to ask you to give us your aid in a supreme and, I believe, a final effort to dethrone once and for all the English Government of our country.[9]

In spite of this apparently unequivocal utterance Mr. Redmond was loudly accused in Ireland, notably by the Sinn Feiners, of "lowering the flag," a charge which, after his triumphant return on Nov. 12 with a fund of $200,000, he proceeded to rebut. Thus at Tipperary on the 13th he referred to the "ridiculous rumour" that he had lowered the flag, and at Waterford, on the 27th, he defined his demands for Ireland as a Parliament elected by the Irish people, with an executive responsible to it, and with full control of purely Irish affairs. This definition of "independence" only increased the wrath of the extremists, while Unionists failed to be convinced by his asseveration that under Home Rule there would be no "persecution of Protestants." In Dublin, on Nov. 26, a great meeting of Irish Unionists recorded their unalterable opposition to Home Rule in any form; and two days later, another great meeting at Belfast uttered a more ominous note, the threat being uttered that no taxes would be paid to a Home Rule Parliament, and that any attempt to enforce Nationalist Government on Ulster might meet with armed resistance. Thus the year 1910 ended with the first rumblings of the storm to come. A minor event of this year, which attracted no notice in England but embittered feeling in Ireland, was the decision of the Cunard Co., with the consent of Government, to omit the call at Queenstown of their great trans-atlantic liners. This was due to the exigencies of competition with the rival foreign lines, but was widely assumed in Ireland to be a fresh example of the deliberate policy of Great Britain to depress Irish commercial interests.[10]

The year 1911 was, on the whole, uneventful in Ireland. Agrarian unrest continued, with sporadic cases of cattle-driving, boycotting, shooting and bomb outrages, and incendiarism; and in many cases, owing to intimidation of witnesses, the Crown was unable to bring the perpetrators to justice.[11] At Wexford, in Jan., a demonstration of the Gaelic Athletic Association was held, under the presidency of the mayor, at which the Association was definitely advertised as a rebel organization.[1] Demonstrations were also organized against the celebrations connected with the coronation of King George V. On Coronation Day (June 22) a meeting at the Custom House in Dublin was addressed by John Devoy, Countess Markievicz and others, in terms of violent denunciation, and the preparations made for the reception of the King and Queen in Dublin were met by a formal protest on the part of the Ancient Order of Hibernians, which declined "to identify itself with the wretched compromise sought to be effected by the misguided section of our fellow-countrymen who seek to sacrifice the great national principle of Ireland as a nation by the slavish adulation of a foreign monarch."[2] This protest was reëchoed in a resolution passed by a meeting of Sinn Fein;[3] but the royal visit to Dublin (July 7–11) was none the less a great success. Mr. Redmond, speaking at Woodford in Essex, had indeed emphasized the loyalty of the Nationalists to the Crown and Empire, and had been duly denounced by *Irish Freedom*, a Sinn Féin monthly, for betraying Irish Nationalism in "an orgy of Imperialism."

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[1] Paul-Dubois, in his *Contemporary Ireland* (1908), called attention to the good effects of the bill of 1898, which set up in Ireland the British system of democratic local government. He added, however, "Even at the present there is a tendency to 'corner' offices and even contracts for members of this or that political league; the custom of *combinazione* is widely diffused; everybody is on the scent for places for his friends and relatives; and the reign of rings and bosses seems to be opening."

[2] For statistics of the rapid decay of Gaelic from 1851 onward *see* 5.616. The efforts to revive it have not met with any wide popular response; which is the less surprising as modern literary Gaelic is largely an artificial language unintelligible to the Irish who still speak the dialects of Connaught, Munster and Ulster.

[3] Ireland is preëminently a grazing country. The uncertain climate is unfavourable to the growth of corn, and the soil which produces magnificent pasture is often too rich for cereal crops.

[4] At Kilcommon, near Ballimore, on March 21, the fighting between the factions was so severe—even revolver shots being exchanged—that the Constabulary had to interfere. At Dundalk, on Sept. 8, a Redmondite mob invaded the town hall, where Mr. T. M. Healy was addressing his constituents, and pelted the platform with iron bolts and stones.

[5] A letter from the Earl of Dunraven, approving the movement, was read at the inaugural meeting.

[6] Mr. William O'Brien explained this as meaning "boycott of Protestants." In Ireland "Unionist" and "Protestant" are, or were, practically synonymous terms, though many better-class Catholics are Unionists and some Protestants Nationalists.

[7] *Freeman's Journal* of March 1910.

[8] *ib.*, March 8.

[9] *Irish World*, Oct. 8 1910.

[10] This and the natural competition of Liverpool are the sole foundation for the charge made in the report of the American delegates to the Foreign Relations Committee of the Senate that "England allows no ship to come trans-Atlantic to her ports" (66th Congress, 1st Session, Senate Document 106, p. 828).

[11] See, *e.g.*, the charge of Judge Madden to the Grand Jury of Galway. (*Freeman's Journal*, March 2 1911.)

Attitude of the North, 1911.

In view of this confusion of voices in the South it is perhaps not surprising that the mood of the Protestant North tended to harden; and this mood was at the moment still further embittered by attempts on the part of certain of the Catholic clergy to enforce the logical consequences of the *Ne temere* decree[4] in the case of "mixed marriages" already contracted. The annual July celebrations[5] in Ulster passed off quietly, and a great meeting on Aug. 12 at Londonderry did no more than emphasize the *moral* of the successful defence of the city as applied to the present perils. On the 21st, however, a meeting of Presbyterians was held in the same city, in which a stronger note of defiance was sounded, one clergyman declaring that a Home Rule bill forced through the House of Lords would be resisted by force.[6] This defiant temper was illustrated more especially by the great Unionist demonstration at Craigavon, Belfast, on Sept. 23, at which a hundred thousand people were present. In an impassioned speech Sir Edward Carson protested against the "base betrayal" of the Irish loyalists contemplated by the Liberal Government. "Never," he said, "under any circumstances, would they submit to Home Rule."[7] At the same meeting an address was presented, signed by a thousand Ulster business men, pointing out the disastrous effects to Ulster industry of any separation from Great Britain; and on the following Monday, as a result of the mandate given by the great mass meeting, a conference at Belfast of delegates from Orange Lodges, Unionist Clubs and the Ulster Unionist Council, resolved to frame a constitution for Ulster and to set up a provisional Government, should the Home Rule bill become law.

Ulster and the Home Rule Bill.

The imminence of the introduction of the new Government of Ireland bill increased the agitation at the opening of 1912, and especially in the north of Ireland. On Jan. 5 a meeting of Southern Unionists at Omagh, in Tyrone, was addressed by Sir Edward Carson, who defended his attitude as leader of the Ulster resistance. He was, he said, a rebel in the sense that he desired to remain under the king and the Imperial Parliament and was prepared to face a charge on that issue. On the 16th the Ulster Unionist Council decided not to allow Mr. Winston Churchill to address a meeting in the Ulster Hall, Belfast, in favour of Home Rule. The meeting, however, took place on Feb. 8 on ground belonging to a Nationalist football club, and passed off without disaster, Mr. Churchill explaining "that any plan for Home Rule put forward would be an integral part of parliamentary devolution, and would not be inconsistent with the design of the ultimate federation of the Empire." The realities of the situation were, however, more clearly revealed by the great demonstration of Unionists held on Easter Tuesday at Balmoral, Belfast, and presided over by Dr. Crozier, the Protestant Primate of All Ireland. From the temper of this assembly it was clear that, as Mr. Bonar Law put it, "Ireland is not a nation, but two peoples separated by a deeper gulf than that dividing Ireland from Great Britain."

The same moral was drawn by Sir Edward Carson in his speech during the debate on the introduction of the Home Rule bill on April 11. The dividing line in Ireland, he said, was between Catholic and Protestant, and any argument for Home Rule for Ireland applied with equal force to Home Rule for the Protestant North. Mr. Asquith, on the other hand, declared it to be "impossible to concede the demand of a small minority to veto the verdict of the Irish nation"; but in the adjourned debate on the 15th Mr. Balfour exposed this fallacy. The United Kingdom, he said, should be treated as a whole: "If Ireland is a nation, what right has Great Britain to supremacy?"

Parliament and the Irish Question.

The debates on the bill in the House and in the country showed, indeed, an extraordinary confusion of mind in British legislators as to the Irish demand. There was talk of devolution as a step towards federalization, of "local autonomy" and of the necessity of delegating the work of the over-burdened Imperial Parliament. But the Irish Nationalists, whatever concessions they were prepared to yield to expediency, never budged from their principle of "Ireland a nation," with all that this implied. This ideal the bill did little enough to realize. It proposed to establish in Dublin a subordinate Parliament, consisting of two Chambers, and having control over all concerns in Ireland not specifically reserved to the Imperial Parliament; but the number of matters thus reserved, either temporarily or permanently, was very great,[8] while the difficulty, so long as any union existed, of disentangling the finance of the two countries opened the financial clauses of the bill to a destructive fire of criticism; for, as Sir Edward Carson had said at Liverpool (Jan. 23), without fiscal autonomy Home Rule was an impossibility.

Nationalists and the Bill.

In Ireland, the bill was endorsed by the Nationalist Convention which met in Dublin on April 23, but Mr. O'Brien pointed out in the House of Commons in the course of the second reading debate on April 30, that, save for the reconciliation it would bring, there was no finality about it. This, indeed, was the opinion of most people in Ireland, in spite of demonstrations to the contrary; and Prof. T. M. Kettle, of the National University, expressed the general view of Nationalists when he welcomed it as "not the end, but the beginning," and said that it had "the seed of freedom lodged in Irish soil."[9] Sinn Fein was less complimentary. According to Patrick H. Pearse, who was afterwards to head the Easter rebellion in 1916, Mr. Redmond by accepting the bill had "sold Ireland's birthright for a mess of pottage, and a dubious mess of pottage at that." He himself defined the object of true Nationalism as the completion of the work left unfinished by Wolfe Tone:—

> "To break the connexion with England, the never-failing source of all our political evils, and to assist the independence of my country—these were my objects. To unite the whole people of Ireland, to abolish the memory of all past dissensions, and to substitute the common name of Irishman in place of the denominations of Protestant, Catholic and Dissenter—these were my means."

In these words of Tone he found "implicit all the philosophy of Irish Nationalism, all the teaching of the Gaelic League and the later prophets."[10] It was the Sinn Fein confession of faith.

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[1] Mr. Daniel McCarthy said: "It is an organization to keep the bone and muscle of our country from donning the red coat or the black coat of England (*i.e.* from enlisting in the army or the Royal Irish Constabulary) . . . We want our men to be physically strong, and when the time comes the hurlers will cast away the caman for the sharp, bright steel that will drive the Saxon from our land." *Wicklow People*, Jan. 21 1911.

[2] Dublin papers, June 12.

[3] The resolution was seconded by Mr. Sheehy-Skeffington.

[4] *See* 17.755.

[5] In commemoration of William III.'s victory at the Boyne.

[6] *Notes from Ireland* (1911), p. 78.

[7] Text in *Notes from Ireland* (1911), p. 84.

[8] At Preston, on June 13, Mr. Balfour said that the bill gave Ireland a National Constitution without national powers.

[9] *Notes from Ireland* (1913), p. 40. Mr. Kettle joined the army and was killed at the front in France in 1915.

[10] Address at the grave of Wolfe Tone, June 22 1913, *Bodenstown Series*, No. 1.

Unionists, on the other hand, whose danger had been fully recognized by Mr. O'Brien, failed to be won over by the inadequate safeguards provided for them in the bill. The Synod of the Church of Ireland, with only five dissentients, protested against it, and the protest was reëchoed in a great meeting of Southern Unionists at Cork on April 20. In Ireland, at least, no one was convinced by Mr. Redmond's assertion, during the second reading debate, that the bill would be accepted by the Irish, in Ireland and out of it, as a final settlement.

Question of "Partition."

The debate on the committee stage of the bill, which opened on June 11, is mainly memorable owing to the fact that in it the question of the exclusion of Ulster was first definitely raised, the proposal being to exclude from the scope of the bill the four predominantly Protestant counties of Antrim, Armagh, Down and Londonderry. The motion was defeated, Mr. Asquith asserting that it was impossible to split Ireland, for which he claimed "a fundamental unity of race, temperament and tradition," while Mr. Redmond said that Home Rule was put forward as a national demand and that the Irish nation must not be partitioned. There was, however, little sign in Ireland of the correctness of Mr. Birrell's forecast that there would be no civil war and that the minority would accept the situation. The temper of the Protestant North was rapidly rising, and fortified by Mr. Bonar Law's declaration at the meeting at Blenheim on July 27—that he could imagine no length of resistance to which the Ulster people might go in which he would not be ready to support them—the northern Protestants organized numerous demonstrations against Home Rule, culminating on "Ulster Day" (Sept. 28) in the signing at Belfast of the solemn Covenant pledging the signatories to stand by one another in defending for themselves and their children their cherished position of equal citizenship in the United Kingdom, and in using all means which might be found necessary to defeat the conspiracy to set up a Home Rule Parliament in Ireland.

The Ulster Covenant.

The impression made by this event was immense. The proceedings were attended by a vast concourse of people, and a deep religious significance was given to them by the fact that in some 500 Protestant churches of various denominations special services were held on the same day, with appropriate hymns and lessons, and closing with the National Anthem. The impression made by it was not lessened when, on Nov. 22, it was announced that the Covenant had been signed by half a million people.

Religious Antagonisms.

Apart from a certain number of agrarian outrages, there were during this year ominous signs that the old religious antagonisms, which had all but died down, were beginning to revive. On June 29 members of the Ancient Order of Hibernians, armed with pikes, attacked a Belfast Presbyterian Sunday School procession consisting mainly of women and children,[1] and the Protestant shipyard workers of Belfast retaliated by an assault on their Catholic fellow-workmen. On Sept. 14 a serious political riot broke out on the Celtic football ground in Belfast, in which 100 people were injured.

While the Home Rule bill, twice thrown out by the House of Lords, was making its painful way through Parliament, the realities of the situation in Ireland itself were becoming more and more apparent. Mr. Birrell was right when he said in the House of Commons that "a new movement and a new spirit were springing up in Ireland—a national movement, full of Irish sentiment." He went much too far, or not nearly far enough, when he described the Ulster opposition to this movement as "based on religious bigotry." It was based on the broad conviction that in any Irish National Parliament the religious and material interests of the Protestants and industrial North would be sacrificed to those of the Catholic and agricultural South. Their attitude was not modified by such "safeguards" as Mr. Asquith and Mr. Redmond were prepared to offer, *e.g.* disproportionate representation in the Irish Parliament, which they rejected as undemocratic and fallacious, since it would still leave them in the minority; and Mr. Asquith's refusal to meet their views they interpreted as a "declaration of war." During 1913, accordingly, the organization of resistance in Ulster proceeded apace, and by the autumn it was complete. On Sept. 25 the Ulster Unionist Council formally organized itself as a Provisional Government consisting of a central authority of 76 members, under the chairmanship of Sir Edward Carson; with committees for the volunteers, legal subjects, education and Customs, excise and posts; and on the following day Sir Edward Carson began a tour of inspection of the volunteers in various centres, the whole force—estimated at 100,000—being under the supreme command of Gen. Sir George Richardson.

Ulster Organizes.

Sinn Fein Looks to Germany.

In making these warlike preparations the Ulster leaders were careful to insist that they were actuated solely by the determination to maintain their traditional rights and liberties; they reaffirmed their complete loyalty to the Empire, and undertook to place the whole armed force of Ulster at its disposal in the event of its being attacked. But the arming of the North was bound to have an unfortunate repercussion in the South. The Sinn Fein organ *Irish Freedom*, Jan. 1913, pointed out that war between England and Germany was practically inevitable, and declared such a war to be "Ireland's opportunity"; and this was elaborated by Sir Roger Casement in an article on "Ireland, Germany and the next War," contributed to the July number of the same review.[2] On Jan. 23 the Sinn Fein National Council passed a resolution refusing to be content with anything short of independence, and affirming it to be the duty of all Irishmen to possess a knowledge of arms.[3] A vigorous anti-recruiting campaign was started, and every effort was made to pour contempt on the British army. "Rifles would hardly be needed, fly-paper would surely suffice to capture the greater part of the little 'Yorks' and 'Berks,'" wrote a popular Nationalist paper. "By the way, we have pigs of these breeds in Tipperary already. Poor kiddies, poor little boy soldiers! How will they withstand the onrush of conquering German uhlans some day?"[4] Meanwhile the arming of Ulster was hailed among Sinn Feiners as a practical step worthy of imitation.

The National Volunteers.

On the initiative of a provisional committee, consisting of members of the Sinn Fein League, the Gaelic Athletic Association, the Gaelic League and the Irish Republican Brotherhood, a mass meeting was held on Nov. 25 in the Rotunda Rink in Dublin, under the presidency of Prof. John MacNeill of the National University, to inaugurate the National Volunteers. It was noted that the Ancient Order of Hibernians and the United Irish League, which were attached to Mr. Redmond's party, were not officially represented at the meeting, though many of their members were present. The Transport Workers' Union, on the other hand, sent a contingent with bands. As the immediate result of the meeting 4,000 men were enrolled, and on the following day a committee was established for their drilling and organization. The object of the volunteers, as defined in the form of application for membership, was "to secure and maintain the rights and liberties common to all the people of Ireland without distinction of class, creed or politics."

Transport Workers Strike.

A new and more dangerous element was added to this welter by the strike of transport workers which began in Dublin in August. The conditions of life to which labour in Dublin was subjected were described in the report of the Local Government Board Commission on the strike as "the worst in Europe";[5] and at first public sympathy was largely enlisted on the side of the strikers. But this sympathy was soon alienated by the violence of Larkin's language and actions. On Aug. 26 he was arrested, but released on bail. On the 30th the mob in Sackville Street furiously attacked the Dublin Metropolitan police, who quickly quelled the riot. On the 31st Larkin reached the balcony of a hotel in Sackville Street in disguise, delivered a violent harangue to the mob, and this produced another riot. Delegates of the English trade unions were called in to assist at arriving at a settlement; but on Sept. 13 the employers, in view of the fact that "Larkinism" included in its programme a repudiation of the obligation to keep inconvenient agreements, refused to resume negotiations and decided on a sympathetic lock-out. This threw out of work several thousand men who refused to sign a pledge not to join or to assist the Transport Workers' Union. On the 21st there was another serious conflict with the police, and the unemployed next day were estimated to number 13,000. The strike spread sporadically to England, owing to the refusal of English workers to handle "tainted goods"; but Larkin's violent attitude during a propaganda tour in England alienated the still predominantly sober elements in the British movement, and the strike collapsed early in 1914. There was nothing Nationalist about it; at the Board of Trade inquiry Larkin had exposed the failure of the Nationalist members to assist the cause of the workers, and he denounced Redmond and Carson as "in league with capitalism"; the arch strike-breaker, William Martin Murphy, on whom the hatred of the proletariat was concentrated, was owner and inspirer of the Nationalist *Independent.* The strike failed, but its consequences were momentous. Liberty Hall became definitely the centre of that spirit which was to be known later as Bolshevist. Moreover, during the late autumn, Larkin had begun drilling and organizing that "Citizen Army"—a body distinct from the Irish Volunteers—which was to play the leading part in the Easter rebellion.[1]

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[1] Twenty-three of the Hibernians were convicted at the winter assizes of riot and condemned by Mr. Justice Wright to three months' imprisonment with hard labour. After a few weeks in prison they were released by order of the Lord Lieutenant, Lord Aberdeen.

[2] Under the pseudonym of "Shan Van Vocht."

[3] Reported in the *Gaelic American*, New York, Feb. 8 1913.

[4] *Tipperary Star*, Sept. 20 1913.

[5] In Dublin 21,000 families were found to live in one-room tenements, of which 9,000 were occupied by four or more persons.

Attempts to Compromise the Ulster Question.

The situation in Ireland was now very alarming, and competent judges, such as Sir Henry Blake and Earl Grey, pointed out the imminent danger of civil war were the Government policy persisted in. Liberal statesmen began to talk of compromise, Sir Edward Grey, for instance, affirming at Berwick (Oct. 17) and again at Alnwick (Dec. 17) that "Home Rule within Home Rule" for Ulster was quite consistent with the maintenance of the essential unity of Ireland. On Dec. 6 Mr. Asquith, at Manchester, said that he saw nothing with which he would quarrel in principle in the bases of settlement laid down by Sir Edward Carson at Sheffield four days earlier, namely, "that it must not humiliate Ulstermen, that they must not be treated differently to other parts of the United Kingdom, and that there must be no measure establishing a basis for the ultimate separation of Ireland from Great Britain." On Nov. 14, at Newcastle-on-Tyne, however, Mr. Redmond had violently attacked the claim of a small minority in Ireland to dictate to the rest. It would be worth paying a large price, he said, to obtain a settlement by consent, but the door of the Empire must not be slammed in the face of Ireland by the fear of fanatics or by the bludgeons of bullies.

The Boycott as a Political Weapon.

The opinion of the Protestant North against Home Rule was hardened—if that were possible—by the continued activities of the United Irish League and the Hibernians during 1913. Boycotting was again in operation as a political weapon, the most notable instance being the boycott proclaimed (Nov. 29) against 29 Sligo merchants who had signed a pronouncement criticizing the financial provisions of the Home Rule bill and declaring that it would be fatal to the commercial interests of Ireland. Point was given to the boycotting resolution by the statement that it was a "united protest against the conduct of a number of local *Protestant* merchants."[2] On the other hand, at a great demonstration to celebrate the 225th anniversary of the relief of Derry, held on Dec. 18, Dr. D'Arcy, Protestant Bishop of Down and later (1920) Primate of All Ireland, while affirming that Protestants bore "no ill-will to any dwellers in this land" and were "patriotic Irishmen," reaffirmed the Covenant as "the inevitable outcome of the heart and mind of Ulster."[3]

The Arms Proclamation.

Temporary Exclusion of Ulster Suggested.

In the face of this dangerous situation the Irish Government appeared to regard itself as impotent. It would not be true to say that the arming of Ulster had been connived at: for more than one considerable seizure of arms was made.[4] It was not, however, until Dec. that a proclamation was issued prohibiting the importation of arms altogether; and from the first, in view of the appeal of the Arms Act, its legality was disputed.[5] At the opening of 1914 serious efforts were made to arrive at a compromise; but the conference of the Liberal and Nationalist leaders with Sir Edward Carson and Mr. Bonar Law only resulted—to use Mr. Asquith's words—in "bringing out the difficulties." In these circumstances the Prime Minister on the second reading of the bill (March 9), proposed a "middle course," *i.e.* the provisional exclusion of Ulster for six years by county option, the excluded counties to come automatically under the Dublin Government at the end of that time unless the Imperial Parliament decided otherwise. This proposal Mr. Redmond supported, but as "the ultimate limit of concession." Mr. O'Brien, on the other hand, protested against this plan for "chopping an ancient nation into a thing of shreds and patches," and he was supported by Mr. Tim Healy. More fatal, however, was the attitude of Sir Edward Carson. He would, he said, never consent to sacrifice the loyal people of the South and West, and the men of Ulster did not want "sentence of death with a stay of execution for six years." In the debate on Mr. Bonar Law's motion of censure on the Government (March 19) the tension reached breaking point. Mr. Redmond had earlier declared that if Ulster did not accept the compromise proposed, the bill must pass as it stood and be imposed on Ulster with all the forces of the Crown, and on Dec. 4 Sir Edward Grey, Minister for Foreign Affairs, had declared that a "fanatical outburst" in Ulster would have to be suppressed by force. The leader of the Opposition now declared that the attitude of the army would be for the army to decide, since while "in case of mere disorder it ought to and would obey, if it were a question of civil war soldiers were citizens like the rest of us." Sir Edward Carson, for his part, accused the Government of wanting an outbreak in Ulster as a pretext for putting the Ulstermen down. At the close of his speech he left the debate and, with eight of the Unionist leaders, started at once for Belfast to concert measure of resistance.

Military Measures Against Ulster.

So early as March 14, the Government had taken certain military precautions in case of "serious disorder" breaking out in Ulster, the general commanding in Ireland, Sir Arthur Paget, being instructed to convey a force of cavalry, infantry and artillery northward, ostensibly to protect military stores from possible depredations by the Volunteers. This movement was to be supported by a British squadron stationed at Lamlash, in Arran. Whatever truth there may have been in the belief that the Government intended to crush the resistance of Ulster by force—and this was strenuously denied—the result was to show that in any such policy they would not have the support of the army.[6] The troops were received in

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[1] See James Connolly, *Labour in Ireland* (1917), for the Liberty Hall view of the strike, and Arnold Wright, *Disturbed Dublin, The story of the Great Strike* (1914), for the other point of view.

[2] *Sligo Champion*, Nov. 29 1913. *The Times*, Dec. 1.

[3] *Irish Times*, Dec. 19 1913.

[4] At Belfast, in June, 1,000 rifles, shipped as "electrical plant" were seized, and in Dublin some consigned to Lord Farnham.

[5] Doubt was thrown on the validity of the proclamation by the decision of the court of first instance in the case of *Hunter v. Coleman*, an action brought by a firm of Belfast gunsmiths at Belfast Assizes against a Collector of Customs at the port for detaining arms consigned to plaintiffs at Hamburg on Dec. 18 1913. This decision was later reversed.

[6] In Feb. Lord Roberts had said in the House of Lords that any such attempt would wreck the British army.

The Curragh Incident.

Ulster not as enemies but as friends, mutual courtesies being exchanged,[1] while Sir Edward Carson declared that he never could or would be associated with any movement for weakening the Empire, and that in the event of international difficulties the Ulster volunteers would fight shoulder to shoulder with the British army in its defence.[2] The temper of the army, on the other hand, was shown by the Curragh incident of March 20, when Gen. Gough, commanding the 3rd Cavalry Brigade stationed at the Curragh with 57 of his officers (out of 70) preferred to accept dismissal from the army if ordered North. The circumstances in which this resolution was arrived at are obscure and complicated; but there can be no doubt that the officers believed that they had been given an option in the matter, and that they were under the impression that an immediate aggressive movement against Ulster was contemplated.[3] Rage and consternation were general in the Liberal and Nationalist camps, where the action of the officers was denounced as "militarism" and "a second Zabern."

The Larne Gun-running.

Affairs in Ireland were now rapidly coming to a head. On April 17 the Ulster Unionist Council issued a statement giving what purported to be the actual facts with regard to recent military and naval operations and plans of the Government, and accusing ministers of a deliberate design to crush the Ulster movement by force. The volunteers had completed their organization. Their armament was now also provided; for on the night of April 24–5, 35,000 rifles and 3,000,000 rounds of ammunition were successfully distributed by means of 600 motor-cars to the various centres; 12,000 rifles were at the same time landed at Bangor and Donaghadee on the coast of Down. This "gun-running" had been admirably organized; until the last moment none, save the mysterious directing committee, knew where the arms were to be landed; and the Government was completely outwitted. Mr. Asquith described it in Parliament as "an unparalleled outrage," and British warships were ordered to patrol the Irish coast, to prevent its repetition.[4]

Redmond and the National Volunteers.

Ulster, then, was armed and defiant. Meanwhile the National Volunteers, on their side, were growing into a formidable force.[5] The Nationalist leaders were perturbed by the spread of a movement from which they had hitherto held aloof, since it threatened to transfer power from them to the extremer men who had hitherto directed it, and on June 9 Mr. Redmond issued a statement to the effect that his party, which had thought the movement premature, had been converted by the Curragh incident and the Larne gun-running, and he demanded a reconstitution of the governing committee on representative lines, suggesting that it should at once be reënforced by 25 members, from different parts of the country, nominated at the instance of the Nationalist party and in sympathy with its policy and aims. Towards the end of the month the committee, realizing that it had little support in the country for its resistance, grudgingly acceded to this demand. The Volunteer movement in the South was thus for a time saved from disruption, and in July the Nationalists started the Defence of Ireland Fund, to secure arms and complete the organization of the force.

There were thus in Ireland two rival armed organizations, and in Parliament the extreme danger of the situation was pointed out in June 16 by Lord Robert Cecil, who moved the adjournment of the House. But nothing would disturb the equanimity of Mr. Birrell, who argued that, provided that the due formalities were observed, drilling and the carrying of arms were alike legal; that the Volunteer movement did not add greatly to the danger; and that discipline and the ability to use fire-arms would be good for the Irish people.

The Amending Bill.

Meanwhile an amending bill, embodying Mr. Asquith's "middle course," had been sent up to the House of Lords, where it underwent a drastic transformation (July 8). On July 10, at a meeting of the Ulster Unionist Council, Capt. (afterwards Sir James) Craig read the preamble to the Constitution of the Ulster Provisional Government, and the Boyne celebrations on the 12th were made the occasion for a series of monster demonstrations, the moral of which was tersely put by Sir Edward Carson at Drumbeg—"Give us a clean cut, or come and fight us!" In the South, on the other hand, opposition to any form of partition was hardening, and the Wolfe Tone celebration at Bodenstown on the 14th was attended by an unprecedented concourse of people. A telegram from Mr. John Devoy, editor of the *Gaelic American*, and later a leading spirit in the Sinn Fein-German plot against the Entente,[6] hailed "the voice from the grave which forbids partition and brands as infamous any man who consents to exclude Ulster even for one day,"[7] a theme enlarged on by the Sinn Fein press. On the 21st a conference was held at Buckingham Palace, at the instance of the King, between ministers and the leaders of the Irish parties, to consider the possibility of finding an area to be excluded from the operation of the Home Rule bill; but on the 24th it dissolved, being unable, in the words of the Speaker, who presided, "to agree, in principle or in detail, on such an area."

Buckingham Palace Conference.

The Howth Gun-running.

Such was the situation when an unfortunate incident poured fresh oil on the flames. On the morning of Sunday July 26 the "Dublin Regiment" of the National Volunteers, about 1,000 strong, marched to the little port of Howth, some 9 m. from the capital, arriving at the harbour at about one o'clock. Simultaneously a yacht loaded with arms berthed at the pier; and presently every one of the volunteers was supplied with a rifle, those remaining being loaded into motor-cars. The few police present were prevented from interfering, and shortly before two o'clock the Volunteers set out on the march back to Dublin.

The local police had already telephoned to headquarters in Dublin, and, in the absence of the chief commissioner, the deputy commissioner, Mr. Harrel, believed it to be his duty to take action. This seemed all the more necessary, if the law was not to be brought into utter contempt, owing to the peculiar circumstances of the gun-running at Howth. The Ulster Volunteers had imported arms by stratagem, under cover of night, and had been able to justify their action in some sort by the judicial decision which had declared the Arms Proclamation illegal. But this decision had been reversed by the Dublin Court of King's Bench on June 15, and the act of the Irish Volunteers was therefore one of ostentatious defiance of the law; for the Proclamation remained in force until its withdrawal on Aug. 5.[8] Unable to obtain immediate instructions from the under-secretary, Sir James Dougherty—who did not record his views till 5 P.M., when the affair was over—Mr. Harrel applied on his own responsibility for military assistance, no Royal Irish Constabulary being available. With a small force of Metropolitan police and two companies of infantry he then set out on the road to Howth, and when the Volunteers on their return march neared Clontarf they found this force blocking both the main roads to Dublin.

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[1] See, *e.g.*, *Irish Times*, March 21, 24, 26 1914.

[2] *Irish Times*, March 25 1914.

[3] The whole matter later formed the subject of acrimonious debates in Parliament. An abstract of these will be found in the *Ann. Reg.* (1914), pp. 55 ff.

[4] The Government at first determined to institute proceedings against the leaders in the High Court by filing an *ex-officio* information for riot, disturbance and obstructing the King's officers, and this was actually drafted by the Irish Attorney-General. Afterwards, however, on the advice of Mr. Redmond, it was decided to take no proceedings.

[5] On May 6 their numbers were returned as 26,696, on the following Oct. 7 as 178,649.

[6] See *Documents relative to the Sinn Fein Movement*, Government "White Paper" (Cmd. 1108), issued in Jan. 1921.

[7] *Irish Freedom*, July 1914.

[8] "Some arms were smuggled into the north of Ireland, and they were secretly and unostentatiously distributed. That proceeding was, of course, very wrong, but the authority of the Government was not defied. . . .The course at Howth differed altogether from the method of the landing in the North. At Howth the arms were ostentatiously landed in daylight, and the constabulary there, as well as the coastguard officers, were overpowered with violence" (evidence of Sir John Ross of Bladensburg, formerly chief commissioner of the Dublin Metropolitan Police, before the Royal Commission on the insurrection in Ireland: *Irish Times*, May 30 1916).

A halt was called, and Mr. Harrel stepped forward to parley with the two leaders of the Volunteers. On their refusal to order their men to give up their rifles, he ordered the police to disarm them. In the short scuffle that followed the soldiers assisted the police; the Volunteers fought with clubbed rifles, and some of them received slight bayonet wounds. In the end 19 rifles and a number of wooden clubs or batons were captured; but the rear ranks of the Volunteers had taken advantage of the fight in front to disperse and carry off their rifles singly. After the road was clear two soldiers were wounded by revolver shots, fired, not by Volunteers, but by bystanders.[1]

The Bachelors' Walk Massacre.

The affair being now considered at an end, the troops were ordered to march back to Dublin. They consisted of 100 Scottish Borderers, under Capt. Cobden, who were joined near Fairview by about 60 men of the same regiment under Maj. Coke. Their route took them through a low quarter of the city, where they were followed by a crowd which, not content with hurling abusive epithets at them, presently began to pelt them with stones and other missiles. All down Talbot Street, Earl Street and Sackville Street, it had been possible to hold the mob in check by the rear-guard occasionally turning and threatening them with bayonets. But by the time the troops, marching along the quay of the Liffey called Bachelors' Walk, had reached the corner of Liffey Street, matters were so serious—25% of the men being badly hurt—that Maj. Haig, who had just arrived and taken command as senior officer, told off 30 men, who turned and lined the road, four or five of them kneeling. He asked five or six of them if they were loaded, and ordered them to be ready to fire if he gave the order. Immediately afterwards, owing to some misunderstanding, 21 of the men discharged their rifles, with the result that three persons were killed and 38 more or less seriously wounded. In the course of the inquiry into this unhappy affair Maj. Haig stated that he was not aware that the 100 men under Capt. Cobden had been ordered to load at Howth Road and were still loaded. A judicial commission decided that the soldiers were not justified in firing, but failed to come to any decision as to whether or not an order to fire had been given.[2]

This Bachelors' Walk " Massacre " was a serious embarrassment to the Liberal Government. Their efforts to make Mr. Harrel solely responsible, on the ground that he had disobeyed his instructions, broke down on the fact, revealed under cross-examination in Parliament, that these instructions had only been written four hours after the event. A Royal Commission, carefully selected, was more effective. Mr. Harrel was found to have exceeded his powers in calling out the military, and was dismissed from the force. The effect on the *moral* of the police was disastrous, for henceforward it was felt that no action could be taken by them, even in grave emergencies, without risk of being " broken " by the Government.[3] The effect on the *moral* of Sinn Fein is best explained in the words of Thomas MacDonagh:—

> The whole moral of this story, as of the whole rise and progress of the Irish Volunteers during the past eight months, is that if the leaders of the Irish people act strongly and decisively, they can succeed in their action. The young men of Ireland have got a strong lead from the Irish Volunteers; and they march to victory. Ireland has now the strength to enforce her choice of destiny. The men who ruled Ireland in the past under Tory régime, and under Liberal régime, lost their power on July 26. At Clontarf in 1914, as at Clontarf in 1014, has been won a national victory.[4]

Such was the situation in Ireland within a month of the crime of Sarajevo—two organized hostile forces standing face to face, both protesting their pacific intentions, both refusing to budge an inch from claims which made an agreed peace impossible.[5] Small wonder that to foreign observers the Bachelors' Walk affair seemed the beginning of troubles which would keep the British Government fully occupied at home.[6]

Effect of the Declaration of War.

The most surprising effect of the declaration of war against Germany on Aug. 4 1914, however, was that it seemed at once to unite all Ireland with the rest of the United Kingdom in a common cause. In the House of Commons Irish Unionists and both sections of Irish Nationalists gave their support to the Government. Mr. Redmond, in his speech on Aug. 5 in support of the vote of credit, declared that the events of recent years had completely changed the feeling of Nationalists towards Great Britain. The Government might safely withdraw all the troops from Ireland, for her coasts would be defended by her armed sons, and the National Volunteers would gladly join with their brethren of the North for this purpose. When Nationalists and Ulstermen had fought together on the Continent, and drilled together for home defence, he believed it would be possible, as regarded Home Rule, to present a real Amending Bill to the Government by agreement. Thus Ireland was committed to the World War by the united voice of her representatives. " Ireland, " said Sir Edward Grey in his speech announcing to Parliament the declaration of war, " is the one bright spot."

Passing of the Home Rule Bill 1914.

It was almost at once apparent, however, that the old antagonisms, though obscured for the time, survived. Attempts to settle the Home Rule controversy by negotiation between the party leaders broke down; and on Sept. 14 it was announced that the Prime Minister intended to wind up the session at once, and that then the Home Rule bill would become law automatically under the Parliament Act, but that the Government would introduce a bill[7] postponing the operation of the Act till after the war and pledged itself to introduce an Amending bill dealing with Ulster before the Home Rule Act should become operative. In announcing this policy to the House of Commons Mr. Asquith said that the new bill would provide that the Act should not be put in operation for 12 months in any case, or, if the war was not then ended, before such further date, not later than the termination of the war, as might be fixed by Order in Council.

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[1] This follows the official account (for further details see report of the Royal Commission, Cd. 7631 and 7649). In " Clontarf "—a supplement to the *Irish Review*, July–Aug. 1914—Thomas MacDonagh—afterwards executed as one of the leaders of the Easter rebellion—who was one of the Volunteer officers with whom Mr. Harrel talked, gives a somewhat different version. He does not mention any scuffle but says that the commissioner, after negotiation, allowed the Volunteers to keep their rifles on condition of their being at once dismissed. The force, he says, was thereupon marched into Fairview Park and formally dismissed. His account, while naturally magnifying the rôle played by the Volunteers, is moderate and restrained.

[2] In his evidence before the Foreign Relations Committee of the U.S. Senate (Aug. 30 1919) the Hon. W. Bourke Cockran thus summarized the Howth gun-running incident: " Gun-running promised to become a favourite sport of these chartered rebels, the Ulstermen—chartered by the very Government they were defying. But when the Nationalists undertook to bring in a cargo of arms the British soldiery appeared on the spot and with bullet and bayonet prevented them from landing a single rifle, shooting down women and children who happened to be spectators " (see 66th Congress, 1st Session, Senate Document No. 106, p. 893).

A recent German " historian " of Ireland succeeds in outdoing even Mr. Bourke Cockran. His succinct account of the Howth gun-running is as follows: " On July 26 1914, the Volunteers brilliantly underwent their baptism of fire; a yacht from Rouen had secretly landed arms and ammunition at Howth, and when the English garrison of Dublin tried to disarm the Volunteers, it was put to flight by them with the butt-ends of their rifles; whereupon, in anger at its defeat, it fired into the unarmed crowd, mostly consisting of women and children, and killed and wounded very many persons." Julius Pokorny, *Ireland* (Perthes' Kleine Völker- und Länder-Kunde, Band 1), Gotha 1916, p. 135.

[3] See Report of Royal Commission on the rebellion in Ireland (Cd. 8279), p. 6.

[4] " Clontarf," *loc. cit.* The writer omits to mention that, in spite of Brian Boru's victory at Clontarf, Dublin remained after it, just as before, a Danish city.

[5] The Ulster proclamations of a purely defensive attitude have already been noted. On June 30 the Irish Volunteers published a manifesto stating that they would " do their utmost to promote peace and good-will throughout Ireland," their object being " to secure the unity of all Ireland and of all Irishmen on the ground of national liberty."

[6] Baron Kühlmann cabled to Berlin " the hour has come."

[7] This bill also provided for a similar postponement of the Act disestablishing the Welsh Church.

Attitude of Ulster.

This action of the Government in taking advantage of the "party truce" to place Home Rule upon the Statute Book, though it rallied the more moderate Nationalists to the common cause, was strongly resented by Unionists both in England and Ireland; and Mr. Bonar Law denounced it in the House of Commons as a breach of faith. His language was reëchoed by Sir Edward Carson in a manifesto to the Ulster loyalists, in which he reiterated the determination of Ulster never to submit to Home Rule, but at the same time urged his followers, in view of the peril to the Empire, to be true to their motto of "our country first." At a great meeting held on Sept. 28 to celebrate the second anniversary of Ulster Day he spoke in the same sense. On Sept. 16 the executive committee of the Irish Unionist Alliance, representing the Unionists of the three southern provinces, also passed a resolution condemning "the flagrant breach of faith by the Government," but at the same time added another pointing out "the duty of Irishmen to undertake their full share of Imperial responsibility in the present national emergency" and calling upon its members and supporters to continue their efforts to secure recruits for the army.

Split in the National Volunteer Movement.

It seemed of happy augury that on this same Sept. 16 Mr. Redmond also issued a manifesto calling on the people of Ireland to take their part in this great national crisis and asking that Irish recruits for the expeditionary force should be kept together in an Irish Brigade under Irish officers. The latter demand was endorsed by the Prime Minister, Mr. Asquith, at a great recruiting meeting held at the Dublin Mansion House on Sept. 25, at which Mr. Redmond again urged his countrymen to enlist. Meanwhile, however, though there had been no outward sign of disunion in the committee of the National Volunteers, it had from the first been clear that its Sinn Fein members were determined to resist recruiting in every way, and on the eve of the Mansion House meeting (Sept. 24) 20 members of the committee, headed by the chairman, Prof. MacNeill, issued a manifesto denouncing Mr. Redmond for consenting to "a dismemberment of Ireland" and accusing him of being willing to "risk another disruption" by announcing for the Irish Volunteers "a programme fundamentally at variance with their own published and accepted aims and pledges," viz. that it was their duty to take foreign service under a Government which was not Irish. In view of this attitude the signatories declared that the nominees of Mr. Redmond ceased to be members of the Provisional Committee, and they ended their pronouncement by reaffirming without qualification the manifesto proposed and adopted at the inaugural meeting, repudiating any undertaking for the partition of Ireland and declaring that Ireland could not, with honour or safety, take part in foreign quarrels otherwise than through the free action of a National Government of her own.[1] That this manifesto had a strong support among the Dublin Volunteers was shown on the following night, for while a few acted as sentinels at the Mansion House several thousand paraded in Sackville Street amid dense masses of spectators, in support of Prof. MacNeill. This was a declaration of war against the Nationalist party, and Mr. Redmond was prompt to take it up. He appealed, with striking success, to the provincial centres; and at a convention of Volunteers held in Dublin on Sept. 30 a new Provisional Committee was elected, with Mr. Redmond as president. The Sinn Fein leaders who had signed the manifesto of the 25th thereupon seceded and proceeded to organize a force of their own under the style of the Irish Volunteers.

Ireland and the War.

This movement was not at the time regarded as serious. The spokesmen of Sinn Fein were men of no particular position or weight; and there was plentiful evidence that their gospel of hate made little appeal to the people at large, and that the interest of Ireland in the victory of the Empire was all but universally recognized. From Tyrone, for instance, the very storm centre of sectarian strife, the police had reported in June that "distrust and hatred between Catholic and Protestant had never been so deep" within their memory; a few weeks later they reported that, during the mobilization, Ulster and National Volunteers were turning out together with their bands to escort the troops leaving for the front. The same was true, in varying degrees, of all parts of the country: "the outbreak of war"—to quote the police reports—"worked a revolution in the state of party feeling." Here and there, as *e.g.* in Monaghan and Westmeath, agrarian trouble continued intermittently, but from Aug. 4 1914 to the end of 1915 the reports from every county in the four provinces agree that "there were practically no displays of party feeling." Ireland seemed at last united in a common effort directed to a common end. The union seemed to be symbolized by the support given to the National Volunteers by the prominent Unionists in the South and the occasional fraternization of the Ulster and National Volunteers in the North. To those who know Ireland and its deep-seated passions and antagonisms the mere list of the names of the notabilities who attended the great recruiting meeting at Warrenpoint in county Down (July 7 1915) reads like a miracle: there were present the Lord Lieutenant (the Marquess of Aberdeen), Mr. Justice Ross,[2] Mr. W. A. Redmond, the Lord Mayors of Dublin and Cork and the Mayor of Londonderry. It was characteristic of the spirit of this unique year in Irish history.

Recruiting in Ireland.

Beneath the surface, however, the passions simmered, the antagonisms still glowed. The index to the true feelings of the people, the measure of their devotion, were the returns of the number of recruits to the army and to the various bodies of Volunteers. For the famous Irish regiments of the regular army recruiting was at first brisk, though even their cadres had to be filled up with English recruits who happened to be training in Ireland.[3] In the towns of Ulster recruiting was from the first fairly satisfactory, while—as was also the case in the South—the men of the countryside hung back. Of the Ulster Volunteers, numbering 85,000 in Aug. 1914, 20,700 had joined the army by the end of Dec., this number representing the mass of those who were at that time of military age. The returns of enlistments from the ranks of the National Volunteers were less satisfactory; but under the stimulus of the eloquence of the Nationalist leaders the situation in this respect was much improved later, the official returns showing that between Dec. 15 1914 and Dec. 15 1915, 10,794 joined the colours. It is clear, however, from these returns that there was never any question of either body of Volunteers joining the army *en masse*, and that the main source of recruits lay outside them. At the close of the year 1915 the Ulster Volunteers still numbered 56,000, while the number of National Volunteers, which had reached 178,649 in Oct. 1914, had only sunk to 152,090.

The unsatisfactory results of the recruiting campaign have been ascribed to a variety of causes.[4] Mr. Lloyd George himself blamed "the folly almost amounting to malignancy of the War Office," which had refused to entertain the idea of turning the National Volunteers into an Irish Army Corps and had rejected the offer of a group of loyal Irish ladies to work flags for the new regiments. But in judging the War Office for its refusal to consider the formation of a separate Irish Army Corps, two things have to be remembered. In the early and critical stages of the war mobile units were the great need, and regiments are more quickly made efficient than army corps, which—as the experience of the two Irish divisions was to prove—take a long time to organize and train.[1] Secondly, until the definite breach between the Sinn Feiners and the Redmondites in Oct. 1914, it was by no means certain that the National Volunteers were to be trusted, and even after the breach the police reported that a considerable proportion of the Redmondite volunteers were in sympathy with Prof. MacNeill. It might well have seemed too speculative an undertaking to train and arm "for the protection of the coasts of Ireland" (which were in little danger) a force which, under influences already at work, might be used for less innocent purposes.

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[1] Published in the *Irish Volunteer*, Oct. 3 1914. Among the signatories were Patrick H. Pearse, Joseph Plunkett, Thomas MacDonagh, and other leaders of the 1916 rebellion. Regret was expressed that, owing to his absence in America, the signature of Sir Roger Casement was not attached.

[2] Sir John Ross, appointed Lord Chancellor of Ireland in July 1921.

[3] After the retreat from Mons the urgent need for replenishing infantry battalions led to the drafting of Irish recruits who had enlisted in the Irish cavalry into English line regiments. This was greatly resented.

[4] Much was due to defective organization. In many cases the ardour of would-be soldiers was damped when they found that they had to go 30 or 40 m. to the nearest recruiting station.

The Irish Volunteers

It is, indeed, to these influences and to other causes which they exploited, rather than to any action or inaction of the War Office, that the refusal to enlist for the war on the part of large sections of the population must be ascribed. In setting up the organization of the Irish Volunteers, the Sinn Feiners did not succeed in obtaining any large nominal following, but they made up for their lack of numbers by their fanatical zeal, and the efficiency of their organization. Of all the volunteer forces in existence during 1915 the Irish Volunteers and their allies the Citizen Army alone displayed any activity in drilling and exercising, which they were allowed to do without let or hindrance, occasionally even enjoying the protection of the police.[2] Meanwhile their organizers and agitators were busy in those counties where the tradition of disaffection was strongest—Limerick, Kerry, Kilkenny, Waterford, Wexford and Galway. Their object, openly avowed, was to prevent recruiting for the army and to build up their own force with a view to taking immediate advantage of "Ireland's opportunity." They conjured up the bogey of "conscription" with notable effect, until the exclusion of Ireland from the Military Service Act laid this spectre to rest for the time being. Many National Volunteers ceased to attend drill because they feared that, if they drilled, they might be called upon to fight; and a certain number joined the Irish Volunteers as the best safeguard against conscription.[3] The Sinn Feiners were helped, too, by the immense prosperity of the country, which—what with separation allowances and the high prices of agricultural produce—had never been so full of money; for this disinclined the young men of the more prosperous classes to exchange present comforts for the miseries and dangers of the trenches. If, as the Sinn Feiners reiterated, this was solely "England's war," they had the most patriotic reasons for abstaining from it. On the whole the wonder is, not that Ireland did not provide more recruits, but that she provided so many.

Progress of Sedition.

Incredible as it may now seem, there was between Aug. 5 1914 and Dec. 5 1915 no law in force prohibiting the importation of arms into Ireland.[4] Certain warrants were, indeed, issued during this time to the police by the Lord Lieutenant, authorizing them to seize arms, but it was not until the amendment of the regulations under the Defence of the Realm Act, on Dec. 5, that they were empowered to seize arms and explosives landed on the coast.[5] In spite of these laws, arms and ammunition continued to be smuggled into the country. At the same time a flood of seditious literature began to be disseminated by the leaders of the Irish Volunteers. Its exuberance was to a certain extent tempered by the existence of the military censorship, but as this took notice only of matter which was judged to have military importance, articles merely abusing the British Government and army, or praising the gallantry and humanity of the Germans, gained for the ignorant public an enhanced authority by having been "passed by the censor." From time to time certain of the seditious papers, having exceeded all bounds, were suppressed (e.g. *Irish Freedom* and the *Irish Worker* in Dec. 1914), and others, after their printers had been warned by the authorities, ceased to appear (*Sinn Fein*, *Fianna Fail* and *Ireland*). But their place was taken by others no less violent[6]—*The Spark* (Feb. 7 1915), *The Workers' Republic* (May 30) edited by James Connolly, *The Hibernian* (June 24), *Nationality* (June 26), *Honesty* (Oct. 16), *The Irishman* (Jan. 15 1916) and *The Gael* (Jan. 29). The only one of them to reach any high standard of even journalistic excellence was *Nationality*, which, under the editorship of Mr. Arthur Griffith, became the most influential organ of the anti-Ally propaganda. The circulation of these seditious newspapers was never large[7] but they passed from hand to hand and wrought untold harm among the ignorant people. Their circulation was never seriously interfered with.[8]

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[1] Much bitterness was afterwards caused by the transference—under stress of circumstances at the front—of the artillery of the 16th (Irish) Division to the Guards.

[2] On Whit Sunday 1915, 1,100 Irish Volunteers, 700 of them armed, held a parade in Limerick. When returning to the station through the Irishtown quarter, where many soldiers' families lived, they were furiously attacked by a crowd of women (wives of the Munster Fusiliers) and had to be protected by the R.I.C.

On Nov. 19, at Loughrea in Galway, on the formation of a branch of the Irish Volunteers, the National Volunteers marched through the town and smashed the windows of prominent Sinn Feiners.

[3] Reports of County Inspectors. The numbers of the Nationalist Volunteers given in the subjoined table, showing fluctuations during the year preceding the Easter 1916 rebellion, are taken from the official returns. Those in the sections marked (*a*), (*b*), (*c*) were reckoned as disloyal.

	National Volunteers (Redmondite)	National Volunteers (in sympathy with MacNeill) (*a*)	Irish Volunteers		Citizen Army (*c*)
				County Dublin (*b*)	
May 6 1914	26,696				
Oct. 7 1914	178,649	7,443		2,150	60
Dec. 16 1914	152,090	11,247		2,100	60
Jan. 15 1915	149,742	9,543		2,100	60
Dec. 27 1915	112,446	5,112	6,137	2,225	100
Jan. 3 1916	112,050	5,038	6,355	2,225	100
April 17 1916	104,984	4,457	8,381	2,225	100

[4] "Up to Nov. 1914 anybody could send arms or ammunition into Ireland provided the Customs regulations had been complied with." Evidence of Sir Mathew Nathan, Under-Secretary for Ireland, before the Royal Commission (*The Times*, May 19 1916).

[5] Sporting guns and ammunition were excepted. This exception was cancelled on Feb. 5 1915.

[6] *Ireland* speedily reappeared as *Scissors and Paste* (Dec. 12 1914). This consisted of cuttings from British and foreign newspapers "selected for their derogatory references to the cause and military operations of the Allies and for their praise of the methods and successes of the enemy." It was suppressed on March 2.

[7] Circulation of Sinn Fein papers:—

	Nov. 1915	Feb. 1916
Irish Volunteer	3,937	4,615
The Spark	1,587	2,382
Workers' Republic	1,390	1,549
Hibernian	2,555	2,567
Nationality	3,895	4,539
Honesty	1,250	1,592
Irishman	—	1,692
The Gael	—	1,246

[8] In his evidence to the Royal Commission on the 1916 rebellion, Maj. Price, Assistant-Commissioner of Police, said: "One unfortunate thing which hindered us a good deal was the attitude of the official Nationalist party and their press. Whenever Gen. Friend did anything strong in the way of suppressing or deporting these men (the organizers) from Ireland, they at once deprecated it, and said it was a monstrous thing to turn a man out of Ireland." On this the commissioners made the shrewd comment: "Irishmen no doubt appreciate the maintenance of order, but they appear to have an inveterate prejudice against the punishment of disorder." (Cd. 8279, p. 7.)

In July 1914 orders were issued under the Defence of the Realm Regulations for the expulsion from Ireland of four Sinn Fein agitators—Pim, MacCullagh, Blythe and Mellowes. They disobeyed and were arrested and imprisoned. The Limerick Corporation passed a resolution condemning the authorities for expelling Irishmen from their country.

So early as June 15 1914 the inspector-general of the Royal Irish Constabulary had presented to the Chief Secretary, Mr. Birrell, a report of which the following paragraph reads now like inspired prophecy:—

> In Ireland the training and drilling to the use of arms of a great part of the male population is a new departure which is bound in the not distant future to alter all the existing conditions of life. Obedience to the law has never been a prominent characteristic of the people. In times of passion or excitement the law has only been maintained by force, and this has been rendered practicable owing to the want of cohesion among the crowds hostile to the police. If the people became armed and drilled effective police control would vanish. Events are moving. Each county will soon have a trained army far outnumbering the police, and those who control the Volunteers will be in a position to dictate to what extent the law of the land may be carried into effect.[1]

Weakness of the Government.

Throughout 1915 and the early months of 1916 the police continued to warn the Government of the dangerous character of the Sinn Fein agitation. At a meeting of the Council of the Irish Volunteers, on May 30 1915, a resolution, moved by Mr. Bulmer Hobson, in favour of an immediate rising had only been defeated by the casting vote of the chairman, Prof. MacNeill; and in Dec. the movement had become so menacing that the Under-Secretary, Sir Mathew Nathan, wrote to Mr. Birrell pointing out the futility of the efforts of Messrs. Redmond and Dillon to minimize it, and the serious consequences that might easily ensue if it were not dealt with in time.[2] Lord Midleton, leader of the Southern Unionists, had already more than once urged upon the Chief Secretary the necessity for disarming the disloyal Volunteers and prosecuting the leaders. But none of these representations produced the slightest effect.[3] Indeed, so far from the arm of the law being strengthened, it had been appreciably weakened by the passing on March 16 1915 of the second Defence of the Realm Act, by which any British subject could claim trial by jury for an offence against the regulations. In Ireland, this was tantamount to enacting that no offender should ever be convicted, for neither the juries nor the local J. P.'s could be trusted to return verdicts or decide in accordance with the evidence.[4] At this time the only tribunals that could be relied upon were those presided over in the country districts by two resident magistrates, who constituted under the Crimes Act a special court in cases of riot or unlawful assembly, or by the metropolitan or stipendiary justices in Dublin or Belfast; and these tribunals had no power to impose a greater sentence than six months' hard labour.

In vain the heads of the Royal Irish Constabulary pointed out to the Government, in Jan. 1916, that it was impossible to get juries to convict on the clearest evidence, that in various parts of Ireland the ordinary justices—whether through fear or favour—were just as bad, and that to meet the situation an amendment of the Defence of the Realm Act was absolutely essential. Conversations followed; but nothing was done.

Growth of Sinn Fein.

The Sinn Fein organization, however, helped mightily by the feeble efforts of the authorities to discourage it, was gaining strength and vigour. It had won a notable victory when at the annual festival (Oireachtar) of the Gaelic League, held at Dundalk on July 24–9 1915 the majority of the elected candidates for the executive committee were Sinn Feiners. The League thus became a political body, and its founder, Dr. Douglas Hyde, resigned the presidency as a protest against a change of character with which he, though an ardent Nationalist, had no sympathy. From this time onward the police reports record an ever increased activity on the part of Sinn Fein. The movement, in spite of the efforts of some of the bishops, had even been joined by many of the younger Roman Catholic clergy, the most conspicuous being Father Michael O'Flanagan, a priest from Roscommon, who on the anniversary of the "Manchester martyrs" declared that the work of the Irish people was to get rid of the connexion with England, and that if there were no other way to get rid of it, he prayed for the victory of an enemy who would deprive England of her power.[5] In Oct. it was reported that the Irish Volunteers had planned a rising, ostensibly in opposition to conscription, an object which would have enlisted the sympathies of many Redmondite volunteers, and on the 6th an attack on the Castle was actually rehearsed by them without interference on the part of the authorities. On Nov. 14 a large parade of Irish Volunteers was held at Athenry, in Galway, at which shots were fired, a display of force which—according to the police reports—overawed the people, who "disapproved of the Sinn Fein policy, but were afraid to show this, as they had no confidence in either the will or the power of the Government to protect them." With the opening of 1916 the seditious activities increased. The *Workers' Republic* for Jan. 8 advertised the sympathy of the Citizen Army for the Irish Volunteers, and quoted with approval the words of Fintan Lalor in the *Irish Felon* of 1848—that the one question was how best to kill or capture the 40,000 men "in the livery and service of England" who were in occupation of Ireland. Large quantities of explosives were now continually being stolen from quarries and railway stores,[6] and it was noted as significant in connexion with this that articles on the use of explosives were published in the *Irish Volunteer*. In Feb. the Irish Volunteers began to take up "a truculent attitude" towards recruiting meetings, men armed with guns and pikes attempting to break them up. On St. Patrick's Day (March 17) they held parades throughout the country, 4,555 turning out in the provinces and 1,400 mustering in College Green in Dublin; and the leaders issued manifestos affirming their right to be armed and declaring that any attempt to disarm them would be resisted by force.[7]

The Easter Rebellion 1916.

It is now known that resistance to a threatened disarmament was to be the pretext for the rising planned for Easter 1916 in concert with the German Government. On April 19 Alderman Thomas Kelly,[8] at a meeting of the Dublin Corporation, read a circular[9] purporting to set out certain "precautionary measures" sanctioned by the Irish Office on the recommendation of the general officer commanding forces in Ireland, measures involving the arrest of all the Sinn Fein leaders and the occupation by the military of all important centres in Dublin. This document was a forgery, but it undoubtedly acted as one of the proximate causes of the outbreak. On the previous day, the 18th, news reached Dublin Castle that a ship had left Germany for Ireland on April 12, accompanied by two German submarines, that it was due to arrive on the 21st, and that a rising had been planned for Easter eve. On the 22nd the *Irish Volunteer* announced, under the heading "Headquarters' Bulletin," that arrangements were all but complete for "a very interesting series of manœuvres at Easter," and that the Dublin programme might well stand as a model for others. But on that very day it was also announced that the German ship "Aud," laden with arms and ammunition, had been captured off the coast of Kerry, and that Sir Roger Casement, who had landed at Banna with two companions from a German submarine in a collapsible boat, had been arrested.[1] The same evening, since all prospect of a successful rising seemed to be at an end, Prof. MacNeill, as chairman of the Council, issued orders countermanding the Easter parades. This action put the authorities, who were fairly accurately informed of what was passing, off their guard; immediate danger was supposed to be at an end; and no orders were given to bring troops into Dublin or to stop the leave of officers. Under the influence of James Connolly, however, the more violent section of the volunteers—the Inner Council of which MacNeill was kept in ignorance[2]—decided to go on with the movement, owing, it is said, to information having reached them on Sunday night that the headquarters, with stores of explosives and arms, were to be raided on Monday.

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[1] Royal Commission Report (Cd. 8279), p. 8.

[2] *ib.* p. 9.

[3] "The witness (Maj. Price, intelligence officer of the Irish Military headquarters) read an account of the parade of the Irish Volunteers in College Green on St. Patrick's Day, and said it was a translation of a letter to America dated April 14 last, written in Irish from St. Mary's College, Rathmines, Dublin. He had described that as an extremely bad letter, pointing to some outbreak during the summer of this year. The letter had been sent to the Chief Secretary, the Under-Secretary and the Lord Lieutenant. The Under-Secretary wrote *re* the outbreak in the summer, 'I look upon it as vague talk.' Mr. Birrell wrote, 'The whole letter is rubbish'; and Lord Wimborne initialed it. 'That is only typical,' added the witness." Report of inquiry by the Royal Commission (*The Times* May 26 1916).

[4] On Feb. 24 1915 John Hegarty and James Bolger were arrested for unlawful possession and larceny of high explosives. At the time of their arrest the D. R. Regulations provided for trial by court-martial only, but as the Act was under amendment in Parliament decision in the case was deferred, and when it was decided to try the men the amending bill had passed, and they had the right to be tried by jury. In April, at the Dublin City Commission, the grand jury returned a true bill against them. But when they came to be tried, Hegarty—in spite of overwhelming proof—was acquitted on the charge in connexion with the explosives. On the further charge of writing and uttering seditious statements the jury disagreed; and the same thing happened at the June commission. Both prisoners were then discharged and placed under military supervision. In Hegarty's bedroom the police had found 19 sticks of gelatine dynamite, some fuse and 303 cartridges, and seditious literature.

[5] The attitude of the Church throughout was equivocal. There can be no doubt that, apart from the strong Nationalist sympathies of the Roman Catholic clergy, the victory of the Central Powers was ardently desired by many, who regarded France as an "infidel" country, and saw in the defeat of the Entente the best hope of restoring the temporal power of the Papacy.

[6] On Jan. 15 1916 90 lb. of dynobol were stolen from the colliery of Messrs. Addie and Sons in Lanarkshire, and taken to Dublin. Two men were arrested for this.

[7] John MacNeill, in the *Irish Volunteer* (April 1 1916); and the O'Rahilly in the *Hibernian* (April 9).

[8] Elected Lord Mayor of Dublin in 1920 while in prison in England for sedition.

[9] Report of the Royal Commission (Cd. 8279), p. 11.

The Rising in Dublin.

When, on the beautiful morning of Easter Monday, the Irish Volunteers and Citizen Army paraded in various parts of Dublin, the holiday crowds believed it to be no more than the usual "play-boy" display. They were soon undeceived. The plan of the insurrection included the seizure of buildings and places commanding strategic positions in the city, the Castle, the Four Courts, the Post Office, Stephen's Green, certain factories, and, above all perhaps, Trinity College, which commands the intersection of all the main arteries in College Green. In the first surprise the rebels succeeded in occupying the Post Office in Sackville Street, which gave them the command of the whole telegraph system,[3] the Four Courts, Stephen's Green, and Jacob's biscuit factory. The attack on Trinity College was beaten off by a few cadets of the Officers' Training Corps, assisted by some of the college staff, while the Castle was made safe by the arrival of a small detachment of troops in the early afternoon. The first attack on the Castle had been signalized by the brutal murder of an unarmed policeman, and the same ruthlessness characterized the proceedings of the rebels elsewhere. Everyone in uniform was marked out for death, and among the victims were not only unarmed officers and police, but army doctors, wounded soldiers in hospital uniform, and elderly members of the Veterans' Corps returning unarmed from a route march.[4] In Stephen's Green a carter was shot in cold blood for resisting the requisitioning of his cart to add to a barricade.[5]

It is not to be supposed that the young idealists who were the nominal leaders of the rebellion all approved of this butchery—at the headquarters in the Post Office British officers were held prisoner and treated kindly enough—but they had unloosed forces which they were unable to control. As soon as it was clear that the city was at the mercy of the armed rebels the police, who were unarmed, were withdrawn from the streets. The under-world of Dublin seized its opportunity. A seething mob issued from the slums, invaded the main thoroughfares and looted the shops; but for the fact that most of the banks and some of the best shopping centres were commanded by the rifles of Trinity College, the loss and destruction would have been greater than it was. Presently the terror of fire was added to mob violence. How the fire originated is not known; it may well have been the work of irresponsible incendiaries among the looting mob. However this may be, on the night of April 26–7 several fires broke out in this quarter; the fire brigade could not get to work because it was fired on by the rebels; and in the end a considerable part of Sackville Street, including the General Post Office, together with part of the surrounding area, was reduced to ruins.

The rebellion was heralded on the morning of the outbreak by a proclamation "to the people of Ireland," issued in the name of "the Provisional Government of the Irish Republic." After denouncing the long usurpation of the right to govern Ireland by a foreign people, this proclaimed Ireland a sovereign and independent state, adding that "the Irish Republic is entitled to, and hereby claims, the allegiance of every Irishman and Irishwoman":—

> "Having organized and trained her manhood through her secret revolutionary organizations, the Irish Republican Brotherhood, and through her open military organizations, the Irish Volunteers and the Irish Citizen Army, having patiently perfected her discipline, having resolutely waited for the right moment to reveal itself, she now seizes that moment, and, supported by her exiled children in America and by gallant allies in Europe, but relying first on her own strength, she strikes in full confidence of victory."

The confidence would, perhaps, not have been misplaced had the original plot not miscarried. There were but few troops in Ireland; these were scattered in depots in various parts of the country; and had the unbroken strength of the Irish Volunteers been available, it is probable that all Dublin would have been occupied by them and the task of putting down the rebellion rendered tenfold more difficult, if not impossible. As it was, the prompt concentration of such troops as were available[6] enabled the authorities to maintain their position in the city pending the arrival of reënforcements with artillery in sufficient numbers to enable them to surround and isolate the rebel detachments, and so to reduce them without undue destruction of life and property.

The task was one of immense difficulty. The rebel leaders had laid their plans ably enough. Apart from the occupation of strategic positions in the heart of the city itself, they had posted detachments in hastily fortified houses commanding the approaches from the port of Kingstown, while armies of snipers occupied the roofs everywhere. Their failure to capture Trinity College and the Castle, however, seriously affected their plans, and by mid-day on the 25th the military had succeeded in cutting off the rebels on the north side of the Liffey from those on the south by a line of posts established from King's Bridge Station via the Castle to Trinity College. Towards the evening of the 25th the 178th Infantry Brigade began to arrive at Kingstown from England and was at once directed on Dublin. It was during this advance that the military suffered the heaviest casualties. This was especially the case near the bridge over the canal at Lower Mount Street, where the rebels had entrenched themselves in the schools and houses commanding its approach. Ordered to carry this position at all costs, the 7th Battalion Sherwood Foresters attacked it in successive waves, and succeeded in carrying it, but at heavy cost, four officers being killed and 14 wounded, while of other ranks 216 were killed and wounded. Meanwhile heavy fighting had been taking place in the Sackville Street quarter, where the destruction of Liberty Hall by fire from the gunboat "Helga" enabled the troops to make progress. It was not, however, till the morning of the 28th, when Gen. Sir John Maxwell arrived to take command, that troops were present in sufficient numbers to carry out the plan of encirclement efficiently. A complete cordon was now established round Dublin, and at the same time detachments were ordered to clear the various quarters of the rebels by a steady advance from house to house and street to street. This street fighting was exceedingly trying to the troops, nearly all young recruits, exposed as they were to fire from snipers on all sides, and their courage, discipline and humanity gained them the admiration even of their opponents.[1] The fact that the Volunteers were for the most part not in uniform made the fighting doubly difficult.

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[1] He was tried in London for high treason and hanged on Aug. 3.

[2] John Devoy, editor of the *Gaelic American*, asserted that Prof. MacNeill had been kept in ignorance of the projected rising until the evening of Good Friday, that "he was at first shocked, but on hearing of the shipload of arms consented." The rising was countermanded by MacNeill on receipt of a message from Casement that "all was up." *Documents relative to the Sinn Fein Movement* (Cmd. 1108), p. 19.

[3] The situation was saved by the fact that the telephone exchange in Crown Alley, though commanded on all sides by rebel snipers, was not captured by the insurgents. The girl operators displayed great courage (*Irish Times* May 24 1916).

[4] Five were fatally and many seriously wounded by a volley poured into their defenceless ranks, without warning, by Sinn Feiners in ambush in Haddington Road.

[5] A volley was deliberately fired at a motor in which a friend of the present writer, with his wife, was about to enter Stephen's Green. The lady was shot through the neck and her husband through the arm. An old man who had run out to warn them was pursued into his house, but what happened to him the writer does not know.

[6] On the morning of the second day of the rebellion (the 25th) the forces in the Dublin area consisted of some 2,300 men of the Dublin garrison, the Curragh mobile column of 1,500 dismounted cavalrymen, and 840 men of the 25th Irish Reserve Infantry Brigade.

On the 29th, the infantry having now been reënforced by a battery of field artillery, the situation of the rebels became hopeless, and at 2 o'clock Pearse surrendered unconditionally, and, in the presence of Sir John Maxwell, wrote and signed notices to the various "commanders" to follow his example. Thomas MacDonagh, who commanded the garrison of Jacob's biscuit factory, at first refused to surrender except on conditions, and two Franciscan friars were deputed to inform Gen. Maxwell of his desire to negotiate. The request was refused, and on the 30th he, too, surrendered unconditionally. These surrenders practically ended the rebellion in the city of Dublin. Throughout the night of April 30–May 1, indeed, isolated rebels continued to snipe the troops, but during the following day these were gradually cleared out, and a systematic house-to-house search for rebels and arms was continued.

Rebellion in the Provinces.

The rebellion in the provinces had met with even less success. In general the country remained absolutely quiet. In Kerry, which was to have been the focus of the rising, the capture of the consignment of German arms nipped the insurrection in the bud, and it was only in four counties—Dublin, Wexford, Galway and Louth—that the Volunteers rose in arms. In Louth the rebels accomplished nothing but a single dastardly crime. A party of Irish Volunteers started on the 23rd from Dundalk to Slane, where they spent the night. On the 24th, learning that the Republic had been proclaimed in Dublin, they proceeded to commandeer motor-cars and carts which they met on the way, seriously wounding a farmer who refused to stop. At Castlebellingham they crowned their achievements by placing Lieut. Dunville, Grenadier Guards, whose motor-car they had seized, and Constable Magee against some railings and shooting them both. In county Dublin a more serious affair took place on the 27th. A large party of rebels, led by Thomas Ashe, having been deterred by the sight of 20 soldiers and 8 police, and the more distant vision of two gunboats on their way to Skerries, from carrying out their plan of cutting the English cable at Howth, decided to attack the police barracks at Ashbourne, in Meath. Hearing of the attack, County Inspector Gray, with 54 men of the R.I.C., went north from Navan in motor-cars to engage them. Close to Ashbourne this party fell into an ambush. The Volunteers were estimated to number 400, and the police, after fighting for five hours until their ammunition was exhausted, were forced to surrender. They had lost one officer and six men killed, and their inspector and 14 men were wounded.

This was the only serious encounter in the provinces; for though the Volunteers assembled in Galway, they fled on the slightest sign of effective opposition (only one R.I.C. man was killed) and finally melted away on the 29th without accomplishing anything.[2] In Wexford the rebellion broke out on April 27 at Enniscorthy and spread to Ferns, both places being in the hands of the Volunteers until the arrival of the military on May 1. But the police reported that the movement was unpopular in the county generally, and that large numbers of people assembled in arms to assist the authorities. The surrender of the rebels at Enniscorthy was the closing incident of the rebellion. It had cost the lives of 450 people—soldiers, police and civilians—while 2,614 were wounded.

Punishment of the Rebels.

As soon as the rebellion in Dublin had been crushed, mobile columns, consisting of a company of infantry, a squadron of cavalry, an 18-pounder gun and an armoured car, were sent to the disturbed parts of Ireland, a definite area being allotted to each. In coöperation with the police these arrested dangerous Sinn Feiners and all those who were known to have taken part in the rising. On April 25 the right to try offenders against the Defence of the Realm Regulations had been restored to the military authorities by royal proclamation, and field general courts-martial were at once constituted for the trial of the rebels. In all 3,430 men and 79 women had been arrested, and of these 1,424 men and 73 women were released after inquiry. 170 men and one woman (Countess Markievicz) were tried by court-martial, and of these 159 and the woman were convicted. The remainder of the prisoners, 1,836 men and five women, were sent to England and there interned. Of those convicted by court-martial 15 were sentenced to death and executed,[3] the death sentence in 75 other cases being commuted into penal servitude for terms varying from the duration of life (in one case) to three years, while 23 were sentenced to from two years to six months' imprisonment with hard labour.

Effects of the Executions.

There can be no doubt that when on April 27 Mr. Redmond expressed in the House of Commons his feeling of detestation and horror for the rebellion, his claim to speak on behalf not only of the Nationalist party but of the overwhelming majority of the Irish people was justified. The troops had been welcomed by the people of Dublin with every manifestation of relief and joy, and the rebellion was hardly suppressed before corporations all over the country began passing resolutions condemning its folly and wickedness.[4] It is the painful duty of the historian to record how in the course of a few weeks this sentiment was completely changed and the rebellion converted, from the Sinn

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[1] Mr. James Stephens, in his "Insurrection in Dublin," p. 78, said that there was "no bitterness . . . due to the more than admirable behaviour of the troops you sent over." In his introduction, written later, he says that "it is no longer true that there is no bitterness in Ireland," but he ascribes this to the execution of the rebel leaders (p. 14).

[2] The centres of the rebellion in Galway were Athenry and Loughrea. These were described by County Inspector Clayton in his evidence before the Royal Commission, as "the black spots in Galway." "There were secret societies in this district at all times for years past. They were the centres of much of the land agitation, and many cold-blooded murders were committed there." Reported in the *Sunday Independent*, Dublin, May 28 1916.

[3] The leaders executed were the seven who had signed the declaration proclaiming the formation of the Irish Republic, viz. P. H. Pearse, Thomas MacDonagh, Joseph Plunkett, Edmund Kent, Thomas J. Clarke, James Connolly and John McDermott, together with such prominent leaders as Edward Daly, William Pearse, Cornelius Colbert, J. J. Heaston, Michael O'Hanrahan, John McBride and Michael Mallin. To these must be added Thomas Kent, who was executed for the murder of Head Constable Rowe at Fermoy on May 2.

[4] The attitude of Nationalists towards Sinn Fein before the rebellion, and generally the temper of politics in Ireland, are well illustrated by the following extracts from an account in the *Irish Times* of Jan. 29 1916 of an attempt made by the Sinn Feiners to give a concert at Carrickmore in Tyrone:—

"Desperate fighting of a hand-to-hand character ensued, both within and without the hall, but for the most part the Sinn Feiners held the school, while the Nationalists remained outside. . . . The Sinn Feiners cheered for the Kaiser, and there were shouts of 'Carson' whilst the Nationalists cheered the Allies and the constabulary. . . . Then the Nationalists, having gathered all their reënforcements, delivered a united and determined attack on the roof, doors and windows of the school. . . . An indescribable scene followed. . . . There were shrieks for the Kaiser from the Sinn Feiners, and counter-cheers for the Allies, King George and the constabulary, from the Nationalists. The fighting continued till half-past nine o'clock, when the Sinn Feiners decided to abandon the concert, and they were escorted home by the police."

Fein point of view, from a pitiful failure into a famous success. One cause of this change—though not the main one—was undoubtedly the trial and execution of the leaders; for the Irish, though they have no native horror of violence and murder, cannot bear the long-drawn-out procedure of a trial for life or death; and the slow and secret procedure of the court-martial, with the execution day by day of small batches of the condemned men, revolted every instinct of their nature. That the sentences, according to the codes of all civilized nations, were just, made no difference. Public opinion swung suddenly and violently round. The book-shops of Dublin, in an incredibly short time, reflected the public sentiment by filling their windows with the portraits and works of the "martyrs."

To this sentimental appeal a practical one, even more potent, was soon to be added. By Nationalist Ireland the rebellion had been condemned as criminal folly because it was believed that it had indefinitely postponed all prospect of Home Rule; and it was generally thought that the Government would seize the occasion to extend the Military Service Act to Ireland. Mr. Asquith, however, believing that the punishment already inflicted had been enough to prove the power of the Government, determined to try a policy of generous conciliation. He was helped in this by the attitude of certain of the Nationalist members, who, feeling that their influence in Ireland was in danger, showed a disposition to "hedge" in the matter of the rebellion. On May 11 Mr. John Dillon, Mr. Redmond's principal lieutenant, moved the adjournment of the House to discuss the executions, and in the course of a violent speech, in which he accused the Government and soldiers of washing out the life-work of the Nationalist party in "a sea of blood," he took occasion to say that he was "proud of the rebels." In his reply Mr. Asquith defended Gen. Maxwell and the troops from the wild charges brought against them, and announced that he himself was going to Ireland that evening to consult the civil and military authorities with a view to arriving at some arrangement for the future government of Ireland that would commend itself to all parties.

Mr. Asquith's Visit to Ireland.

The days spent by Mr. Asquith in Ireland, May 12–8 1916, mark an epoch in Irish history. The mere fact of having brought the Prime Minister to Ireland was in itself a triumph for Sinn Fein. But, in addition to talking with "representative exponents of the various shades and complexions of Irish opinion," Mr. Asquith visited the prisons and "talked with the utmost freedom to a large number of those who had been arrested and detained."[1] The effect was immediate. The prisoners, who had been depressed and in some cases penitent, realized that they had won a victory; their demeanour after Mr. Asquith's departure completely changed and they became boastful, truculent and unruly.[2] The effect was completed when, after his return to London, the Prime Minister announced to the House of Commons (May 25) that the dominant impression left on his mind by his visit was "the breakdown of the existing machinery of Irish Government," and that he had commissioned Mr. Lloyd George to negotiate with the Irish party leaders with a view to a compromise which would enable the Government of Ireland Act to be brought into immediate operation. The rebellion was thus advertised to all the world as the most successful failure in history. So far from destroying the prospects of Home Rule it had brought that blessing within measurable distance, and what years of constitutional agitation had failed to secure had been secured by one short week's armed argument. At the end of the year the police reports from every part of Ireland announced a general movement of Nationalist opinion towards Sinn Fein.[3]

Negotiations for a Settlement.

A new weapon was put into the hands of Sinn Fein as the outcome of the negotiations conducted, under the auspices of Mr. Lloyd George, between the Nationalist and Ulster leaders with a view to a compromise. On June 10 Mr. Redmond announced to a meeting of his supporters in Dublin that Mr. Lloyd George had proposed in the name of the Government that the Home Rule Act should be brought into immediate operation, but that an amending bill should be introduced providing for the retention of the Irish members at Westminster, and for the exclusion of six Ulster counties from the operation of the Act during the continuance of the war and for a short period after it. On the 12th the Ulster Unionist Council, whilst reaffirming its unalterable objection to Home Rule, decided in the interests of the Empire to give full authority to Sir Edward Carson to continue negotiations with Mr. Lloyd George on the basis of the definite exclusion of the six counties. Mr. Joseph Devlin used all his great influence to persuade his followers in Belfast to agree; and on June 23 a meeting of Nationalists from the six counties decided by a large majority to accept the principle of temporary exclusion.

Irish Opinion and the Proposed "Partition."

What followed is somewhat obscure. It is clear, however, that there must from the first have been a misunderstanding or what might be regarded as a misrepresentation; for the Ulstermen were as little disposed as ever to come under a Home Rule Government, except by their own consent. By the southern Unionists, on the other hand, and the large body of those living in the counties of Ulster which were not among those excluded, the suggested compromise was viewed with dismay, and numerous meetings of protest were held, at which it was pointed out, with some force, that in making special arrangements for the six counties the northern Protestants had been guilty of breaking the solemn Covenant to which they had subscribed three years earlier.[4] Whatever the reason may have been—original misunderstanding, or subsequent Unionist pressure within the Cabinet—the statement made by Mr. Asquith on July 10 as to the suggested settlement, and still more Lord Lansdowne's glosses on it in the House of Lords, roused indignant protests from Mr. Redmond and his followers, for it became known that a pledge had been given to Sir Edward Carson that the six counties would be definitely excluded from the operation of the Act and could not be included again without a fresh bill. This, together with Lord Lansdowne's statement that Gen. Maxwell would be retained in his command, that the Defence of the Realm Regulations would be strengthened, and that the prisoners would not be amnestied, was described by Mr. Redmond as an insult to Ireland and tantamount to a declaration of war against the Irish people; he demanded strict adherence to the basis of the negotiations to which he had agreed and announced that any departure from this would bring the negotiations to an end. Matters came to a crisis on the 24th, when, in answer to Mr. Redmond, the Prime Minister said he would not introduce any bill unless there were substantial agreement between the parties. This meant the collapse of the whole effort, Mr. Lloyd George asserting that it was impossible to bring the Act into operation during the war except on the terms announced by the Prime Minister. Mr. Redmond, for his part, pointed out the "deplorable effects in Ireland" of the failure of the Government to carry out the terms of the agreement, a failure which was bound to increase Irish suspicion of their good faith, and ended by announcing that, while he would continue to support the war, he would henceforth hold himself free to criticize the conduct of the Government.

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[1] Mr. Asquith's statement in the House of Commons (May 25), *The Times* May 26.

[2] From information supplied by an official eye-witness.

[3] "At the time of the rebellion the people generally condemned it, but the speeches of Mr. Dillon and others in the House of Commons on the subject, and the visit of the Prime Minister to Ireland in order to effect a settlement of the Home Rule question caused a strong reaction in Nationalist circles in favour of the rebels, as it was felt that the rebellion had done more than ten years of constitutional agitation to convince the Government of the urgent necessity for Home Rule" (police report from county Monaghan).

"Then came the visit of the Prime Minister to Ireland, his statement in the House of Commons, the announcement that Home Rule must immediately be granted, followed by Mr. Dillon's speech in the House eulogizing the rebels, and finally the letters of the Bishop of Limerick (Dr. O'Dwyer, who denounced the execution of the 'poor boys' who had headed the rebellion). These changed the whole feeling. The Sinn Feiners from being objects of contempt became heroes" (report from county Tyrone).

"The people generally had no sympathy with the rebels until after Mr. Asquith's speech in the House of Commons and his visit to Ireland, which, coupled with the execution of the leaders, completely changed the feelings of a large number of people" (report from Kilkenny).

[4] The Ulster argument was that they were keeping the Covenant in spirit, if not in the letter, because a separate Ulster Government, with a Catholic minority under it, would be a better guarantee for the just treatment of Protestants in Catholic Ireland than if the whole Protestant body were to form a minority in a Catholic State.

Breakdown of the Negotiations.

The temper of the Nationalists was not improved by Mr. Asquith's announcement on July 31 that Mr. (afterwards Sir Henry) Duke, a Unionist, had been appointed to succeed Mr. Birrell as Chief Secretary, and by the further appointment of Mr. (afterwards Sir) James Campbell, junior member for Trinity College and Sir Edward Carson's lieutenant in the Ulster movement, as Irish Attorney-General. This "restoration of the Castle regime, with a Unionist executive" was, in Mr. Redmond's language, another insult to Ireland, and on Aug. 1 a Nationalist meeting in Dublin protested against it.

Decline of Mr. Redmond's Influence.

The only gainers by Mr. Asquith's unfortunate attempts at a settlement by compromise were the Sinn Feiners, who from this moment never allowed the Irish people to forget that Mr. Redmond and his party had consented to the "partition of Ireland." Mr. Redmond did his best to undo these disastrous effects of his moderation. When, in the autumn, the question of extending the Military Service Act to Ireland was again raised, and its extension strongly supported by Irish Unionists, he threw himself into violent opposition. To his constituents at Waterford, on Oct. 6, he said that "conscription" was the most fatal thing that could happen to Ireland, and on the 18th, two days after the publication of the report of the Royal Commission on the shooting of Mr. Sheehy-Skeffington,[1] he moved a resolution in the House of Commons practically amounting to a vote of censure; charged the Government with maintaining in Ireland a system of administration inconsistent with the principles for which the Allies were fighting; demanded the recall of Gen. Maxwell and the abrogation of martial law; asked for the release of 500 untried prisoners, and the treatment of the rest as prisoners of war; and ended by adjuring the Government to show its trust of the Irish people by putting the Home Rule Act into immediate operation.

"Martial Law" in Ireland.

To all this Mr. Asquith replied, with perfect accuracy, that though martial law existed in Ireland, it was not in operation,[2] the occasional suspensions of the right to trial by jury being under the Defence of the Realm Act. Mr. Duke, the Chief Secretary, said with equal truth that the real obstacle to Home Rule was the disagreement among Irishmen, and that the only chance of obtaining it was for them to present an agreed scheme to Parliament. As for "martial law," peaceful Irish subjects must be protected, and there were men still free in Ireland who were ready at the first opportunity to repeat the proceedings of Easter week.

That this was true, and that these men were still looking for help to Germany, is proved by the intercepted correspondence of Count Bernstorff, the German ambassador in Washington. "No parades of volunteers are allowed," wrote an anonymous correspondent to him on June 30 1916, "the organization is supposed to be dead, but they are keeping in touch with each other and their spirit is excellent. Very few arms have been given up in the country and no munitions. . . . Though many arms are hidden safely there are not sufficient for future offence, unless supplemented. . . . Our present position is this: There is not a leader left. The men are there and the women too, full of spirit, but all the real brains of the organization are dead or locked up. Anyone who could voice the desires of the country to be represented at the Peace Conference is not here to do it. . . . What we need now is to get into touch with America if possible. . . . Tell John Devoy and the Clan-na-Gael that our hearts are full of courage, but that we count on them to help us." The fear that a measure of Home Rule might be granted and that John Redmond might go to the Peace Conference as Ireland's representative torments the writer:—"Better martial law and Gen. Maxwell."[3]

Revival of Sinn Fein.

There was in fact no martial law in Ireland; for martial law implies the entire supersession of the ordinary law, of which Mr. Duke, the new Chief Secretary, was a meticulously jealous guardian. The result of the consequent friction between the civil and military authorities presently became apparent; on Nov. 5 Gen. Maxwell was recalled, under pressure from the Nationalist members in Parliament; and Sinn Fein, which had fallen silent during the months succeeding the rebellion, gathered courage to revive its active propaganda.

On Dec. 9 *The Irishman* explained the policy of Sinn Fein to be "a combination of passive resistance to foreign aggression and of a coördinated development of national resources, together with the fostering of national characteristics. It rejects Parliamentarism and other such methods, and seeks in a National Council a lever to upset the whole foreign administration of the country."[4] On the 30th *New Ireland* appeared with an article deploring the life-long imprisonment of Eoin MacNeill, who "saw in the Irish Volunteers the only protection against the armed violence of the Primrose League and its dupes," another—entitled "Ireland's Revenge"—ascribing the refusal of conscription in Australia to the effect of the Easter week rebellion, and yet another ("What will Ireland do?") in which a Catholic curate argued that it was not to Ireland's interest to help to "put down Germany" and compared the lot of Ireland under the British unfavourably with that of Belgium or Poland under the Germans.

Early in 1917 the police reported that the seditious press was becoming very daring and that its influence was probably increasing. On Feb. 17 a new Sinn Fein weekly, the *Irish World*, made its appearance, and on the same day Mr. Arthur Griffith resumed the publication of *Nationality* with an article in which he denounced Mr. Redmond for his speech of May 3 1916, in which he had spoken of the "guilt" of the instigators and promoters of the rebellion. All this, in the language of the police reports, was "a bold renewal of the campaign carried out before the rebellion," and both Gen. Sir Brian Mahon, who had succeeded Gen. Maxwell in the Irish command, and the heads of the police pressed the Chief Secretary to take strong measures. Mr. Duke, however, declined to direct the seizure of these papers, and the seditious propaganda, as in Mr. Birrell's day, went on practically unchecked.

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[1] Mr. Sheehy-Skeffington, with two others, had been captured in the streets by a small party of soldiers under Capt. Bowen Coulthurst and taken as prisoner to Portobello Barracks. All three were subsequently shot by order of Bowen Coulthurst. This officer was tried by court-martial and was adjudged to be insane; his mind had been affected at the front, he had been sent to Dublin to "rest," and it was held that the horror and excitement at the outbreak of the rebellion had developed what the evidence showed to be religious mania. The Royal Commission found that Mr. Skeffington had no connexion with the rebellion, that he was in principle a "pacifist," and that he had been engaged in making an appeal to prevent looting and violence. He belonged, however, to the Sinn Fein organization, had taken an active part in the Republican propaganda, and had lectured in the United States against the cause of the Allies. In view of the fact that Mrs. Sheehy-Skeffington, during her lecture tour in America, denounced the "cruel *English* eyes" of the unfortunate young officer who killed her husband, it is necessary to add that he was not English, but belonged to a very old Irish family.

[2] The present writer was in Dublin during this year and is able to vouch for the truth of this. The life of the ordinary citizen, after the removal of the curfew and other restrictions which immediately followed the rebellion, was absolutely uninterfered with. The powers under martial law were merely held in reserve to be used in case of absolute necessity. An extraordinary latitude, not to say licence, was allowed to the seditious press, and even to seditious action so long as it kept within certain limits and did not threaten to lead to breaches of the peace.

[3] *Documents relative to the Sinn Fein Movement* (Cmd. 1108), p. 17.

[4] Note that, with the exception of the Chief Secretary, the whole administration of the country was at that time in the hands of Irishmen. The "Castle" is the name given to the whole group of buildings occupying the site of the old royal castle in Dublin, including the Lord Lieutenant's town residence and the Irish Government offices.

America Enters the War. New Sinn Fein Policy.

The year 1917 was, indeed, an extremely critical one for the Union Government in Ireland, and saw the beginnings of that policy of alternate concession and repression which was to lead to the disastrous situation of 1920 and 1921. The entry of the United States into the war on the side of the Entente was, of course, a blow to the Sinn Feiners. They did not, however, give up the idea of securing separate representation for Ireland at the Peace Conference, and meanwhile they revived the plan of making "English" Government in the island impossible by an organized system of passive resistance to, and boycotting of, the authorities. To make this system a success, however, it was necessary to enlist the active sympathy of the mass of the agricultural population, and to this task they set themselves. The old motives of agrarian discontent were no longer available for political purposes; for owing to the rise in the value of produce the small holders were enjoying an immense prosperity; it was only here and there that the police reported agrarian disturbances arising out of the agitation for the breaking up of the grazing lands. It was necessary to find other means of appealing to the Irish farmers and peasants, and these means were found in the possible effects upon Ireland of Great Britain's need for men, money and food to carry on the great struggle, which had reached its most critical stage with the beginning of the "ruthless" submarine war by Germany in Feb. of that year. The "anti-conscription" cry had already served its purpose. To this were now added appeals to the farmers on the ground that Ireland would be bled white by war-taxation and starved in order that the British might be fed.

Of these cries the most effective, next to "conscription," was the promise that independent Ireland would be relieved not only of war-taxation but also of the whole burden of the national debt,[1] and there can be no doubt that it largely contributed to the later victories of Sinn Fein at the polls. But more immediate and obvious in its effect was the agitation against the system of food-control which the submarine menace had made necessary. "The 'clutching hand' is out to capture our food," was the cry;[2] the maximum meat prices would destroy the cattle trade; and the export of bacon and butter to England would lead to starvation in Ireland. All this had its effect. The Government, following the traditional policy of humouring Ireland, excluded her from the more drastic conditions of the food-control, and actually forbade the free export of bacon and butter to England. It is not too much to say that during the critical years of the war Ireland was not only more peaceful and prosperous than she had ever been, but was the only peaceful and prosperous country in Europe.

New German Plot.

But Sinn Fein, encouraged by the almost complete immunity of its press—which even the censorship could only control within very narrow limits—continued its preparations. The beginning of the year saw the launching of the official Sinn Fein organization in the United States (Jan. 18) under the auspices of the Friends of Irish Freedom, and a beginning was made of a vast propaganda, which was to flood the world with the most amazing myths about conditions in Ireland. The new *point d'appui* in America, however, was to be used for more than propaganda, and early in Feb. the Government learned that the Germans had planned to land another huge consignment of arms and ammunition on the coast of Galway between the 21st and 25th of the month. "Adequate arrangements were made, and the consignments did not reach Ireland"; but it was clear that Sinn Fein, through its agents in America, was still in touch with Berlin and still hoped for a German victory. It was this hope which inspired the Sinn Fein executive with the idea of drawing up a statement of "Ireland's Case for a Peace Conference," claiming sovereign independence, and demanding from the Powers to be assembled that "that sovereignty be now recognized and established under their security."[3] In Germany the "Case" had a sympathetic reception, and shortly after the American declaration of war (April 4) a "German-Irish Society" was founded in Berlin by Prof. Kuno Meyer, acting in concert with St. John Gaffney, a former American consul, and Dr. George Chatterton-Hill, "a *soi-disant* Irishman, born in Madras, educated at Geneva, and resident for many years in Germany."[4] Its organ, *Irische Blätter*, held out the prospect to Ireland of being made self-reliant "by the employment of efficient German education, industrial organization and military training."

Sinn Fein and the Nationalist Party.

The Irish Nationalist party viewed with alarm the growing influence of Sinn Fein, whose organs—presently increased by a new batch of weeklies, *The Leader*, *Irish Opinion*, *The Irish Nation* and *The Phoenix*—poured derision and abuse upon Mr. Redmond and his followers. Mr. John Dillon took the lead in the effort to counter this campaign. He declared publicly that he had never stood on a recruiting platform and never would. In response to his pressure, Mr. Duke announced on Dec. 22 1916 that the 600 rebel prisoners interned in Wales were to be unconditionally released. But in vain did the Nationalist organ, the *Freeman's Journal*, try to make capital out of this for the Parliamentary party; the Sinn Fein papers scoffed at its claims to have effected anything; it was fear, and fear alone, which had dictated the action of the Government; "one direct appeal to America by the Dublin Corporation effected more than all the 'blethers' at Westminster."[5]

Roscommon Election.

Mr. Lloyd George on an Irish Settlement.

Nationalist Protest.

The release of the interned rebels was greeted by the Sinn Fein as a triumph; and on Feb. 5 it gained its first victory at the polls by the return of Count George Plunkett, father of one of the executed leaders of the Easter rebellion, for North Roscommon.[6] The discovery of the German plan to land arms followed; the Government decided to take vigorous measures; and 28 Sinn Fein agitators, all of them implicated in the late rebellion, were arrested on the 23rd and deported by order of Sir Brian Mahon under the Defence of the Realm Regulations. The Nationalist party now took a further step in the direction of Sinn Fein, Mr. Dillon moving the adjournment of the House of Commons on the 26th as a protest against the deportation of men without trial. On March 7 Mr. T. P. O'Connor, member for the Scotland division of Liverpool, moved a resolution in favour of the immediate bestowal upon Ireland of "the free institutions long promised her," and in the course of the debate that followed Mr. Lloyd George, who had succeeded Mr. Asquith as Prime Minister on Dec. 5 1916, defined the principle on which the Government was prepared to act. The Government, he said, was willing to give Home Rule at once to any part of Ireland which desired it, but could not take any action to force Home Rule on the portion of Ireland to which it was repugnant. He suggested that the details of a settlement on this basis might be arranged either by a conference of Irishmen or by a commission, and ended by moving an amendment welcoming any settlement that did not involve the coercion of any part of Ireland. This was met by a violent protest by Mr. Redmond, in the name of the Nationalist party, who said that he would enter into no more negotiations, that the Government was playing into the hands of Sinn Fein, and that he and his followers would withdraw and consider apart what they would do. The Nationalists then left the House in a body. Next day they held a meeting, at which a statement was drawn up repudiating the right of a small minority in N.E. Ulster to have a veto on self-government for a united Ireland, and appealing to men of Irish blood in the Dominions and the United States to bring pressure to bear upon the Government to act towards Ireland "in accordance with the principles for which they were fighting in Europe."

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[1] "Ireland repudiates financial responsibility for the payment of interest on England's war loan and proposes to back her repudiation with all the forces at her command." (Mr. Arthur Griffith, in *Nationality*, Feb. 24 1917.)

"The club formed at Castlemahon, Newcastle-west, is urging the local farmers to consider the present taxation, and the trend of future taxation. Other districts, please copy this headline." (*Nationality*, June 9 1917.)

"Ireland will be bled of all her resources, and a terrible emigration will ensue, if she continues bound to England. If she establishes her freedom, she will be the only nation in Europe free of a national debt." Mr. Darrell Figgis at Ennis, July 4 1917 (*Irish Times*, July 5).

[2] *Nationality*, Aug. 4 1917.

[3] Copies of this "Case" were seized by the police at the Sinn Fein headquarters in Dublin on May 18 1918.

[4] See *Doc. rel. to the Sinn Fein Movement* (Cmd. 1108), Appendix C.

[5] *New Ireland*, quoted in *Notes from Ireland*, No. 1, vol. 26, p. 2.

[6] The figures were Plunkett (S. F.) 1,708; Tully (Nat.) 687.

Agitation for an Amnesty.

Organization of Sinn Fein.

For more than two months no further open attempts at a settlement were made, and meanwhile in Ireland itself Sinn Fein gathered courage and force. On Feb. 23 it had gained a footing in the Dublin Mansion House when Alderman O'Neill succeeded Sir William Gallagher as Lord Mayor. On March 6 a Royal Irish constable was fired at and wounded in Ennistymon—a sinister portent in the light of later events. On the 21st Count Plunkett, who had received the freedom of the city of Sligo four days earlier, issued a circular calling for a Sinn Fein conference and stating that the duty had been cast upon him of inaugurating a policy for Ireland. As the anniversary of Easter week approached the tension increased. On April 2 the Dublin Corporation passed a resolution demanding an amnesty of the rebel prisoners, and on the 9th (Easter Monday) there were disturbances in Dublin, where the Sinn Fein flag was hoisted on the ruins of the Post Office, and in Cork, where, after high mass in the cathedral for the souls of the executed leaders, a noisy crowd of Sinn Fein demonstrators had to be dispersed by the police. The most significant episode, however, was the meeting at the Dublin Mansion House, on April 19, of the conference summoned by Count Plunkett. There were present between 500 and 600 delegates from elective bodies throughout the country, and from labour organizations, the Ancient Order of Hibernians, Sinn Fein clubs and the Women's League, together with about 100 representatives of the younger Roman Catholic clergy. In his address Count Plunkett declared that "they would not be fettered slaves—and that any offer that England had to make that was short of complete liberty would be treated with contempt," and he ended by proposing a long series of resolutions asserting the right of Ireland to complete independence and to representation at the Peace Conference, and pledging those present "to use every means in their power" to attain the complete liberty of Ireland. After these resolutions had been carried unanimously, Mr. John Milroy moved, and Mr. Arthur Griffith seconded, a resolution in favour of united action between such bodies as Sinn Fein, the Nation League, the Irish-American Alliance, the Irish Volunteers, and the Irish Labour party, and proposing that, in order to secure control of public institutions and elective bodies, a 'Council,' to be called the Executive Council of the Irish National Alliance, be created, with instructions to bring into being at the earliest possible moment a constituent assembly, to be known as the Council of the Irish Nation. This resolution, however, the chairman refused to put to the meeting, as too directly aimed against a still powerful section of Nationalist opinion, and he substituted one couched in more general terms, namely, "That we desire to establish an organization to unite Irish advanced opinion, and provide for action as a result of its conclusion." This was carried by acclamation.[1] Sinn Fein was thus provided with the nucleus of a national organization. It was soon to be provided once more with the brains to make this organization effective.

Fresh Proposals for a Settlement.

On May 16 the Prime Minister addressed to Mr. Redmond a letter in which he made two alternative proposals for the settlement of the Irish question:—(1) the immediate introduction of a bill for the application of the Act of 1914, subject to an amendment providing for the exclusion for five years of the counties of N.E. Ulster; (2) the summoning of a Convention of Irishmen of all parties for the purpose of devising a scheme for Irish self-government. That the first of these proposals would find favour was improbable, in view of the unpopularity already incurred by the Nationalist party owing to their concessions to the principle of "partition"; and the improbability was increased by another Sinn Fein victory at the polls on May 10, Mr. McGuinness, the Sinn Fein candidate, being returned by a majority of 37 over the official candidate of the Nationalist party.[2] Mr. Redmond, accordingly, rejected the first proposal, but accepted the second, which certainly gave a better prospect of some tangible result. On behalf of the Southern Unionists Lord Midleton also agreed, on condition that the Convention should be fully representative, and that its decision should be subject to review by the Imperial Parliament. The representatives of Ulster in Parliament said that they would lay the Prime Minister's proposal before the Ulster Unionist Council.[3] Count Plunkett, on the other hand, without waiting for the Government scheme, announced on May 18 that Sinn Fein would take no part in it.

Irish Convention Announced.

Release of the Sinn Fein Convicts.

Undeterred by this attitude of Sinn Fein, the Government announced on May 21 that they would summon an Irish Convention empowered to submit to the Imperial Parliament a scheme for the future self-government of Ireland within the Empire. In making this announcement the Prime Minister said that if the Convention reached substantial agreement, the Government would give legislative effect to its decision. It was not, he added, to be an assembly merely of politicians, but of representatives of all Irish interests and opinions, including Sinn Fein. The Government letter was to define the terms of reference, and the debates, in order to obviate undue pressure and intimidation from without, would be held with closed doors. On June 11 the Prime Minister announced the composition of the Convention. Invitations were to be sent to 101 representative Irishmen—chairmen of county and borough councils, with elected representatives from small towns and urban districts; four Roman Catholic bishops, the Protestant archbishops of Armagh and Dublin, and the moderator of the Presbyterian Church; the chairmen of the Dublin, Belfast and Cork chambers of commerce; five representatives of labour from the Trade Councils of Dublin and Cork and the Trade Unions of Belfast; five members each from the Nationalist party, the Ulster Unionists and the Southern Unionists, two from the O'Brienites,[4] and two Irish peers. Five seats were reserved for Sinn Fein; and the Government proposed to nominate the chairman and 15 prominent Irishmen of all sections of opinion. Among those thus nominated were Dr. Mahaffy, Provost of Trinity College, and Mr. George Russell ("A. E."), whose "Thoughts for the Convention," published in the *Irish Times*, won the approval of that fiery Nationalist, Archbishop Walsh of Dublin. Finally, on June 15, Mr. Bonar Law announced in the House of Commons that, "in order that the Convention may meet in an atmosphere of harmony and good-will," the Government had decided to release all the prisoners convicted and sentenced for their share in the rebellion of 1916.

This release was unconditional. There was no such "iron-clad" oath as the North had imposed upon the South after the American Civil War. The released Sinn Feiners were free to exercise all the rights of citizenship without first swearing allegiance to the United Kingdom; still less were they required to make a statement, before voting or taking office, that in sharing in the rebellion they had been guilty of "treason and felony." It was an act of political generosity without parallel in history. In Ireland it was very generally regarded as an act of political folly equally without parallel. The Lord Mayor might, in addressing his Corporation, hail the release as "a happy omen of peace and good-will"; but by the mass of the Irish people

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[1] *Irish Times*, April 20 1917.

[2] The figures were: McGuinness, 1,498; McKenna, 1,461.

[3] The Ulster Council consented on condition that no scheme should be forced on Ulster to which its representatives did not consent (June 8).

[4] Mr. William O'Brien, on June 18, announced his refusal to attend the Convention, on the ground that nine-tenths of its members were "pawned beforehand to partitionist compromise."

Sinn Fein Appeals to President Wilson.

it was looked upon as yet another victory for Sinn Fein, and the released leaders were quick to proclaim it as the outcome not of generosity, but of fear.[1] From the first they made their intentions perfectly clear; and their intentions were not peaceful. On the very day of their release (June 18) they joined in signing two appeals to the President and Congress of the United States, calling attention, in the name of "the provisional Government of the Irish Republic," to Mr. Wilson's statement, in his recent letter to the new Russian Government, that "no people must be forced under a sovereignty under which it does not wish to live"; denouncing the "English conspiracy against Ireland" and John Redmond's share in it, notably the "hypocritical sham on the Statute Book" (the Act of 1914); representing the proposed Convention as but a device to find out the minimum that Ireland would accept; and ending by expressing their determination to be content with nothing short of the practical application in the case of Ireland of the principles which the President had enunciated, viz. that of the right of small nations to independence of foreign control. "We are engaged," the appeal of the "officers" concluded, "and mean to engage ourselves in the practical means for establishing this right."[2]

Return of the Released Prisoners.

Attitude of the Roman Catholic Clergy.

East Clare Election.

They lost no time in setting to work to organize these practical means. The arrival of 118 released prisoners in Dublin was celebrated by a procession in which Sinn Fein flags were liberally displayed. The return of the liberated prisoners to Cork was the signal for a riot, in the course of which the gaol was wrecked and the military had to fire on the mob. Edward (Eamonn) De Valera, who had been one of the leaders of the 1916 rebellion, at once became the most conspicuous figure in the movement. In vain the Roman Catholic hierarchy issued, on June 19, an "instruction" to priests warning them against "dangerous associations" and "organizations that plot against the Church or lawfully constituted authority," and reminding them that it was strictly forbidden by the statutes of the National Synod "to speak of politics or kindred subjects in church."[3] Among the younger priests national sentiment proved in the long run stronger than ecclesiastical discipline; and the Sinn Feiners knew well that, if they could carry the mass of the people with them, sooner or later the Church would also fall into line. And it seemed as though the mass of the people were willing to be carried. There were, indeed, spasmodic outbreaks against the revolutionists, as when, on July 9, Countess Markievicz was attacked by a Nationalist mob at Ennis. But the true trend of public feeling was soon to be revealed by the election for the parliamentary representation of East Clare, vacant owing to the death of Maj. Willie Redmond at the front. Mr. De Valera had already been selected as the Sinn Fein candidate, and on July 11 he was returned by a majority of nearly 3,000 votes over his Nationalist opponent.[4] He was not slow to point the moral of his victory. In Clare itself he had said that if the Irish people would only combine, they could easily make "English law" impossible.

Addressing a large crowd in Dublin on the day following the election he explained the method of the combination. It must be under the Republican flag, and no other, and if Ulster stood in the way of Irish freedom, Ulster would have to be coerced.[5] This was said on July 12, the day of the Boyne celebrations, the resumption of which showed that the men of Ulster had no intention of being coerced. Six days later an event of sinister import occurred—Mr. Redmond's severance of his connexion with the National Volunteers (July 18). Col. Maurice Moore,[6] their commander, now announced that a convention would be held to nominate a governing body; and it was held, under his chairmanship, on Aug. 5, when it was decided to reaffirm allegiance to the original declaration of the Volunteers and to elect a committee to negotiate a reunion with the Irish Volunteers. Thus began the formidable organization of the Irish Republican Army; and such was the "atmosphere" in which, on July 25, the Convention met to discuss and settle the future government of Ireland.

Reorganization of the Volunteers.

The Convention.

The meeting-place of the Convention was in the hall (known as the Regent House) over the entrance gate of Trinity College, which had been placed at its disposal by the Provost and Fellows. It was felt that the selection of Trinity as the scene of its labours was symbolical of the hoped-for fusion of the two conflicting streams of Irish political sentiment; for the old college founded by Queen Elizabeth, though traditionally loyal, had been a fruitful mother of Irish Nationalist leaders, among its *alumni* being Wolfe Tone and Robert Emmet. It was, however, of evil augury that the assembling of the members was greeted by no popular demonstrations. It was noted, too, that the delegates were nearly all elderly men; young Ireland stood contemptuously and ostentatiously aside; and, indeed, among Irishmen generally there was little belief in any satisfactory outcome of the deliberations. Yet the earlier meetings gave the happiest promise. In Sir Francis Hopwood (afterwards Lord Southborough) the Convention had a secretary who brought to its aid his experience of the not very dissimilar problems presented by the negotiating of the Union of S. Africa, and the general good-will of the members was advertised by the unanimous election to the chair of Sir Horace Plunkett, who had proclaimed his conversion to Home Rule, but without attaching himself to any political party. A grand committee of 20 was elected to consider schemes presented under the terms of reference and to select those considered suitable for discussion. On Aug. 21 the Convention met to consider these schemes, most of which suggested a form of government on the Dominion model, but with modifications to suit the peculiar conditions of Ireland. These debates lasted till Sept. 27, during which time the Convention visited and held several sessions in Belfast and Cork. On the latter date it was decided to refer the various schemes to the grand committee to report, and the Bishop of Raphoe, one of the representatives of the Roman Catholic hierarchy, was commissioned by the chairman to draft the heads of a scheme to serve as the basis of discussion in the committee.

The Grand Committee met on Oct. 11, and, to facilitate business, decided to delegate the task of examining the draft scheme to a sub-committee of nine, other sub-committees being appointed to deal with the questions of electoral areas and representation, defence and police, and land purchase. The final report of the committee was presented on Nov. 21. It stated that it had arrived at certain provisional conclusions on most of the heads, but that these were all contingent on full agreement being reached on the general scheme. It was soon clear that no such general agreement was likely to be reached. The first point of fundamental disagreement was as to the safeguards to be provided for permanent minorities. It had been agreed in the sub-committee that the Unionists,[7] North and South, should be guaranteed a 40% representation in the lower House of the Parliament, this proportion to be made up, when necessary, by nomination. This proposal was submitted by the Ulster representatives to the advisory committee, outside the Convention, which had been set up to watch and guide their proceedings; and this decided that the proposal, though perhaps defensible in the case of the southern Unionists, could not be accepted in the case of Ulster. Far more fateful, however, was the failure to reach an agreement on the fiscal powers to be given to the Irish Parliament. The Bishop of Raphoe's scheme contemplated that, pending federation of the United Kingdom, there should be no Irish representation in the Imperial Parliament; provided for the exercise by the Irish Parliament of complete control over finance, including customs and excise; and suggested the appointment of a commission to negotiate a trade, postal and customs union with Great Britain. These proposals represented a great departure from the principles of the Act of 1914 and an approximation to the Sinn Fein ideal of an independent Ireland. They were opposed by the Unionists both of the South and North. The former were, indeed, prepared to concede to the Irish Parliament control of excise; but the Ulstermen insisted on full control of finance being left to the Imperial Parliament. Mr. Hugh T. Barrie, chairman of the Ulster representatives, pointed out in a letter to Sir Horace Plunkett[1] that the difference which had brought matters "nearly to a dead-lock" rested on points of principle and not of detail. He urged that in matters of fiscal policy and economic life the interests of Ireland were inseparable from those of Great Britain, and that there could be no differentiation of taxation or customs barrier between countries which must continue to be so intimately associated. The doctrine of fiscal autonomy was more than "a symbol of political autonomy"—as Sir Horace had described it; it would, under a colonial form of government, separate the interests of Ireland from those of Great Britain and thus inevitably lead to the same goal as the Sinn Feiners desired to reach under a republic.[2] The practical independence of Ireland, under the Crown, would mean that, desiring to increase her industrial activities and with practically no raw material within herself, she would be cut adrift from the strongest commercial power in the world and have to rely on her own resources in the welter of economic trouble with which the world would be faced at the end of the war. Ulstermen refused to be divorced from the great industrial people with whom they had so much in common.

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[1] De Valera in conversation with Mr. John Balderston, *McClure's* correspondent in Ireland.

[2] *Doc. rel. to the Sinn Fein Movement*, pp. 30 ff.

[3] The Instruction was signed by the Cardinal Archbishop of Armagh and the bishops of Cloyne and Ross (*Irish Times*, June 20 1917).

[4] The figures were: De Valera, 5,010; P. Lynch, 2,035.

[5] *Irish Times*, July 13 1917.

[6] Brother of George Moore, the novelist. He had commanded a battalion of the Connaught Rangers.

[7] In Ireland the words "Unionist" and "Protestant" are practically synonymous and are commonly used alternatively. "Unionists," as such, would of course cease to exist under Home Rule, and the "safeguard" suggested would therefore have meant the stereotyping of parties on sectarian lines. The objection of Ulster, however, was that the nomination of parliamentary representatives is undemocratic and quite unsuitable to a democratic and industrial community such as N.E. Ulster.

On this rock the Convention split. The final report of the sub-committee, presented on Nov. 21, stated that on the all-important fiscal question it had been impossible to find a basis of agreement. The grand committee equally failed; and the question was introduced in the Convention itself, which debated it from Dec. 18 to Jan. 24 without coming nearer to a decision, a compromise suggested by Lord Midleton being rejected by a combination of Nationalists and Ulstermen. The Convention was now in danger of breaking up without effecting anything, and on Jan. 21 the Prime Minister addressed a letter to Sir Horace Plunkett inviting a delegation from the Convention to go to London to discuss the crisis with the Cabinet, with a view to arriving at a solution. The invitation was accepted, but the resulting conferences were fruitless, and the problem was once more transferred to Dublin for the Convention to solve as best it might. The Prime Minister still hoped that substantial agreement might be reached; and on Feb. 21 he addressed a letter of appeal to Mr. Barrie, the terms of which left no doubt of his anxiety to effect an immediate settlement and of his readiness to do all in his power to promote it; and on the 25th he sent another letter, in almost identical language, to Sir Horace Plunkett.[3] No appeals and no arguments, however, could effect a compromise when interests and sentiments were in such diametrical opposition. On March 12 the Convention, despairing of reaching agreement, passed a compromise proposed by Lord Macdonnell to the effect that customs and excise should be under the control of the Imperial Parliament during the war, and thereafter until the question of such control had been considered and a decision arrived at by the Imperial Parliament, the decision to be taken not later than seven years after the conclusion of peace. The motion was carried, but only by a majority of four in a house of 72 members; the minority included all the Ulster representatives and a number of Nationalists. Three days later (March 15) Mr. Barrie moved an amendment providing for the exclusion of Ulster from the jurisdiction of the Irish Parliament. This was defeated by 52 to 19, the southern Unionists voting with the Nationalists against it. It marked, however, the definite withdrawal of the Ulster representatives from any appearance of compromise with the Nationalist principle, and the Statement of Conclusions reached by the Convention shows that they voted solidly against all proposals which involved recognition of the principle of setting up an Irish Parliament.[4]

Proposed Constitution.

The scheme, as ultimately accepted by a majority of the Convention on April 5 1918, provided for the establishment of a Parliament for the whole of Ireland, with an executive responsible to it. The Parliament was to consist of the King, a Senate, and a House of Commons, but the supreme power and authority of the Imperial Parliament over all persons and causes in Ireland was reserved. The Irish Parliament was to have a general power to make laws for Ireland, subject to certain reservations. Imperial matters—right of peace or war, army and navy, treaties and foreign relations, etc.—were specifically excluded from its competence. There were also to be certain restrictions imposed on its power in matters within its competence, mainly directed to safeguarding the liberties of the Protestant minority and the interests of existing Irish officers. To this end also the Convention accepted the principle that 40% of the membership of the House of Commons should be guaranteed to the Unionists, the nominated members to disappear in whole or in part after 15 years. Representation at Westminster was to continue, 42 members being elected by panels formed in each of the four provinces by members of the Irish House of Commons in that province, and a fifth composed of members nominated by the House of Commons. All branches of taxation, other than customs and excise, were to be under the control of the Irish Parliament. The question of customs and excise was to be postponed in accordance with the terms of Lord Macdonnell's motion already quoted.

The various sections of the Report had been carried by majorities varying from 51 to 18, to 38 to 34, and the Report itself was adopted by a vote of 44 to 29, several prominent Nationalists, including the Bishop of Raphoe, voting with the Ulster representatives in the minority. It was clear that on no points had that substantial agreement been reached which would alone have justified the Government in attempting a dangerous constitutional experiment in the midst of the war.[5]

Failure of the Convention.

In Ireland it was all but universally recognized that the Convention, for all the common love of country and mutual good-will between Irishmen of different creeds and parties which it had revealed, had been a failure. It belongs to the history of Ireland, but on the future development of that history it had, unhappily, no influence. It was outside the Convention that the fate of Ireland was being shaped. The truth is that the "atmosphere" provided for the Convention by the release of the Sinn

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[1] Nov. 14 1917. Report of the Proceedings of the Irish Convention (Cd. 9019), p. 68. Sched. vii.

[2] Cf. with this 18 of the "Report of the undersigned Nationalists" attached to the *Report* of the chairman of the Convention, p. 38:—"Federation is not in view. Even if it were, and Ireland were still intent on retaining control of her customs, her sea boundary, and her distinct national character, economic interests would give her a claim in that respect which no member of a federation anywhere else can advance."

[3] The letter to Sir H. Plunkett is printed in the *Report*, p. 20.

[4] See *Report*, p. 24, and compare the division list, Appendix xvii.

[5] The Ulster Unionist delegates attached to the chairman's *Report* a protest of their own. They ascribed the failure of the Convention to the refusal of the Nationalist members to agree to a *modus vivendi* which would both maintain existing fiscal unity, guarantee protection for the Unionist minority, and ensure the safety of Irish industrial enterprises, "the vast proportion of which are situated in the N. E. counties of Ulster, and from which the bulk of the Irish revenue is derived" (p. 30).

Fein prisoners had been far from wholesome. The Sinn Fein organization had never been broken up, but it had languished because its "brains" were in prison. The sickness was now cured, and it at once displayed an astonishing vitality, Mr. De Valera, crowned with the double glory of his share in the rebellion and his victory in Clare, becoming its recognized leader.

While the Convention was continuing its more or less amicable discussions in the academic calm of Trinity College, Sinn Fein orators were touring the country inspiring increasing crowds of ignorant and excitable people with their own venom and their own views as to how Ireland was to find salvation. Their text, generally speaking, was the dictum of Parnell, uttered in 1883: "It is no use relying on the Government; it is no use relying on the Irish members; it is no use relying on the House of Commons. You must rely on your own determination, and if you are determined, I tell you, you have the game in your hands."[1] Their programme remained the same; to capture the parliamentary representation and the elected organs of local government; to boycott and supersede the royal courts and the officers of the law; to organize and arm a force capable of effective resistance to the forces of the Crown. The latter object was pursued with no attempt at disguise. On July 28 the Government issued a proclamation prohibiting the carrying of weapons, or of objects capable of being used as such, in public places. On the following day Mr. De Valera, after addressing an assembly of 10,000 people at Tullamore, reviewed 1,000 Irish Volunteers; and on the same day 100 men carrying hurleys[2] marched from Liberty Hall through Dublin to Terenure. On Aug. 5, the anniversary of Casement's execution, a vast concourse of people assembled at Tralee in county Kerry and went in procession to "Casement's fort." Sinn Fein tricolours were worn and waved, and it was noted that large numbers of Volunteers appeared in uniform.[3] From county Clare the police reported that De Valera's advice to the people to combine "to make English law impossible" had produced a complete condition of lawlessness, the supporters of the Nationalist candidate at the recent election being boycotted together with the police; from Tipperary, that Sinn Fein had become violent and menacing, especially in Thurles, and that the movement was being worked up in concerts, dances, club meetings, Gaelic athletic tournaments, lectures and public meetings; from Cork, that serious disturbances had broken out, including a cowardly attack on female munition workers.[4] A similar agitation, with similar results, was taking place in many other parts of Ireland. Already there were reports of attacks on police barracks, and in many places the drilling of Volunteers was being resumed. At the same time the Sinn Fein clubs, and in some cases the County Councils (*e.g.* Kerry, Aug. 26), were calling upon their Nationalist members to resign. The result of all this was advertised by another victory of Sinn Fein at the polls, at Kilkenny (Aug. 11).[5]

DeValera's Influence.

Death of Thomas Ashe.

It became absolutely necessary for the Government to take action, if any semblance of authority was to remain to it; on Aug. 14 prominent Sinn Feiners were arrested in every province of Ireland; and this was followed by the seizure of arms belonging to the Irish and National Volunteers. The prisoners, many of whom had taken an active part in the German plot of 1916, were sentenced under the Defence of the Realm Act to various terms of penal servitude or imprisonment. But the greatest care was taken not to interfere with the free expression of opinion, so long as this did not amount to incitement to illegal acts; and when meetings were proclaimed, which was comparatively rarely, it was always because, in the opinion of the police, they would lead to grave disorder. Throughout the year, and during the earlier months of 1918, De Valera and his lieutenants continued their agitation practically unchecked. Their cause was helped by an untoward event which occurred on Sept. 25—the death of Thomas Ashe as the result of forcible feeding in prison. For some time past Sinn Fein prisoners had been imitating the suffragette device of the "hunger strike," in order to secure their treatment as prisoners of war or political prisoners. Ashe, the hero of the Ashbourne affair, had been tried for murder and condemned to death by court-martial after the Easter week rebellion, but reprieved. Released by the general amnesty, he was rearrested on Aug. 14, and on the 20th was condemned to one year's hard labour for attempting to cause disaffection among the civil population. He went on hunger strike, was forcibly fed by the prison doctor in the ordinary execution of his duty, and died of heart failure as a result of the process. The affair created an immense sensation, and Sinn Fein exploited it to the full. The funeral of the latest martyr in Dublin was attended by a vast concourse of people; the coffin was draped in the Sinn Fein tricolour and escorted by Irish Volunteers in uniform and armed; the Lord Mayor of Dublin (Alderman O'Neill) and Dr. Walsh, Roman Catholic Archbishop of Dublin, sent their coaches to swell the cortège, while the Dublin Corporation adjourned for a week as a sign of sympathy and respect.

For the Government, which during the inquest was loudly accused of deliberate murder, nothing could have been more unfortunate. On the 29th the authorities decided to modify the treatment of political prisoners; but the hunger strikes continued; the Government, afraid of the effect of forcible feeding, and as yet unwilling to allow the prisoners to take the consequences of their self-imposed deprivation, had recourse to the provisions of the "Cat-and-Mouse Act," under which prisoners on hunger strike could be released but were subject to rearrest when they had recovered their strength. The result in Ireland was to make imprisonment little more than a cheap advertisement, prisoners being released after a few days' abstention from food. By Nov. the situation had become so farcical that Sir John Ross, in the Land Judges' Court, declared that the government of Ireland had been abandoned. Yet even the feeble half-measures employed by the Chief Secretary, Mr. Duke, roused the opposition of the Nationalist members, who saw in obstructing the action of the Irish Executive the only surviving hope of retaining their weakening hold on the country. In reply to Mr. Redmond, who on Oct. 23 opened the attack on the Government in the House of Commons, Mr. Duke enlarged on the peril of the situation, pointing out that 200,000 young men were being enrolled in Ireland for the purpose of a new rebellion. Point was given to this by the news next day that the United States had frustrated an elaborate scheme for a new rising, with German aid, by the arrest of the Sinn Fein agent Liam Mellowes and Dr. Patrick MacCartan, Sinn Fein "ambassador" in America.

Sinn Fein Convention.

The forbearance of the Government was illustrated by the assembling on Oct. 25, in the Dublin Mansion House, of a Convention summoned by Sinn Fein to formulate a constitution for Ireland. This Convention, which claimed to represent 12,000 Sinn Fein clubs with 250,000 members, concluded with a public session on Oct. 27, when the Sinn Fein constitution was announced. The object of the organization was declared to be to secure the international recognition of Ireland as an independent Republic, and to "make use of any and every means available to render impotent the power of England to hold Ireland in subjection by military force or otherwise." Mr. De Valera was elected president, Mr. Arthur Griffith and Father Michael O'Flanagan vice-presidents, Messrs. Austin Stack and Darrell Figgis secretaries. "Departments," under "Ministers," were to be created for military organization, political organization, education and propaganda, foreign relations and finance. After the meeting a convention of Irish Volunteers was held in a large store in Dublin. At this meeting De Valera said that by proper organization and recruiting Sinn Fein would secure

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[1] Quoted by Darrell Figgis in *Nationality*, Aug. 4 1917. He adds: "That is Sinn Fein!"

[2] Practically a hockey club. The *Daily News*, among others, ridiculed the prohibition to carry these "toys." It was with a hurley that Inspector Mills was murdered in Dublin.

[3] *Irish Times*, Aug. 7 1919.

[4] On Sept. 2 and 3 American sailors walking out with girls were mobbed and maltreated by the Sinn Fein "Vigilance Committee."

[5] The figures were: Cosgrave (S. F.) 772; Magennis (Nat.) 392.

500,000 fighting volunteers, that the only hope of another rebellion with any chance of success lay in a German invasion of England and the landing of further arms in Ireland, but for that they must prepare. He further said:—

> "That there would never be peace in Ireland till they got their independence. When the war was over England would be tottering. The Allies could not win. All nations at the Peace Conference would claim their right to the freedom of the seas, and Ireland was of such international importance in that respect that her claim must be admitted. They wanted an army to back their claim. . . ."

On Nov. 4 at Athy he delivered another speech, important as an index to Sinn Fein principles and methods. England, he urged, did not "desire another front," and therefore, if Ireland were armed, there would be no conscription. Turning to the attitude of the hierarchy, and possible action by the Vatican, he said that England would doubtless like such an intervention, but he claimed for priests in political matters full freedom, including that to join Sinn Fein.[1]

A bitter attack on Mr. Redmond[2] followed, and a stout assertion that Sinn Fein was "not afraid of Sir Edward Carson and his crew."

It is not surprising that the repetition of this sort of language should towards the end of the year have produced a situation with which the Government, hampered by the "atmospheric" theory of administration, were unable to cope. Disciplinary measures, even of a mild sort, had—according to the police reports—an instantaneously good effect; but discipline was all but impossible when the only available punishment, imprisonment, was rendered nugatory by the expedient of the hunger strike, and prisoners were released almost as soon as they were condemned.[3] The sword of justice, dropped from the nerveless hands of the legitimate administrators of the law, was grasped by Sinn Fein, which did not scruple to use "any and every means" to attain its end. Thus, even so early as this, the effective control of affairs in large parts of Ireland was passing out of the hands of the officers of the Crown. The process may be illustrated by one instance. In Dec., according to police reports from Clare, "Sinn Fein continued to rule the county, and persons who were not Sinn Feiners must show sympathy with the movement if they wished to live in peace with their neighbours"—in other words, if they wished to escape the terrible weapon of the boycott or worse.[4] That Sinn Fein was still in touch with Germany was proved when James Ruane, a local Sinn Fein leader, was arrested on Dec. 2 at Kiltimagh in county Mayo, when he was found in possession of two pamphlets printed in Germany and bearing the official impress, "Kriegsausschuss der Deutschen Industrie, Berlin."[5]

The beginning of 1918, which saw affairs in the Convention come to a crisis, saw also the development of grave disorders in large parts of the country. Through the south and west a flood of lawlessness was sweeping; in the counties of Clare, Sligo, Roscommon and Mayo the King's writ had virtually ceased to run. From Clare, especially, the police reported that during the first four months of the year there was "utter anarchy." There were huge cattle "drives," encouraged by the local clergy; illegal drilling was openly carried on; R.I.C. barracks were attacked; on three occasions small patrols of police were overwhelmed and their arms taken; telegraph wires were cut and roads blocked to hamper the movements of the police and troops. "It was not until a large force of soldiers were drafted in, and the county made a special military area[6] with very severe restrictions, that some sort of order was restored." Similar reports, though not so grave, came from other counties; in Galway and in Tipperary, as in Clare, there were numerous raids for arms on isolated country houses, carried out by bands of masked men; and Tipperary, where the police reported a "reign of terror," had to be declared a special military area so early as March 6. On the same day there were serious riots in Limerick.

Death of John Redmond.

On March 6, John Redmond died in London, and with him seemed to go the last hope of settling the Irish question on a basis of reasonable compromise. In him, indeed, it is said that the hope had died already, and that his death was hastened by the consciousness of the breakdown of his life's work. On Jan. 11 the Ulster Unionist Council had urged the Government to extend the Military Service Act to Ireland, but three days later, when the new bill was introduced in the House of Commons, Sir Auckland Geddes announced that this course would not be followed. This was a victory for the Irish Parliamentary party, and its reflex was seen in the results of the Irish by-elections, Nationalist candidates defeating Sinn Feiners in South Armagh (Feb. 2), at Waterford (March 23) and in East Tyrone (April 4).[7] The day following this latter election saw the last meeting of the Irish Convention; and the set-back to Sinn Fein seemed of favourable augury for some satisfactory outcome of its labours. But circumstances almost at once arose which again made any peaceful solution of the Irish question impossible.

The Man Power Act. Extension to Ireland.

The March offensive of the Germans, resulting in the pressing back of the British line with an immense loss of men and material, made it necessary for the Government to summon every possibly available man in Great Britain to the colours, the age limit being raised to 50. It was felt, however, that to call elderly men to arms in Great Britain while thousands of young men of military age in Ireland continued to be exempt would strain the patience of the British to breaking point; and when, on April 9, Mr. Lloyd George introduced the Man Power bill, he announced that he proposed to extend obligatory military service to Ireland on the same terms as to England. On the following day the second reading of the bill passed by 323 votes to 100, the clause extending it to Ireland being carried two days later by a slightly smaller majority.

The passing of this measure, which two years earlier would probably have been accepted in Ireland without serious demur, at once threw the whole country into fresh turmoil, which Mr. Lloyd George's undertaking to introduce a bill to give self-government to Ireland did nothing to allay. On March 12 Mr. John Dillon had been elected as Mr. Redmond's successor in the leadership of the Nationalist party. Under his auspices Nationalists and Sinn Feiners established a sort of temporary alliance, ominous of the ultimate fate of the Parliamentary party. On April 17, after the defeat of an amendment to exclude Ireland from the Man Power bill, the Nationalists left the House of Commons in a body and decided to transfer their deliberations to Dublin. On the 18th, the day on which the bill received the royal assent, a meeting to denounce it was held at the Mansion House, Dublin, and was attended by the leaders of the Nationalists, of Sinn Fein and of the various labour groups; it was noted that Mr. Dillon referred to Mr. De Valera and Mr. Tom Johnson, the Labour leader,[1] as his "colleagues." On the following day they issued a joint statement protesting against the claim of the Imperial Parliament to impose "conscription" on Ireland, and commissioned the Lord Mayor (Alderman O'Neill) to proceed to the United States in order to lay it before President Wilson.[2] On the 20th Mr. Dillon presided over a meeting of the Nationalist party in Dublin, at which it was decided to cease attendance at Westminster and to remain in Ireland for the purpose of defeating conscription. On the 23rd the Transport Workers' Union carried out a one day's strike in all parts of Ireland, except in the N. E. counties of Ulster, as a protest against conscription. But by far the most serious effect was produced by the action of the Roman Catholic hierarchy. On April 18, the day on which the first anti-conscription conference was held at the Mansion House, the bishops had met at Maynooth, under the presidency of Cardinal Logue, and decided to throw the whole weight of the Church against the Act. They drew up a form of pledge to resist conscription, directing it to be administered by the priests after Mass to all the faithful, and every Roman Catholic parish church in Ireland was soon turned into an active centre of political resistance. In vain loyal Catholics protested, while Protestants were not reassured by the theological arguments by which the learned Father Peter Finlay, S.J., sought to justify the incursion of the hierarchy into politics:—

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[1] On Nov. 25 Cardinal Logue issued a pastoral condemning the agitation. Speaking at Roscommon, next day, De Valera refused to discuss it. The movement, he said, had two sides, destructive and constructive; the destructive side to destroy English misgovernment, and the constructive side to build up a self-respecting, self-reliant nation, a nation able to manage for itself, without looking abroad for help of any sort; and when the opportunity comes for producing Ireland's case before the world, then to ask those nations who are supposed to be fighting for small nationalities if they are not hypocrites. It was on that plea, he believed, that England went into the war; so far as England was concerned that plea was hypocrisy.

[2] These and similar attacks threatened to have unpleasant consequences; and while at Aughavanagh, in Wicklow, Mr. Redmond was protected by a police patrol.

[3] Between Nov. 15 and 21 102 hunger strikers were released from various prisons. From County Clare the police reported that "the arrests for illegal drilling in Nov. had a good effect until the release of the prisoners on hunger strike, which made matters worse." On the other hand they reported that in Dec. the cessation of arrests had made many give up drilling, as done out of mere bravado.

[4] As an indication of the spread of Sinn Fein it is interesting to note the great rise in the circulation of Sinn Fein organs. The *Irishman*, *e.g.*, which in Feb. 1916 had a circulation of only 1,692, had increased this in Nov. 1917 to nearly 15,000 weekly.

[5] *Documents rel. to Sinn Fein Movement*, p. 39.

[6] March 30.

[7] The figures were: S. Armagh—Donnelly (Nat.) 2,324; Dr. MacCartan (the Sinn Fein "ambassador" to the United States) 1,305; Richardson (Ind. Unionist) 40. Waterford—Capt. W. A. Redmond (Nat.) 1,242; Dr. White (S. F.) 764. E. Tyrone—Harbison (Nat.) 1,802; Sean Milroy (S. F.) 1,222.

> "No doubt," he wrote, "political consequences of the first magnitude have followed on the action of the bishops; but the issue laid before them was religious and moral, not political. . . . Laws of Parliament may be just or unjust, binding or not binding upon conscience; and when we Catholics doubt their justice and binding force, we appeal, not to politicians or to civil court for guidance, but to the Catholic bishops."[3]

From the point of view of Irish Protestants this justification of the attitude of the Catholic hierarchy was even more disconcerting than the attitude itself. They had seen, from recent cases of the papal "Motu Proprio" *Quantavis diligentia* and the *Ne temere* decree, how completely the Roman Church adhered to the most extreme claims to jurisdiction put forward by the mediaeval popes. They knew that the principle of toleration had been anathematized by three popes during the 19th century, and they naturally asked themselves what use parliamentary safeguards for their religious liberties would be under Home Rule, if the laws of the Irish Parliament were to be subject to the "moral" censorship of the Roman Catholic hierarchy with an ultimate appeal to Rome. The whole "conscription" controversy, indeed, still further increased the unhappy national cleavage represented by religion; for while the Roman Catholic clergy were organizing their forces to resist, the Protestant Archbishops of Armagh and Dublin sent out an "urgent appeal" to the young men of the Church of Ireland to join the colours, hoping that compulsory service would be "cheerfully accepted," while the Moderator and General Assembly of the Presbyterian Church issued a similar appeal.

Split in the Unionist Alliance.

Unfortunately for the Protestants, at this crisis in their fate, their own ranks were broken by an angry controversy as to the attitude in the Convention of the five delegates appointed by the general council of the Irish Unionist Alliance. These delegates, under the leadership of Lord Midleton, had interpreted their mandate as meaning that, in the interests of the Empire, they were to arrive at some compromise with the Nationalists in the matter of Home Rule; and, while affirming their own unshaken belief in the system of the Union, they had accepted the principle of Irish self-government and voted on many occasions with the Nationalists against the Ulster Unionist delegates. On Jan. 1 1918 Lord Midleton made his first report to the executive committee of the Alliance, and this was approved by 41 votes to four. It was soon found, however, that the executive committee, which had not been renewed since the beginning of the war, did not in this matter represent the opinions of the great majority in the Alliance. A Southern Unionist Committee was at once formed under the chairmanship of Mr. Richard Bagwell, the eminent historian of Ireland, and on March 4 issued a "Call to Unionists":—

> The circumstances of the present time demand that all true Unionists, especially outside Ulster, should reiterate, with no uncertain voice, their conviction that in the maintenance of the legislative union between Great Britain and Ireland, and in the firm, just, and impartial administration of the law, lies the only hope for the future of our country and security of the Empire.

It pointed out that the present revolutionary movement, which was "gaining strength day by day," aimed—like all preceding ones—at complete separation; it urged that the true policy to be pursued towards Ireland was, in combination with firm and just government, the development of her material resources and the removal of agrarian discontent by the completion of land purchase; and it ended by stating that "the burdens and obligations of the war, already imposed on the rest of the United Kingdom should be shared by Ireland."

This manifesto led to a heated controversy in the press. It had, however, no effect on Lord Midleton and his followers in the Convention, who voted in the majority for the Report. The Southern Unionist Committee at once issued a criticism of the Report, pointing out that the delegates of the Alliance had publicly declared for Home Rule in its most drastic form, and calling on Unionists to "stand firm." That this attitude represented the dominant view in the Alliance was proved when, at a meeting of the General Council held on June 7, 16 out of 20 members elected to fill vacancies on the executive committee were nominees of the Southern Unionist Committee. Lord Midleton's supporters were, however, still in the majority on the executive committee, and it became necessary to amend the constitution so as to make this representative of the views of the General Committee. This was done at a special meeting summoned by the Southern Unionist Committee on Jan. 24 1919. Lord Midleton proposed at this meeting to exclude the northern members from its deliberations, should the question of partition arise. This motion was lost by an overwhelming majority; the amendments to the constitution were carried by 400 votes to 62; and at the subsequent elections to the executive committee the 40 nominees of the Southern Unionists Committee were elected by large majorities. Lord Midleton and his friends, taking this as a vote of censure, thereupon left the Alliance, and formed the separate group known as the "Anti-Partition League." The Unionist Alliance was thus reëstablished on the basis of uncompromising adherence to the Union, with branches in every county in Ireland, including Ulster. It continued to work in close touch with the Ulster Unionist Council, which represented the exclusive interests of Unionists in the six counties. From the Unionist point of view, however, the schism was disastrous; for the seceding members of the Alliance, though few in numbers, included many Irish peers of great influence in the House of Lords, and their defection greatly crippled the resources of the Alliance, which was left practically without representation in Parliament.

Meanwhile excitement among the people had been growing apace. In every Roman Catholic church in Ireland the people were signing the anti-conscription pledge, and to refuse to do so called for more than ordinary courage. It was clear that a change of system was necessary in the administration if the Crown was to preserve any shadow of authority in the country. The change was heralded on May 1 by the retirement of Mr. Duke,[4] and the appointment of Mr. Edward Shortt, K.C., as

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[1] An Englishman, formerly a commercial traveller.

[2] It was believed that the Government would create another occasion for outcry by refusing to give the Lord Mayor a passport. The Government, however, consented to issue passports, but made it a condition that the document to be presented to the President should be first shown to the Lord Lieutenant. To this the Irish leaders refused to agree, and it was made the excuse for abandoning the whole enterprise. The Cork Corporation had also protested, and appealed to President Wilson (April 12).

[3] Letter to the *Irish Times*, May 14 1918, afterwards amplified in an article in the Jesuit Sinn Fein quarterly *Studies*.

[4] He became a Lord Justice of Appeal.

Lord French, Viceroy.

Chief Secretary. On the 6th it was announced that the lord-lieutenancy, in succession to Lord Wimborne, had been accepted by Visct. French of Ypres; and on the 11th the new Viceroy and Chief Secretary arrived in Dublin. Sir Brian Mahon had resigned the Irish command two days earlier. On June 5 Sir James Campbell succeeded the Nationalist Sir Ignatius O'Brien—created Lord Shandon—as Lord Chancellor. The spirit of the new order was symbolized by the changes at the viceregal lodge, where Lord Wimborne had maintained traditions of splendour. For this was now substituted the simple discipline of a military household.

The new administration was not slow in getting to work. On May 17 De Valera was arrested, a number of compromising documents being found on his person.[1] Next day, a proclamation announced the discovery of a dangerous German intrigue.[2] On the 20th a large number of Sinn Fein leaders were arrested, including Arthur Griffith, Count Plunkett, Countess Markievicz, John Milroy and Herbert Mellowes. These were all deported to England, and further deportations followed on the 22nd and 24th. On the 21st, at a meeting of the Anti-Conscription Committee at the Dublin Mansion House, Messrs. Dillon, Tim Healy, William O'Brien, Joseph Devlin and Tom Johnson combined in denouncing the deportations as "a wicked plot of English politicians," and on June 3 the Dublin Corporation followed their example. On May 25 the Council of the National University—a government institution largely supported by the British taxpayer—advertised its views by reappointing Mr. John MacNeill to the professorial chair which he had forfeited owing to his share in the rebellion.[3] Meanwhile the Military Service Act had not been put in force in Ireland, and on June 3 the Lord Lieutenant issued a proclamation calling for voluntary recruits, announcing that in the event of a satisfactory response the Act would not be applied, and promising grants of land to men who had served in the war. An active recruiting campaign was at once begun under the direction of a committee consisting largely of Nationalists who had served at the front, including Col. Lynch, who had been condemned to death for fighting with the Boers against the British in the Boer War. The response to this appeal, however, was slow. The meetings were exposed to an organized interruption by Sinn Feiners, and this sometimes developed into violence, necessitating the intervention of the police.[4] By Nov. 12, when recruiting was stopped after the Armistice, of some 150,000 men of military age only 11,301 had joined the colours. The only practical outcome of the campaign, conducted as it was by Nationalists with a loud appeal to President Wilson's programme, was to commit the Government irrevocably in the eyes of the Irish people to the principle of "self-determination."

Proclamation of Sinn Fein.

Evidence of the revolutionary activities of Sinn Fein continued to reach the Government, and 40,000 rounds of ammunition, concealed in corn sacks from the North, were seized in Dublin on June 24. The arrest of a German agent named Dowling (alias O'Brien) in April, and his trial in London in July, pointed the moral of these military preparations; and on July 3 the Sinn Fein organization, Sinn Fein clubs, the Irish Volunteers, the Cumann na mBan (Women's Association) and the Gaelic League, were proclaimed as dangerous associations under the Defence of the Realm Act. Next day the whole western sea-board of Ireland was declared a military area under the same Act. From all parts of the south and west came reports of raids for arms by masked men on isolated country houses. In Wexford, in Wicklow, in Longford, in King's county, as well as in such perennially lawless counties as Clare and Tipperary, the charges of the judges to the grand juries, at the summer assizes, referred to a dangerous state of things "which could not go on in any civilized country"—outrages, intimidation, boycotting. The grand jury of county Clare handed in a resolution approving of the steps taken by the Government "to restore the rudimentary elements of law and order," and stating their opinion that "the retention of a competent military authority, together with sufficient forces, was absolutely necessary to the continued maintenance of the peace of the county." Such, however, was not the opinion of Mr. John Dillon and the Nationalist members, who after an absence of three months had returned to Parliament on July 23. On the 29th Mr. Dillon moved that the Irish policy of the Government was inconsistent with the principles for which the Allies were fighting, and in the course of a violent speech spoke of Ireland as "under the unfettered tyranny of military government" and suggested that President Wilson should be called in to settle the question. In his reply Mr. Shortt, the Chief Secretary, threw the blame for the condition of Ireland on the Nationalists, who were trying to outbid the Sinn Feiners in violence instead of restraining them.

This was truer than his sanguine assertion that things in Ireland had improved. It had early become apparent that the union of all the Nationalist elements on the common ground of opposition to conscription had been more apparent than real, and that its most obvious outcome was a formidable accession of prestige and power to Sinn Fein. It had persuaded Mr. Dillon to accept, at least for the time, its policy of abstaining from attendance at Westminster; it had secured the control of the anti-conscription funds raised by the Mansion House committee for a Sinn Fein organization; and it had made not the slightest concession in return. The full import of this was revealed during the contest which preceded the election for East Cavan on June 21, and its result. Over the question of a candidate the Nationalist party and Sinn Fein were "at one another's throats." It was suggested that this seat, which had been held by a Nationalist, should be left to a Sinn Feiner, for the sake of preserving "national unity." But on May 3 Mr. Dillon had declared that "if the spirit exhibited by the leaders of Sinn Fein in making an attempt to capture the seat were to prevail, national unity would be obviously impossible."[5] The attempt did prevail, Mr. J. F. O'Hanlon, the candidate of the United Irish League and the Ancient Order of Hibernians, being soundly beaten by Mr. Arthur Griffith.[6]

Coalition Policy.

In the autumn, shortly before the Armistice and the dissolution of Parliament which followed, Mr. Dillon made another effort to retrieve the falling fortunes of his party. On Nov. 4 Mr. T. P. O'Connor moved in the House of Commons that the Irish question should be taken up at the Peace Conference and settled in accordance with President Wilson's principle of "self-determination." This proposal, though it had the support of Mr. Asquith, was naturally rejected. In the course of his speech in opposition to the motion Mr. Shortt challenged the Nationalists to say what settlement they wanted, and drew from Mr. Dillon the admission that he contemplated the coercion of Ulster. The Chief Secretary also took occasion to draw attention to conditions in Ireland, which he painted in gloomy colours contrasting oddly with his optimistic picture of July. All the materials for an armed rising were prepared, he said, and only the week before the armed forces of the Crown had captured at the headquarters of the Irish Republican Brotherhood enough explosives to blow up all Dublin and Belfast. On Nov. 28, immediately after the dissolution of Parliament, Mr. Lloyd George and Mr. Bonar Law, on behalf of the Coalition Liberals, and the Coalition Unionists respectively, issued a joint manifesto on the Irish question:—

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[1] They included an elaborate scheme for the military organization of Ireland, based on the principle of compulsory service, when the country should have secured its independence. See *Documents* (Cmd. 1108), *cit.* Appendix A (1), pp. 47 ff.

[2] *ib.*, pp. 41 ff.

[3] It is of interest to note, as illustrating the attitude of the Government, that, in common with the other professors of this university who ranked as Government officials, Mr. MacNeill subsequently received a "war bonus" of £200 a year from the Government.

[4] The uncertainty of opinion at this time may be illustrated by the fact that while on July 31 the Galway County Council refused to hear Col. Lynch and Capt. Stephen Gwynn on behalf of the recruiting council, on the next day the Galway Urban Council gave them a sympathetic hearing.

[5] At Bailieborough, E. Cavan. (*Irish Times*, May 3.)

[6] The figures were: Griffith (S.F.) 3,785; O'Hanlon (Nat.) 2,581.

> Ireland is unhappily rent by contending forces, and the main body of Irish opinion has seldom been more inflamed or less disposed to compromise than at the present moment. So long as the Irish question remains unsettled, there can be no political peace either in the United Kingdom or in the Empire, and we regard it as a first object in British statesmanship to explore all practical paths towards the settlement of this grave and difficult question, on the basis of self-government. But there are two paths which are closed—the one leading to a complete severance of Ireland from the British Empire, and the other the forcible submission of the six counties of Ulster to a Home Rule Parliament against their will.

Thus the Unionist party, after 30 years' resistance, surrendered to the principle of Home Rule. The surrender was perhaps justified, from the point of view of party tactics, by the political situation after the war. In Ireland, however, its effect was not reassuring. It did not reconcile the Nationalists, still less Sinn Fein, to what remained of the Union; among the Unionists of the South it strained the ties of sentiment connecting them with Great Britain almost to breaking point.

The General Election.

The general election under the new franchise, which practically amounted to universal suffrage, was held on Dec. 14 1918. Save in Ulster and in one or two constituencies in Dublin, the struggle was wholly between the Nationalist party and Sinn Fein,[1] and in this contest Sinn Fein was bound to win. The Nationalist party was disorganized, and its funds all but exhausted. The Sinn Fein leaders, on the other hand, had had plenty of time to perfect their organization after their release in 1917, and the easy conditions of their internment had made it possible to direct it even after their rearrest. Irish-America, too, having taken up their cause, supplied them with plentiful funds. All the conditions, therefore, favoured them. Owing to the state of the country, no police were available for maintaining order. Personation was rife—the dead voted in large numbers, while known opponents of Sinn Fein were warned not to vote if they did not wish to be dead; and since the polling clerks were almost exclusively Sinn Fein, the electors believed, rightly or wrongly, that their voting-papers would be examined and they themselves marked. The result was that there was a vast number of abstentions.[2] All this, in addition to the undoubted swing-round of opinion in the direction of Sinn Fein, secured for the Republicans a sweeping victory. John Dillon himself was rejected, and the Nationalist party, which had crumbled under his leadership, was all but wiped out, retaining only six seats out of 68;[3] the Independent Nationalists (O'Brienites) vanished altogether; Sinn Fein captured 73 out of a total of 105 seats. The Unionists improved their position; before the election they had returned 18 members, they now returned 26, and the 400,000 Protestants of the South were actually represented in the new Parliament by three members—two for Trinity College and one for S. Dublin.

Dail Eireann.

The victorious group assumed the title of the Irish Republican party, and styled themselves not M.P., but F.D.E. (*Feisire Dail Eireann, i.e.* members of the Assembly of Ireland). On Jan. 8 1919 they held their first meeting in the Dublin Mansion House, under the presidency of Count Plunkett, and on the 21st the first formal meeting of Dail Eireann[4] was held in the same place. The proceedings were opened with prayer by Father O'Flanagan. Mr. Cathal Brugha (Charles Burgess) was then elected speaker, and a solemn Declaration of Independence was read in English, Gaelic and French, the 29 members present rising and subscribing to it in a body. The proceedings closed with the nomination of Count Plunkett, Mr. Arthur Griffith and Mr. De Valera as "delegates to the Peace Conference." This meeting was public. On the following day a private session was held at which Mr. De Valera was elected "President of the Irish Republic," and a ministry was established, with departments for finance, home affairs, foreign affairs and defence. Among the "ministers" was the redoubtable Michael Collins,[5] who as head of the "War Office" was later to organize the reign of terror.

Policy of Irish Government.

That an opposition Parliament should have been allowed to debate openly, and to set up an opposition Government, in a country under "martial law," may well surprise those who judge events in Ireland by the universal experience of other countries, and the spectacle of the metropolitan police guarding the peace of a rebel assembly would have yet more surprised them. In order to account for this singular phenomenon, and much else that happened during the time of troubles to come, it is necessary to explain the powers possessed by the Irish Government and the principles on which these powers were exercised. Ireland had not been put under martial law in the sense in which the South was after the Civil War in the United States.[6] The Defence of the Realm Act, which gave large powers to the Government to deal more or less summarily with persons dangerous to the State, was a temporary war measure common to the whole United Kingdom, and its operation was very jealously safeguarded. In addition to this, however, the Government had a reserve weapon in the Criminal Law and Procedure (Ireland) Act of 1887, but nearly all the clauses of this Act required a proclamation of the lord lieutenant in council before they came into force. The principle followed was to use these powers only in cases of grave necessity, so as to interfere as little as possible with the ordinary life of the country, and to apply them only temporarily and to certain disturbed areas. Meetings were only interfered with when, in the opinion of the police, they were likely to lead to grave breaches of the peace, and the ban at times fell on Orange demonstrations as well as on those of Sinn Fein. Thus the murder on Jan. 21 1919 of Constable MacDonnell—the first indication of a campaign which was to reach terrible proportions—was followed on the 28th by the proclamation under the Defence of the Realm Act of S. Tipperary as a "military area"; the murder of Mr. J. C. Milling, a resident magistrate, on March 31, led to Westport being proclaimed; the murder of Constable O'Brien and the wounding of several others, during the rescue of a Sinn Fein prisoner from Limerick workhouse infirmary on April 6, led to the proclamation of the district of Limerick.[7]

The same policy was pursued, during the greater part of the year, towards the various revolutionary associations. They were allowed to carry on their propaganda, but whenever and wherever this led, or threatened to lead, to serious breaches of the peace they were proclaimed. Thus after a series of outrages, including a bomb attack on a police hut (July 21), the ambushing and murder of a constable (Aug. 6), and the murder of a boy of 15 (Aug. 15), Sinn Fein "and kindred bodies" were proclaimed in county Clare. On Sept. 10 they were suppressed in the county and borough of Cork, and on the same date Tipperary, Limerick, Clare and the county and borough of Dublin were proclaimed under sec. 1 of the Crimes Act (1887). All these proclamations were the result of definite outrages, which showed an alarming tendency to increase as the year went on, though as yet they were confined to a number of more or less limited areas in the South and West.

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[1] At the suggestion of Cardinal Logue, who pointed out the danger of losing seats to "the enemy," the Sinn Feiners and Nationalists agreed not to stand against each other in certain Ulster constituencies, the Cardinal acting as arbitrator in their apportionment.

[2] "The only totals that can be estimated are those of the seats where a contest took place, and where Sinn Fein was admittedly polled to the last man. Yet in those seats, with a total electorate of over 1,452,000 voters, Sinn Fein polled only 480,000 votes—less than one-third" (*The Times*, Jan. 17 1919).

[3] Mr. Joseph Devlin held his seat in East Belfast, and Major Redmond his father's constituency in Waterford.

[4] Pronounced dahl eerahn.

[5] He had been a junior clerk in the Post Office.

[6] When on May 1, in the debate on the Budget, Mr. Joseph Devlin denied the moral right of the Government to tax Ireland, on the ground that martial law had been substituted for the Constitution, he was merely indulging in the usual wild exaggeration.

[7] The prisoner, R. J. Byrne, condemned to a year's imprisonment, had gone on hunger strike and been removed to the infirmary. During visiting hours 30 armed men, who had mixed with the visitors, suddenly fell with bludgeons and revolvers on the five policemen guarding the prisoner; Byrne himself seized Constable Spillane from behind round the waist, while others shot and bludgeoned him. The constable, however, succeeded in drawing his revolver and shooting Byrne under his arm. The Sinn Feiners got away with the prisoner, but he was mortally wounded. Some of the rescuers were traced to county Clare and arrested.

Belfast Strike.

On Jan. 25 the situation was further complicated by a great strike of the Belfast shipyards workers; but this had nothing to do with politics, and was settled on Feb. 19. More significant of political undercurrents was the attack by Mr. Joseph Devlin, in the House of Commons (March 4), on the Belfast Harbour bill, the rejection of which he moved on the ground that, under the actual franchise, no Catholic was ever elected on the Board of Commissioners. Asked what religion had to do with this, Mr. Devlin replied, "Religion, or irreligion, has everything to do with everything in Belfast."[1]

New Party Groups.

Meanwhile the result of the general election was leading to certain developments of opinion in the South, which are historically more important rather for the influence they exerted outside Ireland than within it. On Jan. 24 occurred the split in the Unionist party already mentioned, the Anti-Partition League, under the leadership of Lord Midleton, supporting a moderate form of Home Rule for all Ireland. On the same day was established, under the chairmanship of Capt. Stephen Gwynn,[2] the Irish Centre party, which advocated self-government on the Dominion models for a united Ireland within the Empire. This subsequently developed into the Irish Dominion League, of which the secretary and moving spirit was Capt. Henry Harrison, (b. 1867), who in early life, though coming of a well-known north of Ireland family, had cast his lot in with Parnell, becoming Nationalist M.P. for mid-Tipperary (1888–1892), and during the war, having obtained a commission in the Royal Irish Regiment, had won the Military Cross and Bar by distinguished gallantry on the western front. This organization was supported by a certain number of former Unionists as well as Home Rulers of the less extreme type, including Sir Horace Plunkett and Gen. Sir Hubert Gough, and had for its chief organ the *Irish Statesman*, a high-class weekly. Its effect on public opinion was, however, relatively small in Ireland. Its main success was in encouraging Lord Northcliffe to use his powerful influence in the English press in favour of a full measure of Irish self-government. During the year 1919 the columns of the newspapers, both in Ireland and Great Britain, were filled with the most varied suggestions for a solution of the problem,[3] but in Ireland itself mass opinion seemed to have become stereotyped, under one influence or another. With the internment of the leading Sinn Fein orators, the flood of eloquence, punctuated with revolver shots, which enlivened the first half of 1918, had stopped, and Ireland was divided into two camps, by no means silent, but more concerned with acts than arguments. In the North, though no attempt was made to revive the Volunteer force, the Ulstermen remained as determined as ever, and they made full use of the tactical advantage given them by the refusal of the Sinn Fein M.P.'s to attend at Westminster. In the South Dail Eireann claimed the undivided allegiance of Irishmen, and enforced this claim by penalties which, since they were ruthlessly applied, tended more and more to make it effective.

America and Ireland.

The prestige of Dail Eireann in Ireland was increased by American support. The proclamation by President Wilson of the principle of "self-determination" as the basis of the coming peace treaty, and its acceptance by the other Powers, gave Sinn Fein a lever which it was not slow to use; and the President himself, before the experience of a month or two in Europe had taught him prudence, had held out hopes that the Irish question might be raised at the Peace Conference. To the Sinn Feiners, at a very critical period, this hope seemed about to be realized when it was announced that Mr. Lloyd George, then in Paris, had authorized the issue of passports to a deputation of three American-Irish gentlemen whose ostensible mission was to report to President Wilson on conditions in Ireland, but whose principal aim was to confer with "President" De Valera on the question of securing international recognition of the Irish Republic at the Peace Conference. These envoys, who appeared to be invested with a quasi-official status from the Peace Conference, arrived in Dublin on May 3, and on the 9th were welcomed by Dail Eireann in special session. On the 12th they left for Paris, to prepare their report and lay it before President Wilson. The nature of this report could hardly be doubtful. The three American "commissioners," Messrs. Frank P. Walsh, Edward F. Dunne and Michael J. Ryan, were closely associated with the Clan-na-Gael and other extremist American-Irish organizations, the first named being chairman of the "American Commission on Irish Independence." It is not surprising then that an eight days' stay in Ireland sufficed to supply them with the most amazing stories of English "atrocities" and of English misgovernment and misbehaviour generally, which they proceeded to present to the American people and the American Congress as facts proved by unimpeachable evidence.[4] But their efforts to persuade President Wilson to champion the cause of Irish independence at the Conference were vain, and on May 31 the American Peace Delegation definitely refused to request the Conference to receive "the representatives of the so-called Irish Republic."[5] In vain they pointed out, in a personal interview with President Wilson, that he himself had stated at the plenary session of the Conference on Jan. 25 that among the instructions of the American delegates, of which "they would not abate one jot," was that of seeing "that every people in the world shall choose its own master."[6] The President had realized by this time that, in loudly championing the principle of "self-determination," he had brought to Europe not peace but a sword. "You have touched on the great metaphysical tragedy of to-day," he said, "my words have raised hopes in the hearts of millions of people. . . . When I gave utterance to those words, I said them without the knowledge that nationalities existed which are coming to us day by day."[7]

Disappointed in their hopes of obtaining satisfaction from the Peace Conference, the Sinn Feiners determined to use their wide-spread organization in an attempt to wreck its work, and especially the League of Nations, which they had supported so long as they believed that independent Ireland would be represented in its Assembly. To this end an intensive propaganda campaign was set on foot in the United States. On Feb. 4 Mr. De Valera had succeeded, with two others, in escaping from Lincoln gaol; and the release of all interned Sinn Fein prisoners early in March, which regularized his position, enabled him to receive the American delegates in Dublin. After the breakdown of the negotiation at Paris, the "President" decided to transfer his activities to the United States, which he succeeded in reaching in disguise. The agitation conducted by him in the United States belongs to the history of Ireland only in so far as it reacted upon it. The reaction was, of course, great. Sinn Fein was encouraged by the sympathy with its views manifested by large sections of the American people, culminating in the amazing action of the Foreign Relations Committee of the Senate in adopting the 15th reservation to the Covenant of the League of Nations, which would have committed the United States not only to the support of Irish independence but to that of the principle of self-determination generally. It was helped in yet more practical fashion by the response to the invitation issued in Sept. by Dail Eireann to subscribe to a loan guaranteed by the Irish Republic.

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[1] *Parliamentary Debates*, 119, vol. cxiii., p. 329.

[2] Son of the Rev. John Gwynn, D.D., Professor in Dublin University and senior fellow of Trinity, b. 1864. He was Nationalist member for Galway city from 1906 to 1918, enlisted in Jan. 1915, and obtained a commission in April, and served in France till 1917, when he was nominated by the Government as a member of the Irish Convention. He was a well-known writer.

[3] The more important of these are noted under their dates in the "Diurnal" given in *Notes from Ireland* (Ir. Un. All).

[4] "Much of the detailed evidence of atrocities committed against women prisoners in Ireland was furnished us by Countess Markievicz." This was written by Messrs. Walsh and Dunne in a letter to Mr. Lloyd George, dated Paris June 19 1919 (see 66th Congress, 1st Session, Senate Document 106, p. 817). The report of evidence given by the three envoys, with others, before the Foreign Relations Committee of the Senate is given *verbatim* in the Document. The value of this evidence may perhaps be gauged by one or two quotations. "When the Irish get together, north and south, they always agree" (p. 835). "Ireland is the most law-abiding country on the face of the earth" (p. 835). Liberty Hall is the headquarters of "the most conservative labor organization in the world" (p. 853). "England allows no ship to come trans-Atlantic to her (Ireland's) ports" (p. 828). "There is no religious question in the Irish movement" (p. 859). "Mercenary Gurkhas are imported to police Ireland" (p. 906).

[5] Senate Document 106 cit., p. 809.

[6] *ib.*, p. 280 *seq.*

[7] Interview between President Wilson and Messrs. Edward F. Dunne and Frank P. Walsh, at the President's house, 11, Place des États-Unis, Paris, Wed. June 11 1919 (*ib.*, pp. 835 *seq*).

Beginning of the Terror.

The organization of the terror in Ireland proceeded apace during the year 1919. The Irish Republican army (I. R. A.) was supplied with arms, partly by numerous raids on private houses, partly by the overwhelming of small parties of police and soldiers, and increasingly as time went on by shipments from the United States and elsewhere, which on a coast so wild and indented as that of Ireland there was little difficulty in smuggling in. Illegal drilling continued, and occasionally led to fights with the police, as at Kilrush, in W. Clare, on April 15. But the most effective weapon was the boycott. It had early been applied against those who had dared to vote against Mr. De Valera in E. Clare; at the "President's" request it was now to be applied universally to the police. Before Sinn Fein brought its blessings to Ireland, the Royal Irish Constabulary had been friends of every one. The service was exceedingly popular, there being often a hundred applications for one vacancy in the ranks. It was an armed and disciplined force, it is true, but in so wild and lawless a country as much of Ireland is, this was as necessary as the arming of the sheriffs in the western states of America. The force, moreover, was wholly manned by Irishmen, drawn for the most part from the ranks of the Catholic peasantry. These men very rarely used their arms. Their main duties consisted in checking ordinary crime, in preventing the illegal distillation of *potheen*, in protecting boycotted persons, and in saving the tails of "unpopular" farmers' cattle from the knives of their neighbours. They were debarred from voting or taking any other part in politics. Their functions in this respect were limited to trying to keep the peace between the contending factions, and they never intervened in debates until the champions of rival ideals had exhausted their armoury of abuse and, as is the way in Ireland, continued the argument with weapons more or less lethal. These men, whose courage and faithfulness to their trust had been so often proved, were now to be treated as pariahs and outcasts. On April 26 the executive committee of Cumann na mBan, the quasi-military Sinn Fein women's organization, issued instructions to its members not to be in company with nor to speak to a policeman, not even to occupy the same bench in church.[1] This might have been borne with philosophy; but an economic was added to a social boycott, and in many districts no tradesman or farmer dared to supply the police or their families with the very necessaries of life. In view of this, and of the campaign of wholesale murder to which they were presently subjected, it is perhaps not surprising that, after many months, the discipline of the force suffered, and its members occasionally took the law into their own hands.[2] The first "reprisals," however, were the work not of the police but of soldiers. On Sept. 7 at Fermoy, in Cork, a small party of soldiers leaving Mass were attacked by armed men on the steps of the church, one being killed and three wounded, the assailants making off in a motor with their rifles. The coroner's jury returned an open verdict, which so enraged the soldiers that in the evening they paraded the town and wrecked the shops of the tradesmen who had acted on the jury.

Speaking at Glasgow on Sept. 1 Mr. Joseph Devlin said that Ireland had never "been more prosperous."[3] It had also rarely been more disturbed; and at Belfast on Sept. 11 Lord French declared that to restore order the Government would, if necessary, use the most drastic means. On the following day Dail Eireann was at last proclaimed as a dangerous association, and extensive military raids on Sinn Fein centres were carried out everywhere, in a systematic search for arms and seditious literature. During the month, also, a considerable number of Sinn Fein newspapers were suppressed in Dublin and the provinces. On the 22nd the seriousness of the situation was advertised by the arming of the constabulary with hand-grenades. Outrages, however, including several brutal murders,[4] continued and were followed by further proclamations and arrests. The arrests were followed in their turn by hunger strikes, and the prisoners continued to be released. Matters became worse in Nov.; systematic attacks on police barracks now became frequent; raids for arms continued, including one on the American steamship "Pensacola" at Cork (Nov. 5); on the 10th and 11th there were serious riots in Cork city; and on the 19th a new precedent was set by the burning down of the petty sessions court at Liscarroll, county Cork. In these circumstances the Government found it necessary to take additional powers. On Oct. 16 the city and county of Dublin had been proclaimed under the Crimes Act; on Nov. 13 the proclamation was extended to considerable areas of the country; on the 24th the Government announced in Parliament that hunger strikers would no longer be released, but must, "if they would not take their food, take the consequences"; and on the 27th the Sinn Fein organization, the Sinn Fein clubs, Cumann na mBan, etc., which had been proclaimed in Dublin on Oct. 16, were banned by proclamation in all Ireland.

Organization of the Sinn Fein Terror.

Meanwhile abortive efforts had been made to arrive at an accommodation, Lord Southborough's[5] offer of his services to this end (Oct. 30) being contemptuously rejected by Mr. Arthur Griffith in the name of Sinn Fein. The situation was not improved by the issue (Nov. 20) of the report of the Irish Dominion League, which advertised the tendency of the "moderate" elements towards Sinn Fein; by the declaration of Sir Horace Plunkett that "civil management must be substituted for Prussian militarism";[6] and by his denunciation of the proclamation of Sinn Fein. The endorsement of this attitude by an influential section of the British press merely persuaded the Sinn Feiners that their policy of violence was on the eve of success, and that it only needed to be accentuated to make success certain. The month of Dec. accordingly saw a great increase in the number of outrages, which gave evidence also of increasing organization. All Dublin was horror-stricken by the murder on Dec. 1 of Detective-Sergeant Barton, a very popular officer, which was carried out in a populous thoroughfare in the heart of the city. It was the beginning of the terror which was to dominate the country during many months to come. The nature of this terror may be understood by the fact that when, on the 19th, a school-teacher named Blanchfield was murdered near Kinsale, the body lay for hours where it fell, as none of the villagers dared to touch it.[7] On the 20th a murderous attack was made on Lord French, the Lord Lieutenant, as he was motoring from Ashtown station to the viceregal lodge. Happily none of the bombs and shots discharged at the viceregal party took effect; but one of the assailants, a youth named Michael Savage, was killed. On the 22nd the offices of the *Irish Independent* were raided and the machinery smashed, by masked men, because the editor had described this young man as "a would-be assassin." Murders, assaults, highway robberies, burnings, attempts to wreck trains—such was the situation in Ireland when, on the eve of the close of the parliamentary session, the Chief Secretary, Mr. Ian Macpherson, and Mr. Lloyd George, introduced the new Government of Ireland bill.

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[1] The following diatribe against the police was circulated at the same time. It was headed "Aceldama" (the field of blood).

> For money their hands are dipped in the blood of their people . . .
> They are the eyes and ears of the enemy.
> Let those eyes and ears know no friendship.
> Let them be outcasts in their own land.
> The blood of the martyrs shall be on them and their children's children, and they shall curse the mothers that bring them forth.

(Copy this out accurately four times, and send it to four of your friends.)

[2] During 1919 11 policemen were murdered, in addition to many seriously wounded.

[3] Writing in *The Times* (Nov. 4) Prof. A. L. P. Dennis, of Wisconsin University, described Ireland as "a land of plenty."

[4] In Clare, on Oct. 21, a farmer was murdered, and his wife kicked and beaten, by masked men.

[5] Secretary to the Irish Convention (see above).

[6] At the National Liberal Club, Oct. 30.

[7] Policemen, mortally wounded, sometimes lay unattended in crowded streets, no one daring to give them a drink of water.

The Home Rule bill, 1920.

This measure proposed to set up in Ireland two parliaments, one for the six counties of N.E. Ulster, another for the rest of Ireland. The unity of Ireland was to be preserved by a Council of Ireland, consisting of members nominated by the two parliaments, "with a view to the eventual establishment of a parliament for the whole of Ireland, and to bringing about harmonious action between the parliaments and governments of Southern Ireland and Northern Ireland, and to the promotion of mutual intercourse and uniformity in relation to matters affecting the whole of Ireland, and to providing for the administration of services which the two parliaments mutually agree should be administered uniformly throughout the whole of Ireland." It was proposed, under Sec. 3, that the two parliaments, by identical Acts agreed to by an absolute majority of the House of Commons of each parliament, should have power to establish, in lieu of the Council, a parliament for the whole of Ireland. Imperial services—army, navy, foreign relations, etc.—were reserved to the Imperial Parliament; but certain services, *e.g.* the post-office, were to be transferred if and when the two parliaments should agree to merge into one, while, in this event, the vexed question of customs and excise was to be settled by agreement between the Irish and Imperial Parliaments. The contribution of Ireland to Imperial expenditure was provisionally fixed at £18,000,000 per annum.

Reception in Ireland.

The reception met with in Ireland by this attempt to reconcile the principles of the self-determination of Ireland with that of the self-determination of Ulster and the interests of Great Britain and the Empire was not encouraging. The Sinn Feiners and Nationalists generally refused to have anything to say to a scheme which, in view of the temper of Ulster, seemed to make the partition of Ireland permanent, and certainly fell very short of the ideal of national independence. The Unionists in the South, and especially those of the three Ulster counties excluded from the northern parliamentary area, denounced the bill as a betrayal of their interests, since it left the Protestants elsewhere than in the N.E. in a hopeless minority; while the Roman Catholic hierarchy equally denounced "an impossible scheme" which subjected the Catholics of the North to a Protestant parliament. Only the Ulstermen accepted the settlement, not because they liked it, but because they saw in it the only alternative to the automatic coming into force of the Home Rule Act of 1914.[1]

The Education Bill.

Even more immediately unhappy was the effort of the Government to clear the way for Home Rule by removing the deep-seated grievance of the Irish school-teachers, which had been one of the strongest recruiting agents of Sinn Fein. The teachers had for long past been grossly underpaid; they were at the mercy of their clerical school managers; and neither of these wrongs could be righted without introducing into Ireland the principle of popular control which had long been established in Great Britain. Two specially appointed viceregal commissions had recently reported on the subject, and their reports had been signed unanimously by the Irish Roman Catholic representatives. When, therefore, on Nov. 24 Mr. Ian Macpherson, the Chief Secretary, introduced in the House of Commons an Education bill embodying the recommendations of the reports, he did so with some confidence that it would be welcomed in Ireland. By the school-teachers it was indeed welcomed; but the hierarchy at once protested against a measure which threatened their autocratic control of the schools, their protest was supported by the Council of the (Catholic) National University, and after nearly a year of abortive effort the bill was shelved.

The Murder Campaign.

One great remedial measure had thus broken down once more on the opposition of the Irish hierarchy; another, the Labourers' (Ireland) Act, passed unnoticed in the general turmoil. The situation, indeed, was rapidly passing beyond the stage when the Government could hope to meet it by a policy of alternate "conciliation" and "coercion." Hitherto the campaign of murder and of intimidation generally had been sporadic and to a certain extent spontaneous. Early in 1920 it received a definite organization, which was developed during the year with such thoroughness that there was scarce a house in Ireland where the ordinary citizen felt safe from the activities of Sinn Fein spies and agents. To speak with disapproval of the policy of murder was to risk incurring a sentence at least of "banishment," conveyed by anonymous letter; and, since the police were powerless to give effective protection, the sentence had to be obeyed. Death was the penalty for disobeying the orders of the "Republic" and the executive of this Republic was a body shrouded in mystery. "Executions" of "traitors," or "informers," or of those who dared continue in the service of the "foreign" Government, were carried out ruthlessly in broad daylight, in the crowded streets of cities, in the smoking-rooms of clubs, in the bar-rooms and bedrooms of hotels, and no one knew by whom the sentences were passed nor what process of trial, if any, was used in arriving at them. The murders were, with a few exceptions, carried out with perfect impunity; for such was the terror that no one dared interfere or come forward as a witness,[2] and in the few cases where arrests were effected the Government had generally to depend on the evidence of soldiers and police, if any happened to have been present.

It is impossible here even to outline the terrible tale of crime which stains the annals of Ireland during 1920, the most bloody since the mutual slaughter of 1798. Most of the victims were of humble rank, usually policemen and soldiers, done to death on the instructions issued towards the close of 1919[3] by Sinn Fein—or the hidden force of the old Irish Republican Brotherhood masquerading under its name. The comparative numbers tell their own tale. From May 1 to Dec. 31 1919 18 policemen had been murdered in Ireland; the number from Jan. 1 to Dec. 18 1920 was 176 killed and 251 wounded.[4] From time to time there were more conspicuous victims. On March 20 the Lord Mayor of Cork, Alderman MacCurtain, was done to death in his own house by a band of masked men. The affair was surrounded with mystery, for the victim was a prominent Sinn Feiner. The coroner's jury, on April 18, found that the murder had been committed by the R.I.C., acting under the directions of the Government, and brought in a verdict of wilful murder against Mr. Lloyd George, Lord French, Mr. Ian Macpherson, Acting Inspector-Gen. Smith, R.I.C., and District-Inspector Swanzy;[5] on the 24th the Cork Corporation resolved to call on the Executive of the Irish Republic to bring this verdict to the notice of foreign Governments—which showed a characteristic lack of the sense of humour. It was very generally believed, however, that the Lord Mayor, who had expressed strong disapproval of the murder campaign, was "executed" as an object-lesson to other weak-kneed supporters of the cause. The same fate was, later, to fall upon the Mayor and Ex-Mayor of Limerick, who, though Sinn Feiners, had used their local influence in favour of peace and order. Of other crimes, three of outstanding atrocity need mention. On March 27 Mr. Alan Bell, an experienced resident magistrate who had been holding a secret inquiry under the Crimes Act, was dragged from a crowded tramcar near Dublin by a band of armed men and shot dead by the roadside. On July 31 Mr. Frank Brooke, a member of the Irish Privy Council and chairman of the S. E. Railway Co., was shot dead by armed men in his office at Westland Row Station. In neither of these cases were the murderers caught. But the blackest day of crime was Sunday Nov. 21, when, at 9 o'clock in the morning, bands of armed men visited the houses where certain young officers, mainly engaged in court-martial work, were lodged, found them all unarmed, some still in bed and others dressing, and shot them down in cold blood. Some succeeded in escaping, but in all 14 were killed. This crime, which showed the most elaborate preparation, gave proof of the most revolting treachery, and for a moment awakened the British public from its apathy about Irish affairs, received the high approval of Mr. De Valera in America, and—to judge by the description of it by Father Dominic, Lord Mayor MacSwiney's chaplain, as "a wonderful day"—was regarded by the fanatics of Sinn Fein as a glorious victory.[1]

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[1] Resolution of the Ulster Unionist Council. *The Times*, March 11 1920. "The decisions of the Council that day had been momentous. They would take no responsibility for the Home Rule bill. . . . It was all very well to say 'Why don't you go on fighting as you did before?' What were they to fight for? Could they fight for more than the freeing of Ulster from a Home Rule Parliament in Dublin? If the bill passed, they had won, and won without fighting." Sir Edward Carson to the Ulster Unionist Labour Association, *ib.*

[2] *i.e.* for the prosecution. Witnesses for the defence, to prove an alibi, could always be found in abundance.

[3] The instructions to murder police and soldiers were published in the *Belfast Newsletter* (Jan. 2 1920).

[4] In addition 54 soldiers were killed and 118 wounded.

[5] Murdered later at Lisburn.

Predominance of Sinn Fein.

Yet to say that Sinn Fein organized or approved these crimes, without qualification, would be to give a false impression. For certainly all Catholic Ireland did not approve them; and Catholic Ireland, with rare exceptions, was by this time Sinn Fein. In the case of very many people this adherence was due to the terror, but it would be untrue to pretend that this cause alone operated. Among the young people, especially, the Sinn Fein creed had by this time developed into something like a religious fanaticism. Since the rebellion of 1916 a whole new generation of boys and girls had grown up, baptized in the blood of the martyrs, trained to regard Ireland as the centre of the universe and England as the barbarous oppressor who for 700 years past had arrested its development and obscured its glory, and firmly convinced that, if only the yoke of the barbarian could be shaken off, Ireland would once again become a pattern of civilization to the nations. And behind this crude idealism was the economic pressure of the young manhood of the country, cooped within its narrow limits, without work, without money, and without prospects. These were the recruits, inexorably conscribed, of the armies of the "Republic" and the executors of its decrees. The great majority of this army consisted of shop-assistants and town labourers. If the farmers and the petty tradesmen professed and called themselves Sinn Fein, this was often but an accommodation to circumstances; and the term Sinn Fein, covering a variety of aspirations, might mean much or little—at most an intransigeant faith, at least a mantle of protection against an ever-present fear. And the terror was the more poignant since its sources remained obscure. None could tell what sinister forces lurked behind the self-styled "Republic," who really issued the orders in the name of Dail Eireann, or who held command at the elusive "headquarters" of the Irish Republican army. And to the welter thus produced was presently added on orgy of private crime, ancient vendettas being satisfied under the disguise of one or other of the warring forces,[2] while burglaries and highway robberies became common.

Revolt of the Municipalities.

Against certain private crimes Sinn Fein for a time attempted to set its face. With the breakdown of the legal organs of Government, during the early months of 1920, in large parts of the country, the Sinn Fein organization gradually took over the administration. The municipal elections in Jan., though the new principle of proportional representation introduced under the Act of 1919 here and there produced remarkable results,[3] placed Sinn Fein in the majority in most of the corporations and councils of the South and West, which is not surprising, since apart from the intense resentment at the proposed partition of Ireland, the Sinn Fein organization had long since made it clear that those who refused allegiance to the "Republic" would be under its ban.[4] The election of Alderman T. Kelly, who was interned in England, as Lord Mayor of Dublin (Jan. 24), the hoisting of the Sinn Fein flag on the City Hall, and the removal of the sword and mace from the council chamber as "relics of barbarism," advertised the new spirit of the Nationalist municipalities. It was not, however, until May 4 that the Dublin Corporation resolved formally to acknowledge the authority of Dail Eireann and to undertake to give effect to its decrees, and its example was soon followed by other corporations, and county and district councils. On April 14 Sinn Fein "headquarters" had defined its policy with regard to these bodies; all the old councillors were to stand aside and give place to younger men who would refuse to recognize the Local Government Board, and who, being without property, could not be made liable for damages in resisting the Government. The result was, of course, the complete confusion of local administration; for the refusal of the elected bodies to submit their accounts to the Board's inspector was met by the refusal of the Government to make the statutory grants in aid of rates. The mutual boycott continued in many cases into the following year. It was combined with the wrecking and burning of inland revenue offices and the looting of Government money from post-office vans and mail trains. At the same time a general destruction of Government property began, starting with the police "barracks," which in many parts of the country had been left unprotected owing to the necessity of concentrating the police.[5] Many empty country houses, suspected of having been requisitioned by the military, were also burned down.

The Sinn Fein Courts.

Meanwhile Sinn Fein had set out to cure the anarchy which it had created by setting up an organized system of justice. Sinn Fein courts were early in operation; on May 12, at Kilfinane in Limerick, two Sinn Feiners were put on trial before such a court for cattle-"driving." Such irregularities were no longer to be permitted, and on the 19th, at Ballinrobe, the first public court established in Ireland under the aegis of Dail Eireann was opened to determine land disputes and effect settlements of agrarian trouble. By the 3rd of next month Sinn Fein courts had been established in 21 Irish counties,[6] and a fortnight later it was reported that a Sinn Fein supreme court was to be established in Dublin. Before the end of the summer, in two-thirds of Ireland, Sinn Fein justice was alone available; the King's writ had ceased to run; the royal judges still went on circuit, but their courts—guarded by police and soldiers—were empty of litigants, who, often unwillingly enough, had to transfer their suits to the improvised tribunals of the "Republic."

These tribunals might or might not be honest and effective. They usually consisted of a Roman Catholic curate and one or two prominent local Sinn Feiners; and sometimes a lawyer's clerk, or others with a rudimentary knowledge of the procedure of the courts, took part in their decisions, which were often reported as reasonable. Substantial court fees were exacted from the litigants, which went to supply a fund for salaries for the members of the court.

In course of time people of all political opinions found it expedient to apply to these courts, if they were to have any redress; solicitors, deprived of practice in the ordinary courts, made no scruple of appearing before them, and even loyalists, compelled to sell their property occasionally, weakened when they found that the Sinn Fein land courts imposed a higher price for land compulsorily purchased than that allowed by the Land Commission. And, so long as it lasted, the authority of these courts was absolute, and for a sufficient reason—the ultimate penalty for disobedience was death.

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[1] For an eye-witness's account see "Experiences of an Officer's Wife in Ireland." *Blackwood's Magazine* for May 1921, vol. ccix., No. mccxvii. "Studies in Green," published serially in the same magazine, also give a vivid picture of conditions under the terror.

[2] This accounts for several mysterious murders, charged (according to taste) to Sinn Fein or Crown forces. Outrages were often committed by men dressed in stolen police and army uniforms.

[3] A few Unionists were elected in constituencies which had always been solidly Nationalist, while the Belfast corporation included a minority of Nationalists and Sinn Feiners.

[4] "The candidates for the chairmanship of the Granard Rural District Council are requested to attend the Executive meeting and sign the Sinn Fein pledge." *Nationality*, Aug. 4 1917.

[5] These "barracks" were usually cottages, privately owned, which had been leased to the Government. Their destruction imposed a heavy burden on the ratepayers of the county—including the owners—who were assessed for compensation.

[6] *Freeman's Journal*, June 4 1920.

The existence of these courts was, of course, a criminal offence under the ordinary law of sedition; but in Ireland, after the proclamation of Sinn Fein under the Crimes Act as a dangerous association, they came within the prohibitions of the Crimes Act of 1887, and every person taking part in them was liable, after conviction before a court of two resident magistrates, to a sentence of six months' imprisonment. But the difficulty of the Government in dealing with them lay in the fact that evidence was almost impossible to procure as to their personnel or the proceedings that took place before them. It was, in short, not until the ordinary law was superseded by military administration that the Sinn Fein courts were dissolved, not by the ordinary processes of law, but by force. Once scattered, under the influence of counter-terror, they ceased to appeal even to the sentiment of the people, who on the whole had had reason to fear the incidence of a justice wholly irresponsible and arbitrary in its methods.[1]

For the highly idealized Sinn Fein account of the organization and work of these courts, see "The Republican Police and Courts of Justice," in the *Irish Bulletin*, vol. v., No. 46, Aug. 4. For the Sinn Fein Land Settlement Commission, see *ib.* No. 49, Aug. 9.

In the spring of 1921 the King's writ was once more running in the "disturbed" counties, the courts were sitting, juries were attending, and litigants were appearing to press their suits.

Sir Hamar Greenwood and the Constabulary.

This change, with many others, was due to the more consistently vigorous policy introduced by Sir Hamar Greenwood, who had succeeded Mr. Ian Macpherson as Chief Secretary on April 4 1920. Though formerly a Liberal Home Ruler, he realized that the distempers of Ireland had passed beyond hope of cure by any panaceas which British Liberalism was prepared to apply, and that the choice for the Government lay between yielding to force or opposing force to force. The first necessity was to restore the *moral* of the forces of the Crown. The men of the R.I.C. had for more than a year borne with amazing patience and courage the campaign directed against them. But with the intensification of this campaign towards the middle of 1920 their patience and their discipline had begun to break down. Time after time they had seen men they had arrested, for serious crimes against the State, released after a few days of easy imprisonment. Again and again they had been "let down" owing to a clamour in Parliament and the press which threatened to become inconvenient to ministers. They were murdered wholesale, and none of their neighbours dared to help them in their death agonies, still less to give evidence against their assassins, not one of whom was punished. They were subjected by order of the "Republic" to a rigorous boycott, and the tradesmen, the farmers and the creameries refused to supply their wives and their babies with the very necessaries of life, since to do so was to involve themselves in the same penalty. For armed and organized men to endure this for ever was not in human nature, and least of all in Irish human nature. In short, there was apprehension that the police, realizing that Sinn Fein had succeeded in breaking down the law, would begin to take the matter into their own hands.

The "Black-and-Tans."

The Royal Irish Constabulary, indeed, was by this time but a remnant of a once magnificent force. The campaign of murder and boycott had largely done its work; the men were resigning under a threat of murder or other outrage on their parents, and any young man who was announced as going to join the force was promptly shot. At the same time the catalogue of crimes of all descriptions in Ireland was reaching appalling proportions; and it became necessary for the Government to adopt a far stronger policy, if the country was to be saved from lapsing into utter anarchy. In March Mr. Ian Macpherson, in answer to a question in the House of Commons, had estimated the numbers of the Irish Republican army at 200,000, thus outnumbering the forces of the Crown in Ireland by about five to one. In July the troops in Ireland were increased to 60,000, and the supreme command was taken over by Sir Nevil Macready, a general[2] with a long and distinguished record. On the 10th the Government issued instructions for the reorganization of the R.I.C., the depleted ranks of which were to be filled up with English and Irish ex-service men; and at the same time there was created an auxiliary police force consisting of 1,500 ex-officers, divided into 15 mobile companies, for the purpose of carrying out special duties wherever they might be required. Since there were not enough of the dark green uniforms of the R.I.C. to supply all the new recruits, these were clothed temporarily in military khaki, with a black hat and arm band to distinguish them as constables—whence the name "black-and-tans." They must be distinguished from the auxiliary police, whose uniform continued to be khaki with a black glengarry cap, and who were therefore also sometimes known as "black-and-tans." The whole of this force was placed under the control of Maj.-Gen. Sir Henry Tudor,[3] who was established in the Castle as Police Adviser.

The presence of this force soon altered the condition of things in Ireland. The military, who after the great disbandment had consisted mainly of raw boys hardly able to bear the weight of their rifles, had been no match for the strapping guerrillas of Sinn Fein. The "black-and-tans" and the auxiliary cadets (it is well to distinguish them) were men hardened by years of service at the front and brave to recklessness, as they needed to be. Systematically distributed over the disturbed areas of the country, they proceeded to break up the Sinn Fein organization; soon its leaders were "on the run"; and the authority of the Crown was gradually reëstablished in wide districts where for months past the *de facto* Government had been that of the "Republic." In the performance of this difficult and very dangerous task serious irregularities were sometimes committed, but on the whole the "black-and-tans" were not unpopular; for they broke the Sinn Fein terror and—as the women put it—saved the boys from being forced into the murder gangs.[4] Soon, however, the wildest reports began to circulate about the outrages committed by them, reports grossly exaggerated, but none the less having a basis in fact. There is, indeed, no evidence whatever to support the accusations of outrages on women, or indeed of any gross crimes committed on innocent people, and these may be characterized as absolute lies. But there is evidence that some of these men—by no means all—brought to Ireland the loose view as to the rights of property which had been current during the war at the front, and helped themselves to what they needed without always discriminating between the loyal and the disloyal.

Reprisals.

More serious were the issues raised by the "reprisals" carried out by the force, or rather by some of its members, when any of them were murdered. In matters of this sort it is not the function of the historian to approve or to condemn, but to explain; and in this case the explanation is not far to seek. The general attitude of the "black-and-tans" is explicable by the abnormal conditions under which they worked. They found themselves in a country nominally and even apparently at peace, for its normal life continued through all the troubles, and among a people polite and outwardly even demonstratively friendly. They soon discovered that this was all illusion; that the country was a prey to civil strife in its most cruel and barbarous form; and that the seeming urbanity of the people was too often a treacherous mask. It is not surprising if, not knowing the people as the old R.I.C. men had intimately known them, they were often unable to distinguish realities from appearances, and confounded the veiled Sinn Feiner with the real Sinn Feiner, and the loyalist with both. As for reprisals, they are best explained by instances.

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[1] Dail Eireann had fixed a prescription of 20 years as giving legal title to land. A Sinn Fein Court in county Cork ordered the sale of his farm by a man whose family had held it since 1847, and the distribution of the proceeds among people who claimed to be descendants of the owner who had emigrated to America after the great famine. (Private information.)

[2] B. 1862. In addition to distinguished war service in Egypt, S. Africa and the World War, Sir Nevil Macready was commissioner of the London Metropolitan Police 1918–20 and had dealt successfully with the great police strike.

[3] B. 1871. Served with distinction in the S. African War and throughout the World War. He commanded the 9th Division in France in 1918.

[4] From private information. Reports about this, as about most matters in Ireland, are very contradictory.

The first serious act of reprisal took place at Balbriggan, county Dublin, on Sept. 21, when District-Inspector Burke, an exceedingly popular officer, and another constable were shot dead in the bar of a public-house. The murderers used expanding bullets, and when the disfigured corpses of the two constables were carried into the police barracks the men "saw red," and that night the houses and shops of the Sinn Fein leaders in the town went up in flames. Similar scenes followed the ambushing and murder of six constables at Rinneen, county Clare, on the 29th. The infuriated police descended on the neighbouring towns of Miltown-Malbay, Lahinch and Ennistymon, set fire to certain houses and shot two men.[1] Continued murders of police led, at the end of Oct., to a renewal of these reprisals, armed men invading and causing much destruction in the towns of Granard, Tralee, Ballymote, Tipperary, Athlone, Killorglin, Miltown-Malbay, Longford and Templemore.[2] The discovery of five constables lying on the high road, with their brains battered out, led to similar reprisals at Tubercurry (Oct. 2). In vain their officers tried to restrain the enraged men; they turned savagely upon them and threatened to shoot them if they interfered.[3] The ambushing of a party of auxiliary police at Dillon's Cross, Cork, on Dec. 18, was followed by incendiary fires in Cork city, in the course of which the City Hall and the Carnegie Library were destroyed, but there is no information as to who was responsible, though public opinion fixed responsibility upon the police. But though, in these other cases, the discipline of the police gave way, the cases were far more numerous in which it stood the awful test. No reprisals followed the treacherous massacre of the young officers in Dublin on Nov. 21. No reprisals followed the horrible affair of Macroom, county Cork, when (Nov. 29) 17 auxiliary cadets were lured into an ambush of 100 Sinn Feiners disguised as British soldiers, and 15 of them murdered, no quarter being given and the dead savagely mutilated.[4]

The irregular reprisals, moreover, were not all the work of the police. When Inspector Swanzy was murdered at Lisburn on Aug. 8 1920, the Protestants, who were in a great majority in the town, doubly enraged by this outrage in evangelical Ulster, rose and—in spite of all the efforts of the local clergy to stop them—burned many Catholic houses. The murder of a policeman in Belfast was followed, on Sept. 25, by attacks of Orangemen on Sinn Feiners and a renewal of the sectarian riots which in July had kept the city in a turmoil and now again necessitated its occupation by the military.[5]

The temper of the constabulary placed the Government in a delicate position. To approve of irregular reprisals was impossible, to condone them was dangerous, and worse. Yet to take stern and drastic measures against them was equally impossible in view of the general feeling among the troops and the police, for this might easily have led, either to their resignation *en masse* (which was what Sinn Fein was aiming at), or to their getting utterly out of hand and sweeping with fire and sword through the country. Above all, to have shown the slightest sign of a disposition to "let the police down" again, would have been almost certainly disastrous. It is not the present writer's intention either to attack or to defend the apparently equivocal attitude at first assumed by the Government towards this question of reprisals, which was bitterly criticised, but merely to state the conditions by which it was determined. It is certainly true to say that Sir Hamar Greenwood, by his consistent championship of the forces of the Crown against their critics and detractors, succeeded in winning their confidence and thus in re-creating the essential conditions for the restoration of effective discipline. One lesson, moreover, the irregular reprisals had taught the Government, namely, that fear will open the lips that fear has sealed. On the very night of the Balbriggan reprisal, for the first time, men came to the police to denounce the murderers, moved by fear that their own houses might be burned.

In view of the refusal of people to come forward except under pressure of this kind, the Government decided to make certain areas collectively responsible for the murder of soldiers and police. Where ambushes were elaborately prepared for days beforehand, telegraph wires being cut, and the roads for miles round being made impassable by trenches or felled trees, it was assumed that these treacherous attacks must have been delivered if not with the connivance, at least with the acquiescence, of the people. While, then, irregular reprisals were to be sternly repressed and punished, Gen. Macready issued an order that houses in the immediate neighbourhood of an ambush were to be burned, not as a reprisal, but as a punishment for the failure of the inhabitants to give information which by law they were bound to do. This was the origin of what were known as "official reprisals," which began to be carried out early in 1921.

Such was the condition of things in Ireland—frankly recognized as "a state of war"—when, on Dec. 23 1920, the new Government of Ireland bill became law. It had few friends even in Parliament; it had been debated in empty Houses; it received no welcome outside, except in Ulster, where it was welcomed as an ark of salvation from worse things. It gave, it is true, greater powers to the Irish legislatures than those given by the Act of 1914; it provided machinery for safeguarding the essential unity of Ireland in spite of "partition," and for securing corporate unity whenever the dissevered halves of the Irish people should arrive at an understanding. But the machinery for conciliation is useless without the driving force of the spirit of conciliation; and to the mass of the Irish people, who do not know the meaning of the word compromise, it seemed but a cumbrous device for burdening their shoulders with a responsibility which was not theirs. In the North preparations at once began to put the Act in force whenever "the appointed day" should be named, Sir James Craig for this purpose taking over the Ulster leadership from Sir Edward Carson. In the South nobody believed that the day would ever be named, at least so far as Ireland outside Ulster was concerned; for it was thought improbable that sane men would try inflammatory constitutional experiments in a political powder magazine. In this, however, the South was mistaken; for in April the Government fixed the appointed day, and on the 21st instructions were sent to Dublin to make all the preparations necessary for the elections. At the same time it was announced that the lord lieutenancy had been accepted by Lord Edmund Talbot (created Viscount Fitzalan of Derwent), a brother of the late and uncle of the actual Duke of Norfolk, who, as a Roman Catholic, had become eligible for the office owing to the removal of the last remnant of Catholic disabilities by the Act.[6] The attitude of the Government at this stage on the question of "reprisals" can be best explained by quoting from a letter written on April 19 1921 by Mr. Lloyd George to the Bishop of Chelmsford, who with 19 other English Protestant prelates and ministers had addressed to him a strong remonstrance against "the whole reprisals policy" and a plea for negotiations for a "truce."[7] The Prime Minister wrote:—

The Government and "Reprisals."

> That there have been deplorable excesses I will not attempt to deny. Individuals working under conditions of extraordinary personal danger and strain, where they are in uniform and their adversaries mingle unrecognizable among the ordinary civilian population, have undoubtedly been guilty of unjustifiable acts. A certain number of undesirables have got into the corps, and in the earlier days discipline in the novel and exacting conditions took some time to establish.
>
> There is no question that, despite all difficulties, discipline is improving, the force is consolidating, and that the acts of indisci-

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[1] The fires were put out by the military, assisted by police.

[2] *Irish Times*, weekly ed., Nov. 6 1920.

[3] Private information. All these reprisals up to Oct., were the work of the old R.I.C., not of the "black-and-tans."

[4] It was reported at first that Macroom had been burned, but this was contradicted next day. One fire broke out, but was extinguished with the aid of the soldiers and auxiliary police.

[5] During 1920 the partisan war had been assuming more and more a "religious" character, many outrages on Protestant churches and murders of Protestant farmers being reported from the South.

[6] Hitherto the Lord Lieutenant had by law to be Protestant.

[7] It may be noted that no such remonstrance came from the Protestant bishops or Presbyterian ministers of Ireland.

> pline, despite ambushes, assassinations and outrages, often designed to provoke retaliation for the purposes of propaganda, are becoming increasingly infrequent. I venture to believe that when the history of the past nine months in Ireland comes to be written, and the authentic acts of misconduct can be disentangled from the vastly greater mass of reckless and lying accusations, the general record of patience and forbearance displayed by the sorely tried police, by the auxiliaries as well as by the ordinary Constabulary, will command not the condemnation but the admiration of posterity.

The deplorable condition of Ireland Mr. Lloyd George ascribed mainly to the intransigeance of Sinn Fein:—

> I do not wish to minimize in the least Great Britain's share of responsibility for the present state of the Irish question. But at last all parties in Great Britain had united, in the general election of 1918, in asking and securing from the electorate a mandate to give to Ireland the Home Rule which had been pleaded for by Gladstone and asked for by all the leaders of Irish Nationalism since Isaac Butt, including Parnell, Dillon and Redmond. The only unsettled question was the treatment of Ulster, and as to that, both the Liberal party had recognized in 1914, and the Irish Nationalists in 1916, that if there was to be a peaceful settlement Ulster must have separate treatment.
>
> Sinn Fein rejected Home Rule and demanded in its place an Irish Republic for the whole of Ireland. Sinn Fein went further. It deliberately set to work to destroy conciliation and constitutional methods, because it recognized that violence was the only method by which it could realize a Republic. The rebellion of 1916 was its first blow to conciliation and reason. Its refusal to take part in the Convention was the second. Its proclamation of a Republic by the Dail Eireann and abstention from Westminster was the third. Its inauguration of the policy of murder and assassination in order to defeat Home Rule, rather than to discuss the Home Rule bill in Parliament or enter upon direct conference outside, was the fourth.
>
> I do not think that anybody can doubt that the principal reason why the war did not bring a peaceful settlement, and why Ireland is more deeply divided to-day than it has ever been, has been the determination of Sinn Fein to prevent such a settlement and to fight for a republic instead.
>
> But there is another aspect of the question to which I must allude. Sinn Fein does not confine its activities to attacks on servants of the Crown. It has inaugurated a reign of terror in Ireland which is certainly equal to anything in Irish history. Its hold on the country is due partly, no doubt, to the fanatical enthusiasm it invokes, but partly it is due to terrorism of the most extreme kind. Its opponents in Ireland are murdered ruthlessly, usually without any form of trial, with no chance of pleading their case, simply because the Sinn Fein leaders think them better out of the way.
>
> The case of Sir Arthur Vicars[1] has excited horror because it is the murder of a well-known man. But it is only typical of what is going on all over the country. I may mention two other instances.
>
> In the first, William P. Kennedy, a Nationalist Irishman of the school of Dillon, refused to close his premises, at Borris, county Carlow, on the occasion of the death of Lord Mayor McSwiney of Cork.[2] He was boycotted, and thereupon took an action for damages against a number of his enemies, Michael O'Dempsey being his solicitor. A short while after, both Kennedy and O'Dempsey were shot from behind a wall in front of Kennedy's house.
>
> In the second case William Good, an ex-captain in the army, who had resumed his studies at Trinity College, Dublin, after being demobilized, returned home to attend the funeral of his father who had been murdered at his own door a few days before. He drove in to Bandon on marketing business. On his return he was waylaid by armed and masked men, carried some way and done to death, the following notice being found:—"Tried, convicted, and executed; spies and informers beware."
>
> The last two cases seem even worse. The first was the atrocious case recorded in the newspapers of April 8, where an unarmed, defenceless, and war-crippled ex-soldier was murdered with revolting brutality in the presence of his mother and sister, who were spattered with his blood. The second is in the papers this morning, where a poor woman named Kitty Carroll, the sole support of her aged father and mother and invalid brother, was dragged from her house by a party of masked men, who murdered her and attached to her body this legend: "Spies and informers beware! Tried, convicted, and executed by I.R.A."[3]
>
> I cite these cases because I think it is essential that people should realize the character of the Sinn Fein policy, the principles upon which it acts, and the nature of its campaign. Sinn Fein has never issued any condemnation of murder. Assassination and outrage are the weapons which it has deliberately chosen as the means by which it is to gain its ends. I should like to repeat that it was not until over 100 of their comrades had been cruelly assassinated that the police began to strike a blow in self-defence. . . . The present state of affairs is due to one cause, and one cause only—that there is still an irreconcilable difference between the two sides. The one side—or, rather, the group which controls it—stands for an independent Irish Republic; the other stands for maintenance in fundamentals of the Union, together with the completest self-government for Ireland within the Empire which is compatible with conceding to Ulster the same right of self-determination within Ireland as Nationalist Ireland has claimed within the Union. . . .
>
> A truce in itself will not bridge the gulf, though it might be useful if there were any doubt on either side as to where the other stands, or a basis for discussion were in sight. What really matters, if we are to attain to peace, is that a basis for a permanent settlement should be reached.
>
> I fully admit, and I have always admitted, that the declared policy of Sinn Fein and the policy of His Majesty's Government are irreconcilable. I believe that the policy of establishing an Irish Republic is impossible for two reasons; first, because it is incompatible with the security of Great Britain and with the existence of the British commonwealth; and second, because if it were conceded it would mean civil war in Ireland—for Ulster would certainly resist incorporation in an Irish Republic by force—and in this war hundreds of thousands of people, not only from Great Britain but from all over the world, would hasten to take part.
>
> On the other hand, I believe that the policy of the Government—the maintenance in fundamentals of the unity of the kingdom, coupled with the immediate establishment of two parliaments in Ireland with full powers to unite on any terms upon which they can agree upon themselves—is not only the sole practical solution, but one which is both just and wise in itself.
>
> But the present struggle is not about the Home Rule Act at all. Fundamentally the issue is the same as that in the War of North and South in the United States—between secession and union.
>
> At the outbreak of the great American struggle nearly everybody in these islands sympathized with the South and was against the North. Even Gladstone took this view. Only John Bright never wavered in his adherence to Lincoln's cause. That war lasted four years. It cost a million lives and much devastation and ruin. There was more destruction of property in a single Confederate county than in all the so-called "reprisals" throughout the whole of Ireland.
>
> Lincoln always rejected alike truce and compromise. As he often said, he was fighting for the Union and meant to save it even if he could only do so at the price of retaining slavery in the South. . . .
>
> Is not our policy exactly the same? It is by reason of the contiguity of the two islands and their strategic and economic interdependence that it is necessary to fight secession and to maintain the fundamental unity of our ancient kingdom of many nations from Flamborough Head to Cape Clear, and from Cape Wrath to Land's End. I believe that our ideal of combining unity with Home Rule is a finer and a nobler ideal than that excessive nationalism which will take nothing less than isolation, which is Sinn Fein's creed today, and which if it had full play would Balkanize the world. . . .
>
> I do not see, therefore, how we can pursue a different line of policy. It has never been our policy to refuse compromise about anything but the Union itself and the non-coercion of Ulster. Throughout the whole of last year when the Home Rule bill was before Parliament, I invited negotiations with the elected representatives of Ireland, stating that the only points I could not discuss were the secession of Ireland and the forcing of Ulster into an Irish Parliament against its will. . . .
>
> To these overtures there was never a reply. And there has never been a reply, for the good reason that the real Sinn Fein organization is not yet ready to abandon its ideal of an independent Irish Republic, including Ulster. That there are many Sinn Feiners who recognize the folly and impossibilism of this attitude is certain. But I regret that no less certainly up to the present the directing minds of the Sinn Fein movement, who control the Irish Republican army—the real obstacle to peace—believe that they can ultimately win a republic by continuing to fight, as they fight to-day, and are resolutely opposed to compromise. . . .
>
> So long as the leaders of Sinn Fein stand in this position, and receive the support of their countrymen, settlement, is in my judgment, impossible. The Government of which I am the head will never give way upon the fundamental question of secession. Nor do I believe that any alternative Government could do so either.

Lord Fitzalan Viceroy.

Such was the situation when, on May 2 1921, the new Lord Lieutenant took the oath of office, with all the old world ceremonial, in Dublin Castle. The realities of the situation were more clearly suggested three days later. On May 5 Sir James Craig, the Ulster leader, accepted an invitation to a conference with the Sinn Fein "President," Mr. De Valera. Rumour was rife as to the significance of this meeting. Sinn Fein had declared "war" against secessionist Ulster; the campaign of outrage had been extended to the North; and in the South a boycott of goods coming from Belfast was said to be spreading consternation in Northern trading circles. It was suggested that De Valera had merely invited Sir James Craig in order to impress upon him the ultimate consequences of this policy to Ulster, and to invite him to come to terms with the "Republic." The general opinion, however, was that the meeting was a genuine sign of a desire to find a *modus vivendi*, and this impression was deepened by the manifesto issued by the Ulster leader next day. Sir Edward Carson, in resigning the leadership, had said that the supreme object of the new Government of the six counties ought to be peace. "Rather than fight these people," he said, "try to win them over to us." Similarly Sir James Craig now put in the forefront the "earnest desire for the peace of Ireland."

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[1] Formerly Ulster King-at-Arms and head of the Irish Heralds College. He was dragged from his house by a roving band of armed men on the night of April 14 1921 and riddled with bullets, his house being burned.

[2] He died as the result of a hunger strike of 63 days on Oct. 25 1920 in Brixton prison. This ended the policy of hunger strikes.

[3] She had rashly given information, *through post*, to the police of the existence of a still for the illicit distribution of whisky. This came out after the date of the Prime Minister's letter.

Elections for the Irish Parliaments, 1921.

There was little enough evidence of the growth of a spirit of compromise. Sinn Fein had decided to take part in the elections for the new Parliament, but without thereby receding an inch from its intransigeant position. In the actual conditions of the country it was clear that no one would dare to stand in opposition to a Sinn Fein candidate, and the unopposed return of a Republican member for every constituency in the South and West of Ireland, combined with the solid refusal of those returned to attend the new Parliament or to take the oath of allegiance, would be the best possible advertisement to the world of the deliberate verdict of the Irish people on the policy of "partition." In effect, when on May 13 the nominations were made, it was found that in no single constituency was there to be a contested election. Of the 128 constituencies of the South and West 124 returned Sinn Feiners unopposed. The four members for Dublin University, also returned unopposed, were not Sinn Feiners; but they were nominees of no party and were bound by no pledges save to study the interest of the university and to work for a settlement which should bring peace and unity to Ireland. The elections for the Northern Parliament, which took place on the 23rd, produced results scarcely less unequivocal as an expression of the temper of the Protestant North. The Unionists had only counted on winning 32 of the 52 seats; they actually won 40. Six Nationalists, including Mr. Joseph Devlin, were returned, and six Sinn Feiners, including De Valera, Arthur Griffith, and Michael Collins, all in the preponderantly Roman Catholic constituencies. Both Nationalists and Sinn Feiners announced their intention of not taking their seats.

"War" in Ireland and England.

The triumph of Sinn Fein at the elections was followed by an intensification of the "war," which was now carried into "the enemy's country." During the week-end May 14–16 large numbers of armed and masked men engaged in shooting and burnings in London, St. Albans and Liverpool, the objects of these attentions being the relatives of members of the R.I.C. In Ireland itself the same week-end witnessed two horrible crimes—the murder of District-Inspector Maj. Biggs and of Miss Barrington, daughter of Sir Charles Barrington, between Glenstal and Newport, and the murder of District-Inspector Blake and his heroic young wife, together with two young army officers, as they were returning from a tennis party at Ballyturin House in Galway. On the 22nd, the day before the Ulster elections, there was read in all the Roman Catholic churches a letter of Pope Benedict XV. to Cardinal Logue, in which His Holiness, while urging peace, gave discreet encouragement to the Sinn Fein cause by suggesting that the Treaty of Versailles had not given "sufficient consideration to the desires of the nations." Three days later the Customs House, a lovely example of late 18th century classical architecture and the most beautiful building in Dublin, was entered by a large band of armed men and set on fire; it burned for three days, till only the shell remained. This act was ordered by Dail Eireann, which justified its action in the *Irish Bulletin* by saying that the destruction of this noble monument was necessary in order "to save the lives of four million people." Of the attackers more than 100 were arrested, while 30 or 40 are said to have been trapped in the building and burned to death. Some inconvenience was caused to the Government, owing to the destruction of the records of the Local Government Board and the Board of Inland Revenue, but far more to private individuals, since an immense number of deeds and other documents were lost. Claims for damages amounting to several millions of pounds sterling were immediately lodged against the Dublin Corporation.

On the day following this outrage (May 26) Mr. Lloyd George declared in Parliament that it would be necessary to send more troops to Ireland, and two days later a considerable number were accordingly dispatched. Meanwhile Sir James Craig had gone to London, and on the 31st it was announced that further efforts were to be made to secure peace. The omens were not auspicious. In Sinn Fein Ireland the more turbulent elements were entirely out of hand, and the utter insecurity of life and property, together in many cases with the complete interruption of ordinary communications, were quickly strangling the economic life of the country. The organization of the I.R.A. in the county districts had been largely broken up, and many once disturbed areas were now peaceful; but "flying columns," which owed their mobility to "commandeered" motor-cars and bicycles, scoured the country, ambushing small parties of constabulary—as in Kerry on June 2—levying "taxes," burning country houses and kidnapping gentlemen, and sometimes ladies, of unpopular views. The cutting of telegraph and telephone poles, and the digging of trenches across roads, were organized on a large scale, men of all classes and opinions being forced at the revolver's point to take part in this work. On June 2 telephone posts were cut down at Liverpool, and on the night of June 7–8 hundreds of wires were cut in places so far apart as Cardiff, Hatfield and Bexley; the outrages in England culminated on the night of June 16 in a series of attacks on signal boxes and signalmen in the suburbs of London with the object of wrecking trains, attacks which were renewed at Manchester on the 18th. On June 9 the Government published as a "white paper" (Cmd. 1326), under the title of "Intercourse between Bolshevism and Sinn Fein," the text of a proposed treaty between the Russian Soviet Government and the Irish Republic which Dr. McCartan, M.P. for King's county, had gone to Moscow to negotiate.

The Northern Parliament.

Meanwhile, on the 7th, the Northern Parliament had been opened at Belfast, and the Government constituted. Sir James Craig became Prime Minister; Mr. H. McD. Pollock, chairman of the Belfast Chamber of Commerce, Minister of Finance; Sir R. Dawson Bates, Minister for Home Affairs; Mr. J. M. Andrews, Minister of Labour; the Marquess of Londonderry, Minister of Education, and Mr. E. M. Archdale, Minister of Agriculture and Commerce. The Hon. Hugh O'Neill, son of Lord O'Neill, was elected Speaker. The Parliament was opened by Visct. Fitzalan, the Lord Lieutenant, whose speech excited particular attention because of its reference to the Government of Ireland Act. "The Act," he said, "is not perfect. It needs amending, and I should not be surprised if it were amended in the near future."

The Government and Sinn Fein.

The significance of this statement was taken to lie in the fact that in parliamentary circles in London the opinion was gaining ground that, before applying "crown colony" Government to the refractory South of Ireland as provided for in the Act, an attempt should be made to win it over by further concessions. On June 21 the Earl of Donoughmore, a large landowner in county Tipperary, moved in the House of Lords that "the situation in Ireland urgently requires that His Majesty's Government should be prepared to propose and authorize negotiations to be opened on such terms as they think calculated to terminate the present deadlock." In opposing the motion the Lord Chancellor, speaking presumably on behalf of the Government, denied that anything in Lord Fitzalan's speech implied any intention of the Government to bring in an amending bill, and said that the amendments referred to were only concerned with minor matters. He admitted the gloom of the situation;

that there was a "small war in Ireland"; and that "our military methods had failed to keep pace with and to overcome the military methods of our opponents." The establishment of the Northern Parliament had emphasized the fact that there was not one Ireland, but two Irelands. The only hope lay in the representatives of these two Irelands coming together and working out a basis of agreement, and from this point of view the meeting of Sir James Craig and Mr. De Valera was of hopeful augury. If it were still necessary to deal with the situation by force, the force would be forthcoming, whatever sacrifices this might involve for the people of Great Britain. As for the suggestion that the Government should negotiate, "those with whom we should negotiate are most illusive . . . there will be no peace until an adjustment is made—if, indeed, that be possible—with those actually carrying on, or inspiring, the policy of violence."

The King in Belfast.

This speech showed an accurate appreciation of the situation in Ireland; it was less accurate as an interpretation of the mind of the Government, or at least of the Prime Minister. On the next day (June 22) a new phase of the question was opened by the visit of the King and Queen to Belfast to open the first session of the new Parliament. The news that the King intended to open the Parliament in person had been received with misgiving in the South of Ireland, not because of any possible danger involved, but because it was feared that this action might compromise the position of the Crown as an impartial influence, and that Republican sentiment, which in Ireland is not very deep or strictly logical, might be still further alienated by this royal patronage of Belfast to the neglect of Dublin. These fears were, however, speedily belied. Their Majesties were, indeed, received in Belfast with splendid demonstrations of popular loyalty, but in his speech from the throne the King made it clear that his visit was not intended for Belfast or the six counties alone. "This is a great and critical occasion for the six counties," he said, "but not for the six counties alone, for everything which interests them touches Ireland, and everything which touches Ireland finds an echo in the remotest corners of the Empire. . . . I appeal to all Irishmen to pause, to stretch out the hand of forbearance and conciliation, to forgive and forget, and to join in making for the land they love a new era of peace, contentment, and good-will."

Negotiations for a Settlement.

Two days later (June 24), a troop train carrying the 10th Hussars, who had formed part of the King's escort in Belfast, was blown up by a land-mine at Adavoyle, some 10 m. south of Dundalk; three soldiers and a guard were killed, and a large number of horses were mutilated and killed. On the same day Mr. Lloyd George addressed a letter to Mr. De Valera, as "the chosen leader of the great majority of Southern Ireland," inviting him to attend a conference in London, "to explore to the utmost the possibility of a settlement," and to bring with him for the purpose any colleagues whom he might select. A similar invitation was addressed to Sir James Craig, the Ulster Prime Minister, who at once accepted. Four days later (June 28) the Parliament of Southern Ireland was opened in the Council Chamber of the Department of Agriculture; but the only members of the Lower House present were the four representatives of Dublin University, together with 15 out of 64 senators, and the Parliament was at once adjourned. On the same day a special issue of the *Irish Bulletin*, the official publication of the Sinn Fein "Government," published the "President's" reply to Mr. Lloyd George. Mr. De Valera said that he was in consultation with such of the principal representatives of the Irish nation as were available, that he and they desired most earnestly to bring about a lasting peace between the English and Irish peoples, but that he could see no avenue by which a lasting peace could be reached if the British Premier "denied Ireland's essential unity and set aside the principle of national self-determination." He added that he was seeking a conference with certain representatives of the political minority in Ireland. The five gentlemen invited to this conference were, as announced in the same number of the *Bulletin*, Sir James Craig; the Earl of Midleton; Sir Maurice E. Dockrell, Unionist member for S. Dublin in the Imperial Parliament; Sir Robert H. Woods, an eminent surgeon who had been elected as a Unionist for Dublin University mainly as a representative at Westminster of the medical faculty; and Mr. Andrew Jameson, head of the famous firm of whisky distillers and chairman of the Dublin Chamber of Commerce. Sir James Craig refused the invitation on the ground that he had already accepted the Prime Minister's invitation to London. This refusal and Mr. De Valera's comment on it illustrated the fundamental cleavage between Sinn Fein and the Ulster Unionists. "Mr. Lloyd George's proposal," wrote the "President," "because of its implications is impossible of acceptance in its present form." Irish political differences, he urged, ought to be settled on Irish soil, and in negotiating with Great Britain the Irish delegation ought to act as a unit on some common principle. It seemed, indeed, from the first as though it would prove impossible to find a basis even for discussion, let alone a settlement. Throughout the preliminary negotiations the Sinn Fein President and officials carefully avoided using a single phrase susceptible of being interpreted as a modification of their claim to be the legitimate Government of Ireland negotiating with a foreign Power. The representatives of the six counties, on the other hand, "stood with both feet on the Better Government of Ireland Act," and, as Sir James Craig put it, made no offers because they "had nothing to give away."

On June 30, as an earnest of the genuineness of the Government's desire for an accommodation, four members of Dail Eireann, Messrs. Arthur Griffith, John McNeill, Staines and Eamon Duggan, were released from Mountjoy gaol, where they had been interned for eight months, in order that they might take part in the discussion. Meanwhile, the four "representatives of the minority"—they were, of course, representatives in no strict sense—had accepted the invitation of Mr. De Valera, and the first conference between them and the Sinn Fein leaders took place at the Dublin Mansion House on July 4. The fact that the conference did not at once collapse, but was adjourned, was announced in the *Irish Bulletin* of the 5th as affording gratifying proof "that Irishmen of hitherto widely divergent opinions can continue to deliberate upon the best means of showing a united front to England at this crisis." To emphasize the moral of this phenomenon, Mr. De Valera directed that the day of the first meeting of the conference should be celebrated by a display of American flags, in significant commemoration of the Declaration of American Independence.

On the 5th Gen. Smuts visited Dublin and had a meeting with the Republican leaders. On the 8th the conference reassembled at the Mansion House, and at its close Mr. De Valera addressed a letter to the Prime Minister accepting his invitation to a conference in London.

The "Truce."

At the first Mansion House meeting it had been agreed that it would be impossible to conduct negotiations with any hope of achieving a satisfactory result unless there was a cessation of bloodshed in Ireland, and Mr. Lloyd George had subsequently addressed a letter to Lord Midleton concurring in this view. Gen. Sir Nevil Macready, the British commander-in-chief in Ireland, accordingly attended the second Mansion House conference, with a view to discussing a cessation of hostilities, and as a result of this, on Saturday the 10th, a formal truce was signed on the one part by Gen. Macready and on the other part by Risteard Ua Maolchatha (Richard Mulcahy), chief of the staff of the Irish Republican army. This truce was to take effect as from noon on the following Monday (July 11), so as to allow time for the news of it to be communicated to all parts of the country. In Dublin, where the news was welcomed with universal rejoicing, the suspension of hostilities came into effect at once, the curfew being suspended, and the unarmed soldiers and "black-and-tans" mixing freely with the people. Mr. De Valera had issued a proclamation as President on the 9th calling on all "soldiers and citizens" to observe the strictest self-control and discipline during the truce. It was, however, a question of curious interest as to how far this direction would be obeyed. If it were not obeyed, it would show that the Sinn Fein Government had no power to come to decisions in the name of the nation; if it were obeyed, it would prove that this Government was responsible for the whole policy of outrage, terrorism and murder by which the extremists had sought to gain their ends.

The signs during the days spent in negotiation were not hopeful; indeed the week-end before the coming into force of the truce was one of the bloodiest on record in Ireland. On July 8 the murder of a constable by Sinn Feiners in Belfast led to serious rioting, in the course of which 14 people were killed and over a hundred wounded, and this rioting continued intermittently for over a week, with further casualties. On the 9th Mr. George B. O'Connor, who had been a Unionist candidate in Dublin, was murdered in Cork, where, on the evening of the same day, four unarmed soldiers were kidnapped and done to death.[1] On the same date three soldiers were killed in an ambush in Castleisland; one was murdered in Doneraile; an R.I.C. sergeant was murdered in Castlerea; and near Clonmel a girl of fifteen was killed by Sinn Feiners in an effort to murder her brother, an ex-soldier. On the 10th a farmer was murdered at Kilbride, Portarlington. On July 7 the *Irish Bulletin* denied the statements made in certain British journals that there had been an "easing-up" on the part of the Crown of its measures of repression since Mr. Lloyd George's letter, and described the "terror" as still "in full blast," and in its issue of the 8th it gave a lurid account of the "war on women and children." Except in Belfast, however, not only the operations of the Crown forces, but Sinn Fein outrages, seem to have ceased from the coming into force of the truce, officers of the British army and the R.I.C. in some cases concerting with officers of the I.R.A. measures for the preservation of order.[2]

De Valera Appeals to the World.

Attitude of Ulster.

Sinn Fein, with its accustomed ability, meanwhile exploited the situation in order to secure foreign support for its claim to independence. On the 9th Mr. De Valera addressed a series of messages to the United States, to France, to Norway and to Denmark, of which the general moral was that, in the event of the coming conferences leading to the satisfaction of Ireland's just demands, "British prestige will be restored, and Young Ireland will live in history as having saved, by its courage and by its steadfastness, the ideals for which millions were led to offer up their lives in the Great War." To impress upon the outside world the nature of this courage and steadfastness the *Irish Bulletin* issued on July 13 a number of "thrilling stories of the Guerrilla War," as a counterblast to "the British Government's ignoble propaganda against the Republican army, the daily descriptions of these unpaid Irish Volunteers as 'murder gangs' and 'hired assassins.'" On the 12th Mr. De Valera travelled to London, accompanied by Mr. Arthur Griffith, Mr. Austin Stack, Mr. R. O. Barton and Mr. Erskine Childers, and on the 14th had his first interview with Mr. Lloyd George. Next day the Prime Minister held a separate conversation with Sir James Craig and other members of the Parliament of Northern Ireland. Sir James Craig returned to Ireland almost at once, and there issued a declaration which showed that he had not budged an inch from the position he had always taken up. To De Valera's talk about self-determination for the whole of Ireland he opposed the accomplished fact of self-determination for Northern Ireland, whose Parliament the King had so recently opened, and pointed out that De Valera himself had acquiesced in this fact by standing as a candidate for the Belfast Parliament. From this position the North had no intention of receding, though it would meet the South at any time on equal terms, and work with her in a spirit of good-will and coöperation.

The Government's Offer.

De Valera, on the other hand, continued the conversations, and on July 20 Mr. Lloyd George handed to him the proposals of the Government, which were still, however, kept secret from the public till Aug. 15. After a preamble enlarging on the desire of the British people that nothing should "hinder Irish statesmen from joining together to build up an Irish State in free and willing coöperation with the other peoples of the Empire," the document went on to offer to Ireland forthwith "the status of a Dominion," with "complete autonomy in taxation and finance," the right to "maintain her own Courts of Law and Judges, . . . her own military forces for home defence, her own constabulary and her own police," that she should "take over the Irish postal services and all matters relating thereto, education, land, agriculture, mining and minerals, forestry, housing, labour, unemployment, transport, trade, public health, health insurance and the liquor traffic," and "in sum, that she shall exercise all those powers and privileges upon which the autonomy of the self-governing Dominions is based," subject, however, to six conditions, "vital to the welfare and safety of both Great Britain and Ireland, forming as they do the heart of the Commonwealth." The control of the seas round Ireland was to be reserved for the British navy; the Irish territorial force was to be kept "within reasonable limits," to conform in numbers with the military establishment in Great Britain; the Royal Air Force was to have facilities in Ireland for air defence and communications; voluntary recruiting for the Empire forces was to be permitted in Ireland; no protective duties were to be imposed between all parts of the British islands; and Ireland was to assume responsibility for a share of the debt of the United Kingdom and of the liability for war pensions, this share, failing agreement, to be determined by an independent arbitrator appointed from within His Majesty's Dominions. The conditions of settlement on these lines were to be embodied in a treaty ratified by the British and Irish Parliaments, but the settlement must "allow for full recognition of the existing powers and privileges of the Parliament and Government of Northern Ireland, which cannot be abrogated except by their own consent." The British Government would leave Irishmen to determine by negotiations among themselves whether the new powers should be taken over by Ireland as a whole and administered by a single Irish body, or taken over separately by Southern and Northern Ireland, with or without a joint authority to harmonize their common interests. The Government would willingly assist in the negotiations of such a settlement. But they would not consent to any proposals which would kindle civil war in Ireland.

Reply of De Valera.

On July 22 Mr. De Valera returned to Dublin to consult his colleagues as to the answer to be given to this offer. A meeting of Dail Eireann, by permission of the Government, was convoked for Aug. 16. It was noted, however, that De Valera had taken the position throughout that he was negotiating with Great Britain as the elected head of the Irish republic and on equal terms. To the National University, which had elected him chancellor during his absence, he sent a letter acknowledging this honour done to "the Head of the State." There were ominous signs, too, that Sinn Fein was in no mood for compromise. In the execution of the Government's order for the release of the interned and convicted members of Parliament in order that they might attend the Dail, what the *Irish Bulletin* described as "a disastrous exception" was made in the case of John McKeon (Sean McKeown), a commandant of the Irish Republican army who had been convicted of the murder of a district inspector of the R.I.C. while resisting arrest. This exception was resented by Sinn Fein, and the Government gave way rather than incur a break-down at this part in the negotiations. Mr. De Valera, however, did not wait for the meeting of Dail Eireann before intimating on his own account to Mr. Lloyd George ("on the occasion of our last interview") that his offer was unacceptable; and on Aug. 10 ("having consulted my colleagues") he addressed to the Prime Minister a letter confirming this judgment. The Government's draft was appreciated and accepted "to the extent that it implies a recognition of Ireland's separate nationhood and her right to self-determination"; but the offer of "Dominion status" was rejected as "illusory" unless the "right to secede" was sufficiently guaranteed. The "independence" of Ireland was claimed "on the basis of moral right"; and Mr. De Valera asserted "for myself and my colleagues our deep conviction that true friendship with England can be obtained and most readily through amicable but absolute separation." The present proposals were such as the Irish people could not be asked to accept, though he would have been ready to recommend "a certain treaty of free association with the British Commonwealth group" if it would secure the allegiance of "the present dissenting minority," or to negotiate treaties about trade, armaments, etc. They were prepared to leave Ireland's share of the national debt to be determined by three arbitrators, one chosen by Ireland, one by Great Britain, and a third by agreement, or, in default, "to be nominated, say, by the President of the United States." The question at issue with "the political minority" (*i.e.* Ulster) was one "for the Irish people themselves to settle," but "we cannot admit the right of the British Government to mutilate our country, either in its own interest or at the call of any section of our population." They did not "contemplate the use of force," however, in bringing Ulster to terms, and if conciliation failed the question might, he suggested, be submitted to "external arbitration."

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[1] They were being "treated" by a friendly publican in celebration of the truce.

[2] The *Irish Bulletin* of July 21 rightly pointed out that this disposed of the legend of a "moderate" and an "extreme" section of Sinn Fein.

On Aug. 15 the Government at last published the text of the terms offered to Mr. De Valera on July 20, his reply on Aug. 10, and a rejoinder from Mr. Lloyd George on Aug. 13, together with a letter addressed to De Valera on Aug. 4 by Gen. Smuts advising him to accept the "Dominion status" offered and "to leave Ulster alone for the present" in the sure hope that, sooner or later, economic considerations would lead her to seek union with the rest of Ireland. In Mr. Lloyd George's rejoinder on Aug. 13, he declared emphatically that no right of Ireland to secede from allegiance to the King could be admitted, and no claim that she should negotiate with Britain as a "separate and foreign Power," nor could the relations between Southern and Northern Ireland nor any other question be allowed to be referred to foreign arbitration. He repeated that, if the conditions of the Government's offer were accepted in principle, their application in detail would form material for discussion.

On Aug. 16, Dail Eireann assembled at the Dublin Mansion House. The proceedings, which were conducted according to all the forms of an ordinary parliament, began by the taking by all the members of an oath "to support and defend the Irish Republic and the Government of the Irish Republic." Then followed the address of "President" De Valera, in which he asserted once more the right of Ireland to complete independence, "which could not be realized at the present time in any other way so suitably as through a Republic," and declared it to be impossible to negotiate to any effect with the British Government, because the two parties to the negotiations had no common basis of principle.[1] At the adjourned meeting on the following day he reasserted this attitude yet more uncompromisingly. "We cannot, and we will not," he said, "on behalf of this nation, accept these terms." As for the Six Counties, the Irish Republic would "go a long way in order to satisfy the sentiments of Ulster"; but he insisted that "the minority problem in Ireland had its origin in British policy."[2]

De Valera's attitude caused something like consternation in those circles in England which believed or affected to believe that Sinn Fein might be conciliated by the concession of "Dominion status." English Radical organs like the *Nation*, which had consistently supported Sinn Fein and vilified the police and the soldiers in Ireland, betrayed their discomfiture by efforts to find in De Valera's utterances phrases which might be twisted into an expression of some willingness to compromise. The Northcliffe Press,[3] whose criticisms of the Government had previously done so much to encourage Sinn Fein, enlarged on the far-reaching character of Mr. Lloyd George's offer, and for the first time for about two years warned De Valera that British opinion would not tolerate an Irish Republic. On Aug. 19 the Prime Minister, in the House of Commons, declared that the terms offered to Ireland by the Government had defined the issues more clearly than they had ever been defined before, and that their rejection would be "an unmistakable challenge to the authority of the Crown and the unity of the Empire in the very heart of the Empire." In the House of Lords the Lord Chancellor defended the action of the Government in attempting to reach a settlement, but went still further in warning Sinn Fein that, in the event of a rejection of the offer, Great Britain would be committed to hostilities in Ireland on an unprecedented scale. This declaration by Lord Birkenhead was attacked by a small section of the Liberal Press as provocative, but, in general, British newspapers of all complexions, with surprising unanimity, emphasized the inevitable result of a refusal by Sinn Fein to come to terms. On the other hand the *Irish Bulletin* commented caustically on the contradiction involved in threatening dire consequences in the event of the Irish "declining as 'a free Dominion' to 'join voluntarily' 'a free association' of 'free nations'" (v., No. 57, Aug. 19). The *Bulletin*, indeed, which represented day by day the views of the republican leaders, denied that the British offer was really one of "Dominion status" as understood in the overseas Dominions; and it protested against the publication of Gen. Smuts's letter, the comments contained in which, it argued, were not justified by the actual proposals made by the Government, which implied the "military subjection of Ireland," and were "incompatible with an independent voice in foreign affairs." The rights and privileges of the Dominions, it argued, were all summed up in the right to secede, which "gives them the authentic stamp of freedom; that is, of free choice; self-determination." The *Bulletin* denied, however, that the phrase "the right to secede" was applicable to Ireland, "which can never be said to 'secede' from an authority never acknowledged."[4]

On Aug. 21 Dail Eireann met in secret session in order to agree upon its formal answer to the Government's terms. From all parts of the world came messages urging the Sinn Fein leaders to listen to reason. They were, however, in a singularly difficult position, and therefore, both in order to safeguard themselves and to add weight to whatever decision might be arrived at, they determined to consult those who might be considered more closely in touch with opinion throughout the country than the members of the Dail, who had been elected under the conditions already described. For this purpose the executive council, representing all the district councils of Sinn Fein in Ireland, was summoned to Dublin to sit concurrently with Dail Eireann, and met at the Mansion House on Aug. 24. On Aug. 26 a public session of the Dail was held. At the outset of the proceedings Mr. De Valera announced that, as this was a new Dail, the "Ministry" had resigned. On the motion of Mr. McKeon, Mr. De Valera was next reëlected "President of the Irish Republic," and in this capacity proceeded to nominate a new "Ministry," all of whom were at once elected. The most notable perhaps of the appointments were those of Michael Collins as Secretary for Finance, and Countess Markievicz, a popular figure at Liberty Hall, as Secretary for Labour.

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[1] *Ir. Bull.* v., No. 55, Aug. 17.

[2] *Ir. Bull.* v., No. 56, Aug. 18.

[3] In 1919 *The Times*, departing from its previous policy, had published a scheme of its own, on Home Rule lines, for an Irish settlement.

[4] This claim, frequently repeated by De Valera and others, that Ireland never acknowledged the sovereignty of the Crown, is, of course, quite without foundation either in history or in public law. It was examined, from the point of view both of a historian and a canonist, by Father Walter McDonald, D.D. (d. 1920), Professor of Moral Philosophy in the Roman Catholic College of Maynooth, in his *Some Ethical Questions of Peace and War* (1919). In this, Father McDonald demolished the Sinn Fein position with pitiless logic, his intimate knowledge of Ireland and its history giving his arguments special weight. The book was violently assailed in *The Catholic Times* (No. 22, "Ireland's Plain Rights"), to which Father McDonald replied in a *Postcript in Reply to Certain Criticisms* (1920). For the issues of principle involved in the Sinn Fein claim *see* SELF-DETERMINATION.

Before the nomination of the new "Ministers" the "President" read the letter addressed by him on the previous day to the Prime Minister, in which he announced the Dail's unanimous rejection of the proposals for a settlement made on behalf of the Government. In this document Mr. De Valera once more enlarged on the principle of self-determination, stigmatizing as fundamentally false "in Ireland's case to speak of her seceding from a partnership she has not accepted, or from an allegiance she has not undertaken to render," and as fundamentally unjust "the claim to subordinate her independence to British strategy." Dail Eireann, he concluded, was willing to appoint representatives to negotiate a peace "on the broad general principle of government by consent of the governed"; the responsibility for a renewal of the conflict would rest upon the Government, if it refused to come to terms on this principle.

The Prime Minister replied, in the name of the Cabinet, on Aug. 26. In a lengthy statement, he declared it to be "playing with phrases" to say that the principle of government by the consent of the governed involved the recognition of the demand to recognize Ireland as a foreign Power. The demand that Ireland should be treated as a separate sovereign Power, with no allegiance to the Crown and no loyalty to the sister nations of the Commonwealth, was one which the most famous national leaders in Irish history, from Grattan to Parnell and Redmond, had always explicitly disowned. In reply to the contention that Ireland had never undertaken to render allegiance to the Crown, Mr. Lloyd George pointed out that for over a hundred years the representatives of Ireland in the Imperial Parliament had, without protest, taken the oath of allegiance. The British Government had offered to Ireland all that O'Connell and Thomas Davis asked, and more; and from all quarters of the world had come nothing but praise for the generosity of their policy. The Government did not believe that the permanent reconciliation of Great Britain and Ireland could ever be attained without a recognition of their physical and historical interdependence, which made complete political and economic separation impossible for both. Pressing this point, Mr. Lloyd George quoted from President Lincoln's first presidential address:—

> Physically speaking we cannot separate. We cannot remove our respective sections from each other, nor build an impassable wall between them. . . . It is impossible, then, to make that intercourse more advantageous or more satisfactory after separation than before. . . . Suppose you go to war, you cannot fight always; and when, after much loss on both sides and no gain on either, you cease fighting, the identical old questions as to terms of intercourse are again upon you.

"I thought I had made it clear," wrote Mr. Lloyd George, "both in my conversations with you and in my two subsequent communications, that we can discuss no settlement which involves a refusal on the part of Ireland to accept our invitation to free, equal and loyal partnership in the British Commonwealth under one Sovereign." He pointed out that action was being taken in various directions[1] which, if continued, would prejudice the truce and must ultimately lead to its termination. While, therefore, he was prepared to make every allowance as to time which would advance the cause of peace, he added that the Government were not prepared to prolong a mere exchange of notes, and that it was essential that some definite and immediate progress should be made towards a basis upon which further negotiations could usefully proceed. They could not proceed unless the essential facts of the situation were recognized and admitted. Mr. De Valera's letter, unfortunately, had shown no progress towards such an understanding.

First Conference Proposal Fails.

A second phase of the negotiations between Mr. Lloyd George and Mr. De Valera opened after the definite rejection by Dail Eireann of the British Government's proposals of July 20. Cabinet meetings were held, on the Prime Minister's summons, at Inverness, in order that his holiday in Scotland might not otherwise be interrupted; and eventually, on Sept. 7, they resulted in his sending to Mr. De Valera an invitation to a conference at Inverness for which the date of Sept. 20 was proposed. The basis of the conference was to be, "How the association of Ireland with the community of nations known as the British Empire can best be reconciled with Irish national aspirations"; and the Prime Minister's letter of invitation laid down no other condition than that the British Government could not accept the setting up of an Irish Republic or any repudiation of allegiance to the Crown. On Sept. 14 Mr. De Valera's answer, as agreed to by Dail Eireann, was published, in circumstances distinctly embarrassing to a continuation of the negotiations. In its first paragraph it accepted the invitation, but it then went on aggressively to reaffirm that Ireland had already declared its independence as a sovereign state, and that its representatives would enter into the conference on that basis. This reply had been sent a day or two earlier to Mr. Lloyd George at Inverness by Sinn Fein emissaries, and he had sent word to Mr. De Valera that he was willing to treat it as withdrawn if it were redrafted and an acceptance sent without the latter part, which would make a conference impossible. But this diplomatic suggestion was ignored by Mr. De Valera, who incontinently sent the Sinn Fein reply, as originally communicated, to the press. Once more the negotiations had come to a dead-lock. On Sept. 15 Mr. Lloyd George telegraphed to Mr. De Valera, cancelling his invitation to the proposed conference, on the ground that it was impossible to proceed with it now that Mr. De Valera had insisted on the independence of Ireland as a sovereign state—a point on which the British Government could not give way. At the same time he intimated that, owing to his being unwell, he would take time for consultation with his colleagues before taking further steps. On Sept. 16 Mr. De Valera sent a reply telegram, expressing surprise at the way in which his acceptance of the proposed conference had been received, and saying that his own view was that the negotiators must meet "without prejudice" to the claims made on either side. The inevitable comment on this rejoinder, and one that was generally made, was that, if that was what he had meant, he would have been well-advised to use that phrase, which would have contained no offence, rather than make an aggressive statement which was bound to be offensive. Any lawyer, or experienced negotiator, would have known that "without prejudice" would be harmless.

London Conference Accepted.

Up to Sept. 29 the *détente* was maintained, further communications passing meanwhile between Mr. Lloyd George and his colleagues, among whom Lord Birkenhead played an active part in counselling moderation. The British Cabinet then decided to assume that Mr. De Valera had not intended deliberately to wreck their proposal for a conference, and on Sept. 29 a new invitation was sent to him, opening a third phase in the *pourparlers*. After premising that the result of the previous correspondence with regard to a meeting at Inverness was that the British Government could not now accept it as the basis of negotiations, since it might be argued, if they did, that they had recognized the claim made for Irish independence, "which no British Government can accord," Mr. Lloyd George wrote that they were, nevertheless, keenly anxious to make, "in coöperation with your delegates, another determined effort to explore every possibility of settlement by personal discussion." He therefore sent "a fresh invitation to a conference in London on Oct. 11, where we can meet your delegates as spokesmen of the people whom you represent, with a view to ascertaining"—and here the formula of Sept. 7 was repeated—"how the association of Ireland with the community of nations known as the British Empire may best be reconciled with Irish national aspirations." On Sept. 30 Mr. De Valera sent in reply a simple acceptance of this invitation, merely adding the words, "our respective positions have been stated and understood."

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[1] *e.g.* Reorganization of and recruiting for the I.R.A., and organized attacks by Sinn Feiners in Ulster, aimed at exciting reprisals, which culminated in serious rioting in Belfast.

Agreement for Irish Free State.

Thus at last the two sides were brought to the council-table, after three months' parley. Mr. De Valera did not include himself among the Sinn Fein delegates, and Dail Eireann nominated for this purpose Mr. Arthur Griffith (in the Gaelic form, Art of Griobhtha), Mr. Michael Collins (Michael O. O. Sileain), Mr. Robert C. Barton (Riobard Bartun), and Mr. George Gavan Duffy (Seorsa Ghabgain ui Dhubhthaigh), with Mr. Erskine Childers as principal secretary. They duly attended in London, and the conference began as arranged on Oct. 11, the British Government being represented by Mr. Lloyd George, Mr. Austen Chamberlain, Lord Birkenhead, Mr. Winston Churchill, Sir L. Worthington-Evans, Sir Gordon Hewart and Sir Hamar Greenwood. For many weeks there were "alarums and excursions" in the press as to the way in which the attempts at a settlement were proceeding; and from time to time, owing to "die-hard" criticisms and objections on both sides, and to the unwillingness of Ulster, as now represented by the Parliament of Northern Ireland and its Premier, Sir James Craig, to waive any point in its own newly acquired status, agreement seemed to be unobtainable. It must suffice here to say that, at last, on Dec. 6, a scheme was found to which both the Sinn Fein delegation and the British Government's representatives were able to affix their signatures. It was in the form of a definite treaty for the establishment of an Irish Free State, and is of such historic importance that its terms must be set out in full:—

Article I.—Ireland shall have the same constitutional status in the community of nations known as the British Empire as the Dominion of Canada, the Commonwealth of Australia, the Dominion of New Zealand and the Union of South Africa, with a Parliament having powers to make laws for the peace, order and good government of Ireland, and an executive responsible to that Parliament, and shall be styled and known as the Irish Free State.

Article II.—Subject to provisions hereinafter set out, the position of the Irish Free State in relation to the Imperial Parliament and Government and otherwise shall be that of the Dominion of Canada, and the law, practice and constitutional usage governing the relationship of the Crown or the representative of the Crown and of the Imperial Parliament to the Dominion of Canada shall govern their relationship to the Irish Free State.

Article III.—The representative of the Crown in Ireland shall be appointed in like manner as the Governor-General of Canada and in accordance with the practice observed in the making of such appointments.

Article IV.—The oath to be taken by members of the Parliament of the Irish Free State shall be in the following form:

"I. . . . do solemnly swear true faith and allegiance to the Constitution of the Irish Free State as by law established, and that I will be faithful to H.M. King George V., his heirs and successors by law, in virtue of the common citizenship of Ireland with Great Britain and her adherence to and membership of the group of nations forming the British Commonwealth of Nations."

Article V.—The Irish Free State shall assume liability for the service of the public debt of the United Kingdom as existing at the date hereof and towards the payment of war pensions as existing at that date in such proportion as may be fair and equitable, having regard to any just claims on the part of Ireland by way of set-off or counter-claim, the amount of such sums being determined, in default of agreement, by the arbitration of one or more independent persons being citizens of the British Empire.

Article VI.—Until an arrangement has been made between the British and Irish Governments whereby the Irish Free State undertakes her own coastal defence, the defence by sea of Great Britain and Ireland shall be undertaken by His Majesty's Imperial Forces, but this shall not prevent the construction or maintenance by the Government of the Irish Free State of such vessels as are necessary for the protection of the Revenue or the Fisheries. The foregoing provisions of this article shall be reviewed at a conference of representatives of the British and Irish Governments to be held at the expiration of five years from the date hereof with a view to the undertaking by Ireland of a share in her own coastal defence.

Article VII.—The Government of the Irish Free State shall afford to His Majesty's Imperial Forces (*a*) in time of peace such harbour and other facilities as are indicated in the annex hereto, or such other facilities as may from time to time be agreed between the British Government and the Government of the Irish Free State, and (*b*) in time of war or of strained relations with a Foreign Power such harbour and other facilities as the British Government may require for the purposes of such defence, as aforesaid.

Article VIII.—With a view to securing the observance of the principle of international limitation of armaments, if the Government of the Irish Free State establishes and maintains a military defence force, the establishments thereof shall not exceed in size such proportion of the military establishments maintained in Great Britain as that which the population of Ireland bears to the population of Great Britain.

Article IX.—The ports of Great Britain and the Irish Free State shall be freely open to the ships of the other country on payment of the customary port and other dues.

Article X.—The Government of the Irish Free State agrees to pay fair compensation, on terms not less favourable than those accorded by the Act of 1920, to judges, officials, members of the Police Forces and other Public Servants who are discharged by it or who retire in consequence of the change of government effected in pursuance hereof.

Provided that this agreement shall not apply to members of the Auxiliary Police Force or to persons recruited in Great Britain for the Royal Irish Constabulary during the two years next preceding the date hereof. The British Government will assume responsibility for such compensation or pensions as may be payable to any of these excepted persons.

Article XI.—Until the expiration of one month from the passing of the Act of Parliament for the ratification of this instrument, the powers of the Parliament and the Government of the Irish Free State shall not be exercisable as respects Northern Ireland, and the provisions of the Government of Ireland Act, 1920 shall, so far as they relate to Northern Ireland, remain of full force and effect, and no election shall be held for the return of members to serve in the Parliament of the Irish Free State for constituencies in Northern Ireland unless a resolution is passed by both houses of the Parliament of Northern Ireland in favour of holding such elections before the end of said month.

Article XII.—If before the expiration of the said month an address is presented to His Majesty by both houses of the Parliament of Northern Ireland to that effect, the powers of the Parliament and the Government of the Irish Free State shall no longer extend to Northern Ireland, and the provisions of the Government of Ireland Act, 1920 (including those relating to the Council of Ireland) shall, so far as they relate to Northern Ireland, continue to be of full force and effect, and this instrument shall have effect, subject to the necessary modifications.

Provided, that if such an address is so presented, a commission consisting of three persons, one to be appointed by the Government of the Irish Free State, one to be appointed by the Government of Northern Ireland, and one, who shall be Chairman, to be appointed by the British Government, shall determine in accordance with the wishes of the inhabitants, so far as may be compatible with economic and geographic conditions, the boundaries between Northern Ireland and the rest of Ireland, and for the purposes of the Government of Ireland Act, 1920, and of this instrument, the boundary of Northern Ireland shall be such as may be determined by such Commission.

Article XIII.—For the purpose of the last foregoing article the powers of the Parliament of Southern Ireland under the Government of Ireland Act, 1920, to elect members of the Council of Ireland, shall, after the Parliament of the Irish Free State is constituted, be exercised by that Parliament.

Article XIV.—After the expiration of the said month, if no such address as is mentioned in Article XII. hereof is presented, the Parliament and Government of Northern Ireland shall continue to exercise as respects Northern Ireland the powers conferred on them by the Government of Ireland Act, 1920, but the Parliament and Government of the Irish Free State shall in Northern Ireland have in relation to matters, in respect of which the Parliament of Northern Ireland has not power to make laws under that Act (including matters which, under the said Act, are within the jurisdiction of the Council of Ireland), the same powers as in the rest of Ireland, subject to such other provisions as may be agreed in manner hereinafter appearing.

Article XV.—At any time after the date hereof the Government of Northern Ireland and the Provisional Government of Southern Ireland, hereinafter constituted, may meet for the purpose of discussing the provisions, subject to which the last foregoing article is to operate in the event of no such address as is therein mentioned being presented, and those provisions may include: (*a*) Safeguards with regard to patronage in Northern Ireland; (*b*) safeguards with regard to the collection of revenue in Northern Ireland; (*c*) safeguards with regard to import and export duties affecting the trade or industry of Northern Ireland; (*d*) safeguards for minorities in Northern Ireland; (*e*) the settlement of financial relations between Northern Ireland and the Irish Free State; (*f*) the establishment and powers of a local militia in Northern Ireland and the relation of the Defence Forces of the Irish Free State and of Northern Ireland, respectively, and if at any such meeting provisions are agreed to, the same shall have effect as if they were included amongst the provisions subject to which the powers of the Parliament and of the Government of the Irish Free State are to be exercisable in Northern Ireland under Article XIV. hereof.

Article XVI.—Neither the Parliament of the Irish Free State nor the Parliament of Northern Ireland shall make any law so as either directly or indirectly to endow any religion or prohibit or restrict the free exercise thereof or give any preference or impose any disability on account of religious belief or religious status, or affect prejudicially the right of any child to attend a school receiving public money without attending the religious instruction at the school, or make any discrimination as respects State aid between schools under the management of different religious denominations, or divert from any religious denomination or any educational institution any of its property except for public utility purposes and on payment of compensation.

Article XVII.—By way of provisional arrangement for the administration of Southern Ireland during the interval which must elapse between the date hereof and the constitution of a Parliament and Government of the Irish Free State in accordance therewith, steps shall be taken forthwith for summoning a meeting of Members of Parliament elected for constituencies in Southern Ireland since the passing of the Government of Ireland Act, 1920, and for constituting a provisional Government. And the British Government shall take the steps necessary to transfer to such provisional Government the powers and machinery requisite for the discharge of its duties, provided that every member of such provisional Government shall have signified in writing his or her acceptance of this instrument. But this arrangement shall not continue in force beyond the expiration of twelve months from the date hereof.

Article XVIII.—This instrument shall be submitted forthwith by His Majesty's Government for the approval of Parliament and by the Irish signatories to a meeting summoned for the purpose of the members elected to sit in the House of Commons of Southern Ireland and, if approved, shall be ratified by the necessary legislation.

Signed on behalf of the British delegation:

LLOYD GEORGE. L. WORTHINGTON-EVANS.
AUSTEN CHAMBERLAIN. HAMAR GREENWOOD.
BIRKENHEAD. GORDON HEWART.
WINSTON S. CHURCHILL.

On behalf of the Irish delegation:

ART O GRIOBHTHA (ARTHUR GRIFFITH).
MICHEAL O COILEAIN (MICHAEL COLLINS).
RIOBARD BARTUN (ROBERT C. BARTON).
E. S. DUGAN (EAMON J. DUGGAN).
SEORSA GHABGAIN UI DHUBHTHAIGH (GEORGE GAVAN DUFFY).

Dated the 6th of December, 1921.

ANNEX

An annex was attached to the treaty. Clause 1 specifies that Admiralty property and rights at the dockyard port of Berehaven are to be retained as at present date and the harbour defences and facilities for coastal defence by air at Queenstown, Belfast Lough and Lough Swilly to remain under British care, provision also being made for oil, fuel and storage.

Clause 2 provides that a convention shall be made between the two Governments, to give effect to the following conditions: That submarine cables shall not be landed or wireless stations for communication with places outside of Ireland established, except by agreement with the British Government, that existing cable rights and wireless concessions shall not be withdrawn except by agreement with the British Government, and that the British Government shall be entitled to land additional submarine cables or establish additional wireless stations for communication with places outside of Ireland, that lighthouses, buoys, beacons, &c., shall be maintained by the Irish Government and not be removed or added to except by agreement with the British Government, that war signal stations shall be closed down and left in charge of care and maintenance parties, the Government of the Irish Free State being offered the option of taking them over and working them for commercial purposes, subject to Admiralty inspection, and guaranteeing the upkeep of existing telegraphic communication therewith.

Clause 3 provides that a convention shall be made between the two Governments for the regulation of civil communication by air.

De Valera's Opposition.

On the announcement being made that the agreement had been signed, the greatest relief was felt on practically all sides. Ulster, it was noted, might "contract out"; and the misgivings of the Ulster leaders about the terms on which the Irish Free State was to be set up were on that account regarded as of minor moment. From all parts of the world, congratulations began to pour in on Mr. Lloyd George. Summonses were at once sent out for Parliament to meet, in order to ratify the treaty; and the Government took immediate action for recognizing its validity by releasing all Sinn Fein prisoners. It was not known till Dec. 8 that there was opposition in the Sinn Fein camp itself. On that day, however, Mr. De Valera issued a "message to the Irish people," disavowing and disapproving of the agreement. It ran as follows:—

"You have seen in the public press the text of the proposed treaty with Great Britain. The terms of this agreement are in violent conflict with the wishes of the majority of the nation, as expressed freely in successive elections in the past three years. I feel it my duty to inform you immediately that I cannot recommend acceptance of this treaty either to the Dail Eireann or to the country. In this attitude I am supported by the Ministers of Home Affairs (Austin Stack) and of Defence (Charles Burgess). A public session of the Dail Eireann is being summoned for Wednesday (Dec. 14). I ask the people to maintain in the interval the same discipline as heretofore. The members of the Cabinet, though of divided opinions, are prepared to carry on public service as usual. The army, as such, is, of course, not affected by the political situation and continues under the same orders and control.

"The great test of our people has come. Let us face it worthily without bitterness, and above all, without recrimination. There is a definite constitutional way of resolving our political differences. Let us not depart from it, and let the conduct of the Cabinet in this matter be an example to the whole nation."

In spite of this repudiation from Mr. De Valera, the situation was dominated by the fact that the agreement had been signed by all the Sinn Fein delegates to the conference. As the leading Irish plenipotentiary, Mr. Griffith thus became its chief champion.

Irish Free State Adopted and Started.

So far as the British Government was concerned, no time was lost. On Dec. 16 Parliamentary sanction was obtained, after comparatively short debates in both Houses, in which adverse criticism played a very small part, except for a hot denunciation by Lord Carson, in the Lords, of the betrayal of the Unionist cause in Ireland. The fact that Mr. De Valera was hostile to the agreement, and that Dail Eireann had met on Dec. 14 and was starting what seemed likely to be an interminable debate, with rather doubtful prospects, created, however, a somewhat delicate situation for the Government. It was not till Jan. 7 that the discussion in Dail Eireann was at last concluded, Mr. Griffith's motion for the approval of the agreement being carried by a narrow majority of 64 to 57. During the debates a profound gulf was disclosed between Mr. Griffith and his supporters on the one side, chief among whom was Mr. Michael Collins, and Mr. De Valera and the irreconcilable Republicans on the other. Many things were said, indeed, which might seem to bode ill for the future, should the result only be to create opposing factions in the new Irish Free State. Mr. De Valera passionately urged his view that the delegates had had no right to abandon "the republic." Great play was made with the contention that the agreement had been signed "under duress"—the suggestion being that the British Government had finally threatened a renewal of "war" should it not be signed. The fact was entirely ignored that "duress" had been exerted much more from the Sinn Fein side, since it was only the intolerable situation of the past two years that had made English opinion ready to accept "dominion status" for Ireland at all. No "threat" had, in fact, been made except in so far as Mr. Lloyd George had frankly intimated that a break-down in the negotiations, resulting from a refusal of Sinn Fein to accept anything but an independent republic for Ireland, would leave Great Britain no option but to fight. Mr. Griffith, Mr. Collins and their supporters, while anxious to show themselves no less determined than Mr. De Valera to stand for the independence of the Irish Free State, hotly resented the charge that the Sinn Fein delegates were not acting within their mandate. In all parts of Nationalist Ireland, moreover, resolutions were passed in favour of ratification and peace.

The final division developed into a theatrical resignation of De Valera as "President," and the reconstitution of the Dail Eireann "Cabinet." On Jan. 10 a further meeting of Dail Eireann was held, at which only Mr. Griffith's 64 supporters attended, and he was unanimously elected "President" in Mr. De Valera's place, an adjournment then being taken till Feb. 14. On Mr. Griffith's summons, the Irish Southern Parliament (under the Home Rule Act of 1920) was convened on Jan. 14, and formally ratified the agreement. A Provisional Government, for the purpose of bringing the new Irish Free State into being, was constituted at the same time, consisting of Mr. Michael Collins, Mr. William Cosgrove, Mr. Eamon J. Duggan, Mr. P. J. Hogan, Mr. Finian Lynch, Mr. Joseph McGrath, Prof. John McNeill, and Mr. Bryan O'Higgins,—Mr. Griffith himself not being included, since he wished to continue for the present to act as the head of the Dail Eireann. With the formation of the Provisional Government, as provided by the agreement, a start was made at once with the transfer of authority to the new administration; on Jan. 16 Lord Fitzalan, at Dublin Castle, handed over the reins of Government to Mr. Michael Collins, as acting Premier; and the Irish Free State came formally into being.

Here, at a dramatic turn in Irish history, our record breaks off in Jan. 1922. The 19th-century Union had been definitely dissolved. Ireland, under the Act of 1920 or under the Treaty of 1921, had been given self-government. Southern Ireland, under Sinn Fein, had been granted a constitution which put her on practically the same footing as Canada. Northern Ireland, under its separate Government, had, however, declined so far to make common cause with it. The future would have to show how this latest experiment in the loose federalism of the British Empire would succeed.

AUTHORITIES.—Of the vast mass of literature on the Irish question published in 1910–21 very little has any independent critical value. The numerous books or pamphlets written on one or other of its aspects are for the most part useful only as reflecting particular points of view. Subject to this last limitation, it may be said that the Sinn Fein propaganda works are almost wholly useless for purposes of scientific history, and must be used with extreme caution. The Government publications are valuable as "sources," in so far as they either reprint original documents or, as in the case of the Report of the Royal Commission on the Rebellion of 1916, provide evidence of first-hand witnesses under judicial examination. These publications, however, only cover a very small field.

By the courtesy of the Chief Secretary the present writer was given access in 1921 to the unpublished documents in the archives of the Castle, without conditions or censorship of any kind. Among these he found the confidential reports submitted annually by the county inspectors of the R.I.C., and they are of exceptional value for the light they throw on the general conditions of the country and the shifting phases of popular sentiment in the several counties. These reports are printed, together with an annual statistics of crime and other matters with which the police are concerned. In addition to these, the enormous number of unprinted reports on special cases, *dossiers* of the depositions of witnesses, recommendations of particular policies by the police and military authorities, with the departmental comments upon them, and so on, were freely placed at the writer's disposal for the elucidation of particular points.

Of great value, especially as affording some sort of check on the official records, are the Sinn Fein official publications, especially *Sinn Fein* and, later, the *Irish Bulletin*. As a record of Sinn Fein policy and activities they are indispensable, but, as propagandist publications, they must of course be used with caution. As regards the Irish Press it may be said generally that the local newspapers are more valuable as historical material than those published in Dublin, since they throw a more intimate light upon the life of the people.

Of the publications referred to in the text, *Notes from Ireland* needs some comment. This was published monthly, and later every quarter, by the Irish Unionist Alliance. Its intention is, therefore, to present the case from the Unionist point of view. Subject to this caution, its volumes provide an invaluable supply of historical material. It gives a whole series of quotations from speeches and from the Press of all political complexions, which may be relied on as accurate; it also provides in its "Diurnal" a very full chronological record of events. For this record the weekly editions of the more important Irish newspapers, e.g. *The Irish Times*, may also be referred to. A complete collection of all published materials for the recent history of Ireland is preserved at the National Library in Dublin. (W. A. P.)

IRISH (GAELIC) LANGUAGE AND LITERATURE

The decade following 1910 was a period of much activity in the publication of literature written in the Irish language (see 5.622 *seq.*). This activity took two forms, one the editing of older texts which had never seen the light before, and the other the creation of wholly new works. The Irish Texts Society in London, the learned magazine *Erin* published in Dublin, the *Zeitschrift für celtische Philologie*, published at Halle, the *Revue Celtique* of Paris, and the *Celtic Review* of Edinburgh (which ceased publication after 1915) were the principal media for the publication of the older texts. The Irish Texts Society in especial published a number of handsome volumes, all *editiones principes* of important works, the *Poems* of Dáibhi ó Bruadair in three vols., the *Contention of the Bards* in two vols., an ancient Irish book on astronomy, the fourth vol. of Keating's history, the poems of Carolan, an Irish version of the wars of Charlemagne, and some lives of saints. The *Cath Catharda*, an extended Middle Irish version of Lucan's *Pharsalia*, had already been finished by Whitley Stokes in 1909. It was the last work of that great scholar and was published posthumously in Leipzig as one of the *Irische Texte* series. In the following year Kuno Meyer printed his researches into the Finn Saga, with the oldest texts bearing upon it, in the *Proceedings* of the Royal Irish Academy, Todd Lecture series. The same scholar published in the *Preussische Akademie der Wissenschaften* a masterly article on the early Irish poetry of the first half of the seventh century, in 1913. He died in 1919, and in the same year appeared the first half of his work on *Fragments of the Oldest Lyrics of Ireland*. Two other works which have lately appeared are Manus O'Donnel's *Life of Columcille* and O'Clery's recension of the *Book of Conquests*. The first was published in America in a sumptuous volume by the Irish Foundation of Chicago, and edited by Father Kelleher and Miss Schöperle; the second was published by University College, Dublin, and edited by Professors MacNeill and Macalister.

The *Gaelic Journal*, which had been founded in 1882, came to an end in 1906, with the 197th number, and the want of a scholarly magazine dealing with the phases and difficulties of the more modern language was keenly felt. In 1912 T. O'Rahilly started a magazine *Gadelica*, to which he himself was the chief contributor, which reproduced all the best and most scholarly features of the old *Gaelic Journal*. Unfortunately this magazine came to an end in 1913, and nothing of quite the same kind has since taken its place.

Other *editiones principes* of valuable Irish texts published by various scholars are Sean O'Neachtain's *Adventures of Edmund O'Clery*, edited by O'Neachtain; the poems of Pádraigin Hackett, many of which had been wrongly ascribed to the historian Keating, edited by Prof. O'Donoghue; a collection of *One Hundred Ulster Poems* by Morris; the romance of *The Son of the Eagle* by Brian O'Corcorain, who died in 1487, edited by Digby and Lloyd; Art MacCooey's poems, edited by Morris; the poems of John Murphy "na Raithineach," edited by O'Donoghue; *The Maguires of Fermanagh*, an historical tract, edited by Dinneen; *The Flight of the Earls*, edited by Walsh; *The Book of the MacSweeneys*, by the same; and many others. All these works, now for the first time given to the press, have had a considerable effect in directing the eyes of the Irish people to their own past. They showed them what their language was capable of doing, and they stimulated modern writers.

It would be invidious to mention the names of some of these new authors while leaving out others whose claims to mention may be just as good. But the name of the late Canon Peter O'Leary, parish priest of Castlelyons, must be mentioned above all others. Although he began to write late in life, after the rise of the Gaelic League, he produced an amazing number of excellent works, of which his first book, *Séadna*, is nearly sure to live. He wrote another long Irish novel, *Niamh*, about the battle of Clontarf; he retold the old stories of Ireland in several volumes; he translated much of *Don Quixote*, *The Catiline Conspiracy*, the *Imitatio Christi* (of which two other Irish versions have been also printed), the *Fables of Aesop* and other works. He also wrote two volumes of sermons. His great merit is that he was the first to turn his back resolutely upon everything that was bookish and old and unclear, and to turn for his mode of expressing himself to the folk speech of his native county of Cork, which he wrote with a clarity and power that have never been surpassed. How suitable the speech of the people became in his hands to express the whole gamut of the emotions was to many a revelation. He died in 1920, and has left his trace upon the language more deeply than any other writer of his time. Father O'Leary stands for the most representative writer of the Southern half of Ireland. Pádraig O'Conaire (or Conry) would probably be regarded by many in 1921 as the best living writer of the Northern half. No two people could well be more different. Coming from Connemara, he had spent a considerable time in England, and many of his stories, notably the powerful tale called *Exile*, deal with life outside of Ireland. In him we see a determined tramp camping out beneath a tent or the stars, and walking all over the country, stick in hand, or driving a donkey before him with his belongings. Entirely *fin de siècle*, he never resorted to the past for his subject-matter, which he draws wholly from his own experience or imagination. In many ways he reminds the reader of Maupassant.

Of late many stories have been translated from modern European languages into Irish, and these have helped to make the idiom flexible, although they are not original work. Irish literature got a great set-back during the political troubles following the rebellion of 1916. Two monthly magazines which published stories and folklore were burnt, one in Munster and one in Connacht. The Connacht editor was "on the run" in the mountains, and of the joint editors of the Southern paper one was "interned" and the other had his house burned, with all the MSS. which he had spent half a lifetime collecting, and all the songs and music he had taken down from old people, now for the most part dead. Pádraig O'Conaire too had his little hut in the Dublin mountains burnt and several plays destroyed. The most scholarly work, and the latest upon Irish saga literature, is that of Thurneysen published at Halle in 1921, *Die Irische Helden- und Königsage*, a volume of over 700 pages, the first part of which contains a general treatment of the subject and the second the Ulster saga.

It is difficult to say with any certainty how far the Irish language has maintained itself in Ireland since 1910. The action of Dail Eireann (the "Irish Republican Parliament") in making it the official language of their first meeting, nothing else being spoken on that day, gave it a great lift in popular estimation. Many people might have been noticed, especially young men and women, wearing a gold ring on their dress, in the streets of the bigger cities and towns. This was to show that they spoke Irish and wished to be addressed in that language. It was observed that many of these people came to a violent end, and the wearing of this ring was consequently to some extent discontinued. Finally it may be said that whilst the reading, writing and speaking of the Irish language have increased very much amongst the cultured classes in the towns, the language, where it is still naturally spoken in the north-west, west and north, has not fared equally well, and it is in many of these places barely holding its own against English. (D. Hy.)

IRIGOYEN, HIPÓLITO (1853–), President of Argentina, was born in Buenos Aires in 1853. He attended private schools, the Colegio Nacional, and for three years the Facultad de Derecho, in Buenos Aires. He early became identified with the activities of the Union Civica (*see* 2.472), of which his uncle, Leandro N. Alem, was a founder, and in 1890 he was in charge of a revolutionary force attacking Buenos Aires. From 1891 to 1909 he was professor of civic instruction in the Universidad de Buenos Aires, and for many years held at the same time a similar chair in the Escuela Normal de Mujeres. On the death of Alem he succeeded him as head of the Radical party, which nominated him president in 1916. On March 12 he was elected president, receiving 152 out of the 298 votes of the Electoral College, and on Oct. 12 was inaugurated as the successor of Dr. Saenz Peña (*see* ARGENTINA). He was the first Radical to hold this office. He possessed considerable wealth and neither as teacher nor president did he accept his salary, but turned it over regularly to the Sociedad de Beneficencia for use in charities.

IRON AND STEEL (*see* 14.801*).—Developments in the second decade of the 20th century in iron and steel were improvements in processes and equipment rather than new methods. An increase in the *per capita* consumption, far greater than the remarkable increase of the preceding decade, forced attention to means of securing maximum outputs as well as to the ever-present effort to secure economies. Larger units of manufacture were generally favoured and so-called "duplexing" and "triplexing" were outstanding features in steel-making. The latter part of the decade was marked also by a marvellous growth in popularity of the electric furnace, until at the end of 1920 there were 960 such furnaces in the world for steel-making alone, against 114 in 1910. The World War gave an artificial stimulus in general to plant expansion to meet the demands for ships and shells and resulted in a realignment of national capacity. In the main the following analysis is devoted to the economic side of the evolution of the decade.

Iron Blast-Furnace Construction.—Design was influenced by local experience of experts in the different iron-producing districts. Profiles depend on raw materials—quality of coke, nature and concentration of ores. Generally speaking, tendency toward greater bosh and shaft angles continued (bosh angle 75° to 80°; shaft angle 84° to 86°). The size of stack increased only in the districts treating low-grade ore, while with high-grade ore (50% to 62% iron) the 500- to 600-ton-per-day size became the standard and many old furnaces were enlarged. In the Minette district of Europe, where the ore charged contained between 30% and 35% iron, the 200- to 250-ton unit became popular in all new construction. The cubical capacity of a blast furnace range between 40 and 100 cub. ft. per ton of pig-iron blown in 24 hours. Individual parts of blast furnaces received particular attention. The hearth construction became reënforced and often cooled to avoid breakouts of the molten metal, and greater attention was given to brickwork to limit the downward destructive action of the metal. Emergency tuyeres at mid-height of the bosh—standard in the Minette district—lost their popularity and disappeared in nearly all new furnaces. For the handling of the material—ore, limestone and coke—mechanical devices won increased favour owing to the enormous masses involved and to the growing scarcity of labour. In America the simple skip hoist was almost universally adopted in new plants, while in Europe the drop-bottom-bucket hoist became popular and its design was ingeniously varied. It is noteworthy that the drop-bottom bucket, which was originated in America (Duquesne works) and was perfected in Germany during the years 1905–10, was little used in the United States 10 years later. It had been supplanted by the cup-and-cone top with a rotary distributor (McKee), while in Europe the double cup-and-cone construction, giving low drop height and assuring less breakage of the softer coke, was preferred. These two solutions were more or less linked to the hoist system adopted. The furnace interiors were bricked up in America of standard-shaped refractories giving a multitude of joints, while it was customary all over Europe to use special large-volume brick, shaped to reduce the joints. Both systems seemed to give satisfaction to the operators, and comparisons were not possible owing to the difference in the operating conditions. Speaking generally, the American design with a plate lining involved less steel for construction, while the Luxemburg-Lorraine type of blast furnace was conservative and substantial.

Blast-Furnace Operation.—General progress was marked; greater familiarity with the chemical problems and increased mechanical equipment made operation more easily controllable, results more positive and disturbances less frequent. The use of excessively fine ore was accompanied by a high-solution loss of coke, and agglomerating of ore was recognized as desirable. This led to increasing attention to sintering fine ore mixed with flue-dust, and recharging of dust without treatment seemed likely to die out. Higher temperature of the air blast was a noteworthy development, as each increase of 200° F. has been reflected by 4% to 5% reduction in coke consumption. In the Minette district 850° to 900° F. blast temperatures were quite common. The blast pressure, which remained without much change, varied according to districts and the forcing of the operation, from 4 to 15 lb. per square inch. In case of a relatively cold spell within the furnace due to overfluxing, bad coke or dropping of a hanging, the introduction of kerosene (paraffin) through the tuyeres proved a quick remedy, although it necessarily required care and progressive application to avoid accidents. The use of this cure rendered superfluous the auxiliary tuyeres at mid-height of bosh. The use of the oxygen torch to burn out the iron notch in case of metallic incrustations extremely difficult to remove proved a great help to the working crews. Mechanical appliances in cast-houses were installed in increasing numbers to supplant hand work, especially in sand casting floors. Cranes equipped with lifting magnets and pneumatic hammers elastically suspended proved a step toward the best method of moulding, breaking and handling of sand-cast pig-iron. For all qualities of pig-iron the continuous casting machines continued to be the accepted standard. In plants adjoining steel-works transport ladles of larger size (30 to 50 tons) and designs assuring better insulation and easier skimming of slag were evolved.

Blast-Furnace Gas.—Continuously increasing price of coal and coke affected the economics of the blast-furnace gas and made it a by-product of great importance. The fuel value of this original waste became more and more recognized in America. The first effort, to avoid all gas losses so far as possible, led to the installation of double furnace tops, which became universal. Next gas-cleaning processes were developed to remove dust impurities from the by-product fuel, thus increasing its adaptability to combustion and securing greater efficiencies in its utilization. To facilitate operation and render supervision automatic, pressure-regulating devices were evolved and accumulators were installed to equalize supply and provide steady outflow. Gas-cleaning attracted the attention of operators in European countries greatly in need of fuel, because the calorific value of the gas counterbalanced the cost of purification. In America the coal shortage, due to inordinate demand and dislocation of railway service, produced the same result. The first step in gas-cleaning was the installation of a dust collector close to the off-takes and the downcomers of each blast furnace. In it the coarse dust was deposited by a slowing-down of the gas flow and a sudden change in its direction. This apparatus was independent of all further cleaning methods.

To separate the fine dust particles two different processes were applied: (1) wet method; (2) dry filtration.

(1) By the wet method the gases were cooled by injection of water, and the dust particles, passing through the fog artificially produced, were arrested by scrubbers. Experience led to a subdivi-

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* *These figures indicate the volume and page number of the previous article.*

sion of the operations, called medium cleaning and fine cleaning, with apparatus protected by patents. The sludge of dust and water was removed by the application of centrifugal force, separating gas and liquid in specially designed fans or washers (Theissen, Brassert, etc.). The disposal of the water created a problem, as contamination of rivers is against the law in most industrial countries. In deposit ponds the settling of the impurities was incomplete and its removal a tedious manual operation; and the Dorr thickener, developed in ore-concentration districts, was adopted, as assuring continuous service automatically by means of a special mud pump requiring little attention. A drawback of wet systems was that the sensible heat of the blast-furnace gas was absorbed by the cleaning water and lost beyond recovery. On the other hand, it permitted the installation of smaller gas-piping and dispensed with the insulation of the lines against heat loss, thus saving appreciable capital outlay in the case of long-distance distribution. Another drawback of the wet method was that recovery of the dust required driving off the water from the heavy mud in any briquetting or concentrating process attempted.

(2) The dry methods of gas-cleaning had their advocates where every little economy was watched, such as retaining the sensible heat of the gas and saving the expense of water-handling in keeping the dust dry. To separate the dust out of the hot gases, filtration appeared to be the best process. With mechanical filtration, finely woven cloth or asbestos-fabric bags or slag-wool layers let the gas pass at low velocity but retained the solid dust, which was removed periodically by return currents of clean gas. The principle was adopted in the Beth-Halberg system in Europe and the Kling-Weidlein apparatus in the United States.

Through the researches of Dr. F. G. Cottrell, in the United States, electricity promised to serve as a filtering medium in the so-called electric precipitation process. By creating high-tension discharge currents in the flow of the gas the solid particles became separated from the gas. At the end of the decade 1910–20 high potential electric deposition had its noteworthy applications among non-ferrous blast-furnace installations. The utilization of the thermal value of blast-furnace gas was sometimes credited against the conversion cost of ore, plus limestone, plus coke, into pig-iron. A ton of iron blown, requiring 2,200 lb. of coke of about 80% pure carbon (equal to 1,700 lb.), produced an amount of gas, expressed in cub. ft., equal to 90 to 100 times that weight, or some 160,000 cub. ft., averaging about 100 B.T.U. per cub. ft. In assuming a value of 2 cents or 1d. per 1,000 cub. ft., the gas would represent an asset of some $3.20, or 13s. to 14s., per ton, a figure indicating the great importance of the by-product gas in the cost-sheet of the plant. The gross valuation must be diminished by such factors as the cost of cleaning, but a net surplus of about $1 per ton per day was not uncommonly left after allowing for material and conversion outlays of the plant.

The chief ways in which blast-furnace gases were utilized were as follows:—

(*a*) *Cowper or Hot-Blast Stoves.*—The absence of dust in the gas provided for rational stove design, as the complicating side issues of clogged-up passes and slagged-up checker holes disappeared, as well as the periodic waste of cooling, cleaning and warming-up of each unit. The clean gas meant a reduction of the area of heating surfaces and brick volume expressed by fewer stoves per blast furnace—three to four per furnace against four to five 10 years earlier. Then began a systematic study of the heat-transmission phenomena within the mass of checker work, a study which in 1920 was not yet completed. Close observation and scientific research, coupled with improved combustion methods regulating more closely and more positively the two elements of combustion—gas and air,—promised at that time to lead to a further reduction of the number of stoves, and also to higher blast temperatures and less gas consumption.

(*b*) *Boilers.*—Clean blast-furnace gas allowed for advantageous use in connexion with steam boilers; first, through more efficient combustion, in effect less gas per pound of steam produced; second, higher ratings of boilers, in effect more steam per unit of boiler evaporating surface or fewer boilers for a given plant capacity; and, third, quick adaptation to any load required, in effect flexibility or ease of operation. Many efficient burners were invented and some were installed on a large scale.

(*c*) *Metallurgical Furnaces.*—The removal of flue-dust made possible a wider distribution of the blast-furnace gas, and in Europe use was made of the surplus gas with success in all kinds of furnaces. The low calorific value coupled with the small amount of air required for complete combustion opened fields where so-called mellow heating flames are demanded, such as core drying, mould drying, annealing, roasting and ore concentrating.

(*d*) *Gas Engines.*—The principle that clean gas was indispensable for internal-combustion engines was long recognized, but its practical application did not occur until after 1910. Also a cool gas was regarded as essential to secure adequate volumetric efficiency of each cylinder. Among gas engines the four-cycle type outranked considerably the two-cycle type. Devices for close regulation were developed on the principle of qualitative-quantitative mixture. The built-up cylinder seemed to win greater favour than the one-piece casting. The safety of operation reached a parity with that of steam-engines or turbines, the gas being clean. The exhaust heat of the engines, representing some 40% of the energy, was utilized to generate steam, and 70% was thus recovered in some instances.

Of all the various uses made of the gaseous by-products of the blast furnace only the heating of the hot-blast stoves was universally applied. All experts agreed that 30% to 40% of the gases are best employed for that purpose. The surplus of 60% to 65% was utilized for the other purposes already mentioned. In the utilization to produce blast pressure and to develop power, the battle for supremacy between the gas-engine using blast-furnace gas and the steam boiler using the gas to supply energy to engine or turbine remained undecided. Thermal efficiencies were not the only issues at stake. In Europe the gas-engine had the firmer standing, while in America the boiler seemed to be the more in favour. Even for generating the blast pressures, the competition between gas-engine-driven air compressors, steam-engine blowing engines and turbo-blowers had gone on without absolutely proving the superiority of any one combination. Varying economic conditions in each country and different local considerations, as well as the purely technical aspects of the problem, were deciding factors. Europe, with its skilled workmen and more stabilized market conditions, presented a background different from that of America with its fluid trade conditions and its unsettled, unskilled labour.

The fact that the dust in blast-furnace gas is made up of coke, ore and flux additions, combined with the fact that the cleaning plants provide for collecting it, led to the reintroduction of the material into the furnaces. By previous nodulization, as in rotary kilns, or briquetting under presses with or without binding agent, the flue-dust became available for use. Numerous processes were developed, of which the Dwight-Lloyd sintering system gave good results, judging from the number of installations in America.

Plant Layout and Size.—A single blast furnace built alone on a site, no matter how well chosen, proved not to be a logical industrial enterprise. The number of such plants existing was the result of competition, of fluctuating market conditions, and constituted an economic waste, speaking generally. With combined units the accessory equipment became cheaper in installation cost and in terms of iron output and more efficient in operation, through flexibility and insurance against breakdown. Three to six furnaces grouped in well-laid-out plants were established as an economic whole. To avoid the loss of the sensible heat of the molten pig-iron and to refine the metal without cooling, steel-works were logically joined to blast-furnace plants. The two separate departments were thus combined in one industrial unit, with the added advantage that the surplus of power available at the furnaces could be absorbed in the rolling-mills.

Electric Pig-Iron Furnaces.—Tests at Trollhättan, Sweden, made on a coöperative basis by steel interests and the Government, were conclusive only for high-grade pig-iron similar to the Swedish charcoal pig-iron. Since 1918 the Domnarfret works in Sweden had operated several shaft-type furnaces (with gas circulation using 60% to 62% of iron ore and charcoal as a reducing agent). Mixtures of charcoal and coke up to 50% coke were found satisfactory. Per ton of pig-iron produced, 3,400 lb. of ore (containing 61·5% Fe), 120 lb. of lime and 740 lb. of charcoal were charged; 15,000 cub. ft. of gas at 240 B.T.U. per cub. ft. were captured at the top; 2,150 kilowatt-hours was the electric energy consumption per 2,000 lb. of pig-iron. The problem of using electric current for supplying heat in the blast-furnace reactions had particular interest for the eastern Pyrenees in France, British Columbia, Brazil, Italy, as well as Sweden and Norway, where fuel is scarce and low-priced electricity might be made available.

The Steel Plant.—The usefulness of mixers as an important adjunct of the steel-making plant was universally recognized, as numerous installations attest. Their field was established in equalizing qualitatively the successive outgivings of the blast furnaces and in desulphurizing the molten metal. To accelerate the removal of sulphur, less than 0·5% of manganese proved most helpful. The shape of the mixer that gave best results was the simple cylinder rotating on its axis. The most popular size proved to be 1,000 to 1,400 tons' containing capacity. Simple oil or gas burners without regenerating chamber in the United States, with pre-heating checkers sometimes in Europe, completed the equipment. In Germany a 2,000-ton-capacity mixer was reported built, but only after considerable discussion as to its size. The mixer was, of course, brought into being for receiving metal from the blast furnace and delivering to the ladle for transport to the steel plant as needed. Slag that floats on the top of the bath must be skimmed off from time to time.

Converter Plants.—No noteworthy development took place in the acid operating (Bessemer) converter or in the basic operating (Thomas) converter for making steel. The 20- to 25-ton-capacity vessel remained nearly universal. A 40-ton size was proposed in 1918 by a Belgian engineer. As between Europe and the United States, the hydraulic tilting mechanism of the former did not give way to the electric drive of the latter, nor did the gas-engine blowing units succumb to the turbo-blowers of American practice.

Open-Hearth Plants.—Without radical change in type, sizes of open-hearth furnaces increased up to and above 100 tons' capacity, but the tendency was toward fully controllable sizes. The practice in the United States settled to 80 to 100 tons and in Europe 40 to 50 tons. Volumes of checker chamber increased to get better so-called flywheel effect. Greater attention was paid to port and head construction to lengthen life, and to a reinforced roof. Reversing valves were marketed for reducing flow resistance and waste of gas. Waste-heat boilers were more generally installed, but not universally adopted because of their interference with concentration and general electrification of plants. Marked superiority or inferiority was not shown for the tilting construction of furnace when tested by use beside the stationary type. Natural gas disappearing in America, producer gas was the more generally adopted fuel. Powdered coal was tried with some success but without proved superiority; one difficulty was that checker chambers got clogged by ashdust. By-product tar and crude oil proved fuels well suited for the purpose if available at low price and in large quantities.

Electric Steel Furnaces.—The electric steel furnace for refining and melting iron and steel developed to a surprising extent in the decade 1910–20 in size and in number of installations. It proved ideally suited for quality products and high-grade materials, because no complication through fuel medium exists and because atmosphere and temperature are attainable practically at will. From 500-lb. capacity, single furnaces were built to 40 tons, with most of them of 5- to 8-ton capacities. (For electric furnace statistics, see *Iron Age*, Jan. 1 1921.) Of the 960 known electric steel furnaces in existence in Jan. 1921, 356 were in the United States, 150 in England, 100 in Germany, 69 in France and 43 in Canada. Of the total, 308 were Héroult arc furnaces, 102 Rennerfelt induction furnaces and 90 Greaves-Etchells furnaces. The electric furnace was adopted for making metal mixtures, ferro-alloys, special steels of high quality in large amounts—strict repetition being possible in an absolute positive way. A disadvantage was that the metal is not at rest but always in motion, through electric or magnetic influences. Though agitation was often desirable, the action hampered the separation of the slag and the rising of impurities out of the molten mass. A remedy for this was repeated skimming of slag and careful supervision. One unusual utilization of the electric furnace was the making of pig-iron out of scrap, especially in the United States, to supply deficiencies in the amount of low phosphorus pig-iron, particularly in the manufacture of ordnance. It amounted to a synthetic reconversion of steel into pig-iron. Fine coke was added to the slagged refined scrap for carburization, and the method promised to be commercially feasible in regions having electric power but little local fuel available and situated so that delivered pig-iron was high in price. For deoxidation in the refining process and for recarburization, ferromanganese and spiegeleisen retained their popularity in spite of high prices under erratic market conditions. In Europe pre-heating, often pre-melting, of the addition was the current practice, to save in the amount needed and to accelerate effects. In America the wasteful method of cold additions prevailed. Ferrotitanium, with carbon or carbon-free, was used, as well as ferrosilicon and aluminium in small quantities. Some steel plants made additions in the ladle, others finished the operation in the furnace.

Steel-making Operations.—The outstanding feature of steel-making operations was the recognition of splitting the refining process into two phases, or the two-slag method, to increase production and to lower production costs. The efforts of Bertrand-Thiel and Talbot recognized in effect this principle; and duplexing and triplexing were only operating variations of the same principle, to remove the impurities of the pig-iron stepwise in the furnaces best suited for each purpose. Thus sulphur and manganese pass out in the mixer; silicon and part of the carbon in the converter; the rest of the carbon and phosphorus in the open-hearth furnace; additions were made and alloys were added in the electric furnace. The plant necessitated considerable equipment, but it secured ease of operation, exact control of results and made possible quantity production. Below 1,600 tons per 24 hours, savings in operation were regarded as hardly possible, as in slack market periods overhead expense was too large. During the World War about 10 duplexing plants, refining in an acid converter and finishing in basic open-hearth furnaces, were built in the United States under the pressure created by an ammunition famine. Electric duplexing plants (meaning melting and preparing in open-hearth furnaces and finishing in electric furnaces) were built in large numbers, offering a special-quality product on a large scale.

A number of new independent efforts were made to produce steel direct from the ore without the interpolation of the iron blast furnace, but none could be said to have been proved feasible on a scale beyond that of the laboratory.

The problem of casting crude steel, particularly the ingot problem, received close study. The mould may be stationary, located in pits, or put on railway bogies moved on tracks by locomotives. Both systems have their field, the former being more suited for small plants. The sizes of the ingots varied from 1,000 lb. to 6 tons. In America 6,000-lb. and 8,000-lb. ingots were in wide use, while in Europe 4,000-kgm. to 5,000-kgm. sizes were adopted in large up-to-date plants. To facilitate the stripping operation, that is the separation of mould from ingot, about 80% of all moulds were made slightly conical with top smaller than bottom. Most of the pouring was done direct into the mould from the ladle, some by attaching to the ladle a little dished pan to break the jet and to produce a quiet overflow pouring, while in another class the metal flowed upward from the bottom by means of a special riser connecting through refractory channels with the several moulds. About 20% of the steel-makers used the conical mould that is larger at the top than at the bottom, and in some cases a refractory or heated top was placed on top of the mould to secure better results; these moulds require a tilting-over to allow for the stripping. All these mould forms were evolved by the study of the cooling of steel in ingot form and the defects occurring in the metal—the volume shrinkage due to change of physical state from liquid to solid; cooling by strata; crystallization and segregation phenomena; inclusion of solid and gaseous impurities, called blowholes, piping, sonims, etc. One type of ingot mould which was well received in America provided a bulk of metal in the lower part, thus to absorb more heat from the lower strata of the molten steel and leave the upper ones as the last to freeze or solidify and afford an opportunity for the segregation of gaseous and solid impurities.

The Shaping of Steel.—Rolling-mills (used if the demand for a product is large and if its shape lends itself to a continuous process, like rails, angles, plates, bars, etc.) and the forge-shop (if the shapes to be produced are complicated, short in length, unsuited for the rolling-mill), both change the shape of the metal heated at high temperature, about 2,000° to 2,300° F. Both require finishing departments to straighten, shear or bundle the rolled product or to clean off the fins, rough off the unevenness of the forging operations, and they may need annealing and pickling facilities to improve the quality of the product. A special process of milling the top and bottom of rail blooms, to remove cracks and roughness from the semi finished steel and also surfaces decarbonized in the heating furnaces, was put into use at the Lackawanna mills in America and resulted in a reduction in the number of finished rails classed as seconds.

In the period 1908–20 the development of the rolling-mill was influenced, first, by the great manufacturing principles of concentration and specialization, and, second, by the electrification of the motive power. Concentration demanded large production in one unit and suitable equipment to attain that aim; in other words, mechanical devices in preference to hand operation. Specialization was applied to the shape to be rolled as well as to the mill used for production. Standardization of rails, beams, and angles, the reduction of the number of profiles, and the simplification of shapes were consequences, as well as the installation of mills for specific purposes. The application of these rational principles was accelerated by the use of the electric motor. The advantages were recognized about 1905, but the next 15 years brought their practical realization. The numerous little steam-engines disappeared and the electric motor revolutionized the handling of the material by cranes and overhead trolleys as well as the mill accessories, like tables, skids, transfers, etc. The first step was the creation of central power plants where electricity was generated either in turbine or gas-engine generators, preferably with the help of the surplus gas from the blast furnace. Many steel plants in 1920 were equipped with 20,000- to 40,000-K.W. power stations. The second step was the development of speed-reducing devices made necessary by the high speed of electric motors. The advance of the gear-cutting industry and the advent of spiral-type teeth, single or herringbone, and the development of new types of teeth giving less wear, more rolling surface, and, later, the use of special hardened, heat-treated steels were eagerly taken up by the designers of mill machinery to increase the quality of their product. Reduction gears transmitting up to 5,000 H.P. came into daily use, and the ratio of 10 or 12 to 1 in one reduction gave satisfactory service. The third step was the development of speed-regulating devices, especially in connexion with alternating-current motors, to secure efficient operation for variable conditions. The fourth step was the solving of the load problem of large, intermittently operating motors, reversing their direction of rotation by means of the motor-flywheel set advocated by the Austrian engineer Ilgner in connexion with suitable controllers of which the Ward-Leonard system was the prototype. Much work and inventive genius were concentrated on these difficulties to bring about in less than 15 years the high efficiency and great safety of operation by electricity of steel-mills. The development of the rolling-mills by 1921 is shown in the diagram.

A rolling-mill proper consists of its motor (steam-engine or electric motor), a universal coupling (speed-reducing drive or not), pinion stand transmitting power to all rolls by means of toothed pinions, together with spindles and couplings, and one or more roll stands solidly bolted to foundation shoes. A roll stand has two housings with adjusting mechanism and is fitted with two or three rolls and called either two-high or three-high, according to the number of rolls. But rolling-mills bear various other designations that are confusing. Sometimes they are characterized by their roll diameter (a 20-in. mill or a 35-in. mill); sometimes they are called after their inventor (Mannesmann mill, Lamberton mill); sometimes they get their name from the product (blooming-mill, plate-mill, wire-mill); sometimes their direction of operation is judged most important and then they are called reversing or non-reversing mills. Slabbing-mills are large mills with two horizontal rolls of 30- to 40-in. diameter and two vertical rolls of 24- to 32-in. diameter, built to roll slabs, which have a rectangular section. They roll the four sides of the slab without the need of handling or tilting. They are expensive in installation, requiring two reversing motors developing 15,000 and 10,000 H.P. respectively. They are seldom provided for in new plants (perhaps the latest installation being that in the Gary plant, Indiana, 1910) and were superseded either by universal-mills or blooming-mills. Blooming-mills have two horizontal rolls of 24- to 40-in. diameter, mostly of the reversing type equipment, with manipulators for the mechanical turning-over of the ingot, and side-

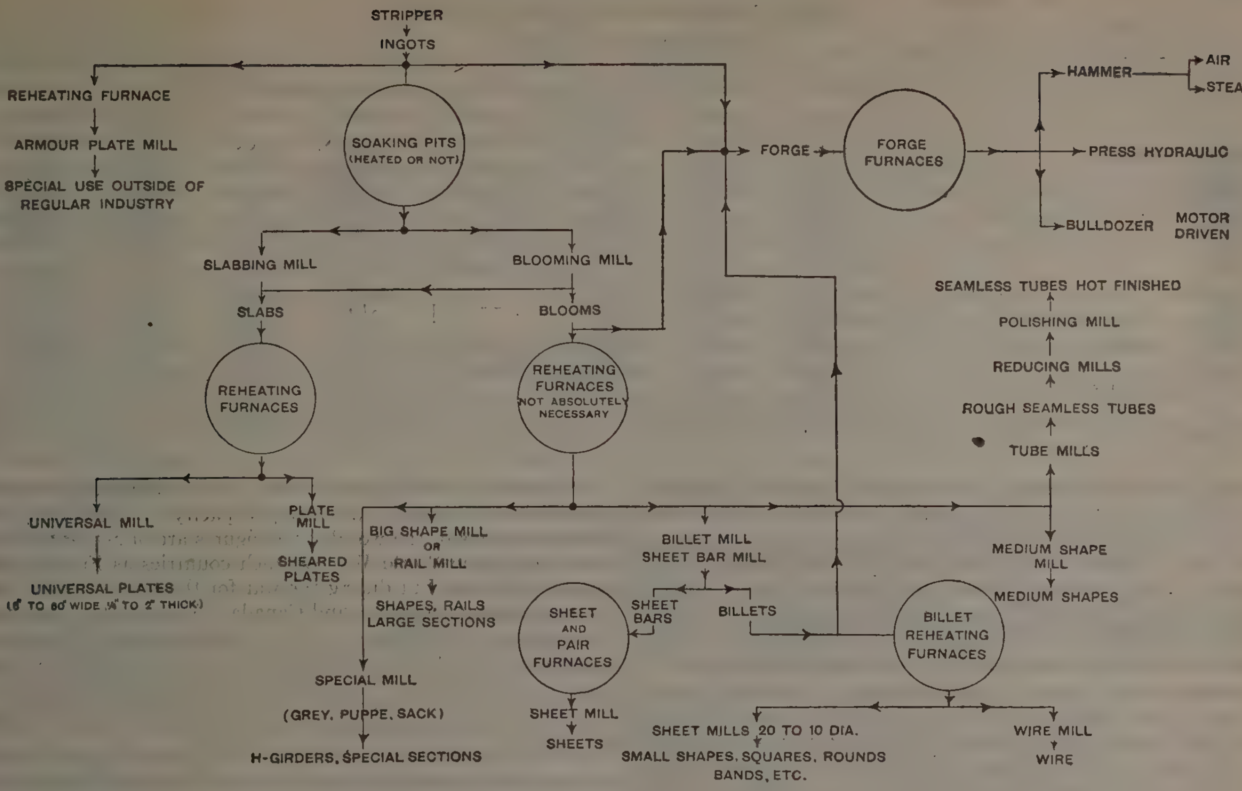
STRIPPER
INGOTS
REHEATING FURNACE
ARMOUR PLATE MILL
SPECIAL USE OUTSIDE OF REGULAR INDUSTRY
SOAKING PITS (HEATED OR NOT)
SLABBING MILL
BLOOMING MILL
SLABS
BLOOMS
REHEATING FURNACES
REHEATING FURNACES NOT ABSOLUTELY NECESSARY
UNIVERSAL MILL
PLATE MILL
SHEARED PLATES
UNIVERSAL PLATES (6" TO 60" WIDE ¼" TO 2" THICK)
BIG SHAPE MILL OR RAIL MILL
SHAPES, RAILS LARGE SECTIONS
SPECIAL MILL
(GREY, PUPPE, SACK)
H-GIRDERS, SPECIAL SECTIONS
SHEET AND PAIR FURNACES
SHEET MILL
SHEETS
BILLET MILL
SHEET BAR MILL
SHEET BARS
BILLETS
BILLET REHEATING FURNACES
SHEET MILLS 20 TO 10 DIA.
SMALL SHAPES, SQUARES, ROUNDS BANDS, ETC.
WIRE MILL
WIRE
FORGE
FORGE FURNACES
HAMMER
AIR
STEAM
PRESS HYDRAULIC
BULLDOZER
MOTOR DRIVEN
SEAMLESS TUBES HOT FINISHED
POLISHING MILL
REDUCING MILLS
ROUGH SEAMLESS TUBES
TUBE MILLS
MEDIUM SHAPE MILL
MEDIUM SHAPES

FIG. 1.—Steps in the Process of Making Various Forms of Steel.

guards; they roll either blooms or slabs. Plate-mills carry cylindrical rolls to produce sheared plates (or plates which are subsequently sheared to required width), but may have in addition two sets of vertical rolls driven from the main pinion housing, to produce universal plates which require no shearing, both sides of the slabs being rolled. Both forms may be of the three-high continuous running or the two-high reversing type. Their roll diameters are 24 up to 42 in. The three-high or Fritz form of plate-mill is often called the Lauth type and is characterized by the fact that the middle roll is smaller and not direct-driven, but rotated by friction from the upper or lower roll. For large blooming-mills preference for the reversing drive was shown in the decade 1910–20. Three-high blooming-mills were seldom built in the larger units because of clumsy accessories. For the heavy plate-mills, also, the two-high reversing type was preferred. For small knocking-down or cogging-mills and the smaller plate-mills, the two types were in competition, with no apparent superiority of either system.

For driving continuous mills electricity was preferred to the steam-engine. The uniflow steam-engine found favour up to 3,000-H.P. units, but installations were few. Where the effort was to bring about a complete electrification of the plant, steam-engines proved unpopular, possible economy being counterbalanced by complication of maintenance and other administrative considerations. For the reversing drive of large units, requiring loads up to 20,000 or 25,000 H.P., the electrical drive was not necessarily in the ascendency. The high initial cost of the motor generator flywheel set with direct-current motor directly connected to pinion and mill was made the chief argument against universal adoption of electricity, and numbers of old plants were reluctant to change their somewhat obsolete steam equipment. In America only a few engines as large as 25,000 to 30,000 H.P. (Weirton and Lukens) were installed in new work, and in England large vertical engines were built. The electrical units, however, increased considerably in number and size and considerable progress was realized in the matter of manœuvring capacity, in standardization of winding and accessories, in records of output and efficiency of running. In 1920 the electrical industry was aggressively working on betterments, while the partisans of the steam-engine rested on past laurels. Parity existed on all points except first cost of installation. Even for smaller mills of the reversing type electrical drives were built, such as 24-in. mill (Mark, Indiana Harbor), 26-in. mill (Atlanta, Ga.). Two-high reversing plate-mills also disputed the field with the three-high type in the medium-sized equipment, and latest universal-mill installations were of the reversing type electrically driven. The largest mill for plates, 192 in. wide, at Lukens, Pa., which was completed in 1918, was of special design, reversing, and steam-driven. (*Iron Age*, Jan. 2 1919.)

In shape, billet and smaller mills no revolutionary change was made. In shape- or rail-mills great subdivision of rolling-passes into individually driven stands proved to be an exaggeration, and later installations concentrated the drives. The use of a second reversing roughing-mill, however, bade fair to become standard, in relieving the burden of the first blooming-mill and in preparing quickly for the finishing stands. Billet and sheet-bar mills, usually of the continuous type, were standardized into two units, the 24-in. mill of four to six stands and the 21-in. mill of six stands. Patented mills for special beam shapes having wide flanges were built under Grey patents in Differdange, Luxemburg, in 1904, and in Bethlehem, Pa., 1908 and 1915, and under Puppe patents in Peine, Germany, in 1914, and Sack patents in Rombach, Lorraine, in 1912. Mechanical solutions of the reversing problem were attempted by the Lamberton mill or the Fawell mill but were not put into any wide use. Sheet-mill construction changed little except that the electric drive became universal. The design with two overhung flywheels on pinion shaft proved efficient and final. The reduction ratio showed a tendency to increase from 8 to 1 to 12 to 1.

		Billets (in.) 5x5 to 2x2	Bars (in.) below 1½x1½
Bloom ingots (in.) 12x12 to 24x24	Blooms (in.) 6x6 to 12x12	Sheet bars (in.) 15x2 to 8x½	
Slab ingots (in.) 20x8 to 40x16	Slabs (in.) 10x3 to 36x10	Plates up to 190 in. wide	

The concentration of production in large well-balanced plants with adequate resources and sales organization permitted a logical subdivision of the rolling-mill programme with a subsequent reduction of production cost. The smallest bloom section, 6x6 in., had a tendency to grow toward 8x8 in., as some experts claimed that 50 sq. in. was the economic limit of the range of a large mill. To reduce the time required for roll changing, complete spare housings, completely mounted, came to be good mill practice, these being dropped on the shoeplates by the cranes. In some specialty plants sometimes two or three housings were changed together.

Furnaces.—The development of soaking, reheating and annealing furnaces was influenced by the increasing price of fuel and considerable efforts were made to boost heating efficiencies. In Europe gas-firing with recuperation and regeneration of waste heat was the favourite, especially because producer-gas firing was much used and remarkable results achieved. In America continuing shortage of natural gas for industrial purposes in regions such as the Pittsburgh district made a substitute market for crude oils, coke-oven gas and powdered coal. Especially since 1915, the use of powdered coal developed to a surprising degree for all kinds of metal-heating appli-

ANNUAL PRODUCTION OF PIG-IRON AND STEEL
(In thousands of metric tons)

	Pig-Iron				Steel Ingots			
	1910	1913	Best year in 1911–20	1920	1910	1913	Best year in 1911–20	1920
Austria-Hungary	2,010	2,370	2,418	—	2,188	2,682	3,337	—
Belgium	1,852	2,485	2,485	1,132	1,450	2,467	2,515	1,237
Canada	726	1,024	1,085	991	746	1,060	1,700	1,128
France	4,038	4,207	5,939	3,317	3,506	4,687	4,687	2,961
Germany	14,793	19,292	19,292	7,000*	13,699	18,959	18,959	9,000*
Italy	215	427	472	—	635	846	1,332	—
Japan	—	57	77	384*	—	14	24	1,050*
Russia	3,042	4,548	4,548	—	3,479	4,827	4,900	—
Spain	367	425	498	—	316	365	470	—
Sweden	604	735	821	—	469	583	718	—
United Kingdom	10,381	10,482	10,482	8,139	6,477	7,787	10,434	9,205
United States	27,637	31,482	40,092	37,530	26,512	31,823	45,786	42,821
All other countries	525	495	550	—	315	325	350	—
	66,190	78,029			59,792	76,425		

*Estimated.

cations. Mechanical stokers were evolved in numerous designs to dispense with hand labour and to control by mechanical contrivances the combustion of coal in an efficient way.

Mill Equipment.—Roller tables, skids, transfers, cooling-beds and tilters were perfected and installed in increasing numbers owing mainly to the efficiency and handiness of electric motors. Variable-speed drives gained in favour. Straighteners, saws, punches and shears were made in conformity with the availability of electric power. Hydraulic devices were pushed in the background and electric drives supplanted engines in the field of these mill accessories.

Metallographic Progress.—Metallographic knowledge spread in the decade 1910–20 from the university laboratory to the steel-mill, outgrowing the narrow circle of students to become the helpmate of the operator. Pyrometers or temperature recorders and the scientific control of temperature came as a matter of course in numbers of steel-mills. The variety of alloy steels offered for practical uses was due to the theoretical investigations of the metallograph. Chromium and vanadium, nickel and cobalt, tungsten and molybdenum added their special properties to steel, and improved heat-treating methods enhanced these qualities with a skill and positiveness hitherto unknown.

Beyond the realm of iron and steel making, properly regarded, but coming within the purview of the industry, the remarkable development of the second decade of the 20th century was the heat treatment of metals. It went hand-in-hand with the study (by means of the microscope, and thus of the photomicrograph) of grain structure and the transformations which take place in the so-called solid solutions, according to the degree of heating and cooling given to the metal. Practical applications of the investigations of the scientist were numerous, and the history of the temperature experience of a given metal product going into an article of commerce was accepted as every bit as important as the chemical constituents, for two pieces of steel, identical chemically, may be made to behave physically very differently according to their crystalline state.

Other developments which must be briefly enumerated were: Efforts to test a material's fitness or agreement to specifications without destroying it, as by X-ray photographs (sheets), or by magnetic analysis (by noting changes in permeability of an article of constant cross-section, as a rifle-barrel, wire or steel rail, by moving it through a magnetic field); these, however, were not definitely of commercial dependence, pending further investigation; success in making large chains of cast-steel links followed by heat treatment, such as annealing; efforts to cast in centrifugal moulds, such as cast-iron pipe by introducing molten iron into the rotating mould; commercial recovery of potash from blast-furnace flue-dust deposits at the base of hot stoves finding a market; making iron pipe by an electrolytic process of depositing iron on a rotating cathode in a ferrous-chloride electrolyte; commercial manufacture of a stainless steel having 10% to 15% of chromium, which, Harry Brearley in England discovered, gave amazing resistance to corrosion, so that it became the base of an important cutlery industry and offered a satisfactory material for rifle-barrels, turbine blades and steel articles subject to both erosion and corrosion; additions to the numberless varieties of alloy steels, largely to secure some desired physical characteristic for specific needs, such as increased tensile strength in terms of lighter members of a fabricated steel product; elements like cerium and zirconium entered the ferro-alloy circle, but a delineation of the various alloys and of their definite fields of usefulness was not completed.

Production.—The appended table was compiled to give some measure of the relative producing capacity of the leading industrial nations of the world. The figures are of actual production—before the World War for such countries as France, Belgium and Russia, but during the war for the United States, the United Kingdom (in steel) and Canada. Authoritative information was not obtainable as to the realignment of Europe's capabilities after the war, but the effect of the Versailles Treaty was to bring Germany down close to the level of England in this respect, and to raise France, on the completion of rebuilding plans, to 80% of Great Britain's capacity.

The world's steel-making capacity was put in 1920 at 100,000,000 tons in round numbers. Nearly one-half was credited to the United States, which could make four times as much as Great Britain. The United States' percentage of the world's pig-iron-making facilities was somewhat over 45%. More than one-third of the total annual output of iron ore in the world came from the United States, and of the American production 85% came from the Lake Superior district. The Lorraine ore fields supplied about 25% of the world needs and 80% of it went to France and Germany.

World statistics of the production of ore, pig-iron and crude and finished forms of steel are obtainable from the National Federation of Iron and Steel Manufacturers, London. (W. W. M.)

IRVING, HENRY BRODRIBB (1870–1919), English actor, elder son of Sir Henry Irving (*see* 14.855), was born in London Aug. 5 1870. He was educated at Marlborough and New College, Oxford, and was called to the bar in 1894; but he quickly abandoned this profession for that of the stage, for which his inherited aptitude had always been very marked. At Oxford he had belonged to the O.U.D.S. and had played the leading parts in Browning's *Strafford* and Shakespeare's *King John.* His first professional appearance in London was made Sept. 1891 with John Hare at the Garrick theatre in Robertson's *School.* Three years later he joined Mr. Ben Greet's company, where he met Miss Dorothea Baird, whom he married in 1896 at the time of her great popular success in Du Maurier's play of *Trilby.* His earliest notable success was in Barrie's *The Admirable Crichton* in 1903, and he followed it by an interesting impersonation of Hamlet in 1905. His picturesque appearance and strong likeness to his father induced him to repeat many of his father's famous parts; but he did original work of a high order in Stevenson's *Dr. Jekyll and Mr. Hyde*, in Stephen Phillips's *The Sin of David*, in Walter Hackett's *The Barton Mystery*, and in other romantic and melodramatic productions, many of them produced at the Savoy theatre, London, of which he was lessee and manager from 1913 until his death. Throughout his life he was a keen student of criminology, and he published a *Life of Judge Jeffreys* (1898); *French Criminals of the 19th Century* (1901); *A Book of Remarkable Criminals* (1918) and other papers on the subject. He died in London Oct. 17 1919.

His younger brother, LAURENCE SYDNEY BRODRIBB IRVING (1871–1914), English actor, was born in London Dec. 21 1871.

He was educated at Marlborough and abroad, being destined for the diplomatic service; but he joined Frank Benson's Shakespearean company in 1893 and made his first professional appearance in London a year later with J. L. Toole in Barrie's *Walker, London.* He married the actress Mabel Hackney, and with his wife played in Brieux's *The Three Daughters of M. Dupont* and *The Incubus*, as well as in *The Unwritten Law*—his own adaptation of Dostoievsky's *Crime and Punishment*—and in Lengyell's *Typhoon.* In 1912 he acted Iago in Herbert Tree's production of *Othello.* He wrote *Peter the Great*, produced by his father in 1898, *Bonnie Dundee* and *Richard Lovelace*, as well as a number of translations and adaptations of plays. Both he and his wife lost their lives when the "Empress of Ireland" sank in the St. Lawrence river May 29 1914.

ISOSTASY, in Geology.—When the Great Trigonometrical Survey of India was initiated, it was found that the deflection of the plumb-line by the Himalayas was much less than the calculated amount due to the theoretical attraction of the visible mass of the mountains. Sir G. B. Airy suggested that this might be caused by the presence of a mass of matter, of less than the average density, under the mountains; this explanation was further investigated by Archdeacon J. H. Pratt, who applied the term *compensation* to the negative effect of the underlying defect of density, in compensating the direct effect of the attraction of the visible mass of the mountains. In 1892 Major C. E. Dutton, discussing the greater problems of physical geology, deduced a general principle that the weight of matter under any unit area of the earth's surface tended to become uniform, and suggested that this was brought about by an underground transfer of material to balance the visible surface transport from regions of erosion to those of deposition. To this principle he gave the name *isostasy* (ἴσος, equal, and στάσις, position), not as a synonym for Pratt's compensation, but as a name for the principle and process by which it was brought about. In 1909 there appeared a very complete and elaborate investigation of the subject, by J. F. Hayford, in which the word isostasy is used throughout as synonymous with what Pratt called compensation, and this use of the term has since become general among geodesists. Some inconvenience results from this change in the meaning attached to the word, for it is still largely understood by geologists in the sense intended by its inventor, as the process by which the fact implied by Pratt's word, compensation, is brought about (*see also* GEOLOGY).

See G. B. Airy, *Phil. Trans.*, cxlv., 1855, p. 101; J. H. Pratt, *Phil Trans.*, cxliv., 1859, p. 745; C. E. Dutton, *Bull. Phil. Soc. Washington*, xi., 1892, p. 51; J. F. Hayford, *The Figure of the Earth and Isostasy, from Measurements in the United States* (Washington 1909). (R. D. O.)

ISRAËLS, JOSEF (1824–1911), Dutch painter (*see* 14.885), died at The Hague Aug. 12 1911.

ISVOLSKY, ALEXANDER PETROVICH (1856–1919), Russian statesman, was born in 1856 in the government of Vladimir, of a family which for generations had appertained to the lower officialdom. At the age of 20 he received his first diplomatic appointment at Rome, and was thence transferred to Philippopolis and Bucharest, where, by the patronage of Princess Urussov (wife of a future Russian ambassador at Paris), he made his reputation. Thence he was sent to Washington and the Vatican. At this time he was already so much the coming man that, upon the retirement of Count Lobanov, his mother-in-law, Countess Toll, saw fit to inform Count Muraviev that her son-in-law, upon his appointment as foreign minister, would bear him in mind. Muraviev, who already carried his nomination in his pocket, resented this condescension, and relegated Isvolsky to Belgrade and to Munich, where he had the rank of a minister plenipotentiary. Returning to favour in 1899, he was promoted to the Legation at Tokio, where, however, under the influence of German reports concerning the Japanese army—and especially its artillery—he misjudged Japan's advent as a Great Power. His eleventh-hour conversion could not avert the conflict of interests which led to the war of 1904–5, from which Russia emerged defeated, but enabled him to veil a serious diplomatic error by relinquishing the odium of failure to his successor, Rosen. He himself went to Copenhagen, where he negotiated the passage of Adml. Rozhestvensky's fleet through the Great Belt (Oct. 1904). There also, in July 1905, he had his historic interview with the Emperor William II. in which an alliance between Russia, Germany and France was proposed. Isvolsky was ignorant of the "personal" treaty of defensive alliance "between Germany and Russia, entered into by the respective sovereigns at Björkö." Though this secret compact did not bear his signature (since he had not been present), the Russian Minister for Foreign Affairs, Count Lambsdorff, fell over its repudiation, and was, in May 1906, succeeded by Isvolsky.

Russia's military prestige was at a low ebb, her finance in a state of chaos, the Tsarist régime discredited and the country in the throes of revolution. At this time, Isvolsky displayed great physical courage in that he went about St. Petersburg unattended, but also great lack of faith in the existing order, since, having discovered that through an irregularity his pay depended on the Privy Purse, he caused it to be charged to the Treasury as the first act of his tenure of office. He also raised his brother to the office of Procurator of the Holy Synod and his Goadachev relations to high diplomatic appointments.

Slowly he restored the national prestige, for he asserted loyalty to France as the first principle of policy and brought about the Anglo-Russian agreement in Persia of Aug. 31 1907, which was followed on June 9 1908 by a meeting between King Edward VII. and the Tsar Nicholas II. near Reval. The long Balkan troubles of 1908-12, which originated in Count Aehrenthal's exploitation of Russia's transitory weakness, called for great care, especially during the crisis of 1908–9, which laid bare Russian impotence. After four years at the Foreign Office, which gained Russia the time she needed to recuperate, Isvolsky succeeded M. Nelidov as Russian ambassador in Paris. He lived to see the World War of 1914 and the Russian revolution of 1917, which forced him into impoverished retirement at his villa at Biarritz. He died on Aug. 18 1919. An accomplished man of letters, a competent critic of art, a linguist of rare perfection and charming in manner, but cynical and pleasure-loving, he was certainly one of the chief diplomatic personages in the reign of the last of the tsars. He married Marguerite Carlovna, *née* Countess Toll, a Balt of great charm whose influence at court was impeded by her ignorance of the Russian tongue. By her he had one son, who fought in the Dardanelles. (W. L. B.)

ITAGAKI, TAISUKE, COUNT (1837–1920), Japanese statesman (*see* 14.887), died in 1920. True to his radical principles, he forbade his son to apply for the succession to his title, and it lapsed.

ITALIAN CAMPAIGNS, 1915–8.—At the outbreak of the World War the Italian general staff had no worked-out plan for an offensive campaign against Austria-Hungary. The omission was not due to the fact of the Triple Alliance, for the prospect of war on the N.E. front had always been faced, but to the relative military position of the two countries. The Habsburg Empire had a great superiority over Italy in organized and potential man-power and in material, but the controlling factor which seemed to deny the possibility of Italian offensive action was the frontier drawn in 1866. The Trentino salient, thrust down like a great wedge to within a few miles of the Lombardo-Venetian plains, dominated the strategical situation. Nor was the hampering influence of the frontier confined to a practical veto upon attack. Its length in relation to Italian military strength, and above all the fact that the threat of the Trentino came so far west in the long line, meant that Italy's defensive frontiers were far from being coterminous with her political boundaries. The first possible line of defence was held to be the Tagliamento, with its fortified bridgeheads at Osoppo, Codroipo and Latisana; plans had been drawn up with the Piave as the main line of resistance, though with the intention of meeting the enemy in the plain E. of the river; but there was much to be said for the contention that the true military frontier of Italy was still the line of the Mincio and the Po.

The plans and studies of peacetime had been based upon the supposition of a duel between Italy and Austria-Hungary, and the outlook changed in view of the general conflagration. The prospect of a break with Austria-Hungary was at once considered by the Italian general staff, and by Aug. 21 1914 a scheme of offensive operations had been outlined. This plan was based upon the supposition of Italy's entry into the war within a month and upon the consent of the Italian Government to provide at once for the requirements put forward by Gen. Cadorna, chief of the general staff. As neither condition was fulfilled, the plan need not be discussed, and it was in fact withdrawn by Cadorna a month later. The preparations of the winter and spring and the march of events on the French and Russian fronts determined the plan of operations which it was hoped to carry out upon Italy's entry into the war.

Gen. Cadorna, who took command of the Italian armies on the declaration of war, had worked out his scheme on the idea that Italy's object should be to hold on the N. and push towards the E. He had not sufficient strength to attack in both sectors. This decision, however, did not imply a passive defensive on the mountain front. On the contrary, the choice of the eastern sector for the main offensive demanded an active defensive, or rather a limited offensive, on the mountain front, and especially in the Trentino. If the operations towards the E. were to be developed with reasonable security it was absolutely essential to improve the position in the Trentino, to reduce, at least, the threat to Italian communications caused by the great salient. The long frontier may be divided into three sectors: (1) the Trentino salient; (2) the great barrier of the Cadore and Carnic Alps; (3) the eastern frontier from Pontebba to the sea. In the first of these sectors the Austrians had an overwhelming advantage in the natural lie of the terrain and the use which had been made of it. The salient was well protected on the flanks; on the W. by the great Alpine mass that is broken only by two feasible passes, the Stelvio and the Tonale, and on the E. by the mountains N. of Asiago and the great rocks of the western Dolomites, a wall that had only two gaps, the narrow valley of the Brenta and the road that runs from Feltre by Fiera di Primiero and the Passo di Rolle. The Austrians were in this position, that they could defend the salient with a comparatively small number of troops thanks to the immense natural strength of the positions they occupied and the system of fortifications which had been prepared, while within their mountain walls and behind these fortifications they could concentrate forces for an attack through the comparatively narrow mountainous zone which lay between the frontier and the plains. Three classic military routes led into Italy, through the Guidicaria, Lagarina and Sugana valleys, and other roads had opened up the difficult country between the Adige and the Brenta. East of the Trentino, from the Marmolada through the Alps of Cadore and Carnia as far as Pontebba, operations on an important scale were almost equally difficult for both sides, in face of the natural advantages that lay with the defensive. The Italians had a greater depth of mountainous zone to back their first lines, but the Austrians, with the Pusterthal and the Gailthal, were very much better off for lateral communications. The third sector of the front, from Pontebba to the sea, was less unfavourable to an Italian attack, but here also the conditions were very difficult. Between Pontebba and the Isonzo great mountains blocked the way, while the upper and middle reaches of the Isonzo flow through a wild, mountainous country with few roads. South of Tolmino indeed the mountain masses decrease in height and steepness, but the country still has the aspect of a giant ridge and furrow. The plain of Friuli narrows rapidly as it approaches its eastern limits, and at the old frontier the gap between the lagoons and the foothills of the Julian Alps is not 15 m. in width. And this gap has little depth; less than 10 m. to the E. of the old frontier begins the plateau of the Carso. The approaches from the W. are completely commanded from the Carso and the hills about Gorizia, and to the E. the ground rises again. Here, too, Italy had to fight over country where the enemy had a very great advantage in position. Still, the natural obstacles were much less formidable towards the Isonzo than elsewhere along the frontier; communications were fair in the plain and there was space for an attack upon a relatively wide front. Above all, a successful advance in this direction would lead somewhere, would threaten a vital part of the monarchy. An invasion of the Trentino held no such promise. At the most, success would have meant the reduction of the salient and the occupation of the "unredeemed" territories, for northern Tirol must be considered impregnable. The choice of Cadore and Carnia for the main offensive was open to the same objection. Given the strong defensive positions near the frontier, the Austrian superiority in communications and the distance of any objective of first-class importance, the prospects of an advance in strength afforded by this region were not tempting, the less so as the district afforded little in the way of supplies. There was a further argument in favour of attacking towards the E., that an attack in this direction would be calculated to occupy a much greater number of enemy troops than an attempt to advance in the mountains. The fact that Austria-Hungary was already heavily engaged elsewhere gave the Italian general staff the chance of attacking but there were corresponding obligations. The Italian campaign had obviously to be planned as part of a whole, and it was the duty of the Italian command not merely to strike for Italian aims but to coöperate in the general struggle.

Cadorna decided on the plan that offered the chance of the greater success, and he framed his scheme of operations on the supposition that in May 1915 he could expect simultaneous offensive action on the part of Russia and Serbia. The objections to an offensive in the direction of Trieste and Laibach were obvious enough: a successful advance meant the lengthening of a front that was already very long in proportion to the number of troops and guns available, and, moreover, increased the menace of the Trentino salient. But the drawback was lessened by the expectation of Allied action on the N.E. and S. fronts of Austria-Hungary, which would prevent the enemy from taking advantage of this weakness.

Cadorna's plan, completed in detail while the Russians were still upon the Dunajec, was as follows. Gen. Roberto Brusati with the I. Army was to conduct a limited offensive against the Trentino salient, with the object of shortening the line and securing strong defensive positions. Gen. Nava with the IV. Army was to push N. from Cadore to threaten the enemy communications in the Pusterthal and coöperate in an advance from Carnia. This advance was to be conducted by a separate force under Gen. Lequio, consisting mainly of mountain troops, which was to move in the direction of Tarvis. The II. and III. Armies, under Generals Frugoni and Zuccari respectively, were to cross the Isonzo and attack E. with all speed. A large number of troops, with units brought up to war strength by the recall of several classes, had been in the neighbourhood of the frontier for many months. They were not in sufficient strength for attack, but were aligned with the object of covering mobilization; for the enemy was already fully mobilized, and the prospect of a sudden attack on his part had to be considered.

As the discussions between Rome and Vienna gradually led towards the final break, the Austro-Hungarian command prepared for defence. In addition to the strong permanent works already existing on the main routes, "barrier lines" were constructed in the valleys and on the open sectors of the front; many of the fortress guns were removed and placed in well-concealed positions, and wire was lavishly employed. At the end of April the Austrian covering troops, under the command of Gen. von Rohr, numbered about 80,000 infantry, 1,400 cavalry and 54 batteries, in addition to fortress troops and guns. Two divisions under Gen. von Koennen-Horac were stationed in the Trentino; one division under Gen. von Langen watched the approaches to Carinthia; two divisions under Generals von Boog and von Kuczera were upon the middle and lower Isonzo respectively, or, rather, E. of the river, in the mountains, on the Carso and about Gorizia. These divisions were improvised formations, with a considerable proportion of second-line troops and volunteer battalions.

When Italy denounced the alliance with Austria-Hungary, on May 3 1915, Vienna was already convinced that war was certain. The attempts to continue discussions had only been undertaken for the purpose of gaining time, and military preparations were hastened. It was the first intention of Gen. Conrad von Hötzendorf to wait for the Italians at Klagenfurt and Laibach and attack them as their columns came out of the mountainous country, but the plan was not approved by the German command. Falkenhayn declined to give the 10 divisions which Conrad required for this plan, and it was abandoned. Conrad wished to smash Cadorna's offensive by manœuvre and counter-attack. Falkenhayn was not only unwilling to spare the troops for this plan but he doubted whether Cadorna would allow himself to be led into Conrad's trap; he feared the difficulties of recovering territory once abandoned, and he realized the great natural strength of the Isonzo and Carso lines. It was decided to conduct an obstinate defensive rather than to attempt Conrad's plan. The command of the Austro-Hungarian armies on the Italian front was given to the Archduke Eugene, who had commanded the Balkan armies. His chief of staff was Gen. Krauss, and under his direction Gen. Dankl, lately in command of the I. Army, was entrusted with the Tirol and Trentino sector; Gen. von Rohr commanded on the Carinthia front, while Gen. Boroevich von Bojna, lately in command of the III. Army, took charge of the Isonzo–Carso front. It was not until May 21, three days before the declaration of war, that the main body of Boroevich's army, consisting of five divisions brought from the Serbian front, began to be entrained from near Agram. When war was declared the Isonzo front, from Tolmino southward, was lightly held by three divisions under Gen. Ludvig von Goiginger.

Meanwhile Cadorna had to adapt his plans to the quickly changing circumstances. The Russian armies N. of the Carpathians had given way under the attacks of Mackensen and Boehm-Ermolli, and had begun the great retreat that was to go so far. There was no word of movement, even of demonstration, on the Serbian front. The request of the Allies that the Serbian armies should resume action, or at least make a show of action, met with no response, and in May the Austro-Hungarian troops on the Serbian front were reduced by five divisions, their place being taken by three newly formed German divisions, which had not yet completed their establishment. Various reasons, military and political, have been given for the inaction of the Serbians, but in the present connexion it is simply the fact that matters, the fact which allowed five Austro-Hungarian divisions to be transferred *en bloc* from the Serbian front to the Italian theatre of war.

The altered circumstances compelled Cadorna to revise his immediate objectives, but not his general plan of attack. A further handicap, in his view, was imposed by the denunciation of the alliance with Austria-Hungary three weeks before the declaration of war, and by the immediate leakage regarding the London agreement between Italy and the Entente, which gave the enemy more grace to prepare against his initial moves. The time for preparation was further lengthened by the political crisis caused by the last efforts of Berlin and Vienna to keep Italy out of the war. On the other hand, the main body of the Italian army was not ready for an earlier advance. It was not fully ready when war was declared. Mobilization was nearly complete as far as the men were concerned, for drafts had been brought up gradually during the previous months. The armies were ready to fight in their positions against an Austrian attack, or for preparatory movements on a limited scale. They were not ready, the eastern armies in particular, for a big advance.

On the eve of war, Cadorna's dispositions were as follows: Brusati's I. Army, with 5 divisions and 10 battalions of Alpine troops, was to push forward in the Trentino, and carry out the limited offensive already indicated. The IV. Army under Nava was to advance, the right wing upon the Pusterthal, the left wing across the great Dolomite road, past the peaks of the Sella group, to threaten the valleys running down to the Eisack. Nava had five divisions and seven Alpine battalions, while a sixth division of his army was at first held in reserve about Spilimbergo, near where the Tagliamento runs out into the plain of Friuli. To this army, in view of the positions which it had to attack, especially the Landro and Sexten fortifications, was assigned the bulk of Cadorna's very limited supply of heavy artillery, including practically all the guns above 149 mm., with the exception of seven batteries of 210's, assigned to the Carnia force. The task of Lequio's Carnia force, which consisted of an infantry division and 16 battalions of Alpine troops, was that designed in the original plan, the probable movements, in the event of success, depending upon those of the armies to right and left. The II. and III. Armies were to attack with all speed upon the Isonzo front, but their movements were to be inspired by strategic caution. They were to get under way as quickly as possible and break through the enemy's covering troops. Further movement was to depend upon what they found, and upon the news from the other fronts. While initial speed was obviously the essence of Cadorna's plan, he was handicapped by the fact that another fortnight was required for complete mobilization. Frugoni's II. Army was to consist of three army corps (eight divisions), and Zuccari's III. Army of three corps (six divisions) with three cavalry divisions. On May 24 only three corps and two cavalry divisions were ready for the initial attack. Meantime there had been a difference of opinion between Cadorna and Zuccari, and the clash of two strong characters made the difference irreparable. As a result Zuccari was relieved of his command and the III. Army was entrusted to the Duke of Aosta, on the very eve of the declaration of war.

In addition to the divisions already mentioned, a central reserve of 10 divisions and one cavalry division was in process of mobilization in the plains of the Veneto and Friuli,—5 infantry divisions in the rear of the Trentino sector, the other 5 and the cavalry between the Tagliamento and the eastern frontier,—but these troops could not be ready for action for some three weeks. The first shots of the war were fired by Austrian guns upon the Carnia front, a few hours before midnight on May 23, the hour fixed for the opening of hostilities, and early on May 24 the Italian advance began.

The opening moves of the campaign, all-important as they were in relation to the future operations which depended upon them, failed to obtain the results hoped for in Cadorna's design. The I. Army was prompt to carry the limited objectives assigned to it, overcoming the weak resistance of the enemy covering troops and occupying positions which not only were in themselves much better adapted for defense than the frontier, but greatly reduced the length of the line to be held. The IV. Army was very slow. Its heavy guns were not ready when hostilities began, and Nava waited upon their arrival, preoccupied by the strong positions which faced him and the permanent fortifications which lay beyond. It would appear that he was influenced by the positions themselves and assumed the existence of an opposition which in fact he would not have found. He was not ready himself to carry out his plan of advance, which was based on the supposition that the enemy resistance was already adequately organized. He held by his plan and may have missed an opportunity of reaching his objective by changing it. His initiative was hampered by adherence to method. Lequio's Carnia force was quick to move, and found that the enemy was equally quick. This sector was all-important to the Austrians, from the point of view both of offence and defence. It was essential to prevent a break-through to Tarvis and Villach, and if they could hold the frontier line it preserved for them the chance of the attack down the valleys converging upon the Tagliamento which had long figured in the plans of their general staff. This sector had been quickly reënforced as the danger of war became imminent; and here alone, in the first days of the campaign, there was, roughly speaking, an equivalence of infantry strength. The contending troops met on the passes and the mountains that flanked them; and though the Italians had the best of the fighting which followed, and wrested several important positions from the enemy, it was quickly evident that the way was blocked here against all but an attack in overwhelming strength. On the other hand, Lequio's quickness had locked a door upon which the enemy had his eye.

Meanwhile the II. and III. Armies were on the move. Frugoni with two corps (5 divisions and 14 battalions of *Alpini*) attacked along the line of the Isonzo from Saga to opposite Gorizia. The Duke of Aosta, with a single corps and two cavalry divisions, was to force the passage of the lower Isonzo and push on towards the Carso, his other divisions following rapidly as their preparations for movement were completed. The II. and III. Armies were in theory organized for quick movement; their artillery, except for 12 batteries of 149-mm. guns, consisted entirely of field-guns, mountain-guns and 149-mm. field-howitzers (19 batteries), and the proportion of guns to men and shells was very low. Speed and initiative were essential to the success of the opening moves, and at various points speed and initiative were lacking.

The Austrians had withdrawn beyond the line of the Isonzo, except at the two bridgeheads opposite Tolmino and Gorizia, which were held in force, and S. of Gorizia the line of defence chosen was the Carso plateau, only a few covering troops being disposed along the lower reaches of the river, which leaves the Carso at Sagrado. For the II. Army the first obstacle was the river line and the two bridgeheads, and the main initial attack was to come from the II. Army, whose preparations were further advanced and which was écheloned forward; but the I. Cavalry Division, which was attached to the III. Army, was to dash for the Pieris bridges and secure the crossing for the infantry. The cavalry were inexplicably slow, and the bridges were destroyed just before they arrived. This failure would have mattered less, and might have mattered not at all, but for a sudden and violent flood which filled the wide bed of the Isonzo with a deep and rapid stream and made the fords impassable. And the pontoon trains were far away. Cadorna had counted on passing the lower reaches of the river by bridge and ford, and his very inadequate supply of bridging material had been designed for later use or use in other sectors of the front. It was not until June 4, when the river was falling, that it was possible for the right wing of the III. Army to throw troops across in force. Meanwhile the left wing had advanced from Cormons against the northern half of the Carso, where the Isonzo flows like a moat under the plateau, and farther N. the II. Army had come in touch with the enemy all along its front. The long ridge which separates the valleys of the Judrio and the Isonzo from Kolovrat to Verhoolje, was occupied without resistance, but the Austrians had fortified the bridgeheads opposite Tolmino and Gorizia, and here an unexpected opposition was found. Both bridgeheads were naturally very strong. In neither case, owing to the course of the river, did the Austrian position form a salient. The defence of the hills of Santa Lucia and Santa Maria opposite Tolmino, and of Monte Sabotino and Podgora, N. and W. of Gorizia, was supported by direct flanking fire from the positions to the N. and S. on the left bank of the river. The right wing and centre of the II. Army were quickly brought to a standstill in front of the bridgeheads; tentative attacks, carried out by small detachments, were readily repulsed, and a pause followed. The bridgeheads were invested, and here too, perhaps, the theory of "fixed positions," the old rule that these could not be ignored, had too much weight with the attacking forces. For every day lessened the chance of breaking through the thin enemy line, strong only at selected points. On the other hand, the country is extraordinarily difficult, and roads were few and mostly bad. And those which were suitable for the movement of troops and guns led only to the points where the enemy was holding in some force. On the left wing of the army the IV. Corps under Gen. Di Robilant crossed the Isonzo N. of Tolmino and pushed up into the mountains E. of the river, hoping to turn the Tolmino position. Appalling weather made movement in the mountains impossible during the critical week, and when the chance of a surprise had gone the great barrier of the Julian Alps was an insuperable obstacle to such forces as the Italians could bring against it. Guns, shells, machine-guns and transport were lacking.

The Austrians were rushing troops to the Italian front, and by the middle of June Boroevich had eight divisions to put against the II. and III. Italian Armies. Rohr's Carinthian army had been reënforced by two divisions and a mountain brigade from the Russian front. Dankl's Trentino army, which was not organized in divisions, but in groups assigned to various defensive sectors, had been increased to 96 battalions, including the Bavarian *Alpenkorps* which had come into line by the end of May. The Austrians were greatly inferior in numbers—they had on the front some 20 divisions against Cadorna's 35—but they held positions which were naturally ideal for defence, and these were well fortified by art, too well for the limited means of destruction at the disposal of the Italians.

Cadorna had counted upon surprising the enemy, but this advantage had been partly denied him. When he heard of the denunciation of the treaty with Austria-Hungary he pressed for an immediate declaration of war, which would allow him to move at once and reach the positions he had designed as his first objective. A striking force was ready then—there were nearly as many troops available for immediate movement in the first week of May as there were at the outbreak of war—and he would have gained between 15 and 20 precious days. Political considerations stayed his hand, and the initial delay was lengthened by the Bülow-Giolitti crisis. Bad weather and hesitation on the part of junior generals did the rest. The operations N. of Tolmino were practically stopped by the fierce mountain storms, and the advance of the III. Army only reached Monfalcone on June 6. Nor even then was it possible to attack the plateau in force. By blowing out a bank of the Sagrado-Monfalcone canal and closing the dam across the river, the Austrians had used the flood waters of the Isonzo to inundate a great stretch of low-lying ground below the Carso. It was not until June 11 that the dam near Sagrado was destroyed and the flooded area ceased to be fed by the waters of the river. During the following days the Italians succeeded in throwing troops across the Isonzo near Sagrado and by June 27, after prolonged and heavy fighting, they had pushed the Austrians up the slopes S. of Monte San Michele and established the bridgehead that was necessary for a general attack on the whole front of the Carso. Meanwhile a small bridgehead had been established at Plava, a few miles N. of Gorizia. The quick-flowing waters of the Isonzo, which here run pent in a narrow gorge, were crossed on June 9, 10 and 11, with great difficulty. The bridgehead won was very limited in area, and dominated by the mountains on the eastern bank; it was long before it could be enlarged to any great extent. Attacks were made along the greater part of the front from Tolmino to the sea at the end of June and during the early days of July, but these hardly reached the standard of a methodical, organized offensive on the scale that was now clearly necessary. There was some very stiff fighting during these days, and both sides lost heavily, especially on the slopes of the Carso, where the Austrians gave ground here and there and on more than one occasion were very hard pressed to maintain their lines intact. Two fresh divisions were brought from Carinthia to strengthen the threatened line between Gorizia and the sea, while another division was brought from the Balkan front and a mountain brigade from Pola. The Italian attacks had hitherto been conducted at "long range": that is to say, the point of departure for the infantry advance was at a considerable distance from the enemy entrenchments. In many cases the attacking infantry was checked before it reached the wire entanglements; too often when the wire was reached it was found nearly intact, for the destructive power of the Italian guns was insufficient to clear the way for the infantry, and many gallant attempts with wire-cutters and gelatine tubes were inevitably condemned to failure. Gradually it became evident that the hopes of a war of movement must be given up, that only the slow processes of trench warfare could lead to success. Sporadic attacks continued during the first half of July, and though the Austrians held on to most of their positions the Italians established themselves at much better jumping-off places than those which they had occupied before.

On July 18 the Italian III. Army attacked in the most determined manner, and after three weeks' hard fighting, during which the Austrians made a great attempt to push the Italians back across the river near Sagrado, the struggle came to an end with the latter firmly established under the crest of Monte San Michele and the village of San Martino del Carso, and in possession of most of Monte Sei Busi. Similar attacks by the II. Army made little impression on the Austrian lines, and losses were heavy, but the Austrians also suffered severely, losing more than 10,000 prisoners. The lesson of two months' fighting, apart from the necessity of learning the business of trench warfare, was that the artillery, and especially the heavy artillery, at the disposal of the II. and III. Armies was altogether inadequate. There were not enough heavy guns and not enough shells, and much of the ammunition was defective. The bursting charge was weak, and there were a large number of "prematures." It was essential to increase the weight of artillery fire if the infantry were to have a chance. It was clear that developments in artillery technique were necessary, and the importance of counter-battery work began to impress itself upon some of the commands. But shells were few, and observation from the air was not taken seriously, so that it was long before the advocates of counter-battery work made any headway.

After two months' preparation a fresh attempt was made to break through on the Julian front. This action was preceded by various attacks in other sectors of the front, some of which resulted in useful territorial gains, while others carried the line forward without improving the general position or even with the result of weakening it. By his main attack Cadorna hoped to turn the Gorizia positions both from the N. and the S., and as a secondary operation, after crossing the middle Isonzo, to threaten Tolmino from the S. while the bridgehead and the town were attacked from the W. and N. It was also hoped to gain ground on the southern Carso, in the direction of Trieste. Cadorna had a great numerical superiority in men. The II. Army now consisted of 12 divisions and the III. of 7, while a reserve of 5 divisions lay ready in the Friuli plain. In all, Cadorna could dispose of 312 battalions on the Julian front. When the attack began Boroevich had about half this number of troops, but within three weeks he had the equivalent of 15 divisions at his disposal. It was on the II. Army front that the Italian superiority in number was great; on the Carso indeed the Duke of Aosta had no great advantage in numbers over the Archduke Joseph, who had assumed the command in this sector in July. But the terrain on Boroevich's right was such that he could expect to hold with greatly inferior forces, especially in view of the Italian weakness in artillery. Cadorna had put upon the Julian front every piece he could collect. He reduced the guns in the other sectors to the barest minimum; he dismantled the forts at Mestre and the lines of the Tagliamento, and so was able to form 20 batteries of medium-calibre guns, of old pattern. Altogether he had been able to give to the II. and III. Armies some 300 medium and heavy guns, but many of these were obsolete. And the supply of shells was very meagre, 25–30 per gun per day. The III. Army had the bulk of the heavy artillery, only 125 pieces being given to the II. Army, which had to attempt, by sheer superiority in infantry strength, to make up for its deficiencies in material. Along the whole Julian front there were some 1,250 guns of all calibre, and a million shells had been collected by the date fixed for the attack—Oct. 21.

The offensive went badly, like all the Allied offensives of those days. The means were insufficient for the width of front attacked; the artillery technique was not adapted to modern requirements, nor, as was natural at this stage, had the staffs as a whole,—army, corps or divisional,—fully realized the necessity of minute preparation and strict attention to detail. And a tendency noticeable during the first months of the war, especially in the II. Army, to use men in isolated *petits paquets*, first one detachment and if that failed then another and another, was still observable. The attempt to cross the river between Plava and Tolmino never promised success, for the preparations were insufficient and the crossing-points not well chosen. Although some successes were obtained N. and W. of Tolmino the attack in this region was not persisted in, owing to the failure farther south. The attempt to extend the Plava bridgehead and so gain room to threaten Gorizia from the N. was equally unsuccessful. After various attempts both these actions were broken off, and the battle was concentrated upon the Gorizia bridgehead and the Carso. Sabotino had been taken by direct assault on the first day of the battle, but, owing to defective staff work and an attitude on the part of the army command that can best be described by the phrase "*laisser aller*," this success was not promptly backed up, and a fierce counter-attack drove the Italians off the ridge they had so gallantly stormed. All subsequent attempts to retake Sabotino failed, and the prolonged struggle for the hills about Oslavia and the battered hog-back of Podgora was little more successful. The Italians gained ground here and there, eating into the Austrian lines, but they could not break through. Farther S. the attacks of the III. Army met with similar fortune. Ground was gained, a trench here, a trench there, and the Italian line was carried almost to the summits of Monte San Michele. The attacks were renewed again and again, and the troops displayed remarkable gallantry and resolution. They were met by a resistance no less determined, and the losses on both sides were very heavy indeed. Early in Dec. the offensive died down. Cadorna's battalions were worn out by their prolonged and gallant efforts, and drafts were not forthcoming to fill their terribly depleted ranks. During the six weeks' fighting Cadorna lost nearly 140,000 men, and he had little to show in the way of tangible prize. Nor did the mere figures of the casualty list give the measure of the loss suffered. The gravest loss was that of the trained officers and under-officers, who could not be replaced. Cadorna could not claim a victory, but he had reduced the forces of Boroevich to the last extremity. He had come very near performing what he had not means to perform, and only stubborn valour and an ample supply of machine-guns saved the Austrian lines. Boroevich had his back to the wall when the Italian offensive came to an end. He had lost nearly 9,000 prisoners; his battalions were worn out and his reserves were exhausted; but Cadorna had no strength left for a further attack.

The results of the first seven months' campaigning were disappointing to those—and they were many, both in Italy and in the Allied countries—who had hoped for far greater effects from Italy's intervention. Some of the reasons for Cadorna's comparative lack of success have been indicated in the course of the narrative and some are illustrated more fully in other articles. First of all stands the fact that in May 1915 the Italian army was very meagrely provided with the material necessary to modern war. Cadorna's only chance of early success on the lines expected by the optimists lay in quick movement against an enemy unable to man the passes and defensive lines that lent themselves so well to resistance, even in face of greatly superior forces. The southern half of the Julian front offered a far better chance of an Italian success than any other sector. There was no comparison as regards terrain or communications. Yet it was the Austrian positions in this region that Falkenhayn described as "ideal for defence against superior numbers." When, for the various reasons which have been given, Cadorna's first move failed to secure the results hoped for, the Italian armies were forced into a warfare for which they were very badly prepared. It is true that they were badly prepared for any kind of warfare, and would hardly have fared better in a campaign of movement. In any case, a new technique had to be learned and the means for developing it were not available. The story of the first seven months of the Italian campaign is the story of a magnificent attempt to supplement deficiencies in skill and material by resolution and heroism. Not that resolution was always evident. Instances of the contrary have been given, and there were others: the long tale of general officers dismissed by Cadorna during the first months of the war bears witness to failures.

During these early months the Austrians, both officers and men, were clearly superior in skill to their opponents. They had the advantage of nine months' experience when Italy took the field, and they made good use of it. And their superior skill was backed by a spirit which the armies of the Dual Monarchy sometimes failed to show on the eastern front. The Slav troops which fought with reluctance against Russia displayed a very different demeanour against Italy, and, according to Gen. von Cramon, head of the German Mission at Austro-Hungarian headquarters, this was specially noticeable in the case of the Southern Slavs, whose country was immediately threatened with invasion, and who had ambitions of their own which conflicted with those of Italy. The rest of the Habsburg peoples, moreover, were embittered by Italy's transformation from an ally to an enemy, and both Falkenhayn and Hindenburg bear witness to the fact that the Austrian army showed a very different spirit against its two main adversaries.

Many lessons were learned by the Italian army during the campaign of 1915, and the experience of these months bore fruit also in other quarters. It began to be realized in Rome that the army must have what it needed, that "conservative finance" had to give way before the imperious requirements of modern war, that every idea or estimate regarding numbers of men and supplies of munitions had to be revised in the light of new experience. The winter months were busily employed, especially in the munition factories. A great effort was necessary, for at the end of the 1915 campaign Cadorna had lost half of his small supply of middle-calibre guns through "prematures" or other accidents, and the factories, instead of augmenting his artillery strength, had so far scarcely kept pace with wastage. But the preparatory work was beginning to tell, and as far as artillery was concerned the situation was largely transformed during the winter of 1915–6. The small total of heavy and medium guns was increased sevenfold. But shells were still scarce in proportion to modern requirements, especially as these went on increasing with each month. And if Cadorna's artillery strength was greatly increased, so was that of his adversary.

The supply of men, no less than that of material, required to be replenished and augmented. In seven months the Italian losses in the field were close upon 280,000—66,090 killed, 190,400 wounded, and 22,520 prisoners. This was in addition to casualties from sickness, which were heavy, including as they did the losses from an outbreak of cholera which originated with prisoners freshly arrived from the eastern theatre of war. This outbreak was promptly tackled, and did not spread widely, but there were several thousand deaths in the isolated area. Men had to be found, not only to fill up the gaps but to make new formations, for it was clear that the war was going to make untold demands upon man-power. During the winter the gaps were filled and eight new divisions were ready in the spring, while others were in process of formation; and Cadorna had succeeded, after some difficulty, in having the classes required for drafts called up well ahead of his immediate needs. This was especially necessary, as, owing to the small annual contingent taken before the war, the bulk of each class was practically untrained. It was, moreover, necessary to instruct the trained units in the new methods which the trench warfare was evolving, if these new methods were to be carried out successfully. Unfortunately, the necessity for this methodical training was not generally, or even widely, understood, and the Italian army and nation paid heavily for the absence of properly organized training schools and camps. On the other hand, it must be admitted that, to begin with, at least, except for the drafts there was little opportunity for instruction. The men were fully occupied either in fighting or working at the trenches and shelters which had to be made out of live rock, working at roads or hutments or other necessary constructions. There was not even time for necessary rest in these first months. The front was very long in proportion to the number of men available, and if there were relatively few men required to hold the mountain positions, the number required to supply these few with food and drink and fuel and ammunition, especially in winter, was far greater than in the plains.

During the early months of 1916 there was a good deal of sharp fighting on the Julian front, especially at the Gorizia bridgehead. The long struggle of the autumn and early winter had left the Italians in possession of an irregular and unsystematized line, unsuitable for prolonged occupation, and both sides carried out numerous small operations with the object of "rectifying the front." The Austrians were the more skilful at this game, as they were in conducting raids with the object of securing information, but the work done by the Italians with sap and mine on Monte Sabotino advanced the line by more than 600 yd., and brought it close under the main Austrian trenches, eliminating the wide stretch of open ground, exposed to both frontal and flanking fire, which had led to the failure of repeated attacks. In March, when the German attacks upon Verdun were at their fiercest, and rumour said that Austrian reënforcements might be sent to increase the weight of the offensive, Cadorna opened a big demonstrative action against the Gorizia bridgehead. This was only a demonstration, but brisk fighting took place, and both sides suffered considerable loss. Meanwhile preparations for a real offensive on the Julian front were well advanced, when news came that the Austrians were preparing a big attack in the Trentino. Cadorna was slow to believe in this project, which was first reported to him by Brusati on March 22. He considered that the news was a deliberate attempt on the part of the enemy to distract his attention from the Julian front, but further information convinced him that the Trentino offensive was really intended, and meanwhile he had taken what seemed adequate measures against the threat.

It was not unnatural that Cadorna should doubt the report of a really formidable enemy offensive in the Trentino. The situation on the Russian front hardly seemed to justify an Austrian offensive on the grand scale in a sector so "eccentric" (in the literal sense of the word). Conrad, however, had calculated that he could carry out the attack in the Trentino before Brusilov's armies could move. Relying upon his advantage of interior lines and the late passing of winter on the Russian front, he made his preparations gradually and secretly throughout the winter and spring, collecting vast quantities of stores and ammunition about Trento, and sending his reënforcements piecemeal until March, when troops were hurried to the front with all speed. Conrad had proposed the plan to Falkenhayn in the previous Dec., but Falkenhayn disapproved, and in the end Conrad acted independently, stripping his eastern front, especially of guns, to a dangerous extent. According to Falkenhayn, no official intimation of the offensive was given to Germany, and Falkenhayn himself did not know the extent to which Conrad had weakened his forces in the east. On the other hand, Falkenhayn attacked at Verdun without informing Conrad, so that each would seem to have the like ground for complaint.

The *Strafexpedition*, as it was termed in Austria, before the event, consisted of 14 divisions of picked troops, with over 2,000 guns, including a large proportion of heavy artillery. It is clear that such a force was by itself insufficient to "knock out" Cadorna's armies, but it is equally clear that a successful drive through the Italian lines in this sector might have compelled a rectification of the whole Italian front, and might have prepared the way for a further offensive in greater strength. And in the worst event there seemed the prospect that Cadorna's programme for the summer would be seriously upset. But the Austrian staff underestimated the resistance of the Italian infantry and Cadorna's power of manœuvre; and it was mistaken about the date on which Brussilov could attack.

To meet the Austrian attack Brusati had a sufficient number of troops, but a considerable proportion of these were untried, and he was greatly inferior in artillery. He had 850 guns of all calibres, of which 336 were heavy or medium. Apparently both Cadorna and Brusati considered that the I. Army was sufficiently strong to resist the coming attack, and, though both had underestimated the weight of fire that was actually brought to bear on the Italian lines, their estimate of the situation would probably have been justified if the troops available had been more skilfully disposed, if the defensive positions had been better chosen and adequately prepared. Cadorna has been much criticized for his hesitation to believe

ITALIAN CAMPAIGNS (1915-1918)

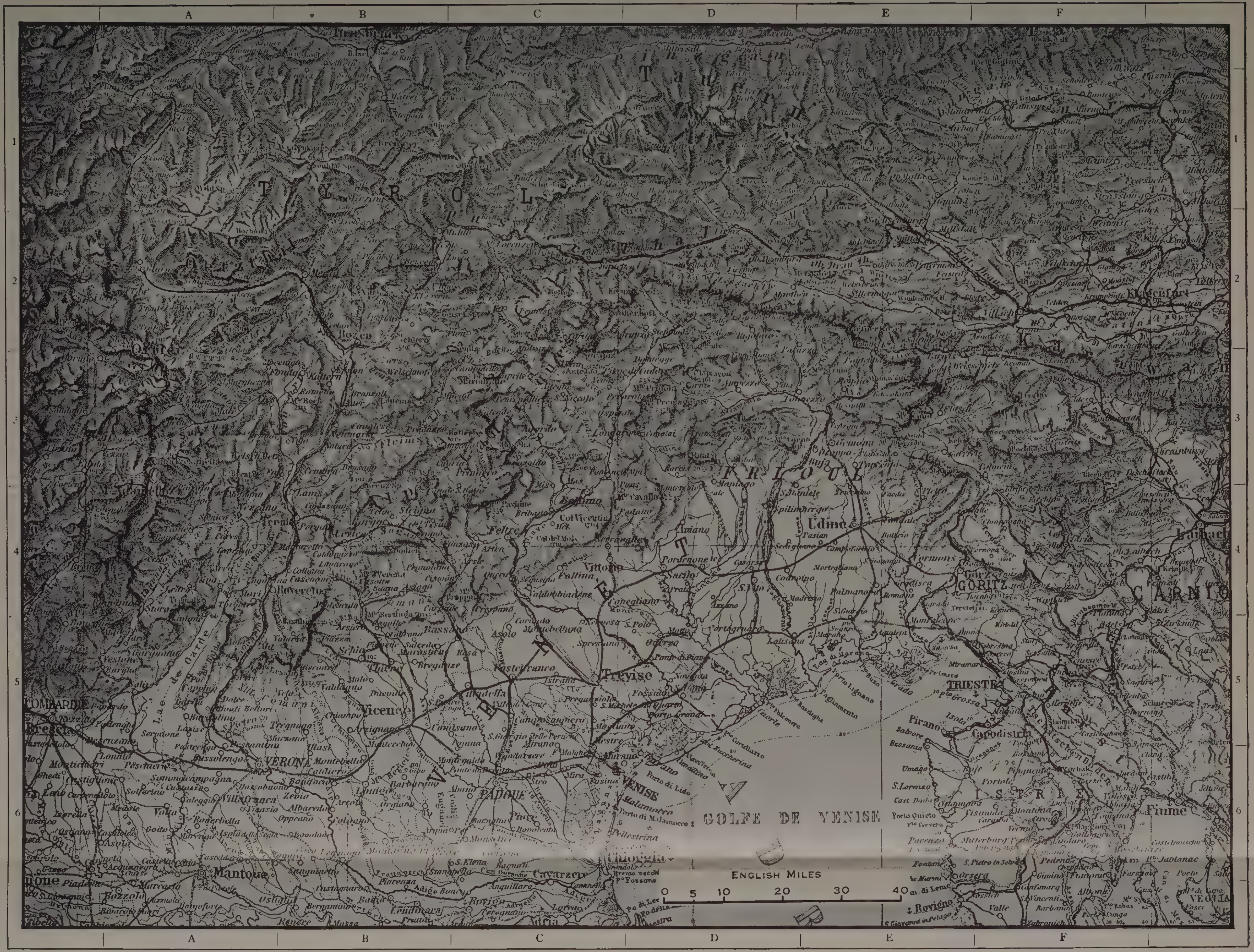
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in the forthcoming attack, and for his tardy concession of reserves for the threatened sector. The reënforcements sent before the battle may have been insufficient in view of the dispositions made by Brusati, but these dispositions did not fit in with Cadorna's general plan, and, in fact, transgressed his definite instructions. The positions held by the I. Army were at many important points well in advance of those laid down by Cadorna as the definite line of defence upon which he relied for relative freedom in his operations on the Julian front. And much labour had been expended in fortifying these advanced lines, while the "battle positions," marked out as such by nature and by the orders of the supreme command, had been inexplicably neglected. There had already been friction between headquarters and the I. Army command in regard to the tendency of the latter to go outside the rôle allotted. The difficulty was to some extent an outcome of the difference of opinion in regard to Cadorna's strategy which prevailed in the Italian army. It was natural that those who had to deal with the Trentino and Cadore sectors should see opportunity for offensive action and chafe because they were not given the means to act. It was perhaps natural, too, that they should be inclined to do what they could with limited means in the hope of inducing, by the bait of actual success, a revision of the general plan. But such experiments in despite of discipline can only be justified by success. This attitude, and these actions, were inspired partly by the wish to exploit the opportunities that seemed to offer and partly by the difficulty of maintaining permanently an inactive defensive; but they were probably influenced by the belief, which was widely shared, that an offensive in the Trentino would give better results than continuance of the attempts upon the Julian front. In any case, Brusati's I. Army was aligned as though for an offensive. Its main infantry positions and the bulk of its guns were alike badly placed for defence against a resolute attack. By Cadorna's direct intervention the lines were modified in the Val Lagarina and Val Sugana, and on May 8 Brusati was relieved of his command, a measure which Cadorna had wished to take at a much earlier stage. He was succeeded by Gen. Pecori-Giraldi, commander of the VII. Corps (III. Army).

A week later the Austrian offensive was launched. The Italian wings in Val Lagarina and Val Sugana held firm, though some of the positions which should have been prepared had not been touched; but in the centre, between the Val d'Assa and the Val Terragnolo, where the Austrian fire was heaviest and the positions occupied were not suitable for defence, and where the Italian line was thin, the front was driven in. Cadorna, who had himself assumed direct control of the operations, ordered a withdrawal to S. of the Posina and E. of the Astico and Assa, while he dispatched ample reënforcements to support the retiring troops and gave orders for the concentration of a large reserve force, to be known as the V. Army, E. and S. of Vicenza. Heavy fighting went on until June 17, but a fortnight before that date the Austrians were held. By June 2 Cadorna felt himself safe, though his opinion was not generally shared. The line was holding; his V. Army was practically ready in the plains, and still untouched; and in fact, although the Austrians were to gain a little more ground at heavy cost, his confidence was fully justified. The *Strafexpedition* was already condemned to failure when Brussilov, answering the appeal for coöperation made by Cadorna on May 19, attacked the weakened Austrian lines in front of him on June 4, and won the great victory that came within an ace of being decisive, if Cramon may be believed. At the Allied Conference held in the preceding March Brussilov's offensive had been fixed for the first half of May. As the time drew near the delay of a month was proposed, but when Cadorna asked for Russian coöperation and pointed out that the Austrian front in the E. had been weakened in order to carry out the *Strafexpedition*, the answer came that Brussilov would attack on June 2. His offensive, according to Falkenhayn, was not expected by the enemy to take place until the beginning of July; and, though it was delayed by two days in order to bring more troops into line, the surprise was complete. The attack in the Trentino, based on a miscalculation, nearly ended in the collapse of Austria's eastern front and it brought no gain corresponding to the risk run and the losses suffered.

The Austrians were loth to give up the attack that had begun so well. For a fortnight after the beginning of Brussilov's drive they struggled to break through from the mountains to the plain, but at the end of that time, having made but negligible progress, they found their left wing attacked. Cadorna had begun his counter-offensive, and after a week's pressure the Austrians withdrew, flattening the salient which their advance had made. They withdrew skilfully and steadily, before the Italian counter-attack was fully under way, to a line considerably in advance of their old positions, including as it did Cima Dodici, both sides of the Val d'Assa and the Tonezza plateau. This advance was the sole gain made, and the immediate price paid for it, apart from the disaster on the Russian front, was a casualty list that was estimated at over 100,000 men. Nor did the penalty end here. Cadorna refrained from knocking his head against the lines upon which his retreating enemy turned and stood. The positions which he had regained were adequate to his aims in the Trentino, which were purely defensive, and instead of persisting in his counter-offensive he rapidly swung his reserves back to the Julian front, smashed through the Gorizia bridgehead and took Gorizia, and drove the Austrians from the western regment of the Carso plateau.

Cadorna had judged rightly and Conrad wrongly, and the former's swiftness of decision and manœuvre led to a big Italian success. But there was a moment when the situation compelled Cadorna to consider and prepare for the possible retreat of the II., III. and IV. Armies from the Julian and Cadore fronts. Ten days after the opening of the Austrian attack he had to reckon with a possible failure of the troops of the I. Army to prevent the enemy reaching the plains in force. Cadorna made his plans for such a retreat, from the Isonzo to the Piave, and his frank statement of the possibility, together with his request for the recall of a division from Albania and one from Libya (one division had already been recalled from Albania towards the end of April), caused natural alarm in Rome. Salandra suggested a meeting of the commander-in-chief, the four army commanders, the premier, the Minister of War and two other members of the Cabinet, a suggestion which Cadorna declined, insisting that the responsibility for military decisions lay with himself, and not, as Salandra's proposal claimed, with the premier and council of ministers. He requested that if he no longer enjoyed the confidence of the Government he should be replaced at once. Salandra replied that his proposal had been misunderstood; but when the measures taken preparatory to a possible retreat from the Isonzo line were communicated to the Cabinet he returned to the charge, maintaining that such provisions could not be regarded as being confined to the province of the military authorities, but must be subordinate to the decisions of the Government. In reply Cadorna pointed out that military exigencies might demand immediate decisions which could not wait upon the deliberations of a Government, and that responsibility must lie with the commander-in-chief. Fortunately the question was not put to the test. The Austrian offensive was now fairly held, and it was not necessary to consider further, at this time, the question of a general retreat. The incident, however, has an importance as exemplifying a difference of opinion regarding the relative functions of the Government and the supreme command, which was to grow more serious as time went on. It was difficult, if not impossible, to say where precisely the functions of each should begin and end, and at a later date the friction increased.

During July, while a gradual transference of troops from W. to E. was being carried out, and preparations for an offensive on the Julian front were being hastened, the counter-offensive on the Trentino front was continued and several positions were taken, while the Austrians were kept on the *qui vive* by movements in Tirol. The attacks against the new Austrian lines in the Asiago and Arsiero uplands were not very fruitful; and on

July 9, with his eye on Gorizia, Cadorna gave orders to slow down the offensive and return to the idea of defence. The attack farther N., on the other hand, gave good results. It was clearly unexpected by the Austrians, and the Italians made a considerable advance in the region of the Fassa Alps, occupying the Passo di Rolle and the mountains of Cavallazza and Colbricon on July 22, and seizing the village of Paneveggio, in the Val Travignolo, at the end of the month. The Austrians made repeated attempts to recapture their lost positions, hurrying reënforcements into the Val Travignolo, but their efforts were useless, and as the summer went on the Italians gained more ground in successive sharp actions, though operations on the grand scale were never undertaken and were indeed practically excluded by the nature of the terrain and the lack of communications. But the continued threat kept the Austrians nervous, and by the autumn some three divisions of picked mountain troops were concentrated in the valley of the Avisio.

During the winter of 1915–6, in preparation for an attack on Gorizia and the Carso, the right wing of the II. Army had been transferred to the III., so that the whole front from N. of Monte Sabotino down to the sea was under the command of the Duke of Aosta. Both III. and II. Armies had been temporarily weakened by the withdrawal of troops to form the V. Army, but even at the most critical moment of the Asiago battle the Duke had eight divisions and a dismounted cavalry division at his disposal. During July he was reënforced by three divisions, and a considerable number of heavy guns, and at the end of the month four more divisions with their artillery were rapidly transported from the Vicentine plain to the III. Army front. A further division was given to the army from the general reserve, so that the Duke of Aosta had under his direct command 16 divisions and a dismounted cavalry division. He had 1,250 guns, of which 520 were heavy or medium, and these were supplemented by nearly 800 trench-mortars (*bombarde*), of which 138 were of 240-mm. calibre. These *bombarde* had been constructed during the winter in order to make up for the deficiency in heavy artillery which the manufacturing resources of Italy were inadequate to meet. The *bombarda* was in fact much more than what is usually understood by the term trench-mortar. Its range was much longer, and the destructive power of its big projectile was very great. Its advantage over the big gun, given Italy's poverty in manufacturing resources, was obvious. Its disadvantages are equally obvious: its forward position and the big flame of its discharge made it a relatively easy mark for the enemy's guns. The question of ammunition supply was also complicated by the forward position. The *bombarda* was a *pis aller*, but thanks to the devotion of the *bombardieri* it rendered great service.

On the Carso and about Gorizia Boroevich was badly prepared to meet the Italian attack, for Cadorna's quick transference of troops to the III. Army front enabled the Duke of Aosta to throw an overwhelming force against the Austrian lines. Boroevich had only five divisions in line and one in immediate reserve between Sabotino and the sea when the Duke launched his attack, and the Austrians were taken by surprise. The Duke began with a feint. On Aug. 4, after a heavy bombardment, the Italian VII. Corps attacked the low hills E. of Monfalcone, which had already seen much stubborn fighting. They stormed the enemy lines, but were driven back again by a counter-attack. The thunder of the guns continued all along the III. Army front—a far heavier fire than had ever come from the Italian side,—and on the morning of Aug. 6 the intensity of the bombardment was redoubled. The infantry attack came in the afternoon, when the VI. Corps attacked the Gorizia bridgehead and the XI. the summits of Monte San Michele. The VI. Corps, commanded by Gen. Luigi Capello, had outgrown the dimensions of an army corps, for Capello, acting under the Duke of Aosta, was in command of no fewer than six divisions. His attack was brilliantly successful. Sabotino was taken on the run, in 40 minutes, while farther S. the greater part of the Podgora ridge was torn from the Austrians and some detachments reached the river at sunset. The Austrians defended themselves with the most obstinate valour. They counter-attacked frequently, and on the afternoon of Aug. 8, when they were finally driven across the river, they had gained precious time for their hard-pressed commander. Italian troops crossed the river the same night and the town of Gorizia was occupied next day without resistance, while a general attack on the Carso was breaking down the stubborn defence which had survived the loss of the summits of San Michele early in the first day's fighting. On Aug. 10 the Austrians were driven back across the Vallone, the deep cut that separates the San Michele–Doberdò section of the Carso from the main plateau. Only at the extreme S. of their line, on the low ridges above the Lisert marshes, did they succeed in preventing a break through their original lines of defence.

Both to the E. of Gorizia and on the far side of the Vallone the advancing Italians found themselves faced by new lines, hidden among the woody slopes beyond the town or the stony undulations of the Carso. Cadorna still hoped to go through, for it was not yet clear whether the Austrians were standing on a line which they had fully prepared, or whether they were fighting to cover a retreat to positions still farther east. Hoping to find a way round, and at the same time to prevent a concentration of force against the advance of the VI. Corps, he ordered an attack by the II. Corps from the Plava bridgehead, at the same time restoring the VI. Corps to the II. Army, and instructing the Duke of Aosta to continue his attacks on the Carso. The attack from Plava came to nothing—given the difficulties of the terrain, the artillery preparation and support, through shortages of guns and ammunition, was totally insufficient—and the VI. Corps was held up by hidden machine-gun posts. The information regarding the new enemy lines was meagre, and they were well concealed among the trees. Only the III. Army continued to make progress, and Cadorna broke off the action in the plain of Gorizia, deciding that careful preparation was necessary for an attack upon the new positions. He reënforced the artillery of the III. Army with guns taken from the II., and the Duke of Aosta carried on his attack for a few days more before it became evident that on the Carso also the enemy lines were too strong to be taken in the later stages of an offensive, with ammunition ebbing and troops already weary. The enemy troops, of course, were still more worn-out. Their reserves were all in line, and to back these were only broken units and march battalions. If Cadorna had been able to bring, immediately, a fresh weight of destructive fire to bear upon the new lines he would almost certainly have gone through. He was still handicapped by lack of material.

The loss of the Gorizia bridgehead was a serious blow to the Austrians, but the advance on the Carso was a still greater threat to their line as a whole. It gave the Italian III. Army ample room beyond the Isonzo, and an admirable line of observation posts. The Duke of Aosta's divisions were no longer attacking a formidable glacis, with every inch of their own ground under the observation of the enemy, and with no "eyes" themselves to view his country. And an advance upon the Carso, now rendered more feasible by the alteration in relative position, threatened to turn the enemy lines E. of Gorizia. To complete the scheme, it is clear, a simultaneous attack to the N. of the town was indicated. Such an attack was always in Cadorna's mind; it had been attempted more than once. But he had not been able, nor was he now able, to collect the means necessary to the simultaneous attack. His artillery strength, both in guns and shells, was altogether insufficient. He had to choose between the Middle Isonzo and the Carso, and he chose the latter, with Dornberg, the Iron Gates and the Hermada as his objectives.

This idea governed the operations on the Julian front during the rest of the year 1916. Three times Cadorna attacked on the main Carso plateau, between the Vippacco and the Brestovica valley, using the right wing of the II. Army in the Gorizia plain to support the main operation, the attack by the Duke of Aosta's left. The first attack, launched on Sept. 14 and pursued for three days, was affected by bad weather and gave disappointing results, though considerable progress was made. The handicap of bad weather continued, and delayed each of the two short, sharp blows dealt by Cadorna before winter closed down. In four days' heavy fighting in Oct. and three days' still fiercer struggle at the beginning of Nov., the Duke of Aosta punched out a big salient on the northern half of the Carso, driving the Austrians back to their last line of trenches and occupying the important position of Faiti Hrib. In each of these three actions the attack was broken off as soon as it slowed down. The second and third were in fact only preparatory actions, not offensives on the grand scale. Previous experience had shown that more men and more guns and shells were necessary for a successful attack on a wide front; and it had now become an axiom that only with a wide front of attack was success possible. Cadorna was ready to strike another blow if the weather had let him, but winter came early with heavy mists and much rain, and in Dec. he decided that he must reserve his strength for the following year.

The early advent of winter put a stop to other operations, in the mountain zone, which had borne considerable fruit. Good progress had been made in the region of the Fassa Alps, towards the Val d'Avision, and in Oct. an attack N. of Pasubio gained a wide stretch of high plateau which gave additional depth to the Italian defensive position and freed some 10 m. of the Vallarsa road from direct observation and worrying fire. Both here and in the Fassa Alps bad weather put an end to active military operations in the middle of Oct.; and an attack in the Asiago uplands, which was planned for the middle of Nov., had to be given up owing to the heavy snows that came a few days before the date was fixed.

The year had seen much heavy fighting, and both sides had suffered severely. The Italian casualties were nearly 120,000 dead, 285,000 wounded and 78,000 prisoners. The bulk of the latter were taken in the first days of the Austrian offensive in May, when the front lines, too full of troops, were overwhelmed, and a number of detachments were cut off in isolated mountain positions. The Austrian losses were also heavy. The *Strafexpedition* is said to have cost about 100,000 men. The Italian offensives on the Julian front, from Aug. to Nov., yielded more than 40,000 prisoners to the attacking forces, and the list of killed and wounded during these months came not far short of 100,000. If the territorial gains at the end of the year's fighting were not great, Cadorna's continued attacks, following upon the costly failure of the Austrian offensive in May, had done their work in occupying an increasing number of the enemy's troops and wearing down his powers of resistance. The Italian casualty list, as was the rule with the attackers, greatly exceeded that of the Austrians, but the advantage of man-power lay with the Entente, and the policy of attrition was generally, though not universally, accepted as indicating the only road to victory. No other policy, certainly, was open to Cadorna while the plans of the Allies were based upon this idea. His rôle was clearly marked out: he had to hammer when he could, with what means he could collect from month to month as the output of guns and munitions increased and fresh troops were trained, keeping always in view as an essential aim that of attracting to his front, and wearing out, the maximum number of enemy forces. Judged from this standpoint, the Italian effort in 1916 was of the greatest value to the Allied cause. Some 35 Austrian divisions, with their march battalions, were pinned to the Italian front; and Ludendorff in his *Memoirs* refers to the impossibility of detaching any Austrian troops from the Italian front to assist in other operations, notably to continue the operations against Rumania.

Although Cadorna was strongly opposed to the dispersal of his forces in *petits paquets* and had resisted the suggestion of an expedition to Libya to quell the rising which had reduced the Italian occupation to a few points on the coast, the importance of the Balkan front had not been lost sight of by the Italian Government. In March a strong force was dispatched to strengthen the Italian position at Valona. The Austrian attack on the Trentino caused two divisions to be recalled to Italy almost at once. It is worthy of note that the Albanian expedition was dispatched at a time when Italy was being criticized in the British and French press for her supposed refusal to coöperate in the Allied operations towards the Balkans. That coöperation was only delayed. When the situation on the Italian front permitted, fresh troops were sent to Albania, and in Aug. a strong force arrived in Salonika under the command of Gen. Petitti di Roreto to take part in the Allied advance upon Monastir. Early in Oct. an Italian column occupied Argyrokastro and before November the Italians were in touch with the left wing of the Allied forces based upon Salonika.

Up to the end of 1916, except in the case of the Balkan campaign, the question of military coöperation between the Allies had been confined to the timing of the individual efforts on each front, so as to minimize the advantage possessed by the Central Powers by their possession of the interior lines. The suggestion was now put forward that a wider meaning should be given to the word coöperation, that an Allied force should join the armies of Italy in an attempt to "knock out" the weaker of the two enemy Powers and so hasten the end of the war. The idea had been the subject of discussion in Italy in 1916, but the formal proposal was made Jan. 1917, during the Allied Conference held in Rome. The chief work of this conference, on the military side, was the organization of a line of communications through Italy to Salonika, *via* the south Italian ports, a route which greatly lessened the dangers from submarine attack, and at the same time made a much smaller demand upon the diminishing tonnage of the Allies; but the question of a joint offensive on the Italian front was also discussed. The French and British general staffs were against the proposal which came to be known as "Cadorna's plan," but it appealed to Mr. Lloyd George, who was in favour of Allied troops and heavy guns being sent to Italy, in order to add that extra weight to the attack which, to judge from the experience of 1916, would lead to important military successes. In spite of Mr. Lloyd George's advocacy, the French and British military authorities decided that they could not spare the men and guns asked for, but they offered to send 300 heavy guns for an immediate offensive, on condition that they were returned to the French front by the month of April, in which it had been decided to launch a general offensive. This offer was refused by Cadorna, on the ground that the season was not suited to an offensive on his front, and that the guns would have to be returned at the moment when they would be most useful. The discussion and rejection of Cadorna's plan gave rise to many rumours, among them the report that he had asked for "a million men or nothing." This legend found consecration even in serious commentaries published after the war.

Cadorna's actual proposals, embodied in a memorandum written after the Rome Conference, were as follows: If the Allies would send at least 300 heavy guns he would make two attacks, on the Trentino and Julian fronts—his own artillery was insufficient for this double offensive—and so find the enemy's weak point. He had the advantage of interior lines, and would move his reserves of guns and men from the Venetian plain according to the development of the two actions. If, on the other hand, the Allies would send a minimum of eight divisions in addition to the heavy guns, he would concentrate upon the Julian front and attack from Tolmino to the sea, with the object of breaking through towards Laibach. Such an attack, in Cadorna's view, would have had decisive results. He believed that Austria could not recover from such a blow.

The plan was tempting, but it did not commend itself to the Allied commands. French and British military opinion was against any further diversion of effort from the western front, for there was the chief enemy, upon whose defeat the result of the war depended. Great things were hoped from the offensives which had been planned for the spring, and it was not realized that Russia's active military contribution to the Allied cause, so valuable in the past, was practically ended; still less was it foreseen that before the finish of the year the Russian front would cease to exist at all. It was realized that Cadorna was short of munitions, but he was stronger than he had been in 1916, when he had pressed the Austrians very hard. There was reason to think that he and Brussilov between them could be trusted to deal with the hard-tried armies of the Dual Monarchy, even though these were reënforced by German armies in the east. There were, moreover, obvious technical reasons against the choice of the Julian front for a joint offensive. The front lay far from the French and British bases and from their munition factories, and communications from France to Italy were not too good. On the other hand, Cadorna was right in pointing out that on the Isonzo front the enemy was more vulnerable than anywhere else in the whole western theatre of war, and that the Habsburg Monarchy was "less disposed to persist in the struggle" than Germany. An advance on the Julian front would have the great advantage of carrying the war well into enemy territory and so bearing more directly upon the resisting power of the people.

There were excellent arguments for both plans, but it is not surprising that the "Westerners" prevailed. If it had been realized that Germany and Austria were one for the purposes of the war,—if the Italian front had been regarded as the right wing of the front in the W.,—a different decision might have been reached. But at this stage the tendency was to distinguish between Austria and Germany and rather to consider the Italian operations as being linked up specially with the war in the East. Still, the idea which was brought forward in Rome did receive consideration during the following months, and in the spring of 1917 both Nivelle and Robertson visited the Italian front. These were the first visits of any important British or French military authorities since those of Joffre and Kitchener in the autumn of 1915, and the occasion was taken by Cadorna to press the question of closer coöperation, especially in the event of an Austro-German offensive against Italy. Both Nivelle and Robertson agreed to the principle of direct coöperation by the dispatch of troops and guns, but both were inclined to prefer coöperation by a simultaneous attack, and, while a scheme for the quick transport of troops from France to Italy was prepared, no definite engagements were taken. It was agreed, on the other hand, between Cadorna and Nivelle that the French and Italian spring offensives, which had been provisionally planned at Chantilly the previous autumn, should be timed to coincide as nearly as possible. The Chantilly agreement had in view an attack in Feb. but the date was deferred till April. In the meantime the Austrian forces on the Italian front were considerably increased, and the fact of the German retreat in France, which upset the French and British plans, seemed also to increase the possibility of an Austro-German offensive on the Trentino front, or even of the double attack on the Trentino and Julian fronts which had strong advocates in Austro-Hungarian military circles. The prospect of an attack from the Trentino seemed to be increased by the fact that Conrad, who had been replaced by Arz von Straussenburg as chief of the general staff, was now in command at Bozen. Cadorna held that he could not attack on the Julian front until he could feel reasonably safe in regard to the Trentino, for his offensive would imply the weakening of the Trentino front, especially in artillery. His request for guns had not been met, and to give his attack a chance he had to strip the Trentino front of its heavy artillery. His case seems unanswerable, but in March Nivelle demanded the assurance that Cadorna would attack in the middle of April and suggested diplomatic pressure upon the Italian Government. Cadorna maintained his position, that he would attack when the situation in the Trentino permitted him to move eastward the heavy guns he required for his offensive. In April he received 11 batteries of British 6-in. howitzers and 35 French heavy guns, but this assistance, useful though it was, fell far short of the requirements he had indicated. Three days after launching his ill-fated offensive, Nivelle called upon Cadorna to attack, but the latter had already given the order, fixing the date of May 7. Bad weather caused a short delay, but the Italian guns opened fire on May 12. But for the weather Cadorna would not have exceeded the margin of three weeks by which the Chantilly agreement had enlarged the expression "contemporaneous." The threat from the Trentino obviously justified a delay, but even with this handicap Cadorna succeeded in attacking within, or nearly within, the limits allowed by the provisional agreement. In the circumstances it is difficult to understand Nivelle's attitude or the comments made at the time, still less the criticisms published after the war.

Cadorna attacked on the morning of May 12, feinting with the III. Army on the Carso, and making his real attack against the hills N. and E. of Gorizia. North of the town the greater part of the long ridge (Kuk Vodice) running southward from above Plava was gallantly stormed and held against the most determined counter-attacks, but on the hills E. of the town little progress was made. As soon as the occupation of the Kuk Vodice ridge seemed assured Cadorna moved the bulk of his heavy guns southward, and attacked with the III. Army on the Carso. Lack of guns and ammunition made it impossible to attack in both sectors at once. Useful progress was made here also, a number of enemy positions being captured on the Carso proper, and the VII. Corps on the right carrying one line after another till they were half-way up Monte Hermada, which dominated all the southern Carso and was the enemy's main bastion in this sector. But ammunition was running low: the offensive had to be broken off at a moment when it seemed as though further success lay very near.

There was only a short breathing space. On June 4 the Austrian troops on the Carso, now grouped under the command of Gen. Wenzel von Wurm, counter-attacked in the most determined manner. Against the Italian left and centre they had no success, but on the right they found a weak resistance on the part of the troops who had come into line as reliefs. They freed the lower slopes of the Hermada and took a large number of prisoners. This was the limit of Wurm's success, though his attacks were conducted with great determination and his artillery fire was both accurate and intense. If Cadorna had been able to increase his artillery, his adversary had kept pace. The Austrian gunfire, both in defence and attack, was far heavier than it had been in former actions.

During the four weeks' fighting Cadorna used 31 divisions, and his casualty list was very heavy: 132,000 killed and wounded. He also lost more than 25,000 prisoners, the bulk of them due to the weak resistance in the Austrian counter-offensive in the Hermada region, though a considerable number of captures were those of troops who had pushed on too far in the Italian attacks. Boroevich had held his ground, or nearly, with 17 divisions, and his losses, including 25,000 prisoners, were close upon 120,000. Once more he had been pushed to the last extremity, and once more the fighting power of his troops and an ample supply of machine-guns had checked the Italian effort, handicapped as it was by lack of ammunition for the guns.

The rumour of battle had scarcely ceased on the Julian front when the Italians attacked N. of Asiago, in an attempt to drive the Austrians off the line which they had occupied after their offensive in 1916. The Italian attacking force consisted of 12 divisions, with 1,500 guns and trench-mortars, and the front did not exceed 9 miles. In spite of the strength of the forces employed and the weight of fire brought to bear upon the enemy lines, the general attack was a failure. On the extreme right alone, in the region of Monte Ortigara, the Alpine troops of the 52nd Div. made good headway and captured 500 prisoners. The left wing also gained ground to begin with, but could not maintain their success. Bad weather interfered with the artillery work, and the troops suffered very heavily. The feeling was general that the Austrian positions were nearly impregnable, and some of the troops fell below the usual standard. After a pause the Alpine troops renewed their magnificent effort, gained more ground in spite of the extreme difficulty of the terrain, and captured another 1,000 prisoners with several guns. But their advance left them in an impossible position, completely dominated by the enemy's reserve lines, and largely isolated from the rest of the Italian force. The Austrians brought up strong reserves of guns and men, and after a heavy artillery fire, which caused heavy losses among the troops who were lying on the bare rocky slopes of Monte Ortigara, they counter-attacked in force. The *Alpini* were driven off the summits of the Ortigara, but after a long struggle kept the Passo dell' Agnello.

The Italian losses in this abortive action were very heavy indeed, 24,000 killed and wounded and 2,000 prisoners, and it was commonly felt that in view of the initial failure farther S. it was a mistake to persist in the attack upon the Ortigara positions. An isolated success at this point was useless, as it could lead nowhere. The officers in command of the *Alpini*, who knew what was possible in such difficult conditions of terrain, were opposed to the further attempt and their misgivings were fully justified. The record of the Alpine battalions was proof that they had no objection to attempting the impossible if there were sound reason for the attempt. On this occasion they felt that their sacrifice was useless, and though they fought and died as staunchly as ever, the remnants who came back from the Ortigara had the bitterness of failure.

The general situation at the end of June gave cause for disappointment and some anxiety. The big battle on the Julian front had come very near triumphant success. It had brought the Austrians close upon disaster, and it had shown once more that with a little added weight, especially of heavy guns and shells, the stubborn resistance of Boroevich might have been overcome. But the balance was swinging against the Entente. The whole military situation threatened to be altered by the disorganization which had followed upon the Russian revolution. While it was not yet fully clear that the revolution meant the defection of Russia, it had already meant the possibility of a considerable transference of guns and men from E. to W., and it had heartened the weary soldiers of Austria-Hungary. The prisoners taken by the Italians boasted that the whole effective strength of the monarchy would shortly be concentrated against Italy; and the information that came from the East all tended to confirm the fear that the Russian front, which had filled such an important part in the war for nearly three years, would shortly become a vast rest-camp for the soldiers of the Central Empires.

Russia was going out of action, and the consequences for the Western Allies showed clear enough. Nor was it only in Russia that signs of war-weariness had made themselves evident. This was in fact the critical year. France for the first time, after the failure of Nivelle's offensive, had to deal with serious disaffection in the army which had borne the heaviest burden, and suffered most, of the Western Allies. In the case of England, though the army was sound, there were disquieting symptoms among the population. In Italy war-weariness was showing itself in various ways. The troops who failed on the slopes of the Hermada had displayed a mutinous tendency before going into line, and in the attack in the Asiago uplands some of the units had shown less than the usual spirit. Cadorna was disturbed by these manifestations, especially by the first, which he put down to "defeatist" propaganda in the country. He addressed urgent protests to the Government, claiming that the Ministry of the Interior did not show sufficient severity towards anti-war propaganda. The fact of war-weariness could not be disputed, and there were ample reasons for its existence, both in the army and in the country. Units were kept too long in the trenches, partly because the wearing effects of these long spells were not fully realized, but partly also because the number of troops available was small in relation to the length of the front, which was nearly as long as the Allied front in France. Nor was it then generally understood that the soldier who comes into rest billets requires "remaking" as well as rest. In the first place, little or nothing was done in the way of providing comforts and recreation. It was only in the summer of 1917 that recreation huts began to be established and the idea of organizing amusements found favour with the authorities. Another lack was the almost complete absence of the volunteer canteens near the front which proved so useful in France. For his modest additional comforts the Italian soldier had to depend almost entirely upon the speculative ventures of small dealers who made large profits. And the pay of the soldier gave him no margin for such expenditure. There was little to soften the hardships or lessen the dreariness of life in the war zone.

In the second place, the rest periods were not utilized as they might have been for the training of the troops in the methods of warfare that experience was constantly developing. The loss was double. Both officers and men suffered from lack of knowledge and practice, and, not less important, they suffered from *ennui*. They were either occupied in dull fatigue duties, or, in many cases, they were not sufficiently occupied at all. Too often they had little to do but to wonder when the war would come to an end. Socialist newspapers preached that the enemy was ready for peace, and among the new drafts were some who told the same story. Anti-war propaganda was active both in the country and in the army, and neither at the front nor among the public was there efficient counter-propaganda.

Another reason for depression was the actual shortage of food, both in the army and in the country. Conditions had grown very difficult in Italy. The soldier's ration had to be cut down to a very low standard, so that the lack of extra comforts was all the more severely felt. And at the same time the troops were distressed by the news that their families were suffering want, and even actual hunger. The allowance to soldiers' families was altogether insufficient in view of the great rise in the cost of living. In all these ways the strain upon the army was far greater than that experienced by the troops of England or France. To those conversant with the conditions it was a matter of surprise, not that there was discontent here and there, but that the willingness and cheerfulness of the troops as a whole triumphed over circumstances that tried them so hardly.

There was reason for anxiety owing to war-weariness, but there were many signs of the same trouble in the enemy's camp. It was felt that Austria-Hungary was very near the end of her tether, and subsequent revelations showed how grave the situation was. The chief cause for anxiety lay not in the occasional symptoms of weariness, which had become evident elsewhere as well as in Italy, but in the hard fact of the Russian catastrophe. The effect of this disaster was both material and moral. It definitely altered the military balance, and, while it encouraged the Central Empires to go on, it clearly removed to a distance the prospect of an Entente victory with which the year had opened. The advocates of "peace without victory" were heartened in their efforts to show that a continuance of the struggle was useless.

The military situation was changing for the worse, but there seemed a chance of striking the enemy hard before he could definitely ignore the eastern front. At the end of July there was a further inter-Allied discussion regarding plans, in Paris first and then in London. In Paris, Cadorna was urged to undertake two big offensives, one in Aug. and one in Oct., but it was not difficult for him to show that his supply of shells would not permit of two attacks on the grand scale. Nor were his trained reserves adequate, in view of the casualties with which he had to reckon. The discussions were continued in London, when Cadorna had returned to Italy from Paris, and the idea of a joint offensive on the Italian front was brought forward again by Gen. Albricci, who represented Italy. It was clear that such an attack could not be undertaken at once, in view of the great Flanders offensive which had just begun, and from which so much was hoped. Albricci's proposal was to delay the Italian offensive planned for Aug. until the Allies could spare troops and guns to give the added weight which experience had shown to be necessary. The idea was not at once rejected on this occasion. The suggestion was made that Allied reënforcements should be sent in Oct., when it was hoped to have reached objectives set for the Flanders attack. Albricci feared that this might mean losing the favourable season for an Italian offensive. The experience of the previous year had shown that the autumn mist and rain on the Isonzo front were a serious handicap to artillery fire, and the countervailing advantages to an attack were not yet realized by the

Allies. It was decided to keep to the Paris plan and attack in Aug. without reënforcements. The efforts of the Italian munition factories and depots had provided many new heavy batteries, and there were now 99 British and French heavy guns on the Italian front. Altogether Cadorna could dispose of 2,300 heavy guns for his attack.

The army was strung to the highest point of tension, awaiting the order to attack, when Pope Benedict XV. launched his appeal for peace. A forecast came first, in the clerical press, on Aug. 14. Next day, the festival of *Ferragosto*, there were no newspapers, but the text was published on Aug. 16. Forty hours later Italian guns began, from Monte Nero to the sea; and on the night of Aug. 18 the offensive began. Parts of the army were shaken. For the Pope in his impartiality placed the two contending groups of Powers on the same level; he held out the hope that Germany and Austria were ready to consider certain territorial questions "in a conciliatory spirit," taking into account "the aspirations of the peoples"; and to the long and weary struggle he attached the label "useless slaughter." The Papal Note in itself was vague, and promised little. But it hinted much, and some of the press comments upon it filled in the gaps. The word ran round that a peace might be arranged which would give Trentino and Trieste to Italy. Some of the commands were anxious about their men when the attack began.

As a matter of fact the troops put aside their questionings, and the blow dealt to the Austrians was a very heavy one. The Isonzo was crossed in many places between Tolmino and Plava, and the greater part of the Bainsizza (Bainsitsa) plateau was occupied by troops of the II. Army, while the southern end of the Chiapovano valley was passed, and a footing obtained on the western corner of the Ternova plateau. No progress was made against the positions E. of Gorizia, and the action in this sector was quickly broken off, but the right wing of the III. Army gained ground, especially on the southern edge of the main Carso plateau and in the Hermada sector. The Carso action was broken off when it was clear that the initial impetus would carry the troops no farther, and guns and men were moved N. to endeavour to make the most of the success gained by the II. Army. The extreme difficulty of the country and, above all, the lack of roads called a halt after 10 days. The infantry had outrun the heavy guns in position on the right bank of the Isonzo, and they found the Austrians, as the pressure relaxed, strongly placed among the hills to the W. of the Chiapovano valley. Capello's II. Army had won a big victory, but at two vital points the Austrians had held their own, on the Lom plateau S. of Tolmino and on Monte San Gabriele, N.E. of Gorizia. While these positions were maintained the Italians could not obtain the fruits of their initial tactical success in breaking through the lines on the Bainsizza.

Little progress had been made by the left of the Italian attack. Austrian reënforcements had been hurried to the spot, and an immediate renewal of the attack, without further preparation, did not commend itself to the Italian command. It was decided to concentrate against the Austrian centre, and attempt the capture of San Gabriele, while the troops on the Bainsizza dug in and roads were made from the left bank of the Isonzo to join those leading to the old Austrian positions. In spite of prolonged and furious bombardments, and infantry attacks renewed again and again, the defenders succeeded in maintaining their principal line of resistance on the battered mountain, though they were driven off more than once. With the failure of the attack on San Gabriele, the hope of finding, at least, a way through the defences of the Gorizia zone was abandoned for the time.

Cadorna hoped to renew his offensive at the end of Sept., when he had rested his troops and replenished his supply of shells, by an attack against the Ternova plateau, in the hope of definitely turning the Gorizia positions from the N. and cutting the main line of communications between the Austrian right and left. The III. Army was to hold the troops on its front and pass to the attack when the right wing of the II. Army had made the necessary ground. The drawback to this plan was that it left the Tolmino bridgehead in undisturbed possession of the Austrians, and by advancing the Italian right increased the danger which would come from an Austrian drive in this sector. But Cadorna had faith in the natural and prepared strength of his positions opposite Tolmino, and if he were to succeed in his attack upon the Ternova plateau, the chances were that his adversary would be too busily employed to attack his left at Tolmino.

Towards the middle of Sept. news came of increased enemy forces and a probable counter-offensive at an early date, and when Cadorna took stock of his forces he decided that he could not go on. He came to this decision on Sept. 18, and on that day he gave orders to the II. and III. Armies to "concentrate all their activities in preparations for defence." At the same time he communicated his decision to the Allied commanders, explaining his reasons. Unfortunately, there was a misunderstanding caused by a hasty and incomplete transmission of Cadorna's memorandum to the Allies. The first news received by Gen. Robertson did not give Cadorna's reasons for suspending his offensive action, and the result was a telegram which said that the 64 British guns sent to the Italian front had been given for offensive purposes, not for defences, and requested their withdrawal. A similar request came from France, for the return not only of the 35 guns which had been in action already, but of a further reënforcement of 102 guns which were arriving. Cadorna at once ordered the guns to be returned, but he pointed out that he was the only judge of what should or should not be done on the front for which he was responsible, and he took very natural exception to the tone of the communications which he received from England. The arrival of Cadorna's explanatory memorandum relaxed the tension, and some of the British batteries were left in Italy. The others, however, were sent to Egypt, and the French guns were withdrawn. This misunderstanding emphasized the drawbacks of the absence of a permanent inter-Allied war council, which was only to come into being when disaster had taught a further lesson.

Cadorna's reasons for suspending his offensive, or rather for giving up the idea of a new attack, can hardly be questioned. The four weeks fighting in Aug. and Sept. had cost him over 166,000 men—40,000 killed, 108,000 wounded, and over 18,000 prisoners. His casualties from May to Sept. reached the total of 92,000 killed and 226,000 wounded. The toll taken by sickness had also been very heavy. There had been much malaria among the troops in the low ground near Monfalcone. a severe type of jaundice had made its appearance in various parts of the front, and the II. Army had suffered severely from an intestinal epidemic which had been prevalent in the Judrio and Natisone valleys. The units were at a low strength, and the new drafts had not been satisfactorily absorbed. A breathing space was urgently needed.

A number of Cadorna's critics have urged that the best way of meeting the forthcoming enemy attack was to anticipate it by renewing his own offensive. But the weakness of his units and the shortage of ammunition made it very doubtful whether he could win even an initial success. The one thing certain was that he would suffer heavy losses and reduce to danger-point his limited reserve of shells. He had to look forward, and face the fact that if strong enemy reënforcements were already coming from Russia these were only the advance-guard of what was to be expected within a few months. If he were to gain the small amount of ground that seemed all he could hope for, he would find himself in a much less favourable position to meet a later attack from still stronger forces.

The Austro-German success against the II. Army, and the subsequent retreat of the Italian forces to the line of the Piave, and the resistance in the new positions, are fully described in a separate article (*see* CAPORETTO, BATTLE OF), and only a bare record of facts need to be given here. The Austro-German forces under the command of the German General Otto von Below (XIV. Army), divided into four "groups," attacked the left wing and centre of the Italian II. Army on the morning of Oct. 24. The Italian line was pierced between Tolmino and

Caporetto, and by the afternoon of the 24th the situation was already serious. Owing to a complex of causes the situation grew rapidly worse. The Italian left wing crumbled, and on the night of Oct. 26–7 the order was given to retire beyond the Tagliamento. This was only a first step in the move decided upon by Cadorna. In view of the breakdown of the II. Army and the danger of attack from the N., Cadorna decided that it was essential to shorten his line by a retreat to the Piave. He had already foreseen such a contingency (*see* ASIAGO, BATTLE OF), and after the failure of the Austrian offensive of May 1916 he had given orders for the preparation of a line of defence on the mountain ridges between the Piave and the Brenta and to the N.E. of Asiago.

By the end of the first week in Nov. the Italians were in line W. of the Piave. The III. Army, reënforced by the VII. Corps of the II., held the greater part of the river line, and was in touch with the IV. Army, which had come down from Cadore and occupied the northern sector of the river line and the mountains between the Piave and the Brenta, where it had established contact with the right wing of the I. Army. The remnants of the II. Army and the Carnia force were being reassembled in the Venetian plain.

In the meantime France and England had acted with all possible speed. As soon as the gravity of the situation became apparent the order was given for six French and five British divisions to entrain for Italy, precedence being given to the French troops, and Foch and Robertson hastened to the spot. Foch arrived at Treviso, where Cadorna had been for three days, on the morning of Oct. 30, and the situation was fully discussed. Cadorna felt that the troops available for the defence of the Piave line were dangerously weak in numbers, the more so as he was anxious to detach two divisions of the III. Army to reënforce the line W. of Lake Garda, where there were rumours of intended attacks, and he suggested to Foch that as soon as the French troops arrived they should go into line on the Montello, between the III. and IV. Armies. Later in the day, having received further news regarding the threat W. of Garda, he asked that Foch should detach a French division to reënforce this sector. Foch was unwilling to divide the French X. Army, and it was finally agreed that the French, as they arrived, should be aligned between the Mella and the Adige, ready to reënforce the I. Army in case of necessity, the defence of the Piave line being left to the Italian troops. Foch agreed with Cadorna's dispositions for the defence of the Piave line, but he was naturally much preoccupied by the appearance which the situation presented: weary disheartened troops, insufficiently provided with guns and ammunition and relatively weak in numbers, facing a greatly superior army flushed with a victory that had exceeded all hopes. And behind these, their only reserve, with the exception of the young boys recently called to the colours and a limited number of troops from the depots, was a great mass of broken troops largely without arms and equipment, who had lost order in the immense confusion of the heavy retreat. These troops, disorganized, worn-out, sullen and bewildered, might well have seemed more of a danger than a potential reserve of strength. There had been a failure in *moral* among certain units in the first phase of the fight. It had spread during the retreat. None could be sure how far it had gone or would go.

The Italian losses, both in men and material, had been enormous. To the casualties suffered in the enemy attack upon the II. Army, some 10,000 killed and 30,000 wounded, were added some 230,000 missing, who had already surrendered, or were still fighting hopeless isolated actions among the mountains, cut off and doomed. The retreat was not yet over, and the list was sure to be swelled still further. Many guns which had been brought safely as far as the Tagliamento had been lost owing to the premature destruction of the main bridges between Codroipo and Casarsa. When the material losses came to be calculated, the figures were as follows: 3,152 guns, 1,732 trench mortars, 3,000 machine-guns, 2,000 "pistol" machine-guns, considerably over 300,000 rifles, and an immense mass of stores and war material of every kind.

On Nov. 4 Mr. Lloyd George, Gen. Smuts, Gen. Sir Henry Wilson, M. Painlevé and M. Franklin Bouillon arrived at Rapallo, and were there met by Gens. Foch and Robertson, Signor Orlando (who had just succeeded Signor Boselli as Italian premier), Baron Sonnino, the Foreign Minister, Gen. Alfieri, Minister of War, Gen. Porro, sub-chief of the Italian general staff, and M. Barrère, French ambassador in Rome. From the Rapallo discussions were born the Supreme Allied Council which was to meet, once a month if possible, at Versailles, and the Versailles Military Council, which was to sit permanently. It was agreed that the failure of the Italian armies to resist the enemy attack called for a change in the Italian command, and Cadorna was appointed Italian military representative at Versailles. He was succeeded by Gen. Armando Diaz, commander of the XXIII. Army Corps, and the functions of Gen. Porro, who was also relieved of his post, were divided between Gen. Giardino, who had been Minister of War during the summer, and Gen. Badoglio, commander of the XXVII. Corps. These were all comparatively young men, who had come to the front during the war. Diaz was not yet 56, Giardino was 53, and Badoglio was only 46.

The moment was critical in the extreme, for the reasons given above, but the work done by Cadorna during the last days of his leadership had laid solid foundations for the wonderful recovery that put a term to the enemy advance. Cadorna's conduct of the great retreat was a masterpiece of military skill and cool judgment, and he had long ago made his plans for a defensive battle on the Piave line.

A legend was put about both in France and in England that the Italian command wished to continue the retreat to the line of the Adige, and it was asserted that only Foch's intervention prevented this further retirement. The legend had no basis of fact. Both the Italian and Allied press indicated the possibility of a further retreat, and their opinion was no doubt inspired by soldiers who realized the dangers of the situation and by politicians who wished to prepare opinion for the possibility of a further enemy success. But neither Cadorna nor Diaz had any intention of leaving the Piave line, unless, of course, the step was compelled by a new defeat. The line of the Piave was to be defended "to the last." Cadorna's orders are quite explicit, and he never entertained the idea of a retreat to the Adige unless he were forced back from the Piave line, or had his flank turned by an attack from the north. Diaz was no less resolved that resistance on the Piave line was the only possible course. An order of the day published by Cadorna on Nov. 7 fixed the Piave as the line on which "the honour and life of Italy" must be defended, and this blunt statement unhedged by reservations, frightened the politicians. They feared that after such a statement the effect of further disaster, if it should come, would be more serious. But the soldiers realized the mistake of playing with the idea of a further "strategic retreat," and when Diaz was asked his view, he said plainly that he would resign rather than carry out such a plan.

Both Cadorna and Diaz, who succeeded him on Nov. 9, were convinced of the necessity of standing on the Piave, and they had good hopes that their troops would hold. The Allied commanders were equally against any further retreat, but they were strongly impressed by the uncertainty of the situation. The break-through at Caporetto was universally attributed to a failure in *moral*. Since that failure the Italian armies had undergone the trial of the retreat, and they were weakened by great losses of men and material. Would they "come again," or would their *moral* suffer a more widespread breakdown under a new strain? It was natural that both British and French commanders should hesitate to send in the Allied troops to the front to stiffen it by units as they arrived. There was the chance that they might be involved in a fresh disaster, and in the circumstances it was obviously more prudent that both French and British armies should be held intact on a reserve line. The French X. Army stood behind the Italian I. Army, while the British divisions under Gen. Plumer, which began to arrive as soon as the railway communications from France were free from their transport, were detrained at Mantua and assembled near the Adige.

On Nov. 10, the day after Diaz took over the command from Cadorna, came the first enemy attack against the new lines, a tentative action on the Middle Piave, but after several unsuccessful attempts to pierce the line W. of the river, the Austro-German efforts were concentrated on the mountain front, between Asiago and the Piave. The main thrust was between the Brenta and the Piave, where a desperate struggle raged for weeks, though Conrad gained ground in the Asiago uplands, and might perhaps have gained more if he had been given the reënforcements for which he called in vain. The critical period was the fortnight from Nov. 10–25, and the end of the month saw the line fairly established. The Austro-German attack was to continue for another four weeks, and the Italians were to lose more ground in the mountains, more prisoners and some guns. But the crisis was past.

At the end of the third week in Nov. the Allied divisions began to move up to the front, and at the beginning of Dec. they took over the sectors assigned to them, three French divisions occupying the Monte Tomba–Monfenera ridge W. of the Piave and a similar British force holding the Montello sector, on the Middle Piave. It was expected that the enemy would attack at both these points, but throughout Dec. Boroevich's Isonzo army lay practically idle to the E. of the Piave, nor were the French attacked. The aim, naturally, was to attack as far W. as possible and so turn the Italian positions from the N., and compel a further retreat. Conrad in the Seven Communes and Krauss in the Grappa sector hammered in vain, favoured by the late coming of the snow, but hampered by bad weather and insufficient communications. Their efforts were fruitless. On both sides of the Brenta the Italians fought them to a standstill, and on Christmas day the long struggle ended, with the Italians counter-attacking, and the enemy hard pressed to hold the slight advantages they had won.

The Italian recovery on the Piave–Grappa line, that great triumph over disaster and despair, was one of the most remarkable achievements of the war. On the result of the fighting in those November days depended the ability of Italy to continue playing a principal part in the world-struggle. Further defeat would not have meant submission, for the Austrian invasion had stilled the questioning voices and bound the nation in one resolve. But further defeat, with its consequent loss of war material and territory, would have so weakened Italian military strength as to render still more critical the position of the Allies. If Austria had been able to assist Germany the following spring, the course of the 1918 campaigns would certainly have been changed. Hence the service rendered to the Allies by the men who held fast on the Piave and in the mountains was incalculable.

During Nov. and Dec. the Italian armies suffered further heavy losses, some 20,000 killed and 50,000 wounded, and the total number of prisoners lost in the last three months of the year, including those belonging to labour battalions and the sick and wounded left behind in hospitals or on the field, was increased to 335,000. The total loss in men from Caporetto to the end of the year was close upon 450,000. When to these are added the disorganized troops of the II. Army, and the Carnia Force and the stragglers from the III. Army, the temporary loss may be calculated at 750,000. But the prompt arrival of the British and French troops and the quick reorganization of a portion of the broken units shortened the critical period. The Allied divisions, as has been said, were in position by the beginning of Dec., and before that time two corps of the II. Army had been reconstituted and had gone into line. Another followed immediately afterwards, and by the end of the year two others were reformed and ready. For the remaining three disbanded corps, which were reorganized as the V. Army, under the command of Gen. Capello, late commander of the II. Army, a longer period was necessary. In the case of these units the loss of cohesion had been more complete, and, moreover, the supply of guns, rifles, etc., was insufficient to arm them. When they moved into the zone of operations in Feb. they were still partially equipped with French guns and rifles, but before long these were replaced by Italian material. In addition to the reorganization of these units, a system of march brigades was instituted for the retraining of stragglers and other troops superfluous to establishments.

The winter saw a comprehensive reorganization of the whole Italian army. There was a technical reorganization, based on a recognition of new war conditions, and greater attention was given to specialized instruction, both for officers and men. More important still were the measures taken for the welfare of the troops and their families. The shock of disaster and invasion had brought about a great reaction both in the army and the country, but it was clearly necessary to alter the conditions which had made some of the troops inclined to lend an ear to the peace propaganda which had been rife during the summer. Diaz devoted special attention to this work, and it would be difficult to exaggerate the value to the Allied cause of the great task of reorganization carried out by him during the winter.

After the failure of Krauss and Conrad to break through to the Venetian plain, the Italian front saw no action of first-class importance for nearly six months, but there were several minor combats worthy of mention. The first of these was a brilliant attack by a French division on Monte Tomba, which finally drove the Austrians down the northern slope of the ridge to the Ornio torrent. The artillery preparation was particularly destructive, and the positions were stormed with great dash. Nearly 1,500 prisoners were taken, and the French losses were insignificant. This attack was followed by two small Italian attacks, on the Lower Piave and on Monte Grappa respectively, which showed that the troops had regained their offensive spirit and, at the end of Jan., by a notable success in the Asiago uplands. Two important positions were wrested from the Austrians and held against repeated counter-attacks. More than 2,500 prisoners were taken, with six guns and 100 machine-guns. The only other important feature during the winter months was supplied by the Austro-German air raids against Padua and Venice and the little towns of the Venetian plain, and the activity of the Allied airmen along more legitimate lines.

Gen. Otto von Below and the German divisions left the Italian front at the beginning of 1918, in anticipation of the great offensive which was being prepared on the western front. Austrian and German divisions were now coming W. in increasing numbers from the Russian front, and it was clear that both armies would attack at the earliest possible moment. Gen. Plumer left Italy to take up his old command when it was evident that the German blow would come first. He had acquired a great popularity among all with whom he came in contact and his departure was much regretted. Fortunately he left in the Earl of Cavan an admirable successor.

The spring saw a change at the Italian headquarters. On the appointment of a commission to enquire into the Caporetto disaster Cadorna was recalled from Versailles and replaced by Giardino, who had shared with Badoglio the duties of sub-chief of staff. This appointment was only temporary, for shortly afterwards Giardino and Di Robilant changed places, Di Robilant going to Versailles and Giardino assuming command of the IV. Army.

When the German offensive in March 1918 pierced the line of the British V. Army four French and two British divisions were immediately withdrawn from Italy to reënforce the Allied armies in France. These were followed by the Italian II. Corps under the command of Gen. Albricci, which was to distinguish itself in the fighting W. of Reims. This left Diaz with 55 divisions (50 Italian and 5 Allied) as against 60 freshly organized Austrian divisions. The Austrian command had taken the opportunity of the winter lull to reorganize the army, of which 60 divisions were now concentrated on the Italian front, and, according to Krauss, the reorganization gave rise to great confusion and much unnecessary work and fatigue. It was probably due to this work of reorganization that the Austrian offensive which was expected in April was planned for the end of May or beginning of June.

The original proposal of the Austrian command was to make a drive on both sides of the Brenta and concentrate upon this single attack, but Conrad thought the sector unsuitable and pressed for an attack upon the line in the Asiago uplands. Krauss was consulted, and disapproved of both plans. He argued that the aim of an offensive must be the destruction of the Italian army, and that this could only be achieved by an attack farther W., on both sides of the Lake of Garda. A successful break-through by the Val Lagarina and the Giudicaria would cut off the whole Italian army, while the other attacks could do no more than force a retreat. He pointed out the great difficulty of movement, both of guns and troops in mass, in the Brenta and Asiago sectors, and claimed that his plan, based upon good communications, was in every way preferable.

Krauss's plan found no support, and it was arranged that Conrad should have his way. But Boroevich urged that the main offensive should be accompanied by a straight drive by his armies across the Piave. He apparently thought that this should be the main operation, and opposed the attack in the Asiago uplands, but a compromise was effected, and both army groups attacked on June 15. Conrad attacked with Scheuchenstuel's XI. Army, from S. of Asiago to Monte Grappa, the main drive being against the British and French divisions S. of Asiago, who had taken over this sector in March, while the Archduke Joseph attacked the Montello and Werzel von Wurm crossed the Lower Piave. Conrad had 27 divisions at his disposal, and Boroevich 23. Conrad's attack was a complete failure. It went well to begin with, but by the end of the day all hope of success had gone. Counter-attacks had retaken most of the positions lost in the first rush, and by the evening of June 16 Conrad was finally beaten. Boroevich on the other hand made good headway on the first two days. Though his principal attack, astride the Oderzo-Treviso railway, was immediately held up, he succeeded in establishing three bridgeheads across the Piave, and at two of these on the Montello and opposite San Donà del Piave, the attacking troops penetrated some distance westward. In various places the Italian front lines were quickly overrun, and many prisoners were taken. But a very thorough defensive system had been prepared, and while the front lines had been comparatively lightly held, there were ample reserves on the spot and within easy reach. After a week's fighting, at the end of which time the Austrians were being closely held within the limited room they had won, and had lost ground in various places to Italian counter-attacks, the order was given to retire across the Piave. Some days previously the attacking troops had been handicapped by the sudden rising of the Piave, but the river was falling again before the retreat was ordered and Boroevich, in a letter written after the battle, lays the blame, not on the Piave, but on Austrian headquarters, which had failed to organize the attack on proper lines and give the necessary supplies in time.

It is clear that the offensive suffered from the struggle between two opposite views, that of Boroevich and that of Conrad, and that strength was distributed instead of being concentrated. But Conrad probably had as many divisions as he could use in the sector he chose for his attack, and it is difficult to see that Boroevich could have won a big success even if he had been able to dispose of more troops. A concentration of force in the mountains and an extension of Conrad's attacking front farther W., to include the Val d'Astico and even the Val Lagarina, might perhaps have offered a better chance, but judging from the circumstances and issue of the fight it is hardly likely that any different plan would have led to a victory worth gaining. Even where the attack was initially successful, it was fairly held when the reserves of the defence came into play. The fact is that the Austrians had greatly under-estimated the Italian powers of resistance. Von Cramon stated that the spirit of the Austrian troops was excellent, and that every technical preparation had been made—that both Conrad and Boroevich reported in this sense to the Emperor.

The Austrian failure was costly, for the casualty list totalled over 135,000 and more than 24,000 prisoners were taken; but the moral effect of the defeat was far more important than the material loss, grave though that was. Few single weeks throughout the whole war saw more bloodshed, for the Italian list of killed and wounded was over 40,000. No single week, perhaps, up to this point, led to so evident a victory or marked so clear a turning point. The defeat on the Piave and in the mountains broke forever the offensive power of the Austro-Hungarian Empire, and the fact was plain to see. There was, moreover, a further significance in the Italian victory. It was the first Allied success of the year, and it came at the end of a period in which the resistance of the Allied arms had been tried to the uttermost. The message which Mr. Lloyd George sent to the Italian premier, Signor Orlando, gave full emphasis to the fact. "This great success has been a deep source of encouragement to the Allies. Coming as it has at the most fateful hour of the whole war, it is a good augury that the alliance of free nations will ere long free the world once for all from the military domination which has threatened it so long."

The defeat made a profound impression in Austria-Hungary, and led to much criticism of the army command. The discussion was specially bitter in the Hungarian Parliament, for the Hungarian troops had suffered very heavily, and it was alleged that the attack had been conducted with insufficient means. This charge was not borne out by the facts, and it was proved that the attacking armies were stronger in artillery and better supplied with shells than ever before, a comparison with the guns and shells available for the Caporetto offensive the previous year showing a very large increase. But the consciousness of impending disaster grew and spread through the monarchy and the troops were greatly disheartened by failure.

Prior to the Austrian attack the Italian command had had under consideration the question of an anticipatory offensive, on the Asiago plateau, with the object of gaining depth of position, and, if possible, of reaching the main Austrian line of communication between Trento and Feltre. When the extent of the forthcoming enemy offensive became apparent, this plan was given up and the Italian armies stood on the defensive. The general situation, and particularly the supply of guns and men available, did not allow the concentration on the Asiago plateau of a force sufficient to carry out the attack contemplated. When the Austrian offensive was broken and the armies of Conrad and Boroevich thrown back in disorder, the question of a counter-offensive on the grand scale was considered by the Italian command. Lord Cavan urged that the original plan should be carried out, and was of opinion that Conrad's troops were so demoralized that an attack in the Asiago uplands early in July would lead to a very important success. Local counter-attacks by Italian troops, both on the Piave and in the mountains, gave good results, important positions being occupied and many prisoners taken W. of the Brenta, in the Grappa sector and on the Lower Piave, but as the enemy put up a stout resistance and the Italian losses were heavy, Diaz did not feel himself strong enough to attack in force without further careful preparation. His armies on the Piave had suffered severely, he had only six fresh divisions on the spot, and, above all, as his report states, "the supply services—never very ample—had been severely strained and were quite unequal to fresh operations over a wide area." A general counter-offensive, to include an attack across the Piave, was not practicable without prolonged and careful preparation. The same considerations did not apply in equal measure to an offensive operation on the Asiago plateau, where there was no treacherous river to cross, but Diaz was preoccupied by the question of reserves. Excluding the boys of the 1900 class, who were being held in reserve against the possibility of the war continuing into another year (at that time the possibility was generally regarded as a probability, if not a certainty), his supply of men was little more than sufficient to make good the normal wastage of the next six months. An immediate attack in the Asiago uplands might very well have led to important results—looking back after the event with further information available, the chance of success can be seen more clearly—but at the moment the general circumstances of the war seemed to impose caution. In July Germany was still on the offensive, though the failure E. and W. of Reims in the middle of the month and Mangin's great counter-blow a few days later were finally to put an end to all hopes of victory on the western front. But Diaz had to count upon his own resources, and he had to take into consideration the possibility that Germany might succeed in establishing a defensive front in France, and join Austria-Hungary in a last attempt against Italy. He had to be prepared for defence as well as attack, and his weakness in man-power and material enjoined caution. He decided to wait until his units were remade, his stores of ammunition replenished, and his supply services reënforced. Plans were drawn up and preparations made for an offensive between the Vallarsa and the Brenta in the middle of September.

The considerations which governed the Italian preparations were resumed by Diaz in a report published in the spring of 1919. "The plan for the offensive, considered by itself, had to aim at assisting the general effort of the Allies to the utmost in accordance with two different and possible solutions; to drive the attack home with all available forces, throwing even the last available man into the scale, in case the possibility presented itself on the fronts of the Entente of obtaining a real superiority of forces and of gaining a decision at one blow; or else to make a preparatory attack as a first phase of a more complex effort, in case the enemy, although already beaten, should succeed in reëstablishing a solid defensive front in all the theatres of war." Diaz did not think that the time was ripe for the more ambitious effort, but he did not lose sight of the possibility which might be afforded by a change in the course of events. He prepared for the attack between the Vallarsa and the Brenta, but at the same time, according to his report, "another and bigger scheme was being silently matured in the interior of the *Comando Supremo*, entrusted to a few men only to be worked out and guarded with the strictest secrecy."

In the meantime a joint Franco-Italian offensive in Albania had caused the Austrians some trouble and compelled them to reënforce their line. They had lost several thousand prisoners, and the Italians had occupied both Berat and Fieri. This occupation was only temporary. When Gen. Pflanzer-Baltin arrived with reënforcements in Aug. the Italian line, which was too far ahead of the French on their right, was withdrawn to the high ground S. of Berat and the Semeni river. Although the Italians had a large force in Albania (nearly 100,000 men), the difficulties of communications and the ravages of malaria made prolonged operations nearly impracticable, but the advance upon Berat served a useful purpose in detaching enemy reserves from a sector where they were badly needed, for the Allied attack against Bulgaria was imminent.

Early in Sept. Diaz went to Paris to discuss the situation. He was still preoccupied in regard to his reserves, and in view of the very large number of American troops now in France he urged that a strong American force should be sent to Italy, not to take part in the offensive planned for the middle of the month, but to act as a reserve in case of need. He pointed out that he was still inferior in numbers to the enemy, and that in spite of great efforts on the part of the munition factories he had no marked superiority in guns. He had to attack an enemy who held very strong positions, and he was without what an Allied committee of experts had agreed were the two essentials to a successful offensive—tanks and *ypérite* gas. He was not satisfied that the *moral* of the enemy troops had fallen so low as to have any marked effect upon their powers of resistance. Several minor actions undertaken with the express object of testing their *moral* had found no lack of combative spirit. The appeal for American reënforcements did not commend itself to the Allies, who thought that the situation demanded the concentration of every available man and gun against the German armies, now very hard-pressed. Diaz was urged to attack with his own forces, and it was pointed out that the desperate internal conditions in the Austro-Hungarian Monarchy must have affected the spirit of the army.

Diaz was not convinced by the arguments addressed to him in Paris, and the denial of American reënforcements, to be on the spot in case of need, was strongly felt at Italian headquarters. Diaz was determined to choose his own time for his attack, and Badoglio was at one with him. Waiting meant an increased supply of guns and shells, apart from other advantages. The situation was summed up in the report already quoted: "The *Comando Supremo* would never have been induced to incur a useless sacrifice of men, but it was ready to take any risks as soon as ever the situation rendered this useful and necessary."

The Italian command was severely criticised for its cautious attitude, in Italy as well as in the Allied countries, and as time went on, leaving the date originally fixed for the Asiago offensive so far behind as to preclude the explanation of a delay due to weather or to the necessity of putting the finishing touches to preparations, criticism in some quarters descended to the level of recrimination. Italy's difficulties and Italy's losses had never at any time been properly realized in England and France, and it was only natural that now, while British and French troops were slowly driving the Germans back and no news came from the Italian front, there should be a revival of the suggestion, so strangely current at various periods of the war, that Italy "was not pulling her weight."

This was ignorant criticism, but the Allied commands also felt strongly that Diaz was now in a position to attack, and the order had already been given to withdraw a portion of the British force in Italy when Diaz disclosed his plan for an early offensive on the grand scale. The general situation had been definitely changed shortly after the Paris visit. In the middle of Sept. the victorious advance from Salonika began, and seemed to offer the chance for the more ambitious scheme which had already been under consideration. The final details of this scheme were quickly worked out, and "on Sept. 25, four days before the conclusion of the Bulgarian armistice, orders were issued for a rapid concentration of troops, artillery, and technical services in the sector chosen for the attack, which was no longer the plateau, but the Middle Piave" (Gen. Diaz's report).

The Italian plan was to concentrate on the river front between Pederobba and Ponte di Piave (E. of Treviso), to cross the river and break through by way of Conegliano to Vittorio Veneto, dividing the Austrian V. and VI. Armies. The general situation rapidly improved, and it was clear that the German request for an armistice on Oct. 4, to which Austria-Hungary subscribed, would further weaken the resisting power of the troops of the monarchy. The attack was fixed for Oct. 16, but bad weather and a rise of the Piave caused a delay which was used to extend the plan of operations. It was decided to open the action with an attack by the IV. Army in the Grappa sector, with the double object of drawing the enemy reserves from the Feltre sector and of breaking through in this direction. The attack on the Piave was to be carried out by three armies, the XII., VIII. and X., of which the first and last had been formed specially for this offensive. The XII. Army, which included a French division, was commanded by Gen. Graziani, the commander of the French troops in Italy; and the X. Army, which included the British XIV. Corps, was commanded by Lord Cavan. The main drive was to be made by the VIII. Army, attacking from below Pederobba to Ponte della Priula. The XII. Army was to advance northward astride the Piave, while the X. Army was to attack the right wing of the Austrian V. Army and form "a defensive flank to cover and protect the principal manœuvre of the VIII. Army" (Gen. Diaz's report). The attacking mass consisted of 22 divisions, of which two were British and one French, while 19 divisions were held in reserve. Against this force the Austrians had 23 divisions in line or immediate reserve, with 10 more divisions within reach. Nearly half the Austro-Hungarian force (30 divisions) lay between the Stelvio and the Brenta, or along the Lower Piave, while in these sectors the Italian forces had been reduced to a total of 16 divisions.

The IV. Army attacked at dawn on Oct. 24, and though some headway was made the enemy put up a very stubborn resistance.

In the early hours of the same day British troops occupied the long shoal island of the Grave di Popodopoli, crossing the main channel and driving back the Austrian outposts. The general offensive should have followed the next night, but a sudden rise in the river counselled delay, and it was not until the night of Oct. 26 that the bridges began to be thrown across the river for the main attack. Next day three bridgeheads were established: opposite Pederobba, N. of the Montello, and opposite the Grave di Popodopoli. The most important advance was made in the latter sector, where the X. Army succeeded in advancing to a depth of over two miles, and took over 5,000 prisoners. North of the Montello the left wing of the VIII. Army gained about a mile, though its bridges were all destroyed during the day, but the right wing of the army was unable to throw its bridges and only a detachment of storm-troops reached the left bank. There was a gap of some six miles between the left wing of the VIII. Army and the British Corps which formed the left wing of the X. Army, and the chief move in the general manœuvre was checked. No better fortune attended the efforts made the following night. The swift current and the enemy guns defied all attempts to establish the bridges, and the engineers suffered very heavy casualties. In spite of the initial successes, the situation was unsatisfactory, but after the first failure to cross the river E. of the Montello Gen. Caviglia, who commanded the VIII. Army and had the general direction of the attack, had detached the XVIII. Corps to cross by the X. Army bridges, push N. and clear the front of the troops who were held up. The move was entirely successful. The XII., VIII. and X. Armies all made good progress, especially the X.; the separation of the Austrian V. and VI. Armies was effected, and on Oct. 29 troops of the VIII. Army reached the town of Vittorio Veneto. By that evening the attacking armies had taken 33,000 prisoners, and the position of the Austrian troops on the Piave front was hopeless. Next day resistance broke down, and the retirement which had already begun became a complete rout. The troops on Monte Grappa had hitherto held firm against the repeated attacks of the IV. Army, losing little ground, but here too, on the night of Oct. 30, a retreat began that was to turn into a flight.

Late on the evening of Oct. 30 the Austrian command announced that in view of the discussions regarding an armistice which were being conducted between Germany and the United States "our troops fighting on Italian soil will evacuate the occupied region." On the same day the order for a general retreat was given, and that evening, in the Val Lagarina, Gen. Weber von Webernau, commander of the VI. Corps, made a formal demand for an armistice. Next day he and his staff were taken to the Villa Giusti near Padua, and discussions were begun. It was, of course, necessary to communicate with Versailles, where the Allied War Council was discussing the question of a reply to Germany's demand for an armistice.

Meanwhile the fighting continued, and the armies of the monarchy crumbled away. The Italian VI. and I. Armies attacked on the Trentino, and the III. Army, which had crossed the Piave two days before, was already taking part in the pursuit of Boroevich's broken divisions. On the night of Nov. 2–3, although the armistice was not yet signed, the Austrian command issued an order for the cessation of hostilities. It was at first revoked by the Emperor Charles, but was reissued and reached the front on the morning of Nov. 3. In point of fact the terms of the armistice were only agreed on verbally on the afternoon of Nov. 3, and signed at 6:30 P.M. Hostilities were to terminate at 3 P.M. on Nov. 4.

The Austrian surrender was complete. The troops of the monarchy were to retire beyond the Treaty of London line, leaving all war material and railway equipments. The army was to be demobilized except for 20 divisions at pre-war peace strength, and the Allies were to have the right to occupy any strategic points in Austria-Hungary which they might deem necessary, and were to have free right of passage and use of Austro-Hungarian means of transport "over all road- and rail- and water-ways in Austro-Hungarian territory."

When hostilities ceased Italian troops were far up the Trentino, in the Upper Adige valley and in the hills to the S.W. of Bozen, while in the main valley they had pushed beyond Trento and reached Salorno. Other troops had advanced far into Cadore, and to the E. the line of the old frontier was passed and the middle waters of the Isonzo were reached. On Nov. 3 Trieste had been occupied from the sea, and half an hour before the expiration of the armistice term an Italian force was landed at Zara in Dalmatia.

When the hour struck for the cessation of hostilities, more than 300,000 prisoners had already been counted by the Italians, and the total figure exceeded half a million. A number of troops who had been cut off were allowed to pass the frontier after being disarmed, but not much more than half of the Austro-Hungarian troops on the Italian front reached the territory of the crumbling empire. All material was left behind, including some 7,000 guns. The defeat was overwhelming.

The Austro-Hungarian armies, in spite of their bad food and growing depression, began by putting up a stout resistance. The troops in the Grappa sector in particular not only resisted firmly but counter-attacked with great vigour, and punished the Italian IV. Army very heavily. The seven divisions of the IV. Army lost over 20,000 men, nearly three-fifths of the total casualty list, which exceeded 35,000. The fighting on the river front was stiff at first, but the defenders were heavily out-gunned (their main artillery concentration was in the Grappa sector), and they were outmanœuvred and outfought by the attacking infantry. They were already soundly beaten when the order to retreat was given, and when that order reached them they threw up the sponge. Some of the reserve units had shown a disinclination to move up to the front, and two brigades had previously been sent to the rear because they could not be trusted. The troops in reserve had been more affected than those in line by the news of the general breakdown in Austria-Hungary, and they had no stomach for what must have seemed to them a useless fight. In the end the leaders too threw up the sponge. They knew, although the troops did not know, the hopelessness of the situation.

It was exactly a year after the great disaster of Caporetto that Italy shattered the armies of Austria-Hungary. Seldom in history has so great a disaster been followed by so complete a triumph. Yet the final overwhelming success of Vittorio Veneto was not Italy's greatest victory. The way to it was paved by greater deeds, the wonderful recovery on the new line after the great retreat, and the successful resistance against the last Austrian offensive that was the first ray of light to break upon those gloomy months when the fortunes of the Allies seemed at their lowest. Nor can the sum of Italian achievements be judged by the issue of those battles which were crowned with victory. Italy's achievement, her contribution to the great effort that led to the final triumph of the Allies, can only be gauged by a review of the campaign as a whole, by a realization of the extent to which she drained the resources of Austria-Hungary, and of the price which she paid. Her dead totalled 564,000 (a revision promised to increase this figure); her wounded exceeded 900,000; 570,000 men were permanently disabled for military service by wounds or disease. The proportion of dead to population (in 1915) was over 1.5%, nearly as great as the proportion suffered by the United Kingdom, and greater than the percentage of dead among the white population of the British Empire. For the first two and a half years of the war the Italian armies were fighting almost entirely in enemy territory, threatening the Austrians in a vital spot and keeping employed a number of enemy divisions that increased from 20 to 40 (in the summer of 1917). During the last three months of 1917 the number of enemy divisions rose to 55, and in 1918 practically the whole effective strength of Austria-Hungary was arrayed against Italy, the number of divisions at one time approaching 70.

The figures speak plainly, and Ludendorff, in an interview published in the spring of 1919, gave Italy her due in placing among the chief causes of the German defeat "the lack of support from Austria, gripped ever more tightly at the throat by Italy." Cadorna rightly claims that Italy's "grip on Austria's throat from 1915, compelling her to immobilize against us ever-increasing forces, constituted the most notable result of our war, although it was little apparent to the eyes of civilians. It contributed largely to the victory of the Allied arms and to our final triumph." (W. K. McC.)

ITALIAN LITERATURE (*see* 14.897).—In the decade after 1910 the best Italian writers had given up that exaggerated imitation of D'Annunzio which had prevailed at the opening of the century. Among the poets Giovanni Pascoli, Giovanni Bertacchi, Francesco Pastonchi and Ada Negri continued to produce actively. Pascoli was the most prolific, with his *Canzoni di Re Enzio, Il Paradiso, Il Carroccio*, the *Inni* to Rome and Turin, and the *Poemi italici;* Bertacchi published the *Canzonieri delle Alpi* and *A fior di silenzio;* Pastonchi *Il Randagio;* and Ada Negri some more lyrics, of which the most remarkable are *Dal profondo* and *Il libro di Mara*. G. A. Cesareo, best known as a literary critic, published a volume of verse entitled *I canti di Pan*. Among the younger poets Sem Benelli, chiefly a dramatic author and an active politician, published a fine poem entitled *L'altare;* Guido Cozzano a volume of lyrics *I colloqui;* Giovanni Castanzi *Luce lontana;* and Francesco Gaeta *Poesie d'amore*. The most prolific of the dialect poets was "Trilussa" (Salustri), who has written a number of clever satirical poems in the Roman dialect. An author of excellent Latin verses who came to the fore was Francesco Sofia Alessio, with his volume *Musa latina*, which also includes an Italian translation.

Among the novelists D'Annunzio brought out a strange tale in three volumes entitled *La Leda senza cigno*, and *Forse che sì, forse che no*, a long novel in which aviation plays an important part. Grazia Deledda continued her output of Sardinian stories, all more or less in the same grey pessimistic key—*La colpa altrui, Marianna Sirca, La madre*. Luigi Pirandello, one of the most prolific of Italian novelists, was in 1921 perhaps the best living Italian humorist; the most important of his recent novels are *Si gira, Suo marito, I vecchi e i giovani* (a political novel), *Terzetti*. Dora Melegari, essayist and literary critic, who writes in French as well as in Italian, has published a novel with a background of Risorgimento history, *La città del giglio*. Matilde Serao was still active, with her novels *Stella mattutina, Addio amore, Ella non rispose* and *Preghiera*. Cesare Pascarella, the well-known Roman dialect poet, produced a novel, *Le memorie d'uno smemorato*. Luciano Zuccoli, another very active young writer, published numerous novels, among which may be mentioned *La freccia nel fianco*, perhaps his best, depicting the development of a boy's soul from early youth to manhood; *Farfui, La divina fanciulla*. Giulio Bechi, a regular officer who was killed in the World War, wrote a novel, *I seminatori*. The Anglo-Italian writer, Annie Vivanti (Mrs. John Chartres), published two novels, *I divoratori* (about the war) and *Naja tripudians*. Alfredo Panzini, a young writer of originality, produced *La madonna di Mamà*, a war novel; *Santippe*, a half-classical, half-modern novel; and *Il mondo è rotondo*. Another very young writer is Rosso di San Secondo, author of *La fuga* and *La festa delle rose*. Perhaps the "best seller" in 1921 was Guido da Verona, whose novels, *La vita comincia domani, Colei che non si deve amare, Sciogli la treccia Maria Maddalena*, etc., combine a good deal of rather cheap philosophy with amorous adventures; his *Mimi Bleuette, fiore del mio giardino* is written partly in French. Of Virgilio Brocchi's many novels, *Il labirinto, Miti, Secondo il cuor mio, Il posto nel mondo*, may be mentioned, as well as several volumes of short stories. G. A. Borgese, professor of German literature and well known as a journalist and critic, tried his hand at fiction with *Rubè*, a novel of the post-war period and spirit. Among Mario Mariani's stories, *I colloqui colla morte*, impressions of the war and life in the trenches, is particularly striking. Francesco Sapori also wrote a war novel, *La trincea*. Guido Milanesi wrote some good sea stories, such as *La voce del fondo*, dealing with life on a submarine. Marino Moretti, Raffaele Calzini and Massimo Bontempelli are all prolific short-story writers, while the last-named is further known for his essays on the Greek classics. Ugo Ojetti, who is more generally known as an art critic, has also written a number of witty and satirical but somewhat bitter short stories.

The Italian stage is still too much under the predominance of foreign and especially of French influence to offer much attraction for first-rate native talent. D'Annunzio has, however, written much for the stage, and during the decade he produced his picturesque Venetian-Byzantine poetical drama, *La nave; Fedra*, a classical reconstruction; the mystery play, *Il mistero di San Sebastiano*, originally written in French; and *La Pisanella*, a vivid presentment of the mediaeval Levant, also written in French. His *Il ferro* is a drama of modern life with a plot reminiscent of *Hamlet*. Sem Benelli, already mentioned as a poet, has achieved considerable success with his historical plays, *La maschera di Bruto, Il mantellaccio*, and, above all, *La cena delle beffe; L'amore dei tre re* was less successful. Domenico Tumiati has written some plays on the Risorgimento—*Giovine Italia* and *Il Tessitore*, the latter with Cavour for its hero. The novelist Luigi Pirandello is also a dramatic author (*Pensaci Giacomino, Il giuoco delle parti, Il berretto a sonagli*). Alfredo Testoni, Fausto M. Martini, Dario Niccodemi have all written for the stage with some success. Among the most popular dialect plays should be mentioned those of Salvatore di Giacomo in the Neapolitan vernacular (he has also written a good deal of dialect poetry) and Nino Martoglio in that of Sicily.

The "futurists" continued their strange vagaries, and a small number gave proof of some real literary quality, but they showed signs of ceasing in consequence to be pure futurists and tending to become more normal. This is particularly the case with Marinetti, generally recognized as the leader of the movement, who was better appreciated as he became less futurist.

Diego Angeli produced an excellent translation of Shakespeare's plays into Italian verse; while Adolfo de Bosis's translations of Shelley and Homer reach a very high level.

The war gave rise to considerable literary but especially journalistic output in Italy. A large number of writers published articles, essays, and books on the various political and economic problems, especially those concerning Italy's rights and aspirations. Among the names appearing most frequently in the press and in the booksellers' windows are those of Virginio Gayda, author of valuable writings on Austria and Russia; the economist Prof. Antonio de Viti de Marco; Giuseppe Prezzolini; Giovanni Preziosi, the ardent Nationalist and editor of the monthly *La vita italiana;* Giuseppe Bruccoleri; Attilio Tamaro, a specialist on Adriatic questions; Umberto Zanotti-Bianco; the Nationalists Ezio Maria Gray, Francesco Coppola, Cantalupo, Leonardo Vitetti, the late Gualtiero Castellini, and the embittered anti-Nationalist historian Gaetano Salvemini.

The most eminent of the purely military writers is undoubtedly Gen. Cadorna, whose important work *La guerra alla fronte italiana*, in spite of its somewhat polemical character, is a most valuable contribution to the history of the war, and also a piece of real literature. Gen. Capello's books, *Note di guerra* and *Per la verità*, are also useful, while Col. Angelo Gatti's essays on various aspects of the war contain admirable criticism.

A curious book which does not come into any of the above categories is Giovanni Papini's *Vita di Cristo*, a paraphrase of the Gospels by an erstwhile freethinker turned mystic.

Perhaps the most distinguished living stylist in Italy in 1921 was Emilio Bodrero, professor of philosophy at the university of Padua and author of numerous literary and aesthetic essays, articles, reviews, as well as of some purely philosophical works of high scientific value. His literary activities were interrupted by the war, in which he distinguished himself for conspicuous gallantry in the field, but he subsequently resumed them as well as his lectures at the university. (G. B.*)

ITALO-TURKISH WAR, 1911–2.—Following upon the discussions which took place between Rome and Constantinople during the summer of 1911, an ultimatum from Italy was delivered to the Porte on Sept. 28, demanding Turkey's consent to a military occupation of Tripolitana and Cyrenaica. A period of 24 hours was set by the ultimatum, and as the Turkish reply did not meet the Italian demands a state of war was declared as from 2:30 P.M. on Sept. 29.

Military action was slow to succeed the formal declaration of war: the political situation had developed so rapidly that the diplomats had far outrun the soldiers. On Sept. 3 at the close of the Italian grand manœuvres, the 1889 class of conscripts had been dismissed, leaving only the 1890 class with the colours. On Sept. 23 the 1888 class was called up, and two days later secret mobilization orders were issued. It was no doubt in the belief that Turkey would yield to pressure that the ultimatum was presented more than a week before an expeditionary force could be dispatched from Italy. In the interval the Italian navy had to act alone, at first by demonstration and later in earnest.

On Sept. 28 an Italian squadron appeared off Tripoli, and the following morning an officer landed and informed the acting Vali that if a satisfactory answer were not received from the Porte that afternoon a state of war would begin. Next day, the news of Turkey's refusal having arrived, the blockade of Tripoli was declared, and the Turkish authorities were notified that if the town were not surrendered in three days it would be bombarded. Most of the Italian subjects resident in Tripoli had already left and those who remained were taken off on the morning of Sept. 30. Next day the cable between Tripoli and Malta was cut.

Meanwhile hostilities had begun elsewhere. On Sept. 29 and 30 Italian destroyers, under the command of the Duke of the Abruzzi, sank two Turkish torpedo boats off Prevesa, on the coast of Epirus, and on Oct. 1 Adml. Aubry left Augusta to go in search of the Turkish fleet, which the declaration of war had found at Beirut. He had with him the two battleships "Roma" and "Vittorio Emanuele" and the torpedo cruiser "Agordat," and on the way he was to pick up the battleship "Napoli," which was in the narrow seas between Sicily and Tripoli, and the two cruisers "Amalfi" and "Pisa," which had been sent to Derna, in Cyrenaica, to destroy the wireless station there. But the orders given to Adml. Aubry were suddenly countermanded. Instead of steaming for the Aegean in order to intercept the Turks, he was sent to Tobruk, which was occupied by a detachment of sailors on Oct. 4. Tobruk, which had been much discussed as a potential naval base, was thus the first point on the long coastline of Turkish N. Africa to be occupied by the Italians. The first detachment of the expeditionary force, moreover, which left Naples on the evening of Oct. 5, was sent to Tobruk instead of to Tripoli.

The renunciation of the attempt to cut off the Turkish fleet was a political move. The Italian Government believed that the Porte would soon realize that it was impossible to defend the Tripolitan provinces, and would be willing to enter into some arrangement which would satisfy Italian aspirations and save the face of Turkey. In these circumstances there was a natural disinclination to embitter relations by the destruction of the Turkish fleet. Another reason was the desire to localize the conflict, if a real conflict had to come. Italy was well aware that in declaring war against Turkey she ran the risk of stirring up further trouble, and if hostile operations could be confined to the African coast, the danger of other complications would certainly be lessened.

On Oct. 2 Adml. Thaon de Revel, who commanded the Italian cruiser squadron, landed in Tripoli under a white flag and again demanded the surrender of the town. The Turkish authorities, after a good deal of discussion, declined, and next day the Italian fleet bombarded the obsolete fortifications for about two hours. There was a mere show of resistance. The bulk of the Turkish garrison had already begun to leave Tripoli, and by the next day, in pursuance of the last orders received from Constantinople, all the troops had retired into the sandy plains. At noon the German consul reported the evacuation of the town. He stated that the Arabs had begun to pillage, and asked that troops should be landed at once. Next day a force of 1,600 sailors was disembarked, and two days later Adml. Borea-Ricci assumed the governorship of the town and received the submission of about a hundred sheikhs and other men of position, among them Hasuna Pasha Karamanli, lineal representative of the family which had ruled Tripoli prior to the Turkish occupation, and mayor under the Turkish régime. A week elapsed between the landing of the sailors and the arrival of the expeditionary force, and during this time the sailors, besides patrolling the town, had to hold a defensive line some 8 m. in length. If the Turks had chosen to attack, they could almost certainly have retaken Tripoli. But they made better use of the time allowed them. When the Turkish garrison retired from the town and the Italian sailors landed, the majority of the Tripolitan chiefs were ready to make submission. They had no love for the Turk, and little objection to a new overlord. Two men turned the scale in favour of resistance by supporting the efforts of Neshat Bey, the Turkish commander in Tripoli—Ferhat Bey, deputy for Tripoli, and Suleiman el Baruni, a Berber from Fessato, who was deputy for the Jebel region. Each was possessed of great influence in his own district, and was able, first, to prevent the submission of the tribesmen, and, as time went on, to bring native levies to support the Turkish regular troops.

The first Italian transports appeared off Tripoli at dawn on Oct. 11, and the disembarkation at once began. But bad weather made it difficult to land guns, stores and transport, and it was not until Oct. 20 that all the equipment had been put on shore. The expeditionary force consisted of some 9,000 rifles with a few field and mountain batteries and two squadrons of cavalry, but this force had only a very limited radius of action owing to lack of transport. The conviction that the Turks would not receive support from the native tribesmen, and consequently, would never retreat toward the interior, had limited the transport organization to what was necessary for a two days' march. General Caneva, who was in command of the troops in the two provinces and had assumed the governorship of Tripoli, was practically tied to his base. He was faced by an unexpected situation, caused by the retreat of the Turks, but all his information was to the effect that the Italian occupation would be welcome to the Arabs and Berbers. He believed that he could deal with the Turks at his leisure. He had not yet realized that the Turkish garrison was now a nucleus round which a formidable resistance was being built up, and that already a reaction against the invader was imminent.

Meanwhile Derna, Homs and Bengazi (Benghazi) had been occupied. At Derna and Homs the Turkish garrisons retired southward after a short bombardment. At Bengazi the Italian landing was opposed, and the town was only occupied after a long day's fighting, the Italians, who had disembarked to the south of the little port, losing over 100 men. There was no further fighting in the Bengazi district for a considerable time, but both at Derna and Homs there were sharp encounters during the first few days after the landing of the troops.

The blow against the Italians in Tripoli came unexpectedly. During the early days of the occupation the belief that the Arabs would never make common cause with the Turks led to an over-confidence and lack of vigilance. There was little apprehension of an attack now that the Italian troops were in great superiority over the Turks, and the conviction that the Arabs were friendly led to no hindrance being placed upon communications between the town and the surrounding country. Arabs, and supposed Arabs, came and went freely. It was due to over-confidence also that the disarmament of the natives was not pursued with vigour or system until it was too late. In this way it was possible for the Turks, and those Arabs who were opposed to the coming of the Italians, to arrange for a rising behind the lines which should coincide with an attack.

To the west and south the Italian lines faced the open, rolling plain, but on the east, for a distance of two miles, they ran through the wide strip of palm groves and fruit gardens that stretches eastward from the town for nearly a dozen miles. Against this part of the line the Turks and Arabs, favoured by the thick vegetation, attacked suddenly on the morning of Oct. 23, simultaneous demonstrations being made on the south and west. The attack upon the regiment of Bersaglieri who held the long line in the oasis was carried out with decision and was aided by a simultaneous attack from a number of natives within the lines. On the left, by the village of Shara Shat, two companies were overwhelmed and cut to pieces, and the rest of the regiment was hard put to it to hold its own. Supporting troops were sent up from the town, but they had to fight their way through the network of gardens, sniped by those of the local Arabs who had joined in the fight, and the much greater number who had come through the gap made by the destruction of the two companies at Shara Shat. The fighting lasted all day, but in the evening the assailants were finally driven off.

There was much excitement in the town during the morning, and a few Italian soldiers were killed, one of them by a *kavass* of the German Consulate. The streets were rapidly cleared, and there was a good deal of firing by the troops, mostly in the air. A few Arabs were shot out of hand, and the *kavass* above mentioned was executed after a summary trial. In the oasis, not only to the east of the town, but behind the southern lines, sniping went on all day, and the order was given that the oasis within the Italian lines should be cleared of its inhabitants, and that those found in arms against the Italians should be shot. The oasis was cleared during the next few days, and several thousand Arabs were brought into the town. There was a good deal of sniping, especially at first, and those who were found in possession of arms were either shot or brought into Tripoli under guard. Undoubtedly, innocent persons were killed during these days, but they were not very many, and most of them were shot by mistake in the confused bush fighting that succeeded the first inrush at Shara Shat. In all, according to the figures furnished by the Arab authorities, a little over 400 inhabitants of the oasis lost their lives. There were some cases of excess on the part of the Italian troops. Careful subsequent investigation showed that they were very few.

The European press, and especially that of England and Germany, was filled with messages which multiplied the number of Arabs killed by ten, and assumed that they were practically all unarmed and harmless peasants. It was soon realized that there had been gross exaggeration, and European opinion changed, but the fact that the repression had been severe, and that some innocent persons had been killed, was exploited to the utmost by the Turks in Tripoli and their supporters. Many men of the Tripoli district fought against Italy for a year in the mistaken belief that their families had been massacred.

The attack of Oct. 23 was followed three days later by another. The Turks and Arabs who attacked in the eastern oasis were beaten off after some hours' fighting, but south of the town the line was rushed by a large body of Arabs who penetrated into the gardens and were dislodged with difficulty by the reserves. For a short time the situation was anxious, but after about five hours' fighting the attacking tribesmen were driven off, leaving many dead. This fight showed that the line occupied was too long for the number of troops available, and it was reduced in extent by a considerable withdrawal in the eastern oasis. This withdrawal was made the subject of alarmist rumours in the European press and many thought that Tripoli would shortly be retaken; and the United States cruiser "Chester" was sent with orders to embark the American consul and any other American subjects. The consul declined to go, and his action was of value in indicating the true situation. No doubt, in addition to frightening Europe, the withdrawal encouraged the Turks and Arabs, who appeared to be in the position of besieging Tripoli. For a month the town did give the impression of being beleaguered; in reality, during this period, Gen. Caneva's chief enemy was cholera. The disease broke out towards the end of Oct. and for some weeks it caused much loss and still more anxiety. In all, nearly a thousand soldiers died of cholera, and the native population suffered heavily. The problem of tackling the epidemic was rendered more difficult by the large number of "immigrants" from the oasis, who had sought refuge in the town in the early days of the occupation, or had been brought in when the oasis was cleared. Prompt and effective measures were taken, but it was not until the middle of Nov. that the authorities could breathe freely, and for some weeks the situation required vigilance.

From the events of Oct. 23 and the following days it was clear that the calculations of the Italian Government had been at fault. Turkey was not prepared to lose the Tripolitan provinces without a struggle, and the local tribesmen were joining in the resistance of the garrison. Reinforcements were immediately dispatched to Tripoli, and on Nov. 5 a decree was published in Rome, annexing the two Turkish provinces. Italy was no longer inclined to consider a compromise, and the annexation was proclaimed in order to stop all efforts in that direction and define her intentions, not only to Turkey, but to the European Powers. Further reënforcements followed, and by the fourth week in Nov. Gen. Caneva had under his command 34 battalions of infantry (nearly 25,000 rifles) and 16 batteries of field and mountain artillery. On Nov. 26 an advance was made through the oasis on the east and the old lines were occupied after stiff fighting. Eight days after, on Dec. 4, a force of 12,000 men, with five mountain batteries and two squadrons, supported from the trenches by field guns and a few heavy guns which had arrived some days earlier, advanced into the plain against the main body of the enemy, which was based upon the little oasis of 'Ain Zara. It was hoped that the Turks would stand, but this was not their policy. They fought a stubborn containing action, and lost the few guns they possessed, but they retreated in good time, leaving to the quick-moving tribesmen the task of delaying the Italian advance. 'Ain Zara was occupied in force by the Italians, and Turkish headquarters were established at 'Aziziya, some 30 m. south of Tripoli, while a strong force, mainly Arab, was encamped at Suani Beni Adham, a day's march from the town. The eastern oasis was deserted by the Arabs, and its farthest point, Tajura, was occupied by the Italians on Dec. 13.

At the beginning of Nov. the Italian Government had considered the possibility of extending the theatre of war, by sea at least, in the hope of inducing Turkey to give up the struggle. Austria-Hungary intervened, backed by Germany, and on receipt of a report of Italian activity off Salonika, Count Aehrenthal told the Italian ambassador in Vienna that Italian action "on the Ottoman coasts of European Turkey or in the Aegean Islands could not be allowed either by Austria or by Germany, as it would be contrary to the Treaty of Alliance." He said further that he considered "the bombardment of ports in European Turkey such as Salonika, Kavalla, etc., as contrary to Article VII." (of the Alliance). Italy's action being limited in this way, it was necessary to solve the Tripoli problem directly, but the task was more difficult than it need have been owing to other limitations laid upon the military authorities by the Italian Government. Gen. Caneva's orders appear to have been that he must not risk reverses or suffer heavy loss. In the circumstances a desert expedition in pursuit of the Turks and their mobile auxiliaries seemed hardly practical. In any event, the four months following the battle of 'Ain Zara passed without any action of importance in Tripolitana. A flying column sent southwards from 'Ain Zara on Dec. 1919 had a stiff fight near Bir Tubras. The oasis of Gargaresh, 2 m. west of Tripoli, was occupied on Jan. 20, after a skirmish with a body of Arabs who came up from the south when the Italians advanced into the open. Five weeks later the situation at Homs was improved by the capture and retention against counter-attack of the Mergheb, a hill which dominates the little town. No other fighting took place in the western province until the spring was nearly over, though in Feb. the arrival of camels, motor lorries and Eritrean askaris seemed to point to an early advance.

During the period of inaction the relations between Italy and France came under a cloud. On Jan. 15 and 18, respectively, the French mail steamers "Carthage" and "Manouba," *en route* from Marseilles to Tunis, were stopped and brought into Cagliari by Italian cruisers. The grounds given were that the "Carthage" was carrying an aeroplane destined for the Turks, and that a Red Crescent Mission which was on board the "Manouba" included several Turkish officers. The French Prime Minister, M. Poincaré, made a speech that was exceedingly sharp in tone, and the press of both countries heaped fuel on the flames kindled by the incident. The matter was referred to The Hague, where the verdict was given in favour of Italy, but M. Poincaré's speech and the threats of the French press were not forgotten by Italian public opinion.

In Cyrenaica progress had been no more speedy than in the region of Tripoli. No effort, in fact, had been made to advance towards the interior, or even to extend the area of occupation round Bengazi, Derna and Tobruk. Nothing, certainly, was to be gained by an advance into the blank desert behind Tobruk, and it was decided to make no move from Bengazi and Derna. Enver Bey succeeded in reaching Cyrenaica early in the winter, and by his energy and personality he succeeded in organizing a formidable resistance, securing a unity among the tribesmen, and a willingness to coöperate with the Turks, which had never before existed. Under Enver's direction both Bengazi and Derna, but especially the latter, were closely beset throughout the winter. The Derna lines, which were dominated from the hilly ground immediately behind the town, were harassed frequently, and between the end of Dec. and the first week in March four important attacks were delivered at intervals of about three weeks. All these attacks were repulsed after hard fighting, and the result of the engagement of March 3, in which the attack was directed by Enver Bey in person, seemed to convince the Turks and Arabs that their attempts were useless. The neighbourhood of Derna remained quiet for nearly five months. At Bengazi, except for one reconnaissance in force at the end of Nov. when an Italian column went out some 6 m. from the town and returned after a sharp fight, there was no action of any importance till March. Blockhouses were built to secure the Italian lines, and these were occasionally attacked, but the Italians made no movement until March 12, when Gen. Briccola, who commanded the garrison, sent out a column to attack a large body of Arabs who had occupied an oasis, or rather a collection of gardens, known as the Two Palms, less than half-a-mile from one of the Italian redoubts. A mixed force of Turks and Arabs also approached the town from the south-east, but did not press home their attack. The Arabs in the oasis stood firm, but they were overwhelmed by the Italian attack and suffered very heavily.

After the battle of the Two Palms there was practically no fighting in the Bengazi district, but in April the long spell of inaction in the western province came to an end, and from that time onward the resistance of the Turks and Arabs was gradually broken by a series of operations at various points. On April 10 and 11 a landing was effected, without opposition, at Ras Makabes, a headland not far from the Tunis border, and a base was established near the old fort of Bu Kamesh. The Italian force consisted of two brigades, one from Tripoli and one from Italy, under the command of Gen. Garioni, and it made short work of a few minor attacks delivered by the Arabs. A landing on this part of the coast would have been effected earlier if it had not been for the difficulty of keeping up supplies during the winter.[1]

In April Italian warships appeared off the entrance to the Dardanelles. They were fired on by the Turkish forts, and their answer to this fire drew a fresh and very energetic protest from Vienna. The Italian ambassador was informed that if Italy "wished to resume her freedom of action" Austria could do the same. Any further action on similar lines "might have grave consequences." After a daring exploit by Capt. Millo, who penetrated the Dardanelles in a small destroyer, the northern Aegean was left alone by the Italians, but in May the island of Rhodes and 12 small islands of the Sporades were occupied by Italy. Only in Rhodes was there any resistance, but the Italian force under Gen. Ameglio, which was formed in the main of troops from Tripoli and Bengazi, fought a brilliant little action at Psithos and captured some 2,000 Turkish regulars.

On May 2 Gen. Reisoli pushed back the Arabs some distance to the east of Homs, inflicting considerable loss, and five weeks later the Tripoli district once more became the scene of fighting. Encouraged by the long period of quiet the Turks and Arabs had come nearer the town, and a considerable force was entrenched near the oasis of Zanzur, a few miles west of Gargaresh. On June 8 two Italian brigades drove the enemy out of their positions, while a reserve brigade nearer Tripoli awaited the expected arrival of enemy reinforcements. The Arabs came up in strength, but were soundly beaten, losing nearly 1,000 killed, while the Italians had over 300 casualties. A few days later the Arabs attacked the Italian positions near Homs, but were driven off with heavy loss (about 700 killed). They were taken in flank by a battalion of Bersaglieri, and after this repulse Homs was undisturbed by any further fighting. On June 15 an Italian force under Gen. Camerana landed near Misurata, and occupied the town some days later, and on June 27 Gen. Garioni started a series of operations from Bu Kamesh, which ended, after various successful actions, in the occupation of Zuara and an advance towards the oases of Regdaline, from which the Arabs were driven on Aug. 16.

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[1] Transports actually left Italy for Zuara (Zoara) in Dec. but returned after being a month at sea in persistent bad weather.

Peace negotiations were already being conducted at Lausanne but progress was very slow, and two important actions were fought before a conclusion was reached. On Sept. 2 Gen. Caneva was recalled to Italy, and the command of the troops in Libya was divided, Gen. Ragni becoming governor and commander-in-chief in Tripoli, and Gen. Briccola, who had hitherto been subordinate to Gen. Caneva, being given independent authority in Cyrenaica. Gen. Briccola's first action was to improve the position at Derna, which had been a daily target for a few Turkish shells for more than eight weeks. The Derna garrison had been weakened in order to provide troops for the Rhodes and Misurata expeditions, but early in Sept. detachments were sent from Bengazi, Homs, Zuara and Rhodes, and on the 14th three columns moved out from the lines, and occupied new positions on the high ground to the south. Three days later the Turks and Arabs attacked in force, but though they fought with the most reckless bravery they met with a very severe defeat, and lost some 1,500 men in killed alone. A week later a further Italian advance, both south and east, met with little resistance, and a number of unwounded prisoners were taken.

Meanwhile one more blow had been struck near Tripoli. Large numbers of Arabs had concentrated on the far side of Zanzur, and at dawn on Sept. 20 the Italians attacked. The battle, known as Sidi Bilal, followed the same course as that of the Zanzur battle on June 8, large numbers of Arabs and Turks coming up from the south, and the result was the same. The Arabs fought with great determination, and with greater skill than they had shown before, but their bravery was useless. The Turks and Arabs between them lost over 1,500 killed, while the Italian casualty list was nearly 600.

The Arabs of the plains were now convinced that further resistance was useless, and the Italian advance in preparation would probably have met with little opposition. But peace was imminent. The Treaty of Ouchy was signed on Oct. 15.

The conduct of the Tripoli campaign, as the narrative of events alone would indicate, was prejudiced, first, by the failure of the Italian Government to judge the situation correctly, and, secondly, by the limitations which were laid upon the military authorities. When it became evident that the original plan of campaign, which provided more for demonstration than for action, had failed, the Government were slow to admit the necessity for a change of policy. It was not possible at once to launch a desert expedition, and the difficulties of an advance to the Jebel, through country largely waterless, may be said to have justified the adoption of a less ambitious plan. What is difficult to understand is the practical veto upon action of any kind, which immobilized large forces in Tripoli from Dec. till April, and delayed the carrying-out of the policy which eventually put an end to hostilities, the policy of extending the area of operations and striking a blow whenever the chance offered. It was after long hesitation that the bulk of the native tribesmen joined those who had thrown in their lot with the Turk in the early days of the war. The Arab forces in the Tripolitan plains quadrupled between Dec. and March, the numbers increasing from 5,000 or 6,000 to over 20,000, and the cause of the increase was Italian inaction during that period. The operations of the summer changed the views of the Arabs, but Italian prestige was not wholly restored by the later successes. The policy of the Government bore heavily upon the army, which was the subject of much unfair criticism, and increased the difficulties of those who undertook the administration of the country after the peace. The troubles which were to come with the outbreak of the World War may be traced in part at least to the hesitations and uncertainties of the six months following the first landing. (W. K. McC.)

ITALY (*see* 15.1*)[1].—The area of Italy in 1921 was 110,664 sq. m., to which 3,550 had been added for the new territories. In 1919 the pop. was estimated by the statistical department at 36,099,657, or slightly lower than in 1914 (36,120,118.) This does not, however, take into account the very large number of temporary emigrants who returned on the outbreak of the World War, few of whom reëmigrated since; some 600,000 should therefore be added to the total. It was estimated that the census on Dec. 1 1921 would show a total pop. (including the newly annexed provinces) of about four millions more than at the census of 1911 (34,686,683). The figures for the new territories are: Trentino and Alto Adige 632,380; Trieste 235,509; Gorizia-Gradisca 326,674; Istria 372,117; Zara 18,930. In 1916 the pop. had been 36,546,400. While the immense majority of the pop. are of Italian race and language there are in the old provinces (1911) 87,350 Albanians (Calabria, Puglie and Sicily), 85,960 French in the Val d'Aosta, 9,960 Germans in the same valley and in the Veneto, 40,080 Slavs in the district of Cividale and a few in the Abruzzi and Molise, 30,290 Greeks in the South, and 11,740 Catalans in Sardinia. The pop. of the new provinces comprises 215,345 Germans in the Alto Adige, 13,920 in the Trentino and a few at Tarvis, 326,715 Slovenes, and 141,663 Croats in Eastern Istria. The non-Italian-speaking peoples in the territories annexed after the war represent a far smaller percentage than that of any other victorious nation on the Continent. The religion of the overwhelming majority is Roman Catholicism; there are 123,253 Protestants, 34,324 Jews, and 874,532 declaring themselves to be without religion.

Marriages, which in 1914 were 7·08 per 1,000 inhabitants, fell to 2·72 in 1917, rose to 3·03 in 1918, and to 8·82 in 1919. Births for the same years were: 31·07, 19·45, 17·91 and 21·19, and deaths 17·94, 19·20, 32·29 and 19·01. These figures do not include deaths due to the war. The heavy rise in the mortality in 1918 was due to the influenza epidemic.

The pop. of the chief cities is as follows (1915):—Naples 697,917, Milan 663,059, Rome 590,960, Turin 451,994, Palermo 345,891, Genoa 300,139, Florence 242,147, Catania 217,389, Bologna 189,770, Venice 168,038, Messina (1911) 126,557, Bari 109,218, Leghorn 108,585, Padua 105,135, Ferrara 102,550, Brescia 89,622, Verona 86,448.

During the period 1909–13 the average number of emigrants was about 650,000 per annum, to France, Germany, Austria, Switzerland, Tunisia, and other European and N. African countries (temporary emigrants), and to the United States, Canada, Argentina, Brazil and other parts of America (partly temporary and partly permanent). About 500,000 emigrants returned to Italy each year, and the average excess of emigrants over immigrants in 10 years amounted to 1,500,000. The high birth-rate prevented the population from decreasing, in spite of this heavy drain. In 1914 there were about 6,000,000 Italians residing in foreign countries (2,400,000 in the United States, 1,500,000 in Brazil, 1,000,000 in Argentina, 450,000 in France, 220,000 in Switzerland, 150,000 in Tunisia, Algeria and Morocco, and 120,000 in Germany). The outbreak of the World War, if it did not absolutely put an end to emigration, greatly reduced it; in 1913, 873,000 persons emigrated, in 1914 the number fell to 479,000, in 1915 to 146,000, in 1918 to 28,000. As soon as the war was over emigration rose again, and in 1919 it was 230,000, in 1920 364,944. More than half of these emigrated to America, and about 150,900 to European countries (of whom 72 % went to France, chiefly for reconstruction work, 14 % to Switzerland and only 3 % to Germany and Austria). In the first quarter of 1921 81,000 persons emigrated, of whom 71,000 went to America. In 1919 90,000 emigrants returned to Italy. Emigration was in 1921 still restrained by the high wages in Italy, legal restrictions against immigration in the United States and some other countries, the generally unfavourable conditions of trade almost everywhere, and to some extent by the temporary insufficiency of shipping accommodation. It was estimated that before the war emigrants sent or brought home some 500,000,000 lire a year.

Government.—The only important change in the form of Government is the electoral law of 1919, whereby the 508 single-member constituencies were abolished and replaced by 54 constituencies returning 5 to 20 members each, elected by *scrutin de liste* (each voter votes for one or other of the party lists *en bloc*, but he can add preference votes to any three names within his own list). At the elections of May 1921 the number of constituencies in the old provinces was reduced to 40 somewhat larger ones, returning the same 508 members, while six new ones were added for the Trentino, the Alto Adige, Trieste, Istria, Gorizia and Zara, returning in all 27 members, thus bringing the total number of deputies to 535.

Labour.—The war and the epidemics which followed it caused the death or disablement of some 1,250,000 men; even if the normal death-rate for the war period (120,000) and the normal number of men disabled through illness or accident (30,000) be deducted, the war losses above the normal still are over a million. These were, however, made good by the return of large numbers of emigrants and the almost complete suspension of new emigration. On the other hand, the war undoubtedly reduced the capacity and above all the will to work in a large number of men, at least temporarily, although many unskilled workers learned new skilled trades while in the army. The great mass of the working classes after the war felt a positive distaste for work, and demanded ever higher wages quite out of proportion even to the increased cost of living, and ever shorter hours. The strike movement assumed an extent and intensity never before dreamed of, and workmen "downed tools" continually. In 1920 no fewer than 1,781,230 workmen went on strike, with a loss of 21,650,200 working days.

The trade crisis, which began to be felt in the autumn of 1920 and became more extensive early in 1921, had a salutary effect however, on labour, and the workmen began to realize that unlimited strikes did not bring increased prosperity. In April 1921 it was estimated that there were about 145,000 unemployed, besides 300,000 men working on short hours. Unemployment was greatest in the metallurgical and mechanical industries.

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[1] Much of the statistical information in this article is drawn from Prof. Giorgio Mortara's *Prospetti economiche.* Other figures have been obtained from Government publications.

Cost of living.—The rise in prices after the war was very considerable. Taking the average prices of the various goods in 1901–5 at 100, the increases were as follows:—

	Cereals	Other food-stuffs	Textiles	Minerals	General
Aug. 1914	114	127·2	116·9	111·6	115·6
Jan. 1918	326	264·3	513·8	869·4	457·6
" 1919	370·8	438·7	398·4	357·3	410·1
" 1920	436·5	578·1	937·4	811·9	634·7

The increased inflation of the paper currency was one of the chief causes of the rise of prices, while the rise itself led to further inflation to meet the increased expenses of the Government. Wages on the whole increased to a greater extent than prices, and in many trades the workmen were paid seven to ten times what they were before the war. But the result was that certain trades, such as building, suffered severely and were indeed almost suspended long before the general trade slump, so that those categories of workmen remained unemployed most of the year, unless they changed their occupation, and thus derived no benefit from the general increase. Professional men were able to increase their earnings in proportion to the rise in prices, and the shop-keeping class sold dearer what they had bought dearer, so that they were not hard hit. People with fixed incomes, on the other hand, found themselves several times poorer, but this had the effect of stimulating many *rentiers* to seek occupation and go into business to make good the deficit in their budgets. Pensioners and persons incapable of earning were the worst off. Government officials received various increases of salaries, bonuses, allowances for the increased cost of living; but the total rise did not more than double their former earnings, whereas prices were very much more than doubled. During the first half of 1921 wholesale prices showed a downward tendency, and there were also signs of a slight decline in retail prices.

Finance.—In 1913–4 the budget revenue was 2,245 million lire, and there was no deficit. The budget for 1921–2 was estimated as follows: revenue 14,786 million lire; expenditure 24,497 million lire, divided as follows:—(*a*) ordinary recurrent expenditure (interest on the debt, peace-time military expenditure, colonies, civil service, railways, etc.) 11,806 million lire; (*b*) extraordinary non-recurrent expenditure for the liquidation of the war (military expenditure connected with the Armistice, maritime transport, bread subsidy, extra expenses due to the unfavourable exchange) 9,807 million lire; (*c*) expenditure due to the war, but of a less transitory nature (war pensions, indemnities for war losses, reconstruction in the liberated provinces) 2,884 million lire. A deficit was thus shown of 9,711 million lire; but it was anticipated that, by the dropping of the bread subsidy and other steps, this could be considerably reduced.

The cost of the war, to Nov. 30 1918, amounted to 48,490 million lire, not including certain sums still owing, while the long delay in the settlement of the Adriatic question added very considerably to post-war military expenditure. The public debt rose from 15,705 million lire on Aug. 1 1914, to 70,599 on Feb. 28 1919, and 108,072 on Oct. 31 1920. Excluding the paper currency which bears no interest and the 20,600 million lire of foreign debt on which no interest was being paid, the interest-bearing debt amounted to 65,000 million lire, of which the annual service was 3,000 million lire. The foreign debt, mostly held in the United States, was in 1921, owing to the depreciation of the Italian currency, equivalent to 80,000 or 90,000 million lire, with interest accumulating at the rate of about 3,000 per annum. The foreign debt was a much debated problem, and although the Italian Government had repeatedly confirmed its intention of meeting its obligations, public opinion demanded that some arrangement should be agreed to by the creditor Allies, bearing in mind Italy's financial difficulties, the fact that the money was lent when Italian currency was almost at par, whereas if payment were immediately exacted the country would have to disburse nearly four times that amount, and the consideration that a large part of the loans served to pay for war material and supplies at a rate allowing for very large profits. At all events it was expected that Italy would be accorded a long delay so as to allow for an improvement of the currency and other facilities.

In 1914 the lira was at par; during the war its value declined (*see* EXCHANGES, FOREIGN); but after the Armistice the decline was far greater, and the fluctuations in exchange were such as to render the most ordinary commercial transactions with foreign countries highly speculative operations. The depreciation of the lira was due partly to the greatly increased inflation and partly to the unfavourable trade balance, as well as to the constant strikes and disorders, which diminished public confidence abroad. The £ reached 106 lire in the autumn of 1920, the Swiss franc 4·53, the French franc 1·90, the dollar 28·58 lire.

The capital invested in Italian limited liability companies (mostly industrial and commercial undertakings) increased very rapidly in 1910–20. In 1911 the amount of new capital invested was 310,800,000 lire, whereas in 1920 the figure was 5,077,583,124 lire, from which 243,041,168 lire must be deducted for capital withdrawn, leaving a net addition of 4,834,541,956, or about two milliards more than the average of the two preceding years. In comparing these figures with those of the pre-war period the decreased value of money must be taken into account, but even so the increase is considerable. In all from 1911 to 1920 over 14½ milliards of new capital were invested, and the net increase was over 13 milliards.

The coöperative movement in Italy greatly developed during 1900–20, and was acquiring ever greater importance. In 1915 there were 7,429 coöperative societies (production and labour 3,022, consumption 2,408, farming 1,142, building 752, insurance 105). The membership was nearly a million, and the capital over 118 million lire, with a turn-over of nearly 650 million lire in one year. The coöperative movement is favoured by all parties—Socialist, Catholic and Liberal, while the Government confers many privileges on the societies, including exemption from taxation and preference in the assignment of contracts for public works. Unfortunately, they were also exploited for party purposes; and cases were known in which groups of five or more persons formed themselves into a bogus coöperative society in order to obtain valuable Government contracts on easy terms. The Socialists of Emilia were particularly active in this connexion.

Agriculture.—The production of cereals declined during the war years owing to the scarcity of labour, and after the Armistice on account of bad harvests and of the Government requisition of crops at inadequate prices.

Production of Cereals, in 1,000 quintals.

	Wheat	Indian Corn	Oats	Rice	Other Cereals	Total
1909–14 (average)	49,272	25,682	5,118	4,867	3,436	88,375
1919	46,204	21,806	5,936	4,867	2,074	80,887
1920	38,500	22,000	3,500	4,300	2,430	70,730

The harvest of 1920 was exceptionally bad; prospects for 1921 were better, as the Government requisitions were gradually ceasing.

The grape-producing area of Italy was in 1909–14 4,400,000 hectares, or nearly half of the world total, but the wine produced—45,500,000 hectolitres—was only 3/10 of the whole, as a large part of the land under grapes is cultivated by small farmers for their own use and not with the scientific intensity of the French or Rhenish vineyards. During the war the wine output fell to an average of 35,800,000 hectol. and in 1919 to 35,000,000 hectol.; in 1920 it rose to 42,000,000 hectol., the new provinces excluded. Only a comparatively small part was exported: in 1909–13 the yearly average was 1,410,000 hectol. and 180,000,000 bottles; in 1919 it had fallen to 638,000 hectol. and 87,000,000 bottles.

Olives were cultivated over 2,300,000 hectares before the war, producing 10,769,000 quintals of olives, from which 2,200,000 hectol. of oil were extracted, valued at (including by-products) over 300,000,000 lire. The output during the war years was about the same; in 1919 there was a slight diminution of the better qualities. Exports before the war averaged 340,000 hectol. and in 1919 were 86,000, with prospects of improvement.

Fruit is an important item in Italy's agricultural production, and one capable of considerable development, but it has been hampered by want of organization and lack of capital among the producers, the excessive numbers of intermediaries, and insufficient care in packing and preserving. In the period 1909–14 the average crop of *agrumi* (oranges and lemons) was 7,888,000 quintals; chestnuts, 6,070,000; apples, pears, quinces, pomegranates, 2,823,000; almonds, nuts and walnuts, 2,333,000. During the war years the averages for these crops were 7,347,000, 6,642,000, 2,468,000 and 1,288,000; in 1919 the decline was further accentuated (6,625,000, 4,900,000, 2,104,000 and 881,000). Prospects for 1920 were better.

The production of silk cocoons in 1909–13 was 41,000,000 kgms. according to Government statistics, or 46,000,000 kgms. according to those of the Silk Association; but even this figure is said to be an undervaluation, and 50,000,000 appears to be nearer the mark. During the war the output was about 42,000,000; it fell to 23,500,000 in 1919, owing to unfavourable weather conditions, but it rose to 35,500,000 in 1920. The hemp crop improved steadily after 1914, owing to the great demand and increased price of textiles; whereas it was 860,000 quintals in 1909–14, it averaged 880,000 in the war years, rose to 940,000 in 1919 and to 960,000 in 1920. The wool crop, which was 280,000 quintals in 1909–13, rose to 300,000 in 1920 (valued at 500,000,000 lire).

Mining.—Italy has no coal-mines and therefore has to import all her coal. Lignite mines, however, exist in various parts of Italy, and the war stimulated their development owing to the urgent need of fuel and the ever-increasing cost of imported coal. Thus, while in 1909 555,000 tons were extracted, in 1918 the amount was 2,171,000 tons; in 1919 it fell to 1,158,000, and in the first half of 1920 600,000 tons were extracted. The chief source of the coal supply before the war was Britain; in 1909–13 the average annual imports were 9,820,000 tons, of which 8,810,000 came from Britain alone. During the war, owing to the greatly increased cost and difficulties of transport, the imports fell to 7,420,000 (6,080,000 from Britain), and in 1919 to 6,220,000, of which only 4,690,000 from Britain, while the United States sent 1,160,000 as compared with 80,000 in 1909–13. In the first half of 1920 only 2,800,000 tons were imported (1,880,000 from Britain and 680,000 from the United States).

The tendency to try to tap other sources of supply than the United Kingdom was increasing; more and more coal was being imported from the United States, Germany, the Saar basin, etc. Much was also hoped from the Heraclea concession on the Black Sea. Prospects for 1921 were more satisfactory; the demand was less owing to the industrial crisis, and supplies more abundant and cheaper. Before the war coal cost about 40 lire per ton in Italy; during the war and at certain periods after the Armistice it rose to as high as 800 lire. At the end of 1920 it had fallen to 650 lire, and lower in 1921.

Italy is almost as poor in iron as in coal, but she had nevertheless developed her iron and steel industry to a fair degree. In 1909–13 the average annual amount of iron ore mined was only 535,000 tons while the yearly output of iron and steel was 1,048,000 tons. During the war, owing to imperious military necessities, mining was greatly intensified, and in 1917 1,000,000 tons of iron ore were extracted; in 1918 the amount fell to 695,000, and in 1919 to 466,000, owing to the reduced demand. The total known deposits are estimated at only 40,000,000 tons, but the amount is probably larger, and the Cogne mines in the Val d'Aosta and those at Nurra in Sardinia are capable of much greater development. The output of iron and steel during the later years was as follows:—1913, 933,000; 1914, 911,000; 1915, 1,009,000; 1917, 1,332,000; 1918, 993,000; 1919, 732,000 tons. In 1913 840,000 tons of iron, steel, scrap iron, rails, pipes, plates, etc., were imported; 789,000 tons in 1919, and 378,000 tons in the first half of 1920.

Electric Power.—Electric power and its applications have been developed to a very high degree in Italy, and extensive use has been made of the water-power, which is taking the place of steam in many fields of industrial activity. In 1914 900,000 H.P. produced by water-power were in use, and at the end of 1920 the figure had risen to 1,500,000. There is still a great deal more water-power available, notably in the newly annexed territories, but the high cost of setting up new plant and of materials and labour has been a deterrent to further development. There are several lines with electric traction, of which the most important are the Simplon tunnel, the Turin–Modane line with the Mt. Cenis tunnel, Genoa–Arquata, Genoa–Savona, Milan–Sondrio, Naples–Piedimonte d'Alife. It was intended to adopt electric traction on several other lines as soon as possible, including the new Rome–Naples short line which was under construction in 1921. Altogether it is estimated that there are 3,000,000 H.P. available in Italy.

Raw Materials.—Scarcity of raw materials seriously handicapped Italy during the war, but then, at least, the Allies accorded her certain facilities for obtaining them. After the Armistice not only were these facilities withdrawn, but several countries imposed what practically amounted to export duties on raw materials, while in some cases they altogether prohibited their export. The worst difficulties were those connected with coal and wheat. The system, by which British coal was being exported in 1919–20 at a far higher price than was charged to the home consumer resulted in Italian consumers having to pay 55s. more per ton than the British, which with the £ exchanging for 90 lire, meant an annual tribute on 4,000,000 tons of 1,000 million lire, not counting freights. Even apart from this discrimination the Italian consumer had to pay four times as much as the British for coal. For a long time British coal enjoyed a practical monopoly of the Italian market, as there were few other sources of supply available. Afterwards American and German coal came to be imported into Italy in increasing quantities, and the British discrimination was removed. Argentina for a time imposed an export duty on wheat, and afterwards prohibited its export altogether. France stopped the export of scrap iron, of which Italy had great need. All these restrictions caused much hardship and not a little ill-feeling. At the Brussels Financial Conference (Sept.–Oct. 1920) the Italian delegates complained of the tendencies of certain countries richer than Italy in raw materials to improve their budgets by raising their export prices, and asked for freedom of circulation for raw materials. Senator Schanzer, Italian delegate at the League of Nations Assembly in Dec. 1920, supported the theory of economic solidarity, demanding that artificial barriers and differential prices should be eliminated and that the whole world be regarded as one great economic system.

Trade.—Before the war, Italy's trade returns had shown annual imports from 25 % to 50 % higher than the exports. But the difference was made up by "invisible" exports—the sums sent or brought home by emigrants, those spent by foreigners in Italy, freights earned by Italian ships, etc. During the war and after the Armistice the trade deficit grew very considerably, owing to the immense quantities of war material and foodstuffs which had to be imported, without a corresponding increase of exports, visible or invisible. In 1919 the imports amounted to 13,677,169,245 lire and the exports to 4,500,653,431 lire. The following year the imports declined slightly to 13,038,034,351 lire, while exports rose to 6,219,585,088 lire.

Transport.—The total railway system of Italy increased from 3,728 m. in 1870 to 11,895 m. on Dec. 31 1919, to which must be added 870 m. for the new territories. Before the war there were 6,000 locomotives, 12,000 passenger coaches and 112,000 goods vans and trucks. After 1914 the rolling-stock slightly increased, but a good deal of it was worn out during the war and would have been scrapped had it not been for the difficulty of obtaining new material. On June 30 1919 there were building 860 locomotives and 17,000 cars of all sorts, but the necessary repairs to the old ones were going on very slowly, and a large number of passenger coaches remained in a very bad state. The number of railwaymen before the war was 170,000. During the war a number of men were taken on temporarily (*avvintizi*) to replace those who were serving in the army, and after the Armistice, when the old ones were taken back, the new ones were not dismissed; this fact, the introduction of the eight-hour day, and the decreased efficiency of the bulk of the railwaymen, resulted in a large addition to the staff. The State railways alone, which before the war employed 154,000 men, had 200,000 on their pay-rolls in 1921. In 1913 the railways transported 130 million passengers and 47 million tons of goods, and the revenue was 655 million lire, which was 45 millions less than the sum necessary to cover expenditure, including the $3\frac{1}{2}$% interest. The inadequacy of the revenue was due to the low traffic of the lines in the south and in the islands, which were also the most costly to build. During the war the traffic increased considerably, but more than half of it was war traffic; expenses also increased enormously, owing to the rise in the price of coal, the inferior quality of much of the fuel used, and the huge increase of wages, which varied from 158 % for the higher management to 643 % for the lowest grade of linesmen in 1920–1 as compared with 1913–4. Expenses in 1920–1 were 1,800 million lire for wages, 1,000 million for fuel and 500 million for other items—a total of nearly 3,500 millions. The revenue was barely 2,000 millions, in spite of the increase of the tariffs.

The total length of the interurban tramway system (steam and electric) was 2,796 m. in 1921; and that of the motor-omnibus service, conveying passengers and goods, was 8,700 m. in 1917.

Shipping.—The total tonnage of Italy on Aug. 1 1914 was 1,534,738; her losses during the war were higher in proportion than those of any other country, amounting by Nov. 11 1918 to no less than 905,393 tons, or 58·93 % of the whole mercantile marine. But the large development of shipbuilding, encouraged by high freights, and the addition of the greater part of the Austro-Hungarian shipping, brought up the total to more than the pre-war figure—2,118,000 tons. Freights rose during the war from 9 to 15 times what they were before, and in 1921 were still three times the pre-war rate. In 1913 31,800,000 tons of goods were transported on Italian ships; the amount fell to 16,800,000 in 1918, rose to 19,200,000 in 1919, and continued to increase slightly until 1921.

HISTORY 1909–21

The general elections of March 1909 had returned a strong majority in favour of the Government of which Sig. Giolitti was the head. A new Shipping Subsidies bill was now introduced by the premier, the old agreements with the steamship companies having lapsed, but attacks made on the measure by the opposition, led by Baron Sonnino, so shook the Cabinet's position that Sig. Giolitti deemed it prudent to adjourn the debate until the autumn. When Parliament reassembled he modified the steamship bill, but the Cabinet was defeated on a point of procedure and resigned on Dec. 2. Baron Sonnino was now called upon for the second time to form a Ministry, which comprised some of the best brains in Italy—Count Guicciardini (Foreign Affairs), Sig. Luzzatti (Agriculture), Sig. Salandra (Treasury), Adml. Bettolo (Marine), and Gen. Spinfardi, who remained at the War Office. But the new Government, though widely supported in the country, had no stable majority in the Chamber, which was still Giolittian at heart. On March 21 it was defeated over the new shipping bill and resigned. Sig. Luzzatti succeeded, with the Marquis di San Giuliano at the Foreign Office, Adml. Leonardi Cattolica as Minister of Marine, and Signori Tedesco, Facta, Credaro and Sacchi in other departments. In spite of his great financial ability and abundant self-confidence, the new premier proved unequal to his task, and it was obvious to all, save to himself, that he only held office on sufferance, until Sig. Giolitti saw fit to return to power after the shipping bill and one or two other awkward questions had been disposed of. The Government was extremely feeble in dealing with agrarian disorders in Romagna and other internal troubles. On Dec. 21 there was a division on the Cabinet's extension of the Franchise bill; although a majority voted in its favour, the Radicals opposed it, and the two Radical ministers (Sacchi and Credaro) felt bound to resign. The whole Cabinet followed suit on March 18 1911. The King sent for the inevitable Giolitti, who formed a new Cabinet comprising most of the former ministers, including Sacchi and Credaro. Sig. Bissolati, one of the leading but moderate Socialists, declined office at the last moment.

The year 1911 being the 50th anniversary of the creation of the Italian Kingdom, exhibitions were organized in Rome, Turin and Florence; but although they proved interesting in themselves, defective management, an exceptionally hot summer and an outbreak of cholera made them financially unsuccessful; the charges of dishonesty brought against certain officials in connexion with them proved, however, unfounded.

The Cabinet's programme, presented to the Chamber on April 6, included an extension of the franchise, increasing the number of voters from three millions to eight, the payment of members, and a Government monopoly of life insurance. These bills were chiefly designed to win the favour of the Extreme Left, but found little support in the country and aroused much opposition even in Parliament, especially as regards the insurance bill. The monopoly, however, eventually became an important source of revenue. The final debate on these bills was adjourned to the autumn, and the Chamber rose on July 10. In the summer a dispute broke out with Argentina over the sanitary measures which the latter wished to impose on Italian immigrants in connexion with the cholera epidemic. An agreement was concluded on Aug. 17 1912, giving full satisfaction to Italy.

War with Turkey.

During the last few years relations with Turkey had become strained. With the advent to power of the Young Turks the situation got worse instead of better, and the new Ottoman Government, while hating all things foreign, showed particular animosity towards Italy, whom it regarded as the weakest of the Great Powers. Italian enterprise throughout Turkey was hampered, especially in Tripolitana, where Italy's reversionary interest had been recognized by Britain and France. Italy had intended to extend her influence in that province by peaceful means, but numerous diplomatic incidents embittered the feeling on both sides, while the reopening of the Morocco question by Germany made it clear that the last unoccupied lands in the Mediterranean were about to be divided up, and that Italy's final chance of acquiring a colony on the North African coast had come. The Nationalist party, which had been constituted at the Florence Congress in Dec. 1910, had conducted a propaganda in favour of a more vigorous foreign policy, in opposition to the professed anti-patriotism of the Socialists and the sentimental pacifism of the Democrats and now roused public opinion to the need for bold action. Although the Cabinet was anxious to avoid international complications it could not afford to disregard the new spirit animating the Italian people. In July it informed the Powers that the conduct of Turkey was becoming intolerable, and as no improvement in the situation occurred, military preparations were commenced on Sept. 20. On the 23rd the class of 1888 was called back to the colours, and on the 26th a Note was presented to the Porte calling its attention to the risks to which Moslem fanaticism was subjecting Italian residents in Turkey, and adding that the sending of reënforcements or arms to Tripolitana would be regarded as "a very serious act." The next day the Turkish steamer "Derna," flying the German flag, arrrived at Tripoli and landed 15,000 rifles and much ammunition, which were distributed among the local Arabs. The Italian Government presented an ultimatum to Turkey on the 28th, and, no satisfaction having been obtained, declared war on the 29th (*see* ITALO-TURKISH WAR). Public opinion supported the Government in its African policy, which was not merely a colonial adventure, but represented a patriotic reaction against the bad old policy of "*quieto vivere*," while the gallantry displayed by officers and men offered a welcome relief from the petty bickerings of Parliamentary politics.

On Nov. 4 1911, Italian sovereignty was extended to Tripolitana and Cyrenaica (as the eastern part of the Tripoli vilayet was now called) by royal decree. The international preparation of the African war had been inadequate, and public opinion and the press in foreign countries were not well disposed. The most violent attacks came from the German and Austrian press, and the Austrian Government placed its veto on the extension of Italy's military and naval operations to the Balkans. France was also not too friendly, and the stopping and searching by Italian cruisers of the French steamers "Carthage" and "Manouba," suspected of conveying contraband to the Turkish forces, provoked a serious Franco-Italian diplomatic incident and caused a violent outbreak of anti-Italian feeling in France. Although the episode was settled by arbitration at The Hague, it did not improve relations between the two countries. Various unsuccessful attempts at mediation were made by the Powers, but in July 1912 unofficial negotiations were opened between Italian and Turkish delegates in Switzerland. After laborious discussions the peace preliminaries were signed at Ouchy on Oct. 14, and the final peace treaty on the 18th. Turkey renounced her sovereignty over Libya (as the whole territory was now called), and undertook to withdraw her troops from it, the Sultan retaining only spiritual authority over his former subjects, while Italy agreed to restore to Turkey the islands she had occupied in the Aegean during the war (Rhodes and 11 islands out of the 12 constituting the Dodecanese) as soon as Turkey fulfilled her own undertaking. Although the settlement gave Italy the objects for which she had fought, it was not considered satisfactory by public opinion, which believed that if the Government had conducted the campaign with more vigour and supported the gallant efforts of the troops more adequately, a fuller victory might have been obtained in a shorter time. The total cost of the campaign amounted to 458,000,000 lire, including the value of unconsumed supplies; this sum was paid out of the budget surpluses of the last few years, redeemable Treasury bills, Treasury reserves, credits with banks, etc. No new loans were raised, nor fresh taxes imposed. Business had not been much affected; in fact exports and revenue continued to increase.

Socialist Split.

An unsuccessful attempt on the King's life by an anarchist named D'Alba on March 14 1912, provoked an enthusiastic demonstration of loyalty among all classes. The insurance monopoly, the extension of the franchise and payment of members were voted without much opposition, as Parliament did not wish to embarrass the Ministry during the war. The Socialist party had always opposed the war because it feared that patriotic feeling would divert public interest from the class war on which Socialism battened. But some of its ablest leaders refused to put party before country and supported the Government's African policy; the result was that at the Socialist Congress of Reggio Emilia (June 1912) they were "excommunicated" by the majority. The party thus split into two separate groups or those who were ready to collaborate with the Constitutional parties, calling themselves "Reformist" Socialists and comprising such men as Sig. Bissolati and Sig. Bonomi, both future Ministers, and the others who remained uncompromisingly hostile to the constitution and assumed the style of "Official" Socialists. The Reformists ended by being absorbed into the Liberal groups, while the Official Socialists assumed a more and more revolutionary attitude.

Trouble in Tripoli.

In Nov. 1912 a new Ministry of the Colonies was created, with Sig. Bertolini as minister. His attempt to extend to the African territories the less desirable features of the home bureaucratic system greatly hindered their peaceful development. The peace of Ouchy did not immediately put an end to the fighting in Libya. Most of Tripolitana was quickly pacified, except in the Garian, where a large body of rebels under Suleiman el Baruni held out until they were defeated by Gen. Lequio's column at Assaba. The situation proved more difficult in Cyrenaica, where a number of Turkish officers and soldiers, as well as local Arab chiefs, commanded by Aziz Bey and acting under the inspiration of the head of the powerful Senussi sect, organized resistance and caused considerable trouble which resulted in serious fighting. The extent of occupied territory gradually increased, but sporadic outbreaks among the tribesmen of the interior continued.

Triple Alliance Renewed.

The parliamentary session following on the conclusion of the peace, which was ratified Dec. 4, was a somewhat agitated one. The Socialists attacked the Cabinet for its war policy with their usual violence, supported by a few non-Socialist democrats while the scandals which came to light in connexion with the building of the new Palace of Justice, implicating three or four deputies, provided material for "scenes" in the Chamber. Adml. Leonardi Cattolica resigned from the Ministry of Marine owing to the Senate's opposition to his naval pensions bill, and was succeeded by Adml. Millo, the hero of the Dardanelles torpedo raid. The Triple Alliance was renewed on Dec. 7 1912. In the labour field the chief event was the strike at the F.I.A.T. works, Turin, which lasted three months and caused a loss of 10,000,000 lire, an agrarian strike in the Ferrara province and a general industrial strike at Milan in the summer of 1913.

Relations with Austria.

The Balkan War had broken out when the Libyan War had ended. After the victories of the Balkan Allies over Turkey the Serbs had descended to the Adriatic and occupied Durazzo, while the Greeks from the south invaded South Albania. Austria, not wishing the Serbs to have an outlet on the Adriatic, demanded the evacuation of Durazzo, and was supported in this demand by Italy, both because she was a member of the Triple Alliance and because she had always felt an interest in the Albanians. She also opposed the Greek advance into South Albania for similar reasons, and because she did not wish Valona to fall into the hands of a possibly hostile power, who might use it or let others use it as naval base against Italy. Austria and Italy therefore agreed on the creation of an independent Albanian state under the protection of the Great Powers. Italo-Austrian relations had often been strained to breaking point, but the Marquis di San Giuliano's foreign policy was based on a complete agreement with Austria, and he hoped to achieve his end by removing one of the chief causes of conflict—the struggle for influence in Albania. In spite of this settlement, the petty persecutions by the Austrian Government against its Italian subjects, the frequent anti-Italian utterances of prominent Austrian generals and public men and the constant expulsions of Italian citizens from Austria for the most trifling pretexts, served to keep up ill-feeling. Just as matters were beginning to improve Prince Hohenlohe, the governor of Trieste, on Aug 23 1913, ordered the municipality to dismiss all foreigners, *i.e.* Italians, from its employ and that of the municipalized public services. Although, after much controversy, the Austrian Government allowed the Hohenlohe ordinance to lapse, the incident left a trail of irritation behind it.

Elections of 1913.

On Oct. 26 1913, the general elections with the extended franchise were held, followed by the second ballots of Nov. 2. The result was an increase in the Socialist vote. Socialist victories were particularly notable in Milan, Florence, Turin and Naples. Although some 300 Constitutionalists were returned, the Cabinet was faced by 53 Official Socialists, 26 Reformist Socialists and 70 Radicals of uncertain attitude; the Republicans were much reduced, while 33 Catholics were elected—it was the first time that a real Catholic party presented itself to the polls, a fact which the Pope had rendered possible by withdrawing the *non-expedit*. The Nationalists, who alone had the courage to attack the Socialists with vigour, captured all the five constituencies which they contested. Of the new members the very eloquent Sig. Raimondo (Reformist Socialist), and Sig. Federzoni (Nationalist), were real acquisitions for Parliament. A number of anti-Giolittians of all shades were elected, and Sicily for the first time returned several anti-Government members. The elections were accompanied by some serious disorders, for which both Sig. Giolitti and the Official Socialists were responsible.

A considerable sensation was caused soon after the elections by a statement made by Count Gentiloni, president of the "Unione elettorale cattolica," that 228 of the Constitutional members owed their election to Clerical support, obtained by undertaking to oppose all legislation hostile to Catholic interests. The anti-Clericals rose up in wrath, and many of the 228 indignantly denied having subscribed to the "*patto Gentiloni*." Parliament met on Nov. 27, and the Socialists renewed their attacks on the Cabinet, but there was reason to believe that they were by no means as hostile to Sig. Giolitti as they professed to be, and that, even while giving utterance to virtuous indignation at his shortcomings, they were ever ready for a deal. The Cabinet's African policy was voted by a large majority, and new taxes, estimated to bring in 35 million lire, were imposed on tobacco and alcohol.

Salandra Succeeds Giolitti.

The premier's position was now somewhat shaken. The elections had shown that the country was getting tired of the predominance of one man. Giolitti had ruled supreme, save for a few brief interludes, for 10 years. He now realized that the Albanian tangle, the need for fresh taxation, the divisions among his own supporters over the question of Catholic support, and the rumours of a threatened railway strike, were likely to cause considerable difficulties in the immediate future, and that a period of rest *procul negotiis* was desirable for his health. He therefore seized the occasion of a hostile vote of the Radical group to resign on March 10 1914. Sig. Bertolini, his chief henchman, having spoilt his chances by his mismanagement of the Colonial Office, Sig. Antonio Salandra, who had been Treasury Minister in the second Sonnino Cabinet, was induced, after protracted negotiations, to take office. He enlisted some of the best political men in Italy San Giuliano (Foreign Affairs), Adml. Millo (Marine), Ferdinando Martini (Colonies), Dari (Justice), Ciuffelli (Public Works), Daneo (Education), Cavasola (Agriculture and Trade), Rubini (Treasury), Rava (Finance) and Riccio (Posts and Telegraphs). Gen. Spimgardi refused to remain at the War Office, and several other generals to whom the portfolio was offered would not accept it, as they could not obtain from the Treasury the amount necessary to reorganize the army and replenish the depots left empty after the Libyan War. Finally Gen. Grandi was appointed.

Strike Movements, 1913.

The first problem which the new Cabinet had to face was the truculent attitude of the Sindacato dei Ferrovieri, a nominally economic but in reality a revolutionary political organization of railwaymen. The Sindacato began by demanding a general rise of wages for the whole staff, threatening a strike in case of non-compliance. The Government recognized that the lowest categories were inadequately paid, and was ready to grant them an increase involving an outlay of 15 millions; but it could do no more, as the railways barely paid their working expenses. The railwaymen blustered and threatened, but adjourned the strike to a more favourable opportunity.

On the national festival of the Statuto (June 7) some anarchists, revolutionary Socialists and Republicans at Ancona organized a demonstration to protest against the authorities for forbidding an anti-militarist meeting; riots ensued, and the police, overwhelmed by an armed mob of hooligans, fired on their assailants, killing two and wounding several. This was the signal for a general strike in Ancona which spread to other towns. There were no economic demands, the movement being of a purely revolutionary character, and it was so well organized as to prove the existence of an understanding between the various local groups. The soul of the movement at Ancona was the anarchist Enrico Malatesta, who had been condemned to a long term of imprisonment for murder years ago but had subsequently been amnestied, while in Romagna it was the work of the agricultural syndicates who had been conducting an active campaign at first to improve the conditions of day labourers, but subsequently to get possession of the private estates. The railwaymen at Bologna and some other towns struck, and for nearly a week Ancona, Rome, Florence, Naples, Bologna, Milan and many smaller towns, especially in the Marche, were under mob rule. Gangs of anarchists and thieves terrorized whole districts. A popular reaction, however, soon set in, and the Nationalists organized patriotic counter-demonstrations which cleared the streets of revolutionary elements in the large towns and caused the shops to reopen and the trams to operate. In the smaller centers of the Marche and Romagna, where there was an old tradition of faction fights, the agitation lasted some days longer, and in a few cases ridiculous mock republics were set up. But then large bodies of troops were sent into the rebellious districts and numbers of the leading agitators were arrested, order was restored without recourse to violent measures. The civil authorities had been reduced to impotence, several public and private buildings and churches had been pillaged and burnt, but not much violence was done to persons, except to the soldiers and police, many of whom were wounded and a few killed. Several of the arrested persons were found guilty and condemned to varying terms of imprisonment, but Malatesta escaped abroad. The Government came in for much criticism on account of its slackness in dealing with this criminal outbreak.

Sig. Salandra's position was not very secure, and while the Socialists lashed themselves into a state of hysteria in their mock indignation over his "reactionary" methods, a group of Giolittian deputies, led by Signori Orlando and Schanzer, tried to make political capital out of the recent disorders and conspired to bring about his fall. But the premier parried the stroke with skill, and the Chamber howled down the plotters. On a vote of confidence the Government obtained a majority of 254 against 112, and the Chamber rose on July 5. The municipal and provincial elections, which had begun in June 14, resulted in some important constitutional victories in Rome, Turin, Genoa, Venice, etc., whereas in Milan and Bologna Socialist town councils were elected. The railway syndicate now threatened another strike if the railwaymen guilty of participating in the June disorders were punished, but this time the Government held firm and let the law take its course, with the result that some 50 railwaymen were dismissed and many others received lesser punishments. At the same time the class of 1891 was called back to the colours.

The World War.

There now seemed to be some chance of a quiet spell, after all the recent agitations, when suddenly the international situation began to assume an alarming aspect. On June 28 the Archduke Francis Ferdinand and his wife were murdered at Serajevo. Although it was realized that the Austro-Hungarian Government would demand serious guarantees against anti-Austrian propaganda and plots conducted from Serbia, the famous Note of July 23 burst like a bombshell on the Italian as on most other Foreign Offices. The gravity of the situation was grasped at once, for few in Italy doubted that Austria was spoiling for a quarrel whereby she might regain her lost prestige in the Balkans, that she would be supported by Germany, and that Russia would not allow Serbia to be humiliated and perhaps dismembered. The Italian Government coöperated heartily with that of Great Britain in the last desperate efforts to avert a catastrophe. The terms of the Triple Alliance had been kept secret, but, while public opinion realized that if a *casus foederis* were to arise Italy would be in honour bound to stand by her Allies, the idea of siding with Austria, especially in so unpopular a cause, was profoundly repugnant to the immense majority of the nation. Events now moved rapidly.

To the relief of practically the whole of Italy, the Italian Government on Aug. 3 issued its declaration of neutrality. The grounds on which this decision was based were the following. (1) According to the terms of the Triple Alliance none of the contracting parties might undertake an action likely to compromise the common interests of all without first notifying the other two and coming to an understanding with them; this Austria had failed to do. In the case of Balkan affairs this principle had been reconfirmed by special agreements between Austria and Italy. (2) The Austrian Note to Serbia not having been previously communicated to Italy, the latter had had no opportunity of exercising diplomatic action in favour of peace. (3) The Triple Alliance being essentially defensive in character and based on the maintenance of the territorial *status quo*, Italy was not bound to assist her Allies in an aggressive policy. (4) Not having been warned in time of the intentions of her Allies, Italy had been unable to take the necessary military measures even if she had been willing to assist them. The relief at the proclamation of neutrality was further enhanced when Britain entered the lists against Germany, for it would have been as repugnant to the enormous majority of the Italians to be at war against Britain as to be on the side of Austria. It was afterwards officially announced in Italy that no *casus foederis* could arise in the event of Britain being in the conflict, but at the time the public did not know this.

It was felt, however, that at any moment Italy might herself be involved in the conflict, so that it was necessary to prepare the defences of the country. The classes of 1889 and 1890 were called out, so that, with that of 1891, previously summoned, and the two regular classes of 1892 and 1893, there were five classes under arms, to which the recruits of 1894 were added in the autumn. But the stores had to be replenished, immense quantities of arms and ammunition manufactured, and everything reorganized, as the army had been left in a deplorable state after the Libyan War, because the Giolitti Government had not wished to risk unpopularity by asking for the necessary funds. The work of practically re-creating the army was colossal, and that it was achieved in a few months is chiefly the merit of the chief of the general staff, Gen. Cadorna, appointed on July 27 1914.

The question which now preoccupied the public was no longer whether Italy should intervene in favour of the Central Empires or not, but whether she should remain neutral until the end of the war or intervene on the side of the Entente. The *Triplicisti* were fairly numerous among the diplomatists and in a part of the army, but hardly anyone went so far as to advocate intervention on the side of Germany and Austria; German violation of Belgian neutrality and the German atrocities in their conduct of the war had alienated many sympathizers. The Nationalists, Radicals, Republicans, Reformist Socialists and a large section of Liberals of various shades, realizing that this war would be the last opportunity for completing Italian unity, were in favour of intervention against Austria with the primary object of liberating the Italian territories of the Dual Monarchy. The Official Socialists declared for absolute neutrality, on the orthodox Socialist theory that all wars are wicked (except class war) and waged only for the benefit of the capitalists; the party afterwards developed this theory into a more or less avowed sympathy with Germany and Austria. On the other hand a large number of Socialists rejected this policy and favoured Italian intervention, provided it was on the side of democratic France; even Benito Mussolini, the fiery editor of the Socialist *Avanti*, resigned his appointment when the party voted for neutrality, became one of the more ardent interventionists, and fought himself as a volunteer in the war. The Catholics were opposed to intervention against the Central Empires because they disliked France as the "atheist" nation, admired Catholic Austria and feared the triumph of Orthodox Russia. A good many people, even in the upper classes, were opposed to intervention, apart from any question of sympathy, because they were afraid of Germany and thought she was bound to win. A still larger class, belonging to all parties and representing perhaps the bulk of public opinion, hesitated on the ground that though Austria had not shown much regard for Italy's interests or feelings, it would be wrong to attack an ally without a definite *casus belli;* they felt that it was advisable to wait for fresh developments of the situation and only intervene when there should be a real danger that the unredeemed provinces might be annexed by some other Power. This view prevailed until about the end of March 1915, and the Government was supported on this understanding.

Economic Effects of the War.

The economic effects of the war were at first severely felt. Prices did not rise to any great extent, but there was a run on the banks which necessitated a moratorium. For a few weeks many factories had to shut down owing to lack of funds, while large numbers of temporary emigrants (estimated at 350,000) in Central Europe were forced to return home on the outbreak of hostilities. All this produced a considerable amount of unemployment. But the measures adopted by the Government and the activity of many private committees alleviated the distress, and more or less normal conditions were gradually restored. The moratorium was made less stringent, and an agreement with Britain averted the danger of a coal famine, although in the spring of 1915 the price of coal rose considerably; other raw materials were again imported after a short suspension due to the interruption of maritime traffic, and the Italian steamship lines did profitable business. The export of food-stuffs, of certain other goods and of war material was prohibited; in Oct. 1914 the import duty on wheat was reduced by more than one-half to make up for the rise in freights, and in Dec. it was removed altogether. By somewhat relaxing the export prohibition Italy saved Switzerland from famine and sent large shipments of sugar to Britain.

Internal affairs aroused little interest, as public attention was monopolized by the war, and even the death of Pope Pius X. and the election of Benedict XV. passed almost unnoticed. On Oct. 9 Gen. Grandi resigned from the War Office on account of a disagreement with Gen. Cadorna over the needs of the army, and was succeeded by Gen. Zupelli (a native of the unredeemed provinces), who provided the chief of the staff with the necessary supplies. A week later the Marquis di San Giuliano died, and the premier temporarily took charge of the Foreign Office.

Valona Occupied.

Throughout the autumn anarchy had been spreading in Albania and soon after the outbreak of war Prince William of Wied and the foreign contingents had departed. The Greeks had seized the opportunity to invade and devastate South Albania, and Italy feared that they or one of the belligerent Powers might occupy Valona, which would be a serious menace to Italian security. A landing party from the Italian fleet began by occupying the islet of Saseno, which dominates Valona harbour, on Oct. 30. On Dec. 26 sailors landed in the town, followed by a regiment of infantry.

Sonnino Foreign Minister.

A new Cabinet crisis now occurred. Sig. Rubini, the Treasury Minister, refused to supply the funds required for the army unless they were immediately covered by corresponding increases of revenue. Sig. Salandra, however, realizing that a new scheme of financial reform required time, whereas military necessities were urgent, backed up Gen. Zupelli; Rubini resigned on Oct. 31, and the whole Cabinet followed suit. But the King, after consulting the leading statesmen, entrusted Salandra himself with the formation of a new ministry. This was accomplished by Nov. 5; the chief innovation was Baron Sonnino at the Foreign Office, an appointment which strengthened the Cabinet considerably; other new appointments were Orlando (Justice), Grippo (Education), Daneo (Finance), and Carcano (Treasury). Thus the Cabinet came to represent practically every section of the Chamber except the Extreme Left. On Dec. 3 Parliament met, and Sig. Salandra in a dignified speech explained the reasons for Italy's neutrality and insisted on the necessity for the nation to be well armed so as to defend her interests and realize her aspirations. It was on this occasion that the premier pronounced the famous and much-discussed phrase about "*sacro egoismo*," *i.e.* the duty of subordinating everything to the higher interests of the country.

The intervention of Turkey on the side of the Central Empires affected Italy very closely, for there was every reason to doubt that the limitation of the Holy War, proclaimed by the Sultan at Germany's suggestion, to the territories held by the Entente Powers would be respected. These doubts proved indeed justified, and there was a recrudescence of rebellion among the tribesmen of Libya, fomented by German as well as by Turkish agents. On Dec. 17 Prince von Bülow, the new German ambassador, arrived in Rome with the mission of exerting all his influence, through his aristocratic and political Italian connexions, to secure Italy's neutrality to the end of the conflict.

The year 1915 did not begin auspiciously for Italy; on Jan. 13 an earthquake of unusual severity was felt over a large part of Central Italy, and destroyed Avezzano and many other smaller towns and villages in the Abruzzi and the provinces of Caserta and Rome. The total number of victims was 30,000.

Foreign Negotiations.

The diplomatic activity of the Government was now greatly intensified. The current in favour of intervention was growing ever stronger, in spite of Prince von Bülow's efforts and the pacifist tendencies of certain classes. But both Sig. Salandra and Baron Sonnino were determined that Italy should not emerge from the European conflict without realizing at least a part of her aspirations, acquiring some of the Italian districts of Austria and correcting the iniquitous frontiers of 1866 designed to leave the country at the mercy of invasion. As early as Dec. 1914 the Italian Government had called Austria's attention to the fact that the invasion of Serbia tended to destroy the balance of power in the Balkans; Art. 7 of the Triple Alliance Treaty gave Italy, in these circumstances, a right to compensation. Austria at first rejected this claim *in toto*, then admitted it grudgingly, but offered Italy by way of compensation territories belonging to her enemies (Nice, Corsica and Tunisia were mentioned). Baron Sonnino, however, insisted that only territories already in Austrian possession could form a basis for negotiation. To this Austria gave evasive replies and then offered a small part of the Trentino, to be ceded after the war. But Sonnino replied that no territorial cession could be considered unless it was to be made at once. Germany did her best to bring about an agreement between Italy and Austria, and tried hard to induce Austria to be more conciliatory. Austria having at last reluctantly accepted the principle of immediate cession, Sonnino presented Italy's minimum demands. These were: the Trentino as far as the frontiers of the Napoleonic kingdom of Italy, a strip of territory in the Isonzo valley comprising Gorizia, Gradisca and Monfalcone, and the Curzola group of islands in the middle Adriatic, to be ceded to Italy; Trieste and the N.W. part of Istria to form an independent state; Italy to have a free hand in Albania. In return Italy would remain neutral to the end of the war. But Austria, still convinced that Italy had no intention of going to war and was merely bluffing, continued to raise objections, in spite of the extremely candid remarks of the German Government. Italy now came to the conclusion that agreement was impossible and that war was inevitable.

Pact of London.

Negotiations for intervention were opened with the Entente, and on April 26 an agreement was concluded with Britain, France and Russia known as the Pact of London; it was in reality a memorandum presented by Italy and agreed to by those Powers, and completed by military and naval conventions. Italy was to conduct the war against the Entente's enemies with all her means, and was to receive the following compensation at the end of the war:—The whole of the Trentino and South Tirol as far as the natural geographic frontier, *i.e.* the Brenner range; the city and district of Trieste; the county of Gorizia and Gradisca; Istria to the Quarnero, including Volosca and the Istrian islands; the islands of Cherso and Lussin and some adjoining smaller islands; Dalmatia as far as Cape Planka, with some of the Dalmatian islands; Valona and its district; and full possession of Rhodes and the Dodecanese. In Southern Asia Minor she was to have a zone of influence and a share in its partition if it should be effected. If Great Britain and France obtained any part of the German colonies in Africa Italy was to be compensated by French and British colonial territories adjoining her own possessions. The E. coast of the Adriatic from Cape Planka to the Voyusa was to be neutralized, except from a point S. of the Sabbioncello peninsula to 10 km. S. of Ragusa Vecchia. The Croatian coast, with Fiume, and the Dalmatian coast S. of Cape Planka, was to go to Serbia, Croatia and Montenegro. If a neutral Albanian state were created its foreign policy was to be under Italian guidance, but if Britain, France and Russia so desired Italy would not oppose the cession of the northern and southern districts of Albania to Serbia, Montenegro and Greece. The Pact of London was kept secret, but most of its clauses soon became known. It was first published by the Russian Bolshevists after the revolution in 1917.

Rupture with the Triplice.

The poet Gabriele D'Annunzio, by his fiery eloquence, largely influenced Italian public opinion in favour of intervention, particularly by his speeches at Quart near Genoa and in Rome. On May 3 Italy declared that the Alliance with Austria was at an end. Prince von Bülow, realizing that this meant war, made a last desperate effort to save the situation through Sig. Giolitti's ambition. That politician could not resign himself to be out of office at this critical juncture, and, as his friends declare, he genuinely believed that Italy's interests could best be served by neutrality. On the eve of the reopening of Parliament he returned to Rome, and, although the premier had informed him that the Alliance was dissolved and that Italy had contracted obligations with the Entente, he announced, in a public letter to his faithful henchman Sig. Peano, that he believed still that Italy might obtain a great deal (the famous *parecchio*) without going to war. He knew that he could rely on a majority in the Chamber (300 deputies left cards on him during those days), and that if he declared his opposition the Cabinet was bound to fall. Salandra realized this too and on May 13 he resigned, on the ground of the disagreement between the various Constitutional groups as to Italy's foreign policy, but in reality in consequence of Giolitti's manœuvre. It seemed as though the latter's triumph were assured, but at this juncture the true voice of the country made itself heard. Huge demonstrations against Giolitti, and in favour of Salandra and the war, were held in every town, and in an instant the whole political system built up by Giolitti was swept away. The various leading political men summoned by the King all advised him to refuse Salandra's resignation, as he evidently enjoyed the country's favour, and this advice was followed. Prince von Bülow now informed Giolitti of Austria's final offer (before communicating it to the Government), which comprised, besides the Trentino, a strip of territory as far as the Isonzo, the town of Gradisca, but excluding Gorizia and all the east bank of the river, while Trieste was to be autonomous. But it was now too late, even if Austria's terms had been satisfactory.

Italy declares War.

On May 20 Parliament met, and the Chamber granted the Cabinet full powers by a large majority, only 74 members (about half of them Official Socialists and the rest impenitent Giolittians) voting against it. Giolitti himself retired to Piedmont, while most of his supporters disappeared or voted for Salandra. The Senate, in spite of its strong neutralist tendencies, voted the bill unanimously. Neutralism and Germanophilism disappeared as if by magic. Many former opponents had been genuinely converted, to a large extent by the revelations contained in the official "Green Book," which set forth the diplomatic history of the preceding months, while others found it expedient to draw a veil over their feelings. The Official Socialists remained in opposition, but they thought it safer not to run counter to the general trend of public opinion too openly, and so kept in the background. On May 23 the general mobilization was ordered and on the 24th war against Austria declared. It was not then declared against Germany, but the German ambassador, his staff, the consuls and most of the German residents left Italy together with the Austrians. The Austrian, Prussian and Bavarian representatives to the Holy See also departed, although the Italian Government did not oblige them to do so. The outbreak of war was received with sober enthusiasm. The mobilization had to a considerable extent been carried out already, and the staffs of many corps as well as large numbers of troops had been concentrating in the Veneto for some weeks. Consequently there was no general disorganization of the economic and commercial life of the country. In July an internal loan at 4½% was floated and brought in 1,100 million lire. A new member was added to the Cabinet in the person of Sig. Salvatore Barzilai, deputy for Rome, without a portfolio but entrusted with the civil affairs of the Austrian districts occupied by Italian troops. The significance of the appointment lay in the fact that he was one of the leaders of the Republican group in the Chamber, but, being a Triestino, he was an irredentist first and a Republican afterwards.

Although Italy did not declare war on Turkey, Italian subjects in the Ottoman Empire were persecuted and those in the Asiatic provinces prevented from leaving, while the Turkish Government continued to send officers, emissaries, funds and supplies to foment rebellion in Libya, in violation of the Treaty of Ouchy. On Aug. 3 the Italian ambassador at Constantinople presented an ultimatum to the Porte, and, no satisfactory reply having been received, war was declared on the 21st. When Bulgaria invaded Serbia in Sept. 1915 Italy followed the example of her Allies and declared war on the former. No operations were conducted either against Turkey or Bulgaria except the bombardment of the Bulgarian port of Dede Aghach by an Italian cruiser. In Dec., in view of the invasion of Serbia by Austrian, German and Bulgarian armies which constituted a menace to Albania, an expeditionary force was sent to that country. The Albanian expedition, in addition to other operations, was instrumental in saving the remains of the beaten Serbian army, which had been driven from its own country by Mackensen's offensive. It is indeed chiefly due to Italian assistance that 150,000 Serbo-Montenegrin troops were spared death by starvation and disease, and could be afterwards transferred to Corfu to refit and eventually to Macedonia to fight again. Large numbers of civilians found a refuge and a cordial welcome in Italy, while some 30,000 Austrian prisoners captured by the Serbs were interned in Sardinia. On Dec. 1 Baron Sonnino informed Parliament that Italy adhered to the London agreement, whereby the Allied Powers undertook not to conclude a separate peace with the enemy.

In Feb. 1916 a new internal loan brought in 3,000 million lire. When the Chamber reassembled on March 1 there appeared to be some opposition to the Cabinet. The Giolittians and the Socialists regained courage from the fact that the war still continued and no decisive success had been achieved on any front, which they hoped would alienate the country from the Government's policy. The interventionists, on the other hand, criticized the Ministry for what they regarded as its insufficient energy in conducting the campaign, and, above all, they were anxious that war should be declared against Germany. Criticisms were also levelled at the Government's economic policy: facilities for the import of wheat and coal had proved inadequate, nor had anything been done to keep down freights, the rise of which had resulted in large increases in the price of many imported goods (coal had risen to six times its normal price). But the general opinion of the country was unfavourable to a change of Ministry, and when Sig. Salandra asked for an explicit vote of confidence, he obtained it on March 19 by 394 to 61, the Nationalist group voting this time with the opposition. On Feb. 7 the Government issued a decree absolutely forbidding trade with Germany. Trade relations had practically been broken off since Italy entered the war, but a small amount of trade had still been carried on through neutral countries; the new measure put an end even to this, and brought the declaration of war against Germany a step nearer.

In the winter of 1915–6 an exchange of visits between Allied statesmen and military chiefs began. In Feb. M. Briand, the French premier, visited Rome, and as a result of his conversations with Sig. Salandra and Baron Sonnino, a joint inter-Allied council was created; the first meeting was settled for the end of March. On March 20 Gen. Cadorna departed for Paris and the French G.H.Q., after which he visited London and then returned to Paris to take part in the above-mentioned council, on which Italy was represented by the premier and the Minister for Foreign Affairs. On the return of the two statesmen to Rome they were visited by Mr. Asquith, the British Premier, who was very warmly welcomed; he also went to the Italian front and was received by the King. Gen. Zupelli resigned from the War Ministry on April 6, as the result of a disagreement with Gen. Cadorna about the Albanian force, which the latter insisted on having under his own control as commander-in-chief and not under that of the War Ministry. Gen. Morrone, one of the corps commanders at the front, succeeded him.

Italian Reverses.

The initial successes of the Austrian offensive in the Trentino and on the Asiago plateau (May 1916) caused a painful impression, as it was the first setback which the Italian troops had suffered and resulted in the first enemy occupation of any part of Italian territory. Coming after a long period of only partial Italian successes, combined with the very heavy losses suffered, it caused a certain revival of anti-war tendencies. There was also much criticism of the Supreme Command, which had apparently allowed itself to be taken by surprise. Gen. Brusati, commanding the I. Army (Trentino–Asiago), was relieved of his command, together with several other generals. As a matter of fact Gen. Cadorna, knowing that the great Russian offensive was imminent, never believed that the Austrians would have attempted their famous

Strafexpedition, which, with the forces at their disposal, they could not conduct to a successful issue. Gen. Brusati certainly appears to deserve censure, in spite of the whitewashing he afterwards got from the Caporetto commission. Gen. Cadorna's counter-offensive succeeded in holding back the enemy before Gen. Brussilov's offensive in Galicia had begun. By June 24 most of the lost territory had been regained.

Boselli Ministry.

Undoubtedly the Trentino-Asiago offensive weakened the Cabinet's position; the hostility of the Democratic Alliance, composed of the interventionist groups, turned the scale, and on June 10 the Salandra Ministry was defeated on a vote of confidence by 197 to 158; the next day it resigned. It had never had a majority of its own, but had been accepted on sufferance by the Giolittians. But while the latter regarded this result as a success of their own, they were to be disappointed in the outcome, for instead of a new Cabinet being formed from their ranks, the general feeling of the Chamber indicated the veteran statesman, Paolo Boselli, as the obvious successor to Salandra; as he was outside and above the militant factions of the Chamber, he alone could hope to form a national ministry representing all parties. After a laborious crisis he succeeded in his task by June 19. The new premier remained without a portfolio; Baron Sonnino, Gen. Morrone, Adml. Corsi and Sig. Carcano retained their departments; Sig. Orlando passed from the Ministry of Justice to the Interior; the Radicals, Sacchi and Fera, became Ministers of Justice and of Posts and Telegraphs; Meda, the Catholic leader, Minister of Finance; the Reformist Socialist Bonimi Minister of Public Works; Giovanni Raineri Minister of Agriculture; the new Ministries of Industry and Labour and of Transport were assigned to Giuseppe de Nava and Enrico Arlotta; the Giolittian Colosimo obtained the Colonies; while the Reformist Socialist Bissolati, the Republican Comandini, Leonardo Bianchi and Vittorio Scialoja were made ministers without portfolio.

Occupation of Gorizia.

The Austrian spring offensive had delayed Gen. Cadorna's main operations, the objectives of which were Gorizia and Trieste. The attack on Gorizia was begun on Aug. 4, and after 11 days of strenuous fighting the town and the formidable positions to the W., N.W., S. and S.E. were captured. Gen. Cadorna and his lieutenants, among whom the young Col. (later Gen.) Badoglio deserves especial mention, conducted the whole offensive with consummate skill; while the troops behaved with great gallantry. But there were other lines of defence E. and N.E. of Gorizia still in enemy hands, and there were not enough reserves to complete the action. The victory, however, revived public confidence. Italy now decided to participate in the expedition to Macedonia, where a mixed force of French, British, Serbs and Russians had been fighting in very difficult conditions for nearly a year. The Italian Supreme Command was not very favourable to such a dispersion of forces. But the Government thought that Italy should be represented. On Aug. 11 the first detachments, commanded by Gen. Petitti di Roreto, landed at Salonika; the expeditionary force eventually reached the total of 55,000 men, and was commanded from June 1917 by Gen. Mombelli. After taking part in the operations for the capture of Monastir (Nov. 1916), it was entrusted with one of the most dangerous sectors of the whole front. The Italian force in Albania, commanded by Gen. Ferrero, extended its occupation northward to the banks of the Voyusa in Aug. 1916, and then eastward, so that by the end of the year contact with the French army of the east had been established at Ersek. In June 1917 Gen. Ferrero at Argyrokastro proclaimed an Italian protectorate over Albania.

War against Germany.

On Aug. 1916 Italy declared war against Germany. Many reasons have been assigned for the delay in taking this decision. Germany had no reason to declare war against Italy, and in fact she always hoped that at the future peace conference she would have in Italy, if not a friend, at least a friendly enemy among the Entente Powers. The Italian Government believed that, while public opinion fully realized the necessity for war with Austria, it did not see that Germany was the predominant partner in the hostile coalition, and that, as Italian forces were not in direct contact with those of Germany, except for a few detachments in the Trentino at the beginning of the war, there was no need to precipitate matters. In view of later events, and especially of the Allies' attitude towards Italy, the delayed declaration of war is now generally regarded as a mistake. The immediate cause of the declaration of Aug. 27 1916 was the assistance afforded by Germany to Austria in the recent operations and the seizure of Italian property by the German Government. On the same day Rumania declared war against Austria. The Italian military attaché in the former country, alone of the Allied representatives, had deprecated Rumanian intervention at that moment and disapproved of the plan of invading Transylvania while neglecting the Bulgarian front. The course of events was to prove his judgment only too accurate. In Jan. 1917 a conference of Allied premiers and commanders-in-chief met in Rome. Gen Cadorna, supported by Mr. Lloyd George, advocated an inter-Allied offensive on the Austrian front. But the French view that the western front alone was decisive prevailed. In April 1917 the British, French and Italian premiers and foreign ministers met at St. Jean de Maurienne, in Savoy, to discuss the future settlement of the Eastern problem. The meeting was the result of Baron Sonnino's insistence that the previous agreements between Britain, France and Russia concerning the same questions, and especially the fate of Constantinople and Asia Minor, were invalid as Italy was not a party to them. At St. Jean it was agreed that, in a future partition of Asia Minor, Smyrna was to be assigned to Italy, an undertaking subsequently broken.

During the autumn of 1916, and again in the spring and summer of 1917, operations on the Carso-Isonzo front were carried out. Many thousands of prisoners were captured and some important positions conquered, especially on the Bainsitsa plateau. But no decisive victory was achieved, and the losses were terrible. What the Italian public only half realized, and that of the other Allied countries hardly at all, was that by these frightfully costly operations the Italian army was pinning down Austria's best troops—and after the Russian revolution practically all her troops—and preventing her from sending any reënforcements to the Germans on the western front.

Anti-War Agitation, 1917.

It now became known that the Austrians, free of all danger on the Russian side, and aided by several German divisions and by the advice of Marshal von Ludendorff, were preparing an offensive on a large scale against Italy. Their preparations were not limited to the accumulation of reserves and artillery, but comprised an active and subtle propaganda among the Italian troops and, above all, in the interior of the country. The protracted struggle, the slow progress achieved, the serious defeats on many Allied fronts, the fearful losses, the grave privations of the civil population and, above all, the collapse of Russia, had accentuated the sense of depression which had begun to be felt in Italy more than a year before. Among the troops themselves the discomfort of life in the trenches, as well as the constant danger, the too-long periods at the front which each unit had to undergo, and the absence or inadequacy of the arrangements for providing amusements in the rest camps, began to react on the men who had fought for over two years. The more extreme Socialists were not slow to profit by this state of feeling; some of them were no doubt in the enemy's pay, others hoped to reëstablish their influence over the masses by provoking a military mutiny which would bring about peace, and all were influenced by the example of the Russian revolution and by the prospects of unlimited plunder which a similar movement in Italy would offer. An immense number of people, both civilians and soldiers, were simply war-weary, and there were other influences at work besides that of the Socialists. A "defeatist" campaign had already been started in Giolitti's organ *La Stampa* of Turin. The Clericals, who had never approved of the war, were ever suggesting that peace might be obtained by agreement, and the Pope's Encyclical about the "useless carnage" made a considerable impression, although it must be added that many individual Catholics, including nearly all the army chaplains, had done their duty nobly. The German "peace offensive," and a speech by the Socialist deputy Treves, in which he promised that in the following winter no one should be in the trenches, all served to accentuate the state of mind which made Caporetto possible. A minor cause was the revolutionary strike in Turin in Aug. 1917. The pretext of the rioting was that on a certain day the city's bread supply had failed. The men who promoted the trouble were very highly paid workmen in the munition and motor factories, who had not a shadow of a grievance, but merely wished to imitate the Russian Bolshevists; German and Austrian money was probably not unconnected with the affair. The authorities repressed the rising with considerable energy and several of the rioters were killed or wounded. Many of those implicated were punished by being deprived of their exemption from service in the army and sent to the front, where they at once initiated a revolutionary propaganda among the other troops. Many of these men were incorporated in the brigades which afterwards collapsed at Caporetto, while others, employed in the motor transport service, were able to spread their suggestions throughout many units.

There had been signs of unrest and of a diminished military spirit among certain regiments, notably in the fighting on the Monte Ortigara on the Asiago plateau (June 1917), and in the operations against the Hermada on the road to Trieste in Aug., which, after a successful beginning, had been held up owing to the failure of certain units. This state of things had certainly not escaped Gen. Cadorna, but, in spite of his warnings, the Government, and in particular Sig. Orlando, the Minister of the Interior, had failed to pay attention to them or to take any adequate measures against the Bolshevist, defeatist and pacifist propaganda. Papers like the *Avanti* were not only published freely with only the mildest censorship, but were even allowed to reach the troops at the front.

Caporetto.

The enemy offensive began on Oct. 23 1917, at Caporetto on the upper Isonzo. The objective had been not only to drive the Italians out of Austrian territory and to inflict a crushing defeat on the whole Italian army, but, as far as Austria was concerned, to reconquer Venetia for the Monarchy. The attack on Caporetto was followed immediately by another on the Asiago plateau. The results actually achieved were the breaking of the eastern front and the collapse of the whole of the Italian II. Army (Gen. Capello), which involved the retirement, albeit in order, of the III. (Duke of Aosta) from the Carso, and of the IV. (Gen. di Robilant) from the Cadore. The whole of the provinces of Udine and Belluno and parts of those of Venice, Treviso and Vicenza were occupied by the enemy. On the Asiago plateau, on Monte Grappa (between the Brenta and the Piave) and along the lower course of the Piave the Austro-Germans were held up, but no one knew if it would be possible to resist for long. The consequences of the disaster were grave indeed. The enemy had captured 300,000 prisoners, 2,500 guns (including most of the heavy artillery) and vast quantities of stores. Venice was now only 30 km. from the front and its fall at one time seemed inevitable, together with that of other important towns, manufacturing centres and rich agricultural districts. Depression and gloom spread throughout Italy, intensified by the throngs of refugees flying panic-stricken before the invaders, who murdered, raped, plundered and burnt their way onward (*see* CAPORETTO, BATTLE OF).[1]

Germany and Austria were convinced that a knock-down blow like this would have left Italy prostrate, and they counted on a revolution leading to a separate peace, as was afterwards to take place in Russia at Brest Litovsk. Then all the enemy armies would be able to concentrate on the western front and obtain a decisive victory there before American help could arrive. Even in the Allied countries and in Italy herself it was thought impossible that after so crushing a disaster the army and people could recover. But the impossible happened. The feeling of dissatisfaction at the length of the war, the hope of peace by compromise, Germanophil sentiments, and the general sense of hopeless weariness gave way to the determination to resist at all costs. Everyone from the King to the poorest peasant realized that the new lines must be held. "*Di qui non passeranno*" ("Here they shall not pass") became the universal cry. The King's example was splendid. Since the beginning of the war he had always been at the front, constantly visiting the trenches and the most exposed positions, but without interfering in the conduct of military operations, although nominally commander-in-chief; he took only the same leave as any ordinary soldier, 15 days a year. But now he multiplied his efforts a thousandfold. His proclamation of Nov. 10 was a stirring trumpet call to the whole nation. "As neither My House nor My People, united in a single spirit, have ever wavered before danger, so even now we look adversity in the face undaunted. Citizens and soldiers, be a single army! All cowardice is treachery, all discord is treachery, all recrimination is treachery." Another man who did much to rouse the country was the poet D'Annunzio. He had given proof of wonderful courage in fighting, and he now influenced public opinion by the marvellous eloquence of his speeches and articles. Between Nov. 10 and 22 the defeated Italian army, which had pulled itself together, resisted on the Asiago-Grappa-Piave line, and the enemy, in spite of repeated attacks, failed to break through.

Orlando Ministry.

As soon as the extent of the Caporetto disaster was realized the Boselli Cabinet resigned (Oct. 26), and on the 30th Sig. Orlando succeeded in forming another, with himself as premier. Baron Sonnino remained Foreign Minister and the other portfolios were distributed as follows: Gen. Alfieri (War), Adml. Del Bono (Marine), Meda (Finance), Nitti (Treasury), Colosimo (Colonies), Dari (Public Works), Gen. Dallolio (Arms and Munitions), Sacchi (Justice), Fera (Post Office), Miliani (Agriculture), Ciuffelli (Trade and Industry), Bianchi (Transport), Bissolati (Pensions), Crespi (Supplies). Gen. Cadorna now ceased to command the army, and Gen. Diaz was appointed chief of the general staff in his place, with Gens. Badoglio and Giardino as assistant chiefs.

The Allies came forward generously to aid Italy in her dire need, and at once hurried fresh troops to the Italian front, amounting eventually to six British and five French divisions. Marshal Foch also visited the Supreme Command to assist with his valuable advice, but he endorsed all that Gen. Cadorna proposed almost without suggesting any change. The arrival of the Allied contingents exercised a most inspiriting moral effect on the Italian troops and public. But it must be remembered that no French or British contingent actually came into the fighting line until after the enemy had been definitely held up by Italian troops alone between Nov. 10 and 22. This fact had an important bearing on events yet to come, but is apt to be forgotten. On Nov. 5 the prime ministers of Italy, France and Britain and the Italian Ministers of War and Foreign Affairs met at Rapallo, where the permanent Inter-Allied Military Committee of Versailles was constituted. Gen. Cadorna was the first Italian representative on it, and remained there until, the Caporetto inquiry having been ordered, he was recalled.

A very serious problem which faced the new Government was the relief of the refugees from the invaded area. About 4·4% of Italy's territory had been occupied by the enemy and one-third of the inhabitants of those provinces had been able to escape and were scattered all over the country. The Government granted large sums for their assistance, and 35,000,000 lire was raised by public subscription. Their presence did much to strengthen the national spirit of resistance, and much valuable propaganda was carried out by the association of disabled soldiers (*mutilati di guerra*), the organization of which was largely due to the heroic Capt. Paulucci di Calboli, who, although hopelessly crippled, toured the country advocating resistance to the bitter end, until he died in consequence of his wounds. In the meanwhile the army was almost wholly reorganized, and the losses in artillery and other material more than made good in about four months' time, largely owing to the patriotic enterprise of the Italian manufacturers and the organizing and technical genius of Gen. Dallolio. On Feb. 8 1918 Gen. Giardino was appointed to Versailles in the place of Gen. Cadorna, who was placed on the retired list, and on the 20th Gen. Alfieri resigned from the War Ministry, to which Gen. Zupelli returned. Valuable work was done by the American Red Cross, whose relief workers penetrated into every corner of Italy, and not only gave the most generous and efficient material assistance to the needy, but carried on a most vigorous political propaganda. The British Red Cross was also extremely active, especially at the front. At the same time both the Government and numerous Italian private committees set to work with energy to care for the comfort of the troops at the front and in the rest camps.

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[1] The report of the Royal Commission on the responsibilities of Germany and Austria for violations of international law, published in April 1921, contains a vast mass of evidence of the atrocious behaviour of the enemy in the united provinces.

Italy and the 14 Points.

On Jan. 8 1918 President Wilson published his Peace programme containing the famous 14 points. Those which referred to Italy and the Adriatic question were of a nature to raise some doubts as to his policy. He spoke in fact of "rectifications of the Italian frontiers on clearly recognized national lines," a phrase which has no meaning where the population is mixed. Point 10 speaks of "autonomy" for the peoples of Austria-Hungary which might imply the maintenance of the Dual Monarchy; but as long as that Monarchy existed Italy could never hope to retain peacefully even Trieste. To Serbia he offered no more than a free outlet to the sea, which might have been obtained outside the Austro-Hungarian dominions; this point also implied an unspoken desire to preserve the Monarchy. In Italy, even among the most ardent interventionists, there were a few who did not wish for the total destruction of Austria-Hungary, but their desire was obviously incompatible with the realization of Italian aspirations.

Pact of Rome.

Between April 8 and 10 the congress of nationalities oppressed by Austria-Hungary was held in Rome, and, although organized by a private committee, its delegates were received on the 11th by the premier, to whom they presented the so-called "Pact of Rome." Sig. Orlando had previously received in private the Yugoslav delegation to the Congress headed by M. Trumbich. The Pact of Rome, if carried out, meant the death-knell of the Dual Monarchy, inasmuch as it provided that each of the peoples subjected wholly or partly to Austro-Hungarian rule "proclaim its right to constitute its nationality and state unity and to complete it and attain full political and economic independence." The Italian and Yugoslav delegates recognized further that "the unity and independence of the Yugoslav nation are a vital interest for Italy, as the completion of Italian unity is a vital interest of the Yugoslav nation." They also agreed "to settle amicably the various territorial controversies on the basis of the principle of nationality and of the right of self-determination of peoples, and so as to avoid causing prejudice to the vital interests of the nations, which will be defined at the moment of making peace." Guarantees for the maintenance of their language, culture and moral and economic interests were promised to the racial minorities which might be included in each state. This agreement was an earnest of mutual good-will and the result of the tendencies of Bissolati and certain political men and writers who wished Italy to assume the leadership of the movement for the liberation of Austria-Hungary's subject peoples. But it really had no binding force, and it failed to offer a definite solution for the practical territorial problems which were destined later to assume so acute a character. The Nationalists claimed that the attitude of certain Italian representatives, who seemed prepared to give up Dalmatia, was responsible for the future *intransigeance* of the Yugoslavs.[1] At the same time the Yugoslav propagandists were conducting an active campaign to induce Britain and France to go back on the territorial agreements with Italy contained in the Pact of London, and they tried to enlist the support of the United States, which was not a party to that convention. In Sept. 1918 they actually proposed that, if Italy remained obdurate, Britain, France and the United States should force her to give way by cutting off her supplies of food and coal. It need hardly be said that this suggestion was not accepted by the Allies.

Italy had already sent a number of territorial troops to France to form labour corps (about 70,000 in all). But now, in view of the very serious situation on the French front caused by the successful German offensive of March and April, and as a return for the assistance of Allied forces on the Italian front, it was decided to send an Italian fighting force to the western front, consisting of an army corps under Gen. Albricci. The announcement was made in the Chamber on April 18. In May there were certain Cabinet changes: Gen. Dallolio left the Munitions Ministry, and Senator Villa succeeded Sig. Bianchi at that of Transport, and on the 22nd Sig. Crespi was appointed to the newly created Ministry of Supply. On the 24th the third anniversary of Italy's declaration of war was celebrated in Rome, and the Prince of Wales took part in the ceremony.

Defence on the Piave.

After the great German offensive in France the Supreme Command received information that another Austrian offensive on the Italian front was in preparation. Although the spirit of the army and of the country as a whole was much higher than it had been before Caporetto, and it was generally believed that the enemy would be ultimately held up, it was feared that the enemy push would result in at least a temporary occupation of more Italian territory, containing rich industrial and agricultural areas which the country could not afford to lose. Fortunately the reorganized intelligence service was able to obtain full details of the enemy's plans in good time. This was partly due also to the Italian and Allied air forces, which had now acquired a complete mastery of the air on the Italian front, and to some extent to the work of propaganda carried out among the Austrian troops belonging to the oppressed nationalities. Among the Austrian prisoners captured, those of Czechoslovak, Rumanian and Polish nationality were formed into special units to serve at the front—the Czechoslovaks eventually constituted a division which took part in the fighting. Negotiations were also opened with a view to raising a Yugoslav force, but the plan failed. On June 15 1918, the Austrian offensive was launched on the Asiago plateau and on the Piave-Grappa front, and on the 23rd, after eight days' desperate fighting, the Austrians were completely driven back to their old positions defeated and in disorder. This victory, in which the Anglo-French divisions had an important share, produced a general sense of relief.

Material Privation.

The internal economic situation was difficult enough, but the public were ready to support all necessary privations. Bread, rice, macaroni paste, meat, sugar and many other food-stuffs were strictly rationed. The bread ration was reduced to 250 grammes per day per head, meat could be obtained only twice a week, and the manufacture of cakes and sweets was prohibited. Coal, which had risen enormously in price, was so scarce that the railway service for passengers had to be greatly curtailed on all lines. The size of newspapers was strictly limited so as to avoid wastage of paper. On the other hand, war industries assumed an enormous development, and the whole country became one huge arsenal, in spite of the fact that practically all the raw material had to be imported. Some mines, however, such as the iron-mines of the Val d'Aosta and several lignite-mines, which had remained idle for many years because it did not pay to run them, were now reopened and proved valuable war assets. The shipping losses were very serious, as the enemy submarines were particularly active in the Mediterranean and Adriatic, and by the end of the war Italy had lost just over half of her mercantile tonnage. This, together with the losses of British and other Allied shipping, enhanced the supply difficulty.

Italy had now contingents on five fronts outside Italy—France, Albania, Macedonia, Palestine (since June 1917) and Libya. Before the war ended other detachments were to be sent to the Murman coast and to East Siberia. The Albanian force had not taken part in important operations since the end of 1916, but in the spring and summer of 1918 it came in for a good deal of fighting and extended the occupied territory considerably, in coöperation with the left wing of the French Armée d'Orient. After the occupation of Fieri and Berat, Gen. Ferrero's corps suffered a setback owing to the enemy's strong reënforcements, while his own effectives had been greatly depleted by fever, but it subsequently contributed to the success of the Macedonian offensive in September. In the latter operation Gen. Mombelli's contingent played a useful part. During the summer of 1918 preparations were being made for an Italian offensive on the Asiago plateau and in the Pasubio sector. But a vaster general offensive was also being prepared with the object of completely breaking the Austrian front. Events in France rendered any help to Austria from Germany improbable, while the surrender of Bulgaria constituted a new menace to the Dual Monarchy from the south-east. The army under Gen. Diaz comprised 51 Italian, 3 British, 2 French and one Czechoslovak divisions and one U.S. regiment. The attacking force consisted of 22 divisions divided into four armies, of whom one was commanded by Gen. the Earl of Cavan and another by the French Gen. Graziani; the two Italian army commanders were Gens. Caviglia and Giardino. The total enemy forces amounted to 73½ divisions, but they were inferior in artillery. The offensive known as the battle of Vittorio Veneto began on Oct. 24—a year and a day after the beginning of the Caporetto disaster. By Nov. 3, "what had been one of the most powerful armies in the world," as Gen. Diaz's victory communiqué states, "was annihilated." Some 600,000 prisoners, 7,000 guns and an immense quantity of material of all kinds were captured—the biggest haul of the whole war. The same day, at Villa Giusti, near Padua, an armistice between the Italian and Austro-Hungarian armies was signed. By its terms the enemy troops were to evacuate not only all Italian territory, but also all the territory assigned to Italy by the Treaty of London, and all Italian prisoners were to be liberated without reciprocity. At the moment it was signed the Italian troops were well beyond the old frontier in the western and central sectors of the front; Rovereto, Trento and the Val Sugana were occupied; and a column, descending the Val di Sole, was rapidly approaching Bozen. The enemy had also been driven out of a large part of the province of Belluno and most of the Friuli, while the city of Trieste had been occupied by troops under Gen. Petitti di Roerto transported by sea from Venice. The armistice went into force on the 4th, and on that day Cividale, Cervignano, Grado, Aquileia and Gorizia were reoccupied, and detachments landed at Monfalcone, various Istrian ports, Zara and on the islands of Lussin, Lagosta, Maleda and Curzola. There had been at first no intention of occupying Fiume, but it was done at the urgent appeal of the inhabitants, who were in fear of violence at the hands of the Croat bands.

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[1] See the whole correspondence on the subject in *La Vita Italiana*, July–Aug. 1919, p. 120.

Vittorio Veneto.

The Armistice.

Meanwhile the Armistice of Nov. 11 with Germany was being concluded in France, as the result of events there, to which the victory of Vittorio Veneto had been an important contribution. For Bavaria was now open to the Italian armies. The first difficulty with which Italy was confronted immediately after her armistice with Austria was the handling of the enormous and unexpected number of enemy prisoners, to which were added the very numerous Italian prisoners who had been suddenly set free, or had freed themselves, without any arrangements for their food or transport; a considerable number who had been employed in Hungary, Rumania, Bulgaria and South Russia came pouring down into Macedonia, taxing to the uttermost the very limited resources of Gen. Mombelli's force. It was also urgently necessary to provide food, seed corn, cattle and clothing for the inhabitants of the liberated territories, whom the Austrians had plundered of everything. The problem of the prisoners was rapidly and efficiently handled, and in a comparatively short time the Italian prisoners were repatriated, although not a few of them, especially those in the Balkans, died of starvation and exhaustion on the way home. The question of the *terre liberate* proved far more serious; a special ministry was created for it, but in 1921 much still then remained to be done before those provinces could be restored to normal conditions.

Occupation of Italia Irredenta.

After Vittorio Veneto the Italian troops occupied the whole territory assigned to Italy by the Pact of London, and also certain other points beyond the line for the maintenance of order. Troops landed at Pirano and Muggia on Nov. 5, and a naval division entered Pola harbour the same day; Bozen in Tirol and Sebenico in Dalmatia were occupied on the 6th, and on the 10th the northernmost limit of the line arranged with Austria, the Brenner pass, was reached. The Duke of Aosta, commanding the III. Army, entered Trieste, where he established his H.Q., and on the same day a detachment under Gen. di San Marzano, together with a U.S. battalion, entered Fiume. On the 22nd the greater part of the former Austro-Hungarian mercantile fleet, which had taken shelter in the Prokljan lagoon near Sebenico, was taken over by Italian warships. Innsbruck and Landeck, at the request of the local authorities, were occupied on the 23rd for the maintenance of order, while on the 24th Italian patrols reached the high peaks of the Vetta d'Italia and the Pizzo dei Tre Signori, where they planted the Italian flag. The final settlement of Italy's new frontiers was of course a matter for the Peace Conference to decide.

Italian Losses.

The extremely heavy losses suffered by Italy in the war materially influenced public opinion in the country during the discussion of the peace terms, for it was generally felt that in the other Allied countries these losses were not adequately appreciated, neither in their absolute nor in their relative importance. With a total pop. of about 38,000,000 inhabitants (including the African colonies) Italy had mobilized 26 classes, or 5,615,000 men. Her losses in men were 496,921 killed (of whom 15,500 were officers) and 949,576 wounded (slightly wounded not included); of these 219,145 remained permanently disabled. The killed alone represent 1·3% of the population. The fact that Italy entered the war 10 months later than the other Powers makes her percentage of losses still more significant.

Italy's Territorial Claims.

Italy's territorial claims had been set forth in the Pact of London, although certain Nationalist elements aspired to somewhat wider lands. The reasons for Italy's aspirations, as stated in the memorandum presented by the Italian Delegation to the Paris Conference on Feb. 7 1919, may be summarized as follows:—

1. *The Trentino.*—This was a purely Italian province, whose inhabitants had always demanded union with Italy; on this point there was no controversy.

2. *The Alto Adige.*—The upper valleys of the Adige and its affluents as far as the Brenner were necessary for Italy's strategic security, and although they contained a German pop. of 180,000, it would be very difficult to find a possible geographical frontier south of the Brenner. This was one of the cases in which geographical considerations prevailed over purely ethnical ones.

3. *The Venezia Giulia.*—This territory comprised the city and district of Trieste, Gorizia-Gradisca, Istria and certain adjoining districts of Carinthia and Carniola. The total pop. was 893,000; according to Austrian statistics 48% were Italian, 32% Slovenes and 20% Croats, but these figures were, as is well known, doctored to make the Italians appear less numerous, while the Slav element had been largely increased in recent times by the importation of numbers of Slovene officials and workmen for the Government services, railways and State industries, always with the object of reducing the Italian percentage. On the other hand, the numerous Italian citizens permanently settled in the Venezia Giulia, although included in the total population, did not affect the Italian official percentage, being aliens, although they would affect it under Italian rule; if they were included the total of Italians would be 482,000 to 411,000 Slavs. Furthermore, even under Austrian rule, 70% of the total population lived in communes administered by Italian councils.

4. *Dalmatia.*—In this province the majority of the population was Slav. According to Austrian statistics, out of a total of 645,000 inhabitants only 18,000, or 3%, were Italians. According to Italian statistics the proportion of Italians amounted to 10% of the total. All the Dalmatian deputies to the Reichsrat were Slavs, and so were all the communes except Zara. But in 1861 the Diet comprised 30 Italians and 13 Slavs, and in 1869 seven Reichsrat deputies were Italians and two Slavs. The whole civilization, traditions, manners and customs of Dalmatia were undoubtedly Italian rather than Slav, and until after 1866, when Austria inaugurated her policy of fomenting hatred between the two races and of backing up the Slavs, Italians and Slavs had lived amicably together. Of this province, whose total area was 12,385 sq. km., Italy, by the Pact

of London, claimed 6,326 sq. km. with a pop. of 287,000, or 44 % of the total, including at least 15,000 Italians. Italy demanded Dalmatia also for strategic reasons. The Dalmatian coast, with its innumerable bays, inlets, ample natural harbours and islands, represented a danger for Italian security if it was held by an unfriendly Power, more especially as the opposite Italian coast had practically no ports from Venice to Brindisi.

5. *Fiume.*—Though the Pact of London did not include Fiume in Italy's claims, a memorial as to what Italy should demand, presented to the Government in April 1917 by Senator Franchetti and bearing 3,000 signatures, expressly included Fiume as well as the other territories provided for in the Pact.

Italian public opinion was not unanimous as to Italy's territorial aspirations, and this was one of the causes of the weakness of the Italian position at the Peace Conference. The Nationalists demanded all the territories of the London Treaty plus Fiume, and some claimed South Dalmatia as well. The *rinunciatari* on the other hand, as those who were prepared to give up part of these claims, were ready to abandon Dalmatia and part of Istria and of the Trieste hinterland, because they wanted to conciliate the Yugoslavs and took no account of Italy's strategical necessities, but they demanded Fiume as an Italian town. Sig. Bissolati was the leader of this group, and he even wished to give up the Alto Adige because of its German majority. Among the Italian delegates at Paris there were also differences of tendency if not actually of opinion. While Baron Sonnino held to the Pact of London and did not insist on Fiume, Sig. Orlando demanded the latter but was ready to compromise on Dalmatia. Military opinion attached especial importance to the Trieste hinterland, as far as the Monte Nevoso line, as indispensable for the defence of Trieste and Pola, but it was less certain about Dalmatia, which it would be difficult to defend. Naval opinion, especially Adml. Thaon di Revel, the chief of the naval staff, was strongly in favour of retaining Dalmatia owing to its geographical situation and its many ports and islands. The general mass of public opinion demanded above all a good frontier—the Brenner and the Julian Alps with the Nevoso line—and the protection of the Italian character of Fiume and the other Italian communities on the Adriatic coast so that they should not be wiped out by the Slav tide. This latter point of view appealed to nearly every Italian, to whom the idea that civilized Italian communities should be ruled by semi-civilized Balkan races was profoundly repugnant. In the case of Fiume this feeling became peculiarly bitter owing to the subsequent developments of the controversy.

Yugoslav Counter-Claims.

To the Italian claims on the eastern Adriatic the Yugoslavs now opposed their demands. The minimum on which they insisted would have brought the frontier to the Isonzo, leaving even Trieste outside Italy, while their maximum claims extended to the old Austro-Italian frontier and even beyond it so as to include the eastern part of the province of Udine. The difference between the Italian attitude and that of the Yugoslavs was that, whereas in Italy only the ultra-Nationalists made exaggerated demands, and many moderate-minded men were ready to brave unpopularity by reducing Italy's claims very considerably and pleaded earnestly for conciliation with the Yugoslavs, among the latter no one said a word in favour of an understanding except the gallant Voivoda Michich, the Serbian commander-in-chief.

Italy and the Yugoslavs.—Rivalry between Italy and the Yugoslavs did not date from the end of the war. Under the Austrian régime bitter hatred had grown up, fostered by Austria herself, between the Italian and Slav elements of the population, and this antagonism had repercussions in Italy. Italians wishing to complete Italian unity hoped that on the day when the Dual Monarchy should collapse Italy would acquire those of its territories which had an Italian population and civilization. The Slavs, who also looked forward to their own unity—most of them believed that it would be realized under Austrian aegis—laid claim to those same territories on the ground that a part of their inhabitants were Slavs. As long as Austria-Hungary existed this rivalry assumed an acute form only in the disputed territories themselves and did not affect Italian policy very closely. But with the outbreak of the war the national aspirations of Italy and of the Yugoslavs came into more direct conflict. At first Italian sympathies, regardless of Serbia's eventual aspirations to Austria's Adriatic lands, were undoubtedly with the small and gallant Serb nation struggling against a brutal and overbearing bully, and when Italy was about to enter the war coöperation between the two nations seemed the obvious course. A plan of campaign whereby Serbia was to attack the Austrians in the direction of Agram, while Italy was attacking on the Carso, had been agreed upon; but it fell through at the last moment, in spite of the insistent appeals of the Allies to the Belgrade Government, owing to the influence of the Serbian secret societies, who dominated the army and refused to countenance any action which might be of advantage to Italy. The Serbs, although they did not then know the exact terms of the Pact of London, knew that Italy claimed Gorizia, Trieste, Istria and parts of Dalmatia and the islands. There seemed then little prospect of a complete break-up of Austria, but the Serbs, who aspired to a union of all the Yugoslav peoples, laid claim to all these territories; some even of the Serbs would have been ready to accept national unity under Austrian suzerainty. The Yugoslav soldiers in the Austrian army fought with particular energy against Italy, because they considered that they were defending what they regarded as Yugoslav territory against an Italian invasion. The fact remains that, owing to the failure of the Serbs to attack, Austria was able to withdraw five out of six divisions from the Serb front and send them to the Italian front.

During the war the first contact between the Italians and the Serbs occurred in Albania, where Italian assistance materially helped to save the remnants of the Serbian army from annihilation by starvation and disease. Incidents, however, occurred in that connexion which caused bitterness of feeling on the part of the Serbs, for some individual Italian officers, including one general, failed to show proper consideration and tact, and subjected them to certain moral humiliations. These lapses were not forgotten. Later, indeed, when Italian and Serb troops were fighting side by side in Macedonia, relations between the two armies became excellent, and on the eve of the Sept. offensive the Crown Prince Alexander deplored the fact that the plan of operations precluded a direct liaison between Italian and Serb troops. A certain amount of tension was caused, however, by the question of the Yugoslav prisoners in Italy. The Serbian Government wanted Italy to send those prisoners—both those captured by the Serbian army and interned in Italy and those captured by the Italians—to fight under Serbian command in Macedonia. The Italian Government raised difficulties, not so much from hostility to the idea of Yugoslav unity, as the Serbs asserted, as because most of these prisoners were Croats and Slovenes and had no wish to go and fight against Austria or her allies. There were other difficulties concerning the choice of officers, and the result was that only a very small number were sent to Macedonia.

It must be remembered in explanation of Italy's attitude, that the notion of Yugoslav unity independent of Austria-Hungary only assumed practical shape at the very end of the war save in a very limited circle. Austria's Yugoslav soldiers fought valiantly against the Italians, and even against the Serbs. Throughout the war the Yugoslav subjects of the Dual Monarchy were most emphatic in their expressions of loyalty to the dynasty. Thus on May 8 1917, the Serbo-Croat coalition in the Croatian Diet presented an address of loyalty to the Emperor Charles, demanding the formation of "Trialism," with a Yugoslav state which would constitute "on the Adriatic coast the most powerful bulwark of the greatness and splendour of Your Majesty's throne." On Oct. 19 1917, Herr Korosetz,[1] president of the Yugoslav club in the Austrian Reichsrat, after speaking of the heroic sacrifices of the Yugoslav people "for the Emperor and the Fatherland," stated that Yugoslavism was "the warden of the Monarchy as a great Power on the Adriatic." On May 30 1918, the Yugoslav Congress in Trieste protested against the friendliness towards Italy displayed by the Yugoslav delegates at the Rome Congress, and insisted that Trieste and all the coast from the Isonzo to the last town in Dalmatia must belong to the Yugoslav state under Austrian auspices. It was only on the eve of the Armistice, when the defeat of the Central Empires appeared inevitable even to their own subjects, that the project of breaking away from the Dual Monarchy was openly entertained by the Austro-Hungarian Yugoslavs. The Croatian Association did not actually proclaim the independence of Yugoslavia until Oct. 30 1918. An attempt was then made to secure the Austro-Hungarian fleet for the new state, and on Oct. 31 the Austro-Hungarian Government ordered the ships at Pola to place themselves under the Serbo-Croat-Slovene National Council created at Agram. The Yugoslav colours were raised on the fleet, but of course such a change of flag during war-time was null and void, and the Italians torpedoed the dreadnought "Viribus Unitis" in Pola harbour on Nov. 1.

Italy after the War.—Orlando and Baron Sonnino returned to Italy from the Versailles War Council on Nov. 4 1918, and great demonstrations were held to celebrate the victory. On the 14th the King returned to Rome from the front and had a triumphant reception. The Government was now faced by the difficult task of bridging the gulf between the state of war and the state of peace. It was still necessary to keep a large number of troops at the front until the frontier question was settled; and Serbia, now the Serbo-Croat-Slovene state, or Yugoslavia, instead of demobilizing, was increasing her army by taking over ex-Austro-

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[1] Who was afterwards a member of the Yugoslav Cabinet.

Hungarian units *en bloc* and even calling up recruits in the new territories. There was also a state of anarchy in certain Austrian and Slav districts along the Armistice line, while the Italian forces in the Balkans had to be kept up to strength for the occupation of all Albania, now that the Austrian forces had left, to garrison Bulgaria and to provide contingents for Constantinople and other points in European Turkey. The internal situation also required careful handling, as the Socialist and anarchist elements, now that the war régime and the censorship were relaxed, took advantage of the general weariness of the people to foment revolutionary agitations. The economic situation was serious. On Nov. 26 Sig. Nitti presented the budget statement for 1917–8, which showed a revenue of 19,496 millions (of which 12,000 millions were borrowed) and an expenditure of 25,339 millions, leaving a deficit of 6,271 millions. The Cabinet obtained a vote of confidence from the Chamber on the 27th (325 to 33), after which Sig. Orlando and Baron Sonnino left for London for a series of preliminary meetings in view of the coming Peace Conference. On Dec. 12 the first demobilization order was issued, and the classes from 1878 to 1884 were disbanded. Owing to a disagreement with his colleagues over foreign policy, and particularly over the questions of the Alto Adige and Dalmatia, Sig. Bissolati resigned from the Cabinet. Sig. Dari, the Minister of Public Works, also resigned on account of ill-health, and was succeeded by Sig. Bonomi. On Jan. 1 1919, the state of war was declared at an end throughout Italy except in the Veneto. On the 3rd President Wilson arrived in Rome, and was received with a frenzied enthusiasm as the man who had most contributed to bringing the war to an end. But the ministers who had occasion to discuss politics with him suspected that he was by no means too favourable to Italy's claims.

Ministerial Crisis, 1919.

The ministerial crisis which had been brewing since Bissolati's resignation came to a head on Jan. 18, and resulted in the resignation of Signori Sacchi, Nitti, Villa, Miliani and Gen. Zupelli from the ministries of Justice, Treasury, Transport, Agriculture and War; their portfolios were assumed by Signori Facta, Stringher, De Nava, Riccio and Gen. Caviglia, while the newly constituted ministry for the liberated territories was entrusted to Senator Fradeletto. The Italian delegation to the Peace Conference, which held its first meeting in Paris the same day, was composed of Sig. Orlando, Baron Sonnino, the ex-ministers Salandra and Barzilai and the ambassador Marquis Salvago-Raggi.

The Peace Conference.

The Italo-Yugoslav conflict soon broke out in an acute form. An initial mistake of the Italian delegation was their failure to protest against the presence of Herr Zolger, the ex-Austrian minister, among the Yugoslav delegates. On Feb. 17 the Yugoslav delegation in Paris proposed to refer all territorial disputes to the arbitration of President Wilson, but Baron Sonnino replied that Italy could not accept arbitration on a question for which she had fought for three years and lost half a million of her sons, and it must now be submitted to the Conference. The following day the Yugoslavs presented their territorial claims, which corresponded to the minimum mentioned above, plus Montenegro and North Albania. On the Armistice line frequent incidents occurred between Italian and Yugoslav troops, and the latter even expelled the Italian military mission from Laibach, where it had been sent to regulate through traffic to Czechoslovakia. As a result of the report of a special Inter-Allied Commission the Italian mission returned to Laibach. On Feb. 24 Italian officers were insulted by Croat roughs at Spalato. At Belgrade the Government refused to accept the credentials of the new Italian minister, Don Livio Borghese, because they were addressed to the King of Serbia and not to the King of the Serbs, Croats and Slovenes, Italy not having recognized the new state. The discussion of the Adriatic question at the Peace Conference was adjourned and the peace with Germany given precedence. The Italian delegation practically agreed to all the proposals of her Allies in this connexion, and raised no objection to the division of Germany's colonies solely between France, Britain and Belgium, without asking for any concessions in return. For this the delegation was afterwards criticized in Italy, where bitter and sometimes extremely violent attacks on the Allies were made in a section of the press, for their supposed unfairness in support of the Yugoslav claims.

The Adriatic Question.

When the Adriatic question itself came up for discussion the Italian delegation maintained that the Pact of London assigned certain territories to Italy, and that on these there could be no controversy; Fiume, admittedly, was not comprised in them, but as the population had by an overwhelming majority demanded union with Italy, its wishes deserved every consideration. To facilitate a settlement Italy was disposed to agree to certain modifications of the Pact of London. The French and British Governments seemed at first inclined to agree to this view. But President Wilson insisted that the territories inhabited by a Yugoslav majority must be assigned to the Yugoslavs even if the Pact assigned them to Italy, and that Fiume must also be given to them because it was the best outlet for them on the coast, regardless of the wishes of the inhabitants. Matters had reached a deadlock by April 22, but conversations still continued apparently in a friendly tone, when suddenly, on the 23rd, Wilson published an appeal on his own account to the Italian people, over the head of their Government, in which he set forth his reasons for opposing Italy's claims. The arguments contained in the message were said to have been communicated privately to Orlando a few days previously, but the President had stated that he had no objection to further discussions, so that there was nothing to suggest this new move. The message caused widespread astonishment, as an unprecedented violation of the rules of correct diplomacy. Orlando at once declared that he must go to Rome to consult Parliament and the country.[1] On the 24th he left Paris, followed two days later by Sonnino and Salandra. There were enthusiastic demonstrations throughout Italy in favour of the Government and against Wilson, and the Fiume problem became now a question of national honour. On the 29th the premier recounted the story of the Fiume negotiations to the Chamber, which supported his policy by 382 votes to 40. The Government found support even in the Socialist camp and among the *rinunciatari*. Sig. Bissolati confirmed his conviction that Fiume must be Italian on ethnical grounds, and the labour organizations, in reply to appeals from the British Labour party and the French C.G.T. to uphold Wilson's policy, declared that they could not accept a one-sided Wilsonism, unbending towards Italy and accommodating where the interests of other Powers were concerned.

Mr. Wilson's Bombshell.

The poet D'Annunzio took up the question of Fiume and Dalmatia with his accustomed ardour, and the Nationalists urged the Government to annex both. But Orlando refrained from hasty action. The other Powers were very anxious that Italy should sign the Treaty with Germany, for, although it could have been signed without her, her absence would have strengthened the position of Germany. But Sig. Orlando failed to take advantage of this situation, and on May 5 returned to Paris, without having obtained those guarantees in favour of Italy's interests which the Italian public believed he had secured. On the contrary, on reaching Paris the delegation found its situation less favourable than when it had quitted the Conference. The German treaty was ready, and contained certain modifications concerning reparations, introduced during the absence of the Italian delegation, and against which Sig. Crespi, assistant delegate, had protested. A defensive alliance between France, Britain and the United States had also been concluded without Italy being asked to participate, and although she would probably have refused, the Italian public considered that want of consideration had been shown in not asking her. On the 7th the peace terms were presented to Germany by the combined delegations.

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[1] Italy's attitude with regard to President Wilson's 14 points has often been misapprehended. When President Wilson originally asked the Allied Powers whether they were prepared to accept his 14 points and subsequent declarations of policy as a basis for an armistice and eventually for peace, their delegates (premiers and ministers for foreign affairs) met in Paris at the end of Oct. 1918 to concert a reply. At one of these meetings Sig. Orlando formally declared that he must make reservations as to point 9 concerning the future frontiers of Italy, as it was "liable to interpretations which Italy could not accept." Lloyd George and Clemenceau replied that the question concerning Italy did not arise, as the Armistice with Germany was the sole object of the discussion. Orlando accepted this statement, but at a subsequent meeting, on Nov. 1, at which experts and American representatives were also present, he repeated his reservations, saying that he wished to make the matter clear also in this plenary sitting. Again Lloyd George and Clemenceau replied, with some impatience this time, that the matter concerned Germany alone and not the frontiers with Austria. Orlando again accepted this declaration, adding that he would renew the exception at the proper time and place. When Orlando left the Peace Conference on April 24 1919, in consequence of Wilson's action, the press in Britain and America said that Italy had spoilt her case by accepting the 14 points. But the fact is that the above-mentioned reservations of Orlando, stated also in the presence of American delegates, although published in Italy and in a few foreign papers, were ignored by the great bulk of foreign public opinion.

Discussions on the Adriatic question were now resumed. The British, French and U.S. ambassadors in Rome proposed that Fiume be placed under the League of Nations, but the scheme fell through owing to President Wilson's opposition to any solution which gave Italy any predominance, however slight, over Fiume. Mr. Nelson Page, the U.S. ambassador in Rome, went to Paris to impress on the President the violence of Italian feeling on the Fiume question, but he proved obdurate. Violent personal attacks against him were being made in the Italian press, often of a scurrilous nature and some of them penned by D'Annunzio. One of the French delegates, M. Tardieu, came forward on May 27 with yet another proposal: Fiume with a strip of territory to the W. was to form an independent state with a mixed administration, Zara, Sebenico and most of the islands to go to Italy, the rest of Dalmatia to Yugoslavia. The Italian delegation could not accept the scheme quite as it stood, but was ready to discuss it. At one moment it seemed as if an agreement had been reached, but Wilson and the Yugoslav delegates met again and both decided to reject it.

Sig. Orlando now returned to Rome to inform Parliament of the course of the negotiations, and was defeated by 259 votes to 78 (June 19). The Cabinet in consequence resigned. Sig. Nitti was entrusted with the formation of a new ministry, and he had accomplished the task by June 22 in the following manner: Nitti (Presidency and Interior), Tittoni (Foreign Office), Luigi Rossi (Colonies), Mortara (Justice), Tedesco (Finance), Schanzer (Treasury), Adml. Sechi (Marine), Gen. Albrici (War), Alfredo Baccelli (Education), Pantano (Public Works), Dante Ferraris (Industry), De Vito (Transport), Chimienti (Post Office), De Nava (Liberated Provinces). A new peace delegation was formed, without the premier, and composed of Senators Tittoni, Scialoja, Maggiorino Ferraris and Marconi, to whom was added later the Marquis Imperiali, ambassador in London. It left for Paris on June 28, the same day the Treaty of Peace with Germany was signed by Baron Sonnino and Marquis Imperiali.

During this agitated period of international politics, the internal situation in Italy was also grave. Prices rose rapidly after the Armistice, and there was a serious dearth of many goods, such as coal, wheat, meat and sugar. Government measures to meet these difficulties proved quite inadequate, and consisted in a series of regulations for limiting prices which merely made the goods disappear for a time and then reappear at higher prices; in selling bread below cost, which involved a huge deficit in the budget; in doles and subsidies which encouraged idleness, and in innumerable regulations which hampered trade and transport. The working-classes were enjoying very high wages, and squandering their earnings, but were discontented because prices had risen, largely in consequence of the rise in wages. War profiteers, on the other hand, were seen indulging in an orgy of extravagance and vulgar display. It was only the people with fixed incomes who were really hard hit by the rise of prices and of taxation, but everybody alike grumbled and was dissatisfied. The extreme Socialist leaders exploited this situation for their own purposes, and encouraged the working-classes in the belief that they had been made to fight in the war for the benefit of the capitalists, while it was now their right to obtain an ever-increasing share in the nation's wealth, with no corresponding obligation to work and produce. The example of Russia was made the most of, and by depicting the condition of the unhappy country as an earthly paradise they persuaded large masses of the people that if a similiar régime were introduced into Italy everyone would be happy. Ex-neutralists in the political field also contributed to the general sense of discontent, by a persistent propaganda of "I told you so," claiming that they were right in opposing the war.

Popular Catholic Party Formed.

A new party now arose which was destined to play an important part in future political development—the Popular or Catholic party. There was already a Catholic group in the Chamber and many communes were run by Catholic administrations. But the Catholics were now absorbed into the wider *Partito popolare italiano*, whose constitution was announced in the *Osservatore Romano* on Jan. 20 1919. It rapidly developed its organization, under the leadership of the Sicilian priest Don Luigi Sturzo, who had set forth its general lines in his speech at Milan on Nov. 17 1918. The executive committee, of which Count Santacci was president, met in Rome, and on Jan. 18 1919 presented as its programme a series of far-reaching reforms of a Christian Socialist character, especially as regards the land question, so as to take the wind out of the sails of the Socialists. It advocated the breaking-up of the large estates with compensation to the landlords, collaboration between capital and labour in industry, freedom of religious education and as to divorce, and a patriotic foreign policy. It gained support chiefly in the Veneto and parts of Lombardy, and in general among the peasant class, largely through the activity and good organization of the Catholic coöperative societies and banks. It also included a great many persons of the middle-class and the aristocracy.

Revolutionary Strikes.

The general consequence of this state of discontent was a series of strikes in every trade, including the public services, a repugnance for work, and a diminution of output. The extreme Socialists hoped to be able to bring about a real revolution of the Russian type, while even those members of the Socialist party who were too sensible to agree in this were too much afraid of losing popularity with the masses to speak out openly. During the war, funds had been received from Germany and Austria; now the wind had to be raised by blackmailing timorous shopkeepers endangered by riots, and by pillaging the shops of those who refused to be blackmailed when the riots occurred. Socialist orators were vigorous not only in denouncing the supposed sins of the bourgeoisie, but in warning them that it was no use struggling against the inevitable. On Dec. 22 1918 the Socialist party held a meeting at Bologna, and immediately afterwards the Postal Employees' Committee of Action threatened a strike which was only averted by the Government's promise of higher wages. Other strikes occurred during the winter and spring, and on April 10 there was a 24-hour strike in Rome because the authorities had forbidden a manifestation in favour of the Russian Bolshevists. A similar demonstration was held in Milan on the 13th, and a few persons were wounded in a scuffle. A shot fired by a Socialist against a patriotic procession near the offices of the *Avanti* resulted in the wrecking of the latter by the crowd. The G.C.L. ordered a protest strike throughout Italy, but it was carried out in only a few places, and in Rome ended in a great patriotic demonstration on the 17th. On May 4 a strike of the tramwaymen and secondary railwaymen began, involving 80,000 persons; it was the first of the strikes in the public services with which the Socialists hoped to disorganize the economic life of the country. A couple of days later the National Seamen's Federation, presided over by the fire-brand "Captain" Giulietti, held up an Italian steamer conveying munitions to British troops in Russia.

Policy in the East.

In the domain of foreign affairs the Government had to deal with a complicated Oriental situation. In addition to the general provisions of the Pact of London for an Italian occupation of southern Anatolia, by the agreement of St. Jean de Maurienne (April 1917), Italy had been promised Smyrna and its district in the future repartition of Asiatic Turkey. But at the Peace Conference it became clear that the other Allies were not anxious to fulfil this promise. British troops had occupied various points in northern and N.W. Asia Minor, and on March 29 a landing party from the Italian fleet occupied Adalia. When, after President Wilson's famous message, the Italian delegation left the Conference, in April 1919, the British, French and U.S. representatives reconsidered the whole question of Asia Minor, and while Mr. Lloyd George and M. Clemenceau hesitated to tear up the St. Jean de Maurienne agreement altogether, President Wilson forced the hands of his colleagues into deciding to send the Greeks to Smyrna under the belief that a massacre of Christians was imminent. Immediately after the Greek landing at Smyrna (May 15), Italian troops landed at Scala Nuova and other points in S.W. Anatolia; the Meander valley was to divide the Italian from the Greek zone of military occupation, but the exact delimitation was not yet defined and gave rise to various incidents. On the 24th an Italian battalion was sent to Konia. All Allied troops in Asia Minor, including Italians and Greeks, were under the orders of Gen. Milne, commanding the British forces at Constantinople (Army of the Black Sea). Other Italian forces were in the East. The Macedonian expeditionary force garrisoned Bulgaria until July 1919, while three battalions formed part of the Allied garrison in European Turkey. Italian policy in the East was dominated by the feeling that it was unwise to exasperate the Turks too much, and that peace could only be secured by a more conciliatory attitude, even towards the Nationalist movement organized by Mustafa Kemal Pasha in Asia Minor. At the same time Sig. Tittoni tried to conciliate Greece, and in July he concluded an agreement with M. Venizelos for the delimitation of the respective military zones in Asia Minor and providing that the Greeks should have a free hand in S. Albania. The agreement afterwards was rescinded and most of its clauses modified, but the provisions concerning Albania had an unfortunate reaction on Italo-Albanian relations. In the meanwhile Italian banks and business men showed considerable enterprise in the Near East; the steamers of the ex-Austrian Lloyd and other lines obtained practically the monopoly of the passenger traffic and a large share in the goods traffic between Europe and Constantinople and the Black Sea ports. The scheme to send an Italian expedition to the Caucasus, which had been suggested at the Peace Conference and practically accepted by Sig. Orlando, was abandoned when Sig. Nitti came into power. Various Italian commercial undertakings were, however, started in Transcaucasia, including the Italo-Caucasian bank at Tiflis and a concession for developing the coal-mines of Ochemchiri.

D'Annunzio and Fiume.

The Adriatic negotiations dragged on without reaching a conclusion. Fresh trouble broke out at Fiume, where the antagonism of the soldiers attached to the French base (mostly colonials) to the Italian inhabitants, and their open support of the Croat element, provoked reprisals and some French soldiers and Annamites were killed and several wounded (July 2 and 5). In consequence of these incidents the Peace Conference appointed a Commission of Inquiry, on which Gen. Di Robilant was the Italian representative. It advised the dissolution of the Fiume National Council, elections to be held under an Inter-Allied Commission, the disbanding of the Fiume volunteers, a considerable reduction of the Italian forces in the town, and the importation of British or U.S. police. These latter steps were in course of being taken, when D'Annunzio suddenly arrived (Sept. 12) from Ronchi, at the head of some Italian troops whom he had induced to follow him to Fiume in order to save it for Italy. Most of the Italian troops in Fiume and the crews of the warships in the port joined him also, and he became master of the town. The Allied troops then left. The effect of D'Annunzio's enterprise throughout Italy was astonishing. The premier stigmatized it in violent terms, established a blockade round the place, and practically appealed to the Socialists to back him up against D'Annunzio. But a large section of public opinion supported the latter. Volunteers from all parts of the country flocked to his standard, including Gen. Ceccherini, one of the bravest men in the army, and a number of other officers of the army and navy, Prof. Pantaleoni, many young men of the highest character as well as not a few adventurers. D'Annunzio's adventure became, in the eyes of a large section of public opinion, the symbol of Italian patriotism and idealism. But it placed Italy in an awkward international situation and intensified the suspicions of foreign Governments. The Yugoslavs made no move, but although D'Annunzio informed them that they were free to use the port of Fiume for their trade, they refused to do so.

Revolution and Reaction.

Riots against the ever-increasing high cost of living broke out in Italy in the summer. Though it was chiefly due to the inflated paper currency, high freights, scarcity of goods and the perpetual strikes, and only in a lesser degree to the greed and speculation of the shopkeepers and merchants, the populace attributed it wholly to the last-named cause. Troubles began at Forlì on June 30, but were more serious in Florence on July 3, in Turin, Alessandria, Milan, Pisa, Genoa and Bari. Shops and markets were pillaged, much property destroyed, including precious food-stuffs; and agents of the *Camere del Lavoro* (organizations for promoting strikes and riots, camouflaged as labour exchanges) requisitioned food in the shops, warehouses and country estates, paying for them at rates below the market price. *Calmieri* (minimum prices) were imposed locally, at 40% or 50% of the previous prices, with the only result that the opportunity was taken for reselling at a large profit. The Government did nothing to stop these outbreaks, and the Socialist leaders concluded that the time was ripe for revolution. An international strike of protest against the hostile attitude of the bourgeois Governments towards the Soviets of Russia and Hungary was announced for July 20 and 21. Sig. D'Aragona, secretary of the G.C.L., tried to organize the movement, but the Labour parties of Britain and France, whose Governments still kept troops in Russia to fight the Bolshevists, refused to agree. In Italy, whose troops had been withdrawn from Russia, the working-classes seemed prepared to join, but a reaction was already at work among the masses as well as the bourgeoisie itself. The reign of terror which the Socialists had been trying to establish all over Italy was first countered by the Association of Combatants (ex-soldiers); citizens' committees were formed, and afterwards the *fasci di combattimento*, societies of energetic young men of all parties and classes who had fought in the war and organized themselves for patriotic objects and the maintenance of order. The result was that the Labour protest of July 20-21 was a failure. Work was suspended in most of the factories of N. Italy, and the tramwaymen in certain towns took a holiday, but the railwaymen worked as usual, and in many towns of the N. there was no strike and the whole of the S. was unaffected. There was no revolution and no rioting to speak of. This fiasco was due to the action of the bourgeoisie itself far more than to any official precautions.

After the July manifestation there were other strikes and riots in various parts of Italy, but not of a general or alarming character. Disorders at Trieste on Aug. 3 ended in a patriotic demonstration in which the offices of the Bolshevist organ *Il Lavoratore* were wrecked. There was also an agricultural strike for an eight-hour day affecting 80,000 persons in the districts of Novara, Vercelli, Pavia and the Lomellina. The Government as usual hardly took any action at all. Apparently Sig. Nitti's theory of the general state of disorder was that it was a form of madness consequent on the war, and that the only thing to be done was to let it work itself out.

Throughout all the strikes and disorders the troops and police behaved admirably. Sig. Nitti deserved credit in this connexion by his reorganization of the police; he increased the number of the excellent *carabinieri* to 60,000, and while abolishing the unsatisfactory *Guardie di Pubblica Sicurezza*, he created the *Agenti investigativi* of plain-clothes detectives (Aug. 14), and the corps of *Guardie Regie* under the orders of the Ministry of the Interior, comprising cavalry and machine-gun detachments (Oct. 2); the number of the latter was gradually brought up to 25,000. The premier's policy towards the army, on the other hand, was open to serious criticism. While huge increases of wages were being granted to civilian labour, the pay of military officers, even of high rank, was left miserably low; and when officers were insulted and even murdered in the course of the riots the Government did nothing but order them to go about unarmed. A decree was issued by the War Minister, inspired by the premier, amnestying deserters (Sept. 2), and thereby placing them on the same footing as soldiers who had done their duty. The previous Cabinet, moreover, had instituted a carefully packed commission to inquire into the causes of the Caporetto disaster; and on July 24 it presented its report, apparently condoning the Socialist propaganda and attributing the whole blame to certain generals who were in bad odour with the Government. In consequence of its findings, Gens. Cadorna, Porro, Capello (commanding the II. Army), and Cavaciocchi (commanding the IV. Corps) were placed on the retired list, Montuori, Bongiovanni and Boccacci at the disposal of the Ministry without commands, while Gen. Brusati, who had been exonerated after the Trentino offensive of 1916, was recalled into service. The report intensified public depression, by recalling only the more painful aspects of Italy's military effort.

Peace Treaty with Austria.

On Sept. 10 the Peace Treaty with Austria was signed at St. Germain-en-Laye. Italy thereby acquired the frontiers assigned to her by the Pact of London, as far as the Trentino and Alto Adige were concerned, with the addition of the Sexten valley and the Tarvis district. Thus were the roads of invasion from the N. closed. The new territory was rich in water-power and forests, and contained some good agricultural and fruit-bearing land, a few mines and many fine mountain resorts. The population comprised 383,367 Italians[1] of a sturdy mountain stock and 235,165 Germans. But although the latter showed no Italian sympathies, the Government treated them with liberality and showed every intention of granting the widest freedom for their language and culture. But the public was so obsessed by the unsatisfactory state of the Adriatic question that the Austrian Peace, which gave Italy such considerable material and moral advantages, passed almost unnoticed. On Nov. 12 Senator Tittoni returned from Paris and resigned both from the Peace Delegation and the Foreign Office, on account of his bad health, and was appointed president of the Senate and Italian representative on the League of Nations Council. He was succeeded at the consulate by Senator Scialoja, the eminent Neapolitan jurist. It was under increasingly onerous economic conditions throughout the country that the elections of Nov. 1919 were held. Wheat had risen from $1.01 per 60 lb. in 1913–4 to $2.40 in 1919, and the value of the dollar had risen from 5.20 lire to 13.07. Freights had risen from 3s. per 480 lb. to 17s., with the pound more than doubled in value. The Government made the wheat trade a State monopoly; it tried to reduce consumption by mixing wheat-flour with that of cheaper cereals and rationing the supply. It requisitioned home-grown wheat at a price below the cost of production, but as it had to pay for imported wheat (with Russia and Rumania no longer available as sources of supply) at the market price, it could only sell it cheap by paying the difference; thus wheat-growing was discouraged at home and the State budget involved in a deficit of many milliards. The war had also caused a serious disorganization of transport. Locomotives, trucks and permanent way had been over-used, coal had risen enormously in price and could not be obtained in sufficient quantities nor of the best quality, so that the train service had been reduced, and the staff, while increasing in numbers from 154,000 in 1914 to 180,000 in 1919, had become less efficient and more undisciplined. Thefts of goods on the railways were increasingly frequent, and the innumerable restrictions on trade made life ever harder. By the new electoral law the country was divided into 54 constituencies, each returning from 5 to 20 members, and the elector voted not for an individual but for a list. The object of the system was to prevent elections from being based on purely local interests, but its weak point was that the voter could not scratch any name he did not like, but had to swallow the list as a whole; he could add a preferential vote to any particular candidate, and this gave rise to bitter rivalry among candidates in the same list. The consequence was that a very large percentage of the voters, mostly in the constitutional parties, abstained.

Elections of 1919.

The two parties which presented themselves to the polls with a complete organization and a definite programme were the Socialists and Catholics. The former held a Congress in Bologna on Oct. 5–8, where they decided to participate in the coming elections with a revolutionary "maximalist" programme, with the object of abolishing capitalism and instituting a Socialist republic on the Russian model; only a small section led by Prof. Bardiga declared for abstention from the polls and for a revolution by armed risings. The Congress also adhered to the Moscow Third International. The Popular or Catholic party had made rapid progress, and on June 14 1919 a general Congress had been held at Bologna where a resolution in favour of going to the country with its own candidates, instead of coöperating with the other parties, was voted by a large majority. But during its first year of existence a more extreme tendency appeared within its ranks, headed by Sig. Miglioli, whose principles and tactics differed but little from those of the ultra Socialists; the extremists were particularly active among the peasantry, especially in the province of Treviso, parts of Lombardy and Tuscany, and their agitations and excessive demands often led to strikes and riots, in spite of the disapproval of the bishops and even of the Vatican. The various constitutional groups were split up without a programme; the Government was discredited and unpopular, the foreign situation of the country in a hopeless tangle, and everyone more or less discontented.

The elections were held on Nov. 16 1919, without serious incidents. The result was that the Official, or Maximalist, Socialists elected 156 members, and the Catholics 101. These were the two most successful parties; the Republicans were reduced to 8 or 9, while the *Combattenti* won some 30 seats. The Socialist members were by no means all authentic "proletarians"; 50 of them were lawyers, a large proportion "organizers," and only 19 more or less genuine working men. Quite a number were wealthy, and at least eight were millionaires.

Socialist Agitation.

On the opening of Parliament (Dec. 1), the King was greeted with enthusiasm by the majority, but the Socialist deputies shouted "Long live Socialism!" and left the Chamber. As a protest against this offence to the King, popular demonstrations were held outside Montecitorio, and a number of Socialist members were attacked and injured. The leaders of the party ordered a general strike throughout Italy as a protest: work was stopped in many towns, and there were riots in some places, which often took the form of assaults by bands of hooligans on isolated officers. At Mantua on Dec. 3 a crowd of anarchists succeeded for a few hours in making themselves masters of the town: they burnt the prison and let loose 200 criminals, pillaged a number of shops and committed several murders. The next day, reënforcements having arrived, order was restored. The strike ended in most places on the 2nd, but in a few cases continued until the 4th or 5th. Sig. Nitti's position was certainly not strengthened by the result of the elections. The Socialists rejected his advances while taking his gifts, and constituted a noisy and violent opposition; the Catholics, although bitterly hostile to the Socialists, could not be relied upon to support the Cabinet, as they had their own policy to further; the mass of Constitutionalists were divided into many groups, some of which, such as those of Nationalist sympathies, were in opposition, while others were but lukewarm supporters. The Ministry remained in office because there was no other combination ready to succeed it.

The Fiume Proposals.

On the Adriatic coast, meanwhile, further incidents were occurring; the French base was withdrawn from Fiume (Oct. 2), and the Yugoslav mob at Spalato continued to attack the Italian inhabitants under the eyes of the American admiral. A series of fresh proposals to unravel the Adriatic tangle were made. Early in Oct. Senator Tittoni had suggested to D'Annunzio a *modus vivendi* whereby the Italian regular troops would occupy the town pending the settlement of the problem at Paris, Italy undertaking not to permit Fiume's annexation to Yugoslavia; but D'Annunzio refused to agree. On Oct. 27 the U.S. Government presented a new scheme whereby Fiume was to be made into an independent state, under the League of Nations, but comprising not only the ancient *corpus separatum*, but also a large part of Istria. Since the Slav population would then have swamped the Italians of the town, the plan was not acceptable to Italy nor to the Fiumani. President Wilson on Nov. 13 followed this with a stiff message to the Italian Government, in which he insisted on the question being settled on the lines of the American scheme. On Dec. 9, however, the British, French and U.S. Governments presented a memorandum to Senator Scialoja, proposing certain modifications—the town of Fiume to enjoy full autonomy (not independence) within the proposed buffer state, but without territorial contiguity with Italy (as the latter demanded), and Zara to choose which state should represent it diplomatically. The tone of this communication was regarded in Italy as unfriendly, and Senator Scialoja, in his speech in the Chamber on Dec. 21, set forth the state of the negotiations and the reasons why the various Allied proposals were inacceptable to Italy—above all the fact that they failed to provide for the security of the Italian frontier and coast. M. Clemenceau's speech of the 24th was considered offensive to Italy and also inaccurate, as he spoke of Fiume having been " promised " by Italy to Croatia, whereas the Pact of London merely contained a declaration on that point and not a bilateral agreement, as Croatia was not a party to it and indeed did not then exist as a separate state. To this Sig. Scialoja replied on the 29th that Italy had only asked for the execution of the Pact of London, that the Fiumani themselves had asked to be annexed to Italy, and that the Allies seemed to ignore Italy's readiness to compromise on Dalmatia: he would enter into direct negotiations with the Yugoslavs, provided the latter were acting solely on their own account and were not guaranteed a minimum by other Powers.

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[1] Austrian pre-war statistics.

After trying again, but without success, to induce D'Annunzio to leave Fiume, the Italian Government presented a new project on Jan. 6 1920, on the following lines:—Independence within the buffer state for the town of Fiume, the latter being connected by a strip of territory with Italy, and the S.W. frontier of the buffer state corresponding to that fixed by the Pact of London; Cherso and Lagosta to be assigned to Italy, as well as the islands which Wilson was ready to cede to her; the coast from Fiume to the Voyusa to be neutralized, and the Italian element in Dalmatia guaranteed adequately. On Jan. 9 the British and French Governments (the U.S. having now withdrawn from the Allied Supreme Council) stated that they were ready to apply the Pact of London, or, if Italy considered it no longer applicable under present conditions, the Memorandum of Dec. 9, with certain modifications suggested by the Italian note of Jan. 6. The following day the Italian Government replied to the Memorandum of Dec. 9, objecting above all to the proposed Istrian frontier, which would only be 18 km. from Trieste and 22 from the defences of Pola. On Jan. 14 the following agreement was arrived at in London between Sig. Nitti, Mr. Lloyd George, and M. Clemenceau:—Fiume under Italian sovereignty, but Susak to Yugoslavia, the port and railway under the League of Nations; Lussin, Lissa and Pelagosa to Italy but demilitarized; Zara independent, but free to choose its own diplomatic representation; Albania under an Italian mandate but certain districts of it ceded to Greece and Yugoslavia.

The Yugoslav delegation objected to the whole scheme, and even Nitti's offer to renounce Italian sovereignty over Fiume, which would remain quite independent, failed to satisfy them, and they referred the matter to the Belgrade Government. The latter insisted on the Wilson line as the only possible frontier for Istria, and objected to Fiume and Zara being free to choose their diplomatic representation. On Jan. 20 the U.S. Government protested against any decision being taken without their having a voice in it; to this Britain and France replied on the 23rd that they had come to an agreement with Italy on the basis of the Nitti compromise, but that if the latter were not accepted, the Pact of London, which satisfied no one, would be the only alternative. The Yugoslav Government objected to having to choose between these two proposals, and professed itself unacquainted with the contents of the Pact of London; this was now communicated to it officially. President Wilson, on his side, replied to the Allies on Feb. 10 (in a note communicated on the 13th) that their new proposals of Jan. 14 contained several unjust modifications in favour of Italy as compared with the Memorandum of Dec. 9 to which he had agreed, while he rejected the Pact of London altogether; unless the Memorandum of Dec. 9 was accepted he would seriously consider the withdrawal of the Versailles treaty now before the American Senate. There followed a further exchange of correspondence and notes between Italy, France, Britain, Yugoslavia and President Wilson, without any solution being arrived at.

Further Strikes and Disorders, 1920.

In the domestic situation, one of the first consequences of the Socialist successes at the polls in Nov. 1919 was an increase of indiscipline and revolutionary spirit among the railwaymen and postal employees. On Jan. 13 1920, the postal workers went on strike. Citizen committees, however, were formed who supplied volunteers, and this action broke the back of the movement; when the Government undertook to present the demands to Parliament, the employees returned to work (Jan. 22). The railwaymen, too, declared a general strike throughout Italy on the 20th, though only 66,000 men actually responded out of a total of 193,000. Here, again, it was the provision made by volunteers that enabled the Government to face the situation. On no line was the railway service wholly suspended: 1,063 trains ran on the first day, and the number was raised to 1,789 on Jan. 29, when, after Sig. Nitti came forward with concessions, the strike ended. All strikers were readmitted and although their wages were not paid to them the amount was to be devoted to a building fund for railwaymen's dwellings, the decision on the men's original demands being referred to Parliament, while the eight-hour day was to be extended as soon as possible to the few categories to whom it had not yet been applied.

Other strikes and disorders followed, of which the most serious were the strike of men on the secondary railways of Lombardy, which lasted several weeks (Feb.–April); the strike in the Mazzonis cotton mills at Luserna and Ponte Canavese, where the workmen occupied the factories for a few days; the metal workers' strike at Turin, which began on March 24 over a dispute about a clock that had been tampered with at the F.I.A.T. works, and ended on April 23 with the defeat of the strikers. The railwaymen caused further trouble by refusing to run trains which conveyed troops or police; and on June 8–24 the Cremona railwaymen struck because the under station-master had insisted on forwarding a train which they suspected of conveying war material to Poland, the strike extending to Milan and other places. At Viareggio there were serious disorders on May 1, 2 and 3, which began with a row over a football match. On June 26 a mutiny broke out at Ancona, promoted by anarchists. There had been a good deal of discontent among the men of the 11th Bersaglieri because their regiment, of which they were justly proud, was to be disbanded; furthermore, the anarchists spread the false report that they were to be sent to Albania, an unpopular destination. On the morning of the 26th some anarchists disguised as Bersaglieri entered the barracks and induced a certain number of the soldiers to revolt and disarm the officers. Other officers, however, quickly succeeded in restoring discipline, and when bands of anarchists and other criminals in the town, who thought that the mutiny in the barracks was succeeding, proceeded to pillage the shops and terrorize the inhabitants, the Bersaglieri, including the ex-mutineers at their own request, went out into the streets and quelled the disorders, seizing the labour exchange, which was the anarchists' headquarters, by assault. Disorders continued outside the town a little while longer, as the anarchists from the neighbouring hills fired on passing trains, killing and wounding several persons. By the 27th order was fully restored and large numbers of arrests were made: in all 25 persons had been killed. The mutineers were tried in March 1921 and got sentences up to eight years.

Nitti Cabinet Reconstructed.

In the meanwhile there had been another Cabinet crisis. On March 12 Sig. Nitti, finding himself unable to conduct the Government in the face of the growing opposition, resigned. But as no one could be found ready to assume office, he was again entrusted with the formation of the Cabinet, which included Sig. Bonomi (War), Schanzer (Finance), Luzzatti (Treasury), Torre (Education), De Nava (Public Works), Falcioni (Agriculture), Alessio (Post Office) and Raineri (Liberated Provinces); the other ministers retained their portfolios, but the Transport Ministry was suppressed. Count Sforza, High Commissioner at Constantinople, was made Under Secretary for Foreign Affairs. The new Cabinet was not well received in the Chamber, and on a vote of confidence it only got 250 votes to 195 (June 30). The Chamber voted in favour of continuing the uneconomic policy of selling bread under cost price, and proposed to make up the deficit by a bill confiscating war profits.

San Remo Council.

On April 17 1920, the Supreme Council met at San Remo under the presidency of Sig. Nitti, Britain being represented by Mr. Lloyd George and Lord Curzon, France by M. Millerand, and Italy by Sig. Nitti and Senator Scialoja. Some of the other Allied Governments were also represented, and numerous military, naval and air experts and commercial specialists were present. The bases of the treaty with Turkey were there laid down, and the Adriatic question was also raised. Mr. Lloyd George and M. Millerand stated that the only alternatives were the Memorandum of Dec. 9 or the Pact of London. Of the two the latter found more favour in Italian circles, especially in the army, because the former, while providing an unsatisfactory solution of the Fiume problem, gave Italy an impossible eastern frontier. But before the Italian delegation could come to a decision, M. Trumbich, the Yugoslav Foreign Secretary, telegraphed to Sig. Nitti stating that the Yugoslavs preferred direct negotiations with Italy as more likely to lead to an amicable solution. The premier having agreed to this, the Adriatic question was adjourned to an Italo-Yugoslav meeting, and the conference broke up on the 26th. Senator Scialoja met the Yugoslav delegates, MM. Paschich and Trumbich, at Pallanza on May 10; but in the meanwhile Sig. Nitti's parliamentary position had become worse again owing to the general dissatisfaction at his internal policy, and on the 12th the Cabinet, outvoted by 193 to 112, resigned; the crisis, of course, broke up the Pallanza conference.

Fall of Nitti.

After a protracted interval, during which Sig. Bonomi was entrusted with the formation of a Cabinet but failed, Sig. Nitti was again sent for, and on May 21 succeeded in composing a ministry for the third time, with the following changes:—Ruini (Colonies), Falcioni (Justice), De Nava (Finance), Schanzer (Treasury), Rodino, of the *Partito Popolare* (War), Peano (Public Works), Micheli (Agriculture), Abbiate (Industry), Paratore (Post Office) and La Pegna (Liberated Provinces). But even at its third reincarnation the Nitti Ministry was stillborn, and found little favour in any quarter. The arrest of all Dalmatians and Fiumani in Rome, ordered by Nitti, in consequence of a riot between a patriotic students' demonstration and the police in Rome on May 24, provoked violent indignation throughout Italy. The premier's failure to solve the Adriatic problem alienated his remaining supporters. His fall at last came over his bread policy. On June 4 the Cabinet issued a decree raising the price of bread to 1.50 lire per kgm., but Sig. Nitti, yielding to the Socialists, withdrew it five days later. The Cabinet now resigned, and Nitti's premiership came to an end.

Giolitti Government.

With Nitti's fall, Giolitti was the only man capable of forming a Government. The wheel had come full circle in Italian politics. The advent of Sig. Giolitti at first caused some alarm in Allied countries. But the composition of his Cabinet, constituted on June 16, to some extent dispelled both fears and expectations. It comprised Count Sforza as Minister for Foreign Affairs; Meda, of the *Partito Popolare*, at the Treasury; Tedesco, afterwards replaced by Facta (Finance); Bonomi (War); Luigi Rossi (Colonies); the eminent philosopher Benedetto Croce (Education); Peano (Public Works); Labriola, a reformed revolutionary Socialist (Labour); Alessio (Industry); Fera (Justice); Micheli (Agriculture) and Sechi (Marine). The ministry contained only two pure Giolittians—Tedesco (afterwards substituted by Facta) and Peano; the other ministers represented all shades of Constitutional opinion, from the Catholic Meda to the Radical Alessio and the ex-revolutionist Labriola. On June 24 Giolitti presented various treaties to Parliament for ratification and laid several bills before the Chamber—the obligatory conversion of bearer shares and bonds into nominative certificates, so as to prevent evasion of the new levy on capital;[1] the confiscation of war profits; the increase of sundry taxes; a bill for enforcing the cultivation of cereals, and one instituting an inquiry into war expenditure. On the 27th Sig. Meda made his financial statement for 1920–1, which showed a deficit of one milliard for ordinary expenditure; but the extraordinary expenditure, including the sale of bread under cost, raised the deficit to 14 milliards.

Foreign Policy.

No appreciable change was made in Italy's foreign policy. Public feeling towards the Allies had not been too cordial for some time past. With Czechoslovakia relations were cordial, while Italian sentiment towards the Poles and the Rumanians was also friendly. Towards the Yugoslavs alone there was antagonism. With regard to the ex-enemy states feeling had certainly changed since the Armistice. Now that the Habsburg Monarchy was broken up and the Alpine frontier satisfactorily settled, Italy felt no longer any bitterness towards Austria. Against Germany there had never been the same hatred as against the Habsburg Monarchy, and the hard attitude of the French over the execution of the Peace Treaty produced a certain reaction in Germany's favour. In the Allied conferences Italy's representatives, while admitting the necessity for disarming Germany, always tried to introduce a spirit of conciliation, for the common good of Europe; and in this they usually found themselves in agreement with their British colleagues. For Hungary there was also a certain amount of sympathy, and Italy was much relieved when that country succeeded in liberating itself from Bolshevism under Bela Kun. With regard to the League of Nations the Government and public opinion were rather sceptical. The fact that President Wilson was the author of the idea was not a recommendation in Italy. A small group of earnest and high-minded men, of whom the late Sig. Bissolati and Senator Ruffini were the most eminent, strenuously advocated the League's principles, while Senator Tittoni, Italy's representative on the Council and the Assembly, supported them with vigour and ability. Still, the League found considerable support both among the Radicals and among the Catholics. The Pope, in his encyclical of May 23, while authorizing Catholic heads of states, for the first time, to visit Rome, expressed his hope for its success.

Italy and Albania.

In June trouble had broken out in Albania. Gen. Ferrero, who had commanded the Italian forces there during the war, had proclaimed an Italian protectorate in June 1917, but the legal status of Italo-Albanian relations had never been properly defined. Italian troops had occupied all Albania south of the Voyusa, and in the last months of the war had pushed beyond the river; some civil officials had also been appointed. After the Armistice the rest of Albania was also occupied, but unfortunately the officers and civil officials who had at first taken a real interest in the people were recalled, and were succeeded by others who were less sympathetic; this proved a cause of some discontent. The various agreements whereby Italy was to hand over parts of Albania to Greece and Yugoslavia aroused great dissatisfaction. An Albanian Government had been formed at Tirana, and the Italian garrison had been reduced to a minimum; and in the spring of 1920 Albanian bands began to be formed, composed largely of men who during the war had been armed and trained by the Italians. On June 5 they attacked various Italian outposts, and some of the smaller outlying garrisons, including that of Tepeleni, were surrounded and captured. Valona itself was attacked on the 11th, and some of the Albanians in the town rose in revolt; but the rebels were beaten off with heavy losses. Reënforcements were hurried across, and subsequent attacks were repulsed. But on June 24 Sig. Giolitti announced that Italy would withdraw her troops from Albania, and open negotiations with the Tirana Government. The negotiations initiated on July 4 were concluded at Tirana on Aug. 3, Italy agreeing to evacuate Albania, retaining only the island of Saseno, which dominates Valona harbour. The last Italian troops left Valona on Sept. 2.

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[1] This measure was finally dropped.

Treaty with Turkey.

At the Spa Conference (July 5–16) Italy, represented by Count Sforza and Sig. Bertolini, who was Italian delegate on the Reparations Commission, succeeded in getting her share of the German indemnity raised to 10%, that of the Austrian, Hungarian and Bulgarian indemnities to 25%, while Great Britain and France ceded to Italy their share of the Austrian tonnage. On Sept. 6 a meeting of Italian, British, French and German delegates met at Stresa to deal with the distribution of foodstuffs and coal. Incidents occurred between Italian and Greek troops in Asia Minor, as the latter constantly tended to go beyond the limits assigned to their occupation. On Aug. 6 Count Sforza announced that, as the Turkish treaty was about to be signed, the Tittoni-Venizelos agreement was rescinded. The treaty with Turkey was signed at Sèvres on the 10th. Italy obtained economic priority over a wide zone in Anatolia, extending from the Gulf of Adramit, round the territory assigned to Greece, to the watershed between the Great and the Little Meander, then along the latter to the sea coast and from Scala Nuova to a point between Adalia and Selevke, and inland as far as Konia; she also acquired a concession for exploiting the Heraclea coal fields. A separate agreement was concluded with Greece concerning the islands; Italy would cede the Dodecanese minus Khalki and Castellorizo, which together with Rhodes would remain under Italian rule for 15 years, and then, if Britain evacuated Cyprus, a plebiscite was to decide to whom they were to belong. On Aug. 21 Sig. Giolitti had a friendly meeting with Mr. Lloyd George at Lucerne, when it was agreed that, as long as Russia tried to impose on Poland conditions incompatible with her independence, it was impossible to have dealings with her. On Sept. 11–14 he conferred with M. Millerand at Aix-les-Bains on the general political situation. These conferences tended to improve Allied relations.

For some months the Adriatic question was not discussed, but numerous incidents occurred in Dalmatia between Italians and Slavs. Serious disorders occurred on July 11 at Spalato, where the Croatian mob murdered the commander of the Italian cruiser "Puglia" and wounded other officers and sailors. Protest demonstrations were held at Trieste on the 13th, and, in consequence of shots being fired from the offices of one of the Yugoslav institutions, several of the latter were burnt to the ground or wrecked. At Fiume the National Council resigned on Sept. 7, and D'Annunzio proclaimed the independence of the town and its territory under the name of "*Reggenza del Carnaro*," for which he composed a curious semi-mediaeval constitution, but its frontiers were not defined. Incidents also occurred in the plebiscite area of Carinthia, where Yugoslav bands attacked and wounded some Italian officers and men (Sept. 26); the Yugoslavs were, however, obliged by the Allies to evacuate that region, and the plebiscite resulted in favour of union with Austria.

Treaty of Rapallo.

As long as Mr. Wilson was president of the United States no settlement of the Adriatic problem was possible. Now, however, that his term was nearly up, the Yugoslavs felt that a direct understanding with Italy was the best way out of the tangle. The Italian Government communicated to Britain and France the conditions it intended to propose to the Yugoslavs, and both the Allies brought pressure to bear on Belgrade to accept them. A meeting was held at Rapallo on Nov. 8, Italy being represented by Sig. Giolitti, Count Sforza and Sig. Bonomi, assisted by Gen. Badoglio and Adml. Acton, and Yugoslavia by MM. Vesnich, prime minister, Trumbich, Minister for Foreign Affairs, and Kosta Stojanovich, Minister of Finance, assisted by Col. Kalafatovich. Negotiations were rapidly conducted, and on Nov. 12 the treaty was signed.[1] Italy agreed to waive her rights based on the Pact of London over Dalmatia, while Yugoslavia renounced all claims to Trieste, Gorizia and Istria, and certain adjoining districts of Carinthia and Carniola. The following frontier was agreed upon:—Monte Pec (where Italy, Austria and Yugoslavia meet) to Mt. Yalovets (Jalovec), the watershed between the Isonzo and the Wurzen See and then the Wocheiner Save, N.E. slopes of Mt. Mozik, E. slope of Mt. Porzen, W. slope of Mt. Blegos (leaving the Podlanisham passes to Italy), Zelse, Cabranska, E. of Mt. Trstenik, E. of Griza, E. of Matuglie, frontier of Fiume on the Fiume-Castua road; the islands of Cherso, Lussin, Lagosta and Pelagosa were assigned to Italy, and also the town of Zara. Italy and Yugoslavia recognized the full independence of the state of Fiume, consisting of the ancient *Corpus Separatum* and a small strip of Istrian territory. All Italian-speaking natives of the territories assigned to Yugoslavia were granted the right to opt for Italian citizenship without having to leave the country, and full freedom of language, culture and religion, with reciprocity for Yugoslavs in Italy; special provisions in favour of economic concessions accorded to Italian citizens before Nov. 12 1920 were agreed to. Italy renounced her rights to the part of Dalmatia assigned to her by the Pact of London, except for the town of Zara, to all the islands except those mentioned above and to Longatico and a couple of other small districts on the eastern frontier. All that she obtained in exchange was the recognition of the Italian character of Fiume. By a secret clause, however, which soon became public property, Porto Baros, an integral part of the Fiume port system, was practically promised to Yugoslavia. The Rapallo Treaty was ratified by the Prince Regent of Serbia on Nov. 22, by the Italian Chamber on the 27th (263 votes in favour, 14 against and 50 abstentions), by the Senate on Dec. 17 by 215 in favour and 29 against; 87 senators signed a statement that they accepted the treaty, but declared that it left the Adriatic defence problem unsolved and created difficult conditions for Fiume and Zara. The treaty became law on the 19th and ratifications were exchanged on Feb. 2 1921. Italy thus acquired 9,200 sq. km. with 948,768 inhabitants.

D'Annunzio.

There still remained the question of D'Annunzio. He refused to recognize the validity of the treaty, because he disapproved of the cession of Dalmatia and of the frontiers assigned to Fiume: as the latter had not been a party to the treaty, he considered himself free to disregard it. He sent detachments of his *legionari* to Castua, Veglia and Arbe and attempted to invade Dalmatia. But the Government was determined to enforce the treaty, and, after protracted but fruitless negotiations with D'Annunzio, it established a blockade round Fiume. D'Annunzio again tried to tamper with the loyalty of the blockading troops and seamen, and succeeded in inducing the crews of two destroyers and two torpedo boats to arrest their officers and go over to the Fiumani; the same thing happened with the crews of two armoured cars. Many of D'Annunzio's followers, however, including Gen. Ceccherini and Prof. Pantaleoni, abandoned him. On Dec. 23, D'Annunzio having refused to obey Gen. Caviglia's summons to submit, operations of a more serious character were begun. There was some fighting that day and the two following days, and on the 30th D'Annunzio authorized his plenipotentiaries, Sig. Giganti, mayor of Fiume, and his war minister, to accept the conditions imposed by Gen. Caviglia. The town was to be placed under the authority of the municipal council and order maintained by local volunteers, D'Annunzio's *legionari* to be disarmed and to leave the town, and the Italian soldiers who had deserted to D'Annunzio to be pardoned and sent back to their units, except those who had deserted after the Rapallo Treaty—these were arrested and courtmartialled. Italian *carabinieri* would enter Fiume to assist the local levies until after the elections to the Constituent Assembly. D'Annunzio himself left Fiume on Jan. 18 1921. The end of the Fiume adventure was received with a feeling of relief by all except a few irreconcilables; now that the *italianità* of Fiume was guaranteed there seemed to be no reason for continuing in an illegal situation. The evacuation of Dalmatia began in the spring of 1921. Subsequently, on April 24, the election for the Constituent Assembly in Fiume caused disorder, necessitating the intervention of Italian forces. The port question, left unsettled at Rapallo, was the subject of an Italo-Yugoslav agreement at Belgrade in June 1921, the whole port system, including Porto Baros and Sussale, being placed for 12 years under a governing board consisting of two Italians, two Fiumani, and two Yugoslavs.

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[1] The negotiations at Rapallo and those leading up to that meeting and immediately following it (May 11 1920 to Feb. 2 1921) are set forth in a "Green Book" published by the Italian Foreign Office on June 20 1921.

Communist Movement, 1920.

During the summer and autumn of 1920 there were further internal troubles in Italy itself. Sporadic strikes and disorders had been going on through the summer; the employees of the secondary railways had been again on strike for some time; on July 14 the tramwaymen in most Italian towns proclaimed a sympathy strike, and the electricians in Rome interrupted the electric supply spasmodically and continued to do so for several nights. On the 19th the secondary railways strike came to an end on the understanding that the strikers would not be dismissed. The Rome tramwaymen on returning to work tried to make a demonstration with red flags, but the people rose against them; a general protest strike attempted on the 21st failed and resulted in the wrecking of the Rome offices of the *Avanti*, while several Socialist deputies, including Modigliani, were beaten by the crowd. The electricians' strike ended on the 29th. The agrarian strikes in Romagna, after a long period of agitation disastrous to production, ended on Sept. 3, when the Government requisitioned the crops to save them from destruction.

A more serious movement now broke out in the metal trades. The metallurgical industry had greatly developed during the war, and Italian manufacturers had rapidly transformed their plants after the war in view of peace production. They had made large profits, and had been able to grant very large increases of wages to their men. But working costs were now very high and there were signs of a coming trade slump; the workmen nevertheless demanded still higher wages. On Aug. 13, after a three-day conference, the representatives of the Industrial Metallurgical Federation finally rejected the demands of the delegates of the workmen's union, the F.I.O.M. (*Federazione italiana operai metallurgici*), on the ground that the conditions of the industry made any further concessions impossible. On the 20th the workmen began to adopt obstructive tactics, impeding all production and in some cases committing acts of sabotage. This was particularly the case at the Romeo works at Milan, where a lock-out was proclaimed in consequence. Thereupon the F.I.O.M. ordered the workmen of other metal factories in Milan to remain in permanence at their works so as to prevent an extension of the lock-out. On Aug. 31 the Federation of Mechanical Industries proclaimed a general lock-out throughout Italy. The workmen then proceeded to seize a number of metallurgical works, at first in Lombardy alone, then in Piedmont and other parts of the country; these occupations were also extended to plants of other kinds (chemical works, textiles, etc.). The Socialists regarded this action as a beginning of practical Communism, and, although there were but few acts of violence at first, the extremists, encouraged by the passive attitude of the authorities, attempted to force the owners, managers and experts to continue to conduct the works in the exclusive interests of the workmen; "red guards" were organized, revolutionary tribunals set up, and persons trying to enter the factories or even passing near them were shot at. At Turin, where the movement was more general, the factory councils attempted even to sell the goods manufactured, but the owners warned the public that they refused to recognize the validity of such sales. In any case, the workmen found it more and more difficult to run the factories without the managers and experts, as they could get no credit to purchase raw materials, and ended by making the occupation of the factories merely an occasion for drunken orgies. On Sept. 6 the General Confederation of Labour declared that the action of the metal workers was justified, but that the conflict must be placed under its own guidance in order eventually to achieve collectivist management; it did not, however, authorize the extension of the seizures to other industries for the moment. On the other hand, the General Confederation of Industry approved the conduct of the Mechanical Federation in resisting the workmen's imposition. The Socialist party now attempted to get control of the movement, but at the meeting of the general council of the G.C.L. a resolution in favour of control by the latter was voted by 591,245 votes to 409,569 and 93,623 abstentions; this confirmed by a small majority the economic as opposed to the political character of the agitation.

The Government now instructed the prefects of Milan and Turin to open negotiations for a peaceful solution. The extremists were becoming every day more truculent, and in some cases the leaders had broken open the safes and pocketed the contents. At Turin acts of violence were more frequent, and on Sept. 22 the "red guards" brutally murdered a Nationalist student and a detective who happened to be passing near a factory; the murderers were, however, apprehended soon afterwards. The police at last began to act, and seized and occupied the Gilardini works, where the worst criminals were concentrated. Sig. Giolitti, on his return from Aix-les-Bains, had continued his holiday at Bardonnecchia with Olympic serenity; but he, too, now felt that he must do something. He summoned representatives of the owners and workmen to meet him at Turin, and formed a joint commission to formulate proposals for introducing some form of syndicalist control into factory management, which was what the G.C.L. and the union leaders were now demanding. The National Council of the Industrial Confederation expressed its willingness to consider the question of syndicalist control, but protested against the outrages committed by the extremists and the tolerance of the authorities. On the 19th the delegates of the conflicting parties, summoned by the premier, met in Rome and came to a settlement concerning the demand for a rise in wages, and the owners agreed to pay for the work actually done during the occupation of the factories on condition that all damage done should be deducted. The principle of syndicalist control was also accepted, the Government undertaking to present a bill embodying it to Parliament. The owners would not agree to the readmission of all the workmen, and only ended by accepting it under protest as an imposition by the Government. The Congress of the F.I.O.M. accepted the Rome agreement by 118 votes to 18 on the 22nd, and submitted it to a referendum of the local section, which approved it by 127,904 votes to 44,531 and a few abstentions. The agitation committee of the F.I.O.M. then ordered the workmen to evacuate the factories on the 27th; work was resumed on Oct. 4, after the plants, which had been left in appalling state of filth and disorder, had been tidied up. The evacuation did not take place everywhere at once, and there were some further troubles, but gradually normal conditions were reëstablished. As an attempt on the part of the extremists, represented by Bombacci, to promote a revolution and establish Communism, the movement had failed. But it did a great deal of harm to Italian industry and credit, for which even the more moderate leaders, such as Buozzi, were responsible.

Agrarian Trouble.

About the same time agrarian troubles had broken out in various parts of Italy, especially in Sicily, where the associations of ex-soldiers and other agricultural labourers demanded land and seized many estates; but the movement was directed chiefly against the middlemen and large farmers, and settlements were usually effected by agreement with the landlords, who were willing to rent their estates to the agricultural and coöperative associations. Estates were forcibly occupied by the peasantry in the province of Rome and in the Tuscan Maremma, but the disputes were usually settled without serious incidents. In the Veneto, in parts of Tuscany and in the provinces of Bergamo and Cremona, the troubles were more serious; the peasantry demanded ever more favourable land contracts, which, if granted, would have left the landlord without enough income to pay the taxes. The movement was usually promoted by the *Popolari*, especially by Sig. Miglioli and Cocchi, the leaders of the Catholic extremists. In the Puglie similar movements occurred, attended by more violent episodes, including the murder of a few landlords and farmers, whose colleagues retaliated with equal violence. As a rule, however, the agrarian troubles never assumed the widespread or revolutionary character of the industrial agitations, except in Romagna.

The Fascisti.

Meanwhile, the public, including the great bulk of all classes, was getting heartily sick of these constant disorders and of the tyranny of a factious minority composed in part of doctrinaires, but largely of criminals of a degenerate type. The middle-class suddenly realized that it was by no means dead, and that if it only organized itself it could again assume the lead. It now set to work to perfect the various associations for social and political defence already mentioned. The movement of the Fascisti, destined to play an important part in the immediate future, was an outcome of the combatants' associations; the Fasci were composed of young men, mostly ex-officers and soldiers, university students, and not a few of the more intelligent workmen, peasant proprietors and small farmers. Their "extreme left" was constituted out of the ex-*arditi* (assault troops), comprising all the more adventurous spirits, while at the other end were older and steadier persons, professional and business men, professors and intellectuals. The Fasci comprised people of all parties, including not a few Socialists who were disgusted with the tendencies of the party. Fasci were formed in one town after another over the whole country.

Local Elections 1920.

On Nov. 4 the great Victory Parade, which had been delayed for two years because Sig. Nitti had been anxious to make people forget the war, was held in Rome, amid scenes of great enthusiasm. The administrative elections were held in Oct. and Nov. and resulted in a decline of Socialist influence as compared with the political election of 1919. Notable successes were gained in Rome, Naples, Florence, Venice, Genoa and even Turin, while at Milan the Socialists got in by a small majority; at Bologna alone among the large towns the Socialist success was overwhelming. The Catholic party came out badly, although it achieved some successes in the Veneto and Lombardy. These successes raised the spirits of the country considerably, but the reign of disorder was not yet over. The formal assumption of authority in the Socialist municipal councils was to offer a pretext for fresh outbursts of violence. What happened at Bologna was particularly remarkable.

Red Terror in Bologna.

On Sept. 20 the Bologna Bolshevists had determined to organize a demonstration as a counterblast to the official celebrations on that day; a patriotic procession of modest proportions went to lay wreaths on the monuments of Victor Emmanuel and Garibaldi, and when it was about to break up it was fired at from a restaurant which was the haunt of the extremists, but some members of the patriotic group fired back. It was the first popular reaction against red tyranny in Bologna, but it was the beginning of the end. On Oct. 14 a strike and demonstration were organized in Bologna and other towns to protest against the "white terror" in Hungary. The anarchist Malatesta came to Bologna and the demonstration ended with the murder of a Royal Guardsman and a police inspector. These crimes provoked a violent reaction. Small groups of Nationalists and Fascisti paraded the streets; tricolor flags appeared everywhere, and the council of the labour unions ordered a cessation of the strike. The authorities showed greater energy and arrested a number of anarchists. The municipal elections were lost, because the anti-Socialist movement was still too recent; but a week later occurred the collapse of the deputy Bucco, who had made himself dictator of Bologna, with a sort of prætorian guard of bravos. Now, however, he began to fear for his own safety, and asked for the protection of the Royal Guards against the Fascisti. Being arrested for having arms in his possession, he tried to buy his liberty by accusing his comrades. This was the end of his power; and afterwards a deficit in the accounts of the labour exchange of which he was secretary, for nearly a quarter of a million, was discovered. On Nov. 21 the first meeting of the new town council was intended to be the occasion of a general revolutionary movement, organized by a certain Martelli, an elementary schoolmaster, and other communist leaders. Two of the constitutional members of the council, one of them Sig. Giordani, a disabled officer, were shot in the council hall by hired assassins. The upheaval of public opinion was now irresistible; the leading organizers had to fly for their lives to San Marino, many arrests were made, and the whole fabric of Bolshevist organization in Bologna crashed. The council never met again, as most of its members were in prison or fugitives from justice, and was eventually dissolved. The Fascisti now proceeded to attack and wreck a number of Socialist and Bolshevist institutions; the best-known Socialist leaders hardly dared show themselves in the streets except under large escorts of Royal Guards or *carabinieri*. At Modena, a Fascista having been murdered by a band of Socialists, a number of Fascisti from Bologna and elsewhere went to attend the funeral; during the ceremony the Socialists fired and killed two Fascisti. Their companions then burnt down the labour exchange and wrecked the office of Donati, the local deputy. The Bologna labour exchange was also burnt down. A parliamentary commission was sent to Bologna to inquire into the affair of Nov. 21, and its report was a terrible indictment of maladministration. The town council finally resigned, and the administration was taken over by a Government commissary.

In the province of Ferrara the situation was equally intolerable. Most of the communes were in the hands of the Socialists, while the secretaries of the labour exchanges and the leaders of the labour and agricultural unions had become small despots, not unlike the petty tyrants of the Romagna in the Middle Ages; they amassed fortunes by extortion, blackmail and even open robbery. Landowners, farmers or labourers who refused to submit to their rule were boycotted, fined and occasionally murdered. Farming had become almost impossible; no one could employ labour except through the Socialist, or rather Bolshevist, *leghe;* strikes were endemic, and the landlords barely earned enough to pay the taxes, while the labour leaders made highly profitable speculations in land. Now that the reaction had set in, the Fasci gradually broke down the tyranny of the reds in one district after another, not always without fighting. In Ferrara town the murder of several Fascisti by Socialists on Dec. 20 produced a reaction similar to that of Bologna after Nov. 21. In many places the peasantry found red rule so intolerable that they went over *en masse* to the Fasci, who organized labour employment offices for the equal advantage of all classes. In Feb. the Government withdrew all permits to carry arms and ordered the whole population to give up its arms; a certain number of weapons were given up, but enough remained for fighting between Socialists and Fascisti to continue.

Socialist Split.

During the last months the Socialist party had shown signs of splitting up. The Reformist group had long ago broken loose and was hardly considered Socialist at all. Now even in the "Official" party two or three tendencies became more and more clearly marked. The extremist group led by Bombacci, Bordiga, Gennari, and, until his fall, by Bucco, proclaimed the necessity for an immediate revolution and the dictatorship of the proletariat. Others, such as Turati and Treves, were frankly opposed to revolution, although favourable to Socialist doctrines. The more moderate section had held a congress at Reggio Emilia in the autumn, at which men like Nofri and Ponzani had the courage to condemn the methods of Soviet Government in Russia. The Russian leaders, however, demanded the absolute and unquestioning submission of the Italian party to the Moscow creed, and decreed the expulsion from the party of all Socialists who were barely suspected of the Reformist heresy, including such veterans of Socialism as Turati and Treves. A general congress of the party was therefore held at Leghorn from Jan. 13 to 22 1921. The Bombacci group were prepared to swallow the full Moscow programme, but the group led by Serrati, editor of the Milan *Avanti*, accepted Russian communism only in a bowdlerized form suited to Italian conditions, while the Turati group frankly opposed revolution. The Congress soon degenerated into wild disorder. The extremists shrieked insults and foamed at the mouth; Bombacci flourished a revolver which he did not fire; others replied in kind, and Kabatcheff, a Bulgarian Jew representing the Russian Bolshevists, read out the indictment against the moderates and ordered their expulsion. But when it came to voting, the Florence resolution—representing the middle tendency hostile to Moscow, supported by Turati, Treves, Buozzi, Baldisi, D'Aragoni, and the G.C.L., who called themselves *unitari* and were prepared to collaborate with a bourgeois Government—obtained 98,028 votes; the Imola resolution, representing the Communists led by Bombacci, Bordiga, Misiani and Count Gregiadci, got 58,783; and the Reggio Emilia resolution, whose advocates called themselves *centristi*, got 14,695. The split was now an accomplished fact, and the Communists moved into another building to hold a congress of their own; 18 members of Parliament belonged to that group. Moscow now pronounced the major excommunication against the Italian Socialist party, but it was this very claim of the Russians to dictate to Italy that aroused the opposition of the bulk of the Italian Socialists, for in Italy even Socialists do not like being ordered about by foreign Governments.

The Bread Subsidy.

Sig. Giolitti's parliamentary position was somewhat weakening at this time. Most of the constitutional groups were but lukewarm supporters, and accepted his administration merely as a *pis aller*, disapproving of his policy towards revolutionary tendencies. Sig. Nitti, who desired to return to power, now began to oppose the Cabinet. The Nationalists and their sympathizers were opposed to Giolitti, but disliked Nitti still more. The Catholics were an uncertain quantity and could not be counted upon. The Socialists were, of course, in opposition, but Turati and his group were tending more and more towards the idea of collaboration with Giolitti, a tendency which alienated from the latter a good deal of support from the constitutionals, who feared that even a moderate Socialist amalgamation would mean further extravagance and incompetence in the administration, and legislation fatal to production and work. The chief practical question before Parliament was that of the price of bread. The Government still maintained a monopoly of the wheat trade, and, by selling bread under cost price, cast a tremendous burden on the budget. The situation at the end of 1920 was as follows. The harvest, which in 1913 had been as high as 58,452,000 quintals of wheat, had decreased during the war, and in 1919 had fallen to a little over 46,000,000; 1920 was a still worse year and had given only 38,500,000. As the average annual consumption amounted to 167 kgm. per inhabitant it was necessary to purchase 24,000,000 quintals abroad. The State requisitioned 12,500,000 quintals of the home crop (the rest being consumed by the producers) at 113 lire per quintal, and bought 24,000,000 abroad at 210 lire. Thus one kgm. of bread cost the State 1 lira 80c., while it was sold at only 90 centesimi. In Dec. 1920 Giolitti introduced a bill for raising the price. The Socialists adopted obstructionist tactics. Finally, the bill was voted by a large majority on March 1. Home-grown wheat was then sold at cost price, and that purchased abroad at 150 lire. Bread was of two qualities, sold at two prices, the commoner sort at 1 lira 20c. to 1 lira 25c., and the better sort at varying higher prices. The Government expressed the intention of gradually returning to freedom of trade in all foodstuffs. The Budget deficit for 1921–2 had been estimated at 10,370 millions, of which 7,000 millions was due to the State monopoly of cereals; but the new measures reduced the estimated deficit to about 4,000 millions, which it was hoped to cover by other means. The Cabinet was less successful over its education bill. Ever since the Catholics had entered Parliament in large numbers they had demanded State examinations in the schools, so that pupils from the private schools, mostly Catholic institutions, should be on an equal footing with those of the Government schools. Sig. Torre, when Minister of Education, had presented a bill to that effect, but had been unable to carry it through owing to the fall of the Cabinet. Now Sig. Croce, a Liberal not remotely suspected of Clerical leanings, brought forth a new bill to the same effect. But the majority of the Chamber voted against it and Sig. Croce wished to resign (Feb. 11), but his resignation was not accepted. At the end of Feb. a bill providing for syndicalist control in industry was also presented to Parliament, but it encountered much opposition.

Communist Outrages.

The new Communist party was determined to try its strength in the country by a series of terrorist outrages, by which it hoped to draw the masses into that revolution which the Official Socialist party had failed to bring about. The first attempt was in Florence, where a regular revolutionary plot was discovered; on Feb. 27 a group of Communists threw a bomb at a patriotic procession of schoolboys, killing and wounding several people. The Fascisti retaliated by attacking and wrecking the offices of the Socialist organizations, and killed Lavagnini, a noted railway agitator and editor of a local Communist paper. The Florence railwaymen went out on strike, and so did the electricians; a series of affrays between the Communists and Fascisti took place, and the former erected barricades in the popular San Frediano quarter. The troops and police repressed the rioting with energy, backed up by the Fascisti and the enormous majority of the population. The Communists committed several cold-blooded murders, including that of the small son of a manufacturer, whereat the Fascisti burnt down the labour exchange and the offices of the F.I.O.M. Other encounters took place in the environs, notably at Bandino and Scandicci, and in one or two cases the troops had to resort to artillery fire to demolish barricades. In all 20 persons were killed and 100 wounded. Minor outbreaks and individual murders took place at Pisa, Siena, Cascina, Empoli, etc. But everywhere popular reaction was unmistakable and vigorous; in many places it was the soldiers and police who had to protect the Communists from being lynched by the crowd. The Fascista movement acquired ever fresh impetus, and more and more peasants' unions cast off Socialism to join the Fasci. In many places it was discovered that the Socialist or Communist labour leaders had derived large profits from the employment offices, the coöperative stores and the distribution of food-stuffs. More and more Socialist municipal councils, especially in Central Italy, resigned.

Break-up of the Giolitti Cabinet, 1921.

The Government's parliamentary position continued uncertain. On March 10 a motion presented by Sig. Amendola (Constitutional Liberal) in favour of an immediate discussion on foreign affairs, which the Cabinet opposed, was rejected by only a small majority, the Nationalists, Democratic Liberals, as well as the Socialists, voting in favour of it. In the Allied Councils increasingly during the course of 1921 Italy found herself in support of Great Britain in exercising a moderating influence over the more violent tendencies of France against Germany. A movement in favour of a general election had been gathering strength for some months. The Chamber elected in Nov. 1919 in very special circumstances no longer represented anything like public opinion, but it rose for the Easter holidays without any decision having been arrived at. On April 1 Sig. Meda, having resigned on account of his health, was succeeded at the Treasury by Sig. Bonomi, whose place at the War Ministry was taken by Sig. Rodino of the Catholic party. Giolitti then issued a decree dissolving the Chamber on the 7th, the elections to take place on May 15 and Parliament to reassemble on June 8. The elections went off without serious incidents, save a certain number of encounters between Fascisti and Socialists or Communists on the days immediately preceding or following that of the polls (May 15). The total percentage of voters was higher than at previous elections, reaching in some cases 80 or 90% of the total. The new Chamber comprised 535 members, as compared with 508 in the old one, owing to the 27 seats assigned to the annexed provinces. Of this total the various Liberal groups obtained 275 seats (239 in the previous Chamber), the Catholics rose from 101 to 107, the Socialists fell from 156 to 122 for the *unitari* or Socialists proper and 16 for the Communists, the Republicans fell from 13 to 7; there were, in addition, four Germans from the Alto Adige and five Slavs from the Venezia Giulia. The actual proportions of the various parties were not therefore very different from those of the previous Parliament, save that the Socialists, Communists and Republicans were undoubtedly weaker and the Liberals and Catholics somewhat stronger. But the spirit of the Chamber was different; if the Socialists had suffered a less severe reverse than was expected, the dominant note was the success of the Fascisti and Nationalists. The former were about 40 and the latter ten, while a number of other members not actually inscribed as belonging to either group, but describing themselves as ex-combatants and agrarians, might be classed as sympathizers. The new provinces returned five *Popolari* and one Socialist for the Trentino, four Germans for the Alto Adige, three Italians and one Communist for Trieste, five Italians and one Slav for Istria, four Slavs and one Communist for Gorizia-Gradisca.

On June 11 1921 Parliament was opened by the King amid scenes of great enthusiasm. The Socialists, Communists and Republicans did not attend, nor did the Fascisti of Republican tendencies or the Germans from the Alto Adige. On the debate on the speech from the Throne, while the internal policy of the Government met with general approval from all parties except the Socialists and Communists, its foreign policy was subjected to very severe criticism; Sig. Federzoni, the Nationalist leader, delivered a stringent attack on Count Sforza, whose reply made a bad impression. On June 26 the Cabinet obtained only a small majority on a vote of confidence (234 to 202), and although Count Sforza offered his resignation Giolitti professed to regard the vote as involving his policy as a whole, and the Cabinet therefore resigned. Although Giolitti could have formed a new Cabinet himself he declined to do so; and after various other attempts Sig. Bonomi, the Treasury Minister in the late Cabinet, finally undertook to form an administration. On July 4 the new ministers took the oath. The Cabinet was constituted as follows: Ivanoe Bonomi (Presidency and Interior), Marquis Tomasi della Torretta (Foreign Office), Girardini (Colonies), Rodino (Justice), Soleri (Finance), De Nava (Treasury), Bergamasco (Marine), Corbino (Education), Micheli (Public Works), Belotti (Industry and Trade), Mauri (Agriculture), Beneduce (Labour), Giuffrida (Post Office), Raineri (Liberated Provinces). Sig. Bonomi had at one time been a militant Socialist and editor of the *Avanti*, but he broke away from the party in disgust at its anti-patriotic attitude, and on the outbreak of the World War was a whole-hearted interventionist; he served for a time in the army, was afterwards Minister of Public Works during the war, and after the Armistice Minister of War. The new Cabinet comprised members of all the chief parties except the extreme Right and the Socialists. On July 23 the Chamber gave the new premier a vote of confidence with a majority of 166 (302 to 136). (L. V.*)

THE POST-WAR ARMY

As the result of post-war considerations, in November 1919 the Royal Decree No. 2,143 provided for a first preliminary organization of the Italian army as follows: (*a*) an increase, as compared with the pre-war period, of one army command, three Territorial army corps commands, and five Territorial divisional commands (or a total of 5 army commands, 15 Territorial army corps commands and 30 Territorial divisional commands). These measures were suggested by the increase in the extent of the national territory; (*b*) a slight increase in the infantry; (*c*) a very marked reduction in the cavalry; (*d*) a very large increase in the artillery and in the engineers; (*e*) the formation of an Aeronautical Service and of an automobile corps; (*f*) term of service fixed at one year, or even less; (*g*) the force on the estimates reduced to 210,000; (*h*) a budget framed in such a way as to reduce the outlay for the army to 11% of the total expenditure of the State, while before the war it amounted to 14%. This scheme was not carried into effect, as the Government held that under it the army would still have been too large and too expensive as compared with the requirements and financial resources of the moment. It was considered that the increase of territory and of population did not call for the formation of new units; that on the contrary the improved conditions of the frontier should permit of a reduction from the pre-war strength of the army. It was necessary also that the army should weigh as lightly as possible on the financial resources of the country, thus facilitating Italy's economic revival. Furthermore, the Government believed in the principle of an "armed nation" in the sense that it desired to reduce the term of military service in time of peace, training all citizens and getting the most out of them in time of war. Some politicians, in advocating a further reduction of the army, were influenced by pre-war, anti-military and almost anti-national ideas, which had for some time affected the country. In any case, within a few months of the first "provisional organization" a second was planned (Royal Decree No. 451 of April 20 1920).

The following are the details of this organization, and the provisions relating thereto formed the basis of actual conditions in 1921: 4 army commands, consisting of the general appointed to the command of the army in time of war and a very small staff; 10 Territorial army corps commands, named after the city in which the command is stationed; 27 commands of infantry divisions numbered progressively; 3 commands of "Alpini" divisions similarly numbered; one cavalry divisional command. Each army corps has three divisions of infantry or "Alpini," as well as other troops not incorporated into any division. A division of infantry consists of two brigades of infantry (grenadiers, infantry of the line and "Bersaglieri") and one regiment of field artillery. An "Alpini" division includes three regiments of "Alpini" and one of mountain artillery. This formation is made for purposes of instruction. In actual fact the "Alpini" regiments and the mountain artillery are scattered along the whole frontier; so that the commands of "Alpini" divisions have in their territory and under their direct orders only a portion of the Alpine troops allotted to them. They have, on the other hand, direct control over other infantry and artillery units as is the case with an ordinary division. The troops and services of army corps not incorporated into divisions are: a regiment of heavy field artillery; a group of anti-aircraft artillery; a battalion of sappers; a battalion of telegraph operators; an automobile park; a train park; a sanitary company; a supply company. These troops and services are capable of supplying in case of mobilization the requirements of the divisions of the army corps and of the command of such army corps. This arrangement, which has been rendered more practical by stationing the various units within the territory of the big units to which they are assigned, represents a marked improvement on the system prevalent before the war, when there were entire Territorial divisions without artillery, engineers or intendance. Other units, generally of specialists, are distributed in different parts of the country, and, while they are not assigned to divisions of army corps, they receive orders therefrom in matters of discipline and of service.

The infantry should consist of: 2 regiments of grenadiers (one brigade), 102 regiments of infantry of the line (51 brigades), 4 regiments of "Bersaglieri" (2 brigades), 9 regiments of "Alpini," one group of armoured cars. In addition there were in 1921 still other regiments of infantry in Upper Silesia and in the Eastern Mediterranean, as well as 8 regiments of "Bersaglieri" which were to be abolished. The abolition of these regiments had been decided upon for the purpose of not depriving the infantry of the line of its best elements, and in order to preserve an equal number of line regiments which had been formed during the war and had won the gold medal for valour. But popular opposition to the reduction of the "Bersaglieri" units, so characteristically Italian and so full of noble traditions, had the effect of suspending the execution of the proposed measure. For the present, at least, the 12 regiments of "Bersaglieri" remain. The regiments of grenadiers, infantry of the line, and "Bersaglieri" consist of 3 battalions each (2 effective and one reduced to a cadre). Each battalion has 3 companies of rifles and one machine-gun company. "Alpini" regiments are composed of 2 to 4 battalions each (27 in all).

The cavalry consists of 12 regiments (4 of lancers and 8 of light cavalry) and of 4 farrier squadrons (or "palafrenieri"). Each regiment consists of two groups of squadrons—2 per group. There are 4 commands of cavalry brigades, each having 3 regiments. Two of these brigades form the division of cavalry already existing.

The artillery consists of: 27 regiments of field artillery; 3 regiments of mountain artillery; one regiment of artillery drawn by motors; 14 regiments of heavy field artillery; 6 regiments of heavy artillery; 4 regiments of coast artillery; 3 depot-schools for anti-aircraft artillery. The regiments of field artillery have animal transport. Each regiment has 4 groups, one reduced to a cadre. In each regiment 2 groups are armed with the 75-mm. gun, one group has 100-mm. howitzers, and the fourth group has 65-mm. guns carried on mules. Each group has 3 batteries. The regiment with guns on motor-cars includes 5 groups of 75-mm. guns. To this regiment is allotted the only group of horse artillery still kept up (2 batteries of 75-mm. guns). The heavy field regiments have guns drawn by motors; each has 4 groups of 3 batteries. Some groups are armed with the 149-mm. howitzer; others with the 105-mm. gun. The 6 heavy regiments each consist of 4 groups of 3 batteries (one is reduced to its cadre). Guns are drawn by motors, and are of different types, varying from the 149-mm. gun to the 305-mm. howitzer. Coast regiments have the same formation as the heavy regiments. The depot-schools for anti-aircraft service consist of 3 or 4 groups each. A group has 2 batteries on motor vehicles and a position battery.

The Engineer Corps consists of: 10 battalions of sappers (of 3 companies); 10 telegraph battalions (of 3 telegraph companies, one section of photo-electricians and one of pigeon carriers); one regiment of miners (of 5 battalions); one inland water transport regiment (one lagoon and 3 pontoon companies); one railway regiment.

The Air Force consists of aeroplanes, kite-balloons and airships. The aeroplanes are organized into one group of chasing-machines, one of bombing units and one of scouts. Each group has a depot-school, a certain number of squadrons, of aeroports and stations. There are also a command of Air Force schools having at its dependence various schools, training centres, workshops, etc.; an aeronautic command in the Venezia Giulia controlling a certain number of squadrons; several depot, supply and training offices.

The Automobile Corps of recent foundation includes 10 automobile parks, each of which has a depot, a school and a number of sections which are charged with transport services generally.

The Royal Carbineers (" Carabinieri Reali ") are military police, carefully selected, originating from the old Piedmontese army and having very good traditions. During the war the " Carabinieri " were formed into a regiment of infantry which distinguished itself on Podgora, and had to be dissolved at an early date owing to its heavy losses. The " Carabinieri " discharged police duty for the mobilized troops and in the war zone. Now they are divided into 21 " legions " (plus one of recruits) and perform police duty chiefly in the country districts. In some of the big towns there are special battalions of " Carabinieri," formed of riflemen and machine-gunners to be employed together in case of riots. The " Carabinieri " are recruited from volunteers, or from levy men, on special service.

The Royal Guards (" Guardia Regia ") for police service constitute a special corps, of a military character, of recent formation and originating from the former police corps. The men enlist under a system similar to that adopted for the " Carabinieri," and discharge police duties in big centres. There are 10 " legions " (plus one of recruits). Like the " Carabinieri " they are divided into battalions and squadrons.

The new recruiting law is based on the principle that all valid men must receive military training and are liable to conscription. The provisions as to physical fitness of the men have been modified considerably so as to reduce the number of those discharged permanently or temporarily as medically unfit. It is calculated that each levy will thus give 250,000 recruits. The majority of these will have to serve eight months, while the rest, consisting chiefly of men who under the old law would have been allotted to the third category, will have to serve three months. In 1921, however, a period of transition was still in existence, and these terms of service were not yet in force. It was expected, however, that men having to serve for eight months would be called up in groups, so that there would always be a certain number of trained men under arms, while those who had to serve for three months would have to be drafted into the infantry.

Men are liable to serve as before from their 20th to their 39th year of age; but the distinction between reservists of the permanent army and those of the mobile and Territorial militias has been abolished. All men on unlimited leave form one large reserve, which in due course is detailed according to age, physical fitness, or special qualifications, to the active army, the troops stationed in the country, the industrial factories, etc.

The force on the 1921 estimates for the time when the eight months' service would be adopted was set down at 175,000 men, and the average yearly outlay at 9·80 % of the total expenditure of the State. (M. R.)

JACKSON, HENRY (1839–1921), English classical scholar, was born at Sheffield March 12 1839. He was educated at the Sheffield collegiate school, at Cheltenham College and at Trinity College, Cambridge, where he was elected fellow in 1864 and vice-master in 1914. From 1875 to 1906 he was praelector in Ancient Philosophy, and in 1906 was appointed Regius professor of Greek. In 1908 he was given the O.M. He resigned the vice-mastership of his college in 1919, and died at Bournemouth Sept. 25 1921. His important work in translating and commenting upon Aristotle's Ethics is alluded to in 2.513. He published *Texts to Illustrate Greek Philosophy from Thales to Aristotle* (1901) and a series of articles on "Plato's Later Theory of Ideas" (*Journal of Philology*); also *About Edwin Drood* (1911). The principal articles on ancient Greek philosophers in this Encyclopædia were his contributions.

JACKSON, SIR JOHN (1851–1919), English engineer and contractor, was born at York Feb. 4 1851. He was educated at Edinburgh University and received his training as an engineer at Newcastle-on-Tyne. Amongst his more important constructions were the docks at Middlesbrough, Hartlepool and N. Sunderland, the commercial harbour at Dover and the extension there of the Admiralty pier, the last section of the Manchester Ship canal, the foundations of the Tower bridge, the new naval harbour at Simon's Town, Cape Colony, and the irrigation works in Mesopotamia. He was knighted in 1895. From 1910 to 1918 he represented Devonport in the House of Commons. Early in the World War he offered to erect army huts at the bare cost. Complaint was made in April 1917 to the royal commission appointed to inquire into profits made on army huts, that his firm had later claimed 5% on future work and that the amount paid to them was excessive. The commission endorsed this charge, though exonerating the firm from having "intentionally brought about a state of things in which they could extort exorbitant terms." Sir John died at Godalming Dec. 14 1919.

JACKSON, SIR THOMAS GRAHAM, Bart. (1835–), English architect, was born in London Dec. 21 1835, the son of a solicitor. After a brilliant career at Oxford, where he became a fellow of Wadham, he entered the office of Sir George Gilbert Scott at the age of 23, and remained there for three years, but his future work showed that he was not very deeply influenced by the somewhat narrowly Gothic method and predilection of Scott. To accommodate himself to the calls upon his sense of propriety in design, one who was later to be asked to add additional building work to many of the Oxford colleges—(Brasenose, Lincoln, Balliol and others, and especially the University Examination Schools)—needed that wide range of knowledge of the architecture of the late 16th and 17th centuries that is indicated in much of Jackson's work. Upon Oxford he has left an especial impress with which his name will be always associated. For Cambridge, again, he carried out many important university buildings, the Law library and school, the Archaeological museum, and the Physiological laboratories amongst them. Less bound there than at Oxford to the precedent of an existing design his work, mostly of a late English Renaissance character, shows facility and invention. His new buildings and additions at so many great English schools—including Eton, Harrow, Rugby and Westminster—formed a very large proportion of his artistic output in the 'eighties and 'nineties. The interior of the chapel at Giggleswick school, Yorks., is an example of that treatment of colour—in marble and mosaic—upon which he relied so much as a complement to his architectural design. He was always keen on bringing together the various arts as tributary to, or allied with, architecture, and in support of this endeavour was a member, and in 1896 master, of the Art Workers' Guild. Jackson's name will also be connected with a large number of new churches for which he was responsible, and of even more in the restoration of which he was concerned, amongst the latter being St. Mary's, Oxford. Though subjected at the time to much criticism as to the decorative features of the exterior, and especially the spire, Jackson's work still holds its own as dealing conscientiously and conservatively with the difficult and disputed problem of restoration. He carried out many new houses, and a large number of alterations and additions to others. As an author he was responsible for several works, covering a wide area of his profession, and, in especial, his many visits to the Nearer East, especially to the Balkan States, have resulted in his giving nearly all of what is known as to the architecture of Ragusa, Dalmatia, Istria and the Adriatic coast. He was so far recognized as the authority on their traditional type of Romanesque building that the Dalmatians sought his help in the building of the Campanile at Zara. In 1910 the Royal Institute of British Architects awarded him their gold medal. He was elected A.R.A. in 1892, and R.A. in 1896, became hon. D.C.L. of Oxford, and hon. LL.D. of Cambridge, and was created a baronet in 1913.

JACOB, EDGAR (1844–1920), English bishop, was born at Crawley rectory, near Winchester, Nov. 16 1844, the son of Philip Jacob, archdeacon of Winchester. He was educated at Winchester and New College, Oxford, where he graduated in 1867. He was ordained in 1868, and in 1871 went to India as domestic chaplain to Dr. Milman, Bishop of Calcutta. In 1876 he returned to England, and in 1878 became vicar of Portsea, where he worked wonders in a difficult parish. In 1896 he became Bishop of Newcastle, and in 1903 was translated to the see of St. Albans. This diocese, which embraced a large part of the poorer outlying parts of London, was too large for the effective control of one bishop, consisting as it did of 630 benefices and nearly 900 clergy, and Dr. Jacob worked hard to secure the formation of a new bishopric out of it. It was not, however, until 1913 that the bill providing for the erection of the bishopric of Chelmsford passed. He retired from his see in Dec. 1919, and died at St. Cross, Winchester, March 25 1920.

JÄGER, GUSTAV (1832–1917), German naturalist and hygienist (*see* 15.124*), died in 1917.

JAGOW, GOTTLIEB VON (1863–), German Foreign Secretary at the outbreak of the World War, was born June 22 1863 in Berlin. He entered the diplomatic service in 1895 and after having been Prussian minister at Munich, German ambassador at Rome, and German minister at The Hague, was appointed in 1913 Secretary of State for Foreign Affairs. He played an active part in the negotiations preceding the outbreak of the World War and was, in particular, concerned in the German relations with Austria, having been the first member of the Imperial Government in Berlin to become acquainted with the terms of the Austrian ultimatum to Serbia. Jagow retired in Nov. 1916. He wrote a defence of German policy entitled *Ursachen und Ausbruch des Weltkrieges* (1919).

JAMES, HENRY (1843–1916), Anglo-American man of letters (*see* 15.143), died in London Feb. 28 1916. In 1913 nearly 300 of his English friends presented him with his portrait by J. S. Sargent, on the occasion of his 70th birthday; in the following year the portrait was damaged by a militant suffragette as it hung upon the walls of the Royal Academy. The outbreak of the World War aroused in him such a passionate sympathy for England and her Allies that he decided to identify himself once for all with England and to apply for naturalization. On July 26 1915 he became a British subject. The following Jan. he was awarded the Order of Merit, the insignia being brought to him on his sick-bed by his friend Viscount Bryce. His later works include *A Small Boy and Others* (1913), *Notes of a Son and Brother* (1914), *The Middle Years* (1917, left uncompleted). Two unfinished novels, *The Ivory Tower* and *The Sense of the Past*, appeared in 1917. In 1915 he contributed a preface to the *Letters from America* of Rupert Brooke, and his impressions of the war were published in 1919 under the title of *Within the Rim*.

See *The Letters of Henry James*, selected and edited by Percy Lubbock, 2 vols. (1920).

** These figures indicate the volume and page number of the previous article.*

JAMES OF HEREFORD, HENRY JAMES, 1st Baron (1828–1911), English lawyer and statesman (*see* 15.144), died at Epsom Aug. 18 1911.

JAMESON, SIR LEANDER STARR, Bart. (1853–1917), British South African statesman (*see* 15.147). The union of the South African colonies in 1909 accomplished the main object which Jameson had set before himself as a political leader. He wished to carry the spirit of union further by forming a combination of political parties to support a non-racial Government for the new Union, regarded Gen. Botha as the natural leader of such a combination, and was completely ready to serve under him. This project of a "best man" Government, however, was not accepted by Botha, who thought that the Dutch-speaking people of South Africa were not ready for it. The alternative, to which Jameson then set himself, was the formation of a new party representing the majority of the English-speaking people in the Cape, the Transvaal, the Orange Free State and Natal. At a conference in Bloemfontein in 1910, before the first general election for the new South African Parliament took place, this project was carried out. Jameson presided over the conference with a patience, a tact and an insight which exhibited once more his remarkable gift for the ruling of men. The programme of the party thus formed—known as the Unionist party of South Africa—showed his influence in every clause. It repudiated opposition to the Botha Government for the mere sake of opposition, and promised the Prime Minister support in all measures designed to promote racial peace and material prosperity in South Africa. At the first South African general election in Sept. 1910 the Unionists fought on this programme with a considerable measure of success, especially in the Cape and Transvaal provinces. Natal, where the English-speaking people were in a great majority, withheld from Jameson and the Unionists the general support which it might have been expected to give, though the Unionists won a number of seats in that province. For two years Jameson led the Unionists in the South African House of Assembly with great moderation and self-restraint, but was compelled by ill health to retire from the leadership of the party in 1912. He returned to England and settled in London, devoting himself, when his health took a turn for the better, to business interests. He had an intimate knowledge of the affairs of the De Beers Corp. and of the British South African Co., commonly known as the Chartered Co. In June 1913 he became chairman of the Chartered Co., whose general meetings gave him, year by year, till his death in 1917, opportunities of proving in a new sphere his power of exercising a dominating influence over assemblies of men. When the war came in 1914 Jameson devoted himself to public work, leaving to members of the Government the choice of the sphere in which they thought he could be most useful. Meanwhile he had made more than one visit to Rhodesia as chairman of the Chartered Co., and the work which he did on behalf of the territory that he had helped to establish was recognized even by opponents of the policy of the Chartered Co. The war work which the Government chose for him was that of chairman of the Central Prisoners-of-War Committee, to which he devoted himself with all his remaining strength, organizing at the same time more than one private hospital overseas. Jameson's health had been precarious for years, and on Nov. 26 1917 he succumbed to a short illness. His name will stand very high among those of the men who did service to South Africa and Rhodesia. Diffident and utterly free from self-seeking, he was of those who make the least of their service to their country. But his labours for racial reconciliation and material prosperity in South Africa were conspicuous, and the close friendship of Botha was a final proof of the quality of his patriotism. It was, too, the measure of his stature as a man able beyond the recognition of most of his contemporaries, honest and plain-speaking, with a deep devotion to the most lofty ideals of public service. Jameson was created a K.C.M.G. on the inauguration of the Union in 1910 and a baronet in 1911. (B. K. L.)

JANEWAY, THEODORE CALDWELL (1872–1917), American physician, was born in New York City Nov. 2 1872, the son of Dr. Edward Gamaliel Janeway, a distinguished physician. He was educated at the Sheffield Scientific School, Yale University (Ph.B. 1892) and the College of Physicians and Surgeons, Columbia University (M.D. 1895). From 1898 to 1906 he taught medical diagnosis in New York University. In 1907 he became associate in medicine in Columbia and two years later professor of medicine. He was attending physician at St. Luke's Hospital and in 1911 became senior attending physician at the Presbyterian Hospital and head of the medical staff. In 1914 he was called to Johns Hopkins University to succeed Dr. William Osler as professor of medicine, and became physician-in-chief to Johns Hopkins Hospital. After America's entrance into the World War he became major in the Medical Officers' Reserve Corps and was engaged in research in Washington, D.C. He died at Baltimore, Md., Dec. 27 1917. He was secretary of the Russell Sage Institute of Pathology, a member of the board of scientific directors of the Rockefeller Institute for Medical Research, and of the editorial board of the *Archives of Internal Medicine*. He was the author of *The Clinical Study of Blood Pressure* (1904).

JAPAN (*see* 15.156).—The first national census in Japan took place on Oct. 1 1920; prior to that date only the figures prepared by the local registrars and police authorities were available. Table 1 gives the census figures for Japan proper, Formosa and Japanese Sakhalin, together with those obtained for Korea from the local registrars' records. The figures for Japan proper (area, 148,756 sq. m.) show that she ranks sixth in pop. of the countries of the world, the first five being China, India, Russia, the United States and Germany. With regard to the density of pop., Japan (376 per sq. m.) ranks third, immediately following Belgium (658) and the Netherlands (536), and above Great Britain (374).

Table 1.—Population, 1920

	Households	Population		Total
		Male	Female	
Japan, Proper	11,222,053	28,042,995	27,918,145	55,961,140
Taiwan (Formosa)	690,000	1,894,141	1,760,257	3,654,398
Karaofuto (Japanese Sakhalin)	22,087	62,241	43,524	105,765
Chosen (Korea)	3,297,285	8,923,060	8,361,147	17,284,207
Total	15,231,425	38,922,437	38,083,073	77,005,510

The ratio between men and women of the whole pop. is 100·4 to 100, the number of men being 28,042,995 and that of women 27,918,145. The larger number of men is recorded in the district of Tokyo and Hokkaido (112 men to 100 women) and other 11 prefectures, whilst there are 3 prefectures in which the ratio is balanced and 31 prefectures in which the number of women exceeds that of men, the prefectures of Shiga, Kagoshima, and Okinawa (the Luchu Is.) showing the lowest figures for men (93 men to 100 women). The higher proportion of men is accounted for either by the inclusion of a large city, with its commercial and industrial activities, or of a military barrack or a silver-, copper- or coal-mine. Women are generally found to be more numerous in the provincial districts, for it is oftener men than women who migrate to large cities or even abroad in quest of knowledge or fortune.

Cities and the Country.—Table 2 gives the census figures for 16 cities with a pop. numbering more than 100,000 souls.

Table 2.—Principal Cities, 1920

	Households	Male	Female	Total
Tokyo	456,820	1,171,180	1,001,982	2,173,162
Osaka	276,331	673,636	579,336	1,252,972
Kobe	138,986	324,037	284,591	608,628
Kyoto	128,892	299,689	291,616	591,305
Nagoya	92,426	220,276	209,714	429,990
Yokohama	95,241	224,050	198,892	422,942
Nagasaki	37,036	90,897	85,657	176,554
Hiroshima	34,553	83,337	77,167	160,504
Hakodate	29,155	75,647	69,093	144,740
Kure	28,268	73,754	56,600	130,354
Kanazawa	29,287	62,842	66,478	129,320
Sendai	21,861	62,529	56,449	118,978
Otaru	21,275	56,406	51,707	108,113
Sapporo	20,038	53,011	49,560	102,571
Kagoshima	19,942	49,191	53,205	102,396
Yawata	22,322	56,373	43,854	100,227

There are 25 cities with a pop. of from 50,000 to 100,000; 34 with from 30,000 to 50,000, and eight with less than 30,000.

Economic and Financial Conditions.—Prior to 1914 Japan had already almost recovered from the effects of the Russo-Japanese War, and her economic activities had yearly been making steady and more or less symmetrical progress. The World War, however, caused and even compelled the Island Empire to undertake a prodigious development of her commercial and industrial life.

During the early days of the war the disturbance in international commercial relations affected the Japanese nation in common with the other peoples of the world. She was immediately conscious of the disquieting falling-off in the demand for silk, the most important of her exports. This situation, however, began to be perceptibly modified later, when a huge demand arose on the part of Russia and other Allied Powers for the supply of immense quantities of munitions of war, and, in addition, the inability of the European belligerents to continue their overseas commerce on the pre-war scale caused a demand for Japanese products in the markets of India, the South Seas, Australia, S. America and even Africa. The wave of prosperity which the satisfaction of these demands created was increased by the great volume of the carrying trade which fell to Japan's share, owing to the number of Allied merchantmen which had been directed to warlike purposes. All these factors, in addition to the natural decline in imports from the countries of the European belligerents, conduced to turn the balance of Japanese trade in her favour practically for the first time in 20 years.

A great increase in the amount of specie held by Japan abroad inevitably resulted, and the gold accumulated at home also tended to grow rapidly. The lowering of the rate of interest followed; prices of shares began to soar—the shares of the steamship companies advanced by 400% in 1915—and the enthronement of the Emperor in the autumn of that year strewed with roses the already bright path leading to improved industrial activities. A considerable number of new undertakings, notably in the field of shipbuilding, iron and steel manufacture and the chemical industry, were brought into being. Once more the rate of interest showed an upward tendency, and the issue of bank-notes increased rapidly. The trend of circumstances described above became more and more accentuated as time went on, until at the end of 1916 the premature peace-talk counselled temporary caution to Japanese manufacturers and merchants.

The momentous events of 1917, such as the general Allied trade embargo, the introduction by the Germans of ruthless submarine warfare, the declaration by the United States of war upon Germany and the *débâcle* of the Russian Revolution, all had their repercussion upon Japanese commerce. The continuous internal troubles in China further added to the general international confusion. Nevertheless, in spite of the far-reaching effects of these great outside influences, Japan's trade and industry continued on the whole to register a steady development. The tightened restrictions on commerce on the part of Great Britain and the United States, especially the ban placed at one period by the latter on the export of iron and steel, caused a proportionate measure of agitation in the circles of industrial enterprise in Japan. Her shipbuilding and steel industries, however, were relieved from anxiety, and even stimulated into further development, by an arrangement which was speedily arrived at between the United States and Japan as to the exchange of ships and steel.

With the conclusion of the Armistice in Nov. 1918 the demand for warlike materials came to an abrupt end; and the branches of industry and commerce dealing with iron, steel, copper, dyestuffs and chemicals, which had owed their inauguration or development to the abnormal situation caused by the war, received a sudden and serious blow. The demand for bottoms slackened down as a natural consequence, and the shipbuilders, who had been enjoying a period of tremendous and unprecedented prosperity, were forced to arrest their activities. There were even threatening signs of economic depression. But the revived demand for food-stuffs, and industrial materials necessary for the economic reconstruction of Europe, coupled with the roaring trade activities in the United States, still sustained the flourishing state of Japan's commerce.

For the rest, a financial panic which occurred in April 1920, due to over-speculation and misuse of credit, administered a telling blow to trade and industry. Nevertheless, Japan had amassed great wealth, her industry had advanced marvellously, not only in quantity but in variety; her merchants had acquired wide knowledge and a seasoned experience; her ships now cruised to the remotest corner of the seven seas; and many a country had been newly added to the list of her foreign customers. The foundation of industrial Japan had become incomparably stronger than in pre-war days and the brightest vista opened up before her future economic development.

The State Budget.—The general budget of Japan, which was doubled both in revenue and expenditure during the Russo-Japanese War, was more than redoubled in the course of 1910–20. The total revenue and expenditure, which amounted in the fiscal year 1910–11 to 672,874,000 yen (£68,600,000) and 569,154,000 yen (£57,900,000) respectively, balanced at 1,563,000,000 yen (£160,000,000) in 1921–2. Table 3 shows the increasing figures of the Japanese State budget for the decade 1910–20.

Although in the early months of the war the more or less disturbed economic conditions in Japan checked the natural increase of revenue in general—the customs duties in particular yielded a considerably diminished income owing to the marked decline in foreign trade—the gradual recovery, followed by the unprecedented prosperity of industry and commerce, caused the revenue to show an upward tendency. Since 1916–7 the income-tax, especially the amount contributed by commercial and industrial corporations, had begun rapidly to ascend in amount. Receipts from public undertakings and State property, especially the income of the steel foundries and the proceeds of munition sales to Allied belligerents, contributed enormously to the general growth of the revenue, although it should be noted that the manufacture of arms necessitated the disbursement of a sum practically equal to the income.

A noteworthy step was taken in 1918 in the creation of the war profits tax, which required the profiteers, including ship *narikin*, to pay not less than 20% either of their income in excess of their average profits in pre-war days, or, in case such could not be ascertained, of 10% of their invested capital. This item yielded nearly 82 million yen (£8,300,000) in 1918–9 and 93 million yen (£9,400,000) in the following fiscal year, but with the end of the war the revenue dropped to 7 million yen (£700,000).

As the war progressed it became more and more imperative that Japan should put forth her best efforts to render to her Allies military and economic industrial support. The trade boom and the enhancement at home of the national power also led to expansive industrial and educational measures. It became, moreover, evident that the salaries and wages of Government officials should be raised to meet the increased cost of living. It was only natural that State expenditure should expand in juxtaposition with the growth of the revenue. With the completion of the national defence programme spread over seven years, there were to be further enormous outlays.

Table 3.—Budget Figures 1910–21 (in 1,000 yen)

Year	Revenue			Expenditure			Surplus Revenue
	Ordinary	Extraordinary	Total	Ordinary	Extraordinary	Total	
1910–1	491,331·3	181,542·4	672,873·7	412,009·1	157,144·8	569,154·0	103,719·7
1911–2	508,558·6	148,633·5	657,192·2	409,889·0	175,485·5	585,374·6	71,817·6
1912–3	552,085·5	135,306·8	687,392·4	416,895·0	176,701·3	593,596·4	93,796·0
1913–4	575,428·0	146,547·4	721,975·4	415,635·8	157,998·1	573,633·9	148,341·5
1914–5	536,342·5	198,305·5	734,648·0	399,225·4	249,195·0	648,420·4	86,227·6
1915–6	538,999·6	169,616·2	708,615·8	386,516·4	196,753·3	583,269·8	125,346·0
1916–7	622,052·1	191,256·5	813,308·6	386,065·9	204,729·3	590,795·3	222,513·2
1917–8	763,760·1	321,198·2	1,084,958·3	437,821·4	297,202·7	735,024·2	349,934·1
1918–9	911,579·4	567,536·4	1,479,115·8	490,167·1	526,868·4	1,017,035·5	462,080·2
1919–20	839,140·9	225,049·3	1,064,190·3	505,936·6	558,253·6	1,064,190·3	—
1920–1	1,012,614·1	322,741·1	1,335,355·3	724,790·8	610,564·4	1,335,355·3	—
1921–2	1,237,219·2	325,323·5	1,562,542·7	902,940·8	659,601·9	1,562,542·7	—

To meet all these increases in expenses, the war profit tax alone was calculated to be insufficient; and the income-tax was so adjusted as to yield a larger revenue, at the same time, with a view to effecting a fair distribution of the burden. The *saké* tax was raised; postal, telegraph and telephone charges were increased; and a higher price was charged for the Government monopoly tobaccos.

Those revenue measures were rewarded with success in 1918–9, and in the following fiscal year the sums so raised still showed an increase. In 1919–20 the effect of the conclusion of the war was felt in the marked decrease in the returns of the steel foundries. But in all other items, the budget estimates were greatly exceeded. The bourse tax and forest revenues were double the figures of the previous year. Japan had thus emerged from the five years of the World War with her financial position considerably strengthened, though during 1920–1 the effect was discounted by industrial unrest and economic depression which reacted adversely on the domestic financial conditions. The budget for 1921–2 contained the estimated expenditure for the eight-to-eight fleet-unit scheme, and it was a question at the end of 1921 how far this might be subject to modification as a result of the Washington Conference. The chief items of revenue and expenditure for 1921–2 are given in Table 4.

Table 4.—Revenue and Expenditure 1921–2

Ordinary Revenue:—	Yen
Land Tax	73,985,325
Income Tax	268,099,093
Business Tax	48,670,969
Tax on liquors	171,237,991
Sugar Excise	41,886,037
Consumption Tax on textile fabrics	33,260,882
Customs Duty	69,872,070
Other Taxes	44,452,169
Stamp Duty	90,165,422
Receipts from postal, telegraph and telephone services	187,177,396
Forests	32,057,000
Profits of monopoly	93,981,954
Other receipts from public undertakings and State property	17,611,690
Miscellaneous receipts	21,260,434
Transferred from special account for deposits	43,500,776
Total	1,237,219,208
Extraordinary Revenue:—	Yen
Proceeds of sale of State property	7,361,888
Receipts from the issue of public loan	54,264,892
Public bodies' contributions to expenses for river, road, harbour improvements, etc.	16,373,877
Transferred from special account for various funds	8,251,168
Local contributions to expenses incurred by the State	6,356,400
Surplus of the preceding year transferred	193,095,985
Miscellaneous receipts	39,719,379
Total	325,323,589
Total Revenue	1,562,542,797
Ordinary Expenditures:—	Yen
Imperial Household	4,500,000
Foreign Affairs	18,488,310
Home Affairs	40,860,512
Finance	223,146,614
Army	183,290,831
Navy	144,811,078
Justice	27,242,184
Public Instruction	33,938,167
Agriculture and Commerce	19,377,811
Communications	207,285,315
Total	902,940,823
Extraordinary Expenditure:—	Yen
Foreign Affairs	3,130,574
Home Affairs	76,426,341
Finance	35,271,551
Army	79,853,871
Navy	353,826,000
Justice	2,426,472
Public Instruction	20,672,879
Agriculture and Commerce	31,303,978
Communications	56,690,308
Total	659,601,974
Total Expenditure	1,562,542,797

The National Debt.—The National Debt stood at 2,793,000,000 yen (£284,800,000) at the end of 1919–20, of which 1,482,000,000 yen (£151,000,000) represented the internal, and 1,311,000,000 yen (£133,700,000) the foreign loans. Table 5 gives the figures.

Table 5.—Debt 1910–20 (in 1,000,000 yen)

Financial Year	INTERNAL LOANS Amount outstanding at the end of the financial year	FOREIGN LOANS Amount outstanding at the end of the financial year	Total	Debt per head in yen
1910–1	1,203·1	1,447·2	2,650·3	39·1
1911–2	1,146·2	1,437·4	2,583·6	37·3
1912–3	1,116·2	1,456·9	2,573·2	36·3
1913–4	1,054·6	1,529·4	2,584·1	35·6
1914–5	991·5	1,514·8	2,506·3	33·9
1915–6	1,028·0	1,461·1	2,489·2	33·0
1916–7	1,097·4	1,370·2	2,467·7	32·1
1917–8	1,159·9	1,338·7	2,498·7	32·3
1918–9	1,268·8	1,311·1	2,579·9	33·0
1919–20	1,482·4	1,311·1	2,793·5	36·4

Foreign Trade.—The rapidity with which Japan's foreign trade had developed, both in volume and extent, during the half-century preceding 1920 provides a remarkable record in commercial history. The total value of exports and imports, which in the first year of Meiji (1868) amounted to the insignificant total of 26 million yen (£2,650,000), increased tenfold in 1895, a hundredfold in 1917, and 167-fold in 1920. The most striking progress was attained during the World War, when Japan's foreign trade leapt from 1,362 million yen (£139,000,000) in 1913 to 4,284 million yen (£438,000,000) in 1920; although it should be remarked that these figures do not correctly represent the proper rate of increase in the volume of trade, owing to the inflation of prices. The war first reacted prejudicially upon the foreign trade of Japan, as well as upon other branches of her commerce and industry, and the figures for the total imports and exports in 1914 indicated the marked decrease of 12·9% on those of the preceding year. The effect of the war in increasing foreign trade first showed itself appreciably in the returns for 1915, when the adverse balance of trade which had obtained for 20 years—with the exception of the years 1906 and 1909, when slight excesses of exports were recorded—was superseded by a favourable trade balance. The total value of the imports and exports for that year was 1,241 million yen (£127,000,000), an increase of 54 million yen (£5,500,000), or 4·5%, compared with 1914, although the value of the total trade for 1913 was not achieved on account of the diminished volume of imports. The favourable tendency in Japan's oversea trade was accelerated in succeeding years, until the excess of exports over imports attained 371 million yen (£38,000,000) in 1916 and 567 million yen (£58,000,000) in 1920.

This sudden expansion of trade was occasioned by the war both directly, through the great demand by the Allied belligerents for munitions of war, and also indirectly, through the temporary retirement of the great industrial Powers of Europe from the arena of world commerce and trade. Soon after the outbreak of the war Japanese goods—chiefly consisting of semi-manufactured and finished articles, such as cotton fabrics, leather goods, watches, silk tissues and so forth—found their way in large quantities not only to the established markets in the Far East, but to various quarters of the world hitherto but little explored by Japanese traders, viz. the South Seas, S. America and even Africa. The most conspicuous expansion, however, was effected in the exports to China and India, and, until the explosion of the Russian Revolution in 1917, large shipments to Vladivostok of munitions of war and food-stuffs for use in European Russia assisted to augment the volume of trade with Asia. The United States began to buy heavily in 1916, when the figures advanced from 204 million yen (£20,900,000) in the preceding year to the substantial amount of 340 million yen (£34,800,000), the goods purchased consisting mostly of raw silk, *habutai*, cotton yarns, cotton fabrics and tea. British America and also Mexico increased their orders from Japan and the S. American trade showed such glowing prospects as to induce Japanese companies to open shipping facilities to Brazil through the Straits of Magellan.

The import trade, which had been on the wane in the early days of the war, commenced to revive in 1916, owing to larger purchases of raw materials and semi-manufactured goods, such as raw cotton, iron, wool, crude caoutchouc, flax and jute. By far the largest volume of raw cotton came from British India, but the United States had doubled her exports to Japan of that article, as well as of iron, in a twelvemonth. Australia supplied Japan largely with wool.

The war situation developed serious vicissitudes in 1917, and in a measure militated against the trend to expansion of Japan's commerce. The entry of the United States of America into the war, with its attendant embargo on steel, iron and gold, temporarily disturbed the economic equipoise of the Far Eastern Empire. The Russian Revolution and the subsequent repudiation of all foreign liabilities by the Bolshevik commissaries introduced a fresh factor of discouragement in the export trade of Japan. The internal political feuds in China would also have dismayed Japanese exporters but for the tremendous appreciation in the price of silver, which resulted in maintaining an abundant demand for Japanese articles. But in spite of all, Japan's foreign trade made progress more or less on the lines indicated before, until a complete change of the situation was brought about by the conclusion of the Armistice in the autumn of

1918. The demand for munitions of war naturally came to an end, but the rate of exchange on Europe continued on a high level. At home the cost of production had greatly increased owing to the advance in wages and the higher prices of industrial materials, whereas the enriched public demanded a higher proportion of the necessaries of life. An anti-Japanese boycott was proceeding in China to add to the curtailment of Japan's exports. All these circumstances, reënforced by the Imperial Ordinance of Nov. 1919, for the regulation of the price of commodities, temporarily exempting certain foodstuffs and industrial materials from import duties and restricting the exportation of cotton yarns, brought about a reverse in the balance of foreign trade, which had been favourable to Japan for the preceding four years. But the fact that her exports consisted of finished and semi-manufactured articles, as well as of a huge value of raw and waste silk, whilst food-stuffs, raw materials and machinery were mainly imported, was a reassuring sign. Table 6 gives the foreign trade of Japan (excluding bullion) for 1909–20.

Table 6.—Foreign Trade (in 1,000 yen)

	Exports	Imports	Excess or deficit of Exports
1909	413,113	394,199	+ 18,914
1910	458,429	464,234	− 5,805
1911	447,434	573,806	− 66,372
1912	526,982	618,992	− 92,010
1913	632,460	729,432	− 96,972
1914	591,101	595,736	− 4,634
1915	708,307	532,450	+175,857
1916	1,127,468	756,428	+371,040
1917	1,603,005	1,035,811	+567,194
1918	1,962,101	1,668,144	+293,957
1919	2,098,873	2,173,460	− 74,587
1920	1,948,395	2,336,175	−387,780

Coin and Bullion.—As regards the movement of gold and silver coins and bullion, the balance of trade in favour of Japan, coupled with the increase arising out of freight, charterage and so forth, had resulted in an unusual influx of these metals since 1916, and in the following year the high-water mark was reached, the import being 392 million yen (£40,000,000) as against the export of 154 million yen (£15,700,000). But owing to the ban placed on the export of gold in the United States in 1917, the import of the precious metal to Japan dwindled in value to 5 million yen (£520,000), whilst in view of Japan's own embargo on gold, instituted later as a measure of self-preservation, the export only amounted to 937,000 yen (£96,000). In 1919 there were imported 327 million yen (£33,500,000), as against an exodus to the value of 5 million yen (£520,000); and in 1920 405 million yen (£48,600,000), as against 4 million yen (£410,000). The United States had raised her embargo on gold, but Japan had not yet done so in 1921.

Distribution of Foreign Trade.—The dramatic expansion of Japan's foreign commerce was not only in the old markets in Asia and America but to the new fields in the South Seas and Africa. The geographical distribution of the expansion in terms of continents is shown in Tables 7 and 8.

Table 7.—Exports, by Continents (in 1,000 yen)

To	1913	1918	1919	1920
Asia	275,928	935,550	995,146	998,374
America	191,761	597,175	877,925	632,159
Europe	147,225	298,257	194,853	195,590
Australia	8,638	64,828	30,826	58,117
Africa	1,846	46,811	24,107	38,842

Table 8.—Imports, by Continents (in 1,000 yen)

From	1913	1918	1919	1920
Asia	348,055	812,713	1,074,370	942,547
America	127,035	655,011	791,643	910,648
Europe	220,290	82,787	162,970	305,318
Australia	14,943	48,874	56,635	62,459
Africa	7,189	38,627	53,168	87,157

In the receipt of exports from Japan, the United States of America has always headed the list, the zenith of purchase being reached in 1919—that country taking 29 % of the total value of exports in 1913, 28 % in 1918, 39 % in 1919, and 28 % in 1920—and she has been followed immediately by China (including Kwantung province), whose shares in those years were 29 %, 25 %, 28 % and 27 % respectively. Next to China, though with a wide hiatus, came France in 1913 and then followed Hong-Kong, Great Britain, British India, Italy, Germany and others. But British India and Great Britain had surpassed France by 1918. Notable, also, are the advances of Australia, the Dutch East Indies, the Philippine Islands, Egypt, Argentina, British America, Cape Colony, Hawaii and others in the scale of demand for Japanese goods.

As regards imports into Japan, British India, which had been the chief supplier for several years precedent to the World War (her share was 23 % in 1913), yielded her place to the United States in 1916. The value bought by Japan from the latter country aggregated 766 million yen (£78,400,000, 35 % of the total) in 1919 and 837 million yen (£85,700,000, 36 % of the total and nearly five times the figures of 1913) in 1920. Great Britain's sale to Japan showed a marked decline during the war, but in 1920 a revival had set in. As in the case of exports, Asia, the South Seas, South America and Africa have all contributed fair shares to the advancement of Japan's import trade; but various European countries, including Germany, commenced to resume their activities in 1920.

Tables 9 and 10 show the development of Japan's foreign trade in more important commodities.

Table 9.—Principal Exports (in 1,000 yen)

Article	1914	1918	1920
Silk (raw waste, floss, etc.)	169,720·7	412,848·9	418,140·7
Silk tissues and fabrics	34,022·8	117,532·8	158,416·0
Cotton (yarn, thread, etc.)	81,242·5	175,368·7	173,435·3
Cotton tissues and fabrics	34,840·7	237,913·1	334,966·0
Drugs (chemicals, etc.)	23,819·7	73,660·2	68,984·8
Matches	7,619·1	37,742·5	28,543·0
Coal	23,914·5	32,009.4	45,200·0
Cement	1,033·0	6,010·1	10,059·9
Pottery and glass	8,914·8	36,037·0	54,691·2
Clocks, scientific instruments	4,548·9	30,561·3	34,182·1
Ships	711·1	80,060·7	15,829·0
Sugar, refined	12,382·8	23,252·1	30,592·9
Metal manufactures	3,490·4	48,562·5	38,447·9
Copper	28,467·5	44,702·7	12,313·0
Rice	4,974·0	8,317·6	5,897·5
Kidney-beans	832·8	30,194·0	5,287·9
Starch	123·3	29,610·1	4,996·2
Tea	12,709·9	23,056·3	17,112·5
Aquatic products	13,416·1	17,099·3	17,342·6
Clothing	23,876·3	83,001·4	88,487·0

Table 10.—Principal Imports (in 1,000 yen)

Article	1914	1918	1920
Raw cotton	218,974·5	513,738·4	720,160·5
Iron	41,662·9	310,391·4	279,222·2
Rice	24,823·9	89,755·6	18,059·1
Wool	14,783·7	61,432·7	121 982·7
Drugs, chemicals, etc.	37,372·7	77,963·4	140,906·7
Machinery	24,942·3	58,497·9	110,571·3
Sugar	21,833·4	33,693·8	61,034·3
Oils, fats, waxes and manufactures	17,077·7	33,312·9	60,340·2
Metal manufactures	8,468·4	33,351·1	47,009·5
Skins, hair, bones, horns, teeth, etc.	8,165.0	28,583.7	44,847.7
Dyes, pigments, coating and filling matters	8,080·7	22,002·1	34,441·6
Tissues of wool	10,225·1	11,485·5	31,270·2
Paper, books and pictures	10,445·8	17,765·4	36,191·7

Industrial Development.—Although the expansion of Japanese industries was enormous during the Word War, the rate of progress registered in the pre-war period of 1908–13 had also been remarkable. In 1908 there were 11,390 industrial establishments and 196 Government factories; in 1913 the Government factories had decreased to 188 (in 1918 there was a further drop to 161), but the other industrial establishments had increased in number to 15,811, or 38·8 %. By 1918 the figure had risen to 22,391, an increase of 41·6 % on 1913 and 96·6 % on 1908. In a decade, that is to say, Japan had practically doubled the number of factories in operation. Table 11 illustrates the development.

Table 11.—Industrial Progress

Government Factories					
	No.	Motors	H.P.	Men	Women
1908	196	1,746	169,510	98,533	25,351
1913	188	5,211	292,177	99,992	29,994
1918	161	7,014	361,226	123,087	36,349
Industrial Establishments					
1908	11,390	11,848	379,556	248,751	400,925
1913	15,811	20,013	916,828	375,596	540,656
1918	22,391	42,436	2,006,098	646,115	763,081

It is significant that the number of male workers employed increased in a higher proportion than that of the female workers, showing that the trend of expansion was in the heavier grades of production, such as the iron and steel industries and shipbuilding. A striking advance was also attained in the use of mechanical power in factories, for not only had the number of motors in actual use advanced by 68·9 % and 112 % in the first and second half of the decade respectively, but the actual horse-power developed had increased to the unprecedented extent of 141·5 % and 118·8 % in the same periods. In other words, Japan nearly quadrupled the number of motors in use, whilst the horse-power developed increased fiftyfold during the decade.

Shipbuilding.—In 1896 the Diet passed the Navigation Encouragement Law, and from that time onwards remarkable progress in the shipbuilding industry was made. In 1898 a steamer of 6,000 tons, the first large boat to be built in a Japanese yard, was completed by the Mitsubishi dockyard at Nagasaki for the Nippon Yusen Kaisha. Subsequently the same dockyard and the Kawasaki establishment constructed steamers of over 10,000 tons, as well as cruisers for the Imperial Japanese navy and for China. In 1912 these two dockyards had reached such a pitch of development that each was entrusted with the building of a dreadnought of 27,500 tons.

In 1913 there were six shipyards, with 17 slipways and employing 26,139 workers, and a year later the output of ships of over 1,000 tons gross was 16, the total tonnage being 78,010. In the following five years, owing to the great demand for bottoms to replace the wastage of war, the shipbuilding industry worked with an intensity and vigour which overcame the serious difficulties of lack of skilled workers and of sufficient iron and steel material. Table 12 is eloquent of the results achieved.

Table 12.—Shipbuilding

	End of 1913	March 1918
Number of shipyards	6	57
	Yen	Yen
Nominal capital	25,550,000	163,050,000
Paid-up capital	23,150,000	109,542,000
Debentures	3,600,000	22,050,000
Number of slipways	17	157
Number of workers	26,139	97,355

The tonnage built at the leading dockyards in Japan during the four years ending in 1918 is shown in Table 13.

Table 13.—Tonnage built in 1914–8

Dockyard	No. of Steamers	Gross Tons
Kawasaki	49	289,083
Mitsubishi (Nagasaki)	27	160,161
Osaka Ironworks (Osaka)	40	133,927
Uraga	24	99,086
Osaka Ironworks (Innoshima)	24	97,021
Asano	12	65,329
Ishikawajima	14	31,005
Mitsubishi (Kobe)	10	29,312
Harima	10	22,953
Fujinagata	10	20,249
Yokohama	6	13,124
Ono Ironworks	7	11,557
Total	233	972,807

With regard to her steam merchant fleet, Japan advanced during June 1914 to June 1920 from sixth to third position among the world Powers, since at the latter date she possessed 2,996,000 tons as against 1,708,000 tons in 1914, thus emerging after the war with an increase of 1,288,000 gross tons. Japan also established a world record in shipbuilding speed during the war. On Oct. 7 1918 at 7 a.m. the keel was laid in the Kawasaki shipyard at Kobe of the "Raifuku Maru," a steamer of 9,000 tons dead weight, length 385 ft., breadth 51 ft., moulded depth 28 ft. At 6 a.m. on Oct. 30 1918, or only 23 days later, the vessel was successfully launched, and later achieved a mean speed of 17·39 knots on two trial runs of 3 m. each.

The principal shipyards in Japan are as follows: The Mitsubishi Dockyard, Nagasaki, is the oldest and most important dockyard in Japan with up-to-date equipment. It has a water-frontage of about 1½ m. and is nearly 115 ac. in extent. This yard also possesses its own power station with turbo-generators developing 2,000 kw., as the chief machines, machine tools, shop and wharf cranes are all electrically driven. About 10,000 hands are employed and the firm holds the licence for building Parsons turbines. The Kawasaki Dockyards cover about 40 ac. of land, with a water-frontage of about 1 mile. Although formerly only medium-sized steamers and torpedo craft were built here, the capacity is now sufficient for any vessel up to 27,000 tons. At Hyogo the same company has a steel foundry, with a 20-ton Siemens furnace, producing very fine steel castings. The firm has also secured Italian patents for submarine construction and for motors. The Osaka Ironworks, founded in 1880 by the late Mr. E. H. Hunter, was converted into a joint-stock company in 1914, and now consists of separate engineering, shipyard and repairing departments, with a branch at Innoshima, on the Inland Sea. The shipyard covers nearly 16 ac., with a water-frontage of over 1,000 feet. The firm formerly specialized in the construction of dredgers, shallow-draught steamers, trawlers, etc., but now builds passenger and cargo boats up to 10,000 tons. The annual capacity of the yards is 200,000 tons, and the firm has specialized in the Isherwood type of vessel, having purchased the patent. The Asano Dockyard at Tsurumi, near Tokyo, was started to meet the war emergency and has a number of slips for ships of 12,000 tons. Its yearly capacity is almost equal to the pre-war total of the Japanese dockyards. The Suzuki Dockyard comprises the Harima and Toda yards, which were purchased by the Suzuki Co. of Kobe. When completely reorganized, the capacity of the former will be five vessels of 5,000 tons, and of the latter two of 3,000 and one of 1,000 tons. The Ishikawajima Dockyard at Tokyo has been reorganized to build ships of 6,000 tons. The Uraga Dockyard has a capacity of six vessels; between 5,000 and 10,000 tons. It should also be mentioned that the Yokohama Dockyard, which formerly confined itself to repairs, has now started building. Two other yards, of considerable size, are the Asahi, under the firm of Masudaya, Yokohama, and the Uchida yard, owned by Messrs. S. Uchida of Kobe.

Raw Silk and Silk-Weaving.—The manual dexterity peculiar to Japanese women is a factor which ensures the lasting prosperity of Japan's raw-silk industry, and when full advantage has been taken in modernizing the various processes of production in silk filiatures, enhanced benefit should accrue. Japanese silk goods have made great progress, and particularly silk pongee, which has now practically driven the Chinese product from the markets of the United States. At the end of 1918 there were 3,848 factories engaged in the silk industry, employing 64,188 male and 430,110 female operatives.

Cotton-Spinning, Cotton Textiles and Knitted Goods.—In spite of the difficulties during the World War of importing from Great Britain and the United States sufficient machinery to meet the enhanced demand for cotton yarn, the spinning-mills of Japan prospered exceedingly. The paid-up capital invested in the mills at the end of June 1920 was 248,180,000 yen, equivalent to an increase of 288 % over the pre-war figure, whilst the number of spindles in use in 1918 was 3,384,800, and in June 1920 3,689,000, compared with 2,409,900 in 1914. At the end of 1918 there were 6,710 factories, with 65,316 male and 218,041 female operatives, the total number of workers in the textile industries being therefore 777,655. The latter figure includes about 25,000 who are engaged in the production of knitted goods, consisting principally of gloves, stockings and underwear, in which a large trade, chiefly with British India, has grown up in the last few years. As knitting was formerly entirely a domestic industry, there have been difficulties in producing goods of uniform quality for export, and a system of inspection was therefore instituted towards the end of 1917, under which it was prohibited to export articles of inferior quality. Previous to the war, the average output of knitted goods was 6,660,000 doz., valued at 8,937,000 yen, but during the five years of the war the output averaged 15,143,000 doz., of a value of 23,073,000 yen.

Iron-foundries.—Before the war there were only some 20 iron-foundries in Japan, but the difficulties during the war in obtaining from abroad the large quantities of iron and steel required to meet the boom in industry resulted in the establishment of over 250 foundries before the close of 1919. In 1914 the output of pig-iron amounted to 302,000 tons and of steel materials to 283,000 tons. In spite of the slump in the iron industry which occurred after the Armistice, in the year 1919 613,000 tons of pig-iron and 553,000 tons of steel materials were produced.

Machine- and Tool-Making.—At the end of 1918 about 2,700 factories were engaged in various forms of machine making; and also in many branches of metalwork and metalware. The manufacture of machinery for the production of electric apparatus and lamps, as well as the construction of dynamos, telephones, railway signals and measuring instruments, are practically new growths of iron and steel industrial activity. Table 14 shows the position of four representative concerns engaged in machine construction in the second half of 1918.

Table 14.—Machine Construction Firms 1918

	Paid-up capital (1,000 yen)	Receipts (1,000 yen)	Expenditure (1,000 yen)	Dividend
Shibaura Engineering Works	5,000	17,401	3,208	35·0 %
Nigata Ironworks	1,818	3,224	2,842	22·0 %
Tokyo Electric Co.	6,000	6,664	5,943	20·0 %
Osaka Ironworks	10,500	10,095	4,398	35·0 %

Dyestuffs.—The manufacture of dyestuffs was an untried industry in Japan prior to the war, and in 1913 no less than 6,000 tons of dyestuffs, valued at 8,000,000 yen, were imported for use in the cotton and silk industries. After the outbreak of the war the cessation of foreign supplies, chiefly derived from Germany, compelled Japan to make an effort to become, to some extent, self-supporting. In 1915 certain dyes were produced, the largest quantity being sulphuric black, then alizarin, acid blue and aniline salt. These were followed by yellow, red, and blue acid, yellow and red direct, and purple, blue and brown basic colours. Early in 1916 the Japanese Government started and subsidized the Japan Dyestuff Manufacturing Co., which later succeeded in producing an artificial indigo, though only on a laboratory scale. By the end of 1918 nearly 100 factories, with a paid-up capital of 14,000,000 yen, had come into existence, and the annual output, including some 80 varieties of dyestuffs, reached 5,400 tons.

Chemicals.—The manufacture of chemicals in Japan does not owe its inception to the war, but its great development and the many innovations introduced were the direct result of war-time conditions. There was, however, a sharp decline in the prosperity of the chemical industry immediately after the Armistice. In 1916 the Japanese Government set up a subsidized company for the production of glycerine, entitled the Glycerine Industry Co., and, as the result of extensive investigations at the Industrial Institute into the qualities of sea-weeds and vegetable ash, the production of basic chloridized alkali increased from 2,000 tons in 1913 to 10,000 tons in 1917. The match industry, which formerly derived chlorate of potash from European sources, by the end of 1917 was able to depend on the home supply. In that year there were over 50 factories in existence, producing 10,000 tons of chlorate of potash, which in quality compared favourably with the imported article.

The soda industry, although it existed as long ago as 1880, did not reach a high standard of technical perfection before the war and also failed to satisfy the total annual requirements in caustic soda, amounting to about 25,000 tons. During the war, however, the number of factories increased to about 20, and the annual production rose to 14,000 tons in 1918 and 20,000 tons in the following year.

Some of the chief products in the chemical industry are: sulphuric, hydrochloric and nitric acids, sodium sulphate, carbonate of soda, caustic soda, iodine, potassium iodine, potassium chlorate and chloride, ammonium sulphate, acetic acid, acetone and wood spirit. Table 15 indicates the growth of the industry.

Table 15.—Chemical Industry

Year	No. of Factories	Employees		Value of Products Yen
		Male	Female	
1908	36	1,605	52	2,740,441
1909	143	1,902	159	4,356,718
1910	218	2,436	168	4,890,043
1911	230	2,570	223	6,406,024
1912	237	2,449	212	5,646,356
1913	341	3,089	276	7,687,232
1914	402	3,048	134	7,583,782
1915	468	4,708	407	16,717,143
1916	717	9,422	883	37,848,244
1917	832	12,435	900	42,494,620
1918	841	12,781	1,026	47,399,696

Agriculture.—The movement of the agrarian population towards the cities, a familiar phenomenon in most European countries, found its counterpart in Japan during 1910–20. The increase in pop. was about 7,000,000, or roughly 14%, so that it might reasonably have been expected that a corresponding increase would take place in the number of persons engaged in agriculture. The figures, however, show the reverse, as in 1908 there were 5,408,363 persons and in 1918 5,476,784 in the category in question, the increase being only 1¼%. During 1916 and 1917, when Japan was putting forth her greatest effort in producing munitions of war for the Allies, the number of those actually holding land decreased to the extent of 20,800 and 36,400 respectively, whilst in 1918, when the war boom in industry was practically over, the gain to agriculture was only 20,200 persons.

The relative proportion of farmers cultivating their own land, tenant farmers, and farmers combining tenantship with cultivation, showed little variation in the decade, as is shown by Table 16.

Table 16.—Farmers and Tenant Farmers

	Farmers cultivating own land	Tenant farmers	Farmers combining tenantship
1908	33·27%	27·58%	39·15%
1918	30·98%	28·31%	40·71%

The high proportion of small holders in Japan is characteristic of the agricultural life of the country. Table 17 shows that the variation in this proportion has remained practically negligible.

Table 17.—Percentage Proportion of Land Holders

	Under 1·23 ac.	Over 1·23 ac.	Over 2·45 ac.	Over 4·90 ac.	Over 7·35 ac.	Over 12·25 ac.
1908	37·28	32·61	19·51	6·44	3·01	1·15
1918	35·54	33·30	20·70	6·33	2·82	1·31

Rice still remains the staple food of the country, and the area under cultivation is nearly twice that devoted to the production of barley, rye and wheat. Intensive cultivation of all crops is carried out, and the limit of return has actually been reached in some cases. In the decade from 1908 to 1918 an additional 418,515 ac. were under rice cultivation, and the yield per acre only fell fractionally from 36·42 to 36·24 bushels. In barley and rye the cultivated area showed a slight drop, but in wheat there was an increase of 242,376 ac., the yield per acre showing an increase in all three cases. Little progress as far as yield is concerned was obtained with millet, the area under cultivation also decreasing. The production of potatoes was practically doubled during the decade, although the yield per acre was not so satisfactory.

Cotton, hemp and indigo were all retrogressive, the cotton chiefly owing to the large imports of cheaper cotton from abroad. Table 18 shows the acreage of the chief food products under cultivation at the beginning and end of the decade, and also the position with regard to certain special crops.

Table 19 shows, by index-numbers based on the year 1912, the rise in prices of commodities in Japan between 1912 and 1919.

Table 18.—Principal Crops

	Area in Acres		Production	
	1908	1918	1908	1918
			Bus.	Bus.
Rice	7,159,850	7,578,365	259,669,465	273,495,435
Barley	1,578,203	1,308,983*	47,219,585	49,175,375
Rye	1,687,213	1,583,586*	37,893,020	38,103,475
Wheat	1,101,467	1,343,843*	22,062,225	31,804,235
Millet	719,178	560,981	17,141,625	14,514,970
Beans	1,659,682	1,456,975	27,378,725	25,112,525
Buckwheat	405,579	333,966	6,170,890	4,261,825
Rape-seed	359,738	284,936	6,096,350	4,284,400
			Tons	Tons
Potatoes	148,705	323,621	567,055	1,195,315
Sweet Potatoes	745,799	754,223	3,556,229	3,388,664
Cotton	12,934	6,197	4,120	2,513
Hemp	33,010	28,960	8,606	9,460
Indigo (leaf)	29,809	13,647	20,730	10,029
Sugar-cane	42,344	71,950	631.058	1,165,113

*This figure is the 1919 acreage.

Table 19.—Prices of Commodities

	1912	1914	1916	1917	1918	1919
Rice	100	77	66	95	156	219
Wheat	100	99	100	124	203	203
Soya Beans	100	100	99	124	162	198
Salt	100	93	90	103	120	135
Soy	100	97	88	91	106	168
White Sugar	100	99	110	115	129	180
Saké	100	93	100	111	130	179
Tea	100	102	104	111	139	213
Beef	100	97	98	141	202	248
Eggs	100	100	95	113	163	224
Milk	100	95	89	105	134	174
Cut Tobacco	100	101	101	102	115	127
Cotton Yarn	100	81	101	191	253	371
Raw Silk	100	98	124	136	162	220
Hemp	100	85	90	107	126	187
Silk Tissues	100	94	108	155	172	215
Cedar Square Timber	100	97	123	146	212	240
Pig-iron	100	100	244	569	1,006	425
Petroleum	100	104	141	140	217	277
Coal	100	115	132	276	399	416
Firewood	100	95	97	103	165	241
Charcoal	100	107	111	120	209	278
Seed Oil	100	92	108	164	216	227
Paper	100	103	107	113	170	197
Average	100	97	107	146	208	237

Railways.—The first railway line in Japan was opened to traffic in 1872, subsequent developments of the railways being chiefly in the hands of private companies. In March 1906 the Railway Nationalization Law was enacted, and in the next two years the Government gradually assumed control of some 17 of the leading railway companies. On the completion of nationalization, the Government possessed 4,371 m. of railway, representing a capital of 700,000,000 yen. By the end of 1917 the process of absorption was practically complete.

The decade 1910–20 witnessed an increase of over 31% in the mileage of the State railway system (from 4,624 m. to 6,073 m.), and in the same period the number of passengers carried was more than double (from 128 millions to 288 millions). A marked advance in receipts was seen in the years 1917–9, partly owing to increased fares and partly to the large number of additional passengers carried under war conditions.

Tramways.—The number of electric tramway undertakings, both owned by municipalities and by private companies, showed a remarkable increase in the decade, from 34 in 1910 to 74 in 1919. The mileage rose from 367 to 1,059; and passengers carried from 328 millions to 1,225 millions. Further progress should be seen when it is possible to realize some tentative schemes which were being discussed in 1921 for utilizing hydro-electric power to a greater extent. Japan is well endowed by nature with waterfalls, many of which have already been harnessed.

Posts.—The postal service of Japan has developed steadily, both in extent and efficiency, since 1908. There are three grades of post-office, known as first, second and third class: the first class is confined to the larger cities, such as Tokyo and Osaka, and these offices not only act as supervising offices for those of lower category, but also control maritime affairs in their respective districts. The great majority of the post-offices belong to the third grade, and are conducted on a contract system, which has proved eminently satisfactory. The post-offices in Japan include in their operations such diverse matters as the carrying, within limits as to size and weight, of every kind of freight, the collection of taxes and bills, the distribution of advertisements, and the paying of pensions and annuities on behalf of the national Treasury. The post-offices also undertake the business of State life insurance by a simplified process for the benefit of the middle and working classes. Table 20 shows the expansion of the postal services, the figures being compiled in each case to the end of the respective fiscal years (March 31).

Table 20.—Postal Service

End of Fiscal Year	Number of Post-Offices	Number of Packets	Number of Parcels
1910	6,946	1,464,557,721	20,281,823
1911	7,086	1,512,029,475	22,210,422
1912	7,166	1,634,423,611	23,178,936
1913	7,268	1,635,151,146	24,393,232
1914	7,268	1,798,716,674	25,370,165
1915	7,266	1,801,092,286	25,202,220
1916	7,358	1,888,002,293	26,128,093
1917	7,530	2,043,601,963	29,578,542
1918	7,647	2,362,802,401	33,243,648
1919	7,764	2,783,803,434	40,246,772

The Post-Office Savings Bank was first inaugurated in 1875, and the rate of interest was raised from 4·2 % to 4·8 % in April 1915. The number of depositors increased from 10,052,641 on March 31 1910 to 20,088,713 in 1919, the deposits having advanced in the same period from 127,112,097 yen to 605,480,783. The figures at the end of the fiscal year 1920 were 23,787,626 depositors and 827,550,777 yen respectively.

Telegraphs.—Since 1879 Japan has belonged to the International Telegraph Convention, and in June 1908 she ratified her membership of the International Wireless Union. The expansion of her home telegraph service has been noteworthy. In 1910, with a total of 3,951 telegraph offices, 101,500 m. of wires were in use and 28,205,032 messages were sent; in 1919, there were 5,651 offices, 124,776 m. of wire in use, and 60,262,101 messages were transmitted.

Wireless.—In addition to the main wireless station of Funabashi, Japan has nine other shore stations, with a daytime transmission distance varying between 300 and 600 nautical m., the night distance being between 1,000 and 1,800 nautical miles. Two of these stations, Choshi and Osezaki, have been reconstructed and have a daytime transmission power of 1,500 nautical m., with 3,000 at night. In 1910 there were 7,817 wireless messages, and 121,974 in 1919.

Telephones.—When first inaugurated in Dec. 1890, the telephone service failed to attract many subscribers, but its popularity gradually increased, until in March 1918 there were 210,321 applications for installations outstanding, and the sums deposited by would-be subscribers in the hands of the authorities exceeded 3,000,000 yen. The authorities had started in 1909 a system of giving preference for an installation in consideration of a payment varying between 150 and 285 yen, according to locality, and this system, which has been very successful, still obtains. The maximum annual charge for the telephone service is 66 yen and the minimum 36 yen, according to locality, and at the end of the fiscal year 1918–9 there were 273,309 subscribers and 3,090 telephone offices, besides 799 fitted with automatic apparatus. At the same period the length of telephone lines was 9,467 m., the length of wires 700,651 m., and the number of messages in the year was 1,821,038,722.

Aerial Communications.—Japan keeps in close touch with the latest developments in aviation, and especially with those which hold possibilities of improving the facilities for the transmission of postal matter and goods. In 1920 and 1921 experiments in civil aviation were carried out, and early progress was anticipated.

The Army.—After the Russo-Japanese War, six divisions were added to the Japanese army, making the whole strength 19 divisions, and in 1915, two more divisions were established for the defence of Chosen. After the World War it was planned to bring the Japanese military organization up to the standard of efficiency and equipment set by new experiences in Europe. An 18-year reorganization scheme, involving 180,000,000 yen (£18,400,000) was passed by the Diet in 1918; and in 1920 it was decided not only to alter the scheme considerably but to expedite its execution and have it completed in 14 years. The estimate passed was 290,000,000 yen (£29,600,000). The expansion of the flying corps was also decided upon. There were to be six flying squadrons consisting of three flights and each flight was to be equipped with 12 aeroplanes.

The Japanese army consisted in 1920 of 84 regiments of infantry, 28 regiments of cavalry, 26 regiments of field artillery, 6 regiments of heavy artillery, 3 regiments of mountain artillery, 20 companies of engineers, 18 companies of commissariat, 2 regiments of communication troops, 1 regiment and 1 company of telegraph corps and 4 flying corps.

Under the system of conscription, able-bodied males of from 17 to 40 years of age are liable for service in the army. Those who have completed the middle school education or who are recognized to have had an equal education, can apply for the volunteer service of one year in lieu of the ordinary three years' service. A young man who is receiving a liberal education may be exempted from military service until it is finished; residents abroad are also exempted until they attain their 37th year.

The new scheme of organization entails the constitution of each division on a three-regiment basis and the abolition of the brigade. An army corps will thus consist of two divisions; and six army corps, exclusive of the Guards' division, are to be established. A Japanese infantry regiment contains four battalions, each of a strength of 600 men; a cavalry regiment has four squadrons, each of 100 sabres; six four-gun batteries, that is, 24 guns, are the strength of a regiment of field artillery, and a battalion of engineers consists of three companies, each 300 strong.

The Navy.—As a sequel to the Russo-Japanese War, the Japanese naval authorities came to the conclusion that the most efficient fleet unit would be the so-called "8–8 plan"; viz. a unit consisting of eight battleships, eight battle-cruisers and a suitable strength of subsidiary boats. The Diet agreed to the scheme in principle in 1917, but owing to financial reasons it was decided to start with an 8–4 fleet. In the following year, the Diet passed an expanded plan of 8–6 unit, spread over seven years. On account of the strengthened financial situation, the naval authorities proposed, in Dec. 1920, an additional appropriation of 751,900,000 yen (£76,990,000) beyond the 408,000,000 yen (£41,700,000) previously assigned for warship construction, with the view of completing the 8–8 unit scheme in eight years. The Diet gave its assent to this proposal in passing the Budget for 1921–2, and, according to this plan, Japan was expected to have in commission, by 1927, 4 battleships, 4 battle-cruisers, 12 cruisers, 32 destroyers, 5 gunboats, 12 fleet auxiliaries, 6 mine sweepers, and several submarines, thus bringing the strength of the Japanese navy in ships not exceeding eight years in age to 8 battleships, 8 battle-cruisers, 23 cruisers, 73 destroyers, approximately 80 submarines, 5 gunboats, 27 fleet auxiliaries and 120 submarines. In conjunction with this 8–8 scheme, the expansion of the naval air force was decided upon, and by 1923 the formation of 17 service corps and 2 practice corps was to have been completed.

In 1910 the tonnage of the Japanese navy was 524,273; in 1920 it was 796,288. In 1920 its strength was 15 battleships, 7 battle-cruisers, 9 armoured cruisers, 16 light cruisers, 14 coast-defence vessels, 8 gunboats, 87 destroyers, 20 torpedo-boats, and about 20 submarines. In 1910 the navy had 4,814 officers, 193 cadets, 14,616 non-commissioned officers, and 47,998 men.

Domestic History

Social Aspects.—The chronological mutation from the Era of Enlightened Peace (*Meiji*) to the Era of Great Righteousness (*Taisho*) also incidentally registers a period of great historic moment for the Japanese people, who were gradually awakening to the evolutional necessity of moral reconstruction. The wars with China and Russia had given them the reassuring confidence that their country was safe from any foreign aggression, the fear of which had been a perpetual nightmare to the founders of modern Japan. The considerable achievements in the domains of her trade and industry strengthened their belief in the destiny of the nation. Especially the younger generation, whose cradles were neither haunted by the shapes of monstrous "black ships" and belching guns, nor were oppressed by the overwhelming influx of novel knowledge and strange customs, had set themselves to the task of self-orientation. Western literature itself, translated on a large scale into the vernacular, had taught them that the undigested application of foreign laws and institutions would do more harm than good to the national well-being. The alleged attempt on the person of the Emperor Meiji in 1910—a solitary occurrence in the age-long history of a patriotic people—brought men to serious reflection. The dazzling glory of victories was somehow eclipsed by the growing social agitation. Is it not the mission of the islanders of Nippon now to take upon themselves the creation of a new civilization by harmonizing and uniting the East and the West? This was the question which presented itself to the mind of young Japan. There followed a remarkable revival in the study of the Japanese and Chinese classics. There was heard a voice in the wilderness crying that men must return to nature before aspiring to be a Japanese, a father, a scholar, or in fact almost anything. A leader of the *Shirakaba* circle, a coterie of literary men strongly advocating the latter movement, selected a mountain site in southern Japan to establish his "New Village" to be conducted on the humanitarian principle. The repeated famines in the N.E. districts of Japan, the disastrous eruption of the Sakurajima volcano, the rapid rise in the cost of living, the revelation of bribery scandals, the frequent changes of Cabinets—all these worked together to cause popular disquietude. The external relations of Japan, too, contributed their quota to the stirring of the popular imagination and excitement: Korea had been annexed; China had started a revolution; and California was adopting the policy of racial discrimination towards Japanese immigrants. But, what most deeply affected the heart of the Japanese people was the demise of the Emperor Meiji in July 1912. The whole nation mourned and lamented the loss of the great leader under whose rule modern Japan was created. The dramatic suicide, on the occasion of the Imperial funeral, of Gen. Nogi, the hero of Port Arthur and Mukden, added a climax to the national bewilderment. And the Era of Taisho was but two years old at the advent of the World War.

After several months of commercial depression the trade and industry of Japan began to prosper, and had attained a most remarkable development by the time of the Armistice. This progress, however, was not without its attendant evils: war profiteers—the *narikin* or queened pawns—sprang up like mushrooms overnight; into the maw of busy factories was poured a tremendous amount of labour; the cost of living advanced by leaps and bounds; but wages and salaries did not keep pace with the soaring prices. An age of Western capitalism was in sight. Public sentiment in Japan was, moreover, heartened by the Allied assertions that the war was a democratic crusade against the rule of despotism. The word "democracy" was on the lips of the man in the street. Strikes, which had long been stifled by Article 17 of the Peace Police Regulations issued in 1900, practically prohibiting the establishment of trade unions, began, despite all restraining circumstances, to be more and more frequently organized. Encouraged by the results achieved in 1916, the following year saw no less than 417 strikes involving 66,000 wage-earners, and in 1918 the number increased to 497. Most of these resulted in favour of the workers, earnings being ultimately nearly trebled in some trades and a marked improvement being also effected in the hygienic conditions of the workpeople. A significant incident, which was the spark to ignite the train of strikes in 1918, was the "rice riot" started in Toyama, a small town on the coast of the Sea of Japan, by village fisherwomen whose thread of patience had snapped at the never-ending rise in the price of that commodity. The whole nation was involved in the general conflagration which followed. There occurred, in rapid succession, strikes in Nagoya, Kobe, Osaka, Tokyo and elsewhere, and riot and destruction took place to such an extent that the Government, at last, found it necessary to resort to the use of troops in the pacification of the angry mobs.

Even such methods as sabotage and "ca'canny" strikes were introduced. As a consequence, no less than 200 new labour organizations were formed, of which the *Yuai Kai* and a dozen others are of importance. The Government, in an eager attempt to meet the extraordinary developments of the situation, encouraged the establishment of the *Roshi Kyocho Kai*, or the Labour and Capital Harmonizing Association, which came into being in 1919 with Prince I. Tokugawa as president and Visct. Shibusawa as one of the vice-presidents. Moreover, Japan participated in the International Labour Conference; the revision of the Factory Law which was enacted in 1911 and came into force in 1916, was taken in hand. Meantime, popular agitation against the bureaucratic method of administration arose on all hands, and the question of universal suffrage was vociferously discussed. In the spring of 1918 a reform bill was passed, and the number of electors was doubled.

With the restoration of peace, however, a slump set in, profits fell and the demand for labour abated. The unemployment question also arose to a certain extent, but not in an entirely threatening aspect. Although the high-water mark of labour agitation had probably been reached by 1921, the causes for the phenomenon remained to offer food for the deepest reflection on the part of the thinkers and statesmen of Japan. The national characteristics of Japan, which are the heritage of her history—the peculiar harmony and self-restraint pervading all classes of the people, the spirit of individual sacrifice and self-abnegation, in the interests of the whole—were indeed strong relieving factors in all the social unrest she had experienced. How far this mentality was the legacy of feudalism and destined to disappear in time, and how far it was born of the unique social conditions of the Yamato race, which has remained homogeneous and unmolested on the Far Eastern islands for 30 long centuries without a single case of successful external invasion and subjugation, is a question which perhaps the future alone can definitely answer. Be that as it may, it was the eager hope of young Japan in 1921 that she might struggle to work out her own solutions of the perplexing problem of capital and labour.

Political Developments.—Owing to the necessity of establishing a strong central authority—imposed upon Japan for self-defence owing to the apparently aggressive policies in the Orient of the Western Powers towards the end of the 19th century—and probably from an abundance of conservative caution, as the country had just emerged from ages of feudalism, the makers of modern Japan often turned to German legislation in seeking for models of the constitution and other laws. But an important factor that should not be lost sight of by students of Japanese politics is that English has long been by far the most extensively studied foreign language among the people. Whilst the static institutions remain more or less Teutonic in form, dynamic inspiration has continuously been drawn from English-speaking sources. That explains why the Japanese body politic understands democracy along the lines of its common acceptation in the British Empire and the United States; why the press and students of politics often advocate the development of a polity somewhat like the British parliamentary system. The political history of Japan in 1910–21 was the last phase of the struggle between the wise council for the national security with which the *Genro*, the Elder Statesmen, are popularly identified, and the progressive outcry for the emancipation of the people's will. As external dangers diminish, *vox populi* speaks more effectively.

After the longest tenure of office in the constitutional history of Japan, four and a half years, Premier Katsura resigned in Aug. 1911, "with a view to renovating the spirit of the people." With the collaboration of Marquis Komara, Foreign Minister, Marquis Katsura had accomplished with great merit various financial reforms, the annexation of Korea and the revision of commercial treaties with the Western Powers. Katsura was succeeded by Marquis Saionzi, who had been leading the Seiyukai party after the retirement of Prince Ito (*see* 15.272).

It was during the premiership of Marquis Saionzi that a tremendous moral shock was experienced by the whole nation on account of the death on July 30 1912 of the Emperor Mutsuhito, the centre of reverence and affection of the nation. Meiji Tenno, as he was posthumously styled after the name of the era of his 45 years' reign, which stands out with glorious prominence in the annals of the empire, was succeeded by his son, Yoshihito Shinno, who ascended the throne at the age of thirty-three.

The downfall of the Saionzi Cabinet was due to a very peculiar circumstance, which is accounted for only by the paramountcy of the instinct of national self-defence. Before the year 1912 had closed, the establishment of two army divisions in Korea (Chosen) had been tenaciously persisted in by Lt.-Gen. Uyehara, Minister of War. But his colleagues on the Cabinet, as well as the press, counselled retrenchment and economy. Uyehara resigned; and the premier sought for his successor. But no soldier would accept the post without a commitment by Saionzi as to the two-division increase; and by law a Minister of War must hold the rank of a general or lieutenant-general in the active service. The premier was constrained to request the Emperor to relieve him from his office. There followed a ministerial deadlock, until Katsura, actuated by chivalrous motives, descended upon the confused arena. He had been created a prince, and had made up his mind to offer the young Emperor the loyal but non-political services of the rest of his life in the capacity of Grand Chamberlain and Lord Keeper of the Great Seal. The young and care-free generation of Japan had come to assert themselves, and the unconstitutional tendency of the *Genro's* activities had been made the object of popular criticism. The wide-spread suspicion that he harboured the intention of attempting to direct the affairs of state unconstitutionally "from behind the sleeves of the Sacred Dragon," coupled with his personal failing health, made the path of Prince Katsura's renewed political life immeasurably thorny and arduous. He found the Lower House unexpectedly untractable. Mr. Ozaki's resolution of no confidence caused a tremendous sensation; riotous mobs demolished the offices of the *Kokumin*, which newspaper had been loyally supporting the ministerial programme. No choice was left Katsura but to tender his resignation.

As soon as Prince Katsura became unfettered from official duties, he essayed to demonstrate his sincere aspirations for the constitutional development of the Empire by starting a political party, the *Rikken Doshikai* (the Constitutional Comrades Association). Under this banner there rallied all the members of the Chuo Club, and a majority of the members of the *Kokuminto* (the National party). But before the realization of his hopes Katsura died in the following December. The Yamamoto Cabinet which followed (Feb. 20 1913) was short-lived, owing to the unfortunate "naval scandal," involving the arrest and trial of high officials in the navy; the Siemens-Schuckert Co. had dispensed bribes in connexion with the building of a Japanese warship.

After the refusal of Prince I. Tokugawa, and the abortive attempt by Visct. Kiyoura, to form a Cabinet, Count Okuma, the "grand old man" of Waseda, undertook, on April 14 1914, to stand at the helm of the Empire, backed by the legacy of Katsura, the *Doshikai*, and Baron Kato, the leader of that party, was entrusted with the portfolio of Foreign Affairs. It fell to the lot of this Cabinet to deal with the invitation of Great Britain to join in the World War under the Anglo-Japanese Alliance.

In Nov. 1915 the enthronement of the Emperor was conducted with the time-honoured imposing ceremonies at Kyoto, and the whole nation was *en fête* for seven days.

Premier Okuma, in tendering his resignation on account of indifferent health, in the summer of 1916, recommended Visct. Kato, who had yielded the charge of Foreign Affairs to Visct. Ishii and was outside the Cabinet, to be his successor. At that moment, however, the *Genros* are reported to have intervened, and, in spite of the fact that Kato's new party, the *Kenseikai* (the Constitutionalists), which was an amalgamation of the *Doshikai*, the *Chuseikai* and *Koya* Club, commanded a majority in the diet, Marshal Terauchi was appointed premier on Oct. 9. This alleged irregular development excited the hostility, not only of the Kenseikai, but of the general public, and ended in an antagonistic attitude on the part of the diet towards the new Government. Parliament was dissolved, and a general election took place on April 20 1917. The result was a signal victory for the Government party, the Seiyukai winning 157 seats, whilst the number of the Kenseikai dwindled from 204 to 117.

Actuated by the desire, in view of the war, to effect unity of all shades of opinions, Premier Terauchi's ingenuity brought forth soon after his instalment in office the Temporary Diplomatic Investigation Council (*Rinji Gaiko Chosa Kai*), where leaders of all political parties were represented. Kato was invited to join, but refused on the ground that he could not associate himself with the idea of establishing a responsible body for external affairs outside of the Cabinet itself.

The "rice riot" and the ensuing serious disturbances, and strikes which raged like wild-fire in various parts of Japan in the summer of 1918, sealed the fate of the Terauchi Cabinet, which tendered its resignation in the middle of September.

By that time democratic ideas had been gaining strength on account of the war and internal social unrest. Moreover, the manner in which the Terauchi Cabinet was installed had its due reaction. The people demanded that the next administration should be more in keeping with the spirit of the parliamentary system. Mr. Takashi Hara, the leader of the Seiyukai in succession to Marquis Saionzi, was entrusted with the task of forming a new Cabinet, as the first commoner to hold the office of premier in Japan. The ministers, except those holding the portfolios of War and the Navy, were, for the first time, a body of party politicians more or less free from the bureaucratic savour which had always clung to the former administrations. Incidentally, a new Ministry—that of Railways—was included in the Cabinet. In March 1918, in response to the popular demand, a political reform bill was passed, lowering the property qualification of voters to the payment of a direct national tax of three yen instead of ten yen. The number of electors was thus more than doubled, increasing from 1,450,000 to 3,000,000. The people were, however, not satisfied, and a year of popular clamour for the universal suffrage followed. In Feb. 1920 a universal suffrage bill was at last introduced by the Opposition in the House of Representatives. But, on the ground that no election on the basis of extended franchise had as yet taken place and consequently it was premature to make any further attempt at suffrage reform, the diet was immediately dissolved. The nation was called upon to express its opinion on the matter by the general election of May 10. The result was a decided victory for the Seiyukai, the Goverment party, which secured 280 seats, whilst the Kenseikai registered 110.

FOREIGN RELATIONS

Having emerged victorious from the Russo-Japanese War, Japan was relieved from the long nightmare that Korea might be engulfed in the Russian hegemony and constitute a permanent menace to her national safety; moreover, the wrong done to her by the three-Power intervention in wresting from her the natural fruits of her victory in the Chino-Japanese War—the Liaotung peninsula—was fully and conclusively avenged. But the Russian grip on N. Manchuria and Mongolia was not only unabated but, on the contrary, became signally tightened. There were even fears of a renewed clash between the quondam foes. Statesmanship, however, counselled Japan and Russia to come to a friendly entente in 1907. There was made a similar understanding between Japan and France in the same year. Further, the complicated post-war situation in Manchuria was decisively, if not definitely, disposed of by the Chino-Japanese understandings of 1909. In 1910 and 1916 more definite agreements were reached between Japan and Russia with the view of maintaining the *status quo* of Manchuria. Korea was, in the meantime, made a Protectorate of Japan, and the gradual development of affairs in that country led to the final annexation. The Anglo-Japanese alliance, which had been not only the keystone of Japan's foreign relations, but the mainstay of the general tranquillity of East Asia, was renewed (1911). Whilst Japan's position in the Far East became thus more or less reassuring, the dark cloud of anti-Japanese sentiment, on the Pacific coast of the United States, loomed up on the horizon. China's revolution in 1911, instead of bringing immediate peace and liberty to the denizens of the Celestial Empire, divided the nation into two irreconcilable camps, and contributed temporarily to the political instability of the Extreme Orient. To the neighbouring Japan, this meant an exacting burden upon her diplomatic wisdom and tact. When Japan was, on the one hand, racking her wits how to cope with the quicksand situation in China and, on the other, how to safeguard Japanese residents against discriminatory treatment in the west of America, the fateful Aug. of 1914 came to pass.

Japan's part in the World War dwindles into insignificance in face of the stupendous efforts of other great Powers espousing the Allied cause. But she contributed what little she could with her very limited national strength and resources. Her geographical situation, however, afforded her, from the economic point of view, a position of vantage. In pre-war days she was still struggling in financial straits as a result of her Russian conflict, but she came out of the World War with overflowing coffers, even if these coffers were of modest dimensions. At the Peace Conference in Paris, she lost her issue on the question of racial dignity, but her claims with regard to Shantung and the South Sea Islands were recognized; and her position among the great World Powers was assured. But her immediate outlook in 1920–1 bristled with difficulties and complexities: China had refused to negotiate Japan's offer to restore Shantung; the Washington Government would not be persuaded to the Japanese point of view on the Yap question; several states on the Pacific coast of America were vying with each other to abridge the civil rights of Japanese residents; Korean malcontents abroad were in a fitful mood of rebellion; the Siberian situation was far from being tranquil. Japan's natural path of aspirations was beset with suspicions and misunderstandings. Never before in Japan's diplomatic history was she burdened with weightier responsibilities.

Manchurian Question.—Prior to the outbreak of the Russo-Japanese War, the growing international rivalry for spheres of influence in the Chinese Empire had convinced the interested Powers of the necessity of establishing the policy of the "open door" and equal opportunities for commerce and trade in that country. That principle was from time to time enunciated by Great Britain in the latter decades of the 19th century, but it was reserved to Mr. John Hay, Secretary of State under President McKinley's administration, to make its definite pronouncement to the world. In Secretary Hay's Circular Note addressed to various Powers under date of July 3 1900, it was declared that the policy of the United States was to assure permanent safety and peace to China, to preserve Chinese territorial and administrative entity, to protect all rights guaranteed to friendly Powers by treaty and international law, and to safeguard for the world the principle of equal and impartial trade with all parts of the Empire. The doctrine was accepted in principle by Japan, Great Britain, Russia, France and Germany. Japan went so far as to conclude specific agreements for its execution with Russia (July 30 1907) and France (June 6 1907). It was, however, understood that the spheres of influence already established—Great Britain in the Yangtsze valley, Tibet, and Weihaiwei; Germany in Kiaochow; Russia in Manchuria and Mongolia; France in Yunnan—were not to be prejudiced by the newly professed principle of commercial impartiality.

The Russo-Japanese War brought about the tenure by Japan in S. Manchuria of a similar position to that which the great Western Powers had held in other parts of China. But "because Manchuria had been the scene of the greatest war of modern times," the world's eye became fixed upon every act of Japan in that region in "an exceptionally rigorous scrutiny" and "the nations behaved as though they expected her to live up to a standard of almost ideal altitude." Meanwhile, China, for her part, fell into a mood of impatient irritation on account of the presumed encroachments upon her sovereignty, and the "rights-recovery campaign," clamorously conducted throughout that Empire, somewhat strained her relations with Japan in the early part of 1909 in respect of various questions in Manchuria. However, in Aug. of that year, a series of agreements was reached between the two States by which all those outstanding problems were composed. Among the rest, Chinese sovereignty over Chientao was confirmed, and arrangements about railways, including that of the Antung–Mukden line, were effected.

From out of the blue, there came from America a proposal for the neutralization of the Manchurian railways in Jan. 1910. In the view of Mr. Philander C. Knox, Secretary of State, that was best calculated to further the principle of the "open door" by putting an end to the abnormal conditions obtaining in Manchuria. But Russia and Japan could not accede to the scheme, on the grounds that their established rights and interests ought to be respected and that they were by no means threatening the Chinese sovereignty or the "open door" principle. Great Britain kept aloof, declaring that the question should be settled among the immediately interested Powers, namely, China, Japan and Russia. Nor was the proposal to the taste of China, who regarded it as a further encroachment upon her sovereignty. She replied that her treaty obligations with Japan and Russia precluded her from supporting the American idea. And the proposal fell through. Meanwhile, the Russo-Japanese negotiations as to their future attitude in Manchuria and Mongolia came to a satisfactory conclusion and a steadying element was added to the situation in the Far East in the form of an agreement between Japan and Russia, signed at St. Petersburg on July 4 1910, under which they pledged themselves to maintain the *status quo* in Manchuria and to abstain from any unfriendly competition in the development of that region. The Russo-Japanese *rapprochement* was further solidified, in view of the World War, by the Convention of July 3 1916, which provided that each of the two countries would not become a party to "any political arrangement or combination" directed against the other and that they would take counsel together for the necessary measures, "should the territorial rights or the special interests in the Far East of one of the High Contracting Parties be threatened." The agreement made greatly for the maintenance of good order in the Orient until the Russian Revolution brought about the drastic change of the whole situation.

Annexation of Korea.—Japan had waged two wars, one against China and the other against Russia, in order to prevent Korea from becoming "a dagger pointed against Japan's heart." In June 1905 she established a protectorate over the Hermit Kingdom so as to put a definite end to the wayward and suicidal diplomacy of the Seoul courtiers, but the whole peninsula could not be cleansed of its inveterate political and social iniquities. The hopelessness of real reform under the existing régime had become manifest; and the assassination of Prince Ito by a Korean, in Oct. 1909, was the climax.

The Tokyo Government thus came to the conclusion that "the responsibilities devolving upon Japan for the due administration of the country (Korea) cannot be justly fulfilled without the complete annexation of Korea to the Empire." The fusion was accomplished by a treaty concluded between the Governments of Japan and Korea on Aug. 22 1910. It was decided that the ancient name of *Chosen* should be revived in lieu of Tai-Han and in future be officially used. Under the terms of the treaty, the Korean Imperial House was assured of high honours and dignities as well as a liberal grant for maintenance. Japan, at the same time, notified the foreign Powers concerned that their treaties with Korea, including those of extra-territoriality, were all annulled; but that, nevertheless, their vested rights and interests would be fully respected; that the tariffs in force in Korea would be maintained for 10 years; that cabotage would be permitted to foreign vessels for the same period; and that the port of Masanpo would be closed for naval reasons, but Shin Wiju or Gishu would be added to the open commercial ports.

The Anglo-Japanese Alliance.—The general changes of situation in the Orient after the Russo-Japanese War, notably the annexation of Korea to the Japanese Empire in 1910, impelled the British and the Japanese Governments to revise the Agreement of Alliance concluded in 1905. The negotiations in London between Sir Edward (afterward Visct.) Grey and Baron (afterward Visct.) T. Kato ended in the renewal of the Alliance on July 13 1911. The important feature of the new agreement was the inclusion of an Article exempting either high contracting party from the obligation to come to the armed assistance of the other when a general arbitration treaty was concluded between that other Power and a third party (Art. IV.). At that particular time a treaty of such a description was under negotiation between the British and the American Governments, and it was with the particular object of excluding the United States from the application of the Alliance that Art. IV. was inserted. The proposed general arbitration treaty, however, failed to obtain the consent of the American Senate for its ratification, but the British and the Japanese Governments undertook on several occasions to make it clear that the spirit in which the Article was conceived had not on that account been altered in the least. The Alliance of 1911 was to last for 10 years, and, in the absence of a year's notice from either contracting party to terminate the agreement, it would automatically continue in existence, even after July 1921, until such denouncement was made. The World War, into which Japan readily entered on account of the Anglo-Japanese Alliance, ended with the Treaty of Versailles which brought forth the League of Nations. The question was then mooted, though more academically than politically, whether the Anglo-Japanese Alliance would not be in contravention with the letter of the Covenant of the League, and on July 8 1920 the two high contracting parties addressed a joint note to the Secretary-General of the League to the purport that the Agreement of Alliance would in case of its renewal be made to conform to the Covenant in its form. The renewal of the Alliance was discussed at the British Imperial Conference in London in June 1921; and it was then announced that, under the terms of the treaty, it would continue, without definite renewal. But at the Washington Conference, in Dec., the agreement made for a four-Power treaty (America, France, England, Japan) provided for the Anglo-Japanese Alliance being brought to an end.

The Chinese Loan Consortium.—A gradual change came about in the opening years of the 20th century in the general policies toward China of the Great Powers, who had become convinced of the fruitlessness of mutual competition; signs also became visible of the altered attitude of Western financiers in regard to the investments in that Empire. In 1908, a British and a German bank undertook to finance in common the Tientsin–Pukow railway. In 1911, a four-Power group consisting of Great Britain, Germany, France and the United States, was formed in connexion with the Hankow–Szechuen railway loan, as well as the loan for currency reform in China and industrial enterprise in Manchuria. Japanese and Russian bankers agreed to join this Consortium in 1912, with the understanding that the special interests of Japan and Russia in Manchuria and Mongolia would not be interfered with in the internationalization of the Chinese loans. With the inauguration of Mr. Woodrow Wilson as President in 1913, the U.S. Government decided to withdraw their bankers from the Consortium, and subsequently the World War prevented Germany from remaining in the financial league. In 1917 the Consortium, now comprising the four Powers, Great Britain, France, Japan and Russia, invited the United States to rejoin in its activities. The American Government hesitated at first to respond to this call, but in June 1918, took the initiative for the reconstruction of the financial group. By that time the Tsarist régime in Russia had come to an end, but the other nations interested expressed their assent to the American proposal; and negotiations were started in May 1919, in Paris, between the financial representatives of Great Britain, France, Japan and the United States, simultaneously with the Peace Conference. After considerable interchange of views, part of which concerned the reservations by Japan as to S. Manchuria and E. Inner Mongolia, an agreement was signed in New York on Oct. 15 1920. The most important feature of the new agreement was that the object was purely and simply economic, being entirely free from any political complexion. All the members were to pool their existing and future loans (*i.e.* options) both as regards industrial and administrative undertakings, with the exception of the industrial enterprises upon which substantial progress had already been made. As to Manchuria and Mongolia, the Powers arrived at a satisfactory understanding, Japan withdrawing her previous reservations. The statement of the Japanese Government issued on April 1 1921 contained the assurance that Japan only desired in those regions definitely to ensure "her national defence and the security of her economic life," and she was confident that she could safely rely upon the mutual trust and friendship of the Powers in regard to the exigencies of any situation that might arise in future.

Equality of opportunities was fully guaranteed to all members, thus eliminating unnecessary and harmful competition. It was believed that this coöperative action of the various banking groups, which alone could offer the enormous amount of capital necessary for the reconstruction of Chinese economic life and for the building of sufficient means of communication and transportation all over her vast territory, would be in the best interests of the Chinese people.

The Anti-Japanese Movement in America.—In the opening years of the century, the continuous influx of a large number of Japanese immigrants from the Hawaiian Islands to California had caused much alarm to the labour organizations in that state, and even in wider circles. Anti-Japanese feeling first overtly manifested itself by the attempted segregation in 1905 of Japanese children in the public schools of San Francisco. With characteristic perspicacity, President Roosevelt early discerned that public sentiment on the Pacific slope towards the Japanese was taking an untoward course, and, bent upon stemming the tide in time, in 1906 he advocated, in his presidential message to the Federal Congress, that an Act should be passed investing the Japanese, who had "won in a single generation the right to stand abreast of the most intelligent and enlightened peoples of Europe and America," with the right to naturalization, which had been reserved to "free white persons, aliens of African nativity and persons of African descent." The lawgivers at Washington, however, did not, or could not on account of the agitation in the West, so much as consider the question. Nevertheless, an informal agreement was reached between the Washington and Tokyo Governments, by which Japan pledged herself that she would not issue passports for the continental United States to those classes of Japanese who would, or might, engage in manual labour. Those Japanese who had previously resided in the United States, or were the immediate relatives of Japanese immigrants already in the United States, or the "settled agriculturists" who were to assume active control of an already established farming interest (only three or four persons actually came under this last category), were to be accepted. Japan engaged herself to observe this arrangement voluntarily, and the sincere efforts of her Government in executing it received recognition from many American publicists.

This "Gentleman's Agreement," as it was generally styled, was confirmed by a declaration on the part of Japan made simultaneously with the revision of the Treaty of Commerce and Navigation in Feb. 1911. However, the feeling against the Japanese in the United States subsequently became more and more pronounced. Apart from sporadic legislation imposing restrictions on them with regard to civil rights, such as marriage and the pursuit of an avocation, the Alien Land Act was passed by the California Legislature in May 1913, and put into force three months later, despite strong Japanese protests and repeated admonitions from Pres. Wilson's Cabinet. This law prohibited aliens ineligible to citizenship of the United States (including companies the majority of whose interests were under the control of such aliens either in point of their number or the amount of capital held) from owning land in the state of California, allowing them only the privilege of leasing land on a three years' tenure. The terminology employed invested this law with an appearance of innocent impartiality, but it was none the less obvious that the Japanese alone would, in point of fact, be the sufferers from an invidious discrimination.

The exigencies of American participation in the World War tended to lull Californian opposition towards the Japanese. But, with the termination of the war, it was renewed. In spite of the efforts of the Japanese Government to respect the susceptibilities of their American neighbours, of which the stoppage of passports in the spring of 1920 to the so-called "picture brides" was an example, the day of the presidential election—Nov. 2—witnessed the passage by the Californians of the most drastic law yet enacted against "ineligible aliens," by which they forfeited even those rights which they had formerly been allowed to retain of holding land under a three years' lease. The Federal authorities had been averse to such a step, but the "initiative" poll decided in favour of the enactment by a majority of three to one (668,483 to 202,086 votes), and the law came into force as from the Dec. following. Thus in 1921 no Japanese might own or lease land, neither could he act as guardian of his own American-born offspring (who are of right American citizens) in whose name land is held, nor might he possess a share even in American-controlled landowning companies. "In that State," wrote *The Nation* (New York), "America's traditional sense of fair play has been swept away in a ferment of race prejudice and campaign buncombe. The notion that the Japanese land ownership constitutes a 'menace' in the sense employed by anti-immigrationists is entirely refuted by the facts. Of the 28 million acres of farming area which compose one-fourth of the State's total acreage, only 458,000 acres, or 1.6 per cent, are under cultivation by Japanese. But this is not all. Of this small proportion not over 27 thousand acres—less than one-tenth of one per cent—are owned by Japanese, the balance being made up of lands cultivated by Japanese under leases, under crop share contracts, under labour contracts, and finally, of 48,000 acres owned by American corporations with some Japanese shareholders."

Anti-alien land legislation would appear to have become the fashion on the Pacific slope in 1921, the example set by California being emulated by Nebraska, Idaho, Oregon and Washington; the last two states, be it remarked, had systematically refused to make common cause with California during the past decade.

In the meantime, conversations were taking place at Washington between Mr. Roland S. Morris, the American ambassador in Tokyo, and Baron Shidehara, the Japanese ambassador in Washington, with the view of working out a formula which, whilst providing a practical solution of the unfortunate and complicated problem, would be at the same time acceptable to both nations. An agreement was reported to have been reached in Feb. 1921, and it appeared that it remained for the new Republican administration to give its assent in order that the desired arrangement might be put into actual operation.

There would appear to be some misapprehension with regard to the rights of foreigners in Japan to hold land and it has been stated that no such rights exist. This is not the case, as all persons, without discrimination, who are not Japanese subjects, may enjoy absolute ownership of land, if they are formed and registered under Japanese law as a juridical person, that is, as a partnership or corporation. There are, in fact, many such corporations in existence in Japan, composed exclusively of aliens.

Foreigners are further permitted to acquire rights in land, other than ownership, on the same footing as Japanese nationals, the following being some of the most important of these rights.

1. *Superficies.*—This is a right *in rem* by virtue of which land belonging to another person can be used for the purpose of owning thereon structures, trees or bamboos. It can be created even though no structures, trees or bamboos are actually in existence on such land, provided that the object and intention is to use the land for the purpose named. The law contains no limitation upon the period of time for which that right can be created, consequently a superficies for, say, 1,000 years will sell for a sum closely approximating to the value of a right of absolute ownership.

2. *Emphyteusis.*—This is a right *in rem* to carry on agricultural or stock farming on the land of another person. The period of time for its duration is to be fixed by the parties concerned at not less than 20 years and not more than 50 years.

3. *Lease in Perpetuity.*—This is a lease without limit as to its duration, and, for all practical purposes, it is as good as ownership. It was originally granted to foreigners within the Foreign Settlements for a nominal consideration paid to the Japanese Government. Although the Foreign Settlements were abolished in 1898, perpetual leasehold survives and is still enjoyed by foreigners.

4. *Leasehold.*—This is a right *in personam*, effective only as between the parties concerned. When registered, however, it can be set up against third persons as the effect of such registration. The duration period is fixed at 20 years, renewable for a further 20 years from the time of renewal.

The World War.—No sooner had the World War broken out in 1914 than there took place several exchanges of views between the British and the Japanese Governments as to possible assistance by Japan in the protection of British trade in the Far East. Japan soon made it clear that she was prepared to take the responsibility imposed upon her by the Anglo-Japanese Agreement of Alliance, should the menace by the Germans to British interests necessitate such a step. It was not long before such a contingency arose, and on Aug. 15 1914 the Japanese Government sent an ultimatum to Berlin demanding the immediate withdrawal of the German warships from Chinese and Japanese waters and the surrender of Kiaochow to Japan by Sept. 15, with a view to eventual restoration of the leased territory to China; a week was allowed to the German Government in which to make a definite reply. On Aug. 23, the term having expired without any answer being forthcoming from the Kaiser's Government, Japan declared war against Germany. In coming to this decision Japan remembered that it had been through the machinations of the Berlin Government that Germany, France and Russia acted jointly in 1895 in "advising" Japan in the name of peace in the Orient, and not without a hint of force, to retrocede to China the peninsula of Liaotung, which had been won by Japan at a heavy sacrifice of life and treasure and ceded to her under the Shimonoseki Treaty, and further that it was barely two years after that incident that Germany had installed herself at Tsingtao on a flimsy pretext. The Japanese nation welcomed the opportunity of eradicating the German menace in the East which owed its inception to such unfortunate circumstances.

The Capture of Tsingtao.—The first part which Japan took upon herself to play after she aligned herself with the Allies, was the reduction of the German stronghold in the Far East. Tsingtao, on the bay of Kiaochow, had been converted in the hands of the Germans into one of the most impregnable fortresses in the Orient—the "mailed fist" calculated to intimidate any possible objectors to the Kaiser's imperialist aims. It served at the outset of the war as the only base of operations in E. Asia for the German marauders menacing the Allied trade routes. The five German warships forming the main part of Adml. von Spee's squadron had been running amok, not only in Chinese and Japanese waters, but as far as the South Seas. It was imperative to make these raiders homeless, if they could not be captured or destroyed, and the military and naval operations against the redoubtable base, which was under the command of Capt. Meyer-Waldeck and garrisoned by some 13,000 men, of whom 5,599 were German regulars, were started with the utmost dispatch. On Aug. 27, the blockade of Kiaochow Bay was declared by the Japanese navy and Lungkow, 150 m. N. of Tsingtao, was chosen as the point for landing troops. The selection of Lungkow as the spot for disembarkation had been agreed upon between the Japanese and British commanders, who saw the necessity of clearing the hinterland prior to the landing of troops at some point nearer the fortress. However, the point being outside the zone of the leased territory, it was thought necessary to have a war zone established, following the precedent of the Russo-Japanese War, and negotiations with that view were started between the Japanese and the Chinese Governments as early as Aug. 20. An understanding was soon come to between the two Governments, and the Peking Government issued a declaration establishing such a war zone on Sept. 3. The Chinese Government, in the meantime, intimated to the Japanese Government that it might nevertheless be found advisable to enter a formal protest to Japan against her troops' landing at Lungkow, for the sole purpose of exonerating themselves from all responsibility towards the German Government. Upon Germany's strong protest against permitting the Japanese troops to land in the neutral territory, the Chinese Government went so far as to point out that Germany herself had in a measure created the situation through her unauthorized fortification of Tsingtao.

On Sept. 2 1914, the Japanese division, under the orders of Lt.-Gen. Kamio, commenced landing at Lungkow, in the teeth of a heavy downpour of rain, which swelled into a terrible tempest and caused the whole district to be flooded as it had not been flooded for half a century; the advance of the troops was therefore immeasurably hard and dangerous. They had to wade through muddy streams; their diet for days consisted of a handful of millet. Despite such extreme adversity of circumstance, the vanguards arrived on the 12th at the small town of Chimo, where they encountered the enemy for the first time. In the meantime, the railway connecting Tsingtao with Tsinan, the capital of Shantung, was freely used by the Germans for military purposes. The crew of the Austrian cruiser "Kaiserin Elisabeth," who were on leave at Tientsin, were brought back to Tsingtao by means of that line, and war materials were incessantly transported into the fort by the same route. It was discovered that China not only winked at such acts of violation of her neutrality but actually gave aid and comfort to the Germans. Japan made protests to the Peking Government but to no purpose; she was constrained to take over the operation and the safeguarding of the railway. The second Japanese contingent began to land at Laoshan Bay, within the leased zone, on Sept. 18 and soon established touch with the I. Army. The Japanese forces under Gen. Kamio thus amounted to about 22,980 officers and men and they succeeded in some ten days in wresting from the Germans several of their advanced positions. On Sept. 24, there arrived at the arena of campaign the British force, commanded by Gen. Barnardiston, consisting of 910 officers and men of the 2nd South Wales Borderers and 450 of the 36th Sikhs. After permitting the non-combatants to leave the fortress, the general attack on the position was commenced on Oct. 31, the Japanese blockading fleet off the harbour assisting by a continuous bombardment. On the morning of Nov. 7, white flags were descried on the forts of Moltke, Bismarck and Iltis, to the pleasant surprise of the attacking army, which had expected a protracted siege. After the fall of the stronghold, it was ascertained that all enemy ships, including the Austrian cruiser "Kaiserin Elisabeth," had been sunk in the port of Tsingtao. The Japanese army lost, during the campaign, 1,968 killed or wounded, and the Japanese navy a cruiser, a destroyer and a torpedo boat. The port of Kiaochow was reopened for trade by the Japanese on Dec. 28 1914.

The Japanese Navy in the War.—Although Tsingtao was thus early captured, there still remained the important task of locating and disposing of Adml. von Spee's squadron, consisting of the "Scharnhorst," the "Gneisenau," the "Nürnberg," the "Leipzig," and the "Dresden," which were seriously menacing the Allied commerce in the South Seas. It had further been reported that several German warships were at large in the Pacific Ocean. As early as Aug. 26, the battle cruiser "Ibuki" and the cruiser "Chikuma," and shortly afterwards six more Japanese cruisers, were ordered to join the British China Squadron under the command of Adml. Jerram. There were further dispatched a squadron of eight cruisers to the China and the East Seas and two squadrons—one comprising two battle cruisers, two cruisers, and a division of torpedo destroyers and the other one battleship and two cruisers—to the South Pacific Ocean. The cruiser "Idzumo," which happened to be in Mexican waters, as well as the "Asama" and the "Hizen," were entrusted with the patrol of the western coast of America, in coöperation with the Canadian "Rainbow" and the British cruiser "Newcastle."

In the middle of Sept., a great sensation was aroused by the dramatic appearance in the Bay of Bengal of the German raider "Emden," which had effected her egress from Tsingtao before the blockade was instituted by the Japanese navy. Several British merchantmen fell victims to her ruthless attack in appallingly swift succession, and it was only after two months' strenuous chase by the British and the Japanese squadrons that the "Emden" was sunk by the Australian cruiser "Sydney" near the island of Cocos. In the meantime, Australian and New Zealand troops were being hurried to various theatres of war in Europe, and Japanese warships assisted in the convoy of the transports across the Indian Ocean. At one time, whilst the "Emden" was still working havoc in Indian waters, the "Ibuki" was obliged to convoy no fewer than 38 troopships by herself. Apart from the anxious, as well as hazardous task of convoy, Japanese warships were, in Feb. 1915, called upon to hurry to Singapore and land troops there to assist the British forces, side by side with French and Russian marines, in suppressing a mutiny of Indian soldiers who had come under German influence. In 1917, and after, the Japanese navy undertook the guardianship of the safety of the Indian Ocean as far as the Cape of Good Hope. Von Spee's squadron, as a result of the concerted operation of the British and the Japanese navies, was chased in the direction of Cape Horn towards the end of 1914, and on Dec. 8 was encountered by Adml. Sturdee's squadron off the Falkland Is. and was completely annihilated, with the exception of the "Dresden," which, however, was also sunk by the British off Chile three months later. Meanwhile the German gunboat "Geier" was disarmed and interned at Honolulu, and thus the Pacific Ocean was cleared of the enemy, greatly to the relief of Allied commerce.

The next, and not the least important, contribution of the Japanese navy toward the successful conduct of the war, was the sending of the cruiser "Akashi" and three destroyer divisions under the command of Rear-Adml. Sato to the Mediterranean. The German submarine warfare was about that time beginning to be carried on in a ruthless manner, and the British navy had been earnestly requesting Japanese help. Whilst the British, French and Italian forces were engaged in blockading the Adriatic Sea and the Dardanelles, Adml. Sato's squadron assumed the all-important duties of convoying Allied vessels to and fro between ports in the Mediterranean. The Japanese destroyers successfully escorted 21 British warships, as well as 623 British, 100 French, 18 Italian and 26 other troopships or merchantmen, totalling 788 ships, and they cruised altogether 220,000 miles.

Japan's "Twenty-one Demands" upon China.—Friction between neighbours is deplorable, though far too common, but it is altogether exasperating when friction is caused by the neglect of order in the house of a neighbour. No one more regretted the continued internal troubles and disorder in China, which had been divided into two camps since the Republic was proclaimed, than Japan herself, whose national destiny is so intimately entwined with that of China. The Tokyo Cabinet became impatient toward the end of 1914, of the general trend of the Chinese-Japanese relations which, largely owing to China's procrastinating and wayward diplomacy, had been marked by constant and cumulative misunderstandings and irritations. In the judgment of the Okuma Cabinet the only effective move was an attempt to cleanse the Augean stable, and on Jan. 18 1915, with a view to liquidating all outstanding problems between Japan and China, the "twenty-one demands" were presented to President Yuan Shi-k'ai at the hands of Mr. Hioki, the Japanese minister in Peking. The demands consisted of five groups: Group I., which related to Shantung province, comprised four items; Group II., in respect of S. Manchuria and Eastern Inner Mongolia, had seven items; Group III. concerned the Hanyehping Co. and included two items; Group IV. consisted of one item relative to the territorial integrity of China. The V. Group was not presented as "demands" but as "wishes," consisting of seven items, covering the employment of Japanese advisers; land ownership by Japanese hospitals, temples and schools; the purchase of munitions of war from Japan; the right to construct a line connecting Wuchang with the Kiukang–Nanchang railway as well as the Nanchang–Hangchow and the Nanchang–Chaochow lines; the priority of Japanese capital regarding railways, mines and harbour works in Fukien province; and Japanese missionary propaganda. The too ambitious attempt of the Tokyo Cabinet evoked adverse criticisms from various quarters. But that was more on account of the manner in which the demands were made to China. It was undoubtedly unfortunate that, whatever cogent reasons there might have been, the "wishes" were not placed on the table from the outset as well as the "demands." As to their intrinsic merit, the London *Times* (Feb. 13 1915) observed: "Even in the Peking version . . . these terms do not look harsh or unreasonable in principle. . . . They do not in any wise threaten the integrity of China, nor do they appear to violate the doctrines of the equality of opportunity and of the open door as hitherto accepted by other Powers." Even granting that some of the proposals were unwisely conceived, the general belief that Japan purposed at that time to establish a veiled protectorate over China was merely the result of active and extensive hostile propaganda; no insinuation could be more malicious and misguided. For Japan it was a matter of superlative interest and importance that her neighbours should attain a good Government, a prosperous industry and a flourishing trade; it was her greatest fear that China should become the Turkey of the extreme Orient. Chagrined by the endless tergiversation of the Chinese Government, in entire disregard of Japan's friendly and conciliatory intentions, which were amply shown during the four months' negotiations at Peking, the Japanese Government pressed the Peking Government, on May 7 1918, to express their definite answer within a time limit. In the result the Chinese President, Yuan Shi-k'ai, acceded to the Japanese proposals; and on the 25th of the same month, under the signature of Mr. Hioki and Lu Cheng-Hsieng, the Chinese Minister for Foreign Affairs, two treaties were concluded—one respecting the province of Shantung, and the other regarding S. Manchuria and Eastern Inner Mongolia—and 13 notes were exchanged. The treaty respecting the province of Shantung stipulated that China should recognize all arrangements to be made between Japan and Germany as to the German rights in that province; that, for the construction in future of a railway connecting Chefoo or Lungkow with the Kiaochow–Tsinan railway, Japanese capitalists should first be approached; that China should of her own accord early open suitable cities and towns for the residence and trading of foreigners. China further pledged herself in a note that she would not lease or alienate any part of Shantung, including the islands off its coast.

With special reference to Kiaochow, the Japanese Minister, in an exchange of notes, made the following declaration:—

> "If upon the conclusion of the present war, the Japanese Government should be given an absolutely free disposal of the leased territory of Kiaochow Bay, they will return the said territory to China, subject to the following conditions:—
>
> "1. Opening of the whole of Kiaochow as a commercial port;
>
> "2. Establishment of a Japanese settlement in the locality to be designated by the Japanese Government;
>
> "3. Establishment, if desired by the Powers, of an international settlement;
>
> "4. Arrangements to be made, before the return of the said treaty is effected, between the Japanese and the Chinese Governments with respect to the disposal of German public establishments and properties and with regard to the other conditions and procedures."

By the treaty respecting S. Manchuria and Eastern Inner Mongolia, the Chinese Government engaged that the terms of lease of Port Arthur and Dairen, and of the S. Manchuria railway and the Antung–Mukden railway, should be extended to 99 years respectively; that Japanese should be permitted in S. Manchuria to lease land for residential, commercial, industrial and agricultural purposes, and further should be free to enter, travel, reside and pursue various vocations; that in Eastern Mongolia Japanese should be permitted to carry on, jointly with Chinese, agricultural undertakings; that Japanese conducting business in those regions should be submitted to Chinese police laws and taxation; that civil and criminal cases should be tried by the Japanese consul or by Chinese officials according as the defendant was Japanese or Chinese, save in cases of land disputes where a mixed tribunal would have the power of adjudication (all this pending the eventual reform of the Chinese judicial system); that suitable cities and towns would early be opened to foreigners of China's own accord; that various agreements relating to the Kirin–Changchun railway should early be revised. By the exchange of notes, certain mining rights, and the priority of Japanese capital in relation to loans for building railways and other loans on the security of taxes, save the salt gabelle and customs revenue, were granted to Japan. It was further agreed that Japanese might be employed first in case China needed foreign advisers or instructors in S. Manchuria. As to the Hanyehping Co., in view of the very close relations existing between Japanese capitalists and the company, China agreed to approve a possible future arrangement for its joint undertaking and further not to confiscate or nationalize it without Japan's consent, or let it contract foreign loans other than Japanese. In regard to the province of Fukien, the Chinese Government declared that they would not permit a foreign Power to build or finance any shipyard or military or naval establishment.

If Yuan Shi-k'ai had been disinterested and had taken a wider view of the general situation, those treaties and agreements could very well have been utilized for bringing China and Japan closer, and consolidating the peace of the East. But he was paving his way to his ambitious goal—to ascend the throne. It was unfortunate that Yuan's subsequent actions and proclamations inspired undue ill-will in the Chinese people.

Japan's War Mission to the United States.—Shortly after the declaration of war against Germany by the United States in April 1917, the Allied Powers sent their leading statesmen and soldiers to Washington to confer as to the best methods of coöperation in the war; how to coördinate their respective national strengths so as to bring about an early victory. Great Britain was represented by Mr. Balfour and France by M. Viviani and Marshal Joffre. Japan entrusted the mission to Viscount K. Ishii, whose major task was to consult about the distribution of the Allied naval forces, and the arrangement as to the exchange of ships and steel, for whereas America urgently needed transports to convey her troops to the western front, the Japanese steel plants and shipbuilding yards would shortly be forced to remain idle if they were unable to obtain a supply of American iron. During Viscount Ishii's stay in Washington, the Ishii-Lansing Agreement in regard to China was incidentally concluded.

The Ishii-Lansing Agreement.—In the course of conversation which took place between Mr. Robert Lansing, the United States Secretary of State, and Viscount Ishii, when the latter went to Washington on the Special War Mission in 1917, it was found advisable that a public announcement of the desires and intentions of the two Governments with regard to China should once again be made, "in order to silence mischievous reports" that had from time to time been circulated. On Nov. 2 notes were exchanged between the two plenipotentiaries, declaring:—

> "The Governments of Japan and the United States recognize that territorial propinquity creates special relations between countries, and, consequently the Government of the United States recognizes that Japan has special interests in China, particularly in the part to which her possessions are contiguous.
>
> "The territorial sovereignty of China, nevertheless, remains unimpaired, and the Government of the United States has every confidence in the repeated assurances of the Imperial Japanese Government that while geographical position gives Japan such special interests they have no desire to discriminate against the trade of other nations or to disregard the commercial rights heretofore granted by China in treaties with other Powers.
>
> "The Governments of Japan and the United States deny that they have any purpose to infringe in any way the independence or territorial integrity of China and they declare, furthermore, that they always adhere to the principle of the so-called 'open door,' or equal opportunity for commerce and industry in China.
>
> "Moreover, they mutually declare that they are opposed to the acquisition by any Government of any special rights or privileges that would affect the independence or territorial integrity of China or that would deny to the subjects or citizens of any country the full enjoyment of equal opportunity in its commerce and industry."

The Japanese Expedition to Siberia.—After the Russian Revolution in 1917, a unique and anomalous situation developed in Siberia owing to the conjunction effected by German and Austro-Hungarian prisoners-of-war with Bolshevik forces, the former assuming the practical command. These Teutonic-Bolshevik allies seriously threatened the safety of the Czechoslovak troops who had essayed through the only available route of Siberia to join the Allied armies fighting on the western front in France. The U.S. Government proposed to the Japanese Government in the early part of 1918 to dispatch an Allied contingent to Eastern Siberia to give succour to the helpless and distressed Czechoslovaks. To this Japan gave her assent, and in Aug. undertook to detail a contingent to Vladivostok; the United States and Great Britain also dispatched troops to Siberia. Early in Sept. Khabarovsk was captured by the Allied forces, and during the month of Oct. the Bolshevik influence in Eastern Siberia was signally diminished and the Czechoslovaks in the interior succeeded in re-establishing communication with their compatriots in the littoral districts. The Allied successes in Siberia endowed the anti-Bolshevists, rallying under the banner of Adml. Kolchak, with fresh power; and the orders of the Omsk Government, established in Nov. 1918, extended as far as the Ural regions by the end of that year. But in May 1919 the anti-Bolshevik forces sustained a crushing reverse at the hands of the Red army; and Adml. Kolchak's Government first removed from Omsk and then, toward the winter, to Chita. In the face of such unfavourable developments of affairs, Japan saw the necessity of early arriving at a definite understanding with the U.S. Government as to the future dispatch of reënforcements to Siberia. The Washington Government, however, responded in Jan. 1920 with a sudden decision to withdraw all the American troops and railway experts; first, because the repatriation of the Czechoslovak forces was about to be completed, and secondly because the very unstable situation in Siberia would render futile any military assistance to the attempt to establish an autonomous Russian Government in Siberia. The American Government further stated that if Japan would continue in her endeavours in Siberia single-handed, they had no objection whatever. In point of fact, the exigencies of the situation soon obliged Japan to send a reënforcement. But the Social Revolutionaries and the Bolshevists were in the spring of 1920 fast establishing ascendancy in Eastern Siberia, having their headquarters at Vladivostok, Verkhne Udinsk and Blagovyeshchensk—the three centres being more or less independent of each other. After the arrest and execution by Bolshevists of

Adml. Kolchak in Feb. 1920, the only remaining reactionary leader was Gen. Semenoff, who had established his Government at Chita and had the whole province of Trans-Baikalia under his sway. In March 1920 a most sanguinary incident occurred at Nikolaievsk, capital of Sakhalin Province and situated on the river Amur; all the Japanese residents of that city, men, women and children, numbering 350, including Consul Ishida and his family, were murdered by the "Partisans," a Bolshevist guerrilla gang infesting the littoral regions. The Japanese Government declared on July 3 that as there existed no responsible administrative centre in Russia which could negotiate about the flagrant outrage on Japan's prestige at Nikolaievsk, the Japanese forces would occupy certain places in Sakhalin province, pending the establishment of a legitimate Government. At the same time, it was made known that Japanese contingents would soon be withdrawn, as in fact they were, from Trans-Baikalia, inasmuch as the Czechoslovak troops had been successfully assisted on their homeward journey (the last troops left Vladivostok in Sept. 1920), but that Vladivostok and Khabarovsk would still have to be garrisoned by a small military strength. Upon inquiry from the Washington Government, it was explained by the Japanese Government that Vladivostok was the prolific hatchery of Korean revolutionary plots, and further the safety of the Japanese residents had to be provided for, and that Khabarovsk was a point in close strategic relation with Nikolaievsk. As soon as signs became visible of the growing stability of Khabarovsk, in Sept., evacuation of that region was immediately started. Meantime, the Bolshevists at Verkhne Udinsk began to style themselves the "Far Eastern Republic," and in concluding an agreement as to the suspension of hostilities with the Japanese military authorities in July 1920, formulated a memorandum to the purport that the Republic would follow democratic and not communist principles of administration and would constitute itself a buffer state in the interests of a speedy resuscitation of peace and order in Siberia. Then the movement for the unification of the several "Governments" in Eastern Russia was started, and in Nov. the so-called Amalgamation Assembly at Chita declared the independence of the "Far Eastern Republic"—adopting the name at first conceived at Verkhne Udinsk—holding as its territory the Russian provinces E. of the Selenga river and professing anti-communist democracy as its basic political principle. The *coup d'état* carried out by the reactionary Kappelists in Vladivostok on May 26 1921 showed that the Siberian situation was still very unstable.

Anti-Bolshevist Agreements.—In view of the Siberian situation, military and naval agreements were concluded between the Governments of Tokyo and Peking in March 1918 for the purpose of coördinating the forces of the two countries to oppose the probable invasion by the Bolshevists from the Siberian direction. China inaugurated an Office for Joint Military Action under the directorship of Tuan Chijui, to give effect to the terms of the agreements, receiving from Japan a supply of capital to the amount of 20,000,000 yen for the upkeep of the forces and 33,000,000 yen for purchasing munitions of war. Whilst the arrangement proved to be of considerable service in impeding the Bolshevik advance to the S., the incidental increase in the power of Tuan's party—the Anfu Club—gave rise to considerable misgivings and misunderstandings, at the expense of Japan's good name. It was, therefore, decided by Japan in March 1919, to furnish no further supplies of money and arms. After the downfall of Tuan and his friends in July 1920, the Peking Cabinet expressed their desire to discontinue the pact, and, but for the unfortunate state of affairs in Eastern Siberia, it would have been early terminated. As it was, the annulment was agreed upon by Tokyo and Peking on Jan. 27 1921.

Japan at the Peace Conference.—At the Peace Conference in Paris in 1919, Japan was represented by Marquis (afterwards Prince) Saionzi; Baron (afterwards Viscount) Makino; Viscount (afterwards Count) Chinda; Mr. (afterwards Baron) K. Matsui; and Mr. (afterwards Baron) K. Ijuin. The plenipotentiaries went to France with the firm conviction, as Baron Makino had made unmistakably clear before he left Japanese shores, that the attitude of Japan at Paris should be, not so much to advance her own case before the comrade nations in the war, as to take counsel with them in the creation of a new world in which justice and humanity would reign supreme and which would assure an enduring peace. The first claim laid on the peace table by the Japanese delegates was for the recognition of racial equality. The public opinion of Japan demanded that, if a new era of righteousness and fairness was to be established and peace and good-will among men were to be assured for all time, one of the postulates should be the principle of the equal dignity of races. The Japanese nation had been deeply conscious of the discriminatory treatment meted out to its nationals in various parts of the world. It recognized that differences in ability, power and character among men always exist; but it appeared wrong that there should be inequality of opportunities—inequality before the law. The present state of human civilization having been achieved by a series of social, religious, political and economic emancipations, it seemed certainly to be time that racial emancipation should, in the interests of the real progress of civilization, be foreshadowed and approved at least in principle. The original Japanese proposal for insertion in the Covenant of the League of Nations read:—

> "The equality of nations being a basic principle of the League of Nations, the High Contracting Parties agree to accord, *as soon as possible*, to all alien nationals of the states members of the league equal and just treatment in every respect, making no distinction, either in law or in fact, on account of their race or nationality."

In explaining the Japanese position, Baron Makino made it clear "that the question being of a very delicate and complicated nature involving the play of a deep human passion, the immediate realization of the ideal equality was not proposed, but that the clause presented enunciated the *principle* only and left the actual working of it in the hands of the different Governments concerned." Every national of the States in the League was expected "to share military expenditure for the common cause and, if need be, sacrifice his own person. In view of these new duties . . . arising before him. . . each national would naturally feel, and in fact demand, that he be placed on an equal footing with the people whom he undertook to defend even with his own life." The Japanese proposal, which was later somewhat modified in terminology in an attempt to meet objections, obtained 11 votes out of 17 in its favour, but it was ruled that unanimity was necessary. Japan abided by that decision, reserving the right to raise the question again at an opportune moment.

The disposition as regards Kiaochow was the next question with which the Japanese delegates had to grapple. When the Japanese people gave a hearty send-off to their plenipotentiaries, they had no shadow of doubt as to the final issue of this question. The greater, therefore, was their disappointment, if not stupefaction, when the Chinese delegates came out with a demand for the direct restitution of the ex-German stronghold. Japan claimed Kiaochow in recognition of all her military and naval services, by which, with British assistance, the German Far Eastern base had been reduced, by which trade routes in the Orient had been kept unmolested and by which Allied troopships had safely been convoyed to various fronts. It was at the same time made clear that Japan would be content, having once secured Kiaochow in her hand, not to retain it in her possession, but to offer it to China as a mark of good-will and friendship. "A cordial friendship between Japan and China" had been a slogan on the lips of thinking Japanese, and it was expected that a new leaf in Japanese-Chinese relations would be turned by this timely offering. The Chinese delegates, however, insisted that the declaration of war by China against Germany on Aug. 14 1917 had abrogated all her treaties with Germany, including that of the lease of Kiaochow. Whether a lease treaty is not a sort of *pacta transitoria* is, to say the least, a moot question; it would appear to be contrary to common sense to contend that a paper declaration of war could constitute a magic wand to transfer to her possession a formidable fortress which China could never have reduced with her own resources, and which, if it had not been captured beforehand, would have been a potential intimidation, and would possibly have prevented her making that very declaration. China's further plea was that her engagement of May 1915 (see p. 653, the *Twenty-one Demands*) had been made under duress and was therefore null and void. It is a fact, however, that China did not question the validity of that engagement, when she willingly concluded the formal understanding of Sept. 24 1918, which was actually based on the above-mentioned agreement of May 1915, and accepted an advance of 20,000,000 yen under that understanding. The position of Japan, it should be observed, had furthermore been fortified by the previous undertakings of Great Britain, France, Russia and Italy in 1917, to support or at least raise no objection to the Japanese claim.

The Supreme Council finally decided in favour of Japan, on May 5 1919 (Arts. 156–158, Treaty of Versailles). Rumours were in circulation that Japan had struck a bargain between the race question and the Shantung dispute; and further, that the withdrawal of Italy from the Peace Conference had made for Japan's strength. The latter surmise may have been true in a certain measure, but the former was hopelessly wide of the mark.

The ex-German islands in the Pacific lying N. of the Equator, which had been under the Japanese occupation since 1914, were allocated to the Japanese administration under the newly formulated mandatory system, at the Supreme Council held at the Trianon Palace on May 7 1919. They include the Marshall, Caroline, Palau (Pelew), and Marianne (Ladrone) islands.

The Restitution of Kiaochow.—With the coming into force of the Treaty of Versailles on Jan. 10 1920, the German rights and interests in Shantung passed to the hands of Japan, and the Tokyo Government, in conformity with their pledged obligation to China, and true to their repeated public avowals (by Baron Makino in Paris on May 4 1919; by Viscount Uchida in Tokyo, May 17 and Aug. 2 1919), immediately instructed Minister Obata to invite the Peking Government to open negotiations for effecting the restitution of the ex-German possessions in Shantung (Jan. 19). It was desired that the necessary preparations for accepting the restoration should forthwith be started, and that China should organize a police force to take over the charge of guarding the Tsinan–Kiaochow railway. As soon as such an organization was completed—even if it were prior to an agreement being reached as to the restoration—the Japanese troops would be immediately withdrawn. Three months passed without any response from Peking to the Japanese overtures. Japan repeated on April 26 her desire to start negotiations, and the Chinese reply (May 22) was that she could not conduct direct negotiations with Japan as to the question of Tsingtau on the basis of the Treaty of Versailles, which she did not sign, and further, that the whole public of China had assumed a strongly antagonistic attitude in respect of the question. Whereupon the Tokyo Government asked the Chinese Government to reconsider the matter, assuring the latter that they were ready to commence negotiations at any time China might deem convenient. But Peking again remained deaf. It was then rumoured that the question might be brought up by the Chinese delegation before the First Assembly of the League of Nations at Geneva in Nov. and Dec. 1920. No direct mention of the question was made; but Dr. Koo reserved for "a more appropriate time in the future," the matter of bringing before the League certain "subjects of vital interest to China, affecting international relations."

The Yap Controversy.—The Council of the League which met in Geneva on Dec. 17 1920, decided upon the statute relative to "C" class mandates, under the terms of the Covenant of the League (Art. 22, 6) and pursuant to the decision of the Supreme Council on May 7 1919, allocating the ex-German South Sea islands to Great Britain, Australia, New Zealand and Japan. The Japanese Government had been contending that, according to their legal interpretation, the principle of equal opportunities for trade and commerce should, under the Covenant, be assured to "C" class as well as to "B" class mandates (Art. 22, 5). But in view of the importance of unity and coöperation among the Allied nations, Japan gave her assent to the issue of the statutes, on the understanding that "that decision should not be considered as an acquiescence by the Japanese Government in the submission of Japanese subjects to discriminatory and disadvantageous treatment in the mandated territories, nor have they thereby discarded their claim that the rights and interests hitherto enjoyed by Japanese subjects in these territories should be fully respected."

To the statute relative to the islands N. of the Equator which came under the Japanese mandate, "as an integral portion of its territory," the United States took exception, on the plea that the island of Yap should not be included in the islands to be so assigned. It was argued that President Wilson had submitted to the Supreme Council his proposal of having that island internationalized for reasons vitally affecting the world communications, and that its decision, published on May 7 1919, should not be regarded as by any means conclusive. Further, the Washington Government declared that they had never ratified the Treaty of Versailles and accordingly were not bound by that instrument in any sense; but the United States should, treaty or no treaty, have a voice in the disposition of the affairs immediately arising from the World War. So far as the status of the island was concerned, Japan's position was that, if the published decision of the Supreme Council were not final, she did not know what she could rely upon as definite finality; the Allied powers in Europe appeared to support the Japanese view. In the presentation of their case, the American Government further stated that "even if Yap should be assigned under mandate to Japan, all other Powers should have free and unhampered access to the island for the landing and operation of cables." Japan contended that "the (cables) question seems to be one which should be freely settled by the nation which has the charge of the place." As the result of the Washington Conference at the end of 1921, an agreement between Japan and the United States was eventually signed on Dec. 12, by which Japan's sovereignty (as the mandatory Power) in Yap was admitted by the United States, while Japan accorded to the United States full rights and facilities in connexion with the cables and other matters.

The European Tour of the Crown Prince.—The Crown Prince Hirohito broke the age-long tradition of Japan's history, and, as the first heir to the throne to leave his native shores, set forth early in March 1921, in company with Prince Kan-in, and escorted by Count Chinda, ex-ambassador to the court of St. James's, upon a tour of study and observation in Europe. Prior to his departure, the more conservative section of the Japanese public, including some influential leaders in politics, gave vent to their anachronistic, though loyal, solicitude as to the safety of the Prince in risking such an unprecedented adventure, the reported indifferent health of the Emperor also inspiring anxiety in many uneasy minds. To add fuel to the popular disquietude a rumour was in circulation that the betrothal between the Crown Prince and Princess Nagako of Kuni might be cancelled, and this development was even attributed to political reasons; a timely *dementi*, however, was issued by the Imperial Household. The battleship "Katori," with the Crown Prince on board, called at Hong-Kong, Singapore, Bombay, Port Said, Malta and Gibraltar, en route to Portsmouth, where she anchored on May 8. The reception by the King and the public of Great Britain was most cordial and spontaneous, befitting the Alliance uniting the two nations for the past two decades. The Crown Prince, leaving for France on May 29, said in his farewell message to the British nation: "It has been my happiness to see something of almost every side of the national life and institutions of the British people." The Imperial tour extended to France, Belgium, Holland and Italy. As to the United States of America, the Crown Prince had occasion to say that he much regretted he could not visit that country on this trip, but that he still hoped to do so in the not far distant future. (H. SA.)

JASTROW, MORRIS (1861–1921), American orientalist, was born in Warsaw, Russian Poland, Aug. 13 1861, but went to Philadelphia at the age of five. Educated at the schools of that city and in the university of Pennsylvania, he studied subsequently at the universities of Leipzig and Breslau, Paris and Strassburg until 1885, when he returned to the university of

Pennsylvania as professor of Semitic languages and librarian. He became president of the American Oriental Society (1914–5) and president of the Society of Biblical Literature (1916). He died June 22 1921 at Jenkintown, Pa. He published numerous works on the religions and civilization of Babylonia and Assyria, and, in connexion with the World War, *The War and the Baghdad Railway* (1917); *The War and the Coming Peace* (1918); *A Gentle Cynic* (1919); *Zionism and the Future of Palestine* (1919).

JAURÈS, JEAN (1859–1914), French Socialist leader (*see* 15.283), was already in 1910 the recognized leader of the Unified Socialists in the Chamber of Deputies. He continued to play a prominent part in International Socialist politics, striving to arrange concerted action of the working classes to make wars impossible by means of general strikes. He was the most active and effective critic of the three-years Military Service Law and other measures by which France sought in 1913 to meet German war preparations. He was assassinated July 31 1914.

JELF, SIR ARTHUR RICHARD (1837–1917), English judge, was born at Pankow, near Berlin, Sept. 10 1837, the son of the Rev. Richard William Jelf, principal of King's College, London, by his wife Countess Emmy Schlippenbach, at one time maid of honour to the Queen of Hanover. He was educated at Eton and Christ Church, Oxford, where he took his degree in 1860. He was called to the bar in 1863, and became a Q.C. in 1880. From 1879 to 1901 he was recorder of Shrewsbury, and in 1901 was raised to the bench, retiring in 1910. He died at Putney July 24 1917.

JELLICOE, JOHN RUSHWORTH JELLICOE, VISCOUNT (1859–), British admiral, was born Dec. 5 1859. His family had for some generations been connected with Hampshire, and his father held an honourable position in the merchant service. Young Jellicoe, after a preliminary education at Rottingdean, entered the navy in 1872. He soon gave evidence of exceptional industry and ability, and was fortunate in seeing active service at an early stage of his career. He served in the Egyptian War in 1882, and on his examination for promotion to lieutenant took no less than three first-class certificates. As a lieutenant he laid the foundations of that special knowledge of gunnery which was so useful to him at a later stage. The science of naval gunnery was then being revived under the inspiration and inventive genius of Comm. Percy Scott. Jellicoe while a lieutenant won the gunnery prize of £80, and thus successfully identified himself with what was, if not a new science, a new scientific development of an old art. With that of Lord Fisher, who gave it his countenance and furthered its development, the names of Sir Percy Scott and Lord Jellicoe are those which deserve to be most honourably associated with this great revival. In 1893 Jellicoe was promoted to commander and joined the "Achilles," passing soon after to the "Victoria," flagship of Sir George Tryon in the Mediterranean. He was among the survivors from this ship when she was sunk in collision with the "Camperdown" in June 1893. In Aug. of the same year Jellicoe was appointed to the "Ramillies."

In 1897 he was promoted to the rank of captain and took up his first Admiralty appointment on the ordnance committee, a service for which his proficiency in the science of gunnery had qualified him. A year later he was appointed to the "Centurion," flagship of Sir E. H. Seymour on the China station, and as chief-of-staff took part in the expedition to relieve the legations at Pekin during the Boxer rising in 1900. After this he returned to the Admiralty for two years, this time to the department of the comptroller, to whom he became naval assistant in March 1902. In Aug. 1903 he went to sea for a year in command of the "Drake," but in Nov. 1904 returned to the Admiralty for committee work, remaining there until 1907. He was a member of the design committee and in 1905 became director of naval ordnance. In 1907 he was promoted to rear-admiral and hoisted his flag (Aug. 1907) in the "Albemarle" in the Atlantic Fleet, where he remained for a year. He then once more returned to the Admiralty, this time as Third Sea Lord. In Dec. 1910 he received the appointment of vice-admiral (acting) commanding the Atlantic Fleet, the rank being made substantive in Nov. 1911. A month later he was appointed to the command of the 2nd Division of the Home Fleets; and in Dec. 1912 he returned to the Admiralty for two years as Second Sea Lord, during which time he took command of the Red Fleet in the naval manœuvres of 1913.

He was then designated as second-in-command of the Home Fleets, but on the outbreak of the World War this appointment was changed to that of commander-in-chief, Grand Fleet, in succession to Sir George Callaghan, whose term of service was in any case due to expire in a few months. He became admiral in March 1915, and admiral of the fleet in 1919. During his period of command the German fleet gave, on May 31st 1916, for the first and only time in the war, an opportunity to the British to fight a Grand Fleet action (*see* JUTLAND, BATTLE OF); but after a brilliant encircling movement by Sir David Beatty with his battle cruisers, which crossed the enemy's T and delivered him in confusion under the guns of the Grand Fleet, the Germans, aided by misty weather and successful torpedo threats on Sir John Jellicoe's deployed divisions, succeeded in extricating themselves from a situation which had seemed, even to themselves, to be hopeless. A few months later Sir John Jellicoe was succeeded as commander-in-chief by Sir David Beatty, and returned to the Admiralty as First Sea Lord, where he remained until the end of 1917. After the signing of peace he visited the principal dominions in a semi-official capacity, and in 1920 was appointed governor-general of New Zealand.

A study of this brief record of his services reveals the fact that Sir John Jellicoe at different times and in various departments had a great deal to do with the welding and preparation of the weapon which the German menace had called into existence, and his service as commander-in-chief of the Grand Fleet is largely to be judged by the condition of that weapon when it came to be tried. If he is entitled to his full share of the credit for the marvellous efficiency shown by the navy as a whole, both in the departments of material and trained personnel, he can hardly, having regard to the long years he spent in the Admiralty in positions of high technical responsibility, escape some part of the responsibility for the matters in which the naval organization showed itself to be less than perfectly equipped and prepared. Many of these defects, which caused him great difficulty and anxiety as commander-in-chief, he himself pointed out in two books written after the war; but his criticism lay open to the rejoinder that no one who was to fight in the navy had had anything like his opportunities to see to it beforehand that the requirements of the navy were supplied. It is probable that in many cases, where he had foreseen these requirements, he was not strong enough to force them on the political heads by whom expenditure was controlled—a position in which the naval officer serving on the Admiralty board is always liable to find himself. Jellicoe had great administrative experience and ability, which proved invaluable in his organization of the Grand Fleet in the early stages of the World War, and he showed a conscientious and unwearying care for the interests of those serving under him which won him the loyalty of the entire service in a remarkable degree. His previous career, however, while marked by valuable technical work and covering long periods of administration, had been of a kind to develop the qualities of an organizer rather than a tactician and fleet commander; and he undoubtedly felt the heavy responsibility that rested upon him for carrying out the policy, by no means clearly defined or consistently observed, which was laid down by the Admiralty and the War Cabinet. For much that has, with apparent reason, aroused criticism with regard to his strategy and tactics in the North Sea warfare, the Cabinet and the Admiralty should properly be held responsible. It could be said of him, at all events, after Jutland, that if he did not then succeed in overwhelming the German fleet, it was very careful not to risk another fleet action up to the end of the war, when it surrendered under the terms of the Armistice.

He received the thanks of Parliament, together with a grant of £50,000, after the Armistice, and was raised in 1918 to the peerage as Viscount Jellicoe of Scapa. He also received the Grand Cross of the Bath, the O.M. and other decorations. In 1920 he was given the freedom of the City of London. In 1902 he married the daughter of Sir Charles Cayzer, Bart., and after he had had four daughters, a son and heir was born to him in 1918. (F. Y.)

JELLINEK, GEORGE (1852–1911), Hungarian jurist (*see* 15.315), died at Heidelberg Jan. 12 1911.

JENSEN, WILHELM (1837–1911), German author (*see* 15.321), died at Munich Nov. 24 1911. His later works include *Die Fränkische Leuchte* (1901); *Vor der Elbmündung* (1905); *Unter der Tarnkappe* (1906); and *Fremdlinge unter den Menschen* (1911).

See J. A. Erdmann, *Wilhelm Jensen, sein Leben und Dichten* (1907); W. Barchfeld, *Wilhelm Jensen als Lyriker* (1913).

JESSOPP, AUGUSTUS (1823–1914), British archaeologist and author, was born Dec. 20 1823 at Cheshunt. He was educated at St. John's College, Cambridge, of which he was afterwards elected fellow. He was also hon. fellow of Worcester College, Oxford, and a select preacher of that university in 1896. His first curacy was at Papworth St. Agnes, Cambs., but the greater part of his life was given up to teaching, as headmaster of Helston grammar school from 1855 to 1859 and of King Edward VI. school, Norwich, 1859–79. He was rector of Scarning, Norf., from 1879 to 1911 and during most of that time he acted as chaplain in ordinary to King Edward VII. Besides some archaeological articles in the *Nineteenth Century* and contributions to the *Dictionary of National Biography*, he published a *History of the Diocese of Norwich* (1879); *The Coming of the Friars* (1885); *The Autobiography of Roger North* (1887) and *Trials of a Country Parson* (1890). He died at Scarning Feb. 12 1914.

JEX-BLAKE, SOPHIA (1840–1912), English medical practitioner, was born in 1840. In 1858–61 she was mathematical tutor at Queen's College, London. She subsequently set out on a tour of inspection of girls' education institutions, and in America became a pupil of Dr. Elizabeth Blackwell. In 1866 Miss Jex-Blake began a course of study in Boston under Dr. Lucy Sewall. In 1868 she returned to England and applied to the university of London for admission to their medical examinations. Being refused, she returned to the university of Edinburgh and was told that they could not admit one lady only. She got others to join her, and finally in 1869 they were admitted to classes, and in 1870 to the hospitals, though here they encountered much riotous hostility from a section of the male students. The university, however, still refused to allow graduation, and after some legal proceedings and much expense Miss Jex-Blake in 1874 went to London, where she took a leading part in establishing the London School of Medicine for Women. In 1877 this was associated with the Royal Free Hospital, and in the same year Miss Jex-Blake obtained the M.D. degree of Bern. She was also admitted a licentiate of the College of Physicians, Dublin, and member in 1880. She began practice in Edinburgh in 1878 and opened a dispensary there for women and children. In 1886 she founded the Edinburgh School of Medicine for Women. She retired in 1899. Besides various medical works she published *Medical Women* (1872) and *American Schools and Colleges* (1886). She died at Mark Cross, Sussex, Jan. 7 1912. Her niece Katherine (b. 1860) became mistress of Girton College, Cambridge, in 1916, and another niece, Henrietta (b. 1862), became principal of Lady Margaret Hall, Oxford, in 1909. Both retired in 1921.

JIREČEK, HERMENEGILD, RITTER VON SAMAKOW (1827–1909), Bohemian jurisconsult (*see* 15.417), died in 1909; and KONSTANTIN JOSEF JIREČEK (1854–1918), archaeologist and historian, died in 1918.

JOFFRE, JOSEPH JACQUES CÉSARE (1852–), marshal of France, was born at Rivesaltes (Pyrénées-Orientales) on Jan. 12 1852. While he was still a student at the École Polytechnique the Franco-German War broke out. He was given a temporary appointment as a sub-lieutenant and was employed with the artillery engaged in the defence of Paris. On the signing of peace he returned to the École Polytechnique to complete his course, and on Sept. 21 1872 was given a permanent appointment as a lieutenant in the engineers. In April 1876 he became a captain and was posted to a railway works company; after three years spent on the defence works of Paris, he returned to regimental duty in 1879. In 1885 he took part in the expedition to Formosa, and for his services was (Sept. 7 1885) made a chevalier of the Legion of Honour. From Formosa he went, as chief engineer, to Hanoï, and became responsible for the organization of the defences of Upper Tonkin. He returned to France in July 1888 and was attached for duty to the department of the inspector of engineers (War Office). Promoted commandant in May 1889 he next served for two years at Versailles with a railway operating unit. In 1892 he was seconded for service under the colonial administration, and was sent to the Sudan in order to direct the works on the Senegal–Niger railway. While in the Sudan he greatly distinguished himself in command of the force which made the brilliant and audacious march to Timbuctoo to relieve the ambushed Bonnier column, and was made a lieutenant-colonel (March 6 1894) and an officer of the Legion of Honour (Dec. 26 1894). In 1896 he returned from the Sudan and became secretary to the Military Inventions Commission, a post which he continued to hold after his promotion to colonel in Aug. 1897. Four years later he was—while serving in Madagascar under Galliéni—made a general of brigade and was appointed to command the 19th Artillery Bde. at Vincennes. He was at the same time made a member of the *Comité technique du génie.* In 1903 he became director of engineers at the War Office, and was promoted a commander of the Legion of Honour. He was made a general of division on March 24 1905, and then successively held appointments as military governor of Lille, commander of a division, permanent inspector of schools, commander of the II. Corps (Amiens), and member of the *conseil supérieur de la guerre.*

On first being nominated to the *conseil supérieur de la guerre* Joffre was designated, in case of war, to be head of the administrative and lines-of-communication services, for which task his varied experience evidently fitted him. When, however, disputes arose between the generalissimo designate, Michel, and the general staff as to the plan of campaign to be prepared for, Joffre was selected to succeed Michel, after Pau had declined the office and Galliéni had been set aside on account of age. The appointment was a surprise, as Joffre was a "colonial" and an administrator who was not familiar with the particulars of the one problem which the generalissimo might be required to solve. It was intended to give him as assistant Castelnau, a "metropolitan" soldier thoroughly versed in the details of European staff work. Castelnau however, probably on account of his clerical connexions and sympathies, was set aside, and when Aug. 1914 came Joffre's staff was constituted entirely of men of a younger generation, amongst whom Berthelot at once took the lead. Covered by his authority, it was they who conducted the offensive into Lorraine, the battle of the frontiers, and the retreat that followed. Joffre himself, by nature and through experience, was essentially a man of authority, and, feeling perhaps that the greatest need of the army and the nation in the crisis was confidence in the leader as leader, he gave himself up entirely to the act of commanding. His operations bureau indicated when and where the armies should move and fight; he himself displayed ceaseless activity to ensure that they did so. Thus, while for want of energetic command the victorious German offensive was breaking up, the French retreat, in Joffre's strong hands, became more and more coherent, till finally, when Galliéni's initiative began the counter-stroke of the Ourcq, by a supreme act of command Joffre bade the retreating army turn about and take the offensive, and was obeyed. Earlier disasters and the stabilization of the Germans in the heart of northern France were forgotten in gratitude for the Marne, and in Dec. 1914 Joffre's prestige at home and abroad was higher than that of any living man. Those who knew the inner history of the crisis were even less inclined than the rest to diminish this prestige, as it seemed that Joffre possessed the secret that had escaped all the general staffs, that of effectively commanding an army of two million citizen soldiers spread over an immense front. Moreover, that prestige was considered essential to the realization of the project of centralizing the command of all Entente forces in French hands.

During 1915, however, when Joffre and his G.H.Q. had settled down to a trench warfare for which they were not prepared, criticism began to make itself felt, especially as to the aloofness of G.H.Q. from the front, its arbitrary methods, and its stubborn attitude with respect to the civil power and Parliament. Had it not been well known that Joffre was a moderate Republican, this last—always, to the French political mind, indication of a possible *coup d'état*—would alone have caused Joffre's overthrow. Millerand fell from power chiefly because he would not reassert the Ministerial rights usurped by G.H.Q. Briand followed, and his ingenuity was taxed to the utmost in pacifying criticism while retaining Joffre, behind whose imperturbable authority the bureaux of G.H.Q. acted as they pleased. In Dec. 1915 the endeavour to impose an effective control on G.H.Q. took shape in the appointment of Joffre as commander-in-chief of French forces in all theatres; but in assuming the new and wider responsibility Joffre managed to retain his immediate command of the armies of the western front, from which it had been intended to remove him by this step. Complaints, however, which had grown more and more audible as each offensive of 1915 ended in disappointment, came to a head in the winter of 1915–6 when the French Parliament became alarmed about the state of the Verdun front. To direct inquiry by the Government, Joffre returned a direct answer that this front was safe and well equipped—coupled with a protest against any reports being listened to other than his own,—and when the storm of the German offensive broke upon this front, found it weak, and nearly swept it away, Joffre's prestige received a blow from which it did not recover. Although the policy of the Briand Government towards the general survived both the resignation of Galliéni and the secret session on Verdun, the slow progress of the battle of the Somme and the disastrous sequel to Rumania's intervention led in Nov. to the final step being taken. Nivelle was placed in charge of the armies in France, Sarrail restored to his independence as commander in the east, and Joffre called to Paris as "technical adviser to the Government" (Dec. 13). A few days later (Dec. 16) he was created a marshal of France—the first since 1870. Thenceforward his rôle in the war was that of a spectator, except for a period in which he was sent on a mission to the United States (spring 1917). Marshal Joffre was elected a member of the *Académie Française* in 1918. Having in July 1914 been given the grand cross of the Legion of Honour, he had received the still higher honour of the *médaille militaire* in Nov. 1914.

His evidence before the Briey Commission as to the early events of the war, republished under the title *La préparation de la guerre et la conduite des opérations*, is the most important document that has appeared on the French side concerning 1914. The story of his tenure of the command, on its political side is given in Mermeix's *Les Crises du Commandement*, part i.

JOHANNESBURG, TRANSVAAL, S. AFRICA (*see* 15.431).—At the 1911 census the pop. within the municipal area was 237,104, compared with 155,642 in 1904. In the interval Johannesburg had outstripped Cape Town in number of inhabitants and had become the largest city in Africa S. of Egypt. In 1919 the pop. was estimated at 260,000, of whom 149,750 were whites (the white pop. in 1904 having been 83,903).

Though other industries were developed the life of Johannesburg continued to be bound up with the working of the Witwatersrand gold-mines, and it is the business centre for the other municipalities on the Rand, some of which grew at a more rapid rate than Johannesburg itself. Improvement in the amenities of the town were carried out with energy, largely the result of the activities of the town council which acquired and worked all public utility services and possessed live stock and produce markets. New law courts, a new town hall and a municipal art gallery (the last in Joubert Park) were completed between 1910 and 1915. Eighty acres of Milner Park were given in 1916 by the town council as a site for a university; owing to the World War building did not begin till 1920. The proposed university became a constituent college of the university of South Africa, and includes the S.A. School of Mines and Technology (situated in Plein Square), and, since 1919, schools of anatomy and art. Many street improvements were effected, the suburbs provided with open spaces, and churches, clubs and handsome business premises erected by private enterprise. The Asiatic and native locations at Vrededorp, little over a mile from the centre of the city, were however allowed to remain in an insanitary and shocking condition. The S.A. Asiatic Inquiry Commission after a visit in 1920 wrote of the location, "It is difficult to conceive of a worse slum existing in any part of the world."

Johannesburg retains its position as the chief horse-racing centre in South Africa, and from 1919, when an aerodrome was laid out, it also became a centre for air travel.

The rateable value of the municipality for 1919–20 was £34,358,000 (including £14,565,000 land value) and the rate 7d. in the £ on site values. The municipal income in 1918–9 was £1,988,000, the expenditure £1,934,000. In that year the net profit on the trading departments' transactions (gas, electricity, tramways, water and markets) was £149,000.

Johannesburg was the scene of serious riots in 1913–4 arising out of strikes by white miners and railwaymen and of anti-German riots in 1915 when, following the sinking of the "Lusitania," property valued at fully £500,000 was destroyed. In 1917 the first S.A. trade union congress was held in the city. In 1919 there were strikes and disturbances among the native workers in the mines.

JOHN, AUGUSTUS EDWYN (1879–), British painter, was born at Tenby on Jan. 4 1879. He received his art education at the Slade School, London, and afterwards worked in Paris, later spending some time in Provence. He became a regular exhibitor at the New English Art Club, and in 1901–2 was teacher of art in the university of Liverpool, returning to London in 1902. He early became prominent as a powerful draughtsman and painter with a fine sense of design. His earlier work includes "The Way Down to the Sea" (1906), lent by Mr. John Quinn to the Metropolitan Museum of New York; "The Kitchen Garden," "The Smiling Woman" (1910) and "The Mumpers" (1912). For the Arts and Crafts Exhibition at Burlington House 1916, he executed a mural decoration illustrating "Peasant Industry." During the war he held a commission as official artist in the Canadian Corps, and exhibited at the Canadian War Memorial Exhibition 1919 a cartoon for a large decoration, "Canadians opposite Lens." He was later commissioned by the Imperial authorities to paint the chief characters of the Peace Conference. These portraits include two of the Emir Faisal and of Mr. W. M. Hughes, and those of Lt.-Col. T. E. Lawrence (presented to the Tate Gallery by the Duke of Westminster), Sir Robert Borden and Mr. Massey. He also painted portraits of Mr. Lloyd George (1916), Mr. Bernard Shaw (1916), Lord Fisher (1917), Lord Sumner (1918–9) and the Marchesa Casati (1918–9). His etchings form an important part of his work, the majority being produced between 1901–10. They include portraits, single figures and groups. He is marked among his contemporaries by his choice of figure subjects and a preference for small plates. He is represented in the Tate Gallery by several pictures, including "The Smiling Woman," "Peasant Industry," "Robin" (1917–8), and "Rachael," and in the Print Room of the British Museum. His early work, with its definite contour enclosing areas of colour, relates him to the quattrocento Italian painters. Distortion for personal emphasis and decorative effect is another marked characteristic. In 1921 he was elected A.R.A.

JOHN, GRIFFITH (1831–1912), Welsh missionary, was born at Swansea Dec. 14 1831. He was brought up a Congregationalist, and at the age of eight was admitted to full membership of his chapel. When only fourteen he delivered his first sermon at a prayer meeting; at sixteen he became a regular preacher, and was subsequently trained at the Brecon Congregational College for the ministry. In 1853 he offered his services to the London Missionary Society, and after two years' training sailed for Shanghai in 1855. His work in China covered a period of 55 years. In 1861 he went from Shanghai through the provinces of central China, which he was the first Christian missionary to penetrate, and he claimed that with his colleagues he had established over 100 mission stations in Hu-peh and Hu-nan. He acquired an intimate knowledge of the Chinese language and literature, and translated the New Testament and a great part of the Old into more than one Chinese dialect. In the Yang-tsze valley he founded a theological college for native preachers, which bears his name. In 1911 his health finally gave way and he returned to England. He died at Hampstead July 25 1912.

JOHNS HOPKINS UNIVERSITY (*see* 15.460) moved in 1916 to its new site at Homewood in the northern suburbs of Baltimore, and all departments were established there except those of graduate chemistry, medicine and hygiene. On the resignation in Jan. 1913 of Dr. Remsen, Dr. Frank J. Goodnow, who had been associated with the faculty of Columbia since 1883, took his place as president in Oct. 1914.

The faculty in 1920 numbered 380, the students 3,300, as against 175 faculty members and 683 students in 1907. In 1920 the library contained 226,000 bound volumes. In 1909 college courses were established for teachers and others (both men and women), given at afternoon and evening hours and on Saturday mornings, and leading to the degrees of Bachelor of Science and Bachelor of Arts. Summer courses, graduate and collegiate, work in which is credited towards various degrees, were inaugurated in 1911, and in 1916 evening classes were added under the title "courses in business economics" and "courses for technical workers," the latter conducted by the engineering department. These are open to men and women. By Act of the Maryland Legislature the department of engineering was established in 1912. This provided four-year courses in civil, electrical and mechanical engineering and in chemistry, as well as advanced graduate courses.

In June 1916, the Rockefeller Foundation of New York notified the university that the Foundation was prepared "to coöperate with the University in the establishment of a School of Hygiene and Public Health for the advancement of knowledge and the training of investigators, teachers, officials and other workers in these fields." The offer was accepted. Dr. William H. Welch was appointed director and Dr. William H. Howell was named to assist in the work of organization and administration. The main objects of the school were to establish courses for the training of qualified persons for public health work, to promote investigative work in hygiene and preventive medicine and to provide opportunities for the training of investigators in these subjects. Men and women are admitted on the same terms.

JOHNSON, HIRAM WARREN (1866–), American politician, was born at Sacramento, Cal., Sept. 2 1866. He entered the university of California but did not finish his course. He became a reporter, at the same time studying law in his father's office; was admitted to the bar in 1888; and practised with his father and his brother in Sacramento. In 1902 he established his office in San Francisco, where he became widely known for the vigour and success with which, as prosecuting attorney, he proceeded against dishonest public officials and corporations. He was elected governor of California for the term 1911–5; and in 1912 was an unsuccessful candidate for vice-president (on the ticket with Theodore Roosevelt), as the nominee of the short-lived National Progressive party, which he had helped to organize. As governor he signed in 1913 the Webb anti-alien bill, designed to prohibit the ownership of land in California by Japanese, although the President had asked for delay. He was reëlected governor 1915–9 but resigned in 1917, having been elected a U.S. senator. He opposed many of the policies of President Wilson's administration and declared that a league of nations would involve the United States in European wars. At the Republican National Convention in 1920 he had considerable support as presidential candidate, especially from those opposed to the League of Nations and the Treaty of Peace as submitted to the Senate.

JOHNSTON, SIR HENRY HAMILTON (1858–), English administrator and writer (*see* 15.473), has published in recent years *A History of the British Empire in Africa* (1910); *The Negro in the New World* (1910); *The Opening-up of Africa* (1911); *Pioneers in West Africa* (1911–3) and *Comparative Study of the Bantu and Semi-Bantu Languages* (vol. i., 1919). He has also come forward as a novelist. *The Gay-Dombeys* (1919) was an attempt to follow up the subsequent lives of some of Dickens's characters, and he employed the same method in *Mrs. Warren's Daughter* (1920), a "continuation" of G. B. Shaw's play, *Mrs. Warren's Profession.*

JONES, EMILY ELISABETH CONSTANCE (1848–), English educator, was born at Langstone Court, Hereford., in 1848. She was educated partly privately and partly at a school in Cheltenham, and afterwards went to Girton College, Cambridge, where she took a first-class in the moral sciences tripos in 1880. In 1884 she was appointed a resident lecturer at Girton, and in 1896 became vice-mistress of the college. She became mistress of Girton in 1903, and in 1916 retired.

Miss Jones published various works on moral science, including *Elements of Logic as a Science of Propositions* (1890); *Primer of Logic* (1905); *Primer of Ethics* (1909); and *A New Law of Thought and its Logical Bearings* (1911). She also, with Miss E. Hamilton, translated Lotze's *Mikrokosmus* (1885), and has edited (1902) Henry Sidgwick's *Lectures on T. H. Green, Herbert Spencer and J. Martineau.*

JONES, HENRY ARTHUR (1851–), English dramatist (*see* 15.498), produced subsequently to 1910 *The Ogre* (1911); *The Divine Gift* and *Mary Goes First* (both 1913); *The Lie* (1914) and *Cock o' the Walk* (1915), both produced in America; and *The Pacifists*, a war play produced at the St. James's theatre, London, in 1917. He also published some notable essays on patriotism and on education, and in 1920–1 carried on a vigorous newspaper polemic against Bolshevism and against the views of Mr. H. G. Wells and Mr. Bernard Shaw.

JONES, THOMAS RUPERT (1819–1911), English geologist (*see* 15.500), died at Chesham, Bucks., April 13 1911.

JOSEPH, former Archduke of Austria (1872–), Austro-Hungarian field-marshal, was born at the château of Alcsuth in Hungary May 24 1872. The prince belongs to the "Hungarian branch" of the House of Habsburg-Lorraine, and is a nephew of the last Palatine of Hungary, the Archduke Stephen. In his military career Joseph of Habsburg took over at the outbreak of the World War the post of commander of the 31st (Budapest) Div. of infantry. He fought against Serbia, then in the Carpathians, and in Poland against Russia; subsequently he commanded the IX. Corps in nine battles on the Isonzo, then commanded on the Russian front, extending from the S.E. corner of Transylvania along the ridges of the Carpathians as far as the Upper Theiss, and finally was leader of the V. Army against Italy. He displayed conspicuous personal bravery, and understood in a remarkable degree how to attach the troops to his person. During the reign of the Emperor-King Charles the Archduke Joseph repeatedly took a prominent part in politics. At the outbreak of the revolution he conducted negotiations, as *homo regius*, between King Charles and the Karolyi party (*see* HUNGARY). After the fall of the Soviet Republic he was at first made Regent of Hungary (Aug.–Sept. 1919), but was compelled to retire owing to the intervention of the Entente Powers, who would not permit any Habsburg to hold a commanding position in Hungary. He married in 1893 the Princess Augusta of Bavaria and has continued to live in Hungary.

JUTLAND, BATTLE OF.—The battle of Jutland (known to the Germans as the battle of Skagerrak), fought between the British Grand Fleet and the German High Sea Fleet on May 31 1916, round a position in lat. 57° N., long. 6° E., 75 m. from the coast of Denmark, was the one great fleet action during the World War.

The appointment of Vice-Adml. Reinhold Scheer to command the German High Sea Fleet in Jan. 1916 was the harbinger of a more offensive naval policy on the German side. The temporary cessation of their submarine operations in April 1916, following on the American note of April 18, set free a number of German submarines for fleet operations, and Scheer devised a plan for the High Sea Fleet to appear off the Norwegian coast in the hope that the British fleet would put to sea and be attacked by submarines lying in wait for it. With this object in view, 14 submarines were despatched to the Dutch coast and took up their position as follows:—Off Scapa U44, U43; off Kinnaird Head U47; off the Forth U66, U63, U51, U32, U70, U24, U52; off the Tyne U24; off the Humber UB22, UB21; off the Dogger Bank U67. Their movements had not escaped notice. The British Admiralty was on the alert. Indications derived from wireless directionals pointed to some exceptional undertaking, and in the afternoon of May 30 the C.-in-C. was warned of the probability of the High Sea Fleet coming out. The Grand Fleet at the time was in three divisions. Adml. Jellicoe was at Scapa with the main body, comprising the 1st and 4th Battle Squadrons, the 3rd B.C.S., the 2nd C.S. and three destroyer flotillas. The 2nd B.S. and 1st C.S. were at Cromarty. Beatty with the battle cruisers and 5th B.S. was in the Forth. The order to prepare for sea went out at 5:40 P.M. The Cromarty detachment was ordered to join the battle fleet at sea, and by 10 P.M. the battle fleet had passed Hoxa gate on its way to a rendezvous in lat. 57° 45′ N., long. 4° 15′ E., 240 m. from Scapa. Beatty had received orders to proceed to a position in lat. 56° 40′ N., long. 5° E., and by midnight the whole British fleet was at sea, making swiftly for the Bight.

Never had so mighty an array been marshalled under one command as that which was led by Adml. Jellicoe. One hundred and fifty-one pennants were flown, with the flags of 15 admirals, and the ships comprised 28 dreadnoughts, 9 battle cruisers, 9 cruisers, 22 light cruisers and 82 destroyers. Forty more destroyers might have been added, but for the fact that the Harwich flotillas were retained in harbour, straining at their leash. Commodore Tyrwhitt the next day, seeing the battle signals coming in, put to sea after them, but was ordered back to harbour in spite of a promise made by the C.-in-C. in Nov. 1914 that his flotillas should reënforce the Grand Fleet when word arrived that an action was imminent. The word arrived at 4:51 P.M. on May 31, but the Harwich force was not sent.

Vice-Adml. Hipper, commanding the German advance force, had left the Jade at 2 A.M. and was followed half an hour later by the German battle fleet. Though inferior to the British, it mustered 16 dreadnoughts, 6 pre-dreadnoughts, 5 battle cruisers, 11 light cruisers and 72 destroyers. Mine-sweepers had cleared the way for it past Amrum Bank, and Adml. Hipper proceeded N. with orders to show himself off the Skagerrak before dark, cruise there during the night, and join the main fleet the next day.

The constitution of the British fleet was in detail as follows:—

MAIN BODY

Fleet Flagship, "Iron Duke"
(C.-in-C., Adml. Sir John Jellicoe; Chief of Staff, Vice-Adml. Sir Chas. Madden), with attached destroyers "Oak," "Abdid."

2ND B.S. (Vice-Adml. Sir Thos. H. Jerram):
1st Div.:
"King George V." (flag),
"Ajax,"
"Centurion,"
"Erin"
(all 10 13·5-in.).
2nd Div.:
"Orion" (Rear-Adml. A. C. Leveson),
"Monarch,"
"Conqueror,"
"Thunderer"
(all 10 13·5-in.).

4TH B.S. (Vice-Adml. Sir Doveton Sturdee):
3rd Div.:
"Iron Duke" (C.-in-C.; 10 13·5-in.),
"Royal Oak" (8 15-in.),
"Superb" (Rear-Adml. Alex. L. Duff; 10 12-in.),
"Canada" (10 14-in.).
4th Div.:
"Benbow" (flag; 10 13·5-in.),
"Bellerophon" (10 12-in.),
"Temeraire" (10 12-in.),
"Vanguard" (10 12-in.).

1ST B.S. (Vice-Adml. Sir Cecil Burney):
5th Div.:
"Colossus" (Rear-Adml. E. F. Gaunt),
"Collingwood,"
"Neptune,"
"St. Vincent"
(all 10 12-in.).
6th Div.:
"Marlborough" (flag; 10 13·5-in.),
"Revenge" (8 15-in.),
"Hercules" (10 12-in.),
"Agincourt" (14 12-in.).
With attached light cruisers "Boadicea," "Blanche," "Bellona," "Active."

1ST C.S. (Rear-Adml. Sir Robert Arbuthnot):
"Defence" (flag; 4 9·2-in., 10 7·5-in.),
"Warrior" (6 9·2-in., 4 7·5-in.),
"Duke of Edinburgh" (6 9·2-in., 10 6-in.),
"Black Prince" (6 9·2-in., 10 6-in.).

2ND C.S. (Rear-Adml. H. L. Heath; 10 7·5-in.):
"Minotaur" (flag; 4 9·2-in.),
"Hampshire" (4 7·5-in., 6 6-in.),
"Cochrane" (6 9·2-in., 4 7·5-in.),
"Shannon" (4 9·2-in., 10 7·5-in.).

3RD B.C.S. (Rear-Adml. Hon. Horace Hood):
"Invincible" (flag; 8 12-in.),
"Indomitable" (8 12-in.),
"Inflexible" (8 12-in.).

4TH L.C.S. (Commodore C. Le Mesurier):
"Calliope,"
"Constance,"
"Comus,"
"Caroline,"
"Royalist"
Attached light cruisers "Chester," "Canterbury."

DESTROYERS WITH BRITISH MAIN BODY

11TH FLOTILLA: "Castor" (Commodore Jas. R. P. Hawkesley, Commodore),
"Kempenfelt," "Ossory," "Mystic," "Moon," "Morning Star," "Magic," "Mounsey," "Mandate," "Marne," "Minion," "Manners," "Michael," "Mons," "Martial," "Milbrook."

12TH FLOTILLA: "Faulknor" (Capt. Anselm Stirling, Comm.),
"Marksman," "Obedient," "Maenad," "Opal," "Mary Rose," "Marvel," "Menace," "Nessus," "Narwhal," "Mindful," "Onslaught," "Munster," "Nonsuch," "Noble," "Mischief."

4TH FLOTILLA: "Tipperary" (Capt. Chas. J. Wintour, Comm.),
"Brook," "Achates," "Porpoise," "Spitfire," "Unity," "Garland," "Ambuscade," "Ardent," "Fortune," "Sparrowhawk," "Contest," "Shark," "Acasta," "Ophelia," "Christopher," "Owl," "Hardy," "Midge."

ADVANCED FORCE

Battle Cruiser Fleet, Flagship, "Lion"
Vice-Adml. Sir David Beatty; Chief of Staff, Capt. R. W. Bentinck (8 13·5-in.).

1ST B.C.S.:
"Princess Royal" (flag; Rear-Adml. Osmond de B. Brook),
"Queen Mary,"
"Tiger"
(all 8 13·5-in.).

2ND B.C.S.:
"New Zealand" (flag; Rear-Adml. Wm. C. Pakenham, 8 12-in.),
"Indefatigable" (8 12-in.).

5TH B.S.:
"Barham" (flag; Rear-Adml. Hugh Evan-Thomas),
"Valiant,"
"Warspite,"
"Malaya"
(all 8 15-in.).

1ST L.C.S.:
"Galatea" (flag; Commodore E. S. Alexander-Sinclair),
"Phaeton,"
"Inconstant,"
"Cordelia."

2ND L.C.S.:
"Southampton" (flag; Commodore W. E. Goodenough),
"Birmingham,"
"Nottingham,"
"Dublin."

3RD L.C.S.:
"Falmouth" (Commodore T. D. W. Napier),
"Yarmouth,"
"Birkenhead,"
"Gloucester."

DESTROYERS WITH ADVANCED FORCE

1ST FLOTILLA: "Fearless" (Capt. C. D. Roper, Comm.),
"Acheron," "Ariel," "Attack," "Hydra," "Badger," "Goshawk," "Defender," "Lizard," "Lapwing."

13TH FLOTILLA: "Champion" (Capt. J. U. Farie, Comm.),
"Nestor," "Nomad," "Narborough," "Obdurate," "Petard," "Pelican," "Nerissa," "Onslow," "Moresby," "Nicator."

9TH AND 10TH FLOTILLAS (Harwich): "Lydiard" (Comdr. Malcolm Goldsmith),
"Liberty," "Landrail," "Laurel," "Moorsom," "Morris," "Turbulent," "Termagant."
Seaplane Carrier, "Engadine."

The German High Sea Fleet was organized as follows:—

MAIN BODY

Fleet Flagship, "Friedrich der Grosse"
(C.-in-C., Vice-Adml. Reinhold Scheer; Chief of Staff, Capt. Adolf von Trotha).

3RD SQUADRON (Rear-Adml. Behncke):

5th Div.:	*6th Div.:*
"König" (flag),	"Kaiser,"
"Grosser Kurfürst,"	"Kaiserin,"
"Kronprinz,"	"Prinzregent Luitpold"
"Markgraf"	(all 10 12-in.).
(all 10 12-in.).	

1ST SQUADRON (Vice-Adml. Ehrhard Schmidt):

1st Div.:	*2nd Div.:*
"Ostfriesland" (flag),	"Posen,"
"Thüringen,"	"Rheinland,"
"Helgoland,"	"Nassau,"
"Oldenburg"	"Westfalen"
(all 12 12-in.).	(all 12 11-in.).

2ND SQUADRON (Rear-Adml. Mauve):

3rd Div.:	*4th Div.:*
"Deutschland" (flag),	"Hannover,"
"Hessen,"	"Schlesien,"
"Pommern"	"Schleswig-Holstein"
(all 4 11-in.).	(all 4 11-in.).

4TH SCOUTING GROUP (Light Cruisers; Commodore von Reuter): "Stettin," "München," "Frauenlob," "Stuttgart," "Hamburg."

DESTROYERS WITH MAIN BODY

"Rostock," light cruiser (Commodore Michelsen, First Commodore T. B. Forces).

1ST HALF FLOTILLA (Comdr. Albrecht): G39 and 5 boats.

3RD FLOTILLA (Capt. Böst): G101 and 10 boats.

5TH FLOTILLA (Capt. Heinecke): G11 and 10 boats.

7TH FLOTILLA (Capt. von Koch): S24 and 10 boats.

ADVANCED FORCE

(Vice-Adml. Hipper).

1ST SCOUTING GROUP	2ND SCOUTING GROUP (Light Cruisers):
"Lützow" (8 12-in.),	"Frankfurt", (flag; Rear-Adml. Bodicker),
"Derfflinger" (8 12-in.),	"Pillau,"
"Seydlitz" (8 12-in.),	"Elbing,"
"Moltke" (10 11-in.),	"Wiesbaden."
"Von der Tann" (8 11-in).	

DESTROYERS WITH ADVANCED FORCE

"Regensburg," light cruiser (Commodore Heinrich, Second Commodore T. B. Forces).

2ND FLOTILLA (Capt. Schuur): B98 and 10 boats.

6TH FLOTILLA (Capt. Max Schultz): G41 and 10 boats.

9TH FLOTILLA (Capt. Göhle): V28 and 10 boats.

The British fleet was decidedly superior in almost every material element of fighting strength except armour protection, in which Beatty's battle cruisers were inferior to Hipper's.

The following table gives the aggregate strength of the opposing forces:—

ADVANCED FORCES

	British	German
Dreadnoughts	4	0
Battle cruisers	6	5
Light cruisers	12	5
Destroyers	29	33
Seaplane carrier	1	0

MAIN BODY

	British	German
Dreadnoughts	24	16
Pre-dreadnoughts	0	6
Battle cruisers	3	0
Armoured cruisers	8	0
Light cruisers	10	6
Destroyers	53	39

The total fleet on both sides may further be classified thus:—

	Dr.	Pre-dr.	B.C.	Cr.	L.C.	T.B.D.
British	28	0	9	8	22	82
German	16	6	5	0	11	72

On a tonnage basis the British fleet had a superiority of about seven to four. Its superiority in heavy guns was equally marked. The British had a total of 344 heavy guns (48 15-in., 10 14-in., 142 13·5-in., 144 12-in.) with a weight of discharge of 396,700 lb. The Germans had a total of 244 heavy guns (144 12-in. and 100 11-in.) with a weight of discharge of 189,940 lb. The British fleet was also considerably superior in speed. Its slowest battleship had a sea-going speed of 20 knots, its fastest (the Barham class) could do 25. The German Königs, in spite of a current belief that they could do 23 knots, did little more than 21, and the six Deutschlands of the 2nd Squadron only 16.

Neither submarine nor aircraft played any actual part in the battle. In spite of numerous reports to the contrary, there was not a single submarine with either fleet nor in the immediate vicinity. A single seaplane was flown from the "Engadine" (with Beatty's force) but its report never reached the "Lion." The Germans had five Zeppelins on reconnaissance work to the N.W. of Heligoland, but they saw nothing of the battle.

At 2 P.M. the forces were in the position shown in fig. 1.

Beatty bore S.S.E. from Jellicoe. Criticism has been directed against the distance at which he was operating from the main body. It may be said that, though the speed of the battle cruisers and the presence of the 5th Battle Squadron greatly diminished the danger of operating so far apart, there was no real advantage in it; and had the distance of the battle fleet been reduced to 30 m., the battle would have been joined an hour earlier. The wide separation of the two forces introduced a further complication. No arrangements had been made for maintaining visual touch, with the result that a discrepancy arose between the reckonings of the two forces, which led later to uncertainty as to the "Lion's" position and that of the enemy.

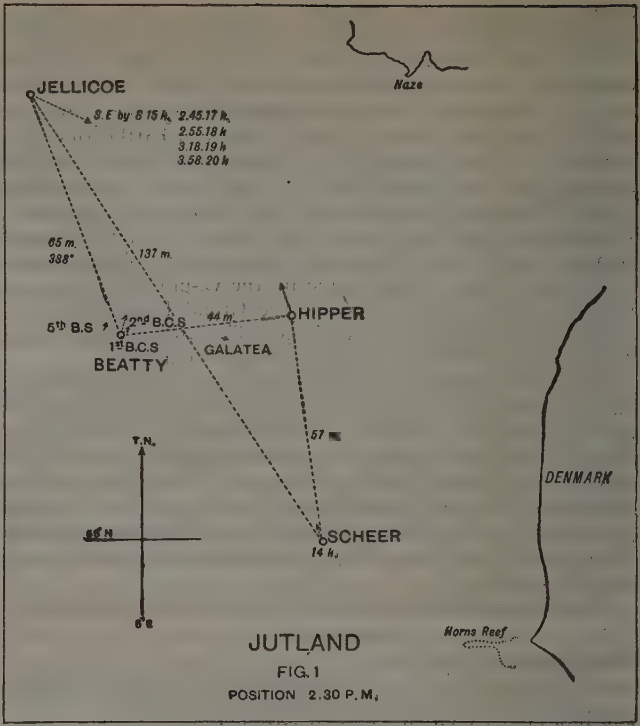

JUTLAND

FIG. 1

POSITION 2.30 P.M.

Both Jellicoe and Beatty were behind time in reaching their positions. Jellicoe's fleet was in six columns disposed abeam 1 m. apart on a S. 50° E. course zigzagging at 15 knots, with the first C.S. and second C.S. some 6 m. ahead spread 4 m. apart. Hood and the 3rd B.C.S. were some 20 m. ahead of him on the port bow. At 2:15 Beatty had reached his rendezvous and turned to N.E. to join the main body. The four battle cruisers of the 1st B.C.S. were in single line, led by the "Lion" and screened by the 13th Flotilla; the 5th B.S. was 5 m. off to the N.N.W. screened by the 1st Flotilla; the 2nd B.C.S. was 3 m. E.N.E. of the "Lion." The 12 light cruisers of the 1st, 2nd, 3rd L.C.S. were spread on a line bearing E.N.E. 8 m. apart, with the centre of the screen bearing S.S.E. 8 m. from the "Lion." Meanwhile Hipper's force of 5 battle cruisers, 5 light cruisers and 33 destroyers was on a northerly course some 50 m. ahead of Scheer and about 50 m. E. of Beatty. His light cruisers, with a number of attendant destroyers, were spread in a semicircle about 10 m. ahead. The German main fleet of 22 battleships, coming on behind him, was in line ahead, steering N. at 14 knots with the seven Königs in the van, the Heligolands led by the "Friedrich der Grosse" in the centre and the Deutschlands in the rear. The battleships were 763 yd. and squadrons 3,800 yd. apart.

The battle which followed may be divided conveniently into three principal phases:—

Phase I.: 2:15 to 5:40 P.M.—The battle-cruiser action between Beatty and Hipper. Hipper's junction with Scheer and the run to the north.

Phase II.: 5:40 to 9 P.M.—The junction with Jellicoe, the deployment of the British battle fleet at 6:15; Scheer's turn-away at 6:35. Scheer's return and second turn-away at 7:17 P.M. The British turn-away at 7:22 P.M. Beatty's engagement at 8:17 P.M.

Phase III.: 9 P.M. to 3:30 A.M.—The British fleet steers south. Scheer shapes course to the S.S.E. across its stern, breaks through the British destroyer flotillas and reaches Horn's Reef.

To return to the action impending between the battle cruisers. About 2:10 the "Elbing," on the left wing of Hipper's screen of light cruisers, sighted a neutral steamer and despatched a destroyer to examine it. The "Galatea" sighted the steamer and destroyer and proceeded to close them. The two forces were in touch and the light cruisers began to stream down to the point of contact, while Beatty altered course to S.S.E. at 2:32 P.M. to cut the enemy off from Horn's Reef. The 5th B.S. unfortunately did not immediately follow suit, but continued on its northerly course till 2:40 P.M., opening its distance from 5 to over 7 m. so that subsequently a considerable delay was caused in its coming into action. Hipper's light cruisers proceeded to chase the "Galatea" to the N.W., while the battle-cruiser forces, working up to full speed, came hurrying up to the support of their light cruisers.

At 3:24 P.M. the smoke of Hipper's battle cruisers could be seen, and at 3:30 they came in sight of the "Lion" bearing N.E. and steering N.N.W. Beatty now increased to 25 knots, and ordered the 2nd B.C.S. to take station astern. The enemy were still some 23,000 yd. off. Everything augured well for the coming battle. The visibility was good, the sun was behind the British squadron and the wind southeast. At 3:45 Beatty made a signal to the battle cruisers to form on a line of bearing N.W. to clear the smoke; but he had hardly done so when, at 3:48 P.M., the "Lützow" opened fire at 14,250 yd., and both squadrons turned to the S. to engage. Beatty's battle cruisers were now in single line ahead, Hipper's in starboard quarter line, and a fierce action ensued between the two squadrons, running to the S. on parallel courses at ranges varying from 14,500 to 20,000 yards. The action had hardly lasted a quarter of an hour when one of the "Lion's" turrets was hit by a shell which burst inside and put the turret out of action. Maj. Francis Harvey, R.M.L.I., the officer of the turret, though mortally wounded, ordered the magazine doors to be closed, a precaution which saved the ship from destruction and won him a V.C. in death. Almost at the same time a salvo from the "Von der Tann" struck the "Indefatigable" (Capt. C. F. Sowerby) by the after-turret at 4:2 P.M., and drove her out of line, sinking by the stern. As the fleet went on, another salvo struck her forward and she turned over and disappeared.

The 5th B.S., which was some 7 m. behind Beatty when the action began, did not get within range till about 4:11 P.M.; it then opened fire at 19,000 yd. on the rear ship, the "Von der Tann." By 4:16 the "Moltke" was also under its fire, but the light was becoming difficult and the enemy could not be clearly seen. Another disaster now befell the British battle cruisers. At 4:26 P.M. a salvo from the "Derfflinger" struck the "Queen Mary," causing an explosion in the forepart of the ship, and she sank by the bows with the stern high in the air. Then followed a terrific explosion, which rent the whole ship, and she disappeared in a dense pall of smoke. The "Tiger" and "New Zealand" passed through the dreadful cloud with a rain of debris falling on their decks. But the fire of the British battle cruisers, joined to that of the 5th B.S., was now telling heavily on the enemy; and at 4:30 P.M. Hipper turned abruptly four points to port and proceeded E., with the "Lützow" on fire.

The loss of these two British battle cruisers must be attributed to insufficient armour protection and defective turret construction, which allowed flash and flame to pass into the magazines. The Germans had profited by the lesson learnt at the Dogger Bank, when the turrets of the "Seydlitz" were burnt out, and their turrets had been equipped with suitable safeguards.

As early as 4:15 P.M. the 13th Flotilla, on the "Lion's" starboard side, had been ordered to attack and, crossing the "Lion's" bows about 4:30 P.M., rushed to the S.E. to do so. The German destroyers came out to meet them, and a sharp destroyer action developed between the two lines. Two German boats were lost—V27 sunk by gunfire and V29 by a torpedo from the "Petard." The "Nestor" (Comdr. Hon. E. A. Bingham), "Nomad" and "Nicator" pressed boldly on to the E. and pushed home their attack, but were badly hit, and the first two were left helpless between the lines, to be sunk by a tornado of fire from the German battle fleet as it came up. Their crews were saved by German destroyers, and Comdr. Bingham was awarded a V.C. No torpedoes got home on either side.

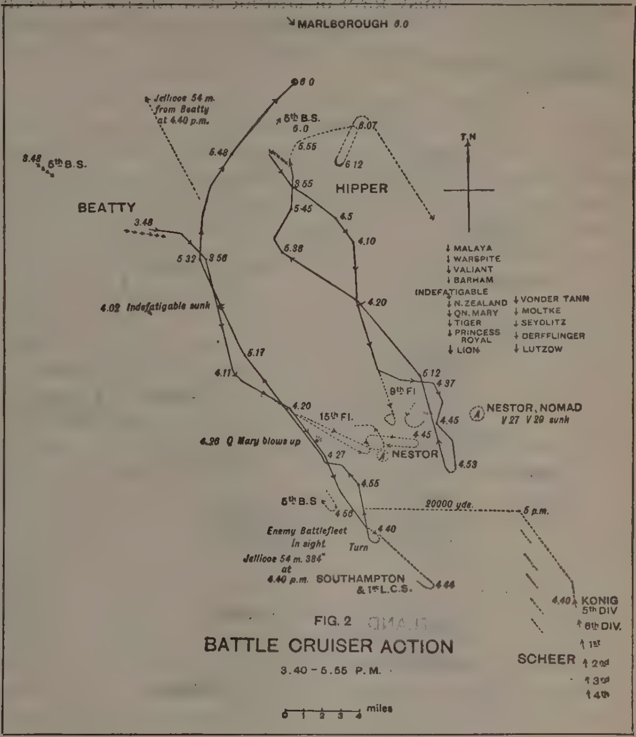

FIG. 2

BATTLE CRUISER ACTION

3.40 – 5.55 P.M.

It was now 4:33 P.M. The battle cruisers had run some 20 m. to the S. since the action commenced, when the "Southampton," 4 m. ahead of the "Lion," suddenly sighted the enemy's battle fleet to the S.E. for the first time during the war. The great opportunity so eagerly awaited in the British fleet seemed to have come at last. The German fleet was some 14 m. off, and at 4:40 P.M. Beatty, still well beyond its range, turned to the N. to draw it back on Jellicoe and the battle fleet. The 5th B.S. was coming down from the N. and at 4:48 P.M. he signalled to them to turn. Unfortunately the rear-admiral delayed his turn till 4:56 and ran past the battle cruisers, perhaps with the intention of covering them, but with the result that the squadron came under a heavy fire from the leading division of Scheer's battle fleet, and the "Barham," "Warspite" and "Malaya" were severely hit. Scheer, on receiving information of the British battle cruisers at 3:35, had closed his line to battle formation (ships 545 yd. and squadrons 1,090 yd. apart). At 4:5 P.M. he altered course N.W. and increased to 15 knots, and at 4:20 altered course to W., intending to catch Beatty between two fires. But hearing that five battleships had joined in the fight he thought better of it and turned to north. At 4:30 the British forces were in sight. The weather was clear, with a light breeze from north-west. At 4:45 fire was opened by the Königs in the van on the 5th B.S. Hipper, as he saw the battle fleet coming up, turned to starboard at 4:48 and took station 7 m. ahead of it.

Now commenced a long rush to the N., with Scheer some 10 m. on Beatty's starboard quarter and Hipper 9 m. or so to the eastward. At 4:45 P.M. Jellicoe was some 66 m. to the N.W., and Hood with the 3rd B.C.S. some 30 m. to the N.N.E., so that Scheer was approaching the mouth of a trap, with Jellicoe to the N.W., Hood to the N.E., and Beatty to the W. shepherding him in. Beatty's squadron had suffered severely, but if he could once bring Scheer within reach of the thunderbolt coming down on him from the N.W. his losses should be amply avenged.

Jellicoe meanwhile, going S.E. by S. at 19 knots, had received news of the enemy battle cruisers at 3:40 P.M., and had increased to 20 knots at 3:59. Hood had been ordered to proceed to Beatty's support at 4:5 and had shaped course S.S.E. at 25 knots, a course which turned out very happily in the end, and gave the enemy an entirely wrong idea of the tactical situation. The discrepancies in reckoning, in conjunction with mistakes arising from the clumsy form of latitude and longitude code in use at the time, made it difficult for the C.-in-C. to get a clear idea of the exact situation, but by 4:45 P.M. it was clear to him that the enemy's battle fleet was coming N. and he informed the Admiralty that a fleet action was imminent. The word ran down to the dockyards and started a bustle of preparation to meet the needs of the fleet. It is impossible to give in detail the events of the next crowded hour. It was of great importance for the C.-in-C. to get the correct bearing of the enemy battle fleet, but the wireless reports were confusing for the reasons mentioned above. The "Iron Duke" was actually some 4 or 5 m. to the S.E. of her reckoning and the "Lion" some 5 m. to W. of hers, which threw out their bearings and the estimated positions of the enemy.

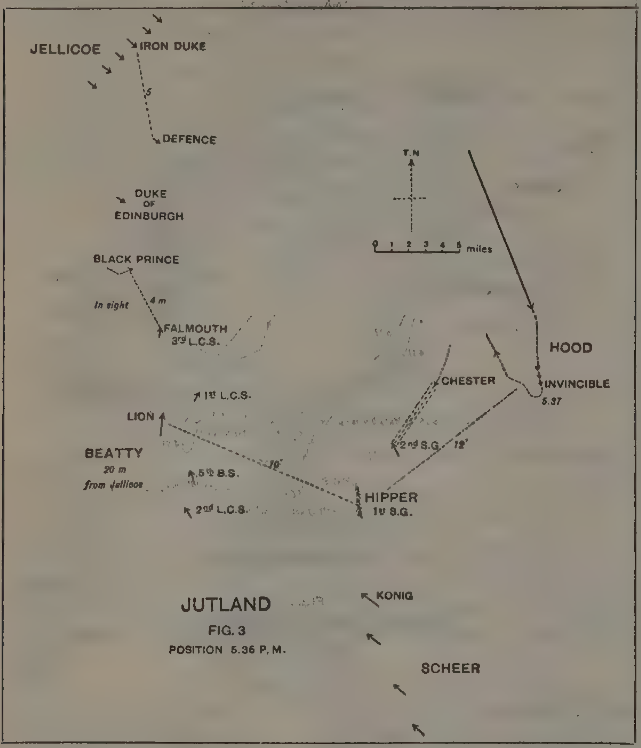

JUTLAND
FIG. 3
POSITION 5.36 P.M.

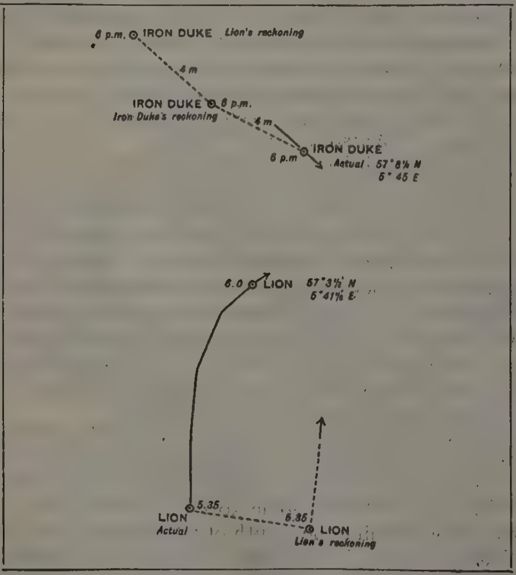

Fig. 4.—Discrepancies in Reckonings ("Iron Duke" and "Lion").

The 5th B.S., following some 3 m. astern of the "Lion," remained for some time within range of the enemy battle fleet, and its rear ship, the "Malaya," was being hit right up to 5:35 P.M. This gave rise to an erroneous idea that the enemy had a speed much in excess of 21 knots, but it was due to the 5th B.S. running on a convergent course and not to the enemy's speed, which never exceeded 21 knots.

Between 5:40 and 6 P.M. two actions developed. The action between Beatty and Hipper burst out afresh (5:40); the "Chester" (on the starboard beam of Hood's squadron), coming down from the N.E., struck the 2nd Scouting Group ahead of Hipper, got badly mauled and retired—leaving the British with the heroic picture of Boy Jack Cornwell winning the V.C. Hipper, whose fire was hampered by the setting sun, was heavily hit by Beatty and was forced to turn to the eastward (5:53). By this time Hood in the "Invincible" had arrived on the scene some 20 m. to the E. of Beatty; hearing the roar of the guns, he turned to the N. with the 3rd B.C.S. (5:57) and engaged the light cruisers of the 2nd S.G. to the W., which were chasing the "Chester" east. The sudden appearance of battle cruisers to the E. gave Boedicker's cruisers a severe shock. Hood's 12-in. shell forced them sharply to the S.E. (5:55), seriously damaging the "Pillau" and sending the "Wiesbaden" limping W. to her destruction. The "Shark's" little flotilla behind the 3rd B.C.S. saw the German light cruisers and pushed boldly out to the N.W. to attack them. Hipper, now coming E. behind Boedicker, heard the "Invincible's" guns ahead, thought they were those of the British battle fleet, took the "Shark" to be the head of a big destroyer attack, and turned right round to S.W. to close his own battle fleet (6:7). The German 9th Flotilla rushed out to screen their light cruisers, drove off the "Shark's" little flotilla and sank the "Shark"; the V48 was sunk at this time, and, close to where Jack Cornwell won his V.C., Comm. Loftus Jones, with his leg shot off and his ship sinking, won another. Hipper, after proceeding to the S.W. for five minutes, turned round again at 6:12 P.M., and as he came up on a N.E. course, the little "Acasta" (Lt.-Comdr. J. O. Barron), which had been trying bravely to help the "Shark," sent a torpedo into the "Seydlitz."

All this happened some 10 m. ahead of the British battle fleet, which was now close at hand to the north-west. Its deployment had been deferred too long, and it was still in divisions disposed abeam, with the "Marlborough" on the starboard wing. Mist had come down, reducing the visibility to 5 or 6 m., and it was difficult to get a correct idea of the situation, for the thunder of heavy guns could be heard from right ahead (Hood) almost to the starboard beam (Beatty). The "Lion" had been steering approximately N. by E. since 5:35 P.M., with the 5th Battle Squadron about 3 m. on her starboard quarter. The "Falmouth," ahead of the "Lion," was in touch with the "Black Prince" as early as 5:30 P.M., but it was not till about 5:55 P.M. that Beatty's force could be clearly seen. By 6 P.M. the battle fleet was clearly in sight, and, finding himself converging on the "Marlborough," which was then some 3 m. N. by E., Beatty turned to the E. to take station ahead of her. Scheer had deployed at 5:42 P.M. and was now on a N.E. course led by the "König," which at 6:14 P.M. was about 7½ m. 27° on the "Marlborough's" starboard bow. At this moment two reports of the enemy battle fleet came in from the "Barham" and "Lion," the former placing it S.S.E., the latter S.S.W. The "Lion" was then a mile or two sharp on the "Iron Duke's" starboard bow, going hard to the E. and engaging the enemy. The "Barham" was some 3 m. off, before the "Iron Duke's" beam, drawing ahead of the "Marlborough" on a S.E. course. In conditions of low visibility, the C.-in-C. had prescribed a deployment on the wing next the enemy, and this is evidently what Beatty expected. But there seemed to be a risk of deployment into single line on the right wing, involving the "Marlborough" and her division in a premature action, and the C.-in-C. decided to deploy on the left wing. The signal, equal speed—pennant, C.L.—went up at 6:15 P.M.

With columns covering a front of 5 m., to deploy on the wing farthest from the enemy meant an increase of the range from about 8,500 to 13,000 yd., a serious matter when visibility was not much more than 11,000 yards. But in the mist and uncertainty one thing could be clearly seen.

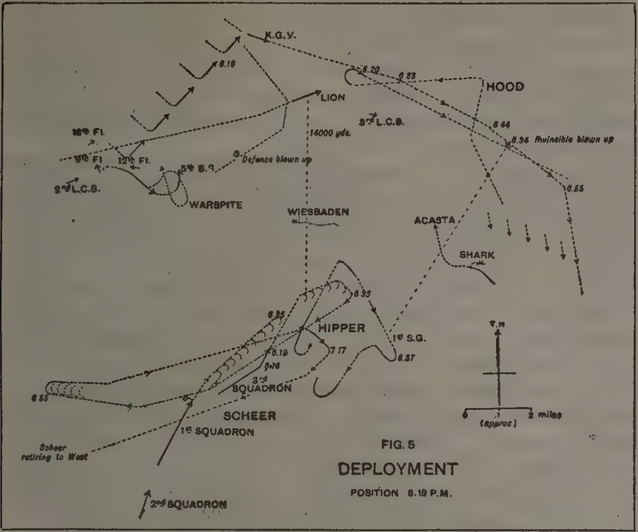

FIG. 5

DEPLOYMENT

POSITION 6.19 P.M.

The "Lion" with Beatty's flag could be seen some 2 m. ahead of the "Benbow," steering E.S.E. and engaging the enemy. To bring the enemy within effective range, the C.-in-C. had only to follow in that direction, ordering the battle fleet to deploy on one of the centre columns led by the "Benbow" or "Iron Duke." Whether this course occurred to the C.-in-C. it is impossible to say (no mention of it appears in his own book). In any case, the deployment signal did not permit of deployment on a centre column or on any but a wing column. The deployment therefore began on the left wing. The "King George V." led out on a S.E. by E. course; the five leaders of divisions turned to N.E., their ships formed a long single line behind them and filed round behind the "King George V." The "Defence" ahead of the battle fleet had already engaged the 2nd S.G. about 5:50 P.M. and now saw the "Wiesbaden" returning. She pressed impatiently with the "Warrior" across the bows of the "Lion" to engage her, only to receive two crushing salvos from the "Lützow" or "Friedrich der Grosse," and to blow up at 6:19 P.M. in a vast pall of smoke. The deployment on the left wing placed Rear-Adml. Evan-Thomas in a difficult position. The battle orders instructed him to take station in the van in the event of the enemy deploying away from Heligoland, but this meant fouling the range of the battle fleet, and he decided to turn up astern of the "Marlborough" and made a wide sweep to port to do so; here the "Warspite's" helm jammed (6:17), and she made a complete circle to starboard, passing right round the "Warrior," saving her from the fate of the "Defence." The deployment was completed by 6:40 P.M. When it started Scheer was coming up on a N.E. course. By 6:27 P.M. when the fleets engaged, his 1st and 3rd Squadrons were on an E.N.E. course, just visible in twos and threes at about 14,000 yards.

Both fleets were now steering to the E. on approximately parallel courses. The "Iron Duke" opened fire at 6:30 P.M., and between 6:25 P.M. and 6:40 P.M. the British, who had evidently much the better horizon, were able to inflict considerable punishment on the head of the German line, whose ships could see nothing but the flashes of the British guns. Meanwhile the "Invincible" had turned E. ahead of Beatty's squadron and come into action (6:23 P.M.) with Hipper as he came up again on a N.E. course. A fierce engagement ensued between them, running to the S.E. at about 10,000 yd. The mist cleared for a few minutes, and at 6:34 the "Derfflinger" sent a salvo into the "Invincible's" midship turret. A tremendous explosion followed, the masts collapsed, and the great ship disappeared beneath the waves, leaving her bow and stem standing as if to mark the place where an admiral lay. The "König" at the head of the German line had turned to S.E. at 6:33 P.M. Scheer was now fully alive to the fact that he was facing the entire British fleet. The whole northern horizon was aflame. He gave the order for a "battle turn" (*Gefechtswendung*). The whole line turned at 6:35 and drew off to westward. In the mist and smoke it was lost to view and Scheer obtained a much-needed respite.

As the line turned, the German 3rd Flotilla darted out to attack the British line. It was recalled, but three boats (G88, V73, and S32) went on and, unopposed by any British flotillas, who were apparently too busy taking up their deployment positions to notice them, made two attacks on the British line, one of which was probably responsible for torpedoing the "Marlborough" at 6:54 P.M. At 6.55 P.M. the long British line turned to S., leaders together, bringing the fleet into divisions again with guides bearing south-east. The movement fulfilled no tactical purpose. It had taken half an hour to deploy the fleet, and no sooner was it deployed than it turned back into divisions in a formation unsuitable either for attack or defence. The "Marlborough's" division was left on the right wing, exposed to attack, uncovered by any of the destroyer flotillas, which remained clinging to the positions given them for deployment in single line.

Beatty grasped the significance of the new formation, and, turning to allow the 3rd B.C.S. to take station behind him, shaped course to the S.W. right across the track of the advancing battle fleet and towards its exposed wing. Scheer was meanwhile making to the W. in a ragged sort of single line, with the battle cruisers in rear. The "Lützow" was down by the bows and on fire, and Hipper left her to transfer his flag to the "Seydlitz," but, finding her full of water with her wireless out of action, went on to the "Moltke." But the battle cruisers had now turned to renew the action; the "Moltke" was under fire and could not stop, and it was 9 P.M. before Hipper could get on board.

When Jellicoe turned to S. at 6:55 P.M. the German fleet was some 13 m. S.W. of him, making to the westward. Scheer's next movement was one which exposed him to a tremendous counterblow. He still had his whole fleet with him, and as it was too early to get into formation for the night he decided to turn and make a determined advance in the teeth of the foe. The motives actuating him are described by himself as follows. If the British were following him his move to the W. was nothing more than a retreat, which would involve the sacrifice of damaged ships and meant his tactics being dictated by the enemy. It was still less feasible to try and detach himself from the enemy, leaving the British C.-in-C. to choose where to engage him in the morning. The only way of preventing this seemed to be to force the British into a second battle by another determined advance. This would be bound to surprise the enemy and upset his plans for the rest of the day, and, if the blow fell heavily, would help the German fleet to liberate itself during the night. These arguments are grandiloquent but inconclusive, and it is more probable that Scheer intended to slip past the stern of the British fleet unobserved, but he had mistaken its position and ran right into it. In any case, the fact that Scheer did liberate himself must not obscure the fact that his movement was full of risk, and, had the British fleet been pursuing him, must have ended in disaster. As it was, it met with a considerable measure of success. The whole German line swung round together to the E. again (6:55 P.M.), with the battle cruisers ahead led by Capt. Hartog in the "Derfflinger." The German destroyers attached to the battle cruisers attacked the "Marlborough's" division about 7 P.M., but were driven off by gunfire, after firing six or seven torpedoes without effect.

At 7:12 P.M. the British fleet coming S. saw the enemy battle cruisers returning through the mist. The Germans sighted them simultaneously and turned parallel to the British course at a range of under 10,000 yards. The "Hercules" opened on the "Seydlitz," and the guns of most of the fleet, with Beatty's battle cruisers ahead of it, joined in. The "Derfflinger" and "Seydlitz," now came under a terrific fire. In the former two 15-in. shells (probably from the "Revenge") crashed into the after-turrets, igniting the charges and sending great pillars of flame roaring skywards in which the crews of both turrets perished. The "Derfflinger" succeeded in getting two hits into the "Colossus," the only hits scored by the Germans on the battle fleet. Scheer, some 3 m. behind his battle cruisers, saw it was time to turn. The line swung round together to the W. again at 7:17 P.M., and the 6th and 9th Flotillas threw up a smoke cloud and rushed out to attack.

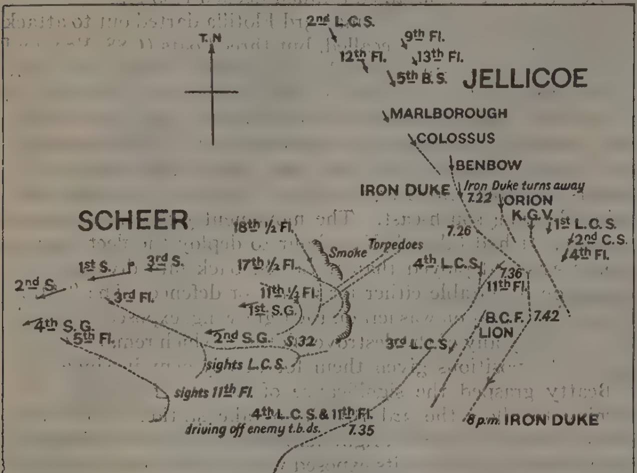
T.N
2nd L.C.S.
9th Fl.
12th Fl.
13th Fl.
5th B.S.
JELLICOE
MARLBOROUGH
COLOSSUS
BENBOW
IRON DUKE
Iron Duke turns away 7.22
ORION
K.G.V.
1st L.C.S.
2nd C.S.
4th Fl.
SCHEER
18th ½ Fl.
7.26
Smoke
Torpedoes
1st S.
3rd S.
17th ½ Fl.
4th L.C.S.
7.36
2nd S.
3rd Fl.
11th ½ Fl.
11th Fl.
1st S.G.
B.C.F.
7.42
LION
4th S.G.
5th Fl.
2nd S.G.
8.32
3rd L.C.S.
sights L.C.S.
sights 11th Fl.
4th L.C.S. & 11th Fl. driving off enemy t.b.ds.
7.35
8 p.m. IRON DUKE

FIG. 6
7.22 P.M.
"IRON DUKE'S" TURN-AWAY

As they approached, the British battle fleet turned away two points to port by signal at 7:22 P.M. and another two points at 7:26, making the "Iron Duke's" course south-east. This was the "turn-away" which has given rise to considerable controversy. Eleven torpedoes reached the lines of the 1st B.S. at 7:35 P.M. and were avoided by the use of helm. The British fleet was now going no more than 15 knots. The 5th B.S. (except the "Warspite," which had fallen out) was plodding along in rear at the same speed, wasting all the foresight, money and ingenuity expended in giving it a speed of 25 knots to pursue and encircle an enemy. But now the real counter to torpedo attack was found. The 4th L.C.S. and 11th Flotilla were ordered to attack and were making W. towards the exposed wing of the battle fleet. The German 5th and 3rd Flotillas, which were advancing to attack, fled before them, and only one of their torpedoes reached the "Marlborough's" line. At 7:35 P.M. Adml. Jellicoe turned back from S.E. to S. by W. and re-formed single line on a S.W. course by 8 o'clock.

The actual transfer to the E. of the original course in the case of the "Marlborough," caused by the turn-away, was little more than 1,250 yards. This in itself was no great distance, but the retention of the battle fleet on a south-easterly course, while the enemy was making W., opened a gap of several miles between the two fleets and made it difficult to renew the engagement before nightfall. The only movement of any real use at 6:55 P.M. and 7:22 P.M. was to follow the enemy and cut him off, as the battle cruisers attempted to do. From 6:55 P.M. the British fleet was meandering along to the S., when tactics of encirclement and pursuit were required to deal a decisive blow. Unfortunately Adml. Jellicoe considered the risk of submarine and torpedo too great for such tactics, though there were no submarines anywhere near the scene of action; and, after 7:36 P.M., as soon as the 4th L.C.S. and 11th Flotillas gripped the situation, they never allowed the German flotillas to approach.

Beatty's battle cruisers had meanwhile been making to the S.W. and were 5 or 6 m. ahead of the battle fleet. At 7:47 P.M. the enemy was still in sight from the "Lion," and Beatty, evidently fearing that night might fall without a decisive blow, sent a signal to the C.-in-C. asking that the van of the battle fleet might follow him in an attempt to cut them off. At 8 P.M. the battle fleet turned W. in divisions with guides bearing north-east. Scheer was some 18 m. W.N.W. of it on a S. course, so that the fleets were again converging. At 8:10 P.M. the C.-in-C., in reply to Beatty's signal, ordered the 2nd Battle Squadron (Vice-Adml. Sir Thomas Jerram in the "King George V.") to follow the battle cruisers. But, apparently because Beatty was not actually in sight,—though the "Minotaur" (2nd C.S.) was in sight of both the "Lion" and "King George V." and could have given him the "Lion's" position as she gave the "Lion" that of the "King George V.,"—he remained with the battle fleet and made no attempt to follow Beatty.

At 8:15 P.M. the fleets again came into contact. The "Castor" and 11th Flotilla ahead of the British battle fleet sighted the German destroyers on Scheer's port bow, and, supported by the 4th L.C.S., drove them helter-skelter away. The "Calliope," "Comus" and "Constance" chased them right back to their battle fleet; and the "Calliope," making a torpedo attack on the "Westfalen," came under a heavy fire, and was hit five times, though not disabled. About 8:15, too, the "Falmouth" (3rd L.C.S.) and Beatty's battle cruisers, about 6 m. to S.W. of the battle fleet, sighted Hipper's squadron and the 2nd Squadron of Deutschlands on a S. course. A short sharp action developed at about 10,000 yd. Hipper's ships were hit again, as well as the "Schlesien," "Schleswig-Holstein" and "Pommern." At 8:30 P.M. they turned away to the S.W., passing behind the 3rd and 1st Squadrons. The British battle fleet heard the guns, and at 8:30 P.M. turned into single line again on a S.W. course.

At 9 P.M. there could be no doubt that the enemy was some 6 or 7 m. to the N.W., but dusk was falling (sunset 8:7 P.M.), and the C.-in-C., having decided not to run the risk of a night action, turned S. in divisions. Half an hour later (9:27) the destroyers were ordered to take station astern 5 m. and took station in the following order from W. to E.: the 11th (next the enemy), 4th, 13th, 9th and 12th Flotillas. Unfortunately they were given no information as to the position of the enemy or of their own squadrons and flotillas or of the C.-in-C.'s intended movements, with the result that, instead of making organized attacks on the enemy fleet, the 4th Flotilla blundered into it during the night and was broken up or driven away.

Scheer at 9 P.M. had ordered his fleet to proceed in on a course S.S.E. ¼ E. at 16 knots. The 2nd Scouting Group was on the port bow, the 4th Scouting Group just ahead. Then came the battle fleet in line ahead, the 1st Squadron in front (ships in re-

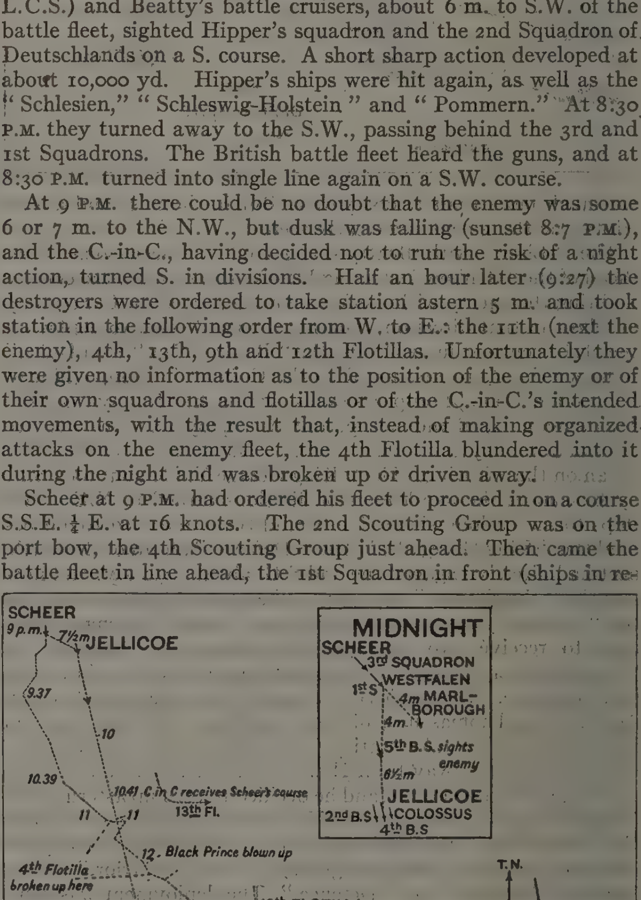
SCHEER
9 p.m.
7½m
JELLICOE
9.37
10
10.39
10.41 C in C receives Scheer's course
13th Fl.
11
11
12 - Black Prince blown up
4th Flotilla broken up here
12
1 a.m.
12th FLOTILLA
Pommern Sunk
2 a.m.
18½ m.
1 a.m.
3 a.m.
Horns Reef
27½ m.
4.0
DI
4 a.m.
E26
E55
Vyl L.S.
34 m.
2 a.m.
5 a.m.
Ostfriesland mined
3
NO MINES
2.45
Jellicoe turns north
LION 2.45 a.m.
T.N.
20
10
0
MILES
SYLT
BRITISH MINES
MIDNIGHT
SCHEER
3rd SQUADRON
WESTFALEN
1st S
4m
MARLBOROUGH
4m
5th B.S. sights enemy
6½m
JELLICOE
2nd B.S.
COLOSSUS
4th B.S

FIG. 7
SCHEER'S RETURN HOME
NIGHT MAY 31

versed order), with the "Westfalen" leading, and the 3rd and 2nd Squadrons behind. The "Derfflinger" and "Von der Tann" formed the rear guard. The "Lützow" and "Seydlitz" had fallen out. The movements of the night can only be briefly described. The British fleet continued to steer south. The German fleet passed diagonally across its rear on a S.S.E. course, crashing through the British destroyer flotillas on its way.

About 10:30 P.M. the 4th Scouting Group struck the 2nd L.C.S., then some 7 m. astern of the battle fleet. A short but fierce action ensued. The "Southampton" and "Dublin" were severely damaged, but the former, though she suffered severely, torpedoed the "Frauenlob," which had to be abandoned later. At 10:41 P.M. Adml. Jellicoe received Scheer's course from the Admiralty, which showed clearly that the latter was retiring towards Horn's Reef. To ensure meeting him next morning it was necessary to turn to a parallel course; Adml. Jellicoe did not do so, nor did he inform Beatty or anyone else of the enemy's course, and the fleet continued to steer south. At 11:30 P.M. there commenced a series of actions behind the battle fleet, which, passing from W. to E. across its stern, pointed a great finger almost directly at Horn's Reef, leaving a trail of burning vessels to mark the course of the German fleet as surely as the compass in Scheer's flagship. They can only be briefly described. At 11:30 P.M. the 4th Flotilla was struck and the "Tipperary" left blazing. The gallant little "Spitfire," trying to help her, rammed the "Nassau," smashed the battleship's searchlights, had her own bridge and funnel blown away by an 11-in. shell, but got safely away with some 30 ft. of German plating on her bows. The "Rostock" was torpedoed in this encounter; the "Elbing" was rammed by the "Posen" and had to be abandoned, and sank. The 4th Flotilla turned away to the E., but, turning S. and ignorant of the German fleet's course, ran into it again at midnight, when the "Fortune" and "Ardent" were sunk. The "Black Prince," which had evidently been following the British fleet, was unlucky enough to run into the German fleet at this time, and, coming under a tornado of fire from the "Ostfriesland" and "Thüringen" at 1,600 yd., vanished in a terrific explosion. The "Marlborough's" division and the 5th B.S. had fallen behind the fleet and crossed only some 3 or 4 m. ahead of the enemy battle fleet, whose ships were seen (the "Westfalen" being even recognized), a situation which might have developed in a variety of ways.

At 0:25 A.M. the 9th Flotilla was struck and the "Turbulent" sunk. The 13th Flotilla had made off to the eastward. At about 1:45 A.M. the 12th Flotilla sighted the enemy, but Capt. Anselm Stirling drew off and made an organized attack at about 2:10 A.M., sinking the old battleship "Pommern." The 13th Flotilla sighted the enemy again at 3:30 A.M. and turned away, but the "Moresby" attacked and torpedoed the V4.

It was now getting light. Not a moment was to be lost if the German fleet was to be cut off, but at 2:40 A.M. the C.-in-C., instead of steering E. by N. for Vyl Shoal or Horn's Reef, altered course to north. At 3:29 A.M. another important signal arrived from the Admiralty, giving the German position not far from Horn's Reef at 2:30 A.M. It was still possible to try to intercept their disabled ships. There were no German mine-fields, nor any information of any, N. of Heligoland, and the only mine-fields near Amrum were a couple of British ones laid in 1915, which were certainly extensive but whose position was known. The C.-in-C., however, did not proceed farther, but at 3:42 A.M. turned W. and reduced to 15 knots. It is impossible to see in the fleet's movements any intention of renewing the action. The reason given is that the fleet was too scattered, but it would not have been scattered if it had been told to be 15 m. from Horn's Reef at 2:30 A.M. The destroyers would not have been scattered if they had not been left right in the path of an advancing enemy with no information as to his movements. Beatty would not have been 15 m. away to the S.W. of the battle fleet if he had known the German fleet was making for Horn's Reef. But he was not told. No one was told.

The action ends here. The German fleet proceeded in. The "Ostfriesland" struck a mine laid by the "Abdiel" on May 5. The "Seydlitz" did not pass the Reef till 4 A.M. Three British submarines were off Vyl Light, but they had been told nothing and saw nothing.

The battle was not a decisive one, and the British battle fleet was never seriously under fire (its casualties were two men killed and five wounded). It must be admitted that the British C.-in-C.'s tactics were characterized by excessive caution. They were limited to the conception of a battle in single line at long ranges on a parallel course, and when Scheer turned away the British system of tactics did not permit of pursuit and fell to pieces. The C.-in-C.'s conception of tactics is to be found in a letter to the Admiralty of Oct. 30 1914 (Jutland Despatches, 601), which merits careful study, for (while it shows that he acted on a prearranged plan) it really constitutes a negation of the battleship and of battle-fleet tactics. Movements in battle were to be governed on this theory, not by the necessity of getting within effective range, but by the necessity of avoiding supposititious submarines. The principles formulated in that letter had, however, been endorsed by the Admiralty, and they were followed at Jutland, though a defence of these principles or of the tactics of the British fleet at Jutland must lead with stern and irrefutable logic to the proposition that the battleship is an instrument of the past. The British tactics were dominated by a fear of the submarine or torpedo. There were no submarines present in the vicinity, and after 7:36 P.M. one light cruiser squadron and a single flotilla of destroyers proved sufficient to drive off the enemy's destroyers. It has been argued that this caution was justified because Britain's naval strength was practically all concentrated in the Grand Fleet. The answer, from a naval point of view, is that it was concentrated in the Grand Fleet for the very purpose of dealing a decisive blow; and commerce defence, convoy and anti-submarine work had all been sacrificed to enable it to do so. The immediate result of the failure of Jellicoe to strike a decisive blow was that the German High Fleet remained intact, to be a bulwark to its submarines, and, by barring the Baltic, to hasten the disintegration of Russia.

Measured in terms of size and serried steel, and of opportunity, the battle of Jutland must bulk large in naval history, but the actual results at the moment were small. If a battle is merely an incident or a move in a blockade it may possibly be regarded as won when the enemy retires to harbour. No further fleet action occurred during the war, and eventually the German fleet surrendered. From one point of view, therefore, it may be said that the result was successful. But if a battle represents in war the economy of the decisive blow; if the enemy's fleet can still play an important part in the campaign; if, as Foch said, there can be no victory without a battle; and if Nelson's teachings are sound—then the battle of Jutland, taken by itself, must rank merely as a great and unique opportunity for the British fleet, of which advantage was not sufficiently taken.

Losses.—The British losses were 3 battle cruisers, 3 cruisers and 8 destroyers—namely, battle cruisers: "Indefatigable" (gunfire, 4:6 P.M.), "Queen Mary" (gunfire, 4:26 P.M.), "Invincible" (gunfire, 6:34 P.M.); cruisers: "Defence" (gunfire, 6:19 P.M.), "Warrior" (gunfire and abandoned, 7:45 A.M.), "Black Prince" (gunfire, 0:25 A.M.); destroyers: "Nestor" and "Nomad" (5:15 P.M.), "Shark" (6:5 P.M.), "Tipperary" (11:30 P.M.), "Ardent" and "Fortune" (midnight), "Turbulent" (0:30 A.M.), "Sparrowhawk" (collision and abandoned, 9:10 A.M.).

The German losses were one battleship, one battle cruiser, four light cruisers and five destroyers—namely, battleship: "Pommern" (torpedoed, 12th Flotilla, 2:10 A.M.); battle cruiser "Lützow" (gunfire, abandoned and sunk, 1:45 A.M.); light cruisers: "Wiesbaden" (gunfire, 7 P.M.), "Frauenlob" (torpedoed, "Southampton," 10:20 P.M.), "Elbing" (collision, 11:30 P.M.), "Rostock" (torpedoed, 4th Flotilla, 11:30 P.M.); destroyers V27 (13th Flotilla, 4:40 P.M.), V29 (torpedoed by "Petard," 4:40 P.M.), V48 (about 6:30 P.M.), S35 (gunfire, at 7:25 P.M.), V4 (torpedoed by "Moresby," 2:45 A.M).

Casualties.—On the two sides these may be tabulated as follows:—

	Officers			Men			
	Killed	Wounded	Prisoners	Killed	Wounded	Prisoners	Total
British	328	28	10	5,769	485	167	6,787
German	160	40		2,385	454		3,039

(A. C. D.)

JUVENILE EMPLOYMENT. I. Great Britain.—At the census of April 1911, 2,272,766 persons under 18 (1,336,907 boys and 935,859 girls) were returned as employed in Britain. Of this number 147,023 (98,157 boys and 48,866 girls) were under 14 years of age. These figures, in so far as they related to children under 14 years of age, were made up of children who had obtained partial or total exemption from school attendance. The Employment of Women, Young Persons and Children Act, 1920, now forbids the employment of children under 14 in any industrial undertaking, unless they were legally so employed on Jan. 1 1921.

Pending the coming into operation of certain sections of the Education Act, 1918, which were suspended for temporary reasons, total or partial exemption from school attendance might in 1921 be granted by the local education authority to enable children over 12 years of age to undertake work of a non-industrial character.[1] In England children over 11 years of age and in Scotland children over 8 years of age (in this latter case for six weeks of the year only) may obtain partial exemption for the purpose of employment in agriculture. Exemption from school attendance is granted subject to the attainment of a minimum standard of education or of school attendance, and on condition that the prospective employment of the child is, in the view of the local education authority, "beneficial." The practice as to the grant of exemptions varies widely in different areas and in accordance with different local by-laws. In addition to employed children who are relieved in part or altogether from school attendance, a considerable number who are in full-time school attendance are employed out of school hours. The total number of such children in 1913 was roughly estimated to be 245,000.

From the beginning of the 20th century there was a marked increase of public interest in Great Britain in the social results of the industrial employment of juvenile workers. This interest was shown in movements to preserve and restore the practice of formal apprenticeship, and in an agitation, for which Mr. R. H. Tawney was largely responsible, to discourage, or at all events to control, the entry of boys into "blind-alley" employment upon leaving the elementary schools. Attention was drawn to the fact that very large numbers of boys were employed in industries which offered them no career as adults. Boys were attracted to such industries by relatively high wages, were retained for two or three years, *e.g.* as van-boys or as workers upon routine processes of little or no educational value, and were thrown upon the labour market at the age of 16 or 17 to find fresh employment. These difficulties were brought very fully to the notice of the Royal Commission on the Poor-Law (appointed Dec. 1905; reported Feb. 1909). Both the majority and minority reports of the Royal Commission made recommendations in the matter. There was agreement that boys should remain at school until 15 years of age. The minority recommended part-time compulsory attendance at "continuation" classes up to the age of 18. The majority recommended exemption below 15 years of age only to boys leaving to learn a skilled trade, and the grant of power to recall to school boys under 16 years of age "not properly employed." The majority further recommended the establishment in connexion with labour exchanges of a special organization for giving boys, parents, teachers and school managers information and guidance as to suitable occupations for children leaving school. Nine years were to elapse before legislation was obtained to enable the school-leaving age to be raised, but prompt action was taken upon the other recommendations of the majority.

The Labour Exchanges Act, passed in Aug. 1909, provided the labour exchanges which were to be the centre round which the organization for the direction of juvenile labour was to be formed, and gave power to establish the advisory committees which such an organization required.

In 1910 the Choice of Employment Act enabled local education authorities, with the approval of the Board of Education, to form committees designed to assist children upon their entry into employment. By arrangement between the Board of Trade and the Board of Education "juvenile employment committees" have been formed in practically all industrial areas of importance by the Board of Trade (from Feb. 1918 the Ministry of Labour) under the Labour Exchanges Act, or by the local education authorities under the Choice of Employment Act. Fifty-two such committees had been formed in July 1914, and at the beginning of 1921 some 250 were in operation (150 working directly under the Ministry of Labour and 100 responsible to the local education authorities). The committees consist of representatives of local employers and workpeople, of the local education authority, and generally include independent persons with a knowledge of, and interested in, questions affecting juvenile employment.

Juvenile employment committees in Great Britain are generally responsible for collecting and disseminating knowledge about the employment of boys and girls in their areas and, by approaching employers and local and central Government authorities, for securing improvements in the conditions of juvenile employment, *e.g.* by extending the practice of apprenticeship, formulating other less formal methods of systematic industrial training and securing the abolition of blind alley occupations by more scientific methods of transfer and promotion. The committees undertake at special meetings of "rota" sub-committees to advise children and their parents upon the available openings in local industries, and in doing so they usually emphasize the value of choosing employment which offers opportunities for definite training. In many cases arrangements are made for the supply to the juvenile employment committee of reports from the elementary schools upon all children at the end of their school life. This assists the committee in giving advice as to the employment which seems suitable for individual children and is also of value when the committee is called upon to deal with children who have fallen out of work within a year or two of leaving school. The committees naturally coöperate with other agencies concerned with the welfare of boys and girls (care committees, juvenile organizations committees, clubs, etc.), and they sometimes maintain schemes of "after-care" for keeping in touch with employed children in their area in order to help them in any difficulties which may arise. The degree of elaboration in the work of juvenile employment committees and its value varies very widely. The work of the committees depends largely upon the zeal and knowledge of the members and upon the quality of the officials of the employment exchanges and of the local education authorities whose duty it is to carry out many of the decisions of the committees. During the year ending Nov. 12 1920, more than 500,000 children under 18 years of age, the number of boys and girls being practically equal, came within the purview of juvenile employment committees.

The Effect of the War.—The most authoritative estimates of the fluctuations in the number of persons employed in various industries and callings during and after the war are those prepared officially upon the basis of sample returns obtained from selected employers. They relate to an estimated total employed population under 18 years of age of 1,923,000 in 1914. The table on next page shows separately for boys and girls the changes which are estimated to have occurred in the number employed as at Nov. 1918 (the Armistice), and at July 1920, when normal industrial conditions had been largely reëstablished and industry was prosperous.

These figures indicate first of all an absolute increase, since July 1914, in the numbers of boys and girls employed during and after the war. This increase occurred mainly among the girls because among them alone was there any large reserve of unoccupied labour. There was, however, during the war a marked increase, although not upon a large scale, in the number of partial and total exemptions from school attendance before the age of fourteen. The position in this respect was practically normal by July 1920.

Secondly, the figures show the directions in which the fresh supplies of juvenile labour which became available during the war were used, and the industries from which juveniles were attracted to war work. Thus among both boys and girls there was a marked reduction in the numbers employed in the textile and paper and printing groups; in the number of boys engaged in finance and commerce and in the civil service (the Post Office is responsible for the larger part of the reduction); in the number of girls employed in the clothing group. On the other hand, there were large increases in the number of boys and girls employed in the "war industries," predominantly in the metal and chemical groups. The number of boys increased in mines and quarries; upon the production of food, drink and tobacco; in the wood industries and in transport. The number of girls employed also increased in the last-named, and large numbers entered "finance and commerce" and the civil service, in these cases no doubt taking the place of boys and men who passed to other occupations, including service in the forces.

The war had other important effects upon juvenile employment. At the outbreak of hostilities in Aug. 1914, widespread unemployment was feared, and for a short period many boys and girls were out of work as the result of the reduction of their staffs which employers found prudent in view of uncertainty as to the future. By the beginning of 1915, however, boys found little difficulty in obtaining employment. Enlistment of men for the forces was already making

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[1] In the majority of areas in England total exemption cannot be obtained under 13 years of age.

Occupations	Numbers employed in						Percentage of number employed in July 1914			
	July 1914		Nov. 1918		July 1920		Nov. 1918		July 1920	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
	thousand	thousand	thousand	thousand	thousand	thousand				
Building	53	1	56	7·9	52	2	106·0	790·0	98·1	240·0
Mines and quarries	151	2	179	3·1	169	2	119·0	155·0	112·0	92·7
Metal industries	193	45	343	115	287	83	178·0	256·0	149·0	183·0
Chemical industries	14	11	20	24	16	22	143·0	216·0	115·0	199·0
Textile industries	123	215	108	203	109	208	88·1	94·4	88·4	96·6
Clothing industries	42	141	41	129	37	136	98·6	91·5	87·8	96·8
Food, drink and tobacco industries	38	49	43	55	32	59	112·0	111·0	83·5	120·0
Paper and printing industries	41	46	31	43	34	55	74·6	95·0	82·0	119·0
Wood industries	33	10	38	24	37	17	115·0	232·0	113·0	174·0
Other industries (incl. gas, water and electricity under local authorities	48	24	45	39	45	35	92·2	162·0	92·6	147·0
Government establishments, dockyards, arsenals, national factories, etc.	3	—	22	9·2	5·4	·2	733·0	—	180·0	—
Transport	79	2·2	91	11	87	3·5	115·0	505·0	110·0	157·0
Finance and commerce	248	84	199	218	182	178	80·3	260·0	73·5	212·0
Miscellaneous professions, hotels, theatres, hospitals, municipal services (except tramway, gas, water, etc.)	35·9	24·5	46	37·1	37	30·4	128·0	151·0	103·0	124·0
Civil service	21	10·1	15	30	10	11	71·4	300·0	49·2	110·0
Total	1,123	665	1,277	948	1,139	842	114·0	143·0	101·0	127·0

vacant places to which the elder boys could be promoted and the issue of war contracts was beginning to have its effect upon the demand for labour of all kinds. The demand for girls for war work came rather later, as the number of boys transferred to work done hitherto by men increased, and as the manufacture of munitions of war of all kinds was developed upon a basis of routine processes upon many of which boys could be employed in very large numbers. The majority of the boys who were attracted to war work were employed upon such routine processes, and at the same time the proportion of boys to the total number of boys and men employed increased. This followed partly from the general extension of routine processes and partly from the promotion of boys to do the work of men. The girls who were drawn into war work also took part in the performance of routine processes, and, as indicated already, they entered such occupations as that of clerks in banks, insurance offices and commercial houses from which men and boys had been drawn away.

In so far as boys and girls took the places of men, they obtained opportunities of doing work of a higher grade than would normally have fallen to them at such an early age. Any advantages which might have followed from such causes were, however, more than counterbalanced by the general character of the work of producing munitions of war. As the war proceeded, routine processes were multiplied. Work was standardized so as to secure a large and certain output. With the increasing shortage of skilled workmen it became increasingly necessary to limit the demand for them, and this alone provided a strong inducement to extend routine work. At the same time the rates of wages paid to juvenile workers, especially to boys, steadily increased; and by 1917 boys of 15, who before the war might have been earning from 10s. to 15s. a week, were earning as much as £2 and £3 a week upon working automatic machines. The educational value of such work was negligible. The boys expected to join the army upon reaching the age of 18; wages were constantly rising and the demand for boy labour was very strong. Many boys found themselves, in the absence of their fathers and elder brothers with the forces, the principal wage-earners of their families. In such circumstances it was not in human nature that they should care about the effect of the work which they were doing upon their prospects as adult workmen in industry. Boys constantly changed their place of employment in pursuit of higher wages; the strain of the work was severe, and constraint upon their actions outside the factory was generally lacking. While, therefore, the work done by boys and girls in the munitions factories was of essential value, it did not provide a favourable environment in which to pass the years leading to manhood and womanhood.

During the war the juvenile employment committees took such action as was possible to meet the exceptional conditions. They, in common with boys' clubs and other agencies interested, were, however, much handicapped by the service of many of their members and officials with the forces or upon war work of other kinds. Committees were not formed in new centres during the war and the committees already in existence were largely occupied with the conditions in which juvenile workers were employed in war industries. It was found necessary to draw, through the employment exchanges, considerable numbers of boys and girls from a distance to work at such centres as Woolwich Arsenal and in the shipyards on the Clyde. The juvenile employment committees endeavoured to ensure that the arrangements both inside and outside the workshops were satisfactory. They encouraged the appointment by the employers of "Welfare Supervisors" and interested themselves in the arrangements made at the hostels in which juvenile workers were lodged. They collected information as to the effects upon juvenile workers of the exceptional working conditions (long hours, night work, the effects of monotonous employment, etc.), and in a number of cases they were able to secure important reforms in the arrangements made. Responsibility for the welfare of munitions workers rested during the war with the Ministry of Munitions, and much was done to obtain proper industrial conditions for juvenile workers.

In addition to the powers which they possess under the Factory Acts in regard to health, sanitation, safety, the hours of work of women and young persons, etc., the Home Office, under the Police, Factories, etc. (Miscellaneous Provisions) Act, 1916, may by order, when the circumstances of the work warrant it, require employers to make reasonable provision for the welfare of the workers in regard to such matters as supply of protective clothing, canteen arrangements, supervision, etc.

During the war careful consideration was given to the measures for dealing with juvenile employment which would be necessary upon the return of peace. The juvenile employment committees undertook extensive inquiries in 1916 and 1917 into the conditions of juvenile employment, the changes which the war had produced and the situation which would probably arise at the end of the war. In the report of a departmental committee on juvenile education in relation to employment after the war, and in a report upon "Juvenile Employment, During the War and After," issued in 1918 by the Ministry of Reconstruction, the evidence so obtained was examined. Both reports recommended an extension of juvenile employment committees and the opening during the demobilization period of "Unemployment Centres" at which boys and girls could attend to receive continued education with a maintenance grant during unemployment. The report of 1918 further recommended a number of measures for avoiding the sudden discharge of large numbers of juvenile workers at the end of the war, and for avoiding juvenile unemployment by the general and immediate use of the powers given by the Education Act, 1918, to require extended compulsory education. The reduction of normal working hours for juvenile workers in industry was also recommended.

With the beginning of the demobilization period at the end of 1918 action was taken in accordance with several of these recommendations. Juvenile employment committees of a permanent or temporary character were set up in districts in which it seemed probable that any extensive dislocation of juvenile employment would occur. So far as possible the discharge of juvenile workers was carried out gradually by arrangement with employers. Employers were asked to give juvenile employment committees advance notice of pending discharges of juveniles, in order that, so far as possible, the committees could gauge the extent of unemployment amongst juveniles and make alternative provision for those juveniles for whom other employment could not immediately be found.

Educational Centres for Unemployed.—Early in 1919 arrangements were made by the education departments with the local education authorities for special centres to be opened at which unemployed boys and girls could attend, usually for five days a week. The objects with which these centres were established were to occupy the time of unemployed boys and girls by mental and physical instruction and to prevent them from wasting their days in the streets. Means to ensure attendance was provided by the out-of-work donation scheme, under which unemployed boys and girls were entitled to substantial payments (at the outset 14s. 6d. for boys and 12s. 6d. for girls) each week during unemployment. Educational centres were opened in most areas in which it was likely that a

	1914		1915		1916		1917		1918		1919		1920	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Jan.	—	—	4,889	9,921	5,215	9,552	6,552	8,230	8,568	8,502	26,406	25,770	16,605	11,680
Feb.	—	—	4,189	9,051	5,388	9,566	5,943	8,399	8,713	8,869	33,493	35,805	13,786	11,588
March	—	—	3,887	8,435	5,164	9,031	5,894	8,679	7,696	8,102	35,123	36,814	10,446	10,714
April	—	—	3,998	9,490	5,574	8,779	6,245	8,098	8,412	8,888	33,176	37,575	13,021	11,288
May	—	—	3,425	7,873	5,956	9,040	7,052	9,350	8,232	8,382	28,497	31,318	12,177	11,630
June	—	—	3,729	8,086	5,454	7,970	6,925	9,360	7,946	8,144	18,130	18,070	10,635	10,574
July	—	—	4,546	8,065	6,263	8,481	6,808	9,272	7,574	7,323	14,746	14,259	11,728	11,236
Aug.	9,571	9,532	5,116	8,664	6,667	7,900	6,632	8,246	7,453	6,704	16,836	13,975	16,481	14,459
Sept.	9,363	12,100	4,439	8,065	6,053	7,917	7,024	9,384	8,049	8,081	14,148	12,815	17,428	17,324
Oct.	6,695	11,282	4,666	8,449	6,274	8,015	7,030	8,327	7,491	7,689	16,486	14,592	17,222	18,407
Nov.	5,496	10,298	4,337	8,993	5,521	8,097	7,627	8,546	6,391	5,906	17,772	12,514	21,386	22,555
Dec.	4,096	8,243	3,813	7,540	4,845	6,682	7,251	7,725	11,714	8,754	12,063	9,023	21,418	23,911

NOTE.—The comparison above is affected by the fact that the juvenile age limit was raised at the end of 1918 from 17 to 18.

considerable number of juvenile workers would be unemployed, and the payment of out-of-work donations was made conditional upon regular attendance at the centres. Attendance at a centre was accepted in lieu of attendance at an employment exchange as proof of unemployment, and arrangements were made to inform boys and girls at the centres of any suitable opportunities of employment which might occur. Twenty-eight centres were open at the beginning of Jan. 1919, and they were attended by over 3,000 boys and girls. A month later the number of centres had increased to 116 and the number of daily attendances to more than 13,500. There was a steady increase in the provision made up to the middle of April, when there were 215 centres open. The largest number of attendances was reached at the beginning of April, when the number was nearly 24,700. The attendances fell off from that date with the gradual absorption of boys and girls in industry and as the result of a strict review by juvenile employment committees of claims to grants of extended out-of-work donation. The scheme was wound up with the termination of the payment of out-of-work donation to civilians in Nov. 1919. The local education authorities undertook a difficult task in opening the centres. They found much difficulty in obtaining suitable teachers, and it was not easy to devise a satisfactory curriculum for the fluctuating attendance of boys and girls of all ages from 15 to 18. As a rule it was sought to make each day's teaching self-contained. The subjects taught included, for boys, drawing, practical measurements, workshop calculation, building construction, woodwork, physical exercises and organized games; and for girls, needlework, practical arithmetic, first aid, cookery, hygiene, home nursing, games, gymnastics, dancing and singing. At most centres there were also lectures on historical, literary, scientific or industrial subjects. It was only in rare cases that definite vocational training was attempted. The experiment met with a very considerable measure of success. The boys and girls who attended the centres accepted readily the necessary discipline, and responded very well to the instruction given. There can be no doubt that the centres were of much value in carrying very many juvenile workers over a difficult period.

The appended table shows the course of juvenile unemployment as recorded at the employment exchanges in the United Kingdom from Nov. 1918 (the Armistice) to the end of 1920.

Education Act, 1918.—The sections of the Education Act, 1918, which extend the ages at which education is compulsory, have the important effect upon juvenile employment of withdrawing, either wholly or in part, large classes of juvenile workers from industry. Thus [Section 9 (1)] children are to remain at the elementary schools until the end of the school term during which they reach an age at which they become entitled to leave school. This has the effect of raising the ages of school attendance by about 8 weeks upon an average. Section 8 (1) prohibits any exemption from school attendance before the age of 14, and Section 8 (2) permits local education authorities to increase this age to 15, with power to grant exemption between the ages of 14 and 15 in approved cases. These provisions were to operate at a date or dates to be determined by the Board of Education, but not before the formal termination of the war [Section 52 (3)]. Thirdly, by Section 10 continued education after the age of 14 is made compulsory during a minimum of 280 hours in the course of a year. This obligation rests upon children who become 14 after the "appointed day" for the commencement of the scheme in each area until they reach the age of 16 during the first seven years of the scheme and up to the age of 18 thereafter. Provision is made [Section 10 (6)] for such suspension of employment as will enable boys and girls who are required to attend at continuation schools to do so without undue physical and mental strain.

At the beginning of 1921, the Board of Education had named appointed days for the purposes of Section 10 in respect of the areas of the local education authorities in London, Birmingham, Rugby, Stratford-on-Avon and West Ham; but it had become temporarily necessary to refrain, in the interests of economy, from bringing the Section into operation elsewhere. (J. S. Nc.)

II. UNITED STATES.—Well-developed tendencies with reference to child labour legislation and reliance by employers on the employment of children in the United States were interrupted by the conditions created by the World War. The census of manufactures of 1914 showed that during the years before that date the number of children employed in manufacturing was decreasing. The serious industrial depression which followed the outbreak of the war brought a sharp decrease in the number of children employed in 1914, amounting to one-fifth of the number employed in 1913 in St. Louis and New York City, one-fourth in Buffalo and Rochester, N.Y., about one-third in Bridgeport, Conn., nearly one-half in Baltimore, and two-thirds in Manchester, N.H., a textile centre. By the latter part of 1915 the effect of foreign orders for war goods was beginning to make itself felt, and an unprecedented rise in the number of employed children followed. Except for isolated places affected by peculiar conditions, the increase in the number legally at work in 1916 over the number so employed in 1915 was very large, especially in centres where children had not been employed before. Reports to the U.S. Children's Bureau of the number of work permits issued showed that this increase was as high as 167% in Toledo, O.; 145% in Springfield, Mass.; 92% in Boston; and 63% in Indianapolis.

After the United States entered the war, the rising cost of living, the absence of older members of the family on military duty, high wages offered by employers to children because of the labour shortage, and a restlessness on the part of the children themselves led many under 16 years of age to leave school for work. Available statistics show that in most places the peak in the employment of children was reached in 1918. The shutting-down of war industries and the return of soldiers resulted in a temporary decline in the numbers in 1919, to be followed in 1920 by an increase in 18 out of 29 cities reporting to the U.S. Children's Bureau numbers of work permits issued. The end of 1920 saw a sharp decline as the result of the industrial depression. It should be noted that the figures given above are based on the number of work permits issued to children, and indicate therefore an increase in the number of children legally employed. Evidence is not lacking that there was difficulty in the enforcement of child labour legislation during the war period and that in consequence the number of children illegally employed during that time probably also increased.

In the field of legislation the most important development was the public demand for national control, which led to the first Federal child labour law, which went into effect Sept. 1917. This Act prohibited the shipment in interstate or foreign commerce of the product of any mine or quarry in which children under 16 were employed, and the products of any mill, cannery, factory, workshop or manufacturing establishment in which children under 14 were employed or children between 14 and 16 were employed more than 8 hours a day, or 6 days a week, or before 6 A.M. or after 7 P.M. This law was attacked as unconstitutional before it went into effect, and about nine months later (June 3 1918) the U.S. Supreme Court held, by a vote of 5 to 4, that it did not constitute a valid exercise of Congress's constitutional authority to regulate foreign and interstate commerce. A child labour tax clause was then inserted in the Revenue Act of 1918. It placed a 10% tax on the net incomes of establishments employing children of the ages and for the hours specified in the Act of Sept. 1 1917. This law in June 1921 was before the U.S. Supreme Court for decision as to its constitutionality. In view of the fact that the Court has been in the habit of construing liberally the taxing power of Congress, friends of the measure expected its constitutionality to be upheld. In the child labour legislation enacted by the various states there are many differences. The tendency is, however, for each state to require: (1) that a child must reach a specified age and an educational and physical standard before he can be industrially employed; (2) that an official work permit must certify his ability to meet the standards established by the statute; (3) that the age at which children or young persons may be employed at night or in hazardous or unhealthy occupations must be higher than the age at which they may be employed in general occupations. Of these standards the minimum age was the first to be generally adopted. With some exceptions, for vacation periods and certain occupations, every state except three (Mississippi, New Mexico, and Wyoming) has prohibited the employment in industry of children under 14 years of age. That the present tendency is toward the establishment of a higher age is indicated by the fact that seven states (California, Maine, Michigan, Montana, Ohio, South Dakota and Texas), representing all parts of the country, have raised the age for entering industry above 14 years. In 1920 seven states required completion of the eighth grade and nine of the sixth grade in school before a work permit could be issued to children between 14 and 16 years of age.

It is only recently that adequate recognition of the facts that the physical effects of premature employment are as serious as the educational, and that the age of a child is not a guaranty of his corresponding physical development, has become general in the United States. Eighteen states provide that although a child may be of the minimum age and have passed the educational test, he cannot go to work until he has had a physical examination by a public health or public school physician and has been found to be of normal development for a child of his age and physically fit for the work at which he is to be employed. In most states, if he fails to pass this test he must return to school pending correction of defects or improvement in his general condition. In 10 other states and the District of Columbia an examination may be required in all doubtful cases or at the discretion of the officer issuing work permits, and a permit may be refused if the child does not measure up to standard. The increased expenditures necessary for the effective administration of these laws indicate that the public has become converted to the need of a physical standard.

In all except six states child labour laws prohibit the employment of children at night in an enumerated list of occupations. The hours vary. For example, New York prohibits the employment of children under 16 years after 5 P.M. or before 8 A.M.; California after 10 P.M. or before 5 A.M. The Federal tax virtually establishes a minimum so that employment is in effect prohibited after 7 P.M. or before 6 A.M. in California and other states in which state laws are below the Federal standard in this respect.

In 27 states, including those of most importance industrially, laws prohibit the employment in certain unhealthy processes of children, the minimum age being usually 16 years, sometimes 18 years of age. While the lists of prohibited occupations are not identical, the recently enacted laws follow closely the so-called uniform child labour law. It prohibits children under 16 years of age operating or assisting in operating sandpaper or wood-polishing machinery; picker machines, or machines used in picking wool, cotton, hair, or any other material; carding machines; leather-burnishing machines; and prohibits their employment in any capacity in, about, or in connexion with any processes in which dangerous or poisonous acids are used; in the manufacture or packing of paints, colours, white or red lead; in soldering, in occupations causing dust in injurious quantities; in the manufacture or use of dangerous or poisonous dyes; in the manufacture or preparation of compositions with dangerous or poisonous gases; in the manufacture or use of compositions of dye injurious to health; and in assorting, manufacturing, or packing tobacco.

During the decade there was a great development of the earlier movement for manual training in the schools. The Smith-Hughes Act of 1917 offers to the states Federal reimbursement, up to a fixed maximum, of one-half of the money spent by the local boards for training teachers and providing vocational education in the public schools. Interest in vocational education has also greatly stimulated the establishment of compulsory part-time continuation schools in which vocational education is offered. A movement toward juvenile employment agencies also developed. It began with efforts by private organizations to place children in skilled trades and with advice in school as to employment opportunities. The development of vocational classes in the schools increased the appreciation on the part of school authorities of the value of this work. During the war a beginning was made in coördinating all the placement work for minors under the Junior Department of the U.S. Employment Service in the Department of Labour. At the end of the war the appropriation of the Employment Service was so reduced by Congress that there has been little development of this plan, but many of the bureaux established in connexion with the schools have increased in importance.

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KAHN, OTTO HERMANN (1867–), American financier, was born in Mannheim, Germany, Feb. 21 1867. His father had been among the refugees to America after the revolution of 1848 and had become an American citizen, but later returned to Germany. He was educated in a *Gymnasium* in Mannheim, and after a year's service in the German army entered a banking house. In 1888 he entered the London branch of the Deutsche Bank, remaining there five years and becoming a British citizen. In 1893 he went to the United States, and for two years held a position with the house of Speyer & Co. in New York City. Then after travel in Europe he joined the firm of Kuhn, Loeb & Co., in New York City. In March 1917 he became an American citizen. He was a patron of music and gave private assistance to promising talent. He was chairman of the New York committee of the Shakespeare Tercentenary (1916) and was vice-president of the Permanent Blind Relief War Fund. He was chairman of the board of directors of the Metropolitan Opera Co. of New York and of the French theatre of New York, and a founder and later treasurer of the New Theatre Co. He was a trustee of the Massachusetts Institute of Technology and of Rutgers College. He was a director in numerous corporations, including the Equitable Trust Co. (N.Y.) and the Union Pacific railway. During the World War he took a leading part in showing to the Germans in the United States that Germany was in the wrong and must be opposed. He was the author of *Right Above Race* (1918); *Our Economic Problems: A Financier's Point of View* (1920) and *Two Years of Faulty Taxation* (1920).

KAHR, AUGUST RICHARD VON (1862–), Bavarian Minister-President from March 14 1920 to Sept. 20 1921, was born on Nov. 29 1862 at Weissenburg in Bavaria. After March 14 1920 he came into office under military influences as a secondary result of the Kapp *coup* (March 13) in Berlin. The most powerful party in Bavaria, the Bavarian *Volkspartei*, was then in a state of much anxiety as a result of the experiences of Bolshevism, anarchy and violence through which Munich had passed in the spring of 1919. The Ministry presided over by the Moderate Socialist Hoffmann had, it is true, succeeded in quelling Bolshevism with the aid of Republican troops from Prussia and Württemberg. The great majority of the Bavarian Catholic *Volkspartei*, however, as well as Liberals of various shades, not to speak of the Royalists and reactionaries, wanted further guarantees against a recurrence of the Bolshevist terror. The Kapp *coup* in Berlin, which in some of its aspects sprang from similar anxieties in Prussia, gave the signal for political action in Munich, and at a midnight sitting the Bavarian Socialist Ministry was somewhat unceremoniously hustled out of office—it is alleged under military pressure—and a Coalition Cabinet under von Kahr installed. The Coalition included reactionary Conservatives whose influence became more and more predominant. They were backed up by formerly Liberal Bavarian journals which had been bought up by the Prussian great industrialists. The new Minister-President had been *Landeshauptmann*—the highest position in the provincial administrative hierarchy—in Upper Franconia. He was known as a capable and energetic bureaucrat and as nothing else. Under his Government a formal state of siege was maintained, and the police under the reactionary prefect Poehner exercised the greatest severity in the supervision of foreigners and even of non-Bavarian Germans, who were only admitted to the country by special permit. Above all, von Kahr and his Ministry endeavoured to maintain the armed volunteer force, the *Einwohnerwehr*. But the Reichstag in Berlin had passed a law for disarmament of this force, and the Government of the Reich insisted that Bavaria, like the rest of Germany, should comply in this respect with the Treaty of Versailles, the Spa decisions and the reiterated demands of the Allied Powers. Repeatedly it seemed as if the conflict between the Government of the Reich and that of Bavaria would end in open rupture. In the late summer of 1921, however, the Bavarian Government—formally at any rate—gave way, and it was understood that, by arrangement, the *Einwohnerwehr* was surrendering its arms and equipment. A fresh conflict arose over the measures which were taken by the President of the Reich, Ebert, on the advice of the Ministry of the Reich, as a sequel to the assassination of the Democratic Catholic Centre leader Erzberger (Aug. 26 1921). Orders were issued from Berlin for the suppression of several Bavarian newspapers which had been indulging in violent denunciation of Erzberger, the Republican constitution and the Government of the Reich. Von Kahr and his Ministry questioned the right of the Reich to apply such measures to one of the German federated states without previous arrangement, or at least consultation, with the Government of that state. A serious complication was that the attitude of the Bavarian Government was supported by the Prussian reactionaries, several of whom, like Ludendorff, had taken up their residence in Bavaria and were hoping to make it the centre of an anti-Republican or Royalist movement for the whole of Germany. The Government of the Reich, under Dr. Wirth as Chancellor, manifested considerable firmness, and ultimately in Sept. 1921 von Kahr resigned and was succeeded as Minister-President by the minister in Darmstadt, Count Lerchenfeld, a man of experience and character, who commanded the confidence of the Catholic *Volkspartei* and of the Bavarian Liberals of all shades.

KALA-AZAR, or Black Fever (*see* 15.637*), a disease first described in 1882 as a chronic form of malaria, or malarial cachexia, prevalent at the foot of the Garo Hills at the W. end of the range separating the Brahmaputra or Assam valley on the N. from the Sylhet valley on the S. in India. From 1882 it spread steadily up the Assam valley along the Grand Trunk Road to the S. of the Brahmaputra river. Travelling at a rate of about 10 m. a year in a wave of greatly increased mortality, leaving behind a few sporadic cases of the disease, it culminated in such a terrible outbreak in the Nowgong district during the first decade of the 20th century that there was a decrease of 31.5% in the population, against an increase of 8 to 16% in the more easterly unaffected districts, while much land fell out of cultivation. The epidemic carried off about one-third of the population over a narrow tract of country 250 m. in length in the course of 30 years, while various places on the N. bank of the Brahmaputra river were also affected to a lesser extent.

In 1889 an investigation of the epidemic was carried out by a selected medical officer, who found hook-worm ova in the evacuations of many of the cases, and reported the disease to be ankylostomiasis—a theory which was soon disproved by the discovery that a larger proportion of healthy coolies imported into Assam after two medical inspections harboured these worms than did kala-azar patients. In 1896 Sir Leonard Rogers investigated the disease for the Government and wrote the first full description of it, but found no means of distinguishing it from what had always been known as malarial cachexia, which had long been sporadic in the Sylhet valley, except that it was more severe with a shorter duration and higher mortality. He concluded that it was an epidemic malaria, an opinion which was endorsed by the high authority of Sir Ronald Ross after a personal investigation in Assam in 1899. Rogers also obtained strong evidence of the disease being communicable, the infection being a very local or house one, and made recommendations based on this discovery for dealing with the disease in infected tea-gardens and to check its further extension up the Brahmaputra valley, a natural obstruction to which existed in the shape of the sparsely populated Mikir Hills to the E. of the Nowgong district. These measures resulted within the next few years in the disease being stamped out of a number of tea estates and the cessation to a great extent of the further spread of the epidemic, for over 10 years later the distribution of the disease in Assam was still the same, although a limited fresh outbreak appeared in the more easterly Sibsagar district a little later.

**** These figures indicate the volume and page number of the previous article.***

It was not until 1903 that the problem of the true causation of kala-azar was solved, for after Dutton had discovered the first human trypanosome in an African fever, later shown by Sir David Bruce to be an early stage of sleeping sickness, Sir William Leishman recorded having found some time earlier small oval binucleated bodies in the spleen of a fatal case of kala-azar, which he now suggested were degenerate trypanosomes. Col. Donovan, I.M.S., at once reported that he had independently discovered the same bodies in malarial cachexia cases in Madras, and he proved that they were not degenerate trypanosomes, as they could be obtained by puncturing the spleen during life. Sir L. Rogers and Dr. Bentley soon after found the same parasites in the epidemic kala-azar of Assam. In 1904 the former cultivated the protozoal parasite and obtained the development of a flagellate stage, and it was eventually named *Leishmania donovani* in honour of the joint discoverers. Further cultural studies led him to suggest the bed-bug as the probable carrier of the infection, and later Maj. Patton, I.M.S., and others obtained development of the flagellate stage in these insects after feeding them on the blood of kala-azar patients; but the complete life-history of the parasite has not yet (1921) been worked out.

In 1904 a Mediterranean, or infantile, form of kala-azar was discovered, affecting mainly children, most prevalent in Tunis and other N. African countries, and to a less degree on the N. shores of the Mediterranean, extending from Spain, Sicily and southern Italy and Greece to Asia Minor and the Sudan. Dogs were found infected (though they are not with Indian kala-azar), and the dog-flea is suspected of conveying the infection.

Kala-azar may be briefly described as a very prolonged fever, accompanied by great enlargement of the spleen, and in the later stages of the liver, with marked emaciation, leading to its having been confused with the so-called malarial cachexia in India, which is now known to be nothing but sporadic kala-azar, still widely prevalent over Bengal, Bihar, Western United Provinces and on the Madras coast, but absent, except as rare imported cases, from the more westerly portions of India.

The fever is very varying in its character, but frequently presents for a time a characteristic double rise of temperature in the 24 hours of diagnostic importance. The persistent nature of the fever and the failure of full doses of quinine to check it quickly is most important in differentiating it from a true malarial fever. In the Assam epidemic form the average duration of the disease was seven months, sometimes without complete cessation of fever for a single day, while in the sporadic form it often lasts several years with periods of temporary freedom from fever. Another feature of diagnostic and prognostic importance is the remarkable decrease of the leucocytes, or white corpuscules, of the blood, which are commonly reduced to from one-third to one-fifth of the normal numbers; an extreme fall being of serious import, as the consequent loss of resisting powers against microbial invasion is the usual cause of fatal terminations due to secondary septic infections, including terrible sloughing of the tissues of the cheeks in children, dysentery, pneumonia and phthisis, which are the common causes of death in kala-azar, the fever of which is comparatively seldom fatal in itself. The mortality in the Assam epidemic form in hundreds of cases, carefully treated from first to last, on tea estates by Dr. Dodds Price, was no less than 96%, while it was not very much less in the sporadic form in other parts of India. The very prolonged nature of the disease and its excessive mortality constitute kala-azar one of the most terrible diseases which afflict mankind.

Up to 1915 the treatment of the disease was very unsatisfactory, although Rogers obtained 25% of recoveries by measures to increase the leucocytes of the blood. The close resemblance in many ways between kala-azar and African trypanosomiasis terminating in sleeping sickness, together with the zoölogical affinities of the flagellate organisms of the two diseases, raised the hope that any drug which proved efficient in trypanosomiasis might very likely also be effective in kala-azar, while the fact that rats and other animals could be infected with human trypanosomes and the effect of various drugs tested experimentally on the disease in them, eventually solved this serious problem. Various arsenical preparations, which had proved of some value in trypanosomiasis, produced little effect in kala-azar, but when tartar emetic intravenously was found to be of value in the former, it was also tried by several workers in kala-azar with complete success. Di Cristina and Caronia of Palermo first reported cures of the Mediterranean form of kala-azar early in 1915, and Sir L. Rogers, who was at the same time using the drug quite independently in India, very shortly after recorded its curative action in Indian kala-azar, and later showed that sodium antimony tartrate and a new preparation, colloid antimony sulphide, were less toxic and rather more effective than the first-used tartar emetic or potassium antimony tartrate, and reported 35 cases in Europeans with only one death from complicating phthisis and 29 complete and lasting cures, so that about 90% of these unfortunate patients can now be rescued from almost certain death. Moreover, the new treatment has proved of great value in controlling the recent focus of the epidemic disease, while the sporadic form had in 1921 nearly disappeared from a portion of the Bardwan district of Bengal, where numerous cases had been treated, so that there was good reason to believe that kala-azar could eventually be stamped out. The results obtained by segregation methods and the new treatment thus constitute one of the greatest triumphs of modern medical science. (L. Ro.)

KALEDIN, ALEXEI (1861–1918), Russian general, was born in 1861, and entered the army in 1882. For some years he served in the artillery and then, on passing out of the General Staff Academy in 1889, he was appointed on the general staff. He reached the rank of general in 1907, and when the World War broke out in 1914 he was at the head of the 12th Cavalry Division. With this division he served in the Galician campaigns of 1914–5, in which his marked qualities of leadership soon showed themselves. In March 1915 he was seriously wounded. Later in 1915 he commanded the XII. Corps, and in the beginning of 1916 the VIII. Army. With this army, in 1916, he carried out the great offensive campaign of Lutsk. More than 100,000 prisoners and much booty were the results of his summer battles. In May 1917, being out of sympathy with the policy of the Provisional Government, which was causing the disintegration of the army, he resigned his post as an army commander. In the summer of the same year he was elected Ataman of the Don. His popularity among the Cossacks did not cease, even after the conflict between Kornilov and Kerensky. Notwithstanding the latter's demand that Kaledin should come to Moscow to explain his conduct during the Kornilov affair, the Cossack parliament forbade him to go, fearing some treachery in relation to Kaledin. After the seizure of power by the Bolsheviks and the conclusion of their armistice with the Germans, he called up the Cossack regiments to the Don. The great moral influence he exercised over the Cossacks kept them at first from internal anarchy and aroused them to an armed defence of the Don district against invasion by the Bolsheviks. He thus made it possible for Generals Alexeiev and Kornilov, in Dec. 1917, to muster the troops of the Volunteer Army to the south of the Don district. But in the beginning of 1918 an inner fermentation began on the Don; on the front the Cossacks began to surrender to the Bolsheviks. The Volunteer Army left the Don and went to the Kuban district. When all means of saving the Don Cossacks from Bolshevism were exhausted, Kaledin, hoping even at the last to rally the Cossacks by an act of self-devotion, shot himself on Feb. 11 1918. (N. N. G.)

KANSAS (*see* 15.654).—The pop. of Kansas in 1920 was 1,769,257, as against 1,690,969 in 1910, an increase of 78,288 or 4·6%. Relatively to the other states, Kansas lost its position, falling from 22nd to 24th place. Of the 105 counties, 48 showed an increase and 57 a decrease in pop. during the decade. The average number of inhabitants to the sq. m. was 21.6 in 1920. There were three cities of over 25,000 inhabitants, 14 from 10,000 to 25,000 and 10 from 5,000 to 10,000. The urban pop. (in cities of over 2,500) increased from 29·2% in 1910 to 34·9% in 1920.

The following are the cities with over 12,000 inhabitants, with pop. in 1920 and 1910 and percentage of increase:—

	1920	1910	Per cent Increase
Kansas City	101,177	82,331	22·9
Wichita	72,217	52,450	37·6
Topeka	50,022	43,684	14·5
Hutchinson	23,298	16,364	42·4
Pittsburg	18,052	14,755	22·3
Leavenworth	16,912	19,363	—12·7
Parsons	16,028	12,463	28·6
Salina	15,085	9,688	55·7
Coffeyville	13,452	12,687	6·0
Atchison	12,630	16,429	—23·1
Lawrence	12,456	12,374	0·7

Agriculture.—Kansas is preëminently an agricultural state. It is the largest producer of wheat and corn taken together in the Union, although the wheat crop is in some years exceeded by North Dakota and the corn crop in some years by Illinois. The wheat crop was 61,000,000 bus. in 1910; production was increased by 1914 to 180,000,000 bus.; in 1920 it was 140,000,000 bushels. The corn crop was 152,000,000 bus. in 1910 and despite increase in area planted in wheat, 132,000,000 bus. in 1920. The crops next in value were alfalfa and oats. High prices of agricultural produce during the World War brought great prosperity to the state, but the slump in the winter of 1920–1 reduced prices below the cost of production and created acute depression. Despite increase in the area under cultivation, the number of individual farms decreased from 177,841 in 1910 to 165,287 in 1920.

Mineral Products.—There are considerable deposits of bituminous coal along the eastern border of the state and production amounted in 1920 to 7,500,000 tons. Natural gas reached its peak in 1908 with a yield of 80 billion cub. ft., after which the yield gradually decreased to 27·8 billion cub. ft. in 1920. There has been little effective control of the distribution of gas, and distributing companies have fixed rates in total disregard of their original contracts. The most striking development of the decade in this field has been in the production of petroleum which stood at only 3,000,000 bar. in 1914, jumped to 36,500,000 in 1917, reached the peak at 45,500,000 in 1918 and stood at 34,000,000 in 1920. The supply of materials for cement seems inexhaustible and the value of this product is exceeded only by oil, coal and gas. Kansas ranks fourth in the Union in the production of salt, of which the production in 1920 was reported by the State Geological Survey at 873,576 barrels. The Joplin zinc and lead field overlaps the S.E. corner of the state, but while the field approaches exhaustion on the Missouri side, it is capable of indefinite development in Kansas. The output in 1920 was 20,249 tons of zinc and 3,025 tons of lead.

Manufactures and Transportation.—Federal statistics distinguish 36 industrial groups in each of which the value of the annual output exceeds $300,000. The state issued an *Industrial Directory* in 1919 which presented a preliminary survey of all the establishments engaged in any kind of manufacture. The larger interests were based upon products of agriculture. The largest is the slaughtering and packing of meat, which produces almost one-tenth of the total output of the United States. The State Board of Agriculture valued the animals slaughtered and sold for slaughter in 1920 at about $105,000,000. Nearly the whole of this industry is localized in Kansas City. The next largest interest is the milling of flour, which is widely distributed over the state. During the year ending June 30 1920, 18,000,000 bar. of flour was milled. Slaughtering and milling together contribute considerably more than half the value of the manufactured products of the state. Railways and the industries subsidiary to them employ a large part of the labour of the state. The railway mileage was 9,006 in 1910 and 9,525 in 1915, but construction was suspended during Federal control and mileage declined in 1920 to 9,352. Electric interurban railways (mileage 512 in 1920) have developed less rapidly than in more thickly settled states.

Constitution.—Kansas in 1921 was still governed by her original constitution, adopted in 1859. Twenty-one amendments were made prior to 1910 and six have been added since that time. Unlimited suffrage was extended to women in 1912 (they had enjoyed municipal suffrage since 1887), and under pressure of the World War the suffrage was limited in 1918 to citizens of the United States. Provision was made for recall of public officers in 1914, but the Supreme Court (*State* v. *Deck*, 106 Kans. 518) decided that the clauses are not self-executing, in that they make no provision for special elections, and the Legislature has not seen fit to give them effect. As the result of a campaign for a stable income for the state educational institutions, the Legislature was authorized in 1918 to levy a permanent tax for their support but in 1921 had failed to act. In the face of a constitutional requirement that all property be taxed at a uniform rate, it had not been possible to make any progress in the direction of tax reform. In 1915 the Legislature attempted to reach intangible property by an Act exempting from taxation all mortgages on which a certain registration fee had been paid, but the Supreme Court (*Wheeler* v. *Weightman*, 96 Kans. 50) held that the Act involved a classification of property and was therefore unconstitutional. An amendment had been submitted in 1914 and was resubmitted in 1920, permitting the classification of property for purposes of taxation but on both occasions was rejected. Two amendments were adopted in 1920. One, resulting from the efforts of Gov. Allen to reduce farm tenantry, authorized the creation of a fund to assist in the purchase of farm homes. The other so far removed the prohibition of state action in works of internal improvement as to allow the state to assist counties in building roads. No action was taken by the succeeding session of the Legislature under either head. It is a conspicuous fact that the amendments adopted by the people during the decade 1910–20, depending for execution upon legislative action, were not given effect.

Legislation.—The Legislature met in biennial sessions from 1911 to 1921 and in special session in 1920. Except for the "blue sky" law and the Act establishing a Court of Industrial Relations, legislation has followed the drift in other states. The "blue sky" law, for the regulation of investment companies, was passed in 1911 and amended in detail in 1913 and 1915. It prohibits the sale in the state of stocks not approved by a board, consisting of the Secretary of State, and Attorney-General and the State Bank Commissioner, and thus prevents the floating of worthless securities. It has been extensively copied in other states. Another step in advance was the Act of 1913 which provides for the nomination and election of judges by separate ballots without party designation. During the decade 1910–20 the management of all of the state's institutions was highly centralized. The first step was taken in 1913 by placing all the educational institutions under a single Board of Educational Administration, consisting of three members, and in 1917 all the institutions, educational, charitable and correctional, were placed under control of a State Board of Administration, consisting of three members and the governor as chairman *ex officio*. The Act was based on the manager idea, according to which the head of each institution is chosen by the Board and held responsible for the administration of his own institution. It is open to question whether the duties of such a board are not too diverse. There is also danger that the change may lead to political interference with the internal management of the educational institutions, but no such tendency had developed by 1921. The expectation that the Legislature would accept the estimates of the Board as to the financial needs of the various institutions had not been realized. An attempt made by Gov. Capper in 1917 and renewed by Gov. Allen in 1921 to consolidate on a similar plan the various bureaus that compose the State Board of Agriculture did not succeed. In 1911 the State Board of Railroad Commissioners was superseded by a Public Utilities Commission, modelled on the commissions already established in New York and Wisconsin, to which was given supervision of all public utilities in the state. In 1919 a general strike in the coal-field suspended production and threatened a coal famine in the midst of an exceptionally severe winter. Gov. Allen took over the coal-mines and began their operation by means of volunteers recruited chiefly from among the students in the educational institutions, and called the Legislature in special session to provide against the recurrence of such conditions. The result was the passage in 1920 of an Act which created a Court of Industrial Relations, consisting of three members. The Act declared the manufacture of food and clothing, the mining of fuel and transportation to be essential industries and "affected with a public interest" to such a degree as to justify public control. The right of collective bargaining was recognized but strikes were prohibited and the Court was given authority, either on its own initiative or on complaint, to investigate and to issue orders regulating limitation of production, hours and conditions of labour and rate of wages. Appeal from the orders of the Court may be taken to the civil courts. Originally the Public Utilities Commission was merged in the Industrial Court but at the regular session of the Legislature in 1921 the former was reëstablished as a separate body and the Labour Bureau and the Industrial Commission were merged in the latter. The purpose of the Court of Industrial Relations is to protect the interests of the public as between the employer on the one hand and labour on the other and to avert industrial war. The Court was not entirely satisfactory either to the employer or to labour, but it constituted the most interesting experiment that had been made in this field during the decade and the outlook was encouraging. The Act establishing the court was sustained by the State Supreme Court.

In some other directions legislative progress has been less satisfactory. An Act of 1903, prohibiting discharge of workmen on account of union membership, was lost through judicial interpretation. The Act was sustained in 1912 by the Supreme Court of the state (*Kans.* v. *Coppage*, 87 Kans. 752) but in 1915 was held by the U.S. Supreme Court to be a taking of property without due process of law, in that it curtailed the employer's right to make contracts on the most favourable terms (*Coppage* v. *Kans.* 236 U.S. 1). In 1915 the Legislature created a Civil Service Commission, consisting of three state officers, one of them to be a member of the faculty of the state university, and all serving without compensation. The Commission functioned as well as the inadequacy of the law would admit, but in 1921 employees in the State Banking Department were removed from its control and the Commission was left without appropriation for contingent expenses. The state thus reverted to the spoils system. The laws respecting child labour, budget and workmen's compensation were not regarded as satisfactory. A commission was created in 1919 to draft a law upon workmen's compensation, but in 1921 no action had been taken upon its report. An act of 1919 prohibited the use of a red flag or of any flag emblematic of "bolshevism, anarchy or radical socialism." A bill, passed in 1921, requiring voters in primary elections to register their party affiliations in advance, was prevented from becoming law only by the veto of the governor. Acts passed in 1907 and amended in 1909 provided for the adoption of commission form of government in cities of the first (over 15,000 inhabitants) and second (between 2,000 and 15,000) classes. Fifty-two cities, including all those of the first class, had availed themselves in 1921 of this opportunity and the question was pending in several others. The cities that have acted more recently have favoured a combination of the commission and city-manager plan. Of the 525 cities in the state, 158 are members of the Kansas League of Municipalities which maintains a monthly bulletin, entitled *Kansas Municipalities*, edited by the secretary and published at the state university. Taken as a whole, the legislation of the decade hardly sustained the reputation enjoyed by Kansas as being particularly radical in its measures. More progress in this direction would doubtless have been made but for the World War and its reaction.

History.—Kansas has been overwhelmingly Republican in politics and there has been practically no Democratic press in the state. W. R. Stubbs was elected governor in 1909 and re-elected in 1911, as representative of the reform wing of the Republican party. Under the leadership of William Allen White, Victor Murdock and Henry J. Allen, the reform wing of the party joined the Progressive movement and the primaries in Aug. 1912 declared for Roosevelt for presidential nominee. The division in the Republican ranks resulted in giving the electoral vote of the state that year to Wilson and in the election of a Democratic governor, George H. Hodges. In 1914 the Republicans regained control of the state Government by the election as governor of Arthur Capper, owner of the Topeka *Capital* and of a group of farm papers, and he was reëlected in 1916, although the electoral vote of the state again went to Wilson. Henry J. Allen, Republican, owner of the Wichita *Beacon*, was elected governor in 1918 and reëlected in 1920. In the latter year the electoral vote for President went to Harding by enormous majorities. The World War was enthusiastically supported by all parties. One of the larger training camps, named from Gen. F. Funston (who died early in 1917), was located on land adjoining the Fort Riley military reservation. The state supplied 63,428 men to the rank and file of the army. The amounts subscribed to the war loans were: First Liberty Loan, $11,108,750; Second, $27,895,200; Third, $47,381,200; Fourth, $73,914,550; Victory Loan, $51,208,250.

State Documents.—Session laws and Senate and House journals are issued after each legislative session. The last edition of the *Compiled Statutes* was issued in 1915. A complete revision was in preparation in 1921. Reports of executive departments are brought together in a collective volume entitled *Combined Department Reports.* Other important publications are the *Biennial Reports* of the State Board of Agriculture and the State Board of Health and the Collections of the State Historical Society. The State Library issued in 1920 a reprint of the *Proceedings* of the Constitutional Convention of 1859, with much supplementary historical matter, edited by H. G. Larimer. (F. H. H.*)

KAPP, WOLFGANG (1868–), German conspirator, the author or chief instrument of what is known as the Kapp *coup d'état* (or *Putsch*) of March 13 1920, was born in New York July 28 1868. He was the son of one of the leading German Liberals of 1848, Friedrich Kapp, who, when the reaction triumphed, had sought refuge in America and remained there until the establishment of the German Empire by Bismarck in 1871. Friedrich wrote books which had a considerable vogue on the history of German immigration into the United States and on the question of slavery. He returned to Germany and was a National Liberal member of the Reichstag until he separated from Bismarck on the question of protection. His son Wolfgang grew up under Bismarckian influences, and after an ordinary official career became the founder of the Agricultural Credit Institute in East Prussia, which achieved great success in promoting the prosperity of landowners and farmers in that province. He was consequently in close touch with the Junkers of East Prussia, and during the World War made himself their mouthpiece in an attack on the Imperial Chancellor Bethmann Hollweg published in 1916 under the title of *Die Nationalen Kreise und der Reichskanzler.* This pamphlet appeared about the same time as the attacks of "Junius Alter" and evoked an indignant reply from Bethmann Hollweg in the Reichstag, in which he spoke of "loathsome abuse and slanders." Kapp continued his campaign against the Government, and was one of the chief founders of the *Vaterlandspartei* under the auspices of Tirpitz. For a brief period before the Revolution he was a Conservative member of the Reichstag.

Nothing more was heard of him until on March 12 1920 the Republican Government of the Reich suddenly issued an order for his arrest. It turned out that he had organized, with Gen. von Lüttwitz and other officers, a conspiracy to seize power in Berlin and to occupy the Government offices. Noske, the Socialist Minister of National Defence, had, with misplaced confidence, put Lüttwitz at the head of the troops which suppressed the Communist risings in Berlin. Lüttwitz, after delivering a kind of ultimatum to the Government, placed himself at the disposal of Kapp, and led the troops, which consisted mainly of the so-called "Baltikum" and other Free Corps, from the camp of Döberitz near Berlin into the capital in the early morning of March 13, where he occupied the Government buildings. Kapp was installed in the Imperial Chancellery and issued proclamations with his signature as "Chancellor of the Reich." President Ebert, Chancellor Bauer, and other members of the Ministry fled in motor-cars first to Dresden and afterwards to Stuttgart, where a meeting of as many members of the Reichstag as could be assembled took place. Meanwhile Kapp tried to form a Government, with a number of desperate and in part criminal characters in the subordinate offices. Well-known Conservatives and former secretaries of state, who were invited to assume the more important offices, declined to associate themselves with him. He endeavoured to negotiate with ministers who remained in Berlin, particularly with Schiffer, Minister of Justice. The chief grievances which Kapp and his followers professed to have against the Government were (*a*) that the National Assembly, which had been elected as a Constituent Assembly, was prolonging its existence and acting as a permanent Reichstag; (*b*) that this Assembly was manifesting an inclination to revise the constitution in respect of the election of the President of the Republic so as to make the election lie with the Reichstag instead of with the electorate of the country. There was something in these complaints, and in the sequel the date of the general election for the first republican Reichstag was hastened and was fixed for the following June, while all attempts to change the method of election for the presidency of the republic were abandoned.

The Government had no troops whom it could trust to put down the Kapp insurrection, but the working classes of Berlin took the matter into their own hands, and by a universal strike rendered the continuance of the Kapp "Government" impossible. The leading generals of the army, with the exception of Ludendorff, had at the same time informed Lüttwitz that his position and action were entirely irregular and that he must resign in the interests of the country. Kapp saw that the game was up, and on the evening of March 17 he and Lüttwitz fled from Berlin in motor-cars. The insurrectionary Government had lasted four days. The legitimate Government on its return to Berlin issued warrants for the arrest of Kapp, Lüttwitz and their associates. Lüttwitz entirely disappeared, but Kapp remained in hiding for a time on his East Prussian estates, and ultimately managed to escape by aeroplane to Sweden.

The effects of the Kapp *coup* throughout Germany were more lasting than in Berlin. On the one hand it led to a succession of Communist insurrections, of which the most serious was that which was suppressed by reactionary troops and with reactionary severity in the Ruhr region, March–April 1920. On the other hand it left a rump of military conspirators such as Col. Bauer, Maj. Pabst and Capt. Ehrhardt, who found refuge in Bavaria under the reactionary Government of Herr von Kahr (itself an indirect product of the Kapp *coup*) and there attempted to organize plots against the republican Constitution and Government of Germany. The crisis in the relations of Bavaria with the Reich (Aug.–Sept. 1921) which ended in von Kahr's resignation was a further phase of the same trouble.

KAROLYI, MICHAEL, Count (1875–), Hungarian politician, was born on March 4 1875. He was at first an agrarian Conservative, and as such president of the Hungarian Agricultural Union, and then, as deputy, an adherent of the extreme Chauvinist party. He became the leader of the Radical wing of the Independence party (*see* Hungary), a personal opponent of Count Stephen Tisza, and led the parliamentary opposition and obstruction against him. In the spring of 1914 he travelled to America to collect among Hungarians resident there election funds for his party. The outbreak of war found him in France, where his companions were interned, but he was allowed to go free, and returned to Hungary. He entered the army as a volunteer. On the approach of the catastrophe he allied himself and his party with the anti-Chauvinist Bourgeois-Radicals and the Social Democrats, developed pacifist views, and sought to bring an end to the war by preparing the way for the revolution. He was prime minister in the Oct. revolution, and was elected by the National Council on Jan. 11 1919 President of the Hungarian People's Republic. He handed over the Government on March 21 1919 to the Soviet Government, and after its fall emigrated to Czechoslovakia, then to Italy, but was expelled from there on Feb. 1 1921 on account of Communist propaganda. He then obtained permission to live in Yugoslavia.

KATO, TAKAAKI [KOMEI], Viscount (1859–), Japanese statesman (*see* 15.696), resigned his post as ambassador in London in Dec. 1912. Returning to Japan, he joined the late Prince Katsura's third Cabinet as Foreign Minister for the third time, but resigned soon after. He then reorganized the Doshikai, created by Katsura, and renamed it the Kensei-kai or Constitutionalist party, becoming its president in 1913 (*see* Japan: *Political Developments*). In April 1914 he joined the Okuma Cabinet as Foreign Minister, resigning in the following August. In Aug. 1915 he was elected to the House of Peers.

KATSURA, TARO, Prince (1847–1913), Japanese soldier and statesman (*see* 15.697). In Aug. 1911 he resigned in favour of Marquess Saionji, having completed the work of financial reform and treaty revision he had undertaken, and received the rank of prince. On Dec. 20 1912 he again accepted office as premier, gallantly facing the difficulties due to lack of public confidence in the control of State policy by the *Genro* (Elder Statesmen). In Feb. 1913, however, a vote of censure on the premier was moved in the Diet for the alleged misuse of imperial rescripts, and on Feb. 11 the Prince resigned office and was succeeded by Adml. Yamamoto. His health was already failing and he died on Oct. 10 1913.

KEANE, AUGUSTUS HENRY (1833–1912), Irish anthropologist, was born at Cork June 1 1833. He was educated at Dublin and in Rome for the Roman Catholic priesthood; but he declined to enter the Church, and devoted himself to geographical and ethnological research (*see* 1.442; 9.900; 22.678). He registered and classified almost every known language, and from these data worked out a system of ethnology. He edited Stanford's *Compendium of Geography* and, besides many papers in the journals of learned societies and in encyclopaedias, published *Man, Past and Present* (1899); *Ethnology* (1896 and later editions); *The Gold of Ophir* (1901), etc. He was professor of Hindustani at University College, London, till 1885. He died Feb. 3 1912.

KEANE, JOHN JOSEPH (1839–1918), American Roman Catholic archbishop (*see* 15.706), died at Dubuque, Ia., June 22 1918. He had retired in 1911.

KEARY, CHARLES FRANCIS (1848–1917), English author, was born near Stoke-on-Trent, March 28 1848. Educated at Marlborough and Trinity College, Cambridge, he was for some years in the coins department of the British Museum. His first published work was *Outlines of Primitive Belief among the Indo-European Races* (1882), followed by several works on Norse history and mythology, *The Mythology of the Eddas* (1882); *The Vikings in Western Christendom* (1890) and *Norway and the Norwegians* (1892). In 1910 he published a philosophical work *The Pursuit of Reason*; but from 1889 onwards he devoted most of his time to fiction and verse. Amongst his novels may be named *A Marriage de Convenance* (1889); *Herbert Vaulennert* (1895) and *Bloomsbury* (1905); and amongst his poems, *Rigel, a Mystery* (1903) and *Religious Hours* (1916). He died in London Oct. 25 1917.

KELLOGG, CLARA LOUISE (1842–1916), American singer (*see* 15.719), died at New Hartford, Conn., May 13 1916. She was the author of *Memoirs of an American Prima Donna* (1913).

KELTIE, SIR JOHN SCOTT (1840–), British geographer, was born at Dundee March 29 1840. He was educated at Perth, and afterwards at St. Andrews and Edinburgh. In 1861 he joined the editorial staff of W. & R. Chambers, of Edinburgh, and from 1871 to 1884 was employed by Macmillan & Co., being also for some years the sub-editor of *Nature*. In 1880 he was appointed editor of the *Statesman's Year Book*. He became in 1884 inspector of geographical education in connexion with the Royal Geographical Society, becoming librarian of the society in 1885 and its secretary in 1892. This position he held till 1915, when he was appointed joint-editor of the *Geographical Journal*. In 1917 he retired and in 1918 was knighted. Sir John Keltie has been the recipient of many honours from learned societies, including the Cullum gold medal of the American Geographical Society and the gold medals of the Paris and Royal Scottish Geographical Societies (1915), besides the Victoria medal of the Royal Geographical Society (1917). In 1897 he was president of the geographical section of the British Association. His best-known book is *The Partition of Africa* (1894), which is one of the standard works on the subject. He has also published *A History of the Scottish Highlands and Clans* (1874); *Report on Geographical Education* (1886); *Applied Geography* (1890; new ed. 1908) and *The History of Geography* (with O. J. R. Howarth, 1914); besides many articles in scientific and geographical journals. He acted during the winter of 1918–9 as a geographical adviser to the historical section of the Foreign Office.

KENDAL, WILLIAM HUNTER (1843–1917), English actor (*see* 15.727), died in London Nov. 7 1917.

KENNEDY, SIR WILLIAM RANN (1846–1915), English judge, was born at Dublin Jan. 14 1846. He was educated at Eton and King's College, Cambridge, where he had a distinguished career. He was called to the bar in 1871, and became a Q.C. in 1885. He joined the northern circuit and settled in Liverpool, where as an expert in shipping and mercantile cases he earned a very high reputation. He unsuccessfully contested Birkenhead in 1885 and 1886, and St. Helens in 1892, in the Liberal interest. In 1892 he was appointed a judge of the Queen's Bench division and was knighted, and in 1907 became a lord of appeal, being made a Privy Councillor in 1909. He died in London Jan. 17 1915.

KENTUCKY (*see* 15.740).—The census of 1920 ranked Kentucky as 15th state with a pop. of 2,416,630; in 1910 the state was 14th with 2,289,905. The gain of 126,725, or 5·5%, was numerically the least since 1840 and per cent the least since 1790. There were 1,227,494 males and 1,189,136 females. The whites numbered 2,180,560, an increase since 1910 of 7·5%; the negroes 235,938, a decrease of 9·8%. Foreign-born whites numbered 30,780, or 1·3% of the total pop., as against 40,053, or 1·7% in 1910. There were also 57 Indians, 62 Chinese, 9 Japanese, and 4 others. White men 21 years of age and over numbered 584,721; white women, 560,804; total, including negroes, 1,289,496, most of whom may vote under the new election laws of 1920. The density of pop. in 1920 was 60·1 to the sq. m.; in 1910, 57. The state remained overwhelmingly rural, despite a rise of urban pop. from 24·3% in 1910 to 26·2% in 1920. Sixty-four counties, widely scattered, lost pop. in the decade; while four in the eastern coal-fields gained 50% or more. In 1916 the Baptists claimed 367,731 members; Roman Catholics, 160,185; Methodists, 155,229; Disciples of Christ, 129,972; Presbyterians, 48,423; Church of Christ, 24,216; Episcopalians, 9,383. The eight cities with a pop. of over 10,000 in 1920 were:

	1920	1910	Increase Per cent
Louisville	234,891	223,928	4·9
Covington	57,121	53,270	7·2
Lexington	41,534	35,099	18·3
Newport	29,317	30,309	−3·3
Paducah	24,735	22,760	8·7
Owensboro	21,055	16,011	31·5
Ashland	14,729	8,688	69·5
Henderson	12,169	11,452	6·3

Education.—The large number of illiterates reported in 1910 (208,084) led to the creation of two illiteracy commissions in 1914 and 1918 respectively. In Rowan county in 1911 night schools for adult illiterates were inaugurated. Renewed educational campaigns secured a compulsory attendance law, higher salaries, consolidated schools, better organization and more revenue, reducing illiteracy from 12·1% in 1910 to 8·4% in 1920. An Act of 1920 grants to counties and cities ample taxing powers to provide for their schools. The census reported 702,391 children of school age, of whom 519,093 were enrolled. High schools shared in this expansion, increasing from 83 in 1910 to 400 in 1920.

Agriculture.—The number of farms increased from 259,185 in 1910 to 270,626 in 1920, but the improved land decreased from 14,354,471 ac. to 13,975,746, despite the efforts of the reclamation service, which expended $1,620,027 in the counties bordering on the great rivers and in the western coal area. This drainage and flood-prevention work involved 471,874 acres. No control has been perfected to meet floods, such as that of 1913. The number of farm owners increased from 170,332 in 1910 to 179,327 in 1920; the number of tenants decreased in the mining counties and increased in Mason 82%, Boyle 76%, Mercer 68%, Fayette 63%, and Bourbon and Jessamine 60% each. Women who operated farms in 1920 numbered 11,399; negro farmers, 12,628. The average size of farms decreased from 85·6 acres in 1910 to 79·9 in 1920. The value of all farm property rose from $773,797,880 in 1910 to $1,511,901,077 in 1920. The average value of farms in 1910, $2,452, rose to $4,823 in 1920; the average value of the land from $21.83 per acre to $48.62. Of the farms which in 1920 were operated by their owners, 25·8% were mortgaged.

Live-stock figures are not closely comparable because the census of 1910 was taken April 15, that of 1920 on Jan. 1. Despite this change, however, mules increased from 216,915 to 292,857, cattle from 898,444 to 1,093,453, and chickens from 8 to 10 millions. A decrease is recorded in horses from 425,000 to 382,000, though the price of thoroughbreds did not decline; in sheep from 778,154 to 707,845. The number of swine in 1920 was 1,504,431, valued at $15,471,514. The total value of all live stock in 1920 was $148,125,506.

The value of the crops in 1919 and 1909 was:

	1919	1909
Cereals	$151,792,740	$60,738,651
Other grains and seeds	1,660,745	765,903
Hay and forage	43,399,964	10,510,422
Vegetables	26,163,576	11,850,994
Fruits and nuts	4,989,367	5,019,231
Tobacco	117,730,675	37,174,000
Miscellaneous	2,917,857	4,535,607
All crops	$348,654,924	$130,594,808

After 1915 there was a marked increase in farmers' unions, marketing associations, young people's clubs and agricultural extension courses. On the other hand, orchards revealed a distinct decline both in trees and fruit, apparently suffering from neglect.

Minerals.—The coal output in 1910 was 14,623,319 tons; in 1916 it was over 25,000,000 and in 1920, 38,892,044 tons, the increase being partly due to strikes in other regions. To provide for this increase, most of which was in the eastern counties, the Louisville and Nashville Railroad constructed 333 m. of track and expended $30,000,000 during the decade of 1910–20; the Baltimore and Ohio constructed 55 m. In Pike, Perry, Letcher and Harlan counties the pop. increased 50% or more, while the number of tenants in the agricultural districts decreased. New towns, such as Ravenna, Jenkins, McRoberts and Lynch, sprang into existence. Petroleum was marketed in small quantities, because of the low prices, prior to 1916. Stimulated by the war, prices rose from $2.05 per bar. on Jan. 1 1917 to $4.50 at the close of 1920. No trustworthy figures are available prior to the reports of the tax commission, according to which 17 counties produced as follows:

	No. of bar. produced	Value
1918 (8 months April–Dec.)	3,444,620	$ 8,906,422
1919 (12 months)	9,226,472	24,459,016
1920 (12 months)	8,552,877	33,556,241

The greatest pool, Big Sinking, was opened in Lee county. A new field appeared in the south-western counties, centering about Allen and Warren. In many locations the drillers opened gas wells which have reduced the state's dependence on West Virginia's supply. Mt. Sterling, Winchester, Paris, Lexington, Frankfort and Louisville now obtain natural gas. The principal oil refinery is at Louisville. That city manufactured in 1919 various products to the value of $204,568,000 out of the state's total of $395,660,000.

From 1909 to 1919 capital invested in mines, quarries and wells rose from 26 to 201 millions, or 651%; value of products from 12 to 98 millions, or 713%.

Communications.—Railway facilities were, as already stated, enlarged to meet the increased coal production after 1910. Extension of existing pipe-lines provided for oil transportation, supplemented by river boats for which locks were built by the U.S. Government. But the largest expansion was in road-building and automobiles. Motor licenses increased from 2,808 in 1911 to 114,228 in 1920, bringing with them an insistent demand for better roads. To this end the state roads department receives a tax of $.01 per gal. on the sales of gasoline, and a tax of $.03 from state funds, with Federal aid for approved projects; it also shares with counties the cost of some inter-county roads.

Finance.—The old revenue system based on a general property tax proved inadequate to meet the cost of progressive legislation. After thorough investigation by a legislative committee in 1914, the Assembly at a special session in 1917 created a tax commission. The general tax was reduced from $.50 to $.40; the levy on bank deposits and live stock was fixed at $.10 per $100 of taxable property; a tax of 1% of the market value of oil goes to the state, and half as much to the producing county. Increased by license and franchise revenues, the general fund is then apportioned to various purposes by the Act of 1918. Under the new law, bank deposits rose from $11,000,000 in 1916 to $179,000,000 in 1917; assessed values from $922,000,000 in 1917 to $1,912,343,940 in 1921; railway valuations from $70,000,000 in 1914 to $160,000,000 in 1917. The total revenues in 1920 were $11,628,336. The need of a budget is shown by a floating debt which is carried in the form of warrants.

Legislation.—The Acts of the General Assembly for the period 1910–20 contain many provisions in regard to labour, education, and public health. The Child Labor Act of 1908 was improved in 1910, 1912, 1914 and 1916. Other progressive laws cover the subjects of tax reform, prisoners, banking, insurance, vital statistics and sanitation. In general the Assembly has welcomed all tenders of Federal coöperation in matters of agricultural extension, road-building and public health. No appropriations were made to meet the exigencies of the war beyond the Act of 1918 creating the Council of Defense at a cost of $50,000 per annum. An Act of 1920 to prevent the sale of worthless securities was due to the speculation in oil shares after 1916. A series of Acts permits all cities to adopt the commission plan of government.

History.—The great changes in the political and economic life of Kentucky during the decade 1910–20 were due to three factors: a programme of social legislation carried over from the previous decade; the World War; and participation in national reforms. Of secondary importance were two other factors: the exceptionally severe winter of 1917–8 which was accompanied by pandemic influenza; and the active road-building induced by the increased use of the motor-car. While disease and war tended to check the growth of population as well as to prevent construction work of all sorts, the demand for war supplies and the rise of prices distributed new wealth, created new towns in the eastern counties and permanently enriched all who could assimilate their prosperity. Toward the close of the decade the Prohibition Amendment destroyed the distilling industry, which stood first in value of output in 1914, amounting to $48,862,526; but tobacco alone at war prices in 1919 yielded the unprecedented sum of $117,730,675. Two Democratic governors were elected, J. B. McCreary (1911–5) and A. O. Stanley (1915–9). The latter, however, had a plurality of only 471 votes over E. P. Morrow, Republican, and a Republican was elected secretary of state. Governor Stanley resigned to take his seat as U.S. senator on May 19 1919, Lieut.-Gov. J. B. Black succeeding him. In Nov. 1919 Edwin P. Morrow, Republican, defeated Black by the surprising plurality of 40,176. While the state cast all her electoral votes for Woodrow Wilson in 1912 and 1916 and for Cox in 1920, she chose a Republican senator, R. P. Ernst, in 1920. Several changes were made in the state constitution by popular referendum: in 1915, to permit classification of property for taxation and to employ convicts on public roads; in 1917, to permit telephone companies to merge; in 1919, to adopt prohibition. The 120th county—McCreary—was organized in 1912 out of parts of Pulaski, Wayne and Whitley. In Nov. 1917 the U.S. Supreme Court declared void Louisville's race-segregation ordinance.

On April 3 1910 a night rider was convicted at Marion and in the same year certain farmers and residents of Grant county were convicted of violation of the Sherman Anti-Trust Act by conspiring to prevent the marketing of tobacco. In Aug. 1914 at Hartford, of 65 persons accused of "regulating conduct" by coercing their neighbours, 2 were sentenced; Jan. 11 1917 Governor Stanley persuaded a mob at Murray to disperse after threatening the judge and state's attorney for safeguarding a negro prisoner; and in the same year at Providence a miners' outbreak was quelled by guards returning from the Mexican border. On March 13 1921 a negro prisoner was lynched at Versailles, but the gaoler was removed from office. The most serious outbreak occurred Feb. 9 1920 when at Lexington a mob, attempting to enter the Fayette county court-house to seize a negro during the progress of his trial, was fired upon by state troops after repeated warnings. Seven men were killed and 22 wounded. Soldiers from Camp Taylor arrived later in the day, averting further bloodshed. The negro was convicted and sentenced a few minutes after the firing ceased.

Kentucky furnished for the World War 91,821 men in all branches of the army and navy. Of these, 3,015 died and more than 4,000 were wounded, 300 remaining in hospitals in 1920. Camp Zachary Taylor at Louisville was one of the national cantonments for infantry, while artillerymen were trained at West Point in Jefferson county and at Camp Knox. Total subscriptions to the Liberty and Victory loans were $199,846,510. (E. T.*)

KENYA COLONY (*see* 4.601).—The East Africa Protectorate, commonly known as British East Africa, was annexed to the British Crown in July 1920 and renamed Kenya Colony after Mt. Kenya, the most commanding natural feature of the country. The coast lands included in the protectorate which formed part of the Sultanate of Zanzibar were, however, not annexed; these became the Kenya Protectorate. The present article deals with the country as a whole after 1910, before and after the change in the form of government.

Census returns for 1911 gave the white pop. as 3,175 and the Asiatic (mainly British Indians) at 11,886. In 1920 the whites numbered about 5,570, Asiatics 17,427, Arabs (*i.e.* those long settled in E. Africa and not classed as Asiatics) about 8,000. The native pop. was estimated at 2,620,000. Mombasa, the chief seaport, had 32,000 inhabitants (350 Europeans); Nairobi, the capital, 15,274, of whom 2,020 were Europeans and about 5,000 Indians. The town has handsome public and private buildings, and nearly all the conveniences of a European city.

The period 1904–14 witnessed a great development in the highlands. The area suited to white colonization proved less than had been supposed and does not greatly exceed 12,000 sq. miles. Nearly all of this area had been alienated by 1921. In addition considerable areas along the sea-coast and adjoining Victoria Nyanza were developed by whites as "jungle" plantations, and a beginning made in exploiting the mineral deposits. Unlike the Baganda and other tribes of the Uganda Protectorate the natives produced comparatively little on their own account for export, except sim-sim, which is in demand for its oil, and is grown extensively by the natives of the Nyanza province. Somalis conduct a large trade in cattle. The white settlers in the highlands grow maize, wheat, barley, coffee, potatoes and other vegetables, fruits, flax, etc.; in the lowlands coco-nut, sisal, rubber, cotton and tobacco are the chief products. There are extensive grazing grounds in the highlands with large stocks of cattle and sheep. There are a few ostrich farms. By 1920 over 500,000 ac. had been granted for timber exploitation.

The Uganda railway was taxed to its greatest capacity to carry the rapid increase in goods. This growth of traffic was largely due to exports from the Uganda Protectorate and the north-west part of German East Africa. A branch line, 93 m. long, starting from the Uganda railway 282 m. from Mombasa (*i.e.* S. of Nairobi), was built in 1911–2 to the Magadi soda lake. Owned by the company which exploits the soda, it is worked by the Government. Another railway (30 m. long) was built from Nairobi to the Thika river (towards Mt. Kenya), opening up a rich highland region. In 1915–6, for military purposes, a railway was built from Voi (103 m. from Mombasa) via Taveta to Kahe, on the Usambara railway, German East Africa. But lack of adequate means of communication was a great hindrance to the opening up of the country.

Between 1909–10 and 1913–4 revenue increased from £503,000 to £1,123,000 and expenditure from £669,000 to £1,115,000. In 1912 the protectorate became self-supporting. Railway receipts, licences, taxes and customs are the chief sources of revenue.

The value of imports (excluding railway material, administration stores and specie) rose from £775,000 in 1909–10 to £2,147,000 in 1913–4. In the same period exports increased from £590,000 to £1,482,000. In the last-named year tonnage entering Mombasa and Kilindini harbours was 1,791,000. In the same year the net revenue from the customs reached £197,000, the highest recorded. Of the exports goods to the value of £443,000 were the produce of the protectorate; Uganda exported goods worth £564,000 and goods worth £448,000 reached Mombasa from German East Africa. The principal exports from the protectorate itself were hides and skins (£147,000), grain (£118,000), copra (£35,000), coffee (£18,000) and fibre (£16,000). Tobacco figured in that year (1913–4) for the first time in the exports. Over 60% of the trade was with the United Kingdom or India; the rest went chiefly to the United States, France and Germany. The German East African steamship line had however a large share in the shipping (over 600,000 tons in 1913–4) both to Europe and Bombay.

The World War rendered the trade returns of 1914–9 abnormal, imports largely increasing to meet the needs of the army and exports fluctuating greatly, while shipping dropped. More than half the white settlers joined the military forces and agriculture and stock-raising suffered in consequence. The revenue and trade figures for 1918–9 were: revenue, £1,548,000; expenditure, £1,570,000; imports, £3,397,000; exports, £2,498,000; tonnage, 455,000; customs receipts, £257,000. In 1919–20 a period of depression set in, and while expenditure was £2,170,000 revenue was only £1,726,000. In 1920–1 (year ending March 31) revenue and expenditure was estimated to balance at £3,192,000. The increase was nominal rather than real for the basis of calculation had been changed from rupees at 15 to the £ to florins at 10 to the £, the rupee being given the value of a florin (see below). Despite efforts at economy the year closed with a deficit of £166,000. From 1920 the Uganda railway surpluses which had up to then gone into the general revenue account were devoted to railway developments. In 1917 the customs departments of the protectorate and of Uganda were amalgamated.

History.—In July 1909 Sir Percy Girouard became governor in succession to Sir J. Hayes Sadler. The white community, then numbering some 3,000, was chafing under long delays in obtaining land grants and other grievances. Sir P. Girouard achieved the difficult task of working harmoniously with the settlers, who were largely recruited from the upper and middle classes of England, though they included some hundreds of Boer families. The settlers were mostly men of capital, and in 10 years after the first settler (Lord Delamere, the 3rd baron) had made the highlands his home that region was provided with churches, schools, hospitals, newspapers, substantial farm-houses and fenced farms and race and golf courses. The climate had been shown to suit the European constitution, though even at an altitude of 5,000 to 6,000 ft. manual labour under the Equator was not possible to many white men. The bulk of the farm work was done by the Kikuyu, a race with an aptitude for agriculture. Nevertheless much of the labour was of an indifferent character. Normally relations between the whites and the natives were satisfactory, but there were exceptions. In Sept. 1911 the indignation of the white community was roused by the deportation of Mr. Galbraith Cole, a pioneer settler, by order of the British colonial secretary. Mr. Cole, after vainly seeking protection from stock thieves, shot dead, while he was trying to escape, a Kikuyu caught sheep-stealing. Tried at Nairobi for murder the jury had acquitted Mr. Cole without leaving the box. One result of this episode was the taking of measures by the administration to afford the white settlers better protection, while the Kikuyu and other tribes were given reserves in which they were secure from interference by the settlers. The problem of obtaining adequate labour was serious, and an ordinance compelled the natives to give 60 days paid labour a year on public works. A circular issued in Oct. 1920 was so worded that it aroused the suspicion that the administration was favouring compulsory labour for private persons (*i.e.* the white farmers) and caused many protests in Great Britain. In July 1920 Lord Milner (then colonial secretary) made it clear that no such compulsion would be allowed. In general the good master had little difficulty in getting sufficient native help. In 1921 some 100,000 natives were working for Europeans.

In July 1912 the resignation was announced of Sir Percy Girouard, who had accepted an offer to join the engineering firm of Armstrong, Whitworth & Co. in England. Mr. (afterwards Sir) H. C. Belfield, the new governor, who had served 25 years in the Malay States, reached East Africa in Oct. 1912.

In June 1913 a missionary conference was held at the settlement of Kikuyu (some 15 m. from Nairobi) which was the subject of wide-spread and acute controversy. The missionary societies, as in many other parts of Africa, carried on the greater part of the work not only of Christianizing, but of civilizing the natives, giving them industrial as well as literary education. Their influence is great and nearly always beneficent. The Kikuyu conference was called to consider the matters of common interest to all Protestant missions. At the close of the conference the Bishop of Mombasa (Dr. W. G. Peel) officiated—in a Presbyterian church—at a communion service in which Anglicans, Wesleyans, Presbyterians, Congregationalists and others took part; a service not unusual in the mission field. But this service was strongly denounced by the Bishop of Zanzibar (Dr. Frank Weston), who sought to have Dr. Peel's action condemned. This the Archbishop of Canterbury (Dr. Randall Davidson) refused to do. The aim of the Church, he declared, was to create, out of the labours of all, a native African Church, not a part of the Church organization of England transplanted to Africa. The harmony among the various missionary bodies at work in the country was not disturbed by this episode and the reports of the administration bore increasing testimony to the value of their labours. The missionaries found some of their strongest supporters among the white settlers.

The hostile attitude of the Merehan tribe in Jubaland compelled the Government to begin operations against them in Dec. 1913, and disturbances among the Turkana and other tribes in the frontier district adjoining Abyssinian Somaliland necessitated further operations. Thus when the World War began in Aug. 1914 nearly all the military forces of the protectorate—one battalion and two companies of the King's African Rifles—were in the region most distant from the frontier of German East Africa, and it was some weeks before they could be brought back to Mombasa. In the meantime the majority of the male settlers volunteered for active service, and from their ranks two regiments were formed. The story of the campaign which followed is told in the article East Africa.

It was not until March 1916 that the protectorate was finally freed from German incursions. The war proved very onerous for the natives, heavy demands being made on them for carriers, transport oxen and for meat supplies for the troops, while large numbers of them joined the combatant ranks. The natives responded remarkably well to the needs of the campaign and, despite an inevitable shortage in the white staff and a great loss of cattle through *rinderpest*, their loyalty was not shaken, and the administration continued on practically normal lines. The official report for 1917–8 described the work of the district officials, chiefs and native authorities as "worthy of the highest praise." Tribes on the Abyssinian border and in Jubaland continued however to give trouble. They had never been brought fully under control, and during 1915–6, despite the exigencies of the campaign against the Germans, further punitive measures had to be undertaken.

In 1917 Sir H. C. Belfield went on leave and later resigned, the administration being taken over by Mr. (afterwards Sir) C. C. Bowring, chief secretary to the Government. Changes in the administration, including an elected Legislative Council, were recommended by a committee of the existing nominated Council in June 1917, but no action was then taken. On Jan. 31 1919 Maj.-Gen. Sir Edward Northey took over the governorship. It was a period of change and strain, and Gen. Northey was called upon to deal with difficult political, racial and economic problems. A currency crisis was one of the effects of the war. The original currency was the Indian rupee, and since 1905 the £ sterling had been legal tender at 15 rupees. With the appreciation of silver during the war the exchange value of the rupee began to rise in 1917. The rise, at first gradual, was rapid in 1919 and early in 1920 had reached 2s. 9d. The result was to inflict hardship on the producing class, not only in Kenya, but in Uganda, which had the same currency. In an effort, ill considered, to rectify this state of affairs the Colonial Office in Feb. 1920 fixed the rate of exchange at 2s. sterling a rupee for Kenya, Uganda and Tanganyika Territory. This interference with the course of the exchange prevented the producer from benefiting by the subsequent fall in the price of silver and the reversion of the rupee in 1921 in the open market to the value of 1s. 4d. or less, and in effect added 50% to his costs. The result on the industries of Kenya and Uganda was serious. The very marked decrease in trade in 1920–1 was not due wholly to this cause; the fall in value on the world's markets of tropical produce was a considerable factor, and many of the recent white settlers were without experience as farmers or planters. Sir Edward Northey strongly but unavailingly opposed the alteration in the exchange value of the rupee. In April 1920 a further change was made—a new coinage based on British currency was introduced, the unit being the florin at 2s. sterling, at which value the Indian rupee continued current until it could be replaced. In May 1921, "to prevent too abrupt fluctuations in local values," the Colonial Office decided to make the shilling and not the florin the standard coin. This appeared a reasonable change, as the labourer, clerk and petty trader had persisted in regarding the florin as of no more value than the rupee at the old rate of exchange.

Conditions in Kenya were further strained by the failure, as a whole, of a scheme launched in 1919 to establish ex-soldiers on the land. For this result the administration was partly responsible. Most of the settlers were allotted farms remote from the railway and in some cases undiscoverable, while the need for considerable capital had not been sufficiently made known.

During this period the change from a protectorate to a Crown colony was effected. In July 1919 an ordinance came into force establishing an elective element in the Legislative Council for Europeans, with two nominated members representing the Indian community and one nominated member representing the Arabs. A sufficient number of other nominated members was however retained to give the administration a majority in the Council. Eleven single member constituencies were created for the European electors. Adult franchise on a residential qualification was enacted. The first election was held in Feb. 1920. This was followed, in July 1920, by the formal annexation of the protectorate to the British Crown and the change of name to Kenya Colony. At the same time the raising of a large loan under the Colonial Securities Act was announced, the money to be spent chiefly on railway development, harbours and other public works. The building of a deep-water wharf at Kilindini so that goods could be loaded direct on to the Uganda railway was begun.

The discrimination against Indians made by the administration and in the new constitution caused acute controversy. The Indians outnumbered the whites by nearly three to one, and while the majority of them were mechanics, clerks, shop assistants, small traders or labourers there were many of higher class, professional men and merchants with large interests in the country. The effect of the growth of national sentiment and the progress towards self-government in India was seen in East Africa, where associations were formed to protect Indian interests. These were held to be threatened by the withholding from Indians of "due and effective" representation on the Legislative and Municipal Councils, by the adoption of the principle of segregation of races and by the restriction placed on ownership of land by Indians. The Indians claimed full political and economic equality with Europeans. Neither claim was admitted either in theory or practice by the white settlers in Kenya, to whom the development of the country was predominantly due. The Europeans had the support of the local administration and of the Colonial Office in London, though the Colonial Office disavowed racial prejudice. Such prejudice existed in Kenya, as was seen in the report (published in 1919) of an official commission on the economic condition of the country. If this prejudice was not shared by the administration its position was, as stated by Sir Edward Northey in June 1919, that "though Indian interests should not be lost sight of, European interests must be paramount." Lord Milner (Colonial Secretary), in a despatch dated May 21 1920 to Sir E. Northey, laid down certain principles affecting Indians, including approval of the segregation policy and the reservation of the highlands (outside municipal limits) for Europeans. He proposed that the two Indian members of the Legislative Council should henceforth be elected on a special franchise, similar arrangements to be made for municipal elections. To these proposals the Indian community replied by reiterating their demand for equal rights, and they found powerful supporters in the Government of India and the India Office. The case for the Indians was put with much cogency in a despatch by the Government of India dated Oct. 21 1920. This despatch stated that in the opinion of the Government of India the true solution of the problem was "a common electoral roll and a common franchise on a reasonable property basis, plus an educational test without racial discrimination, for all British subjects,"—a formula which would admit natives as well as Indians to the franchise:—

> Public opinion throughout India (the despatch added) regards the case of the Indians in East Africa as a test of the position of India in the British Empire. At the Imperial Conference of 1918, for the sake of Imperial unity, we accepted the reciprocity resolution, which practically excludes Indians from the self-governing dominions. We cannot agree to inequality of treatment in a Crown colony, especially in which India has always had a peculiar interest.

Further, objection was taken in the despatch to the application, as directed by the Colonial Office, of discrimination against Indians to the Uganda Protectorate, where Indians and Europeans had lived in full harmony. It was also pointed out that in the adjoining Tanganyika Territory, where Indians were protected by the Covenant of the League of Nations, Lord Milner's decision could not be applied (*see* TANGANYIKA TERRITORY). In June 1921 Mr. Winston Churchill, who had become Colonial Secretary, laid down as a principle for application to the Crown colonies and with special reference to Kenya, that there should be no barrier of race, colour or creed which should prevent any man, by merit, from filling any station for which he was fit.

In 1919 negotiations were opened with Italy for the transfer to Italian Somaliland of the right bank of the river Juba and of the port of Kismayu (*see* AFRICA: *History*).

See Lord Cranworth, *A Colony in the Making* (1912) and *Profit and Sport in British East Africa* (1919); C. H. Stigand, *The Land of Zinj* (1913); A. S. and G. G. Brown, *The South and East Africa Year Book and Guide*; T. J. O'Shea (editor), *Farming and Planting in B. E. Africa* (1917); G. D. Hale Carpenter, *A Naturalist on Lake Victoria* (1920); Guy Babault, *Chasses et recherches zoologiques en Afrique Oriental Anglaise* (1917); and *Voyage de M. Guy Babault . . . Résultats scientifiques* (1916–20). An annual report on the administration, etc., is published by the Colonial Office, London, and a special report by J. Parkinson on the geology and geography of the northern part of the country (Colonial Reports, Miscellaneous, No. 91) appeared in 1920. See also the reports on the Uganda railway (Nairobi, yearly) and the British Parliamentary Paper, "Correspondence regarding the position of Indians in East Africa" (1921). (F. R. C.)

KENYON, SIR FREDERIC GEORGE (1863–), English classical scholar and librarian, was born in London Jan. 15 1863, the son of John Kenyon, Vinerian professor of law at Oxford. He was educated at Winchester and New College, Oxford, and in 1888 was elected to a fellowship at Magdalen College. In 1889 he became an assistant in the British Museum, and in 1898 was chosen assistant keeper of MSS. there, being in 1909 appointed director and principal librarian of the Museum. In 1912 he was created K.C.B., and in 1913 was president of the Classical Association. During the World War he served with the army (1914–9), and in 1918 became adviser to the Imperial War Graves Commission. In 1917 he became president of the British Academy, in 1918 professor of ancient history in the Royal Academy, and in 1919 president of the Society for Hellenic Studies.

His published works include editions of Aristotle's *Constitution of Athens* (1891, 1904, 1920) with translations of the same (1891, 1920); *Classical Texts from Papyri in the British Museum* (1891); *Catalogue of Greek Papyri in the British Museum* (1893, 1898, 1907); *Our Bible and the Ancient Manuscripts* (1895); *Palaeography of Greek Papyri* (1899); and *Handbook to the Textual Criticism of the New Testament* (1901, new ed. 1912). He has also produced various editions of the works of the Brownings, including the *Letters* (1897) and *Poems* (1897) of Elizabeth Barrett Browning. He was editor of the centenary edition of Robert Browning's works (1912) and produced in 1914 *New Poems* of Robert and Elizabeth Barrett Browning. In 1914 he published an account of the buildings of the British Museum.

KEOGH, SIR ALFRED (1857–), British physician and surgeon, was born in Dublin July 3 1857, and was educated at Guy's hospital and Queen's University, where he took his degree in 1878. In 1880 he entered the R.A.M.C. He served throughout the South African War. He was director of the R.A.M.C. from 1904 to 1910, and again throughout the World War,—his work in this capacity during 1914–8 proving him to be a most efficient administrator. He was made a K.C.B. in 1906, G.C.B. in 1917 and G.C.V.O. in 1918.

KER, WILLIAM PATON (1855–), British man of letters, was born at Glasgow Aug. 30 1855. Educated at Glasgow University and Balliol College, Oxford, he became professor of English literature and history at Cardiff in 1883 and professor of English literature at University College, London, in 1889. In 1920 he was elected professor of poetry at Oxford. He made a special study of mediaeval literature, and amongst his publications are *Epic and Romance* (1897); *The Dark Ages* (1904); *Essays on Mediaeval Literature* (1905); *Sturla the Historian* (1907). An inspiring teacher, his pupils included many of the ablest *littérateurs* of the younger generation.

KÉRATRY, (COMTE) ÉMILE DE (1832–1904), French author and politician (*see* 15.753), died in Paris April 7 1904.

KERENSKY, ALEXANDER FEODOROVICH (1881–), Russian politician, was born in 1881, the son of the principal of a high school in Saratoff. He studied at the university of St. Petersburg, took part in students' disturbances there and was expelled, but was readmitted and eventually took his degree in law. He joined the St. Petersburg bar and practised for some years as a junior and as leader, often appearing in cases concerning abuses of the administration. When troubles broke out in Turkestan and were supported by military force, Kerensky went to the affected districts and published a scathing indictment of the policy of the Government in Central Asia. In 1912 he was elected to the Fourth Duma and joined the Group of Toil: he was in reality an adherent of the Social Revolutionary party, but as it was impossible in those days to enter the Duma under this flag he chose the Group of Toil in preference to the Social Democrats, whom he considered to be too pedantic and distant from the people. As a member of the Duma he attained a certain notoriety by impassioned speeches and appeals for root-and-branch reform, but he was never conspicuous for steady work or constructive statesmanship. When the first Revolutionary Government was formed people were astonished to hear that Kerensky had been nominated Minister of Justice. The explanation was that he served as a link between the new Government and the Soviet of Workmen and Soldiers. His career as member and head of the Provisional Government is described in the article RUSSIA. He may be said to have played in Russia to some extent the part played by Lamartine in the French Revolution of 1848.

KIAMIL PASHA (1833–1913), Turkish statesman, was born at Nikosia, Cyprus, in 1833 and studied at the military school at Alexandria. In early life he held various offices in Cyprus, and in 1876 was governor of the vilayet of Kosovo. Between 1878 and 1885 he was successively Minister of the Interior, Evkaf (pious foundations), Instruction, and Justice, and in the latter year was appointed Grand Vizier by ʿAbdul Hamid, which post he held until 1891. In 1895 he again became Grand Vizier but, after a short period, was dismissed as a too ardent reformer and was made governor, first of Aleppo and then of Smyrna. In 1907 he was removed from Smyrna and banished to Rhodes. After the Turkish Revolution in 1908, he succeeded Said Pasha as the first Grand Vizier under the regime of the Committee of Union and Progress but, refusing to submit to its dictation, he resigned in 1909. He again became Grand Vizier in 1912, but was driven from office by the Young Turk *coup d'état*, and retired to Cyprus, where he died Nov. 14 1913.

KIDD, BENJAMIN (1858–1916), British sociologist, was born Sept. 9 1858. He entered the civil service, becoming a clerk in the Inland Revenue office. During 1898 he travelled extensively in the United States and Canada for the purpose of economic study, and in 1902 he visited S. Africa for the same reason. In 1904 he published *Social Evolution*, the work by which he is best known. It was widely read and was translated into most European languages as well as into Chinese. His later publications included *The Control of the Tropics* (1898) and *Principles of Western Civilization* (1902). He died at Croydon Oct. 2 1916.

KIDERLEN-WÄCHTER, ALFRED VON (1852–1912), German diplomatist, was born at Stallgast July 10 1852, and was the son of a banker, Robert Kiderlen, who had married Baroness Marie von Wächter. He fought as a volunteer in the Franco-German War (1870–1) and then studied at different universities, retaining throughout his subsequent career a good deal of the jovial (*burschikos*) manner of a German student. In 1879 he entered the German Foreign Office, where he was regarded as one of the most promising members of the small clique that gathered round the celebrated and much over-rated Herr von Holstein. After holding various diplomatic posts, among them that of Prussian minister to Hamburg, he was sent to Bucharest in 1900 and remained there for 10 years, when he was recalled to occupy the post of Foreign Secretary under the somewhat inexperienced Chancellor, Herr von Bethmann Hollweg. He was soon in the thick of the negotiations with France (1911) which arose over the Agadir incident, and which, owing to the state of Kiderlen-Wächter's health, were partly conducted between him and the French ambassador, Jules Cambon, at the Bavarian spa of Kissingen. The mystery which Kiderlen-Wächter, with the complicity of his chief, Bethmann Hollweg, chose to maintain with regard to Germany's ultimate intentions in Morocco, was largely responsible for the crisis which arose between the Western Powers and Germany and which necessitated very plain speaking in the House of Commons by Sir Edward Grey (Nov. 27 1911), and had previously given occasion for a very firm declaration on the British attitude by Mr. Lloyd George, then Chancellor of the Exchequer, at the Mansion House (July 21 1911). French public opinion was, moreover, indignant at certain negotiations which were secretly carried on with Berlin by the French Prime Minister, M. Caillaux, behind the back of the French Minister for Foreign Affairs, de Selves. An agreement on the basis of a cession of territory in the French Congo in exchange for a German declaration of complete *désintéressement* in Morocco was nevertheless ultimately effected. Kiderlen-Wächter died at Stuttgart Dec. 30 1912. (G.S.)

KIELMANSEGG, ERICH, Count (1847–), Austrian statesman, was born at Hanover on Feb. 13 1847, and emigrated in 1866, after the incorporation of Hanover in Prussia, to Austria, where he entered the service of the State in 1870. He became governor of Lower Austria (1889–95), carried through the union of Vienna with the suburbs (Greater Vienna), was Minister of the Interior (1895), Prime Minister (June 19–Sept. 29 1895), then again governor until 1911. He was, with the exception of the Chancellor Beust, the only Protestant minister of Austria.

KIEPERT, RICHARD (1846–1915), German cartographer, was born at Weimar Sept. 13 1846, the son of Heinrich Kiepert, also a noted cartographer. Richard pursued geographical and historical studies at Berlin and Heidelberg universities. In 1870 he travelled in Palestine and Asia Minor, returning to take part in the Franco-Prussian War. He received the Doctorate of Philosophy at Jena in 1874; from that year until 1878 he was engaged in the compilation of Richthofen's atlas of China, and from 1875 to 1887 he edited the geographical periodical *Globus*. He had to do with the preparation of maps from the data collected by many well-known German travellers, such as Rohlfs, Barth, Möllendorf and Lenz. In 1893 he published a *Deutscher Kolonialatlas*, and subsequently, among other works, a *Spezialkarte von Deutsch-Ostafrika* (*1: 300,000*), and numerous school maps, being associated with the map-publishing firm of Dietrich Reimer in Berlin for 25 years. After his father's death in 1898 he completed or brought up to date many of his maps, including such historical works as the *Formae Orbis Antiqui*. Perhaps his most important single work was the *Spezialkarte von Kleinasien* (Asia Minor), (*1: 400,000*) (1902–8). He received the Ritter medal in 1908, and the honorary title of professor in 1913. He died in Berlin Aug. 4 1915.

KING, LEONARD WILLIAM (1869–1919), English archaeologist, was born in London Dec. 8 1869. Educated at Rugby and King's College, Cambridge, he obtained an appointment in the Egyptian and Assyrian department of the British Museum and conducted the Museum's excavations on the site of Nineveh. He also travelled widely in the Near East and collected rock inscriptions in Assyria, Persia and Kurdistan. He was for some years professor of Assyrian and Babylonian archaeology at King's College, London, and published a large number of works on these subjects, including *Babylonian Magic and Sorcery* (1896); *Cuneiform Texts in the British Museum* (1896–1909); *Babylonian Religion and Mythology* (1899) and many others. He died in London Aug. 20 1919.

KINNEAR, ALEXANDER SMITH KINNEAR, 1st Baron (1833–1917), Scottish judge, was born at Edinburgh Nov. 3 1833. He was educated at Glasgow and Edinburgh universities, and was called to the Scottish bar in 1856. For some years he acted as a law reporter, but in 1878 he was chosen leading counsel in the Court of Session for the liquidators in the case arising out of the failure of the City of Glasgow Bank, and henceforward his rise was rapid. In 1881 he became a Q.C., and the same year was chosen dean of the Faculty of Advocates. In 1882 he was made a judge, with the courtesy title of Lord Kinnear, and in 1890 an appellate judge, retiring from the Court of Session in 1913, although he continued to sit in the House of Lords as a lord of appeal. Kinnear was raised to the peerage in 1897 in recognition of his services as chairman of the Scottish Universities Commission of 1889. He was also a member of the commission of 1904 for settling the question of the division of Scottish church property. He died at Edinburgh Dec. 20 1917.

KIPLING, RUDYARD (1865–), British author (*see* 15.825), published (with C. R. L. Fletcher) a *History of England* (1911); *Songs from Books* (1913); and a play, *The Harbour Watch* (1913). After the outbreak of the World War, he wrote a number of descriptive studies of the forces, viz., *The New Armies in Training* (1914); *France at War* (1915); *Fringes of the Fleet* (1915); and *Sea Warfare* (1916), as well as a volume of short stories, *A Diversity of Creatures* (1917), and some small volumes of war poetry. In 1920 he published *Letters of Travel*, an account of various wanderings between 1892 and 1913.

KIRK, SIR JOHN (1832–1922), British explorer (*see* 15.829), died Jan. 15 1922.

KITCHENER, HORATIO HERBERT KITCHENER, Earl (1850–1916), British field-marshal (*see* 15.838). In the autumn of 1910 Lord Kitchener accepted a seat on the Committee of Imperial Defence, and he spent the following winter in the Sudan and E. Africa. In the summer of 1911 he commanded the troops in London during King George's coronation, and he was a few days later appointed British agent and consul-general in Egypt. This modest title concealed a position tantamount to that of supreme authority, and during his tenure of office he introduced many reforms designed to develop the resources of the country and to ameliorate the condition of its people, a task in which he had made great progress when in June 1914, immediately after an earldom had been conferred on him, he proceeded to England on his annual leave. Thus it came about that he was in England when war was declared against Germany. He was asked by Mr. Asquith to accept the Secretaryship of State for War, and he took up his new duties in Whitehall on Aug. 6, the day after mobilization.

In view of the circumstances under which he was assuming this post, Kitchener laboured under certain disadvantages, coming as he did to the War Office for the first time. There was no precedent for a great soldier occupying the position at a moment of supreme national emergency. He possessed no previous experience of the central administration of the army. He was not familiar with the various ramifications of the existing military organization. He had made no close study of strategical problems involved in a campaign in Belgium and north-eastern France, nor could he lay claim to intimate acquaintance with the martial resources of the various belligerents. Owing to a misapprehension of the scope of the contest on which the country was embarking, arrangements had moreover been made in advance under which the general staff at headquarters was being seriously depleted in the interests of the Expeditionary Force that was proceeding to the front. But on the other hand his countrymen trusted him and were roused to enthusiasm by the magic of his name, his Cabinet colleagues placed their confidence in him as they would have done in no other conceivable War Minister, and these factors more than compensated for the disabilities from which he suffered. For Kitchener realized from the very outset that the struggle was practically certain to be much more prolonged than those in authority anticipated, and that a far more strenuous effort than had been prepared for would have to be made by the British Empire if it was to conquer. His remark on reaching his office the first day, "There is no army," was scarcely an exaggeration; for the admirably trained and well-equipped Expeditionary Force stood for no more than an insignificant fraction of the numbers that must be placed in the field, whereas existing means of expansion were totally inadequate.

He perceived that entirely new forces composed of personnel enrolled for the duration of the war must be created, and he straightway issued a stirring appeal to the nation asking for

100,000 men. It was followed by analogous appeals at short intervals, and the response was wonderful. He has been criticised for not making greater use of the existing Territorial organization in the earlier days—the numbers at the front might conceivably have, within narrow limits, been increased more rapidly had he done so. But he was looking far ahead. Realizing that the war would last long enough for his daring and original plan to bear fruit, he was resolved to transform the United Kingdom into a great military Power while the struggle was actually in progress, and complete success eventually crowned his efforts. If clothing and equipping the swarms of new levies presented obstacles at first, the skilfully tapped textile wealth of the country overcame them within a short space of time. But armament from the outset presented a much more perplexing problem. Plants admitting of a vastly increased output did not exist and had to be created, while expenditure of ammunition in the field speedily proved to be far in excess of the estimates which European experts had made in peace-time. Although steps were taken at once to expand munitions manufacture on a great scale, months were bound to elapse before these could possibly produce satisfactory results, industrial troubles indeed aggravating the difficulty.

While this swelling of the national fighting resources constituted Kitchener's greatest and most urgent preoccupation, the Secretary of State for War was also closely concerned in the general disposition of the military forces, and in superintending the plans that were being adopted to achieve victory in the field. India and the colonies were practically drained of regular British troops so as to strengthen the Expeditionary Force. His relations with the French were from the start most cordial, and that the western front represented the vital theatre of war he never doubted; but he found difficulty in restraining the ardour for ventures in the Near East that was displayed by certain Cabinet colleagues who were impatient at the slow progress of the Allies in France and Flanders. He was, no doubt, largely responsible for committing the country to the Dardanelles operations; but in the first instance he agreed to them under the influence of non-professional Admiralty optimism, and a special interest in Egypt perhaps weakened his soldierly reluctance to dissipate fighting forces. As member of a Government whose objections had been over-ruled by French insistence, he was obliged to assent to Macedonian projects in the autumn of 1915. Unwarranted confidence entertained by his fellow countrymen—it was reflected by the attitude of the military authorities in pre-war days—tended however to make his position difficult. Victory had been expected within a few months, whereas a situation of stalemate succeeded the dramatic opening weeks of the conflict. The public as a whole, it is true, never lost their trust in Kitchener, but doubts made themselves heard in some quarters, and these found expression in scarcely veiled attacks upon him in connexion with the shell shortage from which the British armies suffered during the first half of 1915. They helped to focus attention upon an all-important subject, and to bring about the setting up of the Ministry of Munitions, which made such effective use of the foundations laid by Kitchener and his subordinates.

When in the late autumn of 1915 evacuation of the Gallipoli Peninsula was in contemplation he dreaded the effect which withdrawal might exert in the East, and he proceeded to the Aegean. But there he satisfied himself that no other course was admissible; his proposal to divert the forces that would be made available to Alexandretta was opposed by naval and military experts at home, whose view the Government accepted. He visited Salonika and Athens, where he saw King Constantine, and on his way home spent a few hours at Italian headquarters. Shortly after his reaching England, work in connexion with operations, previously kept largely in his own hands, was transferred to the chief of the general staff, and he thenceforward concerned himself almost entirely with administration. There were already 45 British infantry divisions, produced by voluntary enlistment, in the field on Jan. 1 1916; but some of them were short of training, and it was only after the death of the creator of the "new armies" that they proved their real worth. Amidst his multitudinous labours Lord Kitchener had accepted heavy responsibilities in 1915 in connexion with rearming the Tsar's forces, and it was now arranged that he should visit Russia to discuss matters on the spot. On June 5 1916 he sailed from Scapa Flow in H.M.S. "Hampshire." The cruiser struck a mine off the Orkneys, and the great War Minister and most of his staff were drowned.

One of the foremost figures of his time, Kitchener inspired multitudes to a singular extent by his personality. Although a soldier by profession, with victorious campaigns to his credit, his title to fame rests upon statesmanship even more than upon martial prowess. He proved a resolute, capable commander on the Nile, at Paardeberg, and during the later stages of the S. African contest. His recovery of the Sudan was a masterpiece of military organization. To him was it due that India in 1914 possessed nine divisions fit to take the field. But his most conspicuous services to his country are to be traced to his grasp of political conditions and to his comprehensive and prescient outlook over public affairs. In the S. African War other generals might have worn down the Boer guerillas as he did, none would have stood so firm for reconciliation as opposed to insistence upon unconditional surrender. His record while virtual ruler of Egypt for four years was worthy of the traditions laid down by Lord Cromer. The crowning triumph of his career—the creation of the "new armies" and the raising of the United Kingdom to the status of a great military Power within the period of a few months—resulted from his instinctive realization of the gravity of an emergency which others, better situated to form conclusions than he was, had failed to appreciate. Thanks to diplomatic gifts of no mean order, he handled delicate international problems with unfailing tact. An accomplished linguist, he understood Oriental susceptibilities and aspirations to an extent given to few. Never sparing himself, he exacted a high standard of application and efficiency from subordinates. He thus achieved far-reaching administrative successes both in peace and in war, and as War Minister in 1914-6 he not only enjoyed public confidence as no other man could have done, but paved the way for the ultimate victory. (C. E. C.)

KLINGER, MAX (1857-1920), German painter, etcher and sculptor (*see* 15.847), died July 6 1920.

KLUCK, ALEXANDER VON (1846-), Prussian general, was born May 20 1846 at Münster in Westphalia. He took part in the campaigns of 1866 and 1870, and was twice wounded at the battle of Colombey-Neuilly. In 1906 he was promoted to the rank of general of infantry, and at the outbreak of the World War was *Generaloberst* and Inspector-General of the VIII. Army Inspection. He was placed in chief command of the I. Army of the West, which he led in the battles of Maubeuge and St. Quentin, and the advance upon the Marne. He claimed to have repelled the outflanking movement of the French in the battle of the Marne, but he was nevertheless compelled, in consequence of the faulty disposition of the German forces in the line of battle and the success of the Allied offensive, to withdraw his army before what he described as overwhelming odds to the Aisne positions. In March 1915 he was wounded while visiting the front trenches, and was placed on the retired list in Oct. 1916. He published *Führung und Taten der I. Armee* (1920).

KNIGHTS OF COLUMBUS.—The American order of Knights of Columbus is a fraternal beneficiary society of Roman Catholics, founded by Rev. Michael Joseph McGivney in New Haven, Conn., on Feb. 2 1882, and organized under a charter granted by the state of Connecticut (March 29 1882). Beginning with 11 members the society grew rapidly; branches or councils were established throughout the state, then in other states, and finally in adjacent countries. In 1921 there were 2,200 councils, with a membership of over 800,000, found in every state of the United States, in Alaska, Canada, Mexico, Cuba, the Canal Zone, and Panama. From its beginning the order maintained a system of insurance, in which originally all members were required to participate; but after 1893 non-insurance members were enrolled as associates. On Jan. 1 1919 there were 128,935 insured members of an average age of 35 years; the Mortuary Reserve and Death

Benefit funds amounted to $8,740,000. The society is not a “secret” one, and no oaths are administered. Much attention is given to educational work. A chair of American history was founded by the society at the Catholic University of America, Washington, D.C., and 50 scholarships endowed at the same institution. The Knights of Columbus endeavour to combat socialism and radicalism by public lectures and publications. Beginning with the Spanish-American War (1898) they engaged in humanitarian relief. When America entered the World War (1917) about $1,000,000 was at once raised among the members, and work was undertaken at the various training camps in the United States. Further public appeals were made, and in recognition of their excellent service $40,000,000 in all was raised for war relief work. In America 350 buildings were maintained in the camps, and recreation was provided for enlisted men. Similar service was undertaken overseas and 250 recreation centres established. Comforts were provided on board transports and at piers. After the Armistice the Knights established employment bureaus and assisted ex-service men in finding work.

KNOX, PHILANDER CHASE (1853–1921), American politician, was born at Brownsville, Pa., May 6 1853. He graduated from Mount Union College, Alliance, Ohio, in 1872; studied law in an office in Pittsburgh and was admitted to the bar in 1875. The following year he was appointed assistant U.S. attorney for the western district of Pennsylvania. In 1877 he opened an office in Pittsburgh and soon developed a lucrative practice. In 1901 he was appointed Attorney-General by President McKinley and was retained by President Roosevelt. He resigned in 1904, having been appointed to fill the unexpired term of Matthew S. Quay deceased, as senator for Pennsylvania and was reëlected to serve 1905–11. In 1909 he resigned from the Senate to enter the Cabinet of President Taft as Secretary of State, holding that office for four years. He was again returned to the Senate for 1917–23. While he was Attorney-General many important suits were instituted, notably those against the “Beef Trust” and the Northern Securities Co. As senator he was active in debates relating to the Panama Canal, favouring the lock type which was finally adopted. He was opposed to the Panama Canal Tolls Repeal Bill passed in 1914. In 1916 he attacked the administration's Mexican policy and disapproved of the Adamson Eight-Hour Law. In 1919 he desired to separate the League of Nations, which he opposed, from the Peace Treaty. In 1920 he offered a resolution declaring that war with Germany was at an end, which was adopted by both Senate and House, but later failed to pass over President Wilson's veto; but a similar joint resolution of Congress was approved by President Harding July 2 1921 and a formal treaty of peace with Germany signed Aug. 25. He was the author of numerous addresses on railroad rates and commerce. He died in Washington, D.C., Oct. 12 1921.

KNOX-LITTLE, WILLIAM JOHN (1839–1918), British divine, was born at Stewartstown, Co. Tyrone, Ireland, Dec. 1 1839. He was educated at Trinity College, Cambridge, where he took his degree in 1862, being ordained in 1863. From 1865 to 1870 he was assistant master at Sherborne school, but afterwards held various curacies and livings, attracting much attention as an eloquent preacher. He was made canon of Worcester in 1881, and in 1885 became rector of Hoar Cross, Staffs. During the South African War he acted as chaplain to the brigade of Guards, and was mentioned in despatches. He resigned his living in 1907, and died at Worcester Feb. 3 1918.

KOLCHAK, VLADIMIR VASILIEVICH (1875–1920), Russian admiral, was the son of an engineer. His father took part in the Crimean War, and was one of the defenders of the famous Malakhoff Hill. Kolchak spent his childhood at a factory where his father was employed. In 1888 he entered the naval college at St. Petersburg and finished his studies successfully in 1894. In 1900 an Arctic expedition was organized by the Academy of Sciences for the purpose of exploring the “Sannikov Land,” to the north of the Siberian shore, the true position and even the existence of which was uncertain. Baron Toll, the leader of the expedition, invited Kolchak to come with him. At that time he was abroad with the battle fleet, in which he held the rank of lieutenant, but he joined the expedition and took part in its hardships. After many exciting adventures the non-existence of the “Sannikov Land” was proved. The expedition was then divided into two sections: one of them, under Baron Toll, undertook the exploration of the uninhabited Bennet Is.; no member of this expedition was ever seen again. The other party, which included Lieut. Kolchak, after waiting in vain for the return of their companions, sailed back for St. Petersburg in the autumn of 1903.

Kolchak insisted on the necessity of sending a new expedition for the recovery of Baron Toll and his companions. The Academy upheld this opinion, and a new small expedition under Kolchak was sent to Bennet Is. in Jan. 1904. It succeeded in finding the place of the last camp of Baron Toll and in discovering his journal, from which it was clear that the unfortunate explorers, being at the end of their food supplies, had tried to return to the continent and had undoubtedly perished in the Arctic Sea. Kolchak returned to Siberia, bringing with him rich collections accumulated by Baron Toll. In Irkutsk he learned the news of the Russo-Japanese War, and left immediately for Port Arthur. His gallant behaviour during the siege received recognition even from the enemy: after the capitulation of Port Arthur he was allowed to wear his sword with the Cross of St. George when all weapons were taken from other officers. On his return to St. Petersburg in 1905 Kolchak handed to the Academy a report on his Arctic expedition, which was fully approved, and he was presented with a gold medal. Subsequently Kolchak took a leading part in the campaign for the reorganization of the Russian Naval Department and the reconstruction of the Russian fleet. A new general staff of the navy was created and Kolchak was appointed the head of the organizing and statistical section. His report on the “Distribution of the Naval Forces” was used as a basis of the new naval programme.

At the beginning of the World War Kolchak had the rank of captain and was in command of a destroyer in the Baltic. He took part in the operations in the Gulf of Riga in Aug. 1915 which resulted in the complete failure of the German attempt to seize the Riga shore and secured for a long time the right wing of the Russian front. In the summer of 1916 he was appointed commander of the Black Sea Fleet, with the rank of rear-admiral. His activities in this command were most valuable. Even after the revolution the Black Sea Fleet remained for some time the only part of the Russian military force where order and discipline were maintained. But the rising wave of disorganization eventually prevailed here as elsewhere. Kolchak refused to recognize the dictatorship of the Council of Workmen, Sailors and Soldiers at Sevastopol, and when he was ordered to surrender to them his sword with the Cross of St. George, he threw it overboard and left the fleet.

After staying for some time in America, Kolchak returned to Russia, and took an active part in the fighting against the Bolshevists in Siberia. On Nov. 18 1917, by a decision of the Russian Government at Omsk, Adml. Kolchak elected to assume the supreme power instead of the Directorate, which was abolished. He became virtually dictator of Russia. The Council of Ministers remained unchanged under the leadership of Vologodsky. Kolchak assumed the title of Supreme Ruler of Russia, and declared officially that he would convoke a National Assembly, which must be convened as soon as normal conditions were restored, and which alone could have power to decide the future organization of Russia. But he refused to recognize the Constituent Assembly elected in 1917 under abnormal conditions as it did not represent the will of the nation. He proclaimed his sole aim to be the liberation of Russia from enslavement by the Bolshevists, and pledged himself to carry on the struggle to complete victory.

On Jan. 20 1918, at the first meeting of the revived Russian Senate, whose sitting at Petrograd had been suspended by the Bolshevists, Kolchak solemnly took the oath to obey the laws and to fulfil faithfully his trust as Supreme Ruler. The land policy of the new Government was modelled on democratic lines, in view of the advance of the army westward. Whoever sowed was entitled to the harvest, irrespective of the ownership of the land; every encouragement was promised to peasant owners. A final agrarian settlement was reserved for the decision of the National Assembly. But the exceptionally difficult conditions in which the new Government was placed forced Kolchak to take other and less democratic measures. An order was published stating that any attempt to murder the Supreme Ruler, or to wrest power from him, would be punished with death; failure to execute his orders and decrees would be punished with deprivation of civil rights and penal servitude. Numerous arrests were made among political opponents, especially among the members of the Social Revolutionary party. A certain number of executions were ordered by the courts martial.

Kolchak was recognized as Supreme Ruler of Russia by the anti-Bolshevist army of Gen. Denikin in the south of Russia, by the Archangel Government, and, later, by the leader of the N.W. Russian army, Gen. Yudenich. The success of the Siberian offensive in the first half of 1919 had as a result the conditional recognition of Kolchak's Government by the Supreme Council in Paris, June 1919, as the *de facto* Government in Russia. In his declaration to the Allied Powers Kolchak recognized the Russian foreign debts, but refused to recognize the independence of Finland and of the Baltic States, considering that a final decision on these questions could only be taken by the National Assembly.

A peculiar feature of the situation in Siberia was the presence of foreign troops, which were under the command of the French Gen. Janin on the front, and under the orders of the British Gen. Knox in the rear, and thus were quite independent of the Supreme Ruler. In March 1919 the foreign effectives in Siberia numbered over 118,000 men, as follows: Czechoslovaks, 55,000; Poles, 12,000; Serbians, 4,000; Rumanians, 4,000; Italians, 2,000; British, 1,600; French, 760; Japanese, 28,000; Americans, 7,500; Canadians, 4,000. These forces were, however, mostly employed in guarding communications. As for the Czechoslovaks, they were not in sympathy with Kolchak's Government and their chief object was to go home. The Russian army of Kolchak was at the same period estimated at about 150,000 men; this number increased considerably later, but the greater part of this army was composed of raw recruits. When Kolchak assumed the supreme power, the Ural front was held by the Czechoslovaks, but a few weeks later they were relieved by the new Russian army, in the organization of which Kolchak took a leading part as War Minister of the late Government. An offensive was ordered in the middle of Dec. and proved a considerable success. In a great advance of the right wing of the Siberian army the Bolshevist troops suffered a heavy defeat. The town of Perm was occupied on Dec. 24, and more than 18,000 prisoners fell into the hands of Kolchak's troops. Ufa was captured on Dec. 31, and the victorious Siberian army crossed the Kama river and pursued the retreating enemy towards Glazov, taking another 30,000 prisoners. The unfavourable conditions of the Siberian winter, however, and the necessity of completing the organization of the army, did not allow Kolchak to develop his offensive at that moment, but the situation on that front remained fairly satisfactory during the whole spring. On the other hand, the Bolshevists had an important success on the southern front, occupying Orenburg with control of the Turkestan railway.

The great offensive of the Siberian army started in March, when the weather became less unfavourable. For more than two months the young Russian army was advancing on a broad front towards Moscow, which was to be the final objective. Orenburg and Ekaterinburg were occupied in April, and in May Kolchak's troops reached the river Viatka on the Kazan–Sarapul railway line, moving towards Kazan from E. and S.E. Only a few dozen miles separated them from that city and the Volga river. The great advance on the northern section of the front seemed to favour the daring plan of a junction with the Archangel troops. But the great effort of these months had exhausted the power of the Siberian army. Lack of munitions and food supplies, bad communications, lack of true discipline, which could not be created in a few weeks, the absence of efficient administration, continuous misunderstanding between the Government and the Allied Missions which disposed of the munitions and food supply, internal troubles and quarrels among the leaders of different political parties, Bolshevist propaganda, and, most important of all, lack of staunch support from the mass of the population—all these conditions broke down the vigorous advance of the army; it was even unable to resist the Bolshevist counter-offensive. The Moscow Government sent new troops to the eastern front and launched an attack in the direction of Ufa. In the beginning the Siberian army defended the line gallantly, but after a few weeks of constant fighting Kolchak's troops were obliged to retire, and Ufa was captured by the Reds on June 9. The success of the Bolshevists grew rapidly. On July 1 they occupied Perm, and a fortnight later entered the town of Ekaterinburg. Nothing could stop now the retreat of Kolchak's army; demoralization was growing every day. The Ural was crossed in Aug., and in the beginning of Sept. the Bolshevists captured Tobolsk in Siberia and the town of Orsk in the Orenburg district. This disastrous retreat could not remain without influence on the Russian policy of the Allies. On Sept. 15 the Supreme Council in Paris unanimously agreed to follow the British policy of evacuation from Russia and expressed itself as absolutely opposed to any "Russian adventures." The news from abroad certainly did not strengthen the resistance of the Russian army. A last military effort was made in Sept. in the region of Tobol river, and the army had a temporary and local success on this sector of the front, but this diversion was not important enough to stop the advancing Reds. Omsk, the capital of the Siberian Government, was captured by them on Nov. 15; 10 generals, 100 officers, 80 locomotives, 3,000 waggons, etc., fell into their hands.

The seat of the Siberian Government had been transferred to Irkutsk. The leaders of the opposition, especially the members of Socialist parties, took the opportunity of the disaster on the front to renew their activities. A rebellion against Kolchak's Government took place in Vladivostok, and the rebels were joined by Gen. Gaida, the former chief of the Czechoslovaks in Siberia; the movement was suppressed by military force, and Gen. Gaida had to leave the country. Similar riots on a smaller scale were reported from Irkutsk and other places. Under the pressure of the growing hostility of the population Kolchak made a last attempt to reorganize the Government. Victor Pepeliaev, a former teacher and member of the Russian State Duma, was appointed prime minister. He tried to save the situation, basing the policy of his Government on the principle of local autonomy, which was advocated and supported by Gen. Diterichs, formerly chief commander of the troops, and Gen. Semenov, the Cossack leader. But no change of governmental policy could stop the course of the disintegration. The Reds took Novo-Nicholaievsk on Dec. 14, and were moving towards Irkutsk without meeting any resistance as the Siberian army was practically dissolved at that time. The socialist Zemstvo and municipal council of Irkutsk took energetic steps to overthrow the Central Government. The rising resulted in the creation of a new socialist Government, which was elected at the end of Dec. at a joint meeting of the Irkutsk Zemstvo and municipality. Kolchak was asked to resign; at first he refused, but on Jan. 4 he signed an ukaz transferring his power to Gen. Denikin and the supreme military authority in Siberia to Gen. Semenov. At the same time he asked for the protection of the Allies and this was promised to him. But when Kolchak, under the guard of Czechoslovaks, was passing through Irkutsk in his train, which was also loaded with a considerable part of the £65,000,000 gold reserve, the new Irkutsk Government demanded his surrender, threatening in the case of non-acceptance to resist the free passage of the Allied Missions. Gen. Janin ordered the surrender of Kolchak and Pepeliaev. They were kept prisoners for some time at Nijni-Udinsk, and were shot by the Bolshevists on Feb. 6 1920.

(P. Vi.)

KOMURA, JUTARO, Marquess (1855–1911), Japanese statesman (*see* 15.892), was Foreign Minister in the second Katsura administration (1908–11) and died Nov. 24 1911.

KORBAY, FRANCIS (1846–1913), Hungarian musician, was born at Budapest in 1846. He was a godson of Liszt, of whose music he became a well-known interpreter. He had many successful European tours, and was also extremely popular in England. Korbay wrote many pianoforte pieces and songs, but he is best known by his collections of Magyar folk-songs, which have attained a very wide popularity. He died in London, which for many years was his home, March 9 1913.

KÖRBER, ERNST, Ritter Von (1860–1919), Austrian statesman, was born at Trent on Nov. 6 1860, the son of an officer. He entered the State service in 1872, became Minister of Commerce (Nov. 30 1897–March 5 1898); Minister of the Interior (Oct. 2–Dec. 21 1899); Prime Minister (Jan. 18 1900–Dec. 31 1904 and Oct. 28–Dec. 20 1916); deputy curator of the Academy of Sciences (1904–19).

Körber represented the old Austrian tradition of faithful public service; his aim being to ward off by a comprehensive scheme of administrative reform the obvious crumbling of the old system of centralized Government. His *Studies* in administrative reform, published in 1904, involved an indictment of the administration unheard of hitherto in Austrian official circles; he wanted to do away with the "notorious double-tracking" of the parallel administration of the central State and its units, to make a sharp distinction between their respective competence, and to establish a sort of clearing-house of the mixed jurisdictions, leaving intact the whole of the rights of both the State and the unit. This great work remained unachieved, because none of the separate nationalities was prepared to make the necessary sacrifice, even in return for compensation. He tried, with "passionless perseverance," to set Parliament functioning again, seeking to win support by granting large State credits for Alpine railways and Galician waterways; but his success was short-lived, and the delays in the execution of the canalization schemes, which were increasingly costly as time went on, even led to special obstruction on the part of the Poles. The concessions which he made to each national group led to corruption (the purchase of votes by concessions, parliamentary "milking"). After the murder of Stürgkh, Francis Joseph summoned him to the rescue of the State (Oct. 1916), but on the old Emperor's death the new monarch quickly got rid of his unaccommodating adviser. He died in Vienna, March 6 1919.

KOREA (Chosen).—On Aug. 22 1910 Korea (*see* 15.908) became an integral part of the Japanese Empire, under its ancient name of *Chosen*, formerly in use for over five centuries and now officially restored: with this event, a new era dawned for what was formerly the "Hermit Kingdom." The ordered and systematic progress, already inaugurated by Japan in 1906, advanced steadily, though attacks were still made by some foreign critics on her suppression of Korean nationalism.

The peninsula of Chosen, with its outlying islands, has an area of 85,229 sq. m. of which 82,926 sq. m. form the mainland. It is thus about as large as the mainland of Japan or about two-thirds of the size of the British Isles. The pop. in 1920 was 17,284,207, including about 337,000 Japanese and about 23,000 foreigners. The density is only about 208 inhabitants per sq. m. compared with 376 in Japan and about 374 in Great Britain. The climate is dry and bracing, without intense variations of cold and heat, and, in contrast to Japan, there is an absence of hurricanes and practically no visitation of earthquakes. The country is mountainous, especially in the N., but there are extensive plains, well-watered with good rivers, on the S. and W. where are situated the excellent harbours of Fusan, Mokpo, Chemulpo and Chinnampo. The mineral wealth of the country is concentrated in the N., while agriculture is the predominant characteristic of the level and fertile south-west. Chosen's geographical position affords her easy access to the markets of China, Manchuria and Siberia, and a railway line now connects her with northern Asia and thus to the heart of Europe.

Administration.—Subsequently to the annexation, the functions of the Japanese residency-general and of the Korean Government were merged in those of a governor-general, the first to be appointed being Gen. Terauchi, with Mr. I. Yamagata, son of Prince Yamagata, as administrative superintendent. In Oct. 1916 Gen. Terauchi vacated his post to become Premier of Japan and was succeeded by Gen. Count Hasegawa, Mr. Yamagata continuing in office. An important reform effected in this period was the unification of the police and the *gendarmerie* services, by which a better control of the outlying districts was obtained, where hitherto the peace and security of the inhabitants had been frequently disturbed by bands of robbers and marauders. The serenity of Chosen, which had remained unclouded since the annexation, was broken up somewhat abruptly by widespread disturbances which took place in March 1919. Owing to a spirit of unrest, partly due to the World War, partly due to agitators and, no doubt, partly engendered by the cautious slowness of the Japanese in introducing administrative reforms suitable to the measure of progress already achieved, the Koreans were submerged in a wave of desire to achieve at one step that measure of "self-determination" which President Wilson's utterances appeared to them to justify. The disturbances, however, were quickly subdued and the Japanese Government hastened forward reform measures which had already been contemplated. The heads of the administration resigned and Baron Saito was appointed governor-general and Dr. R. Midzuno administrative superintendent. The reforms introduced were: (1) the extension to civil officials of eligibility to the post of governor-general, hitherto only open to a military officer of the rank of general; (2) the governor-general, formerly only directly responsible to the Throne, to be amenable to the Prime Minister of Japan; (3) the governor-general to be relieved, even when a military officer, of the right to the military command, which should be exercised only by the commander of the army; (4) the substitution of a police force for the mixed system of *gendarmerie* and police.

The premier, Mr. Hara, also issued a statement that the Government were desirous of further eliminating as time went on, all differences between Japan proper and Chosen in matters of education, industry and the civil service. A system of provincial and municipal administration, similar to that in Japan, would also gradually be evolved.

Peace was thus established and the Koreans again settled down, although various agitators and malcontents who had fled either to Shanghai, or to Manchuria, from time to time made abortive attempts again to stir up the feelings of discontent which had been so successfully allayed. Episodes which occurred in the autumn of 1920 in the Chientao district, when a Japanese consulate was burned, and attacks were made on peaceful Japanese and other civilians, were subsequently found to have been engineered by Korean agitators.

Finance.—After the Russo-Japanese War, 1904–5, Japan turned her attention more actively to the reform of Chosen fiscal affairs, hitherto sadly neglected, as the budgetary laws enacted in 1895 were not adhered to in practice. Detailed regulations regarding revenue and expenditure were promulgated in June 1906, the system of public tenders was introduced and a Bureau of Audit was established. The Seoul branch of a Japanese joint-stock bank was authorized to act as the Central Treasury of the Chosen Government and the post-offices were also entrusted with Treasury business. In Sept. 1906 regulations with regard to the collection of taxes were issued and assessors appointed, all being made directly responsible to the Minister of Finance.

The coinage system of Chosen was a matter urgently in need of reform, as not only was there no standard money and an excess of nickel coins, but a great deal of spurious foreign coin was also in circulation. A law of 1901, not then put into force, by which the coinage system was to be made analogous to that of Japan, was therefore revived and became operative in June 1905, and it was further provided that the standard money of Japan, or bank-notes, should become the standard money of Chosen. Thus Chosen became a gold country and in a few years' time the country reaped an enormous benefit, both at home and abroad.

The ordinary revenue rose from 44,764,559 yen in 1916–7 to 69,347,820 yen in 1920–1; while the extraordinary revenue rose from 23,437,548 yen in 1916–7 to 54,462,123 yen in 1920–1. The total expenditure which in 1916–7 was 57,562,710 yen, was in 1920–1 113,328,334 yen.

Foreign Trade.—The external trade of Chosen, rapidly increased during the decade 1910–20, is chiefly owing to the development of her agriculture and industry. Contributing factors have been the improvements effected in transport, both by sea and land, with a consequent lowering of freights, the revision of the customs tariff, and also to the greater demand created by the World War.

Exports, valued at 15,369,009 yen in 1912 (in addition to exports to Japan itself of 5,616,608 yen), increased to 199,848,854 yen in 1919 (with 19,816,927 yen to Japan itself); and imports, 40,756,013 yen in 1912 (plus 26,359,434 from Japan), rose to 184,917,978 yen in 1919 (plus 95,868,640 yen from Japan).

During the same period the ratio of the total foreign trade with that of trade with Japan and other countries may be seen from the figures given in the following table.

	Trade with Japan	Trade with foreign countries
1912	67 %	33 %
1913	68 %	32 %
1914	72 %	28 %
1915	78 %	22 %
1916	75 %	25 %
1917	75 %	25 %
1918	81 %	19 %
1919	77 %	23 %

Agriculture and Industry.—In 1908 a special Government office was established in order to control and foster the cultivation of the medicinal plant ginseng, an unrivalled quality of which is produced in the peninsula. Experiments were conducted to counteract disease in the crop and to improve the methods of cultivation, associations of cultivators being also formed. The area under cultivation increased fifteenfold from 1908 to 1920, the present annual value of the medicinal ginseng raised being 2,000,000 yen.

In 1907 the Government commenced operations for the natural evaporation of salt, a product hitherto obtained by the artificial boiling process, and the results being satisfactory, the manufacture was developed as a Government enterprise. By 1918, salt-pans covering an area of 2,528 ac. were in operation, producing 102,396,141 lb. of salt. As this quantity is still insufficient for home consumption, in 1920 the Government commenced laying out an additional 6,370 ac., the work to be completed in seven years.

The production of tobacco, an old-established industry in Chosen, has been greatly improved, both as regards cultivation and manufacture, by the encouragement received from the Government. The area under cultivation has increased from 33,261 ac. in 1915 to 42,525 ac. in 1919, the total value having risen from 4,878,127 yen to 14,501,169 yen in the same period.

Sericulture.—The dryness of the Chosen climate being very favourable to the cultivation of the mulberry tree and the rearing of silkworms, sericulture had been long established, though it had developed but slowly. When the Government undertook the reorganization of the industry in 1906 a great improvement was effected. The native silk-worms being found to be inferior to the Japanese species, the latter were gradually introduced and the production of cocoons was greatly augmented thereby. Some 400,000 families are engaged in the industry, nearly 60,000 ac. of mulberry trees are under cultivation and, in 1918, over 600,000 bus. of cocoons (against 69,000 in 1910) were produced, whilst the value of the cocoons exported in 1918 was nearly 5,000,000 yen. The export of silk itself is negligible, the silk industry of Chosen being still in its infancy.

Stock-Farming.—Cattle-breeding is carried on nearly everywhere in the peninsula, the bulls being employed largely for agricultural and draught purposes on account of their hardy constitution and massive build. The cows give little milk, but furnish good beef. Cow-hides occupy an important place in the export trade. A decline of export was shown in 1912 and 1913 due to cattle plague on the frontier districts, and the large increases in hide exports in 1915 and 1916 were due to the war demand in Japan for tanning purposes.

The Chosen horses are poor but experiments in improving the breed are being conducted by the Government: the breeding of asses, mules, sheep, pigs and goats is proceeding and poultry-raising is also being encouraged.

Horticulture. — Fruit-farming received considerable impetus through the establishment of model agricultural farms by the Government. Generally speaking, the number of pear, apple and chestnut trees and also of grape vines has doubled in the years 1913 to 1918. Afforestation has progressed uninterruptedly since 1907 when the Government first undertook a share of this necessary work, which is also actively carried on by private enterprise. By 1918 the Government had planted 13,004 trees covering 7,880 ac., the local administration 8,194 trees on 17,738 ac., whilst private enterprise had taken up, under lease, 240,443 ac. of State forest-land.

Mining.—Prior to the annexation, the mining industry of Chosen was chiefly in the hands of foreigners, four American corporations and four individuals holding rights, two English corporations and one individual, two Frenchmen, one Russian and one Italian, besides several Japanese and Americans jointly, all enjoying mining privileges and exploiting some 270,000 ac. of mining area, principally gold-bearing. A mining law enacted after the annexation and made operative on April 1 1916, prohibited foreigners from acquiring mining rights in Chosen, unless as a legal Japanese corporation, although the rights existing and already granted to foreigners by the former Korean Government were strictly respected.

The principal mineral products, in addition to gold, are silver, zinc, copper, lead, iron, tungsten ore, graphite, coal (especially anthracite), quartz sand and kaolin. A number of Japanese mine-owners have recently commenced operations in the peninsula and the mining enterprise shows a steady expansion. The total yield from all the mines in the country was as follows:—

1910	6,067,952 yen	1916	14,078,188 yen
1912	6,815,121 "	1918	30,838,074 "
1914	8,522,418 "	1919	25,414,510 "

Manufactures.—Strictly speaking, the factory system of Chosen is still in the first stages of development, the native handicrafts of weaving, ceramics, metal-casting, etc., having been much neglected. New industries, however, are now growing up. The principal ones are ore-smelting, pulp manufacture, cotton-spinning, rice-cleaning, brewing, the production of gas and electric current, as well as the ginseng, tobacco and salt industries already mentioned.

Iron works have been founded at Kyumipo, in the Hwanghai province, which it is estimated will produce annually 100,000 tons of pig iron, 62,000 tons of iron ingots, and 73,000 tons of iron plates, bars, etc., besides by-products. In Shin Wiju a large factory has been established for pulp-making for which the native Yalu timber is being employed. A tanning factory at Yung-dung-po is producing leather belting, sole-leather, harness leather, etc., by the process of oak-chrome tanning.

In 1917 there were in all 1,358 factories in Chosen, with a capital of 39,038,966 yen, the year's production having a value of nearly 100 million yen. About 85 % of the capital was provided from Japanese sources, but there are signs that the natives are awakening to a new interest in manufacturing enterprise.

Fisheries.—Since 1911 the Chosen fisheries have been much improved owing to the provisions of the Fishery Law, promulgated in that year. New fishing associations have been formed, havens for the fishing fleet provided, and proper investigations conducted into the suitability of gear and the movements and location of fish. As a result the fishing population has increased from 93,400 with 16,709 boats in 1910, to 346,349 with 53,118 boats in 1918, the total value of the catch having risen from 7,871,910 yen to 32,863,402 yen in the same period.

Communications.—Prior to the establishment of the protectorate, Chosen possessed no highways worthy of the name, such roads as existed having been allowed to lapse into a shocking state of repair. Few roads were wide enough for vehicular traffic and many were only six feet broad, besides being extremely rough and difficult for coolies and horses alike. After the commencement of the protectorate régime, the Government engineering department planned an extensive scheme of highway construction and by Mar. 1918 over 5,000 m. of road had been constructed or repaired. Some 3,850 m. were undertaken at Government expense and the cost of the remainder was shared between the Government and the local authorities, the total outlay being about 25,000,000 yen.

The first railway line in Chosen, between Seoul and Chemulpo, was completed by a Japanese syndicate in 1900 and opened to traffic in Oct. of that year, whilst the same syndicate undertook the construction of the Seoul–Fusan railway (274 m.), which was completed and opened to traffic in Jan. 1905. The trunk line Seoul-Wiju (309 m.), which traverses the peninsula lengthwise, was built by the Japanese army and completed in 1906. Branch lines were added from time to time, so that by the time Chosen became part of the empire, some 759 m. of railway were in operation. By 1919–20 this figure had been increased to 1,153 miles.

Posts, etc.—Since 1910 the expansion of the postal, telegraph and telephone services in Chosen has been normal, the number of post-offices having increased from 447 in 1910 to 562 in 1920, the postal packets from 100,265,041 to 267,635,965 and the parcels from 1,589,722 to 4,230,179. The length of telegraph lines increased in the same period from 3,389 m. to 4,870 m.; the length of wires from 7,740 to 16,063 m.; and the number of messages from 7,127,235 to 11,012,075. The length of telephone lines increased from 314 m. to 3,260 m.; the wires from 10,121 m. to 225,016 m.; and the messages from 21,260,918 to 58,691,425.

A great increase both in the number of depositors and the amount of their savings was a feature of the Post-Office Savings Bank in Chosen; in 1911–2 there were 223,599 depositors (4,365,996 yen), and in 1919–20 there were 1,406,259 depositors (14,925,990 yen).

(H. SA.)

KORNILOV, LAVR GEORGIEVICH (1870–1918), Russian general and patriot, born on Aug. 31 1870 in the little town of Ust-Kamenogorodsk, Siberia, was essentially a son of the people, his father being a poor Cossack officer and his mother also a Cossack. As a boy he went through a severe schooling in a life of want and privation. At nine years old he entered the parish school, where somehow he learnt to read and write. He prepared himself unaided for his entrance into the Siberian Cadet Corps, which he joined in 1883. Passing thence to the Michailovsky artillery school in St. Petersburg, he was in 1892 commissioned and posted to the Turkestan Artillery Brigade. Within three years he was back again at the capital to enter the academy of the general staff, in the final examinations of which, in 1898, he was among the first. Not attracted, however, by life in the big civilized centres, and instinctively drawn to the open spaces of the Russian borderlands, Kornilov again devoted himself to service in Turkestan, whence he undertook a series of daring journeys into Afghanistan, Chinese Turkestan, Persia and Baluchistan. In 1904, on the outbreak of the Russo-Japanese War, Kornilov, then a lieutenant-colonel, received an appointment with the field army. As a staff officer he took part in many engagements, and for gallant conduct in a difficult rear-guard action at the battle of Mukden he was decorated with the order of St. George of the fourth class. Subsequently he served in the headquarters offices of the general staff and spent four years (1907–11) as Russian military attaché in Pekin, during which period he made journeys into the interior of China.

In the opening stage of the World War, during the Russian campaign of 1914–5 in Galicia, Gen. Kornilov commanded the 48th Inf. Div., which, under his leadership, performed many daring exploits as part of Brussilov's VIII. Army. In the great battle of May 1915 this division became isolated in the Carpathians, and was only extricated by the self-sacrifice of its rear-guard, which Kornilov personally led. He himself was wounded and taken prisoner. He was sent to the fortress of Laka, in Hungary, but, having learnt the Czech language, he managed to escape, dressed as an Austrian private, with the help of a Czech medical officer. They made for the Rumanian frontier on foot, but on their way Kornilov's companion was arrested, the general himself escaping and reaching Russia in the autumn of 1916. He was at once appointed commander of the XX. Army Corps. This corps operated in conjunction with the Rumanians and in Oct. 1916 made a brilliant diversion to save Bucharest from the invading army: but when the Rumanian troops on Kornilov's right gave way he had to retreat. At the beginning of March 1917, with the outbreak of the Russian Revolution, Kornilov was called by Gutchkov to command the troops of the military district of Petrograd. As in this appointment he was responsible for guarding the Provisional Government, it was from this moment that his influence on political events began to be felt. He found the troops, however, in such a demoralized state under the influence of the "Soviet of workers' and soldiers' deputies" that he asked to be relieved and sent to the front, and at the beginning of May he was made commander of the VIII. Army. During the June offensive movement ordered by Kerensky, who went round appealing to the soldiers to advance, Kornilov with his army broke the Austrian front and occupied Kalusz and Halicz, but the impetus was not of long duration and success was followed by débâcle. It now became clear that to restore the fighting capacity of the Russian army, stern decisive measures would have to be taken. Hopes were centred on Kornilov when he was appointed by Kerensky supreme commander-in-chief. "The man with the lion's heart" inspired a general confidence. At the beginning of August, just before the opening of the "State Conference" at Moscow, Kornilov went to Petrograd and presented his programme to Kerensky as president of the Provisional Government. This "programme" demanded the severe punishment of military offenders, not only at the front, but in the rear as well; it called for extraordinary measures for the improvement of transport and the insuring of order at the factories that were working for defence; it demanded the limitations of the privileges of the soldiers' committees and the reëstablishment of the officers' power of enforcing discipline. The programme was, however, rejected, and this was the beginning of the split between Kerensky and Kornilov (*see* Russia: *History*). The gulf between the two men, who proclaimed two opposite political faiths, became wider, and the struggle between them ended in the outbreak of Sept. 8–12. Kerensky gained an apparent victory, and Kornilov, with some faithful followers, was interned in Bikhov, where he remained for over two and a half months. After the October revolution, when the Provisional Government had fallen and power was forcibly seized by the Bolsheviks, Kornilov left Bikhov and early in December made his way to the Don (Novotcherkask), where he assisted Gen. Alexeiev in collecting some 3,500 men and eight guns, and forming the Volunteer Army. Kornilov was given a command in this army, which was badly clad, had no winter equipment and hardly any munitions, but was ready to go anywhere and do anything. The position of the Don, however, grew more and more complicated. The sympathies of the population were divided and doubtful and the Bolshevik forces steadily advanced. The new army, still small in numbers and incompletely organized, was compelled to leave Rostov on Feb. 9 1918, and Kornilov then began his march to the Kuban, where he hoped to find help and support. Through country where the Bolsheviks held all the principal centres and railway lines his men fought their way victoriously but under great difficulties, and crossed the Kuban on March 7, having marched on to the mountain villages of the North Caucasian range and established connexion with a group of Volunteers which had formed under Gen. Erdeli. After a short rest they started again for Ekäterinodar, which, as the capital of Kuban, Kornilov held it essential to occupy. On March 17, in the neighbourhood of Novo Dmitrievskaya, they had to march knee-deep in water and to ford a mountain stream; the men reached the bank half frozen. This adventure was popularly known as the "ice flight." The attack in Ekaterinodar, however, resulted in a terrible misfortune. A stiff battle ensued and the Volunteer Army carried some of the outskirts of the town. But early on the morning of March 31 Kornilov was struck down by the burst of a shell and died without regaining consciousness. His loss was irreparable. A magnetic personality and born leader of men, he knew no fear and shared the hardships with his soldiers.

(Y. D.; P. Vi.)

KOSSUTH, FRANCIS (1841–1914), Hungarian statesman (*see* 15.916). As Minister of Commerce in the Wekerle Cabinet, Kossuth had many opportunities of turning to account his technical and economic experience. At the critical period of the Coalition he showed throughout solid ability, in contrast to Justh, who in 1909 brought about the break-up of the Independence party, which split into the Kossuth and the Justh wings. In consequence of increasing ill-health Kossuth withdrew more and more from active politics, and only appeared in Parliament on special occasions. When in the summer of 1913 the two wings of the Independence party were again united Count Michael Karolyi undertook their actual leadership. In articles published in the *Budapest* Kossuth continued to express his views. He made his last appearance in Parliament on Oct. 30 1913. From his bed of sickness, to which he was confined from the autumn of 1913 onwards, he declined any participation with Count Michael Karolyi against the Triple Alliance policy of the Dual Monarchy. He died May 25 1914. (E. v. W.)

KÖVESS, HERMANN, Freiherr von Kövesshaza (1854–), Austro-Hungarian field-marshal, was born in Temesvar in 1854, and began his military career in the engineers, then served on the general staff and in the infantry. At the beginning of the World War he commanded the XII. (Transylvania) Corps, and fought in the tenacious defence against the superior Russian forces in east and central Galicia, and later in Russian Poland. During the spring offensive of 1915 he captured by storm the fortress of Ivangorod, and in the autumn, under the command of Mackensen, led the III. Army, with which he captured Belgrade and penetrated into Serbia, then, in independent command, overthrew Montenegro, and occupied Albania. In the early summer of 1916 Kövess' army coöperated in the operation against Arsiero-Asiago, but after the break-through of Brussilov was transported in all haste to the Galician theatre of war. Kövess soon after took over the command of the VII. Army, and defended the ridges of the Wooded Carpathians against Russian attack. In the summer of 1917 he sallied from the mountains with his troops, made himself master of Czernowitz and Radautz, and drove the Russians almost entirely from the Bukovina. From the middle of Jan. to the beginning of April 1918 the field-marshal commanded the army front consisting of the I. and VII. Armies, extending from the Dniester to the south-eastern corner of Transylvania. Entrusted after the desertion of Bulgaria with the thankless task of the command of the troops in the Balkans, he could do nothing more than arrange for the evacuation of the occupied territories according to plan, and for the defence of the Danube-Save line. When the Emperor Charles laid down the supreme command he nominated Kövess as his successor. But the dispersal of the forces closed the field-marshal's military career. He was one of the most popular army leaders of the old monarchy. After its downfall he lived in retirement, cultivating his historical and artistic tastes.

KROBATIN, ALEXANDER, Freiherr von (1849–   ), Austro-Hungarian field-marshal, was born at Olmütz in 1849. Krobatin was recognized as a sound technical expert in munitions; he did successful work as head of a department and as chief of a section in the War Ministry. From Dec. 1912 to April 1917 he was War Minister, and during the war supported the army in the field by bold and comprehensive measures. After his resignation from the Ministry of War he commanded the X. Army operating against Italy on the Carinthian and Tirolese fronts.

KROPOTKIN, PETER ALEXEIVICH, Prince (1842–1921), Russian geographer, author and revolutionary (*see* 15.928), returned to Russia in June 1917, after the revolution, expressing in a farewell letter to *The Times* his gratitude for the hospitality which he had received in England. His short period of residence in Russia was full of disappointment, as his criticisms of the Bolshevist regime caused him to be regarded with suspicion by the extremists. After various contradictory reports of his death had been received it was ascertained that he had died at Moscow after a long illness Feb. 8 1921.

KRÜMMEL, OTTO (1854–1912), German geographer, was born at Exin, near Bromberg, July 8 1854. He was educated principally in the university of Göttingen, and approached the subject of geography at first through the study of classics, and by the historical road. But in 1883 he succeeded to the chair of geography at Kiel, and in that seaport found the connexion of his subject with marine investigations which directed his subsequent career. He retained his chair at Kiel until 1911, and during his tenure of it he introduced the science of oceanography to public interest through his handbook *Der Ozean* (1886), completed Boguslavsky's work on oceanography in Ratzel's series of geographical handbooks (1887), joined, and published an account of, the "Plankton expedition" on board the "National" in the North Atlantic Ocean (1889), served on the International Council for the Study of the Sea (1900–9), and finally produced the great work of his life, the *Handbuch der Ozeanographie*, in 1907–11. In 1911 Krümmel quitted Kiel to take up the professorship of geography at Marburg. He died at Cologne Oct. 12 1912.

KÜHLMANN, RICHARD VON (1873–   ), German diplomatist, was born March 17 1873 at Constantinople. From 1908 to 1914 he was councillor of the German embassy in London, and was very active in the study of all phases of contemporary political and social life in Great Britain and even in Ireland. During the World War he was successively councillor of embassy at Constantinople, minister at The Hague and, from Sept. 1916 till Aug. 1917, ambassador at Constantinople. He was then appointed Secretary of State for Foreign Affairs, and represented Germany at the Brest Litovsk negotiations, which on March 3 1918 led to the treaty of peace with Russia. He also negotiated the Peace of Bucharest (May 7 1918) with Rumania. In these negotiations he had to encounter the opposition of the Higher Command of the army, and, in particular, of Ludendorff, who desired fuller territorial guarantees on Germany's eastern frontier, the establishment of a German protectorate over the Baltic States and stronger precautions against the spread of Bolshevism. In July 1918 he delivered in the Reichstag a speech on the general situation, in the course of which he declared that the war could not be ended by arms alone, implying that it would require diplomacy to secure peace. This utterance was misinterpreted in the country, and the Higher Command was drawn into the controversy which arose over it, so that Kühlmann's position became untenable. He was practically thrown over by the Chancellor, Count Hertling, in a speech intended to explain away his statement and, after an interview with the Emperor at the front, he tendered his resignation (July 1918).

KÜLPE, OSWALD (1862–1915), German philosopher (*see* 18.242), was born at Candau, Courland, Aug. 3 1862. He was educated at the universities of Leipzig, Berlin, Göttingen and Dorpat; in 1891 he became lecturer in philosophy at Würzburg, holding subsequently (1894–1909) the chair of philosophy and aesthetics in that university, at Bonn (1909–13) and at Munich from 1913 until his death in 1915.

KUN, BELA (1886–   ), Hungarian Communist leader, was born in 1886 of a Jewish family in Transylvania, and became a journalist and an official in the Workmen's Insurance Office in Kolozsvár. Enrolled in the Hungarian army during the World War, he was a prisoner of war in Russia, when he was instructed by Lenin for the purposes of Communist propaganda, and after the collapse of the Central Powers he was sent back to Hungary with a commission to set up a Soviet Republic. From March 21 to Aug. 1 1919 he was People's Commissary for Foreign Affairs in the Soviet Republic, and after its fall he found refuge in Austria (*see* Hungary). In July 1920 he succeeded in escaping to Russia, where he was employed by the Soviet Government.

KUPRIN, ALEXANDER IVANOVICH (1870–   ), Russian writer, was born in 1870. He passed through the cadet school and military college at Moscow, and in 1890 entered the army as lieutenant. In 1897 he resigned his commission in order to devote himself to literature. He first made a name by his stories of Russian army life, and later wrote many satires on various sections of society. He is considered to be, after Chekhov, the most popular writer of short stores in Russia. His short stories include *Rekajizori* (The River of Life, 1916); *Duel* (first published 1907; English translation 1916) and *Sasha* (1920).

KURDISTAN (*see* 15.949).—During the last eight years of his reign Sultan ʿAbdul Hamid pursued the policy of attracting to his person those Kurdish leaders whom he found to have the greatest local power, and of creating the impression that he looked to the Kurds as his special adherents. There were at the time several descendants of the Badr Khan Bey and Baban families in exile in Constantinople, and from these certain members were given considerable Government posts in the capital and in Syria and Anatolia. By this means the Sultan contrived to exact some taxes, and succeeded in producing a state of the country more tranquil than had existed for several generations. In the north Ibrahim Pasha Milli, and in the south the Sheikh of Barzan and Sheikh Said Barzinja of Sulaimani, became the great leaders, while Saiyid Taha of Shemsdinan held the greatest power in central Kurdistan.

When in 1908 the Turkish Revolution occurred, resulting in the deposition of the Sultan and the victory of Enver Bey's Young Turk party, Kurdistan remained generally loyal to the old régime, and Ibrahim Pasha Milli and Sheikh Said of Sulaimani both declared themselves loyalists. The former gathered a considerable army and terrorized the country in the neighbourhood of ʿUrfa, Diarbekr, Mardin and Nisibin, while Sheikh Said and the Sheikh of Barzan led a condition of rebellion extending over the whole of central and southern Kurdistan. In 1908 Sheikh Said of Sulaimani was murdered in Mosul, an event which only aggravated matters in southern Kurdistan and excited a sympathy for the family even deeper than had existed before. In 1909 Ibrahim Pasha Milli was defeated and lost his life and comparative order was restored in his district.

Meanwhile southern Kurdistan, led by Sheikh Mahmud, the son of Sheikh Said, continued in a state of rebellion, in which the two most active tribes were the Jaf and the Hamawand. Various means were tried to quell the rebellion. Sulaimani was occupied in 1910 after heavy bribes had been paid to Sheikh Mahmud; Mahmud Pasha, leader of the Jaf, was induced to go to Mosul and there detained for a year. Mustafa Pasha Bajlan, of the Khaniqin district, was likewise detained in Bagdad in 1912. In this year military measures at last succeeded against the Hamawand tribe, which fled *en masse* to Persian territory.

At the outbreak of the World War conditions were not favourable to the Turks in Kurdistan. An insurrection had occurred in Bitlis, the Hamawand were still virtually outlaws and the whole country refused to respond to the call to a *jihad* against the British. In the south a small volunteer force of cavalry was eventually raised, but after fighting against the British at Shuʿaiba near Basra it returned to Kurdistan owing to the ill-treatment it received at the hands of the Turks. With the preoccupation of the Government in the war, Kurdistan remained for the time being untouched and indifferent.

In 1915 the official massacre of Armenians occurred, but evidence conclusively proves that, though there were cases of Kurdish participation, the greater portion of the nation not only held aloof, but, as in the case of the Dersim Kurds (who actually saved 25,000 Armenians), displayed their repugnance to the Turkish orders in a practical manner. Throughout central and northern Kurdistan there were in 1919 numbers of Armenians who had lived as refugees among the Kurds.

About this time Russia began to formulate a policy to encourage the Kurdish national movement, for she hoped to use Kurdistan as a counterpoise to Armenia, and when in 1916 Russian forces were in possession of Erzerum and Bitlis, members of the Badr Khan Bey family were appointed as provincial governors in pursuance of the policy. In this year events happened which complicated political matters in Kurdistan. Isma'il Agha Shekak, better known as Simko, living between Van and Urmia, murdered the patriarch of the Nestorians, who fled to Persian territory and called upon the Russians to avenge the murder. In the same year a Russian force moved towards and occupied Rawanduz in central Kurdistan. This force was largely composed of Armenians and other Christian volunteers, calling themselves "the army of revenge," and the atrocities committed by them in the destruction of Rawanduz upon Kurds who had till then known nothing of them were in every way equal to anything attributed to Kurds in former massacres of Armenians. Further apprehension and unrest were caused in central and northern Kurdistan by the Sykes-Picot agreement, which provisionally assigned the Mosul vilayet to France, a Power regarded by the Kurds as violently pro-Christian.

Early in 1917 the Russians further alienated Kurdish sympathy by brutal treatment of the population of Khaniqin and the Shilyar valley in southern Kurdistan. The British forces, beyond a reconnaissance in April 1917, did not enter Kurdistan till Dec. 1917, when Khaniqin was occupied without opposition from the Kurds. In the early part of 1918 the desire for autonomy and the favourable attitude of Kurdistan to Great Britain was becoming apparent; at Sairt, in central Kurdistan, the Kurds actually expelled the Kurdish garrison, while leaders throughout the country contrived to get into touch with the British and assure them of their friendly sentiments and desire for autonomy and final independence of Turkey.

In Nov. 1918 an officer of the political department of the Mesopotamian Expeditionary Force was sent to Sulaimani, where he received a welcome from all classes. He appointed as governor Sheikh Mahmud Barzinja, and instituted a form of government designed to be acceptable to southern Kurdistan. A few other officers were sent at Sheikh Mahmud's request to assist in organizing the local Government under British protection. No troops entered the country. Meanwhile in the north, the Turks, alarmed at the rapid spread of pro-British and nationalist expression, busied themselves with propaganda which bore fruit to some extent on the northern borders of the Mosul vilayet, which was occupied by British troops in Nov. and Dec. 1918. The tribes in that neighbourhood are violently anti-Christian and have frequently been in armed opposition to British forces.

While propaganda and counter-propaganda were busy throughout northern and central Kurdistan, in May 1919 Sheikh Mahmud, who conceived that he had received ill-treatment at British hands in his capacity of governor of southern Kurdistan, effected a *coup de main* by which he filled Sulaimani town with Persian Kurd freebooters. He then entered upon a campaign, and, after defeating a small British force at Tasluja on May 26 1919, was himself defeated and captured wounded at Bazian Pass on June 20 1919.

Since the future status of Kurdistan had not been determined at that time by the League of Nations, those portions of it which fell south of the northern boundary of the Mosul vilayet were directed from Bagdad. The expedition of Major Noel in 1919 to northern Kurdistan had revealed a very general and genuine desire for separation from Turkey and independence.

The Treaty of Sèvres, signed on Aug. 10 1920, provided for these aspirations as follows (Section III.):—

(Article 62.) "A Commission sitting at Constantinople and composed of three members appointed by the British, French and Italian Governments respectively shall draft within six months from the coming into force of the present Treaty a scheme of local autonomy for the predominantly Kurdish areas lying east of the Euphrates, south of the southern boundary of Armenia as it may be hereafter determined, and north of the frontier of Turkey with Syria and Mesopotamia, as defined in Article 27, II. (2) and (3). If unanimity cannot be secured on any question, it will be referred by the members of the Commission to their respective Governments. The scheme shall contain in full safeguards for the protection of the Assyro-Chaldeans and other racial or religious minorities within these areas, and with this object a Commission composed of British, French, Italian, Persian and Kurdish representatives shall visit the spot to examine and decide what rectifications, if any, should be made in the Turkish frontier where, under the provisions of the present Treaty, that frontier coincides with that of Persia."

(Article 63.) "The Turkish Government hereby agrees to accept and execute the decisions of both the Commissions mentioned in Article 62 within three months from their communication to the said Government."

(Article 64.) "If within one year from the coming into force of the present Treaty the Kurdish peoples within the areas defined in Article 62 shall address themselves to the Council of the League of Nations in such a manner as to show that a majority of the population of these areas desires independence from Turkey, and if the Council then considers that these peoples are capable of such independence and recommends that it should be granted to them, Turkey hereby agrees to execute such a recommendation, and to renounce all rights and title over these areas.

"The detailed provisions of such renunciation will form the subject of a separate agreement between the Principal Allied Powers and Turkey. When such renunciation takes place, no objection will be raised by the Principal Allied Powers to the voluntary adhesion to such an independent Kurdish State of the Kurds inhabiting that part of Kurdistan which has hitherto been included in the Mosul vilayet."

Some suitable temporary status for the Kurds of the Mosul vilayet and the south, which are included in the British mandate, was under consideration in 1921. (E. B. S.)

KUROPATKIN, ALEXEI (1848–), Russian general (*see* 15.952). After the Russo-Japanese War Kuropatkin retired to his estate in the Government of Novgorod, but during the World War, after repeated request, in 1916 he was appointed a corps commander. Once more he distinguished himself as a leader of troops, and he was again promoted to the position of army commander. Later he became commander of the Northern "front" (group of armies), but his operations in the spring offensive of 1916 did not restore his prestige as a higher commander, and he was shortly afterwards sent to Turkestan as governor-general. Here his wide and deep knowledge of conditions in that province proved very useful in maintaining order in an atmosphere of discontent. In 1917 Kuropatkin once more retired into private life.

The best known of his published works is *Plevna, Lovtchen and Sheinovo*. His memoirs were published after the Japanese War in four volumes, the fourth of which was forbidden in Russia and had to be published in Berlin. They were translated into English.

KUSMANEK VON BURGNEUSTÄTTEN, HERMANN (1860–), Austro-Hungarian general, was born at Hermannstadt. He was in command of the fortress of Przemsyl when it was attacked in the first Russian campaign of the World War. It was only after a six months' investment and the repulse of powerful Russian onslaughts, and when the food supply was completely exhausted, that he surrendered on March 22 1915. Kusmanek and the garrison became prisoners of war. As a member of the War Archives Department he coöperated in the compilation of the *History of the War of the Austrian Succession*, and together with Maj. von Hoen wrote a manual on the sanitary service.

KUYPER, ABRAHAM (1837–1920), Dutch theologian and politician, was born Oct. 29 1837 at Maassluis, and was educated at the university of Leiden. He became Doctor of Divinity and pastor of the Dutch Reformed Church at Beesd in 1863, and in 1870 moved to Amsterdam, where he became in 1876 leader of the anti-Revolutionary party which aimed at the restoration of strictly Calvinistic doctrine in the guidance of State affairs. In 1879 he detailed fully the principles and wishes of his party in *Ons Program* (Our Programme). A few years later a Calvinistic university was formed through his instrumentality at Amsterdam, and he himself became professor of theology. Under his leadership a considerable section of the old Netherland Reformed Church seceded in 1886 and founded the strictly orthodox Calvinistic Reformed Church Community. Until 1894 he devoted himself to religious teaching, and subsequently to politics, literature and journalism, having founded the *Standaard* and the *Heraut* in 1872, and contributing to it a daily front-page column of notes on current politics and theology. From 1874–7 he had sat in the Second Chamber, but in the latter year a serious illness forced him to resign his seat. In 1894 he was returned to the Second Chamber. In 1895 he defended the workers' right to strike, but in 1903, as head of the Government (1901–5), he crushed a railway strike by rushing a bill through Parliament making illegal a stoppage of work by those engaged in the public and semi-public services. This won him the enmity of the Dutch Socialists. As minister he conferred upon his Calvinistic university the *Jus Promovendi.* He deserves great credit for having converted the somewhat old-fashioned polytechnical school at Delft into a technical university which rivals the very best. During the South African War he took a prominent part in the attempts to get Holland to mediate between Great Britain and the Boers. In the World War he sided openly with Germany, but his influence had already greatly diminished. He was the author of numerous publications dealing mostly with religious subjects and held honorary degrees from various universities. A popular edition of his works appeared in 1896–8, and his parliamentary speeches were published in four volumes (1908–10). He also published a book describing the Dutch community in London in 1570–1. He died at The Hague Nov. 8 1920.

See W. F. A. Winckel, *Leven en Arbeid van Dr. Kuyper* (1921); Dr. A. Kuyper, *Gedenkboek* (1921) and A. S. S. and J. H. Kuyper, *De Levensavond van Dr. A. Kuyper* (1921).

LABORI, FERNAND (1860–1917), French lawyer, was born at Reims April 18 1860. He was educated at Reims and Paris, and spent several years in England and Germany. He was called to the bar in 1884, and rapidly made a reputation as a brilliant lawyer and advocate, being counsel for the defence in most of the important political trials of the day during a period of nearly thirty years. It was his conduct of the Dreyfus case, however, which placed him at the top of his profession and earned him his unique reputation. He fought with unremitting energy for his client during both the first and second revisions of the trial, in 1898 and 1899, a task attended with considerable danger, as political passions were so strongly excited at the time that Labori was shot at and wounded at Rennes on the eve of his cross-examination of the witnesses for the prosecution. Dreyfus was not finally declared innocent until 1906, and Labori never once relaxed his efforts on behalf of the unfortunate officer. Other notable trials in which he was concerned were the prosecution of Émile Zola for libel (1898), which arose out of the Dreyfus case; the Humbert affair (1902); and the trial of Madame Caillaux for the murder of M. Calmette, editor of the *Figaro* (1914), when he secured her acquittal. He died in Paris March 14 1917.

LABOUCHERE, HENRY DU PRÉ (1831–1912), Radical politician and proprietor of *Truth*, was born in London Nov. 9 1831, the son of John Labouchere, of Broome Hall, and nephew of Lord Taunton (*see* 26.453). He was educated at Eton, and, after spending a short time at Cambridge, entered the diplomatic service in 1854, becoming in 1863 second secretary to the British embassy at Constantinople. In 1864 he abandoned diplomacy for politics, and in 1865 was elected Liberal member for Windsor, but was unseated on petition. In 1866 he won a by-election for Middlesex, but failed to be reëlected in 1868. In 1880 he again entered the House of Commons as Radical member for Northampton with Mr. Bradlaugh as his colleague, and this seat he retained until his retirement in 1905. He began his journalistic career with the *Daily News*, of which he became part proprietor just before the Franco-German War, and he was himself the author of the *Letters of a Besieged Resident*, sent to that newspaper from Paris by balloon post during the siege, addressed to his wife in London. In 1874 he became associated with Edmund Yates on the *World* (*see* 28.908); but two years later he started *Truth* as a rival society paper, destined, as he himself said, "to be another and a better *World*." It had a remarkable record in the exposure of shams and organized impostures, especially frauds on the charitable. Many libel actions were brought against it, but in 25 between 1897 and 1907 only three verdicts were given definitely against the paper. For many years Mr. Labouchere himself contributed racy articles and notes, and he was to the end popularly identified with *Truth*, though in fact he left the direction in later years first to Mr. Horace Voules and then to Mr. Bennett, and took no active part either in writing or editing. He was a thorough Bohemian, and after his death the whole story of his life connexion with *Truth* was very candidly told in a series of admirable articles in its columns. As a politician "Labby" was the chartered jester of the House of Commons, but his pungent and somewhat cynical speeches were the expression of highly independent democratic convictions, deeply opposed to all forms of social privilege or Jingo imperialism. He was a strenuous advocate of the abolition of the House of Lords (*see* 20.845, 846); at the time of the Parnell Commission he had much to do with the unmasking of Pigott; and he was a member of the inquiry into the Jameson Raid, his hostility to Mr. Chamberlain being as pronounced as against Lord Rosebery when the latter became leader of the Liberal party. He considered himself entitled to office when his party was in power, and was decidedly mortified at not getting it from Mr. Gladstone. In 1868 he married Miss Henrietta Hodson, a popular actress. After 1903 he lived mainly in Italy, at a villa near Florence, where he died Jan. 15 1912. He left a fortune of some two millions sterling to his daughter, who married first a son of the Marquis di Rudini, and secondly Prince Gyalma Odescalchi.

See Algar Labouchere Thorold, *Life of Henry Labouchere* (1913).

LABOR, DEPARTMENT OF (United States): *see* LABOUR MINISTRY AND DEPARTMENT OF LABOUR.

LABOUR LEGISLATION (*see* 16.7*).—The decade 1910–20 was very productive of labour legislation, partly the natural outcome of years of agitation and the growing political power of Labour, and partly the result of the strong economic position in which Labour found itself as a result of the World War and the change of spirit which developed during it. While important progress has been made in connexion with the regulation of the conditions of employment of women, young persons and children, labour legislation has also advanced largely in new directions, such as the limitation of the hours of employment of all classes of workpeople, the fixing of minimum rates of wages for badly paid industries, and the development of social measures such as insurance against sickness, accident or unemployment. One of the most interesting developments, and one which may have far-reaching results, has been the movement towards international labour legislation.

The tendency towards uniformity in industrial conditions in the principal countries, and the world-wide increased economic and political power of the working-classes, had already resulted in a series of industrial laws in the various countries, very broadly on uniform lines. It would appear that Switzerland, in 1876, was the first country to invoke the aid of European diplomacy with a view to international labour legislation. Following on conferences in regard to international labour legislation held at Berlin in 1890, at Zürich in 1897, and at Paris in 1900, there was established in 1901 the International Association for Labour Legislation. By the international treaties of Berne of 1906, the use of white phosphorus in the match industry was forbidden in the interests of the health of the workers, and a night rest of 11 hours secured for female industrial workers.

A development in this direction, so great as to constitute a new era, came with the labour provisions of the Treaty of Versailles. These, together with the subsequent history of the International Labour Office set up under the treaty, are dealt with in the article on INTERNATIONAL LABOUR ORGANIZATION.

UNITED KINGDOM

A series of Acts extending over more than a century had prescribed in the United Kingdom a detailed code for the protection of workers in factories, mines and shops, and especially for the protection of women, young persons and children. Labour legislation was tending strongly in new directions before the World War. Except for war purposes it was temporarily interrupted, but the importance which labour legislation had reached is indicated by the establishment of a separate Ministry of Labour (*see* LABOUR MINISTRY) by the New Ministries and Secretaries Act, 1916.

Before proceeding to a more detailed statement of the various Acts concerning labour that were placed on the statute book between 1910 and 1921, reference may be made to the point emphasized by Prof. Tillyard, that legislation in England is so usually associated with Parliament and with Parliament alone, that it may not be generally realized that, taking into consideration quantity only and disregarding importance, probably the larger part of existing enactments regarding labour have not been directly passed by Parliament but are the creation of inferior bodies to whom law-making powers have been delegated. The reason is that industrial legislation in many cases can hope to be successful only on condition that complicated details are patiently investigated and interested persons listened to. Parliament has of late years become more and more content to

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** These figures indicate the volume and page number of the previous article.*

settle principles, and to leave detailed decisions and the working-out of extensions to other bodies, reserving to itself a varying amount of ultimate control. This legislation by inferior law-making bodies takes several forms:—

(*a*) Provisional Orders, made by Government departments and having the force of law provided they are expressly sanctioned by Parliament, *e.g.* under the Workmen's Compensation Act, 1906;

(*b*) Statutory Orders, made by Government departments and requiring to be laid before Parliament for varying periods, but taking effect unless Parliament actively intervenes, *e.g.* under the Factory Acts;

(*c*) Determinations such as those under the Trade Boards Acts dealing with wages to be paid in specified trades;

(*d*) Legislation by local by-laws made by local authorities in exercise of the permissive powers bestowed by Act of Parliament.

Women and Children.—As regards recent legislation on the subject of the employment of women, young persons and children, it is to be observed that important measures regarding the employment of children were embodied in the Education Act, 1918, which consolidated and amended the various Acts relating to the national system of public education. But, owing to financial exigencies, the operation of several provisions of this Act was postponed in 1920–1.

Under the Act, subject to specified exceptions, no exemption from school attendance may be granted to any child between the ages of 5 and 14 years, and 15 years is substituted for 14 years as the normal elementary school-leaving age. Subject to certain conditions, all young persons are required to attend continuation schools for a specified number of hours in each year, at such times or on such days as the local education authority may require; and the local education authority may require, in the case of young persons who are under an obligation to attend a continuation school, that their employment shall be suspended on any day when their school attendance is required. The Employment of Children Act, 1903, is also amended so that a child under the age of 12 may not be employed, and a child of the age of 12 or upwards may not be employed on any Sunday for more than 2 hours, or on any day on which such child is required to attend school before the close of school hours on that day, nor on any day before 6 o'clock in the morning or after 8 o'clock in the evening. By a further amendment of the Act of 1903, the employment of children in street trading is prohibited, and certain amendments are made to the Prevention of Cruelty to Children Act, 1904, in so far as that Act deals with the employment of children for the purpose of singing, playing or performing, or being exhibited for profit or offering anything for sale. The local education authority may further, if they are satisfied by a report of the school medical officer or otherwise, that any child is being employed in such a manner as to be prejudicial to his health or development or as to render him unfit to obtain the proper benefit from his education, either prohibit or attach such conditions as they think fit to his employment. No child (which expression is defined to mean any child up to the age when his parents cease to be under an obligation to cause him to receive efficient elementary instruction or to attend school under the enactments relating to elementary education and the by-laws made thereunder) may be employed in any factory or workshop to which the Factory and Workshop Acts, 1901 to 1911, apply: or in any mine to which the Coal Mines Act, 1911, applies: or in any mine or quarry to which the Metalliferous Mines Acts, 1872 and 1875, apply: unless lawfully so employed when the Education Act becomes operative. The Education (Scotland) Act, 1918, is broadly on the same lines, although it differs in details.

A further important step was taken by the Employment of Women, Young Persons and Children Act, 1920.

Its main purpose was to give legislative ratification in the United Kingdom (*a*) to three draft conventions adopted at Washington by the first session of the General Conference of the International Labour Organization of the League of Nations, fixing 14 as the minimum age for the admission of children to industrial employment, and prohibiting, with certain exceptions, night-work in industrial undertakings by young persons under the age of 18 and by all women without distinction of age, and (*b*) to the draft convention fixing the minimum age for the admission of children to employment at sea, adopted at Genoa by the second session of the General Conference. The Act also contains a section permitting double shifts (averaging each not more than 8 hours per day) for women and young persons between the hours of 6 A.M. and 10 P.M., subject to any conditions which the Secretary of State may prescribe. The object of this section was to continue the powers of the Home Secretary in this respect which, in the emergency of the war, he had exercised under section 150 of the Factory and Workshop Act, 1901, as extended by Defence of the Realm Regulation No. 6, A. The provisions of the clause aroused considerable opposition, and, during the progress of the bill through Parliament, a departmental committee was appointed to inquire into the whole question of allowing women and young persons to be employed on the system of two-day shifts. The committee decided generally that the Home Office should retain its existing power of deciding in which cases the adoption of the system should be allowed, and that for this purpose the adoption of the system in any works should be dependent upon the issue of a Home Office Order and subject to such conditions to secure the welfare of the workers as might be attached by the Home Office. The relevant section of the Act also provides that the Secretary of State may not make an order in any industry if objection is jointly made by organizations representing the majority of employers and workers in the industry; the section and orders made thereunder are to remain in force for a period of five years and no longer.

The Women and Young Persons (Employment in Lead Processes) Act, 1920, prohibited the employment of women and young persons in certain processes connected with lead manufacture, and regulated their employment in certain processes involving the use of lead compounds in accordance with the recommendation of the Washington Conference concerning lead-poisoning.

Hours.—In addition to the above special measures concerning the employment of women, young persons and children, a bill was introduced in 1921 by the Minister of Labour, providing, subject to certain necessary exceptions and conditions, for the establishment of a maximum working week of 48 hours. A measure for this purpose was recommended by the provisional joint committee appointed by a National Industrial Conference of employers and workpeople held in Feb. 1919, to consider means for removing the existing labour unrest, and by the Washington General Conference. The terms of the bill were still under discussion in 1921. Hours of employment in the coal-mining industry and in shops have been regulated by special measures. (*See* HOURS OF LABOUR.)

Coal-Mines.—The coal-mining industry has been the subject of a number of special laws, which may be accounted for by the vital position which the industry holds in the economic life of the community, the strong organization of the workers, and the exceptional conditions under which the work has to be carried on. The Coal Mines Act, 1911, amended slightly by the Coal Mines Act, 1914, consolidated the existing law relative to coal-mines. The Act deals with management (certificates of competency, etc.); provisions as to safety, health, accidents; employment of boys, girls and women; prohibition of payment of wages in licensed premises and provision as to weekly payment of wages; inspectors, etc. It did not, however, amend the Coal Mines Regulation Act, 1908, relating to the 8-hour day, nor such part of existing legislation as related to checkweighing. In 1912 the Coal Mines (Minimum Wage) Act was passed to terminate a general strike of coal-miners and provided that certain district minimum rates, fixed by district boards under the Act, should form part of the terms of contract of every person employed underground in a coal-mine.

During the World War the Government assumed control of the coal-mines. Early in 1919 the Coal Industry Commission Act was passed, in connexion with a threatened general strike of coal-miners, to enable the Government to set up a commission to inquire into the condition of the industry. In accordance with an interim report of this commission, the Coal Mines Act, 1919, was passed, providing for a reduction, as from July 16 1919, of the hours of labour of coal-mine workers below ground from 8 to 7 per day, and making provision, contingent upon the condition of the industry, for a further reduction in 1921.

The Mining Industry Act, 1920, established the Mines Department of the Board of Trade for the exercise of the powers of that department and also of the transferred powers of the Secretary of State relating to mines and quarries.

This Act authorized the Board of Trade, for a period of one year from Aug. 31 1920, to issue directions regulating the export of coal and the supply of coal for the bunkering of vessels, and regulating the pithead price to be charged for coal sold for consumption in the British Isles and for the bunkering of vessels other than vessels proceeding to ports outside the British Isles. While any such directions are operative, the Board of Trade can also give directions as to the wages to be paid to workers in coal-mines and to regulate the distribution of profits on principles similar to those shown in the Coal Mines (Emergency) Act, 1920, so as to secure as far as practicable an equitable distribution as between the different collieries.

The Act further provides for the constitution of (*a*) Pit Committees for each coal-mine where a resolution in favour thereof is passed by the majority of the workers employed in or about the mine; (*b*) District Committees; (*c*) Area Boards, and (*d*) a National Board. Pit committees consist of representatives, not exceeding 10 in number, of the owners and management of the mine and the workers employed in or about the mine, selected by ballot. The functions of a pit committee are to discuss and make recommendations with respect to (*a*) the safety, health and welfare of the workers in connexion with their work in the mine; (*b*) the maintenance and increase of output; (*c*) reports made on an inspection under section 16 of the Coal Mines Act, 1911, which reports shall be referred to the committee by the manager; (*d*) disputes arising in connexion with the mine, including disputes as to wages; and (*e*) any other questions and matters relative to the mine which may be prescribed by the regulations to be drawn up by the Board of Trade. Any matters which cannot be satisfactorily disposed of by a pit committee are to be referred to the appropriate district committee, or, in the case of questions to which the Coal Mines Act (1911) applies, to the inspector of the division. To enable a pit committee to exercise its functions on the first two points indicated above, it is required that the committee should be furnished by the manager of the mine with such relevant information as may be necessary for its purpose and may appoint members to make periodical inspections of the mine.

The district committees and the area boards, which likewise consist of representatives of the owners and the management and an equal number of representatives of the workers, consider questions of a similar nature; a district committee is also required to consider any matter referred to them by a pit committee or by the area board or the Board of Trade, and the area board is required to consider any questions which may be referred to it by a district committee or by the national board or the Board of Trade. An area board is in addition required to formulate, at such intervals and on such principles as may be prescribed by the national board, schemes for adjusting the remuneration of the workers within the area; the Board of Trade may by regulation provide for district committees or area boards determining any question and exercising any powers which, before the passing of this Act, were determined or exercised by a conciliation board or by a joint district board constituted under the Coal Mines (Minimum Wage) Act, 1912.

The national board, which is equally representative of owners and workpeople, is required to take into consideration questions, including wages questions, affecting the coal-mining industry as a whole, any questions which may be referred to them by an area board, and any questions which may be referred to them by the Board of Trade. The national board is also to determine, subject to the approval of the Board of Trade, the principles on which schemes by area boards for adjusting the remuneration of workers are to be framed. Where any recommendation made by a district committee or area board or by the national board, or any scheme made by an area board and approved by the national board, has been forwarded or referred to the Board of Trade, the Board of Trade may give directions requiring any person engaged in the coal-mining industry to comply therewith.

A further provision of the Act requires the constitution of a fund to be applied to such purposes connected with the social well-being, recreation and conditions of living of workers in or about coal-mines, and with mining education and research, as the Board of Trade, after consultation with any Government department concerned, may approve; and the owners of every coal-mine are required for a period of six years to pay a sum equal to 1d. a ton of the output of the mine for the creation of such a fund.

Shops.—Further legislation has been enacted in regard to employment in shops. The Shops Regulation Acts, 1892–1911, were consolidated by the Shops Act, 1912, which contains various provisions for protecting shop assistants.

The Act requires *inter alia* that, on at least one weekday in each week, a shop assistant may not be employed about the business of the shop after 1:30 P.M.; it contains requirements as to intervals for meals, and further requires that no person under the age of 18 years is to be employed in or about a shop for a longer period than 74 hours (including meal times) in any one week. Besides these provisions, the Act contains provisions under which every shop, save for exceptions allowed by the Act, must be closed for the serving of customers not later than 1 P.M. on one weekday in every week; closing orders may also be made fixing the hours on the several days of the week at which, either throughout the area of a local authority or in any specified part thereof, all shops or shops of any specified class are to be closed for the serving of customers, but the hours fixed by the closing order may not be earlier than 7 P.M. on any day.

The Shops Act, 1913, amended the Act of 1912 in its application to premises for the sale of refreshments. The Shops (Early Closing) Act, 1920, continues Regulation 10 B. of the Defence of the Realm Regulations, as amended, and requires that, subject to certain specified exceptions, every shop shall be closed for the serving of customers not later than 8 o'clock in the evening on every day other than Saturday and not later than 9 o'clock in the evening on Saturday.

Minimum Wage.—One of the most important developments of labour legislation in recent years has been minimum-wage legislation. Minimum-wage boards had been in existence for some time in Australasia before they were tentatively introduced into the United Kingdom by the Trade Boards Act, 1909, followed by the Trade Boards Act, 1918 (*see* TRADE BOARDS). The latter empowers the Minister of Labour to extend by Special Order the provisions of the Trade Boards Act, 1909, to other trades, and under its provision trade boards have now been set up in a large number of trades. The Corn Production Act, 1917, extended similar legislation to agriculture. A rather different kind of minimum-wage legislation was that embodied in the Coal Mines (Minimum Wage) Act, 1912, which was passed to terminate a general strike of coal-miners in respect of their claims for "individual district minimum rates." The method of administration of the Act is different from that of the Trade Boards Acts: no inspectorate was appointed, the payment of the minimum rate being part of the workman's contract of service and enforceable in an ordinary court of law.

The Munitions of War Acts, 1915–7, contained provisions which enabled minimum rates of wages to be fixed. These were repealed, however, by the Wages (Temporary Regulation) Act, 1918, the purpose of which was to secure that the standard district rates existing at the date of the Armistice should be continued during the transition period when industry was changing from war to peace conditions. It was extended to Nov. 21 1919 by the Wages (Temporary Regulation) Extension Act, 1919, and the principle of the Acts was continued up to Sept. 30 1920 by the Industrial Courts Act, 1920. In connexion with this subject it should be recorded that the Industrial Conference of 1919 recommended the enforcement by legal enactment of minimum time rates of wages to be of universal applicability.

Old Age and Sickness.—For an account of the recent considerable developments in the United Kingdom in connexion with unemployment insurance, *see* UNEMPLOYMENT. Legislation of widespread social importance has been undertaken in a series of measures designed to relieve distress arising from old age or sickness. The Old Age Pensions Act, 1908, under which, subject to certain conditions as to means of support, etc., a pension at the rate of 5s. per week became payable to persons who had attained the age of 70, was preliminary to the National Health Insurance Act of 1911, which instituted, with certain specified exceptions, a universal scheme of compulsory insurance against sickness. Contributions are payable by the insured person and by the employer, and in return the insured person receives certain benefits. These benefits in the main are:—

(1) Sickness benefit, *i.e.* a periodical money payment to the insured person while rendered incapable of work by some specified disease, either bodily or mental;

(2) Disablement benefit, *i.e.* a periodical payment after the right to sickness benefit has been exhausted, and continuing so long as the incapacity continues;

(3) Maternity benefit, being a lump-sum payment in the case of the confinement of an insured woman, or the wife or widow of an insured man;

(4) Medical benefit, being medical treatment and attendance and the provision of medicine and of prescribed medical and surgical appliances; and

(5) Sanatorium benefit, being the treatment of persons suffering from tuberculosis or any other disease specified by the Ministry of Health.

Sickness and disablement benefits cease when the insured person reaches the age of seventy. The Act is administered largely through approved societies, these being principally friendly societies, trade unions, and industrial insurance societies.

The Old Age Pensions Act was amended in certain respects in 1911 and the National Insurance Act in 1913, 1914, 1915, 1917, and 1918. As a result of the war, certain other amendments became necessary in order to bring the rates of money contributions and benefits into closer relationship with the lessened value of money and the higher cost of living. During the latter part of the war, additional allowances were paid in view of the increased cost of living: the Old Age Pensions Act, 1919, increased the weekly sum to 10s. per week and made various other amendments to earlier Acts.

It may also be noted that the Blind Persons Act, 1920, provides that every blind person who has attained the age of 50 shall be entitled to such pension as, under the Old Age Pensions Acts, 1908–19, he would be entitled to receive if he had attained the age of 70. In the case of the health insurance scheme, the National Health Insurance Act, 1919, increased from £160 to £250 per annum the rate of remuneration for the purpose of exemption from insurance; and the National Health Insurance Act, 1920, amended the scales of weekly contributions and benefits.

Workmen's Compensation.—Reference may also be made to the Acts dealing with compensation to workpeople in the event of accidents which occur notwithstanding the preventive measures required by the Factory and Workshops Acts, Coal Mines Regulation Acts, Railway Employment (Prevention of Accidents) Act, Merchant Shipping Acts and kindred legislation.

Originally, under the common law of England, all workmen suffering injury, as the result of the negligence or wilful act or omission of an employer, might sue for damages. Lord Campbell's Act of 1846 introduced an improvement whereby, if the injury resulted in death, relatives of a specified relationship might bring an action; previously the right to bring an action had been deemed to die with the injured person. The Employers' Liability Act of 1880 introduced further changes, as also did the Workmen's Compensation Acts of 1897 and 1900, which were repealed by the Workmen's Compensation Act of 1906 under which any injured workman (or his relatives in case of death) can recover compensation from the employer, if the accident arises out of and in the course of his employment. The employer cannot protect himself by proving either contributory negligence or common employment. The amount of compensation is limited to £300 in case of death and £1 per week in case of injury. Amendments in details were made by Acts of 1918, and as a result of the fall in the value of money brought about by the war, the Workmen's Compensation (War Addition) Act, 1917, increased the compensation payable in the event of total incapacity by 25% and the Workmen's Compensation (War Addition) Amendment Act, 1919, again increased it by 50%, making the maximum allowance 35s.

Another step necessitated by the war was the Disabled Men (Facilities for Employment) Act, 1919, which enables arrangements to be made to relieve or indemnify an employer in respect of the whole or part of any increase of expenditure arising from his liability to pay compensation in respect of accidents or industrial disease, where such increase is attributable to the employment of men disabled in the war. It may further be noted that a committee appointed by the Home Secretary presented a report in July 1920, recommending various modifications of the present system and a considerable widening of the scope of the 1906 Act.

Trade Unions.—Recent years have witnessed in the United Kingdom a remarkable growth in the trade-union movement, and also some changes in the legal status of trade unions. Thus, following on the Trade Disputes Act of 1906, the Trade Union Act, 1913, made provisions relative to the application of trade union funds for political purposes, and the Trade Union Amalgamation Act, 1917, amended the Act of 1876 in respect to the amalgamation of trade unions. The growth of the unions has been followed by legislation to meet emergencies in strikes.

The Conspiracy and Protection of Property Act, 1875, contained a provision whereby a person employed in a gas or water undertaking was liable to penalties if he " wilfully and maliciously breaks a contract of service ... knowing or having reasonable cause to believe that the consequence of his so doing, either alone or in combination with others, will be to deprive the inhabitants of that city, borough, town, place or part, wholly or to a great extent, of their supply of gas or water." A similar provision was contained in the Electricity (Supply) Act, 1919, in respect of electrical undertakings. Attention should be called in this connexion also to the Police Act, 1919, which, while it does not directly prohibit strikes in the police forces, adopts an indirect method by forbidding members of the police forces from becoming members of " any Trade Union or of any Association having for its objects, or one of its objects, to control or influence the pay, pensions, or conditions of service of any Police Force." In the autumn of 1920 the Emergency Powers Act was passed, enabling His Majesty, in the event of action being taken or threatened which would be likely to interfere with the supply or distribution of food, water, fuel or light, or with the means of locomotion, or to deprive the community or any substantial proportion of the community, of the essentials of life, by proclamation to declare the existence of a state of emergency; where such a proclamation has been made it shall be lawful for the Government to make regulations for the preservation of the peace and for securing and regulating the supply of the public necessities.

War Measures.—Reference has been made to some of the special measures necessitated by the World War; these include legislation directly for war purposes, such as the Munitions of War Acts, designed to increase the output of munitions; Defence of the Realm Regulations, such as those concerning incitement to strike; employment of women under the two-shift system, and the closing hours of shops. The war also indirectly necessitated, through the change in the value of money, amendments to the Insurance Acts, Old Age Pensions Act, and Workmen's Compensation Acts.

A war measure to which attention may specially be called is the Restoration of Pre-War Practices Act, 1919. In connexion with the steps taken at the beginning of 1915 to increase the output of munitions, the Government held conferences with representatives of a large number of trade unions and came to an understanding known as the " Treasury Agreement," whereby the unions agreed to relax such trade practices as tended to restrict output of munitions or equipment, on condition that their position in regard to such practices after the war should not be prejudiced by relaxation during the war. Certain provisions in this respect were embodied in the Munitions of War Act, 1915. The Restoration of Pre-War Practices Act, passed in Aug. 1919 (which applied only to establishments in which munitions work was carried on during the war, and to other establishments in which a departure from practice was made in consequence of the Treasury Agreement or in pursuance of some other agreement in writing), provided that the owner of the establishment should be under obligation from Oct. 1919 to restore the trade practice previously obtaining, and to maintain the practice for 12 months. Failure to comply with the obligation rendered him liable to prosecution before a munitions tribunal. In nearly every case the practices were restored where the workpeople so desired.

Miscellaneous.—Among other miscellaneous labour legislation, attention may be called to the following Acts: The Factory and Workshop (Cotton Cloth Factories) Act, 1911, enabled the Secretary of State to make any regulations which he deemed necessary for the purpose of giving effect to the recommendations contained in the second report, dated Jan. 1911, of a committee appointed in 1907 to inquire into the question of humidity and ventilation in cotton-cloth factories. The Checkweighing in Various Industries Act, 1919, provides for " checking the weight or measurement of materials produced, handled or gotten by workmen paid by weight or measure in certain industries," including the production or manufacture of iron or steel, the loading or unloading of goods into or from vessels, the getting of chalk or limestone from quarries, and the manufacture of cement and lime. Provision is made for the inclusion of other materials by regulation.

OTHER COUNTRIES

Eight-hour Day.—The movement for reduced hours of labour which set in after the signing of the Armistice was world-wide, and, either by way of legislation or by agreement between the representatives of employers and workpeople, the length of the working day formerly in operation has been curtailed in many countries.

In *France* the Labour Code was amended by a general 8-hour-day law passed in April 1919, and in June the existing legislation as to the length of the working day in the mining industry was amended by extending the 8-hour day to all classes of workpeople, whether employed underground or on the surface. Previously, under a law of Dec. 1913, the limit of 8 hours per day had applied only to workpeople employed underground. In Aug. 1919, a similar limit was enacted for all persons employed in French vessels.

In *Germany* one of the first enactments of the Provisional Government was a law fixing an 8-hour day for all industrial workers, special arrangements being made to meet the case of transport workers and of those employed in establishments in continuous operation. In Jan. 1919, the German Government issued a new code in respect of agricultural labour, fixing a limit for the hours of labour of agricultural workers—in four months of the year the average hours not to exceed 8 *per diem*, in four months 10, and in four months 11.

From Nov. 1918 onwards, laws or decrees have also been passed fixing 8 hours per day (or alternatively 48 hours per week) as the normal working time in *Switzerland*, *Holland* (45-hour week, *i.e.* 8-hour day for five days of the week and a half-holiday on Saturday), *Denmark* (in respect of establishments with continuous working as from the commencement of Jan. 1920), *Norway*, *Sweden*, *Spain*, *Poland*, *Czechoslovakia*, *Austria*, etc. It may, however, be noted that it has been deemed necessary to grant temporary exemptions from the strict statutory application of the 8-hour day in France, Austria and the Netherlands; and in all cases certain exceptions are permitted in respect of national emergency, such as war, accident and unforeseen circumstances, subsidiary and complementary processes requiring to be done before the main work can begin or after it has ceased, adjustment of shifts, seasonal trades, and emergencies, as, for example, in order to prevent industrial dislocation. Conditions are usually attached to any relaxation of, or exemption from, the normal limit of hours.

In several countries a shorter working day has been introduced by agreement between employers and workpeople, thus anticipating or supplementing legislation on this point. This method has been largely adopted in Italy, the United States, etc. In Australia the 8-hour day, or 48-hour week, has been in operation for many years either by agreement or arbitration award.

Hours of Women and Children.—A great deal was done, in various countries, to improve conditions under this heading during 1910–20 (*see* also HOURS OF LABOUR).

France.—A law dated 1911 amended the law of Nov. 1892, on the labour of women and children in industrial establishments, so as to bring it into accord with the Berne Convention on night-work of women. The provision of the earlier law, prescribing that young persons of less than 18 and women might not be employed between the hours of 9 P.M. and 5 A.M., was retained, and in addition it was laid down that such persons must have not less than 11 consecutive hours of rest at night. In the case of lads and boys working underground in mines and quarries, work might, as before, be authorized from 4 A.M. to 10 P.M., provided that it was divided into two shifts of not more than 9 hours each, broken by an interval of at least one hour. For women over 18 employed in certain trades, to be determined by ordinance and on due notice being given, work might continue up to 10 P.M. (formerly 11 P.M.) at certain periods of the year for not more than 60 days in the year, but in no case must the number of hours worked per day exceed 12. In these trades and in trades in which, under Article 7 of the law of 1892, the restrictions as to the length of the daily hours of labour might be temporarily suspended by ordinance, the consecutive rest period might be reduced to 10 hours. Temporary exemptions might be made in the case of certain industries determined by ordinance, and, as before, permission to work beyond the usual hours, or to shorten the period of nightly rest, might also be granted in the case of stoppages due to accident or unforeseen occurrences. A law of June 1913 was passed for the protection of women workers before and after childbirth. By a law dated 1917, the principle of freedom from work on Saturday afternoons was laid down for women employed in the clothing trades in France. A law dated 1919, and operating as from Oct. 1920, prohibited employment in bakeries between 10 P.M. and 4 A.M.

Belgium.—A law passed in April 1911 amended the existing laws, and, among other provisions, required the abolition of the underground labour of all females and of males under 14 years of age, as from the beginning of the third year from the date of promulgation. By a law of Aug. 1911, night-work of women and girls was prohibited in industrial establishments in which more than 10 workpeople are employed, and every woman or girl employed in such establishments must be granted not less than 11 consecutive hours of rest at night, this period of rest including the interval from 9 P.M. to 5 A.M. Exceptions were made in the case of seasonal trades, unforeseen circumstances and materials liable to rapid deterioration.

Switzerland.—In 1915, the Swiss Factory Act of 1877, which was amended in certain respects in 1905, was superseded by a new Act. As in the former law, women are forbidden to work at night or on Sundays. A new provision states that the Federal Council is to prescribe the branches of work or particular occupations in which women may not be employed under any circumstances. Women must have a night's rest of at least 11 consecutive hours, including the period from 10 P.M. to 5 A.M.; but by special permission this may be reduced to 10 hours for 60 days in the year, or, when perishable materials are being worked upon, for 140 days. The former law provided that, for a period in all of 8 weeks before and after confinement, women should be exempted from work in factories; the later law provides for their exclusion from work in factories for 6 weeks following confinement, which period, at their request, may be extended to 8 weeks. The later law retains the limit of 14 years as the minimum age at which children may be allowed to work in factories, and also the provision forbidding the employment of young persons under 18 at night-work and on Sundays. A new provision states that children under 16 may not be employed upon work where the normal hours are exceeded, and the Federal Council is to prescribe certain branches of industry or certain occupations at which young persons under 16 must not be employed at all. The new law also reduced the length of the working-day in factories from 11 to 10 hours.

Holland.—A royal decree dated Oct. 1911 approved the text of a labour law amending the regulations hitherto in operation governing the employment of young persons and women in industry in the Netherlands. No child under the age of 13 might be employed in an industrial establishment, nor any person over that age not exempt from school attendance. Previously the minimum age of admission had been 12 years. The hours of labour of young persons (defined as those under the age of 17) and women in factories, etc., might not exceed 10 per day or 58 per week (instead of 11 per day as before), nor might these workers be employed, as a general rule, before 6 A.M. or after 7 P.M. (formerly 5 A.M. and 7 P.M.). Women having household duties to perform, and making a declaration to that effect, might not be employed after 1 P.M. on Saturdays; and by ministerial order no young person or woman might be employed after that hour in any or in certain specified trades. Under a labour law of 1919, any work by children under 14 years of age or by those to whom the Education Act is applicable is prohibited as from July 1921. Young persons (*i. e.* persons between 14 and 18) are not to work on Sundays, except *outside* factories, workshops, shops, offices, etc. Young persons may not work *outside* factories, workshops, shops, etc., between 7 P.M. and 6 A.M.; in shops and in coffee-houses and hotels between 8 P.M. and 8 A.M.; in offices between 6 P.M. and 8 A.M. In factories, workers over 15 may do certain defined work, or work under certain defined conditions, between the hours of 6 P.M. and 10 P.M. and between 5 A.M. and 7 A.M. By royal decree, certain kinds of work, or work under certain conditions to be defined by such decree, may not be done by young persons or women on the ground of its danger to health, morality or life. Women may not work for at least 2 weeks before, and 6 weeks after, confinement.

Norway.—The Norwegian Factory Act of 1909, together with amending laws dated 1910 and 1911, was superseded by a law dated Sept. 1915. With the exception of new provisions relating to daily working hours and night-work, the 1915 Act was practically identical with that of 1909. The most important change introduced by the new clauses is the limitation of the working hours of adults employed in factories, irrespective of sex, to 10 hours per day, or 54 weekly. In the previous law no regulations whatever were included with regard to working hours of adults (defined as persons over 18 years of age). In the case of persons employed in mines (so far as concerns underground work), foundries, and book and newspaper printing works, the hours of labour as a general rule are not to exceed 48 per week. For the first time in Norwegian factory legislation, the law made general regulations as to night-work, which is defined as work performed between the hours of 9 P.M. and 6 A.M. As a rule, special permission is required for night-work, except with regard to adult workers in continuous trades. The provisions as to hours of labour and night-work do not apply to adults employed in stores and warehouses, building works and yards, wharves, loading and unloading steamships and analogous occupations, or to those employed in handicraft workshops not using mechanical power; nor are adults employed in paper, cellulose and wood-pulp factories, in which work is continuous, affected by the new provision.

Sweden.—A new law for the protection of workpeople, dated 1912, consolidated, completed, and superseded all laws and regulations previously enacted for safeguarding workpeople against accident and other risks of employment, with the exception of (1) the law of Nov. 1909, forbidding the employment of women on night-work in certain trades; (2) the decree of Dec. 1897, regarding the employment of children in public exhibitions; and (3) the decree of Dec. 1896, for the prevention of "phossy jaw." New provisions for reducing risk of accidents were laid down with special reference to the testing of steam boilers, vats, etc., liable to explode. Among new provisions for ensuring healthy conditions of work may be mentioned the increase of the minimum air-space in workrooms from 247 to 353 cub. ft. per worker. The provisions affecting minors were of a wider character than those contained in the former law regarding these employees. The old law had reference only to those employed in factories or in analogous occupations, whereas the new law was extended to occupations other than those conducted in factories. The age-limit for minors of both sexes imposed by the previous law was 12 years. This was now raised to 13 years for boys and 14 for girls. The old limit was retained for employment other than in factories, *e.g.* in handicrafts and in shops. The age of minors employed in mines or quarries was advanced from 14 to 15 years. In addition, the hours of employment of young persons were more completely regulated than formerly.

Spain.—By an Act dated July 1912, the employment of women during the night-time in factories or workshops is declared to be illegal in Spain. "Night-time," within the meaning of the Act, covers a period of not less than 11 consecutive hours, in which must be comprised the time between 9 P.M. and 5 A.M. The foregoing prohibition does not apply (*a*) in cases of *force majeure*; (*b*) in agricultural enterprises, or in trades in which perishable materials are used, provided, as regards the latter, that their loss cannot be avoided without resort to night-work. By a royal decree dated April 1919, work is forbidden in bakehouses, factories and other places where bread is made for a period of 6 consecutive hours in each 24, which period must fall between 8 P.M. and 5 A.M.

Austria.—A new law of Dec. 1911 amended the law of 1884 in respect to the employment of women and children in mines. By a law of Feb. 1911, the employment of women and girls between the hours of 8 P.M. and 5 A.M. is prohibited in any industrial establishment in Austria in which more than 10 workpeople are employed (in the case of raw sugar factories, the law was not to come into operation till 1915). Furthermore, every woman or girl must be granted not less than 11 consecutive hours of rest at night. If, however, work is done in shifts of not more than 8 hours, this 11-hour rest period may commence at 10 P.M. in the case of women over 16 years of age. Special provision is made for unforeseen circumstances, seasonal trades and trades where raw materials are subject to rapid deterioration. It was reported in 1919 that a new Act containing similar provisions, and including also young persons, came into force in German Austria as from June of that year.

Japan.—A new factory law was passed in Japan in 1911, whereby the minimum age of employment in factories is 12 years. The administrative authorities may sanction the employment of minors between 10 and 12 years of age when the work is not too exacting, at the same time imposing conditions as to such employment. Lads under 15 and females must not be employed for more than 12 hours per day. For a period of 15 years from the date of the enforcement of the law the minister concerned may, however, permit the extension of the working hours, according to the class of work, but not beyond the limit of 14 hours per day. These two categories of workers are not to be employed between 10 P.M. and 4 A.M., except in special circumstances and upon special work to be determined by the competent minister. Where the operatives are employed in two or more shifts these restrictions as to night-work will not be enforced during 15 years from the date on which the law enters into force. The law, which was put into force in Sept. 1916, is recognized as a tentative piece of legislation, and its practical effect has been inconsiderable. As a result of the deliberations of the International Labour Conference at Washington, in the autumn of 1919, referred to above, the provisions of this measure were to be amended as regards working hours and employment at night.

Minimum Wage.—An important development in recent labour legislation outside England has been that for the fixing of statutorily enforceable minimum rates of wages, in certain cases for home-workers only.

British Overseas Dominions.—Minimum-wage legislation began with the *New Zealand* Act of 1894; primarily the laws had for their purpose the settlement of trade disputes involving strikes and lockouts. The legislation enacted in *Victoria* in 1896 was based upon an entirely different reason; the Victoria Wages Board law was directed against the evils of sweating, particularly of the home-workers. This type of legislation was followed by the Governments of several of the other Australian states. Up to 1921 seven out of the nine provinces of *Canada* had adopted the principle of the provision of a minimum wage for working women. The laws passed are all of very recent date, the earliest step in this direction being taken in 1917, when Alberta inserted a clause in the Factories Act of that year, establishing a flat-rate minimum wage for all employees covered by the Act, with a lower rate for apprentices. In 1918 the first minimum-wage laws for women only were passed by Manitoba and British Columbia, followed in 1919 by Quebec and Saskatchewan, and in 1920 by Nova Scotia and Ontario. In 1920, also, Alberta amended its law with special reference to women. The two remaining provinces, New Brunswick and Prince Edward Island, have as yet (1921) taken no action in the matter. The application of the law is more or less restricted in all the provinces. In five provinces the minimum-wage laws deal also with hours of labour, while in three the 48-hour week has been fixed for one or more industries under the regulations for the execution of the Acts; British Columbia recognizes this standard in all trades. In all provinces except Alberta special provision is made for handicapped workers. In *South Africa* a bill was recently introduced for the creation of local joint boards to fix minimum wages in particular trades.

France.—The principle of a minimum wage was adopted in France by the enactment of a law in July 1915, which provides for special boards to fix such a wage for women employed in home-work in the clothing industry.

Switzerland.—Minimum rates were introduced in the embroidery industry in Switzerland by a decree of the Federal Council of March 1917. In June 1919 the Federal Assembly promulgated an Act for the establishment of:—(1) a Federal Labour Department; (2) a Federal Wage Commission; (3) Federal Wage Boards. Subsequent to the passing of the measure a demand was made that it should be submitted to the Referendum, which resulted in a narrow majority for rejecting the measure.

Norway.—A law dated Feb. 1918 provided for the establishment of trade boards for certain industries in Norway. The provisions of the Act relative to the fixing of minimum wages applied primarily to outwork in industries engaged in the manufacture of clothing and articles of needlework generally; the application of the law may be extended to other occupations in which outworkers are employed.

Sweden.—A bill has been prepared by the Government in Sweden for the regulation of wages and working conditions of home-workers; the provisions include power to appoint trade boards on the English model for any occupation and district.

Czechoslovakia.—A law on home-work, modelled on the Austrian law of Jan. 1919, was passed by the National Assembly of Czechoslovakia at the end of 1919, and provides for the fixing of minimum wages for home-workers.

Unemployment Insurance.—Before the World War, little had been done outside England in the way of the compulsory insurance of the working-classes against unemployment. Schemes have for some time been established in a number of European countries whereby voluntary funds managed by trade unions and other societies, and compulsory or voluntary municipal funds providing unemployment benefit, receive subsidies from the State, provincial council, or municipality. Unemployment resulting from strikes and lockouts, and also from sickness and accident where the provision exists, is excluded. As a rule, the receipt of benefit is further dependent upon a qualifying term of membership and of local residence. A maximum duration of benefit is invariably fixed, and it is usual to impose a short "waiting time" during which no benefit can be obtained. Subsidized schemes of unemployment benefit are usually worked in conjunction with labour registries.

Switzerland.—The earliest experiments of this kind were made in Switzerland, where the municipality of Berne organized a fund in 1873, and other Swiss municipalities also subsequently introduced schemes. Recent developments in Switzerland are that, between Aug. 5 1918 and April 5 1919, five decrees of an emergency character were issued by the Swiss Federal Council regulating the grant of assistance to unemployed workers. Two of these related to unemployment in private industry arising out of war conditions, the third to unemployment among workers employed by the Federal Government, the fourth to unemployment of Swiss subjects returning from abroad, while the fifth laid down conditions for the relief of all workers not covered by the preceding measures. These were repealed and revised by a single decree dated Oct. 1919, which is to be regarded as a provisional measure to be replaced ultimately by an Unemployment Insurance law. Assistance is granted both for whole and for partial unemployment, subject to the fulfilment of conditions laid down in the decree.

France.—In France many trade-union unemployment funds are subsidized by the State, the departments and the communes. The towns were the first to take action (as early as 1896), while the first departments acted in 1903. Under a law of April 1905, a certain credit is earmarked in the French budget for the purpose of public subsidies for unemployment benefit funds. A decree dated Oct. 1919 amended previous decrees relating to State subsidies to municipal and departmental relief funds.

Belgium.—Assisted provision against unemployment has been in operation in Belgium since 1901, subsidies being granted from special municipal unemployment funds to trade unions and other organizations paying unemployed benefit. Several of the provincial councils subsidize trade union and communal unemployment funds, and since 1907 the State has made small grants both towards the establishment of funds and in direct relief of unemployed members.

Italy.—In Italy assisted unemployment benefit schemes were introduced in a few towns. A decree of April 1916 authorized periodical subsidies to be granted or lent as a war measure to various organizations providing unemployment benefits for their members. A system of compulsory insurance against involuntary unemployment in Italy came into force on Jan. 1 1920.

Germany.—In Germany a voluntary unemployment fund, with a municipal subsidy, was introduced in Cologne in 1896, and certain other German municipalities also introduced schemes. Immediately after the signing of the Armistice, the German Government issued an order regulating the payment of unemployment donations. Under the order the communal authorities were required to pay out-of-work benefit to residents who were out of employment. Persons receiving out-of-work pay were required to take up work other than their usual employment, and at a distance from their place of abode, but no penalty was incurred in the event of refusal. Various abuses were soon found to exist, and amending orders have been made.

Other European Countries.—The "Ghent" system of assisting trade unions which maintain unemployment funds has been introduced in a number of the larger towns in *Holland* since 1906. In *Norway* a law offering State subsidies to unemployment benefit funds complying with certain conditions was passed in June 1906 and amended in July 1908, simultaneously with another law establishing labour registries. State assistance to recognized unemployment benefit societies in *Denmark* was first granted under a law dated April 1907. A law of April 1914 increased the amount of the State subsidy to such societies and made other amendments; it has been revised in certain particulars by a law dated Jan. 1920. In 1919, a royal decree in *Spain* was issued under which the State was to grant a subsidy equal to the amount of the subscriptions collected from their members by workmen's mutual unemployment benefit societies and similar institutions which have a separate organization for dealing with unemployment. The new Unemployment Insurance Act of *Austria*, dated March 1920, supersedes a temporary measure on the same subject. A change in the unemployment relief system had become necessary in order to relieve the State of its heavy financial burden, and because of the steady fall in the number of unemployed. As regards *Poland*, the official *Gazette* of Nov. 1919 announced arrangements in aid of the unemployed pending the passing of a law dealing with this subject. Able-bodied workers of either sex, in trade, commerce or transport, who, through no fault of their own, are out of work are entitled to State assistance.

Old Age and Infirmity Insurance.—Compulsory insurance of the working-classes against old age and infirmity has existed in some countries for a number of years, *e.g.* Germany since 1889, France since 1910, etc. Certain other countries have also for some time applied this principle to special classes, as, for example, Austria, Hungary and Belgium to miners; while State or other public subsidies have been granted in aid of voluntary insurance or savings in France, Belgium, Denmark, Italy and Spain. The more recent developments have been as follows:—

France.—The French Finance Act, 1912, amended in certain respects the provisions of the law of April 1910 relating to compulsory insurance against old age and infirmity, the principal amendments being that, while in the law as originally passed the State added to the annuity purchased by the insured person £2 8s. per annum on his attaining the age of 65, the new law raised the State addition to £4 per annum, and provided for its payment from the age of 60. The Act of June 1894, in which the principle of compulsory insurance against infirmity and old age was applied to French miners, was amended in Feb. 1914, as to the State contribution, the administration of the funds, etc. Further amendments were introduced by a law passed in March 1920, the main provisions of this new law being the allocation of higher subventions towards the pensions granted to miners or their widows.

Belgium.—A law of June 1911 prescribed that all workpeople employed in coal-mining in Belgium must be insured in the National Superannuation Fund. A law dated May 1912 has for its object the promotion by State subsidies of recognized associations and friendly societies who grant benefits to their members suffering from illnesses of a chronic nature or from premature infirmity. It is stated that a general old age pension law is contemplated.

Italy.—In conformity with a law promulgated in Italy in June 1913, a Seamen's Old Age and Infirmity Fund was formed by the amalgamation of existing institutions having similar objects. As regards ships' crews, the principle of compulsory contributions was already in operation under a law of July 1861, but the obligation imposed by the later law upon shipowners introduced a new principle in Italian legislation on this subject. As from Jan. 1 1920, a scheme was introduced in Italy under which insurance against disability, resulting either from sickness or accident, and old age became obligatory (with certain specified exceptions) on (1) all Italian subjects of both sexes between the ages of 15 and 65 working for an employer in any industry, trade or profession, agriculture and the public services, or occupied in domestic service or in any private employment, and (2) foreigners working at the same occupations who, however, receive full benefits only if reciprocal treatment is granted to Italians employed in their countries.

In *Germany* an Imperial law of June 1916 reduced the age of eligibility for an old age pension from 70 to 65; laws of Dec. 1919 extended compulsory insurance against infirmity and old age to certain new classes of workpeople.

In *Holland* provision was made for the institution of national schemes for compulsory insurance against sickness, infirmity and old age by a series of three Acts dated June 1913.

In *Sweden* a law dated June 1913 introduced a national scheme of compulsory insurance against old age and infirmity.

In *Spain* provision for the creation of deferred life annuities on a contributory and State-aided basis was made by the law of Feb. 1908. This Act, however, was of a permissive nature. A royal decree was issued in March 1919, making insurance against old age compulsory for all wage-earners between the ages of 16 and 65 whose total annual income does not exceed £160.

Sickness and Accident Insurance.—Compulsory insurance against sickness and accident has been applied in a number of countries, for example in Germany (1883), Austria (1888), Hungary (1891), United Kingdom (1911), etc., but the range of occupations covered by the various schemes varies considerably. In a number of other countries (*e.g.* Sweden) the sick funds recognized by the State receive State subsidies. The principal developments in recent years are as follows:—

Italy.—Legislation in respect of compulsory accident insurance in Italy dates from 1898; a consolidated text was promulgated in Jan. 1904 embodying all the amendments up to that date. For the most part agricultural workers in Italy were excluded, but, by a decree of Aug. 1917, the principle of compulsory insurance against accidents was extended to agricultural workers generally. Reference has been made above to the general scheme for compulsory insurance against sickness or accident and old age, introduced in Italy as from the beginning of 1920.

Switzerland.—A new law in Switzerland on insurance against sickness and accidents, passed in June 1911, was accepted by National Referendum in Feb. 1912. The sickness insurance scheme is a system of Federal State grants to recognized sick funds conducted on a mutual basis. Generally the insurance is voluntary, but the cantonal governments may, subject to the approval of the Federal Government, (*a*) declare it obligatory either for all persons or for certain specified classes; (*b*) establish public sick funds, while having due regard to funds already in existence; and (*c*) compel the employers to see that the premiums of their employees compulsorily insured in such public funds are paid. (The power to compel the employers themselves to contribute is, however, expressly withheld from the cantons.) These powers may be delegated by the cantonal governments to their communes. Under the second part of the law provision is made for a system of compulsory insurance against accidents, which, in certain respects, involves a notable departure as compared with schemes of compulsory accident insurance hitherto enacted in other countries. In the first place, the principle of compulsion is not confined to "occupational" but also extends to "non-occupational" accidents. In the second place, the State defrays part of the premiums for insurance, and it does so not only for those coming under the compulsory provisions of the law, but also for those voluntarily insured through the National Insurance Fund which the Act sets up. Those for whom the law declares insurance against accidents, whether "occupational" or not, to be obligatory, comprise all persons employed in Switzerland for a wage or salary in factories, workshops, mines, building, and transport by land or water (including the postal service).

Workmen's Compensation.—Compensation for industrial accidents was established in *Germany* in 1884, in *Austria* in 1887, and *Norway* followed in 1894. The development of legislation providing for workmen's compensation for industrial accidents in Europe and throughout the world has been extremely rapid. Recent legislation (whether of compensation or insurance) recognizes the principles of compensation as distinguished from the older idea of employers' liability.

For ARBITRATION AND CONCILIATION in labour disputes, *see* the article under that heading.

BIBLIOGRAPHY.—The monthly *Labour Gazette* and the quarterly *Labour Overseas*, published by the Ministry of Labour in Great Britain, contain valuable information; there are also official publications issued by the appropriate Government Departments in other countries, notably the *Bulletins of the United States Department of Labor*, which Department has published a number of special reports on such subjects as Workmen's Compensation, Child Labour Legislation, etc. Among unofficial books, reference may be made to *A Handbook of Industrial Law* by J. H. Greenwood, and *Industrial Law* by F. Tillyard. (H. J. W.)

UNITED STATES

During the decade 1910–20 there was a remarkable development of labour legislation in the United States. Within these years were enacted, by the Federal and state Governments, statutes dealing with workmen's compensation, minimum wage, health and safety, hours of labour, vocational education and employment service. Even more significant was the creation by several states of industrial commissions with power to issue rules and regulations having the force of law and thus relieving the Legislature of a mass of technical details. It was a period also of distinct forward movement in the field of judicial interpretation, particularly with regard to the police power in the application of the principles of "public benefit" and "equal protection of the laws" as first stated in the case of *Holden* v. *Hardy* (18 Sup. Ct. 383, 1898).

Individual Bargaining.—Since the passage of the Thirteenth Amendment, abolishing slavery, there has been a steady development of laws designed to equalize bargaining power between employer and employee. Laws dealing with labour as debtor and as creditor have included such subjects as contract labour, the padrone system, wage exemptions, assignment of wages, time of payment, place of payment, basis of payment, medium of payment, deductions, mechanics' liens and wage preference.

Seamen.—Until 1914 seamen were considered in a different class from other employees and with them enforced contracts were permitted. The Seamen's Act of 1915, however, abolished arrest and imprisonment as a penalty for desertion and stipulated that it should be unlawful in any case to pay seamen wages in advance or to pay any person for the shipment of seamen when payment is deducted from seamen's wages. It permits forfeiture of one month's pay for quitting the vessel without leave after arrival at the port of delivery and before she is placed in security. The law also regulates the nature of the contract, the term of service, the payment and assignment of wages, advance payments and credits, the regulation of sailors' lodging-houses, of shipping masters, quarters on board ship, rations and other details.

Service and Rent.—Another important group of laws which fall under the classification of medium of payment are those dealing with company houses and labour camps. Since it is legal for an employer to require his workmen to occupy company houses and to deduct the rent from wages, there is here an opportunity for abuse. Consequently, in 1913, New York granted to the Industrial Commission power of inspection. In three other states labour camps for certain kinds of work have been brought under supervision. A new development in the regulation of deductions from wages for the purpose of furnishing certain benefits is found in the laws of Oregon and Minnesota. The former has legalized deductions for hospital benefits on approval of the Industrial Accident Commission. The Minnesota law requires employers who make deductions for benefit funds to secure a licence for the benefit plan from the State Insurance Commission. Statutes have recently been enacted by half the states, the Philippines and the Federal Government, providing that no contract of insurance or relief-benefit shall constitute a bar to action for damages in case of an employee's injury or death, though sometimes the employer may offset against such claims benefits contributed.

Laws dealing with labour as tenant and as competitor belong, also, under individual bargaining. There has been little agricultural labour legislation except a law of Texas passed in 1915, which is the first American law designed to regulate the rents of share tenants by limiting the amount of rent which can be charged the "cropper." Among the laws protecting the labourer as competitor are the Immigration Bill of 1915 and a group of laws relating to convict labour which can be divided into three general classes: (1) prohibition of convict work which competes with free labour; (2) prohibition of convict labour in certain forms of industry; and (3) distribution of convicts among diversified lines of industry. A few states have adopted different plans.

Legal Aid.—Another method of protecting the individual in his bargaining relations is by legal aid and industrial courts. From New York private legal aid societies have spread throughout the larger cities of the United States. Kansas City, Mo., is the only city, however, possessing a free municipal legal aid bureau, established in 1910, while Los Angeles county, Cal., was the first to establish the office of public defender in 1913. Similar offices have been created in six other cities. California has an Act providing for the collection of wages, enforced by the Bureau of Labor Statistics. Wilful refusal to pay labour, with intent to secure a discount or to defraud, constitutes a misdemeanour. Under the N.Y. Commission Law the commission is given power to investigate claims made by employees against employers and to present the cases to the proper authorities for action. The only industrial court in the United States is in Cleveland, O., established in 1912.

Collective Bargaining.—Though the right of workmen to combine was secured in the United States by common consent and favourable construction without legislation earlier than by law in Great Britain, the conspiracy law has remained without being clarified. When the Sherman Anti-Trust Law was enacted in 1890 it was almost immediately held applicable to labour unions, and it was feared that it rendered all strikes, if not all labour organizations, unlawful. The Clayton Act (1914), however, declared that the anti-trust laws should not be construed to forbid the existence of labour organizations or to restrain their members from carrying out the "legitimate objects" thereof. This provision has probably eliminated the danger of the extension of the restraint-of-trade doctrine to a possible outlawing of all labour organizations, though the decision by the Supreme Court in the Duplex case (*The Duplex Printing Press Co. of Battle Creek, Mich.*, v. *International Association of Machinists*, 41 Sup. Ct., 172) has demonstrated that labour organizations in their actual practices are still within the anti-trust laws.

Most of the cases of which labour complains have been premised not on the anti-trust laws but on the common-law doctrine of conspiracy. While the legality of trade unions has not been questioned, except organizations advocating criminal syndicalism, various restrictions have been placed on efforts to make them effective. Generalizing from a large number of cases, it can be said that the strike is usually considered illegal when its purpose is primarily to injure the employer or the non-union workman and that, except where compulsory arbitration has been introduced, as in Kansas in 1920, strikes solely and directly involving the rate of pay or hours of labour are in ordinary times everywhere considered legal. But strikes to gain a closed shop, sympathetic strikes, and against non-union material, have been condemned in many jurisdictions.

California is the only state which has a settled law that all strikes are legal. The only method of preventing them is the injunction. In some cases "conspiracy to quit work" has been enjoined, and in others the union officers have been prohibited from advising or ordering the workmen to strike, or from paying strike benefits. A famous injunction of this type was secured by the Federal Government during the bituminous-coal mine dispute of 1919. Though formerly the boycott was condemned as unlawful, an effort is being made to distinguish between the primary boycott and secondary boycott, which is the boycott of a third party. At present there is great lack of uniformity among the laws. The two famous boycott cases are the Danbury Hatters' case (*Loewe* v. *Lawlor*, 35 Sup. Ct., 170, 1915), which was in the courts from 1903 to 1917, and the Duplex case (1921) already mentioned, in both of which the secondary boycott was declared illegal. Picketing laws, also, vary widely. California, which recognizes both the strike and boycott as legal, will not permit picketing. It has been condemned by the courts of six states and is held a misdemeanour in three others. Nine states hold that "peaceful" picketing is lawful. A further cause of illegality was laid down by the Supreme Court in the case of *Hitchman Coal & Coke Co.* v. *Mitchell* (1917), in which it was contended that where an employer has required all his employees to sign a contract that they will not join any labour union it is illegal to make any effort to organize them. In the Clayton Act (1914), which many believed would remove the restrictions which hamper trade unions, the most tangible gain is in the provision for jury trial in contempt cases where the offence charged is also indictable as a crime. This Act further provides that injunctions issued by the Federal courts shall not prohibit the quitting of work, the refusal to patronize, peaceful picketing or peaceful persuasion. Nor are these acts to be considered "violations of any law of the United States," whether they are done "singly or in concert." Yet those in charge of the legislation pointed out that it did not modify the law of conspiracy with regard to the substantive rights of employers and employees. When workmen combine to injure an employer or non-unionists, their illegal purpose colours all their conduct. Furthermore, it does not affect the cases in the state courts, which far outnumber those in the Federal courts.

Laws restricting employers' rights are few in number. Most of the states have laws prohibiting blacklisting, but they have been dead letters. Other statutes have been declared unconstitutional which attempted to prohibit employers from coercing workmen into surrendering their rights to belong to labour unions (*Adair* v. *United States*, 28 Sup. Ct., 277, 1908, and *Coppage* v. *Kansas*, 35 Sup. Ct., 240, 1915). The Supreme Court furthermore has held that, while it is illegal to induce a workman to join a union where he has signed an agreement not to belong (the Hitchman coal case), it is not coercion for the employer to threaten to discharge a workman unless he will renounce his union membership, as in the Coppage case.

While there have been many damage suits in connexion with labour disputes and many judgments against unions or their members, only two recent cases are important: the Danbury Hatters' case (see above) and the Arkansas coal-miners' case (*Dowd* v. *United Mine Workers*, 235 Fed., 1, 1916; *Coronado Coal* v. *United Mine Workers*, Circuit Court of Appeals, 1919). Both of these cases involved suits for triple damages under the Sherman Anti-Trust Act, and in both the cause of action antedated the passage of the Clayton Act. The decisions in these cases have established the principle that labour unions and their individual members are responsible without limit for the unlawful actions of the union officers and agents which they have in any manner authorized or sanctioned. Such antecedent authorization or subsequent approval of unlawful acts does not require to be expressed, but may be inferred from all the facts in the situation.

Minimum Wage.—The first minimum-wage law for women and children was passed by Massachusetts in 1912. By 1920, 13 states and Porto Rico had followed this example, and Congress had legislated for the District of Columbia. Constitutional amendments specifically allowing minimum-wage legislation were passed by California in 1914 for women and children, and by Ohio in 1912 for all classes of workers. In general the laws are very much restricted in scope and are regarded as a remedy for exceptional conditions, providing only a bare subsistence wage for those considered the most helpless class of sweated workers—women and children.

Since the purpose of minimum-wage legislation is to raise excessively low wages, the question of the standards of wage awards is the important issue. Nearly all the American laws define in general terms the principle to be followed in fixing wages, which is usually that of a living wage. For women the standard commonly used is the cost of living of the entirely self-supporting woman. Early orders were in the neighbourhood of $8 and $9 a week. In response to war-time increases, new rates were introduced which varied from $11.10 in the state of Oregon to $15.50 in the printing and engraving industry in Washington, D.C. Wisconsin set up the general rate of 22 cents an hour for experienced adults, increased to 25 cents in 1921; and Minnesota 23 cents an hour, limited to 54 hours weekly.

In connexion with fixing the minimum standard, the question of the "financial condition of the business" has arisen with regard to the continued existence of an industry, and exceptions have been made in some states for certain industries which could not stand the rate. California has best met the problem of adjusting piece rates by providing that piece rates must yield the minimum wage to two-thirds of the female employees. The employment of slow or infirm workers at lower rates is generally permitted by special licence. Practically all minimum-wage laws permit the fixing of rates for sub-standard workers. As a guide for adjusting these special rates, most Amercian statutes contain only a provision that rates for children and apprentices shall be suitable. To offset the tendency to substitute young girls and inexperienced workers for adults in trades requiring little skill, it has been found necessary to specify the length of apprenticeship and the proportion of apprentices allowed.

There are two methods of operation: the flat-rate law, which prescribes a legal minimum in the statute itself, and the more common type which provides for a board or commission to fix rates after proper investigation. The commissions are generally unsalaried. Their jurisdiction extends over persons covered by the law with full power of investigation. A subordinate board is usually provided for, which is representative of employers, employees and the public. It must make a report with recommendations to the commission, which the latter accepts or refers back. When the report has been accepted and a public hearing has been held, the recommendations are promulgated as orders. Provisions for a court review are customarily included. A new application of the police power is involved in the constitutionality of the minimum-wage legislation. The question was settled definitely by the Supreme Court decision in the famous Oregon case (1917) which held the law constitutional on the same ground on which laws restricting hours of labour for women and children had been sustained.

Hours of Labour.—Beginning with Illinois in 1903, the 8-hour standard for children under 16 has been established in 25 states and the District of Columbia, with certain exemptions in a few states. Other states have less favourable laws, especially some of the southern states, which still allow children to work legally 11 hours a day. To meet the arguments of employers who opposed restriction of hours of labour of children on the ground that it put them at a disadvantage with their competitors in neighbouring states, Congress in 1916 enacted a measure which forbade the transportation in interstate commerce of the products of factories or mines on which children between 14 and 16 had worked more than eight hours a day or more than six days a week or at night. The law was declared unconstitutional by the U.S. Supreme Court as an undue extension of the power to regulate interstate commerce. In 1919 Congress again enacted a law containing similar standards based on the taxing power, which levies a tax of 10% on the annual net profits of any concern which employs children in violation of the above standards.

By 1920 only six states, in most of which comparatively few women were employed industrially, had placed no restrictions on women's hours of work; many had limited hours to eight or nine a day; and a large number had a weekly limit of less than 60 hours. The majority of statutes fix the same daily and weekly maximum hours for all occupations covered, and generally include the principal industrial occupations for women except those in homes and agriculture. In several states the law applies only to cities within a given classification. In only a few cases, however, do the laws define the time during which the work period must fall by naming the spread of the hours allowed, by fixing opening and closing hours or by forbidding night-work. In detail the statutes vary from a 12- to an 8-hour-day minimum in 10 jurisdictions and from a 60- to a 48-hour week. About one-third of the laws permit overtime. Recently a few states have adopted a more progressive method of regulating hours by replacing the flat-rate law with statutes containing the general principle that a woman is not to be employed for any period of time dangerous to her health, safety and welfare. A commission is given power to determine, after investigation, maximum periods for different industries and even for different localities.

Though the constitutionality of the 10-hour day was established in the Oregon case (*Muller* v. *Oregon*, 28 Sup. Ct., 324, 1908), the reasonableness of the 8-hour day was still in doubt until the U.S. Supreme Court upheld the constitutionality of the California law on the same ground of public health. The laws have been attacked also on the ground of class legislation, but the courts have given little weight to this objection, asserting the freedom of the Legislature to use discretion in enlarging the scope of laws or to single out groups most in need of protection.

Statutes regarding the limitation of hours of men are more restricted in scope. In 1912 Congress required that an 8-hour clause be inserted in all contracts involving the employment of labourers or mechanics when made by the Federal Government, its territories or the District of Columbia, and extended the provision to post-office employees. On declaration of the President, violation is excusable for certain emergencies and extraordinary events. During the World War Congress empowered the President to suspend the law in case of national emergency, with pay at the rate of time-and-a-half for all work in excess of eight hours. This privilege was frequently exercised. In 1915 Federal legislation with regard to the amount of work which might be exacted took a new turn in the appropriation bills for the army and navy. Provisions were included against time studies, bonuses or cash rewards except for suggestions resulting in improvements in service. Over half of the states and many cities have 8-hour laws for employees on public works.

With regard to private employment, progress has been made mainly through collective bargaining, with a few important exceptions. In 1916 the Federal statute applying to railway employees on interstate lines and in the District of Columbia was supplemented by the Adamson law, which provides the basic 8-hour day for railway trainmen. About a dozen states regulate hours of street-railway employees to 10 or 12 a day, while Massachusetts has fixed a 9-hour day which must fall within 11 consecutive hours. A few cities, also, have regulated the hours of service on street railways. Regulation of hours in water transportation is found in the Federal Act of 1913, limiting hours of deck officers in port to 9 and at sea to 12, except in cases of emergency. The Federal Act of 1915, known as the "Seamen's Act," provides that when a vessel is in a safe harbour, 9 hours, inclusive of anchor watch, shall constitute a day's work. By Jan. 1920 the 16 states in which the mining industry is important limited hours in the various classes of mine work to 8 in one day, with special provision in a few laws for additional hours at the time of changing shifts.

With regard to regulation of hours in factories and workshops, two states, Mississippi in 1912 and Oregon in 1913, adopted the 10-hour day, with certain exceptions, for all classes of employees in certain manufacturing industries. The Oregon statute permits three hours' overtime at time-and-a-half pay, and the Mississippi Act allows 20 minutes' overtime on each of the first five days of the week and deducts this time from the 10 hours of the sixth day. In the Oregon case (*Bunting* v. *Oregon*, 37 Sup. Ct., 435, 1917) the constitutionality of the 10-hour daily limit for adult males was assured and the way was opened for much larger regulation of men's work. A small number of states also regulate the hours of employment of adult males in a few specified employments.

In spite of the considerable development of maximum hour regulation in the United States, not much attention has been paid to the question of legal rest periods. Several states have laws requiring daily rest periods; 12 states forbid certain forms of night work by women, and a few others shorten the number of hours of night work; 40 states have prohibited night work for children under 16. While more than a dozen states have made Saturday afternoon a legal holiday, practically none has made effective provision for enforcement. By 1920 six states and the Federal Government had passed laws embodying the principle of one day's rest in seven, only three of which are effective from the point of view of enforcement or number of industries included. Sunday laws have been upheld almost universally by the courts, formerly on religious grounds and in later years as a legitimate use of the police power. In the only test case of one-day's-rest-in-seven laws, the N.Y. State Court of Appeals (*People* v. *Klenck Packing Co.*, 214 N.Y., 121, 1915) sustained it as a police-power regulation. Classifications were likewise upheld as meeting modern industrial conditions.

Unemployment.—Private employment agencies situated in industrial and railway centres have long been a means of connecting the man with the job. The abuses of these profit-making agencies have resulted in restrictive legislation designed to prevent fraud and extortion and to ensure moral surroundings. These laws usually require owners of private employment agencies to deposit a bond with the State Department of Labor or the city authorities and to secure a licence. Twelve states prohibit the location of such offices in saloons, and several others forbid association with lodging-houses, restaurants or gambling-places. Frequently the sending of minors and women to immoral resorts is forbidden. Fees are regulated as to maximum amount. Some laws specify that all advertisements or other information must be truthful. Several states require records, but, with the exception of New York, they are rarely comprehensive enough to be valuable. There was almost unanimous testimony of investigators and public officials up to 1921 that these laws had not been successful in eradicating abuses, and there arose a widespread movement to abolish them altogether. The state of Washington took the initiative by prohibiting the collection of fees from workers by an employment agent. The U.S. Supreme Court, however, held the law unconstitutional as "arbitrary" and "oppressive," an undue restriction on the liberty of the appellants, and therefore a violation of the Fourteenth Amendment. In 1919 the Wisconsin Legislature gave the State Industrial Commission discretionary power to refuse licences to private employment agencies if the public bureau in the district is sufficient to supply the needs.

At the time of the entrance of the United States into the World War there were between 80 and 90 public employment exchanges maintained by 23 states and more than a dozen cities. In 1920 44 states and the District of Columbia were coöperating with the U.S. Employment Service. The older laws which create only a state employment office and make no provision for local branches have been practically a dead letter. The more recent legislation, however, which can be exemplified by the N.Y. statute of 1914, has been successful. It establishes a bureau of employment in the State Department of Labor under the immediate charge of a director who must be under civil service rules. The industrial commission is given power to establish such free local offices as it deems necessary. The activities of the local bureaus are coördinated by a labour market bulletin and the interchange of lists of vacancies. Partial recognition of the policy of joint control is given in the appointment by the Commissioner of Labor of a representative committee of employers and employees. Other clauses provide for registration, special regulations for children, and various details. The most controversial point in the administration of a bureau is the policy to be pursued in the case of a strike or lock-out. The first laws forbidding applications under those conditions were declared illegal. Since then the problem has been dealt with by some form of publicity clause requiring the exhibition at the exchanges of statements in regard to trade disputes. But state offices cannot organize the labour market. The war-time demands of labour emphasized the weaknesses of the state systems and led to the development of new administrative machinery, the U.S. Employment Service (*see* LABOUR SUPPLY AND REGULATION).

In regard to the progressive measures dealing with the systematic distribution of public work, little of value has been accomplished, though a number of cities have inaugurated plans to meet temporary emergencies and have made definite arrangements for reserve work. Pennsylvania is the only state which has established a permanent fund to be used for public work during slack seasons. The question of the prevention of unemployment is only just beginning to be recognized. The Illinois and Pennsylvania laws of 1915 instruct the administration authorities to take steps toward the regularization of employment, but nothing has been accomplished. A more definite inducement to the regularization of employment is found in the laws under consideration by several legislatures which require the employers to take out insurance against the unemployment of their employees and to provide compensation to the workers during the unemployed periods.

Safety and Health.—Legislative activities for the control of industrial accidents and occupational diseases have developed along four main lines: reporting, prohibition, regulation and compensation or insurance. Though the early laws did not bring satisfactory results, accident-reporting laws have proved useful as a guide for inspection, safeguarding and advanced legislation, and have continued to spread to new states and to new branches of industry. Laws relating to the reporting of occupational disease are of more recent origin. California in 1911 was the first state to pass such a law, and within five years 16 states had enacted similar measures. The latest tendency is to include within the laws "any ailment or disease contracted as a result of the nature of the patient's employment" instead of limiting them to certain diseases.

The prohibitive method has been applied to the exclusion of certain classes from employment and to the outlawry of dangerous substances and instruments. As a result of continuous agitation, by 1920 the 14-year minimum-age limit had been established for general factory work in all except five states and by the Federal Government, while several states have raised the limit to 16 years and in some instances to 18 years and even 21 for certain more hazardous and morally dangerous occupations. The street-trade laws are still far from adequate. In 1920 only two states had the same age limit, 14 years, for street trades as for other employments, and only about half of the states had any regulations at all. In regard to physical requirements no standards have been fixed, but 12 states require a physical examination of all children granted permits. The New York law makes further provision also for a corps of medical examiners under the Department of Labor to examine any children in any industry and to recommend the withdrawal of the employment certificate. A number of states modify the age requirements by forbidding the employment of children who do not come up to certain standards of knowledge. These vary from a mere literacy requirement in any language to graduation from the eighth grade. The principal agencies for the enforcement of child labour laws are the school authorities, the boards of health, and, in some states, special child-labour inspectors. Probation officers and child-welfare agencies may sometimes aid. The issuance of certificates is usually in the hands of the local school authorities, though in New York it is in the control of the Board of Health and in Wisconsin of the State Industrial Commission.

The exclusion of women from certain occupations has not been extensively developed in America. Work in mines is forbidden in most of the mining states, and work in saloons (except by members of the family) in 15 states. In addition there are a few scattered provisions in regard to the cleaning of moving machinery, work requiring constant standing, operation of emery or other polishing wheels and coremaking in foundries. Child-birth protection did not receive consideration until 1911. Since then five states have passed laws forbidding employment of any women in manufacturing, mechanical or mercantile establishments within two weeks before and four weeks after child-birth. Legal requirements for the exclusion of men from dangerous occupations are limited to certain classes of individuals. Four states require certain physical qualifications for work in compressed air; the "lead laws" require monthly examinations; absence of contagious disease is required in bakeshops; and freedom from colour-blindness of railway employees is mentioned in a few states. Technical qualifications required for licensing men to carry on certain trades are far more numerous. In regard to the prohibition of substances and instruments, there are two laws. In 1912 Congress placed a prohibitory tax of 2 cents per 100 on matches containing white sulphur and prohibited their import or export. This was the first time that the power of internal revenue taxation had been exercised for the protection of the health of the workers. There is also a regulation in Massachusetts forbidding the use of certain shuttles.

The need of standards, drafted and enforced by public authority, has led to the development of codes dealing with factories and workshops, mines and tunnels and transportation. The factory codes include regulations which deal with the construction and use of machinery, steam boilers and elevators, stationary equipment, etc., protection against fire, lighting, heating and ventilation, seats, toilets and dressing-rooms, protection from infectious disease, and tenement-house manufacture. In connexion with mines and tunnels the regulations treat mainly of accident dangers, though the health hazard has been given some consideration. Compressed-air illness (or caisson disease) is the industrial hazard which has been brought into prominence by the increasing construction of tunnels, subways, bridges and skyscrapers. Three states have attempted to control the disease by legislation, and several states have issued orders which include periodic physical examination, a sliding scale of working hours (decreasing as the pressure increases), and a period of gradual decompression. More than a 50-lb. pressure is forbidden.

In regard to navigation the Federal Seamen's Act of 1915 provides for a substantial increase of the size of crews, for a certain percentage of able seamen, for certified life-boat men and for a given number of properly constructed life-boats. Laws dealing with railways and street cars can be divided into two groups: those designed to protect the employee and those designed to protect the public. In the case of the first group, continued progress has been made since 1910 by giving the Interstate Commerce Commission power to designate standards of equipment and to investigate accidents. The latest development of laws for the protection of travellers are the full-crew laws, applying to both passenger and freight service. These have been upheld by the courts on the ground of public safety. Their enforcement is usually entrusted to state railway and public utility commissions with delegated power to work out details.

Social Insurance.—The first accident compensation law of general application was passed by New York in 1910. This statute was declared unconstitutional, but an amendment to the state constitution made possible the enactment of a compulsory law in 1914. Other states followed, and by 1919 compensation laws had been passed by 42 states in addition to Alaska, Hawaii and Porto Rico. The Federal law of 1908 was repealed in favour of the Act of 1916, which covers all civilian employees of the Federal Government. Early laws had been declared unconstitutional on the ground that to require an employer to pay damages for an accident for which he was not to blame was taking property without due process of law; that both employer and employee were deprived of the right of trial by jury and that the employer was charged with liability without fault. In 1917, however, the constitutionality of the chief types of compensation was affirmed by the U.S. Supreme Court in three far-reaching decisions (*New York Central R.R. Co.* v. *White*, 37 Sup. Ct., 247, 1917; *Hawkins* v. *Bleakly*, 37 Sup. Ct., 255, 1917; *Mountain Timber Co.* v. *Washington*, 37 Sup. Ct., 260, 1917). The Court ruled that the enactment of laws providing compensation for industrial accidents tended to promote the public welfare and were, therefore, within the scope of the police power. It upheld laws requiring compulsory insurance in state funds on the ground of a "fair and reasonable exercise of governmental power." Because of the adverse decision of the first N.Y. law, most American compensation acts have been made elective according to the following device. The employer is given the choice of accepting the law or of operating under the liability laws with the old liability defences—fellow-servant's fault, contributory negligence, and assumption of risk—abrogated or greatly modified.

The laws vary greatly in detail. Though a compensation system should apply to all employments and cover all industries, nine main groups are usually excluded (employees in non-hazardous occupations, agricultural labour, domestic servants, employees in interstate commerce, workmen in establishments employing fewer than a given number of persons, public employees, casual labourers, those not engaged in the regular course of the employer's business and those in employments not conducted for gain). Laws of four states and the Federal statute have been amended to include occupational diseases. Medical attendance is usually provided for, though it varies in time limit from two weeks to 90 days and in amount from $50 to $600. An increasing number of states, however, are giving their administrative boards power to use their discretion to increase the period and the amount. The waiting period during which no compensation is paid varies from no waiting period at all to 14 days. The compensation rates range for total disability from 65% of the wage (within certain limits) to 50% with time limitations varying from 208 weeks to 550 weeks, and money limitations from $4,000 to $6,000. Compensation for partial disability is usually based on a fixed schedule of a certain number of weeks' benefit for each specific dismemberment. In a few states it is reckoned as a proportion of the loss of earning power. Most states grant funeral benefits. Few are liberal in prescribing compensation to be paid dependents, which is either a specified monthly amount or a maximum amount ranging from $3,000 to $6,000. In recent years the question of rehabilitation has been given considerable attention, and by 1920 11 states had made provision for the aid of industrial cripples. In that year also, Congress passed a bill to grant Federal aid on the basis of dollar for dollar to states undertaking to rehabilitate industrial cripples. Administration of the laws is usually by a central board with general powers of enforcing the law, though a few states still leave the questions to be settled by the courts. In order to protect both the employer and employee most states compel employers to insure their risks unless they can give satisfactory evidence that they are able to bear serious losses due to accident. Besides this so-called self-insurance, three methods have been developed: insurance in a state fund, which has been established in half of the states; insurance in a stock company and insurance in a mutual or inter-insurance company.

Other forms of social insurance have not received much attention in the United States. Several bills have been introduced in state legislatures on health insurance, unemployment compensation and old-age insurance, but as yet only a few have been enacted for special classes. In 1920 a law establishing compulsory contributory old-age and invalidity insurance for the Federal Government's employees in the classified civil service was enacted. Pensions are provided by state and municipal governments for certain groups of employees, such as policemen, firemen and teachers, and by the Federal Government for soldiers and sailors.

Besides the system of life insurance administered by the savings banks under supervision in Massachusetts, the customary form of protection of widows and orphans is by means of mothers' or widows' pensions paid to certain classes of mothers with dependent children. In the years from 1911 to 1919 39 states, Alaska and Hawaii had enacted such laws. The legislation uniformly provides for straight pensions on condition that the mother is capable of providing a proper home for the child.

Vocational Education.—The Federal Act for the promotion of vocational education in the fields of agriculture, trade, home economics and industry was passed in 1917, and since then there has been a rapid expansion of this form of labour legislation. The law popularly known as the Smith-Hughes Act is based on four ideas, namely: that vocational education is essential to national welfare; that Federal funds are necessary in order to equalize the burden of carrying on the work among the states; that since the Federal Government is vitally interested in the success of vocational education it should, so to speak, purchase a degree of participation in that work; and that only by such Federal and state relationships can proper standards be set up. According to the statute, the Federal Government does not undertake the organization or immediate direction of vocational training in the several states, but agrees to make substantial yearly contributions to its support. The Federal grants are conditional and their acceptance imposes on the state specific obligations. By 1919 every state had accepted the Act.

The Federal law is administered by the Federal Board for Vocational Education, appointed by the President, which consists of the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Labor and the Commissioner of Education, together with three citizens who represent the manufacturing, commercial, agricultural and labour interests. A staff, composed of a director and four assistant directors, is chosen by the board. The state board, which must be created on acceptance of the Act, is the connecting link between the Federal board and the states. Each year Congress appropriates a given sum, according to a graduated scale increasing up to 1926, when the maximum, $7,367,000, will be reached, which will then become the annual appropriation. Money is granted to the states only on condition that it is matched by an equal amount appropriated for the same purpose (salaries and maintenance of teacher training) by the state, local community or both. In addition state grants must be made for buildings and equipment.

The law deals only with general standards and policies. Each state draws up its own plan of education to meet its own needs, which it submits to the Federal board for approval. The guiding principle laid down is that the education furnished must be under public supervision and control and must be designated to train persons for useful, common, wage-earning employments. It applies to boys and girls of 14 years and over who desire preparation as trained wage-earners, or who, having already taken up a wage-earning employment, seek greater efficiency; and to wage-earners, established in their trade or occupation, who wish to advance to positions of responsibility. No academic studies are to be supported out of the Act. In 1920 3,155 schools were aided.

Prior to the enactment of the Federal law two states had provided for compulsory part-time school attendance. Since then 16 other states have enacted similar measures, and several others have passed permissive mandatory statutes authorizing local districts to establish such schools. The laws vary in detail. The most common ages of required attendance are 14 to 18 years; hours required per week range from four to eight; the length of the school-year varies from 144 hours to the same as that of the common schools. Though the work in the United States is still new, these laws represent one of the most important developments in the labour and educational fields.

Wisconsin has gone one step further in her apprenticeship law, passed in 1911 and revised in 1915. It provides that all minors who receive instruction in a trade as a part of their consideration of employment shall be indentured. All such indentures must be approved by the Industrial Commission and can be enforced against both employer and apprentice. During the first two years of apprenticeship the apprentice must attend a part-time school for five hours each week to receive instruction in the theory of the trade, to supplement shop training. The employer is required to pay for such instruction at the same rate per hour as for service. The Industrial Commission has broad powers to investigate, determine and fix classifications, issue rules and regulations and to enforce the same with penalties. It is the duty of all public-school officers and teachers to coöperate with the commission and employers to furnish the instruction designated. Since all trades must be standardized and different schedules of training outlined, trade committees of employers and journeymen are organized to fix the length of apprenticeship, wages and the various branches to be taught. There is, also, another advisory board composed of employers, employees and educators which is consulted on questions of changes in the general policy governing apprenticeship.

Administration of Labour Laws.—The development of industrial commissions is the most significant fact in the recent history of the administration of labour legislation. The growing complexity of conditions has made it practically impossible to embody sufficient details within laws or to make them flexible enough to provide for constant changes. To meet the varying needs and to set the different standards required, the legislatures at first established special commissions, such as the minimum-wage commissions. This policy, however, led to duplication of functions and conflict of authority, and in their place six states have created industrial commissions which have general administrative control over the branches of labour legislation dealing with minimum wage, hours of labour, public and private employment offices, workmen's compensation and other related laws. Under these statutes the Legislature lays down the general state policy of reasonable standards and leaves to the commission the intricate details of investigation. It is given authority to make the findings necessary for the effective application of the standard to each case or class of cases. It can make classifications and issue different rules for different conditions and can change its rules when conditions change or when it discovers new and more effective remedies. These rulings of the commission are known as orders and are *prima facie* lawful.

This substitution of administrative rules for legislative details has made it possible to apply the principle of representation of interests. In Wisconsin, for example, joint committees representative of capital and labour are appointed by the employers and workers to serve in an advisory capacity. Generally these committees actually draw up the rules, assisted by the staff of the industrial commission, after an exhaustive coöperative investigation. In some cases, as, for instance, in the determination of the minimum wage, consultation with joint committees is made mandatory. These committees form, in fact, an inferior industrial legislature, composed of leaders and representatives of both interests, who are continually in session under state supervision and working on those details of administration which, after all, are the actual substance of such legislation as is enforced.

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LABOUR MINISTRY AND DEPARTMENT OF LABOUR.—One of the outward signs of the intensified governmental interest in labour has been the establishment in 1913 of a Department of Labor in the United States, and in 1917 of a Ministry of Labour in Great Britain.

United Kingdom.—The demand for the creation in the United Kingdom of a separate Ministry of Labour had been since 1904 a stock subject of discussion at the annual Trade Union Congress, and resolutions in favour of it had been introduced in various years up to 1916. Meanwhile, the attention of employers had been principally directed to the advocacy of a Ministry of Commerce which was to be a development of the Board of Trade. Employers had not contemplated in general a separate ministry for the labour side of the commercial problem. The general policy of the Government had been to leave to each department of State that portion of the labour problem which naturally was associated with its main functions. In so far as there was any department which was primarily charged with labour problems, that department was the Home Office, as having charge of factory legislation, though the Board of Trade had also a considerable share of the responsibility for handling labour questions, and through its "Commercial, Labour and Statistical Department" (*see* 27.127) was being given continually larger association with them. Thus the Labour Department of the Board of Trade was made responsible in turn for the administration of the Labour Exchanges Act (1908), the first Trade Boards Act (1909), and Part II. of the Insurance Act of 1911, which dealt with unemployment insurance; and this Department dealt with the work of conciliation in labour disputes until the establishment of the separate department of the Chief Industrial Commissioner in 1911. Other departments concerned were:—the Local Government Board, as responsible for the administration of the poor law; the Board of Education; and the Board of Agriculture and Fisheries, in so far as any labour questions affecting agriculture arose. Finally, there was the position of the State as a direct employer of labour—both of clerical and semi-clerical labour in the Civil Service and the Post Office, and of industrial labour in Woolwich Arsenal and the dockyards. The general labour policy in this respect was under the financial control of the Treasury; the actual handling of the labour problems affecting the postal service was dealt with by the Post Office, those affecting Woolwich Arsenal and Enfield by the War Office, those affecting the dockyards by the Admiralty. The only general measure of coördination was given by the Fair Wages Advisory Committee, which considered from time to time what were in fact the fair wages in terms of the House of Commons resolution requiring that Government contractors should pay fair wages, and which instructed the contracting departments as to the wages that they should require their contractors to pay.

With the outbreak of the World War in 1914 labour problems immediately assumed a new importance, since the paramount question was the control of man-power. It was natural in these circumstances that resort should be had by the Government primarily to the Board of Trade, upon which the handling of labour problems had increasingly centred in the years immediately preceding the war. Thus it was to the Labour Exchanges Department of the Board of Trade that the Government looked for the supply of labour for mobilization and for the grouping of labour which was required for the munitions programme. In the same way the Government looked to the Chief Industrial Commissioner for advice and guidance upon the policy to be adopted in respect of general labour problems such as trade disputes and the need for increasing production. But, as these problems assumed an ever-increasing importance, it began to be obvious that possible conflict, which might arise from separate policies carried out by the War Office, Admiralty and Board of Trade, might lead to grave consequences. More and more it was felt that some department, charged at any rate with the labour war problems, should be established, and effect was given to this view by the establishment of the Labour Department of the Ministry of Munitions in Aug. 1915. That department was in the first place largely staffed by officers lent by the Board of Trade, and from the outset discharged the dual function of war labour supply and regulation.

At the same time, it was laid down that the duty of holding the scales between the two sides in industry, *i.e.* the duties of conciliation and arbitration, must remain separate from the Ministry of Munitions, which was in itself an employing department. Thus the arbitration tribunal, known as the Committee on Production, which had grown out of the Chief Industrial Commissioner's Department, remained with the Board of Trade.

At first the Labour Department of the Ministry of Munitions had charge of labour problems affecting both the Admiralty and the War Office. But, even so, there were many labour problems of the first importance for which this department was not responsible. The control of the railways remained with the Railway Department of the Board of Trade, and similarly the control of mines with the Home Office. But the problems arising on mines and railways were of a general character affecting the whole labour situation. Moreover, while technically the Ministry of Munitions had responsibility over the labour policy of the Admiralty, it was hardly to be expected that one department of State would find itself able to take instructions from another which, in labour matters, was in fact a competitor. In consequence, although the Ministry of Munitions had achieved a certain measure of centralization and coördination, it was increasingly felt that some central department, not itself directly an employer of labour, should be available for giving general advice to the Government.

The first attempt to secure this was the creation during 1916 of the Department of the Chief Labour Adviser to the Government. It was the intention that Mr. Arthur Henderson, M.P., who was appointed to this post, should in a sense fulfil the function of guiding the labour policy of all departments and advising the Cabinet generally on labour affairs. The difficulty, however, was that Mr. Henderson had no direct authority over the employing departments, and was not in direct relation with the Committee on Production, which remained attached to the Board of Trade. In the result, therefore, though Mr. Henderson's advice was always available, the office of Chief Labour Adviser was not found to fulfil the requirements of the situation.

Ministry of Labour, 1917.—One of the first steps of the first Lloyd George Government was to establish early in 1917 a new Ministry of Labour. It was constituted under the powers given by the New Ministers and Secretaries Act, 1916. The Act did not itself invest the Minister of Labour with any specific powers except that it provided that the labour functions of any other department of State could be transferred to him by Order in Council. The Ministry started its official existence with the responsibility for the Chief Industrial Commissioner's Department, the administration of the Trade Boards Acts, and of the employment exchanges. Shortly afterwards there was added to these functions the responsibility for labour statistics. It happened, however, that simultaneously with the creation of the Ministry of Labour the Department of the Director-General of National Service also came into existence, and the question of the control of labour exchanges at once created complications. Every effort was made to bring the two Departments into the closest possible touch, but since the Admiralty and the Ministry of Munitions, as well as the Board of Agriculture, were using the exchanges, it was difficult to effect a satisfactory coördination. During the war period the Ministry of Labour exercised the two functions of advising on general labour policy and of preparing for the post-war situation. So far as the first part of the Ministry's functions was concerned, great difficulties were experienced in effecting control. Not only had the Ministry of Munitions and the Admiralty established large and powerful Labour Departments, but as time went on separate Labour Departments under the Coal Controller of the Board of Trade and the Board of Agriculture and Fisheries were established, to be followed by an attempt to set up a separate department for the Air Ministry.

Each of these departments had its own special and pressing problems. Each was constantly driven by the pressure of circumstances to give decisions, without previous reference to the Ministry of Labour, which seriously affected Government policy as a whole. Thus the Ministry of Munitions made wages orders affecting women and men, which were not necessarily consistent with the awards given by the Committee on Production.

The Coal Controller arrived at a settlement with the miners which had the most unexpected repercussions on every class of miner engaged in non-ferrous mining. Here again there was no previous consultation with the Ministry of Labour. The Board of Agriculture pursued its own policy, and, under the Corn Production Act of 1917, set up Agricultural Wages Boards, which departed from the principles guiding the Trade Boards controlled by the Ministry of Labour in that the agricultural boards were entirely independent of any Government control. Moreover, the Board of Trade in its negotiations with the railway men was often too pressed by circumstances to be able to consult with the Ministry of Labour.

All these difficulties were almost inevitable with a new department created in the middle of the World War—a stranger among long-established departments. But in spite of these handicaps the existence of a single department which had no direct interest in production and could view labour problems from a general point of view was undoubtedly of great service. Of still greater service was the work performed by the Ministry of Labour during the war in preparing for peace conditions. The Ministry of Labour was responsible for drawing up, in conjunction with the War Office, the elaborate schemes for the demobilization of the forces, and was responsible with the Ministry of Reconstruction for drawing up the schemes for demobilization of civilian war workers. In addition the Ministry of Labour, by the creation of Whitley Councils, the extension of the Trade Boards Act and the proposals with regard to the control of wages after the war, was laying the post-war foundations.

Immediately upon the declaration of the Armistice at the end of 1918, it was decided to transfer to the Ministry of Labour the labour departments of the Admiralty and Ministry of Munitions. There was set up, to meet the special emergency created by demobilization, a new department of the Ministry of Labour under a Controller-General of Demobilization and Resettlement. The Ministry was then, for the immediate post-Armistice period, divided into two broad halves. The first half dealt with industrial conditions, and was responsible for the administration of the Wages (Temporary Regulation) Act, conciliation, the administration of the Trade Boards Acts, watching the progress of Joint Industrial Councils, and for the general industrial policy of the Government. This half of the Ministry of Labour was placed under the Permanent Secretary.

The second half of the Ministry of Labour under the post-Armistice scheme, under the Controller-General, divided itself into permanent and temporary departments. The permanent department was the machinery of the employment exchanges. Side by side with this permanent machine there were three temporary departments:—

(a) The Training Department, which was set up to provide training for disabled men and for certain classes of women.

(b) The Appointments Department, which dealt with the placing and training of officers and men of similar educational qualifications.

(c) The Civil Liabilities Department, which provided resettlement grants for ex-service men under certain conditions.[1]

With the enormous accession of work that the Armistice threw upon the Ministry of Labour it was not possible to attempt to plan out the permanent foundations of the department. Consequently at this stage, so far from all questions of labour policy being transferred to the Ministry of Labour, at least one new department dealing with labour matters was set up in the Mines Department of the Board of Trade. Moreover, the Board of Agriculture retained its complete control of questions of agricultural labour, though it was rapidly becoming apparent that these questions could not with advantage be considered separately from the general labour questions before the Ministry of Labour.

The difficulties of this grouping of the situation were further accentuated by the increasing importance of the handling of international labour problems. With the establishment, under the Versailles Treaty, of an International Labour Office, it became of even greater importance that there should be one department, speaking for the Government as a whole, on labour topics. It was plain that action taken by the International Labour Office would profoundly affect labour problems in the United Kingdom, but, owing to the heavy burden cast upon the Ministry of Labour, it was not possible definitely to associate the department with the governing body of the International Labour Office.

Post-war Reconstruction.—When the first rush of Armistice work was over, an attempt was made to lay down to some extent the permanent lines upon which the Ministry of Labour was to develop. It was recognized that in any event it would be necessary to proceed slowly with the complete centralization in one department of all labour matters, but it was felt that an organization must be devised which would be ultimately capable of taking such a position if this were finally decided upon. Speaking generally, the functions of a Ministry of Labour would be:—

(a) To advise the Cabinet of the day generally on labour policy.

(b) To administer the Government's labour code; by which is meant, to be responsible for all Acts of Parliament directly affecting the relations of employers and employed.

(c) To act for the Government in respect of international labour problems as a sort of foreign office for labour.

The situation did not permit of the discontinuance of the temporary departments. Apart from these, the Ministry is divided into three main administrative departments with certain common service departments.

The administrative departments are:—

(a) *The Industrial Relations Department*, which deals with arbitration and conciliation relations with the industrial courts set up under the Industrial Courts Act, 1919, the administration of Joint Industrial Councils, the Fair Wages Clause and hours of labour.

(b) *The General Department*, concerned with administration of the Trade Board Acts, intelligence and statistics, and parliamentary and international work.

(c) *The Employment and Insurance Department*, responsible for administration of the Unemployment Insurance Acts, control of employment exchanges, employment of ex-service men, and juvenile employment.

The Common Services departments include (1) Finance, (2) Establishment, and (3) Solicitor's Department.

It will be observed that this arrangement tends to divide the work of the departments into two main groups—conditions and employment, with a central group which, for the purpose of convenience, has taken part of the work of conditions of employment in the administration of trade boards. Considerable tracts of work, however, which would be covered by the general basis of the department suggested above, are not included. Thus the responsibility for the administration of the Factory Acts and the Workmen's Compensation Acts remains with the Home Office, as does the responsibility for the labour policy in respect of merchant seamen with the Board of Trade, for railwaymen with the Ministry of Transport and for agricultural labour with the Ministry of Agriculture. Moreover, though the existing arrangements provide for the administration of unemployment insurance by the Ministry of Labour, this is the only degree in which the department has responsibility for the treatment of the able-bodied unemployed. So far as international labour is concerned, the position has been made definite by the establishment of an interdepartmental committee under the chairmanship of the Minister of Labour, which is responsible to the Cabinet for handling international labour problems.

(H. WF.)

UNITED STATES.—The Department of Labor was created by Act of Congress on March 4 1913. Its chief official, the Secretary of Labor, is a member of the President's Cabinet. He is "charged with the duty of fostering, promoting and developing the welfare of the wage-earners of the United States, improving their working conditions and advancing their opportunities for profitable employment." He is authorized to direct the collection of statistics concerning the conditions of labour, its products, and their distribution, and may call upon the other governmental departments for the data they possess. He is also empowered to act as mediator in labour disputes and to appoint commissioners of conciliation, whenever he deems it desirable for promoting industrial peace. There is also an assistant secretary and a solicitor of the Department of Labor, the latter acting as legal adviser to the Secretary and to the heads of the various bureaus.

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[1] A separate department for Ireland, under a secretary responsible to the Permanent Secretary, was established early in 1919.

The four original bureaus comprised (1) the bureau of labour statistics, charged with gathering and diffusing information about labour, especially its relations with capital, hours of labour, earnings of labourers, and means of improving their conditions; (2) the bureau of immigration, charged with administering the immigration laws, including the Chinese-exclusion laws; (3) the naturalization bureau, for administering the naturalization laws; and (4) the children's bureau, charged with investigating and reporting upon all matters pertaining to children and child life among all classes of people, including infant mortality, maternal mortality, juvenile delinquency and diseases of children.

The exigencies of the World War led to the formation (1918) of a woman-in-industry service, or women's bureau, to safeguard the interests of the large number of women who replaced men withdrawn for war service. In the same year the U.S. employment service, formerly a part of the immigration bureau, was made a separate bureau and became the medium for recruiting unskilled labour for war industries, excepting farms and railways. Between Jan. 1 1918 and June 30 1919 employment was secured for 4,955,159 persons, and after the Armistice many discharged soldiers were placed in positions. As a temporary war emergency measure there were created also (1) a bureau of industrial housing and transportation for labourers engaged on Government contracts; (2) an information and education service for creating, through publicity, a spirit of coöperation and mutual understanding between labour and capital; and (3) a national war labour board, for settling labour disputes and ensuring uninterrupted production of the essentials for war.

The Department of Labor is the outgrowth of public agitation extending over a long period. In 1884 a Bureau of Labor was created under the jurisdiction of the Department of the Interior. In 1888 this bureau was converted into an independent Department of Labor, headed by a commissioner who, however, was not admitted to the President's Cabinet. In 1903, after the creation of the Department of Commerce and Labor, the old Department of Labor, thereafter known as the Bureau of Labor, was placed under its jurisdiction. For 10 years the interests of both labour and capital were entrusted to the same executive department. This proved unsatisfactory because these interests were often in conflict. Finally, in 1913, the Department of Commerce and Labor was changed to the Department of Commerce, and there was created a separate Department of Labor especially entrusted with the problems that concerned the welfare of the wage-earners.

LABOUR SUPPLY AND REGULATION.—During the World War the question of national "man-power" came to the front as never before. In a war engaging the whole resources of a nation its man-power must be distributed to meet four paramount obligations: (1) The maintenance at requisite strength of the fighting forces; (2) the supply to the forces of the necessary men for carrying on war; (3) the supply of the necessities of life for the civilian population, and (4) the maintenance of ordinary commercial work to the fullest possible extent in order to maintain financial credit. It is the business of Government to see that as far as possible the appropriate categories of men are drafted into each class. If there is a shortage of the gross supply it becomes a duty not merely to attempt to increase the total from new sources, but to regulate the existing supply in such a way as to increase its productivity.

The problem of "man-power" in war-time is obviously different from the outset in countries which begin a war with universal compulsory service and those which begin a war on the basis of voluntaryism. In the case of countries such as France and Germany, the approximate size of the fighting forces was known in advance, and this fact, combined with universal compulsory service, at any rate canalized the problem. In the United Kingdom of Great Britain and Ireland, where the fighting forces were expanded sevenfold, and where there was no compulsion at the outset and never universal compulsion, the problem was of a completely different order.

I. UNITED KINGDOM

The history of labour supply and regulation in the United Kingdom during the World War is the history of how a system had to be improvised to meet the ever-shifting demands of the four predominant national needs. The problem for those concerned with the handling of labour throughout was to attempt, with an inadequate supply, to meet each of the four demands to the widest possible extent.

The first necessity in point of time was the recruitment of fighting forces on a scale hitherto unimagined. No attempt was made to limit the area of recruitment, nor would it have been possible in the early days to impose any such check. If limits had been imposed upon the patriotic enthusiasm which brought millions to the colours, serious obstacles would have been put in the way of building up the immense armies that were ultimately achieved; but the very impetus of recruitment of itself created in an acute degree the shortage of man-power, and accentuated it by reason of the fact that men were drawn largely from the very trades upon which the fighting forces depended for munitions.

To a certain extent the account of labour regulation and supply is an account of the long and difficult attempt to repair the ravages in the industrial ranks created by indiscriminate recruiting. The account of the handling of the problem may be approached from three points of view—the first negative, and the latter two positive:—

(A)—The negative, which consisted in the limitation of recruitment.

(B)—The stage of increase of labour supply, (1) by drawing on to vital work workers engaged on less vital work, (2) by bringing back from the forces skilled men to assist in the production of munitions, (3) by getting workers from new sources.

(C)—The intensive use of the available supplies of labour by its regulation, (1) by increasing mobility, (2) by preventing wastage, (3) by removal of trade-union restrictions, including ultimately dilution, (4) by obtaining full value for hours worked (under which is included the prevention of strikes and lockouts, the regulation of hours of employment, the provision of workshop discipline, and the provision of satisfactory working conditions), (5) by the handling of wages problems.

(A) THE LIMITATION OF RECRUITMENT.—So far were the Government and the country from realizing the probability that excessive recruitment might lead to grave shortage of man-power, with the result that instead of widespread unemployment there would be practically no unemployment whatever of able-bodied persons, that the first steps in the handling of the labour problem by the Government and by the engineering trades respectively were as follows:—(*a*) The Government set up in the early days of Aug. 1914 a strong Cabinet committee for the prevention and relief of distress. (*b*) On Aug. 19 the executives of the Engineering Employers' Federation and the Amalgamated Society of Engineers met to discuss ways and means whereby the unemployment contingent on the national crisis might be minimized. (*c*) The attitude of the general business community was crystallized in the phrase "business as usual."

This early point of view was rapidly modified. As early as the end of Sept. 1914 it began to appear that the rate of unemployment was far from high; and from Oct. onwards, to the shell conference of Dec. 21, the outstanding feature of the labour situation which began to emerge was the grave shortage of skilled engineering labour, threatening to make impossible the vitally needed expansion of production. Nor, when the figures of recruitment are examined, is this result surprising. By Oct. 1914 the group in the engineering trades had lost by enlistment 12·2% of their pre-war male workers. This percentage had risen by July 1915 to 19·5.[1] Against this loss must be offset the large proportion of new entrants into these trades, but these entrants never filled the gap thus created and would have been inadequate if the demand on this group had remained at the pre-war standard, whereas in effect it was increased out of knowledge.

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[1] Board of Trade report on the state of employment in the United Kingdom in July 1915, Part I, page 3.

The situation accordingly was grave. The shortage of munitions was causing acute apprehension, and early in 1915 it had attracted general public attention. The first step, therefore, taken to deal with the matter was to provide some form of protection from recruiting for men engaged on munitions production. As early as Sept. 8 1914 Messrs. Vickers had suggested the possibility of the issue of a badge which should protect men from the recruiting officer on the one hand, and from irresponsible persecution on the ground of shirking on the other; but throughout 1914 nothing on a systematic or even considerable basis had been attempted in this direction.

Badging.

In Jan. and Feb., however, the matter was seriously taken in hand by the War Office, and a special branch was set up to deal with the "badging" of indispensable workmen engaged on munitions. A scheme was brought into operation in March 1915, under which contractors were classified according to the importance and urgency of their work. Similar action was taken by the Admiralty, and in May of that year instructions were issued to recruiting officers that men in certain categories were not to be accepted for enlistment, but this action was in itself almost nugatory. The patriotic impulse to join up among the younger men was still too strong to admit of artificial restriction, but the lists were not really drawn up on any scientific basis. In fact, they were directed rather to protect the manufacturers of the finished product, *i.e.* shells, guns and ships, while making no real endeavour to cover the sources of supply, *e.g.* machine tools. The action taken by the Admiralty was probably more effective than that taken by the War Office.

The original war service badges issued by the War Office were accompanied by a certificate signed by Lord Kitchener.

> "In token that his services are urgently required in the manufacture of ordnance war material for the defence of the realm, in which service he is required to exercise diligence and faithfulness."

By the end of July 1915, 79,738 badges had been issued, over 60%, however, to a very limited number of firms.

At this stage (Aug. 1915) the Ministry of Munitions comes upon the scene. It was clear that one of the first duties of that department would be to organize labour supply. This meant, as a first step, the protection of workers engaged on the output of munitions from further recruitment. Speaking generally, when the Ministry of Munitions took over the work, one-fifth of the males employed in the industry specially concerned with recruiting had joined the forces. As a first step, to regulate the position and to take powers, a provision was introduced into the Munitions of War Act, in July 1915, enabling the Minister of Munitions to make rules authorizing the wearing of badges by persons engaged on munitions work or other work for war purposes.[1] Provisional rules under this section were made on July 23, and became statutory on Oct. 9.[2] Before this date, however, namely on July 26, the Ministry of Munitions took over the administration of the badges from both the Admiralty and the War Office. Letters were immediately sent to the firms on the War Office and Admiralty lists of exemption, informing them that the basis of protection would be badges. At the same time letters were issued to firms on lists prepared by the supply departments of the Ministry of Munitions, in particular to firms such as machine-tool makers, iron and steel firms, principal electrical power stations, gas works extracting toluol, and chemical firms which had not been previously protected.

In order to keep this list up to date and to extend it where necessary, the Ministry of Munitions kept in constant touch with all the supply departments concerned and with employers of labour throughout the country; but from the first, and throughout, there was an almost inevitable conflict of interest between the points of view of the Ministry of Munitions as the department protecting labour for munitions work, and the fighting departments who were in urgent need of recruits.

The scheme was by no means a complete success. In the first place, there was the conflict of interest already mentioned. In the second place, it was difficult to obtain a scientific list of the firms to be covered, particularly when, as was the case, the types of munitions urgently required varied almost from week to week. In the third place, it was a matter of difficulty to decide to what class of men within protected industries or firms badges should be issued. Finally, at this stage the actual distribution of the badges was not in the hands of the department, but of necessity in the hands of the employer who alone knew the requirements.

National Registration.

Concurrently with the work of the issue of badges a new method upon which industry could be more scientifically protected was being provided by the National Registration Act of 1915. The registration undertaken on Aug. 15 1915 had among its objects that of discovering what proportion of men of military age were still eligible for service and what proportion of those were employed on work vital to the output of munitions. When the results were supplied special arrangements were made for writing the account of men in industries vital to the continuance of the war upon starred forms, and when at the end of Oct. the figures were reported by the Registrar-General and the Scottish Office it appeared that 29·4% of the whole available labour was in "starred" industries. Of that more than 50% was on munitions production, the remainder being on railways, mining and agriculture.

It was becoming apparent while these two steps were being taken to protect industry that the existing method of obtaining recruits for the fighting forces was not merely producing an inadequate supply, but was, by its indiscriminate nature, severely handicapping the output of munitions. Accordingly, in Sept. 1915, the question of an immediate adoption of compulsory military service was seriously weighed, but on the balance of considerations it was decided to make a last appeal on a voluntary basis—the Derby scheme. The essential aspect of the Derby scheme, from the point of view of limitation of recruitment, was the establishment of the local tribunal for giving exemption, which formed the basis of the tribunals which functioned under the Military Service Acts when they came into force. The question arose whether all men should be submitted to these tribunals, or whether those protected by the Ministry of Munitions and the starred lists should be automatically exempted. After discussion the question was settled by the issue, on Nov. 16 1915, of the following notice on the enlistment of munitions workers, signed by Mr. Lloyd George and Lord Derby:—

> No man officially badged or starred for munitions work may be enlisted for immediate service in the Army. Men so badged or starred may be "attested" for the Reserve on condition of returning to civil employment. They will receive the khaki armlet, and will not be called up for service unless at some future time the Ministry of Munitions decides that they are more urgently needed in the Army than for munitions work.

Provision at the same time was made for the release from the colours of starred and badged men wrongly enlisted.

On Nov. 19 the Local Government Board issued the first instructions to the local tribunals, and in a public announcement the list of starred occupations subsequently reserved was set out as follows:—

List A.—Occupations required for the production or transport of munitions supplied by the Ministry of Munitions.

List B.—Coal-mining.

List C.—Agricultural, railway, and certain occupations in mining, etc.

List D.—Occupations (reserved occupations) of cardinal importance for the maintenance of some other branches of trade and industry.

Supplements to List D. were issued on Nov. 29 and Dec. 20 1915.

By this means, for the first time after the outbreak of war, something like a basis of a scientific protection for workers required for the output of munitions, and the maintenance of civilian necessities, was laid down.

Military Service Act.

The Derby scheme did not produce the necessary number of recruits. The facts were, as Lord Derby's report, made public on Dec. 19 1915, stated, that 1,029,231 unmarried men had not offered themselves for service, of whom

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[1] Munitions of War Act, 1915. Section 8.

[2] Statutory Rules and Orders, 1915. No. 1001.

651,160 were not starred. This figure of itself sounded the knell of voluntaryism, and on Jan. 5 1916 Mr. Asquith introduced the first Military Service bill. From the point of view of limitation of recruitment the important provisions of that Act are contained in Section 2, which empowered a Government department to grant certificates of exemption to men on work of national importance in consultation with the Army Council. It provided further that a Government department might direct that certificates of this nature previously granted should be regarded as certificates within the meaning of the Act.

In the course of the discussion on the bill grave fears were expressed by the Labour party lest the powers of the Act, and particularly those as to exemption, should be used for the purpose of industrial compulsion. It was pointed out by Mr. W. C. Anderson on the second reading[1] that an employer would have power of life and death over his employee, and safeguards were accordingly introduced into the bill so that an employer should not, by merely dismissing a man, compel him to take military service. The Military Service Act became law on Jan. 27 1916. It was laid down that numbered badges issued by the Admiralty, War Office or Ministry of Munitions should be treated as certificates of exemption for the purpose of the Act. Steps were further taken to exchange for numbered certificates the unnumbered Admiralty badges. The actual exchange was obviously a matter of considerable difficulty.

It is certain that for many reasons the exchange was never complete or satisfactory, but it is probable that no system could have been devised to render it so.

It was expected that the operation of the first Military Service Act would remedy the admittedly grave shortage in the inflow of recruits for the services. These hopes were not realized. Many causes operated to defeat them, but one to which increasing attention was drawn was the system of exemptions. The position was now reversed. At the outset of munitions shortage the forces were accused of starving the factories, now the factories were accused of starving the forces, the truth being that there were never enough men for both needs, and that each was supplied at the expense of the other according to the predominant military need of the moment.

However this may be, from the passing of the first Military Service Act the problem of limitation of recruitment became rather one of finding men for the forces than of preventing their enlistment, but with this vital qualification that they were to be found with the least possible loss to munitions production.

Debadging.

From this point begins the active policy of debadging, which was in effect the negative side of "dilution." Public feeling against men "under the umbrella" was growing, and so well-informed a critic as Lord Derby could say on May 18,[2] in the debate in the House of Lords on the second Military Service bill, which extended compulsory service to married men who had not attested:

> "That is the question of men in munition works who are eligible for military service, and who are, in the opinion of the various localities in which they are working, only shirking by being in those works. That has given rise to more trouble with regard to recruiting than anything else. You have grocers, pawnbrokers' assistants, all classes of men going into munition works and securing exemptions; and it is the fact of their so securing exemption, although not skilled, that gives rise to so much irritation. . . .
>
> "Arrangements are being made by means of a committee to debadge these men and secure them for military service. But I should be deceiving your Lordships if I did not tell you that these methods of debadging are excessively slow; and if we are to wait for that system to work itself out, coupled with two months' exemption, we shall not get the men as rapidly as is desired."

His reference to the Debadging Committee indicates a step which had already been taken in the hope of controlling the issue of badges. This committee, with Mr. Walter Long, M.P., as chairman, held its first meeting on March 20. But although it was a Cabinet committee of an authoritative kind it was able to accomplish little. The difficulty was one which was common to this and to practically all other subsequent coördinating committees set up to deal with the problem of the labour supply. The questions to be determined depended on two sets of considerations—(*a*) the general strategic policy of the Government, and (*b*) the practical facts of industry and production.

No committee could ever replace the actual departments concerned with the supply of munitions from the second point of view, nor the War Council or Cabinet from the first. This particular committee, possessing neither the power to decide policy nor the knowledge to settle badging questions in detail (which in the second week of May were coming in at the rate of 12,195 per week), was doomed to failure, and, after some months of struggling with an impossible task, made way for the Man-Power Distribution Board on Sept. 3.

But while the committee was sitting the departments were not idle. The extent to which protection from enlistment had now proceeded may be judged from a consideration of the results of two returns obtained from badged firms to the number of 12,000, May and Dec. 1916. These returns showed that, of a total number of 2,112,896 males employed, a total of 1,118,767 were of military age. Of these 698,587 were skilled, leaving a very considerable balance of semi-skilled and unskilled whose retention was naturally challenged. A return covering a wider area indicated that the total number of men protected either by badges, exemptions or recruiting officers' certificates, was 2,686,400. A change in the basis of badging was introduced in May 1916. Up to that date the employer had been responsible for the issue of the badges. From that date the direct responsibility for their issue was assumed by the Ministry of Munitions. This shifting of responsibility, while casting a great additional burden on the department, put them in a position to deal with the whole question more comprehensively and with greater certainty. It enabled them, for example, to attack with increased vigour the problem of debadging. Debadging was necessarily carried on in close association with and by the same officers responsible for dilution. The principles upon which these officers worked were to deal with all cases of badged men who were not occupied three-quarters of their time on important work, or whose work could be done by female or other labour ineligible for military service, and for whom substitutes could be found. If the men were skilled they should be drafted to other civilian work of national importance; if unskilled, to the forces. The task set these officers was one of great difficulty,[3] but by Aug. 1916 32,798 badges had been withdrawn, 9,475 firms, covering 850,268 badges, having been visited.

But even so the position was far from satisfactory. The first battle of the Somme had made severe inroads on the man-power of the nation, and the situation in this respect was perhaps as critical at the date of the establishment of the Man-Power Board as at any time during the war.

Man-Power Board.

This board were set up with at least a partial understanding of the difficulties which had been encountered by the committee on exemptions, the place of which they took. Their functions included the settlement of questions arising between Government departments on the use of man-power, and the giving of directions to the departments. Moreover, programmes involving important demands for man-power were to be submitted to the board; the authority of which, subject to the War Committee, was final.

The board were only more successful than their predecessors in that, by their recommendations, they brought the rapidly growing difficulty to a crisis. They found themselves confronted by the two same root difficulties. They could not regulate the programmes either of the forces or the departments, as they did not control policy, and they were bound, on the practical question of the number and quality of men required to carry out the programmes, to rely on the executive departments.

But in spite of these difficulties the Man-Power Board were able to make new recommendations of first-class importance. One was that no badge certificates should be issued to men (*a*) who had already been decertified by a Government department;

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[1] Parliamentary Debates (1916) H. of C., LXXVII. 1416 *et seq.*

[2] Parliamentary Debates (1916) H. of L., XXI. 1099.

[3] For fuller account of "dilution," see below.

(*b*) whose cases were pending before tribunals; (*c*) to whom tribunals had refused exemption; (*d*) to whom tribunals had given temporary exemptions, and (*e*) already under notice to join the army. A second was that the Ministry of Munitions should be allowed to claim the services of men in the above classes, who would then, unless immediately required for service in an equally skilled capacity in the army, be transferred to reserve as the "army reserve munitions workers."

Two results emerged from these recommendations when they were adopted, neither of which could have been expected by those who made them. The first was the growth of considerable resentment amongst the skilled trade unions, who complained that the new arrangement was contrary to the pledge given by the Prime Minister that skilled men should not be taken for general service. This feeling was so strong that in the end it led to a complete revision of the basis of exemption by what came to be known as the trade-card agreement. In the second place the Man-Power Board saw that they could not hope really to deal with their main problem of adjudicating between departments, unless they had effective local machinery. Though the machinery they planned was never put into force, they had indicated two things. First, the vital need of the whole question of manpower both from the recruiting and the civilian points of view being under one authority. Second, the necessity that that authority should be independent of all the departments interested. In this way they sowed the seeds of the Ministry of National Service, and it cannot therefore be said, even if at the time the upshot seemed disappointing, that in the long run it was unfruitful.

Trade-Card Agreement.

The new policy of exemptions caused grave difficulties with the trade unions. Their complaints were:—(*a*) that recruiting officers ignored the validity of badge certificates; indeed that badged and certificated trade unionists had actually been arrested as defaulters; (*b*) that there were skilled men unbadged in railway shops; (*c*) that skilled men in commercial work were being taken, greatly to the detriment of the country's credit system; and (*d*) that skilled men with the colours were still being used for general service instead of skilled work. At the same time as these complaints were growing, grew the demand for men with the colours. To meet the demand, various proposals were mooted, but their shape was ultimately determined by the crisis precipitated by the wide-spread feeling of uneasiness among the men. There were three proposals before the Government. There was first the proposal of the Man-Power Board, which, subject to elaborate safeguards, suggested the immediate decertification and debadging of all men of military age under 26. There was the proposal of the Ministry of Munitions to leave all skilled men alone, but, with certain special exemptions for steel and similar work, to release all both semi-skilled and unskilled men as far as possible. There was finally the proposal of the skilled trade unions to the effect that no skilled men should be taken for the colours, that they should be protected from military service by a card issued to them by their societies and that skilled men with the colours should be used in mechanical units.

While these three proposals were being debated, the storm broke early in November. A strike at Sheffield centred round the recruiting of a man named Hargreaves, and in order to allay the general uneasiness, of which this strike was a symptom, on Nov. 18 the Trade-Card Agreement was signed at a meeting with the Executive of the A.S.E.:—

1. That all members of [1] the Amalgamated Society of Engineers as one of the Trade Unions of the skilled engineering trades not now fully engaged, or at any time hereafter ceasing to be fully engaged, on war work, shall enrol as war munitions volunteers, and thus place their services at the disposal of the country, in accordance with arrangements under the war munitions volunteers scheme.
2. The skilled men referred to in this agreement are men who were either journeymen or apprentices prior to Aug. 15 1915.
3. All skilled men on war work or who have enrolled as war munitions volunteers shall be provided with a card of exemption from military service. The form of this card will be authorised by the Army Council and the card will be issued through the trade unions. Orders will be issued by the Army Council to all recruiting officers that no man who produces such a card to the local recruiting officer shall be removed from his work without a specific authority from the War Office, which will not be given without reference to the Minister of Munitions and the executive of the man's union. In case of any dispute arising as to a man's right to hold a card, it shall be decided by a representative of the War Office, a representative of the Ministry of Munitions, and a representative appointed by the executive of the union to which the man belongs.
4. The provision of skilled mechanics for the army will in future be made by the Ministry of Munitions. The trade unions will do their utmost to provide the Ministry of Munitions with skilled men, who will undertake to serve at the choice of the Ministry either in the artificers' corps in the army or as war munitions volunteers in civil life. If skilled men for the army are not secured in this way, it is clearly understood that recourse must again be had to the statutory powers.
5. That the Amalgamated Society of Engineers will furnish names and, wherever possible, particulars of skilled men, now serving in non-mechanical corps, and the Army Council will continue to make every effort to transfer mechanical units.

The scheme was subsequently extended to the remainder of the unions in the engineering and shipbuilding group.

This agreement did nothing directly to increase the supply of men for the army, except in the condition which required skilled men to enrol themselves as war munitions volunteers and thus render themselves mobile. It remained accordingly for the Government to decide how to draw from the ranks of the skilled and the semi-skilled the necessary recruits. This problem was still unsolved when in the middle of Dec. 1916 the first Lloyd George Government was formed.

First Ministry of National Service.

The first step taken by the new Government in this matter was to form a Ministry of National Service. By doing this the Government recognised that the coördination of man-power could only be effected by an executive body, and that no committee, however powerful and strongly constituted, could hope to deal with a problem which was in the last resort inevitably one of detail. Thus one of the lessons of the Man-Power Board was learned, but the second and more vital was at this stage overlooked. The Ministry of National Service under its original constitution dealt only with civilian labour: it did not touch recruiting. This was a fatal flaw, for by the omission of this function not only did the department fail to balance the rival demands of the forces and home production, but it became a fifth wheel which, side by side with the organization of the Ministry of Munitions and the Admiralty, necessarily tended to revolve in the air, or if on the ground, then only to get in the way of the four effective wheels. As the result, till this defect was remedied by the reconstitution of this Ministry in Aug. 1917, the department was practically powerless.

But the needs of the forces and of production were incessant and remorseless. Consequently, until the reconstituted ministry was set up, the burden, as in the time of the Badge Committee and the Man-Power Board, continued to fall on the executive departments. These departments found that the Trade-Card Agreement had not alleviated their difficulties. Not only did the intake of recruits continue to be much below requirements, but the Agreement itself had led to new embarrassments of its own creation. On the one hand, so far as labour was concerned, it created almost as much unrest as it allayed. For its operation had been restricted to a selected list of unions, with the result that all those excluded resented their exclusion. On the other hand, from the Government point of view, a system which practically handed the exemption of skilled men to the trade unions was bound to work unsatisfactorily.

Protected Occupations.

In the beginning of 1917 accordingly the Government decided that the needs of the forces rendered imperative the abolition of the Trade-Card scheme. Its place was taken by the schedule of protected occupations. Under this schedule men engaged in the specified occupations on Admiralty, War Office or munitions work or in railway workshops were entitled to a "scheduled occupations certificate if over a specified age or in a medical category below A." Men put in scheduled occupations received a "protection certificate" of a more limited and precarious character.

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[1] The words "the Amalgamated Society of Engineers as one of the" were added at the conclusion of the conference with the Government on Nov. 18.

It was obvious that this change would not be effected without the most strenuous opposition from the trade unions. It might have gone through, however, without actual industrial disturbance if it had not coincided in point of time with an amending Munitions Bill, which among other provisions rendered possible the compulsory introduction of dilution on private work. The combination of these new factors led in May 1917 to the outbreak of perhaps the most serious strike which the Government had to face during the World War. In the result the Government adhered to their schedule, but it was announced that progress with that part of the bill which provided for dilution on private work would be deferred. It did not, in fact, reappear.

Reference must here be made to the work of the Reserved Occupations Committee, which, dealing with non-munitions trades, had functioned continuously since Sept. 1915, side by side with the Ministry of Munitions and the Admiralty, and was finally absorbed in the Ministry of National Service in Aug. 1917. As the recruiting campaign was intensified during the end of 1915, and particularly when the tribunal system came into operation with the Derby scheme, it became obvious that a real necessity existed for the creation of some central body which could give advice to tribunals in respect of trades not covered by the Ministry of Munitions and the Admiralty. This committee, originally appointed in Sept. 1915, and composed entirely of experts, framed successive lists of occupations in which, in their view, men should be protected from recruiting. The lists had regard to the necessity of maintaining national trade and food supply. At no stage did the issue of these lists entitle persons covered by them to automatic exemption as was the case with badged men. The only effect of the list was to set clearly before the tribunals, before which the men concerned would appear, the view that recruiting in the "certified" lists should not be encouraged. The "certified" lists originally included "badged" occupations, but these were gradually eliminated as time went on, it being made clear that in the case of these trades men must rely on their badges and not on the list. The general tendency of these lists was, after the first general scheme had been settled, to reduce the area of exemption. This reduction was carried out in three ways:—

(1) By removal of industries from the list;
(2) by removal of occupations;
(3) by fixing, and from time to time raising, the age limit below which protection should not be afforded. The age limit was taken in conjunction with the question whether a man was married or single in some of the earlier lists and in the final list with his medical category.

Even the institution of the schedule of protected occupations, and the progressive reduction of the area covered by the lists issued by the Reserved Occupations Committee, did not meet the needs of the situation. By the middle of 1917 it became evident that an effort on the widest possible scale must be put forward to rally the man-power of the nation for the campaign of 1918. The Government set themselves to attempt to remove the difficulties which had been indicated by the successive failures of the Man-Power Board and the first National Service Ministry by setting up a reconstituted Ministry, which (*a*) was responsible both for recruiting and for allocation of civilian labour, and (*b*) had an effective labour priority committee which weighed the claims of the various classes of production, under the general direction of (*c*) the War Priority Committee, a Cabinet committee presided over by Gen. Smuts, which had power to give general instructions as to the parts of the programme to which special attention should be directed.

Second Ministry of National Service.

The new Ministry of National Service came into effective operation at the end of Aug. 1917. It was presented with a very formidable task. The Russian collapse and the likelihood that the campaign of 1918 might be decisive, together with the heavy wastage in the forces during 1917, rendered it vital that there should be a large addition to the forces. On the other hand the man-power resources at home were subjected to the greatest strain, (*a*) to meet the ever-growing and varying munitions programme, (*b*) to meet the urgent claims of food production rendered daily more vital by the increasing menace of the submarine campaign, and (*c*) to maintain normal private industry at the highest point possible in the interest of the nation's credit.

There can be no question that the associating under one minister of recruiting and the supply of civilian man-power profoundly affected and improved the situation. The mere transfer of military recruiting to a civilian organization in itself tended to inspire confidence in the ranks of labour, a confidence which was increased by reason of the fact that the same civilian authority was generally responsible for the supply of labour for all other national purposes. But this confidence in itself did not supply the necessary recruits. It became necessary as 1917 progressed to make new and drastic proposals to meet the demands of the armies. But while these proposals were maturing, steps were taken to provide a new pool of substitutes for men released for military service. The men in the army at home unfit for general service were catalogued in a card index showing their civil trades and the employers for whom they worked before enlistment. These men were available not only for munitions work, but for work of national importance. The needs of the land were met by the provision of part-time labour, by German prisoner labour, by the enrolment under the Board of Agriculture of the Women's Land Army, and by the temporary release for harvest operations of units of the Home Army.

But all these measures of themselves could not solve the central problem of recruiting which was more and more becoming one of a scientific removal of exemptions at a far increased speed. It was becoming obvious all through the autumn of 1917 that it was necessary to get rid of exemptions held on occupational grounds, thus avoiding the long and tedious process of applying to the tribunals for the withdrawal of individual certificates of exemptions. This policy, currently known as the policy of the "clean cut," naturally was regarded with disfavour by labour. But after a long series of conferences it was finally embodied in the Military Service Act of Feb. 1918. This Act was supplemented by a second, passed in April 1918 immediately after the beginning of the German offensive of that year, raising the age limit to 51 and giving powers to cancel certificates of exemption on personal grounds.

Under these two Acts, two Withdrawal Orders—one in April and the other in June—were carried cancelling exemptions in a large number of trades and occupations, including most of those named in the list of certified occupations, though the withdrawals in that case were generally confined to men in medical Grade I. The result of these measures may be summed up in the statement that, from the inception of the reconstituted Ministry to the Armistice, 70,000 men were posted to the colours. At the same time so far as food production is concerned the position may be summarized in the following table [1]:—

	1918 *Quarters*	1916 *Quarters*	Increase over 1916 *Quarters*
Wheat	11,644,000	7,472,000	4,172,000
Barley	7,768,000	6,613,000	1,155,000
Oats	31,196,000	21,334,000	9,862,000
	Tons	*Tons*	*Tons*
Potatoes	9,233,000	5,468,000	3,765,000

Finally the trade of the country had been maintained so that it emerged from the war second only to the United States in point of its financial credit.

(B) THE INCREASE OF LABOUR SUPPLY.—In order to estimate the problem to be faced in reënforcing the ranks of labour depleted by recruitment, it is necessary to set out what was the estimated employed population at July 1914, what was the total enlistment for the forces until July 1918, and what numbers, apart from any extraneous action, would in the ordinary course of nature have flowed in to fill the gap thus created.

There is no absolute statistical basis for the period in question, but a trustworthy estimate can be framed by an examination of the Z8 returns obtained by the Board of Trade, checked by the census of population of 1911, and by considering the Board of Trade "Statistical Abstract of Information regarding the Armies at Home and Abroad" (No. 28–C5–1 Feb. 1917).

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[1] War Cabinet Report for 1918 (Cmd. 325).

The Z8 return (supplied by employers to the Board of Trade) indicates that the employed male population in the occupations covered by the Z8 return, was at July 1914, 10,610,000.

Analysis of Occupations.

The total occupied male population shown in the census of population was approximately 4,060,000. The Board of Trade estimates that, allowing for the normal increase of population, and for emigration, this last number would have increased by July 1914 to 14,350,000, leaving a balance of 3,750,000 occupied persons not included in Z8 occupations. It is further estimated that of these, 2,150,000 were engaged as follows:—

Occupation	*Males Occupied*
Agriculture in Ireland	850,000
Mercantile marine	125,000
Clergymen, physicians, literary and other professional occupations	270,000
Sundry minor commercial occupations . .	240,000
Costermongers, hawkers, and sundry dealers.	130,000
Domestic service (outdoor and indoor) . .	315,000
Gardeners (except market gardeners) covered under agriculture in Great Britain . .	160,000
Other occupations	60,000
Total	2,150,000

An examination of these categories will indicate that enlistment (except in the case of domestic service) would probably be inconsiderable, and it may fairly be estimated at not more than half that in the occupations covered by Z8. The total enlistment for the 10,610,000 covered by that return is 4,896,000. If half the proportion enlisted in these occupations is accepted in respect of the 2,150,000 males occupied in the miscellaneous occupations not covered by Z8, a total of about 450,000 is reached, giving a grand total of 5,346,000.

There remains the further 1,600,000 males necessary to complete the estimated total of 14,350,000 at July 1914. The majority of these would be employers and persons working on their own account, the one-man businesses from which in the nature of the case the proportion of enlistment would be comparatively small, and if 250,000 is added for this class this probably does not err in the low side. A grand total therefore of 5,596,000.

There are, however, still to be taken into account the unoccupied males, of whom there were approximately 200,000 in July 1914, and a considerable number of boys at school in 1914 who enlisted without entering an occupation. The proportion of enlistments here would in the nature of the case be high, and 250,000 would not be an excessive figure.

There is thus reached a total figure of approximately 5,850,000 for the whole of the United Kingdom. This will include reservists and territorials called to the colours at the beginning of the war both for the navy and army, but excludes men already serving with the regular forces.

This total can be checked by reference to the Board of Trade estimate for enlistment shown in the "Statistical Abstract of Information regarding the Armies at Home and Abroad." This shows the number of men enlisted in the armies up to the Armistice to be 4,970,000. To this must be added approximately 500,000 men called up to join the colours from the army reserve, special reserve, and pre-war territorials, giving a total not far short of 5,500,000. Similar figures are not available for the navy, but it is a very reasonable conjecture that the numbers would bring the total near the estimate of 5,850,000.

Provision for Vital Service.

When this enormous total is envisaged, we see the task before those engaged on carrying on the output of munitions and the maintenance of vital services. Clearly if this 5,850,000 had been a net loss the problem would have been practically insoluble. It was not, however, a net loss, as will be shown immediately, but over and above the operation of factors tending to alleviate the difficulty, the principal steps taken, apart from the intensive use of existing labour, were the following:—

(*a*) The diversion of labour from less vital work, a diversion effected as to the greater part not so much by Government action as by the operation of first patriotic impulse and then economic stress.

(*b*) The return of men from the forces for causes other than physical disability.

(*c*) The introduction of new sources of labour, *i.e.* Belgian, Dominion, and finally enemy prisoner labour, on the one hand and the enormous influx of female labour.

If we take the causes entirely independent of Government action, which reduced the total, the two most important elements are (1) men returning from the forces to civil work, and (2) the natural increase of the population. Under the first head it is probable that the total reached was in the neighbourhood of 700,000. The figure, however, includes both men discharged for disability and men returned from munitions. The number in the latter class is dealt with below.

As to the causes of increase not directed by Government action, these may be set out in the following tabular form, which is necessarily based on a comparatively rough estimate for the occupations covered by the Z8 returns:—

Increase consequent upon natural growth of male population	695,000
Net immigration	25,000
Boys entering employment earlier than usual . . .	90,000
Older men who deferred retirement or who returned to work after retirement	200,000
Males on strike or lock-out July 1914	40,000
Males out of work on an average on any one day July 1914	250,000
Men returned to civil work from the forces . . .	700,000
	2,000,000

To these must be added, in respect of the 4,000,000 not covered by Z8, approximately 100,000, making a total of 2,100,000. This figure is in a large measure conjectural, but if it errs, it probably errs (though not considerably) on the small side. As a matter of fact the actual tables based on Z8 returns show a total of 2,366,000. The difference between the two figures may be due to:—

(1) Inclusion among enlistments of a certain number of men who joined the forces more than once.

(2) Inclusion among enlistments of a certain number of men who would normally have had to be replaced owing to death, disablement, etc., and for other causes, *e.g.* in consequence of their having become employers.

(3) Possible slight exaggeration by employers of numbers enlisted.

(4) Possible slight exaggeration of total male employment owing to omission of some firms which were shut down.

The true figure is probably therefore somewhere between the two, but for purposes of estimating the total net loss the higher figure of 2,366,000 is taken.

To get the figure for the net loss on the 10,610,000 covered by the Z8 returns, there must therefore be subtracted from the 4,896,000 who had enlisted as at July 1918 2,366,000. An examination in the next place of the women employed in industry indicates that at July 1914 the number employed was 3,276,000, and that this had risen by July 1918 to 4,935,000, a net increase of 1,659,000 females. Of these additions to the ranks of industry analysis is precarious, but it is probable that not less than 75% were women who had left work or who entered upon it for the first time and that the remaining quarter were drawn largely from domestic service.

Loss to Industry.

If the male and female replacements are added together the net numerical loss to industry is reduced to the comparatively small figure of 871,000. But this does not in the least represent the real loss to industry. In the first place, while the decrease in the number of males employed represented 23·8%, the increase in females was 50·6%. Without attempting to gauge the comparative values to industry of the sexes, these proportions of themselves indicate almost a quarter decrease of skilled or at any rate experienced persons, compensated for by an increase of unskilled or at best inexperienced persons. Moreover, so far as the male replacements are concerned, to a large extent these were not and could not be of the pre-war quality. To begin with, there was the large group of men discharged as physically unfit from the army. In the second place the newcomers were often, indeed for the most part, boys or men well past the prime of life or available for civilian service because of rejection for military service. This last statement is indeed amply borne out by an examination of the ages of males employed in Oct. 1918, which shows that approximately 43 % were boys under 18 or men over 51½—a very high proportion indeed. When to these considerations is added the fact that never in the history of industry had work to be carried at greater speed, at such continuous pressure, and in such circumstances of physical and mental strain, the deficiency to be filled is difficult to estimate in numbers.

To meet this deficiency the one effective method was the regulation of labour so as to spread the skilled men over the widest possible area, to automatize the work to the last degree, and to introduce unskilled labour (by which in the last resort is meant woman labour) into every possible piece of work from which a skilled man could be withdrawn. The history of "dilution" is therefore in practice the history of how the deficiency was as far as practicable met. The other expedients, except the direct release of men from the colours, had a much smaller comparative effect. Such expedients as the use of part-time labour and the control of building licences to prevent the prosecution of private work had no doubt their effects. It is claimed, for example,[1] that 2,400,000 hours of part-time were worked in 1918, and that building licences in respect of work totalling £1,500,000 were dealt with in the same period. But when it is remembered that the average working year during the war was not less than 3,000 hours, this gives us the time of 800 men, and incredibly composite men at that!

The diversion of men from less vital to vital work was a more serious contribution, and still more serious the release of men from the colours. So far as the first is concerned, however, this was achieved rather by patriotic impulse, and economic and military pressure, than by any direct Government action. Various attempts were made from time to time to close down forcibly the luxury trades, notably by the first National Service Ministry. But these efforts were neither successful nor necessary. Greater forces than orders of Government departments were at work remorselessly weeding out the unnecessary business, and either converting it for use in some effective national capacity or distributing its workpeople to national work. For not only did patriotic citizens resent being kept on private as opposed to war work, but the less patriotic, as compulsory service began to draw on, were quick to realize the protection from military service afforded by work of national importance.

On this point it is perhaps sufficient to give the actual figures of additional males absorbed by July 1918 into the principal occupations that may be described as directly involving war work. In three branches of trade only, and these three the most vital to the prosecution of the war, was there a net increase in the number of males employed at July 1918 as against July 1914, as may be seen from the statistics:—

	July 1914	July 1918
Metals (including engineering, etc.)	1,634,000	1,824,000 plus 11·7 %
Chemicals	159,000	162,000 plus 2·1 %
Government establishments (National factories, etc.)	76,000	257,000 plus 237·6 %

In all other occupations there was a net decrease, which bears something like a direct relation to the remoteness of the industry from immediate war work, reaching at its highest in the building trade a net decrease of 52·1 %. Except in the case of actual Government establishments, this huge shifting over must be attributed to causes other than direct Government action, though the machinery which put the changes into operation—the priority lists and the employment exchanges—of course facilitated a natural process which, without these aids, would undoubtedly have taken far longer to complete itself, and might indeed have been, if not directed, self-destructive. In this respect the employment exchanges rendered a service difficult to overestimate (*see* UNEMPLOYMENT).

Release from the Colours.

The second device for increasing the available supply was the release of men from the colours. Of all the tasks set to the civilian authorities in control of labour supply, this perhaps of its nature offered the most obstinate difficulties in administration. Nor is this surprising when it is remembered that the men had to be recovered from an army literally gasping for recruits. It has been stated above that 700,000 men in all were released from the colours for civilian work. The vast majority of these were released on medical grounds. The number of fit soldiers actually recorded in Nov. 1916 as having started work was 51,781. The percentages of these over the trades in which they were employed was shown in Sept. 1917 as follows:—

Shipbuilding and marine engineering	30·1 %
Mines and quarries	1·3 %
Metal smelting, forging, rolling, casting and drawing	23·4 %
Chemicals and explosives	6·5 %
Machinery plant and tools	13·1 %
Arms and ammunition	14·4 %
Aircraft	4·9 %
Transport vehicles	2·7 %
Miscellaneous	3·7 %

The actual number of men recovered is perhaps not a fair criterion of the value of the scheme, as many of them were or described themselves as pivotal men, but on the other hand a considerable proportion were found to have been released under a misconception as to their skill. On the whole, however, it was obviously necessary to attempt something of the kind, and when the difficulties are considered the civilian authorities are entitled to congratulate themselves on a not inconsiderable achievement.

This brings us to the really substantial contribution which was by way of bringing into bearing a completely new body of labour, and this resolves itself largely into "dilution."

Dilution.

The schemes for bringing in Belgian and Dominion labour, like the schemes for part-time labour, were more attractive in appearance than of actual service. So far as the Belgians were concerned, a certain number of skilled men came over in the first rush after the fall of Antwerp. To supplement the ranks of these, an organization, which worked with tireless energy, was set up in Holland to bring men over from that country. But though a good deal was accomplished the results with certain notable exceptions were disappointing. It was found in practice undesirable for various reasons that British and Belgian workmen should work side by side. It followed, therefore, that they could only be employed either in factories solely manned by men of their own nationality, or by firms so large that they could allocate to them a completely separate sphere of work. As a result they came to be employed only by such firms as Vickers, by one or two Belgian firms started in England for the manufacture of munitions, and finally and most successfully at the Birtley national factory. While, therefore, the high hopes originally entertained were not realized, a substantial, if limited, contribution was achieved.

The reënforcement by Dominion labour was less fruitful, and for obvious reasons. In the first place the number of skilled men (and the most acute shortage was always in this class) was not extremely high in the Dominions. But even if the number had been high it was never clear from the point of view of production whether it would not be better to use their services by placing contracts in Canada, Australia, etc. Indeed, it is probably true to say that as the war went on the general tendency was in this direction rather than in the direction of bringing the men over to the United Kingdom. And there were good grounds for this. In the first place, particularly as regards the Australians, there had to be taken into consideration not only the great distances to be covered, but the extreme difficulties with the immense calls on the mercantile marine of providing transport. In the next place, labour conditions as to wages, hours, etc., differed radically as between the Dominions and the mother-country. To introduce into the same shop men working side by side on the same work at different rates of pay necessarily would be productive of difficulties, and experience showed that anticipations on this score were not ill-founded. In spite, however, of all these considerations a certain number of men were brought from Australia, Canada and South Africa, and on the whole the experiment was not unsuccessful. The numbers were small, but the men worked with zeal and loyalty.[1]

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[1] War Cabinet Report for 1918 (Cmd. 325).

Finally, before dilution is described, there must be mentioned the employment of German prisoners. From the outset British labour refused to work side by side with these men, and indeed when their employment in the Medway shipways was mooted, a strike was only averted by dropping the proposal. They were in effect confined to agricultural work, and to certain isolated and uncongenial occupations such as quarrying. From the munitions point of view they may be left out of account.

The negotiations which preceded the introduction of dilution are dealt with below in the consideration of the Treasury Agreement of March 21 1915, and the subsequent events. What is described here is merely the mechanism by which a profound change was brought into industry without which it is certain that the munitions programme could never have been carried out.

Before, however, the actual introduction of women on to work previously performed by men is described, it is necessary to make it clear that this introduction on the mechanical side was only rendered possible by the immense simplification of the processes of production. It was the designers of jigs, the manufacturers of the automatic machines that rendered dilution possible, and the credit of making dilution possible must be laid at their door. And it is incidentally interesting to note, as will be noted more than once in the course of describing the regulation of labour, that war necessity introduced great and often beneficial changes in the whole structure of industry that have every appearance of permanence. In so far as the war preached the lesson of the automatic, a far-reaching change had been introduced, whether beneficial or not will be a matter for the future to decide.

There were two fundamental difficulties in the way of dilution. In the first place the employer resented the complete change of his system of working that dilution involved, and this attitude was only changed as the result of a long process of persuasion in which it is fair to say leading employers played an equal part with the officials whose special duty this persuasion was. In the second place there was the deep-seated objection of the trade unions to the invasion of the jealously preserved sphere of the skilled men by overwhelming numbers of possibly permanent competitors. When it is realized that both parties to the scheme—employers and employed—equally resented it the wonder is not that it took so long to launch but that it had in the end so convincing a triumph.

Central Munitions Supply Committee.

Up to Sept. 1915 practically no progress had been made. On Sept. 9 Mr. Lloyd George made an appeal to the Trades Union Congress at Bristol.[2] It met with some opposition, but undoubtedly had a profound effect on the labour movement as a whole, and the steady advance may fairly be marked from that date. One immediate and practical result of that speech was the establishment of a Central Munitions Labour Supply Committee (which was partly an extension of the National Advisory Committee, referred to below, which had negotiated the Treasury Agreement) with the following objects:—

> "A joint committee representing the National Labour Advisory Committee and the Ministry of Munitions with additional members to advise and assist the Ministry in regard to the transference of skilled labour and the introduction of semi-skilled and unskilled labour for munition work, so as to secure the most productive use of all available labour supplies in the manufacture of munitions."

The committee met for the first time and appointed two sub-committees to consider and report on (1) the fixing of wages in connexion with the introduction of semi-skilled and unskilled labour where only skilled workmen were previously employed and (2) the constitution and functions of local labour advisory boards. The proposals of the second committee, with regard to the duties of each board, were adopted by the Ministry on Oct. 14, as follows:—

(1) Its general function was to act as agent of the National Advisory Committee in the district, reporting to it and negotiating with the local representatives of the trade unions. But the board should in no case take up disputes with employers. That was either a matter for the Ministry of Munitions or for the trade union.

(2) It was the board's duty to see that employers carried out the provisions of Schedule II. of the Munitions of War Act, to report all cases of failure to the labour officer of the National Advisory Committee for action by the Ministry and to record or verify changes of workshop practice.

(3) The board should assist the Ministry in the enrolment and transfer of war munition volunteers. It would receive from the Ministry a statement of the number of men who could be set free from the various workshops, and should take steps to encourage the enrolment of men up to this number at least. The labour supply officer would also report to the board particular cases where sufficient enrolments could not be secured, in order that the board might remedy this if possible through the trade unions.

(4) The board should report to the labour officer or the National Advisory Committee all disputes and difficulties and cases in which men were engaged on private work or insufficiently employed, and should coöperate generally with the labour officers and the local representatives of the trade unions, to secure the most effective use of labour on the production of munitions of war.

Finally it was proposed that each member of the board should receive a fee of 2s. 6d. for attending a minuted meeting (not more often than once a day), travelling expenses (if he had a distance exceeding two m. to travel), and compensation for time necessarily lost from work at the rate of 1s. an hour. Trade union officials in receipt of fixed salaries were not entitled to claim this compensation.

These boards, though their mere existence probably contributed to the smoother working of the scheme, did not have considerable effect as executive agents. Nor is this surprising when it is remembered (*a*) that they consisted of members all of whom had full-time work in other directions, and (*b*) that dilution required for its effective institution the full-time work of specially trained men, whose sole object was the successful achievement of their task.

More important was the consideration by this committee of the all-important letter, known as CE1, addressed to all controlled establishments by Mr. Lloyd George early in Oct. 1915. This letter enjoined in the most precise terms the necessity for the immediate introduction of dilution, and to give point to this injunction the firms were required to fill up a form showing the number of skilled men employed in operating (1) machines of any kind on shell and gun work, (2) capstan lathes and other automatic and semi-automatic machines or other work, or (3) engaged in other processes which might be performed by less skilled labour. The result of this letter was entirely disappointing, the replies indicating that, in all the firms circulated, only 2,124 skilled men were available for transfer. But if it proved nothing else, at any rate the letter proved that the scheme could only be put through by actual personal visits on a large scale.

The next matter to which the committee, with a great measure of success, devoted their attention was the procedure for effecting dilution. The recommendations made by the committee on this head were adopted by the Ministry of Munitions and circulated as circular L6 to controlled establishments. The essence of the circular was to insist on ample consultation of the workpeople and their representatives before introducing dilution—a recommendation which, if more faithfully observed in practice, would have prevented many disputes. It also gave a preliminary list of processes upon which women might suitably be employed. Further it emphasized the desirability of introducing a three-shift system where possible, and of avoiding the employment of women on night-work—again an interesting example of the emergence from war necessity of a practical contribution to permanent social reform.

Dilution Department.

While the committee, in these directions and particularly in respect of wages matters, was rendering service of first-rate importance by preparing labour opinion for the acceptance of dilution, steps were being taken to set up the executive administration machine without which it was clearly impossible to carry out a policy dependent for its success on its detailed application. After numerous experiments the final and successful solution of the problem was the establishment of a strong Dilution Department, manned largely by engineers, with a central and local organization. The work of the Department, which had a large travelling staff, had two objects—the first to convince employers of the possibility of dilution on a scale hitherto unimagined, and the second to see that conviction was followed by practical effect, which meant in innumerable cases prolonged and delicate negotiations with local trade unions. It is not proposed here to discuss the industrial disputes, such as those on the Clyde early in 1916, which were occasioned by opposition to the dilution policy. It is sufficient here to say that, when the intense feeling necessarily engendered in workpeople by a policy which appeared permanently to mortgage their future is appreciated, the comparatively slight nature of these disturbances was a great tribute both to the dilution officers and to the patriotism of the workmen.

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[1] The total number of Dominion workmen came to about 7,000 of which by far the largest number (5,158) were Australians, whose passages, subsistence allowance and unemployment pay were met by the Australian Government. The number of aliens (Belgians, Dutch, Portuguese and Danes) was probably in the neighbourhood of 75,000, of which the large majority were Belgians.

[2] Trades Union Congress Annual Report 1915, pp. 353–362.

If ever it were true that it was the first step that counted, it was true of dilution. It will perhaps therefore be sufficient here if a brief reference is made (*a*) to the admirable work performed by the Clyde dilution commission, which in effect broke the back of the opposition to dilution in the area where it was most actively resisted, and thus gave an admirable start to the campaign; (*b*) to the attempt at a later period to introduce dilution on private work, and (*c*) to the principal characteristics of dilution.

The Clyde dilution commission was appointed on Jan. 22 1916. The Minister of Munitions, on the advice of the trade-union leaders, had visited Glasgow and made a speech on Dec. 25 1915, at St. Andrew's Hall, to a meeting of shop-stewards. The shop-stewards, who represented what was subsequently known as the rank and file movement in labour circles, were embittered opponents of dilution. Though the meeting was stormy, and followed by a strike and the seizing of an advanced labour organ known as *The Forward*, yet it was not without its practical results. The opponents of dilution had been faced on their own ground, and though a noisy section had broken up the meeting, the mere appearance of a minister, prepared to face such opposition, had driven home to good and doubtful citizens alike the vital issue in controversy. Mr. Lloyd George had prepared the way for the Clyde dilution commission, and though the greatest storm was yet to break, it cannot be doubted that his action had rallied not only public but labour opinion to the side of the Government.

The commission started its work immediately at Messrs. Beardmore's, and proceeded at the same time to deal with Messrs. Lang, of Paisley, and Messrs. Weir. This action was almost immediately followed by a strike at Messrs. Lang's, which was settled after an interpretation had been given of a point in dispute in the circular governing dilution. A further trouble arose when at the beginning of Feb. another labour organ, *The Worker*, was suppressed, and various persons connected with it were arrested. A strike followed which ceased when the men, who were subsequently duly convicted and punished, were admitted to bail.

In spite of this beginning the commissioners persisted in their work, and on Feb. 22 a circular letter was addressed to all controlled establishments on the Clyde, with the result that by Feb. 29 the commissioners were able to report that schemes of dilution were in operation at ten establishments, which provided for the release of 740 men and apprentices for more difficult and responsible work and the introduction of 1,333 persons, the bulk of whom were women.

This promising start was interrupted by the strike originating at Beardmore's on March 17, which lasted for a fortnight and led to the deportation under the Defence of the Realm Regulations of the ringleaders. The strike did not, as might have been expected, leave great bitterness behind it, and the commissioners were able to continue their work with such success that at the end of Aug. 1916, after having arranged for the employment of 14,000 women, they were able to hand over their work to the administrative machine which was now actively functioning.

The work of the Clyde dilution commission exhibits on a large scale the work carried out from day to day with always increasing success and facility by the dilution officers of the Ministry of Munitions. How many women they directly introduced cannot be said. It would of course be absurd to claim that the officers were responsible even to an appreciable extent for the influx into industry of 1,659,000 females referred to above. There were in the first place the Government establishments themselves with 223,000 more females than pre-war, and the vast majority of these were introduced without the direct intervention or indeed in many cases without any intervention by the Dilution Department. Then there were some 158,000 females in the Civil Service and some 600,000 females in occupations with which the Department were not concerned. But allowing for all this it is not open to question that in controlled establishments their work was of the highest importance, and that without it the introduction of women could never have approached the figure it ultimately attained. It should be added that the responsibility of dilution for Admiralty establishments was transferred from the Ministry to the Admiralty at the beginning of 1917 when the Admiralty Shipyard Labour Department was established. Thereafter the two departments worked side by side following common principles and closely similar methods. Later when the Ministry of National Service was reconstituted in Aug. 1917 the possibility of transferring the executive work of dilution from these departments to the Ministry of National Service was mooted. But it was ultimately decided that the work could not be better performed elsewhere, and the Ministry of National Service therefore confined itself to requiring an account of the progress of dilution and to developing substitution in areas not covered by the Admiralty and the Ministry of Munitions.

The interest for the present purpose of the attempt to introduce dilution in private work is not in the success that attended the effort. For it had none, and from this source no contribution to the man-power of the nation was made. The importance of the effort is the indication which it gives of the change in the objects of dilution. When the scheme was first canvassed in 1915 it had for its only object the increased output of munitions. It was generally understood, and indeed pledges were given, that no skilled men should be released for the armies in consequence of dilution. But during 1916, and particularly after the first battle of the Somme, dilution came to be regarded at least as much as a means of securing men for the colours as of increasing munitions production. As 1916 drew to a close and the army's need for men was more acute than ever, it was decided to extend dilution, hitherto strictly confined to munitions work, to ordinary commercial work. The result of the attempt, combined with the abolition of the Trade-Card scheme, produced the great engineering strike of 1917, and the proposal was deferred, never to be taken up again. The trade unions were prepared to part with what they regarded as their industrial liberties in the national cause; they were sternly and finally opposed to part with them in what seemed to them the interests of private profit.

Before judgment is passed on the unions for their attitude, it is desirable to have in mind what in fact dilution really meant in practice and how deeply it cut into the cherished safeguards against unemployment and underpayment which years of trade unionism had patiently built up. Dilution involved four things, all interconnected; subdivision of processes, the installation of specialized automatic machinery, the upgrading of existing labour, and the introduction of new labour. Each of these four aspects of the system was bound to modify not only temporarily, but in some degree permanently, the whole organization of industry. It was plain that when employers had once realized the success of mass-production, which was rendered possible by subdivision of processes, and the introduction of the automatic machine, they would be slow to abandon on private work what had proved so eminently successful on war work. It was true of course that with the disappearance of war orders for immense quantities of standardized articles the possibilities of mass-production would be seriously curtailed. But the employers had learned a lesson, and the unions realized that when the war was over it would not be forgotten.

Moreover, the subdivision of processes combined with upgrading tended to blur, if not to obliterate, the sharp line drawn between skilled men and all other workers. To appreciate the feelings of trade unions on this change it would help to consider what would have been the feelings of the medical profession if the Government had insisted that they should admit herbalists to their ranks.

Finally, the introduction of huge numbers of possible competitors was in itself a grave consideration, particularly in the engineering trades which were no strangers to a high rate of unemployment. Indeed the engineering trade was one of the six trades compulsorily insured under the Insurance Act 1911 against unemployment, as being specially affected by periods when work was not plentiful.

If, therefore, in spite of the natural reluctance of the trade unions and of the employers to accept dilution, and in spite of the great technical difficulties of its introduction in practice so great a measure of success was attained, the result is a high tribute not only to the dilution officers but to the employers and workpeople.

Finally, before leaving the measures adopted to reënforce the labour supply it is necessary to refer briefly to the training of munition workers. We need not explore the long history of negotiations with trade unions and education authorities which preceded the launching of the scheme of July 1915. It will, however, be some indication of the success which attended the scheme if it is stated that up to Aug. 31 1916 about 22,500 students received certificates of proficiency from the technical schools, of whom not less than 18,000 were placed. Moreover, at that date a great step forward was taken by the establishment of the first instructional factory. Messrs. Straker Squire's establishment at Twickenham was taken over and the foundations were laid for a scheme which not merely proved of immense service during the war but which was developed on an even greater scale after the war for the training of disabled ex-service men. By the end of the war about 50,000 persons had graduated through training establishments. Here once again war necessity had pointed the way to what may well develop into a permanent addition to the industrial resources of Great Britain.

(C) THE INTENSIVE USE OF LABOUR.—It is a mistake to suppose that working-men, as a general rule, any more than any other class of the community, are prepared to adopt a roving life. There are certain occupations such as those of the navvy, and in less degree of the builder, in which regular movement is an essential incident. But generally, although the working classes probably tend to migrate more easily than other classes, they share the general preference for a fixed home and unchanging environment. But from the beginning of the war it was plain that mobility would have to be largely stimulated. It was, as Mr. Lloyd George said at Manchester in 1915, "an engineers' war," and it was plain that one or both of two courses must be adopted—either men must be brought to the engineering centres or engineering must be spread over areas where it had not previously been carried out, or both expedients must be adopted. The approach to this problem indeed passed through at least three stages—the first in which the man was brought to the work, the second where the work was brought to the man and the third a combination of the other two.

(1) *Increase of Mobility.*—The first step of all was when, at the beginning of Aug. 1914 labour was supplied to Aldershot to get the Expeditionary Force off to France, and men were moved in large numbers from the northern shipbuilding yards to the naval dockyards. Valuable and indeed vital as this service was in itself, it did not really form part of the general plans for increasing mobility. Many, indeed a majority, of the men engaged on getting the Expeditionary Force off returned after a short period to their old work; and this, though in much less degree, was also true of some of the men moved to the dockyards.

The origins of a more general effort were found in the King's Squad, organized in July 1915 by the Newcastle armaments committee, and the war squad organized by the Glasgow committee. But it is necessary in the first place to give some explanation of the events that led up to the formation of these committees.

Armament Committees.

When about the beginning of 1915 public attention was riveted on the shell shortage, the general view held by the authorities was that the only way to increase production was to place further orders with the very limited number of Government establishments and private firms that had experience in the manufacture of munitions. All these establishments had declared emphatically that they could not possibly increase production unless (*a*) they could have a largely increased labour supply, and (*b*) trade union restrictions could be removed. The solution of the second demand was afforded by the Treasury agreement and the subsequent Munitions Acts. But the first demand in itself helped to create a position which converted the authorities to the belief that work must be spread to where the men were, rather than impose on the already breaking resources of the great armament firms a burden which was *ex hypothesi* beyond them.

As early as the end of 1914 the Board of Trade had challenged the policy of concentrating labour on the armament firms. They had suggested the possibility of group arrangements in districts with engineering experience where by a reasonable subdivision of work among the various firms the whole article required by the War Office could be provided. The War Office, however, did not accept this view, and in accordance with their wishes the Board of Trade made an intensive effort to discover new sources of labour and to divert to the armament firms large bodies of workpeople from other engineering works. The first part of the campaign has been already mentioned. The result of the second part was, as the Board of Trade anticipated, a failure. Employers were not prepared to release their men, when most of them felt confident that if contracts could be placed with them they could carry out the work far more expeditiously than if the same contracts were undertaken with men new to them by the already overburdened armament firms. As a matter of fact, at the end of Jan. the total number released by employers on commercial work for armament firms had reached a total of 942. The value of this figure will be realized when it is remembered that at this period one armament firm alone (Messrs. Armstrong's) were asking for 4,150 men.

It was plain that matters could not be left at that point. The Board of Trade proposed a survey of the engineering trade in order to discover what its capacity for armament production was. This plan was not adopted, but later a Home Office census of machinery following much the same lines was put in hand and produced excellent results. The Board of Trade were, however, authorized by the War Office to exhibit samples of shells, etc., at various engineering centres with a view to obtaining possible offers from local manufacturers.

In the meantime, following on a successful experiment on organizing a saddlery group in 1914 by the Board of Trade, the first coöperative group of manufacturers was formed in Jan. at Leicester. This group was formed under the auspices of the Board of Trade on Jan. 8, and the first order for 1,000 4·5 shells per week was placed with it by the War Office on March 30.

At this point the armament outputs committee of the War Office, under the chairmanship of Mr. G. M. Booth, and a little later the Treasury munitions committee, under the chairmanship of Mr. Lloyd George, come upon the scene. Mr. Booth and his committee from the outset took the view that both of the contending policies must be worked side by side—that is to say, that within the areas of the big armament firms men should be brought to the firms, while in other engineering areas the work should be brought to the men by distribution of contracts.

These principles were endorsed by the Treasury munitions committee, but they took the matter one step further by ordering the construction of national factories, a proposal first put to them in a memorandum presented by Sir P. Girouard.

Spreading of Contracts.

Thus by April and May 1915 the principles, though destined to every form of subsequent modification of detail, had been established which moulded the whole supply of labour for munitions throughout the war. In short the vital decision had been reached that the whole engineering capacity of the nation should be used. In the first place the great firms with years of experience should be strengthened to the greatest extent possible, but this strengthening was not to be at the expense of encouraging the wide distribution of contracts to all firms or groups of firms capable of munitions manufacture; and in the second place national factories were to be set up under direct State management to supplement production from the other two sources. These general decisions depended for their successful carrying out in practice upon the supply of labour required being forthcoming. While it had been decided that movement of labour should be limited by spreading contracts, it was still obvious that before the work and the workman could be successfully brought together there would have to be considerable adjustments. The Board of Trade had through their employment exchanges already stimulated movement to a great extent, but the time had now come for a further step forward. As part of Mr. Booth's scheme for concentrating labour in armament firms in districts where these firms existed, two committees were established in Newcastle and Glasgow, known respectively as the N.E. Coast and the West of Scotland Armaments Committees.

Of these two committees, that of the N.E. Coast was the earlier and perhaps the more successful. It addressed itself immediately to the question of the transfer of labour from commercial to munitions work. With this end in view it took two steps: the first, which followed the precedent adopted by the Board of Trade, was to appeal to employers to release men; the second, destined to form the germ of the war munitions volunteer scheme, was to appeal to workmen to enlist voluntarily for munitions work. The first, even with local influence, was a failure, producing a negligible number of men for transfer, but the second was a striking success. By the middle of May under the first head 290 men had been transferred, by the end of June under the second 1,080. At Glasgow a similar appeal for volunteers produced 434 transfers. But not only did these committees by the method of direct appeal lay the foundations of the war munitions volunteer scheme, but they went further and settled two vital points as to the basis of their employment. These points arose on the question of who was to be responsible for travelling and subsistence allowances of men transferred. It was finally decided, with the approval of the Treasury munitions committee, that both these charges should be borne by the Government, and the financial basis of the war munitions volunteer scheme was thus established.

Ministry of Munitions.

But matters had now reached a point where local effort, guided only by a small expert committee, could no longer control the situation. A strong movement was on foot for the supersession of the committee by a strong central department. The first step in this direction was taken when, on the advice of the Treasury munitions committee, Sir P. Girouard and Mr. Booth were appointed by Lord Kitchener to carry out the general scheme for the increase of the output of munitions proposed by Sir P. Girouard. This was on May 9, and Mr. Booth and Sir P. Girouard set themselves actively to work to create a department. But events were moving with such swiftness that by May 26 the Prime Minister announced that a new department for the manufacture of munitions was to be established, and on that day Mr. Lloyd George took over this department at Whitehall Gardens.

The first steps taken by Mr. Lloyd George were to take over the organization of Sir P. Girouard and Mr. Booth to form the basis of the great supply departments of the Ministry of Munitions that were almost miraculously to alter the munitions position, and on the other hand to bring in Sir H. Llewellyn Smith, then permanent secretary of the Board of Trade, as general secretary of the Ministry with special charge of labour matters, thus laying the foundations of the two great departments of the Ministry that were ultimately to be known as the Labour Supply and Labour Regulation Departments.

War Munition Volunteers.

It was upon the labour side of the new Department that the duty devolved of working out the schemes for transfer of labour initiated at Newcastle and Glasgow. Nor was much time lost in setting about this task. On June 8 1915 Mr. Lloyd George met the National Advisory Committee and represented the gravity of the national situation, particularly from the point of view of munitions production. The National Advisory Committee devoted the next day to the consideration of a scheme which might help by increasing mobility to remedy the shortage of labour. They proposed in effect the extension to the country as a whole of the schemes adopted at Newcastle and Glasgow. Only skilled workmen in employment, but not engaged on Government work, should be enrolled. The volunteers should be transferred only to firms controlled by Government whose profits were restricted. They should on transfer be entitled to the same subsistence and travelling allowances as were authorized in respect of the earlier schemes. Mr. Lloyd George accepted the scheme in principle at conferences with the trade unions on June 10 and 16, and the war munition volunteer scheme was born. The conditions of the form of enrolment are worth giving *in extenso*.

> " In accordance with arrangements which have been made with the Minister of Munitions by the National Advisory Committee, acting on behalf of the Trade Unions, I undertake with the Minister of Munitions to accept employment on making munitions of war in such controlled establishments as may be named by him, and to remain in such employment during the war for so long as required (not exceeding six months in all) subject to the conditions set out.
>
> " 1. The rate of wages paid will be that of the district to which the workman is transferred, provided that if in any case the workman proves that this is less than the rate he was receiving before enrolment, he shall be entitled to receive such higher rate.
>
> " 2. The workman will receive over and above his wages the following allowances:—
>
> " (*a*) If brought from a distance beyond that which he can reasonably travel daily, railway fare at the commencement and completion of the work for which transferred; and, where necessary, subsistence allowance at the rate of 2s. 6d. per day for seven days per week. It is clearly understood that the subsistence allowance is not intended to enable any workman to make a pecuniary profit.
>
> " (*b*) If within daily travelling distance (exceeding half an hour each way) the value of workman's tickets and one hour's travelling time per day at the rate of time and a half.
>
> " (*c*) If within daily travelling distance (not exceeding half an hour) the cost of workman's tickets.
>
> " Subsistence and travelling allowances will be paid by the firm employing the workman, with the wages.
>
> " 3. The workman may volunteer for a further period of employment after the completion of the period for which he is required in the first instance.
>
> " 4. Any workman transferred from employment under this undertaking shall, if found suitable, be guaranteed employment during the war for a period not exceeding six months.
>
> " I agree that any breach of this undertaking may be dealt with by a munitions court, consisting of a chairman appointed by the Minister of Munitions, with assessors equally representing employers and workmen, which may impose a fine not exceeding £3."

It may be noted that throughout the discussions at this stage Mr. Lloyd George accepted the war munition volunteer scheme as the alternative to industrial compulsion.

The scheme was accepted in principle on June 20. On June 24 enrolment began under the auspices of the Labour Department of the Ministry of Munitions. A vast campaign of publicity was started, and munition work bureaux were initiated with almost startling rapidity at 200 town halls and 200 labour exchanges. The intensive period of enrolment was closed on July 10, though enrolment continued after that date at the labour exchanges. The final results of the enrolments were as follows:—

Platers, riveters, drillers and shipwrights	23,564
Tool-makers, toolroom workers and gauge-makers	1,834
Tool-setters	193
Millwrights	1,727
Turners	7,971
Fitters	24,830
Capstan and turret-lathe operators	830
Skilled metal machinists	6,710
Other metal machinists	1,884
Workers in brass and other metals	4,667
Lead-burners	256
Coppersmiths	395
Miscellaneous unanalysed	27,166
	102,027

These were promising figures, but the result was to show that the first expectations were not to be realized.

In the first place it was obviously necessary that the employers, on whose work the volunteers were engaged, should have an opportunity of expressing their views on the transfer. Accordingly arrangements were made for a regular system by which employers should be given an opportunity of lodging a protest, and an expert panel of adjudicators on these protests was set up. When it is realized that protests in respect of no less than 60,000 volunteers were lodged, the sort of task set the adjudicators may be imagined. Nor was the volume of the protests the only difficulty. To decide on a protest involved an inspection of the firm to ascertain its direct or indirect contracts with the War Office (a constantly varying factor); to see the order books, and if necessary verify the work by inspection of the shops; to report on the nature of the work done by the volunteers; to find out what numbers of men of the same grade as the volunteers were employed by the firm, and if on short time or overtime; to discover what the effect of removal of volunteers would be on private work and on the continuance of the establishment.

Inquiries such as these made the progress of adjudication slow. Moreover, many men had volunteered who were not really skilled, and many more who were, without knowing it, engaged on munitions contracts, or who, knowing this, desired a change of firm. The result of the scheme at the end of Sept. was reported as follows:—out of 103,000 volunteers, 37,551 had been submitted to employers, of whom 28,551 had been rejected and 8,581 had been accepted. Of those accepted, only 4,529 had started work, including 721 placed by the Clyde and N.E. Coast Committees.

These results were at first sight extremely disappointing. The reasons for the comparative failure have already been indicated—*i.e.* employers' protests, the number of unskilled men volunteering, and the fact that many volunteers were engaged on munitions work. But there was another cause which had a very profound effect. The volunteer was entitled on transfer, in accordance with the Government undertaking, to the rate which he was receiving before transfer. Not only, especially in the case of piece-work earners, did this lead to grave administrative difficulties, but (what was more important) it excited the apprehensions of the employer, who viewed with dismay the prospect of the introduction into his works of men receiving different rates of pay from those enjoyed by his own workpeople. But all this does not show that the scheme, if disappointing, was a failure; 100,000 men scattered all over the country had been enrolled. Very few, it is true, had been moved, but all, if the Government so decided, could be moved, for Sect. 6 (2) of the Munitions of War Act, 1915 made it an offence for an employer to attempt to dissuade a volunteer from moving. Unless, therefore, an employer in the early stages of the war radically reduced his private work, and in the later stages pressed dilution to its fullest extent, he was liable at any time to lose some of his best workers. In this indirect way the scheme had a far-reaching effect.

During the latter part of Sept. 1915 efforts were made to improve its working by a change in the method of administration. Under the scheme as originally launched the work had been done from London. An attempt was made in Nov. to carry out the work through the employment exchanges. The lists of men available for transfer (amounting to 10,000) were forwarded to the appropriate exchanges, who were given elaborate and precise instructions as to procedure. But the new system had no better results than the old. In Nov. and Dec. 1915 only 753 were placed, although, in addition to the 10,000 men whose names had been sent from the Ministry, 6,515 more men had enrolled.

At this point the problem was complicated by reason of the fact that undertakings were running out and that reënrolment was becoming necessary. Invitations to reënrol were issued, and the response indicated that there was much dissatisfaction among the volunteers. None the less, enrolments proceeded speedily at the rate of about 2,250 a month. At the same time placings went on steadily, rising from 237 in Jan. 1916 to 337 in May, with the result that in June 1916 12,234 war munition volunteers had been placed in employment.

Criticisms of the Scheme.

Again, one is face to face with the criticism that the scheme failed, and again it is necessary to point out that the failure was only partial. If numbers alone are examined it may be urged that the result was trifling, but numbers alone are by no means the final criterion. These men in effect constituted a mobile corps who could be thrown in at the point of greatest pressure at the most critical moments. They were a sort of Guards Brigade, who could be hurried to the weak spot when most needed. For example, in the autumn of 1916 more than a quarter of the skilled men employed at Dudley, Lancaster, Leeds, Renfrew and Templeborough were munitions workers. And again and again in the later years of the war, when every month, almost every week, involved sudden changes in the munitions programme, the availability of these men was of the highest possible service. It happened more than once, notably when the poison-gas factories formed almost a turning-point in the munitions programme, that the fitters, without whom the factories could not operate, were supplied from volunteers.

The work proceeded steadily, with the result that by Nov. 1918 212,000 war munitions volunteers had been enrolled and 81,180 transferred. This of course shows a notable improvement in 1917 and 1918. One of the reasons for the improvement, no doubt, was, for example, that enrolment was one of the conditions of the Trade-card Agreement.

As recruiting became increasingly intensive it was made clear that not only must a man, to obtain exemption, be shifted, but he must in addition be on indispensable work. By enrolling as a war munitions volunteer a skilled man automatically fulfilled the latter condition. Quite apart, therefore, from the patriotic impulse which moved men to seek work of national importance, enrolment, as affording a protection in itself, became increasingly attractive. It may, therefore, be fairly said that on the whole, over the period from its inception to the Armistice, the war munitions volunteer scheme both directly and indirectly was of vital national service.

Closely allied to, and indeed at the time indistinguishable from, the war munitions volunteer scheme was the scheme of the other mobile corps, incorporated in 1916 by the Ministry of Munitions, of the army reserve munitions workers, under which, by the end of the war, 58,200 men had been placed in employment. Under this scheme men were drafted into the army, but not detailed for service on placing themselves at the disposal of the authorities for use where they were required. The difference between them and the war munitions volunteers was more technical than actual, though in their case they were always liable to be called to the colours for general service.

Before leaving the war munitions volunteer scheme, brief reference should be made to the other pools of mobile labour which it was sought to form later in the war on the precedent of the war munitions volunteers. There were three schemes inaugurated under the first auspices of the old Ministry of National Service, the second and third under the reconstituted Ministry. The first was known as the National Service volunteer scheme. Under this scheme the surprising total of 400,000 volunteers were enrolled. As, however, invitations to enroll were issued to persons with little regard to their experience and ability, and to the work upon which they were engaged, it is not to be wondered at if the scheme produced no results. Indeed, by the time that this scheme was launched early in 1917, it is not an exaggeration to say that the field of labour available for vital national service had been searched not with a rake but with a fine-tooth comb. The only hope for any effective addition to the labour supply was by a carefully selected list of occupations adapted to persons of little experience in manual labour and of small or reduced physical powers. The second scheme of war work volunteers, initiated by the reconstituted Ministry of National Service, was on a smaller basis, and under this 32,700 persons were enrolled and placed on work of national importance, thus releasing younger men for the army.

There was finally the much more modest, though by no means ineffective, scheme of war agricultural volunteers, under which 3,255 persons were placed in agriculture. In addition to this, 17,000 women were enrolled in the Women's Land Army, and 1,816 in the Scottish Women's Land Army.

(2) *Preventing Wastage.*—When the supply of labour was far below the demand, it was of the greatest importance that the fullest possible use should be made of it. There were two vital points in this respect—the first to *get* it where it was wanted, the second to *keep* it there. The war munitions volunteer and allied schemes were the means adopted to achieve the first purpose. The Defence of the Realm Acts and the Munitions of War Acts were used for the second purpose.

The question which presented itself to the Government early in 1915 was:—What check could be put on the freedom of the workman, on the one hand, to go to work not profitable in the national interest, and upon the freedom of the employer to attract him there? There were four courses open. The first was to close down commercial work so that the employer would be compelled to release his workmen for work of national importance. The second was to impose penalties on employers engaged on commercial work for attracting labour from munitions work. The third was to apply the penalty for moving to the workmen. The fourth, which was the simplest, and which was shown to be repugnant to the British character, was universal compulsion whether for war-work or fighting.

Competition for Labour.

Whichever remedy was to be adopted, the fact that some remedy must be found grew plainer every day. Not only was it clear that a great volume of labour urgently needed for munitions work was still retained for commercial production, but what added to the difficulty was the bidding among contractors engaged on munitions work for one another's labour. Not only were rates of wages undergoing the most surprising variations, but every kind of device to add to workmen's earnings was adopted. Excessive overtime at double rates was freely advertised, immemorial practice as to travelling allowances was overturned, systems of piece rates designed to produce the highest rather than the lowest earnings were devised, and indeed in the shipyards there were allegations that a number of rivets were added to a workman's total to swell his takings. Nor was the competition confined to private employers. The Government factories were bidding not only against private employers but against one another. The result was naturally, by making workmen restless, to reduce production all around.

All the four expedients mentioned above were canvassed by the Government. The fourth,—universal conscription,—by reason of its simplicity and its boldness, was the most attractive. Scheme after scheme to enforce it was considered only to be rejected when the result on labour opinion was weighed, but as late as June 3 1915, in a speech at Manchester, Mr. Lloyd George was suggesting the advantages of this way out. And the war munitions volunteer scheme, like the Derby scheme that followed it, was introduced as the final alternative to industrial conscription. But unlike the Derby scheme, when it failed to realize expectations it was not converted into a compulsory scheme. The country was, as events showed, prepared to be conscripted for fighting. It was not prepared to be conscripted for working, when the work was still in a large measure to yield private profit.

Industrial conscription as a means of preventing wastage was, therefore, never adopted. The three other methods were all attempted—the first with no result; the second two, as will be shown, with very considerable results. In March 1915, a bill was introduced and passed through both Houses of Parliament in two days, amending Section 1 (3) of the Defence of the Realm Consolidation Act 1914, which empowered the Admiralty or the Army Council

> " (*a*) to require that there shall be placed at their disposal the whole or any part of the output of any factory or workshop in which arms, ammunition, or warlike stores or equipment, or any articles required for the production thereof, are manufactured;
>
> " (*b*) to take possession of and use for the purpose of his Majesty's naval or military service any such factory or workshop or any plant thereof."

This was amended to enable the Admiralty or Army Council to take over private factories and shipyards and to require them to be worked as directed, and "*to regulate or restrict the carrying of work in any factory or workshop.*" The object of these words was not plain on the face of them, but their intention was to enable the Admiralty or Army Council, by giving directions which would in effect close down a factory or workshop, to cause the labour to be diverted to war work. This intention was made plain when this provision was reënacted by Section 10 of the Munitions of War Act 1915, with the addition of words directly referring to the engagement or employment of any workman or classes of workmen.

Like many other war enactments this power proved useful, but not for the purpose for which it was intended. The wholesale closing of factories in order to release labour was seen almost at once to bear too much similarity to the Chinaman's method of roasting pig. It would not only gravely dislocate trade, but it would necessarily throw out of work, not only the skilled men who would be readily reabsorbed, but a large army of unskilled men for whom work was not at the time available. Moreover, the new theory of sending work to the workman rather than the workman to the work was beginning to gain ground. And the provision, though reënacted, from this point of view fell into desuetude. But from the point of view of a weapon often flourished, and on very rare occasions used, it remained a potent weapon till the end of the war for coercing refractory employers.

The second method was attempted in the following month. On April 29 a regulation was made under the Defence of the Realm Regulations (amended later to extend its scope) imposing a penalty on manufacturers of munitions for (*a*) attracting men away from munitions work, and (*b*) for engaging any workman resident more than 10 m. from the factory in question except through a labour exchange. And as supplementary to this, the Board of Trade made a regulation under the Labour Exchange Act requiring employment-exchange officials to give priority to vacancies on war work. These regulations, except possibly in a deterrent sense, were hardly more effective than had been the effort on the first plan. So far as the first offence was concerned, evasion was fatally difficult to detect; indeed there was throughout the war no instance even of a prosecution on this head. Moreover, there was one perfectly simple method of evading the spirit of the regulation without infringing the letter. All that was necessary was for a firm to raise wages above the level of its competitors, and leave the news to percolate, as it invariably did.

So far as the second part of the regulation is concerned, there can be little doubt that it did contribute substantially to the centralization of labour supply, but here again the means of evasion were easily discovered. Where men from a distance were required, if it could be arranged that they should shift their residence of their own accord to within 10 m. of the factory, they could be, and constantly were, taken in at the gates.

Leaving Certificates.

The solution was found under the third scheme. It had long been clear that the effective method was to restrict the workman's liberty of movement rather than the employer's right to engage, while at the same time taking action to limit the employer's freedom to fix any rates of wages which he might choose. The delay in resorting to this method was due to the great reluctance which was felt in introducing any measure which could readily be represented as, if not industrial conscription, at least as, in a way, a system of indentured labour. Both steps were taken by the first Munitions of War Act, 1915. Section 4 (2) of that Act required the employer to seek the sanction of the Minister before varying rates of wages. Section 7 required a workman on munitions work to stay with his employer unless in possession of a "leaving certificate." The actual form of the prohibition was to impose a penalty on an employer who, within six weeks from a man's leaving his previous employment on munitions work, took him on without a leaving certificate. In order to provide against a misuse of the power given to the employer by this section an appeal was allowed to a workman to a special domestic court constituted by the Munitions of War Act, known as the munitions tribunal.

The measure of the efficacy of this step is illustrated in part by the fact that, with the sections controlling profits and forbidding strikes and lockouts, it was regarded by employers and workmen alike as the central provision of the new Act, and partly by the extraordinary results which followed its total repeal by the Munitions of War Act, 1917. From the day that Section 7 came into force an employer could be sure of his quota of labour, and the workman, realizing that his freedom of movement was no longer unlimited, settled down with more regularity to his work. But along with its obvious advantages this new instrument of labour regulation possessed certain obvious defects. The employer was given remarkable powers. While the workman could not leave without a certificate, the employer could dismiss without one. When with the heavy preoccupations that the war cast on employers, dismissals and engagements were often left in the hands of foremen, it will be seen how provocative of difficulty the section might be. On the one hand, from the national point of view, a workman might be out of work for six weeks when his services were urgently needed. From the workman's point of view the difficulty was more acute, since an unjustifiable dismissal without a certificate might lead to his recruitment. These were the main sources of grievance, and the complaints were bitter. The commission, consisting of Lord Balfour of Burleigh, and Mr. (afterwards Sir) Lynden Macassey, who investigated the unrest on the Clyde at the end of 1915, reported that the operation of Section 7 was in many cases harsh, and was generally one of the principal causes of labour uneasiness. They did not recommend a repeal of the provision, but were strongly in favour of amendments to make its operation less harsh. The Ministry of Munitions had concurrently arrived at the same conclusions as those submitted by this commission, and in the amending Act of 1916 effect was given to them. The three most important amendments in that Act were those requiring an employer to give a certificate in all cases of dismissal, except those of misconduct, giving the workpeople the right to demand a certificate if suspended for more than two days, and to require a week's notice or wages in lieu.

Even these amendments did not remove the growing tide of resentment against what was freely described in labour circles as the "slavery" section. The truth was that this was a measure which definitely affected the individual in his daily work, and its operation was always present to his mind. The measure was endurable in the earlier years of the war, but with the growing strain it began to have serious effects on the *moral* of the workpeople. After the May strike of 1917, commissions of inquiry, under the general chairmanship of Mr. G. N. Barnes, M.P., were set up into the causes of labour unrest. All the commissions (which reported territorially) agreed in finding that Section 7 was a potent source of trouble.

Economic Check on Wages Removed.

Repeal was, accordingly, decided upon, and the section disappeared with the Munitions of War Act, 1917. The result, though not what was expected, was profound. Employers had prognosticated a wholesale shifting of labour from factory to factory. This expectation was not fulfilled, but it only failed of fulfilment by reason of the action of the employers themselves in raising wages often to extravagant heights to retain workpeople. The plain fact was that with a huge shortage of labour there was no longer any economic check on wages. The provisions of Section 4 (2) of the Munitions of War Act, 1915, had in this regard been futile, and the real check had been Section 7. Its disappearance restored his bargaining power to the workman with formidable results in the variation of wages.

No subsequent action could hope to arrest the forces let loose by the abolition of the section. But as the difficulties of the position became increasingly apparent, an effort was made to meet the difficulty in 1918 by the introduction of a system of licensing of firms, known popularly as the "embargo" scheme. Under this scheme it was proposed to take advantage of the Defence of the Realm regulation already referred to, which enabled the Government to direct the methods of employment or engagement in a factory. Firms were instructed that after the receipt of the effective letter no further labour of the types scheduled was to be engaged without the licence of the Ministry of Munitions. In fact, though more than 32,000 firms were known to be engaged on munitions, by Sept. 1918 letters had been issued to only 100 firms. But the proposal was bitterly resented as an attempt to reintroduce Section 7 under a new form. It led on July 23 to a strike at Coventry which seriously threatened the production of munitions. A committee under Mr. Justice McCardie, which was set up to inquire into the circumstances of the strike, reported that the Government's scheme was justified by circumstances, though possibly the method of its introduction might have been more tactful. But the strike struck at the whole basis of the scheme, with the result that it had little effect. The only substantial contribution to the problem of the prevention of wastage had been Section 7. Nothing before or after it took its place.

(3) *Removal of Trade-Union Restrictions.*—The history of the actual introduction of "dilution"—which, of course, represented by far the most important removal of trade-union restrictions—has already been given. It is only necessary here to give an account of the negotiations which led up to the Treasury agreement of March 21 1915 (later scheduled to the Munitions of War Act, 1915) with some indications of its value.

Already by the end of 1914, both in shipyards and engineering shops, an acute shortage of labour had manifested itself. One of the methods of remedying this shortage generally recommended by employers was the removal of trade-union practices and restrictions. These practices were of four main types:—

(*a*) The practice providing that only a skilled man with certain credentials might do certain classes of work;

(*b*) the practice which distinguished sharply the allocation of skilled work as between various classes of skilled men;

(*c*) the practice which defined the hours and output permissible in given classes of work;

(*d*) the practice requiring the employment only of trade unionists in certain shops or in certain classes of work.

There were, and are, of course many variations and gradations of four main types, but these are probably predominant. There was a long and painful history behind these restrictions. They represented to the workman the entrenchments patiently established through long years of struggle against under-payment and unemployment. They were, in fact, labour's *Magna Carta*. War necessity demanded from labour its temporary repeal.

Trade-Union Practices.

The first attempts to secure this end were made by the employers—both by ship-builders and engineers. The ship-builders had their first meeting as early as Nov. 3 1914 at York. The employers there proposed for the first time the suspension of trade-union practices and customs. The meeting had no result. Local meetings at Glasgow and Newcastle were equally fruitless, and another general meeting on Dec. 9 carried the matter no further. Later in Dec. the Admiralty intervened but without success, and the matter was reported to the Board of Trade at the end of the year almost at the same time as the equally fruitless result of the series of engineering conferences.

The three main difficulties felt by the trade unions were:—

(*a*) The danger even in war-time of sacrificing the results of years of struggle without the most stringent guarantees that the sacrifice should be purely temporary;

(*b*) the necessity of confining the sacrifice wholly to war-work;

(*c*) the importance, even so far as war-work was concerned, of securing that private employers should not reap financial advantage from the sacrifice.

The subsequent negotiations, under the aegis first of the Board of Trade, and later of the Chancellor of the Exchequer and the President of the Board of Trade, were directed to meet these three points. As a first step letters were addressed to the A.S.E. by the War Office and the Admiralty, pointing out in general terms the need for increased labour supply. This was followed on Jan. 13 by a general conference between the Engineering Employers' Federation and the A.S.E. and kindred unions at Sheffield. This conference, like all its predecessors, was a failure.

Committee on Production.

After this breakdown Sir George (afterwards Lord) Askwith was appointed by the Board of Trade to attempt to reach a settlement. At his suggestion his single-handed efforts were supplemented by the appointment by the Prime Minister on Feb. 12 of the Committee on Production, consisting of Sir G. Askwith (chairman), Sir George Gibb, representing the War Office, and Sir Francis Hopwood (afterwards Lord Southborough), representing the Admiralty. The committee directed their attention in the first instance to the shipbuilding trade, and succeeded in making an agreement on the subject of broken time, which unhappily broke down on May 23.

On the greater issue, though it was ultimately necessary to bring in the Cabinet, the committee were at any rate successful in effectively preparing the ground for a settlement. In their interim report of Feb. 20 they made three principal recommendations:—

(*a*) Increased production by removal of restrictions on the manufacture of shells and fuzes with extension of the employment of female labour;

(*b*) the prevention of stoppages of work by reference of differences to an impartial tribunal to be set up by the Government;

(*c*) guarantees to be given by contracting firms and held by Government in respect of removal of restrictions.

Simultaneously, on March 5, the Engineering Employers' Federation, with the A.S.E. and kindred unions, had ultimately reached a limited agreement in a memorandum known as the Shells and Fuzes Agreement. This made the following provisions:—

(i.) It assigned certain processes definitely to skilled men, but allowed interchange of skilled men;

(ii.) it permitted the introduction of semi-skilled or female labour in suitable cases, subject to no reduction of wages;

(iii.) it insisted on restitution of pre-war practices.

A ballot taken on this among the members of the constituent unions in April was favourable, but even before the result was known the agreement had marked a long step forward on the road to the Treasury agreement. In the meantime the committee on production were negotiating further with the unions, and in their third interim report recommended immediate removal of demarcation restrictions in Government establishments, and removal in private establishments subject to safeguards akin to those provided in the Shells and Fuzes Agreement.

But in spite of the Shells and Fuzes Agreement, and the efforts of the committee on production, nothing really effective had been accomplished. Men and employers alike were waiting upon the Government. In March 1915 the Government acted. Up to this point two of the principal difficulties of the trade unions in respect to removal of restrictions had been faced—*i.e.* the limitation of removal to war-work, and guarantees for restitution—but the aspect of the financial position of the private employer remained to be considered. And its consideration was vital, because the workmen were little disposed to give either their lives or their privileges in the cause of increased private profits. The committee on production were fully alive to the need not only for a dramatic gesture in this matter, but for dramatic results following upon the gesture. They recommended accordingly in their fourth report (March 5) that the Government should assume direct control of shipbuilding and armament firms, and should use this direct control radically to restrict profits. These proposals were explored, and throughout March the Board of Trade were conferring with the principal armament firms with the object, not so much of controlling their methods of manufacture, as of controlling their profits. These negotiations did not do more than place the Government in the position of announcing to the A.S.E. in the course of the negotiations for the second Treasury agreement (and embodying the announcement in the agreement) that profits would be limited. But the announcement was, in fact, the decisive factor in securing adhesion to the agreement.

Restriction of Profits.

In the middle of March the Government, as represented by the Chancellor of the Exchequer, the President of the Board of Trade, Mr. Montagu and Dr. Macnamara, together with Mr. Balfour as representing the Opposition, met representatives of the trade unions in full conference. The trade unions were represented by a committee under the chairmanship of Mr. Arthur Henderson, which was constituted as the result of the conference as the National Labour Advisory Committee. The negotiations started on March 17 and were concluded on March 19, and resulted in a document of such vital importance to the whole future of labour regulation that it is given in full:—

The workmen's representatives at the conference will recommend to their members the following proposals with a view to accelerating the output of munitions and equipments of war.

(1) During the war period there shall in no case be any stoppage of work upon munitions and equipments of war or other work required for a satisfactory completion of the war.

All differences on wages or conditions of employment arising out of the war shall be dealt with without stoppage in accordance with paragraph (2).

Questions not arising out of the war should not be made the cause of stoppage during the war period.

(2) Subject to any existing agreements or methods now prevailing for the settlement of disputes, differences of a purely individual or local character shall, unless mutually arranged, be the subject of a deputation to the firm representing the workmen concerned, and differences of a general character affecting wages and conditions of employment arising out of the war shall be the subject of conferences between the parties.

In all cases of failure to reach a settlement of disputes by the parties directly concerned, or their representatives, or under the existing agreements, the matter in dispute shall be dealt with under any one of the three following alternatives as may be mutually agreed, or in default of agreement, settled by the Board of Trade:

(*a*) The committee on production.

(*b*) A single arbitrator agreed upon by the parties or appointed by the Board of Trade.

(*c*) A court of arbitration upon which labour is represented equally with the employers.

(3) An advisory committee representative of the organized workers engaged in production for Government requirements shall be appointed by the Government for the purpose of facilitating the carrying out of these recommendations and for consultation by the Government or by the workmen concerned.

(4) Provided that the conditions set out in paragraph (5) are accepted by the Government as applicable to all contracts for the execution of war munitions and equipments, the workmen's representatives at the conference are of opinion that during the war period the relaxation of the present trade practices is imperative, and that each union be recommended to take into favourable consideration such changes in working conditions or trade customs as may be necessary with a view to accelerating the output of war munitions or equipments.

(5) The recommendations contained in paragraph (4) are conditional on Government requiring all contractors and sub-contractors engaged on munitions and equipments of war or other work required for the satisfactory completion of the war to give an undertaking to the following effect:—

Any departure during the war from the practice ruling in our workshops, shipyards, and other industries prior to the war, shall only be for the period of the war.

No change in practice made during the war shall be allowed to prejudice the position of the workpeople in our employment, or of their trade unions, in regard to the resumption and maintenance after the war of any rules or customs existing prior to the war.

In any readjustment of staff which may have to be effected after the war priority of employment will be given to workmen in the employment at the beginning of the war who are serving with our colours or who are now in our employment.[1]

Where the custom of a shop is changed during the war by the introduction of semi-skilled men to perform work hitherto performed by a class of workmen of higher skill, the rates paid shall be the usual rates of the district for that class of work.[2]

The relaxation of existing demarcation restrictions or admission of semi-skilled or female labour shall not affect adversely the rates customarily paid for the job. In cases where men who ordinarily do the work are adversely affected thereby, the necessary readjustments shall be made so that they can maintain their earnings.

A record of the nature of the departure from the conditions prevailing before the date of this undertaking shall be kept and shall be open for inspection by the authorized representative of the Government.

Due notice shall be given to the workmen concerned wherever practicable of any changes of working conditions which it is desired to introduce as the result of this arrangement, and opportunity of local consultation with the men or their representatives shall be given if desired.

All differences with our workmen engaged on Government work arising out of changes so introduced or with regard to wages or conditions of employment arising out of the war shall be settled without stoppage of work in accordance with the procedure laid down in paragraph (2).

It is clearly understood that except as expressly provided in the fourth paragraph of clause (5) nothing in this undertaking is to prejudice the position of employers or employees after the war.

(Signed)
D. Lloyd George.
Walter Runciman.

Arthur Henderson.
(Chairman of Workmen's Representatives.)
Wm. Mosses.
(Secretary of Workmen's Representatives.)

March 19th, 1915.

The Amalgamated Society of Engineers were not parties to this agreement, and on March 25 a further agreement was concluded with that Society which contained two additional points of first-rate importance—an undertaking by the Government to limit the profits of contractors on war work, and the limitation of the agreements to war work purely.

This was a great achievement, and equal credit is due to the members of the Government who secured it and the unions who accepted it. But the plain truth is that its acceptance by the rank and file in actual practice was not a matter of weeks but of weary months, as the account of the progress of dilution indicates. Indeed it is fair to say that the agreement had not a real chance to produce results until not merely the first Munitions Act had made the safeguards statutory and the removal of restrictions compulsory, and had limited profits, but the second Munitions Act of 1916 had provided effective powers to regulate the wages of women entrants. From that date, as has been shown elsewhere, progress began, but the Treasury agreement may well take its place among historical records of the World War as a crystallization of the deep and unswerving purpose of the ordinary British citizen to serve the nation even at the cost of his livelihood.

It should be added that throughout the war considerable uneasiness was manifested by the trade unions lest the safeguards provided by the Munitions Acts would not be adequate to secure effective restitution. Conscious of the great changes produced by the widespread introduction of the automatic machine, they feared that the changes might tend to become permanent. One step taken during the war to reassure them was the appointment of a number of officers by the Labour Department of the Ministry of Munitions to keep effective records of all departures from previous practice. The work of these officers was extremely effective, and there is no doubt that the records provided by them covered a great deal of the ground.

The existence of the records made restitution practicable. The trade unions did not rest content till what was practicable was made inevitable. Two committees were appointed in turn to consider what added safeguards were necessary—the first under the chairmanship of Sir John Simon, K.C., M.P., in 1916; the second under the chairmanship of Sir Stephenson Kent, K.C.B., in 1918. The result of these two committees was the Act of 1919, which rigidly enforced the restitution of practices.

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[1] These three clauses are taken from the form of undertaking proposed in the Second Report of the Committee on Production.

[2] A point not provided for in this paragraph was the question whether the semi-skilled worker should also receive the guarantee (given according to the practice of some shops to the skilled worker) of his minimum time rate when he was employed on piece-work. The reason of the omission was probably that the practice was not general before the war.

Perhaps it would not be unfair to say that this Act was unnecessary, and that in so far as effective safeguards were required, they were provided by the original Acts. But circumstances showed that complete restitution was in fact impracticable, and the trade unions realized that, if this were so, they were entitled to adequate compensation, which the further Act would secure for them.

(4) *Full Value for Hours Worked.*—This aspect of labour regulation may be regarded under the three main heads:—(*a*) the prevention of strikes and lockouts; (*b*) regulation of workshop discipline and hours through the Munitions Acts and particularly through munitions tribunals; and (*c*) the improvement of working conditions, under which is included the welfare work and the provision of housing.

Prevention of Strikes.

It is not necessary here to deal with the original labour truce, the appointment of the committee on production, the provisions of the Munitions of War Acts and the Defence of the Realm Regulations, making strikes and lockouts and incitements thereto offences, and the work of the general munitions tribunals set up by the Munitions of War Acts to deal with strikers or employers guilty of lockouts. It is sufficient to say that any attempt to make a full use of available labour without regulation of strikes and lockouts is obviously doomed to failure, and therefore in so far as the methods adopted directly to prevent strikes and lockouts were successful an important aspect of labour regulation was adequately handled. But experience showed that it was not in the machinery for preventing disputes, so much as in the spirit operating among employers and workers, that the best security against industrial disputes lies. In the earliest days of the war, when the sense of national danger and of patriotism was at its highest, no machinery was devised or required. In the later years of the war, when continuous strain, disappointment, anxiety, and, above all, reflexion on what appeared to the workers were the huge profits made out of the war by employers, had strained tempers, elaborate machinery could not prevent such stoppages as the dilution strike of May 1917, or the Coventry "embargo" strike of 1918. No machinery, however perfect, can cure a disease of the spirit, and the ultimate sanction of all anti-strike legislation must be the willingness of those affected by it to accept its terms. Machinery without the right direction of labour policy, and without skilful officers in charge of the detailed working, would inevitably break down. The committee on production of itself—great and respected machine as it was—would have been ineffective but for the steady patriotism of both employers and workpeople as a whole, and for the unremitting and completely unrecognized efforts first of the Labour Department of the Board of Trade, then of the Ministry of Munitions, and finally of that Ministry, the Ministry of Labour and the Shipyard Labour Department of the Admiralty, to prove to the workers that whatever might be demanded of them was only demanded in the national interest. As prevention is better than cure, so conciliation is better than arbitration. Doctors are required, and arbitrators are vital, but it is the wise direction of policy that makes the task of the arbitrator a possible one. And, when full account is taken of the many mistakes that were made, the work of the conciliating departments played no small part in seeing that the available labour produced the munitions which won the "engineers'" war.

Workshop Discipline.

The munitions tribunals were set up by the first Munitions of War Act, 1915. They represented a compromise between industrial compulsion and voluntarism. Grave complaints had been made that one of the principal causes of failure to produce the required output of munitions was the bad time-keeping both in shipyards and engineering establishments. Various causes for this were ascribed, most prominent among them being high wages and drunkenness. Acute controversy was aroused by allegations and counter-allegations, and an official enquiry was instituted in 1915, the results of which were presented in a paper laid before Parliament on May 1 1915, entitled "Report and Statistics of Bad Time Kept in Shipbuilding, Munitions and Transport Areas." The paper, though inconclusive, tended to show that, whatever the causes, there was in some areas room for improvement.

When, therefore, the first Munitions of War Act was introduced, with a general scheme for regulating labour, this aspect of the question could not be shelved. Nor could it be allowed to solve itself by the ordinary economic checks of peace-time. In peace-time the remedy for bad time-keeping, and generally of ineffective workmanship, is dismissal. With an acute shortage of labour, dismissal can only be resorted to in extreme cases. It was accordingly decided to make deliberately inefficient workmanship an offence by Section 4 (5) of the Munitions of War Act, 1915, which was as follows:—

> "The employer and every person employed in the establishment shall comply with any regulations made applicable to that establishment by the Minister of Munitions with respect to the general ordering of work in the establishment with a view to attaining and maintaining a proper standard of efficiency and with respect to the due observance of the rules of the establishment.
>
> "If the employer or any person so employed acts in contravention of, or fails to comply with, any such regulation, that employer or person shall be guilty of an offence under this Act."

The offence thus created was a new one in law, and the first point to determine was whether it should be tried in the ordinary courts. After discussion in Parliament it was decided to set up munitions tribunals (Section 15, Ministry of War Act, 1915) of two classes—known respectively as general and local tribunals—to deal with all new offences created by the Munitions of War Act and with appeals in respect of leaving certificates under Section 7. The essential features of the tribunals were:—

(i.) The fact that the independent chairman was assisted by two assessors—one employer and one workman. Originally the assessors were merely advisory, but they were made a part of the court by the Act of 1916, which also provided for a woman assessor in cases affecting women.

(ii.) The comparative informality and the cheapness of their proceedings. These two points were emphasized in the munitions tribunals' rules governing the procedure of the tribunals. These rules provided first for the exceedingly low fees, and secondly that lawyers could not appear before the local tribunals, though representatives of the workmen could.

Munitions Tribunals.

Like so many other of the instruments devised to meet war emergencies, the tribunals worked well, but not in the direction anticipated. It was expected in the first place that the general munitions tribunals, which were to deal with strikes and lockouts and employers' offences, would play a predominant part. The fact, however, was that except for six or seven notorious cases, such as the trial of the strikers at Fairfield's, at Glasgow, this class of tribunal rapidly receded into the background. For experience showed that actual prosecutions for the offence of striking had little result. To begin with, it was impracticable to lodge complaints against 10,000 men, and it was invidious to select among the offenders. In the second place, when imprisonment for failure to pay fines had been abolished by the Act of 1916, there was no certainty of recovery. And finally, even if recovery was possible, the individual did not suffer, since levies could always be raised to pay the fine. Indeed, so far as legal action in respect of strikes was effective it was the Defence of the Realm Act with its heavy penalties against incitement rather than the Munitions Acts that operated. But, though the general munitions tribunals were in fact little used yet none the less their existence was of great deterrent value.

So far as the local tribunals were concerned, their work in respect of workshop discipline formed in volume at any rate as time went on the lesser part of their heavy duties. They were worked hard, indeed sometimes almost overwhelmed, but their principal work consisted, so long as the leaving certificates remained, in dealing with appeals, and after their abolition with claims for failure to give notice and with questions arising upon claims for payment of wages under the orders issued by the Minister of Munitions under the powers vested in him by the Munitions Acts. So complex and difficult were these questions, and so liable to different interpretations by the fifty or sixty tribunals in existence, that it was found necessary under the Act of 1916 to provide for an appeal to the High Court in England

and to the Court of Session in Scotland. But the same principles of cheapness and informality marked the change and though the judicial decisions given had far-reaching results, they were given quickly with a minimum of expense to appellants and often without the assistance of counsel.

Section 4 (5) provided for regulations to be made by the Minister of Munitions for the general ordering of work in controlled establishments. When the bill passed into law the Minister of Munitions was faced with the difficulty of drawing up a code of workshop rules for the controlled establishments, the number of which increased from 134 on July 12 1915, to 2,422 on Jan. 1 1916, and ultimately exceeded 6,000. The difficulty of interfering with the delicate mechanism of workshop discipline by central edict was very much in the mind of the Ministry, and consequently the first regulations did not themselves make workshop rules but required the owner of a controlled establishment to post his own rules, thus giving them statutory effect.

Model Workshop Rules.

This was an ingenious shortcut, but it failed in its object. The workmen were not prepared for possibly arbitrary rules, made to suit an employer's convenience, being made statutory. On their side the employers realized the reasonable nature of the workpeoples' objection, and moreover large numbers of the smaller employers had never drawn up a regular code of workshop rules. Accordingly in Aug. 1915 the Ministry of Munitions drew up a model code of rules for posting. These provided for regularity and diligence, suspension of restrictions, and sobriety and good order, but the model rules did not of necessity supersede the existing workshop rules. The result of this step is shown by the following figures for Dec. 4 1915, in respect of establishments controlled by Nov. 4:—

	Posting of Rules.
Model rules only	800
Model rules with variations	21
Own rules	116
Model rules and own rules	303
Model rules prepared by Engineering Employers' Federation	64
	1,304

Certain difficulties arose subsequently in rules posted by employers, notably a rule imposing small fines for bad time-keeping. But these difficulties were ultimately surmounted by an agreement in the autumn of 1915 to substitute the Ministry of Munitions code for the unpopular rules.

Up to Dec. 1915 there had been 4,166 cases under Section 4 (5) before munitions tribunals, of which the great majority had been cases of bad time-keeping. It is a matter of real difficulty to decide whether convictions in this respect had or had not any real effect. It was often argued that the irritation caused by prosecutions far outweighed the advantages derived from convictions. However this may be, employers continued to revert with a certain freedom to this method, until the abolition of the leaving certificate. When this was abolished, the employer, through fear of losing workmen prosecuted, was far more chary of bringing prosecutions; indeed employers felt that the abolition of Section 7 carried with it the repeal of Section 4 (5).

The Ministry of Munitions were conscious that legal proceedings in themselves would not necessarily cure the undoubted evil of bad time-keeping, which remained throughout the war, especially in the shipyards, a real menace to production. The causes were variously diagnosed, but there can be little doubt that the real causes were overstrain and high wages. To supplement the work of the tribunals the Ministry instituted a system of warning offenders, and appointed in this connexion a number of time-keeping officers, whose duty it was to investigate the time-keeping in the various controlled establishments and to put themselves into direct touch with culprits. It is difficult to show statistically what effect this policy had, but numerous testimonies to its good effects were received from employers.

But, if no direct results could be estimated, the indirect results of the efforts to deal with time-keeping were remarkable, providing another instance of permanent changes in the social structure arising from war measures. It was clear that overstrain was one of the effective causes of bad time-keeping, and that under the general head of overstrain must be included excessive hours, and unsatisfactory workshop and housing conditions. In the effort to repair these defects an important advance was made in the direction of elevating the position of workpeople generally.

Improvement of Working Conditions.

The first indirect result of the bad time-keeping campaign was the encouragement of duly authorized workshop committees, which should themselves act as judges of their fellow workpeople. In the setting up of these committees the Ministry of Munitions had to proceed very slowly, and indeed were able to do little that was effective until late in 1917. The employers regarded this innovation with the greatest suspicion. Certain advanced employers (like Hans Renold, Ltd., at Manchester, and Messrs. Rowntree) had installed them with the most favourable results. But the employers generally regarded them as an attempt by the workpeople to interfere with management, and they were the less prepared to accept them in view of the activities of the labour movement known as the "shop-steward" or "rank and file" movement. This movement, which originated with the Clyde workers' committee, advocated workshop committees, partly as a means of countering the centralized powers of the trade unions, and partly as a means of reaching workshop control. When, therefore, the Ministry of Munitions urged upon employers' committees, which in everything except name were fundamentally different from those advocated by the shop stewards, the similarity of name and the possible misuse of any powers entrusted to the committees were powerful obstacles to progress. But the Ministry persevered, and a considerable number of these committees were set up, all of which, if only for the vigorous way in which they dealt with bad time-keeping, fully justified their creation. After the Coventry strike of 1918 the Engineering Employers' Federation signed an agreement with the engineering unions setting out the basis upon which committees might be established, thus setting the seal on the labour of the Ministry of Munitions in this respect. But the point of real interest is that in this work the Ministry of Munitions anticipated in practice on a very modest scale the far-reaching proposals of the committee under Mr. J. H. Whitley, M.P., which recommended the establishment of joint industrial councils for industries.

It would be untrue to allege that the control of hours, the provision of welfare facilities and the provision of housing, were undertaken primarily or indeed chiefly to cure bad time-keeping. These steps were necessary at least as much in the interests of the general *moral* of the workpeople as of the actual volume of production. But that bad time-keeping was an effective cause of the special attention given to these matters cannot be doubted. It was a consideration almost as much present to the industrial research committee, which investigated industrial fatigue, as to the Ministry of Munitions. It was certainly constantly in the mind of the welfare department of the Ministry of Munitions, and it was seriously taken into account by the Ministry in deciding on building schemes. Thus again from a war necessity were made contributions of first-rate importance to the whole future of industrial organization.

So far as hours of labour are concerned, it is sufficient here to note that the labour department of the Ministry of Munitions had a special responsibility as the labour side of the great supply department. The Home Office had the statutory duty under the Factory Acts of regulating the hours of women and young persons, but trade-union rules were the only instrument that existed to control men's hours, and then not from the health, but from the economic point of view. The Home Office, faced by the urgent demands for munitions, the validity of which they were not able to estimate, had even so far as women and young persons were concerned great difficulty in maintaining hours at a reasonable level. So far as men's hours were concerned, in the early days of the war, working weeks of 80 and 90, and even 100, hours were by no means uncommon. It was upon the labour department of the Ministry of Munitions, which could in some measure control or at least estimate the demands of the supply departments, that the duty fell of attempting to bring hours down to a reasonable level. It was the Medical Research Committee, constituted by the Home Office, which pointed out the waste of energy and efficiency involved by excessive hours, but it was the labour department of the Ministry of Munitions which, by using their influence with the supply departments, were able to see that the views of the committee were carried out at least in part.

So far as welfare is concerned, here again the Ministry of Munitions came in as the supply department, which, by reason of its intimate association with employers, could effectively supplement the statutory duties of the Home Office. It is doubtful how far the Ministry had any statutory basis for the important duties they discharged in this direction. But they had a power greater perhaps even than that of statute—the power of the purse. When the Department urged upon employers the provision of suitable canteens, rest-rooms and welfare superintendents, they could hope that their recommendations would be (as they generally were) accepted because they had power to write off the firms' expenditure in this respect against excess profits. But here again the interesting point that emerges is that the experiment of the Ministry of Munitions for meeting a war need has profoundly affected the attitude of employers generally to these problems.

Finally, so far as housing is concerned, the first point of interest is that by assuming direct responsibility for the provision of houses, the Ministry foreshadowed or perhaps even pointed the way to the great responsibility for the general housing of the population assumed after the war by the Ministry of Health. The State had admitted that for certain war purposes it had obligations in respect of housing; it was difficult to deny these obligations in the face of the even more clamant demands of peace.

Before leaving the subject of housing, a brief reference should be made to the Billeting of Civilians Act of 1917. When it became apparent that housing difficulties were proving a real obstacle to the production of munitions, and that it was hopeless to expect that new houses could be built in time to meet the need, the Government decided on the drastic step of introducing an Act, under which they took power to billet munitions workers compulsorily, if adequate accommodation were not forthcoming. A central billeting board was set up to carry the Act into effect, and billeting officers were appointed. In fact, the principal value of the Act proved to be the threat of compulsion. In place of making orders, the general procedure was to hold conferences in the most congested districts, which generally resulted in the provision of increased accommodation without the need of a resort to compulsion. Though figures could not easily be obtained to support the view it is probable that the Act had a considerable success.

(5) *The Handling of Wages Problem.*—Any account of labour regulation would be incomplete which did not indicate the degree to which success or failure in handling the wages problem may affect the whole labour situation. During the war, wages did not have quite so predominant a share in moulding the point of view of workmen to industrial questions as during peace. Questions such as dilution, and compulsory military service, took their place side by side with wages as topics of first-class importance to labour. But none the less a failure to deal with wages would have constituted a failure to regulate labour. Clear above all the conflicting considerations that remain when the general Government policy is considered there stand out the two great experiments in handling wages—(*a*) compulsory arbitration, and (*b*) fixing of wages by administrative orders.

Compulsory arbitration had long formed the subject of controversy, and had long been repudiated by labour opinion, on the plain ground that such arbitration necessarily destroyed the right to strike. Labour opinion, though fully conscious of the economic wastefulness of this desperate resort, regarded it none the less as the *ultima ratio*. The right to resort to it had been finally consecrated by the Trade Disputes Act of 1906, and any interference with or reduction of the extreme right was regarded as a vital attack on the general liberties of labour. But the war proved in the end too strong even for this view. For the first few months, in the general engineering and shipbuilding trades, wages did not play any very considerable part. Overtime to an unheard-of extent was being worked, and unemployment was non-existent for any man who cared to work; so that rates of wages could safely be left to look after themselves. But as the shortage of labour grew more and more pronounced, a sharp change came over the situation. Employers began to bid against one another; and disparities between one factory and another, and between one district and another, began to have an effect on the minds of the workpeople. Moreover, at the beginning of 1915 an old-standing difficulty between employers and employed in the Clyde reëmerged, and the atmosphere began to be charged with a certain liveliness. But over and above this there was a genuine reluctance among workpeople to put themselves in the position of striking, and thus ceasing to produce the munitions of which their brothers in the field were so urgently in want. It was principally this factor, though the others were also material, that made it possible, when the Treasury agreement forbidding strikes and lockouts was concluded, to couple with that provision the institution of arbitration, which by the Munitions of War Act, 1915, became compulsory.

Compulsory Arbitration.

It cannot be pretended that at any time the strongly organized part of the labour world welcomed or approved of compulsory arbitration, but equally it cannot be denied that the principle was legally accepted. The statistics of strikes and lockouts during the war period indeed show that the principle was by no means universally accepted, but in weighing the statistics account must be taken of the fact that all the most considerable strikes were unconnected with wages. But, even allowing for a considerable body of strikes on wages and even against decisions of the compulsory tribunals, the experiment must be considered to have been successful. It is therefore the more surprising that labour opinion should have been so little converted to its use.

The reasons for this are not far to seek. In the first place it is one thing to abandon the strike weapon during war, when it operates as much against the strikers as against the employers. It is quite another thing to abandon or even to restrict its use during peace. In the second place, from the labour point of view, compulsory arbitration during a period of acute labour shortage and rising prices resolved itself into a question of determining only how much wages should be advanced, and never how much they should be reduced. And finally there existed the order-making powers of the Ministry of Munitions, which could be, and indeed constantly were, resorted to, as an alternative to, and as a means of evading, compulsory arbitration.

On the general effect of compulsory arbitration it may fairly be said that, though its compulsory character was abandoned with the termination of the war except in so far as it was kept alive for a strictly limited period by the Wages (Temporary Regulation) Acts, it had familiarized great masses of workpeople to the principle of arbitration, whether compulsory or not. In this way, by pointing to a central settlement of labour questions without resort to industrial warfare, the system of compulsory arbitration has had enduring effects.

Orders of the Ministry of Munitions.

Side by side with the awards of the arbitration tribunals, and only too often conflicting with them, there came into existence the direct power of the Ministry of Munitions to make orders. As between awards and orders it is sufficient to say here that, while there is a great deal to be said for orders, whether direct or through a trade organization, in respect of unorganized trades, it is difficult in theory to defend orders in respect of organized trades. But theory in war-time has a habit of being ineffective. The critics who point scornfully to what they regard as the disaster of the repeal of Section 7 and the granting of the 12½% bonus, have this advantage over those responsible for these measures. They see what happened as a result of their introduction: they do not, however, see what was avoided. They are therefore ready to assume that the difficulties avoided are negligible in comparison with those created. Nothing can controvert them, except possibly the fact that in spite, it may even be as a result, of measures such as these in face of unspeakable strain and anxiety, the working classes remained resolutely, loyally, and with but trifling interruptions, at work till Nov. 11 1918.

The origin of the order-making power is to be found in the prosecution of the Government's proposals for dilution. The principal stumbling block at the end of 1915 was the fear that the introduction of semi-skilled men and women upon work hitherto performed by skilled men would depress the level of the wages. The trade unions demanded that the Government should take powers to prevent that depression. These powers were taken under Sections 6, 7 and 8 of the Munitions of War Act, 1916, which enabled the Minister of Munitions (1) to make orders concerning the wages, hours of labour and conditions of employment, (*a*) of women employed on munitions work in establishments subject to the provisions of Section 7 of the principal Act, and (*b*) of certain classes of semi-skilled and unskilled men employed in controlled establishments; and also (2) to constitute special arbitration tribunals, (*a*) to deal with differences in the matters mentioned above, and (*b*) to advise the Minister on questions referred to them affecting such matters.

This order-making power was assumed by the Minister of Munitions as an indispensable preliminary to securing dilution. It is important to note that the orders, so far as women were concerned, were of two classes: the first, and for this purpose the less important, were those which dealt with women engaged on what was previously men's work; the second with women on women's work. These orders, dealing as they did with practically unorganized trades, for the first time in general industry, introduced an effective underpinning minimum. The first order fixed 20s. per week as the minimum, representing in itself a 6s. to 8s. advance over the average wage previously enjoyed by women in industry. From that time, with the steadily increasing cost of living, the women's rate mounted steadily till it reached the neighbourhood of 35s. There are those who maintain that these last rates were excessive. There are none, however, who dare pretend that the pre-war level was adequate. The action of the Ministry of Munitions had destroyed the old standards, which never returned, for the Wages (Temporary Regulation) Acts, temporarily, and the Trade Board Act, 1918, permanently, stepped in to uphold the standard thus fixed. When, therefore, the wages policy of the Government is criticised, it is only fair to remember that the women's wages orders of the Ministry of Munitions opened a new era in women's employment.

But, if these orders can be defended, it will be more difficult to find those who would accept a defence of the order giving the 12½% bonus in the autumn of 1917. Yet when this order is criticised, the stages that led up to it should be remembered. The introduction of the automatic machine and mass production had afforded unprecedentedly high wages to semi-skilled and unskilled workers employed on piece-work. Side by side with those working on operations which, because of their delicacy, could not be performed on a piece-work basis, were the skilled men, whose wages had by no means advanced at an equal rate. Not only, therefore, had the relative wage superiority of the skilled man not been maintained, but in many cases the less skilled worker—who had often been taught by the skilled man—was receiving a higher wage than his teacher. This grievance—which was generally known as the skilled man's grievance—had been noticed by all the commissions on industrial unrest appointed after the May strike of 1917 under the general chairmanship of Mr. Barnes. They were unanimous in declaring that it should be remedied, but not unanimous as to the means. The 12½% bonus given on the advice of the labour side of a mixed committee appointed to consider the matters was the means adopted by the Government. Designed to remove the disparity between skilled and unskilled, it was ultimately extended to time and piece-workers skilled and unskilled alike. It is clear that it did not achieve its object of removing the disparity; that it was extremely expensive, and that during the days when it was first imposed it led to much confusion and grave irritation. But what is not clear is whether, if it had not been granted as an earnest proof of the Government's sincere determination to remedy a labour grievance, other troubles of a deeper and more formidable sort, of which angry signs had already appeared, might not have developed. Admittedly, only an acute emergency could justify the attempt to regulate the general wages of the country by central order. (H. Wf.)

II. United States

Before the World War there was no national American system of labour placement. There were thousands of employment agencies of every type (commercial fee-charging agencies, philanthropic offices, union, employers' and commercial association offices, Federal, state and municipal agencies), competing, duplicating and working at cross purposes. War-time demands for labour soon overstrained the existing facilities. The flow of immigrants stopped; the draft drew off large numbers of men; war industries bid against each other in competition for workers; there was little contraction of non-essential industries. By the spring of 1918 the surplus had been absorbed, and war labour needs had reached the total of 3,928,956 workers. The problem was one both of distribution and training. To meet the war emergency, the U.S. Employment Service and the U.S. Training and Dilution Service were established.

The first plan to establish a Federal employment service was inaugurated by the Bureau of Immigration in 1907 for the purpose of placing immigrants on farms. In Jan. 1915 it was extended to cover all occupations and all classes of workers, and effort was made to coöperate with state bureaus. A special division of "reserves" (public service reserves and boys' working reserve) was created to enroll skilled workers and to enlist boys between 16 and 21 for vacation work. In Jan. 1918 the Secretary of Labor ordered the separation of the employment service from the bureau of immigration and a few months later when the Department of Labor was reorganized, the United States Employment Service was made one of its eight new divisions. Two million dollars was granted to it from the President's emergency fund.

The service passed through several stages of reorganization. In its final form it consisted of five divisions:—(1) the control division, which was in charge of general correspondence, statistics and research, expenditures and accounts; (2) the field organization division, which supervised the employment offices; (3) the clearance division, which handled reports on labour supply and distributed unfilled requests for help; (4) the personnel division, which dealt with the selection and training of help and worked out standard classifications of occupations; and (5) the information division, which published the *U.S. Employment Service Bulletin* and had charge of all publicity work. Responsibility for organization was centred in a Federal director in each state. State advisory boards, consisting of representative employers and workers, were organized, as well as community labour boards. Dependence of employers on the service was further increased when, on Aug. 1 1918, by Presidential proclamation, all employers engaged in war industries, who employed more than 100 persons, were required to hire their unskilled labourers through the service. By Oct. 1918, 832 offices had been opened, covering every state, the District of Columbia and Porto Rico. Special divisions were organized for woman labour, railway labour, farm labour, shipyard labour, longshoremen, negro labour, mine labour and engineers.

Following the cessation of hostilities a plan was worked out for the placement of ex-soldiers and war workers. Lack of adequate funds, however, forced the service to curtail its work, and by Oct. 1919 all of the offices were closed except those which the states and municipalities took over. These were granted a small sum of money and remained in coöperation with the Federal office. During the period from Oct. 11 1919 to June 30 1920, 269 such offices were in operation in 41 states and the District of Columbia, supported mostly by state and municipal funds.

Though the service had many weaknesses and shortcomings, due mainly to the fact that it was created under pressure to relieve a disorganized labour market, it accomplished remarkable results, as the following table shows:—

Activities of the U.S. Employment Service and coöperating Public Employment Offices, Jan. 1918 to June 1920, inclusive.

	Help Wanted	Registrations	Referred to Positions	Placements Number	Per cent of Registrations
1918	8,929,005	4,225,451	3,969,579	3,091,821	73·2
1919	4,857,264	4,367,190	3,807,448	2,920,839	66·9
1920 (6 mos.)	1,496,819	1,138,773	1,152,162	833,368	73·1

Credit for its success must be given, also, to some of the well-organized state services which had existed for several years.

As in other countries during the war, the labour shortage was overcome in part by the increased employment of women, who entered industry in large numbers, particularly after the second draft. In a study recently made from Ohio statistics, it has been shown that there was no marked increase of employers' demands for women until March 1918, but that from then to

March 1919 there was a much stronger demand for women workers than before the war. In fact, just before the termination of the war, employers were asking for twice as many women workers as in 1917. The figures show, also, that the number of women seeking industrial employment rose in almost exact proportion to the demand for their services. In another study, made for the country as a whole, of 15,000 firms employing 2,500,000 workers, it is estimated that in 1914 6·5% of the workers on the labour force of leading war agency and implement industries were women; in 1916 7·7% were women; after the first draft (Feb.–March 1918) 10·6% were women; after the second draft (Oct.–Nov. 1918) 13·9% were women. In Aug. 1919 women still remained as 10% of the labour force. In the production of munitions, Benedict Crowell, Assistant Secretary of War and Director of Munitions, says that the women played a "highly important part." Fifty per cent of the employees in explosive plants were women; in the manufacture of hand grenades 19 out of 20 workers were women; in the Government gas-mask defence plant 8,500 out of 12,000 employees were women. In transportation the highest employment of women was reached in Oct. 1918, when there were 101,785 employed by first-class roads, an increase of 66% in the first nine months of 1918 and of 225% from the beginning of the war. In Oct. 1919 the number had fallen to 81,803. This increase in the war industries was secured in part by the absolute increase in numbers of women employed and in part by a shift from the traditional occupations of women in the textile, garment, food and tobacco industries which showed in some instances actual decrease in the numbers employed.

Women were first substituted for men in hundreds of repetitive occupations, and in unskilled and labouring jobs, in industries varying in their main divisions from blast furnaces to lumber camps. More important for the future was the fact that the war emergency in some cases opened the way to the "master machines" and key occupations. In all the industries taken together where women were substituted, 98 to 100 men were released for every 100 women employed, though there were exceptions such as crane operating where three women on 8-hour shifts replaced two men on 12-hour shifts. With regard to the success of their work in the new occupations a recent study of representative firms where women were substituted for men shows that 77·4% of the firms investigated reported that women's work, where comparable, was as satisfactory as, or better than, that of men. On the whole the results of their work seemed to depend less on the kind of work or degree of skill required than upon the intelligence with which they were initiated into their new work.

To meet the demand for technically skilled labour, the training and dilution service of the Department of Labor was organized, July 16 1918, under the authority of the War Labor Administration Act, and $150,000 was appropriated for its use. Its particular function was to ascertain the best methods of training workers and to provide information. Plans for factory training were designed, the various types of training were classified, and information was widely disseminated among employers. Especially was training needed for women, who were, with few exceptions, unprepared for the skilled and semi-skilled work. This was usually given in the factory training-room or vestibule school. Though the life of the service was so brief that it had no appreciable effect in augmenting the supply of skilled labour, it accomplished an important result in emphasizing the need for industrial training.

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LABRADOR (*see* 16.28).—Developments in Labrador during the decade 1910–20 were comparatively few and unimportant. The Newfoundland fishermen pursued their calling along its seaboard, and wireless stations were established at several points there to render communication easier. The work of the Grenfell mission among the fishermen was maintained and extended, and farther N. the Moravian missionaries continued their Christianizing work among the Eskimos, originated more than a century ago. The Hudson's Bay Co. and its more recent rival, the Revillon Co., kept up contact with the trappers on the coast and the Indian tribes of the wilderness behind, and occasional American exploring parties, geologists and others, visited the region during the summer seasons. The epidemic of influenza in 1918 ravaged the northern section despite the efforts of the Moravian missionaries and their medical staff; 20% of the natives perished. The mortality in some settlements was such that the dead had to be buried in pits, through lack of help to dig individual graves.

Labrador contributed a substantial quota of men—whites and half-breeds—for the Newfoundland Regiment and Naval Reserve, and even the smallest settlements helped in raising funds for Red Cross and other patriotic purposes. During the World War the attitude of some of the Moravian missionaries of German descent resulted in steps being taken for their internment. Other safeguards were applied and patrols were maintained by the Newfoundland Government during two seasons in case German submarines should use the coast to operate against Allied shipping passing through Belle Isle Strait to leave or reach Canadian harbours.

The production of codfish, salmon, trout and peltries, the principal yield of the region, continued about normal, but a survey of the seaboard and a thorough investigation of the fishery possibilities of the outer waters, which the Newfoundland Government had in contemplation, should result in largely increasing the magnitude of the fishing industry. Conditions on the eastern coast of "Newfoundland" Labrador, as it is known, are virtually identical with those on the western coast or "Canadian" Labrador from Belle Isle Strait westward to the St. Lawrence. The Grenfell mission operates here also but to a smaller extent than on the Atlantic seaboard, while the Canadian church organizations, Protestant and Catholic, play a larger part in caring for the natives there than the very limited resources of the kindred organizations in Newfoundland permit of their doing on the ocean front.

In Nov. 1920, after several years of negotiation, the Canadian and Newfoundland Governments, through their respective Ministers of Justice, signed an agreement in London for the submission to the Privy Council of the question of the Labrador boundary, on which depends, amongst other things, the right to valuable timber and mineral areas in that region. Broadly speaking, Newfoundland claims that her jurisdiction should extend inland from the Atlantic coast to the watershed or "height of land" in the interior, and that she should possess all the territory draining into the Atlantic; while Canada claims that the whole of this territory should be hers except a narrow strip along the seaboard necessary to enable the Newfoundlanders to carry on successfully their fishing enterprise, which is at present the only substantial industry in the region.

LADENBURG, ALBERT (1842–1911), German chemist, was born at Mannheim July 2 1842. He was educated at a Realgymnasium at Mannheim and after the age of 15 at the technical school of Karlsruhe, proceeding to the university of Heidelberg, where he graduated as doctor of philosophy (1863). From 1863 to 1867 he first studied organic chemistry under A. Kekule at Ghent, then visited England, studied in Paris and with Ch. Friedel and Wurtz, and returned to teach at Heidelberg. In 1873 he went to Kiel as professor of chemistry and director of the laboratory, remaining there until 1889 when he went to the university of Breslau in the same capacity. He was made an honorary member of the Pharmaceutical Society of Great Britain in 1886 and received the Hanbury medal for original research in chemistry in 1889. Details of his work, especially in connexion with benzene derivatives, are given in 6.53, 55 and 942; 11.215; 20.430; 25.892 and 21.635. He published *Entwicklungsgeschichte der Chemie von Lavoisier bis zur Gegenwart* (1868) and other works on chemistry, collaborated in a *Handwörterbuch der Chemie* (13 vols., 1882–96), and wrote a volume of reminiscences, *Lebenserinnerungen* (1912). He died at Breslau Aug. 15 1911.

See *Biographisches Jahrbuch und Deutscher Nekrolog.*, Bd. xvi., 171 (1914), and W. Herz's *Albert Ladenburg.*

LA FOLLETTE, ROBERT MARION (1855–), American politician, was born on a farm in Primrose township, Dane co., Wis., June 14 1855. He graduated from the university of Wisconsin in 1879, studied law there for one term, and was admitted to the bar in 1880. He began immediately to practise in Madison and served as district attorney for Dane co. for two terms (1880–4). From 1885 to 1891 he was a representative in Congress, and, as a member of the Ways and Means Committee, helped to draft the McKinley Tariff bill. On being defeated for Congress in 1891 he returned to practise in Madison. In 1896 he was a delegate to the Republican National Convention. He was elected governor of Wisconsin in 1901 and was reëlected in 1903 and 1905. It was largely due to him that state laws were passed for taxing railways according to valuation (1903), for nominating all candidates for public office by direct vote of the people (1904), and for regulating the railways in the state through a state commission (1905). He resigned the governorship in 1905 on being elected to the U.S. Senate, and was reëlected for two succeeding terms. He was an unsuccessful candidate for the presidential nomination at the Republican National Convention in 1908. In 1915 he was sponsor in the Senate for the seamen's bill providing for better working conditions and increase of life-saving equipment on board ship. He favoured, in 1916, an embargo on the shipment of arms from America, but supported armed intervention in Mexico. After America's entrance into the World War he was a pronounced and conspicuous pacifist.

He was the author of *La Follette's Autobiography* (1913).

LAGERLÖF, SELMA (1858–), Swedish writer, was born Nov. 20 1858 at Mårbacke in Värmland (Vermland). She grew up among country surroundings in a province in which tradition and folk-lore survived to an extent unknown elsewhere in the land. After going through the course in the Royal Women's Superior Training College of Stockholm, she became a teacher in the girls' high school at Landskrona. A weekly journal offered a prize for competition. She sent in some chapters of her first work, *Gösta Berlings Saga*, and won the prize. Thus began her public career as author. The book was a collection of tales, each to some extent independent of the others, gathered together in one framework: wild and moving scenes from Värmland life, depicted with lively imagination in a style of diction in keeping with her subject. The book is peculiarly Swedish in its character but it has been translated into English, Danish, German, Finnish, French, Dutch, Italian, Spanish, Hungarian, Portuguese, Czech and Russian. In 1894 she published *Osynliga Länkar* (*Invisible Links*).

In 1895 she was able to give up her work as teacher. Two journeys abroad which she now made, one of them to Italy, the other to Palestine and other parts of the East, were largely instrumental in providing material for her next book. In *Antikrists Mirakler* (1897) she gives a picture, in legendary shape, of the mystical and socialistic aspects of Sicilian life. In *Jerusalem* (1901–2) she tells of a strange flitting from the Swedish province of Dalarne to the Holy Land. Among her other works may be mentioned *Drottningar i Kungahälla*, stories from Swedish history (1899); *En Herrgårdssägen* (1899); *Kristuslegender* (1904); *Herr Arnes Penningar* (1904); *Nils Holgerssons Underbara Resa* (1906–7), a book for children, recounting a small boy's remarkable adventures on a journey through Sweden on the back of a wild-goose, embodying at the same time a series of stories touching on Swedish nature and history; *En Saga om en Saga* (1908); *Liljecronas Hem* (1911); *Körkarlen* (1912); *Dunungen*, a comedy (1914); *Kejsarn av Portugallien* (1914); *Troll och Människor* (1915); *Bannlyst* (1918) and *Kavaljersnoveller* (1918); as well as a volume of essays entitled *Hem och Stat*, published in 1911. Most of her books have been translated into English and other languages.

Honours and marks of esteem began gradually to come to her. In 1907 she was given a doctor's degree by Upsala University; in 1909 the Swedish Academy awarded her the Nobel prize for literature, and subsequently she was elected one of its 18 members—the first woman to be elected since its foundation in the 18th century. She purchased and restored the old farm in Värmland which was the home of her fathers.

See M. Kristenson, *Selma Lagerlöf* (1917); O. I. Levertin, *Selma Lagerlöf* (1904).

LAGOS (*see* 16.74), the principal port and the administrative capital of the colony and protectorate of Nigeria. The name was formerly borne also by the Crown colony of Lagos, an area of approximately 1,400 sq. m., adjoining the protectorate of Nigeria, of which the area is some 334,300 sq. m. in extent. The principal residence of the governor of Nigeria is at Lagos, and the colony possesses a Legislative Council, the authority of which extends only to the area enclosed within its boundaries. The town and island are linked to Iddo I., on which the terminus of the railway to Kano is situated, by Carter bridge; and Iddo I. is, in its turn, joined to the mainland by Denton bridge.

Extensive wharves were in 1921 about to be constructed by Messrs. Armstrong at Apapa, on the side of the lagoon facing the town, and a large electrical power-station to work the cranes on these wharves and to supply power to the main railway-workshops, which are under construction on the mainland beyond Denton bridge, was being built on Iddo I. to supplement the smaller power-station by which the town is at present lighted. Under the administration of Sir Walter Egerton fine waterworks were constructed at Ijau, on the mainland, which furnish an abundant supply of potable water to the town and its environs. Extensive harbour-works, still in progress in 1921, had already done much to improve the port, and these, aided by dredging, enable ships of approximately 20-ft. draft to enter the harbour and to lie alongside the customs wharf. It was hoped that the works in hand would eventually enable ships drawing 32 ft. to make use of the port. Lagos is the outlet and inlet of all the trade of that part of Nigeria served by the Iddo-Kano railway, which is 705 m. in length, and it has also a considerable canoe-borne trade with the adjacent portions of the Southern Provinces of Nigeria.

LAGUERRE, JEAN HENRI GEORGES (1858–1912), French lawyer and politician (*see* 16.79), died June 17 1912.

LAISANT, CHARLES ANNE (1841–1920), French politician (*see* 16.84), died at Asnières, near Paris, May 5 1920.

LAKING, SIR FRANCIS HENRY, 1ST BART. (1847–1914), English physician, was born in Kensington Jan. 9 1847. He was educated at Heidelberg, and afterwards studied medicine at St. George's hospital, taking his degree of M.D. in 1869. He was for many years one of the physicians to the royal household, and was appointed physician-in-ordinary to King Edward VII. in 1901. He was knighted in 1893, created a baronet in 1902, G.C.V.O. in 1903, and K.C.B. in 1910. He died in London May 21 1914.

His son, Sir Guy Francis Laking, 2nd Bart. (1875–1919), English antiquary, was born in London Oct. 21 1875. He was educated at Westminster school, and later studied art, but instead of adopting this as a career he entered Christie's, art dealers, where his apprenticeship stimulated all his antiquarian tastes. He was an enthusiastic student of armour, and this led to his appointment by King Edward VII. as keeper of the king's armoury, and also to his being appointed hon. inspector of the armouries of the Wallace collection (1900). He was also responsible for the arrangement of the London museum (1914). Sir Guy Laking published the following works: *The Armoury at Windsor Castle* (1904); *The Armoury of the Knights of St. John* (1905); *The Furniture of Windsor Castle* (1905) and *The Sèvres Porcelain of Buckingham Palace* (1907), besides a *catalogue raisonné* of the armour at Hertford House. He died in London Nov. 22 1919.

LAMMASCH, HEINRICH (1853–1920), Austrian jurist and statesman, was born on May 18 1853. He was professor of criminal and international law, a member of the Hague Arbitration Tribunal, and in 1918 the last prime minister of Austria. He qualified for the teaching faculty at Vienna in 1878. His pioneer pamphlet on the objective danger in the conception of attempted crime won for him in 1882 an extraordinary professorship, and in 1885 a full professorship at Innsbruck. In 1889 he returned to Vienna and there became an advocate of the idea of a league of nations in the spirit of Christian philosophy. He became an international arbitrator, and arranged the Newfoundland dispute between Great Britain and the United States, and the Orinoco dispute between the latter and Venezuela. He was sent to represent Austria at St. Germain, returned broken in body and spirit, and died shortly afterwards, on Jan. 6 1920. (C. Br.)

LAMONT, THOMAS WILLIAM (1870–), American banker, was born at Claverack, N.Y., Sept. 30 1870. He was educated at Phillips Academy, Exeter, N.H., and at Harvard (A.B. 1892). After graduation he was for two years on the editorial staff of the *New York Tribune;* then for some years was actively engaged in the manufacturing and mercantile business of Lamont, Corliss & Co. From 1903 to 1909 he was connected with the Bankers Trust Company, in New York, first as secretary and treasurer, and, after 1905, as vice-president. In 1909 he was elected vice-president of the First National Bank of New York City, serving for two years. On Jan. 1 1911 he entered the firm of J. P. Morgan & Co. In 1912 he was elected a member of the board of overseers of Harvard College and in 1915 president of the Associated Harvard Clubs. He was active in raising additional endowment for the Harvard School of Business Administration, in which he was specially interested. He took an active part in floating the British, French and Russian loans in America during the World War. In 1918–22 he was proprietor of the *New York Evening Post.* In 1919 he was financial and economic adviser of the American delegation to the Peace Conference in Paris, and was U.S. delegate in the formation of the new Consortium, composed of American, British, French and Japanese bankers, for aiding Chinese industries and railways; in 1920 he visited China as the representative of the American group, and in 1921 he was chairman of the American Committee for the China Famine Fund.

LANCIANI, RODOLFO (1846–), Italian architect and archaeologist, was born at Rome Jan. 1 1846. Educated at the Collegio Romano and the university of Rome, he became professor of ancient topography at that university in 1878. In 1872 he had been appointed secretary to the Archaeological Commission (of Rome), in 1876 vice-director of the Kircherian museum and in 1878 director of excavations. He was the designer and builder of the archaeological park at Rome. The recipient of hon. degrees from many universities, English, American and European, he was made a member of numerous archaeological and similar societies, including the Royal Institute of British Architects, who bestowed on him their gold medal. He became a senator of the kingdom of Italy. In 1920 he married Princess Caracciolo Colonna. Among his books are *Golden Days of the Renaissance in Rome* (1906); and *Wanderings in the Roman Campagna* (1909).

LANE, FRANKLIN KNIGHT (1864–1921), American public official, was born near Charlottetown, P.E.I., Canada, July 15 1864. He was taken to California in childhood and graduated from the university of California in 1886. He began his career as a newspaper reporter, studied law, and was admitted to the bar in 1889. He practised in San Francisco, drafted a charter for that city, and soon afterwards, in 1897, was elected city attorney, to which office he was twice reëlected. In 1902 he was the unsuccessful Democratic candidate for governor of California and the following year received the Democratic vote of the state legislature for the U.S. Senate, but failed of election. In 1905 he was appointed by President Roosevelt a member of the Interstate Commerce Commission and was retained by President Taft, serving for eight years, part of the time as chairman. The decisions which he wrote, many of which were regarded as radical at the time, were all upheld by the courts. In 1913 he entered the Cabinet of President Wilson as Secretary of the Interior. During his term of office the wealth of Alaska was made more accessible by the construction of a Government railway. Dams were built in several western states for conserving the water-supply in dry regions. To the Indians he gave special attention, maintaining that perpetual tutelage was wrong. Long before, authority had been granted the Secretary of the Interior to deal with individual cases, and by a generous interpretation of his powers many Indians were made free citizens. In connexion with national resources he advocated development without waste as being reasonable conservation. He was an earnest advocate of reclamation of land, and suggested that farms for soldiers returned from the World War could be provided by extensive drainage and irrigation. He favoured a policy of Americanization for the foreign population and the education of illiterates. In 1916 he was a member of the American-Mexican Joint High Commission, and the following year became a member of the Council of National Defense. In 1920 he resigned his post as Secretary of the Interior. He was treasurer of the European Relief Council. He died at Rochester, Minn., May 18 1921. He was the author of *The American Spirit* (1918, addresses delivered in war time).

LANE, SIR HUGH PERCY (1875–1915), Irish art collector and critic, was born in co. Cork Nov. 9 1875, the son of the Rev. J. W. Lane. His mother was a daughter of Dudley Persse, of Roxburgh, co. Galway, and a sister of Lady Gregory, the Irish playwright. Hugh Lane entered the firm of Colnaghi & Co. in 1893, and he rapidly made a name as a gifted connoisseur and collector of extraordinary perception. In 1898 he began dealing on his own account at 2, Pall Mall Place. He took a prominent part in the revival of an interest in art in Ireland, and was especially enthusiastic in the matter of establishing a gallery of modern art in Dublin. With the object of interesting the general public in this idea, an exhibition was held at the Guildhall in 1904 of works by artists of Irish birth, and exhibitions of modern art were subsequently held in Dublin and Belfast, with the object of raising money for the purchase of pictures for Dublin. A fine collection was ultimately made, and housed in Harcourt Street, Dublin, where it was opened in 1906. Sir Hugh Lane, who was knighted in 1909, also offered a number of his own splendid purchases of old masters to the city of Dublin on condition that a suitable building be provided for housing them; but, owing to the attitude adopted on the subject by the Dublin Corporation, his gift did not take effect. He acted as adviser on the formation of the Johannesburg Municipal Gallery of modern art founded by Lady Phillips (1909), and brought together the Cape Town National Gallery collection of 17th-century Dutch pictures (1912). He was in 1914 appointed director of the National Gallery of Ireland. In the early months of 1915 he paid a visit to America, and sold two of his most important pictures (Titian's "Man in the Red Cap" and Holbein's "Portrait of Thomas Cromwell") to American collectors. He returned to England on the "Lusitania," and was drowned in the sinking of that ship May 7 1915, one of his last acts having been to secure by telegram for £10,000 the blank canvas contributed by J. S. Sargent to a Red Cross sale at Christie's.

Sir Hugh Lane left a considerable fortune and also a splendid collection of pictures, including fine examples of Gainsborough, Goya and Rembrandt. Most of these were left to the National Gallery of Ireland, but a certain number came to the English National Gallery. Owing to an informality in the drawing-up of a codicil to the will, which had been signed but not witnessed, it was the occasion of controversy. It was contended that Sir Hugh Lane had altered his intention of bequeathing some of his pictures to the English National Gallery, and that the entire bequest was thus the property of the Irish National Gallery. The court, however, decided otherwise.

See *The Life and Achievements of Hugh Lane: with some account of the Dublin Galleries,* by Lady Gregory (1920).

LANESSAN, JEAN MARIE ANTOINE DE (1843–1919), French statesman and naturalist (*see* 16.169). At the elections of 1914 he was again, as in 1906, not returned, and he retired definitely from politics. Among his latest works were *La Crise de la République; Introduction à la Guerre de 1914* and *l'Histoire de l'Entente Cordiale Anglo-Française,* of which he was an ardent admirer. He died at Écouen, Seine-et-Oise, Nov. 7 1919.

LANG, ANDREW (1844–1912), English writer (*see* 16.171), died at Banchory, Aberdeenshire, July 20 1912.

LANG, COSMO GORDON (1864–), Archbishop of York, was born Oct. 31 1864 at Aberdeen, son of John Marshall Lang, sometime moderator of the Church of Scotland, and educated at Glasgow University until 1882, when he won a scholarship at Balliol College, Oxford. He took his degree in 1886, becoming fellow of All Souls in 1888. From 1883 to 1889 he was a student of the Inner Temple, but abandoned law for the church and was ordained curate of Leeds parish church in 1890. He was fellow and dean of divinity at Magdalen College, Oxford, from 1893 to 1896, and at the same time vicar of the university church of St. Mary's. In 1896 he became vicar of Portsea, when his success in administering a large working-class parish led in 1901 to his nomination as bishop suffragan of Stepney in the East End of London. In 1908 he was made Archbishop of York. The confirmation of his appointment was formally opposed on ritualistic grounds by the Protestant Truth Society (*see* 6.907). He was hon. chaplain to, and a personal friend of, Queen Victoria, and published several religious books, notably *The Miracles of Jesus as Marks of the Way of Life* (1900) and *The Opportunity of the Church of England* (1906). He was a member of the royal commission appointed in 1909 to inquire into the law of divorce, and with Sir Lewis Dibdin and Sir William Anson signed the minority report. As Archbishop of the Northern Province he took a conspicuous part in the social and economic, as well as the religious, questions agitating an industrial community, while in the House of Lords his eloquence and clear common-sense gave him an influence not confined to ecclesiastical matters. These same qualities proved of value in a mission which he undertook to the United States in 1918 in connexion with the war.

LANGLE DE CARY, FERNAND LOUIS ARMAND MARIE DE (1849–), French general, was born at Lorient July 4 1849, entered the St. Cyr military school in 1867 and left at the head of his class in 1869, being commissioned to the Chasseurs d'Afrique. In the war of 1870, having been selected for staff employment, he was orderly officer to Gen. Trochu, commander-in-chief of the Paris forces, and at the last sortie from Paris (Buzenval, Jan. 19 1871) he was severely wounded, and decorated for bravery. In the years of peace his promotion was at first somewhat rapid, but later, owing to his political and religious opinions, it was slow; and though he had become *chef de bataillon* as early as 1885 it was not till 1900 that he was made a general of brigade, and not till 12 years later that he obtained the membership of the Superior War Council which carried with it the command of an army in war. When the World War broke out in 1914 he was appointed to the IV. Army, which underwent the vicissitudes and final disaster of the battle in the Ardennes; but, unlike Ruffey and Lanrezac, he was not relieved of his command. He continued at the head of this army—though its strength was greatly reduced for the benefit of Foch's new IX. Army—in the Marne and Aisne operations and in the trench-warfare fighting of 1915, and in Dec. 1915 was made commander-in-chief of the centre group of armies. In this capacity he became responsible, amongst other duties, for overseeing the defensive readiness of Verdun. Already grave uneasiness existed in the army and in Parliament as to the capacity of Verdun to resist attack. The assurances given by the military authorities only half satisfied public opinion, and when the storm broke over Verdun in Feb. 1916 and the fears that had been expressed proved to be only too well founded, the command was radically reorganized, and Langle, who had already reached the age-limit for retirement, was replaced at the head of the centre group of armies by Pétain.

LANGLOIS, HIPPOLYTE (1839–1912), French general (*see* 16.177), died in Paris Feb. 12 1912.

LANKESTER, SIR EDWIN RAY (1847–), English biologist, was born in London May 15 1847, eldest son of Edwin Lankester (1814–74), a well-known physician and naturalist and F.R.S. He was educated at St. Paul's school, Downing College, Cambridge, and Christ Church, Oxford. In 1870 he was made Radcliffe travelling fellow, and in 1872 was elected to a fellowship at Exeter College, Oxford. During 1874–90 he was professor of zoölogy and comparative anatomy at University College, London; from 1891 to 1898 he was Linacre professor of comparative anatomy at Oxford; and from 1898 to 1907 he was director of the natural history departments of the British Museum. He was created K.C.B. in 1907. He received hon. degrees from most of the universities of Europe and became a member of many learned societies in England and America. His numerous publications include *Comparative Longevity* (1871); *Degeneration* (1880); and the more popular *Science from an Easy Chair* (1910); *Diversions of a Naturalist* (1915); *Science and Education* (1919) and *Secrets of Earth and Sea* (1920).

LANREZAC, CHARLES LOUIS (1852–), French soldier, was born at Pointe-à-Pitre, Guadeloupe, July 31 1852. Entering the military academy of St. Cyr in 1869, he fought in the latter part of the war of 1870–1 as a sub-lieutenant of infantry. Graduating from the École de Guerre (staff college) in 1879, he held in succession various staff and instructional positions, in particular at the École de Guerre during the period in which, under the influence of Maillard, Langlois and Bonnal, the new French doctrine of strategy and tactics was being established. To the furthering of this doctrine Lanrezac himself contributed a study of Napoleon's spring campaign of 1813 (*La Manœuvre de Lützen*), but it was chiefly through his personal methods of instruction that his influence made itself felt. He became colonel in 1902, general of brigade in 1906, general of division in 1911, corps commander in 1912, and finally in April 1914 he succeeded Galliéni as a member of the *Conseil Supérieur de la Guerre* and commander-designate of the V. Army in case of war.

In this capacity, Lanrezac, as Galliéni had done before him, soon came to the conclusion that the V. Army, on the left of the French line, would be exposed to the weight of a decisive German attack coming through southern Belgium. But General Joffre and those members of the general staff who, under him, had prepared "Plan No. 17" for the war concentration of the French army, thought otherwise, and when war came at the end of July in the same year, the railway concentration of the army was carried out as planned, without the modifications in the defensive sense that Lanrezac's views, if accepted, would have required. Moreover, the later French doctrine of strategy and tactics, which had sprung up since 1910 and was championed by the younger school of staff officers, rejected the new Napoleonic theories of Lanrezac's generation, tended to the almost complete exclusion of the defensive as a mode of war, and its advocates were fully prepared to commit the fate of France to the chances of an immediate general offensive in Lorraine and Ardennes. This being presumed to succeed, events beyond the extreme left of Lanrezac's army might be ignored, and his fears might be (and undoubtedly were) put down to his predilection for that defensive-offensive which he had constantly taught. The Grand Quartier Général thus began the campaign with a prejudice against Lanrezac's theories of war.

It was not until Aug. 15 that the reality of the danger to the V. Army began to be accepted by Joffre, and measures were taken to bring that army towards Namur and Charleroi; and even then the fact that the greater part of the German striking wing would be W. of the Meuse was not definitely admitted either by Joffre or, for that matter, by Lanrezac himself. Thus the battles of Charleroi and Mons were begun under the most unpromising conditions as regards unity of purpose. Moreover, Lanrezac's own subordinates allowed themselves to be carried away by the doctrine of the offensive, and engaged in a confused battle with Bülow's II. Army in the tangle of suburbs and mining villages round Charleroi, in spite of Lanrezac's formal order to stand on the defensive on the open heights S. of the Sambre. And, lastly, tactical liaison with the British on the left and personal liaison with its commander, Sir J. French, were both imperfect. In such circumstances misunderstandings could hardly be cleared up or good relations established either with the distant Grand Quartier Général or with French during the unexpected and trying retreat of the Allied left wing which followed. But Lanrezac, aided by his chief-of-staff General Hely d'Oissel, managed to bring off his army, and so far to restore its normal organization and *moral* that it was able to take the offensive in the battle of Guise-St. Quentin without support[1] either from the IV. Army on its right or from the British on its left. The success of the V. Army at Guise could not, in the general situation of the moment, be followed up or extended, and the retreat was resumed. Henceforward the army headquarters had the troops well in hand, and such attempts as were made by the Germans to envelop the now exposed left wing came to nothing. Already, however, Joffre had determined to dismiss summarily a large number of the generals who had played a part in the battle of the Frontiers, as a measure tending to restore the *moral* of the army and the nation. One of these, and the most conspicuous, was Lanrezac. On the day of the battle of Guise, Joffre had visited his headquarters with the intention of relieving him of his command, but had thought better of it. Nevertheless, a few days later, on the eve of the battle of the Marne, Lanrezac was removed from his command, being succeeded by one of his corps commanders, General Franchet d'Espérey.

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[1] As regards the British, Sir Douglas Haig, commanding the I. Corps, promised coöperation, but was obliged by orders from Sir John French to withdraw the promise before the battle.

The justice of his dismissal was far too questionable for him to be relegated to unemployment. He served as an inspector-general of infantry-training till the end of the war, and retired on reaching the age limit.

After the war General Lanrezac published a short account of the Charleroi campaign and the retreat of the V. Army, which besides his personal justification contains important documentary material for the general history of the 1914 campaign. (*Le Plan de Campagne Français*, Paris 1920.)

LANSBURY, GEORGE (1859–), English Socialist, was born Feb. 21 1859, at Halesworth, Suffolk, where his father was engaged as a sub-contractor on the railway line between Ipswich and Yarmouth. When he was seven years old the family moved to London, and his childhood was chiefly spent in Whitechapel. In 1880 he was married to Elizabeth Brine, daughter of Isaac Brine, timber merchant. In 1884 they went with their three older children to Australia, returning in 1885, and soon afterwards settling in Bow, where their home has been ever since. Lansbury worked in the business of his father-in-law and was one of the first members of the Gas Workers' and General Labourers' Union—now the National Union of General Workers. In 1921 he had been a member of this union for 30 years, and for the greater part of this time one of its trustees. He began his political life at the age of 15 as a keen Radical, but subsequently became a convinced Socialist, a member of the I.L.P. and a member of the National Executive of the Labour party. He was a member of the Church Socialist League from its inception. He was first elected a guardian in Bow in 1892, was elected to the Borough Council in 1901 and was mayor of Poplar in 1919–20. As a member of the Royal Commission on the Poor Law he signed the Minority Report. He sat for three years on the L.C.C. In 1910 he was elected Labour M.P. for Bow and Bromley. He resigned his seat in 1912, in order to recontest it as a supporter of women's suffrage, and was defeated. He was defeated again in the general election in 1918. In 1913 he was sentenced to six months' imprisonment for a speech made at the Albert Hall, but was released after some days of hunger strike. He had helped to found the first *Daily Herald* in 1912 as a Labour organ, and he became its editor in 1913. The *Herald* became a weekly in September 1914, and reappeared as a daily in March 1919, its policy being extremist and even Bolshevist. In this connexion Mr. Lansbury visited Russia in 1920 and was accorded an interview with Lenin.

LANSDOWNE, HENRY CHARLES KEITH PETTY FITZMAURICE, 5TH MARQUESS OF (1845–), British statesman (*see* 16.184), had, during his tenure of office as Foreign Minister (1900–5), definitely set his mark on British foreign policy at a crucial period in history. The system which his predecessor, Lord Salisbury, had inherited from Lord Beaconsfield, of a general reliance on Germany and the Triple Alliance, had become no longer possible, in view of the unconcealed ill-will of Germany during the Boer War, and the German resolve to build a fleet sufficiently large to constitute a serious challenge to the British navy. During the South African War of 1899–1902 Great Britain felt all the disadvantages of isolation. If she could no longer rely on Germany, she had recently nearly come to blows with France over Fashoda, and her historical friction with Russia continued. Her isolation was equally marked in the Far East. Germany, Russia and France had forced Japan, after her Chinese war, to relinquish her conquest of the Liaotung peninsula. England had refused to join the other European Powers in their action, but had simply stood on one side and allowed them to work their will. Subsequently Russia had overrun Manchuria and seized Port Arthur; France had effected a favourable revision of her frontier in the Mekong valley, and Germany had seized Kiaochow. It is Lord Lansdowne's great title to fame that his five years' tenure of the Foreign Office rescued Great Britain from this position of peril, procured her an ally in the rising maritime Power of the Pacific, Japan, and in Europe established her on terms of friendship and mutual understanding with France, by clearing away all the sources of bickering between Paris and London. He shares this credit, indeed, with Mr. Balfour, who was Prime Minister 1902–5, and of whom he himself testified, in Nov. 1905, that there had never been a Prime Minister who had given closer and more unremitting attention to foreign affairs.

When the Duke of Devonshire resigned from Mr. Balfour's Government in 1903 Lord Lansdowne became the Unionist leader in the House of Lords, and though the fall of Mr. Balfour's Ministry in Nov. 1905 transferred him to the Opposition bench he remained the leader of the majority of that House until his resignation in Dec. 1916 at the close of Mr. Asquith's Coalition Ministry. His polished and courteous manner, his thorough acquaintance both with his work and with the idiosyncrasies of the peers, his cool temper and the sweet reasonableness of his expositions of policy speedily rendered his leadership most acceptable to his followers, in spite of the drawback, from the point of view of the Tory majority among them, that he was himself an old Whig. He rendered consistently patriotic support to the development by Sir Edward Grey of the foreign policy for which he himself had been responsible. In domestic politics he endeavoured, as far as possible, to limit points of difference with the Commons; but the measures of the Liberal Ministry inevitably brought about a conflict, which came to a head over Mr. Lloyd George's budget of 1909. In advising the Lords to reject it—as they did—he claimed that it was not an ordinary budget, but emphatically one that ought to be referred to the electorate to decide. Next year, however, he accepted the result of the general election of Jan. 1910 as making it obligatory upon the peers to pass the Finance bill. On the constitutional question he formed one of the abortive conference which met after King George's accession to endeavour to come to an agreed solution. He supported Lord Rosebery's Resolutions for the reform of the House of Lords, and, after the second general election of 1910 on the point of the Lords' veto, he brought forward in 1911, as an alternative to the Parliament bill, a scheme for reconstructing the Upper House, which, however, was dropped after a second reading. When the Parliament bill itself came up to the House of Lords he moved and carried, by 253 to 40, an amendment providing for a submission to a popular vote of bills affecting the Constitution or otherwise of great gravity. From that amendment he and his friends would not, he said, recede so long as they were "free agents." Ministers immediately announced that they would not accept the amendment, and that the King had consented to create, if necessary, sufficient peers to ensure the passage of the bill in its original form. Lord Lansdowne held that, after this threat of coercion, the peers had ceased to be free agents, and he therefore advised them to desist from further resistence. In this advice he was supported by Mr. Balfour; but a vehement opposition developed in the Unionist party, headed by the ex-Lord Chancellor, Lord Halsbury, and these "Diehards" were supported by such a large body of opinion that the bill was only carried eventually by 17 votes.

This episode gave a shock to Lord Lansdowne's authority both in his House and in the Unionist party, but he remained leader, though Mr. Balfour retired shortly afterwards and was succeeded in the leadership of the party in the Commons by

Mr. Bonar Law. He fought the Irish Home Rule bill and the Welsh Disestablishment bill strenuously on their successive appearances in the House of Lords, and procured their rejection by large majorities. But he was always ready for an agreement by consent over the Irish question, to avoid the "irremediable misfortune," the "overwhelming catastrophe," of civil war. He endeavoured to make the Government's Amending bill in 1914 more satisfactory by getting an amendment inserted to exclude the whole of Ulster from the operation of the Home Rule bill. When ministers would not accept this he became a member of the Buckingham Palace Conference as a last chance of a peaceful settlement.

The World War reduced all these issues to comparative insignificance, and Lord Lansdowne associated himself with Mr. Bonar Law in tendering at once their hearty support to the Government, as leaders of the Opposition, in rallying to the assistance of France and Russia. In 1915 he joined Mr. Asquith's Coalition Ministry without portfolio; and took the lead in pressing the military service bills on the House of Lords. He concurred in sanctioning Mr. Lloyd George's efforts, in the early summer of 1916, to find some satisfactory settlement of the Irish question, but he dissociated the Government from Mr. Lloyd George's actual proposals; and the failure to reach an agreement was largely attributed by Irish Nationalists to his insistence on the necessity of repressing treason and sedition. He retired from office at the close of Mr. Asquith's Ministry, the Unionist leadership in the Lords being then entrusted to Lord Curzon. In his retirement he got somewhat out of touch with public opinion, and published in the *Daily Telegraph*, in Nov. 1917, a letter in which, to the general surprise, he strongly advocated a negotiated peace instead of the policy of Thorough, on which the Ministry and the Empire were set. His ideas received hardly any support save from the small pacifist section. In subsequent years he took little or no active part in politics, his health having failed.

Lord Lansdowne's great and various services to his country were rewarded with the K.G., G.C.S.I., G.C.M.G., and G.C.I.E. He was a trustee of the National Gallery, and chairman of the Council of the British Royal Red Cross Society 1915–20. His own university of Oxford gave him an honorary degree; and so did Cambridge, McGill and Leeds. He had two sons and two daughters. His elder son, Lt.-Col. the Earl of Kerry (b. 1872), a soldier who won both the D.S.O. and the Legion of Honour, was in the Irish Guards, and served in the S. African War. He was a member of the L.C.C. in 1907, and was M.P. for W. Derbyshire 1908–18. He married in 1904 Elizabeth Caroline, only daughter of Sir E. S. Hope, and had a family. The younger son, Lord Charles G. F. Mercer Nairne (1874–1914), major 1st Dragoons, served both in the S. African War and in the World War, and was killed in action in France, Oct. 30 1914, leaving a widow and children. The elder daughter married the 9th Duke of Devonshire, and the younger married the 6th Marquess of Waterford, and, after his death, Lord Osborne de Vere Beauclerk. (G. E. B.)

LANSING, ROBERT (1864–), American diplomatist, was born at Watertown, N.Y., Oct. 17 1864. He graduated from Amherst in 1886, was admitted to the bar in 1889, and for the next 18 years was associated with his father in legal practice at Watertown. In 1892 he was appointed associate counsel for the United States on the Bering Sea Commission, and later was American counsel or agent before several important arbitral tribunals or mixed commissions, including the Alaskan Boundary Tribunal (1903), the Hague Tribunal for Arbitration of the North Atlantic Fisheries (1910), and the Anglo-American Commission (1911) for settling outstanding claims between Great Britain and the United States. He was technical delegate at several international conferences, including the fur-seal conference (1911) at Washington between the United States, Great Britain, Russia and Japan. In 1914 he was appointed counsellor of the Department of State. When Mr. W. J. Bryan resigned (June 8 1915) because of unwillingness to sign the second "Lusitania" note, Mr. Lansing was appointed Secretary of State *ad interim*, and his first official action was to sign that note. He was definitely appointed Secretary of State on June 23 1915. In Aug. he was attacked by the Friends of Peace, representing several societies, mostly German-American, who declared that he was liable to plunge America into war. In his attempts to uphold American rights he was called upon to direct notes to all the warring countries. On Oct. 18 1915, defining safety for crews in a note to Germany after the sinking of the "William P. Frye," he pointed out that it was not sufficient that Americans be given an opportunity to embark in life-boats; it must be under circumstances that assured landing in safety. A little later he sent a protest to England against the commercial blockade and the detention of cargoes bound for neutral ports. On Jan. 18 1916 he addressed a note to all the European belligerents, asking, for the sake of safety of those on board, that all guns be removed from merchantmen. He pointed out the disadvantage of a submarine in attempting to stop such an armed vessel for search, and emphasized that armament on a merchantman had every appearance of being offensive. In March this proposal was rejected by all the Allies. On Aug. 4 1916 he signed a treaty for the purchase by America of the Danish West Indies for $25,000,000. In reply to a note addressed by England to neutrals, asking that all belligerent submarines be excluded from neutral waters, he said that the nature of each submarine must govern the decision. He thus drew an important distinction between the "Deutschland," which had peacefully brought a cargo to America, and the U53, which had raided several ships off the New England coast Oct. 7 1916. In March 1917 he refused Government support to the proposed reorganization of the so-called "Six Power" loan for China. He declared that American bankers should not enter into agreement with foreign institutions which had more or less a Government connexion and might therefore have political as well as financial interest in the matter. The same year he notified President Carranza, of Mexico, that the United States would not adopt his proposed Pan-American plan of stopping the shipment of food and munitions to all the European belligerents. In Nov. 1917 he signed an agreement with Japan (the Lansing-Ishii agreement) which, while recognizing Japan's special interests in China, provided for a continuance of the "open door" policy for commerce.

He was a member of the American Commission to Negotiate Peace at Paris 1918–9, and, together with Lord Robert Cecil and Col. House, prepared a draft of the League of Nations in Jan. 1919. In a book issued in 1921 in justification of his own actions, Mr. Lansing explained that he disagreed with Mr. Wilson on various points, including that of incorporation of the League of Nations in the Peace Treaty; but he was overtly responsible with him for signing the Treaty, and on his return to Washington he urged that the Treaty as formulated be adopted by the Senate. On Feb. 13 1920 he resigned as Secretary of State on being reprimanded by the President for having called together the heads of the executive departments of the Government. Such meetings of the Cabinet had, however, frequently been called before during the President's illness, naturally by the Secretary of State as ranking member. Lansing's conduct at this juncture showed dignity and self-possession, and the action of the President was generally regarded as that of a sick and worried man. In Aug. 1920 he opened a law office in Washington. He was the author of *The Peace Negotiations* (1921) and *The Big Four and Others* (1921).

LAPWORTH, CHARLES (1842–1920), English geologist (*see* 16.208), died at Birmingham March 13 1920.

LASCELLES, SIR FRANK CAVENDISH (1841–1920), English diplomatist, was born in London March 23 1841, the third son of the Rt. Hon. William Saunders Sebright Lascelles by his wife Lady Caroline Georgiana Howard, daughter of the 6th Earl of Carlisle. He entered the diplomatic service in 1861. In 1867 he was secretary of legation at Berlin, and in 1871 was transferred to Paris as second secretary. After various more or less brief appointments, he went in 1879 as agent and consul-general to Bulgaria. He was created K.C.M.G. in 1886, and in 1887 was appointed minister to Rumania. In 1891 he went to Persia, but in 1894 was recalled from Teheran and sent as ambassador to Russia, where, however, he only remained a year, being transferred in 1895 to the court of Berlin. His period as ambassador to Germany opened in a singularly inauspicious manner, as in 1896 occurred the incident of the Kruger telegram, which naturally aroused great anger in England and rendered his position extremely difficult. After the storm had blown over, however, the relations of the British ambassador with the Emperor became of the most friendly and intimate character. He retired in 1908 and died in London Jan. 2 1920. He was made a privy councillor in 1894, G.C.M.G. in 1892, G.C.B. in 1897, and G.C.V.O. in 1904. He married in 1867 Mary Emma, the eldest daughter of Sir Joseph Olliffe, physician to the British embassy in Paris. He left, besides two sons, a daughter, who married in 1904 Sir Cecil Spring-Rice.

LATVIA.—The independent republic of Latvia (capital Riga) was proclaimed on Nov. 18 1918, and was recognized by the Supreme Council of the Allied Powers on Jan. 21 1921. Its territory comprises chiefly districts of the Baltic provinces of the Russian Empire, which linguistically or ethnographically belonged to the Letts, whence the name of Latvia as a new nation-state. Its area is approximately 25,096 sq. m., formed by: (*a*) four districts of Livonia (Riga, Wenden or Zehsis, Wolmar or Walmer, and Walk, with the exclusion of the chief town ceded to Esthonia), 7,900 sq. m.; (*b*) Courland, about 10,500 sq. m., both parts being united legally by the Russian law of April 12 1917 but actually since Jan. 1919; (*c*) districts of the province of Vitebsk, called Latgalia, 5,290 sq. m., with the towns of Riezhitsy (Rositten, Resekna), and Lutzin (Ludze), obtained by force of arms from Soviet Russia (Art. 2 of the Russo-Latvian Treaty, Aug. 11 1920), with the town of Dvinsk (Dünaburg, Daugapils) obtained by agreement from the Poles. Rectifications of the frontiers with Lithuania, with regard to the coast of Polangen and the zone near Illuxt, were still in process in 1921.

Population.—According to the census of June 15 1920 the population of Latvia was less numerous and homogeneous than was anticipated in 1918, amounting in all to 1,515,815 inhabitants, of whom 1,146,554 were Letts and 355,518 belonged to other nationalities (Livonia, 477,839 Letts and 104,091 non-Letts; Courland, 404,159 Letts and 71,524 non-Letts; Latgalia, 264,556 Letts and 179,103 non-Letts), the non-Letts thus forming about 25% of the total population. These so-called "minority" nationalities were: Russians, Germano-Balts (Balts, Balto-Saxons), Jews, Lithuanians, Poles. In consequence of the political events the number of resident Russians and Balts was in 1921 decreasing, though the number of Russian refugees was considerable. The losses of the Letts were due to: (*a*) the evacuation of the factories by the Russian Government; (*b*) the partly forced removal of the population of Courland before the German advance; (*c*) the wars. In 1916–7 there were 735,000 Lettish refugees in Russia, and 250,000 men aged 20–40 are supposed to have perished between 1914–20. During 1920 and the first two months of 1921 134,000 returned to Latvia, of which 94,000 entered Latvia from Russia, while only 6,400 left for Russia.

Education, in those parts of Latvia where it was standardized by the Protestant Church and Baltic régime, remained on a higher level than in Latgalia with only 38% able to read. The census of June 1920 gave instructive figures: 69·82% able to read, children below 10 years included; 50% able to read and write. The percentage of literacy according to nationalities was: Germano-Balts 85, Esthonians 82, Poles 78, Letts 74, Jews 72, unknown 60, Lithuanians 55, Great Russians 36, others 33, White Russians 32. In Sept. 1919 the Polytechnic Institute of Riga was converted into the Latvia University. Lectures are delivered in Lettish, Russian and German, and nearly all the staff is Latvian. Students on March 1 1921 numbered 2,111 men and 1,145 women, 2,328 students being Letts, 803 minority nationalities, 125 foreigners. In 1912 in the corresponding area there were 98 secondary schools with 22,600 pupils, one per 26,000 inhabitants (in Germany one per 54,000). Compulsory and gratuitous schooling for the Protestants had been enforced in Livonia since 1860, and in Courland since 1875.

Religion.—Seventy-five per cent at least of the Letts are Protestants, but there is a Catholic majority in Latgalia and a number of Greek Orthodox among the Letts. The organization of the Protestant Church was formerly connected with the corporation of the nobles of Livonia and Courland, but the rights of presentation pertaining to the manorial estates of the knights and to the Government estates have been abolished by the introduction of a democratic free church.

Occupations.—The pre-war growth of industries, especially in Riga and Libau, tended to reduce the percentage of the agricultural population, but agriculture is still the chief occupation, and the redivision of the rural population was the outstanding feature after 1918. (*a*) The large landowners, owning about 1,899 estates (of these 310 were in Latgalia), mostly Balts and gentry ("Baltic barons"), were expropriated (Land Act, Sept. 16 1920); (*b*) about 40,000 owners of small holdings, averaging from 26 to 150 ac., formed the backbone of the Lettish middle class, and the liberal professions (nicknamed the "grey barons") were partly supported by about 10,000 tenants of small farms; (*c*) the owners of very small holdings in Latgalia and Courland numbered some 10,600. Of the agricultural proletariat two-thirds were employed by small owners and one-third by the owners of large estates. This class, who desired to own their own land, were believed to have been won over and pacified by the expropriation of the owners of the large estates. In the territory of Latvia the creation of peasant proprietorship was secured before the war in different ways: (*a*) on the manorial estates; (*b*) on the Government estates; and (*c*) in Latgalia, on the Russian system.

Effects of the World War.—The losses suffered by Latvia from evacuation, war, occupation, invasion and Bolshevik rule almost ruined her beyond hope; the official statistician Skuieneeks estimated in 1920 that it would take 50 years to bring her back to the pre-war level. In 1920 there were only 17,606 workers and employees in private industrial enterprises, 988 in municipal enterprises, and 2,880 in state enterprises; in Riga alone, 9,739 in private enterprises against 62,000 in 1914. In Jan. 1913 Riga numbered 517,522 inhabitants, in Aug. 1917 210,590. According to the census of 1920, of 609,475 buildings in the rural districts 84,163 had been completely destroyed and 117,015 partly. In 1920 there were 238,736 horses, 730,421 cattle, 934,084 sheep and 457,052 pigs, against 297,645 horses, 940,319 cattle, 1,100,481 sheep and 538,920 pigs in 1913. Of the total area of arable land, *i.e.* 4,091,490 ac., only 2,978,570 were under cultivation in 1920, with 473,410 ac. under winter rye against 862,400 in 1913. The total losses suffered by private citizens and corporate societies until the advent of Bolshevism is valued at 1,930,000,000 gold rubles; Soviet Russia inflicted losses to the amount of 953,000,000 gold rubles; German occupation and warfare to that of 481,000,000 marks. Through confiscation of money, and deposits in banks removed to Russia, cancellation of shares, destruction of private and public bonds, and loss of interest, a loss of 379,000,000 gold rubles was caused by Russia, and 6,000,000 marks by Germany. Courland during the advance of the German army lost two-thirds of the population, which began to return after the Brest Litovsk Peace in 1918. In 1916–7 there were 735,000 Lettish refugees in Russia. Lettish man-power suffered more particularly. Soviet Russia found many soldiers among the Lettish refugees, and retained the Lettish rifle division which had fought during the war. In Aug. 1913–4 there were 550 engines and 18,000 carriages and trucks, 3,000 telegraph and 800 telephone apparatus; on Aug. 5 1919 only 25 engines, 64 carriages and 2,023 trucks, 49 telegraph and 28 telephone apparatus were left. Only 11 engines were working. Trade was therefore still a mere fraction of what it was before the war. Both industry and commerce were largely dependent on foreign (German, Baltic and Russian) capital, and agriculture on large and small agricultural enterprise constantly and rapidly growing. The German industrial capital in Riga amounted to 40,000,000 rubles before the war. The arable land in Livonia covered 15·28% in 1866, 16·52% in 1881, 26·65% in 1911. What the war and revolution had left of the large farms, subsequent agrarian legislation further damaged; and in 1921 the Latvian state was still struggling against the dislocating effects of war and revolution, and its finance and commerce were seeking new methods of reconstruction. The rate of exchange had become adverse (by May 1921 £1 = 1,850–1,900 Latvian rubles), and imported goods were getting more and more expensive to the consumer. The returns for 1920 show that 805 ships left Libau, 751 Riga and 123 Windau. British tonnage held the first place, German the second and Danish the third.

Resources.—The natural resources of Latvia are mainly timber and agricultural produce. Brown coal has been discovered in Courland, while peat is already a valuable fuel.

History of Latvian Independence.—With the outbreak of the World War in 1914 a prospect of some kind of national existence opened out to the Lettish *intelligentsia,* whose antipathy to Germany did not imply a readiness to die for Russia. They rose in order to fight for their own rights, liberties and land. The immediate object was to overthrow Russian administrative supremacy and to emancipate themselves from the Baltic barons. Great political skill was displayed in finding subsequently support against both. Libau was taken on May 7 1915 by the Germans; the rest of Courland, with one-third of its former population left, was occupied, and German preponderance materialized. The Russian Government permitted the formation on July 13 1915 of a Lettish rifle division 50,000 men strong. During the winter of 1916–7 these volunteers experienced heavy losses; after the Russian revolution in March 1917, Bolshevik sympathies spread among these troops and large sections of the people, while on the other hand national aspirations united the Farmers' Political League (40,000 members), headed by K. Ulmanis, with numerous Letts abroad and in Russia. Even after the fall of Riga (Aug. 20 and the supplementary treaty Aug. 27 1917) this action was continued as opposed to the policy of the leading Balts (Sievers, Oettingen, Baron Pilar, Stryck), who were alarmed by the Bolshevik upheaval, the congress of the landless workers at Wolmar (Dec. 16–19 1917), the outrages of the Russian soldiery, the impotence of the more moderate Letts, the universal anti-German feeling, the danger to life and property, and obtained the occupation of the whole region up to Narva by German troops, thus aiding and abetting the Germans in their plans of domination. The Bolsheviks, on their retiring from Wenden and Walk (Feb. 1918), carried away hundreds of hostages, chiefly Balts, to Siberia, some of whom were shot, whilst others were repatriated later. The German occupation did not prevent the Lettish National Council, on June 26–29 1918, from claiming the reunion of all Lettish territories in accordance with the protest addressed to the German Chancellor on April 4. On Nov. 11 Z. A. Meierovich received from the British Cabinet a favourable reply to his appeal of Oct. 30 on behalf of Lettish independence. Immediately after the collapse of Germany, on Nov. 23, independence was declared, and K. Ulmanis was elected president.

Wars for the Liberation of Latvia.—The German retreat could not be prevented by the provisions of the Armistice (Nov. 11, Art. XIII.); and Ulmanis, under the pressure of a Bolshevik invasion and Bolshevik influence among the Letts, did not succeed in forming an anti-Bolshevik Lettish defence force, but on Dec. 7 consented to the creation of a Baltic *Landeswehr.* Lettish units were shelled on Dec. 30 from a British mine-layer in the harbour of the new capital—Riga. The Baltic volunteers were defeated by the Bolsheviks on Dec. 29 at Hintzenberg; and since the agreement made on Dec. 29 by Ulmanis with the German representative, the Socialist Winnig, did not attract a sufficient number of volunteers from Germany for the formation of an Iron Div., Riga fell on Jan. 3, the British squadron leaving with 500 refugees on board, including members of the new Latvian Government. A Bolshevik Government headed by Shtuchka was installed in Riga. The Baltic *Landeswehr* retired behind the Windau river, and, reënforced by German volunteers, a Russian (Private A. Lieven) and a Lett (Col. Ballod) unit took in Feb. Goldingen and Windau, in March Kandau, Zabeln, Kabillen and Tukkum. By March 18 the Bolsheviks were thrown back over the Aa river. Libau formed the base; Germany furnished the supplies; the Balts (Baron Pilar, Baron Rahden) undertook the leadership. The liberation was thus made dependent on the goodwill of Germany. Ulmanis, confined on the steamer "Saratov" at Libau, had no fighting force at his disposal, and his attempts to call the population to arms were opposed as pro-Bolshevik manœuvres. The murder of three men of the Baltic *Landeswehr* led to the *coup* of April 16 1919, by the proclamation of the Government of a Lettish clergyman, Needra. Parleys, in which the United States and England took part, did not prevent the advance on Riga and the liberation of this city on May 22, where Baron H. Manteuffel made an entry with a small detachment, and died leading his men. The Bolsheviks, having killed a number of imprisoned "bourgeois," abandoned the city and the whole region after heavy losses. It now appeared necessary to the Entente Powers to avert Baltic and German preponderance in Latvia as a consequence of the military situation, and the policy of non-intervention was abandoned in favour of Ulmanis' Government. The Baltic *Landeswehr*, unsupported by the other units, were engaged with Esthonian and Lettish forces near Wenden, and were defeated. The Esthonians were hailed as liberators of Riga by the Lettish Assembly. The German volunteers, forming about 15%, had to evacuate according to the armistice of July 3, losing the advantages of the Dec. agreement. The *Landeswehr*, under an English officer, Col. A. R. Alexander, became a unit of the Lettish army (Olai agreement on July 15 1919) to be formed by Gen. Ballod, and had now to own allegiance to the Ulmanis Government, while the Russian volunteers were transferred to the Narva front. But the Ulmanis Cabinet was not as yet the sole ruler of Latvia, the Bolsheviks holding Latgalia, and a Russo-German force under Bermondt-Avalov preparing an advance against the Bolsheviks across Latvian territory, a plan adopted at a Riga conference on Aug. 26 presided over by Gen. March, but later abandoned. Bermondt's army in Aug. numbered 10,000 men. The Lettish Government decided to stop the advance on Dvinsk and Rezhitsa at any cost, as a danger to Latvia's independence, and succeeded in obtaining British and Esthonian support. Bermondt, having refused to join Gen. Yudenich's army on the Narva front, decided to advance and to occupy the Duna line, after small skirmishes with the Letts. On Oct. 9 the fighting began; Riga was shelled for five weeks. By Dec. 1919 what had been regarded as a Russo-German danger was averted, the Russian volunteers on the left flank having suffered heavily from the English gunfire. The German mercenaries evacuated Courland by Jan. 1920 and vented their disappointment at the non-fulfilment of the promises made them by devastations. On the eastern front the Bolshevik danger was also overcome. Dvinsk was taken by the Poles, and Rezhitsa (the main town of Latgalia) by the *Landeswehr*, who advanced to Rozhanova. One-quarter of the opposing Bolshevik army were Letts; Gen. Ballod's Lettish troops played a minor part on this front.

The New Government.—The result of the operations consolidated the Latvian Government. On Feb. 18 the Bolsheviks made peace overtures, and Latvia was prepared to negotiate. The *Landeswehr*, having been the chief instrument of freeing Latvia from the Reds, was reorganized (March 10 1920), and Col. Alexander departed. The elections for the Constituent Assembly took place on April 18, and negotiations with Germany for reparation were opened. On Aug. 11 1920 the Russo-Latvian peace treaty was signed, following the agreement of June 20 1920 regarding the reëvacuation of war refugees, of whom about 100,000 were supposed to be in Russia. Riga and the other towns were provided with foodstuffs by the United States.

The Russo-Latvian treaty granted to Latvia: (*a*) an ethnographic frontier; (*b*) the restoration of confiscated property; (*c*) an advance payment of 4,000,000 gold rubles (=£1,200,000) on account of the returnable securities; (*d*) a timber concession of 260,000 ac., in order to assist the peasantry to reconstruct their buildings; (*e*) amnesty for Latvian citizens; and (*f*) non-liability for Russian state debts. Soviet Russia, represented by A. Joffe and J. Ganetsky, obtained: (*a*) the disarmament of anti-Bolshevik forces in the territory of Latvia; and (*b*) favourable transit conditions. The amnesty was not to be extended to the participators in the *coup* of April 16 1919 and the Bermondt campaign. The security offered by this treaty was further guaranteed by the formation of a regional league of the Baltic states against external aggression.

The Constituent Assembly convened in 1920 was still at work in 1921. The question of the rights of the national minorities and the enforcement of the Land Act were among the problems of the day that led on June 3 1921 to the fall of the Cabinet of Ulmanis. The recognition of Latvia by the Supreme Council at Paris on Jan. 21 1921 was one of the numerous achievements of Latvian diplomacy; but an attempt against the life of the ex-Premier Ulmanis and the opposition of the Social Democrats and Communists showed that the pacification necessary for a work of reconstruction had not yet been accomplished.

By the Land Act of Sept. 1920 (passed in order to curtail the power of Baltic landowners) a State fund was created with a view to forming new holdings and increasing the size of the minute holdings, and "in order to satisfy the requirements of economic enterprises, social and cultural institutions and to enlarge the areas of towns and villages." With the State fund are incorporated all large estates, small farms not yet purchased by the occupants and lands acquired by colonization companies, foreign banks and similar bodies. Along with the land are expropriated all claims and rights appended to the land and all instruments of husbandry, live stock included, with the exception of such industrial establishments as are not working to satisfy the local rural demand only. A portion of the estate, equal in size to the average holdings, is left to the owner, without, however, the proviso that this portion must necessarily coincide with the administrative centre, the manor or family house. Lands with an acreage below 246 ac. are not expropriated. The churches retain land not exceeding the average size of a holding, including the buildings. The owners of the expropriated properties are given a term of five months for the removal of their furniture. Liabilities arising out of agreements concluded after May 6 1915 are null and void if not sanctioned by the Government. All contracts of lease, exploitation of forests, waters and natural riches are cancelled. Firewood and timber felled during the period of the German occupation fall to the State. Compensation for the expropriated land and the categories of land to be expropriated without compensation will be determined by a special law. The local market price will form the basis of the indemnity for the live stock and implements to be expropriated. Though radical enough, this Land Act was still not sufficient to satisfy the groups which came into political power on June 3 1921. Foreign Governments lodged protests against their subjects being dispossessed before obtaining adequate compensation. About 160 estates were not to be subdivided, but preserved as funds for schools, hospitals, local institutions, etc.

See *The Latvian Economist*, published monthly in Riga since May 1920. (A. M.)

LAUDER, SIR HARRY MACLENNAN (1870–), British variety actor, was born at Portobello Aug. 4 1870. He was first a mill-boy in a flax mill at Arbroath, then a coal-miner, and finally took to the variety stage, where he soon became a great favourite on account of his Scotch songs, written and composed by himself on folk-song foundations and sung in character. In this career he earned enormous fees, and made a large fortune. During the World War he worked hard to assist recruiting, and the death in action of his only son in 1918 elicited widespread sympathy. He was knighted in 1919. Early in 1921 he had a season of his own at the Palace theatre, London.

LAUGHTON, SIR JOHN KNOX (1830–1915), English naval historian, was born at Liverpool April 23 1830, and was educated at the Royal Institution school, Liverpool, and Caius College, Cambridge. In 1853 he entered the navy as an instructor, and served during the Crimean War, afterwards entering the Mediterranean and Channel fleets successively. In 1866 he became instructor at the Royal Naval College, Portsmouth, and in 1873 was transferred to the Royal Naval College, Greenwich. In 1885 he was appointed professor of modern history at King's College, London, a post which he held until his death. In 1893 he founded the Navy Records Society, of which he became secretary, retiring in 1912. He was knighted in 1907. Sir John Laughton was also a distinguished meteorologist, and from 1882 to 1884 was president of the Royal Meteorological Society. His numerous writings include *Physical Geography in its Relation to the Prevailing Winds and Currents* (1870); *A Treatise on Nautical Surveying* (1872); an edition of Nelson's letters and despatches (1886); *Studies in Naval History* (1887); *Nelson* (in "English Men of Action," 1895); *Nelson and his Companions in Arms* (1896); *A Life of Henry Reeve* (1898); *From Howard to Nelson* (1899), and *Sea Fights and Adventures* (1901). He died in London Sept. 14 1915.

LAURANCE, SIR JOHN COMPTON (1832–1912), English judge, was born in Lincs. May 30 1832. Called to the bar in 1859, he became Q.C. in 1877 and recorder of Derby in 1879. In 1880 he was returned to Parliament as Conservative member for S. Lincs., and in 1885 was elected member for the Stamford division. He was made a judge in 1890, retiring in March 1912. He died in London Dec. 5 1912.

LAURIER, SIR WILFRID (1841–1919), Canadian statesman (*see* 16.286*). In Jan. 1911 Sir Wilfrid Laurier was still Premier of Canada and had begun the official negotiations for reciprocity with the United States which were to bring about his fall. He was strongly opposed in the Dominion House of Commons. The terms of the agreement, announced in Parliament Jan. 26 1911, were debated throughout the session. Finally, on July 29, Laurier dissolved Parliament and in the ensuing general elections was decisively defeated. He never again held office, though, with the outbreak of the World War in 1914, he came once more into political prominence. No one could more eloquently have urged the justice of Great Britain's cause, or the whole-hearted determination of Canada to take her part in the struggle. But he did not see eye to eye with the Borden Ministry on the question of levies for compulsory foreign service, and in July 1917 he declined Sir Robert Borden's invitation to join a Coalition Cabinet. He died at Ottawa Feb. 17 1919.

LAVERY, SIR JOHN (1857–), British painter (*see* 16.293), was knighted in 1918. Among his works since 1910 are portraits of Mr. Winston Churchill, Mr. H. H. Asquith, Lord Derby, Mr. John Redmond and Sir Edward Carson, besides "The Madonna of the Lakes"; "Canadians Embarking on the Western Front"; "Sir David Beatty Reading the Terms of the Armistice to the German Delegates" and "Fore Cabin, H.M.S. 'Queen Elizabeth,' Rosyth, Nov. 1918." He also painted a number of naval pictures of the fleet at Scapa Flow, which he presented to the Imperial War Museum.

LAW, ANDREW BONAR (1858–), British statesman, was born in New Brunswick, in Canada, on Sept. 16 1858, the son of a Presbyterian minister, the Rev. James Law, by his marriage with Eliza, daughter of William Kidston of Glasgow. Though his early life was passed, and his education begun, in Canada, he, a Scot on both sides, came to Scotland when still a boy, and finished his schooling at the Glasgow high school. He entered at once into commercial life in Glasgow, and became a member of a kinsman's firm, William Kidston & Sons, iron merchants, subsequently joining William Jacks & Co., iron merchants. His success as an iron merchant led to his becoming chairman of the Glasgow Iron Trade Association. But success in business did not satisfy him. He retired with a sufficient competence, and went into Parliament in 1900 as Conservative and Unionist member for the Blackfriars division of Glasgow. His experience in business had led him to the conclusion that Free Trade, in the Cobdenite sense, was no longer beneficial for Great Britain. He made a distinct impression on the House by a speech on April 22 1902, in favour of Hicks-Beach's corn duty, which was imposed in order to find money to carry on the Boer War. In that speech he predicted that, if the cry for protection were again seriously raised in Great Britain, it would not be in the interests of agriculture, but in those of working men, who saw their employment disappearing. The speech so much impressed Mr. Balfour that he introduced Mr. Law into his Government as Parliamentary Secretary of the Board of Trade; and Mr. Joseph Chamberlain's Tariff Reform movement, which was started in the following year, showed how right Mr. Law was in his diagnosis of the future. As the movement proceeded, Mr. Law was regarded as, along with Mr. Austen Chamberlain, the most decided Tariff Reformer left in the Ministry after Mr. Chamberlain's resignation. When he was accused by the Liberals in 1904 of being a Protectionist, he explained on Feb. 9 that he wanted, like Cobden, to improve foreign trade, but adapted his means to present conditions. The Government did not object to imports as such, but wished to see more raw material and fewer manufactured goods. He dwelt on the injury to the working classes caused by "dumping" and unfair foreign competition. He made several speeches in the country in this year and the next, of which the gist was that British trade policy must be relative to circumstances, which had wholly changed from what they were in Cobden's time. He saw the true field for commercial expansion within the Empire, and therefore advocated preferential duties.

There is no doubt that he chafed, in these years, at the slow rate at which his chief, Mr. Balfour, moved in the direction of Tariff Reform; but, though he would have preferred a more whole-hearted acceptance of Mr. Chamberlain's programme, he remained loyal to the Prime Minister. He shared in the general rout of the Unionists in Jan. 1906, but returned to Parliament in May for Dulwich at a by-election. The withdrawal of Mr. Chamberlain from active work in Parliament, owing to ill-health, left the stalwart Tariff Reform Ministry without a leader; his son, Mr. Austen Chamberlain, was his natural representative; but Mr. Law, by a series of fighting speeches both in the House and in the country, made himself particularly congenial to the more prominent members of that section. In 1907, the year of the Imperial Conference, he pleaded strongly for Colonial Preference, a policy against which, in spite of the support which it obtained from Dominion Ministers, Sir Henry Campbell-

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**** These figures indicate the volume and page number of the previous article.***

Bannerman's Government set its face. He denounced Mr. Lloyd George's famous budget of 1909 as vindictive and socialistic. In the new Parliament returned in Jan. 1910 Mr. Austen Chamberlain and he had the satisfaction of mustering 254 votes (against only 285) in favour of a Tariff Reform amendment to the Address. He left his constituency to fight N.W. Manchester in the election of Dec. 1910, but failed to capture the seat. He returned to Parliament, however, in a by-election for Bootle in March 1911, in time to take his share in the fight over the Parliament bill. But he kept aloof from the "Diehard" movement, and warmly defended his leader, Mr. Balfour, from the reproaches cast upon him. This loyal attitude, no doubt, was one of the reasons, and his strong Tariff Reform programme was another, which recommended him to his party as Mr. Balfour's successor in the leadership when the claims of Mr. Austen Chamberlain and Mr. (afterwards Lord) Long appeared to divide the Unionists pretty evenly. Both the rivals stood aside, and on Nov. 13 1911 Mr. Law was unanimously elected Leader in the Commons, Lord Lansdowne continuing to lead the party in the Lords.

He remained leader for nine years and a few months, the first three years and a half in Opposition and the rest in office. He was very trenchant in his criticism of the Government; thus giving satisfaction to ardent spirits in the Unionist ranks, but causing ministerial speakers to contrast his bitterness and violence with Mr. Balfour's quieter methods. He led a strong fight against the ministerial bills introduced to take advantage of the Parliament Act, and protested vehemently against the relentless closure by which they were driven through the House of Commons. He accused ministers of violating two fundamental conditions of representative government: that the Ministry should not ride roughshod over the minority, and that they should make no vital change till it was clearly desired by the majority of the people. Of the Welsh Disestablishment measure he said that a meaner bill, or one brought forward by meaner methods, had never been placed before the House; in view of the growth of materialism, he protested against depriving a spiritual organization of its funds. But his principal concern was the Home Rule bill and the situation created by it in Ireland. Before it was introduced he went to Belfast in Easter week, and at a great demonstration, presided over by Sir Edward Carson, encouraged the Ulstermen to trust to themselves; Belfast was again, he said, a besieged city; the Government by the Parliament Act had erected a boom against them—they would burst that boom; and it would be said of them that they had saved themselves by their exertions, and would save the Empire by their example. After nearly four months of strenuous opposition to the bill in Parliament, he renewed and strengthened his encouragement to Ulster by declaring, at a large Unionist gathering at Blenheim on July 27, that the Ulster people would submit to no ascendancy, and that he could imagine no lengths of resistance to which they might go in which he would not be ready to support them, and in which they would not be supported by the overwhelming majority of the British people. The Ulster Covenant was adopted in the following Sept.; and, in the course of the prolonged fight in Parliament in the autumn and winter over the bill, Mr. Law took occasion to say that his words at Blenheim were deliberate, written down beforehand, and that he withdrew nothing. Government, he maintained, had no moral right to force through a revolution. When Sir E. Carson moved on New Year's Day 1913 to exempt Ulster from the operation of the bill, Mr. Law defined his position thus. If the bill were—as he claimed it should be—submitted to the electors and approved by them, he and his party would not encourage Ulster to resist. But if it was forced on Ulster he would assist in the resistance. In spite of his efforts the bill was carried through all its stages by an unbroken phalanx of Liberals, Labour men, and Nationalists, showing a majority in important divisions of 110; and was only rejected by the Lords in the early months of 1913.

Meanwhile Mr. Law had to encounter difficulties among his own followers. The two branches of the party, the Conservatives and the Liberal Unionists, had indeed been fused, in May 1912, into one party with a combined national Unionist organization. But the present differences were not on the old lines, but on the extent to which the policy of Tariff Reform should be carried. Mr. Law and Lord Lansdowne announced in Nov. 1912 that they no longer held themselves bound, by the policy advocated by Mr. Balfour before the second election of 1910, to submit the first Tariff Reform budget to a referendum. At once a large section of Unionists, especially in Unionist Lancashire, became alarmed lest their electoral chances should be jeopardized by the prospect of food taxes imposed without reference to the people. Mr. Law endeavoured to reassure these doubters by a speech at Ashton-under-Lyne on Dec. 16. He refused altogether to haul down the flag of Tariff Reform; it was his policy to give British workmen a preference, both in the home and in the colonial market; but he said that a Unionist Government did not intend themselves to impose food duties. What they would do would be to call a colonial conference; and they wished to be authorized to meet colonial views if in the conference the colonies considered a duty on wheat to be necessary. This declaration did not satisfy the free fooders; but there was a general disposition to compromise the question without injuring the unity of the party. Finally, on Jan. 14 1913, in answer to a memorial from the bulk of the Unionist M.P.'s—a memorial which wished for a reassurance as to food duties, but strongly deprecated a change of leadership—Mr. Law announced that he and Lord Lansdowne were willing to agree that food duties should not be imposed without the approval of the electorate at a subsequent general election; and to remain leaders in deference to their followers' appeal, in spite of the party's disregard of their advice. After this declaration the unrest in the party gradually died down.

Mr. Law maintained his stout opposition to the Home Rule and Welsh Church bills on their second and third appearances in the sessions of 1913 and 1914. But in the course of 1913 he found that, partly no doubt owing to his insistence, Ministers began to appreciate the serious difficulty to Home Rule presented by Ulster's determined attitude. Accordingly he stated in the House that Unionists would welcome an Irish settlement by general consent, but would not make new friends by betraying old; and in Oct., in answer to Mr. Asquith's overtures at Ladybank, he said that he and his colleagues would consider any proposals with a real desire to find a solution if possible. If there were not such a solution, he foresaw national disaster and ruin. He attended a great demonstration in Dublin on Nov. 28 and declared then that Ulster would not submit, and the Unionist party would not allow her to be coerced. He did not find in Mr. Asquith's proposals, in the session of 1914, for exclusion by county option for six years, any sufficient compromise; but he formally announced that, if they were endorsed by the country, Lord Lansdowne would use his authority in the Lords to have them passed without delay. The offer was not accepted, and Mr. Law, though he joined the Buckingham Palace Conference in a last hope of aiming at a reasonable settlement, was anticipating the immediate outbreak of civil war in Ireland when the World War supervened.

He had always been anxious for good relations with Germany, provided that they were not attained at the expense of France; for, like Sir Edward Grey, he based his whole foreign policy on the maintenance of the Entente, and therefore supported the Foreign Secretary steadily against Radicals and Labour men and Nationalists. The only quarrel he had with the increased armaments proposed by Mr. Churchill was that he doubted whether they were adequate. Accordingly, directly the crisis became acute, he wrote, on Sunday Aug. 2, on behalf of Lord Lansdowne and their colleagues, tendering to Mr. Asquith the unhesitating support of the Opposition in any measures necessary to support France and Russia; and he warmly welcomed Sir E. Grey's speech of Aug. 3, which converted the country to the justice and inevitableness of war. Not only did he render a steady support to Ministers in Parliament; but he aided the national cause and promoted recruiting by speeches at Guildhall, in Belfast and elsewhere; and even when criticism of the mismanagement of the war began legitimately to raise its head in the early months of 1915, he used his influence, in the national interest, to repress or moderate its expression in Parliament. The tenor of his speeches was always to encourage Ministers in vigorous action—on such questions, for instance, as the mobilization of industry, the treatment of aliens and the provision of munitions. In spite, therefore, of the vigour, or even violence, of his opposition before the war, it was comparatively easy for Mr. Asquith to approach him in May 1915 with a view to the formation of a National Coalition Government, and for him to respond with immediate acceptance. He believed, he subsequently told a Unionist audience, that the Opposition could have turned out the Government at this time owing to the indignation about the shortage of munitions; but that would have meant an election and renewal of party feeling, and so have prevented the concentration of effort on the war. He brought seven of his colleagues into the Cabinet with him—Lord Lansdowne, Mr. Balfour, Mr. Austen Chamberlain, Mr. Long, Lord Curzon, Lord Selborne and Sir Edward Carson—and he himself took the Secretaryship of State for the Colonies. This was an office which, however congenial to Mr. Law with his colonial birth and his belief in Colonial Preference, did not bring him much into the limelight; and, influential as he was in the councils of the Ministry, in public he was content to play a comparatively subordinate part. To his loyalty to his chief, during their 18 months' association, Mr. Asquith himself subsequently bore emphatic testimony. While the controversy on compulsory military service was raging in the late autumn of 1915, he stated his own view to be that it was a better system than the voluntary system, but could only be gained at too high a price—namely, the price of national unity. But when circumstances had overcome Mr. Asquith's antipathy to compulsion, Mr. Law took charge of the first military service bill in the House of Commons in Jan. 1916, and got it through all its stages with little difficulty. Another policy which he threw his energies into carrying out was the utilization of the economic forces of the Allies in the prosecution of the war. He promoted the Economic Conference in Paris in June 1916, and represented his country on the occasion, with Mr. Hughes, the Australian Premier, and Lord Crewe as his colleagues. He cordially concurred in the coöperative and protective resolutions then adopted (*see* ENGLISH HISTORY) and joined Mr. Asquith in recommending them to the House of Commons. He was a member of the War Committee of the Cabinet, but, like Mr. Lloyd George, he was far from satisfied with its organization and powers. It was natural, therefore, that he should be one of the four persons (the others being Mr. Lloyd George himself, Sir Edward Carson, and a Labour member) to whom Mr. Lloyd George, forcing the issue on Dec. 1, asked Mr. Asquith to confide the absolute conduct of the war. The crisis started by this demand produced, in the course of a few days, first Mr. Lloyd George's and then Mr. Asquith's resignation; and the King, adopting the ordinary constitutional course, sent on Dec. 5 for Mr. Bonar Law, who had become, through by-elections before the war, the leader of the largest single party in the House of Commons, and invited him to form an administration. He took the view that for the due prosecution of the war a Coalition Government was necessary. He could count on the assistance of Mr. Lloyd George, but Mr. Asquith and his principal Liberal colleagues refused their coöperation. Moreover, he felt that Mr. Lloyd George was the Minister whom the country demanded. So he resigned his commission, and on Mr. Lloyd George's acceptance of the premiership he promised full coöperation from his party.

In this second Coalition Mr. Law's position was much more considerable than in the first. His followers supplied the main body of its supporters; and he himself was rather the partner of his chief than his second-in-command. He became not merely Chancellor of the Exchequer, but also leader of the House of Commons, the Prime Minister concentrating his energies on the work of the War Cabinet (*see* ENGLISH HISTORY), the supreme directing authority, of which Cabinet Mr. Law was also a member, though he was not expected to give regular attendance. At first the House of Commons was disposed to resent the apparent neglect with which it was treated by being asked to accept a deputy as its leader in place of a Prime Minister who was himself an M.P.; and cries for "Lloyd George" were raised when Mr. Law rose to play the leader's part in the debate on the Address in 1917. But the respect and, after a while, even the affection of the House were won by his business habits, his courtesy, his readiness to yield on non-essentials coupled with firmness in essentials, his exceptional clearness of head and of expression, and his extraordinary capacity for impromptu reply, without taking a note, at the close of a long debate on an intricate subject involving perhaps complicated figures.

It was his duty to obtain votes of credit from time to time from Parliament to carry on the war; and in the two years for which this Government was responsible the total voted amounted to more than £5,500,000,000, as compared with some £3,200,000,000 during the preceding period of two years and four months. But of course it must be remembered that not merely were munitions provided in 1917 and 1918 on an unprecedented scale, but that prices had risen enormously until, towards the close of the war, they were about double those of four years before. As Chancellor of the Exchequer Mr. Law had to find the money to meet this gigantic cost. This he did principally by means of two great loans, and by immense increases of taxation. The first loan was launched in Jan. 1917, and its basis was the issue of a 5% Government stock at 95; but there was also a 4% tax-compounded loan issued at par, and there were various provisions for conversion of certain previous issues. It brought in the enormous sum of £1,000,312,950 from no fewer than 5,289,000 subscribers; and Mr. Law justly hailed it both as an expression of the will of the people to win the war and also as evidence of the financial ability of the country to see it to a successful conclusion. The second loan, which was launched in Oct. of the same year, was of a new and ingenious character. The title of the issue was National War Bonds, and it combined the advantages of short-term securities, such as Exchequer bonds, and three sorts of longer-dated securities for seven and ten years. The interest was, as before, 5%, or 4% "tax-compounded," and elaborate and comprehensive rights of conversion were given. The amount was unlimited; all the securities were for continuous sale till further notice. Mr. Law explained that his hope was that the new War Bonds would lead to a steady and persistent flow of money loaned to the State without the financial dislocation inseparable from a great loan. His hope was justified. Interest was stimulated in the National War Bonds by various devices from time to time, such as the use of "tanks" as collecting boxes, the institution of a "Business Men's" week and a "Feed the Guns" week, and the transformation of Trafalgar Square in Oct. 1918 into a shell-shattered French village. From the time they were first put on sale till Jan. 11 1919, £1,446,625,613 of these bonds were sold, and nearly £50,000,000 small post-office bonds in addition.

Mr. Law's first budget, that of 1917, coming as it did after the great increases which Mr. McKenna had made in taxation, only raised the excess profits tax from 60 to 80%, and increased the taxes on entertainments, tobacco and dogs. He had proposed to double the tobacco duty, but on reconsideration came to the conclusion that with this burden it would be impossible to keep down the price of the cheaper kinds, and so reduced the additional duty to one of 50%. His great taxing budget was that of 1918, introduced during the early stages of the great German offensive. This imposed additional taxation calculated to bring in no less than £114,000,000. Income-tax was raised from 5s. to 6s.; farmers' tax was doubled; super-tax was increased; the stamp on cheques was to be 2d. instead of 1d.; beer and spirit duties were doubled, and tobacco and match and sugar duties raised; letters were to be 1½d. and postcards 1d. He budgeted for a revenue of no less than £842,050,000. He explained that it was his duty to levy as much as the nation could bear; but at the same time he must not cripple industry. Besides the taxes already mentioned, all of which were carried through; there was considerable opposition to the increased tax on cheques. Mr. Law also proposed a tax on luxuries, following the general principles adopted in this matter by the French Government. He got the House to set up a select committee to prepare a schedule with the advice of the traders who would be affected; but the report of the committee was not received sufficiently early in the year to enable Parliament to pass upon it, and the project was abandoned. He also appointed another select committee to consider how to control expenditure, the chairman of which, Mr. Herbert Samuel, told him that his fault as a Chancellor of the Exchequer was that he was "too amiable." The fault that the City of London found with him was that he was too much occupied as Leader of the House and member of the War Cabinet to give sufficient attention to finance.

His influence in the Government was especially felt in economic questions. It must have been with peculiar gratification that he announced to the House of Commons in April 1917 that the Imperial War Cabinet had accepted the principle of Imperial Preference; and that it was hoped that each part of the Empire, having due regard to the interests of the Allies, would give specially favourable treatment and facilities to the produce and manufactures of other parts of the Empire—a hope which, as regards the mother country, was translated into action in the budgets introduced under Mr. Law's leadership after the war. After the sittings of the Imperial War Cabinet in 1918 he spoke of the resolutions then passed in favour of retaining the control of essential raw materials as an immense move forward in the whole conception of trade policy. In May 1918 he told the House of Commons that the French Government had denounced all commercial conventions containing "most-favourable-nation" clauses; and that, in view of the probable scarcity of raw material after the war, the British Government would take a similar course. He had warned the German Government in the previous Dec. that the longer war lasted, the less raw material there would be to go round, and, as the Allies would help themselves first, the less there would be for Germany to receive. In regard to Ireland, he frankly admitted, Unionist though he was, the need for a change. What was wanted was a settlement, but the sacrifices would have to be on all sides if a settlement was to be obtained. He remonstrated, however, with the Nationalists for their threats in the session of 1918 and indignantly rejected as preposterous their claim to self-determination as a condition precedent to the entry of Britain into the Peace Conference. He opposed throughout the war a firm front both to pacifists and to pessimists. He asked the pacifists what other method there was, in the circumstances, of saving the liberties of the country except by fighting for them; and the constant readiness of his countrymen to bear the heaviest taxation and to subscribe to loan after loan was again and again treated by him as a certain pledge of eventual victory. Nor was he ever in doubt as to the necessity of fighting until the Germans surrendered. "We are fighting," he said, some six weeks before the Armistice, "for peace now and for security for peace in the time to come. You cannot get that by treaty. There can be no peace until the Germans are beaten and know that they are beaten."

As the general election approached he responded heartily to Mr. Lloyd George's proposal that the Coalition should be continued, and that the country should be definitely invited to return candidates who should undertake to support the Coalition Government; and he joined with him in issuing the letters or certificates, nicknamed "coupons," accepting Coalition candidates. He also signed with Mr. Lloyd George a joint manifesto, in which a good measure of his own economic doctrines held a conspicuous place. He left Bootle and stood for Central Glasgow, the business quarter of his own city, being returned by a huge majority. The result of the general election greatly strengthened his position, as the Unionists had a considerable predominance in the new House of Commons.

When the Ministry was reconstituted in Jan. 1919 the arrangement by which Mr. Law led the House of Commons was continued, as the Prime Minister would be much away at the Peace Conferences; but he was relieved of the Chancellorship of the Exchequer, which was transferred to Mr. Austen Chamberlain, he himself taking the sinecure office of Lord Privy Seal. He was constituted one of the British plenipotentiaries at the Conference; but his duties at Westminster seldom allowed him to go to Paris, though he ultimately affixed his signature to the Treaty of Versailles. The business of the session mainly consisted of measures either to demobilize the forces which had been mobilized for the war and restore previous peace conditions, or to improve the social condition of the people in accordance with the pledges of the joint leaders' election manifesto. Mr. Law's handling of the business of the House was, as ever, efficient and conciliatory; but for the greater occasions Mr. Lloyd George returned; and Mr. Law's most outstanding appearance in this session was when he announced that the Government were prepared to adopt the Sankey report in the spirit as well as in the letter, and to take all necessary steps to carry out its recommendations without delay. This was said of the first report, which contained no decision on nationalization; but it was afterwards unfairly alleged by Labour speakers that the Government, by refusing to accept the principle of nationalization, approved in a subsequent report, had broken Mr. Law's pledge. The main business of the session of 1920 was the Irish Home Rule bill, which Mr. Law justified as giving to Ireland the largest measure of self-government compatible with national security and pledges given. He strongly upheld in the House of Commons the measures taken, first by Mr. Macpherson and then by Sir Hamar Greenwood, to restore law and order in that country; and definitely refused to interfere in the case of the Lord Mayor of Cork who, sentenced to imprisonment for conducting a rebel organization, went on hunger-strike and eventually succumbed in gaol. The affection in which Mr. Law was held by the House which he led was shown this session in a peculiarly happy manner. The members, with few exceptions, subscribed to give a wedding present to his daughter on her marriage to Maj.-Gen. Sir F. W. Sykes, Controller-General of Civil Aviation.

Mr. Bonar Law was whole-heartedly in favour of the Coalition, and frequently adjured his Conservative friends to remain true to it. In its cause he sacrificed his health. In March of the following session, that of 1921, while he was in the full swing of his multifarious activities, he suddenly broke down, and was recommended by his medical advisers to abandon his work at once. The shock to the public, to the House of Commons, to his party, and to Mr. Lloyd George was great; and genuine expressions of regret were heard on every side. Mr. Lloyd George seemed almost unmanned in telling the news to the House; and it was clear that he felt that a great prop of his Government had fallen. Mr. Law resigned office, but not his seat for Glasgow. He went away immediately to rest in the south of France; and his health rapidly improved, so that by the autumn he was well again. He married in 1891 Annie Pitcairn, daughter of Harrington Robley, of Glasgow, by whom he had a family; but he was left a widower in 1909. Two sons perished in the World War. (G. E. B.)

LAWES-WITTEWRONGE, SIR CHARLES BENNET, 2ND BART. (1843–1911), English sculptor, was born at Teignmouth Oct. 3 1843. The only son of Sir John Lawes of Rothamsted (*see* 16.300), he was educated at Eton and Cambridge, where he was a notable athlete. Subsequently he devoted himself to sculpture, while doing much also to further the scientific side of the Lawes Agricultural Trust, founded by his father, of which he was chairman. In 1882 he was defendant in a famous libel action, brought by another sculptor, Mr. Belt, for a criticism published in *Vanity Fair*, imputing dishonesty to Mr. Belt in taking credit for work done by another man. The question of how much a sculptor may be aided by others in work to which he attaches his name was inconclusively debated through a long and costly trial, and the verdict of the jury, awarding £5,000 damages to the plaintiff, was much discussed at the time. He died at Rothamsted, Herts., Oct. 6 1911.

LAWLESS, EMILY (1845–1913), Irish novelist and poet, was born at Lyons, co. Kildare, June 17 1845. She was the daughter of the 3rd Baron Cloncurry and wrote a number of novels and verses dealing with Irish life. Of her novels *Hurrish* (1886), *With Essex in Ireland* (1890) and *Grania* (1902) are the most important, and of her verses *With the Wild Geese* (1902) is the best-known volume. She was given an hon. degree at Dublin University in 1905. She died at Gomshall, Surrey, Oct. 19 1913.

LAWRENCE, THOMAS EDWARD (1888–), British traveller, archaeologist and soldier, was born in Wales Aug. 15 1888, and educated in Jersey and at Dinard as well as at the High School, Oxford, proceeding on to Jesus College, Oxford, and graduating 1st class in modern history 1910. He went the same year to Carchemish on the Euphrates, as assistant in the British Museum's excavation of that ancient Hittite site. There he was still working when the outbreak of the World War and the decision of Turkey to join the Central European Powers put an abrupt stop to all archaeological work and called Lawrence to what proved a wider field. From Oct. to Dec. 1914 he worked at home in a department of the War Office. In 1915 he went to Egypt as a staff captain. The following spring he was in Mesopotamia at Army Headquarters, whence he returned to Cairo as intelligence officer for the Mesopotamia expeditionary force. In the autumn he was attached to the Arab Bureau at Cairo, under Lt.-Comm. D. G. Hogarth, being then a staff captain on the Foreign Office list, not under War Office control. In that capacity he was attached in 1917 to the staff of Gen. Sir F. Wingate, the general in command of the Hejaz expeditionary force. This gave Lawrence his great opportunity. He possessed, to an extraordinary degree, a power of getting into intimate association with the Arabs of the desert, such as has belonged to but one or two of his predecessors in Arabian travel, and he combined with this gift the soldier's instinct and a capacity for leadership which raised him at once to the first rank of commanders in desert warfare. The story of how he raised and led a force of Arabs, which cut the Hejaz railway, pushed forward in the van of Allenby's advancing army and were first into Damascus, is but faintly reflected in the dry official record of his various promotions to major (Aug. 1917) and lieutenant-colonel (1918), when he was transferred to Gen. Allenby's staff.

To decorations and official recognitions he was notoriously indifferent. He was a Prince of Mecca, a Chevalier of the Legion of Honour, the holder of the Croix de Guerre (with palms), the Italian silver medal and various British war medals. But what he cared for was the cause of the Arabs, whom he had learned to know and admire, and for whose interests he pleaded at the Paris Peace Conference in 1919. In that year he was demobilized and retired into academic life, being elected to a research fellowship at All Souls College, Oxford. Unofficially he remained in frequent touch with the Emir Faisal; but he did not reëmerge officially until March 1921, when Mr. Winston Churchill, on succeeding Lord Milner at the Colonial Office, appointed Lawrence to be his adviser there on Middle Eastern affairs, with a view to the subsequent creation of a special department dealing with them.

LEAGUE OF NATIONS.—The Covenant of the League of Nations, incorporated in the Peace Treaty in 1919, was perhaps the most remarkable of all the direct results of the World War.

The League of Nations may be regarded as a necessary result of the development of human society in political organizations. It is not an abnormal achievement of human idealism—a great leap in advance beyond the achievements of the present age, outstripping the practical needs and requirements of the world. On the contrary, it is a practical method for achieving practical ends which are of importance to every citizen of every country. The demand for an international organization to prevent war has often been made in the last four centuries after any great European conflict. Fundamentally, this demand is that the relation of these States among themselves shall be subjected to something analogous to the system of law and order to which men have subjected themselves within the smaller units in which they live. It is an illustrative commentary on the maxim of the Roman lawyers—*ubi societas ibi lex.* But the purpose and the content of these rules for the conduct of their relations—the *lex*—necessarily depend on the nature of the units of the society and on the nature of their relations. When Grotius, for example, wrote his famous work on the Law of Nations, he was writing of a Society of States whose intercourse was disturbed by the continual outbreak of hostility. Indeed, Europe had been convulsed by the Thirty Years' War for a whole generation prior to the publication of his work. Thus it was natural and indeed inevitable that the rules which Grotius produced for the guidance of the Society of States, as he knew it, amounted to little more than a code of laws for the better conduct of war. He did indeed sketch the outlines of a law for the pacific relations of States, and in the following century and a half his successors developed to some extent what he had begun. But only after the Napoleonic wars was the first serious attempt made to establish an organized system of conducting international affairs with a view to the avoidance of war. To Alexander of Russia's scheme of a Holy Alliance we need only briefly allude. Though admirable in intention it was rejected as "sublime nonsense and mysticism" by Castlereagh, and it eventually degenerated into a mere prop of despotism supported by the empires of Central Europe and France. But the work of Castlereagh is worthy of closer attention. He tried to substitute for the chaotic political methods of the past a system of diplomacy by conference, confining his efforts, however, to the Great Powers; though he desired to make their attitude to the Smaller Powers one of "influence rather than authority." He provided his "Conference of Ambassadors" with an organized plan of work and with a secretariat, and he supplemented it by occasional Conferences of the Principal Statesmen of the Concert. His Conference of Ambassadors continued to sit in one form or another for almost six years, and he held four or five of his Conferences of Principal Statesmen.

Later in the 19th century Castlereagh's work bore fruit in the European Concert, which proved on a number of occasions to be an effective instrument for the joint settlement of Balkan problems and for the maintenance of European peace. But at the time, and for the purpose for which he had created it, Castlereagh's system of diplomacy by conference almost completely failed. It did so because it never had in it the seeds of life. Its members differed fundamentally on all the greater issues of international politics; while some of them were independent and autocratic sovereigns, subject to no control, and without the pressure behind them of a general democratic will for peace. Indeed the paramount cause of failure, not only of the vague and mystic ideas of Alexander, but also of the more practical and definite schemes of Castlereagh, was that they were not backed by the force of a strong, persistent, instructed public opinion.

Since the Napoleonic wars, forces have been at work which have slowly changed the economic condition of the world—knitting its many parts together, and making more and more possible an international political organization, which shall exist side by side with the economic organization already created. The first of these forces is the revolution in communications which has occurred in the course of the last century, and which has brought the most remote parts of the world nearer to each other than neighbouring towns were a hundred years ago. The second of the forces—in a sense it is the result of the first—is the remarkable raising of the standards of civilization through the coöperation of mankind in ever larger groups and in enterprises conceived and conducted on an ever greater scale. To-day no part of the world can live without the rest; and a greater proportion of the world's commerce is conducted by vast international companies. Thus we have a general community of interests between human beings living in different States. It was evident before the World War—and if it were not, the war proved it to demonstration—that the interests of any one civilized country are indissolubly bound up with those of every other country, and no sensible statesman will ever again base his policy on the principle that his country will gain by another's loss.

Nor is this community of interests between peoples confined to their material well-being. It extends to every sort of scientific, political and moral activity in which men coöperate for the progress of their race. The revolution in communications, which is still in progress, rapidly destroying the factors of space and time, has rendered possible a development of warfare which has changed its whole character, and rendered it universal in a sense never hitherto imagined. Withal, "science," as Lord Esher remarks, "sleepless, restless and revolutionary, is exploring every day new methods of destruction, and opening up avenues to novel tactics, rendering certain that war in the future will be waged with weapons hitherto undreamt of, fought in the air and under the water by contrivances which will render those of 1918 as obsolete as gunpowder rendered bows and bills." Thus it is not too much to assert that another world war would almost certainly throw mankind back into the dark ages. For these among other reasons some sort of international organization for the conduct of the relations of States is essential, if the human race is not to abandon the hopes and the ideals for which it has striven during centuries of progress.

Essential Conditions.—With the reasons for the failure of the earlier scheme of a century before, and with the nature of modern national States in our minds, we can perhaps now proceed to lay down the essentials of a league of nations.

It may be taken as commonly accepted that the purposes and objects of a league are the following:—First, the maintenance of peace. Second, and as a corollary to the first, the solution of international disputes by methods of law, if and when the necessary law exists; when it does not, their solution by political methods, by public debate, by impartial investigation and by conciliation on the basis of the accepted canons of right and justice. Third, the promotion of international coöperation wherever necessary or useful, between States and between the citizens of different States. The promotion of such coöperation will imply the development of rules and the general acceptance of common machinery and common practice in ever wider spheres of international activity. Further, a first principle which must be borne continually in mind is that the fundamental basis of all law, and the primary condition of all political organization, is the consent of those who are to obey it. And an important and relevant corollary of the proposition is that the force, even the united force, of the greater or more powerful members of a society cannot in the long run coerce the will, or replace the consent, of the others. It is useless, therefore, to plan any organism which depends on the coöperation of the powerful States, but which will not also receive the willing acceptance and coöperation of the great body of other States.

An examination of the results of these limiting conditions, and of the lessons to be drawn from historical experience, and of the accepted objects which it is desirable that a league should achieve, will perhaps indicate to us without further discussion the minimum of rules and of machinery which is essential.

In the first place, then, there must be rules laying down the conditions of membership of the League. As the members of the League, in order to carry out the objects which they agree upon, must give reciprocal undertakings, they must have some guarantee that those with whom they associate themselves are willing and able to carry out what they promise. Next, it is essential that all the members should enter into agreements to meet in full conference from time to time. Third, it will in practice be necessary, and even in theory it is most desirable, that there should be some smaller organ than the full conference of all the members, which in the current business of the League, and when executive action is required, can represent the whole body of the members. It is evident that the composition of such an executive organ will—in a society in which members are so unequal in size, population and power—involve most difficult problems of representation. And a further consequence of any attempt to organize international affairs through regular conferences of all the members of the League, and through a smaller executive organ, is the necessity for a secretariat which shall be charged with the duty of preparing the work of the organs of the League, which shall act as a central exchange for information among members of the League and shall organize the central and technical services for conferences and for the meetings of the executive organ. The secretariat would also have to keep the records of the League, supervise the execution of the League's decisions and in general act as an organizing agency for the promotion of international coöperation. It is, perhaps, theoretically possible that these duties should be fulfilled by means of national secretariats attached to the representatives who compose the full conference or the executive organ of the League; but there are great practical advantages in an international secretariat whose members are individually independent.

The above represents the minimum machinery that is essential to the effective working of any league. We must next consider the minimum mutual obligations which the members of the League must assume if it is to prove an effective instrument for the maintenance of peace.

It is evidently essential that every member must agree that it will not go to war with any other member without previously submitting the dispute to peaceful methods of settlement, either through the instrumentality of the League or otherwise. Further, and as a corollary to this first undertaking, there must be a second one providing for common action against members who break this fundamental agreement. What the nature of this common action must be is a matter for discussion; but it must at the least provide for united and energetic moral pressure by the whole body of the League against the recalcitrant member. It may well be argued that in the world as it is to-day this united moral pressure should be supported in whatever way may be possible by united material pressure as well. What in any case is essential is to find some means of bringing home to every citizen of a member which breaks its League agreements the universal disapprobation of the other members. Thirdly, it is practically, if not theoretically, necessary to lay down in advance some method, or methods, for the settlement of disputes by peaceful means. Great elasticity may be left as to the nature of these methods, and as to the choice of method which the parties to a dispute may adopt. But the agreements of the League should include plans for settlement by conciliation, or arbitration, or judicial verdict; and these plans should be based on the essential principles by which alone moral pressure can be brought to bear on individuals or on Governments—that is to say, on strictly impartial inquiry into the merits of disputes, and on full publicity for the contentions of the parties and for the proceedings by which settlement is attempted.

It is further essential that the agreements of the League should include the automatic abrogation by members of all treaties or undertakings which are not consistent with their obligations as members of the League. No general organization such as a league of nations can operate or inspire confidence in its members if the undertakings to which they agree by their membership are overborne or superseded by other inconsistent agreements which they may enter into with individual States.

The organization and the undertakings indicated seem to constitute the minimum that can serve as the basis of any effective international organization for the prevention of war. Beyond this minimum, there are other things not absolutely essential, but highly desirable. For example, in the plans laid down for the settlement of disputes, it is necessary to make provision for settlement by conciliation, by arbitration and by judicial verdict. The last of these alternatives implies a court of international law. It is true that such a court might be set up *ad hoc* for any dispute in which it is required. But it is pre-eminently desirable that a permanent court of international justice should be established as part of the machinery of the League. Only such a permanent court can guarantee the full, absolute and unquestionable impartiality without which States will not submit their disputes to its jurisdiction. Further, such a court appears to be a necessity if we are to achieve the development of international law as an increasingly important factor in the relations between States.

Again, it is highly desirable, though it is not theoretically essential, that the agreements of the League should provide that any dispute, or any circumstances affecting the peace of the world, should be a matter of general concern to every member, so that any member may be within its right in demanding the consideration of any such matter by the organs of the League.

Interdependence of States had so far advanced during the course of the 19th century that this principle received some slight and tentative recognition in the international conventions for the peaceful settlement of international disputes drawn up by the conferences at The Hague. But the principle needs full recognition and application if countries are to be prevented from drifting into armed conflicts which, in these times, certainly will involve the interests of their neighbours.

And lastly, it is desirable, though again not essential, that the League should be given the necessary powers to enable it to act as the coördinating agency for the international activities of its members in all the multifarious spheres hitherto governed by international bureaux, by general treaties, and by other forms of official and unofficial coöperation.

Features of the League.—Impartial consideration of the Covenant of the League, first signed by the 32 signatories of the Treaty of Versailles, and accepted and acted upon by the 48 States who in 1921 were members of the League, will show that it embodies every one of the features which have been enumerated as the essentials of an effective league. It may further be said that where the Covenant goes beyond the essentials it does so in a way which was intended to make, and does make, for greater completeness and efficiency.

Article 1 of the Covenant consists of the rules of membership. It stipulates that the original members of the League shall be the signatories to the Covenant and such other States named in the annex thereto as shall accede to it without reservation; and that any fully self-governing State, dominion or colony may become a member if its admission is agreed to by two-thirds of the members, and provided that it shall give effective guarantees of its sincere intention to observe its international obligations and shall accept the regulations of the League in regard to its military forces. Article 1 also makes provision for the withdrawal after two years' notice of any member who wishes to abandon its membership. These rules constitute a statement of the principles concerning membership that are essential if the members of the League are to have confidence that their mutual undertakings will be carried out.

With regard to agreements to meet in conference, Articles 2, 3 and 4 of the Covenant stipulate for the creation of an assembly consisting of three representatives of each member of the League, and for a smaller council consisting of representatives of four Great Powers and of four smaller ones. The Covenant does not lay down the intervals at which these bodies shall meet: it merely stipulates that the Assembly shall meet at stated intervals and from time to time as occasion may require; and that the Council shall meet in the same way, and at least once a year. It leaves these questions to be dealt with in whatever rules of procedure the Council and the Assembly may respectively consider it wise to adopt.

The question of representation of the members at the Assembly was one which naturally involved serious difficulties. It was solved by according to every member an equal right to send three representatives. There was considerable discussion when the Covenant was being drafted as to whether three was a sufficiently large number. In practice this point has been dealt with in a way indicated later on.

The question of representation on the Council was still more difficult. A definite preponderance of influence in international affairs had been recognized prior to the war on the part of the Great Powers of the world. It was inevitable, and surely right, that the Great Powers who are members of the League should be accorded permanent representation on its principal executive organ, and this has been done. The representation of the smaller Powers—an exceedingly difficult matter—was dealt with in a way which in practice seems likely to prove quite satisfactory, namely by providing that the four non-permanent members of the Council shall be selected by the Assembly from time to time in its discretion.

Articles 6 and 7 provide for the necessary secretariat, and for the nomination of a secretary-general who shall make all the appointments to the secretariat with the approval of the Council, and who shall act as secretary at all the meetings of the Assembly and of the Council. These Articles also provide that every position in the secretariat shall be open to women.

So much for the institutional organization of the League as it is established by the Covenant.

With regard to the agreements not to resort to war, which are included above among the essentials, the Covenant embodies practically everything that any responsible authority had advocated as practicable. By Article 12 the members agree that if there should arise between them any dispute likely to lead to a rupture, they will submit the matter either to arbitration or to inquiry by the Council, and they agree that they will in no case resort to arms until three months after an award has been made by the arbitrators or a report has been made by the Council. Article 12 thus not only embodies an agreement not to go to war without previous recourse to peaceful methods of settlement for disputes, but also lays down two alternative procedures by which, through the agency of the League, settlement can be effected. The first is ambiguously referred to as "arbitration," but it is evident from Articles 13 and 14 that the use of the word "arbitration" is a loose one, and that what is really intended is recourse to legal decision. For Article 13 proceeds to give a definition of disputes which the members recognize to be "generally suitable for submission to arbitration"; and this definition is textually that agreed to by various high authorities in international law as the best that can be devised for disputes which may be called "juridical," *i.e.* suitable for decision by means of legal verdict. Further, while Article 13 leaves the parties free to choose any court or board of arbitration to which they may agree for the judicial settlement of their disputes, Article 14 nevertheless charges the Council with formulating, and submitting to the members of the League for adoption, plans for the establishment of a permanent court of international justice which shall be competent to hear any dispute of an international character which the parties thereto submit to it. While, therefore, these two Articles leave great elasticity, it is evident that the intention was to lay down a normal legal procedure, and to secure the establishment of a permanent international court to which the parties should, in the normal course, take disputes of a legal nature. There is, moreover, at the end of Article 14 a clause which greatly increases the value of the Permanent Court. This clause provides that the Court may also give an advisory opinion upon any dispute or question referred to it by the Council or by the Assembly. It is evident that in the course of a dispute one party may maintain that a whole or a part of the question at issue is juridical in nature, and should be determined on legal grounds. If one of the parties put forward such a contention and were able to support it by sound arguments, there is no doubt that the Council would act on the final clause of Article 14 and would submit the question to the Court for an advisory opinion; and it is to be particularly noted that they could do this as a matter of procedure, and, therefore, by a majority vote. If, then, a litigant should bring to the League a dispute in which it believes the law to be on its side, it will be able to demand, even if the other party does not agree, that the Council shall secure on the juridical questions at issue an advisory opinion from the Court: and the Court in rendering this opinion will give the Council the elements for a decision which would have all the force of a legal verdict.

Thus, while avoiding the pitfall of "obligatory arbitration," which very few of the States of the world at the present time are ready to accept, the Covenant includes provisions which go very far towards securing that all international disputes of a genuinely legal nature shall be determined by legal methods.

With regard to the other alternative method provided for the settlement of disputes, which members agree to by Article 12, that is to say, inquiry by the Council, Article 15 lays down in considerable detail the procedure which is to be adopted. It provides that any party to a dispute can oblige the League to take cognizance of it by giving notice to the Secretary-General, who is then obliged to make all the necessary arrangements for a full investigation and consideration thereof. The parties undertake to communicate to the Secretary-General as promptly as possible statements of their case, with all the relevant facts and papers. The Council is then given discretion to endeavour to effect a settlement of the dispute, and it is provided that if its efforts are successful, a statement shall be made public giving such an account of the dispute and of the settlement arrived at as the Council may deem proper. If the Council fails to settle the dispute, it is to make a report setting forth the merits of the dispute and the recommendations which the Council thinks would be suitable for a settlement, and this report is to be published. A report may be made either unanimously or by a majority vote, and any individual member of the League which is represented on the Council has a right to make its own public statement concerning the dispute and the conclusions which it draws from them. There is a further provision in Article 15 to the effect that if such a report is agreed to by the Council unanimously, with the exception of the representatives of one or more of the parties to the dispute, the members of the League—including the parties—agree that they will not go to war with any party to the dispute who complies with the provisions of the report. This is a most important additional limitation of the right of members to resort to arms. Article 15 also provides for an appeal to the Assembly, conditional on its being made within 14 days after the submission of the dispute to the Council. If a dispute is so referred to the Assembly, the Assembly is to deal with the matter in the same way as the Council, with this exception, that if a report is agreed to in the Assembly by all the members of the League represented on the Council, and by a majority of the other members of the League, exclusive in each case of the representatives of the parties to the dispute, the report shall have the same force as a unanimous report agreed to by the Council. In other words, the members of the League must not go to war with any of the parties to the dispute which accept it. These Articles, then, provide two, or rather three, methods by which disputes can be settled by peaceful means through the agency of the League. The first of these methods provides for legal verdicts, when such verdicts are possible and useful; the second provides for arbitration by some other tribunal agreed to by the parties to a dispute; and the third, for settlement by the political agency of the Council or the Assembly, in accordance with procedure based on the principles of full publicity and strict impartiality. It may perhaps be observed that publicity will of itself ensure impartiality; for it is not conceivable that a council, acting as the representative of the whole body of the League and in circumstances of utmost publicity, should conduct its inquiries into a dispute in any way not consistent with the strictest fairness to all the parties concerned.

Articles 12 to 15 also make provision for the next essential of a league—united pressure by all the members against any of their number which disregards its undertakings. In providing for a public report by the Council on the merits of a dispute and for the publication of its recommendations as to a settlement, the Covenant lays down a method which, in practice, must exert the strongest moral pressure on any State which in defiance of Article 12 is disposed to go to war. Anyone who knows how great a factor in the conduct of international affairs the public opinion of the Society of States was, even prior to 1914, will realize that such a verdict of the organized opinion of the world is bound to be a weapon of great power.

But the Covenant goes beyond this, and provides in Article 16 that, if any member of the League in contravention of its agreements resorts to arms, such a member is *ipso facto* "deemed to have committed an act of war against all other members of the League," and the other members are obliged to prevent all financial, commercial or personal intercourse between the nationals of the Covenant-breaking State and the nationals of any other State. It was difficult in the disturbed condition of the world during 1919–21 to realize just what would be the effect of such a complete economic and financial boycott in times of normal peace. But it is not too much to say that no civilized State would, in 1914, have ventured to declare war had it been threatened by such a universal boycott as Article 16 stipulates.

It may be held that in providing for such a universal boycott, the Covenant goes beyond the essentials of a league. It may even be held that it goes beyond what is practicable and wise. Certainly it is a matter which will give rise to the gravest problems, and on which, indeed, the League had in 1921 already found it necessary to appoint a commission to determine the precise obligations of the members and to recommend the machinery required for their fulfilment. But it must be remembered that Article 16 only comes into force in the case of a State insisting on going to war without waiting for any attempt at peaceful settlement such as is provided for in Articles 12, 13 and 15, or where the agreed tribunal or a unanimous council have given a decision which has been accepted by the other party. In other cases ultimate resort to war is envisaged as possible.

And the Covenant goes even further than this in making provision for pressure on recalcitrant members of the League.

Article 16 further lays down that in addition to the blockade, which is an automatic obligation of all the members of the League, the Council shall consider and shall *recommend* to the several Governments concerned, what effective military, naval or air forces members of the League shall severally contribute to the armed forces to be used to protect the Covenant. In other words, while leaving again the greatest possible elasticity, and while laying no positive obligation on any member to contribute military force, the Covenant yet definitely foreshadows united military action against a Covenant-breaking State.

To turn to another matter, the Covenant provides by Article 20 for the abrogation of treaties, obligations and understandings which are inconsistent with its own terms, and thus meets, in yet another particular, the essentials of a league.

How far, and in what respects, does the Covenant go beyond what we have recognized to be these essentials?

To begin with perhaps the most important point of all, there are the much-discussed provisions of Article 10. This Article has been very generally misunderstood. It has been widely proclaimed as containing the central and essential obligation of the whole Covenant—an obligation, moreover, which most States are unlikely to accept in practice and which, indeed, they would be right in refusing. This is quite untrue. As a matter of fact the great objection to it is that it has little actual effect while appearing to mean a great deal. It does not create, as has been thought, an obligation on all the members of the League to maintain by force of arms the existing territorial and political arrangement of the world. It does indeed guarantee the members *against external aggression* which would impair their territorial integrity or political independence. But this guarantee is only to be enforced, if at all, as the Council acting unanimously shall agree. In practice the protection against sudden and unjust attacks provided by Articles 12–16 will be much more useful. Article 10, when closely examined, will be found to be little more than a rather clumsy assertion that territorial or political changes ought not to be made by aggressive warfare. Such changes, if required, should be made under Article 19, which enables the Assembly to reconsider treaties which have become obsolete or dangerous to peace.

It may perhaps with more show of reason be said that, by the provisions of Article 8 on the subject of armaments, the Covenant introduces something which is extraneous to an agreement to preserve the peace. But the history of the 20th century has already demonstrated that if you prepare for war you will have war; that increase of armaments in one country provokes increase of armaments in other countries, and that if rivalry in preparation for war continues, within a certain time war will break out. Unless the rivalry in armaments can be prevented, any league of nations, however it be constituted, will fail. Doubtless complete disarmament is not practicable or probable at an early date. But an agreement not to engage in unlimited competition on the development of armaments is absolutely necessary to the peace of the world. The Covenant deals with the matter in a way which is preëminently practical and sane. It recognizes that the maintenance of peace requires the reduction of national armaments to the lowest point consistent with national safety and directs the Council to formulate plans for such reduction for the consideration of the several members of the League. In other words, the members agree to coöperate in working out a general international plan embodying scales in accordance which with their armaments shall be limited or reduced. Further, the members agree that they will, through the League, endeavour to take measures for abolishing the evil effects of the private manufacture of armaments and material of war, and they agree to exchange full information as to their armaments, their preparations for war, and the condition of their industries which may be adapted to warlike purposes. Lastly, by Article 23 they agree that, subject to conventions to be arranged, the international traffic in arms, admittedly one of the minor contributing causes of war, shall be placed under the League's supervision.

These are only general principles. In themselves they would be of small value. But the Covenant, by Article 9, establishes a Permanent Commission to advise the Council in working them out in detail and securing their effective application. It may fairly be hoped that this machinery will in time enable the members of the League to give effect to the purpose of Article 8; and if so, great strides will undoubtedly be made towards the disarmament which everyone desires. In this respect, as in others, the authors of the Covenant were careful not to travel too fast; they laid foundations on which those who were to wield authority in the League could later build.

By providing in Article 18 for the publication of all treaties, the Covenant again goes beyond essentials. Yet no reasonable man can doubt that, under the diplomatic system which prevailed before 1914, secret treaties of alliance, directly by mere existence and indirectly through mistrust which they created, were one of the serious causes of international conflict.

Article 22 of the Covenant introduces a new principle into international affairs which is certainly extraneous to the central purpose of a league. The mandates system which it creates is a great experiment in the government by advanced peoples of backward territories and races. The main principles are simple. The Article is based on the proposition that backward peoples and territories are not for the future to be exploited for the exclusive benefit of those who govern them; that, on the contrary, their interests and well-being constitute a sacred trust of civilization, and that the way in which they are ruled is a matter of interest to the world at large. The Article therefore lays down that in the government of such territories the interests and progress of the inhabitants must be the guiding purpose of the administration. The methods by which their interests are to be protected and their development secured vary, of course, in every case with the nature of the territory and the character of the people concerned. But in every case the fundamental principles are the same; and to secure the observance of them the Covenant imposes on the mandatories a duty to make annual reports for submission to a permanent mandates commission; which is, in turn, to report to the Council. Here, again, the Covenant relies on publicity and public opinion as a guarantee that Article 22 will be faithfully carried into effect.

With regard to international coöperation, the Covenant in Articles 23 and 24 goes a great deal further than might be considered essential. It provides in general terms for the establishment of a labour organization (which in fact has been elaborated separately by another agreement); for the equitable treatment of commerce; for the development of freedom of transit; for League supervision of the traffic in arms; for League action in matters of public health; and for the general supervision by the League of all official, and also, if necessary or useful, of unofficial, international offices established for international purposes of general interest. There is no need to deal in detail with the provisions of these Articles. Their general effect is to make the League what it is clearly desirable that it should be—a central organism through which international activities of every sort can be coördinated and when useful assisted by the Council and the Secretariat. There can be no doubt that the result of this must be to prevent waste of effort and promote efficiency in the conduct of international business of every kind.

In the last place the Covenant, by Article 26, provides a method by which it can itself be amended; and this, it may be held, is not an essential of a league. It is true that the Covenant might have been regarded as an ordinary international treaty, valid, as most treaties are now made, for a certain fixed period, at the end of which it might have been renewed or changed by the ordinary methods. But it was precisely because the authors of the Covenant did not regard it as an ordinary international treaty that they provided a special means for amendment; and there can be no doubt that morally Article 26 is of great significance, and that practically it may prove to be of great constitutional value. It still leaves it difficult to secure amendment of the terms of the Covenant. It can only be done if all the members of the Council and the majority of the members of the Assembly are agreed. But the fact that amendment is definitely envisaged is in itself important, and the proceedings of the Amendments Commission established last year by the first Assembly, which will report for the acceptance of the next Assembly certain amendments of importance, have demonstrated the essential soundness of the conception of Article 26.

Generally, it may be said that when the Covenant goes beyond the essential features which are necessary to any effective league to preserve peace, it does so with one of two objects in view. Either it is with the purpose of giving real life to the machinery which it establishes: of bringing the international forces actually at work into effective coöperation, in order that members of the League may be brought closer together, and the League itself be strengthened and have the vitality that comes from continuous and varied work; or else it is with the purpose of removing those deep-seated causes which public opinion has recognized as having led to war. It is not by chance that the Covenant contains more or less elaborate provisions concerning armaments, the traffic in arms, annexation by conquest, the avoidance of unfair economic competition, imperial rivalry in the exploitation of backward countries, secret treaties and alliances. It is because these things have led to war in the past that the Covenant seeks to deal with them in a practical and effective way, to the end that war may be rendered less probable in the future.

It has already been said that the authors of the Covenant confined themselves to laying down the essentials of the organization which they considered the League required and the general rather than the detailed obligations to which they thought that members of the League must agree. Elasticity is one of the chief "notes" of the whole machinery of the League. The Council and the Assembly have been free to develop their own methods and systems as they chose, to appoint committees and commissions at their discretion, and to draw up codes of procedure which they could themselves change, and have thus been able to give to the general principles of the Covenant a free development on sound lines.

It is in pursuit of this same elasticity that in several cases the Council is charged to carry into execution plans which the authors of the Covenant felt to be essential, but which they were not themselves, for lack of time and for lack of expert technical advice, able immediately to develop. Much good has been done under these provisions.

It will perhaps be worth while to examine more in detail the working of the Covenant in action, and to examine it under three separate aspects: the first, the institutions of the League considered as political machinery; the second, the working of the Covenant in connexion with disputes; and the third, the activity of the League in the promotion of international coöperation.

The League in Action.—Of the two principal organs of the League, the Council was naturally the one which, up to the summer of 1921, had the best opportunity of proving in practice its working value. Meeting at Geneva, in the first 18 months of its existence, it held 13 sessions, many of which lasted a fortnight. Its members therefore had time to prove by experience whether or not the conception of the Council, as set forth in the Covenant, is right or not. There is probably no statesman who has sat as a member of the Council who would deny that it is an institution which has proved a success.

In its working there were, of course, great difficulties to be overcome. The first and most important of these was that of representation of the Governments entitled to seats on the Council. How was it to be—by ambassadors, by Cabinet ministers, by prime ministers? There is an evident difficulty in expecting a prime minister to give up so much time as the members of the Council had to give up during 1920–1 to their duties. There are no less solid objections to allowing the representation of members by ambassadors. Nevertheless, for far-distant countries—such as China and Japan—it is obvious that their coöperation can only be secured by representatives permanently residing in Europe, which, in practice, means their ambassadors; and of course the solution adopted by the European countries had varied. It is a matter which the Covenant leaves every country free to decide for itself. For the ordinary conduct of the affairs which come within the consideration of the League the solution acted on by Great Britain is probably the best one, namely that it should be represented by a Cabinet minister, whose duties are primarily to deal with all League of Nations business. He must act in close coöperation with the Foreign Office, even if he is not, as perhaps he should be, directly attached to it. When matters of first-class political or general importance are under discussion, it is eminently desirable that prime ministers or foreign ministers should themselves attend, and, if the League is to succeed, it will at great crises be essential that they should do so.

In a great deal of its work the Council required expert and technical study to enable it to take decisions, and to this end it adopted in a large number of cases a plan of appointing special temporary commissions to study the matter under discussion and to make a report. In practice this plan worked admirably. A striking example is the commission which prepared the project for the International Court of Justice. The Council appointed this commission, consisting of nine of the most eminent jurists in the world, and provided it with an expert secretariat. The Commission invited proposals, examined numerous schemes laid before them, prepared a detailed plan and submitted it, unanimously, for the consideration of the Council. The Council examined it, amended it in important particulars and presented it, in turn, to the Assembly. The Assembly again amended it, adopted it, and signed it in the form of an International Convention. It is a remarkable example of how the Council, by delegating technical work and by then taking the necessary political action on technical reports, can achieve results which, without the League, could not have been achieved.

The Council also adopted another method of delegating authority, namely, by the appointment of high commissioners. It appointed Dr. Nansen to act on its behalf in securing the repatriation of nearly half a million prisoners-of-war in Russia and Central Europe, who, 18 months after the Armistice, were still without prospect of being able to reach their homes. Dr. Nansen was able to coördinate the action of Governments, to obtain an international loan, to induce Governments and voluntary philanthropic societies to act harmoniously together, and, in general, to secure effective international coöperation in a sphere in which such coöperation could certainly have been achieved by no other means.

The Council also had to solve the problem of carrying on the detailed work and providing for the day-to-day decisions required by some of the administrative, or quasi-administrative, tasks which were entrusted to it. It solved this difficulty by entrusting its president with authority to take current decisions, in conjunction with the Secretary-General, and to exercise his own discretion as to when and how he must consult his colleagues by telegram or otherwise on any given matter. Thus, by means of a permanent secretariat, the difficulties of time and space are minimized.

On the whole it may be said that most of the very different tasks confided during its early existence to the Council were executed with a remarkable degree of unanimity and efficiency. The machine worked even better than it was expected to work and the advantages of continuous coöperation and discussion among the members were made increasingly plain.

The Assembly, considered as a political machine, was no less successful than the Council. Its first meeting was, indeed, a great event in the history of the world. No man could say beforehand what manner of thing it would prove to be. It might have been like previous international Conferences—remarkable for ill-prepared work, for formalism, and confused debate, or it might even have ended in disorder and sterility. Such was not the case. On the contrary, on the basis of the admirable preparatory work accomplished by the Council and the Secretariat, a very great amount of constructive work on the organization of the League and its subsidiary bodies was done. Some international agreements of the first importance were made. Compared with national parliaments the Assembly must be ranked very high, both for the order and interest of its debates,—in spite of the difficulty of interpretation—and for the amount which it accomplished in the comparatively brief period of five weeks for which it sat. Most important of all, it created an international spirit, and an atmosphere of conciliation and coöperation, which were certainly unique in the history of international conferences, and augured well for the future of the League.

At the beginning of its labours the Assembly was bound to be faced by very difficult problems of its own internal organization. Obviously a great many items of its long agenda would have to be thrashed out in committee before they could be dealt with by the Assembly at large. It was also obvious that every country represented might wish to take part in any or all of these detailed preliminary discussions. That is to say, every country might wish to be represented on any, or all, of the Committees which the Assembly might set up. The following device was therefore adopted: the whole of the agenda was divided into six groups, and each of the groups was entrusted to a separate Commission. On each of these Commissions every member of the League had the right to one representative. Thus each delegate could serve on two of the Commissions (since each member can have three representatives), or could nominate a substitute to take his place. This system resulted in six Commissions which theoretically might each consist of 42 members, but at which, in practice, there was an attendance of from 25 to 40 members. These Commissions were not too large for the effective conduct of business; and yet they satisfied the legitimate desire of every country to be heard at all stages of every debate. In practice the Commissions studied the business put before them in great detail, and with great efficiency, and laid before the Assembly reports which, for the most part, were adopted as they stood. For some work it was of course necessary for the Commissions to appoint smaller Sub-Committees; but this in no way destroyed the control of every member over the detailed conduct of business.

For the general organization of the work of the Assembly, a central Committee or Bureau was appointed. This consisted of the President of the Assembly, the President of each of the six Commissions, and six other members elected by the Assembly at large. This body was responsible for settling the order of the agenda and for dealing with any current questions which arose. The system worked to the satisfaction of everyone. In its conduct of detailed practical business, no less than as a forum of international opinion, the Assembly fulfilled the best hopes that had been placed in it.

The Secretariat similarly proved in practice to be a sound working instrument. In many ways its task was more difficult even than that of the Council and of the Assembly. In accordance with the spirit of the Covenant, it was built up on lines as truly international as is consistent with the efficient conduct of its work. Over 20 nationalities were represented among its members, and yet the whole staff worked together harmoniously in pursuit of common ends. It was divided into sections, following the general division of the work which has been entrusted to the League. It is in no sense a rival to the Foreign Offices. It proved an efficient agency for the preparation of the work of the Council and of the Assembly, and for the execution of their decisions. Its work is greatly complicated by the fact that both French and English are official languages, and by the difficulties of maintaining continuous contact with 48 different and distant States. Its work was none the less carried out in a spirit of devotion and with a degree of economy which earned the high approbation of a special Committee of Inquiry appointed by the Assembly.

The provisions of the Covenant with reference to disputes (Articles 11–17) had not yet been put into application sufficiently for a conclusive opinion to be formed on them. But there was sufficient experience of their working to make it fair to claim that they are based on sound principles.

The Articles relating to the legal settlement of disputes had hardly as yet been tested. The plan laid down in Article 14 for the creation of the Court worked well. It is worthy of special note that nine States had by the middle of 1921 already agreed to give the Court obligatory jurisdiction in all juridical disputes which might arise between them.

Apart from this, one legal question was solved in 1921 by the League, which would have been referred to the Court had it been in existence. This was the question of the competence of the League to deal with the Åland Is. dispute. Finland claimed that the islands lay entirely within its sovereignty, and that therefore the League could not deal with the matter. As there was no Court, the Council referred this contention to a Commission of three eminent international lawyers, a Frenchman, a Dutchman and a Swiss. This Commission made an elaborate report and produced so great a body of convincing legal argument in support of the League's competence that their decision was never for one moment questioned even by Finland, against whom it went. It was a good demonstration of the value of judicial methods; and it indicates the great authority which the International Court may be expected to wield.

The provisions of the Covenant for the settlement of disputes by political methods (Article 15) had more extensive trial. Three disputes of first-rate importance had been dealt with by the League by Aug. 1921—the Åland Is. dispute, between Finland and Sweden; the Vilna dispute, between Poland and Lithuania; and the Albanian frontier dispute, between Albania, Serbia and Greece. Of these the first in date and importance was that of the Åland Is. It was laid before the League in the month of June 1920, at a moment when there was great tension between the parties—tension which in the opinion of a good many competent judges was very likely to result in war. The Council's conduct of the matter afforded an illustration of the working of almost every provision in the Covenant that relates to the settlement of disputes. To begin with, the matter was brought to the League by the action of a third party—Great Britain—under the terms of Article 11; no better example could be wished for of the value of this Article. Next, the question of the legal competence of the League was referred by the Council, under Article 14, for an advisory opinion to a Commission of jurists representing the International Court. Next the Council appointed a political Commission of persons of high international authority, and of impeachable impartiality, to investigate the contentions of the parties and the merits of the dispute. This Commission spent several months on its inquiries, and passed a long time among the Åland Islanders themselves. As a result, they produced a remarkable report, against parts of which the Swedish Government strongly protested, but which nevertheless was recognized by public opinion as a fair and statesmanlike presentation of the facts and merits of the problem, and as a wide and practicable proposal for its solution. This report was published for the examination of the world at large as soon as it was laid before the Council. The matter was finally dealt with by the Council at its 13th session. The substance of the Commission's report was adopted as the Council's decision, and this in turn was accepted by all the parties. The Åland Islanders, whose representatives were themselves heard by the Council, secured guarantees from Finland amounting almost to autonomy, while the Swedish-speaking population of Finland secured protection, which, without the intervention of the League, they would not have done. Thus a very probable war was averted, and a path to friendly coöperation between close neighbours was opened. Such was the result of the full application of the new methods of delay, publicity and impartial investigation which the Covenant provides.

The history of the Council's conduct of the Vilna dispute between Poland and Lithuania is less satisfactory. The matter was rendered far more difficult from the start by the fact that, immediately it was referred to the League, the Polish forces of Gen. Zeligowski executed a *coup de force* and occupied the area in dispute. The Polish Government repudiated Gen. Zeligowski, but have since tacitly admitted their responsibility for his actions. There are provisions in the Covenant which might have been applied to induce Poland to remove Zeligowski's forces from the territory he had unlawfully invaded. These provisions were not applied. Moreover, had greater publicity been given to the conduct of the dispute by the Council in its early stages, the parties would have found it difficult to maintain their unreasonable, and on some points unjustifiable, course of action. But, in spite of these difficulties and mistakes, the Council nevertheless succeeded in preventing the outbreak of war. It even induced the parties to continue direct negotiations under the presidency of a distinguished member of the Council. It unanimously adopted recommendations at its 13th session, which, if the parties accepted them, seemed likely to lead to the settlement of the dispute by methods of peaceful negotiation and not by force of arms. Thus, even when the Council fails to avail itself of its full powers under the Covenant, it may still, as a result of the moral authority which it possesses, achieve very important results.

With regard to the promotion of international coöperation (Articles 8 and 9, 23, 24 and 25 of the Covenant) the League had done perhaps the most convincing and successful work of its early history. Reference may be made to the principal activities it engaged in. The first was the Brussels Financial Conference of 1920, which resulted in the formation of economic and financial Advisory Committees, and the preparation of a scheme for the financial and economic rehabilitation of Austria. The next was the Transit Conference, held at Barcelona in the spring of 1921, which drew up a number of conventions and recommendations on transit by sea, by river and by railway. The work of this Conference was prepared in the greatest detail by a League Committee, acting under the authority of the Council, and the results which it achieved, including the establishment of a Transit Committee, on which 14 different countries were represented, were of an encouraging kind. Another Conference, on the regulation of the white slave traffic, was held in June 1921, and was attended by a far greater number of States than any other similar Conference before, and achieved results of great importance which were shortly to be embodied in the form of a convention. With regard to the allied subject of opium, the Assembly appointed a Committee which has begun its work for the supervision of the traffic in drugs in a systematic way, on the basis of which a machinery of supervision and control will in due time be worked out.

In another order of ideas, the League acted as the coördinating centre of international action in various matters in which such action could not have been achieved except through the League and its Secretariat. As an example may be cited the repatriation of prisoners-of-war already referred to. Another was the campaign against typhus in central Europe, carried out by means of a central fund raised by members of the League and administered under the authority of an Epidemics Commission appointed by the Council. Such administrative international action is unique in the history of international relations, and there seems no reason why it should not be extended advantageously in the future.

There is one other matter which should be mentioned in connexion with this aspect of the League's work—the protection of racial and religious minorities. A great number of treaties have been signed in the last 70 years or so, in which provision has been made, and solemn obligations undertaken, for the protection of such minorities, particularly in central and south-eastern Europe. It is unfortunately true that these treaties have been of very little worth. But by a series of new treaties, to which practically every State in central and south-eastern Europe has given its consent, the protection of these minorities is now placed under the authority of the League. When it is remembered how very mixed are the populations of the new States created by the Treaties of Peace, and how strong are the national feelings left by the war, it cannot be doubted that, if the League succeeds in securing the effective protection of minorities, it will do much to remove a very potent cause of trouble.

With regard to the League's work for disarmament, in addition to the Permanent Commission to which reference has already been made, the Assembly recommended to the Council that it should adopt again the plan to which it had had resort in connexion with the project for the Court of International Justice; and accordingly the Council appointed a Temporary Mixed Commission, consisting of military men, of politicians, of economists, of employers and of workmen, to study in more detail the application of Article 8, and to propose plans for the adoption of the Council and of the Assembly. This Commission had only just begun its work in the summer of 1921.

As a result, then, of the general review which has been given of the Covenant in action, it may fairly be held that in technical spheres the results which the League had achieved up to the middle of 1921 had been good. In political matters they had, whenever the Covenant had been acted upon, been no less good. But only too often the Governments of the members of the League and the members of the Council had failed to apply the provisions of the Covenant to matters of political importance with which it was intended that the League should deal. Until the members of the League use the methods of the Covenant for dealing with all international questions of first-rate political importance which arise, the League cannot have that full authority by means of which alone it will be able at times of crisis to prevent the outbreak of great world wars. If the members of the League do use the methods of the Covenant, experience justifies the belief that they will secure the effective settlement of their disputes, and that in doing so they will calm the passions and mitigate the hatreds which otherwise are calculated so gravely to menace the peace of the world.

See also the articles INTERNATIONAL LABOUR ORGANIZATION and MEDICINE, INTERNATIONAL. (R. C.)

LEATHER (*see* 16.330).—The decade 1910–20 saw considerable advances made in many of the processes incidental to leather manufacture. In addition to improvements in the older-fashioned methods of tanning, and the manufacture of leather generally, several new processes were perfected. The application of chemical control in the leather industry during this period made great headway. Whereas previously most leather manufacturers worked on empirical methods, it is now the general rule for all large leather works to employ the services of a chemist; and in consequence methods of leather manufacture have become more scientifically exact than was previously the case. Changes of procedure made necessary by the cutting-off of certain supplies during the World War period have ultimately had a beneficial influence on the industry. Alterations in the manufacturing process, thus rendered compulsory, have resulted in the perfecting of more economical working of various processes, and many of the methods used have consequently been retained with advantageous results.

Tanning Materials.—Additions to the earlier list of materials (*see* 16.332) are mimosa bark and mimosa extract. These tanning materials have attained a considerable degree of importance in the tanning of light and heavy leathers. Whereas mimosa was originally cultivated in Australia, it has latterly been introduced into S. Africa, which is now the principal source of supply. *Acacia pycnantha* (golden wattle) contains upwards of 40%–45% tannin. *Acacia decurrens* (green or black wattle) contains 36%–40% tannin. This latter variety is the one which is now most commonly cultivated in Natal and Cape Colony; its cultivation is also being carried out in northern Africa, Ceylon, and elsewhere. The manufacture of mimosa extract in S. Africa has become a commercial industry of considerable and increasing importance. This extract, which is exported from Natal in the solid form, contains from 60%–62% tannin matter. The product possesses excellent tanning properties, producing a leather of a slightly pinkish colour; it is a fermentable tannin which gives fair weight and rapid penetration, and is likely to compete with quebracho extract produced in Argentina.

Synthetic Tannins.—Great advances have been made in the manufacture of synthetic tannins. The original product of this important branch of tanning agents was "Neradol," prepared by the action of formaldehyde upon phenolic bodies, under suitable conditions. Since the introduction of this product, patented by E. Stiasny and manufactured by the Badische Anilin und Soda Fabrik in 1911, considerable progress has been made in the production of tanning agents of this character. Products of this class made by British firms are commercially obtainable under the names of "Synthetic tannin," "Syntan," "Cresyntan," "Paradol," "Maxyntan."

The leather produced by synthetic tannin is of a white colour and possesses light-weighing properties. Its principal use is in conjunction with natural tannins, either employing the material as a preliminary tannage prior to the application of the natural tannin, or using same in combination with the natural stuffs. Synthetic tannins differ from most natural tannin materials chiefly in the direction that they permeate the pelt with great rapidity and thereby accelerate the tanning process. These products are very useful for employment by curriers and leather dressers in the retanning of leather which has only been lightly or half tanned, *e.g.* E. India tanned kips, goat and sheep skins. The rapid penetration of the tannin above referred to enables the retanning to be done in a minimum of time. Whilst, in the early stages of its introduction, many difficulties were encountered in the method of application of these products, improved processes used in their manufacture have eliminated most of these, and the results are quite reliable, and synthetic tannins are now somewhat extensively used.

The introduction of synthetic tannins undoubtedly marks an epoch in the history of leather manufacture. Whilst the progress made up to the present is not sufficient to allow of their entire substitution for the natural products, it would appear probable that, aided by the great advances made in chemical technology, the day may not be so far distant when leather will be produced entirely by products of this kind.

Sulphite Cellulose Extract.—This product, sold under the names of "Wood Pulp Extract," "Spruce Extract," etc., results as a by-product from the manufacture of paper from wood pulp. The liquor resulting on the treatment of wood with calcium and sodium bisulphite in the manufacture of cellulose was, prior to about ten years ago, a waste product which had no industrial application. By a special method of treatment, with a view to ridding the product of objectionable impurities, *e.g.* calcium and iron salts, and subsequent concentration, an extract was prepared of 18°–25° Baumé, which has considerable application in the manufacture of leather. Whilst the product may not be regarded as a true tanning agent, it may be employed in conjunction with natural tannins. The material is most generally applied towards the latter end of the tanning process; and when retanning leather for the purpose of obtaining increased weight, the application is made when the tanning process is almost entirely complete. The fact that this is a by-product and can, consequently, be cheaply prepared, has caused it to be used to quite a considerable extent. The amount of matter absorbable by hide powder present in the commercial products varies from about 18% to as high in some cases as 25%.

Analysis of Tanning Materials.—The method of analysis most generally used is the hide-powder method, resulting upon the work of the International Association of Leather Trades' Chemists and the Society of Leather Trades' Chemists. This method for the estimation of tannin, whilst still being somewhat empirical, enables the obtainment of concordant results, and furnishes a figure which bears some relationship to that obtainable in practical tanning.

The following is the method of carrying out the analysis which is officially recognized by the Society of Leather Trades' Chemists:—Such a quantity of material shall be employed as to give a solution containing as nearly as possible four grams of tanning matter per litre, and not less than 3·5 or more than 4·5 grams. Liquid extracts shall be weighed in a basin or beaker and washed with boiling distilled water into a litre flask, filled up to the mark with boiling water, and well mixed and rapidly cooled to a temperature of 17·5° C., after which it shall be accurately made up to the mark, again well mixed, and filtration at once proceeded with. Sumach and myrabolam extracts should be dissolved at a lower temperature. Solid extracts shall be dissolved by stirring in a beaker with successive quantities of boiling water, the dissolved portions being poured into a litre flask, and the undissolved being allowed to settle and treated with further portions of boiling water. After the whole of the soluble matter is dissolved, the solution is treated similarly to that of a liquid extract. Solid tanning materials, previously ground till they will pass through a sieve of five wires per centimetre, are extracted in Koch's or Procter's extractor with 500 c.c. of water at a temperature not exceeding 50° C., and the extraction continued with boiling water till the filtrate amounts to one litre. It is desirable to allow the material to soak for some hours before commencing the percolation, which should occupy not less than three hours, so as to extract the maximum of tannin. Any remaining solubles in the material must be neglected, or reported separately as "difficultly soluble" substances. The volume of liquor in the flask must, after cooling, be accurately made up to one litre.

Filtration.—The infusion must be filtered until optically clear. No correction for absorption is needed for the Berkefeld candle, or for S. and S.-590 paper if a sufficient quantity (250–300 c.c.) is rejected before measuring the quantity for evaporation, and the solution may be passed through repeatedly to obtain a clear filtrate. If other methods of filtration are employed the average correction necessary must be determined in the following manner:—About 500 c.c. of the same or a similar tanning solution is filtered perfectly clear, and, after thorough mixing, 50 c.c. is evaporated to determine "total soluble No. 1." A further portion is now filtered in the exact method for which the correction is required (time of contact and volume rejected being kept as constant as possible) and 50 c.c. is evaporated to determine "total soluble No. 2." The difference between No. 1 and No. 2 is the correction sought, which must be added to the weight of the total solubles found in analysis.

An alternative method of determining correction, which is equally accurate and often more convenient, is to filter a portion of the tanning solution through the Berkefeld candle till optically clear, which can generally be accomplished by rejecting 300 or 400 c.c. and returning the remaining filtrate repeatedly; and at the same time to evaporate 50 c.c. of the clear filtrate, obtained by the method for which correction is required, when the difference between the residues will be the correction sought. (It is obvious that an average correction must be obtained from at least five determinations.) It will be found that this is approximately constant for all materials, and amounts in the case of S. and S.-605, 150 c.c. being rejected, to about 5 mgm. per 50 c.c., and where 2 grams of kaolin are employed in addition, to $7\frac{1}{2}$ mgm. The kaolin must be previously washed with 75 c.c. of the same liquor, which is allowed to stand fifteen minutes and then poured off. Paper 605 has a special absorption for the yellow colouring matter in sulphited extracts.

Hide powder must be of a woolly texture, thoroughly delimed, preferably with hydrochloric acid, and must not require more than 5 c.c. or less than 2·5 c.c. of decinormal NaOH or KOH to produce a permanent pink colour with phenolphthalein on $6\frac{1}{2}$ grams of the dry powder suspended in water. If the acidity does not fall within these limits it must be corrected by soaking the powder before chroming for 20 minutes in 10 to 12 times its weight of water, to which the requisite calculated quantity of standard alkali or acid has been added. The hide powder must not swell in chroming to such an extent as to render difficult the necessary squeezing to 70–75% of water, and must be sufficiently free from soluble organic matter to render it possible in the ordinary washing to reduce the total solubles in a blank experiment with distilled water below 5 mgm. per 100 c.c. The powder when sent out from the maker must not contain more than 14% of moisture, and must be sent out in airtight tins.

The detannization must be carried out in the following manner:—The moisture in the air-dried powder is determined, and the quantity equal to 6·5 grams actual dry hide powder is calculated, which will be practically constant if the powder be kept in an airtight vessel. Any multiple of this quantity is taken according to the number of analyses to be made, and wet back with approximately 10 times its weight of distilled water. Very woolly powders require slightly more than 10 times their weight of water; a powder may be considered "woolly" if it cannot be poured like sand from a beaker. Two grams per 100 of dry powder of crystallized chromic chloride, $CrCl_3 6H_2O$, is now dissolved in water and made basic with 0·6 gram of Na_2CO_3 by the gradual addition of 11·25 c.c. of normal Na_2CO_3, thus making the salt correspond to the formula $Cr_2Cl_3(OH)_3$. This solution is added to the powder, and the whole churned slowly for one hour. In laboratories where analyses are continually being made, it is more convenient to employ a 10% stock solution, made by dissolving 100 grams of $CrCl_3 6H_2O$ in a little distilled water in a litre flask and very slowly adding a solution containing 30 grams of anhydrous sodium carbonate, with constant stirring, finally making up to the mark with distilled water and well mixing. Of this solution 20 c.c. per 100 grams or 1·3 per 6·5 grams of dry powder should be used.

At the end of one hour the powder is squeezed in linen to free it as far as possible from the residual liquor, and washed and squeezed repeatedly with distilled water, until, on addition to 50 c.c. of the filtrate of one drop of 10% K_2CrO_4, and four drops of decinormal silver nitrate, a brick-red colour appears. Four or five squeezings are usually sufficient. Such a filtrate cannot contain more than 0.001 gram of NaCl in 50 c.c.

The powder is then squeezed to contain 70–75% of water, and the whole weighed. The quantity Q containing 6·5 grams dry hide is thus found, weighed out, and added immediately to 100 c.c. of the unfiltered tannin infusion along with $(26{\cdot}5-Q)$ of distilled water. The whole is corked up and agitated for 15 minutes in a rotating bottle at not less than 60 revolutions per minute. It is then squeezed immediately through linen, one gram of kaolin added to the filtrate, stirred and filtered through a folded filter of sufficient size to hold the entire filtrate, returning until clear, and 60 c.c. of the filtrate is evaporated and reckoned as 50 c.c., or the residue of 50 c.c. is multiplied by six-fifths. The non-tannin filtrate must give no turbidity with a drop of 1% gelatine, 10% salt solution. The kaolin may be used by mixing it with the hide powder in the shaking bottle. The analysis of used liquors and spent tans must be made by the same methods employed for fresh tanning materials. The liquors or infusions, being diluted, are concentrated by boiling *in vacuo*, or in a vessel so closed as to restrict access of air, until the tanning matter is, if possible, between 3·5 and 4·5 grams per litre, but in no case beyond a concentration of 10 grams per litre of total solids, and the weight of hide powder must not vary from 6·5 grams.

The results must be reported as shown by the direct estimation, but it is desirable that, in addition, efforts should be made, by determination of acids in the original solution and in the non-tannin residues, to ascertain the amount of lactic and other non-volatile acids absorbed by the hide powder and hence returned as "tanning matters." In the case of used tans it must be clearly stated in the report whether the calculation is on the sample with moisture as received, or upon some arbitrarily assumed percentage of water; and in that of used liquors whether the percentage given refers to weight or to grams per 100 c.c., and in both cases the specific gravity shall be reported.

Processes Preparatory to Tanning.—Considerable advances have been made in the methods of preparation of the hides and skins for tanning, particularly in the liming process. The beneficial influence of the addition of sodium sulphide to lime in the depilation of skins and hides, in the direction of accelerating the process and effecting the desired result as regards loosening of the hair and epidermis, has long been well known. During recent years the employment of gradually increasing strengths of this addition to the liming process has been more largely practised, with the result that the time required for the depilation of various goods has been materially shortened. Particularly in the manufacture of calf, sheep and goat skins into chrome tanned leather, the use of this depilatory has assumed great importance. Dependent upon the characteristics required in the resulting leather, the percentage of sodium sulphide employed varies between 1% and 5% of the soaked weight of skins. When dealing with somewhat common sun-dried or dry-salted skins, it is now general practice to use a very strong solution, with a view to reducing the time of the liming process to two or three days, whereas previously two or three weeks was not considered unduly prolonged.

Improvements have been made in the carrying-out of the liming process in the direction of applying mechanical labour-saving devices.

In order to obtain greater uniformity than is the case in the finished leather resulting from the older-fashioned method of laying the goods in a saturated solution of lime in a pit for varying periods, several manufacturers have, with a view to saving time and labour, installed special mechanical apparatus for the purpose of agitating the lime liquor. In the case of heavy goods, *e.g.* hides, the goods are either suspended in the lime-pit and the liquor agitated by means of a screw propeller or small paddle-wheel working in the bottom of the pit; or the hides are suspended from a wooden or steel framework placed slightly below the surface of the liquor in the pit, and the necessary movement imparted by rocking the frame by mechanical power. A further method installed in several large works consists in keeping the lime liquors in a state of agitation by blowing compressed air into the bottom of the pit, thereby causing the liquor to be continually in a state of motion during the period of immersion of the goods.

With a view to minimizing the labour involved in handling hides or skins when liming by the pit method, liming in cages is now practised. In this method the goods are placed in a large wooden cage contained in the ordinary lime-pit; the cage and its contents can be bodily removed by means of a travelling crane working overhead. The goods are placed in the cage on one of the pits and are then transferred, as and when required, from one lime solution to another by attaching same to the travelling crane, withdrawing the cage containing the pack of hides and skins. The removal of the goods through the whole of the series of pits, and the transference of the pack to the unhairing and fleshing machines without the employment of any hand-labour for handling the goods, may thus be accomplished by this means.

In the liming of light skins, sheep and goats, for example, the liming process has been considerably accelerated by liming in paddle-wheels instead of in pits; the goods being paddled several times daily during the period of their immersion, thus eliminating the labour involved in the older-fashioned method of withdrawing each individual skin by hand from the pit and then replacing for the purpose of altering the position in the solution.

Puering and Bating.—Great improvements have been made in the operations of puering and bating by substituting solutions containing pancreatic enzymes for the ordinary bird-excrement and dog-manure infusion used for depleting skins after the liming process. Enzymes of pancreas absorbed in wood sawdust, or vegetable meal, mixed with varying proportions of ammonium chloride or boracic acid, are now almost entirely used in substitution for the older-fashioned disgusting process. These substitutes have resulted on the researches of J. T. Wood; and it has been recently shown by A. Seymour-Jones and J. T. Wilson that the depleting action of pancreatic enzymes is due to their solvent action upon elastins. The addition of ammonium chloride or boracic acid is for the purpose of effecting the removal of the lime; the enzymes by their liquefaction of the elastins bring about that degree of flaccidity required on most light leathers before tanning.

Currying.—The older-fashioned process of impregnating leather with grease by the application of a dubbin consisting of a mixture of tallow and cod oil, when manufacturing the so-called "waxed" leathers for boot upper leather, has now almost become a thing of the past. Chrome tanned "box" and "willow" calf leather have almost entirely supplanted the old-fashioned greasy leather for use in the manufacture of boot uppers for general wear. For leather intended for army boots and boots for agricultural and similar purposes, the method of grease impregnation by drum-stuffing is the one universally practised. In the manufacture of belting leathers, and leather for hydraulic purposes, hose pipes, leather buckets, etc., the method of impregnating by dipping the leather in melted greases is very commonly practised. This is carried out by placing the previously thoroughly dried leather in a suitable vat, which can be heated by means of a steam coil to any desired temperature, and which contains a mixture of melted paraffin wax, and hard tallow or wool stearine, etc.; the leather being immersed for a few moments until complete permeation has been effected, when it is withdrawn and then scoured for the purpose of removing grease from the grain and flesh surfaces.

Sulphonated Oils.—Sulphonated oils, the original of which was the so-called Turkey Red Oil, made by treating castor oil with sulphuric acid, have now been generally adopted in the fatliquoring and dressing of leather of all kinds. On account of the fact that these oils are acidic in character and are not adversely affected by acid solution, their employment has been considerably extended in respect of their application in the nourishing and fatliquoring of dyed leather. Properly prepared sulphonated oils have no adverse influence on leather which has been dyed with acid colours, with the consequence that they greatly facilitate the manufacture of dyed leathers and enable the fatliquoring operation to be done in the same solution as the dyeing has been performed, if this method of application is to be desired on the grounds of economy.

Sulphonated oils specially prepared for the leather industry consist of sulphonated wool olein, sulphonated castor oil, sulphonated neatsfoot oil, and sulphonated mineral oils. All these have been used for this purpose in addition to being used for oiling leather in the tanned condition prior to drying, in substitution for cod oil, mineral oil, etc., which were almost universally used previously for this purpose; the emulsion which results on dilution of these oils with water is useful in the direction of producing a lighter-coloured leather than is the case when the older-fashioned process is employed.

Glove-Leather Dressing.—The alum, salt, flour and egg process ordinarily practised in the manufacture of sheep and lamb skins for the lighter grades of glove leather has been either partially or entirely substituted by many manufacturers, who have adopted the chrome tanning process. For the heavier grade of glove leather required for men's wear, chrome leather would appear to possess many advantages over the ordinary alum and salt process; the leather being softer, more tensilely strong, and stouter in substance than that produced by the alum and salt method, in addition to being waterproof and enabling the gloves to be washed after wear, which is not practicable with alum leather, the tannage of which is readily removable by washing, causing the gloves to lose softness on drying.

The dyeing of glove leather is now more extensively carried out by the aid of coal-tar colours in substitution, either entirely or partially, for the wood and natural dye-stuffs previously used.

Suede Leather.—Suede leathers finished with a velvet-like surface or "nap" are now largely employed in the manufacture of gloves, fancy leather articles, trimmings for clothing, ladies' hats, shoes and handbags, etc. These goods are invariably finished on the flesh side, and the larger proportion of these leathers are made from E. India tanned ("Persian") sheep.

These goods, after the usual preparation and retanning with sumach, are dried, nailed, strained out on boards, and then buffed on the flesh side to obtain the desired fineness of "nap." After buffing, they are wetted down and dyed, and afterwards fatliquored with sulphonated oil, being finally dried, and finished either on the buffing-wheel or by "scurfing" with an emery-covered scurfer.

Suede glove leathers are tanned by the alum, salt, flour and egg process, or by the chrome tanning process, and are then fluffed on the flesh side, fluffing several times on a fine emery or carborundum wheel, being afterwards re-dyed with a mixture of natural dye-stuffs and "topped" with a suitable coal-tar colour; the finishing operations consisting of staking and re-wheeling.

Calfskins with a suede finish are generally finished on the grain side, the goods previous to dyeing being buffed on a rapidly rotating carborundum buffing wheel, after setting and drying; the goods being re-buffed lightly or the required "nap" raised by rubbing over with an emery-covered block after dyeing and drying.

Aldehyde Leather.—Sheep fleshes tanned by the aldehyde process and finished white are now largely used in the manufacture of washable gloves. This tannage effected by means of formaldehyde, originally invented by Payne and Pullman in 1898, has come into considerably extended use in this branch of the leather industry.

The goods, after liming, are frizzed and then delimed and leathered in the drum with a weak solution of formaldehyde rendered slightly alkaline by the addition of washing soda or soda ash, to which French chalk or other white filling agent is sometimes added. The goods, after leathering, are dried, staked and wheeled on both sides, and finally calendered to produce the fine nap-like surface.

Chrome Tanning.—The rapidity with which this method of tanning converts pelt into leather, combined with the strength, appearance, and wearing properties of the finished leather, has caused this method to be almost universally adopted in the manufacture of boot upper leather; glacé kid (*i.e.* chrome tanned goatskins), "box," "willow" calf, and side leather.

Considerable improvements have been made in the manufacture of chrome tanned leather. These improvements consist chiefly in modifying the original processes invented by Schultz and Martin Dennis; the former inventing the "double-bath" process which is employed almost exclusively in the manufacture of glacé kid, and the latter the "single-bath" process which is used on calf and side leather. The more accurate adjustment of quantities combined with a chemical control of the tanning process and greater skill in the finishing processes are chiefly responsible for the improved manufacture, rather than any material alteration in the general process.

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LECOCQ, ALEXANDRE CHARLES (1832–1918), French musical composer (*see* 16.355), died in Paris Oct. 24 1918.

LEE, SIR SIDNEY (1859–), English man of letters (*see* 16.363), was knighted in 1911. His lectures on *The French Renaissance in England* and *Great Englishmen of the 16th Century* were published in 1910; and his later works include *Principles of Biography* (1911) and *Shakespeare and the Italian Renaissance* (1915). He became president of the English Association in 1917 and dean of Arts in the university of London in 1918.

LEE, VERNON, the pen-name of Violet Paget (1856–), English author, was born in France of English parentage Oct. 14 1856, and made her home at Maiano, near Florence, identifying herself with her adopted country and making special study of its art and history. Amongst her publications are *Studies of the Eighteenth Century in Italy* (1880) and many volumes of essays; certain novels and stories, such as *Miss Brown* (1884); *A Phantom Lover* (1886); *Hauntings* (1890); *Vanitas* (1892); *Sister Benvenuta* (1906) and *Louis Norbert* (1914); a play in verse, *Ariadne in Mantua* (1903), and *Satan the Waster*, a philosophic trilogy (1920), as well as a volume of political essays, *Gospels of Anarchy* (1908).

Her half-brother, EUGENE LEE-HAMILTON (1845–1907), who was also born in France Jan. 6 1845, was educated in France and Germany and at Oriel College, Oxford, afterwards entering the diplomatic service. He married in 1898 Annie E. Holdsworth, author of *Joanna Traill, Spinster; The Years that the Locust Hath Eaten*, and other novels. He published a number of volumes of poetry, as well as a translation of Dante's *Inferno*, and (with his wife) *Forest Notes* (1899). He died at Florence Sept. 7 1907.

LEGROS, ALPHONSE (1837–1911), Anglo-French artist (*see* 16.380), died in London Dec. 8 1911.

LEHMANN, LIZA (1862–1918), English singer and composer, was born in London July 11 1862, the daughter of the artist Rudolf Lehmann. She studied singing under Alberto Randegger and Hamish MacCunn, making her début in 1885, and became extremely popular as a concert singer. In 1894 she married Herbert Bedford, the composer, and retired from the concert platform, devoting herself henceforward chiefly to composition. Her most popular works are the song cycles *In a Persian Garden* (1896, words from the Rubaiyat of Omar Khayyam) and *The Daisy Chain* (1900), and various Shakespearean songs, while she also produced a light opera, *The Vicar of Wakefield* (1907); the music for the farce *Sergeant Brue* (1904) and the morality play *Everyman* (1915). Madame Lehmann became well known as a teacher of singing. She died at Hatch End, Pinner, Sept. 19 1918.

LELAND STANFORD JR. UNIVERSITY (*see* 16.406).—The work of the university was so reorganized during the decade 1910–20 that the first two years constituted a so-called lower division with certain specified requirements, including biology, a course in citizenship, etc. The major department system became operative at the beginning of the junior year, and degrees were granted upon the recommendation of the departments. The institution sold some of its large ranch property in 1919, and in 1921 had about $25,000,000 in investment securities and an educational plant that included the Stanford Medical School, Lane and Stanford hospitals, Stanford school for nurses, the Lane medical library, all in San Francisco, and the Hopkins marine station on Monterey Bay, the whole valued at $10,000,000. The medical school owed its origin to the fact that the directors of the Cooper Medical College in 1910 turned over that institution and the associate Lane hospital to Stanford. In addition to the schools of law, medicine and education, a graduate school was organized with a dean at its head in 1917. New dormitories for women were constructed and a housing scheme inaugurated whereby practically all the faculty and students will eventually live on the college campus. Volumes in the library numbered 319,872 in 1920, of which 48,187 are in the Lane medical library and 23,360 in the law library.

In 1920–1 the students numbered 2,489, of whom 500 were women and 281 graduates, a gain of 43% over the 1907–8 figures, which were 1,738, of whom 500 were women and 126 graduates. Limitation in the size of the endowments and of the facilities of the plant caused a restriction in the student body to something over 2,000. Only 500 men with less than a year and a half of college standing are admitted each year, but there are no limitations for upper-class students. The tuition fee in 1920 was $40 per quarter, but after Oct. 1 1921 it was to be $75.00. There was in operation a tuition note system by which worthy students might delay payment of tuition until three or more years after graduation. Although in 1921 military training was not required, there was a field artillery unit of the Reserve Officers' Training Corps.

During the World War Stanford was represented by about 3,000 of its members, graduates and undergraduates, of whom 70 lost their lives. A Students' Army Training Corps unit, comprising practically all the men students, was organized during the war period.

Dr. John Casper Branner, a distinguished geologist, was president from 1913 to 1915. Dr. Ray Lyman Wilbur became president Jan. 1 1916. (R. L. W.)

LEMAÎTRE, FRANÇOIS ÉLIE JULES (1853–1915), French critic and dramatist (*see* 16.408), died in Paris Jan. 21 1915.

LEMAN, GÉRARD JOSEPH MATHIEU GEORGES (1851–1920), Belgian general, was born at Liége Jan. 8 1851, the son of an artillery captain who was a professor at the École Militaire. He entered the École Militaire at Brussels, and when he left it in 1869 had acquired a reputation for brilliance. During the Franco-German War he served in a Belgian observation corps. In 1882 he became a member of the teaching staff of the École Militaire, and both then and later, as head of the school, he exerted considerable influence on military matters. In Jan. 1914 he was appointed commander of the fortress of Liége and also of the 3rd Div., and concentrated all his efforts upon strengthening the defences of the town against a possible German attack. This came in Aug. 1914, when Gen. von Emmich's army appeared before Liége and summoned it to surrender. On Gen. Leman's refusal the fortress was attacked and ultimately destroyed, while its heroic defender was captured and imprisoned in Germany. As a token of respect, however, he was allowed to retain his sword. He returned to Belgium after the Armistice, and died at Brussels Oct. 17 1920.

LEMBERG (LVOV), BATTLES ROUND, 1914–5.—In the Austro-German campaign against Russia, the operations round Lemberg (Polish, Lvov) both in 1914 and in 1915 formed an important part of the fighting in Galicia. They are described here in two general sections.

I. The Galician Battle of Aug.–Sept. 1914

In accordance with the general tactical and strategical situation, the main body of the Austro-Hungarian army concentrated and formed up for deployment in Central and Eastern Galicia, about Aug. 20 1914. The four armies (I., II., III., IV.) formed up for deployment under cover of a frontier guard for which provision had been made in peace-time. This was augmented by other troops as follows: (*a*) those corps which had been stationed in the deployment area (I. Cracow, X. Przemysl, XI. Lemberg), parts of which had even in peace-time been pushed forward to the frontier; (*b*) the cavalry divisions quartered in the above-named areas, which had been hastily reënforced from the interior of the monarchy; (*c*) the Territorial Landsturm, Gendarmerie and Customs guards, which had been called up on the first day of the alarm to occupy all the important frontier posts. These precautions were taken on the definite assumption that the Russians would employ their powerful cavalry masses in a rapid incursion for the purpose of hindering the mobilization and deployment of the Austro-Hungarian armies, an assumption which subsequent events almost completely belied.

Although all components of the army formed up for deployment according to programme, the advantage to be gained by greater speed in their mobilization, on which the Army Commands of the Central Powers had always counted, was not achieved. The fact was that, though incomparably better situated as regards mobilization and deployment, the Central Powers suffered from mistaken political and military-political calculations, which delayed effective war preparation by nearly a month, and also from the fundamentally unsound grouping of the armies. The main portion of the II. Army (IV. and VII. Corps) was first deployed against Serbia on the Sava, where portions of it were even engaged, with the result that this army—having to traverse the whole breadth of the monarchy to the N.—was only represented by one-third of its strength (the Kövess army group, XII. Corps) in the great introductory battles. After the arrival of all forces allocated to the N. the total strength of the armies was, roughly, 750,000 rifles, 60,000 sabres and 2,000 guns.

The first-line infantry was well armed and equipped, though the rifle was ballistically somewhat inferior to the Russian service pattern. The cavalry was well mounted, but undeniably old-fashioned in its equipment. The artillery was relatively inferior to the Russian in the quantity, and absolutely in the quality of its guns. In view of the medley of races within the Austro-Hungarian Monarchy, and the violent constitutional struggles arising from the centrifugal nationalist agitation fanned from outside, doubts had arisen in many quarters as to the trustworthiness of the troops. As regards the first period of the war these doubts were certainly not justified. The spirit of the army resisted all attempts to undermine it, and the bearing of the troops in the initial battles was excellent, superior indeed to that of the enemy on more than one front.

Strategic Aims.—On the Russian side the forces used in the opening operations and the preliminary battles were as follows:—(*a*) against East Prussia—the I. and II. Armies with over 20 infantry divisions; (*b*) against Austria-Hungary—the IV., V., III. and VIII. Armies in the first line, the VII. Army in the second. These armies had each a strength of 9–12 infantry and 3–4 cavalry (or Cossack) divisions. Judged by the number of units, therefore, Russia's superiority in numbers did not appear to be overwhelming, but it was actually greater than appeared, since the Russian infantry division was about one-fifth stronger in infantry and artillery than the Austro-Hungarian. About one-quarter of the Russian forces consisted of reserve divisions.

The information received by the Austro-Hungarian Higher Command, before and during deployment, gave a far from clear idea of the operative situation. They knew that the transport of troops for deployment was going forward on all railway lines and were aware of the evacuation of Congress Poland; but as regards grouping and strength, particularly in the case of the heavy-massed groups rolling up from the E., they appear to have been in uncertainty. It is possible that they underestimated these. For the Austro-Hungarian conduct of operations two alternatives presented themselves: (1) to unite the whole of the fighting forces on the Middle and Lower San and accept a defensive battle, advantage at the same time being taken of any opportunity for a well-timed offensive, using as a pivot for this the San and Vistula line (by that time completely prepared), the fortress of Przemysl, and the San and Vistula bridgeheads, designed for the purpose; (2) to open an immediate offensive against the Russian army masses, as yet divided, while they were making their concentric advance.

The advantage of the first plan lay in the possibility of utilizing the whole of the forces to the last rifle and gun, and also of inflicting partial tactical defeats on the enemy by swift and skilful advances from the bridgeheads. Against this weighed the disadvantage of allowing the Russians to bring up the whole of their superior forces. East Galicia, too, with Lemberg, its political and economic centre, as well as large portions of Central Galicia, would be relinquished without a struggle to the enemy, who could also make use of his increasing numerical superiority to invade Hungary—with momentous political results.

The advantage of the second plan lay in the reasonable hope of falling on the still divided enemy armies with relatively superior forces. But here the danger was that, as the army would at first have to advance fan-wise owing to its obligatory initial situation, a mishap in any one of the armies might—owing to the relatively small extent of the area available for manœuvring—compromise the whole situation and even bring all the armies into a critical position. Thus the second alternative was by far the more risky solution, depending as it did on skill in the leading of the various armies. Provided, however, that no important errors of detail were made, it promised the greater results; and it was the alternative chosen by the Army Higher Command.

For the Russians the natural procedure, aimed at from the very first, was to make a concentric attack on the Dual Monarchy simultaneously with a threat to East Prussia, and one to Berlin in the background. The enormous fighting masses of the Russian Empire, and the relative shortness of the lines, admitted of this double project. Thanks to the early completion of their preparation they were also enabled to make full use of their original enveloping base against Austrian territory and the armies forming up for deployment within it. All the main lines of transport converged thither, while the whole conduct of operations was materially advanced by the circumstance that the strategical and even the tactical communications between the two great concentration areas—the territory between the Vistula and the Bug on the one side and Podolia on the other—were completely guaranteed by the triangle of fortresses—Kovno, Dubno and Luck (Lutsk). The Russian plan of operations was accordingly drawn up on these lines. In the area between the Vistula and the Bug were posted the V. Army (Chelm) and the IV. Army (Lublin) facing generally southward; and against East Galicia the III. and VIII. Armies facing generally westward, while the VII. Army followed in échelon to the left.

Preliminary Operations.—Some characterization of the fighting methods on both sides, as evidenced in the beginning of the war, may not be out of place here.

In all Austro-Hungarian tactical regulations and training manuals the greatest stress was laid on the encounter battle. Conscious and deliberate initiative was represented as the leading motive of every sort of action in war or battle. In practice, particularly in the grand manœuvres, this motive, correct as it was, came to be so exaggerated that the attack was practically asserted to be the one true form of battle. This undoubtedly created a certain rigidity of opinion which in the long run developed into schematism. To fail to attack was to run great risk of adverse criticism and judgment, a decisive personal motive being thus added. Another result was a frequently very marked belittling of the effect of weapons, which was particularly the case with the artillery. Rigorous battle-training and profitable employment of this arm were consequently taken too little into account; and its tactical coöperation was developed rather on the formal side. With the cavalry analogous principles were laid down. Dismounted fire action above all was a method of fighting rarely and unwillingly practised. The infantry was very well trained on modern principles, particularly in the technique of rifle fire; but the tactical coöperation of the three arms received no special attention. Taking all in all it was reasonable to count upon a quick engagement by all detachments and groups, particularly as the fighting *moral*—especially at the beginning of the war—was at its highest level, and the flexibility of units and the uniform training of commanders of all grades seemed to guarantee high manœuvring power.

For the Russian army the war with Japan had been an excellent training. The coöperation of all arms, and particularly the employment of their strong artillery, had reached a high stage of development. Especially remarkable was their rapid fortifying of the field of battle by means of which a Russian front habitually covered itself almost as soon as an action began. In this respect the Russians were at first far superior to their opponents. Indirectly this no doubt contributed to the clumsiness of most of the attacks, which often resulted, contrary to the wish of the Command, in a stationary fire-fight in which the superiority of the Russian artillery was usually balanced by that of the Austro-Hungarian musketry training. In manœuvring the Russians were less skilful than their opponents, who profited by this fact to extricate themselves from many an awkward tactical situation. The Russians were capable of great marching feats on occasion, but their pace was generally rather slow. Their fighting *moral* was excellent throughout; indeed their endurance in the most difficult tactical situations could not be surpassed. The reconnoitring activities of the Russian cavalry, particularly of the Cossacks, was remarkable, and not less remarkable was the use made of political propaganda, systematically introduced in peace, and the good organization of intelligence in the potential theatre of operations. On the other hand, the Russian cavalry was disinclined to mounted action on a large scale and had a marked preference for the dismounted fire-fight. No considerable mounted attack therefore ever occurred, though on several occasions large masses of cavalry were opposed to each other.

On Aug. 15 the Austro-Hungarians pushed forward all the cavalry divisions in the deployment area to gain touch with the enemy. It was hoped that this, combined with a general air reconnaissance the day before, would give the necessary data for decisive conclusions. But the reconnoitring activity of the cavalry resulted only in a series of small cavalry actions, successful and unsuccessful, without bringing in trustworthy information as to the grouping of the enemy, whose fighting strength and readiness for operations were, speaking generally, underestimated in consequence. Nevertheless Aug. 18 saw the issue of orders which formed the basis of the offensive scheme in all armies. This inevitably involved—even merely geometrically—the armies drawing apart excentrically. The Army Higher Command, however, reserved to itself the definitive grouping of the larger units. This was particularly the case with the IV. Army, in the centre, whose orders were "to group itself in such a way as to be able to push forward towards the N., N.E. or E."

On the three following days (Aug. 20, 21 and 22) the I. Army successfully accomplished the crossing of the Tanew region, dreaded for its impracticability, without mishap, and took possession through its advanced guards of the pronounced ridge lying north of this region from E. to W. For the rest, the I. Army was required to occupy the whole of the ridge on Aug. 22, the IV. Army, as before, to hold itself in readiness to proceed to the N. or N.E., while the III. and II. Armies (or rather that group of the latter, under Gen. von Kövess, which had arrived in the theatre of war), with fronts facing E., were to deal with any possible attacks.

Out of this situation there arose a string of combats which at first were favourable to Austria-Hungary. Thus at Czernowitz a Russian division was repulsed by an Austrian Landwehr division and thus also arose S. of Krasnik from the 23rd onwards a series of actions which are collectively known as "the battle of Krasnik." The I. Army went forward, with its nine divisions in columns aligned, and came upon the enemy in a prepared position but numerically greatly inferior. At first, indeed, there were only two and a half infantry divisions, hurriedly thrown forward from the Lublin concentration area, and though reënforcements were sent up to them they remained considerably inferior in numbers. Fighting with extraordinary bravery they were nevertheless ousted from all their positions by the morning of Aug. 25, the I. Army attempting to envelop the Russian right wing. In their hasty retreat the Russians left behind them 6,000 prisoners, 28 guns and a number of standards.

Under the influence of these events the Austro-Hungarian Army Higher Command, on the evening of Aug. 24, issued the definitive dispositions for developing its offensive. In accordance with this the I. and IV. Armies were to deliver the proposed great blow northward, *i.e.* against the IV. and V. Russian Armies, the general direction given being "Lublin and Chelm." The III. Army and the available portions of the II. Army were to be entrusted with the defence against the Russian III. and VIII. Armies advancing from the E., which mission—it must be emphasized—they were to carry out offensively. Thus on the Austro-Hungarian side a mass of 350 first-line battalions was allotted to the main blow northward while 150 battalions (which could soon be reënforced up to 200) were to act on the defensive towards the east.

The first great scheme in the operations, which aimed at a rapid advance and an attack on the enemy's oncoming main groups before they could unite, might therefore be considered a success—at least as regards the first part. In view of the difficulties surmounted this was certainly a considerable strategical achievement. It now remained to secure the tactical results—that is to say, the blow in the N. must end in a complete victory, and the enemy in the E. must be effectually repulsed. The first of these efforts succeeded, the second did not; and from this failure arose the general battle of Grodek–Rawa Ruska and eventually the retreat beyond the San.

It should be added that Gen. von Kummer's army group had received instructions as early as Aug. 15 to invade Russian Poland from the concentration area at Cracow and to traverse that country in a north-easterly direction, thus forming a strategic protecting flank for the main army advancing on the right bank of the Vistula. It was also expected to provide the necessary reserve and nucleus for the anticipated revolutionary movement in Congress Poland. The execution of this task should not have been difficult, in view of the fact that the Russians had at first only the one cavalry division (the 14th) in the area W. of the Vistula, but in fact it proved extraordinarily difficult, as the whole army group—excepting the 7th Cav. Div.—was made up of Landsturm formations which had been thrown together on the spot and whose armament and equipment were quite inadequate.[1] In these circumstances and with these masses, it became almost a work of art to carry through the extremely exhausting marches and small skirmishes which arose out of the Russian opposition. As, too, the desired insurrection almost entirely failed to materialize, the Army Higher Command recalled the whole army group—from below Zawichost—on Aug. 24, to the right bank of the Vistula, where it was placed under the command of the I. Army, which had thenceforward 12 divisions at its disposal. In addition to this Gen. von Woyrsch's Silesian Landwehr corps had now pushed through from Prussia, so that, from Sept. 4 on, the I. Army had the strength of 14 inf. and 3 cav. divisions. This army had meanwhile continued its advance to an attack in the general direction of Lublin, according to orders. By Sept. 2, it had, after winning a succession of skirmishes, come within half a day's march of the line which had been formed S. of the central point just referred to, and was being vigorously defended by the whole of the IV. Russian Army, which had come up in the meantime. The I. Army's attempt to envelop the Russian right wing met with but slight success, but a group that had formed up behind the Russian left wing delivered a thrust which, at a later stage in the action, was to influence the course of events considerably. Before going further into this it will be well to describe the operations and battles of the IV. Austro-Hungarian Army which culminated in the eight days' battle of Komarow.

Battle of Komarow.—Portions of the IV. Army's II. Corps had gone into action on the afternoon of the 24th being attached to the I. Army. It was known that a strong enemy group (the XXV. Corps) was in the act of deploying before Zamosc. The IV. Army had at its disposal, prepared for prompt service, only the 3 divisions of the II. Corps, the 10th Div. of the IX. Corps and parts of the VI. Corps. The remainder (the 26th Div. of the IX. Corps and the XVII. Corps) were still forming up for deployment and in some cases had not yet arrived on the scene of action. The army commander decided to proceed to the attack with the troops on the spot, in order to bring the enemy to a stand, and then make an enveloping attack on both wings, in which he would be supported by the Archduke Joseph Ferdinand's army group (3rd and 8th Infantry, 41st Landwehr and 2nd Cav. Divs.) which had been allotted to the army command on the evening of the 24th. But first the nearest enemy corps had to be repulsed and the advance of the Russian XIX. Corps, marching from Tyszowice, cut off.

To deal with the first of these tasks a group was formed of 3 divisions (4th, 13th and 25th) of the II. Corps and the 10th Div. of the IX. Corps, under the command of General of Infantry Schemua. From 6 A.M. on Aug. 26 this group went forward in several parallel columns along the ridge W. of the Tomaszow–Zamosc road. The collision with the enemy, who were established in hastily erected shelters, took place in the afternoon. By evening the enemy had been thrown out of their positions and forced back to the northern ridge. Here they established themselves firmly in prepared positions.

The VI. Corps, advancing in three divisional columns (39th, 27th and 15th Divs.) écheloned in rear to the right, had first of all to change its direction of march from north-east to north. The 39th Div., advancing on and E. of the Tomaszow–Zamosc road, came up against the enemy (the Russian XIX. Corps) in a strong position and captured his outposts; but, in front of the main position at Tarnawatka, the division was surprised by gunfire and forced to retire to the heights N. of Tomaszow until evening. The 27th Div. (especially the 85th Infantry Regt.), advancing eastwards on the right, delivered an exceptionally brave and persistent attack which unfortunately entailed heavy losses owing to inadequate artillery preparation. The attack in itself succeeded, but the enemy could not be prevented from taking up another position farther back. The right-wing division of the corps, which had had the greatest distance to come, did not come into action that day. On the other hand a violent fire-fight had occurred in the afternoon, E. of the Huczwa at Posadow, in which a cavalry corps under Gen. von Wittmann, formed from the 6th and 10th Cav. Divs., fought with some success against a Cossack division reënforced by infantry. In the evening, after the fight, the cavalry corps retired for the night to Dyniska, followed by all portions of the IV. Army which were écheloned to the rear (26th Div. and the temporarily formed XVII. Corps consisting of the XIX. Infantry Div. and three march brigades).

For the following day (Aug. 27) the II. Corps had as their allotted task to drive the enemy back beyond Zamosc. At the same time a combined attack, in which portions of the VI. and IX. Corps took part, was organized against the Russian XIX. Corps, which had dug itself in above Tarnawatka, and in particular against the right wing. The remainder of the army was to continue its advance, but here some delay was caused by the Higher Command's granting and withdrawing alternately, three times over, the right of Archduke Joseph Ferdinand's army group to make its own dispositions. The unfavourable turn of events in the E. was the cause of the Higher Command's difficulty in deciding as to the definite distribution of this fighting group. The day (Aug. 27) began with a misfortune to the IV. Army.

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[1] It was a singular fact that the Army Higher Command brought on to the field in the very first moments of the battle all the fighting forces that could by any means be got together. Nearly one-third of the battalions assembled in the deployment area were second or rather third-line troops (the third line is practically non-existent in Austria-Hungary). But this method, though demonstrating great energy in the leading and employment of fighting masses, was hardly suitable to apply to troops about to be sent to two separate theatres of war. Here again the totally inadequate armament and equipment of the Landsturm formations formed a serious drawback. Not only was their fighting power materially damaged but unusually heavy losses were suffered on the march and in action which might have been avoided.

The 10th Cav. Div., encamped on the extreme right wing, was in the early morning hours surprised and routed. Gen. Schemua's attack, on the contrary, was carried out according to programme, and his group succeeded, by evening, in throwing back the whole of the XXV. Russian Corps beyond Zamosc, some portions of it being put to flight. A large number of prisoners and 20 guns, including some heavy pieces, were left in the hands of the Austro-Hungarians.

The combined attack on the right wing of the XIX. Russian Corps, however, met with no success, and its chances became smaller in proportion as the enemy fronts visibly gained by reënforcements. Airmen's reports confirmed the approach of an enemy corps (the XVII.) from Grubieszow (Hyubieszow) and Krylow and also the direct approach from the N. (in the direction of Chelm) of enemy forces on all the lines of communication. These proved later to be the troops of the V. and XIII. Russian Corps. By evening on the same day the Austro-Hungarian 15th Div. (VI. Corps) had after a short fight reached the neighbourhood of Laszczow (Pukarzow). Acting on these various reports, the Command of the IV. Army ordered the right wing (in particular the 15th Div.) to bend backwards and take up a frontal position to the N.E. on the line Laszczow–Posadow. This was done partly to enable the advancing group (Archduke Joseph Ferdinand's 19th Div.) to deliver a blow at the enemy's flank and rear.

But the day of Aug. 28 began with a surprise attack at dawn on the 15th Infantry Div., which was massed in the narrow space near Pukarzow. After a short and costly battle, in which the divisional commander and the chief of the general staff were killed, the division was routed and in its flight westward lost the greater part of its artillery irretrievably in a swamp. The enemy pursued, and came up with the flank and rear of the 27th Infantry Div., but their progress was checked by the vigorous intervention of a brigadier, the position saved and the shattered remnants of the 15th Div. reassembled at Tomaszow. On other parts of the front the day was spent in fruitless fighting, though the enemy was at least prevented from breaking through, from the concentration area at Tarnawatka, by the now reassembled 26th Div., which unfortunately suffered heavy losses in the process. Certain portions of the II. Corps followed the enemy in his retreat northward, while others joined in the fighting on the I. Army's right wing; but the main body of the corps remained concentrated round Zamosc.

All these varying incidents notwithstanding, the fact remained that the IV. Army with all its groups had been brought up for the purpose of a uniform attack, and during the evening the Army Command issued orders for such an attack to be made by the whole army. This attack was based on the plan of battle drawn up on Aug. 25, in which the VI. Corps and the 19th Infantry Div. were to form the battle-front, while the IX. Corps (10th and 26th Divs.) was to envelop the enemy on the W. (especially in the Tarnawatka position) and the II. Corps to wheel from the N. on to the enemy's rear with two of its divisions, using a third division (the 4th) to cover the manœuvre. This cover in rear was to be made complete by the 10th Cav. Div. which had been transferred from the I. Army to the IV. for the purpose. Lastly, the Archduke Joseph Ferdinand's army group was to attack vigorously from the S. and to attempt an enveloping attack on the enemy's left flank. That is to say, there was to be a double enveloping attack by all portions of the IV. Army. On the evening of Aug. 28 reports had already come in of effective attacks by both the 19th Div. and the Archduke's divisions. These were particularly valuable on account of the surprising number of guns captured under fire, of which there were over fifty.

On August 29 this army group repeated its tactical successes and made a further haul of 26 guns. But while the enemy was being continuously reënforced, the Austro-Hungarian troops, though fighting splendidly, were greatly exhausted by their marching and fighting achievements of the previous days, and therefore did not gain ground to the desired extent. As regards the remaining parts of the battle-front, the heavy persistent fighting in the area occupied by the XVII., VI. and IX. Corps took on the character of a fixed battle broken by repeated enemy attacks, which were in particular directed against the reëntrant formed by the VI. and IX. Corps. The intention was obviously to effect a breach in this joint and break up the IV. Army front. It did not succeed; but the battle was a very costly one, owing largely to the superiority of the Russian artillery, which in a stationary fire-fight made itself plainly felt. In the II. Corps the two divisions (13th and 25th of Archduke Peter Ferdinand's army group), told off to attack in rear, commenced their wheeling manœuvres in a southerly direction. But their movements were not as rapid as could have been desired.

On the following day (Aug. 30), the fifth day of the battle, information came through from the Army Higher Command that according to an intercepted radiotelegram, a strong army body of the enemy's forces advancing from the E. had instructions to attack from Sokal the rear of the Austro-Hungarian right. This sounded unlikely, and in fact all that the IV. Army Command did was to send the 6th Cav. Div. to the Solokija in the direction of Beiz (Belz). But undeniably the report, on becoming known (it penetrated also to the Archduke Joseph Ferdinand's army group), did so far prejudice the advance that the desired wheel to the W. by this group did not take place. This was partly due, no doubt, to the fact that the enemy, realizing the magnitude of the danger which threatened him, reënforced his left wing more and more until he was able, the next day, actually to show once more a numerical superiority in artillery—and this although 80 guns had been taken from him on this sector.

On this day, too, the XVII., VI. and IX. Corps fought some violent local battles on their own part of the front. The enemy confined himself this time to defensive tactics, in contrast to the two preceding days. From the N. a vehement blow was struck on the same day against the 4th Div. of the II. Corps by 2–2½ enemy divisions. But the troops of this division, reënforced by 3 Landwehr battalions, parried bravely all the thrusts of its more powerful enemy, who pushed forward as far as the Labunka, but, being apparently incapable of any further action, retired in the night of Aug. 31 in a northerly direction. The Archduke Peter Ferdinand's group (13th and 25th Divs.) had now at last finished its wheel manœuvre southwards, so that by the evening of the same day two divisions were able to deploy in rear of the enemy. One detachment on the left wing, commanded by Col. von Stöhr, pushed forward as far as Perespa (on the Dub). On the same evening Gen. von Boroević, commanding the VI. Corps, arranged for an attack to be delivered by the 15th Infantry Div. from the S. on the enemy position to the S. of Komarow. This attack, courageously executed and well prepared by concentric artillery fire, was successful. Large masses of the enemy (the XIX. and V. Corps) within the Komarow area were surrounded on three sides, the S., the W. and the North.

The enemy, being extremely brave, did not submit to his fate, but during the night of Aug. 31 concentrated 18–20 battalions and three battery groups with which to force a way of retreat, and meanwhile withdrew from the centre of his front detachments and also transport which were set to march along the Komarow–Tyszowice road in an easterly and later a northerly direction. Groups of infantry, artillery and army service corps from the Russian left army wing were similarly withdrawn and retreated towards Grubieszow and Krylow. Into the midst of these groups burst the 2nd Austro-Hungarian Div. after violent artillery preparation, and captured 20 guns. The reports of these actions on the enemy's line of retreat came in to the Army Command in the course of the day (Aug. 31). On the morning of this day the attacking groups, mentioned above, which had been improvised on the Russian right wing, went forward against the Archduke Peter's front, which faced S., and subjected it to a rain of overwhelming artillery fire. But Col. von Stöhr's detachment on the left wing still held the Russian outermost wing in a vice, even after the fire of a Cossack division in rear had made itself vigorously felt. Naturally the Austro-Hungarian 9th Cav. Div., posted behind the Archduke Peter's front, found it hard to remain inactive. Moreover, the Archduke Peter had received a report early in the morning that an enemy column, three battalions strong, was approaching from the north. This report—in no case a very alarming one—was afterwards proved to be false, but it caused the group commander, already shaken by the powerful artillery fire, to order a retreat—in other words a wheel to the west. This rearward wheel was carried out unmolested, but it opened to the enemy the line of retreat which had been completely blocked. This was a tactical error which greatly influenced the outcome of the battle. It was curious that, on both wings of the army, false reports of danger in the rear were able to upset a well-conceived scheme, one of which the greater part had already been put into effect, for surrounding the enemy.

The result of the fighting on Aug. 31 was the capture of Komarow, with the heavily fortified position on the heights around it and the repulse of the enemy from all parts of the front except on the E. wing, where their strong position and very considerable forces enabled the Russians to cover the wheel and retreat of the army towards Chelm and Grubieszow. This wing maintained its position throughout Sept., when the pursuit was in full force along the remainder of the front, and in this way a series of rearguard actions took place. But during the night of Sept. 1–2 the last of the Russian detachments quitted the field, and fell back, in some cases in disorder, in the direction of Grubieszow.

The eight days' battle had ended in a complete victory for the Austro-Hungarian troops, but, owing to the events just described, the complete breakdown of the enemy, which was to be the outcome of the battle, did not follow. The number of guns captured was unusually large, amounting to 156, but very serious, too, were the losses suffered by the Austro-Hungarian troops, who had been almost entirely on the offensive, amounting in all to 40,000, including 8 generals and a number of senior officers.

With the Eastern Group (II. and III. Armies).—In the meantime events had taken a most unfortunate turn with the Eastern group of armies. At the beginning of operations the two great units, on forming up for deployment, had had about two infantry divisions available, to which were added six cavalry divisions that had been pushed forward up to and beyond the frontier of the empire. Since the middle of Aug. these mounted troops had been in sharp contact with the enemy's cavalry masses, which were being followed by infantry, and sections of the Austro-Hungarian cavalry at times took refuge between the heads of their own infantry division.

The task allotted to the two armies was, as has been stated, to hold off "by offensive operations" the enemy forces advancing from the E. until the I. and IV. Armies should have delivered their blow. This task was no easy one, since the enemy would obviously be in a position to develop a considerable superiority, particularly as two corps (the IV. and VII.) were still rolling up. The problem could be solved either offensively or defensively. The argument for the offensive was that the greater the space won towards the E. by these two covering armies, the greater would be the security of the two attacking armies (I. and IV.). The disadvantage it involved was the distance which the columns would put between themselves and the troops still on the way to the front in proportion as they pushed forward to the east. Above all there was the danger of the Austro-Hungarian troops being drawn into decisive battles against a more powerful enemy with practically no chance of success. If, on the other hand, a solution was sought in the defensive, a tactical advantage could be drawn from the excellent defensive fronts offered by the many parallel sectional lines (deep-cut streams and rivers) which traverse the Podolian land ridges, E. of Lemberg. These fronts were particularly suited to long-drawn-out battles, especially against an enemy inclined to be clumsy in attack, as the Russians undoubtedly were. But the Army Higher Command decided to solve the problem offensively, and the two armies (the III., XI. and XII. Corps and 2 Landwehr divisions) with a strength of 2 infantry divisions began their eastward advance on Aug. 24 accordingly. From the 26th onwards there was violent fighting on the Zlota Lipa and at Zloczow. The Russians settled down at once in typical fashion to a defensive action, while the Austro-Hungarians for their part failed to make their attack uniform along the whole front. With such unfavourable tactical and numerical conditions, no amount of bravery could bring success, and both armies were forced to retreat on the evening of the 27th. But the retreat was checked at the Gnila Lipa after a day's march, and on Aug. 29 and 30 violent battles again took place at Glynjany, Przemyslany, and Bobrka. Here the VII. Corps, which had now been brought up, took part, but still no success was achieved. The losses were very heavy, especially in the XII. Corps (Gen. von Kövess), which lost nearly all its artillery. At the last moment the Army Higher Command decided to give up the attempt to advance, to abandon Lemberg and the Dniester bridgehead at Mikolajow, and to withdraw the two armies behind the line of the Wereszyca. During these battles the Russians, after repulsing the attacks, had aimed especially at throwing their weight on to the Austro-Hungarian weak left wing, and thus to carry out an enveloping movement. This was in fact only possible after the crossing of the Bug basin, E. of Lemberg.

The costly fighting waged by the two covering armies had at least gained the time needed by the other armies (the I. and IV.) for their blow, but this object might have been attained by far less costly means. Eleven infantry divisions, reënforced by successive bodies of troops from the rear up to fifteen divisions, would, if placed in a strong defensive position on the Gnila Lipa, for instance—have been able to offer a resistance which the Russians could not have broken without heavy sacrifices. These battles to the E. of Lemberg provided in fact the clearest possible illustration of the exaggeration of the offensive principle. They weakened considerably the fighting power of the troops, and the fact that they were able to take part in a leading battle a few days later only proved their excellent quality.

Operations Introductory to the Battle of Grodek–Rawa Ruska.—After the close of these battles fronting eastwards, which coincided with the victory at Komarow, the Austro-Hungarian Army Higher Command was confronted with grave issues. It should be added that, although the battles fought by the I. Army in its advance on Lublin had had favourable and lasting results, the enemy's growing power of resistance was making itself felt. Two solutions of the problem were now possible:—(*a*) To bring the II. and III. Armies once more into action and to let the IV. Army wheel against the N. flank of the Russian forces now pursuing the II. and III. Armies, thus bringing about a major decision in accordance with the proposed "Operation on the interior line"; (*b*) To withdraw all the armies to the now fully prepared line of the San, to defend this line and to seize any favourable opportunity for renewing the attack.

As regards (*a*), this plan involved going on with the scheme of operations in accordance with the policy originally adopted, but at the same time ignoring the fact that one part of the problem to be solved had already ended in failure. The Army Higher Command would also be bound to admit that the blow on the N., though successful, had not finally crushed the enemy. For the decisive moment—that is, for the main battle, the I. Army would not be available at all and the IV. Army would be incomplete. For there was not, in the opinion of the Army Higher Command, much time to lose—in other words, the initial operations must begin *immediately*. That being so, the IV. Army would have to give up the vigorous and effectual fighting pursuit of the defeated Russian army. And yet this was the one way in which this army could have been eliminated from the calculation for the time being. The topographical conditions for forcing a great tactical decision in the Grodek area were certainly favourable. A strong front might be formed protected by the line of the Wereszyca behind which the II. and III. Armies, unlucky up till now in their fighting, could receive such local reënforcements as would restore their full fighting power. But these conditions, again, were so obvious as to exclude any possible alternative plan of operations. To get into the right position for this, namely, "frontal defence on the part of the II. and III. Armies behind the Wereszyca, flank action and a blow from the N. on the part of the IV. Army," the IV. Army, at the close of the battle of Komarow, would have *immediately* to wheel and to execute within a narrow area a tricky manœuvre such as only units specially trained in manœuvring could perform. At the same time a flank-protecting force, of sufficient strength to guard against any possible attack by the defeated V. Russian Army, would have to be told off from the main body. At the IV. Army headquarters this flank-protecting force was calculated, in consideration of all the determining factors, at 4 infantry and 2 cavalry divisions, so that 8 infantry and 1–2 cavalry divisions would still be available for the blow towards the south. But the Army Higher Command, in its anxiety to keep the attacking force as powerful as possible, wanted the protecting force reduced to 3 infantry and one cavalry division. In view of the sharp defeat suffered by the V. Russian Army even such a force might possibly have sufficed had their task been exclusively that of protecting the IV. Army, but this, as will be seen, was not the case. If all the conditions here outlined were fulfilled, there was certainly reason to hope for a favourable decision which would undeniably have great tactical, and possibly even greater political, results. It was absolutely essential, however, (1) "to have an unconditional guarantee of the I. Army's power to hold out N. of the San–Tanew region, at least up to the line of the Por; (2) that the wheel manœuvre of the IV. Army should succeed completely; (3) that this army should be covered by the pinning down of the V. Russian Army on the lower Huczwa; (4) that the main attack from N. to S. in the area E. of the Wereszyca should be successful."[1]

Turning to a consideration of the scheme of operations under (*b*), the "concentration of all four armies on the San," it would seem that the obvious drawback was that it would rob the two victories of Krasnik and Komarow of their strategical importance. To give up yet another slice of Galicia would have been a disadvantage from the military and still more from the political standpoint. Yet the plan was not without considerable advantages. First and foremost the II. and III. Armies would have a still longer respite from the enemy's attentions and could have all the available reënforcements and supplies sent to them at leisure. The Russian opponent would then find himself opposed by an entrenched front, which as far as could be foreseeen he would be unable to overpower with his first- and second-line forces on the spot; while the time gained would certainly give the Austro-Hungarian armies opportunities for an offensive attack from the manœuvre area on the San. Finally the IV. Army would have one or two days in which to pursue and rout the defeated enemy before wheeling from the battle-field. In addition this scheme of operations offered the least risk in contrast to (*a*), in which practically everything was staked on one throw, a risk for which no absolute necessity could be pleaded. Nor could the fact be overlooked that—unlike Russia—the Dual Monarchy had, in the united armies at that moment in Galicia, practically all its available military forces assembled and could still absolutely rely on them. The Army Higher Command decided to solve the problem by the first scheme. It was by far the more daring, and yet, given the four conditions just enumerated, it was not unreasonable, so long as these conditions obtained, to count upon that measure of luck which must always attend the execution of a resolve to force a direct decision.

First of all the advance of the IV. Army's main body was expedited to the utmost by order of the Army Higher Command. It will be remembered that the battle of Komarow was brought to a complete finish only on Sept. 2, early in the morning. In order to carry out the Army Higher Command's instructions the heads of the newly grouped army columns would have to reach the line Belzec–Uhnow by the evening of the following day. But this line lay 30 km. to the S. of the axis of the battle-field, that is, in precisely the opposite direction from that of the previous advance.

The immense difficulties which arose out of this re-grouping, particularly in the case of the mass of transport, need not be dwelt on here. It is enough to say that by Sept. 5 everything was in order, and the army began its prescribed march southwards in three great columns. The western column (IX. Corps) was composed of 3 divisions (the 25th, 10th and 26th), the centre (VI. Corps) also had 3 divisions (the 39th, 27th and 15th), the eastern (XVII. Corps) 2 divisions (the 19th and 41st) as well as 2 march brigades. These three columns, marching towards the line Magierow–Niemirow, given as their first destination, were preceded by the 6th Cav. Div. and followed by the 3rd Infantry Div. écheloned to the left, and by the 2nd Cav. Div. still further behind. Protection in rear was provided by the Archduke Joseph Ferdinand's newly formed army group, consisting of the 4th and 13th Divs. of the II. Corps, and the 8th Inf. and 9th Cav. Divisions. The Army Higher Command's original order was that the IV. Army should continue the pursuit of the defeated enemy as long as possible and then wheel to the S., but it was also to protect the I. Army's right flank against which the enemy's attacks were becoming more and more alarming. Indeed this question of protection assumed an ever-growing importance in the eyes of the Army Higher Command and an order was presently issued placing the whole of the Archduke Joseph Ferdinand's army group under the I. Army command with the exception of certain detachments to be left behind. On these detachments the IV. Army would now depend entirely for protection in its rear. But the circumstances did not—as will be seen—admit of such a splitting up of the army group as this entailed, and the double task had undoubtedly an adverse influence on the measures taken by the group commanders. The idea of transferring the whole of the Archduke's army group to the W. was probably inspired mainly by a captured radio-telegram from the Russian Supreme Command which led the Army Higher Command to assume that "the V. Russian Army (Plehwe) was being transported by train from Wladimir Wostok to Brest Litovsk and that any danger threatening the IV. Army from the N. was therefore removed." One more example of a false or misinterpreted report which was to lead to fateful decisions!

Meanwhile, from Sept. 3 onwards, all the II. and III. Army detachments which had been thrown back behind the Wereszyca line were concentrating in preparation for a prolonged defence. On the left (northern) wing of the III. Army in particular 6 infantry divisions, ready for action, were assembled, and here too the 4th, 10th and 11th Cav. Divs. were brought together for recuperation. From this time on, these cavalry divisions were to be under the IV. Army Command. Lastly the IV. Corps was assigned to the II. Army, or rather to its right wing. Thus—apart from the Landsturm formations—the II. Army (forming the right wing of the united front) could now take the field with 9 divisions and the adjacent III. Army with 7 divisions.

The IV. Army, once it had overcome all the obstacles caused by its wheel through 180 degrees, made its advance southwards in good style, bringing up the heads of the armies to their proper destinations each day, though the left wing column (XVII. Corps) came sharply into contact with some enemy units coming from the east.

The forward push of the I. Army towards the Lublin area came to an end on Sept. 2. On the 3rd and 4th there were local battles along the line of its advance, but from Sept. 5 onwards pressure on the I. Army's right wing was so strong that it was forced to give ground and had to be withdrawn behind the line of the Por. This involved a retirement on the other parts of the front, which even the appearance on the scene of Gen. von Woyrsch's Prussian Landwehr corps failed to prevent. Even so the enemy's pressure on the I. Army's right wing was still so strong that both the I. Army Command and the Army Higher Command appealed to Archduke Joseph Ferdinand's group for help—an appeal to which it was now impossible to respond. It is evident from the map that the enemy columns, curving outward to the N., had begun to be a menace to the advancing IV. Army, while the 3rd and 8th Divs. écheloned in rear were forced to deploy fully in an eastward direction against enemy columns superior in numbers. The 8th Div. was hereby compelled to fight a very sharp and costly action. The 3rd Div. during the night of Sept. 6–7 succeeded in surprising a Russian division in the wood N. of Hujcze, but in the general fighting that ensued was forced to retire westwards and join up with the XVII. Corps.

The Army Higher Command, to whom all these events were reported in the course of the day (Sept. 27), were compelled to see that the situation on which the decision to bring about an important battle on the Wereszyca was based had now undergone a substantial change. Of the four essential conditions laid down earlier as the necessary basis for this decision, practically only one remained, or rather had been carried out:—the one relating to the wheel of the IV. Army. This manœuvre had succeeded. On the other hand, it seemed doubtful whether the I. Army could continue its resistance N. of the Tanew for any length of time; the Archduke's weak army group stood opposed to superior forces moving to outflank it; and the decisive blow from N. to S. was rendered impossible by the general enemy grouping, in which the weight had been flung on to the right (N.) wing. The Army Higher Command had therefore no alternative but to make a radical change in the original plan of operations. It would perhaps have been most to the purpose to discard altogether the guiding idea which now offered so little chance of success, and to concentrate all the armies on the already constructed line of the San. But the Army Higher Command held fast to its resolution to bring about a decisive battle in the Grodek area, though making certain concessions to meet the altered situation. Thus the IV. Army, designed as the attacking wing in the original scheme, was to be converted into the defensive wing with its front facing E., while the II. and III. Armies were to deliver the blow from the S. to N.—a complete exchange of rôles. To this end the IV. Army had to continue its wheel manœuvre and the II. and III. Armies to fight their way across the Wereszyca line, which until then formed the cover for their front, and then proceed to the attack. As a result of these operations the two opponents laid their weight on opposite wings, the Russians on the N., the Austro-Hungarians on the S. wing. This was quite against the original intention of the Austro-Hungarians, and it undoubtedly weakened their position appreciably, from a strategic and still more from a tactical point of view.

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[1] Extract from Auffenberg-Komarow's *Aus Österreich-Ungarns Teilnahme am Weltkrieg*, Berlin, 1920.

The Battle of Grodek–Rawa Ruska. Retreat behind the San.—Directions for the execution of this plan were issued on the afternoon of Sept. 7. The IV. Army Command at once dispatched all heavy trains in a westerly direction to beyond the San. Rzycki, to the E. of Rawa Ruska, was selected as a pivot for the continuation of the army's wheel, and here were brought into action for the fire-fight the 4th and 6th Cav. Divs. (Gen. von Wittmann), which had been selected from the very considerable cavalry masses actually on the spot. A second cavalry corps (the 10th and 11th Cav. Divs. under Gen. Nagy) was ordered to provide cover, mounted, for the army's extreme outer flank. The first of these cavalry groups executed its task admirably in a two-days' fire-fight. The army's right wing (the VI. and IX. Corps) was allowed to continue its offensive advance, partly with the object of drawing upon itself as the "defensive wing" as many as possible of the enemy's forces, and partly so as to use its infantry —so well schooled in attack—to the best advantage in an area of which a comprehensive survey was quite impossible and showed no obvious boundary line. The left wing (3rd and 8th Divs.) went back, after the heavy fighting already described, to the N. of Wittmann's cavalry corps, where it remained for the rest of the proceedings in close touch with the II. Corps (4th and 8th Divs.). This corps, being pressed by the attacking V. Russian Army, retired after a series of battles by successive stages to Tomaszow.

Following out the Army Higher Command's plan of attack, the divisions of the II. and III. Armies began an offensive advance over the Wereszyca on Sept. 8 and wrested certain advantages from the enemy, who on this front was considerably weaker; but point 315 (Stawczany–Mostki–Dornfeld), the line which the II. Army was to have reached by the evening of Sept. 8, was only taken on Sept. 11. On the other parts of the front the fighting, on Sept. 9 and 10, swung backward and forward without a decisive advantage being gained on any one section. Here the Austro-Hungarians made effective use of that form of warfare which consists in throwing up cover during the battle on an extended front—in other words, trench warfare, which later was to become the characteristic feature.

In contrast to the progress made on the right wing of the Austro-Hungarian battle-front, the development of the battle positions on the 9th, 10th and 11th showed that the left wing had recoiled. There the IV. Army was fighting against a superiority of almost two to one. The IX., VI. and XVII. Corps on that part of the front facing E. were, it is true, able to hold their position, and the artillery line with about 100 guns which had been formed behind the salient (the XVII. and II. Corps) defeated all the enemy's attempts at attack; but the Archduke Joseph Ferdinand's army group (the 4th, 8th, 13th and 3rd Divs.), which had been in action for nearly 20 days without a break, could no longer hold out after all its heavy losses, and had to be led backwards from one position to another. Even the relatively strong I. Army was forced to retire by stages, and into the gap thus formed between the IV. Army, after its wheel, and the I. Army, the V. Russian Army pushed forward slowly but surely its cavalry division and corps. This army had resumed its advance on Sept. 7 after re-forming.[1] On the same day the 8th Div. had been put out of action by a strong column of the III. Russian Army advancing from the southeast. This left the Archduke Joseph Ferdinand with only the 4th and 8th Divs. of the VI. Corps and the 9th Cav. Div. at his disposal. These weak forces could offer no permanent resistance on such open ground and, after fighting a serious battle on Sept. 9, they were withdrawn behind the line of the Rata (which ran provisionally parallel with the railway line from Jaroslau to Belzec), where they joined the 3rd and 8th Divs. of the XIV. Corps, which had likewise been severely battered.

The general strategic situation now appeared to the Army Higher Command to be untenable. Instructions were therefore issued on the afternoon of Sept. 11 to break off the fighting and retire behind the San. This retreat, facing full W., had, so far as the II. and III. Armies were concerned, only one disadvantage—the scarcity of communications available within the narrow zone of retreat. But for the IV. Army the conditions almost brought about a catastrophe.

On the afternoon of Sept. 11, the V. and XVII. Corps of the V. Russian Army, reaching out to the W., were posted, together with their own powerful artillery forces, in the direction of the rear and flank of the IV. Army. A single determined blow from these forces would infallibly have placed that army in a most hopeless situation. It was fortunate that the Russian corps in question were those that had received the worst punishment at Komarow and had therefore lost much of their fighting power. But behind this immediate danger there lay another not less serious. The Russian IV. Army, now pursuing the Austro-Hungarian I. Army in its retreat over the San, could easily detach large groups from the massed forces on its left wing and send them forward against the line of retreat of the IV. Austro-Hungarian Army, thus attacking this army at its most vulnerable point in the critical moment of the San crossing. The precautions which had to be taken against both these dangers were the more difficult to carry out in view of the fact that the whole of the army's infantry units were just then heavily engaged.

Under these circumstances the violent attack delivered in the afternoon by the united forces brought up from the E. and N.E. (the III. Russian Army) came as a welcome incident. The attack was repulsed along the whole front after an obstinate and bloody battle lasting on into the evening. Particularly in front of the 19th Div., composed of Bohemian regiments, there lay heaps of corpses. After the failure of the attack the Russians ceased fighting, and at many points whole sections of their front were discovered by reconnoitring patrols to be in retreat. Under these conditions it was an easy matter to shake off the enemy during the night of Sept. 11–12, and by following this up during the day with a powerful backward push, to break off fighting contact with the enemy almost entirely. To deal with the Russians attacking from the N. (V. and XVIII. Russian Corps) both the cavalry corps were brought into action. Although these were units which had been greatly exhausted in the course of the operations, they succeeded, with the help of the rearguard of the XVII. and IX. Corps, in holding off the not very strong enemy pressure. It was none the less necessary to place the swampy line of the Sklo between themselves and the enemy as soon as possible, so as to rule out any possibility of further contact. But this meant crowding together all the divisions now holding a front of about 50 km. into a defile only some 15 km. wide. But although this manœuvre could be executed without such very great difficulty, the same could not be said when it came to removing the second danger already alluded to—the blow from the IV. Russian Army which had now arrived at the San. To do this, the area Laszki–Lazy–Krakowiec–Chotyniec and that portion of the line of the Sklo which borders it would have to be barricaded off with all possible haste. The IV. Army Command effected this by bringing up a weak brigade by motor from the VI. Corps, which was posted nearest to the only metalled road of communication within the zone of march. A pivot was thus formed, in the course of Sept. 13, from this brigade in conjunction with line of communication posts and field troops. These were able to repulse all attacks coming from the N., in particular one at Krakowiec on Sept. 13. These attacks, it is true, were made chiefly by cavalry, with artillery, as the enemy had not grasped the opportunity offered him of a decisive flank attack by strong forces.

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[1] Incidentally the Russian V. Army, which had been defeated at Komarow, but not pursued—this being impracticable—took exactly as long to re-form and return to the field as the II. and III. Austro-Hungarian Armies after their misfortunes E. of Lemberg, although in their case pursuit did follow.

In spite of this the II. Corps was kept in the Krakowiec area on Sept. 14, as a precaution. Under cover of this corps and the cavalry corps the armies carried out their retreat and crossed the San. It is true that from Sept. 13 onward the enemy's columns were active in their pursuit from the E. and made it infinitely difficult—especially for the IV. Army—to get the masses of trains brought back. Within the stretch N. of Przemysl up to and including Jaroslaw there were, including the temporary pontoon bridges, only six bridges over the San which were practicable. Even fewer were the permanent roads leading to them. It was therefore necessary to fall back on improvised roads. It has already been said that the great trains of supplies and material had been dispatched in good time to the W. and across the San; but even so, the train units that are absolutely indispensable in battle (munitions, sanitary, technical and field supplies) and in addition the supply wagons (essential in view of the many days duration of the battle) formed a train mass many kilometres long. Out of these conditions arose the immediate danger of the sensible weakening of the troops' fighting power as a result of continual protective and rearguard battles and even the contingent danger of disorder and disbandment. The commander of the IV. Army, which was most exposed to these dangers, therefore gave a plain order that no fighting in protection of the trains would be permitted. The trains were, if it became inevitable, to be given up, the teams having first been set free and the communications blocked.

In this manner the crossing of the San was achieved by all the army columns without a single fighting unit having suffered serious losses, such losses being confined to men unable to march, who succumbed because they were no longer equal to the fatigues of 25 days of operations and fighting at a stretch.

The crossing of the line of the San by all four armies brought to a close the first period of operations, which was marked by a continuous series of severe battles and difficult manœuvres within the Lemberg area. The plan of an offensive operation on the interior line had led to no useful, lasting success. Conceived under the influence of the strategical conditions that had formerly prevailed when tactical decisions were quickly reached, it was not suited to the present day when, even in fortunate cases, days—weeks—were spent in straining after victory; when the numerically weaker opponent could only seize the advantage of a momentarily favourable situation quickly enough if he were able to inflict an annihilating defeat on the isolated groups of the numerically stronger enemy forces during their concentric advance. But such success could only be attained under specially favourable circumstances and through the perfect coöperation of all subordinate commanders. In this case these conditions did not exist; and, as the space separating the Russian groups was from the first not overwide, the double blow could not succeed in spite of great isolated successes. Only the manœuvring skill of the Austro-Hungarian units, coupled with the hesitating advance of the Russian forces, enabled the Austro-Hungarians to escape unharmed from situations which might easily have led to the kind of disaster typical of an unsuccessful "operation on the interior line."

With such tremendous fighting power displayed on both sides the losses were enormous, telling with double intensity on the Austro-Hungarian as the weaker of the two armies. (A.–K.)

II. The Summer Battles of 1915

The Battle of Grodek–Magierow, June 16–19 1915.—After the break-through at Mosciska Lubaczow the Russians retired slowly, fighting as they went, to a position behind the Wereszyca on the heights of Magierow and Cieszanow, and behind the Tanew. In this naturally strong line of defence, which was continued to the left by the strong Dniester line facing the Southern and VII. Armies, they proposed to fight a defensive battle to cover East Galicia and Lemberg. The continuous defeats of the last six weeks, resulting from the Austro-German spring offensive, had already caused them heavy casualties, and the loss of East Gálicia would exercise a disastrous effect on the prestige of the Entente, while the evacuation of hard-won territory could not fail to exercise a demoralizing influence on the Russian army, already greatly exhausted.

The strong position selected had therefore long been carefully prepared and fortified; the country, which had been the scene of operations in Aug. and Sept. 1914, was well known to both sides. The defences constructed by the Austrians around Lemberg at this period had been strengthened by the Russians, and a circle of more or less defensible works now surrounded the Galician capital on a circumference of some 30 miles. The Grodek-Magierow position was specially designed to secure it against the first rush of the enemy. It ran from the *point d'appui* of Mikolajow along the N. bank of the Dniester to Manasterzec, then along the E. bank of the Wereszyca to Cuniow and W. of that river to the heights of Janow, whence it ran by the heights S. of Rawa Ruska to Narol Miasto, and thence by the heights N. of the Tanew to the Vistula. Farther to the rear the Russians had provided for the possibility of a break-through by constructing a second position W. of the Rawa Ruska–Lemberg railway. This line, as yet incomplete, was connected with the ring of forts near the height of Lysa Gora, N.W. of Lemberg, and was continued thence W. of the Szczerek to the Dniester.

Early in June all the Austro-German troops between the Dniester and the Vistula (Austro-Hungarian II., German XI. and Austro-Hungarian IV. Armies) had been placed under Gen. von Mackensen. His intention was to direct the attack of the centre and southern wing of the XI. Army on Magierow and thence due E., passing N. of Lemberg. The strong left wing of the II. Army was to deliver an enveloping attack upon the fortified line Janow–Kommarno, while the IV. Army, although maintaining its position in the angle of the San and Vistula, was to press N. in conjunction with the XI. Army's left, and then to advance with its right on Rawa Ruska. On the Russian side there stood facing Mackensen's army group, which comprised in all the 41st Infantry and 2 cavalry divisions, Gen. Lesch's III. and Gen. Brussilov's VIII. Armies, with same number of infantry divisions and 5 cavalry divisions.

On June 16 the Austro-Germans pressed the Russians hard along the whole line. The centre of the VIII. Russian Army offered a stubborn resistance to Böhm's centre and northern wing, while its left withdrew before his right early in the day. The Austro-Hungarian XVIII. Corps, in the course of the afternoon, stormed the Russian rearguard positions at Wolczuchy and Dobrzany, while parts of it penetrated into the part of the town of Grodek, which lies W. of the Wereszyca. On the northern front of the German XI. Army Brussilov's army on the heights N. and N.E. of Lubaczow was heavily engaged with the combined corps and the X. Corps, while farther S. the remainder of the Army (XLI. Corps, Austro-Hungarian VI. Corps, Guard Corps and XXII. Reserve Corps) reached their objectives on the line Niemirow–Jaworow without opposition. On the front of the Archduke Joseph Ferdinand the right and centre of the Russian III. Army held its ground. In the afternoon violent fighting commenced at Cewkow and Cieplice. This ended on the following morning (June 17) in the storming of the heights N. of Cewkow by the XVII. Corps, which led to the retreat of the Russian III. Army behind the Upper Tanew and also to the evacuation of the Rudnik area. The IV. Army followed them up as far as the heights parallel with the S. bank of the Tanew, its right wing having reached N. of Cieszanow.

The II. Army, which had on the previous day worked its way up to the main Russian positions, now began its preliminary bombardment, and attacked the main crossing points. Heavy fighting took place between the XVIII. Corps and the Russian XXVIII. Corps for the possession of Grodek, as also for the bridges of Kommarno and Lubien Wk. (Great). Meanwhile on the left the Austro-Hungarian XIX. Corps crossed the Wereszyca near Kamienobrod and in conjunction with the IV. Corps began an enveloping attack against the Wielkopole ridge.

The XI. Army had now arrived in face of the Russian main position, and a general attack in the direction Rawa Ruska–Zolkiew was ordered for June 19.

On the 18th the Russians resisted fiercely on the whole front. The II. Army, however, succeeded in taking Mosty and Kommarno and in completely clearing the W. bank of the Wereszyca. The XI. Army pushed closer up to the Russian positions, against which the artillery preparation had already begun, and grouped itself for the forthcoming attack. This was to be begun at 7 A.M. on the 19th, after two hours' artillery preparation, by the XLI. Austro-Hungarian, VI. Guard and XXII. Corps, while the X. Corps and Stein's combined corps were to cover its northern flank towards Rawa Ruska. The II. Army was to capture Lemberg and to outflank and roll up the Russian line on the Dniester, while the IV. Army was to cover the XI. in the direction of the Tanew, and with its right wing corps to follow the XI. Army. The assaulting wedge of the four corps of the XI. Army succeeded in breaking the stubborn resistance of the principal Russian front, pressing through it in the direction of Magierow, and penetrating as far as the Rawa Ruska–Lemberg railway. The II. Army had heavy fighting before the Russian main position. After two days' fierce battle the XVIII. Corps completed the capture of Grodek, the XIX. Corps took two *points d'appui* N.W. of Kamienobrod, while the IV. and the Beskiden Corps to the N. began at 5 P.M. the bombardment of the heights by Wielkopole and Stradec in the bend of the Wereszyca. The infantry assaults that followed lasted till the late evening of the 20th, and resulted at 4 A.M. next morning in the capture of the Stradec height, which was the key position for the next advance. That same evening the S. wing stormed the heights on the E. bank of the Wereszyca, while the XVIII. Corps broke through the Russian positions on the Grodek road. These successes marked the failure of the last Russian attempts to bar the way to Lemberg. Their main position was no longer tenable, and a general retreat now began on the eastern front of the XI. Army and the whole front of the II. Army.

The Battle of Lemberg, June 20–22.—On the evening of June 20 the Russians recognized that, in view of the disastrous break-through at Magierow, they could no longer hold their main position. The next line of defence ran from the Dniester at Mikolajow, along the hills E. of the Szczerek to Sokolniki, where it joined the girdle of fortified positions extending from Sokolniki by Rzesna Polska to the height of Lysa Gora. From this point it continued on the heights W. of Kulikow by Glinsko, and along the Rawa Ruska road, where it joined the unchanged portion of the Russian main position running by Brusno Stary and the heights N. of Cieszanow along the Tanew.

After the break-through at Magierow the Austro-Hungarian VI. Corps, the German Guard, and parts of the XXII. Res. Corps had pressed forward a considerable distance. The situation being still somewhat obscure, it was deemed advisable not to push the XI. Army on June 20 beyond the Lemberg–Rawa Ruska railway, particularly as wireless messages and aviation reports, while announcing the Russian forces were retiring towards the N.E., gave reason to suspect a strong hostile concentration N. of Rawa Ruska. The XI. Army in its further advance could not run the risk of being exposed to a stroke against its flank from this direction. It was therefore not to advance E. beyond the line of the above-mentioned road, and was to keep in close touch to the N. with the right flank of the IV. Army. Should the enemy retire, however, he was to be energetically pursued.

On the evening of the 20th the XLI. Corps, fighting on Mackensen's right wing, had succeeded in coming up to the strong Russian positions at Glinsko and had begun its artillery attack. Arz's Austro-Hungarian corps to the N., after repulsing several hostile counter-attacks during the previous night, had also made progress. The Guard, and parts of the XXII. Reserve Corps, after heavy fighting, had stormed the Lemberg–Rawa Ruska road and railway on a front of 7 m. N.E. of Dobrosin. On the front of the remainder of the XXII. Reserve and X. Corps there was little change, advance troops of the 19th Div. (X. Corps) occupied the village of Rawa Ruska, driving the Russians back to the heights immediately N. of it. Meanwhile on Mackensen's left army wing Stein's combined corps drove back the Russian Guard at Brusno Stary. On the IV. Army front there was no important change.

The II. Army was closely following up the retiring Russians. On the left the Beskiden Corps, completing its success of the previous night, reached the line Polany–Rokitno. The IV., XIX., and XVIII. Corps were, by the evening, close up to the fortified line, while the V. Corps, during the pursuit of June 20, reached the Szczerek below Pustomyty in the south. The 51st Honved Div. and Szurmay's corps, which had been transferred from the Southern to the II. Army, drove the Russians completely across the Dniester

The main burden of the further attack fell upon the II. Army, which was to capture Lemberg as soon as possible, while the right wing of the XI. Army was to render the northern front of Lemberg untenable by a wide turning movement to the east. The forcing of the Dniester line by the German Southern Army, and its advance into the area E. of Lemberg against Brussilov's left flank, would materially increase the success of the plan.

The energetic advance of the II. Army on the S. wing on June 21 bore full fruit; the V. Corps succeeded in several places in capturing the Russian advanced positions on the E. bank of the Szczerek. Thus the 51st Honved Inf. Div. gained possession of a hill just N. of Usiec at the confluence of the Szczerek with the Dniester. The 14th Inf. Div. penetrated the Russian positions at Dmytrze 4 m. S. of Szczerek, while the 33rd Inf. Div. stormed the bridge to the N. of this place at Za Grobla. The XVIII. Corps, exposed to the flank fire of heavy artillery from Sokolniki, was unable to advance, but the XIX. Corps worked its way close up to the *points d'appui* of Sokolniki, Sknitów and Rzesna Polska. The IV. Corps had already captured the advanced positions of the Lysa Gora and Brzuchowice forts, making an enveloping position against them secure, while the Beskiden Corps cleared the edge of the woods W. of Zarudce.

On the XI. Army front Arz crossed the Lemberg road in the forest region S. of Dobrosin, while Lt.-Gen. François' XLI. Corps was heavily engaged round the strong positions on the heights at Glinsko, capturing the most westerly summit in the afternoon. On the remainder of the XI. Army front and that of the IV. Army the situation remained unchanged.

On the night of the 22nd the Russians, at Glinsko, threatened to the N. by the advance of Arz's corps, and to the S. by the Beskiden Corps, which had beaten them back in the actions at Zaszków and Zarudce, evacuated their now very exposed positions facing the XLI. Corps and fell back by Blyszczywody and Dzibulki. Arz on the afternoon of the 22nd penetrated deeply into the forest area N.E. of Zolkiew.

Meanwhile great events had taken place on the front of Böhm's army. In the forenoon the Beskiden Corps, after storming the heights S.W. of Kulików, advanced well beyond this place, and by pushing detachments forward succeeded in blocking the road from Lemberg by Zoltance to Kamionka.

At 4 A.M. the IV. and XIX. Corps opened a bombardment against the works on the N. and N.W. fronts of Lemberg. At 5 A.M. the 13th Landwehr Inf. Div. of the XIX. Corps penetrated into the Rzesna work on Hill 320. At 11 A.M. the 29th Div. of the same corps had captured the group of works at Sknitów, while the 43rd Landwehr Inf. Div. of the IV. Corps stormed the work Brzuchowice 348. At the same time the 13th Landwehr Div. continued the attack on the heights E. of Rzesna Polska, and the 27th and 32nd Inf. Divs. were heavily engaged round the Lysa Gora heights. Shortly after 11 A.M. this strong bulwark of the N.W. front of Lemberg also fell into the hands of the Austro-Hungarians. Under pressure of these events, the Russians, who had defended themselves by numerous counter-attacks, evacuated Lemberg. At noon Böhm's troops entered the city, which had been in Russian hands for over 10 months.

During the morning, the V. Corps had succeeded in storming the Russian positions on the heights E. of the Szczerek. In the afternoon the Russians, obviously as a result of the fall of Lemberg, into which Gen. Böhm had made his own entry at 4 P.M., abandoned their whole front facing the Austro-Hungarian II. Army.

The battle of Lemberg had thus ended in a victory for the Central Powers. By the evening of the 22nd the II. Army had reached the line Dawidow–Remenow. The effect of the victory was now making itself felt along the whole front; even the angle between the San and the Vistula, so long and stubbornly defended by the Russian XV. Corps, was evacuated by the evening of the 22nd, and the Russians fell back also before the Austro-Hungarian I. Army and the southern wing of Woyrsch's Army.

The hoped-for separation of the Russian armies, in the direction of Tomaszow and Sokal on the one hand and eastwards on the other, seemed nearer, but was not yet achieved.

The Army Supreme Command, after consultation with the German Supreme Command, now ordered new dispositions.

Mackensen was to continue the pursuit of the retreating enemy in a northerly direction with the Austro-Hungarian IV. and German XI. Armies. The Beskiden Corps was subordinated to him, in order to cover his eastern flank. The II. Army was detached from Mackensen's group and ordered to pursue eastwards by way of Busk and Zloczów, while the Southern Army was to force the passage of the Dniester below Źurawno, in order to envelop Halicz from the N. and press on further across the lower Gnila Lipa.

By the evening of the 23rd the centre and left of the Russian IV. Army were also withdrawn, on the front of Woyrsch's right wing and that of the Austro-Hungarian I. Army, to Ilźa, Sienna, Ozarków and Zawichost. Both armies followed them up, Woyrsch with some rearguard fighting, the I. Army practically unopposed.

The VIII. and XIV. Corps of the Austro-Hungarian IV. Army followed the Russians to the San. On the remainder of the front of the IV. and XI. Armies the situation remained unchanged.

Pursuit by Mackensen's Army Group Northwards; Battles in East Galicia (*June 23–July 14*).—The northern wing of the II. Army met with stubborn opposition on June 23, on the line Jaryczów–Dmytrowice, but succeeded by the middle of the day in capturing a part of the Russian positions S. of the latter village. On the 24th also the II. Army found itself faced along its whole front by strong Russian lines, from the northern wing of which the Russians even delivered exceedingly violent counter-attacks. Owing to this the relief of the Beskiden Corps by a new group under Field-Marshal-Lt. Kreysa, formed of two divisions of the II. Army, appeared almost impossible.

On the German Southern Army front, also, the Russians struck hard against the two centre corps, and drove back the 19th Inf. Div. to the Dniester. Linsingen's northern wing, on the other hand, succeeded in reaching Bortniki and Chodorów, where, however, it met with fresh resistance. His southern wing was able to secure the N. bank of the Dniester below Halicz.

The pursuit by Mackensen to the N. and by Böhm to the E. had been determined automatically by the lines of the Russian retreat. The continuation of the offensive on the grand scale, however, would involve the choice of only one of these directions for the main attack; and whether this attack were delivered to the N. or to the E. there would be serious risk of a Russian assault on its open flank.

After the battle of Lemberg the Russians had concentrated their main strength between the Vistula and the Bug, while a smaller force had retired into East Galicia. Consequently, an advance by Mackensen northwards must bring him into contact with the main force of the Russians, while the protection of his eastern flank would be comparatively easy, owing to the favourable configuration of the ground in East Galicia, where, in order to assail him, the Russians would have to cross several tributaries of the Dniester flowing from N. to S. The protection of the N. flank of an army advancing eastward would be more difficult, and would require considerable covering forces. These considerations outweighed the fact that an eastward advance would be in the same direction as had hitherto been followed in the attack, and also the prospect of freeing East Galicia, which it was felt could be postponed.

The thrust to the N., moreover, was better fitted to meet the general situation. The centre of the Russian front was still bent far forward into Russian Poland. The greatest possible success to be aimed at by the Austro-Germans was to envelop this front, and, at the proper moment, helped by the pressure of their northern wing (the German E. front), to surround it. Were this to succeed, East Galicia would fall into their hands of itself. The northward advance was therefore decided on.

This might be carried out by the IV. and XI. Armies, in conjunction with the main body of the II., swinging northwards, leaving the remainder of the latter with the Southern and VII. Armies to drive the Russians out of East Galicia, or at least to contain them. A more promising alternative, however, was to leave the whole II. Army in East Galicia, while Mackensen led the northward thrust with the IV. and XI. Armies, together with fresh forces to be marched up between the II. and the XI. Armies. The shortening of the front at the end of June, as a result of the progress made by Woyrsch and Puhallo, made it possible to withdraw Puhallo's army from the front and form it up behind the inner wings of the II. and XI. Armies. Moreover, the XLI. Res. Corps, which had been ordered to the western front, was not now urgently needed there in view of recent favourable developments of the situation, and was thus for the moment available. On the other hand, the complete withdrawal of the II. Army from East Galicia appeared dangerous. The Austrian and German High Commands decided therefore for the second plan.

The regrouping between the Vistula and the Bug could be completed, and the northward advance begun, by the middle of July. The armies, meanwhile, continued to carry out their previous tasks. Mackensen followed up the retiring Russians to the N., Böhm to the E. The ever-widening gap between the two armies was provisionally filled up pending the arrival of the I. Army by the extension of the II. Army's left wing to Kamionka Strumiłówa and to the Rata, and the concentration of strong reserves behind their N. wing.

By the evening of the 25th all the XI. Army's measures for the continuance of the pursuit had been completed. On the morning of the 26th the attack was to be continued on the whole front; the XVII. Corps on the right of the IV. Army, which adjoined the XI. Army on the W., was to join in and occupy the Loczwa depression N. of Cieszanów, while Böhm's wing corps to the E. of it was to advance on Kamionka Strumiłówa.

The southern wing of the II. Army (5 corps), in the battle of Bobrka, stormed the positions of the Russian VI. Corps W. of the Biala Potok, and by the evening of the 25th had forced it back to the hills E. of that brook. The XVIII. and XIX. Corps also advanced successfully E. of Budków and at Dzwinogrod, while Brussilov's southern wing on both sides of Jaryczów Nowy delivered a succession of fierce counter-attacks against the northern wing of the II. Army.

By this date the Southern Army also had not only repulsed all the attacks directed against its centre, but in the battle of Bukaczowce had occupied the whole left bank of the Dniester from Bortniki to W. of Halicz.

The attack of the VI. Guard and XXII. Corps of the XI. Army pressed forward in to the line Bojanicze–Mosty Mle–Brusno Stary. In the afternoon Mackensen's left wing corps succeeded in defeating the Russians and, carrying with it the adjoining Austro-Hungarian XVII. Corps of the IV. Army, pressed forward. By the evening of the 27th the Russians were falling back before these corps and on the whole front of the XI. Army. The II. Army had been heavily engaged on both these days, had taken Jaryczów Nowy and driven the Russians behind the Swirz; the Russians evacuated all the right bank of the Dniester before that army's S. wing and the N. wing of the Southern Army, and abandoned Halicz on the approach of Hoffmann's corps.

Next day they fell back behind the Gnila Lipa, followed by the northern wing of the Southern Army and the main body of Böhm's, while the latter's northern wing reached the Bug, S.E. of Kamionka Strumilówa. The XI. Army drove back the Russians north-westwards, its left wing corps and the adjoining XVII. Corps being heavily engaged at Narol Miasto. These corps reached Osuchy and Tarnawatka; the centre of the XI. Army gained the area S. of Laszczów and S.W. of Krystynopol, while the Beskiden Corps filled the gap between Kamionka and the Rata. The IV. Army passed the Upper Tanew.

Early on the 29th the Russians evacuated their lines facing the last-named army and retired to the ridge bordering the Tanew region to the N. The Archduke's army was in touch with them again by the evening, in spite of the difficulty of advancing over tracks through heavy sand and swamp, the destruction of the bridges and the partial obliteration of the roads, and in spite, too, of having had to fight repeated actions with the Russian rearguards.

The left wing corps of the IV. Army was, meanwhile, on the 30th, to push forward with all possible speed on Annopol, in order to menace the flank of the Russians opposing the I. Army and force them also to retire. This was successfully accomplished by midday, and before nightfall the main body of the I. Army had reached the Kamiena and the area S. of Tarlow in pursuit, while parts of it were already being prepared for transport away. On the 30th the whole of the IV. Army was able to begin its advance into the mountainous district of Krasnik and Turobin; little opposition was met with, as the Russians had fallen back to fresh positions on the heights N. of the Wyźnica and N. of the Por. The left and centre of the XI. Army, driving before them the hostile rearguards, which fell back behind the Wolica and to the area S. of Grubieszów, advanced beyond Szczebrzeźyn, Zamósz and Tyszowce.

The Battle on the Gnila Lipa.—Meanwhile on the Gnila Lipa front there developed a severe battle which continued till July 4. By the end of June the II. and Southern Armies had, after a series of determined attacks, secured a footing on the heights to the E. of the river at several points. On July 1 the offensive of the Southern Army here met with a decisive success. Bothmer and Kosch, advancing against the line held by the Russians' XVIII., XXIII. and XI. Corps on the front Firlejów–Bursztyn, drove them back, despite their fierce resistance and determined counter-attacks, behind the Narajówka. A slight check suffered on the same date by the 51st Honved Inf. Div. on the southern wing of the II. Army was thus fully counterbalanced, and the idea of stopping the pursuit on the Gnila Lipa, which had occurred to the II. Army, was once more abandoned.

The success achieved was increased during the following days. The Russians in face of Böhm's southern wing evacuated their ground under pressure of the Southern Army's advance, whereupon Böhm also began to move forward across the Gnila Lipa. On the night of the 2nd Böhm's centre also assumed the offensive successfully, and drove back the enemy to the heights W. of the Zlota Lipa, where they were again attacked all along their front on the 3rd.

During the night of the 4th the Russians, unable to hold out against Böhm's and Linsingen's vigorous assaults, abandoned this height also, and took up positions behind the Upper Bug and behind the Zlota Lipa. Here they intended to entrench themselves so strongly as to be able to offer a prolonged resistance. Böhm and Linsingen continued their attacks without achieving any conspicuous successes. Both sides, therefore, settled down to trench warfare, using the respite to recuperate and regroup their troops. It was not till the end of Aug. that heavy fighting again developed on the Zlota Lipa front (Campaign of Rovno).

In the middle of July Pflanzer-Baltin attacked the Russian IX. Army's lines between the Sereth and Strypa, in order to assist the main offensive by containing the Russian forces opposed to him. This was known as the battle of the Dniester (July 14–19). At the same time his northern wing advanced across the Zlota Lipa below Zadarów and established itself on the E. bank. The Russians stubbornly held their ground and delivered counter-attacks, so that six days of fighting produced no results worth speaking of. The main object of the operations had, however, been fully secured.

Second Battle of Krasnik, July 1–14.—The Austrian IV. Army, pushing forward into the mountainous area of Krasnik and Turobin, had now reached the area already made famous by the successful campaign of Dankl's army in Aug. 1914. The Russians were now established N. of the Wyźnica and the Por in order to stop, or at least to delay, any further advance of Archduke Joseph Ferdinand's army and the left of the XI. Army which was next to it. Strong Russian concentrations had moreover been reported at Vladimir-Volhynskiy and Grubieszów. Gen. Russky, the commander of the Russian N.W. front, appeared to be putting up a determined resistance.

The Archduke's troops had reached the Wyźnica and the Por without meeting with any particular opposition, and, in spite of their exhaustion, at once began their attacks. The Austrian X. Corps took possession of Krasnik in the first rush. At the same time the German X. Corps of the XI. Army forced the passage of the Por after overcoming stiff opposition, while the XXII. and Guard Corps secured the heights on the N. bank of the Labunka after fierce fighting.

On July 2 the offensive was to be continued by both armies at all costs. An assault group composed of five divisions of the XIV. and IX. Corps (IV. Army) was formed under command of Field-Marshal-Lt. Roth for the actual breaking through of the hostile positions E. of Krasnik. The Russians, however, anticipating some such move, had strengthened their forces at Krasnik, and forced the Austrian X. Corps by very violent counter-attacks to evacuate it. However, when, after the necessary artillery preparation, Roth's attacking wedge drove deeply into their front by way of Studzianka on July 3, the Russians had to cease their attacks; whereupon the X. Corps reoccupied Krasnik, while the 47th Res. Div. (VII. Corps) pushed four battalions to the N. bank of the Wyźnica. The right wing of the army had also continued its offensive, and with the German X. Corps had advanced completely across the Por; while the XXII. and Guard Corps had worked forward nearly as far as the Wolica after heavy fighting. The right wing of the XI. Army had reached the area Terebinn-Krylów and to the S.E. of Sokal, whence the Beskiden Corps continued the line as before to Kamionka Strumilówa. The XLI. Corps was sent back to the army and placed behind its right wing.

Puhallo's army, meanwhile, had given a striking sign of its presence by taking the Russian bridgehead of Tarlów and clearing the angle between the Kamiena and the Vistula. After this success the rest of this army was also held in readiness for transport elsewhere; Woyrsch assumed command of all the forces on the left bank of the Vistula, and Bredow's division relieved the I. Army in its positions. It was reckoned that they would finish taking up their positions in the area behind the inner wings of the II. and XI. Armies by July 13. Mackensen, meanwhile, in view of the Russian concentration of forces at Vladimir Volhynsk and Grubieszów and the great extension of his front which must result from any further advance, resolved to stop the pursuit by the XI. Army and only to resume the further offensive northwards when Puhallo's army had joined him. The right wing of the XI. Army therefore ceased to attack. The left wing, on the other hand, had to continue its advance in order to keep pace with the progress of the Archduke's attack; it pushed forward to Czernieczin and Staw, while the centre had to repulse violent counter-attacks. On its right wing a new group from the II. Army under Szurmay took over the sector between Kamionka Strumilówa and the Rata from the Beskiden Corps.

On the 4th Roth's group met with complete success. Pressing forward into the line Stara Wies–Wilkolaz it carried with it the XVII. Corps on its right beyond Tarnawka, while the X. Corps on its left, with part of the VIII. Corps, reached Urzedowka.

Next day the attack was successfully continued along the whole front of the IV. Army. The XVII. Corps reached Gilczew and the left wing of the XI. Army the Zolkiewka.

On the 6th the X. and VIII. Corps had very hard fighting. The Russians now really seemed to be pulling themselves together for a counter-blow, and they began by offering a desperate resistance to the attack of the two corps. The Command of the IV. Army followed their attack with considerable anxiety, for they had made very little headway up to the present, while on the front of Roth's group and the XVII. Corps a cessation in the fighting was ordered so as to allow of regrouping the forces and preparing for a continuance of the break-through.

During this pause, on July 7 a serious set-back occurred. On the 5th an intercepted Russian wireless message had notified the presence of the VI. Siberian Corps and a grenadier div., both consisting of entirely fresh troops. On the 6th the Russian resistance noticeably stiffened and on the 7th the Siberian VI. Corps energetically attacked the inner wings of the XIV. and X. Corps. The 106th Inf. Div. and the X. Corps were driven back to the heights N. of Krasnik and behind the Wyźnica, and the right wing of the VIII. Corps had to retire in conformity. During the next few days the Russians secured further successes, forcing back the XVII. Corps and the 47th Reserve Div. of the VIII. Corps. But by the 10th the IV. Army, which had been hastily reënforced by two cavalry divisions and some Landsturm formations from the I. Army, had overcome the crisis by its own strength. The 4th Inf. Div. from the I. Army, which had been sent to Zolkiew, had, it is true, now been placed under it, but before its arrival the Russian attacks had died down and even showed signs of turning into a retreat.

This counter-blow, thus fortunately parried, had no serious effect on Mackensen's army, of which the regrouping could be carried out as planned, under cover of the activity on the IV. Army's front, almost without the enemy noticing it.

After the capture of the Tarlów bridgehead the transfer of the I. Army proceeded rapidly. The Army Command arrived in Zolkiew by one of the earliest trains, and there took over the command of Szurmay's group and superintended the assembly of the army on the Rata and the Bug as far as Krylów. The German High Command was at the same time arranging for the formation of a new German army, "the Army of the Bug," under Gen. von Linsingen, which was to operate between the XI. and I. Armies, and to consist of 7 infantry and one cavalry divisions from the XI. Army and one infantry and one cavalry division from the Southern Army.

The Russians, in the meantime, had also undertaken a regrouping of their forces. At the beginning of the battle of Krasnik the German XI. and Austro-Hungarian IV. Armies were faced by the Russian III. Army, which had been gradually brought up to a strength of 26 infantry and 6 cavalry divisions. This force, already too large for effective handling from a single centre, had further been increased by the arrival of two fresh corps in the Wlodawa area, of which the one was to reënforce the III. and the other the IV. Army. In order to simplify the problem of command the Grand Duke Nicholas resolved to break up the III. Army, the five western corps forming the new III. Army, and the other six being reorganized into a new XIII. Army. After completion of the regrouping, Mackensen's command consisted of the IV., XI., Bug, and I. Armies. With these he was to subdue Russian Poland by means of a new offensive to the N. in conjunction with Woyrsch and the IX. German Army W. of the Vistula. (E. J.)

LEMONNIER, ANTOINE LOUIS CAMILLE (1844–1913), Belgian poet (*see* 16.415), published among his later works *L'Amant passionné* (1905); *Tante Amy* (1906); *La maison qui dort* (1909) and *La chanson du carillon* (1911); as well as *L'école belge de peinture, 1830–1905* (1906). He died at Brussels June 13 1913.

See L. Bazalgette, *Camille Lemonnier* (1904).

LENIN (originally OULIANOV), **VLADIMIR ILICH** (1870–), Russian Communist leader, was born in Simbirsk in 1870, his father being an official of middle rank—a district inspector of schools. His elder brother, Alexander, was an active member of the terrorist party of the "Will of the people." In 1887 he planned with some friends to assassinate Emperor Alexander III. by the explosion of an infernal machine: the plot was discovered and Alexander Oulianov was hanged together with four of his accomplices. Vladimir entered the university of Kazan as a student of law, but was expelled for taking part in revolutionary agitation. He went to St. Petersburg and passed his bar examination there. He did not practise long, but joined a secret organization of professional revolutionists. Towards the end of the 'nineties he was arrested, escaped and went abroad. He had joined the Social Democratic movement which in those days was spreading widely in Russia. Plekhanov and Struve were at that time the chief exponents of Marxism: they adopted the teaching of Karl Marx as regards the necessary sequence of economic stages—feudalism, *bourgeois* individualism, capitalism, proletarian upheaval. In that scheme the rise and growth of capitalism was considered to be a necessary preliminary to social revolution, and it was thought that Russia had hardly entered that stage: therefore it was not ripe for a social upheaval. Lenin was in agreement with these views for some time. But while Struve, and to a less degree Plekhanov, were induced by this admission to seek an alliance with Liberal intellectuals in their struggle against Tsarism, Lenin (as he had taken to calling himself), together with Martov, Axelrod and other fiery spirits, forsook the Liberal platform and strove for a violent outbreak of a downright class war. This produced a split in the ranks of Social Democracy between the Majority and Minority sections (Bolsheviks and Mensheviks). This split, first apparent in the Congress of 1903, gradually widened. At the third Congress in 1905 it led to the formation of two parties, the Bolsheviks meeting in London, and the Mensheviks in Geneva.

The revolution of 1905 saw Lenin again in St. Petersburg, and he worked a good deal behind the scenes, inciting to violence, advising a boycott of the Duma, hostility to the Cadets, etc. But he did not play any part in the Soviet of workmen, and disappeared as soon as it became clear, after the crushing of the outbreak in Moscow, that the troops and the people were not on the side of the revolutionaries.

During his second stay abroad (1906–17) Lenin published several pamphlets and books which attracted a good deal of attention. In the *Two Tactics* (1905) he had announced that terrorism was inevitable as a weapon in the hands of revolutionists. He said among other things: "The Jacobins of contemporary social democracy—the Bolsheviks—desire that the people, that is the proletarians and peasants, should settle the reckoning of Monarchy and Aristocracy in plebeian fashion—by ruthlessly annihilating the enemies of freedom."

The disillusionment as regards material means for improving the life of mankind had given rise in many minds to a quest for religion, and this mystic current had attracted men like Struve, Bulgakov, Berdiayev and others. Lenin regarded such strivings as a betrayal of the claims of the labouring class. His book on *Materialism and Empiric Criticism* (1909) heaps abuse on idealistic philosophers and religious teachers of all schools and creeds. He does not enquire into the abstract right and wrong of any case, but subjects it to the acid test of proletarian interests.

He quotes Lafargue with approval: "The working-man who eats a sausage and is paid five francs a day knows quite well that his employer robs him, and that a sausage tastes well and is good food." "Not at all," says a *bourgeois* sophist (let it be Pierson, Hume or Kant), "the working-man's opinion on this question is a personal view, a *subjective* view; he would have been quite as justified in thinking that the employer is his benefactor and that the sausage is hashed leather, for he is unable to know a thing as it is (*Ding an Sich*)."

The period of reading and writing was also a period of propaganda in which Lenin was not troubled by any scruples. He rather preferred to have to do with common criminals like Malinovsky, Radek or Peters. Malinovsky had been caught in committing burglary and forgery. This gave a handle to the Petersburg secret police, and they employed him as a spy and *agent provocateur*. He managed to get into the Fourth Duma through the joint protection of Bieletzky, the Russian Fouché, and Lenin. It would be wrong to suppose that Lenin drew profits from the misdeeds of his associates. His one passion was lust of power, and he was not in the least attracted by gain. He was guided rather by the motto: *Je prends mon bien où je le trouve*. This feature of his character served him well when the World War brought about the long-expected upheaval of European society. Lenin was one of the leading spirits of the Zimmerwald and Kienthal meetings, and urged a general revolt of the workmen of all countries against the war. But he rightly felt that the social catastrophe would be most likely to break out in Russia, as the worst governed and the least civilized country. Therefore he upheld to the full extent of his influence the cause of Germany against the Entente. "As things actually are," he said in Oct. 1914, in his organ published at Geneva, "it is impossible, from the point of view of the international proletariat, to say which would be the lesser evil for Socialism, an Austro-German defeat or a Franco-Russo-English defeat. But for us, Russian Social Democrats, there can be no doubt that, from the point of view of the working-classes and of the toiling masses of all the Russian peoples, the lesser evil would be a defeat of the Tsarist monarchy. We cannot ignore the fact that this or that issue of the military operations will facilitate or render more difficult our work of liberation in Russia. And we say: 'Yes, we hope for the defeat of Russia because it will facilitate the internal victory of Russia—the abolition of her slavery, her liberation from the chains of Tsarism.'"

He and his associates found ready support from the funds at the disposal of the German secret service. And it came to pass that the Kaiser, who deemed himself the champion of monarchical principle in Europe, should assist him and his retinue to reach Russia after the overthrow of the Tsar. From that point his career up to 1921 is merged in the general history of Russia (*see* Russia), where he established himself as president of the Soviet Government. (P. Vi.)

LEONCAVALLO, RUGGIERO (1858–1919), Italian composer (*see* 16.455), died at Montecatini Aug. 9 1919.

LEROY-BEAULIEU, HENRI JEAN BAPTISTE ANATOLE (1842–1912), French publicist (*see* 16.485), published among his later works *Les congrégations religieuses et l'expansion de la France* (1904) and *Christianisme et démocratie, et socialisme* (1905). He died in Paris June 16 1912.

LEROY-BEAULIEU, PIERRE PAUL (1843–1916), French economist (*see* 16.485), died in Paris Dec. 9 1916.

LESCHETIZSKY, THEODOR (1830–1915), Polish pianist and teacher, was born in Poland June 22 1830. He was a pupil of Czerny, and for many years enjoyed a wide reputation as a pianist. His fame, however, chiefly rests upon his establishment (1878) of the Leschetizsky school of pianoforte playing at Vienna, which earned a world-wide reputation for the soundness of its methods of teaching and the number of eminent artists whom it produced. Among his pupils may be mentioned Paderewski, Mark Hambourg and Moiseiwitsch. The famous teacher died at Vienna Nov. 17 1915.

LETHABY, WILLIAM RICHARD (1857–), English architect, was born in Barnstaple in 1857, and began his architectural training in that town. In 1879 he won the Soane travelling studentship of the R.I.B.A., and soon afterwards entered the office of Norman Shaw, remaining with him for 12 years. In 1892 he started practice on his own account. Shaw's inspiring influence, together with that of William Morris and Philip Webb, shaped and coloured Lethaby's design and work. His first important building was Avon Tyrrell, Hants., for Lord Manners, followed by Melrotter, Orkney and other smaller houses. He also carried out the Eagle Insurance building in Birmingham, and a church at Brockhampton, Hereford. A keen student of the past, Lethaby covered several fields in his writings on architecture and applied art. He published in 1892 *Architecture Mysticism and Myth* and *London before the Conquest*, and in the following year *Leadwork*, where his subject is treated both historically and from the craftsman's point of view. For several years he acted as editor of the series covering the whole ground of the *Artistic Crafts*, and for the Arts and Crafts Society wrote, later, *Handicrafts and Re-construction*. Concentrating on the study of Byzantine art, in 1893 he visited Constantinople, and there, in collaboration with Harold Swainson, gathered material for his book *The Church of Sancta Sophia* (1894). His *Westminster Abbey and the King's Craftsmen*—a study of mediaeval master-masons and building methods—was largely responsible for his being appointed in 1906 surveyor to the fabric of the Abbey, and becoming responsible for its repair and conservation. Amongst Lethaby's many other contributions to the literature dealing with the history and methods of architecture and its dependent arts are *Mediaeval Art* (1908), based on a study of the French cathedrals; *Greek Buildings, represented by fragments in the British Museum* (1908); *Architecture, an introduction to the history and theory of the Art* (1912); *National Architecture and Modernism* (1918–21) and many articles and papers in the *Hibbert*, the *Hellenic* and other journals and magazines. He was appointed in 1893 one of the two art inspectors by the then newly constituted Technical Education Board of the London County Council, and, with Sir G. Frampton, was responsible for the establishment of the Council's principal technical education centre. Of this, the Central School of Arts and Crafts, he was principal from 1893 to 1911. He was professor of design at the Royal College of Art from 1900 to 1918.

LETTOW-VORBECK, PAUL VON (1870–), German general, was born March 20 1870 at Saarlouis. He took part in the China expedition in 1900, and fought in 1904 in the operations for the suppression of the German South-West African insurrection. In 1911 he was appointed commander of the colonial troops in Cameroon, and in 1913 to the corresponding command in German East Africa. There he conducted a four years' struggle against the British forces, extorting general admiration by the remarkable way in which he contrived to move his men and to elude his adversary through tropical jungles and regions which had only been partially explored. The remainder of his force finally withdrew into Portuguese East Africa. In 1919 he returned to Germany, and was made leader of the corps which bore his name in the organization of the Republican army (*Reichswehr*) before the disarmament clauses of the Treaty of Versailles were fully enforced. He was active in suppressing Communist risings in Hamburg, and finally left the service in March 1920. He published in 1919 *Meine Erinnerungen aus Deutsch-Ostafrika*.

LEVASSEUR, PIERRE ÉMILE (1828–1911), French economist (*see* 16.505), died July 9 1911.

LEVERHULME, WILLIAM HESKETH LEVER, 1st Baron (1851–), British soap manufacturer, was born at Bolton, Lancs., Sept. 19 1851, and educated at the Bolton church institute. In 1867 he entered his father's grocery business at Bolton. In 1874 he devised a tablet of "Lever's Pure Honey Soap," which, on the passing of the Trademark Act in 1875, enabled him to register his name as a soap manufacturer. But it was not until 1886 that he and his brother D'Arcy Lever started soap manufacture in earnest at Warrington as Lever Brothers. Their immediate success, and the popularity of their "Sunlight" brands, led to rapid extension, and their works, christened

Port Sunlight, became models of their kind. Schools, clubs, libraries, rest-rooms, a hospital and many other institutions for the benefit of the workpeople were included, and a system of co-partnership was inaugurated in 1909 with successful results. The brothers also established works at Mannheim in Germany, as well as businesses in France; Switzerland; Sydney, N.S.W.; Boston, Mass.; Toronto; Japan, and elsewhere. In the Belgian Congo they acquired vast forests for their supply of palm-oil, and in 1911 they established there the settlement of Leverville. In 1900 Mr. Lever unsuccessfully contested the Wirral division of Cheshire as a Liberal, and in 1906 was elected, retaining his seat till 1910. In 1911 he was made a baronet, and in 1917 he was raised to the peerage as Baron Leverhulme. In 1912 he bought Stafford House, the London home of the Dukes of Sutherland, and presented it to the nation as a home for the London museum, and in 1918 he bought the island of Lewis in the Hebrides, Scotland, as a centre for a reorganized fishing industry.

See Mrs. Stuart Menzies, *Modern Men of Mark* (1920); H. M. Macrosty, *The Trust Movement in British Industry* (1907).

LEVY, AUGUSTE MICHEL (1844–1911), French geologist (*see* 16.519), died Sept. 21 1911.

LEWIS, SIR GEORGE HENRY, 1ST BART. (1833–1911), English solicitor, was born at Ely Place, Holborn, April 21 1833. Educated at University College, London, he was articled in 1856, and became head of the firm of Lewis & Lewis. He was engaged in a very large number of notable public cases, including the Bravo poisoning case, the Hatton Garden diamond robbery, and the Overend-Gurney and other banking prosecutions. Later (1887) he was solicitor for Mr. Parnell and the Irish party in the Parnell Commission. Sir George Lewis, who was made a baronet in 1893, was for many years the most prominent man in his profession, and had a unique practice, especially in advising on difficult family affairs; he was the trusted confidential adviser of many important people. He died in London Dec. 7 1911, being succeeded in the baronetcy by his son.

LEWIS, ISAAC NEWTON (1858–), American soldier and inventor, was born at New Salem, Pa., Oct. 12 1858. On graduating from the U.S. Military Academy in 1884 he was commissioned second lieutenant of artillery, and seven years later was made first lieutenant. From 1894 to 1898 he was a member of the board on the regulation of coast artillery fire in New York harbour. For the next four years he was recorder of the board of ordnance and fortification in Washington. He was promoted captain in 1900, and the same year made a study of ordnance in Europe. His report led to the rearmament of the U.S. field artillery. From 1904 to 1911 he was instructor and director of the coast artillery school at Fort Monroe, being promoted major in 1907 and lieutenant-colonel in 1911. In 1913 he was made colonel and retired from active service. The same year a machine-gun of his invention (the Lewis gun) was accepted by the British Government after it had been rejected in America. During the World War it was extensively used by the different Allied armies, by the American navy, and in American and Allied airplanes. Colonel Lewis refused to accept any of the royalties, amounting to about $1,000,000, on his guns made for the American Government after the United States entered the World War. His other numerous inventions included a time-interval clock-and-bell system of signals, a replotting and relocating system for coast batteries, an automatic sight, quick-reading mechanical verniers used in coast defences, and a speed indicator for locomotives.

LEWKOWITSCH, JULIUS (1857–1913), British chemist, was born at Ostrovo in Prussian Silesia in 1857. He graduated as doctor of philosophy at Breslau, afterwards working in the Berlin agricultural high school and at Heidelberg University. About 1888 he came to England and became a naturalized British subject. He devoted much time to stereo-chemistry and to developing the industrial technology of fats and oils, becoming the first living authority in that branch of chemistry. He died at Chamonix Sept. 18 1913.

LIBERIA (*see* 16.539).—From 1912 this negro republic on the Guinea Coast of Africa was under the virtual protection of the United States, an American officer being receiver-general and financial adviser to the Government. Pop., 1920 estimates, 1,500,000 to 2,100,000. Of the inhabitants about 12,000 are American negroes or their descendants and some 50,000 negroes in the coast region are "assimilated," that is they have adopted the religion (Christianity), standards and language (English) of the American negroes, whose authority extends, at least nominally, over the whole country. Europeans number under 200. Monrovia, the capital and chief seaport, had (1920) about 6,000 inhabitants. It has two wireless stations and direct cable connexion with Europe and New York.

The inability of the Liberian Government to control the tribes in the interior led to many boundary disputes with France, whose Guinea and Ivory Coast colonies adjoin Liberia on the N. and E. By an agreement concluded in 1910 France obtained some 2,000 sq. m. which Liberia claimed but had not administered. This reduced the area of the republic to about 40,000 sq. miles. The new frontier was delimited by a commission on which Liberia was represented by two Dutch officers. By an Anglo-Liberian Convention dated Jan. 21 1911 an exchange of territory advantageous to both parties was effected with the British protectorate of Sierra Leone, which acquired the district of Kanre Lahun and ceded the Morro Forest district.

At that time—1910–12—the condition of Liberia was far from satisfactory. It was burdened with debt, it had granted concessions to various companies (British, German and others) without being able to control the regions in which the concessionaires were to work; after over 60 years' existence the authority of the Government rarely extended more than 20 m. from the coast. The remnants of Samory's army, and other malcontents with French rule, took refuge in the Liberian forests and raided across the frontier. This formed a constant source of exasperation to the French (and in minor degree to the British) and, not unnaturally, the French saw in the annexation of the hinterland the only method of securing peace in their own possessions. There were no railways and no roads in the country, whose great natural resources in coffee, oil palms, rubber, timber, etc., were almost totally neglected. Thus in 1911 the total value of all exports was but £230,000.

It appeared as if the experiment of "running" the country by American negroes on the lines of the Constitution of the United States would collapse, but the intervention of the American Government led to a reorganization which gave the Liberians a new start. In 1911 the Liberian Legislature passed an Act approving the raising of a loan through the good offices of the United States to refund or extinguish all debts of the republic, domestic and foreign. Before the loan was issued all outstanding claims against Liberia had to be fixed and some delay ensued owing to the discrepancy between the German claims and the views of the Liberian Government. The German claims were energetically pressed, and in 1911 the gunboat "Panther" was anchored for a month off Monrovia, with guns trained on the executive mansion. All difficulties were, however, overcome by June 1912, when an international loan of $1,700,000 (£340,000) was raised, the bonds being payable in New York, both as to principal and interest, in gold coin of the United States; the bonds to be issued for a period of not fewer than 40 years, and for this period the control of the finances of Liberia passed in effect into the hands of the United States. The customs duties, the rubber tax, etc., were pledged as security for the loan, which is administered by an American receiver-general assisted by a British, a French and (originally) a German receiver, the American receiver-general acting as financial adviser to the Government. In accord with another provision for the security of the revenue a frontier police force was organized by officers of the U.S. army. This force enabled the Government to obtain control of the Kru country in the south, and of N. Liberia. Under the new financial control expenditure was kept within the limits of the revenue, and internal peace was secured.

The new system had not had time to show any marked results when the World War began. Its effect was greatly to restrict trade which up to that time was chiefly with Germany, Great

Britain and Holland and had an annual average value of about £450,000. By 1914 fully two-thirds of the trade was in the hands of Germans, by whom the wireless station at Monrovia was owned and worked, as well as a four-cable line to New York. Deprived of their own colonies and ejected from the French and British possessions on the Gulf of Guinea the Germans during the war found in Liberia their last foothold in W. Africa. The position created was as unsatisfactory to the Liberians as to the Allied Powers, but Liberia was itself helpless. However, soon after the entry of the United States into the war the Liberian Government (May 1917) broke off diplomatic relations with Germany, the president, Mr. Daniel E. Howard, announcing that Liberia would coöperate sympathetically with the United States, Great Britain and France. On Aug. 4 a state of war with Germany was declared, and the Germans in Liberia were deported. The only act of hostility reported in Liberia was the bombardment of Monrovia by a German submarine on April 10 1918, following a refusal to dismantle the wireless station. The Germans destroyed the station, killed four persons and sunk the armed steamer "President Howard," which constituted the whole of the Liberian "navy." Liberia was one of the signatories of the Treaty of Versailles. In Jan. 1920 Mr. C. D. B. King took office as president for a period of four years. Mr. King had been the peace delegate to Paris in 1919 and in the autumn of that year had paid a lengthy visit to America. An announcement was made, with reference to financial control, that Liberia would henceforth be placed under the exclusive supervision of the United States.

After the war renewed efforts were made by British and American interests to develop the trade and resources of the country, but up to 1921 little more than preliminary work had been done. Indigenous coffee is the staple product—761,300 lb. of coffee were exported in 1917. In the same year the export of cocoa was 65,000 lb.; of piassava fibre (prepared from the raphea palm), 5,912,000 lb.; of palm oil, 336,000 gallons. Since 1914 the trade had been almost wholly with Great Britain, which in 1920 imported from Liberia goods to the value of £513,000 and exported to Liberia goods valued at £271,000. (The corresponding figures for 1913 were £56,000 and £90,000.) Shipping was also mainly British. In 1919 of the 244 vessels visiting Monrovia 116 were British, and British tonnage was 483,000 out of a total of 622,000 tons.

Revenue, which had been $618,800 (£124,000) in 1912–3 (accounts are kept in American currency though the money chiefly used is British), had fallen to $273,000 (£54,600) in 1914–5, and remained at about that figure for the next three years. Expenditure was rigidly curtailed, and obviously the Government had no money to spend on reproductive works.

Liberia continued to be of special interest to the naturalist. A valuable fodder grass, the *Pennisetum purpureum*, was discovered and in 1912 the first living specimens of pigmy Liberian hippopotami were captured and exported (by Maj. Schomburgh, who sent specimens to American and German zoölogical gardens).

See *The Republic of Liberia* (1920) by R. C. F. Maughan, since 1913 British consul-general at Monrovia, and Sir A. Sharpe, "The Hinterland of Liberia," *Geog. Jour.* (vol. lv., 1920). (F. R. C.)

LIBERTY, SIR ARTHUR LASENBY (1843–1917), English merchant, was born at Chesham Aug. 13 1843, the son of a Nottingham lace manufacturer. He was educated at the university school of Nottingham and at 19 became manager of the shop in Regent St., London, which he developed into an important adjunct of the art world of the period. In 1875 he became independent and at once set to work to adapt Eastern art in weaving and design to Western requirements, becoming famous both for his textiles and for his colourings. He was a fellow of the Asiatic Society and chairman of the advisory committee of the Royal School of Art Needlework at Kensington. Knighted in 1913, he died at Gt. Missenden, Bucks., May 11 1917.

LIBERTY LOAN PUBLICITY CAMPAIGNS.—The success of the Liberty Loan campaigns in the United States, after its entrance into the World War, must be judged in the light of the fact that, before 1914, America had little experience of raising huge amounts of capital for lending abroad. At the outbreak of the war the United States was a debtor nation. It was indebted to foreign creditors on capital account to the estimated extent of $3,500,000,000. Since July 1913 there had been, moreover, a steady export of gold, which had occasioned grave apprehension among American bankers; and in June 1914 New York clearing-house banks had fallen $50,000,000 below their legal gold reserve requirements. On July 31 1914 drafts payable in gold were coming due immediately on the arrival of shipments of American railway and industrial securities sold abroad, and later, but within a few months, obligations to the amount of $600,000,000 would have to be met with gold in London and on the European continent. Foreign exchange leaped to the unheard-of figure of $7 for the pound sterling early in August. By Jan. 1 1915, however, financial conditions in the United States assumed a different aspect in consequence of the action of the bankers, assisted by the U.S. Treasury, in devising and making available a gold fund of $100,000,000 to protect the country's foreign credit. The warring nations were placing in haste huge orders for munitions of war, foodstuffs and general supplies. Exchange rates thus not only became normal, but turned in favour of the United States. Exportation of gold ceased, and its flow towards the United States began. In Sept. 1915 England and France contracted in New York for the Anglo-French loan of $500,000,000. From Sept. 1 1915 to April 15 1917, a period of 19 months, the belligerent nations negotiated loans in the United States amounting to $1,650,000,000, at a rate not exceeding $5\frac{1}{2}\%$; and the net balance of imports of gold into the United States during the same period was $1,074,777,133. These conditions in April 1917 are significant in contrast with those of July 30 1914.

When the United States entered the war it was apparent that huge sums would have to be made available by the U.S. Government for the use of the Allies as well as for its own expenses. The stupendous cost of the war to England, France and Italy clearly indicated that the United States must secure a war-chest of thousands of millions of dollars. Taxation and bond issues were the only methods by which the needed money could be raised. Congress, April 24 1917, 18 days after the declaration of a state of war, authorized the Secretary of the Treasury to issue bonds of the United States to the extent of $5,000,000,000. These Liberty Loan Bonds carried interest at the rate of $3\frac{1}{2}\%$ per annum, were tax-exempt, and convertible into bonds bearing higher interest if any subsequent series should be issued at a higher rate. The unprecedented issues of loans by foreign Governments, and the purchase of large blocks of American railway and industrial securities which foreign holders had unloaded on the New York market during 1915 and 1916, however, seemed to have absorbed all the fluid money in the country. It was most uncertain how $3\frac{1}{2}\%$ bonds would fare in the open market while those of England and France were yielding $5\frac{1}{2}\%$, and railway and industrial securities carrying 6% were selling below par. Leading bankers in all parts of the country advised that the issue should not be in excess of $500,000,000, in the belief that the market could not absorb more. In the face of these discouraging advices the Secretary of the Treasury determined, nevertheless, to be influenced only by the essential requirements of the Government. He fixed upon the amount of $2,000,000,000, and offered the loan to the public May 17 1917, believing that an appeal to the patriotism of the people would bring a satisfactory response. This first offering closed June 15 1917, with subscriptions by 4,000,000 people aggregating $3,035,226,850. Then, within the next 23 months, at intervals of about 6 months, there followed the Second, Third, Fourth and Fifth Liberty and Victory loans, aggregating $19,000,000,000 more, and in each campaign the offerings were over-subscribed. But this was only as a result of an appeal to the public such as had never before been attempted.

Appeals to the people, however patriotic they may be, cannot be forcefully made without organization.[1] A selling agency had to be created, one that would be nation-wide in its operations, replete with energy, enthusiastic in its patriotism, and determined to uphold American honour and credit.

Geographically the United States is divided into 12 financial sections, each of which is termed a Reserve Bank District, with its Reserve Bank. The Federal Reserve Board was located in Washington. The system was but newly created, and had begun to function early in 1915. After the United States entered the war a War Loan Organization under the Treasury Department was established at Washington, and in each of the 12 Federal Reserve Districts a Central Liberty Loan Committee was constituted, with the governor of the Reserve Bank as chairman, and to these committees was entrusted the work of selling the bonds in their respective districts.

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[1] For an account of what was done in England, for the same purpose, see the article WAR LOAN PUBLICITY.

The Treasury Department allotted to each district the amount of bonds it was to sell, and each central committee divided the allotment throughout its territory, calling upon its sub-committees in various localities to have their quotas subscribed. The men who served on the central committees and on the principal sub-committees represented the most capable, experienced and influential men in their respective communities—financial, professional and industrial. The success of all the loans was largely due to the perfection of the selling organizations and to the energetic action of the central committees under the direction of the Treasury Department. American women figured in every great war movement, and in these campaigns they proved their value in an entirely new capacity as sellers of bonds. They perfected a nation-wide organization—the National Woman's Liberty Loan Committee, which coöperated with the Liberty Loan Organizations of the Federal Reserve Districts. They had enrolled on their committees 800,000 women during the campaigns for the Fourth and Fifth loans.

Inasmuch as New York City is the heart of financial America, and as the Second Federal Reserve Bank is there, a description of the bond-selling campaign there will be sufficient. The Central Liberty Loan Committee of the Second Federal Reserve District was composed of Benjamin Strong, chairman; James S. Alexander (President National Bank of Commerce); George F. Baker (chairman board of directors, First National Bank); Allen B. Forbes (Harris, Forbes & Co.); Walter E. Frew (president Corn Exchange Bank); Gates W. McGarrah (President Mechanics and Metals Bank); J. P. Morgan (J. P. Morgan & Co.); Seward Prosser (president Bankers' Trust Co.); Charles H. Sabin (president Guaranty Trust Co.); Jacob H. Schiff (Kuhn, Loeb & Co.); Frank A. Vanderlip (president National City Bank); Martin Vogel (Assistant Treasurer of the United States, in charge of the Sub-Treasury in New York, and representative of the Secretary of the Treasury); James N. Wallace (president Central Union Trust Co.); Albert H. Wiggin (president Chase National Bank); and William Woodward (president Hanover National Bank). These men met daily during each campaign. They formed sub-committees on distribution publicity speakers' bureaus, banks and trust companies, various industries, manufactures and professions, each composed of the leading men in their respective industries and professions. Every city town and village had its Liberty Loan Committee as part of this huge organization. Each district was given its allotment, and daily returns were reported to the Central Committee throughout each campaign. If the reports from any district showed that it was lagging behind, speakers of national repute were sent to arouse it. Campaigns of education were inaugurated making widely known the causes of the war, the object sought by victory, and the necessity of financing the Allies and supporting the military arm of the Government. To the thoroughness of the educational campaign may be attributed much of the success of the issues. It convinced everyone that each man, woman and child must "do his bit." It made an army of workers with an individual responsibility. No device to assemble crowds was ignored, and there was no assembly without its speakers. Bands, processions, parades, balloon ascensions, flights of aeroplanes dropping leaflets, steeple climbers, altars of liberty, "Nation Days" for aliens and citizens of foreign birth, and, later, captured tanks, cannon and submarines, pyramids of German helmets—all were used. Walls were covered with special cartoons; magazines and newspapers contained full pages of advertising. "Buy a bond" was a slogan from which there was no escape. In café and club, in hotel corridor and restaurant, between the acts in the theatre, and in all public places came the cry "Buy a bond." The jargon of the money market was abandoned. It was not the question of investment *versus* investment, or interest rate *versus* interest rate. It was that of the National Treasury in need of funds. Performance of patriotic duty and pride in American institutions was the key of the educational campaign. When the great "drives" came the nation responded to a man. Every village and city in the land sought not merely to sell its quota of bonds, but strove to "go over the top."

The Treasury Department and the central committees realized that the people did not have sufficient available money to pay in cash for the bonds, and therefore the slogan "Borrow, buy and save" was employed, and the banks throughout the country were urged to make loans freely to subscribers who offered bonds as collateral. The banks aided the small investors by financing their subscriptions, permitting them to pay off in monthly instalments, with interest at the coupon rate. The large mercantile and industrial establishments likewise financed the subscriptions made by their employees. In the later campaigns coupon instalment books were introduced. The banks aided the large investor to subscribe beyond his available cash resources by loaning on the subscriber's three-months note, with the bonds as collateral, and with the privilege of one, two or three renewals of three months each, with interest at the coupon rate. Usually a substantial payment in reduction of loan was required and the rate of interest raised at the end of the renewal periods. There was no special rule, each bank using its own judgment in individual cases. The banks, in turn, rediscounted these notes at their Federal Reserve Banks, thereby maintaining a liquid position. Had this "borrow-and-buy" method not been put into practice, the people would not have been able to subscribe and pay in cash the vast amounts necessary. The mere "borrow-and-buy" method in itself may not have been economically sound, but with it was joined the slogan "Save," in order that the borrowings might be repaid, and the borrowing was a war necessity. Immediately after the Armistice there was an orgy of spending, prices of all commodities rose, and merchants found that they required more cash to expand and increase their inventories. This need resulted in a wide selling movement of the bonds, and was in great measure the cause of their selling temporarily below par.

Details of the Loans.—The Liberty Bonds and Victory Notes were issued under authority of the Acts of Congress approved April 24 1917, Sept. 24 1917, April 4 1918, July 9 1918, Sept. 24 1918 and March 3 1919, and pursuant to official Treasury Department circulars. The following are some of the details in connexion with their flotation:—The First loan was a 30-year 3½% loan dating from June 15 1917; interest payable semi-annually (as in the case of all the loans); redeemable at the option of the Government on and after June 15 1932 and exempt from all taxation, except inheritance and estate taxes, both as to principal and interest. This exemption made the First loan especially desirable for persons with large incomes and kept its market price higher than that of subsequent issues. The amount offered and issued was $2,000,000,000, the subscription $3,035,226,850. Subscriptions opened May 17 1917 and closed June 15 1917.

The Second Liberty Loan was a 4% issue dated Nov. 15 1917; maturity Nov. 15 1942 but redeemable on and after Nov. 15 1927. It was convertible into subsequent issues of bonds bearing a higher rate than 4% and was exempt from state and local taxes and from the normal income tax, but not from estate and inheritance taxes, or from the super-tax, on personal incomes or the excess and war profits taxes on corporate incomes above $5,000. Thus by increasing the interest rate and restricting the tax exemption these bonds were made more attractive to small than to large investors. Subscriptions for this Second loan began Oct. 1 and ended Oct. 27 1917. The total amount sought by the Treasury Department was $3,000,000,000, but the Secretary reserved the right to allot additional bonds up to one-half the amount of any over-subscription. Subscribers were permitted to make payment in four instalments, and this plan of allowing deferred payment to be completed in about three months was followed in subsequent campaigns. Many banks and business houses allowed their clients and employees to distribute the payments over still longer periods. The subscription was $4,617,532,300 and the issue $3,808,766,150. The Second loan was issued under the Act of Sept. 24 1917, authorizing total bonds of somewhat more than $7,000,000,000.

The Third Liberty Loan was an issue of 10-year 4¼% bonds dated May 9 1918 and not redeemable until maturity, Sept. 15 1928. The exemptions were the same as in the Second loan, but the privilege of converting these bonds into those of future issues was withheld. The amount offered was $3,000,000,000 and the Secretary reserved the right to accept any over-subscriptions. The loan was offered to the public on April 6 1918, the first anniversary of the declaration of war by the United States, and the campaign closed May 4. These bonds were authorized under the Third Liberty Loan Act of April 4 1918, which made them available for use in the payment of estate and inheritance taxes and authorized the Secretary of the Treasury to purchase each year 5 % of each outstanding issue of Liberty bonds, with the exception of the First. This provision was designed to stabilize the price of Liberty bonds in the market. The amount subscribed and issued was $4,176,516,850.

The Fourth Liberty Loan consisted of 20-year 4¼ % bonds, dated Oct. 24 1918, maturing Oct. 15 1938, but redeemable after the end of 15 years. These bonds were not convertible into future issues and the exemptions from taxation were similar to those provided for the Second and Third loans, although it was provided that $30,000 of these bonds were to be exempt from surtaxes for two years after the end of the war, while an original subscriber holding this amount would also be entitled for the same period to an additional exemption as to any previous issue of 4 % and 4¼ % bonds to the extent of $45,000. Subscriptions to this issue, for which $6,000,000,000 was asked, began Sept. 28 and ended Oct. 19 1918. The Secretary of the Treasury accepted all over-subscriptions. The total subscription was $6,992,927,100, due to later adjustments the amount actually issued was $6,964,524,650. "The success of this largest of all loans," the Secretary said in his annual report for 1918, "was the greatest financial achievement in all history and a wonderful manifestation of the strength and purpose of the American people." The Fourth Liberty Loan Act of July 9 1918 had increased the authorization for Liberty loans from $12,000,000,000 to $20,000,000,000; it also increased the authorization for the purchase of Allied Government securities from $5,500,000,000 to $7,000,000,000.

The Victory Liberty Loan was an issue of 3- and 4-year interchangeable 3¾ % and 4¾ % notes dated May 20 1919 and maturing May 20 1923, but redeemable June 15 and Dec. 15 1922. The 3¾ % notes were exempt from all except estate and inheritance taxes; the 4¾ % notes from all except inheritance taxes, surtaxes and excess-profits taxes. The amount of the issue was $4,500,000,000 and the Secretary of the Treasury, Carter Glass, who had succeeded Mr. McAdoo, announced that over-subscriptions would not be accepted. Subscriptions began April 21 and ended May 10 1919. The amount offered was $4,498,312,650 and the subscription $5,249,908,300.

The Victory Liberty Loan Act (March 3 1919) under which the loan was floated, provided certain additional tax exemptions for holders of various issues of Liberty loans. It was calculated that the total possible exemption under these and earlier provisions was $160,000 in Liberty bonds and notes, not including the first 3½ % bonds and the 3¾ % Victory notes which were always exempt.

The following tables show with respect to the five U.S. war loans the quotas, subscriptions and allotments for the twelve Federal Reserve Districts of which the cities named are the Reserve banking centres. For the Third loan certain additional data are given.

First Liberty Loan (1917)

District	Quota	Subscription	Allotment
Boston	$240,000,000	$ 332,447,600	$265,017,900
New York	600,000,000	1,186,788,400	593,987,000
Philadelphia	140,000,000	232,309,250	164,759,750
Cleveland	180,000,000	286,148,700	201,976,850
Richmond	80,000,000	109,737,100	88,593,650
Atlanta	60,000,000	57,878,550	46,283,150
Chicago	260,000,000	357,195,950	272,702,100
St. Louis	80,000,000	86,134,700	65,029,450
Minneapolis	80,000,000	70,255,500	53,759,250
Kansas City	100,000,000	91,758,850	62,182,900
Dallas	40,000,000	48,948,350	36,663,550
San Francisco	140,000,000	175,623,900	149,044,450
Total	$2,000,000,000	$3,035,226,850	$2,000,000,000

More than 4,000,000 persons subscribed to this loan, and 99 % of the subscriptions were from $50 to $10,000. There were 21 subscribers for $5,000,000 and over, aggregating $188,789,900.

Second Liberty Loan (1917)

District	Quota	Subscription	Allotment
Boston	$300,000,000	$ 476,950,050	$ 407,713,700
New York	900,000,000	1,550,453,450	1,151,184,900
Philadelphia	250,000,000	380,350,250	295,127,000
Cleveland	300,000,000	486,106,800	409,787,200
Richmond	120,000,000	201,212,500	182,581,700
Atlanta	80,000,000	90,695,750	82,943,050
Chicago	420,000,000	585,853,350	525,955,600
St. Louis	120,000,000	184,280,750	150,122,200
Minneapolis	105,000,000	140,932,650	131,972,450
Kansas City	120,000,000	150,125,750	136,549,500
Dallas	75,000,000	77,899,850	74,567,100
San Francisco	210,000,000	292,671,150	260,261,750
Total	$3,000,000,000	$4,617,532,300	$3,808,766,150

There were approximately 9,306,000 subscriptions to the Second loan; of this number 99 % were for amounts ranging from $50 to $50,000 and aggregating $2,488,469,350.

Third Liberty Loan (1918)

District	Quota	Subscription and Allotment	% of Quota	No. of Subscribers	% of Pop.
Minneapolis	$105,000,000	$ 180,892,100	172·28	1,221,504	23·6
Kansas City	130,000,000	204,092,800	156·99	1,190,193	16·0
St. Louis	130,000,000	199,835,900	153·72	1,186,377	12·7
Atlanta	90,000,000	137,649,450	152·94	584,196	5·8
Dallas	80,000,000	116,220,650	145·27	719,210	12·7
Philadelphia	250,000,000	361,963,500	144·79	1,670,229	25·2
Richmond	130,000,000	186,259,050	143·27	858,358	9·2
Chicago	425,000,000	608,878,600	143·26	3,479,315	24·7
Boston	250,000,000	354,537,250	141·81	1,512,555	22·7
San Francisco	210,000,000	287,975,000	137·13	1,402,584	21·1
Cleveland	300,000,000	405,051,150	135·02	1,440,681	15·4
New York	900,000,000	1,115,243,650	123·91	3,043,123	23·2
Treasury Department		17,917,750		68,490	
Total	$3,000,000,000	$4,176,516,850	139·21	18,376,815	17·7

It will be noted with respect to this loan that the Treasury Department calculated the relative standing of the districts with regard to the amounts by which they exceeded their quotas. It should be noted, however, that this rank shifted with various loans; for example the Minneapolis district, which here stands first with a percentage of 172·28, subscribed less than its quota in the First loan, while the New York district's subscription was nearly 200 % of its quota in that loan. In the Third loan bonds were allotted to the full extent of the subscriptions.

Fourth Liberty Loan (1918)

District	Quota	Subscription and Allotment
Boston	$ 500,000,000	$ 632,101,250
New York	1,800,000,000	2,044,901,750
Philadelphia	500,000,000	598,763,650
Cleveland	600,000,000	701,909,800
Richmond	280,000,000	352,685,200
Atlanta	192,000,000	217,885,200
Chicago	870,000,000	969,209,000
St. Louis	260,000,000	295,340,250
Minneapolis	210,000,000	242,046,050
Kansas City	260,000,000	295,951,450
Dallas	126,000,000	145,997,950
San Francisco	402,000,000	462,250,000
Other Subscriptions		33,885,550
Total	$6,000,000,000	$6,992,927,100

As in the case of the Third loan, bonds were allotted to the full amount of the subscriptions. The number of subscribers to this loan was 22,777,680.

Victory (Fifth) Liberty Loan (1919)

District	Quota	Subscription	Allotment
Boston	$ 375,000,000	$ 425,159,950	$ 371,910,150
New York	1,350,000,000	1,762,684,900	1,318,041,150
Philadelphia	375,000,000	422,756,100	376,290,150
Cleveland	450,000,000	496,750,650	443,802,250
Richmond	210,000,000	225,146,850	201,889,300
Atlanta	144,000,000	143,062,050	133,080,800
Chicago	652,500,000	772,046,550	694,330,000
St. Louis	195,000,000	210,431,950	201,787,600
Minneapolis	157,500,000	176,114,850	170,076,650
Kansas City	195,000,000	197,989,100	192,429,300
Dallas	94,500,000	87,504,250	84,002,500
San Francisco	301,500,000	319,120,800	294,905,050
Other Subscriptions		11,140,308	6,767,800
Total	$4,500,000,000	$5,249,908,300	$4,498,312,650

The total number of subscribers to this loan was 11,803,895.

In addition to the great war loans, the Treasury Department placed on sale beginning in the autumn of 1917 War Savings Certificate Stamps in two denominations, 25 cents (thrift stamps), and $5 (war savings stamps). The latter were sold at rates beginning at $4.12 each, increasing one cent monthly to $4.23 and matured in 5 years, at the end of which time the Government agreed to redeem them at $5 each, this being equivalent to 4 % interest compounded quarterly. The war savings stamps were designed to be attached to a folder called War Savings Certificate, which had spaces for 20 stamps (*see* SAVINGS MOVEMENT). Treasury Savings Certificates, in denominations of $100 and $1,000, were also issued, which increased monthly in value at the same rate as the stamps. Up to June 1919 the net cash receipts from War Savings Certificates amounted to about $950,000,000. At that time the total indebtedness of the United States was approximately $26,597,000,000, or $249.38 *per capita*, the annual debt charges being about $8.38 *per capita*. It was estimated that at the close of the war at least 20,000,000 persons, and probably as many as 25,000,000, were holders of Liberty bonds. Although complete data were not available it seemed probable that the war loans of the United States were much more widely distributed among the population than those of any other country. By an Act of March 3 1919 Congress established a cumulative sinking fund amounting to 2½% annually of the aggregate total of the loans outstanding July 1 1920, less the amount which had been invested in foreign Government securities.

For a study of the U.S. Government's financing of the war, see Jacob H. Hollander, *War Borrowing* (1919). (M. V.*)

LICHNOWSKY, PRINCE KARL MAX VON (1860–), German diplomatist, was born March 8 1860 at Kreuzenort in Upper Silesia. He entered the German Foreign Office in 1884 and from 1904 to 1911 held secretarial posts in different German embassies abroad. In 1912 he was sent to London as ambassador, and remained at that post until the outbreak of the World War. He took part in the negotiations for a convention with Great Britain regarding the Bagdad railway and various colonial questions, which was on the point of being signed when the crisis of July and August 1914 became acute. Lichnowsky was convinced that for years the relations between Germany and Great Britain had been mismanaged and misunderstood by the Foreign Office in Berlin, and, in particular, he believed that Bethmann Hollweg and his advisers failed to appreciate the pacific attitude and intentions of Sir Edward Grey and the British Government during the crisis that ended in the World War. He embodied his views in the pamphlet entitled *Meine Londoner Mission*, which he circulated privately in manuscript among his German friends. This document came into the hands of a harebrained enthusiast, Capt. von Beerfelde, who was the means of its being published, without authorization, in 1917. The publication exercised a very prejudicial effect upon the German war spirit and there were loud demands among the Conservative and National Liberals for the prosecution of the author. The Prussian Upper House, of which Lichnowsky was a member, passed a resolution excluding him from that assembly. It became impossible for him to live in Germany, and he sought refuge in Switzerland.

LIEBKNECHT, KARL (1871–1919), German Socialist and revolutionary leader, was the son of Wilhelm Liebknecht (*see* 16.592). He was born in Aug. 1871 at Leipzig. In 1899 he qualified as a lawyer, and speedily became a prominent agitator on the extreme Left wing of the Socialist party. In 1907 he was sentenced to 18 months' imprisonment for high treason. In the following year he was elected a member of the Prussian Chamber of Deputies; in 1912 he also became a member of the Reichstag, and on the outbreak of the World War he distinguished himself by the violent opposition which he offered to the policy of the Government and the successive votes of credit. Liebknecht was then expelled from the Social Democratic party and founded a faction of his own, which he called "die Sozialdemokratische Arbeitsgemeinschaft." In 1916 he was once more arrested on a charge of high treason brought against him by the military authorities and was sentenced to four years' penal servitude. On the eve of the revolution in Oct. 1918 he was reprieved, and, on his release, at once put himself at the head of the Spartacists, the extreme revolutionary section in sympathy with Russian Bolshevism. He was once more arrested during the Spartacist insurrection in Jan. 1919, for which he was largely responsible. While he was being conveyed in a motor-car from the Government military headquarters in the west end of Berlin to the prison at Moabit he was shot down by his military escort while, as was subsequently alleged, he was attempting escape. His death, as well as that of his associate, Rosa Luxemburg, who perished on the same night at the hands of the soldiers or the mob, was constantly made a subject of reproach to the Government Socialists by the extreme Communist party.

LIÉGE (*see* 16.593).—The pop. of the city (not including the suburbs) had risen from 168,532 in 1904 to 172,643 in 1913 but, according to a census estimate on Dec. 31 1920, had then fallen slightly below 165,000. During the World War factories and works were sacked by the Germans and the machinery either broken up or removed, but on the declaration of peace the work of restoration was undertaken with remarkable vigour. Apart from the main iron and steel works and the manufacture of arms, industrial development has been towards the production of zinc and automobiles, thousands of hands being employed in the latter industry. Previous to the war a School of Mines, Arts and Manufactures had been established and an institute for research in electricity, the gift of Montefiore-Lévy, had been founded.

Liége was the first serious obstacle to the German invasion when they violated Belgian neutrality in 1914. Gen. Leman, the military governor, commanded the defence force. On Aug. 16 the last fort capitulated and the passage of the Meuse was forced, but only after a serious delay of eight days to the Germans and after heavy losses. The forts were repaired by Krupp in 1914–5. On the night of Aug. 20 1914, under the pretext of Gen. Kolewe, "Kommandantur," that his troops had been fired upon by Russian students, a massacre took place in the streets and 18 persons lost their lives. Many houses in the Rue des Pitteurs, the Place de l'Université, and Quai des Pêcheurs were systematically fired by the German soldiery, and order was not restored for several days. Under the occupation, the industrial workers gave proof of their independence of spirit by refusing to take part in the manufacture of weapons for use on the western front, and resisted to the utmost the deportation which took place during 1915–6. At the close of war, the Place de l'Université was re-named Place du Vingt Août to recall the scenes of Aug. 20 1914, and the Place Verte became the Place du Maréchal Foch.

See Kurth, *La Cité de Liége* (3 vols., 1909–10).

THE SIEGE OF 1914

The importance of the fortress at the opening of the World War lay in its control of the routes from the region of Aachen to that of Maubeuge, and until these routes were in German control the assembly of the masses of the German I. and II. Army in the Belgian plain was impossible. The first phase of operations was therefore an attempt to seize Liége and these routes by an immediate *coup de main*, delivered by troops which were brought from their normal stations at peace strength without waiting for reservists to rejoin.

The fortress was a ring-fortress of about 9 miles average diameter, lying astride the Meuse and its tributaries, the Ourthe and the Vesdre. All these rivers were in deep-cut narrow valleys, which on the right bank of the Meuse lie some 350–400 ft. below the plateau level. On the left bank the country in the vicinity of the forts was more undulating than scarped, but on the side opposed to Germany the works occupied commanding eminences, but imperfectly controlled the defiles of the rivers, which, however, were in themselves highly defensible by the ordinary methods of field warfare. From the Meuse above Liége, over the Ourthe to the Vesdre valley, the country—forming the edge of the Ardennes—is heavily wooded. The northernmost forts of the ring could just reach the Dutch frontier line with their artillery. The Prussian frontier to the E. was little beyond the range of Fort Evegnée. Liége was, therefore, both an effective obstacle to manœuvre and a tempting target for surprise attack; and these contrasted characters made it difficult for the Belgian military authorities to decide in advance whether it should be considered as a stronghold to be equipped as a self-sufficing entrenched camp or only as a barrier position. In the event, it was treated as the latter.

The defences consisted of a ring of large and small self-contained forts of the well-known Brialmont type, that is, commanding concrete masses with all guns under armour, each fort being disguised to participate both in the distant and in the close defence without differentiation of the guns. In the intervals, therefore, there was no peace-time provision for the long-range batteries, and the forts themselves possessed no element corresponding to the *traditore* batteries and Bourges casemates characteristic of the "infantry" type of fort. Thus, the power of counter-battering the enemy's siege artillery depended wholly on the strength of the armour and concrete protecting the distant-defence guns while the power of guarding the intervals, and firing into the rear of any opponent who had penetrated them, was conditional on the freedom of action of certain guns which, however, were as fully exposed to neutralizing and demolition fire as the rest. The passive strength of the fort, and practically that alone, was supposed to guarantee that the guns it protected would be available for fire in any direction on all necessary occasions, and it was therefore a fact of great importance that this strength was calculated as against attack by 21-cm. howitzers only. In Brialmont's time, and indeed at the time of the construction of the latest forts, this calibre was regarded as the heaviest available for mobile siege trains. But in 1914 this was no longer the case. Though the Germans succeeded in keeping secret the existence of their very heaviest siege guns, it was well understood that calibres above 21 cm. could figure in any modern siege, and it was known that Austria-Hungary possessed road-mobile howitzers of 30·5 cm.

Beginning from the N.E. and proceeding clockwise—*i.e.* by S. to W.—the names and positions of the forts were as follows. From the right bank of the Meuse below Liége, to the Vesdre: Fort Barchon near the Maestricht road, Fort Evegnée, Fort Fléron on the Aachen road, Fort Chaudfontaine overlooking the Vesdre valley; between the Vesdre and the Ourthe: Fort Embourg; between the Ourthe and the upper Meuse: Fort Boncelles. On the left bank of the Meuse in a semicircle from W. to N.E.: Forts Flémalle, Hollogne, Loncin, Lantin, Liers, Pontisse, the last-named crossing its fire with Barchon. The garrison commanded by Lt.-Gen. Leman consisted (originally) of the III. Army Div. reinforced by one brigade, 12 fortress battalions, 4 fortress artillery battalions, one engineer battalion, and the local *Juide Civique* equivalent in strength to rather less than a battalion. The bridge of Visé and Argenteau, N. of the fortress, was held by a detachment of the 3rd Div. The Germans brought up, for the storming attack, 6½ brigades and 5 Jäger battalions at peace strength. At this stage, the siege artillery was still in process of mobilization and it was hoped to master the fortress without it. The commander of the siege troops, designated as the "Army of the Meuse," was Lt.-Gen. v. Emmich. An important part of his task was to enable the cavalry divisions of Gen. v. der Marwitz to traverse the Meuse between Liége and the Dutch frontier, at or near Visé. The flooding of the Belgian plain, and the reconnaissance of the Belgian field army disposition by this cavalry, was in fact almost as essential a preliminary to the deployment of the German I. and II. Armies W. of the Meuse as was the capture of Liége itself. Von Emmich advanced over the frontier on Aug. 4 with the 34th reinforced Bde. and the 4th Cav. Div. on Visé; the 27th Bde. formed Fort Barchon, the 14th Bde. formed the interval Evegnée–Fléron, the 11th Bde. between Fort Fléron and the Vesdre, the 38th and 43rd Bdes. between the Vesdre and the upper Meuse (chiefly on the Ourthe), with the 9th Cav. Div. on the left rear screening the enterprise against possible interference from French cavalry in the Ardennes. Two mobile 21-cm. mortar batteries prepared to act against Barchon and Evegnée as required; and such light artillery as was available was, in the main, told off to keep the forts under neutralizing shrapnel fire. All artillery was put under cover, and in the sequel the forts were practically unable to find targets. On both sides, it is evident from what followed, nervous tension was high and uneasiness great. The Belgians in evacuating the foreground had blocked roads and blown up bridges, and the German advance, especially that of the transport, was laborious. On the 4th, owing to these obstacles, the 4th Cav. Div. reached the Meuse at Visé only very little in advance of the infantry. Finding the passage held by Belgian infantry, the cavalry forded the Meuse at Lische, just short of the Dutch frontier; the Belgians thereupon fell back on Liége, but destroyed Visé bridge before doing so. The German cavalry with the leading troops of the 27th Bde. thus spent the night of the 4th and 5th astride the Meuse, but as their troop train could not be got forward, the movement came to a standstill on the 5th. Meanwhile the other brigades advanced in their respective sectors, employing the daylight of Aug. 5 in driving back Belgian advanced troops on the various roads. After dark, the six brigades, formed in five columns, set out on the evidently desperate enterprise of storming the intervals. The procedure was practically uniform—the brigade advanced, well closed up, in fours along the road, detaching to right or left a company or two to occupy the attention of the adjacent fort by a false attack. In some columns a battery or more of field guns or field howitzers was inserted, near the head. One regiment of the 27th Bde. (which had 3) was deployed on the Barchon-Evegnée front to demonstrate and to cover the positions of the 21-cm. batteries, which themselves had the rôle of neutralizing rather than battering these forts. Of the five storming columns two were repulsed, two penetrated but then withdrew, and only one reached its objective. In all cases fighting was heavy and confused, and on the German side it was marked by very severe losses in brigade and regimental commanders. Two of the five major-generals and five colonels out of eleven were killed, a proportion perhaps never equalled in the later history of the war. A colour of the 89th Mecklenburg Regiment was captured by the Belgians. Yet by 8 A.M. on the 6th Gen. Leman had ordered the evacuation of the E. bank of the Meuse and of Liége itself, by all troops not forming part of the fort garrisons. To understand this strange result, the fortunes of the different storming columns must be followed in detail, and a brief account of the movements of each is therefore given here.

The most important sectors, from the point of view of the attack and of the defence alike, were the northern (or Fort Pontisse–lower Meuse–Fort Barchon) and the southern (or Ourthe–Fort Boncelles–upper Meuse). To each of these Von Emmich allocated two brigades, while on the eastern sector (Fort Barchon–Fort Chaudfontaine) the intervals Evegnée–Fléron and Fléron–Chaudfontaine were to be attacked by a brigade each. On the N. side, the 34th Bde. and a Jäger battalion, moving W. of the Meuse from the positions above Lische occupied on the 4th and 5th, successfully broke in between Fort Pontisse and Fort Liers, but became entangled in the dark in the villages beyond. Resistance was stiff, the brigade column broke up into four or five units attacking the discernible objectives, and the whole swerved eastward into Herstal and the area behind Fort Pontisse instead of pursuing the Liége direction. One party of Jägers reached Liége and penetrated to Leman's headquarters in broad daylight, partly through being mistaken by the inhabitants for the British troops that, rumour said, were on the way to relieve the city. After a momentary fierce fight the intruders were disarmed. The German, but not the Belgian official, account mentions also the inroad and subsequent surrender of a whole battalion of the 89th Regt. The main body of the 34th Bde. had meantime been counter-attacked in and about Herstal by part of Leman's general reserve, and had retreated in confusion to Lische, where most of the troops withdrew E. of the river. The next column, 27th Bde., moving down the Visé–Liége road, after heavy fighting carried the village of Chératte but was brought to a full stop at the next village, Wandre, and retreated to Argenteau whence it had come. Both the northern attacks were thus complete failures.

On the S. side, the 38th and 43rd Bdes. moved up in one column between Fort Boncelles and the Ourthe, detaching one battalion to demonstrate against Fort Embourg in the angle of Ourthe and Vesdre and half a battalion against Fort Boncelles. The fighting area of these brigades was the most heavily wooded and deeply scarped of the whole field, and the difficulties of the advance were increased by a thunderstorm and torrential rain. Here, too, Leman felt his position most sensitive and employed the bulk of his general reserve, so that, in sum, the Germans after penetrating as far as Oujnée and Sart Tilman, and looking down on the Meuse, withdrew again through the woods to the villages round Esneux, where meantime their baggage and rear parties had been subjected to constant attack by Belgian soldiers and civilians; for Liége, Herstal, and Sering were centres of the arms industry and the use of firearms was familiar to all. On this front and on others, the German and the Belgian accounts alike complain of the fighting troops being fired upon from the rear. A comparison of the available items of evidence leads to the conclusion that not only did civilians participate, but that the shooting of the troops on both sides was, in the confusion of night fighting in streets and woods, frequently a wild and indiscriminate fusillade. The two brigades, after mastering this local opposition, settled down to wait for their reservists to come in from Germany. Thus the southern attack also failed on the E. side. The 11th Bde. attacked between the Vesdre and Fort Fléron, and the 14th Bde. between Ft. Fléron and Ft. Evegnée, while the 3rd Regt. of the 27th Bde. maintained its position of liaison opposite the E. side of Fort Barchon. The 11th Bde. followed the winding route from St. Hadelin by Magnée and Romsée to Beyne-Haussay behind the fort and village of Fléron. But their whole progress from locality to locality had been won by sharp fighting and it came to a standstill in the first houses of Beyne-Haussay. Thus, having no news of the column to the right, this brigade withdrew to Magnée to wait for the situation to clear up and to obtain ammunition for a renewed attack after dark, for, in spite of formal orders to employ the bayonet only, all the German columns seem to have shot away most of the contents of their pouches. Companies of the brigade remained in front of Fort Chaudfontaine and S. of Fort Fléron.

The 14th Bde., between Fléron and Evegnée, alone was successful. It moved off from Herve in the dark, branched off companies to observe Fort Evegnée, and through Micheroux advanced on the hamlet of Sur Fosse. There it was brought to a standstill with the loss of its general, the leading colonel, and many other leaders. Meanwhile, in the darkness and excitement, the rear portion of the column had lost touch with the front and became unsteady. At that moment Maj.-Gen. Ludendorff, who was watching the operations on behalf of II. Army headquarters, took command, and brought the rear troops forward. Finding the brigade commander dead, he assumed control of the column, cleared Liéry and the adjacent ground, pushed on to and captured Quene du Bois (which was attacked and defended by infantry, machine-guns and accompanying artillery), and then, daylight having come, looked around for signs of the neighbouring brigades. Nothing was seen but a column of troops on the river-road N. of Supille (actually, these were Belgians), but Ludendorff determined to push on. About midday on the 6th the column, now only 1,500 strong, seized La Chartreuse, began with its field howitzers a bombardment of the city, and pushed outposts down to the bridges. Gen. v. Emmich joined it in the afternoon.

Meantime Gen. Leman, having expended his general reserves in the struggle on the northern and southern fronts and finding himself unable for that reason to check the advance or to appreciate the strength of the column which had penetrated between Evegnée and Fléron,—believing moreover, that he had four army corps in front of him—decided shortly after 7 A.M. to withdraw all field troops W. of Liége, and to leave the eastern forts to be defended by their respective garrisons only. A little later he obtained permission from the King's headquarters to send the 3rd Div. to rejoin the field army (which was assembled on and in front of the River Jette), leaving the forts alone, garrisoned by some 4,000 men in all, to bar the passage of the Germans. In the main, the order was successfully carried out, though the troops between Ourthe and Vesdre were not notified. Forgotten by both sides, these lived in the woods for a week or more, and then escaped, not without many adventures, to Tirlemont. Gen. Leman himself chose to stay with his forts, and established his headquarters at Loncin.

Thus the Ludendorff column met with no opposition when on the 6th, after an anxious night at La Chartreuse, it entered and took possession of the city. In the course of the 6th and 7th it was joined there by the 11th and 27th Bdes. But behind it the fort garrisons were active, and, so far as normal communications were concerned, Emmich's 3½ brigades were isolated in the midst of the forts, while the other 3, outside, were engaged in receiving and incorporating their reservists. Meantime more and more troops of the II. Army were coming up, and General v. Einem was placed in immediate charge of the forces outside and in general charge of the whole. The confused situation was not cleared up even when Ludendorff returned from Liége, for next day he was unable to get in again, and the impression prevailed at Bülow's headquarters that Emmich and the forces inside had been destroyed by a counter-attack.

By the 10th, however, the situation was cleared up, and the plan of the Germans was now to emplace the super-heavy siege artillery which was becoming available so as to demolish the forts in succession, beginning with the northern forts on either side of the Meuse (Fléron, Evegnée, Barchon, Pontisse, Liers) so as to clear the way as rapidly as possible for the crossing of the congested I. Army below Liége. This was carried out systematically after the 12th; but at that date both Barchon and Evegnée had fallen to the 21-cm. mortars alone, owing to their poor concrete and to the fact of being bombarded from the rear. The remainder continued to hold out and, till ruined, to keep up an effective interdiction fire on all important cross roads, defiles, etc., although they were unable to locate the bombarding artillery. After the 12th, the German super-heavy artillery (30·5-cm. and 42-cm. howitzers) came into play. The tactics of the attack were, in general, to push infantry as close as possible to the work attacked, in readiness to seize it when "ripe for assault," to bombard steadily with 30·5- and 42-cm. and with medium long range guns till the concrete was ruined and the cupolas jammed, and to attack the gorges by means of heavy truck mortars, which here made their first appearance. To these methods there was no effective possibility of resistance. Pontisse fell on the 13th, Fléron and Liers on the 14th; Chaudfontaine and Embourg on the 13th fell to intensive bombardment by 21-cm.; Boncelles and Lantin on the 15th. On the 15th also Loncin blew up, a 42-cm. shell having penetrated to the magazine; amongst the few survivors was Gen. Leman, picked up wounded and unconscious by the Germans. The last forts, Flémalle and Hollogne, surrendered on the 16th.

The effect of the resistance of Liége on the development of the German offensive plan has been a subject of much controversy, some going so far as to deny that it had any influence thereon. Consideration of all the circumstances of time, position and intention, however, lead to the conclusion that the German failure to seize the passage on the 6th, and the subsequent resistance of the forts till Aug. 15–16, put back the deployment of the I. and II. Armies in the Belgian plain four days. This means that the grand offensive movement which began on the 18th would, but for the resistance of Liége, have begun on the 14th. Whether that resistance would have been possible had the Germans brought up their super-heavy artillery immediately after the advanced brigades, on the 6th and 7th, instead of on 10th and 11th, is another question. On this their procedure at Namur, where the artillery was installed at the very opening of the attack, is a significant commentary. The delay, whatever its causes, was of incalculable importance. (C. F. A.)

LIGGETT, HUNTER (1857–), American soldier, was born at Reading, Pa., March 21 1857. He graduated from the U.S. Military Academy in 1879, was commissioned second lieutenant, and saw service in the west against the Indians. He was appointed first lieutenant in 1881 and captain 1897. On the outbreak of the Spanish-American War in 1898 he served on the staff of the adjutant-general and later was in Cuba as major of volunteers. After honourable discharge in 1899 he again entered volunteer service and was in the Philippines for two years as major. In 1902 he was appointed a major in the regular army and spent several years with the Department of the Lakes and at Ft. Leavenworth. In 1909 he was sent to study in the War College, being promoted lieutenant-colonel the same year. On graduating from the War College in 1910 he was appointed a director there and in 1913 president, in 1912 being promoted colonel and in 1913 brigadier-general. In 1914 he was on the Mexican border and from 1915 to 1917 was again in the Philippines, being for one year commander of the Department of the Philippines. In 1917 he was made major-general and commander of the Western Department but in Sept. went to France as commander of the 41st division of the A.E.F. The following year he commanded the 1st army corps and later the I. Army. He was at the second battle of the Marne, at St. Mihiel, and in the Argonne. In 1919 he was made commander of the Western Division and in 1920 commander of the IX. Corps, retiring March 21 1921.

LIGHTING, ELECTRIC (*see* 16.659).—Notable progress in illuminants was made during the period 1911–21. Advances in the art of applying artificial light to the best advantage have been even more remarkable, and as these apply to all illuminants they are dealt with in a separate article (*see* ILLUMINATING ENGINEERING).

Progress in Lamps.—Some idea of the position in regard to electric lamps at the end of 1910 may be gathered from two papers read by E. W. Marchant (*Recent Progress in Electric Lighting*, Illum. Eng. Soc., London Dec. 9 1910) and Haydn T. Harrison (*Street Lighting by Modern Electric Lamps*, Inst. of Elec. Engrs. Nov. 24 1910).

Metal filament lamps were in general use, and their advantages, in comparison with arc lamps, were already the subject of discussion; tabular data of cost are given in Maurice Solomon's work on *Electric Lamps*. The use of arc lamps with flame carbons was extending, but ordinary carbons were still widely used. Efforts were made to extend the period of burning of flame arcs before recarboning became necessary. In the magazine flame arcs carbons are automatically replaced from a stock in the lamp as they burn away. In this way a period of burning of 80–100 hours has been secured. In the Jandus Regenerative arc lamp the flame carbons were enclosed in an air-tight chamber, with a special circulatory system to prevent deposition of fumes on the globe. Approximately five c.p. (mean hemispherical) per watt and 70 hours burning with one pair of carbons were stated to be obtained. The enclosed Carbone arc was designed with a similar object, a special shape of globe being used to prevent inconvenient deposition of fumes. Quite recently a form of enclosed flame arc has been developed in Germany, the burning period being 80–120 hours, and the efficiency, on direct current 4–6 c.p. per watt (*Lichttechnik*, by L. Bloch). Inclined carbons are commonly used in flame arc lamps, but in the Crompton-Blondel arc vertical carbons, one above the other, were adopted. Marchant (*loc. cit.*) gives values ranging from 3·72 to 6·85 c.p. per watt for various flame arcs —efficiencies well above those yet attained with incandescent lamps.

Various circumstances have tended to limit the field for arc lamps. During the World War carbons were almost unobtainable, and their cost has risen considerably. Moreover, gas-filled incandescent lamps tend to displace arc lamps for many purposes. At the present time (1921) lamps using ordinary carbons are becoming obsolete, but flame arcs still hold their own for lighting large areas. Most flame arcs furnish light of a pronounced yellow colour, owing to the influence of calcium salts in their electrodes. Flame carbons yielding white light have, however, been used for photographic and cinema work. The arc lamp using a magnetite negative electrode, with a life of 150–175 hours, is still used in America but little known in England.

A step of great scientific interest has been the introduction, during the war, of searchlights using carbons cooled either by a spray of alcohol (Beck-Goerz system) or a blast of air (Sperry searchlight). (See Harrison, *Illum. Eng.* March 1918; also *Illum. Eng.* Feb. 1915; also McDowell, *Trans. Illum. Eng. Soc.*, U.S.A., Sept. 1916; also *Electrician* Feb. 2 1917). This leads to a smaller crater of increased intrinsic brightness, estimated at 200,000–300,000 candles per sq. in. as compared with 85,000 for the ordinary arc-crater. Thus, a much more powerful beam, which is stated to approach 500 million candles (max.) may be attained, and a diminished angle of dispersion. Intrinsic brilliancies of 600,000 c.p. per sq. in. are said to have been obtained in Germany (*Lichttechnik* by L. Bloch), while Lummer, with an arc operating in a pressure of 22 atmospheres and at a temperature of 7,600° Abs., attained 1,500,000 candles per sq. in.

No very striking advances in illuminants using the luminescence of metallic vapours are recorded. The tubular mercury vapour lamp has been improved by the use of devices enabling the lamp to start automatically without tilting by hand. Attempts have been made to supply the missing red rays by mounting over the tube a fluorescing rhodamine reflector, but the effect is comparatively slight.

Wolfke, in Germany, obtained an approximately white light by using an amalgam of cadmium and mercury (*Elektrot. Zeitschr.* 1912, p. 917), but the lamp does not appear to have reached a commercial stage. In the other familiar form of mercury vapour lamp with a quartz or silica glass tube, operated at a high temperature, the red and orange rays are not entirely missing. The chief feature of this lamp, apart from the higher luminous efficiency (estimated at about five c.p. per watt) is the high proportion of ultra-violet rays emitted. For ordinary lighting purposes these rays are masked by an outer globe of dense glass. Forms of lamps enabling the ultra-violet light to be applied in a concentrated form for therapeutic purposes are also available.

The Moore tube lamp, utilizing the luminescence arising from a high tension (5,000–17,000 V.) discharge through rarified nitrogen gas, is little known in England. The length of tube is usually considerable, but a small and compact form using carbon dioxide gas, the light of which is stated to resemble daylight closely in colour is used in industries involving accurate colour-matching.

The use of the rare gas neon in such luminescent tubes, announced by Claudes in 1911 (*Comptes Rendus*, May 22 1911) and since developed to a commercial stage, has had interesting results. Owing to the higher brightness and greater efficiency of luminescent neon (approx. two candles per watt) tubes of moderate dimensions and varied shape can be constructed. Such lamps can now be operated direct on 220 volts, but a special starting device, applying an inductive discharge, is necessary. The vivid orange colour of the light is favourable to its use for spectacular lighting. Quite recently small neon lamps, resembling an ordinary glow lamp in appearance and capable of being inserted in an ordinary lamp holder, were exhibited before the Illuminating Engineering Society (see *Illum. Engineer* Jan. 1921; *ibid* Aug. 1920). The cathode is extended and brought close to the anode, light appearing as a diffused orange glow. Although the efficiency is as yet low (apparently of the order of 0·06 c.p. per watt) such lamps consume only five watts or less on 220 volts. They may therefore prove useful in cases where only a weak light is necessary but a small consumption of electricity desirable. Further improvements may be anticipated.

Incandescent lamps using tungsten filaments in vacuo have now displaced the Nernst, tantalum and other forms, and the proportion of carbon filament lamps in use is constantly decreasing. The introduction in 1911 of filaments drawn out as wire from ductile tungsten has had important consequences. Filaments made by other processes (*e.g.* squirted or pasted) are now little used. The ductile tungsten wire now prepared can be more easily mounted in the bulb, can be readily wound in any desired shape, and is better able to resist shock and vibration. Ten-watt lamps are now available on 100–105 volts and 20-watt lamps on 200–210 volts, thus rendering such special devices as running lamps in series and the reduction of supply voltage by transformers largely unnecessary. Useful life and efficiency have also improved. Candle-power should not diminish by more than 20% in 1,000 hours' burning, the luminous efficiency being about 0·75–0·9 candles per watt, according to type. Filaments can be arranged in a bunched compact form suitable for automobile lamps, pocket torches, etc., and special "traction" forms, designed to withstand vibration, have been developed.

Another step of importance has been the development of the gas-filled or so-called "half-watt" lamp, announced in 1913 (see Langmuir and Orange, *Trans. Am. Inst. of Elec. Engrs. 1913; Gen. Elec. Rev.*, U.S.A. Oct., Dec. 1913; Pirani and Meyer, *Elektrot. Zeitschr.* 1915). The filament consists of a compact tungsten spiral brought to incandescence in an atmosphere of inert gas (usually nitrogen but in the smaller forms argon). The tendency of the tungsten to volatilize is checked by the pressure exerted by this envelope of gas. Filaments can accordingly be run at a higher temperature, with correspondingly improved efficiency. Recent specifications indicate that lamps should operate at 1–1·6 candles per watt with a useful life of 1,000 hours. Still higher efficiencies may be expected from high candle-power low voltage units. A feature of the lamp is the formation of convection currents within the bulb which has a long neck in which particles of tungsten tend to deposit, thus largely obviating blackening of the bulb proper. In England the smallest units available on ordinary lighting pressures are 40 watts on 100–130 volts, and 60 watts on 200–260 volts. The largest lamps ordinarily listed consume 1,500 watts. Thus we have for the first time incandescent lamps of a candle-power comparable with that of arc lamps. For special purposes even larger units have been developed. Special lighthouse lamps consuming 2,400 watts have been used in Holland, and 4,000-watt types are stated to be in course of preparation. Filaments of gas-filled lamps may assume a wide variety of shapes. In the United States special forms have been developed for use in cinema lanterns.

The "arc-incandescent" ("Pointolite") lamp, developed in the Ediswan laboratory during the war, has interesting features (*Illum. Eng.* Jan. 1916; Jan. 1920). The source of light is a globule of tungsten brought to incandescence as the anode of an arc within a sealed glass bulb. The cathode is a rod composed of tungsten and certain rare earths, which is heated by the passage of a current, ionizes the space between the electrodes and starts the arc. As an approximate "point-source," with a brightness near 13,000 candles per sq. in., the lamp is adapted for use with optical lanterns, etc. Lamps giving up to 1,000 c.p. have been developed, and it is hoped that a 4,000-c.p. type now being prepared will prove valuable for cinema lanterns in view of the steady light and the fact that no manipulation is needed once the lamp is switched on.

A feature of the past few years has been the rapid development in lamp manufacture in the United States. In 1920 the production was estimated to reach 230 million lamps, of which only 7% were of the carbon filament type (*Gen. Elec. Review*, U.S.A., Jan. 1921). Considerable progress in the manufacture of miniature lamps for automobiles, flashlights, miners' lamps, etc., is recorded, an output of 125 million being attained in 1920. Progress in lamp manufacture has been aided by success in standardizing supply voltages, nearly 79% of the lamps sold in 1920 being for the standard pressures of 110, 115 and 120 volts. In Japan a uniform pressure of 100 volts throughout the country has been established.

Physical Data Underlying the Efficiency of Light Production.—Researches in the physics of light production have yielded interesting conclusions, revealing the comparative inefficiency of most artificial illuminants. Thus it is estimated that the ordinary tungsten filament radiates as visible light not more than 5% of the energy imparted to it. Increasing temperature shifts the maximum of radiation nearer the visible region of the spectrum and is thus favourable to high luminous efficiency. It has been computed that a source operating at solar temperature might attain a luminous efficiency of 50%. P. G. Nutting (*Bull. Bureau of Standards*, May 1911) estimated that a source which produced only visible white light should yield 26 candles per watt, whereas the most efficient illuminants available do not give more than about five candles per watt. Nutting also calculated that a source producing only light of the most efficient wave-length for creating brightness, namely 0·54, would yield 65 candles per watt.

Our ideal should be to control emission of radiation so as to produce only light of the particular colour desired. This has a bearing on attempts made to imitate the colour of daylight. By the introduction of a suitable tinted glass in the path of light from a gas-filled lamp, or by reflecting the light from a matt surface having a suitable coloured pattern, a close resemblance to normal daylight may be obtained (*Illum. Eng.* Feb. 1920). Such "artificial daylight" units are of great value in industries where accurate colour matching is needed. But present processes involve the sacrifice of much light by absorption, and the overall efficiency of accurate units probably does not exceed about 15–20% of the light yielded by the lamp.

Progress in Shades, Reflectors and Lighting Appliances.—Advances in the efficiency of illuminants have been accompanied by considerable progress in methods of distributing light. Reflectors are now designed to screen the source from the eyes of persons using them, soften shadows and modify the natural distribution of light in any desired manner. Spacing rules for standard reflectors of "Extensive," "Intensive" and "Focussing" types are furnished and adherence to these should ensure the provision of uniform illumination of a specified value in foot-candles. Prismatic glass devices, for use with arc lamps and gas-filled lamps, have been designed to give a distribution of light favourable to uniform illumination between street lamps. An example is the Holophane street lighting lantern, which utilizes two prismatic glass surfaces, superimposed one on the other, with a smooth exterior and interior such that the lantern can be easily cleaned. Improved and simplified illumination photometers have enabled much information to be obtained regarding the illumination necessary for various purposes. It is now considered preferable to state the illumination in foot-candles at the actual place where light is needed rather than to prescribe so many lamps of a specified consumption per square feet. This illumination can be related to the consumption of electricity per sq. ft. of area lighted. Thus with direct lighting by vacuum tungsten lamps in modern reflectors about 0·2–0·3 watts per lumen (*i.e.* per foot-candle per sq. ft.) is usual; with gas-filled lamps about 0·1–0·15. With indirect lighting about twice of the above values are required.

The introduction of the more efficient gas-filled lamps, which require screening on account of the great brilliancy of the filament, has encouraged the use of indirect and semi-indirect methods of lighting. Small gas-filled lamps with opal glass bulbs have also been introduced. Lamps are now commonly mounted high up near the ceiling so as to be out of the direct range of vision and leave a clear space for the supervision of work. The high candle-powers available allow of greater mounting heights than those formerly used. Thus in factories lamps mounted 30 or even 40 ft. above the working plane are not unusual (see *The Gas-filled Lamp and its Effect on Illuminating Engineering* by F. W. Willcox, *Illum. Eng.* June 1919). Certain fine industrial processes, however, require local lighting with well shaded lamps. Reflectors have been developed for lighting large vertical surfaces, notably for picture lighting. A feature in the United States has been the development of "flood-lighting," *i.e.* concealed lighting by compact filament gas-filled lamps in parabolic reflectors giving a concentrated beam of light with a dispersion of 10°–15°. Thus a 500-watt lamp in a suitable mirror will yield a maximum beam-candle-power of 330,000. Such lighting units have been used for spectacular lighting (*e.g.* illuminating historic monuments and buildings, large advertisement-placards, etc.), and during the war served as a measure of protection, to prevent unauthorized persons approaching arsenals or other works unseen.

For further information the following works may be consulted:—*The Development of the Incandescent Lamp*, by G. B. Barham (1912); *Elektrische Lichteffekte*, by W. Biscan (1909); *Lichttechnik*, edited by L. Bloch, issued by the German Illuminating Engineering Society (1921); *Grundzüge der Beleuchtungstechnik* by L. Bloch (1907), translated by W. C. Clinton; *The Application of Arc Lamps to Practical Purposes*, by J. Eck (1910); *Le Nuove Lampade Elettriche ad Incandenza*, by G. Mantica (1908); *Elektrische Beleuchtung*, by B. Monasch (1907); *The Electric Lamp Industry*, by G. A. Percival (1920); *Electric Lamps*, by M. Solomon (1908); *Electric Arc Lamps*, by O. Zeidler and J. Lustgarten (1908).

Frequent articles on electric lighting appear in *The Illuminating Engineer* (London); *The Transactions of the Illuminating Eng. Society U.S.A.* (New York); and *Licht und Lampe* (Berlin). *See* also ILLUMINATING ENGINEERING. (J. S. D.)

LIGHT RAILWAYS, MILITARY.—To transportation engineers, both civil and military, one of the most interesting features of railway work during the World War was the development of the network of 60-cm. lines ("soixante") in rear of all the main fronts in France during the days of position warfare. These little narrow-gauge lines were, of course, no novelty, since similar lines had been employed in industrial plants, on large plantations and on large construction works. Lt.-Col. W. H. Cole, in *Light Railways at Home and Abroad* (1899), describes a 60-cm. line built under a concession granted in 1890 to the Decauville Co. between Caen and Dives. Another 60-cm. line of lighter rail (19·1 lb. to the yd., the same as the French military track) was built about the same time between Pithiviers and Toury, France. It was worked under lease by the Decauville Company. Nor was the idea new to the student of military affairs, as at the French siege manœuvres before Paris in 1894 some 30 m. of such line were laid under simulated field conditions upon which complete trains were drawn by double-ended engines. German military tests in 1895 had shown that it was practicable to lay 60-cm. (or 2-ft.) tracks, with rails weighing 10 to 19 lb. to the yd., at a rate of from 600 to 700 yd. per hour for a distance of 31 m. of continuous laying. In the campaign in Manchuria (1904–5) both belligerents had made use of light narrow-gauge lines for distribution purposes. At Port Arthur, for example, despite the fact that the main railway supply line of the Japanese army was itself of 3 ft. 6 in. gauge, equipped with medium-weight engines and light cars of small capacity (6 tons), it was found desirable to lay 60-cm. (2-ft.) track from a transfer station or siege junction to the adjacent artillery and engineer parks and thence to the siege batteries and smaller dumps near the troops. These lines of the Japanese were not suited to the use of locomotives. The sections were merely hooked together as laid. One hook was formed by a bend in an extension of the lower flange of a rail, and this engaged with a companion hook on the end of a fish plate bolted to the web of the rail of the adjoining section. At Port Arthur the sections came to the front already assembled so that no field bolts were necessary. Where transportation on mountain roads was involved, as it was in the main campaign, the rails and ties came up separately and were assembled shortly before use. At Port Arthur the light flat cars were pushed about by soldiers, at the Sha-ho by horses.

No discussion of these special railways would be complete without some reference to the "battle of the gauges," which raged around them during and subsequent to the World War (1914–8). Many officers with railway and military experience contend that the gauge of field railways should invariably correspond to that of the main supply railway—special light locomotives, and, if necessary, light cars being used on rapidly laid, light rail lines. Others believe that where the main line is of 4 ft. $8\frac{1}{2}$ in. gauge a lesser gauge is desirable for distribution within the combat area, but think that 60-cm. is too narrow; some have suggested 30-in., others 36-in., and so on increasing to standard, most of them agreeing, however, that when the main line is narrow, 3 ft. 6 in. or less, no lesser gauge is necessary. Others contend for the 60-cm., and these include many who have had long experience with these diminutive systems.

It is of value to examine into the purpose for which this character of equipment was intended at the outbreak of the World War. Gen. von Bernhardi, writing in 1912, had already indicated the use the Germans intended to make of them in the following words:—

"Where, during the further advance of the army, the railways are commanded by hostile fortresses or '*forts d'arrêt*,' the capture

> of which will probably take some time, field railways turning them must be constructed. Where the railway network is altogether insufficient to satisfy the wants of the army, or where too many difficulties are encountered in repairing the trunk lines, field railways must be laid along lines of advance from railheads. There is no occasion in these cases for being too pedantic in constructing such lines. They are not built to last for ever, and must sometimes be rapidly taken up again. At times horse power must suffice for them until time and circumstances permit the line to be constructed for steam power. Rapidity of construction is the first object. If the line to be constructed is long, we must try to begin building it at various points simultaneously. We must try to follow each corps, if possible, with one field railway line, provided material and personnel are available to build it, which of course is not the case to an unlimited extent."

Gen. von Kluck, in his book *The March on Paris*, says:—

> "To assist the work of supply, a light railway system up to the several corps was successfully opened for traffic on Aug. 22 (1914); that for the II. Corps to Ninove and Vollezeel; for the IV. Corps at first to Castre, later to Enghien; and for the III. Corps to Hal."

These two quotations are sufficient to establish the fact that the Germans had adopted these lines as an essential part of the open warfare equipment of an army marching to attack, and not as an expedient for trench warfare. Experience at Metz, at Toul, and at the tunnel of Nauteuil in 1870, had impressed the minds of the German general staff with the need of some means for supplying the several corps of an army attacking an enemy army just beyond or pivoting on an obstacle on the main railway line. Doubtless they had, with their usual attention to detail, selected the 19-lb. rail, 60-cm. Decauville track, as the lightest which could accommodate the locomotives and cars necessary to forward a daily corps supply of ammunition and food for a serious engagement (about 600 tons for the German corps of 1914).

This character of service was rendered by the 60-cm. lines in the open warfare attacks by the American army in 1918. Rapidly extended for each corps, they served to free the roads and standard-gauge railway terminals from congestion by animal and motor transport, and thus gave a freedom of manœuvre for the troops engaged in breaking the hold, which the enemy insisted on maintaining, on the valleys where standard-gauge lines existed or where they could be built. For example on the American front in the attack N. from Verdun–Ste. Menehould railway, two standard-gauge lines were contemplated for the supply of the army. One of these followed the Meuse river valley to Stenay and Sedan. The enemy clung desperately to this line, and it was not until the III. Corps supplied by "soixante" forced a crossing of the river at Dun-sur-Meuse that the valley was freed and the reconstruction of the standard-gauge line could proceed. The "soixante" had given the power of manœuvre required. The second was the Aubreville–Grandpré–Mouzon line. For the attack on Verdun, the Germans had constructed a standard-gauge railway line from Mouzon to Grandpré, where it connected with a French standard-gauge railway leading to Ste. Menehould. The American plan was to build a line from Aubreville to Grandpré and thence along the German roadbed to Mouzon. Work was put under way at the beginning of the advance, Sept. 26 1918, the line being constructed as far as, and to include, a terminal at Varennes under standard-gauge railway practice. From Varennes, the "soixante" reached out to the east to supply the V. Corps. and the manœuvres of that corps and of the I. Corps on its left, supplied from Varennes and also by "soixante" from Les Islettes, freed Grandpré and opened the Aire valley for the advance of the standard-gauge railway, which from Varennes northward was constructed in accordance with light railway practice, no ballast being used, the track being supported by ties almost in juxtaposition, alternate ties extending outside of track to permit tamping and to spread the foundation. In advance of the standard-gauge track, and on the same roadbed, a "soixante" line was laid, partly of fabricated track and partly of separate rail construction, on standard ties. While this was pushed ahead of the standard line, primarily for the supply of troops, it served to speed up the construction of the standard railway by handling materials, rails, and ties in advance of standard railhead. Points of transfer from standard gauge to the "soixante" were advanced as terminals permitted and as desired, and when so advanced the "soixante" material in rear of transfer point could be taken up if needed. This was rarely done, as the line to the rear was useful.

Ever since the days of Sevastopol, students of siege warfare had insisted upon a railway for use both by the attack and defence in fortress warfare. An 18-in. gauge had been adopted for these siege railways, and $5\frac{1}{2}$ m. of this track were to be carried as a part of the regular authorized store of a siege train in British practice. This equipment, including wooden sleepers but excluding cars, weighed approximately 62 tons to the m.; 25 trollies on two four-wheel bogies, weighing 54 tons, were also to be taken. The siege train included 16 pieces of artillery. For similar purposes the French had adopted a Decauville pattern track of 40-cm. gauge (16 in.). In the original conception of these hand-operated lines of from 16-in. to 18-in. gauge, the ordinary gauge of the country was to be brought to the field arsenal (siege junction), and the break of gauge between it and the narrow-gauge lines was to be made there, though it was accepted that under certain circumstances lines of wider gauge would be pushed forward to the front, even to the first batteries, independent of the break in gauge at the field arsenal. The *British Siege Artillery Drill Book* in 1898 estimated the distance of the siege arsenal at 7,000 yd. from the fortress, as being out of range of the defence guns, and this distance and the width of front to be covered by a siege unit formed the basis for the estimate upon which the $5\frac{1}{2}$ m. of siege track per unit was arrived at. But increases in range, and particularly in accuracy and effectiveness of fortress guns, caused a new estimate to be made of the distance to the siege arsenal, and led to a realization that not only ammunition but other stores as well would need to be more widely dispersed, not for security alone but also for better service. Such changes increased unduly the length of haul and led to the adoption of a light line suitable for locomotives.

During the World War, after position warfare was entered upon and lines became more and more permanent, the daily wear and tear led to the replacement of light rail by heavier, the improvement of the roadbeds, the increase of ballast, the increase of loads, the connecting up of separate detached lines into systems, the installation of shops and other facilities pertaining to complete systems, and a tendency, as evinced by the action of the Americans, to adopt heavier rolling-stock and more powerful locomotives so as to secure greater tonnage per engine and train mile. Unquestionably at this period, had the design *de novo* of a railway to meet the then existing conditions arisen, most officers would have favoured a wider gauge. But when the advance began once more, the weight of a mile of track, including sleepers, came to be a vital one and the "soixante" reverted to type. Then the heavy engines and heavy cars, still very useful in bringing up materials of construction from the rear, came to be, temporarily at least, out of place on the forward lines.

In their simplest diagrammatic form the "soixante" lines ran perpendicular to the front, from stations along a standard-gauge line which roughly paralleled the front. These perpendicular lines were connected by laterals, the whole forming a series of loops, and trains were operated out on one line and back on another. The loop system permitted a density of traffic exceeding that of double track lines, and offered an alternate route if the track was broken at any point. Most of the grading was done by hand, and every effort was made to reduce earth work by following the contour of the ground even when rather sharp curves resulted. Surface location was also advantageous because it permitted a shifting of the track in repair of a break made by shell-fire. Embankments were especially to be avoided, as hand-made fills in a rainy climate meant soft track and washouts.

A most difficult problem in track construction was met with in crossing badly shell-torn ground. Old craters were half-filled with water. To level off and proceed with track-laying meant certain trouble later. Here wooden ties were used to great advantage, the fabricated track, spiked down occasionally, being frequently laid on a roadbed formed by them, the ends being supported if necessary on crib work in a manner customary in the repair of washed-out track in America.

The light railway manuals of all the Allied armies specified a depth of ballast of 6 in., extending at least 6 in. beyond the ends of ties, and noted broken stone as the most suitable material. This required about 1,000 cub. yd. of stone for each mile. Of course no such amount of material could be brought up by the line itself during rapid construction, even if it had been available in rear. Whatever was available locally was used.

Speed of construction varied greatly according to conditions. On the construction of a line between Abainville and Sorcy (28·5 km. of heavy work) it was found that 1,758 man-days were required for the construction of one mile. During the progress of this piece of work, 2·69 m. of track were built in a few minutes over half a day. The entire force engaged was 2 officers and 135 men, 2 locomotives and 2 motor-trucks. The work was in rear of a quiet sector of the American front, the conditions not being very different from those of peace. On four short tracks constructed to connect American and German 60-cm. lines after the battle of St. Mihiel (total length laid in all 19 km.), 2,012 man-days of work were required per mile. French experience indicates that this latter figure is about what is to be expected under favourable conditions. British figures vary from 1,760 to 2,400 man-days per mile. These figures may be compared with 4,300 man-days of work required in the construction of a standard-gauge line, following light-railway methods, between Varennes and Grandpré during the American Meuse–Argonne offensive.

French "soixante" track consisted of rails weighing from 15- to 19-lb. to the yard, made up into sections, 5 metres, $2\frac{1}{2}$ metres and $1\frac{1}{4}$ metres long, the steel ties being riveted to the rails. When riveted sections became bent or broken, they could not be repaired in the field. For this reason the Americans adopted a fabricated section, in which the ties were fastened to the rails by bolts and clips. If a section became bent or broken, the ties could be removed, the rails bent back to line and new ties substituted. The American rail weighed 25 lb. per linear yd., and came separately in 30-ft. lengths for laying on wooden ties as well as in fabricated sections. A mile of American track (fabricated sections) weighed a little over 75 tons, while a mile of track on wooden ties weighed about 90 tons, but where the wooden ties were cut in the forward area, the actual material from the rear weighed but 43 tons. The British used 20-lb. rail, and both British and Americans favoured the track made with separate rails laid on wooden ties. Fabricated track, however, was of great value in laying temporary lines and particularly in forward areas, as a damaged section could be removed and replaced in the dark and without much noise.

The German equipment track came in 10- and 19-lb. rail, but they too made much use of the separate rail, wooden tie construction. On their main arterial lines on the Verdun front a great part of the rail weighed upward of 30 lb. to the yard, a considerable amount being very heavy rail taken from standard-gauge lines which could not be operated so far forward. The Germans made wise use of the standard-gauge track and roadbed for these narrow-gauge lines. By merely moving one rail over to 60-cm. gauge, they could use the light rolling-stock and, if need came, the standard track could be promptly reëstablished. This, however, proved to be a distinct advantage to their enemies when they came to reconstruct captured lines for standard-gauge operations.

The American 60-cm. motive power consisted of 10-wheeled, 2—6—2, side-tank steam locomotives, with a weight on driving wheels of 12 tons (17·5 tons total) and 6,225 lb. tractive effort; and gasoline tractors of 0—4—0 type, weighing 7 tons and 4 tons rated at 50 and 35 H.P. respectively. By actual field tests, the pulling power of these engines on various grades was determined to be (in gross tons) as follows:—

Compensated Grade in %	Steam Loco.	50 H.P. Gas. Loco.		35 H.P. Gas. Loco.	
		High Gear	Low Gear	High Gear	Low Gear
0·0	258	62·5	125	31	62·5
1·0	133	32·5	65	16	32·0
2·0	86	21·0	42	—	21
3·0	61	15·0	30	—	15
3·5	54	13·0	26	—	—

The steam locomotive was powerful and gave valuable service on first-class track. It derailed and turned over very easily, owing to its lack of flexibility and very high centre of gravity. The French Pechot, having low centre of gravity and pivoted truck, was able to take curves with ease. It was not so powerful (tractive effort 5,060 lb.) as the American engine, but it stayed on the track. The German eight-wheeled, 0—8—0 locomotive had a total wheel base of 7 ft. $4\frac{1}{2}$ in., as compared with the American 5 ft. 10 in. driving-wheel base and total wheel base of 15 ft. 7 in. It weighed approximately the same, 18 tons, but all the weight was on the drivers. There was little overhang and the centre of gravity was low. A flexible arrangement of end drivers gave radial action on curves. While not armoured, the cabs were low and well protected. The four-wheel well-tank locomotive of the Germans had a wheel base of but 3 ft. $7\frac{1}{4}$ in., permitting its use on very sharp curves. The British armies used four or five types of steam locomotives. The Hunslet, 4—6—0, seemed to have given best satisfaction. The weight on drivers was 12 tons; total weight 16 tons.

Of gasoline tractors the French had several types, the principal ones being the Schneider 0—6—0, and the Crochat (petrol-electric) 0—4—4—0. The Schneider, which was equipped with a 65-H.P., 4-cylinder, 4-speed engine, compared favourably in pulling power with the steam locomotives. In part, at least, the success of this tractor was due to superior workmanship on the motor and clutch, which was of the three-disc type, and the skill of the operators. The four speeds and low centre of gravity made it suitable for work of all character. The Crochat was completely armoured. The German gasoline tractors were of two types, 0—4—0 and 0—6—0. In general construction there was little difference between them, the outstanding features of both being low construction and little side overhang. Lubrication was supplied to all moving parts from local sight feed reservoirs or from a mechanical lubricator in the cab. The planetary transmission was controlled by a hand-wheel in the cab, and the operator could apply the power gradually. No effort on his part was required to hold the power at a certain stage of engagement, as is necessary with the clutch and spring action. Simple engines, low speed, heavy fly-wheels, smooth and positive application of power, were the great points in the German tractors.

The American rolling-stock was heavier and of greater capacity than that of other armies. For long hauls on fine track this was of advantage, but the "soixante" was not intended to be a long haul, heavy-traffic railway. British cars were relatively light and flexible, but included more types than those of the other armies. The German equipment was the lightest of all. Their gondola was made by attaching removable sides and ends to a flat car. One end only of their tank car was provided with roller side-bearings enabling it to run on uneven track. The tank cars of other armies derailed frequently because of lack of flexibility between the trucks.

The "soixante" lines were operated by a simple system of telephone dispatching, adapted from the Manual Block System. The railway was divided into several dispatching districts, each controlling from 25 to 75 km. of track. Control was exercised by telephone through operators stationed along the line at intervals of from 3 to 5 kilometres. At advanced points, where night operation alone was possible, and during extensions, temporary operators equipped with portable field telephone sets kept in touch with the permanent operator next in rear or with a special dispatcher.

The general superintendent of a system was connected by telephone with all the dispatching districts, and all orders for the movement of supplies and personnel were handled through his office. He also arranged for the proper distribution of motor-power and rolling-stock among the several districts under his control in proportion to the relative traffic requirements. (G. R. S.)

Pioneer Railways in the Middle East.—In the World War, the development of standard-gauge lines in the western theatre was so high that "pioneer" lines were totally unnecessary. Much work was done in creating new sidings, short loops and the like, but owing to the nearness of the sources of supply, the quantity of labour available and other causes, all this work was rather accelerated normal work than pioneer building proper.

In the eastern theatre of war, too, most of the work done in Russia was rather a speeded-up development of the normal railway system than pioneer work, except in the case of the railway between Murmansk and Ivanka (Zuanka). Work on this line, however, was carried out by the civil authorities and under peace conditions and it can hardly be called a military pioneer railway.

In two theatres, however, the pioneer railways were constructed in immediate connexion with operations, and the work done in these two theatres must be considered in some detail, both as an illustration of military railway principles and as an important element in the history of the World War.

Mesopotamia.—In no theatre of war was the maintenance of communications so precarious a matter as in Mesopotamia. The rivers during the flood season became hardly navigable, while the constant silt deposits have not only constricted the beds but even raised them above the level of the country on either side the banks. Consequently, hundreds of square miles of land are, in spite of the protective "bunds," inundated almost every year; and railway construction is hampered or made impossible. Moreover, the climate is subject to great extremes. So intense is the heat during the months of June, July and Aug. that work has to be suspended for several hours each day; while, on the other hand, the mornings and evenings during Dec. to Feb. are so cold that the output of eastern labour is restricted. Again, it was found that, owing to the peculiar nature of the soil, unballasted surface rail-track often became unworkable after rain. And apart from these difficulties, of course—difficulties peculiar to Mesopotamia—there was also the difficulty, common to all theatres, due to shortage of material and rolling-stock; and the strain thrown upon India was very great.

Railway construction in Mesopotamia began in the middle of 1916. Two railways were decided upon—the one, between Basra and Nasiriya, the other between Qurna and 'Amara. The Basra-Nasiriya line was built on the metre-gauge; the Qurna-'Amara line on the 2 ft. 6 in.-gauge. This question of gauge was a vital and controversial one. No definitive ruling was possible during the war, however; and the gauge of each railway in Mesopotamia was usually determined by some such consideration as the availability of material and rolling-stock. But the decision to convert the Qurna-'Amara line to metre-gauge had important effect. By the end of 1916 there were in the country three unconnected railway lines, totalling 234 m. of track. One, the Sheikh Sa'd-As Sinn line (24 m. of 2 ft. 6 in.-gauge line, opened in Oct. 1916) was built in order to maintain communication between the advanced base on the Tigris and the troops on the Kut front. It was dismantled in 1917 after the Turkish retreat. The Qurna-'Amara line (70 m. of 2 ft. 6 in.-gauge line, afterwards [April 1917] converted to metre-gauge line) was opened for traffic in Nov. 1916. It ran along the right bank of the Tigris and its principal object was to relieve the river transport on the difficult section of the Tigris between Qurna and 'Amara. Almost all the country through which the line had to pass is liable to flooding and the track had to be carried on high banks. Many bridges were also necessary, that at the Majar Kebir spill being 200 ft. wide. The Basra-Nasiriya line (the first metre-gauge line to be opened in Mesopotamia) followed the Euphrates and was 140 m. long. The rails were so laid on the sleepers (mostly of the Indian broad-gauge type) that, by shifting one rail, the line could be converted to a standard-gauge track. Much of the land through which the line had to pass was below flood level and banks had to be constructed. In addition to these three lines, a further 126 m. of track had been authorized in 1916—one line to link up Basra and Qurna, the other to connect 'Amara and Sheikh Sa'd. The latter line (the construction of which was not proceeded with owing to the rapid advance of the British forces) would have been some 86 m. long. Work on the Basra-Qurna line was begun in Feb. 1917. The principal constructional difficulty which had to be overcome was the crossing of the new channel of the Euphrates at Gurmat 'Ali. The river there is between 60 ft. and 70 ft. deep and an ordinary pile bridge was not possible. A floating bridge was brought from India and was placed in position on Dec. 26 1917. This pontoon, however, was not a great success; owing to the rise and fall of the tide the bridge could not be used more than 16 hours daily. The old channel of the Euphrates at Qurna was crossed by a pile bridge 900 ft. long.

In April 1917 the Bagdad-Samarra standard-gauge line (74 m. long)—a well-ballasted track built by the Germans in 1915—fell into British hands. The Turks, when retreating, had damaged the line—had blown up bridges and destroyed stations; but they made no attempt to demolish the track itself; and on May 6 1917 the first British train ran through from Bagdad to Samarra. In June 1918 work began on an extension of this line; and by Sept. 1 connexion between Bagdad and Tikrit was established. In Oct. work began on a further extension—from Tikrit to Shuraimiya, a distance of 30 m.; but when the line reached Baiji, 26 m. beyond Tikrit, the Armistice was signed and any further construction on the line was abandoned. The Sumaiki-Sadiya branch of this line was opened in July 1917.

After the advance beyond Bagdad in July 1917, the completion of the Kut-Bagdad line (already in course of construction) became of vital importance. This line (metre-gauge) reached Hinaidi (4 m. S. of Bagdad) on July 24 1917, the average rate of progress in construction working out at about 1½ m. per day. The line was later extended to Bagdad East, though Hinaidi remained the terminal centre. It was 109 m. long, with crossing stations at 13 points, and afforded great relief to the river traffic; for while the upstream journey from Kut occupied two days, Bagdad could be reached by rail from Kut in about eight hours.

In May 1917 work had been begun on a line from Bagdad to the Diala front. It was (owing to shortage of metre-gauge material) constructed on the 2 ft. 6 in.-gauge—material from the dismantled Sheikh Sa'd-As Sinn line and the abandoned Qurna-'Amara line being used. The line—as far as Baquba—was opened for traffic on July 13 1917. It was later extended to Table Mountain, 65 m. from Bagdad. (Between Baquba and Table Mountain, it should be added, was a branch line [4 m. long and opened at the end of 1917] connecting Abu Jezra and Abu Saida on the Diala river.) The whole of this line was afterwards converted to metre-gauge—or, more accurately, a new metre-gauge line was laid beside the existing track; the section Bagdad-Baquba being opened in Nov. 1917, and the section Baquba-Table Mountain, in June 1918. The line was originally carried over the Diala river at Baquba by a pile-and-trestle bridge. At the end of 1918, however, the pile bridge was replaced by a permanent structure, consisting of four spans of 100 ft. and two spans of 75 ft. on well piers. Towards the end of 1918, an extension of this line to Khaniqin, on the Persian frontier, was completed; later, the line was again extended—to Quretu, 130 m. from Bagdad.

In Aug. 1917 work was begun on the standard-gauge line between Bagdad and Falluja. Owing to shortage of material, however, it was not finished until the following December. One bridge—290 ft. long—had to be built over the Euphrates just outside Bagdad. After the occupation of Ramadi, at the end of Sept. 1917, it became necessary, for the support of the advancing troops, to extend the Falluja line. The original intention was to carry it to Ramadi; but it was, in practice, only extended to Dhibban, 48½ m. from Bagdad, the work being completed by Feb. 1918.

The Bagdad-Hilla line was opened for traffic in May 1918. This line was, originally, to have connected Bagdad with Musaiyib, branching from the existing standard-gauge line to Dhibban at a point 3 m. from Bagdad. Changes in the strategical situation, however, led to the abandonment of the proposed line to Musaiyib, one to Hilla being decided upon instead. The Bagdad-Hilla line—58 m. long—was built of 75-lb. rails on broad-gauge sleepers. In Aug. 1918 a 2 ft. 6 in.-line was opened from Hilla to Kifl, 21 m. away, for the purpose of carrying the harvest from the Hindiya agricultural district to Bagdad.

As the joint result of strategical requirements and the shortage of material, it was not found possible to complete the Bagdad-Basra through line until after the close of the campaign in Mesopotamia. Of the three alternative routes for the through line, that along the Euphrates was eventually decided on; and work on the connecting link between Nasiriya and Hilla was begun in Aug. 1918. The through line is on the metre-gauge; but it will undoubtedly be converted to the standard-gauge later.

It was not, as has been said, until the middle of 1916 that railway construction began in Mesopotamia. At the beginning of 1919, however,—just after the close of the campaign—the railway system in the country consisted of some 1,000 m. of track, 799 m. being main line track, and 200 m. secondary line track. Rolling stock, too, was at first extremely scarce. In July 1917, for example, only 20 standard-gauge engines and 323 standard-gauge waggons were available, together with 57 metre-gauge engines and 979 metre-gauge waggons. But by Sept. 1918 the numbers of standard-gauge engines and waggons available had increased to 38 and 562 respectively, and the numbers of metre-gauge engines and waggons to 145 and 4,158.

Inland water transport was, unquestionably, the first line of communication in Mesopotamia. It is certain however that after the advance beyond Bagdad the railways played the most vital part; and the following figures—showing the total of War Department stores (D.W. tons) carried on the principal lines in Mesopotamia during the two years 1917–8—will make clear the growth of the freight traffic service:—Basra-Nasiriya line (metre-gauge), 542,407 tons; Basra-'Amara line (metre-gauge), 699,526 tons; Kut-Bagdad line (metre-gauge), 572,696 tons; Bagdad-Baquba-Table Mountain and Qizil Robat line (metre-gauge), 403,087 tons; Bagdad-Samarra-Tikrit and Baiji line (standard-gauge), 388,934 tons; Bagdad-Falluja-Dhibban line (standard-gauge), 122,001 tons; Bagdad-Hilla line, 37,551 tons: a total of 2,766,202 tons.

Sinai and Syria.—The first steps towards developing a military railway system in Palestine were taken in the early part of 1916. The strategical position at the time seemed to be such as to favour a British offensive; and, as a preliminary to an offensive, certain railway construction was decided on. The doubling of the existing line from Zagazig to Ismailia was essential and, in addition, several short 2 ft. 6 in.-gauge lines on the E. bank of the Suez Canal were necessary. The Egyptian State railways undertook to carry out the work, which had to be completed by the middle of Jan. 1916. A 2 ft. 6 in.-gauge line to the Baharia oasis and a similar line to the Kharga oasis were also laid down, though not by the State railways; the necessary material being obtained by dismantling certain private lines in Egypt. In addition, since an advance into Palestine had been decided on, the construction of a line from Qantara (on the E. bank of the Suez Canal) towards Romani and El 'Arish had to be undertaken. Royal Engineer construction companies were made responsible for the actual laying of the track on this line, the preliminary formation work being carried out by Egyptian labour. A single standard-gauge line only was laid down, the question of the double line being deferred. By Aug. 1916 the line reached Romani (41 km. from Qantara); and, within a month of the British entry into El 'Arish (Dec. 21 1916), it had been extended to that place, which is 155 km. from Qantara. By mid-March 1917 the line was at Rafa, 200 km. from the base, and by June—in which month Gen. Allenby took over command of the E.E.F.—at a point (El Belah) about 13 km. from Gaza. In July the special commission on the Palestine railways, under Brig.-Gen. Stewart, recommended that, in view of the proposed further advance into Syria, the line from Qantara to Rafa should be doubled and at the end of the month the work was begun. During the subsequent advance to Jerusalem the Turkish line from Beit Hanun to Wadi Sarar was captured, and as it was practically undamaged it was, at the end of Nov.,—by which time the main line from Qantara had been extended to Beit Hanun—used for the onward conveyance of supplies. With the capture of Jerusalem (Dec. 9) the Turkish branch line from Wadi Sarar (1·05-metre gauge, like the line Beit Hanun-Wadi Sarar) came under British control and was converted to standard-gauge. Meanwhile, the work on the main line from the base at Qantara had been continued; by March 30 1918 it had been extended to a point some 8 km. N. of Ludd, and by Dec. of the same year to Haifa, 412 km. from Qantara. A branch line from Rafa to Beersheba had been completed by the end of June 1918 and the conversion of the Turkish line—Ludd to Jerusalem—from 1·05-metre gauge to 4 ft. 8½-in. gauge was also completed. The latter formed part of the original Jaffa-Jerusalem line (completed in 1892); but the section, Jaffa-Ludd, was dismantled by the Turks. The construction of the standard-gauge line from Qantara to Haifa was a remarkable achievement. Most difficult country had to be traversed. From Qantara to Rafa there was nothing but desert; and, in the early days of the line's working, derailments were constantly occurring through the silting-up of the track by sand. Later on, however, this was avoided by covering the banks with brushwood and thorn; and when the line settled firmly on the sand formation no ballasting was necessary, the hard, closely-packed sand serving as ballast. From Rafa northward and towards Beersheba was a fertile plain, but even here the heavy growth of grass and corn on the tracks made large maintenance gangs necessary. Beyond Gaza marshy land was met with and it was found to be almost impossible to build banks during wet weather owing to the spongy nature of the cotton soil. Often, indeed, sand had to be transported to provide a bed for the track, and many culverts and drains were required to combat the effect of rain on the yielding soil. As Ludd was approached the country became hilly and heavy earthwork was necessary; and a sea wall had to be built for a considerable distance S. of Haifa. From Qantara to El 'Arish no bridges were necessary; but from El 'Arish northward wadys and streams of varying size and depth had to be crossed; and, owing to the soft nature of the soil round the wadys, scouring of the bridge foundations had to be most carefully guarded against. Trestle bridges on concrete footings were usually constructed, pile bridges being the exception; but permanent bridges were erected at El 'Arish and over the Wadi Ghuzze at Gaza, and a special swing bridge, capable of being opened in about 10 minutes, was built over the Suez Canal. Water for the use of locomotives on the main line was provided by a pipe-line system—between Qantara and El 'Arish—which was capable of supplying 600,000 gal. a day. On the recommendation of Gen. Stewart's committee in 1917, additional engines and pumps were installed at a cost of £376,000; and though in March 1918 the consumption from the pipe-line was not more than 400,000 gal. a day, it was capable of supplying something like twice that amount. The furthest points from Qantara at which water was drawn for locomotives were at kilometre 194 on the main line and Karm on the Beersheba branch line. Beyond kilometre 194 water was obtained from wells.

Some 15 R.O.D. sections (each consisting of 267 men) and four construction companies (each of 250 men), together with native labour, were employed on the Palestine railways; the construction companies being responsible for purely constructional work, and the Railway Operating Division sections for maintenance work other than sand clearing, the sand clearing being carried out by special gangs. Traffic on the Palestine system was heaviest in 1918. In that year the total of passenger traffic increased from 325,000 in the March quarter to nearly 650,000 in the Dec. quarter; the stores carried increasing from just over 300,000 tons (D.W.) in the first quarter of the year to 400,000 tons (D.W.) in the Sept. quarter.

Throughout the campaign, it should be added, the strain on the resources of the Egyptian State railways was very great. Not only did the State railways undertake much new construction work for the military authorities, but they also had to provide for a greatly increased freight and passenger traffic at a time when their rolling-stock and material were greatly depleted and when even their repair shops were being utilized for the manufacture of bombs and grenades and the repair of ordnance and machine-guns.

A full account, from the technical point of view, of the Syrian and Mesopotamian railways is to be found in the *Railway Gazette* of Sept. 21 1920. (X.)

LILLY, WILLIAM SAMUEL (1840–1919), English man of letters, was born at Fifehead, Dorset, July 10 1840. He was educated at Peterhouse, Cambridge, taking his degree in 1862, and subsequently entered the Indian civil service, becoming in 1869 secretary to the governor of Madras. Owing to a breakdown in health, however, he had to return to England, where he devoted himself to literature. Lilly was a convert to Roman Catholicism, and from 1874 was secretary to the Catholic Union of Great Britain. His works include *Ancient Religion and Modern Thought* (1884); *The Claims of Christianity* (1894); *Four English Humorists of the Nineteenth Century* (1895), and *Studies in Religion and Literature* (1904). He died in London Aug. 29 1919.

LIMAN VON SANDERS, OTTO (1855–), Prussian general, was born Feb. 18 1855 at Stolp. After he had attained the rank of divisional commander in the German army he entered the Turkish service in 1913 for a period of five years as chief of a commission for reforming the Turkish army. He was likewise given command of the I. Turkish Army Corps, an appointment to which the Russian Government strongly objected. Liman's appointment was accordingly annulled, but he remained Inspector of the Turkish army. In Jan. 1914 he was promoted to be a Prussian general of cavalry, and in Nov. of the same year, after the outbreak of the World War, he was placed in chief command of the Turkish troops in the Caucasus. In March 1915 he took command of the V. Turkish Army on the Dardanelles, and successfully opposed the attacks of the British forces and the French contingent on the peninsula of Gallipoli. In 1918 he was given the chief command of the Turkish forces in Palestine, where he shared in the disaster which overtook them at the hands of Gen. Allenby's forces and narrowly escaped being captured. After the close of the military operations he was interned at Constantinople at the end of 1918, but was liberated in the course of the following year. He recounted his war experiences in *Fünf Jahre Türkei*.

LINDAU, PAUL (1839–1919), German dramatist and novelist (*see* 16.717), published in 1909 a collection of short stories *Der Held des Tages*. A volume of memoirs, under the title *Nur Erinnerungen*, appeared in 1917. He died in Berlin Jan. 31 1919. His elder brother, Rudolph Lindau, died in 1910.

LINDLEY, NATHANIEL LINDLEY, Baron (1828–1921), English judge (*see* 16.719), died at Norwich Dec. 9 1921.

LINDSAY, SIR COUTTS, 2nd Bart. (1824–1913), English artist, was born Feb. 2 1824. He succeeded in 1839 by special remainder to the baronetcy of his maternal grandfather, Sir Coutts Trotter, and afterwards entered the army, where he commanded the 1st Regt. of the Italian Legion during the Crimean War. He subsequently retired from the army and devoted himself to art. Between 1862 and 1874 he exhibited many pictures, including various successful portraits, and in 1877 founded the Grosvenor Gallery, which devoted itself to exhibiting the works of the pre-Raphaelite group and other artists who were at that time considered to be too advanced in style for the Royal Academy. His first wife, whom he married in 1864, was Caroline Blanche Elizabeth, daughter of the Rt. Hon. Henry Fitzroy by his wife Hannah Mayer de Rothschild. She was herself an artist and poet of some distinction. For 30 years before her death she lived in London or Venice, gathering a circle of friends about her which included G. F. Watts, Alma-Tadema and Browning. She collected a number of fine pictures, some of which she left to the National Gallery. She published several volumes of verse, among them *From a Venetian Balcony* (1903) and *Poems of Love and Death* (1907). She died in London Aug. 10 1912. Sir Coutts Lindsay married secondly, in 1912, Kate Harriet Madley, daughter of William Burfield. He died at Kingston May 7 1913, the baronetcy becoming extinct.

LINDSAY, [NICHOLAS] VACHEL (1879–), American writer, was born at Springfield, Ill., Nov. 10 1879. In 1897 he entered Hiram College, O., but left after three years to study art in Chicago and New York. For several winters he was a Y.M.C.A. lecturer, and during 1909–10 lectured for the Anti-Saloon League in his native state. Meanwhile he had begun during the summers a series of wanderings on foot which carried him through many states, reciting or singing his own verses like an ancient minstrel, and delivering an occasional lecture, receiving in return food and lodging. In 1920 he visited England, where he gave recitals. Many of his poems have the true ballad ring.

He wrote *General William Booth Enters into Heaven, and Other Poems* (1913); *The Congo, and Other Poems* (1914); *Adventures While Preaching the Gospel of Beauty* (1914, prose); *The Art of the Moving Picture* (1915, prose); *A Handy Guide for Beggars* (1916, prose); *The Chinese Nightingale, and Other Poems* (1917); *The Golden Book of Springfield* (1920, prose) and *The Golden Whales of California, and Other Rhymes in the American Language* (1920).

LINSINGEN, ALEXANDER VON (1850–), Prussian general, was born on Feb. 10 1850 at Hildesheim. From 1909 to 1914, he was in command of the II. Army Corps, and in Jan. 1915 was given the command of the German Southern Army, which he exchanged in July of the same year for the command of the Army of the Bug. In the following Sept. the German-Austrian south-eastern group (Army Group L) was likewise placed under his command. With these forces he succeeded in repelling Russian attempts to break through in Oct. and Nov. 1915, and in 1916 and 1917. He was in command at the battle of Gartorysk on Oct. 8 when the German-Austrian troops captured the Russian positions, while the operations which the Russians initiated nine days later resulted in their breaking the Austro-German front on Oct. 20. In March 1918 Linsingen led the advance into the Ukraine, and was advanced to the rank of Generaloberst. In the following June he was appointed chief-in-command in the Mark, *i.e.* in the province of Brandenburg including Berlin. In this capacity he was responsible for the disposition of the troops which had been left in Berlin and neighbouring garrisons for the purpose of preserving order. On the eve of the revolution he and the officers in command under him failed to maintain their authority, and, on Nov. 9 1918, the troops made common cause with the revolutionary workmen, who overthrew the imperial and royal régime and secured the proclamation of the German Republic.

LINTON, SIR JAMES DRUMGOLE (1840–1916), British painter, was born in London Dec. 26 1840. He was educated at Cleveland House, Barnes, and afterwards studied art. He frequently exhibited his works and was best known as a water-colour painter. From 1884 to 1899 he was president of the Royal Institute of Painters in Water Colours, and was again elected in 1909, holding the office till his death. He was knighted in 1885. He died at Hampstead Oct. 3 1916.

LIQUOR LAWS AND LIQUOR CONTROL (*see* 16.759).—In the following article, the later developments on this subject are dealt with as regards the United Kingdom and the United States, but the article PROHIBITION should also be consulted in this connexion, especially as concerns the United States.

UNITED KINGDOM

1. *Pre-War Legislation.*—Two legislative enactments relating to the sale of intoxicating liquors in the United Kingdom are to be recorded respecting the four years from 1910 to the beginning of the World War.

(*a*) The Licensing (Consolidation) Act of 1910 codified the greater part of the existing licensing laws of England and Wales. The changes introduced by this Act were few and of minor importance. It was designed to bring within one code the complex legislation outlined in 16.763–4. This Act remained the statute law at the opening of 1921, although during the period 1915–21 it was superseded, in many of its main provisions, by the Orders of the Central Control Board (Liquor Traffic); (*b*) The Temperance (Scotland) Act, 1913, appointed 10 A.M. as the opening hour for licensed premises throughout Scotland; strengthened the law respecting clubs supplying liquor; and gave powers of Local Option to Scottish Local Government electors on the three resolutions of "no licence," "limitation of licences by one-fourth," and "no change." Under the terms of this Act, the first local option polls were taken in Scotland in 1920 (*see* SCOTLAND).

2. *Emergency Legislation in 1914.*—The necessity for more stringent measures of control over the sale of drink was manifest in the opening days of the war. Insobriety in the services was too obvious a peril to be disregarded. Steps were at once taken under the first Defence of the Realm Act (Aug. 1914). Competent naval and military authorities were empowered to reduce hours of sale, and, in cases of emergency, to close licensed premises in naval and military areas; the supply (except under doctor's orders) of intoxicants to sailors or soldiers undergoing hospital treatment was prohibited; as was also the bringing of liquor into dock premises used for naval or military purposes. Nearly 500 restrictive orders were made by service authorities during the first ten months of the war. But the question was speedily recognized to be one affecting civilians as well as service men. The Intoxicating Liquor (Temporary Restriction) Act, passed on the last day of Aug. 1914, and intended to apply to the conditions of civil life, was asked for by the service authorities. It gave licensing justices power, upon the recommendation of the chief officer of police, to vary within narrow limits the opening and closing hours of sale. The Act applied also to the supply of liquor in clubs. The ground for action was "the maintenance of order, or the suppression of drunkenness." Within four months restrictive orders were made in 427 out of the 1,000 licensing districts in England and Wales.

3. *The Demand for Further Action.*—As the growth of the army and munition industries drew the vast majority of the adult population into national work, spread camps and munitions works throughout the kingdom, and made efficiency the national watchword, the need for much more drastic action was realized. Lord Kitchener in Oct. 1914, and Lord Roberts a few weeks later, appealed to the public to avoid treating men of the new armies to drink. Sir Edward Henry, the chief commissioner of police for the metropolis, called attention "to the serious difficulties with which the military authorities are at present faced owing to the late hours to which the numerous public houses are kept open." The chairman of the Birmingham justices, announcing an order under the Intoxicating Liquor (Temporary Restriction) Act, said, "the order has been made owing to the accumulated evidence in the hands of the authorities as to the delay in the execution of Government orders, arising from the bad time-keeping and drinking habits of a minority of the workmen employed on such orders." On March 29 1915, a deputation from the Shipbuilding Employers' Federation waited on the Chancellor of the Exchequer to urge "the total prohibition during the period of the war of the sale of exciseable liquors," basing their claim on serious delays in shipbuilding and repairs. The statement of delays submitted by the deputation was forwarded to the King, who, resting his action on the evidence thus furnished, "set the example by giving up all alcoholic liquor himself, and issuing orders against its consumption in the Royal Household, so that no difference should be made, so far as His Majesty is concerned, between the treatment of rich and poor in this question." The Royal example stirred public thought, yet it was seen ere long that only new legislation could effectively meet national requirements. A speech by Mr. Lloyd George at Bangor on Feb. 28 1915 riveted public attention. The "lure of drink," he affirmed, was delaying the output and transport of stores of war. This was true of only a minority of manual workers, but "a small minority of workmen can throw a whole works out of gear." There was an extraordinary consensus of opinion in favour of entrusting the Government with whatever new legislative powers they deemed requisite. Possible remedies for the impairment of efficiency by alcoholism were widely canvassed. These included total prohibition; the prohibition of spirits; the sale of light instead of heavy liquors; a general restriction of drinking facilities; State purchase, to be followed by drastic curtailment of the traffic in drink; and the provision of works' canteens to supply wholesome meals for war workers.

4. *Control Board (Liquor Traffic).*—When the Government plan was announced in the Commons, on April 29, it was seen that neither prohibition nor national purchase was to be adopted. "Control" was the key-word of the policy. A new national authority was to be established, with unprecedented powers. It was further proposed to increase substantially the taxes on intoxicating liquors. The fiscal plan, devised partly to aid revenue and partly to promote sobriety, did not survive hostile Parliamentary criticism. But the "control" proposals, supported by a White Paper "showing the effects of excessive drinking on the output of work on shipbuilding, repairs and munitions of war," were approved by Parliament as the Defence of the Realm (Amendment) (No. 3) Act. The new authority, entitled the Central Control Board (Liquor Traffic), was set up on May 27. The Board, as finally constituted, comprised representatives of the Admiralty, War Office, Home Office and Treasury Departments; men expert in licensing law and public health administration; well-known employers and Labour leaders; and leaders of the temperance movement and liquor trade. Lord D'Abernon served with great distinction as chairman for five years (1915–20). Sir John Baird was appointed chairman in May 1921; in the year preceding his appointment the acting chairman was Sir John Pedder. The secretary of the Board was Sir John Sykes. By the death of Mr. Richard Cross in 1916, the Board lost a member of unusual vigour of mind and long experience in licensing administration.

The Board could take action where, and only where, war material was being made or loaded or unloaded or dealt with in transit, or where men belonging to H.M. naval or military forces were assembled. Action must be "for the purpose of increasing directly or indirectly the efficiency of labour in such areas, and preventing the efficiency of labour in such areas from being impaired by drunkenness, alcoholism, or excess." It would be a mistake, therefore, to regard the Board's work as a designed contribution to temperance reform. Conversely, the fact that the vast experiment which the Board made in modes of liquor control was entered upon without bias, and dictated solely by concern for the industrial efficiency of the nation, gives it a unique public value.

The first areas were scheduled and restrictions applied in July–Aug. 1915. These areas included most of the seaports of England, Wales and Scotland, for it was speedily established that the intemperance of a minority of ship and shore workers had caused delay in the sailing of vessels laden with stores of war. Restrictive orders for London and the great industrial neighbourhoods of the Midlands and the North followed. Ultimately, the Board's orders came to apply to all the main manufacturing and transport areas; the only parts of Great Britain excluded were certain agricultural districts, and a few of the smaller towns where military orders restricting the sale of drink made action by the Board unnecessary. The procedure was normally this: complaints that drink was delaying war work or efficiency in the services were received from the Ministry of Munitions, the service authorities, or other responsible quarters; a delegation of members of the Board, appointed for the purpose, held a one or two days' conference in the neighbourhood concerned, taking evidence from naval, military, licensing and municipal representatives, the chief constables, employers and trades unionists, deputations from churches and temperance societies, and from the various sections of the local liquor trade; the delegation's report was considered by the Board; where action was found necessary, a restrictive order was prepared to apply to a definite area, usually an extensive one; a statement of the case for action in the area suggested was submitted to the Minister of Munitions; when the area had been defined by an Order in Council an Order was issued by the Board to take effect therein about ten days later. In the areas so defined, the Board was able, during the war emergency period, to vary the restrictions in force, to provide or encourage the provision of industrial canteens for war workers, or to exercise their power to acquire licensed property by purchase and thus directly control the sale of drink.

5. *Methods of Liquor Control. (A) The Restrictive Code of the Board.*—The most notable changes made by the Board in the hours and customs of liquor sale are summarized below. The main lines of policy were found applicable to all the scheduled areas, but minor deviations were made to meet the requests of naval or military authorities, or the special circumstances of localities. The "Standard Order" comprised the following important divergences from statute law or popular custom:—

(1) Weekday hours for "on" sale (*i.e.* for consumption *on* the premises). England and Wales: hours reduced by two-thirds; from 19½ (London), 17 (large towns), and 16 (other places) to a maximum of 5½, divided between the mid-day and evening meal-time periods; no sale before noon; sale for 2½ hours at mid-day (12–2:30 P.M.); period of non-sale until 6 or 6:30 P.M.; sale resumed for three hours in the evening, ceasing at 9 or 9:30 P.M. Scotland: hours reduced from 12 to a maximum of 5½, divided into mid-day and evening meal-time periods, as in England; a special provision for the industrial areas of the Lowlands and North prohibited sale on Saturdays (the usual pay day) until 4 P.M., sale to continue until 9 P.M.

(2) Sunday hours for "on" sale. England: hours reduced from seven to five. In Wales and Scotland, where a Sunday closing law prohibited ordinary sale or supply from licensed premises, the Board's order brought clubs within the probihition. In Monmouthshire and the Forest of Dean complete Sunday closing enforced, in keeping with the practice in the adjoining Welsh counties from which there had been a considerable Sunday incursion of drinkers.

(3) Hours for "off" sale, *i.e.*, for consumption *off* the premises. "Off" sale and dispatch of brewed liquors, and wines, ceased one hour earlier at night than "on" sale. "Off" sale and dispatch of spirits (save to meet medical emergencies) limited to the permitted mid-day hours (12–2:30 P.M.) from Monday to Friday, and no "off" sale on Saturday or Sunday. No "off" sale of spirits from railway refreshment rooms.

(4) Additional restrictions on spirits, because of their greater alcoholic strength. Before the war, whisky, brandy and rum might not be diluted, without notice to the purchaser, to a lower strength than 25° under proof; the Board extended this limit to 50° and made dilution to 30° compulsory. To stop the trade in "nips" and small flasks of spirits, the "off" sale of a less quantity of spirits than "a reputed quart" prohibited.

(5) Treating prohibited, to stop the general and pernicious practice of pressing liquor on men in uniform, and the habit of "group drinking" among workmen, a custom to which a considerable amount of intemperance was due. (A "saving provision" permitted treating to liquor as part of a meal.)

(6) The "long-pull," or over-measure of beer, given by a publican to draw trade to his house, prohibited.

(7) Retail sale of liquor on credit prohibited, to stop the practice of running into debt for drink.

(8) Canvassing for liquor orders, elsewhere than on licensed premises, prohibited.

(9) In view of the fact that before the war clubs supplying liquor were not required to conform to the same restrictions as licensed premises, and could supply drink at any hour, it is important to note that the whole code of the Board's restrictions applied to clubs not less than to all classes of licensed premises.

When informed of police-court convictions showing that the restrictive order had been disregarded and the public interest imperilled, the Board was empowered, after due enquiry, to stop the sale or supply of drink in the licensed premises or club concerned for the remainder of the current licensing year. This step was taken in regard to 178 licensed premises and four registered clubs.

In two Scottish neighbourhoods of outstanding naval importance, Glasgow Docks and the Firth of Forth, the Board supplemented the restrictive order by a system of direct supervision, appointing a "supervisor" to assure compliance with the restrictions and to recommend further action as required.

(*B*) *The Industrial Canteen Movement.*—The Home Office investigators, whose reports were included in the White Paper of 1915 mentioned above, stated that in the shipbuilding areas "many of the workmen take insufficient food, which not only increases the temptation to drink, but makes the effect of the liquor taken more injurious, so that the result is to incapacitate the workmen for the strain of heavy work." They emphasized "the need for mess-rooms and canteens in the yards where the men could get good meals in comfort without having to resort to the public houses." "Such accommodation," they said, "is very rarely provided." The need was even more obvious in the munition areas. The answer of the Board was a widespread development of industrial canteens, ranging from the simplest of mess-rooms to "social centres" with extensive recreative as well as culinary provision. A canteen committee under the chairmanship of Sir George Newman was set up to direct the enterprise. Employers were encouraged to erect canteens under a scheme which permitted them to deduct a proportion of the cost from the sum which would otherwise have been payable to the state as "excess profits." Between 800 and 900 canteens were thus provided for over a million employees in transport or munition areas. Over 95% of the canteens were "dry"; where intoxicating liquor was retailed, the supply per person was restricted to one pint of beer served with a meal. The sale of "light beer" of a non-intoxicating strength was encouraged. The Health of Munition Workers' Committee attributed to this industrial canteen movement the improved nutrition of the workers in the industrial establishments affected, increased contentment and efficiency, and "a lessened tendency to excessive consumption of alcohol."

(*C*) *The Direct-Control Areas.*—In three neighbourhoods of supreme importance to the nation at war the Board acquired the licensed premises, and carried on the trade in intoxicants under a stringent control. A group of licensed premises adjacent to the Royal Small Arms Factory at Enfield Lock, N. London, was purchased in Jan. 1916. All the licensed premises in a wide area around the Cromarty Firth were acquired in 1916–8 to enable the Board to repress intemperance at the then base of the Grand Fleet, which at a later date became a base for American naval forces. The largest State Purchase enterprise, and the most famous, was on the Scottish Border, where a huge national explosive factory was erected, surrounded by the new township of Gretna.

Table I shows the number of licensed premises acquired in the three State Purchase areas (from 1916 to 1921), and the number of these licences suppressed after purchase as redundant.

TABLE I.—*Licensed Premises Acquired in the Direct-Control Areas.*

Area	Breweries	"On" licences	"Off" licences	Total retail licences acquired	Retail licences suppressed after purchase because redundant
Enfield . . .	—	4	1	5	—
Cromarty Firth Area . .	—	28	11	39	19
Scottish Border Area, Gretna (including Annan) . .	—	20	8	28	16
Carlisle (city) .	4	104	12	116	50
Carlisle (adjacent country districts)	1	196	2	198	67
Total	5	352	34	386	152

The rapid influx of a new industrial population overwhelmed the normal social life of Carlisle and district. Sixteen thousand navvies were at work at Gretna. The available housing accommodation proved inadequate, and the public houses were packed to excess. "Broken time" at Gretna became a matter of grave concern; of 953 persons convicted for drunkenness in 1916 at Carlisle 788 were Gretna factory workers. The Board's restrictive code had been applied but was extremely difficult to enforce; the abnormal conditions demanded changes more fundamental. Consultations with the local authorities led to the decision to purchase the licensed properties throughout the area, and to institute under State ownership a firmer control of the traffic in intoxicants. The houses first acquired were those adjacent to the national factory; but the problem was speedily seen to be co-extensive with the district over which the industrial workers had spread, and in successive stages the purchase area was extended to a territory of 500 sq. m., flanking both shores of the Solway Firth, with a war-time pop. of 140,000, including the towns of Annan and Gretna in Dumfriesshire, and the city of Carlisle and the town of Maryport in Cumberland. The properties acquired in this Border area numbered five breweries and 342 licensed premises (320 "on," 22 "off" licences). Local advisory committees were set up at Carlisle and Gretna to coöperate with the Board in the work of administration. Sir Edgar Sanders, as general manager of the Carlisle undertaking, rendered unique national service.

The chief changes effected under the State Purchase régime at Carlisle, over and above the Board's usual restrictive code, were these:—

(1) A vast improvement was speedily achieved in the observance of the restrictive code. (2) Redundant and undesirable licences were extinguished; up to June 1921 133 licensed premises were closed, and brewing discontinued at three of the five breweries; all "grocers' licences" were extinguished as soon as purchased. (3) The sale of spirits was stringently regulated. The number of houses selling spirits for "off" consumption was greatly reduced, and throughout the war no sale of spirits ("on" or "off") was permitted on Saturdays. (4) The "on" sale of intoxicants to young persons under 18 was prohibited, excepting the sale of beer with a meal. (5) All display of liquor advertisements outside licensed premises ceased. (6) During the war complete Sunday closing was enforced in the State Purchase area of Cumberland to accord with the practice north of the Border. (7) Certain licensed premises were reconstructed and structural improvements made in others. (8) All private interests in the sale of intoxicants were eliminated, and a weekly wage paid to bar employees irrespective of the quantity of liquor sold. (9) The sale of food and non-alcoholic refreshments was encouraged, and a commission on these paid to the managers of licensed houses. "Food taverns" were established in industrial neighbourhoods, and tea-rooms provided at country inns. In 1920 570,000 meals were served in the Board's "food taverns" at Carlisle. (10) Licensed restaurants with ample recreative facilities were opened at Carlisle, Longtown and Annan. (11) Provision was made at Carlisle for the meeting of Trades Union Branches and Friendly Societies on unlicensed premises. (12) Substantial economies in the manufacture and sale of liquor were secured as a result of the acquirement of many competing businesses by one organization.

The social results of this new system of administration were seen in a rapid decrease of drunkenness, and a marked improvement alike in public order and in industrial efficiency at the neighbouring national factory. The annual reports of the chief constable of Carlisle testify to the reduction of insobriety. A convincing proof of the social value of the policy of direct control in the Scottish section of the Border area was an official request to the Board from the local authorities of Dumfriesshire asking that the whole of the county should be included in the State Purchase area. Similarly valuable social results were achieved at Enfield and in the Cromarty Firth area.

The value of the assets of the Board's direct-control undertakings—in the Carlisle and Gretna, Cromarty Firth, and Enfield areas—amounted at March 31 1920 to £1,307,448; while the balance of Exchequer issues outstanding, after crediting interest amounting to £89,058, was £646,939; and the accumulated profits amounted to £435,335. The direct-control undertakings had at that date been in existence for about four years, and as the current annual profits were sufficient, after allowing for Exchequer interest, to admit of the Exchequer issues being repaid at the rate of £120,000 per annum, it was possible that the whole capital expenditure would be repaid with interest in about ten years from the commencement of operations.

(*D*) *Investigation of the Effects of Alcoholic Beverages.*—Early in the Board's career it was found essential to obtain reliable data concerning "the physiological action of alcohol, and, more particularly, the effects on health and industrial efficiency produced by the consumption of beverages of various alcoholic strengths." An advisory committee for this purpose was formed under the chairmanship of Lord D'Abernon, and their successive reports on the nature and action of alcohol were ultimately published under the title of *Alcohol: its Action on the Human Organism.* The impartial spirit of this volume, and the representative character of the distinguished men of science who served upon the advisory committee, combine to make the volume the standard authority upon the field which it covers.

6. *The Food Controller's Limitation of Output.*—Within the period under review another series of drastic restrictions on the liquor trade is to be recorded, a limitation of brewing and of the release of spirits and wines from bond. The Output of Beer (Restriction) Act, 1916, caused some reduction in the output of beer; but it was the activity of German submarines in the third year of the war which, by endangering the national food supplies, led to the policy of severe limitation of liquor output adopted by the Food Controller in the early months of 1917. On April 1 1917, brewing was restricted to an output of 10,000,000 standard barrels per annum, compared with 36,000,000 standard barrels, the output for the year ending March 31 1914; and the quantity of spirits and wines to be released from bond was limited by one half. This policy of restriction of output was maintained for three years in varying degrees of stringency. After the Armistice, successive relaxations were made, and the restrictions on output were finally withdrawn in July 1919. The permitted average gravity of beer, and the retail prices of beers and spirits, were fixed by a series of Orders of the Food Controller; this system of control was continued until the passage of the Licensing Act in Aug. 1921.

7. *Effects of the Policy of Liquor Control.*—The relevant statistics point to a remarkable decrease in drunkenness, and in the disease and tragedies which follow alcoholic indulgence. The appended table displays, for the period 1913–20, the number of recorded convictions for drunkenness, deaths from alcoholism and from cirrhosis of the liver, a disease often attribut-

TABLE II.—*Drunkenness and other Alcoholic Phenomena in England and Wales 1913–20.*

	Convictions for Drunkenness			Recorded Deaths from Alcoholism	Recorded Deaths from Cirrhosis of the Liver	Recorded Deaths from Suffocation (Children under one year)	Attempted Suicide
	Males	Females	Total				
1913	153,112	35,765	188,877	1,831	3,880	1,226	2,426
1914	146,517	37,311	183,828	1,816	3,999	1,233	2,385
1915	102,600	33,211	135,811	1,451	3,632	1,021	1,608
1916	62,946	21,245	84,191	953	2,986	744	945
1917	34,103	12,307	46,410	580	2,283	704	935
1918	21,853	7,222	29,075	296	1,671	557	810
1919	46,767	11,180	57,947	369	1,507	525	1,222
1920	80,517	15,246	95,763	591	1,763	593	1,448

able to alcoholic indulgence, deaths of children (under one year of age) from suffocation, and cases of attempted suicide. The figures refer to England and Wales. 1913, as the year immediately preceding the outbreak of war, is taken as a pre-war standard. The influence of the restrictions can be clearly traced. The convictions of males for drunkenness show an enormous decrease from 1915 to the close of the war, but the transfer of millions of men from civil to military discipline makes it difficult to determine the part in this reduction which is properly attributable to the new drink policy. Students of the problem have accordingly turned to the statistics for drunkenness among women as a much more reliable index. In comparison with 1913, the convictions of females for drunkenness increased in 1914 by 4%, an indication of what was likeliest to happen as a result of the tension among women whose male relatives were serving with the forces. The influence of the restrictions is reflected in the figures for 1915. Repeated experience shows that in Great Britain the curves of spending power and convictions for drunkenness normally rise together; yet, notwithstanding the great increase in the spending power of women due to the fact that from 1915 to 1918 women were engaged in national industries in very large numbers, and so became regular wage earners, convictions for drunkenness among females actually decreased in 1915 by 7%; in 1916 by 41%; in 1917 by 66%; in 1918 by 80%. The group of "vital statistics" which follows supplies confirmatory evidence. The deaths certified as due to or connected with alcoholism, in comparison with 1913, declined in 1915 by 20%; in 1916 by 48%; in 1917 by 68%; in 1918 by 83%. The deaths certified as due to cirrhosis of the liver, in comparison with 1913, declined in 1915 by 6%; in 1916 by 23%; in 1917 by 41%; in 1918 by 57%. The deaths of children under one year from "overlying" (a form of mortality frequently attributable to parental drunkenness), in comparison with 1913, declined in 1915 by 16%; in 1916 by 39%; in 1917 by 42%; in 1918 by 54%. "The suicidal impulse is the most frequent and most characteristic of the graver disorders of conduct to which the habitual drunkard is prone" (Sullivan); the recorded cases of attempted suicide, in comparison with 1913, declined in 1915 by 33%; in 1916 by 61%; in 1917 by 62%; in 1918 by 67%.

In estimating the significance of these statistics it should be borne in mind that from the autumn of 1915 to the spring of 1917 the Control Board's restrictive code was applied stage by stage to a territory equalling five-sixths of Great Britain, peopled by nineteen-twentieths of the population; and that, in the later months of 1917 and throughout 1918, the Food Controller's restrictions on output were operating side by side with the Board's restrictions on hours and customs of sale. It will be noted that in 1919 and 1920, years marked by some relaxations of the Board's restrictions, and a progressive diminution leading on to complete revocation of the Food Controller's limitation of liquor output, there was a very considerable increase in convictions for drunkenness, and the curve of mortality began to move upwards again.

Apart from statistics, a mass of valuable evidence exists to show that the Board's restrictions led directly to an increase of discipline and health in the services, and a very marked improvement in efficiency in munition and transport industries. Numerous testimonies from the Admiralty and War Office, and from large employers of labour are cited in successive reports of the Board. Chief constables in all parts of the country noted in their annual reports a wonderful improvement in public order. The commissioners of prisons in successive reports pointed to the restrictive Orders as an influential cause in the reduction of crime. Hospital authorities recorded a diminution in street accidents and injuries arising from street brawls. Health visitors testified to the domestic advantages and gains to child welfare which were manifest as soon as the shorter hours for the sale of drink came into force. A mass of evidence respecting the bearing of the restrictive code on industrial and social life, and an examination of the available statistical data, will be found in *The Control of the Drink Trade* by Henry Carter (2nd ed., pp. 237–281).

8. *Changes in Liquor Taxation.*—There were large increases in liquor taxation in the later years of the period under review. At the outbreak of war the duty on beer was 7s. 9d. per standard barrel; on spirits 14s. 9d. per proof gallon. The beer duty was raised to 23s. per standard barrel in Nov. 1914; to 25s. in 1917; to 50s. in 1918; to 70s. in 1919; and to 100s. in 1920. The duty on spirits was raised to 30s. per proof gal. in 1918; to 50s. in 1919; to 70s. in 1920. The Finance Act (1920) practically doubled the pre-war import duties on wines. These heavy increases in liquor duties, which led to corresponding increases in the retail prices of liquor, doubtless had a considerable influence in checking the consumption of liquor in the years immediately following the war.

9. *The Close of the Period of Control.*—The beneficial results of the policy of liquor control were widely recognized, and it was commonly expected that the Government would at an early date, when dissolving the Board, enact new legislation based on the experience gained through what the *Scotsman* had described as "the largest social experiment of our time." The Government were, however, pre-occupied with the terms of world peace. In Nov. 1919 the Prime Minister told a deputation from the Temperance Council of the Christian Churches that a bill dealing comprehensively with the subject "would be introduced before Christmas." No bill was introduced. The King's Speech in 1919 renewed the promise of legislation. In Nov. 1920 a bill was introduced which would have transferred for a limited period the powers and properties of the Board to the Home Office, but the bill did not survive the criticism directed against what was deemed to be a perpetuation of war emergency "control." The Board made various modifications in their code, to meet in some degree the changed conditions. At length, in April 1921, in a second reading debate on a private member's bill, the Government announced their decision; the Board's rule would continue for a while longer, but an effort would be made to reach agreement amongst moderate men of all parties as to the form in which the work done for national sobriety since 1915 could best be expressed in permanent legislation. There was sufficient response to enable the Government, in June, to set up a Round Table Conference of members of the Commons; the terms of reference were "to consider, with reference to the law of licensing, how best to adapt to times of peace the experience gained in time of war." The attorney-general (Sir Gordon Hewart) was chairman of the Conference, which comprised members chosen as representative of the temperance movement, the liquor trade, the clubs associations, and "average public opinion." Agreement was reached, and a bill, incorporating the terms of the agreement, subsequently introduced.

The bill, treated for the most part as a non-controversial measure, passed with exceptional rapidity and ease through all its stages, and received the Royal Assent on Aug. 17 1921. Its main provisions were (1) the appointment of eight hours as the period for the sale and supply of intoxicating liquors on weekdays outside the metropolis; (2) the appointment of nine hours for sale and supply within the metropolis; (3) the actual hours could be fixed by local licensing justices, provided that the first hour should not be earlier than 11 A.M., that there should be a break of at least two hours between the mid-day and evening periods of sale, and that the normal latest evening hour outside the metropolis should be 10 P.M., and within the metropolis 11 P.M.; (4) an additional hour for sale and supply was permitted after the normal evening hour for premises habitually providing "substantial refreshment, to which the sale and supply of intoxicating liquor is ancillary"; (5) further safeguards against the hawking of liquor were provided; (6) credit for "on" sales of liquor was prohibited; (7) the "long pull" was prohibited; (8) the dilution of spirits to 35° under proof, without notice to the purchaser, was permitted; (9) the "*bona fide*" traveller was abolished; (10) all the foregoing provisions were applied to registered clubs as to licensed premises, and were extended to the whole of Great Britain, thus bringing within the scope of the Act those parts of the country to which the Control Board's restrictions did not apply; (12) the properties of the three State Management schemes, and their administration, were transferred as regards the English areas to the Home Office, and as regards the Scottish areas to the Scottish Office; (13) the Welsh Sunday Closing provisions were extended to Monmouthshire.

With the passage of this Act, the period of control closed. The Central Control Board (Liquor Traffic) came to an end two months later, on transfer of its responsibilities in the State Management districts. The Act was in itself a recognition of the worth of the work done for national sobriety by the Board during the six years of its existence.

Authorities.—*Reports of the Central Control Board (Liquor Traffic)*, first, 1915 (Cd. 8117); second, 1915–6 (Cd. 8243); third, 1916–7 (Cd. 8558); fourth, 1917–8 (Cd. 9055); *Reports to Board of General Manager for Carlisle and District Direct Control Area*, 1918 (Cd. 137); 1919 (Cd. 666); 1920 (Cd. 1252); *Alcohol: Its Action on the Human Organism* (H.M. Stationery Office); Henry Carter, *The Control of the Drink Trade in Britain.* (H. Ca.)

United States

Nowhere is a wider range of experimentation or a greater variety of legislation dealing with the liquor traffic to be found than in the United States. The Federal Congress legislates for the District of Columbia and Federal territory, such as military and naval stations, Indian reservations, etc., located in the several states, and has exclusive control over interstate commerce. The 48 state Legislatures, before national prohibition was adopted in 1919, had almost exclusive independent and sovereign power to deal with the matter. The result was that a great number of statutes were enacted after 1910 for the regulation and control of the liquor traffic. There was, however, no new departure from the general principles of the liquor laws in force in the United States in 1910. The more important state statutes and the Federal legislation leading up to and including the adoption of the Prohibition Amendment to the Constitution in 1919 with its enforcing legislation (Act of Oct. 28 1919, National Prohibition Act, also known as the Volstead Act) are discussed in the article Prohibition.

The spread of state prohibition by both constitutional amendment of state constitutions and by enactments of state Legislatures was continuous during the five-year period prior to the adoption of national prohibition. On Jan. 17 1920, when national prohibition went into effect, only 15 of the 48 states had any "wet" area and of the total pop. of all the states 68·3% resided in "dry" areas. The land area under prohibition was 95·4% dry as compared with 4·6% under licence by state law, although this fact is perhaps less significant than the percentage of population. National prohibition provided for "concurrent" power in the Federal Congress and in the state Legislatures for its enforcement so that many of the state Legislatures, since national prohibition went into effect, have taken their own measures for the definition and enforcement of state-wide prohibition, which may be more, but not less, than strict national constitutional prohibition or the enforcement legislation enacted by Congress. Local option within the several states made continuous progress (1910–9) and resulted in the extension of dry territory, all kinds of expedients being employed to protect the population of dry areas, against the influence and practices of contiguous wet areas.

A considerable and interesting effort has been made in many states to provide by legislation for the treatment of inebriety, the prevention of public drunkenness, and the protection of minors and habitual drunkards and persons in an intoxicated condition to whom the sale of intoxicating beverages was prohibited by state and local laws and ordinances. Liquor selling in connexion with dance-halls and places of public amusement and recreation has been increasingly restricted or prohibited by state and local legislation in the interest of public morals.

(S. McC. L.)

LISTER, JOSEPH LISTER, Baron (1827–1912), English physician (*see* 16.777*), died at Walmer Feb. 10 1912.

LITHOGRAPHY (*see* 16.785).—The most important development in lithography, during the decade 1910–20 was the invention of the mechanical transfer machine. This machine eliminates the pulling-over of the design upon the press plate by hand labour, the process being termed "mechanical transferring." The design or designs are positioned on the metal plate with the aid of photo-lithography. The plate is prepared for the mechanical transfer in practically the same way as for hand transferring from lithographic stones; that is, the plate is first grained to hold water when printing and then counter-etched to secure a clean surface. The plate is next coated with a light-sensitive solution such as bichromated albumen, after which it is placed in the mechanical transferring machine in contact with a negative, representing the picture, or a colour of the picture, and exposed to light. The plate is then covered with ink, and the albumen not affected by the light washed away with water, leaving the image, or images, in hardened albumen. The plate is then etched, gummed up and is ready for printing.

The mechanical transfer machine consists of a metal plate-holder, in which the sensitized printing surface is placed, a negative holder, and an arc lamp. The print of the negative upon the press plate is obtained by either contact-printing or projection, the positioning of the image being controlled by an accurate system of gauges or dials. After one impression has been obtained, the printing plate or the negative is moved to where it is desired, according to the layout, that the next impression should appear.

Another method is to project or contact-print the image of a positive the required number of times upon a large negative. This multiple negative is then placed in a contact-printing frame and exposed upon a sensitized press plate the desired number of times through moving the negative by hand, according to a system of register marks. Still other variations are in use.

LITHUANIA, REPUBLIC OF.—Lithuania is on the whole a low-lying country watered by the Niemen ("Niemunas"—name of a heathen deity) and its tributaries. The highest part is in the south and east, where the Baltic hills extend in crescent formation from Gumbinnen in East Prussia through Suvalki (Suwalki) and Vilna to Dvinsk. This chain of hills is broken by two valleys, that of the Niemen flowing through Grodno and Olita to Kovno, that of the Vilya, flowing from Vilna to Janov to its junction with the Niemen below Kovno. In the north-west is situated another triangle of hills, the Telshi-Shavli-Rossieni. Between these two hilly regions lies the plain of the Niemen with its two principal tributaries, the Niaviaza and the Dubissa flowing in from the north. The only other river of importance is the Svienta, flowing south-west to join the Vilya near Janov, and in the north the Muscha, which joins the Aa at Bausk in Latvia.

Early History.—For early history *see* Lithuanians and Letts (16.789), also Poland (21.902). The union between the kingdom of Poland and the grand duchy of Lithuania was brought about on Feb. 14 1386 by the marriage of the Lithuanian Grand Duke Jogaila (Jagello) to the Polish Queen Jadviga and confirmed by the subsequent pacts of Vilna in 1401 and 1432, of Horodlo in 1413, of Grodno in 1501 and 1512 and, parliamentarily, of Lublin in 1569. Thus was established a political combination in which Lithuania in point of territory was three times the size of Poland. The contracting parties were to retain their names, laws, administrative institutions, financial and military organizations. Through the fact, however, that from 1501 onwards the Lithuanians and the Poles were ruled over by one sovereign and from 1569 onwards had a common legislature, the former, though ever anxious to break away, gradually sank into a state of dependence. The Poles, past-masters in the art of political intrigue, never lost an opportunity of imposing their hegemony. Accordingly the Dual State was involved in a common downfall, and in the three partitions of 1772, 1792 and 1795 to which it was subjected at the hands of Russia, Prussia and Austria, Lithuania fell a prey to Russia and Prussia. But, while the Tsarist régime, unable to denationalize a homogeneous population of a different religion and language, initially conceded a minimum of rights to the Polish nation, in Lithuania proper from the outset an unrelenting system of tyranny was established which was designed to break by force every non-Russian element in the country.

Russia had annexed the six Lithuanian Governments between 1772 and 1795 and united them as the "Litovskaya Gubernia" in 1797, that is to say, before the Treaty of Vienna conceded her the kingdom of Poland in 1815. At the Warsaw Diet of 1818, the liberal-minded Alexander I. still spoke of the reunion of Lithuania with Poland under constitutional forms. But the project lapsed because already then any measure of self-government by extending the power of the Polish "szlachta" (land-owning noble class) in Lithuania menaced Russia's influence in that country which strategically rounded off her north-western frontier. Yet, under the influence of the Polish Prince Adam Czartoryski, Alexander I. encouraged education and enterprise. The cultural influence of Vilna University produced the poet Mickiewicz and others.

In the closing years of Alexander's reign events in Poland cast their shadow before them, and in answer to political conspiracies Novosiltsov, formerly adviser to the Grand Duke Constantine as governor of Poland, upon his transfer to Lithuania initiated the persecution of liberal thought. Under the new Tsar, Nicholas I., the plan of the reunion of the two states was definitely rejected, his ukase of 1839 making of Lithuania the "Sievero-Zapadny Krai" (North-western Province).

As a result of the Polish rebellion of 1830, in which the peasantry, whether Lithuanian, Polish or White Russian, did not take so great a part as the upper classes, the university of Vilna was abolished in 1832, its faculties being transferred in bulk to Kiev and in part to Kharkov and St. Petersburg; Catholic and Uniate Church property sequestrated from 1836 onwards; the Lithuanian Statute, which had remained the law of the land through four centuries of union with Poland, replaced by the Russian code in 1840, while prominent natives, debarred from public service in their own country, were forced to emigrate or exiled to Siberia. Even the reign of Alexander II. bringing no changes in Lithuania and only slight modifications in the kingdom of Poland, the revolutionary spirit led to the great rebellion of 1863.

This abortive insurrection in which the Polish nobility and intelligentsia were primarily involved, though the Lithuanians also took a prominent part, led to the suppression of the printing of Lithuanian books by the dictator Gen. Muraviov, which measure was only abolished in 1904.

The Tsarist policy was henceforth perfectly consistent in that it strove to make Lithuania a genuine part of Russia and sought to extirpate Polish culture beyond the frontiers of the kingdom. Under these circumstances began in 1864 the great persecution of the "croyance Polonaise," as the Catholic faith was called. However fiercely conducted, it failed, though the Uniate Church with slighter powers of resistance was now completely forced into Orthodoxy, its ceremonial being definitely forbidden and its monasteries dissolved. The attack upon Polish property by the edict of 1865, though never fully applied, prevented the increase of Polish-owned estates for 40 years. The additional taxation of 5% on all incomes derived from land, imposed in 1869 and not repealed until the reign of Nicholas II., together with the suppression of the Polish language in all official matters, served the same ends. By way of reprisal land was taken from Polish owners and given to Russians, and settlements were established for colonization purposes—a measure of this kind taking place as late as 1913—so that proportionately more convicts and political exiles were sent into Lithuania than even into Siberia. The abolition of serfdom without cancellation of the peasants' prerogatives as to pasturage and timber rights served to accentuate class-antagonism. Further, Lithuania was specially excluded from the Zemstvo system which was introduced into Russia in 1864.

An early expression of reviving Lithuanian national consciousness was the appearance of the newspaper "Ausra," which, printed in East Prussia, lived for three years, though even in that short period its editor, banished from Germany, had to take refuge at Prague. It was socially significant that he and his political collaborators were drawn of the stock of newly emancipated peasants.

In Prussian Lithuania a craftier policy allowed greater outward liberty, though the process of German colonization, seconded by persecution, restricted the Lithuanian language which was once dominant in East Prussia to barely five districts (Tilsit 38%, Heydekrug 61·9%, Memel 47·1%, Ragnit 27%, Labiau 30%).

Period of Popular Representation, 1905–14.—Russia's defeat in the Russo-Japanese War and the revolution which followed in its wake led, in Sept. 1905, to a measure of reform in the Russian system of government in Lithuania. The first National Lithuanian Assembly, which, however, in the eyes of the Tsar's Government was merely a revolutionary body tolerated for the time being, met at Vilnius (Vilna). It consisted of two thousand delegates who demanded autonomy for the four governments of Vilna, Kovno, Grodno and Suvalki under a Diet at Vilna to be elected by universal, direct, equal and secret franchise. It was the first modern attempt to define Lithuania ethnographically, to respect national minorities and continue the connexion with Russia upon the federative principle.

The Tsar's Government under the electoral statute of 1905 granted the four-class franchise (landowners, peasants, townsmen and workmen) in such wise as to favour the rural population. Only Poles were elected to the first Duma in 1906.

As the imperial ukase which followed the dissolution of the second Duma in 1907 conferred more power upon the great landowners, it was modified as regards Lithuania by a nationality clause which provided that the total of electors of each class should be in proportion to the amount of land possessed by the respective nationalities in the district. This measure, applied by Russian officials, was designed against the Poles and the Lithuanian Nationalists alike, for not even the Progressives who favoured autonomy for Poland contemplated its grant to Lithuania. In the third Duma the five delegates allotted to the non-Russian population of Vilna government were all Poles who joined the Polish party; in Kovno government three delegates were Lithuanians, one was a Pole and one a Jew.

War Period, 1914–20.—The outbreak of the World War in 1914 led to a German invasion which, from midsummer 1915 until Aug. 1919, lay heavily upon the land, which was ruthlessly exploited. To further their own purpose, which was the lasting hold over Lithuania, the Germans after the military collapse of Russia allowed the phantom existence of a State. While a Lithuanian conference met at Vilna (Sept. 18–23 1917), and, in negotiations which dragged until March 1918, petitioned the then German Chancellor, Count Hertling, for the restoration of the country's independence under condition of a perpetual alliance between it and the German Empire ("Bundesverhältnis"), the German clerical party caused the "Taryba," or Council of State, which was then unavoidably still largely under the control of their army of occupation authorities, to offer the Lithuanian crown to Prince William of Urach, a younger member of the Württemberg reigning family. On July 11 1918 he accepted under the title of "Mindove II., King of Lithuania," thus strangely choosing the style of a heathen prince of the 13th century who fiercely resisted the Teutonic order.

While the opposition of the German annexationists thwarted this candidature which the Council of State eventually cancelled (Nov. 2 1918), their delegates at the peace negotiations of Brest Litovsk, in March 1918, on the contrary upheld against Trotsky the authority of the Lithuanian Council of State despite the fact that they had previously refused to regard it as the "legal representative of Lithuania." Their last argument rested upon this, that "Germany had recognized Lithuania's independence only on the condition that the conventions to be concluded, among them, of course, the form of constitution and the choice of a ruler, shall correspond to German interests" (*Nordd. Allgem. Zeitung*, Aug. 1918).

By Nov. 1918, the magnitude of Germany's defeat being no longer in doubt, the Taryba, or Council of State, promulgated a provisional constitution under which it became the Lithuanian Parliament. The supreme power was vested in three persons, A. Smetona, J. Staugaitis, and St. Silingas, who on Nov. 5 1918 invited Prof. Voldemar to form the first independent administration on non-party lines and reach an understanding with the national minorities resident within the still indeterminate frontiers, viz. White Russians, Poles, Jews and Great Russians. Alone the Pan-Polish party reverted irreconcilably to the historic solution of union or federation with Poland. The initial difficulties of setting up an administrative machine on national lines were the greater as the troops of the occupying Power, affected by the revolution which had broken out in Germany, engaged in pillage and highway robbery, which a national militia as yet barely armed had to suppress. The German troops were to a large extent composed of men who had been on the eastern front for some time, who had never themselves suffered defeat by the Allies, and were therefore indisposed to admit themselves beaten. They behaved in the most high-handed, brutal and truculent manner. Although Kovno itself was evacuated in June 1919, and shortly afterwards southern and eastern Lithuania, the area Mitau–Shavli–Taurogen remained in their hands until Dec. 13 of that year. In their withdrawal, by a historic disregard of fair play, the Germans not merely refused to put at the disposal of the Lithuanian authorities the necessary means of defence, but under a military convention allowed the Bolshevist troops to march into evacuated zones at a mean distance of 10 kilometres. They were by this procedure, moreover, directly violating the terms of the Armistice concluded with the Entente Powers on Nov. 11 1918. Thus in lieu of the German appeared the Bolshevist menace.

The Voldemar administration resigned on Dec. 26 1918, the new premier, M. Slezevicius, widening the Cabinet on coalition lines. Prof. Voldemar, whom the precarious situation of the country and the approaching Peace Conference called to Paris, served as Foreign Minister, M. Yčas as Finance Minister, M. Velykis as Minister of War. In Jan. 1919 the near approach of the Bolsheviks to Vilna caused the removal of the Government to Kovno. Owing to this menace of the enemy and disputes over very urgent questions the Provisional National Assembly was elected with difficulty, but in session at Kaunas (Kovno) from Jan. 16–23 1919 it recognized the Council of State ("Taryba") and the Slezevicius Cabinet as the regular Government of Lithuania, which had the confidence of the country. Thereupon, although large stretches of territory were still in enemy occupation, the Taryba voted the provisional constitution, elected A. Smetona President of the State, and composed the statute for the election of the Constituent Assembly by universal, equal, direct and secret franchise according to a proportional system based on d'Hondt's distributive principle which contains elaborate safeguards against the tyranny of the majority. Despite the most painful conditions, national defence began to be organized at first in the form of volunteers and afterwards by regular troops. Under these circumstances the Bolshevist advance reached its culminating point in May 1919, when the Soviet armies occupied Telshi and Shavli in the north and Olita in the south, thus threatening Kovno itself. Until Sept. 1919 fighting took place against the Bolshevist forces, which were successfully cleared out of the northern districts of the country, and until Dec. of that year against the so-called Bermondt troops, and sporadically all through 1920 against Polish units. The Constituent Assembly, or "Seimas," composed of 112 members, met on May 15 1920. The President of the State, the National Council and the Cabinet resigned, and, all power passing to the assembly, the provisional Government gave way to the permanent Government.

Meanwhile the Polish Government's proposal for joint action against the Bolsheviks was rejected pending Lithuania's recognition as an independent state with Vilna for its capital. The state of war with Soviet Russia, however, continued until the Peace Treaty of July 12 1920, whereunder the Lithuanian claim to Vilna and Grodno was recognized by the Bolsheviks and Lithuania received three million rubles in gold and 100,000 hectares of forest land for exploitation.

The Polish war against Soviet Russia continued. The initial victories of the Bolsheviks were followed by defeat and the victorious Poles, under the so-called "rebel" Gen. Zeligowski, on Oct. 9 1920 drove the Lithuanians out of Vilna, which they had temporarily occupied after the retreat of the Soviet armies. This incident leading to an informal war between the Lithuanians and Gen. Zeligowski's so-called mutineers, the matter was taken up by the League of Nations, which strove to establish the fate of Vilna and other disputed areas by means of a plebiscite. An armistice was concluded with effect from Nov. 30 1920. In the beginning of March 1921, direct negotiation between Poland and Lithuania under the auspices of the League of Nations, to be followed by arbitration on unsettled points, was proposed in lieu of the plebiscite and agreed to by all parties.

The independence of Lithuania *de facto* was recognized by Sweden, Norway, England, Esthonia, Finland, France and Poland; *de jure* by Germany on March 23 1918, by Soviet Russia on July 12 1920, by Latvia and Esthonia in Feb. 1921 and by the Argentine Republic in March 1921.

Constitution.—The provisional constitution adopted by the Constituent Assembly on June 2 1920 describes the State of Lithuania as a democratic republic, over which, until the final constitution is established, the president of the Constituent Assembly (A. Stulginskis) rules as temporary President, whose acts need to be countersigned by the premier.

Territorial Possessions.—Ethnographical Lithuania (approximately as defined in the Soviet Peace Treaty of July 12 1920) includes:—

(1) The whole of the former Russian province of Kovno (20,260 sq. km. and 1,857,000 inhabitants);

(2) The province of Vilna, minus the districts of Disna and Vileika (29,818 sq. km. and 1,538,000 inhabitants);

(3) Part of the province of Grodno north of the Niemen river and the narrow hinterland of Grodno city in the south (say 2,000 sq. km. and about 100,000 inhabitants);

(4) The province of Suvalki, minus the southern parts of the districts of Suvalki and Augustovo (Augustow) (10,000 sq. km. and 615,800 inhabitants);

(5) Parts of the former province of Courland between the old German frontier and the Holy Aa river, as also part of the district of Illuxt.

Including the Memel area, to which the people aspire as an outlet to the sea, it may be said that 4,295,000 souls inhabit ethnographical Lithuania. Of these only 1,844,000 residents of Kovno are fully under State control plus from 33 to 50% of the 615,000 persons inhabiting Suvalki province.

The remainder of the Suvalki population is under Polish governance, as also nearly the whole of the 1,471,000 persons inhabiting Vilna province and the 139,000 inhabiting Grodno province. In the Memel area 165,000 persons are under temporary French occupation; in the Polangen district 3,000 under Lettish governance. In the disputed Illuxt area 53,000 persons are also under Lettish rule. Thus not less than 1,143,500 subjects, or just one-half of the total, are temporarily or permanently not under the jurisdiction of the Lithuanian State.

Religion and Education.—In the Vilna, Kovno and Suvalki provinces Roman Catholics make up 75·2% of the population, Jews 12·5%, Orthodox 8·9% and Protestants and Calvinists 3·5%. Elementary school education (4 years' teaching) is not yet compulsory. There is a higher training course, but as yet no university. Secondary schools are few, one foreign language being compulsory. The official language being Lithuanian, Russian is almost universally understood. Polish, Yiddish and German are widely spoken.

Economics.—In the provinces of Vilna, Kovno and Suvalki 71·4% of the population belong to the rural class, industry and commerce absorbing 12·8%. Of the 82,000 sq. km. in question before the war 40% belonged to the large estate owners, 10% to the Government and the churches, 50% to the farmers. Of the last-named class 30% owned less than 3 hectares, 60% from 10–50 hectares, 3% from 3–10 hectares, 1% from 50–100 hectares, while 17% of all the villagers were landless. An agricultural reform initiated by the provisional Government aims at the distribution of the fallow lands of the large estates and the better exploitation of the land.

Agriculture.—Lithuania is essentially an agricultural country in which the soil is richest in the old Kovno Government, north of Suvalki and north-west of Vilna. Grain of all kinds (chiefly rye), clover and potatoes are grown. Flax is mainly grown in the northern districts of Kiejdani, Shavli, Ponevyez and Rakishki.

In 1920 the territory administered by the Lithuanian Government (5,200,000 hectares out of 8,500,000 hectares) yielded:—

Rye	10,000,000 cwt.
Wheat	1,500,000 "
Barley	3,000,000 "
Oats	5,000,000 "
Potatoes	20,000,000 "
Peas	1,200,000 "
Flax seed	700,000 "
Harl	730,000 "

As regards live-stock raising there were in 1920 in the same area:—

Horses	380,000
Cattle	865,000
Sheep and Goats	730,000
Swine	1,400,000

Forests.—Twenty-five per cent of the whole extent of Lithuanian territory is covered by forests, 80% of which consist of needle-bearing and 20% of leaf-bearing trees. The country is thickly wooded (the areas under timber comprising some 25·5% of the whole against 35% fifty years ago). The most heavily wooded districts are in the southern and eastern parts (fir, pine, birch, aspen, alder and oak). Sixty per cent of the present output of timber being needed for internal consumption, about 200,000 festmetres are available annually for export. Coal has not been found, but peat may be exploited under favourable economic conditions.

Manufactures.—In 1913 there were 5,140 industrial establishments in Lithuania with 33,000 workmen and a yearly productive value of 62 million Russian (gold) rubles. During the war the larger industrial establishments were destroyed.

Exports and Imports.—In 1920 were exported farm products, live stock, fowls, timber and flax valued at 501,797,000 marks, and imported foreign products and machines at 428,728,000 marks.

Lithuania requires primarily manufactured fertilizers and agricultural machinery and salt, sugar, herrings, manufactured articles, etc.

Towns.—The towns in order of importance are in political Lithuania: Kovno (Kaunas) with about 60,000 inhabitants, Ponevyez with 20,000, Shavli (Šiauliai) with 8,146, Vilkomierz with 8,000. The ethnographical claim in its extreme form would include Vilna (Vilnius) with about 170,000 inhabitants, Grodno (Gardinas) with 61,000, Memel (Klaipeda) with 32,000, Suvalki with 31,600.

Roads.—The only first-class roads are: Kovno–Vilkomierz–Dvinsk; Kovno–Mariampol–Suvalki; Mitau–Shavli–Tilsit. Roads were purposely neglected under the Russian régime in the frontier area, Kovno itself being then a first-class fortress.

Railways.—The lines which existed under the old Russian Empire were converted by the Germans during their occupation from Russian 5-ft. gauge to German 4 ft. 8½ in. The total length is 720 kilometres. Double lines are: Wirballen–Kovno–Koszedari; Janov–Shavli; Koszedari–Jewie (to Vilna). Single lines are: Koszedari–Janov–Shavli–Murajevo–Lusha (to Mitau); Radzivilishki–Ponevez–Jalovka–Kalkuni (which joins the Vilna–Dvinsk double line at Kalkuni); Murajevo (Musheiki)–Ringen (to Mitau with ballasted track for second line); Suvalki–Pinsk–Olita–Daugi (to Orani), which joins a double line at Orani. The following new single lines totalling 288 km. were built by the Germans during their occupation: Shavli–Pozeruni (to Tilsit); Shavli–Meiten (to Mitau); Memel–Bajohren–Skudi (to Prekuln and Mitau).

Waterways.—The length of the Niemen from Olita to the German frontier (village of Polejki) is 266 kilometres. The river, which is navigable for 8 months in the year, has been internationalized under the Treaty of Versailles as far as Grodno (extreme point for steamer navigation). Its width varies from 75 to 325 yd. as far as Kovno and thence to the Baltic from 185 to 650 yards. Its average depth is 3 ft. and its average speed of current 2½ m. per hour. The Vilya is navigable from its mouth at Kovno to Janov (40 kilometres). The Niaviaza is navigable from its mouth, northwest of Kovno, to Bobri (25 kilometres).

Currency, Weights and Measures.—Alone among the Baltic states Lithuania had as yet no national currency in 1921. Legal tender were the "Ostmark" (originally introduced by the German Military Administration of the Army of Occupation, "Militärisches Verwaltungsgebiet Ober-Ost"), which in Lithuania proper ranked *pari passu* with the German "Reichsmark," and other German fiduciary currency to a total not less than one milliard marks.

The weights and measures were still Russian, but the introduction of the metric system was contemplated in 1921.

Laws.—In all cases where special enactments had not yet been made the laws of the former Russian Empire were considered valid.

Political Parties.—The Seim (Constituent Assembly) in existence in 1921 was elected in April 1920 by universal, direct, equal and secret franchise. All men and women who were 21 years of age and all soldiers who were 18 years of age were entitled to vote. The Seim comprised 112 members, of whom 59 were Christian Democrats, 29 Popular Socialists, 14 Social Democrats, 6 Jewish party, 3 Polish party and 1 German party. The Peasants' party combined with the Popular Socialist party, while the "Workers' Federation" and the "Yeomen's Union" (these being but the small landowners) formed part of the Christian Socialist governing *bloc*. Legally recognized parties which were not represented in the Seim were: (*a*) the Progressive party (Pajanga); (*b*) the Liberal party (known as the Santara Union); (*c*) "Landlords' Association" (which comprised only large landed proprietors). The Social Revolutionary and the Communist parties were not legally recognized and were unrepresented. The president was chosen by the governing party, the Christian Democrats; the first vice-president by the Popular Socialists; the second vice-president by the Christian Democrats.

The Government which took office in June 1920 was a coalition Cabinet of the Christian Democrat and Popular Socialist parties plus three ministers who did not belong to any party. The Opposition was formed of the Social Democrat and the Polish parties. The prime minister was Dr. K. Grinius (Peasants' Union); Minister of Finance, Trade and Commerce and Communications, E. Galvanauskas (non-party); of Foreign Affairs, Dr. J. Purizkis (Christian Democrat); of War, Dr. Shimkus (Popular Socialist); of the Interior, K. Skipitis (Santara); of Education, K. Bizauskas (Christian Democrat); of Justice, V. Karobis (non-party); for Jewish Affairs, M. Soloveicik (Democrat); for White Russian Affairs, D. Siemasko (non-party); and of the department of Agriculture, Alexa (Popular Socialist).

Army.—The serious disadvantage under which the Lithuanian army suffers is the shortage of the officer class, but the sturdy, phlegmatic peasants should, under good leadership, make good fighting material. The army in 1921 was organized in 4 divisions, each division normally containing 3 regiments of infantry, 3 field batteries and 1 squadron of cavalry. The total number of units were, in the infantry, 28 regular battalions, 1 reserve battalion and 3 battalions of Frontier Guards; in the cavalry some 8 squadrons; in the artillery 9 field batteries; in the engineers 1 electro-technical and 1 auto battalion, a pioneer company and a railway operating company plus an aviation corps, or a total of about 1,200 officers and 35,000 men. This was the maximum expansion possible under the conditions prevailing in 1920–1, of a crisis in the political relations with Poland; but the maintenance of this establishment for any length of time appeared to be impracticable, since on this basis the army absorbed close on 60% of the revenue of the State, viz. some 460 million German marks.

Climate.—The climate of Lithuania is, on the whole, more moderate than that of other parts of Russia in the same latitude. Winter sets in normally at the end of Nov. and lasts till the end of March. The rivers are frozen from Dec. to Feb. Spring begins at the end of March. June, July and Aug. are considered the summer months. Autumn begins in Sept., light frosts occurring at its close.

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LIVERPOOL, England (*see* 16.804).—The pop. of the city had increased from 684,958 in 1901 to 753,353 in 1911. The municipal area, which covered 16,619 ac. in 1911, was extended in 1913 so as to include the townships of Allerton (1,589 ac.), Childwall (830 ac.), Little Woolton (1,389 ac.), and Much Woolton (792 ac.), making a total area (exclusive of 2,883 ac. of river-bed) of 21,219 acres. The estimated pop. of this area in 1919 was 781,948 and the ratable value in 1920–1 was £5,114,256. The death-rate per thousand was 17 in 1919—almost the lowest on record for the city—but the death-rate from zymotic diseases remained proportionately high (0·96 per 1,000) and, under the insistence of the Home Office, it was decided to establish an experimental disinfecting station for the disinfection of all imported dangerous wool.

The city in 1921 was divided into 39 wards with 36 aldermen and 111 councillors, and the total number of municipal electors according to the 1920 register was 283,760. The 11 parliamentary divisions are:—the Scotland, Exchange, W. Toxteth, E. Toxteth, Edge Hill, Everton, Kirkdale, Walton, W. Derby, Fairfield and Wavertree. The electors numbered 355,755.

Under the Housing of Working Classes Acts, 1890–1909, 1,510 insanitary dwellings were demolished during 1910–5. During the period 1916–9, owing to conditions created by the war, no proceedings were taken, but in 1920 the Housing Committee were again giving attention to the pre-war schemes for demolition and rebuilding in various insanitary areas and had entered into contracts for the erection of 2,730 houses on the Larkhill Estate and 2,000 at Allerton.

The water-supply up to 1920 was derived in the proportions of 65% from Lake Vyrnwy, Riverton 29% and wells 6%, but, to meet the urgent need of an additional supply, the construction of a third main pipe from Lake Vyrnwy (to be followed by a fourth) was decided upon and the crossing of the Mersey is to be effected by laying pipes in the bed of the river. The average daily supply from all sources in 1919 was approximately 43,000,000 gallons.

Among important buildings completed since 1910 are the prominent Royal Liver building of 17 storeys and a tower 295 ft. high and the Cunard building, both near the landing-stage. The latter, in the Roman Renaissance style of the Farnese Palace at Rome, was opened in 1916. On July 5 1921, the Prince of Wales unveiled the bronze equestrian statue of King Edward VII. by Sir W. Goscombe John, erected on the river front between the Cunard building and the landing-stage.

At Liverpool University the foundation stone of a new engineering laboratory was laid on Oct. 22 1910. The Liverpool School of Tropical Medicine, in the same year, endowed a chair known as the Dutton Chair of Entomology, and in 1911 the cost of building a central hall for the Undergraduates' Union was undertaken by Capt. Gilmour. Sir William Hartley presented a wireless telegraphic installation for the purpose of experiment and research in 1913, and a plant for tests in connexion with the erosion of metals was established. A certificate in architectural design and a diploma in ophthalmic surgery were also instituted.

The work of building the cathedral (*see* Architecture), which had practically ceased during the war, was being vigorously carried forward in 1921. The original design has been considerably revised and modified by the architect, Giles Gilbert Scott, A.R.A. Owing to the exigencies of the site on St. James's Mount the building lies north and south, the rubrical "east" thus pointing south. The general plan, which is marked by much individuality, consists of a great central space 200 x 72 ft., formed by a central tower with the crossings of two pairs of transepts; a choir in three bays; and a nave

—the whole to have an interior length of 480 feet. The central tower will be 335 ft. in height, and the principal portal of the cathedral will be at the west side of the tower, not at the traditional "west end." The stone is Woolton red sandstone, which weathers to a greyish pink in a smoky atmosphere. The Lady chapel, 114 ft. long, 35½ ft. wide and 58 ft. to the vaulting, was completed and consecrated in 1910 and has been embellished by the gift of a reredos from designs by Mr. Scott. It was decided in 1912 to proceed with the building of the choir, chapter-house and S.E. transept: the chapter-house with its copper roof was built by 1915 and the walls and vaulting of the choir and transept were completed in 1921.

The Council acquired the Harthill estate of 32½ ac. (1913), Walton Hall estate of 130½ ac. (1913), Walton Wood estate of 62 ac. (1917), and the Princes Park of 44½ ac. (1918); and in 1921 the total acreage of parks and open spaces within the municipal area was 1,386 acres.

The Mersey Docks and Harbour Board were in 1921 carrying out various important schemes of improvement of the port, the expenditure involved being about £10,000,000.

In 1906 the Board obtained parliamentary powers for the construction of new docks at the N. end of their Liverpool estate. The work was suspended during the war but has since been pressed forward. The scheme embraces:—(*a*) the construction of a great vestibule dock 1,070 ft. by 130 ft. to provide a depth of water of 48 ft. at high water of spring tides and having a river lock entrance; (*b*) a lock 645 ft. long and 90 ft. wide (opened in 1921) between the new dock and the adjacent Hornby dock; (*c*) two branch docks (to be called Gladstone dock No. 1 and No. 2) opening out of the vestibule dock and having three-storey sheds on the N. and S. sides. The Board also acquired 340 ac. of foreshore in Seaforth and Waterloo to the northward to meet future developments.

With the object of providing further facilities for the embarkation of passengers on ocean-going and local steamers, parliamentary powers were obtained in 1921 for the extension of the Prince's landing-stage by 500 ft.; and (to improve the cross-river ferry traffic) a small extension of the George's landing-stage at its southern end was in hand in 1921. Considerable progress had also been made with a scheme for electrification of the whole of the dock estate to provide, eventually, not only light but power for all the mechanical appliances. The cable work, including switch gear for the supply of the whole of the northern section of the estate, was practically complete in 1921 and involved the laying of about 40 m. of main cables between Sandon and Hornby docks.

To provide ample accommodation for the rapidly growing oil trade of Liverpool, the Board set apart a large area of land known as the "Parkhill and Dingle Estates" at the extreme S. end of the dock estate, and of this 25 ac. had in 1921 been leased to leading oil companies for the erection of oil storage tanks. Some of these were already in use in 1921 and when all are erected the tanks will provide storage for 140,000 tons of oil. Pipe lines to oil berths in the Herculaneum dock will enable tank steamers to discharge direct into the storage tanks. The reclamation of the foreshore and the extension of the Herculaneum river wall, undertaken in 1921, will provide further berths for oil steamers and barges immediately opposite the oil installation.

To meet the requirements of the East India and Colonial wool trade, of which Liverpool has become the chief centre in the United Kingdom, two immense warehouses have been built: that of Great Howard Street has "dead" storage capacity for 150,000 bales and that in Love Lane (completed in 1920) of 85,000 bales. Important work in connexion with the provision of stone revetments and training banks in the sea channels—the Queen's and Crossby—leading to the port was in progress in 1920. The proposal to construct a bridge between Liverpool and Birkenhead was revived in 1912 but, in 1921, was still being studied.

LLANDAFF, HENRY MATTHEWS, 1st Visct. (1826–1913), English politician (*see* 16.828), died in London April 3 1913.

LLOYD, CHARLES HARFORD (1849–1919), English organist and composer, was born at Thornbury, Glos., Oct. 16 1849. He was educated at Rossall and at Hertford College, Oxford, where he was one of the founders of the Oxford University musical club, becoming its first president. In 1876 he became organist of Gloucester cathedral, in 1882 organist of Christ Church cathedral, Oxford, and in 1892 precentor and musical instructor at Eton. In 1914 he became organist at the Chapel Royal, St. James's. Dr. Lloyd was well known both as a teacher and as a composer, his best-known work being the cantata *Hero and Leander*, composed for the Worcester festival of 1884. He also wrote much church music. He died at Slough Oct. 16 1919.

LLOYD GEORGE, DAVID (1863–), British statesman (*see* 16.832). After the constitutional conference of 1910 had failed, Mr. Lloyd George took his full share in the party campaign which ushered in the second general election of that year. He was especially sarcastic about the proposal for a Referendum, which was put in the forefront of Unionist policy. "A prohibition tariff against Liberalism," he called it. After the general election of Dec. 1910, which showed that the campaign of the Liberals against the Lords' veto had merely enabled them to maintain the somewhat precarious position established by the general election of the previous Jan., Mr. Lloyd George left the prosecution of the Parliament bill, and the subjugation of the Lords by means of a threat of promiscuous swamping, to the Prime Minister and other colleagues; and he devoted himself to the enthusiastic forwarding of his social programme, which was to show Labour that he and his party could and would do more to raise the condition of the workers than their professed advocates. His budget, which, owing to a realized surplus of £5,600,000, did not raise taxation, provided £1,500,000 for sanatoria for consumptives and £250,000 for the payment of members—a cause dear to the heart of Labour. This latter provision was carried in Aug. after a somewhat perfunctory Unionist protest in debate, by a majority of nearly a hundred.

But his principal contribution to social reform was in his National Insurance bill, providing insurance for all workers by means of contributions from employers, employed and the State. By it there was set up not merely unemployment insurance, administered under the Board of Trade, but National health insurance, which imposed a somewhat complicated card and stamp system on all employments, including even that of domestic service. In order to work the system, the coöperation of the doctors was essential, and the terms offered were hardly attractive. Mr. Lloyd George soared to uncommon heights of eloquence in pressing his scheme upon Parliament and the country, appealing earnestly for a measure which would relieve undeserved misery, help to prevent much wretchedness, and arm the nation until it conquered "the pestilence that walketh in darkness and the destruction that wasteth at noonday." Though benevolently received at first, the bill soon met with the banded opposition of the doctors, who protested that the terms offered the profession were absurdly inadequate; and it was far from popular with either the employing or the employed class, both of whom resented the liabilities imposed upon them, and the cumbersome process of stamp-affixing. This general unpopularity cost the Government some seats at by-elections; but Mr. Lloyd George stood firm, and the bill duly became law. But the doctors held out even after the bill was passed. The negotiations, carried on for more than a year, produced no agreement, and it looked as if the Act would break down through a boycott by the medical profession. But owing to Mr. Lloyd George's mingled diplomacy and tenacity, the minority in favour of acceptance slowly grew, and a sufficient number of panel doctors were registered to bring the medical benefit into effect on the appointed day early in Jan. 1913. Thereafter the opposition to the Act gradually died away, as its benefits to all parties became evident. A year later, in Feb. 1914, Mr. Lloyd George could claim that, out of 22,500 general practitioners in Great Britain, over 20,000 were on the panels.

In the discussions of the two bills going forward in the years 1912–4 under the Parliament Act, the Irish Home Rule bill and the Welsh Church bill, Mr. Lloyd George did not take a prominent part, though he was heartily in favour of both. Indeed he had been throughout one of the principal promoters of disestablishment in Wales, and, when he did speak, advocated it with almost apostolic fervour; but the conduct of the measure was in the hands of Mr. McKenna. This cause appealed to him not merely on its religious, but also on its social, side. It was, however, another social change, that affecting the land, to which, after National Insurance, he devoted his principal attention from the autumn of 1912 down to the outbreak of the World War. He even accused his opponents of dragging the red herring of Ulster across the trail of his projects of land reform. His earliest political campaign in Wales had been aimed against the landed interest; and he had made a further move in that direction in the taxation of land values in his budget of 1909. Though the Prime Minister, Mr. Asquith, formally disclaimed the notorious specific of advanced land reformers, the single tax on land, he sanctioned an unofficial committee of inquiry which Mr. Lloyd George desired to institute in order to investigate rural grievances. The first essential condition of every social reform, Mr. Lloyd George said at Aberdeen in Nov. 1912, was change in the land system, which was still in its essence feudal. The first purpose of the land, he said, should be the provision of sustenance and shelter for the cultivator. The movement attracted a considerable amount of public support; and he found it a convenient subject to which to direct public attention after the shock to confidence produced in the spring of 1913 by the Marconi revelations, which showed, in the general estimation, a reprehensible carelessness in the private financial operations of the Chancellor of the Exchequer (*see* ENGLISH HISTORY). He advised purists to recall the manner in which landlord parliaments had bartered away the common land. The Liberals, he said at Sutton-in-Ashfield in Aug., were about to march against the central position where land monopoly was entrenched. During the autumn he made many eloquent speeches in different districts of England and Wales in support of his movement, denouncing agricultural conditions, bad wages, atrocious housing, damage to crops by game, insufficient prospect of small holdings; and also promising relief to harassed leaseholders in towns. At Swindon on Oct. 22 he detailed a ministerial scheme, which should recast the whole conditions of land monopoly. The main provision was the establishment of a Ministry of Lands, with comprehensive powers for the supervision of everything connected with land, and with a number of roving or local commissioners by whom in a general way these powers would be exercised. The Unionists scoffed at the idea of these hordes of despotic officials; and the course of events in 1914 prevented the scheme from ever seeing the light as a Government bill. But the spirit in which Mr. Lloyd George pursued his campaign was shown in a speech at Pwllheli in December. The landlord, he said then, was no more necessary to agriculture than a gold chain to a watch; a breath of liberty must be brought into the villages.

To realize the promises of these social campaigns Mr. Lloyd George required ever-increasing millions from the national purse. Indeed he may fairly be charged with having turned the Treasury from a department to control and limit expenditure into a spending department. Between the time when he took over the Exchequer in 1908 from Mr. Asquith and his last budget before the war, that of 1914, the national revenue and expenditure increased by about £55,000,000, reaching in 1914 nearly £210,000,000 in all. Besides the social expenditure, the other main item of increase was, of course, the navy estimates; and Mr. Lloyd George, in an interview published on the first day of 1914, declared that Liberalism would be false to its trust if it did not seize the opportunity of what he asserted to be the improvement in Anglo-German relations to diminish expenditure on armaments. Happily, though many Liberal associates responded, the common sense of the Cabinet and of the public prevented any such suicidal operation, and the navy estimates laid before the House were the highest on record. To meet the increased expenditure Mr. Lloyd George, who had been content to mark time in his budget for 1913, made, in 1914, new proposals which carried to a further pitch the principles of the budget of 1909. He had to meet a deficit of £5,330,000, which he increased to £9,800,000 by further larger grants for social purposes, such as education, health and insurance. To procure this heavy additional sum he took £1,000,000 from the Sinking Fund and then fell back once more on income tax, supertax and death duties. There were to be increases of the higher grades of income tax, which was to rise to 1s. 4d.; supertax was to begin with incomes of £3,000, rising to the same maximum of 1s. 4d.; and the rates of death duties were to be raised from all estates over £60,000, rising to a maximum of 20% for a million. There was also to be a national system of valuation for local taxation, including the taxation of site values. An outcry from Liberals no less than Conservatives caused him to abandon the extra penny on the income tax, so that the maximum would be only 1s. 3d., and therefore to postpone many of the grants for social purposes for a year. But, with some modifications, the rest of the budget passed, not without difficulty, into law.

With all these schemes of social betterment in his head he was eager for short-cuts in the matter of Irish Home Rule. At Huddersfield on March 21 he violently attacked the House of Lords and the province of Ulster, denounced the doctrine of "optional obedience," and dwelt on the necessity of settling the Home Rule controversy in order to open the way to deliverance from social wretchedness. At the Mansion House in July he insisted that in view of the threatened war between capital and labour at home and between Nationalist and Orangeman in Ireland, it was the duty of responsible men of all parties to work for peace; and he himself took part in the abortive Buckingham Palace Conference, and impressed his opponents with the sincerity of his desire for an agreed settlement.

The sudden approach of the World War threatened an even more complete end to his social Utopias. Accordingly, in spite of the fact that he had made in 1911, at the time of the Agadir incident, a spirited declaration that Great Britain was determined at all hazards to maintain her place among the Great Powers, he was slow to realize her peril and her duty in the last days of July, and clung, down to a late hour, to the policy of neutrality. When once, however, he was convinced, by the German violation of Belgium, that honour and justice and human liberty demanded British intervention in arms, he reverted to his position of 1911, and was from the beginning to the end the most resolute of all British ministers to prosecute the war to a triumphant conclusion.

As Chancellor of the Exchequer it was his duty to provide at once against a financial collapse. Ever since the budget of 1909 there had been a coldness between him and the natural friends of the Exchequer, the bankers and merchants of the City of London; but he and they buried the hatchet at once, and he had their advice and aid in the measures which were promptly taken. He availed himself liberally of the assistance of his friend, Lord Reading, in this connexion, with excellent results. On Nov. 17 1914 he introduced the first war budget. He had to meet a deficit of nearly £340,000,000; and he determined to follow the precedents set by Pitt and Gladstone and to raise a considerable portion by taxation. Accordingly he doubled the income tax and supertax; added an extra ½d. a half-pint on beer; and raised the tax on tea by 3d. a pound. He calculated that in a full year his new taxation would provide over £65,000,000, and for the current year he raised £2,750,000 by a partial suspension of the Sinking Fund. To meet the remainder of the deficit he announced a War Loan of £350,000,000 at 3½% issued at 95. Moreover, in order to further the recruiting campaign he made eloquent appeals this autumn to those sections of the people with whom he was peculiarly associated, to Welshmen at the Queen's Hall in London and at Criccieth, and to the Nonconformists at the City Temple. He dwelt on his own record as a man of peace; but insisted that peace could not have been had this August without national dishonour. If treaties could be disregarded as "scraps of paper," why should any regard be paid to bank-notes and bills of exchange? He appealed to the great principles of Duty, Patriotism, Sacrifice. Peace at any price was not a Christian principle. The only way to establish peace on earth was by making the way of the peace-breaker too hard for rulers to tread.

Early in the next year, 1915, Mr. Lloyd George attended a conference of finance ministers in Paris, where it was agreed that each of the Allies should bring to the common cause that which they were most competent to supply, without reference to any principle of equal sharing by all. This was one of the first of those services to the cause of more intimate coöperation among the Allies which he was to make peculiarly his own in subsequent years. There was no change of taxation in his budget this spring. He bent his whole energies this year to the increase of munitions of war, wherein British supplies were lamentably deficient. He first sounded the note on March 9 in introducing a new and drastic Defence of the Realm bill, whose object was the mobilization of industrial resources, and which gave Government wide powers of commandeering factories capable of turning out munitions. He called a conference of trade-union representatives on March 17 with a view to preventing strikes and stoppage of work and removing all restrictions on output; and announced that Government would limit the profits of employers. He pointed to drink as one of the great drawbacks to increased output. "We are fighting," he said, "Germany, Austria and drink; and as far as I can see the greatest of these three deadly foes is drink." The regulation of drink was relegated to a Board of Control with wide powers. But, in the face of a minimizing speech from Mr. Asquith at Newcastle, Mr. Lloyd George enlarged in the House of Commons on the absolute necessity of an enormously increased output of munitions, and of munitions of a different kind. Public opinion strongly supported him, with the result that, in the Coalition Ministry which Mr. Asquith formed in May, a new department of munitions was created, with Mr. Lloyd George as Minister of Munitions.

He flung himself with ardour into this new work; appealed for and obtained the coöperation of eminent men of business and experts, divided up the country into 10 munition areas, went in person to the great centres of trade and manufacture, Manchester, Liverpool, Cardiff, Glasgow, and urged the imperious necessity of setting to work as one man, of removing all limiting restrictions, of planting the flag on the workshops. He was indefatigable in conferences with the unions to persuade men to consent to abrogate the Eight Hours' Act and to consent to labour dilution, and to suspend all hampering rules, promising that all should be restored in their integrity after the war. He had a considerable measure of success, owing largely no doubt to the confidence felt by the working-men in a minister who had devoted himself so whole-heartedly to social betterment. He took special powers in the various Munitions Acts to deal summarily with labour difficulties in the factories. Meanwhile, all over the country, shops that had previously turned out utensils of peace were converted into factories of munitions; new factories were rising, sometimes in the most secluded and unlikely spots, and volunteers, men and women, were pressed into the service. The heartening orations which Mr. Lloyd George had made since the war broke out were collected into a shilling volume in the autumn under the title "Through Terror to Triumph." In this winter and in the spring of 1916 there were troubles on the Clyde, where the very small leaven of revolutionary feeling was concentrated; but the strong measures, including the arrest of six ringleaders, which Mr. Lloyd George and his Munitions Ministry took, brought appeasement before long.

His absorption in his new and engrossing work did not leave Mr. Lloyd George much leisure for dealing with other aspects of the critical situation; but he made a strong speech in May in favour of the second and comprehensive Military Service bill of 1916, in which he said that he would rather be driven out of the Liberal party and indeed out of public life than have on his conscience that he opposed a bill calculated to supply the men who, in the opinion of the military authorities, would make all the difference between defeat and victory. No country, he maintained, had saved itself from great military peril without resort to compulsory service. A call was also made by his ministerial colleagues on his powers as a peacemaker after the Dublin rebellion had convinced Mr. Asquith that the system of Irish government had broken down and that there was a unique opportunity for a new departure. He was authorized to put himself in communication with all Irish parties and endeavour to promote a settlement. Accordingly in June he came to a preliminary arrangement with both Nationalists and Ulstermen, on the basis of bringing the Home Rule Act into immediate operation, and of introducing an Amending bill to cover only the period of the war and a short interval after it, during which the Irish members were to remain at Westminster and the six Ulster counties to continue under the Imperial Government. Neither southern Irish Unionists nor English ministers were happy about these proposals; and some small changes made to conciliate them were taken by Mr. Redmond as a ground for abandoning the negotiations, though Mr. Lloyd George maintained that the arrangement was still one that might well be accepted.

Meanwhile Mr. Lloyd George's relations to the war had become still more intimate and responsible. On the sudden death of Lord Kitchener, it was felt necessary to instal in the War Office a statesman on whose determination and energy both the nation and the Allies could rely; and Mr. Lloyd George had now come to fill so large a space in the civilian administration of the war that no other choice would be acceptable. He took Lord Derby, the hero of the voluntary recruiting campaign, as his Under-Secretary. The spirit in which he proposed to administer his office was shown in an interview which he granted in Sept. to an American journalist. Britain, he said, had only begun to fight. The British Empire had invested thousands of its best lives to purchase future immunity for civilization. After all these sacrifices "the fight must be to a finish—to a knock-out"—a view which, when it was challenged, the House of Commons warmly supported. Desiring to promote the war in this spirit, he showed justifiable anxiety both about the number of exemptions allowed under the Military Service Acts and about the unsatisfactory results of recruiting in Ireland. But what gave him the keenest anxiety was the defective constitution and limited authority of the War Committee of the Cabinet. It was too large, it did not meet sufficiently often, it was subject to the over-ruling of the Cabinet, and its chairman, Mr. Asquith, was overburdened with other duties, including the leadership of the House of Commons, and had hardly the temperament of a resourceful and enterprising controller of war. Public opinion, in the press and in the Parliamentary War Committees, was becoming mobilized in this sense. Accordingly, on Dec. 1 Mr. Lloyd George wrote to Mr. Asquith demanding, on threat of resignation, that the conduct of the war should be placed in the absolute control of a small committee of four, sitting day by day, including himself but not including Mr. Asquith. In the negotiations which followed and in which Mr. Lloyd George made some concessions in order to win Mr. Asquith if possible, it became clear that the result would be to transfer the main conduct of the war from Mr. Asquith to Mr. Lloyd George. This was eventually effected by the formation of a Ministry under Mr. Lloyd George, with Mr. Bonar Law as his partner, and with the support not only of the Ministry but of the Labour party, and a large contingent of the Liberals, while Mr. Asquith and his immediate friends remained outside but did not oppose.

Mr. Lloyd George's advent to supreme power was well received, as his reputation as a War Minister had steadily augmented from Aug. 1914 onwards; and by constituting a War Cabinet of four persons in permanent session with full powers, and transferring the leadership of the House of Commons to Mr. Law in order to devote himself to the conduct of the war, he strengthened the good impression of the public. They welcomed also the evidence of determination given by the creation of new departments—Food, Labour, Shipping, Pensions, National Service; by the assumption by Government of control over shipping and mines, and by the appointment of business men and experts to some of the more important posts. They welcomed too his firm reply to the German Chancellor's peace overture: "We shall put our trust in an unbroken army rather than in a broken faith"; and his decision to summon the Prime Ministers of the Dominions to a series of special meetings of the War Cabinet. His popularity was increased by the discovery in Jan. 1917 of a conspiracy in a Derby family of anarchists to murder him and Mr. Henderson, his Labour colleague in the War Cabinet. Three of the family were found guilty at the Central Criminal Court and sentenced to substantial terms of penal servitude. Sympathy was again roused later in the year when it was suggested by a portion of the press that he—one of the most courageous of men—had left London to avoid an air-raid. The offenders apologized and withdrew, agreeing to indemnify the Prime Minister for his costs.

The successive measures taken by the Government in the next two years and a half to carry out its policy of subordinating everything to the prosecution of the war to a victorious conclusion, and of marshalling the whole of the resources of the nation for that one purpose, are detailed in the article on English History. So far as the work was done in Parliament it was carried through mainly by Mr. Bonar Law. Mr. Lloyd George adhered closely to his programme of concentrating his own energies on the day-by-day conduct of the war in the War Cabinet, and in the War Councils of the Allies of which he was so keen a promoter; and he spoke comparatively seldom in the House of Commons save at critical moments, or in order to give Parliament from time to time an authentic statement of the progress of the national cause. But he took upon himself the duty of heartening and inspiriting the nation, and made, as occasion served, eloquent appeals to his countrymen, sometimes by letters and messages, sometimes by speeches in the City of London or in big towns. In these he constantly sounded that note of sacrifice which had been the text on which he had preached in the first of his great war orations, in the City Temple in the autumn of 1914. Thus in Carnarvon in Feb. 1917 he appealed for support to the Government in men, money and labour, in the sacrifices of conveniences and even of comforts. In order to win, Britons must endure more. In the past the sacrifices had been too much relegated to the trenches. He appealed to housewives to see, each one in her own home, that not an ounce of food was eaten beyond the amount laid down by Lord Devonport, the Food Controller. Those who were doing nothing should do something; those who were doing something should do more and all should do their best. Everyone who had got enough land to grow a potato or a cabbage must use it for that purpose. If train services were inconvenient and fares increased, people should remember that the limitation of railway facilities helped the army in France. At Dundee in July he urged the cheerful acceptance of restrictions which, he declared, could not yet be regarded as privations. In a message to the nation at the beginning of the critical last year of war, he wrote:—

> The sacrifices which the men—and the women also—are making at the front we all know. Despite all that they have gone through, they are still facing frost and mud, privation and suffering, wounds and death, with undaunted courage, that mankind may be freed from the tyranny of militarism and rejoice in lasting freedom and peace. No sacrifice that we who stay at home are called to make can equal or faintly approach what is daily and hourly demanded of them. So long as they are called upon to endure these things let us see to it that we do not take our ease at the price of their sacrifice.

He appealed during this year to Labour men to surrender the pledges given them about recruiting, to farmers to concentrate on potato-growing, to women to abandon a life of ease and come upon the land, and to munition workers to remember their exemption from the dangers of the front and not imperil the national cause by wanton strikes.

At the same time he never failed to proclaim that victory could be won if all did their best and maintained a stout heart. At the Guildhall in Jan. 1917 he told his hearers that the feeling of the Allies at their recent conference in Rome was that if victory was difficult defeat was impossible. The Allied peoples were looking more and more to Great Britain. She was to them like a great tower in the deep: the hope of the oppressed and the despair of the oppressor. While there was much, he told the people of Carnarvon in Feb., in the existing state of affairs—especially the "piratical devices" of the German submarine—to cause anxiety, he had never had any doubt of ultimate victory; neither had he any doubt that, before we reached it, there were many broad and turbulent rivers to cross which the nation must help to bridge. Even at the period when the losses from submarines were greatest, he refused to be daunted and reassured the country by his confidence in the Admiralty's plan of defence, and in the adequacy of the food supplies. He constantly declared that British difficulties were declining while those of the enemy were augmenting. He welcomed, in April, the entry of the United States into the war as not merely a vindication of the character of the struggle as a great fight for human liberty, but also as an assurance that the war would be effective and successful and would result in a beneficent peace. In her, he said in Oct., the Central Powers had to deal with a country of infinite resources that had never yet been beaten. He set her advent against the defection of Russia, which was a bitter disappointment to him, as he had hailed her revolution as a sure promise that the Prussian military autocracy would, before long, be overthrown, and as he clung, till the establishment of Soviet government in Oct., to the hope that the demoralization of her armies was not beyond repair. Still, although his war plans and those of the Allies, which had been based on the assumption that the Germans would have to retain large forces on the eastern front, were ruined by her cessation of fighting, he could point in Dec. to the number of battles fought during the year on the western front in which the Germans had been beaten, and to the prestige which British arms had won by the capture of Bagdad and Jerusalem.

The critical situation produced by the rapid and victorious German advance in March 1918 called forth all his energy. He had already largely coördinated Allied military operations by means of the Supreme War Council at Versailles; he now, through his colleague, Lord Milner, secured a unity of military command at the front. He sent immediately across to France a large portion of the home defence force—it was complained with some justice that he should have reënforced Sir Douglas Haig with these troops some weeks earlier; he effected a further drastic comb-out from essential industries; he introduced in Parliament a man-power bill of excessive stringency; he sent his most capable and vigorous colleague, Lord Milner, to the War Office; he was urgent with the American authorities to hurry up as many of their troops as possible into the fighting line. The situation was saved, owing mainly to the skilful strategy of Gen. Foch and to the magnificently efficient fighting machine into which Sir Douglas Haig had converted his armies. Accordingly, Mr. Lloyd George could assure the Empire, in a message on the fourth anniversary of the war in Aug., that although the battle was not yet won, yet, thanks to the extraordinary bravery of all the Allied armies, the prospects of victory had never been so great. All that was wanted was to "hold fast."

Mr. Lloyd George was reproached by his critics with too great a disposition to encourage and strengthen the various subsidiary fronts, such as Mesopotamia, Palestine, Salonika and Italy, at the expense of the western front, where the struggle must mainly be decided; and in this and other respects to overrule, on questions of what may be called the higher strategy, the decisions of his military advisers. If that be so, he might plead the example of Chatham; and at any rate the eventual and dramatic success of what were called derisively "side-shows" contributed not a little to the downfall of the Central Powers. He was also charged with reducing his colleagues to ciphers, and acting as a dictator rather than a first minister. The loyalty with which he was served by eminent men who had been formerly in sharp antagonism to him is sufficient to show that his colleagues recognized that he assumed no more authority than was inevitable when the State was in danger. But undoubtedly the system of a Supreme Council of the Allies represented by their Prime Ministers, which he helped to establish in war and which continued for a while in peace, tended to enhance his authority and position, and in particular to reduce the importance of his Foreign Minister. Moreover, it was impossible for him and his colleagues not to realize that it was preëminently in him, after Lord Kitchener's death, that the British nation and Empire trusted to bring them safely through the war. He never contemplated, or allowed the country to consider conceivable, any other termination of the war than a fight to a finish. He would not palter either with any of the insincere or inadequate German overtures, with President Wilson's early formula of "peace without victory," with the Russian phrase "no annexations and no indemnities," or with Lord Lansdowne's negotiated peace; he insisted on eliminating the doctrine of the "freedom of the seas" from President Wilson's Fourteen Points. He steadily pressed for the war aims originally laid down by Mr. Asquith, though, an idealist himself, he expressed them in terms agreeable to idealists, such as President Wilson and the loftier spirits among the Labour men. On the publication of Lord Lansdowne's letter he made his position clear. It was not the extreme pacifist, he said, who was the danger, but the man who thought there was a halfway-house between defeat and victory. To end a war entered upon to enforce a treaty, without reparation for the infringement of that treaty, merely by entering into a new and more comprehensive treaty, would indeed be a farce in the setting of a tragedy. "To stop short of victory," he wrote in Aug. 1918, "would be to compromise the future of mankind." He was as good as his word. Hostilities were closed with each of the enemy allies in succession—Bulgaria, Turkey, Austria-Hungary and Germany—by what was virtually a surrender, and a surrender on terms implying severe defeat. It was in keeping with the character of a man who, a lay preacher himself, regarded the war as a sacred, religious duty, that, after reading the terms of the Armistice from his place in the House of Commons on Nov. 11, he should ask Parliament to come, with Chancellor and Speaker at their head, to render thanks to God at St. Margaret's.

In spite of his bitter partisan sallies in the past, Mr. Lloyd George was a great conciliator, as he showed over and over again both in his dealings with Britain's Allies, and in his interventions in Labour disputes; and therefore it is not unnatural that he should appreciate highly the value of government by Coalition. Owing to it he had the satisfaction, even during the war, of promoting social welfare by means of a comprehensive Education bill; and of settling on a wide basis the question of reform, including the extension of the franchise to women—an extension of which he was always a warm advocate, though the militants had, in the past, unfairly flouted him as a renegade. It was his firm belief that by Coalition it would be possible to settle the Irish question. The convention which he set up in 1917 gave hope of success but its report was not sufficiently unanimous; and his vacillation in first promising, and then refusing, to introduce a Home Rule bill after the convention in 1918, together with his attempt to force conscription upon Ireland, contributed to the spread of Sinn Fein disaffection; though there was a plausible justification at the time for each of his actions. Coalition also helped towards that great constitutional development of the Imperial War Cabinet, with its corollaries of imperial preference and conservation of the essential raw materials of the Empire, for which, even apart from the war, Mr. Lloyd George's Ministry will always be honourably remembered.

Hence, when a general election, long overdue, and now rendered inevitable by the passage of a reform bill, was impending on the termination of hostilities, Mr. Lloyd George, with the cordial assent of Mr. Law, determined to maintain the Coalition, and to ask the country to return candidates pledged to support the Government in the negotiations of peace and in the problems of reconstruction that must immediately arise. As he wrote to Mr. Law, the Government had had a unity both in aims and in action which was very remarkable in a Coalition Government. This was, it may be pointed out, the less surprising, as the platform of social reform united Mr. Lloyd George and his followers among the Liberals not merely to the moderate Labour leaders but to Mr. Law and the great majority of his party, who inherited the Disraelian tradition of *Sybil* and of the social measures of the 1874 Government. It was a policy of this character that the joint leaders put forward in their manifesto, and they invited candidates who agreed with their aims to pledge them their support. This was surely not unreasonable, as they could not rely upon organized parties; but the Liberals who followed Mr. Asquith, and the Labour party as a whole, though they both claimed independence of the Coalition and stood practically as opposition candidates, denounced the practice as unfair, and nicknamed the pledge a "coupon." The result was an overwhelming vote of confidence in the Coalition, and the absolute rout of the pacifists, the discomfiture of Mr. Asquith and the Liberals who refused to follow Mr. Lloyd George, and the comparative failure of an ambitious effort by the Labour party.

This enormous majority gave Mr. Lloyd George a position of exceptional strength and authority at the Peace Conference of 1919 at Paris, which he attended as the principal British plenipotentiary. He established a new precedent by taking to the conference with him not merely some of his principal colleagues, but also the Prime Ministers and other representatives of the Dominions and of India; who, as representing peoples whose fighting strength had contributed materially to the victory, were obviously entitled to have their share in arranging terms of peace and to sign the treaty ultimately agreed upon. At the conference he was one of three principal figures, along with President Wilson and M. Clemenceau; and his remarkable powers of conciliation were often required to harmonize the very divergent points of view of these eminent men. He strongly supported the President's idealistic scheme of a League of Nations, having himself always regarded the war as one to end war. At the same time he sympathized with M. Clemenceau's resolve to obtain security for France, though he refused to consent to the annexation, with that object, of German populations, either to France herself or her *protégé*, Poland. But he was ready to protect France in another fashion by signing along with President Wilson a separate Treaty of Alliance with her, whereby Great Britain and the United States agreed to come to her assistance in the event of an unprovoked attack on her by Germany. The agreement with England was, however, only to come into force after the ratification of that with the United States—a ratification which was never accorded. He insisted also on German disarmament and German reparations—which latter should only be limited by German ability to pay. Further, he pressed for the due trial of war criminals, and, among them, for that of the most responsible of all, the Emperor William. He signed the Treaty of Versailles on June 28, and obtained its prompt acceptance by the House of Commons. The King in Aug. conferred on Mr. Lloyd George the Order of Merit in recognition of his preëminent services, "both in carrying the war to a victorious end and in securing an honourable peace."

But the signing of the treaty with Germany, and of the treaties with the other enemy Powers, by no means settled finally the issues between the Allies and their late foes. Mr. Lloyd George had on frequent occasions in the next two years to attend meetings of the Supreme Council at Paris, San Remo, Spa, Lympne and occasionally in London, in order to deal with difficult questions arising—to take a few of the most critical points—now out of the provisions relating to German reparations or disarmament, now out of those providing for the future of Silesia. In regard to some of these matters the points of view of France and Britain were so different that even Mr. Lloyd George was hard put to it to find an acceptable formula; and in regard to Silesia he dexterously managed in the summer of 1921 to avoid an open breach by referring the whole matter to the League of Nations. One provision of the Treaty of Versailles, which both Mr. Lloyd George and the British public considered important—namely, that which provided for the trial of Emperor William—proved abortive; as the Government of the Netherlands maintained its right of asylum, and refused to surrender him to the Allies. One foreign question, indirectly connected with the treaty, occasioned Mr. Lloyd George great trouble. He strongly condemned the Soviet Government of Russia, and the principles upon which it was based; but he gradually extricated British troops from their commitments to various Russian generals who were waging civil war upon it; and, as it established its position, yielded to the desire of the Labour party for the reopening of trade with Russia, but on the conditions of a release of all British prisoners and a cessation of foreign revolutionary propaganda.

The immediate prospect of the Peace Conference in Paris and the probability that international complications arising out of the war and of the peace would necessarily weigh heavily on the Prime Minister for many months, if not years, caused Mr. Lloyd George, when he made a partial reconstruction of his ministry after the general election, to continue the arrangement by which Mr. Bonar Law led the House of Commons. But, after the close of the conference, he himself was more frequently in his place in Parliament than during the last three years; and the rank and file after a while began to question whether this war arrangement should not come, with other war arrangements, to an end. On this point, however, Mr. Lloyd George remained firm; though he gratified constitutionalists by restoring, after the Treaty of Versailles, the old form of Cabinet Government, only with the addition of a permanent secretariat.

His principal domestic preoccupations during the years immediately following the peace were the industrial unrest, which continued with practically no intermission for two years and a half, and which demanded, again and again, his personal intervention; the social reforms promised in the joint manifesto, which were to make Britain, in his own words, "a land fit for heroes to live in"; the difficulties of finance and of controlling the extravagant expenditure which war habits had generated; and finally the settlement, if possible, of Ireland and the Irish question. He laid down his policy on the labour upheaval in the debate on the Address in 1919. The Government would welcome a general investigation into the whole causes of industrial unrest; one individual trade could not be considered without reference to the rest. A great increase in some essential ingredients like coal or transport might easily destroy the chances of restarting British export industry. Every demand which was put forward by any body of workmen would be examined fairly and carefully by the Government with the view of removing any legitimate grievance; but the Government were determined to fight Prussianism in the industrial world, as they had fought it on the continent of Europe, with the whole might of the nation. He had at once to deal with a threatened strike of coal-miners, and his was the energy which promptly set up the Sankey Commission to avert a coal-miners' strike in the early spring of 1919, and got the Commission to issue a preliminary report in three weeks. He sought also at once a wider remedy. He called an Industrial Conference of masters and men, and persuaded it to set up a provisional joint committee. He addressed this body at its first meeting, terming it a peace congress, and saying that with so much of the world in pieces, Britain might have to save civilization. It was necessary to find the legitimate boundary between wages and hours on the one side and adequate production on the other. The huge war debt must be met by saving or by increasing productivity. Employers and workmen should come to an understanding by some sort of dead level of talk. Though the committee came to an agreement on the basis of a legal 48-hour week, minimum time rates of wages of universal application, and the creation of a permanent industrial council, half masters half workmen, to advise the Government on industrial questions, the article on ENGLISH HISTORY shows that this well-intentioned effort was of no avail to calm the unrest.

To take one or two instances of his methods. Of the railway strike in Aug. 1919 he said that he could recall no strike entered into so lightly, with so little justification and with such entire disregard of the public interest. He pointed out that the State was running the railways at a loss due mainly to the enormous increases in the wages of railway workers since the beginning of the war. He took strong measures and succeeded in stopping the strike after 10 days, though promising hardly any further concession than was previously offered. He declined absolutely to adopt the final report of the Sankey Commission and concede the nationalization of the coal industry. The Government had never, he said, committed themselves blindfold to whatever the Commission might recommend, and they had definitely decided that they could not undertake the State management of the mines. In the great coal dispute of the autumn of 1920, he insisted that there must be guarantees as to output before there could be an advance of wages, and that wages and output must advance together. He treated the refusal of Irish railwaymen in that year to carry munitions of war, which was backed in a half-hearted way by the English railwaymen, as a challenge to the whole constitution of the country and was prepared to close the Irish railways rather than submit.

A speech which he delivered at the City Temple on Sept. 17 1919 shows his general views of reconstruction. He appealed for brotherhood between nations and brotherhood between classes. He sketched in broad outline the fundamental changes which he wished to see in the political, social and industrial conditions of the United Kingdom. Slums would have to go, and he hoped that the great armaments would disappear, as also the wretched misunderstandings between Ireland and the rest of the United Kingdom. He looked forward to seeing waste in every shape and form disappear. But these changes could only be effected by patient work, in the spirit of comradeship of classes, a passionate desire to see justice done to all classes. He pleaded not only for the League of Nations, but for fair play between employers and employed. If workmen merely considered how much they could extort from employers at the cost, perhaps, of the community, or if employers only asked at how low a price they could buy off labour, the result would be disastrous. In this spirit, while prices were high and the fictitious boom in trade born of war was still in existence, he started the Ministry of Health and the Ministry of Transport on large lines, encouraged Dr. Addison in a great housing scheme, for the reason that, as he said, adequate housing would make happy homes, which were the surest guarantee against agitation and unrest; he promoted legislation guaranteeing a minimum price of wheat and security of tenure to the farmer, and a minimum wage and better hours to the labourer; and he encouraged Mr. Austen Chamberlain to continue to lay the same, or greater, burdens on the taxpayer in peace, as that patriotic citizen had borne in patience during war.

Then in the late autumn of 1920 there came without warning a sharp depression in trade, and prices suddenly fell. This at once rendered acute the question of expenditure about which there had been many sporadic protests already. Mr. Lloyd George pointed out that the depression was universal, that it was desirable to remove Government control from trade as soon as possible, and that public and private economy were necessary on the strictest lines. He had already addressed a strong letter to the spending departments, but with little result; and in the previous year he had pointed to armaments as the only item on which considerable reductions could be made. But the public thought that there were other possibilities of reduction, especially in the grandiose schemes of Mr. Fisher, Dr. Addison and Sir Eric Geddes, the Ministers of Education, Health and Transport. This opinion was forcibly brought home to Mr. Lloyd George in the spring of 1921 by the rapid growth of an "Anti-Waste" party, unaffiliated to any of the historical connexions, which defeated Government candidates in by-election after by-election; and by the formation of a growing "cave," in the ministerial ranks, of members who announced that they held themselves free to vote against the Government on questions of expenditure. Reluctant as Mr. Lloyd George, always a social reformer rather than an economist, was to abandon his cherished policy, he recognized that it was necessary to bow to public opinion. The greater part of Mr. Fisher's scheme was postponed; Sir Eric Geddes reduced the dimensions of his railway bill; Dr. Addison's proposals were so mutilated that he resigned; the agricultural policy was reversed; the abandonment of control of mines was advanced by four months in order to save the subsidy, and incidentally the greatest strike of recent times was precipitated. But the movement for a severe reduction of expenditure still gathered force.

There was nothing nearer to Mr. Lloyd George's heart than to effect an Irish settlement, and he carried through Parliament in 1919-20 a Home Rule bill creating two self-governing Parliaments, one at Dublin and one at Belfast, with a Federal Council as a link between them making for the unity of Ireland. He explained to Parliament that the measure rested on three basic facts:—(1) three-fourths of the Irish people were bitterly hostile and rebels at heart; (2) N.E. Ireland was alien in race sympathy and tradition from the rest; (3) severance of the United Kingdom and Ireland would be fatal to both. The first of these facts was abundantly illustrated in 1919-21. The Sinn Feiners of the south kept up a ruthless campaign of assassination against soldiers, police and well-affected civilians, sparing neither age nor sex. Mr. Lloyd George reënforced both soldiers and police, and backed them up strongly, even palliating unauthorized and severe reprisals which newly recruited police without sufficient discipline committed during several weeks. But though he assured Parliament and the public, at intervals, that he had murder by the throat, the campaign was still continued; and Sinn Fein held such a control of southern Ireland that it captured in 1921 without contests the whole of the seats for the southern Parliament except those allotted to Trinity College, and then its members refused to come and take the oath. But the northern Parliament, where the Unionists had a large majority, was opened with great *éclat* in the spring by the King in person, who adjured Irishmen to "forgive and forget." The words chimed in with a great yearning in the public mind for peace. Mr. Lloyd George seized the occasion, asked Mr. De Valera, the Sinn Fein leader, and Sir James Craig, the Ulster Prime Minister, to come and see him, and a truce to bloodshed was arranged pending negotiations. Mr. Lloyd George's subsequent offer of "Dominion Home Rule," with certain safeguards, the Sinn Fein rejections of it during August and September, and its acceptance in December, are dealt with in the article on IRELAND.

Mr. Lloyd George also held further sessions in the summer of 1921 of the Imperial Cabinet, or Conference, as some prefer to call it. The decisions mainly affected the treaty with Japan, the renewal of which was approved, and the Pacific question. While the Dominion Premiers were still in session with British ministers in London, President Harding issued an invitation to a Conference on Disarmament at Washington, which was accepted. The Imperial Cabinet suggested a preliminary Pacific Conference which the Dominion ministers might attend, but the United States would not agree.

Mr. Lloyd George lost in the early spring of 1921 two valuable colleagues, Lord Milner and Mr. (afterwards Lord) Long; and he suffered a still greater loss in the sudden break-down in health of his partner in Government, Mr. Bonar Law, with whom his relations had been peculiarly intimate and cordial. But he arranged that the newly elected Unionist leader, Mr. Austen Chamberlain, should occupy exactly the same position as his predecessor. He was as convinced of the necessity of Coalition as ever, though there were some signs of disaffection on both wings, and the "Anti-Waste" movement was proving a disintegrating force. His own astounding vitality appeared to have suffered no diminution. There was no sign of weariness or lack of grasp in his prompt action after the King's speech at Belfast, in spite of the fact that he had been uninterruptedly in high office for nearly 15 years, had been in the forefront of political strife almost the whole time, had carried the country with safety and success through the greatest war in history, and had survived an amount of abuse from different quarters that would have crushed any but a very exceptional personality. Though public confidence in him was not so general in the summer of 1921 as it had been at the close of the war, no statesman had yet arisen who could seriously be put in competition with him for the post of Prime Minister. (G. E. B.)

LOCHEE OF GOWRIE, EDMUND ROBERTSON, BARON (1845–1911), British jurist and politician. Born in Scotland Oct. 28 1845, and educated at Oxford, he became a fellow of Corpus Christi College in 1872; he was called to the English bar, and became well known as a jurist, filling the posts of examiner in jurisprudence at Oxford, professor of Roman law at London University, and reader in law to the council of legal education. He was Liberal member for Dundee from 1885 until he was raised to the peerage in 1908. In 1892 he became a civil lord of the Admiralty, and in 1906 was secretary to the Admiralty. His writings include a book on *American Home Rule*, and numerous articles on legal and constitutional subjects in the *E.B.* He died at Canterbury Sept. 13 1911.

LOCKE, WILLIAM JOHN (1863–), English novelist and playwright, was born March 20 1863 in Georgetown, Demerara, the eldest son of John Locke of the Colonial Bank Service. He was educated at Trinidad and St. John's College, Cambridge. On leaving the university he became a schoolmaster until in 1897 he was appointed secretary to the R.I.B.A. He became a corresponding member of many European architectural societies; but it is as a writer of novels that he is best known. Of these the chief are: *At the Gate of Samaria* (1895); *Where Love Is* (1903); *The Morals of Marcus Ordeyne* (1905); *The Beloved Vagabond* (1906); *Stella Maris* (1913); *The Wonderful Year* (1916); *The Rough Road* (1918); *The House of Baltazar* (1920) and *The Mountebank* (1921), several of which have been reproduced on the film. Besides original plays, such as *Mr. Cynic* (1899), *The Lost Legion* (1900) and *The Man from the Sea* (1910), he dramatized *The Morals of Marcus*, produced at the Garrick theatre (1906), and *The Beloved Vagabond*, produced at His Majesty's theatre (1908).

LOCKROY, ÉDOUARD (1838–1913), French politician (*see* 16.854), died Nov. 22 1913.

LOCKWOOD, WILTON (1861–1914), American painter (*see* 16.855), died at Brookline, Mass., March 20 1914. In 1912 he was elected a member of the National Academy of Design.

LOCKYER, SIR JOSEPH NORMAN (1836–1920), English astronomer (*see* 16.855), died at Sidmouth Aug. 16 1920. In 1912 he became president of the British Science Guild, which owed its existence to a suggestion made by him in his presidential address to the British Association in 1903.

LODGE, HENRY CABOT (1850–), American statesman and author (*see* 16.860), as a member of the Committee on Foreign Relations of the U.S. Senate supported (1914) the repeal of the Panama Canal toll exemptions clause as desired by President Wilson. Although he believed that under the Hay-Pauncefote Treaty the United States had full right to discriminate in favour of American shipping, he felt that a mistake had been made in refusing Great Britain's request for arbitration of the question. He was opposed to woman suffrage and in Aug. was "blacklisted" by the National American Suffrage Association. In Jan. 1915 he opposed the ship purchase bill for the acquisition of shipping which the President had asked Congress to pass, on the ground that it would lead to endless foreign complications because of conditions arising out of the World War. In Feb. he also opposed the treaty negotiated by Secretary Bryan with Colombia, in which it was proposed to pay Colombia $25,000,000 and to express regrets for incidents attending America's recognition of the independence of Panama and acquisition of the Panama Canal Zone. He construed this as a criticism of the administration of President Roosevelt when the Canal Zone was acquired. In 1916 he assailed the suggestion of an American embargo on arms, declaring that such action would place America on the side of the Central Powers. In Jan. of the same year he offered a resolution calling for armed intervention in Mexico. He was an unpledged delegate-at-large from Massachusetts to the Republican National Convention, 1916, and served as chairman of the Committee on Resolutions. The same year he was elected vice-president of the American Society of International Law. In July he supported the navy bill, calling for an appropriation of $315,000,000, and declared that America needed a fleet both in the Atlantic and Pacific oceans as the Panama Canal was "vulnerable." In Oct. he publicly charged that the President had added a "postscript" to the second "Lusitania" note, informing the German Government that the strong words in the first note were "not to be taken seriously" and had withdrawn it when members of the Cabinet threatened to resign. Later he accepted, somewhat perfunctorily, the President's denial of such action. He opposed prohibition and urged moderate taxation of individual incomes and of excess war profits of corporations. In 1918 he opposed the Overman bill, bestowing special war powers on the President, on the ground that it might lead to autocracy. Senator Lodge had long been a sharp critic of President Wilson's policies and his antagonism became more personal after the meeting of the Peace Conference. In Dec. 1918 he advocated postponement of the question of a league of nations until after the signing of the treaty, insisting that the two should be considered separately. In the same year he was elected Republican floor leader of the Senate and, as such and as chairman of the Foreign Relations Committee, his position was one of great influence. When the President submitted to the Senate the Treaty of Peace, Senator Lodge became the leader of the opposition. He assailed the President for usurping power and ignoring the Senate whose responsibility in the matter, he declared, was as great as the President's. Under his leadership 14 reservations were carried through the Senate, "all designed to protect the safety, independence and sovereignty of the United States. They did not nullify the treaty. They simply Americanized it"; these, he maintained, constituted the "irreducible minimum," which the President must accept, if the treaty was to be ratified by the Senate. The President refused to accept the reservations, a prolonged deadlock ensued, ending in rejection of the treaty as submitted by the President. At the Republican National Convention in 1920 Senator Lodge served as permanent chairman. He was one of the four U.S. delegates at the Washington Conference on the Limitation of Armament, in 1921.

LODGE, SIR OLIVER JOSEPH (1851–), English physicist (*see* 16.860). Subsequently to 1910 Sir Oliver Lodge became increasingly prominent as a leader in psychical research and a strong believer in the possibility of communicating with the dead. Amongst his later publications are *The Survival of Man* (1909); *Reason and Belief* (1911, 3rd ed.); *The War and After* (1915); *Raymond, or Life and Death* (1916), a memoir of his son killed in the World War, with an account of communications thought to have been received from him since; *Christopher: a Study in Human Personality* (1918), etc. In the early part of 1920 he made an extensive lecturing tour in the United States, having just previously retired from his post as principal of the university of Birmingham.

LODZ-CRACOW, BATTLES OF, 1914.—Under this heading an account is given of the offensive operations of the Central Powers in the eastern theatre of war in Nov. 1914, succeeding the Vistula–San battles, which had ended in their retreat through Poland and West Galicia to the verge of Silesia. The battle-front was enormous, extending as it did from the country N. of Warsaw, across western Poland and past Cracow into the Carpathians. But this front was held in very unequal density, and, in this event, the execution of the general plan led to the focussing of the German operations upon the manufacturing town and rail centre of Lodz, while the Austrian centre of gravity lay at and to the S. of Cracow.

Having decided to break off the battles of Warsaw and Ivangorod, the Central Powers instantly formulated a new plan of campaign, regrouping their troops and placing them in readiness for a new offensive. The Russian IV. and IX. Armies had kept in touch with the Austro-Hungarian I. Army after the battle of Ivangorod, but the Russian I., II. and V. Armies soon lost all contact with Hindenburg's army, owing to his rapid retreat and the destruction of all communications. By Nov. 3 these three armies had reached the line Kovel (Kowel)–Klodawa–Uniejow–Zdunska Wola–Belchatów–Checiny, where they lay without attacking until Nov. 8. It may be assumed that the Grand Duke Nicholas left them in this section to recover and prepare for a great new offensive through Silesia into the interior of Germany.

The Russian III. and VIII. Armies pursued the Austro-Hungarian Armies very cautiously in their retreat in Galicia, while the Russian XI. Army was being formed under Lt.-Gen. Selivanov for the second siege of Przemysl.

Hindenburg, who on Nov. 1 had taken over the supreme command of the whole German E. front, resigning the command of the IX. Army to Gen. von Mackensen, commander of the XVII. Corps, proposed to meet the Russian attack by sending the German IX. Army from the Silesian frontier by train to the Posen–Thorn area and pushing off the German I. Corps and XXV. Res. Corps of the German VIII. Army—then fighting in East Prussia—to meet it there.

With this force—consisting of 5½ corps and 2 cavalry divisions—he intended to make an enveloping attack on the Russian I. Army, which was advancing on the N. wing, and to entrust the direct protection of the Silesian frontier to Landsturm formations, the Posen and Breslau garrisons, Frommel's newly formed cavalry corps (German 5th and 8th and Austro-Hungarian 7th Cavalry Divs.) and Gen. von Woyrsch's army detachment, consisting of 5 infantry divisions which had been left in the area of Czenstochowa and Zarki.

On the right bank of the Vistula Zastrow's German corps, consisting of the war garrisons of the Vistula fortresses and of Landsturm, was to simulate a strong attack on N. Poland from Soldau, while the main reserve of the Thorn fortress pushed forward up the Vistula towards Plock (Plotsk).

The Austro-Hungarian I. Army, having the Cracow fortress as a support for its S. flank, had by Nov. 8 established itself on the line Zarki–Komolów–Bydlin–Proks–Krzeszowice. In conjunction with Woyrsch's army, which was under the Austro-Hungarian Army Higher Command, it was to intercept the expected impact of the Russian IV. and IX. Armies. The Austro-Hungarian IV. Army was to join up with the I. Army, cross the Vistula either within or to the E. of the Cracow fortress area on Nov. 10 or 11, according to the stage reached in the battle, and fall on the flank of the Russian IX. Army attack. The S. wing of the I. Army was to join in this attack at discretion.

In Galicia no important Russian offensive was expected in the near future. Confirmation of this view was provided by the very slight pressure exercised upon the retreating Austro-Hungarians by the Russian III. and VIII. Armies, and also by some intercepted radio telegrams. On the one hand, the Russians were exhausted after the heavy fighting on the San and the successful attacks by the II. and III. Austro-Hungarian Armies at Chyrow; on the other, the siege army raised for Przemysl had absorbed a large part of their mobile forces.

In case of an attack, the Austro-Hungarian Army Higher Command intended to answer by a counter-advance in western Galicia—in touch with the IV. Army—and on the Carpathian ridge. This it hoped to be in a position to carry out even after the original front had been weakened. In the Silesian frontier defence, N. of Woyrsch's army, there was a large, inadequately defended gap which the German Supreme Command ardently desired to see filled. The Austro-Hungarian Army Higher Command therefore withdrew the II. Army Command with the IV. and XII. Corps from the front, added a Hussar regiment, and sent them all by train through Silesia to Woyrsch's N. wing, to be placed under his command. In the deployment area this army was also joined by Hauer's cavalry corps, consisting of the 2nd and 9th Cav. Divisions.

The remaining army groups of the II. Army—including the VII. Corps, 17th and 34th Infantry Divs., 38th Honved Infantry Div., 1st, 5th and 8th Cav. Divs., 103rd and 105th Landsturm Bdes., and the 1st, 2nd and 17th Landsturm territorial brigades—were placed under the III. Army Command and, in conjunction with this army, had to prevent a Russian advance over the Carpathian ridge. The direct protection of western Galicia was left to the XI. Corps (Field-Marshal-Lt. von Ljubičić).

In Oct. an army group was formed under Gen. von Pflanzer in order to defend the eastern Carpathians and drive the Russians out of Austria-Hungary. On this group fell the task of defending the Carpathians E. of the Verecke pass, and of protecting the reconquered portions of Bukovina.

In accordance with this plan of operations big battles now developed, during Nov. and Dec., in Russian Poland, at Cracow in western Galicia, and on the Carpathian ridge.

Mackensen's attack on the Russian I. and II. Armies led to the two battles of Lodz (Nov. 17–Dec. 15), the Austro-Hungarian IV. and I. Armies' operations to the battle of Cracow (Nov. 12–26), to which was added in Dec. the battle of Limanowa–Lapanow in western Galicia (Dec. 3–12).

In the second half of Dec. a Russian counter-offensive set in, leading to the battle of Jaslo.

First Battle of Lodz (*Nov. 17–Dec. 1*).—The advance of the German IX. Army from the Thorn–Posen area between the Warta and the Vistula began on Nov. 11. On the N. wing the XXV. and I. Reserve Corps advanced on Wloclawek, the XX. Corps and the 3rd General Reserve Div. from Hohensalza on Kutno, the XVII. Corps from Gnesen through Kolo towards Leczyca, and the XI. Corps from Wreschen (Wrzesnia) through Konin towards Dabie.

Before the front a screen was provided by von Richthofen's cavalry corps—formed from the 6th and 9th Cav. Divs.—which had been brought up from the W. and was driving back the Russian cavalry through Lubomin and Blena. In the space between the XI. Corps and Gen. Woyrsch's N. wing the formation of the Posen and Breslau corps was screened by German Landsturm and by Frommel's cavalry corps, which had been winning battles against Novakov's Russian cavalry corps.

Frommel's corps had to push forward on Lodz, the Posen corps on Sieradz and Lask. The Breslau corps was not yet ready.

It was anticipated that the II. Army would come in by the middle of Nov. from the area N. of Czenstochowa, and that towards the end of the month 8 German divs., released by the breaking-off of the Ypres battle, would have come up by train. The Zastrow corps and the Westenhausen brigade of the Thorn fortress garrison had also begun to advance on Nov. 11, the Zastrow corps being reënforced by Hollan's cavalry corps (2nd and 4th Cav. Divs.), likewise brought from the west.

The Russian I. Army had on Nov. 9 advanced its front to Wloclawek. The rest of the front remained more or less stationary. Their preparations were apparently not complete. They also assumed the German and Austro-Hungarian forces to be so thoroughly beaten that they could begin the offensive at their leisure. Their great distance from the drafting base, too, made very thorough preparations essential.

On Nov. 12 the German N. wing came up against the Russian front quite unexpectedly on the line Wloclawek–Lubraniec. After a brief but heavy battle, the Siberian V. Corps and the Russian 79th and 50th Divs. were overthrown, Wloclawek taken, and the Russian I. Army forced to retreat to the line Plock–Gostynin–Kutno–Ozorkow, where it established itself afresh, prepared for a stubborn resistance. To withdraw from this position would mean losing the Vistula crossing at Plock, and with it the possibility of bringing the corps on the N. bank of the Vistula over to the S. bank by the shortest way. On the 15th Mackensen overran this line also. In the battle of Kutno on Nov. 16 the resistance of the Russian I. Army was broken, and it withdrew to a sort of bridgehead position S. of Plock. Mackensen left only the one reserve corps under Lt.-Gen. von Morgen to protect him in rear against the Russian I. Army, and pushed forward with his main force on the line Leczyca–Lowicz.

The Russian situation had become critical, for the I. and II. Armies had been torn apart. As the right wing of the II. Army was in danger of being surrounded, the Grand Duke Nicholas led the army back to the line Strzykow–Lutomirsk, which it reached on the evening of Nov. 17. Here, together with the IV., II. Siberian and XVII. Corps and the I. Corps, brought up to the right wing from Lask, it was to intercept Mackensen's blow, aimed in the direction of Lodz. The Russian V. Army, consisting of the XIX., V., I. and IV. Siberian Corps, was also brought up, instead of being sent to march towards Silesia, as was originally intended. At the same time the advance of the Russian corps still engaged on the right bank of the Vistula was diverted towards Plock, Wyszogrod and Warsaw for the purpose of making a thrust at Mackensen's left flank.

On Nov. 17 the German corps crossed over the Lowicz–Leczyca line, and, after the Russian II. Army's right wing had been thrown back on Brzeziny, and Brzeziny itself had been taken by the XX. Corps on Nov. 19, advanced concentrically on Lodz. As in the meantime Lask had been taken by the Posen corps, a close ring was, on the 20th, formed round the Russian II. and V. Armies, consisting of 14½ divisions, which stretched in a long course of 90 km. from Tuszyn through Bukowiec, Nowosolna, Lutomirsk and Lask to Grebuszow, leaving only a gap of 20 km. open to the south-east.

The middle of Nov. also saw the beginning of the enveloping attack on Nowo-Radomsk by the IV. Army, Woyrsch's army and Böhm's army, by which the Russian IV. and IX. Armies were prevented from sending any of their forces to the dangerously situated Russian II. and V. Armies.

On the 21st, when Mackensen's victory over these two armies seemed to be assured, there arrived Russian reënforcements, coming from Lowicz and Warsaw by way of Skiernewice, which pressed forward on the German rear up to Brzeziny.

Although Plock had fallen on Nov. 11, and Gen. von Morgen, who had fetched the main reserve of the Thorn fortress garrison across the Vistula for his own use, was holding out against the numerically superior Russians, the diversion of Russian forces to Lodz could not be prevented.

To repulse the Russian forces advancing from Warsaw and Skierniewice (the II. Corps, 55th Infantry Div., Russian 5th and Caucasian Cav. Divs.) Richthofen's cavalry corps, the Guard Reserve Division and the XXV. Res. Corps reversed their front. The German ring had to be opened. On the 23rd the right wing fell back on Zdunska Wola, the left on Nowosolna. When the XX. Corps gave way on Nov. 24, the XXV. Res. Corps, with the 3rd Guard Res. Div. and Richthofen's cavalry corps, became cut off and surrounded by the triumphant Russians, who had trains in readiness for transporting their prisoners. But in the night of the 24th–25th, Lt.-Gen. Schäffer-Boyadel, commanding the XXV. Res. Corps, succeeded by means of a vigorous attack in breaking through to the N. and joining up with the left wing of his own front, taking with him all the surrounded units and 10,000 prisoners.

The effort to encircle the two Russian armies had not succeeded, and the hope of annihilating the Russian armies in the bend of the Vistula had therefore once more to be deferred.

By the end of November, after the arrival of the Schäffer-Boyadel group, Hindenburg had organized a strong connected front on the line Dobrzyków–Zychlin–Piatek–Zgierz–Szadek–Zdunska Wola–Widowa–Rusiec, at which point a junction was made with Böhm's army. Against this front the Russians battered in vain.

Meanwhile in the latter half of November the battle of Cracow was being fought N. of Cracow and E. of Czenstochowa.

Battle of Cracow.—At the Austro-Hungarian Army Higher Command the attack by the Russian V., IV. and IX. Armies was expected on Nov. 15 on the front of Woyrsch's and Dankl's armies. Woyrsch was to hold his own position at all costs, and to échelon Böhm's army in rear of his N. wing for a subsequent counter-attack. Dankl's army was also to maintain its front and be ready on the morning of Nov. 16 to advance to the attack from its N. wing in conjunction with the Archduke Joseph Ferdinand's army.

The Archduke was instructed to execute a surprise assault on Nov. 16 on the flank of the attack which the Russian IX. Army was expected to deliver on Dankl's army front. To this end one group—consisting of the XIV. Corps, with 4 infantry divisions, under Field-Marshal-Lt. Roth—was to attack by way of Pietrzejowici; a second group—the VI. Corps, with 2 infantry divisions, under Field-Marshal-Lt. von Arz—was to attack at Slomniki; the XVII. Corps was to be in readiness at Wieliczka to gain the N. bank of the Vistula at Niepolomice and Szczurow on the 17th, and to join in the attack by Field-Marshal-Lt. Roth's group. On Nov. 16 the line Nowo Brzesko–Proszowice–the heights E. of Slomniki was to be reached.

In fact, however, the Russian IV. Army came within artillery range of Woyrsch's army and the left wing of the I. Army on Nov. 15. The Russian advance had, it is true, an appearance of great caution, and only minor artillery battles and skirmishes between advanced detachments took place on that day. Still more hesitatingly did the Russian IX. Army advance its right wing to the line Wolbrom–Skala. The left wing was meantime being technically strengthened in the Wawrzenczyce–Smardzowice position, facing the Cracow ring of forts, which it had reached on Nov. 14.

Again, on Nov. 16, no particular battles were fought by Woyrsch's army and the deploying II. Army. The right wing of the Russian IX. Army, on the other hand, made a vigorous attack on the Austro-Hungarian I. Corps of Dankl's army, but was repulsed. Neither had the somewhat premature attack by the right wing of Dankl's army (X. and V. Corps) and the whole of the IV. Army any success that day.

On the morning of Nov. 17, the II. Army advanced to the attack with the 35th Reserve Div., while Woyrsch's main body and Dankl's N. wing (consisting of the II. Corps, the Tschurtschenthaler group and the 12th Infantry Div.) were repulsing strong Russian attacks. The right wing of the I. Army gained some ground. The IV. Army came up against strong Russian positions but, towards evening, had managed to work its way up to the heights S. of Gorzyce and to Smardzowice. The XVII. Corps achieved the crossing of the Vistula in the course of the day.

For Nov. 18 the Army Higher Command had ordered an enveloping attack by the II. Army on the right wing of the Russian IV. Army at Nowo-Radomsk, an assault on Szczekociny by Woyrsch's S. and Dankl's N. wing, and the capture of Skala by Dankl's S. wing and the Archduke Joseph Ferdinand—who were also to gain ground in the direction of Proszowice. But this day again brought only partial success. The 16th and 31st Infantry Divs. of the II. Army reached Kocin by dint of heavy fighting, and Hauer's cavalry corps encountered a Russian cavalry division N.W. of Nowo-Radomsk and forced it back.

On the 19th only local successes were obtained. The attacks on the S. wing of the Austro-Hungarian I. Army (X. Corps) by the Russian XIV. Corps were repulsed by the 24th Infantry Div. The X. Corps in the end captured the Russian trenches at Saspow and the N. wing of the I. Army also gained ground. The V. Corps made an enveloping attack in the direction of Jangrot, thus enabling the 33rd Infantry Div. to take the heights N. of the Suloszowa church. The I. Corps and the Tschurtschenthaler group stormed the heights 2 km. W. of Wolbrom and also those E. of Kielkowice and Zerkowice. The II. Corps advanced as far as Lgota Murowana.

In the meantime violent attacks on the Landwehr corps of Woyrsch's army had been made by the Russian grenadier corps, and were only repulsed after the left wing division of the II. Army (16th Infantry Div.) had made its enveloping attack on the line Cykarzew–Kruszyna.

Of the remaining divisions of the II. Army the 35th Infantry Div. reached the area round Miedzno, and the 31st Infantry Div. went as far as Brzeznica. The IV. Army attack made no particular progress, except that the XVII. Corps, attacking just N. of the Vistula, won its way to the Kotowiec hollow.

On Nov. 20 the N. wing of Woyrsch's army made a successful advance. The Prussian Landwehr corps took Radostków and drove back the Russian 1st Grenadier Div. through Mykanów; and the 35th German Reserve Div. under Lt.-Gen. Schmettau, advancing to the N. of the Landwehr corps, also gained ground. In the II. Army the 31st Austro-Hungarian Infantry Div. approached to within about 8 km. of Nowo-Radomsk on both sides of the Brzeznica–Nowo-Radomsk road and Hauer's corps reached Dobryszyce.

On Nov. 21 the Russian grenadier corps opened a strong counter-attack, and forced the 31st Infantry Div. to fall back on Brzeznica. Hauer's cavalry corps was also forced to retire to Wiewiec and Chorzenice. Woyrsch's army front remained as it was; and in the next few days his army went on the defensive, joining up W. of Szczerczow and Widawa with the N. wing of the German IX. Army which, in consequence of the events at Lodz, had also had to be brought back.

Further S., the N. wing and centre of Dankl's army gained a certain amount of ground, but there were no successes worth recording. Neither did the Archduke Joseph Ferdinand's army reap any particular advantages up to Nov. 22. The Austro-Hungarian XVII. Corps did, indeed, drive the left wing of the Russian IX. Army back across the Szreniawa, but the Russian XXI. Corps, which had been fetched over from the S. to the N. bank of the Vistula, prevented any further advance.

The Russian III. Army at the Battle of Cracow.—After the fighting on the San and the battle of Chyrow had been broken off, Field-Marshal Ljubičić led the XI. Corps (11th and 30th Infantry Divs.) back through Jaslo and Neu Sandec to join the N. wing of the III. Army. To him and to Field-Marshal-Lt. Nikić's group (consisting of half of the 41st Honved Infantry Div., the 1st and 11th Landsturm Bdes. and the 6th and 10th Cavalry Divs.), which had been assigned to him by the IV. Army Command, the protection of W. Galicia was entrusted. The IV. Army was to deliver the flank assault towards the N. and the main body of the III. Army was to retire to the Carpathian ridge. At the same time Ljubičić was to prevent the withdrawal of any portion of the Russian III. Army to the N. bank of the Vistula.

Of Radko Dimitriev's army, 8 divisions strong, only the XXI. Corps (33rd and 45th Infantry Divs.) and a few cav. divs. had reached Tarnow and the Dunajec up to the middle of November. These were followed, at a great distance, by the cavalry only of Boroević's army. Radko Dimitriev's main body was at Jaslo, Krosno and Dynow.

Screened by the Austro-Hungarian 4th Cavalry Div., the transfer of the XI. Corps to the Brzesko–Tymowa area was completed by Nov. 19. Here Ljubičić proposed to hold up the Russians. If necessary, he would be able to fall back on the Raba, or, possibly, on a position stretching from Kolko through Bloto (E. of Niepolomice), Targowisko and Dobczyce to the Kamienik heights S. of Dobczyce—and finally on a technically prepared position in the Wieliczka–Dobczyce area, where the strongest resistance could be offered.

On Nov. 17 the cavalry were already engaged. At Strzelce the Austro-Hungarian 10th Cavalry Div. drove the Russian 7th Cavalry Div. back towards Rylowa and Borzecin, but were themselves forced to retreat when parts of the Russian 44th Infantry Div. came on to the field at Borzecin. On the S. wing W. of Grybow, actions were fought between the 9th Dragoons of the 14th Cavalry Div. and the Russian cavalry.

On Nov. 18 the advanced guards of the XI. Corps had forced back some Cossack sotnias at Tymowa, and on the 19th the 30th Infantry Div. reached the area E. of Tymbark, the 11th Infantry Div. and Nikić's group the areas E. and W. of Brzesko respectively, while the 5th Cavalry Div. stopped a Russian column advancing from Zacliczyn. The gap of about 80 km. which had been formed between the XI. Corps and the III. Army's N. wing was protected by the 4th Cavalry Div. and a mixed detachment at Neu Sandec and on the Dunajec. But, as the 4th Cavalry Div. was forced by a Russian cavalry corps to retire on Alt Sandec on Nov. 19, the road now lay open on Ljubičić's flank and also in the direction of the IV. and I. Armies' communications. The closing of this gap therefore called for instant attention.

The protection of the area was entrusted to the commander of the 11th Cavalry Div., Field-Marshal-Lt. von Nagy, to whom were allotted the 6th and 10th Cavalry Divs. and also a few auxiliary battalions and the Polish legion.

On learning through a radio telegram that the Russian XXV. Corps had asked the XXI. Corps to come in on both sides of the Vistula, Ljubičić decided to deliver an attack in a N.E. direction, at the same time covering himself against Wojnicz and Zacliczyn, with the aim of preventing the Russian XXI. Corps from attacking on the N. bank of the Vistula.

Radko Dimitriev's intention was to group his army on the Dunajec as soon as possible and let the XXI. Corps go to the help of the hard-pressed IX. Army on the N. bank of the Vistula. The bridging preparations on both sides of the mouth of the Dunajec and numerous intercepted messages pointed clearly to the early execution of this project.

When Ljubičić attacked on Nov. 22 he already encountered fairly strong Russian forces. Nikić went into action at Brzesko with but slight results. The 11th Infantry Div. attacked the Russian XI. Corps E. of Brzesko, while the 30th Infantry Div. engaged a column of the Russian IX. Corps advancing from Tarnow. Heavy battles also took place on Nov. 21 and 22, for Nikić's group and the 11th Infantry Div. had renewed their attacks, in order to delay the Russian XXI. Corps in their crossing of the river. But the Russians had meanwhile brought up the whole of the IX. and XI. Corps, as well as parts of the X. Corps, thus securing the safe withdrawal of the XXI. Corps. If this corps could not be prevented from reaching the opposite bank, however, the Austro-Hungarian Army Higher Command intended that it should at least be harried during the crossing and prevented from taking part in the IV. Army's battle. Ljubičić had therefore hurriedly to transfer Nikić's group to the N. bank of the Vistula, where, in conjunction with the Austro-Hungarian XVII. Corps, it was immediately to advance against the Russian XXI. Corps. Portions of the XI. Corps were also to make preparations to cross over if necessary. But the preparations were not called for, as Radko Dimitriev, on Nov. 23, launched an attack on the whole of Ljubičić's front (the 11th and 30th Infantry Divs. and the 1st and 11th Landsturm Bdes.). Although it proved possible to repulse all the Russian attacks—with the exception of one at Brzesko, where an infantry regiment's position was crushed in—and although the Austro-Hungarian troops were offering a most stubborn and enduring resistance, Ljubičić decided, in view of the numerical superiority of the Russians (they had 2 corps, 1 reserve division and 2 cavalry divisions), to retire on Nov. 24 to Bochnia-Muchowka.

On the N. bank of the Vistula, similarly, no real success was achieved. The E. wing of the IV. Army had certainly obtained some fine results up to this point, but a new situation seemed to have been created on the N. bank of the Vistula by the bringing into action of the Russian XXI. Corps, which made furious onslaughts on the Austro-Hungarian XVII. Corps.

Meanwhile the Russians had apparently intended to break through on the inner wings of the I. and IV. Armies at all costs, but all their attacks were in vain. On the S. wing of the I. Army they threw themselves on the V. and X. Corps' front without any result. Von Arz achieved some minor successes with counter-attacks by the IV. Corps on the N. wing of the IV. Army, but was not able to push through to Skola.

When the Russian III. Army came into action on both banks of the Vistula, and particularly when it advanced against Ljubičić on the S. bank with a force more than twice as strong as his, the right flank of the Austro-Hungarian IV. Army seemed to be dangerously involved. There were already 2 corps fighting against Ljubičić, and 2 divisions of the Russian X. Corps were still coming up. Should Ljubičić be forced to retreat, a repercussion on the right wing of the IV. Army was inevitable.

In the meantime Brussilov had pressed hard upon Boroević's army in its retreat to the Carpathian ridge, and the Russian XXIV. Corps had pushed forward on Homonna.

The danger attaching to Radko Dimitriev's advance led the Austro-Hungarian Higher Command to decide definitely on a new plan of operations. Ljubičić's group was in no case to be exposed to a check, but was to yield gradually to the Russian pressure and fall back on the last-prepared position—Wieliczka, Dobczyce and the Kamienik height. In accordance with this retreat the Archduke Joseph Ferdinand was to take back Kritek's (17th) and Roth's (14th) groups, which were heavily engaged on the right wing, and Arz's group was to refuse its flank. The consequent shortening of the IV. Army's front, however, enabled Kritek's group to move back to the S. bank of the Vistula, thus placing Ljubičić's group in a position to offer an obstinate resistance on the line mentioned.

Up to this point the decision had been sought N. of the Vistula, but Conrad von Hötzendorf, whose one anxiety had been to resume the offensive, now planned a blow to be delivered from the S. against the left flank of that part of the Russian III. Army which was advancing against Ljubičić.

This flank attack was to be carried out by the XIV. Corps (3rd and 8th Infantry Divs.), the 13th Landwehr Infantry Div. and the German 47th Reserve Div. (Lt.-Gen. von Besser) from the Mszana-Tymbark area in the direction of Bochnia. The Austro-Hungarian formations were brought up by train from the IV. Army supply area through Cracow and Sucha to Chabowka. The 47th Reserve Div. came up by train to Cracow from the western theatre of war. Further, the orders issued by the Austro-Hungarian Supreme Command contained instructions to General von Woyrsch to prevent any withdrawal of troops from the Russian IV. Army front opposed to him, and to associate himself with the attack just begun by Mackensen on Lodz and Lowicz, as soon as the German division should have arrived on the field from the western front.

The Austro-Hungarian I. Army was to maintain a strictly defensive attitude. Under its command were placed the left wing of the IV. Army, Arz's group with the 15th and 27th Infantry Divs., and also the Honved infantry div.

The IV. Army was to give way before the Russian pressure and be drawn back gradually to the ring of forts round Cracow. Ljubičić's group, to which Kritek's Corps (the XVII.) was to be added, went to its command area with Nagy's cavalry group.

On Nov. 25 the whole IV. Army front and Ljubičić's group were sharply engaged, and on the 26th Ljubičić, to avoid exposing his group to the approaching great Russian attack, retired to the line Niepolomice-Szarow-Gdow-Dobczyce, the 11th Infantry Div. being hard pressed by the Russians in the retreat.

The IX. Army also began its retreat on Nov. 26, but without being molested by the Russians. Even the XVII. Corps, on the right wing, reached the W. bank of the Kosielniki brook, N. of Niepolomice, without interference, and was able to begin placing its reserves on the S. bank of the Vistula during the night.

On the 27th the Russian pursuit began to make itself felt. Vigorous attacks were made on Ljubičić's centre and N. wing, and he retired before them by order of the IV. Army Command to the prepared position near Cracow—Rybitwy-Prokocim-Soboniowice-Siepraw-Kamienik-Lubien. By the evening of the 27th the entire XVII. Corps had arrived on Ljubičić's right wing.

North of the Vistula the IV. Army had by the evening of the 28th come in behind the ring of forts.

To the S. of Ljubičić's group, in the meantime, Nagy was to have repulsed a Russian cavalry corps concentrated at Neu Sandec. As, however, the 10th Cavalry Div. was involved in difficult fighting on Ljubičić's right wing, Nagy could not get his whole force together and had to limit himself to obstructing a possible Russian line of advance at Tymbark with the 6th and 11th Cavalry Divs., a group of the Polish volunteer legion and 2 Landsturm battalions. But, on being attacked there by infantry detachments and the Russian cavalry corps in superior numbers on Nov. 27, he withdrew to a strong position, which he was able to hold, on the Dobra heights. During the retreat of the IV. Army the 106th Infantry Div., and 1st and 11th Landsturm Bdes., as well as the 45th Landwehr Infantry Div., were drawn in to reënforce the fortress garrison, while the German 47th Reserve Div. was detraining at Cracow. On the left wing of the IV. Army the VI. Corps, between Kosciol and Zieloniki, formed a link with the I. Army. One brigade of this corps came to Olkusz behind the right wing of the I. Army. On Nov. 28, the XIV. Corps sent off the 13th Landwehr Infantry Division.

The Russian III. and IX. Armies made their way slowly and cautiously up to the ring of forts, coming to a halt N. of the Vistula in an arc from Niepolomice by Point 320 (W. of Wierbzno), and Michalowice to Skala. South of the Vistula the Russian XI. and IX. Corps were pursuing Ljubičić's group.

Meanwhile, on the Austro-Hungarian I. Army's front, the N. wing of the Russian IX. Army and the IV. Army had been fairly quiet, whereas Woyrsch's and Böhm's armies went through some fierce fighting in connexion with Mackensen's army.

On Nov. 26 the N. wing of the Austro-Hungarian II. Army (Hauer's cavalry corps) had attacked in the direction of Szczerczow, in order to relieve Mackensen's right wing, which was fighting at Wola Wiezowa. At the same time the IV. and XII. Corps of this army were fighting hard, on both sides of the road leading from Dzialoszyn to Nowo-Radomsk on the line Koscielec-Struza, against the Russian Grenadier Corps and XVI. Corps.

Hauer's attack and the advance of the German general reserve brigade, to the N. of it, were successful. Hauer's cavalry drove the Russians out of the Sosnia hollow, and the general reserve brigade took possession of Nowa Wies and Leczyska. But on the arrival of Russian reënforcements the attack came to a standstill before Szczerczow.

The Russians, who were concerned above all to prevent Mackensen's S. wing and the Austro-Hungarian II. Army from advancing on Piotrkow and Nowo-Radomsk respectively, had actually detrained 2 new divisions (7th and 10th Infantry Divs.) and set them on the march towards Belchatow—as became known from a captured report. In view of these reënforcements, which threatened the N. wing of the II. Army, Woyrsch and Böhm had to divert some of their forces towards the north. The 16th Infantry Div. of the XII. Corps—which was replaced by the 35th Reserve Div.—was withdrawn from the front and sent to Brzeznica on the Nowo-Radomsk road under the protection of the Austro-Hungarian 35th Infantry Div. The main force of the IV. Corps remained in its position N. of this road, but 11 battalions of the 31st Infantry Div. were taken back to Pajeczno as reserve. This section was added to the 16th Infantry Division.

Farther N., meanwhile, the Russian 7th Infantry Div.'s action had made itself felt from Belchatow. On Nov. 30 the general reserve brigade had to retire to the Sosnia, while Hauer, being also involved, fell back behind the Krasowa and on Rusiec. On the adjacent right wing of Mackensen's army, the 48th Res. Div., which had rolled up from the western front, had meanwhile engaged the Russian V. Corps. On Nov. 30 the Russians—presumably only in order to prevent a withdrawal of forces—arranged for another vigorous attack by their IX. and IV. Armies against Woyrsch's S. wing and the Austro-Hungarian I. Army, but this met with no success whatever.

The actions fought during the retreat in the last days of Nov., S. of Cracow in W. Galicia, together with the events which took place N. of the fortress in the zone of Dankl's and Woyrsch's armies, may be said to have brought the battle of Cracow to a close. No strategic success for the Central Powers had resulted from it. New operations were therefore begun on both wings of the front, which resulted in the second part of the battle of Lodz in the N. (Dec. 1–15), the action at Belchatow by the II. Army, and the victorious battle of Limanowa–Lapanow, S. of Cracow (Dec. 3–14), following on the regrouping ordered by the Austro-Hungarian Army Higher Command on Nov. 26.

Second Battle of Lodz (*Dec. 1–15*).—The numerous attacks delivered by the Russian I., II. and V. Armies in the end of Nov. against Mackensen were one and all fruitless. But when the expected German reënforcements rolled up from the W. (II. and XIII. Army Corps and III. and XXIV. Res. Corps) and from E. Prussia (German 1st Infantry Div.), there was a revival of the offensive idea on the part of the Germans.

The III. Res. and XIII. Corps were sent to the extreme N. wing to Lt.-Gen. von Morgen's group (I. Res. Corps) which was being hard pressed by the Russian I. Army. The II. Corps was to reënforce Mackensen's S. wing.

When the German 1st Infantry Div. had arrived on Gen. von Morgen's front, his group made a successful counter-attack, the Russian I. Army's right wing being surprised and thrown back on to the line Ilow–Kiernoznia–Bielawy.

Simultaneously the German II. Corps entered the area N. of Lask to reënforce Frommel's cavalry corps and the Posen fortress garrison in their struggle with the Russian XIX. Corps. The 48th Res. Div. of the XXIV. Res. Corps had already been sent into action with the main body of the Breslau fortress garrison, N.E. of Widawa, against the Russian 7th Infantry Division.

Dec. 1 was the date fixed by Mackensen for the concentric attack on Lodz by the IX. Army. His N. wing alone—Gen. von Morgen's group—was to push forward N. of the Bzura in an easterly direction. Böhm's army was to support this attack by a blow on Piotrkow. The strong pressure by the II. Corps with which the attack began was rewarded at the end of the day by the capture of Dobran and Pabianice.

After the arrival of all the German reënforcements—of which the 25th Res. Div. had come up to Wloclawek on Nov. 30, while the III. Res. Corps was on its way thither by train—the German IX. Army had 21 infantry and 5 cavalry divs. as against the Russians' 26 infantry and 2 cavalry divisions.

While Gen. von Morgen's attack could make only very slow progress against the strong and technically well-constructed enemy positions, the concentric advance on Lodz proceeded rapidly. The German XI. and XVII. Corps came through some particularly severe fighting with conspicuous success. On the S. wing a successful push was also carried out by the German II. Corps and the 48th Reserve Div., in conjunction with the left wing of Woyrsch's army, against the Russian XIX. and V. Corps and a group of cavalry.

Little of importance had happened meanwhile to the Austro-Hungarian I. Army. Its task, which was also that of the centre and S. wing of Woyrsch's army, consisted mainly in preventing the shifting of Russian troops from the IV. and IX. Armies towards Lodz. The two armies could both solve this task either by attacking vigorously along the whole front, or by transferring reserves to the N. wing of the II. Army, thus enabling it to inflict more damage by its attack on Piotrkow.

The Austro-Hungarian Higher Command decided in favour of the second alternative. It extended the left wing of Dankl's army to beyond Zarki, and transferred the German 15th Reserve Bde. promptly from there to Böhm's N. wing. The 27th Infantry Div. was at the same time withdrawn from the VI. Corps on the N. wing of the IV. Army and sent to Sieradz on Dec. 4.

But the Russians had already in the last days of Nov. taken from the front the III. Caucasian Corps, which had greatly distinguished itself in the battle of Ivangorod and had been fighting during Nov. on the left wing of the Russian IV. Army against Dankl's N. wing, and brought it up through Nowo-Radomsk to the S. wing of their V. Army, in readiness for an advance against the II. Corps, which had been put in on Mackensen's S. wing, and the 58th Res. Division.

Böhm's attack on Piotrkow, however, which set in on Dec. 1, caught the III. Caucasian Corps while it was being shifted and forced it into an engagement at Belchatow. Thus it could not play its ordained part in the decisive battle of Lodz.

In this engagement the Russians had on the field the III. Caucasian Corps, parts of the XVI. Corps, the Guard Cavalry Corps, the 13th Cavalry Div. and 2 Cossack divs. Böhm's forces consisted at first only of the IV. Corps, the German Guard Res. Bde. and Hauer's cavalry corps.

After initial Austro-Hungarian successes the numerical superiority of the Russians began to tell. Böhm had therefore to await the arrival of the 27th Infantry Div.—which was to be placed on the N. wing on the road leading from Widawa to Piotrkow—and the 15th Reserve Bde., and then to renew the attack, strengthened by these new forces.

In the meantime the decision at Lodz had been reached on Dec. 6. Yielding to the constant pressure of the German II. and XI. Corps, the Russians evacuated Lodz during the night of the 5th–6th, and retired to the line Brzeziny–Podwiaczyn–Bedkow.

This retreat, however, brought no relief to Böhm's army. On the contrary, the Russians concentrated new forces at Piotrkow and employed them in violent counter-attacks against Böhm, forcing him, on Dec. 7, to close down the attack on Piotrkow and place himself on the defensive. In case of an attack being delivered from Piotrkow against Mackensen's right army wing, however, Böhm planned a flank assault from his position.

In Mackensen's army—now that Lodz had been taken and the Russians pursued up to the new line of resistance at Brzeziny–Bedkow—the interest of the German Supreme Command was focussed on the N. wing of the German IX. Army, General von Morgen's group. Before the capture of Lodz the German VII. Corps had already been withdrawn from the front at Zgierz, and sent to Piatek to coöperate in the attack on the very strong front at Lowicz–Ilów. By Dec. 6 the 25th Reserve Div. was also able to join in the attack from Gabin and the III. Res. Corps had finished detraining at Wloclawek.

On Dec. 7 the XIII. Corps, being now assembled, was ordered to make an encircling attack on the N. wing of the Russian I. Army and succeeded in forcing it back a little way on the 8th. On the same day the III. Res. Corps also came into the battle, attacking N. of the XIII. Corps; the XVII. Corps advanced along the Piatek–Lowicz road and reached the Sobota–Bielawy area. On Dec. 9 the grouping was completed and the general attack by von Morgen's group, starting from the N. wing, could now be launched in full force. There were 4½ German corps as against 6 Russian in the attack (III. Res. Corps, XIII. Corps, 1st Infantry Div., XVII. and I. Res. Corps against V. Siberian, II. Caucasian—brought from East Prussia—VI. Siberian, I. Turkestan, and VI. Corps and one infantry div. each of the IV. and VIII. Siberian Corps).

An extremely violent bombardment set in on Dec. 11 along the whole front. On the right wing the XVII. Corps, supported by parts of the I. Res. Corps, penetrated the Russian infantry position N. of Lowicz. On the 12th the heights at Ilów and N. of it were taken by the III. Res. Corps and the hamlet of Wiejsce was stormed by the XIII. Corps.

By the 15th the Russians had been beaten back to the Bzura, in spite of their gallant counter-attacks. On the same day and during the night they were forced by further very heavy German attacks to retire to the E. bank of the Bzura, leaving Lowicz in the hands of the XVII. and I. Res. Corps.

Battle of Limanowa-Lapanow (*Dec. 3–12*).—According to the plan drawn up for the battle of Limanowa–Lapanow Field-Marshal-Lt. Roth, commander of the XIV. Corps, was to attack the Russian III. Army in flank and rear on Dec. 2 with the 3rd and 8th Infantry Divs., the 13th Landwehr Div. and the 47th Reserve Div. from the area of Mszanadolna–Chabowka, E. of Lapanow. In the meantime, Ljubičić was to maintain his position, and, in proportion as the XIV. Army attack progressed, to go over to the attack likewise, starting from his right wing. The 6th and 10th Cavalry Divs. and the 11th Honved Cavalry Div., which had also been placed under Roth's group, were to cover the proceedings in the direction of Neu Sandec.

At the beginning of Dec., before the envelopment by Roth's group could take effect, Ljubičić's 4th Infantry Div. and 3rd Cavalry Div.—reduced to less than half their strength—were opposed by 4 infantry divs. and 3 to 4 cavalry divisions.

The forces which Roth had assembled for the flank attack were by no means up to their full establishment. The 3rd and 8th Infantry Divs. and 13th Landwehr Infantry Div. could be counted in all at 9,000 rifles, and the three cavalry divs. at 1,500. Only the German res. div., with a strength of 14,000 rifles, was up to its full establishment.

On Dec. 3 the 3rd Infantry and 13th Landwehr Infantry Div. began their advance from Dobra to the N. and, after some difficult combats with the Russian cavalry, reached the line of Wisniowo and the heights N. of Wilkowsko. At Wisniowo Ljubičić's right-wing division (the 30th) joined up with the 13th Landwehr Infantry Div. and began to advance likewise in the course of the day (Dec. 3).

Meanwhile, the 8th Infantry Div. had gone forward, with the XI. Honved Cavalry Div., along the road to Tymbark and driven back the Russians in the direction of Neu Sandec. The VI. Cavalry Div. had advanced to the Widoma height, to give direct protection to Roth's right flank, and had driven the Russian infantry in front of them.

By Dec. 5 the flank attack was in full swing. The German 47th Res. Div. had pushed forward beyond Rzegocina and Trczina, the 8th Infantry Div. up to Zbydniow and Tarnawa. Ljubičić's left wing had to deal with heavy Russian counter-attacks. The 13th Landwehr Infantry Div. came up to the Russian positions at Gora Sv Jana.

The Russians now realized the threatening nature of the attack by Roth's group. The Russian VIII. Corps (15th and 16th Infantry Divs.) was sent off from the Dukla area, on the W. wing of Brussilov's army, in the direction of Roth's right flank. At the same time the front of the IX. and XI. Corps at Wieliczka and Dobczyce was drawn back to Bochnia, and parts of the XXI. and X. Corps were transferred to the S. wing of the III. Army.

On the N. wing of the Austro-Hungarian IV. Army, Kritek's group, the XVII. Corps (15th and 16th Infantry Divs.) pressed forward S.W. of Niepolomice up to the line Grabie–Ksiaznice without encountering any important resistance. Roth's group and the XI. Corps had fought their way through Lapanow and S. of it as far as Ksiaznice–Sobolow–Raybrot.

To all appearances Radko Dimitriev was expected to offer a determined resistance on this line until the shifting of the XXI. and X. Corps had been completed. The flank attack delivered at this moment by the Russian VIII. Corps, which had come up from Neu Sandec and was fighting vigorously on the line Limanowa–Raybrot, made itself very unpleasantly felt. It was opposed at Limanowa by Nagy's 3 cavalry divs. (6th and 10th Cavalry Divs., 11th Honved Cavalry Div.) which heroically repulsed all the onslaughts.

On the whole front of the Austro-Hungarian IV. Army violent fighting had broken out everywhere. The Higher Command had been informed in good time of the shifting of the Russian VIII. Corps, and taken measures to counter it. An order was issued on Dec. 5 to transfer the 55th Landwehr Infantry Div. from Cracow and the 39th Honved Infantry Div. from the right wing of the I. Army by train to the S. wing of the IV. Army. Von Arz, commanding the VI. Corps, was to take over the command of both divs. At the same time Boroević's army was to carry out a relief offensive towards the N., by which the Russians were to be prevented from transferring yet more of their forces from the Carpathian front to Radko Dimitriev's army.

Boroević therefore proceeded to reinforce his left wing. At Muszyna Leluchow he concentrated a group, under Gen. Szurmay, consisting of half of the 38th Honved Infantry Div. and one combined Honved infantry div.—in all 20 battalions, 3 batteries and one squadron. These he had brought up by train from the Uzsok pass.

On Dec. 7 Szurmay was to take the offensive at Neu Sandec conjointly with the 4th Cavalry Div. and Col. von Weiss's brigade, which were holding the crossings S. of Neu Sandec and W. of Alt Sandec respectively.

On Dec. 8 the whole front of Boroević's army was to begin the advance on Bartfa on both sides of the Ondava and Laborcza valley. The remaining half of the 38th Honved Infantry Div. stayed behind in the Uzsok pass under Col. Czermak.

Meanwhile, on the right wing of the IV. Army, Field-Marshal-Lt. von Arz, who had been placed under the Roth group, had taken over the command of the 3 cavalry divs., the 13th and 45th Landwehr Infantry Divs., the 39th Honved Infantry Div. and the Polish Legion, and received in addition a combined brigade sent up from the I. Army. The 15th Infantry Div. was brought into the Wieliczka area.

The IV. Army attack went forward with great vigour in an easterly direction on Dec. 8. On the N. wing the 110th Landsturm Bde. and 106th Landsturm Infantry Div. made a sortie on Kocmyrzów from the ring of forts. Kritek stormed Zakrzów (S.W. of Niepolomice), and the XIV. Corps gained ground by attacking in the direction of Bochnia. On the S. wing Arz, with the 13th and 45th Landwehr Infantry Divs., made a furious attack on the right wing of the Russian VIII. Corps by way of Rzegocina and the S. of Raybrot and stormed the Kobyla height S.E. of Raybrot, while the 3 cavalry divs. and those parts of the 39th Honved Infantry Div. already engaged had to contain the left wing of the VIII. Corps at Limanowa. The following day brought yet more successes, but on Dec. 10 the Russians were able to put parts of the XXI. and X. Corps into the field against the Austro-Hungarian XIV. Corps, which gradually found itself faced by superior numbers.

Strengthened by these new additions to their forces, the Russians, on Dec. 10, started an embittered counter-offensive along the whole front, during which the XIV. Corps lost all the advantages it had won on the previous day, and had to retire. On the N. wing Kritek repulsed all attacks, but had to withdraw his right wing to Jaroszowka in conjunction with the XIV. Corps. On the S. wing also the fighting broke out afresh with great violence. Arz was forced to surrender the Kobyla height, and the Hussars of the 10th Cavalry Div. and 11th Honved Cavalry Div. won undying laurels at Limanowa, where they repulsed all the Russian attacks in a fine fight. The vigorous Russian counter-offensive had brought the Austro-German offensive to a standstill. The Army Higher Command was obliged to bring up new forces with which to repeat the attack.

Meanwhile, in the I. Army an XVIII. Corps had been formed from 2 Landwehr divs. Both this corps and the 6th Infantry Div., advancing on Boroević's left wing, were to be brought up. At 11 A.M. the battle, raging with the same intensity along the whole front, and particularly on the S. wing, had reached its climax, and by the afternoon the crisis seemed to have been overcome. Although Arz had to retreat on Mlynne and to the W. of Limanowa, Roth's centre and left wing held their ground.

With the arrival on the field of the combined brigade of the X. Corps N. of Limanowa during the afternoon, and the encircling attack by half of the Honved infantry div., coming from Zalesie, which completely surprised the Russian left wing, the Russian power of attack was crippled here also, and the battle on the S.

wing decided in favour of Arz. Similar merciless attacks against the centre and N. wing recoiled without any result. The arrival of the combined brigade and the advance of Szurmay's group, reinforced by the 6th Div., on Neu Sandec in rear of the VIII. Corps had sufficed to turn the scale.

On Dec. 12 the Russian VIII. Corps fell back before Arz who occupied Chomranice and Marcinkowice. Szurmay drove the Russians out of Neu Sandec and found touch with the Arz group.

On Dec. 13 the Hungarian 39th Honved Infantry Div. pressed forward through Jakobkowice to Michalczow, where the Russian 15th Infantry Div. was lying, in order to ease the attack in front of the main body of Roth's group. The 45th Landwehr Infantry Div. had meanwhile taken the Russian positions in the Lososina valley, and the 13th Landwehr Infantry Div. had again seized the hotly disputed Kobla height. These victories by Arz's and Roth's groups, together with the rapid advance of the III. Army—which by Dec. 14 had reached the area S. of Jaslo, Krosno and Lisko,—decided the battle of Limanowa–Lapanow.

The effect of the Austro-German victory at Lowicz, coinciding with this, and of the earlier one at Lodz, was to cause the Russians to retreat on Dec. 15 on their whole front.

By evening on Dec. 15 the IV. Army had reached the area of the mouth of the Szreniawa and Zacliczyn, while the III. Army remained in the area it had already occupied and joined up with the Szurmay group S. of Zacliczyn.

General Tanassy's sortie from the Przemysl fortress on Bircza, with 19 battalions and 12 batteries, which took place at the same time, was intended to threaten the retreating Russians in rear, establish communications with Krautwald's group which had pushed forward to the area S. of Lisko, and at least prevent any more troops being taken from the siege army to strengthen the Russian Carpathian front.

The heroic defenders of Przemysl were actually able by the 17th to reach the heights at Cholowicze, S. of Cisowa, at Struzyna, and the Szybewice height, and even to seize a Russian *point d'appui.* But when it became certain on Dec. 19 that coöperation was impossible, owing to the distance between themselves and Krautwald's group, and as at the same time a new Russian attack was threatening the foreground position of the fortress, Kusmanek drew the sortie groups back inside the ring of forts.

North of the Vistula the I. Army had advanced as far as the Szreniawa, Woyrsch's army and the II. Army up to the Pilica and Piotrkow. The German IX. Army was heavily engaged in the Bzura–Rawka sector.

On Dec. 15 the Austro-Hungarian 27th Infantry Div. took Piotrków, and parts of Woyrsch's and Böhm's armies crossed the upper reach of the Pilica. On Dec. 17 Woyrsch pressed forward to the Nida, Dankl to the Nidzica. The IV. Army came up to the Dunajec, Szurmay took Tuchów, and Boroević's army reached the line Jodlowa–Frysztak–Odrzykon–Korczyna and the area N.W. of Lisko.

The Russian Counter-Offensive in Western Galicia.—While practically no opposition was encountered in the pursuit of the Russian IX. and IV. Armies in the bend of the Vistula and of the Russian III. Army N. of the river, Boroević's army had to do some hard fighting against the Russian VIII. Army, particularly on its left flank at Lisko. Protected in the W. by the Dunajec and their strong positions on the Nida, the Russians on Dec. 18 began a counter-offensive in western Galicia directed against the IV. and III. Armies. During their retreat they had again brought up reënforcements to eastern Galicia and also parts of the siege army from Przemysl (60th Reserve Div.) which they used against the III. Army.

Krautwald's group, which had pushed on in the direction of Lisko, was the first to break off the offensive. The W. wing and centre of the III. Army succeeded by hard fighting in holding the line Tuchow–Jodlowa–Brzostek until Dec. 20. On Dec. 21 an extremely violent attack was launched along the whole front in western Galicia, culminating in the battle of Jaslo (Dec. 21–25), which caused the retreat of Boroević's army (the III.). Although the Austro-Hungarian VI. Corps came into action on the W. wing, and the X. and XVIII. Corps on the E. wing, the Russian offensive could not be checked. By Dec. 25 the W. wing of the III. Army (IX. Corps) had retired on Gorlice, the centre (III. and VII. Corps) on Zmigrod and Dukla, and the E. wing (X. and XVIII. Corps) on to the Carpathian ridge to the E. of Lisko. At the end of Dec. the IX. Corps was incorporated with the Austro-Hungarian IV. Army, where Arz took over the command of the VI. and IX. Corps and the Szurmay group and intercepted all attacks against the right wing of the IV. Army on the Luzna–Gorlice–Malastow front.

The III. Army continued its retreat as far as the line Konieczna–Alsópagony–Alsókimes–Rosadomb–Radoszyce and the heights N. of Cisna.

In the gap between the two armies in the Malastow–Konieczna area, the 4th and 6th Cavalry Divs. and the Honved Cavalry Div. prevented the break-through by which the Russians were attempting to outflank the S. wing of the IV. Army.

The Russian counter-offensive brought the campaigns of 1914 to a close. During the latter half of Dec. active fighting in the bend of the Vistula died down. Mackensen's victory-hardened troops, indeed, took Skierniewice, Lubocz and Inowlodz, but at the end of Dec. his front settled down to a war of positions, which lasted throughout the winter, over the whole bend of the Vistula, until the spring offensive in Galicia.

On the Carpathian front there was no respite, for the actions fought by the III. Army during the retreat developed into new battles of gigantic proportions, by which the Austro-Hungarians hoped to achieve the relief of Przemysl, while the Russians were exerting themselves to break through into Austria-Hungary across the Carpathians and crush the Austro-Hungarian army, as a fighting factor, out of existence.

Although the battles of 1914 had given the Russians possession of the whole of eastern and central Galicia, the Central Powers for their part could point to their great success in bringing the Russian "steam-roller" to a standstill before the gates of Germany and, in addition, to having repeatedly seriously beaten the Russian colossus in battle and taken the initiative from him by repeated offensives which were distinguished by the rapid and effective shifting of forces. (E. J.)

LÖFFLER, FRIEDRICH (1852–1915), German biologist, was born at Frankfort-on-the-Oder June 24 1852 and educated at the universities of Würzburg and Berlin. He early began the study of parasitic diseases, and his description of the bacillus of diphtheria, published in 1884, was the originating cause of the modern anti-toxin treatment. He died in Berlin April 8 1915.

LOGUE, MICHAEL (1840–), Irish ecclesiastic, was born at Kilmacrenan, co. Donegal, on Oct. 1 1840, of peasant stock. He was ordained priest in 1866 at Paris, where he had been professor of belles lettres and theology at the Irish College. In 1879 he was consecrated Bishop of Raphoe, was made Archbishop of Armagh in 1887, and was raised to the cardinalate in 1893. Though completely in sympathy with the nationalist aspirations of his Roman Catholic fellow-countrymen, Cardinal Logue maintained a correct and loyal attitude during the World War, and on June 19 1917, when numbers of the younger clergy were beginning to take part in the Sinn Fein agitation, he issued an "instruction" calling attention to the teaching of the Church as to the obedience due to legitimate authority, warning the clergy against belonging to "dangerous associations," and reminding priests that it was strictly forbidden by the statutes of the National Synod to speak of political or kindred affairs in the church. In 1918, however, he placed himself at the head of the opposition to the extension of the Military Service Act to Ireland, priests being allowed to denounce "conscription" from the altar on the ground that the question was not political but moral. He reprobated the campaign of murder against the police and military begun in 1919, and in his Lenten pastoral of 1921 he vigorously denounced murder by whomsoever committed, though the force of this denunciation was weakened by an almost equally vigorous attack on the methods and policy of the Government. The cardinal was much respected by people of all classes and creeds. In earlier life he was a keen student of nature and an excellent yachtsman.

LONDON, JACK (1876–1916), American novelist, was born at San Francisco Jan. 12 1876 and educated at the university of California. He was a born adventurer, going to sea at the age of 17 and serving before the mast as A.B. He went with the first rush to Klondike in 1897 and tramped across the States and Canada, being in gaol more than once as a vagabond. In 1904 he went to Japan as war correspondent and in 1914 to Mexico in the same capacity. In 1906 he started on a voyage round the world in a 50-ft. ketch-rigged yacht and disappeared for two years. His novels, for the most part published first in London, reflect his wild adventurous life, the best known being *The Son of the Wolf* (1900); *The Call of the Wild* (1903); *Moon Face* (1906); *Martin Eden* (1909); *South Sea Tales* (1912), and his last, *The Little Lady of the Big House* (1916). He died at Glen Ellen, Cal., Nov. 22 1916.

See *The Book of Jack London* (1921), by his wife Charmian London.

LONDON (*see* 16.938), the capital of the British Empire, was still in 1921 the largest city in the world, surpassing its nearest competitor (Greater New York) by at least one and a half million souls. The Metropolitan Police District has a radius of 15 m. from Charing Cross (area about 692 sq. m.), but it does not include the City of London (area 658 ac.), which has its own police force. The area of the administrative county of London, which coincides with that within the registrar-general's tables of mortality, is about 117 sq. m.; by the Representation of the People Act of 1918 it included the whole of the Metropolitan Parliamentary Divisions, as well as the 28 Metropolitan Boroughs and the City. The London main drainage area is 148·6 sq. m. in extent. Water London has an area of 561·4 sq. m.

The multiplication and electrification of suburban railways and the extraordinary development of the motor-omnibus and the private motor-car have greatly increased the extent of what may be called the practicable area of suburban London. An interesting development is the Hampstead Garden Suburb, at Golders Green, on the N. side of London, in which every house stands in its own garden and the number of houses is limited to eight to the acre. The pre-war rents varied from 3s. 3d. a week to £350 a year. About 2,000 houses have been erected.

The Unemployment (Relief Works) Act of 1920, largely designed for the benefit of ex-service men, enabled entry to be made upon land for new roads at seven days' notice. Under this Act no fewer than nine great arterial roads had been taken in hand in 1921 by highway authorities with the assistance of the Ministry of Transport (which absorbed the old Road Board). These were the Eltham Bye Pass, the Shooters Hill Bye Pass, the South Circular Rd. (through Woolwich, etc.), the North Circular Rd. (through Willesden, Hendon, etc.), the Western Avenue (through Hammersmith), the Eastern Avenue (across the Lea Marshes), the new Cambridge Rd. (starting at Tottenham), the Barking Bye Pass, and the new Chertsey Rd. The Croydon Bye Pass and the Brentford Bye Pass were begun somewhat earlier. There were in 1921 over 2,200 m. of streets in the county of London, maintained and kept in good order at a total cost of at least £3,000,000 per annum. Street improvements of more than local importance are generally carried out by the London County Council.

The only new bridge over the Thames is Southwark bridge, which was opened for traffic on June 6 1921. It has five arches and is 13 ft. wider than the old one.

The Woolwich tunnel, connecting N. and S. Woolwich and consisting of an iron tube 327 yd. long and 11 ft. in diameter, was opened in 1912 at a cost of £85,862. It is intended as a supplement to the free ferry (still used by vehicles), which is subject to interference from fogs. In 1920 the daily average of passengers using this tunnel was about 28,000, not far short of double the number using the Greenwich tunnel. Blackwall tunnel is traversed daily by about 2,000 vehicles. Rotherhithe tunnel was closed from 1915 to 1918, but its daily average in 1919 was about 1,500 vehicles.

Architecture.—During 1910–21 comparatively few additions of importance were made to the architectural glories of London; but it is, perhaps, more strange that the interminable series of aerial bombardments to which it was subjected during the World War left practically no trace on any buildings of public interest. There was really almost nothing to show that London was besieged from the air for four years. The fine old Flemish windows in the chapel of Lincoln's Inn were indeed shattered by a Zeppelin bomb on Oct. 13 1915; but this loss is, perhaps, counterbalanced by the discovery of an unknown Elizabethan façade near St. Bartholomew's church, brought to light by the concussion of another bomb in the same year.

Such new buildings as call for mention here were mainly erected in connexion with schemes of improvement initiated before the World War. The extensive clearances made in and to the N. of the Strand in 1899–1905, chiefly to provide a new approach to Holborn, opened up the view of St. Mary-le-Strand and St. Clement Danes, and created the handsome crescent of Aldwych and the broad new thoroughfare of Kingsway. Among the edifices already erected in the former are Australia House (1911–18), the imposing London headquarters of the Commonwealth of Australia; the Marconi House, and the Gaiety theatre (elevation by Norman Shaw). The Bush House, close by, designed by Harvey Corbett, architect of the Bush building in New York, illustrates (with some restrictions as to height) the merits of American commercial architecture. The substantial buildings of Kingsway belong mainly to the domain of architectural engineering. Prominent among them are the Kodak building and the large office of the Public Trustee (1916). The Wesleyan Central Hall in Westminster is a huge domed building by Lanchester and Rickard (1911), with a fine staircase. Not far off is the Middlesex Guildhall, a Gothic building by J. S. Gibson (1913). The new Ministries of Education, Health, Trade and Works were designed by J. M. Brydon in an Italian Renaissance style and completed in 1919. Across the river, at the other end of Westminster bridge, stands the new London County Hall, designed by Ralph Knott in a Renaissance style. It is one of the largest buildings of modern times, having nine storeys and a river façade of 750 feet. In the City is the new General Post Office (1910), a reënforced concrete building by Sir Henry Tanner. The Royal Automobile Club in Pall Mall was built in 1911 by Mewes & Davis, in a somewhat florid French Renaissance style. Among commercial buildings of importance are the large extension of Selfridge's store by Sir J. Burnet (1921); the extension of Whiteley's in Queen's Rd., Bayswater; the new offices of the Port of London Authority (by T. E. Cooper) and the Metropolitan Water Board (by H. Austen Hall, 1920).

Monuments and Memorials.—On Nov. 11 1920, the second anniversary of the Armistice after the World War, in the middle of the roadway of Whitehall, was unveiled the Cenotaph, commemorating in dignified simplicity the "Glorious Dead of 1914–18." It was designed by Sir Edwin Lutyens. Other war memorials include one to Edith Cavell (by Frampton) near Trafalgar Sq., one to London's soldiers (by Sir Aston Webb) in front of the Royal Exchange, and the Monument of Belgium's Gratitude (by J. Rousseau and Sir R. Blomfield) on the Victoria Embankment. In front of Buckingham Palace is the elaborate National Memorial to Queen Victoria, designed by Sir Aston Webb, the sculptures by Sir Thomas Brock. To provide a suitable background for this monument the façade of the E. wing of Buckingham Palace was rebuilt by Sir Aston Webb, while the Mall was widened to provide a "triumphal avenue" to the massive Admiralty arch. Near Westminster Abbey has been erected a replica of St. Gaudens' famous Chicago statue of Abraham Lincoln; and a replica of Houdon's statue of George Washington has been set up near the National Gallery. On the top of the Green Park arch is a fine group of Peace in her quadriga, by Adrian Jones (1912). On the Horse Guards Parade are statues of Lord Wolseley (by Goscombe John) and Lord Roberts (by H. Bates); and similar monuments to Lord Kitchener and Lord Fisher are to follow. Statues of Florence Nightingale (1913) and Captain Scott, the Arctic navigator (1915), have been erected in Waterloo Place; and here, too, is the monument to Edward VII., by Bertram MacKennal (1921).

Communication.—The terminal railway stations were, of course, a favourite target of the German airmen during the war; considerable damage was done to Liverpool St. station on June 13 1917, and St. Pancras also was injured slightly on Feb. 17 1918. The new Waterloo station, begun before the war, was nearly completed in 1921. The Central London railway had been extended to Liverpool St. and Ealing (in conjunction with the G.W.R.) The Bakerloo tube ran to Queen's Park, where a junction was effected with the L. & N.W.R. for through running to Watford. The Metropolitan District trains reach Hounslow, Uxbridge, East Ham and Barking. No new "tubes" had been opened, but various schemes of extension were in the air. The Underground group of companies (popularly known as the "Traffic Combine"), formed by the amalgamation of the Metropolitan District, the London Electric, the City and South London and Central London railways, and the London General Omnibus Co., had greatly improved facilities for through traffic between the associated companies. Its headquarters are at Electric Railway House, Broadway, Westminster. Fares had been standardized and, though necessarily higher than in pre-war days, were (judged by the average fare paid per passenger) cheaper than in New York, Paris or Berlin.

The total mileage of tramways in Greater London in 1921 was 350. Horse traction for trams had disappeared. The annual number of passengers approached 700 millions. There were no tramways in the City or West End.

The great majority of motor omnibuses belong to the London General Omnibus Co., and are included in the above-mentioned "Combine" and in one system of numbered routes. Improved new vehicles have been introduced, carrying from 46 to 54 passengers (as compared with 34 on the old type). They carried 860 million passengers in all in 1919. During the busiest traffic period at least 300 to 400 omnibuses pass certain points hourly. In summer motor-omnibuses run to points 30 m. from the centre of the metropolis. A notable feature has been the great increase in motor chars-à-bancs running to places of interest within a radius of 50 m. or more from London.

Hansoms are now rarely seen, and the horse-drawn four-wheeler carries on a precarious existence only in the service of railway passengers with bulky luggage. The general service is maintained by motor vehicles ("taxicabs"), all provided with automatic taximeters. Of the 13,794 hackney carriages licensed to ply for hire in 1919, less than 2,000 were horse-drawn. Probably 75% of the entire traffic of the London streets is now carried on by motor.

London was in 1921 in regular communication with the continent of Europe by air. There were four daily services to Paris, one to Brussels, and one to Amsterdam, all starting from the Croydon aerodrome. About 400 passengers were dealt with weekly, and the number was steadily increasing. These services connect with air-services to various other points in Europe and even (*via* Spain) to Africa (Casablanca).

Post Office.—The buildings of the General Post Office were greatly extended, and an underground tube railway was constructed for the conveyance of postal packets of all kinds, extending W. to Paddington and E. to Whitechapel. The eight postal districts were subdivided into delivery office areas, each with its distinctive number, so that postal addresses are now completed with such formulae as W.C.1, N.W.3, S.E.25, and so on. In addition to the General Post Office and the head district offices there were 105 local delivery offices.

Telephones.—In accordance with the agreement of 1905 the State took over the whole business of the National Telephone Co. on Jan. 1 1912. Telephone call offices for public use are now found at nearly all post-offices and railway stations, and at many shops, public libraries and the like. The London telephone area is 640 sq. m. in extent, containing 83 exchanges with an average of about 1,000,000 daily calls. Its headquarters are at 144A, Queen Victoria Street. From certain offices trunk calls may be made to any part of the country; and London is also in telephonic communication with various Continental towns.

Population and Public Health.—The pop. of Greater London in 1911 was 7,251,358 and in 1921 7,476,168; that of the county was 4,521,685 in 1911 and 4,483,249 in 1921; of the Outer Ring 2,729,673 in 1911 and 2,992,929 in 1921; of the City 19,657 in 1911 and 13,706 in 1921. Greater London increased by 10·2% between 1901 and 1911 and by 3·1% between 1911 and 1921, but the county of London had decreased by 0·3% and 0·9%.

The statistics for the metropolitan boroughs are as follows:—

	Area in statute ac.	Population		Increase (+) or Decrease (−)
		1911	1921	
Battersea . . .	2,163	167,743	167,693	− 50
Bermondsey . . .	1,503	125,903	119,455	− 6,448
Bethnal Green . .	760	128,183	117,238	−10,945
Camberwell . . .	4,480	261,328	267,235	+ 5,907
Chelsea	660	66,385	63,700	− 2,685
Deptford. . . .	1,564	109,496	112,500	+ 3,004
Finsbury. . . .	587	87,923	76,019	−11,904
Fulham	1,706	153,284	157,944	+ 4,660
Greenwich . . .	3,859	95,968	100,493	+ 4,525
Hackney. . . .	3,287	222,533	222,159	− 374
Hammersmith . .	2,287	121,521	130,287	+ 8,766
Hampstead . . .	2,265	85,495	86,080	+ 585
Holborn	405	49,357	42,796	− 6,561
Islington. . . .	3,092	327,403	330,028	+ 2,625
Kensington . . .	2,290	172,317	175,686	+ 3,369
Lambeth. . . .	4,083	298,058	302,960	+ 4,902
Lewisham . . .	7,015	160,834	174,194	+13,360
Paddington . . .	1,357	142,551	144,273	+ 1,722
Poplar	2,331	162,442	162,618	+ 176
St. Marylebone . .	1,473	118,160	104,222	−13,938
St. Pancras . . .	2,694	218,387	210,986	− 7,401
Shoreditch . . .	658	111,390	104,308	− 7,082
Southwark . . .	1,131	191,907	184,388	− 7,519
Stepney	1,767	279,804	249,738	−30,066
Stoke Newington . .	863	50,659	52,167	+ 1,508
Wandsworth . . .	9,107	311,360	328,656	+17,296
Westminster, City of .	2,503	160,261	141,317	−18,944
Woolwich . . .	8,282	121,376	140,403	+19,027
City of London (County Corporate) .	678	19,657	13,706	− 5,951

The proposed new "London health area" would contain more than 9,000,000 souls.

The birth-rate sank from 24·3 per 1,000 in 1914 to 17·9 in 1917, but it had climbed again (according to the estimates of the registrar-general) to 26·5 in 1920. The death-rate curve for the same period was 13, 18, 12·4. Both birth and death rates are below the figures for 1910–4 (28·5 and 16·5 respectively). The comparative death-rates for the different boroughs were about the same, and London maintained its relatively favourable position in comparison with other large towns.

Sanitation.—The general regulations as to public health remain much as they were in 1910. The Act of 1891 was supplemented by the Housing Acts of 1909 and 1919, and various Diseases of Animals Acts. Many of the provisions of the National Insurance Acts of 1911–20 are administered by an Insurance Committee of 80 members, one-fifth of whom are appointed by the County Council. The mileage of the main sewers had increased to about 370 m., the cost of construction (to March 1919) to £12,608,000, and the annual cost of maintenance to about £500,000 (1918–9). The total annual cost, including debt charges and the work of the Metropolitan Borough Councils, was nearly £1,000,000 (1918–9).

Hospitals.—The powers of the Metropolitan Asylums Board were further defined by sundry orders of the Ministry of Health, and its scope and services increased. The activity of the London County Council, which controls the asylums for acute or recoverable cases of insanity, was especially notable in the improved treatment of tuberculosis and venereal diseases and in the campaign against infant mortality. The growing share of woman in the medical life of London is illustrated, *e.g.* by the existence of several hospitals wholly run by women. The so-called "Unit System," adopted from America, will (it is hoped) prove of great benefit.

Water Supply.—Under the Metropolitan Water Board Act of 1915 the Board was completing in 1921 a reservoir at Littleton, with a capacity of 6,350,000,000 gallons. The existing storage reservoirs for unfiltered water had an area of nearly 2,000 ac. with a capacity of 13,000,000 gallons. The total supply in 1919–20 was 100,079,000,000 gals. of water, being a daily average of 273,400,000 gallons (about 40 gallons per head of population). The total income on revenue account for 1919–20 was £3,158,391, and the expenditure £4,143,258, leaving a deficiency of £984,867, which was met by precepts levied on the contributory authorities. In 1916 the Metropolitan Water Board decided to save coal by chlorinating raw

Thames river water (70–80 million gals. per day) and allowing the treated water to flow by gravity down the Staines aqueduct, instead of first pumping it up into the Staines reservoir. The amount thus saved up to March 31 1921 was calculated at £20,000. As regards the reduction of bacteria (95%) the success was complete.

Fire Prevention.—The London Fire Brigade had in 1921 a staff of about 1,900, and the gross cost of its maintenance exceeded £650,000 annually. In 1920 it dealt with 4,282 fires (besides 2,272 false alarms). An interesting part of its work is that carried on on the Thames, where it had three stations with fire-floats.

Cemeteries.—Twenty-one of the Metropolitan Borough Councils had adopted the Burial Acts and seven had not. The City Corp. had a crematorium at Little Ilford, the London Cremation Co. had established crematoria at Woking and Golders Green, and the South Metropolitan Cemetery Co. had one at Norwood; but no Borough Council had in 1921 provided one. The practice of cremation is controlled by the Home Secretary. In 1920 the cremations in London numbered 1,337.

Education.—The London County Council is the local education authority for the Administrative County of London. It works through a statutory committee of 50 members, including the chairman, vice-chairman and deputy-chairman of the council, and 12 coöpted members. In 1920 14 of the members were women. The total number of public elementary schools in London in 1920 was 950, with 854,979 children scheduled and an average attendance of 624,436. The expenditure was £5,972,375 on Council schools and £1,272,701 on Non-Provided schools. The Education (Provision of Meals) Acts of 1906 and 1914 empower local authorities to provide meals for necessitous children in elementary schools, and in 1921 about 29,000 children were fed in this way. The secondary schools in the county of London were attended by about 41,000 pupils and cost about £180,000. The evening institutes and continuation schools were taken advantage of by 135,000 students and involve an annual expenditure of over £300,000. The total annual expenditure of the London County Council for higher education of all kinds approaches £3,000,000.

Public Schools.—To the public schools named in the earlier article must be added University College school, founded in 1830 by a group of Liberal thinkers (including Brougham, Hallam and James Mill) and removed in 1907 from Gower Street to large new premises in Hampstead. It is attended by over 400 boys.

University of London.—The teaching and research work of the university are carried out in (*a*) incorporated colleges and institutions (University College, King's College, King's College for Women, including the Household and Social Science department, Goldsmiths' College, the Brown Animal Sanatory Institution, the Physiological Laboratory, the Galton Laboratory for Eugenics, and the Bartlett School of Architecture); (*b*) over 30 schools of the university, including the Imperial College of Science and Technology (Royal College of Science, Royal School of Mines, and the City and Guilds Engineering College), Bedford College, London School of Economics, East London College, Royal Holloway College, Birkbeck College, and the medical schools attached to the great hospitals; and (*c*) about 25 institutes having recognized teachers. During the World War, the university had, of course, largely to mark time; but it had in 1921 more than regained its pre-war standard of efficiency. The number of internal students was nearly 8,000, and the total number of candidates for examinations in 1920–1 was 23,563. Among the chief events in its recent history are the opening of the handsome new buildings of Bedford College in Regent's Park (1913), and of the new buildings of the Imperial College and University College, the opening of the School of Oriental Studies in 1917, and the establishment of degrees in commerce (1918), of training in journalism (1920), and of an Institute of Historical Research (1921), and the erection of new buildings for commerce teaching at the School of Economics. In 1920 the Rockefeller Trustees presented to the university a sum of £370,000 for University College, and £835,000 for University College hospital school. In this year, too, the Government offered the university a site of 11½ ac. in Bloomsbury, where it was hoped that it would soon possess a dignified home of its own.

Museums, Art Galleries, Libraries.—The museums and public galleries of London, generally closed or commandeered for Government purposes during the World War, had all been practically restored by 1921 to their normal functions. A new feature at the chief collections is the guide-lecturer who conducts visitors round one or more of the departments (free). The British Museum was greatly extended by the opening in 1914 of the King Edward VII. Galleries, to the N. of the main building. The Victoria and Albert Museum had been placed on a more autonomous basis and divided into seven departments. The collections are arranged upon strict scientific lines, with the double purpose of stimulating the designer and manufacturer, and of spreading a knowledge and appreciation of art. The Indian section now occupies a separate building in the Imperial Institute Road. In 1916 the Imperial Institute was placed under the control of the Colonial Office. On the S. side of Imperial Institute Rd., adjoining the Imperial College of Science, is the new Science Museum, the first completed block of which was opened in 1920. The London Museum (1914) is a collection illustrating the history, life and manners of London, on the lines of the Musée Carnavalet at Paris; it occupies what was long known as Stafford House, which was presented to the nation by Lord Leverhulme in 1912, when its name was changed to Lancaster House, in honour of the royal title "Duke of Lancaster" and of the generosity of a Lancashire man. The Imperial War Museum, provisionally housed in the Crystal Palace at Sydenham, is a marvellous record of the efforts and unity of the British Commonwealth during the war. The National Gallery was considerably enlarged in 1911, the Tate Gallery in 1910. The Geffrye Museum (1914), situated in the heart of the cabinet-making district of London (Hoxton), illustrates the development of furniture design.

The provision of public libraries by local authorities is governed by the Public Libraries Acts, 1892–1919. In London these Acts have been adopted by practically all the Metropolitan Borough Councils, and the free public libraries contained in 1921 over one and a quarter million books. Among the largest are those of Lambeth (110,000 vols.), Wandsworth (100,000), and Westminster (90,000). Over 6,000,000 books are taken out annually by about 220,000 borrowers.

Theatres and Places of Entertainment.—Places of public entertainment operate under one or more of four licences:—(1) Stage plays, (2) music and dancing, (3) music only, (4) cinematograph. The licensing authorities are the Lord Chamberlain and the County Council. Covent Garden is still the chief home of opera; of equal importance with it in the history of the drama is Drury Lane theatre, now used mainly for spectacular drama. Additions to the London theatres were the Winter Garden, the Ambassador's, the New Oxford, Prince's and St. Martin's. The growth of the cinematograph was a notable feature, and the "films" or "pictures," besides numerous specially erected buildings, now occupy several old theatres. Various suburban theatres (such as the Lyric at Hammersmith and Everyman's at Hampstead) made a reputation for the excellence of their productions, and the Royal Victoria Hall (the "Old Vic.") in Waterloo Rd. has done admirable work in familiarizing the masses with classic English drama and good music.

The chief public flying-grounds are at Hendon, Croydon and Northolt, at any of which machines may be hired for short flights, for day trips to places like Brighton, and for longer journeys. Exhibitions of fancy flying and racing are also held.

Port of London.—The Port of London occupies about 70 m. of the Thames, extending from just below Teddington Lock to a line drawn from Havengore Creek (Essex) to Warden Point (Kent). The Port Authority was constituted by an Act of 1908, and an Act of 1920 consolidated and unified all Acts relating to the Docks and Rivers since 1828. Trinity House also exercises rights in respect of pilotage, lighting and buoying, and the City Corp. is the port sanitary authority. The total area of the dock estate is about 3,000 ac. (of which 704 are water), with over 30 m. of quayage. The wharf and jetties (with 15 m. of quayage) remain in private hands. Between 1909 and 1921 very considerable improvements and extensions were carried out in the system of docks. The most important of these was the new Albert dock extension (south), opened in July 1921, which includes a dock 64 ac. in area with accommodation for the largest vessels afloat, a new entrance lock 800 ft. long, and a dry-dock 750 ft. long. Tilbury docks were also being extended, and were supplemented by a cargo jetty 1,000 ft. long and a pontoon for passenger steamers similar to that at Liverpool. The warehouse accommodation at the docks was greatly enlarged, and various spacious uptown warehouses constructed. In 1913 (the last complete year before the World War) the total value of imports and exports of London (excluding coastwise trade) was £411,792,149 (about one-fourth of the total for the United Kingdom). The tonnage of vessels entering the port (foreign and colonial trade) was 12,916,378, of those clearing 8,131,660. The war affected the business of the port in many directions. Large requisitions were made on the Authority's facilities, space and plant; and a serious disturbance of all normal trade was inevitable. The tonnage of vessels entering and clearing sank in 1914–5 to 11,586,967 and 6,832,569 (a decrease of 2½ million tons); and the lowest point was reached in 1917–8 with 5,276,445 and 3,631,009 tons. The value of the trade, however, increased to £505,000,000 in 1917, and £542,000,000 in 1918. This increase was solely in imports, exports showing a continual decrease. In the year ending March 31 1919 the total value of the trade was £819,875,330 (about one-third of that for the United Kingdom), the highest figures ever attained. That this was due mainly to a rise in price, not in quantity, is shown by the fact that the total tonnage in 1919–20 was only 15,224,787, about 6,000,000 tons below that of the last pre-war year.

Government.—The Representation of the People Act of 1918 somewhat altered the boundaries of the London parliamentary boroughs. Since the passing of the Act, the London County Council has consisted of 124 councillors and 20 aldermen. The number of electors in London on the first registers compiled under the Act of 1918 was as follows:—

	Men	Women	Total
Parliamentary	1,151,522	806,533	1,958,055
Local Government	806,217	805,778	1,611,995

At the election of 1919 (postponed during the World War) there were returned 68 Municipal Reform (or "Moderates"), 40 Progressive, one Independent, and 15 Labour members.

The Representation of the People Act, 1918, rearranged the boundaries of all the London parliamentary boroughs, except the City of London. It provided that the Administrative County of London should be divided into 61 parliamentary constituencies, the City of London returning two members, the others one each (*see* UNITED KINGDOM). The boundaries of the county electoral divisions are coterminous with those of the parliamentary constituencies.

Ecclesiastical Divisions.—To the suffragan bishops must be added those of Willesden (1911), Woolwich (1918) and Kingston (1914). Leading Nonconformist churches were Westbourne Park chapel, Westminster chapel, Christ church (Westminster), King's Weigh House chapel, the Scottish National church, and St. Columba's (Presbyterian). There were in 1921 eight Christian Science churches in London proper, and as many more in extra-London. The headquarters of the Church Army are at 55 Bryanston Street. To the French churches should be added the Huguenot Episcopal church in Shaftesbury Avenue. The Dutch church in Austin Friars is of great historical interest. The church of the Theosophical Society in Tavistock Sq. is a striking building by Sir E. Lutyens. The Catholic Apostolic church in Gordon Sq. is one of the largest and most striking ecclesiastical edifices in London. The number of ecclesiastical parishes is now 633.

Finance.—Apart from provisional and temporary measures during the World War there have been no important modifications of the financial government of London since 1911. For the year 1919–20 the total sum raised by the General Rates was £22,104,510, an increase of about 6½ millions over that of 1906–7. The rate for 1920–1 showed an increase of about 10 millions over 1906–7. The total local expenditure of London for 1917–8 (the latest year available) was £30,528,746; the chief items were London County Council £13,512,674; Metropolitan Borough Councils £5,555,217; Board of Guardians £3,427,456; Metropolitan Water Board £2,645,073; Metropolitan Police £2,679,002; City Corporation £1,314,696; Metropolitan Asylums Board £1,330,557. The average rate for 1919–20 was slightly under 10s. in the £, and the estimated rate for the first half-year of 1921–2 about 7s. 10½d. (equal to an annual rate of 15s. 9d.). In 1920 the total ratable value of immovable property in the county of London was £45,638,701 (an increase of 2·3% since 1909).[1] In 1921, however, it rose to £48,708,752 (9·2% over 1909). A penny rate produces over £200,000 (1921–2). The Equalization Fund produces about £1,217,000; but rates still vary from 22s. 10d. in Poplar to 11s. 6d. in Westminster and 10s. 6d. in the City. The estimated income of the London County Council for 1920–1 was £27,535,033; that of the City Corporation in 1919–20 was £211,272. The debts of the London local authorities on March 31 1918 were as follows: London County Council £47,549,550; Metropolitan Asylums Board £1,191,783; Metropolitan Police £74,345; Metropolitan Water Board £39,255,555; Central (Unemployed) Body £1,200; City of London Corporation and Metropolitan Borough Councils £16,190,366; Guardians and Sick Asylum managers £2,048,448 (total £106,311,247, a decrease of 8 millions since 1908). The aggregate capital expenditure by the London County Council and its predecessors down to March 31 1919 was £98,576,171.

History.—The history of London after 1909 was largely the chronicle of an interruption or arrest of its normal growth in population, extent, wealth and progress generally. According to the estimates of the registrar-general the increase in population from 1911–20 was relatively small. Between 1911 and 1920 the assessable value increased only by about 2½%, as compared with an increase of 12½% in 1901–11, and of 20% in 1891–1901. The tonnage of shipping entering and clearing the port had not yet regained in 1920 its pre-war figure, though the inflation of values showed an increase in terms of money. With the exception of relatively unimportant extensions no new tubes or tramways had been constructed; new schemes of improvement and extensions in streets, housing, water-supply and the like had been suspended, or only just resumed. The death-rate, which had decreased steadily down to 1912, jumped from 13·6 per 1,000 in that year to 19·2 in 1918, and the birth-rate decreased in a similar proportion. This "arrest," however, had by no means been due to stagnation, because probably no similar period had taken London's citizens more emphatically out of the category of the happy people who have no history and into the realm of excitement and adventure. On May 31 1915, London was startled by the first hostile attack it had experienced for nine centuries; and from then till May 1918 it was the persistent target of German airmen (*see* AIR-RAIDS). In all it was reached 25 times by hostile air-ships (seven raids) and aeroplanes (eighteen raids). No fewer than 922 bombs were dropped within the county of London, of which 355 were incendiary and 567 explosive; 524 persons were killed and 1,264 injured. The material damage has been estimated at over £2,000,000, or about one-fifth of that occasioned by the great fire of 1666. East London suffered most severely. Practically no buildings of historic or artistic value were seriously injured. London's defence, which was increasingly successful, consisted partly of barrage fire from anti-aircraft guns and partly of British "counterplanes." An "apron barrage" of wire trailed from balloons was also tried. Tube stations, church crypts, and so on were used as refuges between the "warning" and "all clear" signals. On June 13 1917, a bomb fell on a County Council school at Poplar, killing and injuring a number of children. On March 7 1918, a single bomb destroyed four four-storey houses in Paddington, wrecked two, and seriously damaged twelve others. The greatest financial damage was done by the raid of Sept. 7 1915, when City property to the value of over £500,000 was destroyed by fire. (For particulars of damage done elsewhere than in Poplar by the air raid of June 13 1917, *see* 30.97.)

The war-time restrictions included the great diminution of the lighting of the streets after nightfall; an airship patrol to see that the shading of all lights was properly carried out; the patrolling of voluntary "special constables," taking over many of the duties of the regular police; the multiplication of "flag-days," when little flags were sold in the streets for benevolent purposes usually directly associated with the war; the occupation of the public parks and other open spaces by hutments for one kind or another of Government service, or by allotments cultivated by private citizens for the increase of the national food-supply; the limitation in the transport services, including the closing of several suburban stations; the restriction of private motoring; the queues outside the provision shops; the commandeering by Government of many of the leading hotels and of numerous large private houses, the latter chiefly as hospitals and convalescent homes; the closing of a certain proportion of places of entertainment, and the temporary abandonment or transference elsewhere of some of the chief annual fixtures in the sphere of sport; the closing (total or partial) of the British Museum, National Gallery, and other public collections; the protection of historic buildings by sand-bags, the temporary removal of their treasures, and the substitution of wood for stained glass; the arrangements for the accommodation and support of many thousands of Belgian refugees; the setting apart of the Alexandra Palace and other large institutions as internment camps; the appearance of women as omnibus and tramway conductors (an outward and visible sign of the enormous part played by women during the war in providing substitutes for male labour). Aliens, of course, had to submit in London to the general restrictions, but London never became a "prohibited area."

During the war London and its neighbourhood became the seat of a very extensive production of munitions of all kinds, employing great numbers of women as well as men. One of the unhappy incidents of their activity was the explosion of a munition factory at Silvertown on Jan. 19 1917, followed by a disastrous fire and the loss of 69 lives (400 casualties in all).

Among other London incidents directly connected with the war may be mentioned the anti-German riots of 1914; the execution of Sir Roger Casement at Pentonville on Aug. 13 1916; the execution in the Tower of Carl Lodz (1914), Müller (1915), and other spies and traitors; the march of American troops through London on Aug. 15 1917; the burial of the Unknown Warrior in Westminster Abbey (Nov. 11 1920), the great memorial services in St. Paul's Cathedral in honour of Nurse Cavell (1915); to celebrate America's coming into the war (1917); to render thanks for the restoration of peace (July 6 1919); and the remarkable scenes of rejoicing in the London streets on the proclamation of the Armistice on Nov. 11 1918.

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[1] The retardation of growth in ratable value was largely due to the reduction of assessment of licensed premises in 1910.

Among events not due to the war were the death of Edward VII. at Buckingham Palace in 1910, the coronation of George V. at Westminster Abbey in the following year; the "Suffragette" violence of 1914, amply atoned for later in public estimation by the admirable war services of the women suffragists; the first aerial Derby round London on June 6 1914; the more or less abortive police strike of Aug. 1919 (for recognition of their union); the railway strike of Sept. in the same year, when 20,000 motor-cars were assembled in Hyde Park to maintain the supply of milk; the coal-miners' strike of 1921, when the authorities had again to have recourse to emergency measures for public protection; the great advance in the use of oil fuel, largely consequent on the shortage of coal caused by the strike.

Recent excavations in London have brought to light an arch of old London bridge (near St. Magnus' church), fragments of the Roman wall in Moorfields, and a number of 15th century boots and shoes in such good condition that the leather was used by the modern workmen to mend their own footwear; a water conduit of doubtful use and date under Bond St. (possibly of the 17th century, and used as a reservoir for the water of Tyburn); and Roman coins and charred remains of clay and wood in King William St., referred by some authorities to Boadicea's destruction of London in 61 A.D.

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(J. F. M.)

LONDONDERRY, CHARLES STEWART VANE-TEMPEST-STEWART, 6TH MARQUESS OF (1852–1915), British Unionist politician (*see* 16.969), was a prominent leader of the opposition to the Home Rule bill introduced by the Asquith Government in April 1912. He was one of the first Unionists to sign the Ulster covenant Sept. 28 1912, and subscribed largely to the funds accumulated by the Irish Unionists. Lord Londonderry was one of the largest coal-owners in the north of England, and by his energy and business capacity greatly increased the value of his property. He died at Wynyard Park, Stockton-on-Tees, Feb. 8 1915. Lord Londonderry married in 1875 Lady Theresa Chetwynd Talbot, elder daughter of the 19th Earl of Shrewsbury, who was well known for her philanthropic and political work and also as a brilliant hostess. During her residence in Ireland Lady Londonderry did much for the promotion of Irish industries, and in later life she completely identified herself with her husband's activities on behalf of the Unionist cause. She died in London March 16 1919.

Their eldest son, CHARLES STEWART HENRY VANE-TEMPEST-STEWART, 7th Marquess of Londonderry (1878–), was born in London May 13 1878. He was educated at Eton, and afterwards entered the Royal Military College at Sandhurst. As Viscount Castlereagh he entered the House of Commons in 1906 as Unionist member for Maidstone. He served during the World War, and in 1915 succeeded his father as 7th marquess. He married in 1899 Edith, daughter of 1st Viscount Chaplin, who did much valuable work during the World War as the originator of the Women's Legion. She founded the corps of "Domestic Legionaries," as an attempt to solve the problem of domestic service, and in 1917 was created D.B.E.

LONG, JOHN DAVIS (1838–1915), American lawyer and politician (*see* 16.974), died at Hingham, Mass., Aug. 28 1915.

LONG, WALTER HUME LONG, 1ST VISCOUNT (1854–), English statesman, born at Bath July 13 1854, was the eldest son of Richard Penruddocke Long, of Rood Ashton, Wilts., and Dolforgan, Montgomeryshire, and his wife, Charlotte, daughter of the Right Hon. W. W. Fitzwilliam Hume Dick. He was educated at Harrow and Christ Church, Oxford. Being the representative of an old county family with a tradition of Parliamentary service it was natural that he should contemplate a political career. He entered the House of Commons in 1880 as Conservative member for N. Wilts., and sat in every Parliament since till he was created a peer in May 1921, though he changed his constituency several times. The Reform Act of 1884 abolished his first constituency, so in 1885 he became member for the Devizes division of the county. From 1892 to 1900 he sat for W. Derby, Liverpool, from 1900–6 for S. Bristol, from 1906–10 for Dublin county, S., from 1910–18 for the Strand division of London, and after 1918 for St. George's, Westminster. He early showed interest in, and knowledge of, questions of local administration, especially in country districts, and was accordingly appointed Parliamentary secretary of the Local Government Board in 1886. The industry, capacity and common sense which he showed in his six years' tenure of this office marked him out for promotion when his party returned to power. Accordingly in 1895 he became president of the Board of Agriculture, remaining for five years, and then for the five following years he was president of the Local Government Board. His administration at the Board of Agriculture was marked by the stamping out of hydrophobia through the strict enforcement of a muzzling order for dogs, and the tenacity and resolution which he showed in carrying his policy through, in the face of a violent agitation by many dog-owners and dog-lovers, raised him greatly in public esteem.

Hitherto Mr. Long, despite his administrative efficiency, had not counted for much in the main party struggle. But in March 1905 he emerged into the limelight, being chosen by Mr. Balfour to succeed Mr. Wyndham, after the latter's breach with Irish Unionism, as Chief Secretary for Ireland. He at once restored Unionist confidence by reducing the under-secretary, Sir Antony MacDonnell, afterwards Lord MacDonnell, to definite subordination to himself as the responsible minister, and by the firmness with which he proceeded to enforce the law and repress agrarian intimidation. At the same time he proclaimed that his policy was to redress legitimate grievances, and to give everybody justice and fair play. The impression which he produced in Ireland in the few months before Mr. Balfour's resignation was so considerable that he, an Englishman, was returned to Parliament in the general election of 1906 as member for the S. Dublin division. In the years of Opposition which followed he proved a vigorous opponent of Mr. Birrell's policy of *laisser-faire* in Ireland and of Mr. Lloyd George's proposals with regard to the land, and a more benevolent critic of the Government Old-Age Pension scheme and of Mr. Burns's administration at the Local Government Board. When Mr. Balfour resigned the leadership of the Unionist party in Nov. 1911 he was the candidate of the more conservative branch of the party; but both he and Mr. Austen Chamberlain, his rival, agreed to stand aside in favour of Mr. Bonar Law. In the years immediately following Mr. Long was not very prominent in Parliament, though he took his share in the determined opposition to the Home Rule bill. But he had the respect of all parties, as the chief representative in public life of old-fashioned conservatism and the "agricultural interest."

With the other Unionist leaders he joined the first Coalition Ministry in 1915, returning to his old post of president of the Local Government Board. In that capacity he carried bills for national registration for suspension of municipal elections, and for restriction of the raising of rent on small houses, and took a leading part in pressing upon the House the military service bills of 1916. In the second Coalition Ministry he was Secretary of State for the Colonies. He had been hitherto a decided opponent of woman suffrage, but he was converted by the services of women during the World War, and in 1917 he introduced in the House of Commons the Franchise bill, which became law in the following year, and under which women over 30 obtained the franchise. When Mr. Lloyd George reconstructed his Ministry in the beginning of 1919 Mr. Long became First Lord of the Admiralty and had the difficult task of supervising the reduction to a peace basis of the gigantic navy which had been built up during the war. He refused to be rushed into precipitate action either by the challenge of the United States and Japan, who both started large schemes of shipbuilding, or by the clamour of the enthusiasts for air-warfare who proclaimed that battleships had become useless, but announced in the Estimates of 1921 a moderate programme of four new battleships. For some years his health had been periodically unsatisfactory, and in the spring of 1921 he resigned office. Mr. Bonar Law's breakdown in health occurred immediately afterwards, and Mr. Long heartily supported the election of his old rival, Mr. Austen Chamberlain, to the leadership of the Unionist party in the House of Commons. A few months later he was raised to the House of Lords, amid general approval, as Viscount Long of Wraxall.

He had married in 1878 Lady Doreen Boyle, daughter of the 9th Earl of Cork and Orrery. His elder son, Brig.-Gen. Walter Long, C.M.G., D.S.O., served in the S. African War, and fell in action in France in Jan. 1917 at the head of his brigade.

(G. E. B.)

LOREBURN, ROBERT THRESHIE REID, 1st Earl (1846–), British lawyer and politician, was born at Corfu April 3 1846, and was educated at Cheltenham and Balliol College, Oxford, where he had a distinguished career, winning the Ireland scholarship in 1868. He was called to the bar in 1871, and in 1880 entered politics as Liberal member for Hereford. In 1882 he became a Q.C., and having in 1885 lost his seat at Hereford, was returned in 1886 for Dumfries Burghs, retaining the seat until 1905. In 1894 he was for a few months Solicitor-General and was knighted, and during 1894–5 was Attorney-General. From 1899 to 1906 he was counsel to the university of Oxford. On the formation of Sir Henry Campbell-Bannerman's Government in 1905, Sir Robert Reid became Lord Chancellor, and was raised to the peerage as Baron Loreburn. To him, while Chancellor, the passage of the Court of Criminal Appeal Act (1907) was largely due. In 1912 he resigned on grounds of health. Lord Loreburn was created an earl in July 1911. He published *Capture at Sea* (1913) and *How the War Came* (1919).

LORIMER, SIR ROBERT STODART (1864–), Scottish architect, son of Prof. Lorimer of Edinburgh University, was born at Edinburgh Nov. 4 1864. After an education at the Edinburgh academy, and then at the university, Lorimer entered the office of Sir Rowand Anderson as a pupil, at the age of 21. Here he passed some four or five years, and after travelling in England for study he spent upwards of two years in the London office of G. F. Bodley, R.A. Under his guidance Lorimer's predilection for Gothic work—fostered by subsequent travel abroad—received the encouragement that fitted him for the church work which, later, played so large a part in his career. In 1893 he returned to Edinburgh to undertake the restoration of Earlshall, Lewchars and other commissions. This was the beginning of a large series of additions and restorations he was called on to carry out—amongst them Dunderaw and Monzie castles and Pilkerro in Scotland; Lympne Castle, Kent; and Barton Hartshorne, Bucks. His domestic work, apart from restorations and alterations, included new houses at Ardinglar, Argyllshire, Cupar, Fife; Hallyburton; Brackenbrough in Cumberland, and St. Marnock's, co. Dublin. Throughout his restoration design there is evident a full acquaintance with, and feeling for, the methods and principles of the earlier builder, without too close and academic an adherence to them. A great opportunity was afforded him in 1909 in his design for the new chapel of the Knights of the Order of the Thistle, on the south side of St. Giles's cathedral, Edinburgh, the chief example of his skill and architectural ability. The large sum of money left by Lord Leven and Melville for the restoration of the chapel at Holyrood Palace it was found impossible to utilize for that purpose, and on its reversion to the estate his heir, with great generosity, devoted the amount to the building of a new chapel for the use of the Order, and for this Lorimer was appointed architect. This building, small but highly ornate and enriched with carefully conceived detail, gave him the opportunity of giving to Scotland a worthy modern example of ecclesiastical woodwork to add to its only existing specimens of any importance—the few stalls at Dunblane cathedral, and the woodwork in King's College, Aberdeen. It was in connexion with this fine work that, in 1911, he was knighted. He also designed a large number of churches, and fitted many others with screens, organ-cases, and choir-stalls. In 1920 he was elected Associate of the Royal Academy and in 1921 a member of the Scottish Academy.

LOS ANGELES, California (*see* 17.12), increased in its population more than 80% in the period 1910–20, reaching 576,673, surpassing San Francisco, and changing from sixteenth to tenth place among the cities of the United States. The area of the city increased more than fourfold, being 365·67 sq. m. in 1920. In 1910 Hollywood (4·45 sq. m.), East Hollywood and Ivanhoe (11·11 sq. m.) were annexed, and in 1912 Arroyo Seco (6·9 sq. m.). In 1915 168 sq. m. of San Fernando Valley and 4 sq. m. of the Palm District was annexed. In 1910 there were 22 parks with 3,800 ac.; these had increased by 1920 to 25 parks with 4,100 acres. The playground department, established in 1911, maintained in 1920 12 playgrounds and 34 summer centres at a cost of $207,836. Three summer camps for family outings in the mountains were supported by the municipality. In 1910 builders' permits were granted for buildings valued at $21,684,100; in 1920 the value was $60,023,600. The museum of the Southwest Society of the Archaeological Institute of America began in 1912 its first group of buildings. A new museum was added by a building at Exposition Park.

Los Angeles has maintained its position as a winter resort. During 1910–20 it became predominantly an industrial rather than an agricultural centre, though agriculture, which had hitherto been its chief economic interest, continued to furnish a large share of the city's prosperity. In 1919 the value of all farm products in Los Angeles county was $426,045,843, an amount greater than that for any other county in the United States. The chief products were citrus fruits, valued at $80,140,000. There were 13,013 farms in 1920, against 7,919 in 1910.

Communications.—In 1912 only half-a-dozen steamship lines were in operation between Los Angeles and other coast ports, with a few lines to Mexico, Central America, and Hawaii. By 1920 direct lines were in operation to the Orient, the Philippines and the Straits Settlements. On Jan. 31 1921 there were 34 marine services reaching more than 100 important ports throughout the world. Steamship travel to and from Los Angeles more than doubled in 1919. The urban and suburban electric railways had in 1920 over 591 m. of single track within the city and 1,095 m. outside its limits, extending to points 72 m. distant.

During 1909–20 the Federal Government spent approximately $6,000,000, and the city of Los Angeles $5,800,000, in improving the harbour, Port San Pedro. The arrangement of U.S. pierhead lines as established in 1920 permitted approximately 24 m. of wharf frontage; 35,283 ft. was already improved, of which the city owned and operated 13,315 ft.

Education.—There were in 1920 over 800 public and over 140 private schools and colleges in the city. The value of school property was nearly $19,000,000; the enrolment 115,530, and the teaching force 5,147. The university of California organized in Los Angeles a southern branch, providing a two-year course. The public library in 1920 contained 383,925 volumes with a home circulation of 2,581,214, and there were 12 branches, 24 sub-branches, and 139 depositories with 14,792 volumes.

Industries and Commerce.—In 1914 Los Angeles was the twenty-sixth city in the United States in value of manufactured products; in Jan. 1921 an estimate showed it to be tenth. In 1912 the value of the manufactured products was $85,000,000. In 1919 according to an estimate of the Los Angeles chamber of commerce there were 3,300 establishments representing an investment of $400,000,000 and producing a product valued at $618,772,500. The chief industries with the value of their products were motion-picture films, $150,000,000, 80% of the world's supply; petroleum refining, $83,000,000; shipbuilding, $68,000,000; meat-packing, $42,000,000; food products, $41,000,000; garment manufacture, $30,000,000; iron and steel, $25,000,000; automobiles and accessories, $21,000,000; and railway car construction, $20,000,000. In 1919 Southern California produced 102,000,000 bar. of crude oil, Los Angeles being the centre for this industry. In 1914 there were 2,100 oil wells in the city. Bank clearings increased from $942,914,424 in 1911 to $3,994,280,518.83 for 1920. The post-office receipts during the same period increased from $1,646,601.84 in 1911 to $4,180,057.70 for 1920. The assessed valuation of property of Los Angeles in 1920 on a 50% basis was $636,147,965. The most important event in the economic development of Los Angeles was the building of the municipal aqueduct, placed in operation Nov. 5 1913. It is capable of furnishing water to over a million population and a surplus to irrigate 135,000 ac., and also sufficient for all demands of industry. The fall in the aqueduct is used to develop electric power. In 1917 a plant of 37,500 H.P., and in 1919 one of 28,000 H.P. was thus supplied. In the decade 1910–20 Los Angeles developed from a port of relative unimportance to one of the leading ports on the Pacific coast, though the immediate increase in shipping and industry which the city expected as a result of the completion of the Panama Canal did not materialize. This was partly due to the unusual conditions arising from the World War. Since 1918 the city's commerce has increased remarkably. The value of its foreign exports in 1912 was $235,460, in 1919 $10,496,172, and in 1920 $18,606,121, the latter an increase of 80% over 1919. The imports in 1912 were $1,710,127, in 1919 $3,218,490 and in 1920 $9,724,217, the latter an increase of 206% over 1919. (R. A. V.)

LOUIS [LUDWIG], Ex-King of Bavaria (1845–1921), assumed the regency in succession to his father on Dec. 12 1912. In accordance with the bill passed by the Bavarian Diet he assumed the crown on Nov. 5 1913 (King Otto, who had been kept in confinement as a lunatic, died on Oct. 11 1916). On the afternoon of Nov. 7 1918, the King was taking a walk with his daughters in the Englischer Garten, unconscious of the fact that the Socialist demonstration organized by Eisner on the Theresienwiese was developing into a revolution. A plain man of the people met the King and said to him: "Get home as quickly as you can, your Majesty, things are not going well." Later in the evening the monarch was informed by his ministers that the republic had been proclaimed. With the Queen and his daughters the King promptly left Munich in one of his motor-cars, the whole luggage consisting of a few handbags. The royal family resided first at Berchtesgaden, and afterwards at a castle assigned to them on the shores of the Chiem See. On Nov. 13 he formally signed his abdication, and relieved all Bavarian officials, officers and soldiers from their oath of allegiance. He died at Sarvar, Hungary, Oct. 17 1921.

LOUISIANA (*see* 17.53).—The pop. of the state in 1920 was 1,798,509 as compared with 1,656,388 in 1910, an increase of 142,121, or 8·3% for the decade. During 1910–20 negroes decreased from 713,874 to 700,257, or from 43·1% of the total pop. to 38·9%. The percentage of urban pop. increased from 30·0 in 1910 to 34·9 in 1920. Owing to the size of its principal city, New Orleans, Louisiana had a larger percentage of urban pop. than any other Southern state, except Florida.

The cities having a pop. of over 10,000 in 1920 and their percentage of increase were as follows:—

	1920	1910	Increase per cent.
Alexandria	17,510	11,213	56·2
Baton Rouge	21,782	14,897	46·2
Lake Charles	13,088	11,449	14·3
Monroe	12,675	10,209	24·2
New Orleans	387,219	339,075	14·2
Shreveport	43,874	28,015	56·6

Agriculture.—The most important industry of the state has always been agriculture. The total value of all farm crops in 1919 as reported by the Bureau of the Census was $206,182,548 as compared with $73,536,538 reported by the same bureau in 1909. The total number of farms in 1920 was 135,463, representing a gain of 14,917 during the preceding decade. Cotton, sugar-cane, corn, rice, hay and forage in the order named constitute the most important field crops. The advent of the boll weevil in the state in 1908 resulted in a sharp decline in the production of cotton and in the introduction of more diversified farming in the parishes where cotton had constituted the principal crop. The effect of this pest on cotton production is shown by the decline in the yield from 675,000 bales in 1908 to 246,000 bales two years later. By 1917, however, with improved methods of production and the stimulus of high prices, the output had increased to 639,000 bales, to fall again in 1918 to 588,000, and in 1919 to 307,000. With the development of diversified farming the yield of maize (Indian corn) steadily increased, being 28,800,000 bus. in 1918 and 21,676,000 in 1919. The live-stock industry also gained in importance. The production of rice in 1919 was 16,011,000 bus., with a farm value of $42,751,000. Practically all the cane sugar produced in the United States came from Louisiana. The trucking industry has attained considerable importance in the vicinity of New Orleans, and the raising of strawberries has proved profitable and is being steadily extended in the cut-over pine lands of Livingston and Tangipahoa parishes. Citrus fruits are grown in considerable quantity along the Mississippi river below New Orleans.

Manufactures.—The production of lumber is the leading manufacturing industry of the state. In 1914 the lumber and timber products had a value of $66,656,268, Louisiana ranking second among the states. The manufacture of sugar, including refining and the production of molasses, came second with total products valued at $57,948,322. There was a considerable variation in the output of cane sugar, as the following figures in short tons indicate: 1915, 137,500; 1916, 303,900; 1917, 243,600; 1918, 280,900; 1919, 115,590; 1920, 169,126. The production of cotton-seed oil and cake and the cleaning and polishing of rice occupied third and fourth places in the state's manufactures, with products valued in 1914 at $18,106,257 and $12,966,690 respectively. The refining of petroleum has attained increasing importance in recent years.

Minerals.—Louisiana leads all other states in the production of sulphur, and in 1917 was third in the production of rock salt. Both the sulphur and rock-salt deposits lie in the southern portion of the state and yield a product of unusual purity. The south-eastern limit of the mid-continental petroleum field lies in the north-western section of the state, in the parishes of Caddo, Red River, De Soto and Claiborne. The Gulf Coast oil-field reaches into the state from the S.W., and is most productive in the vicinity of Vinton, Jennings and Anse La Butte. The state's output in 1920 was 35,649,000 bar.; in 1918, 15,423,520. In 1920 the live stock on farms was valued by the Department of Agriculture at $120,000,000 as compared with $43,315,000 in 1910.

Administration.—On March 1 1921 a constitutional convention assembled at Baton Rouge to draft a new constitution which, on its adoption, would become the tenth under which the state has been governed since its admission to the Union in 1812, not including the constitution of the Confederate period, 1861–5. The constitution of 1913, the immediate predecessor of that of 1921, was not, strictly speaking, a new instrument, but was mainly a textual revision of the constitution of 1898 by the incorporation into the body of the document of some 60-odd amendments which had been adopted in previous years and had become so numerous as to create confusion. Other than this change in form, the 1913 constitution included no new material except provisions for refunding the state debt, due Jan. 1 1914, and for the prevention of combinations in restraint of trade. Owing to the many restrictions of a statutory nature included in the constitution of 1898, it was found necessary to submit a large number of amendments to the voters after nearly every biennial session of the Legislature. This defect was not avoided in the constitution of 1913. Consequently in Nov. 1916 18 constitutional amendments were submitted to the voters, and 17 were adopted. In Nov. 1918 14 more were submitted, and 13 were adopted. This constant addition of amendments proved both costly and confusing, and was one of the chief factors in bringing about the movement for the adoption of a new constitution in 1921.

Education.—Material improvement in the provision for the educational institutions of the state was effected in 1918 and 1920. In the former year five constitutional amendments were adopted which resulted in more than doubling the state and local revenues for the support of the public schools. A special tax was also provided for the support of the institutions for higher education. In 1920 a special tax of 2% on the value of all natural products from the land—oil, natural gas, sulphur, salt and lumber—was imposed to create a fund for the maintenance of the state institutions, and the proceeds of this tax were appropriated the following year for the physical equipment of the College of Agriculture, which is one department of the Louisiana State University. In 1916 the system of compulsory education according to the option of each parish gave way to a state-wide compulsory education law requiring a minimum attendance of 140 days at school in each school year by all children between the ages of 7 and 14 years. There has been difficulty, however, in the strict enforcement of the law, and in 1919 there were 87,000 whites and 128,000 negro children of school age not enrolled in the public schools. The total expenditures from all sources on the public-school system in 1919 amounted to $9,702,067 as compared with $7,954,552 in 1918, and $4,310,100 in 1910. In 1919 21·4 % of the school revenues were derived from the state Government, 41·6 % from general parish resources, 32·7 % from special maintenance taxes, and 4·3 % from bond issues. The average salary for white male teachers was $1,011, as against $758 for the previous year, and for white female teachers $598, as against $526 for the previous year. In 1919 negro male teachers received an average salary of $298 and female teachers an average of $217.

Taxation.—From 1908 to 1916 the reform of the system of taxation was the most important public question within the state. A special tax commission created by the Legislature in 1908 reported a plan for the separation of the sources of state and local revenues, but no action was taken then. In 1912 a second tax commission drafted a more elaborate plan, providing separate sources of revenue for the state and local Governments and including a provision for an inheritance tax with highly progressive rates. This was submitted to the voters by the Legislature in the form of a constitutional amendment, and was rejected by a large majority. In 1916 a new plan providing separate assessments of the same property for state and local purposes was submitted as a constitutional amendment and adopted. This amendment provides a board of three members, designated the Board of State Affairs, which is charged with the duty of securing an equalized assessment of property throughout the state, and with the preparation of a state budget. The Board of State Affairs also supplanted the State Board of Equalization and the State Board of Appraisers, the latter having had control of the assessment of the property of railway, telegraph, telephone, sleeping-car, and express companies. Under the new system the local or parish authorities may take as the basis for local taxes any fraction, not less than 25 %, of the state assessment of general property. At the close of the fiscal year 1919 the state's finances were in satisfactory condition, with receipts aggregating $17,035,351 and expenditures $14,504,468. The bonded debt on March 1 1920 was $11,108,300.

History.—Although the state is normally Democratic, the reduction of the duty on raw sugar by the Tariff Act of 1913, framed by a Democratic Congress, caused a defection from that party in that section of Louisiana where the production of cane sugar is the chief industry, and this resulted in the election in 1914 of a candidate to Congress from the Third Congressional District on the Progressive ticket. For a short period this party showed considerable strength in the southern portion of the state. In the gubernatorial election in 1916 many regular Democrats supported the Progressive candidate, but the Democrat was elected by a majority of 32,000. The Democratic party in this election, however, polled some 25,000 fewer votes than were cast for its candidates in the preceding primary election. Inasmuch as many Democrats had voted the Progressive ticket in the regular election after participating in the primary election of their own party, the Democratic Legislature in 1916 enacted new primary and general election laws. These measures stipulated that all officially recognized political parties must nominate their candidates by means of primary elections, and that all such elections must be held on the same day. Every voter was required to register his party affiliation in order to obtain the privilege of participating in a primary election, and was required to sign a pledge to support the nominee of the party with which he registered his affiliation. Violation of this pledge was made a misdemeanour subject to legal penalties. In 1920 John M. Parker, who had been the unsuccessful Progressive candidate for governor in 1916, was nominated for the same office on the Democratic ticket and was elected. Practically all the members of the Progressive party had by this time rejoined the Democratic party.

The governors after 1908 were: Jared Y. Sanders, 1908–12; Luther E. Hall, 1912–6; Ruffin G. Pleasant, 1916–20; John M. Parker, 1920.

During the World War the total state registration under the selective draft regulations was 392,316, and the number inducted into service was 80,834. The total amount subscribed in the state to war loans was $154,071,000. (W. O. S.)

LOUVAIN (*see* 17.67).—Pop. 42,490 in 1914, as against 42,194 in 1904. The Germans entered Louvain Aug. 19 1914. The city was systematically sacked and in large part destroyed by fire between Aug. 25 and Sept. 2. About one-third of the city perished, including the famous University Library with its treasures, the church of St. Pierre and the markets. About 300 civilians, many of whom were shot, lost their lives.

The destroyed fabrics were in process of reconstruction (as far as might be) in 1921, and about 700 out of 1,200 houses had been rebuilt. The foundation stone of the new library was laid July 28 1921 in the presence of the King and Queen of the Belgians. A clause of the Peace Treaty provides that Germany should make reparation for the burning of the library by furnishing books, MSS., etc., to the value of those destroyed. Great Britain (on the initiative of the John Rylands Library, Manchester) and the United States contributed largely to its replenishment; over 38,000 books had been sent to Belgium from the John Rylands Library up to Aug. 1921.

LOW, SETH (1850–1916), American administrator and educationist (*see* 17.72), died at Bedford Hills, N.Y., Sept. 17 1916. In 1914 he was appointed by President Wilson as one of the arbitrators in the Colorado coal strike. He was delegate-at-large to the New York State constitutional convention in 1915, and was chairman of the committee on City government.

LOWDEN, FRANK ORREN (1861–), American politician, was born at Sunrise City, Minn., Jan. 26 1861. After studying at Iowa State University (A.B. 1885) and the Union College of Law, Chicago (LL.B. 1887), he practised in Chicago for about 20 years. In 1899 he was professor of law at Northwestern University, Evanston, Illinois. In 1900 he declined the first assistant postmaster-generalship, offered him by President McKinley, whom he had supported. He was a delegate to the Republican National Convention in 1900 and 1904, and from 1904 to 1912 was a member of the Republican National Committee. He was also a member of the executive committee in 1904 and 1908. In 1906 he was elected to the U.S. House of Representatives for the unexpired term of R. R. Hitt, deceased, and was reelected for the terms of 1907–11. He declined to run for another term. He was governor of Illinois 1917–21, and was energetic in marshalling the resources of his state in support of America's war programme. In 1917, when the mayor of Chicago refused to interfere with a meeting of the People's Council, an organization accused of pro-Germanism, he ordered out the state troops to prevent the meeting. He introduced the budget system for state expenditure, thereby reducing the rate of taxation in spite of rising prices. He favoured woman suffrage and the enforcement of the Volstead Act for war-time prohibition. He was opposed to the League of Nations without reservations, on the ground that it would create a super-state. At the Republican National Convention in 1920 he had strong support for president. In the first four ballots he stood second; on the fifth he led with 303 votes (493 being necessary for nomination); on the sixth he tied for first place (311½ votes); on the seventh ballot he was second (311½ votes); on the eighth he again led (307 votes), but then to avoid a prolonged deadlock he released his delegates, who transferred their votes to Warren G. Harding, who was nominated on the tenth ballot.

LOWELL, ABBOTT LAWRENCE (1856–), American educationist (*see* 17.73), built for Harvard at his own expense a president's house, which was finished in 1912. From the time that he became president (1909) he took great interest in the social life of the students, and was specially desirous that members of the entering class should have the opportunity of becoming thoroughly acquainted. The result was the erection of an attractive group of dormitories in which all freshmen roomed and had their meals together (*see* also HARVARD UNIVERSITY). President Lowell was a strong supporter of free speech among the members of the faculty. After the outbreak of the World War in 1914 he refused to accept, in spite of considerable pressure, the resignation of Prof. Hugo Münsterberg, who had defended the German cause. In 1915 Prof. Kuno Meyer, of the university of Berlin, a prospective exchange professor to Harvard, sent a letter of protest because of the publication in one of the college magazines of a satirical poem, *Gott mit Uns*, by an undergraduate. In his reply President Lowell pointed out that freedom of speech was an important characteristic of American universities as distinguished from those in Germany. He was chairman of the executive committee of the League to Enforce Peace, and later was a strong supporter of the League of Nations.

He was the author of *Public Opinion and Popular Government* (1913, based on lectures at Johns Hopkins University); *The Governments of France, Italy, and Germany* (1914, abridged from his earlier *Government and Parties in Continental Europe*) and *Greater European Governments* (1918, abridged from earlier works).

His brother PERCIVAL LOWELL (1855–1916), American astronomer (*see* 17.73), died at Flagstaff, Ariz., Nov. 12 1916. In 1910 he lectured in London before the Royal Institute and in Paris before the Association Astronomique.

His sister AMY LOWELL (1874–), American poet, was born in Brookline, Mass., Feb. 9 1874. She was an accomplished writer of *vers libre* and well known as a critic.

Her works include *A Dome of Many-Colored Glass* (1912); *Sword Blades and Poppy Seed* (1914); *Six French Poets* (1915); *Men, Women, and Ghosts* (1916); *Tendencies in Modern American Poetry* (1917); *Can Grande's Castle* (1918); *Pictures of the Floating World* (1919); *Legends* (1921); *Fir-Flower Tablets* (1921), translations from the Chinese, with the collaboration of Florence Ayscough.

LOYSON, CHARLES (1827–1912), better known as "Père Hyacinthe," a famous French preacher, was born at Orleans in 1827. He was educated for the priesthood and entered the Carmelite order. His eloquence drew all Paris to his Advent sermons in Notre-Dame between 1865 and 1869, but his orthodoxy fell under suspicion, and in 1870 he associated himself with Döllinger's protest against the dogma of Papal infallibility (*see* 14.512, 20.67). Being excommunicated, he broke finally with the Church of Rome, and removed first to Geneva and then to London. He married an English lady, Emily Jane Merriman, and settled in Paris in 1877, where he founded an Old Catholic church. He died in Paris Feb. 9, 1912.

LUCK (LUTSK), BATTLES OF, 1916.—The battles in the World War which constituted the Russian summer offensive of 1916 are known collectively by the name of Luck (Lutsk), a town in Volhynia, on the river Styr, which before the war formed part of the Russian fortified region of Rovno. The choice of this point as indicative of a series of great battles which extended in space from the river Pripet to the frontier of Rumania and in time from early June to late Aug.—and, with decreasing intensity, into Nov.—is justified by the fact that the break-through of the Austrian front at Luck was the principal factor in determining the course of the whole series.

After the fruitless attacks of the Russians in Courland and Lithuania in March 1916, a perceptible lull had set in on the eastern front. It was nevertheless obvious to the Central Powers that Russia was preparing for a new trial of strength. Their artillery, in particular, which had been augmented in comparison with the previous year, was initiated into all the intricacies of the newest fire-tactics, French and Japanese instructors being employed in some cases. A very ample supply of ammunition was accumulated, and air reconnaissance and aeroplane photography were brought to a high pitch. The general attack of the Entente was planned for July 1.

Brussilov's Offensive.—From the disposition of the Russian troops in May 1916, it was assumed that they would repeat their attacks against the former pressure-points on the German front, N. of the Pripet, viz.: at Baranovichi, Smorgon, Lake Naroch and Dvinsk. But the Austro-Hungarian offensive against Italy made it imperative for Russia to go to the relief of her ally, and accordingly General Brussilov was called on to take the offensive against the front S. of the Pripet, which was almost entirely occupied by Austro-Hungarian troops. However, no troops were shifted at first from the area N. of Pinsk to the Russian S.W. front. Brussilov's command included the following:—the IX. Army (Letchitsky), with 10–11 inf. divs. and 2–3 cav. divs., from the Pruth E. of Czernowitz along the Bukovina–Bessarabia frontier and on the N. bank of the Dniester to the N. of Uscieczko; the VII. Army (Shcherbachev), with 6–8 inf. divs. and 2½ cav. divs., generally on the E. bank of the Strypa as far as Bohatkowce; the XI. Army (Sakharov), with 8 inf. divs. and 1 cav. div.; from the upper course of the Strypa across the watershed between Sereth and Horyn (Goryn) to the E. bank of the upper Ikwa as far as the N. of Kremieniec; finally, the VIII. Army (Kaledin), with 12–13 inf. divs. and 3 cav. divs., on the E. bank of the Ikwa to Mlynow, from there through gently undulating country to the Putilowka, N. of Olyka, thence to the bend of the Styr between Kulikowce and Kolodia, and on through the marshy regions W. of the Styr along the Wiesiolucha to the Pripet.

The Austro-Hungarian Higher Command looked forward with confidence to the next battle on the eastern front. For although the offensive against Italy had meant the removal of five good attack divisions and much heavy artillery to the Tirol, the regiments, excepting those of the VII. Army, had been brought up to full fighting strength again by the march battalions that were drafted to them monthly, some of them being even in a position to form supernumerary companies or battalions. Compared with the previous year the number of guns had also been increased through the development of the general artillery organization. But the allocation of ammunition was meagre. Much time and labour were spent on organizing the positions. The defence system consisted for the most part of three positions, which were supposed to be at such a distance apart that, after the failure of the first position, the battle for the second position would require a new movement of the enemy's artillery. The first position, which again consisted of two or three lines, each behind the other, was in fact very well organized. But for the construction of the rearward positions there was not enough labour, time or wire left over. They were therefore incomplete.

The plan for the defence was conceived to be that the troops were to stand by, during the very violent artillery demolition fire that was expected, in deep dug-outs (so called "fox holes") either near the front line or actually in it. As soon as the enemy infantry rushed to the attack the defenders, promptly warned by observers, were to hurry into the fighting trenches, while their own artillery by barrage-fire (where possible, oblique) mowed down the storming enemy infantry, or at least prevented the enemy reserves from following up. In this way the troops in the trenches would have only the first rush of the enemy's attack to beat back in hand-to-hand fighting. These tactics were open to serious objections. Timely detection of the moment when the enemy's storming columns should break forth, and consequently the instant alarming of the garrison in its dug-outs, as also the instantaneous putting down of the barrage, could not be counted upon, in view of the destruction of observation and liaison by the hostile drum-fire. Further, the defence was concentrated far too rigidly on the fighting in the front line, the loss of which would mean also the loss of the greater part of the fighting material there, such as machine-guns, trench mortars, flame-throwers, searchlights, flanking guns, etc. The troops' power of resistance was bound up far too closely with the possession of the foremost position.

The calm assurance with which the Russians went about their attack preparations, which were plain to see but impossible to hinder, induced such a state of nervousness in the staffs and troops of the defence that the launching of the Russian attack would have been felt almost as a relief had it not been for the annihilating results of the attacks at various points.

On the part of the front under the Austro-Hungarian Army Higher Command, stretching from the Pruth to the Jasiolada N. of Pinsk, there were:—(1) VII. Army (Pflanzer-Baltin), with the XI. Corps, Benigni's and Hadfy's groups, the XIII. and the VI. Corps (12 inf. divs. and 5 cav. divs.), from the Pruth E. of Czernowitz to Wisniowczyk on the Strypa; (2) the German South Army (Graf Bothmer), which now contained only 1 German inf. div., the 48th Res. Div. with Hoffmann's Corps and the IX. Corps (6 inf. divs.), along the middle Strypa and as far as Czerniechow on the upper course of the Sereth; (3) the groups of armies of Generaloberst von Böhm-Ermolli, comprising the Austro-Hungarian IV. and V. Corps and Kosak's group (5 inf. divs. and 1 cav. div.) forming the II. Austro-Hungarian Army under his own command and holding from E. of Zalosce along the upper reach of the Ikwa up to Bereczy; together with the XVIII. Corps (2½ inf. and 1½ cav. divs.), constituting the Austro-Hungarian I. Army (Puhallo), along the lower course of the Ikwa up to Mlynow; (4) the German groups of armies under Linsingen, to which were assigned the Austro-Hungarian IV. Army (Archduke Joseph Ferdinand) with Szurmay's Corps and the X. and II. Corps (8 inf. divs.), from Mlynow to Kolki on the Styr; Fath's Austro-Hungarian Corps ($2\frac{1}{2}$ inf. divs.) on the Styr up to Kolodia, with, to the N. of it, Hauer's Austro-Hungarian Cav. Corps (3 cav. divs. and 3 bdes. Polish legions) and Gronau's German groups (3 inf. divs. and 2 cav. divs.), on the Wiesiolucha–Strumien–Pinsk–lower course of the Jasiolda and Oginski canal. As regards reserves, Linsingen was given the half of the 45th Schützen Div. at Kolki, and the 10th Cav. Div. engaged in constructional work in the line-of-communications area.

Counting by the number of divisions the Russians had only a slight majority in this particular battle area. But their divisions were larger, and in addition they had a considerable number of drafts placed in readiness behind the attacking front, to make good the losses in the regiments as they occurred.

From the methodical pushing forward of the Russian trench system right up to the obstacles of the enemy, it became clear by the end of May that the Russians were proposing to exert their strength especially against the N. wing of Benigni's group at Okna, the XIII. Corps S. of Buczacz, the N. wing of the South Army N.W. of Tarnopol and the IV. Army W. of Olyka. It was accordingly easy for the command on the Austro-Hungarian side to place the reserves behind the parts that were threatened.

In the IV. Army the 13th Schützen Div. was pushed in behind the X. Corps (2nd and 37th Inf. Divs.), posted astride the Olyka–Luck road, and the 11th Inf. Div. behind the Szurmay Corps (7th and 70th Inf. Divs.) S. of that road, so that each of these corps had a brigade from the reserves placed at its disposal.

The Break-through Battle of Olyka–Luck.—On June 4, from 4 A.M., the Russians opened battle on the whole section of the front from the Pruth to the Pripet with drum-fire of a violence hitherto unknown in the East. Their artillery systematically battered the enemy's foremost positions and the locality occupied by the higher staff, which was accurately known. The defence system suffered severely, and communication between command and troops was in many cases destroyed. Owing to the dry weather, high whirling clouds of dust and smoke arose, and even on the first day it became an anxious question whether the breaking loose of the enemy's storming columns could be detected in time. At several points the Russians "felt" the enemy first with infantry detachments, but no infantry attack occurred on that day (June 4). In the evening the Russians ceased fire. After a comparatively quiet night, spent by the defenders in making the most essential preparations in the trenches and restoring the badly damaged obstacles, drum-fire was resumed on June 5, with increased violence. During the morning, attacks were launched by the Russian XL. Corps, with the 2nd and 4th Rifle Divs., against the Austro-Hungarian 2nd Inf. Div. to the W. of Olyka, and by the VIII. Corps, with the 14th and 15th Inf. Divs., against the 70th Honved Inf. Division. The blow of the XL. Corps fell upon the men of the Hungarian 82nd Inf. Regt., who, owing to the destruction by drum-fire of all means of observation and communication, were surprised in their dug-outs and either taken prisoners or killed. The fate of the 40th Inf. Regt., to the S. of them, was no better. For with wonderful rapidity the Russians rolled up all the lines of the 2nd Inf. Div. first position, and only fractions of the garrison could escape.

Towards noon the battalions of the Austrian 13th Schützen Div. (25th Schützen Bde.), lying in reserve in the second position, suddenly found the Russians upon them without knowing what had happened to the first-position garrison.

The Russians proceeded systematically to the capture of the second position, in which the battalions of the Viennese 1st and 24th Schützen Regts. were as islands stemming the Russian tide which poured in from all sides. They were too weak to occupy the position completely, and were surrounded and forced back by the Russians after a gallant defence, who advanced through the gaps and communication trenches before the belated 2nd Bde. of the 13th Schützen Div. could come to their aid. By evening the 13th Schützen Div., in a state of great exhaustion, and the scanty remainder of the 2nd Inf. Div. had occupied the third position, which was but weakly organized.

South of the XL. Corps, the VIII. Corps had penetrated the first position, held by the Landsturm of the 70th Honved Inf. Div., and here the battle raged backward and forward. As the 70th Div. was too weak to expel its more powerful enemy unassisted, the 4th Inf. Bde. of the 11th Inf. Div. was sent to be placed under it. But these East Galician regiments, the 89th and 90th, advanced but half-heartedly to the counter-attack against their Russian kindred, and the attack was not pushed home. The 70th Div. was still holding the second line of the first position in the evening, but in consideration of its exposed N. flank, already threatened, it also was withdrawn to the third position in the night of June 5–6. This division, too, had suffered heavy losses, having indeed shrunk to one-third of its fighting strength.

Despite the warning of Generaloberst von Linsingen, the commander of the group of armies, not to put in the reserves too soon in case of an enemy break-through, but only to employ them in a uniform, concentric counter-attack, they were at Olyka thrown into the battle, dispersed, and were therefore unable to make any stand against the Russian onslaught. Carried away in the fatal rush of the retreat, they not only lost their fighting power, but, in effect, did practically nothing towards turning the battle. It was also a calamity that the best troops in the section where the attack was awaiting with certainty, the 82nd Inf. Regt. (5 batts.), should have been placed in front. There they could have no chance of developing their own power of attack, but must necessarily sustain heavy losses, while the less-capable regiments, consisting of Ruthenians of the 11th Inf. Div., held in reserve, broke down in the counter-attack.

On June 6 no special effort was required on the Russian side to overcome the troops of the X. Corps and Szurmay Corps who were mixed up in confusion in the third position. The inner wings of the 37th Honved Inf. Div. and the 7th Inf. Div., which lined the N. and S. corners of the pocket respectively, were sucked into the tide of the retreat. The X. Corps made an attempt at resistance, in an intermediate position W. of Romanow, in the hope of covering the stream of transport flowing back in the direction of Luck, but in vain.

The IV. Army Command now decided to withdraw the Szurmay Corps behind the Ikwa and the Styr, the X. Corps to the bridgehead of Luck, and the II. Corps to a position 6–8 km. E. of the Luck–Kolki road, to insure the protection of the Kivercy railway station. Here 5 German batts. of the Gronau group and half of the Austrian 45th Schützen Div. had already been detrained, and it was proposed to use them for a counter-blow in a southerly direction. Besides these the 29th Inf. Div. from the II. Army, a guard cav. bde. from the German group, and 6 batts. with artillery from Prince Leopold's group of armies were being brought up by train to the IV. Army.

On June 7 the Russian VIII. Corps, reinforced by the 101st Inf. Div., pushed forward against the S. side of the Luck bridgehead, and the XL. Corps against the N. side. The bridgehead was—unknown to the troops—to be defended in the southern section by the 11th Inf. Div. and parts of the 10th Cav. Div., in the northern section by the remnants of the 2nd and 13th Divisions. Towards evening the Russians, advancing from the S.E. and cutting off the southward-facing salient at Krupy, forced their way into the bridgehead, captured part of the 11th Inf. Div., and forced the X. Corps to evacuate it. The counter-attack led by General von Bernhardi, with half the 40th Schützen Div. and the 5 German batts., did not get through. This group now retired at Roziszce to the W. bank of the Styr, and was joined there by the II. Corps. The 7th Inf. Div. was handed over to the I. Army for convenience of supply.

In the morning of June 8 the Russians were able again, without appreciable effort, to force the broken-down troops of the X. Corps to relinquish the W. bank of the Styr. The Russians then swept on in broad masses over the fourth, and—so far as the IV. Army was concerned—last line of defence.

The X. Corps retired with the 37th and 13th Divs. behind the Sierna, while the 2nd Inf. Div. and 10th Cav. Div. to the E. and

S.E. of Torczyn established communication with the Szurmay Corps standing on the S. bank of the Polanka, facing north. But this corps, threatened by the Russian attempts to break through, was obliged to wheel back on June 9 behind the Leniewka line, between Korszew and Czarakow, and the bent-back N. wing of the I. Army could only be extended as far as Lawrow. There were no longer sufficient forces for the widening curve. A dangerous gap yawned between the I. and IV. Armies.

Meanwhile the Russians had also continued their attacks against all the armies farther to the south. The S. wing of the I. Army near Sapanok had, thanks to the arrival of the 25th Inf. Div., been able to ward off a Russian assault; and the I. and South Armies also repelled all attacks, the South Army being able even to send a brigade of its reserves to the N. wing of the VII. Army. But in the case of Pflanzer-Baltin's Army the Russians gained some important success on June 7 at Jazlowiec, where the Russian II. Corps of Shcherbachev's Army succeeded by dint of continuous assaults in breaking through the XIII. Corps and forcing it back behind the Strypa. On June 8 even this position became untenable, and the corps had to retire behind the Buczacz–Karopiec line before it could stabilize itself; and on June 9, Buczacz and the Strypa line as far as Bobulince were lost by the VI. Corps, which had now also begun to waver. On the S. wing of Bothmer's Army, both then and after, all the Russian assaults broke down. In the area between the Dniester and the Pruth, Letchitsky directed his efforts principally against Benigni's group on the N. wing, which, though it was able for the moment to ward off a Russian assault at Okna, had to sacrifice the positions on the N. bank of the Dniester to the necessity of forming reserves. The situation of the defenders here was undoubtedly very tense. All the available reserves (4 regts. of 3 divs.) had been given to the XIII. Corps; in Benigni's group there were troops from 8 different divs., already inextricably mixed. In sum, this section of the front was no longer in a condition to withstand a powerful push.

The allied Higher Commands were now confronted with the problem of finding measures to restore the equilibrium of the eastern front, which had been so rudely and abruptly disturbed. On the western front violent battles were raging, and in the Italian theatre all forces were engaged. Yet it seemed inadvisable to consider seriously the idea of leaving the eastern front to its fate, without sending new forces; for the distress already felt by the Central Powers forbade the abandonment of so much territory, with all its grain and other products, and the industries started and re-started in it. It was necessary, besides, for the Central Powers to avoid as far as possible any defeat in Galicia and the Bukovina, lest their neighbour Rumania, once more in a state of indecision, should deem it advisable to join the Entente; and, finally, the German front N. of Polyesie, still faced by numerically superior Russian forces, had to be considered. In short, it was essential immediately to improve the situation. The two Higher Commands therefore decided to proceed at once to a counter-offensive in Volhynia. This was to take the form of an assault on both sides of the Kowet–Rowno railway by a group consisting of 7½ divisions. Until this attack-group should have been formed, decisive battle was to be avoided. If pressed by the enemy, the Szurmay Corps, X. Corps, the Bernhardi group and the II. Corps were to fall back in a north-westerly direction—if necessary as far as the Stochod.

Battles on the Styr.—Brussilov made his troops follow up into the bend W. of Luck with great caution, fortifying each section as it was taken. He directed his energies towards breaking through the Styr front, as yet intact, thus widening the breach towards the north. After several vain attempts at crossing on the fronts of Fath's Corps and Hauer's Cav. Corps, the Russian XXX. Corps finally succeeded, on June 9, in setting foot on the N. bank of the Styr E. of Kolki. But a counter-attack by the 4th Inf. Div. threw the Russians back to the S. bank and cost them 1,500 prisoners. Another later attempt by the Russians to cross at Sokul on June 12 ended likewise in failure.

On the S. wing of Linsingen's group of armies, preparations for the proposed counter-attack were meanwhile going forward systematically, without any serious interruption from the Russians. The IV. Army (10th Cav. Div., the Szurmay Corps and X. Corps), now commanded by Generaloberst von Tersztyánszky, was shifted to the line Biskupiczy–Chorostow–Siviniarin, to make room for the attack-group (108th Inf. Div., Rusche's combined German Inf. Div., and the German X. Corps consisting of the 19th and 20th Inf. Divs.), under the experienced command of General von der Marwitz, which was deploying in the area Siviniarin–Ozierany.

The Russians also carried out a series of violent attacks against the Stochod and Styr section between the Kowel–Rowno railway and Kolki, but here again the attacks were repulsed with heavy losses except for a passing local success at Kolki.

The result of shifting the IV. Army to the N.W. and forcing back the I. Army, whose N. wing had reached Molatyngorni on the Lipa, was to extend the gap between the two armies by 50 km. Owing to the shortage of fighting troops this gap could, for the moment, only be kept under observation by line-of-communication troops. Had the Russians had more troops, in particular cavalry, or, still more important, sufficient enterprise, this could have been an opportunity for undreamed-of successes. But Kaledin obstinately persisted in his attacks on the Styr front, thereby allowing the allies to close the yawning gap, for the time being, with cavalry. This was achieved by hastily bringing up the Ostermuth Cav. Corps (4th and 7th Cav. Divs. and 1st Landsturm Hussar Bde.) to the area round Gorochow, in addition to the 10th Cav. Div. and a German cav. bde., which were placed in front of the IV. Army to hide its movements. Finally the 61st Inf. Div., which was on its way by train from the Tirol to the VII. Army, was detrained at Stojanów behind the left wing of the I. Army and placed under its command.

It was not until June 14 that the Russians brought forward great cavalry masses against the area between the I. and IV. Armies. As a result, violent battles were fought, first at Lokaczy against the 10th Cav. Div. and, after Ostermuth's Cav. Corps had hurried up to assist that division, against the 4th and 7th Cav. Divs. at Swiniuchy; and the Russians were forced to realize that the gap between the two armies was now closed.

The Break-through at Okna.—At the same time, events in the Bukovina and Eastern Galicia had taken a most unfavourable turn for the allies. After many vain attacks on the Bukovina front, Letchitsky eventually succeeded in breaking through Benigni's Corps on June 10 to the W. of Okna by means of a powerful push between Dobronoutz and Doroschoutz. Although the right portion held its ground, the left was driven back in spite of all the reserves that were put in, and this whole section of the front had to be taken back to the line Dobronoutz–Zastawna. A renewed attack delivered by the Russians, forty deep, on Zastawna, undermined the corps' power of resistance to such a degree that the XI. Corps, immediately to the S. of it, had to be withdrawn behind the Pruth during the following night, while Benigni (who could only with difficulty prevent his corps from being driven away southward) and the Hadfy group tried to take up a position again 12–15 km. to the W. of the original front. The Russians, who at first pursued hotly, forced General Pflanzer-Baltin, whose vigorous leadership was nullified in these critical days by illness, to put back the Bukovina front to a line running from Bojan (on the Rumanian frontier) up the Pruth to Zablotow, then bending northward through Gwozdziec–Obertyn–Niezwiska. This line was reached on June 14 by the Austro-Hungarian troops, who were now being but little molested; as the VI. and XIII. Corps had been placed under the South Army, General Pflanzer-Baltin's command area became limited to the troops S. of the Dniester.

These battles in Bukovina and Eastern Galicia, of which the outcome was so unfortunate for the Austro-Hungarian troops, were of very great importance, not only on account of the grievous sacrifice of ground, prisoners and war material, but also because of their repercussion on the attitude of Rumania. The continuous violent attacks by the Russian VII. Army against the two weakened and confused VI. and XIII. Corps on the South Army's right wing offered no prospect whatever of a stabilization of the fighting front, and the Army Higher Command was therefore compelled to dispatch the two divisions (German 105th from Macedonia and Austro-Hungarian 48th from the Isonzo) originally intended for Marwitz's attack-group to back up the S. wing of Bothmer's Army.

Counter-Attacks on Luck.—As a result of the diversion of these two divisions the allies had no longer forces enough to carry out the flank blow planned on the right of the Kowel–Luck road. It was therefore decided to deliver a concentric attack in the general direction of Luck. The following were to take part:—the N. wing of the I. Army (now also brought under Linsingen's command), with the 7th and 61st Inf. Divs. and Ostermuth's (later Leonhardi's) Cav. Corps, advancing from the Lipa brook to the N.E.; the IV. Army in an easterly direction; Marwitz's group (German X. Corps, German 108th Inf. Div., and Austro-Hungarian 29th Inf. Div.), and Bernhardi's Corps with the combined infantry division Rusche and half of the 45th Schützen Div., in a south-easterly direction; and the II. Corps on both sides of the Styr. This broadly conceived attack was to begin on June 16.

On June 15 the I. Army suffered another reverse. The N. wing of the Russian XI. Army (XXXII. Corps) drove back the 25th and parts of the 46th Div. at Rudnia on the Brody–Dubno railway. As there were no forces available for a counter-attack the N. wing of the Austro-Hungarian II. Army (Kosak's Corps) and the S. wing of the I. Army (XVIII. Corps) had to be withdrawn generally to the frontier between Lopuszno–Radzievilow–Beresteczko.

The offensive against Luck, on which the allies had set all their hopes, did not go well. The I. Army's N. wing had indeed succeeded in reaching the N. bank of the Lipa and pushing on to Swiniuchy on June 16–17; the sparsely filled-up divisions of the IV. Army had pushed forward to the E. of Lokaczy and Wojmica; and Marwitz's group had gained ground W. of Kisielin, in spite of fierce Russian opposition. But Bernhardi was forced back to the N. bank of the Stochod by heavy counter-attacks, and, when the Russians again began to press the I. Army's S. wing, the I. Army Command had no choice but to fetch back the 7th Inf. Div. (which had just succeeded in crossing the Lipa) to the S. bank, and place it behind the threatened 46th Division. As regards the II. Corps, there could be no question of crossing the Styr, and it was obliged—like Fath's Corps—to devote its whole strength to warding off the continuous attempts of the Russians to cross at Gruziatyn and Kolki.

Only on June 21 did Linsingen's group of armies resume the attack, after a new attack-group had been formed on its right wing under General von Falkenhayn. This group consisted of the 61st Inf. Div., Leonhardi's Cav. Corps, the newly arrived German 43rd Res. Div., and the Austro-Hungarian 48th Inf. Div. brought by train from the South Army. The N. wing had also to be reinforced by the 11th Bavarian Inf. Div. on account of the arrival of fresh Russian forces. Falkenhayn's blow gained ground up to the line Zwiniacze–Bubnowa, whereupon the Russians fell back also in front of the IV. Army, so that the latter was able to follow up to the Sadowa height. Marwitz broke through three positions by means of vigorous attacks, though constantly checked by Russian counter-assaults, but found himself confronted, just W. of Zaturcy, with a new Russian line of resistance. Meanwhile Bernhardi had difficulty, in spite of the Bavarian reinforcements, in withstanding the powerful mass-attacks which the Russians repeatedly delivered against the neck of land between the Styr and the Stochod at Sokul.

But although the counter-offensive of Linsingen's group of armies had up till then met with undeniable success, the fruits of which—apart from the ground gained—were 12,000 prisoners, 2 guns and 54 machine-guns, Luck, the objective, was still far from being attained, owing to the growing strength of the Russian resistance which was fed by drafts that were actually taken in part from the front N. of Polyesie.

In the meantime the Russian XXII. and XVI. Corps of Shcherbachev's Army continued their costly attacks against the South Army, in order to shake the southern hinge of the hitherto unchanged Strypa front at Wismiowczyk. Their temporary successes over the 39th Honved Inf. Div. were invariably neutralized by counter-attacks from the Oppeln group, consisting of Austro-Hungarian and German regiments, until finally the Russians after June 21 gave up their fruitless efforts. Equally bold was the stand made by Maj.-Gen. Leide's little group on the South Army's S. wing, which warded off several attempts by the Russians to cross the Dniester N.E. of Olesza.

The Loss of Bukovina.—Pflanzer-Baltin in Bukovina, on the other hand, had met with fresh misfortune. After the bridgehead on the N. bank of the Pruth at Czernowitz had been levelled by Russian artillery-fire on June 16, and its garrison had retired, strong Russian forces of the XI. Corps crossed the Pruth both above and below the town, whereupon General Korda, commander of the Austro-Hungarian XI. Corps, considered it necessary to order the evacuation of Czernowitz and the S. bank of the Pruth. He led his corps behind the Sereth, and Brudermann's Cav. Corps (3rd and 8th Cav. Divs.) had also to retreat.

On June 19th Korda and Brudermann were again attacked by the Russian XI. and XII. Corps and III. Cav. Corps, and forced to relinquish the Sereth line. Korda was now to retire on the line Gwrahumora–Oberwikow–Lukawetz and to hold the defiles by groups, while Brudermann in the Czermos valley was to safeguard the right flank of Benigni's group, in front of which the Russians had so far remained quiet.

In the S. of Bukovina the Russians pursued only with the III. Cav. Corps, reinforced by one infantry division. Nevertheless, Korda's troops, extended over so wide an area, could not hold the proposed line for fear of being outflanked. Papp's group fell back in sections to the often-contested position N.E. of Jakobeny, and, reinforced by the 79th Honved Bde., occupied it on June 24, while the 202nd Inf. Bde. and the 80th Honved Bde.—entirely unmolested by the enemy—reached Moldawa for the purpose of blocking the route leading to Kirlibaba. Meanwhile Brudermann's Cav. Corps and, N. of it, Habermann's group (parts of the 24th and 30th Inf. Divs.), against which the Russian XI. and XII. Corps had now turned, had to sustain severe fighting at and N. of Kuty. Evidently Letchitsky was preparing the next blow on Kolomea.

Continuation of the Counter-Attack on Luck.—In the meantime the allies persisted in their intention to force a change in the situation at Luck—this time by increasing the pressure on the S. flank of the bridge formed by the Russian VIII. Army, which had made over the section N. of Kulikowice (in the bend of the Styr) to the III. Army (Lyesh). General von der Marwitz, giving up his own command to General von Lüneburg, now took over, on the S. wing of Linsingen's group of armies, the main attack-group, consisting of the 7th Inf. Div., recently brought to the Lipa, the newly arrived German 22nd Inf. Div., the 108th Inf. Div. brought up from the former Marwitz group, and Falkenhayn's Corps (Austrian 4th and 7th Cav. Divs. and 48th and 61st Inf. Divs., German 43rd Res. Div. and 9th Cav. Div.). After the heavy artillery, needed for the forcing of the powerful Russian position at Bludow, had come up, the attack began on June 29. The IV. Army with a strong N. wing, the Lüneburg group and Bernhardi's Corps, were to join in, the last-named having stormed several Russian positions at Sokul since June 24.

The attack brought encouraging initial results to all groups engaged. Bernhardi followed up his successes at Sokul, and was also able to force the Russians to evacuate the bridgehead lying on both sides of the railway on the N. bank of the Stochod. Lüneburg advanced his line 2–3 km., and the Austro-Hungarian X. Corps stormed the often-contested position of Zatwicy. The greatest success was, however, won by Marwitz, who, on July 1, undeterred by the rainy weather which hampered both the artillery fire and the mobility of the troops, penetrated the enemy position between Boremel and Ugrinow on a front 20 km. wide and 5 km. deep, and was able to hold his ground in spite of violent counter-attacks, some of which were delivered by cavalry. But Bludow could not be captured and the IV. Army was accordingly extended southward while the three divisions standing before Bludow were sent to reinforce the main attack-group to the E. of it. In spite of this, no further success was achieved in the attack.

The Russian resistance, which manifested itself in violent counterblows, was not to be overcome. Farther N., too, neither the Lüneburg group, which had been forced to give up a brigade to Woyrsch's army group (attacked by superior numbers at Baranovichi), nor Bernhardi's Corps (which had sent the 11th Bavarian Inf. Div. from Sokul to the seriously menaced position in the Styr salient) could make any further progress.

Loss of the Styr Bend.—The increasing exhaustion of the troops of the II. Corps and Fath's Corps in the Styr bend, due to incessant fighting, was not lost upon the Russians, and Brussilov turned his attention more and more to the wing of the Russian VIII. and III. Armies. On the S. flank of the Styr bend, the I. Turkestan and V. Cav. Corps were brought up to join the XXX. Corps in the attack, while the Russian XLVI. Corps, with 4½ inf. and 2 cav. divs., pressed against the N. flank. The Russians won the first success on July 4 at Kopyli, when they established themselves on the N. bank, and were not to be driven away even by the 11th Bavarian Inf. Div. which was hurriedly brought up. On July 5, at Kolki, the 2nd Polish Bde. and half of the 45th Schützen Div. had also to yield ground; and as on the same day Fath's left wing and the 1st and 3rd Polish Bdes. posted at Kolodia on Hauer's S. wing were broken through in spite of a brave defence, the risk of Fath's doubly outflanked corps being cut off could now only be averted by ordering his seriously exhausted troops back to behind the Stochod. Hauer's Cav. Corps, whose position had now become untenable owing to its exposed S. flank, had also to retire behind the Stochod, whereby the 11th Honved Cav. Div. on its flank was involved in further fighting which cost it heavy losses. To strengthen the new Stochod front the 37th Inf. Bde., which had been sent northward by train, to join Woyrsch, was now diverted to Fath's Corps, while in the new area of Hauer's Cav. Corps the German 9th Cav. Div. from Marwitz's group, the Bavarian Cav. Div. sent up by train from Hindenburg's group, and the combined Clausius Div., were assembled. Fath's Corps was placed under General Bernhardi, to assure unity of command. In connexion with these events, the centre and right wing of Bernhardi's Corps from Sokul, and the S. wing of the Gronau group (82nd Res. Div.) from the Wiesiloncha, had to be withdrawn behind the Stochod. The Russians pursued hotly, and tried to push across the Stochod, attacking at different points up to the middle of July, but were everywhere, in some cases after the defence had put in its now adequate reserves, repulsed with bloody losses.

In view of the changed situation and the shifting of forces that had become essential, a renewal of Linsingen's offensive could no longer be considered. His troops received orders to establish themselves in a permanent position on the line reached.

At the end of June the Austro-Hungarian Supreme Command saw itself forced to close down the offensive against Italy, and shorten the front on the Sette Communi plateau, in order to release troops for the difficult fighting on the eastern front. The first forces available (the VIII. Corps staff with the 45th Schützen Div. and 59th Inf. Div.) were dispatched at once by train to Pflanzer-Baltin's Army which was now, at the turn of the month, once more the focus of the fighting.

Battle of Kolomea.—After the Russian XI. Corps, in the fighting at Kuty and Wiznitz, had pushed back Habermann's group to the heights W. of Kuty, Letchitsky massed his XII. and XLI. Corps astride the Pruth, and advanced against Benigni's weak divisions on June 28. On the N. wing the attack was repulsed with the aid of reserves, but in the centre and on the S. wing the Russians broke through, and Benigni's troops had to retire to the bridgehead at Kolomea and behind the Pistyanka. To conform to this, Pflanzer-Baltin brought back also those parts of his army that were farther north.

On June 29 the Russians renewed the attack with the XI. Corps against Benigni's S. wing at Pistyn, and forced it back westwards. The course that the battle was taking, and the danger of Brudermann's Cav. Corps, farther to the S., being driven southward, led the Austrian Supreme Command to order the withdrawal of the army to the prepared position Berenzow–Sadzowka–Ottynia. Brudermann's Cav. Corps, with its right still écheloned forward for the time being, held its ground until July 1, when new attacks drove it to retire to the line Kosmacz–Zabie. Kolomea was thus given up by the Austro-Hungarian troops. Maj.-Gen. Leide's group, belonging to the South Army, which on the S. bank had been maintaining the liaison with the VII. Army, had meanwhile had to ward off mounted attacks by the 6th Don Cossack Div. on June 29. On June 30 this division again attacked on both sides of the Olesza–Tlumacz road, with a mass 6 lines deep and 3 km. wide, but once more the attack spent itself in vain, suffering exceptionally heavy losses, and providing yet another example of the uselessness of this type of cavalry attack on infantry, under modern conditions. Meanwhile reinforcements had come up from the Italian theatre, and were detrained at Nadworna and Delatyn. The 119th Inf. Div. was sent by the German Command to Tysmienica for the VII. Army.

Pflanzer-Baltin now intended, in conjunction with the South Army, to give the movement of battle a new character by attacks directed from the N. and S. wings of his Galician front. From the area S. of Delatyn the 44th Schützen Div., reinforced by a regiment of the German 105th Inf. Div., attacked northwestward, covered on its E. flank by Habermann's group; and from the area E. of Tlumacz, General Kraewell's group (German 119th and main body 105th Inf. Div., Maj.-Gen. Leide's group and 10 companies of the XIII. Corps) pushed southward. Both attacks met with success on July 2 and 3. In particular, Kraewell's group, to which Hadfy's group attached itself, gained ground up to the line running from the Dniester bend at Piotrow to Chocimierz and Molodylow, after once more repelling Russian cavalry attacks. But Brussilov had already taken his countermeasures. While the Russian IX. Army sent forward its powerful cavalry against Brudermann's N. wing, pressing him back to Tatarow at the northern exit of the Jablonica (Tartaren) Pass, Shcherbachev attacked the XIII. Corps of the South Army at Barysz and pushed it in. After some temporary successes in counter-attack by the reserves, the corps had to be taken back to the Koropiec brook in consequence of renewed Russian attacks. Violent attacks were also made on Benigni's group, N. of Sadzawka, Leide's group on the Dniester and the VI. Corps E. of Monasterzyska. But whereas Benigni, by the aid of 11 batts. of his own reserves, and the VI. Corps, with parts of the German 1st Res. Div. which had just reached the South Army, was able to restore the situation, Kraewell's attack had to close down on account of the successes obtained by the Russians against Leide's group. All attempts to drive the Russians out of the region of the Jablonica Pass failed.

A brief offensive movement by the Austro-Hungarian XI. Corps from the S. corner of Bukovina did in fact gain ground up to Moldawa, but it had to be cut short and the troops withdrawn to their starting-point as soon as the object of drawing down the enemy's forces upon them was attained; and a brigade had had to be given up to guard the threatened Jablonica Pass.

If, however, the numerous counter-offensive actions which arose out of Pflanzer-Baltin's initiative were insufficient to bring about a change in the situation of his army, they had at least had the effect of forcing Letchitsky to remain passive for the moment between the Dniester and the Pruth, in order to give his exhausted troops a respite after the heavy losses they had suffered in consequence of his ruthless mass-attacks. The Russians opposing Linsingen's group of armies, on the contrary, displayed much activity after the middle of July; and, moreover, by their repeated advances against the Carpathian front between the Jablonica and Prislop Passes they obliged the allies to give closer attention to this part of the front, not so much on account of the strategical importance of these operations, as in consideration of public opinion in Hungary, and of the extent to which a fresh misfortune in this quarter might be expected to react upon Rumania's attitude.

Organization of Command.—The command of the front from the Jablonica Pass to the Rumanian frontier was accordingly given to General von Pflanzer-Baltin on account of his long experience in the minor operations in this mountainous country; and on the N. of the Carpathian front a reorganization of the command was to take place. The German Command, which since the beginning of June had sent 16 divs. and numerous higher staffs to the support of the front S. of the Pripet, urgently demanded an increased influence on the conduct of operations on that front, controlled by the Austro-Hungarian Supreme Command. Already German troops were fighting on all parts of the front, except with the II. Army; and German groups and corps commands were now systematically pushed in where German troops were placed, the intermediate and adjacent Austro-Hungarian formations being put under their command. It is undeniable that, by interspersing German troops and commands in this manner on the Austrian eastern front, which was at that time badly battered, no mean increase in the power of resistance was obtained. But these measures also produced an increase of the influence which the German General Staff arrogated to itself in the conduct of the war.

In order to bring about a fundamental improvement in the position S. of the Dniester, which was going from bad to worse, the two Supreme Commands proposed to deliver a counter-attack on a grand scale on both sides of the river in a south-easterly direction. For this purpose a new army—the Austro-Hungarian XII.—was to be formed from the troops of the inner wings of the VII. and South Armies and the new divisions now being brought up by train. It was to be under the command of the Archduke Karl Franz Josef to whom General von Seeckt was appointed chief-of-staff. But since the incoming troops had always to be thrown into the battle as soon as they detrained, the formation of this army never took effect. On the other hand, the section of the former VII. Army lying between the Jablonica Pass and the Dniester was handed over, as the "III. Army," to the III. Army Command (Generaloberst von Kövess), which was on the way by train from Tirol. Archduke Karl was made commander of an "Army Front" consisting of the VII., III. and South Armies. This new distribution came into effect on July 20. Another result of the agreement reached by the two general staffs was the appointment of Gen. Field-Marshal von Hindenburg to the supreme command of all the remainder of the eastern front, *i.e.* from Riga up to and inclusive of the II. Austro-Hungarian Army. He took over the command on Aug. 30, with Brest Litovsk as headquarters. The German Command decided further to give the 2nd Jäger Bde., now brought up to divisional strength and known as the "Carpathian Corps" (later as the 200th Inf. Div.), to the VII. Army, so as to enable this army to take the offensive, believing that the anticipated success would in the end dissuade Rumania from abandoning her neutrality. The Austro-Hungarian Higher Command on the other hand transferred the Austro-Hungarian 61st Inf. Div. (worn out as it was) from Marwitz's group, and the 11th Honved Cav. Div. from Hauer's Cav. Corps, to northern Transylvania, since, from reliable information received, it appeared that Rumania's intervention on the side of the Entente would have to be reckoned with before August was out.

Battles at Monasterzyska and in the Carpathians.—In the meantime Brussilov had persisted in his mass attacks, regardless of enormous losses. Undeterred by the reverse suffered on July 7, Shcherbachev again attacked the inner wings of the XIII. and VI. Corps between the Koropiec brook and the Strypa with his II. and XVI. Corps, on July 12–13. He succeeded on the two days in breaking through the Austro-Hungarian 12th Inf. Div. and German 1st Res. Div. in turn, but the two divisions, each supporting the other with its own reserves, succeeded in ejecting the Russians from their positions again. Against emergencies, however, the main body of the German 105th Inf. Div. was transferred from the area S. of the Dniester to the South Army.

The Russians now brought up fresh forces (11th and 82nd Inf. Divs.) to the Carpathian front, and by dogged mountain fighting forced the 8th Cav. Div.—which had to give up the commanding Chomiak height—back on to the wall of the Jablonica Pass, and defeated the 3rd Cav. Div. in the battle of the Ludowa massif, driving it back also to the frontier heights. About the headwaters of the White Czeremos, Russian detachments had already advanced over the crest line in the direction of the Visso valley, but were stopped in front of Borsa by the newly arrived 34th Inf. Div. which with one of its brigades pushed the Russians back on to the N. slope of the mountains, while the other brigade relieved the exhausted 8th Cav. Div. at the Jablonica Pass. Farther E. the Russians strove to wrest the pass at Kilibaba, which commanded the Caput height, from the left wing of the XI. Corps, but without success.

Battles on the Lipa and at Beresteczko.—The first attacks executed by von der Marwitz's group on July 10 and 11, which were designed to screen the shifting of troops to the Stochod front, attracted the attention of the XI. Russian Army (Sakharov). This army had been comparatively inactive since the middle of June, and was now selected by Brussilov to deliver fresh blows against the centre of the battle-front.

In the night of July 15–16 a powerful assault by the V. Siberian Corps and the VIII. Corps threw back the centre of Marwitz's group to Zwiniacze. Since a counter-attack made by 9 German battalions failed to restore the situation, Marwitz was obliged to bring back his far-advanced right wing behind the Lipa also. For the same reason the bridgehead at Werben, on the E. bank of the Styr, which was still held, had to be evacuated, for though all attacks against it on July 16 were repulsed, no operation E. of the Styr could be contemplated in view of the general situation. As Marwitz considered his right wing, now behind the Lipa and the Styr, to be adequately secured, he shifted two divisions—the 22nd and 43rd Inf. Divs.—which seemed to him not there indispensable, to his left wing at Gorochow, where he feared the Russians would launch fresh attacks.

The Russians now extended the violent artillery fire which they had maintained against Marwitz's group for some days as far as to the S.E. of Beresteczko. On July 18 they undertook a demonstrative attack against the 25th Austro-Hungarian Div. N. of Brody, and on July 20, after crossing the Styr at Werben, directed a powerful blow by their XXXII. Corps S. of the Lipa against the 46th and 7th Divs. This blow so strongly affected these divisions that, in spite of a counter-attack undertaken by 6 batts. of the army reserve, they were unable to hold their ground on the new line Beresteczko–Smolaiva, as was intended by the Army Command. The whole front of the I. Army had to be withdrawn to the line Beresteczko–Leszniow–Siestratyn. But Marwitz had again to surrender his reserves—the 48th Austro-Hungarian Div. and 3 batts. each of the German 22nd and 43rd Res. Divs.—to the I. Army in the area S. of the Lipa. The II. Army also transferred half of the 33rd Austro-Hungarian Div. to Radziechow behind Puhallo's Army. This part of the front was now thought to have sufficient support, and it was hoped that there would be quiet for a time.

Battle of Brody.—Brussilov, however, continued his assaults against the centre of the allied front opposite him without intermittance. His immediate objective was Brody. On July 24th the Russian XXXII. Corps, which had been shifted to the S., attacked the 25th Austro-Hungarian Div. at Leszniow, and pressed it back several kilometres, together with the adjacent 33rd Austro-Hungarian Div. N. of it. In the following night the Russian XVI. Corps, next in line to the XXXII. Corps on the S., attacked the N. wing of the II. Army and forced it back to a prepared position on the frontier of the Dual Monarchy.

To ensure unity of command in the Brody area, the Austro-Hungarian XVIII. Corps was placed under the II. Army Command, but the troops of the I. Army standing W. of the Styr were put under the command of Linsingen's group of armies, as Lt.-Gen. von Dieffenbach's group, and the I. Army Command was dissolved. The Austrian 106th Landsturm Inf. Div. arrived in the Brody area from the Italian theatre of war, while the German 10th Landwehr Div. was coming up by train by way of Lemberg, the latter, however, being short of one regiment left in the zone of the IV. Army, where comprehensive Russian attack preparations had been discerned.

On July 26 Sakharov renewed his violent attacks between the Styr and Radziwilow with directions towards Brody. Difficult and changeful fighting ensued, in which portions of the 106th Landsturm Inf. Div., just detrained, took part with success.

On July 27 the battle still raged with undiminished fury. Up to 4 P.M. all the Russian assaults had been repulsed, but a new massed blow, delivered by the V. Siberian Corps to the E. of the Leszniow–Brody road, proved decisive. Brody had to be relinquished, and positions occupied immediately S. and N. of it. Then, as it seemed impossible without appreciable reinforcements to hold the new positions, the 10th Landwehr Div., intended for the II. Army, having been diverted en route to Linsingen's group, the troops of the II. Army were withdrawn to a prepared position behind the ponds of the upper reaches of the Sereth and the Styr, on the line Zalosce–Jasionow–Boldury. This line was occupied during the night of July 28–29 without serious molestation.

During the battle of Brody the Russians had also delivered mass-assaults N. of the Pripet at Baranovichi and Gorodishche but they were repulsed with very heavy losses. Immediately afterward, on July 28, a fresh Russian attack on a large scale was launched against the front S. of the Pripet, and particularly against the III. and South Armies, parts of the IV. Army and the Stochod front. The allies, still condemned to play the thankless rôle of defenders, were in a most difficult position. With their few available reserves they could send fresh forces only to the most sorely pressed parts of the front, while at the remaining points, which could no longer be held, salvation could be sought only in shaking off the enemy without—so far as could be seen—any hope of winning back the lost positions.

Battle of Kovel.—In his scheme for the general attack launched in the end of July, Brussilov had selected Kovel as the objective for the N. wing of his group of armies, and to this end had brought up the 23rd Inf. Div. and 8th Cav. Div. as far as Tobol, N. of the Lipa. To facilitate the transmission of orders the N. wing of the VIII. Army—to which had been added the I. and II. Guard Corps and the Guard Cav. Corps—was formed into a separate group under General Bezobrazov.

On the morning of July 28 Szurmay's Corps of the IV. Army, after being heavily bombarded with gas-shell, were attacked by the Russian XL. and VIII. Corps at Sadowa and thrown back on Szelwow, where a part of the artillery, after holding out until the last, was sacrificed to the pursuing Cossacks and Circassians. But the Russian cavalry, wheeling S., was held up by some intervening reserves, and in the counter-attack some of the lost ground was regained.

At the same time the N. wing of the VIII. Army (XXIII. and XXXIX. Corps) and Bezobrazow's Guard attacked the reinforced Lüneburg Corps, standing E. of the Stochod, and forced it, in spite of the intervention of the 121st Inf. Div., to retire behind the Stochod. The attacks launched on the same day by the S. wing of the Russian III. Army against Bernhardi's group and Hauer's Cav. Corps at several crossing-places on the middle Stochod broke down with unusually heavy losses to the Russians. The next day the Russians repeated their costly attacks with equal vehemence, but were everywhere repulsed. Only at Kaszowka did a successful break-through force the II. Corps to retire from their pronounced salient in the Styr bend to a shorter line running farther W. and long since prepared. Unencouraging, too, were the Russian assaults against Linsingen's group of armies, the most hotly contested points being Szelwow, Kisielin and the railway crossing on the Stochod. But their efforts were all in vain. At Stobychowa, again, the Russians, after a hard struggle, succeeded in establishing themselves on the W. bank, but were thrown back to the E. bank after several days of counter-attacks. Thus Brussilov, in spite of his tremendous output of force, failed to reach his objective, Kovel.

Battle of Tlumacz.—From July 28 onward the attacks directed against the South Army N.W. of Buczacz were all completely repulsed; but Bothmer's Army, as the result partly of the constant bending-back and extension of its own S. wing, and partly of the retreat of the II. Army N. of it, became exposed to envelopment on both sides, and its position was soon untenable.

Letchitsky directed his attacks, renewed likewise on July 28, against the sector immediately S. of the Dniester, and drove in Kraewell's group with the first assault. This group, after vainly putting in its reserves, had to fall back—carrying with it Hadfy's N. wing—to the line from Molodylow along the eastern edge of Tlumacz to the Dniester loop S.W. of Koropiec. On Aug. 7 Letchitsky repeated his assaults against the Kraewell group and pushed it back, inflicting heavy losses, through Tlumacz towards the west. The Kraewell and Hadfy groups, and the adjacent I. Corps on the S., were now reëstablished several kilometres away from the enemy, while the VIII. Corps (Benigni's) repulsed all Russian attacks. But when, on Aug. 10, yet another of Letchitsky's mass assaults fell on the Kraewell group, the III. Army could no longer hold its ground; after giving up Stanislau, it had to be withdrawn to the line Zielona–Nadworna–Bohorodczany–heights W. of Stanislau–Jezupol.

Thus another way into Hungary—that over the Pantyr Pass—now lay exposed to Russian attacks, for it was only possible temporarily to block it by a weak detachment. Conforming to this retreat of the III. Army the right wing of the South Army had again been bent back, having been fiercely attacked by the Russians at Monasterzyska. Farther in the N., that part of the front of the South Army which still projected E. of the Strypa was also taken back.

Battles at Zalozce and on the Zlota Lipa.—In the beginning of August there was also fierce fighting in progress on the II. Army's front at Zalozce, in the course of which Lt.-Gen. Eben's newly formed German Corps (195th and 197th Inf. Divs.) came to the assistance of the Austro-Hungarian V. Corps, hard pressed by the Russian VII. and XVII. Corps. Although the Russian break-through was stopped, the counter-attack was not able to win back the former positions completely, and it was suspended on Aug. 10.

In spite of all previous failures, the Russian Guard to the N. of the Kovel–Rovno railway, and, N. again of the Guard up to Stobychwa, the I. Turkestan and I. Siberian Corps, driven on with ferocious energy, persisted in their attacks against the Stochod line. Extraordinarily heavy losses, no longer to be replaced from those great reservoirs of men that had hitherto seemed inexhaustible, forced Brussilov after Aug. 10 to suspend the attacks on Kovel.

This relieved the difficulties of the now unavoidable withdrawal of the South Army, which with its N. wing was still holding the last section of the original front line on the Strypa between Wisniowczyk and Kozlow. On the evening of Aug. 11 it began a two-night movement of retreat, which was to take it to the line Horozanka–Zawalówn–heights E. of Brzezany–Koniuchy–Zborow. Conforming to this movement, Eben's Corps, forming the S. wing of the II. Army, swung back. The retreat was not accomplished without several sharp rearguard actions, but the pursuing Russians could not prevent the retreating army from duly occupying the new position that had been chosen. The Turkish XV. Corps, intended for the Linsingen group of armies but now no longer needed in view of the improved situation there, was sent to the South Army, and intervened with its 19th Div. on Aug. 13th at Brzezany with success. The attacks led by the Russians against the South Army's S. wing on the two following days ended in failure.

With Kövess's Army a comparatively peaceful interval had set in, and, in consequence, the 51st Honved Inf. Div. was able to go to Transylvania, where from day to day an inroad by the Rumanians was expected, while the 44th Schützen Div. was handed over to the Isonzo front. To replace these the German XXIV. Res. Corps with 1½ inf. divs. was sent to the III. Army, the German commander, General von Gerok, taking over the command of the III. Army's N. wing from General Kraewell.

The Counter-Offensive in the Wooded Carpathians.—On the S. wing of Archduke Karl's Army front the allies had so many troops available in the beginning of Aug. that they were able at last to proceed to a counter-offensive. Lt.-Gen. Conta was to attack from the centre of the VII. Army with the Carpathian Corps and the 68th Inf. Bde. in the Czeremos valley. The two neighbouring groups were to join in with this attack: Field-Marshal-Lt. Rudolf Krauss (67th and 202nd Inf. Bdes. and 8th Cav. Div.) from the Jablonica Pass into the Pruth valley; and the 40th Honved Inf. Div., which was later placed under the command of Conta, from Kirlibaba toward the N. into the Suczawa valley. In this operation, which did not follow the old army road Jakobeny–Gurahumora, but took the main forces into impassable country without a through line of communications, the risk of failure was inherent. On Aug. 3 Conta's attack was launched. An initial success was recorded in the capture of the Ludowa massif. But the rest of the advance, which culminated in the taking of Jablonica in the Bilyj Czeremos valley, was made with great difficulty; for the Russians, who were now at home in the hill country, fought with a religious fanaticism such as they had not yet been known to display. The Krauss group began their attack on Aug. 5, and advanced as far as Worochta. The 40th Honved Div. could only with difficulty overcome the Russian resistance, in spite of gallant efforts, and only won a few heights N. of Mt. Capul. As the struggles for these mountain positions, so skilfully defended by the Russians, necessitated long preparation, the Russians had always time to bring up new forces. Above all, bad weather began in the middle of Aug., making artillery operations difficult.

On Aug. 10 the German 1st Inf. Div. arrived at Kirlibaba, to reinforce the 40th Honved Division. The 3rd Cav. Div. was then transferred from Dornawatra to Krauss's group, to increase that group's power of attack. But already the Russians were launching their counter-attacks, having brought up 4 new inf. divs. against the Carpathian front. On Aug. 14 Krauss's group was overthrown at Worochta, and was forced to retire to the heights of the pass. An attack begun by their right wing, which was to have been assisted by the German 2nd Cyclist Bde., with the object of recapturing the Kukul height, was never carried out. For the cyclist brigade had to be hurriedly dispatched to Borsa, to hold a crossing momentarily threatened in consequence of a Russian inroad S. of the Tomnatik height. Meanwhile the Russians were also pushing forward against the Pantyr Pass, and half of the 3rd Cav. Div. was accordingly sent there. To ensure unity of command in the Pantyr–Jablonica Pass section, the I. Corps headquarters was transferred from the III. to the VII. Army. Further, the German 117th Inf. Div., which had now arrived just in time to ward off the violent Russian attacks on the Jablonica Pass, was placed under the I. Corps command. The 2nd Cyclist Bde. was finally transferred to the 3rd Cav. Div. at the Pantyr Pass where the Russians had pushed through up to the Hungarian frontier. At the end of Aug., in order to enable reserves to be formed, the Carpathian Corps also was withdrawn to a shorter line near the Hungarian frontier.

Pflanzer-Baltin's offensive had not got beyond the initial stages though from no fault of this experienced commander, for his well-considered counter-proposals had been ignored. The threat of Rumania's entry into the war made it necessary at the end of Aug. to put in the 11th Honved Cav. Div. on the right army wing at the junction point of three frontiers. The 10th Bavarian Inf. Div. and 5th Honved Cav. Div. were also brought up into this area.

On the Galician-Volhynian fronts no fighting actions of more than local importance took place during the second half of August. The Russians succeeded in penetrating the IV. and V. Corps of Böhm-Ermolli's Army, N.W. of Zalozce, but, after several days of counter-attack, everything, down to the last bit of trench, was recovered. On the Stochod, all that remained to the Russians as the prize of their persistent efforts and costly attacks was one small bridgehead S. of Tobol on the W. bank. From this they could not be dislodged, owing to the impossibility of bringing up heavy artillery.

In the second half of Aug. it became obvious that the Russians' summer offensive had lost its driving power. Brussilov had, it is true, recaptured nearly the whole of Bukovina and large portions of Eastern Galicia and Volhynia, at the cost of heavy sacrifices and of practically doubling the number of his divisions between the beginning of June and the end of Aug. But his main object, the total destruction of the Austro-Hungarian eastern front, had not been achieved. The structure of the Dual Monarchy's army had, however, shown dangerous signs of disruption. The difficulties that arose in fighting with an army that was full of Slavs, against the Russians, their brothers, were plain to all the world, being most clearly shown by the fact that more than 200,000 prisoners were taken from the Austro-Hungarian eastern front in the months of June, July and August.

The allies, in particular the Germans, had been obliged to take strong forces from the other fronts, where they could ill be spared, and put them into the battle S. of Polyesie without coming a step nearer to their war-aim, the final overthrow of the enemy. On the contrary a new enemy, the one-time ally, Rumania, had been enticed on to the stage by the Russian successes. On the evening of Aug. 27, simultaneously with the declaration of war, Rumanian troops crossed the Hungarian-Rumanian frontier. Gladly did exhausted Russia resign the rôle of attacker to her new ally, in the vain hope that this ally would succeed where the utmost efforts of the Russian Empire had failed.

(R. K.)

LUCY, SIR HENRY (1845–), English journalist, was born at Crosby near Liverpool Dec. 5 1845. Educated in Liverpool, he began life in a Liverpool merchant's office, but soon became a reporter for a Shrewsbury periodical. In 1870 he joined the staff of the *Pall Mall Gazette*, London, and in 1873 became Parliamentary reporter to the *Daily News*, with which paper he had a long connexion in various capacities. In 1881 he also joined the staff of *Punch* as contributor of its Parliamentary sketch over the signature of "Toby M.P." He was knighted in 1909 and retired from Parliamentary work in 1916. He published his autobiography, *Sixty Years in the Wilderness*, in 1909, and *The Diary of a Journalist* in 1920.

LUDENDORFF, ERICH (1865–), Prussian general, who was associated with Hindenburg in the Higher Command of the German armies, first on the eastern front and afterwards throughout the whole theatre of the World War, was born at Kruszewnia near Posen on April 9 1865. He was for a long period employed in the work of the general staff, and from 1904–13 he was in what was called the *Aufmarschabteilung*, the department which drew up the plans for the transport, disposition and advance of the troops to be employed in a prospective campaign. In 1908 he was appointed chief of this department. It was he who worked out the last great German Army bill, passed by the Reichstag in 1913. Almost all the proposals he had recommended were adopted without question, but three new army corps for which he had pressed were not even proposed by the War Minister. He believed that it was his insistence upon this particular proposal that led to his being removed from the general staff and sent to Düsseldorf to command the 39th Fusilier Regiment. (It may be noted here that, when he resigned on Oct. 26 1918, he was made hon. colonel of this regiment, which, until its dissolution by the republican Government, bore his name.) In April 1914 he was promoted to the command of a brigade at Strassburg and was there at the outbreak of the World War. He was at once made chief quartermaster of the II. Army under Gen. von Emmich, and proceeded to the western front, where he took part in the assault upon Liége. He accompanied the advance of the 14th Bde. of infantry, as a spectator, but, when its commander fell, he took command of it as the senior officer present and led it in a night march (Aug. 5–6) past the forts to the heights of La Chartreuse outside Liége. On Aug. 7, while the forts were still untaken, he entered the town of Liége with his troops and himself knocked at the door of the citadel, which was surrendered to him without a blow by its garrison of several hundred Belgians. For this feat he received the Prussian *Ordre Pour le Mérite*. He afterwards advanced with the II. Army as far as the Somme until Aug. 22, when he was sent to the eastern front as chief of the general staff of the VIII. Army in East Prussia, with Hindenburg in command. His first meeting with Hindenburg was when the latter joined him in the train at Hanover on his way to East Prussia. The battles of Tannenberg and the Masurian Lakes, which cleared East Prussia of the Russian invaders, at once placed Hindenburg and Ludendorff on a pinnacle by themselves in the estimation of the German people. In Nov. 1914 Hindenburg was appointed chief in command over the armies of the East (*Oberost*), with Ludendorff as his chief-of-staff.

On Aug. 29 1916 Hindenburg was made chief of the general staff of the whole army, and Ludendorff, who had been advanced to the rank of general of infantry, remained in closest association with him, as chief quartermaster-general. The tale of his work in conjunction with Hindenburg, of his successes and failures, belongs to the military history of the World War. In particular his name will always be associated with the great German offensive of the spring and summer of 1918 and with the collapse of that brilliant and audacious enterprise, followed by the disastrous German retreat, the overtures for an armistice and the dissolution of Germany's military power. Ludendorff's attitude towards the Government of Germany and his repeated political interventions form a very important chapter in the events which led up to the German collapse in the autumn of 1918. The motives of his political action are clearly revealed in his book *Meine Kriegserinnerungen* (1919). He maintains that he never desired to interfere in internal politics. He even complains in his book that successive chancellors and ministers forced him and Hindenburg into a false position by constantly adducing their approval for ministerial measures. The truth is that the whole German system, especially in time of war and in the absence of a commanding political personality like Bismarck, inevitably led to encroachments of military influence. Ludendorff denies that he brought about the fall of Bethmann Hollweg; but he was in communication with those leaders of parties whose views approximated to his own, and, after the Crown Prince, who was also in frequent communication with him, had seen the political leaders and had satisfied himself that they would offer no objection, the Emperor accepted his Chancellor's resignation. Ludendorff asserts in his book that he did his best to keep on terms with successive Imperial Chancellors. But he recalls that the machinery of the Government worked slowly, while he and his officers at the front were full of ardour and eagerness. There was often a delay of weeks in getting urgent things done, "and thus," he says, "the tone of communications between the front and Berlin sometimes became stern (*hart*)." In another place he speaks of "the struggle with the Government to obtain what the army required in order to achieve a final and decisive victory." Of Count Hertling he says, "Hertling was no War Chancellor." The kind of War Chancellor Ludendorff would have liked is revealed in his exclamation of despair: "Who was going to be Imperial Chancellor after the Emperor had repeatedly declared against Prince Bülow and Grand Adml. Tirpitz?" Ludendorff seemed to forget that the country, as represented by the majority of the Reichstag, would have none of either of these candidates and that the Emperor, in addition to being himself alienated from Bülow, was becoming more and more dependent upon public opinion and more and more afraid of it. Ludendorff, on the other hand, whenever he refers to the Reichstag or to the leaders of parties, shows that in his conception their business was to rouse patriotic feeling in the country and to get the masses into a mood which would make them support the military leaders' conduct of the war through thick and thin. Thus he pointed out to the politicians of the Reichstag in July 1917 that the so-called Peace Resolution would have a depressing effect throughout Germany, and that in enemy countries it would produce an impression of German weakness. Perhaps he was right. In any case it was impossible for the Allied and Associated Powers to be content with the *status quo ante*; and the German supporters of the Resolution themselves departed from the principle of "no annexations and no indemnities" whenever successes of the German arms encouraged them to believe that Germany might be able to make more advantageous terms. Instances of this were the Peace of Brest Litovsk and the Peace with Rumania. In the negotiations for the first of these Ludendorff was impatient of Count Czernin's Austrian policy as regards Poland, and he desired the extension of German territory and influence on her eastern frontiers both as a military precaution and as a defence against the spread of Bolshevism.

In pursuance of his idea of improving the spirit of the army, Ludendorff caused to be organized under the superintendence of a Lieut.-Col. Nicolai a scheme for giving what was called "patriotic instruction" to the soldiers at the front. The services of a large number of invalided officers and others were enlisted to carry out this scheme. It ultimately developed in many instances into a system of espionage upon the political opinions of the soldiers, and the removal of Nicolai and other officers who were engaged in this work was one of the demands which the leaders of the majority in the Reichstag had put forward when, in Oct. 1918, they compelled the Chancellor, Prince Max of Baden, to break with Ludendorff and to bring about his resignation. Ludendorff had further attempted to extend his system of "patriotic instruction" to the interior of the country through the medium of the generals in command of the reserve corps formations. This home propaganda brought him and his subordinates into conflict with the Social Democrats, who were daily strengthening their hold upon the masses and were influencing them in favour of a "peace by understanding." The Independent Socialists were going still farther and were agitating in the trenches and on the ships of the navy for a military strike, such as actually took place at Kiel in the first week of Nov. 1918 as a prelude to the German Revolution. There were similar demonstrations at various points on the western front, where new recruits abused regiments going into action as "strike-breakers" and "blacklegs."

The most debated episode of Ludendorff's career is his action on Sept. 30 and Oct. 1 1918 in pressing upon the Government the immediate necessity of making overtures for an armistice. The view of the German republicans is that the retreating German armies on the western front were on the brink of a great disaster, that Hindenburg and Ludendorff were aware of this, and that they urged the necessity of an armistice in order to escape the worst. Ludendorff's contention amounts to a plea that he wanted an armistice on reasonable terms in order to enable the German army to be withdrawn to the frontier, where it might have time to reconstitute itself if necessary, with a view to resisting oppressive terms of peace by standing on the defensive. He seems to imply that he did not realize that neither the Allied Powers nor President Wilson would have agreed to an armistice of this kind. When Ludendorff saw the kind of terms which the Allied and Associated Powers were going to impose, he changed his attitude and desired the German Government to hold out. He had also, he says, formed the conviction by the end of Sept. that the Allied and Associated Powers were not in a position to press home an immediate and decisive attack. It was mainly the attempt to urge his changed views upon the Government of Prince Max of Baden that led to that Government's insistence upon Ludendorff's resignation being accepted by the Emperor on Oct. 26 1918. The immediate occasion of what amounted to his dismissal was a General Army Order, which had been issued on Oct. 24, informing the troops that President Wilson's final terms for an armistice were dishonourable to Germany and that the army must fight to the last gasp. This order was contrary to what Ludendorff knew to be the policy of his Government and he finds it necessary in his book to make excuses for having caused it to be promulgated. It was really as far back as Aug. 8 1918, as Ludendorff himself testifies, that he had lost confidence in the possibility of compelling the Allies by military pressure to accept what they would have regarded as a "German peace." After the German lines between the Somme and the Luce had been broken through by the British on Aug. 8, he had a conference (on Aug. 13) in the presence of the Emperor with the then Foreign Secretary, Adml. von Hintze, and advised overtures for peace, which Hintze proposed to initiate through the mediation of the Queen of Holland. According to Ludendorff, it was the delay of the Government in prosecuting these overtures that had made him impatient at the end of Sept. when he urged the immediate necessity of an armistice. It has even been alleged that in Aug. 1918 Ludendorff, under the influence of events at the front, had had a complete nervous breakdown.

As a military organizer and resourceful man of action in the field, Ludendorff has, perhaps, had no equal since Napoleon. He did not, however, possess Napoleon's insight into the necessities of domestic politics, while he shared Napoleon's inability, under the stress of action and the spur of ambition, to realize either the limits of military success or the spirit of the nations he was attempting to crush. He was not exempt from personal vanity. Complaining of the action of the republican German Reich in altering the name of the popular contribution (*Kriegsspende*) of 150,000,000 marks, collected for war invalids, from "Ludendorff Fund" to "People's Fund," he says: "Could not the Republic have continued to let it bear my name—this fund which, precisely on account of its bearing my name, had brought in so much money and was so beneficial?" He was a master of caustic retort. Prince Max of Baden, instigated by his Socialist colleagues in the Government, had complained that the table of the officers at the front was in glaring contrast with the poverty of the common soldiers' rations, and had suggested that the officers should be content with the same food as their men. Ludendorff replied that the staff could not do its brain work on the common soldier's rations, but he would undertake to try to live on these rations, if Prince Max and the members of his Government would do likewise. "Prince Max," Ludendorff reports, "did not care to eat the soldiers' rations," and, accordingly, the subject was dropped.

After the revolution, Ludendorff knew that his influence in the country was gone and that he even ran the risk of being impeached by the revolutionary Government for having prolonged the war, as well as for his political activities. He, therefore, like Tirpitz, went abroad, choosing Sweden as his place of refuge, and did not return to Berlin till the spring of 1919. His behaviour after his return was ambiguous. He refrained from placing himself at the head of any reactionary movement, but he was always in evidence whenever such movements seemed likely to achieve any success. The reactionaries continued to regard him as one of their main hopes, and during some of their manifestations of 1919 he showed himself in the streets and was cheered by ex-officers and royalist crowds. During the days of the Kapp *coup d'état* (March 1920) he was a frequent visitor at the headquarters of Kapp's usurping "Government." After the failure of Kapp and his associates, Ludendorff betook himself to Bavaria, which, under the Government of Herr von Kahr (1920–1) and under a formal state of siege, was administered in a reactionary spirit. Bavaria thus became a refuge for Prussian plotters like Col. Bauer, Major Pabst and Capt. Ehrhardt, whose Marine Brigade had supported Kapp. The Prussian refugees seem to have enjoyed the protection of this Bavarian Government, and it was among them that assassinations like those of Gareis, the Bavarian Independent Socialist leader, and of Erzberger, the Democratic Catholic leader, were planned. It is unlikely that Ludendorff was associated with these particular schemes, but his name and his influence were identified with the royalist parties, whose unmeasured agitation favoured the wildest plots and contributed to the spirit which led to assassinations like that of Erzberger.

In addition to his *Kriegserinnerungen 1914–18* (1919), Ludendorff published *Fälschung meiner Denkschrift von 1912* (1919); *Entgegnung auf das amtliche Weissbuch, Vorgeschichte des Waffenstillstands* (3 pamphlets, 1919).

LUDLOW, JOHN MALCOLM FORBES (1821–1911), English philanthropist, was born at Nimach, India, March 8 1821, and was called to the bar in 1843. Becoming associated with Kingsley, Hughes and F. D. Maurice, he helped to found the Working-Men's College in Great Ormond Street in 1854, having previously (1850) founded and become editor of *The Christian Socialist* newspaper. He was secretary to the royal commission on Friendly Societies (1870–4). From 1875 to 1890 he was chief registrar of Friendly Societies. He was one of the first members and subsequently president of the Labour Co-Partnership Association. He died in London Oct. 17 1911.

LUEGER, KARL (1844–1910), burgomaster of Vienna, was born Oct. 24 1844, the son of an usher, and, studying under the greatest material difficulties, succeeded in qualifying as an advocate. He was at first a partisan of the Democratic party, then a leader of the Christian Socialists, an anti-Semite and advocate in the courts for artisans and "small men." He overthrew the German-Liberal municipal government of Vienna, and was elected burgomaster in 1895, but the Emperor did not confirm the appointment and Vienna was placed under the government of a State commission. In the new elections Lueger allowed another member of his party to be set up as dummy burgomaster, while he himself in form became vice-burgomaster. In 1897, however, when the "people's candidate," Lueger, was again elected burgomaster, the Emperor confirmed his election and repeatedly honoured him as a loyal patriot. Lueger, who was a powerful orator, was seven times elected burgomaster. He was a zealous Catholic, and wished to "capture the university" for the Church; he would have neither Social Democrats nor Pan-Germans nor Jews in the municipal administration. He secured good treatment for Czech immigrants, and established Viennese municipal electrical stations, gasworks and tramways, independent of the English gas and tramway companies. He planned to make Vienna one of the most beautiful of garden cities. He died March 10 1910.

(C. Br.)

LUGARD, SIR FREDERICK JOHN DEALTRY (1858–), English administrator (*see* 17.115), in 1912 resigned his position as governor of Hong-Kong. From 1912 to 1919 he was governor of Northern and Southern Nigeria, the two protectorates having been unified in 1912.

His wife, Flora Louise Shaw, whom he married in 1902, was a well-known author and journalist. She was for some years a contributor to *The Times*, subsequently becoming head of the colonial section of that paper. In connexion with this work, she went as special correspondent to South Africa (1892 and 1901), and to Australia and New Zealand (1892) partly in order to study the question of Kanaka labour in the sugar plantations of Queensland. She also made two journeys to Canada (1893 and 1898), the second of which included a journey to the gold-diggings of Klondike. During the World War Lady Lugard was prominent in the founding of the War Refugees Committee, which dealt with the problem of the Belgian refugees, and also founded the Lady Lugard hospitality committee. She was in 1918 created D.B.E.

LUND, TROELS FREDERIK (1840–1921), Danish historian (*see* 17.123), published in 1906 *De tre Nordiske Brödrefolk* and in 1909 *Nye Tanker i det XVI. Aarhundrede.* In 1911–2 appeared his historical tales, *Tider og Tanker.* He died in 1921.

LUTYENS, SIR EDWIN LANDSEER (1869–), English architect, was born in London March 29 1869. For one who was to occupy such a commanding figure in the whole world of modern English architecture, Sir Edwin Lutyens' art owes singularly little to a training and education of the usual description. After a couple of years at the South Kensington schools he was at first placed in the office of an architect in the country, with whom he remained for the briefest possible time, passing afterwards a year with Mr. (later Sir) Ernest George. His first commission came to him at the age of 19, and, from this and his other early experiences, he has himself remarked that the best training for an architect is the building of houses. His earliest important work (1890) followed shortly after this—Crooksbury—to which some eight years later he made very characteristic additions, which interestingly show his development and his enlargement of the principles of Norman Shaw and Philip Webb—particularly the latter—as well as his growing grasp of abstract design. Amongst other strong influences on his thought and work should be counted his early association with Miss Jekyll, the gifted designer and contriver of gardens treated as an integral feature of the homestead, and playing a part of the greatest importance in its design and treatment. At "Hestercombe," a not very interesting house from another hand, Lutyens carried out his largest essay in garden-work, suggesting the finer manner of such work as was done under William III. and Anne, rather than the less elaborate and smaller methods of the Elizabethan period. His many houses in Surrey—such as "Orchards"—show him as carrying still further his development in the direction of individuality in his design, tempered by a reticence that has always kept his work far removed from attempts at "originality"—a quality based upon the impossible. A fine house at Sonning—"Deanery Gardens"—is a later important essay in half-timbered design, and the value he has always placed on a varied use of materials, as giving different qualities of texture to a building, found expression in "Daneshill," one of his earliest uses of the small bricks he affects so much. "Marshcourt," again, with its interesting play of contrasting chalk and flint, shows Lutyens, designing a house that would be Tudor in style and treatment if it were not essentially modern and his own. Much of his domestic work has been in the direction of the restoration of, and adding to, old houses. The largest example of his powers in this direction is the treatment of Lindisfarne Castle, Holy I., where he carried out, during upwards of nine years (1903–12), a very complete and yet conservative restoration. Sir E. Lutyens' civic work shows equally with his domestic design a personal quality, in such buildings as that for the *Country Life* offices in London, and for the British Sections at the Exhibitions in Paris (1900) and in Rome (1911). The Garden Suburb at Hampstead has important examples of his treatment of small houses, as in the large Central Square, and of his method of dealing with church design. His two churches in the centre of the square, planned for use by supporters of differing schools of religious thought, are neither of them on the conventional lines of ecclesiastical design, but show in each case a characteristic simplicity and culture.

It was, however, as principal architect of the New Delhi (*see* DELHI) that the culmination of Sir E. Lutyens' professional career was reached. In 1912 a committee, on which Sir Edwin served, and which included Mr. H. Baker and Mr. Lanchester, visited Delhi with a view to advising the Indian Government as to the practical considerations involved in the scheme for the new capital. The plan adopted was elaborated in detail and in what may be described as "the Grand Manner" by Lutyens and H. Baker. Another conspicuous success of a more popular character was his design for the Cenotaph in Whitehall. The nation's memorial to those who died in the World War, of which Sir E. Lutyens had provided a temporary model for the Peace celebration in 1919, was in 1920 perpetuated in stone as a lasting monument. Its striking simplicity, dignity and proportion lift it above the level of the host of memorials that followed the war.

Sir Edwin was elected an Associate of the Royal Academy in 1913 and a full Academician in 1920. The Royal Institute of British Architects awarded him its gold medal in 1921. He was knighted in 1918. In 1897 he had married Lady Emily Lytton, daughter of the first Earl of Lytton.

LUXEMBURG, ROSA (1870–1919), German Socialist and revolutionary agitator, was born a Jewess on Dec. 25 1870 in Russian Poland. Her earliest political activities in her student days were connected with the Socialist movement in the country of her birth, but about 1895 she migrated to Germany. She there went through the form of marriage with a German workman named Luxemburg with the object of acquiring German nationality. In 1898 she edited for a short time the Saxon *Arbeiterzeitung*, but soon afterwards became a member of the staff of the *Leipziger Volkszeitung*. She took part in the Russian revolutionary movement of 1905 in Russian Poland, but soon returned to Germany in order to engage in extreme Communist propaganda and founded together with Karl Liebknecht the Spartacus League. In 1914, after the outbreak of war, she was sentenced to a year's imprisonment for inciting to insubordination and remained throughout the war in preventive custody (*Schutzhaft*). After the revolution she edited in conjunction with Karl Liebknecht the *Rote Fahne*, the organ of the Spartacist or Communist advocates of violent revolutionary methods. After the Jan. (1919) street fighting in Berlin, of which she and Liebknecht were the chief instigators, both agitators were for some days in hiding, but were ultimately arrested and conveyed to temporary military headquarters of the Government forces at the Eden Hotel in the west end of Berlin, on the night of Jan. 16 1919. The mob and some of the soldiers became menacing in their attitude towards the prisoners, so that it was deemed advisable to convey them to one or other of the Berlin prisons. Liebknecht was shot on his way to the Moabit prison, while Rosa Luxemburg was brutally attacked on leaving the hotel and was finally shot dead as she was being conveyed, insensible from her injuries, in a motor-car under a military escort. Her body was thrown into a neighbouring canal and was only recovered some months later.

LUXEMBURG (*see* 17.145).—The Grand Duchy as a whole is a plateau 1,000 ft. above sea-level on the N. and N.W., sloping down to S.E. into the Moselle valley, a deep and winding gorge which forms its frontier on this side.

The whole district is furrowed by deep river valleys, and falls into two contrasted divisions, the Ösling or northern portion and the Gutland or southern. The Ösling forms part of the Ardennes-Eifel massif, a high and bleak plateau with a cold, swampy clay soil overlying Devonian and Silurian rocks. Here only the river valleys are fertile or at all thickly inhabited; the plateau, which is over 1,300 ft. above sea-level, has little agriculture (oats, rye, potatoes; hay in the valleys) and a thin population. The Gutland, so called on account of its relative fertility, is a part of the Lorraine plateau, geologically composed of Jurassic formations (mostly oölites and marls) with some Triassic sandstones. Here the lower elevation and the comparatively good calcareous soils, even apart from the presence of iron ore, enable the country to support a denser population. Even here the soil is not rich; on the oölites it is thin and dry, on the marls cold and heavy; but a good deal of wheat is grown, some barley, beets, peas and beans, and some lucerne.

The Luxemburg section of the Moselle valley, like its German continuation north-eastwards, is warm and sheltered, and contains extensive vineyards which, together with orchards, occupy the greater part of the Moselle valley communes. The main centres of wine-growing are Wormeldingen, Wellenstein, and Remerschen: Grevenmacher is the chief market. A few vineyards may be found in the lateral valleys, but never very far from the Moselle except up the Sauer, where isolated examples occur even as far up as Vianden. The total vineyards occupy 1 % of the cultivated area.

The amount of live stock kept is negligible except for pigs, which are common everywhere.

The average density of the pop. is 246 per sq. m. for the whole country. The valleys generally, the centre round the capital, and the iron-working district of the extreme S.W., are somewhat densely inhabited, especially the last named, which has a pop. of 1,000–3,000 per square mile. The main river valleys have a density of 200–400, rising in the neighbourhood of the towns; the Gutland plateau an average of 150, and the Ösling below 100. The rainfall varies from rather over 30 in. in the extreme W. to 25 in the E.

The Grand Duchy possesses a small portion of the extreme N. end of the famous *minette* iron-field of Lorraine. The ore occupies a continuous stratum in the so-called Dogger beds of the Jurassic oölite. Its importance is due to the great size and continuous character of the deposits, and to the special suitability of the pig-iron produced for conversion into steel by the basic process. The Luxemburg portion of the field (14 sq. m., of which the unexhausted portion was estimated in 1913 to contain 270,000,000 metric tons of ore) yields 7,000,000 tons of ore per annum; this is mostly smelted in the Grand Duchy, apart from a certain amount exported to Belgium. The output of iron and steel is declining; that of pig was 1,950,514 tons in 1916 as against 1,266,271 in 1918, while the output of steel declined in the same period from 1,296,407 tons to 857,937.

Industries occupy over a quarter of the population. Of the total industrial population one-third works in the mines and furnaces of the iron district, which also contains mechanical construction, electrical and other factories of similar kinds. The centre of the country has a fair number of industrial establishments, including foundries, potteries, textile works, saw-mills and quarries. In the capital there are 4,000 industrial workers, especially engaged in the production of food-stuffs and hardware. The northern districts have practically no industry, and the same is true of the east, which lives chiefly by its wines and fruit.

The population is prevailingly Germanic in speech, but this has only been the case since 1839, when the present western frontier was drawn, whose claim to be a natural frontier rests on the fact that it roughly corresponds with the linguistic frontier between Teutonic and Romance dialects.

The entry of the Grand Duchy into the German Customs Union (1842) marked the beginning of a close economic union with Germany which was the chief cause of Luxemburg's industrial development. Her railways, on the other hand, were in 1857 taken over by the Eastern Railway Company of France. After the Franco-German War Germany deprived the French Eastern Co. of its rights and worked the Luxemburg railways herself as part of the Reichsland system, pledging herself not to use them for the transport of troops or munitions in time of war, a pledge which, however, was not taken into account in the plans of the German general staff.

On Aug. 2 1914 the capital and the chief railway bridges were seized by German troops, which had already entered the country on the previous day. The protests of the Grand Duchess Marie Adelaide and the Government were ignored, and the country remained in German hands for the remainder of the World War. The native authorities were allowed to conduct the civil administration, but there was a strict German censorship of post, telegraphs and telephones, and for some time the German Emperor resided in the Grand Duchy. There were no allegations of German atrocities, but the openly Francophil attitude of the inhabitants led to a good deal of friction and was probably responsible for such events as the Cabinet crisis of 1915. The American troops which entered the capital after the Armistice, on Nov. 22 1918, were received with the greatest enthusiasm.

On the conclusion of the war it became necessary to reconsider both the position of the Grand Duchy as a member of the German Zollverein and of the Grand Duchess, whose German sympathies were in conflict with the general views of her subjects. She accordingly abdicated in favour of her sister Charlotte Adelgonde early in 1919, and a referendum was held later in the year to decide the political and economic future of the country. The Treaty of Versailles acquitted Luxemburg of her obligations towards Germany, and it was known that the Peace Conference would not permit the resumption of the old relation, even if the Luxemburgers had wished it. Voters were therefore asked to choose between economic union with France and with Belgium, and between the existing Grand Duchess, a new ruler, and a republic. They resolved by a large majority upon economic union with France and on the retention of their constitution and of the Grand Duchess Charlotte. (R. G. C.)

LUZZATTI, LUIGI (1841–), Italian statesman and economist (*see* 17.148), was Minister of Agriculture in the second Sonnino Cabinet (Dec. 2 1909–March 21 1910), and on the resignation of the latter was called upon to form a Cabinet himself. His administration, which lasted until March 18 1911, was not very successful. Although a man of first-class financial ability, great honesty and wide culture, he had not the strength of character necessary to lead a Government; he showed lack of energy in dealing with opposition and tried to avoid all measures likely to make him unpopular. Furthermore he never realized that with the Chamber, as it was then constituted, he only held office at Giolitti's good pleasure. During the World War he was consistently pro-Ally and strongly supported Italian intervention, but his tone was on the whole pessimistic. Although he did not take office while the war lasted, he was always consulted on all financial matters, and his sound advice was generally followed. He became Treasury Minister in the second incarnation of the Nitti Cabinet (March 12–May 10 1920), but did not resume office in the third. At the general elections of May 1921 he decided not to stand for Parliament again, and was made a senator. In spite of his great age, he continued to write on economic and financial problems with his accustomed lucidity and soundness of judgment, insisting on the necessity for Italy to return to freedom of trade and to reduce Government interference in business matters to a minimum.

LVOV, PRINCE GEORGE EUGENIEVICH (1861–), Russian statesman, was born in 1861, and belonged to the old Russian nobility. After taking his degree in law in 1885, he spent the greater part of his life in Zemstvo work. He was a member of the executive board of the Tula Zemstvo from 1888 and president of the same from 1902 to 1905. In 1905 he was elected member of the first State Duma and joined the right wing of the Constitutional-Democratic party; he also took part in the All-Russian Assembly of Zemstvos. He refused to sign the Viborg manifesto. In 1909 Lvov went to Canada to study the emigration question in that country.

During the Russo-Japanese War Lvov was the leader of the Zemstvos' organization for the relief of wounded and disabled soldiers. The Minister of the Interior, M. Plehve, tried to stop the development of the Zemstvo work in this direction, because he disapproved of its liberal tendencies. But Lvov contrived to extend the activities of his organization in such a way that even the Government were obliged to recognize the ability of its work and on many occasions called upon it for assistance. From the beginning of the World War Lvov took a leading part in the organization of the All-Russian Union of Zemstvos and Towns for the relief of sick and wounded soldiers, of which he was the president. The activities of this organization were of the greatest value to the army; the administrative incompetence of the Government obliged the latter against its will to enlarge the sphere of action of the Zemstvos' Union, which took a large share in the supervision of production and distribution of munitions and food supplies. In the conflicts which arose continually between the Government and the Zemstvos, Lvov always defended the independence of his organization. He also participated in the manifestations directed towards liberal reforms during the last period of the old régime.

As one of the most popular public men of Russia he was elected Prime Minister and Minister of the Interior of the first Russian Provisional Government, on March 14 1917. Unfortunately he did not possess the qualities needed to save Russia from the approaching catastrophe. His popularity diminished with amazing rapidity and in a few weeks his Government proved a complete failure. On May 19 Lvov addressed a letter to Rodzianko and Tchkeidze, insisting on the creation of a Coalition Government. The new Cabinet was formed on May 17, and Lvov again accepted the leadership of the Cabinet and the portfolio of the Interior, but he had no real influence in political life, and he resigned from both offices on July 7, ceding the place to the first Kerensky Government. Lvov was arrested and imprisoned in Ekaterinburg after the Bolshevist revolution, but he escaped to Siberia and was sent to Japan as the head of a deputation of the anti-Bolshevist Ufa Government. From Tokyo he proceeded to Europe by way of the United States. On his arrival in Paris Lvov took an active part in the anti-Bolshevist agitation and joined the so-called "Political Consultation" in Paris. Together with some other Russian public men he protested against the proposal of the Prinkipo Conference, and warned the Allies that no treaty with the Soviet Government would be recognized by the future Government of Russia. Lvov always advocated loyalty to the Western Alliance and admitted of no compromise with the Bolsheviks.

LYALL, SIR ALFRED COMYN (1835–1911), English writer (*see* 17.148), died in the Isle of Wight April 10 1911.

LYALL, SIR CHARLES JAMES (1845–1920), English orientalist, was born in London March 9 1845 and educated at King's College, London, and Balliol College, Oxford. He entered the Bengal civil service in 1867 and had a distinguished career as an administrator, becoming secretary to the Home Department of the Government of India in 1889, chief commissioner of Assam in 1894 and of the Central Provinces from 1895 to 1898, whence he was transferred to the India Office at home as secretary to the Judicial and Public Department, a post which he held until his retirement in 1910. But his greatest claim to distinction lay in his studies in Arabic literature. He published two volumes of translations of Arabic poetry (1885 and 1894), a translation of two ancient Arabic *Dīwāns* (1913), as well as articles on Hindustani and Arabic literature in the *E.B.* 9th and 11th editions. He was made K.C.S.I. in 1897, and was elected a fellow of the British Academy, and he received hon. degrees from the universities of Oxford, Edinburgh and Strassburg. He died in London Sept. 2 1920.

LYAUTEY, LOUIS HUBERT GONZALVE (1854–), French marshal, was born at Nancy Nov. 17 1854. He entered St. Cyr in 1873 and two years later was appointed a sub-lieutenant. He was nominated to the old staff corps (*Corps d'État-Major*), but when that corps was abolished transferred to the cavalry, with which he served chiefly in Algeria until 1894. He became a lieutenant in 1878, a captain in 1882 and major in 1893. In 1894 he was made chief-of-staff to Gen. Galliéni, and took part in the operations in the upper valley of the Song-Caw in 1895 and against the pirates of Upper Tonkin in 1896. In the latter year he went with Gen. Galliéni to Madagascar and took an important part in restoring French domination in that island. He was promoted lieutenant-colonel in 1898 and colonel in 1900. He returned from Madagascar to France in 1902 and was given command of the 14th Regt. of Hussars. On Oct. 9 1903 he was promoted general of brigade and four years later (July 30 1907) was made a substantive divisional general and placed in command of the Oran division. On April 28 1912 he was appointed resident general and commissioner in Morocco—an appointment which he held continuously until Dec. 1916, when he relinquished it, against his own wish, to become Minister for War under M. Briand's premiership. He resigned his portfolio in March 1917 and thereby precipitated the fall of the Briand Cabinet. He then returned to continue his work in Morocco. He was admitted to the French Academy in 1912. He received the Grand Cross of the Legion of Honour on Sept. 17 1913, and was made a marshal of France in Feb. 1921 in reward for his great services as a soldier-proconsul in that N. African empire which many Frenchmen regard as the future basis of their national power.

LYDEKKER, RICHARD (1849–1915), English naturalist and geologist, was born in London July 25 1849. He entered Trinity College, Cambridge, where he took a first-class in the Natural Science tripos (1871). He joined the staff of the geological survey of India in 1874, remaining in this post till 1882. He became very widely known as a naturalist, and was elected a fellow of the Royal Society in 1894. His works include *Catalogues* (in 10 vols.) of the fossil mammals, reptiles and birds in the British Museum (1891); *A Manual of Palaeontology* (with Prof. H. A. Nicholson, 2 vols., 1889); *Phases of Animal Life* (1892); *The Royal Natural History* (with Sir W. H. Fowler, 8 vols., 1893–6); *The Great and Small Game of India, Burma and Tibet* (1900). He died at Harpenden April 16 1915.

LYONS, SIR JOSEPH (1848–1917), British caterer, was born in London Sept. 29 1848 and educated at the Borough Jewish school. In early life he studied painting and exhibited at the Royal Institute, but by 1886 he had turned to business enterprises, in conjunction with the brothers Isidore (d. 1920) and Montagu Gluckstein. He began by catering at public exhibitions. He next opened tea-shops in London, the first in 1894; 20 years later these numbered over 200 and provided cheap food for the large class of clerical workers and junior members of professions. Later he opened several restaurants of a more ambitious nature, as well as hotels on the "no-tipping" principle. He initiated the athletic side of the Territorial Army scheme, and, for his services in this direction, was knighted in 1911. He died in London June 22 1917.

See Mrs. Stuart Menzies, *Modern Men of Mark* (1920).

LYS, BATTLE OF THE (1918).—In the great German offensive of 1918 the idea of breaking through the British-Portuguese front in French Flanders had from the first played a considerable part in the scheme of attack considered by Rupprecht's group of armies. Under the code name "George," this was originally intended as the operation to force a decision, but it shrank later—as "Little George" ("Georgette")—to a diversion, and was eventually dropped altogether in favour of the "Michael" operation (*see* WESTERN FRONT CAMPAIGNS). Only the preparations for it were carried out, immediately before the main attack in the Somme area, to mislead the opponent. Arrangements had also been made to revert quickly to the attack in Flanders in case the Somme offensive should come to a standstill.

When, on March 30, the great battle in France actually was broken off, the German Supreme Command snatched at the Flanders attack—now "Georgette"—which was limited in extent. There the second blow was to be struck at the British army. They could not expect to decide the war here, where the means were considerably more scanty than in the March offensive, but they hoped for a break-through in the direction of St. Omer-Hazebrouck and considerable gains of ground towards the coast. An extension of the break-through towards the S. was a secondary consideration only.

The conditions were favourable to carrying out the operation. The dry weather held out hopes that the Lys plain would prove practicable. The Portuguese, put in S. of Armentières, were inferior as opponents, and the Flanders front had had an extraordinarily weakening effect on the British. Everything depended on whether the Lys depression, which was difficult to traverse and impossible to reconnoitre, could be conquered so quickly as to prevent renewed resistance on the river itself, and the use of the rising ground beyond the Lys and the Lawe for the defence.

The main German attack was entrusted to the VI. Army under von Quast, with the Corps Staffs II. B, XIX., LV. and IV. For this purpose the Army was to put in 17 divisions in all. The attack was to be led from the line Armentières–La Bassée canal, with its centre of gravity on Hazebrouck. The IV. Army under Sixt von Armin, in the event of the VI. Army's attack having sufficient success, was to advance with a strong left wing to the W., passing N. of Armentières, which in itself was to be left untouched and made to fall by envelopment. Four divisions of the IV. Army, under the Staffs of the X. and XVIII. Reserve Corps, were to take part in the attack. The further development of the attack was to depend upon whether the heights S. of Poperinghe could be reached. If this were achieved the British and Belgians would be threatened from the rear, and their evacuation of the positions stretching northwards to Dixmude could be counted upon, if the subsidiary attacks arranged for by the IV. Army at this town and from the Houthoulst forest were carried out. The destruction of the important mining and industrial centre in the Béthune region might also be expected if the left wing, in accordance with the progress of the centre, should wheel in to the south-west. It was particularly important here, as in the March offensive, to succeed in really surprising the enemy. The successful crossing of the Lys especially depended on this. Emphasis was therefore laid on the need for the utmost haste. April 8 was the date desired for the attack, but in the end the VI. Army's attack had to be postponed till the 9th. The IV. Army's attack was fixed for the 10th.

The armies made their preparations with the greatest zeal and with scrupulous care, guided by the same principles as in the attack in the Somme area. By direction of the Supreme Army Command the artillery programme was revised by Colonel Bruchmüller. The order of battle gave the VI. Army nine divisions in the first, five in the second, and three in the third line; the IV. Army had three divisions in the first and one in the second line. The first- and second-line divisions were placed under the Corps Staffs, the third-line divisions under the Army Higher Command. To reënforce the attack still further, 14 more divisions were specially sent in the course of the battle, 9 by the army group, 5 by the Supreme Army Command. On an average the troops used were inferior to those in the March offensive. Quite a number of them were not fitted out and trained as attack divisions. But in spite of this both leaders and troops were full of confidence.

The attack itself was prepared by the artillery in the same way as that of March 21. Gas-shelling by the VI. Army began at 4:15 A.M., and, according to British reports, succeeded in poisoning the ground for miles behind the British front line. The deployment of the infantry had been carried out without any serious counter-measures on the part of the enemy. At 8:45 A.M. the infantry passed to the assault, meeting with only slight resistance, but found themselves, like the artillery, hindered by the mist hanging over the Lys depression, which greatly hampered their leading and the communication of information. In spite of this all three lines of the first position had been passed by 10 A.M. But now came the great problem of crossing the area under shell-fire with artillery and transport. The roads ran unfavourably, and were almost all destroyed. The ground was still soft in many places, and the shell-holes full of water. A few downpours of rain shortly before the day of the attack had made the condition of the ground worse. In spite of the immediate sending forward of pioneers and engineers and of the devoted zeal they put into their work it was only possible to effect a gradual improvement and to make at least the more important roads passable. On the first day only some few guns were got up to the front, in immediate support of the attacking infantry. This difficulty was distinctly felt when fresh resistance was encountered on the Lys. Nevertheless the initial success was considerable. The Portuguese divisions were as good as annihilated. The II. Bavarian Corps turned in to the left and took Bois Grenier and Fleurbois. The XIX. and LV. Corps pushed through to the Lys. General Hoefer crossed the Lys at the lock E. of Sailly on April 9, thus enabling the troops attacking in a westerly direction to reach the opposite bank in the night of the 10th. The crisis which threatened to develop in the afternoon, owing to the wearied German troops coming on fresh British reserves, was thus overcome. Further S. the LV. Corps, commanded by von Bernhardi, reached the Lawe at certain points. On the left wing the IV. Army Corps took Richebourg l'Avoué, but failed to break the British resistance in the strongly fortified villages of Festubert and Givenchy.

This result did not come up to the Supreme Army Command's expectations. All depended now upon whether the next few days would bring a more rapid advance. With the VI. Army this was not the case. The British machine-gun nests gave the German infantry much trouble, as the guns necessary for destroying them could only be brought up with difficulty. An independent success was gained by the II. Bavarian Corps, which reached La Chapelle d'Armentières after more or less violent fighting. These troops, having advanced across the Lys at Sailly, had at first to repel some heavy British counter-attacks. They then pushed forward—after being reinforced—to Steenwerk, and so made the Lys crossing at Erquingham available. Further W. there was some heavy fighting round Pont Mortier. Here, too, some very lively British attacks were repelled. The XIX. Corps took the town of Estaires by house-to-house fighting and opened up the Lys crossing from La Gorgue. The LV. Corps managed to cross the Lawe between Lestrem and Vieille Chapelle. Of the IV. Corps only the right wing was able to advance with heavy fighting. On the left it could do no more than defend itself against heavy counter-attacks coming from Festubert. It was plain that the British were concerned above all to prevent any further rolling up of their front to the south.

Meanwhile the IV. Army had begun its attack. In the night of April 9–10 its artillery prepared the attack by several hours' gunfire, but without quite silencing the opponent's guns. Under cover of darkness the left wing of the X. Reserve Corps crossed the Lys, which flowed immediately in front of the opposing lines. At 5:15 A.M. came the infantry attack delivered from Warneton and from either side of it. From the first it encountered violent resistance. But the XVIII. Reserve Corps succeeded in enveloping and taking Meesen, and in holding it against heavy counter-attacks. The Hollebeke Park was also taken, and the attack carried to within 800 metres of Wytschaete. The X. Reserve Corps pushed through to the eastern boundary of the Ploegsteert Wood. Its left wing reached Ploegsteert village and Le Bizet, and repelled some violent counter-attacks. Behind the front the Lys was bridged at Deulemont and Frélinghien.

For this army, too, the difficulties were considerable. The completely ruined country of the Wytschaete battle-field (1917) made it extremely difficult to move or to judge what position had been reached. The superiority of the German artillery was not sufficiently great. The time for preparation had had to be cut very short; and the forces available were disproportionately weak. The success gained was all the more noteworthy.

The British were again chiefly concerned with reënforcing their wings which had held firm, and tried thereby to prevent the operative development of the break-through and the rolling-up of the adjoining fronts. A continuation of the German attack still, however, offered fair prospects. The army group therefore brought up further reënforcements on to the roads. The attack itself was resumed on April 11, with lively fighting. The XVIII. Reserve Corps pushed its way into Wytschaete, and established itself later E. of that place and in advance of the Wytschaete–Meesen road. The X. Reserve Corps took the Nightingale height (between the Douve brook and the Ploegsteert Wood) by envelopment from the Ploegsteert Wood, and its left wing a new position at Romarin. Further S., the town of Armentières, with more than 3,000 men, 45 guns and ample stores, fell into the hands of the Germans. The II. Bavarian Corps pushed through Nieppe to the Steenwerk railway station. The XIX. Corps succeeded by vigorous fighting in reaching Neuf Berquin church. The LV. Corps took Merville and Lestrem.

On April 12 no particular progress was made by the Germans. On the other hand, the counter-assaults to which the British had now resorted were all repelled in each case. The VI. Army took the northern portion of Calonne and the village of Lâcon. An order from the army group on April 12 arranged for the continuation of the attacks by the inner wings of the two armies. Besides this the VI. Army was to prepare for the continuance of the attack on the left wing according to plan. It was still important for the Germans to force a way into the hilly country N. of Bailleul, in order to relieve the position of the troops still remaining on the plain, and to excercise a strategical influence on the Yser front. But the British resistance had been greatly strengthened in the meantime, and the German attack could only proceed spasmodically and in limited sectors.

The next effort, on April 13, was directed against the Nieuwekerke–Bailleul range of hills. The 36th Reserve Div. succeeded, though with heavy losses, in taking the high-standing Nieuwekerke from across the exposed plain. The heights W. of that place were also captured. The VI. Army made only slight progress. The XIX. Army Corps took Merris. Some portions of the LV. Corps, which had penetrated into the Nieppe Wood, had, however, soon to give ground again.

On April 15 the corps of the IV. Army, to which the Guard Reserve Corps had been added on the left wing, pushed on towards the hill of Kemmel. The XVIII. Reserve Corps got beyond the Wulverghem–Wytschaete road. The X. and the Guard Reserve Corps climbed the heights W. of Wulverghem and E. of Bailleul in the afternoon.

In spite of these advances at independent points the attack had, substantially, come to a standstill. The army group hoped to set it going again by a "Tannenberg" assault from the Houthoulst forest. This was to be directed against the line Merckem–Langemark, and was intended to force the British and Belgians to evacuate the northern part of the Ypres salient. But before the preparations were definitely arranged the Entente armies in the night of April 15–16 evacuated their positions from Poelkapelle to Hollebeke and retired to a position nearer Ypres. By this they gave up the whole gain of the battle in Flanders in 1917. The IV. Army immediately decided to follow up their advantage. After a short burst of fire the first-line troops advanced and, by evening, had reached the line Mangelaere–Langemark–Veldhoek. The XVIII. Reserve Corps took Wytschaete and the heights N.W. of Wulverghem; the Guard Reserve Corps in conjunction with the VI. Army's right wing took Bailleul; and the III. Bavarian Corps—which had replaced the II. Bavarian Corps—took Meteren.

Here the battle of Armentières ended. The IV. Army encountered strong British-Belgian resistance at the Steen brook and gave up the projected attack there as hopeless. On the following day a German division was even forced backwards a little by a Belgian attack coming from Merckem. The attack, prepared some days before, by the left wing of the VI. Army (the IV. Army Corps and IX. Reserve Corps) against Bernenchon–Hinges and Festubert–Givenchy had no success.

Everywhere the strengthening of the resistance on the British front was evident, French divisions and batteries having been brought up here in daily increasing numbers. Only an organized attack, necessitating a great employment of force, would have been capable of overthrowing them. The German Higher Command had no intention of attempting this, for in default of any surprise the conduct of the attack, if resumed, would necessarily have approximated to battles of material, favourable in their nature to the other side, and only capable in any case of minor results. The army group, therefore, made a proposal on April 18 which was sanctioned by the Army Command on the 20th, that the Georgette attack should be abandoned. Only Mt. Kemmel, and, by order of the Higher Command, the much-fought-over villages of Festubert and Givenchy, were still to be taken—in particular Mt. Kemmel, the possession of which was necessary to safeguard the situation of the inner wings of the two armies. But even so the battle of Armentières had meant an important success for German arms; 22,000 prisoners, 400 guns, thousands of machine-guns and a mountain of stores fell into the hands of the Germans. A considerable portion of the British army and the whole Portuguese auxiliary corps would for a certain period be unfit for fighting. Strong French forces had been removed from their own front to assist the British, and any possible plans the French Higher Command had formed for an offensive must have been hindered. The creation of a new salient was balanced by a shortening of the German lines opposite Ypres. The captured heights, in particular those around Wytschaete which commanded the whole of the Ypres depression, formed the given point from which new attacks could be undertaken, especially in case Mt. Kemmel should still be captured. The fact that it was possible to take the Béthune mines and the railway lines of Hazebrouck and Poperinghe under artillery fire added considerably to the difficulties of the enemy.

Mt. Kemmel, the eastern spur of the Bailleul heights, commands a wide view over the plain of Flanders to the S., E., and N., and provides an unrivalled observation point for those in possession. Any troops lying in the low plain beneath it must be prepared for intensive artillery action, and when, as in case of the VI. Army, their flank and rear were exposed to the artillery observers on the hill, the position was intolerable. The German Higher Command entrusted the attack on Mt. Kemmel to the XVIII. and X. Reserve Corps. April 25 was fixed as the date of attack. By that time some fresh forces at least could be placed in readiness. To make the attack easier the X. Reserve Corps took the Vlengelhoek heights N. E. of Bailleul and held them against sharp counter-attacks. On April 25 the attack troops were to reach the line from St. Eloi–Groote Vierstraat (1 km. N. of the village of Kemmel and the hill) to the village of Dranouter. The attack began at 3:30 A.M. with a particularly powerful gas attack. At about 6 A.M. this was followed by a bombardment, and this in turn by the assault at 6:45. Simultaneously battleplanes and bombing squadrons broke loose against the enemy positions and the communication centres. The attack, well prepared by the gas, was a complete success. The XVIII. Reserve Corps took Kemmel village and, later on, St. Eloi. The Alpine Corps stormed the hill and pushed forward its most advanced sections to the so-called Scheipenberg. The left wing of the X. Reserve Corps reached Dranouter and gained ground N. of Vlengelhoek. The objective of the attack had, accordingly, not only been reached but in part exceeded, although the German plans, as was subsequently discovered, were known to the enemy, and the element of surprise was consequently lacking. In consideration of this rapid success the attack was to be resumed on the 26th after renewed artillery preparation. The Entente, however, forestalled this attack by a counter-attack on a large scale, which came to grief. Mt. Kemmel remained in German hands on that day and for nine days after. Other detachments coming on behind took possession of Lokeren.

By April 27 the results of the Mt. Kemmel victory were evident. The British again gave up a wide strip of ground to the E. and S.E. of Ypres.

An additional result was the capture by the Germans of 7,100 prisoners, 53 guns and 233 machine-guns. As a point of issue for a renewed offensive in the future Mt. Kemmel was also of the first importance. For the time being the offensive in Flanders had reached its close with the victory of April 25–26.

(W. M.-Lo.)

LYTTELTON, ALFRED (1857–1913), English politician, was the youngest child and eighth son of the 4th Lord Lyttelton, a brilliant scholar who had been senior classic at Cambridge. His mother, daughter of Sir Stephen Glynne and sister of Mrs. W. E. Gladstone, died six months after his birth. All the eight boys were brought up to be keen cricketers, the cricket-ground at Hagley, Worcs., their home, being close to the house; all went to Eton, and six were in the Eton eleven. Many of them distinguished themselves in after life. The eldest, VISCOUNT COBHAM (1842–), became a land commissioner and a railway commissioner; GENERAL SIR NEVILLE LYTTELTON, G.C.B. (1845–), an experienced soldier and governor of Chelsea hospital; SPENCER LYTTELTON, C.B. (1847–1913), three times private secretary to Gladstone when Prime Minister; the RIGHT REV. ARTHUR LYTTELTON, D.D. (1852–1903), Bishop of Southampton; and the REV. EDWARD LYTTELTON, D.D. (1854–), headmaster, first of Haileybury and then of Eton. Alfred, the youngest, was the most famous cricketer of them all. Indeed, for nearly all ball games he had an extraordinary aptitude. He excelled in football of three kinds, and in fives, racquets, and especially tennis—holding the amateur championship for tennis from 1882 to 1896. Golf he did not take up till comparatively late in life; and, though he became keen on the game, he never attained more than a moderate proficiency. At cricket he was equally good as a bat and as a wicket-keeper. He was four years, 1872–5, in the Eton eleven, and captain the last year; four years, 1876–9, in the Cambridge eleven, and captain the last year. Moreover, he played for England against Australia, and for Gentlemen against Players; and for some years was a notable member of the Middlesex eleven. The infectious joyousness of his nature, his sterling character, his solid, if not brilliant, intellect, and his prowess at games gave him an undisputed lead among his contemporaries. He was king of the place before he left Eton; and when he went up to Trinity, Cambridge, in 1875 he gained a similar ascendancy. Perhaps his popularity and many-sidedness militated against his academical success; at any rate he only obtained, to his chagrin, a second class in the History Tripos. He chose the law as his profession, and was called to the bar in 1881. Here his reputation stood him in good stead, and he soon obtained a considerable practice both in London and on the Oxford circuit. In 1883 he was invited to assist in chambers the then Attorney-General, Sir Henry James, and from this time his success was assured. He was appointed recorder of Hereford in 1893 and of Oxford in 1894, and in due course took silk. His first wife was the brilliant Laura Tennant, sister of Mrs. Asquith; but she died in 1886, a year after the marriage, and her little boy lived only a couple of years. He married again in 1892 Edith Sophy, daughter of Archibald Balfour, who, with a son and daughter, survived him. By family tradition and an idealistic outlook a Liberal, Alfred Lyttelton had always taken a great interest in politics; and he formed one of the party at Dalmeny, when his uncle Gladstone carried his Midlothian campaign to a successful issue in the general election of 1880. But the Home Rule departure filled him with misgivings, and he declined the offer of a safe Liberal seat in 1891. Nevertheless, so long as Gladstone was in active politics he felt he could not publicly join a party in opposition to an uncle whom he revered. After the great man's retirement he entered Parliament as a Liberal Unionist at a by-election in 1895 for Warwick and Leamington—a seat which he held till the Unionist downfall in 1906, returning, however, to the House a few months after the general election as member for St. George's, Hanover Square. It gave him great satisfaction to serve his apprenticeship to politics under the leadership of Mr. Arthur Balfour, to whom he was personally much attached. He did not at first speak very often, though he showed an active interest both in legal questions and in Chamberlain's schemes of social betterment and imperial unity. The Boer War afforded him an opportunity to show his capacity. He was appointed in 1900 chairman of a commission to inquire into the various concessions which President Kruger and the Rand had granted to companies and private individuals in the Transvaal, and to report which should be maintained and which annulled. In pursuance of the investigation he spent the autumn of 1900 in S. Africa, and he so impressed Lord Milner by his qualities that the High Commissioner hoped to secure him as his successor. It was, however, destined that his S. African experience should be utilized in another way. When Chamberlain resigned in 1903 in order to carry on his Tariff Reform campaign unhampered by office, Lyttelton was selected by Mr. Balfour, after Lord Milner's refusal, for the vacant secretaryship for the Colonies. His tenure of office lasted two years, and was marked by the drafting of a temporary constitution which should give representative institutions to the Transvaal until such time as it should be safe to concede responsible government. This constitution was never put in force, as Sir Henry Campbell-Bannerman's Ministry determined that they would risk the grant of responsible government at once. He incurred much ill-informed odium by sanctioning the scheme of importing Chinese coolies into Johannesburg, in order to remedy the shortness of native labour and to restart the mines, and thereby the whole economic machinery of S. Africa.

After the change of government the last years of his life were spent in taking his due share in the vigorous opposition which the Unionists offered to the Liberal Education bills. the budget of 1909, the Parliament bill, the Home Rule bill, and the Welsh Disestablishment bill. Of this last bill he was one of the protagonists. A man of deep religious feeling and an earnest churchman, he strongly resented a measure which was calculated, to his mind, greatly to injure the cause of religion in Wales. He was also, though he deplored the conduct of the militants, a decided supporter of woman suffrage; and he took an active interest in, and lent a helping hand to, many social movements, the Working Men's College, Toynbee Hall, the Hampstead Garden Suburb, Children's Country Holidays, the Shakespeare National Memorial, as well as to a number of miscellaneous church societies. His death came very unexpectedly, after an injury in a local cricket match. An enormous attendance at the funeral service at St. Margaret's testified to the warm place he held in the hearts of people of all classes. Mr. Asquith, then Prime Minister, spoke of him in the House of Commons as having come nearest, of all men of his generation, to that ideal of manhood to which every English father would wish to see his son aspire.

See Edith Lyttelton, *Alfred Lyttelton* (London, 1917).

(G. E. B.)

McADOO, WILLIAM GIBBS (1863–), American public official, was born near Marietta, Ga., Oct. 31 1863. He entered the university of Tennessee but did not finish his course. In 1882 he became a clerk in the U.S. Circuit Court of Chattanooga, read law, and three years later was admitted to the bar. He at once began practice in Chattanooga but in 1892 removed to New York City. There he became interested in the problem of passenger transportation. As early as 1874 a tunnel under the Hudson river from Hoboken to New York had been started but abandoned because of seemingly insuperable difficulties of construction. In 1902 he formed a company which took over the abandoned tunnel and in March 1904 this tunnel was completed. Later the system was extended to connect with the Erie and Pennsylvania terminals in Jersey City, and in 1909 the tunnel under the Hudson river to downtown New York was finished. In 1912 he was vice-chairman of the Democratic National Committee and during most of the campaign was acting chairman because of the illness of Chairman McCombs. He was a strong supporter of Woodrow Wilson for president; and on the latter's election he was appointed, in 1913, Secretary of the Treasury. In this position he contributed largely to the working-out of the new Federal Reserve Banks system. He was chairman of the committee which divided the country into 12 Federal Reserve districts and selected the centres for the 12 banks; and was likewise chairman of the Federal Reserve Board which had supervision over the system inaugurated in Nov. 1914. He was also chairman *ex officio* of the Federal Farm Loan Board. In 1915 he brought about the meeting of the Pan-American Financial Congress in Washington and the organization of the International High Commission, of which he was chairman, for improving trade relations of the United States with Central and S. America. At the outbreak of the World War in Europe he favoured strict neutrality. After America's entrance into the war he was called upon to raise unprecedented sums of money. He was successful in floating four Liberty Loans between May 1917 and Oct. 1918, amounting in all to more than $16,000,000,000. He also secured the creation of a Bureau of War Risk Insurance for shipping, later extended to include life insurance for soldiers and sailors in the World War. He was the first Secretary of the Treasury to require national banks to pay interest on all Government deposits. When the railways were taken over by the Federal Government in 1917 he was appointed director-general. He favoured the League of Nations and woman suffrage, and likewise the prohibition amendment. He resigned the secretaryship of the Treasury in Dec. 1918 and the directorship of railways the following January. He then resumed the practice of law in New York City. In 1885 he was married to Miss Sarah Fleming of Chattanooga, who died in 1912. In 1914 he married Miss Eleanor Wilson, a daughter of the President.

MACARTHUR, MARY (1880–1921), British labour organizer, was born at Ayr Aug. 13 1880, her father being the proprietor of a drapery establishment. She was educated in Glasgow, and afterwards studied for some time in Germany. About 1901 she became interested in the Shop Assistants' Union, and her interest in this union led to her work for the improvement of women's labour conditions. She was active in furthering various strikes of women against insufficient wages, and her work for the sweated women chain-makers of Cradley Heath made her name very well known. To her the foundation of the Women's Trade Union League was chiefly due, and she was a prominent member of the National Anti-Sweating League. One of her main objects was the establishment of a minimum wage for women, and it was largely through her efforts that this principle was carried out in the Trade Boards Act of 1909. She herself became a member of the chain-making trade board. She was secretary to the Women's Trade Union League and to the National Federation of Women Workers, and was a member of the National Insurance advisory committee, while on the formation of the Central Committee on Women's Employment (1914) she became its hon. secretary. Miss Macarthur married in 1911 William C. Anderson (d. 1919), chairman of the executive committee of the Labour party, who was from 1914 to 1918 member for the Attercliffe division of Sheffield. She died at Golders Green Jan. 1 1921.

MACBETH, ROBERT WALKER (1848–1910), British painter, was born at Glasgow Sept. 30 1848. He studied art in the schools of the Royal Scottish Academy, and in 1871 came to London, where he was for some time on the staff of the *Graphic*. In 1874 he became an associate of the Royal Water Colour Society. Both as painter and as etcher he was very popular. He died at Golders Green Nov. 1 1910. Among his best-known works are "Dunster Castle" (1895), "The End of a Good Day" (1897) and "Naval Manœuvres" (1899).

McBRIDE, SIR RICHARD (1870–1917), Canadian statesman, was born at New Westminster, B.C., Dec. 15 1870 and was educated first in that city and later at Dalhousie University, Halifax, N.S. He was called to the Canadian bar in 1892, and entered the British Columbian Parliament as member for Dewdney in 1898. In 1900 he became Minister of Mines and in 1902 leader of the Opposition. In June 1903 he was returned to office as Prime Minister for the province and retained that position until 1916, when he became Agent-General for his province in London. His most notable achievement was an active railway policy fully endorsed by the electorate in Dec. 1909. He was created K.C.M.G. in 1912 and died in London Aug. 6 1917.

M'CARTHY, JUSTIN (1830–1912), Irish politician and writer (*see* 17.200*), died at Folkestone April 24 1912.

MACCOLL, DUGALD SUTHERLAND (1859–), British art critic, was born at Glasgow in 1859. He was educated at Glasgow and later at University College, London, and Lincoln College, Oxford, where he won the Newdigate prize. He studied art at the Westminster school of art and the Slade school. He became art critic of the *Spectator* and also of the *Saturday Review*, later becoming editor of the *Architectural Review*. In 1906 he was appointed keeper of the National Gallery of British Art, and in 1911 keeper of the Wallace Collection. In 1917 he became a trustee of the National Gallery of British Art. He was prominent in the foundation of the National Art Collections Fund and the Contemporary Art Society. His published works include *Greek Vase Paintings* (1894); *Nineteenth Century Art* (1902); *The Administration of the Chantrey Bequest* (1904); and *Rhythm in English Verse, Prose and Speech* (1914).

McCORMICK, VANCE CRISWELL (1872–), American politician, was born at Harrisburg, Pa., June 19 1872. He was educated at Yale (Ph.B. 1893). In 1900 he became a member of the city council of Harrisburg, and from 1902 to 1905 was mayor. In 1914 he was an unsuccessful candidate for governor of Pennsylvania. He was active in promoting President Wilson's reëlection in 1916 and was that year chairman of the National Democratic Campaign Committee. From 1917 to 1919 he was chairman of the War Trade Board which supervised exports to neutral countries, after the entry of America into the World War. Soon after his appointment he visited England and France on a war mission. In Dec. 1918 he was invited to join President Wilson in Paris as adviser, and was a member of the American Commission to Negotiate Peace the following year. In Feb. 1919 he was appointed a member of the Supreme Allied Blockade Council and the Economic Council. Before his appointment as chairman of the National Democratic Committee in 1916 he was a director of the Federal Reserve Board.

MACCUNN, HAMISH (1868–1916), Scottish composer (*see* 17.209), died in London Aug. 2 1916.

MACDONALD, JAMES RAMSAY (1866–), British politician, was born at Lossiemouth, and educated at a board school. He early threw himself into the Socialist movement, and became before long, as organizer and writer, an important personality

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** These figures indicate the volume and page number of the previous article.*

in it. He was appointed secretary of the Labour party in 1900 and held the position for 11 years; and editor of the "Socialist Library" in 1905. He naturally turned to public life, and served on the London County Council from 1901 to 1904.

In 1906 he was elected to Parliament as Labour member for Leicester, and held the seat for a dozen years. It was as chairman of the Independent Labour party—the section led by Mr. Keir Hardie—that he entered the House of Commons; and he explained at the congress of the party in April 1907 that its object was to mould society into the socialist State. He adapted himself early to parliamentary conditions. One of the points which he constantly pressed, with eventual success, was that the terms of Government employment should be as good as those offered by the best private firms. In the controversy with the House of Lords he openly proclaimed himself a Single-Chamber man. On the National Insurance bill in 1911 he pointed out that a fundamental change of opinion had taken place, both parties now accepting the principle that social welfare was the care of the State. In that year he became the chairman of the Labour party in Parliament. He brought the whole weight of his party to bear in favour, first of the Parliament bill, and afterwards of the Home Rule bill. But he was suspicious of Sir Edward Grey's foreign policy, which he thought too slavish in its following of Lord Lansdowne; and he opposed the naval increases of the years before the World War, as the socialists in Berlin had opposed the German increases which provoked British rejoinders.

His devotion, indeed, to the ideal of international socialism caused him, at the outbreak of the World War, to lose touch not only with British public feeling in general, but even with the sentiment of the Labour party which he led. In response to Sir Edward Grey's statement in the House of Commons on Aug. 3 1914, he contended that no proof had been given that the country was in danger; that the conflict could not be confined to the neutrality of Belgium; that the action of Russia was suspicious; that France could not be annihilated; and that, in consequence, Great Britain should remain neutral. He found, however, that the bulk of the Labour party were convinced by the words of Sir Edward Grey and by the action of Germany; and he resigned the leadership of his party, being succeeded by Mr. Arthur Henderson. He remained a pacifist throughout the war, and used his influence in this direction in the labour and socialist movement, but he seldom spoke in Parliament, though he associated himself with the occasional anti-war demonstrations of Mr. Snowden and Mr. Arthur Ponsonby, and claimed the right of public meeting and free speech for pacifists. He endeavoured unsuccessfully to prevent the Labour Conference in Jan. 1916, at the time of the first Military Service bill, from pledging themselves to support the Government in the prosecution of the war; but he declared at the same time, to the general surprise, that he and his friends were the most bitterly anti-German section of the people. He was active in the summer of 1917 in promoting the participation of representatives of the English Labour and Socialist parties in an International Socialist Conference at Stockholm, to which German representatives were coming, and he went to Paris with Mr. Arthur Henderson on a fruitless mission to secure the coöperation of French and Belgian socialists. He himself did not get to Stockholm, as the Sailors' and Firemen's Union, whose distrust of Germany was based on practical knowledge of her crimes at sea, refused to permit him to sail. His record as a pacifist cost him his seat at Leicester at the general election of Dec. 1918; he received only 6,347 votes to the 20,570 polled for his opponent, Mr. J. F. Green, a leading member of the National Democratic party.

Mr. Macdonald published several works on socialism and labour, besides a couple of books on India, which he visited in 1913 as a member of the Public Services Commission. He also wrote a memoir of his wife, Margaret Ethel, daughter of the eminent chemist, Dr. J. H. Gladstone, a woman of much character and ability, who died in 1911, leaving two sons and three daughters.

MACDONALD, SIR JOHN HAY ATHOLE (1836–1919), British lawyer and judge, was born at Edinburgh Dec. 27 1836. He was educated at Edinburgh and at Basel University, was called to the Scottish bar in 1859, and rapidly made his name as an advocate. From 1874 to 1876 he was sheriff for the counties of Ross, Cromarty and Sutherland, and from 1876 to 1880 solicitor-general for Scotland. In 1880 he became a Q.C. and sheriff of Perth, and from 1882 to 1885 was dean of the Faculty of Advocates. In 1885 he successfully contested Edinburgh and St. Andrew's universities in the Conservative interest, and was appointed lord-advocate by Lord Salisbury's Government, resuming this office when the Conservatives returned to power in 1886. In 1888 he became lord justice clerk of Scotland and president of the second division of the Court of Session, with the courtesy title of Lord Kingsburgh, retiring in 1915. He was made K.C.B. in 1900 and G.C.B. in 1916. He died at Edinburgh May 9 1919. Macdonald was all his life a strong supporter of the volunteer movement, for which he did much valuable work. He published various books on the subject, the most important being *Fifty Years of It* (1909).

MACDONELL, SIR JOHN (1846–1921), British jurist, was born at Brechin, Forfarshire, Aug. 11 1846, and was educated at the universities of Aberdeen and Edinburgh. He was called to the bar at the Middle Temple in 1873 and for some years was counsel to the Board of Trade and the London Chamber of Commerce. In 1889 he was made a Master of the Supreme Court and in 1912 was appointed King's Remembrancer. His knowledge of the science of law, both ancient and modern, was wide and exhaustive. He was Quain professor of comparative law in the university of London (1901), president of the Society of Public Teachers of Law (1912–3), a member of several royal commissions and editor for many years of the *Journal of Comparative Legislation and International Law.* In 1913 he was elected a fellow of the British Academy and in 1914 was created K.C.B. Besides editing the *State Trials* (1887), *The Civil Judicial Statistics* (from 1894), the *Criminal Judicial Statistics* (from 1900) and *Smith's Mercantile Law*, he published works on the subject of capture at sea and the law of master and servant, and was the author of many papers on questions of international law. He was also for 40 years an influential leader-writer for *The Times.* He died in London March 17 1921.

MACH, ERNST (1838–1916), Austrian physicist and psychologist (*see* 17.232), died in 1916.

MACHINE-GUN (*see* 17.237).—Prior to 1910 the standard machine-guns of all nations were comparatively heavy and unwieldy. The principal types in use were the Maxim and the Hotchkiss, each of which weighed about 75 lb.; and, as they were mounted on tripods of about the same weight, the combined weight of the gun and tripod was approximately 150 pounds. The bulky nature of these machine-guns was a serious handicap to their usefulness, and the efforts of the inventors and designers reflected a universal desire for a lighter automatic weapon.

The Benét-Mercié.—The desire for a lighter gun was met in France by the production of a portable automatic weapon designed by the Hotchkiss Company. This gun, which is known in Europe as the Portable Hotchkiss, and in America as the Benét-Mercié, weighs less than 30 lb. complete. It has no tripod but is supported at the muzzle by a pair of light folding legs and at the breech by an adjustable rest which telescopes into the butt-stock. By means of these attachments the rifle is rested at the proper height for firing from the prone position. The gun resembles the heavy Hotchkiss in mechanism, and, like it, is air-cooled and fed by metallic feed strips or charger bands holding 30 shots each. Following the developments of the World War, this weapon would be classed, not as a machine-gun, but as a machine-rifle, a type which has its own sphere of usefulness, but which cannot fulfil the rôle of the machine-gun in modern tactics.

However, at the time when this weapon was first introduced, the art of machine-gun design and manufacture had not advanced to the point where the production of a diversity of different types forced a tactical division of automatic weapons according to weight and fire capacity. Consequently, the gun entered tests as the competitor of heavy-type machine-guns. After extensive trials it was adopted by the United States in 1909 as the service machine-gun, succeeding the Maxim, which had been adopted in 1904. The several hundred Maxims on hand were, however, continued in service. After its adoption by the United States the Portable Hotchkiss was tried in Great Britain, and a number were purchased for cavalry use. The British also used this gun with great success for the arming of tanks during the World War.

The Vickers Machine-Gun.—A more conservative effort toward the reduction of weight resulted in the production of the Vickers light machine-gun (afterwards called the Vickers machine-gun) by Vickers, Ltd., in 1910. The mechanism of this gun is essentially the same as that of the Maxim, formerly produced by the same company, but the gun is considerably smaller, and the weight has been reduced by one-half. This reduction in size and weight was accomplished without sacrifice, for the Vickers is superior to the old Maxim not only in portability and ease of concealment but also in durability and reliability, while its volume of fire and steadiness of mounting are the same. The weight of the gun is 38 lb., and that of the tripod is 35 pounds. The gun has a corrugated steel water-jacket holding 7½ pt., and is fed from a belt holding 250 rounds of ammunition. The Vickers gun became the standard of the British army, and, after a series of trials, it was adopted by the United States in 1915 to supersede the Benèt-Mercié as the service gun. It was also adopted by the Russians. During the World War the bulk of the machine-guns in the British army were of the Vickers type, and many thousands of Vickers guns were used by the American troops.

The Lewis Gun.—The outbreak of the war in 1914 forced upon Great Britain the necessity of rapidly supplementing the small stock of machine-guns then on hand. In this emergency a portable air-cooled machine-rifle, invented by Col. I. N. Lewis, a retired officer of the U.S. army, was adopted and manufactured in quantity. In size and weight the Lewis gun resembles the Benèt-Mercié and, like it, is gas-operated; but it differs in the methods of feeding and cooling. The cartridges are fed to the gun in flat disc-shaped magazines, each holding 47 rounds. The characteristic method of cooling employed on this gun is known as the positive air-cooling system. There is an aluminium radiator surrounding the barrel, and encased in a sheet-metal jacket which extends beyond the muzzle of the gun and is open at both ends. During the firing of the piece, the blast of gases from the muzzle induces a draft of air through the radiator casing. This rapidly moving column of air passes over fins on the aluminium radiator and cools the gun almost as effectively as a water-jacket would. As the war progressed, the Lewis guns became extremely popular, and were used in a very effective manner. Owing to their portability and the absence of such encumbrances as tripods and water-supply, it became possible to use them for direct fire in the most advanced positions. However, it was soon recognized that their limited fire capacity and lack of a steady mount rendered them unsuitable for overhead supporting fire, indirect fire, and barrage work, all of which functions were fulfilled admirably by the Vickers guns from positions farther in the rear.

American Controversy.—In 1916 the United States, which had become involved in a threatening situation on the Mexican border, experienced a shortage of machine-guns. None of the Vickers guns under manufacture had been delivered, so, in order to meet the immediate need for guns on the border, several hundred Lewis guns, chambered for the British cartridge, were purchased, together with a supply of ammunition. About this time Congress made an appropriation of $12,000,000 for the purchase of machine-guns. Immediately afterwards a sharp controversy arose as to the relative merits of the Lewis machine-gun and of the service automatic weapons (Benèt-Mercié and Vickers). To settle this controversy the Secretary of War appointed a board, consisting partly of army and navy officials of high rank and partly of civilians, to go deeply into the subject of the proper machine-gun policy. After extended sittings this board rendered a report which for the first time in the United States called attention to a fact which the machine-gun tactics developed in the British army during two years of war should have rendered plainly apparent long before. This was the fact that the heavy machine-gun and the light machine-gun or machine-rifle (Lewis gun) were not interchangeable in function, and that a certain proportion of each type should be supplied. The board defined the two types under consideration as (1) *heavy type*, relatively heavy, with substantive tripod mount, effectively cooled for continuous fire, fed from a belt; and (2) *light type*, comparatively light weight, highly portable, without tripod mount, air-cooled, fed from a magazine. The board recommended that the relative proportion of these weapons to be purchased should be two of the light type to one of the heavy. It also reported that the Vickers machine-gun "fulfilled to a high degree the requirements of the service for a machine-rifle of the heavy type. The board is not able at this time to recommend a machine-rifle that will fulfil the requirements of the military for a machine-rifle of the light type." The board recommended the immediate purchase of 4,600 Vickers machine-guns, and made recommendations for a test to be held in May 1917. A notice was published giving the date of the proposed test and inviting manufacturers and inventors to submit weapons for trial. Just before the date set for the test the United States declared war on Germany, and, as a result, emergency orders were placed for a large quantity of Lewis guns, and for several thousand Colt guns made by the Marlin-Rockwell Co. who were building these guns in large quantities for Russia. In May 1917 the Machine-Gun Board held the official test that had been advertised some months before. The Vickers and Lewis guns proved efficient, but the most marked superiority was shown by a new gun introduced by Mr. John M. Browning, the inventor of the Colt machine-gun and of many rifles and automatic pistols. The standard endurance test was the firing of 20,000 rounds. Mr. Browning fired this test without stopping to clean his gun, and with so little trouble that he was ordered to continue firing until some trouble developed. The gun fired over 39,000 rounds before the first breakage occurred. In order to verify this phenomenal performance, the inventor was required to fire a duplicate gun, which completed the 20,000-round test in 48 minutes and 12 seconds with only three stoppages, all of which were due to defective ammunition. In size, weight, and general appearance the Browning gun resembles the Vickers, but it has an entirely different mechanism. An examination of the mechanical construction of this gun revealed a remarkable simplicity from a manufacturing point of view. This gun showed such promise that, before proceeding with the trials of the remaining weapons before it, the Board rendered a preliminary report recommending that the manufacture of the Browning gun in quantities be undertaken at once. The recommendations of the Board were followed, and several large arms factories were started on the task of producing the new gun in the shortest possible time. Thanks to the simplicity of the design, the manufacturers who were entrusted with the task of producing Browning guns were enabled to turn out enormous quantities of them during the war.

The Browning Automatic Rifle.—After the test of his heavy machine-gun Mr. Browning submitted a weapon weighing only 15 lb., but at the same time capable of automatic fire from detachable magazines holding either 20 or 40 rounds. This rifle passed a highly successful test and was ordered adopted. It was at once recognized that this was a new and distinct type of gun, as its fire-power was nearly equal to that of the machine-rifle type (Lewis and Benèt-Mercié), while its weight was but little more than half as great, a fact which enabled it to be fired from the shoulder or hip with ease. The success of this weapon led to the immediate elimination of the intermediate type from the armament of the ground forces of the United States, and the assignment of the Lewis guns to the air service, to be stripped and mounted on aeroplanes as flexible guns.

As a result of the introduction of the light Browning machine-rifle, as it was at first called, and of the Chauchat, a gun somewhat similar in general type introduced by the French, it became desirable to adopt terms to define more clearly the different classes of automatic weapons. In order to accomplish this purpose, an order was issued by the War Department assigning to the heavy type of automatic weapon the designation "machine-gun"; to the intermediate type (Lewis, Benèt-Mercié), the designation "machine-rifle"; and to the light type (Browning, etc.), the term "automatic rifle." The term "semi-automatic rifle" was assigned to self-loading weapons weighing 10 lb. or less, designed to take the place of the magazine-rifle. During the remainder of this article the terminology given will be adhered to, and as the lighter weapons are separately described in the article on RIFLES AND LIGHT MACHINE-GUNS—the machine-gun only will be considered here.

Aircraft Machine-Gun.—Early in the World War, the application of machine-guns to aircraft began by the improvised mounting of the regular ground-type guns on aeroplanes. Soon, however, the increasing use of machine-guns in aerial warfare developed two standard systems of mounting guns in aircraft. According to the method of mounting them, aircraft guns are either "flexible" or "fixed." In flexible mountings the guns are pivoted so that they may be freely swung or pointed in any direction by the gunner. Flexible guns are usually mounted in the rear cockpit, but in some large bombing airplanes they have been mounted in the nose, or in the fuselage to shoot through a shutter in the bottom. The standard flexible gun in the Allied services was the Lewis, which, for aircraft use, was stripped of the cooling system and was fitted with magazines of extra capacity holding 97 shots. These guns were frequently mounted in pairs, with the idea of shooting both guns at once and thus increasing the volume of fire. "Fixed" aeroplane guns are usually mounted either above or beside the engine, and are permanently pointed in one direction, which is straight ahead. Consequently, in order to aim the guns, it is necessary to turn the whole aeroplane so that it is pointing at the enemy. For this reason these guns are operated by the pilot. Because the guns fire straight ahead, it is necessary for them to shoot through the arc swept by the propeller blades. In order to avoid damage to the propeller, fixed guns are synchronized so that the shots go between the blades. This synchronization is accomplished by having the trigger of the gun operated from a cam on the engine shaft. This cam and the firing mechanism, which it operates, are so timed that the gun will be fired only when the propeller blades are in such a position that the shots will not strike them. The firing mechanism is so arranged that it is inoperative except when it is thrown into gear by a lever situated for convenient manipulation by the pilot. Synchronized guns are generally of the type fed by a belt. Those used by the Americans and the British usually employ link belts instead of woven fabric belts. The metallic links are pinned together by the cartridges themselves, and as the cartridges are pulled out of the belt in being fed through the gun the belt disintegrates into a series of separate links. This avoids the complications and dangers incident to the use in aircraft guns of fabric belts which have to be reeled up as they leave the gun in order to avoid having them trailing in the wind and perhaps flying into the pilot's face or interfering with the controls. Owing to the fact that the fleeting opportunities of aerial combat do not allow many shots to be fired at a time, aircraft guns do not suffer from overheating as ground guns do. In addition, the rush of the aeroplane through the atmosphere is very effective in cooling the guns. For this reason no cooling devices are employed in aircraft guns. In the case of the Lewis guns the radiators are removed; and when the Vickers or other water-jacketed guns are used the water-jackets are cut open to allow a free circulation of air and to reduce weight. On account of the very high speed of modern aeroplanes, the relative motion of passing machines is great enough to leave a very large interval between machine-gun bullets fired from one aeroplane at another. In order to reduce this interval and increase the chances of a hit, most aircraft machine-guns are arranged to work at a higher rate of fire than ground guns are. The Browning aircraft gun fires over 1,000 shots per minute.

Large-Calibre Machine-Guns.—The desire for an increased incendiary effect against balloons led to the adoption by the Allied armies of aircraft machine-guns of a larger calibre than that of the standard service cartridge. The first guns of this type were Vickers guns chambered for the old 11-mm. (·44 in.) French cartridge. These cartridges were loaded with a tracer bullet in which the burning of the tracer composition was sufficiently intense to give an incendiary effect on impact with a balloon. A large number of the 11-mm. Vickers guns were used, but, owing to the fact that the velocity of the cartridge was low (1,300 f. s.), a more powerful cartridge of about this calibre was considered desirable. The result was that large-calibre (·45 to ·50 in.) machine-guns, intended to give a velocity of about 2,500 f. s., were designed in both America and Great Britain during the latter stages of the World War. These designs, however, were not completed in time for any of the guns to be placed in service before the Armistice.

Tank Machine-Guns.—The introduction of the tank as a weapon of warfare was followed by the adoption of the machine-gun as part of its armament. This use of the machine-gun, like its use on aircraft, is so different from its normal employment as to call for a special type of gun or for a special adaptation of existing types. By virtue of its heavy armour protection, the tank can approach very close to hostile positions, and is consequently the target of an extreme concentration of rifle and machine-gun fire. For this reason, water-cooled machine-guns are unsuitable for the armament of tanks, because the water-jacket, which must necessarily project out through the armour, would soon be riddled. For the same reason it is desirable to have for a tank machine-gun a weapon with a barrel heavy enough to withstand rifle fire. For this purpose the French used the Hotchkiss, and the British used the portable Hotchkiss, or Benèt-Mercié, which was admirably suited for this use. The first tanks built in America were armed with the Marlin tank-gun, which was the Marlin aircraft-gun with an aluminium radiator added. Later a special Browning-type gun was designed for use in tanks. This weapon, which is called the Browning tank-gun, is similar in its mechanism to the Browning machine-gun, with the difference that the water-jacket is omitted and the barrel is made very heavy, and is only 18 in. long instead of 24. There is a special latch provided on this gun to hold the mechanism open when the gun is not firing, and thus prevent the heat of the barrel from exploding the cartridge.

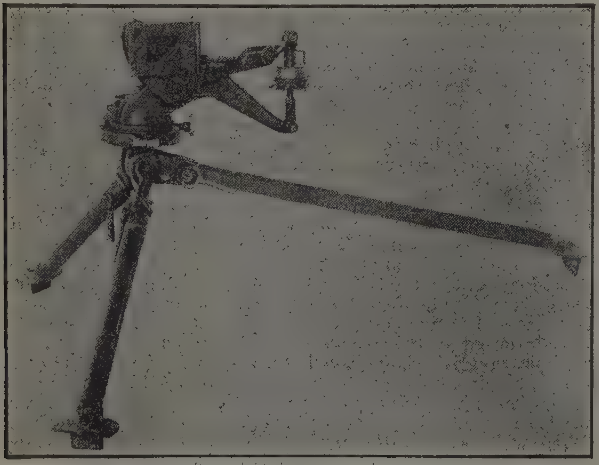

FIG. 1.—U.S. Army Tripod.

Machine-Gun Mountings.—The universal method of firing ground-type machine-guns is from a tripod, which allows the gun either to be controlled for elevation by means of handwheels and clamps or to be swung free. The British Mark IV. tripod is an excellent example (*see* 17.246). This very simple and rugged device remained standard in the British army during the World War, and was used extensively by the American army. The three legs are each adjustable by means of clamps which allow their relative positions to be changed to compensate for inequalities of the ground, or to alter the height of the gun. Changes in elevation are obtained by means of an elevating screw and hand-wheel. There is a friction clamp for deflection. Small changes in azimuth are obtained by setting up the deflection clamp lightly, and then "tapping" the gun with the hand on one side or the other until the proper direction is obtained. It will be noted that by throwing off the deflection clamp this gun can be swung freely from side to side, which is important in meeting a rush at close quarters, but there is no hand-wheel or other device for setting off a given deflection from a known direction, which is often very desirable in indirect fire. It will also be noted that there is no satisfactory way of allowing the gun to be swung freely in elevation, which is important in shooting at aircraft. When this becomes necessary, the elevation pin must be pulled out, and the gun must be reversed in its cradle. These disadvantages have been overcome, though at the expense of a considerable amount of mechanical complication, in the U.S. army tripods, models of 1917 and of 1918 (*see* fig. 1), which have a slow-motion hand-wheel and index, and a throw-off for both elevation and deflection. These devices allow the gunner to make adjustments of known amounts in indirect fire, or to swing the gun freely in any direction when this becomes desirable. The French tripods have a hand-wheel for elevating, and a clamp for traversing. The elevating screw is attached to the gun by a snap-catch which can be quickly released to allow free elevation. Stops, which can be set to limit the traverse to any desired amount, are provided. The legs are provided with a quick adjustment to allow the use of either a high or low gun position. The Germans used tripods to some extent, but placed their main reliance on a distinctive style of mount which can best be described by referring to the illustration (fig. 2). This device provides both for mounting the gun and for transporting it. The gun is fastened into the mount by means of trunnions on the water-jacket, which fit into gimbals so that the gun may be pointed in any direction. There is a slow-motion hand-wheel for elevating the gun, and a throw-off which allows it to be swung free. The deflection is controlled by means of a friction clamp. The mount is hinged in the middle so as to be adjustable for height. When it is desired to transport the gun, the

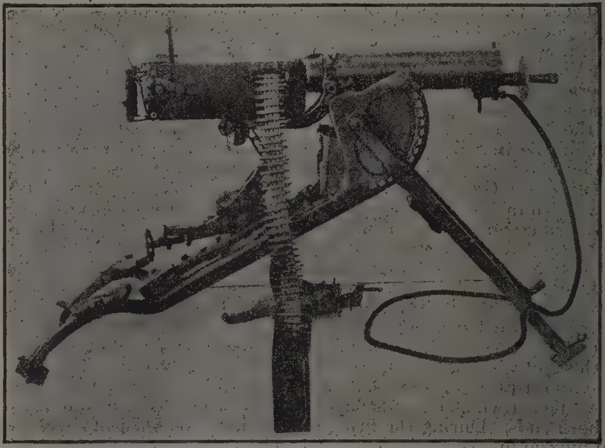

FIG. 2.—German Machine-Gun Mounting.

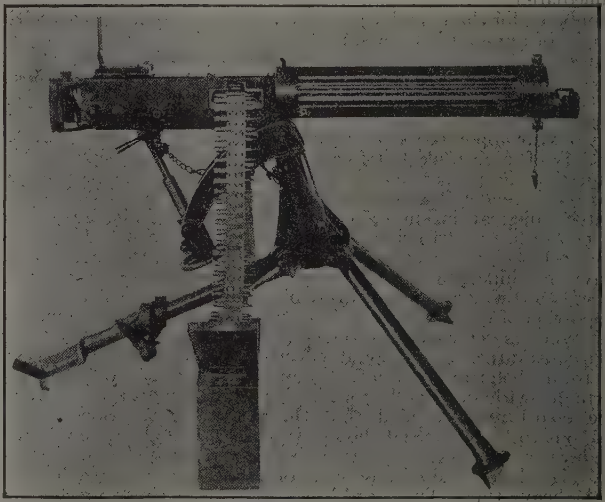

FIG. 3.—Vickers Machine-Gun.

mount is placed in its lowest position, so that it forms a litter with the front and rear legs projecting for handles; or the front legs may be hinged back to the rear, when the mount becomes a sledge which may be dragged by means of cords hooked into rings provided for this purpose.

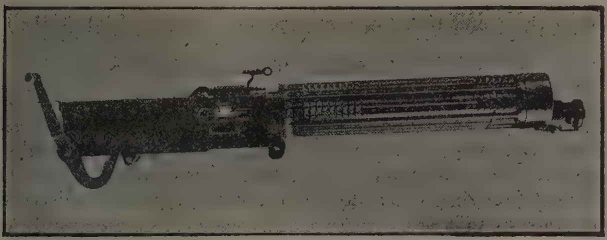

Fig. 4.—Vickers Machine-Gun.

Transportation of Machine-Guns.—The standard method of transporting machine-guns and their equipment is by means of animal-drawn transportation. For this purpose the British use limbered wagons drawn by horses. The French use small carts or *voiturettes*, which are drawn by one horse or dragged by men. Before the World War, pack outfits were the only transportation used for machine-guns by the United States. During the World War, the one-mule cart, patterned after the French design, became standard for the transportation of both machine-guns and their ammunition, though motor transportation was provided in the case of special machine-gun battalions.

The Vickers Machine-Gun.—The Vickers machine-gun is a Maxim greatly lightened, and slightly changed as to details of the mechanism. The description of the operation of the Maxim will serve equally for the Vickers. The weight of the gun is 38 lb., including $7\frac{1}{2}$ pt. of water in the jacket. The ammunition belt used is the same as for the Maxim. When the gun is used in aircraft, metallic link belts are employed.

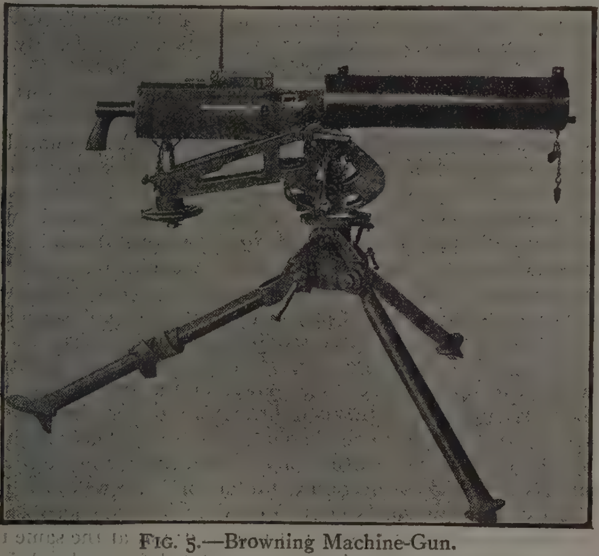

Fig. 5.—Browning Machine-Gun.

The Browning Machine-Gun.—In this gun, as in the Vickers, the actuating force is the recoil of the barrel. The principal parts in the mechanism are the barrel, which is mounted in a water-jacket and arranged to have a sliding motion; a heavy rectangular breech-block, or bolt; a strong piece screwed on to the barrel, called the barrel extension, on which the bolt slides; a vertical lock in the barrel extension, for locking the bolt against the rearward thrust of the explosion; a short curved lever, called the accelerator, for utilizing the recoiling energy of the barrel for throwing the bolt rapidly to the rear; a firing pin and trigger mechanism; a belt-feeding mechanism; and the necessary springs and small parts. The parts are enclosed in a rectangular breech casing consisting of side, top, and bottom plates riveted together, with a hinged cover and a sliding back plate. The relations of these parts in both the forward and rearward positions can be seen in the illustration. When the trigger is pulled, its forward end draws the sear downward, thus releasing the firing pin, which flies forward and primes the cartridge. The force of the explosion causes the barrel to recoil sharply to the rear, carrying with it the barrel extension and the bolt. During the backward motion, the projecting end of the breech-lock pin strikes against cams on the forward extension of the lock frame. These cams force the breech lock down, thus unlocking the bolt from the barrel extension. At this instant the rear end of the barrel extension in its backward motion comes into contact with the curved face of the accelerator. The pressure of the barrel extension on the accelerator causes it to rotate so that its point, which is in contact with a lip on the breech block, swings away from the barrel. As the accelerator rolls over, the curve on its face causes the point of contact with the barrel extension to move closer to its pivot, which is the fulcrum of its motion. This produces a rapid acceleration of the motion of the bolt, with a corresponding increase of resistance to the rearward motion of the barrel. The result is that the sharp backward motion of the barrel is checked, and its momentum is transferred to the bolt, which is thrown to the rear of the breech casing. During the backward motion of the bolt the firing pin is cocked by the cocking lever, and a live round is drawn from the belt by the extractor and forced downward into guideways in the face of the bolt by means of a cam in the cover plate which acts on the top of the extractor. After the backward motion of the bolt is completed, the driving spring pushes it forward. During the forward motion of the bolt a cam in its upper surface acts through a lever to feed the belt along so that a fresh cartridge is in place. At the same time a spring stud in the side of the extractor engages in a cam groove cut in the side plate. This cam first lowers the extractor, so as to bring the cartridge in line with the chamber. After the cartridge is partly into the chamber, the cam raises the extractor into a position to grasp the fresh cartridge that is in the feedway. Just before the bolt completes its forward motion the lip on its under side strikes the tip of the accelerator and rotates it forward. This motion of the accelerator, acting through the barrel extension, forces the barrel forward. At the end of this movement, the breech lock is carried up the inclined face of the breech-lock cam, which causes the breech lock to rise and engage in its slot in the bolt, thus locking the bolt and barrel extension together. After the locking is completed, the further motion of the bolt brings the inclined faces on the sear into engagement with the corresponding surfaces on the trigger; and if the trigger is being held down the action of these surfaces forces the sear down, releasing the firing pin and causing the cycle to be repeated. This gun, when supplied to infantry, uses woven cartridge belts holding 250 rounds each. An excellent feature of this belt is its cheapness and ease of manufacture. It consists simply of a narrow strip of cotton tape with cartridge pockets woven in it. There are no metallic components to make the belt expensive or render its manufacture difficult. A belt-filling machine is furnished for loading cartridges rapidly into the belts. The weight of the Browning machine-gun, with 7 pt. of water in the jacket, is 37 lb. The tripod weighs 45 lb. The rate of fire is about 500 rounds per minute. In the Browning aircraft machine-gun the water-jacket is replaced by a light ventilated barrel casing, and a trigger mechanism capable of being operated by a synchronizing device is substituted for the regular trigger and sear. In order to cause the gun to operate at a higher speed, the breech block is greatly lightened. The gun fires at a speed of about 1,100 shots per minute. This gun uses disintegrating belts formed of metallic links.

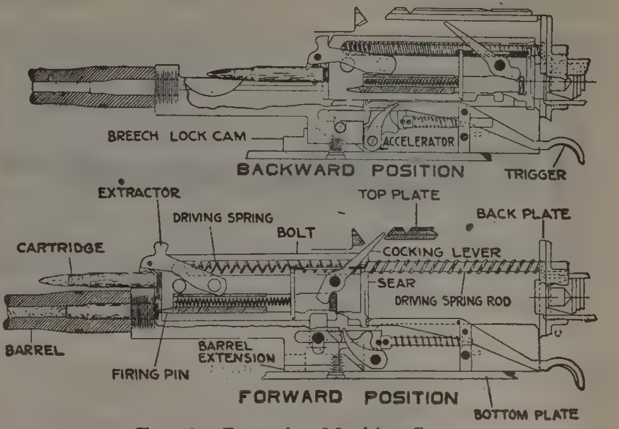

Fig. 6.—Browning Machine-Gun.

The Marlin Aircraft Machine-Gun.—This gun is a development of the Colt machine-gun (*see* 17.244). It is greatly lightened to fit it for use in the air, and a reciprocating piston operating in a gas cylinder under the barrel is substituted for the swinging gas lever used in the Colt gun. Except for minor changes, the breech action of this gun is the same as that of the Colt. A special firing mechanism and trigger motor is fitted to allow the gun to be fired through the propeller by either a mechanical or a hydraulic synchronizing gear. This gun uses the same disintegrating metallic belt as is furnished for the Browning. The gun weighs $23\frac{1}{2}$ lb., and fires at the rate of about 680 shots per minute.

The Lewis Aircraft Machine-Gun.—The mechanism of this gun is the same as that of the Lewis machine-rifle, described in the article on RIFLES AND LIGHT MACHINE-GUNS. The gun differs from the ground type in having the cooling system removed, in being supplied with a "spade grip" instead of the butt stock, and in having special air-craft sights fitted. The magazines used in the air differ from those used on the ground in holding 97 rounds instead of 47, and in being fitted with a counter showing the number of cartridges remaining. This gun is used as a flexible gun, and is mounted either singly or in pairs in the rear cockpit of two-seated aeroplanes. The mounting used for these guns, called, from the name of its inventor, the Scarff mount, allows easily controlled universal pointing of the gun.

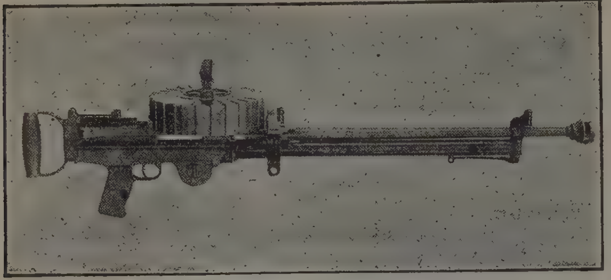

FIG. 7.—Lewis Aircraft Machine-Gun.

Theory of Machine-Gun Fire.—Machine-gun fire is usually applied in one of the following ways:—(*a*) as direct fire, (*b*) as overhead supporting fire, (*c*) as indirect fire. Machine-gun fire falls under the classification of "direct fire" when the situation is such that the objective is in plain sight and the gun is pointed directly at it by means of the sights. Overhead fire occurs when the line of friendly troops is supported by machine-guns located at positions in the rear. If either the machine-guns or the enemy targets occupy a position sufficiently elevated with reference to the friendly troops, the curve of the trajectory allows the bullets to pass over the heads of the supported troops and descend on the enemy. The height of the trajectory is sufficient at medium and long ranges to make it theoretically safe to execute overhead fire when the guns, the enemy, and the supported toops are all on the same plane; but, in order to ensure the safety of the friendly troops, fire of this nature is not usually employed unless the target occupies a position relatively higher than that of the supported troops. The established method of determining whether or not overhead fire may be safely executed is by the use of an arbitrary "safety angle" which is the minimum angle by which the line from the gun to the target must be above the line from the gun to the heads of the friendly troops. In employing this class of fire, careful control is necessary to ensure the safety of the troops being supported, and it is of prime importance to know when it is safe to begin firing over the heads of friendly troops, also when to cease firing before their advance has proceeded far enough to bring them into the danger zone. The practice in this regard varied in different armies and at different times during the World War. One British practice was to employ a safety angle of 30 min. for ranges up to 1,000 yd., and a safety angle of 60 min. (1°) for ranges from 1,000 yd. to 1,500 yd. These angles are found by holding a 24-in. string to the eye and sighting past a card upon which are three lines. The first and second are 0·21 in. apart, and the first and third are 0·42 in. apart. At 24 in. these distances correspond to 30 min. and 10 min. respectively. Another British method is as follows:—(1) set the sights for the true range and aim at the target; (2) without moving the gun, raise the sight 400 yd. and locate a point by aiming. This point is the danger point beyond which it is not safe for troops to advance while overhead fire is being executed; (3) when the friendly troops reach this point, either cease firing or elevate the guns and fire behind the enemy's lines to harass his retreat. Indirect fire is fire aimed at some object other than the one it is desired to hit. One of the simplest kinds of indirect fire is night firing. Suppose that it is desired to control by machine-gun fire at any time during the night some point, such as a crossroad, which is in plain sight during the day. The gun is laid on the objective by means of the sights. Then, without moving the gun, the sights are changed so as to bear on some small object near at hand, called an aiming mark. As long as the sights are kept pointing at this aiming mark, the gun will be pointing at its objective. For use as an aiming mark at night, a special apparatus is furnished, consisting of a metallic box with an electric battery and a small light. This is called the night-firing box. It has several holes in one side through which the light can shine to form aiming marks. In use, it is set up a short distance in front of the gun, in such a position that the lighted spots can be seen only from the gun position. The spots of light on the box are a measured distance apart, so that known changes in deflection can be obtained by shifting the aim from one spot to the next. Another case in which indirect fire must be used is when the target is not visible from the gun position. In this case the gun must be laid entirely by calculation. Before this can be done, the following data must be obtained:—(*a*) the angle of elevation, which can be determined only when the range, or horizontal distance to the target, and the difference in height between the gun and the target are both known. When these factors are known, the angle of departure corresponding to the given range is determined from a range table, and then the angle of elevation is obtained from it by adding or subtracting the angle of site, which is the vertical angle between the horizontal plane and the line from the gun to the target; (*b*) the azimuth, or horizontal direction of the target from the gun position. (J. S. HA.)

EVOLUTION OF MACHINE-GUN TACTICS

Before the outbreak of war in 1914, the British army authorities, with the exception of a small body of officers who possessed expert knowledge of the weapon, had devoted little thought or study to the development of machine-guns or machine-gun tactics. At that time the army as a whole undoubtedly mistrusted the machine-gun as a weapon. This mistrust was probably due in great measure to the indifferent results achieved with the Maxim gun during the S. African War (1899–1902), in which the gun frequently "jammed" at a critical moment, not from any fault in the mechanism, but from lack of knowledge amongst the personnel as to how the gun should be handled. The gun was not popular in the ranks, since its appearance was apt to attract hostile artillery fire on to the firing line.

The Russo-Japanese War clearly demonstrated the value of machine-guns both in attack and defence; and the Germans, as a result of their study of the fighting in Manchuria, multiplied their machine-guns and organized them in companies.

On the outbreak of the World War, the machine-gun resources of the British Expeditionary Force consisted of a "section" of two machine-guns in each infantry battalion and cavalry regiment. The infantry section was armed with the Maxim ·303-in., the cavalry section with the Vickers ·303-in. gun. The war establishment of these sections was as follows:—infantry section, one officer, one sergeant and 16 rank and file; cavalry section, one officer, one sergeant and 25 rank and file. By this date the transport in use consisted of a G.S. limbered wagon (two-horsed) which carried two guns and mountings with the necessary accessories and first-line supply of ammunition. In the cavalry section the gun detachments were mounted on riding-horses and the cavalry section was, therefore, more mobile than the infantry section. Pack-saddlery was carried to enable the sections to be taken into action on pack animals when necessary. A study of the British 1914 Training Manuals shows that the accepted doctrine as regards machine-gun tactics at that date was briefly as follows. The machine-gun was considered to be essentially a direct-fire weapon; it was not considered sufficiently reliable to carry out overhead or indirect fire. To quote *Infantry Training* (1914): "Machine-guns are essentially weapons of opportunity. The power of the gun is best used to develop unexpected bursts of fire against favourable targets"; and, again, "Owing to the liability of the mechanism to interruption and the expenditure of the ammunition involved, the gun is not suited for sustained fire action." It was laid down that the machine-gun section formed an integral part of the battalion or regiment to which it belonged; but at the same time the "brigading" of sections was legislated for, and a brigade machine-gun officer was appointed in each brigade to command the sections when brigaded. The advantages and disadvantages of either leaving the sections with their battalions or of brigading them were stated, but no indication was given as to which was to be considered the normal method of employment, or as to the circumstances under which either method would best be utilized.

Soon after taking the field in Aug. 1914 it became apparent that the Germans were far ahead of the British in machine-gun tactics and organization; and, moreover, that a very great increase in the number of machine-guns in proportion to rifles was necessary. In Great Britain, the first step to remedy the deficiency was, towards the end of 1914, to increase the number of guns in the section from two to four. But the need for any alteration in methods of tactical handling was not yet realized by the British army at large; and since the machine-gun was considered to be solely a direct-fire weapon it was employed with the most forward troops, and, in defence, was almost invariably positioned in the front-line trench.

Early in 1915 the Lewis gun was first issued to battalions in the field, and at the same time the ·303-in. Vickers machine-gun was issued to infantry machine-gun sections and entirely superseded the Maxim gun. At this time, therefore, the two weapons (*i.e.* the Vickers and Lewis guns) were used side by side in the same unit, but little or no difference was made in their tactical handling.

It is an accepted principle that the tactical handling of a weapon must be based on its characteristics, and it is necessary to state briefly what is the difference between the characteristics of the so-called "light" machine-guns, such as the Lewis and the Hotchkiss guns, and the "heavy" machine-gun, *i.e.* the Vickers gun in the British service, the modified Maxim in the German and others, and the Browning Heavy in the U.S. army.

Owing to the fact that it is not fired from a stable mounting, the Lewis gun cannot carry out overhead fire with safety and is not adapted for indirect fire. Being an air-cooled weapon it is not capable of sustained fire action and is limited to short bursts of fire. It is sufficiently light and portable to accompany and keep pace with the leading infantry. In the World War, functions similar to those which came to be allotted to the Lewis gun were performed by the Chauchat and others in the French army; by the Chauchat and, later, the Browning Light in the American; and by a somewhat lightened (finally an air-cooled) pattern of the Maxim in the German army. Their characteristics are dealt with under RIFLES AND LIGHT MACHINE-GUNS.

The Vickers gun is fired from a stable (tripod) mounting; it is therefore capable of overhead and indirect fire with safety to one's own troops. Being a water-cooled gun it is capable of sustained fire action subject only to considerations of ammunition supply. Neither the gun nor the mounting is sufficiently light to enable machine-gunners when man-handling their loads to accompany and keep pace with infantry in a rapid advance. It is evident that the tactical handling of two weapons having such widely different characteristics cannot be the same if the best possible value is to be obtained from each weapon.

At the outbreak of the World War the higher command of the British army did not appear to have realized the characteristic difference between the various types of automatic small arms in use (Vickers, Maxim, Lewis and Colt guns): all were classified under the general heading of "machine-guns." This lack of discrimination between the characteristics and consequently between the true tactical rôles of the weapons undoubtedly retarded the development of machine-gun tactics for upwards of two years. In the autumn of 1915, however, partly owing to the very considerable increase in the output of Vickers guns and partly to a realization of the need for differentiation in methods of tactical handling, it was determined to form brigade machine-gun companies, armed with Vickers guns, to be separate from and independent of battalion machine-gun sections, the latter to be armed with Lewis guns. It was evident that the personnel to man these companies could not be found from and maintained by the infantry, and it was therefore decided to form "a corps of machine-gunners." The large increase in machine-gun resources, and the decision to form machine-gun companies, led to the issue, in Oct. 1915, of a Royal Warrant for the formation of the Machine-Gun Corps, to be divided into three branches—cavalry, infantry and motors. The machine-gun company comprised a headquarters and four sections, each of four guns. Unfortunately, the original establishment of these companies was fixed at a very low figure, only four men per gun being allowed for in the section; and this low establishment seriously militated against the efficiency of the companies when they took the field. It was finally decided that the Machine-Gun Corps should be armed solely with the Vickers gun and that the personnel should be trained in its use alone.

The year 1915 saw no change of doctrine in the British army at large as to the tactical handling of the Vickers gun. Nevertheless, by the end of that year there existed a small body of officers who had had experience of handling the gun in the field, and who saw the possibilities of development in machine-gun tactics if overhead and indirect fire were put into practice. These officers used every endeavour to prove the need for and practicability of these methods of fire tactics, but a considerable time elapsed before general recognition was afforded to the principles they advocated. In March 1916 it was decided that, as additional Vickers guns and personnel became available, a fourth machine-gun company per division should be formed, this company to be known as the divisional machine-gun company and to be at the disposal of the divisional commander, whilst the brigade machine-gun companies remained as an integral portion of the brigades to which they were attached.

The summer of 1916 brought the long-drawn-out battle of the Somme. By this time each infantry brigade had its machine-gun company, which was entirely under the orders and at the disposal of the brigade commander. Throughout the period covered by this battle, it cannot be said that the new brigade machine-gun companies proved to be of any greater value than the former battalion machine-gun sections.

By this time, in the minds of officers of real experience, the following principles had, however, been definitely established. (i.) That the *raison d'être* of machine-guns (*i.e.* Vickers guns) was the support of the infantry in all phases of the battle, and that this support was afforded by supplying covering fire of which a very large proportion must necessarily be overhead fire. (ii.) That the machine-gun was a weapon well adapted for carrying out overhead fire and that this form of fire facilitated disposition in depth. (iii.) That the movements of machine-gun units would rarely synchronize with the movements of the infantry they were supporting; in other words, that although machine-guns fight for the infantry they do not necessarily fight from the same positions as the infantry. In fact, as long as the machine-gun bullets are falling in the right place at the right time, it does not matter to the infantry where the guns are.

Throughout the battle of the Somme the low establishment of the British machine-gun companies had militated seriously against their efficiency. As a temporary measure to remedy this shortage of personnel, the expedient of attaching from 8 to 12 infantrymen to each machine-gun section had been resorted to. These men were mainly employed as ammunition carriers and some attempt was made to train them as machine-gunners. The arrangement was not, however, satisfactory to either the Machine-Gun Corps or the infantry, and, owing to strong representations on the subject from many quarters, approval was given in Oct. 1916 to the addition of two men per gun to the establishment of the machine-gun company. The gun detachment then consisted of six men; but subsequent experience showed that even this number was insufficient, and before the end of the war the establishment was raised to eight men per gun exclusive of headquarters and other details.

By the end of 1916 many of the British divisions in the field had received their fourth (or divisional) machine-gun company. The addition of this company pointed to the necessity for the appointment of a divisional machine-gun commander to control and coördinate machine-gun action within the division. The suggestion that such an appointment should be created met with considerable opposition, and eventually a divisional machine-gun *officer* was appointed, his status being solely that of an adviser, and he was appointed to command the fourth or divisional company only. A corps machine-gun officer, whose status was that of an adviser only, was also appointed in each army corps.

By the beginning of 1917 a distinct advance had been made in the methods of tactical handling of machine-guns throughout the army, due in great measure to the influence exerted by corps and divisional machine-gun officers. There was not such a general inclination to position machine-guns in the front-line trench, and some attempt was made to effect disposition in depth, although the dispositions adopted were entirely linear and still in many cases by single guns. There was as yet little or no realization of the offensive power available in machine-gun fire, *i.e.* the power of the weapon to afford close support to infantry in the attack. Neither had the infantry yet attained much confidence in the overhead fire of machine-guns. In the spring and summer of 1917, however, considerable advance in the development of machine-gun tactics was made, for which the Canadian Corps must be given full credit. The Canadians had devoted much thought and care to their machine-gun organization and had determined to organize and employ their machine-guns on a divisional basis. They also determined to make full use of the offensive power available in machine-gun fire, for which purpose their machine-gunners had perfected themselves in the use of overhead and indirect fire, and had obtained the equipment necessary for carrying out the latter. The highly successful machine-gun barrage arranged by the Canadian Corps for the support of their infantry in the attack on Vimy Ridge was the first example of the coördinate action of a large number of machine-guns in the British attack. The machine-gun arrangements made by the Canadian Corps were enlarged on in the battle of Messines in June 1917, with highly successful results. Subsequently machine-gun barrage fire, coördinated with the artillery barrage, became a regular feature in all the operations of the British army, whether offensive or defensive, as long as the period of trench warfare continued.

The use of barrage fire led to considerable strides in the development of machine-gun tactics. It proved beyond doubt that the Vickers gun was fully capable of accurate long-range fire and of carrying out overhead and indirect fire with safety, with the result that most of the British infantry units would by this time advance under the fire of their machine-guns with complete confidence. The use of barrage fire also necessitated coördinated action between machine-gun companies, and thus pointed the way to the higher organization of the Machine-Gun Corps. By this time it was realized that the value of the disposition of machine-guns in depth, not only in defence but also in attack, was enhanced by a combination of direct and indirect fire. Consequently machine-guns were now divided into two main categories—forward guns and rear guns. In the attack the forward guns were allotted the rôle of affording immediate support to the leading troops and of assisting in the consolidation of the final objective.

The rear guns supplied long-range covering fire, generally organized in the form of barrage fire, from positions in rear. It must be remembered that at this time the operations still consisted entirely of trench-to-trench attacks with limited objectives, and it was generally possible to site the rear guns so that they could cover the advance of the infantry up to the final objective without moving from their original gun positions.

In any case it was unusual for the rear guns to be obliged to make more than one forward move during the operation.

In the defence the forward guns were allotted for the defence of the outpost line of resistance, whilst the rear guns were disposed in depth for the defence of the battle position. The primary task of the rear guns was the defence of specific areas by means of direct fire; but as a secondary task, subject to limitations as to expenditure of available ammunition, as many of these guns as possible were utilized to afford long-range fire (either direct or indirect) for the assistance of the troops in the more forward areas. No hard-and-fast rules were laid down as to the proportion of forward guns to rear guns, but it was realized that the number of the former must be kept to the lowest possible minimum in order that there might be sufficient depth in the machine-gun dispositions.

By the end of 1917 the following conclusions were also drawn by those who had made a continuous study of machine-gun tactics. (i.) That machine-guns are as valuable in offensive as in defensive operations. (ii.) That, except at close ranges, the fire of one machine-gun is of little tactical value. That the section of four guns is the tactical unit for all purposes of fire direction and control. (iii.) That the machine-gun is a distinctive weapon with tactics of its own, which are neither those of the infantry nor of the artillery, but intermediate between the two. (iv.) That adequate depth in machine-gun dispositions can only be attained and maintained by means of a suitable organization, enabling machine-gun resources to be disposed according to tactical necessity.

Before the end of 1917 it had become apparent that the British machine-gun organization was not suitable for putting into practice the tactical principles enunciated above. The system of having a machine-gun company definitely and permanently attached to each infantry brigade had proved to be very wasteful. Eventually approval was given in Jan. 1918 to the formation of divisional machine-gun battalions. From a tactical point of view the following important results followed:—(*a*) The principle that machine-guns should be allotted and fought on a divisional basis was conceded, and (*b*) the divisional machine-gun *officer*, who was merely an adviser, was replaced by a *commander* who was also an adviser. At the same time it was agreed that the Machine-Gun Corps should be granted higher representation to the extent of the appointment of an inspector of machine-gun units (brigadier-general) at G.H.Q. and of a deputy inspector (colonel) at each army headquarters.

The following brief statement of tactical principles, which were put into practice during the closing stages of the 1918 campaign, indicates the final stage in the evolution of machine-gun tactics during the World War. The section of four guns is the tactical unit of machine-guns and should be kept intact. The maximum fire effect is obtained by the employment of collective fire from a number of guns operating under one control. The use of individual machine-guns, operating alone, results in loss of control, difficulty of supply and dissipation of fire-power. Unity of control is essential if full use is to be made of available resources; within reasonable limits, the larger the number of machine-guns which can be placed under one directing authority the less will be the overlapping of functions and consequent waste of fire-power. Disposition in depth is essential and must be a guiding principle in machine-gun tactics. It enables flexibility of control to be maintained and automatically affords protection to flanks. Unless there is a general prearranged and comprehensive plan for the action of machine-guns, machine-gun units will not be able to render that continuous support during the attack which is necessary if fire superiority is to be gained and if the demoralization of the enemy is to be effected at each successive stage of the advance.

Coöperation is the foundation upon which successful machine-gun tactics rest. To ensure it, the closest possible liaison must be maintained between machine-gun units themselves, and between machine-gun units and other arms. Sustained fire and surprise effect are both dependent upon the skilful use of ground and cover while the gun is being brought up to its position and when it is in action. At close and medium ranges, enfilade fire gives the best results with the minimum expenditure of ammunition. Normally, frontal fire at these ranges should not be used unless an exceptional target presents itself, such as troops in mass. In an offensive operation the fullest advantage must be taken of the mobility conferred on machine-gun units by the use of limbered wagons and pack transport. Resort must only be made to man-handling when all other means of transport have been found impossible. In the attack the first duty of machine-gun units is to assist the advance of the infantry. They must carry out this task by providing covering fire, both direct and indirect; by dealing rapidly with serious hostile opposition, and by producing the greatest fire effect at points where the progress of the infantry is checked. Their other duties are to protect the flanks of the infantry against counter-attacks during the advance; to form pivots upon which the infantry can rally if driven back; and to act as a reserve of fire-power in the hands of commanders for offensive or defensive purposes as the situation may demand. It follows from the above that the disposition of guns in depth must be maintained throughout. In the defence the rôle of machine-guns is to assist the infantry in maintaining their positions. For this purpose machine-guns must be employed—(i.) To assist the infantry in the outpost zone to check and disorganize a hostile attack. (ii.) To assist in the defence of the battle position, should the enemy succeed in crossing the outpost zone. (iii.) To support the infantry and tanks in the execution of counter-attacks.

The bulk of the machine-guns available with divisions in front line must be disposed for the defence of the battle position, a proportion being retained as a mobile reserve in order to support the action of the offensive reserves in the divisional sectors of defence. Only a small proportion of the available machine-guns should be allotted for the support of the troops in the outpost zone. No attempt should be made to site machine-guns so that every yard of ground is swept by their fire, which should be reserved for protection on a larger scale, covering the more important features and denying to the enemy the most favourable routes of advance. Localities of tactical importance must be strongly covered even though it becomes necessary to leave gaps on parts of the front where an attack is considered less probable. Guns must be sited primarily for the defence of ground by direct fire, but, subject to limitations as regards expenditure of available ammunition, the long-range fire of guns in rearward positions should be utilized for the assistance of troops in the more forward areas.

Such were the tactical principles which were made possible of application by the organization of machine-guns on a divisional basis. Experience showed that a rigid battalion organization on the model of the infantry battalion was not the most suitable for machine-guns. The application of the tactical principles enunciated above necessitated the organization of the divisional machine-guns into groups of varying sizes. But as the machine-gun company was not self-contained as regards train transport and supply, the splitting-up of a company in order to organize the required groups led to considerable administrative difficulties. The organization of a battalion by grouping together the machine-gun companies already in the division was the quickest and least expensive method of placing the machine-gun organization on a divisional basis; but it was subsequently realized that a more suitable organization would have been attained by making each machine-gun company self-contained in all administrative matters in such a manner that sections could be detached as and when required.

MACHINE TOOLS (*see* 27.21).—The decade 1910–20 saw a noteworthy development in every branch of machine-tool engineering. In no branch was the progress more marked than in instruments for precise measurements. These include types employing both physical and optical means. Their perfection has made possible the production of interchangeable parts in commercial quantities. Without means of accurate gauging the making of cheap automobiles in great numbers would be impossible. This is also true of rifles, typewriters, sewing-machines and hundreds of other things made and used daily in great numbers. For accuracy and almost universal application, the gauge blocks shown on Plate I., fig. 1, made by C. E. Johansson, Eskilstuna, Sweden, stand high. The first combination set on his system was made in 1897, but not until 1911 was Johansson able to produce them in commercial quantities of a guaranteed quality. Subsequently these blocks became so recognized as standard that there is hardly a manufacturing plant in the world doing accurate or interchangeable metal work that has not one or more sets for reference purposes or actual use. They are also in constant use at the National Physical Laboratory, London; the National Bureau of Standards, Washington; the Bureau International des Poids et Mesures, Paris, and similar institutions of all the principal nations.

A full set consists of 81 blocks with surfaces flat and parallel within one hundred-thousandth of an inch. A standard set is made up of four series. The first series consists of nine blocks, the first 0·1001 in. wide, increasing by 0·0001 in. each to the ninth, 0·1009 in. wide. The second series consists of 49 blocks, the first 0·101 in. wide, increasing by 0·001 in. each to the 49th, 0·149 in. wide. The third series consists of 19 blocks from 0·050 in. to 0·950 in. wide, each increasing by 0·050 in. The fourth series consists of four blocks 1, 2, 3 and 4 in. wide respectively. These blocks may be stacked or "wrung" together to form an enormous number of very accurate "blocks" practically equal to a similar solid block. For instance, the blocks of the fourth series can be combined to give any size in even inches from one to ten. The blocks of the third series can be combined with those of the fourth so as to give any even multiple of 0·050 between 0·050 and 10 in. The second series furnishes means of stacking the gauges to obtain dimensions varying by thousandths, and the first series gives variations by ten-thousandths of an inch. One stack of all the blocks wrung together gives accurate results.

That these blocks are held together by far more than atmospheric pressure is proved by a demonstration given Nov. 10 1917 before the Stockholm Technical Institute. Two blocks were wrung together. The sizes of the two surfaces in contact were 0·49 sq. in. and they sustained a weight of 220 lb. The atmospheric pressure contributed about 6·6 lb., from which it will be seen that the adhesive power of the blocks was more than 30 times atmospheric pressure. In spite of this extraordinary adhesive power the blocks are easily separated by a simple sliding movement, and they are as easily "wrung" together in the same way if the surfaces are first wiped with the hand. The great advantage given by these blocks is that they furnish a practically universal standard of gauging, since parts, gauges, templets or tools, made in England and checked with reference to them, will check the same with a set in America, France or Japan. The composition of these gauging blocks is such that they are long-wearing and little affected by ordinary changes in temperature.

A gauge known as the Prestwich fluid micrometer is shown on Plate I., fig. 2. This is the invention of John Alfred Prestwich, of the English firm of John A. Prestwich & Co., Ltd. It was originally developed about 1910 for use in his own works, but later was put on the market.

The gauge is shown with a piston ring between the gauging points. The lower gauging point, or "anvil," is a stationary block of hard steel set into the base of the instrument. The movable gauging point is set directly above the anvil and is attached to the lower side of a thin, springy diaphragm of metal which forms the bottom of a fluid container about $2\frac{1}{2}$ or 3 in. in diameter, and about $\frac{1}{4}$ in. thick. A small glass tube leads upward from this container and a coloured liquid is put into the container and extends part way up into the glass tube. Pressure on the movable gauging point presses the diaphragm upward and causes the coloured liquid to rise higher in the glass tube, where it is plainly visible. A graduated scale at one side of the tube shows the amount of upward movement, and pointers at the left of the scale may be set to show the limits for various kinds of work. Owing to the size of the diaphragm and the small hole in the tube, any movement of the gauging point is greatly multiplied by the liquid in the tube, and in some of the instruments a variation of one thousandth of an inch between the gauging points will cause a difference of half an inch in the height of the liquid in the glass tube. This instrument is especially valuable for quickly inspecting machine products, as any variation is instantly visible.

During the World War considerable difficulty was experienced in finding a satisfactory method of quickly inspecting screw threads for size, shape and lead. This was solved in 1916 by the National Physical Laboratory in England, under the direction of Sir R. T. Glazebrook, by means of a projection lantern. The general principle of this lantern is along the lines of the stereopticon or the motion-picture machine, as the threaded (screwed) piece to be inspected is placed in the path of a powerful beam of light which projects a greatly enlarged image of the object upon a screen. An accurate drawing of the screw is previously imprinted on the screen, and the faithfulness with which the projected image conforms to the lines of the drawing instantly determines the accuracy or inaccuracy of the screw or any part of it. Building on this original idea, a number of concerns have placed on the market "comparators," "projectoscopes," "projection lanterns" and similar instruments under various names.

A measuring machine sufficiently accurate for all ordinary shop purposes is illustrated on Plate I., fig. 3. It consists of a bed with a sliding work-table and a microscope mounted on a compound slide. The latter is furnished with a large dial micrometer reading to 0·0001 in. In addition the microscope is fitted with two hair-lines, one rotating with the eyepiece and one with the outside tube. This is fitted with a dial reading to half degrees, while the eyepiece carries a vernier reading to one minute.

The accuracy of measurements depends upon standard rods inserted between blocks at the left-hand end, one block being on the bed and the other on the work-table. The work-table is provided with centres, one of which has cross adjustment for alignment. The method of using this machine will be evident in the case of limit gauges and the like, having plain length measurements, since the selection of suitable measuring rods, the setting of the hair-lines and the reading of the traversing micrometers present no difficulties. With little additional trouble the machine may be used for contour work, while the two hair-lines enable the operator to measure the pitch and angle of screw threads as well as the depth. The table will accommodate work 12 in. long and up to 3 in. in diameter. A lamp and mirror are set as shown in the illustration to give clear projection.

For testing the flatness of a lapped steel surface of a gauge, or other polished surface, the U.S. Bureau of Standards has developed a tool known as the "optical flat." This consists of a polished piece of flat, clear glass, one surface of which is very accurately flat. The principle is, that if a piece of clear glass with an optically flat surface is laid on another more or less flat surface, and is illumined by monochromatic light, dark and light bands will be observed on the lower surface. If these bands are parallel and equally spaced the surface under inspection is flat. If the bands are curved, then the surface below the glass is curved, the reason being that a difference in the thickness of the film of air between the adjacent surfaces causes a variation in the direction and spacing of the light bands. By observing certain conditions of light and position, flatness to within one millionth of an inch may be plainly observed with the naked eye.

The diagrams shown on Plate I., fig. 4, indicate how light bands, or "interference fringes," look when an optical flat is laid on surfaces of different degrees of flatness. The optical flat may be used for comparing the height of two pieces laid side by side. If one is higher than the other the arrangement of the light bands will instantly indicate it. Curved surfaces may also be as easily inspected and the amount of error estimated. Complete apparatus for accurately measuring with optical flats is made by H. L. Van Keuren, Boston, Mass.

Among recent developments in the small-tool field, those of importance in lathe and planer cutting tools have been slight, apart from the research work of the late Frederick Taylor, of Philadelphia, and the advances in steel making and treating which make the tools more durable. Taylor spent many years and much money investigating the proper shape, clearance and cutting angles for lathe and planer tools. He also designed and built for the market a machine for grinding these tools according to the shapes outlined in his charts. He also did a share of the work in evolving the Taylor-White process of hardening high-speed steel, which made possible higher speeds and heavier cuts than had previously been imagined. This discovery profoundly affected machine design as well as production methods, since it compelled the building of heavier, speedier and more powerful machine tools to meet the severe demands placed upon them by properly hardened high-speed steel. Except for this strengthening, standard lathes, planers and shapers have really advanced but little. One feature, however, may be noted, and that is the increasing use of air-operated chucks on turret lathes (monitors) and chucking-machines.

An unusual type of single-purpose lathe was designed by Lucien I. Yeomans, of the Amalgamated Machinery Co., Chicago, for which he was awarded a medal by the Franklin Institute of Philadelphia. This type of lathe was intended for making large shell of from 6 to 16 in. in diameter. The head-stock and body of the lathe were cast in one solid piece, with holes cored out for the spindle and ways. The ways were merely accurately ground lengths of round steel shafting so placed that the ends projected through the cored holes in the bed. They were properly located by means of huge master jigs, and then type-metal was poured into the cored holes and around the ends of the shafting. This held them securely in place. The carriage and cross-slide guides were made and located in the same general way. The lathe spindle turned in a machined bushing which was set into the cored hole in the head and secured with type-metal. This method of construction saved an immense amount of machining, as there was no work put into its construction except such as could be turned or bored. The makers were enabled to turn out a large number of machines in an astonishingly short time, and they agreed to furnish any order for such machines at the rate of 10% per day, beginning with the confirmation of the order. The American Car and Foundry Co. had 173 of these machines in one battery making shell, and other large installations were placed. A number of large gun-boring lathes were also made on the same plan, but the close of the World War put an end to this work, as the machines were not suited to other purposes. A wartime machine designed and built by Yeomans was a "concrete planer" with a 93-ft. table and 185-ft. bed, used for gun-carriage work. All of the heavy parts, including the bed, table and housings, were made of reinforced concrete with inserted metal ways and facings. Five of these machines were made for Government war work. At the time the Armistice was signed the bed for a planer 500 ft. long had actually been almost completed.

Closely allied to the lathes are the machines of the vertical boring-mill type. Most of these are well known, but modern manufacturing methods have induced the design of certain advanced types, such as the duplex boring-mills made by two English houses, Webster & Bennett, Ltd., of Coventry, and G. Wilkinson & Sons, of Keighley (see Plate I., fig. 5).

Rapid production has also been responsible for what is known as the vertical "station-type" of machine. These machines are an outgrowth of the vertical boring-mill or "vertical turret lathe."

A typical example is the "Mult-Au-Matic" (Plate I., fig. 6) made by the Bullard Machine Tool Co., Bridgeport, Conn. In this machine there are six "stations" or chucks, though other holding devices may be used. The chucks are mounted on a table which "indexes" or makes $\frac{1}{6}$ of a revolution at set periods, bringing the work under different tools each time. Each chuck revolves or remains stationary on its own centre, making it possible to do drilling, boring, facing, turning and other work either simultaneously or successively. One station is used for the insertion and removal of the work, and after the chucks have once been filled all round, a piece of work is removed and another inserted at each indexing of the table. This machine is mechanically operated throughout; but a similar machine, in which all the feeding and indexing movements are hydraulically operated, is made by Giddings & Lewis, Fond du Lac, Wis.

Drilling-machines of the station type are also made by several concerns. One made by the Cincinnati Automatic Machine Co., Cincinnati, Ohio, is shown in Plate II., fig. 7. Both of these types were foreshadowed by the five-spindle automatic screw machines made by the National Acme Co., Cleveland, O., whose machines have been on the market for over 25 years. The general principle is the same, the main difference, as in the case of the lathe and the boring-mill, being that one is horizontal and the other vertical, the latter being of much later date in each case.

Apart from the station-type drilling-machines, others now in common use include those of the "gang" and the "multiple spindle" types. The gang types consist mainly of several individual drilling-machines of a like size bolted side by side, or mounted on a single base. The multiple spindle type may have a considerable number of spindles mounted on a single head, the spindles being run by worms, gears or universal joints.

Gear-driven spindles lend themselves well to mounting in heads which may be used in the spindle of ordinary single-spindle drilling-machines. Holes of varied arrangement or "pattern" may be simultaneously and quickly drilled in this way. The worm-driven spindles are more conveniently used if mounted on a cross-rail, making it possible to drill a large number of holes in a straight line, although the spacing between the various holes may be varied. The universal joint-driven spindles (Plate II., fig. 8) furnish the most flexible means of arrangement of all, as they may be set to conform to almost any arrangement or pattern of holes. The National Automatic Machine Co., Richmond, Ind., and the Foote-Burt Co., Cleveland, O., have made many machines drilling up to 100 or more holes at once. Some of their machines feed a large number of drills in from several angles at once. For instance, one model simultaneously drills from 5 to 20 holes in each of five sides of a cast-iron box.

Milling-machines form attractive subjects for tool designers, and new forms are constantly being evolved. The more modern forms include the continuous milling-machines, which are of two principal types, the rotary and the reciprocating.

The reciprocating machine is simply a modification of the regular type of milling-machine. It carries fixtures for holding the work at opposite ends of the table. While the cutters are acting on the work at one end of the table the fixtures at the other end are being emptied and reloaded. The feed of the table is reversed as soon as the work is milled, and the cutters immediately begin to cut on the work in the other fixture. The operator then steps to the other end of the table, removes the finished work and reloads the fixture, and so on.

The rotary continuous milling-machines may be of the horizontal-table-vertical-spindle, or the vertical-table-horizontal-spindle, type. On Plate II. are shown examples of the former, the more common (fig. 9), another form, with work-holding fixtures in place (fig. 10), and of the vertical-table, or "drum type" (fig. 11). In all of these shown in the last three cuts the table moves continuously, the work being removed or inserted while in motion. A machine built on a slightly different plan is shown on Plate III., fig. 12. In this the table is tilted and the motion is not continuous. The table movement more closely resembles that of a station-type machine in that it indexes and remains stationary as the cutter is fed to the work by the sliding spindle head. Milling-machines of the planer type shown on Plate III., fig. 13, are made in a variety of forms, largely for automobile work. They may carry from one to a dozen cutters placed on spindles at various angles. In some cases the tables are made to reciprocate and one end of the table may be emptied and reloaded while the cutters are at work at the other end, after the manner of the lighter types previously referred to.

A highly developed type of milling-machine is shown on Plate III., fig. 14. This is an automatic profiling-machine designed for the sinking of forging dies and the like. In the illustration a model or master-die is shown below and a finished forging die above. Any number of dies may be made from the same pattern and they will be all alike. A "finger" is automatically fed over the surfaces of the model and as it moves a revolving cutter cuts corresponding

1

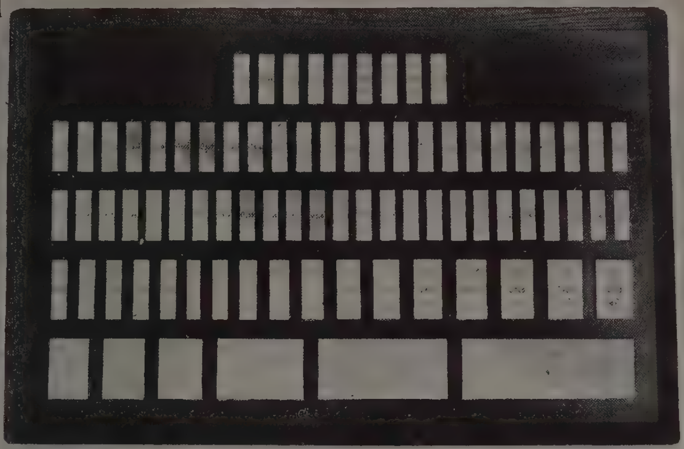

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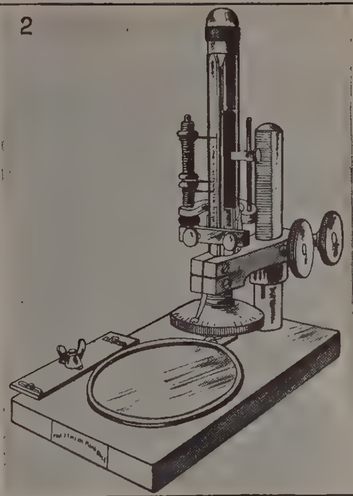

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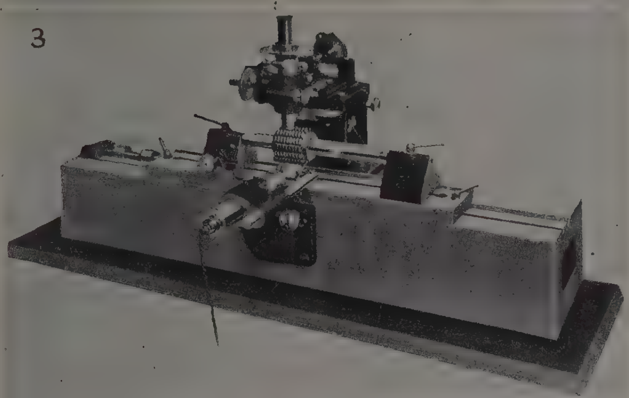

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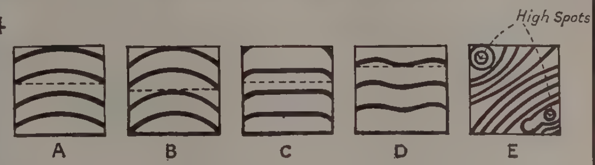

Different conditions and degrees of surface error. Heavy lines indicate edge in contact with flat

A. Convex surface—Side edges low 5 millionths. B. Convex surface—Side edges low 10 millionths. C. Nearly flat Side edges low or rounded 5 millionths. D. Surface both convex and concave—Hollow in centre higher each side of centre and lower at side edges: Error 3 millionths. E. Note 2 High Spots with 12 bands between. Indicating a valley 6 bands or 60 millionths deep.

5

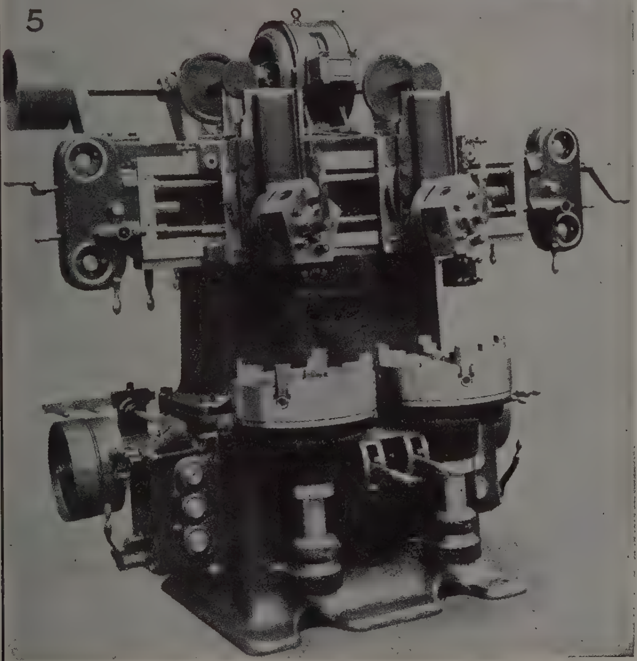

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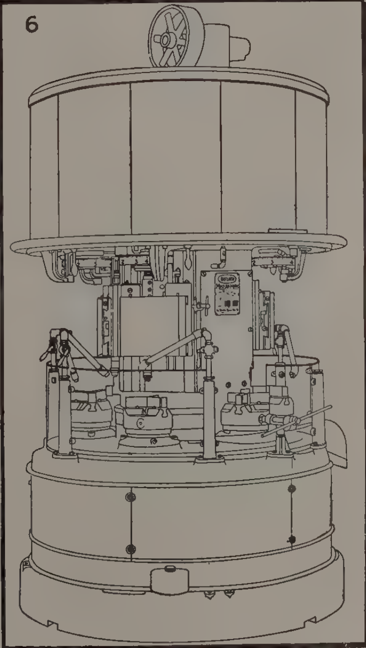

FIG. 1.—Combination Set of Johansson Gauge Blocks.

FIG. 2.—Prestwich Fluid Micrometer.

FIG. 3.—Microscopic Measuring-Machine.

FIG. 4.—"Interference Fringes."

FIG. 5.—Duplex Boring-Mill.

FIG. 6.—Bullard "Mult-Au-Matic."

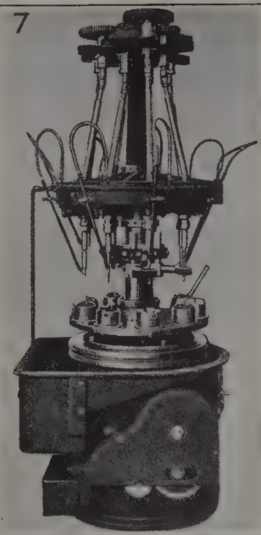

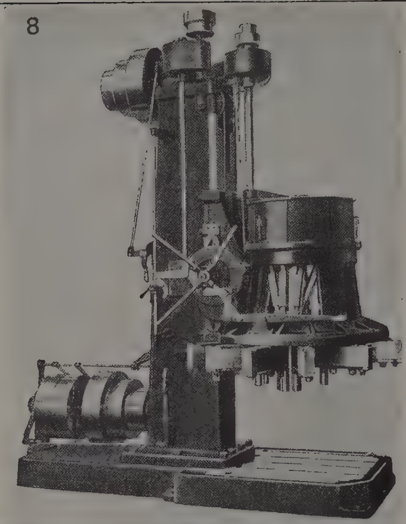

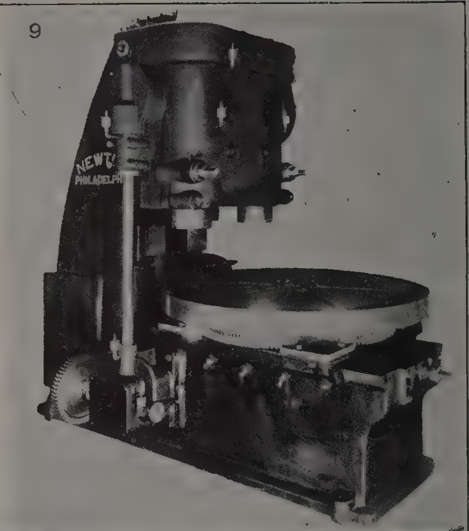

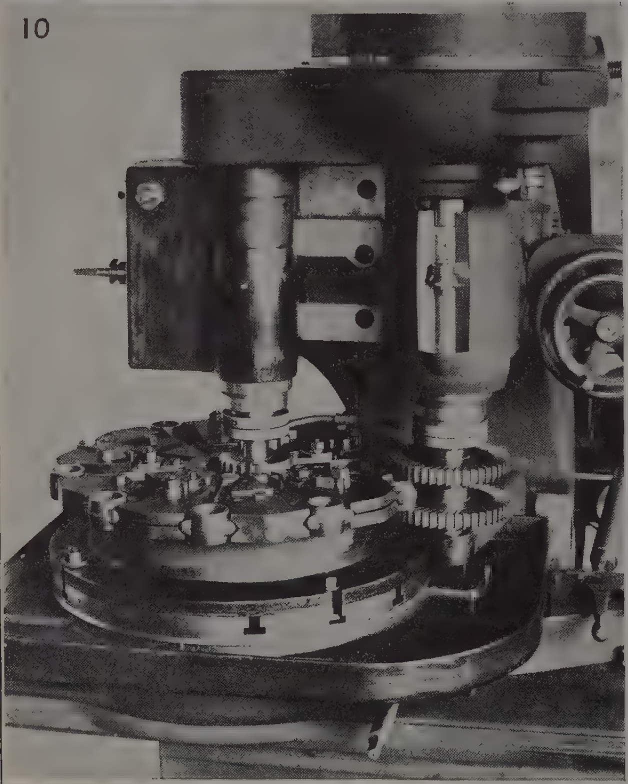

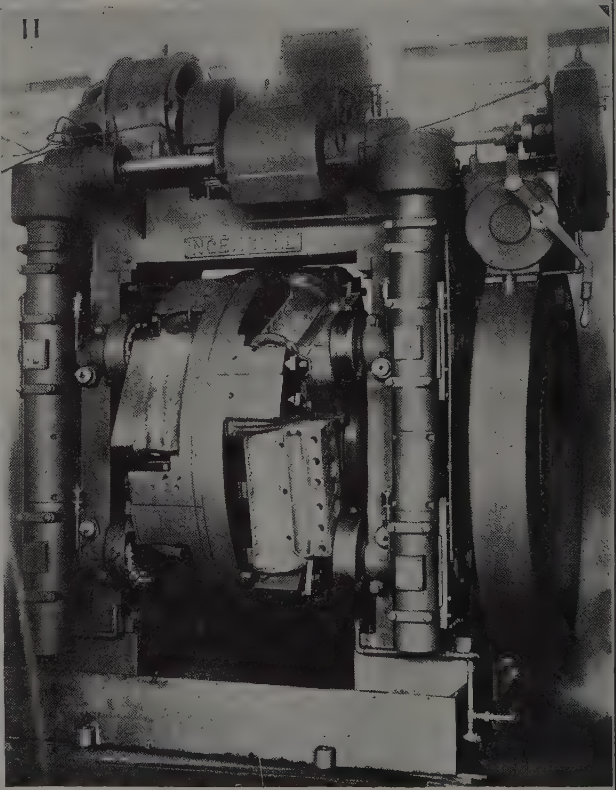

FIG. 7.—DRILLING-MACHINE OF STATION TYPE.

FIG. 8.—UNIVERSAL JOINT MULTIPLE-SPINDLE DRILLING-MACHINE.

FIGS. 9 and 10.—ROTARY CONTINUOUS MILLING-MACHINES (HORIZONTAL TABLE).

FIG. 11.—"DRUM-TYPE" CONTINUOUS MILLING-MACHINE.

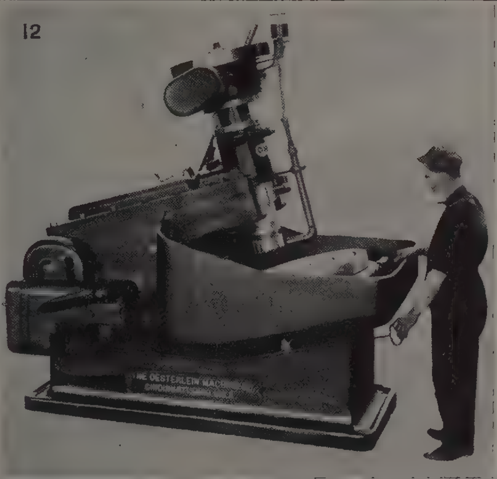
12
THE OESTERLEIN MACHINE CO.
CINCINNATI

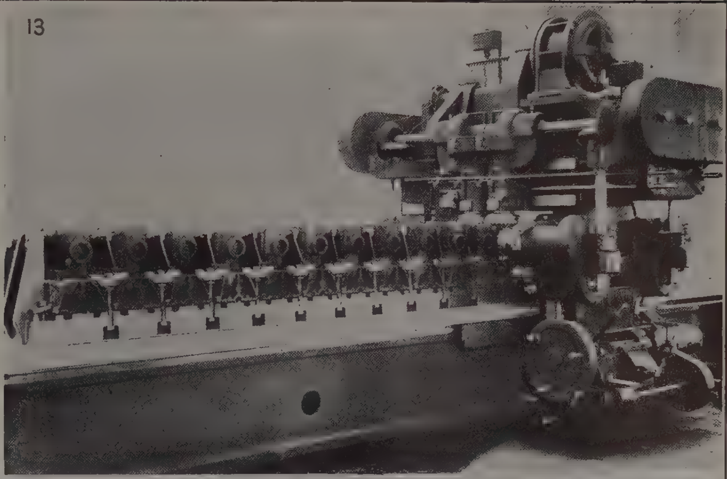

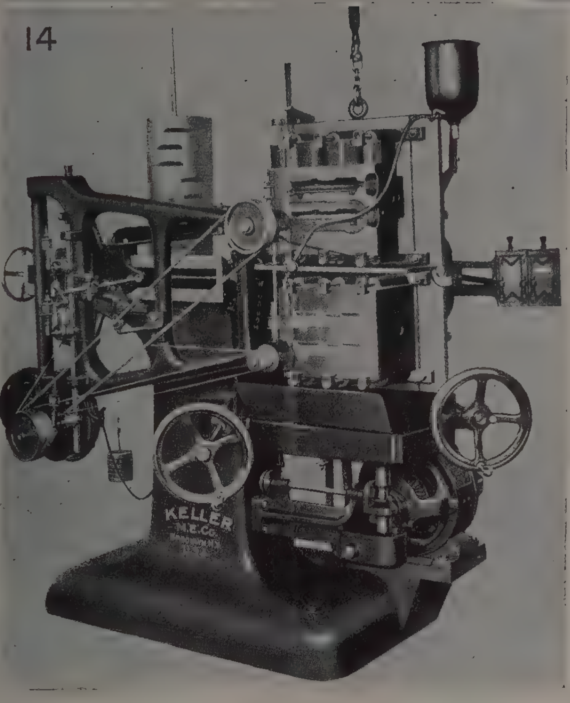
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KELLER
M.E.CO.

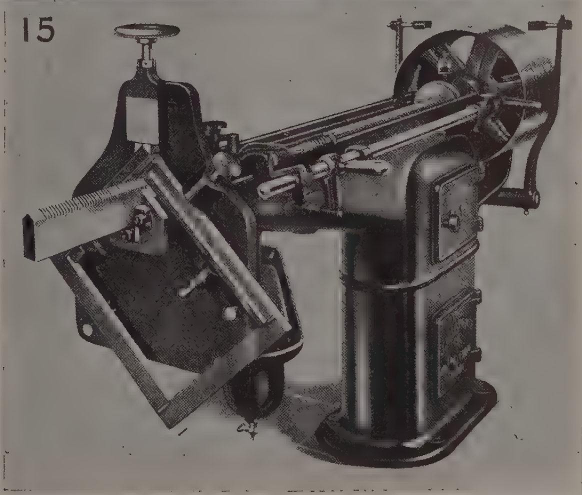

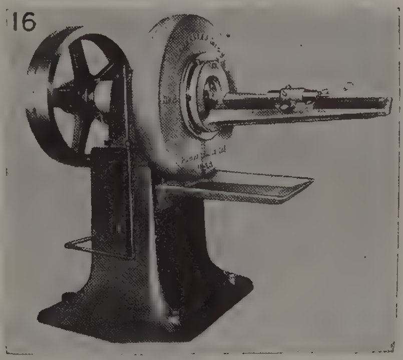

Fig. 12.—ROTARY CONTINUOUS MILLING-MACHINE.

Fig. 13.—MILLING-MACHINE—PLANER TYPE.

Fig. 14.—AUTOMATIC PROFILING-MACHINE.

Fig. 15.—BROACHING-MACHINE, WITH WORK IN PLACE.

Fig. 16.—LANGELIER SWAGING-MACHINE.

depressions in the die block above. After the die is cut it must be smoothed by hand, as the milling cutter leaves a rather rough surface.

In grinding-machines there are several models made with rotary tables, like those of the continuous milling-machines. Magnetic chucks are largely used on this type, as well as on others of the reciprocating-table and the horizontal-table types.

One of the principal developments has been the use of grinding wheels, which are fed straight in to the work. These wheels are wide enough to finish the surface desired, and the face is formed to conform to the contour of the finished work. This shape of the grinding wheel is obtained by means of a master form and diamond truing tool. A form of machine, known as the "centreless grinder," makes use of a wide-faced wheel, the face of which is dressed bevel. Small steel pins or rods fed across the face of this wheel by means of a grooved guide are automatically ground to size without the necessity of having centre holes drilled in them, as is necessary with the usual type of cylindrical grinder.

Broaching-machines are largely a development of the automotive industry. The La Pointes in the United States and Alfred Herbert in England have built most of the machines of this kind.

A broach is a tool having a number of saw-like teeth so made that they will finish or machine a hole or surface when moved through or over it. As a rule, the teeth of a broach are made to increase a thousandth of an inch or more in size until the last few, or finishing teeth, are reached. These last teeth merely scrape so as to properly size the work. A very common use for broaches is in the production of keyways in gears or wheels. With a properly made broach a keyway may be finished at one pass with no danger of spoiled work. Broaches are either pushed through the work by means of a press or are pulled through by means of a special machine, such as shown on Plate III., fig. 15.

In the example shown the broach is used to finish the inside corner of a type-chase, but almost any form of hole may be broached. In many cases round broaches take the place of reamers for finishing round holes. A round hole may be squared at one pass, or it may be as easily made into a hexagon, splined or irregular shape. In the special machines the broach is pulled through the work by means of a screw in a majority of cases, though some machines are made with a rack-and-pinion movement instead of a lead screw.

Swaging-machines for the cold hammering down of bars or rods are made by the Langelier Manufacturing Co., Providence, R.I. One such is shown on Plate III., fig. 16. A small rod is shown held in a sliding holder. As this rod is pushed into the head of the machine it is hit on opposite sides by hammers operating at a high rate of speed. The rod will be reduced to a point, or to a smaller diameter, according to the shape of the ends of the hammer-heads. Round parts or reduced sections are easily produced almost instantly. A familiar example of swaging can be seen in the reduced sections of bicycle or wire automobile spokes. Sewing-machine needles and other similar work are also reduced in machines of this type.

(E. VI.)

MACKAY, CLARENCE HUNGERFORD (1874–), American capitalist, was born at San Francisco April 17 1874. He was a son of John William Mackay (*see* 17.250), who had wide interests in cable and telegraph lines. He received his education in Europe, chiefly in England and France, and at the age of 20 entered his father's office in New York. In 1896 he was made president of the Forcite Powder Manufacturing Co., and also a director of the Commercial Cable Co. and the Postal Telegraph Co., being made vice-president of both a little later. After his father's death in 1902 he succeeded to the presidency of various companies, including the Commercial Cable Co. and the Postal Telegraph Cable Co. He was elected president of the Mackay Companies, organized in 1903, and owning all the capital stock of the Commercial Cable Co. and a majority of the stock of various cable, telegraph and telephone companies in the United States, Canada and Europe, including the Postal Telegraph Cable Co. In 1921 the Mackay Companies operated some 350,000 m. of wires and 29,000 m. of cables, connecting with all parts of the civilized world. At that time the Commercial Cable Co. owned cables from Ireland to England and France, five cables from America to Europe, cables along the North Atlantic coast, a cable from New York to Cuba, a cable from Florida to Cuba, and a Pacific cable from San Francisco *via* Honolulu, Midway, Guam and Manila, to Shanghai, with an extension to Japan. The Postal Telegraph Cable Co. owned a telegraph system throughout the United States, and at the same time used many thousand miles of the same wire for long-distance telephone. Acting under authority of a joint resolution of Congress of July 16 1918, President Wilson took over the wires as from Aug. 1 1918 and placed them under the control of Postmaster-General Burleson. Mr. Mackay opposed many of the Postmaster-General's policies on the ground that he was using war-time control to bring about Government ownership of the wires. In Dec. Mackay was removed from control of the Commercial Cable Co., and all cables taken over by the Government were placed under the president of the Western Union Telegraph Co. In March 1919 he was also dismissed by order of the Postmaster-General from the presidency of the Postal Telegraph Cable Co., but was reinstated after the return of the wires to their private owners in 1919.

MACKAYE, PERCY (1875–), American poet and playwright, was born in New York City March 16 1875. He graduated from Harvard in 1897 and later was a student in the university of Leipzig. From 1900 to 1904 he was a teacher in private schools in New York, and in the latter year became a member of the Cornish (N.H.) colony of artists and writers. He was made a member of the National Institute of Arts and Letters in 1914.

His numerous works include *The Canterbury Pilgrims* (1903); *Fenris the Wolf* (1905); *Jeanne d'Arc* (1906, played by E. H. Sothern and Julia Marlowe); *Sappho and Phaon* (1907); *The Scarecrow* (1908); *The Playhouse and the Play* (1908, essays); *The Civic Theatre* (1912); *Sanctuary* (1913, a bird masque); *A New Citizenship* (1915, a civic ritual); *Caliban by the Yellow Sands* (1916, a community masque to commemorate the Shakespeare Tercentenary); *Community Drama* (1917, essay); *Rip Van Winkle* (1919, folk opera); *The Pilgrim and the Book* (1920, a dramatic "Service" for celebrating the Pilgrim Centenary). In 1912 he edited with J. S. P. Tatlock *The Modern Reader's Chaucer.*

McKENNA, REGINALD (1863–), British politician and financier, was born in London July 6 1863, and educated at King's College. He went up to Trinity Hall, Cambridge, as a scholar and graduated as a senior optime in 1885, being elected an hon. fellow of his college in 1916. He also gained distinction as an oar, rowing bow in the university eight in 1887. He was called to the bar in 1887, and practised till, after an unsuccessful attempt at Clapham in 1892, he was elected Liberal member for North Monmouthshire in 1895. He found his party in opposition, but during the following ten years he established a reputation as a vigilant and acute critic of ministerial proceedings, especially in matters of education and finance. When his party returned to power in Dec. 1905 he became Financial Secretary to the Treasury, and in 1907 was promoted to the presidency of the Board of Education, but he was no better able than his predecessor, Mr. Birrell, to draft a bill which would satisfy the Nonconformists and yet pass the House of Lords. His tenure of the office was brief, as, on Mr. Asquith's succeeding to the premiership in the spring of 1908, he was transferred to the Admiralty.

He entered on his new duties at a time when the country was profoundly stirred by the rapid increase of the German fleet, and was in doubt whether the preparations of the Admiralty were on a sufficiently extensive scale. At the same time a large portion of the Liberal party was disposed to belittle the danger and to call a halt to building-schemes in the interest of peace and economy. Mr. McKenna, relying upon the advice of his First Sea Lord, Lord Fisher, resisted the section of the Cabinet, represented by the powerful figures of Mr. Lloyd George and Mr. Churchill, who took this last view; and, supported by the Prime Minister and Sir Edward Grey, he persuaded his colleagues to begin the building of four battleships of the "Dreadnought" type in 1909, and to ask for power, if necessary, to prepare for the construction of four more a year later. This programme disgusted the Radical economists, but did not satisfy public opinion. The Unionists and other friends of a big navy carried on an agitation to the slogan, "We want eight, and we won't wait," and eventually, on July 26, Mr. McKenna announced that the second four Dreadnoughts would definitely be ordered. The estimates of 1909 had shown an increase of nearly £3,000,000; those of 1910 showed a further increase of £5,500,000, mainly due to new construction. A still further increase of £3,750,000 in 1911 made it clear that Mr. McKenna and the Admiralty were in earnest in their determination to maintain "a fleet sufficient to hold the seas against any reasonably probable combination." In June 1911 he was able to make satisfactory arrangements at the Imperial Conference for complete unity of action in time of war between Dominion fleets and those of the mother country. He could feel, when in the autumn he passed from the Admiralty to the Home Office, that he left behind him a much stronger fleet than he had found. As Home Secretary he had charge of the Welsh Church Disestablishment bill.

When war broke out in Aug. 1914 he had the arduous duty of safeguarding the country against the machinations of spies—a task in which it was impossible to give entire satisfaction to a sensitive public. When Mr. Asquith's Coalition Ministry was formed in the summer of 1915 he was made Chancellor of the Exchequer, and a still more difficult task was imposed on him—to find the money to carry on the war. By the 4½% War Loan a subscription of nearly £600,000,000 was obtained. He also raised a loan of £100,000,000 in the United States on the joint credit of England and France. In the autumn he introduced a supplementary war budget for the year, providing over £100,000,000 by new taxation. Income-tax was raised 40%, and the abatement and exemption limits lowered; the rates of super-tax were seriously heightened; all the old duties on sugar, tea, tobacco, cacao, coffee, motor spirit and patent medicines were almost doubled; the import of luxuries such as motor-cars, cinema films, clocks and musical instruments was restrained by an *ad valorem* duty of 33⅓%; and an excess profits tax of 50% was imposed. Other methods of financing the war which he adopted were War Savings Certificates, which realized over £40,000,000 in their first year; 5% Exchequer bonds, replaced after a year for a short time by 6% Exchequer bonds; but for current expenses he relied mainly on the sale of Treasury bills, of which at the end of his period of office in Dec. 1916 there were over £1,000,000,000 outstanding. In his 1916 budget he raised taxation still further. Income-tax was increased to 5s. in the pound and excess profits tax to 60%; there were further increases on sugar, cacao and coffee; higher duties were imposed on motor vehicles; there were new taxes on amusements, railway tickets, matches and mineral waters. He calculated that the country was raising over £300,000,000 in the year by new taxation imposed since the war; and he budgeted for a net revenue of £502,000,000 to meet an estimated expenditure of £1,825,000,000. He enunciated the doctrine that Great Britain ought never again to be dependent for supplies or many essential commodities on a nation like Germany which in peace had plotted and prepared for war; and he said that Government was prepared to assist the development of British foreign trade.

Mr. McKenna went out of office with Mr. Asquith in Dec. 1916, and, along with other Liberal leaders who had refused to serve under Mr. Lloyd George, lost his seat at the General Election of Dec. 1918. He made no attempt to reënter the House, but accepted the position of chairman of the London City & Midland Bank in 1919. He speedily gained a position of financial authority in the City. He married in 1908 Pamela, daughter of Sir Herbert Jekyll, and had two sons. (G. E. B.)

MACKENSEN, AUGUST VON (1849–), Prussian field-marshal, was born Dec. 6 1849 at Hausleipnitz in the Prussian province of Saxony. His career was in the cavalry, and he at one time commanded at Danzig the well-known regiment of Hussars who wore a silver skull and crossbones on their busbies. As the commander of the XVII. Army Corps he was brought into close touch with the German Crown Prince at a time when the heir to the imperial dignity had been sent to Danzig in order to withdraw him from the temptation of meddling with politics. In 1914, at the outbreak of the World War, Mackensen was appointed to the command of the IX. Army on the eastern front, and won victories over the Russians at Kutno, Lodz and Lowitz. After April 1915 he led the German troops in western Galicia and helped to break through the Russian line at Gorlice. On June 20 of the same year he was made a field-marshal. In the advance into Russia Mackensen took Litovsk on Aug. 26 and Pinsk on Sept. 15 1915. Later in the autumn of the same year he was in command of the army sent against Serbia, and in 1916 he commanded the expedition against Rumania. In Nov. 1918, after the conclusion of the Armistice, when the German troops were being brought home from the Balkans, he was detained by the French and interned at Neusatz, where, in spite of many protests from the German Government, he remained until he was set at liberty at the beginning of Dec. 1919.

MACLAGAN, WILLIAM DALRYMPLE (1826–1910), Archbishop of York, was born in Edinburgh June 18 1826. He began life in the army, retiring as lieutenant in 1852 in order to go to Cambridge to study for the Church. He became a London rector, first at Newington and then at St. Mary Abbott's, Kensington, and in 1878 was nominated by the Crown to the bishopric of Lichfield. In 1891 he was made Archbishop of York. In 1899 he sat as assessor with Dr. Temple, Archbishop of Canterbury, when the decision was given against the use of incense and other ritualistic practices, and though himself a strong High Churchman he loyally upheld the primate's "opinion." He resigned his archbishopric in 1908, and died in London Sept. 19 1910.

M'MAHON, SIR ARTHUR HENRY (1862–), British soldier and administrator, was born Nov. 28 1862, the son of Gen. C. A. M'Mahon, F.R.S. He was educated at Haileybury and afterwards entered Sandhurst, where he obtained a sword of honour in 1882. In 1883 he joined the army, and in 1885 was appointed to the Indian Staff Corps and entered the Punjab frontier force. In 1890 he joined the Indian Political Department, and after acting as political agent in various small states was in 1901 appointed revenue and judicial commissioner in Baluchistan. From 1903 to 1905 he was commissioner in Seistan, also acting as arbitrator on the boundary question between Persia and Afghanistan in Seistan. In 1906 he received the K.C.I.E. From 1905 to 1911 he was agent and chief commissioner in Baluchistan, and from 1911 to 1914 Foreign Secretary to the Government of India. He was appointed Master of Ceremonies to King George V. during his visit to India (1912) and in 1914 became first High Commissioner for Egypt under the British Protectorate. He retired from this office in 1916 and was created G.C.M.G.

MACNAGHTEN, EDWARD MACNAGHTEN, Baron (1830–1913), British judge, was born in London Feb. 3 1830, the son of Sir Edmund Macnaghten, 2nd bart., of Dundarave, co. Antrim, whose baronetcy he succeeded to on the death of his elder brother, the 3rd bart., in 1911. He was educated at Queen's College, Belfast, and Trinity College, Cambridge, where he was bracketed senior classic in 1852. He was an enthusiastic oarsman, winning the Colquhoun sculls at Cambridge (1851), and the diamond sculls at Henley (1852). He was called to the bar in 1857, and became Q.C. in 1880, and a lord of appeal and life peer in 1887, having previously refused a judgeship. He sat as Conservative member for co. Antrim from 1880–5, and for co. Antrim (northern division) from 1885–7. Among the many important cases in which he came into prominence as a lord of appeal were the Taff Vale case of 1900–1, the Osborne judgment of 1909, both of these being concerned with points of trade-union law, and the Scottish Church case of 1904. He was also one of the arbitrators in the boundary dispute of 1899 between Chile and Argentina. Lord Macnaghten died in London Feb. 17 1913. His life peerage became extinct, but he was succeeded as 5th bart. by his son Edward (1859–1914).

MACNAMARA, THOMAS JAMES (1861–), British politician, was born at Montreal Aug. 23 1861. He was educated at St. Thomas's school, Exeter, and was afterwards trained as an elementary-school teacher at the Borough Road training college for teachers. He taught in various schools until 1892, when he became editor of the *Schoolmaster*. He was elected a member of the London School Board in 1894; in 1895 he unsuccessfully contested Deptford as a Radical, and in 1896 was elected president of the National Union of Teachers. He was elected for North Camberwell in 1900, and in 1907 entered the Government as parliamentary secretary to the Local Government Board. In 1908 he became parliamentary secretary to the Admiralty, retaining this office until 1915, when he became financial secretary to the Admiralty. He lost his seat in 1918, but the same year was elected for North-West Camberwell. In 1920 he became Minister of Labour in succession to Sir Robert Horne.

MACNAUGHTAN, SARAH BROOM (1864–1916), British novelist, was born at Partick, near Glasgow, Oct. 26 1864, the sixth child of Peter Macnaughtan, secretary to the British Steam Navigation Co. She was educated at home in Glasgow, and on the death of her parents came to England, living first in Kent, and then in London. Her first novel, *Selah Harrison*, appeared in 1898, and it was followed by several others, the best known being *The Fortune of Christina M'Nab* (1901); *A Lame Dog's Diary* (1905) and *The Expensive Miss Du Cane* (1907). She travelled a good deal, and had considerable experience in army nursing, gained partly in South Africa. At the beginning of the World War she joined Mrs. St. Clair Stobart's ambulance unit, and was head orderly through the siege of Antwerp, afterwards working under fire on the Belgian front. For this she received the Order of Leopold. In 1915 she went to Russia, penetrating as far as Persia, where illness overtook her. She returned to England in May 1916 and died in London July 24.

She had published *A Woman's Diary of the War* (1915), and a further account of her work, edited by her niece, Mrs. Lionel Salmon, *My War Experiences in Two Continents*, appeared in 1919.

MacVEAGH, WAYNE (1833–1917), American lawyer and diplomatist (*see* 17.269), died in Washington, D.C., Jan. 11 1917. After the outbreak of the World War he championed the cause of the Allies in an article, "The Impassable Chasm," contributed to the *North American Review* for July 1915. In his last article, "Lusitania Day: May 7 1916," published in the same magazine for June 1916, he assailed the slowness of the American Government in asserting its rights against Germany.

MACWHIRTER, JOHN (1839–1911), British landscape painter, was born at Slateford, near Edinburgh, March 27 1839. He began his art training under Robert Scott Lauder, and was elected a member of the Royal Scottish Academy in 1867, A.R.A. in 1879 and R.A. in 1893. His "June in the Austrian Tyrol" was bought in 1892 out of the Chantrey bequest. He died in London Jan. 28 1911.

MADAGASCAR (*see* 17.270).—The total pop. was estimated in 1921 at 3,504,900, including 17,600 Europeans (of whom nine-tenths were French), 5,300 Asiatics or Africans, and 3,482,000 natives of whose origin, because of their constant migrations, little was known. The pop. of Tananarivo (Antananarivo), the capital, was about 75,000. Madagascar is divided for purposes of administration into 23 provinces and 2 autonomous districts. Colonization takes place under the system of Government land concessions, limited to 10,000 hectares each and held under grant from the governor-general either free or subject to certain payments. The free concessions are reserved for French citizens, but land and forests near the railway connecting Tananarivo with the east coast can only be conceded by auction.

Tananarivo is connected with Tamatave, the chief port, by a railway 230 m. long, and another railway 100 m. in length runs from Tananarivo to Antisarabe, a watering-place.

Rice cultivation has greatly extended in consequence of improved means of transport, which made possible the establishment of large mills: the export in 1919 was 21,000 tons, valued at 12,436,000 francs. 14,886 tons of manioc, valued at 8,608,000 fr., were exported, for arrow root. Mangrove bark, used for tanning, is obtained in the forests, which cover ten to twelve million hectares. The frozen meat industry developed considerably during the World War; the export in 1919 amounted to 22,083 tons, valued at 66,131,000 francs. There were in 1921 eight million head of cattle, of which 420,000 were destined for slaughter. Six factories had been installed and the prospects of the industry were extremely favourable.

Coal occurs in four principal seams, one of which is 15 ft. thick. Heavy oils are obtained at great depths. The exploitation of graphite, which occurs in a stretch of country 750 m. in length, developed rapidly during the war, 27,838 tons being produced in 1917. Uraniferous and other radioactive ores also occur.

The total commerce of Madagascar, which in 1896 was about 17½ million fr., was in 1919 276,140,327 fr., of which imports represented 98,972,737 fr. and exports 177,167,590 fr.; trade with France, the United Kingdom and British colonies was as follows:—

	Imports fr.	*Exports* fr.
France	40,736,379	51,682,000
United Kingdom	12,215,181	5,113,000
British Colonies	27,227,962	4,139,771

Réunion (*see* 23.206), although nominally a dependency of Madagascar, is in effect a department of France. The cultivation of sugar, which is the chief industry, continued to develop, the annual export being between 30,000 and 40,000 tons, along with 35,000 to 40,000 hectolitres of rum. The production of vanilla also made progress. The general trade in 1918 amounted to 60,582,000 fr. (of which 16,592,000 were imports), showing an increase of 11,797,000 fr. over the previous year and an excess of 17,642,000 fr. over the average for the five years 1913–7.

MADERO, FRANCISCO INDALEGIO (1873–1913), Mexican president, was the son of Evaristo Madero, governor of Coahuila under Díaz and a large property owner of Jewish extraction. He was born on the family estate, Rosario, at Parras, Coahuila, Oct. 18 1873. His youth was employed in managing the family properties. During part of 1893 he attended the university of California. By 1903 he was known for independent political views, and in 1905 opposed the Díaz candidate for state governor. In 1908 he began his opposition to the reëlection of Díaz in 1910, writing *La sucesión presidencial en 1910*, which went to three editions. In 1909 he headed the anti-reëlectionist party as candidate for the presidency. His vigorous campaign was ignored by Díaz until June 1910, when he was arrested at Monterrey for seditious utterances at San Luís Potosí and incarcerated until after the election of Díaz. Being released on bail July 20, he escaped Oct. 7 to San Antonio, Texas, where he issued the Plan de San Luís Potosí, dated Oct. 5. It was then evident that the Díaz election had been legally affirmed. The revolutionists in San Antonio voted Nov. 6 to begin armed revolts simultaneously throughout Mexico. Disturbances began prematurely, and Madero, threatened with arrest for violation of neutrality, crossed into Chihuahua and headed the movement begun by Pascual Orozco and others. The revolutionists took Ciudad Juárez early in May, ending the prestige of Díaz, who resigned under pressure May 25. Madero entered Mexico City in triumph June 7. During the *ad-interim* presidency of Francisco de la Barra he was elected President in Oct. and inaugurated Nov. 6 for a term to end Nov. 30 1916. His rule was marked by visionary schemes which provoked party dissensions. Revolts caused strained relations with the United States. The revolutionary programme did not become law. Felix Díaz, nephew of Porfirio Díaz, revolted, but was captured in Oct. 1912. General Bernardo Reyes, ex-governor of Nuevo León, had previously been captured in the United States and given over to Mexico. Both were confined in the capital, but they were released Feb. 9 1913 by a rising of military cadets. Government troops joined them, besieging the national palace for 10 days. Then Huerta, commanding Madero's troops, deserted him, and forced the President and vice-president, José Pino Suárez, to resign Feb. 18. Although promised personal safety, they were killed on the night of Feb. 22 while being removed from the national palace to the Penitenciaría. In Nov. 1920 Francisco Cárdenas, the alleged assassin, committed suicide in Guatemala while under arrest for extradition demanded by the Mexican Government. (H. I. P.)

MAETERLINCK, MAURICE (1862–), Belgian dramatist and poet (*see* 17.298), produced his most popular work, *L'Oiseau bleu*, in 1911. It was first performed in Moscow, then in London as *The Blue Bird*, and later in Paris and New York. *Mary Magdalene* appeared in 1910, and in 1913 *La Mort de Tintagiles* was acted in London. During the World War he published a volume of essays, *Les Débris de la Guerre* (1916), and in 1919 appeared *Les Sentiers dans la Montagne* and two plays, *Le Miracle de St. Antoine* and *Le Bourgmestre de Stilmonde*. In 1921 his play *The Betrothal*, originally published in 1918, was produced in London, with special settings designed by Charles Ricketts.

MAGAZINES: *see* NEWSPAPERS.

MAGAZINES AND SHELL STORES.—In the following article an account is given of the storage of explosive ammunition in arsenal conditions, in fortresses, and in field warfare, from the point of view of safety and condition. Administration and working are discussed under Supply and Transport, and questions of site under Barracks and Hutments and Training Camps. A "magazine" is a building or buildings with passages leading thereto in which are stored explosives in bulk. A magazine must be under special "magazine" conditions with regard to precautions against fire or explosion. An "explosive store" is a building, standing apart from others, used for storage of explosives which are not kept under magazine conditions. A filled "shell store" is a store in which filled shells are kept.

Although in England the Explosives Act, 1875, expressly exempts Government magazines from its provisions, the conditions imposed by the Act apply generally to them.

The general principles that govern the arrangement for a magazine in Great Britain are as follows.

Site.—The site should be remote from dwelling houses, and from embankments for preventing inundations, as well as from any property which might be injured by an explosion. The distances away from buildings in which fires are used vary according to the amount of explosive to be stored, but 200 yd. may be generally assumed to be sufficient. Public thoroughfares or buildings having chimneys should not be permitted in the vicinity of a magazine; and such an extent of land should be acquired round the magazine as would preserve the isolation of the site. In this connexion two points have to be considered: (*a*) the danger to the magazine arising from too close proximity of other buildings; and (*b*) the danger to those buildings from the effect of the explosion of the magazine. The best protection is afforded by intervening heights of ground. Failing that, much protection is afforded by massive traverses of earth; and close plantation of trees will reduce the effects of explosion.

Construction.—The structural arrangements must be such that when the magazine is closed it will be as airtight as possible. The building should be substantially built, or excavated in solid rock, earth or mine refuse not liable to ignition; and be so made and closed as to prevent unauthorized persons having access thereto and to secure it from danger from without. Every magazine should have a lightning conductor. The compartments inside a magazine must be separated by partitions of such substance and character as will effectively prevent explosion or fire in one communicating with another. Protection must be provided against weather and dampness, and ventilation cared for. Suitable and uniform temperatures must be maintained. If a heating system is installed, it should be a steam or hot-water apparatus, with the pipes detached from the walls and clear of any timber work. In tropical climates cooling apparatus may be necessary when the temperature is continuously or for long periods above 70° F. In every magazine a chamber or portion of the entrance passage must be set aside for the putting on and taking off of magazine clothing and a barrier arranged between it and the magazine. Metal working parts of every kind used inside a magazine, such as locks, bolts, window fastenings, truck wheels, rails, and working parts of lifting machinery, must be of copper or copper alloy. This applies generally also to hand tools. For floors, a suitable asphalt, devoid of grit, is well adapted, and a rendering of "neat" cement for linings. Dados of glazed brick may be used to prevent the cement being detached by packages knocking against the walls. The interior of the building, and the benches, shelves and fittings should be of non-inflammable material, or be so lined or covered as to prevent the exposure of any iron or steel, or detaching any grit in such manner as to come into contact with the explosives in store. If the magazine be intended for storing cordite only, it should be of as light a form of construction as possible.

Working Conditions.—Lighting fires or smoking in or near a magazine is, of course, absolutely prohibited. Due provision must be made, by the use of suitable working clothes without pockets, suitable shoes, searching and otherwise, for preventing the introduction of tobacco pipes, tobacco in any form, matches, grit in any form, exposed iron or steel articles, or any substance or article likely to cause explosion or fire. Operations of weighing and packing should not be carried out in a magazine. Only lamps of special pattern must be used, and these, when not in use, must be kept in the proper lamp room. When electric light is installed, the distributing board must be outside the barrier of the shifting lobby.

For explosive stores the regulations for magazines are modified as regards the necessity for special clothing, but otherwise the regulations for magazines should be strictly enforced.

For the purpose of storage, all British service explosives are classified as follows:—

GROUP I. including generally all explosives in bulk, and cartridges if not protected by metallic cases. The explosives in this group must be stored in a magazine.

GROUP II. including percussion caps, detonators, fuzes, gaines, igniters, primers, tubes and similar items. The explosives in this group must be kept in an explosive store.

GROUP III. including inert fillings for shells and quick-firing cartridges. The explosives in this group may be stored in either a magazine or explosive store.

GROUP IV. including various bombs and chemical shell. The explosives in this group must be stored in a separate explosive store.

Each group is subdivided into divisions according to the characteristics of the explosives, which must each be kept in a separate compartment of the magazine or explosive store. Packages should be securely stacked in the several bays, and a clear space left between them and the walls to allow of free circulation of air and to prevent injury from damp.

In fortresses and defensive works, magazines and stores, from their position, must usually be more or less exposed to enemy fire, and must therefore be of sufficiently strong construction to keep out projectiles. Heavy traverses should be built round them. The general regulations regarding safety in magazines must be strictly adhered to, but as regards storage, variations may be permitted so as to allow fuzes and tubes to be kept in the shell stores adjoining the guns, provided that special shelves are fixed for them. In fortresses, cartridges, shells, etc., are always kept in batches according to date of manufacture and filling, in order to obtain uniform effect in firing.

In a theatre of war such definite provision of magazines and explosives stores cannot be made, except perhaps at the main base; and the necessary arrangements have to be improvised at base depôts and advanced depôts. Specific instructions cannot be given to meet all the contingencies of varying local conditions, and adequate measures must depend upon local ingenuity and constant supervision. The regulations for safety should be observed, whatever building or shelter is used.

Wooden huts with corrugated iron roofs can be employed in connexion with storage of explosives and ammunition; a height of 8 to 10 ft. from floor to eaves would be suitable, and such huts can be made splinter-proof by layers of sand-bags. A large storage hut may occupy a space 30 ft. wide by 300 ft. long, and would be divided into compartments or bays by traverses made of double walls of galvanized iron sheeting. A floor of road metal, rammed hard, would suffice. When a building is not available, a raised floor with tarpaulin supported on a framework, so as to allow of ventilation, is readily inprovised. All explosives should be kept in substantial cases or receptacles where possible. All ammunition necessarily kept in the open should be stored on battens and covered with tarpaulins, which covering should be removed whenever conditions are favourable in order to permit of ventilation and to prevent sweating. When shells are piled in the open they should not be exposed to the direct rays of the sun.

In the World War, ammunition was arranged in the British service as follows —

i. boxed ammunition;
ii. unboxed ammunition;
iii. trench-warfare ammunition;
iv. miscellaneous ammunition;
v. demolition explosives.

The stacks of ammunition require suitable disposition to minimize risks of explosion by accident or from enemy fire. For safety, distances of 400 yd. may be taken as adequate between categories, and 30 yd. to 100 yd. between stacks of the same category. At base depôts and advanced depôts arrangements for storage of ammunition can be made on more or less semi-permanent lines. From these depôts, ammunition passes to ammunition parks and ammunition columns where the arrangements have to be improvised as local conditions permit. With mobile warfare the movement of parks and columns would prevent any arrangements for storage, separate from the vehicles, of more than a very temporary character, as the principal object would be to deliver, as rapidly as possible, ammunition from the depôts to the particular batteries where it might be most urgently and immediately required.

For trench warfare, the system of "dumps" very naturally came into being, in order that there should be at hand quite a large supply for immediate use, irrespective of the quantity held by an ammunition column. These dumps would be classified according to the nature of the ammunition, and might take the form merely of stacks in the open, separated from each other by traverses of sand-bags and lying at convenient places. For dumps in the rearward area, convenience of transport would determine the locality; while for dumps near gun positions, local circumstances would dictate as to whether the dumps might be actually around the gun positions, or placed a few hundred yards away. (F. M. R.)

MAGNETISM, TERRESTRIAL (*see* 17.353).—During 1909–21 further developments occurred in various directions in the study of terrestrial magnetism; and these are dealt with below.

Instruments.—The intercomparison of the magnetic instruments of different countries has long had a recognized importance, and a good many comparisons have been effected since the early part of the 20th century, especially by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. A difficulty increasingly realized is the uncertainty whether any magnetometer can be considered invariable to the degree of accuracy ordinarily aimed at, viz. $1\sqrt{(0\cdot00001 \text{ C. G. S.})}$ in force and 0′·1 in direction. Until this difficulty is surmounted the establishment of any international standard would probably be premature. The use of a coil and an electrical current promises greater accuracy for force measurements than the ordinary magnetometer, with less risk of undetected change. Coil instruments for the measurement of H (horizontal force) have accordingly been designed in various countries, including Russia, Japan, Britain and America, but the accuracy attained remains for investigation. An additional reason for the development of an electrical method of measuring H is that the Q term in the deflection formula $2mr^{-3}(1+Pr^{-2}+Qr^{-4})$—where m is the magnetic moment, r the distance—is not really negligible under ordinary conditions. This complicates the observation by requiring three deflection distances, and the apparent changes in P and Q in some instruments raise doubts as to the measure of success attained. An instrument for the direct measurement of the vertical force would possess advantages, especially in high magnetic latitudes.

Survey.—Survey work on land and sea has gone on continuously under the auspices of the Carnegie Institution, and many of the results have been published. This work includes a survey of Australia by E. Kidson, and surveys of numerous remote regions in Asia, Africa and South America. Other recent surveys are those of New Zealand by C. Coleridge Farr, Belgium by A. Hermant, and Spain (preliminary) by U. de Azpiazu and R. Gil. There have been re-surveys of the British Isles by G. W. Walker, and of Japan under the general guidance of A. Tanakadate. A survey of India has long been in progress.

Diurnal Inequality Potential.—The derivation of the diurnal variation from a potential suggested by A. Schuster has been further considered. Assuming the derivation possible, W. van Bemmelen and S. Chapman have found the part of the potential representing internal forces relatively larger than Schuster did.

A. van Vleuten, examining the hypothesis critically, especially as applicable to quiet-day phenomena, has concluded that the balance of evidence is against it. A difficulty in the way of any general theory of the diurnal variation is the varied influence of disturbance. Not merely is the influence different at different places. At the same place it differs for the several elements, varies according to the season of the year, and is not the same at the same season of different years.

Eclipse Phenomena.—Several attempts have been made to ascertain how magnetic phenomena are affected by an eclipse of the sun. No final conclusion has yet been reached, but it seems fairly certain that if an eclipse effect exists, it is small, and probably represents a slight retardation in the changes natural to the hour.

Sudden Commencements.—Another inquiry depending on coöperation has been into the simultaneity or non-simultaneity of the so-called "sudden commencements" (S.C.s) of magnetic storms. Several independent investigators have failed to find any certain difference between the times of commencement at remote stations. It has been found, however, that S.C.s differ markedly in type in high and low latitudes, and their apparent duration may differ considerably at different stations. The investigation is complicated by the great difference in sensitiveness and in type exhibited by magnetographs.

De Bilt "Characters."—The study of magnetic phenomena has benefited from the international scheme which has had its headquarters since 1906 at De Bilt, Netherlands. Each coöperating station assigns to every day a "character" figure, 0, 1 or 2, according as the day is quiet, moderately disturbed or highly disturbed. The arithmetic means of the figures so assigned are given in the annual De Bilt lists, so that all days have international "character" figures ranging from 0·0 to 2·0. The intercomparison of the "characters" assigned at different stations has confirmed the view that disturbance is seldom, if ever, confined to one area.

Twenty-seven Day Period.—The existence of an authoritative international measure of disturbance for individual days has enabled the reality of a "27-day period," in magnetic disturbance to be investigated without any possible prejudice. The phenomenon has been found to exist for quiet as well as for disturbed days. A day which follows a conspicuously disturbed (or quiet) day after an interval of from 26 to 28 days has decidedly more than the average chance of being itself a disturbed (or quiet) day.

Diurnal Variation.—Again, comparisons have become possible of the diurnal inequalities in days, undoubtedly representative of quiet and of disturbed conditions. It has been found that in high southern latitudes—and presumably equally in high northern latitudes—the diurnal inequality is exceedingly sensitive to disturbance, and more especially so in winter. For instance, at the station of the Scott Antarctic Expedition in 1911–2 the diurnal inequality derived from the five days of largest international "character" figure in each of the four midwinter months had in each of the elements a range fully four times that of the inequality derived from the international quiet days (five a month). The type of the inequality was in this case but slightly affected by disturbance.

"Character" v. "Magnetic Activity."—For these and similar investigations the really important thing is to discriminate between the magnetic conditions on days of the same month or season. For this purpose the existing De Bilt scheme seems eminently satisfactory. But it is otherwise when we wish to compare different years. There is a natural tendency to vary the standard of "character" according as the year is quiet or disturbed. "Character" 1·0 is apt to mean decidedly less disturbance near sunspot minimum than near sunspot maximum. To remove this difficulty, F. Bidlingmaier suggested the use of "Magnetic Activity," defined as the mean value throughout the day of $\frac{1}{8}\pi\,(\alpha^2+\beta^2+\gamma^2)$ where α, β, γ represent the departures of the 3 magnetic components from their normal values. Apart from the difficulty of assigning normal values, the amount of labour entailed appears prohibitive. An alternative, suggested by C. Chree, to employ the square of the absolute daily range, or some quantity based thereon, has been tried at Eskdalemuir and De Bilt. It seems fairly workable, but entails sensibly more labour than the "character" scheme.

Variation of Disturbance with Latitude.—A comparison of the disturbances recorded in 1911–2 at the Scott Antarctic station with those at various other stations extending from Mauritius to Sitka (Alaska) has shown a marked tendency for disturbance to be simultaneously great in high northern and southern latitudes, and to be less at intermediate stations, whether north or south of the equator. Again, comparison of auroras with magnetic "character" figures, got out for individual hours as well as for individual days, has confirmed the view that an intimate relation exists between aurora and magnetic disturbance. This has long been accepted as true of large magnetic storms and aurora in countries such as England, where both phenomena are rare; but it seems also true of less extreme cases of the phenomena, which abound in high latitudes. The two phenomena at a station in high latitudes do not perhaps as a rule wax and wane together, but if we select a number of days (or hours) when there is bright aurora, the mean magnetic "character" of these days (or hours) is well above the average. It is doubtful whether visible aurora is not the rule rather than the exception in high latitudes. Faint aurora is undoubtedly sometimes seen on days which magnetically are quieter than the average.

Theory.—The various phenomena we have referred to—the synchronous occurrence of magnetic disturbance in different parts of the earth, its special development in high latitudes, the enhancement of the regular diurnal variation during disturbance, the association of disturbance with aurora, and the "27-day period" —all accord *in a general way* with the theory pretty generally held that magnetic disturbance and aurora are both due to the emission from the sun of some species of electrical radiation. On the nature of the radiation there is, however, a lack of agreement. Kr. Birkeland, one of the earliest and most eminent supporters of the theory, believed in β (negative) rays, possibly of greater velocity than any of artificial origin. C. Störmer, another eminent Norwegian authority, favours α (positive) rays. Difficulties in the way of either theory undiluted have been discussed by A. Schuster, S. Chapman and F. A. Lindemann. One of the chief difficulties is the scattering to be expected from the mutual repulsion of ions all of one sign.

When approaching the earth, ions, whether positive or negative, would naturally spiral round the lines of magnetic force, and so be concentrated in high latitudes. This fits in with the special development of aurora and disturbance in high latitudes, but leaves unexplained the occasional appearance of aurora in latitudes like those of central and southern Europe. The presence of ions should increase the electrical conductivity of the atmosphere, thus enhancing the amplitude of the regular diurnal variation, supposing that due, as is generally believed, to electrical currents in the upper atmosphere. The fact that disturbance enhances the diurnal inequality relatively more in winter than in summer would follow naturally from the very probable hypothesis that ordinary solar radiation itself increases the conductivity of the atmosphere. In high latitudes we may suppose that in winter the electrical currents associated with aurora play the part which in summer is largely played by direct solar radiation.

In the simplified mathematical theory of aurora and magnetic disturbance developed by C. Störmer the earth is treated as magnetized as it would be if only the first order Gaussian harmonic existed. Everything is then symmetrical round the axis of the first harmonic, whose north end according to J. C. Adams was in 1880 at 78° 24′ N. and 68° 4′ W., but moving west through about 0°·1 per annum.

In a theory of magnetic storms S. Chapman also assumes symmetry round an axis regarded as magnetic latitude 90°. He has derived mean results from 40 storms recorded at 12 stations arranged in 5 groups according to magnetic latitude. Confining himself to storms having an S.C., he regards the "general storm" phenomena, *i.e.* the phenomena not dependent on local time, as determined by the "storm time," or time elapsed since the S.C. The phenomena varying with local time he regards as composed of the ordinary diurnal variation + a "local storm variation," determined like the "general storm" phenomena by the magnetic latitude. He discusses the electrical current systems supposed to "flow in more or less horizontal strata in the upper atmosphere" to which the magnetic changes he has arrived at may be ultimately ascribed. "The external currents will, of course, be accompanied by corresponding induced currents within the earth which will modify their effects." Taking what he considered an average storm, Chapman calculated that it called for the expenditure of energy at the rate of about 2×10^{18} ergs per second for 15 hours.

To many minds theoretical researches of this kind are fascinating, but deductions from them, until confirmed by direct observation, are just as hypothetical as the theories themselves.

A statement of the respects in which there is a lack of uniformity or symmetry in magnetic phenomena may thus be of service in more ways than one. The complete Gaussian analysis indicates in reality a considerable departure from symmetry round an axis. High latitudes, moreover, were practically unrepresented in the data used for calculating the Gaussian constants, while the asymmetry in the positions of the north and south magnetic poles suggests that the result of the analysis may depart most from reality in the very regions where aurora and magnetic storms are most developed. Whatever may be true of a hypothetical aurora or magnetic storm representing the mean of a large number, the individual aurora or magnetic storm shows no approach to symmetry round a magnetic axis. The magnetic disturbance, though universally experienced, seems on a given occasion developed to a very different extent at stations having the same magnetic latitude. Even when there is a recognizable S.C. the sequence of events is widely different at different places, and on different occasions varies much at any one station. In low latitudes the S.C. is a change mainly in H, almost invariably a rise. This enhancement usually persists for a short time, and is then followed by a fall, which brings H below its normal value. But even in low latitudes an oscillation may often be seen in one or more of the elements; while in higher latitudes the S.C. movement is usually oscillatory in all the elements, the first and smaller change in H being a fall. The duration of the enhanced value in H following the S.C. is very variable. Sometimes it lasts five or six hours; sometimes, especially in large storms, a reversal and large drop occur within a minute or two. The superposition, following "storm time," of disturbance curves, unless these be sorted out, may lead to no happier results than the superposition of measurements taken from animals varying promiscuously from a giraffe to a whale. The result *may* be to give us a storm such as never existed. The average intensity even of magnetic disturbance must depend on other things than the magnetic latitude as defined by Chapman. According to this definition Agincourt (Toronto) and Kew are very similarly situated, but during 1911–2 disturbance was almost invariably much larger at Agincourt than at Kew. Again, the relative amplitude of magnetic oscillations at stations so comparatively near together as Kew, Stonyhurst and Eskdalemuir depends on the season of the year, and is considerably different in different years. Chapman's estimate of the energy of a magnetic storm depends fundamentally on several assumptions, the degree of probability of which is at present entirely a matter of opinion. But the estimate is at all events enormously less improbable than that made in 1892 by Lord Kelvin, on the hypothesis of direct magnetic action between the sun and the earth. Kelvin's numerical figure is nearly the square of Chapman's. Before another 30 years have elapsed magnetic phenomena may have been sufficiently investigated to admit of a really satisfactory comparison of theory and observation, but at present that stage has not been reached.

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MAHAFFY, SIR JOHN PENTLAND (1839–1919), Irish classical scholar (*see* 17.394). He became vice-provost of Trinity College, Dublin, in 1913 and succeeded Dr. Traill as provost in 1914. His provostship covered an eventful period in the history of Ireland and of the college, and Dr. Mahaffy took an active part in the questions which agitated the country. He was a vigorous supporter of the cause of the Allies in the World War, and encouraged the loyal effort of the college, which sent practically all its young men who were eligible for service to the front. Though a strong Unionist by conviction, he believed that the conditions after the rebellion of 1916 necessitated compromise. At his invitation the Irish Convention met in Trinity College in 1917, and Dr. Mahaffy, who was one of the members nominated by the Government, took an active part in the debates. He pressed for a solution of the Irish question on the lines of Swiss federalism, and embodied his views in a minority report which was signed also by Dr. Crozier, Protestant Archbishop of Armagh. In recognition of the services of the college during the war, Dr. Mahaffy was in 1918 made a G.B.E., the Lord Lieutenant, Visct. French, at the same time giving him the accolade. Dr. Mahaffy was thus the first Priest in Holy Orders to be made a knight. Dr. Mahaffy held many foreign and other distinctions; he was a D.C.L. of Oxford, an LL.D. of St. Andrew's, a Ph.D. of Louvain and a Ph.D. of Athens, as well as a corresponding member of several foreign learned societies. From 1911 to 1916 he was president of the Royal Irish Academy. He died April 30 1919.

MAHAN, ALFRED THAYER (1840–1914), American naval officer and historian (*see* 17.394), died in Washington, D.C., Dec. 1 1914. His later works included *The Interest of America in International Conditions* (1910); *Naval Strategy Compared and Contrasted with the Principles of Military Operations on Land* (1911, lectures delivered at the U.S. Naval War College, Newport, R.I., between 1887 and 1911); *Armaments and Arbitration* (1912) and *The Major Operations of the Navies in the War of American Independence* (1913).

See C. Carlisle Taylor, *The Life of Admiral Mahan* (1921).

MAHOMMED V. (1844–1918), Sultan of Turkey, was born at Topkapu Nov. 3 1844, a younger son of the Sultan 'Abdul Mejid (1822–1861). He led a quiet and retired life, and suffered at times considerably from the jealousy and suspicion of his elder brother, the Sultan 'Abdul Hamid II. On the deposition of 'Abdul Hamid he was invested as caliph (April 27 1909). He was for the most part merely a tool in the hands of the Committee of Union and Progress, and though he was supposed to dislike the pro-German policy of Enver Pasha, he was unable to take any effective steps to oppose him. He died at Yildiz July 3 1918, and was succeeded by his brother Vahid-ed-Din (b. 1861), who took the title of Mahommed VI.

MAINE (*see* 17.434).—The pop. of the state in 1920 was 768,014, in 1910 742,371, an increase of only 3·5%, as compared with 14·9% for the United States in the same period and 6·9% for Maine in the previous decade. There was a significant increase in urban population. The proportion living in places of 2,500 or more was 33·5% in 1900, 35·3% in 1910 and 39% in 1920. In 1910 the rural pop. was 480,123; in 1920, 468,445. The only one of the 16 counties showing a marked increase in rural pop. was Aroostook, which is one of the richest farming regions of New England.

The principal cities of the state, with their pop. of 1920 and rate of increase, were as follows:—

City	1920	1910	Increase per cent.
Portland	69,272	58,571	18·3
Lewiston	31,791	26,247	21·1
Bangor	25,978	24,803	4·7
Biddeford	18,008	17,079	5·4
Auburn	16,985	15,064	12·8
Bath	14,731	9,396	56·8
Augusta	14,114	13,211	6·8
Waterville	13,351	11,458	16·5

Of these cities Bath showed the largest increase, 56·8%, due to the shipbuilding activity in the World War period.

Agriculture.—According to the census of 1920 the number of farms in Maine was 48,227 as compared with 60,016 in 1910 and 59,299 in 1900. In 1920 28·4% of the land area was in farms as compared with 32·9% in 1910. There was, however, a large increase in the value of all farm property: $270,526,733 in 1920 as against 199,271,998 in 1910. A large proportion of the farmers, 94·2%, owned their farms. On Jan. 1 1920 there were 226,997 cows and heifers one year old and over as against 174,794 on April 15 1910. The receipt from sales of dairy products increased from $6,722,779 in 1909 to $15,543,524, or 131·2%, in 1919. Hay still leads other crops; 1,326,289 tons in 1919 as against 1,113,390 in 1909. Potatoes showed a decrease of 10·6% in amount but the value increased 411·9% from $10,224,714 in 1909 to $52,339,514 in 1919. Aroostook county has been very prosperous.

Forests and Lumber.—In 1909 an Act was passed by the Legislature creating a Maine Forestry Division, and providing for protection against forest fires therein. The area of this district is estimated at 9,500,000 acres. The forests outside the district contain about 4,500,000 acres. The average yearly cut along the Penobscot alone is more than 150,000,000 ft. b.m. Maine stands second only to New York in the manufacture of pulp and paper, and was first in the year 1916. Two great industries flourish in Maine on account of its rich possession of fine white birch—spool making and the wood novelty business. The International Paper Co. has developed Rumford Falls from a straggling village to a lively progressive town whose pop. has increased from 3,770 in 1900 to 8,576 in 1920. Millinocket, the centre of the Great Northern Paper Co., has also been made among the most progressive of new towns.

Shipbuilding and Fisheries.—The World War revived what was once a great industry in Maine, shipbuilding. Up to 1900 more than half the ocean vessels of the nation were built in Maine, but in 1916 only about 10,000 tons of merchant shipping was launched in the state. In 1917 over 40,000 tons was completed and in 1918 over 80,000 tons. The revival of the industry made Bath a boom town and also affected other coast towns, particularly Rockland, Camden, Belfast and Stockton. Maine lost the first American ship sunk by the Germans, the "William P. Frye," built and owned by Arthur Sewell & Co., destroyed by the German cruiser "Prinz Eitel Friedrich" Jan. 28 1915. Maine in 1918 appropriated over $30,000 for the protection and development of the fishing industry. The state department maintains 11 fish hatcheries, chiefly for stocking the inland waters of the state with salmon and trout. In 1909 the Labour Bureau in a careful investigation estimated that 400,000 visitors from other states came to Maine annually to fish, hunt or spend their vacations.

Manufactures.—In 1920 there were 16 mills in the state devoted to the manufacture of cotton goods. In 1917 the total value of the product was $29,239,167. In the same year there were 58 woollen-mills employing 8,440 workers. The cotton-mills occupy the large sources of power on the main rivers, while the woollen-mills located on the smaller streams are more scattered. In the 10 years ending with 1920 there have been no unusual developments in manufacturing except for an increasing realization on the part of the people of the value of water-power, and a good deal of political and industrial agitation has arisen on that question. The organization of the state Chamber of Commerce and Agricultural League in 1919 is an important landmark in the industrial history of the state.

Administration and Finance.—Since 1910 there have been adopted 10 amendments to the state constitution. The most important of these provide for the permanent establishment of Augusta as the state capital; for the issuing of bonds for the building and maintenance of state highways; for the issuing of bonds for a state pier and for the limitation of the state debt. The bonded debt of the state increased from only $698,000 in 1909 to $6,273,000 in 1917 and to $8,902,300 on Dec. 31 1920. This increase was largely due to highway construction.

Education.—Maine has enacted much progressive legislation for education; but on account of her large area and scattered rural population the problem of giving educational advantages to all the children is one of unusual difficulty. Much progress has been made by the abandonment of the small, weak school of less than eight pupils and the centralization of schools by the transportation of the children. But transportation in the rigorous winters and over the country roads in the springtime is not easy. The state Department of Education has endeavoured by a wise system of subsidies to build up the rural schools and has provided for such teachers special inducements. Maine had (1920) 228,489 inhabitants between the ages of 5 and 21; and of these 131,313 were enrolled in the elementary schools and 23,291 in the secondary schools, high schools and academies. The state has done much to advance vocational training through legislation that gives assistance to towns for courses in manual training, domestic science and agriculture.

History.—In Jan. 1911 Frederick W. Plaisted was inaugurated governor, the first Democrat to hold that office since 1880. The same month Charles F. Johnson, of Waterville, a Democrat, was chosen U.S. senator; and in Sept. another Democrat, Obadiah Gardner, of Rockland, was appointed senator. This was the first time since the Civil War that the Democrats had held these three major offices. In Sept. 1911 the state voted on the repeal of the prohibitory amendment to the constitution; in an extraordinary vote the amendment was retained by 60,853 votes to 60,095. The surprisingly large vote for repeal was due in large measure to the disgust of the voters at the lax enforcement of the law. It is interesting to note that this large vote against prohibition in the state of Neal Dow came only a few years before the adoption of national prohibition. At the same election a law which applied the direct primary to all candidates for state and county office was passed. In the Nov. election of 1912 Woodrow Wilson won the electoral vote of Maine by reason of the split in the Republican ranks between Taft and Roosevelt. In 1916 the split was healed, and Maine has since that time run true to form as a Republican state. In 1917 the Legislature was much concerned with the question of water-power, and under the leadership of Percival P. Baxter, of Portland (afterwards governor), refused to allow the transmission of power outside of the state. In Sept. 1917 in a referendum woman suffrage was overwhelmingly defeated, 38,838 voting "No" and 20,604 voting "Yes."

Maine took an active part in the World War, being the first in the Union in the number of volunteers in the army and navy in proportion to population, and the second state to organize a committee of public safety. Up to Dec. 31 1917 over 10,000 men had volunteered. The first drafted man to reach a Federal camp was from Princeton, Maine. Maine was throughout the struggle distinguished for the unity and whole-heartedness of her support, as in the few months after the war she was distinguished for having no radical agitation and no arrests of Reds.

In Jan. 1921 Maine had three governors, Carl E. Milliken until the inauguration of Frederic H. Parkhurst Jan. 6, who served until his sudden death on Jan. 31, when he was automatically and immediately succeeded by Percival P. Baxter, of Portland, the president of the Senate. Governors since 1911: Frederick W. Plaisted, Dem., 1911; William T. Haines, Rep., 1913; Oakley C. Curtis, Dem., 1915; Carl E. Milliken, Rep., 1917; Frederic H. Parkhurst, Rep., 1921; Percival P. Baxter (acting), Rep., 1921.

(K. C. M. S.)

MALABARI, BEHRAMJI (1853–1912), Indian journalist and social reformer (*see* 17.453), died at Bandora, near Bombay, July 12 1912. Up to the time of his death he continued to edit the monthly periodical *East and West*, and he wielded remarkable influence with a long succession of viceroys, governors and heads of departments in India, as well as originating various philanthropic enterprises.

See biographies by Payaram Giduma (1891) and Sirdar Jogendra Singh (1914).

MALARIA (*see* 17.461).—The discovery that this disease—perhaps the most widely spread of all human diseases in warm countries—is carried from man to man by certain species of mosquitoes was made in 1897–99, and gave a great stimulus to the study of tropical diseases, both of men and of animals, in general. Schools of tropical medicine were formed in consequence, in most of the larger countries of the world, where medical men could obtain instruction regarding the new knowledge; societies of tropical medicine and special journals were founded everywhere; the British Colonial Office established a Tropical Diseases Bureau and an Entomological Bureau which publish frequent admirable abstracts of new literature on these subjects; and the whole of tropical sanitation was powerfully affected—though perhaps not quite as decisively as it should have been. Nevertheless, as regards malaria, it cannot be said that the results have been so great as were hoped for. Except for the identification, classification and study of mosquitoes (*Culicidae*) all over the world—based chiefly on F. V. Theobald's monumental book on the subject—and except for numerous local labours of verification, nothing of fundamental value has been added to the knowledge which we possessed at the beginning of the present century. The reason for this has been partly that the attention of investigators was largely diverted to other diseases which had not then been so minutely examined—especially sleeping sickness, yellow fever, Leishmaniasis, and various forms of relapsing fever; but also partly due to absence of that persistent individual effort which alone is capable of solving the difficult problems of science. There has been no encouragement of such effort, and even little coördination of the slighter researches which are always being carried on in various countries. Many important questions therefore still remain unanswered; and if it had not been for the exigencies of the World War there would have been little now to add to what was available up to 1910. Certainly innumerable papers have been published; but in some cases the writers are evidently unacquainted with more than a tithe of the enormous literature; in others they mistake speculation for proof; and in nearly all they discontinue their efforts before reaching definite conclusions.

Similarly, the prevention of malaria on the large scale, which was rendered possible or even easy (in many places) by the new knowledge, has not been carried out as generally as was hoped at the beginning of the century. The classical successes obtained at Ismailia and in the Federated Malay States, in Italy, and at Havana, Hong-Kong, Khartum, and elsewhere do not seem to have encouraged the same kind of work in other localities—excepting the long-continued labour of M. Watson in the Federated Malay States and the brilliant sanitary victory of General Gorgas and the Americans, over both malaria and yellow fever, at Panama. The method of mosquito-reduction against malaria was first suggested and tried by a band of volunteer British workers in Freetown, Sierra Leone, in 1899, when full details of the method were published by them; but the work at Panama was on such a large scale and was so logically and thoroughly done that it set an example which we can only regret has not been more widely followed. The reasons for this are that local authorities always dislike spending money on sanitation and that local sanitary officers seldom possess much influence—or exercise it if they do possess it. For a long time also such practical efforts were much hampered by a school of writers who pleased the authorities by arguing that mosquitoes are irreducible, and that it is better to prevent malaria by quinine or by the use of mosquito-nets, and so on—the truth being that local conditions must always determine the kind of prophylaxis which it is best to adopt. The history and details of all this will be found in *The Prevention of Malaria* (1911), by Sir Ronald Ross, with chapters by A. Celli, W. C. Gorgas, M. Watson, A. Balfour, and others.

Until the war spread to the eastern fronts British armies suffered little from tropical diseases; but then the Empire was compelled to pay dearly indeed for its neglect of investigation of these diseases in the past. In 1915 a terrible epidemic of dysentery, both bacillary and amoebic, afflicted the forces in the Dardanelles and contributed largely to the failure of that expedition. In the summer of 1916 a similar epidemic of malaria occurred among the troops on the Salonika front and continued until the end of the war. Apart from the numerous ship-loads of men invalided to Egypt, Malta, and Britain for these diseases, twenty-five thousand men had to be repatriated from Salonika during the height of the war for general disability caused by malaria. Both malaria and dysentery caused havoc among the forces in German East Africa and, perhaps to a less extent, among the forces in Mesopotamia. Not only did this sickness cripple the armies during the struggle, but it has left a legacy of relapses, both of malaria and of dysentery, which are now being heavily paid for by the British taxpayer in the form of pensions and medical treatment.

Towards the end of the earlier article it was remarked that " recent discoveries have done little or nothing for treatment. Quinine still remains the one specific." This was true in 1910, and it is this fact which has cost the British taxpayer so much. But our ignorance was deeper than is implied in the quotation; for, although we knew that quinine is the specific for malaria, we did not know exactly how it should be used to the best advantage. Malaria is preëminently a disease which continues to relapse for months and years after a single infection by the mosquito, wherever the patient may be, however he may live, and in spite of quinine treatment as it is usually given. We knew that quinine in almost any doses from twenty to forty grains daily, or even less than this, was generally sufficient to control actual attacks of fever in two to four days, and to do so almost with certainty; but we did not know what dosage to use for the purpose of extirpating the infection, nor the nature of these relapses.

Numerous speculations had been advanced as to their nature. Some thought that the parasites enter upon a resting-stage somewhere within the tissues during the fever-free intervals. F. Schaudinn proposed as a hypothesis that the sexual parasites, which generally are not concerned with the patient's fever, suddenly begin to produce spores asexually when a relapse occurs; but the evidence which he gave for this view did not bear careful examination. Sir Ronald Ross, however, had always held that the parasites continue to breed in the blood during the " rallies " just as they breed during the " relapses," except that in the former their numbers are too small to produce a febrile reaction. He had also long been much concerned regarding the defects in our knowledge of how to treat these relapses, and, in consequence, commenced researches on these subjects in collaboration with D. Thomson at Liverpool. The result was that, as he had anticipated, the parasites were found to be present in the blood in very small numbers during the rallies and to multiply greatly during the relapses. The number required to produce an attack of fever was roughly about 250 millions (a man contains about three million cubic millimetres of blood); but during a rally the numbers fall to a very few per cubic millimetre, while during a relapse the numbers may reach a total of many thousands of millions or may even exceed one million millions. This suggested that the proper way to extirpate the infection entirely was to give quinine constantly over a long period until the last parasite had been destroyed; but the material at Liverpool did not provide cases suitable for trial of this thesis—so that when the war broke out we were still ignorant regarding it.

When the outbreak of malaria at Salonika occurred in 1916 Sir Alfred Keogh, the director-general, Army Medical Services, at once endeavoured to cope with the situation; and early in 1917 he appointed a special malaria hospital in each Command in the United Kingdom for the express purpose of investigating these questions, of finding a permanent cure if possible, and of treating the thousands of men who were being returned home sick with malaria from the eastern fronts, Sir Ronald Ross being also appointed Consultant in Malaria at the War Office. Many of the results will be found in the War Office publication: *Observations on Malaria by the Medical Officers of the Army and Others* (War Office, Dec. 1919). The fact, mentioned above, that moderate doses of quinine will control actual attacks within a few days was fully verified, and with very few exceptions; but it was quite otherwise with the complete extirpation of the infection which was so urgently required. Almost every form of treatment that had ever been suggested—enormous doses of quinine reaching one hundred grains *per diem*, smaller doses continued for three weeks or more; additional medication with arsenic and other drugs; continuous doses lasting for a month, and various kinds of interrupted dosage—all proved quite uncertain. Thirty grains of quinine continued every day for three weeks proved a bad failure. Intramuscular injections and even intravenous injections did no better; and the result was that men who were presumed to be cured relapsed again in a month or two after returning to duty, while those who remained apparently well even for some months relapsed later on. That is to say, a large proportion of the men who had once been infected with malaria became almost useless for further service—though certainly a few cases appeared to have been finally cured. It should be added that numerous nostrums advocated for malaria proved incapable not only of checking relapses but also of influencing the number of parasites present during fever; the only exceptions being one or two arsenical preparations, which, however, certainly proved no *better* than ordinary quinine.

In all these attempts, be it noted, treatment had seldom been continued for more than one month and seldom or never for more than two months—owing, of course, to military exigencies. But after the Armistice, when we were called upon to deal with large numbers of discharged soldiers, a longer period of treatment was decided upon. In 1918 two whole divisions, full of malaria, had been brought from Salonika to France and were there subjected to a longer course of treatment preparatory to their being sent again into the firing-line. The regiments arrived in an extremely bad condition, but were all placed in camps in the Dieppe region, and the men were there given 15 grains of quinine in solution once daily for a fortnight, followed by 10 grains of quinine in solution daily for two and a half months more. The course, which was designed by Col. J. Dalrymple, was carried out most strictly under his supervision, and had marvellous results, almost the whole of the two divisions being found fit for the front at the end of the three months. About the same time large malaria concentration-camps were established in England, where cases were given similar treatment but for shorter periods; and it was found generally that:—(1) doses of less than 10 grains daily did not suffice to prevent relapses even while they were being taken; (2) doses of 10 grains daily did suffice to prevent relapses while the doses were being taken, except in about 6% of the cases, most of whom, however, relapsed during the first few days of the treatment; (3) 15 grains a day reduced the relapses still further, but only to about 4% or 5%.

The long-continued treatment of malaria had been advocated previously; but it was now proved to be so satisfactory that the authorities decided to apply it to pensioners also. In Oct. 1919 the Ministry of Pensions established large clinics for tropical diseases; and the three-months' course was given as a routine to the malaria cases. In one London clinic alone nearly 30,000 pensioners have been treated in this way. The results have been admirable, and probably very few men who have taken the treatment properly have returned. But the 10 grains of quinine must be taken religiously every day. The explanation of this success is that each dose of quinine makes a small reduction in the number of the parasites present; and that this reduction occurs every day until finally none of the *Plasmodia* are left. An easy calculation shows that the curve of the fall in the number of *Plasmodia* must be a logarithmic curve—so that the treatment must be continued for a long time in order to reduce to none the vast numbers of the parasites found during the attack. Empirically, three months appear to be enough, but in obstinate cases or in very early ones four months might be better.

Many experiments were made during the war with a view to ascertaining whether *larger doses* of quinine administered less frequently would not be as satisfactory as the 10 grains administered daily. Thirty grains given two days a week and 20 grains given three days a week yielded good results, but any dosage under a total of 60 grains a week proved insufficient; and, in fact, the daily small dose is more easily and therefore more certainly taken by patients (out of hospital) than the larger occasional dose, which causes more dyspepsia and headache and is therefore frequently postponed.

Other salts of quinine besides the sulphate were tried. The hydrochloride and bihydrochloride affect the digestion less and seem to be as satisfactory; the tannate has been much used in Italy, especially for prophylaxis among children; and various other salts have been commended from time to time. Cinchona bark contains many alkaloids besides quinine and many of these were on trial for a long time, especially at the malaria depot, Dagshai, India, where Maj. H. W. Acton obtained the best results for the benign tertian parasite with cinchonidine and quinidine and with the mixture called "cinchona febrifuge." But further investigations are still required.

The fact that relapses are banished or largely reduced while quinine is actually being taken in sufficient amount is now seen to account, at least partially, for the supposed good effect of "quinine prophylaxis"—clearly, if relapses are rendered less frequent, the total number of attacks registered in the malaria returns will be smaller. But this does not prove that persons cannot become infected while they are taking, say, 10 grains of quinine daily—which is the true meaning of the term "quinine prophylaxis." In Salonika it was frequently found that bodies of men who were given as much as 30 grains daily as a prophylactic remained free from attacks while they were taking the drug but "went down" with malaria as soon as they stopped it—showing that they had been infected in spite of it. Much dissatisfaction was felt at these results; but probably they would have been more successful if the medication had been continued longer—long enough to eradicate the infection *if acquired*. Sir Ronald Ross has therefore always felt that, to be effective, quinine prophylaxis should be continued in 10-grain doses daily for three months after a subject has left the malarious locality. There is also much to be said for the view that quinine prophylaxis breaks the initial force of an infection when it does occur. But, from the results obtained at the malaria centres and camps during the war, any dosage under 10 grains daily for an adult is scarcely likely to be useful (children can be given a larger proportion by body-weight—say twice as much). These conclusions have been strongly confirmed by the work of Ed. and Et. Sergent on the malaria of birds.

Many researches have been made regarding the absorption and elimination of quinine. Before the war the chemists laid down that it is absorbed less readily—and not more readily as clinicians seemed to think—from intramuscular injections than when given by the mouth; but this view was not supported by investigations carried out during the war. Many clinicians, especially in Mesopotamia, strongly advocated intravenous injections in serious cases, but analysis of their arguments does not beget complete confidence in their views. According to classical Italian work quinine destroys only the young *Plasmodia*—so that 48 hours or more may elapse before its good effects become manifest. The impatient clinician is therefore often tempted to think that the orally-administered quinine has been a failure and to resort to an intravenous injection just at the moment when the former begins to act—and so, of course, attributes the benefit to the injection. Injections must be given in certain cases; but the very large experience obtained in the home hospitals suggested that there is really very little difference in the values of the various kinds of quinine-administration in ordinary cases. There is also now reason for thinking that very large doses of quinine are resisted by the blood and eliminated more quickly than more moderate doses, and may therefore actually have less effect.

The prevention of malaria on the battle-front was always difficult and sometimes impossible. Mosquito-reduction in the face of enemy fire is impracticable; quinine prophylaxis was, as stated, disappointing; and the armies were obliged to fall back upon mosquito-nets and mosquito-proof tents and bivouac shelters—which were carefully designed by the British War Office. Better results were obtained at the bases of operations, especially in Palestine; and a very successful campaign of mosquito-reduction was carried out by Col. J. C. Robertson at Taranto in southern Italy. Apart from the war, the American Rockefeller Foundation, various authorities in Italy, South America, and elsewhere, and the planters in the Malay States have done similar useful work.

Even long courses of treatment will not necessarily cure people who are subject to re-infection while taking the courses; and it is even possible that they are not so effective during the first six months or the first year of infection as they are later. It must be remembered that the results advocated above were obtained among returned cases in Britain. In old cases the parasites are not easily found in the blood except while a relapse is occurring; but it must not be inferred that they are entirely absent in such cases simply because they cannot be detected in the minute quantity of blood usually examined by the pathologist; and the statement sometimes made that cases which do not show the parasites in the blood are no longer infected, may be for this reason quite untrue. Many detailed investigations of the parasites themselves, of their presence in various organs, and of the pathology of the disease have been made during the last ten years, but have not given new results of any great importance. The definite objective diagnosis of chronic malaria among out-patients still remains difficult in spite of various methods which have been advocated, especially by foreign observers. Lastly it may be mentioned that the mathematical theory of the distribution both of mosquitoes in localities and of the occurrence of cases of malaria from time to time has been worked out by Sir R. Ross and by Prof. Karl Pearson. (R. Ro.)

MALAY STATES, FEDERATED (*see* 17.478).—This territory enjoyed a notable immunity from sufferings entailed by the World War, and was able to make substantial contributions in money and armaments toward the needs of the British Empire. The pop. in 1919 was estimated at 1,315,700; the birth-rate was 24·57 and the death-rate 29·37 per thousand. In 1918 the influenza epidemic caused 5,643 deaths. Malaria is by far the most deadly disease normally; the death-rate from this was 12·9 per thousand in 1919, but a slight reduction is apparent, and the work of the special malaria bureau is extending.

The estimated pop. of the several states was: Perak, 622,403; Selangor, 391,103; Negri Sembilan, 156,679; Pahang, 145,515. The chief towns had populations as follows according to the census of 1911: Kuala Lumpor (Selangor), 46,718; Ipoh, 23,978; Taiping, 19,556; Kampar, 11,604 (all in Perak); Seremban (Negri Sembilan), 8,667; Kuala Kuantan (Pahang), 2,102. The pop. in 1911 included the following nationalities: Europeans and Americans, 3,284; Eurasians, 2,649; Chinese, 433,244; Malays, 420,840; Indians, 172,465; Japanese, 2,029. Out of the total number of labourers on estates, 237,128 in 1919, 160,657 were Indians. Of these, 59,154 came from India on free passage during the year, out of a total of 71,000 Indian immigrants in all. Chinese immigrants numbered 25,816, and emigrants 26,033. The activities of a Chinese Bolshevist society working from headquarters at Canton were revealed among the trade guilds, and many labourers were induced to limit their output. The Chinese Triad societies continued to cause trouble in various directions of organized crime such as robbery and blackmail. Serious crimes numbered 1,002 in 1919 and 821 in 1918; gang robberies were especially numerous in Kinta (Perak) until two powerful robber bands were broken up in 1919. In that year 469 persons were banished, 400 being Chinese. The police numbered 87 British and 3,479 Asiatics.

In 1919 important movements for the extension of education were set on foot, despite difficulties encountered in increasing the number of teachers and the improvement of the teaching standard. A new training college for teachers was established at Tanjong Malim. A temporary scholarship scheme for sending teachers to Hong-Kong University was set on foot, to serve until more training colleges were established and pending the opening of Raffles College, founded in Singapore. In 1919 there were 533 schools, with an average attendance of 27,325.

Revenue amounted in 1919 to $72,135,075 ($=2s. 4d.), the principal sources being customs ($18,024,762), licences, etc. ($17,921,677) and railways ($14,957,460). Expenditure amounted to $70,676,961, the largest item being upon railways ($26,421,822). The expenditure of the agricultural department was $558,156 and the revenue $266,360. Important researches were made on the deterioration of rubber in storage, which was found to be due mainly to surface oxidation, from which it is indicated that the slab form is preferable to the crêped form for storage. The mouldy rot disease (in Negri Sembilan) and the brown bast disease were further investigated. A Government experimental coco-nut plantation has been started. The forest department had in 1919 a surplus of revenue amounting to $490,877, and over 10 per cent of the total area of the states is in reserved forest. The commercial timbers of the country are in process of being scientifically investigated, and the distillation of native woods has also been made a subject of research.

The mines of the territory employed 113,107 hands in 1919. Revenues from mining, exclusive of special war taxes, amounted to $10,489,185. Tin was exported to the amount of 620,518 piculs (of $133\frac{1}{3}$ lb.), and the average price per picul was $120.68, as against $150.62 in the preceding year. In the early part of 1919 tin was unsalable locally, and the Government bought from the local mines pending the reëstablishment of the market, the subsequent sales realizing nearly $1,000,000 profit. Other minerals were produced as follows: tungsten ores, 7,323 piculs (exported); coal, 191,293 tons; gold, 16,402 oz., of which all but 1,096 oz. was from the Raub mine.

The total value of exports in 1919 was $279,135,105 (from Perak, $124,733,232; Selangor, $100,848,202; Negri Sembilan, $42,289,333; Pahang, $11,264,338), the principal articles, in addition to the minerals already mentioned, being rubber and copra. Imports in the same year were valued at $118,854,965. One thousand one hundred and twenty-two merchant vessels, including 197 ocean-going steamers, called at Port Swettenham, over 97 % being British. There were 949 m. of railway with 212 stations open at the end of 1919. Connexion was established between the Malayan and Siamese railways in 1918, and a service between Singapore and Bangkok was inaugurated, the journey occupying four days. The length of metalled roads in 1919 was 2,362 m. (Perak, 835; Selangor, 763; Negri Sembilan, 420; Pahang, 344); of earth roads, 158 m.; of paths (other than the smallest), 1,791 m.

The telegraph and telephone system was extended by over 800 m. of line between 1910 and 1919, and in the latter year amounted to 2,372 m., in addition to which the postal and telegraph department of the Federated States had 121 m. of line in Johor. (O. J. R. H.)

MALAY STATES, NON-FEDERATED (*see* 17.482).—(1) *Johor* (*see* 15.475).—A British general adviser to the Sultan was lent by the Federated Malay States Government in 1910, and other officers of the same service were seconded to conduct Government departments in Johor. In subsequent years the prosperity of the state was greatly enhanced; the administration was improved, roads and railways were extended, and a trigonometrical survey was undertaken. Town boards were created in Johor Bahru, the capital, Bandar Maharani, and Penggaram (Batu Pahat), and effected improvements in sanitation, etc.

With increased prosperity came a great increase in pop.; the pop. according to the census of 1911 was 180,412, but a conservative estimate in 1919 put it at 300,000. In 1919 revenue amounted to $11,002,777 ($=2s. 4d.) and expenditure to $8,223,862, the revenue being almost exactly double, and the expenditure more than double, that in 1915. Imports were valued in 1919 at $29,524,700, and exports at $71,279,930. In 1915, 9,197 tons of rubber were exported; in 1919, 27,890 tons, valued at $53,203,400. Copra, areca nuts, tin, tapioca and gambier were the other chief exports. The development of tin-mining dates almost wholly from 1911; it is carried on principally in two fields, Mersing and Kota Tinggi.

The new educational system of Johor, in which English is taught concurrently with Malay, appears certain of success. In 1919 there were 71 vernacular schools with an average attendance of 3,058, and the attendance at English schools was 693, the chief being the Bukit Zahara school at Johor Bahru, which has been reconstructed.

The state had in 1919 a military force numbering 590; a detachment was employed in the defence of Singapore, 1915–9.

(2) *Kelantan.*—Pop. (1911), 286,751. Revenue (1919), $1,141,444; expenditure, $1,065,012. Exports (1919), $5,467,424; imports $3,876,679. Out of the total exports, rubber represented a value of $3,577,127. The total value of direct trade, or trade other than with the Straits Settlements and Malay States, was $1,847,115, the export trade being almost wholly with the United Kingdom ($641,515), while imports were from that country, the Netherlands, India and Siam.

In 1912 the agreement between the Sultan and the Duff Development Co. was determined, and the Government renewed the sovereign powers previously conceded to the company over nearly two-thirds of the area of the state. The company retained various agricultural and mineral rights, but mining remained almost undeveloped down to 1920. In 1919, however, an agreement was made with Chinese interests for the working of a mineral area in the Nenggiri, and a little tin ore was exported from the Bukit Yong concession in the Kamuning district.

A ferry service between Kota Bharu (capital of Kelantan) and Plekbang was reopened in Sept. 1919.

(3) *Trengganu.*—Pop. (1911), 146,920. In 1918–9, when there was a serious shortage of rice and other food supplies, 3,000 persons were reported to have emigrated from northern Trengganu to Kelantan, and many villages were abandoned.

After the suzerainty of this and other states was transferred to Great Britain by Siam under treaty of 1909, the Sultan of Trengganu only agreed to the appointment of a British agent with the functions of a consular official. In May 1919, however, he agreed to receive a British adviser and to act upon his advice in all matters of finance and general administration, excepting such as touch the Mahommedan religion. The state remains in a backward condition, but this important change of régime was willingly accepted, and presages extensive developments and reform.

Revenue and expenditure in 1915 amounted to $183,723 and $183,470 respectively; in 1919 to $762,455 and $756,977. Revenue was formerly obtained almost wholly from monopolies, but these were retained in 1919 only for gaming, spirits, pawnbroking, and turtle-eggs. This last peculiar monopoly yielded between $5,000 and $6,000. Other former monopolies, such as customs and opium, which were farmed out, yielded greatly enhanced sums under direct Government control.

Complete trade returns for the state are not kept, but imports into the port of Kuala Trengganu were valued at $2,417,645 in 1919, and exports at $1,718,428. Figures for the Singapore-Trengganu trade showed a value of $1,911,014 for imports into Trengganu, and of $3,816,670 for exports. The chief exports were dried fish, tin ore, wolfram ore, copra, Para rubber and silk sarongs. The export of tin ore to Singapore was 10,194 piculs in 1918 and 10,580 in 1919; of wolfram ore 10,368 and 9,408 piculs in the same years. The tin-mining industry, in Kemaman district, is chiefly in European and Chinese hands. Wolfram is worked in the same district and in Dungun; considerable attention has recently been given to prospecting, and extensive deposits of graphite and magnetite have been located. Complaint was made, however, of the corrupt condition of the land department, and the appointment of a European commissioner of lands was urged. Rubber plantations are mainly in Danish hands; the state is not self-supporting in the principal food crops; agricultural development on commercial lines attracts mainly Europeans, Chinese and Japanese; and the fish trade is held by Chinese agents of firms in Singapore. The advance in commercial prosperity it may be observed, has not been conspicuously reflected in improved conditions for the peasantry.

(4) *Kedah.*—Pop., 1911, 245,986; 1919 (est'd), 300,000. The influenza epidemic of 1918–9 was exceptionally severe, notably among Malays and Tamils, but less among the Chinese. Revenue (1919), $4,941,484; expenditure, $4,282,038.

Complete trade returns are wanting, but the chief exports are rubber, tapioca and sago, tin ore, live stock and poultry, and normally rice. But the general shortage of rice in Malayan and adjacent countries in 1918–9 led to such heavy export from Kedah that in Feb. 1919 it was necessary to prohibit export of paddy, and to control the home distribution and milling. The output of tin ore in 1919 was 11,799 piculs, but this represents a decrease, and the known tin-fields were becoming exhausted. In the same year the largest-yielding wolfram workings in the British Malay States, at Sintok, North Kedah, were closed down owing to the fall in price of tungsten. The yield of timber from forests under the forest department was nearly 15,000 tons, but accessible timber was becoming scarce and rising in price, and its want delayed many public works. The export and import of cattle, pigs, sheep and goats continued large though somewhat declining. Cattle and cattle-sales are licensed and registered, and for a better control of the trade with Siam a quarantine station was established for all the British Malay States at Pedang Besar, Perlis. Agricultural estates (of which there were 202 of 100 ac. or more in 1919) employed 35,673 labourers; most of these lands were under rubber cultivation.

The educational system of this state has notably advanced. Two Government English schools were maintained in 1919, at Alor Star and Sungei Patani, with 294 pupils, mostly Malays and Chinese. There were 60 vernacular schools: average attendance 4,867.

The Public Works Department maintained 314 m. of streets, metalled roads, earth roads, and bridlepaths, and 165 m. of canals in North Kedah.

(5) *Perlis.*—Pop., 1911, 32,746; 1919 (est'd), 36,000. Revenue (1919), $294,044; expenditure, $243,885. Copra, tin ore, fish, live stock and paddy were chief exports.

Perlis has not, like other Malay states, neglected its native agricultural pursuits in favour of those of greater commercial value, and it escaped the food shortage common to neighbouring countries in 1918–9. The output of tin ore, 1,896 piculs in 1919, was declining; stream tin appeared to be exhausted, and the revenue from royalties on tin ore declined to $15,897 from $26,948 in 1918. The guano hills had ceased to be worked for export. An outcrop of coal at Bukit Arang has been prospected, but the signs of petroleum had not been exploited in 1921. (O. J. R. H.)

MALTA (*see* 17.507).—The constitution, as set forth in the letters patent of June 3 1903, was amended Dec. 30 1909, when two elected members of the Legislative Council were given seats on the Executive Council. For some time previous to 1919 a scheme was being worked out for the further modification of the terms of the constitution. In Sept. 1919 the Under-Secretary of State for the Colonies (Col. Amery) visited Malta and discussed the various projects put forward. On June 12 1920 the governor (Field-Marshal Lord Plumer) communicated the decision of His Majesty's Government to grant a constitution which provided for responsible control by the Maltese of local affairs. The letters patent, promulgated on April 30 1921, came into force on May 16 and provided for the creation of a Senate of 16 members and a Legislative Council of 32–40, elected on a proportional basis and controlling its own ministers. The Ministry is to consist of not more than 7, representing the Colonial Secretary's office, Justice, the Treasury, Public Works, Agriculture, Industry, and Commerce. Judges are to be appointed by the Government in Council, and can only be removed by a joint address of the Legislature.

Each House will make its own standing orders and rules and define its privileges, such powers, however, not to exceed those of the British House of Commons. Debates may be conducted in English, Italian or Maltese, but all official entries must be in English only. All persons inhabiting the colony are to have full religious liberty. No person is to be subjected to any disability or exclusion from office on the ground of religion. (A covering despatch suggested that the Legislature, at its first sitting, should declare Roman Catholicism the State religion.) English is to be the official language of the colony, but English and Italian are to be recognized as equal languages of culture, and Maltese is to be allowed in the elementary schools. Italian is to be the official language of record in the law courts, but not only English people but any person who is not Maltese may claim to be tried in the English language.

By the new letters patent the power to make laws regarding "reserved matters"—including everything pertaining to defence, the control of the naval, military and air forces, wireless, territorial waters, imperial property and interests, external trade, coinage, immigration, naturalization, treaties and relations with foreign states—remains in the hands of the governor and commander-in-chief assisted by a nominated council consisting of the lieutenant-governor and a legal adviser as *ex officio* members, and an officer of the navy, army and air force. Legislation by order in council is abolished.

The civil pop. on April 1 1920, including Gozo (*see* 12.305) and Comino, was estimated at 224,859 as compared with 211,864 according to the census of April 2 1911. The death-rate in 1918–9, when influenza was rife, rose to 26·3 per 1,000 as against an average of 22·9 during 1910–20. The more rigorous sanitary measures imposed since 1910 and the enforced observation of flocks—341 sheep and goats infected with undulant fever were destroyed in 1919–20—have contributed to raising the general standard of health.

Critical economic conditions manifested themselves after the cessation of war activities. The number of unemployed was swollen in 1919 by the discharge of about 15,000 men from the naval and military establishments, and an emigration committee was perforce established to investigate the most suitable outlets for Maltese labour and to assist emigration in every possible way. The number of emigrants in 1919–20 reached the high total of 5,600, of whom 700 secured employment on reconstruction work in France, and over 2,000, chiefly skilled artisans, attracted by high wages, went to the United States, and 1,268 were awaiting passports on March 31 1920. The distress prevailing among the poorer classes compelled the authorities to continue the bread subsidy in 1920, and a Grant in Aid of £250,000 was made by the Imperial Government to this end. General want and discontent, however, led to serious disorders, and in June 1919 considerable damage, including the burning of a flour-mill, was done to property.

On Aug. 31 1919 the number of Government day schools was 121 (102 Malta and 19 Gozo), with a total of 20,291 scholars; pupils attending secondary schools numbered 765. In Sept. 1919 the minimum age for admission was fixed at the age of six years. The total expenditure for the year on elementary education was £45,374.

During 1918–20 further archaeological investigation of the prehistoric temple at Tarxien was pursued; wall tombs of the Punic and Roman periods were discovered near Rabat; and a number of prehistoric cart tracks were discovered and mapped in the northwest of the island. Palaeontological investigations were also continued, and excavations at the cave of Ghar Dalam yielded important results, among which were the discovery of human teeth assigned to the Neanderthal period and remains of hippopotami and elephants.

The revenue for 1919–20 was £650,489 and expenditure £632,233, as against £463,002 and £410,389 in 1915–6. Expenditure in 1919–20 did not include £160,764 paid as bread subsidy, which was charged to the grant from the Imperial exchequer. Customs dues are the chief source of revenue (£252,822 in 1918–19). The amount of British Treasury paper currency notes in circulation on March 31 1920 was estimated at £880,000.

The total area of land under crops in 1919–20 was 42,860 ac., of which 20,498 were under cereals, 10,569 green fodder, 2,752 potatoes, 2,295 beans and pulse, 920 onions, 630 cotton, and 206 cumin. The existence of phylloxera in the vineyards of Gozo was discovered during the year, and immediate measures were taken to deal with the danger; American immune vines were obtained and nurseries established in Malta.

The trade (inclusive of goods by parcel post, but exclusive of bullion and goods in transit) was as follows:—

	1913–4	1919–20
Imports	£2,589,272	£4,261,745
Exports	1,154,363	918,588
Total	£3,743,635	£5,180,333

Of imports in 1919–20, 54 % were from the United Kingdom. The number of British steamers calling (not including war-vessels and transports) was 489 of aggregate tonnage 1,292,755, and of foreign vessels 386 of 583,528 tonnage.

MANCHESTER, England (*see* 17.544).—Pop. (1911) 714,333. The most important changes in local government have been the bringing of the city entirely under one Board of Guardians (1915), and one Board of Overseers (1916). The area of the city was slightly increased (1913) and a rearrangement of wards (1919) somewhat reduced the representation of the central business wards. Among the important schemes completed or in progress are the completion of the third pipe (1915), and commencement of the fourth pipe, from the Thirlmere water-works; the acquisition of Haweswater for additional water-supply (1921), and the purchase of the North Cheshire Water Co.'s undertaking (1921); the South Manchester town-planning scheme, giving new outlets on the Cheshire side, and housing schemes involving a total expenditure of £6,448,102; a main drainage scheme (1911–21); the purchase of the Stretford gas-works (1921); the erection of an electricity generating station at Barton-on-Irwell; the purchase of the historic Free Trade hall (1921); the Town Hall extension scheme (1921), which will include a new central library; and work in connexion with Abergele sanatorium (1921) to cost nearly £500,000.

Manchester's progress during 1911–21 was marked by the growth of a new warehouse district in the neighbourhood of Whitworth Street; by the erection of numerous chemical and engineering works, many of them in Trafford Park just beyond the city boundary; and by the development of a university quarter, with the principal hospitals in the neighbourhood. Two well-known buildings have been taken down: the reference library (formerly the Town Hall), King Street, replaced by Lloyd's Bank; and the Royal Infirmary, Piccadilly, the site now being occupied by a flower garden and by the temporary buildings of the public libraries. Important new buildings include several hospitals in the vicinity of the Royal Infirmary, Oxford Road, the Diocesan Church House with a hall seating 2,000 persons (1911), the Y.M.C.A. (1911), the enlarged Royal Exchange (1921) and two or three churches. In 1911 Mr. Andrew Carnegie promised £15,000 to the city towards the building of three branch libraries in the Withington district, two of which were opened in 1915.

There have been many additions to the university equipment and buildings, amongst them being the new chemical (1909), botanical (1911) and physical laboratories (1912) and the Faculty of Arts building (1919). To its original faculties of arts, science, law, medicine and music were added faculties of theology (1904), commerce and administration (1904), technology (1905) and education (1914). An extension of the Manchester museum was opened on Oct. 30 1912, providing accommodation for geological, anthropological and Egyptian antiquarian collections.

The public libraries consisted in 1921 of a reference library, housed in temporary buildings, Piccadilly; a commercial, a music, and a foreign library; and 24 lending libraries, with a total of over half a million volumes. The John Rylands Library, an endowed library, containing the invaluable Althorp collection, has grown to over 250,000 volumes, and had a new wing added in 1920.

The public parks and open spaces numbered over 70 in 1921. Among recent additions are two bearing the names of their donors: the Fletcher Moss Playing Fields, Didsbury (1913–20), and the Broadhurst Park, Moston (1920).

As the seat of the Hallé and other concerts and of the Royal Manchester College of Music, Manchester takes a leading place in the musical world. The Gentlemen's Concert Society, founded nearly 200 years earlier, ceased to exist in 1920.

Though best known as the business and warehousing centre of the cotton industry, Manchester has also become a great manufacturing and distributing centre for chemicals and dyes, and some of the greatest engineering workshops in the world are in the city or its immediate neighbourhood. Motor-cars and commercial vehicles are made, and rubber manufacture and the ready-made clothing trade are extending. Manchester is also a great centre of the film trade.

The Manchester Ship Canal, on which the capital expended has been £17,084,110, was not able to pay a dividend on ordinary shares until 1915. The port was extended in 1912–3 at Trafford Park and elsewhere on the canal, and seed-crushing was undertaken at Partington.

During the World War Manchester's energies were devoted to recruiting, war charities, war loan campaigns and not unprofitable munitions work. At the general election (1918) Manchester, with 10 Parliamentary seats, for the first time in its history returned no Liberal candidate. Subsequent to the war there were six months of trade depression, followed by a boom period and a slump (1920). Several serious trade disputes occurred, one of the most interesting in its effects being the printers' strike (Aug.–Sept. 1920) during which the local newspapers appeared as typewritten bulletins. In 1921 were celebrated the centenary of the *Manchester Guardian* and the quincentenary of the Manchester cathedral. (E. A.*)

MANCHURIA (*see* 17.552).—By the terms of the Treaty of Portsmouth, which concluded the Russo-Japanese War (Sept. 5 1905), both the signatory Powers agreed to evacuate Manchuria and to restore China's unfettered administration throughout its three provinces, with the exception of the Liaotung peninsula, the lease of which was transferred, with China's subsequent consent, to Japan. Russia also ceded to Japan the southern section of the Manchurian railway, from Dalny to Changchun (514 m.), retaining the section from Changchun northwards to Harbin. The sovereignty of China and the "open door" were expressly recognized by this treaty.

With a view to the development of commerce and industry, which Russia and Japan had pledged themselves not to obstruct, the Chinese Government proceeded in 1908 to enlist the support of British and American capital for the construction of railways in Manchuria. After prolonged negotiations, a preliminary contract was signed, in Oct. 1909, for the construction of a trunk line from Chinchou to Aigun; but, in the meanwhile, Russia and Japan had come to a definite understanding for the protection and advancement of their respective "special interests" in northern and southern Manchuria. The American State Department's proposals for the "neutralization" of the Manchurian railways (Nov. 1909) brought Russia and Japan more closely together, and on July 4 1910 an agreement was concluded between them, which in its operation materially infringed China's sovereign rights in Manchuria and Mongolia, and violated the principle of the "open door." A joint protest against the conclusion of the Chinchou–Aigun railway agreement was addressed to the Chinese Government by the Russian and Japanese ministers at Peking, and the project, like that of the British loan agreement for a line from Hsinmintun to Fakumen, was subsequently abandoned. Later in 1910 an agreement concluded by the "Four Nations" Consortium, to finance the development of Manchuria, was blocked by Russia and Japan until their participation therein had been conceded, under conditions which secured to them continuance of their privileged position.

As early as Dec. 1905, the claims advanced by the Japanese Government, in negotiating at Peking the treaty wherein China perforce concurred in the arrangements of the Portsmouth Treaty, had given evidence of an intention not only to insist upon the reversion of all the undefined rights, privileges and concessions formerly held by Russia in South Manchuria, but also to extend the limits of Japan's "sphere of influence" in that region. By this treaty, concluded with China in Dec. 1905, Japan obtained, *inter alia*, the right to build and finance a railway from Mukden to Antung on the Korean frontier, and to undertake the construction of lines from Hsinmintun to Mukden and from Changchun to Kirin. By the beginning of 1911, the "peaceful penetration" of Manchuria and Mongolia was proceeding steadily and under conditions generally similar to those which had characterized Russia's forward policy from 1898 to 1905.

In 1912 the railway from Changchun to Kirin was opened to traffic. In May 1915, by the terms of a new treaty concluded by China as the result of the Japanese ultimatum accompanying the "21 demands," the lease of the South Manchurian railway was extended to 99 years (*i.e.* to 1997), and that of the Antung–Mukden line to A.D. 2007. By the same treaty Japanese subjects became entitled to lease land for trade, manufactures and agricultural purposes, and to reside and travel freely in South Manchuria. In 1917 the whole of the railway system of Korea was linked up with the South Manchurian railway and placed under its administration. Under these conditions the activities and influence of the railway rapidly became dominant factors in the economic life of Manchuria. Controlling numerous branch lines, owning its own coal-mines and a fleet of chartered steamers, possessing some 50,000 ac. of land adjacent to the railway line and independent powers of administration within the territory of the railway zone, its business naturally expanded with great rapidity. In 1913 the company carried 4,143,687 passengers and 5,782,161 tons of freight, as compared with 1,888,140 passengers and 2,609,036 tons of freight in 1908.

In Dec. 1915 a loan agreement was signed between the Chinese and Japanese Governments for the construction of a railway from Ssupingkai (120 m. N. of Mukden) to Liaoyuanchow in Mongolia; this line was completed in Dec. 1917. In Oct. 1917 a revision of the Changchun-Kirin loan agreement was concluded between the Chinese Government and the South Manchurian Railway Co., the result being a loan of 6½ million yen for a term of 30 years, during which period the management of the line is vested in the South Manchurian railway, on behalf of the Chinese Government. At the same time a loan of 50 million yen was issued by the Industrial Bank of Japan for four new railways in Manchuria and Mongolia.

The disorganization of the central Government in China and the collapse of Russia after 1917 served to increase the economic, financial and political ascendancy of Japan in Manchuria. As the result of a special mission sent by the Japanese Government to Washington in 1917, an exchange of Notes took place between Secretary Lansing and Viscount Ishii, in which the United States recognized that "Japan has special interests in China, particularly in that part to which her possessions are contiguous." The precise significance of the term "special interests" was undefined. As the result, however, of the negotiations initiated by the United States in July 1918, for the establishment of a four-Power consortium to coöperate in Chinese finance, and of the subsequent *pourparlers* between the British and Japanese Governments on the same subject, the latter finally agreed (May 10 1920) to withdraw the claims, previously put forward by the Japanese bankers, to exclude from the scope of the Consortium "all the rights and options held by Japan in the regions of Manchuria and Mongolia where Japan has special interests." The position adopted alike by the British, French and American Governments in regard to this question was based on the ground that Manchuria is an integral part of China, and on the desirability of eliminating all spheres of influence together with their special claims to industrial preference. The Japanese Government, in modifying its general claims and withdrawing its particular reservation of certain railways from the scope of the Consortium's operations, placed it on record that it did so because of the British Government's repeated assurance that the Consortium would not "direct any activities affecting the security of the economic life and national defence of Japan, and that the Japanese Government might firmly rely upon the good faith of the Powers concerned to refuse to countenance any operations inimical to such interests." The whole question came up for further inquiry at the Washington Conference at the close of 1921.

The economic progress achieved in Manchuria had been very rapid since 1912, and much of the expansion of its trade and industries must undoubtedly be ascribed to the enterprise shown by the Japanese in the development of mines, forestry and agriculture, and in the provision of improved transport, communications and currency.

The accompanying figures not only show the rapid increase of South Manchuria's trade, but they reflect the effects of the Russian *débacle* upon the commerce of the northern province.

There are five Chinese Customs collecting stations in Northern Manchuria, namely: Aigun, Sansing, Manchouli, Harbin and Suifenho. In South Manchuria, there are six, namely: Hunchun, Lungchingtsun, Tatungkow, Antung, Newchwang and Dairen (Dalny). The greater part of the trade of the whole country passes through the last named, which now ranks second only to Shanghai in the list of China's maritime ports; in 1908 it occupied the 42nd place. In 1918 56% of all Manchurian imports and 69% of all exports were handled at Dalny; it is also of interest to note that in 1917 Japan's share of the foreign trade of the four principal South Manchurian ports amounted to 123 millions out of a total of 157 million taels. The Chinese Customs trade report for 1919, commenting on Manchurian affairs, observes that America and Europe will probably continue to purchase Chinese goods through Japan, owing to the greater freight facilities afforded in that country and to the fact that Japanese currency is less liable to fluctuation. In 1908 the trade of Manchuria represented 11·5% of China's total; in 1918 the proportion had risen to 16·8%. The chief source of the provinces'

Value of Manchurian Trade in Haikuan Taels.

	North Manchuria	South Manchuria
1914	41,458,786	150,283,237
1915	37,275,644	164,437,705
1916	56,546,644	161,036,624
1917	41,524,836	209,464,759
1918	27,446,586	289,757,015

increasing prosperity during this period lay in the cultivation and export of the soya bean, the oil of which first found a market in Europe in 1908. In 1917 nearly half the export trade of Manchuria (70 million taels out of 153 millions) represented the value of beans, beancake and bean oil. Coal-mining under Japanese direction also gave a steadily increasing output. In 1917 the Fushun mines produced 2,275,905 tons as against 490,720 tons in 1908. The anarchical conditions prevailing in Russia and Siberia after 1917 served to increase Japan's economic and financial influence in Northern Manchuria, the ruble note being replaced in many parts of the country by the yen notes of the bank of Chosen, which in Jan. 1918 was given control of the treasury business of the Japanese Government in Manchuria. At the end of 1918 this bank had 18 branches operating in Manchuria (as against 10 in Korea), and notes in circulation to the amount of 30 million yen.

According to the statistics compiled by the South Manchurian railway, the population of Manchuria in 1916 was 20,112,100, divided as follows:—

Province.	Area in. sq. m.	Population.	Population per sq. m.
Mukden	90,225	11,979,400	133
Kirin	81,018	5,638,700	63
Amur (Heilungchiang)	211,387	2,494,000	12
Total	382,630	20,112,100	53

The above total includes the population of the leased territory of Kwantung and the South Manchurian railway zone, amounting to 672,000, of whom 118,364 were Japanese and 376 foreigners.

After the revolution in China the administration of each of the three provinces of Manchuria was vested in the dual control of a Tuchun (military governor) and a Shengchang (civil governor) but since 1918 the two offices have been combined in one person in the provinces of Mukden and Amur. Later, towards the beginning of 1920, the Tuchun of Mukden, Chang Tso-lin, became the most prominent figure in Chinese politics and exercised almost dictatorial authority.

See Frederick Coleman, *The Far East Unveiled* (1918); J. O. P. Bland, *China, Japan and Korea* (1921); *The Bank of Chosen, Official Report on the "Economic History of Manchuria"* (1920); *Correspondence respecting the new financial consortium in China. Blue Book, Miscellaneous No. 9* (1921). (J. O. P. B.)

MANGIN, CHARLES MARIE EMMANUEL (1866–), French general, was born at Sarrebourg (Meurthe) on July 6 1866. After six months' service in the ranks (with the 77th Inf. Regt.) he entered the École Speciale Militaire Oct. 30 1886 and was appointed a *sous-lieutenant* on the completion of his two years' course. The following year he went to Senegal and remained there until June 1892. In Oct. 1893 he went to the French Soudan, and spent most of the following six years either in that country or in the Congo (Marchand Mission), being made a captain in 1897. From 1901 to 1904 he was in Tonkin, and in 1905 was made lieutenant-colonel and posted to the 6th Regt. of colonial infantry. From Nov. 1906 to Dec. 1908 he served in W. Africa, returning there for six months in 1910, in which year he was promoted colonel. From Feb. 1912 to July 1913 he served both in W. Africa and Morocco and was made a general of brigade on Aug. 8 1913.

At the outbreak of the World War he was in command of the 8th Inf. Bde., but on Sept. 2 1914 took over the 5th Inf. Division. In June 1916 he was given temporary rank as a general of division and placed at the head of the XI. Army Corps. His temporary rank was made substantive in Oct. of the same year, just before he carried out at Verdun (Oct. 24 1916) the brilliant attack which resulted in the retaking of Fort Douaumont. On Dec. 19 1916 he assumed command of the VI. Army. This command formed part of the group of armies under Gen. Michelet which was designated to carry out the offensive on the Aisne in the spring of 1917. Extravagant hopes of decisive victory were cherished by his Government and the generalissimo Nivelle. Victory indeed was won, but it was a Pyrrhic victory. Mangin, involved in the bitter controversy which followed the disappointment, was made one of the scapegoats and deprived of his command. Later, however, he was exonerated from blame by a commission of inquiry and placed by M. Clemenceau at the head of the X. Army. While commanding this army he carried out, in July 1918 and in conjunction with General Degoutte, the great counter-offensive on the enemy's right flank which resulted in the first of the final series of Allied victories. He was given the Grand Cross of the Legion of Honour on July 6 1919, and was made a member of the Superior War Council in Jan. 1920. In 1921 he was sent on a special mission to South America.

The incorporation of African troops in the French army on a large scale, both before and especially during the war, was the result chiefly of Mangin's persistent advocacy of the idea, which had many opponents. His conception of a "*plus grande France,*" based on political autonomy and military obligation for all parts of the French Empire, is put forward in the concluding chapters of his work *Comment finit la Guerre* (1920), which in spite of its title is really a masterly review of the whole war.

MANITOBA (*see* 17.584).—By the Act of the Canadian Parliament passed in the session 1911–2 the E. boundary of the province of Manitoba was extended N. to lat. 60° N. and N.E. to the point where the meridian of 89° W. intersects the S. shore of Hudson Bay. This gave the province possession of the two ports on Hudson Bay—Fort Churchill and Port Nelson—reserving certain contingent privileges to the province of Ontario in respect of access by railway. The effect of the change was to increase the area of Manitoba from 73,732 to 251,832 sq. m., of which 19,906 sq. m. are covered by water.

The province divides itself naturally into four distinct areas; (1) the prairie region, (2) the lake region, (3) the archaean axis or granitic area, and (4) the Hudsonian plateau. The prairie region lies in the extreme S.W. and comprises some 30,000 sq. m. of ancient lacustrine sediments of immense agricultural capabilities and value. The lake region forms a well-watered zone N.E. of the prairie region, containing about 40,000 sq. m., with extensive fisheries, forest, and agricultural products. The archaean axis or rugged region, of granitic and gneissoid rocks, constituting the backbone of the province, is a Laurentian plateau area of about 150,000 sq. m., where forest trees, minerals, fisheries, wild game, fur-bearing animals, and water-power abound. The maritime or Hudsonian plateau country, in the most easterly corner of the province, occupies the lower portions of the Churchill, Owl, Nelson, Hayes, and Shamattawa rivers, covering 25,000 sq. m. and containing forests, fisheries and the varied resources of a maritime region.

The general physical character of northern Manitoba is rough and broken, though it is not a mountainous region. North of Saskatchewan river and Lake Winnipeg the nature of the surface changes rapidly. The country rises and plains and swamps give way to ridges and limestone ledges. Farther north are countless lakes and streams, and the country is generally thickly wooded except for grassy meadows along the streams. The numerous waterfalls afford vast potential supplies of water-power. According to the official survey Manitoba has available water-power to the extent of 3,218,000 H.P. and is thus third in this respect among the provinces. Only 76,172 H.P. had been developed in 1921.

Population.—The pop. of Manitoba in 1916 was 553,860 (294,604 males and 259,256 females). The urban pop. was 241,014 and the rural 312,846. There were 117,532 families in 104,656 dwellings, with an average of 4·71 to a family. Compared with the result of previous enumerations, the tendency is for the urban pop. to increase in a greater ratio than the rural. The origins of the chief elements of the pop. were: Canadian-born 332,146, English 90,894, Scotch 63,452, Irish 50,300, French 28,573, German 15,228, Austro-Hungarian 18,001, Indian 13,894, Ukrainian 19,028. The immigrants born in the United States were 18,274; of these about 47% were of British origin. There were about 10,000 Indian half-breeds. Winnipeg, the capital city of the province, had in 1919 a pop. of

186,000. Brandon, the second city of Manitoba (pop. 15,225), has grain elevators, flour-mills, and various manufactures. It is the seat of one of the Government normal schools, and near it is the Dominion Experimental Farm. St. Boniface (pop. 11,021), opposite Winnipeg on the Red river, is the centre of the Roman Catholic interest in western Canada and the archiepiscopal seat. It is a thriving manufacturing city, and may be regarded as a suburb of Winnipeg. Selkirk, Dauphin, Waskada, Neepawa, Souris, and Minnedosa are the most important of the railway towns from which agricultural products are shipped.

Government.—Manitoba is administered by a lieutenant-governor appointed by the governor-general in council for a term of five years, an Executive Council of 7 members chosen from the Legislative Assembly, and a Legislative Assembly of 49 members elected by the people. The province is represented in the Dominion Parliament by 15 members in the House of Commons and 6 senators. There are 163 organized municipalities, including cities and towns. A considerable portion in the north and east is as yet without municipal organization, but school districts may be established wherever there are sufficient children.

Education.—The single public-school system in Manitoba is free to all religious denominations and has nearly 4,000 teachers and over 100,000 pupils enrolled. Collegiate institutes have been established in Winnipeg, Brandon, Portage la Prairie, Virden, Souris and Stonewall, and high schools and continuation classes at various smaller places. Higher education is provided by the university of Manitoba at Winnipeg, which has affiliated with it colleges of the Roman Catholic, Episcopalian, Presbyterian and Methodist denominations, also medical and pharmaceutical schools. The medical school of the university is recognized as one of the best in Canada. The Manitoba Agricultural College, near Winnipeg, is supported by the province. The number of schools and pupils enrolled has doubled within 15 years. The cost of education increased from $2,840,693 in 1907 to $6,285,878 in 1918.

Finance.—Revenue and expenditure were respectively $5,788,070 and $5,314,849 in 1913; $5,524,911 and $5,698,059 in 1915; $6,692,985 and $6,860,353 in 1917; and $8,986,076 and $8,544,790 in 1919.

Agriculture.—Ever since the opening of the country by railways Manitoba has been famous as a wheat-growing country (Manitoba wheat, from its flinty hardness and full kernel, is a specialty of the Canadian north-west; it is famed as the Manitoba "No. 1 Hard"). The enormous development in the growing of wheat is evident from the fact that in 1883 the production was 5,686,355 bus., while in 1915 it was 69,274,000 bus. The corn belt is gradually moving northward. Oats, barley and pease are also important crops. From the richness and mellowness of the soil potatoes and all tap-roots reach a great size. Vegetables of all kinds grow to perfection. Flax, rye, potatoes and turnips are also grown in quantity.

The total value of field crops in 1919 was $162,462,200, produced on an area of 6,344,318 acres. The values of farm crops were as follows in that year: fall wheat $101,000; spring wheat $78,706,000; oats $41,420,000; barley $20,137,000; rye $5,228,000; pease $170,000; mixed grains $1,063,000; flax $2,215,000; potatoes $4,266,000; turnips $663,000; hay and clover $6,818,000; fodder corn $1,520,000, and alfalfa $256,200. Wild forage plants of many kinds are abundant, hence Manitoba produces live stock as well as grain. The live-stock industry and dairy-farming are becoming more important every year. In 1918 the total dairy production amounted to over $11,000,000. Some 40 creameries were in operation producing 8,450,132 lb. of butter, an increase in one year of over a million pounds. From an importing province in respect of dairy products, Manitoba within a few years has changed to one with abundant surplus for export. Manitoba in 1919 had 227,872 milch cows and a total head of cattle of 781,771. Of sheep there were 167,170 and of swine 261,542. Hog-raising has been very profitable for the same reason that all other branches of live stock are lucrative—the stock-yards are not in control of the packing-houses, so that the Manitoba farmer has an open market. Sheep-raising is making considerable progress, a large portion of the northern part being especially adapted to that industry. Though not a fruit-growing province, Manitoba has made some progress in that respect. Small fruits grow in great abundance, and orchards of apples and plums have been successfully cultivated. Bee-keeping is also developing rapidly, the natural conditions being favourable.

Forests.—Northern Manitoba is forest-clad as far north as lat. 60° N. Birch, spruce, poplar, jack pine, aspen, balsam poplar, pine and tamarac are the principal trees, and supply sawmills erected at various points. The value of lumber in 1918 was $1,240,000.

Fishing and Game.—Large quantities of fish are obtained from Lakes Winnipeg and Manitoba, the principal catch being whitefish, with which these waters are plentifully stocked, also sturgeon, pike and pickerel. The fish are taken principally in winter, frozen on the ice and shipped to the United States or distributed to local markets. Many of the waters of the more northerly part of the province abound in whitefish, pickerel and trout. The total value of fish caught and marketed in 1919 was $1,008,000.

Prairie chickens are the principal native game birds, and once existed in great numbers throughout the prairie country. Ducks and wild geese are very plentiful on the lakes, rivers and ponds. There are numbers of elk, moose and jumping deer, and in the forests and hills the bear, wolf, lynx, fox, marten, beaver and other fur-bearing animals have their haunts.

Mining.—Considerable prospecting has been done in the north and east and some important discoveries have been made. There are three promising mineral belts—the Pas, Rice Lake and Star Lake areas. The Flin Flon district is rich in copper ore. The "Mandy Mine," on which work commenced in 1906, was the first to make commercial shipments; its ore (zinc blende and copper sulphide) was so rich that it paid to ship it to the smelting furnaces at Trail in British Columbia. The Flin Flon district deposits are described as extensive and rich, but requiring for development a very large amount of capital and the extension of the railway for 40 miles. The ore is a complex admixture containing copper, lead, silver and gold. To the north of Flin Flon lies a territory of great promise for gold-prospecting, and these areas might possibly justify the construction of the Hudson Bay railway for mineral traffic, even if it should fail in its original design as a grain route. Large gypsum deposits occur north-east of Lake Manitoba. The raw material is shipped to Winnipeg and converted into finished gypsum products. Soft lignites occur in the Turtle Mountain district in southern Manitoba, but have not yet been developed. Experiments were being made in 1921 for the utilization of these and other large beds by processes of carbonization and briquetting. A very beautiful mottled-gray stone, of Ordovician age, is quarried at Tyndall, east of Winnipeg. The entire interior of the new Parliament buildings at Ottawa is finished with this stone.

Manufactures.—Although Manitoba is essentially an agricultural province the growth of manufactures has become quite marked. Meat-packing is becoming a large industry. The burning of lime and the making of brick and tile are important. Other manufactures are wire-fencing, leather goods, clothing, cigars and biscuits. In 1918 1,444 factories, with capital $105,983,000, gave employment to 22,808 persons, who received $23,031,000 in salaries and wages and consumed $92,600,000 worth of materials in producing goods valued at $145,030,000.

Communications.—Three lines from the east of Canada converge at Winnipeg and radiate thence to west, north-west and south. There is connexion south with the United States and another outlet is secured by transfer from rail at Fort William and Port Arthur to the Great Lakes. The Great Northern, the Canadian Pacific and the Canadian National railways gave the province in 1920 a mileage of over 4,000 m., and each of these systems was actively extending and constructing branch lines. The Dominion Government undertook the construction of the Hudson Bay railway from the Pas on the Saskatchewan river to Port Nelson (424 m.), which is intended to give the grain-growing country an alternative short ocean route to the British market by Hudson Bay—usually safe for navigation from July 15 to Nov. 15. Its claim to consideration is that it will shorten the distance between Liverpool and the prairies by upwards of 1,000 miles. (W. L. G.*)

MANN, TOM (1856–), British Labour politician, was born at Foleshill, Coventry, Warwickshire, April 15 1856. He received a very scanty education, and at the age of nine years started work on a farm. At the age of ten he was working in a coal-mine, which he left at the age of fourteen. He served seven years with an engineer tool-maker in Birmingham, went to London at the age of 21 and worked in a number of engineering firms. In 1883 he visited the United States and worked there. Returning to England, he became a Socialist in 1884 and a member of the Social Democratic Federation. He took an active part in many trade disputes, notably the London dock strike of 1889. He became president of the Dockers' Union, and first president of the International Transport Workers' Federation, and was expelled both from France and Germany in connexion with his activities as an agitator. He later became the general secretary of the I.L.P., and worked with Keir Hardie in building it up. In 1901 he went to New Zealand, and thence to Australia, where he stayed for eight years, becoming an ardent advocate of Syndicalism. In 1910 he visited South Africa, and in 1913 the United States, where he made a lecture tour from Boston to San Francisco. In 1914 he again visited South Africa to help carry on the work of the trade-union deportees, and covered the whole of South Africa in a six-month campaign of persistent propaganda. He became secretary of the Amalgamated Society of Engineers in 1919, and resigned (per rule) in 1921.

MANOEL II., ex-King of Portugal (1889–), was born at Lisbon Nov. 15 1889, the younger son of Carlos I. by his wife Marie Amélie of Orleans. On the assassination of King Carlos and of the crown prince Luis, Duke of Braganza, Feb. 1 1908, Dom Manoel succeeded to the throne of Portugal, but he only retained it for a short time, as the revolution of Oct. 3 1910 forced him to fly the country. He took refuge with his mother in England, and finally settled at Fulwell Park, Twickenham. On Sept. 4 1913 he was married at Sigmaringen to Princess Augusta Victoria of Hohenzollern (b. Aug. 19 1890), daughter of Prince Wilhelm of Hohenzollern. Dom Manoel supported the Portuguese royalist risings of 1911 and 1912, and in the latter year met the pretender to the Portuguese throne, Dom Miguel, at Dover in order to concert a common plan of action. On the outbreak of the World War, however, he appealed to all classes of his former subjects to lay aside political feelings and unite against the common enemy.

MAP (*see* 17.629).—Steady progress was made in all branches of map construction until the outbreak of the World War, which had the natural effect of stopping or hindering peace-time activities amongst the principal belligerent Powers. The war had another effect, also, in that its special character on the western front resulted in the demand for a type of map not hitherto in general use in warlike operations. With regard to normal geographical and topographical maps a useful landmark was the publication in 1908 by the U.S. Geological Survey of an excellent book on the *Interpretation of Topographic Forms.* As to the historical and technical aspects of the subject there have been some interesting contributions to the history of cartography and to the study of map projections.

In connexion with the war two matters stand out as deserving of particular attention: the revival and standardization of the *International Map of the World*, and the striking progress made in the few years immediately preceding the war with the mapping of the British Empire. The recent history of the surveys of the non-belligerent countries and of most of the belligerent Powers prior to Aug. 1914 is chiefly a record of steady advance along accepted lines (*see* SURVEY). It will, therefore, be sufficient to deal here mainly with three matters: the International Map of the World, war maps, and the mapping of the British Empire.

International Map of the World.—The official title of this international undertaking is " Carte du Monde au Millionième," and it is under this title that references to it will generally be found. It owes its origin to the initiative of Prof. A. Penck, who put forward the project of a map of the world on a uniform scale at the Geographical Congress held at Berne in 1891. The scale proposed was one-millionth of nature, equivalent to 1 km. to 1 mm., or 15·78 m. to 1 in. The scheme and the scale were accepted by the Congress, and an international, but unofficial, committee was appointed for the purpose of prosecuting the idea. This committee reported to successive Geographical Congresses held in London in 1895, in Berlin in 1899, and in Washington in 1904, but not very much progress was made. An important step was, however, taken at the Geographical Congress held at Geneva in 1908. At this Congress the delegates of the United States made a proposal for the definite standardization of the map and for the drawing-up of fixed rules to govern its production. The next step in its history is that the Geographical Section of the British General Staff took up the subject, and a promise was given at the Geneva Congress that, if possible, an official conference should be assembled to deal with the matter. This promise was carried into effect in the following year.

In Nov. 1909 an official conference assembled at the Foreign Office in London, on the invitation of the British Government, and was opened by Sir Charles Hardinge, the Under-Secretary of State for Foreign Affairs. The countries represented were, in addition to Great Britain, Australia, Austria, Austria-Hungary, Hungary, Canada, France, Germany, Italy, Spain, Russia, the United States, *i.e.* the British Empire and the other European and American Great Powers. The Conference came to unanimous conclusions, and an account of it was published in a report issued by the British Government.

The object of having an official, rather than a non-official, or academic, conference was that experience had shown that without the support of the official map-making bodies, such as the great survey departments, little or nothing would be done in the way of actually producing the international sheets. The scale is somewhat too large for ordinary use in atlases, though it is somewhat smaller than the survey departments had been in the habit of printing.

One of the chief features of usefulness in the scale of 1 to 1,000,000 is that it enables the globe to be covered by a reasonable number of sheets, 2,084 sheets sufficing to represent the entire surface, land and water. If the next largest ordinary metric scale had been chosen (1 to 500,000), no less than 8,336 sheets would have been required. Another valuable feature is that the scale serves very well as a base scale for atlas maps, which are generally somewhat smaller. Again, it is not too small for the display of all the main natural and artificial features of a country; in fact, it is admirable for general official purposes, so much so that the provisional editions of this map were used at the Peace Conference at Paris in 1919 for the deciding of the general lines of the new international frontiers. Its uses are many and will grow as the map covers the earth. It will become the geographer's standard reference map. The sheets put together would cover the surface of a globe about 42 ft. in diameter.

At the Geographical Congress at Rome in the spring of 1913 the scheme as formulated in London was accepted generally, but there was a feeling that a more comprehensive official conference was needed in order to put the matter before those countries not hitherto represented officially. Accordingly, after some correspondence between the British and French Governments, it was agreed that the latter should issue invitations to an official conference to be held in Paris in Dec. 1913. This conference took place under the presidency of General Bourgeois; thirty-four States sent representatives and a very thorough examination was made of the London resolutions and of any proposed modifications. In the main the London resolutions were accepted, and the modifications made were not in matters of principle but of detail. The scheme had in fact got into a definite standard form, and the " Carte du Monde au Millionième " is now a world undertaking on lines accepted by practically all the countries of the world.

The authoritative version of the resolutions is to be found in a printed report by the *Service Géographique de l'Armée* (Paris 1914), entitled *Carte du Monde au Millionième, Comptes Rendus des Séances de la Deuxième Conférence Internationale, Paris, Décembre 1913*, with a supplementary volume containing illustrative plates.

The following are the principal resolutions in conformity with which the sheets of the International Map are produced:—

Each sheet of the map covers an area of four degrees in lat. by six in long., except that north of lat. 60 it shall be permissible to join two or more adjoining sheets of the same zone, so that the combined sheet covers 12, 18, etc., degrees of long. But the ordinary sheet, as stated above, will cover 24 " square degrees."

The meridian of Greenwich is the initial meridian and the limiting meridians of the sheets are at successive intervals (reckoning from Greenwich) of six degrees, and the limiting parallels (reckoning from the Equator) are at intervals of four degrees.

Each sheet is described by a letter N. or S., indicating northern or southern hemisphere; another letter for the zone in which it is, the zones being lettered from A to V extending from the Equator to 88° lat.; and a number to indicate the sector, the sectors being numbered from long. 180° E. or W. of Greenwich from 1 to 60, increasing in an easterly direction. Thus the sheet which contains Paris is N.M. 31, as shown on Plate I.

The map is plotted on a slightly modified polyconic projection, each sheet being projected independently. The lettering is to be in varieties of the Latin characters. An important resolution refers to the spelling of place names. It reads thus: " In independent or self-governing countries, in which the Latin alphabet is in habitual, or alternative, use, the spelling of the place names shall follow authorized custom. The spelling of place names in a colony, protectorate, or possession shall be that of the authorized transliteration into Latin characters in use in the governing country, provided that in the latter the Latin alphabet is in habitual, or alternative, use."

The heights are shown by contours at vertical intervals of 100 metres reckoning from mean sea-level. When these would be too crowded some may be omitted, but the 200, 500, 1,000, 1,500, 2,000, 3,000, etc., contours must always be shown. " The map shall be a hypsometric map, *i.e.* the successive altitudes shall be indicated by a system of colour tints. There may, however, be published other editions without altitude tints. . . ."

There are other technical regulations, such as those dealing with the sizes of the lettering, the boundaries, scales (a scale of km. is compulsory), sea-bed contours, all devised to ensure uniformity, and there is a diagram of conventional signs to be followed.

The regulations appear to be admirably adapted for the purpose in view, and in a few years' time it should be quite a natural thing for a traveller or business man to ask for a sheet of the international map of the region in which he intends to travel. For students of geography or history this series, covering the world with maps on a uniform plan, will be indispensable.

In the printing of sheets of the map, perhaps the most difficult matter is to ensure that the hypsometric, or "layer," tints, which show the successive altitudes of the terrain, shall be strictly in accordance with the agreed system. To assist in this the resolutions are accompanied by a detailed diagram in colour, which serves to show the exact shade of each colour printing.

The Paris Conference, in addition to passing the very practical resolutions described above, took an important step in approving of the establishment of a "Bureau Permanent," comprising a central office to be located at the headquarters of the Ordnance Survey at Southampton, with a branch office in London. The functions of the Bureau are: the publication of an annual report on the progress of the scheme; the organization of a service of exchange of information; and the criticism, when desired, of proofs, drawings or impressions. Of these functions the first two are the most important. The branch, or auxiliary, office in London is the Royal Geographical Society, where visitors to London can obtain all information with regard to the International Map and its progress. The Director-General of the Ordnance Survey is *ex-officio* Director of the Bureau.

The Paris Conference came to an end on Dec. 18 1913, but the Report of this Conference was not published when war broke out early in Aug. 1914. The effect of the war on the scheme was twofold. First, it resulted in the immediate cessation of all work on the map so far as the belligerent countries were concerned; but in the second place it led to a demand for maps on, or about, the one-to-a-million scale, and so in England and France, particularly the former, much official cartography was carried out on the million scale, and a large series of maps was produced by the initiative of the General Staff. The General Staff series of maps was for the most part designed by a special staff of experts at the Royal Geographical Society, and was fair-drawn and printed by the Ordnance Survey. It adheres to the sheet lines and projection of the International Map and to a good many of the conventions, but it is not hypsometrically coloured, and from the nature of the case is somewhat roughly produced. It is, however, an important series and comprises ninety maps extending from the Persian Gulf to the Arctic Ocean, and from the western shores of Ireland to beyond the Caspian Sea. Covering as it does so important a part of the world's surface, it is of value to geography on account of its uniformity and general accuracy. A high compliment was paid to this series when its sheets were selected by the Peace Conference for use in determining the new European frontiers, and the Geographical Section of the British General Staff is to be congratulated on its foresight in arranging for its preparation. It differs from the regular international series, not only in small technical details, but also in the fact that the sheets were produced by one country and not by the countries represented; it is an essential element in the construction of the regular series that each country produces its own sheets, and where a sheet includes portions of two or more countries the sheet will be undertaken by one of them, after agreement with the others.

The International Map, so rudely interrupted by the war, has since been taken up again, and satisfactory progress has continued to be made.

At the close of 1920 maps were in hand, or had been published, by the following countries: Brazil, Canada, Chile, Denmark, Egypt, France, Great Britain, India, Italy, Japan, Portugal, Rumania, Siam, Spain, Sweden, United States, Uruguay. Thirty-six sheets had been printed and 102 were in various stages of preparation. The main continents and islands would take about 800 sheets to cover, so that a very substantial beginning amounting to about one-sixth of the full total had been made. Of course there are many parts of the world insufficiently explored for the exact information required by the regular sheets of the series, but provisional editions can be published of these sheets, and their very incompleteness will give a stimulus to exploration. The most striking group of sheets already available is that published by the Survey of India; but important blocks of sheets were, at the opening of 1921, due for early issue by the United States Geological Survey (which carries out most of the official cartography of the United States), and by Brazil and other States of South America.

War Maps.—The trench warfare of 1914–8 in France and Belgium created a demand for maps on a larger scale than had hitherto been in general use by great armies. Before the war, for instance, the French had been content with the black *Carte de l'état major* on the scale of 1:80,000, for the new map on the scale of 1:50,000, of which very few sheets have been printed, was evidently not taken very seriously as a military map. On the outbreak of war, in Aug. 1914, the only map of N.E. France available for the French and British armies was this 1:80,000 map, except that for certain areas round fortresses there existed the so-called "*plans directeurs*" on the scale of 1:20,000. In Belgium the cartographic situation was much better. Belgium was covered by an excellent series of maps, based on field surveys and original drawings on the scale of 1:10,000. The published Belgian maps were on the scales of 1:20,000, 1:40,000, 1:100,000 and 1:160,000. The Germans, however, also possessed these maps, so that the Allied armies had no advantage in this respect. An immediate effect of the rapid stabilizing of the position on the Franco-Belgian front was that large-scale maps became indispensable for the operations of trench warfare, particularly in connexion with the use of artillery.

With regard to that portion of the line which passed through N.E. France all that could at first be done was to enlarge the 1:80,000 to 1:20,000. Of course such an enlargement made an unreliable map, with errors of hundreds of metres, and, bit by bit, these enlargements were corrected. But the mere correction of inaccurate enlargements can never make a reliable map, and eventually all the maps of the western front were redrawn from special surveys, air photographs and revised cadastral manuscripts. The methods are described in the article SURVEY. It is sufficient to note here that the chief scales in use were those of 1:20,000 and 1:40,000; that the former scale showed the enemy's trench system in detail, and that all the maps were provided with a system of "squares," or coördinates, which enabled any point to be defined within a few metres. The use of "squares," or coordinates, is typical of modern military maps. An example of a typical trench map of the western front on the scale of 1:20,000 is shown on Plate II. The number of maps issued to the troops was very large, greatly exceeding all previous anticipations. The Ordnance Survey alone printed 32 millions of trench and other war maps during the four years and three months that the war lasted, and to this must be added the maps printed by the survey battalions in the field. Altogether the British armies in France and Belgium used some forty million maps.

The Progress of Cartography.—A very noticeable feature of all modern topographical maps is the increasing use of colour. The old, black, engraved maps are disappearing one by one. But however beautiful these maps were as specimens of engraving, they were never very easy to read, and in no case did they convey so much, or such accurate, information as do the modern topographical maps printed in five or six colours. However artistic a black, hachured map may be it is far less exact in the representation of hill forms than a coloured, contoured map. But it is doubtful how long the modern coloured map will last; the paper is not nearly so durable as that which is used for the printing of copper-engraved maps; and the colours are in some cases none too permanent. Perhaps in some cases in which the maps are kept in dry presses away from the light they may last for a hundred years or so; but our remote descendants can hardly be expected to see, in anything but a very decayed state, the present triumphs of cartography. These remarks apply with special force to the "layered" maps; changes in the tones of the layers will greatly alter their character.

Topographical Maps.—The following remarks are necessary to bring up to date the account of topographical maps given in 17.649. Such progress as has been made since 1910 was made chiefly before, or after, the war, and not during it.

United Kingdom.—First in order of importance, the map on the scale of one inch to one mile is now no longer published in small sheets or in black with black hachures, or in brown with brown hachures. The "popular edition" now in progress supersedes the old "fully coloured" edition. This popular edition is printed in colours with brown contours and no hachures. The contours are

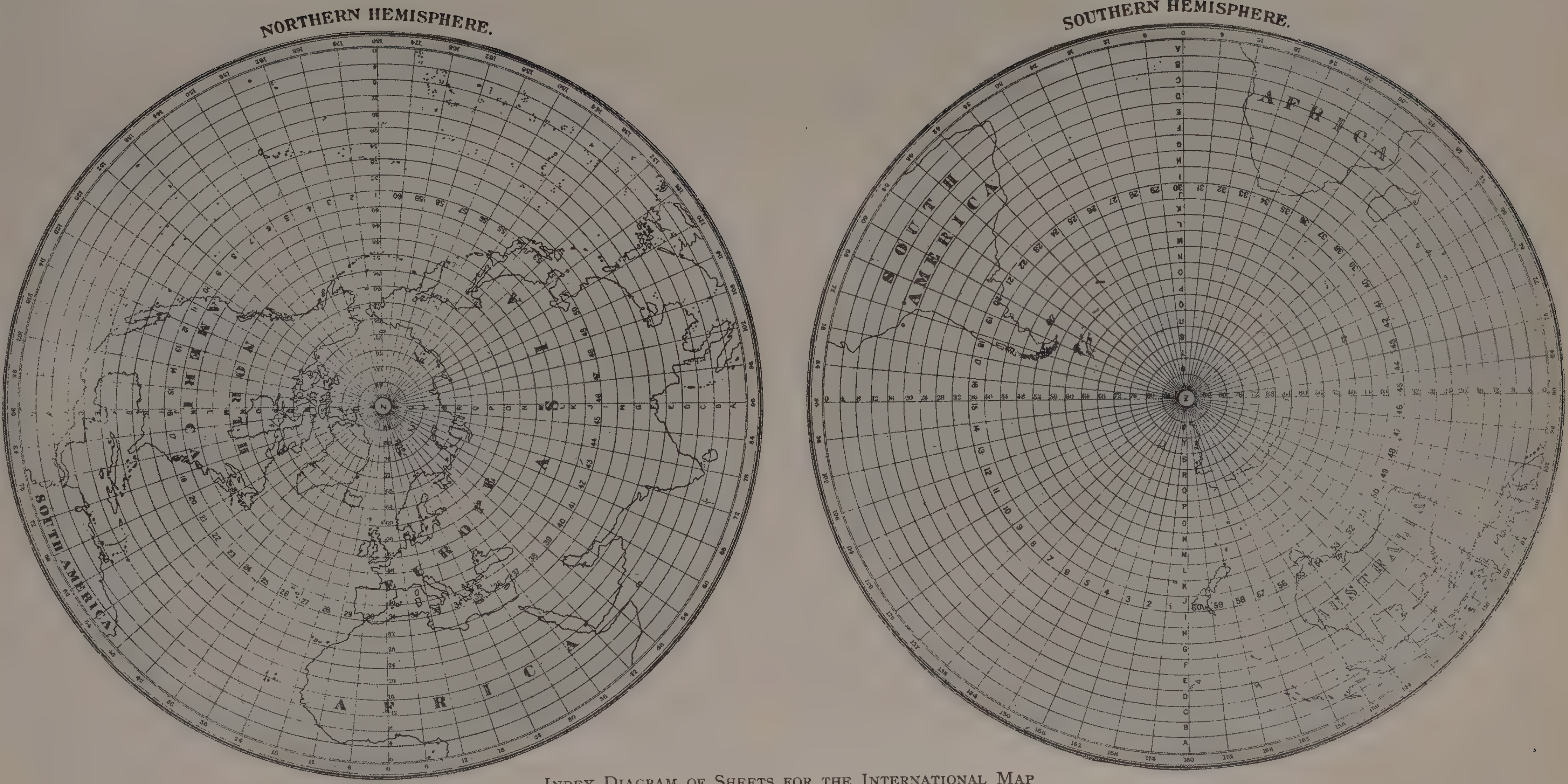
NORTHERN HEMISPHERE.

SOUTHERN HEMISPHERE.

NORTH AMERICA
SOUTH AMERICA
EUROPE
ASIA
AFRICA
SOUTH AMERICA
AFRICA
AUSTRALIA
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INDEX DIAGRAM OF SHEETS FOR THE INTERNATIONAL MAP ON THE SCALE OF 1:1,000,000

MAP

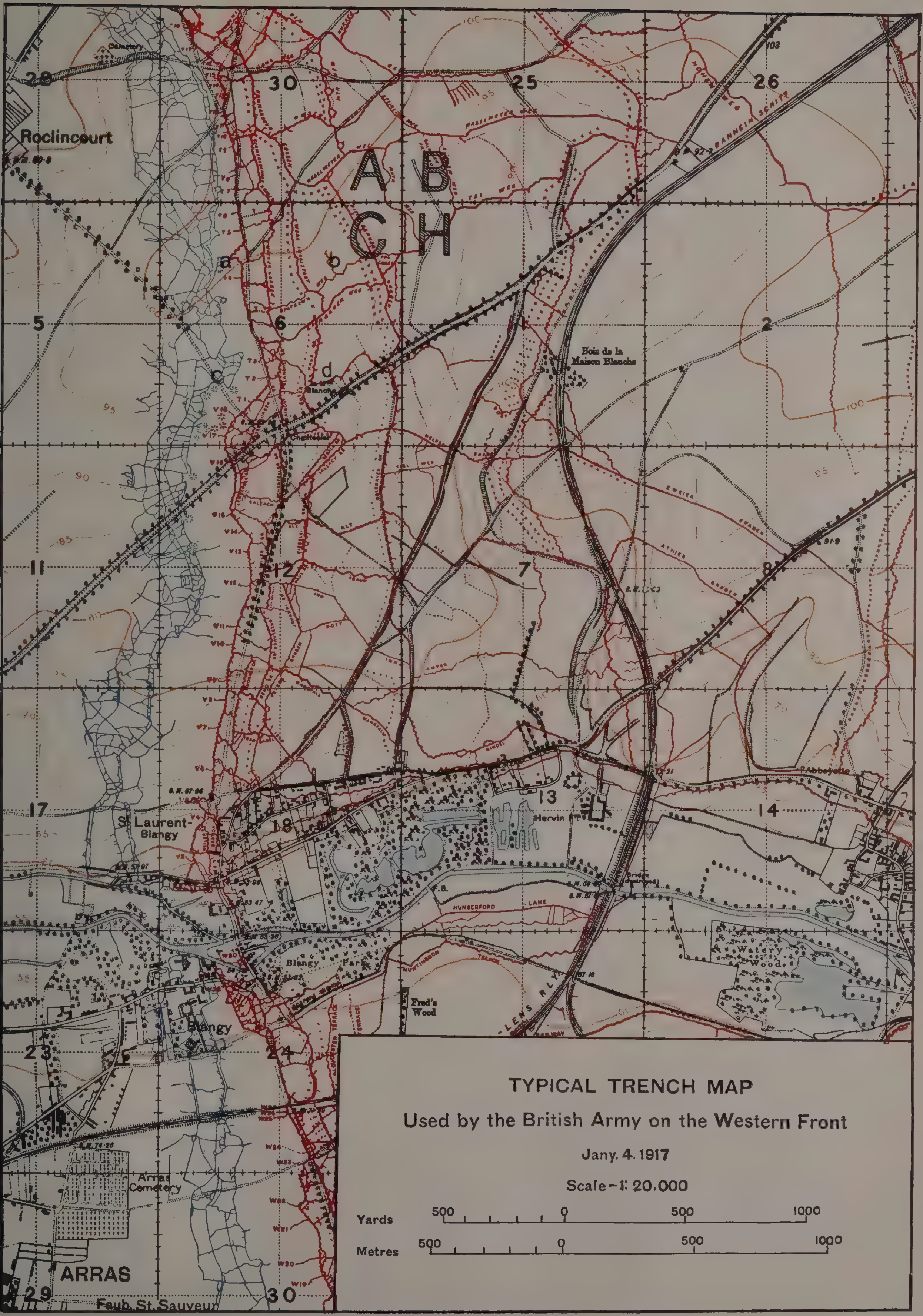
A B
C H
a
b
c
d
29
30
25
26
5
6
1
2
11
12
7
8
17
18
13
14
23
24
29
30
Cemetery
Roclincourt
Bois de la Maison Blanche
Blanche
Chantecler
St Laurent-Blangy
Hervin Fm
Abbeyette
Hungerford Lane
Blangy Park
Watery Wood
Fred's Wood
Lens Rly
Blangy
Arras Cemetery
ARRAS
Faub. St. Sauveur
100
95
90
85
80
75
70
65
60
55

TYPICAL TRENCH MAP

Used by the British Army on the Western Front

Jany. 4. 1917

Scale – 1: 20,000

Yards 500 0 500 1000

Metres 500 0 500 1000

INSTRUCTIONS AS TO THE USE OF THE SQUARES

1. The large rectangles on the map lettered A, B, C, etc., are divided into squares, 1000 yd. side, which are numbered 1, 2, 3, etc. Each of these squares is subdivided into 4 minor squares of 500 yd. side. These minor squares are considered as letters a, b, c, d (see square No. 6 in each rectangle). A point may be thus described as lying within square B.6, M.5, b, etc.

2. To locate a point within a small square, consider the sides divided into tenths and define the point by taking so many tenths from W. to E. along southern side, and so many from S. to N. along western side, the S.W. corner always being taken as the origin, and the distance along the southern side being always given by the first figure. Thus the point Z would be 63; *i.e.* 6 divisions east and 3 divisions north from origin.

3. When more accurate definition is wanted (on the 1:20,000 or 1:10,000 scale) use exactly the same method, but divide sides into 100 parts and use four figures instead of two. Thus 0847 denotes 08 parts east and 47 parts north of origin (see point X). Point Y is 6503.

4. Use 0 but not 10; use either two or four figures; do not use fractions (8½, 4½, etc.).

DIAGRAM

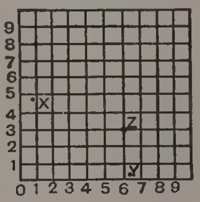

The system of reference by squares shown on the map and described above was used throughout the war by the British armies on the western front. Although clear and simple in practice it was not ideal for gunnery purposes. For this reason it was decided shortly before the Armistice to supersede it by another and more universally useful system (*see* article SURVEYING: *Military*).

CONVENTIONAL COLOURS AND SIGNS

Colours.—The topography was represented in three colours. The detail including towns, houses, railways, roads, woods and grid lines and numbers, was printed in grey, water in blue, and contours in brown.

Military details such as trenches, battery positions, mine craters, obstacles, etc., were shown in blue (British) and red (German). British trenches were not shown *in extenso*, but only for such distance from the front line as might be assumed to be already well surveyed by the enemy.

Conventional Signs.—The signs used for objects of military nature changed considerably during the war as the result of alteration of types of defensive and offensive works.

now spaced at intervals of 50 ft. from sea-level to the tops of the highest mountains, instead of at intervals of 100 ft. to 1,000 ft. and then by intervals of 250 ft. This is, without doubt, a great gain. In place of the old, small-sheet, black, engraved, one-inch maps, there is now issued (following on the publication of the popular edition) an "outline edition" of the one-inch map. This map shows all detail and water in black, but has, in addition, reddish-brown contours at 50-ft. intervals. It is printed from zinc and not from copper, and its form was settled after discussion with the principal representative engineering bodies of Great Britain.

A new series of quarter-inch maps is being issued, and England and Wales are nearly covered by it. This series is completely redrawn and is printed on the layer system with coloured roads and water; 12 sheets cover England and Wales, and the series is to be continued uniformly throughout Scotland, which requires 8 sheets.

The new half-inch engraved map of Ireland is completed and is published in two forms, with brush-shaded hills, and on the layer system.

Various special tourist maps in colours have been issued, and a special series of coloured town maps on the six-inch scale is under publication.

Canada.—An important series of topographical maps on the scale of 1 in. to 1 m. is being published by the Department of Militia and Defence, Ottawa. These maps, which at the opening of 1921 were confined to the provinces of Ontario and Quebec, have been in progress since 1907. Each sheet covers about 25 by 17 m.; more than 70 sheets had been published by 1921, covering a total area of about 30,000 sq. m. The sheets are beautifully printed in six colours; the contours, in brown, are spaced at intervals of 50 ft.

South Africa.—The finest topographical maps of South Africa are those of the Orange Free State. The State was surveyed by the Colonial Survey Section, and the maps are published on the scale of 1:125,000, or about half an inch to one mile. They are printed in colours, cover the whole of the State (about 50,000 sq.m.), and are excellent maps. The northern portion of the Cape of Good Hope is covered by good reconnaissance maps, of a less accurate character, but very well printed by the Geographical Section General Staff.

India.—In recent years there has been a very marked improvement in the execution and printing of the topographical maps of India. Too often in former days the most painstaking and careful work in the field was spoilt and rendered half illegible by poor reproduction. Up-to-date methods of colour-printing have now been adopted with marked success, and the Survey of India maps take a good position in the cartographical world. As examples of excellent Indian work may be noted the half-inch series of the Central Provinces and Central India, and the quarter-inch of the Punjab and N.W. Frontier Province. But all over the Indian Empire there are being produced the most admirable topographical maps worthy of the reputation of that splendid department, the Survey of India.

British Crown Colonies and Protectorates.—Since 1900 the most marked feature of the geographical work of the British Crown Colonies and Protectorates has been the attempt to systematize the work and to accelerate the survey with the advice and encouragement of the Colonial Survey Committee and the Geographical Section General Staff. The new topographical map of *Ceylon* on the scale of 1 in. to 1 m. is an excellent production in colour, providing a great mass of useful information. The new one-inch map of the *Federated Malay States* is also deserving of high praise. In *British Tropical Africa* there is much progress to be recorded. *Uganda* and *British East Africa* are covered, so far as the more important regions are concerned, with excellent maps on the scale of 1:250,000, printed in colour by the Geographical Section General Staff. Excellent topographical surveys of *Nigeria* were being carried out at the outbreak of the war, and some sheets on the 1:125,000 scale have been printed by W. and A. K. Johnston. Admirable surveys and maps of similar series are in progress in the Gold Coast. Of course the war put back all this work, but it has gradually been taken up again, especially in the West African Protectorates. The Sudan Survey Department publishes a useful series of reconnaissance sheets, on the 1:250,000 scale, of that large area. The Peninsula of Sinai, north of the Gulf of Akaba, has been topographically surveyed and a map in colours published by the Geographical Section General Staff, 23 sheets on the 1:125,000 scale and 4 on the 1:250,000 scale.

It is not too much to say that there has been more to record in the systematic mapping of the British Empire during the period 1900–20 than in any previous century.

Other Countries.—The admirable and well-known series of maps of the U.S. Geological Survey continues to be issued. The French 1:50,000 series in colour was, of course, completely stopped during the war, and it is believed that it is not being taken up again; only a few sheets have been issued. The Italians are mapping Tripoli and Italian Somaliland on the 1:100,000 and 1:50,000 scales. The map of Spain on the 1:100,000 scale in colours, published by the Spanish General Staff, is in progress. There is an excellent series of maps of Denmark on the 1:40,000 scale, published in colours by the Danish General Staff, and some fine maps have been issued by Norway.

AUTHORITIES.—See the official annual reports of the Ordnance Survey, the Survey of India, the Surveys of Egypt, of Ceylon, the Federated Malay States, etc. A very useful publication is the *Catalogue of Maps* published by the Geographical Section General Staff; this is, in fact, indispensable for the study of the surveys of the Empire. For the topographical surveys of the United States reference should be made to the *Annual Report of the U.S. Geological Survey;* for France, Algeria and Tunis to the Annual Report of the *Service Géographique de l'Armée.* The official reports published by the various countries provide the most reliable information on the subject. (C. F. Cl.)

MARCH, FRANCIS ANDREW (1825–1911), American philologist (*see* 17.688), died at Easton, Pa., Sept. 9 1911.

His son, PEYTON CONWAY MARCH (1864–), American soldier, was born at Easton, Pa., Dec. 27 1864. He graduated from Lafayette College in 1884 and four years later from the U.S. Military Academy, being commissioned second lieutenant. In 1894 he was appointed first lieutenant. He graduated from the Artillery school in 1898, and on the outbreak of the Spanish-American War went to the Philippines as captain of volunteers, in charge of the Astor battery. He remained there three years, being promoted major of volunteers in 1899 and lieutenant-colonel in 1900. After honourable discharge from volunteer service in 1901 he was appointed captain of artillery in the regular army. From 1903 to 1907 he was a member of the General Staff and in 1904 during the Russo-Japanese War was with the Japanese army in Russia as observer. He was promoted major in 1907, lieutenant-colonel in 1912, and colonel in 1916. Soon after America's entrance into the World War in 1917 he was made a brigadier-general, regular army, and later major-general of the national army, and in Sept. 1917 major-general of the regular army. In 1917 he was with General Pershing in France in charge of the American artillery forces. In March 1918 he was appointed acting chief-of-staff, and the following May chief-of-staff with the rank of general, U.S. army. The same year he was awarded the D.S.M. He also received honours from many foreign powers. In July 1920 his rank reverted to that of major-general and at his own request he was retired from active service Oct. 31 1921.

MARCHAND, JEAN-BAPTISTE (1863–), French general and African explorer, was born at Thoissey (Ain) on Nov. 22 1863. After four years' service in the ranks, he was, in March 1887, appointed a sub-lieutenant. In 1889 he was on active service in Senegal, was twice wounded and made a chevalier of the Legion of Honour. He was promoted lieutenant in Jan. 1890, captain in 1892, and commandant (*chef de bataillon*) in 1898. In the latter year he carried out his historic march on and occupation of Fashoda (*see* 1.341), and for this he was promoted to the high grade of commander in the Legion of Honour, having been previously (July 1895) raised from the grade of chevalier to that of officer. In Jan. 1900 he became lieutenant-colonel, and was made colonel two years later. On the outbreak of war in Aug. 1914 he was serving on the staff of the governor of Belfort; but in Sept. he was appointed to command the Colonial Bde. of the XIV. Corps. He distinguished himself in that capacity, was cited in army orders, and in Feb. 1915 was promoted a temporary-general of brigade. The following May he assumed command of the 10th (Colonial) Division. He was wounded in Sept. 1915, and was made a grand officer of the Legion of Honour. On March 25 1916 he was made a substantive-general of brigade. In the following Oct. he was again wounded, and on March 17 1917 received a second mention for distinguished service. On April 4 1917 he was promoted general of division and confirmed in his appointment as commander of the 10th Colonial Div.—an appointment which he held throughout the later campaigns on the western front. He retired from the army in 1919 with a high reputation as a leader of troops in battle. He was given the Grand Cross of the Legion of Honour in 1920.

MARCHESI, MATHILDE (1826–1913), singer and teacher of singing, was born at Frankfort-on-Main March 26 1826, her father's name being Graumann. She made her début as a singer in 1844, but in 1849 began her career as a teacher, in which she speedily earned a wide reputation, teaching at the conservatoires of Vienna and Cologne, as well as in London and Paris. In 1852 she married Salvatore Marchesi, Cavaliere de Castrone (d. 1908), himself a well-known singer and teacher. Among Madame Marchesi's pupils were Emma Calvé, Emma Eames, Melba

Emma Nevada, Gabrielle Kraus and Etelka Gerster. She published various works on the technique of singing, and in 1897 a volume of reminiscences, *Marchesi and Music*. She died in London Nov. 17 1913.

Her daughter, Blanche Marchesi (b. 1863), also a famous singer and teacher, made her début as a singer very young. She first appeared in opera at Prague in 1900, and subsequently sang at Covent Garden in 1902 and 1903.

MARCONI, GUGLIELMO (1874–), Italian electrical engineer and inventor of the Marconi system of wireless telegraphy, was born at Bologna April 25 1874. He was educated at Leghorn and at Bologna University, and it was in the town of his birth that he made the first wireless tests. In England his earliest wireless messages were sent between Penarth and Weston-super-Mare and on Salisbury Plain (1897). In 1899 he transmitted messages across the English Channel, and in 1902 from England to Canada and the United States. In 1904 he inaugurated the first ocean daily newspaper, the *Cunard Daily Bulletin*, on the R.M.S. "Campania." He was created hon. G.C.V.O. in 1914, was made an Italian senator, and was the recipient of many foreign decorations and honours.

MARGUERITTE, PAUL (1860–1918), French novelist (*see* 17.706), died at Hossegor, Landes, Dec. 30 1918. His later work, written not in collaboration with his brother Victor, included *La Maison brûle* (1913) and *Jouir* (1918).

MARINES (*see* 17.719).—The employment of marine forces in the World War was considerable, and, in the main, characteristic. In some instances they constituted the whole or the main part of forces told off for coastal descents, *e.g.* the British expedition to Ostend in 1914 and the Zeebrugge enterprise of 1918. In others they were called upon to undertake emergency land operations for which no other military force was available, *e.g.* in the case of the Royal Marine Bde. at Antwerp 1914; or again, as in the case of the U.S. Marine Bde. in France 1917–8, and the British 63rd (R.N.) Div., which included marine units, in the composition of a land army in continuous operations. In several instances the marines proper formed a soldier nucleus for formations of which the principal part was made up of sailors, —this was the case not only with the British R.N. Div. but also, and even more so, with the German Marine Corps. France, having long ago converted all her marines into colonial troops, used improvised battalions and brigades of sailors (*Fusiliers-Marins*) in the same way, and a brigade of these under Rear-Adml. Ronarc'h won undying glory by its defence of Dixmude during the first Ypres-Yser battle.

The German Marine Corps, as constituted in the war, had a peculiar organization. It was composed originally as a division partly of marines and partly of sailors, who—as usual in countries where recruiting is based on conscription—were numerically far in excess of naval requirements. As such it took part in the siege of Antwerp and the advance through Flanders. When stabilization came the division was raised to the strength of a corps, and the corps commander (Adml. Schröder) was made responsible not only for the Yser front but also for coast defence between Nieuport and the Dutch frontier. Further, he became responsible for purely naval operations based on the Belgian coast, having both submarines, surface craft, and aircraft under his command for the purpose. Finally, the German corps formed a third mobile division which was sent to any point on the western front where reënforcements were needed. This organization was probably unique in modern military history, and is interesting as a real attempt to weld military and naval effort at the point of junction.

The British Royal Marines, 1914–8.—Just before the outbreak of the World War the total strength (all ranks) of the British Corps of Royal Marines was 18,000. During the war, however, the strength of the corps increased steadily, until at the end its numbers had been more than trebled. The expansion was due to the formation of new units within the corps. Thus when in 1914 the Royal Naval Div. was formed, various divisional units of Royal Marines were raised for service with it: such as engineers (transferred to the Royal Engineers in 1917), medical units and transport. In 1915 another unit—the Royal Marine Submarine Miners—for the mining defence of unprotected ports in Great Britain and in France—was raised. The Royal Marine Labour Corps—for loading and unloading duties at French ports—and the Home Service Labour Corps were each raised in 1917. The Royal Marine Engineers—a unit 8,000 strong, for special Admiralty constructional work in England, France and Belgium—was formed in 1918. The following special units for service during the war were also provided separately, by the Royal Marine Artillery and the Royal Marine Light Infantry: a howitzer brigade R.M.A. (1915), an anti-aircraft brigade (1915, disbanded 1916) and four battalions (Chatham, Portsmouth, Plymouth and Deal) of infantry (R.M.L.I.)—raised in 1914 and absorbed into the 1st and 2nd Royal Marine Batts. in 1915 and into the 1st Royal Marine Batt. in 1918. In addition, the following special units were furnished compositely by the Royal Marine Artillery and the Royal Marine Light Infantry:—A special service battalion for Ireland (1916); the 3rd Royal Marine Batt. for service in the eastern Mediterranean —raised in 1916 and not disbanded until 1921; the 4th Royal Marine Batt. for service at Zeebrugge (1918); the 5th Royal Marine Batt.—for special anti-submarine and anti-aircraft work in connexion with submarine barrages—raised in 1918; the 6th Royal Marine Batt. for service in northern Russia (1919)—the 8th Royal Marine Batt. for service in Ireland (1920–1); 4-in. and 12-pounder batteries for service in East Africa (1916 to 1918); and four siege batteries, R.G.A. (1918–9), containing a proportion of R.M.A. or R.M.L.I.

During the war the services of the Royal Marines were shown in widely different parts of the world. In all naval actions, of course, and in naval patrol duties, the Royal Marine personnel took a part. In the early days of the war personnel of the corps were also employed with the armoured cars operating from Dunkirk. A Royal Marine Bde. was landed at Ostend in 1914 and four battalions of the brigade took part in the defence of Antwerp. Details from two R.M.L.I. battalions were involved in the landing at Kum Kale and Sedd el Bahr (March 4 1915), and Marine Artillery siege guns were used at Dunkirk. The corps sent a battery to Egypt in 1916 for coast-defence duties. Detachments of Royal Marines served also in Cameroon, in the Persian Gulf, and with Adml. Troubridge in Serbia; and personnel of the corps formed the nucleus of the heavy batteries which were raised for service with Gen. Botha in South-West Africa and with Gen. Smuts in East Africa. The corps also furnished gun-crews for armed merchantmen, and garrisons for such defended naval bases as Scapa, Cromarty and St. Helena, and the improvised coast defences at the North Foreland, in the West Indies, and elsewhere. (E. S. H.*)

United States Marine Corps

In 1911 and again in 1912 unsettled conditions in the West Indies and Mexico made it necessary to assemble a brigade of marines at Guantanamo Bay, Cuba. On Oct. 10 of the former year the revolution which overthrew the Manchu dynasty necessitated the reënforcing of the marine legation guard at Peking and an expeditionary force of marines was dispatched to China. In Nicaragua revolutionary conditions required a large expedition to be sent to that country in 1912; there were engagements in Coyotepe, Leon, Chichigalpa and Masaya. In 1913 conditions in the West Indies required that two expeditions of marines be sent to Guantanamo Bay, Cuba, to act as a pacifying influence. In Jan. 1914 marines from the battleships landed in Haiti, in conjunction with forces of Great Britain, France and Germany. In April, marines and blue-jackets occupied Vera Cruz, Mexico, and the marines served as a part of the army in Vera Cruz and vicinity until December. An expedition of marines also served on the west coast of Mexico during these same troubles. The last half of this year found the 5th Regiment of Marines on board the U.S.S. "Hancock" in Haitian and Dominican waters to stabilize conditions in these two republics. In July 1915 marines landed in Haiti, and in May 1916 in the Dominican Republic, and served continuously in these republics.

Upon the acquisition of the Virgin Islands in 1916 a garrison of marines was established there.

When a state of war with Germany was declared to exist on April 6 1917, the corps was composed of 511 officers and 13,214 enlisted men. Of these, 187 officers and 4,546 enlisted men were on duty beyond the continental limits of the United States, and 49 officers and 2,187 enlisted men were serving on board the cruising vessels of the navy. Only five weeks later, on June 14, the 5th Regiment of Marines, consisting of approximately one-sixth of the enlisted strength of the Marine Corps, sailed from the United States, forming one-fifth of the first American troops in France. It was soon joined by the 6th Regiment and the 6th Machine-Gun Battalion, and the 4th Brigade of Marines was formed. This brigade as part of the 2nd Division fought in the Verdun sector, the battle of Belleau Wood, Soissons, Marbache sector, St. Mihiel offensive, battle of Blanc Mont Ridge, and the Meuse–Argonne offensive; and later it served in the Army of Occupation.

A total of 31,824 marines were sent overseas during the war. They were represented in 11 different divisions in the A.E.F. Approximately 2,500 marines were killed in battle and 8,600 wounded, and with deaths from other causes the casualties in France were approximately 11,500.

The Marine Corps also maintained the 5th Brigade of Marines in France; and it furnished a considerable number of officers to command army units of the 2nd and other divisions.

In 1910 the Marine Corps was composed of 334 officers and 9,521 enlisted men. On Aug. 22 1912 the enlisted strength was increased by 400, making the total 9,921. On March 3 1915 Congress authorized a reduction of 110 privates and an increase of 110 non-commissioned officers. On June 12 1916 Congress added 25 officers and 26 enlisted men. On Aug. 29 1916 Congress brought the strength up to 597 officers and 14,981 enlisted men, and established the Marine Corps Reserve, permitting the enrolment of reserves without limit as to number, and on March 26 1917, the President, under Congressional authority, further increased the corps to 693 officers and 17,400 enlisted men. On May 22 1917 Congress authorized 1,323 officers and 30,000 enlisted men. On July 1 1918 this strength was increased to 3,341 officers and 75,500 enlisted men, which is the greatest strength authorized for the Marine Corps during its history. On June 4 1920 Congress established the permanent strength at 1,254 officers and 27,400 enlisted men. Earlier, July 11 1919, Congress had reduced the Marine Corps to this strength, but of the total number 10,000 had been temporary. (E. N. McC.)

MARKBY, SIR WILLIAM (1829–1914), Anglo-Indian jurist (*see* 17.730*), died at Headington Hill, near Oxford, Oct. 15 1914.

MARKETING.—In modern business, special emphasis rests on the importance of proper arrangements for "marketing." Marketing is essentially buying and selling. The central fact is the sale. But to secure sales the goods must often be assembled from the places where they were produced, graded when qualities differ, sorted when there are different varieties, moved to market and in many cases thence to the place of consumption. Hence *assembling*, *grading*, *sorting* and *transportation* are to be considered as parts of the general marketing function. Similarly *financing*, that is, meeting the actual expenses of marketing including that of holding the products until the demand is present, constitutes a branch of market study. The risk of loss from destruction may be covered by *insurance*. Finally there may also be sales and purchases in advance of the appearance of the products on the market or even in advance of production. *Dealing in futures* and *speculation* are phases of marketing.

Methods of Marketing.—There are scores of methods of marketing and hundreds of variations, but the principles involved are few and may be made clear by examples.

(*a*) *Producer Direct to Consumer.*—The simplest form of marketing and the most primitive is the sale by the producer directly to the consumer. The village boy or girl who raises flowers and sells them to passing tourists, the truck gardener near cities who disposes of his vegetables and fruits by sale direct to consumers, either from house to house or at a market-place frequented both by producers and consumers, the dairyman who peddles or delivers milk direct to consumers, are illustrations. In the aggregate, sales made in this way run into immense volume, although but a small part of the total of business. Modern business, the development of large cities, an increasing division of labour in industry, all tend to reduce this form of marketing. There are, however, variations of selling direct from producer to consumer in modern business which deserve notice. There is a considerable amount of marketing of produce, particularly butter and eggs, direct from farmers to consumers, by parcel post. Much more was hoped for from this system some years ago than has actually resulted. The development of marketing relations between small producers and small consumers is a slow process that apparently cannot be forced. Again, certain specialities, complicated machines such as printing presses, power installations, made-to-order devices, and machines requiring much attention and service after the first sale, usually are sold direct by manufacturers to consumers through the medium of speciality salesmen. The salesman is the representative of the producer in the marketing transaction. Similarly the publisher of books, maps or periodicals who sells his product through canvassers or agents is selling direct to the consumer. Again, if a retailing house does so large a business that it can advantageously engage in manufacturing some of the lines of goods it sells, it may combine production with distribution. One of the most important instances of this method of direct dealing is the mail-order house of Sears, Roebuck & Co., of Chicago, which manufactures in great quantities some of the goods—shoes for example—which it sells.

(*b*) *Through Wholesalers and Retailers.*—Most products of common use—such as foods, clothing, footwear, house furnishings, lumber, fuel and so on—are marketed through middlemen. The manufacturer of men's clothing or of shoes usually sells his product to retailers scattered over the country who in turn sell to consumers. Manufactured food products, dry goods and notions, drugs, hardware and house furnishings are generally sold first to wholesalers, who in turn sell to retailers.

(*c*) *Through Local Buyers, Wholesalers and Retailers.*—Farmers' produce, fruits, vegetables, butter and eggs are commonly marketed through local buyers, then to wholesalers or wholesale distributors, then to retailers and lastly to consumers.

(*d*) *Variations in Method.*—Variations are introduced into marketing in many ways. For example, the actual sale may be consummated through personal salesmanship either in the seller's place of business or in the buyer's. If the seller carries a line of goods he must have a store or shop, but even this may not keep him to one location. The old-time pedlar carried his store on his back. More recently grocery stores, meat shops, book and periodical shops, and even dry goods and house furnishings have been put on wheels, on automobile trucks, and sales routes laid out to be covered periodically, making sales direct to housewives and consumers. Again, the sales may be effected through retail institutions by mail. In the United States a gigantic business has been built up by a few large mail-order houses such as Sears, Roebuck & Co. and Montgomery Ward & Co., of Chicago, and the National Cloak and Suit Co. of New York, which are really stores or shops selling retail to consumers. Wholesale concerns selling only to retail dealers, such as Butler Bros., of Chicago, Charles Broadway Rouss, Inc., of New York, and the Baltimore Bargain House, have likewise developed enormous businesses founded on the mail-order method of selling. In addition to these there is an unknown but certainly large amount of business transacted by ordinary retail and wholesale stores by mail, supplementing personal selling.

Commodities of common use and of well-known standards require a minimum of demonstration and explanation. Sales in large quantities of such goods can be, and are made through exchanges, organized meeting-places for those who buy and those who sell. Accordingly exchanges are located in large wholesale centres for the sale of such commodities as grain, cotton, wool, farmers' produce, sugar, coffee, iron and steel, stocks and bonds. At these exchanges, under established rules, wholesale transactions are effected with a minimum of difficulty and risk. In

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** These figures indicate the volume and page number of the previous article.*

the case of highly perishable goods, such as fruits, where no time may be lost in effecting sales in order that they may reach the consumer before spoiling, the auction system is used. Wholesale buyers and salesmen come together at a designated place at a set time and clear their transactions. The auction is a much more widely used mechanism of trade in England and in continental Europe, where large quantities of nearly all kinds of goods are thus sold, than in America. The auction system has seemed, however, to be developing in recent years in America, particularly in lines of known standard or quality, which are bought in wholesale quantities only at certain brief seasons of the year, such as carpets, rugs, wool and furs.

Variation in marketing occurs through variations in ownership of the goods to be marketed. To illustrate, producers or local buyers usually sell outright to wholesalers all goods marketed through the wholesaler-retailer channel of distribution; but in highly perishable goods such as fruits, dressed poultry, live poultry, etc., and also in cases where the value of the goods runs very high in proportion to the value of the service rendered by the wholesale middleman, as for example, finished textiles, real estate, commercial paper and stocks and bonds, the wholesaler (or dealer who takes his place) frequently, if not usually, merely sells or buys as the agent of the owner and secures a commission or brokerage instead of a profit for his services. This arrangement in the case of perishable goods relieves the wholesale dealer of the risk from loss, and, in the case of costly goods, of the burden of carrying the financing of the goods. Such wholesalers are known variously as commission dealers and brokers.

While goods are being gathered together in wholesale quantities and made ready for distribution to the retail trade other factors in marketing frequently enter in, factors of a speculative nature. Well-standardized goods that are not readily perishable, such as grain, cotton, wool, silk, provisions, coffee, sugar and so on, are likely to be bought purely for speculative purposes. Thus a lot of grain or cotton may be bought and sold several times before being moved to consumption. It is but another step for these speculators to make their ventures in hope of gain on what they think future prices will be. Hence " selling futures " is a common occurrence on the great exchanges that deal in the commodities named. Under this system grain may be bought and sold long before it has been harvested or grown, or even before it is planted. A flour-miller may quite legitimately ensure his future supply of grain at a certain price by buying " futures." But a great deal of opposition has been aroused at various times by speculation in the necessities of life. It has been charged that dealing in futures enables powerful speculators to combine unjustly to secure success for their ventures, in some cases tending to hold prices down and in others tending to hold prices up. As a result both producers and consumers are suspicious of such traders. The consensus of opinion among those who have studied the course of speculation on exchanges seems, however, to be that if manipulation of prices and monopoly can be kept out of the market, and if the laws of supply and demand are allowed to operate freely, the effect of speculation, particularly of dealing in futures, has a healthful balancing effect on the market. Under such conditions purchase and sale of commodities for future delivery tend to discount and equilibrate all conditions of supply and demand, so that changes of price are made much more gradually than they would be if buying and selling of such commodities were confined solely to the stock offered each day. Dealing in futures is an essential function of marketing, but it needs careful regulation to prevent unfair practices.

OWNERSHIP OF DISTRIBUTING CONCERNS.—In the matter of ownership of the various concerns which link distribution there is most interesting variation. While the ownership of a single retail or wholesale store resting in an individual, or in a partnership composed of individuals who make this business their means of livelihood, or in a group of investors in the form of a corporation, may be considered the normal unit, gradual integration is going on both from the producers' and consumers' ends of the distribution chain.

Numerous American manufacturers have established retail store outlets of their own, such as the W. L. Douglas Shoe Co., which has now more than 100 stores of its own besides hundreds of agencies scattered through the United States; the Singer Sewing Machine Co., whose retail sales branches are found in nearly every large city; and many others in such lines as hats, baked goods, gasoline, typewriters, office furniture, phonographs, sporting goods, paper novelties, corsets, gloves, etc. One of the most notable recent American ventures into the retail field by a manufacturer is that of the Winchester Repeating Arms Co. now the Winchester Co., of New Haven, Conn. This concern adopted the policy of establishing its own retail outlets in the larger cities and of forming agency relations in other cities.

Practically all chains of stores maintained by manufacturers seem to have originated, in part at least, because the producer felt that his goods were not receiving proper attention from the regular retail stores. Ownership of the retail outlets by the producer makes it possible for the producer to sell his goods in just the way that he desires. If the store is his own, he can make sure that his goods are represented by a full line, he can dictate the price at which they shall be sold and the service that shall be given. Retailers have used coöperative methods in order to make their relations with production more direct, through buying clubs organized to accomplish specific purchases, through buying organizations of a permanent character which rival jobbing houses, through capital-ownership in wholesale houses, and in a few cases through manufacturing institutions. The rapid development of chain-store systems under single ownership and control is almost certain to accelerate the growth of this kind of coöperation of retailers in their buying activities. From the other end of the distributive chain efforts are being made to unite consumers in the ownership and control of retailing and even wholesaling establishments. Coöperative stores have had a most successful development in Europe but have not done well in America. In the United States there have been successive waves of interest in coöperation. An early example was the effort of the Workingmen's Protective Union to establish coöperative stores, beginning in 1844 and falling off at the time of the Civil War; later there were the Patrons of Husbandry and their Grange stores in the 'seventies; still later the Knights of Labor; then the California Rochdale Societies; then the Right Relationship League; and more recently the coöperative movement undertaken as a part of the policies of the Non-Partisan League, a political party with a strong following in the Dakotas and other middle-western states. All these movements, with the possible exception of the last two, seem to have exhausted themselves. The reasons for the failure of coöperation in retailing in the United States are generally said to be poor business management, unwise extension of credit, poor accounting and general slump of interest in coöperation. Coöperative stores usually claim to save customers money by reducing advertising, by cutting down service, and by locating in inexpensive places. In most instances, after a period of success, their competitors, the privately owned stores, defeat them just because they do advertise, offer the service that people want, and locate at the most convenient places.

CONDITIONS AFFECTING METHODS OF MARKETING.—The precise method of marketing and the channels of distribution to be followed for any product under present conditions depend upon a number of factors. A few of these may be enumerated.

(a) *Location of Producers and Size of Output.*—If producers are many and small and are located far apart, it is almost certain that their products will have to be assembled by a local buyer of some kind; whereas, if the producers are able to turn out large quantities, they may be able to deal with wholesalers direct. Producers who by ingenuity or special skill produce some article of exceptional quality are usually able to sell direct to retailers or even to consumers and thus save.

(b) *Location of Consumers and Demand.*—If consumers use small quantities or small lots of any product at one time, it is almost certain that they must purchase from retailers. Foods, clothing and other ordinary necessities of life fall into this classification. But a large consumer—for example, a chair factory using lumber—would not think of buying lumber from an ordinary local lumber dealer. It would be able to buy more advantageously direct from some mill.

(c) *Variability in Demand.*—Whether a product is wanted regularly or only occasionally is another factor in determining how it shall be marketed. Some articles cannot be sold more than once or twice in a lifetime to a customer. If it also happens that such articles require much demonstration and explanation, then the producer is almost forced to sell direct to the consumer or have his sales made by special representatives or agents. Encyclopaedias, subscriptions to high-priced periodicals, adding machines, life insurance and real estate are illustrations of goods that need such specialized attention.

(*d*) *Degree of Perishability.*—Perishable goods need methods of marketing unlike those used for non-perishable goods. Strawberries sent through the same channels as textile piece goods or hardware, or even the channels of most groceries, would never reach the consumer in condition fit for the table. Time is a very important element in the marketing of perishable goods. There must be no delay and little time can be given to the sale of any particular unit. Another illustration of a perishable article (though in a different sense) is the daily paper, the weekly or monthly magazine. Timeliness is the essence of their value. This makes necessary a highly specialized marketing organization to carry papers or magazines over the country and, in the case of magazines, to place them on sale everywhere at the same time. Such specialized handling calls for expense not incurred in goods not perishable.

(*e*) *Unit Price and Distributing Markets.*—The price of the product to dealers and to consumers, whether high or low, constitutes another factor governing the channels to be selected in marketing. A low-priced article with a small margin of gross profit to the seller cannot be sold in the same way as an article that offers a wide margin. A 25-cent (or shilling) article, such as a handkerchief, a magazine or a screwdriver, could scarcely be sold direct. The margin above costs of production could not possibly permit the article to be advertised and sold by itself by the mail-order method. It must take its way to the consumer through the channels of trade followed by thousands of similar articles. The producer of such an article would have to sell to wholesalers, to chain stores, to department stores, or to mail-order houses doing a general business in which this particular item would be but one of a great many.

(*f*) *Competition.*—The competition in the sales field of any article might readily determine the channel of distribution that is taken. For example, a manufacturer of hardware selling direct to the retail trade found that his strongest competitor's policy was to sell to every dealer who would buy and to offer no exclusive sales arrangements, while he himself made a success by offering his goods only under exclusive sales agencies. Certain manufacturers of soaps, perfumes, and toilet goods have found it so difficult to place their products advantageously in drug stores and similar retail outlets because of the number of competing lines that they have found it advisable to sell, especially in country districts or small towns, direct to consumers by means of agents and canvassers working on a commission basis. A motor-car tire maker found it so difficult to break into the market through automobile dealers and garages that he sold his product to a mail-order house.

(*g*) *Familiarity of Consumers with Product.*—A new product must as a rule be sold through channels that may be abandoned after the public has begun to know the article. Office devices at first sold only by speciality men are gradually taken over by stationery stores. Frequently orders for new food products must first be secured by speciality men from customers before dealers will stock them and offer them for sale. Sewing machines, talking machines and musical instruments, formerly sold only by agents directly in the employ of the manufacturers, are now sold more and more through regular retail stores. As demand becomes established specialized marketing systems can give way to the more general methods.

(*h*) *Changes in Marketing Methods.*—Occasionally a product which is being sold through the regular or customary channels and is having a large sale is withdrawn and sold through a more specialized channel. Ivory Soap is a recent example; its manufacturers, after a long experience of selling to retailers through wholesalers only, during which it built up the largest single soap business in the United States, decided to eliminate the wholesaler, July 1 1920, and sell to the retailers direct. No reports on the success of the policy were available in 1921, but it is to be presumed that the sales will show some increase over the previous year unless the general conditions of business interfere. The real test in efficiency in this case will come in comparing the costs of selling per unit. Examples of other large American concerns which sell to retailers direct include the National Biscuit Co., of New York, the H. J. Heinz Co., of Pittsburgh, and the big packing companies. Many, if not most, other large food manufacturing concerns distributing through the jobbers employ their own sales organizations that do "missionary work" among the jobbers' customers.

Inefficiency in Marketing.—Many criticisms of contemporary marketing systems appeared during the decade 1910–20. The cost of living had risen steadily for nearly 20 years, and very rapidly during the period of the World War, but wages in most lines had not risen in proportion. Hence the purchasing power of the average family had, if anything, diminished. This pressure on the family means of subsistence had caused breadwinners and housekeepers, as well as students and public officials, to listen readily to complaints of the shortcomings of distribution and its probable share in high costs of commodities. Many instances have been cited of the inadequacy of the marketing system. Food-stuffs have been reported as lying on the ground decaying in agricultural districts, while city people were ready to pay high prices for them could they but get them. Those engaged in distribution have been charged not only with inefficiency but also in some instances with deliberate waste to keep up prices by reducing the supply. This accusation is mentioned here, not because it is general, but rather because it shows the temper of the people towards distribution. In the main, however, the greatest criticism levelled at distribution is that it costs too much and that these costs must be paid by the consumer. It is asserted that there is a grocery store for every 80 families and that there should not be more than one for every 200 families. In other lines of merchandise, it is urged, there is the same oversupply of dealers, needless duplication of stores, equipment, and needless sales and delivery people, all of which must be paid out of the business. Criticism has become more pointed and perhaps more constructive as information concerning distribution and its real functions has accumulated. From such studies as have been made it seems safe to state that for most goods the costs of marketing, including transportation, run higher than those of production. This fact has been accepted by the public with some surprise and a feeling that marketing should not cost so much.

Reduction of Marketing Costs.—One method of approaching the problem is to propose some new or different method of distribution. It may be urged that a more general introduction of department stores or chain stores would give more economical results. But what do the facts, so far as they are available, show?

(*a*) *Comparison of Costs by Various Methods.*—Table I contains figures compiled from actual records by the Harvard Bureau of Business Research, Harvard University.

Table I.—*Comparison of Costs of Retailing Shoes 1918. Net Sales 100%.*

	Lowest	Highest	Usual
1918			
Independent shoe stores—			
Low-priced shoes	13·3 %	32·33 %	20·5 %
High-priced shoes	23·43	32·85	28·8
Mail-order chain stores	9·85	57·60	24·6
Department stores—			
Shoe departments	19·0	33·4	23·5
1919			
Independent shoe stores	13·62	35·63	24·0

It is clear that the statistics do not prove that in the case of shoes either chain stores or department stores can be conducted at less expense than independent stores. It is true that the lowest figure for chain stores is considerably lower than any other, but the chain stores also show the highest costs. The average costs of selling in chain stores seem to run a little higher than in independent low-priced shoe stores and in department stores. But taking the 1919 figure for the independents (a figure that includes both high- and low-priced shoes), department stores have a little the best of it.

Table II, showing cost of marketing,[1] is compiled and adapted from reports of the Harvard Bureau of Business Research, Northwestern University Bureau of Business Research, several national trades asociations, and from personal studies.

Table II.—*Marketing: Percentage on Sales.*

	Wholesale			Retail		
	Low	High	Usual	Low	High	Usual
Clothing	12 %	18 %	16 %	20 %	28 %	22 %
Drugs	12	20	15	20	28	25
Dry goods	11	17	14	15	30	23
Furniture	—	—	—	20	30	25
Groceries	5	15	9	9	22	14
Hardware	13	21	18	11	32	18
Jewellery	15	20	18	24	32	26
Shoes	12	17	15	13	34	24
General merchandise				10	30	16
Department stores				18	30	28
Chain stores (Shoes)				10	57	24
Chain stores (5 & 10c)				—	—	25
Chain stores (Groceries)				—	—	13
General mail-order houses				18	30	20

Costs of selling through mail-order houses are not officially known. They are supposed to range from 18 to 30% of sales. But the knowledge of a general figure of this kind for a large mail-order house with many departments would be of little value even if correct. Costs of selling vary from department to department in mail-order houses just as in department stores. To be of value in a comparison of selling expenses, the figures should show the cost of selling shoes, for example, by mail. All things considered, the general costs of running a large mail-order house are probably somewhat lower than those for a large department store handling similar lines and classes of goods. The mail-order establishment need not be in a shopping district, so that the rent or investment represented by its site is comparatively small; the employees who fill orders do so more rapidly and for less pay than those who sell in a store; advertising is usually confined to the less expensive publications, and in the case of the largest houses the customers are much more numerous, running into millions. Costs in the shoe department of a mail-order house should run lower than in a department store or speciality shop, because in the mail-order house there is no time and labour lost in fitting shoes. This saving is counterbalanced somewhat by the number of shoes which are probably returned. The lower costs of selling in the mail-order house, however, are offset in part at least by the costs of transportation and other expense incidental to the customer's ordering by mail.

A part of the competitive battle for trade among these various types of institutions consists in the utilization of large buying power. The dealer who buys for the lowest price, other things being equal, can sell for the least and yet make the same profit as his competitors. Large chain-store systems, mail-order houses and large department stores frequently purchase their goods direct from producers and secure the prices usually given wholesale purchasers. In some cases a part of these differences may be used in cutting the prices to consumers, but it would be a mistake to assume that the consumer gets all the benefit from purchases made at lower prices or that this entire difference is gained for the dealers. Concerns that go direct to the producers, and thereby eliminate the wholesalers, as a rule incur practically all the usual expenses of wholesaling, such as interest on the investment in the larger stock of goods, storage risks, buying expense in dealing with numerous producers instead of a few wholesalers, extra record-keeping, and in the case of chain stores, reshipments to their various stores. The only real saving which buying direct from producers insures is the eliminated profit of the wholesaler, with a possible reduction of the expense for salesmen whom wholesalers must employ. Competition in buying has forced the joint creation by small concerns of buying organizations which, united, represent as large a buying power as the chain or department stores. Coöperation in buying certain classes of goods has strong advantages both for dealers and consumers. Buying in group at one time may secure advantages, not only in price but also in transportation and handling, sufficient to cover the added expenses incurred in buying in quantity. Thus farmers find it profitable to unite in buying a carload of fertilizers once a year. On the other hand it may be exceedingly unprofitable to buy other goods in carload lots. Large purchases would be practically out of the question on such goods as shoes, clothing and most other goods.

Comparing the various methods of retailing as exemplified in the ordinary independent stores, the department stores and the mail-order house, from such facts as are available, it does not seem possible to assert positively that any one method presents decided general economic advantages over the rest. Each presents advantages in point of service, but the differences in service appear to be fully compensated in expense, that is, the public pays for what it gets and in proportion to what it gets.

To illustrate: the modern department store gives more service in connexion with its sales than any other retailing type. It offers the purchaser the advantages of buying many kinds of merchandise under one roof. The purchaser has the benefit of elevators, rest-rooms, wash-rooms, free delivery, credit, large stocks from which to choose, liberal policies as to examination and trial, pleasant surroundings in which to shop, courteous attendants, and so on, but department store expense of distribution includes the cost of maintaining these services. The independent store probably comes second in point of service, although there is the greatest variation in this regard. Personal acquaintance and attention to customers' wants are perhaps the most important factors of independent store service. This type of store renders fewer services, and its expenses are therefore apparently somewhat lower than those of the department stores. Chain stores have had the greatest success when giving a minimum of service. No credit, no delivery and even a minimum of packing and wrapping are common policies. The policy of minimum service is in some cases carried to the extreme of having no salesmen, so-called "self-service" stores. Because the chain store gives less service it can obviously sell its goods at a lower expense. The mail-order house offers to its customers a wide range of goods to select from through a catalogue that may be studied at leisure in the home, but the mail-order house gives less personal service and requires in some ways more from the customer than any other system so far devised. The customer must decide what he wants from the study of a catalogue or other printed matter, he must make out a written order and send it, with a remittance, by mail and await the coming of the goods; he must pay transportation charges and he must make such adjustments as are rendered necessary by the fact that he did not see the goods before purchasing. With no need for showrooms, expensive locations, salespeople and some other incidental expenses, the cost of mail-order business should normally be less than that of any other type. Under the most favourable conditions it probably reaches this position. But the consumer, to some extent at least, makes up the difference by supplying the service that other retailing establishments offer him. The customer may make a money saving by trading with the mail-order house, but he does so by contributing his own time and labour to the transaction.

Another factor needs consideration in connexion with this brief study of the mail-order business. Low costs of retailing by the mail-order methods are based on successful mail-order management. But there are really very few concerns in the United States or any other country which have made a marked success of the mail-order business, while there are scores of highly successful department stores and dozens of highly successful chain-store systems. There have been numerous attempts in the mail-order field, but the failures have also been many. One of the main drawbacks of the mail-order business is the necessity to provide for the supply of merchandise, to draw up sales plans, and to publish the catalogue or other printed matter months in advance of sales. Changes in style, development of new demands and price declines or advances cannot always be foreseen. These conditions cause difficulty in the mail-order business. In a period of consistently rising prices such as obtained during the 30 years ending in the middle of 1920, mail-order methods could be safely employed on a large scale barring difficulties with styles and eccentricities of demand. But if there should be a number of years of price decline, mail-order financial managers will find their problems more difficult than they have been in the past.

So far as the public is concerned it seems safe to say that there are large classes who prefer and who will always continue to prefer to trade in those retail establishments offering them the highest developments of service, the department stores and the independent specialty shops. Other large classes prefer and will probably always prefer to buy in stores offering less service and proportionally lower prices. Undoubtedly there are many who find their greatest satisfaction in purchasing in the stores of the self-service kind where they may look about and pick up on their own initiative whatever they may wish to buy. Institutions are built to serve people in the way that they want to be served. There is room, therefore, in the retail trade for many types of stores. Specialty shops, department stores, chain stores, and mail-order houses will all continue to exist as long as there are numbers of people who want the services each institution offers. It seems impossible to believe that any one type will monopolize the retail business or crowd out all the others.

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[1] Costs of retailing in other lines of merchandise, so far as the figures are available, show about the same relationships. The example presented may be taken as typical.

Any discussion of coöperation in distribution is purposely omitted at this point, for, as has already been pointed out, coöperation does not introduce any novelty in distribution method. It merely changes the type of ownership and control from that of investor-interest to consumer- or producer-interest, depending on whether the coöperators are consumers or producers. Obviously, coöperative ownership and control can be applied to specialty shops, department stores, chain stores or mail-order houses. Any degree of service now offered or refused by any type of store can be offered or refused by coöperative institutions. Most of the savings proposed under coöperative management, other than the profit which the coöperators as owners of the business hope to secure in the form of dividends or in lower prices, come definitely from reduced service. Incidentally that has been the cause of the failure of many coöperative enterprises. Their customers withdrew because they desired more service and were willing to pay for it.

(*b*) *Individual Expenses that may be Reduced.*—There is another method of attacking the problem of the high costs of distribution, one that is not spectacular, nor revolutionary, nor necessarily drastic, but which has already given promise of results proportionate to efforts to be applied. This method is merely to apply scientific methods to the improvement of the present systems of distribution, step by step, detail by detail.

In the table already given showing costs of selling in wholesale and retail stores, it may be noted that there is a wide range between the low-cost and the high-cost stores. This range is due, in part, to differences in lines of goods handled and differences in service; but a part of the range is due to differences in operating efficiency. That some stores should be able to show a high efficiency measured in low costs over other stores gives great hope of cutting distribution costs generally, by extending to all the methods now used by the best stores. The first step in a scientific approach to reducing costs of distribution is to determine by survey, investigation and actual measurement what the present difficulties are and what stands in the way of improvement. Although considerable work has already been done in this direction, much more must be undertaken, but it is possible even at present to indicate roughly some of the details in the distribution system which may be profitably studied.

The following statements outline briefly a few of the details of distribution which it seems certain must receive attention in order to secure more economical distribution. No doubt many more could be added. Poor roads greatly increase the costs of bringing the farmers' crops and produce to market, costs that must be added to the price that consumers eventually pay. Inadequate railway transportation is another element that makes a considerable addition to the costs. Car shortages at crop-moving time, cars unsuited to the products to be hauled, excessive delays in forwarding, at terminals, on the way, and at transfer points, are common sources of expense. Every day added to the time required for transportation adds not only to the transportation charges but also directly to the cost of the goods themselves in interest charges on the capital invested in the goods, and in an additional burden of other overhead expense due to lengthening of the period of turnover. Delay in transportation as a factor of expense in distribution has not been given the attention that it deserves. Poor location of terminals makes a great deal of expensive cartage necessary. Congestion of traffic in city thoroughfares is a growing cause of increased costs in distributing goods. Inadequate, inefficient, poorly located storage facilities cause huge losses. Inadequate, unauthoritative and inaccurate collection and dissemination of market information such as is needed by producers, distributors and consumers is responsible for great wastes. Through lack of such information business in many lines now passes constantly from glut to famine and back again. Poor packing of merchandise, inefficient loading, rough handling and uneconomical methods of handling are causes of waste and therefore of higher costs of distribution.

To refer more specifically to the activities of marketing through wholesalers and retailers, there is a startling loss of the wholesale salesman's time in finding customers, in making appointments, in fruitless interviews. The time of both salesmen and buyers is lost. Probably less than a sixth of a salesman's time, averaging salesmen of all classes, is actually employed in selling or even in displaying and describing merchandise. Anything that can be done to improve this deplorable economic condition will increase efficiency and decrease costs. No one can even begin to estimate the losses resulting from poorly trained salespeople, who fail to sell and who waste the time of their purchasers through lack of knowledge of their goods, their customers' wants, and their business, or through lack of ability to use their knowledge properly. Another source of loss that adds to the high level of sales expense is that the rank and file of salespeople of most classes, but more particularly in retail stores, lack interest in their work. The fundamental incentives of profit in proportion to effort expended and of self-expression in management, such as the owners or managers feel, is for the most part totally lacking. For this reason most employees give but a fraction of their ability to their work.

Advertising is or should be an invaluable aid to marketing. In the list of expenses of distribution it occupies a prominent place. There is certainly room for improvement in its administration. Much study has been given in some organizations to such problems as the proper selection of mediums and the right use of the space taken. No doubt much greater progress can and will be made in the future in these directions, but the greatest loss in advertising seems to be in the lack of faith of the public in the advertising. If people gave more credence to advertising, much less of it would be needed to secure the same result. The remedy, of course, lies in the direction of raising the standards and shutting out the dishonest advertiser.

Duplication in delivery organizations by retail stores is a source of economic waste. A beginning has been made towards eliminating some of this waste through coöperative delivery and by utilization of the parcels post. In a few cities a good share of all retail deliveries was in 1921 being made through the post-office with a considerable saving in money and no reduction in efficiency. Poor buying, imperfect realization of public demand, duplication of stocks of goods in too many styles, brands and makes, tying up too much capital, slowing up turnover and increasing overhead expense are causes of high costs of distribution chargeable to buyers of goods both in wholesale and retail stores. There are many who think that there are too many retail stores. Would goods be sold for less if there were fewer? Probably not, because a large part of the competitive losses now occurring because of the number are borne by the dealers themselves in unpaid services. It may be argued that if their number were reduced the rentals for the locations that would be eliminated could be saved. This cannot be definitely checked by such experience as has been recorded in any public way. Concentration of retailing seems invariably to result in increasing rents. In fact, rents tend to increase faster than sales, so that the fewer the stores the higher the share of the landlord. More studies are needed to determine the exact effects of restriction of the number of stores on costs of distribution.

There is another matter that needs consideration in connexion with any attempt to reduce rents, and that is the fact that the store plant is unused for a large part of the time. It seems impossible to secure the high degree of use that may be had in a factory or shop where, when there is plenty of work to be done, the plant can be kept working both night and day by means of two or three labour shifts. Store hours are by custom and legislation steadily growing shorter. This means that the capital invested in stock and plant has fewer hours in which to produce.

Finally, there is undoubtedly an enormous loss due to unfairness and dishonesty, a loss that is now carried in large part if not wholly as an expense of distribution, being added to the price paid by the consumer. Failure to return containers lent by distributors seems a small item, but in such a business as milk distribution in large cities the loss to milk distributors due to non-return of empty bottles is enormous. Uncollectable debts and the cost of collecting delayed payments are important items in the expenses of distribution. Disregard of contracts in such matters as refusal of goods after placing orders, failure to deliver goods after orders are placed, abuse of the privilege to return goods, claims for adjustment, and many other similar items make up large losses in money, time, labour and thought that should be made available for the public good. Unfair competition, efforts made not to increase legitimate business but to impede or even to destroy competitors, commercial bribery, " graft," and the exercise of monopoly, all burden distribution expense far too much. A source of considerable loss is theft by employees, burglars and shoplifters. Some retail establishments count upon a fixed percentage on their sales representing losses due to this cause, a percentage that is added to the gross expenses which form part of the selling prices. Many of the losses of the distributive business, including theft, breakage, fire, and so on, are covered by insurance. In this way the individual distributor saves himself against exceptional loss, but the cost of the insurance is carried as an expense against the distributing process. Hence the public must pay a price for its goods that will cover these losses. Anything that can be done to reduce them will by that much reduce the expenses of distribution and the prices of goods.

EDUCATION IN MARKETING.—The leaks and wastes enumerated above are certainly responsible for at least a quarter of the present costs of marketing. They may be responsible for a third or even more. Here, then, is a great field for reducing costs by improving present methods. The first general step towards such improvement is education. Trained minds are the means through which the improvements may be devised and trained workers are needed to carry the improvements into effect. A beginning has been made. Before 1860 the apprenticeship system was general in England and to some extent in America, in retail, wholesale and importing houses. Young men came to their life's work through a course of experience and training well calculated to give an all-round view of the business. The apprenticeship system gradually decreased about the middle of the 19th century, and for years after no systematic training was provided for young people other than the haphazard effect of their experience. The first training of modern salesmen in America seems to have been by the subscription book houses that flourished during the 'seventies and 'eighties. Their canvassers or book agents were thoroughly drilled or schooled in the art of selling or in securing orders. During the 'nineties sales managers in specialty manufacturing concerns, notably the National Cash Register Co., of Dayton, O., began training their men in special schools held at the factory. Training salespeople for retail stores seems to have begun in the 'nineties in such subjects as arithmetic, spelling and writing and, in 1905, in sales methods, under the auspices of the Women's Education and Industrial Union in Boston. Educational service to salespeople and other workers is now commonly found in the better classes of both wholesale and retail stores. A beginning has been made also in education in distribution and marketing in American colleges and public schools. Several colleges offer courses in marketing, selling, sales management and advertising. Many high schools give similar but somewhat more elementary courses. The main drawback to a rapid development of public education in marketing seems to be a shortage of teachers who can conduct such courses rather than lack of public interest. Considerable aid is being given to distribution through educational short courses, institutes, and conventions and extension classes conducted by some of the state universities on systems much like those adopted by the agricultural colleges in conducting educational work for farmers. Associations of dealers have given to their annual meetings more and more of the spirit of educational gatherings. Such an organization as the U.S. Chamber of Commerce in its relation to distribution is largely a clearing-house for information and educational ideas for its members. One of the notable things in the progress made in educational work for marketing is the growing conception of the relation of the sciences of psychology and sociology when practically applied to the problems of marketing. In addition to these sciences the college courses in marketing now established include economics, statistics, geography and languages, in addition to more technical business subjects such as salesmanship, advertising, sales management and accounting.

Government Aid and Regulation.—The U.S. Government has taken a growing interest in marketing, particularly of agricultural products. In 1913 there was established in the U.S. Department of Agriculture a Bureau of Markets to organize and carry on studies in the marketing of agricultural products, assist in working out grades for various commodities, attack problems of transportation and storage as affecting farm products and so on. The Bureau of Markets issues monthly a document known as the *Market Reporter*. The Bureau of Crop Estimates, another division of the Department of Agriculture, publishes monthly the *Crop Reporter*, which collects and presents information on the condition of production of agricultural products. The International Agricultural Institute, located at Rome, and supported by the coöperative action of most of the Governments of the world, collects and disseminates essential crop information for all parts of the world, information invaluable to the proper distribution of food products. Since the establishment of the Federal Bureau of Markets there has been a strong tendency to establish state and local marketing bureaus to act locally and to coöperate with the national bureau. Up to Feb. 15 1921, 31 American states had started such bureaus, commissions or departments. Proposals to establish similar organizations were then before other states and were almost certain to pass. The county agents, agricultural educational officers appointed by the states to assist in the development of agriculture, working in hundreds of counties scattered all over the United States, help to organize buying and selling clubs and actually serve in many cases as sales and purchasing agents for such goods as seed grains, fertilizers and so on. In addition, the Federal Government shows its interest in marketing through control of transportation, weights and measures, storage plants and exchanges, and prevents adulteration and mishandling of products entering into interstate trade. The U.S. Department of Commerce, through its Bureau of Foreign and Domestic Commerce, collects and distributes information on export trade. The U.S. Geological Survey reports the production and distribution of minerals and metals. The Forest Service reports the production of lumber and other wood products. The Federal Trade Commission has made intensive marketing studies of certain commodities and has drawn up outlines of accounting systems suited to retailers and manufacturers. The chief function of the Commission, however, is to act as a court of investigation and trial of unfair trade.

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MARKHAM, SIR ALBERT HASTINGS (1841–1918), British admiral and Arctic explorer, was born at Bagnères, France, Nov. 11 1841, the son of a naval captain. Entering the Royal Navy in 1856, he served during the next 16 years in the Far East (where he took a prominent part in reprisals upon the Japanese of Kagoshima for the murder of an Englishman) and on the Mediterranean and Australian stations. In 1873 he shipped as A.B. on a whaler for Davis Straits and Baffin Bay with a view to investigating that route for polar research; he took an active share in the work of the vessel, and wrote a fascinating narrative of the voyage (*A Whaling Cruise to Baffin's Bay*). In 1875 and following years he commanded H.M.S. "Alert" on the Arctic expedition under Nares, and at the head of a sledge-party he reached the highest latitude attained up to that time (83° 20′ N.). Subsequently, after further service in the Pacific and as captain of the "Vernon" torpedo school, he visited Novaya Zemlya with Sir H. Gore-Booth, and also Hudson Strait and Bay, upon which he reported to the Canadian Government as to their suitability for a commercial route. In 1886 he was appointed to command the training squadron; he was promoted rear-admiral in 1891, and in 1892 became second-in-command of the Mediterranean squadron under Sir George Tryon. His flagship was the "Camperdown" when she was rammed and sunk by the "Victoria"; he was acting under superior orders and was not censured. Subsequently he was placed in command at the Nore. He was created K.C.B. in 1903 and retired in 1906, devoting himself thereafter to literary work (including a biography of his cousin Sir Clements Markham), to the furtherance of polar exploration, and, during the World War, to the mine-sweeping service. He died in London on Oct. 28 1918.

MARKHAM, SIR ARTHUR BASIL, 1st Bart. (1866–1916), English politician, was born at Brimington Hall, near Chesterfield, Aug. 25 1866. He was educated at Rugby, and later entered the Sherwood Foresters. In 1900 he was elected Liberal member for the Mansfield division of Notts., where, as a wealthy colliery-owner, he exercised considerable influence. He became known as a highly independent but energetic member of the House of Commons, and was created a baronet in 1911. He died at Newstead Abbey, Mansfield, Aug. 5 1916.

His sister, Violet Rosa Markham, born at Brimington Hall Oct. 3 1872, became well known as a traveller, making long journeys in South Africa and Siberia. In connexion with the anti-suffrage movement she made a reputation as a speaker. She was a member of the Central Committee on Women's Employment (1914), and in 1917 deputy director of the women's section of the National Service Department. The same year she became a Companion of Honour, and in 1918 unsuccessfully contested the Mansfield division of Notts. as a Liberal. In 1919 she became a member of the Industrial Court, and in 1920 was appointed a J.P. She married in 1915 Maj. James Carruthers, A.A.G. to the British army of the Rhine. Her published works include *South Africa Past and Present* (1900); *The New Era in South Africa* (1904); *The South African Scene* (1913) and *A Woman's Watch on the Rhine* (1921).

MARKHAM, SIR CLEMENTS ROBERT (1830–1916), English geographer (*see* 17.734), died in London Jan. 30 1916 of shock following an accidental fire. The principal work of his later years was connected with the two Antarctic expeditions under Capt. R. F. Scott, for whom he entertained a warm personal affection, suffering a grievous blow at his loss. Markham's long-standing interest in South American geography, history and affairs led to his election as president of the International Congress of Americanists in 1912. An important history of Arctic and Antarctic exploration by Markham was completed posthumously by Dr. F. H. H. Guillemard and published in 1921 under the title of *The Lands of Silence*.

A *Life*, written by his cousin, Adml. Sir A. H. Markham, was published in 1917.

MARLOWE, JULIA (1870–), American actress (*see* 17.744), first appeared in London in 1907 in Hauptmann's *The Sunken Bell*, following this by successful interpretations of Shakespearean heroines. In 1909 she played Cleopatra at the opening of the New Theatre, New York, with E. H. Sothern, afterwards touring with him in Shakespearean plays and appearing again in New York in 1910 as Lady Macbeth.

MARNE, BATTLE OF THE.—Under this name is included the connected series of actions fought in Sept. 1914 in the area between Paris and Verdun, when the French and British armies, which had been in full retreat from the frontier, turned at bay and inflicted defeat on the Germans, driving them to the Aisne.

To understand the claim of the battle of the Marne to be regarded as a decisive battle of the world, something more than a mere tactical narrative is necessary. The circumstances in which it was fought must be first considered. Tactically, indeed, the result was somewhat of a disappointment. No part of the German host was annihilated, or even immobilized for any length of time; the number both of trophies and prisoners was inconsiderable; the Germans broke off the fight at their own time; no great strategic pursuit such as had succeeded Jena took place; and the Germans were enabled to retire, if not unscathed, at any rate in fair order. Strategically, however, the battle was of immense import. It marked for the Allies the definite turn of the tide of defeat, while for the Germans it signified no less the collapse of the plan with which they had entered the war and on which their Great General Staff had been prepared to hazard the fate of the empire.

In spite of the victories which had marked their entry into France, the situation of the Germans by the end of Aug. 1914 was not without anxiety. The principle underlying their plan of operations had been that France was to be brought to her knees within six weeks; but when two-thirds of this period had expired the French and British armies were still keeping their opponents at arm's length. The German plan had laid down that if the French were to form a great defensive flank resting on Paris the capital was to be turned by forces pushed W. and S. of it; Ersatz divisions were to be dropped for the investment; and the five field armies pivoting on Thionville were to force the whole of the Allied forces against the Swiss frontier. An operation of such a nature, involving the handling of immense masses of men, demanded, however, a supreme direction of the highest order accompanied by most detailed instructions for the frontage of each army so that the general alignment might be preserved and overlapping prevented. These essentials were not forthcoming. Supreme Headquarters were for a time over 100 m. in rear of the German right wing, and the only means of communication were wireless telegraphy—which worked incredibly slowly—and the transmission of orders by officers in motor-cars. The inevitable result of indifferent communication was that on the German right the absence of unity of control soon showed itself to a serious extent. Further, the ever-lengthening lines of communication were adding to the supply and transport difficulties of the invaders, and slowly but surely sapping their strength. Maubeuge, too, still held out, and the retention of this fortress by the French denied to the invaders the use of a valuable line of railway. The inevitable wastage involved by a rapid advance in trying weather had made itself felt, and the cavalry horses were in serious need of rest. Nor was there any depth in the advance. From the I. Army two corps had been left in Belgium to mask Antwerp; while from the II. Army the VII. Reserve Corps was immobilized by the siege of Maubeuge. Worse still, two corps had been sent off post-haste to E. Prussia, and of these one had been subtracted from the German right wing where every man was urgently required. Nor had the right wing been drained merely to find troops for Belgium and E. Prussia. Peremptory orders had been given to send off the Ersatz divisions and 70 heavy batteries—earmarked for the investment of Paris—to take part in an attack against the Grand Couronné de Nancy.

On Aug. 28, when German Supreme Headquarters directed that Gen. von Bülow's II. Army with the I. Cavalry Corps was to advance E. of the Oise on Paris, while the I. Army of Gen. von Kluck, moving down the opposite bank of that river, was to advance towards the Seine below the capital, it was brought home to the Germans that they had not sufficient troops to carry out their grandiose plan. They "had bitten off more than they could chew"; and the net result of the extension of their line was that the II. Army, in comparative isolation, found itself committed to an advance direct against the great fortress of Paris. So perturbed was Gen. von Bülow by his situation that when the French V. Army attacked him on Aug. 29 at the battle of Guise he sent out urgent appeals by wireless messages to the I. and III. Armies to close inwards to his aid. Gen. von Bülow's cries for assistance were destined to alter the whole course of the war, for Gen. von Kluck, apparently glad of an excuse to switch off from the elusive British army, during the evening of Aug. 30 telegraphed to Supreme Headquarters to say that his army had wheeled round towards the Oise and would advance on the 31st by Compiègne and Noyon "to exploit the success of the II. Army." This involved a definite movement S. and S.E. by both these armies; but during the night an answer came by wireless from Supreme Headquarters formally approving of this new operation. In a word, an advance by the right wing against Paris was now postponed, if not definitely written off. Trusting that the newly formed French VI. Army, which had fallen back on Paris, would be chained to the capital, and convinced that the British army was incapable of any action other than licking its wounds, the German General Staff now reduced the scope of their original plan and decreed that the new objective was to be the flank of the "main French forces" in front of the II. Army. Put briefly, while envelopment by the German right wing was still the end in view it was to be an envelopment not of all but of part of the Allied forces. Success was still hoped for; but the colossal Sedan originally aimed at was ruled out of court by the growing difficulties of the strategic situation.

As for the French, the month of Aug. had been marked by a succession of failures which might well have daunted a commander of less resolution than Gen. Joffre. The offensive of their I. and II. Armies S. of Metz had failed, and failed badly; and the failure had necessitated a modification of Gen. Joffre's plan. A new offensive farther N. had begun on the 22nd, but here again failure had dogged the efforts of the French, for owing to misunderstanding and lack of coördination the whole movement collapsed, and the collapse had the effect of completely isolating the V. and British armies in the zone Mons–Charleroi. Even then the cup of failure had not been completely drained. Gen. Joffre's fresh plan, of Aug. 25, of regrouping the Allied forces and strengthening the left wing with a new French army drawn from the E., so as to take the offensive from the general line Verdun–Laon–La Fère–Bray, could not be carried out. On

Aug. 31 Amiens fell; the British were definitely cut off from their bases in the Channel ports; and the whole Allied line was withdrawn, pivoting its right on the fortress of Verdun. Paris was now in danger and the newly formed VI. Army, with Gen. Sordet's cavalry corps, was sent back to the capital, where both units were to come under the orders of Gen. Galliéni, the military governor.

Gen. Joffre, however, never wavered in his intention to assume the offensive at the first opportunity, and he decided to continue his retirement merely until the protection of a topographical obstacle would afford his troops a temporary respite during which reorganization could take place and wastage might be made good. The limits of the withdrawal were laid down as the territory immediately S. of the rivers Seine, Aube and Ornain. Tactically the barrier formed by the river lines might reasonably be expected to afford the brief breathing-time required by the Allied troops, but the project was open to the objection that its adoption would mean the abandonment of a further section of French soil and the isolation of the capital.

Meanwhile, inside Paris Gen. Galliéni was labouring with feverish energy to make good the deficiencies of defence caused by the apathy and neglect of successive French Governments. Even in the critical situation of the last days of Aug. the Government of the day was more alive to the danger of alarming the populace than to the necessity of defence, and refused to sanction some of the measures which Gen. Galliéni regarded as indispensable. The actual garrison consisted of four and a half divisions of the Territorial Army (*i.e.* men of the older classes), some cavalry and field artillery, as well as 5,000 *Fusiliers Marins* sent to reinforce the police of the capital; but on Sept. 1 the newly formed French VI. Army, some 60,000 strong under the command of Gen. Maunoury, was formally placed under the orders of the military governor. In addition to the VI. Army the cavalry corps of Gen. Sordet had been sent back to Paris, and two other reserve divs., the 61st and 62nd, were at Pontoise; but these had been very roughly handled at St. Pol and Arras and had lost most of whatever fighting efficiency they had originally possessed. A far more valuable reinforcement was the 45th Div. from N. Africa, which had just detrained in Paris and was impounded by the military governor.

At six o'clock on the evening of Sept. 1 Gen. Galliéni issued his first operation orders. In that document he laid down definitely that Paris was to form the *point d'appui* of the left of the French armies which were retreating towards the south. Gen. Maunoury, in his retirement on Paris, reinforced by the 92nd Territorial Div. and other units, was to cover the entrenched camp from the N. and E., and the cavalry corps of Gen. Sordet was placed at his disposal as a protection to his left. The 45th Div. was to be the general reserve under Gen. Galliéni's own hand, while the actual garrison of Paris itself was to consist of some four territorial divisions. The IV. Corps (from the IV. Army) had been promised by Gen. Joffre, but was not expected to arrive from Verdun until Sept. 4. In touch with the Army of Paris were the British, for the moment on the line Nanteuil-le-Haudouin–Betz, but retreating *pari passu* with the French armies on its right.

Although for more than 48 hours the Germans had renounced the advance on Paris, all through Sept. 2 it was believed in the city that they were still marching straight on the capital. The arrival of the enemy was, indeed, now thought to be but a matter of hours. German agents had notified the U.S. embassy of the forthcoming entry; the embassy had prepared notices to be affixed as safeguards to the residences of American citizens; and the ambassador came formally in person to request sanction for their issue from the military governor. Gen. Galliéni spent the afternoon in a final survey of the positions occupied by the forces under his command, convinced that the morrow would witness the opening of the battle which was to decide the fate of the French capital. What he had seen of the troops on whom the great duty of defending Paris was thrust had by no means reassured him. The VI. Army—largely made up of reserve troops—had not recovered from the disorganization caused by its hurried retreat from the neighbourhood of Amiens. The 45th Div. from Algiers, however, presented a more encouraging sight. Composed of seasoned soldiers, who had not been exposed to the depressing experience of retreat, and admirably equipped, its *fort bel aspect* gladdened the heart of the military governor on that anxious day; but as for the 92nd Div. of *Territoriales* its field entrenchments were but half finished, and its personnel was hardly of the class which a commander could put with confidence against first-line German troops. Gen. Galliéni's actual instructions were to defend Paris *à outrance* so as to save it from the invader; but his military instinct had led him to aim at active defence so as not only to save the capital but to make the fortress a strong support for the left flank of the Allied armies in the field. The task was a formidable one, and Gen. Galliéni was under no illusions as to the gravity of the outlook when he reached his headquarters in Paris in the evening, and heard news which altered the whole situation.

The German *glissement* towards the S.E. had begun on Aug. 31 and had actually been observed by a French cavalry patrol about noon on that date from a point near St. Maur, but curiously enough the information had never come to Gen. Galliéni's ears. Even as late as the morning of Sept. 3 all the information available had pointed to a German advance on Paris with the Senlis–Paris road as the axis of movement. But by midday the situation had completely changed. Intelligence transmitted by aeroplanes and cavalry patrols showed that the German I. Army had abandoned the march on Paris, and by evening it was clear that the main body of Gen. von Kluck's army was heading S.E. towards the junction of the right of the British with the left of the French V. Army.

Gen. Galliéni's first decision was to verify these reports so as to eliminate all possibility of error. At dawn on the following day all available aircraft ascended from the capital with express instructions to report by 10 A.M. on these movements of the German right wing. The information gathered completely confirmed the intelligence of the evening before. The Senlis–Paris road was free of Germans; Senlis and Creil were in flames; and, with the exception of some cavalry patrols, the country W. of the Senlis road was empty. So much was absolutely definite, and a comparison of the various reports sent in led to the following deduction as to the movements of the German I. Army. The IV. Reserve Corps was acting as a flank guard and was marching in two columns towards Lizy-sur-Ourcq and Meaux, flanked by some cavalry towards Crouy. The II., III., IV. and IX. Corps had crossed the Marne and were at 10 A.M. deploying along the Petit Morin from La Ferté-sous-Jouarre to Orbais.

Gen. Galliéni could now turn his attention from the actual defence of the capital to the far wider issue of the war as a whole. The situation in which he now found himself required exceptional power of judgment to ensure a right decision. On the one hand there was the German I. Army making a flank march across the N.E. of Paris, actually inviting attack, and providing a temptation almost impossible to resist; on the other hand there was the fact that Gen. Joffre had prescribed a retirement behind the Upper Seine and Aube as an essential preliminary before any offensive could be attempted. Gen. Galliéni clearly realized that combined action by the armies in the field and the army in Paris might effect immense results in the new state of affairs; but he also saw that a mere sortie by the army of Paris would be an extremely dangerous measure. He realized, in fact, that Paris and the army in the field must sink or swim together. If Gen. Joffre hoped to resume the offensive the time to do so was while his left was still in touch with the capital, which would form a *point d'appui* for that flank, and before the golden opportunity of striking at the enemy's flank had passed away.

Anticipating the sanction of the commander-in-chief, which he hoped to obtain, Gen. Galliéni at 9 A.M. ordered the commander of the VI. Army to hold his troops in readiness for an advance against the exposed flank of the German I. Army, informing him at the same time that the 45th Div. was now at his disposal. Gen. Galliéni's chief-of-staff then informed G.H.Q. by telephone that the VI. Army had now received orders to move out eastwards in the afternoon, but that it could be directed to operate on the right or left bank of the Marne as required. The next thing was to secure the coöperation of the British, and accordingly at one o'clock Gen. Galliéni started for the headquarters of Sir John French, which were at that time fixed at Melun. The British commander was at the moment with his troops some miles in front, and in his absence it was not possible to arrive at a definite decision on a matter of such importance as the project now suggested. On his return Gen. Galliéni was shown a telegram which had come from Gen. Joffre early in the afternoon. It was to the effect that, while favouring the project of an early offensive in principle, Gen. Joffre considered that the project of carrying the VI. Army to the left bank of the Marne S. of Lagny held out the greatest prospect of success. Gen. Joffre, Gen. Galliéni and Sir John French were all equally desirous of assuming the offensive at the first available opportunity, and any divergence of opinion was but on matters of detail. Further telephonic communication removed from the mind of the commander-in-chief any lingering doubts as to the advisability of adopting Gen. Galliéni's original plan of using the VI. Army N. of the Marne. From all the information gained Gen. Joffre had now realized that a chance not often to be met with in war was offered him. He determined to assume the offensive at the earliest moment, and shortly before midnight he issued his directions in which he stated that advantage was to be taken of the situation of the German I. Army to concentrate against it the efforts of the Allied armies of the extreme left. All necessary preparations were to be carried out during the 5th, and the attack was to be made on Sept. 6. The die was now cast, and it only remained for the Franco-British armies to carry out to the full the tasks assigned them by the French generalissimo.

In detail the orders of Gen. Joffre were as follows: (*a*) All the available forces of the VI. Army N.E. of Meaux to be ready to cross the Ourcq between Lizy and May-en-Multien, in the general direction of Château-Thierry. The available portions of the I. Cavalry Corps which are close at hand to be handed over to Gen. Maunoury for this operation. (*b*) The British army to establish itself on the line Changis–Coulommiers, facing E., ready to attack in the general direction of Montmirail. (*c*) The V. Army to close slightly on its left and take up the general line Courtaçon–Esternay–Sezanne, ready to attack, generally speaking, south to north. The II. Cavalry Corps to ensure connexion between the British army and the V. Army. (*d*) The IX. Army to cover the right of the V. Army by holding the southern outlets of the St. Gond marshes and by placing part of its forces on the tableland N. of Sezanne.

In the orders issued by Gen. Joffre on the afternoon of the 4th only the VI., British, V. and IX. Armies had received detailed instructions as to the task before them, but on the 5th supplementary orders were issued, carrying on the scope of operations so as to include the French III. and IV. Armies. These orders were received by the armies concerned at about 7 P.M. on the 5th, and ran as follows:—

IV. Army.—To-morrow, Sept. 6, our left armies will attack the German I. and II. Armies in front and flank. The IV. Army will cease its southerly movement with that of the III. Army, which will issue N. of Revigny and take the offensive towards the north-west.

III. Army.—The III. Army, covering itself against attack from the N.E., will debouch to the W. to attack the left flank of enemy forces marching W. of the Argonne. It will coördinate its action with that of the IV. Army, which has received orders to attack.

Working from W. to E., the disposition of the armies of France and England between Paris and Verdun, as they stood during Sept. 5, was as follows:—

French VI. Army: Gen. Maunoury. VII. Corps (14th Div., 63rd Reserve Div.); IV. Corps (detraining at Cagny and vicinity; considerable delay had been caused by a railway accident *en route*; 55th and 56th Res. Divs., Gen. Lamaze; 61st and 62nd Res. Divs., Gen. Ebener; a Moroccan Brigade; I. Cavalry Corps, Gen. Sordet, less the Provisional Cavalry Div., Gen. Cornulier-Lucinière).

(This army had endeavoured to effect its concentration at Amiens, but had been forced to fall back on Paris and now stood on a line covering the capital on the N. and north-east. The 45th Div. did not actually come up until the evening of the 5th and was kept in reserve. The I. Cavalry Corps had fallen back S. of the Seine, very exhausted.)

British Army: Field-Marshal Sir John French. I. Corps (1st and 2nd Divs.; Gen. Sir Douglas Haig); II. Corps (3rd and 5th Divs.; Gen. Sir Horace Smith-Dorrien); III. Corps (4th Div. plus 19th Inf. Bde.; Gen. Pulteney); Cavalry Div. (5 cavalry brigades and horse artillery; Gen. Allenby).

(This army lay behind the Grand Morin on the general line Bailly–La Houssaye–Courpalay, in order, from left to right, III., II., I, and covered by the cavalry.)

French V. Army: Gen. Franchet d'Espérey. I., III., X., XVIII. Corps; 37th and 38th (Algerian) Divs.; 51st, 53rd and 69th Reserve Divs.; II. Cavalry Corps (Gen. Conneau).

(The front of this army extended from about Courtaçon on the left to between Esternay and Sezanne on the right.)

French IX. Army: Gen. Foch. IX. Corps (included Moroccan Div. *vice* 18th Div.); XI. Corps (included 18th Div.; strength 3 divs.); 42 Div.; 52nd and 60th Res. Divs.; 9th Cav. Div.

(This army occupied the front Sezanne–Camp-de-Mailly, near Sompuis. The 9th Cavalry Div. was on the right flank.)

French IV. Army: Gen. Langle de Cary. II. Corps; XII. Corps; XVII. Corps; Colonial Corps.

(The IV. Army occupied a position from near Sompuis through Humbauville, thence S. of Vitry-le-François, as far as Sermaize. It was reinforced on Sept. 9 by the XXI. Corps from the I. Army.)

French III. Army: Gen. Sarrail. IV. Corps; sent to VI. Army (IV. Corps); V. Corps; VI. Corps; one brigade of the 54th Div.; 65th, 67th and 75th Res. Divs.; 7th Cav. Div.

(This army was posted on the line Revigny–Souilly, and on its right it joined up with the mobile garrison of the fortress of Verdun. It was reinforced on Sept. 7 by the XXV. Corps from the II. Army.)

On the same date the German armies in France were thus disposed:—

I. Army: Gen. von Kluck. II., III., IV., IV. Res. and IX. Corps; 2nd, 4th and 9th Cav. Divs. under Gen. v. der Marwitz, with three Landwehr brigades on lines of communication.

(The III. Res. Corps of this army had been left behind to watch Antwerp, and the IX. Res. Corps, temporarily held in Germany for the defence of the N.W. coast, was only just beginning its movement to Belgium and France. The IV. Res. Corps was posted on a line S. of Nanteuil and W. of the Ourcq to form a flank guard for the new march of the German I. Army. The main body of that army had its right about Crecy, and the line ran thence generally eastwards through St. Augustine and Sancy to Esternay.)

II. Army: Gen. von Bülow. Guard, VII., X. and X. Res. Corps; Guard and 5th Cavalry Divs. (under Gen. von Richthofen).

(The headquarters of the II. Army were at Montmirail, and its line stretched thence, keeping N. of the marshes of St. Gond, through Congy to Ecury-le-Repos. The VII. Corps was echeloned behind the right rear, N.W. of Montmirail. The VII. Res. Corps of this army had been detached to besiege Maubeuge.)

III. Army: Gen. von Hausen. XII., XII. Res., and XIX. Corps, with one Landwehr brigade.

(This army consisted of Saxon troops, and was in position with its right in touch with advanced troops of the II. Army about Ecury-le-Repos. Its centre was opposite Sommesous and its left extended towards Vitry-le-François. Of the XII. Res. Corps one division—the 24th—had been left investing Givet, and did not rejoin until Sept. 7.)

IV. Army: Duke Albrecht of Württemberg. VIII., VIII. Res., XVIII., and XVIII. Res. Corps, with one Landwehr brigade.

(The line of this army ran from near Vitry-le-François to Ponthion and thence by Possesse to Somme-Yèvre.)

V. Army: German Crown Prince. V., V. Res., VI., VI. Res., XIII. and XVI. Corps; 33rd Res. Div., 2nd Landwehr Div. with additional brigades, five in all; 3rd and 6th Cavalry Divs.

(The Crown Prince's army lay in two portions. One part of it—the VI., XIII. and XVI. active corps—faced the French III. Army on the line Charmontoise–Triaucourt–Froidos. The two reserve corps were to the N. of Verdun, the VI. Res. being on the left-hand bank near Montfaucon and the V. Res. on the opposite bank about Consenvoye. The active corps was E. of Verdun, and the 33rd Res. Div. and the Landwehr formed a special force in Woevre and on the Moselle based on Metz.)

The French, British and German armies thus enumerated were those immediately concerned in the operations which are now known as the battle of the Marne. Farther to the S.E., between the fortress of Toul and the Swiss frontier, the German VI. (Rupprecht, Crown Prince of Bavaria) and VII. (Gen. von Heeringen) Armies had been heavily engaged with the French I. and II. Armies since the middle of August.

The area on which the battle was about to be contested forms roughly a rectangle from E. to W. of 120 m., and as the distance from the southern to the northern edge is 50 m. the battlefield may be said to cover some 6,000 sq. m. of area. Save for the fortress of Verdun the actual battlefield contained no feature, the capture or retention of which would have vitally affected the battle, but it was of a very diversified nature. The western strip is, generally speaking, a large cultivated plain, in which the Marne, flowing through a well-marked valley, receives as tributaries the Ourcq and the two Morins. Like the parent river, the tributaries are slow-moving and unfordable, but well provided with stone bridges and lined with woods and country houses. This sector of the battlefield is fairly open; but an exception must be made of the forests of Villers-Cotterets and Compiègne, where the paths are intricate and blind, and where a force losing direction might find itself in serious difficulties if attacked. East of this sector is a strip bounded generally by N. and S. lines through Soissons and Reims, and roughly bisected by the course of the river Marne. Generally speaking, the terrain here is a plateau cut by the well-marked river valley and marked by copses and plantations which increase in size and frequency towards the east. The eastern edge of the plateau, running from the Montagne de Reims to the Aisne, and thence to Laon and beyond, forms the line of heights known as Les Falaises de Champagne. A tactical feature of some importance is the marshland near Sezanne called Les Marais de Saint Gond, formed by a pocket of clay and extending for about 10–12 m. from E. to W., and 1–2 m. broad. The marshes have been to a large extent reclaimed, and between the acres of grassland the streams which unite to form the Petit Morin run in deep ditches. In fine weather the ground is fairly dry, but in heavy rains the slopes N. and S. drain down to the pocket, the canalized streams overflow, and the clay soil becomes one vast quagmire. Some narrow causeways have been constructed, but these can be brought under artillery fire, particularly from a round-topped hill at Mondement, which is a valuable tactical feature; and since the causeways are neither engineered nor metalled they are all likely in flood time to become as deep in mud as the adjoining marshes. Passing eastward, the third strip of the battlefield is the wide plain of Champagne Pouilleuse. Here are long undulating ridges covered with heath and crowned on top with small fir plantations, moorlands with patches of cultivation, and two large permanent training camps N. and S. of Châlons, the whole forming a fine arena for a conventional battle of the three arms.

East of this immense plain the woods become more frequent and dense, meriting in many cases the larger designation of forests. Chief among these is the Forest of Argonne, a long, densely wooded low ridge running almost N. and S., traversed only by a few paths and by two gaps, through which run two high roads and the St. Menehould–Verdun railway. Between the ridge and the valley of the Meuse lies an upland country, chiefly of pasture-land intersected by numerous narrow ravines; and on the right bank of the Meuse are the abrupt Hauts-de-Meuse (or Côtes de la Meuse), looking down on the plain of the Woevre.

In this sector of the battlefield is situated the fortress of Verdun, which, although it formed a very sharp salient in the French line, yet by its projection served the useful purpose of dividing the Crown Prince's army into two parts. Unlike Namur and Liége, the fortress had been kept in readiness to resist a sudden attack and contained an adequate garrison, including mobile troops distinct from the field armies. Further, the forts of the perimeter had been supplemented by a network of trenches and outworks pushed well out, which greatly minimized the chance of the fortress being quickly crushed by a concentrated storm of heavy artillery fire. In spite of the great use which the Germans made of mechanical transport, the retention of Verdun in French hands was a serious handicap to the invaders, for it prevented their making use of the main line of railway running thence to Germany; and the difficulty of communication was aggravated by the fact that when the battle began Maubeuge was still untaken and the main line of railway from Cologne through Liége and Namur was in consequence blocked. Practically the only line of rail available to supply the $1\frac{1}{4}$ to $1\frac{1}{2}$ million Germans deployed along the general line of the Marne was that which ran N. from Reims to Mezières and thence by the valley of the Meuse to Dinant and Namur. In lateral communications, however, the Germans were admirably served, the Meaux–Reims–Verdun and Meaux–Châlons–Verdun railways affording them the means of transferring troops from one portion of the battlefield to another at will. The suddenness and impetuosity of the Allies' attack, however, was to render the advantage a theoretical rather than an actual benefit.

The new "limited envelopment" scheme of the German General Staff held the field for just four days; and, to carry it out, Supreme Headquarters sent out orders on Sept. 3 to the effect that the I. Army was to follow in echelon behind the II. and to be responsible for the protection of the right flank of the whole German front. But at the moment when the orders were issued the situation was far different from that envisaged by Supreme Headquarters. So far from being echeloned behind the II. Army, Gen. von Kluck's columns were hurrying over the Marne, with the II. Army more than a day's march behind upon the Aisne. It has been suggested that Gen. von Kluck was fired by the recollection of Prince Frederick Charles at Mars-la-Tour, in which battle the former had served as a young officer of artillery. Be this as it may, in spite of the orders issued he continued his advance, and Supreme Headquarters quickly came to the conclusion that even the limited envelopment, which had been substituted for the original plan, must be curtailed.

It was during the evening of Sept. 4 that the new directive was brought to the I. Army. The essential point in it was the announcement that the attempt to force the whole French army back in a south-easterly direction, towards the Swiss frontier, was no longer practicable. Intelligence had reached the Germans about movements of French troops westward from Toul and Belfort, which pointed to a concentration on the French left; and further, there was an ominous reference to a collection of troops in the neighbourhood of Paris to threaten the right flank of the German I. Army. How far the initiative had passed from the Germans is revealed by a study of these orders of the evening of Sept. 4. The whole German plan broke down, and the invaders had to reshape their scheme to cope with that of Gen. Joffre. The I. and II. Armies were now to face E. towards Paris, the former between the Oise and the Marne and the latter between the Marne and the Seine; on the left the IV. and V. Armies by a determined advance S.E. were to open a passage across the Moselle for the VI. and VII. Armies, in which region a *pianissimo* Sedan might still take place, although Supreme Headquarters cautiously stated that "success could not yet be foreseen." The III. Army in the centre was to push S. ready to help either wing as required. Thus Gen. von Moltke was forced to throw to the winds the hopes founded on the great massive wheel of five armies pivoting on Thionville, and, instead, was compelled hurriedly to assign to his armies three divergent axes of march towards the W., S., and S.E.

Gen. von Kluck's contribution towards solving the difficult problem with which Supreme Headquarters were confronted was to disregard his orders. Instead of remaining between the Oise and the Marne he continued to push on over the latter river, increasing at every step his lead over the II. Army, behind which he should have been following. As the French VI. Army had orders to be in a position of readiness N.E. of Paris so as to be able to cross the Ourcq between Lizy and May-en-Multien in the general direction of Château-Thierry, early collision between it and the flank guard of the German I. Army was now but a matter of hours. Gen. Joffre had ordered that the offensive was to be begun by the VI., British, and V. Armies on the morning of Sept. 6, but as a matter of fact the battle was brought on earlier by the preliminary movements of the VI. Army.

In view of the forthcoming offensive the French VI. Army, during Sept. 5, began to fill in to its right so as to deploy generally on the line St. Mesmes–Foret d'Ermonville facing north-east. Opposite the right wing of this position and commanding all the neighbouring terrain runs a well-marked ridge which, starting from the high ground of Dammartin, is prolonged towards the S.E. by the hill at Montgé, and thence by a succession of isolated knolls, of which the more pronounced are those of Monthyon and Penchard. The attempt by the divisions of Gen. Lamaze, which formed the right wing of the VI. Army, to secure this commanding ground brought on the battle of the Marne.

Almost exactly at noon, when a battalion of the 55th Div. was settling down to its midday meal near the hamlet of Villeroy, it was surprised by a storm of shells from some German batteries beyond Monthyon and Penchard. Some very fierce fighting ensued, and the French line gradually forced its way past Plessis and Iverny towards the Montgé–Penchard ridge, while slightly to the S. Neufmontiers fell into the hands of the Moroccan Brigade. The French, however, were not able to hold their gains against the resistance of the German IV. Reserve Corps and during the evening their line in this position of the field was withdrawn to Le Plessis–Iverny–Villeroy–Charny, while to the N. St. Soupplets was held by the 56th Div. The left wing formed by the VII. Corps meanwhile had taken up the line Dammartin–Plailly without incident. Thus the VI. Army after severe fighting in which heavy losses were incurred, had secured but little advantage of ground, although, on the other hand, the possession of St. Soupplets on the Senlis–Marne road was of distinct value.

During the day Gen. von Kluck had drawn up a set of orders in compliance with the instructions he had received from Supreme Headquarters relative to his taking up a position between the Oise and the Marne. This would imply a retrograde movement of the I. Army; but Gen. von Kluck was at the time labouring under the delusion that there was as yet no great danger threatening his right flank, and that a march back to cover it could be carried out without interruption. Consequently his orders fixed no definite time at which the withdrawal across the Marne was to begin, and until late in the night of Sept. 5–6 he seems to have believed that he could still emulate the Red Prince of 1870. The reports which kept coming in, however, eventually undeceived him, and an urgent order was sent to the II. Corps to begin its retrograde movement early on the 6th so as to be in a position to support the IV. Reserve Corps if required, a movement which was to react upon the offensive of the French army.

That army moved out to the attack with both flanks covered by cavalry, on the right being a division under Gen. Cornulier-Lucinière, while Gen. Sordet's cavalry corps was coming up on the left. The bulk of the day's fighting took place opposite the right wing, especially on the extreme right. The 56th Div., leaving St. Soupplets at daybreak, fought its way without much difficulty to Marcilly, but farther S. the 55th Div. experienced far greater difficulties. Barcy was taken and retaken three times, but had finally to be abandoned, and Chambry was occupied by a portion of the 54th Div. only after several attacks by the 55th had been beaten back. It was now clear that the German IV. Reserve Corps was being reinforced, and the same impression was received on the VI. Army's left. No sooner had the VII. Corps come into action than two enemy columns were signalled as moving upon Vareddes and Lizy, and these were in fact the 3rd and 4th Divs. of the German II. Corps. Thus by the middle of the afternoon, while the divisions of Gen. Lamaze were facing the high ground about Etrepilly and the VII. Corps in the left wing had reached the line Villers St. Genest–Bregy, the German resistance had considerably hardened.

Gen. von Kluck could, however, only reinforce his right flank at the expense of his front, and, in consequence, opposite the British there was a noticeable slackening in the advance of the German I. Army. Put briefly, the relative situation of that army had changed. What had been its right flank—consisting of the IV. Reserve Corps and a cavalry division—was, by successive reinforcements, to become the front; while the original front, by a corresponding diminution, was transformed into the left flank, and the army as a whole was to face W. instead of S. The orders conveying to the British troops the news that their long retreat was definitely ended were issued during the afternoon of the 5th, although many of the battalions did not know when they left their billets on the morning of the 6th whether or not they were to march southwards to the Atlantic. As soon as the rank and file discovered that their route led northwards, roars of cheering burst forth with such enthusiasm as to leave a lasting impression on those who shared in that memorable day. The hesitation observable in the German advance was soon followed by an unmistakable retrograde movement. The British lost no time in seizing the heights on the Grand Morin S. of Coulommiers, from which German heavy guns had during the morning brought an effective fire to bear, and by evening the British advance guard had reached Villiers-sur-Morin and Crecy (III. Corps), Coulommiers (II. Corps) and Choisy (I. Corps). Save for some fighting early in the morning about Rozoy—an action brought on by the Germans to cover their retreat—the British were not heavily engaged, though a few prisoners and machine-guns were taken.

In the orders issued by Gen. Joffre on Sept. 4, the V. Army of Gen. Franchet d'Espérey had been ordered to close slightly to its left and to take up the general line Courtaçon–Esternay–Sezanne, so as to be ready to attack in a northerly direction. Some progress had been made in accordance with these orders on the 5th. On Sept. 6 the mission of the V. Army was to attack, in the general direction of Montmirail, with its right wing thrown forward, an operation designed to coincide with the advance of the VI. Army on the Ourcq, and to aim at enclosing the whole of the I. and portion of the II. Army of the Germans. Gen. Franchet d'Espérey sent forward his army at dawn. It was disposed, from left to right, as follows: the XVIII. Corps, III. Corps, I. Corps, X. Corps, with the reserve divs. in second line. Immediately a violent battle developed all along the line, due to the fact that the Germans had also received orders to advance and thus precipitated an encounter. In the fighting which ensued the French showed themselves undoubted masters of the enemy. On the left the XVIII. Corps seized Courtaçon during the day. It was assisted by Gen. Conneau's II. Cavalry Corps, which was operating on the left flank and maintaining touch with the British army, a task which it performed admirably, finally halting for the night on a line E. and W. through Choisy. In the centre, after a particularly fierce artillery preparation, the III. Corps seized the villages of Montceaux-les-Provins and Courgivaux. On the right the I. Corps gained possession of Chatillon-sur-Morin, which had defied their efforts for several hours, and after darkness had set in they continued their efforts, eventually clearing the Germans out of Esternay. From here the X. Corps carried on the line, with its right thrown well forward, and that flank gained touch with the 42nd and Moorish Divs. of the IX. Army at Villeneuve-lez-Charleville.

The fighting round Sezanne had been long and bitter. The Germans had placed many machine-guns in position, and they thoroughly searched the wooded ridges, from which the French attack was expected to develop, with artillery fire. The French guns replied and an artillery duel went on for some hours, until it seemed that the German guns had been silenced and that it was time for the French infantry to go forward. Against the green background the *pantalons rouges* of the attackers showed up like scarlet waves as they moved on with the bayonet, and with such a target the German machine-guns were able to do great execution. The French fell "like corn before the sickle," and to complete their discomfiture many were killed by the fire of their own artillery. The check to the French had, however, only been temporary, and after a day of brilliant fighting the front of the V. Army may be said to have been marked by the line Courtaçon–Esternay–Villeneuve-lez-Charleville.

The whole French countryside between Paris and Verdun was now ablaze, five French and one British army contending with the five German armies which had set out to pivot on Thionville and roll up the Allied line. South, too, of the fortress of Verdun the fighting round the Grand Couronné de Nancy, though not actually forming part of the series of battles included in the title of the Marne, nevertheless had a direct bearing upon it. For the moment, however, the interest in the struggle is confined to the fighting on the western flank within the area roughly marked out by the towns Betz–Meaux–Coulommiers–Montmirail–Château-Thierry. In this great pocket Gen. von Kluck's soldiers were fighting desperately to hold off the converging attack of their opponents; while, on the side of the Allies, the French VI. Army, the British army and the French V. Army were struggling to nip the German I. Army from the main body of the enemy.

The fighting on the Ourcq on Sept. 7 was, therefore, to be hard and bitter. Each of the opposing commanders had special reasons for vigorous attack. On the French side Gen. Maunoury had rather overestimated the success, reported to him, of the V. Army of Gen. Franchet d'Espérey, and was inclined, in consequence, to believe that the Germans might fight merely a delaying action on the Ourcq. As a matter of fact the exact contrary was the case. Gen. von Kluck clearly realized that not only his task of safeguarding the right of the whole German advance but even the preservation of his own army depended on hurling back the attack launched from the direction of Paris. By an order issued at 5:30 P.M. on the 6th the IV. Corps was withdrawn across the Marne and hurried on through the night to reinforce the new front. Thus on the morning of Sept. 7 the II. Corps, the IV. Reserve Corps (still minus a brigade left at Brussels) and the IV. Corps stood between the Thérouane and the Gergogne (a tributary of the Ourcq), with their units intermingled, and covered on the N. by the 4th Cavalry Div. The original right flank had thus been strongly reinforced, but Gen. von Kluck felt that it was no time for half measures. Even at the cost of weakening himself elsewhere, even at the risk of creating a gap between his own and the II. Army, every man must be thrown upon the Ourcq. Merely to repulse the attack from Paris would not be sufficient; the French VI. Army must be defeated by an outflanking counter attack from the N., and accordingly the IX. and III. Corps were ordered to march early on the forenoon of the 7th in the direction of La Ferté–Milon–Crouy. These corps had, only the night before, been lent to Gen. von Bülow, but the II. Army commander had now perforce to send them off, though not without a protest. The effect of his action was that a gap, soon to yawn into 30 m., was opened between the I. and II. Armies, and into this gap the British army and the left of the French V. Army were rapidly moving. Gen. von Kluck now found himself committed to an isolated battle on the Ourcq, facing W. and with his left and rear exposed. Unless he could hold off Sir John French and Gen. Franchet d'Espérey sufficiently long to enable him to crush the French VI. Army and could then turn against the danger to his left and rear he was a beaten general. The task, however, was to prove too great. He had not the time necessary for the operation, and even if he had he had not the men for it.

So far as the actual fighting of the day is concerned the bulk of it fell upon the French VI. Army. Gen. Maunoury's left flank had been reinforced by Gen. Sordet's cavalry corps as well as by the 61st Reserve Div., which had been railed from Paris. At dawn the army was set in motion, and at first some progress was made, but gradually the weight of the reinforcements reaching the Germans began to tell. The II. and IV. Corps had now become available, and the various divisions had been thrown into the fight as they arrived, without regard to corps organization. Strong enemy columns debouched near Etavigny and Acy-en-Multien, and at the latter village the fighting was especially severe. As has so often happened on French battlefields the cemetery was the scene of desperate fighting, 500 dead being subsequently counted within an area of little more than 200 sq. yd. Around the farm of Nogeon, too—about half-way between Vinoy and Bouoilancy—the battle raged with particular fierceness, and the buildings changed hands several times throughout the day. Here a body of the French 298th Regt. fell to the last man, preferring death to surrender. Two companies of the same regiment after dark avenged the loss of their comrades by a desperate hand-to-hand attack, in which they captured a colour of the 38th Magdeburg Fusiliers decorated with the Iron Cross. After a day of hard fighting the French VI. Army had made some further progress, and its front ran generally from Chambry through Barcy, Marcilly, the high ground N.W. of Brunoy, Pusieux, Acy-en-Multien to the hill W. of Etavigny. The *moral* of the French facing the Ourcq at the close of Sept. 7 was high, and Gen. Maunoury determined to outflank Gen. von Kluck's right wing early next day with the I. Cavalry Corps and the 61st Div. As the German army commander was committed to a similar attempt to outflank the VI. Army's left the centre of gravity of the fighting in the western sector of the whole Marne battle was now unmistakably shifting to the neighbourhood of Betz.

The reinforcements hurried off to strengthen the German line upon the Ourcq had now left a comparatively small force to withstand the British. The task of holding back the army of Sir John French was now being carried out mainly by German cavalry, reinforced, as was the German custom, by Jäger battalions. In Gen. Joffre's initial orders for the battle the direction assigned for the advance of the British army had been practically due E., but the course of the battle since its opening necessitated a change in the original instructions. The French generalissimo had apparently visualized either a continuation of the German advance S. and S.E., or—in the event of a suspension of that operation—a withdrawal of the German I. Army towards the E.; but Gen. von Kluck had on the contrary shown every intention of pushing westwards so as to beat back the French VI. Army. In these circumstances it was clear that a more northerly advance would bring the British quickly on Gen. von Kluck's communications, and the necessary change was decided upon by the two Allied commanders. Orders were consequently issued by Sir John French directing the march upon the Grand Morin river, which was to be passed with all possible speed upon the 7th.

The British cavalry acted everywhere with great vigour, particularly on the right of the line where the 2nd Cavalry Brigade was operating beyond Dagny. At Moncel a spirited cavalry action took place, and a charge by a troop and a half of the 9th Lancers effectually dealt with a squadron of Guard Dragoons, the fate of the latter being sealed by dismounted-fire action of the 18th Hussars. Later a squadron of the 18th, holding a position dismounted, was charged by a German squadron, but by well-directed rifle fire the attackers were almost annihilated. A few passed through the firing-line but were accounted for by the horse-holders in rear. Thirty-two dead and wounded Germans were counted on the ground in front of the squadron, and of the 60 or 70 who charged not more than a dozen escaped. By evening the bulk of the German cavalry had fallen back to the Petit Morin, S.E. of La Ferté-sous-Jouarre, and the British position was roughly as follows: on the left was the III. Corps about La Haute Maison; the II. Corps, in the centre, was round Aulnoy; and on the right flank the I. Corps lay about Chailly and Jouy-sur-Morin.

The French V. Army, no less than the British, felt the relaxation of pressure on its front caused by the withdrawal of German troops across the Marne, and the task of its left and centre was really one of pursuit, which was carried out in the general direction of Montmirail. The Germans held their ground stoutly, but finally the XVIII. and III. Corps were able to reach the general line La Ferté Gaucher–Trefols, which represented a gain of some six miles of ground. Farther to the right the fighting had been considerably more severe, for about noon Gen. Franchet d'Espérey had received word from Gen. Foch that the left of his (IX.) army was being violently attacked and was in sore need of assistance. The I. and X. Corps were, therefore, directed to go to the assistance of Gen. Foch.

By the evening of Sept. 7 the original orders of Gen. Joffre "*pour profiter de la situation aventurée de la I. Armée allemande*" were three days old, but that army was still in being and fighting tenaciously. Further, the geographical objectives alluded to by the French generalissimo were far from having been reached. The French VI. Army was to force the passage of the Ourcq and then to advance *en direction générale de Château-Thierry;* while the British army was to attack towards Montmirail. But by the evening of the 7th the passage of the Ourcq had still to be accomplished, and until that preliminary step had been taken Château-Thierry and Montmirail were mere names. A somewhat disquieting feature of the day, too, was the apparent intention of the Germans to make another effort to turn the Paris–Verdun line at Nancy and at Troyon, where a successful thrust would very seriously discount the French efforts on the Ourcq. Worse still, Maubeuge fell on the 7th, and the invaders not only gained another rail line of communication but had now another corps available for operations in the field. Against these drawbacks, however, could be set the fact that the gap between the German I. and II. Armies had considerably widened, and into it the British army and the left of the French V. Army were now advancing with speed.

During the night of the 7th–8th Gen. Galliéni took steps to reinforce Gen. Maunoury's army for the struggle which was expected after daybreak. The IV. Corps had been put at Gen. Galliéni's disposal by Gen. Joffre. Of its two divisions one—the 8th—had been acting as the liaison between the French VI. and the British armies, and by the evening of the 7th was in billets S. of Meaux. Orders were issued during the same evening for the remainder of the corps to proceed from Gagny to Gen. Maunoury's left wing, and the artillery and corps cavalry marched by road while the 7th Div. was transported to the neighbourhood of Nanteuil-le-Haudouin, one brigade by rail and the other in taxicabs, of which Gen. Galliéni had collected over a thousand.

Sept. 8 was remarkable for the violence of the German attacks along the Ourcq. Gen. Maunoury's plan was to attack with his right centre and left, while the VII. Corps in the centre was ordered to hold its line at all costs. That corps was heavily attacked early in the afternoon, and such was the severity of the fighting that a week later the streets of Etrepilly and Trocy were still blocked with the bodies of the slain. To the N. the French outflanking movement was brought to a standstill, while even the superb gallantry of the Zouaves of the 45th Div. on the right centre failed to make any considerable impression on the enemy. During the afternoon Gen. Galliéni visited the commander of the VI. Army at his headquarters at St. Soupplets and found Gen. Maunoury a prey to a certain depression of spirit. The military governor of Paris reassured him somewhat by pointing out that the greater the resistance offered by the Germans on the Ourcq the less opposition would the British meet with in their advance. Nevertheless, Gen. Maunoury considered it advisable to make arrangements for a possible withdrawal on the following day, indicating as the limit of retirement the line Le Plessis–Belleville–St. Soupplets–Monthyon.

Meanwhile, inexorably and methodically the British army was discounting the efforts which Gen. von Kluck was making W. of the Ourcq. After considering alternatives of action by which assistance could be rendered to the VI. Army, Sir John French decided that the best method implied the speedy passage of the Petit Morin and Marne rivers, for after passing the latter the British army would be facing N.W. and thus almost directly threatening the line of retreat of the German I. Army. Orders were accordingly issued for a general attack along the line of the Petit Morin, to begin early on the 8th. At first the march was undisturbed, but on reaching the Petit Morin it was soon realized that the German cavalry would not yield without a struggle, especially as the steep valley covered with small but thick woods distinctly favoured the defence. Some severe fighting ensued, but by evening the British had made good the Petit Morin and were on the line La Noue–Viels Maisons, where they joined up with the II. Cavalry Corps of the French V. Army, the left corps of which extended through Marchais-en-Brie to the southern outskirts of Montmirail.

Wednesday, Sept. 9—a day of high winds and drenching rains—was to witness Gen. von Kluck's last effort on the Ourcq. His IX. Corps was now in position to initiate an enveloping movement against the left of the French VI. Army. Gen. Maunoury's troops were at the end of their strength, and a determined attack delivered by the Germans from Betz and Anthilly bore down the French resistance. The 8th Div. of the IV. Corps had been summoned from the Marne to reinforce the French left, but it could not be brought effectively into action, and as the 61st Res. and 7th Divs. and the VII. Corps failed to hold the Germans Nanteuil and Villers St. Genest were lost; but later, the 7th Div., in response to an urgent message from Gen. Maunoury about 6 P.M., faced about and struggled northwards towards Nanteuil, flanked by the I. Cavalry Corps. Gen. von Kluck, however, had shot his bolt. During the day the British army crossed the Marne, and on its right the XVIII. Corps of the French V. Army gained possession of Château-Thierry. Strangely enough the line of the Marne was not resolutely defended by the Germans, apparently through an error of judgment of the commander of a mixed detachment of the German IX. Corps, specially allotted to reinforce the cavalry already holding the crossings. Thus it came about that British columns advancing at dawn on the 9th found that not only were the bridges to the W. of Château-Thierry intact but that the enemy had made no attempt to hold this part of the Marne, and reports brought in by airmen all through the afternoon made it clear that the retreat of the German I. Army had begun.

So far this narrative of the battle of the Marne has dealt exclusively with the western section of the struggle, which took place, generally speaking, in the area bounded E. and W. by meridians drawn through Château-Thierry and Paris respectively. The story of the fighting must now be transferred to the centre of the whole battle-front, to which N. and S. lines through Château-Thierry and Châlons-sur-Marne form boundaries sufficiently accurate for our purpose.

The German Supreme Headquarters had ordered the I. and II. Armies to form front facing Paris, the former between Oise and Marne and the latter between Marne and Seine, Château-Thierry to be the point of junction of the two armies. This order had been disregarded by Gen. von Kluck, who had persisted in his passage over the Marne and in maintaining his position in front of the II. Army. Gen. von Bülow, however, endeavoured to comply with the orders of his superiors, and did make an effort to wheel his army to the right with the object of taking up the line Château-Thierry (exclusive)–Marigny-le-Grand. The net result of compliance with orders by one army commander and disregard of them by the other was that the right corps of the II. Army was squeezed out of the line by the left corps of the I. In other words, the two armies were acting upon different plans; overlapping had arisen; and the confusion inevitable in such circumstances began to be revealed upon the evening of Sept. 5.

This factor alone was bound to hamper the II. Army, and Gen. von Bülow's task was not lightened by the subsequent conduct of his neighbour. When Gen. von Kluck renounced his plunge S.E. he did it with such thoroughness as to lead to the transfer of practically his whole strength to the Ourcq. On Sept. 7 he demanded back the III. and IX. Corps which he had lent Gen. von Bülow but the day before. The withdrawal of these units to the Ourcq exposed Gen. von Bülow's right flank; a great gap was thus opened between the II. and I. Armies; and Gen. von Kluck, who had on the 5th inconvenienced Gen. von Bülow by his undue proximity, was now seriously embarrassing that commander by his aloofness.

This is, however, to anticipate matters somewhat. It is necessary to go back to the initial stages of the battle in the centre of the field, on Sept. 6. The substantial theatre of the struggle to be described was the area between the marshes of St. Gond and the Sezanne–Sommesous high road. The marshes had been largely reclaimed and canalized since they figured in Napoleon's great campaign exactly 100 years earlier; but in rainy weather traffic is limited to the three or four good roads crossing them, the chief of these leading from Epernay to Sezanne and Fère Champenoise respectively. The former road is commanded by Mondement and the latter by the high ground of Mont Août. Generally speaking, the task of the IX. Army of Gen. Foch for Sept. 6 was to support the advance of the V. Army with its left flank (which for this purpose had been pushed forward as far as Talus), while maintaining a watching attitude along the rest of its front. Gen. Foch, however, found himself quite unable to carry out even the moderate programme he had drawn up.

Gen. von Bülow was endeavouring to wheel into position between Marne and Seine, and on his left the III. Army's orders were to push due south. As a result the French were attacked with considerable vigour all along the line; and so far from the 42nd and Moorish Divs. being able to gain ground on the left, they were forced to abandon Talus to the X. Corps of the German II. Army, and only managed to hold on to Villeneuve-lez-Charleville with some difficulty. The advanced guards of the IX. Corps fared no better against the left wing of the X. Corps and the Guard Corps of the II. Army, for they were driven from their line N. of the marshes and forced to fall back on the main body of the Corps, which, however, by holding the exits was able to maintain its position without difficulty. Farther to the E. the XI. Corps was violently assailed by the XII. Saxon Corps of the German III. Army, and had to swing back its left and take up a position with that flank in the woods S. of Ecury-le-Repos, while E. of Vatry the 9th Cavalry Div. was engaged throughout the day by Saxon cavalry. The close of the day's fighting found the French IX. Army on the line Villeneuve-lez-Charleville–southern edge of the marshes–Lenharée, in touch with the Germans all along the line, except where the marshes separated the two fronts.

Although the right of the German II. Army was becoming exposed, Gen. von Bülow on the 7th was still able to push on with his centre and left, that flank working in conjunction with the right of the III. Army. Gen. von Bülow's left was formed by the Prussian Guard Corps, and, as the III. Army consisted entirely of Saxon troops, memories of the concerted action at St. Privat on Aug. 18 1870 fired the German soldiers to press the French IX. Army to the utmost of their powers. The latter had in consequence to endure a series of very heavy attacks throughout the day. The significance of these efforts was not, however, lost on Gen. Foch, who shrewdly remarked that the very fury of the German onslaught was tantamount to an admission that things could not be going well with them elsewhere on their line. His own orders had contemplated the continuance of the offensive of the day before with his left, and briefly summarized they ran as follows: The 42nd and Moorish Divs. were to preserve connexion with the X. Corps of the V. Army on their left and were to endeavour to renew the offensive from Villeneuve-lez-Charleville towards the north-west. The IX. Corps was to maintain its hold upon the southern edge of the marshes of St. Gond, but was to be ready to advance without delay if called upon. The XI. Corps was to hold the line to which it had been forced back the evening before; but, like the IX. Corps, it was to be ready to advance if required, in which case it would be called upon to move round the eastern edge of the marshes; a reserve division was to be left about Lenharée to protect the right flank. The 9th Cavalry Div. was to be generally S. of the Sommesous–Vitry-le-François railway and was to keep touch with the left of the IV. Army about Humbauville.

Early in the morning the Germans attacked all along the line, and E. of the marshes German heavy artillery of the XII. Corps of the III. Army came into action, to which the French replied with similar pieces. E. of the marshes the outlying villages of Morains and Aulnay, held by advanced units of the IX. Corps, were taken by the Germans, the capture of the villages striking at the junction of the French IX. and XI. Corps, while on the left the 42nd and Moroccan Divs. were hard put to it to stave off the weight of the attacks of the German X. Corps. Here the château of Mondement, a two-story mansion dating from the sixteenth century, was recognized by both sides as a feature of outstanding tactical importance. Headquarters of the Moroccan Div. were shelled out of the building early in the day, but towards evening a combined attack of the 42nd and Moroccan Divs., with the 77th Regt. of the IX. Corps, restored the situation. Owing to this effect and thanks, too, to the assistance afforded by the X. Corps of the V. Army against Gen. von Bülow's exposed right, no ground was lost. So that, after a day of severe fighting, the Germans had made no impression on the French IX. Army, other than to deny it the possibility of making progress to the N. and W.

Before dawn on Sept. 8 from Mondement Hill the French observed enemy troops advancing to the attack. These, belonging to the X. and Guard Corps, were repulsed, and a counter-attack which gained a considerable amount of ground was made by the 42nd and Moroccan Divs., aided again by the 77th Regt. of the IX. Corps. Owing, however, to the unfavourable situation developing on the right of the IX. Army it was impossible to exploit this advantage, and a withdrawal was ordered. For, although immediately to the right of this action the IX. Corps still held the line of the southern edge of the St. Gond marshes, beyond that a somewhat serious situation for the French developed during the day. Attacked by the left wing of the Guard Corps of the German II. Army, and by two corps of the III. Saxon Army, the French XI. Corps was driven back as far as the line Cannantre–Corroy–Gourgançon, a circumstance which involved the transfer of Gen. Foch's headquarters from Pleure right back to Plancy on the Aube. Behind the stream La Maurienne, which runs across the greater portion of the front it had now taken up, the XI. Corps re-formed, and, aided by a counter-attack made by one of the reserve divisions with the IX. Army, it was enabled to advance and regain some high ground N. of Oeuvy. The situation had, however, been distinctly disquieting, and to a chief possessed of less imperturbability than Gen. Foch it might have seemed the prelude of disaster. On the extreme right the 9th Cavalry Div. about Mailly had maintained its close connexion with the IV. Army, and had supported an attack made by it near Sompuis.

In spite of the setback to his right during the 8th Gen. Foch was able to review the situation without alarm. The news which came in during the evening as to the progress of the battle E. and W. of him was reassuring. He learnt that the VI. Army, in spite of violent German counter-attacks, was holding its own upon the Ourcq, that the V. Army was making steady progress N.W. of the marshes of St. Gond, and that on his right the III. and IV. Armies were gaining ground towards Vitry-le-François and Châlons. His orders, issued shortly before midnight, prescribed generally the offensive for the coming day. The X. Corps, from the V. Army, was now definitely under his orders, and this access of strength prompted him to withdraw the 42nd Div. as a general reserve.

Once more was Mondement the scene of bitter fighting. It was seized at daybreak by a sudden German attack, and some hours later Mont Août also fell. Nevertheless, in spite of the disquieting events upon his left, Gen. Foch shortly after 10 A.M. directed the 42nd Div., which had now arrived on the line Linthes–Pleurs, to move farther to the right, where it was to take the offensive with the XI. Corps. The apparent audacity displayed in withdrawing the general reserve of his army from his shaken left to join in an attack from his right flank called forth paeans of praise from critics of the battle. Gen. Foch, however, realized that the danger to his left was more apparent than real. The V. Army, beyond that flank, had reached the line Marchais-en-Brie–Montmirail–right bank of the Petit Morin on the evening of the 8th, and with the great gap which now existed between the right of the German II. Army and Gen. von Kluck any movement of the former S. of Mondement was exceedingly unlikely. As a matter of fact Gen. von Bülow's increasing uneasiness as to the state of affairs had reached fever heat over reports as to the forcing of the line of the Marne by British troops during the 9th. He came to the conclusion that retreat was inevitable for Gen. von Kluck, and that, in these circumstances, his own II. Army must fall back at once if it were to avoid envelopment on its right flank. With the object of gaining time to get his long trains safely back over the Marne, the offensive by his left and centre was carried out with vigour during the morning, the French right being driven back to Salon; but early in the afternoon the German II. Army and the right of the III. Army were in full retreat, strong rearguards being left facing the French. Gen. von Bülow transferred his headquarters from Montmort to Epernay; and by evening, from Betz to beyond Fère Champenoise, the defeated German right and centre were falling back before the victorious Allies.

The operations of Gen. Foch's army in the centre of the battle of the Marne have been garnished with an embroidery of legend by which the real happenings in that portion of the field have been considerably obscured. He has been represented as being obsessed by an optimism so pronounced as to have led him to the issue of orders which, had they really been so framed, would have been unsoldierly bombast. The counter-attack which he conceived during the forenoon of the 9th has been written up as the decisive factor of the whole battle, "a wedge driven into the German centre" being the description of an operation which, when carried out eventually on Sept. 10, encountered nothing but the resistance of rearguards. And, for long, there persisted a thrilling narrative of the engulfment of thousands of Prussian Guards in the marshes of St. Gond. The operations of the Allies' left, though free from such distortions of truth, have by their dramatic decisiveness focussed upon themselves an immense amount of attention, particularly in England where the advance of the British over the Marne on Sept. 9 will rightly live in history as one of the most decisive achievements by British arms. Unfortunately, however, these results of the centre and left have tended to obscure the lesser known events upon the Allied right. The battle from Fère Champenoise to the Ourcq has somewhat diminished the lustre of the operations of the French armies from Vitry-le-François to Verdun. And yet in no quarter of the field was the fighting more severe. In no sector of the battle did the position of the Allied line present greater danger. Nowhere on the whole long front was the tenacity of the French III. and IV. Armies surpassed.

After the shipwreck of the high hopes on which they had entered France the German General Staff had yet one spar to cling to. While the IV. and V. Armies were to press southeastwards the VI. and VII. were to take the offensive against the line of the Moselle between Toul and Epinal, and these coördinated movements might yet bring off a great, if restricted, Sedan. The German idea was, therefore, to cut off Verdun on either side; the Crown Prince with his V. Army was to proceed round the entrenched camp by the W.; the IV. Army with its right passing through Vitry-le-François was to bear down across the flatlands of Champagne; on the other side the VI. and VII. Armies were to advance eastwards over the Moselle. Inside this great converging movement the I., II., III., and IV. Armies of the French might be herded together and destroyed. Had these four French armies been able to unite their efforts to a common end their position would have been less full of risk. Such, however, was not the case. The action of Gen. Sarrail's III. Army was to be coördinated rather with that of Gen. Maunoury on the Ourcq than with that of the French II. Army in front of Nancy. In the original orders for the battle of the Marne Gen. Sarrail was to strike westward against the Crown Prince's flank in a movement reciprocal to that by which Gen. Maunoury struck against von Kluck; and this movement, although it would assist in a double flanking movement against the whole German mass between Paris and Verdun, had the disadvantage that it ignored the danger to the III. Army's rear. Behind Gen. Sarrail was the Meuse, held only by a chain of semi-obsolete *forts d'arrêt*, and but a few miles farther E. was the great fortress of Metz, within which very large forces might be accumulating from all parts of Germany. The concealment afforded by a large fortress is apt to have a disconcerting effect upon an enemy operating in the vicinity. Paris had surprised the Germans by emitting a strong field army at the critical moment, and it was not impossible that Gen. Sarrail might find himself exposed to a similar danger.

Fortunately for the French the German Crown Prince based his advance upon a misconception. He considered that Verdun would be left to its fate, and in his orders of the 5th prescribed the advance of his army on the following day to the line Revigny–Bar le Duc. Gen. Sarrail, however, all through the battle kept hold of the fortress with his right; and, further, he arranged with the fortress commander for the coöperation of the mobile garrison with his army, with the result that the Crown Prince, far from being in a position to plunge due S., found himself compelled to face generally to the E., while his communications now ran roughly parallel to his front, a disadvantage which needs no comment.

When we come to the details of the struggle in this eastern sector of the battle it must be remembered that the French IV. Army had opposite to it the left of the enemy's III. and the whole of the IV. Army under the Duke of Württemberg. Each side had been ordered to attack, and fighting of a particularly severe nature ensued. On the eve of the battle the line of the French IV. Army had run generally from the vicinity of Sompuis on the left, S. of Vitry-le-François, to Sermaize upon the right, and when retreat set in on the German side the French IV. Army was practically on the same line as that from which it had started the battle. That it was able to maintain its position against the heavy attacks launched upon it was due to the tenacity of its units, and also to the fact that, on the 9th, it was reinforced and its left strengthened by the XXI. Corps from the I. Army on the extreme French right. When the battle opened the IV. Army was not very favourably placed for assuming the offensive, for, although it was in touch with the III. Army to the right, there was a wide gap between its left and the right of Gen. Foch's IX. Army at Lenharée, which was only imperfectly filled by the 9th Cavalry Div. This fact enabled the Germans to reinforce their own left, with the result that Sermaize was taken on the 7th, and for a time there was a serious risk that the right flank of the IV. Army might be rolled up. Gen. Langle de Cary was compelled to call upon the III. Army for assistance. Throughout the 8th the IV. Army was overlapped on either flank, but eventually the arrival of the XXI. Corps from the Vosges restored the situation, and upon the 9th Gen. Langle de Cary was able to reinforce his left centre by two more divisions. The fighting had been hard and bitter, and even as late as nightfall on Sept. 9 there was no indication of the Allied victory now clearly revealed in the centre and west.

In Gen. Joffre's instructions of Sept. 1 the limit of the *mouvement de recul* behind the Seine implied the march of the French III. Army to the country N. of Bar-le-Duc, and on the following day it was thought that the III. Army might possibly have to fall back as far as Joinville. Gen. Sarrail was strongly opposed to the isolation of the fortress of Verdun, which would result from a complete obedience to the orders of the generalissimo, and took it upon himself to maintain his right in touch with the fortress while refusing his left, and thus bringing his front on to an alignment generally facing west. This attitude on the part of Gen. Sarrail fitted in admirably with the resolution of Gen. Joffre to suspend his retreat and to pass to the offensive. The commander of the III. Army, having refused to separate his right from Verdun, now resolved to issue a positive order to the fortress commander (Gen. Coutanceau) to coöperate with his garrison. The latter, although he might have stood upon his rights as regards the troops allotted for the defence of the place for which he was responsible, felt that his clear duty was to comply. He moved out the 72nd Reserve Div. S.W. of the fortress, and on Sept. 6 these troops attacked enemy trains and parks and threw them into considerable confusion.

The orders to Gen. Sarrail of Sept. 5 directed him to attack westwards, but reconnaissance having established the advance of strong enemy forces E. of the Argonne the sense of the order had to be reversed; for, to avoid exposing his own communications, Gen. Sarrail considered it advisable to attack in a northerly direction with the bulk of his army while maintaining the remainder on the defensive facing W. This led to some friction with French General Headquarters, whose appreciation of the situation led to what was tantamount to an order to assist the IV. Army even at the expense of leaving Verdun to its resources. Gen. Sarrail was thus in a position of having either to act against his better judgment or to disobey formal orders; luckily the arrival of the XV. Corps—from the II. Army—enabled him to give satisfaction to Headquarters without having to quit his hold upon Verdun.

In the midst of the difficulties caused by severe fighting with the enemy and by the fettering orders of Headquarters Gen.

Sarrail was called upon to deal with a new peril. Early in the afternoon of the 8th a message was received saying: "Fort Troyon violently bombarded this morning by heavy guns of large calibre." The despatch closed with the ominous statement that the state of affairs was critical, and that 48 hours was all the commandant expected to be able to hold out. The situation of Gen. Sarrail was now exceedingly serious. Very violent attacks were in progress against his right and centre; his left was in danger of being rolled up; and now this new peril threatened his rear. Fort Troyon was a small work dating from 1879, of practically obsolete design, the armament of which consisted of four medium guns, twelve smaller, and a couple of mortars, while the garrison numbered some 350 of all ranks. The bombardment was to last for four days—from the 8th to the 12th—and was then succeeded by a thrust which created the well-known St. Mihiel salient, destined to remain as a dent in the French line until it was flattened out by the Americans four years later. Here it is only necessary to say that the garrison of Fort Troyon put up a stout resistance, and that the fortifications, obsolete though they were, proved sufficient to keep the casualties of the defenders surprisingly low. On the 10th the place was relieved by the arrival of a French cavalry division from Toul; and although upon the following day the Germans renewed their attacks upon it these had lost most of their significance. From Verdun to Paris the five German armies were in full retreat in the centre, and on the right and on the left were manœuvring to conform to the retirement. The great battle of the Marne had been fought and won.

So far in this narrative of the battle, beyond the mere mention of the retirement of the German right and centre, no reference has been made as to how, when and why the decision to break off the fight was arrived at. For long the matter was one of some perplexity, and rumours were circulated by the Germans that the Saxon III. Army, in the centre of the line, had failed, and by its failure had frustrated the efforts of the Prussians to the E. and W. Recent German literature has dispelled this unjust legend and has allowed the truth to be known. In the German army, so far back as 1870, liaison officers were a distinctive feature of the Higher Command. These were not mere messengers; they were expected to explain orders, and even, within limits, to give orders in the name of the chief of the General Staff. During the battle of the Marne Supreme Headquarters were over 100 m. in rear, and the slow working of the wireless apparatus brought it about that by the 8th von Moltke had completely lost his grip of the battle. In these circumstances a liaison officer—Lt.-Col. Hentsch—was directed to visit the V., IV., III., II. and I. Armies, and to bring back a clear idea of the situation. Should he find that a retrograde movement had already been initiated on the right wing he was instructed to issue such orders as would close the gap between the II. and I. Armies. During the 8th Lt.-Col. Hentsch visited headquarters of the V., IV., and III. Armies, and spent the night at headquarters of the II. Army. During the forenoon of the following day Gen. von Bülow was considerably disconcerted by the passage of British columns over the Marne, and came to the conclusion that a retreat on the part of the I. Army was now inevitable and that his own II. Army must also fall back if its right flank were not to be enveloped. Lt.-Col. Hentsch agreed with the conclusion, and proceeded then by motor-car to the headquarters of the I. Army at Mareuil. Gen. von Kluck was absent at the time, and it was his chief-of-staff, Gen. von Kuhl, with whom the liaison officer conferred. His view of the whole general situation was unfavourable, and he gave it as his opinion that the I. Army must fall back. Gen. von Kuhl pointed out the difficulty of breaking off the fight, and also argued that there was still a fair prospect of defeating the French troops on the Ourcq, but in face of the absolutely full powers of Lt.-Col. Hentsch there was nothing to be done but to break off the action and order the withdrawal of the I. Army towards the north. Gen. von Bülow had meanwhile telegraphed to the III. Army on his left notifying his retirement; and that army had no option but to comply with the general retrograde movement. Thus, by the late afternoon of the 9th, the whole right and right centre of the German army was falling back. Supreme Headquarters, in ignorance of the fact, had meanwhile prepared instructions for a continuance of the offensive, but events were too strong for them. It was found necessary to bow to the inevitable, and orders were issued during the evening of the 10th for the retreat of all five armies behind the line of the Aisne and Vesle. As to the necessity of renouncing the offensive at this stage opinions are, and will possibly ever remain, at variance. Historical unanimity will, however, probably be reached on two factors—the ineptitude of higher "staff work" on the German side and the serious drawback caused by the absence of a general reserve by which the situation might have been restored upon Sept. 9.

The conduct of Gen. von Kluck had not apparently satisfied Supreme Headquarters, and his army was placed "until further orders" under the command of Gen. von Bülow. On the 11th some considerable anxiety was felt upon the German side over the possibility of a French thrust against the centre, and a modification was made to the orders issued the previous day, by which the line of the III., IV. and V. Armies was to be Thuizy–Suippes–St. Menehould and E. of the latter place. A new VII. Army was formed from the XV. Corps—from the original army of that number in Alsace—and the VII. Reserve Corps set free by the fall of Maubeuge. These units were due to reach the area St. Quentin–Sissy about midday on the 12th, and this army was, like the I., also placed under the orders of Gen. von Bülow. The German right wing fell back in good order but in considerable haste, and on the 12th the I. Army was behind the Aisne on the line Attichy–Soissons–Vailly. The French VI. Army, following up through the forest of Compiègne, crossed the river on the following day, while farther E. of this sector an advanced guard of the British 4th Div. seized the bridge at Venizel and moved forward to the crest of the plateau beyond. On the following morning the battle of the Aisne opened for the British army, and the river line was attacked all along the British front. By nightfall all passages except that at Condé were secured and held, and during the hours of darkness all three corps had constructed bridges, the crossing being completed in the face of considerable opposition during Sept. 14.

The gap which had existed between the German I. and II. Armies during the battle of the Marne was still unclosed when the position behind the Aisne was taken up by the German right. Once again the persistent British columns scared Gen. von Bülow; but, luckily for him, reinforcements were available, since the VII. Army was now coming to hand, and during the night of the 12th and 13th units of the VII. Reserve Corps were hurried down from the neighbourhood of St. Quentin to fill the gap, achieving their object by the narrowest possible margin of time. This reinforcement, which had such an appreciable effect upon the battle of the Aisne, deserves something more than casual mention. On Sept. 9 the VII. Reserve Corps, leaving a detachment at Maubeuge, was ordered N. against the English reinforcements supposed to be advancing from the Flanders coast against Brussels or Antwerp; later in the day a counter order came for it to march S. towards La Fère, as the situation on the Marne was more strained than even that in the north. At 10 A.M. on the 12th, when near Guise, further orders came for the corps to turn off towards Laon at once. The intelligence that arrived from Gen. von Bülow was so alarming that Gen. von Zwehl, the corps commander, marched his divisions on all through the night, rested from about 7 to 10 A.M. and then pressed on again. Thus he managed to arrive on the Chemin des Dames by 2.30 P.M. (British time), and little more than an hour later the leading infantry brigade of the British I. Corps was near Moulins, a mile short of the top of the ridge.

The Allied centre did not experience much opposition in the advance, but on the right the German V. Army gave more trouble. As the pivot of the great German wheel-back the rôle of the Crown Prince was to mark time, and the duty was carried out with some skill. By the 14th he was on his assigned position. In the temporary deadlock now brought about by the occupation, by the Germans, of a defensive position, each side began the attempt of outflanking the other on the W., with the result that the German front by Sept. 16 was thus traced out:—the neighbourhood of Noyon, the plateaus S. of Vic-sur-Aisne and Soissons, the tableland of Laon, the heights N. and W. of Reims, Ville-sur-Tourbe (N. of), Varennes, to the Meuse near Forges Wood, N. of Verdun.

Mention has been made of German operations, after the battle of the Marne, S. of Verdun, and a brief narrative of them is now required. The brilliant defence made by the French III. Army about Verdun was followed a few days later by a mishap. Thenceforward, until the American offensive in 1918, there existed the "pocket of St. Mihiel," a salient jutting into the French position which affected the course of operations throughout the war in the Verdun–Epinal area.

Owing to the exhaustion of the corps of the French III. Army the pursuit of the German V. Army after the battle of the Marne was not pressed; the main body of the French III. Army halted abreast and W. of Verdun, while its VI. Corps and Gen. Durand's group (the 65th, 67th and 75th Res. Divs.) passed through Verdun and crossed to the right bank of the Meuse. On the 16th the VI. Corps was to move N. towards Mangiennes, while Gen. Durand's three divisions marched parallel and E. of it from Etain towards Spincourt. Thus Gen. Sarrail had divided his army into two parts, separated by the Meuse, and while the right of the III. Army was advancing northwards on a broad front E. of the Meuse by Mangiennes and Spincourt, three German corps, the XIV., Bavarian III. and V. Reserve were moving from W. and S.W. of Metz to attack westwards behind it, in the general direction Toul–St. Mihiel.

The defence of the Hauts-de-Meuse was at this time changing hands. The II. Army was in the process of entrainment on its way to the western flank to extend the battle-front E. of Amiens. The VIII. Corps, however, which had been transferred from the I. to the II. Army on Sept. 15, and had taken over the defence of part of the Hauts-de-Meuse, was at first left in position, but on the 19th it was ordered by the French Higher Command to entrain at once for St. Menehould, whence it was to be transported to join the VI. Army N. of Paris, thus creating a gap which Gen. Sarrail could not fill.

In the meantime, the three reserve divisions were sent off to hold the Hauts-de-Meuse on a broad front between Dieppe, E. of Verdun, and Vigneulles, N.E. of St. Mihiel. The three divisions were thus extended over a front of 20 m., with a wide gap of six miles between Grimaucourt and Tresauvoux. With the VI. Corps Gen. Sarrail intended to retake Etain, and did not appear to suspect the danger approaching the Hauts-de-Meuse farther S.; behind the long screen of the reserve divisions along the Hauts-de-Meuse he had no mass of manœuvre in reserve to meet the unexpected. The gap in the battle-front created by the withdrawal of the VIII. Corps from in front of St. Mihiel therefore remained unfilled.

The Bavarian III. Corps advancing westwards towards Vigneulles and St. Mihiel, N. of the XIV. Corps, therefore found the way practically open for it. On Sept. 20, at 8:30 A.M., Hattonchatel, Hattonville, and Vigneulles were bombarded, and at 5 P.M. the Bavarians entered Vigneulles. During the night Hattonchatel was taken without resistance being offered, and the French retired in disorder on St. Mihiel, abandoning the Hauts-de-Meuse to the Bavarian III. Corps, who were astonished at such an easy victory. The enemy by the morning of the 21st held the entire sector of the Hauts-de-Meuse between Combres and Heudicourt, a front of 12 miles.

On the 21st Gen. Sarrail issued orders for the recapture of the lost sector of the Hauts-de-Meuse, but was unable to stop the German offensive on the right bank of the Meuse from Vigneulles on St. Mihiel. He was, however, more successful on the left bank. On the 24th the 65th Res. Div. was brought down by rail from Verdun towards St. Mihiel. It had to detrain at Woimbey, and thence marched to Rupt on the St. Mihiel–Bar-le-Duc road. Here it was rejoined by the remnants of the 75th Div. from the right bank. These two divisions held up the German advance along the Bar-le-Duc road and forced it back on Chauvoncourt. The VI. Corps, with the 65th Div., was able to remain on the right bank of the Meuse, its front running obliquely from Maizey to St. Remy. It was, however, unable to cut the German communications between St. Mihiel and Vigneulles; and the situation established on Sept. 24 1914 remained unchanged for over three years. (F. E. W.*)

MARQUESTE, LAURENT HONORÉ (1848–1920), French sculptor, was born at Toulouse June 12 1848. He was a pupil of Jouffroy and Falguière, and won the Prix de Rome in 1871. In 1893 he became a professor at the École des Beaux Arts. He became a member of the Institute in 1894, having received the Legion of Honour in 1884, and being made officer in 1894, and commander in 1903. His works include a large number of statues which decorate the monuments and buildings of Paris, including Victor Hugo for the Sorbonne (1901) and others for the monumental Quai d'Orsay station, the Collège des Beaux Arts, the Grand Palais, and the Hotel Dufayel in Paris, which was very much criticised; as well as monuments for North and South America. He is also the author of "La Cigale" (1900), statues of Victor Hugo, Léo Delibes, Ferdinand Fabre, and many others, besides "Galatea" (*see* 24:496, Pl. VII.) and a large output of classical subjects. He gained the Grand Prix at the Universal Exhibition of 1900. He died in Paris April 5 1920.

MARSCHALL VON BIEBERSTEIN, BARON ADOLF VON (1842–1912), German diplomatist, was born at Carlsruhe Oct. 12 1842, his father—Augustus, Baron Marschall von Bieberstein—being chamberlain to the Grand Duke of Baden, and his mother before her marriage Baroness von Falkenstein. He was educated at the *Gymnasium* of Frankfort-on-Main and at the universities of Heidelberg and Berlin. He studied law and from 1871 to 1882 held various administrative offices in the Grand Duchy of Baden. From 1875 to 1883 he sat in the Upper Chamber of the Baden Diet. In 1883 he was sent to Berlin as minister for Baden in the Federal Council and from 1884 to 1890 he represented the Council in the Imperial Insurance Office. In 1890 he succeeded Count Herbert Bismarck as Secretary for Foreign Affairs under the Caprivi chancellorship and continued to hold that office under Prince von Hohenlohe; but he had incurred the enmity of Prince Bismarck by refusing his advice when he first assumed office, and the result was a fierce press campaign against him which finally obliged him to speak out when he appeared as a witness at the trial of certain journalists in 1896 for *lèse-majesté*. He was also violently opposed by the Agrarians because he advocated the reduction of corn duties, and in 1897 he resigned office, and a few months later was appointed German ambassador in Constantinople. There he remained for nearly 15 years, creating a commanding position for himself and a growing ascendancy in Turkish affairs for his Government. To him was largely due the promotion of the Bagdad railway. In general European politics Baron Marschall had taken during his Foreign Secretaryship a strongly imperialist attitude. After the Jameson raid and the Emperor's telegram to President Krüger, in the drafting of which Baron Marschall, according to the later testimony now available, bore a leading part, it was he who declared in the Reichstag that the maintenance of the independence of the Boer republics was a "German interest." He was also an advocate of a strong naval policy for Germany. In 1907 he was principal German delegate in the Hague Conference, and was the exponent of Germany's resolute and successful opposition to any practical discussion of the question of restriction of armaments. In May 1912 he was appointed to succeed Count Wolff-Metternich as ambassador to Great Britain, but he had only been in London a short time when his health finally broke down. He died at Badenweiler Sept. 24 1912.

MARSH, CATHARINE (1818–1912), English philanthropic worker, was born at Colchester Sept. 15 1918, being the child of an evangelical clergyman, sometime rector of Beckenham. In company with her father she did remarkable pioneer missionary work amongst navvies. She wrote *Memorials of Captain Hedley Vicars* (1856), an account of the officer-missionary who was killed in the trenches before Sevastopol, and *English Hearts* *and English Hands* (1858), a description of her own work with the navvies. She died in London Dec. 12 1912.

MARSHALL, ALFRED (1842–), English economist (*see* 17.770), produced a memorandum for the Government on the Fiscal Policy of International Trade in 1908. In 1919 he published *Industry and Trade* (vol. 1., 4th ed. 1921). All his work since the publication of his first book in 1879 was done in conjunction with his wife Mary, daughter of the Rev. Thomas Paley, whom he married in 1877. She was one of the first women students at Cambridge, and was highly commended for her work in the Moral Sciences tripos in 1874. In 1875 she became resident lecturer at Newnham Hall, when it was first opened under Miss A. J. Clough, resigning this post on her marriage.

MARSHALL, THOMAS RILEY (1854–), American politician, was born at North Manchester, Ind., March 14 1854. He was educated at Wabash College (A.B. 1873; A.M. 1876) and was admitted to the bar in 1875. From 1876 to 1909 he practised law in Columbia City, Ind., and from 1909 to 1913 was governor of Indiana. He was nominated for vice-president on the ticket with Woodrow Wilson at the Democratic National Convention in 1912 and was elected. He was again nominated with President Wilson in 1916 and elected for the term 1917–21. For almost two years after the outbreak of the World War he urged strict neutrality, but in 1918 publicly expressed regret for this attitude. In 1919 he welcomed the King and Queen of Belgium on their visit to Washington during the illness of President Wilson. He was a strong advocate of the League of Nations, but did not favour woman suffrage.

MARSHALL, SIR WILLIAM RAINE (1865–), British general, was born Oct. 29 1865, and entered the army in 1886. He saw considerable service in the 1897–8 campaign on the N.W. frontier of India and with mounted infantry in the S. African War 1899–1902. He was promoted full colonel in 1908, and in 1912 he obtained command of a battalion in India. Returning with his unit to England soon after the outbreak of the World War he took it over to France, but he was almost immediately recalled to take up command of the 86th Brigade of the 29th Division in England, and early in 1915 he proceeded with it to the Dardanelles. It took part in the famous landing of April 25 at Helles and saw much hard fighting. Marshall was promoted major-general for distinguished service in June; he was afterwards in temporary command of different divisions in the Gallipoli Peninsula, and at the evacuation of Suvla he was in charge of the beach work. He was then transferred to the 27th Division at Salonika and served there until Sept. 1915, when he was chosen to command an army corps that was being organized in Mesopotamia. In the memorable campaign conducted by Sir F. S. Maude, by which Kut was recovered and Bagdad taken, his corps gradually cleared the right bank of the Tigris to some distance above Kut, and then forced a passage over the river in defiance of the Turks. His troops led the advance to Bagdad, and after its fall in March 1917 he inflicted a number of heavy defeats upon the enemy to the north of the city. On Sir Stanley Maude's death in Nov. 1917 Sir William Marshall—who had been given the K.C.B. for his services as a corps commander—succeeded to the chief command. During the ensuing cold season he considerably extended the area under the control of his troops, and on favourable weather again setting in a portion of his army virtually annihilated what was left of the Turkish field forces in Mesopotamia at Kala Shergaat, thus bringing the campaign to a triumphant close. In recognition of his great services Marshall had been promoted lieutenant-general, and he now received the G.C.M.G. At the end of 1919 he took up the command of the Southern Army in India.

MARYLAND (*see* 17.827).—The pop. in 1920 was 1,449,661, as compared with 1,295,346 in 1910, an increase of 11·9% as opposed to 9% in the previous decade. In 1920 the urban pop. of Maryland (that is, residents of towns of 2,500 inhabitants or more) was 869,422 while the rural pop. was 580,239, or 60% urban instead of 50·8% in 1910, the first year in which urban exceeded rural. A part of this increase of urban population may be accounted for by the annexation of portions of Baltimore and Anne Arundel counties to Baltimore city in 1918 (*see* BALTIMORE) by which the population of Baltimore received more than the normal increase for the decade.

The population of those cities in Maryland having more than 11,000 inhabitants and the percentage of increase for the decade was as follows:—

	1920	1910	Increase per cent.
Baltimore	733,826	558,485	31·4
Cumberland	29,837	21,839	36·6
Hagerstown	28,066	16,507	70·0
Annapolis	11,214	8,609	30·3
Frederick	11,066	10,411	6·3

The greatest percentage of increase over the preceding census in the case of any of these cities was the 70% (11,559 in number) of Hagerstown, an important railway and manufacturing centre of the Cumberland valley.

Agriculture.—In 1910, 48,923 farms occupied 5,057,140 ac., or 79·5% of the total land area of Maryland, of which acreage 3,354,767 or 66·3% were improved lands. The slow transition of the state from an agricultural to a manufacturing community is manifested in a comparison of these figures with those for 1920, in which year there were reported 47,908 farms, taking up 4,757,999 ac. or 74·8% of the total land area, and showing 3,136,728 or 65·9% in improved lands. There were 1,015 or 2·1% fewer farms in 1920 than in 1910, a decrease of 5·9% in total acreage and 6·5% in the acreage of improved land. In the same period in which this decrease in acreage occurred (1910–20), the value of all farm property in the state rose from $286,167,028 to $463,638,120; of the average value of a farm from $5,849 to $9,678. The total farm value in 1920 comprised $386,596,850 in lands and buildings, $28,970,020 in implements and $48,071,250 in live stock. The average number of ac. per farm decreased from 103·4 in 1910 to 99·3 in 1920. The largest single group in the classification by acreage was that of farms having from 100 to 174 ac. each, which represented 23·3% of the whole number. The average value per ac. of all farm property in 1920 was $97.44 instead of $56.59 as in 1910, and of land alone was $54.62 instead of $32.32. Of the total number of farms, 41,699 were operated by white farmers and 6,209 by coloured farmers, a decrease in the first class of 2%, in the second class of 2·6%.

Of domestic animals on Maryland farms in 1920, the total value was $43,784,464; of poultry, $4,216,105. The number of horses, 141,341, was 5·5% smaller than in 1910, but the number of mules reported, 32,621, showed an increase of 45·8%. There were 283,377 cattle on the farms, an increase of 13·9%, and of these 188,537 were reported as dairy cows (including heifers one year old and over), an increase of 21,678 or 13%. The total farm value of Maryland dairy products in 1919, excluding products consumed on the farms, was $13,407,526 as against $5,480,900 in 1909, an increase of 144·6%. In spite of the decrease in improved lands in 1919 as compared with 1909, the crop acreage in the former year was 1,988,120 as opposed to 1,927,254 in the latter. The total value of all crops in 1909 was $40,330,688, a figure which under the increased production brought about by the World War rose to $122,368,000 in 1918 but fell to $109,811,164 in 1919. The leading products in value in 1909 were cereals (Indian corn and wheat), hay and forage, vegetables, fruits and nuts and tobacco. The corn acreage of Maryland fell from 647,012 in 1909 (value of crop $11,015,298) to 619,265 (value of crop $32,678,769) in 1919. In the same period the wheat acreage rose from 589,893 (value of crop $9,876,480) to 664,295 (value of crop $21,357,568). The acreage of hay and forage showed 662,939 in 1919 as against 398,892 in 1909, while tobacco with an acreage of 28,550 in 1919 as against 26,072 in 1909 showed an increase in value of 292·6% or the difference between $5,721,164 and $1,457,112. Oats, wheat and tobacco showed a decrease in their average yield per ac., while corn, hay and Irish potatoes showed an increase. The total vegetable acreage in 1919 was 165,106, of which 58,083 was in tomatoes; the value of the vegetable crop was $25,371,723. The total small fruit acreage fell from 16,595 in 1909 (14,292 in strawberries) to 8,360 (7,096 in strawberries) in 1919; a less noticeable decrease occurred in the orchard fruit crop.

Minerals and Manufactures.—The value of the products of all mines and quarries in Maryland in 1909 was $5,782,045, of which amount $4,483,137, or 77·5%, represented the value of the products of bituminous coal-fields; $1,075,726 the product of stone-quarries; the small remainder the product of iron-mines, clay-pits and various other relatively unimportant sources. The total operating expense of the mining industries in 1909 was only $775,888 less than the value of the whole product, but the excess of value over cost in the case of bituminous coal was $541,778. Granite, traprock, limestone and slate, in the order named, came after bituminous coal in value of their product. In 1910 there were mined in Maryland 4,658,147 long tons of bituminous coal, an output which declined steadily until it reached 3,690,667 long tons in 1914, when it began to increase, and in 1918 the output was 4,015,444 long tons, a slightly smaller tonnage than in the previous year. The value of the stone-quarries, excluding marble, in 1916 was $934,130 as opposed to $1,075,726 in

1909. The value of products manufactured from mines and quarries in 1916 was, for brick and tile $1,908,537, lime and cement $2,332,846. The pig-iron production of Maryland furnaces rose from 290,073 tons in 1900 to 501,452 in 1916, and fell from this point to 244,002 in 1919.

The total value of Maryland manufactures in 1909 was $315,669,150 and in 1914 $377,749,078, a sum which placed the state 14th in the Union in value of manufactured goods. Of the amount named $215,171,530 was the product of Baltimore plants alone. In the entire state there were in 1914 131,391 persons engaged in manufacturing industries, and $293,210,925 invested in capital. Baltimore ranked as sixth city in the number of establishments in operation. In the period 1909–14, the value of Maryland manufactures advanced 19·7%, and in general the figures indicate an increasing value in manufactured products, as contrasted with a less satisfactory progress in the yield of natural resources. In both 1909 and 1914 the value of the following six industries exceeded $10,000,000 each:—

Products	1914	1909
Men's clothing	$39,048,000	$36,921,000
Copper, tin and sheet-iron products	25,491,000	16,909,000
Canning and preserving	18,029,000	13,709,000
Lumber and timber products	11,911,000	12,134,000
Foundry and machine products	10,659,000	11,978,000
Slaughtering and meat-packing	17,100,000	13,683,000

By 1914 there had been added to this list: cars and general shop construction and repairs, for steam railways, $13,229,000; fertilizers, $13,987,000; printing and publishing, $11,263,000. Since 1914 there has been a large increase in the number of manufacturing establishments and in capital invested in manufactures in Baltimore, so that the 57%, which in that year was the contribution of that city to the value of manufactures in the state, has been increased. Outside of Baltimore, the chief manufacturing centres are the western Maryland cities, Cumberland and Hagerstown.

Fisheries.—In 1908 the value of the Maryland fishery products had fallen from the second place which it occupied in 1897 to fifth place. Recognizing that the decreased output was due to the unregulated stripping of the natural oyster beds, the state by an Act of 1916 created a Conservation Commission charged with the execution of all laws relating to oysters, fish, crabs and game, supplanting the Shell Fish Commission, the two Fish Commissioners and the state Conservation Bureau, and assuming control and coordination of all existing agencies for the furtherance of the fishing industry and game protection of the state. The report of the Shell Fish Commission in 1907 laid down the general principles of oyster culture followed by the Conservation Commission in encouraging the planting and gathering of oysters, the most valuable products of the Maryland waters. The state had faced a steady decline in its oyster industry since the year 1897, when 7,255,000 bus. were taken from Maryland waters. In 1908 the catch had fallen to 6,232,000 bus., and in the season of 1916–7 to 4,120,819 bus. In the hard winter of 1917–8 an even lower mark was reached, but exceptional conditions account for the poor catch of that year. There is reason to believe that the encouragement given to planting and the enforcement of the "cull" law are beginning to have effect, for since the extremely small catch of 1917–8 there has been a steady increase until the highest figure for several years was attained in 1920–1 with a catch of 4,967,433 bus. (figures of April 15, before the close of the season). An ambitious planting programme has been outlined for all the fish products of the state by the Conservation Commission, in addition to its regular scheme by which many millions of fry are released into Maryland waters every year.

Communications.—Beginning with the passage of the "Shoemaker, or State Aid" Act in 1904, the state entered upon a programme of road construction, the prosecution of which has provided it with one of the best road systems of any state. In 1908 the State Roads Commission was created by the Legislature to construct all state roads and state-aid roads, and as the result of its activities there have been built of both classes 1,585 m. of macadam, concrete and other surfaced roads on the foundations of the once privately owned turnpikes and the connecting county roads.

Education and Religion.—The period of 1910–20 was a notable one in the development of the Johns Hopkins University, of Baltimore. In 1920 the Legislature passed an Act merging the university of Maryland (Baltimore) with its schools of law and medicine, and the Maryland State College of Agriculture (College Park, Md.) under the name of the university of Maryland and under the control of a Board of Regents. In secondary education, the future betterment of the school system throughout the state was provided for by the reorganization of the State Board of Education by legislative enactment of 1916. Industrial and vocational training in the schools have been the subjects of experimentation, but no definite policy has been established with regard to their continuance.

All denominations in Maryland reported 602,587 members in 1916, an increase of 99,870 since 1906. In 1916 the church membership was divided among 2,955 organizations, representing more than 60 denominations. The value of church property in the state was $29,162,381. The Roman Catholic church membership (all baptized persons including infants) numbered 219,530. Following in the order named were the Methodist Episcopal (112,853), Protestant Episcopal (38,469), General Synod of the Evangelical Lutheran (33,555), National Baptist Convention, coloured, (29,405), Presbyterian Church in the United States (19,603).

History.—A series of Acts passed since 1910 indicate a progressive quality in the administration of the state. These Acts created the Public Service Commission (1910), the State Industrial Accident Commission (1914), the Conservation Commission, (1916), the State Board of Prison Control (1916), the State Tax Commission (1914), the State Roads Commission (1908), and the reorganization of the State Board of Education (1916). In 1916 the budget system was adopted and in 1920 a merit system for state employees was put in operation. During the World War, Maryland furnished the following volunteer organizations: three regiments of infantry, one battalion of field artillery, one troop of cavalry, four companies of coast artillery, one field hospital, one ambulance company, two battalions of naval militia and one company of negro infantry. With the exception of the coast artillery companies and the coloured company these volunteer organizations became part of the 29th Div. and the infantry personnel, as the 115th Regt., saw active service on the American front in France. The 3rd Coast Artillery Company, and volunteers from the others, became the 117th Trench Mortar Battery, and as part of the Rainbow Div. was actively engaged at the front in France for many months. By the selective draft 34,000 men were sent from Maryland. Four great military establishments were located in Maryland during the war: the Aberdeen Proving Grounds, the Edgewood Arsenal, Camp Meade and Camp Holabird. Because of their good locations and convenience to Washington, these establishments have been retained for military purposes by the War Department.

Maryland subscribed to the five Liberty and Victory loans $290,247,200, a sum which exceeded the total of its minimum apportionment by nearly $43,000,000, and was $13,000,000 larger than the total of its maximum apportionment. Maryland was the sixth state to ratify the Prohibition amendment but never ratified the Suffrage amendment. Recent governors have been Austin L. Crothers (Dem.), 1908–12; Phillips Lee Goldsborough (Rep.), 1912–6; Emerson C. Harrington (Dem.), 1916–20; Albert C. Ritchie (Dem.), 1920– . The latter was elected by only 165 votes over his Republican opponent, polling 112,240 votes to 112,075.

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MARZIALS, SIR FRANK THOMAS (1840–1912), British civil servant and man of letters, was born at Lille in France Jan. 13 1840 and educated at a school kept by his father who was a clergyman. He entered the War Office during the Crimean War and became accountant-general in 1898, retiring in 1904. He was knighted that year and became a member of the Patriotic Fund Corporation. He was also vice-president of the London Library. As one of the editors of the *Great Writers* series, he contributed *Lives* of Dickens, Victor Hugo and Molière (1904) and also wrote *Death's Disguises and other Sonnets* (1889) and translated the *Chronicles of Villehardouin and Joinville.* He died at Notting Hill, London, Feb. 14 1912.

MASCAGNI, PIETRO (1863–), Italian composer (*see* 17.835). His later works include *Isabeau* (1911) and *Parisina* (1913).

MASEFIELD, JOHN (1875–), English poet, playwright and novelist, was born in 1875. His early poems were of the sea (*Salt-Water Ballads,* 1902; *Ballads,* 1903, etc.). He also wrote sketches of buccaneers, *On the Spanish Main* (1906), and two stirring novels, *Captain Margaret* (1908) and *Multitude and Solitude* (1909), as well as editing *The Voyages of Captain William Dampier.* But narrative poetry and drama proved his natural means of expression, as he showed in his poems *The Everlasting Mercy* (1911); *The Widow in the Bye-Street* (1912); *Dauber*

(1913); *The Daffodil Fields* (1913); *Lollingdon Downs* (1917); *Reynard the Fox* (1919); *Right Royal* (1920); *Enslaved and other Poems* (1920); *King Cole* (1921); and in his sombre plays, *The Campden Wonder* (1907); *The Tragedy of Nan* (1909); *Pompey the Great* (1910); *The Faithful* (1915); and *Good Friday* (1916). He also published some prose war sketches, *Gallipoli* (1916); *The Old Front Line* (1918); *St. George and the Dragon* (1919).

MASON, ALFRED EDWARD WOODLEY (1865–), English novelist, playwright and politician, was born in Camberwell May 7 1865 and was educated at Dulwich College and Trinity College, Oxford. Whilst at Oxford he played Heracles in a production by the O.U.D.S. of the *Alcestis* of Euripides, and when he left the university he joined a theatrical company and toured for a time in the provinces. He soon, however, abandoned acting for literature. His first novel, *A Romance of Wastdale*, was published in 1895. He followed it by the successful *Courtship of Morrice Buckler* (also dramatized) in 1896 and *Miranda of the Balcony* (dramatized in New York) in 1899. Amongst later novels *The Four Feathers* (1902); *The Broken Road* (1907); *Running Water* (1907) and *The Turnstile* (1912) are the most notable. *At the Villa Rose* (1910), an experiment in the detective story, was successfully dramatized and presented at the Strand theatre, London, in July 1920. Besides the dramatization of his novels, he wrote as original plays *Colonel Smith* (1909); *The Witness for the Defence* (1911) and *Open Windows* (1913). He sat as Liberal member for Coventry in the House of Commons from 1906 to 1910. During the World War he held a commission in the Manchester regiment and later was on the general staff of the R.M.L.I. He also went on missions to Spain and to Mexico for the Intelligence Dept. of the Admiralty and utilized some of his experiences in a novel *The Summons* (1920).

MASPERO, SIR GASTON CAMILLE CHARLES (1846–1916), French Egyptologist (*see* 17.848), died in Paris June 30 1916. During his second term of office as director-general of the Service of Antiquities at Cairo he was made an hon. K.C.M.G. (1909). He retired in 1914.

MASSACHUSETTS (*see* 17.850).—The pop. in 1920 was 3,852,356, an increase of 485,940 or 14·4% since 1910, as against 20% in the preceding decade. Nearly one-third of the state's inhabitants lived in metropolitan Boston. Less than 1·3% were negroes; 27·9% were foreign born, of whom 24·4% came from Canada. The average density of pop. was 479·2 per sq.m., as against 418·8 in 1910. The urban pop. (in 169 places of more than 2,500) was 94·8% of the whole as against 92·8% in 1910. The pop. of the 13 chief cities was:—

	1920	1910	Increase per cent
Boston	748,060	670,585	11·6
Worcester	179,754	145,986	23·1
Springfield	129,614	88,926	45·8
New Bedford	121,217	96,652	25·4
Fall River	120,485	119,295	1·0
Lowell	112,759	106,294	6·1
Cambridge	109,694	104,839	4·6
Lynn	99,148	89,336	11·0
Lawrence.	94,270	85,892	9·8
Somerville	93,091	77,236	20·5
Brockton	66,254	56,878	16·5
Haverhill	53,884	44,115	22·1
Holyoke	60,203	57,730	4·3

Agriculture.—Farm property in 1920 was valued at $300,471,743, including live stock valued at $33,524,157. The total value of farm products in 1919 was $87,558,456—crops representing 61·3% of this, and animal products 38·7 per cent. The leading crops and their percentages of the total crop value were: hay and forage 37·5%, vegetables 28·5% and fruits 18·2 per cent. The production of the chief cereals was as follows, in bushels:—

	1919	1909
Maize	1,921,607	2,402,738
Oats	1,515,933	2,029,381
Buckwheat	23,238	32,926
Winter Wheat	21,337	1,710
Spring Wheat	11,916	694
Barley	11,832	9,021
Rye	46,261	59,183

The yield of apples in 1909 was 2,550,259 bus.; in 1919, 3,187,210. Two-thirds of the cranberry yield of the United States in 1920 was raised in the bogs along the S.E. coast of the state. Of the animal products 73% were of the dairy and 26% poultry and eggs.

Mineral Products.—During the decade there was a large increase in the production of building-stone, crushed rock for road and street making, and sand. In 1913 the value of the products of mines and quarries and their manufactured derivatives was $11,292,723. The production of monuments and tombstones was: 1909, $2,852,650; 1918, $2,571,750. The value of clay-products of the state decreased from $1,647,362 in 1908 to $1,451,715 in 1918, of which latter amount $1,230,711 was the value of common brick.

Manufactures.—Massachusetts, with a limited local market for its manufactured products, scanty resources in the form of raw materials, and a declining trans-Atlantic commerce, has added little to its railway and terminal facilities. Only four states are smaller in area; yet in 1918 only four states exceeded it in the value of its industrial output. Its advantage has lain in having a surplus of capital, in its unsurpassed supply of skilled labour and in the superior organization of its factories. In its earlier development it utilized its local water-power, of which it had a liberal supply. Then it became largely dependent on coal for fuel, imported at increasingly high cost. In 1910 the total value of manufactures was $1,490,527,386; in 1914, $1,641,373,047, and in 1918, $3,851,346,215, an increase over 1900 of 324 per cent. While the increase in value is largely to be accounted for by the increased prices, the state as a whole made commendable industrial progress. In textiles (cottons, worsteds and woollens), in boots and shoes, boot and shoe cut stock and findings, rubber footwear, and in fine writing-paper, Massachusetts in 1919 was the foremost state.

The following table deals with the manufacture of leather boots and shoes, cut stock and findings:—

Boots and Shoes.

	Estab's. Reported	Employees	Value of Products
1909 . . .	469	47,710	$187,045,767
1914 . . .	464	76,944	200,529,858
1919 . . .	474	77,196	361,090,261

Boot and Shoe Cut-Stock and Findings.

	Estab's. Reported	Employees	Value of Products
1909 . . .	391	8,353	$49,297,148
1914 . . .	420	8,170	54,658,155
1919 . . .	422	9,964	118,310,617

The value of boots and shoes and cut stock in 1918 was 40% of the country's output, New York ranking second with 13·4 per cent. In 1918 the textile industries employed 30% of the manufacturing wage-earners, the products being 30·9% of the total industrial output and being valued at $1,191,650,551. Nearly one-half of this was in cotton goods and formed 28·9% of the output of the whole country, N. Carolina, the next largest producer of cotton goods, turning out 13·4% of the whole. The output of woollen and worsted goods in 1918 was more than 30% of that of the whole country, Pennsylvania producing the next largest amount. The increase in value from 1900 to 1918 was 5·78%—showing a marked decrease in quantity when the difference in prices is considered. The increase in the value of boots and shoes and cut stock for the same period was 136%—showing small increase in quantity. Boston and Worcester were the principal centres for foundry and machine-shop products, valued in 1918 at $341,751,367. Other industrial products, in order of importance, were: rubber goods, $120,757,575; tanned, curried and finished leather, $81,462,273, in the manufacture of which Massachusetts was second among the states; paper and wood pulp, $91,428,346; slaughtering and meat-packing, $117,730,023; printing and publishing, $73,267,130, of which $39,104,873 was the value of newspapers and periodicals; electrical machinery, apparatus and supplies, $83,742,359; cordage, twine and jute goods, $45,574,887, in which the state was second only to New York; furniture, $17,058,360; jewelry, $9,526,836, Massachusetts ranking second only to Rhode Island; and confectionery $40,869,064, in which Massachusetts was third among the states.

The state is also noted for its fishing industry, the fleets visiting the Newfoundland Banks being very important, with Gloucester and Boston as chief centres of the trade. The value of products in 1920 was $7,596,905. Cod were valued at $2,311,011; haddock, $2,655,303; mackerel, $748,682; and halibut, $518,598.

Education.—Several fundamental changes were made in the organization of the educational enterprises of the state in 1919. Among the most important were the consolidation into a new department of education of several related activities, the abolition of the Board of Education and the creation of the Advisory Board of Education, consisting of six members and the Commissioner of Education, who is *ex-officio* chairman. The passing of the Board of Education, established in 1837, marks the close of an important era in the development of a state policy of education. In vocational education rapid progress in the decade 1909–19 is shown by the following statistics:—

	1919	1909
Schools in which vocations were taught .	107	6
Occupations in which instruction was given	50	4
Enrolment in vocational classes . . .	2,500	1,400
Cost of vocational training . .	$881,000	$5,000

Another significant development was in university extension. The department has carried on its work by correspondence instruction, class instruction, and Americanization classes. In the period Dec. 1 1919 to Nov. 20 1920 6,188 students were receiving instruction by correspondence, 15,520 were registered in adult immigrant classes and 23,720 in other extension classes. In 1911 the Teachers' Registration Bureau was established, a free agency which has proved very successful; three years later a retirement system was put into operation, with membership compulsory, and provision for retirement at 60 years of age under certain conditions or by compulsion at 70. In 1920 the salaries of superintendents in superintendency unions (two or more towns employing one superintendent) was fixed at a minimum of $2,250, with certain reimbursements by the state and allowances for travelling. The Legislature of 1921 made several notable changes, among which are the following: state aid to high schools in towns of less than 500 families was increased from $500 per school to $250 per teacher. Transportation is compulsory from towns where there is no high school, with provisions for state reimbursement.

The State Department may now grant the degree of Bachelor of Education to any person completing a four-year course in a state normal school—one school giving it in the commercial course only, one in household arts, one in art and two in regular courses. In 1920 over $1,000,000 was spent for normal schools and teachers' training. Pupils from 14 to 16 years of age must have completed the requirements of the sixth grade before being certified for employment. Public-school teachers and superintendents have the right to a hearing before the school committee, accompanied by a witness, before dismissal from service. Every town with a valuation of over $1,000,000 must employ a school nurse. Indoor and outdoor games and athletic exercises are also required. Regular public-school teachers cannot be paid less than $750 a year. Reimbursements to small towns and cities are provided, with special arrangements for those of low valuation, enabling them to have good teachers.

Finance.—The receipts of the state in 1909 were approximately $14,700,000 and those in 1920 approximately $47,350,000, or more than three times as much. These figures represent receipts for revenue purposes only and do not include receipts from the issue of bonds or notes. The payments in 1909 were about $17,100,000 and in 1920 about $52,900,000. These represent governmental cost and include no payments of money borrowed. In 1919 the funded debt of the state was $126,555,662 and the total debt $129,404,091.

Road-building.—During 1920 nearly 122 m. of highway was constructed, as well as 22 m. commenced but not completed. Of this, 39 m. was gravel, 38 m. of bituminous macadam, 16 m. of cement concrete, 4 m. of sand and asphalt mixed, and 5 m. waterbound macadam with bituminous surface treatment. Of state highway 27 m. was surfaced, 14 m. widened and resurfaced. Some roads were being constructed 20 ft. wide instead of 18 feet. Much was under construction in 1921 with $6,000,000 more to be spent. The total length of state highways at the end of 1919 was 1,311 m. and the amount spent on roads in that year was about $1,610,200.

Banking.—The resources in 1919 of the national banks within the state were $1,003,945,000. There were 634 banking institutions and agents under state law, with resources of $2,488,606,935, divided as follows: 196 savings banks, $1,215,244,815; 105 trust companies, $1,076,214,436; 190 coöperative banks, $154,879,638; three savings and loan associations, $2,399,791; Mass. Hospital Life Insurance Co., $30,918,328; one foreign banking corporation, $1,838,749; 60 credit unions, $2,791,165; 77 steamship agents receiving deposits of $3,187,506; one state bank, $1,132,507.

History.—During the decade 1910–20 the most important laws enacted by the Legislature were the following: In 1912 a minimum-wage board was established with the right to determine wages of women and children. The inheritance law was amended so that only the real estate of a deceased non-resident is taxed, personal property taxes going to the state of residence. A 1913 law provided for the establishment and maintenance of continuation schools and instruction for working-children. A number of pure-food laws were enacted; also, a law providing for mothers' pensions. Laws relating to elections were so amended that on application signed by 1,200 voters in any senatorial district, or by 200 voters in any representative district, asking for the submission to the voters of any question of instruction to senators or representatives, the Secretary of the Commonwealth shall determine if such a question is one of public policy, and, if so determined, he shall place such question on the official ballot to be used at the next state election. Women voters were given the right of voting for candidates for school committees in 1881. In 1914 a measure was passed submitting to the people a constitutional amendment giving suffrage to women, suffrage being finally granted June 25 1919. In 1916 the civil and criminal jurisdiction of district or municipal courts was extended so that their process runs throughout the state and makes them courts of superior and general jurisdiction. An income tax was enacted. A new law to prevent misstatements in advertising went into effect May 25. An Act forbidding the sale of narcotic drugs, except by prescriptions carefully regulated, was passed in 1917. Massachusetts in 1918 ratified the Federal Prohibition amendment, being the 11th state to do this. That same year a budget system was adopted, also commissions were created to investigate the educational system of the state. The Legislature in 1919 made absentee-voting possible for those in military or naval service and others who make proper arrangements. It also passed a law making all Acts approved by the executive, unless subject to referendum, take effect 30 days after formal enactment. Emergency laws take effect upon passage. The maximum amount of deposit in savings banks was raised to $4,000. Manufacturing corporations can provide for representation of their employees upon the board of directors if more than half the employees so decide by secret ballot. Industrial accident compensation was increased. The income tax was revised. An Act reorganizing the executive and administrative functions of the state Government, approved July 23 1919, established many new departments, and a metropolitan district commission was authorized, with general supervision over the metropolitan area. The Legislature of 1920 passed a law providing for a state constabulary. Motion-pictures within the state were censored. Women were allowed to hold office. Suits were permitted by and against voluntary associations. Important "blue sky" legislation was enacted.

During the World War many emergency measures were passed by the Legislature. The subscriptions to the Liberty Loans were as follows: first, $177,236,400; second, $317,799,250; third, $228,329,750; fourth, $405,257,500; and to the Victory Loan, $252,767,450. Approximately 200,000 men were enlisted in the service of the Federal Government.

The governors for the decade were: Eugene M. Foss (Dem.), 1911–4; David I. Walsh (Dem.), 1914–6; Samuel W. McCall (Rep.), 1916–9; Calvin D. Coolidge (Rep.), 1919–20; and Channing H. Cox (Rep.), 1920– . The opening on July 29 1914 of a canal across Cape Cod shortened by 70 m. the distance by water from New York to Boston. (F. A. Cl.)

MASSENET, JULES EMILE FRÉDÉRIC (1842–1912), French composer (*see* 17.866), died in Paris Aug. 13 1912, having completed an opera, *Panurge*, just before his death.

MASSEY, WILLIAM FERGUSON (1856–), New Zealand statesman, was born at Limavady, co. Derry, Ireland, on March 26 1856, the son of John and Marian (*née* Ferguson) Massey. He was educated at the national school and secondary school at Londonderry, and went to New Zealand in 1870 to join his parents who were among the Nonconformist settlers of 1862. Settling at Mangere, near Auckland, he became a farmer, and after serving an apprenticeship in local government entered Parliament as member for Waitemata in 1894. At the general election of 1896 he was elected for Franklin, and he has held that seat ever since. From 1895 to 1903 he served as Chief Opposition Whip in the House of Representatives. During those eight years Seddon was at the height of his power and the fortunes of the Opposition were at their lowest ebb. For about half this period the party was without a leader, but the courage and faith of the Chief Whip held the party together, and in 1903 he was elected leader. Mr. Massey's chance came after the general election of 1911, which gave the Reform party, as it was now called, a small majority. After serving for 18 years in the Opposition, and without holding any intermediate office, Mr. Massey became Prime Minister on July 10 1912.

His first Cabinet held office for three years, the last of which was the first year of the World War. In Aug. 1915, the general election held in Dec. 1914 having resulted in almost a dead heat between the parties, a Reform-Liberal coalition was effected for the purposes of the war, with Mr. Massey as Prime Minister and Sir Joseph Ward, the Liberal leader, as Finance Minister. The national Government thus formed lasted throughout the war, and on its dissolution by the Liberals in Aug. 1919 Mr. Massey formed a new Reform party Cabinet. At the general election in the following Dec. he scored a decisive victory, due in a large measure to the very difficult position forced upon him at short notice by the dissolution of the Coalition. He was still in power at the close of 1921.

The portfolios held by Mr. Massey in his first two administrations as Prime Minister included those of Lands, Agriculture, Labour, Industries and Commerce, and Imperial Government Supplies. On Sir James Allen's retirement in 1920 he became Minister of Finance, holding also the portfolio of Mines and Railways. Besides enabling and encouraging the country to throw its whole weight into the war, Mr. Massey rendered important service by representing it at the Imperial War Cabinet and War Conference meetings of 1917 and 1918, at the Peace Conference in 1919, and at the Imperial Conference of 1921. At the Peace Conference he faithfully represented the sentiment of New Zealand in pleading for the retention of German Samoa in British hands, and in his uncompromising attitude on the indemnities and reparations to be exacted from Germany. The energy which he displayed in securing the Dominion a share in the valuable phosphates of Nauru I. was also much appreciated. Mr. Massey did valuable work as the second British representative on the Commission on Responsibilities for War and the Enforcement of Penalties, and as president of the sub-committee on Facts and chairman of the Drafting Committee.

He married in 1882 Christina (C.B.E. 1919), daughter of Walter Paul of Auckland, and had three sons (of whom Maj. F. G. Massey served in the war and won the M.C. and D.S.O.) and two daughters. He became a Privy Councillor in 1913, a freeman of London, Edinburgh and five other British cities, and hon. LL.D. of Cambridge and Edinburgh universities.

(A. R. A.)

MASTERS, EDGAR LEE (1868–), American writer, was born at Garnett, Kan., Aug. 23 1868. At the age of 21 he entered Knox College, Ill., but left after one year to read law in his father's office. He was admitted to the bar in 1891 and practised thereafter in Chicago. For several years he was associated with Clarence S. Darrow, known as counsel for labour leaders. He was a member of the National Institute of Art and Letters. The book that first brought him public notice was *Spoon River Anthology*, published in 1915, an extraordinary collection of epitaphs on members, in all walks of life, of a mid-western town. Within three years 50,000 copies were sold. Like much of the modern "realistic" literature it over-emphasizes pathological accidents and ignores the sane and permanent essence of life.

His other works include: *The New Star Chamber, and Other Essays* (1904); *Blood of the Prophets* (1905); *Songs and Satires* (1916); *The Great Valley* (1916); *Toward the Gulf* (1918); *Starved Rock* (1919); *Domesday Book* (1920) and *Mitch Miller* (1920); *The Open Sea* (1921); besides several plays, *Maximilian* (1902); *Althea* (1907); *The Trifler* (1908); *The Locket* (1910); and *The Bread of Idleness* (1911).

MASURIA, BATTLES IN, 1914–5.—The district of East Prussia known as Masuria, which practically coincides with the sickle-shaped region of lakes that rules the geography of the province, was the scene of several great battles in 1914 and the first half of 1915. For the reasons discussed under EASTERN EUROPEAN FRONT CAMPAIGNS (Part I.), the lake region was not so much a battle-ground itself as a barrier behind which the Germans could either resist with inferior numbers or manœuvre for decisive battle at one or both extremities of it. In certain circumstances, the barrier itself could not only passively but actively contribute to the manœuvre, owing to its having sally-ports at Lötzen and elsewhere. Simple resistance was the function of the barrier only in Oct. and Nov. 1914, when the Germans in East Prussia had to gain time, by defence with minimum forces, for a decision to be fought out in Poland. In other circumstances it played its part in great offensive manœuvres, and these German offensives—Tannenberg in Aug. 1914, the "Masurian Lakes" in Sept. 1914, and the "Masurian Winter Battle" in Feb. 1915—form the subject of the present article.

I.—TANNENBERG

As narrated under EASTERN EUROPEAN FRONT CAMPAIGNS (Part II.), the indecisive battle of Gumbinnen, N. of the lakes, combined with the oncoming of the Russian II. Army W. of them, led to a crisis in which the evacuation of the entire province by the German VIII. Army was only prevented by the appointment of General-Oberst von Hindenburg, with Maj.-Gen. Ludendorff as his chief of staff, to retrieve the compromised situation by battle. The contemplated offensive had as its object the defeat of the Russian II. Army of Samsonov at or within the western extremity of the lakes, before the Russian I. Army of Rennenkampf, only momentarily checked at Gumbinnen, could pass beyond their northern extremity, isolate Königsberg, and flood the interior of East Prussia, without further regard to the defensive barrier. It ended in a success that was all the more brilliant because of its unpromising beginnings, and all the more inspiring to German patriotism as the name and locality of the battle recalled the historic defeat of the Teuton by the Slav in 1410 (*see* 21.905). Thus, it was natural, not only that Hindenburg should become at once the national hero of Germany, but also that a host of legends should arise in connection with the battle.

The most picturesque and therefore most widespread of these legends is that of the Russians being driven into the lakes which Hindenburg had personally reconnoitred in peace-time, with a view to such an operation, but though it is difficult to find the seed of this legend in any incidents of the battle, the magnitude of the success and the apparently perfect precision with which the plan was carried into execution undoubtedly lent weight to the idea that the scheme was long premeditated. In one sense this was true. The idea of double envelopment had penetrated throughout the German army since von Schlieffen had set up "Cannae" as the model. The manœuvre on interior lines behind the lake barrier was suggested, and even imposed, by geography. And in one at least of the numerous "war-games" in which the German general staff tried out the alternative types of defence against Russian invasion from the S., the map operations ran a course which was generally similar to that of the battle. It was not surprising, therefore, that the idea occurred both to Ludendorff on his way from the western front and to the staff officers on the spot before the new commander and chief of staff arrived. At any rate, the proposal was at once made by the former and accepted by the latter. But the difficulty lay in the execution, and in reality, as will be seen, the battle was a series of changing situations which demanded ever new dispositions on the part of the Germans. These dispositions were throughout inspired by the same idea—"Cannae"—and restricted by the same unknown factor—Rennenkampf.

On Aug. 23 General Samsonov's II. Army—consisting of the VI., XIII., XV., and XXIII. Corps, one rifle brigade and three cavalry divisions, to which a few days later was added the I. Corps—was within Prussian territory at and near the line Soldau–Neidenburg–Ortelsburg, with cavalry farther W. on the Lautenburg and Strassburg routes. To the E., the II. Corps, nominally of Samsonov's army, really acting in liaison with Rennenkampf, was advancing from Bobr by Grajevo to face the E. front of the lake barrier. Rennenkampf, for his part, was still on the Gumbinnen battlefield expecting a new battle on the line of the Angerapp and the northern lakes. Samsonov had disposed his four (five) corps in order from right to left, VI., XIII., XV., XXIII. (I.), with the right echeloned forward on Ortelsburg (in the hope of obtaining liaison with the II. Corps of Rennenkampf's command), and the left kept back (in the face of a German offensive from the Vistula). His advance was slow and methodical, averaging perhaps 5 m. a day, and at every halt a position was entrenched, as national temperament and the experiences of the Manchurian War dictated. Opposed to the three central corps (XIII., XV., XXIII.) was General von Scholtz with his XX. Corps and part of a force of Landwehr, Ersatz and Landsturm, which had been taken out of the fortresses of Graudenz and Thorn to watch the line of the frontier W. of Soldau. Opposite the Russian VI. Corps on the Ortelsburg side, and holding the lake barrier, there were other German forces of the same kind.

The first efforts of the German command were directed to forming an attack-mass on the basis of the XX. Corps. This mass would have to be taken from the forces confronting Rennenkampf, and released in succession according to the activity displayed from day to day by him. Meanwhile, Scholtz's mission was to maintain an intact front on the wings of which these other forces, of greater or less strength, would come up for the enveloping effort. On the right or W. wing these forces consisted of the I. Corps (von François), which, after Gumbinnen, had been entrained for stations near the Vistula but then had its transport switched to the region at and E. of Deutsch Eylau, and of such Landwehr and Ersatz as could be assembled at the E. end of the frontier cordon. On the other flank, there were successively drawn off from Rennenkampf's front the 3rd Res. Div., the I. Res. Corps (von Below), the XVII. Corps (von Mackensen), and the 6th Landwehr Bde. from the Lötzen area, the defence of Lötzen being left to its Landsturm garrison, the defence of Königsberg to its mobile reserve posted on the Deime, and the observation of Rennenkampf's army to two cavalry brigades. But between Aug. 23–6, the dates at which the offensive was to begin, the 3rd Res. Div., part of the frontier Landwehr and Ersatz forces, and even the first units of the I. Corps which entrained, were involved in the fighting of the XX. Corps, which had to sustain the weight of Samsonov's attack, particularly at Orlau and Lahna on Aug. 23.

On the night of Aug. 25, Below (I. Res. Corps), after cross-country movements imposed by the crowding of main roads with refugees, had reached Seeburg; the 6th Landwehr Bde., Lautern; Mackensen (in one long march), Bischofstein. Von Scholtz with his XX. Corps and attached formations held the line Kosten Forest (exclusive)–Gilgenburg–Hohenstein (inclusive); von François (I. Corps) was detraining at various stations around Deutsch Eylau and forming up on the line Tuschau–Kielpin; while Mühlmann's detachment of the Landwehr and Ersatz forces had driven hostile cavalry out of Strassburg and Lautenburg, and was ready to coöperate from Lautenburg eastward. In a day or two the catalogue of available German forces was to be completed by the arrival at Allenstein of von der Goltz's Landwehr div. from Schleswig-Holstein. On the Russian side, while the I. Corps hung back, as ordered, in échelon on the left, and the XXIII. and XV. swung up in pursuit of von Scholtz from the E.–W. line facing Gilgenburg–Lahna to a N.N.E.–S.S.W. line facing Gilgenburg–Hohenstein, the XIII. Corps was advancing northward on Allenstein, and the right échelon (VI. Corps and 4th Cav. Div.) from Ortelsburg had reached Bischofsburg. Rennenkampf meanwhile reached the line Insterburg–Angerburg and his left corps was approaching the eastern lake barrier. But liaison between Rennenkampf and Samsonov, and their common superior Zhilinsky, was already, as it remained to the end, imperfect; and even within the II. Army itself the various corps maintained only intermittent touch with headquarters by wireless (sent *en clair*), and casual communication by motor-car and aircraft.

On the morning of Aug. 26 the battle opened at all points. In the centre, the Russian XV. Corps drove the 3rd Res. Div. into the woods to the W. of Hohenstein, but von Unger's Landwehr and Ersatz were hurried up from the southern frontier guard and, posted behind the barrier of the Drewenz at Mühlen, prevented a roll-up of the XX. Corps' left, while the 3rd Res. Div. rallied under cover of the woods. Thus the XX. Corps was enabled not only to hold on in front of Tannenberg against the Russian XXIII. Corps and part of the I. Corps, but to open an attack which brought its centre to Ganshorn and Thurau. Farther S. the German I. Corps, the principal element on which the projected "Cannae" depended, had not made the progress expected by Hindenburg. Its detrainment was not complete, and von François attempted to obtain a postponement of the attack; after some discussion, Ludendorff insisted that the corps should begin its attack at noon, and it did so at 1 P.M. But at that time it was too late to capture the heights of Usdau–Gross Tauersee as had been intended. Meantime Mühlmann, holding Strassburg and Lautenburg against the Russian 6th and 15th Cav. Divs.,—though he could not prevent an inroad, between these points, on the rear of von François's assembly area—pulled out his main body eastward to Heinrichsdorf, the capture of this point bringing him into line with von François.

In sum, the left of von Scholtz's forces was already bent back (though in no wise enveloped) by the Russians, and the German enveloping wing under von François was only at the beginning, instead of in the middle, of its task. From the point of view of Hindenburg's headquarters, this was not a satisfactory opening to a battle fought against time. But events on his left wing on Aug. 26 gave a new turn to affairs. The Russian XIII. Corps, approaching Allenstein, met with no opposition, and the VI. Corps, heading N. and seeking for liaison with Rennenkampf, suffered disaster. The latter had pushed its leading division as far N. as Gross Bössau, where it halted and entrenched. In this position it was found and attacked by Mackensen's XVII. Corps, while the 6th Landwehr Bde. and part of the 36th Res. Div. of Below's I. Res. Corps, N. of Lake Lautern, came in upon its rear. At nightfall it was broken by a charge of the Landwehr, and fled in disorder, seriously impairing the *moral* of the following division. Meanwhile the remainder of the German I. Res. Corps moved on Wartenburg. Thus, the Russians' extreme right was in rapid retreat, while their centre was advancing northward, and the Germans saw that the opportunity of double envelopment was not gone by, but only maturing. Accordingly, on the evening of Aug. 26, von François was ordered to attack the Usdau–Gross Tauersee position at dawn with the utmost energy, Mühlmann to push on from Heinrichsdorf on Borchersdorf. This achieved, the I. Corps was to advance as rapidly as possible on Neidenburg, flank-guarded to the S. by Mühlmann. Von Scholtz was to continue the attack of his centre eastward so as to cut off all Russian troops north of Gross Gardienen, while his right intervened in the battle at Usdau and his left held on at Mühlen and on the Drewenz. Mackensen was to pursue the beaten Russians due S. on Ortelsburg, while the movements of Below (whose 1st Res. Div. was already due E. of Wartenburg) and of von der Goltz (whose Landwehr Div. was to begin detrainment Aug. 27, E. of Osterode) were apparently left to their own discretion, since headquarters intended to trust themselves on Aug. 27 entirely to von François and von Scholtz.

On Aug. 27 was fought the battle of Usdau. Here the German I. Corps, well in hand and complete, and aided on its left by the right of the XX. (Schmettau's detachment) and on its right by Mühlmann, completely broke the Russian resistance. But whether through tactical accidents, or a misinterpretation of orders, or desire to obtain elbow-room to the southward, the I. Corps, instead of driving due eastward from the captured line, wheeled to its right, pushing the Russian I. Corps on to Soldau, and itself reaching at nightfall the E.–W. line Heinrichsdorf–Borchersdorf–Schönwiese. The XX. Corps (less Schmettau's detachment) drove on in the centre, and reached a N.–S. line from the E. end of the Mühlen See to Skottau, facing a new Russian position at Waplitz, where their XXIII. Corps, and also part of the force defeated at Usdau, rallied. Meantime there had been critical fighting farther north. West of the line Hohenstein–Paulsgut the Landwehr and Ersatz of Unger and the 3rd Res. Div. were heavily attacked by the Russian XV. Corps, and Allenstein, undefended, was occupied by the Russian XIII. Corps. At the German headquarters it was rumoured that Unger's line had been broken, and the 37th Div. was hurriedly taken from von Scholtz's advancing line and put in on the Drewenz, to prevent a break-through towards Osterode.

Such a break-through with the aid of the fresh XIII. Corps from Allenstein (which could hardly be held up for long by von der Goltz's half-detrained division at Biesselen) was eminently possible, and could hardly fail to be disastrous to the Germans. Meantime 4½ German divs., pursuing the relics of two Russian divs. southward, had advanced to the region N. of Passenheim and of Ortelsburg, so far separated from the main body of the VIII. Army that liaison was maintained by aeroplane. It seemed that they, like von François, were missing the moment of wheeling-in for envelopment, and drawing off eccentrically. And on this day news came that Rennenkampf was at last beginning to advance from Insterburg–Angerburg. Already his cavalry was ranging the country behind Mackensen and Below; the Russian II. Corps from Angerburg was moving on Gerdanen, with a detachment in advance, threatening Lötzen from the rear; the IV. Corps on Friedland and Allenburg, and two others on Königsberg. Against such an advance as that of 4 cav. divs. and 4 inf. divs.—to consider only the troops S. of the Pregel—the two cav. bdes. of the German 1st Cav. Div. and the Lötzen Landsturm could not be expected to offer more than a trifling resistance. But if the situation of the Germans was critical, there was still the possibility, and even the necessity, of attempting the "Cannae" with the principal effort of encirclement made by the corps in the N. instead of by von François. The threatened westward movement of the Russian XIII. Corps could itself be taken in rear by bringing in the I. Res. Corps, while von Mackensen could close some, and von François, by an eastward extension of his left, others, of the routes behind Samsonov's XV. and XXIII. Corps. In any event some such movements were necessary if the two separated parts of the VIII. Army were to be got together, whether for offence or for defence. The crux of the problem lay in the direction to be given to von Mackensen—whether he was to continue southward and join hands with von François, forming the ring round the *whole* of Samsonov's army, or to bear up north-westward, behind the I. Res. Corps, and re-form N. or E. of Allenstein, ready either to coöperate in Below's envelopment of *part* of the Russians or to stave off Rennenkampf's advance on the Alle. In truth, this problem was too difficult for a definitive solution, and thus we find that Mackensen spent Aug. 28, first in marching from Passenheim to E. of Allenstein, and then in marching back, no doubt under successive instructions from headquarters.

The battle of Aug. 28, like that of Aug. 27, presented changing situations. As the Germans expected, the Russian XIII. Corps wheeled in from Allenstein, to coöperate with the XV. at Hohenstein, but, having been for days out of touch with the VI. Corps, and therefore ignorant of its rout, it assumed certain troops (Below's) seen to the N. of Wartenburg to be that corps moving on Allenstein. Thereupon, giving up the westerly direction to its supposed comrades, it turned sharp S.S.W. to assist the XIII. Corps more directly. If any particular moment can be fixed as the turning-point of the battle it is this, for it completed the confusion at Hohenstein. West of that point, on the morning of Aug. 28, Morgen's 3rd Res. Div. had advanced from the Jablonken Forest to the attack of the Russian XV. Corps without waiting for support from the 37th Div. on its left or Unger's men on the right. It had driven the defenders into the W. side of Hohenstein at the same time as von der Goltz's Landwehr Div., detrained on the previous day, entered it from the north. To right and left of Morgen, the 37th Div. and Unger were soon heavily engaged and advancing generally eastward. To the S. of the Mühlen See the German 41st Div., attacking alone on the front which had previously been that of the whole XX. Corps, was repulsed by the Russians posted at Waplitz and S. of it. The fight was already extremely involved when on the rear of von der Goltz came the leading bde. of the Russian XIII. Corps. But, while for the German command there was nothing to do but to "wait for Below as Wellington waited for Blücher at Waterloo,"—as a German staff officer has put it,—the Russian leaders were in reality in the worse position. They were out of touch with each other and with Samsonov. The commander of the XIII. Corps would not promise his companion of the XV. the arrival of his whole corps at Hohenstein in less than 24 hours, and the advanced brigade above mentioned, involved in fighting with the German 37th Div. as well as with von der Goltz, lost its way in the woods, units opening fire upon each other, and finally broke away in panic. In the evening, the perplexed commander of the XIII. Corps found Below on his flank and rear, and came to a standstill. The XV. Corps commander had already, after the ruin of the XIII. Corps, decided that he could not continue this offensive till the intervention of the rest of that corps next day, and made up his mind to retreat while his left was still protected by the Waplitz forces. And, late in the evening, both the XIII. and XV. Corps received orders from Samsonov to retreat at once. The German ring was now rapidly forming itself. Not only had Mackensen, when drawing off to the Alle as ordered, taken the precaution of leaving detachments at Passenheim and S. of Mensguth, but, above all, the German I. Corps had arrived at Neidenburg, and its advanced troops were well on the way to Willenberg.

At the outset of the battle before Soldau which von François had projected for Aug. 28, the Germans realized that little effort was necessary for the capture of that town; and Schmettau's detachment on the left of the southward-facing line was pushed westward on Neidenburg, preceded by cavalry, which, passing round Neidenburg by the S., made havoc amongst the trains and convoys of the enemy on the Willenberg–Chorzele road. Soldau was captured about 10 A.M., and leaving Mühlmann to guard it von François pushed his 1st Div. after Schmettau. Shortly afterwards he received orders to move his 2nd Div. on Rontzgen to relieve pressure on the retiring 41st Div., and this order was soon supplemented by one of general pursuit in the Lahna direction. By evening the corps was beginning to reap a great harvest of prisoners, guns and trains.

Before these events were fully known at the headquarters of the VIII. Army, the German commander seems, for a moment, to have given up hope of bringing about a great encirclement. The Supreme Command was notified that the victory was won, but that it was improbable that the "boxing-in" (*Einkesselung*) of the two northern corps of the enemy would succeed, and army orders for Aug. 29, issued at 5:30 P.M. from Tannenberg, directed a general pursuit eastward by the troops of the XX. Corps and I. Corps, while Mackensen, instead of closing the avenues of escape, was again to march off to the Alle, which he was to occupy between Guttstadt and Allenstein. The 3rd Res. Div. and the two bodies of Landwehr fighting in the Hohenstein area were to fall out of the pursuit and assemble in readiness for other employment. For Rennenkampf, heralded by his cavalry, was at last really on the move. Later in the evening, however, it became apparent that the two northerly Russian corps had not yet made off. Below's divisions, swerving S.S.W. before reaching Allenstein, came upon rear-guards of the XIII. Corps at Zaszdrocz and Thomsdorf, and enforced a stand. The opportunity of boxing-in was seen to be still open; and, taking the risk of ignoring Rennenkampf for yet another day, Hindenburg and Ludendorff issued new instructions, bringing Mackensen's corps back again to the eastern gates of the Russian lines of retreat, and stimulating von François to a farther advance. Driving inward, the I. Corps, on Jedwabno and Willenberg, and the XVII., on Malga and Kannwiesen, were to attack both flanks of whatever forces were retiring through the forests S. of Passenheim, and, if possible, to join hands and to close the ring. Meantime the I. Res. and XX. Corps, von der Goltz, Morgen and Unger were to continue the now concentric effort against the Russians between Thomsdorf, Hohenstein, and Wuttrienen, and especially to master the lake defiles E.S.E. of Hohenstein. These orders did not reach their destinations till Aug. 29; but the corps commanders were already in substance carrying them out, and, in particular, Mackensen had not begun to draw away to the Alle.

In the battle of Aug. 29 the envelopment became definitely tactical. On three sides German regiments and battalions pressed the retreating and now greatly disordered XIII., XV. and XXIII. Corps in the dense country lying between Hohenstein and Passenheim. Von François posted part of his forces at the forest outlets about Muschaken and pressed on his westernmost troops towards Jedwabno and Willenberg. Mackensen barred the lake intervals S.W. of Passenheim and pushed his left to Malga. Meantime Ludendorff assembled all the German forces which were successively crowded out by the concentric advance, as the nucleus of a defence group to be posted along the lakes behind the Alle, at Allenstein and at Passenheim. But the next day severely tested the strength of the ring that had been formed round the Russians. Already on Aug. 29 a part of von François's Corps, which was barring the exit of the forest at Rettkowen, was hard pressed by the weight of the opposing forces that were seeking an outlet, and only the arrival of Mackensen's troops from Malga enabled the gate to be closed again. On Aug. 30, another gate, N. of Muschaken, was burst open from the inside, and the Germans holding it were made prisoners. Reënforcements, however, arrived on the German side, and the emerging columns were pushed back again into the forest. Finally, in the night of Aug. 30–1, a desperate attempt was made to break out by way of Kannwiesen and Puchalowken, but was repulsed. But it was at all times doubtful whether the gates would hold firm, for Mackensen had been ordered to keep the bulk of his forces about Passenheim ready for action toward Allenstein if required, and the southern and south-eastern parts of the ring were in some places no more than a chain of posts. Moreover, on Aug. 30, serious Russian threats were made from outside the ring. Not only did Rennenkampf advance to the line Preuss.-Eylau–Bartenstein–Bischofsburg, with cavalry raiding nearly to Allenstein, and not only did attacks develop on Lötzen, but Ortelsburg, now in rear of Mackensen's corps, was threatened from the S.E. (no doubt, by a rallied portion of the Russian VI. Corps), and, above all, the Russian I. Corps and part of the XXIII., which had followed its retreat by Soldau, now resumed the offensive from Mlawa on Neidenburg, with the aid of parts of the newly arrived XVIII. Corps, while the Russian cavalry division farther W. again broke in behind the German dispositions. To meet this, von François had to face S. with part of his corps, while the rest, facing N., maintained the ring of investment against heavy attempts to break through from the inside; and army headquarters had to place at von François's disposal the forces that it was collecting for the defence of the lakes behind Allenstein. In the event, the crisis was mastered by energetic frontal attack on the head of the Russian I. Corps column, combined with an audacious threat to its left by Mühlmann's Landwehr and Ersatz from Soldau. In fact, the Russian counter-advances were not pressed with any vigour. Rennenkampf certainly, and the Mlawa force probably, had received instructions to withdraw after demonstrating in aid of Samsonov, for the headquarters of the Russian "N.W. Front" (General Zhilinsky) had been informed by Samsonov on Aug. 29 of his decision to retreat, and was quite unaware of the fact that he needed assistance to enable him to do so.

On Aug. 31, all crises being past, it remained only for the Germans to complete the capture of what was left of the Russian XIII., XV., and XXIII. Corps. As on the two previous days, the resistance of the Russians was stubborn, but there was no common action or higher leadership. Entangled in the woods, artillery and trains constantly blocked the way to the infantry, which, after making its way past them, had to attack forces of all arms unaided. Outside the forest, the Germans cut off at their leisure the long columns of transport vehicles which had headed the retiring movement. Hindenburg's victory, doubtful even as late as the afternoon of Aug. 30, was complete by the evening of Aug. 31. The Russian losses in killed and in evacuated wounded are unknown, but 92,000 wounded and unwounded prisoners, 300 guns and immense numbers of vehicles and stores remained in the hands of the Germans. General Samsonov, after wandering in the forest in search of a way of escape, broke up his staff, and, left alone, shot himself.

II.—Battle of the Masurian Lakes, or Angerburg

During the battle of Tannenberg the Russian I. Army had advanced to within a menacingly close distance. On Aug. 28, and again on Aug. 29, the German VIII. Army headquarters had almost given up the effort of encirclement in order to form a northward and north-eastward front against Rennenkampf; and as soon as the victory was complete, no time was lost preparing to take the offensive, both with the strategical object of gaining a free hand for a campaign into Poland in concert with the Austrians, and with the political object of freeing East Prussia from hostile occupation. Reënforced by two corps (Guard Res. and XI.) and a cav. div. (8th Saxon) from the western theatre, Ludendorff planned to attack Rennenkampf as soon as the new corps had detrained and those engaged in the ring of Tannenberg had been sorted out. This process took some time. The defensive group that was being formed to face Rennenkampf on Aug. 29–30 had to be dissolved again so as to reënforce von François against the counter-attacks on Aug. 30 from the S., and to secure Mackensen's rear, threatened on that day at Ortelsburg. Thus, at the close of the battle of Tannenberg, the VIII. Army had to be completely regrouped before any part of it, except the I. Res. Corps, could engage Rennenkampf. But even on Aug. 31, before the end of the battle, there were indications that Rennenkampf's forward movement had been given up.

The Russian general had, in fact, advanced half his army against Königsberg and only two corps and three cav. divs. into the open country S.W. of Insterburg–Angerburg. One of these corps (the IV.) had advanced on a comparatively narrow front and reached Preuss.-Eylau and Bartenstein, while the other (the II.) from Angerburg had made a feeble attack on Lötzen with one brigade and advanced to the line Bartenstein–Bischofstein with the other three. The XX. Corps, on the Deime, N. of the Pregel, and the III. Corps on the lower Alle S. of it, had allowed themselves to be imposed on by local activity of the Königsberg Landwehr and Ersatz forces. The three cav. divs. working with the II. and IV. Corps had raided as far as Wormditt, nearly to Allenstein, and to Sensburg, but without doing serious damage to the road and railway system. Behind the front, res. divs. were coming up to set free the XX. and III. Corps, from the Königsberg front, and eventually to besiege that fortress. Other forces, both active and reserve, were assembling at Grajevo, and skirmishing was in progress between Russian light forces in this region and a detachment of East Prussian Landsturm at Ruvezanny and Johannisburg under Col. Bacmeister, which, like the Lötzen force, had remained in its own area undisturbed during the Gumbinnen and Tannenberg operations. On Aug. 27 Rennenkampf was informed that troops hitherto in front of him had been identified at Gelgenburg and Bischofsburg and Soldau, and he was instructed to help Samsonov by pushing his left wing as near to Bartenstein as possible, his cavalry towards Bischofsburg and the II. Corps towards Passenheim. On Aug. 29 he was ordered to send two corps to meet Samsonov, who was heavily engaged (in reality, practically encircled), and cavalry to Allenstein. But almost immediately this last order was cancelled, as the II. Army was understood at Zhilinsky's headquarters to be retreating. Rennenkampf thereupon drew back on Aug. 30–1 to the line Lower Alle–Allenburg–Gerdanen–Drengfurt. After some discussion between the chiefs of staff of the I. Army and of the N.W. front, Rennenkampf decided to make a stand on the line Wehlau–Deime–Ottenburg–Gerdanen–Nordenburg–Lake Mauer, so as not to enhance still further the crushing moral effect of Tannenberg. But he had no intention of allowing himself to be cut off in this position; and to secure his left flank he ordered a considerable part of the II. Corps to attack Lötzen. This order, executed in the usual tardy fashion, led to nothing, but the forces thus gathered in front of Lötzen proved, as will be seen, a fatal obstacle to the full realization of the German plan.

This plan was, in sum, a strong frontal attack by the left wing and centre of a long, deployed array, while the right wing broke out through the Masurian lakes at Lötzen, Arys and Johannisburg, against the left and rear of the Russians. The newly arrived Guard Res. and XI. Corps, and the I. Res. Corps, with the 6th Landwehr Bde., formed the left wing in the region N. of Allenstein, the XX. Corps the centre about Allenstein, the XVII. Corps and the I. Corps with the 3rd Res. Div. the right at Passenheim and Willenberg. On the extreme left, the

Königsberg mobile force was to coöperate from the Deime line. The 1st and 8th Cav. Divs. grouped themselves in front of the right centre. The Landwehr and Ersatz units which had fought at Tannenberg were formed as a corps under von der Goltz (Goltz's Division, the new 35th Res. Div. formed of Unger's and Mühlmann's troops, and the 70th Landwehr Bde.), with the mission of capturing Mlawa (which was accomplished on Sept. 4), defending the southern frontier in positions in advance of that point and of Willenberg, and prolonging the defence eastward as the battle progressed.

The German forces, inclusive of one division of von der Goltz's corps, consisted, apart from cavalry, of about 16 divs.; those of the Russians, including troops which came into action from Grajevo, 14–16 divs. (II., III., IV., XX., XXII. Corps and 4–6 res. divs.). As usual, the Russian divs. were superior in infantry; the German, in artillery strength.

The battle opened generally on Sept. 7. On that day and the two following days the frontal attack of the Germans made only slow progress, the Guard Res. Corps approaching Allenburg, the I. Res. Gerdanen, and the XX. Angerburg. One div. of the last named, originally kept back as army reserve to add weight to the decisive attack, had to be returned to the corps to enable it to progress in the Mauer See region. Farther to the S., the XVII. Corps, utilizing the gate of Lötzen, sought to debouch on Kruglanken, but the Russians, having intended to attack Lötzen, were in strength here, and the advance of this part of the German enveloping wing was arrested. Army headquarters now possessed no reserve, and to open the way for the XVII. Corps there was no alternative but to swing the greater part of the I. Corps sharply northward instead of northeastward. Thus delay was imposed on the striking wing of the attack; and when, on the night of Sept. 9–10, Rennenkampf decided to take down his line from right to left and retired eastward on Wirballen, Suwalki and Augustowo, it was already unlikely that the Germans would be able to place any important forces across the enemy's lines of retreat in time. Nevertheless, a great effort was made to achieve this result. The German I. Corps had advanced in three columns, the 2nd Div. by Nikolaiken on Arys, the 1st Div. by Johannisburg on Bialla, with the 3rd Res. Div. on its right moving in the same direction. Von der Goltz, like Mühlmann in the Tannenberg operations, drew out his troops eastward as the 3rd Res. Div. advanced, keeping a closed group on that side and thinning the cordon at Mlawa and Willenberg. On Sept. 7 the German 2nd Div., after passing the defile of Nikolaiken, had become engaged at Gurra, N.E. of Lake Spirding, with a strong force of the Russian II. Corps that was ranged in a semicircle, facing W. and S. in the Arys defile. To enable the 2nd Div. to debouch, the 1st Div., leaving the combat in the Bialla direction to the 3rd Res. Div., swung up to the N. to attack the S. face of the Russian semicircle at Arys. On Sept. 8 the Russian resistance was broken by the combined attack, and a brigade of the 1st Cav. Div. attached to the I. Corps struck out northeastward to Klaussen. Meanwhile the 3rd Res. Div. had captured Bialla on Sept. 7th and pushed on to Drygallen on the Lyck road on Sept. 8, flankguarding towards Grajevo until the arrival of troops of von der Goltz's command enabled it to concentrate again.

On Sept. 9 the reunited I. Corps, master of the Arys defile, and joined by the two cav. divs. of the army, continued its northward movement so as to take the opponents of the XVII. Corps in rear. These stood on the line Mauer See–Goldapgar See–Soltmahner See–Gablick See, blocking the defiles between lake and lake. The pressure of the I. Corps from the S. and the XVII. Corps from the front, however, forced the evacuation of this position in the evening, especially as the two German cav. divs. were working out into the more open country towards Goldap. The XVII. Corps was thus released, and the enveloping movements of the German right wing began on Sept. 10. But the frontal attacks had made little impression, and Rennenkampf's XX., III. and IV. Corps were not effectively held in the Angerburg–Gerdanen–Wehlau positions. On the night of Sept. 9–10 the order to take down the line was issued, and thereafter the German frontal attack became a general pursuit, sometimes interrupted by stubborn rearguard fighting. By Sept. 11 the Guard Res. Corps had already fallen out of the scheme and was being grouped N.E. of Wehlau in reserve. The Königsberg troops made for the E. side of Tilsit, to cut off the Russian force that had established itself there. But for the I. Res. Corps, the XI., the XX., and even for the XVII., the operation was a simple follow-up on the respective axes Insterburg–Pillkallen–Schirwindt; Nordenburg–Gumbinnen–Stallupönen; Angerburg–Darkehmen–Walterkehmen–Stallupönen; and Possessezn–Gawaiten–Wysztinice.

Ludendorff, while praising the achievement of the VIII. Army in covering 60 m. in four days against an enemy expert in rearguard tactics, criticizes the pursuit in general as over-eager and lacking in coördination of effort, especially on Sept. 11 when the situation of the XI. Corps led army headquarters to deflect the pursuit of the XVII. and I. Corps northward during some critical hours. Eventually, the XI., XX. and XVII. Corps all converged on Stallupönen and Kibarty; while farther N. the I. Res. Corps, moving in the last stages nearly E., came to a standstill about Wladyslawow. From Sept. 9 the German effort against Rennenkampf's left and rear was carried out entirely by the I. Corps and the cav. divs., while the 3rd Res. Div. and von der Goltz guarded the outer flank against intervention from Osowiec and Augustowo or Suwalki. On this wing the record of Sept. 10–3 is one of true manœuvre.

According to the army orders for Sept. 10, the rôle of the I. Corps was to flankguard the XVII. in its attempt to strike in on Rennenkampf's rear E. of Angerburg, no general retreat of the Russians from Angerburg–Wehlau having yet begun. Accordingly, the two divs. of François's corps were directed on the line Lissen–Pillacken; while the 3rd. Res. Div., which had taken the Lyck road on Sept. 9 instead of swinging up with the others, was to drive in its Lyck opponents and then take the direction Marggrabowa–Filipowo. The 1st and 8th Cav. Divs., which had reached Goldap over night, were to make for Gumbinnen. But in the evening of Sept. 10 it became clear at the German headquarters that the Russian retirement was in progress, and the positions of the German right wing just mentioned became the starting-points of an attempt to reach the enemy's lines of retreat.

On Sept. 11 the I. Corps was to advance with its right pushed forward, to Goldap, and thence S. of the Rominten Heath on Mariampol; the XVII. Corps along the N. side of Rominten Heath, on Wistyniec; the cav. divs. in advance against the Insterburg–Kovno routes. But at midday both corps were ordered to swerve inwards owing to difficulties in which the XI. Corps was supposed to have become involved near Darkehmen. As the right of the I. Corps was écheloned forward, this move in effect crowded out the XVII. Corps, as well as diverting the I. Von François, however, was unwilling to give up the attempted encirclement, and only wheeled up one of his divs. from Goldap on Gawaiten, while the other pushed N.E. along the N. side of Rominten Heath to Tollmingkehmen—the route originally assigned to the XVII. Corps. Later in the day, the alarm at the XI. Corps' front having proved to be baseless, the I. Corps was again directed N.E. towards Pillupönen and Wilkowiszki. But the amplitude of the army wheel had been diminished by a corps front. Wilkowiszki, instead of being the objective of the XVII. Corps, had become that of the I. Only the cav. divs. were left to pursue the advance S. of Rominten Heath on Mariampol. Meantime the 3rd Res. Div. moved from Lyck on Marggrabowa, von der Goltz's Landwehr div. following on as a right échelon against interventions from the S.E. or E.

During Sept. 12 the two parts of the I. Corps had heavy fighting at Gawaiten, Tollmingkehmen and Baubeln with the advanced and flank guards of various Russian columns which were retreating through the country S. of Darkehmen and Stallupönen. All these were checked and deflected northward, but none was cut off, though by evening the right of the Germans had extended up to Pillupönen. Von François, under cover of his 1st Div.'s positions at Tollmingkehmen–Pillupönen, passed the whole 2nd Div. through the Rominten Heath (having only small forces at Goldap and near Gawaiten), and thus prepared for a movement next day in force by Wistyniec and Pillupönen on Wilkowiszki. On Sept. 13 the corps carried out this movement, preceded and flanked by the 8th Cav. Div. which had passed round the S. of Rominten Heath. The 3rd Res. Div. from Marggrabowa was turned eastward on Suwalki and, correspondingly, von der Goltz pushed forces up to Marggrabowa. On Sept. 13, indeed, the German army headquarters still hoped to cut off a considerable part of the Russian I. Army. But this hope was disappointed. Pushing his forces onward as fast as possible on Sept. 13, François was unable to do more than cannonade Russian columns which from time to time passed across his front. On Sept. 14 the Russians were found in force at Wilkowiszki, and both divs. of the German I. Corps had to be deployed to dislodge them. But they were a rear guard and not a flank guard, and since the pursuit thus became a frontal one for the I. Corps, as it already was for the rest, the battle of the Masurian Lakes as such came to an end.

Whether the direct follow-up should be continued to the Niemen or the operation closed down was a question of strategy, not of tactics. The latter alternative was chosen. On the night of Sept. 14 the German positions were:—XI., XX. and XVII. Corps in the area round Stallupönen and Kibarty; I. Res. Corps at Wladislawow, with advanced forces to the N.E.; I. Corps and the cavalry at Wilkowiszki, with advanced troops at Mariampol and Pilwiszki; 3rd Res. Div. at Suwalki; the Guard Res. Corps was in reserve probably between Insterburg and Wehlau and the Königsberg force had reoccupied Tilsit. The protective forces under von der Goltz, to the right rear of the 3rd Res. Div. and along the southern front, extended from Marggrabowa to the Vistula. The posts of this long, thin line were advanced considerably to the southward by frequent minor operations, of which the most important were a demonstration against, and bombardment of, the defences of Osowiec by von der Goltz in the last ten days of Sept.; combats of the 35th Res. Div. about Mlawa, Sonsk, Przasnysz, Chorzele and Janowo (Sept. 12–21); and an expedition of the Thorn garrison, which captured Wloclawek on Sept. 21.

The German gains in the battle of the Masurian Lakes, although less than they had hoped for and not comparable with those of Tannenberg, were considerable. Rennenkampf had been beaten and forced back, if not in dissolution at any rate in disorder, practically to the Niemen. Strategic freedom had been secured to the Germans for a considerable time. East Prussia was cleared of the invaders, 30,000 unwounded prisoners and 150 guns being added to the trophies of Tannenberg.

III.—THE MASURIAN WINTER BATTLE

During Oct., Nov. and Dec. 1914, while the centre of gravity of operations on the Eastern European Front had lain in Poland and West Galicia, the German VIII. Army, much reduced, had defended the E. front of East Prussia against the Russian X. Army (Gen. Sievers), while the S. front had been held, in advance of the political frontier, by bodies and posts of Landwehr, Ersatz and Landsturm. In order to drive the Germans as far away as possible from the sensitive region of Kovno–Grodno which they had approached in the battle of the Masurian Lakes, Sievers took the offensive in Oct. and Nov., and drove back the VIII. Army (commanded successively by von Schubert, von François, and Otto von Below) to the line of the lakes, the Angerapp, and the Schoreller Forest, where the advance came to an end and both sides stabilized their positions.

In Jan. 1915 the German Higher Command decided to reënforce the E. front of East Prussia by the XXI. active and the newly formed XXXVIII., XXXIX. and XL. Res. Corps, and the S. front by various units drawn from Poland, in order to undertake a great offensive against the Russian lines of communication with Poland (of which the X. Army of Sievers was, substantially, a flank guard), while defending the southern front of E. Prussia against attack by the strong Russian XII. Army on the lower Narew. The strategic objects of this offensive are discussed under EASTERN EUROPEAN FRONT CAMPAIGNS; and in the present article, which narrates the operations from the tactical point of view, it is sufficient to note that the envelopment of Sievers's right, combined with pressure on his front and the driving of a wedge into his left, was the immediate tactical idea, while the seizure of Osowiec and a bridgehead E. of the Bobr–Narew line for ulterior operations was the strategic object, which was to be attained in the act of driving this wedge, and secured by the double envelopment and destruction of the Russian X. Army. It was one of the most ambitious schemes attempted during the World War, and all the more so as it was to be carried out in midwinter.

The position of the Russian front line was as follows: Its right rested on the Szeszupa at the point where that river meets the frontier; thence it continued across the W. part of the Schoreller Forest to Spullen, where it turned due S., and, passing just E. of Gumbinnen and just W. of Goldap, followed thence a sinuous line amongst the lakes to Arys. From Arys southward it followed the E. edge of Lake Spirding and the line of the river Pissek (or Pissa) to the region of Lomzha. But S. of Lake Spirding, in advance of Johannisburg and Kolno, Russian light forces occupied most of the Johannisburg Heath, with a front E. of Rudczanny–Turoscheln–Friedrichshof, which, curving into the E.–W. direction, made contact with the line of the Russian forces facing the S. frontier. North of the right wing of the X. Army, *i.e.* of the lower Niemen or Memel river, were only small outposts of the minor Russian group based on Shavli.

In the last days of Jan. the German reënforcements assembled behind the screen formed by the VIII. Army. This screen, from right to left, consisted of Bacmeister's detachment (Landsturm) and the 3rd Cav. Bde. in the Johannisburg Heath, the 2nd Div. with 5th Inf. Bde., 11th Landwehr Div., Lötzen garrison, 1st Landwehr Div., 3rd Res. Div., 10th and Königsberg Landwehr Divs., and 1st Cav. Div., with the 5th Guard Inf. Bde. as support. Of the reënforcements, three corps assembled behind the 1st Cav. Div. screen, unobserved up to the last moment by the Russians, while the XL. Res. Corps joined the 2nd Div. behind Lake Spirding. The XX. Corps, brought from Poland to Ortelsburg, was to be pushed gradually by Myszyniec to the region between Johannisburg Heath and Lomzha, and so to broaden the wedge that it was to be the duty of the XL. Res. Corps and 2nd Div. to drive. In sum, a front line thinly and uniformly manned was secretly to be thickened at two points, on the right between Rudczanny and Kurwien, and on the left astride the Tilsit–Stallupönen railway. On the right, the "wedge" prepared behind the screen of Bacmeister's Landsturm consisted of 3½ (eventually 5 to 5½) divs.; on the left, the enveloping force prepared under cover of the 1st Cav. Div. consisted of 6 to 6½ divisions. The allocation of 10 young and homogeneous divisions, out of a total of 15½ of all categories, to two attack sectors which together covered only 35 m. out of a 110-m. front, and the preparation of these masses behind a continuous line, mark the forthcoming battle, as compared with that of the Masurian Lakes, or even Lodz, as a first approximation to the typical World-War battle.

The VIII. Army and its reënforcements were formed into two armies, the VIII. (Otto von Below) having the front from the right to the Insterburg–Eydtkühnen railway (its left unit being the 10th Landwehr Div.), and the X. (General-Oberst von Eichhorn) from that railway to the extreme left. General-Field-Marshal von Hindenburg and his chief of staff, Lt.-Gen. Ludendorff, moved "General Headquarters, East" to Insterburg so as to direct operations on the spot. The instructions given to Below and Eichhorn in the directives of Jan. 28 and Feb. 5 indicated only the general tactical idea without (so far as known) any allusion to the ultimate strategic objective, and left the army commanders almost a free hand. This was, no doubt, inevitable, owing to the impossibility of regulating liaison in a rapid winter advance, but that very fact made it all the more desirable that the army commanders should be fully acquainted with the Higher Command's intentions. The sequel suggests that this was not the case. In sum, the directives laid it down that Eichhorn's left wing (from left to right, XXI., XXXIX.

Res. and XXXVIII. Res. Corps) should be the enveloping force, the right of its attack-mass of 6 divs. being directed on Kussen and the left "making a wide turning movement on or N. of the river Memel" with Wilkowiszki as its objective. Below's right (XL. Res. Corps and reënforced 2nd Div.) was to attack from Kurwien and Rudczanny, with Kolno and Johannisburg as the first objectives. The intermediate forces (VIII. Army left, X. Army right, viz. the 3rd Res. Div. and the four Landwehr formations) were to bind their opponents by frontal activity; Below's attack was to begin on Feb. 7, Eichhorn's on the next day. Ludendorff himself has admitted that he "found it difficult to start the troops." Snowstorms blew from the E., deep snow and ice covered the ground and obliterated landmarks. Wheeled transport could scarcely move, yet the snow was often not firm enough for sledges. Shelter was rarely found in the advance, since the Russians burnt all villages and farms as they retired. In the later stages, thaw and rain converted the ice-hard ground into mud; the marshes which bordered the streams, great and small, became impassable for guns and transport.

The offensive of the right wing on Feb. 7, beginning in Johannisburg Heath, was delayed at first rather by the ground than by the enemy, but it encountered solid opposition on the line of the Pissek, and especially in front of Johannisburg itself, attacked frontally by the reënforced 2nd Div. But in the night of Feb. 7–8, the left division (80th Res.) of the XL. Res. Corps forced a passage at Wrobeln, and next morning the right (79th Res.) div. did so at Gehsen. Both almost immediately drew up to the N.E. with the object of clearing the passage for the 2nd Div. by threatening the Johannisburg defence in rear, the 79th Res. Div. meeting a Russian threat on its outer flank by putting out a temporary flank guard towards Kolno. Thus, from the outset, tactical incidents gave the offensive a north-eastward direction on Bialla and left Kolno out of its sweep. On the night of Feb. 8–9, after the stubborn defenders of Johannisburg had been enveloped and overcome, the attack reached Bialla and pushed out its 3rd Cav. Bde. northward to Drygallen. On Feb. 9 another difficult march brought the three divisions up to Drygallen (2nd Div.), Bialla (80th Res.), S. of Rollken (79th Res.). Next day began a series of fierce combats about Lyck, which, like those before Lötzen and Arys in the Sept. battle, imposed a fatal delay upon the attempt to envelop the Russian left. In this case, as has been noted above, such an attempt really formed no part of Ludendorff's scheme, which intended a break-through eastward for the furtherance of an ulterior object, and the orders had indicated the rôle of Below as "attack" (*angreifen*) in contradistinction to that given to Eichhorn, "envelopment" (*umfassen*). But in default of any expression in the directive of the intention of driving on to Osowiec, tactical instinct and training led the commanders, once they had found a flank, to wrap themselves round it.

On the northern flank, Eichhorn ignored the suggestion of a wide turning movement N. of the Niemen (Memel river), possibly because he distrusted the Russian roads, and massed his six attack divisions in front of the Schoreller Forest. In the days before the battle the Russian general seemed to have suspected the impending blow, for the cavalry screen of the Germans was several times tested by local attacks. But at the last moment the attention of the defence was drawn off by Below's attack; and when, on the morning of Feb. 8, the German XXI., XXXIX. and XXXVIII. Corps passed through the outposts, they met at first with little resistance. The Schoreller Forest was cleared on the first day. On Feb. 9 the Russian defensive and the state of the ground compelled the attack in general to slow up. But one bde. of the German XXI. Corps broke through, and pushed on in one long march of 29 hours to Wladislawow, which was carried by assault in the night of Feb. 9–10. Thereupon, finding even its defensive échelon turned, the Russian right wing fell back rapidly.

Sievers, in fact, followed the same general policy as Rennenkampf had done. His object in holding a forward line in East Prussia (moral and political considerations apart) was, firstly, to be in position to coöperate in the much larger offensive of the XII. Army contemplated on the southern front, and, secondly, to keep the Germans away from Kovno and Grodno. When, therefore, Hindenburg seized the initiative a month before the Russian XII. Army could be ready, Sievers began to take down his line from right to left as soon as his opponent's purpose became clear. This was on Feb. 9. Next day even the troops facing the Arys–Lötzen–Angerapp front began to withdraw, pivoting on the stubborn resistance of the III. Siberian Corps at Lyck.

Both retreat and advance were carried out with high speed, in spite of the ground and the weather. The six divisions of the German X. Army, soon joined on their right by the Königsberg Landwehr Div., pressed on, ahead of supplies and liaison. On the night of Feb. 10–1 the XXXIX. Res. Corps surprised and overran a Russian div. in Eydtkühnen and Wirballen; the XXI. Corps reached Wilkowiszki, and the XXXVIII. Res. Corps Stallupönen and Deeden. Eichhorn's army was already at right angles to Below's, and its right division (Königsberg Landwehr) was crowded out as early as Feb. 11 by the eastward advance of the VIII. Army's left. On the outer flank of the XXI. Corps, as it swung S. and intercepted the roads and railways leading to Kovno, protection against interference from that direction was provided, first by the 1st Cav. Div. and its attached infantry (5th Guard Inf. Bde.), and then by this Landwehr division sent across the rear of the line on Feb. 12–3. On the night of Feb. 12, the general line of the German X. Army and of the wheeling portion of the VIII. was:—XXI. Corps, Ludwinow and Kalwarja; XXXIX. Res. Corps, Lubowo; XXXVIII. Res. Corps, Wizajny–Szittkehmen–Rominten Heath; 10th Landwehr Div. in Rominten Heath (facing E.) and at Plautzkehmen; 3rd Res. Div., S.E. of Goldap; 1st Landwehr Div., Altenbude. Half of the last-named div. was withdrawn from the ever-contracting line in readiness for service S. of Lake Spirding. Fighting on this day was especially sharp about Rominten Heath and Lake Wystiniec, where, at the angle of the line, the Russian forces had to gain time for the withdrawal of their congested trains.

Meanwhile, at the pivot of this rapid wheel-back, the III. Siberian Corps was still holding positions on both sides of Lyck against the 4½ divs. of Below's right and centre. On Feb. 10 the German reënforced 2nd Div. and advanced guard of the 80th Res. Div. came up against an advanced position of the defence on the line of the villages of Karbowsken, Baitkowen and Miechowen. It was known to the XL. Res. Corps staff that Lyck would be stiffly defended, and the 79th Res. Div. had continued north-northeastward from Rollken in order to reach the left flank of the probable line of defence; and, to strengthen the effect of this movement, the remainder of the 80th Res. Div. was switched southward onto the same route as the 79th Res. On Feb. 11 all attacks by the 2nd Div., 5th Inf. Bde. and advanced guard 80th Res. Div. on the advanced position of Baitkowen failed, and the right column (reënforced 79th Res. Div.) only reached Prostken on the Lyck–Grajevo road, while on the other flank the 11th Landwehr Div. (forming, with the 1st and 10th Landwehr and the 3rd Res., a group under I. Corps headquarters) was brought to a standstill in front of the Russian positions along the northern half of a line of lakes which leaves the main Masurian Lake system at Widminnen and joins the Osowiec marshes at Rajgrod. On Feb. 12 a Russian counter-attack on the left of the German 2nd Div. at Thalussen was only checked by diverting to that field part of the 11th Landwehr Div., which was seeking to force the lake defiles farther N. at Woszellen. But, fearing attack from Prostken, the Russians that night drew back to the line Bartossen–Neuendorf nearer to Lyck, still holding Woszellen with their right.

Feb. 13 was the critical day. The Germans pressed sharply against the new front before Lyck and forced the defile of Woszellen, while their S. column carried out a wide-ranging manœuvre from Prostken. The remainder of the 80th Res. Div. was swung up N. astride the river Lyck, came into line with its advance guard (which, as noted above, had been eneaged in the frontal battle of Feb. 10–2), and, passing on beyond the flank of the defenders of Neuendorf, developed a threat on the rear of Lyck itself. Meanwhile the 79th Res. Div., with the

3rd Cav. Bde., pushed eastward in the hope of seizing Rajgrod. There lay the left flank of the lake line, the gate to Augustowo, and the edge of the Osowiec marshes, and it was stubbornly defended. At this moment, when the 1st Landwehr, 2nd and 80th Res. Divs. were thoroughly involved in the Lyck battle, and the 79th Res. Div. was striving to break through at Rajgrod, Russian counter-attacks developed from the south.

The eastward driving of a wedge, originally intended, had become in fact a northward and northeastward attempt to envelop, with mere picketing of the southward-leading roads. Ludendorff, dissatisfied and anxious, had already begun to cut out parts of the converging line of battle in order to obtain forces which might even now provide a solid right face for a wedge, but these were not available on the spot when the crisis came. At first only the 4th Cav. Div., freshly detrained from Poland, could be put in front of the Russians advancing from Grajevo; and the situation was so serious that the 80th Res. Div., already engaged in the flank of the defenders of Lyck, had to be counter-marched to assist the cavalry. Thus when, late on Feb. 14, the Russians finally gave up the defence of Lyck and fell back all along the line it was only their rear guard, and not the whole III. Siberian Corps, that was sacrificed. At that moment the corps had successfully transferred the weight of its defence to Rajgrod, where the German 79th Res. Div. was completely held up. Moreover, the 80th Res. Div. and 4th Cav. Div. in front of Grajevo repulsed the counter-attack.

On this date, Feb. 14, the advance of Eichhorn and of the left of the VIII. Army had progressed day by day—the troops now far ahead of supplies but living on captures—till the right-angled line of Feb. 12 had become almost a semicircle. Already half of each of the 1st Landwehr and 3rd Res. Divs., and the 5th Inf. Bde. which had been working with the 2nd Div., were out of the line and available for other service, besides the Königsberg Landwehr Div. already transferred to the E. flank. In the semicircle the 79th Res. Div. and 3rd Cav. Bde. (shortly rejoined by the 80th Res. Div. from Grajevo) were before Rajgrod; the forces which had taken Lyck (2nd and parts of the 11th Landwehr Div.) at Sentken, the 11th Landwehr Div. at Kleszowen, half the 1st Landwehr Div. at Willkassen, half the 3rd Res. Div. and part of the 10th Landwehr Div. at Raczki, and the rest of the latter before Poddubowek; while of the X. Army the XXXVIII. Res. Corps was before Suwalki, the XXXIX. Res. Corps before Tatarak and Krasnopol, and the XXI. Corps at Sejny and N. of Berzniki. In the later stages of the drive stubborn resistance had been met, for, as the parts of the Russian X. Army drew closer together and their trains became congested, more time had to be gained by rearguard fighting. But no real relief-attack had developed against Eichhorn's outer flank, either from Kovno or from Olita, and in spite of at least one favourable lake position (that of Kalwarja–Simno–Sereje) there was no counterpart on this side to the resistance offered at Lyck. Thus the eastward-running lines of retreat had been successively lost, till only those leading to Grodno, and to Lipok, Krasnyboz and Sztabin on the upper Bobr, remained open; and the whole Russian X. Army (except on its left, which held out at Rajgrod) was herded, with its guns and transport, into the great forest of Augustowo.

Thenceforward the German operations, by force of circumstances, assumed the twofold form which the Higher Command had originally intended—the tactical encirclement of the Russian X. Army and the strategic penetration of the Bobr barrier. But for the latter it was already too late. Instead of being on the river itself, the Russian forces were well in advance of it, at Stowiski, at Grajevo and at Rajgrod, preventing a *coup de main*, and the thaw had reduced the marshes of Osowiec to a condition in which positions for siege artillery were not to be had.[1] Nor was the tactical envelopment of the Russians in Augustowo Forest achieved without an extremely hazardous manœuvre. Between Feb. 15 and 18 the operations may be described as the battle of Augustowo. Few battle-stories are more complicated.

Having been joined by the 80th Res. Div. and the 4th Cav. Div. the 79th Res. Div. renewed its attacks on Rajgrod on Feb. 15, this time successfully. The 3rd Cav. Bde. on its right had already found its way round the S. side of Rajgrod and surprised the passage of the Augustowski canal S. of Augustowo; hither the 4th Cav. Div. followed, and the four brigades together strove to reach and bar the roads running from Augustowo southward and southeastward. On the opposite flank of the semicircle, the 31st Div. of the XXI. Corps drove on southward from the region E. of Sejny, although its outer flank almost skirted the Niemen, and reached Sopockinie (Feb. 15), barring there the most northerly of the routes leading from the forest into Grodno, but exposing its own rear to any resolute sortie from that fortress. These were the first movements towards converting the semicircle into a ring, and both then and thereafter the ring was exposed to attack from outside, against which it could scarcely have stood. The other divisions of the XXI. Corps and the XXXVIII. and XXXIX. Res. Corps meanwhile entered the forest from the N., except the 77th Res. Div., which seems to have been hastily detached to Sereje as a flank guard; for the 1st Cav. Div., 5th Guard Inf. Bde. and Königsberg Landwehr Div., already finding posts on the eastward routes at and N. of Simno, could do no more.

On Feb. 16 the battle W. and N. of Augustowo began. Here the Russians occupied a semicircular position between Bralobrzegi, on the canal to the S. of the town, and the village of Szczebra, on the marshy Bilzna stream to the N. of it. Augustowo itself, the most important road-centre of the region, lies in a defile formed by two E.–W. lake-chains. Behind the town, the routes to the N.E. and E. traverse this defile, then break with their respective directions over the lake-chains at the villages of Studzieniczna and Sajenek respectively. The position was attacked from the S.W. by the XL. Res. Corps from Rajgrod, the 2nd Div. on the Lyck road, and what was left of the 3rd Res. Div. and 1st Landwehr Div. (the 11th Landwehr Div. being taken out of the line on Feb. 15) on the Raczki road, while half of the 10th Landwehr Div. approached Szczebra from the N.W., and the other half, crossing the front of the XXXVIII. Res. Corps of Eichhorn's army, came down on the same point from the north. But already on the evening of Feb. 15 a brigade of the XXI. Corps from the extreme left of Eichhorn's line, after traversing the forest diagonally from flank to flank, had reached Studzieniczna and Sajenek, and it now stood there, barring the roads immediately behind Augustowo but itself completely isolated.

This was the strangest of many strange episodes in the final phase of the Masurian winter battle. When, on Feb. 14, General von Eichhorn's army bordered the N. edge of the great forest, Fritz von Below, the commander of the XXI. Corps, sent his 31st Div., as already mentioned, to the S., and his 42nd Div. southeastward, into the heart of the forest. On his right the XXXIX. Res. Corps, temporarily reduced to the 78th Res. Div., barred, without advancing, the northern exits, while the XXXVIII. Res. Corps at Suwalki (aided by part of the 10th Landwehr Div., VIII. Army) was forcing a way in from the N.E. corner. The general intention was thus to envelop those Russian forces remaining in the northern part of the forest. But, finding no great opposition, the 65th Bde. of the 42d Div.—the same brigade which had forced a way to Wladislawow six days before—pushed on ahead past Fronczi and Serskilas, and so arrived behind Augustowo, while the brigade following it (59th) halted about Serskilas.

Next morning, when the fighting W. of Augustowo was just beginning, the 65th Bde. made an effort to thrust itself into the human tide which flowed eastward from that town, and even put a battalion over to the village of Sajenek to bar the last exit. But the Russians were determined to keep open their line of retreat, and while the main part of the intrusive force was pinned to its ground at Studzieniczna, the detached battalion was overrun and destroyed. Meantime the Russians in the north part of the forest, who were now retiring, before Eichhorn's frontal attack, in the direction of Grodno, came upon the 59th

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[1] Railway guns were in any case unavailable, owing to the break of gauge at the frontier.

Bde. at Serskilas and Makarcze and forced it out of their path. But at Fronczi this brigade rallied, and again advanced against the flank of the Russian troops as they poured past, while from N., N.N.W. and N.W. the columns of the 78th Res. Div. (XXXIX. Res. Corps) and 76th Res. Div. (XXXIX. Res. Corps) pressed on their rear. Desperate group-to-group and man-to-man fighting went on throughout the afternoon of Feb. 16 and the day of Feb. 17, but with heavy losses the Russians succeeded in bringing a large part of their forces through. Only their rear-guards remained to meet the final concentric effort of the Germans on Serskilas in the night of Feb. 17, and no more than 700 prisoners were here taken by the attack. But the masses only escaped from the N.W. into the S.E. part of the forest. There they were better protected and nearer to Grodno, but this did not save them.

By that time, fighting W. and N. of Augustowo was over. The attacks of the VIII. Army had made little progress during Feb. 16; from sheer determination, or perhaps in ignorance of the presence of the German 65th Bde. in their rear, the defenders of Augustowo held out stolidly, to enable trains and troops to withdraw. But on the morning of Feb. 17 a decision was reached. Storming and rapidly bridging the Blizna, the half of the 10th Landwehr Div. on the Suwalki road forced a way into the town from the N. and the defence collapsed. On that day also, the 31st Div. of the XXI. Corps established itself solidly at Sopockinie and farther S. at Holincze, barring roads and paths from the northern forest towards Grodno, and securing itself only by pickets against counter-attack from the E. and S.E. Lastly this div. reached and barred the great road Augustowo–Grodno at Lipsk, whither the 3rd Cav. Bde. from the extreme right of Below's army made its way. On Feb. 18 the direct pursuit of the 2nd Div. and XL. Res. Corps, which had fought the battle W. of Augustowo, penetrated to this point, shouldering masses of the Russians off the road into the S.E. part of the forest. On Feb. 18, also, forces recovered from the now unnecessary flank guards facing Kovno and Olita (1st Cav. Div., 5th Guard Inf. Bde., 77th Res. Div.) came into the region of Sopockinie to strengthen the now complete, but thin, ring formed round the S.E. part of the forest, where four Russian divisions were penned.

Ignorant of details, but seeing clearly that the encirclement of Sievers's army had practically succeeded, "General Headquarters, East" now exerted themselves to carry out that part of the scheme which was concerned with the forcing of the Bobr. The tactical *dénouement* had taken place so far to the S. and so close to Grodno that there still seemed to be a chance of breaking through between Osowiec and Grodno, for the troops engaged in the fighting in the Augustowo Forest were close at hand, and a considerable number of units (11th Landwehr Div., half 3rd Res. Div., half 1st Landwehr Div., 5th Inf. Bde.) were already in reserve.

In the direct pursuit itself, the forces from Augustowo had reached Lipsk, Krasnybor, and Sztabin, and driven Russian rear-guards over the Bobr. The absence of any formidable counter-attacks from Osowiec suggested that the forces there had been weakened in order to support either the main battle or the troops opposing the advance of the XX. Corps towards Lomzha, or both. In spite of the time which had elapsed, therefore, it was decided to make the attempt, and Otto von Below with the VIII. Army headquarters was placed in charge of all troops (including the XX. Corps) engaged or to be engaged facing the Bobr, Eichhorn assuming control of the remainder. The prospects of success were, however, so small, owing chiefly to the prolonged resistance of the four Russian divs. in the forest, which bound a considerable force for some days, that, after some attempts to force the Bobr crossings, the project was given up.

When, on Feb. 18, the four Russian divs. (27th, 28th, 29th Inf. and 53rd Res. Divs.) were finally enclosed in that portion of Augustowo Forest lying between the Augustowo–Grodno road, the Augustowo–Niemen canal and the Wolkuschek stream, the task of reducing them to surrender was given to six German divisions. From the S. the 2nd Div. (protected in its rear by the Bobr fighting), from the E. the 31st and 77th Res. Div. (protected against Grodno by their own posts only), from the N. the reunited 42nd Div. and from the west the 76th Res. Div. (both of which had followed up after the Serskilas fighting) gradually pressed them onwards, till, after a last fierce counter-attack (coinciding with a sortie from Grodno), they were forced to surrender between Ljubinowo and the Wolkuschek, on Feb. 21. Including these, the total prisoners captured by the Germans in the Masurian winter battle were over 110,000, with some 200 guns. Strategically, the German victory was an isolated episode; but tactically it was complete. It was won in the nick of time, for in these last days the Russian XII. Army's offensive on the Narew front was beginning.

This was the last great battle fought in Masuria, but from time to time the German X. Army and the new Russian X. Army (created almost as soon as the old was destroyed) manœuvred and fought to and fro in the country between the frontier and the Niemen, till in Sept. 1915 the German general offensive took the war over the Niemen, and far to the east. (C. F. A.)

MATHEMATICS (*see* 17.878).—The progress of the 20th century has been accompanied by continued activity in mathematical research. Some of its branches (such as mathematical logic, or the analytical theory of numbers) have actually been created during this period; others (such as the theory of functions of real variables) have been entirely reshaped. The following notes on some of the more recent developments are to be regarded as supplementing the earlier series of mathematical articles in the 11th Edition of this Encyclopædia.

(I.) MATHEMATICAL LOGIC AND THE FOUNDATIONS OF MATHEMATICS

Any branch of mathematics appears to consist of propositions stating the properties of certain relations, such as *being in a straight line with*, or *being the sum of*, holding between certain entities, such as *points* or *numbers*. For example: "If a point c is in a straight line with two other points a, b, and if a point d is in a straight line with the two points b, c, then the point d is also in a straight line with the points a, b"; or again: "The number A which is the sum of the numbers B and C is unique."

The business of the mathematician, like that of any other scientist, is: (*a*) to discover new properties; and (*b*) to reduce all known properties to dependence upon the smallest possible set (called the set of *axioms*). The mathematicians of the past used to regard the simpler propositions of their science (and in particular the axioms) as intuitively evident. On the other hand, they made it a principle to accept no new propositions, except those that could be deduced from the primitive axioms. A mathematical treatise thus consists of a chain of deductions from a small set of initial premises, about which very little is said. This character is an essential and permanent one, although the interpretation given to it may have changed.

The "foundations" of mathematics are constituted by: (*a*) the knowledge used in its deductions; and (*b*) its axioms.

Let us begin with (*a*). It might seem that, in order to understand a mathematical demonstration, one should at least know the meanings of the mathematical terms occurring in it; that no one, for example, could either invent or judge a geometrical demonstration without knowing what is meant by "point," or by "being in a straight line with," or an arithmetical demonstration without knowing the meanings of "number" or of "addition." But modern mathematics insists that this is not so, and appears almost to disown all acquaintance with the meanings of the apparently mathematical terms it uses. An author will declare, for instance, that by "being in a straight line with," or by "being the sum of," he does not mean anything definite, but any relation whatsoever which happens to give a true meaning to his axioms. "Points" and "numbers" become, in the same way, entirely indefinite and unknown sets of entities. Only logical, non-mathematical words and expressions, like "all," "some," "if," "there is," etc., retain a relevant meaning; axioms come to be taken as mere definitions of the mathematical terms occurring in them, and the whole work of mathematics becomes purely formal.

It may seem remarkable that this independence of demonstration from subject-matter, which is so fundamental that its absence in a demonstration can mean nothing but a flaw or an omission, should have taken so long to assert itself in mathematics; but the reason is simple. The older mathematics is full of unanalyzed assumptions. It is only very recently that mathematicians have succeeded in making their hypotheses explicit, though they have been trying to do so since the time of Euclid. Their ultimate success has naturally initiated most important reactions in philosophy. For (*a*), all proof is formal, and the philosopher may therefore abandon the hopeless task of constructing a theory of "non-formal" proof. And (*b*), the modern mathematician separates the mathematical matter from the logical form, and requires logic to give an analysis of the latter. This has inevitably brought about a complete "renaissance" of logical studies, as the Aristotelian logic was entirely unequal to the task, on account both of its unsoundness on many points and of its total omission of relations.

Mathematics thus comes to appear as a beautiful logical exercise, which consists in developing the implications of various sets of formal premises (*i.e.* premises where the terms, other than logical, are *variable*, or symbols without assigned meanings). It may be pointed out that the motive for the choice of these premises, as well as for drawing certain consequences preferably to others, must lie in the region of possible meanings which mathematics itself ignores. Yet there is also a sense of what is formally important and interesting, quite apart from any subject-matter; and this sense, akin to the aesthetic sense, is often what suggests lines of development, and even modifications of the sets of axioms hitherto adopted. Thus Weierstrass says truly that the mathematician is a kind of poet.

But it is clear that *some* of the possible and indefinite meanings of the mathematical terms and axioms, namely their ordinary meanings, are of fundamental importance in the fabric of the world. What are these meanings, and how do we know that they satisfy this or that set of axioms? Not even the "pure" mathematician can wholly ignore this question; for the compatibility (or independence) of two given formal premises can be proved only by discovering some meaning which makes both premises true (or one true, and the other false).

Modern research has brought to light a fact, the possibility of which had escaped all previous philosophy, namely, that the ordinary meanings of geometry and arithmetic are of totally different natures, the former being as entirely empirical as dynamics, while the latter is *a priori*. We shall say nothing here of the ordinary spatial meaning of geometry, as this meaning belongs to physics, and owes no part of its substance to pure reason.[1] But we may note that an arithmetical translation, or rather a variety of such translations, can be found for geometrical axioms. Thus all questions as to the compatibility and independence of these axioms can be treated in a purely arithmetical form.

We now pass to the ordinary meanings of the symbols of arithmetic (*see* 2.523). Negative, fractional, irrational, and complex numbers are often regarded as entities whose existence is postulated in order that certain problems should not remain insoluble. But it is possible to point out certain logical combinations of integers which possess all the advantages of these hypothetical entities.

Thus, $-n$ can be the relation of x to $x+n$, while $+n$ is the converse relation. Again, the rational m/n can be the relation of x to y which holds when $nx=my$. Take now all such rationals arranged in a series by order of magnitude (which is easily defined), and cut this series in two parts, any term of the lower part being inferior to any term of the higher part: then the lower parts of all possible cuts or sections can be taken as the real numbers. Irrational numbers correspond to those "sections" in which neither part has either a first or a last term. Finally, a complex number may be regarded as an ordered couple of real numbers. It is important to realize that the integer n, $+n$, $n/1$, the real n and $n+0.i$ are entities of different structures, and that addition and multiplication, applied to different sets of entities, are different operations. The problem is to define these operations for each "extension" of number in such a way that the special properties of the new numbers result from the definitions, and that, at the same time, those among the new numbers which correspond to the old numbers (as, *e.g.*, $n/1$ to n) retain all the properties of the latter.

All arithmetic thus reduces itself to the arithmetic of the natural integers; and this has been shown by G. Peano to be deducible from five premises, in which "number" means "natural integer." These are: (1) 0 is a number; (2) the successor of any number is a number; (3) no two numbers have the same successor; (4) 0 is not the successor of any number; (5) any property which belongs to 0, and also to the successor of any number which has the property, belongs to all numbers. Three non-logical expressions occur in these premises, namely, *number*, *0*, and *successor*. It was discovered independently by G. Frege and B. Russell that the ordinary meanings of all three expressions can be defined in terms of those very logical notions which are the constituents of all proof. There is no need to insist upon the importance of this reduction of number to logic. It required an elaborate analysis of the fundamental concepts of logic; it had to meet considerable technical difficulties; and the chain of definitions which lead from logic to arithmetic is in consequence very complex. We can give but a rough sketch.

It may perhaps first be noted that the logical nature of the fundamental notions of arithmetic need not come to us as a complete surprise. For it is clear that, since each concept has a determinate number of instances, numbers are as universal as concepts. Then the connexion between the number 0 and the logical notion of negation is obvious; and that between the number 1 and the logical notion of identity hardly less so. Finally, the fundamental arithmetic operation of addition might well have as its kernel the logical operation *and*. But let us pass to the actual definitions of the logical theory of number:—

DEFINITION 1: *A relation is said to be* one–one *when, if* x *has the relation in question to* y, *no other term* x' *has the same relation to* y, *and* x *does not have the same relation to any term* y' *other than* y.

DEFINITION 2: *One class is said to be* SIMILAR *to*, OR TO HAVE THE SAME NUMBER AS, *another, when there is a* one–one *relation of which the one class is the domain, while the other is the converse domain* (the *domain* of a relation being the class of those terms that have the relation to some term or other, its *converse domain* the class of those terms to which some term or other has the relation).

Now we think of a number as of a common property of a group of similar classes. But it is not clear that there is such a property, over and above the *relation* of similarity running through the group, just as it is not clear that there is a property of *direction* common to all the members of a group of parallels, over and above the *relation* of parallelism. A given direction need be nothing more than the group of all parallels to a given line; similarly, a given number need be nothing more than the class of all classes which *have* that number—that is to say, which are similar to any one member of the class. We accordingly adopt:—

DEFINITION 3: *A number is the class of all those classes that are similar to (or have the same number as) a given class.*

This definition is sufficient, at any rate, for all arithmetic purposes. But it will be noticed that it renders necessary to postulate the existence of *instances* of every number, in order to obtain an orderly arithmetic. This postulate is "the axiom of infinity."

The number of Definition 3 applies to all classes, *i.e.* to all concepts; it includes both finite and infinite integers. To obtain the special properties of the finite integers, we must restrict the definition to them; and to do that, we need a logical definition of finitude. A "finite" number is a number of which the "principle of mathematical induction" is true. More strictly, if we adopt:—

DEFINITION 4: 0 *is the number consisting of those classes that have no members;*

and (roughly):—

DEFINITION 5: *The successor of the number of a class* α *is the number of the class consisting of* α *together with* x *where* x *is any term not belonging to* α;

then we say:—

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[1] See on this subject the philosophical works of Henri Poincaré; *Our Knowledge of the External World*, by B. Russell (ch. iv.); *The Principles of Natural Knowledge* and *The Concept of Nature*, by A. N. Whitehead.

DEFINITION 6: *A finite number is a number which possesses any property which belongs to 0, and also to the successor of any number which has the property.*

We can now prove all five of Peano's axioms, *i.e.* all the ordinary arithmetic of the finite integers, and so all the arithmetic of real and complex numbers, without assuming anything beyond the laws of logic and the axiom of infinity. Both geometry and arithmetic are purely formal, or logical, in their method of deduction. But the ordinary meaning of geometry makes it a branch of physics, while the ordinary meaning of arithmetic makes it the development of logic itself.

For the detailed development of arithmetic on a logical basis see G. Peano, *Formulaire de mathématiques* (1908); G. Frege, *Die Grundlagen der Arithmetik* (1884) and *Grundgesetze der Arithmetik* (1893, 1903); B. Russell, *The Principles of Mathematics* (1903) and *Introduction to Mathematical Philosophy* (1919); A. N. Whitehead and B. Russell, *Principia Mathematica* (1910, 1911, 1913).

(J. N.)

(2.) THEORY OF NUMBERS

In the article "Number" (19.847) an excellent summary is given of the classical theory. Modern mathematics has seen the rise of a new theory, the "analytic" theory, which has developed with astonishing rapidity, and has almost monopolized the attention of arithmeticians.

(*a*) *Theory of Primes.*—The modern developments of the theory of numbers depend in the main on the application to the theory of the ideas of the theory of functions of a complex variable (*see* 11.301). It was in the theory of the distribution of primes that these ideas first bore fruit.

It is usual to write $\pi(x)$ for the number of primes less than x. It has been known since Euclid that the number of primes is infinite, that is to say that $\pi(x)$ tends to infinity with x. The central problem of the theory has been the determination of the order of magnitude of $\pi(x)$ when x is large, and its solution is embodied in the *Primzahlsatz*, or "prime number theorem," expressed by the formula

$$\pi(x) \backsim \frac{x}{\log x}$$

where the symbol $\backsim$ expresses the fact that the ratio of the two functions tends to unity. This theorem, conjectured by A. M. Legendre (1798) and C. F. Gauss (about 1792), was first proved by J. Hadamard and Ch. J. de la Vallée Poussin in 1896. The real founder of the modern theory, however, was B. Riemann, who, in a famous memoir published in 1859, first indicated the road along which subsequent research has progressed. Riemann did not prove the prime number theorem; strangely enough, he did not mention it, his object being to obtain, not an asymptotic formula for $\pi(x)$ but an exact expression in the form of an infinite series. Nor did Riemann attain the goal at which he aimed, his analysis, profound and beautiful as it is, being altogether incomplete and inconclusive. But it was Riemann who first recognized where the key to the solution lay, viz. in the study of the "Riemann zeta-function"

$$\zeta(s) = \zeta(\sigma + it) = \Sigma n^{-s} = \Pi\left(\frac{1}{1 - p^{-s}}\right)$$

(where $n = 1, 2, 3, \ldots$ and p runs through the series of primes), considered as a function of the complex variable s. Riemann established some, and conjectured others, of the properties of $\zeta(s)$; one famous conjecture, that all the complex zeros of $\zeta(s)$ lie on the line $\sigma = \frac{1}{2}$, remains unsettled to this day.

Riemann's memoir bore no fruit for over 30 years, when the way was cleared by the researches of Hadamard in the theory of analytic functions (*see* FUNCTION, 11.301 *seq.*). These researches led Hadamard himself, de la Vallée Poussin, and other writers, to a proof not only of the prime number theorem but of very much more. Thus de la Vallée Poussin proved that the logarithm integral $\mathrm{Li}x = \int_2^x \frac{dt}{\log t}$ represents $\pi(x)$ with an error of lower order than $x(\log x)^{-k}$, where k is any number however large. He also investigated the distribution of primes of a linear form $am+b$ or a quadratic form am^2+bm+c, where a, b, c are integers without common factor, showing, for example, that the primes are, on the average, equally distributed between the various arithmetical progressions $am+1$, $am+2$, $\ldots$, as had been conjectured long before by P. G. Lejeune Dirichlet. There is a corresponding theory for the "prime ideals" of the "corpus" associated with any algebraic number. The analogue of Riemann's zeta-function was discovered by R. Dedekind, but it is only recently that, in the hands of E. Hecke and E. Landau, the development of the theory has been pushed to a point corresponding with that of the ordinary theory.

The outstanding unsolved problem of the theory is that of the determination of the order of the *difference* $\pi(x) - \mathrm{Li}x$. This problem is bound up essentially with Riemann's unproved hypothesis concerning the zeros of $\zeta(s)$. If Riemann's hypothesis is true, the maximum order of the difference differs from that of $\sqrt{x}$ by logarithmic factors only. In any case the difference assumes values *of either sign* which tend to infinity with x. This theorem, proved by J. E. Littlewood in 1914, disposes of the old conjecture of Gauss and B. Goldschmidt that $\pi(x)$ is always less than $\mathrm{Li}(x)$.

Apart from applications to the theory of primes, there is a large literature connected with the pure theory of $\zeta(s)$. It has been shown by H. Bohr, E. Landau and F. Carlson that (to put it roughly) nearly all the zeros lie very near the critical line; by G. H. Hardy and J. E. Littlewood that (equally roughly) a considerable proportion lie actually on it. But the hypothesis itself remains unproved.

(*b*) *Additive Theory.*—The "additive" theory of numbers includes Combinatory Analysis (*see* 6.752), Partitions (*see* 19.865), the theory of the representation of numbers by sums of squares, cubes, or higher powers, and so forth.

The central problem is that of determining (exactly or approximately) the number of representations of an arbitrary positive integer n in the form $a_1 + a_2 + \ldots + a_s$, where the a's are numbers of some special type (*e.g.* squares), and s may be fixed or unrestricted, according to the particular problem envisaged. There is a fundamental difference between the "additive" theory and what may be called the "multiplicative" theory, in which the central idea is that of the resolution of a number into prime factors. Analytically, this difference expresses itself as follows: the multiplicative theory depends on the theory of "Dirichlet's series" of the type $\Sigma a_n n^{-s}$, the additive theory on that of power series $\Sigma a_n x^n$. A great deal of the additive theory is purely algebraic, and is intimately bound up with the theory of elliptic functions. This side of the theory (founded by L. Euler) has been developed to a high pitch by English mathematicians, notably A. Cayley, J. J. Sylvester, and P. A. MacMahon, while more recently the methods of complex function theory have been applied to the theory and an "analytic additive" theory has been founded. Among many curious results we may mention the theorem of S. Ramanujan, that the numbers of the unrestricted partitions of numbers of the forms $5m+4$, $7m+5$ and $11m+6$ are divisible by 5, 7 and 11 respectively.

One of the most remarkable problems of the additive theory is "Waring's Problem." It was asserted by E. Waring (1782) that any number n is the sum of at most 4 squares, 9 positive cubes, 19 fourth powers, and, generally, $g(k)$ powers, where $g(k)$ is a number depending on k alone and not on n. This problem (in so far as it simply asserts the existence of *some* such number $g(k)$, was solved by D. Hilbert in 1909. J. L. Lagrange (1774) proved that $g(2) = 4$ (any number is the sum of 4 squares, and some numbers not of less), and E. Wieferich (1909) that $g(3) = 9$ and $g(4) \leqq 37$. Only a finite number of numbers (probably only 23 and 239) require more cubes than 8 (E. Landau, 1908), while an infinite number require 4 at least; and only a finite number of numbers require more than 21 fourth powers (G. H. Hardy and J. E. Littlewood, 1921), while an infinite number require 16 at least; and asymptotic formulae for the number of representations have been found; but our knowledge of this field is still extremely incomplete.

The "empirical theorem" of Chr. Goldbach, that every even number is the sum of two primes, has also received a considerable amount of attention, but is still unproved. Among other unsolved problems of the same character may be mentioned that of proving the existence of an infinity of primes of the form m^2+1 or (more generally) am^2+bm+c. This problem is not to be confused with the problem of primes $am^2+bmn+cn^2$, solved by de la Vallée Poussin.

(*c*) *Miscellaneous Investigations.*—The work of Dirichlet and L. Kronecher on the approximation of irrational numbers by rationals has led to extensive investigations lying on the border line between arithmetic and analysis, developed above all by H. Minkowski under the titles of *Diophantische Approximation* and *Geometrie der Zahlen.* The central idea in this theory is that of the lattice (*Gitter*).

A lattice point (*Gitterpunkt*) in space of any number of dimensions is a point with integral coördinates, and most difficult and fascinating problems arise when we consider the number of lattice points which lie within a volume of specified form in n-dimensional space. Thus Minkowski proved that any convex figure in space of two dimensions with symmetry about a centre, its centre at a lattice point, and of area 4, includes other lattice points besides its centre; with a whole series of corresponding theorems concerning more general configurations. Another class of lattice-point problems is exemplified by the "circle" problem of Gauss and W. Sierpinski, that of determining approximately the number of lattice points inside the circle $x^2+y^2=n$ when n is large. A first approximation is naturally given by πn, the area of the circle, but the estimation of the error is a problem of exceptional difficulty. This problem and the analogous problem for the hyperbola $xy=n$ (Dirichlet's divisor problem) were connected with the theory of $\zeta(s)$ [see (*a*) *supra*] by Landau. These problems also are susceptible of manifold generalization. And in all these problems, we observe the dominating and irresistible tendency of modern higher arithmetic, the tendency to abandon its ancient tradition of isolation and assimilate itself so far as possible to the theory of functions, in order to utilize the immensely powerful weapons which the latter theory alone can provide.

There is one famous problem in which no such reduction of arithmetic to analysis has been effected. "Fermat's last theorem" asserts that there is no integral solution of $x^n+y^n=z^n$ (other than the trivial solution $x=z$, $y=0$) for any value of n greater than 2. It was the attempt to prove this theorem that led to the whole development of the theory of algebraic numbers; but, in spite of the widespread attention which it has excited, and the extreme importance of the general theories of which it has been the starting point, the theorem itself remains unproved, though important additions have been made recently to our knowledge by A. Wieferich, D. Mirimanov, L. E. Dickson, and H. S. Vandiver. Thus Wieferich proved that the theorem holds for odd prime values of n, and values of x, y, z, not divisible by n, unless $2^{n-1}-1$ is a multiple of n^2.

One old conjecture has been definitely disposed of. Mersenne asserted that 2^n-1, where n is a prime not exceeding 257, is prime when, and only when, $n=1, 2, 3, 5, 7, 13, 17, 19, 31, 67, 127, 257$. This statement contains at least four errors, relating to the values 61, 67, 89, 107; and it need no longer be taken seriously.

AUTHORITIES.—An indispensable work for the serious student of higher arithmetic (on any of its sides) is L. E. Dickson, *History of the Theory of Numbers*, 1920–1. This work is not, however, specially concerned with the analytic theory.

For general accounts of the theory of primes see *Encycl. des Sc. Math.* i. 17 ("Propositions transcendantes de la théorie des nombres," by J. Hadamard and E. Maillet: the article by P. Bachmann in the first German edition is inadequate, but the third edition, in preparation in 1921, was to include an account of the theory, as it stands to-day, by H. Cramer); E. Landau, *Handbuch der Lehre von der Verteilung der Primzahlen* (1909), and *Einführung in die elementare und analytische Theorie der algebraischen Zahlen* (1918).

For the additive theory see P. A. MacMahon, *Combinatory Analysis* (1915–6), and *An Introduction to Combinatory Analysis* (1921); P. Bachmann, *Niedere Zahlentheorie*, II. (*Additive Zahlentheorie*) (1910); G. H. Hardy, *Some Famous Problems of the Theory of Numbers* (1920).

For Fermat's last problem see P. Bachmann, *Das Fermatproblem* (1917); L. J. Mordell, *Four Lectures on Fermat's Last Problem* (1921). Comparatively little of recent work is accessible in a connected form, and the study of the original memoirs is indispensable.

(G. H. H.)

(3.) THEORY OF SERIES

The most striking modern developments in the theory of series (*see* 24.668; 10.753; 12.956) have also been suggested by the development of the theory of functions.

The theory of functions of a real variable has been revolutionized by the ideas of E. Borel and H. Lebesgue, and this revolution has inspired a corresponding revolution in the theory of Fourier's series and "series of orthogonal functions" generally.

A system of functions $\phi_m(x)(m=1, 2, 3, \ldots)$ is said to be *orthogonal* if $\int_a^b \phi_m(x)\phi_n(x)dx=0(m\neq n) \ldots (1)$.

The simplest examples are obtained by taking $\phi_m(x)$ to be cos mx or sin mx and the interval (a, b) to be $(0, 2\pi)$; or $\phi_m(x)$ to be Legendre's polynomial $P_m(x)$ and (a, b) to be $(-1, 1)$. There is then a simple procedure by which we may endeavour to expand an arbitrary function $f(x)$ in the form of a series $\Sigma a_m\phi_m(x)$, viz. by multiplying this series by $\phi_m(x)$ and integrating over the interval (a, b): the formula thus suggested is

$$f(x)=\Sigma a_m\phi_m(x),\ a_m=\left(\int_a^b f(x)\phi_m(x)dx\right)\Big/\left(\int_a^b \phi^2{}_m(x)dx\right) \quad \ldots (2).$$

A more accurate analysis of this procedure raises a multitude of profoundly interesting and difficult questions. On the one hand we may start from a series with arbitrary coefficients a_m, and inquire whether there exists a function which stands to it in the relation expressed by the equation (2). In particular, given a trigonometrical series Σa_m cos mx or Σb_m sin mx or, more generally, $\Sigma(a_m$ cos $mx+b_m$ sin $mx)$, with arbitrary coefficients, we may ask whether it is a Fourier's series, that is to say, whether there is a function $f(x)$ such that a_m and b_m are given by Fourier's integral formulae. On the other hand, we may start not from an arbitrary series but from an arbitrary function $f(x)$, form the coefficients (a_m or b_m) by Fourier's formulae or the more general formulae (2), and then inquire whether the formal development thus obtained is convergent, and whether, if convergent, it represents the function $f(x)$ and so forth.

The problems thus raised are among the most difficult of modern mathematics; and a very cursory examination of them is enough to show that the methods of the older analysis are not sufficiently powerful for their solution. It is essential that we should enlarge our conceptions, on the one hand, by taking account of the modern generalizations of the notion of an integral, and, on the other, by adopting a broader view as to what is meant by the "sum" of an infinite series.

The modern theory of functions of a complex variable (*see* 11.301) points to the same conclusion. A function $f(z)$ of the complex variable z, regular for $z=z_0$, is defined throughout a certain circle whose centre is z_0 by a power-series $\Sigma a_n(z-z_0)^n$; but the region of existence of the function is very generally more extensive than the circle of convergence of the series; and this fact has led, during the last generation, to a mass of work on the problem of "analytic continuation." This problem is that of discovering analytic representations of the function, whether by integrals, or by continued fractions, or by series of a different form, which are valid throughout a wider region than that in which it is represented by the original power series. Here also we are confronted by the need for a scientific theory of divergent series.

There are passages in the older analysts (*e.g.* in L. Euler), which suggest a half-conscious anticipation of modern ideas. But it is roughly true to say that they did not concern themselves with the precise meaning of the infinite series of which they made such effective use. A. L. Cauchy and N. H. Abel were the first to give a precise definition of the "sum" of a series $a_0+a_1+a_2+\ldots$ or Σa_n, viz. as the limit of $s_n=a_0+a_1+\ldots+a_n$ when n tends to infinity $(n\rightarrow\infty)$. Such a series as $1-1, 1-\ldots$ has then *no* sum, for s_n is alternately 1 and 0; and it was the tendency, for many years after Cauchy and Abel, to banish such series from analysis entirely. A school of mathematicians survived, among whom one may cite A. de Morgan, who viewed this tendency with obvious discontent, but there was no escape from the conclusion that the followers of Cauchy and Abel were right. It is impossible to say "the sum of Σa_n is so-and-so" except after framing an accurate definition of "sum"; the definition of Cauchy and Abel was the only definition; and, until some new and wider definition was offered, that was the end of the matter.

We may define the meaning of a mathematical word or symbol as we please, provided only that the definition is free from contradiction. Given a sequence of numbers $a_1, a_2, \ldots$ we may associate with the sequence a number s in any manner that we please, and we may say, if we like, that s is the "sum" of the series. We might say, for instance, that the "sum" of every infinite series is, by definition, zero. This definition would be perfectly legitimate; but futile, because it would reduce all equations involving infinite series to the trivial form $0=0$; and confusing, because it would conflict with Cauchy's definition. Cauchy's definition is only one among many, but it is admittedly the most important, and a new definition is only likely to be of value if it is consistent with the standard definition. It must satisfy what is called the *condition of consistency;* it must apply to all convergent series, and give a "sum" equal to their sum in the ordinary sense. Its value for analysis will then be measured by the extent and importance of the class of non-convergent series to which it attributes a "sum."

The simplest and most important of the definitions which have been given is that of the "first arithmetic mean." Suppose that $s_n=a_0+a_1+\ldots+a_n$ and $\sigma_n=(s_0+s_1+\ldots+s_n)(n+1)$, the arithmetic mean of the first $n+1$ values of s_n. If s_n tends to a limit, σ_n tends to a limit also, and the two limits are the same; but σ_n may tend to a limit when s_n does not. For example, if $a_n=(-1)^n$, $s_{2n}=1$ and $s_{2n+1}=0$, and s_n does not tend to a limit; but σ_n tends to the limit $\frac{1}{2}$. If now we agree to call the limit of σ_n, whenever it exists, the "sum" of the series Σa_n, our new definition is in perfect accord with Cauchy's definition, but is applicable to an extensive class of series for which Cauchy's definition fails. It therefore fulfils the conditions required for a theory of divergent series.

The most striking illustration of the importance of these ideas is to be found in the theory of Fourier's series (*see* 10.753). The Fourier's series of a *continuous* function $f(x)$ is not necessarily convergent; further conditions on $f(x)$, of a much more artificial character, are required to insure convergence. It was, however, shown by L. Fejér that the Fourier series of any continuous function is "summable" by the procedure indicated above; that is to say, that the arithmetic mean σ_n tends to a limit equal to the value of the function; and this fundamental result has been the starting point of a mass of modern research.

Another important definition attributes to the series as "sum" the value of the limit of the power series Σa_nx^n when x tends to 1 through positive values less than 1. A third (of particular importance in complex function theory) was advanced by Borel; and all of these definitions have given birth to a multitude of still more general definitions.

AUTHORITIES.—For the general theory of divergent series *see* E. Borel, *Leçons sur les séries divergentes* (1901); T. J. I'A. Bromwich, *Introduction to the Theory of Infinite Series*, ch. x. (1908); G. H. Hardy and M. Riesz, *The General Theory of Dirichlet's Series* (1915). For the theory of Fourier's series, H. Lebesgue, *Leçons sur les séries trigonométriques* (1912); Ch. J. de la Vallée-Poussin, *Cours d'analyse infinitésimale*, 2nd ed., vol. ii. (1916); E. H. Hobson, *The Theory of Functions of a Real Variable* (1907, 2nd ed. in course of publication in 1921). The general theory of series of orthogonal functions is, for the most part, still only to be read in the original memoirs, or in works on the theory of integral equations. (G. H. H.)

(4.) THEORY OF FUNCTIONS

The theory of functions (*see* 11.301, 14.53) has two great branches, the real and the complex theories. Recent advances in the complex theory, important as they are, have been of too technical a character for rapid summary. The real theory, on the other hand, has been remodelled from its foundations. The older form of the theory was cumbrous and unattractive. The modern theory has the aesthetic character required of a first-rate mathematical science, and its development has been perhaps the most striking achievement of modern analysis.

1. *Sets of Points.*—The theory of functions of a real variable is based upon the theory of aggregates (*see* 19.847–850) and in particular the theory of "sets of points." A set of points ζ is an aggregate of real numbers x, such as the aggregate of rational numbers, or of irrational numbers, in the interval $(0, 1)$. A number ξ is said to be a "limit point" (*Häufungstelle*) of ζ if every "neighbourhood" of ξ, that is to say every interval $(\xi-\epsilon, \xi+\epsilon)$ including ξ, contains points of ζ other than ξ itself. A limit point of ζ may or may not belong itself to ζ. Thus every number of $(0, 1)$, rational or irrational, is a limit point of the set ζ of rationals of $(0, 1)$. If every limit point of ζ belongs to ζ, ζ is *closed.* If every point of ζ is a limit point, ζ is *compact* or *dense.* A set which is both closed and compact is *perfect.* In particular, the continuum, the aggregate of all real numbers, is perfect: this is the first and most striking stage in G. Cantor's mathematical analysis of the continuum.

An idea of dominating importance in the theory of functions is that of the *content* or *measure* of a set of points. Suppose, for simplicity, that the set ζ in question is contained in $(0, 1)$. Then Cantor defined the content of ζ as follows:—Divide $(0, 1)$ in any manner into a *finite* number of intervals δ, and these intervals δ into two classes δ_1 and δ_2, according as they do or do not include points of ζ; and let $c(\delta)$ be the sum of the lengths of the intervals δ_1. Then the *content* of ζ is the limit of $c(\delta)$ when the intervals δ tend to zero, if this limit should exist.

There is a striking defect in this definition, the full implications of which were first perceived by E. Borel. *The content of the sum of two sets is not generally the sum of their contents.* Thus the rationals of $(0, 1)$ have content 1 (since every δ is obviously a δ_1), and likewise the irrationals. The sum of the contents is 2, whereas the content of the sum is 1. The rationals of $(0,1)$ cannot be included in a finite set of intervals whose aggregate length is less than 1. If we abandon the restriction that the set of intervals must be *finite*, the situation is completely changed. Thus Borel observed that we may include the rational p/q in the interval $\left(\frac{p}{q}-\frac{\epsilon}{q^3}, \frac{p}{q}+\frac{\epsilon}{q^3}\right)$, and that the sum of all these intervals may be made as small as we please by choice of ϵ; and this simple remark has revolutionized the theory of functions. The first step was to frame a satisfactory definition of *measure*, and this concept, which has entirely superseded Cantor's "content," is now defined as follows. We consider sets ζ included in $(0, 1)$. Let ζ be enclosed, *in any manner whatsoever*, in a system of σ of intervals δ; let $m(\sigma)$ be the sum of the intervals of σ; and let m_e be the lower bound (or "inferior limit") of the aggregate of values of $m(\sigma)$. Then m_e is the *exterior measure* of ζ. The *interior measure* m_i is $1-m'_e$, where m'_e is the exterior measure of ζ, the set complementary to ζ, *i.e.* the set of points of $(0,1)$ which do not belong to ζ. If $m_e=m_i$, the set ζ is *measurable*, and its measure is m, the common value of m_e and m_i. This definition (due to H. Lebesgue) is of extreme generality, and no example of a non-measurable set is known.

Measure, thus defined, has the properties which measure ought to have, but which Cantor's content lacked. In particular the sum of two mutually exclusive and measurable sets is measurable, and its measure is the sum of the measures of the component sets. The measure of any enumerable set, and in particular of the rationals, is zero. The definition may be extended to sets in space of any number of dimensions.

2. *Integration.*—The new theory of measure has led to new theories of integration, in the light of which the older theories are of historical or didactic interest only. The most important of these theories are due to H. Lebesgue and W. H. Young.

(*a*) Lebesgue's definition of an integral is as follows. A function $f(x)$, defined in an interval (a,b), is *measurable* if the set of points S (A) for which $f > \mathrm{A}$ is measurable for every A. All known functions are measurable. We now suppose that f is bounded, so that (say) $h<f<\mathrm{H}$, and we divide up the interval (h, H) into a finite number of intervals $(l_i, l_{i+1}$ or δ_1. It is this subdivision of the range of variation of $f(x)$, instead of (as in the older theory) that of x, that is characteristic of Lebesgue's procedure. The set of points for which $(l_i \leqq f<l_{i+1})$ is measurable. If we denote its measure by m_i, write $\mathrm{J}=\Sigma l_i m_i$ and suppose that the intervals δ_1 tend to zero, then J tends to a limit I, and we write:

$$\mathrm{I}=\int_a^b f(x)dx$$

The integral so defined is a *bona-fide* generalization of the integral of Riemann, for it exists whenever Riemann's integral exists and agrees with it in value. But it is far more general: thus the function $f(x)$ which is unity when x is a rational of $(0,1)$, and zero otherwise, has no Riemann integral, but has a Lebesgue integral equal to zero. The definition is capable of many-sided generalization, to unbounded functions, and functions of many variables; it throws entirely new light on the relations between integration and differentiation; and it has proved itself adapted for a mass of analytical applications of the most far-reaching importance, in particular in the theory of Fourier's series and the theory of integral equations.

(*b*) A different definition was proposed by W. H. Young. He adheres to a subdivision of the range of variation (a,b) of the independent variable; but, instead of dividing it into a finite number of intervals, divides it into a finite or infinite number of measurable sets. This procedure leads to results roughly equivalent to those of Lebesgue's theory; but it is somewhat more general; and is certainly a more natural development of the older theory of measure.

3. *Geometrical Applications.*—Those new theories have led inevitably to a searching reëxamination of the concepts of "curve," "surface," "length," "area," and so forth, which were generally accepted without question by the older analysts on the supposed evidence of geometrical intuition. This unreflective attitude has now been abandoned, and it is recognized that analysis is in no sense dependent upon geometry. The notion of a *curve* was first made precise by C. Jordan. A curve is a set of points (x,y), that is an aggregate of pairs of real numbers x, y where x and y are functions of a single variable t, subject to appropriate restrictions. A simple closed continuous curve is a curve for which (1) $x=x(t)$ and $y=y(t)$ are continuous for $t_1\leqq t\leqq t_2$, (2) $x(t_2)=x(t_1)$ and $y(t_2)=y(t_1)$ and (3) it is false that $x(t')=x(t'')$ and $y(t')=y(t'')$ for any pair of values t', t'' other than t_1, t_2. A fundamental theorem, due in substance to Jordan, asserts that such a curve C divides the plane into two "regions" D and D′ separated by the curve. Two points which lie in the same region can be connected by a continuous curve which has no point in common with C; but points which lie in different regions cannot be thus connected. We thus define the *inside* and *outside* of a closed curve in strictly analytical terms. A similar account has been given of the concepts of *area* and *length.* In particular the simple closed continuous curve C has both an area and a length if $x(t)$ and $y(t)$ are functions of bounded (or limited) variation.

AUTHORITIES.—More or less complete accounts of the modern theories will be found in: E. W. Hobson, *The Theory of Functions of a Real Variable* (ed. 2, vol. i., 1921); Ch. J. de la Vallée Poussin, *Cours d'analyse infinitésimale* (1909, 1912) and *Intégrales de Lebesgue, etc.* (1916). See also E. Borel, *Leçons sur la théorie des fonctions* (ed. 2, 1914); and *Leçons sur les fonctions de variables réelles* (1905); H. Lebesgue, *Leçons sur l'intégration* (1904) and *Leçons sur les séries trigonométriques* (1906); C. Caratheodory, *Vorlesungen über reelle Funktionen* (1918); H. Hahn, *Theorie der reellen Funktionen* (1921).

4. *Integral Equations.*—Among the remaining developments of modern analysis, perhaps the most remarkable are in the theory of integral equations. The typical integral equation is

$$f(x)=\int_a^b \mathrm{K}(x,t)\phi(t)\,dt \qquad (1)$$

where $f(x)$ and $\mathrm{K}(x,t)$ are given and the unknown function $\phi(t)$ is to be determined. This equation is called an integral equation of the first kind; but it has been found that equations of the form

$$\phi(x)=f(x)+\lambda\int_a^b \mathrm{K}(x,t)\phi(t)\,dt \qquad (2)$$

known as equations of the second kind, are better adapted for the foundation of a general theory. It was shown by I. Fredholm that, if f and K satisfy certain conditions, there is in general one and only one continuous solution $\phi(t)$; the exceptions arise when λ is a zero of a certain transcendental function $\mathrm{D}(\lambda)$. When λ has one of these exceptional values, the equation

$$\phi(x)=\lambda\int_a^b \mathrm{K}(x,t)\phi(t)\,dt$$

has a continuous solution other than the obvious solution $\phi(t)=0$; otherwise this is the only solution. The theory has been widely developed by Fredholm, D. Hilbert, V. Volterra and other writers.

See M. Bôcher, *An Introduction to the Study of Integral Equations* (1909); T. Lalesco, *Introduction à la théorie des équations intégrales* (1912); H. B. Heywood and M. Frechet, *L'Équation de Fredholm et ses applications à la physique mathématique* (1912); V. Volterra, *Leçons sur les équations intégrales* (1913); D. Hilbert, *Grundzüge einer allgemeinen Theorie der linearen Integralgleichungen* (1912); A. Kneser, *Die Integralgleichungen und ihre Anwendungen in der Mathematischen Physik* (1911); and the third volume of E. Goursat's *Cours d'Analyse* (ed. 2, 1915). (G. H. H.)

(5.) GEOMETRY

General remarks will be offered here in regard to two aspects of geometry (*see* 11.675) which may be held to be of contemporary interest, under the headings (*a*) Foundations of geometry; (*b*) Theory of classes of surfaces. Under the former heading it is not intended to discuss in detail the so-called Axioms of Geometry, for which the reader may be referred to the article with that title (*see* 11.730), but only to advert in general terms to questions which have indirectly been much in evidence of late in connexion with Einstein's theory of Relativity (*see* RELATIVITY). Under the second heading is included a quite technical theory, which now has great importance and a developing character.

(*a*) *Foundations of Geometry.*—The usual history of the development of the ideas of a student of geometry to-day is somewhat as follows. After a more or less prolonged (and highly desirable) course of experimental geometry, very largely (and undesirably) limited to a plane, in which a line is a mark made on paper, and a straight line is a mark which agrees with a physical object (a ruler), the student passes through a course in which he is shown that there is a logical connexion between the geometrical conceptions his experience may have led him to form. At first, and for a long time, often permanently, lines and circles are regarded as objects of perception and, for instance, there is no hesitation in accepting the idea of two lines being in the same direction, and it appears intuitive that two points must have a certain distance, a result of familiarity with the rigid bodies which the student has had put before him. This teaching, after a certain knowledge has been obtained of the detailed relations of circles and lines, often painfully acquired and difficult to remember, is continued, on the same plan, for the so-called geometrical properties of conic sections, though these are apt to appear at first as much less concrete than circles. After this, as soon as some facility with algebraical computation is acquired, the student learns that a straight line has an *equation*, and that, *e.g.* the common points of two circles depend on the solution of a quadratic equation, while the common points of two conics depend on a quartic equation. If his instruction is pursued far enough, he learns, with the expenditure of much time and energy, a vast number of algebraical devices, and is now, if apt in using them, capable of proving algebraically almost any question that his usual examinations are likely to require of him. For his further efficiency to this end he is probably taught towards the end of his career something about harmonic relations, about homography, and about projections. In particular, for example, he may be taught that the equations which give the foci of a conic are obtainable by applying the analytical conditions for a circle to the equation of the pair of tangents to the conic from any point. If he is fortunate it may be pointed out to him, near the end of his laborious drilling in detail, that a circle behaves as if it were a conic with two definite (albeit imaginary) points; and if he must in any case know the properties of conics he may, for economy of memory, seize hold of this remark, and come also to a geometrical description of the property of foci just referred to—and pursuing this course, if circumstances allow, he may finally reach a framework of hypothetical constructions including the so-called circular points and the circle at infinity, from which, looking back, as from a hill-top, he sees the whole country of geometrical fact, with which he has so laboriously become acquainted, shrink into a landscape dominated by very few main routes. He may now be at the stage of the third year university student. With continued consideration he may be led finally, even if only with the purpose of summarizing his geometrical outlook in the fewest possible ideas, to regard as working hypotheses such as the following: (*a*) there is no fundamental difference between points at infinity and those not at infinity; (*b*) there is no difference in reality between real and imaginary points; (*c*) there is no gain but great loss in refusing to consider space of more than three dimensions; (*d*) distance, as a fundamental conception, is unnecessary. And with these will come a recognition that the so-called non-Euclidian geometries are, logically, prior to the Euclidian geometry.

Leaving aside now the tempting pedagogic question of whether he has been justly treated in being so long denied the synthesis which, if he could have appreciated it, would so much have lightened his task of becoming familiar with the details, we remark that he finally works with a conceptual scheme, which includes the perceptual experiences by which it has been suggested—but discards many ideas which at earlier stages his perceptions seemed to suggest as necessary. For instance, the points of a line are not now in (linear) order, and lines have lost their straightness, the lines of threefold space being for many purposes better regarded as points of a quadric in five dimensions. Questions then arise such as: Is geometry unique in thus replacing the first crude ideas of physical experience by a conceptual scheme of entities, whose properties are determined logically, not from a set of *definitions* which tell us what these entities are, but from a set of fundamental propositions or statements of relations between them? And connected therewith, are the ideal entities of such a conceptual scheme less *real* than those, for example, which the physicist employs, say the aether, or electrons, to explain his conceptions? May the statement that distance is not necessary as a fundamental conception be fairly replaced by the statement that distance in the abstract is an illusion? It would seem that the difference is one only of the degree of abstractness of the conceptual scheme employed. We may in geometry itself have different levels of abstractness; for example, we may in the first instance regard the points of a line as conforming to our idea of an abstract order of such a kind that the so-called Dedekind's axiom is applicable, although finally, when we allow the so-called imaginary points, we discard this notion of order and use the word line in a still more abstract sense. It would seem that every science as it advances in comprehensiveness must similarly evolve for itself a conceptual scheme of ideal entities; and that even in strict logic, no proposition can be asserted to be true or false except in reference to entities whose fundamental relations are made explicit.

Such questions as these arise when it is assumed that it ought to be possible to ascertain by observation whether the world is finite, or still more whether space (in the abstract) is Euclidian or non-Euclidian. If the attitude which has been suggested is sound, the most that can be done is to inquire what would be the modifications in our statements of perceptual regularity which would follow if we adopted a particular scheme of conceptions in regard to the extent of the world, or the character of space.

Of such conceptions, those which have reference to a method of measurement are of fundamental importance. And if measurement is possible at all, it must presumably be based upon a scheme for assigning identification numbers to the points of bodies which are to be measured. This is not the same as assigning numbers to points of space, nor even if this could be done would the method of measurement be determined uniquely thereby. A way of assigning identification numbers to the points of a figure must be conditioned (*a*) by the fundamental theorems of incidence of the elements of the figure (as that a line is determined by two points, or that two planes meet in a line); (*b*) by the nature of the numbers to be used (whether they allow commutative multiplication for example); (*c*) by the freedom of the assignment, that is the number of points of the figure for which the corresponding numbers may be assigned arbitrarily, the numbers belonging to any other point being then determinate; (*d*) which is in fact included under (*a*), by the character of the " infinity " of the figure (as whether the space of the figure is open or closed); and even then (*e*) it appears to be necessary to assume one or more definite limiting theorems of incidence. In the way which has been studied most in detail, as being that which is most naturally suggested by the Euclidian scheme in which geometrical thought has developed, the numbers being taken to be those of ordinary arithmetic, it is possible to assume arbitrarily the numbers for three points of a line, so long as this is considered by itself, the numbers of four points of a plane regarded as isolated, and the numbers of five points of a three-dimensional space; this space is regarded as closed, the numbers belonging to a point are regarded as ratios of numbers, and infinite values of numbers are thereby excluded from consideration—and the assumption is made that four lines of which no two intersect have two common transversals. It is shown that the introduction of this assumption is equivalent (other things being equal) to assuming that the numbers used are commutative in multiplication. The number space of Descartes, in which each point is represented by three ordinary numbers, one or more of which may be infinite, may be regarded as a particular case of the so-called projective space thus described.

In his famous *Habilitationsschrift* (1854), when 28 years old, B. Riemann considered a Cartesian space in which each point is specified not by three but by n numbers or coördinates, and proposed to measure the distance between two neighbouring points by means of a quadratic function of the small differences of their corresponding coördinates. He remarked then that such a space has not necessarily any rigid bodies capable of movement without change of linear dimensions. For this to be possible it is necessary and sufficient that certain functions of the coefficients in the quadratic form and their differential coefficients should be constant. The number of these functions is $^1/_{12}n^2\,(n^2-1)$; for instance for $n=2$, this number is 1, and for $n=3$, it is 6. When these conditions are satisfied the space is said to be of constant curvature. But it is to be remarked that a Cartesian space of n dimensions, such as that considered by Riemann, is in reversible, point-to-point correspondence with a quadratic manifold (also of n dimensions), in a projective space of $n+1$ dimensions. In such a space of $n+1$ dimensions, as was first remarked by Cayley, we can set up a measurement of distance between any two points by taking, quite arbitrarily, a quadric manifold of reference. It is then the case that Riemann's definition of distance, when his space is of constant curvature, and allow srigid bodies capable of movement, is so obtainable, after Cayley's manner.

These details appear to bring out very clearly that even when the difficult step has been made of passing from the descriptive properties of a geometrical figure to the assignment of coördinates, it is a further step of much artificiality to introduce a measure of the distance between any two points.

In recent years, under the stimulus of A. Einstein, H. Minkowski, H. Weyl and others, Riemann's dearest dream of a uniform formulation of all phenomena of physics, has, it would seem, been brought appreciably nearer to realization, in what is known as a Theory of Relativity. An event, occurring in a definite place at a definite time, is regarded as depending on three coördinates for its position, and one for its time, and these four together are spoken of as its coördinates in a Cartesian space of four dimensions. As formulated by Einstein, there is an interval between two neighbouring events, given by a quadratic in the differences of their corresponding coördinates; this quadratic will then have ten coefficients. It can be shown that there exist functions of these coefficients and of their derivatives in regard to the point coördinates, which are unchanged in value if calculated for the quadratic form into which the given one is transformed by any transformation of the coördinates; for instance, the 20 functions which, as has been stated, arise in the consideration of what is called the curvature, are such functions. It is clear that the vanishing of such an invariantive function expresses a fact which is not altered by any simplification that may be possible in the form of the quadratic expression; for instance if the 20 functions above referred to all vanish the quadratic expression has a form the same as in Cartesian Euclidian geometry; and if they are all equal to the same quantity independent of coördinates, the quadratic expression has the form considered by Riemann. In Riemann's theory, following Gauss, account is taken of curves, called geodesics, which satisfy the condition that the integral $\int ds$, taken along with such a curve, shall be stationary according to the ordinary rules of Lagrange's *Calculus of Variations*, where ds is the square root of the quadratic expression referred to. Einstein's suggestion is that the path of a particle under the influence of what we call gravitating masses may be represented as such a geodesic, provided the coefficients in the quadratic form are chosen to depend suitably upon these masses; and this has proved capable of verification in the case of the planet Mercury, and in the case of a ray of light passing near to the Sun. An analogous suggestion has led Weyl not only to the equations belonging to the theory of gravitation, but also to those which express the phenomena of electromagnetism (and light). And it is very interesting from our present point of view to see the character of the modifications which Weyl has been led to make in Einstein's mathematical formulation in order to attain this end. For our present purpose we may state this in a twofold manner without entering into the logical connexions. In the first place, in Weyl's theory, instead of the quadratic form ds^2 being regarded as definite for two specified neighbouring events, a product $e\phi s^2$ is regarded as definite, where ϕ is a function variable from point to point, whose derivatives in regard to the coördinates are utilized to represent electromagnetic phenomena. As Weyl writes (*Math. Zeitschrift*, II. p. 397, 1918), "Riemann machte die . . . Annahme, dass sich Linienelemente nicht nur an derselben Stelle, sondern auch an zwei endlich entfernten Stellen ihrer Länge nach miteinander vergleichen lassen. Die Möglichkeit einer solchen ferngeometrischen Vergleichung kann aber . . . nicht zugestanden werden." This is precisely in the spirit which has moved geometers increasingly since the publication of G. K. C. von Staudt's *Geometrie der Lage* (1847). It introduces however evidently a wide arbitrariness, which Weyl limits by adopting as a datum the possibility of the translation of a vector given at one point to another neighbouring point *without change of direction*. This conception, adopted from T. Levi-Civita (*see* Levi-Civita, *Palermo Rendiconti*, XLII., 1917, pp. 173–205, and F. Severi, *ibid*., p. 254), is as follows:—The two elements of direction defined by (*a*) the vector at the first point P and (*b*) the displacement from P to the neighbouring point P′, define a family of geodesic directions through P, forming a surface; the parallel vector at P′ is that whose direction *on this surface* makes with the direction PP′ the same angle as that made by the vector at P. Evidently the assumption of the possibility of this determination of unchanged direction is fraught with large consequences or conditions. A suggestion subsequent to Weyl's (A. S. Eddington, *Proc. Roy. Soc.* XCIX., 1921, pp. 104–122), begins with Levi-Civita's differential equations for parallel displacement of a vector, but working backwards towards the quadratic differential form leads to a generalization of Weyl's formulation.

So much of detail in regard to these remarkable contemporary speculations seems necessary in order to compare the geometrical aspects with those of older conceptions. In the so-called space of Einstein, still less in Weyl's space, there exist neither bodies, nor movement; and what are the fundamental geometrical conditions assumed prior to the establishment of the system of coördinates is as yet undetermined. The latter fact, which is equally true of any Cartesian space, may provisionally be evaded by regarding the space as being in point to point correspondence with a quadric manifold in a projective space of five dimensions; the former fact, which relates to the consideration of a quadratic differential expression, is most probably, if it proves finally to be possible to put the phenomena of physics into exact correspondence with geometrical considerations, suggestive of a physical theory which, given some fundamental relations of experience, shall be developed not by computation, but by descriptive methods. For the aim of geometry, towards which since von Staudt's time, much progress has been made, is such a descriptive conception of the relations of figures in space as may render computation unnecessary.

(*b*) *General Theory of Surfaces.*—The older theory of circles and conics, or of rational curves in general, as also the theory of quadric surfaces, of cubic surfaces or of rational surfaces in general, can be placed in (1, 1) correspondence with the geometry of lines, or of the planes, respectively; it deals ultimately with linear equations when viewed analytically. A consideration of cubic curves on a plane, or of the curve of intersection of two quadric surfaces, soon shows that these do not depend upon linear equations ultimately—or more precisely that the points of a plane cubic curve cannot be put into (1, 1) correspondence with the points of a line. And it further appears that a quartic curve in a plane is again of a higher category, and cannot be put into (1, 1) correspondence with a cubic curve. This fact first emerges clearly in Abel's great paper on the integrals of algebraic functions. The general theory of the so-called Higher Curves was then historically subsequent to the theory of algebraic functions and the integrals of these; though, when this theory had received a sufficient development, it proved possible to elaborate a descriptive theory of these curves embodying the results obtained by the earlier analytical methods. In geometry, entities which can be put into exact (1, 1) correspondence are equivalent for geometrical purposes, and conversely, for purposes of a general theory, it is vital to know whether two entities have this equivalence or not. It is one of the most important recent developments of geometry to have made it clear that criteria can be given by which to determine whether two surfaces have this (1, 1) correspondence. And it is interesting to remark that historically the development in this case has been on similar lines to that by which the corresponding result was obtained for curves; in the first place, over many years, Picard developed the theory of algebraic integrals associated with surfaces on lines as far as possible analogous to those which had been followed in the case of curves, therein in part carrying out a suggestion due to Clebsch and Noether, though the integrals which have proved most effective hitherto were not those suggested by Clebsch; after this the geometrical aspect of the matter was investigated by Italian geometers, more especially Enriques, Castelnuovo and Severi, who have succeeded in surpassing, in beauty and generality, even the distinguished contributions of their own countrymen to the theory of curves. It is impossible indeed to convey to a nongeometrical reader any idea of the interval which separates the development of geometry in Italy to-day from the development reached in England.

The new theory is under the disadvantage that an appreciation of it is impossible without sympathy and acquaintance with the theory of algebraic functions and their integrals, and it may be some time before detailed applications of it become the common property of mathematicians. But it offers a limitless scope for new work, its importance cannot be doubted, and its permanence is assured.

BIBLIOGRAPHY.—For the questions suggested by the Einstein-Minkowski work, ample material arises in attempting to sift into logical coherence many of the current writings on Relativity. An ample bibliography of these concludes the work of Hermann Weyl, *Raum-Zeit-Materie, Vierte erweiterte Auflage, Berlin, 1921.* The English reader will find much stimulus to geometrical consideration in Eddington's volume, *Space, Time and Gravitation* (Cambridge, 1920); and should consult E. Cunningham's two fundamental volumes on *Relativity*, and A. A. Robb, *A Theory of Time and Space* (Cambridge, 1914).

Emile Picard's work is summarized in his book *Théorie des fonctions algébriques de deux variables indépendentes* (Paris, 1897–1906), which concludes with a summary by MM. Castelnuovo et Enriques (t. II., pp. 485–522) of the results obtained by the Italian geometers up to 1906. Subsequent progress is recorded (and scattered) in the various mathematical journals, mainly of Italy.

(H. F. BA.)

MATHEWS, SIR CHARLES WILLIE (1850–1920), English lawyer, was born in New York Oct. 16 1850, the son of the actress Mrs. Davenport, who became in 1857 the second wife of the comedian Charles James Mathews (*see* 17.887). The boy took his stepfather's name, and was sent to England to be educated at Eton. In 1868 he entered the chambers of Montagu Williams, the well-known criminal lawyer, as a pupil, and in 1872 was called to the bar. His rise was rapid, and he soon built up a wide connexion and became known as an extremely skilful cross-examiner. In 1886 he was made counsel to the Treasury, from 1893 to 1908 was recorder of Salisbury, and in 1908, on the retirement of Lord Desart, became director of public prosecutions. Mathews, who was knighted in 1907 and received the K.C.B. in 1911, was concerned in most of the important criminal cases and *causes célèbres* of his time, among them being the Colin Campbell divorce suit (1886), the trial of the Jameson raiders (1896), and the prosecution of Lynch for high treason (1903). He was also well known in the theatrical world, being a constant attendant at first nights, and was besides an excellent after-dinner speaker and all-round sportsman. He died in London June 6 1920.

MATTEI, TITO (1841–1914), Italian musician and composer, was born at Campobasso, near Naples, May 24 1841. He became at an early age a professor at the Santa Cecilia academy of music at Rome, and subsequently had several successful European tours as a pianist. In 1863 he finally settled in London, where he remained for the rest of his life. He composed several hundred songs and pianoforte pieces, many of which became very popular. He died in London March 30 1914.

MATTER, CONSTITUTION OF (*see* 17.891).—In the decade 1910–20 many important advances were made which gave much more definiteness and precision to our knowledge of the constitution of matter. The atomic theory of matter, which for long appeared to be of necessity unverifiable by direct experiment on account of the minuteness of the atom, received almost direct proof in a number of ways. Methods have been developed, for example, to detect the electrical effect of a single α particle from radium, and a single swift electron (*see* GASES, ELECTRICAL PROPERTIES OF).

The α particle has been shown to be a charged atom of helium projected with high velocity; the number of α particles from a given quantity of radium have been counted, and the volume of helium which they produce has been measured. In this direct way it has been shown that about $2 \cdot 7 \times 10^{19}$ particles or atoms of helium are required to form one cubic centimetre of helium gas at normal pressure and temperature. Not only is it feasible to detect the effect of a single atom of matter in special circumstances but also to show the path of a swift α particle or electron through a gas. This has been made possible by the discovery of C. T. R. Wilson that under suitable conditions the charged ions produced in gases by α or β rays become centres for the condensation of water vapours, and are thus rendered visible as the nuclei of visible drops of water. The photographs of these droplets show in a most striking way the track of the particle through the gas, and illustrate with extraordinary detail the main effects produced by the passage of ionizing radiations through gases.

The essential correctness of the kinetic theory of matter, which assumes that the molecules of matter are in vigorous but irregular motion, has been clearly demonstrated by the experiments of Perrin and others on the motion and equilibrium of small spheres of matter in suspension in fluids which show the Brownian movement. At the same time the atomic or discrete nature of electricity, which had been implicitly assumed in many theories, has received complete experimental verification, and the magnitude of this fundamental unit of charge has been measured with precision. The most accurate experiments on this subject have been made by Millikan by measuring the electric field required to support a small, charged droplet of oil or mercury. The charge on the drop was varied by ionizing the gas in its neighbourhood. In this way he has been able to show that the charge always varies by integral multiples of a fundamental unit. The charge given to a drop by friction or any other method is always an integral multiple of this unit charge. This fundamental unit is the same both for positive and negative electricity, and is numerically equal to the charge carried by the negative electron, the positive and negative ions produced in a gas by X rays, and also to the positive charge carried by the hydrogen atom in the electrolysis of water. The magnitude of this unit charge, combined with electrochemical data, gives a most reliable method of measuring a number of important and molecular magnitudes. The value of the fundamental unit of charge and thus the mass of the individual atoms of matter are now known with an accuracy of certainly within one per cent and possibly within one-tenth of one per cent. The data found by Millikan are given in the following table:—

Fundamental unit of charge .	$e = 4 \cdot 774 \times 10^{-10}$ electrostatic units
The Avogadro Constant, *i.e.* the number of molecules in one gramme molecule	$N = 6 \cdot 062 \times 10^{23}$
The number of molecules per c.c. of any gas at 0° C. and 760 mms.	$n = 2 \cdot 705 \times 10^{19}$
Mass of hydrogen atom in grammes	$m = 1 \cdot 662 \times 10^{-24}$

From these data the number of atoms in one gramme of any element can be determined. While the average distance apart of the atoms or molecules can at once be deduced, the actual dimensions of the molecules or sphere of action of the molecules can only be approximately estimated with the aid of other and much less precise data.

Structure of the Atom.—Since the proof that the negative electron of small mass is a constituent of all atoms of matter, there has been a vigorous attack on the fundamental problem of the structure of the atom. After passing through a number of phases the general ideas on this subject have crystallized into a fairly definite form, and it is now generally believed that the atom is composed of a massive positively charged nucleus of minute dimensions surrounded at a distance by a compensating distribution of negative electricity in the form of negative electrons. Since electricity is atomic the resultant positive charge on the nucleus must be an integral multiple N of the fundamental unit of charge e and is given by Ne. In order for the atom to be electrically neutral it must be surrounded by a distribution of N negative electrons. The value of N for each of the atoms is a fundamental constant, for on it depends the magnitude of the electric field surrounding the nucleus and the arrangement of the external electrons which in turn determine the main physical and chemical properties of the atom. The idea of the nuclear structure of atoms arose initially from a study of the scattering of α particles in their passage through matter. On account of its great energy of motion the charged α particle penetrates the structure of some of the atoms and comes under the influence of the intense repulsive field of the nucleus. Assuming that the law of force is that of the inverse square the α particle describes a hyperbolic path, and the angle of deflexion depends on the nearness of approach to the nucleus. From a close study of the scattering of α rays by Geiger and Marsden it was concluded that the number of α particles scattered through different angles was in close accord with the idea of the nucleus atom, while the actual number scattered through a given angle gave information on the magnitude of the charge carried by the nucleus. The preliminary experiments indicated that for the heavier atoms the value of N was about half the atomic weight in terms of hydrogen. A notable advance was made by the fundamental experiments of Moseley on the X-ray spectra of the elements. He found that the X-ray spectrum was similar for all elements, and that the frequency of vibration of corresponding lines in the spectrum was proportional to the square of a number which varied by unity in passing from one element to the next. He concluded that the nuclear charge in fundamental units was equal to the atomic or ordinal number of the elements when arranged in increasing order of their atomic weights. On this view the lightest element, hydrogen, has a nuclear charge 1, helium 2, lithium 3, and so on up to the heaviest element, uranium, of ordinal number 92. This is a generalization of great importance and simplicity which has guided all subsequent work on the structure of atoms. The essential correctness of Moseley's conclusion has been directly verified in the case of a few representative elements by Chadwick by accurate measurement of the nuclear charge based on the scatteringof α rays. Moseley showed that with few exceptions all values of the nuclear charge between 1 and 92 were represented by known elements. The missing elements were of ordinal numbers 43, 61 and 75, corresponding to positions in the Periodic Table where the existence of additional elements had been suspected. Moreover, when the atomic weight of the element in Mendeleef's classification was replaced by its ordinal number certain irregularities were removed. For example, the positions of argon and potassium, cobalt and nickel, iodine and tellurium were interchanged—a result in complete accord with their chemical properties (*see* CHEMISTRY).

It thus follows that the main physical and chemical properties of an element are defined by a whole number which represents both its nuclear charge in fundamental units and the number of external electrons. The atomic weight of an element is in a sense a secondary property, for, as we shall see, elements can exist of the same nuclear charge but of different atomic weights. The number and position of the external electrons, on which the ordinary chemical and physical properties of an atom depend, are defined by the nuclear charge. The mass of the atom which resides mainly in the nucleus exercises a subordinate effect on the external arrangement of the electrons.

Isotopes.—On Moseley's classification only 92 elements of ordinal numbers 1 to 92 are possible, assuming that uranium (92) is the last of the elements. We shall now briefly discuss some recent advances which clearly show that in some cases several elements can exist with the same nuclear charge but of different atomic masses. Information on this point was first obtained from a study of the radioactive bodies. It was early observed that a number of products which showed different radioactive properties were inseparable from one another by ordinary physical and chemical methods. For example, ionium and thorium, radium and mesothorium, radium D and lead cannot be separated from each other, and appear to be identical in chemical properties. Elements so closely alike in chemical properties were called "isotopes" by Soddy, since they appeared to occupy the same position in the periodic arrangement of the elements. Viewed from the standpoint of the nuclear theory isotopes are elements of the same nuclear charge but of different atomic masses. As we have seen, the nuclear charge controls the ordinary physical and chemical properties of the atom, and the mass which resides almost entirely in the nucleus has only a second-order effect. On the other hand, the property of radioactivity depends on the structure and stability of the nucleus, which may be very different for atoms of the same resultant nuclear charge.

In the article on RADIOACTIVITY attention is drawn to the remarkably simple relation which exists between the chemical properties and radiations of the series of radioactive elements. With the aid of this relation we can at once write down the ordinal numbers and masses of the long series of elements which arise from the transformation of uranium, thorium and actinium, and can follow the origin of the numerous isotopes which arise. One of the most striking results of this generalization was the prediction that the end product of the uranium and thorium series should be an element of the same ordinal number as lead but of atomic masses 206 and 208 respectively, instead of the mass 207 found for ordinary lead. This result has been directly confirmed by atomic weight determinations of uranium-lead and thorium-lead, and was the first definite proof of the existence of isotopes of a non-radioactive element.

It seemed probable that in a similar way many of the ordinary elements might consist of a mixture of isotopes, *i.e.* elements with the same nuclear charge but different atomic masses. This has been confirmed in a number of cases chiefly by the work of Aston. The masses of the positively charged atoms present in the electric discharge in a vacuum tube are examined by bending the rays in a combined magnetic and electric field. In this way it was found that neon consisted of two isotopes of masses 20 and 22 and chlorine of isotopes of masses 35 and 37. The relative proportions of the two isotopes in chlorine was in good accord with that to be expected from the ordinary atomic weight of the mixture of isotopes, viz. 35.45.

This new method of analysis had, up to 1921, been employed only for a small number of the elements, but had yielded results of great interest. Some of the elements, like carbon, nitrogen and oxygen, give no isotopes, and are thus to be regarded as "pure" elements where the atoms have all the same mass and nuclear charge. Others, like chlorine, argon, krypton, and mercury, are composed of a mixture of two or more isotopes. In cases like krypton and mercury as many as six well-defined isotopes have been detected. As far as observation has gone the masses of all the isotopes are expressed by a whole number in terms of $O=16$ with an accuracy of about 1 in 1,000. For example, the isotopes of neon are 20.00 and 22.00. This important conclusion, which has been verified in a number of cases, affords a strong indication that the masses of the parts composing the nucleus have a mass either of one or a multiple of one, and are not direct multiples of the mass of the hydrogen atom which is 1.008 where $O=16$. The reason of this will be discussed later.

While the ordinary physical and chemical properties of isotopes are closely similar, it is to be expected that they should differ in all qualities which involve directly the mass of the atom, *e.g.* the coefficients of diffusion and specific heats. In a similar way second-order effect is to be expected in the rate of vibration of the external electrons, *i.e.* in the light spectrum of the element, and a small effect has been observed in several cases. The most obvious method of partial separation of isotopes is by the process of diffusion or evaporation. In this way a partial separation into light and heavy fractions has been shown in the case of neon, mercury, and chlorine. No evidence of the separation of isotopes in nature has been so far observed except in the case of uranium-lead and thorium-lead already referred to. It will be of great interest to test, for example, whether chlorine obtained from widely different sources shows any difference in the relative proportions of its component isotopes.

Distribution of Electrons.—We have seen that the atom is to be regarded as an electrical structure in which a positively charged nucleus is surrounded by a number of electrons. The magnitude of the nuclear charge and the number of the external electrons are known for each of the elements. In considering the distribution of the external electrons round the nucleus, we are at the outset faced by the great difficulty that no possible arrangement can be permanently stable on the basis of the classical dynamics. For example, an electron in motion round the nucleus must on the classical theory radiate energy and fall into the nucleus. To overcome this fundamental difficulty Bohr has introduced a conception based on the quantum theory, in which radiation only occurs in definite quanta. In this way it is possible to postulate the position of the electrons in the simpler atoms and to calculate their frequency of vibration. The theory of Bohr developed by Sommerfeld and others has achieved remarkable success in explaining many of the details of the spectra of hydrogen and helium both in electric and magnetic fields. Owing, however, to the great complexity of the possible modes of motion when three or more electrons are present, it is difficult to calculate the distribution of the electrons and their modes of vibration in the case of the more complex atoms.

A number of suggestions have been made as to the grouping of the electrons in the atom, notably by Kössel, Lewis, Langmuir and Sir J. J. Thomson, which have had a certain measure of success in offering an explanation of the periodic variation in the properties of the elements with atomic number and the methods of combination to form molecules. These theories, however, are for the most part descriptive and not quantitative in character. The whole problem of the distribution and motion of the electrons in a complex atom is a very difficult one. While definite progress had been made by 1921, much still remained to be done before we could hope to define with any certainty the position, motion and modes of vibration of the electrons for even the lighter and less complex elements.

Structure of the Nucleus.—While it is difficult to estimate the dimensions of atomic nuclei, the general evidence indicates that the nucleus of a heavy atom like uranium, if assumed spherical, has a radius of less than 10^{-11} cm. or less than 1/1000 of the radius of the external atom. No doubt the dimensions of a nucleus depend on its complexity and are much smaller for the lighter atoms. From experiments on the passage of α particles through hydrogen, it has been calculated that the dimensions of the helium nucleus of mass 4 is of the order 10^{-12} cm.

The most direct evidence on the constitution of the nucleus is derived from the study of the radioactive transformations. The disintegration of an atom is accompanied either by the expulsion of an α particle, *i.e.* in helium nucleus, or the release of a swift electron from the nucleus. This shows that the nucleus of the radioactive atoms contains both positively charged masses and negative electrons, and that the nuclear charge represents the resultant charge. It is natural to conclude that the helium nucleus of mass 4 is one of the secondary units which make up the structure of a complex nucleus. This is supported by the observation that the atomic mass of many atoms is expressed by $4n$ where n is a whole number. It is clear, however, from the work of Aston on isotopes that, in addition to the helium nucleus, an element of mass 1 or integral multiple of 1 enters into the structure of all nuclei. This fundamental unit of structure has been named "proton," and its atomic mass is 1 or very nearly 1 in terms of $O=16$. On this view the nuclei of all elements are made up of positively charged protons and electrons. The mass of the atom measures the number of protons in the nucleus. This is in a sense a return to the famous hypothesis of Prout in which all the atoms are supposed to be built up of hydrogen as the fundamental unit.

It seems clear that if a proton could be removed from an atomic nucleus it would prove to be the hydrogen nucleus carrying a unit positive charge. In fact, Rutherford and Chadwick have shown that the hydrogen nucleus can be liberated from certain atoms like nitrogen and aluminium by bombardment with swift α particles. It remains, however, to explain why the proton in a nucleus has a different mass from the free hydrogen nucleus. The latter has a mass 1.008 in terms of $O=16$ while the proton in the nucleus has a mass unity, or nearly unity.

While the negative unit of electricity exists in the form of the electron of very small mass, no evidence has been obtained that its counterpart, the positive electron of very small mass, exists. The unit of positive electricity has never been found to be associated with a mass less than that of the hydrogen atom. This has led to the view that the hydrogen nucleus is the *positive* electron, and that its mass is about 1,845 times that of the negative electron. This difference in mass between the units of positive and negative electricity appears to be fundamental, and offers an explanation of the asymmetrical distribution of positive and negative electricity in the structure of atoms.

Since the helium nucleus has a mass 4 and charge 2, it should be composed of four hydrogen nuclei and two electrons. Its mass, however, is less than that of four free hydrogen nuclei. Such a change of mass in the very close combinations of positive and negative nuclei is to be expected. According to the theory of relativity energy has mass, and the loss of mass m of a system is numerically given by $E=mc^2$ where E is the energy liberated and c the velocity of light. On this view the combination of the positive and negative electrons to form the helium nucleus is accompanied by a large release of energy. From the difference between the mass of the helium nucleus and that of four hydrogen nuclei, it can readily be calculated that the helium nucleus is such a stable combination that an amount of energy corresponding to four or five α particles from radium would be required to dissociate it. The difference between the masses of the protons in the nucleus and free hydrogen nuclei is thus to be ascribed in general to the close packing of the positive and negative units composing the nucleus.

On the views outlined above the number of electrons in any nucleus can at once be calculated. For example, oxygen of nuclear charge 8 should be made up of 16 positive units and 8 electrons. For such a nucleus to hold together it seems clear that the forces between the charged units at such small distances must be different from that of the inverse square. While it has been experimentally shown that the law of the inverse square holds at any rate approximately close to the nucleus of a heavy atom like gold, this law breaks down in very close collisions of light atoms where the nuclei approach very close to each other. For example, it has been found that the number of hydrogen atoms which are set in swift motion when α particles pass through hydrogen is very different from that to be expected if the nuclei behave as point charges repelling each other according to the law of the inverse square. The experimental information at present available is too indefinite to hazard more than a guess as to the nature and magnitude of the forces that come into play when nuclei approach very close to one another, as they must do in the structure of the nucleus of a heavy atom.

Stability of Atoms.—Apart from the heavy radioactive elements which belong to a class by themselves, and two other elements—potassium and rubidium—which spontaneously emit swift electrons, the atoms of the ordinary elements appear to be very stable structures which cannot be broken up by ordinary chemical and physical agencies. Some experiments have suggested that possibly helium and hydrogen may be liberated by the passage of an electric discharge through gases, but on account of the presence of these elements in many materials it is difficult to prove definitely that they arise from artificial transformation. In considering the possibility of the disintegration of elements it should be borne in mind that the loss of one or more electrons from the outer electronic system has no permanent effect on the atom, for other electrons ultimately fall into the atom to fill their place. In order to produce a permanent transformation of the atom it appears necessary to remove a positively charged particle or an electron from the nucleus of the atom. This can only be effected by agencies which are able to penetrate the nucleus or to pass very close to its structure.

The α particle expelled from radium is one of the most concentrated sources of energy known to us, and on account of its speed should be able to penetrate the structure of the nuclei of many of the lighter atoms and still retain sufficient energy to disrupt the bonds that hold the parts of the nucleus together. In the case of an atom of high nuclear charge the α particle may lose so much of its energy in approaching the nucleus that it may be unable to effect its disintegration. It has been found that when α particles pass through hydrogen or any material containing combined hydrogen some of the particles pass so close to the hydrogen nucleus that they set it in swift motion. These swift hydrogen atoms can be detected by the scintillations they produce on a zinc-sulphide screen. This is purely a case of collisions of atomic nuclei, and the speed of the "H" atom set in motion can be calculated by the ordinary laws of mechanics. The maximum range or distance of penetration of such a particle is about four times that of the incident α particle.

In a similar way other nuclei must be set in swift motion by their collision with α particles, but it can be calculated that in most cases such nuclei are unable to travel as far as the α particle, and thus remain undetected amid the great number of incident α particles.

When a strong beam of α rays passes through oxygen or carbon dioxide only a few H atoms are observed, and these appear to come from the radioactive source. When, however, the rays pass through dry nitrogen a much greater number of penetrating particles is observed. Rutherford has shown by the action of a magnetic field that these particles are not atoms of nitrogen but probably charged atoms of hydrogen. Rutherford and Chadwick have tested a number of elements in this way and have found that, in addition to nitrogen, boron, fluorine, sodium and phosphorus show a similar property. As far as observation has gone it seems probable that these expelled particles are H atoms which are released by the disintegration of the nucleus. The velocity of expulsion of such H atoms is greater than that of an H atom in a direct collision with an α particle. For example, using α particles of range 7·0 cm. in air, ordinary H atoms travel 29 cm. in air while the atoms from nitrogen go 40 cm., and those from aluminium not less than 80 cm. It thus seems clear that the effects observed in nitrogen and aluminium cannot be ascribed to ordinary hydrogen as an impurity. It is of interest to note that if the particle from aluminium is an H atom it is released with more energy than that of the incident α particle. Elements like carbon, oxygen, and sulphur, whose atomic mass is given by $4n$ where n is a whole number, do not give rise to H atoms, but only those elements whose mass is given by $4n+2$ or $4n+3$. It thus seems clear that a disintegration of certain atoms can be produced by the intense collisions with the α particle in which an H atom is released with great velocity. General evidence indicates that not only H atoms but possibly also atoms of mass 3 or 4 may be liberated in a similar way, but the experimental evidence was in 1921 too indefinite for any certain conclusion.

It should be borne in mind that the disintegration observed in this way is on an exceedingly small scale. Not more than one particle in a million gets sufficiently close to a nucleus to release an H atom. It seems clear, however, that while the ordinary atom is undoubtedly very stable, its disintegration can be brought about by the aid of sufficiently powerful agencies which are able to penetrate its structure. As already pointed out, there are strong reasons for believing that the helium nucleus is a very stable structure which cannot be broken up even by the swiftest α particle at our disposal.

While it is reasonable to suppose that all the elements have been built up by combinations of protons and electrons, there was in 1921 no experimental evidence to throw light on the conditions necessary to lead to the formation of complex nuclei. No doubt, however, this process of aggregation has gone on in the past, and may still be in progress under favourable conditions, if not on this earth at any rate on some of the stars. (E. Ru.)

MAUBEUGE, SIEGE OF (1914).—The fortress of Maubeuge, which in oldtime wars played an important rôle as commanding the routes leading from the Spanish or Austrian Netherlands to the Oise valley, was reconstructed as a ring fortress of the modern type between 1878 and 1896, under the defence scheme of Gen. Séré de Rivières. Its function, like that of Besançon on the other flank of the French eastern front, was in substance to absorb the forces of a German army which should seek to turn the flank of the Lorraine-Meuse defence. The great development of communications of all sorts in north-eastern France

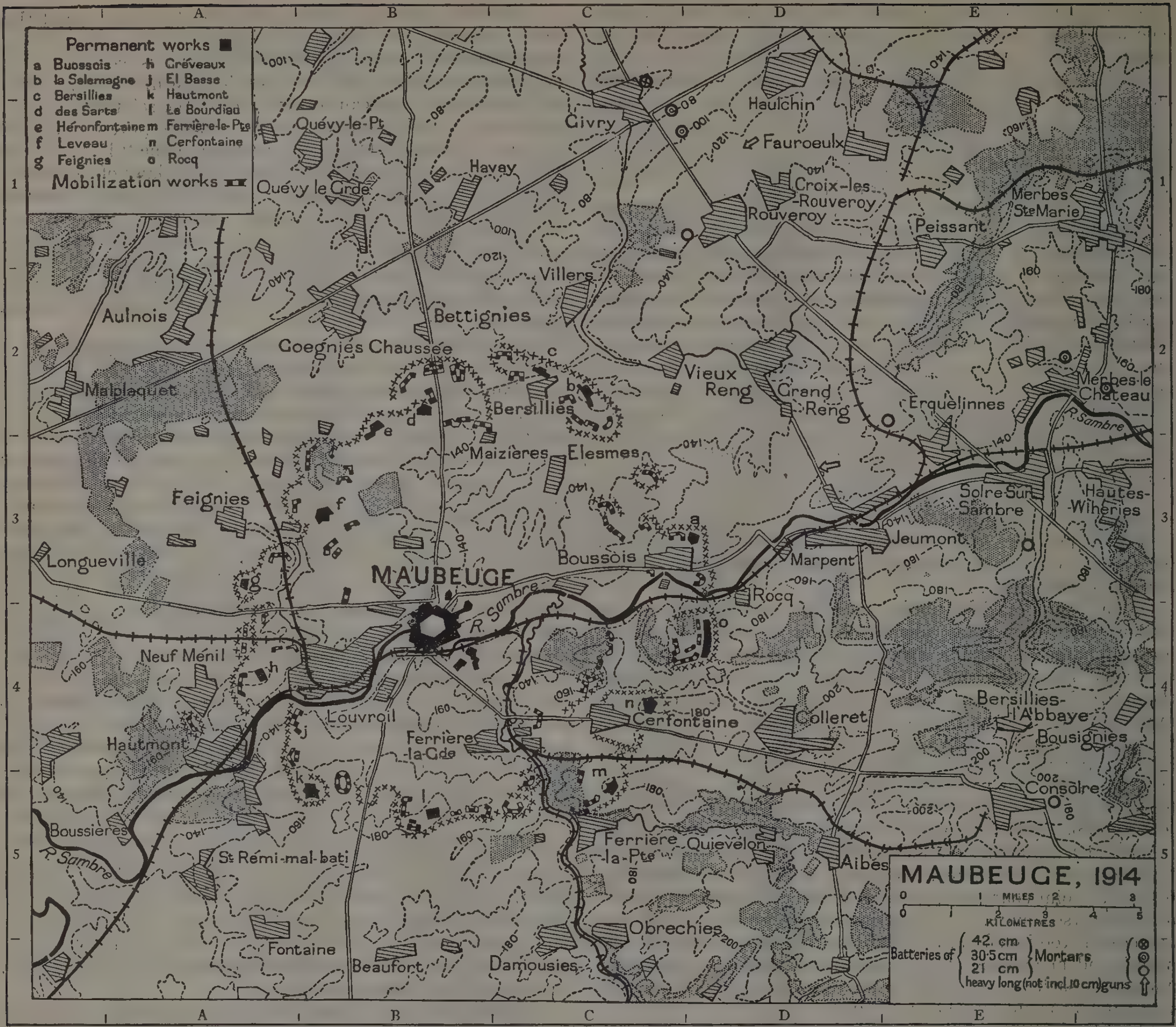
MAUBEUGE, 1914
Permanent works ■
a Boussois
b la Salemagne
c Bersillies
d des Sarts
e Héronfontaine
f Leveau
g Feignies
h Gréveaux
j El Basse
k Hautmont
l Le Bourdiau
m Ferrière-le-Pte
n Cerfontaine
o Rocq
Mobilization works
MILES 0 1 2 3
KILOMETRES 0 1 2 3 4 5
Batteries of 42. cm 30·5 cm 21 cm Mortars
heavy long (not incl. 10 cm) guns
A B C D E
1 2 3 4 5
Quévy-le-Pt
Quévy le Grde
Givry
Havay
Haulchin
Fauroeulx
Croix-les-Rouveroy
Rouveroy
Merbes Ste Marie
Peissant
Villers
Aulnois
Bettignies
Coegnies Chaussée
Malplaquet
Vieux Reng
Grand Reng
Erquelinnes
Merbes-le-Château
R. Sambre
Bersillies
Maizières
Elesmes
Feignies
Solre-Sur-Sambre
Hautes-Wiheries
Jeumont
Longueville
MAUBEUGE
Boussois
Marpent
Rocq
Neuf Menil
Louvroil
Ferrière la-Gde
Cerfontaine
Colleret
Bersillies-l'Abbaye
Bousignies
Hautmont
Consolre
Boussières
St Remi-mal-bati
Ferrière la-Pte
Quievelon
Aibes
Obrechies
Fontaine
Beaufort
Damousies

and Belgium had robbed the place of its former significance as a road centre and river crossing, but on the other hand it was the junction of several lines of railway, and the control of these by fortifications was justified, if not absolutely essential. By 1914 however, conditions had altered considerably. Progress in siege artillery equipment had made Séré de Rivières' designs obsolete, and French mobilization plans had been so far perfected that it was thought possible to initiate operations by an offensive from the eastern front towards the Saar. In these circumstances the French General Staff was confronted with the choice between spending large sums of money on modernizing Maubeuge, or else treating it as a place of subordinate importance; and thus the door was opened for differences of opinion which resulted in the place being neither modernized nor demilitarized. The question of reconstruction was put aside as of "no immediate interest until work on the eastern fortresses has been completed." In 1910, the governor was officially informed that he was not expected to hold out more than a few days if attacked, and that "the hypothesis of an isolated defence against regular siege need not be considered." On the verge of hostilities Joffre told General Fournier, the recently appointed governor, that he would probably employ him and his 30,000 war garrison to besiege Metz.

The ring of forts and internal works had an average diameter of about 4 miles. In the main, the fortifications were high-command works of earth and masonry, but some of the newer works had concrete shelters, two of the eastern forts (Cerfontaine and Boussois) possessed each an old type cupola, and Forts Hautmont and Le Bourvian on the slope south of the town and Fort des Sarts north of it were modernized about 1910. In the first days of mobilization the intervals were converted as usual with artillery positions into infantry redoubts, trenches and wire in front of them, and in some cases the forts themselves were treated as the nuclei of groups of field works.

But already in the mobilization period local difficulties, uncertainties as to the real rôle of the place, lastly, reports of the Germans passing to the left of the Meuse at Huy, had brought about a crisis. The Minister of War, M. Messimy, alarmed by the governor's reports, published a decree dismissing him from his post and, moreover (according to General Pau's evidence before the subsequent court-martial), sent Pau to Maubeuge with instructions to have him shot. Pau, however, was satisfied with what he saw and the decree was cancelled. Thus the defence was morally disorganized from the start, and the collapse of Liége and Namur, both fortresses of concrete and armour, before the 42-cm. and 30·5-cm. howitzers of the enemy, made it evident that resistance could not be maintained for long even before a German patrol had appeared. Finally, the retreat of the French V. Army on the right of the place and of the British forces on the left of it, left Maubeuge exposed to the very form of attack which, officially, it was not expected to meet —investment and regular siege. Owing to its control of rail communications, however, it was important to hold Maubeuge for as long as possible, and the Government gave no instructions relieving the fortress commander of his legal liabilities.

On their side, the Germans, as they pressed on in pursuit of the French and British field forces, at first gave little attention to Maubeuge. A slender cordon of investment was put round it by the first troops which came up, but responsibility for this investment was passed from hand to hand for several days till finally Gen. von Zwehl, with half his VII. Res. Corps (14th Res. Div.) and a brigade of the VII. Active Corps, was left in charge of the operation. It was estimated that the French garrison numbered 7,000; in reality its strength was 40,000 to 45,000. For their part the French seemed to have been equally ignorant of the strength of the investing force, which at first was not more than 10,000.

The plan of attack, proposed by the artillery general who had reduced Liége and Namur, and adopted by von Zwehl, was a main attack on the north-east point (Salemagne Work–Fort Boussois) and a succeeding attack south of the Sambre on Rocq Work and Fort Cerfontaine. The method was that of pure bombardment accompanied by a careful advance of the infantry as close to the objective as possible and followed by assault after the ruin of the defences. But its application was in this instance limited by two factors, the numerical weakness of the besiegers and the shortage of ammunition for the siege artillery, and during the progress of the siege there were several differences of opinion as to procedure between the commander, the artillery general and the engineer general concerned. Thus the record of this siege, as compared with those of Liége and Namur where ammunition could be poured out, is one of slow, careful and somewhat hesitating advance, and it was this principally which enabled the place, in spite of its technical weaknesses, to hold out longer than either of the Belgian fortresses.

The loose investment which had begun on Aug. 25 was first regularized, but the forces available only allowed of the west front being watched by a few squadrons of cavalry in the Autnois region, and the line of defence in front of the siege artillery emplacements scarcely extended far enough north to give adequate protection to the most important of the batteries, viz. the 42-cm., placed near Givry. But, as it turned out, no *coup* was attempted by the garrison, and the siege artillery was gradually put in position east of the fortress during Aug. 28–31, batteries opening fire successively. It formed two main groups north of the Sambre and a scattered group south of it. The 42-cm. battery and two German 30·5-cm. batteries and one battery of medium guns were S.E. of Givry; two Austrian 30·5-cm. batteries, one (afterwards two) of 21-cm. howitzers, and three of medium guns and howitzers, between Erquelinnes, Peissant, Merbes-en-Chateau; and two 21-cm. batteries (afterwards one) and one of medium guns in the wooded valleys south of the Sambre.

Owing to shortage of ammunition, these siege batteries fired only slowly during Aug. 30, while the French from other forts and interval-batteries fired now heavily, now not at all, with the purpose of confusing the ideas of the attack and perhaps enticing the Germans into a premature assault; in this object they very nearly succeeded on Aug. 31 when the German artillery general urged von Zwehl to storm at once. In the end however, von Zwehl declined the proposal. The second division of his VII. Res. Corps (the 13th Res.), hitherto detained at Liége against the contingency of insurrections, only began to arrive piecemeal on Aug. 31 and it had to be used chiefly to complete the investment on the west side. Moreover, he was continually being pressed to give up the brigade borrowed from the II. Army, notably at the time of the battle of Guise when that army was in difficulties. Including this brigade, and all forces of the 13th Res. Div. which had arrived before the end of the siege, the final infantry strength of the siege force was no more than 27 battalions, which were distributed (unequally, of course) over a perimeter of some 60 kilometres.

The bold policy of Namur was obviously impossible here, and the guns were allowed to continue their slow bombardment till the works should be reported as beyond question "storm-ripe." Till the arrival of two aeroplanes on Sept. 2, no definite idea was obtained either of the damage caused by the bombardment or of the internal dispositions of the enemy whose sorties, on Sept. 1, though repulsed, were an additional incentive to caution in the attack procedure. Even on Sept. 3, when it had become known from air observation that Fort Boussois and Salemagne Work were badly damaged, no drastic action was taken.

On Sept. 4, however, the siege entered on a new phase. Calls from the II. Army on the Marne for the return of the borrowed brigade and, even more, reports of the landing of a great army of Russians at Ostend—the latter so convincing that at one time it was under consideration to give up the siege altogether—showed von Zwehl that he must force the issue. Accordingly, on Sept. 5 the German infantry was launched to the assault of Bersillies and Salemagne works, which were carried, and pushed close up to Fort Boussois, in front of which heavy trench mortars were emplaced during the night of Sept. 5–6. A secondary attack on Rocq Work, south of the Sambre, was repulsed. Next day, Sept. 6, Fort Boussois and Rocq Work were stormed, and a general advance was begun from the front Bersillies–Rocq toward Maubeuge while the siege artillery changed positions forward. The resistance of the retiring French infantry however was stubborn, and von Zwehl suspended further penetration till the forts on either side of the breach should have been reduced, viz. Les Sarts, Héronfontaine and Leveau on the N. and N.E. fronts and Cerfontaine on the south-west. Thanks to the arrival of a second battery of 42-cm. guns (on railway mountings) from Mons, and to the expenditure of almost the last rounds of the 42-cm. and 30·5-cm. at Givry (the 21-cm. ammunition was already exhausted), all these works were in the hands of the Germans in the early afternoon of Sept. 7. Thereupon Fournier, the *moral* of whose troops had been completely broken down by a week's bombardment, surrendered with some 40,000 men, plus 377 guns, just as von Zwehl received a peremptory order from von Bülow to send the 29th Infantry Brigade south at once.

The resistance of Maubeuge had lasted for 9 days (counting from the opening of the bombardment), longer than that of Liége or Namur and nearly as long as that of Antwerp, and had kept five brigades of active and reserve infantry occupied during the critical days of the battle of the Marne. If the duration of the defence was due largely to the weakness of the attack, and notably to the shortage of siege ammunition, it must not be forgotten on the other hand that the majority of the forts were completely antiquated, and that the troops of the mobile defence consisted in the main of men of the older and oldest classes, unsuited to field service. General Fournier, after being subjected to bitter persecution, was brought to trial by a court-martial early in 1920 and completely exonerated.

After the surrender, the Germans decided not to retain Maubeuge as a *point d'appui*, and blew up all the works.

(C. F. A.)

MAUDE, CYRIL (1862–), English actor (*see* 17.904*), produced *Rip Van Winkle* at the Playhouse, London, in 1911, and *The Headmaster* in 1913. Between 1911 and 1919 he acted, largely in America, where he played in *Rip Van Winkle, Grumpy, The Headmaster, Lord Richard in the Pantry* and other modern comedies. He returned to London in 1919 and established himself at the Criterion theatre.

MAUDE, SIR (FREDERICK) STANLEY (1864–1917), British general, son of Gen. Sir Frederick Maude, V.C., was born at Gibraltar June 24 1864. Educated at Eton, he entered the Coldstream Guards in 1884, and early in the following year proceeded with his battalion to Suakin and took part in the operations undertaken in connexion with the contemplated Suakin-Berber railway. He was battalion adjutant from 1888 to 1892, married Cecil, daughter of The Rt. Hon. Col. T. E. Taylor in 1893, and joined the Staff College in 1895. On completion of the course he became brigade-major in the Home District, which post he held till the end of 1899, when he was sent out to South

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** These figures indicate the volume and page number of the previous article.*

Africa. As brigade-major of the Guards Brigade there he took part in Lord Roberts' advance from Cape Colony to Bloemfontein, in the advance to Pretoria, and in the subsequent advance by Belfast to Komati Poort. The brigade moved to the Orange river in the latter part of 1900, and Maude was for some time on the staff in that region before proceeding, early in 1901, to Canada as military secretary to the governor-general. For his services in South Africa he was given the D.S.O. He remained in Canada till 1895, receiving the C.M.G., and then returned to regimental and staff service at home. He took an active part as a lieutenant-colonel on the staff, in the development of the organization and training of the new Territorial Force. He was appointed to the War Office in 1909 as a full colonel, and was transferred to the staff of the 3rd Division at the Curragh in 1912, but was recalled to the War Office early in 1914 and, on mobilization in Aug., was posted to the staff of the III. Army Corps. He served with his corps on the Aisne and during its transfer north to Flanders, and then commanded the 14th Brigade with signal success until June 1915, having been wounded and given the C.B. in April. Promoted major-general for distinguished service, he was hurried out to the Dardanelles in Aug. to take up command of the 13th Division. There he played a conspicuous part in the successful evacuations of Suvla and of Helles, and on its being decided early in 1916 to dispatch a British division from Egypt to Mesopotamia to aid in the relief of Kut, his was chosen. They arrived in time to bear a share in the final desperate endeavours to save the doomed stronghold but the effort came to naught and after the surrender of Kut, Maude and his division remained facing the Turks on the Tigris. He had shown himself to be a skilful and resolute leader of men and was in July appointed commander of the army corps constituting the forces at the front, to be advanced in Sept. to the position of army-commander in Mesopotamia.

Realizing that victory in this theatre of war must hinge on effective organization and adequate preparation, Maude, who had been given the K.C.B., spent three months at Basrah, ensuring that when the time came his field army should be capable of acting with vigour and decision. Then, when all was ready early in Dec., he suddenly pushed forward and within a few weeks had driven the Turks in confusion out of their entrenched camp around Kut. Moving relentlessly on and making great captures he occupied Bagdad March 11. This memorable achievement he followed up by trenchant operations, which rapidly secured him a considerable area around the city and inflicted a succession of damaging strokes against the enemy, so that by May his forces could settle down in security for the hot weather. He was rewarded by promotion to lieutenant-general.

His genius for administration and grasp of military requirements were constantly in evidence during the ensuing summer. While interesting himself closely in the welfare of his troops and assuring his communications with the Persian Gulf, he was framing plans for a fresh offensive as soon as the season should become suitable. This had, however, only just made a promising commencement when, to the consternation of his army, over which he had gained a remarkable personal ascendancy, he was struck down by cholera and died at Bagdad Nov. 18 1917. His record since 1914 had been that of a great soldier. As a brigadier and divisional commander he had won to an unusual extent the confidence of superiors and subordinates. As an army commander, operating in a region that offered extraordinary difficulties to the conduct of warfare on a great scale, he had made strategy and administration move hand in hand and had framed and carried into execution plans of campaign at once comprehensive, judicious and bold. His conquest of Mesopotamia and his transformation of a depressing situation into one of signal triumph ranks as one of the finest feats in modern military history.

See *Life* by Maj.-Gen. Sir C. E. Callwell (1920).

MAUDSLEY, HENRY (1835–1918), English physiologist, was born at Thorne, near Settle, Yorks., Feb. 5 1835. He was educated at Giggleswick and at University College hospital, London, taking his M.D. degree in 1857. From 1862 to 1878 he edited the *Journal of Mental Science*, and from 1869 to 1879 he was professor of medical jurisprudence in University College, London. Amongst his published works were *Responsibility in Mental Disease* (1874); *Physiology of Mind* (1876); *Pathology of Mind* (1879); *Body and Will* (1883); *Life in Mind and Conduct* (1902); *Organic to Human* (1916). The views expressed in all his writings were those of medical materialism. In 1908 he gave a sum of £30,000 to the London County Council Asylums Committee to be devoted to the study of mental science. He died at Bushey Heath, Herts., Jan. 23 1918.

MAUNOURY, MICHEL JOSEPH (1847–), French general, was born at Maintenon (Eure-et-Loir) Dec. 11 1847. His family, long established on the soil, is said to have given devoted assistance to Pasteur in his researches on animal chemistry. Entering the École Polytechnique in 1867, and commissioned to the artillery in 1869, he took part in the war of 1870, and at the battle of Champigny he won the Legion of Honour. In 1874 he became captain, in 1881 he entered the staff college, and in 1883 was appointed to the staff of St. Cyr. In 1897 he became colonel, in 1901 general of brigade and in 1906 general of division. His career had been unusually varied; in addition to regimental service in all ranks of the artillery, both field and fortress, he had served on the technical artillery committee, the powders committee, and the military education commission, and had been deputy chief of the general staff at the War Office and director of the École de Guerre. Lastly, as a corps commander he had been placed at the head of the famous frontier corps, the XX., stationed at Nancy. He retired in 1912 on reaching the age limit, his last appointment being as military governor of Paris and a member of the Conseil Supérieur de la Guerre, formed of generals designated for army commands in war.

Shortly after mobilization in Aug. 1914 he was recalled to the active list, and appointed, practically on the field of battle, to command the improvised "Army of Lorraine," with which he won the battle of Aug. 25 on the Othain line—a remarkable success in the midst of disaster. But his pursuit of the Germans was stopped by the break-up of his army on the evening of victory. Maunoury himself and certain of his units, reinforced by others, were dispatched to the region of Montdidier–Amiens, and became the VI. Army, which, remaining outside the sweep of the German advance, found itself on Sept. 4 in the positions N.E. of Paris from which it was launched against the flank of von Kluck's I. Army. In the battle of the Marne the duel of Maunoury and von Kluck was the turning-point. Maunoury continued to command the army during the development of the Aisne line of battle towards the sea, and in the first phases of trench warfare. But on March 15 1915 he was severely wounded, and subsequently had no active command. From Nov. 1915 to March 1916 he was governor of Paris.

MAURITIUS (*see* 17.912).—At the 1911 census the pop. (exclusive of the dependencies of the colony) was 370,393, of whom 222,361 were Indo-Mauritians, that is descendants of Indian immigrants. There were 35,526 other Indians and 3,662 Chinese. The "general population," *i.e.* persons of European, African or mixed descent, numbered 108,844. There was a decrease of 2,232 inhabitants compared with the 1901 census, the first decrease recorded since the 1841 census. In Jan. 1920 the estimated pop. was 364,493. This was a decrease of 12,320 compared with the previous year, a result largely attributed to an epidemic of influenza in May–July 1919, which caused the death of over 11,000 persons. Port Louis, the capital, had 50,060 inhabitants in 1911.

The period 1910–20 was one of marked prosperity in Mauritius, and also of continued dependence on one crop—sugar. The official report for 1911 recorded that the sugar crop of 1909–10 was the largest and most valuable, and the revenue higher than in any previous year; the official report for 1919 again recorded an increase in the volume of trade unprecedented in the history of the colony and a revenue also in excess of that received in any previous year.

The following figures give particulars of trade, revenue and shipping for 1910, 1915 and 1919. The currency is in rupees.

Value of external trade: 1910, exports 37,109,000 Rs., imports 37,545,000 Rs.; 1915, exports 56,220,000 Rs.; imports 48,063,000 Rs.; 1919, exports 127,806,000 Rs., imports 47,037,000 Rs.

Revenue and expenditure (the financial year ends June 30): 1910, revenue 10,799,000 Rs., expenditure 9,449,000 Rs.; 1915, revenue 12,113,000 Rs., expenditure 12,136,000 Rs.; 1919, revenue 13,813,000 Rs., expenditure 14,711,000 Rs.

Shipping: Tonnage entered and cleared 1910, British 763,000, total 986,000; 1915, British 564,000, total 763,000; 1919, British 509,000, total 648,000.

In normal years before the World War the bulk of the sugar crop went to Indian markets, though when there was a failure of the beet-sugar crop large quantities of Mauritius sugar were diverted to Europe. Thus in 1910 France took 51 tons of sugar from the island, but in 1911 the quantity rose to 19,500 tons. Exports to Australia, formerly about a third of the total crop, had fallen in 1911 to 1,500 tons owing to Queensland becoming a sugar-producing country. The development of the Natal sugar estates had also, by 1914, deprived Mauritius of the South African market. On the outbreak of the World War the British Government purchased the bulk of the island's sugar, and this purchase was repeated in the four succeeding years. The high state of efficiency of the industry, largely the result of the exertions for many years of Mr. P. Bouâme, director of the agricultural station at Le Reduit, enabled the British Government to obtain the supplies required, both in quality and quantity. As to quantity, the sugar crop in 1910–1 had been 214,000 metric tons, in 1918–9 it was 252,000 tons. In 1919 the high-water mark of production was recorded to have been reached. Practically the whole area, some 180,000 ac., suitable for cane-growing was under cultivation. Over a third of the sugar estates are held by small planters, of whom the great majority are of Indian origin.

The British Government purchased the sugar at the world's ruling prices and during the war the planters grew very rich. The value of the crops in the period 1915–9 was nearly double its pre-war price. Many planters invested their profits in the development of new plantations in Natal, Réunion and Madagascar. A coöperative scheme was also launched with the object of enabling planters to sell their produce in the best market instead of having, as before the war, to depend mainly on the Indian markets. The Government for its part devoted 20,000,000 Rs. to improvements of the harbour of Port Louis and in irrigation and sanitation works. Mauritius suffered but slightly from the general economic depression of 1920–1. Socially there was progress in well-being; labour troubles were unknown, and education increased. Many of the European planters sent their sons to England to be educated. Some progress too was made in developing subsidiary industries, though nothing great had been achieved by 1921, and Mauritius remained almost entirely dependent on imports for food. The imports came mainly from India (rice, flour, etc.), the United Kingdom (textiles and machinery), and from South Africa (coal, wine, maize). The share of foreign countries in the external trade was about 25 per cent.

Politically the period 1910–21 was marked by cordial coöperation between the people and the administration. Sir Cavendish Boyle was succeeded as governor in Nov. 1911 by Major (afterwards Sir) John R. Chancellor (b. 1870), who had served with distinction in the Tirah expedition (1897–8), and in other campaigns and had been secretary to the Imperial Defence Committee. Sir John Chancellor paid particular attention to local feeling, as did his successor, Sir Hesketh Bell, who became governor in May 1916 on Sir John Chancellor's transference to Trinidad. The influence of leading Mauritians such as Dr. Eugène Laurent (11 years in succession mayor of Port Louis), Sir Henry Leclézio and Sir Célicourt Antelme, as well as that of the leaders of the Indians, was successfully directed to the improvement of social and economic conditions. The island helped liberally both in men and money in the World War and as late as 1921 a Mauritian Volunteer Battalion was on active service in Mesopotamia.

During the Peace Conference in Paris (1919) a small section of the Creole population (that is, the Europeans of French descent) started an agitation for the retrocession of the island to France. They had not the sympathy of the majority of the French-speaking inhabitants and opposition to the movement was organized under the leadership of Dr. Laurent and Mr. A. Duclos. At the elections to the Legislative Council held in Feb. 1921 all the candidates who advocated the retention of the British connexion were returned by large majorities.

See the annual reports issued by the Colonial Office, London; the *Mauritius Almanac*; A. Macmillan, *Mauritius Illustrated* (1914); D. E. Anderson, *The Epidemics of Mauritius, with a descriptive and historical account of the Island* (1918); P. Carie, "L'île Maurice" *La Geog.* vol. lii., (1919); R. E. Hart, *Les Volontaires Mauriciens aux armées* (1919), and the report of the Mauritius Royal Commission (Cd. 5186) issued in 1910, a valuable guide to the economic condition of the island. (F. R. C.)

MAX (OF BADEN), PRINCE (1867–), was born on June 10 1867 at Baden-Baden, the son of Prince William of Baden. As the nearest agnate to the reigning Grand Duke, of whom he was a cousin twice removed, he was heir presumptive to the grand-ducal throne. He studied law and then entered the army, in which he attained the rank of lieutenant-general on quitting the service in 1911. On the outbreak of the World War he was promoted to the honorary rank of general of the cavalry. From 1907 to 1918 he was president of the First Chamber of the Baden Diet. His family had always had English friends, and during the war Prince Max played a useful part behind the scenes in helping to improve conditions for English prisoners in Germany. He played a similar part on behalf of German prisoners, especially in Russia, where he was able to obtain some amelioration of their treatment. On Oct. 3 1918, when the old régime was already tottering to its fall and the German armies in France were being driven back towards the frontier, he was appointed Imperial Chancellor, partly no doubt because of the moderating rôle he had adopted earlier in the war when the probability of peace was being discussed. It fell to his lot to initiate the negotiations for the Armistice, and also to carry through in hot haste those alterations in the old constitution which had long been demanded by the Liberals and the Socialists, but which now came too late to avert the fate of the empire and the Prussian Monarchy. It also became his duty to put pressure upon the Emperor in order to induce him to abdicate. As the Imperial decision was delayed from day to day and the revolution became imminent, he had to take it upon himself to declare, on Nov. 9 1918, the abdication of William II. as German Emperor and as King of Prussia. For a moment it seemed as if he were about to assume the regency, perhaps on behalf of the Crown Prince's eldest son, a young boy, but the hopelessness of such an expedient having become apparent he handed over the control of the Government (Nov. 10) to the majority Socialist leader Ebert, who became the president of the German Reich. The sincerity of Prince Max's liberalism came into question after a private letter full of anti-democratic sentiments, which during the war he had addressed to his cousin Prince Alexander Hohenlohe, had been published by the latter in the Swiss press. He continued after the revolution to publish occasional articles dealing with the situation in Germany before the revolution, and in particular with Ludendorff's action in urging the Government on Oct. 1 1918 to ask for an immediate armistice, and then eight days later, after they had acted in that sense, endeavouring to persuade them that the matter was no longer urgent. He continued, after the abdication of the Grand Duke, to reside at Karlsruhe.

MAX, ADOLPHE (1869–), burgomaster of Brussels at the outbreak of the World War, was born at Brussels Dec. 31 1869, and was educated at the university of his native city. He entered the legal profession, also doing journalistic work, and at the age of 25 was appointed provincial counsel for Brabant, becoming communal counsel in 1903. After serving as magistrate, he was elected burgomaster of Brussels Dec. 6 1909, and distinguished himself by his administrative qualities. In Aug. 1914 M. Max showed the greatest coolness and did his best to calm the populace. On Aug. 20 he met the German army as it approached Brussels, and protested against the conditions imposed by the conquerors on the city. He succeeded in inducing the Germans to abandon that clause of the terms by which the burgomaster, the communal counsel and one hundred citizens were required to surrender themselves as hostages. He refused to sign a convention requiring that he should perform his duties only under the authority of the military governor of Brussels, and reserved to himself the rights of a free agent. The same day he charged his fellow-citizens to keep the national flag flying on their houses. Some of his public announcements became famous, notably that of Aug. 30, in which he gave a formal denial to a false statement of the German governor of Liége, and that of Sept. 16, in which he attempted to calm those of the inhabitants who had been ordered to remove the national flag from their houses. The latter ended with the words "Attendons patiemment l'heure de la réparation." The same evening he was arrested, and though soon released, was again arrested on Sept. 26 owing to a difference with the German authorities as to the amount of the war levy to be paid by the city of Brussels. He was sent to Namur, thence to Cologne and various other towns, being finally sent to Berlin (Oct. 1916), where he was closely confined. On Oct. 30 1918 he was interned at Goslar, whence he escaped on Nov. 13. He was received at Brussels with extraordinary enthusiasm; he was appointed a minister of state, named in a national order of the day, and was elected a member of the Académie Royale de Belgique and vice-president of the Conseil Supérieur du Congo. In 1919 he was elected to the Chamber of Representatives.

MAXIM, SIR HIRAM STEVENS (1841–1916), Anglo-American engineer and inventor (*see* 17.918), died in London Nov.24 1916.

His younger brother, HUDSON MAXIM (1853–), was born Feb. 3 1853 and educated at the Maine Wesleyan Seminary at Kent's Hill, Me. He began life in a printing and publishing business, but in 1888 took up the ordnance and explosives work in which his brother was interested, and invented a smokeless powder called "maximite," the formula of which he sold to the U.S. Government in 1901. He afterwards produced "stabillite," another smokeless powder, as well as "motorite," a self-combustive material for driving automobile torpedoes, and a special form of torpedo-ram. In Sept. 1915 he was made a member of the Naval Consulting Board. He published *The Science of Poetry and the Philosophy of Language* (1910); *Defenseless America* (1915) and *Dynamite Stories* (1916).

MAXWELL, SIR JOHN GRENFELL (1859–), British general, was born July 11 1859. He joined the army in 1879. He served in Egypt in 1882 and in the Nile expedition of 1884–5 and was then seconded to serve with the Egyptian army, with which he spent many years, taking part in all its successive campaigns against the forces of the Mahdi, and finally commanding a brigade during the advances up the Nile (1896–8) which closed with the reoccupation of Khartum; this gave him the rank of full colonel in the British army. He served on the staff during the S. African War and was given the K.C.B. and C.M.G. for his services. He subsequently filled important staff appointments, was promoted major-general in 1906, and was in command of the British troops in Egypt from 1908 to 1912.

A lieutenant-general on the outbreak of the World War, he acted for a few weeks as liaison officer with the French headquarters and was then sent out to take charge of the forces which were arriving in Egypt from the United Kingdom, India and Australasia. Egypt during the months following represented at once a vast depot and training centre, a base for the army in the Gallipoli Peninsula, and a theatre of war in itself, seeing that the Turks threatened the country from the east and the Senussi from the west. His responsibilities were wide and varied, and, in so far as the security of the Nile Delta was concerned, his defensive measures were most successful, as the one serious advance which the Turks attempted was beaten off decisively. He was given the K.C.M.G. for his services and returned to England in March 1916. The Irish rebellion broke out a few weeks later, and Maxwell was thereupon entrusted with the command of the troops in Ireland. He remained there until the autumn, and then was given command of the Northern District in England, which he held for two years. He was promoted full general in 1919.

MAYBRICK, MICHAEL (1841–1913), English singer and composer, was born at Liverpool Jan. 31 1841. He was educated at Liverpool, and studied singing in Italy and Germany, subsequently appearing with great success as a baritone singer in England. It was as a composer of popular songs, however, under the *nom-de-plume* of "Stephen Adams," that he became best known, his most popular works being *Nancy Lee*, *The Star of Bethlehem*, *The Holy City*, *A Warrior Bold*, *Long Live the King*, etc. He died at Buxton Aug. 26 1913.

MAYO, HENRY THOMAS (1856–), American naval officer, was born at Burlington, Vt., Dec. 8 1856. He graduated from the U.S. Naval Academy in 1876 and after passing through the usual stages of promotion became captain in 1908. From 1911 to 1913 he was commandant of the Mare Island navy yard and in the latter year was promoted to rear-admiral. In 1915 he was given the rank of vice-admiral and was in command of the squadrons of the Atlantic Fleet. The following year he was promoted to admiral and made commander-in-chief of the Atlantic Fleet, which position he held during America's participation in the World War. In 1918 he visited England, France and Italy on a tour of inspection. In 1919 his rank reverted to that of rear-admiral.

MAYO, WILLIAM JAMES (1861–), American surgeon, was born at Le Sueur, Minn., June 29 1861. His father, William Worrall Mayo, migrated when a boy from England to America, studied medicine, and served as surgeon at several army posts before settling at Rochester, Minnesota. Here the son, after graduating in medicine from the university of Michigan in 1883, began the practice of surgery. A small hospital was organized under the local branch of the Sisters of St. Francis, the outgrowth of which was St. Mary's hospital. Here he and his younger brother, Charles Horace, developed the Mayo Clinic (organized 1889), which became famous throughout the world for the number and success of operations performed. The elder brother was elected president of the Minnesota State Medical Society in 1895, and in 1907 was appointed a regent of the university of Minnesota. He was elected president of the Society for Clinical Surgery in 1911 and the following year president of the American Surgical Association. On America's entrance into the World War he was appointed colonel in the Medical Corps, U.S. army, and chief consultant for surgical service. In 1919 he was awarded the D.S.M.

CHARLES HORACE MAYO (1865–), American surgeon, was born at Rochester, Minn., July 19 1865. After studying at Northwestern University and the Chicago Medical College (M.D. 1888), he began the practice of surgery at Rochester, Minn., and with his brother became surgeon at the Mayo Clinic. He was elected president of the Minnesota State Medical Society in 1905, president of the surgical section of the International Tuberculosis Congress in 1908, and president of the American Medical Association in 1916. He was appointed Mayo Foundation professor of surgery in 1915. During 1917–8 he was president of the examining board of applicants for commissions in the Medical Corps, having supervision over several states, including Minnesota. In 1918 he was appointed colonel in the Medical Corps and for a year was associate chief consultant for surgical service. Beginning with 1912, graduate courses in medicine were offered at the Mayo Clinic in Rochester. Early in 1915 the Mayo Foundation for Medical Education and Research was incorporated, and to it the brothers gave $1,500,000. In June of the same year, by mutual agreement, the funds and resources of the Foundation were placed under the direction of the regents of the university of Minnesota for promoting "graduate work in medicine and research in this field." On Sept. 13 1917 the Foundation, with its fully-equipped staff, laboratories, and clinics in Rochester, became a department of the university.

MAYOR, JOHN EYTON BICKERSTETH (1825–1910), English classical scholar (*see* 17.937), died at Cambridge Dec. 1 1910.

His brother, JOSEPH BICKERSTETH MAYOR (1828–1916), died at Kingston Hill, Surrey, Nov. 29 1916.

MEATH, REGINALD BRABAZON, 12TH EARL OF (1841–), British philanthropist, was born July 31 1841 in London. He was educated at Eton and in Germany, and in 1863 became a clerk in the Foreign Office. In 1868 he entered the diplomatic service and was sent to Berlin, leaving Germany for The Hague in 1870. From 1871 to 1873 he was in Paris after the conclusion of the Franco-Prussian War. Subsequently he devoted himself to various philanthropic and municipal undertakings in Ireland and London. In 1879 he became the first chairman of the Young Men's Friendly Society; he also became chairman of the Metropolitan Public Gardens Assn., and was founder of the Empire Day movement. His publications include *Social Arrows* (1886); *Social Aims* (1893); *Great Britain in Europe* (1901); *Great Britain in Asia* (1905); *Imperial and Social Subjects* (1906).

MECCA (*see* 17.950), the great Holy City of Islam and capital of the Hejaz, had a resident pop. in 1916 estimated at about 70,000, including some 12,000 Indians. The annual pilgrimage brings normally at least 200,000 visitors to the city, of whom pilgrims from British India and the Malay States number as many as 25,000. Pilgrims from Egypt, by way of the quarantine station of Tor, numbered 14,500 in 1913, decreasing to 84 in 1914. During the early stages of the Arab revolt in 1916 the pilgrimages practically ceased from all parts; on their partial resumption in 1916–7 about 58,000 pilgrims arrived, mostly by way of Jidda, the Hejaz railway at that time being held by the Turks and the caravan roads across the peninsula by way of Jebel Shammar being unsafe. Communication between Mecca and Medina was interrupted from June 1916 until Jan. 1919 (when the Turks surrendered Medina), so that the visit to the Haram of the latter city—not strictly forming part of the pilgrimage—could not be performed during that period. On the capture of Mecca at the outbreak of the Arab revolt in 1916, the Turks opened fire with their artillery on the Great Mosque, and Sherif Husein indicted them, in his proclamation dated 25 Sha'ban 1334 A.H., with having done material damage to the *kiswa* and Ka'ba.

The geographical position of Mecca was observed during war operations but was not fixed precisely, some further adjustments being necessary. The general aspect of the city had changed but little, though some modern buildings had sprung up; there were a number of stately residences, including the new king's palace of six storeys, and there is a considerable display of wealth. The sanitation of the city had made progress under the insistence of the King, and the water-supply, previously in a deplorable condition, had been improved. Much more strict hygienic precautions were reported to have been taken during pilgrimages. Some improvement had been effected in the Meccan postal and telegraphic arrangements, the Hejaz having become a member of the International Postal Union with its own issue of stamps, printed (1920) in Cairo. There was telegraphic communication between Mecca and Jidda, and between Mecca and Taif, the summer residence of the King 75 m. S.E. Before the war a weekly paper, *El Hejaz*, was published in Turkish and Arabic; a new weekly, *El Kibla*, was founded as the organ of the Government after the declaration of independence (1916), and a Hejaz agency was established at Cairo.

MECHNIKOV, ILYA [ELIAS] (1845–1916), Russian biologist, was born in the province of Kharkov May 15 1845. His father was an officer of the Imperial Guard and his mother was a Jewess. At the age of 17 he entered the Kharkov University and two years later went to Germany for further biological training. In 1867 he returned to Russia and took his degree in zoölogy both at Odessa and Petrograd, becoming professor ordinarius of zoölogy and comparative anatomy at Odessa. In 1882 he went to Messina and there began his studies into the nature and habits of microbes. Henceforth he devoted himself to pathological study and in 1888 went to Pasteur in Paris, who encouraged him and gave him a laboratory in the École Normale. By 1892 his views on the essential importance of phagocytosis were firmly established. In that year he published *The Comparative Pathology of Inflammation*, followed in 1901 by his chief work, *Immunity in Infectious Diseases*, and a more popular treatise, *The Nature of Man* (1903). In later years he made a special study of the bacteria infesting the alimentary canal of man, and recommended a diet of sour milk. He was an hon. D.Sc. of Cambridge and Copley medallist of the Royal Society, a member of the Institute of France and of the Academy of Sciences of Petrograd, and in 1908 was awarded the Nobel prize for the benefits his researches had conferred upon humanity. He died in Paris July 16 1916.

See *Life* by his wife, Olga Mechnikov (1920), trans. by Mrs. R. L. Devonshire (1921).

MEDALS AND DECORATIONS (*see* 18.2; 15.860).—In the present article an account is given of British, American and other war medals and decorations created between 1910 and 1921, of new orders of knighthood considered as service decorations, and of changes in the insignia and the eligibility conditions of orders, decorations and medals existing in 1910.

I.—British War Medals of the Period 1910–4

Before the war several new medals, as well as new issues of, and new clasps to, existing medals were authorized.

A new issue of the *African general service medal* was authorized in 1916 under Army Order 89 of 1916, bearing the effigy and titular legend of King George V. on the obverse. The conditions of award were similar to the old medal. Clasps: "East Africa 1913," "East Africa 1913–14," "East Africa 1914," "Shimber Berris 1914–15," "Nyasaland 1915," "Jubaland 1917–18," "East Africa 1918," "Somaliland 1920." Those already in possession of King Edward VII.'s medal received the bars only.

A new issue of the *India general service medal* of 1908 with the effigy of King George V. on the obverse, was made for later Indian frontier services. The clasp "Abor 1911–12" was authorized for the troops who took part in the Abor expedition of 1911–2 and the clasp "Afghanistan N.W. Frontier 1919" for service in the Afghan War of 1919.

The *Natal 1906 silver medal* was granted by the Natal Government in 1908 to all those who took part in suppressing the native revolt of 1906. Obverse: bust of King Edward VII. Reverse: an erect female figure representing Natal with the sword of justice in her right hand and a palm branch in the left, standing on a heap of native arms and supported by Britannia who holds the orb of empire in her left hand. In the background a group of natives with the sun bursting forth from behind the clouds. A clasp inscribed "1906" was issued with the medal. Ribbon: red with black edges.

The *Antarctic medal* was awarded to members of (1) Sir Ernest Shackleton's expedition of 1907 with clasp "Antarctic 1907–1909"; (2) Capt. R. F. Scott's expedition with clasp "Antarctic 1910–1913"; (3) the Mawson expedition 1912 with clasp "Antarctic 1912"; (4) Sir Ernest Shackleton's Imperial trans-Antarctic expedition of 1914–6 with clasp "Antarctic 1914–1916." The medal in bronze was granted to the crews of various relief ships at different dates, and is a separate decoration, which can be held in addition to the silver medal.

In 1915 a *naval general service medal* was awarded by King George V. for service in minor naval operations, whether in the nature of belligerency or police, of sufficient importance to justify the award of a medal where no other medal would be appropriate. Obverse: the head of King George V. in naval uniform. Reverse: a representation of Britannia and two sea-horses travelling through the sea. A clasp, "Persian Gulf 1909–1914," was authorized when this medal was established, for issue to officers and men of His Majesty's ships engaged in the suppression of arms traffic in the Persian Gulf. Ribbon: white with crimson borders and two crimson stripes.

A new *Khedive's Sudan medal*, having effect from 1910, was awarded by the Khedive in 1911. Obverse: the cypher of the Khedive and the date in Arabic. Reverse: a lion with forepaws resting upon a panel bearing the word "Sudan." Below, an oval native shield and spears. In the background the river Nile with palm trees and the rising sun. Clasps: "Atwot," "S. Kordofan 1910," "Sudan 1912," "Zeraf 1913–14," "Mongalla 1915–16," "Darfur 1916," "Fasher," "Lau-Nuer," "Atwot 1918." The medal without bar was given to troops engaged in operations in the Matong Mts., Mongalla, in 1916; and at various times the medal in bronze without the bar was awarded to certain classes of civilian followers.

II.—British World War Medals

The issue of medals commemorating service in the World War is naturally the widest ever recorded. The long duration of the war, the fact that almost every part of the civilized world was involved in it, the great numbers of men and women taken into war service in different capacities, and to some extent popular feeling at different periods during and after the war, resulted in somewhat different principles from those of the past being observed in rewarding war service, all the more so as the conventional idea of "campaign" and "battle" ceased in a great measure to afford a guide in laying down regulations. Thus, in addition to the British general services war medal common to all who served in a theatre of war, the Allied and Associated Powers agreed upon a common medal to commemorate the united effort, and, within the British forces, the characteristic services of the original Expeditionary Force, of the men of the Territorial Force who had undertaken obligations and training in peace, of the war volunteers who formed the new armies of 1914–5 and of the mercantile marine were each recognized by the grant, under certain conditions, of a particular star or medal.

The stars and medals awarded and the general conditions qualifying for award are as follows:—

(1) *1914 Star.*—Awarded by King George V. under Army Order 350 of 1917. This decoration is a four-pointed star in bright bronze on which are superimposed two crossed swords and a laurel wreath. In the centre a scroll with the inscription "Aug. 1914 Nov." Ribbon: red, white and blue, shaded and watered. Granted to all officers, warrant officers, non-commissioned officers and men of the British and Indian forces, including civilian medical practitioners, nursing sisters, nurses and others employed with military hospitals,

who actually served in France or Belgium, on the establishment of a unit of the British Expeditionary Force, between Aug. 5 1914 and midnight of Nov. 22–23 1914.

The star was also granted to officers and men of the Royal Navy, Royal Marines, Royal Naval Air Service, Royal Naval Reserve and Royal Naval Volunteer Reserve who actually served in France or Belgium on the establishment of a unit landed for service on shore between the same dates. By Army Order 361 of 1919, a clasp to the star was authorized for issue to personnel of the naval and military forces who were actually present on duty within range of the enemy's mobile artillery and who were borne on the strength of certain specified units. The clasp is of bronze and bears the inscription "5th Aug.–22nd Nov. 1914." When only the ribbon of this star is worn in service or undress uniform, the possession of the bar is denoted by a small silver rose affixed to the centre of the ribbon.

(2) *1914–5 Star.*—Awarded by King George V. under Army Order 20 of 1919. This decoration is a bronze star, similar in shape and general design to the 1914 star, except that the inscription on the scroll is 1914–15, the words Aug. and Nov. being omitted. Ribbon: identical with that of the 1914 star. Granted to all personnel of the British, Dominion, Colonial and Indian forces, including civilian medical practitioners, nursing sisters, nurses and others employed with military hospitals who actually served on the establishment of a unit of the military forces in certain specified theatres of war between Aug. 5 1914 and Dec. 31 1915. These theatres of war comprised every locality in which troops of the British Empire were engaged against Germany and her allies during the period in question, with the exception that France and Belgium did not constitute a theatre of war for the award of this star till subsequent to midnight Nov. 22–23 1914. Individuals who earned the 1914 star are not eligible for the 1914–15 star.

The star was also granted to (*a*) all officers and men of the Royal Navy, Royal Marines, Royal Naval Air Service, Royal Naval Reserve, Royal Naval Volunteer Reserve, Royal Indian Marine and Dominion Naval Forces, who were mobilized and served at sea, or on shore within the specified theatres of military operations; (*b*) trained pilots and observers and men of the Royal Naval Air Service employed in flying from naval air-stations on overseas patrols; (*c*) mercantile marine officers and men serving under special naval engagements; (*d*) canteen staffs who served in a ship of war at sea.

(3) *British War Medal 1914–1918.*—Awarded by King George V. under Army Order 266 of 1919. Obverse: the effigy of the King. Reverse: a representation of St. George on horseback trampling underfoot the eagle shield of the Central Powers. A skull and crossbones in the foreground. Above, the rising sun of victory. The ribbon has an orange watered centre with stripes of white and black at each side and with borders of royal blue. Granted to record the bringing of the war to a successful conclusion and in recognition of the arduous services rendered by H.M. forces.

The medal in silver was awarded to the following classes who either entered a theatre of war on duty, or who left their places of residence and rendered approved service overseas, other than the waters dividing the different parts of the United Kingdom, between Aug. 5 1914 and Nov. 11 1918, both dates inclusive. (*a*) Officers, warrant officers, attested non-commissioned officers and men of the British, Dominion, Colonial and Indian military forces. (*b*) Members of women's formations, who were enrolled under a direct contract of service for service with H.M. Imperial Forces. (*c*) All who served on staffs of military hospitals and all members of recognized organizations who actually handled sick and wounded. (*d*) Members of duly recognized and authorized organizations. (*e*) Enrolled and attested followers on the establishment of units of the Indian army.

The medal in bronze was granted to all British subjects who were enrolled in native labour corps and who served in theatres of war. The medal was granted to the R.A.F. under similar conditions and also to personnel of the force who (i.) were actively engaged in the air against the enemy whilst borne on the strength of an operational unit in Great Britain; (ii.) were employed in flying new aircraft to France; (iii.) were on an aircraft-carrying ship.

The navy also participated in the grant of this medal, but the main condition of award differed in that it was given to all naval personnel who performed 28 days' mobilized service, or lost their lives in active operations before completing that period, between Aug. 5 1914 and Nov. 11 1918. The medal was also granted to personnel of the mercantile marine who served at sea for not less than six months between Aug. 4 1914 and Nov. 11 1918.

(4) *Victory Medal.*—This medal was the outcome of a meeting between the Allied and Associated Powers in Paris in March 1919, when it was agreed that in order to obviate the interchange of commemorative war medals, a medal should be instituted, called the Victory Medal, which should be of similar design for all the Allied and Associated countries, but that the conditions of award should be laid down by each Government. It was arranged that the obverse should represent a winged figure of Victory, full length in the middle of the medal, and full face; on the reverse an inscription "The Great War for Civilization" translated into different languages. The ribbon is identical for all countries and is red in the centre, with yellow, green and violet on either side shaded to form two rainbows.

The British issue authorized under Army Order 301 of 1919 conforms to the lines laid down at the Paris meeting and is of light bronze attached to the ribbon by a ring. When first manufactured, the medal was of dull bronze which proved unsatisfactory and the few which had already been distributed were recalled as far as possible, though doubtless a few still remain in private hands. It was granted to (1) the usual classes of military personnel who actually served on the establishment of a unit in certain specified theatres of war; (2) naval personnel who were mobilized or rendered approved service either at sea between midnight Aug. 4–5 1914 and midnight Nov. 11–12 1918, or on the establishment of a unit within a theatre of military operations; (3) personnel of the R.A.F. under similar conditions to the army and with the same additions as already specified for the British War Medal. No clasps were issued with this medal but a small bronze oak leaf is worn on the ribbon by personnel of the naval, military and air forces, who were mentioned in despatches by a commander in the field.

(5) *Territorial Force War Medal.*—Awarded by King George V. under Army Order 143 of 1920: granted to members of the Territorial Force or Territorial Force Nursing Service who volunteered for service overseas on or before Sept. 30 1914 and who, having been passed as physically fit for service overseas between Aug. 4 and Sept. 30 1914, rendered such service during the war 1914–8, provided that (*a*) they were serving with the Territorial Force before Aug. 4 1914, or (*b*) had completed a period of not less than four years' service with the Territorial Force before Aug. 4 1914 and rejoined that force on or before Sept. 30 1914. Members of the force who qualified for the award of the 1914 or 1914–5 stars were not eligible for this medal. Ribbon: broad yellow centre flanked on each side by a narrow green stripe; yellow edges.

(6) *Mercantile Marine War Medal.*—Awarded in 1919 by King George V. The medal is of bronze. Obverse: effigy of King George V. Reverse: a merchant steamer in a rough sea with a sailing-ship and a sinking submarine in the background. Ribbon: red and green with a central stripe of white; granted to personnel of the mercantile marine who qualified for the British War Medal, and who, in addition, served at sea on at least one voyage through a danger zone; also to those who, whilst serving at sea, were captured by the enemy or lost their lives through enemy action or were precluded by disablement through enemy action from further service at sea, before being able to complete their qualifying service for one of the medals.

III.—War Medals of the United States, France, Italy and Japan

The war medals issued by the United States prior to 1910 are described at 18.18. The part played by the United States in the war against Germany in 1917–8 is commemorated by the American issue of the Victory Medal, which is granted to military personnel who served on active duty in the army of the United States at any time between April 6 1917 and Nov. 11 1918. The medal is also given to those who served in Siberia or European Russia subsequent to Nov. 11 1918. It is interesting to note that a series of battle clasps has been awarded for wearing on the ribbon of this medal, the United States being the only country which in 1921 sanctioned the issue of battle clasps. They are divided into two classes: (1) those given for certain major operations, and (2) those given for the occupation of a defensive sector; only one of the latter class is given to any one individual. A small bronze star is worn on the ribbon in service dress uniform for each major operation clasp. For each citation of an officer or man for gallantry in action not warranting the award of a Medal of Honor or a Distinguished Service Cross, a small silver star is worn on the ribbon.

In the number of commemorative war medals France comes second to Great Britain. They are as follows:—

(1) *St. Helena Medal.*—A bronze medal granted in 1857 to all survivors of the soldiers and sailors who took part in the wars lasting from 1792 to 1815. Obverse: effigy of Napoleon I. Reverse: the inscription "*Campagnes de 1792 à 1815. A ses compagnons de gloire, sa dernière pensée. Sainte Hélène, 5 Mai 1821.*" Ribbon: green with narrow red stripes.

(2) *Medal for Italy, 1859.*—A silver medal granted in 1859 to all who took part in the war against Austria in Italy in that year. Obverse: effigy of Napoleon III. Reverse: the names of the following battles: "Montebello," "Palestro," "Turbigo," "Magenta," "Marignan," "Solferino," and the words "*Campagne d'Italie, 1859.*" Ribbon: red with narrow white stripes.

(3) *China Medal 1861.*—A silver medal granted in 1861 to those who took part in the China expedition of 1860. Obverse: effigy of Napoleon III. Reverse: the names "Ta-kon," "Chang Kia Wan," "Pa-li-Kao," "Pe-King" and the legend "*Expédition de Chine 1860.*" Ribbon: yellow, with an inscription in Chinese characters.

(4) *Mexico Medal 1862–3.*—A silver medal awarded in 1863 to those who took part in the expedition to Mexico in 1862–3. Obverse: effigy of Napoleon III. Reverse: the names "Cumbres," "Cerro-Borrégo," "San Lorenzo," "Puebla," "Mexico" and the legend

"*Expédition du Mexique, 1862–3.*" Ribbon: white with two diagonal stripes of red and green. In the centre a brown eagle and a green snake.

(5) *Tonkin Medal 1883–93.*—Instituted in 1885 and granted to all those who took part in operations in French China and neighbouring states between 1883–93. Obverse: female head of the Republic. Reverse: the legend "Tonkin, Chine, Annam, 1883–1885" and an inscription "Santay," "Bac-Ninh," "Fou-Tchéou," "Formose," "Tuyen-Quan," "Pescadores." The naval medal also bears the inscription "Cau-Giấi" in addition. Ribbon: yellow, with broad green stripes.

(6) *Madagascar Medal.*—A silver medal first granted in 1886 to those who took part in the Madagascar campaign of 1885. Obverse: female head of the Republic. Reverse: the words "Madagascar 1885–1886." A second medal, similar in design but with the date 1895 on the reverse, was given for the campaign of 1894–5. Those in possession of the first medal were granted a bar only with the date. Ribbon: pale blue and green horizontal stripes.

(7) *Dahomey Medal.*—A silver medal granted in 1892 to those who took part in the Dahomey and Sudan campaigns in previous years. Obverse: female head of the Republic. Reverse: the word "Dahomey." Ribbon: yellow with four broad maroon stripes.

(8) *Colonial Medal 1893.*—A silver medal instituted in 1893 and granted to all who took part in operations in French colonies and protectorates. It is the counterpart of the British general service medals. Obverse: female head of the Republic. Reverse: the terrestrial globe on a trophy of flags with the words "*Médaille Coloniale.*" A bar is always worn on the ribbon supporting the medal, showing the service for which it was awarded. Four gold and numerous silver bars have been issued. Ribbon: pale blue with a broad white stripe in the centre and a narrow one at each end.

(9) *Morocco Medal 1909.*—A silver medal granted in 1909 as a general service medal for operations in Morocco. Obverse: female head of the Republic. Reverse: a military design with the word "Maroc." Numerous bars have been awarded. Ribbon: green with a broad white stripe in the centre and a narrow one at each end.

(10) *Medal for War of 1870–71.*—A bronze medal awarded in 1911 to all survivors of the war 1870–1. Obverse: the usual head of the Republic. Reverse: a trophy of arms surmounted by a standard; on a plaque the words "*Aux Défenseurs de la Patrie.*" At the top the date 1870–1871. Volunteers who served with the army and navy during the war received in addition a silver bar inscribed "*Engagé Volontaire.*" Ribbon: dark green with four black stripes.

(11) The *World War of 1914–8* was commemorated by the issue of the Victory Medal previously described. The conditions of award differ somewhat to those of other countries, it being granted only to various grades of military personnel, nursing sisters and others who served for a minimum period of three months at the front. Naval personnel are also eligible for this medal.

Italy has issued various war medals to commemorate her campaigns, chief among which may be mentioned the Garibaldi Medal of 1860, the Africa War Medal of 1894, the China Medal of 1900–1 and the Libyan War Medal of 1911. The World War is commemorated by the Italian issue of the Victory Medal.

Japan.—The principal commemorative medals are:—(1) Medal for Russo-Japanese War of 1904–5. This medal is of light bronze. Obverse: crossed naval and military flags with the Imperial cypher between them. On the reverse a wreath. (2) Medal for war against Germany 1914–8. This medal is of almost black bronze and the design is very similar to that of the previous medal. Ribbon: dark blue with a broad white stripe in the centre. It is awarded to all naval and military personnel who served during the war. (3) The Japanese Victory Medal; also awarded for the war 1914–8 but confined to naval and military personnel who actually took part in active operations against the enemy.

IV.—British Personal Decorations

Although all war medals are awarded in a sense individually and personally, it is convenient to regard as personal in a more limited sense an award to an individual either of a "decoration" or of membership of an order, for special acts of gallantry or devotion, and for distinguished and meritorious services performed by him or her.

In 15.851 the principal British orders of knighthood are treated as such. In their other aspect, as rewards for service, they are here assimilated to "decorations," which are awards which do not imply membership of an association. This is because, in fact, the majority of orders are now constituted on a service basis; that is, membership is limited to those who have acquired a claim to it by service, and is itself the reward of that service. Its badges and distinctions are *de facto* decorations.

In the World War, appointments to the orders of the Bath, St. Michael and St. George, the Indian Empire, and the Star of India, which had long been essentially service orders, were made in all classes on an enlarged scale, corresponding to the wide extension which State service, both military and civil, assumed. The same applies to the Distinguished Service Order.

During the war itself two new orders were founded, that of the Companions of Honour, and that of the British Empire. Between 1910 and 1914 the following decorations were founded:

The *Indian Distinguished Service Medal*, 1907.—Instituted in 1907 for rewarding distinguished service in the field of Indian commissioned and non-commissioned officers and men of the Indian regular forces, the reserve of the Indian army, border militia and levies, military police and imperial service troops employed under the Indian Government. In 1917 the grant of the medal was extended to Indian non-combatants engaged on field service and the issue of clasps authorized. Obverse: the effigy of the reigning sovereign. Reverse: a laurel wreath with the words "For Distinguished Service." Ribbon: blue with a maroon centre.

The *Egyptian Medal for Bravery*, 1913.—A silver medal established in 1913 by the Khedive. Awarded to non-commissioned officers and men of the Egyptian army who distinguish themselves in action. It is equivalent to the British Distinguished Conduct Medal. Obverse: the cypher of the Khedive. Reverse: the words "For Bravery" in English and Arabic. Ribbon: light blue unwatered.

It is convenient here to state the changes which took place after 1910 in decorations already existing.

The *Victoria Cross.*—Native officers and men of the Indian army were made eligible for the award of the V.C. in 1912. Previously they had only been eligible for the Indian Order of Merit for gallant deeds in action. In 1918 the blue ribbon of the naval V.C. was abolished and the red ribbon made universal for the navy, army, and R.A.F.; and in undress and service dress uniform a miniature of the decoration was authorized to be worn on the ribbon.

A gratuity of £20 on discharge or an addition to pension of 6d. *per diem* is now given to N.C.O.'s and men who have been awarded the *Distinguished Conduct Medal.*

In Oct. 1914, the name of the *Conspicuous Service Cross* was altered to the *Distinguished Service Cross*, and its award was extended to all naval and marine officers below the relative rank of lieutenant-commander, for meritorious or distinguished services which may not be sufficient to warrant the appointment of such officers to the *Distinguished Service Order.* Bars were also awarded.

In 1915, a second class of the order of the *Royal Red Cross* was instituted, and the award of both classes was restricted to those who were actually engaged in nursing duties. The award of a bar to the first class was authorized in 1917. The cross of the first class is of gold, pattée convexed, enamelled red, edged with gold, having on the arms the words Faith, Hope, Charity, and the date 1883. In the centre, in relief, is the royal effigy. Reverse: the royal and imperial crown and cypher. The cross of the second class is of the same shape and size, but is of frosted silver and has superimposed upon it a Maltese cross enamelled red, of about half the size of the cross itself; in the centre, in relief, the royal effigy.

The *Territorial Officers' Decoration* is awarded to officers of the Territorial Force who have completed 20 years' commissioned service in that force, or in its predecessor, the Volunteer Force, and are recommended for the award. It is an oval wreath of silver having in its centre the royal cypher in silver-gilt. The ribbon is green with a broad yellow centre. The period of war service is, under certain conditions, credited as double for the award. The *Territorial Force Efficiency Medal* was established as a reward for efficient service for other ranks; it is the equivalent of the former volunteer long-service medal, the higher efficiency requirements of the Territorial Force being recognized by a reduction in the period of qualifying service from 20 years to 12. The ribbon of this medal, originally similar to that of the T.D. but narrower, was later altered to one of green with yellow edges.

The ribbons of the *Long Service and Good Conduct* (*Army*) medal and the *Meritorious Service Medal* were in 1916 changed to crimson with white edges, in order to distinguish them from that of the Victoria Cross. A further change in 1918 was the addition of a central white stripe to the Meritorious Service Medal to distinguish it from the Long Service Medal. In 1916 the award of the Meritorious Service Medal was extended to all ranks below sergeant.

In 1917 the designations of the Albert medals (sea and land) of the first and second class were altered respectively to "The Albert Medal in Gold" and "The Albert Medal."

The orders and decorations newly founded in the World War period are as follows:—

The *Order of the Companions of Honour* was instituted in June 1917 and consists of the sovereign and one class of members. Not more than 50 persons, men or women who have rendered distinguished service of national importance, are admitted. The badge of the order is oval-shaped, consisting of a gold medallion with an oak tree; hanging from one branch is a shield of the royal arms, and on the right an armed knight in full armour, mounted on a horse. The badge has a blue border with the motto "In action faithful and in honour clear" in gold letters and is surmounted by the imperial crown. The ribbon is carmine with borders of gold thread.

The *Most Excellent Order of the British Empire* was instituted in June 1917 to reward war services in all capacities, military and civil. In 1918, in order to mark the distinction between awards for civilian and military services, a military division of the order was created. Broadly speaking, it may be said that the military division is conferred on military personnel for distinguished service other than gallantry in action during war. The order is divided into five classes. The badge of the first, second, third and fourth classes consists of a silver-gilt cross, that of the fifth class being executed in silver. Members of the first and second classes wear a star on the left breast in addition. A silver medal of the order can also be awarded to those persons, not being members of the order, whose services to the Empire warrant such recognition. The ribbon is plain purple, that of the military division being distinguished by a narrow red line down the centre.

The *Distinguished Service Medal.*—Established in Oct. 1914 by King George V. Obverse: the effigy of King George V. in naval uniform. Reverse: the words "For Distinguished Service," surmounted by a crown and encircled by a wreath of laurel. Ribbon: blue with two broad white stripes in the centre. Awarded to petty officers and men of the Royal Navy, and non-commissioned officers and men of the Royal Marines and all other persons holding corresponding positions in the naval forces who may at any time show themselves to the fore in action and set an example of bravery and resource under fire, but without performing acts of such preëminent bravery as would render them eligible for the Conspicuous Gallantry Medal. Bars are awarded for further services.

The *Military Cross.*—Instituted in Dec. 1914 by royal warrant. It consists of an ornamental silver cross, on each arm of which is an imperial crown with the imperial cypher "G.R.I." in the centre. Bars are awarded for further services. It is awarded to military officers below the rank of major and to warrant officers in the army, Indian army, or Colonial forces. During the first two years after its institution, this decoration was not confined to service in action, but was also given in recognition of distinguished service at the base or with the administrative branches of the army in theatres of war. After 1916, however, it was confined to those whose services were thought worthy of recognition while under the fire of the enemy. Ribbon: white watered silk with a purple centre.

The *Military Medal.*—Instituted in March 1916 for award to non-commissioned officers and men of the army for individual or associated acts of bravery in the field. The medal is of silver. Obverse: the royal effigy. Reverse: the words "For bravery in the Field" encircled by a wreath and surmounted by the royal cypher and crown. Ribbon: dark blue having in the centre three white and two crimson stripes alternating. Bars are awarded for further acts of bravery in action. The award was subsequently extended to warrant officers and to women, the qualification for the last named being "For bravery and devotion under fire."

The *Distinguished Flying Cross.*—Instituted in 1918 for award to officers and warrant officers of the R.A.F. for acts of valour, courage, or devotion to duty performed while flying in active operations against the enemy. The cross is of silver, terminated in the horizontal and base bars with bombs, the upper bar terminating with a rose, surmounted by another cross composed of aeroplane propellers, charged in the centre with a roundel within a wreath of laurels a rose winged ensigned by an imperial crown, thereon the letters R.A.F. On the reverse the royal cypher above the date 1918, the whole attached to the clasp and ribbon by two stripes one-eighth of an inch wide running at an angle of 45° from left to right. Bars are awarded for further services.

The *Distinguished Flying Medal.*—Instituted in 1918 for award under similar conditions to the Distinguished Flying Cross, to non-commissioned officers and men of the R.A.F. The medal is of silver, oval-shaped, bearing on the obverse the royal effigy and on the reverse, within a wreath of laurel, a representation of Athena Nike seated on an aeroplane, a hawk rising from her right arm above the words "For Courage." The whole ensigned by a bomb attached to the clasp and ribbon by two wings. Ribbon: violet and white in alternate diagonal stripes one-sixteenth of an inch wide running at an angle of 45° from left to right. Bars are also awarded.

The *Air Force Cross.*—Instituted in 1918 for award to officers and warrant officers of the R.A.F. for acts of valour, courage or devotion to duty whilst flying, though not in active operations against the enemy, and also to individuals not belonging to the R.A.F. (whether naval, military or civil) who render distinguished service to aviation in actual flying. The cross is of silver and consists of a thunderbolt in the form of a cross, the arms conjoined by wings, the base bar terminating with a bomb, surmounted by another cross composed of aeroplane propellers, the four ends enscribed with the letters G.V.R.I. In the centre a roundel, thereon a representation of Hermes mounted on a hawk in flight bestowing a wreath. Reverse: the royal cypher above the date 1918. The whole ensigned by an imperial crown attached to the clasp and ribbon by two sprigs of laurel. Ribbon: red and white in alternate diagonal stripes one-eighth of an inch wide, running at an angle of 45° from left to right. Bars are awarded for further services.

The *Air Force Medal.*—Instituted in 1918 for award, under similar conditions to the Air Force Cross, to non-commissioned officers and men of the R.A.F. and to individuals not belonging to that force (whether naval, military or civil) who render distinguished service to aviation in actual flying. The medal is of silver, oval-shaped. Obverse: the royal effigy. Reverse: within a wreath of laurel a representation of Hermes mounted on a hawk in flight bestowing a wreath. The whole ensigned by a bomb attached to the clasp and ribbon by two wings. Ribbon: red and white in alternate diagonal stripes one-sixteenth of an inch wide running at an angle of 45° from left to right. Bars are awarded for further services.

The *Military Star of the Sultan Fouad.*—Instituted in 1919 for award to officers of the Egyptian army who are mentioned in despatches for merit or for distinguished services on the field of battle or before the enemy. It consists of a five-rayed star suspended from a straight clasp. The obverse is enamelled white, bordered gilt, with a gilt fillet in the centre of each ray. The centre is enamelled red and blue, upon which appears a garland of laurel, surrounding two crossed swords, and surmounted by the Sultan's crown, all in relief and gilt. The reverse is similar, but has in the centre a blue circle surrounded by a gold chaplet bearing in Arabic the inscription "The Military Star of the Sultan Fouad." Bars are awarded for further services. The ribbon is of five equal stripes of blue, chamois, black, chamois, blue.

V.—American and French Personal Decorations

The World War of 1917–8 caused the institution in the United States of four new service decorations in addition to the Congressional Medal of Honor reserved for acts of the highest bravery.

(1) *Distinguished Service Cross. Army.*—Instituted on Jan. 12 1918 for award to military personnel, including women, who distinguish themselves by extraordinary heroism in connexion with military operations against an armed enemy of the United States under circumstances which do not justify the award of the Medal of Honor. The cross is of bronze surcharged with the American spread eagle, and hangs from a blue ribbon with narrow white and red stripes at either edge. Beneath the eagle is a scroll bearing the words "For Valor." A bronze oak leaf is worn on the ribbon to denote a second award.

(2) *Distinguished Service Medal. Army.*—Instituted on Jan. 12 1918 for award to military personnel, including women, for exceptionally meritorious service to the Government in duty of great responsibility in time of war, or in connexion with military operations against an armed enemy of the United States. The medal is of bronze and bears on the obverse the coat-of-arms of the United States surrounded by a circular ribbon of blue enamel bearing the words "For Distinguished Service" and the date "MCMXVIII." Ribbon: scarlet, in the centre a broad stripe of white, with a narrow stripe of dark blue on each side of it. Further acts of bravery are denoted by a bronze oak leaf worn on the ribbon.

(3) *Distinguished Service Medal. Navy.*—Awarded to naval personnel who, since April 6 1917, distinguished themselves by exceptionally meritorious service to the Government in a duty of great responsibility. The medal is of bronze. Obverse: a foul anchor, placed perpendicularly; on the right a sprig of laurel. The words "Distinguished Service" in raised letters round the top circumference; in the background a squadron of ships with the sun rising over the horizon. Reverse: a plaque for the name of the recipient superimposed upon a sprig of laurel. The clasp for suspension from the ribbon shows the American eagle standing upon a scroll with the date "1917–18." Ribbon: blue with a central stripe of yellow. An emblem is worn on the ribbon to denote a second award. Enlisted or enrolled personnel who receive the medal are granted a monthly increase in pay of two dollars.

(4) *Navy Cross.*—Awarded to naval personnel for extraordinary heroism or distinguished service since April 6 1917 in cases not justifying the award of either the Medal of Honor or the Distinguished Service Medal. The decoration is a bronze cross patée convexed with points of laurel at the junction of the limbs. In the centre are crossed foul anchors and the letters "U.S.N." Ribbon: blue with a central narrow stripe of white. An emblem is worn on the ribbon to denote a second award. Enlisted or enrolled personnel who receive the cross are granted $2 a month increase in pay.

The principal personal decorations in France are as follows:—

The *Médaille Militaire.*—Established in 1852. It is only awarded to general officers in command of armies and to non-commissioned officers and men of the army and navy who specially distinguished themselves in action. The decoration is of rather complicated design. In the centre of the obverse is the gilt female head of the Republic on a roughened gilt ground, surrounded by a narrow band of blue enamel bearing the words "*Republique Française 1870*" in gilt letters. On the reverse "*Valeur et Discipline.*" Above the medal is a trophy of arms. Ribbon: orange with green edges.

The *Legion of Honour* is dealt with in 15.863.

The *Croix de Guerre.*—Established in 1915 to commemorate individual mentions in despatches during the war 1914–8. The cross was awarded to soldiers or sailors of all ranks, including officers, who were mentioned in orders of the day for an individual feat of arms. The different classes of orders (regimental, divisional, etc.) for which the cross was awarded are denoted by a bronze laurel branch or different kinds of stars attached to the ribbon, which is green with narrow red stripes.

VI.—PERSONAL DECORATIONS OF OTHER COUNTRIES

The revolution in Russia, Germany and Austria-Hungary closed the history of many of the older orders; but both those still existing and those which have ceased to exist were given largely for war services during the World War, and they are here briefly dealt with as decorations.

Italy.—The most important of the Italian service orders and decorations are as follows:—

(1) Medals for military valour.—These medals are awarded for special individual acts of bravery to both officers and men of the army and navy. The medals are of three classes, gold, silver and bronze, but the first is rare.

(2) *Cross for merit in war.*—A bronze cross bearing on one side the words "*Merito di Guerra*" surmounted by the royal crown and initials. Reverse: a star surrounded by rays. Awarded to those whose conduct has been meritorious for some considerable period during war, but who have not performed some exceptionally gallant action deserving of the medals for military valour.

(3) *Military Order of Savoy.*—Instituted in 1815, consisting of five classes. Awarded for specially distinguished services in war and for exceptional services in times of peace. The decoration consists of a cross resting on a wreath of laurel.

(4) *Order of the Crown of Italy.*—Established in 1868 to commemorate the annexation of Venetia and the unity of Italy. There are five classes. The badge consists of a gold cross patée convexed enamelled white, edged gold, with gold love knots between the limbs. In the centre on a blue enamelled plaque, edged gold, is a golden representation of the Iron Crown.

(5) *Order of Saint Maurice and Saint Lazarus.*—Founded in 1434. There are five classes. The badge consists of a Maltese cross, placed saltirewise, vert edged gold, with gold knobs on the points for St. Lazarus; surmounted by a cross botoné enamelled white, edged gold, for St. Maurice. The badge of the first four classes has the royal crown above it.

Russia.—(1) The *Order of St. George*, probably the best-known of all Russian decorations, was founded in 1769 by the Empress Catherine II. for rewarding distinguished bravery in action. It consists of a gold, white enamelled cross, patée, with, in the centre, a representation of St. George fighting the dragon. There are four different grades and the ribbon is orange and black. (2) *Order of St. Anne* (three classes and various medals); the cross is of crimson enamel and the ribbon carmine with narrow gold edges. (3) *Order of St. Stanislas* (three classes); cross, ribbon red and white. (4) *St. Vladimir* (four classes); cross, black enamel, ribbon red and black.

Serbia.—(1) *Order of the White Eagle.* Instituted in 1883, consisting of five classes: knight grand cross, grand officer, commander, officer and companion. The badge consists of a gold double-headed eagle surmounted by a crown. (2) *Order of St. Sava.* Instituted in 1883, consisting of five classes. Awarded principally in recognition of valuable sanitary and medical services with the army. (3) Medals for bravery. These are in gold and silver according to class.

Greece.—(1) *Order of the Redeemer.* Instituted in 1829, consisting of five classes: grand cross, grand officer, commander, officer and knight. (2) *Military Cross.* This is the highest award for services in the field. It was instituted in 1917 and consists of three classes.

Rumania.—(1) *Order of the Star of Rumania.* Instituted in 1877 to commemorate the participation of Rumania in the Russo-Turkish War. There are five classes: knights grand cross, knights commanders, commanders, officers and chevaliers. (2) *Order of the Crown.* Instituted in 1881. There are five classes as above.

Belgium.—(1) *Order of the Crown of Belgium.* Instituted in 1897 for honouring those who distinguish themselves in artistic, literary or scientific work; in industrial or commercial activity or by their devotion in works of African civilization. There are five classes of the order and a medal. (2) *Order of Leopold.* Instituted in 1832, consisting of five classes. This order is sometimes conferred upon military officers for service in the field. (3) *Croix de Guerre.* Instituted in 1915 for award to those who are mentioned in despatches and for acts of courage, devotion and valour on the field of battle.

Japan.—The principal Japanese military decoration is *The Order of the Golden Kite*, instituted in 1891 and awarded solely for acts of very distinguished bravery performed in action by officers and men of the army and navy. There are seven classes. It consists of an eight-pointed star edged with gold or silver according to class, upon which is placed a species of St. Andrew's cross in blue enamel. On the top of the decoration is a golden kite with wings spread. Ribbon: green, with a white stripe at each edge. The chief remaining decorations are *The Order of the Rising Sun* and *The Order of the Sacred Treasure* (women), but these are not confined to naval and military persons.

Germany.—While the orders of the various states (which were numerous) were conferred on individuals for war service, the principal decorations were, with one exception, Prussian decorations conferred by the emperor, in his capacity as king of Prussia, upon Germans of all federal states. These Prussian decorations which became in effect German were:—the order *Pour le Mérite* and the *Iron Cross.* The ribbon of both is black with white edging (the Prussian colours). The Iron Cross of the higher class was worn without a ribbon. One award was made of the *Iron Cross with gold star*, perhaps the rarest of all military decorations. This was to Field-Marshal von Hindenburg, and the only previous recipient had been Prince Blücher. Awards of the Iron Cross of 1914 were not made to those who held the Iron Cross of 1870, who received a bar instead. A decoration given for auxiliary war services, both to military and to civil personnel, was the *Verdienstkreuz für Kriegshilfe.* This, which though Prussian was regarded from the outset as purely a German decoration, is a cross in silver-grey metal with a ribbon of the German national colours—silver, with narrow black stripes and red and black edges. (R. E. F.)

MEDICAL EDUCATION (*see* 18.23).—To the reformer's zeal an impetus was lent by the World War in various fields, and in the domain of medical education it was still by no means easy in 1921 to estimate how far the changes that had been effected in the few preceding years had the quality of permanence. Of those changes two overshadow the rest, namely the introduction in 1920 of the Clinical Unit system into England, and the admission of women students to a number of London medical schools, which in that respect came into line with the practice of the great majority of provincial universities. Though these events were actually the outcome of many years of preparation, yet they partook more of the nature of tentative experiments than changes effected and wearing an air of finality. There was a desire to test in practice views long rooted in theory.

Great Britain.—The decision of some of the London schools to admit women students was largely in the nature of an emergency measure planned to meet the exigencies of the moment. These schools, deprived by the war of most of their male students, were led to look elsewhere for recruits. The experiment was first tried in a very tentative way by St. George's hospital, but early in 1916 St. Mary's hospital was thrown open to both sexes. In 1921 the London hospital, St. Mary's, University College hospital, King's College hospital, Charing Cross hospital, Westminster hospital and St. George's hospital all admitted women students. Some of these schools regarded this innovation as an experiment while others were committed to the policy of coeducation.

The Clinical Unit organization undoubtedly constitutes a fundamental modification of the system of medical education, which, arising out of the apprenticeship system, had come to be accepted as a sound and practical course of instruction. In the early days of the medical schools all the teaching, including chemistry, physics and biology, was carried out by the medical and surgical staff. The first subject to break away was chemistry, and in 1870–80 many of the schools engaged chemists to train their students in this subject. Later physics, and later still biology, followed suit. During 1900–20 the same change occurred in the teaching of physiology and anatomy, so that by 1921 the preliminary and intermediate subjects of the curriculum were taught by workers who devoted all their time to that purpose. This change has spread to the later subjects of the medical course, in response to the growing demands which developments in knowledge and technique make upon the time and equipment of teachers. In these proposals to create units there is therefore no rude break with tradition, but rather a step forward in the evolution of medical education forming a logical outcome of the whole trend of contemporary medical teaching and an inevitable sequel to the advances that have taken place in medicine and the allied sciences.

In 1908 grants in aid of medical education were made for the first time by the Board of Education, and with their general acceptance the autonomy of the schools, based on their financial independence, disappeared. It was clear from the first that schools which received a grant must submit to the policy of the Board of Education, and it was on that bedrock fact that the Royal Commission on University Education in London built. The report, published in 1913, indorsed the views of Mr. Abraham Flexner, set forth in his survey of "Medical Education in Europe" (1912), and was in substance, so far as it concerned medical education, an argument for the creation of clinical units. In England, in the provinces, and in Scotland the universities had had for many years the germ and often the essentials of clinical units, but in London, with its various medical schools loosely bound to a central university, this was not the case. But though the Board of Education were now in a position to carry out their policy, no further steps were taken, owing to the outbreak of war, until 1920. In that year clinical units in medicine and surgery were created at St. Bartholomew's hospital, St. Thomas' hospital, the London hospital and University College hospital. The Board of Education undertook, through the University Grants Committee, to defray three-quarters of the cost, the medical school furnishing the other quarter. At two of these schools the directors of the units were expected to devote all their time to the duties of their office and were debarred from private practice. Early in 1921 the London School of Medicine for Women applied for and secured recognition of a unit in gynaecology and obstetrics, the first appointment to be made in that branch of the curriculum, while a little later units in medicine and surgery were created and recognized at St. Mary's hospital, under the same conditions and financial clauses that governed the grants in aid of the first four schools. Subsequently the appointment of the directors was vested in the Senate of the London University, who became not only responsible for the selection of the professoriat, but required to be satisfied that he has an adequate number of assistants, a proper and effective out-patient department, that he is allotted the control of a sufficient number of beds, and that the laboratory accommodation allocated to the unit for research and pathological work is satisfactory.

The unit system is designed to secure that the latest advances in science affecting medicine should be continually brought to the teaching of the clinical subjects. To achieve that end the teachers must themselves actively engage in scientific research, and should be provided with proper equipment, an adequate number of assistants and sufficient leisure to prosecute researches. It is hoped to link up laboratory workers and clinicians and generally to introduce organization into clinical teaching, so that in the issue the defects of the older régime may be removed while its obvious merits are preserved.

A hopeful feature in the story of British medical education during 1910–20 was to be found in the provision of additional facilities for research, for which the Clinical Unit system and the Medical Research Council were jointly responsible. Together they have provided paid posts for the best of the younger men, in which during the waiting years the more hopeful may find opportunities of research and scientific activity. Apart from the higher standard that may reasonably be expected of candidates who are elected to hospital appointments after such opportunities, research and all that comes of it should benefit by a constant stream of recruits drawn from the more promising elements of each year.

The possibilities of clinical instruction that lie latent in the Poor Law infirmaries have long been known, but the difficulties in the way of throwing their wards open to students had proved insuperable until early in 1920 they were overcome by St. Mary's hospital. This hospital entered into an agreement with the Paddington Board of Guardians under the terms of which students belonging to that medical school are allowed to work in the wards of the infirmary. The hospital furnishes bacteriological and pathological services, and a consulting staff who visit the infirmary on appointed days every week, and who hold regular classes in the wards. The significance of such a step becomes plain since there are in London approximately three infirmary beds to every bed in voluntary hospitals with teaching schools attached. In this connexion the Voluntary Hospitals Committee, appointed in Jan. 1921, issued in June a report in which they put on record that they deemed it unfortunate that these institutions should hardly be used at all in the training of medical students, and recommended the extension of the arrangements existing between St. Mary's hospital and Paddington infirmary to other hospitals and infirmaries. If this were carried out, not only would the clinical material available for the purposes of undergraduate instruction be greatly increased, but a class of case would be seen by students at these institutions that is not admitted to the voluntary hospitals, so that a gap that had hitherto existed in the student's education would be filled.

With a search for new facilities for clinical study has gone a growing desire to remove from the student's path obstacles that appear to interfere at present with the true educational purpose of his training. Dissatisfaction with the existing examination system, which is never altogether absent, came to a head early in 1921 when a motion was brought before the Faculty of Medicine of the university of London asking for permission to hold internal examinations at certain medical schools, and that one of the two examiners should be the students' teacher. While there was point in many of the criticisms of the existing system, the feeling of the Faculty was that examinations should not be abolished nor so modified that they no longer provided adequate tests for granting a qualification which carries with it the right to practice, before an efficient substitute had been found for them, and the motion before the Faculty was accordingly defeated by a large majority. It was felt however that this was not the last word, and many held that a reform of the present examination system was overdue, that in its present condition that system exercised a baneful influence on the true educational purposes underlying the curriculum. On the other hand it appeared probable that many of the disadvantages laid at the door of the examination system were in fact due to the overcrowding of the curriculum. Subjects continue to be added to this, while much that is out of date or of little educational value is allowed to remain in the syllabus. While no sustained attempt has been made to unload the unwieldy vehicle which at present contains what the student is expected to carry away with him, there has been a growing tendency to consider and pave the way for ultimate reform, and these matters were in 1921 engaging the attention of the General Medical Council.

With regard to postgraduate instruction, the defects of the existing arrangements had been exposed and opinion was ripe for action. There was a consensus of opinion that undergraduate and postgraduate instruction cannot be combined at the same school, and that the facilities provided by hospitals in London not attached to medical schools were totally inadequate. The way had therefore been prepared for the report of the Committee on Postgraduate Instruction, of which Lord Athlone was chairman. In substance that report (June 1921) recommended that one of the London general hospitals, with at least 300 beds and proper modern equipment, should be set aside as a postgraduate centre. (C. M. Wi.)

United States.—In 1910 there were in existence in America approximately 150 medical schools, mostly in fact, if not in form, private ventures; even the few schools of high grade possessed meagre endowment and inadequate facilities. By a process of natural selection, the number of schools was rapidly reduced, having fallen in 1920 to approximately 85, and there were grounds for the belief that this number would in the near future be still further reduced. The organization, endowment, and facilities for instruction showed a notable advance. In 1910 few medical schools actually controlled the hospitals in which their teaching was done. Subsequently there was a distinct tendency to give the university medical schools exclusive and adequate control of hospital facilities for clinical teaching and research. Harvard, Yale, Washington, and other universities thus came into much more intimate relations with the hospitals in which the clinical staff teaches. The city of Cincinnati built one of the finest public hospitals in the United States, and amended the city charter so as to give the university of Cincinnati (a municipal institution) complete control of the hospital for the purposes of its medical school.

On the financial side public opinion was brought to realize that the university school of medicine is an expensive enterprise, for which large investments must be made by the public in both facilities and endowment. Mr. John D. Rockefeller gave the General Education Board approximately $35,000,000 to be used primarily for the purpose of coöperating with institutions in raising larger sums for the development of their medical schools, and the late Mr. Joseph R. DeLamar gave $5,000,000 each to the medical departments of Harvard, Columbia, and Johns Hopkins. Upwards of $10,000,000 was raised for the establishment of a new medical department at the university of Rochester, Rochester, N.Y., and $8,000,000 for the reorganization of the medical department of Vanderbilt University, Nashville, Tennessee. Many other endowed institutions also procured considerable sums for improved laboratory and teaching facilities. The current budgets of the state universities were similarly increased so as to enable the institutions to go forward in developing their medical schools correspondingly.

In respect to organization the main change in the decade was the introduction of the full-time plan corresponding to the English unit system in the teaching of the clinical subjects. The aim and purpose of this movement are the same in both countries, but in neither had sufficient time elapsed up to 1921 to allow a final verdict to be passed on the merits of the system. The complete satisfaction of the Johns Hopkins Medical School in the working of this plan is shown by the fact that the system, which originally included medicine, surgery, and pediatrics, was in 1920 extended so as to take in gynaecology and obstetrics. The system was also adopted in the main clinical branches by the medical departments of Washington University (St. Louis), Yale University, Vanderbilt University, university of Chicago, and the university of Rochester.

China.—Through a subsidiary board (the China Medical Board) the Rockefeller Foundation of New York has established in China a modern medical school. The Rockefeller Foundation has furnished funds amounting to $8,000,000 to build and equip the Pekin Union Medical College, and in addition it was in 1921 supporting the institution on the basis of a budget for the year amounting to $500,000. The institution furnishes two years of pre-medical work, and intended to develop a four-year medical course. In addition to the undergraduate training of Chinese physicians, it will provide graduate training, offers short courses for physicians in the field, and endeavours to extend in the Orient a popular knowledge of medicine and public health. The China Medical Board also aids four other medical schools in China carried on by other organizations.

Belgium.—The university of Brussels had in 1921 planned a complete reorganization of its medical department. The city, the State, and the university coöperated in maturing plans for a modern teaching hospital, and new, well-equipped laboratories on a single site. Approximately 100,000,000 francs was needed to finance the enterprise, of which 40,000,000 was pledged by the Rockefeller Foundation. (A. Fx.)

Canada.—There were in Canada eight medical colleges in 1921 giving a complete course leading to the degree in medicine. In every case the college forms a part of a university, and most of them are to be found in the eastern provinces. In the West only one university (Manitoba) gives a complete medical course, though the university of Alberta offers the first three years of a six-year course, her students as a rule finishing their work in one of the eastern universities. During the years 1910–21 there was a steady advance in standards in the medical curriculum. The four-year course, which followed a minimum entrance requirement of Junior matriculation, was first increased to five years and later to six years in most of the schools. The five-year course was planned partly to meet the demand for increased instruction in the so-called pre-medical sciences and partly to give more time for the clinical branches. Where this course is in force the first year is devoted to biology, chemistry and physics, the second and third years to anatomy, physiology, histology and embryology, physiological chemistry, pharmacology, pathology and bacteriology, the fourth and fifth years practically to the clinical subjects, namely, medicine, surgery, obstetrics and gynaecology with their various special branches. The increase to six years gives more time to the clinical subjects, and in addition enables the Faculties of at least some of the schools to offer certain electives or options. This latter plan gives to the better-class student an opportunity to graduate with more than the minimum requirements for the degree of M.D. The six-year course is given in certain of the schools entirely within the medical department, although the curriculum includes certain courses to be taken in the other Faculties. Other schools plan to require two years as a pre-medical requirement to the four-year course. These two years may be taken in any of the standard universities and must include biology, chemistry and physics. At least one school was in 1921 planning to add to the four-year course a hospital year, which must be taken before graduation. In most of the medical schools the regular course in medicine leads to the degree of M.D. or to the degree of M.D.-C.M. One school gives the degree of M.B. at the close of the regular course, with the M.D. one year later on presentation of a satisfactory thesis. The combined degrees of B.A.-M.D. or B.Sc.-M.D. may be obtained in practically all the schools in seven or eight years. A special degree of B.Sc. (Med.) may be obtained in two of the schools by a year of special work at any time after the third year of the regular course in medicine. (J. W. S.)

MEDICAL ENTOMOLOGY.—What used to be called comprehensively "economic" entomology is now more conveniently divided into two distinct branches—economic (*see* ECONOMIC ENTOMOLOGY) and medical. In its medical bearings the scope of entomology comprehends not insects only but arthropoda of every kind directly hurtful to health. Until about 1880 the fact that many arthropoda can bite and sting, and that some are troublesome parasites of man, was not thought important enough in medical practice to require special attention in their entomological aspect; but when in the last quarter of the 19th century the startling announcement was made that one of the commonest diseases of the tropics is propagated by a bloodsucking insect it was soon realized that light might be thrown on many obscure problems in the causation of infective disease by a precise knowledge of the arthropoda that come into contact with man. This illuminating doctrine was first opened out in 1879, when Sir Patrick Manson, at that time a plain medical practitioner in China, published the essential parts of an experimental proof that the parasitic worm which causes the disfiguring febrile and subfebrile diseases known collectively as filariasis is communicated from man to man by a common house-haunting mosquito. It is true that long before 1879 seasonal fevers in several parts of the world had been ascribed, not only in popular tradition but also by plausible argument, to the bites of insects, but these vague glimmerings of the truth had not been regarded very seriously, and Manson was the first to demonstrate, by verifiable experiment, that in such cases the insect plays an indispensable triple part, namely, (1) after infecting itself with parasites responsible for the fever by imbibing the blood of a human being infected with them, (2) to provide in its own organs and tissues the appropriate medium for the growth and development of the parasites so absorbed and finally (3) to carry the parasites so fostered to fresh human victims. The precise manner in which the filariated mosquito passes on its acquired infection was not settled by Manson, but his wonderful discovery originated that new branch of study where a full and exact knowledge of all the arthropoda that touch man in his person, his dwellings, and his food and drink, finds, as Medical Entomology, a rational application in the control of disease.

Subject-matter.—In dealing with the subject-matter of Medical Entomology it is convenient rather than severely logical to group the arthropoda inimical to health in five categories, according to the nature, the direct effects and the after consequences of their results, namely as (1) simply parasitic, (2) simply predaceous, (3) specifically infective, (4) contaminative and (5) venomous, the third and fourth being far the most important.

Simple Parasites.—Here are included all those arthropod parasites that are hurtful solely by their presence on or in the body and not by any subsequently disclosed effects. Such are the itch-mites (*Sarcoptes*) specific to man, and the numerous food-mites, animal-mites, bird-mites, insect-mites, harvest-mites, etc., which in certain circumstances or at particular seasons may attack man, though not normally parasitic on him or in every case parasitic at all in normal habit. Though they usually attack the epidermis these mites may get into the bowel, or the lung, or the bladder. Such also are those muscoid flies which in their maggot stage are constantly and entirely dependent on warm-blooded animals for their existence: two such species of maggots are notorious subcutaneous parasites of man, namely the "macaw worm" (*Dermatobia hominis*) in tropical America, and the "tumbu" (*Cordylobia anthropophaga*) in tropical Africa. Bluebottles, flesh-flies and other domestic flies, which normally deposit their eggs or larval progeny in decomposing meat and carrion, may be attracted for this purpose to foul and neglected wounds, or to the eyes, nostrils and other natural orifices of unclean or incapable humanity, with dire results: the "screw-worm" flies (*Cochliomyia* in America and *Chrysomyia* in India) are said to be particularly prone to this deplorably mistaken instinct. Living maggots of many species of flies may find a congenial abode in the human bowel, as also may larvae of other orders of insects. Other simple parasites of man are the "Chigger" flea (*Dermatophilus penetrans*) common in certain parts of tropical America and Africa, the pregnant female of which embeds herself in the skin; and the "Congo floor-maggot" (*Auchmeromyia*) of tropical Africa, a maggot which infests native huts like a bedbug and sucks the blood of sleeping people, though the parent fly is harmless. An abnormal and misdirected parasite that, in places where large snakes are numerous, may get encysted in the human viscera, is the larva of the extraordinary wormlike arthropod *Porocephalus*, the adult of which is a bloodthirsty inhabitant of the lungs of snakes.

Predaceous Arthropoda.—To this category may be relegated a miscellany of blood-sucking insects, etc., the bite of which may be painful or may even cause severe inflammation, but is not known to be followed by any specific infection apart from a chance of ordinary septic contamination as a result of scratching. Though there are times and places when these insects may be an intolerable burden to travellers or to country folk, they have no preference for human blood and no particular affection for houses. They cannot therefore be regarded as a standing menace to the public health, although they may be treated with a reasonable amount of suspicion, because some of them are known to spread specific infections among domestic stock, and also because they may be chance mechanical carriers of some individual contamination, or may have parasites proper to themselves which might possibly under certain circumstances be transferred to man. This suspicious assemblage includes many species of mosquitos and gadflies, a lot of midges (*Simulium, Psychoda, Culicoides,* etc.), and numerous species of muscoid flies (*Stomoxys, Haematobia, Lyperosia,* etc.) that usually feed on cattle; also various flies (*Leptidae, Asilidae,* etc.) that normally feed on other insects; and some kinds of plant bugs and leaf hoppers in which the thirst for blood is an aberration.

Specifically Infective Arthropoda.—The parasitic and predaceous forms so far enumerated are for the most part obnoxious rather than greatly dangerous, and the trouble they cause does not linger after their disappearance; but we have now to deal with an assortment of parasitic and predaceous arthropoda, which, by propagating microparasites pathogenic to man, cause ill effects that outweigh and outlast any direct damage that they themselves can inflict. Such arthropoda, having severally a definite biological association with a particular disease, and being specific "nurses" or intermediary hosts of the parasite actually causing the disease, are known as "carriers" or "vectors." Their function is beautifully exemplified in Sir Ronald Ross's great discovery of the way by which the parasites of malarial fevers are maintained and disseminated—a discovery which must here have precedence, not that it was historically the first of its kind, but because it was originally presented in a complete form and best illustrates the emergence of Medical Entomology as a distinct study.

Independently of Ross's investigations, it was known that the parasites multiplied periodically by non-sexual fission (*schizogony*) in the blood of malaria patients, and that they also gave issue to prospectively sexual bodies (*gametocytes*), male and female, which did not become ripe until after the blood had been withdrawn from the blood vessels; and it had been discovered by MacCallum that when the ripe sexual elements (*gametes*) did become revealed in the drawn blood the males and females paired together to form united couples or *zygotes;* it was known, in short, that while the parasites multiply non-sexually in the blood of the individual human sufferer, the process by which they are maintained as specific parasites of the human race must take place, somehow, outside the individual human host. Manson inferred, from his own earlier investigations of the filaria parasite, that it must be in the interior of some blood-sucking arthropod, probably a mosquito, and the arduous proof of this hypothesis was unravelled by Ross. Ross followed the parasites from the vertebrate host into the stomach of the mosquito, and thence into the insect's stomach wall, where the zygotes encyst and establish themselves as parasitic *oöcysts.* Under favourable conditions the oöcysts increase in size by the internal proliferation of their contents, and in about ten days ripen into *sporocysts*, full of minute spore elements or *sporozoites.* By the rupture of the sporocysts the sporozoites escape into the body cavity of the mosquito and accumulate considerably in its salivary glands, which also lie in the body cavity, so that when the now infective insect bites a healthy person the sporozoites are injected with its saliva into that person's blood, where they grow and multiply non-sexually, and after a definite interval usually reveal their presence in a paroxysm of malarial fever.

The mosquito thus is the medium for the necessary sexual reproduction of the malaria parasites; eventually the insect not only becomes a kind of supersporocyst at whose expense the actual sporocysts and their sporozoites are developed and nourished, but also acts as the locomotor instrument for distributing the sporozoites and planting them in their future sphere of action.

So far as is known, the only mosquitos that serve as nurses for the malaria parasites of man are mosquitos of the genus *Anopheles.* It can hardly be supposed that these parasites originated at the outset either in man or in *Anopheles* mosquitos. Kindred parasites inhabit the blood of other mammals as well as of birds and reptiles and are distributed by other kinds of blood-sucking insects, and it is reasonable to believe that all may have had a common origin and, up to a certain point, a common line of evolution, and that the species now adapted to man were derived, through the intermediation of *Anopheles* mosquitos, from forms whose evolution had been hammered out quite independently of the human race. Not every one of the many species of *Anopheles* is susceptible to infection, nor of the susceptible species are all equally so, or indifferently so under all conditions. Again, not all species of *Anopheles* are disposed to attack man, or to shelter in houses. Furthermore, although under favourable conditions the sexual development of the parasites in the mosquito is completed in about ten days, and although under ordinary circumstances the sporozoites would be discharged from the salivary glands of the infected insect in the course of a few bites, yet the sexual development may be much delayed by cold and other unfavourable conditions, and the salivary glands might remain infective for a long time if the insect remained inactive or torpid.

Ross's great work, which was experimentally elucidated with a common malaria parasite of birds, was the outcome of Manson's illuminative discovery of the necessary intermediation of mosquitos in propagating lymphatic filariasis, a disease, common in most tropical countries, caused by the invasion of the lymphatic system by the parasitic worm *Filaria bancrofti.* In certain phases of this disease the female worm gives issue to swarms of minute embryos, or microfilariae, which are carried into the patient's blood and are usually found in the superficial blood-vessels at night. Manson, in 1878, persuaded a Chinaman with microfilariae in his blood to suffer himself to be bitten by some common house mosquitos during sleep, and on examining the replete insects at intervals during a number of days following their infective repast he traced the ingested microfilariae through definite stages of larval development in the insects' stomach and muscles. Subsequent observers, of whom Dr. G. C. Low was the first to publish his investigations, discovered that the larval filariae find their way into the proboscis of the mosquito, whence on occasion offered they escape into the skin of a fresh human victim. More than a dozen species of mosquitos are now known to be capable of acting as intermediary host to the larvae of the worm of lymphatic filariasis.

Yellow fever is another disease which, so far as is known, is communicated from man to man exclusively by mosquitos of one species, namely, the notorious *Stegomyia fasciata.* The connexion between this characteristically house-haunting insect and the disease was inferred by Dr. Finlay of Havana in 1881, and was experimentally demonstrated by the U.S. Commission under Dr. Walter Reed in 1900. Here again, as in malaria and filariasis, the specific parasite of the disease must undergo a definite development within the insect, since the insect can become infected only if it feeds on a patient during the first three days of fever, and does not become infective until at least 12 days after so feeding.

Another disease spread in this way by mosquitoes is dengue fever. The actual virus of the disease has not yet been demonstrated, but there is good proof that it is transmitted from sick to healthy persons by two of the commonest house-haunting species of the tropics, namely *Stegomyia fasciata* and *Culex fatigans.*

Mosquitos may, possibly, spread other infections mechanically. Indeed they are known to be one of several kinds of flies that mechanically transport the eggs of the "macaw worm" (*Dermatobia hominis*) to its host. But such mechanical work is something different from the constant and indispensable biological accommodation which mosquitos alone provide for the parasites of filariasis, malarial fevers, and yellow fever, outside the human body.

Almost as notorious in recent history as the *Stegomyia* and *Anopheles* that at one time threatened to stop the construction of the Panama Canal are the tsetse flies, which, as intermediary hosts of the trypanosome parasites of sleeping-sickness, have depopulated certain parts of tropical Africa. These bloodthirsty insects, which constitute the genus *Glossina*, are akin to the stable-fly (*Stomoxys*), the house-fly, and the blow-fly, all being included in the great family of *Muscidae.* Except for one species, *Glossina tachinoides*, which ranges into the extreme south-western corner of Arabia, the entire genus *Glossina* is restricted to the torrid regions of the African continent. The trypanosome animalcules, which, so far as the species that cause disease in man and domestic animals in Africa are concerned, are associated mainly with tsetse flies, occur in the state of nature in the blood of all classes of vertebrate animals in most parts of the world; many, if not all, of the trypanosomes living naturally in the blood of wild animals appear to be harmless to their hosts, and it is perhaps because the trypanosomes that get into man and domestic animals, by the agency mainly of biting insects, are trypanosomes out of their proper place, that they are hurtful.

Recent investigations, beginning with the discovery made by Sir David Bruce in 1895 that the destructive "tsetse-fly disease" of domestic animals is due to a trypanosome parasite in the blood, have established the facts that there are two varieties of the human trypanosome disease known as sleeping-sickness, one predominant in equatorial Africa and transmitted mainly by *Glossina palpalis*, the other predominant in south-eastern tropical Africa and transmitted mainly by *Glossina morsitans;* that in both cases the respective trypanosome undergoes definite stages of development in the fly's gut and at last settles itself and continues to proliferate in the fly's salivary glands; and that a fly once infected remains infective by its saliva for the rest of its life. Thus in a general way the part taken by tsetse flies in spreading sleeping-sickness is similar to that taken by *Anopheles* in spreading malaria. But there is this difference: first, that the development of the trypanosome parasite in the tsetse fly is not actually known to have any sexual interpretation; and secondly, that although in epidemics of sleeping-sickness the fly derives its infection from human sufferers, yet in other circumstances it may possibly become infected from a wild animal, since trypanosomes morphologically indistinguishable from those that cause disease in man in Africa have been observed living naturally in some of the big game animals and also in the wild tsetse flies. The existence of these natural foci of possible—though not demonstrated—infection must enormously increase the difficulty of controlling sleeping-sickness. On the other hand, the laboratory experiments of Bruce and others have shown that only a small percentage of tsetse flies fed on infected blood take the infection. Finally it should be mentioned that there are some who still believe that in certain circumstances a tsetse fly may transfer infection from man to man mechanically on its proboscis.

In the instances reviewed so far a blood-sucking insect—mosquito or tsetse fly—acquires a specific infection while feeding, incubates it for a definite term during which infectivity is latent, and then at length transmits it, in the act of feeding, to another susceptible host. In this manner also *Conorhinus megistus* and other Reduviid bugs have been shown to transmit the trypanosome of Chagas's disease in South America, and in like manner the midge *Phlebotomus papatasii* is believed to transmit the virus of phlebotomus fever. In the same way, probably, as Manson suggested, the Tabanid flies *Chrysops dimidiata* and *salacea* in West Africa foster and transmit a filarial worm, *Filaria loa*, that is troublesome to man there. It is possible, too, that the *Leishmania* parasite of kala-azar is communicated from man to man in India, as W. S. Patton thinks, by the bedbug, and in the Mediterranean region, as others suppose, by fleas.

A specific infection acquired by a blood-sucking arthropod in feeding is not always passed on by means of the infected saliva: it may be communicated in its juices and excreta. It is in this way, as numerous observers have ascertained, that body lice infected by imbibing the blood of sufferers from typhus fever, relapsing fever, and trench fever usually transmit the respective virus to a fresh host who, in seeking relief from their presence by scratching, may crush them or rub their infected excrement into his broken skin; in the case of typhus the insect is said to transmit infection by its bite also. The part played by the fleas of rats and other rodents in epidemics of bubonic plague is similar, except that the original foci of infection are infected rodents. From these the fleas absorb the plague bacillus, which, as shown by the Indian Plague Commission, multiplies in their stomach and is voided with undiminished virulence in their excreta. Bacot and Martin have also shown that a flea may sometimes get its stomach so stuffed with the prolific bacilli that it may regurgitate some of them when biting a fresh victim.

A specific infection acquired by a bloodsucking arthropod is not always terminated in the individual: it may be bequeathed to the offspring. This has been shown by Dutton and Todd to be the course of events with the tick *Ornithodorus moubata*, which propagates the spirillum of the African variety of relapsing fever. Hereditary transmission of an acquired infection is said by Nicolle and other authorities to take place in lice with the spirillum of relapsing fever. Another aspect of the same phenomenon occurs in the case of the tick, *Dermatocentor venustus*, that serves as intermediary for the virus of the typhus-like disease known as Rocky Mountain spotted fever. Here, according to Ricketts, it is the minute larval tick that becomes infected, perhaps from natural foci of the infection in ground squirrels and various other local rodents, perhaps by inheritance. The larva, however, has to undergo many vicissitudes before it is transformed into an adult; accommodation has to be found on three different hosts, and in the case of *Dermatocentor venustus* these vicissitudes may be spun out for two years before the larva reaches the adult stage in which the virus subsisting in it can become infective to man. These inherited and postponed infections render preventive measures correspondingly tedious and difficult, even when there are no natural foci of infection to be reckoned with. The noxa of the exanthematous disease known as Japanese river fever, attributed to the bite of the "harvest-mite" larva of a velvet mite, is thought to be inherited by that larva.

Finally, a specific infection can be transmitted from man to man by the intermediation of an arthropod that is neither parasitic nor predaceous. This was shown by Fedshenko to be the case with the guinea-worm (*Dracunculus medinensis*), a subcutaneous parasite of man (and other animals) in certain warm parts of the globe. The embryos of the worm after being set free are ingested by and undergo a definite larval development in fresh-water copepod crustacea of the genus *Cyclops*, and man is infected by swallowing the infected *Cyclops* in unfiltered water. The ribbon-worm (*Dibothriocephalus latus*) is also thus fostered and disseminated by copepod crustacea, as has recently been explained by Janicki and Rosen; only in this case the infected copepods are first swallowed by a fresh-water fish in which the larval ribbon-worms develop still further before they get to man. In the Far East several species of fresh-water crabs harbour the cercaria stage of the lung fluke.

Contaminative Arthropoda.—It is necessary to discriminate between insects which, like *Anopheles* and *Glossina*, supply the indispensable frame for a particular pathogenic microörganism, and insects which, like house-flies, are casual but not necessary agents in the promiscuous dispersal of microbes of many kinds. Among insects of the latter sort, indiscriminately pollutive but not specifically infective, all common house pests, such as cockroaches, crickets, ants, domestic beetles and flies, must be included. By far the most dangerous of them—perhaps the most insidiously dangerous of all the insects that come into the medical purview—is the common house-fly, *Musca domestica*, by reason of its ubiquity, its fecundity, its persistent activity, and, above all, by the profane impartiality with which it distributes its attentions, now upon the purgamenta and faeculenta of the community, and now upon the kitchen, the larder and the refreshment-table. A house-fly may carry contamination on its feet, and so is said to spread purulent ophthalmia, anthrax and perhaps other infections. Or, after feeding upon infected excrement it may void the contents of its crop or its intestine into food or drink, and in this way house-flies have played their part in outbreaks of epidemic diarrhœa, typhoid fevers, bacillary dysentery and, perhaps, cholera, and may also disseminate eggs of intestinal worms and cysts of intestinal protozoa. It must not, however, be supposed that house-flies are always common carriers of all the germs they may pick up: much, fortunately, depends upon coexistent circumstances, and all germs cannot stand such rough and precarious transport.

It is possible that the beetles, moths, mites, etc., which in all parts of the world infest grain, meal, biscuit and dried provisions of all kinds, may at times so befoul and vitiate those commodities as to make them harmful as food though not actually spoiling them for certain markets. Beyond the fact that larvae of the meal moth and the meal beetle may be infected with the larvae of a tapeworm, nothing very definite is known at present on this point.

Venomous Arthropoda.—Some of the insects and ticks mentioned on other grounds might be included here also. The bite of ticks in particular is notoriously venomous, and may cause fever and temporary paralysis by the toxic properties of the saliva; so also may that of some of the gadflies, particularly those of the genus *Chrysops*. Scorpions, bees, wasps, etc., all have special venom glands, the secretion of which is variously neurotoxic and haemolytic like that of snakes, and have special organs for injecting the secretion. The venom of some spiders is known to be seriously toxic even to man: that of *Lathrodectes* is particularly so, and that of the South American "Podadora" (*Glyptocranium gastracanthoides*) is said by Escomel to be sometimes fatal to man. In West Africa the larva (known locally as "Fura") of a tiger-beetle is said by Pollard to inflict a bite having effects almost as severe as the sting of a scorpion. Many species of lepidopterous caterpillars are liberally provided with spines or finely barbed hairs having venomous properties, and numerous kinds of insects, besides the well-known blister beetles, can eject irritant and vesicant secretions. But from the entomological standpoint these venomous arthropoda are not important.

Process of Research.—Having surveyed the field, it remains to consider the economic aspects of medical entomology.

It is plain that the actual discovery of the pathogenic capabilities of any particular arthropod is most likely to be made by the medical or pathological specialist—the history of the subject entirely confirms this assumption. The treatment of pathological effects is even more plainly and exclusively a medical matter. But, once the pathogenetic significance of a species has been established, it becomes the first concern of medical entomology to unravel the biological history of that species in every detail, however apparently trivial, and to investigate every circumstance that may be supposed to influence its noxious powers, with the object of circumventing its activity or of restricting its existence in propinquity to man.

Where the harmful species is a specific parasite of man, or—like the yellow-fever mosquito—constantly haunts domiciles, its biology is usually easy to follow, and its control, in an educated and convinced community, should not be difficult. But where it is a free ranger, like the tsetse fly and many species of *Anopheles*, the investigation of its biology may be extremely difficult.

An entomological investigation must comprehend every stage of the creature's existence, from the egg to the procreant adult. It must include not only its natural affinities, specific characters and anatomical structure, but also its distribution and seasonal prevalence, its habits, hiding-places and hours of work and rest; its powers and usual range of locomotion, and its propensity to extend its range at any season; its fecundity, sexual instincts and manner of reproduction; its times and places of breeding, method of dispensing its eggs and providing for its larvae; and its length of life in every stage of its existence. It must also follow up, in each separate stage, the general conditions of existence, such as food preferences, meteorological requirements and means of withstanding vicissitudes of season and climate, adaptations for transport and dispersal, and all the circumstances of the organic environment—natural shelters, direct and indirect help-givers in the struggle for existence, parasites, enemies and rivals; for, as Darwin explained so well, the species of a fauna do not stand alone in nature, but all hang together in most complicated interdependence. Furthermore, the investigation must embrace the varying circumstances—meteorological, seasonal, etc.—which in the case of a specifically infective species influence its reception and retention of infection.

With some assured knowledge of the bionomy of a harmful species, it becomes the practical work of medical entomology to consider how its harmful activities can be forestalled or it itself entirely banished from the vicinity of man—whether by clearing off everything that can shelter the adult; or by abolishing or restricting or periodically devastating its breeding-places; or by cultivating its parasites and natural enemies; or by depriving it of its ultimate food resources; or by direct attack with insecticides and other destructive appliances; or by screens and defensive apparatus; or by educational propaganda. All these principles have their application, which must be decided with regard to local conditions and resources.

As a general proposition it may be maintained that, although there are many occasions when systematic attack with destructive appliances is advisable, and several instances where it has been eminently successful—the Herculean cleansing of the yellow-fever and malaria stricken Panama Canal Zone from infective mosquitos by Gen. Gorgas and his staff being the crown and garland of them all—yet the only permanently successful procedure against a harmful arthropod is to upset its environment by steady perseverance in the ordinary principles of hygiene.

The truth of this proposition is illustrated by the history of malaria in England. Not so very long ago malarial fevers were quite common in many parts of that country: in 1657 John Evelyn's son Richard died at Deptford "after six fits of a quartan ague": in Shakespeare's time ague must have been an every-day affair, for it is a familiar word in the mouth of his people, from homely persons like Mistress Quickly to great personages like Hotspur and Richard II.: Sir John Falstaff died of a "burning quotidian tertian," old John of Gaunt expired in an ague fit with "frozen admonitions" on his lips, and Sir Andrew Aguecheek is a catch-name for a shivering coward. Yet, except in a few water-logged spots where it may still linger, ague quietly disappeared from England ere ever any connexion with *Anopheles* mosquitos was dreamt of, or ever any malaria parasite had been discovered by a Laveran, although the species of *Anopheles* that used to spread it in England are still familiar British insects to those who know where to look for them. *Anopheles* mosquitos prefer to shelter in dark damp habitations, and they do not fly far from the waters where they are bred; and what seems to have happened in England is that, in the general improvement of drainage and sanitation, conditions have changed so completely that the population no longer lives among the breeding-haunts of *Anopheles* in houses that offer any attraction to those insects, and that thus the old communion between man and *Anopheles*, by which malaria was fostered, has gradually been dissolved. Something of the same sort has happened in the well-kept European quarters of some of the large towns of India.

It follows that medical entomology is really a branch of hygiene—a branch that finds its fullest application not so much in settled countries where man has long since set a bound to organic nature, as in those vast imperfectly developed tropical territories where sanitary arrangements are crude or non-existent and man is struggling with his organic environment.

As a branch of hygiene medical entomology should also be concerned with questions of the unwitting dissemination of pathogenic arthropoda in the intercourse of trade and travel, and in the special circumstances of war; and also with difficult problems relating to the destruction of such elements of the fauna of a particular territory as are believed to foster some local noxious arthropod, and to the introduction of such exotic species and parasites as are thought likely to destroy some local noxious arthropod, as sanitary measures; for such measures, if lightly undertaken, may start new mischiefs without mitigating those they are intended to check. (A. A.)

MEDICINE AND SURGERY (*see* 18.41 and 26.125).—By the year 1910 medical thought had reached one of its turning points, though this fact was not immediately evident. The great age of bacteriology had so vastly enriched our knowledge of disease that other aspects of work had been somewhat neglected. The belief prevailed that every disease was due to the presence of some microörganism, and that patient effort was bound, sooner or later, to find the specific microörganism in each case and enable a great work of prevention to be undertaken. In consequence bacteriology attracted the best brains in medicine, and enormous labour was expended in the search for organisms and in the study of their methods of growth. The fruits of this labour look smaller in the retrospect than the hopes concerning them which were entertained. A few new organisms have, it is true, been discovered, for example the spirochaete of infective jaundice (Weil's disease), the so-called filter-passers, and the still rather dubious rickettsia bodies supposed to be associated with typhus fever, trench fever and other conditions. Some differentiation, too, has been made between various "strains" of bacteria, notably in connexion with cerebro-spinal meningitis and bacillary dysentery (*see* BACTERIOLOGY). But an impression has gradually arisen and is growing that the greatest conquests in this field belong to the past. The trend of modern ideas is rather towards the application and elaboration of the knowledge newly obtained, and its absorption into the general body of medical thought.

I. GENERAL PROGRESS IN MEDICINE, 1910–21

In any review of recent progress the above considerations must be borne steadily in mind. The mere circumstance that many common diseases—for example measles, scarlet fever, rheumatic fever—are still unrelated to a specific causative organism is much less significant than the fact that the after-effects of these complaints have been intensively studied and that the application of the laws of bacteriological invasion and growth has saved many victims who in other days would have perished.

One of the first results of the new orientation was a conception of disease as a process dependent on another parallel process—the course of an infection. The human body reacts in various ways to various assailants. This reaction is expressed in symptoms which tell us of the struggle going on, and may enable us, if we understand their mechanism, to arrive at conclusions about the nature of the attacking force and the strength of the defences. The researches of the laboratory are available here as an additional source of enlightenment, and so fall into their place in the general scheme of clinical medicine.

Importance of Prognosis.—When the World War broke out in 1914 this was the point which had been reached. Sir James Mackenzie and other thinkers, whose outlook was primarily clinical, were recalling attention to the lack of knowledge of symptoms and the lack of understanding of their importance. Medicine, they declared, was concerned too much with the gross signs of disease, too little with its earlier manifestations. The *post-mortem* room had too great an influence on opinion, and even the laboratory had failed to perceive that a vast body of truth lay beyond its reach. The positive side of this teaching was the setting-up of certain functional tests to replace the physical ones then in vogue. It was argued that, no matter what deviations from the normal form an organ or system might show, if it remained functionally efficient it could not, on account of such deviations, be condemned out of hand.

This doctrine was really a challenge. It demanded a restatement in the name of prognosis. The physician must be able to interpret symptoms and laboratory findings in terms of life. He must be in a position to tell his patient what a particular sign betokened, how it would affect him, and how its cause might be removed or rendered harmless. In short, the physician must draw upon all the sources of information available, yet must not abrogate his place as interpreter.

The position taken up was assailed from several quarters. But the outbreak of war served almost immediately to reveal its strength. When that event took place the medical profession was called on suddenly to examine a vast number of men and express views as to their fitness for field service. These views were stated with the knowledge that they would be put to the test immediately and that if they were erroneous the fact would soon be discovered. A test of this kind constitutes a great event in medicine. It will certainly be seen in the retrospect as one of the turning-points of the science. For it brought the whole body of knowledge to trial; it brought the exponents of every theory to account. More than this, it revealed the key to the problem of future progress—prognosis. The doctor was asked to say what the patient could do; it was not enough merely to recount symptoms or signs. Looked at in this way every medical board paper was a kind of forecast.

Almost at once the deficiencies in knowledge began to be apparent. It was found by experience that the organic view was not equal to the strain imposed on it. Those who had been content to recognize a sign and give a name to it perceived that this was not nearly enough. It was not enough even to find a particular germ in a laboratory, nor to discover by the use of X rays some abnormal condition. The laboratory, with all its intricate and beautiful machines, was unable to answer the great new question: "What effect will this symptom or sign exercise on the field of battle?"

The whole weakness of the purely laboratory point of view was exposed in a flash. As a means of diagnosis this branch of medicine was of enormous value; as a means of arriving at a prognosis its value was much less. The new task of medicine was to interpret the findings of the laboratory and of the senses in terms of active life.

At the beginning there were many failures, and an outcry against the medical boards arose. Instances were cited of men who had broken down badly, though they had been passed "fit," and these made a considerable effect on the public mind. Nor did the retort that medicine had failed to find any sign of disease avail much. The layman replied that it was the doctor's duty to make a reasonable prognosis.

Clinical Medicine.—This difficulty led with great rapidity to a new orientation. Clinical medicine—the study of abnormal functioning *at the bedside* of the patient—became really important again; and the clinical revival which began at that time spread with amazing rapidity. Within a few years workers in every school of thought were adopting what are spoken of as "functional" standards.[1]

Heart Disease.—In no direction was progress so rapid as in the study of heart disease. This disease had escaped to some extent the bacteriological obsession. It remained a clinical problem because no definite infective agent had been found. In consequence old ideas prevailed and the shadow of the *post-mortem* room lay over every sign and symptom.

Popular apprehension of heart disease caused physicians, moreover, to stickle at sending any patient with a "murmur" to the fighting line. Happily, the British army medical authorities took a firm line, called to their help the leaders of what was then spoken of as the New Cardiology, who boldly applied their functional tests, and on the strength of them formed conclusions as to fitness for service. In spite of some anxious protests the views expressed were carried into effect, and men sent to fight who, in peace time, might possibly have been sent to bed. The result fully justified the method. Heart diseases, instead of proving the bugbear they had been in the early days of the war, ceased to give much trouble. This news spread rapidly, and a new era in the medical study of the heart began. Incidentally it was found that exercise greatly helped many sufferers from so-called heart affections, and later, still many of those affections were traced back to bacterial diseases. Thus the so-called toxic theory of heart disease was strengthened. It came to be understood that with the advent of an infection disturbances take place in the mechanism of the heart and result in a depreciation of functional efficiency. This can be restored by two methods:—destruction of the invading germ (*e.g.* in syphilis) or increase in the human resisting power (*e.g.* exercise).

Thus modern medicine achieved its two great principles—the understanding of the meaning of signs and symptoms in terms of active life, and the necessity of conserving and building up natural resistance against the enemies of the body. These principles, it will be seen, are complementary to one another. For prognosis must always vary with treatment. In the days before antidiphtheria serum was discovered the prognosis in diphtheria was very bad. Since the use of serum has become general it is, on the whole, good.

General Immunity.—The early days of the bacteriological period had seen a movement away from drugs whose uses are directed to restoring the patient's strength. Instead, great search was made for substances capable of killing bacteria in the human body, and antiseptics and specifics of many kinds were introduced—*e.g.* salvarsan, new combinations of quinine, *sera*. Later still the extension of methods of vaccination, for increasing specific natural immunity, occupied the forefront of research. Now general immunity, health in the broad sense, commanded attention. There was a revival of physical culture, and this was applied to the diseased as well as to the healthy.

Inevitably such a movement brought the study of physiology into new prominence—and this indeed is another of the landmarks in a very interesting period. One of the applications was the work of Sir Almroth Wright and his assistants in war wounds. When the war began, surgery had passed back again from antisepticism to asepticism. It had been found that the technique introduced and used by Lister was not necessary, that antiseptics were troublesome, and that absolute cleanliness secured all the advantages which these bacterial—and protoplasmic—poisons had gained for us.

Treatment of Wounds.—The treatment of wounds made by a surgeon in a modern hospital and the treatment of wounds made by shells on the battlefields of France were two very different things. Asepsis was no use when sepsis was already present. As a consequence the cry "Back to Lister" was raised, and the wounds of war were deluged with strong solutions of carbolic acid, iodine and other substances. This procedure naturally resulted in some trouble, and at length Almroth Wright was commissioned to make an investigation of the whole subject.

His conclusions were that antiseptics are largely useless because they fail to kill the germs of septic poisoning but do injure and weaken the tissues in which these germs are embedded. They thus interfere with a physiological process of repair and cleansing. Wright conducted some most delicate experiments, the object of which was to determine how wounds tend to heal and how deleterious matter is got rid of. He studied the lymph, or natural fluid, which flows out when a wound is made, and came to the conclusion that this, so long as it is fresh and uncontaminated, is an agent capable of destroying bacteria. If, however, the flow of lymph is dammed up, the fluid becomes corrupted and then forms an excellent pabulum for bacteria.

The case against antiseptics was that they tended to cause coagulation of the lymph and so produced "crusts" which dammed up the lymph flow. Thus more harm than good resulted. Wright, on the contrary, used salt solutions of various strengths, which increase lymph flow, and was able by this means to make wounds cleanse themselves. His views were received with immense interest, and were soon under discussion in every theatre of war and indeed in every civilized country. By some they were hotly contested, but they served effectually to put an end to the rash and indiscriminate use of antiseptics. Meanwhile, however, another worker, the Franco-American surgeon Alexis Carrel, had introduced with Prof. H. D. Dakin an antiseptic not formerly much employed. This was a hypochlorite solution which had been christened "ensol" or "Dakin's solution." The technique employed was more important than the antiseptic, and to some extent justified the views of Wright. It was a continuous drainage secured by the use of cans and rubber tubes. The wound was thus kept flushed and all its discharges were washed away. This system found many supporters but was attacked by Wright. Finally a third school dealt with the problem and brought to its solution the methods of the great German biochemist Paul Ehrlich. Ehrlich's idea was that a drug possessing a specific effect on specific forms of protoplasm might be found in connexion with any bacterium. He proved his case with his own discovery "salvarsan" or "606," which possesses a special destructive power where the spirochaetes of syphilis are concerned.

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[1] There was founded in 1920 by Sir James Mackenzie in the town of St. Andrews, Scotland, an Institute for Clinical Research which had hitherto no counterpart in the world. The reasons for taking this step were twofold:—(1) While the signs of organic disease are well known and more or less easily recognizable, those of disease before organ damage occurs are almost entirely unknown. Disease before organic breakdown is thus an uncharted country. (2) In order to chart it, it is necessary to study carefully and extensively the so-called "trivial" symptoms. Only by such an investigation can light be obtained on the real meaning of those symptoms. The town of St. Andrews was chosen for the site of the work because it is small and self-contained. It was felt that, if the history of any given symptom was to be followed up, and its progress into the future—the only final proof of its seriousness or triviality—to be determined, a resident and non-shifting population must be studied. Moreover, the work must be carried out by general practitioners because they alone are consulted by sufferers from trivial ailments, and so alone see the earliest manifestations of disease.

Sir James Mackenzie gathered around him the local medical men at St. Andrews, and they all became research workers in the institute. The methods employed are those of the bedside amplified and extended. Every symptom of which a patient complains is carefully observed and noted down and the records are filed, indexed and classified. Any laboratory examination which may be necessary can be carried out in the institution, but for the most part such instruments as the X rays are inapplicable, there being no objective signs of disease. Periodically a particular symptom is studied intensively, for example exhaustion. By 1921, several important papers had come from the research workers. Their work revealed the fact that all symptoms depend for their production on disturbances of the normal reflexes of the body, another way of saying that they are exaggerations of physiological events. As most reflexes depend on the presence of a stimulating agent, a nervous mechanism and an organ or region stimulated, it is evident that a new pathway to the study of disease had been suggested. Thus, a morbid condition may fall under the heading of one or other of the three factors mentioned: it may be an excessive or extraordinary stimulus (a stone in the ureter), or an agent acting in the nervous mechanism (the toxin of a disease) or actual involvement of organic structure.

In the case of the bacterial poisons of wounds another substance, flavine, was brought forward. This preparation belonged to the same group as salvarsan; it was used in the first instance by Prof. C. H. Browning. Very good reports of its efficacy were received. But again Wright and his followers attacked it on the ground that it failed of its object, the destruction of bacteria, and interfered with the physiological processes of nature.

It cannot be said that any permanent settlement of this dispute has as yet been reached, but it does seem clear that the foundations of Wright's work—physiological study—will be hard to shake. Indeed he has here an advantage over all his critics, the nature of which they did not seem at first to realize.

Vaccine Methods.—To Wright indeed belongs the credit of having brought the laboratory to the bedside. He saw that no method can succeed unless it is based on practice. Practice in this sense means physiological principle. It was recognition of this fact which inspired his antiseptic studies. Further, though this has not been sufficiently appreciated, it was recognition of it which enabled him and those who worked with him to bring the anti-typhoid vaccination to the high pitch of perfection it had reached when war broke out.

Typhoid.—Of the single facts of medical history during the war period the success of this anti-typhoid vaccination is certainly the most conspicuous. Such a success was indeed undreamed of, for of all the enemies of the soldier typhoid fever ranked first. A study of earlier campaigns reveals the fact that this scourge usually swept away large proportions of the armies engaged in European warfare, and in some cases the casualties by bacilli—chiefly typhoid—stood to the casualties by bullets in the proportion of 80 to 20. Thanks largely to the preventive inoculation against typhoid this condition of affairs was reversed in the World War, the proportion being gun-shot wounds (including all forms made by all manner of missiles) 80 and disease 20. The credit for this result is due largely to Sir Almroth Wright and Sir Wm. Leishman, who devoted endless trouble to the work of perfecting this brilliant application of bacteriological and physiological principles to preventive medicine.

Tetanus.—Not less striking, though less dramatic, was the success achieved in the prevention of tetanus or lockjaw. This dreaded disease began to manifest itself almost at the beginning of the campaign. Before the battle of the Marne was fought it was relatively prevalent and was causing great consternation, for it was recognized that the intensively cultivated soil of Europe was impregnated with tetanus bacilli, and that thus every wound was dangerous. Moreover, up till this time the treatment of tetanus had proved singularly ineffective, so much so indeed that the patient was regarded as doomed.

As the tetanus bacillus presents many features in common with the diphtheria bacillus, and as the antidiphtheria serum had proved a very great success, it was thought that a serum prepared in the same manner might solve the tetanus problem. This hope had not been realized in practice at the time of the outbreak of war. Nevertheless, there was some reason to think that, though the serum failed when given after the disease had declared itself, it might not fail if administered at the time of actual wounding.

Tetanus, as is well known, takes several days to incubate. In consequence, there is available a period in which measures for its suppression can be carried out. This fact was the basis of the antitetanus inoculation which was begun experimentally in 1914. From the outset the experiment succeeded beyond the expectation of those who had planned it. Tetanus became a rare disease, thanks to the fact that every wound, no matter how trivial, was regarded as a possible source of danger. It was an order that as soon as a soldier got even a scratch of the skin he must report to his medical officer. A prophylactic dose of serum was then administered.

At a late period the War Office set up a Tetanus Committee under the chairmanship of Sir David Bruce. This committee investigated cases of so-called "delayed" tetanus, and also those cases in which tetanus made its appearance at long periods after the initial wounding when surgical measures had been carried out on the wound. The view which was formed was that the bacilli in such cases were walled in and rendered innocuous; but manipulations of the wound were apt to break down the walls and so release the toxins.

Shell Shock.—Meanwhile the circumstances of war were directing attention to a series of new disease conditions which the peace-time physician had not encountered in so severe a form. Chief perhaps among these was the nervous disturbance caused by high explosive shells. At first a number of wild statements were made and believed, but presently, and thanks in no small measure to the common sense of Sir Frederick Mott and other distinguished neurologists, some light on the darkness was obtained. Mott pointed out that among the large group of cases classed as shell-shock patients there were a number who had suffered actual physical injury of the brain as a result of explosives. If these people died, punctiform haemorrhages were found in the brain substance.

These cases were not psychopathic, they were organic lesions—cases of injury. After elimination of this group there remained a large group of individuals, considerable numbers of whom had not received any injury. These cases were often very severe, but they differed in no material respect from the neurasthenics and victims of functional neuroses well known in civil life. The question was asked why these patients should break down whereas other men could be severely wounded and yet show no sign of nervous disturbance.

Various answers were given to this question, and probably all of them contained a germ of truth. Thus it was pointed out that hereditary influences played a part in some of the cases. The men came from mentally unstable families; they themselves had only just managed to support the conditions of ordinary life. The conditions of life in the trenches broke them down. Again, many of these patients were clearly the victims of chronic infections such as rheumatism, which exercise an irritant effect on the nervous system. Thus the men were more easily stimulated than in normal cases, and so more easily fell victim to the excessive stimulation of war.

Thus new recognition was given to relationship existing between disease and temperament, between the nervous system and the functional activity of the body. It was seen with a clearness not before achieved that the mental case may be the case of disease, slight, unrecognized, yet perpetually active. The treatment of these cases occupied a large number of distinguished workers. Little by little a process was evolved whereby disease elements were eliminated so far as possible before mental conditions as such were pronounced upon. Thus the patient's general health was made the subject of careful study, while at the same time his mind was being dealt with.

Psycho-analysis.—The purely mental aspect of the subject forms one of the fascinating chapters of modern medicine. Never before was so vast a material presented to scientific workers. This material, too, came at an hour when a great upheaval in mental medicine was in process. The writings of Sigmund Freud of Vienna had just begun to find adherents among British psychiatrists. They were the subject of hot dispute; but the first wave of incredulity was spending its force. Thus Freud's methods were applied to many cases of shell shock and their value put to immediate test.

These psychic methods were founded on recognition of a mental field operating below consciousness and charged with various "repressions." A repression is a desire which for one reason or another cannot be fulfilled and so is forgotten. It does not again enter consciousness; but it nevertheless remains active and unsatisfied, and under various disguises attaches itself to desires which are permitted to become conscious and greatly intensifies those. Thus the patient shows abnormal reactions to certain stimuli and evinces abnormal likes and hatreds which cannot be explained in terms of his evident circumstances. This man has an unbalanced mental outlook, and, given circumstances such as warfare, will evince symptoms of nervous breakdown. The method of treatment suggested by Freud was to analyze his mental state, discover the repressed wish, and bring it into consciousness. Once the patient knows it and realizes it, it is said to lose its power over him.

The method is called *psycho-analysis*, and in some hands has yielded important results. It is now being widely practised. Unhappily, while in some directions perversely applied by Freud himself, it lends itself also to the uses of unqualified persons and also of mere charlatans. On this account it has to some extent fallen into evil repute. That it is, when properly applied, a great contribution to the study of the mind is nevertheless evident. Its application to shell shock did much to convince the medical profession of the necessity of seeing its work as a whole and not in little bits. It also helped to convince physicians of the importance of the "imponderabilia" in every case.

Mental Hygiene.—It had another effect not less far-reaching. There sprang into being a body of physicians who declared that mental effects of warfare could be prevented to a great extent if a kind of mental hygiene was instituted for the soldier. So far as possible the causes operating to lower his physical and mental vitality must be found and removed. Well-being must become a study. Effects of this theory were the rest camps, the convalescent depots, the insistence on games, on baths, on lectures, on medical supervision. Other effects included the care taken to show the soldier that if he fell ill or if he was wounded every sort of effort would be made for his safety and comfort. Thus while the enemy on the one hand was doing all in his power to break the soldier's *moral*, physicians of the new school were steadily and tirelessly building it up. In a large view of this work we are entitled to include every one of the schemes which had as their object the comfort of the soldiers—we are entitled also to include such appliances as steel helmets and gas masks. These were more than defensive armaments; they were expressions of preventive medicine as applied to the human mind in time of great stress.

That the success which attended these labours has left an indelible impression on modern medicine goes without saying. Circumstances and environment are now receiving a measure of attention never before accorded to them. The demand for playing-fields for the nation's youth, for swimming-baths, for holiday camps, is a part of this campaign. So is the interest which all doctors are exhibiting in food values, in housing, in ventilation, in industrial welfare. Indeed, the science of industrial welfare is largely a war product.

Welfare Work.—This science has made an immense progress in the last few years. Employers of labour have been aroused to the fact that their human machinery is as important, is indeed more important, than their working plant. In consequence, physicians have been called in to act as expert advisers to many great industrial undertakings. Attempts are being made to select suitable candidates for the vacancies in industrial life, and it is becoming a working maxim that to employ unfit persons is both unjust and uneconomic. The study of what is called "welfare" is progressing, and money is being laid out on good ventilation, on rest-rooms, on workers' canteens, on bathing facilities and other amenities. All this expenditure is found to return a profit both to employer and employed.

Moreover, the study of industrial fatigue has shown that it is in the highest degree wasteful to keep men at work after they have become exhausted. Thus, shorter hours of labour have been instituted on medical advice and have increased instead of lowered output. The method known as motion study has helped to eliminate wasteful movement in particular operations and so has added to the profit of them while reducing their cost. Further investigations have been carried out into the circumstances of what are known as "lost workers," *i.e.* persons who learn a trade only to leave it, and into those of industrial misfits.

The effects, too, of environment on industry have been studied from a new angle. The whole science of ventilation has been reviewed and restated. Thanks to the work of Dr. Leonard Hill, it is now accepted that ventilation is no mere question of cubic feet of air but is a large and difficult problem involving a study of air movement, humidity and temperature. Stimulation of the skin by moving currents of air is of as great or greater importance as the amount of oxygen available. Moreover, the drying quality of the air depends on its movements, and so the degree of evaporation of sweat on which cooling of the body largely depends. In this work Dr. Hill has employed an instrument of his own, known as the kata-thermometer, a thermometer the bulb of which is enclosed in a glove finger and kept moist. It records rate of temperature-loss in any given room. It is significant that changes in ventilation effected on the advice of Dr. Hill have resulted in a marked increase of output.

Another vastly important series of observations of this kind are those of Dr. John Scott Haldane of Oxford on dust phthisis. He has conclusively demonstrated that silica dust is the real agent of destruction. Coal dust is actually beneficial. Why this should be so is not known, but it would seem that the coal dust excites responses in the body which result in a cleansing of the lungs; silica or rock dust, on the other hand, excites no such response, and the gritty particles in consequence tear the lung tissue and prepare a nidus for the tubercle bacillus. An outcome of the work is the clever method of sprinkling coal dust in rock-dust mines. By this means the rock dust is rendered harmless.

The mining industry has further benefited by the work of Dr. Thomas Lister Llewelyn, who has traced miners' nystagmus or blindness to its cause—bad lighting. He has placed this subject on a sure foundation and made it possible to say that if certain changes in lighting are introduced this most costly and disabling disease will be abolished. (*See* INDUSTRIAL MEDICINE.)

Orthopaedic Surgery.—The immense strides recorded in this branch of medicine are paralleled by the brilliant advances in another. (*See* ORTHOPAEDIC SURGERY.) If the war influenced industrial medicine only indirectly, it actually revolutionized orthopaedic surgery. This study had rather languished in England owing to the relatively small number of cripples. In America, where infantile paralysis is rife, it had advanced farther. English practice, however, was well represented at the Liverpool school, at the head of which was Sir Robert Jones. The War Office called on Sir Robert Jones, and he became the organizer of a rest salvage corps, the duty of which was to mend the broken soldier. The subject soon divided itself up into branches; there was the work for the limbless at Roehampton, from which has come the modern light artificial leg. This appliance almost, if not completely, restores lost function; it is a permanent boon to humanity. Again, there was the astounding development of so-called "plastic" surgery, the result of which has been to render any disfigurement capable of great improvement if not of complete cure. The treatment of severe fractures, too, and especially fractures of the thigh was studied as a new problem and undertaken on new lines. These results are now a permanent gain to surgery.

General orthopaedics evolved from a method to a science. The study of muscle groups and their antagonistic action led to the formulation of new ideas and so to the application of new lines of treatment. Every case was considered on its merits and regarded as a separate problem; yet it was found that the same general laws could be applied to all. We are perhaps entitled to include in this progress the surgery of the heart, which was undertaken on a large scale in the war. As a result a remarkable diminution in death-rate from heart wounds was achieved both in England and France. Further, the advances made in the treatment of surgical tuberculosis are really of an orthopaedic nature. They do not belong to war surgery, but they owe something to the conservative spirit which war surgery inspired. They consist, briefly, in preserving the integrity of the skin in all cases of tuberculous invasion of bones or joints. It has been found that if this is maintained the patient outgrows his disease—provided that he has good food and healthy surroundings. If, on the other hand, operative measures are carried out and so the skin broken, other bacilli and cocci enter the tissues, which, being weakened, form a suitable medium for growth. The severe septic cases are those which have been surgically treated. These new methods owe their origin to Sir Harry Gauvain, working at the Sir William Treloar's Cripple Home at Alton.

Trench Fever.—In the realm of medicine proper the war exerted an influence which must endure. Incidentally several diseases were encountered the existence of which had passed unrecognized before. One of these was trench fever, a condition closely resembling the muscular rheumatism of peace time, but characterized by bouts of fever, severe pain in the shins and great chronicity. This disease was investigated by a committee presided over by Sir David Bruce. Col. Wm. Bryan conducted the investigations. Thanks to the fact that volunteers offered themselves for research purposes it was proved that the disease is carried by lice, and that the infective agent is found in the excreta of these insects. The louse does not become infective until some 8–12 days after it has bitten a trench-fever patient. Thereafter it appears to remain infective indefinitely. Its excreta if scratched into the skin produce the disease after a period of incubation lasting about eight days. The disease spread with great rapidity owing to the conditions of trench warfare. It is calculated that some 500,000 persons were affected. Every effort was made to discover a cure, but in spite of this no success was achieved. The disease seems to run a chronic course and relapses are frequent. It is attended by nervous symptoms and also by some cardiac disturbances. As a consequence many people are now labelled " heart disease " and " neurasthenia " who are in reality sufferers from chronic trench fever.

Another disease of this kind came to be known as trench nephritis. It is a true acute nephritis of short duration but showing a tendency to relapse. The evidence, so far as it is available, points to an infection carried by lice. So far no specific organism has been discovered for either condition, but there is some reason to think that the rickettsia bodies which Arkwright found in infected lice are the causative agent. This view is supported by the entomologist Arthur William Bacot, who contracted the disease himself in Poland and found rickettsia bodies in the lice which had been on his person. These diseases accounted between them for a large proportion of the total war morbidity. Had not the work of disinfestation been very well carried on they must have proved a serious menace.

Wound Shock.—Another condition which received careful and intensive study during the war years was surgical or wound shock. A number of eminent physiologists and pharmacologists took part in this work, the names of Prof. Wm. Maddock Bayliss and Dr. H. H. Dale being noteworthy. Wound shock, it was found, is a complicated condition depending on a dilatation and permeability of the capillary circulation. A stasis or stagnation of blood results, mainly in the abdominal area (*see* INTESTINAL STASIS). The blood fluids tend to pass out of the circulation.

Bayliss suggested that this condition might be treated by injections of a viscid fluid which would increase the volume of fluid in circulation and at the same time be retained in the permeable vessels. His choice fell on solutions of gum arabic, which he accordingly introduced. The idea proved eminently successful, and it was found possible by the use of the gum arabic to restore patients who must otherwise have died.

A most interesting feature of this work was the discovery by Dale of a substance, histamine, having the power, when injected, of producing an artificial state of shock with fall of blood-pressure and symptoms of collapse. Dale's work was carried on side by side with that of Bayliss, and thanks to the combined effort a new physiological conception of the capillary circulation was arrived at. The subject nevertheless remains to some extent obscure and still engages the attention of many workers.

Anoxaemia.—Two other advances in medicine remain to be mentioned—the treatment of gas-poisoning and the testing of flying men. To some extent these matters overlap one another because they both gave impetus to a new study of respiration. From the work on poison-gas came Haldane's method of intensive oxygen administration in pneumonia and other conditions. From the necessities of the air was evolved the theory of " oxygen want." The term " anoxaemia " has now been added to medical nomenclature. It signifies not so much impurity of the blood as lack of purity—a negative rather than a positive quality. The chief sign of anoxaemia is cyanosis. The condition is of a most serious character. Arising out of this work came the idea of Haldane and his co-workers that the living membrane of the lungs is able to seize hold of oxygen and actively take possession of it. This quality of oxygen-reception is, it was suggested, capable of cultivation, so that a man might, as it were, develop it in himself to a high degree. More recent work, that of Bancroft, has, however, cast some doubt on the idea.

The medicine of the air (*see* AEROTHERAPEUTICS) is still in its infancy, but already it is clear that candidates for pilots' certificates must possess what is known as a rapid reaction time if they are to prove successful airmen. In other words, action must follow stimulus to action with great speed. This consideration has opened up new vistas in the physiology of nervous response.

(R. M. Wi.)

II. MEDICAL WAR ORGANIZATION

When the World War broke out the British Army Medical Corps was a small body with a personnel amounting to about 1,000 medical officers. At the end of the war its personnel numbered over 12,000 medical officers, a vast number of orderlies and stretcher-bearers, nurses and laboratory attendants, constituting collectively the most efficient medical service ever created.

The deficiencies of the existing corps were seen within a week of the beginning of hostilities. Indeed, the extreme heroism displayed by the officers and men during the retreat from Mons only served to accentuate their ill-equipped condition. There was not a single motor ambulance; there were no hospital trains in the modern sense; the supply of surgical requisites was deficient. It is true that the frequent changes of base, from Boulogne to Havre and again to St. Nazaire and then back again to Boulogne, made it difficult to obtain supplies. Yet the condition of affairs aroused a great deal of anxiety, and those who saw the earliest ambulance trains—mere collections of wagons—set to work to improve matters.

In the late autumn of 1914 Sir Alfred Keogh, an ex-director-general of the Army Medical Service, was recalled to the head of the service and began the work of reorganization which was to prove so successful. At that time the first battle of Ypres was in progress, and the stream of wounded men which flowed down to Boulogne was overwhelming. It was a case for emergency measures. A large number of officers was hurried to the scene and within about 10 days order was brought out of chaos. The Casino and a large number of hotels were taken over, fitted with beds, equipped and filled. A few motor ambulances were got to work, and as many men as possible transferred to England by the hospital ships which, happily, were available. In this way the beds at Boulogne were kept for the very severe cases which could not at once bear a sea voyage.

This arrangement, formed out of the necessities of the case, became the basework of the whole organization. All through the war the medical service had three main areas of work—the front, the base and home. The idea was always to use the base for two purposes: the treatment of cases too ill to be taken across the English Channel immediately, and the treatment of cases which might be expected to recover within a short space of time. Thus evacuation to England was used for the most part in cases where immediate recovery was improbable, yet where the nature of the injury or disease was not such as to preclude a voyage.

This basework remained, but was subject to some important modifications as the campaign progressed. One of these was the tendency to move the operating surgeon nearer and nearer to the front. It was a recognition of the fact that in war-wounds every hour of delay prejudices the chances of recovery. A few experiments carried out at first tentatively showed, for example, that the mortality from abdominal wounds was greatly reduced when these were operated on within a few hours instead of within a few days. The success of these experiments led to the development of the field hospitals, situated close behind the lines. Thus, after a wounded man had been brought from the first-aid post to the casualty clearing-station, he was "sorted out" by a medical officer, and, if he seemed to require immediate attendance by an experienced surgeon, was sent direct to the field hospital, which might adjoin the clearing-station. Cases not so urgently requiring operation went by ambulance to the railhead and from there, by train, to the base.

Another modification was found in the introduction of convalescent camps. Experience showed that if a man was to make a good recovery he must be followed through all the stages of his convalescence. If he was allowed the freedom of the base town he often did himself hurt and always found it a great strain to get ready again for the life of the trenches. If, on the contrary, he was "kept in the machine," taken from hospital to what was a great military camp equipped with every conceivable means of healthful amusement, he recovered much more rapidly and never fell out of the army spirit.

These convalescent camps were therefore established in the near neighbourhood of the base hospitals. They combined sport and pastime with a certain measure of physical culture. Discipline was fully maintained. On coming to the camp a convalescent man found himself in the company of hundreds of other men all in process of recovering and all making ready for the fighting ahead. He lived in the war atmosphere. He trained for war. At the same time he was able to enjoy many different kinds of entertainments and to play any games he chose. He might also engage in gardening or less strenuous pursuits while strength was returning. At all periods of his stay he was under careful medical scrutiny. The camps relieved the burden on the hospital ships and also on the base hospitals themselves. They prevented an undue loss of fighting material, and, moreover, gave to the active forces the sense of being well cared for in the event of wounding, which is an important moral support.

Yet a third modification was the introduction of special methods of treatment in the field. An illustration is furnished by the camps for cases of soldiers' heart or nervous heart. This condition was investigated at the request of the War Office by a group of specialists in England who declared that it was not heart disease and that it could be benefited by a course of graduated exercise. Instructors were therefore obtained and trained in the application of the special exercises and were then sent out to France to work under the direction of highly qualified medical officers. Heart cases of all kinds were forwarded at once from the hospitals to the heart centres. Here they were sorted out into serious and non-serious types. The first class were sent to England forthwith to be discharged from the service as permanently unfit; the second class began at once the course of treatment training. By this means an immense relief was afforded to hospital accommodation—there were vast numbers of these cases—and a large number of useful soldiers were retained in the active force.

In the meanwhile Sir Alfred Keogh inaugurated, in conjunction with the Medical Research Committee, his famous system of team-work research on war diseases. He called to his assistance all the best British brains in medicine and he made it easy for any physician or surgeon with an idea to approach him. Very early in the day anti-typhoid vaccination was enforced throughout the whole army and every recruit received his dose of the vaccine as a matter of routine. Then came the Gallipoli campaign and with it the discovery that, while the vaccination protected against the typhoid bacillus, it did not protect against its prototypes, the paratyphoid bacilli A and B. This discovery was made the basis of an immediate inquiry, and the result was the introduction of a new vaccine giving protection against all the typhoid group of organisms. After this the typhoid fevers steadily declined and became a minor problem.

Another routine which was instituted was the administration to every wounded man, no matter how slight his wound might be, of a dose of anti-tetanic serum. This measure soon made tetanus a negligible factor. Methods of dealing with the infections of wounds also engaged attention and resulted in much greater care being bestowed on the cleansing and treatment of wounds near the front line. Teams of workers were also set to solve the problems of cerebro-spinal meningitis, which broke out severely in various camps, trench fever, trench nephritis, wound shock, gas gangrene, the treatment of fractures and so on.

In almost every instance valuable knowledge was acquired. So perfect had the organization become that it was possible to apply this knowledge forthwith. Thus a better spacing of sleeping accommodation reduced the incidence of cerebro-spinal fever, while the preparation of a serum having powers against all the four strains of meningo-cocci present reduced the mortality by some 30 per cent. As soon as it became known how great a part lice were playing in the spread of trench fever a campaign of disinfestation was started. The services of distinguished entomologists were secured, and these were commissioned and sent out to France to examine and report. The result was an added care of the bathing facilities for men behind the lines and a very perfect system of disinfestation of clothing by heat. In this way enormous numbers of lice and nits were disposed of and the incidence of the disease restricted. Sleeping-quarters were also taken under expert care, and blankets and night attire subjected to careful and continuous scrutiny.

The entomologist indeed became a part of army organization and had plenary powers which were undreamed-of in earlier campaigns. Acting in conjunction with the sanitary corps, he stood between the soldier and the deadly pest which threatened him. Large fly-destruction campaigns were inaugurated and every measure calculated to prevent the breeding of flies in or around camps was put into force. The results were exceedingly good, more especially in the East, where flies constituted a serious menace. In the same way, in the Struma valley, pools containing the larvae of mosquitos were drained or treated with paraffin and the troops thus protected against malaria. In Egypt, too, Col. Leiper was set to solve the riddle of that troublesome disease bilharziosis, and was so successful in his quest that within three months he had located the intermediate host of the parasite, a water snail, and suggested means for its destruction.

Indeed, the organization of preventive medicine in the war was as good in every way as the organization of curative measures. The sanitary corps developed to a state of efficiency which has probably never been equalled. Methods of chlorination of water were brought to high perfection, so that if the men obeyed the instructions issued to them—and most of them did—all danger from imbibing contaminations was eliminated. Cholera threatened, but it never became serious; even dysentery, though it claimed enormous numbers of victims at Gallipoli and elsewhere, was brought under a great measure of control. Nor was food inspection less successful. The army ate well throughout the whole war; it ate safely, thanks to the unremitting vigilance of this most capable body of officers and men.

An organization of this kind was ever ready to seize on and apply new methods. Thus the use of steel helmets was early suggested by surgeons in France and was finally enforced by the demands of the R.A.M.C. These helmets represent a very good example of preventive surgery, since head wounds, before they were introduced, had claimed great numbers of victims. The reduction in the number of those wounds after the helmets were obtained was a complete justification of everything urged in their favour. The small cuts and scratches, the scalp wounds, the bruises, which before had killed many useful soldiers, became things of the past.

Nor was the work accomplished in connexion with poison-gas less triumphantly successful. It is difficult to realize the immense confusion occasioned in the ranks of the medical corps by the introduction of this method of warfare. The problem presented was new and terrible. Men who had been exposed to the fumes were brought in hundreds to physicians who had small idea of how to help them. Yet within a space of some three days measures had been devised. The medical authorities in England had obtained respirators and sent them out. The doctors in the field had learned to use them. Moreover, a body of expert chemists and physiologists were at once set to work to devise better protection and also to seek for efficient means of treatment. The extraordinary elasticity of the organization is shown by the way in which, within a very few weeks, anti-gas measures had been perfected and the treatment of gassed patients reduced to a routine. In this connexion the work of J. S. Haldane, of Oxford, must be mentioned. He introduced his intensive method of administration of oxygen, thanks to which the sufferings of gassed patients were greatly alleviated.

The organization was concerned at first wholly with the task of getting men back to the front. In course of time, however, it was seen that this policy would require to be extended in order to deal with the broken soldier. The reason was that the army had absorbed so many doctors and surgeons that outside of it means were lacking of giving adequate assistance.

The War Office was at first reluctant to add to its labours the care of many hundreds of thousands of disabled and sick men, but in the end consented. Thereafter the rule was that no man should be discharged from the service so long as it was possible to do anything further to help him. In this way there sprang up an immense " repairing " organization collectively described as orthopaedic surgery. It was divided into many sections. There was the central orthopaedic work concerned with problems of restoration of a non-special kind. There was, further, the work of facial reformation known as plastic surgery. This work achieved a series of triumphs which are among the brightest episodes of the war period. No disfigurement was regarded as hopeless, and by a series of carefully planned manœuvres results were achieved which had seemed beyond the scope of possibility. This department of restoration included surgeons, nurses, artists, sculptors and various workers in plastic materials who planned the " new faces " which it was the doctor's duty to create.

Another great department of this work was founded at Roehampton, where limbless men were dealt with. The problem here was the production of a suitable limb at a reasonable price, its accurate fitting and its subsequent care. At first very many difficulties were encountered, for no one possessed the necessary experience. The early limbs were much too heavy and were found by wearers to put a great strain on their energies. Moreover, all kinds of technical troubles arose. Finally, however, a light limb was devised and, under the Ministry of Pensions, standardized. This limb has the great advantage of being capable of manipulation by the muscles of the stump; shoulder action in lifting it is eliminated.

These various branches of orthopaedic surgery necessitated the employment of a great number of masseurs and of attendants. They also necessitated the training of surgeons and nurses in the special methods employed. It speaks for the success of the organization that at the end of the war there were expert staffs in every region of England. Moreover, the so-called manual curative workshops were conducted as a part of the orthopaedic surgery method. The idea was that a man who required to exercise a stiff limb might do this and at the same time learn a trade, *e.g.* by swinging a hammer instead of a club. So great was the success achieved that a curative workshop was soon to be found in proximity to each orthopaedic hospital. This was first suggested by ex-King Manoel of Portugal.

Equally important was the branch of restoration which gained the name of " medical orthopaedics "—the work on behalf of the soldier with broken nerves. The War Office took this matter in hand at a very early period and called to its help noted psychologists and psychotherapists. The result was a reëxamination of functional nervous disorders and the formation of a great department of army medicine. Instead of being branded as a coward the nerve-broken soldier was cared for and treated, and so in many cases saved from the loss of his reason. Here again the method employed was to take advantage of all the available knowledge and attempt to increase it by research work. There were practising side by side, in the military hospitals set apart for nerve cases, physicians of different schools of thought and even of opposite views. Yet so elastic was the organization that no difficulties arose. On the contrary, an immense stimulus to new work was afforded.

This vast organization of British army medical work grew up under the hands of Sir Alfred Keogh. His methods were simple but, as the event proved, invariably effective. He believed that the more complete the organization of the medical corps became the better was the effect exercised on the *moral* of the common soldier. Thus, not only was every effort made to secure personal health and protection against disease and injury, but even personal comfort and happiness became the doctor's business both in the line, in hospital and at the convalescent camps. The soldier, too, knew that if he was broken in mind or body all the resources of medicine would be exhausted over years to save him.

This great effort could never have been achieved had not Sir Alfred Keogh called to his aid the leaders of every branch of medicine and surgery and given them, so far as possible, a free hand. Nor could he have achieved what he did without the assistance of the Medical Research Committee. He saw that research work is as urgent in war as in peace; and he reaped great rewards for this foresight. Indeed, his organization was as strong on its constructive as on its executive side. (R. M. Wi.)

III. Diseases in the World War

The medical diseases of the World War fall into two main groups. In the first are the neuroses or nervous disorders which resulted from the stress of active service, and in the second are the diseases which resulted from infection with disease-producing organisms. Whereas the former were infinitely more common than in any previous war, owing to the far greater strain to which the soldier was subjected as a result of modern methods of warfare, the latter were unexpectedly rare owing to the wonderful improvements in military hygiene, resulting from medical research in the comparatively short period of thirteen years which had elapsed between the conclusion of the South African War and the outbreak of the World War in Aug. 1914. While the neuroses opened up new and perplexing problems to the neurologist, the relative frequency of the various infections differed greatly from that of previous campaigns and presented many subjects for research, which were studied with great enthusiasm and success, especially by the large body of British civilian medical officers who were called in to assist the regular R.A.M.C., whose hands were generally fully occupied with administrative details.

(*A.*) *War Neuroses.*—The frequency of neuroses in soldiers during the war compared with their comparative rarity in men in civil life was due to the exhaustion and emotional strain inseparable from active service. The exhaustion caused by long days of forced marching and strenuous fighting, followed by nights with little or no sleep, combined in some cases with insufficient food, and, especially in eastern campaigns, with a great variety of infections and exposure to extreme heat, naturally led to a more profound condition of nervous exhaustion or neurasthenia than is commonly seen in civil life. It was not, however, as frequent as might have been expected, as exhaustion was largely prevented by the intervals of rest and opportunities for relaxation, which became increasingly common as the war progressed and the need of adapting conditions to fit in with the psychology of the soldier was more fully understood by those in authority. At the same time the supply of food was almost invariably admirable, and there was a remarkable freedom from epidemic infections on a large scale, especially in France, owing to the excellence of the sanitary arrangements. More important perhaps than the actual production of neurasthenia was the increased liability to the development of hysteria and psychasthenia and the aggravation of incipient organic diseases, such as locomotor ataxia, general paralysis, and epilepsy.

Though a few fortunate individuals are born with a temperament which does not allow them to know what fear means, the vast majority, including many of the bravest, were terrified when they first approached the front line. Many men became accustomed to it in time, though never to the horrors of a heavy bombardment, but sooner or later the exhaustion of active service often resulted in a gradual failure of the adaptation, so that not only the constitutionally timid—the martial misfits—but also some who had faced the life cheerfully for months or years broke down from the long-continued emotional strain.

The emotion of fear acted in three ways. In the martial misfit, who is by nature very suggestible, it gave rise at once to such physical symptoms as tremor, inability to speak and inability to move, which might be perpetuated by auto-suggestion as hysterical tremor, mutism and paralysis, the three together constituting one form of the condition often called shell-shock, though it rarely had anything to do with actual shell concussion. In other cases it resulted in a man passing into a dazed condition or stupor, which might lead him to wander from his post of duty and run risk of being court-martialled as a deserter. Finally, it might result in such a disturbance of the suprarenal and thyroid glands that a condition of continuous over-activity, with symptoms not unlike those of Graves's diseases (exophthalmic goitre), might follow.

The acute emotion caused by a single exceptionally terrifying experience sometimes led to such a change in an individual that he became for a time extremely liable to develop hysterical symptoms by suggestion, especially if the experience led to actual physical results. Thus, when a man was gassed he became temporarily unable to see or to speak owing to irritation of his eyes and his larynx, and he often vomited owing to irritation of his stomach. Any of these symptoms might be perpetuated by suggestion—hysterical blindness, inability to make any sound at all or more commonly inability to speak above a whisper, and vomiting being the respective sequels. If a man was blown up or buried, the loss of memory, headache, paralysis, deafness and convulsions which might result from the concussion of his brain were often perpetuated as hysterical symptoms long after the actual changes in the nervous system had so greatly diminished that the symptoms should have completely disappeared. After much study of the problems presented by these hysterical symptoms, which became increasingly frequent as the war progressed, psychotherapeutic methods, consisting of explanation, followed by persuasion and reëducation, were devised, which resulted in extraordinarily rapid recovery, the majority of cases, even after the symptoms had persisted for many months, being cured at a single sitting.

An exhausted officer, who was constitutionally unsuited to the life of a soldier, was more likely to develop psychasthenic symptoms than his men owing to his greater responsibility. He found it increasingly difficult to decide between two possible lines of action, and, when at last he had adopted one, he was full of doubt as to whether he had decided rightly. His power of concentration became deficient owing to his mental energy being largely taken up, without his fully realizing it, in repressing painful thoughts and conflicts, which he kept in the background of his mind in order to avoid distress. He consequently showed want of confidence in his actions, and became terrified that he would be unable to perform his duties in an emergency. His sense of duty urged him to carry on, but this was in acute conflict with his instinct of self-preservation, which urged him to get away from his hateful surroundings. In the daytime he might become suddenly overwhelmed with apparently causeless dread or terror, and he often found it difficult to fall asleep at night owing to the need of active thought to keep his distressing memories and conflicts buried. When at last he fell asleep and the controlling influence over his thoughts was relaxed, they came into consciousness in a distorted form as nightmares, with the result that he would wake in a condition of terror. The disturbed nights increased his exhaustion, until it was no longer possible for him to carry on with his duties. In early cases improvement rapidly followed a change to more favourable surroundings, especially if, instead of receiving the old-fashioned advice to forget his worries and occupy his mind with more pleasant matters, which it was totally impossible for him to do, he fell into the hands of an understanding medical officer, who, after gaining his confidence, helped him to solve his difficulties by freely discussing the thoughts he had been attempting to repress, however painful they might be. It was remarkable how rapidly persistent war nightmares, long-standing phobias and obsessions, and hitherto inexplicable emotional crises disappeared directly the patient understood the mental processes which had given rise to them.

(B.) *Infective Diseases:* (*a*) *Typhoid and Paratyphoid.*—In the South African War of 1899–1902, 60,000 cases of typhoid fever with 8,227 deaths occurred in the British army. In the far larger British army in France and Flanders only 4,571 cases of typhoid and paratyphoid fever occurred between Aug. 1914 and Nov. 1916, and the incidence of these diseases steadily diminished after the first few months of the war in spite of the steadily increasing size of the armies. This was almost entirely due to the remarkable success of the prophylactic inoculation with typhoid and, later on, with mixed typhoid and paratyphoid vaccines.

Paratyphoid fever was throughout much more common than typhoid fever both in France and in the East. There were probably 6,000 cases of paratyphoid fever among the 300,000 troops who were at Gallipoli, but the disease was comparatively rare in all other theatres of the war owing to more thorough protective inoculation after the end of 1915. The mortality in France was only 1·3%; in Gallipoli and Mesopotamia it was higher, but much below that of typhoid fever in the South African War.

(*b*) *Cerebro-spinal Fever.*—An outbreak of cerebro-spinal fever occurred among the Canadian troops on Salisbury Plain in 1915. A wide-spread and very fatal epidemic followed in many home-camps, and shortly afterwards the disease appeared in France. By the end of the year a number of cases developed on the eastern fronts. Investigation showed that the disease was caused by different types of the same bacteria, and when sera were introduced which were specific for each of these types, the very high initial mortality was greatly reduced, particularly when the disease was diagnosed early and serum given without delay.

(*c*) *Trench Fever.*—In the early summer of 1915 a form of fever was observed in the British army in France, in which two or more periods of raised temperature were separated by normal intervals of a few days. Similar cases were recognized with increasing frequency, and the disease soon became widely known as trench fever. Thousands of cases occurred in France and Flanders between April and Oct. 1915; it was comparatively rare in the winter, but increased again each spring. Trench fever did not occur in Gallipoli, but was introduced into Salonika by troops arriving from France in Dec. 1915. It was first recognized in the French army in May 1916 and in the Italian army in Oct. 1917, and it was common both in Germany and Austria from 1916 until the end of the war. The characteristic fever and painful shins of trench fever appear to constitute a disease which had never before been described, but it is conceivably identical with a disease mentioned by Hippocrates, Galen and Avicenna, in which relapses occurred at five-day intervals. The organism which causes trench fever was never isolated, but it was proved that the disease was spread solely by means of lice, which had fed on the blood of patients suffering from the disease and had then bitten other men. The frequency of trench fever thus varied with the prevalence of lice, and if they could be exterminated in an army, the disease would disappear as surely as the lice-borne typhus fever disappeared from the Serbian army when it was freed from lice in 1915. The disease had nothing to do with the trenches beyond the tendency for men to become lousy when herded closely together. It appears to have died out completely since the Armistice. Trench fever was never fatal, but it caused an enormous amount of sickness; it was indeed the only infection which gained any hold on the British army in France and Flanders, except for the wide-spread and very fatal influenza epidemic in the summer of 1918.

(*d*) *Dysentery.*—Amoebic dysentery, though common in tropical and sub-tropical countries, had never occurred in epidemic form in Europe until the summer of 1915, when nearly every soldier in the British army at Gallipoli suffered from it, and a large proportion of the thousand sick men who were daily removed from the peninsula during Aug. and Sept. had amoebic dysentery. It was less common in Oct., and the cold and rain in the great gale at the end of Nov. were quickly followed by the disappearance of the epidemic. But no sooner had amoebic dysentery abated than bacillary dysentery became increasingly frequent. Amoebic dysentery was probably conveyed to Gallipoli by troops coming from Egypt, where 13% of healthy natives harbour the amoeba of dysentery in their intestines and where large numbers of cases occurred among British soldiers. Amoebic dysentery was also very common in the army in Mesopotamia. A few cases occurred in France after the autumn of 1915 owing to the arrival from India, Morocco and Senegal, and later from Gallipoli, of men infested with the amoeba, though not actually suffering from dysentery. The disease was spread mainly by flies which swarmed in enormous numbers wherever there was any food and in every latrine. As flies always defecate each time they feed, amoebic cysts are deposited on jam and any other human food upon which they settle within twenty-four hours of feeding on the stools of dysenteric patients. During the hottest months in Mesopotamia flies were uncommon and dysentery very rare; when flies were present in enormous numbers—in the spring and autumn—dysentery became epidemic. As soon as it became recognized that the predominant form of dysentery on the Gallipoli peninsula was amoebic and men were treated with emetine from the moment of onset, the symptoms rapidly disappeared, but reinfection was common. It was the universal sickness caused by dysentery rather than the occasional death that mattered at Gallipoli, and it can be truly said that dysentery was one of the deciding factors in the failure of the campaign. Cases of inflammation and abscess of the liver due to the amoeba of dysentery continued to occur even three and four years after infection in men who had not been adequately treated.

The dysentery which has been common in armies on active service since the Peloponnesian War has probably always been of the bacillary variety. Out of 30,000 British troops who fought in the Crimea, 7,883 suffered from dysentery, and of these 2,143 died; in the South African War there were 38,103 cases with 1,342 deaths. Bacillary dysentery made its first appearance in the early weeks of the World War in East Prussia and Galicia and was brought to France by von Kluck's ill-fed and tired soldiers on their march on Paris. It was present on every front whenever the weather was hot, and caused an enormous amount of illness in Salonika, Mesopotamia and Palestine as well as in Gallipoli. The disease was spread by flies in the same way as amoebic dysentery.

The chief means of combating both forms of dysentery is to destroy flies and to destroy or disinfect infective faeces directly they are passed. Anti-dysenteric serum was shown to be as valuable in the treatment of bacillary dysentery as emetine was for the amoebic form, but unfortunately the supplies of serum were totally inadequate, and in none of the eastern theatres was there any central bureau of information which could inform the scattered medical officers about recent advances in the treatment of the diseases they were called upon to fight. It is probable that in the future an anti-dysenteric vaccine will be produced which will have as powerful a protective action against bacillary dysentery as anti-typhoid vaccine has against typhoid fever, but very little satisfactory vaccine was available for use during the war.

(*e*) *Epidemic Jaundice.*—A mild form of jaundice was very common in the Gallipoli campaign between Aug. and Dec. 1915, and in Mesopotamia during the hot weather of 1916 and 1917. The symptoms were similar to those of the catarrhal jaundice, which occurs sporadically among civilians in peace-time, and the condition appears to have been of the same nature as the epidemics in the American Civil, Franco-Prussian and South African wars. It appears to have been due to infection with an organism allied to the bacillus of paratyphoid fever, and numerous investigations failed to reveal the presence of a spirochæte. The mortality was so low as to be almost negligible; many men continued on duty though jaundiced, especially at Gallipoli, but the majority were not fit until six or eight weeks had elapsed from the date of onset.

From the spring of 1916 until the end of the war an entirely different form of infective jaundice occurred among the troops of all the armies engaged in France and Flanders. It was caused by infection with a spirochæte, and was identical in nature with a disease which every year attacks between 3,000 and 4,000 miners in Japan. It is best described as spirochætal jaundice rather than by the older name of Weil's disease, as it was accurately observed amongst French soldiers by Larrey at Cairo during Napoleon's Egyptian campaign in 1800, and by numerous other French physicians before Weil's paper appeared in 1886. The spirochæte was discovered in rats caught in trenches in which the disease had occurred; the infection in rats is chronic, the organism being excreted in the urine, which is probably the source of infection in man. The disease could be prevented if adequate steps were taken to drain trenches and exterminate rats. The symptoms were much more severe than those of the bacillary jaundice of Gallipoli and Mesopotamia; the mortality, however, was only about 4% in the British army, though it was 13% in the German army and is about 30% in Japan.

(*f*) *Malaria.*—Malaria had the same effect on the operations in Macedonia that dysentery had in Gallipoli. Few men in the Salonikan army failed to become infected with malaria during the summer of 1916, and there is no doubt that throughout the campaign the mosquito was a far more formidable enemy than the Bulgar. Prophylaxis by means of quinine completely failed and it was found quite impossible to reduce the numbers of malaria-carrying mosquitos to any appreciable extent. The conscientious use of mosquito nets was, however, very effective. The disease was of a particularly virulent form, the mortality being exceptionally high. Even after the Armistice it proved a matter of great difficulty to exterminate malaria in men who were infected in the Struma valley.

The Mesopotamian army also suffered greatly from malaria but not quite to the same extent as the army in Macedonia. The disease was very common and very severe in the army in Persia. The number of cases in France was quite trivial, most cases being due to relapses in men who had been in one of the eastern theatres of war.

(*g*) *Infective Nephritis.*—Acute nephritis, or inflammation of the kidneys, is a comparatively rare disease in civil life. It does not appear to have been common in any previous campaign except the American Civil War, in which over 14,000 soldiers of the Northern armies were invalided for nephritis, and to a less extent in the Franco-Prussian War. A considerable number of cases occurred among British troops in France throughout the World War, and a slighter outbreak occurred in Gallipoli and Salonika. It appears to have been less prevalent among the French and still less among the Belgians. It was very common among the German and Austrian soldiers on every front, though not a single case was observed by German medical officers among the Turks. It was very rare among officers of all nationalities, and was never sufficiently common among the men to be of any real importance to the strength of the army, the maximum incidence (in Dec. 1916) being only 104 cases per 100,000. All attempts to discover the cause of the disease failed, but there appeared to be something about the conditions of life of the soldier, as distinct from those of the civilian, which made him specially liable to develop nephritis, as it never occurred among the civilian population or refugees of Belgium and France, who lived in the midst of soldiers and with many soldiers billeted on them. This was in striking contrast to the parallel incidences of most of the epidemic diseases among civilians and soldiers.

The mortality of the infective nephritis of soldiers is much lower than that of the ordinary nephritis of civil life, being approximately 1% in the early stages, though a few additional deaths probably occurred in relapses some months after apparent recovery. Most patients got well within a month, but the complete disappearance of symptoms was sometimes delayed for a year or even longer.

(C.) *Soldier's Heart.*—Soldiers not infrequently suffer from symptoms due to functional circulatory disturbances during their period of training and still more often whilst on active service. In neither case do the symptoms differ from those which may occur among civilians, but their relative frequency has led to the adoption of the term "soldier's heart." The effect of active service on the heart was first studied during the American Civil War, and a great many valuable investigations were carried out during the World War.

Already by the end of May 1916, 2,503 out of the 33,919 soldiers (7·4%) invalided from the service since the beginning of the war had been discharged on account of "heart disease," and this proportion was maintained until the end.

Soldier's heart was most commonly caused by over-exertion, often associated with prolonged mental strain and insufficient sleep, acting on a heart and nervous system which were already weak before the war or which had become weakened on active service as a result of an infection or other form of poisoning. Some men are born with a circulation sufficient for ordinary purposes, but with insufficient reserve power for increased strain. They generally know their limitations, adopt a sedentary occupation in civil life, and do not indulge in out-of-door sports. Many of them break down during training, but even if they develop into efficient soldiers they are likely to develop cardiac symptoms on active service. Thus nearly 60% of men suffering from soldier's heart were recruited from sedentary occupations.

In most cases the symptoms developed during convalescence from some acute infection, such as typhoid and paratyphoid fever, epidemic bacillary dysentery as well as non-specific chronic diarrhoea, malaria and influenza. Excessive smoking was undoubtedly a contributory cause in many cases, and gassing was frequently followed by cardiac symptoms. In a small proportion of cases the excessive activity of the thyroid and suprarenal glands which results from prolonged mental strain was a further factor.

Over-exertion is a relative term. A well-trained man can do work which would be impossible in the early stages of his training and which again becomes impossible if his heart and nervous system are damaged by the poisons produced by an infection, excessive smoking or incursive activity of the thyroid gland. But in the absence of these factors a trained soldier rarely develops cardiac symptoms.

In addition to the effect of nerve-strain on the circulation through its influence on the thyroid and suprarenal glands, the nervous exhaustion or neurasthenia, which results from the combined effect of physical fatigue, mental strain and infection, gives rise to a condition of nervous irritability, which causes slight circulatory disturbances to produce palpitation and discomfort and pain in the region of the heart, although the actual condition is such that subjective symptoms would not occur in a man with a normal nervous system.

The commonly accepted official diagnosis of "D.A.H." or "disordered action of the heart" for soldier's heart is most undesirable, as it at once makes the patient believe that he has "heart disease." Some indifferent diagnosis such as "debility" would be preferable. Treatment by graduated exercise instead of prolonged rest in bed was almost invariably followed by rapid improvement if undertaken at a sufficiently early stage, and whenever the comparatively innocuous nature of the condition was widely recognized by medical officers most men suffering from "soldier's heart" were able to return to duty after a few weeks in special training camps. When, however, it was regarded as if it were due to a serious disease of the heart and treated for long periods in hospital, the outlook was much less hopeful, and many men were invalided from the service and became chronic invalids as a result.

(D.) *Heat-Stroke.*—Heat-stroke occurred very frequently among the British troops in Mesopotamia during the hot summer months. It did not in any way differ from the heat-stroke which sometimes occurs in India. In Mesopotamia it was, however, more common owing to the less favourable conditions of life.

During the earlier years of the campaign heat-stroke was very nearly always fatal, mainly owing to the lack of facilities for treatment. By 1917, however, great progress had been made both in prevention and treatment, and the proportion of recoveries was much increased. The most important precautions for avoiding heat-stroke were the provision of large quantities of cool drinking-water and of suitable clothing and equipment. Men suffering from other illnesses, such as malaria, sand-fly fever and gastro-intestinal disorders, were specially liable to fall victims to heat-stroke.

The disease was always dramatically sudden in onset, and usually within an hour the patient was completely unconscious and in convulsions. In untreated cases death occurred within a few hours with a body temperature of 110° or over. The one essential for treatment was found to be an ample supply of ice. The establishment of special heat-stroke stations in all camps and depots proved most effective in reducing mortality. Those who recovered, however, were seldom fit for further service in Mesopotamia and in most cases were eventually invalided to England. (A. F. Hu.)

IV. SURGERY DURING THE WAR

Military surgery during the progress of the World War reached unexampled levels of efficiency and width of scope, and the general results attained exceeded any limits which had been anticipated. Yet this consummation was not arrived at by a smooth and easy path, neither were the full fruits rapidly gathered. Experience indeed was but a repetition of that gained in all previous campaigns. In Aug. 1914 time had been allowed for collation and digestion of the observations made in the more recent wars, while in civil life progress in surgery had been continuous and considerable. Hence the military surgeon entered upon his duties with confidence in the methods at his disposal and with fair hope of eliminating more or less completely many of the mischances from which his predecessors had suffered. These anticipations were not promptly realized; in spite of the perfected technique which was considered to have been acquired in the general treatment of wounds, and the accurate knowledge which had accumulated as to the characters of the injuries inflicted by modern rifle bullets, it soon became evident that this war, like all its predecessors, would have to teach its own lessons. This experience depended chiefly upon two factors: (1) bullet wounds did not form the preponderating element, but were less frequent than those produced by fragments of shells and bombs, which latter were of a severity and extent scarcely conceived beforehand; (2) the forms of infection met with were more varied and virulent than those commonly dealt with.

Thus in the earlier stages of the war the entire field of surgery was necessarily dominated by the elementary but fundamental question of appropriate treatment of the mere wound, to an extent which materially prejudiced advance in the management of individual injuries. The actual starting-point of real advance was relegated almost to the pre-Listerian period, and a vast amount of past experience required to be repeated and controlled before a firm foundation for progress was established.

When definite principles had been laid down to guide the routine treatment of infected wounds, a second great question still demanded settlement: At what stage in relation to the fighting-line should the definite treatment of gunshot injuries be undertaken? The result of all previous experience had been to the effect that field hospitals were unsuitable for any but temporary measures except in the case of great urgency. The casualty clearing-stations, a recent introduction into the British establishment, were originally intended to act mainly as sorting and distributing centres, and it was laid down that the great bulk of the wounded men should be transferred to the stationary and general hospitals on the lines of communication.

A short time sufficed to prove this arrangement to be defective, since, in spite of the efficient means of transport which had been rapidly developed, it became evident that the primary treatment of the wound needed to be more radical than had been anticipated; when only provisional measures were adopted the patients were in little better condition for the procedure on their arrival at the stationary and general hospitals than if treatment had been entirely omitted. The progress of the infections, in fact, was far more rapid than any means of transport, and such preliminary steps as had been taken required to be repeated upon wounds already increased in extent, with very definite disadvantage to the patient. At this stage the settling-down of the form of warfare to a stationary character allowed for the development of the casualty clearing-station into a potential stationary hospital, while in addition it was found practicable to establish small advanced operating units still nearer to the front to deal with injuries to the abdomen, head, etc. To this development, and in great measure as a result of the bravery and efficiency of the bearers who brought in the wounded men, the whole of the advance in the primary treatment of gunshot injuries is referable. Such conditions may not often recur, but one result of the work done must remain and exert a permanent influence on military surgery. The efforts and firm convictions of a band of enthusiastic and capable surgeons demonstrated for all time that results of equal excellence can be obtained by the military as by the civil surgeon if only sufficient initiative, care and resolution be maintained. The bugbear of "the exigencies of warfare" has been in fact displaced from the commanding position which it has held heretofore.

The Treatment of Wounds.—At the outbreak of war it was generally held that the treatment of gunshot wounds should approximate itself in procedure to the methods in use in civil practice, purely aseptic measures being supplemented by the addition of some antiseptic medium in the case of open wounds fouled by contact with the clothing, the missile or the soil. It was believed that this addition should suffice at the primary dressing to check the progress of the initial infection. This view was founded upon experience gained in recent wars, in which the great majority of the injuries were inflicted by bullets of small calibre. It had been observed that many of these healed well even in the absence of any surgical aid, while the great majority closed without any serious accidents when protected by an occlusive dressing adjusted either by a bandage or some sort of adhesive such as collodion or mastisol. Too little attention indeed was given to the further observation that the comparatively rare shell wounds always suppurated even under the favourable conditions which attended the S. African War of 1899–1902. In the early days it was assumed that the ravages induced by infection were to be explained by the conditions then existing, such as the long distances the patients had to travel, the impossibility of sufficiently frequent changes of dressing, and the want of proper rest. The pernicious influence of these conditions is obvious, but it was rapidly grasped that they should not be held to be an insurmountable element of failure. An attempt was at once made to combat the primary infection more efficiently by mechanical procedures, consisting of free excision of bruised, soiled or devitalized tissue by the knife or the scissors, followed by drainage of all recesses of the wound by india-rubber tubes and a completely "open" method of treatment.

At this period two principles concerning the management of an open infected wound were freely debated. By Almroth Wright and his school it was maintained that the extinction of infection was most rapidly effected by attempting to increase the activity of the normal factors in the process of healing. The method adopted was called the "physiological or phylacogogic," and an endeavour to accomplish the desired aim was made by flooding the wound with a saline solution of a higher specific gravity than that of the fluids permeating the body tissues and thus to "draw" an abundant flow of lymph towards the free surface. By this means also the tissues were "lavaged" by a stream of lymph, the current of which flowed in a direction opposed to the spread of infection inwards. Later the "hypertonic" solution, while accomplishing this end, was found to check the migration of leucocytes to which Wright eventually ascribed the chief place in subduing the infection; hence at a certain stage in the course of healing an isotonic was substituted for the hypertonic solution.

The second school, influenced by the early work of Lister, retained allegiance to the use of antiseptic media of varying kinds. By many the hope was cherished that an agent might be discovered that would not only cleanse and disinfect the exposed surface of the wound, but would also penetrate the underlying infected tissue and thus hasten the natural process. This dream, emanating from an imperfect appreciation of the "preventive" nature of Lister's work, was not fulfilled. Nevertheless, the supporters of the antiseptic theory played a highly important part during the period of argument and uncertainty both as to principle and practice. The most important of the media employed consisted in perfected solutions of the hypochlorites, and certain anilin dyes, particularly flavine and brilliant green. It may fairly be stated that the application of an antiseptic to the wound, or in the dressing, in itself played a minor part, the real advance which followed depending not upon the antiseptic which was employed but upon the development of an efficient system. In the Carrel-Dakin system, although great importance was attributed to the hypochlorite solution, yet the success which it attained was really due to exact observation of the nature and course of the infection concerned, careful initial preparation of the wound, meticulous precaution against stagnation of infective material in recesses in the cavity, and the prevention of reinfection of the surface. It was the experience gained from the practice of this method in the treatment of compound fractures of the bones that clearly demonstrated the possibility of the routine secondary closure of the accompanying open wound, an achievement only second to that of Lister in his early treatment of similar injuries. This result attained, the practicability of resort to secondary suture in most wounds was established.

Subsequent advance proved the practicability, under favourable conditions and environment, of primary closure of the compound fracture without the aid of any antiseptic medium. This ideal was reached by a rational extirpation of the infected tissue by mechanical means, followed by a sufficient period of rest to the patient and to the injured part.

The net result, therefore, of a period of strenuous work and argument was to reaffirm the principles with which surgeons were already acquainted at the commencement of the war: (1) that sterilization of living tissue can only be effected by the natural vital process; (2) that no chemical agent is known capable of penetrating the tissues of the body and destroying microörganisms which is not at the same time deleterious to the tissue itself, and that the sole means of procuring abortion in an infected portion of the body is radically to remove the infected tissue. Again, no novelty in principle was introduced by the practice of either the primary or secondary closure of compound fractures, or of wounds in general; the triumph consisted in the translation of these occasionally used methods within the limits of routine practice. It may be added that the method of secondary suture is to be regarded as the more valuable of the two, since it is but rarely that conditions will not allow its adoption, while in military surgery it is generally difficult to ensure the requirements essential to the success of primary suture. Paradoxical as these conclusions may appear, success was only gained after strenuous effort and the development of a technique and degree of judgment equal to those required for the most exacting operations in the entire realm of surgery.

Nature of the Infections.—It can hardly be said that any novel form of wound infection was discovered, but knowledge was extended in many directions. The hourly progress of mixed infections was investigated, and the vital tenacity of the different organisms determined, while a still more fruitful series of observations was made in the effort to determine the moment at which a wound with a fouled surface became an actually infected one. The result of the latter investigation allowed a general assumption to be made that during an interval of from four to eight hours the multiplication of organisms in their new environment was slow and penetration of the living tissues by them unlikely. Thus a definite time-limit was assigned, beyond which primary closure should not as a rule be attempted. It was shown that only the staphylococci and streptococci as a rule remained present in the terminal infection, and that of these the streptococcus was the more undesirable occupant of the wound. Further, the power of haemolysis possessed by some forms of streptococcus marked them out as the more dangerous to the progress of the wound and to the life of the patient.

The unusual frequency of anaërobic infections afforded opportunity for an extensive investigation of the microörganisms concerned, the special characters of the changes produced by each, also of the importance of symbiosis in these phenomena, thus accentuating the importance of suppuration in the development of such diseases as tetanus, or in the causation of gangrenous cellulitis.

Although acute traumatic gangrene was well known in civil practice, yet it seems doubtful whether it has played such a prominent part in any previous war. There is good evidence that it was rare in the American Revolutionary War, and in the S. African War it was certainly but very rarely met with. One very distinct advance was made in the treatment of the condition. It was observed that the spread of the infection tended to be limited by the fascial envelopes of the muscles, particularly in the case of *B. perfringens* (the organism which specially attacks the muscle fibres), and that, if the vitality of the muscle was lowered by cutting off its blood-supply, the entire muscle rarely escaped destruction. Hence the practice of complete excision of a muscle from within its sheath was introduced, and proved most successful in limiting the spread of the gangrene in the limb, especially when the long muscles were affected.

Little success attended any but the mechanical treatment of anaërobic gangrene, but the treatment of tetanus afforded one of the great triumphs of preventive medicine—in fact, the result attained must be placed upon a level with that reached in the preventive treatment of enteric fever. It was recognized at an early date that every breach of surface with which the intensively cultured soil of northern France had come in contact was potentially infected with *B. tetanus*. Hence it was laid down that in the case of every serious wound the man was to receive an injection of tetanus anti-toxin, and this rule was shortly extended to every wound, and even to chilled feet, especially when vesication had occurred.

Further, since the protection afforded by this measure is known to disappear rapidly, a second injection was given at the end of seven days, and in severe injuries at similar intervals for the succeeding two or three weeks. Again, in view of the known fact that *B. tetanus* may lie latent in a healed wound for indefinite periods, a prophylactic injection was administered to many of the patients in whom late secondary operations became necessary.

In the curative treatment of tetanus it cannot be claimed that any very important advance was made. The chief variation in method consisted in the administration of greatly increased doses of antitoxin. While it remains doubtful whether much advantage was gained by this procedure, it was demonstrated that in some instances the dosage had previously been insufficient. In base hospitals in England, as a result of mainly intra-thecal injections, the average mortality of the disease was reduced from 57·7 % to 19 %. In France, where a more acute series of cases had to be dealt with, the reduction only reached equivalents of from 78·2 % to 67·4 %.

With regard to the route for the injections, many surgeons considered the spinal intra-thecal the best, but clinical observation does not appear to give strong support to this view, although experimental evidence from animals is adduced in its favour. Intra-muscular injections probably gave the most consistent results, while subcutaneous injections proved sufficient for prophylactic purposes.

In connexion with the prophylactic treatment, mention should be made of the fact that, if it failed to prevent, it was still capable of modifying the disease, and local phenomena were much more common than would otherwise have been the case. Except in the splanchnic form, although the local might be only the commencement of a general attack, the prognosis was much better.

Shock and Haemorrhage.—The circumstances attendant on active warfare, such as anxiety, heated and ill-controlled emotions, fatigue, want of sleep, hunger and thirst, exposure to cold and wet and, lastly, severe injury, often combined with loss of blood and pain, afford every condition with which we are accustomed to associate the occurrence of shock. In spite of the arduous investigations undertaken it can hardly be said that the actual explanation of the phenomena has been unveiled. Observations, however, tended to negative certain theories, such as those of acapnia, acidosis, suprarenal incompetence, exhaustion of the vasomotor centres or cardiac weakness, as a primary factor. Hence we must still be content vaguely to regard the phenomena of shock as nervous in origin. In one particular a definite advance was made in the realization that the fall in blood-pressure, which is so prominent a feature in the condition of shock, is strictly comparable to the fall attendant on haemorrhage, the volume of blood within the arterial system being reduced not by external escape from the open vessels but as a result of stagnation in the capillaries. The older theory of stagnation in the visceral veins of the thorax and abdomen was not only exploded by experimental observation, but its error was also demonstrated by the appearances observed during the performance of numerous operations for visceral injuries during the period in which the state of shock was in some degree persisting.

The condition known as "secondary shock," in which the phenomena develop hours or even days after the initial injury, perhaps after primary shock has already been recovered from, had since the Listerian era been regarded as an evidence of toxaemia. The similarity was well illustrated in the cases of acute toxaemia in connexion with anaërobic infections, with which the war made everybody familiar. The experimental work of Dale and others on the action of histamine when introduced into the circulation of animals led to an investigation which seems to prove that the phenomena of shock may be produced by absorption of the metabolic products resulting from the mechanical destruction of muscle fibre, a common result of gunshot injuries.

The outcome of the observations made was to show that the first principle in combating shock is to attack the most prominent of its phenomena, *i.e.* lowered blood-pressure. The effect of infusions of normal saline solution for this object was known to be evanescent, and successful attempts to prolong the effect and at the same time to diminish the volume of fluid required were made by adding a colloid constituent to the solution. In order to place the patients under the most favourable conditions possible, a heating-system was added to the ambulances, and special resuscitation wards were equipped, so that the more simple means, such as the application of warmth, the administration of fluids by the mouth or *per rectum*, and the ensurance of absolute rest, were facilitated. When necessary, these methods were supplemented by infusion of the "gum-saline" fluid of Bayliss. This solution contained sufficient of the colloid (6 %) to increase its viscosity and endow it with an osmotic pressure comparable to that depending upon the colloid constituent of normal blood. The saline constituent (1·5 to 2 %) of bicarbonate of sodium was introduced to counteract the decreased alkalinity of the blood occurring in shock and to prevent haemolysis.

The same solution was employed in the treatment of the slighter cases of haemorrhage. Serious cases were dealt with by the replacement of whole blood. The indication for the latter method was sought for in persistence of a blood-pressure as low as 80 mm. of mercury. In primary haemorrhage estimation of the haemoglobin content of the blood was considered too elaborate a method and unsuitable for use from want of time.

Transfusion became common in consequence of the ease with which donors of blood could be secured from amongst the soldiers. The older method of direct transfusion was found inconvenient from an operative point of view, and unsatisfactory from the fact that it is difficult to estimate the amount of blood which has actually passed from donor to recipient. Hence blood was more commonly collected from the donor into a glass vessel coated with paraffin to prevent coagulation (Kimpton's tube), and thence transferred to the recipient. To meet difficulties resulting from premature coagulation, the blood was sometimes drawn into a vessel containing a solution of citrate of sodium, since it had been found that the addition of 0·5 % of this salt to the blood had no deleterious action. In the later stages of the war it was found practicable, in view of the possibility of having to transfuse a large number of men in an emergency, to substitute a fluid containing preserved red blood-corpuscles suspended in a sufficient volume of a 2·5 % solution of gelatine to bring the total volume into consonance with that of the whole blood originally drawn from the veins of the donor.

To meet the well-known difficulty that individuals fall into definite classes in regard to their capacity to receive the blood of others with safety, a simple classification was arrived at by means of agglutination tests. Thus suitable donors were previously selected and were always available. Four groups were differentiated, of which it was determined that those belonging to the first (8 %) could take blood from either of the remaining three groups. Of the other three, the second group (40 %), the third group (12 %), and the fourth group (40 %) could receive blood only from individuals belonging either to their own group or to the fourth group.

Special Surgery.—One great principle that in the past has governed the application of a ligature to the great arteries of the limbs received considerable modification. It had always been held that, when a main artery was tied, the conservation of the accompanying vein was of the utmost importance for the preservation of the vitality of the limb affected. Experience gained from observation of a long series of cases, in which both vessels were implicated, demonstrated that not only was the integrity of the vein of no vital importance, but that the immediate results were more favourable when both vessels were occluded simultaneously and a better balance maintained between the capacity of the modified arterial and venous systems. Experimental investigation supported this clinical experience, since it was shown that the blood-pressure in the affected portion of the limb was maintained at a higher level.

The substitution of local repair of the wounded walls of arteries for complete obliteration of the vessel by ligature made little progress until the general methods of wound treatment allowed such operations to be made without fear of subsequent infection. In the later years of the war steady progress was made in this direction, and it was shown that ideal results might be obtained, and further that even should the local patency of the vessel not be maintained, yet the result was at any rate in no way inferior to that following successful ligature of the vessel.

The general treatment of compound fractures has been already alluded to, but beyond improvement in the management of the wound, considerable modification took place in the nature of the means adopted to ensure good position of the bones. The change depended on the general introduction of the metal wire splints of Hugh Owen Thomas. These were found capable of adaptation to the great majority of all fractures of the limbs, and also equally suitable for employment in the front line and in base hospitals. It is of interest to note that one of the main principles of their originator was found capable of modification, as well as variations in construction. Fixed extension did not prove convenient or easy of application in military practice, and the substitution of weight-and-pulley extension, or the employment of the weight of the patient's body as a means of counter-extension, was widely and successfully resorted to. In no department of surgery was more initiative and ingenuity shown than in the numerous devices designed to meet the needs of individual cases or different regions of the body.

Infected wounds involving the articulations maintained the reputation of this form of injury as a source of difficulty and anxiety. One heterodox principle was propounded. Absolute rest to the joint has always been regarded as the surest means of checking the spread of infection, but success attended resort to a method in which active movements of an open articulation were commenced from the outset. It was claimed, and with some justice, that this method favoured the escape of infective exudation from the cavity of the articulation, and that the formation of adhesions and ultimate restriction of the normal movements were minimized. It is perhaps too early to give a definite opinion on this subject.

As regards injuries to the nervous system, it suffices here to say that the advances made in the more accurate knowledge of localization of function in the different parts of the brain and the spinal cord, and increased knowledge of the mode and progress of regeneration in wounded peripheral nerves, took a more important place than those in technical treatment of the injuries.

The book of knowledge concerning the possibilities of thoracic surgery (*see* HEART AND LUNG SURGERY) may be said to have been opened up by the experience of the war. It was proved upon an extensive scale that the mere laying-open of the great serous sacs of the chest was not the dangerous procedure that had been widely assumed, and that, as Sir W. MacEwen had already demonstrated, no special artificial arrangements are necessary to maintain the normal intra-thoracic pressure during operations. Appreciation of this fundamental fact opened the way to free primary treatment of a large number of thoracic injuries which had formerly proved rapidly fatal not from the hopelessness of the actual injury but from the results of the infection which commonly followed it in consequence of insufficiency in boldness of surgical attack. Thus the way was cleared for dealing with intra-thoracic haemorrhage and its complications, wounds of the lung, retained fragments of infected foreign bodies, and even for dealing on rational lines with wounds of the heart. Of scarcely less consequence than these visceral operations were those rendered possible for removal of foreign bodies from the mediastina, a fruitful source of immediate danger, and of intractable fistula-formation at a later date. It is impossible to estimate how widely this new field of surgery may be exploited in the civil practice of the future.

The technique of the surgery of abdominal injuries had been already so highly developed as to call only for judgment and initiative to elevate military practice to the same level that had been reached in civil life. The difficulties which required to be surmounted were partly administrative, depending on the all-important element of time and the ensurance of as near an approximation as possible to the golden interval of six hours between injury and operation; partly dependent upon the severity of the injuries themselves. Both were overcome, and perhaps the most satisfactory feature of the result is seen in the increased tendency to conservancy in the extent of the operations—the effort to repair rather than to excise the injured part. The most striking in a series of successes was that attained in the treatment of severe abdomino-thoracic injuries, which had previously been regarded as beyond legitimate surgical intervention.

The experience gained during the war is likely to influence the future of surgical practice mainly in two directions. In the first place, the intimate personal association of workers in the branches of pure science ancillary to the practice of the art of medicine with the practical application of the principles laid down by them demonstrated the fruitfulness of this combination and its capacity to lead to rapid advance in elucidation of the problems constantly confronting the medical practitioner. Secondly, the assemblage of vast numbers of crippled men brought forcibly before the medical profession and the public the waste in national power which results from impairment or defect in physical capacity amongst a whole population, and accentuated the fact that in civil life circumstances had not been favourable for following up continuously the history and results of many common injuries. Hence surgeons who in the past had busied themselves particularly in the treatment of acquired defects and deformities extended the scope of their activities to preventive effort, and as a consequence greatly increased facilities have been provided for continuous treatment. (G. H. M.)

MEDICINE, INTERNATIONAL.—A decision of considerable importance in matters pertaining to international health was taken by the Assembly of the League of Nations at its first meeting held at Geneva in December 1920, when the following resolution was adopted:—

"In pursuance of Articles 23 (*f*), 24 and 25 of the Covenant of the League of Nations, and in order to facilitate the discharge by the League of Nations of the responsibilities which may be placed upon it by provisions of the various Treaties of Peace, the Assembly of the League of Nations resolves as follows:—

"That a permanent International Health Organization be established as part of the organization of the League of Nations."

Article 23 (*f*) of the Covenant of the League of Nations, embodied in the Treaty of Versailles, contains these words:—

"Subject to, and in accordance with, the provisions of international conventions at present existing, or hereafter to be agreed upon, the members of the League will endeavour to take steps in matters of international concern for the prevention and control of disease."

Articles 24 and 25 of the Covenant refer to the necessity of arrangements being made for carrying out the above principle in so far as it affects existing international health bureaux and voluntary international Red Cross societies.

The functions of the organization are as follows:—

(*a*) To advise the League of Nations in matters affecting health.

(*b*) To bring administrative health authorities in different countries into closer relationship with each other.

(*c*) To organize means of more rapid interchange of information on matters where immediate precautions against disease may be required (*e.g.* epidemics) and to simplify methods for acting rapidly on such information where it affects more than one country.

(*d*) To furnish a ready organization for securing or revising necessary international agreements for administrative action in matters of health and more particularly for examining those subjects which it is proposed to bring before the Standing and General Committees, with a view to international conventions.

(*e*) In regard to measures for the protection of the worker against sickness, disease, and injury arising out of his employment, which falls within the province of the International Labour Organization, the International Health Organization will coöperate with and assist the International Labour Organization, it being understood that the International Labour Organization will on its side act in consultation with the International Health Organization in regard to all health matters.

(*f*) To confer and coöperate with international Red Cross societies and other similar societies.

(*g*) To advise, when requested, other voluntary organizations in health matters of international concern.

(*h*) To organize missions in connexion with matters of health at the request of the League of Nations with the concurrence of the countries affected.

Underlying the various functions, as detailed, is the important principle that this newly created international health organization will "deal with such matters as affect individual countries only in their relation to other countries." This last phrase clearly indicates and defines the international aspect as opposed to any interference with the internal health organization of any individual nation. These functions were in their main outline drafted in London in April 1920, at an international health conference convened by the British Minister of Health, and subsequently submitted to the Council of the League of Nations for approval; such approval was granted by the Council at the meeting held at San Sebastian.

The machinery so far outlined for the new health organization consists of the following three departments: a general committee, a standing or executive committee, and an international health office or secretariat. The general committee was to consist of: (*a*) the delegates or their successors appointed to the Office International d'Hygiène Publique by the various signatory Powers to the international agreement drawn up at Rome in 1907; (*b*) other delegates appointed by countries not included in the Rome agreement, but who had become members of the League of Nations; (*c*) the medical secretary. This committee was to meet at least once a year at its headquarters in Paris, namely the Office International d'Hygiène Publique; it would appoint its own president and sub-committees and draw up its own constitution. Any member of the committee was empowered to call in the assistance of technical advisers, with no power to vote except when acting as deputy in the absence of the delegate he represents and only after due notice of the change has been sent to the president in writing. The main function of this committee was to receive full reports of the standing or executive committee and of all sub-committees.

The standing or executive committee was to consist of: (*a*) delegates of the States permanently represented on the Council of the League of Nations; (*b*) the president and five members of the general committee; (*c*) a representative of the League of Red Cross Societies; (*d*) a representative chosen by the governing body of the Labour Conference. This committee was to elect its own chairman and sub-committees, and meet not less than four times a year, and oftener as occasion required; the members were to be elected for a period of three years, and then be eligible for reëlection. The committee was empowered to draw up new conventions and revise old ones and render all its reports to the general committee. The International Health Bureau, the headquarters of the League of Nations, was to include the medical secretary, appointed by the standing committee, and directly responsible to it for such duties as it might assign. The medical secretary is entitled to attend all committees or sub-committees and to have the right of direct access to the secretary-general of the League and to communicate with the various national health organizations. The personnel of the bureau was to consist as far as possible of persons of different nationalities, all appointed by the standing committee on the nomination of the medical secretary. The medical secretary was to prepare in advance an annual budget for the approval of the standing committee and be responsible to the secretary-general of the League for all expenditure he might incur. The League of Nations was to provide all approved expenditure.

It will readily be agreed that the organization above outlined indicates great possibilities for the advancement of international public health; such machinery as is proposed should be capable of effecting a much-needed coördination among the individual nations, especially in such matters as shipping hygiene, port sanitation, etc., but how far the new organization will prove an advance on the work carried out by the various international health congresses held periodically at different centres will depend in some measure on the capabilities of the personnel to be appointed for the control of the new machine. It is greatly desired that the health organization of the League of Nations shall prove to be something more than an international bureau for the collecting and transmitting of health statistics.

Important as is the consideration of the various points of contact among individual nations in matters pertaining to general sanitation, yet there lies before the League of Nations the larger function of influencing the health of the people in the various countries in matters pertaining to the prevention of disease. Popular educational propaganda for the dissemination of knowledge in hygiene is likely to be more effective in raising the general standard of health of a people than the more tedious method of "patchy" and intermittent legislation. The "will to health" has to be quickened in the individual citizen by means of education, and one of the most hopeful elements in the new organization is the proposal to work in coöperation with voluntary organizations, which are more likely to be effective in carrying out educational health propaganda than when such is attempted by an official state organization.

One other aspect of the new organization that is suggestive of great possibilities is the fact that International Labour is to be represented on the standing or executive committee. The whole question of industrial hygiene as it affects the health and welfare of the worker is thus likely to receive that degree of attention which is so much needed. (N. B.)

MEDINA (*see* 18.64).—Before the World War, Medina was less known to Europeans than Mecca, although it was described by the earlier travellers, Burckhardt and Burton, and by Wavell (who visited it in 1908) as late as 1912. Much new information regarding existing conditions in the city was obtained as a result of the war operations.

A Turkish staff map of the environs of Medina, on the 1:50,000 scale, captured after the surrender,—the first map available since Burton's sketch made about 70 years ago,—shows the plan and disposition of the city, and photographs seized from the Turks revealed for the first time the nature and character of some of its buildings. The dimensions of the city were overestimated by earlier writers, the walls actually measuring not more than $1\frac{1}{2}$ m. in circumference, with the longest diameter a little over $\frac{1}{2}$ m. E. and W. The Hejaz railway has its terminal station outside the city walls at the Bab el 'Ambari, the gate on the S.W. through which runs the road to Yambo'. During the war a branch was carried from the main line, through a breach in the walls on the N.W. side, to the outskirts of the *Haram*, or Great Mosque, which was used as a munition store and intended to serve as an inner citadel in case of siege.

At the outbreak of the revolt in June 1916 the Arabs, unable to take the city by assault, withdrew and began a blockade which—as they were unwilling to bombard the city for fear of damage to the holy places and refused to cut the water-supply conduit—lasted until the Turks surrendered the city in Jan. 1919. In 1917 Fakhri Pasha, commander of the garrison, devised a scheme for the rebuilding and modernization of Medina, but all that happened was the destruction of a great number of houses for the sake of the beams and woodwork to feed the railway locomotives. Extensive palm plantations outside the walls, E. and N.E., were also ravaged for the same purpose. Large palm-gardens which formerly occupied much space within the walls were, in great part, built over, and the Barr el Manakha, or central open space, was encroached upon.

Before the World War the normal resident population was estimated at 40,000, of whom a large proportion were aliens who had settled after pilgrimage. The Turks deported about three-quarters of the inhabitants during the blockade, and, allowing for further decrease by disease, the population in 1920 was well under 10,000.

For plan, see Arabia.

MEHTA, SIR PHEROZESHAH MERWANJI (1845–1915), Indian Moderate leader and municipal reformer, was the son of a Bombay merchant. Educated at the Elphinstone College, he was the first Parsi M.A. of Bombay University, and coming to London to read at Lincoln's Inn was also the first Parsi to be called (1868) to the bar. With Dadabhai Naoroji he founded the organization which grew into the present East India Association. Returning to Bombay he rapidly made a name as an advocate and built up a fortune at the bar. Appointed in 1869 as Justice of the Peace, to participate in municipal affairs, he eagerly promoted the reform of civic administration begun in 1872, from which date he served on the new Bombay Corporation till his death. Through these 43 years he exercised wisely an extraordinary personal ascendency in that body and was four times president. He was also the dominant non-official figure in the Bombay Legislature, where he served for over 30 years. He represented its non-official members on the Supreme Legislature for three triennial terms to 1902, when he made way for G. K. Gokhale. One of the founders of the Indian National Congress, he presided at the Calcutta session of 1890. A stout opponent of violent methods, he did perhaps more than anyone else to stave off the complete triumph the extreme section in the Congress secured soon after his death. Most influential in the affairs of the Bombay University, he was in the last few months of his life vice-chancellor. A great orator, with remarkable gifts for managing men, his steadfast devotion to local and provincial reform and progress, while not irresponsive to wider calls, had a most valuable influence in moulding nascent Indian public life. Created a C.I.E. in 1894, he was advanced to the knighthood of the Order 10 years later. In the last year of his life, in spite of declining health, he threw his great influence strongly on the side of full Indian coöperation with the rest of the Empire in the World War. He died in Bombay Nov. 5 1915.

See the political biography by H. P. Mody (2 vols. 1921). Much light is thrown on Mehta's services to his native city in *Rise and Growth of Bombay Municipal Government* (1913), by his most intimate friend and co-worker, Sir Dinshaw Wacha. (F. H. Br.)

MEIGHEN, ARTHUR (1874–), Canadian statesman, was born June 16 1874 at Anderson, Perth co., Ontario. After studying law, he practised for some years in Portage la Prairie, Manitoba. He was elected to the Canadian House of Commons in the general election of 1908, and was reëlected in 1911 and 1917. In 1913 he was appointed Solicitor-General in the Borden administration and in 1915 was sworn of the Privy Council for Canada. He became Secretary of State and Minister of Mines in 1917, and the same year was made Minister of the Interior and Superintendent-General for Indian Affairs. In 1918 he went to England with the Prime Minister, Sir Robert Borden, to attend the Imperial Conference. Following the retirement of Sir Robert Borden in 1919 he was chosen to succeed him as leader of the Union Government. He became Prime Minister and Secretary of State for External Affairs July 10 1920, and was appointed a member of the King's Privy Council in October of the same year. He attended the conference of Prime Ministers in London in June 1921. But he resigned office on the heavy defeat of his party at the elections in December.

MELBA, MADAME [Nellie Porter Armstrong] (1859–), British singer (*see* 18.90), was the organizer of many charitable efforts during the World War, and collected considerable sums for war charities. In 1918 she was created D.B.E.

MELDOLA, RAPHAEL (1849–1915), British chemist, was born at Islington July 19 1849. Educated at the Royal School of Mines, he became a lecturer at the Royal College of Science, South Kensington, and subsequently professor of chemistry at Finsbury Technical College in 1885, and did valuable work in connexion with the manufacture of coal-tar dyes (*see* 3.82 and 19.168). He was also interested in biological questions, such as the colouring of butterflies and animals (*see* 6.733). He died in London Nov. 16 1915.

See *Raphael Meldola: Reminiscences of his worth and work by those who knew him.* Edited by James Marchant (1916).

MELLON, ANDREW WILLIAM (1855–), American banker and public official, was born in Pittsburgh, Pa., March 24 1855. After graduating from the university of Pittsburgh he entered the banking house of Thomas Mellon & Sons and later became a partner. The business developed into three strong institutions, the Mellon National Bank, the Union Trust Company, and the Union Savings Bank, all of Pittsburgh. Mr. Mellon was elected president of the first mentioned in 1902, and was vice-president of the other two. In the 'eighties he was interested in the development of the coal, coke and iron industry of Western Pennsylvania and was often associated in various enterprises with Henry C. Frick. He founded the town of Donora, Pa., and established a large steel mill there. He built the first independent pipe line, in competition with the Standard Oil Co., through Pennsylvania. He was a director in numerous corporations, and was a conservative Republican, opposing the League of Nations. In 1921 he was appointed Secretary of the Treasury in the Cabinet of President Harding.

MENDELISM (*see* 18.115).—The progress in physiological science made possible by Mendelian methods is described in the articles Genetics and Sex. In the present article the influence of those discoveries on the development of biological thought and their application to the practice of breeding are considered.

(1) *Analysis.*—Modern genetics introduces into biology a factorial or analytical conception of organisms, which are now recognized as largely possessing attributes behaving as units and as such capable of being detached and transferred to any other type with which cross-breeding can be effected. The limits governing this principle of segregation and recombination are still undetermined.

(2) *Phenotype and Genotype.*—In former considerations of biological problems no account was taken of the consequences of the fact that each of the higher organisms is, in modern language, *diploid*, that is to say, a double structure containing factorial contributions derived respectively from the *haploid* or simple male and female cells which in fertilization united to produce it. Since some of these factors inhibit the effect of others, and since some give no sign of their presence in the organism unless other complementary elements are also present, the appearance of an organism is an imperfect guide to its genetic potentialities. We have thus to distinguish the organism as it outwardly appears to be from that which it actually is by genetic composition, a distinction which Johannsen has conveniently expressed by the use of the terms *phenotype* for the former and *genotype* for the latter. Systematic or classificatory works, both zoölogical and botanical, abound with errors arising from want of appreciation of this fundamental distinction, which must constantly be remembered, especially, for instance, whenever the significance of varietal or intermediate forms has to be estimated.

(3) *Variability.*—Evidence formerly regarded as proof of abundant contemporary variability in the species of animals and plants must be submitted to searching tests before it can be so accepted. Observations of variability once deemed adequate are now seen to be capable of quite different constructions. Proof that an observed departure from type is a contemporary genetic variation can only be obtained in exceptional cases which have been critically observed under experimental conditions. Putative variation is commonly nothing but the recurrence of a recessive form, or the emergence of some other segregant, from a stock genetically impure; more often still the direct product of a cross. The existence, therefore, of a multitude of varietal forms, so far from simply providing a convenient basis upon which a theory of the evolution of species can be erected, becomes itself an antecedent problem; and instead of asking, as they used to do, how the species have been built up out of the varieties, biologists are rather concerned to discover whence and by what process these variations have come to exist. The belief that substantial genetic change commonly accrues by summation of impalpable differences has been generally abandoned as devoid of evidential foundation. Such differences are mostly fluctuational, largely dependent on circumstance rather than on genetical units, and hence not transmissible. Summation, when a genuine phenomenon, is a consequence of purification or the attainment of homozygosis. The idea that a characteristic could in any other way increase as a result of selection is out of place in an exact or even a logical science.

(4) *Variation by Loss and by Addition.*—Whether the evidences of authentic variation remaining after the deduction of spurious testimony has been made suffice as a basis of evolutionary theory has been questioned by competent naturalists. Lotsy, for example, maintains that we have no proof of contemporary variation arising otherwise than as a consequence of crossing; and apart from such extreme pronouncements it is noticeable that as regards varieties of animals and plants anciently domesticated, modern authorities usually incline to ascribe a multiple origin even for forms like wheat, the fowls, pigeons, sheep, horses, etc., which used formerly to pass for derivatives from single types, a belief which is now felt to be inconsistent with what is known of the limits of variability. Distinction must be made between recessive and dominant variations, arising respectively by loss and by addition. As regards recessive variations arising by loss of elements few will doubt the adequacy of the records (*e.g.* in the sweet pea, *Primula sinensis*, etc.). As regards the *de novo* appearance of dominant characters the evidence is less abundant. Morgan and the American geneticists have made prominent several instances of this kind in *Drosophila* (fruit fly), of which the spontaneous origin of "eosin" (a new and peculiar pink) eyes in a white-eyed strain may be cited. Admitting provisionally these examples as free from objection they are nevertheless extraordinary events and not common occurrences. Were the dominant in question one already familiar we should hesitate to believe in its spontaneous origin. That a pea genetically wrinkled, having the characteristic starch of the wrinkled varieties, should without crossing produce a variety with "round" starch-grains would in modern lights appear not much less improbable than the spontaneous generation of life.

But, as explained in the article GENETICS, nothing absolutely forbids us from inverting the representation of positive and negative factors by extension of the conception of inhibitors of which many are familiarly known; so that we may express the apparent addition of a new element as a loss of one which when present had repressed the new attribute. This symbolism, though admittedly objectionable when dominance is complete, does without strain apply to all cases in which the heterozygote is intermediate, and a large range of alleged new dominants can be covered. In so far as this conception applies, evolution is conceived of as a process of unpacking, a progress consisting in the loss of component elements.

(5) *Mutation.*—The term *mutation* introduced by de Vries is now generally accepted to denote definite genetical variations which are sensibly discontinuous. Though contemporary examples which satisfy all tests are not abundant, there is no question that they occur and have occurred in most of the forms of life. They are indeed part of the occasional experience of most breeders of animals and plants. The special example, the Oenotheras, on which de Vries mainly founded his own theory was singularly unfortunate; and must, as explained in the article GENETICS, be now discarded as inapplicable. Mendelian analysis was only lately made known and the group of discoveries comprised in the term genetics were in an incipient stage; nor had the criteria of genetic purity, which must be applied to a parental form before the production of new types from it can be accepted as proof of original mutation, been clearly established. The Oenotheras which produce the presumed mutations are now proved to be no pure genotypes, and the suggestion that they were in a "period of mutation" arose from a misunderstanding of the nature and consequences of heterozygosis.

(6) *Inter-specific Sterility.*—The new forms whose productions we witness are never new species. In *Primula sinensis* about 20 pairs of factorial differences have been determined, which in their several combinations present an amazing polymorphism. A systematist, if he met these forms in nature, might and probably would quite justifiably take many of them for distinct species. But interbred, they and their products are perfectly fertile. Polymorphism like this is, even in a state of nature, far more abundant and far greater than the evolutionists of the last century imagined, yet it avails us little as material out of which true specific differences can be supposed to develop. The conspicuous defect in the evidence for the origin of species by common descent remains. Though much is known as to the incidence of variation, not rarely of a magnitude which might naturally be claimed as constituting specific difference, no one has yet raised types from a common origin which when interbred produce sterility of the kind and degree which is one of the commonest attributes of crosses between natural species. By whatever concatenation of arguments theories of evolution have been constructed, that most essential link has never been supplied. The lapse of time is occasionally invoked in the hope of rectifying this and similar evidential defects, a strain which has been maintained distinct for a long period being thought more likely to show interracial sterility when crossed with its progenitor than one newly separated. Reasoning of this kind, plausible enough in scholastic days, is not acceptable in an age of chemistry, nor may we suppose that that which is never begun will be attained by mere effluxion of time. The more genetical experience extends, the more serious does this hiatus in the evidence become.

(7) *Evolution.*—In allusion to this and other difficulties, which genetic research has forced into prominence, the question is sometimes asked whether the theory of evolution holds its place so firmly as it did, or, more crudely put, whether Mendelian discovery has not "upset Darwinism." It should therefore be stated explicitly that in spite of all the objections with which the doctrine of the origin of species by descent is now seen to be beset—objections of which the strength is far more clearly known than before—and though as to the manner by which new species have come into existence geneticists adopt for the most part an agnostic attitude, yet all agree that the lines of argument converging to support the theory of common origin are so forcible and so many that no alternative can be entertained. The geological record is conclusive. To take one most cogent instance: if Angiosperms had existed in the carboniferous age their remains must have been preserved; therefore Angiosperms have arisen since that time, and we cannot conceive whence they came if not by descent from the preëxisting plants. Common descent, though rarely if ever a proposition demonstrable in any detail, ranks as an axiom. For Darwin and any other evolutionist before or after him this is a concession of the main claim. Parts of the apparatus by which the validity of that claim was enhanced have fallen into desuetude. In particular the modern geneticist assigns to *natural selection* a subordinate and inconsiderable *rôle*. Organisms are to be considered as coördinated systems. That each particular structure or instinct comprised in the system, which shows permanence or definiteness, makes a contribution to the success of the system equivalent to the cost of its production is recognized as a fallacy. We are also reluctant to apply to the interrelations of the collective properties of organisms arguments which would be out of place in similar considerations of the attributes of unorganized substances. We no more look for utility in the details of a peacock's feather than in the iridescence of a Roman bottle or in the regularity of basaltic prisms.

(8) *Adaptation.*—It is not merely in regard to the mode by which species have arisen that agnosticism has prevailed. While unwilling to accept adaptation, with Darwin, as a summation of happy accidents, we have no alternative to offer, nor is there in the recent attempts of various experimenters to find that organisms transmit to their posterity structural emendations in response to parental experience anything which sensibly alleviates the difficulty. Most of these claims are obviously faulty and few require serious notice.

Each step in the progress of this branch of science has rather compelled the recognition of genetic determinism; and the hope that by change in the conditions of life or by any external influences significant alteration can be induced in succeeding generations, whether of organisms amenable to experiment or of the human population, must be abandoned.

(9) *Classification.*—The full implications of factorial analysis in relation to biological classification are not yet appreciated. The fundamental idea of the systematist, that animals and plants can be grouped into species, and that the distinctions between species are of a different order from those characteristic of vari-

eties, is now scarcely open to question. Nevertheless the belief held very widely by systematists, that certain classes of differences are important as being more fixed, and others trivial as being more liable to variation, is scarcely consistent with genetical knowledge. The frequency and amplitude of variation and the perfection of segregation must be empirically determined for the various organisms and for the various characters. No general rules can be predicated. Anthropologists, for example, are accustomed to regard special features of anatomy as comparatively sure guides to racial origin. Knowing what we now do of segregation and recombination we suspect that no characteristic is incapable of segregation and so of transference to another race: given the possibility of cross-breeding, the shape of the skull or other bodily peculiarity may be transferred in its entirety to individuals descending by another parent from a different race, and hence to a resulting population, more slowly but not less completely than a language or a custom.

The classificatory dichotomies in common use in the systematic arrangement of animals and plants have no prerogative significance except for mnemonic or demonstrative purposes; for the number of the dichotomies is merely an enumeration of the pairs of factorial differences, and the order in which they are taken into account, though often treated as a matter of cardinal importance, is purely arbitrary. Peas, for instance, are divided first into tall varieties and dwarf varieties, then into round and wrinkled, yellow and green, etc., but it would be logically as sound and physiologically as justifiable to divide them first into yellow and green, then into early and late, and so on. If the races of men could be crossed under experimental conditions we should find the same principles governing their distinctions.

(10) *Applications.*—The applicability of genetic discoveries to the betterment of the human race is discussed in the article EUGENICS, but a few words as to the progress in the art of breeding animals and plants made possible by the development of Mendelism may be given here. The use and consequences of crossing in the search for new forms of economic value are now apparent. The reasons for preserving the first generation (F_1) though it may present no valuable feature and the desirability of raising from it as many individuals (F_2) as space will accommodate, are obvious. The breeder now knows what he is about and is able to interpret countless phenomena previously meaningless. Granting that the chief breeds of animals now in the keeping of civilized man are not capable of much amelioration, experience has shown that enormous improvements can be made by applying accurate knowledge to the breeding of even such old-established crops as wheat, oats, tobacco, etc. If this is true of the crops which have for ages been the object of unremitting care, it will be understood that the cultivated plants of tropical regions offer limitless possibilities. The breeding of coconut, rubber, jute, cacao and many more has scarcely begun. These are all still raised from seed gathered almost promiscuously, the result of uncontrolled fertilization, and the produce is what we should see if our orchards were raised from seeds and those seeds gathered at random from garden varieties and from wildings in the hedgerows. At first, selection and fertilization under control will suffice to make great progress. Even at that stage some genetic knowledge will be of value, but when the more difficult task of making genetic recombinations of desirable qualities is begun the breeder will require skill in the management and interpretation of the generations and the various terms in the series of forms which only accurate knowledge of principle can supply. Genetic science shows primarily what can be expected, providing the breeder with an aim, and also indicates how it may be attained. For example, a crop of sugar beet often contains 4%—sometimes many more—of plants which "bolt" or flower in the first year making no "bulb," and so worthless. This state of things has long been accepted as inevitable. But when the geneticist finds that the annual habit is a recessive, he suspects that the plants which produce the bolters are heterozygous in that respect, and that if he can raise plants homozygous in the biennial habit he will have eliminated bolting. The breeder, whether scientific or practical, ignorant of genetics, would never suspect the nature of the fault, still less could he devise a cure. Common sense in the art of seed-raising is an imperfect guide. Apart from any question of making new races, the purification of existing varieties and their maintenance in a state of purity are exacting tasks. What has been done in these several phases of the industry, in ignorance of principle, is remarkable, but we may confidently foresee that the application of scientific method will in the case of the breeder's art effect a change in magnitude no less than that which has been witnessed in the other industries.

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MENÉNDEZ Y PELAYO, MARCELINO (1856–1912), Spanish scholar and critic (*see* 18.128), was at the time of his death working at the second edition of his *Historia de los heterodoxos españoles*. He died at Santander May 19 1912, and bequeathed his valuable library of 40,000 volumes to that town.

See A. Donoso, *Menéndez y Pelayo y su Obra* (1913); Bonilla y San Martín, *Menéndez y Pelayo, 1856–1912* (1914); and A. G. de Amezua y Mayo, *Nota bibliografica de Menéndez y Pelayo* (1918).

MENSDORFF-POUILLY-DIETRICHSTEIN, ALBERT, COUNT VON (1861–), Austro-Hungarian diplomatist, was born at Lemberg Sept. 5 1861. He was the second son of Alexander von Mensdorff-Pouilly, Prince Dietrichstein von Nicolsburg, and Alexandrine, born Countess Dietrichstein-Proskau and Leslie. Entering the diplomatic service at an early age, he was assigned in 1886 to the Paris embassy and in 1889 transferred to London, where with short intervals he was ambassador from 1904 to Aug. 13 1914. He used his family relations with the English court, derived through the marriage of Count Emmanuel Mensdorff-Pouilly (1777–1862) with Queen Victoria's aunt, Princess Sophia of Saxe-Coburg, his friendship with Edward VII. and George V., and his popularity in English aristocratic circles, to establish and secure friendly relations between the Cabinets of Vienna and London. In the critical negotiations before the outbreak of the World War he supported every attempt to avert the danger. During the war he was repeatedly entrusted with missions directed towards the restoration of peace. He met Gen. Smuts in Switzerland in Dec. 1917, but these negotiations proved as fruitless as those which he conducted with the Entente representatives in the last days of the Habsburg Monarchy. At the end of 1920 he represented the Austrian Republic on the occasion of its reception into the League of Nations.

MERCIÉ, MARIUS JEAN ANTONIN (1845–1916), French sculptor and painter (*see* 18.152), died in Paris Sept. 12 1916.

MERCIER, DÉSIRÉ (1851–), Cardinal Archbishop of Malines, Belgium, was born Nov. 21 1851 at Broine l'Allemt, in the Walloon portion of Brabant, of a bourgeois family. After finishing his course at the college of St. Rombaut at Malines, he entered the larger seminary of that town, and on April 5 1874 was ordained priest. He continued his theological studies at Louvain, and in 1877 was appointed professor of philosophy at the lesser seminary of Malines. In 1882 he was appointed to the recently created chair of Thomist philosophy at Louvain, and during the ensuing years was active in the scheme for founding the Institut Supérieur de Philosophie at Louvain, which was finally opened in 1894.

In Feb. 1906 Monsignor Mercier was appointed Archbishop of Malines in succession to Archbishop Goossens, and in 1907 he was created a cardinal. Soon after the outbreak of war in 1914 he was summoned to Rome to attend the funeral of Pope Pius X. and the election of his successor, and it was therefore not until his return to Belgium that he became fully aware of the incidents of the German invasion. He personally inquired into many of the allegations against the invading army, and as a result issued his famous pastoral letter "Patriotism and Endurance." In this he strongly protested against the cruelties which had been inflicted on the Belgian population, at the same time recommending submission to the authorities in everything that was just. This pastoral was widely read, in spite of all the efforts of the German authorities, and the cardinal declined in any way to retract his words. Henceforth, during the four years of the German occupation, he did not cease to protest against violations of right and justice by the Germans, and was often in conflict with the military authorities, as his correspondence with the German governor shows. Some of his protests were successful and on Oct. 17 1918 Baron von der Lancken, head of the political department at Brussels, announced to him the impending liberation of political prisoners. The dignity and courage of the cardinal's conduct were universally recognized.

Cardinal Mercier's published works include *Cours de philosophie* (in four vols., I. *Logique*, II. *Métaphysique générale*, III. *Psychologie*, IV. *Critériologie générale*, 1892) and also *À mes séminaristes* (1907); *La Vie intérieure* (1918); *Retraite pastorale* and five vols. of *Œuvres pastorales*. See also *Correspondance de S.E. le Cardinal Mercier avec le gouvernant général allemand pendant l'occupation.* (F. M.)

MERRIMAN, JOHN XAVIER (1841–), South African statesman, was born on March 15 1841 at Street, Som., England. He was a son of Nathaniel James Merriman (1810–82) who in 1841 had become vicar of Street, and was afterwards archdeacon of Grahamstown, dean of Cape Town and, from 1871, Bishop of Grahamstown. The family removed to South Africa in 1849. John Xavier was educated at the Diocesan College, Rondesbosch, and later at Radley College, England. He returned to South Africa in 1861 and became a farmer.

Merriman began his political career in 1869, when Cape Colony was in the transition stage of representative government. In temperament and outlook an aristocrat of the Whig school his subtle mind brought him in turn into coöperation with opposing parties, but he was always a champion of personal liberty and an advocate of native rights. In 1872, despite his opposition, the Cape obtained self-government, and in 1875 Merriman joined the Molteno Ministry as commissioner of public works. He was already distinguished for his energy and capacity, and when in 1877 war with the Galeka Kaffirs broke out Merriman became virtually Secretary for War in the Cabinet. In this work he came into collision with the governor, Sir Bartle Frere, who complained of Merriman's "insane attempt to ape Gambetta," and insisted that he (Frere) alone had the right to direct the war. Molteno supported Merriman; in the result Frere dismissed the Cabinet, Feb. 1878.

Merriman came into office again in the Scanlen Ministry (1881–4), and again as commissioner of public works. It was a period of great difficulty following the Majuba campaign and the retrocession of the Transvaal. In the Cape the Afrikander Bond had been formed, and its more than dubious attitude to the British connexion alienated Merriman from the Dutch extremists. "My quarrel with the Bond," he said in a speech at Grahamstown in 1885, "is that it stirs up race differences. Its main object is to make the South African Republic (the Transvaal) the paramount power in South Africa." The Bond had caused the fall of the Scanlen administration because the Ministry opposed the attempt of the Transvaal Boers to seize Bechuanaland. In the last few weeks of its existence Merriman and Cecil Rhodes had been colleagues and when Rhodes formed a Ministry in 1890 Merriman joined it as treasurer-general. Meanwhile the Bond, under the guidance of Jan Hofmeyr, had adopted a constitutional programme, and 1890 saw a drawing-together of the Dutch and British elements at the Cape. But the uitlander troubles in the Transvaal became acute, and in 1893 Merriman resigned. In Dec. 1895 came the Jameson Raid. Merriman, who was chairman of the Cape parliamentary committee which inquired into the raid, and drew up its report, desired reforms in the Transvaal, not its absorption into the British Empire. "The greatest danger to the future," he declared in a letter to President Steyn (dated March 11 1898), "lies in the attitude of President Kruger and his vain hope of building up a State on a narrow, unenlightened minority."

The general election in Cape Colony in the latter half of 1898 gave the Bond a very narrow victory, and P. W. Schreiner became Prime Minister, with Merriman (treasurer-general again) and J. W. Sauer as his chief colleagues, though none of them was members of the Bond. This was the Ministry in office when the Anglo-Boer War of 1899–1902 broke out (*see* 5.244). Merriman was among the ministers who in 1900 opposed the measure to disfranchise the Cape rebels; this opposition led Schreiner to tender the resignation of the Cabinet. Later Merriman and Sauer came to England to plead for the restoration of the independence of the Boer republics. At the general election of 1904 Merriman was defeated, but was returned shortly afterwards at a by-election. He led the opposition during the Ministry of Dr. Jameson and in Jan. 1908 succeeded him as Prime Minister and treasurer-general (*see* 5.247).

Merriman lent the weight of his great authority to the movement for unification and was a member of the national convention which hammered out the new constitution. He was one of the delegates who came to London in connexion with the passing of the South Africa Act as well as a delegate to the imperial conference on naval and military defence of 1909, on which occasion he was made privy councillor. When on the establishment of the Union in 1910 the Cape Parliament ceased to exist he did not join the Union Ministry under Botha (*see* article SOUTH AFRICA, section *History*). He remained a somewhat detached member of the South African party and a not infrequent critic of ministers. Holding that as an equal member of the British commonwealth South Africa had found its proper place, he opposed the disruptive policy of Hertzog as strongly as he had formerly supported the independence of the Boer republics. He married, in 1874, Agnes, daughter of Mr. L. Vintcent, a member of the Cape Legislative Council.

(F. R. C.)

MERRITT, WESLEY (1836–1910), American soldier (*see* 18.173), died at Natural Bridge, Va., Dec. 3 1910.

MERRY, WILLIAM WALTER (1835–1918), English classical scholar, was born at Evesham Sept. 6 1835. Educated at Cheltenham and Balliol College, Oxford, he became fellow and lecturer of Lincoln College, Oxford, in 1859 and rector of the college in 1884. A witty and fluent speaker both in Latin and in English, he acquired a great reputation as public orator to the university, a post he held from 1880 down to the time of his death. He published editions of many of the plays of Aristophanes (1879–1900), as well as an edition of Homer's *Odyssey* (1876–8) and *Selected Fragments of Roman Poetry* (1891). He died at Oxford March 5 1918.

MERSEY, JOHN CHARLES BIGHAM, 1ST VISCOUNT (1840–), English judge, was born at Liverpool, Aug. 3 1840, and was educated at the Liverpool Institute and later at Berlin and Paris. He was called to the bar in 1870, was made a Q.C. in 1883, and became leader of the northern circuit. He entered the House of Commons in 1895 as Unionist member for the Exchange division of Liverpool, but lost his seat in 1897. In the same year he was raised to the bench and knighted. In 1902 he was president of the Royal Commission for the revision of the South African martial law sentences, and from 1904 to 1908 president of the railway and canal commission. From 1904 to 1910 he was chief judge in bankruptcy, and in 1909 became president of the Probate, Divorce and Admiralty division of the High Court, and was made a privy councillor. In 1910 he was raised to the peerage. He was recognized as one of the highest authorities on Admiralty and shipping questions, and in 1912 became wreck commissioner, being the same year president of the commission which investigated the loss of the "Titanic." He presided in 1913 over the conference on the safety of life at sea, and in 1914 over the commission of inquiry into the loss of the "Empress of Ireland." On the outbreak of the World War Lord Mersey's wide experience and knowledge were recognized by his appointment as head of the Admiralty transport arbitration board, and in 1915 he investigated the circumstances attending the losses of the "Falaba" and the "Lusitania." In 1916 he was created a viscount.

MERTHYR, WILLIAM THOMAS LEWIS, 1ST BARON (1837–1914), British engineer, was born at Merthyr-Tydvil Aug. 5 1837. He was trained as a civil engineer and in 1864 married Anne Rees, daughter of a S. Wales coal-owner. Thenceforth he was a large employer of labour in the S. Wales collieries and effected many improvements both in the machinery of the mines and the condition of the miners. He was the originator of the sliding scale of wages introduced into the district in 1875, and also of a miners' provident fund. He was called in to settle the serious Taff Vale railway strike in 1900, and was an active worker for industrial peace. He was a member of several Royal Commissions, was knighted in 1885, created a baronet in 1896 and raised to the peerage in 1911. He was made K.C.V.O. in 1907 and G.C.V.O. in 1912. He died at Newbury, Berks., Aug. 27 1914.

MESDAG, HENDRIK WILLEM (1831–1915), Dutch marine painter, was born at Groningen Feb. 23 1831. He adopted a business career, entering the family banking firm of Mesdag, but about 1866 he came under the influence of Josef Israels, with the result that he took up the study of art. His sea pieces became famous, and earned him the gold medal of the Paris Salon, among them being "Effet du soir à Scheveningen" (1872); "Après l'Orage" (1895); "Rentrée des bateaux de pêche" (1900) and "Une soirée sur la plage de Scheveningen" (1911). He also made a fine collection of pictures and *objets d'art*, which he presented to the nation, and they are housed in the Mesdag museum at The Hague. He died at The Hague July 7 1915.

MESOPOTAMIA (*see* 18.179).—In the classical sense "Mesopotamia" is the country from Mosul and Tikrit on the Tigris to the borders of Syria. In the earlier article it was this area which was described under the heading of MESOPOTAMIA. It was then said concerning the name itself that "in modern times it is often used for the whole Euphrates country. That would provide a useful name for an important geographical unit, but it is too misleading." The point has, however, now been settled, for when the Indian Expeditionary Force landed at the head of the Persian Gulf in 1914 the public decided that it was Mesopotamia which was in question, and the name is now applied, under the sanction of international treaties, to the country stretching from the head of the Persian Gulf as far up the Tigris and the Euphrates as the direct responsibilities of the British Government extend. The area coincides, except for a slight variation in the northern boundary, with the Turkish vilayets of Basra, Bagdad and Mosul. The Arab name for what is now called Mesopotamia is *Iraq*—a term (sometimes Englished as Irak) formerly covering only the alluvial plain from about Tikrit southwards, but now commonly and even officially used for the whole area governed from Bagdad.

The boundaries of Mesopotamia are: N., a line running roughly E. and W. through a point on the Tigris rather nearer to Jeziret ibn 'Umar than to Mosul. S., territory of the Sheikh of Mohammerah (Persia), the Persian Gulf and Kuwait. E., the Turco-Persian frontier (this boundary was the subject of a Turco-Persian commission assisted by British and Russian representatives in 1913–14; the commission completed its labours just before the war began, but its report was never ratified). W., the Arabian and Syrian deserts.

Southern Mesopotamia consists of an alluvial plain which stretches from the Persian Gulf a distance of some 400 m. to the north. This plain passes into rolling downs S. of Mosul; and beyond Mosul, to the N. and E., it rises into the limestone mountains of Kurdistan, where some peaks attain a height of 11,000 feet.

Climate.—The climate of Mesopotamia is continental sub-tropical. The main features are large daily and annual ranges of temperature, lack of moisture and scanty rainfall. The annual rainfall-totals recorded at the three largest towns are:—

Place	Number of years	Annual average rainfall in inches
Basra	18	6·68
Bagdad	29	6·64
Mosul	4	16·71

All the rain falls during the winter months; there is a long rainless summer lasting from April or May to Oct. or November. The temperature in summer is as high as that of any place in the world; 120° F. in the shade is not uncommon at Bagdad and Basra and in 1921 128° F. in the shade was recorded at Basra. On the other hand severe frost is often experienced in winter. At Mosul temperatures of over 30° F. below freezing-point have been registered, and the absolute minimum on record runs from 0° F. at Mosul to 19° F. at Bagdad and 24° F. at Basra. The heat of summer is tempered by the excessive dryness of the atmosphere and by the prevailing wind, the *shamal*, which blows from the north. (A. T. W.)

Medical Conditions.—The Tigris and Euphrates and the Shatt al Arab river formed by their junction overflow their banks in the spring and early summer months owing to the water derived from the melting snows of the mountains near their source. As a result of this, the lower portions of Mesopotamia contain large marshy districts near the banks of these great rivers which have a great influence on the hygienic conditions prevailing. The hot months of the year are from May to Oct., the hottest being July and Aug., but fortunately even in these months the nights are relatively cool. Just as in the case of the Persian Gulf, the intense heat is rendered much more dangerous to human life by the high relative humidity of the atmosphere caused by the moisture derived from the rivers and marshy districts adjoining.

The dangers from heat exposure experienced in the Persian Gulf exist equally in the lower parts of Mesopotamia, such as Basra, Mohammerah, Gurna and as far up the Tigris as Ezra's Tomb, and similarly the lower reaches of the Euphrates up to Nasiriya are subject to like climatic conditions. In these districts, owing to the ample opportunities provided by the marshy areas, mosquitoes flourish abundantly and the malaria-carrying *anopheles* varieties are prevalent. Malaria is consequently a disease which is very common, and it is usually of the type known as benign tertian. In these regions the greatest care is necessary to avoid infection and the constant use of mosquito-nets is essential. The taking of quinine, 5 gr. *per diem*, has been recommended as a prophylactic measure during the months when mosquitoes abound, but the mosquito-net is the surer safeguard. The other parts of Mesopotamia are subject to equally high temperatures but the air is drier and the dangers from heat-stroke are much less. Malaria is less prevalent, though it occurs in the neighbourhood of the marshy districts.

Dysentery is prevalent throughout Mesopotamia. The form of dysentery caused by the *Amoeba dysenteriæ* occurs all the year round and it may be complicated by inflammation of the liver and liver abscess. The other variety of dysentery known as bacillary dysentery is common and is apt to occur in epidemic form, especially in the autumn months. Both varieties of dysentery are conveyed by impure water, so that the drinking of water which has not been boiled or chlorinated, or the eating of salads, etc., which may have been washed in contaminated water, must be carefully avoided.

Enteric fever, which includes typhoid fever and the fevers of paratyphoid A and B organisms, is a water-borne disease and is common in Mesopotamia. A valuable protection against them is afforded by prophylactic inoculation with T.A.B. vaccine, which protects against the three enteric-group fevers. Every resident should obtain the valuable protection afforded by a yearly inoculation with T.A.B. vaccine.

Cholera occurs in Mesopotamia and is a water-borne disease. It is frequently also introduced into Basra by infected persons arriving on ships from India and elsewhere. Prophylactic inoculation against cholera has been recommended, but the immunity conferred is of short duration, only lasting a few months, and it is not recommended as a protection for white residents unless a serious epidemic is prevalent.

"Carriers" of disease are persons who are apparently in good health but whose excreta contain the organisms of an infectious disease. "Carriers" of the water-borne diseases above mentioned, dysentery, enteric-group disease and cholera, are frequently found in tropical countries; and not uncommonly cooks and servants or persons who handle food and drink, when "carriers" of these diseases, cause infection to others. Such persons suspected of being "carriers" of disease should be submitted to a bacteriological examination which would detect the presence of the disease-producing organisms in their excreta.

Sand-fly fever is exceedingly common; it is an acute and painful fever of about three days' duration which is caused by the bite of an infected sand-fly (*Phlebotomus Papatasii*). This pest is so small that it can readily find its way through an ordinary mosquito-net, and in order to protect oneself against sand-fly fever it is necessary to sleep under a net of sufficiently fine mesh to prevent its entry. Sand-fly nets are commonly used in the tropics and are preferable to ordinary mosquito-nets, since they keep out both sand-flies and mosquitoes. Insect repellants, such as oil of citronella, eucalyptus, paraffin, vermijelli, turpentine, etc., may be smeared on exposed parts of the body to prevent the bites of sand-flies and mosquitoes at times when one is not protected by a net.

Plague is not common in Mesopotamia, though in former years serious epidemics have been recorded. At the present day plague is generally introduced from India by cargoes landed in the Mesopotamian ports, and sporadic cases frequently occur in Basra amongst seafaring people. The disease is spread by rats, which are readily infected with the *Bacillus pestis*, the organism being carried from the rat to man by the flea. Prophylactic inoculation is of value when an epidemic is prevalent, and in 1919 it was a valuable means of arresting an epidemic of plague amongst the native populations of Basra, 'Amara and Bagdad.

Oriental sore (Bagdad boil) is very common in Mesopotamia, and few of the native population escape infection. It is a chronic ulcer caused by inoculation of a protozoal organism known as *Leishmania tropica* by means of an insect bite, probably the sandfly. The latent period may be several months. It is a slowly healing sore, lasting often a year or more, and leaves a scar. Usually exposed parts of the body are affected and the scars are known as date-marks.

Eye diseases such as conjunctivitis, trachoma, etc., are exceedingly common amongst the natives of Mesopotamia and cause a great amount of blindness. They are spread by dust, dirt, flies and infection from one person to another. There is an immense field of much-needed work open to specialists in eye diseases in Mesopotamia, since most of these are preventable and many curable.

Tuberculosis in all its forms is a fairly common disease amongst the native population. Leprosy is also fairly common and no attempts have been made in the past to isolate affected persons. Smallpox is of frequent occurrence and every resident should be protected by repeated vaccination. Typhus fever is also of frequent occurrence in Bagdad and the northern areas of Mesopotamia. It is a disease carried by infected lice, and is introduced into the country annually by lice-infected persons along the caravan routes from the cooler countries adjoining, viz. Persia and Asia Minor. Typhus is of rare occurrence in the southern parts of Mesopotamia, the intense heat destroying lice. Venereal diseases, such as syphilis and gonorrhoea, are common amongst the native population.

Diarrhoeal diseases are very common, and are due to infection of food and drink by dust, flies, and contaminated water. The Arab children are severely affected, and infantile mortality is high.

Deficiency diseases, such as scurvy and beri-beri, were prevalent to a great extent during the early part of the World War amongst the British troops in Mesopotamia. This was due to the difficulty of transport of fresh vegetables and fruit on account of their perishability owing to the intense heat. These diseases are not likely to occur during peace conditions and they do not appear to occur amongst the native population, who can obtain fresh and wholesome food, dates, vegetables, corn and meat, etc., in abundance.

Though this account of the diseases occurring in Mesopotamia may appear somewhat alarming to those contemplating residence there, nearly all of the diseases are preventable by simple precautions, such as care of food and drink, protection at night from insect bites, avoidance of unnecessary exposure to heat, and the ordinary habits of personal cleanliness. Under proper precautions Mesopotamia is a healthy country, especially north of 'Amara and Nasiriya, and for 8 months in the year the climate is perfect. There is no reason why white races resident there should not experience excellent health, but it is advisable that residence in a cool climate during July and Aug. should be arranged for as often as possible.

(W. H. W.)

Population.—According to a census taken in 1920 the pop. of Mesopotamia is nearly three millions. The figures, according to religions, are given in Table 1.

The population is Arab, with the following exceptions: (1) A strong Turkish element in a string of towns stretching N. from Mandali near the Persian border, through Kifri and Kirkuk to Altun Köprü and Erbil. Tall Afar, some 40 m. W. of Mosul, is a Turkish town, and there are Turkish villages in the plain of Mosul. These Turks are not Osmanlis but descendants of earlier Turkish invasions and of mercenaries brought in by the Abbasid caliphs to guard the borders of their realm. (2) The Kurds, who inhabit, to the almost complete exclusion of other races, the country E. of the line of Turkish towns. (3) The Jews, most of whom live in Bagdad, Basra and Mosul. They are supposed to be descended from those Jews of the Babylonian captivity who disregarded Nehemiah's summons to return to rebuild the walls of Jerusalem. (4) The Christians, who are confined to the big towns, except in the Mosul area where there are several thriving Christian villages which live by agriculture. Most of the Christian population are Chaldeans (*i.e.* Nestorians who have become Roman Catholics), but there are some Syrian Catholics and a few Jacobites (or old Syrians) and Armenians; and during the war thousands of Nestorians drifted to Mesopotamia as refugees from the country between Lake Van and Lake Urumia, and some of these have settled in villages to the N.E. and E. of Mosul. (5) A considerable Persian population living in the Shiah towns of Najaf (Nejef), Karbala and Kadhimain, and in Bagdad. (6) The Yezidis (the so-called devil-worshippers), who inhabit the Sinjar and also certain villages E. of Mosul. (7) The Sabeans (Mendaites), a curious people, now reduced to a handful, who live in Lower Mesopotamia, mainly at Qal at Salih and Suq ash Shuyukh. They hold John the Baptist in great reverence and there are traces of star-worship in their cult.

The Arabs, who by reason of their numerical predominance give the character to the country, range from the partly Europeanized "notables" of Bagdad to the almost Bedouin population of desert "ports" such as Zobeir and Kubaisa; from sections of ancient tribes, famous in pre-Mahommedan verse, such as Bani Tamin and Khasraj, to the wild "Marsh Arabs" of Lower Mesopotamia, who are hardly recognized as Arabs by the rest of the population; from sheep-rearing tribes, nomad or semi-nomad, to men who have cultivated the same date-gardens for generations and have long lost all their tribal characteristics.

Religion.—Except for the insignificant proportion which is composed of Jews, Christians, Yezidis and Sabeans, the people of Mesopotamia are all Mahommedans. They are, however, split into Shiahs and Sunnis. South of a line drawn roughly from W. to E. through Bagdad, the population, except for the big towns, is almost exclusively Shiah (Shi'ah) while N. of it few Shiahs are found. All the Turks, and with very few exceptions all the Kurds, are Sunnis.

Language.—The Turks of the Erbil–Kirkuk–Mandali line talk a tongue that is akin to Azerbaijani rather than to Ottoman Turkish. The Kurds and the Yezidis talk Kurdish, which is closely allied to Persian and, indeed, is maintained by some to be only a Persian dialect. It may be said, however, that south and west of the Turkish towns only Arabic is spoken. There are considerable variations in vocabulary and pronunciation. Everywhere there is found an admixture of Turkish, Persian and—in the south—English words, but the Arabic of Mesopotamia is generally pure and homogeneous.

Agriculture.—The most important occupation is agriculture. The winter crops are wheat and barley, barley predominant in the Bagdad and Basra areas, wheat in the Mosul area. In the north the winter crops are grown on the rain; but in the south, where the rainfall is less than seven inches, no crops are grown (except, occasionally, scanty catch crops) without assistance from irrigation. For summer crops, even in the north, irrigation is required. The chief summer crop is rice, which is grown chiefly in the marsh lands of the middle and lower reaches of the Tigris and the Euphrates. Most of this rice is red rice of common quality. Better kinds, but in very small quantities, are grown in the Kurdish hills. Millet also is grown, and a little maize. In the Kurdish hills large quantities of cigarette tobacco are produced, and the coarse tobacco used for water-pipes (*tumbak*) is grown on a small scale in the Hilla area. Before the war cotton was grown in very small quantities for local use. The silk industry had been started, but on a small scale.

A very important product is the date. It is grown mainly in the tidal stretches of the Shatt al 'Arab. From Fao to Qurna, a distance of about a hundred miles, there is an almost continuous grove

TABLE 1.—*Population.*

Division	Sunni	Shiah	Jewish	Christian	Other Religions	Total
Bagdad	130,000	54,000	50,000	15,000	1,000	250,000
Samarra	66,455	14,215	300	—	—	80,970
Diyala	54,953	46,097	1,689	397	900	104,036
Kut	8,578	98,712	381	127	—	107,798
Diwaniya	1,000	192,300	6,000	5,000	200	204,500
Shamiya	445	189,000	530	20	5	190,000
Hilla	15,983	155,897	1,065	27	28	173,000
Dulaim	247,000	200	2,600	200	—	250,000
Total vilayet of Bagdad	524,414	750,421	62,565	20,771	2,133	1,360,304
Basra	24,408	130,494	6,928	2,221	1,549	165,600
'Amara	7,000	284,700	3,000	300	5,000	300,000
Muntafiq	11,150	306,220	160	30	2,440	320,000
Total vilayet of Basra	42,558	721,414	10,088	2,551	8,989	785,600
Mosul	244,713	17,180	7,635	50,670	30,180	350,378
Erbil	96,100	—	4,800	4,100	1,000	106,000
Kirkuk	85,000	5,000	1,400	600	—	92,000
Sulaimani	153,900	—	1,000	100	—	155,000
	579,713	22,180	14,835	55,470	31,180	703,378
Grand Total	1,146,685	1,494,015	87,488	78,792	42,302	2,849,282

of date-palms on each side of the river. But every town as far north as Samarra on the Tigris and 'Ana on the Euphrates has its date-groves. Large flocks of sheep are raised, particularly in the Mosul and Kurdistan areas; their wool and skins are important articles of export.

Industries.—The industries of the country—dyeing, tanning, leather-working, silk-spinning and weaving—are for the local market only. The large towns, especially Bagdad, live on the distributing trade of Mesopotamia and Persia. On account of the competition of the Caucasus routes Bagdad was declining in importance during the decade before the World War.

POLITICAL HISTORY, 1910–21

The Constantinople revolution of 1908 brought to Mesopotamia as to other parts of the Turkish Empire such advantages as freedom to travel, but the population outside the big towns was scarcely affected. The strong centralizing influence of the Committee of Union and Progress was represented by branches in the large towns, and the decentralization (Adem-i-Merkeziyet) party seems to have had little open support, though the tribal Arab continued to resist centralization as represented by attempts to collect taxes, and in Basra a local notable, Saiyid Talib, was able to raise himself to a position of influence from which no efforts of the Turkish Government could oust him. In the matter of education Syria was half a century ahead and that perhaps accounts for the greater strength of the Arab movement in Syria. Even in the use of their mother tongue the inhabitants of Mesopotamia seem to have been lukewarm, and the concession regarding the teaching of Arabic and its use in official documents, wrung from the Turks mainly by disturbances in the Yemen, was little appreciated if indeed adopted in Mesopotamia. The most important posts, *e.g.* the governorships of Bagdad and Mosul, continued to be filled by Turks, and such posts of influence as were given to Mesopotamians went, with very few exceptions, to the local Turks of Kirkuk, Erbil, etc. Attempts to encourage education were, however, made, and the largest school in Bagdad owes its construction to a subscription—not perhaps always voluntary—raised by the Committee of Union and Progress. The "Young Turks" also paid some attention to the possibility of developing Mesopotamia. They engaged the distinguished engineer Sir William Willcocks to draw up an irrigation scheme for the country and, by acting on his report to the extent of getting a British firm to build the Hindiya Barrage, whereby the Euphrates could at will be turned down the left arm of the river, past Hilla and Diwaniya, they restored to prosperity an area which had fallen into destitution and been largely depopulated. The claim that this policy was due to real foresight on the part of the "Young Turks" is discounted to some extent by the manner in which they treated the Crown lands which had formerly belonged to Sultan 'Abdul Hamid and had been confiscated when he was deposed. 'Abdul Hamid had been a model landlord to the cultivators of these estates, giving advances of seed on easy terms and granting remissions of revenue in bad years; but the Turkish Government concerned itself with nothing but squeezing out the maximum revenue, and the estates had deteriorated considerably by the time the war began. One real concession, however, was made to provincial opinion in Turkey, and Mesopotamia profited by this. Certain minor heads of revenue were allocated to objects of public utility, *e.g.* education and medical work, in each province and the control of the expenditure was given to the provincial council.

Law and order were no better, though perhaps no worse, than in 'Abdul Hamid's time. Nearly every summer, when the crops had been harvested, there was trouble somewhere. Travel on the Hai and the Euphrates was often unsafe; there were several serious acts of piracy on the Shatt al 'Arab at Basra; the inhabitants of Diwaniya cut off the head of their governor; and in the spring of 1914 Turkish forces were defeated in a pitched battle at Shatra and lost guns and many men.

An important and disagreeable feature of the period was the anti-British attitude of the Turkish authorities in Mesopotamia. Partly as a result of a quite legitimate desire to throw off all foreign control, as represented especially by the judicial and other privileges of foreigners (usually known as the "Capitulations"), and partly as a consequence of an inflated conceit, the "Young Turk" was inclined to be hostile to foreigners in Turkey, and in Mesopotamia there were few other foreigners to share this hostility with the British. Her long connexion with the Persian Gulf, the proximity of Basra to India, the importance attached by the Indian Government to Mesopotamia as a market and as the goal of thousands of Indian pilgrims, and the importance of British trade in the country, combined to give Great Britain a predominant position in Mesopotamia, and that predominance was emphasized by certain privileges consecrated by concession or custom, notably the right of the British Consulate-General at Bagdad to have a sepoy guard at the consulate and an armed Royal Indian Marine ship in the river, and the right of Messrs. Lynch to run boats on the Tigris and to fly the British flag on them. There is no doubt that the hostility of the Turks was fostered by the Germans, who had begun to build a section of the Bagdad railway northwards from Bagdad and had started several German firms in Mesopotamia. Meanwhile British interests were increasing in importance, owing to the relations with the neighbouring sheikhs of Kuwait and Mohammerah, to the growth of the oil interests just over the Persian border, and to the now urgent necessity of ensuring that no European Power should establish itself at the head of the Persian Gulf. Negotiations which had for their object the settlement of all outstanding questions in Mesopotamia were in progress when the World War broke out. It is said that, under an agreement which had been initialed but not ratified, the British Government were to participate in the last section—Bagdad to Basra—of the Bagdad railway, and were to have a controlling interest in the port of Basra.

The outbreak of the World War, however, in Aug. 1914 put an end to this. It speedily became evident that the attitude of Turkey towards the Allies would at best be that of malevolent neutrality, and in Mesopotamia this attitude was particularly marked. Before the end of Aug. the Basra authorities were making badly concealed preparations for blocking the Shatt al 'Arab, with the result that only two British vessels ventured up to Basra during the next two months, and those at the masters' own risk and peril. In defiance of ancient treaties the Turks, believing that Europe was too busy to resent any affront, however gross, issued decrees declaring that as from Oct. 1 1914 the Capitulations would cease to be recognized, the foreign post-offices in Turkey would be closed, and the customs dues would be raised from 11% to 15% *ad valorem*. The predominance of British over all other foreign interests in Basra and Bagdad made it seem to the local population as though these measures were directed almost exclusively against England, and anti-British feeling was created and fostered by the dissemination of propaganda derived mainly from German sources. Not content with action within their own borders, the Turks threatened the sheikh of Mohammerah and the independent sheikh of Kuwait with hostile action unless they adopted a policy of active coöperation with the Turks.

With the outbreak of war consequent on the Turkish bombardment of Odessa the Turkish officials' policy of pin-pricks changed to active hostility. British and British-Indian subjects were arrested and British goods of all kinds seized; and at the British Consulate-General at Bagdad the floors of the cellars were pulled up in a vain search for the stores of arms and ammunition and the hoards of gold which were supposed to be hidden there to be used in a British attempt to seize Mesopotamia.

The hostile attitude of the Turkish Government, their threats to the friends of Great Britain in the Persian Gulf, and the menace to the oil industry in Persia had already compelled the British Government to take precautionary measures. In Oct. a force of all arms was sent from India to Bahrein to await developments. When the Turks forced war on the Allies by attacking Russia, this force moved up the Gulf and occupied Fao and, after some resistance, Basra. The military campaign, from the occupation of Basra with one division till the time of the Armistice, when British and Indian troops—the advance-guard of a great host—were at Mosul, threw a great strain on British resources, and on the personal courage and endurance of the men employed. There were no battles on the scale of those in France; but the qualities of the British and Indian troops in Europe can be matched by those shown by their comrades in arms in Mesopotamia in such operations as the capture of Nasiriya in the middle of the hot weather, in the defence of Kut, in the gallant attempts to relieve Kut, and in the stoical endurance by British and Indian prisoners of the calculated barbarities of the prisoner-of-war camps.

Whether to attack the Turks in Mesopotamia was wise or not has been the subject of much discussion. Why the expeditionary force went to Basra is clear enough. The Turks were threatening the friends of Great Britain in the Persian Gulf; and there was good ground for the belief that the supply of oil from the Persian oil fields—essential for the navy—might be cut off by the Turks on some pretext or other. But was there any necessity to go farther than Basra? Was the occupation conducted as part of a carefully thought-out policy, or was it carried out, as the British Empire is said to have been built up, in a fit of absence of mind? It is claimed that the successive advances were forced on the British Government in the first place by military necessity. The battle at Shu'aiba, only 12 m. from the British base at Basra, and the successful raid (instigated by the Turks) on the oil pipe-line in Persia, showed that it was essential to push the Turks farther back. Once Basra and the pipe-line were secured by the capture of 'Amara and Nasiriya, it might have been thought sufficient to consolidate the position; but as often as Turkish armies re-formed it was necessary, according to the military authorities, to go forward and destroy them, and, having destroyed them, the British forces stayed in the area captured.

There were not wanting critics who attributed the campaign in Mesopotamia to a desire to control the oil supplies of the country, but such critics ignore the considerations set forth in the preceding paragraph and the whole history of British relations with the Persian Gulf. Moreover, the oil supplies of Mesopotamia were already in British hands.

It was repeatedly announced, in the course of the campaign, that Great Britain had come to fight the Turk, not the Arab, and on the whole the Arabs (and the non-Arab inhabitants, too, Kurds and even Turks) reciprocated by not fighting against the British. The Turkish authorities in Mesopotamia got little help from the local people. Of those called up for military service many fled, and those who were actually brought into the fighting line fought without heart. Large bodies of Arab and Kurdish tribesmen came down with the Turks early in 1915 to fight at Shu'aiba, but they held aloof during the battle and after the defeat of the Turks they scattered, never to re-form. It is true that the most prominent member of the Sa'dun family, 'Ajaimi, joined the Turks (after negotiating unsuccessfully with the British authorities) and remained their ally until the end of the war, but he never once joined battle with the British forces, or, indeed, did anything else to earn the monthly subsidy the Turks paid him.

But it must not be thought, because they gave the Turks no help, that the Arabs eschewed violence. They hung on the skirts of both armies, and after a battle murdered the wounded and stragglers and robbed living and dead on both sides. The beaten side suffered most, and it was fortunate that it was usually the Turks who were beaten. Nevertheless, once an area was definitely occupied, the country usually became quiet enough. The sheikhs maintained order among their tribes, and native police were formed to help keep the peace in the towns and along the lines of communication.

It is a proof of the strength of the Turkish hold over Mesopotamia that when the Turks withdrew the whole administration collapsed. The mere departure of the Turkish officials was enough to ensure this, for they held nearly all the highest executive positions; but to make doubly sure the Turks sometimes compelled the few Arab officials occupying posts of importance to go with them, and they always, if there was time, carried away or destroyed the official records, in order to embarrass the invader and—it would appear—to spite the Arabs for the lukewarmness of their support.

Thus it happened that the occupying forces found that the whole framework of civil government had fallen to pieces, and the political officers accompanying the troops had no easy task to put it together. The task would have been impossible but for the retention and extension of the system of using tribal sheikhs as—if one may use the expression—sub-contractors in the work of government. The sheikh was made responsible for law and order in his own tribal area, and was often used as the medium for revenue collection. The defect of this system is that it puts wealth and power into the hands of sheikhs who may at any time use them against the Government which has made them—a defect which the Turks remedied by setting one sheikh against another and by various other devices which could not be copied by a British administration. But, good or bad, the system was inevitable during the occupation.

With each successive advance the task of the administration became more difficult, not merely because of the difficulty of finding officials of experience to take over an area constantly growing, but also because, as the war went on, the country in the Turks' hands fell into greater destitution. Thousands of people at Khaniqin were found to have died of starvation; and at Kifri, when the British forces entered the town, starving women and children—the men had nearly all fled to avoid conscription—were eating grass, and the only food in the whole of the bazaar was a few handfuls of dates. For the last eighteen months of the war, almost the first work of a political officer in a newly occupied district was to get food from Bagdad for the civil population. The country, however, showed great vitality: in a few weeks the bazaar would be busy, in a few months more busy than ever.

On the whole the Turkish system of administration was continued with little change. To effect economy the work of collecting the taxes allotted to the Public Debt and the Tobacco Régie was handed over to the Government revenue officials, and the appointment of British officials as heads of districts made it possible to abolish the clumsy division of executive and revenue functions which provided the Turks with a necessary counter-check on corruption. In the sphere of law two concessions were made to local requirements. The first was the official recognition of the impossibility of treating wild tribesmen by the ordinary processes of law, and the introduction of a regulation, adapted from a regulation in force on the Indian Frontier, providing that civil and criminal cases in which a tribesman was concerned might be settled according to tribal custom.

The second was the institution of recognized Shiah Qadhis to deal with questions of personal status, inheritance, etc., among Shiahs, so that Shiahs might not be forced, as they were under the Turkish régime, either to accept the ruling of a Sunni Qadhi, or to settle their difficulties by private arrangements which might afterwards be questioned in a court of law.

Apart from a few changes of which these are perhaps the most important, the British administration rests its claim to superiority over the Turkish mainly on the greater care and honesty shown in working the existing system. The Department of Waqf (Pious Endowments), for instance, was penniless, the mosque employees were paid ludicrously small stipends, and the mosques and religious schools were tumbling into ruin; yet every year considerable sums were remitted to Constantinople, where they were absorbed to a very large extent in overhead charges. Now salaries were raised—in some cases hundreds per cent, a large number of Waqf buildings were repaired, and a substantial balance was built up. Then, whereas the Crown lands were being rapidly bled to death before the occupation, a system of agricultural loans, combined with irrigation works and skilled advice, and applied to private as well as to Government lands, contributed greatly to the prosperity of the country. And so on in each department of Government activity.

The inquiry is naturally made: Why was it, if the British administration studied the interests of the local population more than the Turkish, and the Arabs showed no hostility to the British during the war, that a widespread rising broke out when the war was over? Some regard the rising as the result of a pure passion for liberty, of an exalted spirit such as led to the liberation of Italy; others consider it a mere ebullition of turbulence such as had swept over Mesopotamia every few years since the Arabs imposed themselves on the Persians in the 7th and 8th centuries. It is worth while setting down the most important of the causes to which the rising was attributed by various authorities.

1. Arab nationalist sentiment. (This is of sufficient importance to be considered separately, below.)

2. The natural turbulence of the Mesopotamian tribes. Many of these tribes—particularly those on the Euphrates—never have submitted to authority for long. They were constantly in revolt against the Turks; and the enforced tranquillity of two or three years under the British peace made the outbreak, when it did come, still more violent.

3. The increase in the number of modern weapons in the hands of the local population. Before the war the Arab of Mesopotamia was lucky if he owned an old Martini; now, as a result of war conditions in the Near and Middle East, nearly every able-bodied man has a Mauser or other magazine-loader, and the temptation to a primitive man to shoot just because he has the means to shoot effectually is very great.

4. The reduction of the British garrison in Mesopotamia. This gave rise to the belief—carefully fostered by interested parties—that the British were leaving the country. The prospect of loot and of hitting an enemy who appeared to be down must have been alluring to the Arab.

5. The talk of "self-determination." This principle, in the form in which it reached minds reared in the rather primitive conditions of tribal Arab life, was often taken to mean the right to throw off all authority, to rob any weaker neighbour of his property or his women folk, to levy tolls on all traffic passing by, and, of course, to refuse payment of taxes.

6. The influence of the Shiah mujtahids. The history of Mesopotamia since the Arab conquest shows clearly that the Shiah towns have constantly rebelled against whatever authority there happened to be. The mujtahid is only carrying out the will of God in rebelling against secular authority and trying to establish a theocratic state in which he will be the sole interpreter of God's will in all matters. Besides, mujtahids receive good fees for settling disputes which in a well-ordered state would be dealt with far less expensively in the regular courts. Then most of the chief mujtahids are of Persian origin, and all are in constant communication with the priesthood of Persia, which has long been anti-British.

7. The delay in the peace negotiations. The Arab is extremely impatient. Many of the officials who have had to do with the settlement of disputes in Mesopotamia maintain that the Arab would sooner have an adverse decision at once than linger in doubt even with the possibility of success in the end, and the uncertainty as to the fate of the occupied portions of the Ottoman Empire was certainly a cause of unrest.

8. The increase in the power and wealth of the sheikhs. It was an ironical result of the British policy of working through the sheikhs that that policy of itself created enemies to the British authorities. Some of the leaders of the revolt on the Euphrates were men who had been raised from nothing to positions of wealth and power by the support of the British administration.

9. By adopting an attitude of sympathy towards the tribal cultivators against their absentee town landlords who wanted to enforce at their face value title-deeds which in many cases had been unenforceable under the Turks, the British authorities lost the support of many of such landowners. On the other hand, the tribes were too much in the hands of the sheikhs to be able to evince any gratitude they may have felt towards the Government which had defended their interests.

10. The increase in prices, and certain restrictions necessitated by the exigencies of the military campaign.

11. The demands for labour on flood-banks. It is true that the Turks used to call up cultivators for this purpose (the right of Government to call up labour is not disputed), and that the flood-banks are to protect the cultivators' own crops; but the British authorities perhaps set too high a standard for the Arab, and exceptionally high floods increased the difficulty. To the Arab a flood is an act of God against which repining would be impious as well as useless; but if Government tries to make him mend a flood-bank to protect his crops—why, there *is* a remedy.

12. The extension of orderly government, preventing crime and collecting taxes, to areas which had lived almost untouched by the Turkish administration. Land taxation was not heavier than in Turkish times; on the contrary, the rate was lowered in many districts, and the 2½% cesses imposed by the Turks have never been collected since the occupation. But taxes have been collected more regularly, and collected from some areas which had usually escaped payment; and it was not to be expected that the obvious fact that he was, on the whole, far richer and had raised his standard of living, would weigh with the wild Arab "whose sense is in his eye" and who thought he could get all the benefits that flowed from Government enterprise and the maintenance of order without the expense of contributing to the upkeep of the Government.

Above are enumerated the most important of the causes of the 1920 rising, which, it must be remembered, by no means affected the whole country. The great Muntafik confederation did not rise, nor did the Albu Mohammed and other tribes on the Tigris, so turbulent in Turkish times. What weight Arab nationalist propaganda had with the tribes which took part in the rising it is impossible to determine. Some Shiah mujtahids preached a holy war and used the religious argument, while clever Sunni leaders promised a reduction in taxation; and some tribes concerned were frankly after loot and nothing else. Yet it cannot be doubted that the rising must be attributed to some extent to the influence of the idea of an independent Arab state—an idea which was almost non-existent in Mesopotamia before the war. Since the Turkish conquest of the 13th century the Arabs of Mesopotamia have always been under foreign domination, and during the first two or three years of the British occupation the only political question which occupied the inhabitants was whether a British amurath would succeed the Turkish or whether after the war the Turk would return; and their attitude towards the invader depended on their decision as to the respective chances of the Allies and the Central Powers. But the alliance between the Allies and the Sherif of Mecca (now recognized as King of the Hejaz), the departure of many Mesopotamians—formerly in the Turkish army—to fight with the Hejaz Arabs against the Turks, and the talk of Arab independence could not fail to affect Mesopotamia. There is a striking contrast between the speech of Lord Hardinge at Basra, in Feb. 1915, and the proclamation issued by Gen. Maude, on instructions from H.M. Government after the capture of Bagdad, little more than two years later. All that Lord Hardinge could say was that "we might be permitted to indulge in the confident assurance that thenceforth a more benign administration would bring back to Mesopotamia that prosperity to which her rich potentialities entitled her." Gen. Maude's proclamation struck a very definite note. It announced that the British forces had come not as conquerors but as liberators, and pointed out that a long trade connexion had existed between Bagdad and Great Britain, and that the British Government could not remain indifferent to what took place in Mesopotamia, and was determined not to permit again that which had been done in Bagdad by the Turks and Germans. The proclamation continued:—

> "But you, the people of Bagdad, whose commercial professions and whose safety from oppression and invasion must ever be a matter of the closest concern to the British Government, are not to understand that it is the wish of the British Government to impose upon you alien institutions. It is the hope of the British Government that the aspirations of your philosophers and writers shall be realized once again. The people of Bagdad shall flourish and enjoy their wealth and substance under institutions which are in consonance with their sacred laws and their racial ideal. In the Hejaz the Arabs have expelled the Turks and Germans who oppressed them and have proclaimed Sherif Husain as their king and His Lordship rules in independence and freedom and is the ally of the nations who are fighting against the power of Turkey and Germany. So, indeed, are the noble Arabs, the Lords of Najd, Kuwait and Asir. Many noble Arabs have perished in the cause of freedom at the hands of those alien rulers, the Turks, who oppressed them. It is the determination of the Government of Great Britain and the Great Powers allied to Great Britain that these noble Arabs shall not have suffered in vain. It is the desire and hope of the British people and the nations in alliance with them that the Arab race may rise once more to greatness and renown amongst the peoples of the earth and that it shall bind itself to this end in unity and concord. O, people of Bagdad! Remember that for 26 generations you have suffered under strange tyrants who have ever endeavoured to set one Arab house against another in order that they might profit by your dissensions. Therefore, I am commanded to invite you, through your nobles and elders and representatives, to participate in the management of your civil affairs, in collaboration with the political representatives of Great Britain who accompany the British army, so that you may unite with your kinsmen in the north, east, south and west in realizing the aspirations of your race."

This rather flamboyant proclamation attracted little attention in Bagdad at the time, but it was destined to be quoted later. But it must not be thought, as some harassed officials in Mesopotamia may well have thought, that the proclamation was a wanton and quite uncalled-for attempt to thrust on the country a form of government for which it was totally unfitted: it was part of the Allies' general Middle Eastern policy, a policy which was defined, in the Anglo-French Declaration of Nov. 8 1918, as having for its object "the complete and definite liberation of the peoples so long oppressed by the Turks and the establishment of National Governments and Administrations drawing their authority from the initiative and free choice of the indigenous populations." Unhappily, it is not easy, in an oriental country, to find out what the people do want. Early in 1919 an attempt was made by the British Government through the British political officers in Mesopotamia to find out what public opinion in Mesopotamia was on three questions of importance:—(1) Should Mosul be included in Mesopotamia? (2) Should Mesopotamia be ruled by an Arab emir? (3) Who should be emir, if an emir was wanted?

The opinions, taken at their face value, showed that Mesopotamia insisted on the union of Mosul with Bagdad and Basra, and on the whole did not want an emir, at any rate for a few years, though a few individuals or groups asked that one of the sons of the Sherif of Mecca should be made emir. It is impossible to say how far the answers were influenced by the universal desire of the East to give the reply which it is believed the questioner wants; nor can any reply, except a denial and a reference to the conduct of British officials in the East in general, be given to critics who say the "plebiscite" was rigged by the political officers. On the other hand, it is easy to see the difficulty of introducing Western electoral systems among tribal Arabs who regard registration for whatsoever purpose as a certain preliminary to taxation or military service.

Prospects for Mesopotamia.—The political future of Mesopotamia was not easy to forecast in 1921. The mandate for that country had been conferred on the Government of His Britannic Majesty by the principal Allied Powers, and a draft mandate was submitted by Mr. Balfour on Dec. 7 1920 to the Secretariat-General of the League of Nations for the approval of the Council of the League of Nations.

The idea of a mandate—the issue of a sort of power of attorney by a group of states to one of their number for the administration of a given country—was new, and the novelty was emphasized by the nature of the draft mandate. While entrusted with the control of the foreign relations of Mesopotamia (Article 3) and authorized to maintain troops in the country (Article 2), the mandatory is bound to facilitate the progressive development of Mesopotamia as an independent state (Article 1): to see that no Mesopotamian territory shall pass under the control of the Government of any foreign Power (Article 4); to ensure freedom of conscience and the free exercise of all forms of worship, subject only to the maintenance of public order and morals (Article 8); to see that there is no discrimination in Mesopotamia against the nationals of any State, member of the League of Nations, as compared with the nationals of the mandatory or of any foreign State, in matters concerning taxation, commerce or navigation, the exercise of industries or professions, or in the treatment of ships or aircraft (Article 11); and to secure the enactment within a year of a law of antiquities which shall ensure equality of treatment in the matter of archaeological research to the nationals of all States, members of the League of Nations (Article 14). The immunities and privileges of foreigners, including the benefits of consular jurisdiction and protection as formerly enjoyed by Capitulation or usage in the Ottoman Empire, are definitely abrogated in Mesopotamia (Article 5); but the mandatory is responsible for seeing that the judicial system established in Mesopotamia shall safeguard the interests of foreigners (Article 6). To safeguard the mandatory from financial loss in the execution of the terms of the mandate Article 20 declares that, "in the event of the termination of the mandate . . . the Council of the League of Nations shall make . . . arrangements . . . for securing, under the guarantee of the League, that the Mesopotamian Government will fully honour the financial obligations legally incurred by the mandatory during the period of the mandate, including the rights of public servants or gratuities."

The Anglo-French Declaration of Nov. 8 1918 stated that it was the aim of His Majesty's Government to establish in Mesopotamia a national government and administration deriving their authority from the initiative and free choice of the indigenous populations; and Mesopotamia has been treated by the Allied Powers as one of those "Communities formerly belonging to the Turkish Empire" which "have reached a stage of development where their existence as independent nations can be provisionally recognized, subject to the rendering of administrative advice and assistance by a mandatory Power until such time as they are able to stand alone" (Treaty of Versailles).

In 1921, pending the election of a constituent assembly, Mesopotamia was being governed by the High Commisioner and a provisional Arab Government over which the Naqib of Bagdad presided. There had been much discussion, both in Mesopotamia and in the English press, of the question of the selection of an emir for Mesopotamia. The idea, which did not appear to have been generally approved by the people of Mesopotamia early in 1919, seemed to be widely accepted by them in 1921, though there was much discussion as to the person to be chosen. Owing to the prominent part taken by the sons of the King of the Hejaz during the war, two of them, ʻAbdalla and Faisal, were the favourite candidates for the Mesopotamian throne. Eventually, at the invitation of some of his supporters in Mesopotamia, Faisal came forward definitely as a candidate, and went to Mesopotamia to press his suit, and his brother ʻAbdalla resigned his claim. On his arrival Faisal was given a warm reception by the people of Mesopotamia, such other candidates as there were withdrew, and the Arab Council of State, on the motion of the president (the Naqib of Bagdad), passed a resolution declaring that Faisal should be regarded as having been chosen ruler of Iraq by acclamation provided that he would consent to rule as a constitutional, democratic sovereign. It had been intended to submit the question of the rulership to an assembly elected under a system based on the Ottoman electoral law, but, as this would have taken some months and the matter was pressing, a referendum was carried out. The result was overwhelmingly in favour of the Emir Faisal. A few extremists in Bagdad made their approval conditional on his being free from foreign influence, while the Basra people, on the contrary, promised their support only for so long as he should maintain the connexion with Great Britain; but on the whole the approval was unanimous and unconditional, and Faisal was accordingly crowned King of Iraq at Bagdad on Aug. 23 1921.

In the course of a speech made at the accession ceremony King Faisal expressed his gratitude to the British nation for its aid in the cause of Arab liberation and independence, and declared that it was from the British nation alone that they should seek help in order to reach their goal. He added: "My first task will be to proceed with the elections and the convocation of the Constituent Assembly. The nation should understand that it is this Congress that will, in consultation with me, draw up the constitution of its independence, on the basis of democratic government, and define the fundamental principles of political and social life. Finally it will confirm the Treaty which I shall lay before it in regard to the relations which are to exist between our Government and the great British Government."

In this fashion was inaugurated the policy described by the British Secretary of State for the Colonies, Mr. Winston Churchill, in his speech in the House of Commons on June 14 1921, as having for its object "to reduce our commitments and extricate ourselves from our burdens, while at the same time discharging our obligations and building up an effective Arab Government which would always be the friend of Britain." Concurrently with the political development of the Arab State, Mr. Churchill explained, there would be created and developed local military forces which would gradually replace most of the British troops. By the end of the financial year 1921–2 the British forces would be reduced to about 12 battalions of infantry, but there would also be the nucleus of an Arab army, maintained by the Mesopotamian treasury, and certain frontier levies, consisting partly of Kurds and partly of Assyrians enlisted from among the refugees. In addition there were arrangements for maintaining public security by means of a powerful air force.

The Kurdish portion of the mandated territory was (1921) in a special position. Article 62 of the Treaty of Sèvres provided for the elaboration of a scheme of autonomy for that part of Kurdistan which lies north of Mesopotamia, east of the Euphrates and south of Armenia; and Article 64 provided that if the Kurds in that area asked for autonomy within a year of the signature of peace with Turkey, "the Kurds inhabiting that part of Kurdistan which has hitherto been included in the Mosul vilayet" might declare their voluntary adhesion to that autonomous state. Article 16 of the final draft of the mandate for Mesopotamia is in harmony with this. It declares that "nothing in this mandate shall prevent the mandatory from establishing a system of local autonomy for predominantly Kurdish areas in Mesopotamia as he may consider suitable."

It may be convenient to summarize the arguments advanced on both sides in the discussion in 1921 as to the stability of the Mesopotamian state. The sceptical pointed to the following difficulties:—

1. Lack of unity among the people of Mesopotamia. The Arabs never have agreed and never will. The Shiahs, who were formerly in a minority and repressed by the Sunni Turks and their Sunni Arab adherents, are now in the majority, and will not tolerate government by Sunnis, while all the men with secular education and experience sufficient to qualify them for high office are Sunnis. Moreover, the Shiahs are under the influence of their mujtahids.

2. Lack of security. The Turks were not able to keep order in Mesopotamia. Can an Arab Government do what was beyond the powers of the Turks, especially now that every tribesman possesses a modern rifle?

3. Lack of funds. An Arab Government will lack the authority to collect the revenue necessary to pay the Government officials—particularly the forces of law and order.

4. Possible trouble on the border, instigated or exacerbated by propaganda from outside.

To these arguments it was replied:—

1. The establishment of an Arab Government and the accession of an emir will draw the Arabs of Mesopotamia together.

2. It is not proved that an Arab Government cannot maintain security, and if it were, why should an Arab Government insist on the degree of security which British officials demand? And finally, if an Arab Government can keep order not less well than the Turks did (not a high standard) they must be held to have succeeded.

3. Being content with a simpler organization than would be expected under a British administration, the Arab Government will not require a large income, and they can afford to tax lightly where—as, for example, in the case of land revenue—heavier taxation might rouse opposition. Probably they will depend in the main on customs dues, which provide more than half the local revenue, are relatively easy to collect, and are not resented by the taxpayer.

4. The mandatory and the people of Mesopotamia must be prepared for predatory raids by Kurdish tribes from over the border and Arab tribes from the desert, but with the conclusion of the outstanding treaties of peace and the gradual settling down of the world after the war little foreign intrigue is to be apprehended.

LINES OF ECONOMIC DEVELOPMENT

Contradictory views as to the possibility of agricultural and other economic development in Mesopotamia are held by authorities. Some maintain that Mesopotamia was formerly and could be again "the granary of the world"; others that the numerous population of Babylon in the time of Herodotus lived mainly by trade and not by agriculture, and that in any case there is too little water or too much salt in the ground or too sparse a population for any considerable extension of agriculture. There are, however, some definite facts which bear upon the conclusion to be reached on this point.

Agriculture.—Any considerable extension of agriculture depends on the fulfilment of one or more of the following requirements:—

1. Increase of population. Before the British occupation the rate of increase was retarded by heavy child mortality, high death-rate from epidemics, and the deaths resulting from blood feuds and tribal fighting. How far these causes will operate in future depends on the ability of the Government to maintain order, to improve sanitary conditions, and to provide medical aid. The settlement of nomads or semi-nomads is always going on, but this is an almost imperceptible process, and in any case it must be remembered that the nomad is also a source of wealth in that he breeds camels and sheep: consequently the settlement of nomads is not a net gain to the country. There may be a slight influx of Kurds from the north, but the experience of the Erbil area during the last few decades leads one to believe that the result of such influx would merely be the displacement of the less industrious Arab cultivator. Immigration from overseas is not likely to attain large proportions. The climate precludes the pursuit of agriculture by European settlers, while the immigration of Asiatics would probably be regarded with some distrust and fear by the Arabs.

2. Improvement in methods of cultivation. Much has already (1921) been done to introduce better implements of a simple kind, *e.g.* ploughs, to improve field drainage, to study local diseases of plants, and to secure clean barley and wheat seed. Moreover, tractors and mechanical implements have been introduced, and their work, under the auspices of the Agricultural Department, is being watched with interest by many landowners.

3. Extension of irrigation. In order to increase local food supplies and thus to economize in money and shipping, the British military authorities in 1917 formed a small Irrigation Department. It was not possible to take up large schemes, but the Hindiya barrage was kept working, miles of flood-banks were built, a canal taking off just above the barrage, which had been begun before the war, was completed and its sister canal dug; the Saqlawiya canal, which used to flood the country west of Bagdad, was brought under control by the construction of a regulator, and many old canals were cleared and made serviceable. Perhaps the most important work has been the construction of regulators at the head of some of the largest of the Tigris canals. The effect of this is not merely to save water which would be wasted in the marshes, but, by throwing more water down the river, to scour out its bed and thus facilitate navigation and prevent flooding.

It seemed probable in 1921 that no large schemes would be undertaken for the present, and that the limited funds available would be used mainly in carrying out a comprehensive survey which would serve as a basis for extensive irrigation schemes later.

Experiments have been made with products previously not grown at all, or grown without scientific attention. In the first category are ground-nuts and sugar-beet, in the latter cotton. It is too soon to dogmatize about Mesopotamian cotton, but the experiments of 1918–21 tend to show that it has a fairly long staple and should fetch a good price in the world market.

Mineral Wealth.—Of minerals, oil occupies the attention of the world. The signs of oil in many places, from Mandali in the latitude of Bagdad to Zakho north of Mosul, and the existence of profitable wells in Persia not far from the Mesopotamian frontier, have induced in the mind of the public the belief that Mesopotamia is another Mexico for petroleum, but in 1921 there was no certain knowledge that petroleum existed in Mesopotamia in quantities to repay the cost of exploitation. Near Kifri there is a so-called coal-mine, which was worked by the Turks during the war when they had no other fuel for their steamers, but the "coal" has been pronounced by experts to be only inspissated petroleum, and has been proved in practice to be of little or no value. Bitumen is found at several places, notably Hit on the Euphrates, but it is doubtful whether the supply is more than sufficient for local needs.

Currency.—The Indian currency is now in use everywhere in Mesopotamia. On account of the close trade connexions with India the rupee was well known in Basra before the war, and passed in the bazaar on equal terms with Turkish money and the Persian kran. The payment of large bills in Indian currency by the British forces caused Turkish silver and copper to disappear rapidly before the silver rupee and the Indian note. This process was repeated in every town occupied: there was a short period of hesitation, and then the replacement of the old currency by the new was effected in a few days. In the more remote parts of Mesopotamia Indian notes have usually been at a small premium, owing to the convenience of carriage. The Turkish gold lira is still used in the bazaar sometimes for large transactions.

Banks.—Before the war the only bank operating in Mesopotamia was the Imperial Ottoman Bank. In addition there are now branches of the Imperial Bank of Persia and the Eastern Bank.

Trade.—Table 2 shows in sterling, calculated on the basis of 15 rupees to the pound, the total value of imports and exports for the port of Basra for each year during the periods 1910–2 and 1917–9.

TABLE 2.—Trade.

	Imports	Exports
1910 . .	£2,633,000	£1,666,000
1911 . .	2,853,000	2,526,000
1912 . .	2,653,000	3,246,000
1917 . .	4,033,000	820,000
1918 . .	7,400,000	900,000
1919 . .	9,326,000	2,406,000

In addition, the figures for Bagdad, both for sea-borne trade and for trade by land, for 1919, were:—Imports, £2,940,000; exports, £4,940,000.

The principal imports and exports (figures for Bagdad and Basra combined) are shown in Tables 3 and 4. In some cases figures for 1912 also are given.

TABLE 3.—Imports.

	1912	1919
Textiles	£1,320,000	£6,380,000
Sugar	293,000	1,453,000
Tea	—	433,000
Grain and Flour	—	433,000
Tobacco	—	426,000
Carpets	—	280,000
Liqueurs	—	193,000
Cigarette-papers and smokers' requisites	—	175,000
Metals and Ores	733,000	166,000
Soap	—	153,000

TABLE 4.—Exports.

		1912	1919
Dates		£466,000	£1,470,000
Piece Goods		—	3,540,000
Grain:	Barley	1,120,000	190,000
	Wheat	240,000	
	Paddy	326,000	
Wool		300,000	160,000
Carpets		—	240,000
Sugar		—	530,000
Tea		—	225,000

Nearly the whole of the piece goods, sugar and tea shown in the exports for 1919 were destined for Persia.

Deductions based on these figures have to be made with caution. The figures give total values, not quantities; consequently the rise in prices between 1912 and 1919 has to be taken into account. Moreover, several abnormal causes contributed to bring about an increase in imports into Mesopotamia. The closing of the Caucasus route diverted to Mesopotamia trade which would ordinarily have gone to Persia via Batum, Baku and the Caspian; the large purchases in Mesopotamia, both by the army authorities and by the troops, gave increased purchasing power to the country; the depletion of stocks during the war led to a rush of trade the moment shipping became available; and the rise in the value of the rupee, considerable during the war and very marked in 1919–20, led to abnormally large purchases. Nevertheless it may be taken for granted that a greater volume of trade will flow into and through Mesopotamia than before the war, if only because: (1) the Caucasus route is not likely to be safe, expeditious and cheap for some time; (2) the Mesopotamian railway system favours the Bagdad route to Persia; (3) the standard of living in Mesopotamia has been raised considerably during the war; and (4) the economic development begun during the war is certain to encourage enterprise.

Communications.—The exigencies of the campaign compelled the British military authorities to maintain a large fleet of river steamers on the Tigris, and this involved the adoption of measures to facilitate navigation. The whole course of the navigable channel has been marked by buoys or by signs erected on the banks, and efforts have been made with considerable success to improve the bed of the river. At Basra a modern port has been constructed; whereas before the war cargo had to be unloaded from steamers into lighters in mid-stream, ocean-going steamers can now come alongside and discharge cargo on to the wharves or railway trucks.

A dictum attributed to Sir William Willcocks, that it would pay Mesopotamia to use all the water from the Tigris and the Euphrates for irrigation and to rely on railways for transport, is not likely to be regarded as practical politics for a very long while. In 1921 there was far more traffic on the Tigris than before the war. The Turkish Government fleet had disappeared as an organization; but, on the other hand, the successors of Messrs. Lynch were no longer restricted to three boats, and in addition many other companies and individuals ran boats purchased from the British military authorities when the river war fleet was reduced. The bed of the Tigris has been improved on the most difficult stretch, and the control of the canals should effect further improvements.

In 1914 Mesopotamia had only 70 m. of railway—a standard-gauge line running from Bagdad northwards to Samarra. This was intended to be linked up with the Bagdad railway, the main portion of which ran from Constantinople through Konia and Aleppo to Nisibin (1917), about 100 m. north-west of Mosul. By 1920 there was a network of railways in Mesopotamia: in metre gauge, Basra to Bagdad (about 354 m.), Bagdad to the Persian frontier (about 130 m.), with extension to Kifri (about 50 m.), and Bagdad to Kut (about 104 m.); in standard gauge, Bagdad via Samarra to Sherghat (about 186 m.). There was also a narrow-gauge line from Bagdad to Falluja, on the Euphrates—a distance of about 30 miles. All these railways, the standard-gauge line excepted, were built by the British military authorities as part of the plan of campaign.

Basra and Bagdad are connected by railway, but it was not yet possible in 1921 to travel from one end of Mesopotamia to the other by rail. The section of the Bagdad railway built by the Germans from Bagdad to Samarra was extended for war purposes as far as Sherghat, which is only about 70 m. south of Mosul; but as it passes through desert for a great part of its length it is unprofitable as a commercial undertaking, and it may be decided to take up the Samarra–Sherghat extension and to establish communication with Mosul by continuing the line from Kifri through the wheat-growing country and the considerable towns of Kirkuk, Altun Köprü and Erbil. No official decision as to military communication with the Mediterranean had yet been published in 1921. Some authorities desired to see the Mesopotamian system connected with the Bagdad railway, which has reached Nisibin, about 100 m. north of Mosul; others would prefer a line across to some port in Palestine. The pilgrim traffic from Persia would, it is believed, justify the construction of a line to connect the Shiah towns of Najaf and Karbala with the existing lines.

The port of Basra is large enough, and sufficiently well supplied with facilities for unloading, to deal with the trade of Mesopotamia for some years to come. It can deal with larger ships than the Fao bar at the mouth of the Shatt al 'Arab will allow to pass, but plans for the dredging of this bar were being made.

Archaeology.—All systematic archaeological research was suspended by the war. The antiquities of Mesopotamia were protected by a Proclamation issued by the General Officer Commanding in Chief in 1917. Article 14 of the draft mandate is of importance to archaeologists. It says:—

"The mandatory will secure the enactment within twelve months from the coming into force of this mandate, and will ensure the execution of a Law of Antiquities, based on the contents of Article 421 of Part XIII. of the Treaty of Peace with Turkey. This law shall replace the former Ottoman Law of Antiquities, and shall ensure equality of treatment in the matter of archaeological research to the nationals of all States, members of the League of Nations."

Some of the Sherghat antiquities, which were being sent to Berlin by the German archaeologists who carried out the excavations, were captured by the Portuguese on the outbreak of war and were declared lawful prize by the Portuguese Government. Certain cases of antiquities collected by a German mission in Samarra before the war were found in Mesopotamia. Having neither the staff nor the facilities for dealing with such treasures, and fearing that they would deteriorate, the Mesopotamian authorities sent the cases to the British Museum to be examined and catalogued.

See also E. B. Soane, *To Mesopotamia and Kurdistan in Disguise* (1912); G. E. Hubbard, *From the Gulf to Ararat* (1916); Official Report on Mesopotamia, White Paper, Dec. 1920; Jas. Saumarez Mann, *An Administration in the Making* (1921); Major Hay, *Two Years in Kurdistan* (1921). (A. T. W.)

MESSEL, RUDOLPH (1848–1920), Anglo-German chemist, was born at Darmstadt Jan. 14 1848, and educated at the universities of Zürich, Heidelberg and Tübingen. He came to England in 1870 and acted as assistant to J. C. Calvert and later to Sir Henry Roscoe at Manchester. He then took up industrial chemistry and made notable experiments, especially in connexion with processes for obtaining sulphuric acid (*see* 26.68) for use in alizarin manufacture. He died in London April 18 1920.

METALLURGY (*see* 18.203).—The progress in metallurgy after 1911 was profoundly affected by the incidence of the World War. Modern warfare is so entirely dependent upon the products of metallurgy that the effort to secure military victory to some extent resolved itself into struggle for supremacy in metallurgical output by the opposing nations. This applied most directly, perhaps, to steel products such as guns and shells, ship-plates and armour plates, etc., but it also applied to copper, and its alloys, to zinc, to lead and antimony, and, in a special degree, to aluminium. During the war period, therefore, the progress of metallurgy became mainly a relentless struggle for output in which, in some directions, quality was ruthlessly sacrificed and heavy "war risks" were cheerfully taken. After the termination of the war, industrial conditions became extremely unsettled and difficult; for a time there was still a great shortage of ships; then followed acute industrial disturbances, particularly in England, while the war-scarred Continental nations only slowly resumed their normal activities, which were gravely hindered on all sides by the direct and indirect economic consequences of the Treaty of Versailles.

The whole period under review (1910–21), therefore, falls into two main divisions—prior to Aug. 1914 and the period of the war and after. During the former period there was a steady development both of metallurgical science and practice, but both were rudely deflected by the war. None the less, the stress of war conditions has produced a large amount of important progress, but in many directions full knowledge of what had been attained is only now reaching publicity. We were still in 1921 too near the World War to be able to appreciate its real permanent influence on metallurgy, and only tentative views can be put forward. One result, however, stands out very clearly. This is, the effort which several nations had made to become self-supporting in regard to all essential supplies, and particularly in regard to metals. This applies particularly to England and France, but the more distant dominions, such as Australia and S. Africa, have displayed the same tendency while there is a strong effort to develop metallurgical industries in India. Some of these efforts, which had been stimulated either by urgent necessity or by the lure of exceptionally high prices resulting from the difficulties of import, were not likely to lead to permanent results. Thus the efforts to introduce a zinc-smelting industry on a large scale into England, or to reopen the tin-production of Cornwall, or the copper mines of Alderley Edge, were apparently destined to collapse on the return of more normal prices, and on the withdrawal of financial support from the State. In England particularly, a very strong reactionary tendency had set in, strictly limiting, if not entirely abolishing, State assistance for any but a very few " key " industries, which were still looked upon as vital from the military point of view. In other countries also there was a marked tendency for the excision of the less profitable ventures which high war-time prices had either revived or brought into being. While this was likely to prove a healthy tendency in the long run, it inevitably led to difficulty and confusion for the time. This was further increased by the world-wide "slump," resulting in 1920–1 partly from wide-spread economic exhaustion and partly from the excessively high cost of production arising from inflation of various charges—chiefly wages—beyond the reasonable economic limit. One consequence, for example, was that there were in July 1921 not more than two copper refineries at work in the whole of America.

Iron and Steel.—Prior to 1914, iron and steel metallurgy showed a definite tendency towards the development of very large plants and larger individual units, both in regard to furnaces and rolling-mill equipment. The tendency towards increased size made itself felt in the blast furnace, particularly in American practice; progress, however, also included the development of practice in the direction of furnaces with thin walls and external water-cooling, such furnaces being driven very hard.

Pre-war Progress.—In the period prior to 1914, considerable attention was given to the importance of drying the blast, and it seemed at one time that this would become universal practice. Under war conditions development in that direction seems to have been checked at all events in England, and it has not been resumed with any degree of vigour since 1918. On the other hand, increased attention has been given to the utilization and cleaning of the blast furnace gases. This became particularly important in England during the war on account of the shortage of potash, a substantial recovery of this material being obtainable from the flue-gases of furnaces in which the charge included potash-felspar bearing material. At the same time it has been found that satisfactory cleaning of the gas very much increases the efficiency of its application in stoves and under boilers, owing to the absence of fouling with dust. On the other hand, a degree of cleaning which will render the gas fit for direct use in gas-engines is a much more expensive matter and not so obviously economical. The cleaning processes adopted are mainly of two kinds; one of these depends upon the electro-static deposition of the dust by the method first developed by Lodge and latterly exploited in America by Cottrell. The other method depends upon mechanical filtration of the gas through fabric bags which are kept in a state of agitation, as in the Halberg-Beth system. Although, under normal conditions, potash recovered from flue-dust could not hope to compete with the product of Continental mines, yet cleaning of blast-furnace gas will doubtless be continued. There is the further possibility that the dust itself may be utilized for the recovery of the iron contained in it. This has actually been done successfully by briquetting the dust by a modification of the Schumacher process, in which a weak solution of ferrous sulphate is used as binder. A further proposal is to concentrate the iron-content by some adaptation of the flotation process.

The actual application of flotation processes (see below) to finely divided iron-ores has not yet been found necessary or practicable, but methods dealing with finely divided ores (both ferrous and non-ferrous) have been considerably developed. In addition to the Schumacher process already mentioned, reference must be made to the Dwight-Lloyd process, in which the ore is mixed with a small proportion of finely divided carbon and pressed into briquettes, which are then heated to a moderate temperature. A partial reduction of the ore takes place, leading to a sintering of the briquette, which thus acquires the necessary strength.

In the production of steel, the open-hearth furnace has made very great progress and at one time appeared likely to displace the Bessemer converter entirely. More recently, however, the converter appears to be holding its own to a certain extent, although the steady increase in the application of basic open-hearth steel tends to give the large open-hearth furnace, particularly when working one of the continuous processes, a very great advantage.

War Period.—The effect of war conditions on metallurgical practice in the iron and steel industry has been profound. In the first place it became necessary, particularly in England, to make use of ores and other materials very different from those for which particular furnace plants had been designed, while the supply of operative labour became very difficult. In consequence of these and other difficulties, relaxation of quality became inevitable, particularly in regard to those grades of steel which were required in enormous quantities. Thus specifications which, at the outset, demanded sulphur and phosphorus contents of less than 0·035 % were gradually relaxed until, in the case of shell steel, the limits were raised to 0·08 % and similar concessions were made in regard to railway material and other grades of steel. This, of course, rendered available large bodies of ore which could not otherwise have been used by the acid process. At the same time, material made by the basic process began to be admitted for many uses for which acid steel had formerly been exclusively specified.

While these relaxations were undoubtedly justified and, on the whole, eminently successful for war purposes, the question has since arisen whether there should or should not be a return to the former more stringent specifications now that war conditions have ceased to exist. It is contended on one side that there have been no serious cases of failure resulting from the wider specifications and that, at the same time, the after-effects of war still make it practicably impossible for British steel-makers to comply with the specifications of pre-war stringency. On the other hand, it is urged that the experience of the war is far too brief to justify full confidence in the steels of lower purity and that much longer experience is embodied in the older specifications. Finally, the British Engineering Standards Assn. has adopted a compromise, leaving the new limits for sulphur and phosphorus for most of the better grades of steel (particularly railway material) at 0·050 per cent.

Apart from the demand for enormous supplies of steels of the more ordinary grades, war conditions also brought with them unprecedented demands for steels of the highest possible quality for special purposes. The production of guns was one of these, and much difficulty was encountered both in England and America with defects —known as " snow flakes " or " gun measles "—occurring particularly in nickel-chrome steels. Reversion to the use of a simple nickel-steel for such purposes followed, but it must be admitted that this entailed a serious disadvantage, if only on account of the greater difficulty experienced in securing satisfactory heat-treatment. This difficulty was also encountered in connexion with the gearing used for the propelling machinery of turbine-driven ships. High-quality steels, mainly alloy steels, were also required in relatively very large quantities for purposes of air-craft construction, principally for the working parts of aero-engines. This demand led to a very great development in the production and treatment of alloy steels. Here, and generally in the production of the better grades of steel, the electric furnace played a remarkable part. A large number of furnaces, mostly of the arc-resistance type, were installed, particularly in Sheffield. Their great value lay in the super-refining of steel, sometimes produced in a basic open-hearth furnace, sometimes obtained by the direct remelting of alloy-steel scrap. Probably the power of the electric steel furnace to deal satisfactorily with such scrap, even when in the form of workshop swarf, constituted its greatest value during the war. Since the end of the war, however, the demand for such steel has almost disappeared, with the result that the greater number of the electric furnaces, both in England and America, are now idle. None the less, there can now be no doubt that there must be, in the future, a definite use and function for a certain number of electric furnaces in steel metallurgy.

Alloy Steels.—In regard to alloy steels, while nickel-chrome and nickel steels have found by far the widest application, particularly for war purposes, other alloy steels have also assumed importance. Nickel-chrome steel in particular, in addition to the difficulties already mentioned, has been found to be subject to a defect known as " temper brittleness." Alloy steels, in order to assume their most desirable physical condition, require specific heat-treatment which, as a rule, consists of quenching in oil, or more rarely in water, from a temperature above the critical range of the steel, followed by a " tempering " or re-heating to a temperature considerably below the critical range. In the majority of steels, the rate of cooling subsequent to such tempering is of little importance, but in a certain number of nickel-chrome steels slow cooling after tempering leads to a form of brittleness, which is entirely removed if the steel is cooled very rapidly (quenched) after tempering. Considerable difference of opinion still prevails as to the cause and nature of such brittleness. One investigator (Andrews) connects it with the presence of phosphorus in the steel, and states that such steels containing very little phosphorus are free from the trouble. Further, acute controversy has arisen as to the importance or otherwise of such "temper brittleness" on the ground that it can only be detected by a particular form of test—the "notched bar impact test." Hatfield has repeatedly suggested that this test measures a property of no practical importance and that, therefore, temper brittleness is only "apparent" and not "real." This view, however, has not been generally accepted, since a number of investigators (Rosenhain, Greaves and others) have found a very distinct correlation between a low value under the notched bar impact test and cases of actual failure in service.

For certain purposes, where simple nickel steels are not found adequate, a chrome-vanadium steel has been extensively used. The fact that vanadium plays a really important rôle in such steels has come to be recognized, but there are still difficulties in its metallurgical applications. For quite a different range of purposes a steel containing relatively large amounts of chromium (about 13%, Brearley) has found wide applications. Its best-known application is to the production of "stainless" cutlery which is proving extremely successful in practice and, in spite of the relatively high cost, is coming into extensive use as a labour-saving device. Some difficulty was at first experienced in hardening this material satisfactorily; it requires a higher quenching temperature than cutlery-hardeners have been accustomed to employ (Hatfield), and, as a consequence, the earlier products were insufficiently hardened and gave rise to the complaint that such cutlery would not keep its edge. Recent practice has overcome this defect, although the fact still remains that "stainless" knives, not being automatically sharpened by daily polishing, require careful sharpening from time to time. The applications of this steel to other purposes where resistance to corrosion is important are being found almost daily. Incidentally, it was found that this steel is capable of resisting the severe conditions which occur in the service of an exhaust-valve in aeroplane engines, although a high-tungsten steel (18% tungsten) has been found to be even slightly better (Aitchison).

High-speed Steels.—In the metallurgical progress of the period under review, the development of high-speed cutting steels occupies an important place, their possibilities having been steadily exploited to an increasing extent, their development being naturally accompanied by an evolution of machine-tools capable of utilizing the high-cutting powers of the new steels. Under war conditions, the great demand for tool-steels of this kind created a relatively enormous demand for tungsten, and considerable developments in the mining and production of tungsten took place. Efforts to replace tungsten by other metals were also made, and very great claims were advanced for a "new" high-speed steel in which molybdenum in combination with vanadium was used in place of tungsten (Arnold). The use of molybdenum in place of tungsten, however, was by no means new, and the merits of the new "discovery" therefore depended entirely upon the extent to which the known disadvantages of molybdenum in this connexion had been overcome. Uncertainty of quality and a strong tendency to crack while in the ingot form were the chief of these. Indeed, at the present time, there seems to be no tendency for the normal tungsten high-speed steel to be discarded in favour of the molybdenum-vanadium alloy.

In connexion with high-speed steels, mention may here be made of two alloys which have been used, with considerable success, in place of such steel. These are known as "stellite" and "cooperite" respectively. Stellite consists, according to one reliable analysis, mainly of cobalt 56%, chromium 34%, tungsten 9%, carbon 1%. Actual cutting tests with this material have shown that it is capable of cutting rather faster than the best tungsten steel, provided that the cut is smooth and regular, but that for roughing cuts, where the tool is subjected to sudden shocks and jars, the alloy is unsuited as it is too brittle and the tool frequently breaks off. In the form as ordinarily marketed, moreover, stellite cannot be softened, so that it must be used in the cast condition and the tool has to be ground to shape while hard. Recently, a form of stellite which can be softened has been announced, but no data in regard to it are yet available.

Cooperite is an alloy of nickel, tungsten and zirconium, described as containing 80% of nickel, 14% of tungsten and 6% of zirconium.

Cobalt Steel.—Returning to alloy steels, mention must be made of the use of cobalt. The great development of cobalt production at Sudbury in Canada has made this metal available and has attracted interest to its possible uses. A high-speed tool-steel containing cobalt has been produced in Sheffield, and has not only been found to be successful in general use, but to have the remarkable property that it does not undergo any distortion during the hardening process. Should this property be established in practical service the steel is likely to prove of very great importance in the production of shaped cutting tools in which great accuracy is required. War conditions brought with them painful experience of the great difficulty which then existed in the production of accurate parts—such as those of shells and fuzes which were required to be strictly interchangeable. This difficulty extended back to the gauges and master-gauges used for the checking of such parts and, ultimately, in many cases to the cutting-tools used in their production. In other cases, the steel of which the gauges themselves were made gave much trouble owing to distortion during hardening, requiring considerable adjustment by "lapping" of the hardened article.

A cobalt-steel has also made its appearance as an important innovation in another field—that of steels for permanent magnets. Made in the first place of hardened carbon steels, the requirements particularly of the magnetos used for ignition purposes in air-craft engines led to the use of special steels containing about 6% of tungsten. A Japanese invention, based upon extensive researches carried out in that country (Honda), has produced a cobalt magnet steel which, in its best examples, gives very surprising results, combining an exceptionally high coercive force with a relatively large remanence. By the use of this steel a much smaller and lighter magnet would suffice for a magneto of given power. The steel is extremely expensive, and when supplied in quantity appears to vary in quality, while there is also some difficulty in its workshop manipulation. These, however, are probably difficulties arising from the novelty of the product and are likely to disappear as it becomes better understood by the makers.

Welding.—One of the most remarkable developments (metallurgical in the wider sense) during the period under review has been that of autogenous welding, both by the oxy-acetylene flame and by the electric arc. Both these processes afford a relatively very cheap and simple means of making joints in metal, particularly in iron and steel, and as the joint consists of "the same metal" as that which is being joined, there is a specious suggestion that the joint is "perfect" in the sense of being as good as the unjointed portions of metal. Although it is quite possible to obtain welded test-pieces which break, under a tensile test, away from the actual joint, the joint itself can never be regarded as equal in strength and toughness to the unjointed steel. There are several reasons for this conclusion. In the first place, the material in the weld itself has simply solidified from fusion and is at best equal in properties to the same steel in the cast condition, while the rest of the plate itself has been immensely improved in quality by forging and rolling and possibly by heat-treatment. Further, adjacent to every such weld there is a region of steel which has either been severely overheated or—a little farther away—which has been heated to a temperature just below the critical range. In both these regions the steel is seriously weakened and it is in the latter that test-pieces generally break. The most serious difficulty, however, is that of being sure that any autogenous weld is truly sound. Examination of many such welds has shown that soundness is very difficult to secure and that it is the exception rather than the rule, even in careful practice; while it is not possible to ascertain by any external examination of a weld whether it is sound or not. Examination by the aid of a powerful X-ray installation can sometimes be employed to assure the soundness of an important weld, but as a rule this is not feasible. It would seem, therefore—and the best-informed opinion is steadily coming to take this view—that welded joints cannot be relied upon to carry severe working stresses, and that they should not be employed in vital parts unless an exceptionally heavy factor of safety can be allowed. Actual experience in aeroplane construction has borne out this view, and a construction in which steel tubes are joined together by pinned and soft-soldered joints has been found more reliable than autogenous welding, provided that the working stress on the solder is kept to a low value. On the other hand, it must be borne in mind that the welding processes afford a ready means of making joints and effecting repairs where no other process could be used, and under war conditions particularly rapid repairs were frequently executed with great success. None the less, many such cases involved very decided "war risks." At the same time, welded joints should not be compared with the unjointed material but rather with joints made in other ways, such as riveting; and there the comparison is much more favourable except for the serious element of uncertainty. The application of welding, and particularly of electric arc welding to such purposes as ship construction, has, however, found considerable acceptance (*see* Welding).

Non-ferrous Metals.—The outstanding feature in the progress of non-ferrous metallurgy is undoubtedly summed up in the one word, "flotation." In spite of long-continued litigation, which has resulted in clouding the whole matter in an obscurity from which published scientific research (Sulman, Langmuir) has not yet fully extricated it, this process has made enormous progress and has to a considerable extent revolutionized the entire practice of the extraction of many non-ferrous metals, particularly those occurring in the form of sulphide minerals, such as galena, zinc-blende and the various pyritic copper ores. Its effects have been direct in superseding most gravitational methods of separation, and indirect in view of the fact that flotation deals primarily with very finely divided material, including the "slimes" which were the greatest difficulty of the pre-flotation metallurgist. Not only has this affected ore-grinding and handling practice, but it has brought about a great change in smelting practice also. Thus the treatment of copper concentrates is being carried out to a rapidly increasing extent in the reverberatory furnace to the steady exclusion of the blast furnace.

Flotation.—The principles of flotation do not appear to be entirely understood from the physical or physicochemical point of view, as there is considerable divergence of opinion on the question whether flotation phenomena are the result of purely "surface tension" forces or whether electrical forces play an important part. The operations involved are, however, sufficiently clearly defined, and consist essentially of three steps which may overlap or merge into one another. The first of these may be described as the "oiling" process. This consists in adding to the slip or mixture of finely ground ore and water some "oiling" reagent. This may be either an essential oil or one of a great range of chemical substances, generally organic in character. Only a very small amount of such a reagent is used, since the addition of larger quantities produces entirely different effects due to the formation of oil-films of appreciable thickness. The minute amount of oiling reagent, on the other hand, appears to produce some change on the surfaces of certain minerals having a metallic or semi-metallic character—zinc-blende being a typical example—which makes them less readily "wetted" by the liquor of the slip, or, put in another way, increases the angle of contact between these surfaces and the liquid. The gangue of the ore is less affected or not all affected by the oiling reagent, but in many cases it is necessary artificially to increase the difference between mineral and gangue by the addition of some "gangue modifying reagent" which renders the gangue more readily wetted by the aqueous liquid of the slip. These "gangue modifiers" are as a rule alkalies or mineral acids.

The third step in the process consists in adding to the slip some substance which causes the ready production of a stiff and lasting froth when air is introduced, either by agitation or by blowing or drawing it through the liquid in a finely divided state. Very frequently the "oiling reagent" also serves as the froth-producer. When the slip thus prepared is treated so as to produce a froth, the oiled mineral particles adhere to the air-bubbles very firmly, the mineral-air surfaces evidently being the seat of less potential energy than the mineral-water surfaces, and consequently the buoyancy of the combined bubble with its mineral burden causes it to float to the surface where it accumulates as a very stiff mineralized froth which can be mechanically separated in various ways. Actually, a further action appears to take place, which is related to the flocculation of the mineral particles in contact with air-bubbles. This results in the attachment to each bubble of much larger and heavier agglomerations of mineral particles, thus greatly increasing the efficiency of the whole process.

The flotation process has found its largest application in the concentration of various types of sulphide ores and, on this ground alone, has attained very great industrial and technical importance. Its application to other minerals has, however, been actively pursued, and in a great many cases with considerable success. Minerals having a more or less metallic character are particularly suited for flotation, so that native metals constitute an obviously promising application. It is quite possible that ultimately the treatment of finely divided gold-bearing ores may revert to flotation, but as yet the older cyaniding processes in their modern forms continue to hold their own. Application to minerals of the oxide and carbonate type is less simple, and here it seems to be necessary, in many cases, to submit the ore to a previous "activating" treatment. Preliminary roasting in a reducing atmosphere in the hope of producing a more or less metallic surface coating upon the ore particles has been tried, while "sulphidizing" by exposing the finely ground ore to the action of hydrogen (or ammonium-sulphide) has also been tried, in some cases with success. Another problem, which offers the promise of most important results when a full solution has been found, is that of "differential flotation" for the purpose of separating different metalliferous minerals in a complex ore, such as the separation of zinc-blende or sphalerite from galena. In a certain number of cases, oiling reagents have been found which act differentially upon different flotable minerals, but every particular case still requires extensive research which does not always lead to a satisfactory industrial solution. Recently, an attempt has been made to recover coal from the waste heaps of collieries by means of flotation plant; technically entire success has been attained, since coal can be readily floated. Whether commercial success can be attained is another question, since the cost of fine grinding is a serious matter where a mineral of relatively low value is to be recovered. There is the further doubt whether coal which has been exposed to the weather, resulting in a dulling of its surface, can be made to float.

Smelting.—Beyond its immensely important direct effects in rendering possible the economic concentration of a number of ores and in cheapening the concentration of others, the development of flotation has also profoundly affected smelting practice, since the product of flotation, being very finely divided and wet, differs widely from the drier product of gravity concentration. The concomitant progress of the reverberatory furnace, to which reference has already been made, has been accompanied by another development which, although to a large extent independent, has also received indirect stimulus from flotation. This is the use of powdered coal as fuel, a development which is still in active progress and shows promise of very wide extension. Extremely finely divided coal is blown or otherwise forced into the actual combustion-space of the furnace, where it burns with a flame very similar to that of a jet of gas. The obvious advantages of such a system are that the loss of heat involved in the gasification of coal in producers is saved, together with the labour and the technical difficulties involved, while most of the advantages of gas-firing can also be secured by burning powdered coal. As against this must be set the cost of grinding the coal sufficiently fine and of injecting it into the furnace, while disadvantages also attach to the fact that the ash of the coal is introduced into the furnace and thence into flues, regenerators, etc. The question of the manner in which the coal is to be powdered and conveyed into the furnace receives rather different treatment in different forms of the process, but it is coming to be recognized that extremely fine grinding is advantageous and in one process the coal is made into an "emulsion" of coal-dust and air which is said to flow and to be capable of being pumped like a dense liquid. The coal particles appear to become coated with a closely adherent (probably "absorbed") layer of air and as soon as the temperature becomes high enough for ignition to occur, very rapid combustion takes place. The use of coal-air mixtures or "emulsions," however, implies the introduction into the furnace of a relatively large amount of cold air and this materially affects the question of regeneration or recuperation of the heat of the waste gases of the furnace. This is also affected by the presence of the fine ash-dust which tends to clog or even to flux the tubes or chequer-work. In some furnaces, where an extremely high temperature is not required, the problem can be solved by dispensing with regeneration or recuperation entirely and utilizing the heat of the waste gases for raising steam, etc. Another point to be borne in mind is that a suspension of coal-dust in air may be a powerful explosive and must be treated with the care due to such substances.

In the methods for the extraction of non-ferrous metals, during the period under review, there has also been an important development in an entirely different direction. This is the very great advance in hydro-metallurgical processes, such as leaching and direct electrolytic treatment of ores. The elimination of the German zinc smelters, during the war, so far as supplies of zinc ores from the British Empire and the Allied countries were concerned, undoubtedly supplied a stimulus to this development, which has been particularly marked in connexion with the extraction of zinc from its ores. But the treatment of many other ores has also come within reach of "wet way" methods, and these undoubtedly promise to play an increasingly prominent part in metallurgical extraction in the near future.

Organization.—Among the factors of metallurgical progress, mention must be made of certain institutions and organizations which now play an important and growing part, particularly in regard to non-ferrous metals. The Imperial Mineral Resources Bureau, constituted in London towards the end of the war, and working by means of a large number of committees, assisted by all the leading metallurgists, serves to compile and publish a large amount of information, mainly in regard to the mineral resources of the British Empire, but dealing also in rather less detail with the resources of other countries. The continued progress and growth of the Institute of Metals has been a very marked feature of metallurgical activity; this body has now attained a membership of over 1,300, and issues two annual volumes of its "Journal," which constitute sources of standard reference and information. In America, an Institute of Metals has been formed on slightly different lines, as part of the Institution of Mining and Metallurgical Engineers. The British Engineering Standards Assn., formerly the Engineering Standards Committee, has also come to exert a powerful influence on the metallurgy of those metals which form the primary materials of engineering. The issue of standard specifications for a large number of non-ferrous metals has been undertaken, mainly for air-craft purposes, while recently the formation of a new Sectional Committee on Non-Ferrous Metals promises a further series of more general specifications. Further, in connexion with the British Government Department of Scientific and Industrial Research, a Non-Ferrous Metals Research Assn. has been formed and has begun to initiate important researches, particularly in connexion with copper.

Copper.—The effect of flotation, powdered-coal firing, and the advance of hydro-metallurgical methods on the metallurgy of copper, have already been mentioned. In regard to the metal itself, there is an increasing tendency for the exclusive employment of electrolytic copper. In part, this arises from the increased supplies of this quality of metal, but more from the increasing demand for high purity. "Best selected" and "tough" (arsenical) copper are still in demand for some purposes, particularly for locomotive fireboxes and stays; but there is considerable doubt as to the value of the arsenic, particularly as more complete de-oxidization of the copper is now practicable. For this purpose, particularly in connexion with the production of sound castings in high-conductivity copper, various agents have been advocated and employed. Crystalline Boron, and a substance known as "Boron sub-oxide," have been advocated and some success has been attained by their use. With regard to finished copper, much attention has been paid to certain anomalies which occur during severe cold-working, such as wire-drawing, while the effect of heating the metal in a reducing atmosphere has also been further studied. A particularly interesting case of failure in copper when heated in a bath of fused sodium chloride has been studied by the Bureau of Standards, at Washington. This material became brittle and broke with a typical inter-crystalline fracture. It was shown that this arose from an electrolytic effect produced by the contact of the copper with the iron containing-vessel in the presence of the fused electrolyte (Rawdon). Metallic sodium is formed in contact with the copper and appears to penetrate between the crystals of the metal. A case has also been described where molten solder (lead-tin) acted in a similar manner when in contact with a particular kind of brass, the so-called "manganese bronze" (Dickenson).

Copper Alloys.—With regard to copper alloys, some progress has been made in regard to the difficult question of nomenclature. A committee appointed by the Institute of Metals has issued a first nomenclature Report which begins by defining the old terms "brass" and "bronze." The former is defined as any alloy of copper with zinc, containing more than 50% of copper; if other elements besides zinc and copper are present, they are to be named as a prefix to the term "brass." Thus an alloy containing 2% tin, 28% zinc, and remainder copper would be termed a "tin brass." Bronze on the other hand is defined as implying an alloy of copper with tin, containing more than 50% of copper, with the same convention in regard to additional elements. Thus an alloy containing 10% tin, 2% zinc, and remainder copper would be called a "zinc bronze." An attempt is also made to systematize nomenclature of more complex alloys. In the course of six or seven years this nomenclature, so far as brass and bronze are concerned, has made considerable headway, and these two terms are now rarely used except within the definitions named. On the other hand, the alloy formerly known as "German silver" and now generally, but quite misleadingly, named "nickel silver," should, under systematic nomenclature, be called "nickel brass," but there is some trade prejudice against the use of such a name.

An immense amount of experiment and research has been devoted to copper alloys, but the results cannot be adequately summarized in a few lines. A considerable number of special alloys are now known, each possessing valuable properties for various purposes. The aluminium manganese copper alloys have been very fully studied and described in the Ninth Report to the Alloys Research Committee of the Institution of Mechanical Engineers; these include alloys capable of attaining tensile strengths as high as 52 tons per sq. inch. Other alloys of special strength have been launched under various proprietary names, such as "Rubel bronze" and "Turbadium." For war purposes a most important part was played by the cupro-nickel alloys, containing either 15 or 20% of nickel, remainder copper. The production of this alloy on the very large scale required for the war, revealed considerable difficulties in its production, arising mainly from casting-defects in the slabs used for rolling. The remarkable power of this material to undergo extremely severe cold-working, without becoming excessively brittle, suggests that it is likely to have other useful applications beside bullet envelopes, but for industrial purposes these alloys have not yet been widely exploited. On the other hand, the much more expensive Monel metal has been widely pushed and has found considerable practical application, mainly on account of the valuable combination of great strength with great power of resisting corrosion which it possesses. This alloy is manufactured "direct" by the reduction of ores from the Sudbury district in Canada, and special virtue is claimed on the ground that it is a "natural" alloy and has not been melted together in the foundry. It is more than doubtful whether such a claim can be in any way substantiated.

Corrosion.—In connexion mainly with copper alloys, a very large amount of study has been devoted to the subject of corrosion, under the auspices of the Corrosion Research Committee of the Institute of Metals. The results have been embodied in five extensive Reports to that body, and serve to throw a large amount of new light on the corrosion, particularly, of marine condenser tubes. This is ascribed, essentially, to the formation on the surfaces of the tubes of an adherent, but by no means impervious, deposit of basic salts. By restricting the circulation of water in contact with the metal under these deposits, they lead to the formation of solutions containing a fairly high concentration of cupric chloride, and such a solution rapidly attacks brass, with the resulting formation of pits and ultimately of holes. It is considered that the brass as a whole is dissolved under these deposits, but that in certain conditions the copper is redeposited as a spongy mass, thus leading to the apparent "dezincification" of the brass at such points. The prevention of this, the most destructive type of corrosion, thus becomes a question of preventing the formation of such adherent deposits, and several devices for this purpose have been suggested. The latest proposal is to coat the interior surfaces of the condenser tubes with a thin layer of metallic lead. Recently, the scope of the researches undertaken by the above-mentioned committee has been extended to include fresh-water (land) condenser plant, and a special sub-committee has been formed to study the whole question of the corrosion of aluminium alloys. Results of these inquiries and of a parallel investigation into atmospheric corrosion, undertaken by the Non-ferrous Metals Research Assn., are not yet available.

Platinum, Etc.—The metallurgy of the noble metals has not undergone any very striking development during the period under review, either in regard to extraction or uses. The cyaniding process has undergone a series of more or less minor improvements, and it was at one time thought that aluminium dust would replace zinc-dust as the precipitant for pregnant solutions. Although aluminium is used to some extent, zinc-dust still predominates and the same remark applies to the proposed method of precipitating the metal electrolytically. In regard to platinum, there has been an ever-increasing scarcity, enhanced by the complete upheaval in Russia. The great rise in the price of platinum has naturally led to the study of possible substitutes for various purposes, and a number of such materials have been put forward. Thus for the "breaks" used in the magnetos of internal combustion engines, tungsten sparking points have been substituted for platinum with great success. For chemical purposes various alloys, some containing gold and palladium, have been tried, but only with partial success, since none of them really possess the combination of properties—chemical resistance and very high melting point—which renders platinum so valuable. A number of special alloys, in which tungsten and chromium generally play an important part, also exhibit great chemical resistance, but in these cases the hardness and brittleness of the material are generally a serious difficulty. For use in chemical work on a large scale, however, a considerable number of alloys have been produced which attain a fair measure of success. Silicon itself has many advantages for some of these purposes, but in the impure form, generally met with, it is relatively weak and brittle.

Zinc.—The metallurgy of zinc received much anxious attention during the war period. Reference has been made above to the general questions relating to zinc extraction, but the use of the metal and its alloys also received attention. On the Allied side there was at one time considerable shortage of zinc, and substitute alloys were studied for all purposes which should avoid the use of zinc. The shortage then disappeared, and at a later stage alloys consisting mainly of zinc were tried as substitutes for brass and for certain aluminium alloys. Some of these zinc alloys proved to possess remarkable properties, tensile strength exceeding 20 tons per square inch being obtained in cast alloys containing about 3% of copper and 7% of aluminium, remainder zinc. It was further found that these alloys could be extruded and, under certain conditions, rolled. In the severely rolled state they show remarkable ductility when slowly loaded, but are entirely brittle if the stress is applied rapidly; if annealed—even by quite moderate warming—they revert to the strength and entire non-ductility of the cast material. Unfortunately it has been found that alloys of this type, when they contain both aluminium and copper, are unstable and undergo serious changes of volume, accompanied by great loss of strength, even at the ordinary temperature if kept for any considerable time, such as a year. None the less, a considerable number of shell-fuses were successfully made of such an alloy, but they were used before dangerous deterioration had set in. It is interesting to note that on the German side, while there was never any shortage of zinc, this metal and its alloys were extensively employed as substitutes for other metals. Pure zinc was widely used in place of copper for electrical purposes, while zinc alloys with copper and aluminium were also largely used. Apparently, cases of failure due to the instability of these materials passed unnoticed under the stress of war; at all events, German metallurgists have described these "war bronzes," without mention of such deterioration with time, except as the result of corrosion. It may be mentioned, however, that alloys rich in zinc, which contain either copper alone or aluminium alone, appear to be free from the trouble in question (Rosenhain, Haughton and Bingham).

Aluminium.—Aluminium and its alloys have played a particularly conspicuous part and have undergone remarkable developments during recent years. Prior to the outbreak of war, aluminium itself had become relatively very cheap (below £100 per ton), and this fact stimulated interest in its use. During the war, on the other hand, while the metal itself became scarce and very dear, its applications for military purposes grew enormously in importance and raised its alloys for the first time to the rank of important materials of engineering construction. Its uses arose mainly in connection with air-craft and became increasingly important in the closing years of the war. It must, of course, be recognized that this rapid development of aluminium alloys under war conditions was to a considerable extent the result of progress which had been made prior to 1914. One step in this progress was marked by the section on light alloys contained in the Ninth Report to the Alloys Research Committee (Rosenhain and Lantsberry), published in 1909; but the discovery, by Wilm of Berlin, of the possibility of hardening aluminium and its alloys, when a small percentage of magnesium had been added to them, led to the next and very important forward step. The application of this discovery to the best of the alloys, described in the above-named Report, led to the production of the now widely known and used alloy "duralumin." This contains from 3 to 5% of copper, about 1% of manganese and about 0·5% of magnesium. As rolled, this material has a tensile strength of about 18 tons per square inch, but if heated to a temperature of 480° C. to 500° C. and quenched, it gradually acquires much greater strength—rising to about 26 tons per square inch; the ductility remaining the same at about 16 to 18% elongation on 2 inches. There can be no doubt that such a material, possessing the strength of a very mild steel combined with a density as low as 2·8, constituted a remarkable advance in wrought aluminium alloys. At quite an early stage in its history this alloy was employed for the construction of Zeppelin airships. The manufacture of the alloys was taken up in England under licence from the German patentee, and the alloy has been extensively used in the construction of British rigid airships. Its use has, however, not been free from difficulties and disadvantages, and great efforts have been made to arrive at better alloys by research in this country. As a result, a series of new aluminium alloys for use in the wrought form have been developed, mainly as the result of extensive researches at the National Physical Laboratory. In the first place, a series of alloys containing from 18 to 20% of zinc were produced. These were of a type which had up to that time been regarded as incapable of being rolled or forged, but the initial difficulties of that kind were overcome by a careful study of their properties both in the foundry and the rolling-mill. The result was the production of an alloy containing 20% of zinc and 3% of copper, generally known as "3–20" or "Alloy A." This shows a tensile strength, in the condition as rolled, of 27 to 28 tons per square inch with an elongation of 18 to 20% on 2 inches. It is thus a little stronger than duralumin, but also a little heavier (its density is about 3·1). It is simpler to make and use than duralumin, as it requires no special heat-treatment, and it is—unlike duralumin—not liable to be seriously weakened by a slight amount of annealing. On the other hand, this alloy is liable to be damaged in other ways if heated much above 250° C., and it loses its strength very rapidly with rising temperature, at all events above 100° C., while it is also distinctly less resistant to corrosion than duralumin. For many purposes, however, where cheapness and simplicity of treatment are important, and where the material is not exposed to severely corrosive conditions, the "Alloy A" (3–20) possesses distinct merits. This alloy has, however, been considerably improved upon by a series of alloys in which both manganese and magnesium have been added to the simple aluminium-zinc alloy. These require quenching and ageing, but after such treatment can be made to attain a tensile strength of 40 tons per square inch. They are, thus, in regard to strength for a given weight, considerably superior to duralumin and this relative value is particularly apparent under compression (buckling) tests. On the other hand, these alloys require careful protection from corrosion and their heat-treatment must be carefully carried out. Another very important group of "wrought" alloys are those containing nickel and magnesium in addition to copper. The most important of these is one developed at the National Physical Laboratory and known as "Alloy Y," or "4–2–1½," the latter figures representing the composition: copper 4%, nickel 2%, and magnesium 1½%. This alloy, when quenched from a temperature of 530° C. after previous cold-rolling, can be made to attain a tensile strength of 28 tons per square inch combined with an elongation of 20% on 2 inches; its density is 2.8, and it possesses two very important further properties, viz. remarkable resistance to corrosion, and a relatively very high resistance to fatigue (repetition stresses), particularly at slightly elevated temperatures. Forgings of this alloy have been successfully used as connecting-rods in high-speed internal combustion engines, and there is every reason to anticipate a constantly widening range of engineering uses.

Promising and important as are the results achieved with the wrought alloys just described, results of more immediate importance were achieved with casting alloys of aluminium. At first these were employed mainly on more or less subsidiary castings, such as crank-cases, and for that purpose an alloy containing from 12 to 14% of zinc and about 2½% of copper (generally known by the number of the British Air-board Specification as "L5") was very widely used. Efforts were soon made, however, to employ light-alloy castings for more important parts in aeroplane machines, viz. cylinders and pistons. Here the value of these materials lies not so much in their specific lightness as in their high thermal conductivity. In the case of the cylinder castings of air-cooled engines particularly, this is valuable in preventing distortion arising from unequal cooling of the windward and leeward sides, while in the pistons it reduces the temperature of the compression space and thus increases the density of the indrawn charge, and at the same time allows of the employment of higher compression ratios. The effect of these advantages is to increase the power output of an engine of given size and weight very appreciably, while also reducing the petrol consumption. The alloys first and most extensively used were those of aluminium with copper, a 12% alloy being particularly popular. Another widely used alloy contains 7% of copper with 1% of zinc and 1% of tin, but it is now recognized that the presence of tin renders the alloy weak under shock when hot. These alloys, although initially not as strong as some of those containing zinc, do not lose their strength so rapidly when heated, so that at the working temperature of an aluminium-alloy piston (about 250° C.) they are stronger than such an alloy as "L5." Even these alloys, however, are relatively very weak when hot—they register a tensile strength of about 6 to 7 tons per square inch at 250° Centigrade. Recently, researches at the National Physical Laboratory have shown that the alloy already referred to above as "Y"—containing copper 4%, nickel 2%, magnesium 1½% is particularly strong at high temperatures, even in the cast state. It is, further, amenable to hardening by quenching and ageing even in the form of castings, and when thus treated attains a tensile strength as high as 20 tons per square inch at the ordinary temperature and 13 tons per square inch at 250° Centigrade. This alloy is rapidly finding its way into extensive use and many important applications are being opened up as the result of its remarkable properties.

Cobalt and Lead.—Developments in the remaining metals are mostly of a minor nature and cannot be referred to in detail. Mention should, however, be made of the progress made in connexion with cobalt. Its use in steel and in certain special alloys has already been mentioned, but it has also been shown to give a more adherent and more durable electro-plate coating than nickel, and it is important to note that its resemblance to nickel is not nearly so close as was previously supposed. In regard to lead and its alloys, a remarkable development has been that of alloys with the rare-earth metals, particularly calcium and barium. These confer a remarkable degree of hardness on lead, and a special alloy of this kind, known as "Ulco," is finding application as a bearing-metal. A substitute of this kind was called for as the result of the very high prices attained by tin under war conditions, but the permanent value of the materials has yet to be established.

PHYSICAL METALLURGY.—Side by side with, and to a great extent furnishing the basis for, the development in the treatment and use of metals and their alloys, there has been a very great and important development of metallurgical science, particularly in the direction of what has been called "Physical Metallurgy." The mass of work which has been published on this subject is so great that even an approximately exhaustive bibliography would occupy more than the space available. Only a few outstanding features of the progress achieved can therefore be briefly mentioned.

A very large amount of work has been devoted to the further and more detailed study of the constitution of alloy systems. Although somewhat rough preliminary determinations of the equilibrium diagrams of most binary alloy systems had been previously made, a number of these have been revised and rendered more accurate. In ferrous alloys, the iron-carbon system has received much further study, particularly in regard to the critical points of iron itself. Important work at the Bureau of Standards, U.S.A. (Burgess and Crowe), has firmly established the three well-known critical points, A_1, A_2, and A_3, and has shown that previous attempts on the one hand to discredit the very existence of A_2 (Carpenter) and on the other to show that it was a double point (Arnold), were based on experimental error. On the other hand, German investigators (Ruer, Hanemann) have established the existence of a higher critical point, which in pure iron occurs at a temperature very close to 1,400° Centigrade. In connexion with the critical points, considerable attention has been devoted to the whole question of allotropy. A Dutch school of investigators (Cohen) have sought to show the existence of numerous allotropic transformations in many metals, but their conclusions are based on extremely slight evidence derived from determinations of minute irregularities in density changes. On the other hand, the Japanese school (Honda) seek to show that the A_2 transformation in iron is not allotropic in character and this view is confirmed, to a certain extent, by strong evidence that the passage through this point does not involve any change of crystallization—evidence which has recently been confirmed by the X-ray analysis of the crystal structure of iron and steel at various temperatures (Westgren). The matter, however, rests entirely upon the precise definition of allotropy which is adopted. In addition to the iron-carbon system, the iron-nickel, iron-chromium, the manganese-carbon and nickel-carbon systems have been carefully investigated. No attempt, however, appears as yet to have been made to attack the detailed study of the equilibria of such important ternary systems as iron-nickel-carbon, iron-manganese-carbon or iron-nickel-chromium, no doubt on account of the length and difficulty of such an investigation. In non-ferrous alloys, considerable attention has been given to the alloys of zinc, a portion of the ternary system copper-aluminium-zinc (alloys rich in zinc) having been very fully worked out (Haughton, Bingham). The allotropy of zinc itself has also been very thoroughly studied (Benedicks, Bingham) and the reality of the transformations well established. Great advances have been made in the knowledge of the equilibria of several of the important alloy systems in which aluminium is the predominant metal. The ternary systems aluminium-zinc-copper, aluminium-iron-silicon and aluminium-magnesium-silicon (Hanson, Gayler) have been very fully worked out so far as the alloys rich in aluminium are concerned. For the representation of the results of such investigations a new type of model has been devised (Rosenhain), in which the various equilibrium surfaces are represented by systems of wires coloured to indicate the phases concerned in each transformation. The study of the aluminium-magnesium-silicon system has proved particularly important, owing to the light which it throws on the age-hardening properties, which are found in many aluminium alloys containing magnesium. It has been shown that the magnesium in these alloys is present as a definite compound Mg_2Si, which is more soluble in solid aluminium at high temperatures than at the ordinary temperature. Quenching such an alloy from a temperature just below its solidus retains the compound in solid solution and in this state the alloy is soft. Gradually, however, at the ordinary temperature, and more rapidly at slightly higher temperatures, this super-saturated solid solution deposits the excess of dissolved compound in an extremely finely divided condition and this process is accompanied by gradual hardening of the alloy. This process is strictly analogous to that which can be brought about in certain alloy steels which can be rendered (or kept) completely "austenitic" (homogeneous solid solution) by quenching; they are then soft and ductile, and do not undergo hardening while at rest at the ordinary temperature. If the temperature is raised so as to bring about "tempering," the solid solution breaks down in precisely the same way as indicated above and the steel becomes hard (and also magnetic). It would thus seem that hardening as the result—direct or indirect—of quenching is due to the separation from solid solution, in a state of extremely fine division, of a phase the formation of which had been suppressed by quenching. According to the theory of amorphous metal (see below) each of the minute crystallites of the phase thus separated will be surrounded by a zone of amorphous metal, which is itself very hard. If the minute crystals thus separated are sufficiently small and numerous, the result will be that a considerable proportion of the whole alloy will be thrown into the amorphous state, extreme hardness resulting. On this view, the martensite of hardened steel should consist mainly of minute crystallites of alpha-iron embedded in an amorphous matrix consisting of iron and carbon (or carbide) in solution in it. This suggested constitution of martensite readily accounts for its hardness and for the fact that it is magnetic, and—in view of the intimate manner in which the minute crystallites of alpha-iron are embedded in unyielding and un-magnetisable amorphous metal—for the magnetic hardness of the martensitic steel. This view is further confirmed by the observation that the chemical behaviour of quench-hardened steel is in certain respects closely similar to that of the same steel hardened by cold work and thus rendered partially amorphous (Whiteley). Finally, it has recently been shown by X-ray methods, that the space-lattice typical of alpha-iron is present in martensitic steel (Westgren).

The theory of amorphous metal, just mentioned, has played a very important part in scientific metallurgical thought during the period under review. The conception that metal could be rendered amorphous by mechanical disturbance of its crystalline structure was originated by Beilby, in the first instance, to account for the phenomena observed by him and others in connexion with the polishing of metals and other substances. Beilby further applied the conception to explain the hardening which metals undergo as the result of plastic deformation (cold work) by suggesting that layers of amorphous metal are formed on the surfaces of internal slip which occurs during plastic straining. Both these theories are now widely, if not universally, accepted in England and America, but still find opposition on the Continent, where the weight of the experimental data is not sufficiently appreciated. More recently Rosenhain has brought forward a conception which has already been present in the minds of many other investigators (notably Osmond) in a less definite form, that a film or thin layer of amorphous metal exists in the inter-crystalline boundaries of all metals, quite apart from any effects of strain. This view has been vigorously contested, but experimental evidence in its confirmation has been steadily accumulated from a very great variety of sources, until at the present time the "intercrystalline amorphous cement" theory is at least as firmly established as that of the "amorphous theory of strain-hardening." The most striking series of facts supporting the "amorphous cement" theory is connected with the behaviour of the inter-crystalline boundaries under stress. It is well established that in normal circumstances these boundaries are stronger than the crystals themselves, so that fractures of metals generally occur by breaking through the crystals and not by pulling them apart. It has, however, been shown that at a high temperature near to, but definitely below, the melting point, pure metals can be easily caused to break with a perfectly inter-crystalline fracture (Rosenhain and Ewen). This is to be ascribed to the greatly decreased viscosity at such temperatures of the inter-crystalline amorphous metal, which is regarded as possessing the properties of a viscous under-cooled liquid. The actual viscosity, however, depends very much upon the nature of the metal and upon the temperature—the farther a metal is below its normal melting-point the higher the viscosity of the amorphous phase. Accordingly, in some of the softer metals and alloys the amorphous material is sufficiently mobile to allow of sensible movement in relatively short times. Thus, an alloy of zinc with copper and aluminium has been discovered which, in the cold-worked state when it is partially amorphous, behaves very much like pitch; it will bend to any desired extent if allowed to do so gradually, but breaks short if rapid bending is attempted. Similarly, the inter-crystalline cement in certain metals and alloys, although it proves stronger than the crystals when the metal is loaded at any normal rate, appears to be capable of giving way by some form of viscous or visco-elastic movement under very prolonged loading such as that due to internal stresses. Much attention has been devoted to the study of fractures occurring in various metals as the result of the application of internal or other prolonged stresses. In brass these phenomena have become known by the misleading term "season cracking," but it has recently been discovered that strikingly similar phenomena are to be found in a number of other metals, including lead, certain alloys of aluminium, platinum and steel (Rosenhain and Archbutt). It has been shown that in the case of brass, lead, steel and aluminium alloys, certain types of chemical reagents which appear to act preferentially upon the material in the crystal boundaries, contribute to the occurrence of such fractures, which are typically inter-crystalline (Moore and Beckinsale). At the same time it has been clearly shown that in the case of the aluminium alloys at all events such chemical action serves to accelerate the fractures, but is not essential to it, since it occurs, although more slowly, in high vacuum or in an atmosphere of pure dry hydrogen (Rosenhain and Archbutt). In the case of brass it seems probable, although it has not yet been finally demonstrated that "season cracking" can occur without the intervention of any chemical action. Similar types of cracking which have been discovered in mild steel, however, appear to be very closely associated with the effects of certain chemicals, such as concentrated solutions of alkalies, fused ammonium nitrate, etc. While there are still some metallurgists who refuse to think in terms of an amorphous inter-crystalline cement (Hatfield, Tammann), the great majority of investigators are agreed that, directly or indirectly, this conception serves to explain the occurrence not only of inter-crystalline fractures under prolonged loading but also a number of other phenomena associated with the crystal boundaries.

Intimately connected, also, with the nature of inter-crystalline boundaries is the whole of the important phenomena of re-crystallization and crystal growth which are of such fundamental importance with all annealing and heat-treatment operations. These have been studied in great detail in recent years. One of the most striking features is the relatively rapid formation of large crystals in certain conditions. Thus in an oblong piece of metal which has been severely strained, and is then heated in such a way as to be well above the usual temperature of re-crystallization at one end and well below it at the other, a zone is found in which very large crystals are formed; this may occur either as the result of a temperature-gradient being applied to a uniformly strained piece of metal or of the application of a suitable uniform temperature to a piece of metal in which there is a strain-gradient. The explanation appears to be that for a given degree of previous plastic strain there is a temperature most favourable to rapid crystal growth (Jeffries). An interesting practical application of the ideas derived from the study of these phenomena is the production of wires of certain metals, notably tungsten, which have been so treated as to consist, for considerable lengths, of single long crystals. This result is achieved by drawing the cold-worked wire into an annealing furnace at a suitable temperature at precisely the right rate. The tungsten wire thus produced is particularly valuable for the manufacture of electric lamp filaments and it has also been shown to possess interesting elastic properties (Wartenberg), which are readily accounted for by the absence in such material of any amorphous inter-crystalline material the viscous or visco-elastic properties of which affect the behaviour of the wire in this respect. Much study has also been devoted particularly to the re-crystallization of aluminium after cold-working, but new theoretical views have not yet been advanced. Here, as in almost every direction, the progress of research upon metals and alloys tends to open up new avenues for further research and further advance. In a subject which is showing such rapid and vigorous growth, such a summary as that here given cannot hope to deal with more than a few outstanding points which appear to be of primary importance, but development is so rapid and on such wide lines that it is impossible to foresee what trend it may follow in the near future.

LITERATURE.—For iron and steel metallurgy, industrial as well as scientific, the journal of the *Iron and Steel Institute* should be consulted, not only for original publications but for abstracts which cover the literature of the whole world on this subject. In addition, excellent abstracts will also be found in the metallurgical section of the journal of the *Society of Chemical Industry*, while such journals as *Stahl und Eisen*, the *Revue de Métallurgie* and *Chemical and Metallurgical Engineering* also deal with this branch of the subject. In addition to *Iron Age*, *The Iron and Coal Trade Review* and similar journals may also be mentioned, but adequate references to these can be found in the abstracting journals already mentioned. As regards general metallurgy, the annual volumes of *Mineral Industry* contain detailed reviews of progress, year by year, while the journal of the *Institution of Mining and Metallurgy* contains important original papers. For the non-ferrous metals, apart from their reduction from the ore, the most valuable reference is to the journal of the *Institute of Metals*, including particularly extensive abstracts as well as original papers. The *Revue de Métallurgie* and several German journals, also formerly the *International Journal of Metallography* (now *Métallographie*), may be named, as well as the appropriate section of the *American Institution of Mining and Metallurgical Engineers* (American Institute of Metals). The publications of the Bureau of Standards (Washington, U.S.A.) and of the National Physical Laboratory (Teddington, England) are also of first-rate importance. The Faraday Society (London) has also published in its *Transactions* several "General Discussions" relating to metallurgical subjects, including particularly one on *The Failure of Metals under Internal and Prolonged Stress*, another relating to metallurgical microscopy, and one on the application of X-rays. (W. RN.)

METEOROLOGY (*see* 18.264*).—Since 1910 considerable advances in meteorological knowledge have been made both on the observational and the theoretical sides. The World War emphasized the importance of meteorology, more particularly in regard to a knowledge of the density and of both the direction and velocity of the wind in the overlying air strata, and the meteorological services of the combatant nations were largely extended to obtain the information and disseminate it rapidly to their own troops. But while the war acted as a stimulus to the obtaining of data about the regions in which aircraft of all kinds are used and through which projectiles pass, in another way it has been a great hindrance to an advance in meteorological science. Not only were the international committees largely broken up but in the latter stages of the war the publication of observations was prohibited; each nation treated its own work as more or less confidential, and although all restrictions are now removed it is not easy to obtain and assimilate the important papers that were written during the war.

The Upper Atmosphere.—During the years before the war observations on the temperature and humidity of the air strata were rapidly accumulating, more particularly from a network of stations spread over Europe, and since the W. and N. of Europe is subject during the winter to the passage of many deep cyclonic depressions, the conditions of temperature in cyclones and anticyclones up to a height of some 20 km. (12½ m.) had become known. The brief tables which were all that were available to Cleveland Abbe in 1909 had been supplemented by much information, drawn up and arranged for the European results by Lt.-Col. E. Gold (M.O. No. 210e, *Geophysical Memoirs*, No. 5), by Dr. Wegener for the Continent (*Die Temperaturverhältnisse in der freien Atmosphäre*, III. Band, Heft 2/3, Leipsic, 1909) and for Russia by Dr. Rykatchew (*Meteorologische Zeitschrift*, Jan. 1911). In 1916 a summary of the information available about the upper air was drawn up for the Meteorological Office but not published. It quoted freely from Gold's paper but included the results of observations up to 1916. This summary together with certain theoretical matter was published in 1919 under the title "Characteristics of the Free Atmosphere" (M.O. 220c, *Geophysical Memoirs*, No. 13), and from it the following abstract summarizing our present knowledge of the strata from 0 to 20 km. is mostly taken.

Temperature.—As the surface of the earth is left the temperature of the air decreases with increasing height, and when the great variations of climate and of the conditions prevalent in different parts of the earth are considered it is remarkable how uniform is the fall of temperature, now commonly called the lapse rate. The height to which it extends is variable, but in all places in which observations have been made, the lapse rate up to 8 km. has been found close to 6° C. per kilometre. This holds, not indeed exactly but approximately, for summer and winter and for places as far apart as the equator and Ross Bay in lat. 78° S. Thus in Batavia the lapse rate up to 8 km. is 6·1° per km.; at Petrograd it is 5·8°. In England in the winter it is 5·8°, in the summer it is 6·0°. These are means but the rule holds quite well even for the individual case, for if in one part of the 8 km. the lapse rate is small this is usually compensated for by its being large in the other part. The only important exception that has been found so far is in regions and at times where the temperature is extremely low, as in Siberia or Canada in the winter. In such instances the bottom layer is unduly cold and the lapse rate is negative over the first 2 km., so that the rule would make the upper air temperature too low. Also it must be remembered that the daily variation of temperature does not extend upward more than one or two km., so that the mean for the day rather than the precise temperature at the moment should represent the surface temperature. This layer, in which temperature falls with increasing height, is called the *troposphere*.

At a certain height, which varies with the latitude, with the barometric conditions and with the season, the fall of temperature ceases, and the air up to the greatest heights that have been explored remains at a nearly uniform temperature in the vertical direction. This upper part in which there is no lapse rate is called the *stratosphere*. The boundary between the two parts is found at about 16 km. near the equator and at 10 km. in northern Europe. Over England its mean height is 10·5 km., falling to rather below 10 km. in the winter, and rising to over 11 km. in the summer. In the centre of a deep cyclone the value may easily fall to 8 km.; in an anticyclone it may exceed 12 km.

The temperature of the stratosphere is below 200° A. over the equator and in tropical regions; it is above 220° A. in northern Europe. In Canada it seems to be lower in the summer than in the winter. These anomalies are roughly expressed by the rule that the mean temperature of the air column taken with regard to height from 0 up to 19 km. is approximately the same in all parts of the earth. There is probably a physical reason for this, and it explains the unexpectedly low temperature above 14 km. over the equator and the curious reversion of temperature between summer and winter over Canada (Toronto) where the seasonal range is very large.

The annual range of temperature in the troposphere does not differ very greatly from the range at the surface; in island and coastal climates like England it is rather greater in the upper parts than at the surface; in continental climates the surface has the greatest range. In the stratosphere the range is much reduced and, as already stated, appears in Canada to be reversed although enough observations are not yet available to make this absolutely certain.

Whether or not there is any regular diurnal change of temperature above 2 km. height is uncertain; all that can be said is that if there be any its amplitude is certainly less than 1° C.

The mean annual temperatures are given in the accompanying Table I. In Europe the probable error of any value is about 1° C.; for Canada and the equator owing to paucity of observations it is greater, especially above 15 km., where it may reach perhaps 3° C. Over Europe the mean temperature does not change from 14 to 20 km. and does not change much over Toronto. Over the equator the lowest temperature, which is about 193° A., is not reached under 16 or 17 kilometres.

Table I.—*Mean Temperature.*

The values are in the Absolute scale with the first "2" omitted. 273·0° = 0° C. = 32° F.

Height km.	Petrograd	Scotland	Manchester	Berlin	England, S.E.	Paris	Strassburg	Vienna	Pavia	Mean for Europe	Toronto	Equator
14	23·5	22·0	20·5	18·7	18·9	19·1	17·9	19·6	17·7	19·1	12·5	3·0
13	23·4	21·8	20 6	19·3	18·7	19·3	17·6	19·6	16·4	19·2	14·0	11·0
12	20·7	21·6	20·0	18·3	18·8	19·5	16·8	18·3	16·1	18·4	16·2	19·0
11	20·0	20·5	20·9	19·2	19·6	20·2	18·1	18·4	18·5	19·1	19·3	27·0
10	21·3	21·2	23·2	21·9	22·2	24·3	22·3	21·8	22·7	22·2	23·2	35·0
9	24·4	24·8	28·2	26·8	27·5	30·0	27·8	26·9	27·3	27·2	29·3	43·0
8	29·8	30·2	33·8	33·1	33·6	36·9	34·8	33·6	33·9	33·4	35·9	51·0
7	37·1	38·0	40·2	40·8	40·7	44·3	42·1	41·2	41·2	40·7	43·5	58·0
6	43·3	45·0	47·0	47·9	47·8	51·4	49·3	48·8	49·4	47·8	50·9	65·0
5	49·8	52·0	53·8	54·8	54·8	58·1	56·1	55·6	56·2	54·6	57·7	72·0
4	55·7	58·4	60·4	61·0	61·7	64·3	62·4	61·9	62·9	61·1	64·1	79·0
3	61·3	64·0	66·6	66·9	67·7	69·8	68·4	67·6	69·2	67·0	69·6	85·0
2	66·7	70·3	71·7	71·7	73·2	74·5	73·8	73·0	75·1	72·4	74·8	90·0
1	71·0	75·3	77·0	76·8	78·0	78·5	78·2	77·6	80·7	76·8	78·3	95·0

Pressure and Density.—The temperature of the air having been found by observation, the pressure and the density are easily found up to the height to which the observations extend. In the same way the mean pressures and mean densities can be determined from the mean temperatures without appreciable error provided the mean pressure at the surface is known.

In the lower strata the pressure at any particular height is naturally most dependent upon the surface pressure, but since the air is lighter, bulk for bulk, when it is warm the pressure decreases less rapidly than usual in a warm area, and the pressure at any given height depends more and more upon the temperature of the underlying air as that height increases. Thus it comes to pass that in the hot regions of the earth, say in the belt included between the two tropics, the pressure at the height of 9 km. is very much less than it is at the same height over temperate latitudes, and the pressure gradient which causes the prevailing westerly winds of the cirrus level is thus produced. At a height of 20 km. the surface pressure has ceased to have much effect, and it requires a rise of nearly 20 mb.[1] in the surface pressure to produce a rise of 1 mb. at 20 km., whereas a change of 1·5° C. in the temperature of the air column will produce that effect. It has been stated that the mean temperature of the air column up to 19 km. is much the same in all parts of the world, and it follows that the same level is one of nearly uniform pressure.

The pressures are given in Table II. at various stations for heights up to 20 kilometres. The values for Canada and the equator at heights above 15 km. are not very reliable owing to paucity of data.

The densities are given in Table III. The variations in the density became of great consequence during the war on account of their influence on the range of projectiles; they depend on the connexion which has been found to exist between temperature and pressure.

Statistical Methods.—Statistical methods have been much in vogue of late years and it is necessary to indicate how the method of correlation has been used for forecasting and for elucidating meteorological problems. A large number of correlation coefficients have been determined between various meteorological events, and the values of many of them are given in the *Computer's Handbook*, M. O. 223, Section V, Tables, published by the Meteorological Office.

The advantage of a correlation coefficient in estimating the connexion if any between two events is that it expresses the connexion as a decimal which must lie between 1 and −1, and

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[1] The average pressure of the atmosphere at sea-level being reckoned as 1 bar, = 1,000 millibars (mb.). 1 mb. = 0·0295306 mercury in. at 32° F. in lat. 45°.

TABLE II.—*Mean Pressure.*
(Millebars)

Height km.	Petrograd	Scotland	Manchester	Berlin	England, S.E.	Paris	Strassburg	Vienna	Pavia	Mean for Europe	Toronto	Equator
20	55·0	55·0	55·2	54·8	54·9	56·0	54·7	55·0	54·8	54·9		53
19	64·0	64·2	64·6	64·0	64·1	65·6	64·0	64·4	64·0	64·1		63
18	74·5	74·8	75·4	74·8	75·0	76·6	74·8	75·2	75·0	75·0		75
17	87·0	87·3	88·0	87·4	87·5	89·6	87·6	88·0	87·6	87·8		90
16	101	102	103	103	102	105	102	103	103	102		107
15	118	118	120	120	120	123	120	121	121	120	120	128
14	138	138	140	140	140	143	141	142	142	140	142	152
13	161	161	164	164	164	167	165	165	165	164	167	178
12	187	187	192	192	192	195	193	193	194	192	195	209
11	218	219	224	225	224	228	226	226	227	225	228	244
10	255	256	261	262	261	266	263	263	264	262	266	283
9	297	299	302	305	303	309	307	306	307	305	309	327
8	346	348	352	354	352	357	355	354	356	353	358	376
7	400	402	407	408	407	412	410	409	412	408	413	430
6	461	464	468	470	469	473	472	471	474	470	475	491
5	529	532	537	538	538	541	540	539	542	538	543	558
4	606	608	613	614	615	617	616	615	618	614	618	632
3	692	694	698	699	699	701	700	700	703	699	703	713
2	787	787	793	795	795	796	794	795	797	794	798	803
1	896	894	898	900	900	900	900	900	901	899	903	903

TABLE III.—*Density, grammes per cubic metre.*

Height km.	England, S.E.	Europe	Canada	Equator
20	87	87	88	96
19	102	102	102	113
18	119	119	121	135
17	139	139	144	162
16	162	162	169	191
15	191	191	198	225
14	223	223	233	261
13	261	261	268	294
12	305	307	314	331
11	355	358	365	374
10	409	411	415	419
9	463	467	470	469
8	524	528	528	522
7	589	590	592	581
6	658	661	662	645
5	735	735	733	714
4	819	819	815	789
3	909	913	905	871
2	1014	1017	1011	968
1	1128	1128	1134	1067
0	1253	1258	1258	1174

thus renders the connexions between different pairs of events comparable with each other. The velocity of the wind and the steepness of the barometric gradient may be taken as an example. The actual connexion is obvious from the daily weather charts; on some it is well marked, on others badly, but the fact that there is a connexion is quite apparent from even two or three charts. The correlation coefficient is about ·70.

The application of the method of correlation to forecasting can hardly be looked upon as very successful. Two highly correlated events are required happening with a definite time interval between them. A correlation coefficient may be high accidentally if it be founded on too small a number of instances, but genuinely high coefficients between meteorological events occurring with more than a few days' interval betweem them are hard to find. The most successful instance is perhaps the forecast of the monsoon rain of India by G. T. Walker from the correlation between it and sundry other events occurring in the spring of the same year or earlier. In this case the correlation coefficients on which the forecast is based have values of about ·50; if values of ·80 or ·90 could be obtained very much greater success would be secured. There are a few coefficients of from ·70 to ·80 between the rainfall at various periods and the subsequent yield of sundry crops. Thus in the eastern counties of England if April and May be wet it is a practical certainty that there will be a large hay crop, and if the autumn be dry there will almost certainly be a large crop of wheat the next year. Mr. R. H. Hooker has calculated a most interesting set of figures relating to the correlation between the weather and the crops. Similar work has been done for the potato crop in America by J. Warren Smith, and many correlation coefficients relating to agricultural matters are available from Sweden and elsewhere.

The case is different where correlation is resorted to for the purpose of elucidating some physical process in the atmosphere; here a small coefficient is just as likely to give information as a large one. But the interpretation of the meaning of the coefficient is often difficult, and in many cases the value obtained is quite different from that which most meteorologists would have expected.

G. T. Walker in addition to his statistical work on the monsoon rain has published several sets of correlation coefficients, and amongst them a set of 100 showing the correlation between the sunspot number and the temperature at 100 stations well distributed over the earth's surface. The correlation is negative and small but it is large enough to be significant and to prove that during the 40 or so odd years considered the temperature of the earth as a whole was lower at the time of the sunspot maxima than at the time of the minima. It is commonly supposed that the sun is giving out most energy when its surface is most disturbed, and this idea has been confirmed by direct observation of the radiant heat. A perfectly satisfactory explanation is at present wanting. Another case is the low correlation between the direction of the wind and the temperature of the lower air strata (see a paper by Capt. C. K. M. Douglas, *Q. J. Met. Soc.*, Jan. 1921, vol. xlvii., No. 197), a most unexpected result. Walker also correlated between sunspots and rainfall, and found the coefficient too small to be significant. However, in none of these cases has the work been wasted since important conclusions have been established.

For high correlation coefficients one must take data relating to the upper air. The relation between pressure and temperature is so remarkable and has such a close relationship to the theory of cyclones and anticyclones that it will be treated separately. The correlation coefficients between the thickness of the troposphere, a height commonly denoted by H_c, the surface pressure, the temperature of the stratosphere and other variables often exceed ·70, and the generally high values show quite plainly that there is an ordered sequence in the processes going on above, which is strikingly absent from the surface phenomena.

Cyclones and Anticyclones.—In the meteorological literature of the past no subject has been so much discussed or has had so much attention directed to it as the causes of cyclones and anticyclones. When it became possible to obtain observations of temperatures and humidity, and in clear weather of wind direction, from the upper air it was confidently hoped a solution would be found—a hope as yet unfulfilled. But the mass of information collected from Europe, more particularly from the northern and western parts where cyclones are frequent, has given a large amount of detailed information and we have a clear conception of what happens as a cyclone passes over. It is true that we have no simultaneous sets of observations, so that we cannot draw a chart of any one particular cyclone, but we have numerous observations showing the departures from the mean corresponding to any observed surface pressure and to any special section of the cyclone.

The facts that stand out are that in a cyclone the troposphere is cold and the stratosphere warm, in an anticyclone the reverse is the case; in a cyclone the tropopause is low, in an anticyclone high. Thus as an area of low pressure passes across the map the following changes occur in the various air strata above. The deficiency of pressure is about the same from the surface up to some 10 km., above which it falls off rapidly until the normal value for the height

TABLE IV.

Correlation Between Pressure and Temperature

Height km.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Jan.–March	– 02	·54	·82	·79	·86	·85	·84	·87	·91	·81	·35	–·32	–·38	–·37
April–June	14	·28	·49	·79	·89	·89	·92	·87	·81	·45	·20	–·12	–·24	–·01
July–Sept.	– 02	·31	·56	·72	·75	·81	·83	·87	·87	·88	·43	–·08	–·41	–·19
Oct.–Dec.	·33	·56	·76	·77	·83	·87	·85	·85	·86	·78	·29	–·24	–·34	–·50
Means	·11	·42	·66	·77	·84	·85	·86	·86	·86	·72	·32	–·19	–·36	–·28

is reached at about 18–20 kilometres. The temperature from about 2 to 8 or 9 km. falls, and from 10 to 20 km. it rises. The height at which the lapse rate ceases, the limit of the troposphere falls. These statements are based on the very high correlation coefficients that are found to exist between pressure and temperature. It will be seen from the accompanying table (which gives the correlation coefficients) that close to the surface the correlation is low, but it is very high from 4 km. to 8 kilometres. In calculating these values the observational errors have not been allowed for, the correct values are most likely well over ·90. There are probably two reasons for this. The surface temperature is governed by many considerations—the time of day, the state of the sky, the strength and direction of the wind; higher up these disturbances do not apply, for, as has been already stated, the diurnal variation is very shallow and the correlation between the components of the wind and the temperature is surprisingly small above a few km. height. Secondly it may well be that the chief item in determining the temperature is the recent vertical motion of the air, and a systematic vertical flow of air either up or down is plainly impossible quite close to the surface. The rise and fall of the tropopause (H_0) and the regularity with which it occurs is shown by the high correlation, ·84, between it and the pressure at 9 km. height. There is hardly a single instance of observations made in Europe at a time of really low barometer in which H_c has not been found well below its average value. The dependence of the temperature of the stratosphere on the barometric conditions is not so close, the correlation being only ·50; but based on some hundreds of observations as these correlation coefficients are, ·50 is amply significant. Still the importance of a correlation in general depends upon its square rather than upon itself, and the significance of ·50 is very different to that of ·90 or ·85.

One noticeable result of this high correlation between pressure and temperature is that the density is not subject to much variation save close to the surface, for a high pressure and a high temperature act upon the density in opposite ways and since they occur together the density remains comparatively unchanged.

The Vertical Flux of Heat in the Atmosphere.—A much clearer and more definite view of the passage of heat upwards and downwards in the atmosphere has been secured, and in no direction excepting perhaps that of our knowledge of the upper air has the advance of meteorological knowledge been greater. This desirable result is largely due to a paper by Major G. T. Taylor (*Phil. Trans.*, A., vol. ccxv., pp. 1–26), which formed the starting-point, and has been followed by other papers on the same subject by himself, by Mr. L. F. Richardson, by Dr. W. Schmidt (Vienna), and by others.

There are seemingly four methods by which an appreciable vertical flux of heat energy is produced in the atmosphere. (1) Convection, which carries heat upwards from the earth's surface; its action does not extend beyond the first few kilometres. (2) The latent heat set free by the condensation of aqueous vapour which carries upwards to the regions where clouds are formed the solar heat which has evaporated the water from the sea or wet land surface; this acts in just the same region as convection. (3) Radiation, which mostly carries heat upwards from a lower to a higher stratum. These three methods present no difficulty but it must be pointed out that "convection," as is usual in meteorological literature, means local convection, *i.e.* heat carried by an ascending current that is produced by local warmth, not heat carried by an air current or by eddy motion due to the general circulation.

The fourth method, which invariably brings heat downwards, is not so easy to understand but is no less genuine than the others. It has been given various names, "mixing," "stirring," "turbulence," and (from the German) "mass-interchange." Taylor seems to have been the first to attempt its numerical measurement. The treatment of the subject has been mostly mathematical, but a rough explanation can be given without resort to mathematical symbols. The amount of heat possessed by a gramme of air is proportional to its potential temperature as defined long since by von Bezold and, save in the comparatively rare cases where the lapse rate is adiabatic, in which case heat is almost certainly being carried upwards by convection, the higher potential temperature is found at the higher level. The interchange, therefore, of two grammes of air between different levels (and it is obvious that if one gramme is carried up another must come down somewhere else to take its place) produces in general a flow of heat downwards, since the downward-coming gramme carries with it more heat than the upward-going gramme carries back. W. Schmidt has estimated the amount of heat carried downwards across the 2-km. level in Europe by this cause as 50 gramme-calories per sq. cm. per day. The necessary interchange of mass between the strata is produced by wind, for even the lightest wind seems capable of mixing the air in a vertical direction. The mixing produced by convection will have the same effect and if the return convection currents are in a region where the lapse rate is not adiabatic the total result of the convection in carrying heat upwards may be very small.

Two important conclusions follow. Since all four causes save radiation convey heat to the lower strata, say 0 up to 4 km., those strata must be losing heat by radiation. Also, since above the region of the formation of heavy clouds neither convection nor the supply of latent heat by condensation is efficacious, the actual lapse rate there must represent the balance of two opposing tendencies, one radiation, tending towards an isothermal condition, and the other, mixing, tending to an adiabatic lapse rate.

Radiation.—Considerable progress has been made in the subject of radiation, solar and atmospheric, both from the observational and theoretical sides. Abbot and Fowle's valuable work has been continued, and each issue of the *Monthly Weather Review* contains an article by Kimball giving the results of observations at Washington and other stations. The value of the solar constant, 1·93 g.c. per sq. cm. per minute, has not been appreciably altered by the later observations, but the instrumental outfit has reached a greater stage of precision, and it appears that the radiant heat given out by the sun varies from week to week within small limits.

Dr. Anders Ångström (Upsala), Prof. Boutaric (Dijon), and others have contributed much useful information on the net radiation between the earth and atmosphere. Dr. Emden has contributed an important paper ("Radiation Equilibrium and Atmospheric Radiation," *Sitz. Ber. Ak. Wien*, 1913, p. 55) dealing with the radiation between layers of the atmosphere. With regard to the net radiation from the earth to the sky on clear nights there seems to be a fairly general agreement that the value is from 200 to 300 g.c. per sq. cm. per day. These values have been obtained in widely different latitudes and seasons. The return radiation from the sky, excluding all solar radiations, is largely dependent on the prevailing temperature at the time; the average in England for all days, cloudy as well as clear, is about 600 gramme-calories.

Weather Forecasts.—During the World War, and since, large sums of money and much time have been spent on preparing forecasts. Of long-range forecasts it must be said that the position is not hopeful; in general a forecast of the weather a month ahead is a pure guess and nothing more. The British Meteorological Office has extended the period to a few days, and now mostly gives on Thursday a forecast for the week-end, with satisfactory results. With regard to the daily forecasts covering a period of 30 hours there has been a decided improvement. The extension of the area of the weather chart to cover Iceland, and the information obtained by wireless from the Atlantic have helped.

Forecasting has been and still is more or less a rule of thumb, but it depends upon the rules which govern the motions of cyclones and anticyclones, and if we could discover those rules and fully understand the causes which produce them an improvement in forecasting should follow. By the extensive use of pilot balloons a very large amount of information is now available with regard to the direction and velocity of the wind at various heights at the times when telegraphic reports are sent in to the head offices so that there is ample material showing the relation of the wind to the barometric gradient; but at present very little of this has been worked up. Much theoretical work has also been done on the gradual change from the surface wind to the gradient wind that generally lies above it. Sir Napier Shaw has contributed two useful papers ("Principia Atmospherica," *Trans. Royal Society of Edinburgh*, Dec. 1913, and "Upper Air Calculus," *J. Scott. Met. Soc.*, vol. xvi., 1913) of which a summary is given in *The Computer's Handbook*, M.O. 223, Section II., Subsection III. Shaw has in these papers emphasized the rule that at all heights save close to the surface the path of the air particle will be along the line in which the isobaric and the geopotential surfaces intersect. The rule is admittedly not exact, and it applies only to cases of steady motion; its general acceptance is probably due to two considerations. It has been found by practical work that in laying down the direction and velocity of the wind at one or two km. height (in the absence of definite information from pilot balloons) for the use of aircraft the best that can be done is to give the gradient wind, and it is not certain that the actual wind at 500 metres differs from the gradient wind by a greater amount than is due to the errors of observation. Secondly it is apparent that a depression could not be maintained for hours together with an approximate uniformity of pressure if air were continuously passing into it or out from it; quite a trifling wind blowing systematically into an ordinary depression for a few minutes would suffice to fill it up. Hence one is led to the conclusion that the strong winds that surround a depression must in general blow along the isobaric lines.

In his *Manual of Meteorology*, Part IV, M.O. 234, Napier Shaw has also provided a valuable account of the "relation of the wind to the distribution of barometric pressure."

In connexion with the subject of forecasting, Prof. V. Bjerknes' theory of the "polar front" must be referred to. His suggestion is that cyclones are caused by the discontinuity between polar and equatorial air, that, provided the network of stations is sufficiently close, the line where the surface of discontinuity meets the earth's surface can be traced on a chart, and the cyclone will move in the direction of a line he calls the steering line. Prof. Bjerknes' views are in the *Q. J. Met. Soc.*, April 1920, vol. xlvi., No. 194, p. 119.

Antarctic Meteorology.—Great additions to our knowledge of the meteorology of the Antarctic regions were made by the publication of the results of Scott's Antarctic expedition of 1911. The observations were taken mostly by Dr. Simpson, who has worked them up and discussed the various problems which had been left in a more or less uncertain condition by previous expeditions. He has greatly extended our knowledge both from the observational and theoretical sides. It must suffice to state here that amongst other matters Dr. Simpson has established the anticyclonic character of the weather in the Ross Sea area, and has shown that the blizzards are not due to the passage of cyclones from W. to E. over the Antarctic Ocean.

See W. N. Shaw, *Forecasting Weather* (1911); Willis L. Moore, *Descriptive Meteorology* (1911); C. J. Plave, *The Structure of the Atmosphere in Clear Weather* (1912); Dr. Julius Hann, *Handbuch der Klimatologie* (3rd ed. 1911); V. Bjerknes and others, *Dynamische Meteorologie und Hydrographie* (Carnegie Institute of Washington, 1912); H. N. Dickson, *Climate and Weather* (1912); Dr. Alfred Wegener, *Thermodynamik der Atmosphäre* (1911); M. W. Campbell Hepworth, *National Antarctic Expedition 1901–1904* (London, Royal Society, 1913); *Ice Observation, Meteorology and Oceanography in the North Atlantic Ocean* (Report on the work carried out by the S.S. "Scotia," 1913); G. E. Abbot, F. E. Fowle and L. B. Aldrich, "New Evidence on the Intensity of Solar Radiation outside the Atmosphere" (*Smithsonian Miscellaneous Collections*, vol. lxv., No. 4); Dr. Gilbert J. Walker, "Correlations in Seasonal Variations of Weather" (*Memoirs of the Indian Meteorological Department*, vols. xx. and xxi.); Anders Ångström, "A Study of the Radiation of the Atmosphere" (*Smithsonian Miscellaneous Collections*, vol. lxv., No. 3, 1915); G. C. Simpson, *British Antarctic Expedition 1910–1913*, Meteorology, vol. i. Discussion, vol. ii. Maps and Curves (1919); W. J. Humphreys, *Physics of the Air* (pub. for the Franklin Inst., 1920); F. N. Exner, *Dynamische Meteorologie* (1917); R. G. K. Lempfert, *Meteorology* (1920); L. J. Richardson, *Forecasting the Weather by Numerical Computation* (1921); the *Geophysical Memoirs* (pub. by the Meteorological Office); the *Meteorological Glossary* (fourth issue, M.O. 225.11, the Meteorological Office).

(W. H. Di.)

METHUEN, PAUL SANFORD, 3rd Baron (1845–), British field-marshal (*see* 18.298), was born Sept. 1 1845, joined the Scots Fusilier Guards in 1864, served in the Ashanti War of 1874, the Egyptian Expedition of 1882 and the Bechuanaland Expedition of 1884–5. As a major-general he served in the Indian Frontier War of 1897–8, shortly after which he was promoted lieutenant-general. On the outbreak of the South African War he went out in charge of the 1st Division, which he commanded at Belmont, Enslin, Modder river and Magersfontein; he remained in the field, engaged constantly on active operations and holding various commands, until just before the end of the conflict when he was, in March 1902, dangerously wounded and taken prisoner at Tweebosch; he was rewarded with the K.C.B. and the G.C.B. for his services in the war. He was in charge of the Eastern Command from 1904, in which year he was promoted general, until 1908, and he then went out as commander-in-chief to South Africa 1908–9. In 1911 he was promoted field-marshal. During the greater part of the World War he was governor of Malta. In 1919 he became Constable of the Tower.

MEUSE-ARGONNE, BATTLE OF (Sept.–Nov. 1918).—The general idea of the Meuse–Argonne attack was agreed upon in a conference between Marshal Foch, Gen. Pétain and Gen. Pershing at Bombon, on Sept. 2. What Foch really desired and had urged upon Pershing in a conference three days previous was to break up the American army, as an offensive force, immediately after the projected St. Mihiel attack, and to employ the best of its troops to reinforce the II. and IV. French Armies for a combined offensive along the front of these two armies. But Pershing firmly opposed the breaking-up of his army and insisted upon adherence to the original design of employing the main part of the American troops as an integral army unit. Foch finally acceded and gave Pershing his choice of the sector of the II. Army (from the Meuse to the Argonne, inclusive) or that of the IV. Army (from the Argonne, exclusive, to the Suippe). He chose the former.

Following this conference Foch issued a general directive for the attack, which Pétain elaborated into precise orders for the two armies concerned, those of Pershing and Gouraud. The general objective named for the combined attack was Mezières. The St. Mihiel operation was conceived as a preparatory phase (or Operation A.), to give a broader base and better communications for the later operations, notably by freeing for use the railway and roads leading to Verdun from the S. along the Meuse. The American army attack on the front Meuse–Argonne inclusive (Operation B.) and the French IV. Army attack extending from the Argonne W. to the Suippe (Operation C.) were to be simultaneous. Following some days later the French V. Army was to continue the attack W. from Reims to the Aisne (Operation D.).

The direction of attack given for Operation B. was Buzancy–Mezières, but the first objectives named were the Hindenburg line on the front Brieulles-sur-Meuse–Romagne-sous-Montfaucon–Grandpré. In fact, the French higher leaders did not at that time conceive that the attack could be carried beyond that line before winter. The American army was to be reinforced for Operation B. by 180 French airplanes, 239 French tanks and a considerable force of French artillery (1,002 heavy guns, 456 light guns and 254 trench mortars). In addition a French cavalry division stood by to take advantage of a possible break through the German lines. The American attacking troops consisted of three army corps, having three divisions each in the front line and three divisions in reserve. Only one of these front-line divisions was composed of regular troops, while of the others three of the four National Guard and three of the four National Army divisions employed lacked any previous battle experience.

The newly formed American Army Staff had been a little apprehensive of the outcome of its initial attack at St. Mihiel (Operation A.), and had in consequence designated for that attack most of its better-trained and more experienced divisions, including four of the six available regular divisions. Further, more resistance, with consequently heavier losses, was anticipated in Operation A. than proved to be the case, and it had been considered that more time would be required for resting and recruiting the divisions engaged. The results of this policy in the light of after events, turned out to be most unfortunate. Operation A. was a simple attack which, as was expressly ordered by Foch, was not to be exploited even to the extent of attacking the reserve German position across the face of the salient. The Meuse–Argonne attack, on the contrary, was to be pushed to the limits of possible success. The fact that Operation B. followed so closely after Operation A., the restricted available road-net, and the need for secrecy, made it difficult to withdraw the better-trained troops from the new Woevre front and again put them in the front line.

The German position between the Meuse and the Argonne was naturally strong and had been strengthened by every possible artifice. Vauquois, a fortified hill E. of and overlooking the Aire valley, was regarded as an impregnable fortress, and Montfaucon, dominating the whole plateau, afforded not only a strong defensive position but observation and command posts which greatly aided in controlling the defence of the whole line. On the other hand the German troops in the line on the front of attack consisted of only five divisions, four of them of inferior quality, and the fifth, a Guard division, much worn from intensive fighting farther N. and sent to this supposedly quiet sector for rest. Among the German divisions immediately in rear in reserve there was only one rated first class. Thus the German infantry actually in line was outnumbered by the attackers about four to one, since the American divisions had twice the infantry strength of the German divisions, while the Americans, thanks to the reënforcing French artillery, had at the outset a decisive artillery superiority, and, altogether, 821 airplanes.

On Gen. Pershing's initiative, various feints and ruses with the employment of American tanks and reconnoitring parties E. of the Moselle as well as in and S. of the Vosges Mts., had served to distract the attention of the German High Command, and led it to expect an attack upon Metz itself or the line E. or S. of Metz rather than W. of the Meuse. The real attack had consequently the advantage of being an almost complete surprise.

Following an artillery preparation of three hours the attack was begun at dawn on Sept. 26. The first day the attack progressed well. The I. Corps, on the left, stormed Vauquois, advanced up the Aire valley to its objectives, and even made sensible progress in the Argonne forest. On the right the III. Corps crossed the difficult Forges brook with its marshy banks and also gained its objectives. But in the centre the V. Corps was held up in passing through the woods in its front, and was unable to take Montfaucon although the III. Corps had passed beyond it on its right. The second day Montfaucon was gained and the attack went forward, but not so far as had been planned. The third day, Sept. 28, there was still less advance in the centre and not what was hoped for on the left. By this time the German reserves from outside the sector began to pour in and, by the fourth day, having nine divisions in the line, the Germans attempted powerful counter-attacks to regain some of their lost positions. The German artillery was also greatly augmented and, from the favourable flanking artillery positions on the heights E. of the Meuse and in the Argonne forest, greatly hampered the work of the American troops in what was now a pronounced salient in the American line on the plateau between the Meuse and the Aire rivers. The weather for the first three days had been favourable, but on the 28th drizzling rains set in which added to the difficulties of both the tactical handling of troops and of supply. The reconstruction of roads across no-man's-land and traffic control had been found especially difficult on the front of the centre corps on account of the depth of the shell-battered zone created by years of intensive fighting. Friction in the railway supply, as was to be expected in a new staff, was not lacking. Under these trying conditions few gains were made on the last two days of Sept., and it became evident that the inexperienced and inadequately trained divisions which had made the initial attack could accomplish little more in the way of further advance.

The difficulties in the way of supply were speedily smoothed out and the worn and tired troops soon replaced by fresh, but the disappointment in the hopes for a clean break through the German army in this its most strongly fortified and from now on most stubbornly defended sector, hopes which had been created by the striking success of the first day's attack, gave rise to exaggerated rumours of blundering in troop leadership at the front and of supply mismanagement in rear, rumours which finally so affected the French Government as to lead it and Foch to urge the substitution of a French commander and staff for the further conduct of Operation B. This was refused by Gen. Pershing on the ground that the honour of the American army was involved in this attack, and that, whether it finally fail or finally succeed, it must be carried through to the end as an American operation under an American commander and staff.

By Oct. 4 the I. Army line had been reorganized, and on that date the systematic renewal of the offensive was taken up.

West of the Argonne the attack of the IV. French Army (Operation C.), also begun on Sept. 26, had not been successful in making any appreciable advance, and Pershing was called on to loan some of his all-too-few veteran divisions to attack the keypoint of the German Champagne position, Blanc Mont. He complied with this request, and all the more willingly since it was the failure of the French attack W. of the Argonne which made the position of the American troops in the forest itself so trying. With these picked troops the IV. French Army, attacking simultaneously with the I. American Army on Oct. 4, gained Blanc Mont, and the German commander, after vain counter-attacks, ordered a withdrawal beyond the Aisne. East of the Argonne the right of the I. Corps gained an advance of 10 kilometres along the right bank of the Aire, an advance exploited three days later by bringing a flank attack on the Upper Argonne from the E., which, combined with the successful advance of the IV. Army of Gouraud, W. of the Argonne, resulted in the capture, by Oct 10, of the entire forest, and enabled the French and American armies to connect their flanks through the pass of Grandpré.

The failure of the American I. Army on Oct. 4 to gain its objectives on the eastern half of the Meuse-Aire plateau in its renewed attack of that date made it clear to Gen. Pétain that a broader base was required to push the attack beyond the main Hindenburg line, and that the possession by the Germans of the heights E. of the Meuse afforded them too favourable artillery positions and observation posts to make possible an extended advance to the N.W. of the Meuse. Accordingly, on Oct. 5 Pétain placed at the tactical disposition of the I. Army the XVII. French Corps, at the time passively holding the line E. of the Meuse, and directed that, reinforced by two or three American divisions, it should be called on to gain the line Dun-sur-Meuse–Damvillers. This attack was made Oct. 7, coincidently with a renewed attack on the west. It was partially successful and gained an advance of 6 kilometres. By Oct. 10 the I. Army was, in general, up to the rearmost carefully prepared positions of the German army in this region, known as the Kriemhilde Stellung. On Oct. 11 Pétain called for a renewal of the attack on both banks of the Meuse with the same objectives as before on the E. bank, but with the breaking of the Kriemhilde line and the capture of Buzancy as the objectives on the W. bank.

This attack was carried out on Oct. 14 and resulted in small but material gains, including the Côte Dame Marie, Cunel and Romagne-sous-Montfaucon. The troops by this time were well worn. There was no adequate replacement system and, notwithstanding the breaking-up of newly arriving divisions, it was impossible to keep units at full strength. For the remainder of the month the I. Army had of necessity to limit itself to local operations and to preparation for a systematic renewal of the offensive. On Oct. 12 the I. Army front, which had hitherto extended E. to the Moselle, was divided into two army sectors and, on the 16th, Gen. Pershing transferred the immediate command of the I. Army to Lt.-Gen. Liggett, and exercised supervision, as group commander, of both armies. On Oct. 21 Pershing ordered a renewal of the offensive with plans for a break-through for Oct. 28, but this attack was, on request, deferred until Nov. 1 to enable the IV. French Army to make plans for attacking simultaneously.

On the German side there was no lack of appreciation by either the opposing army commander or General Headquarters as to the threat which the American attack constituted. Von der Marwitz declared to his army, on Oct. 1, after the first break through his lines: "... The heaviest part of the task will thus fall on the V. Army ... in the coming weeks, and the safety of the Fatherland will be in its hands. It is on the firm resistance of the Verdun front that depends the fate of a great part of the Western Front, perhaps even of our nation. ..." Hindenburg in his memoirs added on this subject: "It was plain that this situation could not last. Our armies were too weak and too tired. Moreover, the pressure which the American masses were putting upon our most sensitive point in the region of the Meuse was too strong."

It is debatable whether a quicker perception on the part of German General Headquarters of the threat of the Meuse-Argonne attack might not have led to a greater concentration of effort against it and a speedier evacuation of the French territory to the N., W. of the Meuse, and thus to a prolongation of the resistance of the German army. Hindenburg and Ludendorff appear, however, to have been at this time preoccupied with events in the Near East (the surrender of Bulgaria occurred on Sept. 29), and the home political situation in both Germany and Austria. In any case, without apparent forethought of consequences, the German strategic reserve of fresh divisions was doled out piecemeal by G.H.Q. until, by Nov. 1, it had ceased to exist. Thereafter troops could be neither relieved nor reinforced. The result was that the general, carefully prepared attack on Nov. 1 broke through the enemy's line at all points, and thenceforth it was a case of rapid pursuit with occasional rear-guard actions until the Armistice on Nov. 11. The chief preoccupation on the Allied side during this pursuit was holding the troops in leash in their sectors and determining who should have the honour of first entering important towns such as Sedan. The main line of the Carignan–Sedan railway, the real objective of the Meuse-Argonne attack, was brought under artillery fire on Nov. 3 and reached, by the I. and V. Corps, on Nov. 7, while the III. Corps had, by the same date, forced the crossing of the Meuse and advanced 10 kilometres to the N. and E.

The I. Army, during the Meuse-Argonne operation, had employed 22 American divisions and 4 French divisions. Of the 22 American divisions 12 were engaged on other fronts during a part of the period (Sept. 26 to Nov. 11). On the German side, in addition to the 5 divisions originally in the sector, 42 divisions had, in the course of the battle, been thrown into line. Thus, in all, one-fourth of the German army in the W. had been engaged and decisively beaten by the I. American Army, although occupying successively the numerous and strong defensive positions prepared long in advance. The strength of the American troops involved was, in the aggregate, about 750,000 men, their losses 117,000 killed and wounded, their captures 26,000 prisoners and 846 guns.

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MEXICO (*see* 18.317).—The ten years of revolutionary conditions following the elimination of Porfirio Díaz had a profound effect on all phases of the national life. A census was impossible. The appended last official count, 1910, gave a total pop. of 15,063,207. The table[1] gives the pop. of the states and territories, arranged in descending order, according to the 1910 census.

In 1912 the pop. was estimated at 15,501,684. Since then there has been a movement toward the cities for safety from banditry, and across the borders for employment and political refuge. Mexico City was estimated in 1920 to contain over 900,000 inhabitants. Decrease has come in the rural districts from the causes mentioned, as well as from famine and influenza. A small return movement set in after conditions became more peaceful. In Jan. 1921 foreign residents numbered about 14,000 Americans, as many Spaniards, 4,000 each of Germans, English and French, and 5,000 Chinese and 3,300 Japanese.

States or Territories	Area in sq. km.	Population 1910	Per cent of increase in 10 years	Density per sq. km. 1910
Jalisco	86,752	1,202,802	4·24	14·
Vera Cruz	75,863	1,124,368	14·61	14·8
Puebla	31,616	1,092,456	6·99	34·5
Guanajuato	28,363	1,075,270	1·3	38·
Oaxaca	91,664	1,041,035	9·75	11·3
Michoacán	58,694	991,649	6·	17·
Mexico	23,185	975,019	4·34	42·1
Distrito Fed.	1,499	719,052	32·8	480·
Hidalgo	22,215	641,895	6·1	28·9
S. Luis Potosí	62,177	624,748	8·6	10·04
Guerrero	64,756	605,437	28·4	9·4
Zacatecas	63,386	475,863	2·9	7·5
Chiapas	70,524	436,817	17·4	6·19
Durango	109,495	436,147	17·8	4·
Chihuahua	233,094	405,265	23·6	1·7
Nuevo León	61,343	368,929	12·5	6·
Coahuila	165,099	367,652	23·8	2·2
Yucatán	42,751	337,020	9·	9·
Sinaloa	71,380	323,499	9·	4·5
Sonora	198,496	262,545	18·4	1·32
Tamaulipas	83,597	249,253	14·	3·
Querétaro	11,638	243,515	4·8	20·9
Tlaxcala	4,132	183,805	6·7	44·2
Tabasco	26,094	183,708	15·	7·
Morelos	7,082	179,814	12·3	25·2
Tepic	28,371	171,837	14·5	6·4
Aguascalientes	7,692	118,978	16·	15·3
Campeche	46,855	85,795	−0·86	1·8
Colima	5,887	77,704	19·3	13·2
Baja Cal., Sur	85,279	42,339	—	0·5
Baja Cal., Norte	69,921	9,905	—	0·13
Baja Cal.	155,200	52,244	9·7	0·33
Quintana Roo	48,450	9,086	—	0·18
Total for republic	1,987,350	15,063,207	10·7	7·58

Communications.—The revolution was an almost continuous struggle for possession of the railways. The result was disastrous to practically every line. Between 1910 and 1913 the Southern Pacific of Mexico suffered traffic losses of $3,000,000. The Mexican Central to Laredo gave the most regular service, running passenger trains and vast amounts of freight to the border with only temporary interruptions. Much freight in northern Mexico was handled by privately owned trains; in 1919, 30 such trains were operated, mostly by American mining companies. From 1910 to 1919 over 10,000 freight cars, about 175 passenger and express cars and a huge number of locomotives were destroyed. In 1919 the Government was using on five systems 837 standard-gauge and 302 narrow-gauge locomotives, 520 standard-gauge and 259 narrow-gauge passenger cars and 12,293 standard-gauge and 2,810 narrow-gauge freight cars. Military campaigns and private use of railways by military officers reduced railway efficiency, and peculation almost prostrated the service. In 1920, 500 freight and passenger cars were bought, and a number of locomotives ordered, in the United States. On Jan. 1 1921 free interchange of traffic between the United States and Mexico, suspended since 1915, was resumed. Since 1914 the Yucatecan roads have been operated by the State. In May 1919 500 m. were in operation. In the year ending June 30 1918 the 8,119 m. of national railways carried 393,968 tons of forest products, 1,236,719 tons of agricultural products, 216,443 tons of animals and animal products, 1,938,105 tons of minerals and 372,475 tons of general merchandise. Gross receipts for the same year were $29,240,485; operating expenses, $19,151,808; net operating income, $10,088,677. The Mexican railway from Vera Cruz to Mexico City was returned to its British owners, with indemnities pending, in the spring of 1920. Lines in Morelos were opened about the same time. War on the railways practically ceased with the success of Obregón. In the spring of 1921 return of the national railways, seized by Carranza in 1914, was being discussed. The Government might still retain the 51% of the stock, as it was acquired in 1906 by Limantour, Díaz's Minister of Finance, and would be liable for indemnities proportionate to earnings for the five years prior to 1914, returning the lines in the condition in which they were received. The liability of the Government was estimated at 990,000,000 pesos of a nominal value of $ .50.

Commerce.—The total trade in 1911 was £20,583,578 in imports and £29,375,214 in exports; for 1912, £18,266,231 in imports and £29,798,912 in exports; for 1913, £19,577,233 in imports and £13,088,508 in exports. Trade with the United States was in 1917, $110,829,375 in imports and $130,526,935 in exports; for 1918, $97,788,736 in imports and $138,643,427 in exports; for 1919, $131,451,901 in imports and $158,926,376 in exports; for 1920, $143,785,526 in imports and $168,033,626 in exports. The total trade, estimated at $70,000,000 in 1890, was over $300,000,000 in 1919. Exports to the United States for 1917–9 were 70% greater than in 1912–4, and imports thence 110% greater. American trade was about 85% of the total, the United Kingdom ranking second. The chief commodities exported in 1920 were sisal, crude petroleum, copper, raw cotton, hides, coffee and lead. Imports were manufactures, as of iron pipe, cotton cloths, flour, sugar, motor vehicles, lard, shoes and lumber. In 1912 the sale of Yucatecan henequin was put under control of a *comisión reguladora* on a plan similar to that for Brazilian coffee valorization. Sales from 1915 to 1918 amounted to 2,205,425 bales of 380 lb. each, a yearly average of 735,141. From 1916 to 1918 production decreased 100,000 bales yearly, due to disorders and labour shortage. Exports from Progreso to the United States in 1917 were $35,881,988, consisting of chicle, coffee, henequin, hides, logwood, etc.

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[1] From A. Petermann's *Mitteilungen aus Justus Perthes' Geographischer Anstalt*, 57. Jahrgang, 1911, II. Halbband, p. 191.

Agriculture.—Production was unequal, due to war, drought and lack of capital. In 1918 exports of products and live stock were valued at $74,253,500. Banana exportation rose to an annual value of $5,000,000. The normal maize crop, 110,000,000 bus., is less than the consumption. Two crops, followed by one of wheat, are produced in some areas. Chihuahua in 1920 produced 44,000,000 lb. more maize than was needed for local consumption. The barley crop is about 7,000,000 bus.; rice, 1,250,000 bus. The frijole (bean) crop, worth $7,500,000, is locally consumed. Garbanzos (chick-peas) exported from Guaymas in 1918 totalled 25,000 tons, worth $4,500,000. In 1919 32,742 tons were exported. The cotton crop of 1918 was 71,266 bales. The 1919 and 1920 crops were poor, due to pests and climatic factors; 90% of the cotton is produced in the Laguna district of Coahuila and Durango. About 90,000 bales are used in Mexican factories, operated by foreigners. Vanilla-bean export in 1919 was 197,403 kgm., worth 2,333,264 pesos. Sesame, or ajonjoli, in 1919 was produced to the extent of 20,000 tons, worth $150 to $200 per ton. Sugar production, as much as 160,000 tons before the revolution, after a temporary fall had risen to 110,000 in 1920. Only 1-45th of the possible sugar land is used. The republic could produce 7,000,000 tons. Coffee decreased only in the rebel district of Vera Cruz. The normal crop is from 77,000,000 to 110,000,000 pounds. In 1919 Mexico imported 1,000,000 lb. of Brazilian coffee from the United States. Tobacco production, normally 11,000,000 kgm., was 2,000,000 in 1919; the 1920 crop was estimated at three times that figure. Guayule rubber in 1918 amounted to 2,656,769 lb., worth $1,004,561. Before the revolution there were 5,000,000 head of cattle, 800,000 horses, 300,000 mules, 250,000 asses, 5,000,000 sheep, 4,000,000 goats and 600,000 hogs. In 1920 it was estimated that stock had decreased 75% since 1910, although there had been some increase since 1917. Meat prices rose 100% in 1919–20. Hides were exported to the United States. Lumber mills are increasing. In 1917 Chihuahua produced 19,500,000 ft. from the Madera and Pearson mills. Mahogany from the south is annually worth $600,000. Twenty-five varieties of hard-wood and cedar annually produce $1,000,000.

Mining.—There was marked resumption of production in 1918 and 1919. Low prices in 1920 reduced operations to high-grade ores. In 1918 exports were worth $34,716,000; in 1919 $10,577,393. In 1919 there were 5,804 mines of silver, 1,800 of gold, 988 of copper, 118 of lead and 73 of zinc. A new law of mining imposts was decreed June 27 1919. In the same year the Japanese began to buy iron-ore deposits. Coal is produced only in Coahuila, though there are deposits in Sinaloa. Mineral production in the leading lines for 1916–9 was as follows (in kgm.):—

Metals	1916	1917	1918	1919
Gold	11,748	23,543	25,313	22,944
Silver	926,142	1,306,988	1,944,542	1,949,673
Copper	28,411,248	50,985,923	70,223,454	50,893,612
Lead	19,970,986	64,124,752	98,837,154	67,378,353
Zinc	37,449,226	14,757,333	20,698,995	8,665,413
Antimony	828,767	2,646,544	3,268,546	627,704
Tin	292	9,214	13,537	2,117
Tungsten	12,250	187,637	149,486	29,292

Molybdenum, manganese, mercury, arsenic and amorphous graphite were also extensively produced.

Petroleum.—Petroleum is produced in the Ebano, Pánuco, Huasteca, Tuxpam and Tehuantepec-Tabasco regions. The area occupied by companies in 1919 was 4,064,870 ac.; their annual rents came to $3,449,033; several companies were paying from $200 to $400 per acre. The companies operating numbered 155. In Feb. 1919 114 new wells were being drilled. In 1920 there were 770 m. of pipe-line, with 2,000,000 bar. capacity; total wells, 1,103. The largest well, Cerro Azul No. 7, was capable of producing 370,000 bar. daily. Tanks numbered 902, with capacity of 50,000,000 barrels. Investments in Tuxpam and Tampico alone were estimated at $1,000,000,000. Export duties collected in 1917, $6,854,537; 1918, $10,135,992; 1919, $15,203,986. Export duties were first levied in 1914. Uncollected royalties, protested as confiscatory, for 1918 and 1919 were $4,500,000. In May 1916 a monthly inspection tax of 150 pesos was fixed; 50 companies out of 373 then operating refused to pay it. The duties in Aug. 1920 were $ .10 to $ .165 per bar. on crude and high-density fuel oils; on gasoline $ .09 per gal.; on kerosene, about $ .01 per gallon. Valuation was based on quotations of American ports minus transportation costs. Dividends of the best-paying companies in 1920 ran from 24% to 40%, after deducting reserves. Production multiplied more than three times in seven years, or 54 times since 1907. Official figures for production are as follows:—

	Barrels		Barrels
1901	10,345	1911	12,552,788
1902	40,000	1912	16,558,215
1903	75,375	1913	25,696,291
1904	125,625	1914	26,235,403
1905	251,250	1915	32,910,508
1906	502,500	1916	40,545,712
1907	1,005,000	1917	55,292,770
1908	3,932,000	1918	63,828,326
1909	2,713,500	1919	80,557,229
1910	3,634,080	1920	153,797,036*

*This 1920 figure is for exportation only, and not total production.

Refined oils were in 1920 34% of the total. The United States took 73% of the output in 1918. Exports in 1917 were worth $26,838,063, and in 1918 $70,278,776. President Carranza's oil decrees of Feb. 19, July 31 and Aug. 8 and 12 1918, which fixed taxes and royalties, controlled issue of titles, and established conditions of concessions, were resisted by operators as without constitutional authority and contravening acquired rights. Protests by Governments whose nationals were concerned, and suits at law by the companies, had not been settled in Nov. 1921, though a suit favourable to the Texas Oil Co. indicated the prospective amicable solution of the oil situation.

Foreign Investments.—The Mexican Government in 1919 estimated investments in the republic as follows: American, $1,057,770,000; English, $331,302,800; French, $143,446,000; Mexican investments, $793,187,242; grand total, including those of other countries, $2,434,241,422. Claims for damage done to American investments are estimated at between $500,000,000 and $1,000,000,000.

National Debt.—In 1908 the total internal and external debt was estimated at £44,101,607. On Dec. 31 1919 the external debt, including unpaid interest, was £69,792,229; the internal debt, 138,795,550 pesos. Middleton, in *Industrial Mexico*, stated the debt for 1919 at $350,181,047.47, besides the railway debt, which was $238,740,393 on June 30 1918, and besides unpaid interest to Jan. 1 1919 $51,824,139. There is no completely authoritative statement of the debt. The International Bankers' Committee on Mexico, organized Feb. 24 1919, acts for the holders of Mexican securities. Rehabilitation of finances was discussed repeatedly in 1919, 1920 and 1921, but without action.

Banking and Credit.—Banking in 1919 was practically confined to foreign-exchange transactions; commercial credits, mostly at 30 days, were increasing. Deposits were not sought. There was lack of confidence, due to the frequent revolutionary "borrowings" of prior years. American trade in 1919–20 was on a cash basis or on sight drafts against shipping documents. In 1913 there were 20 banks of emission, with assets worth $425,500,000; four mortgage banks, with assets worth $43,762,000; and six banks of promotion, with assets worth $83,000,000. There were three other Mexican banks, six foreign ones, and the old colonial Monte de Piedad. Since 1914 there have been no banks at all in Mexico within the meaning of the banking law of 1897. Plans for a single bank of issue as a centre of nationalized reorganization have been under discussion since Sept. 1918. An initiative providing a new banking system was sent to Congress by President Obregón in Feb. 1921. The single bank of issue is to be accompanied by other special banks for commercial, industrial and agricultural needs. Other proposed legislation which might have indirect effects on economic conditions are the new agrarian law and the educational bill, both of which were sent to Congress in Feb. 1921. An executive decree of Jan. 31 1921 provided for the return to owners of banks declared in liquidation Dec. 14 1916. These banks were to be restored to activity or liquidated, according to their financial condition. The most important banks affected by this decree, and the amounts of their paper notes in circulation respectively, were the Banco Nacional de Mexico, 32,571,969 pesos; the Banco de Londres y Mexico, 26,256,141 pesos; the Banco Oriental, 21,831,349 pesos; and the Banco Minero de Chihuahua, 8,001,619 pesos.

History.—The decade 1910–20 was a period of attempted social revolution misdirected and unrealized. The closing years of the rule of Díaz were marked by events portentous of the troubles which ensued. The financial depression of the United States in 1907 was reflected in Mexico in 1908. Financial measures, which included nationalization of the railways and reorganization of the banking system, placed a severe burden on the country. There were serious crop failures due to frosts and drought. In Oct. 1909 free importation of grains was decreed, and in April 1910 the President was authorized to expend a million pesos for importation of corn and beans. In the midst of these economic perplexities the centennial of Mexican independence was celebrated throughout the country. Nearly every city and hamlet initiated commemorative public works. Thirty-one foreign nations participated in the celebrations in the capital during Sept. 1910. Numerous public buildings and monuments were begun, some of which were not completed. Mexico seemed at the height of power and prosperity. But the consequences of a long period of autocracy were about to appear. Accompanying the celebration was the national election for president and vice-president. It had been the subject of much conjecture, particularly since 1908, when Díaz had declared in the Creelman interview that the Mexicans were ready for democracy, that he would permit political campaigning by those not supporting Government candidates, and would surrender the presidency to a legally elected successor. The declaration was taken seriously, especially by certain radicals, the most active of whom had long been agitating against Díaz from the security of American border cities. The Government had endeavoured to promote in turn the candidacies of Limantour and Ramón Corral, but these had failed. The failure of Gen. Reyes to enter the final race brought advantage to the anti-Reëlectionists, who were led by Francisco I. Madero.

The Madero Revolution.—In view of the probable return of Díaz to the presidency for the seventh time, there was a renewal of the agitation for political renovation. Madero's personal campaign, conducted throughout a great part of the republic, was reinforced by his book, *La sucesión presidencial en 1910*, which was issued first in 1908 and had reached three editions by the spring of 1910. It attacked the Díaz system in measured language; his propaganda was at first ignored by the Government, but when his influence became too great he was arrested for sedition at Monterey on June 7 1910, and confined in San Luis Potosí. Thence he escaped in Oct. to San Antonio, Tex., where he and his associates prepared the Plan de San Luis Potosí. This plan declared for effective suffrage, no reëlection, refusal to recognize the Díaz Government elected on Sept. 27, the subdivision of rural agrarian property, and the provisional assumption of the presidency by Madero. At a meeting of the revolutionary junta in San Antonio on Nov. 6 it was agreed that outbreaks against Díaz should occur simultaneously in various places on Nov. 20. There were several premature disorders. In Chihuahua Cástulo Herrera, a trade unionist, and Pascual Orozco, a small commission merchant, began a movement against Gov. Terrazas. In Mexico City on Nov. 9 there were riots caused by a report that a Mexican citizen had been lynched in the United States. Similar disorders occurred in Guadalajara, Chihuahua and Piedras Negras. The first clear indication of the coming revolt was due to the discovery of plotting in Puebla by Dr. Aquiles Serdán, who was attacked and killed in his own house, which he had fortified. The Government then announced that a plot against it had been discovered, and a reign of terror began. The radical press was silenced, the jails were filled with political prisoners. The anti-Reëlectionists fled from the capital. Chihuahua was the scene of much fighting, in which the Government was successful, so that by the end of Dec. Madero was obliged to flee to the United States. The Government was then combating uprisings in a dozen states. Meantime Díaz attempted to appease the popular movement. He suspended personal guarantees, called for the resignation of his Cabinet, chose new ministers supposed to be more in sympathy with changed political thought, and attempted reform legislation. President Taft, who had kept forces along the Río Grande to watch the border, now augmented them by 20,000, and sent warships to Mexican waters. When Díaz read his message to Congress on April 1 he promised to initiate a law prohibiting reëlection of the president, vice-president, or the governors of states. But the results were unsatisfactory, and Díaz entered into negotiations with Madero. The latter demanded the resignation of the president and vice-president, and negotiations were broken off. Then Ciudad Juárez fell to the rebels, and Madero entered it on May 10. Having earlier assumed the title of provisional president, he here organized a civil government.

The ad-Interim Presidency.—The success of the revolution at Ciudad Juárez, coupled with similar victories at Pachuca and Cuernavaca, brought the Government to terms. It was agreed by representatives of Díaz that he and Vice-President Corral would resign before the end of May; that Madero should give up his claim to the provisional presidency in favour of Francisco de la Barra, who should issue a call for elections. In his Cabinet and in the state Governments de la Barra was to place certain officers of the revolution. The pact was signed May 21 1911. Many important cities throughout the country had fallen before the popular movement. After two days of mob activity in the capital the resignations of Díaz and Corral were offered and accepted on May 25. De la Barra assumed office, and Díaz left the country next day. The actual power was in the hands of Madero, who had offices in the capital. His triumphal entry on June 7 had followed a progress from Ciudad Juárez marked by demonstrations of national joy. The *ad-interim* Government was conspicuous for political jockeying, of which the chief example was the successful effort of Madero to dissociate from his candidacy that of Francisco Vázquez Gómez for the vice-presidency and to support José María Pino Suárez as candidate. At the elections Madero and Pino Suárez received the greatest number of votes that had ever been cast in Mexico. Inaugurated on Nov. 6, for the term ending Nov. 30 1916, Madero soon found himself the tool of the Científico group, lacking power and will to act for himself. He began to neglect his earlier supporters and to cater to various groups of the Opposition. Unwise manipulations soon emptied the treasury of a surplus of about 65,000,000 pesos which Díaz had left. Madero chose for the Cabinet his relatives and other Científicos. This Científico group did little to redeem the promises of the Plan de San Luis Potosí. The army was retained at great expense, for fear of a counter-revolt. Ernesto Madero, Minister of Hacienda, played into the hands of the clericals, neglecting enforcement of the Laws of Reform, and finally denying that lands had been promised to the people. Madero, however, asked Congress to create a "National Savings Fund," which should provide a loan of 250,000,000 pesos with which to buy lands for distribution. The committee in charge was composed of the Madero family and other large landholders, and made little progress in its programme. Madero's recognition of the old Congress was a source of weakness. In other matters there was autocracy of the old type. The former revolutionary associates of Madero took the field against him to fight for the lands which they had been promised. Revolt began at the time of his inauguration, and soon became widespread. The national army was continually engaged with insurgents led by Zapata, Reyes and others. The old Díaz favourites resented the benefits showered upon the new group. The Cabinet began to break up, and the state of Oaxaca refused to recognize the Madero Government. Orozco, military governor of Chihuahua, turned against his chief in Feb. 1912, and there was much fighting, in which many foreigners were killed. Thousands of Mexicans fled the country. Conditions during the summer of 1912 were extremely bad. On March 14 President Taft prohibited shipments of arms to Madero's opponents. American residents of Mexico, warned to leave, were brought out in great numbers, the U.S. Congress appropriating $100,000 for their aid. Rebel successes in the north deprived Madero of Chihuahua, Durango and Sinaloa. Zapata had broken with the Government and his forces had almost reached the suburbs of the capital.

The Huerta Coup.—On Oct. 12 1912 Felix Díaz, nephew of the ex-president, revolted in Vera Cruz, but was promptly captured and imprisoned in Mexico City, Madero reprieving him from execution, to which he had been sentenced. On Feb. 9 1913 the students of the military college of Tlalpam marched to the rescue of Díaz and Bernardo Reyes (the latter had been delivered to Mexico by the United States earlier), set them free and, under their leadership, joined some 5,000 disaffected troops which held the Ciudadela (the arsenal), defying the Madero Government. For several days the fire of those in revolt and that of the Government forces swept over the business part of the city between the Ciudadela and the National Palace, killing hundreds of people. Finally Gen. Victoriano Huerta, recently placed at the head of the Government troops in place of Gen. Villar, who had been wounded, turned traitor to Madero, caused his arrest and that of Pino Suárez in the National Palace on Feb. 19, and forced them to resign. He eliminated Díaz, who was a nullity. Congress hastily accepted the resignations, and Pedro Lascuráin, as Minister of Foreign Relations, held the chief executive power for about 40 minutes, during which he made Huerta Minister of Gobernación. Lascuráin then resigned, leaving Huerta constitutionally at the head of the nation. Madero and Pino Suárez were assassinated on Feb. 22, on the pretext that they had been killed in the course of an attempt to rescue them, after having been promised safe-conduct on board a vessel at Vera Cruz. In Nov. 1920 their alleged assassin, ex-Gen. Francisco Cárdenas, committed suicide in Guatemala after his arrest for extradition at the request of the Mexican Government. Every effort was made by Huerta to obtain recognition by the United States, but President Wilson, believing that Huerta had risen to power by political murder and did not represent the will of the Mexican people, refused recognition and soon demanded that an election be held in which all Mexican factions should participate and acquiesce, Huerta not standing for office. This attitude marked a new phase in the foreign policy of the United States. It began a period of direct intervention. The American ambassador, Henry Lane Wilson, who had congratulated Huerta upon his accession to the supreme power, was recalled and caused to resign on July 4 1913. Though several foreign Powers had recognized the new Government, the example of the United States was followed by Argentina, Brazil, and Chile, and in the end proved decisive.

Huerta as Dictator.—The struggle of Huerta for control of the country was going against him. Harshly criticised as a murderer by members of Congress, he arrested 110 members, and on Oct. 10 assumed complete control of the legislative and judicial powers, adding these to his executive functions. This assumption of dictatorship brought a message of solicitude for the imprisoned Congressmen from the American Government. The revolution which had sprung up under Venustiano Carranza of Coahuila, simultaneously with Huerta's seizure of the executive power, was now strongly led in the west by Gens. Buelna, Cabrera and Alvaro Obregón; in the north and centre by Francisco Villa, Felipe Angeles, Pablo González and Antonio I. Villareal; in the south by Zapata, and in Yucatán by Salvador Alvarado. Huerta was hemmed in to the central plateau. The revolutionary movement was conducted under the pronouncement of Carranza, and was known as the Plan de Guadalupe, which declared for the preservation of the national constitution by a Constitutionalist army, of which Carranza was declared the first chief. Numerous successes by the revolutionaries, among which was Villa's capture of Torreón in March 1914, combined with the Tampico incident, hastened the fall of Huerta. A boatload of American marines from the "Dolphin," anchored at Tampico, made a landing within proscribed area on April 10, and were arrested by a Huerta subordinate. Though they were immediately set at liberty with regrets, the American commander demanded a salute to the American flag, in which demand he was upheld by President Wilson. Huerta had been meantime especially irritated by Wilson's personal emissary, John Lind, sent to Mexico in Aug. 1913, who asked that elections should be called in which Huerta should not stand. Huerta's refusal to comply with the terms of Adml. Mayo's ultimatum resulted in the American seizure of Vera Cruz on April 21 1914. Huerta's appeal to his Mexican opponents to join in repelling the invasion was without effect, largely through the agency of Francisco Villa, who opposed Carranza in this question of policy. Harassed on all sides, urged by the foreign ministers to yield to Wilson, unable to make loans, or to effect peace with the Constitutionalists, Huerta severed diplomatic relations with the United States on April 22. The tensity of the situation was soon relieved by the proffer of their good offices for mediation by Argentina, Brazil and Chile. The United States and Huerta accepted. Carranza did so in principle, but his agents took no active part in the negotiations; he had already been designated provisional president by his faction. Effort was made in June, at the Niagara Falls Conference, to find a provisional president acceptable to all parties. This failed, but it was demonstrated that Huerta could not obtain recognition. Yet he attempted to hold an election, the result being a fiasco, whereupon he resigned, July 15 1914, in favour of Francisco Carbajal. The latter ruled less than a month, leaving the city on Aug. 13, and making Carranza Minister of Foreign Relations at the request of the American Government. On Aug. 21 Carranza entered the capital.

The Constitutionalists.—Factional differences among the victors now became open. Zapata's Plan de Ayala, demanding agrarian reforms, was rejected by Carranza. Villa had become antagonistic over the leadership of the campaign against the city of Mexico, which he had captured on April 2 1915. On Sept. 12 Carranza published a call for the election of a non-military president, but the Constitutional generals called a convention on Oct. 1 at Mexico City to choose a provisional president. Carranza declared he would not accept such a position, but would offer his candidacy at the regular election. Villa demanded that Carranza be eliminated, to which Carranza consented provided Villa and Zapata should leave the country. The Convention rejected Carranza's resignation, but moved to Aguascalientes, which was under Villa's control, and there accepted it. Carranza repudiated the Convention, which chose Gen. Eulalio Gutiérrez provisional president for 20 days, and placed Villa in command of forces ordered to advance on the capital. He drove Carranza out on Nov. 20. Carranza moved to Vera Cruz, entering it as the Americans, delayed in their evacuation, moved out on Nov. 23. Zapata entered Mexico City Nov. 24, Villa following him on Dec. 3, the Zapatistas returning again in March. During 1915 the executive power was claimed by four different factions. The status of foreigners at this time was most unhappy. The Spaniards suffered especially, many of them, including their minister, being expelled. In March President Wilson secured permission from the various Mexican leaders to remove foreigners from the capital under American protection.

During 1914 Villa had been much in the public view. He had set up a government in northern Mexico, and seemed for a time to be the man who could restore peace. Emissaries were sent to him by Wilson, but in April 1915 Gen. Obregón defeated him at Celaya and later at León. In Sept. he drove him from Saltillo and Torreón. This gave to Carranza control of all the states save Sonora, Chihuahua and Morelos. After Villa's defeat President Wilson indicated a more vigorous policy by urging the leaders to forget their quarrels lest the United States "use means to help Mexico save herself and help her people." In Aug. 1915 Argentina, Brazil, Chile, Bolivia, Guatemala and Uruguay urged the Mexicans to form a provisional government and call a general election. Carranza protested against this "new policy of interference." The U.S. Department of State joined in the appeal of the Powers named above, calling for a conference and proffering help. Carranza again rejected interference, being at the time successful against Villa, who, being unsuccessful, accepted. A conference of the Powers named met in Sept. and agreed to recognize the faction which after three weeks should show greatest success in maintaining order. This decision gave Carranza the decided advantage, and he was recognized as head of the *de-facto* Government on Oct. 19 by nine American Powers.

The de-Facto Government.—Formal diplomatic relations between Mexico and the United States were resumed in Dec., after an interval of two and a half years, by the appointment of Henry P. Fletcher as ambassador, and the reception at Washington of Eliseo Arredondo as representative of the new Mexican Government. The principal European Powers soon followed suit. Fletcher did not go to Mexico until some time later; his residence was short and intermittent, no doubt as a remonstrance against the attitude assumed by the Carranza Government. But the piqued Villistas were still to be reckoned with. On Jan. 10 1916 18 Americans were shot down by them at Santa Ysabel while going into Mexico to reopen mines at Carranza's solicitation. The U.S. Congress passed resolutions demanding intervention. Carranza promised punishment of the perpetrators of the atrocity; later two Villa leaders, one of them said to be responsible for it, were executed.

The Pershing Expedition.—On March 9 1916 Villa raided Columbus, N.M., killing 17 Americans. United States troops pursued him on a "hot trail," the pursuit becoming on the 15th a punitive expedition under Gen. Pershing. It was announced as an effort to help Mexico while scrupulously avoiding offence to her sovereignty. This attitude led to niceties about use of Mexican railways which doomed the expedition to failure. It roused fierce resentment in Mexico, being condemned by both Americans and Mexicans for diametrically opposite reasons. Carranza had given qualified and reluctant consent to it, but soon began to object, asking how far American troops would penetrate and how long they would remain. There were 12,000 American soldiers in Mexico and 18,000 on the border, the latter number soon being largely increased. The expedition was halted near Parral after a clash with Villa sympathizers. General Obregón, Minister of War, conferred with Gens. Scott and Funston at El Paso, urging withdrawal. The Carranza troops failed to aid in the attempt to capture the bandit leader. The American State Department on May 10 called upon Americans still in Mexico to leave the country. On May 22 Carranza protested sharply against the "invasion and violation of sovereignty." The attempt to take Villa was then ostensibly given up, for he had been wounded and was reported dead. Forces of the United States remained in Mexico only as security against disorders, and Carranza was so informed. On June 21 a troop of American cavalry, moving (against the expressed will of Carranza conveyed by Gen. Treviño on June 16) "in a direction other than northward," was attacked at Carrizal. A number of negro troopers were killed and about a score captured; the latter were released upon the sharp demand of the United States. In July the American forces were moving northward, and Carranza expressed readiness to discuss remedies for the situation, suggesting Hispanic-American mediation. Upon Secretary Lansing's acceptance, a commission sat from Sept. 1916 until Jan. 15 1917, adjourning with no result because Carranza denied American right to send troops into Mexico in pursuit of raiders. During the remainder of his rule frequent crossings of the border occurred, with only *pro forma* objection. On Feb. 5 the withdrawal of the punitive expedition was complete. It had been in Mexico nearly 11 months, had engaged over 100,000 militia on the border in addition to the invading troops, and had cost over $130,000,000.

The Constitution of 1917.—In Nov. and Dec. of 1916 a convention, composed of members of the Carranza party only, met at Querétaro to amend the constitution. It was soon decided that a new instrument was needed, and one was drawn up after short deliberation. It is remarkable for its advanced position on nationalization of natural resources and its attempt to provide definite protection for the labouring classes. It abolishes the vice-presidency and makes the president ineligible to succeed himself. There are also provisions which leave the president complete discretion with regard to ejection of foreigners, and generous control of legislation. The provisions against property-owning by churches are sweeping, though religion is tolerated. The constitution was promulgated on Feb. 5. Carranza was elected president on March 11 1917.

The Petroleum Controversy.—Difficulties arose out of the policy of nationalization under executive decrees of Carranza in pursuance of the theory embodied in article 27 of the constitution, which restored petroleum to the nation as an inalienable national resource. The legislation under Díaz had been thought to assure purchasers of superficial property in their possession of the subsoil products. By decree of Feb. 19 1918 Carranza imposed royalties and area taxes and graduated ground rents. A second decree of July 31, attempting to coerce oil operators into acceptance of the nationalization programme, was followed by others of Aug. 8 and 12 with the same purport. The Mexican juridical theory was that petroleum, being movable under the surface, is not the property of the owner of the superficies until he has brought it to the surface; hence exploitation, even on privately owned land, lies within control of the Government. The foreign attitude, as shown by remonstrances against the decrees made through diplomatic channels beginning April 2 1918, is that any exaction of payments by the Mexican Government under colour of national ownership of petroleum denies the right of direct dominion which was acquired by the present owners, and must be resisted as confiscatory and subversive of the theory of private ownership and contractual obligation. There seemed to be little likelihood, up to Nov. 1921, of change in the Mexican determination that Article 27 should stand as written but should not be construed retroactively as had at first been intimated. The same firmness was shown by petroleum operators, who stood upon "acquired rights," acting through diplomatic channels. The Mexican conception of the status of subsoil products is that the Díaz legislation, giving title to subsoil products with the superficies, was unconstitutional, reversing the basic law of the Spanish period and violating article 72 of the constitution of 1857. The oil interests distrust Congressional legislation to readjust their claims, believing that it can be too easily changed by succeeding Congresses. Hence they desire constitutional changes. Their appeals, pending during the closing months of 1920 before the Mexican Supreme Court, made the claim that the presidential decrees limiting their tenure and production were unconstitutional. Further decrees by Carranza in Jan. 1920 made it possible for the oil companies to resume operations in which they had been stopped because they would not obey the earlier decrees; this action was without prejudice to the attitude of either party pending remedial legislation by Congress, which had not yet been enacted in Nov. 1921.

During 1918 the Carranza Government seemed to grow stronger. A food shortage was relieved, and attempts were made to reorganize the national finances. But the oil controversy weakened the power of Carranza abroad, and the shameless corruption of his Government alienated many friends. In that and the following year rebel activities were widespread, as were deeds of violence committed against both foreigners and Mexicans. The abduction for $150,000 ransom of William O. Jenkins, U.S. consular agent, at Puebla on Oct. 19 1919 aroused intense excitement, especially after his arrest by the Mexican authorities on charges of complicity in the deed. The U.S. Department of State demanded his release, which was refused. He was released on bail against his will, but on Dec. 5 1920 all charges against him were dismissed. During the World War Mexico observed a "rigorous" neutrality, so described by Carranza in his message to Congress of April 15 1915, but this covered an official hostility to the Allied Powers fathered by German sympathies. Carranza on Feb. 13 1917 urged an embargo by American nations on food and munitions to the belligerents, at a time when such action would have benefited Germany alone. The sentiment of the people in favour of the Allies was encouraged by French, Italian and American committees. The interception and publication by the United States of the infamous Zimmermann note, in which effort was made to align Japan and Mexico against the United States, occurred in March 1917. Mexico was proffered the reconquest of the American South-West for participation. Both Japan and Mexico denied knowledge of the note.

The Presidential Campaign.—During the year 1919 the power of Carranza was at its highest, though he was never supported by any really important part of the population. Adequate justification for his recognition in 1915 would have developed had he speedily pacified disturbed areas, consolidated his power on a civil instead of a military basis, and shown a reasonable attitude toward the United States. But pacification was retarded by inactivity of the military, which persisted in treating banditry as opportunity for self-enrichment. The new army, created to support the new Government, caused the downfall of the chief under whose sign-manual it pillaged the country. This military situation caused non-fulfilment of the promises of the Carranza revolution. There were many other contributing causes. The new constitution was not in force even within the controlled area. Its labour provisions were never carried out. The emancipation of the peon class was nullified by disturbed conditions. The financial state of the country left much to be desired, though commerce grew, tax receipts were higher than under Díaz and metallic currency was in use. The educational system had been left largely in the hands of the states and municipalities, and only in a few places did it receive adequate financing and attention. The courts of justice were in deplorable condition; the jails were crowded with untried prisoners. Congress broke with the President in so far as it could, refusing to pass his initiatives and withdrawing many of his extraordinary powers. The city of Mexico, given rein as a "free municipality," was remiss in police regulation, sanitation, education, administration of justice and control of public morals. The President violated the ballot, imposing governors on many states and using them to further his intention to designate his successor. He arrested the partisans of Gen. Obregón, and imprisoned members of Congress who opposed him. In external affairs the non-payment of the interest on the national debt, doubtful neutrality, and nationalization of oil lands, with retroactive enforcement as it affected foreign investors, combined with indifference toward violence committed upon foreigners, cast odium upon the party in power. These attitudes and conditions are not entirely chargeable to Carranza or his party. Many of them typify inveterate evils. There had been improvement in many respects since the revolution began, and it seemed that continued betterment depended chiefly upon the peaceful transmission of the presidential power. The presidential campaign was waged for a year and a half; by the beginning of 1920 it was plain that Gen. Obregón had the support of the army, the people, especially of the radical groups, and of foreign investors. His rivals, Gen. Pablo González and Ignacio Bonillas, were then really eliminated, though they continued their campaigns.

The Sonora Revolt.—The President's determination to defeat Obregón led him in March to attempt to control the Government of Sonora, the candidate's home. The state officials, friends of Obregón, prepared to prevent this. To this end, a railway strike on the Southern Pacific of Mexico was planned and called. When Carranza threatened to operate the road with soldiers, to invade the state with his army though it was at peace, the state anticipated him on April 8, operating the road with strikers, whose terms were conceded. It also seized the public offices at Aguas Prietas, while the state Legislature voted (April 9) to secede until assured that the sovereignty of the state would not be infringed. Troops were raised to repel Federal invasion. General Obregón, summoned to Mexico City to answer charges of fomenting rebellion, escaped to the south-west and took the field. By the middle of April all the west coast was in revolt, and most of the northern states were disaffected. By the end of the month Mexico City was cut off from telegraphic communication with the world. The Liberal Constitutionalist party, as the insurgents called themselves, now demanded Carranza's resignation and set up Adolfo de la Huerta, Governor of Sonora, as provisional president under the terms of the Plan de Aguas Prietas, dated April 9 1920, which promised protection to foreigners, enforcement of legal rights, and development of commerce and industry. On the last day of April it was evident that Carranza was planning to desert the capital. More than 50,000 troops were against him, many of them at the gates of the city. Pablo González then joined the revolt, and his command of the south-east practically ended the power of the Government. On May 6 the exodus of the Federal Government for Vera Cruz began. Twenty-one trains were to carry 20,000 troops, carloads of records, and millions of treasure. The employees of the State, including the Cabinet, the Supreme Court and the Permanent Commission of Congress, were included. Misfortune attended every step. Attacks on the convoy began at once. On May 12 Gen. Guadalupe Sánchez, in control of the way to Vera Cruz, went over to Obregón; Cándido Aguilar, the President's son-in-law, in command at Orizaba, thus deserted, fled. Finally, after his trains were useless and his forces had been defeated at Aljibes, Carranza set out on horseback with a small remnant of followers for the Puebla mountains, in an attempt to escape to a Gulf port. While on his way he was betrayed and shot dead at night on May 21 in a mountain cabin at Tlaxcalantongo, Puebla.

The New Government.—Obregón, who had entered Mexico City May 8, had endeavoured to capture Carranza under reiterated assurances of personal guarantees. It was evidently the intention to spare his life. The dead chief and the wrecked expedition were brought back to the capital. On May 25 Adolfo de la Huerta was made substitute president by the reassembled Congress. As the active ally of Obregón, he initiated the policies of the new régime in company with radicals, who evinced attitudes toward foreign interests antithetical to the Carranza policies. Obregón was opposed in the Sept. elections only nominally by a Catholic candidate. His inauguration on Dec. 1 was attended by large delegations from the United States, including several governors of states, and by many American and European diplomats. During the closing months of 1920 there were occasional minor actions against rebels and bandits. Radical agitation among industrial workers seriously affected the country. The sympathy of the Provisional Government with labour unrest presaged difficulties accentuated by falling markets in Mexican staple products. Recognition by the Great Powers was still pending in Jan. 1922. Delay was due to the non-solution of the petroleum controversy and to Obregón's refusal to negotiate a treaty, demanded by the U.S. Government, guaranteeing protection to American lives and property. (H. I. P.)

MEYER, GEORGE VON LENGERKE (1858–1918), American diplomatist, was born in Boston, Mass., June 24 1858. After graduating from Harvard in 1879 he was engaged in business for 20 years. He entered public life in 1889 as a member of the Boston Common Council and two years later became a member of the Board of Aldermen. From 1892 to 1897 he was a member of the Mass. House of Representatives, being speaker for the last three years. In 1898 he was appointed by Governor Wolcott as chairman of the Mass. Paris Exposition Managers. From 1900 to 1904 he was a member of the Republican National Committee. In 1900 he was appointed ambassador to Italy by President McKinley, and five years later was transferred by President Roosevelt to Russia. In 1907 he was recalled by Roosevelt and made Postmaster-General in his Cabinet. From 1909 to 1913 he was Secretary of the Navy in President Taft's Cabinet. On the outbreak of the World War he urged preparedness and criticised America's naval administration. He was actively associated with the National Security League and the Navy League. He was a director in many organizations, including the Amoskeag Manufacturing Co., Old Colony Trust Co., Puget Sound Light & Power Co., Walter Baker Co., and Ames Plow Co. He died in Boston March 9 1918.

See M. A. De Wolfe Howe, *George von Lengerke Meyer: His Life and Services* (1920).

MEYER, [MARIE] PAUL HYACINTHE (1840–1917), French philologist (*see* 18.349), died at St. Mandé, near Paris, Sept. 8 1917.

MIALL, LOUIS COMPTON (1842–1921), English biologist, was born at Bradford Sept. 12 1842, the son of a Congregational minister. At the age of 15 he became a junior teacher in a Bradford school, and there began the study of natural history, subsequently attending the Leeds School of Medicine for more systematic biological training. His connexion with the discovery of a new labyrinthodont from the coal-seams near Bradford introduced him to Huxley, from whom he had much assistance. In 1871 he became curator of the museum of the Leeds Philosophical Society, of which he was already secretary, and in 1876 he was appointed the first professor of biology in the Yorkshire College, afterwards the university of Leeds. This post he held until 1907. In 1892 he was elected F.R.S. He was Fullerian professor of physiology in the Royal Institution in 1904–5. He presided over the zoölogical section of the British Association (1897) and the education section (1908). Though his earlier work was mainly geological and palaeontological, he eventually paid special attention to entomology (*see* 9.656, 13.429), laying much stress on the observation of living insects. He wrote a monograph (with Prof. A. Denny) on the cockroach in 1886, and also *Object Lessons from Nature* (1891); *Natural History of Aquatic Insects* (1895); *Round the Year* (1896); *Injurious and*

Useful Insects (1902); *House, Garden and Field* (1904); *The Early Naturalists* (1912). He died at Leeds Feb. 21 1921.

MICHAELIS, GEORG (1857–), Prussian official, was born on Sept. 7 1857 at Haynau. He studied law and was for some years after 1885 a lecturer at the university of Tokyo. On his return to Germany he continued his official career and rose to the position of Under-Secretary of State in the Prussian Ministry of Finance. On the outbreak of the World War he was appointed director of the Imperial department for the control of the grain trade, and in Feb. 1917 State commissioner for the national food supply. On the retirement of Bethmann Hollweg in July 1917 the influence of the higher military authorities, including Hindenburg (in the leading strings of Ludendorff), was exercised in favour of the appointment of a chancellor who would accommodate his policy to theirs in home as well as in foreign affairs. In the hope of avoiding conflicts between the highest military and the highest civil authorities of the empire, the immediate entourage of the Emperor, in particular the chief of his Civil Cabinet, Valentini, seems to have suggested the appointment of a colourless Prussian official. Michaelis was accordingly appointed, but even in the first weeks of his chancellorship his weakness became manifest. The so-called Peace Resolution in favour of a peace "without annexation or indemnities" had been passed by the Reichstag on July 19. Michaelis was confronted with the demand of the parliamentary majority that in his public utterances he should identify himself with the spirit and the letter of this resolution. Under the influence of the military authorities he attempted to evade this obligation by declaring himself, in a phrase that became celebrated, the supporter of the resolution "as he understood it." There was a storm of indignation throughout the country, but Michaelis had still further to compromise himself, together with Adml. von Kapelle, over the naval mutiny before it was recognized that his position was altogether untenable. He was with some difficulty induced to resign, and was succeeded by Count Hertling on Nov. 1 1917. He was then appointed chief president in the province of Pomerania, an office which he held till 1919.

MICHELER, JOSEPH ALFRED (1861–), French general, was born at Phalsbourg (Meurthe) on Sept. 23 1861. He entered St. Cyr in Oct. 1880 and was appointed a sub-lieutenant on the completion of his course in 1882. He was promoted lieutenant in 1886, captain in 1891, major in 1901 and lieutenant-colonel in 1909. Three years later he was made a colonel. At the outbreak of the World War he was employed as chief-of-staff to the VI. Corps. In Oct. 1914 he was promoted general of brigade, and in Jan. 1915 was transferred as chief-of-staff to the I. Army. On Aug. 3 1915 he took over command of the 53rd Inf. Div., being later (March 25 1916) promoted a temporary general of division and appointed to the XXXVIII. Army Corps. Ten days later he was placed at the head of the X. Army. On June 22 1916 he was confirmed in his rank as general of division. He commanded the X. Army during the battle of the Somme, and was then called to the head of a new group of armies formed behind the centre for the exploitation of the victory counted upon in Gen. Nivelle's Aisne scheme. He was thus involved very deeply in the controversies which centred upon that scheme both before and after April 16 1917. It was principally his criticisms that initiated the internal crisis, and led to the council of war, in which, however, he seems not to have followed up his objections. His relations were strained with his subordinate Mangin as well as with Nivelle, and the latter sought afterwards to saddle him with part of the responsibility for the relative failure of the offensive. His group of armies being broken up he returned to the duties of an army commander. In May 1918 he vacated the command of the V. Army which he had held for a year. He was made a commander of the Legion of Honour (Sept. 30 1916).

MICHELHAM, HERBERT STERN, 1st Baron (1851–1919), British financier, was born Sept. 28 1851, the son of Hermann de Stern, Portuguese baron and banker, and Julia Goldsmid. He entered his father's banking house, Stern Bros., of London, Paris and Belgium, and inherited from his father the Portuguese barony and a fortune of £2,000,000, which was much increased by his own financial ability. In July 1905 he was created a baronet and in Dec. was raised to the peerage of the United Kingdom as Baron Michelham. He presented to the nation the quadriga surmounting the arch on Constitution Hill, and subscribed liberally for the purchase of pictures for the National Gallery, besides forming a valuable private collection. He was also well known as an owner of race-horses. During the World War he bought the Hotel Astoria in Paris for use as a British hospital, and established and maintained a convalescent home for officers at Cimiez. He died in Paris Jan. 7 1919 and was succeeded by his son Herman Alfred Stern, 2nd Baron (b. 1900).

MICHELSON, ALBERT ABRAHAM (1852–), American physicist, was born in Strelno, Germany, Dec. 19 1852. His parents moved to San Francisco, Cal., where he studied in the public schools. He graduated from U.S. Naval Academy in 1873 and was instructor in physics and chemistry there during 1875–9. He was then for a short time in the *Nautical Almanac* office. From 1880 to 1882 he studied in Berlin, Heidelberg and Paris. He resigned from the navy in 1881. In 1883 he was appointed professor of physics at the Case School of Applied Science, Cleveland, O., and six years later accepted a similar position at Clark University. In 1892 he was appointed professor and head of the department of physics at the university of Chicago. He early directed his researches to the velocity of light and while in Cleveland invented his interferometer (*see* 14.693), which enabled him to measure distances by means of the length of light-waves. In 1892 he was a member of the Bureau Internationale des Poids et Mesures and in 1897 of the International Committee of Weights and Measures. He was made president of the American Physical Society in 1901 and of the American Society for the Advancement of Science in 1910. He received medals and prizes from many learned societies and in 1907 was awarded the Nobel Prize for physics. In 1920 he was able to demonstrate by means of light-interference that the diameter of Alpha Orionis was 260,000,000 miles. This was the first computation ever made of the size of a star. He was the author of numerous papers on light and in 1903 published *Light Waves and Their Uses*, being Lowell lectures for 1899. In 1921 he was awarded the gold medal of the Society of Arts, London. (For the "Michelson-Morley experiment," in interference of light, with its bearing on the Einstein theory, *see* RELATIVITY.)

MICHIGAN (*see* 18.371).—The pop. of Michigan in 1920 was 3,668,412, an increase of 30·5% within the decade. Of the total pop. 61·1% lived in places having at least 2,500 inhabitants, as compared with 47·2% in 1910. This increase in the urban percentage was greater than in any other state in the Union for the decade. The rural pop. underwent a slight actual decrease from 1,483,129 in 1910 to 1,426,852 in 1920.

Education.—In 1917 there were in the state 892,787 children of school age, of whom 633,020 were taught in public schools. In these, particularly in the secondary schools, vocational courses have been added in recent years. At the institutions of higher education attendance greatly increased, especially in 1919 and 1920. Some of the colleges with church connexions shared in this growth; but the chief enlargement has been at the university of Michigan (*see* MICHIGAN, UNIVERSITY OF) and the Michigan Agricultural College.

The pop. and rate of increase of the principal cities are shown in the following table:—

	1920	1910	Increase per cent
Battle Creek	36,164	25,267	43·1
Bay City	47,554	45,166	5·3
Detroit	993,739	465,766	113·4
Flint	91,599	38,550	137·6
Grand Rapids	137,634	112,571	22·3
Hamtramck Village	48,615	3,559	1,266·0
Highland Park	46,499	4,120	1,028·6
Jackson	48,374	31,433	53·9
Kalamazoo	48,858	39,437	23·9
Lansing	57,327	31,229	83·6
Muskegon	36,570	24,062	52·0
Pontiac	34,273	14,532	135·8
Port Huron	25,944	18,863	37·5
Saginaw	61,903	50,510	22·6

To add to the facilities for higher education, "junior colleges," with curricula covering two years of college work, have been established in Detroit, Grand Rapids, Muskegon, Pontiac and Highland Park, in connexion with their secondary-school systems.

Agriculture.—In 1910 there were 196,447 farms in Michigan, a decrease of 10,513, or 5·1 %, as compared with 1910. During the decade all farm land increased from 18,940,614 ac. to 19,632,961 ac.; improved land increased from 12,832,078 ac. to 12,925,521 acres. During the same period the average acreage per farm increased from 91·5 to 96·9. and the average value of land per acre increased from $32.48 to $50.40.

The farming area of Michigan continues to be concentrated mainly in the southern part of the lower peninsula of the state. In the upper peninsula, farms comprise less than 10% of the land area. The area nominally in woodland, including farm woodlots as well as forests and cut-over lands, comprises nearly two-thirds of the surface of the state; but of this area not more than about 5,000,000 ac., nine-tenths of which lies in the upper peninsula, now bear timber worth cutting. Most of the rest has come to be stump lands, on which the recurrence of fires prevents any spontaneous reforestation. The barrenness of the sandy soil and the shortness of the growing-season have hindered the reduction of land to cultivation, and some 10,000,000 ac. (more than one-fourth of the total surface of the state) are thus a deforested desert. Several thousand acres of it revert to the state each year in default of taxes. These reverted tracts, comprising 566,850 ac. in 1918, are administered by the Public Domain Commission (created in 1915) with a view to the sale of such as can be used as agricultural homesteads and to the setting aside of the rest as forest reserves. These forest reserves, 145,035 ac. in 1920, are under state forest management for the prevention of fires and for systematic reforestation. In 1920 some 9,000 ac. had been replanted.

Minerals.—In mineral production no new resources of importance were developed during the decade 1910–20. The mining of iron ore has continued vigorously. The production of copper was pushed to the fullest capacity during the World War; but the severe decline of the market after the Armistice caused a sharp reduction of output. In contrast with its great prosperity in many preceding years, the Calumet & Hecla Co., the largest of the Michigan copper producers, experienced from its operations a loss of $652,286 in 1919 and $4,161,832 in 1920.

Manufactures.—The industrial survey of the U. S. census of 1920 was not yet available in Nov. 1921. The manufactured products in 1914 were valued at $1,086,162,432, as compared with $685,109,000 in 1909, an increase of 58·5 % in five years. This advance was mainly due to the extraordinary growth of the automobile industry and its concentration in the state. The number of automobiles manufactured increased from 9,125 with a value of $7,996,534 in 1904 to 64,800 with a value of $96,651,451 in 1909 to 443,072 valued at $398,289,022 in 1914. In value this was 62·9 % of the whole product of automobiles in the United States in 1914. In more recent years this industry has continued its rapid enlargement. It is estimated for the year 1920 that of the nearly 2,000,000 automobiles made in the United States more than two-thirds were produced in Michigan. The number of wage-earners engaged in the making of automobiles and their parts in 1914 was 67,538, constituting 24·9 % of the total number of wage-earners in the state; and these were probably quadrupled in number and doubled in percentage by 1920. The sharp decline in the demand for automobiles near the end of 1920, however, caused the closing of so many factories that the proportion of labourers unemployed in Michigan exceeded that of any other state in the Union.

As the production of automobiles increased the making of horse-drawn vehicles diminished, from 174,889 carriages and 52,273 wagons in 1904 to 25,265 and 11,454 respectively in 1914. The value of timber products remained about stationary, $58,523,217 in 1914, and the product of flour and grist mills likewise. The output of furniture, leather, chemicals, beet sugar, paper and wood pulp substantially increased.

The 11 leading manufacturing centres in the order of the value of their products in 1914 were, Detroit, Flint, Grand Rapids, Lansing, Battle Creek, Kalamazoo, Saginaw, Jackson, Pontiac, Muskegon, and Bay City. Detroit (*see* DETROIT) maintained an easy primacy. Flint rose rapidly after 1904, standing second in 1914 by virtue of its automobile factories. The product of these and their ancillary foundries and machine shops comprised in 1914 more than nine-tenths of the total value of the city's manufactures. Lansing's rise from seventh to fourth place and Pontiac's great growth were likewise due to their automobile industries. Grand Rapids continued to be the focus of the American furniture industry, and Battle Creek maintained its predominance in cereal preparations.

Finance.—Appropriations by the Legislature, $5,929,306 in 1909, advanced steadily to $9,610,553 in 1915, and then much more rapidly to $17,432,512 in 1919. The volume of the general property tax, which comprised nearly all of the state's revenue, lagged behind the appropriations at the close of the decade 1910–20, and the prospect of a treasury deficit in 1921 caused the passage of a law for a tax on corporation franchises as an emergency recourse. This was expected to yield some $6,000,000 in the two years following.

Legislation and Administration.—Amendments added to the revised constitution of 1908 provided for popular initiative and referendum on constitutional amendments and in legislation (1913); for the recall of elected officials (1915); for prohibition (1916); for woman suffrage (adopted in 1917 after having been successively rejected in 1912 and 1913), and for the issue of state bonds to the amount of $50,000,000 for the improvement of highways (1917). The provisions for initiative, referendum and recall have as yet found little utilization, but the issue of highway bonds facilitated a marked improvement of roads. An increase of the licence charges on automobiles has also increased the road funds, the application of which is largely determined by an Act of the Legislature (1915) establishing a system of state trunk roads. Among other noteworthy enactments by the Legislature are the Judicature Act of 1915, consolidating and revising the laws of civil practice and procedure; the "blue sky" law of 1913 and the creation of the Michigan Securities Commission in 1915 to regulate the sale of securities; the provision for juvenile courts (1911); the creation of a board of mediation and conciliation to deal with labour disputes (1915); a department of state police (1919); and a budget commission (1919).

The World War.—Colonel Bersey, Adjutant General, estimated the number of men who entered the military or naval service from Michigan during the World War at 175,000 to 200,000, and the number who lost their lives at 3,200. The Government reports were not yet complete in Nov. 1921 and were not to include the many men from Michigan who served in the Polish, Canadian or other armies.

The following figures as to Michigan's participation in the Liberty Loans are taken from the official reports of the Loans and Currency Division of the Treasury Department, and differ slightly from the totals reported by the state bank commissioner, 1919:—

Loans	Quota	Amount Subscribed	Accepted
First	$ 56,172,800	$ 65,819,750	$ 44,914,950
Second	82,550,000	115,530,550	104,380,500
Third	83,600,000	107,671,400	107,436,900
Fourth	152,400,000	177,349,000	176,102,700
Fifth	115,425,000	155,787,450	125,372,300

Political History.—Since 1910 there generally have been large Republican majorities in state and national elections, without appreciable representation of any other parties in the state Legislature. In the presidential election of 1912, however, Michigan gave its electoral vote to the Progressive ticket, and in 1912 and 1914 it elected a Democrat as governor. The governors of Michigan, 1911–21, were: Chase S. Osborn (Rep.), 1911–3; Woodbridge N. Ferris (Dem.), 1913–7; Albert E. Sleeper (Rep.), 1917–21; Alexander J. Groesbeck (Rep.), 1921– . In a conspicuous contest in 1918 Truman H. Newberry (Rep.) was elected to the U.S. Senate by a narrow majority over Henry Ford (Dem.). Charges of excessive expenditures in this campaign were brought against Senator Newberry and numerous associates, and they were convicted in the U.S. District Court (1920) and were sentenced to two years' imprisonment. The U.S. Supreme Court set aside the conviction May 2 1921; on Jan. 12 1922 the U.S. Senate decided by a vote of 46 to 41 that Newberry was entitled to his seat. (U. B. P.)

MICHIGAN, UNIVERSITY OF (*see* 18.378), was the first university established by an American state to become conspicuously successful. The promise of its earlier period continued in recent years. The total roll of the faculty increased from 350 in 1907–8 to 616 in 1919–20, while the number of students grew from 5,013 to 9,401 in the same period (5,007 in the college of Literature, Science and the Arts, 2,038 in the college of Engineering and Architecture, 394 in the Medical School, 382 in the Law School, 99 in the college of Pharmacy, 42 in the Homoeopathic Medical School, 350 in the college of Dental Surgery, 340 in the Graduate School, 1,961 in the Summer Session and 222 in the two training schools for nurses). On Jan. 1 1921 there were over 30,000 living graduates. The Medical School, Law School and Homoeopathic Medical School demand two years of college work before admitting students.

Among the buildings erected between 1910 and 1920 were the Hill Auditorium (1913) seating 5,000 persons, with remarkably good acoustic properties; the Natural Science Building (1916); the new University Library (1919) containing approximately 400,000 volumes, with room for over 1,000,000 volumes; the Michigan Union (1919), a student clubhouse costing $1,250,000, the gift of some 14,000 alumni. A new university hospital was to be completed in 1922 with accommodation for 600 patients, affording proper facilities for the teaching of medicine, and the first hospital controlled exclusively for the benefit of the people of the state. Four dormitories for women students were also erected during this period.

The income of the university in 1919–20 was $3,802,164. Of this amount $1,687,500 was derived from the state through the tax of three-eighths of a mill on every dollar of taxable property, $38,428 from the state lands originally granted by the Government for the support of the university, $682,445 from tuition, student fees, etc., and $659,250 from special appropriations and savings for the erection of buildings.

Over 12,000 graduates and students of the university were enlisted in the U.S. forces during the World War, of whom 231 lost their lives. This number included 2,747 students who were enrolled in the collegiate section of the Students' Army Training Corps during the fall of 1918. Pres. James Burrill Angell, upon his resignation in 1909, was succeeded by Harry Burns Hutchins, dean of the Law School, as acting president (1909–10) and president (1910–20). Pres. Hutchins resigned in 1920 and was succeeded by Marion Leroy Burton, who had been president of Smith College (1910–7) and of the university of Minnesota (1917–20).

See *A Memorial of the Seventy-fifth Anniversary of the Founding of the University of Michigan* (Ann Arbor, 1915); also Wilfred Shaw, *The University of Michigan* (New York, 1920) and A. L. Cross, "The University of Michigan and the Training of her Students for the War," *Michigan History Magazine* (Lansing, Jan. 1920).

(W. B. S.)

MIDLETON, WILLIAM ST. JOHN FREMANTLE BRODRICK, 1ST EARL OF (1856–), English politician (*see* 18.419), did not remain long out of Parliament after his defeat in the general election of 1906, as in the following year his father died, and he entered the House of Lords as 9th viscount. He took a considerable share in the work of that House, and played an active part behind the scenes in Unionist politics, without returning to ministerial office. He was indeed perhaps the most conspicuous figure among the Unionist leaders who did not find a place in Mr. Asquith's Coalition Cabinet. He had meanwhile become specially prominent as leader of the southern Unionists of Ireland, in virtue of his position as a landowner in county Cork. In his opposition to the Home Rule bills, he was never willing to base himself mainly on the difficulties of Ulster, but constantly called attention to the necessity of protecting loyalists in the South and securing them from discriminating taxation. He was disquieted by the negotiations carried on in the summer of 1916 with the Irish leaders by Mr. Lloyd George on behalf of Mr. Asquith's Coalition Ministry, on the basis of excluding the six Ulster counties but bringing the Home Rule Act at once into effect in the rest of Ireland. In the Irish Convention, which was set up in the middle of 1917 and sat into the following year, he and a band of southern Unionists separated themselves from the Ulster standpoint, and showed themselves ready to concede a unitary Home Rule Government for Ireland, subject to provisions for safeguarding the minority of loyalists. At the beginning of 1920 he was created an earl.

MILK (*see* 18.451, 7.737).—From time immemorial milk and milk products have been highly prized by man as a food, and Jewish, Egyptian, Greek and Roman literature contain numerous references to the use of milk and milk products. In earlier times the milk of nearly all the domestic animals was used for the food of man, and although at the present time the milk of the cow provides the main bulk of the world's dairy products, the milk from the ass, goat, mare, reindeer, camel, ewe, llama and zebra is still used in various parts of the world.

Milk consists of a watery intimate admixture of protein, fat, carbohydrate, and soluble inorganic constituents (the latter being usually referred to collectively as ash), the proportion and amount of these constituents varying according to the species from which they are derived. The principal protein of milk is casein, a protein not found elsewhere in the body, and belonging to a group of proteins called phosphoproteins owing to the presence of combined phosphorus in the protein. Other proteins are present, namely, lactoglobulin and lactalbumin.

It was formerly believed that the proteins of milk were identical with the proteins of blood serum, and that they found their way into the mammary secretion as a result of simple and direct transference from the blood stream. Recent chemical work on the structure of these proteins has not, however, confirmed this belief. Hartley (1914) analysed the proteins of serum by the method of Van Slyke; Crowther and Raistrick (1916) by the use of the same method analysed the corresponding proteins of milk and colostrum. Woodman (1921) investigated the optical behaviour of these proteins when dissolved in dilute alkali at a temperature of 37°C. The results of these investigations indicate clearly that whereas the globulins of serum, colostrum and milk are one and the same protein, yet serum albumin and lactalbumin are to be regarded as distinct chemical individuals. From this the conclusion must be drawn that a distinct mammary synthesis is necessary for lactalbumin as well as for caseinogen.

Fats occur in milk in the form of minute globules, there being millions present in each c.c. of milk. The average diameter of these globules varies from ·01 mm. to ·0016 mm. Milk fat differs from body fat in that it contains a relatively large amount of olein and also in the fact that considerable quantities of fatty acids of low molecular weight are present. It is upon the presence of the fatty acids in butter fat that one of the tests for the purity of butter fat depends. In addition to traces of other bodies, the milk fat carries with it varying amounts of colouring matter derived from the food eaten.

The carbohydrate present in milk consists of a sugar called lactose. This sugar is peculiar to milk, and it is owing to the fermentation of this sugar by bacteria with the formation of lactic acid that the souring of milk is due.

The table below gives the average composition of the milk of different mammals.

The differences shown in the table below indicate a very important fact—that the milk of the species is peculiarly adapted for the efficient nutrition of the young of that species. Especially is this the case with the inorganic constituents of the milk. It is this difference in composition that necessitates especial care in the use of cow's milk for the rearing of infants. Although the composition of milk varies considerably among individuals of the same species, the variation in the same individual is as a general rule very small, and, contrary to general opinion, is but slightly influenced by conditions of feeding.

Origin of Milk and Development of Mammary Gland.—The first sign of development of the mammary gland in the embryo is the formation of a slightly thickened ridge or line called the mammary ridge. This is a slight thickening of the epidermis extending from the inguinal region to the axilla. This thickening becomes intensified in the areas in which eventually the mammary glands are situated, and little bud-like outgrowths of the epithelium extend into the underlying connective tissue in these regions, forming the mammary ducts. These ducts give rise to the galactophorous or milk sinus and milk ducts, and eventually form the alveoli. The thickened epithelium forms the nipple, so that the fully developed mammary gland in the adult resembles a bunch of grapes bound together with fatty connective tissue.

At birth the mammary glands are alike in both sexes, and consist entirely of a few rudimentary ducts and nipple. During infancy very little growth takes place, although towards puberty considerable deposition of fat takes place in the female in the vicinity of the nipple. At puberty in the female a certain amount of growth takes place, and occasionally a few alveoli, or milk-producing sacs, are

	Woman	Cow	Buffalo	Goat	Ewe	Mare	Ass	Reindeer	Whale
Water	88·32	87·75	82·57	86·34	81·08	90·38	90·30	67·7	60·47
Fat	3·43	3·40	7·63	4·25	7·67	1·00	1·30	17·1	20·00
Protein	1·55	3·50	4·69	4·40	6·08	1·98	1·80	10·9	12·42
Milk Sugar	6·44	4·60	4·30	4·26	4·26	6·28	6·20	2·8	5·63
Salts	0·26	0·75	0·81	0·75	0·91	0·36	0·40	1·5	1·48
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Specific Gravity	1·032	1·0315	1·033	1·033	1·038	1·034	1·033	—	—

formed. The development of the mammary glands after puberty varies considerably with the species. As a general rule, further development of the mammary gland is closely associated with the onset of pregnancy, although in some cases, as in the mare and bitch, the mammary glands occasionally develop to the milk-producing stage even in the absence of pregnancy. The development of the mammary gland and the secretion of milk are closely correlated with the formation and subsequent atrophy of a body called the corpus luteum. This body is found in the ovary as the result of the shedding of an egg cell or ovum, which, if fertilized, develops into the embryo or foetus. Provision is thus made for the adequate nutrition of the young animal after birth, and it is owing to this correlation between the development and atrophy of the corpus luteum and the development of the mammary glands that the mammary glands are enabled to secrete milk shortly after birth of the young.

The milk first secreted after the birth of the young is abnormal in appearance, and contains a large amount of albumin and globulin, together with a large number of cells. This first-produced milk is called colostrum or " biestings " and is generally used by the young calf. The change from colostrum to normal milk is gradual, generally taking about five days. The following table gives the chemical composition of colostrum and ordinary cow's milk:—

	Colostrum	Milk
Water	73·17	87·75
Casein	2·65	3·00
Albumin Globulin	16·56	0·50
Fat	3·54	3·40
Milk Sugar	3·00	4·60
Ash	1·18	0·75

Two views are held as to the manner in which milk is secreted. The first view holds that the cells of the alveolus enlarge, the enlarged end breaking off with its contents and forming milk, the lower half of the cell regenerating again and repeating the process. The second view is that milk is a true secretory fluid, the secretion from the cells being produced in the same way as in any other gland. Recent work tends to confirm the second view as being correct.

Factors Influencing Milk Yield.—The various causes which affect the yield of milk nearly always affect the percentage composition of its ingredients owing to the fact that the fat of milk is secreted independently of the other solids, and the various causes leading to alteration in yield affect only the water and solids, not the fat portion. Any factors therefore which alter the yield of milk will generally lead to variation in the percentage fat content. For this reason the variation in fat content of milk may range from 1·7 to 6·0 per cent. Under normal conditions, however, the percentage of fat present in milk is a breed characteristic, and the capacity to produce milk containing a high percentage of fat is an inherited characteristic. This fact has been utilized in Denmark to grade up the cow population, and by careful control of breeding allied with fat tests on the milk of milk-recorded cows, the average fat content of milk produced by cows in that country has been increased. The chief difficulty in carrying out the same grading-up process in England is due to the common practice of discarding bulls after a few years' use, the result being that the bull is killed before its real value as a milk-getter is known. The following table gives the average fat percentage of the various breeds of cows:—

Breed	Fat Percentage	Breed	Fat Percentage
Jersey	5·35	Brown Swiss	4·25
Guernsey	5·16	Ayrshire	3·66
Devon	4·60	Holstein–Friesian	3·42
Shorthorn	4·05		

The various circumstances that affect the yield and composition of the milk of cows are as follow:—

(*a*) Period of Lactation.—The amount of milk secreted rises for the first two or three weeks after calving, then falls slightly for about six weeks. The rate of fall then gradually increases, accelerating greatly as the cow approaches the next calving period, until near calving the milk flow ceases altogether. In the case of cows not pregnant the milk flow may continue for as long as two years, and it is said that spaying greatly prolongs the period of yield. As the yield falls off, the fat percentage tends to increase.

(*b*) The Act of Milking.—Much of the milk obtained at a single milking is actually secreted at the time of milking. The first-drawn milk is generally poor in fat (it may be as low as 1 %), and the percentage of fat rises gradually until in the strippings the fat content may be as high as 15 per cent.

(*c*) The Frequency of Milking.—The longer the interval between the milkings, the larger is the amount of milk secreted at each milking. This milk, however, is poorer in fat owing to the fact that the quantity of fat secreted at each milking is approximately the same, whereas the quantity of solids not fat and water secreted is dependent upon the interval between the milking. The pressure of the secreted milk in the udder inhibits the secretion of fat, and to a certain extent the secretion of solids not fat, so that a cow milked three times a day at equal periods will yield more milk relatively richer in fat than if milked twice a day.

(*d*) The Time of the Year.—A comparison of milk records, after allowing for effect of lactation period, will show that cows yield most milk in May and June and least in Nov. and December. The greater yield of milk in the spring months is undoubtedly correlated with the abundance of fresh green grass in the feed, and there appears little doubt that the yield of milk is partially dependent upon the palatabilty and succulence of the feed. For this reason, the practice among dairymen of giving wet mashes to cows is sound.

(*e*) Age of the Cow.—The yield of milk given in a lactation period increases up to the sixth lactation period, remains constant for the next two or three lactation periods and then declines.

(*f*) Other Conditions.—Carefully controlled experiments have shown that cows may perform a useful amount of muscular work without diminishing the milk yield to any serious extent, whereas the fat content may be actually increased.

The cow giving a fair yield of milk is producing large quantities of heat in excess of her requirements, and may therefore be subjected to fairly low temperatures without in any way decreasing her yield of milk or increasing her food requirements. In view of the tendency for extension in England of out-of-door cow-keeping, this fact is important. An accumulation of milk in the udder will cause an atrophy of some of the milk-secreting cells, leading to a decrease in the milk-yielding capacity which cannot be regained until the next lactation period. The same effect will be produced by long periods of under-feeding. For this reason it is extremely important that the udder should always be stripped at each milking, that the intervals of milking should be approximately equal, and that the cow should be adequately fed in proportion to her milk yield.

Feeding in Relation to Milk Production.—The magnitude of the dairying industry has directed the attention of research workers to the study of the relationship between milk yield and food requirement. It is obvious from a commercial standpoint that the establishment of such a relationship is the first important step towards the production of cheap clean milk. It is no exaggeration to say that the health of a nation is dependent largely upon an abundant supply of good cheap milk, and, to obtain this milk, production must be made profitable.

Under the auspices of the British Ministry of Agriculture the first essential step was taken by the introduction of milk-recording schemes. Under this scheme cows are ear-marked and the daily supply of milk yielded carefully weighed and recorded. In order to render the records accurate and of commercial value, surprise visits are made by official milk-recorders, who inspect the weighing of the milk, ear-marking and recording of the individual cows in a herd. The farmer who records his cows can thus obtain the annual record of the milk production of each of his cows, and this enables him to weed out of the herd the unprofitable cows. Before the World War it was established that, with cows yielding less than 600 gallons a year, milk could not be produced at a profit, and yet at that time the average milk yield for the country was well below this figure. In other words, the farming community was producing milk at a loss. The milk-recording of dairy cows is, therefore, the first important step towards the economical production of clean milk.

Having satisfactorily obtained the record of the individual yields of milk of cows, the next important item to consider is whether this milk is being produced at the minimum necessary expenditure of food material. Evidence has already shown that the herd giving the largest yield of milk does not necessarily produce the milk at the cheapest cost per gallon. It consequently becomes very important to investigate the possibility of feeding cows in such a way as to ensure the production of the milk with the least possible expenditure of food material.

This problem has been given increased attention since 1910 and, owing chiefly to the labours of keen men of science, has been satisfactorily solved. In this connexion brief mention may be made of Wolff, Lehmann, Kellner, Haecker, Savage, Armsby, Pott, Henry Morrison and their numerous co-workers, to whom our present knowledge on feeding standards is due.

In order to attack the problem, the first necessity was to establish the relative amounts of food material the animal retained for its own use. The chemical analysis of a feeding-stuff was of little value for this purpose, as the chemical analysis of a feeding-stuff, in the absence of any other data, gives no measure of the nutritive value.

The method adopted in order to assess the value of a feeding-stuff was to feed known weights of a given feeding-stuff to an animal, collect, weigh and analyse the excreta, whence by deduction the amounts of the feeding-stuff that were actually absorbed into the system, and were thus available for maintenance of bodily activity, growth, repair of tissues and other purposes, were obtained. The results of these somewhat tedious, patient researches are comprised in tables giving the chemical analyses of the chief feeding-stuffs and their digestible constituents, the most recent table of British figures being contained in *Miscellaneous Publication No. 32*, published by the Ministry of Agriculture.

This proved, however, only a partial solution of the problem, as it quickly became evident that the value of the digested nutrients varied according to the nature of the feeding-stuff from which these nutrients were derived. As a result of further research these difficulties were overcome, and a method was devised whereby it is possible to assess the true value of any given feeding-stuff for any required purpose. The chief facts discovered, stated briefly, are as follows:—

The value of a feeding-stuff may be divided into two portions: (*a*) its value as a supplier of protein; and (*b*) its value as a supplier of energy. The protein is required by the animal for the formation of flesh, the repair of waste tissue and the protein portion of milk; the energy is required for the maintenance of the bodily activities of the animal and the production of fat, milk, work and heat. A certain quantity of the digestible nutrients is required for maintaining the animal in health; this portion is generally called the maintenance requirement: the rest is available for the production of meat, work or any other purpose. The excess of protein beyond the animal's daily requirement is also available for the production of energy, but since the protein portion of a food is dearer than the non-protein portion, the use of protein as a source of energy is wasteful. Kellner, by a series of carefully controlled experiments, compared the relative values of digestible protein, fat and carbohydrate for the purpose of fat production. The method adopted was to adjust an animal's diet so that it neither gained nor lost weight, and then add a stated quantity of pure protein, fat or starch, to the diet and find the amount of fat produced. This gave a comparison between the fat-producing or energy-producing power of the various constituents of a food, and Kellner decided to express this energy value in the form of starch, which figure he called the "starch equivalent." Thus 1 part digestible protein was found to equal 0·94 parts starch, 1 part digestible fat 2·3 parts starch, and 1 part of digestible carbohydrate 1 part starch. This gave the necessary data for calculating the starch equivalent from any food-stuff, given the digestibility figures.

It was found on computation that the theoretical starch equivalent as computed differed from the actual values as found by experiment. This difference was due to the fact that the work of digestion of the feeding-stuffs varied considerably, and the energy thus required formed a prior charge on the digested nutrients, only a proportion of which was thus available for fat production. For this reason a "value number" was given to the different classes of feeding-stuffs, and this enables us with fair accuracy to compute the starch equivalent of a new feeding-stuff from the digestible nutrients.

Kellner's starch equivalent represents the fattening capacity of 100 lb. of a feeding-stuff expressed as starch. Thus 100 lb. of a feeding-stuff whose starch equivalent is 75 would produce as much work, fat or energy as 75 lb. of starch. Through this work, the problem of relating food requirement to milk production became simple.

An animal requires two essential substances, proteins for repair of tissues, and fat, protein or starchy material for energy. The average requirements of a cow for protein and energy for maintenance of bodily activity were ascertained and experiments soon established the relationship between gallons of milk produced and requirements of energy and protein. The results thus obtained form the basis of a scientific feeding standard for milch cows and are given in the following table:—

Maintenance Ration	Digestible protein lb.	Starch equivalent lb.
A cow weighing 1,000 lb. requires	·70	6·25
A cow weighing 1,200 lb. requires	·84	7·50
A cow weighing 1,400 lb. requires	·98	8·75

Production Ration.—In addition to the maintenance ration a cow will require approximately ·58 lb. of digestible protein and 2·50 lb. starch equivalent for every gallon of milk produced.

From the above table it will be quite easy to compute a suitable ration for a dairy cow giving a known quantity of milk. An example will suffice to illustrate the method.

Let us assume that a dairy cow weighing 1,200 lb. gives 3 gallons of milk, and that the foods available are mangolds, oat straw, linseed cake and palm-kernel cake. From a table of analyses similar to that given in the *Miscellaneous Publication No. 32*, already referred to, it is found in British practice that—

	Digestible protein lb.	Starch equivalent lb.
1 lb. oat straw contains	·01	·17
1 lb. mangolds contains	·005	·06
1 lb. linseed cake contains	·24	·74
1 lb. palm-kernel cake	·16	·75

	Digestible protein lb.	Starch equivalent lb.
Now the maintenance requirements of a 1,200-lb. cow are	·84	7·50
3 gallons of milk require	1·74	7·50
Total requirements of a 3-gallon cow =	2·58	15·00

A suitable ration would be:—	Digestible protein lb.	Starch equivalent lb.
20 lb. oat straw	·20	3·40
60 lb. mangolds	·30	3·60
8 lb. palm-kernel cake	1·28	6·00
3 lb. linseed cake	·72	2·22
	2·50	15·22

The above ration would represent a suitable ration for a cow giving 3 gallons of milk a day on the limited foods available. It is possible by this method to feed the entire herd according to their actual milk yield. As a matter of practice, the whole of the herd are given the same maintenance ration, hay, roots and straw, and the cakes and meals are varied according to the milk yield. As a rough working rule it generally takes 3½ to 4 lb. of cake for every gallon of milk produced. The chief value in the scientific valuation of food requirement for a dairy herd lies, however, in the possibility of checking the adequacy of the actual ration fed to a herd and of enabling the computer to suggest a suitable alternative ration in cases where an unsuitable ration is being fed.

Much useful work in this direction is now being done in parts of England by agricultural organizers. The system adopted is for the farmer to fill up a food-record sheet, in which he enters the number of cows in the herd, the total milk produced and the actual weights of foods fed. From this the agricultural organizer computes the food value of the rations given and the scientific requirement. Comparison of the two sets of figures obtained enables him at once to state whether any alteration in feeding is necessary, and to suggest a possibly cheaper ration.

Other systems of feeding for dairy cows deserve mention here. A method based on the fat content of milk is in use in America. According to the Haecker-Savage standard, the food requirements are stated in digestible protein and total digestible nutrients, and the amounts to be added to the maintenance ration vary according to the fat content of the milk.

A system in common use in Denmark depends for its existence on its simplicity, a simplicity which has only been arrived at by sacrificing a certain amount of scientific accuracy. The Danish food-unit system consists of a table of equivalent values of various feeding-stuffs compared with a standard. The values arrived at have been based mainly on the extensive experiments carried out by Fjord and his co-workers with milch cows and swine. In Denmark the standard unit is 1 lb. of grain; in Sweden the standard unit is 1 kgm. (2·2 lb.) of mixed concentrates. A table is generally given showing the quantities of feeding-stuffs equivalent to one unit, and in computing rations all the feeding-stuffs are reduced to units. It is thus quite easy to ascertain the number of food units used to produce a gallon of milk, and enables quick and ready comparisons to be made between different cows or herds of cows. For this reason it has been greatly appreciated, and has proved of great value, especially in coöperative efforts to improve Danish dairy cattle and their feeding.

It is, however, only of value where the conditions ruling, both as to foods fed and to type of farming adopted, are similar, and the Danish food-unit system cannot be applied with safety to the variable conditions of English farming practice.

The Hygiene of Milk Production.—Milk, owing to its composition and liquid nature, forms an ideal medium for most bacteria, whether beneficial or otherwise. The rapidity with which bacteria will multiply in milk and the ease with which milk is contaminated when handled under ordinary conditions have impressed upon certain sections of the population the necessity of taking steps to improve the quality of the milk supply.

The American Medical Milk Commissions have already acted, and have reached general agreement as to the conditions under which milk should be marketed in the United States. The standards are based fundamentally on the bacterial content, and, similarly to the English custom, standards also exist as to fat content and total milk solids. Four grades of milk are recognized. The highest grade is known as "certified" and is produced and marketed under very strict hygienic conditions. The price of production under these conditions is so high as to be out of reach of the general public, and three other grades of milk are recognized, Grade A, Grade B and Grade C. Grade A contains not more than 60,000 bacteria per c.c.; Grade B not more than 200,000 per c.c.; Grade C has no bacterial standard, but must be delivered within 48 hours of milking.

As the result of the grading of milk, very elaborate arrangements exist in America for rapid transit, efficient storage and hygienic manipulation, and it is certain that milk reaches the American consumer in a far cleaner condition than it does the English consumer.

There is undoubtedly need in England for more efficient regulation and control of milk from the dairy to the consumer's table, but much can be done by the observation of simple hygienic rules in the cowshed or milk-shed. Fifty per cent of the bacterial contamination of milk occurs before it leaves the farmer's hands; the elimination of most of this 50% is a comparatively inexpensive matter. There is but little doubt that the bacterial count forms a very reliable indication of the care with which milk is produced and marketed, but, under present conditions, it unfortunately does not distinguish between the beneficial and the dangerous types of bacteria. It is consequently a matter of comfort to all, and a source of material satisfaction to many, that pasteurization kills all the bacteria in milk likely to prove harmful to the consumer. (E. T. H.)

MILL, HUGH ROBERT (1861–), British geographer and meteorologist, was born at Thurso May 28 1861, and was educated at Edinburgh University. In 1884 he was appointed chemist and physicist to the Scottish marine station, and in 1887 became a lecturer for the university extension movement, being at the same time (1893–9) recorder of the geographical section of the British Association. He was president of this section in 1901. In 1892 he succeeded Dr. John Scott Keltie as librarian to the Royal Geographical Society and from 1902 to 1906 was hon. secretary of the Royal Meteorological Society, becoming its president in 1907. Dr. Mill served on many committees connected with meteorology and allied subjects, including the International Council for the study of the sea (1901–8), and the Board of Trade committee on the water power of the British Isles (1918). On the death of Mr. G. J. Symons he became (1901) director of the British Rainfall Organization, and editor of *British Rainfall* and *Symons's Meteorological Magazine*, and when the organization was converted into a trust in 1910 he became chairman of trustees, a position from which he retired in 1919. From 1906 to 1919 he was rainfall expert to the Metropolitan Water Board. Dr. Mill received many honours from learned societies, including the Victoria medal of the Royal Geographical Society (1915), and the Symons medal of the Meteorological Society (1918).

His chief works are *The Realm of Nature* (1892; latest ed. 1913); *The English Lakes* (1895); *Hints on the Choice of Geographical Books* (1897); *New Lands* (1900); *The Siege of the South Pole* (1905) and a historical introduction to Sir Ernest Shackleton's *Heart of the Antarctic* (1909). He also edited *International Geography* (1911).

MILLER, JOAQUIN (1841–1913), American poet (*see* 18.464), died at Oakland, Cal., Feb. 17 1913.

MILLERAND, ALEXANDRE (1859–), French statesman, (*see* 18.465), was included in the Briand Ministry of July 1909 with the portfolio of Public Works, and in the Poincaré Ministry of Jan. 1912 he became Minister of War. He resumed this portfolio when, immediately after the outbreak of war in 1914, the Prime Minister, Viviani, desired to strengthen his team. He was Minister of War during the most difficult period when, after the first battle of the Marne, the Government had to have recourse to all sorts of improvisations in order to make good the deficiencies revealed in the country's military equipment. His administration was severely criticised by Clemenceau on account of the muddle and mismanagement which ruled the army medical services. He was also criticised with some vehemence for the delays in producing the right kind of shell and gun in adequate quantities. His extremely dogged character enabled him to withstand the many parliamentary attacks made upon his political position, and his departure from the War Office only took place when Delcassé's resignation brought about that of the whole Viviani Ministry in 1915. For the rest of the war he devoted himself to relief work, and went back to his very large practice at the bar. After the Armistice M. Clemenceau appointed him to the posts of Commissioner-General of the Republic at Strasbourg and Administrator of Alsace-Lorraine. These posts he filled with great distinction and ability. In the elections of 1919 he played the chief part in constituting the national *bloc* with which the moderate parties successfully fought the elections. When Clemenceau resigned Millerand formed the new Government. He was called upon to play a big part in the protracted inter-Allied negotiations with regard to the application of the Treaty of Versailles. His political prestige grew steadily during office, and when M. Deschanel was forced to resign the presidency of the republic he succeeded him as President, being elected by 695 votes out of 892 on Sept. 23 1920.

MILLET, FRANCIS DAVIS (1846–1912), American painter (*see* 18.466), died in the "Titanic" disaster at sea April 15 1912.

MILLS, ROGER QUARLES (1832–1911), American legislator (*see* 18.475), died at Corsicana, Tex., Sept. 2 1911.

MILNE, SIR GEORGE FREDERICK (1866–), British general, was born Nov. 5 1866 and joined the Royal Artillery in 1885. He served in the Nile Expedition of 1898, and on the staff in S. Africa throughout the war of 1899–1902, for which he was promoted brevet lieutenant-colonel and given the D.S.O. He was afterwards almost continuously on the staff until 1913, and was promoted colonel in 1905. In 1913 he became commander of the artillery of the 4th Div., with which he went out to France in 1914. He was soon promoted major-general for distinguished service, and after some months on the staff on the western front was given, in July 1915, command of the 27th Div. which, three months later, he took out to the Salonika theatre. At the end of the year he was placed in charge of an army corps there. In May 1916 Milne, who had been given the K.C.B. for his services, was advanced to the command of the British forces in Macedonia, and he occupied this responsible position under the orders of three successive French commanders-in-chief until the end of the struggle. Little progress was made during the ensuing two years, the situation scarcely lending itself to the prosecution of effectual offensive operations, and the British military authorities at home being throughout opposed to the using-up of resources in this theatre. Milne, however, filled a difficult position with unfailing tact and sound judgment, and, when a general advance at last took place in the autumn of 1918 after Bulgarian powers of resistance had become spent, the forces under his personal command contributed appreciably to the bringing about of the final victory. He had been promoted lieutenant-general in 1917 and he was, on conclusion of hostilities, given the G.C.M.G. He remained in charge of the British forces in the Near East and about the Black Sea until 1920, and his services received further recognition in 1919 by his being promoted full general.

MILNE, JOHN (1850–1913), British seismologist and mining engineer, was born at Liverpool Dec. 30 1850, and was educated at King's College, London, afterwards studying at the Royal School of Mines. He then worked as a mining engineer in Newfoundland and Labrador, and in 1874 went as geologist with Dr. Beke's expedition to north-western Arabia. In 1875 he was appointed professor of geology and mining in the Imperial Engineering College at Tokyo, and for nearly 20 years made his home in Japan, marrying a Japanese lady. Prof. Milne made a special study of seismology (*see* 8.817, 819, 820), and was recognized as the first authority on the subject. He travelled widely in the East in pursuit of his researches, and about 1880 established the seismic survey of Japan, with 968 stations. He also invented or perfected various forms of seismograph. In 1894 his books and instruments were destroyed by fire, and he returned to England, settling at Shide, I. of Wight, where he established an observing station. During the ensuing years he was largely responsible for the establishment of seismological stations throughout the world, in connexion with his work as secretary of the seismological committee of the British Association. He published two standard works, *Earthquakes* (1883) and *Seismology* (1898), besides books on scientific mining and crystallography and many papers in scientific journals. He died at Shide July 30 1913.

MILNER, ALFRED MILNER, Viscount (1854–), British statesman (*see* 18.476). After Lord Milner's return from South Africa he occupied himself mainly with business interests in the City of London. But, though he took up a somewhat detached attitude with regard to ordinary domestic politics, he was active on behalf of causes which appealed to him from the imperial side; and he made several speeches in different parts of the country in the next few years on behalf of Tariff Reform and Colonial Preference. He paid a visit to Canada, where he himself and his gospel of imperialism were well received. He was roused, however, by Mr. Lloyd George's budget of 1909, and he advised the House of Lords to reject the Finance bill, and, as he said at Glasgow, to "damn the consequences." He made several speeches in the next twelve months in defence of the Lords' position; and when the Parliament bill came up to the House of Lords in 1911, he was a leading spirit among the "Die-hards" who advised resistance to the end. He did not take a very prominent part in the opposition to the Irish Home Rule bill; but he aptly decribed the state of affairs in Ireland in the early summer of 1914 as "smouldering war," and he urged the remodelling of the Amending bill so as to reassure the Ulstermen.

The World War confirmed all his fears as to the disadvantages under which Great Britain and the Empire would labour during hostilities through the practice of unlimited Free Trade by the mother country for over half a century. He gladly accepted in the summer of 1915 the chairmanship of a committee of technical experts and practical agriculturists, appointed by Lord Selborne as President of the Board of Agriculture, to consider the means of maintaining and increasing food production in England and Wales. The committee reported that farmers should be encouraged to grow more wheat by a guaranteed minimum of 45s. a quarter for the four years following the harvest of 1916. Mr. Asquith's Coalition Government did not think the situation serious enough for this drastic remedy—shrinking here, as in other matters, from a bold decision. Lord Milner became critical of this "wait and see" attitude; and especially reprobated on several occasions the policy of concealing disagreeable facts. "Truth all around," he said at Canterbury on Oct. 30, "is the most fortifying thing in the world"; Englishmen could not brace their nerves and steel their hearts to win through by emulating the ostrich. Similarly he endeavoured, in April 1916, to spur on doubting ministers to accept the policy, which the country demanded, of universal compulsory service.

Mr. Lloyd George, when he formed his Ministry in the following Dec., at once turned to this resolute statesman, the only British administrator who before 1914 had directed a war from the civil side, and constituted him one of his principal colleagues in his War Cabinet of four (or five including Mr. Bonar Law). Considering the attitude of the two men at the time of the South African War, the offer and acceptance argued magnanimity on both sides. From this time to the cessation of hostilities their relations were close, and, after Mr. Lloyd George, Lord Milner took the largest share in the civilian conduct of the war. In vigour, resolution and readiness to take responsibility they resembled each other; but Lord Milner's experience, scholarship, steadiness and somewhat bureaucratic habit of mind supplied an invaluable complement to his chief's daring, impatience of precedent, quickness of apprehension and intellectual agility. In Feb. 1917 he attended, on behalf of the British Government, a conference of the Allies in Petrograd, the object of which was to improve the coördination in the prosecution of the war between the Government of the Tsar and the Western Powers; and he does not seem to have at all realized that Russia was on the brink of a revolution. He devoted himself closely to his duties in the War Cabinet, never making speeches in the country, and seldom in the House of Lords, where his appearances were mostly in explanation and defence of the policy of the Government in regard to food production and control. In June 1917 he announced that ministers had added between 70,000 and 80,000 men to the people available for agricultural work. In Feb. 1918 he vigorously defended Lord Rhondda's administration at the Food Ministry against ignorant criticism, and said that in regard to food Britain was in a better position than any other country except the United States. Except for what was necessary for the conduct of the war, everything must give way to food supply. The Corn Production bill of 1917 and the acceptance by the Government of the principle of Imperial Preference, and of the conservation of the raw materials of the empire, must have owed much to his influence and support. He worked heartily for inter-Allied coördination in the conduct of the war, and with Mr. Lloyd George attended meetings of the Supreme War Council at Versailles. He was in France at the time of the victorious German advance in the last ten days of March 1918; and it was largely owing to his influence that Gen. Foch was appointed Generalissimo of the Allied forces in France. It being vital to have a man of unusual capacity and vigour at the War Office in this critical spring of 1918, he was given the seals of Secretary of State for War on April 19; and it was he who presided over the Army Council during the succeeding months of the year which ended with victory.

In the reconstruction of the Ministry after the general election, Lord Milner left the War Office and became Colonial Secretary, a position for which his lifelong interest in the Empire peculiarly qualified him. In that capacity he attended the Paris Peace Conference as one of the British plenipotentiaries, and was a signatory of the Treaty of Versailles; and he subsequently helped to deal with a number of difficult questions arising under the Treaty out of the disposal of the German colonies conquered in war. But his colleagues utilized his services also in other directions. His financial authority was invoked to defend ministerial finance in the House of Lords; and when a serious revolutionary outbreak took place in Egypt in 1919, he was sent there, as the author of *England in Egypt*, at the head of a special mission to inquire into the causes, and to report on the form of constitution best calculated to promote Egyptian peace and prosperity. The mission arrived at Cairo in Dec. and remained till March; then in the summer of 1920 Lord Milner and his colleagues had long conferences with Zaghlul Pasha, the leader of the Nationalists, in London; and ultimately in Nov. they issued a memorandum recommending the recognition of Egyptian independence. Great Britain was to guarantee the integrity of Egypt against aggression; she would have a privileged position in Egypt and would maintain a garrison in the canal zone. The Capitulations were to be abolished, and the veto on legislation affecting foreigners would be vested in the High Commissioner. The new constitution, of which these were to be the principal features, had not yet been accepted when Lord Milner, who had only accepted office because of the national need, resigned in Feb. 1921, and his great services were fittingly recognized by the Order of the Garter. Before the end of the month he married Lady Edward Cecil, the widow of Lord Edward Cecil, formerly Miss Violet Maxse. (G. E. B.)

MILOVANOVIĆ, MILOVAN G. (1863–1912), Serbian statesman and diplomatist, was born at Belgrade on March 2 1863, and was educated there and in Paris, where he was the first Serb to take his degree as Doctor of Law and was awarded a gold medal for his thesis. On returning home he was appointed professor of international law at Belgrade University and soon acquired the position of one of Serbia's leading jurists. He was mainly responsible for drafting the new Serbian constitution of 1888; and, becoming secretary of the central committee of the Radical party, he entered politics and held successively the portfolios of Justice, Commerce, and Finance during the closing decade of last century. In 1901, at the request of King Alexander, he went to Rome as minister, and retained his post after the revolution of 1903. In 1907 he represented Serbia at the Second Hague Conference, and, in virtue of the proposals put forward by him, was appointed a member of the international court of arbitration. In July 1908 he was made Foreign Minister in the Vetimirović Cabinet, and thus had to guide Serbian policy through the difficult period of the Bosnian annexation crisis. The series of visits which he paid to the chief European capitals during the early winter insured due consideration for the Serbian standpoint and at the same time helped to calm down the inflamed sentiments of

Belgrade. In Berlin he was not received by the Imperial Chancellor, Prince Bülow; in London he was given friendly but discouraging advice by Sir Edward Grey, and on his return devoted his whole influence to restraining the war fever and sweetening the pill of Serbia's inevitable surrender to Austria-Hungary and her German ally "in shining armour." In 1910 he succeeded Pašić as Premier, and, being less of a party man than his old Radical colleagues, was able to bridge many gaps, and to acquire within a short space of time an unique position among the politicians of Serbia. Even in foreign politics he showed signal moderation, and though a confirmed Russophil, initiated negotiations for a commercial treaty with Austria-Hungary and actively favoured good relations with Turkey. Indeed the Balkan League, of which he was one of the chief founders, was originally conceived by him on much wider lines than events forced it to assume: the adhesion of Turkey and Rumania as well as the Slavonic States and Greece was to have given the League as a whole such a standing in Europe as would have rendered it immune from foreign dictation and interference. The decisive step towards the creation of the League was taken at a meeting between Milovanović and the Bulgarian Premier, Gešov, on Oct. 11 1911. Secret negotiations continued throughout the winter and led to the conclusion of the Serbo-Bulgarian Treaty of March 13 1912 (*see* SERBIA). Discussions were still pending between the various Balkan capitals for a more precise and comprehensive project of alliance when, on July 1 1912, Dr. Milovanović died suddenly of heart failure, in his 50th year. His removal at so critical a juncture was a grave blow to the cause of peace and moderation, and also deprived Serbia of her ablest statesman since the death of Prince Michael. Dr. Milovanović was married to a Rumanian lady, but left no family. He was the author of various books on law and politics and of a diplomatic study on the partitions of Poland.

MILYUKOV, PAUL NIKOLAYEVICH (1859–), Russian politician and historian, was born in 1859. He studied history and humanities at the university of Moscow, was expelled for taking part in students' riots, but was readmitted and allowed to take his degree. He specialized in the study of Russian history and received the degree of Master in History for a learned work on the *State Economics of Russia in the First Quarter of the 18th Century*. He lectured with great success at the university and at a training institute for girl teachers; these lectures were afterwards expanded by him in his book *Outlines of Russian Culture* (3 vols., translated into German). He also started an association for "home university reading," and, as its first president, edited the first volume of its programme, which was widely read in Russian intellectual circles. His liberal opinions brought him into conflict with the educational authorities, and he was dismissed in 1894 after one of the ever-recurrent university "riots." He was even imprisoned for some time as a political agitator. When liberated he went to Bulgaria, and was appointed professor in the university of Sofia, where he lectured in Bulgarian with great success. He delivered also interesting courses of lectures in the United States—at summer sessions in Chicago and later on the Lowell lectures in Boston. *Russia and Its Crisis* presents a condensed report of one of these courses.

In 1905 the meetings of the Zemstvos which gave expression to the public indignation against the Government brought him back to Russia. He became the political editor of an important liberal paper, the *Retch*, and took an active part in the formation of the Constitutional Democratic party (Cadets), which aimed at political freedom and at a constitution on advanced democratic lines, based on universal suffrage. Milyukov became the leader of that party and had a great influence on the course of events in 1906, although he was not elected a member either of the first or of the second Duma. When the Tsar dissolved the first Duma he was one of the principal prompters of the "Viborg Manifesto," in which the members of the assembly declared themselves ready to follow the people in resisting arbitrary rule. This ill-conceived pronouncement ended in complete fiasco, and disqualified its signatories from participation in political elections. Milyukov had not signed as he was not a member of the Duma, and remained free from the persecution which set in with the Stolypin reaction. He was elected to the third and the fourth Duma, and played the part of a leader of the opposition, systematically criticising the policy of the Government and the attempts at compromise on the part of the Octobrists. In the fourth Duma, however, he was in favour of a progressive block, in which liberal Octobrists took a share, as this rendered the action of the Duma more effective. When the World War broke out he stood squarely for a policy of national union and active coöperation with the Entente, but the ineptitude and corruption of the War Office and of the Court drove him into an attitude of increasing hostility. On Nov. 1 1916 he delivered in the Duma a famous speech in which he asked pointedly, in connection with Sturmer's muddle: "Is it stupidity or is it treason?" His conduct at that time was characteristic of the state of mind of advanced Liberals—they were so disgusted at the misgovernment of the Sturmers, Protopopovs and Galitzins that they were unable and unwilling to make a stand against the growing discontent of the masses. They thought and said: "We must win the war, but it is impossible to win the war with these people at the head."

When the revolt of the troops broke the back of the old régime Milyukov took office in Prince Lvov's Provisional Government as Minister of Foreign Affairs. In a speech delivered to a revolutionary mob in the Taurida Palace he proclaimed his preference for a constitutional monarchy. His hope was that Nicholas II. would abdicate in favour of his son and the Grand Duke Michael Alexandrovich would consent to act as Regent for his nephew. This plan came to nothing on account of the unwillingness of Nicholas II. to part with his son. Milyukov strongly disapproved of Kerensky's policy and of the demagogic weakness of the parties in power—the social revolutionaries and Mensheviks. He would have hailed a restoration of discipline in the army and an energetic resumption of the war on the side of the Allies, but there was no basis for such a reconstruction at a time of revolutionary intoxication. When the Bolsheviks seized power he escaped to Kiev and lived there for some time under the rule of Skoropadsky, the German-appointed Hetman of the Ukraine. In this atmosphere, saturated by German influence, he gave up the cause of the Allies as lost, and began to speculate on the possibility of rebuilding the Russian State with the help of the Kaiser. He had conversations on the subject with von Munn, the German envoy in Kiev, and advised his fellow Cadets in the same sense. The majority of the latter were, however, firmly opposed to any pact with the arch-enemy of Russia, and the turnover on the western front put an end to these plans. After the Armistice Milyukov went to London and subsequently to Paris, where in 1921 he was directing a journal (*Last News*) in which he advocated an alliance with patriotic Socialists. (P. Vi.)

MINCHIN, EDWARD ALFRED (1866–1915), English biologist, was born at Weston-super-Mare in 1866, and educated at Westward-Ho and Keble College, Oxford. He became a fellow of Merton College in 1893, and Radcliffe travelling fellow the same year. From 1890 to 1899 he was demonstrator of comparative anatomy at Oxford, and from 1899 to 1906 he held a similar chair at University College, London, being next elected professor of proto-zoölogy to the university of London. He published several works on the protozoa, especially sponges (*see* 25.716), and translated Bütschli's *Protoplasm* in 1894. He died at Selsey, Sussex, Sept. 30 1915.

MINERALOGY (*see* 18.509).—During the war period of 1914–8 much attention was given in all countries to the development of home resources of various minerals of economic value, and to meet new circumstances new sources of supply were developed. Further, there was an increased demand for certain kinds of minerals, for example those which yield the rarer metals used in the hardening of steel. Much of the mineralogical literature of the period has therefore been of an economic character, *e.g.* a long series of "Special Reports on the Mineral Resources of Great Britain" has been issued by the Geological Survey; and many recent text-books give prominence to the practical uses of minerals. Fortunately, however, pure science has not been altogether neglected. Many new facts have been recorded, and new methods of investigation have been devised. A review of the recent scientific literature is given in the Mineralogical Society's series of "Mineralogical Abstracts."

X Rays and Crystal-Structure.—The new X-ray method of investigating the internal structure of crystals has been applied with much success to the study of minerals (*see* CRYSTALLOGRAPHY). The material for examination has usually been prepared as definitely orientated crystal plates, but it is now found that results can be obtained with a fine powder, *i.e.* an aggregate of minute crystals or fragments of crystals with all possible orientations. The method can therefore be used for the purpose of distinguishing between the crystalline and the amorphous or colloidal states. Stress has recently been laid on the importance of the colloidal forms of minerals, and some authors have separated these as distinct species, to which special names have been applied, from the corresponding crystalline forms possessing the same chemical composition. It has, however, not hitherto been possible, by optical means alone, to distinguish with certainty a colloidal form from a microcrystalline mineral which is opaque or which is cubic in crystallization.

Microscopical Examination of Opaque Minerals.—A new method for the investigation of opaque minerals has recently been borrowed from metallography, in which polished sections are examined under the microscope in reflected light. This method has proved to be especially useful for the study of metallic ores, and it consequently finds an economic application in the valuation of ore-deposits. The several mineral-species of which the ore is composed can be distinguished, and their relations to one another determined; *e.g.* the order of their deposition, and whether they are of primary or secondary origin. The technique of the subject (called mineralography or mineragraphy) is dealt with in the recent text-books of J. Murdoch, *Microscopical Determination of Opaque Minerals* (New York, 1916) and of W. M. Davy and C. M. Farnham, *Microscopic Examination of the Ore Minerals* (New York, 1920). The process of grinding and polishing the sections presents certain difficulties owing to the extreme differences of hardness of the several minerals that may be present. The prepared section is illuminated vertically by means of a right-angle prism placed in the tube of the microscope above the objective. Details of structure can be brought out by etching the section with various chemical reagents. The various characters (colour, hardness, relief) of the minerals, together with their behaviour towards reagents, help in their determination. But in many cases ordinary simple tests made on fragments detached from the polished surface are more reliable. Electrical tests can be made with quite simple apparatus: for example, the electrical conductivity can be determined with a dry cell and voltmeter using needles as terminals on the polished surface. Certain optical determinations can also be made in reflected polarized light; but whilst the use of polarized light is of prime importance for the examination of transparent minerals (*e.g.* in thin slices of rocks), it has only a limited application in the case of opaque minerals. It is, however, possible to determine whether a crystal is isotropic or anisotropic, and in the latter case to determine the directions of the principal axes of refringence and of absorption.

One result of this study of opaque minerals is to draw attention to the extremely intimate association and intergrowth of many of the ore-minerals; this is well shown in the numerous photomicrographs published by American workers in economic geology. What to all appearances by ordinary methods is a homogeneous mineral may be found by the new method to be really heterogeneous; and, in fact, several supposed mineral-species have been proved to be mixtures, and well-developed crystals have in certain cases been found to contain enclosures of other minerals. The method is thus of use for ascertaining the degree of purity of material collected for exact chemical analysis when the formula of a species is to be established. The long-debated question as to how silver exists in argentiferous galena (lead-ore) has been studied by this method. Galena containing 0·10 to 0·35% of silver shows definite spots of tetrahedrite and argentite, whilst specimens containing more silver show evidence of later addition of proustite or pyrargyrite in the form of veinlets.

Mineral Transformations.—In synthetical mineralogy a large amount of experimental work has been done, more especially in the Geophysical Laboratory of the Carnegie Institution at Washington. Many minerals and allied compounds have been prepared artificially in silicate and salt fusions. The conditions necessary for their formation and their ranges of stability—either when alone or when in the presence of other compounds—have been studied in detail. One important result obtained by experimenting over wide ranges of temperature has been to show that practically all compounds known as minerals exist in several polymorphous forms. A long-known example of this is given by the three minerals andalusite, fibrolite and kyanite, all of which are composed of aluminium silicate (Al_2SiO_5), but which differ from one another in crystalline form and physical characters. Recent work has shown that silica (SiO_2) undergoes a remarkable series of changes in its crystalline structure and physical characters when it is submitted to different degrees of temperature. The changes with increasing temperature are:—

α-quartz (tetartohedral hexagonal), passing at 575° C. into
β-quartz (hemihedral hexagonal), passing at 870° C. into
β-tridymite (holohedral hexagonal), passing at 1,470° C. into
β-cristobalite (cubic) melting at 1,625° C.

These transformations are reversible, but with falling temperature they take place very slowly. Molten silica unless cooled very slowly solidifies as a glass. β-tridymite when quickly cooled undergoes a change at 163° C. (β_2-tridymite to β_1-tridymite), and at 117° C. passes over into α-tridymite, which is optically biaxial and probably orthorhombic in crystallization, being identical with the naturally occurring tridymite. Similarly, β-cristobalite when quickly cooled changes at about 180°–270° C. into α-cristobalite, which is optically biaxial (pseudo-cubic) and identical with the cristobalite occasionally found in volcanic rocks.

Now these and many other similar changes give information as to the conditions of temperature under which various minerals were formed in nature, thus providing a "geological thermometer." For example, the presence of tridymite, or of pseudomorphs of the more stable quartz after tridymite, establishes that the rock in which they occur must have been formed at a temperature between 870° and 1,470° C. The quartz of certain veins and that of granite present differences in structure which indicate that the former was formed below 575° C. and the latter above this temperature. Or, again, the presence of orthorhombic copper-glance (β-Cu_2S) as a pseudomorph after cubic α-Cu_2S proves that the ore-deposit in which it occurs was formed at a temperature higher than 91° C.

Chemical Composition.—The chemical composition of many minerals is still imperfectly understood, and even for some quite common species there are doubts as to the correct empirical formulae. This is especially the case in the large division of the silicates, a satisfactory classification of which is still wanting. Many attempts have within recent years been made to gain some idea as to the constitution of the silicates; there has been much experimental work and plenty of speculation, but with no very definite results. In certain groups, *e.g.* the felspars and the garnets, the composition can be satisfactorily expressed on the assumption of the isomorphous mixing of different chemical molecules. But attempts to extend this principle to all silicates often lead to highly complex hypothetical molecules, the existence of which can only be regarded as doubtful. Alternative suggestions have been put forward, such as the "mass effect" of large molecules and the "solid solution" of certain other substances in the main mass of the crystal. Experiments with silicate fusions show that various substances can be taken up, or dissolved, in certain amounts, giving on solidification apparently homogeneous crystals.

As an example, the recent discussion on the composition of nephelite (*see* 19.383) may be cited. Analyses of this mineral invariably show an excess of silica over that required by the orthosilicate formula $NaAlSiO_4$, and sodium is always partly replaced by an equivalent amount of potassium in the varying ratio (Na:K) of 5·5:1 to 3:1, whilst a small amount of calcium is also present. Here the excess of silica (the ratio $SiO_2:Al_2O_3$ ranging from 2·1:1 to 2·2:1) has been assumed to be present in "solid solution" in an isomorphous mixture of $NaAlSiO_4$ and $KAlSiO_4$. The higher ratio of 2·2:1 is regarded as the "saturation ratio" of the silica, for when it is exceeded visible albite is found with the nephelite. Another view expresses the composition of nephelite as an isomorphous mixture in varying proportions of the following molecules, in one of which SiO_4 is replaced by Si_3O_8:—

$$\left\{\begin{array}{ll} NaAlSiO_4 & \text{(known as an artificial compound; soda-nephelite} \\ & \text{below 1,248° C., and as the triclinic felspar} \\ & \text{carnegieite above this inversion-temperature).} \\ KAlSiO_4 & \text{(the mineral kaliophilite).} \\ NaAlSi_3O_8 & \text{(hypothetical isomer of albite).} \\ Ca_{\frac{1}{2}}AlSiO_4 & \text{(hypothetical isomer of anorthite).} \end{array}\right.$$

Or, again, the following series of "normal" nephelites, each representing a double compound of alumotrisilicic acid ($H_2Al_2Si_3O_{10}$) and alumodisilicic acid ($H_2Al_2Si_2O_8$), has been suggested:—

$$\begin{aligned} K_2Na_8Al_{10}Si_{11}O_{42} &= K_2Al_2Si_3O_{10} + 4\,Na_2Al_2Si_2O_8. \\ K_2Na_9Al_{11}Si_{12}O_{46} &= K_2Al_2Si_3O_{10} + 4\tfrac{1}{2}Na_2Al_2Si_2O_8. \\ K_2Na_{10}Al_{12}Si_{13}O_{50} &= K_2Al_2Si_3O_{10} + 5\,Na_2Al_2Si_2O_8. \\ K_2Na_{11}Al_{13}Si_{14}O_{54} &= K_2Al_2Si_3O_{10} + 5\tfrac{1}{2}Na_2Al_2Si_2O_8. \end{aligned}$$

Whilst for a slightly more basic type is given the (highly improbable) formula:—

$$K_4Na_{18}Al_{22}Si_{23}O_{90} = 2K_2Al_2Si_{2\frac{1}{2}}O_9 + 9Na_2Al_2Si_2O_8.$$

Another, less complex, example is afforded by the mineral pyrrhotite (*see* 22.696). In its meteoric equivalent, known as troilite, the composition is quite simple, namely FeS, but in the terrestrial mineral there is always an excess of sulphur, as represented by the formulae Fe_7S_8, $Fe_{11}S_{12}$, etc., or in general Fe_nS_{n+1}. When pyrites (FeS_2) is heated it dissociates at 565° C. into pyrrhotite and free sulphur, and the composition of the resulting pyrrhotite varies with the temperature and the pressure of the surrounding sulphur-vapour. It is therefore concluded that the excess sulphur is absorbed by the ferrous sulphide, or in other words present in "solid solution," the formula being written $FeS(S)_x$. The absence of any excess of sulphur in the troilite of meteorites is accounted for by the coexistence of free iron.

Radioactivity.—The strong radioactivity of uranium minerals affords a ready means of recognizing these valuable ores in the search for them by prospectors. The mineral may be wrapped up with a photographic plate, which is afterwards developed; but a simpler and quicker test is that with a quite simple (home-made) gold-leaf electroscope. A piece of the mineral to be tested is placed on the cap of the electroscope, which is then charged with electricity, readily developed by rubbing glass or vulcanite (say the mouth-piece of a tobacco-pipe): if the mineral contains uranium (and consequently radium), the gold leaves will soon come together. It is always well to make a comparative test, timing the rate of collapse, with a piece of ordinary stone.

Determinations of the ratio of the amount of uranium to the amounts of the various products of its decay (radium, helium, lead, etc.) present in various radioactive minerals give (knowing the rate of the decay) some idea of the period of time during which these products have been accumulating. In this way estimates have been made of the age in years of these minerals and even of the age of the earth; but, of course, many unknown factors must have been omitted from such calculations. Lead of radioactive origin, or isotopic lead—the final product of the decay of uranium—is found to vary slightly in its atomic weight according to the uranium mineral from which it is extracted.

To radioactivity is ascribed the well-known "pleochroic haloes"—tiny spots or borders of deeper colour surrounding microscopic inclusions—long ago observed in certain rock-forming minerals (cordierite, andalusite, mica, etc.) when micro-sections of rocks are examined in polarized light. The long and continued emission of X-rays from zircon or other mineral grains has caused a change in colour of the surrounding mineral for distances varying from 0·002 to 0·04 mm. A study of these has again given some information as to the age of the minerals. In this connexion it may be mentioned that much experimental work on the coloration of minerals has been done within recent years by exposing the minerals to the action of radiations of various kinds, including ultra-violet rays, cathode rays, Röntgen rays and the rays emitted by radium salts. For example, some diamonds acquire a green colour, and fluorspar becomes blue when placed in contact with radium bromide.

New Minerals.—In descriptive mineralogy a considerable number of new minerals have been named, but unfortunately in many cases not completely determined and described. A few of the more prominent and well-established of these are:—

Alamosite, lead metasilicate, $PbSiO_3$, found at Alamos, Sonora, Mexico, as radially fibrous masses with snow-white colour and adamantine lustre. Crystals are monoclinic, and the mineral is analogous to wollastonite ($CaSiO_3$).

Amosite, a variety of monoclinic amphibole-asbestos rich in iron (FeO 32–44%) and consisting essentially of ferrous silicate with but little magnesia. It is of the "cross-fibre" type and resembles crocidolite in its mode of occurrence, thus differing from the ordinary type of amphibole-asbestos. It is found over a wide area in north-eastern Transvaal and is named from the Amosa asbestos mine, this word being formed of the initial letters of the company "Asbestos Mines of South Africa."

Betafite, a hydrated titano-columbate of uranium containing UO_3 26–28%. It occurs in pegmatites near Betafo in Madagascar as sharply developed octahedral crystals with the edges truncated by faces of the rhombic-dodecahedron. Curiously flattened crystals are also found.

Carnotite, hydrated vanadate of uranium and potassium, $K_2O{\cdot}V_2O_4{\cdot}2U_2O_3{\cdot}3H_2O$, occurring as a canary-yellow crystalline powder impregnating sandstones over a wide area in western Colorado and the adjoining portions of Utah and New Mexico. In Colorado it has been collected on a large scale for the extraction of vanadium, uranium and radium. It has also been found in South Australia and in Pennsylvania; and an allied mineral (tyuyamunite, containing calcium in place of potassium) is known from Tyuya-Muyun in Russian Turkestan.

Inyoite, hydrated calcium borate, $2CaO{\cdot}3B_2O_3{\cdot}13H_2O$, found as large, colourless, monoclinic crystals in the borate deposits of Inyo county, Cal., and in the gypsum mines at Hillsborough in New Brunswick.

Lorandite, sulpharsenite of thallium, $TlAsS_2$, forming transparent, monoclinic crystals with a carmine-red colour and adamantine lustre. It is found with realgar at Allchar in Macedonia, and is one of the few minerals that contain the rare element thallium as an essential constituent (Tl 59·5%).

Margarosanite, metasilicate of lead and calcium, $PbCa_2(SiO_3)_3$, occurring as colourless or snow-white, platy masses and anorthic crystals with pearly lustre. It has been found at Franklin in New Jersey and at Långban in Sweden.

Otavite, basic carbonate of cadmium (Cd 61·5%), occurring as small, pearly white, curved rhombohedra on copper and lead ores at Otavi in South-West Africa. The only cadmium mineral previously known is the sulphide, greenockite.

Patronite, vanadium sulphide, VS_4, forming dark, greenish-black, compact masses. It occurs abundantly at Minasragra, Cerro de Pasco, Peru, where it is a valuable ore of vanadium. It weathers very readily with the production of various highly coloured vanadium compounds; even on material kept in collections there is a slow growth of blue and green efflorescences.

Spencerite, hydrated basic zinc phosphate, $Zn_3(PO_4)_2{\cdot}Zn(OH)_2{\cdot}3H_2O$, forming pearly white, scaly cleavage masses and small monoclinic crystals. It has been found in some abundance forming large stalactites in a cavern near Salmo, British Columbia.

Stichtite, hydrated basic carbonate of magnesium and chromium, $MgCO_3{\cdot}5Mg(OH)_2{\cdot}2Cr(OH)_3{\cdot}4H_2O$, occurring as foliated masses with pearly lustre and bright lilac colour. This colour forms a striking contrast to the bright green serpentine in which the mineral is embedded. It has been found in western Tasmania, in the Transvaal, and near Black Lake in Quebec.

Tarbuttite, basic zinc phosphate, $Zn_3(PO_4)_2{\cdot}Zn(OH)_2$, forming colourless, or faintly coloured green or red, anorthic crystals, with a perfect cleavage in one direction. It has been found in considerable quantity at the Rhodesia Broken Hill mine in northern Rhodesia.

Thortveitite, silicate of scandium, yttrium, etc. $(Sc,Y)_2O_3{\cdot}2SiO_2$, occurring as large orthorhombic crystals of prismatic habit in pegmatite in southern Norway and Madagascar. This is the only mineral known to contain the rare element scandium in large amount.

Tungstenite, tungsten sulphide, WS_2, forming minute scales resembling molybdenite and graphite in appearance. It is found intimately intermixed with other ores in the Little Cottonwood district, Utah.

REFERENCES.—Details of descriptive mineralogy are collected in Appendices 1–3 of Dana's *System of Mineralogy* (New York 1899–1915); and numerical data respecting the constants of minerals are tabulated in the international *Tables annuelles de constantes et données numériques* (4 vols., Paris 1912, etc.). A new work of a comprehensive character is C. Doelter, *Handbuch der Mineralchemie* (3 vols., Dresden and Leipzig 1912, etc.). A number of elementary text-books have been published, *e.g.* F. H. Hatch, *Mineralogy* (London 1912); G. A. J. Cole, *Outlines of Mineralogy for Geological Students* (London 1912); A. F. Rogers, *Introduction to the Study of Minerals* (New York 1912); A. H. Phillips, *Mineralogy, an Introduction to the Theoretical and Practical Study of Minerals* (New York 1912); E. H. Kraus and W. F. Hunt, *Mineralogy, an Introduction to the Study of Minerals and Crystals* (New York 1920). A popular book with coloured plates is L. J. Spencer, *The World's Minerals* (London 1911). Books of an economic character are H. Ries, *Economic Geology* (4th ed., New York 1916); T. Crook, *Economic Mineralogy, a Practical Guide to the Study of Useful Minerals* (London 1921); B. Dammer and O. Tietze, *Die nutzbaren Mineralien* (2 vols., Stuttgart 1913–4); O. Stutzer, *Die wichtigsten Lagerstätten der "Nicht-Erze"* (Berlin 1911, etc.). New journals are *Fortschritte der Mineralogie, Kristallographie und Petrographie*, ed. by G. Linck (Jena since 1911); *Beiträge zur Kristallographie und Mineralogie*, ed. by V. Goldschmidt (Heidelberg since 1914). (L. J. S.)

MINESWEEPING AND MINELAYING.—Among the naval services rendered to Great Britain and the Allies during the World War, none were more conspicuously important than the work of British minesweepers and minelayers; and minelaying was a large item in the naval war record of Germany.

Minesweeping.—As early as 1907, Adml. Lord Charles Beresford, when commander-in-chief of the British Home Fleet, had recommended the use of Grimsby trawlers for the service of minesweeping. A trawler reserve, R.N.R. (T.), had been constituted under an inspecting captain of minesweeping vessels, and the system worked so well that by Aug. 8 1914, 96 hired trawlers had put to sea. The needs of minesweeping had, however, only partly been foreseen. When the war broke out the only minesweepers with the fleet were six torpedo gunboats fitted with the "A" sweep, a single wire kept at a required depth by water-kites and towed between two sweepers 500 yd. apart. It soon became evident that minelaying played an important part in German strategy, and after the "Amphion" had been sunk on the field laid off Aldeburgh by the "Königin Louise" on Aug. 5, a hundred additional trawlers were ordered and Lowestoft became the principal minesweeping base on the east coast. On Sept. 1 Rear-Adml. E. Charlton was appointed Rear-Admiral Minesweeping on the East Coast, in charge of minesweeping operations and technical arrangements, leaving the inspecting captain to attend to the business of supply.

Minesweeping at this time was largely in the experimental stage and some time elapsed before it was able to cope with the magnitude of its task. One of the first steps taken to ensure the safety of shipping was the institution of a war channel up the east coast, clearly marked by buoys 2 m. apart, from the Downs, past the Shipwash, Newarp and Cromer's Knoll to Flamborough Head. This was swept daily by local trawler flotillas and provided a safe channel up the east coast. Trawlers, however, were too slow for emergencies, and ordinary excursion paddle-steamers of light draught and good sweep were introduced with very successful results. A special design of sloop—the "Flower" class of 1,200 tons, 250 ft. long, 11 ft. draught and 16 knots—was laid down in large numbers, but these were not ready till April 1915.

The loss of the "Audacious" off Tory I. (Ireland, N.) on Oct. 27 still further emphasized the necessity of a large and efficient minesweeping service. The minefield laid by the German s.s. "Berlin" consisted of some 200 mines running approximately N.E.–S.W. north of Tory Island. It was not definitely located till Dec. 20, and, though 43 mines had been swept up and 70 drifted ashore by the end of April, was not cleared till July 1915. It must be remembered that the loss of a ship or the discovery of a mine merely served to indicate the proximity of a minefield. Before its extent could be defined and the clearance completed a number of exploratory sweeps were required which were often delayed by bad weather.

The German mines laid during 1914 were laid by surface craft in the following areas:—

Date	*By*	*Area*	*Mines*
Aug. 5	"Königin Luise"	Southwold	180
Aug. 26	"Nautilus"	Humber	200
	"Albatross"	Tyne	194
Oct. 26	"Berlin"	Tory I. (Ireland)	200
Nov. 3	"Kolberg"	Smith's Knoll	130
Dec. 16	"Kolberg"	Scarborough	100

They accounted for 42 merchant vessels or approximately one vessel for 24 mines. The measures taken to meet the danger consisted in the establishment of a war channel and the preliminary steps for a great expansion of the minesweeping service.

Minelaying played an important part in the German raids on the east coast, and the raid on Dec. 16 1914 was intended to cover a minelaying operation by the "Kolberg," in which she laid 100 mines off Scarborough. Two of these mines were found by gunboats on Dec. 19, and half an hour later a Grimsby trawler minesweeping unit brought 18 to the surface simultaneously. Two of its trawlers struck mines and the field was not finally cleared till April 1915, 69 mines being accounted for out of 100 laid, with heavy losses to shipping, including 7 British and 7 neutral steamers, 2 trawlers, 4 minesweepers and an armed yacht.

By April 1915 the minesweeping forces had increased considerably and were distributed as follows:—Grand Fleet, 6 gunboats, 1 sloop and 9 trawlers; Scotland, east, 47 trawlers; Humber, 6 paddlers, 30 trawlers; Lowestoft (war channel), 47 trawlers; Harwich and Nore, 33; Dover, 12; South Coast, 24; West Coast, 4; Clyde, 6 paddlers (fitting out). The principal minefields laid by German surface craft in 1915 were:—

Spring 1915	Eastern Dogger Bank	480
April 4	Humber approach (Swarte Bank and Indefatigable minefields)	360
Aug. 7–8	Moray Firth by "Meteor"	380
Jan. 1 1916	Whiten Bank (west of Orkneys) by "Moewe"	252

The Eastern Dogger Bank minefield was large but not a single British vessel of any size was lost in it. Sixty-nine mines were swept up there and the swell of the winter sea probably completed the task of clearance.

The fields off the Humber were responsible for the loss of 4 British, and 5 neutral steamers and 3 minesweepers, but the field was defined by May 1915; 127 mines were swept up that month and by the middle of July it was clear. The fields laid by the "Meteor" in Aug. 1915 and by the "Moewe" on Jan. 1 1916 were aimed directly at the Grand Fleet. The "Meteor" made the Scottish coast at dusk on Aug. 7 and, starting from a position about 22 m. N. of Kinnaird Head, laid 380 mines in the approach to the Moray Firth during the night. The first notification of them came from a Cromarty trawler minesweeper making a routine sweep on the morning of Aug. 8. The destroyer "Lynx" was lost the same day and the sloop "Lilac" had her bows blown off. After clearing a 10-m. channel along each shore and removing 222 mines, the rest of the field was left unswept as a protection against similar attacks. In the final mine clearance in 1918 only four mines were found in it.

The German minefields on the east coast gave rise to the erroneous idea that they were associated with a prospective landing operation. An equally erroneous idea that mines were laid by neutral trawlers obtained so firm a hold in the Grand Fleet that it led the commander-in-chief to ask for the exclusion of all neutral trawlers from British ports.

In the Mediterranean minesweeping played an important part in the attempt to force the Dardanelles. The problem was the same as that which confronted the Germans at Ösel in the Baltic in 1917. The task was one of peculiar difficulty, for it meant sweeping under the fire of batteries, and the strong current reduced the speed of trawlers with sweeps out to less than 3 knots. It was a task which required high-speed sweepers and a highly trained personnel, and even with their agency its feasibility may be doubted. The technical difficulties of the task were greatly underestimated. It was regarded as a simple piece of work which any vessel fitted with a sweep could perform, and it was attempted with a motley collection of slow trawlers, assisted by a parcel of destroyers fitted with sweeps for the first time. The sweep principally used at this time and throughout the war was the "A" sweep, consisting of a single 2½-in. wire towed between two ships steaming 500 yd. apart, with its depth regulated by a water-kite 12 ft. long and weighing a ton. The end of the wire had to be passed from one vessel to the other and to do this rapidly under fire required an exceptional combination of training, skill and courage. In the case of fast sweepers, the momentum of the wire was sufficient to cut the mooring of the mine, but slow sweepers in the early years of the war had to take their sweeps into shallow water where the mines could be seen and sunk. This made sweeping slow work, and it also meant that the "A" sweep was really only effective by day; so that sweeping a minefield under heavy fire was almost impracticable.

The year 1915 saw an important development in the use of submarines for minelaying by the Germans. The Flanders Flotilla were the first workers in this field and their mines were first discovered off the S. Foreland on June 2 1915. These were laid by small boats termed UC boats, equipped with 12 cylindrical mines with charges of 350 lb. of T.N.T., carried in vertical shoots. The mine dropped with its sinker to the bottom and was released from the sinker by a "dashpot" arrangement about half an hour after reaching the bottom, giving the submarine time to get clear. The mooring-wire coiled into the sinker was drawn off by the mine as it rose, and when the proper depth was reached it was gripped by a strong spring clamp released by a hydrostatic valve. Submarine minelaying threw a heavy strain on the minesweeping forces at Harwich, Dover and the Nore, which were the areas principally affected at first, and the continuous location of small groups of mines gave rise to an incessant stream of orders for the diversion or stoppage of traffic which greatly hampered coastal navigation.

The Germans report having laid 648 mines between Grimsby and Dover by submarines in 1915, of which 150 were laid in the Dover area (not including the Belgian and French coasts), 180 off the Nore, 306 in the Lowestoft area and 12 off Grimsby. The number of mines swept up in this area was approximately 500, and the losses in the last six months of the year showed a serious increase, comprising 3 destroyers, 5 supply ships, one hospital ship, 2 Trinity House vessels, 34 British steamers, 24 neutrals, 10 fishing boats, 15 minesweepers (3 paddlers, 9 trawlers)—a total of 94 vessels. In June 1915 the Germans had extended their minelaying to Archangel, and a unit of 6 trawlers had to be despatched there; the unit destroyed over 150 mines by October, with the loss of H.M.S. "Arlanza," one trawler, 6 British steamers, one Russian and 2 neutrals.

The "Actaeon" sweep, called after the parent ship of the Sheerness torpedo school, came into use at this time. It was a single-ship sweep, consisting of a light wire, a small kite, a depth float and an explosive grapnel, and was towed from each quarter of a minesweeper. On meeting a mine, the explosive grapnel parted its mooring; the sweep proved particularly useful in locating new fields, and had the advantage over the "A" sweep that it could be used by night.

The outlook at the end of 1915 was far from bright, and the minesweeping service was barely able to meet the strain in spite of the better design and greater number of its ships.

By the beginning of 1916 the hired paddle-sweeper force had grown to five units, numbering 35 vessels in all, and 14 sloops were in commission with the Grand Fleet. Twenty-four Admiralty paddlers of 810 tons and 6¾ ft. draught were being built and were distributed during the year between the Forth and Dover straits. A new type of twin-screw sweeper of 750 tons with a draught of only 7 ft., called the "Hunt" class, was completing and the whole batch of 12 was allocated to the Grand Fleet. The Burney paravane was also past its trial stage and by the end of the year was supplied to all ships of over 12 ft. draught. This instrument was the product of Lt. Denis Burney's genius. Shaped like a torpedo and about 12 ft. long, it was towed from a special shoe on each side of the bows, being held at its proper depth by a hydrostatic arrangement and at its proper distance by rudders. The mooring-wire of any mine it met was swept clear of the ship into jaws of serrated steel and quickly cut. The mine came to the surface and could be sunk. The "otter" was a modified form of paravane for use in merchant ships where its fitting became compulsory in 1917. The paravane justified its adoption: 180 warships and 2,740 merchant ships were fitted with it; in the former it cut 55 mine wires during the war, and in the latter at least 40 or 50. Another simpler but useful invention, in the form of a special sort of serrated wire for sweeping, also dates from 1916; it could cut through a mine's mooring-rope when towing it no faster than a trawler (4 to 5 knots).

Surface minelayers were still active, and the raider "Moewe" on her way out to the ocean laid a large minefield of some 250 mines on New Year's day, 1916, on the west side of the Orkneys. Commencing about 10 m. from the Orkneys it ran in zig-zags at 3 to 7 m. from the mainland. The loss of the pre-dreadnought battleship "King Edward VII." on the morning of Jan. 5 was the first sign of it, and two neutral steamers were sunk in the same field. Gales interfered seriously with its clearance but by May some 71 mines had been destroyed. All other German mines laid in 1916 were laid by the submarine flotillas, which were now reinforced by a number of UC boats carrying 18 mines and by several larger boats (U71–80) carrying 34 to 36. Some were attached to the Flanders Flotilla and worked from Bruges and Zeebrugge; others, including the larger minelayers, were attached to the High Sea Fleet and worked from the Elbe. Each of the two flotillas was allotted a separate area of the British coast for minelaying. The High Sea Fleet boats worked N. of Flamborough Head. The Flanders Flotilla area comprised the coastline from Flamborough Head to Dover, the English Channel, the Irish Sea and Irish S. coast to Waterford.

A field laid on the west coast of the Orkneys was to have an unforeseen result. It was laid on May 29 by the U75, one of the large minelayers, as part of the Jutland operations, and at 8 P.M. on June 6 the "Hampshire" on her way to Archangel struck a mine in it off Marwick Head, foundering almost immediately and bringing Lord Kitchener's career to a dramatic close. A trawler unit, searching the spot as soon as the weather moderated, found 15 mines laid at 7 metres in a spot where the strong current and tidal dip would have enabled the "Hampshire" to pass over them in a normal sea. From May to Oct. 1916 German minelaying in the English Channel ceased as a result of an imperial order, dictated by the American note of April 18, to confine submarine warfare strictly to the conditions of prize law. Scheer went further than the imperial command, and ordered his flotillas on April 24 to cease all operations against merchant ships, while the Flanders boats, following suit, limited themselves to minelaying off Lowestoft, Harwich and the Nore.

In Oct. 1916 submarine operations against merchant shipping were resumed, and minelaying broke out with renewed activity. Mines were laid off the Clyde (Oct. 3) and in November off the Isle of Man. The close of 1916 saw a determined attack by the Flanders submarines against the ports in the Channel and mines were laid off Portsmouth, Dartmouth, Plymouth and Falmouth. The French coast opposite Dover was also heavily mined. In the Dover area 212 mines were laid during the year (not including 100 off Dunkirk, 100 off Calais and 60 off Boulogne), with a loss of two destroyers, five minesweeping trawlers and 20 steamers.

The unrestricted submarine warfare in 1917 was accompanied by an increase in submarine minelaying, and in the month of April 515 mines were swept up, considerably more than in any previous quarter. The reorganization of the naval staff led to considerable changes in the minesweeping service. The director of torpedoes and mining now took charge of the development, supply and distribution of gear, while the control of operations and the distribution of all vessels was delegated to a captain of minesweeping (Capt. Lionel Preston), who in Oct. 1917 became director of the minesweeping division under the assistant chief of the naval staff. Losses in minesweeping vessels were heavy in the early part of the year, amounting to as many as one *per diem* in April 1917, but the use of aircraft patrols and of shallow-draught motor-launches proved useful in locating mines and diminished the loss of heavy-draught sweepers. The extended range of enemy minelaying and the heavy losses amongst minesweepers led to an increased demand for them. Thirty small paddle-steamers, 10 small tugs and 18 drifters were requisitioned, and orders were issued for the construction of 100 more "Hunt" class (800 tons, 7½ ft. draught, 18 knots) and 300 drifters.

The war channel now ran up the east coast as far as the Tees in the shoalest possible water, and shipping was released from various night anchorages in the Downs, Black Deep and Great Yarmouth as soon as it had been swept at dawn. Improvements in organization during the year led to a reduction of 20% in merchant-ship losses, though the mines swept up were double those in 1916.

The operations of the High Sea Fleet Flotilla were extended in the spring of 1917 to the Minch and the routes of the west coast of Scotland used by destroyers and fleet auxiliaries, much of the work being done by the U80, one of the large submarine minelayers. In 1916 195 distinct mine groups had been laid, chiefly on the east coast; in 1917 the number rose to 536 and the sphere of operations extended right round the British Isles. This involved a further expansion of the minesweeping service, and the fast sweepers (sloops, gunboats, paddlers) increased from 93 to 122, the slow (trawlers, drifters) from 430 to 509. The deep water off the Yorkshire coast had been a favourite cruising ground for submarines, but large protective minefields were now laid there as an off-shore protection with good results.

The Harwich area was exceptionally busy in 1917, and its work in that year must rank as one of the principal minesweeping achievements of the war. Mines were regularly laid by German submarines in the latter part of the year to catch the Holland trade, and a new minefield off the Maas Light, laid in April 1917 and regularly renewed, became a source of constant trouble. Out of 680 mines laid 635 were destroyed, with the loss of four merchant ships and eight minesweepers. The enemy had to pay a heavy toll for his work, and lost 12 minelaying submarines in the southern portion of the North Sea during 1917. The port of Liverpool, as the principal arrival base for Atlantic transports, was a constant source of anxiety, and at the beginning of 1917 had only two minesweeping trawlers attached to it. Mines were reported there on March 24 1917, and on April 9 the "New York," with Adml. Sims on board, struck a mine, but the port was fortunately left alone till December, by which time the protective arrangements had greatly improved. Of 45 mines laid in the Mersey area 33 were accounted for, with the loss of five merchant ships and one pilot steamer in which 28 pilots lost their lives. In the W., Lough Swilly and the approaches to the Clyde were all mined during 1917, some 88 mines being laid in this area and off Belfast, of which 72 were destroyed, with the loss of four steamers, one destroyer and five trawler minesweepers. The south coast of Ireland also became a regular region of visitation, and the small tidal range and heavy swell made minesweeping particularly dangerous there. The 10th Sloop Flotilla was sent from Immingham to Queenstown in Feb. 1917 to cope with the new danger, and two of its sloops were mined in the following month. It was off this coast the UC44 was working in summer, to be blown up on Aug. 4 by one of her own old mines off Waterford. Out of 380 mines laid by the High Sea Fleet minelayers and 36 by the Flanders Flotilla in this area, 332 were accounted for with the loss of nine steamers and nine minesweepers. Some 26 mines were also laid off the west coast of Ireland, but did no damage, except in one case where the villagers mistook one which had drifted ashore for a new sort of cask of liquor and tried to open it, with the loss of nine lives. Off the west coast of Scotland, out of 130 mines cleverly laid by the U80 off Mull, Stornoway, Coll, Skye and Harris, 76 were accounted for.

The year 1917 closed with a total of 3,989 enemy moored mines swept up in home waters, at a cost of 170 Allied and neutral merchant ships sunk and 28 damaged. The whole outlook was more hopeful, for while enemy minelaying as compared with 1916 had more than doubled, the number of ships sunk had increased only from 161 to 170.

Abroad the voyage of the German raider "Wolf" (Capt. Karl Nerger) had given minesweepers work in many an unexpected spot. She left Germany on Nov. 30 1916, slipped through the blockade line and got safely out to sea. She was a ship which registered 6,000 tons and carried 458 mines besides an armament of four 6-in. guns. Her voyage lasted 15 months. Rounding Cape of Good Hope, she cruised in the Indian Ocean, then proceeded south of Australia to New Zealand and Fiji, and, returning by New Guinea, the Dutch East Indies and the Cape, reached Germany safely in March 1918. Her mines were found all over the globe. Her first group of 25 was laid off Dassen I. (Capetown) and her second of 29 on Jan. 18 off Cape Agulhas (S. Africa). The former were swept up by four whaling steamers commissioned for the purpose. In the Agulhas field two vessels were lost and only seven mines swept up in 1917. On Feb. 15 1917 39 mines were laid off Colombo and 19 off Cape Comorin (Ceylon). One of her prizes, the "Turritella" (renamed "Iltis"), dropped some 25 off Aden, and a large group of 68 mines off Bombay was laid by one of the two ships. The Colombo group was swept up by six trawlers, with the loss of two large ships. The Aden group was dealt with by small harbour tugs manned by Somalis within two months of its location and with the loss of one ship. The large group off Bombay was attacked by local vessels manned by British officers and Lascars, and 51 of its mines were swept up by June with the loss of five steamers.

The "Wolf's" next mining exploit was in Australian seas, where she laid 14 mines off Gabo I., the S.E. point of Australia, between Melbourne and Sydney, with the loss of one steamer; this was followed by a cruise to New Zealand, where 15 mines were laid in Cook Strait, between North and South Is., and 17 off Three Kings I. in the extreme north. These were all dealt with by Australian and New Zealand naval forces. Her last effort consisted of 110 mines laid N.W. of the Andaman Is. (Indian Ocean) on Sept. 4 1917, which were not located in that year. Her mines were responsible for the loss of some 15 ships, and it was not till Jan. 15 1918 that definite news of her movements was received at the Admiralty.

But by 1918 the effect of improved British methods was telling heavily on the enemy. The toll of German losses and the difficulty of replacing trained personnel were seriously affecting her minelaying, and the total number of Allied and neutral merchant vessels lost by German mining fell to 27. Closer coöperation between the intelligence and minesweeping divisions, the rapid distribution of intelligence, the firmer control of shipping and the use of the "otter"—all contributed to this very marked decrease.

The Germans now began to concentrate their minelaying efforts in three special directions—the maintenance of a minefield off the Dutch coast directed against the Dutch convoys, the laying of a large semicircular barrage about 45 m. from the Forth aimed at the Grand Fleet, and attacks on the route of the Scandinavian convoys. The first took the form of a field laid off Ymuiden and the Maas containing some 400 mines, which was extended by the labours of two U-boat minelayers working continuously in this area. It was responsible for the loss of five destroyers and remained a source of grave danger, for minesweepers working there were exposed to sudden attacks from the Flanders coast. The barrage off the Forth met with no success. The mines were rapidly located (in two cases by paravanes) and swept up almost as soon as they were laid. The attacks on the Scandinavian convoy routes were equally unsuccessful. Some 90 mines were swept up with the loss of only one steamer.

In the Harwich area 265 mines were laid, of which 213 were accounted for, with the loss of five steamers and four minesweepers. The discovery of a mine off Walney I. (Lancashire) on March 8 led to special vigilance in that area, and when mines were laid in the Mersey the next night, a unit of paddlers, held in readiness for the emergency, was at work at once clearing the fairway and opened the port to traffic within 48 hours.

The introduction of a French pattern of scissors to cut through the mooring-wire of a mine was one of the developments of the later years of the war, though the difficulty of minesweeping did not lie in cutting the mine's mooring-wire when found but in finding the mine in a trackless expanse of water under all sorts of conditions of tide and weather.

A very considerable amount of minesweeping work in 1918 arose out of British minelaying. The mines in a portion of the northern barrage were laid too shallow and had to be swept up in the approaches to the Orkneys. The same fault was found in Dover barrage, where some 280 mines had to be swept up and a great increase in drifting mines was experienced. The Channel still continued to be visited occasionally, and in the Portsmouth area 44 mines were accounted for with the loss of two merchant ships and two minesweepers.

In the Mediterranean, the enemy had devised a mooring system for tideless waters which permitted of mines being laid in 100 fathoms, but the clear blue water lent itself to aircraft reconnaissance which, in concert with light-draught motor-vessels, made location easy. Thirty mines were destroyed off Malta during the year 1918 with the loss of one steamer. The minesweepers were largely manned by Maltese reservemen who displayed a gallant spirit and seamanlike competency in their work.

Long before the Armistice, British minesweeping had gained the mastery over German minelaying, and as soon as Ostend and Zeebrugge fell into British hands, the protective minefields round them were swept up. When the hour of the Armistice struck, a minesweeping force was waiting at the gate of the Dardanelles, and within 24 hours 600 British and enemy mines had been removed from the entrance and a passage cleared for the fleet to Constantinople.

A few words may be said as to the method of distributing information of mines. This was sent out in what were called, from their index letter, "Q" messages, which were priority messages going to all shore stations by land wire and to all forces at sea by Cleethorpes wireless station at regular intervals. Immediately a mine was discovered or swept up, the spot was buoyed and local traffic at once diverted or, if the mine was in the war channel, held up. As soon as tidal conditions permitted, the area was swept. The text of a "Q" message was sent by the senior officer to the Admiralty, and, after being checked by the Minesweeping Division, was at once sent out to all ships and stations, the average time from the discovery of a mine to the issue of information to ships at sea being about 1¼ hours.

The growth of the minesweeping service and the greatness of its task, performed largely by British fishermen, may be gathered from the following figures. At the Armistice the minesweeping forces in British home waters comprised 110 fast sweepers organized in 20 minesweeping flotillas, 52 hired paddlers, 412 trawlers, 142 drifters and 10 "Dance" minesweepers—a total of 726 vessels. The number of mines destroyed at home and abroad by British vessels during the war amounted to 23,873 (moored, 11,487; drifting, 12,386). The ships sunk and damaged by mines numbered 595. The number of minesweepers sunk or damaged was 214, in the following areas: Fleetsweepers, 5; Lerwick, 1; Kirkwall, 3; Cromarty, 3; Peterhead, 2; Granton, 9; Tyne, 6; Grimsby, 15; Lowestoft, 48; Harwich, 24; Nore, 15; Dover, 33; Portsmouth, 13; Portland, 1; Plymouth, 3; Falmouth, 2; Bristol Channel, 6; Queenstown, 7; Belfast, 6; Clyde, 2; Stornoway, 1; abroad, 9.

Minelaying.—Minelaying played a very important part in the later years of the World War, but to form a true estimate of its value a careful distinction must be drawn between three factors essential to its success—its strategical use and function, the technical design of the mine, and the operation of minelaying. The offensive power of the mine and its place in naval strategy had not been appreciated at the outbreak of war. Its use for the defence of harbours had been abandoned by Lord Fisher several years before; and though a squadron of seven old cruisers had been converted into minelayers ("Andromache," "Apollo," "Intrepid," "Iphigenia," "Latona," "Naiad" and "Thetis," 3,400 tons, 18-ft. draught, 14 knots), more than two years were to pass before discovering a reliable mine. This was properly the task of the torpedo school-ship "Vernon," but hampered by lack of funds its work was not attended with very happy results. The details of the Russian mine were well known to the British authorities. It was simple and effective and the pattern was adopted by the Germans with conspicuous success, but it cost some £200 and the British had to be content with a cheaper one. This was the naval spherical mine, and at the outbreak of the war there were 4,000 available.

The original plans had provided for laying mines in the southern part of the North Sea, and the notices to mariners and neutrals were ready to print when it was found that the pistol was too sensitive and the mooring-wire too weak. The older admirals were also inclined to deprecate them, on the grounds that the British should keep the sea as open as possible for the use of their own ships. The sinking of the "Cressy," "Hogue" and "Aboukir," which left the Belgian coast open to attack, startled the navy out of this opinion, and it was decided by Great Britain to lay mines in the North Sea. This was notified to neutrals, and the first line of 1,264 mines was laid on Oct. 2 1914, 10 m. N. of Ostend. In Nov. mines were reintroduced for defence of harbours, and a special corps of Royal Marine submarine miners was started to manipulate them. By the end of 1914 some 2,000 mines had been laid in the southern part of the North Sea, which had a good effect in forcing neutral shipping to pass through the Downs, and for a time deterred enemy submarines from approaching the Channel. During 1915 a number of fields were laid in German waters and the minelaying squadron was greatly strengthened. It now consisted of the "Princess Margaret" (Canadian Pacific railway, 5,440 tons, 21 knots, 500 mines), the "Paris" (cross-Channel, 2,030 tons, 25 knots, 80 mines), "Angora" (Calcutta to Rangoon, 300 mines), "Biarritz" (S. E. & Chatham railway, 2,700 tons, 21 knots, 305 mines); but the mine still lagged behind the minelayer, and in June the British Elia mine was found to be so defective that minelaying ceased for a time.

On May 27 1915 the loss of the "Princess Irene," which was blown up at Sheerness by an internal explosion, was a severe blow to the minelaying service. In the Narrows 15 more minefields were laid during the year, chiefly between the Goodwins and the Belgian coast.

By 1916, the importance of mining in North Sea strategy was beginning to be realized, but an efficient mine was still lacking. There could be no question that the German mine was much more efficient. It was a spherical mine, fitted with lead horns containing a sealed glass tube which held the liquid for exciting an electric cell. When the mine was struck, the lead horn bent, the glass tube broke, the liquid ran into the cell and the mine fired. It was held to the sinker by a catch, and went to the bottom with it when dropped, leaving the water free for the minelayer. After an interval of half an hour or so, glycerine escaping from a dashpot gave play to a plunger which released the catch, and the mine rose gradually to the surface, uncoiling a double mooring-wire from inside the sinker. On reaching its correct depth from the surface, a hydrostatic valve released a strong spring clamp, which clamped the mooring-wire and held the mine at its correct depth. The British mine was more complicated, and, instead of concentrating attention on the production of a good mine, efforts were wasted in an attempt to devise a combination of mines and nets which achieved little or nothing.

The ordinary minefield was usually laid so as to be about 10 to 15 ft. below the surface at low water, but the success of the submarine gave rise to the conception of deep minefields laid at about 60 to 150 ft. to intercept the submarines when submerged. The ordinary surface minelayers now began to be supplemented by submarines and destroyers; the E24 was one of the earliest boats to be fitted for this purpose, and the destroyer "Abdiel" was equipped to carry 80 mines. They were both busy laying minefields in German waters in 1916. The E24 laid a field close to the Elbe on March 3, but never returned from her next trip on March 21; and a field was laid by the "Abdiel" off Horn's Reef on which the "Ostfriesland" struck on June 1 when returning after Jutland. One of the principal British minelaying efforts of 1916 was the Belgian coast barrage, consisting of a double line of deep mines laid about 12 m. off the Belgian coast for some 40 miles. It was begun from Dover on April 24 1916, and consisted of some 1,565 mines, which took some five weeks to lay. The minelayers engaged were the "Princess Margaret" (Capt. Lockhart Leith), "Orvieto" (Capt. H. Smyth), "Biarritz" (Capt. E. Morant), and "Paris" (Comm. John May), under Capt. F. S. Litchfield Speer, supported by Dover and Harwich destroyers and the monitors "Prince Eugene" and "General Wolfe." Three German destroyers sallied out from Zeebrugge on April 24, but were engaged by the "Medea" (Comm. V. F. Gibbs), "Melpomene" (Lt.-Comm. H. De Burgh) and "Murray" (Lt.-Comm. H. Taprell Dorling), and driven off, though the "Melpomene" was badly hit by shore batteries.

The lines of mines were supplemented by mine nets laid by the Dover drifters about a mile to rearward of the mines.

This was the first big undertaking against the submarine, and did not meet with conspicuous success, for with the exception of the UB3, destroyed by a drifter on April 24, no submarine seems to have been sunk by it.

The end of the year saw the institution of a mining school for research and development, and this segregation of the work from the torpedo school, already burdened with torpedoes, electrical engineering and wireless, probably contributed to its efficiency. The Belgian coast barrage was erroneously supposed to have been the cause of the reduced submarine activity in the Channel during the summer, and a similar barrage was now begun across the Straits from the Goodwins to Snouw Bank on the Belgian coast. The nets were 60 ft. deep, each fitted with two mines and hanging from buoys 500 yd. apart. A line of deep mines was laid on their south side, from 54 ft. below the surface to within 30 ft. of the bottom. This field was completed on Feb. 8 1917 by the "Princess Margaret," "Biarritz" and "Paris." Later, the mines dragged into the nets and sank the Trinity House tender "Alert" while tending them. It was considered necessary to sweep the field up and relay it, which took the best part of June-July 1917. The work of 1917 lay chiefly in Heligoland Bight. In Jan. 1917 Adml. Beatty urged the necessity of mining on the largest scale, and proposed a line 157 m. long encircling the Bight, to be watched by light cruisers and destroyers. This was the first task given to the Plans Section, but unfortunately there was a great shortage of mines for the work and the British Elia mine was considered unsuitable. As these fields were intended to be permanent, an official notification of the field was made on Jan. 25 1917.

The Dutch Government, for the convenience of their trade, moored a line of four light-vessels and seven light-buoys which ran for some 180 m. N. and S. to the west of the western limit of the British notified area (light-vessels in 56°N., 5°E.; 54° 47′ N., 4°8′E.; 53°29′N., 4°2′E.; 53°N., 4°5′E.). Their lights, blazing out at night and immune from attack, became so well known a seamark as to earn the name of "Piccadilly" from the submarines and destroyers plying to and fro. During the year 1917 15,686 mines were laid by the "Abdiel" and the minelaying submarines (E24, 41, 45, 51, 34) and led to the loss of a number of German destroyers and minesweepers. The fields in the southern portion of the North Sea were reinforced by 1,120 mines in June 1917, and during the summer a mine-net barrage was laid at the entrance to the Adriatic from Cape Otranto to Fano Is., 45 m. long.

In 1917 the British Admiralty realized that minelaying on a large scale ranked as one of the principal operations of the war, though it was not till September that an efficient mine (pattern H2) began to be turned out in sufficient quantities.

In anticipation of the increased requirements some 12 modern light cruisers had been equipped for minelaying, and a batch of destroyers was fitted out to assist the "Abdiel" ("Tarpon," "Legion," "Telemachus," "Ferret," "Vanoc," "Ariel," "Vanquisher," "Vehement," "Venturous," "Sandfly," "Meteor"). These were to form the 20th Flotilla under Comm. Berwick Curtis, and to lay some 21,500 mines in the Bight in 1918. Meanwhile another big scheme had been propounded, involving nothing less than the closure of the northern exit of the North Sea to submarines, an area 230 m. in length with depths varying from 45 to 150 fathoms. The line first suggested was Aberdeen to Ekersund (Norway), but this was changed to Orkneys to Udsire, to bring it more closely within the purview and under the protection of the Grand Fleet.

FIG. 1

NORTHERN BARRAGE

1918

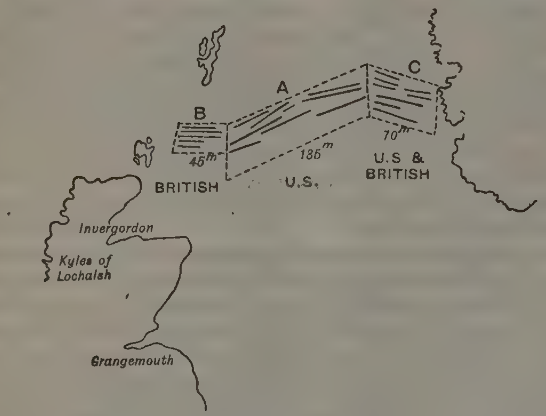

It was divided into three large areas:—B, next the Orkneys, 45 m. long; A, in the centre, 135 m. long; and C, on the Norwegian side, 70 m. long. These required 65,700, 36,300 and 18,000 mines respectively, a total of 120,000, and it was intended to lay nine rows: three at an upper level of 80 ft., three at a middle level of 160 ft., and three at a lower level of 240 feet. A was laid by the U.S. navy; B, by the British; C, by both. An immense organization for transporting, filling, loading and laying the mines grew up round the work. The American base was at Inverness, under Rear-Adml. Joseph Strauss, with Capt. Reg. Belknap as chief-of-staff, and their mines were landed in the Kyles of Lochalsh near Skye and sent across by the Caledonian canal and by rail. The British mining base was at Grangemouth in the upper reaches of the Forth, under Rear-Adml. Lewis Clinton Baker, with Capt. Lockhart Leith as chief-of-staff.

The first mine was laid on March 3 1918, and on May 26 the American squadron (Mine Squadron I.) arrived at Invergordon to take part in the work. It was under Capt. Reg. Belknap and consisted of the U.S.S. "San Francisco" (Flag-Capt. H.V. Butler), "Baltimore" (Capt. A. W. Marshall), "Roanoke" (Capt. C. D. Stearns), "Housatonic" (Capt. J. W. Greenslade), "Canandaigua" (Capt. W. H. Reynolds), "Canonicus" (Capt. T. L. Johnson), "Quinnebaug" (Comm. D. P. Mannix), "Saranac" (Capt. Sinclair Gannon), "Shawmut" (Capt. W. T. Cluverius) and "Aroostook" (Capt. J. H. Tomb), with a total capacity of 5,530 mines. Some 57,000 mines were laid during the next five months by the U.S. squadron, escorted on their expeditions by British and American warships. The mine was of American design (see fig. 2), carrying 300 lb. of T.N.T. and weighing with the sinker 1,400 lb. Antennae 70 ft. long (reduced to 35 ft.) rose from it, which fired the mine if touched by a ship. It was moored by a ⅜-in. wire cable, and attached to the sinker or anchor was a 90-lb. plummet on a reel of ⅛-in. steel wire, carefully measured to the length that the mine was to lie below the surface (160 ft., for instance, at the middle level). The mine was attached to the sinker, and, as it dropped from the steel rails astern, floated for a time. The plummet was released and ran out to the length of its cord, when it was brought up with a jerk. This released the mine from the sinker, which sank slowly with the mine cable running out. When the plummet touched bottom, the cord slackened, releasing a clamp which clamped the cable, and the sinker now pulled the mine down with it to the proper depth.

FIG. 2

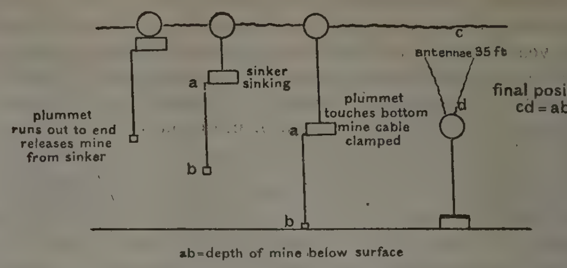

Difficulties were encountered as the work proceeded. A proportion of mines (about 5%) exploded prematurely, and a number of mines in the British area were laid at less than the prescribed depth of 65 ft., which led to the sinking of the British sloop "Gaillardia" on March 22 1918. It was decided to sweep up the mines in the British portion, and when relaid a large gap was left off the Orkney coast to ensure a safe passage for the fleet. The work of laying this field was one of the great achievements of the war, and the accuracy of position required was facilitated by the use of the "taut"-wire method introduced by Vice-Adml. Sir Henry Oliver, in which the distance run was measured by fine piano-wire reeling out from 140-m. spools. To prevent defective mines setting off others, the distance between lines was increased from 150 to 300 ft., and the rows increased to 10 at the upper level, 4 at the middle and 4 at the lower. The work of the American squadron marked a great step in minelaying, and it was no unusual feat for a single ship to lay a line of 860 mines covering 43 m. in 3½ hours.

It must not be supposed that the whole of the water available for a submarine was effectively covered by this field, but the danger of the passage was greatly increased. In July the minefield began to take its toll, and two German submarines were damaged in it, though they managed to get home. They now began to creep past in Norwegian waters, but the Norwegians closed them to both belligerents by minefields of their own. This barrage must be regarded as a colossal attempt to solve the submarine problem, and as it was barely completed by the Armistice a comprehensive judgment of it is hardly possible. It showed every sign of success, and in September and October at least four German submarines (including U92 Sept. 9, UB104 Sept. 19, U156 Sept. 25, U102 probably, UB127 probably, UB123 Oct. 19) were lost in it, with a proportionate effect on the *moral* of their officers and men who saw their last means of exit closing before their eyes. The United States laid 56,571 mines in it, and the British 13,546.

In the south the old cross-Channel mine-net barrage had been abandoned early in the year, and Rear-Adml. Sir Roger Keyes' efforts were concentrated on the Folkestone to Gris Nez barrage, where 9,570 mines were laid with conspicuous success. Nine submarines were lost in it (U109, UB38, UB58, UB33, UB55, UB31, UC38, UC64, UB103), and the High Sea Fleet flotillas abandoned the Dover route early in the year.

The mining of the Bight went steadily on, performed by the 20th Flotilla under Comm. Berwick Curtis and the minelaying submarines. On March 27 the "Abdiel," in company with the "Legion," "Telemachus," "Vanquisher," "Ariel," and "Ferret," were laying a field 70 m. N.W. of Heligoland when they came on three outpost vessels, which they sank, bringing back 72 prisoners. The E34, which left Harwich July 14 to lay a field off Vlieland, never returned. These operations led to the destruc-

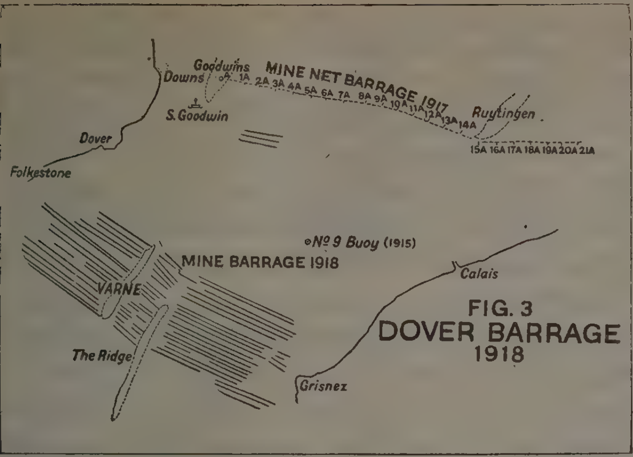

FIG. 3
DOVER BARRAGE
1918

tion of a number of minesweepers and torpedo craft, and though only one or two German submarines were lost on the mines their movements were undoubtedly seriously hampered.

In July the Germans suddenly began laying large protective minefields close to the Dutch line of lights, which resulted in the loss of the "Vehement" and "Ariel" on Aug. 1 and led to a great reduction in British mining in the Bight in the last three months of the war. The dangers of the Bight led to an increased use of the Cattegat by German submarines, and opened an excellent opportunity for deep mines in that area. A field was laid off the Skaw in February, and another in April off Lessö, which evidently caused considerable anxiety in Germany, but the work in this area was sporadic and did not form part of a coherent plan. Controlled minefields (that is, fields fired by instrumental means from a post in the vicinity on the passage of a submarine over them) were now being developed, and three submarines succumbed to them in 1918 (UC11, Harwich, June 26; UB109, Folkestone, Aug. 19; UB116, Scapa Flow, Oct. 28).

A large protective minefield of three deep and three shallow lines holding some 9,000 mines was laid in August and September off the coast of Yorkshire and Durham, where submarines were particularly troublesome.

Minelaying by the end of the war had developed into one of the most important operations, and, favoured by geographical conditions, played a very important part in later British strategy, being an indispensable feature of the war against the submarine. The enormous number of mines used can be gathered from the fact that in the large minefields in home waters alone, there were some 34,300 mines laid in the Dover area and Narrows of the North Sea (including 9,500 in the Sir Roger Keyes' Folkestone to Gris Nez barrage); the Bight absorbed some 43,000 and the Northern barrage 70,117. There can be little doubt that too little importance was attached to the mine in British pre-war views on naval strategy. There was too great a tendency in those days to interpret war at sea wholly in terms of hitting a target at long ranges with a heavy gun. No modern battleship was sunk in this way, and of the various classes of British ships lost during the war, fewer were sunk by guns than by mines—namely 5 battleships out of 13 (38%), no battle cruisers out of 3, 1 cruiser out of 13 (7·7%), 2 light cruisers out of 12 (16·5%), 5 sloops out of 18 (28%), 20 destroyers out of 64 (31%), 4 submarines out of 54 (7·5%). In the destruction of German submarines they played a more important part. Of 200 submarines the loss of 43 (or 21·4%) was due to mines, and as one-fifth of those unknown (4 out of 17) may be attributed to the same cause it may be accepted that 23% of German submarine losses were due to British mines. (A. C. D.)

MINING (*see* 18.528).—While the standard methods of extracting ore from vein deposits, by overhand or underhand stoping, changed little during the period 1910–20, a more definite classification than was formerly possible grew up respecting the application of these methods to given local conditions. Comparatively thin veins, with a steep pitch (dip), are developed by a series of drifts or gangways (levels), and above each of these overhand stopes are opened for extracting the ore, the working being advanced upward and forward. The broken ore is run through chutes (mills or passes) to the level below, in which it is conveyed by small hand-trammed cars, or by mechanical haulage, to the shaft or through a tunnel to the surface. For somewhat thicker veins, especially those with a steep dip, underhand stoping is occasionally employed, most of the holes for blasting being then drilled downward, and the advance is forward and downward towards the haulage level. For flat veins or bedded deposits breast stoping is used, the details of which resemble those of underhand stoping. In all of these methods, the roof of the deposit (hanging wall) is supported by pillars of ore, by timber posts or stulls, by square-set timbering, or by masses of waste ore and rock (filling) carried by stulls. Sometimes stopes are completely filled with waste rock.

General Classification of the Above Methods.—Narrow, steep-dipping veins: open, overhand or underhand stopes, the roof being supported by timbers or pillars. Wide, steep-dipping veins: open, underhand stopes, with pillars or ore. Flat beds or veins: breast stoping, or room-and-pillar working, in which little or no timber is used.

For full illustrated details and variations, see *Mining Engineers' Handbook*, pp. 493–598 (John Wiley & Sons, 1918).

Shrinkage Stopes, a variety of overhand stopes, for both narrow and wide, steeply dipping veins, have in recent years been more widely employed than formerly. In them the broken ore is allowed to accumulate until the stope is completed, thus making timbering or other artificial support for the walls of the stope unnecessary. Since rock when broken increases in bulk, from 25 to 40% of the ore is drawn from the stope as it advances to leave room at the top for the miners, who stand on the broken ore while drilling. Obviously, this method is applicable only when the inclination and width of the vein are great enough to allow the broken ore to slide down freely on the stope floor (footwall). Finally, after all the ore has been drawn off, the stope is allowed to cave, or is filled with waste. Shrinkage-stoping is often employed in connexion with other methods in the same deposit.

Caving Systems.—The prototype of these, long employed in certain British iron-mines, is known as the North of England caving system. In the United States caving was first used for mining the soft iron ores of northern Michigan. More recently, it has been extensively applied to the iron deposits of the Mesabi district, Minnesota, and to some large copper deposits of the south-western part of the United States. The most important requirements for the successful application of caving methods are: (1) massive deposits of relatively cheap minerals; (2) ore-bodies of large horizontal dimensions, overlaid by a capping varying in character from earthy soil or glacial drift to firm rock; (3) large-scale work. There are three distinct methods: top slicing, block caving and sub-level caving. The salient features of all are: (*a*) horizontal subdivision of the ore-body into floors; (*b*) subdivision of each floor into small sections (slices or blocks), which are mined separately; (*c*) delivery of the broken ore through raise-chutes to the haulage-ways below, and thence to the hoisting-shafts; (*d*) as the ore is removed, the overlying capping must gradually cave and settle. Formerly, a method called "bottom slicing" was occasionally employed, in which the mining of the successive floors was begun at the bottom of the ore-body, instead of the top, as in top slicing. It is now almost obsolete. The decade 1910–20 was marked by a much wider use of the slicing and caving methods, especially for mining large low-grade deposits of disseminated copper ore. More deposits of this type were developed and worked in very recent years than ever before. Many variations in practice and changes in details were introduced to suit the given dimensions of ore-body, its depth below the surface, and the physical and mineralogical character of the ore and capping. All this brought a more definite understanding of the applicability and limitations of the caving systems, as determined by the existing local conditions.

Some prominent examples of the newer mines, in which different forms of slicing and caving have been adopted, follow.

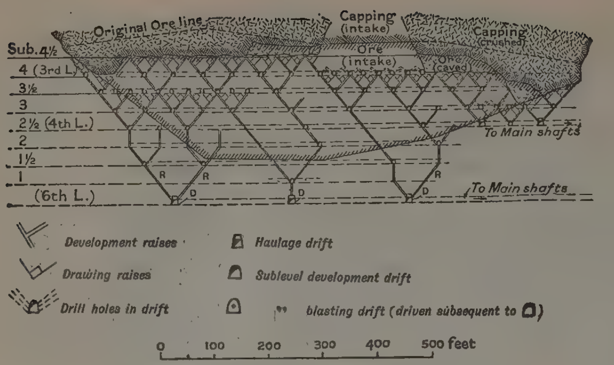

FIG. 1.

Inspiration Mine, Arizona.—The ore-body is a massive deposit of disseminated sulphide of copper (chalcocite), containing about 100,000,000 tons of low-grade ore, and overlaid by a valueless capping, 30 to 350 ft. thick. A variation of the caving system is used, known as "block-caving." The ore-body is intersected at vertical intervals of 150 ft. by main haulage levels, connecting with the hoisting shafts (fig. 1). Above the haulage levels are long chute-raises, inclined at 50° to the horizontal, from which numerous short secondary raises ("finger-raises") are driven to a system of sub-level drifts, 35 ft. apart vertically and 50 ft. horizontally. The ore developed by each series of sub-level drifts is thus divided into relatively small "blocks," which are undercut and broken by blasting out the supporting pillars between the sub-level drifts. The broken ore is drawn down through the branching finger-raises underneath, into the main raises, and thence to the haulage levels, the flow being controlled by gates. As the upper part of the ore-body is thus removed, the overlying capping caves in on top of the solid unmined ore below. (For full details, see *Trans. Amer. Inst. Mining Engs.*, vol. lv., p. 218.) Block-caving, conducted similarly to that of the Inspiration mine, is also used by the Ohio Copper Co., Bingham, Utah, and the Nevada Consolidated Copper Co., Ely, Nev. (Peele, *Mining Engineers' Handbook*, pp. 640–2).

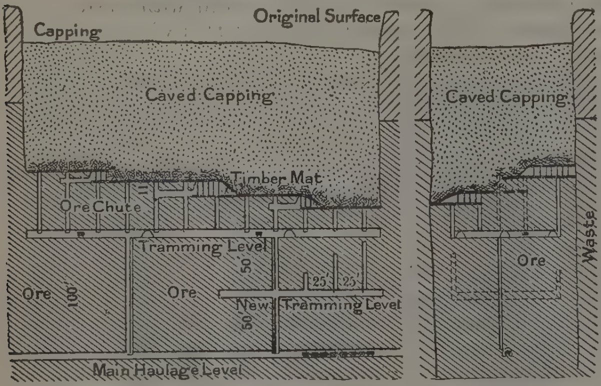

LONGITUDINAL SECTION

VERTICAL CROSS SECTION

FIG. 2.

Arizona Copper Co.—A top-slicing method (fig. 2) is applied to large bodies of soft ore, carrying 2 to 4% copper. A main haulage-way is driven near the bottom of the ore-body, and above it are intermediate working levels, 50 to 60 ft. apart vertically. These comprise a rectangular system of tramming drifts and crosscuts, from which chute-raises are made into the ore above at 25 to 30 ft. intervals. Starting from the tops of these raises, horizontal slices of ore, 7 to 15 ft. thick, are blasted out and the broken ore is run down through the raises to the tramming level. Thence it is conveyed to the nearest main raise, connecting with the haulage-way below. (For details of the slicing operations and the manner in which the overlying capping caves as the successive slices are removed, *see* 18.532.) The modifications of the top slicing system noted above are chiefly in the mode of laying out the main haulage-ways and intermediate tramming levels, and in making raises from the latter at such short intervals as to minimize the labour cost of handling the broken ore mined in the slices. In one of the Arizona Copper Co.'s mines, a further saving has been effected by omitting the tramming levels and the small raises from them to the slices. A main drift is driven longitudinally through the axis of the ore-body, just below the capping, and from it at right angles are crosscuts, 40 ft. apart, to the walls. The panels of ore between the crosscuts are sliced back from the walls of the ore-body towards the main drift. On each side of the latter a pillar is left, which is finally sliced back from its end, in completing a floor. While one floor is being mined, the next, 11 ft. below, is in preparation. This method of panel slicing has recently been adopted successfully in the Herman gold mine, California. Overhand stoping, with square-set timbering, was formerly employed. The vein dips 45° to 60°, and the panels are laid out at an inclination of 52°, across the ore-body. Top slicing is also used in many other copper-mines containing massive deposits of low-grade ore, for example: Cumberland-Ely, Nev.; Cananea, Mexico; Miami, Ariz.; Bingham, Utah, and mines of the Calumet & Arizona Mining Co., Arizona. At the last-named property, the older caving method has been replaced by a modification called the Mitchell top-slicing system, which is found economical in reducing the amount of shovelling required. (For illustrated details, see Peele, *Mining Engineers' Handbook*, pp. 619, 620.)

Other Variations.—In a number of important mines working large ore-bodies, special conditions have been dealt with by combining two or more of the methods referred to above. Examples of such practice are to be found in the mines of the Braden Copper Co., Chile; New Jersey Zinc Co., Franklin, N.J.; Utah Copper Co. (Boston mine); Ray Consolidated Copper Co., Ariz.; Homestake Gold Mining Co., S.D., and of the De Beers Mining Co., S. Africa. In most cases, operations begin by shrinkage stoping, after which the intervening pillars are mined by top slicing, block-caving or sub-level caving. The aim is to obtain a high tonnage extraction from the ore-body; that is, to minimize loss of ore left in permanent pillars or through mixture with waste material.

Stripping Superficial Ore Deposits.—Though this old mode of attacking shallow deposits of large horizontal area underwent little change, it was oftener resorted to in the decade 1910–20 than previously, and, with good organization and plant, was being applied to deeper ore-bodies than formerly were considered minable by stripping operations.

Standard Methods.—Standardization of methods of developing and working mines would undoubtedly promote efficiency and economy of operation. Beds of coal, owing to their comparative uniformity of geological occurrence, can be worked to a considerable degree by standardized methods. The same is true of some regular bedded deposits of the base metals. But, as metalliferous deposits in general vary greatly in their physical characteristics, standards of practice in working them are less readily attainable, and any rules that may be formulated are subject to many exceptions. (To illustrate this matter, see a useful discussion by C. A. Mitke of the "Mining Methods of the United Verde Extension Mining Company, Arizona," *Trans. Amer. Inst. Mining Engs.*, vol. lxi., p. 188.)

In many of the particular operations of mining, there has been of late a stronger tendency toward standardization of details. A standard, in this sense, may be defined as a well-tested and approved mode of doing a certain piece of work. For example, some large mining companies have adopted standard "rounds" of holes for shaft-sinking, drifting, cross-cutting, raising and stoping. The foremen and shift bosses are furnished with instruction sheets which specify the position, angle to the drilling face, depth, and charge of explosive, for each hole of the round. The miners are required to follow these instructions instead of doing their work in accordance with their own individual ideas. The adoption of standardized methods has been assisted by the greater attention now given to efficiency engineering. Many large mines maintain "efficiency engineers," whose duty it is to study in detail the performance of both men and machinery, thus aiming to improve the quality and amount of work done, and so reduce cost. Directed toward this end also are the recent movements inaugurated by several large mining companies to give their employees systematic instruction in the best methods of doing their work. This benefits the employer as well as the employee. Thus, an education department has been organized by the Phelps-Dodge Corp., of New York, which operates a number of mines in the south-western part of the United States. Series of lectures are delivered on practical mining topics, followed by examinations. The North Butte Mining Co., of Montana, has also given much attention in the last few years to instructing its employees and standardizing the details of many of the underground operations. The cost of maintaining these education departments is considerable, but it is amply justified by the results obtained. A wholesome spirit of rivalry is encouraged amongst the miners and their ambition is aroused; hence, better work is done, the *moral* of the whole force is raised, and more cordial relations are established between the employees and the mine management. For certain mining appliances and machines standard designs grew commoner. There are clearer distinctions as to the applicability of different types of hoisting engines, compressors, ventilating fans, coal undercutting machines, mine cars, ore-chutes, etc.

Blasting.—Explosives for blasting rock and ores underwent little change during 1910–20 in general composition, but tests supplied valuable data respecting the disruptive and propulsive forces and the sensitiveness of the various types and grades of dynamite, so that their suitability for different kinds of service is better understood than formerly. Explosives for coal-mines, especially mines in which dangerous gases or dust occur, must be so constituted that ordinary charges will not produce a flame of sufficient intensity and duration to ignite explosive mixtures of gas and air. These comprise the tested "permissible explosives," lists of which are published in coal-mining countries and revised from time to time, to keep them up to date. In Europe their use is required by law. In the United States the lists appear in publications of the Bureau of Mines (a branch of the U.S. Geological Survey). The bureau can only recommend them, though legal requirements exist in some of the individual states. The permissible explosives have certain characteristic ingredients: (*a*) ammonium nitrate; (*b*) salts containing water of crystallization, which, being liberated and vapourized by the heat of the explosion, reduces the flame temperature; (*c*) organic nitrates other than nitro-glycerine, *e.g.* nitro-starch; (*d*) nitro-glycerine, mixed with free water or an excess of carbon. It was formerly assumed that nitro-glycerine compounds and other detonating explosives were not suitable for collieries, because, due to market requirements, excessive shattering of coal is undesirable (except for coke-making); but low-strength, "short-flame" dynamites are now being satisfactorily used. While no explosive can be absolutely safe in gassy mines, those in the permissible lists are relatively safe. As the standard test, an explosive is accepted for the list when a charge of 680 grams (1½ lb.) does not ignite gas or coal dust; it is not accepted if a charge of 250 grams does cause ignition. In 1912, the permissible list of the U.S. Bureau of Mines comprised 96 kinds and grades of safety explosive; in June 1920, the number had increased to 175. The United States is the largest user of permissible explosives, the quantity consumed having nearly doubled in 1912–20.

Blasting methods were improved by the introduction (1909–10) of "delay-action" electrical fuzes.[1] In work like tunnelling and shaft-sinking, where rounds of holes are best fired in volleys, these special fuzes save time, as the miners need not return to the working place after each volley to prepare for the next blast. The entire round is wired, as if all the holes were to be fired simultaneously, and there is but one application of the current. The groups of holes explode successively, in the desired order and at intervals of about one second, by using "no-delay" fuzes for the first group and "first-delay" and "second-delay" fuzes for the following groups. Construction of delay fuzes: The platinum bridge in the cap shell, between the terminals of the fuze wires, is not embedded in the fulminating charge itself, so as to explode it directly, but ignites a short piece of slow-burning ordinary fuse, which in turn explodes the fulminate. This gives a delay interval depending on the length of ordinary fuse used. Another new device for the same purpose is the electric fuze-igniter. A special electric cap contains a small charge of fine-grain black powder, beyond which is a piece of ordinary fuse, with a cap on the end to be placed in the dynamite cartridge. For blasting with black powder, no cap is put on the end of the ordinary fuse. Electric squibs, with paper instead of copper shells, are now used to some extent for blasting with black powder.

Mine Hygiene.—Improvements made in the years 1910–20 were chiefly in five directions: (1) better ventilation of mine workings; (2) enforcement of dust-prevention regulations; (3) introduction of new types of blasting explosives, so constituted as to minimize the quantity of deleterious gases evolved; (4) adoption of precautions aiming to produce more perfect combustion of explosives, and so reduce or prevent the formation of the poisonous carbon monoxide; (5) study and better understanding of special miners' diseases and their treatment.

Formerly, artificial ventilation by fans or blowers was provided only for collieries, to dilute and sweep out gases emanating from the coal, and to remove the explosive coal dust. In recent years, mechanical ventilators have been increasingly used for metalliferous mines also. About the year 1902, the high mortality amongst the miners of some districts began to attract attention. Investigation showed that acute lung trouble ("miner's phthisis" or silicosis) is caused by inhaling silicious dust from drilling in dry rock or ore. In 1903, a Government commission was appointed to study the conditions in the Transvaal gold-mines. Their report led to a demand for better ventilation of the mine workings, and the adoption of water-spraying devices to allay the dust during the operation of drilling. Revised and more stringent regulations went into effect in 1913. Other governmental investigations were made in Cornwall, Australia, and New Zealand, and in the United States by the Bureau of Mines. In 1911, one of the large gold-mining companies in the Transvaal, the Rand Mines (Ltd.), established a department of sanitation, to deal in general with miners' living and working conditions and diseases. The department's activities now cover a large number of the mines of the district, employing between 55,000 and 65,000 men. Marked benefits have resulted from this widespread interest in mine hygiene. For example, tests of the gases from blasting explosives have revealed the extent to which they may vitiate mine air. One pound of standard dynamite produces about 10 cub. ft. of gas, which, due to incomplete detonation, often contains 25 to 30% of carbon monoxide. Since, for safety, this actively poisonous gas should be diluted to about 0·01 of 1%, it is evident that natural ventilation can not always be relied upon, and mechanical ventilators have been installed for many metalliferous mines. In recent years, several new types of high explosives have been introduced, so compounded that they produce much less carbon monoxide and methane (CH_4) than the standard ("straight") dynamites. They are therefore particularly useful in poorly ventilated mine workings, as headings where there can be no through ventilation. Furthermore, there has been increased insistence on the use of high-strength caps or detonators, since imperfectly detonated dynamites of all kinds produce an excessive amount of carbon monoxide.

Explosions in Coal-Mines.—Advances have taken place in the appliances for fighting mine fires, and the modes of preventing and dealing with gas and dust explosions in collieries. Coal-dust explosions are generally much more serious in bituminous than in anthracite mines. An explosion of anthracite dust does not appear to be self-propagating. Most explosions in anthracite mines are of gas, sometimes aided by presence of dust. Many investigations of coal-dust explosions have been made in Europe since 1880, but some of the phenomena attending their initiation and propagation have long been imperfectly understood. Much light was thrown on the subject by the elaborate experiments conducted by J. Taffanel, at the Liévin testing station, France (beginning in 1907), and by the U.S. Bureau of Mines at their testing plant and their Bruceton experimental mine, near Pittsburgh (since 1909). Amongst the facts demonstrated are: (*a*) The blasting of a single hole, charged with long-flame explosive (black powder or ordinary dynamite), may cause the ignition of coal dust; (*b*) respecting the initiation of an explosion, if enough dry coal dust is present, it is immaterial whether the air at the point of origin is quiescent or moving in either direction; (*c*) quantities of dust as small as 1/5 oz. per cub. ft. of space (or 1 lb. per linear ft. of an ordinary gangway) will propagate an explosion; (*d*) in presence of sufficient dust, an explosion may be produced at will in a gangway, even when the roof, sides and floor are wet to the touch; (*e*) the force of a coal-dust explosion usually increases in violence as it is propagated through a mine working, and may reach its maximum after travelling 500 to 800 ft. from the place of origin; (*f*) pressures as high as 120 lb. per sq. in. have been measured at right angles to the direction of movement of an explosion, the pressure in the line of advance being doubtless much greater.

Rock-dust barriers, for checking or preventing the propagation of coal-dust explosions, were invented by J. Taffanel and modified by G. S. Rice, of the U.S. Bureau of Mines. They consist of series of wide shelves, set across the mine gangway near the roof, each loaded with rock dust. In case of an explosion the shelves are tripped mechanically by the advance force waves, being set to operate at certain air velocities or pressures produced by the explosion. From two to three tons of rock dust are thus discharged in a dense cloud, in front of the advancing explosion wave, and, mixing with the coal-dust-laden atmosphere of the gangway, prevent propagation of the explosion. Several forms of dust barrier are used for different local conditions. Gas helmets and oxygen breathing-apparatus, long used in mine rescue work, were considerably improved after about 1913. Interest in these matters was stimulated by the introduction in several countries of Workmen's Compensation Acts (which hold the employer responsible for injury or death due to accident), and also by the use of poisonous gases in the World War.

Hoisting Engines.—Power plants (generally hydro-electric) have been established in many mining districts, and supply electric current at cheaper rates than are possible for equivalent steam power. Electric-driven hoists are consequently used in much greater numbers than formerly. Their control mechanism is now so perfected that they are as manageable as the best steam hoists. The large variations in load, unavoidable in hoisting operations, and very disadvantageous for electric transmission of power, are successfully dealt with by the "equalizing systems" of hoisting, the first of which, the Siemens-Ilgner, was introduced just previous to 1906. Modifications of it, based chiefly on the mode of control, are the Westinghouse and the Ward-Leonard. The design and operation of all of these plants are based on the principle that, when a motor receives electric current, it will deliver mechanical power; conversely, when driven by mechanical power, the motor becomes in effect a generator and furnishes electric current. The alternating current usually supplied to a mine is first reduced to about 500 volts, and then goes to a motor-generator set, comprising a shunt or induction motor, which drives a direct-current generator and a heavy fly-wheel, all on a common shaft. This set is in constant motion, though not at constant speed. From the generator the current goes to a hoist motor, which drives a pair of drums on the drum shaft. At the beginning of a hoisting cycle, the hoist motor receives current from the motor-generator set; but, after the descending cage has reached a point where the trip can be completed by the weight of the rope, the hoist motor is driven by the drum, and therefore supplies current to the generator of the motor-generator set. Thus, part of the recovered power is stored in the fly-wheel, while the remainder is expended in driving the induction motor as a generator, thereby causing it to deliver current to the external circuit or power service. The fly-wheel cuts down the peaks of the load curve. Since 1915, a number of these plants have been erected; they are costly and suitable only where the hoisting is nearly continuous and high peak loads are heavily penalized in the power service.

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[1] The spelling "fuze" is used for electric blasting, "fuse" for ordinary blasting.

Underground Haulage.—For locomotive haulage, the electric trolley system was in 1920 still first in importance; next to this were the compressed-air locomotives. Storage-battery locomotives, though invented many years ago, were rarely used until about 1911, and in 1920 were employed to a limited extent only. Their construction is simple, and, as they carry their power with them, they have the advantage of being able to operate wherever track is laid, without the necessity of stringing trolley wire. They are best suited to short hauls and light service, as for gathering individual cars from the working places and making them up into trains on the main haulage lines. Maximum speed is about 5 m. per hour, and easy track gradients are necessary. Their chief disadvantage is high first cost. A few combined trolley and storage-battery mine locomotives have been built, but they are unlikely to have a wide application. Gasoline locomotives were introduced before 1905, but were not much used until about 1912. Like storage-battery and compressed-air locomotives, they have the advantage of carrying their own power. Ordinary speeds range from 4 to 10 m. per hour. Although reasonable in first cost and running expenses, gasoline locomotives can be employed underground only where there is abundant and active ventilation, because their exhaust usually contains enough carbon monoxide gas to require a high degree of dilution. Their consumption of gasoline at full load is, say, 0·7 to 1·2 lb. per H.P.; considerably more at half speed and load.

Shovelling Machines, for loading broken coal or ore underground, were introduced about 1907. The first was the Thew machine, a dipper shovel of small size, operated by electricity or compressed air and suitable for use in stopes in a flat-lying deposit, or in a tunnel. A later design, the Myers-Whaley, consists of a large scoop, which is thrust into the pile of broken ore or rock, then lifted and dumped backward onto a short travelling conveyer, for loading into a mine car in the rear. This machine occupies but little space, and can be used in a large mine tunnel or drift. In 1915 two of them were installed in the ends of a long haulage drift, 14 ft. wide by 10 ft. high, in the Crown Mines, Transvaal. The Halby shoveller resembles the Myers-Whaley. Other machines, especially for loading coal, have recently been invented, and are undergoing working tests. Mechanically considered, shovelling machines are unquestionably successful. Interest in them has been stimulated by the greatly increased rates of wages now prevailing in most mining regions. It has been proved, however, that, where wages are low, they cannot compete with hand loading.

Machine Drills underwent important changes during 1910–20, especially in the development of the "hammer" drills, which for many kinds of service have largely replaced standard types of piston machines. In the hammer drill, the bit is held stationary in the front end of the machine, and is struck a rapid succession of blows by the reciprocating piston-like hammer. As the bit does not reciprocate, its cutting edge being always in contact with the rock, except during the slight rebound caused by each blow of the hammer, the sludge or cuttings tend to pack in the bottom of the hole. Hence, unless some automatic means be provided for keeping the hole clean, part of the useful effect of the hammer blows would be lost. To keep the hole clean while drilling, most hammer drills use hollow bits; that is, there is a small hole longitudinally through the axis of the bit. Through this hole, a jet of compressed air or water is discharged in the bottom of the hole, thus driving out the cuttings. When compressed air is used, and the rock is dry, the dust discharged from the mouth of the hole is annoying and hurtful to the drill-runner. Hence, most hammer drills use a water jet. The water is delivered under pressure from a 15-gal. to 18-gal. tank, through a short length of hose. Pressure in the tank is produced by connecting it by another hose with the compressed-air pipe.

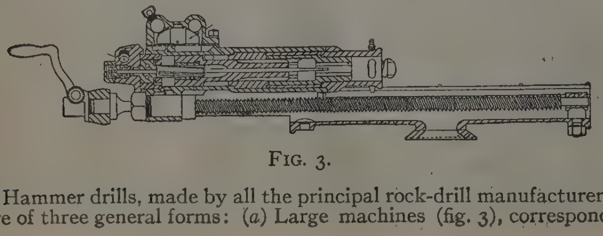

FIG. 3.

Hammer drills, made by all the principal rock-drill manufacturers, are of three general forms: (*a*) Large machines (fig. 3), corresponding in size and weight with ordinary piston drills, mounted on tripod or column and used for the same kinds of work; (*b*) the small D-handle and cross-handle drills for making holes pointing downward, as in shaft-sinking (fig. 4); (*c*) machines having an automatic air-feed standard, used chiefly for holes directed steeply upward, as in most stoping operations (fig. 5). Machines of classes (*b*) and (*c*) have the advantages of lower first cost, of being operated by one man instead of two, and of eliminating the time lost in cleaning out the hole and in "setting up," as for the standard piston drills and class (*a*) hammer drills. In most rocks and ores these hammer drills, therefore, do faster work than piston drills.

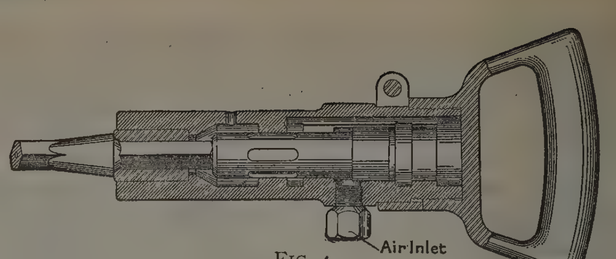

FIG. 4.

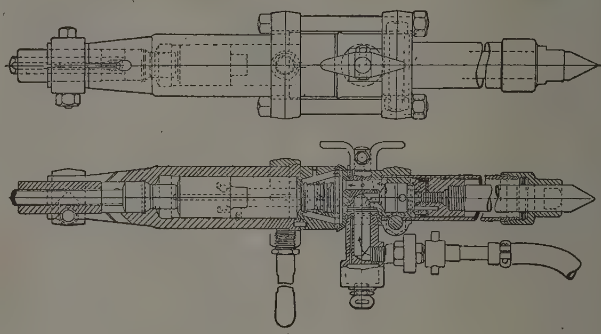

FIG. 5.

Deep Boring.—In recent years, for prospecting by boring, there has been a great increase in the use of the "churn drill"; that is, a drop drill, suspended by a rope from the operating machinery on the surface, and similar in many respects to the standard oil-well drilling plant. For boring holes deeper than, say, 75 or 100 ft., the churn drill has practically superseded the old method of rod-boring, formerly common in Europe. In general, for deep boring, the oil-well "rig," the churn drill and the diamond drill divide the field among them. During the decade 1910–20, many oil and natural gas wells were bored to depths of 4,000 to 5,000 ft., and a few exploratory holes (in Pennsylvania and West Virginia) reached depths of 7,000 to 7,350 feet. For holes of a few hundred ft. in depth, and when cores are desired, the rotary "shot-boring" method, based upon the old Davis Calyx drill, also came into wider use. The apparatus consists essentially of a line of hollow rods, carrying a bit, say, 3 in. diameter by 10 in. long, with a narrow slot cut in its lower edge. At intervals during boring, a quantity of small steel shot is fed down through the hollow rod. The shot distribute themselves between the outside of the bit and the walls of the hole, between the inside of the bit and the core, and under the lower edge of the bit. Due to the rotation of the bit, the shot are caused to roll forcibly with a milling action against the rock, which is thus ground away. (For full details, see Peele, *Mining Engineers' Handbook*, Sec. 9, Art. 16.)

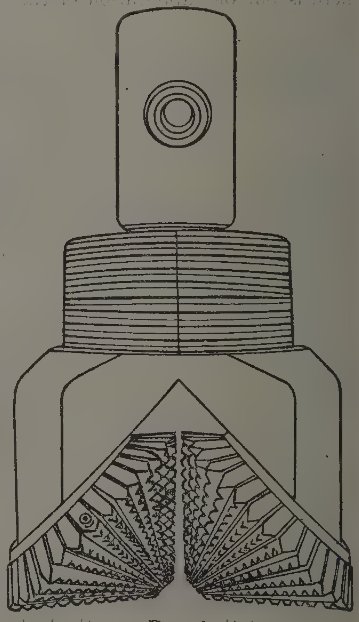

FIG. 6.

For rotary boring in unconsolidated strata overlying the solid rock, the "fish-tail," with two cutting edges resembling those of a large carpenter's auger, has long been employed for oil and gas wells. But this bit wears rapidly if boulders or interbedded strata of shale, etc., be encountered in the gravels and clays. In 1908 the Sharp and Hughes cone-bit (fig. 6) was introduced to replace the fish-tail bit for boring in rock, and it has been widely used in some of the petroleum and natural gas-fields. The bit consists of a pair of hardened steel cones, with serrated or toothed surfaces, revolving on bronze bearings. As the drill rod rotates, the cones roll under pressure upon the rock, crushing and chipping it away. When dull, the cones are readily replaced. These bits in some cases bore as much as 100 ft. of hole in 24 hours. In boring oil wells through soft strata or shattered rock, trouble is often caused by the caving of the sides of the hole before the lining or casing pipe is put in. To overcome this difficulty, "mud-laden" water may be used in the boring operations instead of the ordinary wash-water. Almost any finely divided, clayey material that will remain in suspension for a considerable period of time may be employed. The mixture of mud and water should have a specific gravity high enough to afford a counter-pressure that will support the walls of the hole; a specific gravity of about 1·33 is usually sufficient. The pressures in the bore-hole are thus kept in approximate equilibrium until the hole is lined with pipe (casing), or until screens can be set in the oil-bearing strata and cemented in place. This method was introduced in Europe, about 1895, for sinking cylindrical mine shafts in unstable, water-bearing soil by boring. About 1901 it was adopted for boring oil wells in Texas and Louisiana, and since 1906 has been successfully used in a large number of cases.

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MINING, MILITARY (*see* 10.714).—Until the invention of explosives military mining resembled ordinary mining, in that it consisted of driving galleries or tunnels under the enemy's defences, either with the object of penetrating to the interior of the place attacked, or of undermining the walls and causing them to collapse. The latter method was probably used by Joshua at the siege of Jericho, while he distracted the attention of the defenders by a military promenade round the walls.

When the miner was put in possession of gunpowder he used it first for blowing up the enemy's defences, and later for destroying his galleries and for making craters as points of departure for trenches. The term "mine" in military language thus came gradually to mean, not a system of underground galleries as in civil life, but a charge of explosive operated underground or under water.

The position of military mining in 1910 is described in 10.716; contrary to expectation the first events of the World War seemed to indicate that mining was unnecessary, because the effect of the new heavy howitzers proved to be sufficient in themselves for the reduction of fortresses. But when the armies were settled down in opposing systems of trenches the heavy howitzers lost their preponderating rôle, and in the deadlock that followed old-fashioned methods reasserted themselves for trench warfare, such as grenades, trench mortars, and mining.

On the British front mining was started by the Germans. Before the end of 1914 there were two definite cases of mines under British trenches, and shallow mining systems were started in reply. It soon became evident that there was a probability of mining on an extensive scale, and that the existing R.E. units would be quite unable to supply the necessary personnel. It was proposed that coal-miners should be specially enlisted for the work, and their first detachment arrived in France in Feb. 1915. The formation of "tunnelling companies" followed, and during 1915 there was mine warfare all along the front.

In the early phases mining was chiefly a question of local efforts, partly defensive to counteract enemy mines, and partly directed against close objectives such as strong points in the enemy's trenches or a sniper's post. The mine systems were shallow, being rarely deeper than 20 feet. By June 1915 there was an enormous number of them, and the demands made upon the tunnellers could not be met. The need of a centralized control began to be apparent, not only to coördinate the local schemes, but in order that plans of larger scope might be developed in harmony with strategical ideas. Already in Aug. 1915 the first deep-mining system had been started, against Hill 60, with an object which was more than local; and questions of organization, of instruction, of intelligence and provision of stores all made direct touch with G.H.Q. essential.

Accordingly in Dec. 1915 a mining staff was appointed with an inspector of mines at G.H.Q., and a controller of mines at each army headquarters. The duties of the inspector of mines were defined as follows:—

(*a*) Preparation, under the instruction of the general staff, of mining schemes which were intended to have a bearing on the principal operations of the campaign, and examination of mining schemes prepared by the armies.

(*b*) Inspection, for the information of the commander-in-chief, of the progress of all mining work.

(*c*) Advising the engineer-in-chief on general questions affecting the personnel, organization and equipment of the tunnelling companies.

The officers of the tunnelling companies were chiefly mining engineers drawn from all parts of the world, many of whom had already had experience in the trenches. The men included, besides ordinary coal-miners, a number of specialists known as "clay kickers." These men worked on their backs with cutting tools fastened to their feet. Each man was strapped on a plank which was pushed forward as his excavation advanced, and in this manner, in good ground, he was able to work in a very small gallery and make rapid progress.

Since a good deal of unskilled work was required for removal of soil, transport of materials, etc., a number of infantry were attached to the tunnelling companies. Thus a tunnelling company on the higher establishment had 569 officers and men, and with attached infantry might be 1,000 strong. By the end of June 1916 there were 25 imperial companies and seven overseas companies at work, with a total strength of about 25,000 of all ranks. A new departure was the attachment of geologists to the mining staff; their advice was especially valuable in connexion with the water levels, which in chalk country varied as much as 30 ft. between summer and winter. In the German army the arrangements were much more elaborate, each army having a complete geological staff.

In addition to this it must be noted that for the first time in history the British army had immediate access to scientific brains at home, and could utilize at a moment's notice the most advanced manufacturing facilities of the country. The effect of this showed itself particularly in the development of listening apparatus. In former wars the human ear unaided had to listen for the sounds of the enemy working underground, and estimate his distance and direction; in this war specialists in England were able to turn their attention to the production of listening apparatus as soon as the requirement was made known.

It naturally follows that the headquarters staff, with a very large and highly skilled personnel at their disposal, unlimited resources, and the prospect of a long period of trench warfare, began to conceive operations far in advance of anything that had been contemplated in war.

Shallow mine systems had still to be continued to protect the British trenches, but at the same time deep galleries were started from 50 to 100 ft. below the surface directed against special objects. Naturally the two systems were sometimes worked together. The operations at The Bluff, between St. Eloi and Hill 60, illustrate this. At this point there was a prolonged German offensive from Oct. 1915 to Sept. 1916. Working with a shallow system the Germans blew a large crater in Jan. 1916, which caused many casualties and temporarily destroyed the British position. In July 1916 they blew four mines behind the British trenches, making a crater 150 yd. by 50 yd. The British infantry had been warned by the mine officers; there were few casualties, and a barrage having been arranged for, the Germans could not secure the position. Just before this the British had started a deep gallery about 100 ft. below the surface. Working from this, and after some fighting in shallow systems, they blew four charges, totalling about 10,000 lb.

> "Ten minutes before the blow two officers and eight men of a tunnelling company lay out in a shallow hole in a small crater which had been calculated as directly above the enemy workings. They started to dig down immediately after the blow, and broke through to the enemy gallery by midnight, which they found tamped with sandbags. These were all removed by 10 A.M. next morning, and about mid-day the galleries were entered by men wearing Proto apparatus—a complete survey was made, and 700 ft. of undestroyed enemy gallery, together with much apparatus, was found to have been captured. The enemy system was connected to our own shallow workings, and for the first time in its history The Bluff was reported as absolutely safe from underground attack.
>
> "This final operation was a good example of a successful flank attack; our gallery was well below the enemy, and we succeeded in getting under him and along his front without being discovered."

The Somme offensive in 1916 was an example of mining conceived and executed in connexion with an important attack, the plans being worked out in April, and a programme laid down. The underground work for this attack included mines for destruction of enemy works, galleries to provide advanced emplacements for machine-guns and Stokes' mortars, to be developed into communication galleries, and galleries for emplacements, ammunition, etc., only. There were nine mines containing altogether nearly 200,000 lb. of high explosive. They gave excellent results. The largest, having 40,600 lb. of ammonal, was placed at a depth of 75 ft. at the end of a gallery 300 yd. long; and it destroyed a salient covering 100 yd. of German line. The special point about the "galleries to provide advanced emplacements" was that a tunnelling officer was stationed at the end of each gallery, whose duty it was to break through the top of the emplacements for mortars and machine-guns, and also to break out at the end of the gallery to start the communication trench. Of the galleries for communication purposes only, 16 were connected up with the German lines. The methods of communication were three: by stepping up to the ground level and breaking out and digging; by placing a charge in a bore hole and blowing a crater in the enemy's trenches, then breaking out from the gallery into the crater, and thence into the German trenches; and by making a trench with a "pipe-pusher." Galleries for emplacements to ammunition depots were successfully broken through at the top, and the galleries were used at first for signal cables, runners and ammunition carriers; later for transport of wounded. This operation proved the value of these underground galleries in connexion with an attack.

In Sept. 1916, on the German side, large numbers of miners were sent home for industrial reasons, and mining activity was much reduced. The deep system controlled by G.H.Q., and directed against distant objects, was steadily pushed on, but the old shallow defensive systems were merely kept free of water and watched by listeners. The tunnellers thus set free were employed on what was practically a new development of mining, namely, construction of subways for infantry, and deep dug-outs.

By the end of Feb. 1917 nearly 20 m. of subways had been completed on the I., II. and III. Armies' fronts. In Sept. 1917 the Hohenzollern-Auchy subway system was completed, which made it possible to patrol 4 m. underground. At Nieuport subways and dug-outs were successfully made in spite of great difficulties with water and running sand. At the German attack a subway, not quite completed, east of the Yser, saved a considerable part of the infantry garrison.

The experience gained at the Somme was used to great advantage in preparing the attack of April 9 1917 on the Vimy ridge. In this case the mines, which were actually finished six months before the attack, were not of great importance, only two out of eight being used. The subways, which were made in three and a half months, were an interesting feature:—

> "Twelve infantry subways from reserve line to assaulting trenches. These subways averaged half-a-mile long each, the shortest being 290 yd. and the longest 1,880 yd. They were 6 ft. 6 in. high and 3 ft. wide, with at least 20 ft. of head-cover, and were lit with electric light throughout, small lighting plants being installed in each subway.
>
> "The subways were supplied with dug-outs, assembly chambers, trench-mortar and bomb stores, trench-mortar emplacements, water-tanks, dressing stations, signal offices, and in some cases brigade and battalion headquarters. They had numerous entrances and exits; the latter were broken out into advanced assaulting trenches on the last night, and the troops were able to file out into their assaulting positions through them. Maps on boards were hung at various points to show the position in relation to the surface. Tramways were laid in some of the subways, and these were found most useful for carrying up trench-mortar ammunition, stores and rations; signal cables were carried through the subways and signal stations were installed in them. The dressing stations, being dry and well lit, enabled the wounded to be easily attended to and kept in safety until they could be evacuated. Water-mains were also laid in some.
>
> "Finally, the troops housed in the subways were able to rest in a safe, warm and dry place up to the time of the attack.
>
> "The subways proved most successful, and, throughout, proof against bombardment, the only damage being done to some of the entrances. These were easily and quickly repaired by tunnelling company repair gangs, which were kept in each subway.
>
> "The electric light in the subways was installed and run by the Australian electrical and mechanical mining and boring company. The lights were kept running throughout the whole operation without a breakdown. One plant actually ran 153 hours continuously. Ventilation was good, the only difficulty being in the case of gas attacks, when plenty of ventilation actually increased the danger. Specially appointed traffic officers (not tunnellers) were told off to each subway, and carefully trained beforehand in their duties."

In this connexion the use made of the Arras caves is interesting. These were underground quarries of the 17th century, and were discovered by chance. They were utilized as shelters for men by connecting them with the front-line subways. The main galleries were 6 ft. 6 in. high and 4 ft. wide. The caves and galleries were lit electrically throughout, and water-mains laid. The caves accommodated about 11,000 men.

At Messines (June 7 1917) the main feature was the enormous scale of the explosions, unprecedented in military history. The total charges were nearly 1,000,000 pounds. There were 20 mines distributed over a length of about 8 m., the greatest concentration being 500,000 lb. on 4,500 yd. of front, from Hollandscheschuur to Ontario Farm. The largest mine was 95,600 lb. of ammonal, at a depth of 125 ft., at St. Eloi. The longest gallery was 720 yards.

The first idea of a deep offensive in the Messines-Wytschaete area was in the summer of 1915, when a deep gallery was started against Hill 60. Various deep galleries were started in 1916, but the final scheme had not begun to take shape until the summer. Many mines were laid months before the explosion. From June 1916 to May 1917 the Germans were searching for mine systems and blowing deep camouflets with heavy charges. Galleries were damaged or flooded in many cases, but by strenuous work most of them were restored in time for the attack. A very large amount of dug-out accommodation was provided.

The use of these enormous mines, whose destructive effects could not be definitely foretold, was naturally a matter of anxiety, but they were certainly successful. Ludendorff writes in his memoirs:—

> "We should have succeeded in retaining the position but for the exceptionally powerful mines used by the British, which paved the way for their attack . . . .
>
> "All had been quiet and no sound of underground work on the part of the enemy could be heard at our listening posts. The mines must therefore have been in position long before.
>
> "The moral effect of the explosions was simply staggering; at several points our troops fell back before the onslaught of the enemy's infantry."

This was the last great operation with explosive mines. After this the tunnelling companies were largely employed upon dug-outs and tunnelling. For instance, they made a number of subways through the canal bank near Boesinghe, for storage of material for bridging the canal. Subsequently they made approaches to the bridges by blowing gaps in the bank with bore holes. Other tunnellers were employed on roads and tramways.

During the German offensive in 1918 the tunnellers were used for all sorts of purposes, including demolitions, and when the Allied advance began in August one of their most important duties was the removal of enemy land mines and booby traps.

Advances in Technique.—Probably the most important of these was in the development of "listening apparatus." In the fortress mining systems of 100 years ago an essential feature was the provision of listening galleries pushed out at regular intervals from the front lines of permanent defence galleries; but judgment of direction and distance of the enemy's workings depended entirely on the trained ear of the listener, which might easily be deceived. In the World War listening instruments were invented and employed for the first time.

After much experiment two types were approved, the geophone and the seismomicrophone.

The *Geophone* is on the principle of the stethoscope. A flat circular wooden frame contains mercury enclosed between two discs of mica. Two nipples on the edge of the frame provide for the attachment of ear-pieces with rubber tubes. Sound can be heard through the geophone about two and a half times as loudly as with the unassisted ear. A single geophone can do no more than magnify sound; for this purpose, however, it is very valuable, as it not only increases the distance at which enemy workings can be heard, but it helps the listener to distinguish between various sounds, such as picking, shovelling, talking, etc. With two geophones direction can be obtained, as follows: the two are placed at either end of a frame about 18 in. long, with a compass between them. To ascertain the direction horizontally the frame is placed on the ground and turned about until the sound is equally audible in both ears. The source of sound will then be in a direction at right angles to the line joining the two geophones, and can be plotted from the compass. If a bearing is then taken from another point, the intersection of the two will give the vertical line in which the source must be. To get the direction up or down, the geophones must be placed against the wall of the gallery. An example of the value of this method is given by Standish Ball:—

"A portion of our trenches had been captured by the enemy and heavily wired to repel our expected counter-attack. This was due to take place on the 27th of the month, and the miners were asked to assist in the enterprise and destroy the hostile wire. Owing to the short time available a shaft had to be sunk from the end of a sap, and the objective was reached on the 16th, just as the enemy were heard starting their mining operations. A geophone observation was immediately made, followed by further ones during the ensuing week. On the 24th the enemy were heard talking and laughing, without the aid of an instrument, only 6 ft. away, and to all intents and purposes on the point of breaking through. On examination of the previous observation, however, it was decided that the direction of his gallery was approximately the same as our own, and that he would probably pass along parallel to it. This is what actually happened, and the mine was blown successfully on the appointed day. If it had not been for careful and accurate listening the mine would have been blown prematurely and the success of the infantry attack jeopardized."

The *Seismomicrophone*, an electric detector, does not give direction, but saves man-power. "As many as 50 galleries might be connected up to the switch-board of a central listening chamber, situated in some quiet position behind the mining system. In the event of sounds being heard from the detector in any particular gallery a listener was immediately dispatched with geophones to investigate." This economy of listeners was very important, especially as the end of a gallery is often a very dangerous place.

The following table gives (in feet) the distance at which sounds can be heard by the various methods in chalk and clay:—

Nature of sound	Naked ear	Seismomicrophone	Geophone
Average Chalk			
Picking	125	175	250
Shovelling	70	70	120
Talking	12	45	50
Average Clay			
Picking	50	70	120
Shovelling	8	15	30
Talking	5	10	15

Mine Rescue Work.—One of the greatest dangers in mining has always been the presence in galleries of carbon-monoxide gas from the exploded mines. Owing to the quantity of mines blown and the large charges used this danger became very serious in 1915. "In six weeks one tunnelling company had 16 killed, 48 sent to hospital, and 86 minor cases treated at the shaft head and returned to the company billets." To meet this danger an instructor in the use of Proto apparatus was sent from England in June 1915, and schools for the teaching of rescue work were started.

The Proto apparatus consists roughly of twin cylinders of compressed oxygen, worn slung over the back, and supplying oxygen to a breathing bag containing caustic soda which absorbs CO_2 from the air exhaled. As this apparatus is in use in civil life it is not necessary to describe it here. The Proto set contains oxygen enough to last two hours. The Salvus apparatus is a lighter and more portable modification of the Proto, and is good for about half an hour. Oxygen resuscitating apparatus were also used. Apparatus special to the war were the mine stretcher, designed for dragging a man along a gallery and lifting him up a shaft, and a mine gas-testing set designed in the central laboratory at General Headquarters.

An officer of the R.A.M.C. having been attached to the staff of the engineer-in-chief for mine rescue work, the pathological aspect of the question was very thoroughly investigated.

Bored Mines.—These do not appear to have been much used in their original intention—that of pushing a thin pipe towards an enemy gallery, passing a small charge through it to blow a camouflet, and then filling the latter with a charge of 300 or 400 lb. of explosive. Larger bored mines with tubes up to 6 in. diameter were, however, used to some extent to make connexions. In some cases trenches were made in this way 14 ft. deep and 30 ft. wide. Trenches were also made by sinking bore holes from the surface and placing charges in them 4 ft. deep and 6 ft. apart. This method gave good cover in a very short time.

See *The Work of the Royal Engineers in the European War 1914–19*, section "Military Mining" (1921), which has been freely quoted in this article; also *The Work of the Miner on the Western Front, 1915–18*, by H. Standish Ball (Paper read at a meeting of the Inst. of Mining and Metallurgy, April 10 1919). The mine warfare on the western front is discussed from the German point of view in *Schwarte, Militärischze Lehren des Grossen Krieges* (chap. ii.). (L. J.)

MINNESOTA (*see* 18.548).—The pop. of the state in 1920 was 2,387,125 as against 2,075,708 in 1910, an increase of 311,417, or 15% for the decade, as against an increase of 324,314, or 18·5% for the preceding decade. The total white pop. was 2,368,936, of whom 1,882,772 were natives and 486,164 foreign-born. Negroes numbered 8,809 and Indians 8,761. The density was 29·5 per sq. m.; 25·7 in 1910. The urban pop. (in places having over 2,500 inhabitants) was 1,051,593, or 44·1%, in 1920, 41·0% in 1910, and the rural pop. 1,335,532, or 55·9%; 59·0% in 1910. The following table gives the pop. and the percentage of increase of cities having more than 10,000 inhabitants in 1920.

Cities	1920	1910	Increase per cent
Minneapolis	380,582	301,408	26·3
St. Paul	234,698	214,744	9·3
Duluth	98,917	78,466	26·1
Winona	19,143	18,583	3·0
St. Cloud	15,873	10,600	49·7
Hibbing	15,089	8,832	70·8
Virginia	14,022	10,473	33·9
Rochester	13,722	7,844	74·9
Mankato	12,469	10,365	20·3
Faribault	11,089	9,001	23·2
Austin	10,118	6,960	45·4

Agriculture and Minerals.—There were 178,478 farms in Minnesota in 1920, an increase of 14·3% since 1910. These farms covered about 30,000,000 ac., two-thirds of which was improved; the total value of farm land and buildings was $3,787,420,118. The state's two most valuable crops in 1919 were Indian corn, of which 84,786,096 bus. were raised, the value being $110,221,931; and wheat, 37,616,384 bus., the value being $88,398,508; the total value of the principal farm crops was $506,020,233. Live stock on farms was valued at $293,373,818. The northern part of the state is developing rapidly as a stock-raising and dairying section. About 60% of the output of iron ore in the United States is mined in the three great iron ranges of northern Minnesota. The Mesaba range, 110 m. in length, embraces 180 active mines. The Vermilion and Cuyuna ranges combined form an additional iron belt of about 50 miles. A total of 43,263,240 tons of ore, valued at $144,706,532, was shipped from Minnesota mines in 1918.

Manufactures.—In 1914 Minnesota ranked thirteenth among the states of the Union in the value of its manufactures. In the 5,974 establishments (not including hand industries) then existing, $354,434,177 was invested, 115,690 persons were employed, and products valued at $493,354,136 were manufactured. The value of the products had increased 20% since 1909. The state's five most important industries, in the order of the value of products in 1914, were the flour-mill and grist-mill, slaughtering and meat-packing, lumber and timber, dairy and creamery, and foundry and machine-shop industries. In 1919 some 300 flour-mills produced 29,337,131 bar. of flour; 811 creameries 143,176,204 lb. of butter; and 85 cheese factories 9,452,191 lb. of cheese. In flour and butter Minnesota's products exceed those of any other state. The total value of all dairy products in 1919 was $155,438,698. Since 1910 the slaughtering and meat-packing industries, centred at South St. Paul, have shown rapid growth. Because of the depletion of her forests Minnesota dropped from third place among the states in lumber manufacture in 1900 to sixteenth place in 1920; but, though lumbering declined, timber manufacturing increased, so that Minnesota ranked in 1920 among the first states in the production of pulp wood, railway ties, fence posts, and telegraph poles. The foundry and machine-shop industries also have grown rapidly. A portion of the state's iron ore is now worked in huge iron and steel plants on the St. Louis river near Duluth, and farm machinery is manufactured increasingly.

Transportation.—The railway mileage in Minnesota Dec. 31 1919 was 9,230, an increase of about 9% since 1908. In 1918 there were 161·8 m. of electric line operated in the state. The U.S. Government completed in 1920 the construction of a dam in the Mississippi between St. Paul and Minneapolis, which by means of locks makes the latter city the head of navigation on the river. An attempt is being made to revive freighting on the river, between Minneapolis and St. Louis. With the growth of motor traffic, the demand for good roads has greatly increased, and the state was engaging in 1921 in road building on an extensive scale. An amendment to the constitution (1912) authorized the Legislature to levy a one-mill tax, the proceeds to be distributed among the counties and used for road building and maintenance; another amendment (1920) authorized the Legislature to issue bonds and provided for the taxation of motor vehicles in order to finance a system of state trunk highways covering 7,000 m. and comprising 70 routes which will reach every county seat and important community. There were in 1921 about 98,000 m. of public roads in the state.

Education.—The State Department of Education, as reorganized in 1919, consisted of five citizens, appointed by the governor for terms of five years. The board appoints the commissioner of education, who is actual head of the Department, and holds office for six years. In 1920 240 high schools, 261 graded schools, 255 consolidated schools, and 6,107 rural schools fulfilled the requirements of the Department of Education and therefore received, in addition to local support, state aid, derived from a one-mill tax, from the income on the permanent school fund ($30,920,032 in 1920), and from legislative appropriations. During the year 1920 $38,358,555 was expended upon public education, an average of $76.16 per pupil. A new normal school, the sixth, was opened at Bemidji in 1919. By an Act of 1921 the state normal schools were renamed state teachers' colleges and were authorized to award appropriate degrees. These colleges are controlled by a board consisting of the commissioner of education and eight members appointed by the governor for terms of four years. The university of Minnesota at Minneapolis comprises 13 colleges and schools, those most recently organized being the school of nursing (1909) and the school of business (1919). A noteworthy development in the medical school is its affiliation with the Mayo Clinic at Rochester. In 1915 William J. and Charles H. Mayo, the famous surgeons, established the Mayo Foundation for Medical Education and Research, endowed it to the amount of $1,500,000 and gave it to the university. By virtue of this gift the university controls practically all medical instruction in Minnesota and has been enabled to develop research and graduate instruction in medicine. The Department of Agriculture includes a college of forestry, a school of traction engineering, and a department of home economics. Schools of agriculture and experiment stations at Crookston, Morris, Grand Rapids, Duluth, Waseca, Cloquet, and Zumbra Heights afford assistance and instruction to farmers and students of agriculture in all parts of the state. The university library of 350,000 volumes is supplemented by a number of other libraries accessible to students. These are the Minneapolis Public Library and, in St. Paul, the state Law Library, the library and manuscript collections of the Minnesota Historical Society, housed in a new building erected by the state in the years 1916–8, and the St. Paul Public Library, which with the Hill Reference Library, established by the late James J. Hill, occupies a new and beautiful building. In 1919–20 the university had 9,027 students; in 1920–1, 930 faculty members and 231 buildings (including agricultural schools and experiment stations), erected at a cost of $6,177,443. An extensive building programme covering a period of 10 years was initiated in 1919, when the Legislature appropriated $5,600,000 for this purpose. Besides this the university's income from the state amounts to about $7,500,000 for the biennium 1921–3. Since 1911 the university has had three presidents: Dr. George E. Vincent, 1911–7; Dr. Marion L. Burton, 1917–20; and Dr. Lotus D. Coffman.

Government.—In 1921 the state's machinery for the supervision of labour was reorganized. An industrial commission of three members appointed by the governor superseded the single commissioner previously controlling the Department of Labour. As reorganized, the Department consists of seven divisions: workmen's compensation, boiler inspection, accident prevention, statistics, women and children, employment and mediation and arbitration. The law creating the industrial commission vests it with special powers and duties: (1) to administer the workmen's compensation law; (2) to establish and conduct free employment agencies, supervise the work of private employment agencies, and deal with the problem of unemployment; and (3) to promote voluntary arbitration in labour disputes by appointing, if desirable, temporary boards of arbitration or conciliation and by conducting investigations and hearings.

The consolidation of the direction of the state's charitable and penal institutions under the state Board of Control was completed in 1917, and the Board in 1921 had charge of 17 institutions. Two new ones are an asylum for the insane, with a special ward for inebriates at Willmar (1914), and a state reformatory for women at Shakopee (1920). The new state prison buildings at Stillwater, completed in 1912, cover 22 ac. in a tract of 1,000 ac. The most advanced methods of discipline and management are used, and prisoners are paid wages for their labour. During the year 1919 the *per capita* expense for each prisoner was $368.30 and the earnings averaged $906.66. In the fiscal year ending in June 1920, receipts from prison industries were over $5,000,000. The remarkable development of the prison was due largely to Henry Wolfer, warden from 1892 to 1914. The Legislature of 1921 increased the membership of the state Board of Control from three to five and provided that two members shall be women. The policy of establishing and maintaining state parks, of which Itasca state park was the first in 1891, has been followed consistently, with the result that there were in 1921 14 such parks, located on tracts of land selected for scenic beauty or historic interest. Those recently established are Alexander Ramsey state park in Redwood county (1911); Fort Ridgely state park, Nicollet county (1911); Horace Austin state park, Mower county (1913); Jay Cooke state park, Carlton county (1915); Sibley state park, Kandiyohi county (1919); Toqua Lakes state park, Big Stone county (1919); Whitewater state park, Winona county (1919); Scenic state park, Itasca county (1921); and Sleepy Eye Lake state park, Brown county (1921). In addition the state maintains the Pillsbury state forest, Cass county, and the Burntside state forest, St. Louis county. Two Federal forest reserves are also located in the state: Superior National Forest in St. Louis, Lake and Cook counties; and Minnesota National Forest in Itasca, Cass and Beltrami counties. In 1913 the number of legislative districts in the state was increased from 63 to 67; and in 1920 the term of judges of probate was lengthened from two to four years by constitutional amendment. Over 60 cities of the state, including the three largest, have adopted home-rule charters under the constitutional amendment adopted in 1896 and readopted with some slight changes in 1898. Minneapolis, after many unsuccessful attempts, finally voted favourably on a home-rule charter in 1920.

Finance.—On June 30 1920 there were 1,584 banking institutions in Minnesota, of which 1,151 were state banks, 24 trust companies, 9 savings banks, 69 building and loan associations, and 331 national banks. Their deposits amounted to about $800,000,000. The Federal Reserve Bank for the ninth district is located in Minneapolis. All banking institutions other than national banks are under the supervision of the superintendent of banks. This official, or his deputies, according to the Act of 1909 which created the Department of Banking, examines at least twice a year the banks and other moneyed corporations created under state laws. In 1918, $15,262,760 in income taxes was paid by 84,515 Minnesotans on total net incomes amounting to $291,074,629. The total value of taxable property in the state was $2,084,000,000 in 1921 as compared with $1,194,962,312 in 1910.

History.—The most important political movement of recent years was the growth of the Non-partizan League. The League, organized in North Dakota in 1915 by Arthur C. Townley, aimed to secure "state ownership of elevators, flour-mills, packing-houses and cold-storage plants, the central equipment concerned with the marketing of the farmers' products." The League's organizers began to work in Minnesota in 1916, and in Jan. 1917 its national headquarters were established in St. Paul. To enlist support from the urban population the League attempted to ally itself with labour, through the organization of a Working People's Non-partizan Political League. In June 1920 this movement nearly captured the Republican primary in spite of the fact that the regular Republicans held a pre-primary convention to choose one candidate on whom they should concentrate their votes. Organized labour has rapidly increased its membership, the figures of July 1920 indicating 717 labour unions with a membership of over 90,000. The members of over 80% of the unions reporting to the state Department of Labour received wage increases during the biennium 1918–20. In the same period the Department received reports on 74 strikes, involving 51,940 persons.

Probably the two most important pieces of legislation in the decade 1910–20 were the primary law and the so-called tonnage tax. The former, passed in 1912, provides that candidates for state and county offices be nominated at primary elections in June preceding the general election. With the exception of the state executive officers, the railway and warehouse commissioners, and the clerk of the Supreme Court, all state and local officers, including members of the Legislature, are nominated, and consequently elected, on a non-partizan ballot. The 1921 Legislature provided for pre-primary conventions, but all attempts to modify the non-partizan features of the law have failed. The same Legislature passed an Act for a 6% tax on the net value of mined iron ore, tonnage tax bills having previously been vetoed by Governors Johnson and Burnquist. The alignment on the question was largely sectional, legislators from the mining districts opposing. In Oct. 1918 occurred the most severe forest fires that the state ever knew. The fires burned over 770,500 ac., principally in Aitkin, Pine, Carlton, and St. Louis counties, caused 432 deaths, destroyed about $25,000,000 worth of property, wiped out the thriving towns of Moose Lake and Cloquet, and threatened Duluth. Since this disaster the state forestry board (created in 1911) has greatly increased the state force of forest patrolmen, and during the season of danger local authorities supplement this force. During the unusually dry autumn of 1920, 860 fires were reported (as compared with 525 in 1918), but these were so promptly extinguished that less than 100,000 ac. were burned over.

The following governors held office after 1909: Albert Olson Eberhart (Rep.), 1909–15; Winfield Scott Hammond (Dem.) (died in office), Jan.–Dec. 1915; Joseph A. A. Burnquist (Rep.), 1915–21; Jacob A. O. Preus (Rep.), 1921– .

During the World War the Minnesota National Guard, after serving on the Mexican border in 1916–7, was incorporated in the army, and a total of 123,325 Minnesota men by enlistment and draft entered various arms of the service. The 151st U.S. Field Artillery and Base Hospital No. 26 were probably the most distinctively Minnesotan units in the service. War training schools in Minnesota included the reserve officers' training camps at Fort Snelling, the U.S. Air Service Mechanics' School in St. Paul, the Dunwoody Naval Training Station in Minneapolis, and the Students' Army Training Corps, organized at the state university and at numerous smaller colleges and schools. In order that "Minnesota might have, during the period of the war, a governing body capable of efficiently mobilizing its resources in men and property, and applying them to the war's successful prosecution," the Legislature in April 1917 created the Minnesota Commission of Public Safety, the first of such commissions in the United States, and appropriated $1,000,000 for its use. The people of Minnesota purchased $483,642,950 worth of Liberty Bonds and war savings stamps and contributed about $10,000,000 to war relief agencies. (S. J. B.)

MINTO, GILBERT JOHN ELLIOTT-MURRAY-KYNYNMOND, 4TH EARL OF (1845–1914), English statesman (*see* 18.564), died at Minto House, Hawick, March 1 1914.

MIŠIĆ, ŽIVOJIN (1855–1921), Serbian statesman, was the son of well-to-do peasant parents in a village under Mt. Suvo Bor, in the heart of the famous Shumaja (Shumadia) district, which had always been the backbone of Serbian resistance alike to the Turk and to the Austrian. Born in 1855, he passed through the old Artillery school in Belgrade and served in the Serbo-Turkish War of 1877 and the short Serbo-Bulgarian War of 1885. He then devoted himself to an intense study of military history and strategy. During the Bosnian annexation crisis he became assistant chief-of-staff to Gen. Putnik, and in this capacity made his name in the first Balkan War, being promoted general. In the second Balkan War in 1913 he was mainly responsible, under Putnik's orders, for the decisive operations on the Bregalnitsa, which ended in the overthrow of Bulgaria. When the World War broke out he was once more Voivode Putnik's trusted right-hand man; and when the Austrians, after their initial failure on the Drina and Sava, invaded Serbia with stronger forces in Nov. 1914, Mišić was appointed to the command of the I. Army, which had to bear the brunt of the attack, and strongly urged a counter-offensive. Mišić's simple and unaffected heroism inspired his soldiers with confidence: his army order of Dec. 3 is worthy to rank beside Lord Kitchener's appeal to the new armies of Britain, and certainly holds a record of soldierly directness. "Trust in God and forward, heroes," was all its length. Mišić's spirit spread from his own immediate command to the whole Serbian army and found expression in the decisive victory of Rudnik early in December. The Austrians under Potiorek were driven headlong out of Serbia, with a loss of 40,000 prisoners and an enormous booty, and 10 months were to pass before an enemy was seen again on Serbian soil. Thus, strangely enough was fulfilled an authentic peasant prophecy which foretold that a peasant soldier from the Shumaja would rout a northern invader within sight of his native village.

Mišić, who had been created voivode after Rudnik, distinguished himself still further during the terrible retreat of the Serbian army in the winter of 1915, before the joint German, Austro-Hungarian and Bulgarian advance. Unhappily, politics entered into the military rearrangements which followed the concentration of the wrecked Serbian army at Corfu: but Mišić stood beyond the reach even of party intrigue. After a long interval spent at a western health resort in recovering from the strain of the campaign, he resumed command of the I. Army on the Salonika front in Aug. 1917, and in June 1918 was made chief-of-staff. In this position he played a preëminent part in elaborating the plan to which the piercing of the Bulgarian front and, indirectly, the collapse of Austria-Hungary was due. As a convinced believer in Serbia's national destiny and the idea of Yugoslav unity, he did all in his power to promote the efforts of the exiled Yugoslav committee to organize Yugoslav legions on every front. His death on Jan. 20 1921, after a long and painful illness, was received with national mourning.

MISSISSIPPI (*see* 18.599).—The pop. in 1920 was 1,790,618, a decrease of 6,496, or 0·4%, from the 1,797,114 of 1910, as against an increase of 15·8% in the preceding decade. The negro pop. was 853,962, or 52·2% of the total as compared with 1,009,487, or 56·2% of the total in 1910. The foreign-born whites in 1920 numbered 8,019, or 0·4% of the total pop. The density was 38·6 per sq.m., as against 38·8 in 1910. The urban pop. (in places of over 2,500) was 13·4%; in 1910, 11·5%. The six cities having in 1920 a pop. of over 12,000 were:—

	1920	1910	Increase per cent
Meridian	23,399	23,285	0·5
Jackson	22,817	21,262	7·3
Vicksburg	18,072	20,814	−13·2
Hattiesburg	13,270	11,733	13·1
Laurel	13,037	8,465	54·0
Natchez	12,608	11,791	6·9

Agriculture.—In 1920 61·3% of the land area of the state was in farms, and 51·2% of the farm land was improved. The number of farms was 272,101, a decrease of 0·8% since 1910. These farms contained 18,196,979 ac., of which 9,325,677 ac. were improved land. The improved acreage increased 3·5% from 1910 to 1920. Of the total number of farms in 1920, 91,400, or 33·5%, were worked by owners, or part-owners (68,131 by whites and 23,179 by negroes). The number of white owners increased 12·4% from 1900 to 1920 and the number of negro owners 11%. The average size of the farms decreased from 67·6 ac. in 1910 to 66·9 ac. in 1920. The average value increased from $13.69 per ac. in 1910 to $35.27 in 1920. Cotton continues the most important crop. The acreage of cotton decreased from 3,220,000 in 1907 to 3,100,000 in 1920. The number of acres planted in market-garden produce, peanuts, potatoes, sorghum-cane and corn is increasing. The live-stock industry, pure-bred hogs and cattle, made the greatest relative advance of any branch of agriculture from 1910 to 1920.

Manufactures.—The value of the total output from factories increased from $57,451,445 in 1905 to $79,550,095 in 1914. Mississippi ranked 39th among the states in the value of manufactured products and 31st in number of wage-earners. The capital invested in manufactures increased from $50,256,309 in 1904 to $81,005,484 in 1914, or 62%. The chief manufactured products are lumber, cotton-seed oil and cake, cotton goods (thread, drills, sheetings, muslins, etc.), turpentine and rosin. The leading manufacturing centres are: Meridian, Jackson, Greenville, Columbus, Laurel, Hattiesburg, Natchez and Vicksburg.

Education and Charities.—The most important development in education has been the establishment of county agricultural high schools (1908). Every county may establish one for white children and one for negroes, or two counties may combine and create one set of schools for the two counties. These schools receive state aid on the basis of the number of boarding pupils. They receive also Federal aid. To equalize the term in the grade schools between the delta and hill counties the distribution of the state school fund is based on the number of educable children in each county (1920). A compulsory school attendance law passed in 1920 applies to all children between the ages of seven and fourteen. The state has a normal college for the training of teachers, at Hattiesburg (established 1910). A five-million-dollar bond issue was authorized (1920) to provide buildings for the state's charitable institutions and institutions of higher learning. Greek letter and similar secret fraternities are forbidden by law (1912) in all schools supported in whole or in part by the state. An industrial training school for delinquent and abandoned children is at Columbia (1916), and a tuberculosis sanatorium at Magee (1916).

Administration and Legislation.—In the decade 1910–20 Mississippi enacted much constructive legislation, covering a wide range. The constitution of 1890, enacted to ensure white supremacy, and still in force, has been amended with the view of putting the Government more in the direct control of the people. The initiative and referendum were embodied in the constitution by amendment (1916). An initiative petition must be supported by 7,500 qualified electors, and to refer a law to the people requires 6,000. Any "law, bill, resolution, constitutional amendment, or any other legislative measure" is a proper subject for such petitions. The state also has the recall, but does not apply it to all executive offices. The judiciary is entirely elective—circuit and chancery judges since 1912, Supreme Court judges since 1916. By a constitutional amendment (1916) the Supreme Court consists of six judges and is permitted to sit in two divisions for the consideration of cases. The term of Supreme Court judges is eight years; that of circuit and chancery judges four years. Nine or more jurors may return a verdict in all civil cases in the circuit and chancery courts (1916). The Legislature is elected for four years and meets in regular session biennially (1910). Extra sessions may be called by the governor. All appropriations are made for two years. The fee system for the pay of county officials was abandoned in 1920 and salaries paid according to the assessed valuation of the property of the counties. For this purpose the counties of the state are divided into five classes. The Torrens system for perfecting land titles has been in effect since 1915 and a uniform negotiable-instruments law was enacted in 1916. The state collects a tax of five mills on the dollar on all incomes over $2,500 (1912). A state department of banking was created in 1914 and a board of bank examiners of three is elected for four years. Bank deposits are guaranteed by state law (1916). A bureau of vital statistics was established in 1912, and the Board of Health has done much to reduce malaria, hook-worm and tuberculosis.

The state has a comprehensive child labour law, passed in 1912. No child under 12 may be employed in any mill or factory; and no child under 16 may be employed for more than eight hours per day. No employee is permitted to work in any mill or factory more than 10 hours per day. The county health officer, working under the state factory inspector, is responsible for the enforcement of the law. A pardon board of five members, appointed by the governor for four years, passes on all petitions for pardons (1916). Petitions must be published for 30 days in the county where the crime was committed. The board acts only in an advisory capacity to the governor. A state highway commission was created in 1916.

Mississippi during the World War supplied to the U.S. army 43,362 drafted men (of whom 19,296 were whites and 24,066 negroes), as well as 9,044 volunteers. To the navy 4,069 men were supplied, and to the marine corps 265.

In 1921 the state was represented in the U.S. Senate by John Sharpe Williams and Pat Harrison. The latter defeated James K. Vardaman in 1918 in a hotly contested election, turning largely on Vardaman's opposition to President Wilson's war policies. The following have been governors since 1910: Edmund F. Noel (Dem.), 1908–12; Earl Leroy Brewer (Dem.), 1912–6; Theodore G. Bilbo (Dem.), 1916–20; Lee M. Russell (Dem.), 1920– . (W. C. M.*)

MISSOURI (*see* 18.607).—During the decade 1910–20 Missouri continued her transition from the period of frontier influences, of rapid growth of population and development of natural resources to the stage of industrial development and growth of urban population. The transition was, however, hardly more than well begun, and the state was still primarily agricultural. The total pop. in 1920 was 3,404,055, as compared with 3,293,335 in 1910, an increase of 110,720, or 3·4 per cent. The percentage of urban pop. (in centres of 2,500 or more) increased from 42·5% in 1910 to 46·6% in 1920. Of this urban pop. 34·5% in 1920 was in the three cities of St. Louis, Kansas City and St. Joseph. The rural pop. showed an absolute decrease in both 1910 and 1920; in the latter year only 19 counties showed an increase. The pop. of the 10 chief cities was as follows:—

	1920	1910	Increase per cent
St. Louis	772,897	687,029	12·5
Kansas City	324,410	248,381	30·6
St. Joseph	77,939	77,403	0·7
Springfield	39,631	35,201	12·6
Joplin	29,902	32,073	—6·8
Sedalia	21,144	17,822	18·6
Hannibal	19,306	18,341	5·2
Jefferson City	14,490	11,850	21·6
Moberly	12,808	10,923	17·3
Independence	11,686	9,859	18·5

The Roman Catholic Church remained the largest in the state, having in 1916 445,352 members or 32·5% of the total of 1,370,551 for all denominations. There were 252,107 Baptists, 228,135 Methodists, 145,403 Disciples of Christ, 67,628 Presbyterians, 45,313 Lutherans, and 37,374 members of the German Evangelical Synod of N. America.

Agriculture.—In 1920, 34,774,679 ac., or 79% of the total area of the state, was in farm lands; of this 24,832,966 ac., or 71·4%, was improved. The average size of a farm was 132·2 acres. The percentage of farms operated by owners increased during 1910–20 from 69·4% to 70·4%. In 1920, 51% of the farms operated by owners were mortgaged. The increase in values of farm property in the decade, 74·9%, to $3,591,068,085, reflected primarily the general rise in price level. This rise in price level makes acreage the only intelligible basis for crop comparisons. In 1919 cereal, and hay and forage crops continued to lead. Tobacco remained a relatively unimportant crop, though widely grown, with 4,490 ac. in 1919. Cotton gained from 96,527 ac. in 1909 to 110,927 ac. in 1919. Fruit, primarily apples, continued an important crop. After 1909, the acreage in Indian corn decreased 21·7% to 5,567,079 ac. in 1919, while wheat increased 126·3% to 4,564,990 acres. The greater part of these changes occurred after 1914, resulting from the World War. The total value of all farm crops in 1919 was $559,947,856, of which the cereals contributed $394,195,226, hay and forage $95,897,050. Indian corn was valued at $219,513,084, wheat at $140,202,501, and oats at $32,394,961. Increasing progress is ensured by the extensive drainage operations in the local drainage districts of the S.E., and by the increased interests in improved farming methods and in coöperative organizations. The Agricultural College of the state university in coöperation with the Federal Government has been very active in agricultural extension work; in May 1921 65 counties had farm bureaus, 62 of which employed county farm advisers. On Jan. 1 1920 there were on the farms 906,220 horses, 389,945 mules, 1,714,894 beef cattle, 1,966,750 dairy cattle, 1,271,616 sheep and 3,888,677 swine. The total value of these animals was estimated at $361,841,529. There were 24,883,985 chickens, an increase of 25% over April 15 1910. In 1919 Missouri produced 7,705,993 lb. of wool; dairy products were valued at $34,752,845, and eggs at $42,193,285.

Mines and Quarries.—Lead and zinc continued to be by far the most important mineral products, with a total value of $51,747,580 in 1917, about two-thirds of it for lead, and $27,462,050 in 1918, four-fifths for lead. Under the stimulus of the World War the amount mined as well as the values showed a marked increase; in 1910 Missouri ore produced 161,659 short tons of lead; in 1916 347,869 tons; in 1917 218,253 short tons; and in 1918 287,983 tons. Zinc ore increased from 256,667 short tons in 1910 to 304,070 in 1916, more than one-fourth of the national total, but fell to 113,371 in 1918. Iron, copper, nickel and cobalt, though relatively less important, showed marked increases in 1916, 1917 and 1918, and Missouri retained first place in the production of barytes. The value of coal mined in 1918 was $17,126,498; building stone (chiefly limestone) was valued at $1,652,389. The total value of mining and quarry products was $67,674,146 in 1918; the value of clay products was $9,198,184 and of cement $7,132,470.

Manufactures.—From 1909 to 1914 the total value of manufactured goods increased 11·1% to $637,952,128, while the added value increased 13·4% to $249,237,269. The total of capital invested was $522,548,083. Twelve industries in 1914 had a product valued at more than $10,000,000 each and as a group produced 60·5% of the total value and employed 55·1% of the total wage-earners. Slaughtering and meat-packing continued to furnish the largest single item—$92,060,499 or 14·4% of the total; the boot and shoe industry was second with $52,522,006 (8·2%); flour and grist mills third with $38,686,309 (6·1%); and tobacco fourth with a product valued at $33,380,843 (5·2%). Other industries were malt liquors ($31,801,404); lumber and timber ($18,396,838); men's clothing ($17,300,109), and cars and general shop construction and repairs by steam railways ($12,847,319). The two cities of over 100,000, St. Louis and Kansas City, gave employment to about two-thirds of the wage-earners and produced two-thirds of the total values, St. Louis contributing over half the total in both items.

Government.[1]—Fifty-five constitutional amendments were submitted to popular vote between 1910 and 1920. From 1910 to 1918 out of 42 only one, permitting the pensioning of the blind, was adopted. The bitter opposition to State prohibition (defeated in 1910, 1916 and 1918) and to the single tax (rejected in 1912 and 1918) contributed to the popular distrust of all amendments. In 1920, however, 9 out of the 13 proposed were adopted. Nearly half of all the amendments proposed to relax the limitations on taxing or borrowing power. Seven (all rejected) were to provide more revenue for education, eight (two adopted in 1920) for good roads, and six (two adopted in 1920) relaxed the debt limits for the local units. Other rejected amendments of general interest were those proposing woman suffrage by State action (1914); a State tax commission

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[1] The legislation of 1921 is subject to rejection through the referendum.

(1912); rural credit schemes (1916, 1918); increased pay for legislators (1910, 1914, 1920); pensions for police and school teachers in cities (1910). The uniform failure, until 1920, of the proposed amendments stimulated a demand for a new constitution. Although endorsed by both parties since 1916, the proposal was not submitted by the Assembly, largely because of partizan opposition to the basis of representation in the convention. A constitutional amendment, proposed by the initiative, was adopted by popular vote in 1920, including a compromise on apportionment, and providing that the question of holding a constitutional convention should be submitted to the voters at least every 20 years and for such a submission at a special election in 1921. Missouri ratified the Sixteenth Amendment to the Federal Constitution (income tax) in 1909, the Seventeenth (direct election of U.S. Senators) in 1911, the Eighteenth (prohibition) and Nineteenth (woman suffrage) in 1919. An Amendment to the constitution of the state adopted in 1920 gave cities of over 100,000 the right to draw up their own charters. Fifteen of the proposed constitutional amendments were submitted through the initiative, including prohibition (twice), the single tax (twice) and woman suffrage. Only one of the 15 was adopted, that providing for a new method of summoning a Constitutional Convention (1920). Six Acts of the Legislature have been submitted to a popular vote through the referendum; four were rejected in 1914, including the minimum train crew Act. The "bone dry" prohibition Act was upheld in 1920, but workmen's compensation was defeated.

The more important new administrative boards and bureaus were the Food and Drug Commissioner, 1909 (abolished 1921); the Public Service Commission, 1913; the State Highway Department, 1917; and the Tax Commission, 1917 (abolished 1921). The Public Service Commission 1913 with real powers of regulation marked a departure from the earlier Missouri practice of leaving the regulation of public utilities to local city boards. Consolidation of departments and commissions, urged by Gov. Hadley, began in 1917, when the penitentiary and other reformatory institutions were placed under a single prison board, and by 1921 had made substantial progress. Seven general departments were created: the Department of Finance, including the old Departments of Banking, Building and Loan Associations and Soldiers' Settlement; Commissioner of Public Welfare, including various departments in charge of inspections; the Board of Eleemosynary Institutions; Department of Labour; Department of Agriculture; and the Department of Budget, to take over the supervisory and budget-recommending powers of the Tax Commission and serve also as a purchasing department.

Missouri remained conservative in labour legislation; a minimum train crew law was defeated in 1914, and a workmen's compensation law in 1920, both by the referendum. A new compensation law, elective on the part of the employer, was passed in 1921. A fairly comprehensive but very moderate Act was passed in 1913 to provide for the health and safety of employees, including limitation of hours for women. The compulsory school attendance law of 1919 incidentally limited child labour. The greater part of a children's code, recommended by two commissions, was put in the statute book.

Revenue.—The revenue, inelastic through constitutional limitations, proved increasingly inadequate after 1910, until the unpaid current obligations in 1917 totalled $1,800,000, in spite of many vetoes of appropriations. Attempts to secure relief for special purposes such as schools and good roads by constitutional amendments had all failed. The Assembly in 1917 passed new indirect taxes, a state income tax, a corporation franchise tax, a direct inheritance tax (superseding the collateral inheritance tax), a secured debts tax, "soft" drinks stamps and wholesale liquor dealers' licence, which yielded altogether nearly $2,400,000 in 1917–9. It also established the Tax Commission which in 1918 and 1919 urged a 100% assessment for the direct property tax to secure uniformity of taxation and increase of revenue. The state Board of Equalization raised the total assessed valuation about 20% in 1919 and proposed a further substantial increase in 1921. The assessed valuation of real and personal property increased from $1,658,587,414 in 1916 to $2,471,746,046 in 1920. The total revenue of the state was $7,151,125 in 1910 and $17,666,137 in 1918. The *per capita* cost of state government was still low, $4.51 in 1919; the direct property tax levy was only $0.54 on the $1,000 of actual cash value in 1916, and $0.88 in 1919. The outstanding state debt Jan. 1 1921 consisted of $4,398,839 certificates of indebtedness in the school and seminary funds, and $1,500,000 capital refunding bonds, a total of $5,898,839. The net indebtedness of the counties in 1913 was $6,580,450 and of incorporated places $46,999,383.

Charitable and Penal Institutions.—An industrial home for negro girls was authorized in 1909 and opened at Tipton in 1916. The Training School for Boys at Boonville was in 1915 transformed into the Reformatory for Boys. In 1917 the administration of the penitentiary was reorganized, contract convict labour abolished and conditions improved.

Education.—Missouri appropriates one-third of the general revenue to the support of the public schools, amounting to $1,618,341 in 1910 and to $3,423,849 in 1920. To this must be added $187,040, the interest on the state's common school fund of $3,159,000. The estimated total expenditure for public schools from state and local sources rose in the decade 1910–20 from $13,905,188 to $28,048,051. The permanent county and municipal funds of the counties, derived from the proceeds of the sales of stray animals and from escheats and fines, and from permanent township funds, derived from the sale of lands granted by the Federal Government, increased from $9,825,991 to $11,561,583. The average daily attendance of the public schools rose from 490,374 to 531,221. Although the public schools continued to lack sufficient revenue, there was much constructive legislation, especially as to the rural schools. The state funds were apportioned on the basis of the number of teachers and attendance instead of enrolment (1911) and additional aid was given to rural schools (1909, 1911, 1915) and to high schools (1913) in the poorer districts. The size of the local school district for purposes of administration and taxation was increased through authorizing the appointment of county superintendents (1909), encouraging the consolidation of schools (1913, 1917) and especially by the county unit Act of 1921, which, in all counties that do not include a first-class high school, made the county the unit for administration and taxation. The requirements for teachers' certificates were raised in 1911 and 1921 and provision made for the training of teachers in the high school (1913). An effective compulsory attendance law was passed in 1919. Under the Federal Smith-Hughes Act, Missouri received in 1920 $103,808 from the Federal Government for vocational education and for the training of teachers. The enrolment in the state university at Columbia and Rolla increased from 3,083 (165 at the School of Mines at Rolla) in 1911 to 5,800 (466 at Rolla) in 1920. For the biennial period 1911–2 the university received from interest on the state Seminary Fund, state appropriations, income on endowment, and from the Federal Government a total of $1,555,712; for the biennium 1919–20, the corresponding total was $2,483,808. The Extension Division was organized in 1913; the School of Commerce in 1914, expanded in 1916 to the School of Commerce and Business Administration. There was notable development in extension work in agriculture and home economics under the recent Federal aid laws. In 1911 the university was placed on the approved list of the Carnegie Foundation for the Advancement of Teaching.

History.—Governor Hadley was a leading supporter of Roosevelt for the Republican nomination in 1912, though supporting Taft in the election. Wilson that year received 330,746 votes, Taft 207,821, Roosevelt 124,371. In 1916 Wilson defeated Hughes by 28,693, but the Democratic candidate for governor defeated the Republican by only 2,263. In 1918, however, Folk, the Democratic candidate for U.S. Senator, ran 35,283 behind Spencer, Republican, while the Republican candidate for state Superintendent of Education won over the Democratic by 1,109. The disorganization in the local Democratic party was increased by the opposition of Senator Reed to the League of Nations and, with the general national reaction, resulted in 1920 in the election of a Republican state administration and a Republican majority in both Houses of the Assembly (for the first time since 1870) and in a presidential majority for Harding over Cox of 152,363.

In the World War Missouri furnished (to Oct. 31 1918) 140,257 men; of these 92,843 were inducted under the Selective Service Act. Her losses were 1,270 killed in action; 1,531 dead from wounds, disease and accident; a total of 2,801. Missouri's subscription and quota for the First Liberty Loan were respectively $51,863,388 and $65,562,800; for the Second $80,810,400 and $122,226,600; for the Third $79,599,700 and $110,828,300; for the Fourth $163,884,700 and $172,832,700; and for the Fifth, or Victory Loan $119,118,050 and $121,627,550. Missouri was one of the first states to establish (April 24 1917) a State Council of Defense which, through a very efficient system of county councils, greatly increased the production of food-stuffs, increasing the wheat acreage over 20% in 1917, and by an even greater percentage in 1918, and investigated the few cases there were of disloyalty or disaffection.

Recent governors have been Herbert S. Hadley (Rep.), 1909–13; Eliot W. Major (Dem.), 1913–7; Frederic D. Gardner (Dem.), 1917–21; Arthur M. Hyde (Rep.), 1921– . (J. Vi.)

MISTRAL, FRÉDÉRIC (1830–1914), Provençal poet (*see* 18.616), in 1906 published a Provençal translation of *Genesis*, and *Olivades*, a collection of Provençal poems, in 1912. His memoirs appeared, under the title *Mes Origines*, in 1906. He died at Maillarre, near Marseilles, March 26 1914.

See P. Brousse, *Frédéric Mistral* (1903); E. Lefèvre, *Bibliographie mistralienne* (1903); H. J. Bocken, *Frédéric Mistral* (1910); J. Brochet, *Frédéric Mistral* (1910); J. Charles Roux, *Le Jubilé de Fr. Mistral* (1912); E. Ripert, *La Versification de Frédéric Mistral* (1917); P. Lasserre, *Frédéric Mistral* (1918); J. Vincent, *Frédéric Mistral: sa vie et son influence* (1918).

MITCHELL, SILAS WEIR (1830–1914), American physician and author (*see* 18.618), died in Philadelphia, Pa., Jan. 4 1914. After 1910 he published *John Sherwood, Ironmaster* (1911), *Westways* (1913), and *Complete Poems* (1914).

MOHN, HENRIK (1835–1916), Norwegian meteorologist, was born at Bergen May 15 1835, his family being of German origin. He was educated at the Cathedral school, Bergen, and afterwards entered the university of Christiania, where he took his doctor's degree in 1852. In 1861 he became an observer at the Christiania observatory, in 1866 was elected professor of meteorology at Christiania University, and in 1866 was appointed director of the Norwegian Meteorological Institute, which he was largely instrumental in founding. He retained this post until 1913. Mohn's meteorological researches were of the highest importance. His *Études sur les mouvements de l'atmosphère*, written in collaboration with the mathematician Goldberg (1876–8), is a work of great value for the study of the dynamics of the atmosphere, and the authors continued their researches on the subject in various papers contributed to the *Zeitschrift der Oest. Meteor. Gesell.* (1877–8). Mohn did much work on the subject of storms, publishing storm maps of the Atlantic (1870–1); and he also carried out researches (1876–8) on the meteorology and oceanography of the northern Atlantic. He worked out and published the meteorological observations of various polar expeditions, including those of Nansen in the "Fram" (1893–6), the second "Fram" expedition (1898–1902), and Amundsen's south polar journey (1910–2), some of his papers appearing as supplements to *Petermann's Mitteilungen.* He also published many articles on the climate of Norway and conducted investigations into the use of the hypsometer, which are of great importance for the study of the physics of the earth. Besides the works mentioned above, he produced *Grundzüge der Meteorologie*, which has gone through numerous enlarged editions since its first appearance in 1872 as a small text-book. Mohn was a member of many foreign scientific societies, and was senior hon. member of the Royal Meteorological Society of London, having been elected in 1874. He died at Christiania Sept. 12 1916.

MOLESWORTH, MARY LOUISA (1839–1921), Scottish writer (*see* 18.660), died in London, July 21 1921.

MOLTKE, HELMUTH VON (1848–1916), Prussian general, chief of the German general staff at the outbreak of the World War, was born at Gersdorf in Mecklenburg on May 23 1848, and was the nephew of the great Moltke. From 1902 to 1904 he was in command of the 1st Div. of the Guards Corps with the rank of lieutenant-general. In 1906 he was appointed chief of the general staff of the army. He was responsible for the general conduct of the German operations at the beginning of the World War and is now known to have been acting upon the plan for the invasion of the north-east of France and a rapid advance upon Paris which had been drawn up by his great predecessor, Gen. von Schlieffen. In important particulars, however, he appears to have deviated from Schlieffen's plan, and in particular to have failed to concentrate sufficient force in the blow which was delivered on the north-east. He has likewise been charged with having failed to coördinate the positions of the German forces on the eve of the battle of the Marne, and having allowed to be issued confusing orders which contributed to the German defeat in that decisive battle. About the same time his health had become seriously impaired, and on Oct. 25 1914 he was relieved of his post and was succeeded by Gen. von Falkenhayn. He was entrusted in Berlin with the office of chief of the home substitute for the general staff (*Der stellvertretende Generalstab*), which had the task of organizing and forwarding the reserves and of controlling the Territorial army corps, corresponding to those at the front. General von Moltke died suddenly at a celebration in the Reichstag building on June 18 1916. He left memoirs entitled *Die "Schuld" am Kriege*, which up to 1921 had not yet been published.

MOND, SIR ALFRED MORITZ, 1ST BART. (1868–), British politician, was born at Farnworth, near Widnes, Lancs., Oct. 23 1868, the son of the famous chemist Ludwig Mond (*see* 18.693). He was educated at Cheltenham and St. John's College, Cambridge, and afterwards at Edinburgh University. In 1894 he was called to the bar, and afterwards joined the North Wales and Chester circuit. He entered the firm of Brunner, Mond & Co., becoming a director in 1895, and also became chairman of the Mond Nickel Co. and a director of the South Staffordshire Mond Gas Co. and various other companies. He was elected to Parliament in 1906 as Liberal member for Chester, losing his seat in 1910, but the same year was elected for Swansea and created a baronet. On the formation of Mr. Lloyd George's Ministry in 1916 he became First Commissioner of Works, and in 1921 he became Minister of Health. Sir Alfred Mond was in 1908 chairman of the chemical industries section of the Franco-British exhibition. He published many articles on the alkali trade in scientific and economic journals, besides a volume of essays, *Questions of To-day and To-morrow* (1912). His wife Violet, daughter of J. H. Goetze, was well known in society, and was created D.B.E. for her work during the war; and their daughter Eva Violet married in 1914 Visct. Erleigh, eldest son of Lord Reading.

MONET, CLAUDE (1840–), French painter (*see* 18.694). In his later years Monet worked at his painting solely in the neighbourhood of Giverny, where he lived, and devoted himself to the study of modifications in the aspect of a limited number of subjects caused by changes in the light and the seasons. On the motive of the "Bassin aux Nymphéas" he produced a series of twelve large compositions. Another series, painted in 1913, is the "Arceaux Fleuris," which represents a corner of his garden at Giverny. In 1918 he produced a number of similar studies under the general title of "Saule Pleureur."

MONEY MARKET (*see* 17.732*).—Like most of the terms current in business or in economics, the phrase "money market" is used in different senses. It sometimes means the whole financial machinery as applied to the creation, collection and distribution of both credit and capital, and so includes not only the banks, accepting houses and discount houses, but also the stock exchange, bullion brokers, dealers in foreign exchange, company promoters, and all others who handle the business of lending and investing money and transferring it from one country to another. The subject of the present article, however, is the money market in the narrower sense of the phrase, covering the machinery of the creation and distribution of credit—that is to say, of banking money which can be produced for the use of borrowers by banks and financial firms and companies. Loan issuers, company promoters, and stockbrokers do not exercise this power of creating money; they collect money saved by the public or borrowed by the public from bankers, and hand it over to governments, municipalities or industrial and commercial users to be used by official borrowers for public works, or for military expenditure, or to cover a deficit, and by industry and trade in developing production and distribution. The money market, however, in its strict and narrower sense not only collects money but creates and expands its supply. In England, where before the World War the money market had been developed to a very high point of elasticity and specialization, it worked by means of a ring of banks grouped round the Bank of England as its centre, with the assistance of accepting houses, a group of private firms of high standing, who performed an important function in the creation of bills of exchange, and the discount houses or bill-brokers, a group of joint-stock companies and private firms, which specialized in buying and selling bills of exchange, using for this purpose money largely borrowed from the banks.

In any country which founds its monetary system on a scientific basis the power of the banks to create credit cannot be expanded indefinitely; some check must be imposed either by law, or, as in England, by convention, tradition and the prudence of the bankers. Caution on their part is stimulated by the fact that they have always to be ready to meet demands upon them in legal-tender cash; and so the amount of credit which they can prudently create is limited by the amount of legal-tender cash that they have available or can obtain if required.

Legal-tender cash means cash that can be legally tendered, and must be received by the creditor, in payment of a debt. In

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* *These figures indicate the volume and page number of the previous article.*

England it consisted before the war of gold sovereigns and half-sovereigns and Bank of England notes, which could be tendered up to any amount; silver coins, which could be tendered for payments of not more than forty shillings; and bronze coins up to 12 pence. Since, as will be seen, the amount of Bank of England notes that could be issued depended strictly upon the amount of gold held by the Bank, it thus followed that the amount of gold at the Bank of England and in the hands of the other banks limited the amount of banking currency which the banks were able to create, owing to the fact that this banking currency was convertible on demand into legal-tender cash. This was the justification for the statement that the basis of British credit was gold; but it should be remembered that this statement only conveys half the facts of credit creation. Gold was the basis of credit in so far as it limited the amount which the bankers could prudently make themselves liable to provide if called upon; but another and very important part of the basis of credit consisted of the wealth and standing of the borrowers and the security which they were able to offer for the repayment of the loans, advances and discounts through the creation of which new credit was produced and new banking money was put into circulation.

Returning now to the group, described above, that conducted credit operations in the City of London before the war, we find at the centre of it the Bank of England, whose strength and prestige depended on the fact that it was banker to the British Government and so was believed to be able always to rely upon its support in time of crisis, and also to the great joint-stock banks which had covered England with their branches and held, as we shall see, a balance at the Bank of England as part of their cash reserve, another very important item in which was their holding of Bank of England notes. The issue of these notes was strictly regulated by the terms of the Bank Act of 1844. Up to £18,450,000 (originally £14,000,000) notes could be issued against securities; beyond this sum every note had to be backed by its equivalent in coin and bullion; according to the terms of the Act, one-fifth of this bullion might consist of silver, but this power had never been exercised since 1861; after that date the metallic backing of the Bank of England's note issue always consisted of gold. The securities held against the £18,450,000 notes—the fiduciary issue as they are usually called, which have no metallic backing—have always been Government securities, but this restriction is not imposed by the Bank Act, which only instructed the Bank to transfer to its issue department securities, of which the public debt of 11 millions (a book debt from the Government to the Bank) should form part.

No such legal restrictions limited the extent to which the Bank of England and the other banks of the country could create credit for their customers. In its issue department, which conducts the note issue, the Bank of England was tied hand-and-foot by the Act of 1844. In its banking department it was free to create credit to any extent that its own prudence permitted, and it is this fact that gave the London monetary system the elasticity combined with control which was one of its chief claims to efficiency. The Bank could not, without breaking the law, expand its note issue without an equivalent expansion in its holding of bullion, but it could, according to its own judgment, by making advances and discounting bills, expand the amount of credit in its books held by the other banks; and these book credits at the Bank of England were regarded by the other banks and by the whole financial and commercial community as practically the equivalent of legal-tender cash at least for balance-sheet purposes. To make the matter clearer, specimens are here appended of a pre-war Bank of England return and a balance-sheet of the largest joint-stock bank.

BANK OF ENGLAND

Account for the Week ended Wednesday, July 15 1914

ISSUE DEPARTMENT

Notes Issued	£56,908,235	Government Debt	£11,015,100
		Other Securities	7,434,900
		Gold Coin and Bullion	38,458,235
	£56,908,235		£56,908,235

BANKING DEPARTMENT

Proprietors' Capital	£14,553,000	Government Securities	£11,005,126
Rest	3,431,484	Other Securities	33,623,288
Public Deposits	13,318,714	Notes	27,592,980
Other Deposits	42,485,605	Gold and Silver Coin	1,596,419
Seven-day and other Bills	29,010		
	£73,817,813		£73,817,813

LONDON CITY AND MIDLAND BANK

Balance Sheet, June 30 1914

(Condensed and simplified)

Paid-up Capital	£ 4,348,650	Cash in Hand and at Bank of England	£15,128,192
Reserve Fund	3,700,000	Money at Call and Short Notice	12,510,356
Current, Deposit and other Accounts (including Undivided Profits)	95,027,439	Investments	8,835,697
Acceptances	7,353,110	Bills of Exchange	10,230,300
		Advances, Loans and other Accounts	54,081,382
		Liability of Customers for Acceptances	7,353,110
		Premises	2,290,162
	£110,429,199		£110,429,199

In an ordinary bank balance-sheet the first item on the "Assets" side consisted of: "Cash in hand and at the Bank of England," which were put together under one heading as if there were no practical difference between a holding of legal-tender cash and a credit in the books of the Bank of England. By means of this convention, cash at the Bank of England could be very easily expanded, through advances made by it which became cash at the Bank of England in the balance-sheets of the other banks, whenever there was need for an abnormal amount of money at seasons such as the end of each quarter and especially the last day of the year, owing to heavy payments then made and the large number of balance-sheets, both banking and other, which are then drawn up. These advances were seldom or never made directly to the other banks. The second line in the assets in their balance-sheets consisted of: "Money at call and short notice," which were usually made to discount houses and stockbrokers, though other borrowers, such as Indian and Colonial banks and foreign banks and financial firms, also took large sums at times from the English banks. By calling in some of this money at times of stringency the banks used to compel the discount houses to borrow from, or discount bills at, the Bank of England, and stockbrokers to borrow from it, in order to repay them: the fresh credit so produced was paid into the accounts of the banks and so increased their holding of cash at the Bank of England. This system worked with very great ease and elasticity, but was obviously liable to abuse and tempted the bankers to create credit, perhaps sometimes too freely, relying on this power to replenish their resources as described. The same result was produced when the Government found it necessary to borrow from the Bank of England at times when its expenditure was temporarily larger than its revenue. If, for example, the Government borrowed 2 millions from the Bank on "Ways and Means" or "Deficiency" Advances, in order to pay for battleships or meet the interest on Consols, the Bank of England gave them so much credit in its books, which it paid out to shipbuilders or Consols holders in the form of cheques on the Bank, and those who received this newly created money paid the cheques into their own accounts at their own banks, which thus received an addition to their cash at the Bank of England. Thus, whether the borrowing was done by the Government or by the financial community, the result was usually an addition to the other deposits in the banking department of the Bank of England, with a corresponding increase in the securities on the other side. If the Government were the borrower the increase would be under Government securities; if the borrowing was done by other customers the increase would be in "other" securities. It should be noted that the "other deposits" in the Bank of England's banking department include many other accounts besides those of the other banks. The public deposits are exclusively those of the British Government; the accounts of any other public body, such as the Indian Government and Colonial Governments or British municipalities, and all the private customers who bank with the Bank of England, are included with the other banks in the "other deposits."

On this basis of "cash in hand and at the Bank of England" the other banks had built up the great organization which had covered England with a network of branches which collected, distributed and created cash and credit for the community. The specimen balance-sheet given above needs little explanation. On the liabilities side we have the capital subscribed by the shareholders to start the business, which is only a liability in the sense that it would have to be repaid or accounted for if the bank were wound up. The reserve fund has been accumulated out of past profits and is also a liability only in the sense that it is the property of the shareholders and has to be accounted for. A liability in a much more real sense is the item of current and deposit accounts which makes up the greater part of the total. This is money deposited by the public and liable to be withdrawn on demand in the case of current accounts, or after notice of seven days or some other short period in the case of deposit accounts. On the other side of the account we see: "Cash in hand and at the Bank of England," "Money at call or short notice," which has been lent, as already described, to discount houses, stockbrokers, and other professional dealers in money. The "Bills discounted" are bills of exchange, most of which are probably drawn on other banks or the great London accepting houses, though they also include a considerable number of local bills discounted for industrial customers. With a portfolio of bills of this kind, arranged so that a certain proportion fell due every day, a bank could always replenish its cash by refraining from buying new bills to take the place of those maturing. "Investments" are the bank's holding of British Government and other securities, usually of a kind which it would expect to be able to realize by sale on the Stock Exchange in the case of any sudden demand upon it for cash. The large item of "Loans and advances" expresses the activity of the bank in financing industry and trade by lending money to customers. Here again it should be noted that, just as the Bank of England, by lending money or discounting bills, increased the amount of its own deposits, so the other banks by the same process increased the aggregate of general banking deposits. The borrowing customer gets a credit (say for £10,000) from his bank A, against which he would draw a cheque to make the payment for the purpose for which he borrowed the money. If the cheque was paid to a customer of the same bank its deposits would be increased by £10,000 and its loans and advances by the same amount, its cash total being unaffected. If the recipient of the cheque banked with another bank, B, then the cheque would, through the machinery of the clearing-house, transfer £10,000 of cash at the Bank of England from bank A to bank B, and B's cash and the amount of its deposits will both have been increased by £10,000. Bank A would have had its cash at the Bank of England diminished by £10,000, but its loans and advances would have been increased by this amount and its deposits would be unaltered by the transaction; and as long as this loan was outstanding the increase that it had thus effected in the aggregate of banking deposits would remain. It will be noted that the item of acceptances which appears among the liabilities is exactly balanced on the assets side by "liability of customers on account of acceptances." This item arises out of the creation of bills of exchange which had been accepted by the banks on behalf of customers who had directed those from whom they bought goods to draw upon the bank, so putting into their hands a first-class security which could be easily negotiated. By thus placing its name at the disposal of a customer the bank earned a commission, and the customer was, of course, bound to put the bank in funds before the bill fell due; and the bank's liability to meet the bill was thus offset by the customer's liability to provide it with the wherewithal. By this means home and international trade were financed by the creation of bills of exchange, which have been called the currency of international trade, and the banks, as has been shown above, were enabled, by buying these bills under discount, to provide themselves with a convenient and liquid form of security which could be relied upon to produce cash at its due date. The special function of the banks, however, and the one with which the public is most familiar, was their provision of facilities for deposit, the creation of deposits by advances, and the transfer of such deposits from one to another by cheque. By this means they provided the commercial community with a money or currency that was safer and more convenient to handle than legal-tender cash. Bank deposits thus became potential currency which could be turned into actual currency by drawing a cheque.

The function of the accepting houses has already been described when the accepting business done by the banks was explained. The accepting houses accepted on behalf of customers in exactly the same way as the banks, but in their case this business was generally their chief if not their sole activity. Some of them, however, applied the connexions which they thus acquired abroad in acting as issuers of foreign loans. By accepting bills which were used in commercial payments all over the world they also were, in a sense, creators of credit and currency as long as their paper was readily taken and discounted. Many of the bills drawn on them were against goods or securities or gold going from one foreign country to another, or were drawn in anticipation of shipments of goods, or merely against the credit of the drawer and acceptor. In the two latter cases they were usually called "finance bills."

The position of the discount houses, also, is already to a great extent apparent. They, using their own capital and to a much greater extent money borrowed from banks and others, bought bills of exchange accepted by banks, accepting houses, merchants and traders, and either held them until maturity or sold them to banks and others who required a short investment that could be relied upon to become cash at due date. By the rate at which they borrowed from day to day or for short periods from the banks they established the rate for money in the market, and by the rate at which they bought bills they established the discount rate. As their most important lenders and their most important buyers of bills were the banks, it followed that the extent to which the banks were prepared to lend the money and buy bills had an important influence in fixing rates for loans and discounts.

Since there was no control by law in England over the extent to which the banks could create credit and since, as has been shown, they were able easily to increase their holding of cash at the Bank of England by calling in loans from the discount houses and so compelling them to borrow from the Bank of England, a temptation which was thus put before the banks to create too much credit had to be corrected by constant vigilance on the part of the Bank of England. In the case of all material commodities, cost of production is an influence against excessive supply at too low a price; in the case of credit, the creation of which is a matter of book-keeping, this consideration hardly arises, since no more clerical work is involved by an advance of a million than by one of a thousand pounds. Consequently an artificial check had to be provided by the regulation of the money market by the Bank of England. If the banks created too much credit, with the result that the discount rate in London declined to a point that was not justified by England's position in international trade, an excessive number of bills of exchange on London would be created and, being offered in foreign centres, would turn the foreign exchanges against London. Ultimately this process would correct itself because the depreciation of the exchanges would at a point cause exports of gold from England, so reducing the basis of credit and compelling the banks to restrict its creation. But it was not considered safe to leave the market to its own devices until this tardy remedy worked. The Bank of England, as custodian of the country's chief gold reserve, was accustomed when the exchanges threatened gold exports to raise its official rate of discount, so giving notice to the discount houses that if they were obliged to borrow from it they would have to pay more for the accommodation, and making them more careful about buying bills at too low rates. But if, owing to the flood of cheap money with which the discount houses were provided by the other banks, this warning did not suffice, the Bank of England was accustomed to take further action by borrowing money itself in the market and so artificially restricting the supply. By this means the level of rates in London was raised, with the result in normal times that a demand for bills on London was stimulated among foreign capitalists who wanted to lend funds there, the exchanges turned in London's favour, the threat of gold exports was reduced and, if the policy was maintained with sufficient determination, gold imports finally resulted, thus materially reinforcing the basis of credit.

Effect of the World War.—Such was the delicate machine into which war crashed like a bomb into a greenhouse. Its effects were immediate, and began, in fact, some days before a shot had been exchanged on the field of battle. England declared war on Tuesday, Aug. 4, but on the preceding Friday, July 31, the London Stock Exchange, which had remained open for business all through the Napoleonic wars, decided that it had to close before this war had even begun. The bourses of continental Europe had already set the example and the London Stock Exchange, which had been subjected to an enormous flood of continental selling, was unable to continue alone to bear the brunt of these realizations. It should be noted that the New York Exchange, though it was not then the international market that it has since become, but chiefly confined its operations to dealing in American securities, immediately followed London's lead. The effect on the banking position of the closing of the market in securities was twofold: In the first place the banks were unable to increase their cash resources by realizing their investments; in the second place they were unable to call in loans from stockbrokers and other customers who had given Stock Exchange securities by way of collateral pledge, owing to the inability of the borrowers to realize their security.

Thus one of the banking assets, which had been regarded as more or less liquid, had become unrealizable and frozen—partly, perhaps, owing to the action of the banks themselves, which were said to have increased the pressure of realization on the Stock Exchange by ruthless calling-in of loans, thus compelling their customers to sell securities pledged. This freezing process developed rapidly. The market in foreign exchange was already in a demoralized condition, and the consequence was that foreigners who owed money to England were unable to remit it, however hard they might try.

It has already been explained that, owing to the great international acceptance business which London has developed, the London banks and accepting houses accepted bills drawn by foreigners against shipments of goods from all parts of the world to England or in many cases from one oversea country to another, while a certain number of bills were also drawn, not against shipments of goods at all, but sometimes in anticipation of such shipments and sometimes merely in order to create credit against the wealth and prestige of the parties. The solvency of the London accepting houses thus depended to a certain extent on the ability of foreign customers to remit funds for meeting bills of exchange at their due date. Even when bills had been accepted on behalf of an English customer, who had arranged the credit for a foreigner, the position was almost equally unpleasant, because the British customer might be unable to supply the acceptor with the necessary funds if the foreign drawer was unable to remit. Thus the break-down of the machinery of foreign exchange inflicted a twofold blow upon the banks, because it raised considerable doubt concerning the value of the bills of exchange, which, as has already been shown, formed an asset on the highly liquid nature of which they had been wont to rely, and it also affected them as large acceptors themselves.

With their investments thus locked up by the closing of the stock market and their loans against securities an unrealizable asset and many of their bills of exchange a doubtful quantity, the London banks found themselves faced with an abnormal demand for cash on the part of the public. An extra demand for cash is, of course, usual during the last days of July, when many people are preparing to start for a holiday of many weeks and a still greater number are taking advantage of the Bank Holiday at the beginning of August for a few days' change. And some witnesses of this crisis have maintained that the public did not lose their heads and run upon the banks, but only asked for their usual cash requirements for the holiday; in some cases, however, bankers have admitted that the public were certainly taking more than usual, in the belief or delusion that their money would be safer in their own keeping than in that of the banks. And there is at least no doubt that the banks, very naturally frightened by the freezing of their assets, forgot or ignored the old banking tradition of meeting an abnormal demand for cash with the utmost readiness to pay it out in whatever form the public wished, and met the demands of their customers wholly or partly in Bank of England notes. This they were quite entitled to do, since Bank of England notes are legal tender, but since these notes were for sums of not less than five pounds they were an obviously inconvenient form of currency for holiday makers and there was consequently a crowd of applicants at the Bank of England wanting to change notes into gold.

One effect of the crisis which marked the beginning of the war was thus to cause a heavy drain on the Bank of England both for notes and gold, with the result that in the two weeks from July 24 to Aug. 7 the reserve of its banking department was reduced by nearly 20 millions and was brought down below 10 millions, though for many years previously 20 millions had been regarded as its danger-point. During the same period the Bank's stock of bullion in both departments was reduced by 12½ millions. At the same time demands upon it for advances and discounts were on a very large scale and its holding of other securities rose by nearly 32 millions. It was thus evident that special measures had to be taken for suspending the usual restrictions on the Bank's power to do business, and preparations were made for a suspension of the Bank Act, because it limited the amount of notes which the Bank was empowered to issue against securities. According to precedent this suspension could only be granted if Bank rate were raised to 10%, and consequently the public, whose nerves on the subject of finance were already sufficiently on edge, were startled by a rocket advance from 3 to 8 in Bank rate on Friday, July 31, and a further advance to 10% on Saturday, Aug. 1. This development was the more terrifying because movements in Bank rate on any other day but Thursday, or of more than 1% at a time, are quite exceptional. At the same time the belief that the Bank of England would always meet a crisis by lending freely was disproved by its action in refusing to lend money to bill-brokers who were being pressed by the banks to repay the loans and advances on which they relied as part of their working resources, though this refusal on the part of the Bank of England to provide emergency credit was only maintained for a very short time.

These chaotic conditions clearly had to be met with stronger measures than a mere suspension of the Bank Act. It has already been shown that five-pound notes are of very little use for ordinary currency purposes and that paper money of a smaller denomination was required in order to check the demand for gold. The measures taken included the prolonging of the August Bank Holiday for four days, during which, by reassuring statements from leading politicians of both parties, the publics' nerves, which had been unnecessarily shattered by too much respect for precedent, were soothed into composure. The Currency and Bank Notes Act of 1914 was passed, which suspended the Bank Act of 1844 by empowering the Bank of England and other banks of issue to issue notes "in excess of any limits fixed by law" so far as temporarily authorized by the Treasury and subject to any conditions attached to that authority. According to its published weekly returns the Bank of England never took advantage of this authority, its fiduciary issue being never shown above the £18,450,000 authorized under the terms of the Bank Act (1844). But it was stated by Mr. Asquith in Parliament in Nov. 1915 that there had been an excess issue of £3,043,000 above the legal limit during the crisis. The most important provision of the 1914 Act, however, was that which allowed an issue of £1 and 10s. currency notes by the Treasury which were to be legal tender in the United Kingdom for the payment of any amount. They were also convertible on demand during office hours at the Bank of England into "gold coin, which is for the time being legal tender in the United Kingdom." At the same time postal orders were made temporarily legal tender and similarly convertible at the Bank of England into any legal-tender coin. By the terms of the Act, currency notes were to be issued to such persons and in such manner as the Treasury directed, but the amount of the notes issued was to be a floating charge in priority to all other charges on the assets of the recipient.

This provision was based on the belief that the Treasury notes would be issued by way of loan to bankers. An explanatory memorandum by the Treasury stated that "Currency notes are issued through the Bank of England to bankers as and when required up to a maximum limit not exceeding, in the case of any bank, 20% of its liabilities on deposit and current accounts. The amount of notes issued to each bank is treated as an advance by the Treasury to that bank, bearing interest from day to day at the current Bank rate. The bank is permitted to repay the whole or any part of the advance at any time." But in fact many of the banks never took out currency notes as a loan, but paid for them from the beginning with a draft on their balance at the Bank of England; and this soon became the usual and general way by which the notes went into circulation.

At the same time a general moratorium for postponement of payments was made by proclamation on Aug. 6, which provided that any payments due before that date or on any day before Sept. 4, in respect of any cheques or bills payable on demand drawn before the beginning of the 4th day of August, or in respect of any negotiable instrument, not being a bill of exchange, dated before that time, or in respect of any contract made before that time, should be deemed to be due and payable on a day one calendar month after the day on which the payment originally became due and payable, or on Sept. 4 1914, whichever was the later date. The proclamation did not apply to wages or salaries or to liabilities of less than £5 or to dividends or interest on stocks, funds or securities or to the liability of banks of issue in respect of bank-notes issued by them. This last-named provision is important as showing that the moratorium did not affect the convertibility of the Bank of England note. Any payments to be made by a Government department were also exempted from the moratorium. This general moratorium was afterwards continued for two more months. By its terms all danger of a continued run on the banks was stopped because the banks were enabled to exercise their own discretion as to meeting cheques drawn upon them in respect of money paid in before Aug. 4. Already, however, the public nervousness concerning the banking position had been allayed and it is an open question whether it was really necessary to give the banks the protection of a moratorium of which most of them made little or no use. On Aug. 7 Bank rate was reduced from 10 to 5%.

By these measures—the provision of new currency which the banks were empowered to take by way of loan from the Treasury to a much greater extent than they actually required and the suspension of payments—the situation between the banks and the public was effectively regulated. The more difficult and technical position arising from the position of the accepting houses, the banks as large acceptors of bills and the discount market, owing to the break-down of the machinery of exchange and the consequent inability of foreigners to make remittance, had been already met by a proclamation of Sunday, Aug. 2, for postponing the payment of bills of exchange by reacceptance for a month. On Aug. 13 a notice was published stating that the Government had agreed to guarantee the Bank of England against any loss incurred in discounting bills of exchange, "home or foreign, bank or trade, accepted prior to August 4, 1914," and that the Bank of England was prepared to discount "approved" bills accepted before Aug. 4 without recourse against the holders. By this measure all holders of such bills were able to dispose of them to the Bank of England and be quit of any liability in respect of them as is usually carried by all who endorse a bill. It was also stated that the Bank of England would be prepared "for this purpose to approve such bills of exchange as are customarily discounted by them and also good trade bills and the acceptances of such foreign and colonial firms and bank agencies as are established in Great Britain." It was found, however, that these measures did not sufficiently meet the position by restoring the machinery of acceptance and exchange and on Sept. 5 a fresh step was announced and the Bank of England, instead of merely buying bills accepted before the moratorium, lent money to acceptors to meet them with, so relieving not only the holders of the bills but also previous endorsers from liability. Moreover, the assets of the acceptors were to be subject to a first charge in favour of any bills drawn since the moratorium, and this provision naturally encouraged the creation of new bills by making pre-moratorium bills, the liability for which the Government had accepted, a second charge on the assets of the acceptors. The acceptors were not to be asked to repay these advances made to meet their pre-moratorium bills for a period "of one year after the close of the war," but in the meantime the acceptors were to be under obligation "to collect from their clients all the funds due to them as soon as possible, and to apply those funds to the repayment of advances made by the Bank of England." Interest was charged at 2% above the ruling Bank rate.

Such were the measures taken for dealing with the monetary crisis that preceded and accompanied the beginning of the war. It was then the general belief that the war could not last long, and that the business organization should be encouraged to proceed as far as possible as usual so that British trade should continue to be financed on the old lines with the ordinary machinery of exchange, acceptance and the discounting of commercial bills in Lombard Street. As the war went on, however, the money market became more and more a controlled establishment. As Government purchases of munitions, food, wool, etc., expanded, the credits drawn for their financing were naturally taken out of the hands of private enterprise and were created for the Government by means of Treasury bills, Ways and Means advances, and occasionally by bills drawn on and accepted by Government departments. Moreover, as the war went on and its cost increased, the Government found it necessary to prohibit new capital issues at home except such as were permitted by a Treasury Committee appointed to consider whether they were desirable from the point of view of the country's war efficiency and also to forbid the export of capital. All these measures and tendencies made a profound difference to the nature of the business done by the London money market. The diminished supply of what used to be called "bank" and "trade" bills, that is to say, bills drawn on banks, accepting houses, merchants and traders, was very much more than replaced by the enormous total of Treasury bills, of which there were 15 millions outstanding when the war began, 1,148 millions in Dec. 1916, and 1,124 millions at the date of the Armistice. The system had also been introduced by which the Treasury bills, instead of being offered occasionally for public tender, were on offer from day to day at rates fixed by the Treasury. Thus the discount market, instead of having to compete for bills, fluctuating in number according to the trade and financial demands of Great Britain and her foreign customers, and having to exercise judgment and experience in discriminating concerning the quality of the bills and the degree of favour with which they would be regarded by the banks and other buyers to whom it hoped in due course to sell most of them, had its business enormously simplified by the supply "on tap," in unlimited amounts, of Treasury bills with the credit of the Government behind them. The rate at which Treasury bills were offered became the dominant factor in the discount market. At the same time a new market for Treasury bills came into being, and a large part of the new supply was bought by contractors, shipowners and others who acquired big cash balances during the war. The following table shows the extent to which Treasury bills and Ways and Means advances were created during and after the war.

A still more profound change, and one which had much more important effects upon the general public and upon the whole course of British war finance, was the enormous extent to which the Government found it necessary to apply to the Bank of England.

Floating Debt Outstanding (million £)

Dec. 31	Treasury Bills	Ways and Means Advances	Total
1913 .	21	2	23
1914 .	117	58	175
1915 .	280	70	350
1916 .	1,099	141	1,240
1917 .	1,058	279	1,337
1918 .	1,095	455	1,550
1919 .	1,107	243	1,350
1920 .	1,102	306	1,408

and to the other banks for assistance in providing the necessary funds. It has been shown above, in the analysis given of the pre-war working of our monetary system, that advances made by banks nearly always mean a corresponding addition in banking deposits and consequently an increase in the amount of money that the public can spend in the shape of the cheques that can be drawn against these deposits and are normally taken in payment for goods and services (*see* Inflation). It is important to note that in so far as the Government got funds from the Bank of England on Ways and Means advances or Treasury bills or any other security on which the Bank lent to it, the credit basis on which all the other banks worked was thereby increased; because the money, as it was paid out to contractors and others to whom the Government owed it, was paid in by them to their own accounts with the outside banks, which thus received an increase in their cash at the Bank of England, which they could either hold as such or convert into currency notes; and so an advance was caused in the proportion between their cash and liabilities which encouraged them to expand the credit based on their increased cash holding. In the same way when the outside banks bought Treasury bills or Exchequer bonds or any other form of Government security issued, the result was an increase among their assets in their Government securities or bills discounted (if they included Treasury bills in this item), and a corresponding increase in the aggregate of banking deposits or potential money in the hands of the public, which was thus enabled to draw more cheques; because the money paid by banks for Treasury bills was paid first to the Government and by them paid out to the public, who were able to draw against it. It should also be noted that the outside banks were enabled by the increase in their cash at the Bank of England, caused by the new credits created by it for the Government, to take out currency notes and add them to their cash reserves, paying for them by transferring to the Government cash at the Bank of England.

By this process the whole principle on which the money market worked was radically altered in practice, though in theory the old checks and restrictions were still operative, and London remained throughout the war, on paper, a free market in gold with a banking system working on a convertible currency. It has already been stated that, though the Currency and Bank Notes Act of 1914 suspended the restrictions of the Bank Act of 1844, the Bank of England only availed itself of this suspension for a few hours and in all its published weekly returns showed a gold backing for every note issued above the legal limit of £18,450,000 on the fiduciary issue. Its notes were still convertible on demand, as were also the new currency notes, which were poured out in an almost steadily increasing volume through the process described above. There was during the war period no legal prohibition of gold exports, and so in theory anyone abroad who had a monetary claim on England could still turn his claim into legal-tender cash, turn the latter into gold and take the gold away. In fact, however, he would have found considerable difficulty in doing so, because the British public and banks had had impressed upon them the need for conserving the gold resources of the country for the purpose of financing abroad the war requirements of England and her Allies. The public had been effectively persuaded to pay in its gold holdings into its banks, and the banks and other professional financiers were restrained by patriotic and other considerations from applying to the Bank of England for gold in order to oblige a foreign customer or earn a profit in exchange; moreover, the possibility of profit in exchange was largely extinguished by Admiral Tirpitz and the submarine campaign, which did much—through the cost of freight and insurance—to maintain the convertibility of British currency during the war (*see* Exchanges, Foreign). The convertibility of British currency thus became a pious fiction, and its amount, in the form of legal-tender notes, was limited only by the extent to which the Bank of England created new credit for the Government and others; and, in the shape of cheques, by the extent to which the public drew on the ever-increasing deposits which the other banks created on the basis of the new cash and credit provided by the Treasury and the Bank of England. There was thus a constant tendency to increasing abundance of money of one kind or another, as will be seen from the appended tables.

Currency Notes Circulation

	Last Return of Year	Highest	Lowest
1914	£ 38,478,000	£ 38,478,000	£ 21,535,000
1915	103,125,000	103,125,000	35,409,000
1916	150,144,000	150,144,000	97,758,000
1917	212,782,000	212,782,000	143,043,000
1918	323,241,000	323,644,000	210,143,000
1919	356,152,000	358,231,000	307,480,000
1920	367,626,000	368,231,000	324,994,000
1921	—	360,615,000	323,884,000 (to June 30)

Bank-Note Circulation

End of	Bank of England	English Banks	Scottish Banks	Irish Banks
	£	£	£	£
1913 .	29,608,000	173,000	7,744,000	8,074,000
1914 .	36,139,000	180,000	9,502,000	10,918,000
1915 .	35,309,000	220,000	12,555,000	15,000,000
1916 .	39,676,000	241,000	15,461,000	19,112,000
1917 .	45,944,000	259,000	19,023,000	22,336,000
1918 .	70,307,000	287,000	25,141,000	30,896,000
1919 .	91,350,000	326,000	28,032,000	29,054,000
1920 .	132,851,000	174,000	29,363,000	24,718,000

The growing flood of new currency and credit tended to produce a low level of rates in the money market, which, if unchecked, would have cheapened the raising of the sinews of war, but would also have produced an adverse effect on the foreign exchanges by encouraging Britain's foreign creditors to take their balances home instead of employing them in London. From the point of view of British financial prestige, which was of the highest possible importance for the war, it was necessary to make every effort to keep the foreign exchanges favourable. For the purpose of financing the war cheaply at home there was much to be said for a policy of low rates in the money market. As has already been shown, the Government was practically the only borrower, since no other party could offer issues except with the permission of a Treasury Committee and the export of capital was forbidden. Thus, if the tendency towards ease had been allowed to take its course, the Government could apparently have secured for itself at low rates all the investment money that was available, especially if it had made use of the hint of compulsion so effectively employed by Mr. Bonar Law when he achieved the greatest borrowing success of the war at the beginning of 1917. This consideration, however, gave way, perhaps rightly, to the need for maintaining our prestige abroad as expressed by the foreign exchanges; rates in the money market, as will be shown, were artificially propped up, and it was not until the last year of the war that a system was adopted of differential rates for home and foreign money. In consequence of this system of considering the effect upon foreign exchanges as more important than the price that the Government had to pay for the funds that it needed, and a belief of bankers that, even at a time of war crisis, when no other borrowers were in the market, the only way to induce the public or professional financiers to subscribe for war securities was by offering them continually higher rates for their money, this crescendo movement continued until the autumn of 1916, when 6% was offered on an issue of Exchequer Bonds.

Such were the most important changes that affected the working of the money market during the course of the war, and it now remains to sketch the history of these developments as they evolved. The effect of the measures taken for meeting the crisis of Aug. 1914 was to leave the market very amply supplied with funds created by the Bank of England for the assistance of the accepting houses for discounting pre-moratorium bills and for financing the Government. The "other deposits" at the Bank of England, which stood at 42 millions in the middle of July, had risen to 168 millions by the beginning of Dec., though they declined to 128 millions at the end of the year. Bank rate had been hastily reduced, from the 10% to which it had been raised on the eve of war, to 5% when business was reopened after the prolonged Bank Holiday of Aug. 1914, and remained at this point until July 1916. The market rate of discount for 3-months' bills had risen to 5½% at the end of July 1914 and first emerged into a quotable condition on Aug. 24 at 5%, rapidly descending to 3% by the middle of Sept. and ending the year 1914 at a shade over 2½%. A £350,000,000 War Loan at 3½% issued in Nov. of this year drew very little response from the public and a large part of it was taken by the Bank of England and was subsequently repaid to it out of the proceeds of the War Loan of 1915. By far the greater part of the advances under which the Treasury notes had been originally issued to the banks had been very promptly repaid and henceforward Treasury notes were almost entirely issued under the system already described in exchange for credit at the Bank of England. There were a considerable number of issues which raised their total outstanding to 117 millions. Ways and Means advances, of which 1 million were outstanding when the war began, had reached 58 millions on Dec. 31 1914.

In 1915 extreme ease and weakness of discount rates at first again prevailed. The market rate for 3 months was below 1⅜% in Feb. although Bank rate remained at 5% throughout the year. In April, however, the market was steadied by the beginning of the system under which Treasury bills were offered at fixed rates which were at first 2¾% for 3 months, 3⅝% for 6 months, 3¾% for 9 months. On May 8 12-months' Treasury bills were also put on continuous offer at 3¾ per cent. Towards the end of June the complexion of the market was altered by the appearance of the great 4½% War Loan offered by Mr. McKenna, who had become Chancellor of the Exchequer in May in succession to Mr. Lloyd George, who had taken charge of the newly created Ministry of Munitions. This loan, including conversions of 3½% War Loan, Consols, etc., produced total applications for 900 millions, the actual cash receipts being 585 millions. During the second half of 1915 the market rate for 3-months' bills was close up to Bank rate and rose above it in the middle of Nov., remaining so until the end of the year. By this movement the market was merely following the official fixed rate for Treasury bills on offer, which was raised to 4½% for all dates in Aug. and to 5% in November. An important new departure was instituted during this autumn by which the Bank of England took money from the other banks at a fixed rate. When the system began the terms were 4½% for a month, but the period was soon shortened to three days. By this means the rate for short money was effectively screwed up, since the banks naturally did not lend below the rate that they could get from the Bank of England; but its chief object was to get money direct for the Government at cheaper rates than on Treasury bills.

In 1916, with Treasury bills still "on tap" for all dates at 5%, the market rate remained steady slightly above that level until March, when the Treasury rates of discount were reduced to 4½% for 3 months, 4¾% for 6 and 9 months and 5% for 12 months. On this the market rate for 3 months promptly dipped to a shade above 4½%, and remained so until the middle of June, when it jumped to 5% again when the official rate for all dates was raised to 5. The first half of this year was notable for the beginning on Feb. 21 of the issue of War Savings Certificates for 15s. 6d., to be repaid at the end of five years at £1 or to be convertible into cash with interest accrued at any time after they had been held for a year. Since then the privilege of holding these certificates has been continued for another five years, at the end of which they will be repaid at £1 6s. By the issue of this ingenious and attractive security the savings of the poorest were brought to bear on the problem of war finance and an enormous increase has been secured in the number of citizens who have a stake in the country by being holders of Government obligations (*see* SAVINGS MOVEMENT). A campaign for the purpose of bringing home to all the need for saving during the war had been organized by the Parliamentary War Savings Committee in 1915

Bank of England

	Total Deposits			Total Securities		
	End of Year	Highest	Lowest	End of Year	Highest	Lowest
1913	£ 71,343,555	£ 71,343,555	£ 45,492,483	£ 65,336,807	£ 65,336,807	£ 38,212,049
1914	154,987,891	180,548,003	53,713,186	121,043,658	149,844,663	41,860,118
1915	161,649,874	273,176,698	136,798,248	144,915,726	245,353,124	115,460,762
1916	178,843,038	178,843,038	132,587,088	163,649,111	163,649,111	105,789,175
1917	166,170,777	268,732,015	161,811,401	153,191,740	250,976,135	137,216,026
1918	241,200,306	241,200,306	152,175,628	230,776,674	230,776,674	141,371,957
1919	199,851,122	230,010,622	111,612,495	199,246,783	220,281,576	102,612,974
1920	189,859,334	191,149,003	115,955,156	193,893,040	193,893,040	117,438,601

AGGREGATE BALANCE-SHEET OF BANKS OF THE UNITED KINGDOM
(Excluding Bank of England)
(000's omitted)
LIABILITIES

	End of							
	1913	1914	1915	1916	1917	1918	1919	1920
	£	£	£	£	£	£	£	£
Capital and Reserves	114,076	113,061	112,130	110,746	114,989	125,051	139,651	162,087
Undivided Profits	6,453	6,436	6,009	5,959	7,633	7,376	7,602	8,858
Deposits	1,032,986	1,135,606	1,243,736	1,444,427	1,705,842	1,988,347	2,356,271	2,492,061
Acceptances	67,534	53,960	66,863	75,492	71,131	63,458	158,500	109,896
Notes, Drafts, etc.	24,984	28,799	36,790	45,212	52,755	63,839	65,395	61,985
	1,246,033	1,337,862	1,465,528	1,681,836	1,952,350	2,248,071	2,727,419	2,834,887

ASSETS

	£	£	£	£	£	£	£	£
Cash in hand and Money at Call	293,576	339,668	330,535	454,223	527,739	611,532	586,585	580,363
Investments	191,041	225,298	421,999	439,628	463,518	519,783	602,164	558,848
Discounts and Advances	682,966	701,372	631,580	693,736	873,592	1,025,248	1,366,576	1,561,337
Premises and Cover for Acceptances	78,450	71,524	81,414	94,249	87,501	91,508	172,094	134,339
	1,246,033	1,337,862	1,465,528	1,681,836	1,952,350	2,248,071	2,727,419	2,834,887

at the time of the issue of Mr. McKenna's 4½% War Loan, but had made little headway owing to the lack of a security in which the working classes could invest with a certainty of being able to get their money back in full at any time. This campaign was now taken up with much greater energy by the National War Savings Committee, which, with the assistance of thousands of devoted workers all over the country, especially among the teachers of the primary schools, did most satisfactory and effective work in securing savings for the war, so lessening the degree to which the war had to be financed by the creation of new credit by the Bank of England and the other banks.

The question of exchange was now requiring serious attention, and in July of this year bank rate was raised to 6%, partly owing to a rise in money rates in New York, which actually proved to be short-lived. An issue of 150 millions 6% Exchequer bonds repayable in Feb. 1920 was made in the following Oct., and provoked a good deal of criticism on the ground of the very high rate that was being offered to professional capitalists at a time when economy and self-denial for the war were being extensively preached. During this year, in accordance with the rise in bank rate, the rates at which Treasury bills were offered were raised on July 14 to 5½% for 3 months, 5¾% for 6 months and 6% for 12 months, but on Sept. 27 the official rates for all dates were reduced to 5½%; the 3 months' market rate closely followed as usual the rate for Treasury bills of that usance, being slightly below it for a few weeks in Nov. and at or above it during the rest of the half-year. A feature of this year's war finance was the expansion in Treasury bills and the absence of any great war loan.

In 1917 this system of financing the war largely by Treasury bills and entirely by short-date obligations was at once reversed by Mr. Bonar Law, who had become Chancellor of the Exchequer in succession to Mr. McKenna on the formation of the Coalition Government at the end of 1916. In the first days of 1917 the great 5% War Loan was issued, which realized over 1,000 millions. Mr. Bonar Law told a great meeting at the Guildhall, held to inaugurate the campaign for the placing of the loan, that the rate of 5¼% which it secured to subscribers at the issue price of 95 was as high a rate as they would get from British Government loans, and that if they did not subscribe on these terms the "resources of civilization were not exhausted"; this plain hint at compulsion was heartily cheered by a meeting largely composed of wealthy capitalists. Bank rate was brought down to 5½% in the middle of Jan. and to 5% at the beginning of April. The offer of Treasury bills was suspended altogether on Jan. 4, pending the issue of the War Loan, and the tender system was resumed for a short time, from March 30 to June 15, after which the daily sale was resumed at 4½% for 3 and 6 months' bills. No change was made in the rate which the Bank was giving to clearing bankers for surpluses until Feb. 26, when it was reduced from 5 to 4½%, coming down again to 4% on June 19. On each occasion the rate given by the Bank of England to banks outside the clearing was kept ½% below the rate given to the clearing banks. The market rate of discount fell from 5½% to 5% when the sale of Treasury bills was suspended, and showed renewed weakness in March owing to false hopes of easy money resulting from America's intervention. The huge transfers involved by the War Loan payments were carried out with surprising ease owing to arrangements enabling the banks to borrow from the Bank of England; moreover, the payments on War Loan were continually offset by the Government's disbursements and by the maturing of Treasury bills, the outstanding amount of which was reduced between Jan. 4 and April 14 from 1,093 millions to 454 millions; after that date they began to mount up rapidly again and by the end of the year again exceeded a thousand millions. The second half of 1917 was notable for the institution of a system of continuous borrowing from the beginning of October by issues of National War Bonds, by which the funds necessary for carrying on the war were to a great extent provided, without the disturbance and inflation caused by huge issues made largely with the assistance of credit manufactured by banks, even when the banks themselves were not practically compelled to make subscriptions to securities which involved an inconvenient lock-up of their funds. On Nov. 15 a special rate for foreign money was established by the Bank of England when it announced that it would allow 4½% on deposits of foreign money made through the clearing banks. This measure was a good deal criticised as impracticable, and could, of course, only have been attempted in war-time when patriotic sentiment put a strong bar upon all the openings for fraud which the system offered and when the existence of the censorship over foreign correspondence made it possible to trace any attempts to take advantage of them. In the last days of the year the rate at which Treasury bills were offered was reduced to 4% and there was a corresponding tumble in the market rate of discount. At the same time the rate given by the Bank of England to clearing banks was reduced from 4 to 3½ per cent. As the special rate for foreign money remained at 4½% there was thus established a considerable difference in the rates for home and foreign money; the more favourable terms which were thus made possible for home financing enabled a further reduction to be made in the Treasury bill rate on Feb. 4 1918 to 3½%, and the market rate of discount as usual followed suit; the Bank of England's rate on three-day loans from clearing banks also dropped to 3 per cent. At the end of May another important step was taken when the banks agreed that the special rate on deposits granted by many of them to favoured customers should be abandoned and that 3% should henceforward be the best rate that the clearing banks would grant. Arrangements were also made to bring the banks outside the clearing and the discount houses into line with this arrangement, which was made with a view to cheapening the supply of home money and stimulating the sale of war bonds. Another interesting monetary event was the appointment, brought about by the speed at which bank amalgamations were proceeding, of a committee to consider the question of their effect; its report, issued towards the end of May, made the recommendation, which was afterwards adopted, that in future all such amalgamations should only be permitted after receiving official sanction. In the second half of the year there was hardly any change in monetary conditions, with Treasury bills still on offer at 3½% and the market rate of discount steady at about that level. The Government continued to finance itself by means of the continuous issue of National War Bonds, which was highly successful, though it still left a gap to be filled by Treasury bills and Ways and Means advances. The Armistice was granted to Germany on Nov. 11 1918.

Thus at the end of the war the money market found itself expected to face the problems of peace in a highly water-logged condition. The gold standard was still theoretically existent, for both Bank of England notes and currency notes were by law convertible into gold on demand, and there was no legal prohibition of the export of gold, but the pre-war connexion between the amount of gold in the country and the fabric of credit that could be built upon it no longer existed. New credit had to be continually produced by the Bank of England to finance the inability of the Government to pay its way by taxation or by borrowing of saved money from genuine investors, and on this credit so produced the other banks expanded credit for their customers and so increased the amount of banking money in the form of cheques competing in the purchase of goods and services. Obviously the most efficient check on this process of expansion was reduction of Government expenditure to a point where it could be financed out of taxation and real borrowing. This policy, in fact, had been recommended by the report of a very strong Committee appointed, with Lord Cunliffe as chairman, in Jan. 1918, to consider problems connected with currency and foreign exchanges during the period of reconstruction and to report upon "the steps required to bring about the restoration of normal conditions in due course."

Its report appeared at the end of Oct. 1918 and stated that "the conditions necessary to the maintenance of an effective gold standard in this country no longer exist, and it is imperative that they should be restored without delay." To secure this end the Committee urged that Government borrowing should cease at the earliest possible moment and that a sinking fund should be provided out of revenue for the annual reduction of debt, especially of the floating debt. Money needed for reconstruction purposes should not be provided by the creation of new credit and the shortage of real capital must be made good by genuine savings. Under an effective gold standard all export demands for gold must be met and foreign claims must be checked as before by the use of Bank rate. The Committee also pointed out that the differential rates for home and foreign money would be neither practicable nor desirable when the war was over. It recommended that all banks should transfer their gold holding to the Bank of England and that the principle of the Bank Charter Act should be maintained of a fixed amount of fiduciary issue, the amount of which was to be arrived at by experiment during the after-war period. The committee tentatively put forward 150 millions as a possible limit. It also suggested the transfer of the currency note issue from the Treasury to the Bank of England when once the amount of the fiduciary issue had been settled, and in the meantime recommended the policy of cautiously reducing the uncovered issue and replacing with Bank of England notes the securities with which it was then backed. The Committee's aim was thus in effect a restoration of the Bank Charter Act of 1844, with the suggestion that if the limit on the fiduciary note issue had at any time to be passed this should be done with Treasury sanction as under the Currency Act of 1914 instead of by a letter of indemnity from the Chancellor of the Exchequer. The conservatism of the report was naturally criticised by those who wanted to remodel the British monetary machine, but was on the whole well received in financial circles as indicating the way to return to a system which had worked so well until it was shattered by the war.

Very little had been done up to the middle of 1921 towards the adoption of these recommendations. During 1919 Government finance, by its failure to meet expenditure out of revenue, left the money market struggling under the double burden of financing official expenditure and meeting the needs of commercial customers who wanted to finance after-war enterprise. A Funding Loan brought out in the middle of the year produced only 473 millions, of which 92½ millions were subscribed by banks under official pressure. The Cunliffe Committee's insistence that demands for gold for export should be met was so far from being acted on that the gold standard was abandoned in March 1919 by the addition of gold coin and bullion to the list of articles which could only be exported under licence. This measure immediately followed the removal of artificial support of the price of sterling in New York. On the other hand, something was done towards restoring the money market to normal conditions. The rate given by the Bank of England to other banks for surplus balances was dropped on July 22 1919, and the special rate of 4½% given on foreign money was wholly abolished in Oct., having been dropped with regard to French, Italian and Belgian money in January. The latter part of this year also saw the inauguration of an attempt to improve the monetary position by making money officially dear, by raising the rate at which Treasury bills were offered and by putting Bank rate up from 5 to 6% in November. The idea behind this policy was apparently a desire, by making money dearer, to check speculation, credit expansion and the holding-up of commodities. Its critics pointed out that it was doubtful as a check on speculation in commodities at a time when rising prices were putting enormous profits into the pockets of those who were bold enough to back the advance, and if it checked speculation it would probably also check production and that the only certain result of it would be to cost the country some millions in financing the floating debt. In view of the enormous outstanding amount of Treasury bills the Bank of England's power to control the market by means of its rate was seriously weakened, because the holders of these bills by refusing to renew them when they fell due could at any time compel the Government to borrow from the Bank of England on Ways and Means advances in order to meet the maturing bills, and so increase the amount of cash at the Bank of England in the hands of the other banks, which they could if they chose convert into currency notes. This fact also weakened the effect of a Treasury minute which was produced at the end of this year putting a limit on the fiduciary issue of Treasury notes. Nevertheless there can be no doubt that the policy of the Treasury and the Bank of England in raising the level of money rates had a considerable psychological effect and brought home to many users of credit the fact that the policy of unlimited expansion was abnormal and would have to come to an end some day.

In 1920 another turn of the screw was applied by the raising of Bank rate to 7% in April, following a very large expansion in Ways and Means advances necessitated to meet Treasury bills which their holders had allowed to mature. This measure was shortly afterwards followed by a dramatic change in trade conditions from exuberance to depression, which was accentuated by industrial crises; but in spite of the very heavy fall in wholesale prices there was a further expansion in bank deposits, currency notes and the Bank of England's note circulation; the increase in this last item amounted to more than 41 millions, of which, however, 15 millions were put into the currency note reserve in accordance with the recommendation of the Cunliffe Committee. Moreover, the other banks, adopting another recommendation of the Cunliffe Committee, sent their holdings of gold to be added to the Bank of England's stock. These contributions, in exchange for which they took out notes, or increased their balances at the Bank of England, amounted to over 40 millions.

In 1921 the process of deflation began in earnest with reductions in the circulation of Bank of England notes and currency notes, and also in the deposits of the joint-stock banks, which from the beginning of this year revived the pre-war custom of monthly bank statements. The Bank rate was reduced to 6½% in April and would probably have come down to 6% soon after but for the long-drawn crisis in the coal-mining industry. The reduction to 6% was actually made on June 23. On July 21 the rate was reduced to 5½%, and in Nov. to 5 per cent.

If the London money market was thus a long way from restoration to its pre-war position it had certainly come much nearer to normal working by the end of 1921 than any of its European rivals. How it would fare in future competition with New York, enormously strengthened by the great mass of wealth that America had acquired at the expense of warring Europe, was a matter about which it was only possible then to make guesses, in the existing attenuated condition of international trade. Even in 1921, however, in spite of America's determination to finance her own trade and the measures taken to enable her to do so by the Federal Reserve Act, bills were still to be seen in Lombard Street drawn against shipments of goods from the East and from other foreign countries to the United States.

(H. W.)

MONGOLIA (*see* 18.711).—The economic development of Mongolia remains greatly restricted by lack of transport facilities, and the trade of the country must continue to be insignificant until railway communication is established between Kalgan and the Siberian railway. Passenger traffic by motor-cars between Kalgan and Urga (two days' run) had by 1921 been started by two Chinese companies, but trade was still carried by camel caravans, which take about a month on the journey.

History.—For several years before the overthrow of the Manchu dynasty, resentment against China's military and colonizing policy had steadily increased amongst the Mongol princes and their followers, who realized that China's systematic policy of peaceful penetration, if unchecked, must entail the gradual extinction of the autonomous rights conferred on their country by the Ta Ching emperors. Before the revolution in China, the misgivings and grievances of the Mongol chieftains had produced a definite separatist and nationalist movement in Outer Mongolia, which looked to Russia for support. The provocative attitude and actions of Santo, the Chinese resident at Urga, stiffened the opposition of the Mongol leaders, who rallied round their spiritual ruler, the Living Buddha (Hutukhtu). In July 1911 they despatched a secret mission to Petrograd, asking Russia's help to secure their independence. The outbreak of the revolution in China provided them with an opportunity for a *coup d'état.* Early in Dec. the Amban and other Chinese officials, with their troops, were compelled to return to China, the Living Buddha was proclaimed ruler, and a Mongol Government of five ministers was formed at Urga. From the outset, however, differences of policy were manifested amongst the Mongol chieftains, one party being in favour of complete severance from China under Russian auspices, the other advocating a policy of reasonable compromise and conciliation towards the Government at Peking. These differences were frequently manifested in the subsequent course of events.

In May 1912 the Barguts threw off their allegiance to China, and Barga became part of the new dominion of the Urga Hutukhtu, who appointed a leading Bargut as his Amban at Hailar. Later in the year, the authority of the Urga Government was extended to Uliasutai and Kobdo. At this stage some fighting took place between the Mongols and the Chinese forces in the Altai district, where Prince Palta remained faithful to China; thereafter Peking was frequently alarmed by rumours that the Russian-trained Khalkas were planning an expedition in force from Urga southwards. In Aug. the first outbreak of rebellion occurred in Inner Mongolia (where most of the native princes had declared their adherence to the Chinese republic), but it was quickly suppressed by Chinese forces despatched from Chihli. Desultory fighting, accompanied by brigandage on both sides, continued thereafter in many parts of the country, generally to the advantage of the Mongols. Meanwhile Russia proceeded to recognize the *de facto* Government at Urga and to strengthen the independence movement, by concluding a convention with the Hutukhtu Lama direct (Nov. 3 1912), wherein the latter was recognized as sovereign of Mongolia and promised assistance in refusing to allow Chinese troops or colonists in Mongolian territory. Russia, on her side, was guaranteed full enjoyment of her former trade rights and privileges.

Several communications passed in 1912 between Peking and Urga, the Chinese Government endeavouring to restore amicable relations on the old footing, but without result. At this juncture the Russian representative at Peking intervened, endeavouring to persuade President Yuan Shih-K'ai's Government to recognize the *fait accompli* of Outer Mongolian autonomy in return for recognition of Chinese suzerainty over the whole country and a free hand in Inner Mongolia. *Mutatis mutandis*, the position of affairs created by the Chinese revolution in Mongolia was very similar to that produced in Tibet, it being manifest in both cases that the meaning of the words "suzerainty" and "autonomy" must eventually be determined by the forces behind them.

After protracted negotiations, the Chinese Government, making a virtue of necessity, signed an agreement with the Russian representative at Peking on Nov. 5 1913. By the Declaration and Notes of this agreement, Russia recognized Outer Mongolia as an integral part of Chinese territory under the suzerainty of China, whilst China recognized the autonomy of Outer Mongolia. Autonomous Outer Mongolia was defined as the districts heretofore known under Chinese administration as those of Urga, Kobdo, and Uliasutai. Russia undertook to use her influence with the Hutukhtu, to secure his acceptance of autonomy in lieu of the independence promised by the Russo-Mongolian agreement of Nov. 1912. In Sept. 1914, representatives of Russia, China and the Hutukhtu met at Kiakhta, where, after nine months of negotiations, a tripartite agreement was concluded on the lines proposed by Russia. A Chinese Resident-General was appointed to represent China as suzerain at Urga, with deputies at Kiakhta, Kobdo, and Uliasutai. Russian activities in Mongolia from 1912 to 1917 manifested a forward policy very similar to that displayed in Manchuria and Korea before the Russo-Japanese War, including in their scope arrangements whereby the railways, finance, communications and currency of Outer Mongolia would gradually be made subservient to Russian interests.

The collapse of Russia under Bolshevik rule necessarily entailed a complete change in the situation in Mongolia. On the one hand, it deprived the disaffected Mongol chieftains of the support of their powerful protector; on the other, it exposed Outer Mongolia to serious dangers of invasion by Germans and Bolsheviks from the Baikal region. The Chinese were not slow to take advantage of the opportunity thus created to restore their ascendency, and at the same time to take measures against "Red" incursions from the Russian border. The increasing disorders in Siberia and the retreat of the Czechs eastwards from Baikal in the autumn of 1918, led to a considerable increase of the Chinese garrisons at Urga and elsewhere. In June 1919 the Government of Outer Mongolia invoked the assistance of the Chinese officials to check the increasing activities of the Buriat and other marauders; a considerable Chinese force was therefore despatched from Chihli and Moukden. The northern Chinese Tuchuns assumed the task of protecting Mongolia from the Bolshevik invasion and also from Gen. Semenoff, the Ataman of the Transbaikal Cossacks, who was recruiting a large force of Russian refugees and Buriats at Kiakhta, ostensibly in support of the Pan-Mongol movement, but actually with the object of establishing an anti-Bolshevik Russian province and a new base of military operations. At the beginning of Nov. 1919, there were 4,000 Chinese troops in Outer Mongolia. On Nov. 15, the Chinese resident at Urga presented an ultimatum to the Mongolian Government, requiring them to renounce their claim to independence, failing which the Living Buddha and the prime minister would be conveyed in custody to Peking. The Hutukhtu was opposed to compliance and several of the leading princes were inclined to support his resistance; but the Council of Ministers, finding itself between the deep sea of Chinese domination and the devil of Semenoff's invasion, decided, against the Hutukhtu's wishes, to sign the memorial required of them. On Nov. 22 a Presidential Mandate was issued at Peking, announcing the receipt of this memorial, and approving its proposals. Mongolian autonomy was therefore cancelled and all agreements and treaties, concluded by or with the Government at Urga since the declaration of Mongolian independence, were declared null and void. On the 24th the Russian representative at Peking filed a protest against this mandate, reserving on behalf of Russia all her treaty rights in Mongolia, to be reasserted hereafter.

It is probable that if the Chinese had displayed a reasonable and conciliatory spirit at this juncture, the Mongols might have been content with a position of partnership in the Chinese republic; but the arrogance and brutality displayed by the Chinese military commander, Hsü Shu tseng (commonly known at Peking as "little Hsü") drove them to make common cause with the Russian refugees, and their Buriat and Japanese allies, against the Chinese. Matters reached a crisis in Oct. 1920, when Urga was attacked by Baron Ungern with a small body of Russians (originally belonging to Ataman Semenoff's force), a few Japanese officers and several thousand Buriats and Mongols. The Chinese retaliated by making the Living Buddha a hostage; for the next few months the Chinese garrison so looted and maltreated the civilian population of Urga that, after the escape of the Hutukhtu in Jan., every man's hand was turned against them. On Feb. 19 1921 the city was captured by Baron Ungern's forces and only a remnant of the garrison escaped.

On Feb. 25 the Hutukhtu was proclaimed as sovereign of the independent kingdom of Mongolia. Baron Ungern was appointed to the chief command of the Mongolian forces, and orders were issued by the Hutukhtu for the organization of a national army with compulsory military service. Mongolian troops subsequently occupied Ude, in the Gobi desert, and were threatening Kalgan. The helplessness of the Peking Government was plainly manifest; nevertheless, it declined the help of a Russian "Red" army, proffered by the Soviet Government's representative at Peking (M. Yourin) and in subsequent *pourparlers* with Mongolia, expressed its willingness to revert to the terms of the Kiakhta agreement. The leading Mongol princes, however, refused these overtures and declared their intention to maintain the complete independence of their country, at least until the restoration of the monarchy in China. (J. O. P. B.)

MONOD, GABRIEL (1844–1912), French historian (*see* 18.730), published in 1903 his *Souvenirs d'adolescence*, and in 1905 *Études sur Michelet, sa vie et ses Œuvres*. He died in Paris April 10 1912.

MONRO, SIR CHARLES CARMICHAEL (1860–), British general, was born June 15 1860 and joined the army in 1879. In 1897–8 he saw service at Malakand, in the Mohmand country, in Bajaur and in Tirah, and he was on the staff in S. Africa during the war, for which he was promoted brevet lieutenant-colonel. He was afterwards commandant of the School of Musketry, and he commanded a brigade from 1907 to 1911. Promoted major-general in 1910, he had charge of a Territorial division in 1912–3 and was then transferred from this to the II. Div. of the Expeditionary Force, which he commanded in the first campaign in France in 1914. On the splitting up of General French's forces into two armies at the end of 1914, Monro was placed in command of the I. Army Corps, and he was shortly afterwards given the K.C.B. Then, on a III. Army being organized in July 1915, having acquitted himself admirably as a divisional and as a corps commander in the field, he was given charge of this. He, however, occupied the position for only three months, as he was chosen in October to take over command of the Mediterranean Expeditionary Force and to decide whether the campaign in the Gallipoli Peninsula was to be continued; he was at the same time promoted lieutenant-general for distinguished service. Monro now acted with rare decision under most difficult circumstances. Although the Government was disposed to cling to the peninsula he insisted upon its abandonment, and he was after some delay allowed to have his way, with the result that the forces were withdrawn from a most dangerous position without appreciable loss under his general superintendence. His great services on this occasion were recognized by his being given the G.C.M.G., and then, having accomplished what was required in the Near East, he returned to the western front to succeed Sir Douglas Haig in command of the I. Army. He served in that capacity until Oct. 1916, when he was selected to be commander-in-chief in India, with the rank of full general.

In his new sphere of responsibility Sir Charles Monro proved himself to be a military administrator of the foremost rank. By untiring energy and skilful organization he succeeded in adding substantially to the strength of the native army, in creating a number of fresh regiments, and in greatly developing the non-combatant and hospital services on progressive lines. The consequence was that he was enabled to dispatch considerable and badly needed reinforcements to Mesopotamia and to Egypt and Palestine; the triumphs gained by General Allenby in Syria after he had been obliged to send off a large part of his army to the western front in the spring of 1918, were indeed in no small measure due to the work that had been accomplished by the commander-in-chief in India. Monro received the G.C.B. and he remained in India until 1920, when he returned to England.

MONTAGU, EDWIN SAMUEL (1879–), English politician, second son of the 1st Lord Swaythling, was born Feb. 6 1879 and educated at Clifton, at the City of London School, and at Trinity College, Cambridge. At Cambridge he was president of the Union and acquired a considerable reputation for ability; and when he entered Parliament in 1906, at the age of 27, as Liberal member for the Chesterton division of Cambridgeshire, he was chosen by Mr. Asquith, then Chancellor of the Exchequer, as his parliamentary secretary, and continued in that position when his chief succeeded to the premiership. Early in 1910 he was appointed Under-Secretary for India, at a time when Lord Morley's tenure of the Secretaryship of State for India was drawing to a close. He remained in the post, under Lord Crewe as Lord Morley's successor, till 1914; and so made his first official acquaintance with India under the influence of Lord Morley's reforms and Lord Crewe's Durbar changes of 1911. As both his chiefs were in the Lords, he was the spokesman of the office in the Commons, and he acquitted himself well. That he might equip himself the more completely for his duties, he took the unusual course of visiting India in person. In his Indian budget speech of 1913 he remarked with true insight that the watchword of the future was coöperation between the Government and the governed in India; the difficulty was that in India men of the 20th century lived side by side with men of the 5th. At the beginning of 1914 he was promoted to the responsible post of financial secretary to the Treasury, in which capacity he was of material assistance in the financial improvisation which had to be effected in the early days of the war. Early in the next year he was made Chancellor of the Duchy of Lancaster, but when the first Coalition Ministry was formed he returned to his former post at the Treasury. Thence he was promoted, in the summer of 1916, to the headship of the office of Munitions and a seat on the War Committee of the Cabinet, on Mr. Lloyd George's succession to the Secretaryship of State for War. But when Mr. Asquith's Ministry fell he retired from office along with that minister's principal colleagues. The next summer, however, on Mr. Austen Chamberlain's resignation owing to the Mesopotamia report, he returned to the India Office as Secretary of State and began a tenure of that post which will always be memorable in Indian annals. It was felt that the wholehearted manner in which India, her princes and peoples, had flung themselves into the Imperial quarrel with Germany demanded a reconsideration of the relations between her and England. The new Secretary of State visited India in the following winter for the second time, and held prolonged conferences with the Viceroy, Lord Chelmsford, the leading members of the Indian civil service, ruling princes, and native politicians, and along with the Viceroy received deputations and memoranda from all classes. Ultimately in July 1918 there was published an elaborate report, drawn up and signed by the Viceroy as well as by the Secretary of State, recommending a series of constitutional reforms which should give the Indian peoples a large and real share in their own government. The report was received so cordially in the House of Commons that Mr. Montagu was able to claim at the end of the debate as "a remarkable fact" that all speakers admitted the principle of self-government for India. In India itself opinion was more divided, both among the English and among the Indians; but there was a large moderate section among both which welcomed the proposed reforms. In Dec. 1919 he had the satisfaction of passing the Government of India bill, embodying the recommendations of the report, through Parliament, and on its third reading he described it as a step in the discharge of our trusteeship for India; the ultimate justification of our rule would be in the capacity of the Indian peoples to govern themselves. When the new councils were established and beginning to work, he strongly set his face against any meddling with their proceedings by questions and answers in Parliament. When Lord Reading, the Lord Chief Justice of England, also a Jew, was appointed Viceroy of India in 1921, there was some public criticism, and it was suggested that Mr. Montagu might be moved to another office; but no change took place. He married in 1915 Beatrice Venetia, youngest daughter of the 4th Baron Sheffield.

MONTANA (*see* 18.752).—In 1920 Montana had a pop. of 548,889, an increase of 172,836 or 46% during the decade. The urban pop. was 172,011 or 31·3%, the rural 376,878 or 68·7%. In 1910 the ratio was 35·5% urban and 64·5% rural. The relative increase of rural pop. over urban was due largely to the immigration of an agricultural pop., particularly to the eastern part of the state. The total number of foreign-born whites in 1920 was 93,620. In 1920 there were 12 cities with a pop. of 5,000 or more, of which 6 had over 10,000. These 6, with their increase in the preceding decade, were as follows:—

	1920	1910	Increase per cent
Butte	41,611	39,165	6·2
Great Falls	24,121	13,948	72·9
Billings	15,100	10,031	50·5
Missoula	12,668	12,869	−1·6
Helena	12,037	12,515	−3·8
Anaconda	11,668	10,134	15·1

In 1910 Montana had 28 counties, in 1920 54. In 1920 only 16 counties had cities of more than 2,500 population. Most of the new counties have been formed in the eastern part of the state by the division of the large counties of Teton, Chouteau, Valley, Dawson, Custer, and Rosebud.

Agriculture and Irrigation.—By the census of 1920 there were 57,677 farms in Montana with an aggregate of 35,070,656 ac., of which 11,007,278 ac. were improved. This contrasts with 26,214 farms, containing 13,545,603 ac., of which 3,640,309 ac. were improved in 1910. The value of all farm property in 1920 was $985,961,308 as compared with $347,828,770 in 1910. Of the improved land only about 4,000,000 ac. were under cultivation and the remainder was used for pasture or allowed to lie fallow. More than 3,000,000 ac. were planted to wheat and hay. In 1919 the value of all crops was placed at $69,975,185. For the 10-year period 1909–18 the average yield per ac. was 21·8 bus. for wheat, 40·6 bus. for oats and 140 bus. for potatoes. Farms reporting land with drainage in 1920 numbered 756, or 1·3% of total; farms needing drainage numbered 1,728, or 3%. Approximately 1,700,000 ac. were under irrigation, but projects were under way to irrigate about 30,000,000 ac. of tillable land of Montana, of which about 7,000,000 ac. are capable of being irrigated. Of the area covered by these projects about 1,000,000 ac. were included in seven great Federal reclamation districts, the total outlay on which was estimated at $16,000,000. Under the Carey Land Act the state has undertaken to irrigate 162,285 acres. About half of this land was under irrigation in 1920, and about 25,000 ac. were open to settlement. In 1921 there were no large bodies of irrigable land such as would attract the attention of the Federal Government or of capital under the Carey Act, and further development of irrigation must be by small units. In 1919 the Legislature provided for a State Irrigation Commission to advise and assist in the development of irrigation in districts where the farmers wish to carry on such projects. In 1920 the Commission estimated that under this law a beginning had been made to bring 200,000 ac. under irrigation. Stock-raising in general retained its importance during the decade ending with 1920, but the open range was largely superseded by the fenced ranch. The number of sheep declined from 4,959,835 in 1910 to 2,082,919 in 1920 but the number of cattle increased from 860,521 to 1,268,516, and the number of horses from 304,239 to 668,723. The total value of all live stock in 1920 was $150,000,000. The clip of wool for 1919 was valued at $10,229,632, and the dairy products at $7,534,413.

Forests and Lumbering.—One-sixth of Montana, or 15,957,196 ac., is included within the national forests. The state owns about 500,000 ac. of forest land and there is about 5,000,000 ac. in private hands. The total stand of lumber is estimated at 58,071,000,000 feet. A part of this forest area is also valuable for agricultural land and will be so used when the timber is removed. The remainder will be reforested as the old trees are cut.

Mines.—The World War gave a great impetus to the production of copper and other metals, but after the Armistice mining suffered an acute decline. The output of copper decreased from 323,174,850 lb. in 1918 to 180,240,000 in 1919, a decrease in value from $80,000,000 to $34,000,000. The production of lead increased from 37,135,875 lb. in 1918 to 42,163,000 lb. in 1919 but its value decreased from $2,636,000 to $2,411,000. In 1918 the output of zinc was 209,258,000 lb. and in 1919 it was only 176,000,000 lb. Its value decreased from $19,000,000 to $13,000,000. Silver-mining continued active and in 1919 the value of the output was $15,000,000. The value of gold decreased from $3,104,000 in 1918 to $2,272,000 in 1919. At the end of 1920 it appeared that mining must undergo a still greater depression. Natural gas is found at Havre, Glasgow and Baker. Oil was found in Elk Basin, Carbon county, in 1915. In 1919 a new and promising field was opened up in the Cat Creek district of Fergus county. At the close of 1920 the total oil production of the state was about 6,000 bar. per day. Many new wells were projected for the spring of 1921.

Manufactures.—The vast supplies of water-power in Montana give hopes of great industrial development. The hydro-electric plants in 1920 had a capacity of 300,000 H.P. Much of this was used for the operation of electric trains. In 1920 Congress passed a bill authorizing the Secretary of the Interior to lease the undeveloped power sites and the completion of such enterprises will add greatly to the electric power available for manufacture. In 1909 the total value of manufactures was $73,000,000; in 1919 it had increased to $200,000,000. In 1920 there were 195 lumber-mills, 75 flour-mills, 31 creameries, 7 cheese factories, 2 canning factories, 1 sugar-beet factory, 1 factory for the manufacture of acid phosphate fertilizers, 1 dynamite factory, and a number of brick and tile plants. The most promising field for manufacture appeared to be products of copper and wood. One plant for turning out copper rods and wire had a capacity of 6,000,000 lb. of copper per month. Montana mills produced only about one-half the lumber consumed in the state. High freight rates have retarded the shipment of Montana lumber to eastern markets.

Education.—In 1920 the Russell Sage Foundation of New York ranked the Montana schools as first among all the public school systems of America. The public-school fund belonging to the state amounted (1921) to about $20,000,000 and was increasing by the sale of school lands and by grants from the state. There were still unsold about 4,000,000 ac. of school land. The income from this endowment and from leases of school land was nearly $1,000,000 each year. In 1910 there were 60,678 children attending school out of a school pop. of 93,371. In 1919 there were 120,000 in school out of a school pop. of 161,626. In 1920 there were 81 accredited district high schools and 18 county high schools in the state. In 1912 Pres. E. B. Craighead, of the State University, started a campaign for the consolidation of all the state institutions of higher education into one university. His plan was defeated, but all the institutions were placed under one administrative head called the chancellor. Edward C. Elliott became the first chancellor of the "greater" university of Montana. In 1920 the people voted a tax of 1·5 mills on the dollar for the support of this university and a bond issue of $3,750,000 for buildings at the various institutions.

Legislation.—In 1921, when the new administration took charge of the Government, the state faced a deficit of $2,500,000. Governor Dixon proposed to relieve this by an income tax and by a tax on the production of oil wells and of coal and metal mines. The Legislature opposed these recommendations as radical, but finally agreed to a small tax on oil and coal production. The state has made steady progress in labour legislation. In 1911 the Legislature provided an eight-hour day for miners. In 1914 the state limited the working-day for women in factories, laundries, and stores to nine hours, and in 1917 reduced this to eight hours. By a law of 1919 children under 16 years who have not finished the eighth grade must remain in school. In 1915 a Workmen's Compensation bill was enacted which relieved those engaged in hazardous occupations from the necessity of suing for damages in case of injury. Farm legislation has been enacted to meet the more serious complaints of the farmer. In 1915 provision was made for state inspection and grading of grain, and a Farm Loan Act was passed. In 1917 the state provided insurance against hail for farmers. In 1921 the Legislature established a state Department of Agriculture with the understanding that a "real" farmer should be at its head. In 1911 the Legislature authorized cities to adopt the commission form of government, and in 1917 sanctioned the commission-manager plan. In 1912 the people established through the initiative a system for direct primaries for the nomination of all state and local officials and to express their preference for presidential candidates. They also passed a rigid Corrupt Practices Act limiting campaign expenses, providing for their publicity, and forbidding electioneering on election day. In 1914 the people ratified an amendment to the constitution to provide for woman-suffrage. The most important social legislation between 1910 and 1920 included the following: A rigorous White Slave Act to check commercial vice within the state and an Act raising the age of consent to 18 years; a stringent pure Food and Drug Act; a Mothers' Pension law supported in part by a tax on bachelors; a Teachers' Retirement Pension law; an Act to provide for the establishment and maintenance of county libraries, and state prohibition of the manufacture and sale of alcoholic liquors.

History.—Montana entered upon the second decade of the 20th century under very prosperous conditions. A new railway had just been built across the state. Mines were operating successfully, and there was a growing demand for Montana lumber. Great irrigation projects were under way, and in many sections of the state dry-farming was proving a success. The World War stimulated the mining and lumber industries, but it put a stop to the great reclamation works. During the later years of the decade drought seriously hampered the dry-land farmers and there was a decline in farm production. In 1910 there was a strong opposition to the national policy of conservation. Many people believed that the prosperity of the state depended upon the rapid exploitation of the power sites, the forests and the mines. They urged also that these natural resources should belong to the state. On the other side the conservationists urged that if the Federal Government turned over the natural resources to the state they would soon pass into the hands of a small group of eastern capitalists. They believed also that Federal administration would more nearly assure all the people of a share in them. The larger business interests have in general opposed the Federal conservation policy, particularly as applied to power sites and mineral lands, and most of these have passed out of Federal control. The people, however, came to approve the policy of the national forest service. State politics have largely hinged upon matters of taxation, particularly the taxation of mines. The constitution provides that mines "shall be taxed at the price paid the United States therefor," although the "net proceeds. . . shall be taxed as provided by law." The mining interests maintain that, since mining is a speculative business and the mines are being gradually exhausted, the net proceeds should be taxed at no higher rate than real estate or personal property. Their opponents maintain that since practically no tax is imposed on mines as such, the tax on "net proceeds" should be much higher than the property tax. Farmers complain that when business is poor the mines escape taxation by curtailing production, while poor crops and bad markets in no wise relieve them of their tax burdens.

During the World War a new radical movement spread over the state under the name of the "Non-Partisan League." It started first among the farmers but soon extended among the labour groups. In 1918 it elected a number of members of the state Legislature. In 1920 the farmers and labour men went into the Democratic primaries and nominated a former U.S. district attorney, Burton K. Wheeler, for governor. The Non-Partisan programme demanded for the labourer a more liberal workmen's compensation law and better sanitary conditions in lumber and construction camps. For the farmer it demanded exemption of farm improvements from taxation and a farm-bank system. The merchants and other business interests organized the Montana Development Association to oppose the Non-Partisan League. This organization supported Joseph M. Dixon, former senator and manager of Roosevelt's campaign in 1912, for governor on the Republican ticket. The Republican platform declared for a Conservative programme, and on this issue the entire Republican ticket was elected. In 1914 Jeanette Rankin was elected representative to Congress as a Republican, the first woman to be a member of that body.

For the World War Montana supplied in the neighbourhood of 40,000 soldiers, and subscribed in Liberty Bonds and Victory

Notes $87,406,650, as compared with an allotment of $56,165,450. The governors of Montana after 1910 were as follows: Edwin L. Norris (Dem.) 1909–13; Sam V. Stewart (Dem.) 1913–21; Joseph M. Dixon (Rep.) 1921–

See Helen F. Sanders, *History of Montana* (3 vols., 1913), and the annual reports of the Montana Department of Agriculture and Publicity on *Resources of Montana*. (P. C. P.)

MONTENEGRO (*see* 18.766).—The former kingdom of *Crnagòra* (Black Mountain), as it is known to its inhabitants, was by the Peace Treaty of 1919 merged in the kingdom of the Serbs, Croats and Slovenes (*see* YUGOSLAVIA).

Area and Population.—After the Balkan Wars of 1912–3 Montenegro obtained an accession of territory on the S.E. from the province of Scutari and on the N. and N.E. from Novibazar and Kossovo, which raised its area to an estimated total of 5,603 sq.m., the new Serbo-Montenegro frontier being settled by the treaty of Nov. 12 1913. Starting from the meeting-point of the former frontiers of Montenegro, Bosnia and the sanjak of Novibazar the new boundary followed the common frontier of the two latter provinces to the neighbourhood of Banich eastward of Chaynicha (Čajniče); it then cut the sanjak in a south-easterly direction passing N. of Plevlye and S. of Priyepolye across the headwaters of the Ibar to the Albanian Alps, descended to the White Drin in the neighbourhood of Klina and followed the river to its junction with the Erenik south-eastward of Dyakovitsa, thence striking north-westward to the summit of the Albanian Alps, which it followed to a point south of Gusinye, where it turned northward across the upper valley of the Lim, westward of Gusinye, to the old frontier which it left at a point east of Dinoshi, so as to enclose in Montenegro the tribes of Hoti and Gruda, to pass to the lake of Scutari, which it crossed to a point E. of Skya, and so to the Boyana south of Goritsa.

These additions of territory added to the population an element distinguished in certain respects from the inhabitants of the former kingdom. In historic Montenegro, the districts of Katun, Ryeka and Lyeshanska, situate roughly between the valley of the Zeta, the lake of Scutari, and the Bocche di Cattaro, the tribal system had persisted to the present day, but the smallness of the area, its lack of fertility, the fact that it is divided into distinct basins of limited extent, coupled with the impossibility of expansion at the expense of neighbours under Turkish or Venetian rule, or of the northern tribes, had for result that the individual tribes are numerically small. In the regions acquired after the Russo-Turkish War—in the N.W. and in the N.E., the latter known as the Brda, "the mountains"—the population was also organized on a tribal basis but the individual tribes, as for example the well-known Kuchi and Vasoyevichi, were larger, for here were large pastures, wood, water and a more generous soil, and the tribes, moreover, had succeeded in absorbing some of their neighbours over their open frontier towards the basins of the Tara and Lim, where the population was not organized on a tribal basis. The northern tribes of the Brda are also distinguished by their costume, which is of white braided with black, similar to that of the northern Albanian tribes, many of whom, in fact, claim a common origin with certain of the Montenegrin tribes, whom they resemble also in their physical attributes.

Professor Cvijić has pointed out (*La Péninsule Balkanique*, Livre II., chap. iv.) that most of the tribes represent an amalgam, sometimes of different Serb clans, sometimes of such clans which have absorbed earlier tribal elements which, in some cases, themselves were the result of the absorption of pre-Slav ingredients by the early Serb invaders, though the popular belief is that each tribe represents the descendants of one common tribal ancestor. In the greater part of the territory acquired after the Balkan Wars the Serb population has long lost its tribal organization, the people of the Metohiya forming part of the Serb population of Stara Srbija (Old Serbia)—the Kossovo-Metohiya type of Cvijić—while only a portion of the population in the acquired part of the sanjak is tribal, the remainder belonging to Cvijić's "Era" (Highland) type which extends from the south-westerly regions of the pre-1913 kingdom of Serbia over the sanjak and the Herzegovina. The new boundaries of Montenegro in this direction were quite artificial and determined largely by the line of demarcation between the zones occupied by the Serb and Montenegrin armies respectively. In these new acquisitions are many Albanians, especially in the Pech (Peć)-Dyakovitsa region. The official return for the population in 1920 was 435,000.

Recent History.—The last years of the history of Montenegro as an independent kingdom were marked by the great growth of a purely dynastic policy carried out by the sovereign to whom the organs of government provided by the constitution were entirely subservient. In his early years Prince Nicholas, true to the traditions of his predecessor and the sentiments of his people, had been a Southern Slav, or rather Pan-Serb, patriot who looked to the restoration of the Serb empire of Tsar Dushan. In 1865 an agreement was actually reached with Prince Michael of Serbia, which provided for the abdication of Nicholas, if ever the two States should achieve a common frontier and physical union become a possibility. Gifted with no small measure of the literary ability of his family he dedicated his gifts to the dissemination of his patriotic ideals. His song "Onamo Onamo" ("Yonder, Yonder"), spoke of Prizren the Tsarigrad over the mountains and became a popular classic, while in his play *Carica Balkanska* (*The Empress of the Balkans*) he envisaged the renewal of the old glories of the Serb race. Before the end of the century, however, a change of attitude became apparent. Under the last two Obrenovich sovereigns the reputation of Serbia and of its ruling House suffered eclipse, domestic scandals followed hard upon military disaster, and Prince Nicholas himself began to aspire to the leadership of the Serb race. With King Milan his relations were never good, and they were scarcely better with King Alexander. The brilliant marriages made by his daughters enhanced his sense of dynastic importance; and in particular the marriage in 1896 of the Princess Helena to the King of Italy, then Prince of Naples, fortified his diplomatic and international position by the support of a neighbouring Great Power with interests of its own across the Adriatic. The assumption of the style of "Royal Highness" by Nicholas on Dec. 19 1900 was an overt sign of the developments.

The beginning of the century was thus marked by the open adoption of a dynastic policy, by rivalry with Serbia, and by the close relationship formed by Italy with the little principality which was to form her *point d'appui* in the Balkans. The accession of King Peter to the throne of Serbia failed to effect any change in the relations between the two countries, which became worse than ever, and culminated in the scandal of the "Cettigne Plot" in 1908. At this point the history of Montenegro became involved with the movements and intrigues which were to culminate in the World War. Ever since 1903 the rising tide of the Southern Slav renascence had been flowing swiftly. Two years later, following on the resolutions of Fiume and Zara, the Serbo-Croat coalition was formed in the Croatian Sabor (Diet) and similar coöperation was arranged for in the other provinces of the Slovenski Yug (Slavonic South). Thus the Austro-Magyar policy of *Divide et impera*, which aimed at keeping the Orthodox Serbs and Catholic Croats apart and mutually hostile, had sustained a disastrous check. In 1906 Count Goluchowski was succeeded as Foreign Minister in Vienna by Baron Aehrenthal, an able man without scruples, and determined upon a forward policy for the monarchy. In the early part of 1908, a violent press campaign was waged in the monarchy against Serbia, coupled with denunciations of a vast and dangerous Pan-Serb conspiracy in the Southern Slav provinces directed from Belgrade.

In the spring of the same year some bombs were discovered at Cettigne, and there followed the famous High Treason trial which was the precursor of the Agram treason trial and the Friedjung case. The principal witness was a certain George Nastich, a Bosnian police spy and *agent provocateur* who in Dec. 1906 had been ostensibly expelled from Bosnia whence he proceeded to Belgrade. Here, according to his own account, he became a member of a revolutionary society known as the Slovenski Yug (in reality a literary society with propagandist aims) which was hatching a plot against the Dual Monarchy, the principal means of which was to be the employment of bombs, which were manufactured in the arsenal of Kraguyevats. The King of Serbia and the Crown Prince George were eager patrons of this society—which aimed at a republic. Eventually it was decided to use the bombs against the Montenegrin royal family—the time and place being so chosen as to destroy also King Peter's only daughter—and Nastich in disgust, after returning to Bosnia, put himself in communication with the Montenegrin police, and on the "discovery" of the bombs testified that these were the identical bombs whose manufacture he had witnessed. Nastich figured also in the other two trials mentioned above, in which also the Slovenski Yug appeared as the criminal agency at work, his information being thus connected with the Forgách-Vasich forgeries and forming part of the same general plan. The object of Aehrenthal was to prejudice Serbia and its dynasty as incurably regicidal, to estrange the two Serb States and to create an atmosphere in which his designs should appear legitimate and necessary; that of Nicholas was to strike at his internal opponents and to prepare the way to his headship of the Serbs. It is from its connexion with the wide issues at stake, and as being the first of a long series of similar incidents culminating in the tragedy of Sarajevo (perpetrated by the son of another Bosnian police spy), that the Cettigne trial derives its importance.

Later in the year followed the annexation of Bosnia and the proclamation of Bulgarian independence. In the effervescence which followed, Montenegro stood by Serbia, and in the settlement of the "annexation crisis" obtained the suppression of Article 29 of the Treaty of Berlin which established an Austrian tutelage over her coast and maritime administration. On Aug. 28 1910 Prince Nicholas took the title of king, encouraged thereto by Austria which saw in the kingly style an additional hindrance to a future union with Serbia.

It had early become evident that for the Young Turks liberal reform was but a pretext; that their movement, though largely engineered by Jews and crypto-Jews, was strongly nationalist, and that they were bent upon a policy of forcible Turkification. The disillusionment of the subject population led to a recrudescence of the old troubles. Incidents on the Montenegrin frontier in Aug. 1912 led to the withdrawal of the Turkish mission, and these were followed by fresh massacres at Berane, whilst similar incidents took place in Macedonia. A formal alliance was entered into between Serbia and Bulgaria, and agreements for common action were made with Greece and Montenegro also. The demands of the Balkan League were rejected by the Turks, and on Oct. 8, anticipating its allies by 9 days, Montenegro declared war against Turkey.

Although the principal objective of Montenegro was Scutari, a large portion of the Montenegrin forces was directed upon the Sanjak and Kossovo, apparently with the idea of staking out claims for the future settlement. The Montenegrins entered Pech and Dyakovitsa, but were forestalled at Prizren by the Serbs. In the meantime they were unable to make any serious impression on Scutari, in the siege of which their lack of scientific military training and modern equipment became manifest. The offer of help from Serbia, at first refused from considerations of *amour propre*, was subsequently accepted, and a Serb general took charge of the operations with a reinforcement of troops and especially of artillery.

During the abortive negotiations in London which followed the armistice entered into at Chatalja, Dec. 9 1912, and the renewed war which ensued on its expiration on Feb. 3 1913, the Great Powers had had under consideration the future of Scutari, which they decided to allot to the newly formed principality of Albania, and on April 4, four days after the Porte had accepted the terms laid down by the Powers in return for their mediation, an allied squadron appeared off the Montenegrin coast. The siege continued, however, to be pressed, and, on April 22, the town was surrendered by its commander, the Albanian Essad Pasha, but, on the renewed pressure of the Powers, the Government announced its evacuation on May 5.

On the outbreak of the second Balkan War, Montenegro assisted Serbia and took part in the Peace of Bucharest, Aug. 6. Though Montenegro had gained a notable accession of territory, the outcome of the war was disappointing for both the country and the dynasty. The Montenegrins had failed to retain Scutari, and the sacrifices suffered in its siege had gone for nothing. The dynasty had also greatly suffered in prestige. Complaints were made that the sons of King Nicholas had frequently absented themselves from the army, especially during the severe winter months, and they were compared unfavourably with Alexander, the Prince Royal of Serbia. The troops, too, who had served with the Serbian army, contrasted the organization and equipment of the latter with their own, and realized to an increasing degree that material self-interest, no less than Pan-Serb patriotism, demanded some form of union with the sister State, and the country generally saw that it was too poor and small to develop in isolation. The reputation of Serbia among the Southern Slavs had vastly increased, and on it were centred all hopes of national reunion; the figure of King Peter had grown notably greater, that of King Nicholas smaller. During the early part of 1914 negotiations were entered into with Serbia for a military, diplomatic and economic union between the two kingdoms, but their conclusion was anticipated by the outbreak of the World War.

In the World War Montenegro threw in her lot with the Entente, and her troops coöperated with the Serbian army. At the instance of the Russian Tsar, the Serbian General Yankovich was sent to Cettigne to assume the functions of chief of the staff, a post in which he was subsequently succeeded by Colonel Pesich. The presence of these officers did not, however, prevent King Nicholas from issuing executive commands on his own authority; the Serbian and Montenegrin forces were never combined under one control, and *liaison* was maintained by the presence at Montenegrin headquarters of a delegate from the Serbian High Command. Austria's main strength was directed elsewhere, and she contented herself in the early stages of the campaign with a defensive attitude on the Montenegrin front.

In the early part of 1915 the Montenegrin court engaged in an intrigue with the Austrians, with whom, prior to the war, King Nicholas had long entertained secret relations. In May of that year, Prince Peter, the youngest son of the King and commander of the important Lovchen position, which overlooked Cattaro and protected Cettigne, had a secret meeting at Budua with the Austrian Colonel Hupka, a former military attaché at the Austrian legation; and in July the Crown Prince Danilo proceeded to Italy, via Athens, where he was alleged to have discussed a separate peace with a German agent.

In October the combined Austro-German-Bulgar attack was launched against Serbia, and the bulk of the Serbian army was eventually forced to retreat through Albania to the Adriatic.

The consequences of the Serbian disaster to Montenegro were aggravated by treachery. In the beginning of Jan. 1916 Prince Peter withdrew his troops from one of the key positions of Mont Lovchen, which fell into the hands of the Austrians practically without a struggle. On Jan. 13 King Nicholas addressed a telegram to the Austrian Emperor asking for terms of peace, although his advisers had unanimously expressed themselves in favour of continuing the struggle, and it was only the uncompromising conditions laid down that eventually led him, on Jan. 19, to flee, first to Medua and thence to Italy. In the meantime the Montenegrin army was entrapped, for the King had refused the advice that he should follow the example of the Serbians and withdraw his army with the latter, and had given orders that it should remain in the country. It thus fell into the hands of the Austrians. Prince Mirko, the King's second son, also remained behind, and subsequently went to Vienna. The object of these manœuvres was evidently to assure the future of the dynasty in any event, for Mirko, since his elder brother was childless, was the eventual heir to the throne.

Intrigues were set on foot for the formation of a Southern Slav vassal State under the suzerainty of the Habsburgs with Mirko as ruler, the State to consist of the débris of Serbia and Montenegro. Mirko himself subsequently died in the Austrian capital. The King retired to France, where he established himself successively at Lyons, Bordeaux, and Neuilly, the three Western Powers according him a subsidy. In May 1916 M. Andrew Radovich, an old opponent, was appointed Premier and in the summer the King received not unfavourably a memorandum advocating a union between Montenegro and the other Southern Slav provinces. A visit to Italy in the autumn resulted in a change of attitude, for official Italy was by no means enamoured of a project which would strengthen the trans-Adriatic kingdom and deprive herself of a useful lever. Henceforward the gap between the dynasty and national feeling steadily widened. In Jan. the Ministry resigned after presenting a series of strongly worded memoranda on the question of national union and on the responsibility of the King for the position in which the country was involved. The appointment of General Martinovich as Premier only served to bring out the strength of the movement for unity, for the new Ministry also resigned in June after presenting a memorandum of similar tendency to those mentioned above.

The breach between the King and those entitled to speak on behalf of his people was now complete; a Montenegrin committee for national union was formed in Switzerland, and representatives were appointed for the meeting at Corfu, which resulted in the Declaration of Corfu, July 20 1917, by which the delegates of all sections of the Serbs, Croats, and Slovenes agreed upon the establishment of a single kingdom under the sceptre of the Karageorgevich. The entry of the Allied troops into Montenegro after the defeat of the Austro-Bulgars was followed by steps to bring the resolutions of Corfu into effect. Elections were held for a "Great National Assembly" which, on Nov. 26 1918, proclaimed the deposition of King Nicholas and union with Serbia, the resolutions being confirmed at a popular mass-meeting convened at Cettigne by five former Prime Ministers. Allegations of coercion on the part of Serbian troops in the elections were negatived by an Allied commission under General Franchet d'Espérey, and the report of the subsequent investigation carried out by Count de Salis on behalf of the Supreme Council of the Allies was stated by the British Government to bear testimony to the fact that the Assembly represented national feeling. Some disorders broke out in consequence of the incursion of armed bands acting on behalf of Nicholas, and financed and organized in Italy, but, the number of Serbian troops in the country being very small, these bands were forced to retire by the Montenegrins themselves, the defence of its borders being purposely left to a Montenegrin militia.

The general elections to the Serb-Croat-Slovene Constituent Assembly were held on Nov. 28 1920, and in Montenegro resulted in the election of none but advocates of national union. These elections were observed on behalf of the British Government by Mr. Roland Bryce, who reported that they were held under conditions of scrupulous fairness, without coercion on the part of the administration of the triune kingdom, and that they represented the will of the people. The subsidies paid to, and the diplomatic recognition of, the "Government" of ex-King Nicholas were withdrawn by England and France, but Nicholas was still able to maintain a force of adherents at Gaeta, in Italy.

The ex-King died at Antibes March 1 1921, and his entourage proclaimed the Crown Prince Danilo as King, but after six days the latter abdicated in favour of his nephew Michael, son of Prince Mirko, on the ground that his abstention from taking an active part in the war and his German marriage (with Duchess Jutta of Mecklenburg) made him *persona non grata* to the Allies. With the elections to the Constituent Assembly, however, the withdrawal of diplomatic recognition by Britain and France, and the disbanding in June 1921 of the "Montenegrin Legion" which the Italian Government had maintained hitherto at Gaeta, the "Montenegrin question" was virtually closed; it had, in fact, only been kept open latterly as a means of bringing pressure to bear upon the Southern Slav Government in connexion with the Adriatic question, and, in spite of the saying "pays balkanique pays volcanique," the union of Montenegro with its sister provinces seemed likely to endure. Thus the five centuries of struggle for independence and for the Serbian idea carried on by the "falcons" of the Black Mountain found its consummation in a realm as wide as, and more national than, the empire of Tsar Dushan.

AUTHORITIES.—N. Forbes, *The Balkans;* Jovan Cvijić, *La Péninsule Balkanique;* R. W. Seton-Watson, *The Southern Slav Question;* E. Denis, *La Grande Serbie; The New Europe* (weekly), various numbers; White Papers, Cmd. 1123, 1124; A. Radovich, and others, *The Question of Montenegro.* (A. H. E. T.)

MONTERO RIOS, EUGENIO (1832–1914), Spanish politician, was born at Santiago de Compostela, Corunna, Nov. 13 1832. He had a distinguished career at the university of Santiago. He was elected to the chair of ecclesiastical discipline at the university of Oviedo, was transferred to a similar chair at Santiago, and thence passed to the chair of canonical law at the Central University, Madrid. His political career began with the foundation in Santiago of *La Opiniôn Publica*, a journal designed to reunite the scattered Progressist party. In 1869 he was elected deputy (Progressist) and showed himself in the Chamber a strong opponent of ultramontanism and a defender of democratic monarchy. He was Under-Secretary of the Ministry of Grace and Justice in Zorrilla's administration and became the minister under Prim's, and whilst in office was instrumental in introducing civil marriage. Throughout the revolutionary period Montero was the object of bitter attacks by the clerical parties. He continued to hold office during the short reign of Amadeo I. and drew up that King's act of abdication, but held aloof from politics for some years after the accession of Alphonso XII., occupying himself in legal studies. In 1872 he had been made a member of a commission for codifying criminal law, and later in life (1898) he was president of a section of the General Codification commission. In 1888 he was for a short time president of the Supreme Tribunal. Having held office in Herrera's Cabinet (1883) and Sagasta's (1885 and 1892–3), he became a member of the Senate in 1893 and its president 1894–5. He was chief of the Spanish delegation which negotiated the Treaty of Paris with the U.S. at the close of the Spanish-American War of 1898, being also in 1899 again president of the Senate. Throughout his political career he was regarded as one of the leading men in the Liberal party; from 1903 to 1906 he was its chief, and for a few months in 1905 he was prime minister. From 1909 until his death in 1914 he was again president of the Senate. He died at Madrid May 12 1914.

MONTESSORI SYSTEM.—In connexion with the theory of education, one of the chief points of new interest during 1910–21 was the attention aroused by Dr. Maria Montessori's work. It is hardly too much to say that, since Froebel, no such stimulus has been given to a revolution in the elements of educational method as her success, from 1907 onwards, with the *Case dei Bambini* in Rome; and the Montessori system has given a new direction to ideas upon child education.

Maria Montessori (b. 1870) came to the study of educational theory after a thorough training in practical medicine. She was the first woman to whom (in 1894) the university of Rome gave the degree of M.D., and as assistant doctor in the "psychiatry" clinic at the university she had become specially interested in the question of the treatment of the feeble-minded. At the Pedagogic Congress at Turin in 1898 she gave an address on this subject, which led the Italian Minister of Education, Signor Barcelli, to ask her to give a series of lectures to teachers in Rome; the result was the foundation of a new school for feeble-minded children, the Scuola Ortofrenica, of which she was made directress. Her ideas as to the proper way of awakening a defective intelligence had been founded on a study of what Dr. Itard, physician to the Institution for the Deaf and Dumb in Paris, had attempted early in the 19th century in the case of the much-discussed "Wild Boy of Aveyron," and particularly of the later work of Edouard Séguin (1812–88), author of the *Traitement des idiots* (1846), who opened in 1839 the first school for idiots in France, and who in 1850 made his home in America and there did so much for the education of defective children. In carrying on Séguin's principles at the Scuola Ortofrenica for the two years that she was directress, Dr. Montessori had such remarkable success that it was borne in upon her that something must be wrong with the methods of education ordinarily applied to normal children. Idiots sent to her from the asylums were being taught to read and write so that they passed just as good examinations as pupils of the same age in the public schools; and, as she says, "while everyone was admiring the progress of my idiots, I was wondering what could keep the normal children on so low a plane." The reason, in her opinion, was clear; the children from the asylums, under her treatment, had been helped in their psychic development, while the normal children, taught by ordinary methods, were retarded. If the same methods were applied to good material that were successful with bad, much better results ought to be attainable; and she determined to investigate the whole subject afresh.

In 1900 she left the Scuola Ortofrenica, and turned her attention definitely away from the question of the feeble-minded to that of the normal child mind and its development. She returned to the university of Rome as a student of philosophy, and devoted herself to experimental psychology, then in its infancy at the Italian universities, at the same time making a prolonged and careful study of the actual practice of teaching at the primary schools. The result of several years of child study and practical pedagogy was to establish her conviction that the master principle in any proper system is "self-education"—that the work of mental growth must be done by the child itself, according to its own initiative and inclination, not in mechanical obedience to dogmatic dictation from a teacher; and she set herself to devise new methods for making the child-mind shape its own channels instead of the teacher telling the pupil what to do.

After six or seven years of inquiry and study a unique opportunity arose in Rome for putting her theories into practice. During the building "boom" at the end of the 1880's, a whole new quarter of apartment houses had been run up by speculators outside the Porta San Lorenzo. It was from the first a complete fiasco, the houses failing altogether to attract the superior class of tenants for which they were intended; and the district gradually developed into the worst of slums, the flats being farmed out room by room to the poorest families, so that at last a serious condition of insanitary overcrowding had resulted, which seriously engaged the attention of social reformers. In order to remedy this evil, an association was started on philanthropic lines, the Instituto Romano di Bene Stabili, with Signor Edoardo Talamo as director-general. It bought up a large part of the San Lorenzo quarter, and reorganized it in 1906 in separate and convenient working-class tenements, with proper air-space, prizes being instituted for the best-kept dwellings. A novel point of the scheme was the provision of infant schools (*Case dei Bambini*) for the children of each block, the supervision of which was entrusted to Dr. Montessori, the first of these being opened in Jan. 1907. These "houses of childhood" for children between three and seven were themselves a very interesting social experiment apart from the new methods of teaching which Dr. Montessori introduced. They provided a crêche and something more, taking the children off their mothers' hands during working hours. Each school had a directress living in the block which it served and in touch with the parents, who could at any time come and see how the children were getting on; it was thus part of the home life.

The Montessori system of education was first put in practice in these tenement schools, under teachers following Dr. Montessori's methods. Its fundamental aim and object is self-education by the pupils themselves. There are no time-tables, no set lessons, no classes. There are no rewards or punishments of the ordinary kind. The pleasure of succeeding and getting things right is the only incentive. "Each child is doing what, for the time being, pleases him best. When he is admitted to the school he sees small groups of children playing at various 'games,' and he joins the group which happens to take his fancy. Then and there his education begins. All kinds of interesting 'occupations' are going on, and wherever he goes he will get help and guidance from the teachers. If he gets tired of playing at this thing he goes off and plays at that. But he is never idle, for whatever he does interests him. The children are provided with light and comfortable chairs, which are easily moved about. There are also rugs laid on the floor for them to sit, kneel or recline upon, should they prefer those attitudes. Low and light tables are provided in abundance, but there is also plenty of open floor-space, and many of the 'occupations' are carried on on the floor" (Holmes). An extensive variety of apparatus, elaborately devised by Dr. Montessori, is provided for the educational games by which the children are stimulated to acquire knowledge; and this "didactic material" constitutes a distinctive part of the originality of the system.

The first stage is to develop the senses of touch, sight and hearing; this is done both by games of various sorts and by guiding the attention systematically to the association of things, names and ideas. When a child washes his hands, for instance, he is given first cold and then hot water, and led to observe and understand the difference; the distinction of rough and smooth is emphasized by the provision of different qualities of cards for fingering and sorting. In each case the teacher gets the child to know the word, "hot," "cold," "rough," "smooth," and thus the knowledge of language is extended in all directions ("high," "low," "thick," "thin," "round," "oval," etc.) before any question of writing or reading arises. Ideas of form and colour are given precision by games with blocks, cylinders, etc., of varying sizes, to be fitted into frames, or with shades of silk to be arranged to match; touch is practised by playing the games blindfold; the sense of hearing is developed by the "silence" lesson, and by the use of small cylindrical boxes containing stones, sands and different substances to be rattled by the children, who arrange them in order of intensity of sound and so forth. Skill and neatness in the use of the fingers and movement of limbs are stimulated partly by the mobility of the light furniture, which the children learn to rearrange for their own comfort, and partly by games at tying and untying, hooks and eyes, dressing and undressing, waiting on one another at table, washing up, and so on. Many of these occupations are preliminary to writing and reading, and lead naturally up to both.

Writing comes essentially before reading, on the Montessori system, in any proper sense of "reading." Emery-paper letters gummed on cards are provided, with which the child is familiarized by games of hide and seek, etc., so that, without any active teaching of the alphabet, he not only knows them by sight and by name, but also by feeling. He learns how to imitate them, partly by a touch game of passing the fingers over the paper letter, thus making the actual motion of writing, and partly by playing at pencilling and colouring with specially devised cards on which an outline is given. The child thus learns to write before he knows that "writing" is what he is learning; the sounds and shapes of the letter being known it is a natural transition to build up the letters and their sounds into words.

The next thing is for the child to "read"—not merely to re-translate into sound a word he has translated into symbol, which goes with the acquisition of "writing," but to extract a previously unknown idea from written or printed symbols of the same sort not put together by himself. It is found, however, that, at any rate in so easy and phonetically spelt a language as Italian, this is very quickly learnt. Numbers of words, already well known to the children, are written on cards, and various games are played in identifying them with their objects; and from single words the children pass to phrases and sentences, the teacher writing on the blackboard, for instance, questions or orders which form part of a game. Arithmetic is similarly introduced to the children's minds by the employment of counting games, in which an apparatus of striped poles, counters, etc., is used. The whole curriculum is devised for the content and happy employment of the natural energies of the child, who is left free to respond to his own impulses, under the influence of "didactic material," rather than under the discipline of a teacher.

After 1912 the diffusion of Dr. Montessori's educational influence was rapid and widespread. Following close upon the interest which had already been aroused in Italy and America, Dr. Montessori, in response to urgent requests from educational enthusiasts all over the world, began a series of international training courses for teachers. These courses were held in Rome in 1913 and 1914. In subsequent years Dr. Montessori held training courses in Barcelona and in several cities of the United States, two international courses having been held in London in 1919 and 1921. To these training courses came not only class teachers of the particular country, but persons eminent in the educational field from all over the world. During this later period two of the most notable features in connexion with the Montessori movement were the appearance of Dr. Montessori's new books, *The Advanced Montessori Method* and *The Didactic Material for the Education of Children from 7 to 11 years.* The first volume gives a clear and complete exposition of the scientific researches which led to the establishment of the fundamental psychological and physiological principles upon which Dr.

Montessori bases her method of auto-education, and the second volume fully describes in detail the educational material for the older children. The form of the advanced apparatus is such that the children who have passed beyond infant school age are provided with material which continues to perfect the muscular control achieved in a previous stage, while at the same time the way in which the material is used tends to strengthen those attributes of character which are the tests of educational values. By means of the objects provided for the child between the ages of 7 and 11 he becomes possessed of considerable mental acquirements, notably in the comprehensive intellectual fields of mathematics and language. The arrangements of artistically coloured beads which are used by the child for his progress in arithmetic, the ingenious geometrical forms which render geometry no longer a tedious abstraction, but a fascinating reality, the system of small attractive cards handled by the children in their study of grammar, all form a far more potent incentive to work and persistent effort than any exhortation or command of the teacher.

"Montessori Societies" have, since 1912, come into existence in London, New York, and elsewhere, for dissemination of the ideas of the system and promoting its training courses.

The Special Report (1912) by Mr. E. G. A. Holmes to the Board of Education in England contains a critical examination of the Montessori methods. See also Dr. Montessori's first book on *The Montessori Method* (Eng. trans. by Anne E. George, 1912), in addition to her later books mentioned above. (H. CH.)

MONTREAL (*see* 18.790), the commercial metropolis and the largest city of the Dominion of Canada, had a pop. in the autumn of 1920 estimated at 802,000. The local trading area, including adjoining towns on the island of Montreal and those settlements on the mainland which lie immediately opposite the city, contained in 1920 a pop. of 1,100,000. The port of Montreal is the second largest in America, being surpassed only by New York. Over 25% of Canada's export trade passes through Montreal. The harbour has eight m. of deep water (25–35 ft.) and wharfage with berths for 125 vessels on a 10 m. front. In 1921 a costly scheme for the further improvement of the harbour, including the electrification of the entire water-front, was under way. In 1919 8,280 vessels with a total tonnage of 6,537,014 entered the port. Merchandise to the value of $353,138,249 was exported, and imports amounted to $246,898,626 in the same period. The largest flour-mill in the British Empire, with a capacity of 6,000 bbl. in 24 hours, is located here. The bank clearings amounted in 1920 to $7,109,189,038, the highest in Canada. Taxable property was valued in 1918 at $623,820,958, and property exempt from taxation at $226,934,131. The Montreal Chambers of Commerce had 3,500 members in 1920. Montreal is far ahead of other Canadian cities in the use of electric power in industry.

The form of municipal government underwent several alterations in the decade following 1911, and eventually the control of municipal affairs was placed in the hands of an administrative commission of four, appointed by the Provincial Government.

The construction of a tunnel under Mt. Royal and the centre of the city by the Canadian Northern Railway Co. was an important engineering feat completed in 1918. The company built an imposing new terminal station in the centre of the city at the tunnel head, supplanting its old Moreau Street station. Electric trains running through the tunnel to the north-western side of Mt. Royal caused the growth of a new suburb on that side of the mountain.

Important educational buildings erected since 1911 include the McGill Medical Building, a magnificent structure that replaced the building destroyed by fire in 1907, the Macdonald Engineering Building of McGill University, a large and finely equipped technical school in connexion with Laval University, a new high school erected by the Protestant Board of School Commissioners, and a fine pile of buildings to house Loyola College, a Jesuit school of high standing.

McGill University, benefiting by gifts from its great benefactor, Sir William Macdonald, was able to develop further its faculty of music, to found new degrees in law, commerce and household science, and to further extend some of its departments. A school of physical training was opened in connexion with the university, and a department of social service was inaugurated. The McGill Stadium, one of the finest athletic amphitheatres in North America, was opened in 1918. After the death of Sir William Macdonald in 1919 provision was made for the further endowment of Macdonald College at Ste. Anne de Bellevue, the faculty of agriculture of McGill. Sir William Peterson, the principal of McGill for many years, retired in 1919 owing to ill-health. Under his guidance the university had risen from a local institution to one of the foremost seats of learning in the British Empire. His influence was a chief factor in McGill's war effort, which included the extension of the old Officers" Training Corps, and the raising of a number of infantry companies, an artillery unit, etc. He died in London in 1920, his successor (after Sir Auckland Geddes, who had originally accepted the position, had been appointed British ambassador in Washington) being Sir Arthur Currie, commander-in-chief of the Canadian forces in the World War. A campaign to raise $5,000,000 for the university was organized and carried successfully to completion in the summer of 1920.

The administrative buildings of the Montreal branch of Laval University were destroyed by a disastrous fire in the autumn of 1919. A movement that had been gaining strength for some years to separate the Montreal branch from Laval University at Quebec, now found culmination, and the university of Montreal was founded, the buildings of the old branch of Laval being taken over by the new institution. A number of new courses were added, including social and political science, and the faculty of applied science was further developed. Considerably over $3,000,000 was raised by public subscription as a building fund, and in 1921 negotiations were under way for securing land for new administrative buildings, etc.

The growth of the Jewish pop. of Montreal during the 15 years preceding 1921 has been a notable feature. In 1920 there were estimated to be about 75,000 Jews in the city. A scheme for the foundation of a Jewish university was under consideration.

MONYPENNY, WILLIAM FLAVELLE (1866–1912), British journalist, was born in Ulster Aug. 7 1866. Educated at Trinity College, Dublin, and Balliol College, Oxford, in 1893 he joined the editorial staff of *The Times*, and early in 1899 became editor of the Johannesburg *Star* in the Transvaal. He played a useful part, as a publicist, on the side of the Reform party there, and when war came he joined the Imperial Light Horse and was one of the defenders of Ladysmith. Returning afterwards to his position on the *Star*, he did much to promote Lord Milner's work of reconstruction, but resigned in 1903 owing to his hostility to the introduction of Chinese labour into the mines. He was then entrusted by *The Times* with the task of writing the official biography of Disraeli, and also did other work for that paper, becoming in 1908 a director of the company. Owing to ill-health the first volume of the *Life of Beaconsfield* (ultimately extending to six volumes) did not appear until 1910, and the second shortly before his death. It was completed by Mr. G. E. Buckle, formerly editor of *The Times*. Monypenny died in the New Forest Nov. 23 1912.

MOODY, WILLIAM VAUGHN (1869–1910), American poet and playwright, was born at Spencer, Ind., July 8 1869. He was educated at Harvard (A.B. 1893; A.M. 1894) and was assistant in English there 1894–5. From 1895 to 1907 he was at the university of Chicago as instructor and, after 1901, as assistant professor. He died at Colorado Springs Oct. 17 1910. He was the author of *The Masque of Judgment* (1900); *Poems* (1901); *The Fire-Bringer* (1904, intended as the first member of a trilogy on the Promethean theme, of which *The Masque of Judgment*, already published, was the second member); *The Great Divide* (1907) and *The Faith Healer* (1909). Of these the last two were prose dramas and were very successful on the stage, especially the first. He compiled (with Robert M. Lovett) *A First View of English and American Literature* (1902), and edited *The Complete Poetical Works of John Milton* (1899, Cambridge ed.) and (with George Cabot Lodge and John Ellerton Lodge) *The Poems of Trumbull Stickney* (1905).

His complete works, including *The Death of Eve*, a fragment of the third member of the proposed trilogy mentioned above, were edited with an admirable introduction by Prof. John M. Manly (1912).

See also Daniel Gregory Mason, *Some Letters of William Vaughn Moody* (1913).

MOORE, GEORGE (1853–), Irish writer (*see* 18.808), broke fresh ground in 1916 with *The Brook Kerith*, a work of fiction based on the Gospel story. He had professedly taken leave of literature in three remarkable volumes of quasi-reminiscences, entitled *Ave* (1911), *Salve* (1912) and *Vale* (1914). Later he produced two privately printed volumes-de-luxe, *Avowals* (1918) and *A Story Teller's Holiday* (1920), and retold the story of *Abêlard and Hêloïse* (1921).

MOORE, THOMAS STURGE (1870–), English poet, art critic and engraver, was born at Hastings, Sussex, March 4 1870.

He published the *Vinedresser and other Poems* (1899); *Aphrodite against Artemis* (1901); *Absalom*, a play (1903); *The Little School* (1905, enlarged edition 1917); *Marianne* (1911); *The Sea is Kind* (1914); and other collections of poetry, as well as prose studies of Altdorfer, Dürer, Correggio and others, and several volumes of essays, *Art and Life* (1910); *Hark to these Three* (1915); *Some Soldier Poets* (1919); etc. In 1920 he published two new poems *Danaë* and *Aforetime*, and a prose idyll *Blind Thamyris*.

MOORHOUSE JAMES (1826–1915), English divine, was born at Sheffield Nov. 19 1826. He was educated at St. John's College, Cambridge, where he graduated in 1853. He was ordained the same year, and made a reputation as an eloquent preacher, which brought him to the notice of Queen Victoria. He was made chaplain-in-ordinary to the Queen and a prebendary of St. Paul's in 1874, and in 1876 went to Australia as Bishop of Melbourne. In 1886 he was recalled to England to become Bishop of Manchester. He retired in 1903, and died at Poundisford Park, near Taunton, April 9 1915.

See Edith C. Rickards, *Bishop Moorhouse* (1920).

MORANT, SIR ROBERT LAURIE (1863–1920), English civil servant, was born at Hampstead April 7 1863. He was educated at Winchester and New College, Oxford, and on leaving the university was for a few years a schoolmaster. Later he went to Siam as educational adviser, and was entrusted by King Chulalongkorn with the drawing up of a scheme of education for the whole country. In a few years he returned to England, and after some experience of social work in the East End of London was appointed in 1895 to assist in the direction of the Office of Special Inquiries and Reports in the Board of Education. His first noteworthy piece of work was a report on the condition of the French primary schools. He became private secretary to successive ministers, and on him devolved a great deal of the preparation of Mr. Balfour's Education Act of 1902. In 1903 he was appointed permanent secretary of the Board of Education. In this capacity he proved himself a most efficient administrator, and in 1907 he was created K.C.B. In 1912, on the introduction of the National Insurance bill, Morant was appointed chairman of the Insurance Commission, a position which led naturally to his appointment as secretary to the Ministry of Health on its formation in 1919. He died in London after a few days' illness March 13 1920.

MORET Y PRENDERGAST, SEGISMUNDO (1838–1913), Spanish politician, was born at Cadiz June 2 1838. He was educated at the Central University, Madrid, and became professor of political economy, continuing at the same time his studies in jurisprudence. In 1863 he was elected Liberal deputy for Almaden and took part in the revolution of 1868, afterwards representing Ciudad Real in the Constituent Assembly of 1869 and becoming noted for his eloquence. He took office under Gen. Prim in 1870 first as Colonial Secretary and later as Finance Minister. He was for a few months in 1872 Spanish ambassador to Great Britain, and after resigning this post accepted the directorship of a large London bank. A year later he returned to Spain. He was again elected deputy for Ciudad Real in 1879, rallied to the monarchy in 1882, represented Orgaz from 1886 to 1890, was Minister for Foreign Affairs under Sagasta in 1885 and again in 1893–4, Minister of the Interior 1885–8, and Minister of Colonies 1897. In this capacity he advocated the grant of autonomy to Cuba and Porto Rico, and he was opposed to the war with America of 1898. He rose to be head of the Liberal party and became Prime Minister in 1905, but fell in 1906, though he was called back to office for an ephemeral spell of three days in that year and again in 1909 for a few months. Failing to keep together his unruly hosts he took refuge in the post of president of the Chamber, in which office he died at Madrid Jan. 28 1913.

MORGAN, JOHN PIERPONT (1837–1913), American financier and banker (*see* 18.834), died in Rome March 31 1913. In Jan. 1913 he sailed from New York for Egypt, where he became seriously ill. He was carried to Italy but never recovered. His will provided that after the distribution of enumerated bequests amounting to about $17,000,000, chiefly to his family, the residue of his estate should pass to his son, John Pierpont Morgan, Jun. (see below). In 1916 the estate was finally appraised at $69,499,732. He left only some $700,000 to charities; but while living he had been a generous giver, and in his will suggested that his son continue certain accustomed annual contributions. His works of art and books were left to his son without restrictions, although in his will he said, "It has been my desire and intention to make some suitable disposition of them or of such portion of them as I might determine, which would render them permanently available for the instruction and pleasure of the American people." In the summer of 1913 most of the art collection was placed as a loan exhibit in the Metropolitan Museum of Art, New York. Later some items, mostly replaceable, were sold. The remainder, consisting of over 3,000 pieces, was presented to the museum by the son in Dec. 1917, and a new wing was added to the building to house them permanently (opened June 1918). This collection covers all periods and includes matchless bronzes, enamels, porcelains and tapestries. The library, retained by the son, was appraised at $7,500,000. It consisted of more than 20,000 volumes of illuminated manuscripts, early printed books, examples from famous presses and association copies.

His son, JOHN PIERPONT MORGAN (1867–), American financier, was born at Irvington, N.Y., Sept. 7 1867. On graduating from Harvard in 1889 he entered the banking house of Morgan, Grenfell & Co. (the London branch of J. P. Morgan & Co.) and 12 years later joined his father in New York. When Congress in 1902 authorized the President to purchase the rights of the old Panama Canal Co. for $40,000,000 in gold, Mr. Morgan arranged for the payment (1904). On the death of his father in 1913 he inherited the greater part of his estate and became the head of the firm. On the outbreak of the World War he arranged the first credit, $12,000,000 for Russia. In 1915 his firm was appointed agent in the U.S. for the British Government; and until after America entered the war, was also purchasing agent, receiving a commission of 1% on all purchases. In April his firm provided a loan of $50,000,000 for the French Government; in Sept. it organized a syndicate for floating the Anglo-French loan of $500,000,000 and followed this with other large loans, especially for the British Government. In July he was shot, but not dangerously wounded, in his home by a crazed German sympathizer, who declared that he was trying to force Mr. Morgan to bring about an embargo on arms. From 1914 to 1919 he was a member of the Advisory Council for the Federal Reserve Bank in New York. In 1919 he was for a time chairman of the International Committee, composed of American, British and French bankers, for the protection of the holders of Mexican securities. In Nov. of the same year he was made a director of the Foreign Finance Corp., organized to engage in the investment of funds chiefly in foreign enterprises. In May 1920 President Wilson transmitted to Congress a letter written long before, in which Mr. Morgan offered to give his London home as headquarters of the American embassy there; but it was not until 1921 that Congress accepted the gift. He was a director in numerous corporations, including the U.S. Steel Corp., the Pullman Co., the Aetna Insurance Co., and the Northern Pacific Railway Co.

MORLEY (OF BLACKBURN), **JOHN MORLEY,** VISCOUNT (1838–), English statesman and author (*see* 18.840), continued to hold the seals of the India Office till Nov. 1910, when he resigned them, as he himself revealed subsequently, "partly because I was tired, partly from a feeling that a new viceroy would have fairer openings with a new secretary of state; partly, too, that I might have a farewell chance of literary self-collection." One of his last important official acts had been to resist the appointment of Lord Kitchener to the viceroyalty, pressed strongly upon him by King Edward just before his death. He remained in the Ministry as Lord President, and was one of the four counsellors of state to administer the kingdom during King George's visit to India for the Delhi Durbar in the winter of 1911–2. In the critical period of domestic politics which began with the budget of 1909 he played a somewhat prominent part. He defended Mr. Lloyd George's budget in the great debate of Nov. 1909, and, while admitting that the Lords had the legal right of rejection, said that to assert it was "a gambler's throw." He poured cold water on proposals like Lord Rosebery's for House of Lords reform, and like Lord Lansdowne's for a referendum; and gave warm support to the Parliament bill, which would repair the national machinery. Owing to the temporary failure of Lord Crewe's health, Lord Morley led the House of Lords during most of the Session of 1911, in which that bill was passed; and it was he who read out to the House on the last night of debate the definite assurance from King George which finally secured the exiguous but adequate majority of 17: "His Majesty would assent to a creation of peers sufficient in number to guard against any possible combination of the different parties in opposition by which the Parliament bill might be exposed a second time to defeat." He not only took charge of the India Office during Lord Crewe's illness, and of the Foreign Office in Sir Edward Grey's short holidays, but he was an outstanding figure in the Home Rule debates of 1913 and 1914. In moving the second reading of the Amending bill on July 1 1914, he said that the National Volunteers had dispelled the illusion that the masses of the South and West of Ireland had lost their care for Home Rule; the danger was lest the constitutional agitation for self-government might give place to older methods of violence and disloyalty.

The outbreak of the World War brought Lord Morley's official career to an abrupt termination. He made no public explanation of his reasons for resigning, but withdrew to the retirement of his Wimbledon villa, where he occupied himself with writing two most interesting volumes of *Recollections*, which were warmly welcomed on their publication in 1917. In the introduction he said: "The war and our action in it led to my retirement from public office. The world is travelling under formidable omens into a new era, very unlike the times in which my lot was cast. . . . The world's black catastrophe in your new age is hardly a proved and shining victory over the principles and policies of the age before it." In 1921 his publishers brought out a complete edition of his works in a handsome *format*.

See Viscount Morley, *Recollections* (2 vols., London, 1917).

(G. E. B.)

MOROCCO (*see* 18.850).—The year 1911 was rendered memorable in Morocco by the Agadir crisis. Mulai Hafid had become unpopular through his dependence on the French and the exactions of his grand vizir, El Glawi. There was a general rising of the tribes round Fez in Oct. 1910. Meknes (Mequinez) was captured, and Fez itself besieged in March 1911. French troops were sent in April, and again in May, to occupy the city and pacify the district. El Glawi was dismissed. This French occupation of Fez, though the need for it had been duly notified to the Powers, was resented by Spain and Germany. The former countered it by the sudden occupation (June) of El Qasr and Laraish (El 'Araish). The German Government on July 1 1911 announced to the French Minister for Foreign Affairs its decision to send a gunboat to Agadir, and dispatched the "Panther" forthwith. The alleged motive was to safeguard German subjects and property against disturbances in the Sus; the real one was to challenge the extension of French influence in Morocco as contrary to the Agreements of 1906 and 1909. The situation became extremely critical, and for a time it seemed as if war were inevitable. The protests of France were unavailing until Great Britain declared her intention of standing by the Entente, and her formal objection to Germany's obtaining territorial influence in Morocco. A series of diplomatic "conversations" resulted in the Franco-German Treaty of Nov. 4 1911, by which France was to cede some of her Congo territory to Germany in return for the recognition by the latter of her political protectorate over Morocco, economic equality being reaffirmed. (The word "protectorate" was not used in the actual treaty, but it was in the letters accompanying it.) Spain at first objected, but, through the intervention of Great Britain, a Franco-Spanish treaty was concluded on Nov. 27 1911. This arranged such debated points as customs, the management of the projected Tangier–Fez railway and the appointment of the Sultan's *khalifa* (deputy) at Tetuan. It slightly revised the Franco-Spanish boundaries determined by the Convention of Oct. 3 1904. The boundary of the northern Spanish zone follows the Muluya (Mulwiya) from its mouth to near Meshra el Klila, thence, turning W., it runs immediately N. of the Wad Waghra to Jebel Mulai bu Shta; thence it strikes N.W. to the Wad Lekkus, follows its course and, afterwards, lat. 35° N., to the Atlantic coast. Both banks of the Lekkus and El Qasr and Laraish fall within the Spanish zone. The treaty also recognized the rights of Spain in the S. over the enclave of Ifni, bounded to N. by the Wad bu Sedra, to S. by the Wad Nun, to E. by a line about 15 m. from the coast. The negotiations of 1911–2 between the Powers resulted in the internationalization of the Tangier zone, consisting of Tangier, its environs and the territory of the El Fahs tribe to S. and W. of it—about 100 sq. m. in all. By this understanding Tangier was "to be given a special régime to be agreed upon later." In 1921 Spain maintained that the possession of Tangier was indispensable to her in order to round off her protectorate zone, both from an economic and a territorial point of view. France on her side put forward claims to the town based upon her general position in Morocco and the Mediterranean. Meanwhile the Sultan is sovereign and the town and the harbour are administered by an International Commission.

On March 30 1912 Mulai Hafid signed a treaty with France accepting the protectorate, which was subsequently recognized by the Powers, who withdrew their diplomatic representatives. General Lyautey was appointed resident-general. The protectorate has an office in Paris at 21, Rue des Pyramides.

There were continued risings in the Fez-Sifru district and in the Rif during the autumn of 1911, and Fez was again besieged in March–April 1912, when the Sherifian army mutinied and killed several of their French instructors. In August a new Pretender appeared in the Sus, Hamed el Hiba, son of the notorious religious agitator Ma el 'Ainin, who had died at Tiznit (Oct. 1910). El Hiba occupied Marrakesh (Aug. 1912) but was driven thence in Sept. and fled south. Mulai Hafid abdicated on Aug. 12, appointing his brother, Mulai Yusef, as his successor. Hafid was pensioned by France and lived for a time at Tangier; after the outbreak of the World War both he and 'Abd el 'Aziz resided in Europe. In Oct. Gen. Lyautey occupied Agadir. Fighting in western Morocco continued for some months among the Shiadma, Haha, Zayan and Tadla, the most powerful chiefs being two rival *kaids* of the Haha and Moha u Said of the Tadla. But this district and that round Fez were pacified by the spring of 1913, and attention became increasingly centred on eastern Morocco, and the need for securing communications with Algeria by the occupation of the important strategic position of Taza. This was accomplished in May 1914, in the face of much hostility from the local tribes. The following month saw the capture of the scarcely less important fortress of Khenifra in the Zayan country. These two essential positions had barely been secured when the outbreak of the World War necessitated the withdrawal of French regular troops, whereupon ensued the immediate revolt of the powerful Branes, Ghiata, and Beni Waghrain round Taza, and the Zayan in the west. The diminished French forces, however, gallantly held their own, and the great *kaids* of the Atlas and the *bashas* of Tarudant and Tiznit in the S. remained loyal. The latter kept El Hiba's forces in check. With a view to maintaining confidence, public works were continued and exhibitions and fairs were held at Casablanca (1915, 1918), Fez (1916) and Rabat (1917); these were visited by thousands of natives, and created an immense effect.

All through the war German money, arms and military instruction were lavished on the anti-French tribes through German agents harboured in the northern Spanish zone, while arms were repeatedly smuggled through Ifni and Rio de Oro. The attempt of the submarine U20, however, to land 6,000 rifles at the mouth of the Wad Nun (Oct. 1916) was frustrated. Throughout 1915 and 1916 there was fighting along the Wad Waghra, the chief native leaders being ʻAbd es Salam, ʻAbd el Malek (grandson of ʻAbd el Kader), and Raisuli, while El Hiba came N. to join them. In the Tadla, Moha u Said was simultaneously giving trouble. All these chiefs were in German pay. Military occupation was pushed forward by the French throughout 1916 and 1917, and many important posts established. The advance in the Gigu valley brought about the submission of practically the whole Tafilalt and, with the junction of several French columns on the Upper Muluya, isolated the Ghiata and Beni Waghrain in their mountain fastnesses. In May and June 1917, ʻAbd el Malek was driven from Taza and forced to take refuge in the north On March 24, in the Sus, El Hiba's forces had met with a decisive defeat at Wijan, but he continued to receive encouragement from Germany until Oct. 1918. El Hiba died at Kerdus in the following spring, and his forces, under his brother, Merebbi Rebo, were finally dispersed by the *basha* of Tiznit. The Tafilalt was definitely occupied at the end of 1917, and a wireless station and aerodrome established. In Aug. 1918 the all-powerful Ait Atta of the district were stirred to revolt by a *sherif*, Si Moha Nifruten, but the rising was suppressed by April 1919, with the powerful aid of El Glawi, son of the deposed ex-vizir, *basha* of Marrakesh, who in Jan. brought 10,000 men across the High Atlas. (His brother, the Kaid el Glawi, also a loyal ally of France, had died in Aug. 1918.) In the N. intrigues and hostilities, still engineered by Germany, persisted through the early part of 1918.

In the autumn of 1919 the Beni Waghrain were stirred up by a new pretender, and the Seghrushen round Sifru by Sidi Raho. Two risings occurred in the Gharb, in the spring of 1918 and in Oct. 1920. This last was suppressed by the French occupation of the sacred city of Wazzan. Simultaneously the turbulent Ida u Tanan of the S.W. submitted. French rule was thus consolidated in all districts save the Middle Atlas, the Beni Waghrain stronghold.

In 1912 the territory occupied by the French was about 88,000 sq. km., in 1914 163,000 sq. km.; in 1921 France nominally occupied 235,000 sq. km., but exerted effective economic control over about 100,000 sq. km. only.[1]

In the Spanish zone, the lack of roads and the insecurity resulting from the anarchy and brigandage prevalent among the Rif and Jebala tribes retarded development. Fighting continued in both the eastern and western districts. In March 1919 a rising occurred N.E. of Fez, the remains of ʻAbd el Malek's movement. In the W., Raisuli as protagonist, while affecting to serve the cause of Spain, and actually, in 1916, receiving arms and money from her, was really seeking to make himself quasi-sultan of N.W. Morocco. In 1916 he entrenched himself at Fonduk ʻAin el Jedida near Tetuan, and was driven thence only in Oct. 1919. The Tangiern–Tetuan road, which he had held, was thus reopened and the Anjera and Wad Ras tribes made their submission. A year later, however, there was fresh fighting with the Beni Huzmer and others, probably directed by Raisuli; Spanish troops from Tetuan then made a somewhat precarious entry (Oct. 14 1920) into the "forbidden city" of Sheshawan, and surrounded it by a ring of military posts. Troops advancing to join them from El Qasr were unable to reach Sheshawan, and had to fall back on their base at Laraish, leaving Raisuli free to operate from his mountain stronghold. In Nov. several attacks were made by the tribes on Spanish patrols and posts in the Tetuan-Sheshawan district, and it seemed at the close of the autumn campaign as if the more remote posts might need to be evacuated.

Administration and Finance.—The outlines of the administrative organization in the French zone are to be found in the treaty of March 20 1912. There is on the one hand the *Maghzen* or Sherifian administration, and on the other the French administration of the protectorate. The resident-general has plenary powers; he promulgates the decrees given by the sultan and is the only intermediary between the sultan and foreign Governments. The *Maghzen* includes the grand vizir and the vizirs (ministers)—Justice and Public Worship, the *Habus* (religious endowments) and Domains—the grand vizir being prime minister. Liaison is maintained between the *Maghzen* and the protectorate by the councillor of the Sherifian Government who is director of Sherifian affairs and is at the head of the technical services of control. French administration, under the high authority of the resident-general, is directed by the general secretary of the protectorate. The departments are: General Administration (Civil and Native Affairs), Finance, Economic Services (public works, agriculture, commerce and colonization, posts and telegraphs, etc.), Public Instruction and Public Health. Rabat is the administrative capital.

The French authorities supervise native administration through local *bureaux de renseignements*. In seven of the chief towns the old native council (*Mejlis*) had (1918) been reconstituted, to aid the *basha* in municipal government.

The protectorate at once started to restore the financial position of Morocco by the annual repayment of instalments of the public debt, and careful development of sources of revenue, such as the reformed *tertib* (agricultural tax). In 1919 the revenues were estimated at 102,440,000 francs, the expenditure at slightly less. In 1920 the long-standing difficulty of the double currency, then accentuated by the depreciation of the French franc compared with the Hassani peseta, was solved by the adoption of a local franc currency.

Population.—It is now recognized that past estimates of the population of Morocco, based on acquaintance with the more populous coast regions, were excessive; no statistics were obtainable up to 1920 for a great part of the interior, which seems to be very sparsely inhabited. The total native pop. is variously estimated at from $4\frac{1}{2}$ millions to 5,400,000, of whom about $3\frac{1}{2}$ millions live in the French zone. The European pop. (1921) numbered about 100,000, of whom two-thirds were French. Immigration ceased during the World War but in 1919 had begun again and in that year numbered about 10,000 persons, largely at Casablanca. The most densely peopled region is that of the Atlantic coast (Gharb, Huz, etc.). In 1917 the pop. (in round numbers) of 10 principal towns was:—

	Total	"Total" includes	
		Europeans	Jews
Fez	105,850	850	10,000
Marrakesh	102,000	2,000	18,000
Casablanca	97,000	38,000	10,000
Tangier	52,000	11,700	12,000
Tetuan (1919)	40,000	1,000 (& garrison)	7,250
Rabat	37,550	9,700	3,800
Meknes	36,700	1,200	5,000
Mazagan	21,630	1,600	3,000
Mogador	19,000	600	9,500
Ujda	18,150	4,150	2,000

Saffi had then a pop. of about 20,000; Sallee of 18,000; Melilla, 40,000, of whom 17,700 were soldiers.

Economic Development.—Despite the formidable hindrances created by the World War, the settlement and development of the *French Zone* proceeded steadily, the success of this "peaceful penetration" being in large measure due to the genius and popularity of Gen. Lyautey. The immigrants at Casablanca rose from 3,238 in 1911 to 29,755 in 1913; the war then caused a reduction, but in 1918 they numbered 22,140. Well-built European quarters have sprung up near the old towns; the ports have been improved, and a new port, Kenitra, on the Sebu, opened up. At Casablanca $24\frac{1}{2}$ million francs were expended in 1919 in laying out new sites and in building. The amount of capital engaged in development schemes of various kinds was at the end of 1919 35 million francs. Railways have been extended, and a network of roads constructed, on some of which regular services of motor transport run. Anti-malarial and other hygienic measures have been adopted, and medical centres and travelling infirmaries set up; in 1917 these treated over 1,220,800 native patients. Native schools, teaching French, Arabic and Berber, and Jewish schools numbered 21,520 pupils in 1917. Agricultural and industrial enterprises (*e.g.* flour- and flax-milling) have been fostered, and scientific and antiquarian research prosecuted.

Harbour works were (1921) in construction at most of the ports: at Casablanca they included an inner harbour with two quays and a floating dock, and the construction of a great jetty, 2,100 metres in length (of which 1,240 metres were completed by 1921), to form an outer port. Mehediya has been superseded by Kenitra, $10\frac{1}{2}$ m. up river, which, with its extensive river frontage for quays, is the only port where lighters are not required. Its trade rose from 4 million francs in 1914 to 20 million in 1915; in 1917 it equalled that of Saffi and Mogador. A channel has been cut through the bar at the mouth of the Sebu. At Rabat, a cement bridge over the Wad bu Ragrag, to supersede the ferry to Sallee, was inaugurated Jan. 1 1920.

In the *Spanish Zone* irrigation and cultivation have been attempted in the Selwan and Garet regions; the care of forests undertaken; schools and infirmaries established; and a native police force organized at Melilla. Extensive harbour works were (1920) in progress at Ceuta and Laraish. The mines near Melilla have been worked by several companies. Military posts have pushed forward in the Muluya and Wad Kert regions. The expenditure for 1918 (exclusive of the expenses of the military occupation) was nearly 12 million pesetas, a deficit of $8\frac{1}{2}$ million pesetas having to be met by a subvention from the home Government. In Jan. 1919 Gen. Berenguer was appointed resident-general.

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[1] For the successive stages of the occupation see map in Piquet, *Le Maroc*, 1917.

Agriculture is the principal resource of Morocco as a whole and forms the basis of the economic future of the country. The total cultivable area under French control in 1921 was estimated at approximately 25 million ac., of which 5,900,000 ac. were actually under cultivation, 5,200,000 ac. earmarked for reclamation and drainage, 12,355,000 ac. common lands, and 1,235,000 ac. forests. The chief crops are barley, wheat, maize and millet, representing 88 % of the total cultivated area; other crops are vegetables, flax, hemp and henna; 124,000 ac. were under orchards and vineyards in 1919. Under proper cultivation western Morocco should become one of the richest cereal-producing areas in the world. Stock-breeding is also important; statistics for 1920 show that live stock comprised: sheep 6,700,000, goats over 2,000,000, cattle 1,300,000, pigs 130,000; while beasts of burden numbered: donkeys 420,000, camels 86,000, horses 65,000, and mules 54,000. The total area of forests in the French zone of Morocco is about 3,706,000 ac.; on the coast a belt of cork-trees covers an area of 338,000 ac.; in the Middle Atlas cedars cover 741,000 ac., and oaks and Aleppo pines about 620,000 acres. The revenue derived by the state from the exploitation of forest amounted to 1,500,000 francs in 1921.

Phosphate exists in great quantities—estimated at 100 million tons with a yield of 65 %—and a decree of 1920 reserves to the sultan's Government the right of prospecting and exploiting the deposits. A start was made in 1917-8 in extracting manganese in eastern Morocco and some thousands of tons have been produced. An oil-field extends from Fez to Laraish.

Trade.—The total foreign trade of Morocco increased from 375,000 tons, valued at 178 million francs, in 1912 to 553,000 tons and 1,056 million francs in 1920. The total foreign trade of the French zone (in 1,000 francs) rose from 319,580 in 1917 to 573,160 in 1919, excluding the commerce *via* Algeria, which amounted to 66,660 in 1917 and over 134,000 in 1919. English trade increased from 63,000 in 1916 to 134,500 in 1919. Spain tripled and America quadrupled her trade with Morocco during those years. Of the exports, 98 % went to, and 63 % of the imports were derived from, France and Algeria.

The following table gives the sea-borne trade of the various zones in 1913 and 1918:—

	Imports (in 1,000 francs)		Exports (in 1,000 francs)	
	1913	1918	1913	1918
French zone	181,427	257,580	40,182	97,042
Tangier	24,455	31,600	3,408	5,820
Spanish zone	25,335	35,402	2,876	6,960

The animal products exported from Morocco in 1919 were as follows:—

	Weight (1,000 kgm.)	Value (1,000 francs)
Eggs	8,626	44,949
Goatskins	1,828	13,590
Wool-grease	1,480	5,243
Sheepskins	1,387	—
Cowhides	439	2,269
Wool	104	922
Wax	112	—

The trade of Casablanca had increased from 185,000 tons in 1912 to 425,000 tons in 1920.

Communications.—There are regular services from Europe to the Moroccan ports of the Cie. Gén. Transatlantique, Cie. de Navigation Paquet, Royal Mail Steam Packet, Bland (Gibraltar), Correos de Africa, and other lines, including Dutch and Italian.

A system of roads has been planned for the French zone; on Jan. 1 1920 2,600 km. were completed, 364 in progress and 247 surveyed. Motors are largely used for mails and passengers, *e.g.* between the ports and Marrakesh. The only road, as contrasted with tracks, in the Spanish zone was (1920) from Ceuta to Tetuan, though another was being constructed between Laraish and El Qasr. In that year the Tangier–Fez road was completed in the Tangier zone, and nearly so in the French, but was practically untouched in the Spanish zone.

The railways in the French zone, military lines (2-ft. gauge) open to civilian use, were being gradually changed to standard gauge (4 ft. 8½ in.). In 1920 there were 610 m. of railway. The line linking Ujda *via* Taza with Fez (198 m.) was completed to Tuahar (168 m.); this will later be joined by the Casablanca–Fez line, *via* Rabat and Meknes, which in 1920 ended 10 m. beyond Fez (221 m.). Of the Casablanca–Marrakesh line (324 m.) *via* Ber Reshid, which in 1920 stopped at Kaid Tunsi (96 m.), 40 m. had still to be laid. A branch line runs from Ber Reshid to Wad Zem (83 m.), to be continued to Khenifra. In eastern Morocco a line under construction from Seflet to Utat el Hajj (19 m.) was open as far as Mahirija. In the Spanish zone a narrow-gauge railway runs from Ceuta to Tetuan, and another from Tetuan to Rio Martin. There are two light railways from Melilla to Nador, Selwan, Tiztutin and the mines. In 1920 a line was projected from Melilla to Taza *via* Tafersit, and a coast line to Tangier. Work on the standard-gauge Tangier–Fez line had not actually begun in 1920, though the survey for the French section had been made. The line from Laraish to El Qasr, which will eventually join it, was half completed in 1913; the French have projected a line from Casablanca *via* Rabat and Kenitra to join it at Petit-Jean (132 miles).

Aeroplanes were much used in Morocco by the French during the war and will be increasingly employed for commerce. There were in 1920 a number of aerodromes, including one 6½ m. from Tangier, and a mail-passenger service, calling at several towns in Spain, plied between Rabat and Toulouse eight times a month each way.

Efficient postal services exist in the French zone; Spain has post-offices at her ports; in 1920 the only foreign post-offices were those of Great Britain, at the chief ports, and at Fez, Meknes, El Qasr, and Marrakesh. There are wireless installations at Fez, Marrakesh, Tangier, Mogador and elsewhere. A telegraph line runs across the Spanish zone from Tangier to Arbawa (French zone). Telephones are installed in Tangier and in all the towns of the French zone; Casablanca, Rabat and Kenitra are connected by telephone, and so are Tangier, Arzila and Laraish. There are submarine cables between Casablanca and Brest; Casablanca and Dakar; Tangier and Gibraltar; Ceuta and Tangier; Estopona and Peñon de Velez; Tangier and Oran and Cadiz.

AUTHORITIES.—The output of books and periodicals on Morocco during recent years has been enormous; only a selection can be mentioned here. A. Bernard, *Les Confins algéro-marocains* (1911), *Le Maroc* (4th ed. 1917), *La France au Maroc* (1917); E. Doutté, *Merrakech* (1905), *En Tribu* (1914); L. Gentil, *Le Maroc physique* (1912), *La recherche scientifique au Maroc* (1914); J. Goulven, *Le Maroc* (1919); E. Laoust, *Mots et Choses berbères* (1920); E. Moutet, *Les confréries religieuses de l'Islam marocain* (1912); M. A. H. Poisson de la Martinière, *Souvenirs du Maroc* (1919); Suzanne Nouvel, *Nomades et Sédentaires au Maroc* (1919); V. Piquet, *Le Maroc* (1917); Comte de la Revelière, *Les énergies françaises au Maroc* (1917); E. Rouard de Card, *Traités et accords concernant . . . Maroc* (1914); C. Sainte Chapelle, *La conquete de Maroc* (1913); Marquis de Segonzac, *Au Coeur de L'Atlas* (1910); André Tardieu, *La conférence d'Algésiras* (1909), *Le Mystère d'Agadir* (1912). Works published under the auspices of the protectorate, *e.g. Conférences franco-marocaines* (2 vols. 1916, 1917); *Le Commerce* (1917) and *L'Agriculture* (1918) *au Maroc; Rapport général sur la situation du Protectorat . . . 1914* (Gen. Lyautey, 1916); *Carnet des itinéraires principaux du Maroc* (1917); *Villes et Tribus* (3 vols. 1915, etc.); *Annuaire économique et financier; Archives marocaines.* Also Guides Bleus (Hachette), *Le Maroc; L'Afrique française; France-Maroc* (a superbly illustrated monthly); the *Bulletins* of several geographical societies, notably Algiers, Oran, and Madrid; J. Becker, *Historia de Marruecos* (1915); R. Donoso Cortes, *Estudio geogr. polit. milit. sobre las zonas españolas* (1913); G. Delbrel, *Geografia general de la Provincia del Rif* (1911); A. Garcia y Perez, *Ifni y el Sahara español*, and *Zona española del norte . . .* (both 1913); *Alta Comisaria de España en Marruecos . . . memoria 1917-1918;* A. Vera Salas, *El Rif Oriental* (1918); W. B. Harris and Hon. W. H. Cozens-Hardy, *Modern Morocco* (1919); D. Mackenzie, *The Khaliphate of the West* (1911); E. A. Westermarck, *Ceremonies and Beliefs connected with Agriculture . . . in Morocco* (1913); Edith Wharton, *In Morocco* (1920); *Report of the Trade, Industry and Finance of Morocco* (Dept. of Overseas Trade, 1920); *Morocco* (London weekly); W. Arning, *Marokko-Kongo* (1912); O. C. Artbauer, *Die Rifpiraten und ihre Heimat* (1911); G. Kampffmeyer, *Im neuen Marokko* (1914), *Nordwest Afrika und Deutschland* (1914), and a Moroccan bibliography, *Studien . . . der deutschmar. Bibliothek* (1911, 1915); K. Neumann, *Die Internationalität Marokkos* (1919); W. Schroeder, *Das Schutzgenossenwesen in Marokko* (1917). Maps: *Cartes du bureau topographique du Maroc*, 70 sheets (1913–5); Barrère, 4 sheets (1913).

(E. G. S.)

MORRIS, EDWARD PATRICK MORRIS, 1ST BARON (1859–), Newfoundland statesman, was born at St. John's, Newfoundland, May 8 1859, and was educated at St. Bonaventure's College and the university of Ottawa. In 1884 he was admitted a solicitor and in 1885 was called to the bar (Q.C. 1896). The same year he was elected Liberal member for St. John's. In 1889 he entered the Cabinet, and from 1890 to 1895 was Acting Attorney-General for Newfoundland. From 1893 to 1906 he was director of the Newfoundland Savings Bank. In 1897 he went to England as a delegate to the Colonial Office on the question of the French fishing rights. In 1898 he left the Liberal party and became leader first of the Independent Liberals and later (1908) of the People's party. In 1901 he again visited England as a delegate, and in 1902 he entered the Cabinet as Attorney-General, afterwards becoming Minister of Justice. In 1904 he was knighted. In 1909 he became Prime Minister, retaining this office until 1918. In 1909 he represented Newfoundland at the Imperial Defence Conference, and filled the same position at the Coronation and Imperial Conference in 1911. In 1913 he was made K.C.M.G., and in 1917 was a member of the Imperial War Conference. The same year he received the freedom of the City of London. In 1918 he retired from the premiership and was raised to the peerage. Lord Morris produced an important legal work known as *Morris's Reports*, an edition of the Newfoundland law reports from 1800 to 1904.

MORRISON, GEORGE ERNEST (1862–1920), British traveller and journalist, Peking correspondent of *The Times* from 1897 until 1912, when he resigned to become political adviser to Yuan Shih-k'ai, president of the newly proclaimed Chinese republic, was born at Geelong, Victoria, Australia. He displayed early in life a love of adventurous wandering and an insatiable curiosity concerning every phase and aspect of human affairs. Until his service with *The Times* obliged him to establish his headquarters at Peking, which he came in time to regard as his home, his career was an unbroken series of journeys, in which his love of adventure on unbeaten tracks was usually combined with some practical purpose of exploration. Thus, in 1882, he studied the Kanaka labour question in the South Sea Islands as a sailor before the mast. Later in the same year he crossed Australia on foot, from the Gulf of Carpentaria to Melbourne, covering 2,043 m. in 123 days. His next journey, to New Guinea, nearly cost him his life; he returned from it with two spear-heads in his body, which were eventually removed by Professor Cheyne at Edinburgh, under whom Morrison concluded his medical studies. In 1887 he took his M.D. and C.M. degrees, but the life of a medical practitioner had no attractions for him. After journeys to the United States and the West Indies he worked for a time in his medical capacity, first at the Rio Tinto mines in Spain and then as court physician to the shereef of Wazan in Morocco. From 1890–2 he was in charge of the hospital at Ballarat. In 1893, wearying of routine work, he set out to travel in the Far East; in the following year he made a journey overland from Shanghai to Rangoon, and described it in a work entitled *An Australian in China* (1895). This journey laid the foundation of his reputation and led to the engagement of his services by *The Times*. In Nov. 1895 he went as special *Times* correspondent to Siam, where the French Government's claims in the region of the Mekong valley had necessitated negotiations for an agreement with Great Britain. Here he did excellent work; in Feb. 1897 he accepted the appointment offered him by *The Times* as resident correspondent at Peking, and for the rest of his life all his work and interests became centred in China. He never attained to any degree of proficiency in the Chinese language, but in the course of numerous journeys during the ensuing 20 years he visited every province and dependency of the Empire, with the exception of Tibet, and acquired an intimate knowledge of men and affairs in every part of the country. In 1907 he travelled from Peking to the borders of Tonquin, and three years later from Central China to Russian Turkestan. During the siege of Peking legations by the Boxers in 1900 he displayed conspicuous gallantry and initiative, and was specially mentioned in despatches by Sir Claude Macdonald. In Jan. 1905 he was present at the triumphal entry of the Japanese army into Port Arthur, and subsequently represented *The Times* at the Peace Conference which resulted in the Treaty of Portsmouth.

At the outset of the revolutionary movement in China (Oct. 1911) Dr. Morrison frankly proclaimed his sympathy with the Republican programme of Sun Yat-sen and the Cantonese Radicals, and advocated the abdication of the Manchu dynasty. In Aug. 1912, six months after the abdication, he became one of several foreign advisers engaged by the Chinese Government, with special duties as political adviser to President Yuan. When, during the stormy period between 1913 and 1916, it became evident that Yuan Shih-k'ai intended to restore the monarchy in his own person, there were occasions when Dr. Morrison's position was somewhat delicate, because of the prominent part which he had played as an advocate of Republicanism, but his unfailing tact and good humour, combined with his unquestionable devotion to the best interests of China, enabled him to fill this difficult position and to retain the goodwill and respect even of those who differed from his political opinions. For nearly 20 years his modernized Chinese house, with its famous library of works on China, was a place of pilgrimage for travellers in the Far East, and "Morrison of Peking" was a name familiar in all parts of the world. He died at Sidmouth May 30 1920.

MORTON, LEVI PARSONS (1824–1920), American banker and politician (*see* 18.882), died at Rhinebeck, N.Y., May 16 1920, his 96th birthday.

MOSBY, JOHN SINGLETON (1833–1916), American soldier (*see* 18.890), died in Washington, D.C., May 30 1916.

MOSELEY, HENRY GWYN JEFFREYS (1887–1915), British physicist, was born Nov. 23 1887. He was educated at Eton, where he entered as a King's scholar, and at Trinity College, Oxford, from which he graduated in 1910 with honours in natural science. His earliest research work was undertaken in Rutherford's laboratory in Manchester, whither he went as lecturer in physics after leaving Oxford. He at once gave evidence of unusual ability both as an original thinker and skilful experimenter. After two years he resigned his lectureship in order to devote more time to research work, and was elected John Harling fellow. The researches with which his name is specially associated were those made shortly before his death. Rutherford had announced the nuclear theory of atomic structure which required each atom to consist of a minute positively charged nucleus about which negative electrons were distributed. It seems also that the charge would increase with the atomic weight of the element. It had been suggested, and Bohr had adopted this view, that the nuclear charge was equal to the atomic number, *i.e.* to the number of the element in a complete series of the elements arranged in ascending order, but hitherto no atomic property had been discovered which could be definitely represented by this number. Moseley, shortly after the discovery of the diffraction of X-rays by crystals, set to work to examine the X-ray spectrum of a number of elements each of which he made in turn the target of an X-ray tube. He found that his crystal-grating gave a spectrum of two lines for each element and that their frequency increased by definite steps as he passed from one element to the next; indeed, the frequency of vibration associated with each element was a simple function of a number which he found to be identical with the atomic number. It is now generally accepted that this number, experimentally determined by Moseley for a number of elements, defines the physical and chemical properties of the particular element. This number is probably to be identified with the electric charge upon the nucleus of the atom. From the regular progression of the lines in the X-ray spectra of different elements Moseley was able to indicate the number of elements yet to be discovered, and he cleared up certain anomalies in the periodic tables of the elements. He laid the foundation of what will probably prove to be a new and more precise form of chemistry (*see* CHEMISTRY, and MATTER, CONSTITUTION OF). Moseley was in Australia with the British Association in 1914 when the World War broke out; he returned to England, obtained a commission in the Royal Engineers, and was killed by a Turkish bullet on the Gallipoli peninsula on Aug. 10 1915. (W. G. D.)

MOSS, SIR (HORACE) EDWARD (1852–1912), British director of variety theatres, was born at Manchester in 1852 and in 1877 opened the Gaiety theatre, Edinburgh, first of the Moss's Empire theatres, which by 1912 numbered twenty houses and represented a capital of over £2,000,000. He was the principal pioneer of the changes which have transformed the old music-hall into the modern variety theatre, and in recognition of this fact, and for his charities, he was knighted in 1905. He died at Middleton, Midlothian, Nov. 25 1912.

MOTOR TRANSPORT, MILITARY.—Transport by motor vehicles has very profoundly modified the art of war. Their employment enables a commander—despite the unwieldiness of modern armies—to achieve surprise effects which give him victory. The utilization in modern warfare of the enormous effectives which constitute national armies was made possible only by the railways, which are alone able to assure the supply of food and munitions needed by such a mass of humanity. But steel tracks are by nature rigid, and the employment of motor transport on a large scale has both expanded their functions and rendered them supple. It is by the organized combination of these two means of transport that it is possible to rain on the enemy such rapid and effective blows that he must succumb. Strictly, the railways in times of peace function under conditions quite comparable to those of war. For the economic requirements of peace no less than of war demand incessant and strict attention to ensure railway efficiency. On the other hand, there is only a distant comparison between the use of motor vehicles one by one in times of peace and their employment in compact groups during war operations. There is, therefore, a special interest in trying to trace, after the experience of the World War, the technical facts which would serve as a basis for the employment of motor transport on a large scale in future operations. In the following account, illustrated by practical examples, taken from the use of motor vehicles during the operations of the Allied armies on the French front, there will be discussed the general principles underlying (I.) transport of troops, (II.) transport of *matériel* and (III.) intensive traffic on roads.

I. Transport of Troops

The Vehicle.—Troops have sometimes been carried in ordinary touring-cars. During the battle of the Marne (Sept. 9 1914), at the moment when the French army of General Maunoury was massing outside Paris, there were grouped together all available taxicabs to take direct to the front the infantry of a division which, arriving by rail from the Vosges, was detraining in the stations of the northern suburbs of Paris. This method can only be employed in exceptional cases, because the car or taxicab has so small a carrying power, requiring one driver for every three or four combatants carried, while such vehicles for the most part differ in speed. On the other hand, such motor-vehicles as are designed to convey a larger number of passengers in peace-time, *e.g.* motor omnibuses or *chars-à-bancs*, are eminently serviceable. Thus it was in motor omnibuses, which were employed in the first transport groups of the French army, that there were carried to Belgium, at the beginning of Aug. 1914, the detachments of infantry which operated in support of the cavalry. In the same way the British army employed at the outset the London motor omnibuses; and the "Bus Park," which was placed behind the centre of the English armies, was always able to supply rapid transport for reserves behind the front. Motor omnibuses, sightseeing vehicles, private motor cars, and all other vehicles of a similar character utilized in towns in peace-time, have the advantage of being always prepared to carry passengers. They have often, however, the disadvantage of having been built for street use and not for any and every kind of route; moreover, they are useless for any other form of transport except for carrying men, so that they will often remain useless when the army has no need to move troops and yet the need for the transport of *matériel* is pressing. A park of motor omnibuses represents therefore a collection of drivers and machines that is frequently immobile; one must be very rich in means of transport to enjoy this luxury, and one can never be so rich when operations are active.

The ideal vehicle is the common motor lorry (or truck, as Americans call it). It is necessary to adapt it, *i.e.* to place in it movable benches, which can be very rapidly installed when it is necessary to carry men, and can be removed without difficulty when it is necessary to carry *matériel*. In accordance with the capacity of the body, which itself partly depends on its load capacity, the lorry can carry from 16 to 25 men with their arms and equipment. The lorry is designed for travelling long distances over indifferent roads; having solid rubber tires, it does not suffer from breakdowns through punctures.

The method of loading men into lorries also requires consideration, since the efficiency of transport depends considerably on it. One good rule is for the driver or his assistant to supervise the loading, and to get the men on board first, their arms and baggage following them. It is necessary to appoint a "chief of the lorry" who takes charge of the interior and keeps good order. Again, it is advisable to be very careful lest men lie on the floor boards and breathe the exhaust gases: this is a very serious cause of asphyxiation. It is, therefore, necessary to see to the ventilation of the lorry and to ensure that the exhaust pipes are in good condition.

During the World War not only were units of infantry transported but also artillery formations; likewise, in some exceptional cases, cavalry with their horses. How can horses most easily be carried? The body of the lorry must be as large and the bottom as low as possible, to make the loading more easy, and the ceiling must be high enough to prevent the horses from being injured by striking their heads. In accordance with these arrangements, the horses may be placed either lengthwise or crosswise. But they should be close to one another, to save them from bumping; and there should be no difficulty of access to where their heads are, in order that they may eat and drink on the road. These precautions taken, it has been found that horses travel as well by motor lorry as in a railway wagon.

Is it better, generally, to have for transport of troops heavy lorries (of 5 tons or greater freightage) or lighter lorries (of 2–3 tons)? This question has often been the subject of controversy. Experience shows that, with a proper arrangement of movable benches, it is possible to put in a heavy lorry, which has a very large body, many more men in proportion than in a light lorry; and it must not be forgotten that, for the greatest efficiency, one driver and one machine must carry the maximum number of men. On the other hand, if heavy and light lorries are both available, and troops as well as *matériel* have to be transported, it is better to use the light lorries for the transport of troops.

Organization of Lorries.—Lorries move grouped in formations of varying importance, but two essential conditions must be observed: efficient control and effective maintenance. In proportion as there are built up and put into motion larger and larger masses of lorries, it is necessary to organize a succession of commands in such a way that each will be provided with proper supervision and direction. A type of organization modelled directly on that of infantry or artillery is here unsuitable. The basic unit, the smallest formation to be placed under the orders of an officer, should be formed of 15 to 30 vehicles. The officer who commands this unit is the veritable sheep-dog of his troop of lorries; he must himself have a touring-car (which should be open and not too fast), so as to allow him to follow his lorries when they are on the move, and above all when they are formed into a large column. The officer ought not to lead himself, but be able to keep his attention free, and to jump quickly from his car and speak to his drivers. In a large column the lorries ought to follow one another as closely as possible, because the efficiency of the route is dependent on the continuous progress of the lorries; a certain distance must be kept so as to allow the driver of a lorry to take note of what the lorry ahead is doing, and thus avoid collisions. This distance, which tends to increase uphill and decrease downhill, should average 10 metres at night, when marching with lights extinguished. The drivers ought to be trained to keep their exact distance. For this purpose it is useful to paint, at the back of the lorry, marks on a white ground, perceptible to the eye even in complete darkness. The use of luminous paint has been found practicable. Next above the basic unit (which takes various names according to the armies, *e.g.* "section" or "platoon") is placed the "company" or the "group," normally comprising three or four sections. The commander of the group or company is no longer the sheep-dog of his lorries; he is the shepherd. It is he who guides them in their itineraries, places them in billets and allots them to their work. He must, therefore, have a much more powerful touring-car, so as to be able rapidly to reconnoitre ahead. He should have a liaison officer, with a motor bicycle or cycle-car, to transmit his orders rapidly, and also a second in command, to maintain continuity. There should be as many lorries in a group or company as are needed to transport a battalion of infantry. If the battalion has 1,000 men and the lorry holds 20, there must be 50 lorries always available. But, as some will always require repair or overhauling, while others must be used as service lorries for replenishing food supply and petrol (and also as workshops), the theoretical number is 65 lorries.

The second point in an organization is to ensure effective maintenance. Automobiles require constant care on a long journey, *e.g.* 200 km. At least a dozen out of 100 lorries will have breakdowns or need repair. Some will even fall out, too seriously damaged to go on, and will have to go to the "automobile park." Minor casualties must be attended to, however, as soon as possible. That is the rôle of the workshops. If the workshop is to move with the group, it must be on lorries, and have a stock of tools and various spare parts. To form a workshop for 20 lorries, *i.e.* for a section, means a large drain on workers and *matériel*, and is only advisable when the section has to remain isolated. If the section remains with the group, it is better to form a stronger workshop for the group, reserving two or three vehicles which can have a real arsenal of spare parts, each having two or three picked mechanics attached, with several skilled assistants to attend them. The commanding officer of the group can delegate to one of his subordinate officers (the most capable from the technical point of view) the direction of the workshop.

As soon as large transport movements have to be carried out, higher control above the group must be organized. The transport of the infantry of a division requires 12 groups. Placed in a column on the road, this would make a file 36 km. in length, a reasonable distance for each group being 3 kilometres. This mass would be formless and incapable of manœuvring unless vivified by organization.

It is a common saying that the action of a commander ought to be limited to directing four immediate subordinates and no more. Experience of large demands on transport during the war shows, however, that six groups could be united under one control, if the commander in charge was supported by a fully qualified staff. Such was the composition of the grouping in the French army: such or something very near it was the composition of the "Bus Park" of the British army. The grouping of six groups had a capacity for 6,000 infantry. When transport by automobile has reached a further extension, the group becomes in its turn a basic unit; and it is in studying the rôle of the commander of the grouping and his staff that the working realities of troop transportation can be grasped. It will suffice to note that the groupings ought also, when they are called on to function together, to be united under a superior control. The automobile service of the French army, which comprised 25 groupings in 1918, had a dozen "commanders of transport reserves" to direct them—each reserve comprising two or three groupings.

Organization of Troop Transports.—Let it be supposed that a grouping is ordered to execute the transport of 6,000 infantry, to take them up in their billeting area, and to bring them to the field of battle some 100 km. from billets. What problems must be solved in order to accomplish this mission to the greatest advantage? In the first place, the commander must fix the embarkation-points, *i.e.* the points at which the infantry will be loaded into lorries. In order that this operation may be quickly carried out there must be many loading-points functioning at the same time; to embark one battalion (1,000 men) into a group (80 lorries) requires from 20 minutes to half an hour. The usual procedure of the French automobile service is to place the infantry in column, two deep, and to make them move in this formation. The automobile officer in charge of the embarking-point marshals the drivers of the lorries, at the rate of one per lorry, near to a point where the column of infantry in twos moves out. He divides the column, as it passes him, into small parties, according to the number for each lorry, and assigns each to a lorry driver, who leads his men at the double to the rear of his lorry. When all the parties are grouped behind the lorries, they embark. At the embarking-office, while the backs of the lorries are closed, the crank-handles are turned and the engines are started up. But even so, with a single embarking-point practically three hours are required for embarking 6,000 men; and in another half-hour the lorries will have covered 8 kilometres. The six groups will therefore find themselves, on the march, separated by a considerable interval, and the total column will be 48 km. in length—altogether too long. Further, there may be great gaps in the billeting area in which the embarking infantry are stationed; and it would be a mistake to make them cover great distances on foot in order to reach a common embarking-point when the lorries can just as well come and pick them up near to their own billets. Consequently it is much preferable, if possible, to have six points of embarkation, each corresponding to a battalion, the hours of embarkation being fixed in such a way that each group of lorries, leaving as soon as the embarkation is completed, will take up its normal position, one behind the other, at the "starting-point" for the common itinerary.

When the commander of an automobile grouping has then prepared the organization of his embarkation-points, he must come to an agreement with the infantry headquarters concerned as to the time and place of embarkation of each battalion; such an agreement is much simplified if the orders of the higher authority responsible for the movement have specified a precise time for the start. The work which devolves upon the command of the lorry grouping in the disembarkation of the troops is generally similar to the above; but there is an additional difficulty, caused by uncertainty as to the exact points of disembarkation, which often depend at the last moment on the military situation. Nevertheless, the procedure must be arranged as early as possible, in close touch with the higher staff which has to fix the disembarkation zone; and an understanding must be arrived at with headquarters as to the probable alternatives, between which a decision will be made later, when the lorries are quite near to the arrival zone. It is not possible for the commander of the grouping to do this work of preparation for arrival and for departure by himself alone; he must have another officer in his confidence to help him. While he is making arrangements and reconnaissance in the zones of departure and arrival, he must also choose (or at least reconnoitre) the itinerary between the two zones. And when the itinerary is reconnoitred, it must be marked out. This is the duty of the officer assisting the commander of the grouping. The "route officer," with his own staff, marks the itinerary by posting up placards (and, for night work, hanging lanterns) bearing the distinguishing mark of the grouping and an arrow indicating the direction of the march and the route to take. The distinguishing mark of the grouping is necessary because, in a period of movement, many other groupings will often wish to use some portion of a route in common. Moreover, any lorry which has become isolated or left behind must be enabled to rejoin by following the arrows.

Further, the commander of a grouping is responsible for the care of the well-being of his personnel and *matériel*. He has to supply his lorries with petrol and his men with food, and must organize the movement of his service lorries, supply lorries, work lorries, lorries for towing, lorries for cooking. Here again the commander's control of details depends first on his supply officer, and next on his technical officer, the latter being especially concerned with the workshop of the grouping, the repairing organ. It is the technical officer's endeavour to interrupt the grouping as little as possible, and to follow it up, if it is not returning to its previous zone of billets, with any laggard lorries that have needed repair. He must, therefore, organize repairing squads who will follow different columns and leave nothing behind.

Transport of Complete Divisions.—When a larger unit, like a division of infantry, has to be transported, two or three lorry-groupings are required. The same general principles, however, apply. An interesting example occurs when, together with the infantry of a division, it is necessary to transport all or part of their artillery with its horses. This will happen less and less frequently as the artillery itself tends to become an entire automobile arm, since it will then move simultaneously on its own account; but with horse-drawn artillery it may be a very serious matter for a general of a division not to be able to bring up to the battlefield, in support of his infantry, the artillery who are accustomed to manœuvre with him. It is thus very desirable to be able to transport artillery with horses.

The loading of guns and limbers on lorries does not present any special difficulty; it is sufficient to have fixed rules for putting the *matériel* in place, and these are the same as the loading-rules for the same *matériel* on railway wagons. This is true both for heavy artillery and for artillery of small calibre. As for the horses, they accommodate themselves perfectly to this manner of transport. At the time of the different German attacks in 1918, especially in May and July, there were on the French front enormous transportations of complete divisions which attacked as soon as they were unloaded from the lorries. The automobile almost completely takes the place of the railway, securing much quicker travelling and better surprise effect. There is always one condition, that the troops thus transported can live and fight with a limited quantity of baggage, all their supplies being assured by lorries to the complete exclusion of horse transport. An example may be given from experience in 1918, when the Higher Command had under consideration the possibility of obtaining a great success in Italy. A study of this move, developed in every detail, shows that, with the resources in automobiles which were then available for release from the French front, it was possible, after twelve hours' warning, to move three divisions—complete with divisional artillery, machine-guns, cookers and a number of horses equivalent to three pairs per wagon and two per gun—and to transport them in seven days from the region of Châlons in France to the region of Mantua in Italy. Stages of 15 hours (including one hour for a general halt) would have had nine hours of complete rest between. Three distinct routes were prepared, with provision for petrol depots and workshops, guides, police, and so forth. Undoubtedly this unexpected movement of three divisions, so rapidly as to ensure secrecy, would have had a decisive influence. And it is just such possibilities that are bound to enter into the strategic conceptions of the future.

II. Transport of Matériel

Lorries are not specialized for the transport of *matériel*. The same type is employed as for troops, and therefore the organization is similar. A lorry-group capable of moving a battalion of infantry can alternatively move 100 tons of *matériel*. Experience in the World War has shown that, during the periods of active operations, a division requires an average of 200 tons per day in foodstuffs and ammunition. This is equally true in the case of defensive areas, as at Verdun; in offensive actions of the type of the Somme battles in 1916; or those of July, Aug. and Sept. 1918, on the Marne. Two groups are therefore required for the supply of a division, subject to the distance from the railway being at furthest within a radius of 40 kilometres. Four groups are necessary if the division is 70 km. from a railway. An average of 3 hours must be reckoned for loading at the stations; with allowance for difficulties arising amid intensive operations, 7 or 8 hours are taken up on the journey and 2 hours in unloading. This gives about 13 hours for work, and leaves 11 hours per day for the maintenance of *matériel*, feeding and rest. If the traffic operations are to be continued for a number of days, any more than this cannot be demanded of the personnel or of the *matériel* without risking excessive wastage. On the day after a journey with loads the vehicles return empty, and on the day after that they recommence the journey loaded. As 200 tons a day are required for a division there must be a double set of two groups, with a total capacity of 400 tons.

There has been much argument as to which is the more efficient type of lorry for the transport of *matériel*, the light lorry of 2 or 3 tons' capacity, or the heavy lorry of 5 tons. Before the war, military experts in all countries had a marked objection to the heavy lorry, which was gratuitously supposed to be difficult to handle on bad roads and unsuited for average military requirements. This opinion is now out of date. The first objection does not hold good in countries with a network of well-maintained roads, such as is found in western Europe. The second objection has equally fallen to the ground, since the greater part of transport work is concerned with munitions, which represent weight rather than bulk. The full load is never used in a lorry, however light, if it only carries bread; and only the employment of a trailer allows of the maximum efficiency. Unfortunately, the employment of trailers has great inconveniences, notably in the manœuvring required for loading at stations. Systematic attempts have been made to find a regulation method of yoking a trailer to every 5-ton lorry when it is necessary to transport personnel, or *matériel* of light weight (forage or bread). These trailers have not been very satisfactory: the motor consumes more, and tires wear more; the rate of movement is slower, and any economy in drivers is an illusion.

To sum up it may be said that, for war service, lorries from 2 to 5 tons of average load are equally useful, but that it is useless, as was done before the war, to give prizes to induce constructors of lorries to design vehicles on the light side. In the organization of transport one obtains the greatest efficiency by giving a preference to the light lorry for the transport of personnel and of light *matériel*.

Non-Specialization of Matériel.—At a general mobilization, like that at the opening of the World War, the resources available for transport are necessarily limited not only by financial conditions, but by the number of vehicles in existence in the country capable of being requisitioned, and by the maximum production of the manufacturing firms. On the other hand, there is no limit to the requirements in lorries, because no general worthy of the name thinks he has a large-enough stock of transport at those critical times when every addition means an increase in his power of manœuvre. During the 20 days which intervened between May 27 and June 15 1918, the lorries of the French army had to transport about 800,000 tons of foodstuffs and munitions, in order to ensure the supplies of those armies which were making headway against the German attack. And yet during this same period the French Headquarters Staff had transported by automobile the infantry of 63 divisions. It was necessary also to make numerous evacuations of public records, civil populations, hospitals and engineer parks. This wonderful effort was only possible because in the French army the principle of non-specialization was adopted. Every lorry was controlled by the motor transport service of the armies, and was utilized by it for any form of transport needed. No vehicle was specially or permanently attached to this or that higher or lower formation. When a higher formation, such as a division, had need of transport, the automobile service arranged the transport, but as soon as it was finished the lorries employed on this service returned and were available for other transport services. In short, the lorry capital never remained unproductive.

Unfortunately, the tendency of every service, and of all units subordinate to it, is always to oppose this idea of non-specialization, which ought to be the aim of the Higher Command, whose interest is always to obtain the maximum return on lorry capital. In effect, each service desires to have a special allotment which becomes its own property, and calculates always the value of this "indispensable" allotment by the eventual requirements—the day when the work will be heaviest. But if such demands for special attachments are not very energetically resisted, capital fritters away without any profit.

Supposing that ten lorries are united to one definite formation under the pretext that it may have to make rapid moves at a considerable distance, in practice this rapid move will occur perhaps not once in a month, and in the interval the ten lorries will remain in park. During this same month those lorries in normal use would have been able, if they have a capacity of 2–5 tons and travel 100 km. per day, to do more than 60,000 km.-tons of work, with allowance for overhaul. They could have moved a depot of munitions of 1,000 tons for 60 km. or have maintained the supply of bread every day for a division. It might be supposed that a wide-awake staff, having made this allotment of 10 lorries, would not let them remain idle, but would order the formation conceived to undertake such and such transport of a general kind. But such a practice is only possible in calm periods. As soon as troublesome times arise everybody is fully occupied; the formation does not wish to lose the ten lorries which it will need—and for the very purpose for which it was given them—at a moment when it will not be able rapidly to replace them; and it is precisely at the moment of crisis that the Higher Command will have the greatest need of regaining control of all those resources which it has imprudently dispersed, and it will be entirely unable to do so. On the other hand, if the commander has not made any special allotments, but has kept all his lorries under his immediate care, he will be able to organize the moves which he wishes to effect in accordance with the degree of urgency imposed by the operations he desires to carry out. If he thinks it well to move the formation which was taken as an example, he will allot immediately ten lorries for this move, and they will return as soon as the move is completed. If the formation is not to be moved, there will not be ten lorries lying idle.

The Use and Duties of Depots.—The reasons for avoiding the wastage of lorries apply likewise to avoid wastage of movements. The carrying-out of "detail" transports is the principal cause of low efficiency. In the battle of Verdun, March 1916, the supply of munitions was taken by rail to Bar-le-Duc and to Baudonvilliers. Trains of munitions arrived daily at these two stations to supply the artillery of the ten divisions deployed around Verdun, some 60 km. from the stations. If, to supply each of these divisions, there had been allotted a motor formation, which could come to load up at the stations and go as far as the batteries, bringing munitions, the efficiency would have been mediocre and uncertain. In effect each of these motor formations would have been under the constant repercussion of the events at the front and the difficulties of moving about in the front areas. An accident at a depot, an interrupted road, an advance or a check at the front, would set back the whole time-table of the formation, and one would have seen them arriving in the station for loading their lorries in twos and threes in disorder, and at different hours. The whole organization and supervision of traffic would have been impossible.

There can never be efficiency unless there is regularity of movements. It is never possible to have regularity unless the traffic of the back areas, which can be regular, is definitely separated from the traffic of the front areas, which is always uncertain. How can this separation be effected? By the creation of depots depending on the lines-of-communication authorities, and supplied by them where the formations from the front areas come to refill exactly as they would refill from the railway if there were stations at these fronts. On this principle was organized the transport of munitions for the army at Verdun, as well as the very considerable movements of troops which took place in these operations. The troops were disembarked at stations between Revigny and Ligny-en-Barrois, and their transport to Verdun, as well as that of the supplies, was carried out by the single artery formed by the road Bar-le-Duc–Verdun, which came to be known as the "Sacred Way" and formed the *route gardée* reserved for motors. Through a complete understanding between the motor control at Bar-le-Duc and the railway control at St. Dizier, it was possible to regulate the workings of formations in such a way that the lorries were brought to the stations for loading at the same moment that the troop trains or munition trains arrived there. In continuous movement all formations, when loaded, went via Bar-le-Duc and followed the Sacred Way as far as the unloading point. They at once returned by the same Sacred Way to Bar-le-Duc, and took up their places at their own camp; and after a minimum of time for rest they left for a new town at the order of the regulating staff ("Commission regulatrice automobile," hereafter called the "C.R.A.") of Bar-le-Duc. Movement was continuous. The question of unloading or disembarking was dominated by the necessity of keeping free the *route gardée*. It was therefore necessary at the outset completely to alter the location of the munition depots which had been placed along this route—at Neippes, Lemmes and Verdun itself—so as to permit of "sidings" where lorries could be placed for the duration of the unloading process, which consisted in piling up the munitions along the siding. It was necessary to open fresh munition depots more suited to these working methods, and in this way came into existence the circuits of Regret and of Nixeville, about which were organized a series of lorry stations with stores of *matériel* and supplies of every kind. On the same principle, although at the beginning troops were disembarked in any and every piece of road that led to the Sacred Way, either beyond Verdun or N. of Moulin-Brûlé, it became the rule later to build veritable "stations" for the personnel.

It was to these stations that the C.R.A. directed its movements of personnel and at these same stations troops due for relief came to embark. There also were collected casuals, leave-men and, in particular, the slightly wounded, who at fixed hours took their places in empty lorries on their return journey to Bar-le-Duc.

This situation may be summed up by saying that the employment of the route Bar-le-Duc–Verdun was as strictly conducted as if it were a railway. One looks in vain for any other parallel. The intensity of movements required it, for in addition to the movements mentioned above one must add that of numbers of isolated cars and lorries, of every kind, which entered and circulated on the *route gardée* from the moment that it was given over to the motor vehicles.

III. INTENSIVE TRAFFIC ON ROADS

The Route Gardée.—The command can only depend on movements by motor transport when they are executed with absolute punctuality and in accordance with programme: they must resemble movements by rail and be based on time-tables, just as in railway work. It is essential that breakdowns, and the resultant lagging behind scheduled times, be notified at once. For the organized employment of automobiles on the roads, like that of railway trains, the essential condition is to be master of the road. If, on a road, this or that mishap can take place without it being in someone's power to neutralize its effects, or if all and sundry are permitted to put columns of troops or vehicles on it, it is useless to attempt to carry out important movements. Congestions multiply, and their effect is reflected farther and farther back, leading to accidents, and increasing delay to the degree of stoppage; so that, whatever may be the efforts of those in charge of the movement, their transport fails. It is an absolute rule, based on numerous experiences, that it is not possible to launch a big transport movement involving several hundreds of lorries without being absolutely certain of the complete freedom of the road. Nor does it suffice to be certain at any one particular moment; it must be certain during the whole time that the movement will last. Hence the organization of the *routes gardées*, with their personnel of guards and their traffic orders.

A *route gardée* is not necessarily reserved exclusively for automobiles, though this may be so, as with the *route gardée* from Bar-le-Duc to Verdun. But there are other cases where one has to admit, under certain conditions, the movement of horse-transport. Such was the route Amiens–Bray. But in every case there must be a responsible authority, having power to give orders and have them carried out. In the French army, during the war, this authority was a motor regulating staff (C.R.A.). In the British army, the control of traffic in France was part of the duties of the Provost Marshal (A.P.M.). The organization of the route, on a railway model, is based on the "block-system." The route is divided into a series of districts, each of which is under the direction of a district chief, having assistants for supervision. The district chief is in constant touch by telephone with the neighbouring districts, and with the office of the C.R.A.; he knows all the movements which affect his district, and also keeps a record of all movements which occur there and all the incidents of the traffic. Thus at the office of the C.R.A. it is always known what the state of the traffic may be on every *route gardée*, and the necessary arrangements for launching an important movement can be made in given time.

The route orders for the *routes gardées* are more or less drastic according to the breadth of the road, and whether or not there are relief routes. On the Verdun route, where the traffic was most intense at certain hours (one vehicle every five seconds), the narrowness of the road—seven metres—necessitated very strict rules: every broken-down lorry was thrown off the road; no lorry could range up alongside the preceding lorry, and so on.

The length and the importance of the districts on a *route gardée* depend, obviously, on special difficulties which they have to overcome, *e.g.* the number of adjacent routes, the localities traversed, narrow passages, etc. Between Bar-le-Duc and Verdun there were six "districts" varying in length from 5 to 10 km.

It is quite unnecessary to guard in this permanent fashion a route over which there is not continuous traffic. Whenever such a road is needed, for the time being, for an intensive transport, it is sufficient to occupy it immediately and transform it into a *route gardée*. This requirement leads to the C.R.A. (or any corresponding organization) being given a territorial zone of operation. In each zone it is the immediate business of the C.R.A. concerned to guard any portion of the road over which the transport will be moving. For this purpose the C.R.A. had at its disposal specially organized personnel which may be fairly accurately designated "mobile districts," and which, being in the habit of operating in this way and supplied with the means of rapid installation, can in two or three hours make themselves masters of the traffic on whatever part of the road is entrusted to them. It is well understood that a C.R.A., to whom a zone of operations has been entrusted, prepares as minutely as possible this bringing into action of the mobile districts on a plan of some kind over its route-system. For instance, it installs in advance a network of telephone stations; above all, it establishes and puts into place enormous placard indicators showing the direction of localities, designations of the routes, local traffic, war maps, etc.

A C.R.A. that has organized its zone of operations properly is really master of it; it installs a few permanent districts on the main roads, and has several mobile districts, always at disposal, which are thrown out each day wherever traffic makes it necessary. In the French automobile service system during the war, this rôle of the C.R.A. was facilitated by the fact that the commissions were at the same time executive transport authorities. The head of the C.R.A. was also commander of several "groupings" of transport, and he was responsible for carrying out all military motor transport work required by the army within the territorial limits of his zone. He was thus the first to be informed of any large movement of automobiles in his zone.

Maximum Efficiency over a Road System.—When one is master of circulation throughout a given region, one is free to aim at maximum efficiency. How is this obtained? Formerly, when the staff proposed to carry masses of troops to a theatre of operations it traced the greatest number of parallel and serviceable roads which led to the zone of action decided on, and there was thrown on each of these roads a column of all arms scientifically echeloned in depth. Thus it was that Napoleon moved from the Rhine to the Main in 1805; thus, also, Moltke moved from the Sarre to the Moselle in 1870.

When this system is applied to present-day conditions the efficiency of the road system is low, because the increase of speed due to the automobile is not turned to account. All modern armies have tractor-drawn heavy and automobile light artillery, and possess the means of transporting the bulk of their infantry by motor lorry. There remain the horse columns, on which it is no longer necessary to impose the speed limitations of marching infantry. In consequence, in coördination with the movements made by railway, the movements by road ought to be organized in the form of special itineraries, on each of which move columns of elements that are homogeneous from the point of view of speed. Thus combination of movements can be worked out in which much time is saved, as compared with the old methods.

We will examine further the conditions of carrying out strategical movements on the road. From the point of view of traffic organization, these considerations lead to the principle of allocating the available *routes gardées* according to type of traffic. Thus, such a route is reserved for heavy artillery on tractors having a speed of 8–10 km. an hour: another route is allotted to motor field artillery; others for motor lorries, and yet others for horsed columns—a distinction being made between the requirements of light columns (field artillery and trains) and heavy columns (heavy artillery and bridging equipment). One must also remember, in the distribution of these itineraries, the quality of the roads, their breadth and the strength of the road bridges. Thus one is led to a completely new technique in the utilization of the roads, for which one must know the output of each itinerary for the given density of traffic which it is proposed to put on it. One must work out the crossings and the doublings of the columns, and, above all, the way to place all these elements of different speed so as to make as many different "moving stairways" as there are rates of movement.

The existence of regulating commissions in charge of zones of movement, and masters of the traffic, considerably eased the French problem. But the regulating commissions must have control not only of automobile traffic, but of all traffic: in their zones no movements must occur without their having received notice and taken the necessary measures to facilitate the execution of the movements in question. They must be able to arrest all false movements in good time. And they must be in close touch, so as to form a complete network, covering the whole area over which it may be necessary to move any column.

It was by the functioning of an organization of this nature that the French army was able to make its concentrations of considerable numbers of troops at very short notice in March, May and July 1918.

Strategic Transport by Road.—What is a strategic transport, or, in a wider sense, a strategic move? It is a movement capable, by its results, of affecting the present or future situation of a battle. In war, when the forces are equal on both sides, the only way to act effectively on the opponent is by means of surprise—a word that must be interpreted in the widest sense. The problem is not only to dazzle the enemy by unexpected blows, but also to secure that the blows get home. It is necessary to be stronger than the enemy where he believes he can cope with you, and as strong as he is where he believes he can overcome you.

The battlefield of Rocroy was no more than 2 km., that of Austerlitz no more than 10 kilometres. The French front of 1914–8 was 500 km. long. In modern warfare, up to 1914, one counted only on railways for strategic transport for the large higher formations: the plan of concentration was exclusively a plan of transport by rail, and the movements by road leading to the battle were only the immediate consequence of the deployment of these higher formations on their railheads.

As the automobile has brought on the road again the tourist who had deserted it since the middle of the 19th century, so transport by motor lorry has brought into use again strategic movements by road. And, for the production of surprise effect, by adding the roads to the railways, it has been possible to put to full use all available means of communication.

The air alone has not been utilized; but it may be foreseen in the future that it must be utilized for quick transport of combatants. In order that movements by roads should be serviceable, it is necessary for them to be rapid and powerful; this is attained by applying the same principles as in rail movements—that is to say, the temporary break-up of large units for transport.

To understand these principles better, an example may be taken from the situation of Sept. 16 1918 on the Allied front in the region Toul–Verdun. The American army had at this time, to the E. of St. Mihiel, 8 divisions, which, with corps and army troops, were quite equivalent to 8 French army corps. The orders of Marshal Foch prescribed that this American army should be placed to the N. and N.E. of Verdun, in positions precisely laid down and sharply echeloned in depth, ready to move on the enemy on Sept. 26. Six divisions were coming from different sides, and principally from the region of Chaumont–Neufchâteau; eight would be those already mentioned, which, after carrying the salient of St. Mihiel by a brilliant assault, found themselves in very considerable disorder, as large forces rapidly successful in a convergent offensive must. It was calculated that time admitted of seven nights being devoted—for it was desired to conceal the strategic move entirely—to moving these eight army corps 60 km. from their present position and depositing them in order opposite the new objectives. What was the solution? For movement in suitable stages (three in number) there were available two itineraries, constituted by two roads which in part were very narrow and bad. It would be necessary to put four army corps in succession on each road. Such a movement by road in earlier days, even if perfectly regulated, would have represented ten days' marching with its accompanying difficulties and fatigues for the troops. How could the food supplies have been assured for the infantry, as it marched by night and halted by day along the route, so as to hide all movement of troops? There would be serious risks of congestion, and even complete paralysis, at those points where there must be crossings with the columns of the divisions coming up from Revigny and Bar-le-Duc. The most experienced staffs would not have been able to solve such a problem. By rail 800 trains would have to be operated over lines of which one part only was capable of much traffic. At 40 trains a day the move would need 20 days: and what sort of platform would be available for embarkation? What, moreover, would become of the surprise? Besides, there was at such a moment plenty of other work for the railways. The new system now, however, consists in the movement by road with broken-up formations, their elements being apportioned in accordance with their capacity for movement; and the different scattered members are brought together at a concentration point. Let us look at all the conditions which such solution requires. There is, first, the presence of a solid advance guard, which at all costs prevents the enemy breaking into a system which is incapable of defence. This advanced guard, in the present case, is the "front." Secondly, there is absolute control of the traffic on the route, and a certain professional ease in the art of handling all the various elements,—putting them on the road, directing them, regrouping them. In this case the necessary skill had been acquired in the development of the regulating organizations at Verdun and on the Somme, during the movements of 1917 (Italy, Péronne) and in 1918 (March, May, July). Lastly, there must be the complete confidence of those who are being carried, who hand themselves over bound hand and foot to their transporters. These conditions being fulfilled, the problem set out above was simplified, thanks to the existence of the two C.R.A.'s of Toul and Souilly, the former having as its sphere of action the zone of departure of the American formations, the latter the zone of arrival. The director of automobile services of the French army placed a delegation at Ligny, which took under its direct orders the two regulating commissions and coördinated their action. This delegation at Ligny dealt with eight groupings of automobiles, with which they carried out the transport of the infantry by lorries.

Let us enter into details, and see what are the different operations with which the delegation at Ligny would have to deal, to organize these movements at the outset.

(1) After a rapid evaluation of the kind and quantity of the effectives to be moved—motor transports of infantry, the American divisional motor convoys, teams of the horse-drawn divisional or corps artillery, motor artillery—this staff sets out on the map the different current-paths in which these elements can be analyzed. In the first place, the great road Toul–Void–Ligny–Bar-le-Duc–Chaumont-sur-Aire–Souilly–Nixeville (or Chaumont-sur-Aire–Chermont-en-Argonne) is reserved for transports of infantry by the French motor reserves. A current of motor artillery traffic is deflected to the S. by Gondrecourt. Lastly, two routes N. of the line Toul–Ligny-en-Barrois are reserved for horse-drawn vehicles and horse artillery. These four streams distribute simultaneously all the units of the four types, arrangements being made for the American divisional motor convoys to follow the French motor convoys of infantry transport.

(2) This being done, arrangements are made for the orders of march of each of the elements following the four itineraries. This work involves specifying the character of the elements, their places of departure (date and hour), their points of transfer from the authority of the C.R.A. of Toul to the charge of the C.R.A. of Souilly, and their points of final destination; and all these arrangements when worked out are submitted for the approval of the operations branch of the American general staff, which draws up all executive orders to be sent for despatch to each unit affected. These orders are sent in duplicate by the delegation at Ligny.

(3) The picking-up of each division by its lorries necessitates the working-out and despatch, by the delegation at Ligny, of orders to the two C.R.A.'s of Toul and Souilly, also to the commanders of the various automobile formations concerned. The order prescribes the day and hour of the picking up; the address of the divisional headquarters staff; the billeting distribution of the division; the routes of empty movement to bring their lorries to the embarkation stations, and the routes loaded which are to bring them to their destination; the place of assembling the empty automobile units after they had unloaded; the limit of a zone within which empty movements must not take place after 8 A.M.; points of liaison either by telephone or motor orderly between the delegation at Ligny and the commander of the automobile formation. In conformity with the standing orders of the directorate of motor services, this order would instruct the commander of the automobile formation to make his plan of transport in conjunction with the C.R.A. of embarkation and C.R.A. of disembarkation.

This manner of operating has the advantage that an officer of the C.R.A., perfectly familiar with his region and its road system, takes part in working out his embarkation plan; it enables the loops to be determined by which the different automobile units arriving at the different places of embarkation will assemble. It was the same for the disembarkation.

(4) The D.S.A. of Ligny, using the preliminary table of the *ensemble* of the movements, draws up detailed tables of the movements on which figure the place, the date and the hour of departure of each element, whether horse-drawn or motor; the itinerary in the American zone; the point of handing over from one to the other; the itinerary in the French zone; and the final destination. To establish these detailed tables consultation is necessary with the American staff, and also with the staff of the 2nd French Army at Laheycourt which looks after rationing and billeting areas.

(5) In the course of the movements the American operations section made certain modifications in the list of formation units which it had communicated to the delegation at Ligny. These modifications consisted either of omissions or substitutions, as in the case where one division took the place of another in the new order of battle. The desire to deal suitably with the special qualities of each American division necessitated modifications of this nature. In order to maintain the most exact order in the prescriptions concerning the movements, the delegation at Ligny tabulated a general summary for each day, to which was added in the course of the day a numbered series of "additions" or "alterations." The chief table and the supplementary tables were notified immediately to the two C.R.A.'s affected, who in their turn gave orders to their district chief commanders. The principle which served as an absolute guide was at all costs to make good the movements as they were ordered, in establishing as rapidly as possible the liaisons necessary, in particular with the unit in motion, to be certain of the time-table.

The difficulty of these transports and movements had been considerably increased by the need of secrecy to cover the operations of concentration. General Pershing, who commanded the American I. Army, had definitely ordered that no movement should be visible to the enemy observers able to fly over the American zone. In consequence all movements, without exception, had to be carried out at night, and it was absolutely forbidden to use any light whatsoever, be it touring-car lamp or lorry back-lights. This applied equally to movements on foot. Thus it was in complete darkness that the elements had to be put on the road, march discipline assured, circulation controlled and liaisons established. On Sept. 25 the concentration was achieved as the C.-in-C. had ordered.

Combined Use of Railway and Motors.—The foregoing was an example of a strategic movement carried out solely on the roads. In the majority of cases, however, use is made of railways and roads in combination. The end to be attained is always a rapid move of powerful forces; the staff should therefore make use simultaneously, and as efficiently as possible, of every means of transport which it possesses. Under what conditions will this simultaneous employment give the best results? Is it better to carry out end-to-end movements, parallel and simultaneously by railway and by roads, or, on the other hand, to make movements by railway for one part of the journey, and to prolong these movements by automobile? The question and the answer apply both to transport of troops and to the transport of *matériel*.

The weak point in transport by railways is not in their capacity, for this is very considerable if there are available both a double railway track and a quantity of locomotives and wagons sufficient for the full exploitation of the system. One must never lose sight of the fact that the efficiency of the railway is much superior to that of the road; a train of 50 wagons is equivalent to 150 lorries. At a speed of 30 km. an hour, and with 4 departures an hour, one has four trains in a length of 30 km., or the equivalent of 600 lorries. We have seen that 600 lorries form on the road a length of 20 to 25 kilometres. Railway and road have therefore very nearly the same output. But the lorries, going 15 km. an hour, are only half as quick. Further, at the end of 100 km. it is necessary for the lorries to stop in order to rest the drivers, for, save in exceptional cases, relief crews are out of the question, while trains travel indefinitely without changing locomotives. The weak point in transport by rail really lies in the necessity of having stations for embarking and for disembarking. Save in quite exceptional cases it is an absolute technical necessity to load and unload in stations, and even so only in those where there are sidings sufficient to take the military trains so as to leave free the main line during the times of embarking and disembarking. Without this precaution all the traffic will be blocked. Further, when it is a question of loading *matériel* it is necessary to place it on the platforms. While special platforms or docks are indispensable on the railway, it is always easy, on the road, to find and organize quickly loading-places for lorries; on the railways to install even simple sidings is a serious matter.

Big movements by railway can be made only from a zone A to a zone B, if the two zones A and B are equally rich in loading-places. But—apart from those points which come into the initial concentration scheme, and on which therefore work can be done in peace—it is impossible to ensure, in the large movements which military operations may necessitate at any given moment, that the beginning and the end of rail transports shall take place in zones that are rich in loading-places.

On the other hand, it is generally possible to find, within a radius of 50 to 100 km. in the zones A and B under consideration, one or more regions rich in loading-places. The normal combination consists therefore in utilizing motor transport to prolong railway transport, and to carry the troops or *matériel* (1) from their stationary zone to the places of embarkation, and (2) from their places of disembarkation to the zone of operations. The relatively short movements (50 to 100 km.) it requires are those in which the efficiency of the lorry is at its greatest. And between the two zones of loading thus actually used, the efficiency of the railway will equally be a maximum.

Examples of combined use of rail and road systems were very frequent in the course of the war. In Oct. 1914 all French troops despatched for the Ypres region were carried by rail to the region N.E. of Arras (Doullens, St. Pol, Béthune, Bailleul) and pushed forward from there by automobile to Ypres. Similar arrangements were made on every occasion in the course of the war on which the French army was called upon to put considerable forces into this region. For example, in April 1918, in the movement of reinforcements to Flanders, the French employed three *routes gardées*, by which, though they cut through the lines of communication of the British armies, formations picked up at the railway stations of disembarkation around Amiens and Arras were despatched to the Ypres region.

Naturally, other combinations are also practicable: for example, that by which, on Nov. 20–21 1917, 3 French divisions were to be carried from Meaux and Château-Thierry to Péronne; the infantry, with their machine-guns and cooking-carts, being conveyed in motor lorries, and the artillery by train. The object of these movements, very quickly ordered on Nov. 19, was to reinforce the successful British attack in front of Cambrai with the first use of tanks in mass, and had overwhelming results. While the embarkation of the artillery was proceeding at railway stations in proximity to the divisional billets on the Marne, the C.R.A. of Meaux and Château-Thierry loaded up on 3,000 lorries the infantry, etc., of the 3 divisions. The movements of the lorries, made by 3 separate itineraries, came to an end in the neighbourhood of Péronne, where a C.R.A. of disembarkation put the various elements in their places in the zone where the 3 divisions were re-forming. At the same time the British motor service was working with full efficiency on all the routes converging from the N. and W. on this same region of Péronne. In every case there must be the closest liaison between the authorities who regulate the movements of the trains on the railways and those who regulate the movements of motors on the roads. In the case where troops are loaded into lorries on leaving a train, it is necessary that the motor transport should be constantly informed by the rail-transport authorities of the hours of arrival arranged for the trains, in order to have the lorries at the disembarkation platforms in good time for immediate loading-up of the troops. Finally, as in the case of the move to Péronne, where there were parallel moves by rail and roads, there must be a complete understanding between all concerned, so that, both in the zone of departure and in the zone of arrival, the hours of embarking and disembarking should be so arranged as to avoid crossings of columns and overcrowding; and the working-up and reconstitution of higher formations, whose elements are conveyed partly by rail, partly by lorry, partly again by marching, must be minutely worked out and definitely fixed. A final example may be given of the combined use of the automobile and railway. In this instance it is required to make a rapid movement of certain troops to a zone where, for some reason, it is not possible to use the railway system. Here, combination is needed in the disembarkation and reëmbarkation arrangements at the beginning and the end of the zone; such operations are easy where the two organizing departments of the railways and automobiles are directed by the same superior authority and kept in strict and constant touch. If, after Oct. 1918, the pursuit of the German armies had not been arrested by the Armistice, this problem would have had a thoroughly practical demonstration, for it is probable that the Allies would have been able to take into use the railways existing beyond the devastated zone. In Nov. 1917, at the time of the crossing of the Alps by a portion of the French troops, the C.R.A. of Besançon and of Nice had to deal with an analogous case; viz. to set in motion and to transport over the passes of the Alps those troops which, having been disembarked from the French railways at the foot of the mountains, were to be reloaded on the Italian railways on the other side.

It must be observed that there are many details which complicate considerably the task of the transport officials: such as the question of food supply for the troops during their transportation and at their disembarkation, and the question of moving troops simultaneously with the building-up of the munition dumps which they will require. One last remark should be made: transportation by automobile and by railway, which, we have seen, supplement one another happily in regard to distance, is equally satisfactory in regard to time. Large movements by railway require a concentration of *matériel*, often difficult to achieve; and, in the case of moves decided on in a hurry, the possibility of motor transports on a large scale assumes very great importance, since it takes 4 or 5 days for the railway to show its full powers.

Conclusion.—The experience of the war shows the rôle which transport by motors is called upon to sustain becoming more and more important. The Allied armies, together, placed on the French front about 20,000 vehicles of motor propulsion in Oct. 1914; four years later the number exceeded 200,000.

As regards troop transport alone, the power conferred on the command by the employment of lorries had grown enormously during this period of four years. At the time of the Armistice, the inter-Allied transports reserve, the creation of which had just been decided on, was of a size to transport simultaneously 10 divisions of infantry complete, with all their means of fighting, machine-guns and artillery included. This was a fighting mass of more than 100,000 men, which the Higher Command was able to pick up at short notice and carry at the speed of 100 km. a day to any point where it was required.

As regards the transport of *matériel* at the end of the war, it had become possible—independently of the resources just mentioned—to keep supplied with food and munitions 40 divisions at a distance of 100 km. from the railways.

To show what was actually achieved in those directions, it will be enough to say that, in the French army alone, there were carried by motor transport during July 1918 1,040,000 tons of *matériel* and 950,000 combatants.

In the future it is to be foreseen that mechanical motive power will replace entirely the animal motive power in the armies. Since the use of special tractors enables the artillery to take up positions in any kind of terrain, there will be no reason for not giving it, on the road, the speed of moving which the automobile allows. And as the support of infantry on the battlefield, *i.e.* accompanying guns and also tanks, will in the future be capable of rapid movement on the roads, it will be natural to organize more and more systematically the rapid conveyance by automobile of considerable masses of infantry. The evolution of strategy must always be in the direction of using all available means to surprise and break the enemy by concentrating unexpected strength with unexpected rapidity. (A. D.*)

MOTOR VEHICLES (*see* 18.914).—Improvements in design between 1910 and 1920 made the passenger motor-car a more reliable, more comfortable and, allowing for changed conditions, more economical vehicle; they also rendered it more attractive to the eye. During the same period the use of cars greatly increased, particularly in the United States, where registration figures showed that in the state of Iowa there was on July 1 1920 one car to every 5·49 of the population, while for the whole country the proportion was one to every 13·52 people. To a certain extent the World War was responsible for the fact that in the use of motor-cars Europe did not keep pace with the United States. In France, Belgium, Germany and Austria the manufacture of cars for sale to the public ceased absolutely upon the opening of hostilities, and was not resumed until after the Armistice; in Great Britain and Italy, too, motor-car factories were restricted to work for the armies, practically throughout the war. In the United States, on the other hand, not only was there no interruption in production for private account, but the war-born wave of prosperity of 1915–6 increased sales over what they would have been under normal conditions. After the United States entered the war many motor-car plants were turned over to the production of aero-engines and munitions, and had the war continued after Jan. 1 1919 the manufacture of passenger cars for other than military purposes would have ceased in America as completely as in Europe.

The chief reasons, however, for the preëminence of the United States in the use of motor-cars had nothing to do with the World War. In the first place America is a land of magnificent distances; in many sections towns and cities are far apart, and long trips must often be made over the public roads, for which purpose horse vehicles are quite unsatisfactory. Secondly, petrol (in the United States called gasoline), the fuel commonly used for motor vehicles, is a native product, comparatively cheap and plentiful. Thirdly, *per capita* wealth is greater than in most countries and well distributed. Not all conditions were favourable to the introduction of motor-cars however. Whereas the industrial countries of Europe had magnificent systems of hard-surfaced roads, such roads were practically non-existent in the United States at the beginning of the motor era; but while a handicap, this did not prove a serious obstacle. In the early years of motor-car development the private passenger car was generally regarded as a means of pleasure, and in Europe this remained its chief function. But in the United States and Canada (which comes next after the United States in respect to number of cars owned, notwithstanding its comparatively small population) it became a great factor in business life. In New York City, for instance, a very large proportion of the street traffic in 1920 was by motor, and in the main thoroughfares horse vehicles were almost a rarity. On the other hand, such agricultural states as Iowa and Nebraska had relatively more cars than the industrial states, and the farmers, too, used their cars chiefly for business purposes. As the substitution of the motor-car for the horse came about gradually, it did not greatly impress the general public; nevertheless it profoundly influenced modern life.

Conditions in Nyack, N.Y., a town of 5,000 inhabitants, 25 m. from New York City, may be cited for illustration. In 1905 Nyack had only one motor-car, owned by a physician; in 1920 deliveries of all articles of commerce, from the morning newspaper to coal and building material, were made by motor vehicles, with the one exception of goods delivered by the railway express, which still adhered to horse service. The junkman made his rounds in a motor-car. All moving of household goods was effected by motor-van. Motor-buses were the only means of public transit, and in addition to making their regular trips they carried children in the outlying districts to and from school. The fire department had been "motorized." A large proportion of the residents owned private cars, which they used for driving to church or to the theatre, for shopping and visiting, as well as for pleasure-driving. On Saturday afternoons the main business street was so crowded with cars that it was often difficult to draw up to the curb.

In the cities of the United States the once familiar horse-cabs and hansoms had practically disappeared before the motor-propelled taxicab by 1920. There were bus services competing with the tram services, though these had not been developed to the same extent as in the leading European cities. Numerous bus lines had been established in country districts beyond tram services. About 1915 many owners of private cars began carrying passengers in competition with tram lines, their vehicles being known as jitney buses (jitney, a Russian coin about equal in value to five cents, then the common tram fare). These jitneys did much business, especially during the "rush" hours when people go to work and return home, as their passengers avoided the crowding of the street-cars and the annoyance of frequent stops. But after a short time the greatly increased cost of petrol and war conditions rendered the business unprofitable, and little more was heard of jitneys. Many cars of the private type were still offered for hire, but five cents was no longer a sufficient fare, and the drivers usually called their vehicles taxis, though in the smaller towns as a rule they carried no taximeter.

Motor-trucking and the haulage of freight by motor vehicle began to assume importance in the United States only about 1910. This branch of the industry up to then had been more successful in Great Britain and Germany. Beginning with that year, however, it consistently increased in the United States, where under the stress of war conditions the motor-lorry even entered into competition with the railways. An enormous amount of motor freight traffic grew up over certain routes between important industrial cities, as between Detroit, Mich., and Toledo, O., and between Akron and Cleveland, O. One large tire manufacturing company in Akron, O., with cotton mills in Boston, Mass., over 600 m. away, established a fast freight service between these two distant cities by means of motor-trucks on pneumatic tires. Some of this development was evidently due to the abnormal conditions which made railway freight service inadequate during and immediately after the World War. Military operations gave a great impetus to motor-truck development (*see* MOTOR TRANSPORT, MILITARY). Thousands of motor-trucks were employed by the armies on both sides. The Central Powers were greatly handicapped in this respect, as, owing to the blockade, they could get no rubber for tires, and during the latter part of the war their army trucks ran on wood and steel tires. All of the material for the American army in France was transported by motor-trucks from the landing points to the battle-line. In addition to the urgent demand for trucks for military purposes there was also a strong demand for business purposes, owing to the intense industrial activity and to the breakdown of the railways under the war strain.

The substitution of the motor-car for the horse was beneficial in various ways. In the first place the car is much more speedy and more comfortable for transport. With a motor-car a physician, for instance, can extend his practice over a much wider territory; contractors can oversee more thoroughly a number of projects under way at the same time; stores and factories can deliver goods in the country, at distances of 30 m. or more, in their own vehicles, whereas with horses their delivery territory was limited to the city. Stables, always a nuisance and a breeding place of disease, have been practically eliminated from cities, and street-cleaning has been rendered much easier. Real estate remote from railways has in many instances considerably appreciated in value as a result of the advent of the motor-car, which rendered it accessible to the city man.

In the foregoing the utilitarian aspect of the motor-car has been specially emphasized. While cars are still being built that can properly be classed as vehicles of sport and luxury, they form a small proportion of the whole production. In New York City an annual show was established for this class of car; it started as the Importers' Salon, but during the World War, when the importation of European cars was hedged about with many difficulties, it gradually changed its character and became a show of high-grade domestic as well as imported cars. At the salon in Nov. 1920 there were exhibited cars selling at upward of $20,000, whereas a serviceable five-passenger car could be bought for as low a price as $550. The luxury cars exhibited at these shows were characterized by high power and high speed, elegant body finish, fine upholstery and superior equipment.

In tracing motor-car development in Europe between 1910 and 1921 it is necessary to distinguish two periods,—before

Table I.—*Registration of U. S. Motor Vehicles by States.*

	1912	1916	1920
Alabama	3,385	21,636	74,637
Arizona	1,624	12,124	34,559
Arkansas	2,250	15,000	59,082
California	88,699	232,440	568,892
Colorado	8,950*	43,296	128,951
Connecticut	24,101	61,855	119,134
Delaware	1,732	7,102	18,300
District of Columbia	1,732*	13,118	9,712
Florida	1,749	20,718	57,000*
Georgia	19,120	47,579	144,422
Idaho	2,500*	12,999	50,750
Illinois	68,073	248,429	568,759
Indiana	54,334	139,317	332,707
Iowa	47,188	198,602	437,300
Kansas	22,000	112,122	265,396
Kentucky	5,147	31,700	112,685
Louisiana	7,000*	17,000	66,000
Maine	7,743	30,972	62,907
Maryland	10,487	44,245	105,000*
Massachusetts	50,132	136,809	304,631
Michigan	39,579	160,052	412,717
Minnesota	29,000	46,000	64,312
Mississippi	2,895	25,000	64,000
Missouri	24,379	103,587	295,817
Montana	2,000*	24,440	60,646
Nebraska	33,861	100,534	223,000
Nevada	900*	4,919	10,464
New Hampshire	5,764	17,508	34,680
New Jersey	43,056	104,341	226,459
New Mexico	911	8,228	22,109
New York	107,262	317,866	651,796
North Carolina	6,178	33,904	140,860
North Dakota	8,997	40,446	90,840
Ohio	63,066	252,431	616,800
Oklahoma	6,524	52,718	204,300
Oregon	10,165	33,917	103,790
Pennsylvania	59,357	230,578	570,164
Rhode Island	8,565	21,406	50,375
South Carolina	10,000*	19,000*	92,818
South Dakota	14,481	44,271	122,000
Tennessee	9,973	30,000	101,852
Texas	35,187	197,687	427,634
Utah	2,576	13,507	42,604
Vermont	4,283	15,671	31,625
Virginia	5,760	35,426	134,000
Washington	13,990	60,734	175,000*
West Virginia	5,349	20,571	78,862
Wisconsin	24,578	115,637	293,298
Wyoming	1,300	7,125	23,926
Totals	1,007,882	3,584,567	8,887,572

*Estimated.

and after the outbreak of the World War. During the former period development proceeded normally, from both a technical and a commercial standpoint. Great Britain had the greatest number of cars in use, but France was the greatest producer, about one half of the French production being exported. In continental Europe the introduction of motor-cars was hampered by heavy taxation on the cars themselves and on the fuel. The use of motor-trucks, on the other hand, was encouraged by the so-called subsidy system, by which purchasers of trucks suitable for military purposes were offered by their Governments a bonus on the purchase price and also on the upkeep cost, in consideration of their keeping the trucks always in fit condition and agreeing to turn them over to the Government in case of war. Great Britain, France and Germany had such subsidy systems before the war; Japan adopted the same policy later. As soon as war was declared the motor-car factories were set to work for the war departments, either making trucks or other vehicles for the transport corps or else manufacturing aero-engines or munitions. Soon all the petrol available was needed in war service and the use of motor vehicles by private parties practically ceased. In England some use was made during the war period of town gas for motor fuel; this was carried in a collapsible bag of rubberized fabric, on the roof of single-deck omnibuses for instance. With this fuel it was possible to obtain about 85% as much power from an engine as with petrol, and a satisfactory mileage on one filling was secured. Under normal conditions the gas would have been carried in steel bottles under high pressure, but owing to military requirements no steel could be spared for this purpose. The Central Powers suffered much more from fuel shortage than did the Allies, and extensive researches on substitute motor fuels were carried out in Germany. After their petrol supply ran low the Germans used benzol, petroleum mixtures, benzol-alcohol mixtures, alcohol, wood alcohol, tar oil, gas oil and shale oil, as well as compounded fuels known under the names of electrol, benedixine and melanol. Shale oil was derived from a raw material said to be intermediate between bituminous clay and lignite. Benzol was recognized as a valuable motor fuel, and its use continued, even after petrol was again available.

Registration in Great Britain.—The British Ministry of Transport during the summer of 1921 issued a statement of the number of motor vehicles of different kinds for which licences had been issued under the new motor vehicle tax law during the period Jan. 1–May 31 1921. These included 212,000 private passenger cars, 370,000 motor-cycles, 95,300 public passenger vehicles and 16,000 lorries. According to the same authority there were licensed in Great Britain on March 31 1920, 185,700 private passenger cars, 278,600 motor-cycles and 71,400 public passenger vehicles, there being no record of the number of lorries for that date.

Registration in the United States.—The figures given in Table I are based on information furnished to *Automotive Industries* by the registration officials of the different states. Allowances were made for re-registration of cars sold by their owners during the registration year and for registration of cars by non-residents, and the table is believed to give as accurately as possible the number of cars in service in each state during the years mentioned by residents of the respective states.

Registration in Canada.—Table II. shows that from 1915 to 1919 the number of cars registered increased over 279%.

Table II.—*Canadian Registrations.*

Province	1910	1915	1919
Ontario	4,200	42,346	144,804
Saskatchewan	531	10,225	56,855
Quebec	786	10,112	33,547
Alberta	423	5,832	34,000
Manitoba	1,524	9,225	30,118
Br. Columbia	1,026	8,360	22,420
Nova Scotia	148	1,841	10,290
New Brunswick	299	1,900	8,306
Prince Edw. I.	—	35	790
Yukon	—	69	89
Totals	8,937	89,945	341,219

Technical Developments.—In 1908 the "Silent Knight" engine, invented by Charles Y. Knight of Chicago, was adopted by the Daimler Motor Co. of Coventry, England, and within the next few years licences for its manufacture were taken out also by leading manufacturers of France, Belgium and Germany. This engine was notable for its almost silent operation, due to a form of sleeve valve employed, and its introduction had a strong influence on engine development in general during the next few years. In the Knight engine (fig. 1) the usual poppet valves are dispensed with, and instead there are two concentric sleeves between the piston and the cylinder wall. These sleeves are reciprocated by means of short connecting rods from a short-throw crankshaft which is driven at one-half the speed of the regular crankshaft; when ports in the two sleeves and in the cylinder wall are in register there is communication between the combustion chamber and either the inlet or exhaust manifold. In 1908 noise was one of the most serious objections to the ordinary motor-car, and designers of poppet-valve engines were spurred on by the competition of the Knight engine in their efforts to make their engines silent too. They achieved remarkable success by lightening the valves and parts reciprocating with them, by refining the cam outlines, stiffening the camshafts, adopting silent drives for the camshafts and enclosing the valve mechanism. A most desirable feature in a motor-car is flexibility, that is, the ability to pass from a low to a high speed by merely opening the throttle valve. This is secured by using an engine of great piston displacement (a powerful engine) in proportion to the combined weight of the car and load. The much better performance of modern cars, as compared with earlier ones, from the control or "handling" viewpoint, is largely due to the use of much greater piston displacement relatively. American cars have been specially noted for their flexibility, due to the use of very large engines notwithstanding high fuel consumption per mile travelled. As motor fuel was much more expensive in Europe, European designers could not ignore the factor of fuel economy as American engineers could.

In engine design the constant endeavour was to get greater output from an engine of given piston displacement. Horse-power outpu

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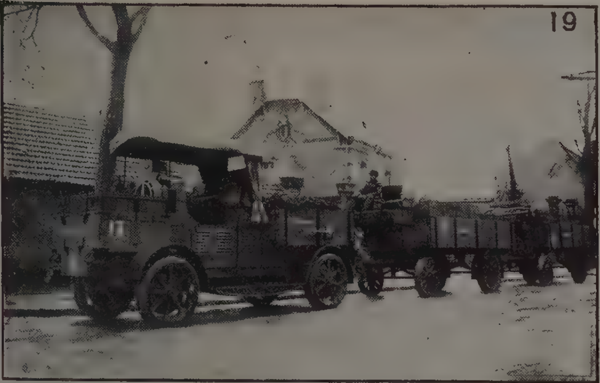

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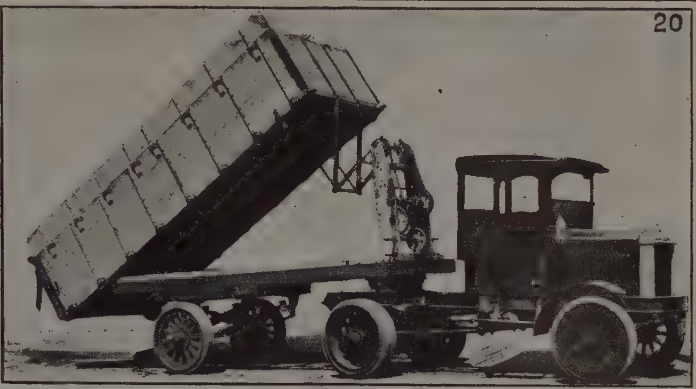

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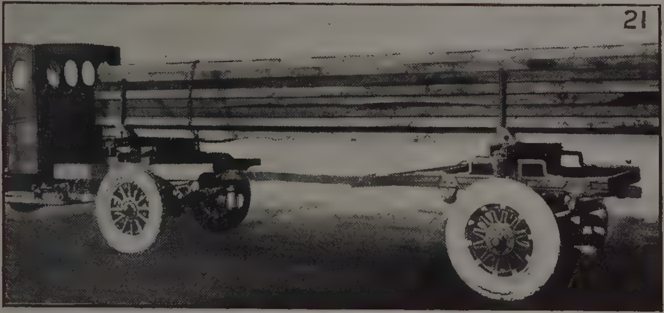

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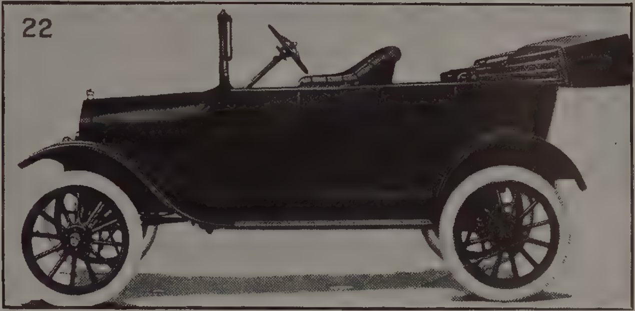

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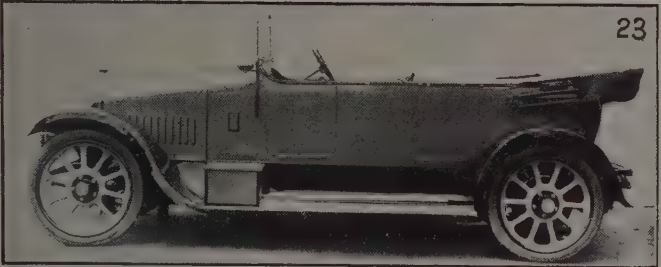

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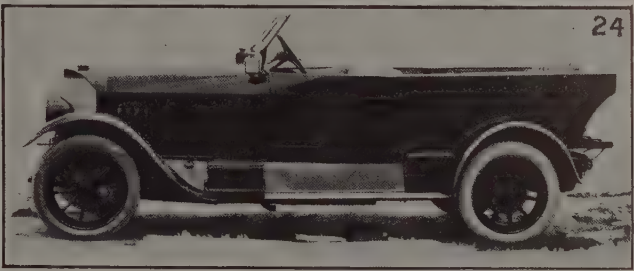

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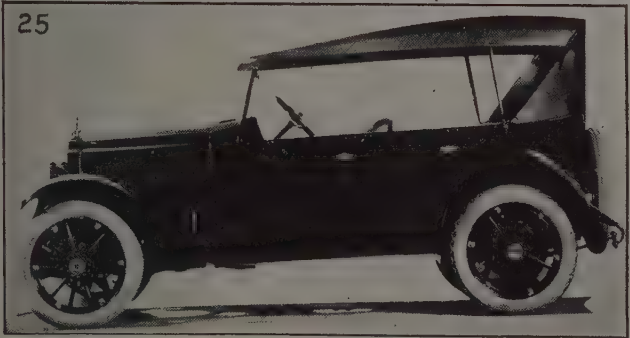

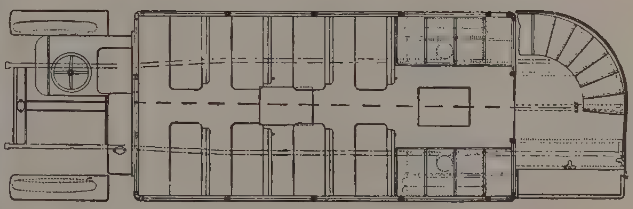

PLAN AT WAIST

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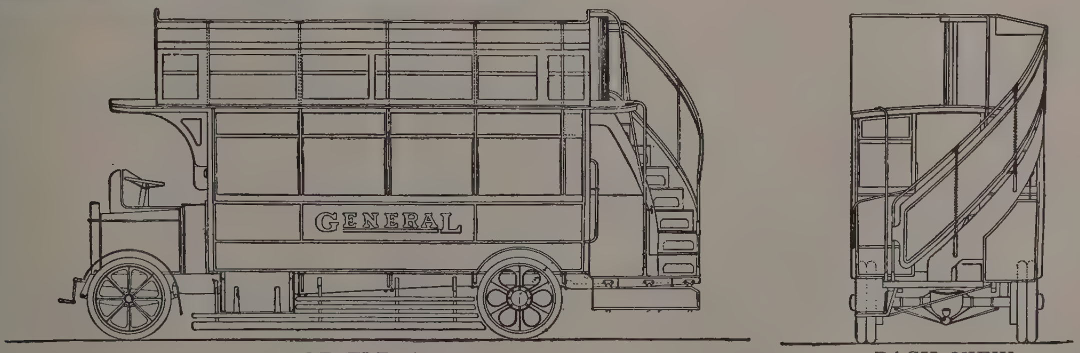

SIDE ELEVATION

BACK VIEW

Fig. 19.—Schneider Tractor with Two Trailers.
Fig. 20.—Trailer.
Fig. 21.—Pole Trailer.
Fig. 22.—Ford.
Fig. 23.—Humber.
Fig. 24.—Mercedes.
Fig. 25.—Packard.
Fig. 26.—New Type Double-Deck Motor Omnibus.

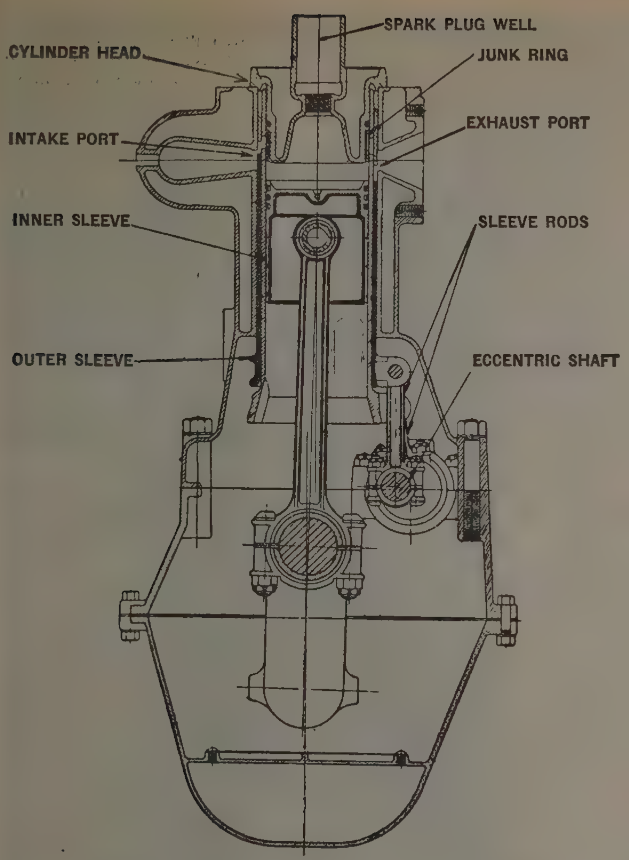

FIG. 1.—Section through cylinder of Knight sleeve-valve engine.

depends upon two factors, the mean effective pressure upon the piston head and the linear speed of the piston. It was not possible to increase greatly the mean effective pressure; in fact, changes in the character of the fuel used for motor-cars, by which some very much less volatile fractions were included than were found in motor fuel of the earlier period, made it necessary to operate with lower compression, which resulted in a lower mean effective pressure. Improvements in combustion chamber design and other changes more than balanced this loss however. A great gain was made by increasing the speed of operation. In 1905 the average engine speed corresponding to maximum engine output was about 1,000 ft. p.m.; in 1920 it was above 2,000 ft. p.m. for passenger-car engines and over 3,000 ft. p.m. for racing engines. The first step in endeavouring to increase engine speed was the enlargement of valve ports and passages, to enable the engine to draw in a normal amount of charge at a higher speed. The valve timing was also changed, the exhaust valve being given a greater lead and the inlet valve a greater lag. Next, the reciprocating parts (piston and connecting-rod) were lightened, so as to reduce the inertia forces on them and the bearing pressures resulting therefrom. This led eventually to the adoption of aluminium alloy pistons. One difficulty with aluminium pistons is that owing to the fact that aluminium has a higher coefficient of heat expansion than cast iron, the aluminium piston must be given a greater clearance in the cylinder, which tends to result in unpleasant piston slap when the engine is cold, and also in "oil pumping," that is, transfer of lubricating oil from the crank-chamber to the combustion chamber, with consequent smokiness of the exhaust. For this reason some makers who had adopted aluminium pistons gave them up. Special means were resorted to in attempts to build ultra high-speed engines, as for racing and similar purposes. These included the use of two inlet and two exhaust valves per cylinder, the use of two simultaneous ignition sparks in each cylinder, and the use of crankshafts in which each individual throw was counterbalanced.

It was recognized early in the history of motor-car development that by increasing the number of cylinders above the one or two employed in the first machines, not only could the engines be reduced in weight, but the objectionable vibration could be minimized. In 1920 the four-cylinder engine was the foremost type for use on vehicles of a strictly utilitarian character. The six-cylinder engine was, however, widely used for the larger and more powerful types of passenger car, particularly in the United States, and the eight- and twelve-cylinder engines also had a run of popularity. In a petrol engine the torque impressed upon the crankshaft is always non-uniform, no matter how many cylinders there are, but the fluctuations decrease with an increase in the number of cylinders. In a four-cylinder engine there is, as with one or two cylinders, a reversal of the torque; that is, just before the end of each stroke the flywheel not only supplies all the power delivered by the engine, but also some of the power necessary for keeping the crankshaft and pistons in motion. Six cylinders are the smallest number delivering continuous torque at the crankshaft; but while continuous the torque is still far from being uniform; with eight cylinders the torque fluctuations are reduced, and with twelve they are still smaller. Four- and six-cylinder engines were always arranged vertically, with all cylinders in a row; eight-cylinder engines were generally of the V type with an angle of 90° between cylinders. The Lincoln eight-cylinder car had a 60° V engine, and several all-in-a-row eights were built; twelve-cylinder motor-car engines were always built in V form, with a 60° angle. In deciding upon the form of the crankshaft of a multi-cylinder engine and the angle between cylinders in a V engine two objects are aimed at, namely, to ensure uniform spacing of explosions and inherent balance of reciprocating parts. Both objects can be attained in six- and eight-cylinder vertical engines and in twelve-cylinder V engines; in a four-cylinder vertical engine there is an unbalanced reciprocating force in a vertical plane, causing vibration of the engine. In an eight-cylinder 90° V engine there is an unbalanced reciprocating force in a horizontal plane.

When multi-cylinder engines were first used the cylinders were generally either cast separately or in pairs; later it became the practice to cast all cylinders in one row in one block. This greatly simplified the outward form of the engine, as with such a cylinder block only one pipe connexion each need be made for the cooling-water inlet, the cooling-water outlet, the combustible charge from the carburetter and the exhaust. Some manufacturers even cast the top part of the crankcase integral with the cylinder block and made the lower part a steel pressing. This construction lent itself well to quantity production. Most makers of the higher-priced cars, produced in smaller numbers, cast all parts of the crankcase of aluminium. In American practice the cylinder heads were generally cast separate from the cylinder block and fitted to the block with a gasket of sheet copper and asbestos between. This construction facilitated manufacturing operations, and when the engine was in service permitted decarbonizing the combustion chamber by scraping without removing the cylinder. It also made it possible to machine completely the combustion chambers, and thus to get all the chambers in one engine of exactly equal volume. European engineers up to 1920 adhered largely to the integral cylinder head.

One thing that caused both manufacturers and users of motor-cars a great deal of trouble between 1910 and 1920 was the continual change in the volatility of the fuel used. When motor-cars were first used the fuel sold consisted of a comparatively narrow range of highly volatile hydro-carbons. When sprayed into air at atmospheric temperature in the required proportion of about one part by weight of petrol to 15 parts of air it vaporized readily. The fuel supplied in the United States in 1920 had an end point of close to 500° F., that is, the least volatile constituents, when under atmospheric pressure, boiled only at that temperature. Hence, in order to vaporize this fuel completely it was necessary to supply heat to the mixture or to the components before they were mixed. When trouble from incomplete vaporization was first experienced the carburetters were provided with a jacket through which hot water from the engine jacket was circulated. When this no longer sufficed the air for the carburetter was drawn through a muff surrounding a part of the exhaust manifold, and to prevent recondensation after the mixture was formed the inlet manifold was so arranged that it was completely surrounded by hot water. Still later this also proved inadequate, and then what is known as the hot spot or exhaust-heated manifold was introduced. When the fuel is incompletely vaporized the liquid particles tend to separate out of the mixture at the bends in the manifold, and it is very difficult to insure that all cylinders get mixture of the same composition. Those portions of the manifold wall where the liquid particles tend to accumulate are then made to form parts of the exhaust manifold wall also, so that they are constantly kept at a high temperature, and the liquid particles upon striking them flash into vapour. The change in the character of motor fuel between 1916 and 1919 is strikingly illustrated by the diagram (fig. 2) of distillation curves of fuels purchased in Detroit, Mich., at various times during 1916–19.

One difficulty encountered in the use of exhaust heat for vaporizing the fuel is that the heat supplied does not vary in accordance with the needs when the load on the engine is varied. When the engine is heavily throttled and runs under light load at low speed, the suction on the spray nozzle is small, and consequently the fuel is not finely sprayed. Relatively more heat is needed to ensure the vaporization of the larger globules of fuel, but under these conditions of operation the exhaust does not supply a great amount of heat. A device designed to overcome this difficulty was developed by the Packard Motor Car Co., and is known as the Fuelizer. With this (*see* fig. 3) a variable fraction of the mixture prepared in the carburetter mixing-chamber is shunted around the throttle valve and through a heating jacket of the carburetter, where it is kept burning by a constant stream of sparks delivered by a sparking plug. The products of combustion are combined with the main stream of combustible charge and pass on into the cylinder. When the throttle valve is fully open

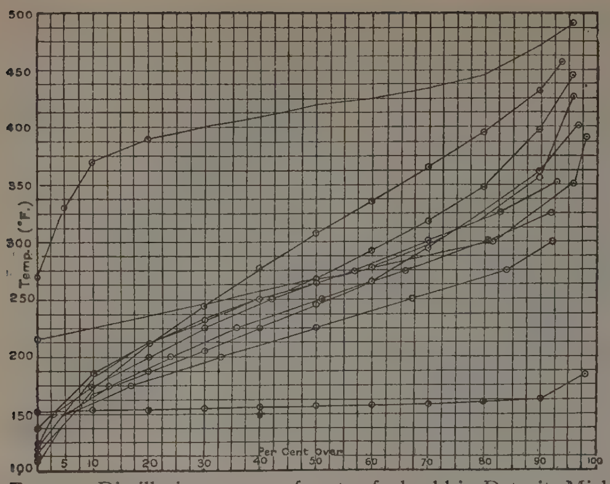

FIG. 2.—Distillation curves of motor fuel sold in Detroit, Mich., from 1916 to 1919. The data for each curve are as follows:—

Curve No.	Fuel	Date of Purchase	Baumé
1	Petrol	4/5/16	60·5
2	Petrol	7/10/16	57·5
3	Petrol	9/11/16	56·8
4	Petrol	6/9/17	56·8
5	Petrol	1/24/19	57·3
6	Petrol	4/30/19	55·7
7	Petrol	6/18/19	55·0
8	Alcohol	10/18	42·2
9	Cal. Dist.	18	51·4
10	Paraffin	18	40·0

there is very little resistance to the passage of the combustible mixture past it, and very little then flows through the by-pass or heating jacket; on the other hand when the throttle is nearly closed the passage through it offers much more resistance, and a much greater proportion of the fuel charge passes through the heating jacket, which is in accordance with the requirements.

In early cars the fuel tank was almost invariably located in the front seat, and the fuel was fed by gravity to the carburetter. Later the bodies were constantly lowered, partly to secure greater stability and partly for the sake of appearance, and at the same time the carburetter had to be raised in relation to the engine, owing to the lessened volatility of the fuel. The result was that sometimes when the car had to ascend a steep grade and there was little fuel in the tank there was no head on the fuel, and none would flow to the carburetter. Some of the earlier high-class cars were provided with a pressure fuel feed system, by which gas under pressure, taken through an "adapter" from the engine cylinders, was made use of to force petrol from a tank carried on the frame at the rear to the carburetter. There were two major objections to this system of feed: carbon particles from the engine cylinder often got into the fuel tank (in spite of the gas being passed through a fine-mesh wire-gauze strainer) and thence into the carburetter jet, which sometimes became clogged; besides, every time the fuel tank was filled the compressed gas escaped, and to get an initial flow it was necessary to obtain pressure by a hand air-pump. By placing the fuel tank under the cowl instead of in the front seat sufficient head for gravity feed was generally obtainable, but the cowl tank usually had an awkward shape and was of rather small capacity. The solution was found in the vacuum feed system, which was developed by the Stewart-Warner Speedometer Corp., Chicago. By this system (fig. 4) the suction or vacuum in the inlet pipe of the engine was made use of for transferring the fuel from a rear tank to an auxiliary tank mounted on the forward side of the dashboard, as high as possible. The auxiliary tank had two compartments, an upper and a lower. Into the upper compartment the fuel was drawn by the vacuum, and it was periodically transferred to the lower by a float valve. Thence it flowed to the carburetter by gravity. There was always sufficient fuel in the carburetter float chamber and in the auxiliary tank to start the engine after the main tank had been refilled.

In 1910 ignition on practically all motor-cars was by high-tension magneto. In 1920 nearly all American makes of passenger car had battery and coil ignition. French manufacturers were also adopting battery ignition, while British manufacturers with few exceptions adhered to the magneto. The reason for the change from magneto to battery ignition was that all passenger cars in 1920 were equipped with a generator and storage battery; consequently there was a constant and plentiful supply of current available, and there was no need for an additional current generator in the form of a magneto. As compared with the early coil and battery systems, the only differences consisted in the use of a plain coil instead of a vibrator coil and of a mechanical interrupter instead of a timer. Sometimes safety devices were provided for automatically opening the circuit or reducing the current flow if the operator should forget to open the switch when the motor stalled. No fundamental changes were made in the cooling system with the exception of the introduction of the thermostat for the control of the circulation. This instrument is connected in the cooling circuit in such a manner that it prevents circulation through the cylinder jackets until the latter have attained a certain predetermined temperature, generally about 170° F. The result is that in starting from cold the engine reaches its normal working temperature in much shorter time, and trouble due to incomplete vaporization of fuel is reduced. The thermostat used, known as the Sylphon, consists of a corrugated copper cylinder filled with a liquid which vaporizes at the temperature at which the thermostat is to act (fig. 5). Many passenger-car radiators are fitted with a radiator thermometer in the filler cap, which is a help to the operator in trying to keep his engine running at its best temperature and gives an early indication of incipient overheating.

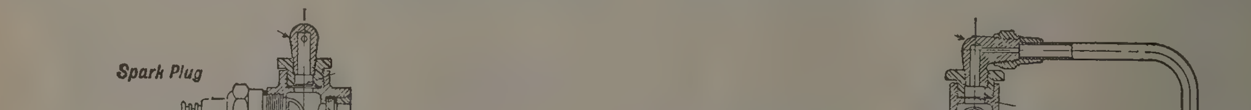

FIG. 3.—Cross section of Fuelizer on Packard "Twin-Six" engine.

As regards engine lubrication two basic methods came into use, the circulating-splash and the force-feed or "drilled-crankshaft" system, as well as combinations of the two. Both systems were employed on early cars, but the force-feed system came into much more extensive use with the development of the high-speed engine.

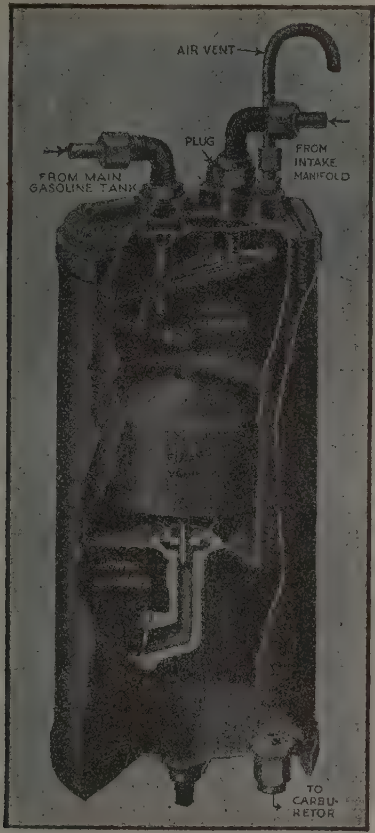

FIG. 4.—Cut-away view of Stewart vacuum tank (fuel feed system).

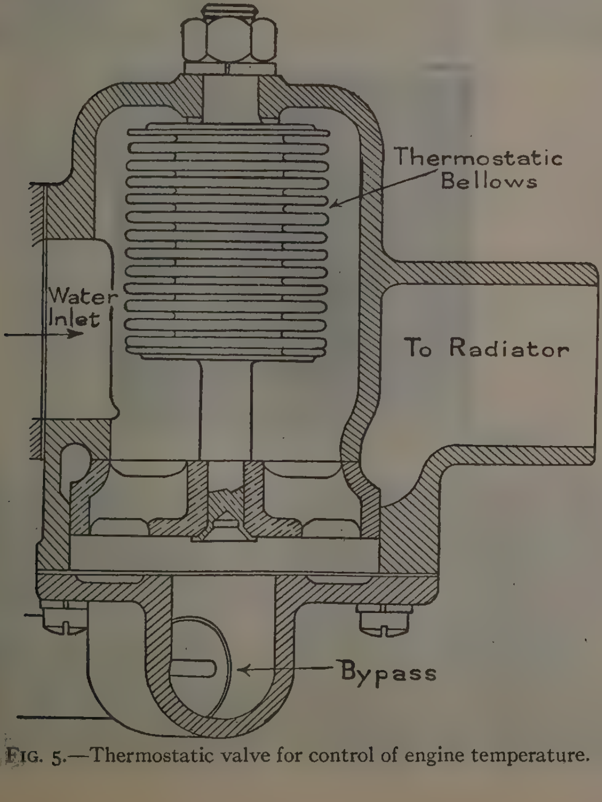

FIG. 5.—Thermostatic valve for control of engine temperature.

The problem of engine lubrication was rendered much more difficult by the change in the character of the fuel used. A good deal of the fuel entered the cylinder in the unvaporized state, and some of it leaked past the pistons into the crankcase, where it diluted the lubricating oil. In 1920 it was a common experience to find a fresh supply of lubricating oil lose much of its viscosity, and hence of its lubricating value, during the first 100 m. of running. Heating of the crankcase oil also reduces its viscosity, and to reduce this heating many British engines were cast with cooling flanges on the bottom of the oil sump.

One of the greatest advances in motor-car practice was the development of electric starting and lighting systems. The first such system on a car in regular production was on the Cadillac in 1912, and was the design of C. F. Kettering. Electric lighting alone had been used on petrol cars for some years previously, in fact ever since the advent of the tungsten-filament bulb. At first the lamps were supplied with current from a storage battery only, which had to be recharged periodically from electric mains; later they were fed with current from a generator and storage-battery installation. The adaptation of an electric generator to storage-battery charging on a motor-car presented considerable difficulties, for the reason that the petrol motor runs at widely varying speeds, and that the voltage of the generator, therefore, tends to vary within wide limits, whereas a substantially constant voltage is needed for charging. Many systems of regulation were used with more or less success, but finally the so-called third brush system was adopted by a majority of the manufacturers of electrical equipment. In this system the generator field was provided with a winding similar to a shunt field winding, but instead of being connected between the positive and negative commutator brushes it was connected between one of these brushes and an auxiliary brush, so that only a fraction of the voltage generated in the armature was applied to the field coils. This system of control did not give a constant generator voltage, but with a storage battery connected to the generator it kept both the voltage and the charging current within permissible limits of variation. In connexion with the electric starter the main problem was that of the drive to the engine crankshaft. After trying various devices nearly all manufacturers in the United States and a good many in Europe settled upon the use of the Bendix drive (fig. 6), invented by Vincent Bendix of Chicago. On an extension of the starter armature shaft was loosely mounted a sleeve, which was placed in driving connexion with the shaft through a coiled spring. The spring had a coarse, square thread cut on its outside, and on this was mounted the driving pinion, the hub of which was cut with a corresponding female thread. When current was applied to the starting motor, which was always of the series wound type, the armature started to revolve at great speed, carrying along the threaded sleeve on its shaft. Owing to its inertia the pinion lagged behind, and was screwed along the shaft and thus shifted into mesh with a gear-ring on the flywheel rim. Upon abutting against a collar it became fast upon the sleeve, and the starter then cranked the engine, the shock being relieved by the coiled spring. As soon as the engine began to pick up its cycle the flywheel ran ahead of the driving pinion, and the latter was automatically thrown out of mesh by being forced along the screw. Fig. 7, illustrating the Fiat motor-car engine, shows one method of mounting the generator and starter. A necessary part of practically all motor-car electric equipments was a battery cut-out, which automatically disconnected the battery from the generator when the engine speed dropped so low that the generator voltage was less than the battery voltage, and connected it on increasing engine speed when the generator voltage surpassed the battery voltage. Ground return wiring was very much used, all electric appliances having one insulated and one grounded connection. The standard voltage for motor-car electric systems in the United States was six volts, while in Europe a pressure of 12 volts was much used.

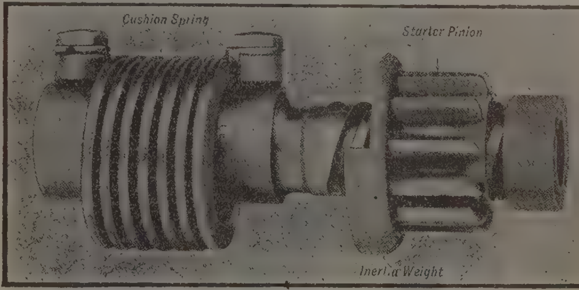

FIG. 6.—Bendix drive for electric starters.

Unit-power-plant construction, that is, the combination of the engine, clutch and change-speed gear in a single unit, became very popular, and in the United States was the almost universal practice for passenger cars. A new type of clutch, the dry-disk, largely replaced the multiple-disk-in-oil type and also partly the cone clutch (fig. 8). It was very similar to the lubricated type of disk clutch in construction, but one set of the metal disks was faced with disks of asbestos fabric on both sides. Its advantage over the lubricated disk clutch was that its operation was not affected by changes in atmospheric temperature, as was that of the latter. There were no important developments in the design of gearsets or transmissions; nearly all manufacturers of passenger cars used the selective sliding pinion type, and this type was also on most commercial vehicles.

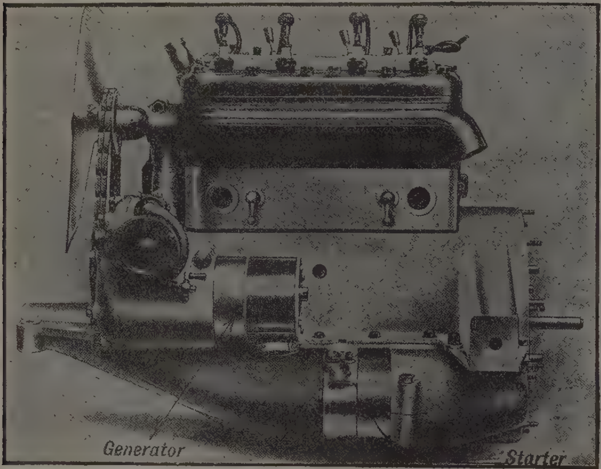

Fig. 7.—Fiat (Italian) engine, showing method of mounting electric generator and starter.

Chain drive was almost entirely discarded, except on trucks in continental Europe, and shaft and bevel-gear drive became the standard for passenger motor-cars throughout the world. But two important improvements were made in this drive. One was the substitution of spiral bevel for straight bevel gears, to secure quiet operation, and the other the partial substitution of disk universal joints for the metallic type, the former requiring no lubrication. The spiral bevel gear (fig. 9) was made possible by a gear-cutting machine developed by the Gleason Works of Rochester, N.Y., and the fabric disk universal joint (fig. 10) by a fabric structure originated by Ed. J. Hardy & Co. of Coventry, England. Practice in regard to final drives for motor lorries remained in a chaotic state in 1920. In continental Europe the chain drive was still predominant, while in Great Britain and the United States the worm drive was in most extensive use. Of the lorry models manufactured in Great Britain in 1920 roughly 50% had worm drive, 25% chain drive and 25% the double-reduction drive, or drive by one pair of bevel and one pair of spur gears enclosed at the middle of the axle. In the United States the most popular drive next to the worm was the internal gear drive, in which there was a first reduction by bevel gears at the middle of the axle and a second by internal gears at the driving wheels.

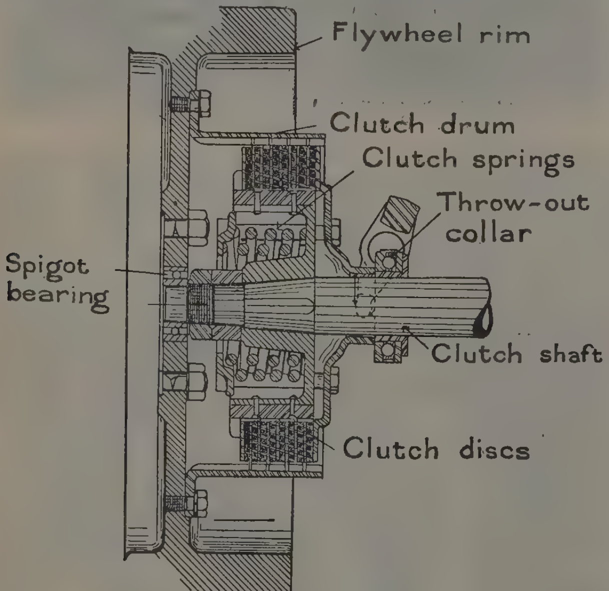

Fig. 8.—Sectional view of dry-disk clutch.

In connexion with lorry axles mention should be made of the development and use, mainly in the United States, of so-called non-stalling differential gears. A vehicle fitted with this type of differential would not lose all traction when one driving wheel gets on slippery ground; on the other hand, in turning corners the drive was entirely through the inner wheel. A type of body suspension spring that gained much in popularity between 1910 and 1920 was the cantilever type first used by F. W. Lanchester in England. The most extensively used type in 1920 was the half-elliptic. Many attempts were made to solve the problem of furnishing the springs with effective means of lubrication, to make them as supple as possible and to prevent squeaking, and in England the practice of enclosing the springs in leather gaiters gained some ground. In the connexion between the rear axle and the frame provision must be made for taking up the driving thrust necessary to overcome the air resistance and the resistance encountered by the front wheels, as well as the reaction to the rear-wheel driving torque, which tends to turn the axle housing in the direction opposite to that in which the wheels are turning. In one construction, known as the Hotchkiss drive, both the drive and the torque reaction were taken up on the body springs, which were securely clipped to the axle housing and directly pinned to the frame at their forward end. This construction became very popular in the United States for both passenger cars and lorries, and was successfully used even on the heavy military lorries. European designers, on the other hand, favoured the torque-tube construction for passenger cars. In this the propeller shaft was surrounded by a torque tube which was rigidly secured to the housing at the centre of the rear axle, and at its forward end had either a forked or a spherical connexion to a cross member of the frame or the rear end of the transmission case. In the United States one manufacturer after another adopted the plan of mounting the steering post on the left side, realizing that in a country where the "right-hand" rule of the road obtains the balance of advantages rests with the left-hand drive. Left-hand steering fits in well with brake and gear-shift levers mounted in the centre of the car, as the driver can use his right hand to operate them. In Great Britain, where the rule of the road is to "keep to the left," right-hand steering has the same advantages as left-hand steering in other countries.

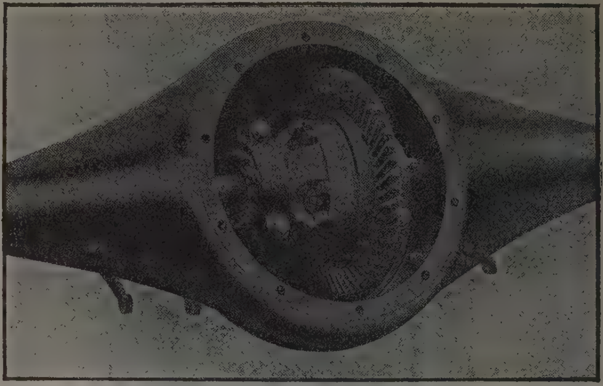

Fig. 9.—Central part of a rear axle with inspection cover removed, showing spiral bevel gear.

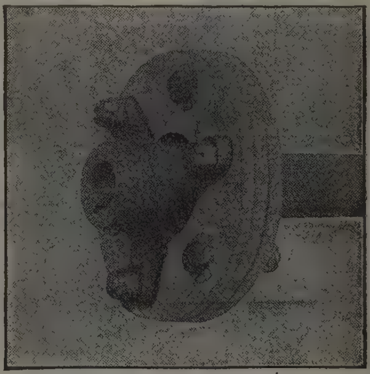

Fig. 10.—Thermoid-Hardy fabric universal joint.

Great improvements were made in hoods and wind-screens. Hoods of 1920 cars could readily be raised and lowered by a single person. The forward end of the hood usually joined up to the wind-screen supports, and by means of easily folded side curtains with transparent celluloid inserts, an open car could quickly be enclosed. Wind-screens were usually in two parts and permitted various adjustments. By setting the lower edge of the upper part slightly forward the driver obtained a view of the road ahead through the opening between the two parts. This was a valuable feature for driving in rain, when the screen was often covered by dew which interfered with vision through it. It was known as the rain-vision effect. In Germany it became customary to provide a compartment in the body into which the hood disappeared when folded. Elsewhere a boot or cover of some rainproof material was drawn over the hood when it was folded. In the early two-part wind-screens both glasses were completely surrounded by the frames, and the frame members at the middle of the screen interfered to a certain extent with the view ahead. This objectionable feature was eliminated by confining the frame to three sides of the glass. Windscreens of this type were known as clear-vision. Extra wind-screens ahead of the rear seat were sometimes fitted.

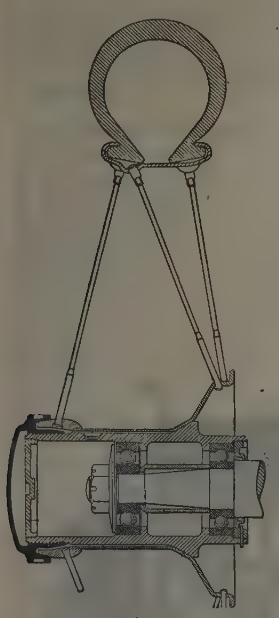
FIG. 11.—Section of Rudge-Whitworth demountable wire wheel with Pugh triple lacing.

The wheel equipment of the earlier cars was almost entirely of the wood-spoked type. Woods suitable for rims and felloes became rare, however, especially in Europe, and a strong tendency toward the use of metal wheels then set in. In fact, with one or two exceptions, all British manufacturers of passenger cars fitted metal wheels as regular equipment on their 1920 models. There were three types of metal wheels for passenger cars, viz. wheels similar in shape to wood-spoked wheels, made of two steel pressings welded together (chiefly used in England), wire-spoked wheels and disk wheels (figs. 11, 12, and 13). An improvement in wire-wheel design, which was a great factor in rendering these wheels practical for heavy, powerful vehicles, was the triple lacing due to John V. Pugh of England. Disk wheels came into extensive use during the war; they may be divided into single and double disk types. To secure the necessary lateral stiffness with a single disk it was customary to cone the disk, and, moreover, the disk was usually reduced in thickness from the hub toward the rim, either by turning in the lathe or by rolling. All motor vehicle wheels are provided with steel rims designed to take the pneumatic or solid rubber tires. The original type of motor vehicle rim for the double-tube pneumatic tire was the clincher rim, the edges of which are formed into clinchers to hold the beaded edges of the tire cover. This type of rim remained the standard in Europe, but American manufacturers early adopted the detachable rim, which permits of the use of a steel cable core in the edges of the tire cover to make it inextensible. In the earlier detachable rims one flange of the rim was removable, and the tire could be stripped off sideways after the flange had been detached. Some of these detachable flange rims could be used with both clincher and straight-sided tires, and were therefore known as universal rims. Later, when the clincher tire was given up by American manufacturers for all except the smallest sizes, a different type of detachable rim was introduced, in which there is a joint in the circumference of the rim. After opening the locking mechanism of this joint the rim can be contracted sufficiently to pass through the tire. In order that detachable rims may always be free-working the rims must be thoroughly rust-proofed, and care must be taken in handling the rim not to distort it.

In the early years of the motor-car, when a tire was punctured or otherwise defective, the operator was obliged to make a repair on the spot, or at least remove the tire cover, insert a new tube, replace the cover and inflate the tire anew. This was always an unpleasant interruption of a pleasure drive and a most aggravating occurrence in the case of an urgent business trip. The difficulty was overcome by the adoption of the demountable wheel in Europe and the demountable rim in America. American motorists thereafter carried one or two spare rims fitted with fully inflated tires, and in case of a puncture merely removed the rim with the defective tire and replaced it with a spare rim and inflated tire, an operation usually requiring from 10 to 15 minutes, leaving the repair of the damaged tire to be done at home or at a tire service station. European motorists carry spare wheels with inflated tires in the same way. The advantage of the demountable rim over the demountable wheel is that the spares weigh less; the advantage of the demountable wheel is that it weighs less than a wheel with a demountable rim, and especially that with it there is less weight near the circumference of the wheel, where it has a strong flywheel action. Moreover, with the detachable wheel the detaching mechanism is at the hub, farther removed from rust-promoting influences.

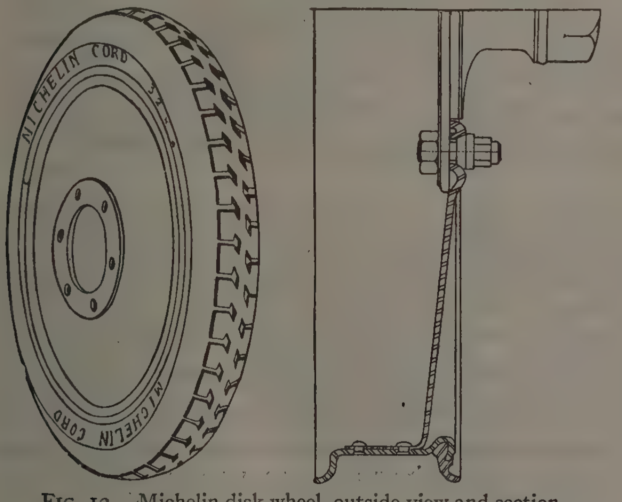

FIG. 12.—Michelin disk wheel, outside view and section.

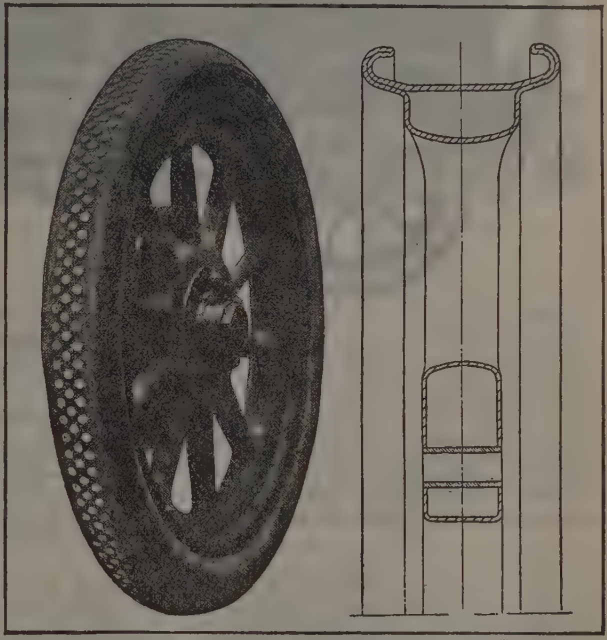
FIG. 13.—Sankey pressed steel wheel, and section.

The structure of demountable rims may be briefly described as follows: forced over the felloe of the wood wheel is a steel felloe band with a wedge surface on its outside, and an inward flange on one edge through which and the wood felloe pass the felloe band bolts. Over this felloe band is passed the rim carrying the tire, which is formed with a wedge surface on its inside, adapted to engage the wedge surface on the felloe band. Rim lugs with wedge-shaped projections are threaded over the ends of the felloe band bolts, and the nuts on the bolts are then screwed up, forcing the wedges into the space between the felloe band and the rim. In this way the rim is subjected to both radial and lateral pressure and is centred and firmly held on the felloe band. Both clincher and detachable rims can be used in connexion with demountable rims.

Solid rubber tires are vulcanized on to the steel base bands, and wood wheels to be fitted with such tires have a steel felloe band shrunk over them. The tires are then mounted on the wheels in a demountable way by means of wedge rings, side flanges and bolts. Cast-steel wheels generally have one wedge ring cast integral and do not need a side flange on that side.

There is one notable difference in the commercial practices of American and European motor-car manufacturers. In the United States it is customary to sell cars complete with bodies and all necessary equipment, so that upon being filled with fuel and water they can immediately take the road. The equipment usually includes such items as wind-screen, lamps, speedometer, jack, tire pump and tools. European manufacturers, on the other hand, previous to the World War, often made it a practice to sell only the bare chassis and let the customer arrange for the body with a coach-builder and select the equipment himself. After the war they showed an inclination to follow the American practice, especially with low-priced cars.

Many of the cars produced in the United States were made on what is known as the assembling plan; that is, the various major components, such as engine, clutch, gearset, axles, frame, springs and steering gear, were all manufactured in different factories by concerns specializing in these products, and were assembled into a complete car in the assembling plant. The advantages of this plan are obvious and include the possibility of intensive development of design and the economy of quantity production. The extent to which assembling was practised may be judged from the following figures: Of the American passenger-car models for 1920 92 % were fitted with stock carburetters, 75 % with stock steering gears, 66·7 % with stock clutches, 65·1 % with stock rear axles, 58·7 % with stock transmissions and 42 % with stock engines, all these stock parts being made by specialists. In the field of commercial vehicles the practice of assembling was even more prevalent.

Closed cars are favoured in countries with severe climate, and in the United States 161,000 such cars were manufactured in 1919. The most popular type among American motorists was the sedan, which seated four or more persons all in one compartment. It was therefore an owner-driver's car. The smallest type of closed car was the coupé, which has seating accommodation for two or three inside, including the driver, though sometimes a fourth seat facing backward was added. Closed cars for operation by a professional driver (chauffeur) were generally either of the town-car or limousine types; both of these seat from three to five persons inside, the difference being that the limousine has the driver's seat enclosed while on the town car it is open. Typical 1920 American designs of closed cars are shown in figs. 15–18.

An intermediate type between the motor-cycle and the full-sized car, referred to as a cycle car, had considerable vogue in Europe. It had a smaller wheel tread than the standard 56 in.; the engine in most cases was a two-cylinder of less than 100 cub. in. displacement; and the two passengers often sat tandem fashion. These cars were of the simplest design and were low in price and upkeep cost.

Motor-trucks must be equipped with engines able to take them fully loaded up the steepest grades which occur on regularly travelled highways. When operated in comparatively level districts they always have a surplus of power, and it was found advantageous under such conditions to use one or two trailers with the truck (fig. 19, Pl.). The advantage is greatest where the merchandise to be transported is very bulky. This plan results in considerable economy, as from two to three times as much load can be carried on one trip as with the truck alone, with little extra expense. In continental Europe there was usually a helper on each trailer to look after the load and apply the brakes, but the use of helpers greatly reduces the gain in economy, especially where wages are high, and in the United States it was not usual to employ an extra man. It was realized that, in order to make it possible to stop in an emergency the trailers as well as the truck must be braked; but the problem of braking the trailers from the truck had not been definitely solved at the close of 1920, although at least one system of air brakes and one system of automatic mechanical brakes applied through the drawbar had been worked out. Another combination for heavy merchandise transportation consisted of a road tractor, which was merely a foreshortened truck chassis, and a semi-trailer (fig. 20, Pl.). This semi-trailer was a two-wheeled construction, the forward end of which was supported on the tractor frame by means of a swivelling fifth wheel. This end of the semi-trailer could be supported by means of jacks while loading and unloading, and the tractor did not need to stand idle while these operations were going on. A particular form of semi-trailer was the pole trailer (fig. 21, Pl.),—the length of which could be varied,—used mainly for transporting lumber, pipes, steel sections, etc.

Commercial Development.—Throughout the first decade of the century motor-car manufacturers in the United States either paid royalties under an alleged basic patent or else were compelled to defend themselves against charges of infringement. This patent (U.S. Patent No. 549,160 of Nov. 5 1895, issued to George B. Selden of Rochester, N.Y.; b. 1845; d. there Jan. 17, 1922) was sustained in the court of original jurisdiction in Sept. 1909, in an action against the Ford Motor Co., which had been pending since Oct. 1903. Many manufacturers had been induced to recognize the patent previous to the decision, and these constituted the membership of the Association of Licensed Automobile Manufacturers (A. L. A. M.),

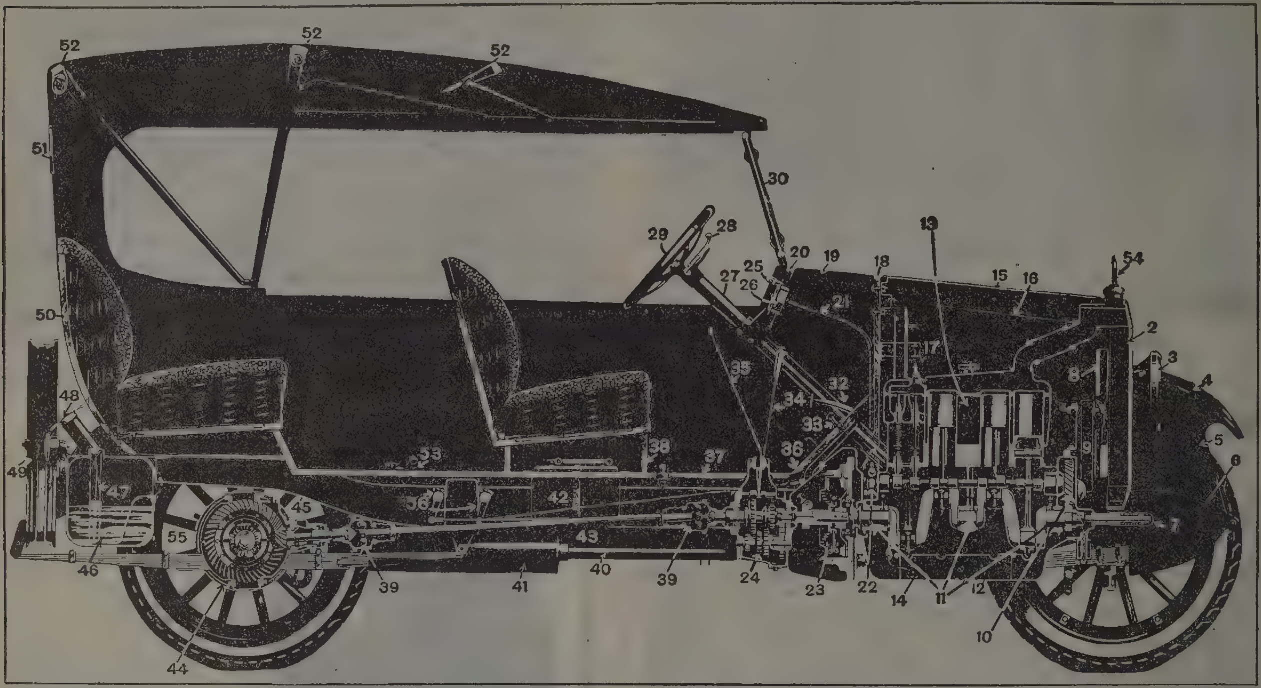

FIG. 14.—Central longitudinal section of typical American four-cylinder passenger car of 1920 (Allen). (1)—Engine cylinder head; (2)—Radiator; (3)—Headlight; (4)—Mud-guard; (5)—Filler plate; (6)—Splash plate; (7)—Engine starting shaft; (8)—Fan; (9)—Fan belt; (10)—Camshaft gear; (11)—Crankshaft main bearings; (12)—Oil pan; (13)—Engine water jacket; (14)—Camshaft; (15)—Hood; (16)—Radiator stay-rod; (17)—Vacuum tank; (18)—Dashboard; (19)—Cowl; (20)—Instrument board; (21)—Speedometer drive; (22)—Oil circulating pump; (23)—Friction clutch; (24)—Change-speed gear; (25)—Dash lamp; (26)—Speedometer; (27)—Steering post; (28)—Spark and throttle levers; (29)—Steering wheel; (30)—Wind-screen; (31)—Steering-post bracket; (32)—Brake pedal (on left of steering post), Clutch pedal (on right of steering post); (33)—Accelerator pedal; (34)—Emergency brake lever; (35)—Gear lever; (36)—Toe-board; (37)—Foot-board; (38)—Knee-board; (39)—Universal joints; (40)—Exhaust pipe; (41)—Silencer; (42)—Storage battery; (43)—Propeller shaft; (44)—Spiral bevel crown gear; (45)—Frame; (46)—Fuel tank; (47)—Fuel tank gauge; (48)—Fuel tank filler; (49)—Spare rim; (50)—Body; (51)—Rear window; (52)—Hood bows; (53)—Foot-rail; (54)—Radiator thermometer; (55)—Brake; (56)—Brake equalizer shafts.

which at one time comprised 90% of the industry. But during the last few years of the litigation many new firms started in business without taking out a Selden licence, and some members of the A.L.A.M. either ceased or delayed paying their royalties. The decision greatly strengthened the position of the A.L.A.M., and the organization of the unlicensed manufacturers, the American Motor Car Manufacturers Assn., dissolved. The Ford Motor Co., however, appealed against the decision of the lower court, and in Sept. 1911 the U.S. Circuit Court of Appeals, Second Circuit, reversed the decision. The patent was held valid but not infringed, as Selden's engine was a two-stroke, constant pressure or Brayton cycle engine, whereas the engine used by the defendant (and by practically every other motor-car manufacturer) was a four-stroke, constant volume or Otto cycle engine. The judges in their opinion said:—

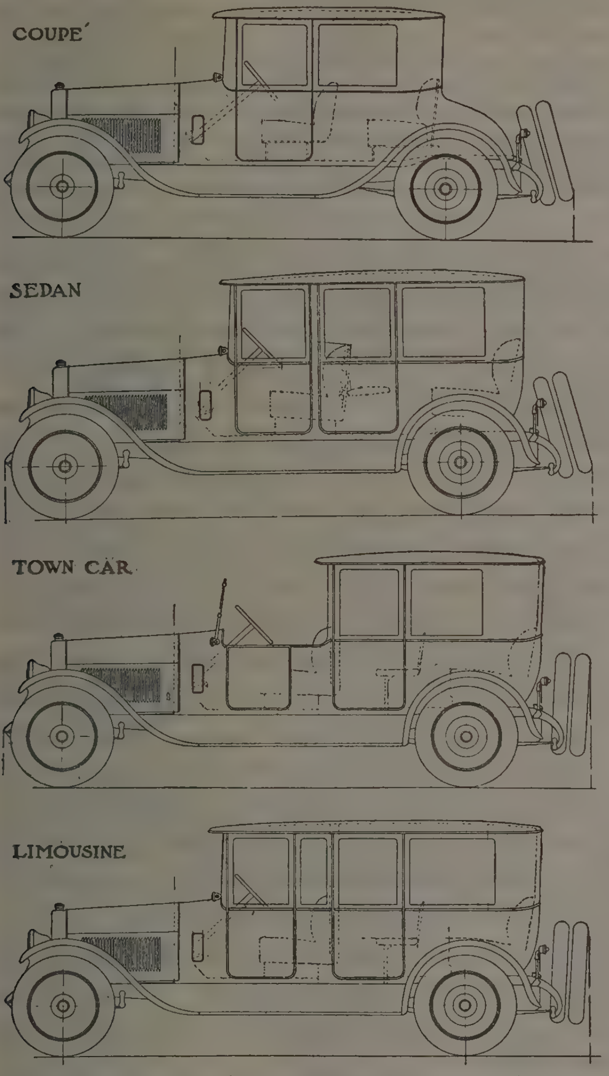

FIGS. 15 to 18.—American 1920 closed-car designs (Lincoln).

"He (Selden) undoubtedly appreciated the possibility of the motor vehicle at a time when his ideas were regarded as chimerical. Had he been able to see far enough he might have taken out a patent as far-reaching as the Circuit Court held this one was. But like many another inventor, while he had a conception of the object to be accomplished, he went in the wrong direction. The Brayton engine was the leading engine of the time, and his attention was naturally drawn to its supposed advantages. He chose that type. In the light of events we can see that had he appreciated the superiority of the Otto engine and adopted that type for his combination his patent would cover the modern automobile. He made a wrong choice, and we cannot, by placing any forced construction upon the patent or by straining the doctrine of equivalents, make another choice for him at the expense of these defendants, who neither legally nor morally owe him anything."

This decision came little more than a year before the expiration of the patent, and no further effort to uphold it was made. Its name having become a misnomer, the A.L.A.M. reorganized as the National Automobile Chamber of Commerce, which came to be regarded as representative of the entire automobile industry, though the Ford Motor Co. never joined it. All of the national motor-car shows in the United States from that time till 1921 were held under its auspices, and it looked after the interests of the industry also in other ways, particularly through its legal, traffic and patent departments. Similar organizations in other countries are:—

Great Britain.—Society of Motor Manufacturers and Traders.
France.—Chambre Syndicale de l'Automobile et des Industries qui s'y rattachent.
Belgium.—Chambre Syndicale de l'Automobile.
Germany.—Verein deutscher Motorfahrzeug-Industrieller.

Racing.—During the years immediately preceding the World War France had the greatest export business in motor-cars, built up by consistent technical development and skilful sales propaganda, chiefly in the form of road-racing. A series of international races held during the first decade of the century, known as the Gordon Bennett Cup Races, came to an end because the French objected to the stipulation in the Deed of Gift of the cup that in the race each country should be represented by a team of three cars, which gave a country with a small industry practically the same chance of winning as a country with a large industry. In 1911 began a new series of races for the *Grand Prix* of the Automobile Club of France in which each manufacturer was allowed to enter up to three cars, and there was no limit to the number of manufacturers of any one nation. In fact, the race was not on the basis of national team against national team, but on that of manufacturer against manufacturer. This race was held four years in succession (1911–4) and was revived in 1921. Owing to the continued improvement in engines and the increased speeds made possible thereby, it was repeatedly necessary to reduce the limit on the piston displacement of competing cars. Originally the displacement was limited to that of a four-cylinder engine of 110-mm. bore and 200-mm. stroke (7·6 litres), but in 1921 the limit was 3 litres.

In England and Scotland racing on the public roads was prohibited, and the only road races in the British Isles were held in the Isle of Man. In the United States a number of important races were held in the East during the early years of the automobile movement, but owing to frequent fatalities a strong public sentiment grew up against them, and race promoters were compelled to shift the scene of their activities first to the South and then to the Middle West and the Far West. Between 1910 and 1914 a number of racing-tracks with high banking, most of them $2\frac{1}{2}$ m. in circumference, were built in the United States after the model of the Brooklands track in England. The first and most successful of these was the Indianapolis Speedway. It was at first attempted to hold races on these tracks at frequent intervals, but they soon began to pall on the public. Later the plan of a single annual race was adopted, European contestants were secured and large cash prizes were offered to the winners, and from that time the Indianapolis races always had an enormous attendance. It is worthy of note, however, that practically none of the large manufacturers of America entered cars in the races held in 1919 and 1920. In earlier years competition in races was regarded as a form of sales propaganda and the expenses were charged to advertising, but the public gradually came to realize that to win a race at close to 100 m.p.h. required an entirely different car from that needed by the average family, and that it would not be safe to base conclusions regarding the quality of a company's stock cars on the performance of its special racing machines. Track-racing then became a form of entertainment, expenses being met out of gate-money.

Shows.—An important influence on the rapid development of the motor-vehicle industry must be ascribed to the motor-car shows held annually (except for interruptions due to the World War) in such centres as Paris, London, Brussels, New York and Chicago, under the auspices and control of the motor-car manufacturers' associations of the respective countries. The Paris show, the oldest and for a long time the largest as regards number of exhibitors, was resumed after the war, in 1919. But in 1920 the show was suspended, because at the time when preparations would have been made trade conditions seemed to make it unnecessary. London shows were held at Olympia, and in 1920 there was an overflow exhibition at the White City. Owing to the fact that Great Britain was one of the greatest markets for motor-cars, importing more cars than any other country in Europe, the Olympia show always had a strong international flavour. There was a special show for commercial cars at Olympia in 1920, shortly before the passenger-car show. In the United States also truck shows had been held separately for several years. National motor-car manufacturers' associations previous to the World War had an international federation with headquarters in Paris. One of the activities of the federation was to allocate dates for national shows to all countries represented, so as to prevent conflict, which would have been annoying to manufacturers wishing to exhibit at several shows. The federation also endeavoured to restrict the organization of shows, to exercise a certain control over races and to influence legislation. In 1920 the original international federation was dissolved and a new allied federation took its place.

Standardization.—A great help to the motor-car industry in the United States was the standardization work of the Society of Automotive Engineers, concurrent with specialization in the manufacture of parts. One of the first things standardized was fine-pitch screw threads. It was found that the former standard threads, such as the U.S.S., Whitworth, etc., were too coarse for motor-car work, and manufacturers began devising their own fine-thread standards; if this had continued it would have led to the use of many different pitches for screws of the same diameter, which would have been most annoying to the user. In order to obviate this the S.A.E. screw thread was evolved, and soon came into common use. A great deal of the standardization work was concerned with the joints or connexions between parts made in different factories. Thus the mountings on the engine, of carburetters, battery ignition units, magnetos, electric generators, starters and tire pumps were standardized, as were flywheel housings, shaft fittings, spring mountings, etc. At the end of 1920 there were about 180 separate motor-car standards on the records of the S.A.E. Great Britain had a similar technical society, the Institution of Automobile Engineers, but motor-car standardization work was carried on by a sub-committee of the British Engineering Standards Committee, on which both the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders were represented. There was also a technical society in Germany, the Automobil und Flugtechnische Gesellschaft, but it had not been active. During the World War engineering standardization work was begun in Germany by a general organization covering the whole engineering trade, and after the war motor-car standardization was continued by the Verein deutscher Motorfahrzeug-Industrieller.

Taxation.—In nearly all countries motor vehicles were subject to an annual road tax based upon the rated horse-power of the engine. Great Britain did not impose such a tax until Jan. 1 1921. The rate of tax was then £1 per horse-power, determined by the following equation:—

$$\text{H.P.} = \frac{\text{N}b^2}{2{\cdot}5}$$

where N is the number of cylinders and b the bore in inches. The same formula, known in Great Britain as the Royal Automobile Club formula, was used in most states of the United States, where it was known as the A.L.A.M. formula. Japan used a very similar formula, the denominator of the fraction being 3 instead of 2·5. Widely different formulas were in use in different countries for determining the tax horse-power. Some, like those above cited, made the horse-power proportional to the cylinder bore, others to the piston displacement volume, and still others to this volume and the normal speed of revolution. Let C be a constant, b the cylinder bore, l the piston stroke, N the number of cylinders, and r the normal engine speed—then the various horse-power formulas used in 1920 may be written as follows:—

For Belgium: $\text{H.P.} = \text{C}.b^2.l.\text{N}.r$ (where C varies between 3 and 3·5 for motor-cycles and between 4·5 and 5 for motor-cars, and b and l are in metres. It was customary to make $\text{C} = 3$ and $r = 1{,}000$ for motor-cycles and $\text{C} = 4{\cdot}5$ and $r = 1{,}000$ for motor-cars).

In France the formula reads the same as that for Belgium; C is equal to 0·0002 for single-cylinder engines, 0·00017 for two-cylinder, 0·00015 for four-cylinder, and 0·00013 for multi-cylinder. b is inserted in centimetres, l in metres, and r in revolutions per second.

In Germany: $\text{H.P.} = 0{\cdot}3\text{N}.b^2.l$ (b being in centimetres and l in metres). Holland, Denmark, Switzerland and Russia used the same formula.

In Italy: $\text{H.P.} = 0{\cdot}0525\text{N}.b^2$ for passenger vehicles and $\text{H.P.} = 0{\cdot}0350\ \text{N}.b^2$ for commercial vehicles (b being in centimetres).

Ford Cars.—A unique position in the American motor-car industry has been occupied by the Ford Motor Co., whose annual production for several years constituted about one-half that of the whole industry. This company in 1909 succeeded in developing a passenger car which it was able to sell for the next 11 years without material modifications in design except as regards the body and equipment. This stability of design made possible production on an unequalled scale and at remarkably low cost. At one time during the World War period this car sold in the United States as low as $325 for the two-seater and $360 for the five-seater. In 1917 the company began to produce also a light truck, and in 1920 the production of passenger cars and trucks combined exceeded 1,000,000 vehicles.

German Lorries.—Motor-lorry services under public ownership were developed in Germany after the Armistice of Nov. 1918 from an emergency service previously established by the War Department. Toward the end of 1916 the German Government, facing a transportation crisis at home, was compelled to withdraw a large number of motor lorries from the front in order to relieve the congestion at freight depôts and to carry agricultural produce to the great centres of population. This service was gradually extended, and during the last full month of the war, Oct. 1918, the lorries in the home service moved 302,000 tons of freight and covered an aggregate distance of 922,000 m., of which 525,000 m. was with load. The useful work done amounted to 1,960,000 ton-miles and the fuel consumed to 260,000 imp. gallons. After the Armistice 16 limited liability corporations (*Kraftverkehrsgesellschaften*) were organized, and operating territories were assigned to each so that the whole country was covered. The National Government furnished the vehicles and received in return shares of stock and certificates of indebtedness. Most of the capital stock of the companies was subscribed by the local governments of the districts served. According to a report made in 1920 these companies then operated 98 services with a rolling-stock consisting of 2,871 motor lorries, 37 tractors, 1,079 trailers, 187 passenger cars, 126 motor-cycles and 150 motor-buses. The personnel numbered 3,000. The interests of the national Government in these companies were looked after by the Treasury Department. Lorries and other vehicles with drivers (and helpers if necessary) were furnished either on a direct ton-mile basis or by the day, in the latter case there being a limit on both the time and the distance covered, with extra rates if either limit was exceeded. Similar services for passengers and mails were established in Germany by the Post-Office Department. In 1920 this department established 100 new mail lines in country districts with an initial equipment of 260 vehicles; it also added between 400 and 500 vehicles to the equipment for carrying mails in the cities.

Motor Omnibuses.—The largest motor-omnibus service in the world in 1920 was that of the London General Omnibus Co., which then had more than 2,500 buses in operation. This company shortly after the World War introduced a new "K" type of double-deck omnibus with seating capacity for 46 passengers (22 below and 24 on top), which weighed no more than the 34-passenger buses in service up to that time (see fig. 26, Pl.). Of the passengers carried on the lower deck six occupied a longitudinal seat while all the rest faced forward. The chassis frame and the framework of the body of this new omnibus were made of ash bars reënforced with steel flitch plates. Practically all the panels of the body consisted of three-ply birch; the main floor was of the same material and had wearing slats secured to it, while the roof consisted of two thicknesses of this three-ply with a layer of waterproof duck between. Fully equipped for service this motor omnibus weighed 7,600 lb., of which 2,350 lb. was body weight. The engine had four cylinders of 100-mm. bore and 140-mm. stroke, which were cast in pairs; it developed 30 H.P. at 1,050 r.p.m. The wheelbase was 170¼ in.; the large passenger capacity for this wheelbase was made possible by placing the driver's seat alongside the engine. On July 1 1920 there were 80 of these buses in service.

War Developments.—During the World War the motor-car industries of all the belligerent countries greatly increased their productive capacities, because they possessed the personnel and the equipment necessary for turning out many essentials of warfare, such as vehicles of all kinds, aero-motors and munitions. Thus the capitalization of the German motor industry increased about 180% between 1914 and 1919. Twenty German motor-car manufacturing concerns during this period issued additional stock to the amount of 176,350,000 marks, and bond issues and the capitalization of newly organized companies brought the capital increase up to 214,950,000 marks. There was a similar increase in the capitalization of the British motor-car industry, but most of the new issues of stock in Great Britain occurred after the Armistice, while in Germany the greatest accession of new capital took place during the war period.

During the early part of the World War the American motor industry furnished large numbers of motor lorries to the British, French and Russian Governments, and this was reflected by the export returns, which showed an increase in the number of trucks exported from 784 in 1914 to 21,265 in 1916. At the same time the foreign demand for American passenger cars increased greatly, because the belligerent European countries could not make deliveries. In 1918, when the United States threw its full strength into the war, motor-car exports suffered a material decline, but they jumped ahead again immediately after the Armistice, an increase of 79% being shown in 1919. That year the exports of passenger cars, lorries and parts together exceeded $100,000,000 in value, yet the passenger cars exported were hardly 4% of the total production, while the exports of commercial vehicles amounted to 4·9 per cent.

After the war the tide of international motor-car commerce showed great fluctuations. As soon as shipping connexions became reëstablished there was a heavy demand, particularly in the neutral countries of northern Europe. In 1919 only the United States was in a position to export large numbers of vehicles, because it took the motor-car industries of the European belligerents a long time to get back to a peace basis. After a short time, however, the low rates of continental exchange and temporary embargoes on motor-car imports in several countries, including Great Britain, France, Germany, Italy, Denmark and Norway, cut down the exports from the United States. Even when the embargoes were lifted imports were restricted by high customs duties, as, for instance, 70% in the case of France.

Electric Cars.—There was little progress in electric vehicles during the decade 1910–20. The electric is essentially a town car, and during the first half of the decade a good many electric passenger vehicles were in use, especially in four of the larger cities of the United States: Buffalo, Cleveland, Chicago and Los Angeles, all of which are comparatively level and have fine boulevard systems. The electric appealed particularly to lady drivers, because it dispensed with the cranking of the petrol car and was generally simpler and less troublesome to operate. With the advent of the electric motor starter this disadvantage of the petrol car largely disappeared. The introduction of demountable rims and power tire pumps further reduced the hard work in connexion with the operation of petrol cars as compared with solid-tired electric vehicles. The electric then became more and more a luxury vehicle, built only in expensive closed-body types and used mainly for town driving by people who owned a petrol car for country driving in addition. The electric commercial vehicle industry also was more or less stationary while the petrol commercial industry forged ahead rapidly. In 1920 the electric lorries in service in New York City formed a small portion of all the commercial vehicles, which was not the case in 1910. A new type of electric commercial vehicle, known in the United States as an industrial truck, but perhaps better described as a floor truck or a low wheel truck, came into extensive use, especially during the war period. These industrial trucks take the place of hand trucks on steamship piers and railway station platforms, in factory buildings and paved yards. Petrol industrial trucks have also been developed, but as they are not admitted to steamship piers on account of the fire hazards the electric has an undisputed field there. There was great inducement in Europe during the war, when petrol was exceedingly scarce, to develop the electric vehicle for both passenger and commercial traffic. In Germany a scheme was worked out for a system of goods transport in large cities by electric lorries with interchangeable batteries, and a few sample trucks were built, but the Armistice intervened and the scheme was dropped. The steam vehicle also retrogressed as a factor in transportation. In 1920 there was only a single concern in all the world making steam-propelled passenger cars in any considerable numbers, the Stanley Motor Carriage Co. of Newton, Mass., which was one of the pioneers in this line of industry. Considerable numbers of steam lorries were still being manufactured in England, but the steam motor-buses at one time in service in London had been taken off the streets. The petrol motor had definitely gained the ascendency over steam and electric motors, and supplies for it could be found and repairs to it had in almost every town. In the United States, for instance, there were, at the beginning of 1920, 43,643 repair shops (besides 36,227 garages), and all of these repair shops were equipped to cater to owners of petrol cars, but only a few to owners of steam and electric vehicles, giving a tremendous advantage to the former.

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TABLE III.—*Statistics of the Development of the American Industry.*

	1909*	1914*	1919†
Capital invested	$173,837,000	$407,730,000	$1,802,302,862
Cars and lorries produced	127,731	569,045	1,974,016
Value of products	$249,202,000	$632,831,000	$2,506,834,594
Persons engaged in mfg.	85,359	145,951	651,450
Wages and salaries	$ 58,173,000	$139,453,000	$ 813,731,856

*From U.S. Census. †Based on statistics of complete car production gathered by National Automobile Chamber of Commerce and on the assumption that the parts and accessories business grew in same proportion.

TABLE IV.—*Statistics of the American Industry for 1919.**

Capital invested in passenger-car industry	$784,660,761
Number of passenger-car factories	131
Number of open cars produced	1,496,652
Number of closed cars produced	161,000
Total number of passenger cars produced	1,657,652
Value of complete cars and lorries produced	$1,885,112,546
Value of passenger cars produced	$1,461,785,925
Value of passenger-car parts and accessories	$621,722,048
Value of motor lorries produced	$423,326,621
Value of repair parts produced	$117,000,000
Number of motor-lorry factories	268
Capital invested in motor-lorry factories	$230,782,577
Number of employees in lorry factories	68,180
Number of lorries produced	316,364
Total number of passenger cars and lorries produced	1,974,016

*From *Facts and Figures of the Automobile Industry*, published by the National Automobile Chamber of Commerce.

TABLE V.—*United States Motor-car Exports (including passenger cars, lorries and parts except motor-car engines and tires).*

Exported to	1910	1914	1919
Austria-Hungary	$ 28,689	$ 202,852	..
Belgium	157,366	160,659	$ 364,004
France	825,904	1,103,481	22,243,042
Germany	275,241	1,272,600	..
Great Britain	2,656,214	7,159,074	9,760,430
Italy	337,614	293,275	215,417
Norway	23,353	124,083	2,102,757
Russia	114,314	917,859	8,292
Spain	21,184	71,024	1,426,650
Sweden	58,936	260,228	689,998
Canada	4,363,694	9,583,655	22,062,779
Argentina	196,827	1,121,474	4,492,522
Brazil	75,489	370,043	1,033,831
Chile	2,487	192,342	2,606,047
British India	28,759	439,968	543,393
Dutch E. Indies	26,345	238,322	4,498,397
Japan	30,134	137,522	6,416,928
Australia	289,807	855,637	5,358,336
New Zealand	60,386	1,089,951	2,589,166
British S. Africa	75,840	1,506,668	2,568,790
Other countries	1,541,637	6,198,089	24,715,879
Totals	$11,190,220	$33,298,806	$113,696,658

TABLE VI.—*United States Motor-car Imports.*

Imported from	1910	1914	1919
Belgium	$ 29,087	$ 144,693	..
France	1,467,646	814,392	..
Germany	368,219	261,168	..
Italy	587,052	205,931	..
Switzerland	60,554	3,103	..
Great Britain	236,015	218,932	$ 7,650
Canada	69,737	32,815	28,731
Other countries	33,136	78,346	260
Totals	$2,851,446	$1,759,380	$36,641

TABLE VII.—*British Motor Vehicle Imports.*

	1910 £	1915 £	1920 £
Cars	1,440,586	3,128,229	10,490,012
Chassis	1,670,969	1,135,146	4,254,949
Parts*	2,023,273	2,183,184	8,713,684
Totals	5,134,828	6,446,559	23,458,645

*Exclusive of tires.

TABLE VIII.—*British Motor Vehicle Exports.*

	1910	1915	1920
	£	£	£
Cars	1,380,190	1,129,717	3,929,455
Chassis	213,378	186,691	2,474,877
Parts*	1,012,835	557,869	1,986,410
Totals	2,606,403	1,874,277	8,390,742

*Exclusive of tires.

TABLE IX.—*French Motor-car Exports (value in francs).*

	1910	1913	1920
Great Britain	65,521,000	55,871,000	265,599,000
Germany	12,734,000	21,029,000	10,361,000
Belgium	30,053,000	41,732,000	217,361,000
United States	4,346,000	3,246,000	15,705,000
Argentina	9,290,000	17,565,000	17,313,000
Italy	5,092,000	5,949,000	22,649,000
Switzerland	4,460,000	4,866,000	36,533,000
Spain	2,355,000	6,960,000	218,949,000
Egypt	1,182,000	1,483,000	..
Mexico	1,956,000	2,253,000	..
Brazil	2,212,000	8,877,000	10,955,000
Russia	5,032,000	6,679,000	..
Holland	1,151,000	1,931,000	..
Austria	980,000	1,253,000	..
Denmark	1,049,000	2,964,000	..
Australia	1,142,000	1,255,000	..
Dutch Indies	778,000	2,401,000	..
Other countries	4,667,000	14,582,000	138,475,000
French colonies	11,183,000	31,099,000	234,072,000
Totals	165,183,000	231,995,000	1,187,972,000

MOTTL, FELIX (1856–1911), German conductor (*see* 18.931*), died July 1 1911.

MOULE, HANDLEY CARR GLYN (1841–1920), English divine, was born at Dorchester Dec. 23 1841, the youngest son of the Rev. H. Moule, vicar of Fordington, Dorchester, a prominent Evangelical clergyman. He was educated at home, and later at Trinity College, Cambridge, where J. B. Lightfoot was his tutor. He was bracketed second classic in 1864, and in 1866 obtained a first-class in theology. From 1865 to 1867 he was an assistant master at Marlborough, and after a few years of a country curacy became dean of Trinity College (1873–6). In 1880 his position as a prominent Evangelical was recognized by his election as first principal of Ridley Hall, Cambridge, an establishment founded for post-graduate training for the ministry. Moule's influence in this position was very great, and he considerably widened his influence by the production of various religious works of a popular kind, among them being *Thoughts on Christian Sanctity* (1886) and *The Secret of the Presence* (1901). He also published a *Commentary on the Epistle to the Romans* (1880) and *Outlines of Christian Doctrine* (1889). In 1899 Moule, who in 1898 had been made an hon. chaplain to Queen Victoria, was elected to the Norrisian professorship of divinity at Cambridge, but in 1901 he was chosen to succeed Westcott in the bishopric of Durham. He died at Cambridge May 8 1920.

His brothers, ARTHUR EVANS MOULE (1836–1918) and GEORGE EVANS MOULE (1828–1912), were both well known as missionaries in China, the former becoming archdeacon of Mid-China in 1881, and the latter the first bishop of Mid-China (1880–1908).

MOULTON, JOHN FLETCHER MOULTON, BARON (1844–1921), English judge, was born at Madeley, Salop, Nov. 1 1844. He was educated at New Kingswood school, Bath, and St. John's College, Cambridge, where he had a brilliant career, becoming in 1868 senior wrangler and first Smith's prizeman. Until 1873 he was a fellow of Christ's College, but in that year he came to London, and in 1874 was called to the bar. He became a Q.C. in 1885, and the same year entered Parliament as Liberal member for the Clapham division. He lost his seat in 1886, but from 1894 to 1895 sat for South Hackney and from 1898 to 1906 for the Launceston division of Cornwall. Fletcher Moulton earned a great reputation not only as a sound and skilful lawyer, but also as a mathematician and experimental chemist of a high order. He was retained as counsel in many important cases, *e.g.* questions of patent law, in which such special knowledge was necessary, and he was one of the first lawyers to perceive the enormous importance which chemistry was likely to assume in relation to various aspects of the law. He was raised to the bench of the Court of Appeal in 1906, being knighted and sworn of the Privy Council, and in 1912 was made a lord of appeal and a life peer, being also appointed to the Judicial Committee of the Privy Council. Lord Moulton's career as a judge was unfortunately marred by a painful family litigation against him. In 1875 he had married Mrs. Thomson, of Edinburgh, who already had a family of two sons and two daughters. She died in 1888, and in 1901 Lord Moulton married again. In 1902 his step-daughters, who had continued to live with him, took proceedings against him with reference to the manner in which the income to which they were entitled under their mother's will had been expended in connexion with the household expenses. The court eventually gave judgment in their favour, after a good deal of scandal had been made over the affair. Lord Moulton became a member of many important legal and scientific committees, being appointed first chairman of the Medical Research Committee under the National Insurance Act (1912). On the outbreak of the World War in 1914 he became chairman of the Committees on Chemical Products and on High Explosives, and the same year was made director-general of explosive supplies in the Ministry of Munitions. In 1915 he was made a K.C.B. and in 1917 a G.B.E. It would be difficult to exaggerate the value of his work for the Government as a scientific adviser during the war, and in stimulating the industrial developments for the production of explosives, a chemical question involving, *inter alia*, the reorganization of the British dyeing industry. In this connexion he acted as chairman of the British Dyestuffs Corporation (*see* DYEING) when it was created in 1919; and his labours were actively continued after the war ended. He died suddenly in London March 9 1921, leaving one son by his first marriage, Hugh Lawrence.

MOUNET-SULLY, JEAN (1841–1916), French actor (*see* 18.936), died in Paris March 1 1916.

See his *Souvenirs d'un Tragédien* (1917).

MOUNTED TROOPS (*see* 5.563; 18.939).—Under the term "Mounted Troops" is here included, in the modern text-book senses: (*a*) *Cavalry*, mounted on horses and able to fight either mounted or on foot; (*b*) *Mounted rifles*, whose characteristics and methods are the same as those of cavalry, except that they are not equipped for mounted combat; (*c*) *Mounted infantry*, denoting infantry carried on horses or camels, employing infantry formations when dismounted, and probably insufficiently trained to perform satisfactorily cavalry duties such as reconnaissance; and (*d*) Cyclists.

In recent years the trend of cavalry ideas has, as regards tactics, undergone very considerable change. In the South African War of 1899–1902 hardly any instances of shock action by cavalry were seen; and in the years immediately following it a large body of military opinion in England was in favour of relinquishing altogether the idea of charging home with the sword or lance. This opinion was strengthened by the events of the Russo-Japanese War. A little later it was realized that the absence of shock action in S. Africa was due not so much to the power of the rifle and machine-gun as to the peculiar tactics of the Boers, who seldom stood their ground to await the British attack; it was found that, while instances of successful cavalry charges were rare, there was no case in which a mounted attack was prevented by fire from reaching its objective. It was further seen that in Manchuria the nature of the country and the quality of the mounted troops engaged alike were inimical to successful cavalry action.

The pendulum of opinion now swung in the direction of shock action, and for a year or two the training of the British cavalry showed a distinct bias in favour of the *arme blanche*. From 1909 onwards, however, thanks to the influence of, amongst others, Sir John French, Sir Douglas Haig, and Maj.-Gen. Allenby, the correct balance was struck between fire and shock, and ideas were crystallized into definite, well-understood principles. As the result it may fairly be claimed that, when the World War broke out in 1914, no more highly trained body of troops existed

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***These figures indicate the volume and page number of the previous article.**

in Europe than the British cavalry. The German cavalry gave the impression of having lost their confidence in the *arme blanche* without having become fully proficient in the tactics of the dismounted attack. The French and Austrian cavalry, on the other hand, probably still relied too much on the *arme blanche*.

At the outbreak of the World War the theory of the employment of cavalry was governed by the following broad principles. (1) Before the battle, cavalry locate the enemy by reconnaissance, screen their own infantry from the enemy's observation, and protect them from interference while marching to the battlefield. (2) During the battle they are posted far out, protecting the flanks; act as a mobile reserve, ready to move quickly to fill a gap in the line or confirm a success; and occasionally intervene in the conflict by attacking the enemy on an unprotected flank. (3) After a successful battle they pursue the retreating enemy, effecting captures and preventing him from recovering himself, or, if they are unable to do these things, providing early information of his dispositions in the next line which he takes up. (4) After an unsuccessful battle they cover the retirement of the infantry, giving them time to recover their *moral* and to reach the next position which they mean to hold.

In order to provide for the above duties cavalry were formed into three groups:—(1) *Independent*, for long-distance reconnaissance and for other missions in which cavalry might be employed independently of the rest of the army; (2) *Protective*, for the duty of screening the main infantry columns; (3) *Corps* or *Divisional*, for minor reconnaissances, and for intercommunication and orderly duties inside the infantry columns.

These groups were intended to be elastic in their composition, and it was correctly foreseen that the requirements of different phases of the campaign or action would often necessitate one group being reinforced at the expense of another. While it was realized that infantry commanders must have some mounted men for their own immediate needs, it was a principle that the minimum number should be allotted to group (3), the bulk being kept as independent or protective cavalry. The reason underlying the division into the two last-named groups was the advisability of separating reconnaissance from protection.

It may be affirmed at once that the above subdivision of cavalry duties still held good in 1921, and that the separation of the duties of reconnaissance and protection is a principle which should underlie the employment of all cavalry bodies.

A reconnoitring detachment, having been asked certain questions, should be free to move in any direction in order to find the answers; moreover, touch with the enemy, once it has been established, should not be relinquished. Protection, on the other hand, entails the detachment regulating its movements to some extent by those of the force which it covers. It follows that, if one detachment is entrusted with a rôle which includes both these duties, the efficient performance of one or the other of them is likely to suffer.

Cavalry in the World War.—If the events of the World War in the various theatres are studied, and if it is remembered that the whole of the campaign in Flanders and northern France, as well as much of those in Russia and Italy, was really one huge battle with flanks non-existent, it will be found that cavalry were constantly called upon to fulfil each and all of the rôles mentioned above. For instance, during the advance into Belgium before the battle of Mons, the British cavalry moved well in advance of the infantry. The latter were thus enabled to reach their battle positions unmolested, and without the extra fatigue of having to deploy for a fight; the cavalry meanwhile had numerous minor skirmishes with the German cavalry, who were fulfilling a similar rôle, but were unable to penetrate the British screen.[1] The plans for the battle of Beersheba in 1917 and those for the final advance in Mesopotamia in 1918 were based very largely on the result of cavalry reconnaissance, in spite of the fact that air reconnaissance had by this time made great strides.

As regards participation in the actual battle, at Mons and Le Cateau the bulk of the British cavalry were posted to the west of the infantry, where they were able to frustrate the German efforts at outflanking. After the fall of Beersheba too, while Sir Philip Chetwode's infantry were wheeling to their left in preparation for the next phase of the operations against the left of the main Turkish position, the mounted troops, placed several miles away to the right, were able to protect the flank of the wheel by defeating several determined counter-attacks. Cavalry used in this way can provide ampler elbow-room for manœuvre than less mobile troops because they can be sent with safety to greater distances.

Of the value of cavalry in battle as a mobile reserve many striking illustrations can be found in the stories of the first and second battles of Ypres and of the German offensive in 1918 on the Somme. On many occasions in these operations they relieved infantry who had been exhausted or practically annihilated by continual heavy fighting; on others, by counter-attacking or by filling a gap defensively, they reëstablished the connexion between infantry formations which had drawn apart. In this respect it should be noted that, while the tactical disadvantages of a gap in the line are of course obvious, only those who have had actual war experience can realize the quite disproportionate moral effect on everyone, from the general to the private, of losing touch with the units or individuals on the right and left. Sir Douglas Haig, in his despatch dealing with the German offensive in 1918, writes as follows: "Without the assistance of mounted troops, skilfully handled and gallantly led, the enemy could scarcely have been prevented from breaking through the long and thinly held front of broken and wooded ground before the French reinforcements had had time to arrive." These words, it may be remarked, refer to a period when tanks were already present in France in fairly plentiful numbers.

It is well to remember that the value of a reserve depends chiefly upon its freshness, and that even where conditions of ground or traffic preclude cavalry, as will often be the case, from moving much faster than infantry, they will invariably arrive on the scene of action less tired. A good illustration of this occurred in the Somme battle of 1916, when two cavalry regiments were ordered to fill the gap between an infantry division which was fighting in Longueval and another which was being launched from reserve against High Wood. The infantry had to advance a few miles only, but the day was a hot one and the shelling heavy. On reaching High Wood they were so exhausted that all efforts to make them dig themselves in were unavailing. The cavalry, owing to the maze of trenches and wire, could not move even as fast as the infantry, but they dug themselves in with such vigour that by the following morning they were completely underground. Nor must it be forgotten that *moral* is largely a question of physical fatigue.

The most brilliant rôle which can be allotted to cavalry in battle is that of intervention on an unprotected flank, or on a flank so weakly protected that the cavalry find themselves in great superiority. In the war on the western front no examples occurred of this, for the simple reason that unprotected flanks of sufficient length to give mounted troops the scope they require did not exist. A possible exception is the German break-through in the spring of 1918, but by this time the bulk of the German cavalry had been dismounted. In the more open theatres of the war, however, such as Palestine and Mesopotamia, cavalry often intervened in the battle with very important results. At the action of El Mughar in Palestine in 1917 a yeomanry brigade charged successfully the flank of a position which was holding up an infantry division, and took upwards of a thousand prisoners. Ramadi, in Mesopotamia, in the same year provides an instance of an entirely unprotected flank which enabled the cavalry to place themselves directly across the enemy's only line of retreat. The Turks, after attempting to break out through the cavalry under cover of darkness, surrendered next morning, and a force of 3,500 was thus destroyed. Examples such as these, and several more like them could be given from the campaigns of Mesopotamia and Palestine, show that the value of cavalry on the battle-field can still be decisive, given the right conditions. These conditions are: (*a*) a theatre of war whose size, in relation to the numbers of troops engaged, admits of wide, open spaces; (*b*) an enemy who, by reason of inferior numbers, skill, or organization, cannot protect his flanks effectively.

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[1] It seems, indeed, probable that when von Kluck issued his orders for the battle of Mons he was very much in the dark as to the position of the British left flank.

There is no reason to suppose that such conditions will not be met with in the future, even in a European war, as often as those obtaining on the western front from 1914-8; and as regards a war outside Europe, they are typical of the campaigns which have been fought in the past, and which will assuredly be fought again. Still, it cannot be denied that, for the cavalry of Europe at any rate, the size of modern armies and the general use of entrenchments, especially barbed wire, have decreased the chances of distinction in battle, already much reduced by the greater power of missile weapons.

The best example of the part which can be played by cavalry after a successful battle is that of Gen. Allenby's victory in Palestine in 1918. The enemy's flank having been rolled up by means of an infantry attack in great strength near the coast, the Desert Mounted Corps, consisting of three divisions, passed through. After riding due north for about 35 m., mopping up prisoners as they went, they turned north-east over the mountains, where they were just in time to forestall a hostile infantry detachment which was being hurried forward to defend the pass, and debouched at dawn into the Plain of Esdraelon. By five o'clock in the evening of the day after the battle these divisions had marched 70 m. in 36 hours, and had placed themselves completely across the Turkish lines of communication. As a result 40,000 prisoners fell into their hands. The remnants of the Turkish army, retreating northwards, were pursued and overtaken. Damascus and Aleppo were successively occupied by the mounted troops, though not without fighting, and the Desert Mounted Troops took altogether 75,000 prisoners out of a total Turkish ration strength of about 100,000. The division which took Aleppo marched 500 m. in five weeks.

Other instances of successful cavalry pursuits during the World War could be found from the campaigns in Russia and Mesopotamia, and that in Palestine in 1917. And, referring to the end of the war in France, Sir Douglas Haig wrote as follows in his final despatch: "On the morning of the Armistice two British cavalry divisions were on the march east of the Scheldt, and before the orders to stop reached them they had already gained a line 10 m. in front of our infantry outposts. There is no doubt that, had the advance of the cavalry been allowed to continue, the enemy's disorganized retreat would have been turned into a rout." The events of the war in all theatres show clearly enough that a retiring force can march more quickly than one which is advancing and that only a comparatively brief respite is required to enable a beaten force to recover itself. It follows that a force of superior mobility is essential if the fruits of victory are to be gathered and a long succession of pitched battles avoided.

As for pursuit, so also for retreat, the value of cavalry was proved many times in the Russian campaigns. But a good instance is provided by the retreat of the British Expeditionary Force from Mons in 1914. During every day of this operation the British cavalry interposed themselves between the main columns of the army and the pursuing Germans, and so saved the infantry many tiresome rearguard actions and much fatigue. But from the point of view of *moral*, the services rendered by the cavalry were perhaps even more important. Some idea will be gained of them if it is remembered, once again, that the horse soldier is almost invariably less tired, and consequently less prone to doubts and fears, than the foot soldier, and that he sees over every hedge while the infantryman has to peer through it. Even so, it is difficult for any but an eye-witness to realize the extent to which the infantryman relies on the protection afforded him by the cavalry, the anxiety with which he awaits news, and the relief with which he receives it from his mounted brother, riding past in the dark, on his way to billets.

Future Organization.—Before considering what influence modern inventions are likely to have on the future of mounted troops, it will be well to clear the ground by pointing out the advantages and disadvantages for war of cyclists as compared with horse soldiers. Their chief advantage is that every man can go into the firing line, whereas one horse soldier out of every four has to remain behind to hold the horses. On really good roads in good weather they can move more quickly than horses; and no supply column is required to feed bicycles. On the other hand, they are completely tied to roads, and if the men leave the roads to fight, they must eventually come back to the place where they left their bicycles, which cannot be brought up to them. Cavalry are preferable to cyclists for fighting purposes in all country except that which is so enclosed that horses also are almost confined to roads. And even then the roads must be specially good for cyclists to justify themselves. On the cobblestone roads which are so common in Flanders and northern France, and in other parts of Europe, the pace of cyclists is, in wet weather, reduced almost to that of a walking man. In fact there seems to be no country except Great Britain where they would advantageously take the place of horse soldiers for fighting purposes. For purposes of intercommunication, however, they are extremely valuable, and the attachment of cyclists to an infantry unit will save much expenditure of horseflesh in any country reasonably well provided with roads. That is to say, they can take the place of part of the divisional cavalry. As a rule they should not be attached to the larger cavalry formations. They will often have to move by a different route to that most suitable for cavalry, and, if marching in a column, discomfort results from the fact that their pace is much altered by gradients which are hardly perceived by horses; consequently the saving of horseflesh does not compensate for the extra trouble and complication of orders. But motor cyclists are of incalculable value with cavalry, and will be still more when a machine is produced which can move across country.

The modern invention which, more than anything else, limited the activities of cavalry in the World War was barbed wire. It is doubtful whether this will be the case in the future. Barbed-wire entanglements are an accompaniment of position warfare; it takes much time and much man-power to erect them and this must always be the case except in the unlikely event of some invention arriving which will enable the soldier to produce barbed wire much in the way that the conjurer emits yards of coloured paper from his mouth. Besides, in view of the introduction of the tank and the development of the wire-cutting technique of artillery it is questionable whether barbed wire will ever again play the part which it fulfilled in 1914-17.

The developments most likely to influence the future of the mounted arm are: (1) the tank; (2) the cross-country tractor; (3) the aeroplane; (4) gas.

The tank is thought by some to be likely before long to oust cavalry entirely from warfare, and the views of these persons, though they may be extremists, are entitled to very respectful consideration. They claim, and claim justly, that the evolution of the tank has made very great strides since the signing of the Armistice; and they assert that it will advance nearly as quickly in the future, a statement which is more open to argument. Experimenting with a new arm is a costly process, and, besides, the tank is not a vehicle which can be easily adapted for civil use in times of peace. The paramount question of expense therefore, coupled with the absence of the stimulus of actual or impending war, is likely to slow down the development of tanks, as well as the provision of them in large numbers.

The latest type of tank can, it is understood, go as fast and as far as cavalry in all but very unfavourable country; but it may be a number of years before a machine is produced which is capable of crossing swamps, thick woods, or rocky mountains, and which is thoroughly satisfactory in a tropical climate. It is true that obstacles of this kind affect cavalry also, but tracks invariably exist by which they can surmount them, though they may have to go in single file at a foot pace. And it would be specially dangerous for the British army entirely to replace cavalry by tanks, because conditions unfavourable to tanks are precisely those with which it has most often to contend.

Nor would it be safe to rely upon the vulnerability of the tank remaining as low as at present. The history of military invention shows us that the missile and the protection against it alternately obtain the mastery. At present, so far as the tank is concerned, the latter is in the ascendent, but the study of anti-tank methods has hardly been begun. A metal machine, which is as conspicuous as the tank, presents certain very weak points of attack to modern science, with electricity, magnetism, and automatic ranging at its command. It may confidently be asserted that in the future anti-tank methods will develop more quickly than the tank itself; but it must also be pointed out that they have much leeway to make up.

Apart from the above question of development the tank possesses an inherent disadvantage in that the force which it represents is very highly concentrated. Tanks will not be able to hold positions even if they take them. For at night or in fog an enemy, if he chooses to attack in great superiority, will get through any line which is not held continuously by men stationed almost at arm's length from one another. The essence of success, for this reason, lies in the concentration of superior man-power at the decisive point; and in the future, as in the past, the rôle of all arms other than infantry and cavalry will be the subsidiary one of facilitating that operation. In the actual attack, too, a lucky shot, putting a tank out of action, destroys a much larger proportion of the force than would the same shot striking the equivalent body of cavalry, which would be dispersed. This disadvantage of over-concentration, aggravated as it is by the conspicuous character of the tank, will not disappear until a machine is produced which provides complete protection for single men, and so allows of dispersion; and this is an event which is very far distant.

Nevertheless, where an attack on trenches is concerned, and especially on those protected by wire, the tank is immeasurably superior to cavalry. In war it will often fall to the lot of cavalry formations to make such an attack, and it is here that tanks may well replace a part of the cavalry, the remainder being employed in assailing the weaker parts of the enemy's front, in holding the position when taken, and in rounding up fugitives, for which again dispersion is necessary. In the World War armoured cars were often used with success for conveying special officers from place to place under fire, and for early-morning reconnaissance, when it was desired simply to locate an enemy with whom touch had been temporarily lost. In the next war fast tanks will replace the armoured car for these purposes. But for the more detailed reconnaissance which usually follows, armoured cars, and tanks also, are unsuitable, by reason of their vulnerability when stationary and the limited range of vision which is obtainable from inside them. In the future then, tanks will not usurp the functions of mounted troops, but on the contrary will widen their scope by relieving them from the necessity of attacking, or of waiting for infantry to attack, organized positions. A force of tanks, fully as mobile in every respect as the horse, will be attached to all higher cavalry formations.

The influence of the second new development, the cross-country tractor, will be wholly in favour of mounted troops. In the past one of the chief obstacles to the employment of cavalry has been the difficulty of supplying them, and the length of road space which the subsidiaries, artillery, engineers, and rearward services, take up. This probably is one of the reasons for the German cavalry showing up so little during the retreat from Mons, and for their not being employed at all to confirm the success gained in March 1918, when, according to Sir Douglas Haig, "their presence could not have failed to have added greatly to the difficulties of our task." Cross-country tractors, independent of roads, carrying supplies of all sorts, and perhaps dragging the guns, will greatly enlarge the radius of action.

Of all novelties in warlike organization, the aeroplane is the most serious rival to cavalry. It has already taken over to a great extent the duties of reconnaissance which were formerly performed almost exclusively by mounted troops. The service of discovering the direction of the enemy's principal concentrations, whether by road or by rail, and of reporting upon his entrenchments, gun positions, and larger activities generally, is now carried out from the air. This was formerly the province of the independent cavalry, which was consequently made as strong as possible. Now, owing to the advent of the aeroplane, the proportion of cavalry allotted to independent work will be relatively smaller, except in the case of a pursuit, and the bulk of the horse soldiers will be employed on missions which are protective in character. It must not be supposed, however, that the service of reconnaissance can be carried out entirely from the air. It is difficult for aeroplanes to observe lesser details or to distinguish between friend and foe; for, if they fly so high as to be invulnerable from the ground, they can distinguish nothing but heavy columns or clearly marked entrenchments and tracks; at medium heights they were, even at the close of the late war, fairly vulnerable to anti-aircraft weapons, which are likely to improve in efficiency in the future; and at low altitudes again the very speed which protects them from anti-aircraft fire militates also against accurate observation. Therefore, for the service of reconnaissance, cavalry will still be required to supplement aircraft reports; to provide, especially in open warfare where clearly marked trenches do not exist, detailed information as to the enemy's dispositions; to secure identifications by the capture of prisoners; and, above all, to replace the aeroplane under conditions of ground or climate which are unfavourable to air reconnaissance. In this connexion it may be mentioned that, during stationary warfare in the summer of 1918 in the Jordan valley, the very efficient Air Force units attached to the Egyptian Expeditionary Force were found to be of comparatively little value for purposes of tactical reconnaissance. The ground, precipitous, rocky, and very complicated, cast deep shadows in every direction; and in the middle of the day atmospheric conditions over the deep trough of the valley made flying almost prohibitively dangerous.

A matter for much more serious consideration by cavalrymen is the question of attack from the air. Towards the end of the war in France it became clear that troops whose location is not completely hidden are liable to be bombed at any time by day or by night, and, further, that even a superior air force is powerless to prevent such attacks. Much can of course be done by attacking the enemy's aerodromes, but the great radius of action of aircraft increases so much the value of the initiative that it is hopeless to expect, however great the superiority, to get command of the air in the sense that it can be obtained by land or sea. And it is next to impossible to conceal the presence of a large number of horses. Led horses will, of course, be specially vulnerable. Given great superiority in aircraft, it may be feasible to provide protection by having some machines continually overhead. By day this might prove adequate, though it would entail a very great strain on the resources of the Air Force. By night it would be of little value. The true defence against aircraft, other than that of carrying the war into the enemy's country and attacking his aerodromes, is from the ground; and it must be admitted that, against an enemy with an efficient and enterprising air force, the existence in war of mounted troops will become precarious unless a great advance is made in the science of anti-aircraft defence from the ground. They must be prepared, in any case, to deliver their blow from widely separated formations, instead of massing for attack. Means of intercommunication must therefore be very specially studied and developed. It should be noted that, in the case of tanks also, the difficulty of concealment from the air will be great if they are employed in large numbers, but here it may be possible to devise some sort of portable and easily erected covering, which will provide at the same time camouflage and overhead protection. Gas attacks will be particularly dangerous to mounted troops because, though horses are less affected by gas than human beings, it is very much harder, if not impossible, to devise for them an efficient protection against it. However, it is doubtful whether gas will ever become an important factor in mobile warfare; and mounted troops can move comparatively quickly out of a gas area.

The division of mounted troops into three groups—independent, protective, and corps or divisional—has already been explained. The corps or divisional group will consist, in every suitable country, partly of cyclists and partly of mounted men; it will have attached to it a few motor-cyclists and a few light and very fast tanks. These latter would correspond to the present-day armoured car but would be able to move off the roads. They would be used principally for what may be called first reconnaissance purposes, to save horseflesh. Owing to the advent of the aeroplane, the independent group will be smaller, during most of the stages of a war, than formerly was thought likely, but mobile land forces will still be required for detailed reconnaissances and other independent missions.

The composition of the independent and protective groups will be governed by the same principles, since their duties are interchangeable at any time. For both groups, a highly mobile mixed force is required, the ingredients of which will vary in their proportion to one another according to the characteristics of the enemy, the nature of the theatre of war, and the climate. In the different echelons of the ammunition, supply, and medical services the replacement should be aimed at of all horse transport by cross-country mechanical tractors, which might also carry drinking-water for men, if not for horses; the heavier guns too might be drawn by mechanical means. To a division of cavalry at least two squadrons of aeroplanes should be allotted, one for protection against hostile aircraft, and one for coöperating in an attack and for carrying out local reconnaissances required by the cavalry commander for his own information. In certain conditions the use of aeroplanes for supply is most desirable, but machines need not normally be attached to cavalry for this purpose. For intercommunication a liberal supply is needed of motor-cycles, capable if possible of moving across country. Light and fast tanks will be required, in small numbers only, for the reconnaissance purposes already indicated in the case of the corps or divisional mounted troops. Tanks, possessing heavier armour and ordnance—but at least as mobile as the cavalry, will break down lanes through the enemy's wire entanglements and trenches, will increase his disorganization and render him ripe for a cavalry attack, and will crush his resistance where he is still holding out. In a word, where cavalry formerly had to wait for the infantry to come up and provide weight for an attack, the coöperation of tanks will now enable them to press forward at once. Though it is extremely dangerous to dogmatize regarding numbers, the proportion of tanks to cavalry should, in a civilized country against a well-organized enemy, perhaps be as much as two to a squadron, or 54 in a division of nine regiments.

In every case the backbone of the mobile force will still consist of horse soldiers, because they alone of mobile troops can provide the dispersion which is necessary to hold a position or to carry out certain other operations of war, such as the policing of a country in insurrection, the pursuit of an enemy, or the hand-to-hand conflict which is the ultimate object of all battles; and because also, in certain conditions of climate or ground, they alone will retain their mobility. For this latter reason also, part of the artillery should be horse-drawn.

Future Tactics and Training.—Before the World War the principles which have already been enunciated held good in all European armies regarding the employment of mounted troops. It was therefore thought probable that in most cases they would come into conflict with, and have to beat, the hostile mounted troops, before being in a position to fulfil their rôle. Further, because both sides would be anxious to waste as little time as possible, it was considered likely that this first conflict between the opposing cavalries would, at least as often as not, take the form of a mounted collision. Neither of these conclusions was justified by the events in the western theatre, in Palestine or in Mesopotamia. The Turkish mounted troops were few in number and despicable in efficiency; the Germans in France and Belgium failed to make much use of their cavalry even during the retreat from Mons. Consequently, so far at least as these three campaigns are concerned, conflicts between mounted troops were somewhat rare. And even when they did occur no mounted collision took place, except in a few instances when very small numbers were engaged. It is thought that, in the future also, mounted collisions will be uncommon, and for the following reasons. Every battle, whatever arm is taking part, resolves itself into a series of minor engagements, in each of which one side is on the offensive and the other on the defensive. It never happens, in these subsidiary fights, that both sides are so confident of victory as to attack simultaneously. Now, in the case of mounted troops, the side which for the moment feels itself to be inferior will of course take to the rifle. It follows then that a mounted collision will not take place unless the inferior side has no time to dismount, that is to say, unless it is completely surprised. And, even if it has neglected to take any precautions itself, it will probably get warning of the impending charge from the protective detachments necessarily thrown out by the other side. In recent years of peace and war the writer knows of only one case of a mounted collision between bodies larger than a squadron which had any semblance of reality. This was on manœuvres in Berkshire in 1907, when two cavalry brigades met. On this occasion, for reasons into which it is not necessary to enter but which would not arise in war, both sides had almost entirely neglected to protect themselves. Patrols, on the other hand, coming suddenly round corners or over a rise of ground, have often met unexpectedly, and, just as in the case of dismounted patrols at night in No Man's Land, the ground has then remained in the possession of the side which has most quickly made up its mind to charge with the *arme blanche*. While, therefore, horse soldiers will often meet in war, collisions on a large scale in which both sides remain mounted will be seldom seen; but single troops or smaller patrols will often succeed best by immediately riding down on the enemy, and will thereby establish a moral ascendency which will be of the utmost value in the subsequent operations.

In the training of cavalry in the past too much attention has been paid to the mounted collision and too little to the mounted attack of infantry or dismounted cavalry. It has been thought apparently that the latter form of attack would be comparatively rare, and that the machine-gun and quick-firing rifle, reinforced by trenches and wire, would nearly always compel the attacker to take to the rifle himself. To take this view is to assume that cavalry will never meet an enemy who is hopelessly inferior in numbers or spirit, or who has run short of ammunition; to suppose that an army will on all occasions have sufficient time, energy and material to dig trenches and erect obstacles; and to ignore the moral effect of a cavalry charge on both the mounted attacker and the dismounted defender. The events of the World War have shown clearly the fallacy of such ideas. At Cerizay, in the retreat from Mons, the British 5th Cavalry Brigade charged some dismounted cavalry who were acting as vanguard to a force of all arms. The advance of this force was stopped for several hours and upwards of 300 of the enemy were killed, wounded or captured, the British casualties being about 40. When the Germans retired from Péronne in the spring of 1917, three regiments of the British 5th Cavalry Div. galloped simultaneously through the villages of Villers Faucon, Guyencourt and Saulcourt and in a few moments had captured them at a negligible cost of life, the hostile rear-guard fleeing on the first appearance of the cavalry. Reference has already been made to the action of El Mughar in Palestine in 1917, in which 1,000 prisoners were taken by the 6th Mounted Brigade at a cost to themselves of under one hundred. In the same theatre of war in 1918 there were numerous successful charges. For instance, two weak squadrons of the 2nd Indian Lancers met a Turkish battalion at Megiddo, killed 46 with the lance and captured 470; near the Jordan two squadrons of the 29th Indian Lancers secured 800 prisoners, with about 30 machine-guns, in one charge; north of Damascus the 3rd Australian Light Horse Brigade struck a retiring column in flank after galloping six miles, and captured a divisional commander and 1,500 men. In these campaigns, which resulted in the capture of Jerusalem and in the expulsion of the Turks from Syria, the successes of the cavalry were in fact most of them gained by mounted attacks against a dismounted enemy. Dismounted attacks usually either failed or took so long to organize and carry through that the mobility of the force was to a very large extent nullified. The advantage of a mounted attack is so great from the point of view of a quick decision that it would be justified even if it were more expensive in life than a dismounted attack. But such is not the case. The fact is that for attack cavalry are useless, either mounted or dismounted, unless the enemy is very much inferior or demoralized, and that wherever a dismounted attack will succeed, a mounted attack will also get home much more quickly and at smaller cost. The only exception to this is in the case of ground which is impassable for horses but passable for men on foot. The speed of the mounted charge more than compensates for the size of the target which it presents; but its comparatively low vulnerability, given ground in any way suitable, is due not so much to this fact as to considerations of *moral*. By the exhilaration of the gallop, and the instinctive feeling of superiority of the mounted man over the man on his feet, the attacker is steeled in his determination to come to close quarters. The defender, on the other hand, already conscious of an inferiority in numbers or *moral*, or both, is impressed by the novel sight of several waves of horsemen galloping towards him well opened out, and offering no very satisfactory target. He exaggerates the pace at which they are approaching him and opens fire too soon. At the very moment when they are coming close enough to be really vulnerable, perturbed by the small amount of impression which he has hitherto made on them, he becomes flustered, fails to take deliberate aim, and even forgets to alter his sights. Thus it happens that a mounted charge often achieves the apparently impossible, by which means the most decisive successes in war have always been won.

Shock action therefore is by no means a thing of the past, and mounted troops must carry some arm which they can use while still on their horses. The only sound exception to this rule is in the case of non-regular troops, for the training of whom in mounted action there has been insufficient time. In other words, mounted infantry or mounted rifles should be looked upon as imperfectly developed cavalry, to be evolved into the fully trained article as soon as time allows of it. Now, in the hands of an expert, the most efficient arm for mounted use is undoubtedly the pistol; but in the hands of an insufficiently trained man it is nearly as dangerous to friend as to foe; and the time necessary to produce an expert, or even a safe, shot with a pistol from the back of a horse is such as to be prohibitive, even for regular troops. There remains the shock weapon or *arme blanche*, of which the three possible forms are the sword, the lance, and the short lance or hogspear. The sword is the least efficient against a dismounted enemy, but its use is more easily taught than that of the lance. The lance, both materially and morally, has more effect than the other two, but is very conspicuous and heavier. The hogspear is nearly as effective against a dismounted enemy as the ordinary lance, is easily carried, and its use soon learnt. Certain difficulties exist, however, in connexion with withdrawing it after the thrust. If these could be got over it would be the best weapon of the three.

The principles of shock action are as follows: (1) In all cases the maximum amount of fire support should be given by artillery and automatic weapons. This fire, which should take the form of a sudden burst of extreme intensity, must be continued up to the last possible moment before the collision, and should therefore usually be delivered from a direction different to that of the charge. (2) Some automatic weapons must follow close behind the charge, to pursue by fire and consolidate the ground gained. (3) Since disorganization is quite inevitable as the result of a charge, a reserve must be kept in hand. (4) In the attack of a mounted enemy, weight is the chief consideration. The charge should therefore be delivered without a moment's hesitation, at full speed, in serried ranks, and, if it can be done without delay, down hill. (5) In the attack of a dismounted enemy, moral effect and avoidance of formations vulnerable to fire must be aimed at. Now the sight of a number of successive lines approaching him impresses the dismounted man more than speed or mere numbers on a broad front. The charge should therefore be delivered in depth, well opened out, and not necessarily at a very great pace. (6) Mounted men are particularly vulnerable to enfilade or oblique fire. Consequently, while depth is the more important consideration, the whole of the enemy's front should be attacked, or, if that is not possible, the heads of the defenders on the part not attacked must be kept down by supporting fire from artillery and machine-guns.

Though a mounted is distinctly preferable to a dismounted attack, it will often happen that the approach to the enemy lies over ground which is impracticable to horses, or that he is sheltering behind an impassable obstacle. Recourse must then be had to the rifle. The typical cavalry dismounted attack consists in utilizing the mobility of the horse to gain a position on the enemy's flank whence he can be devastated by fire. Surprise plays a very important part in such an operation. The cavalry man, moving rapidly, can more easily achieve surprise than the foot soldier; moreover, he can, if his attack fails, break off and try elsewhere, an advantage which is denied to the infantry man, with his more limited range of action. The necessity of keeping the enemy engaged frontally while at the same time turning his flank usually entails a wide extension of the force; the maximum number of rifles is put in the firing line from the outset, and small reserves only are retained. The advance is made mounted up to the last possible moment, and the led horses are kept well forward with a view to a further outflanking movement or a pursuit. The immediate objective of the operation is a fire position. For a purpose such as blocking the retreat of an enemy by bringing fire to bear on a defile these tactics are eminently suitable; but it is doubtful whether they will often be successful in other situations. In modern warfare flanks are hard to find and are seldom left unprotected; the operation therefore usually becomes a frontal attack. Indirect artillery fire and aeroplane observation have greatly increased the vulnerability of led horses, and in practice it usually takes cold steel, or the threat of it, to compel the retreat or surrender of the enemy. For the attackers to succeed mounted, considerable superiority is necessary; for a dismounted attack still greater ascendency is required.

In the World War cavalry were often unable to turn the enemy's flank and found themselves committed to a frontal attack dismounted. It was clear that such a situation demanded the assumption for the moment of infantry tactics. Led horses had to be left some way behind; dispositions had to be made in depth with adequate supports and reserves; artillery and machine-gun bombardments had to be arranged for and the attack driven home with the object, not of gaining a fire position only, but of assaulting the enemy. In the future tanks will, when they are available, free the cavalry from carrying out this kind of operation, for which the latter are not well suited by reason of their small fighting strength when dismounted. Still, tanks may not always be present or able to act, and cavalry must know how to attack dismounted in depth.

This kind of attack is of course valueless without the bayonet, which is also required for use defensively in trenches, and for night attacks dismounted.[1] Cavalry may often be called upon in the future for such tasks. It would not seem to be beyond the limits of human ingenuity to devise a short lance, made in two pieces, which could also be fixed to the rifle as a bayonet.

The tactics of cavalry in defence consist in making full use of their mobility to compensate for their weakness in fire strength. Their mobility gives them over infantry the following advantages: (1) They can counter-attack more rapidly, therefore with more chance of effecting surprise; (2) they can move more quickly to reinforce threatened portions of the line; (3) they can retire more easily to a second position. It follows that they can be pushed out to a greater distance, and can hold a longer front than the equivalent number of infantry. The value of this is most apparent when it is remembered that the vulnerable parts of every force are its flanks. The mobility of cavalry is of course best brought into play in a moving defensive, that is to say, in a rear-guard or flank-guard action. The addition in the middle of the war of 12 automatic rifles to a regiment has greatly increased the fire-power of the arm, but it is to be hoped that in the future some weapon will be evolved which will be less susceptible to inaccuracies and stoppages than the Hotchkiss. It is a waste to use cavalry in a continuous defensive line if other troops are available. The proper dispositions for a cavalry defence are: (1) a chain of localities, with gaps between them, held principally by automatic weapons; (2) reconnaissances far out to the front and flanks, to give ample warning of hostile approach; (3) a large proportion of the force in mobile reserve; (4) careful arrangements for withdrawal to a second position if it should become necessary. But, above all, cavalrymen must not be afraid of a very extended line, relying upon greater mobility and moral superiority to compensate for numerical weakness. The soundness of this doctrine needs no more proof than that furnished by the operations of the British cavalry corps in the first battle of Ypres.

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[1] An example of the latter is the successful counter-attack made by the British 12th Lancers, in company with two infantry battalions, at Wytschaete during the first battle of Ypres.

The principles governing the conduct of a reconnoitring detachment will appear simple if it is remembered that the information required is, in each locality, ultimately obtained by one pair of eyes or one pair of ears. The rôle of the rest of the detachment is that of a conveyance, to enable that pair of eyes or ears to arrive at a place whence it can see or hear, and to allow of the news being sent quickly back to the commander. A reconnoitring detachment, then, fights only in order to arrive at its destination or to keep a road open for messages going back. Its strength is regulated by the amount of opposition which is anticipated, and by the number of messengers which will be required. Sometimes it will act by stealth, when its strength will be reduced to a minimum. More often, however, even if it may be possible to get forward without opposition, the difficulty of maintaining a channel of communication will enforce a fighting rôle on a reconnaissance; and, as the result of recent experience, cavalry opinion has veered very decidedly towards strong detachments, not less than a troop, and often as much as a squadron or more. It should here be mentioned that since the commander of the force alone knows how much importance he attaches to obtaining information, he, and not a subordinate, should decide upon the strength of a reconnoitring detachment. In principle, the order "Send out a patrol" should always be followed by a statement of the strength, and this should be insisted upon in all tactical exercises.

The advance of a reconnoitring detachment, like that of all other cavalry bodies of every size, is conducted on the principle of successive objectives, or bounds. This principle, which seemed before the war to appertain exclusively to cavalry, has now been adopted by infantry also; but, on account of the difficulty of maintaining control with fast-moving troops, it is particularly important that it should be thoroughly well understood by cavalry. The idea underlying the principle is that of getting as quickly as possible through specially dangerous areas. A series of objectives is chosen, the occupation of which by the enemy might cause inconvenience; such objectives may be a position covering a defile, a village, a cross-road in enclosed country, a simple eminence giving a good field of view, or some other feature of tactical importance. The distance between them varies according to the size of the force; for instance, a squadron acting as vanguard would be given objectives intermediate to those thought necessary for the brigade following as main body. The main body does not leave one objective till the advanced guard has reached the next; the advanced guard does not move on till the main body is close up to it, but meanwhile prepares the advance to its next objective by sending forward reconnaissances. The movement resembles in fact that of a caterpillar. This principle has very great advantages, though it tends to some extent to retard movement. In addition to providing security for the main body, it gives to the commander of the advanced guard a definite tactical feature for which to fight should he meet the enemy unexpectedly, and so helps him to make up a plan. Also, in the case of two parallel moving bodies, it ensures the heads keeping more or less level with one another.

The commander of a reconnoitring detachment is given his orders in the form of instructions, the framing of which is an important matter. Once despatched, he will have to act wholly on his own initiative; it will not be possible to overtake him to give him supplementary instructions, and he will often be faced with situations entirely unforeseen. He must therefore be given full information respecting the situation at the moment and the intentions of the commander. It is a truism, but one which is often overlooked, that, in order to get definite answers, one must ask definite questions. Instructions such as "to make good" a certain locality, "to work round," or "to clear up the situation" will result in undecided action and vague information. If negative information is required, the places from which or times at which it is to be sent in should be stated. The reconnaissance commander must know how long he is likely to have to stay out and how far he is to go, whether he is or is not to remain in observation when the enemy is met with, and what he is to do in the event of his reaching his farthest objective without meeting the enemy. These two latter points particularly are often omitted.

Not only reconnaissances, but all other cavalry detachments also, go out to greater distances and are left more to their own resources than is the case in the infantry. For them also, therefore, clear and far-seeing orders are essential if they are to perform their task satisfactorily. And besides this there are certain other matters of staff work which require special attention in cavalry formations. For instance, arrangements for even a simple march have to be particularly carefully thought out by reason of the fact that the mounted men can move slightly faster than the light transport of the formation, and very much faster than the heavy transport; motors, too, complicate the problem. The question has always to be decided: Should the transport move with brigades or what is called divisionalized? If the latter, how is it to be assembled before and dispersed after the march? Should it move off first, allowing the mounted men to overtake and pass it, or last, which usually entails a very late arrival at the destination? In infantry formations the fighting troops and the transport move at the same pace, so that comparatively little difficulty arises. Again, horses have to be fed and watered, and should be offsaddled whenever possible; consequently, unless horsemastership considerations are overruled and the formation is kept in a state of instant readiness, cavalry take longer to get on the move than infantry. This drawback can be minimized by enacting that a portion of the force must be prepared to move off instantly and that the rest must be at some particular length of notice. Much can also be done, on occasion, by issuing warning orders, with the object of shortening the length of the orders to move when the time comes to write them. In the future, too, the coöperation of the component parts of the mobile mixed force will require staff work of a very high order.

Lastly, the most brilliant conception of a rôle, the highest degree of tactical skill, the most unerring staff work—none of these will suffice unless the leader has the requisite personality. It is rare indeed that such a personality is found, and the failures of cavalry in the past can be traced more often to the shortcomings of the commander than to any lack of efficiency elsewhere, or to conditions of ground and armament. It is essential, if the formation is to retain its dash, that the commander should be entirely confident of the rôle of cavalry. Now, during periods of stationary warfare, entailing inactivity for the mounted troops, it requires a character of exceptional firmness to retain that confidence to the fullest possible extent. But the principal stumbling-block consists in the facts that a cavalry detachment once sent out can be recalled with difficulty only, and that a mounted attack once launched cannot be recalled at all. Evidently mistakes must often be made, and the strength of the enemy sometimes underestimated. The cavalry leader will fail if he ponders too much on contingencies; he will not succeed unless to the confidence engendered by knowledge he joins an instinctive appreciation of the situation. It is the possession of this last faculty which has distinguished all great cavalry leaders. It is a plant which is indigenous to a certain soil only, and the components of that soil are knowledge, confidence and dash.

(R. G. H.-V.)

MOUNT STEPHEN, GEORGE STEPHEN, 1st Baron (1829–1921), Canadian financier (*see* 18.942), died at Brocket Hall, Hatfield, Herts, Nov. 29 1921.

MOVING OR MOTION PICTURES: *see* CINEMATOGRAPH.

MUIR, JOHN (1838–1914), American naturalist and writer, was born at Dunbar, Scotland, April 21 1838. When he was 11 years old his father moved to America and settled as a pioneer farmer in Wisconsin. Here the boy grew up taking an active part in clearing his father's land. When 22 years old he entered the university of Wisconsin, where he supported himself by teaching and working on farms during vacation. After finishing his course he began his wanderings on foot which carried him through many states. Later he crossed to Cuba, and thence to Panama and up the Pacific coast to California. In 1868 he first entered the Yosemite Valley which for many years after formed the base of his continued expeditions. In 1876 he joined the U.S. Coast and Geodetic Survey and three years later made his first visit to Alaska where he discovered the glacier that now bears his name. He was specially interested in glaciation and in the Sierra discovered numerous residual glaciers. In 1881 he took part in the expedition in search of the "Jeanette" and the De Long party in the Arctic region. He was an early advocate of national parks, and it was largely due to his efforts that the Yosemite Park was set aside in 1890. In 1903 he set out on a tour covering the Caucasus, Siberia, Manchuria, Japan, India, Australia and New Zealand; in 1911 he went to S. America to explore the Amazon; and in 1912 he visited Africa. He died at Los Angeles, Cal., Dec. 24 1914.

He published *The Mountains of California* (1894); *Our National Parks* (1901); *Stickeen* (1909, the story of a dog); *My First Summer in the Sierra* (1911); *The Yosemite* (1912) and *The Story of My Boyhood and Youth* (1913). In 1888 he edited *Picturesque California*. The following appeared posthumously: *Unpublished Prose and Letters* (1915); *Travels in Alaska* (1915); *Letters to a Friend* (1915); *A Thousand-Mile Walk to the Gulf* (1916); *The Cruise of the Corwin* (1917) and *Steep Trails* (1918).

See also *The Writings of John Muir* (1916), 6 vols., edited by William Frederic Badè.

MUIRHEAD, ALEXANDER (1848–1920), British physicist, was born at Salton, E. Lothian, May 26 1848 and was educated at University College school, London, passing on to University College, whence he subsequently graduated B.Sc. with honours in chemistry in 1868–9, but before doing so he entered his father's works and there invented a method of testing condensers, afterwards widely accepted. In 1870 he became a fellow of the Chemical Society, and in 1872 graduated D.Sc. of London in electrical science. He was an original member of the Physical Society of London (1874) and a member of the Société Française Physique. In 1875 he invented the duplex plan for working Atlantic cables described in 26.518. His siphon recorder (*see* 26.523) is now in general use. Attendance at a lecture on Hertzian waves given by Sir Oliver Lodge at the Royal Institution in 1894 resulted in the Lodge-Muirhead syntonic system (*see* 26.538), which anticipated Marconi. The original idea was Lodge's but Muirhead supplied the practical science required to work it out. He started cable works of his own at Elmer's End, Kent, in 1896, and gave valuable evidence before the commission appointed to inquire into the possibility of laying a Pacific cable. He was elected a fellow of the Royal Society in 1904 and died at Shortlands, Kent, Dec. 13 1920.

MÜLLER, HERMANN (1876–), German Socialist leader, was born May 18 1876 at Mannheim. From 1899 to 1906 he was editor of the Socialist newspaper, the *Görlitzer Volkszeitung*, and from 1906 onwards was a member of the directing board of the German Social Democratic party. From 1916 to 1918 he was a member of the Reichstag. On Aug. 1 1914 he went to Paris on a desperate mission with the object of finding out whether international action by the Socialists of France and Germany could be initiated in order to avert the World War. His mission was unsuccessful, and he had great difficulty in making his way back to Germany through the French lines. His report of his mission did much to determine the attitude of the German Social Democrats in voting in the Reichstag for the first war credit. On June 21 1919 he was appointed Minister of the Reich for Foreign Affairs—under the chancellorship of Gustav Bauer—and in this capacity went to Versailles and with the Colonial Minister, Bell, signed the Peace Treaty for Germany on June 29 1919. After the resignation of the Bauer Ministry, which followed upon the Kapp *coup d'état* (March 1920), Müller was appointed Chancellor of the Reich, an office which he held till the following June, when the result of the general elections for the Reichstag necessitated the formation of a Coalition Ministry with Fehrenbach of the Catholic Centre party as Chancellor. Thereafter Müller continued to play a leading part in the affairs of the Social Democratic party.

MUN, ADRIEN ALBERT MARIE DE, Count (1841–1914), French politician (*see* 19.1), was an energetic advocate of the Three Years Service law of 1913, and his support of the Barthou Ministry during the passage of this measure was very valuable. He published various pamphlets and volumes of speeches, the last being *La Guerre de 1914*. He died at Bordeaux Oct. 6 1914.

MUNITIONS OF WAR.—Under this heading, while it would be impracticable to refer to what was done by all the belligerent countries, the organization of the production of munitions during the World War by the United Kingdom and in the United States, on the one hand, and by the Central Powers on the other, is dealt with. Its history in the United Kingdom is told first.

I.—United Kingdom

The Problem.—When the British army of six divisions took the field in 1914 it possessed about 900 field guns, less than 200 field howitzers, about 60 heavier weapons of 6-in. and upwards and perhaps about 200 obsolescent types, such as the 4·7-in. and the 85-pdr. howitzer, a reserve of ammunition of less than a million rounds weighing some 20,000 tons, and less than 2,000 machine-guns. By the end of 1918, the army had received 10,000 field guns, 6,000 other light guns, over 3,000 field howitzers and 7,500 heavier guns and howitzers; 217 million rounds of artillery ammunition weighing 5¼ million tons and nearly 225,000 machine-guns.

The revolution in the material means of waging war was one which none of the belligerents entirely foresaw. It is true that the German and, to a less extent, the French army had munition reserves on a vastly greater scale than the British; but Germany counted upon a short war, and as she had not made adequate preparation for a continuous industrial effort, her armies were strictly rationed in 1915 while her resources were being mobilized. France was quick to appreciate the significance of the bombardments of the early battles, and in Oct. 1914 set machinery in motion for organizing her industrial resources under the direction of M. Thomas, who was appointed Under-Secretary for War in charge of munitions. For this task France had available a large number of expert officers who had passed through the arsenals, and these were placed in charge of districts in which they combined inspection with control of supplies.

Great Britain, on the other hand, was for various reasons slower to realize the change that had occurred, and in any case had a much smaller trained personnel and equipment for producing land munitions than the continental Powers. The Royal Ordnance Factories were, of course, at once set to work at fullest pressure and in October very large orders were placed with the armament firms who were given very wide instructions to expand their production. Mr. Ernest Moir was also sent to France to report on the schemes of the French Government. But time was needed to enable the situation to be seen in true perspective, for Great Britain was faced not merely with the task of providing a new and unprecedented scale of equipment, but also with the need of enlarging the expeditionary force into a continental army. On this last point opinion was slowly changing during the winter of 1914, but even in the spring of 1915 a large section of instructed opinion still urged that Britain's best contribution to the Allied cause was to conserve her economic strength and carry on "business as usual."

In this environment the authorities at the War Office, many of whose most experienced personnel had been sent to the front, and who were overburdened by the colossal problem of keeping the army supplied with its most urgent daily necessities, failed to appreciate fully the change needed in the standard of equipment and the sweeping character of the plans that would have to be made for dealing with it. At the outbreak of war, for example, the standard of machine-guns was 2 per battalion and it was not until the spring of 1915 that this was raised to 8 per battalion. At the end of the war the standard worked out at 48 per battalion. As regards ammunition a small increase in the number of rounds per gun per day on which the programme of field-gun ammunition was based was made before Christmas 1914; by the early summer of 1915 the basis was raised to 25 rounds per gun per day for field guns and in Sept. 1916 to 50 rounds per gun per day. One reason for this moderation was that in the early months of the war the officers in the War Office who framed the munition programme constantly had in mind the limited capacity of the country for producing munitions, and it was not until the middle of 1915 that this consideration was abandoned.

War Office Policy.—This point of view led to a conservative attitude in the placing of contracts. With its staff both at headquarters and in the inspection departments seriously depleted, the War Office not unnaturally clung to old and tried sources of supply and limited its orders during 1914 to Government factories and the armament firms. It relied for increased supplies on extensions to the Royal Ordnance Factories and at the works of Messrs. Vickers and Armstrong's (for ammunition and other munitions), Coventry Ordnance Works (chiefly for field guns and howitzers) and the Birmingham Small Arms Company (for machine-guns), leaving it to the armament firms to obtain any further increase from the engineering resources of the country by placing their own sub-contracts. The immediate result was a big demand for labour from these armament firms, and while this was at first forthcoming, the continued absorption into the army soon made the position difficult. At the request of the War Office, therefore, the Labour Department of the Board of Trade carried out a brisk campaign in Jan. 1915 for the recruiting of labour for these firms. This canvass produced only small results. It brought to light, however, the strong objection of the ordinary engineering firm against permitting their most essential men to be passed on to the armament firms and the demand that contracts should be more widely distributed.

This claim was constantly pressed by the Board of Trade; but during the spring of 1915 the War Office adhered to the policy of dealing only with the armament firms, and continually pressed for labour to be supplied to them. In March, however, the War Office permitted an exhibition of samples of munitions to be held at the central offices of the labour exchanges in the main towns of the country, and as a result a few small contracts were placed with individual firms.

Armaments and Treasury Committees.—The nation was, however, rapidly realizing the need for more drastic treatment of the problem, and at the end of March Lord Kitchener appointed an "Armaments Output Committee" in the War Office under the chairmanship of Mr. George Booth, a shipowner and banker. A week later the Government appointed a committee under the chairmanship of Mr. Lloyd George—known as the "Treasury Committee"—to take charge of munition policy. The "Armaments Output Committee" at the War Office at once became in effect the executive instrument of the Treasury Committee, and one of its first actions was the securing of an order for the Leicester coöperative group. During the months of April and May the Armaments Committee, on which Sir Percy Girouard (a director of Armstrong's) had now joined Mr. Booth, brought into existence several local committees to produce munitions in some cases by coöperative effort and in others to institute national factories to which the various firms would contribute machinery and labour. At first an effort was made to maintain the predominance of the armament firms in certain areas by giving them within these districts a first call on the available engineering labour. Another plan was for the armament firms to "mother" the new contractors and exercise a general supervision over the work of a district. But after much discussion all restrictions in favour of the armament firms were definitely broken down, and by the time the Ministry of Munitions was formed it had become evident that the list of direct contractors must be enormously increased. Following the lead of Woolwich the armament firms thereupon threw open their doors to visiting parties of engineers to learn and study the method of shell, fuze and other armament production.

But while orders could be and indeed had been placed on a large scale, deliveries were not forthcoming. The Armaments Committee endeavoured to deal with some of the difficulties by setting up a machine-tool department in the charge of Sir Alfred Herbert, who at once issued instructions to machine-tool makers to give priority to orders in hand for the British Government or for armament contractors. A raw materials section, which was placed in May under the charge of Mr. Leonard Llewellyn, also began an inquiry into the situation as regards copper, brass, aluminium, lead, antimony and spelter.

Labour.—A still greater difficulty was labour. For several months the Board of Trade had been making great efforts to deal with the labour situation, and in particular to check the recruiting of skilled engineers, both from armament and other engineering works. Lord Kitchener's view on this matter was that any man who wished to enlist should be permitted to do so, and it was not until March 1915 that he accepted the principle that it might be of greater national advantage to retain a skilled munition worker at his occupation in the workshop than to allow him to join the army. A beginning was made in April 1915 by scheduling certain occupations in respect of which the recruiting officers were to discourage enlistment, and by issuing badges to men in armament firms to save them from the pressure of public opinion, which at this time was being exerted very forcibly on able-bodied men to join the army.

But the labour shortage in the spring of 1915 was approached not only from the point of view of numbers of skilled men in employment. Attempts were also made to increase production by diminishing lost time, suspending such trade-union rules as restricted output, and admitting semi-skilled, unskilled or female labour to do part of the work hitherto done by skilled men. Up to Christmas 1914 negotiations on these points took place between the shipbuilding and engineering employers and employed, but without result. In Jan. and Feb. 1915 a sudden rise in prices and acute competition for labour between the various Government contractors produced considerable migration of labour and a general state of unrest, which found expression in a series of strikes. On March 15 the engineering workpeople agreed with the employers that, to a limited extent and as experience proved necessary, semi-skilled or female labour might be substituted for skilled labour subject to certain conditions, of which the most important was that the substituted workpeople should be paid the district rate of the men replaced. These relaxations were to be withdrawn at the end of the war.

This, however, hardly went far enough, and, as the result of a series of conferences held between March 17 and March 27, the trade-union leaders signed the Treasury Agreement, under which they undertook to recommend their constituents to suspend restrictive practices for the period of the war in return for an undertaking that the Government would see that the profit resulting from these suspensions did not go to private employers. This agreement coincided with the passing of a Defence of the Realm Act which authorized the Government to "take over" firms engaged on munition work. It was at first intended that this should involve the actual control of the four big armament firms in the same way that the Government had "taken over" the railways. But after negotiations with these firms the idea of handing over their management to an executive committee was abandoned, and the limitation of profits retained as the only substantial element in "taking over." On the other hand, it was increasingly evident that the same rule would have to apply to a far wider field than the four big armament firms. Hence the agreement was not at this time carried into effect, since the trade-union leaders found it difficult to carry out their part of the bargain in practice, while the negotiations with the firms dragged on until the Ministry of Munitions came into existence. The labour situation was complicated during this period by the efforts of various employers to entice away the skilled labour of their competitors, and considerable loss of output was suffered by the migration of labour.

Foreign Orders.—At a very early stage the inability of contractors to guarantee prompt delivery led to the placing of orders in America and Canada. These orders, though not very large in amount compared with subsequent purchases, had one important result in the conclusion of a commercial agency agreement between the British Government and Messrs. J. P. Morgan & Co. of New York, who were made solely responsible for the purchase of British munitions in the United States. Orders had been placed by the War Office for 4·7-in. shell and for nitrocellulose powder as early as Oct. 1914, followed in November by orders for rifles, metals and explosives. By the end of the year not only Great Britain but the Allies and the armament firms in all Allied countries were negotiating for munitions, materials or machinery, with the result that considerable confusion and competition existed. Hence, in Jan. 1915, an agreement was arrived at under which Messrs. J. P. Morgan & Co. were made sole purchasing agents for the British Government on the basis of a commission of 1% on all purchases made. At this time the War Office anticipated that the value of these contracts would not exceed 10 millions sterling, but by the middle of the year it was, in fact, approaching 100 millions and by the end of the year was over 200 millions. The large commission payable on these orders subsequently gave rise to some criticism; but Messrs. Morgan had in effect to create a munitions department to deal with this immense volume of business without the powers which the War Office and subsequently the Ministry of Munitions exercised in Great Britain. This organization was placed in charge of Mr. E. R. Stettinius of the Diamond Match Company, and the efficiency of its service and the enterprise shown by the commercial agents in protecting the interests of the British and subsequently of the Allied Governments proved of immense service to the Allied cause. The arrangement continued until shortly after America came into the war, when other machinery was needed for obtaining supplies owing to the institution of far-reaching control by the American Government.

Rifles.—During these early months public attention was mainly devoted to the question of ammunition. But in fact an even more urgent problem was that of rifles, the manufacture of which requires not only very specialized machinery, but also demands labour of special experience which could only be slowly increased. On the other hand, the number of rifles required for training and equipping a rapidly growing army as well as for replacing wastage in the field was far in excess of the stock in the country. For training purposes old-pattern rifles were repaired and resighted and a considerable number of rifles borrowed from Japan. But the date at which the new armies took the field was largely governed during the first twelve months of the war by the slow but steady increase in the output of service rifles, most of which were supplied by the Government arsenal at Enfield. Early in 1915 the War Office became seriously disturbed at the slow rate of increase in production, and finally orders for a million rifles of a slightly modified Enfield pattern were placed early in April 1915 in America with the Remington Co. which had already been given a large order for rifles of Russian pattern. This order was subsequently increased and additional orders placed, but though delivery was originally promised for the autumn of 1915, the rifles were not in fact available before the summer of 1916 and on arrival were found to need adjustment before they could be issued for service. As the cumulative output of Enfield and of the private firms in Great Britain had by that time overtaken requirements and the wastage in trench warfare had proved less than was feared, none of these American rifles were ever actually sent into the field with the British army. The effect of these orders was, however, that when America came into the war she had available two or three of the largest and most modern rifle plants in the world, which had just come into full production.

Situation in May 1915.—By May 1915 it was still uncertain how large a force Great Britain would endeavour to put into the field, and the War Office was still far from realizing the great increase that must be made in the standard of equipment. Substantial orders had been placed at home and abroad; and at home, as a result mainly of civilian pressure, a beginning was being made to place these contracts outside the range of the armament firms. It was, however, fast becoming clear that no contractor would, without assistance, be able to steer through the rising confusion of economic disturbance, and that the Government would have to assist contractors with both plant and material. But the War Office had neither the staff nor the experience to institute effective statistical or technical control over so large a commercial business. A treaty had been made with the labour leaders to abolish restrictive practices and to permit the employment of female and unskilled labour, but the arrangement was not being carried out in the shops. Hence the enormous orders which had been given to the armament firms were not being fulfilled, and subsequent events proved that if the goods had been delivered the inspection, storage, and transit organizations would have been unable to cope with them.

The Ministry of Munitions.—The Ministry of Munitions was an inevitable consequence of the failure of contractors and sub-contractors to cope with this economic situation, and of the fact that the War Office had not the technical resources, even if it had the will, to create the organization needed for handling so complex and so rapidly changing a problem. It was stated on May 14 by the military correspondent of *The Times* (approved by G.H.Q., France) that "we had not sufficient high explosive to level the enemy's parapets to the ground after the French practice." It may be noted in passing that, although this comment refers only to H.E., there were two aspects to the problem, namely (1) inadequacy of ammunition as a whole, and (2) the proportion of shrapnel and H.E. respectively to be supplied for field artillery. On the latter question British tradition had always favoured shrapnel, whereas French practice was to use practically all H.E., with their famous 75-mm. field gun. Experience eventually proved that 18-pdr. H.E. shell, which contained only 13 oz. of H.E., was of little use for destroying deep entrenchments, and it was ultimately limited to use against personnel, against surface works and for wire-cutting.

On the British front the last of these tasks continued mainly to be done by means of shrapnel. Hence, in spite of the fact that, when the initial difficulties had been overcome, the H.E. 18-pdr. shell was easier to manufacture in quantity than shrapnel, the British army in France throughout the war fired only 40 million rounds of H.E. compared with 60 million rounds of shrapnel (of which less than 3 million were fired up to the end of 1915). The event in fact proved that the more fundamental deficiency was in heavy artillery firing H.E. shell of large calibre —the standard types of which were ultimately the 60-pdr. shell containing rather more than 6 lb. H.E., the 6-in. howitzer shell weighing 100 lb. and containing 12½ lb. of H.E., the 8-in. howitzer shell weighing 200 lb. and containing 20 lb. H.E., the 9·2-in. howitzer shell weighing 290 lb. and containing 34 to 52 lb. H.E., and the 12-in. howitzer shell weighing 750 lb. and containing 66 to 105 lb. H.E. In this respect G.H.Q., equally with the authorities at home, were open to the criticism of being slow to see future developments, since at this time they had not put forward any large demand for heavy artillery.

The *Times* article, backed by the authority of the army in the field, confirmed the growing fear that the British troops were inadequately supplied with ammunition compared with the enemy or even with the Allies. The political crisis which ensued brought the Ministry of Munitions into being, with

Mr. Lloyd George at its head, and the members and staff of the Armaments Output Committee and of the Treasury Committee as the nucleus of its personnel.

The first year of the Ministry of Munitions was the creative period not only as regards the internal structure of the Ministry itself, but also in regard to its main duties. It was a period in which army demands were defined, manufacturing programmes laid down, methods of dealing with labour formulated and put into effect, large numbers of specialized factories designed for mass production constructed, and devices evolved for exercising control over the industrial life of the country.

The Ministry of Munitions Act, which received the Royal assent on June 9 1915, did little more than create the post of Minister of Munitions. The definition of his functions was left to be fixed by Orders in Council. The Act was therefore followed a week later by an order transferring to the Minister of Munitions the main functions of the Master-General of the Ordnance in relation to contracts and the supply of munitions (including explosives) and the inspection of munitions. The Minister of Munitions was given concurrent power with the War Office under the Defence of the Realm Act which gave authority to take over and regulate the work of any factory. The Minister was also given a general duty to "examine into and organize the sources of supply and the labour available for the supply of any kind of munitions of war, the supply of which is in whole or in part undertaken by him, and by that means, as far as possible, to ensure such supply of munitions for the present war as may be required by the Army Council or the Admiralty or may otherwise be found necessary."

In the first instance the War Office retained the control of the ordnance factory at Woolwich, the small-arms factory at Enfield, and the Waltham powder factory, and also the right to lay down the standards of inspection to be observed by the inspectors in the factories. Provision was made, however, for the transfer of these or any other functions in the future as might be agreed upon between the Minister of Munitions and the Secretary of State for War or the head of any other interested department, such as the Admiralty.

The ordnance factory at this time and for many months to come was doing the lion's share in supplying the army with munitions, not only because of the volume of its output but even more because its large supply of skilled labour, its staff of technical officers, and the fact that it had drawings and specifications available of all stores in army service, made it the only means of supplying the sudden and often small demands which the inadequate and miscellaneous character of the equipment in the field made inevitable. The War Office was therefore unwilling to hand over so vital an institution until the new organization had got on its feet. The transfer was, however, made in Sept. 1915.

Internal Organization.—From the outset the work of the Ministry fell into two main sections: that concerned with the supply of munitions and all that this involved in technical assistance to contractors, supervision of inspection, stores, transport, control of materials and regulation of non-munition work; and, on the other hand, the regulation and control of munition labour. These two functions divided the Ministry into two divisions which were housed in separate buildings and developed along divergent lines of organization. The labour section of the Ministry, staffed largely by personnel drawn from the Labour Exchanges Branch of the Board of Trade, developed its organization on civil-service principles, the heads of departments reporting to the Minister through the general secretary of the Ministry, Sir Hubert Llewellyn Smith. The business men, on the other hand, who were called in as heads of the supply departments, had a profound distrust of orthodox Government methods and demanded the right of direct access to the Minister. A brief controversy on this point between the general secretary and the director-general of munition supply (Sir Percy Girouard) ended in the latter's victory. This was perhaps justified by the imperative necessity for prompt action; and as Mr. Lloyd George encouraged the heads of departments to act upon their own responsibility on the basis of general instructions, it enabled a large number of activities to be pressed forward at the same time. It had the effect, however, of making the general secretary practically head of the labour sections only of the Ministry; and moreover, as the right of access was secured not only by Sir Percy Girouard (who was succeeded in August by Sir Frederick Black), but also by the deputy directors—Mr. Glynn West (in charge of ammunition), Mr. Booth (establishment, foreign orders, etc.), Mr. Eric Geddes (small arms), Mr. C. E. Ellis (guns)—and by the heads of the departments of explosives (Lord Moulton) and trench warfare (Gen. Louis Jackson, and Mr. Alexander Roger), and as the number claiming this privilege continued to increase, it gave rise to difficulty in coördinating the work of the various sections. Within the first few weeks, these various heads of departments went to the corresponding sections of the War Office, discussed requirements and gave instructions to the contracts department or placed their own contracts, without reference to the programme of the department as a whole. This difficulty was overcome by setting up a "Requirements and Statistics" department, whose primary duty was to be the sole official channel of communication between the Ministry of Munitions and the War Office on all questions relating to supply. Informal discussion was encouraged, but the various departments were authorized to act only on the formal demand from this new department. Since this department had passing through its hands the programme as a whole, it was also given the duty of compiling the statistics of the Ministry and receiving weekly progress reports from the supply departments.

The diversity of experience in organization among the business men also led to confusion in the mechanical arrangements for distribution and registration of papers, and it was some months before the newcomers grasped the essential difference between acting as head of a section of a large public service which is a part of a still greater whole and acting as head of a private business. These defects, which arose from the very qualities which enabled the Ministry successfully to set rapidly in motion and ultimately to control the immense industrial reserves of the country, finally induced Mr. Lloyd George in March 1916 to change his headquarters from the labour department to the main supply department. In March 1916, Mr. E. B. Phipps was transferred from the Board of Education as second general secretary to take charge of the mechanical organization of the supply departments.

Munitions of War Act.—The first task of Mr. Lloyd George was to make the country realize that the munition effort must be second only in importance to the work of the army in the field, and must override all such ideas, for instance, as of the importance on economic grounds of maintaining the export trade. Hence during June he undertook a campaign of speeches in the chief industrial centres to prepare the minds of both employers and workpeople for the very great restrictions imposed by the Munitions of War Act.

The chief provisions of this Act (July 2 1915), which brought to a head the developments in the labour situation seen during the first year of the war, may be summarized as follows:—arbitration in disputes as to wages, hours and conditions of service made compulsory; strikes and lockouts prohibited; Minister authorized to declare factories "Controlled Establishments"; profits of these establishments limited by means of a tax known as the "Munitions Levy"; no wage changes to be made in controlled establishments without consent of Ministry; migration of labour prevented by provision that a controlled establishment must not engage a man unless he held a "leaving certificate" from previous employer; Minister authorized to demand statistical returns; Minister given authority to issue badges which protected men from pressure to join the army and to suppress illicit badges; Minister authorized to create corps of war munition volunteers available for transfer at his discretion; Minister authorized to demand removal of labour from non-munition work. The administration of the labour sections of the Act was placed in the hands of "Munitions Tribunals" set up in all industrial centres. The Act had considerable success in stabilizing labour conditions, and brought to an end the period of unrest.

Almost immediately the Act was passed a strike occurred in the South Wales mines, and it required a personal visit of the Minister to persuade the men to return. But this was the last serious outbreak for a very considerable period.

In regard to female labour and the abandonment of union rules, the objections of the ordinary trade unionist to permitting unskilled labour to do work previously regarded as skilled had been steadily weakening as the shortage of labour became more acute, and as experience of making shells and fuzes on repetition methods spread through the country it became more obvious that the work was unskilled. Finally the disinclination to surrender pre-war practices had largely arisen from the fact that it was impossible to prevent the changes spreading to private work, and in any case it was extremely difficult to distinguish between Government and private work; but as the year proceeded private work fell more and more into the background. Prejudice on the part both of employers and workpeople against the employment of women in engineering work had still to be overcome. The men's opposition to the women was considerably appeased by the decision that women doing skilled or semi-skilled work should be paid the same rate as the men displaced, while the fixing of a minimum wage for unskilled female labour of £1 a week tended to raise the level of women's wages in general and minimize the possibility of men's wages being prejudiced. A department was started to encourage welfare work in the factories, and in many congested districts housing and hostel schemes were initiated. From the passing of the Act the employment of women on munition work increased continuously until the end of the war. In the succeeding six months, the "badging" system of the Ministry (*see* Labour Supply and Regulation) caused a decided check to recruiting from the engineering factories. Indeed, at a later stage it appeared that badges had been given rather too freely, and many badged men were ultimately released for service. The plan of mobilizing a corps of war munition volunteers met with only a qualified success at this period, and a great difficulty was experienced in obtaining the release of men from the army. This problem was somewhat simplified after the introduction of compulsory military service.

The "Munitions Levy" was ultimately succeeded by the general Excess Profits Duty, leviable on all firms in the country, and the assessment passed from the Ministry into the hands of the Board of Inland Revenue. This Act, which created the powers exercised by the labour section of the Ministry of Munitions, involved a very extensive interference by Government with the liberty of the individual worker, and was the more remarkable since at this date the army was still dependent upon voluntary enlistment. Its passage was only made possible by the clauses limiting private profit on munition work.

The Production Programme.—Early steps were taken to ascertain the general requirements of the War Office. But the Minister, in view of the circumstances of his appointment, considered himself in no way bound by these demands, and held that he was free to place such orders as would ensure an enormous increase in the munition-making capacity of the country and also to look very far ahead in placing orders abroad.

Guns.—The most notable action of Mr. Lloyd George in this respect was in the matter of heavy artillery. In June 1915 a conference on munitions was held at Boulogne, at which French experts strongly urged the necessity of increasing enormously the proportion of heavy artillery per division. Field artillery had practically no effect on deep trenches, and as the whole front had become a vast entrenchment it was necessary to contemplate having in the field as many heavy guns as field guns. Following upon this conference, Sir John French put forward a demand to the War Office to provide for each division and army corps a definite establishment of heavy guns and howitzers 6 in. and upwards. This standard was worked out on the basis of 50 divisions and put forward as a definite demand. In view, however, of responsibilities in other theatres of war and of pressure from the French Government, the War Office was already laying its plans on the basis of 70 divisions. The gun programme, therefore, before being passed to the Ministry was proportionately increased and an allowance added as reserve. On receipt of this demand the Minister early in July allocated these orders among the armament firms and authorized the necessary extensions to plant and the purchase of the large quantity of machine tools required from English and American manufacturers. It was obvious, however, that the scale of the plant to be developed would determine the date at which these enormous orders could be fulfilled. Mr. Lloyd George had at this time urged the necessity of increasing the British military effort to 100 divisions. Partly with this object in view and partly to broaden the basis of the munition output of Great Britain, which was still far behind that of Germany, he increased the programme on his own responsibility in Aug. 1915 to a 100-division standard, and ordered all the consequential demands for shell, fuzes, explosives, propellants, steel, etc., to be calculated on this basis. This action was much criticized both on the ground of expense and the alleged impossibility of training personnel to man so vast an armament. But Mr. Lloyd George was supported by the Cabinet, though arrangements were in train in the spring of 1916 for handing over the surplus to the Allies and particularly to Russia if and when it matured.

Within a few days, however, of the opening of the battle of the Somme in July 1916, G.H.Q. revised their ideas and put forward an entirely new basis of equipment. The establishment of 6-in. howitzers, which had seemed large in July 1915, was trebled; the demand for 8-in. and 9·2-in. howitzers was doubled, while a new item was added in the shape of heavy long-range guns. When the programme was examined it was found that the surplus orders of the Ministry covered these increased demands for all heavy howitzers except the 6-in. and that only comparatively small additions to the existing gunmaking capacity would be required to enable the Ministry to cope with the whole of the new programme. So complete a vindication of Mr. Lloyd George's courageous action, with its far-reaching consequences in the subsequent campaigns, marks it as one of his great contributions to the Allied cause. Indeed, his contention that gunmaking capacity would be one of the vital factors in the campaign was repeatedly confirmed by subsequent events which involved new calls upon British gunmaking capacity. In the first place French experience at Verdun, and subsequently British experience on the Somme, soon showed not only that wastage by destruction would be far larger than had been anticipated, but also that expenditure of ammunition was on so huge a scale that the number of guns worn out and needing relining would be very large indeed. Secondly, it was decided before Christmas to arm all merchant ships with two guns capable of coping with submarines. Thirdly, an urgent and increasing demand arose for anti-aircraft guns, not only on the front but also for the defence of London and many other strategic points in Great Britain. Finally, the development of the use of tanks on a large scale called for the production of an enormous number of guns of small calibre.

Hence it was not until the middle of 1918 that the output of guns of all kinds became sufficient for these combined requirements, and after the output and importation from America of large-calibre shells had enabled heavy stocks to be accumulated, it became necessary to divert some of the projectile factories from shell-making to the repair of guns.

Ammunition.—The highly technical processes involved in gun manufacture remained for the most part in the hands of a comparatively few firms. The ammunition programme, on the other hand, with its immense drain on materials and plant, until the end of the war absorbed more than half of the energies of the Ministry and of the munition factories, and was the main cause for the control which was ultimately imposed upon the industry of the country. The shell itself, which at first figured so largely in public discussion, is, as its name implies, merely a container of H.E. or of bullets, and the problem of finding sufficient explosive, propellant, fuzes, primers, cartridge cases and the score or so of other components which go to make up a round of ammunition, proved much more difficult than the manufacture of the shell. The balancing of output, including the appropriate provision of the various metals or chemical substances, was not accomplished without much experience; and as from time to time particular items were ahead or in arrears, the Ministry had to provide for the accommodation of large stocks at all stages of production. The programme thus involved the building-up of a colossal stores organization, the burden upon which was greatly increased by the irregularity in the rate of consumption on the front. Moreover, as the Ministry found it necessary to make itself directly responsible for supplying materials to contractors it became not merely a purchasing department but one of the greatest selling organizations in the world.

The ammunition programme was calculated from the enlarged artillery programme on the basis of the expenditure per gun per day asked for by G.H.Q. But as it was impossible accurately to foresee to what extent new firms or new shell factories would produce the output expected from them, there was added to the net shell demand a margin of 50% in the case of light shell (up to 4·5 in.), which had been ordered largely from inexperienced firms, and 33% in the case of heavier natures, which at first were confined to more experienced firms or new factories built for the purpose. Orders for the former were placed to a large extent through the local committees called into existence by the War Office Armaments Committee or by the Ministry during the June publicity campaign. In some cases the orders went to special factories, in others to coöperative groups, the whole organization being bound together by a local office of the Ministry under a special directorate (in charge of Mr. James Stevenson) at headquarters. The supply of heavier shell was met by orders with armament and other selected firms, but when the programme was increased in Aug. 1915, it was decided that "national projectile factories" should be built for the Ministry and managed by the various experienced firms on a commission basis. These factories, laid out for a special purpose, ultimately proved highly efficient in mass production and enabled an enormous saving to be made in cost. Additional orders for both light and heavy shell were also placed in America and Canada.

Experience proved, however, that light shell could be turned out much more readily than fuzes and other components, and they began to come forward rapidly and before the filling factories were ready to deal with them. The American share of the programme had also been ordered for early delivery. Hence, by the summer of 1916, an enormous stock of light shell had accumulated, partly as a deliberate policy and partly from fortuitous causes. At various dates, therefore, in 1916 light-shell orders in America were allowed to terminate and output at home cut down, and the machinery partly turned on to heavy shell.

The new artillery programme of July 1916, however, based upon experience on the Somme, not only absorbed the surplus Ministry orders for heavy artillery, but also raised the daily ammunition ration for heavy guns. The Minister was still uncertain what output would be attained in the national projectile factories, which were only then coming into production, and therefore almost his last act at the Ministry was to place large orders in America and Canada, in the two natures in which the biggest increase was asked for, viz. 8-in. and 9·2-in. shell.

Shells could be made in any engineering shop; but explosives could only be handled in factories built for the purpose. Hence, as soon as the ammunition programme was settled the ammunition department set to work to plan and to build a dozen large filling factories, which were rapidly completed and began to handle shell in Feb. and March of 1916. The task of these factories was, however, not merely the technical one of filling shell, making cartridges or filling fuzes, but also that of assembling all the necessary components in proper proportion and of handing to the army in complete condition as rapidly as the Ordnance Department could accept delivery. At Christmas 1915 the organization of these filling factories was divided from ammunition manufacture and handed to a new department. During the spring their work was delayed not only by inexperience, but also by the inability of the technicians to find a satisfactory fuze for detonating amatol filled H.E. shell which would avoid the Scylla of over-sensitiveness, with the resulting casualties to the troops through prematures or gunbursts, and the Charybdis of excessive safety, resulting in "blinds" and ineffectiveness against the enemy. Work at the highest possible pressure at Woolwich at last solved the problem, and solved it so satisfactorily that, a year later, British artillery was probably more immune from prematures, etc., than any other. But the constant change of processes during these critical months held back the factories from getting on with bulk production, and it was not until the middle of May that the Ministry began to hand over large supplies to the army. The date of the Somme offensive was largely determined by these considerations.

Explosives and Propellants.—Special steps to develop the production of explosives were taken in 1914—the problem of increasing the output of tri-nitro-toluol (T.N.T.) and other explosives being remitted to a committee under the presidency of Lord Moulton. Hence, when the Ministry was formed, plans were not only in hand but had already achieved considerable success. Pressure had been put upon gas undertakings throughout the United Kingdom to extract the utmost amount of the by-products of coal distillation at the expense of the illuminating-power of their gas, in order to increase the supply of toluol and of benzol, which Great Britain had begun to supply to France. When the Ministry was formed Lord Moulton's department was transferred, and charged in addition with the supply of propellants. At that time this consisted almost entirely of cordite, of which the supply was fairly ample owing to the large capacity which had been developed for naval purposes.

When, however, the new ammunition programme was decided upon, it was evident that the supply both of H.E. and of propellants would also have to be enormously increased. So far as explosives were concerned it was evident that the world's available supplies were insufficient to enable the programme to be carried through by means of either pure T.N.T. or picric acid. It was known that in theory a mixture of T.N.T. and ammonium nitrate could be made to produce as violent a detonation as pure T.N.T., and that the French army was in fact using a mixture of picric acid and ammonium nitrate. In order not to compete for the supplies of picric acid, it was decided to rely upon a mixture of T.N.T. and ammonium nitrate (amatol), and the design department was set to find a means of satisfactory detonation.

The result of their efforts was that during the war, out of about 625,000 tons of explosive supplied, only 210,000 tons (of which 35,000 tons were imported) was T.N.T., less than 80,000 tons picric acid, and the rest ammonium nitrate.

In the case of propellants the stocks and manufacturing capacity for cordite in autumn 1915 were fairly large, and as early steps were taken to increase output its supply never delayed the ammunition programme throughout the war. Its production was, however, limited by the supplies of acetone, and even when an ether-alcohol solvent was used as an alternative to acetone, it was not possible to meet the enlarged programme by cordite alone. The army had accepted as propellant for certain guns a nitro-cellulose powder, which was the standard charge on the Continent before the Ministry came into existence, and since it was not manufactured in England orders had already been placed in America. One of the earliest acts of the Ministry was to place, with Messrs. Dupont of America, enormous additional orders sufficient to justify the manufacturers in making large additions to their plant.

From that date onwards the question between cordite and nitro-cellulose continually exercised the minds of the Ministry. The argument for importing finished propellant was the great saving in tonnage involved, since it is necessary to assemble several tons of material for each ton of propellant and nearly all of the material had to be imported—mostly from very great distances. This advantage had, however, to be balanced against the consideration that, so long as Great Britain remained dependent on a neutral country for a substantial proportion of its propellants, the supplies were out of British control so far as the manufacture was concerned, were liable to serious losses from submarine activity, and in danger of interruption should the United States Government for any reason desire to prohibit the export of munitions. Towards the end of 1916 the last of these considerations assumed considerable importance; and as at that time the use of nitro-cellulose had been adopted for a considerable number of types of artillery, it was decided to commence the manufacture of nitro-cellulose powder in Great Britain. A large factory was projected, but was abandoned when America came into the war.

The novelty of the supply both of explosives and propellants led to the building of large national factories to supplement the limited capacity of the factories in private hands. Indeed, the largest industrial venture of the war was the propellant factory at Gretna, the scale of which is illustrated by the fact that its acid-producing capacity exceeded that of the whole country before the war. As it was considered expedient to build not only out of range of enemy aircraft but also away from industrial centres, it involved building a town to house the workpeople. The factory, which cost £8,000,000 to build, made nearly one-fourth of the cordite required by the army during the war, at a considerable saving of cost.

The relative importance of home sources and of imports of explosives and propellants is shown in Table I, which gives the percentages of the total output during the war:—

TABLE I.

	Trade	National Factories	Imports
Picric Acid	92%	6½%	1½%
T.N.T.	21	63	16
Ammonium Nitrate	65	30	5
All Explosives	53	39	8
Cordite	47	38	15
Nitro-cellulose	—	2	98
All Propellants	26	22	52

The explosive output involved a greatly increased supply of nitrate from abroad. At first this was readily forthcoming, but at an early date Allied competition led to difficulties in Chile, and later, when lack of tonnage made it difficult to spare ships for so long a voyage, an inter-Allied organization was set up to buy for the Allies in common and to ration supplies. In the last year of the war France met her needs to a substantial degree by the fixation of atmospheric nitrogen; but though a plant for this purpose was begun in Great Britain it never reached the production stage.

Trench Warfare.—The stabilizing of the western front led to the employment of a great variety of engines of war subordinate to the artillery, such as mortars, hand grenades, etc., some of which were designed and even produced at the front. These weapons gave great scope for inventive faculties, while the implements themselves did not require the same degree of accuracy as artillery or aeroplanes. Hence they provided an outlet for engineering capacity which was not suitable for more exact munitions, while it enabled civilian enterprise to make substantial contributions on the side of design. The trench warfare department of the Ministry was in fact organized on the principle of setting "design" and "production" side by side. It produced a large number of products which it offered to the army, of which three are of outstanding importance. (1) The first was the Stokes mortar, which was manufactured and sent to the front in spite of a very lukewarm reception by the military authorities. In this case the Ministry proceeded in advance of the sanction of the War Office, but the weapon won its way and became part of the standing equipment in the latter years of the war. (2) The department in the autumn of 1915 experimented with shell filled with lachrymatory gases, and, in the spring of 1916, with poison gases of various kinds. The most powerful of these was at first withheld from use by the army, as the Government was unwilling to go farther in this respect than the Germans; but the experience of the campaign of 1916 finally removed any scruples of this kind. A notable achievement of the trench warfare department in this field was the development of the cast-iron shell as a container for poison gas. This device avoided making an additional call upon the limited supplies of shell steel, and as it could be opened by a less violent explosion than was required with a steel shell there was less likelihood of destroying the properties of the gas and dissipating it too widely. By 1917 the proportion of chemical-filled shell to H.E. shell was rapidly increasing, and as it finally grew from being a small supplement into an integral part of the ammunition programme, the filling of chemical shell was ultimately taken over by the ammunition filling department. In the autumn of 1918, 20% of certain natures and 12% of others were filled with chemical, and the percentage in 1919 would have been immensely greater. (3) During 1916 the department equipped the army with shrapnel-proof helmets, which rapidly became a regular part of the soldier's equipment.

Tanks.—Another feature of Mr. Lloyd George's administration was the commencement of the manufacture of tanks. The design of the first tank was developed (*see* TANKS) by an Admiralty committee and tested before several members of the Cabinet in Feb. 1916. The design was favourably reported upon by the military representatives present, and a special department was created in the Ministry under Col. Albert Stern to manufacture these new weapons. The secret was well maintained, in spite of the special priority in regard to labour and materials which was given to the manufacturers during 1916. Tanks were first used in the field in Sept. 1916, and thereafter their production assumed its normal place among the other departments of the Ministry.

Other Activities.—During Mr. Lloyd George's administration steps were taken to establish a general system of priority not only in regard to machine tools and the use of raw material, but also in all the work done in engineering and chemical factories; but the carrying-out of the scheme in full belongs to a later date.

Foreign Purchases.—Within a month of his appointment Mr. Lloyd George sent Mr. D. A. Thomas (later Lord Rhondda) to the United States and Canada to report upon the progress of munition output in America. Mr. Thomas reported that although the commission paid to Messrs. J. P. Morgan & Co. seemed high the work was being well done and he recommended no modification in the arrangement. In Dec. 1915, Sir Ernest Moir was sent to America to exercise a general supervision over deliveries. An organization was set up in New York which kept track of output, followed goods through to port, and reported progress to the Ministry. This organization continued in existence until the end of the war, but became part of the British mission in the United States when America joined the Allies. In Canada Mr. Thomas found an organization in being under Gen. Sam Hughes, the Canadian Minister of Militia, though Gen. Hughes had no direct control over British orders. Subsequently the Canadian Pacific Railway were made agents for the British Government, and their organization developed into the Imperial Munitions Board, which exercised the functions of the Ministry of Munitions in Canada except that of inspection, which remained under an officer in Ottawa responsible to the head of the inspection department in Great Britain.

Financial Control.—At the commencement of the war it was evident that in the existing state of uncertainty it would be impossible for Parliament to retain control over the details of expenditure, and from Aug. 6 1914 onwards the money for carrying on the war was voted in the form of unallotted votes of credit, whose distribution was placed in the hands of the Treasury. The latter department, however, at once recognized that it was impossible for the spending departments to submit detailed proposals, and it therefore abandoned the machinery by which it normally sanctioned expenditure. This relaxing of control applied first to direct expenditure for the war, but was soon extended to cover advances to contractors, etc.

When the Ministry of Munitions was formed, similar powers were necessarily conferred upon the Minister except as regards the salaries of officials. Nor was it possible for the finance officers of the Ministry to control expenditure in the sense that they could exercise any influence upon the volume of orders to be placed. It has been stated that at the outset the Ministry placed orders largely in excess of War Office requirements in order to increase munition-producing capacity, and at a later date the Ministry discussed the character of the programme put forward by the War Office from the standpoint of the balance between various demands, the extent to which they could be met from stock, or the limitations imposed by lack of materials, tonnage, labour or other limiting factors. But except as regards the limit of money available for foreign purchases, financial considerations did not, in fact, govern the munition programme.

The task of the financial officers of the Ministry, under the assistant financial secretary (Sir Hardman Lever), was, therefore, confined to ascertaining that the public funds were spent as economically as possible. The limitation of contractors' profits to a large extent suspended the normal stimulus to reduce costs of production, and the first and most important enterprise of the finance department of the Ministry was to develop and impose upon contractors an adequate system of "costing" and cost-accounts. These were developed during the first few months of the Ministry's existence, and enabled the officials of the Ministry to negotiate successfully considerable reductions in prices. This costing system, together with the rapidly increasing efficiency of production through experience of manufacture on a large scale, quickly produced substantial reductions in price as compared with the original sums paid for all classes of munitions. In Aug. 1916 it was claimed by Mr. Montagu in the House of Commons that the Ministry had already saved by this means £20,000,000 on home shell contracts alone and that American and Canadian prices for shell had been reduced 15% and 12½% respectively.

Design.—A most important expansion of the functions of the Ministry took place in Nov. 1915, when the design department of Woolwich was transferred to the Minister. A new inventions board had already been instituted in the Ministry, but this did not deal with established service articles. It had for many months been a subject of complaint, by those controlling production in the Ministry, that the design department was still working on pre-war traditions and was not sufficiently in touch with the requirements imposed by methods of mass production, nor was it drawing sufficiently upon the experience which was being gained by those actually engaged in this production. The War Office quite properly attached the very greatest importance to questions of design and the accuracy limits in specifications which the safety of the army made necessary, and were unwilling to release control of this department. The matter, however, was decided by the Prime Minister (Mr. Asquith) in favour of the Minister of Munitions, the transfer was made, and it was laid down that the Army Council should inform the Minister in general terms of the qualities required in a specific supply, that the design department under the Minister should submit its results to the War Office, and that the latter would then indicate the amount of its requirements. The officer in charge of design under the Minister would, however, be responsible for approving the specifications for manufacture. This officer, who in the first instance was also given charge of the inspection staff, thus took over the duty of laying down the standards of inspection.

The work of this department during the first six months after its transfer to the Ministry was of an exceedingly difficult character, for it had to solve the problem of successfully detonating artillery shell filled with the new high explosive (amatol).

The transfer of this department, which was put under a military officer with war experience (Maj.-Gen. Du Cane), had the important consequence of creating direct contact between the Ministry and the army in the field, and so enabled the behaviour of the new munitions under service conditions to be known in the workshops.

The Somme Battle.—The first period of the Ministry's history ends with the opening of the battle of the Somme. The output of artillery and of ammunition, so long delayed by one difficulty after another, had at last permitted the army to accumulate a substantial stock of shell and to dispose of an artillery equipment with which it could match the standard of expenditure set by the Germans at Verdun. But the stock had only begun to accumulate in the preceding six weeks; and as the preliminary bombardment (which could be heard from the English coast) continued day after day, the rapidly dwindling stock was watched with growing anxiety. When the troops went over the parapet, and while the ground was being consolidated and the guns brought up, there was a momentary respite, but within a few days the barrage broke out again, and before the end of July the army was living from hand to mouth upon the incoming supply from Great Britain. So far as all the heavy natures were concerned, practically the whole of this came from a single filling factory. The fear of an untoward accident to Chilwell or of an interruption to the cross-Channel service was thus added to the normal worries of production and transport. Fortunately, however, everything went according to plan, and the supply steadily grew until the winter brought the offensive to an end.

This achievement was not the first fruits of the formation of the Ministry of Munitions. The army had been living for months past on munitions supplied on previous War Office orders; but these orders would not have materialized had it not been for the help rendered by the Ministry to War Office contractors, in technical matters (gauges, drawings, etc.), in supply of materials, and in control of the labour supply, recruiting, etc.

At the end of 12 months, however, the larger plans initiated by Mr. Lloyd George began to bear fruit and became one of the dominating factors in the war. From the middle of 1916 onwards, there was never a general shortage of munitions, and the special emergencies which arose from time to time were met with increasing facility, as the enormous industrial organism which had been set in motion during this first year became more responsive to control.

Centralized Administrative Control.—The second year of the Ministry of Munitions (Mr. E. Montagu becoming Minister in July 1916, and Dr. Addison in Dec. 1916) saw a very considerable readjustment of and increase in the artillery and ammunition programmes of the Ministry as a result of experience in the battle of the Somme. The increased artillery demand naturally involved consequential increases in the ammunition programme, but in Sept. 1916 the army sent in a demand that the *ration* of ammunition per gun should also be increased. It was found that the 18-pdr., which at one period was thought might even be superseded altogether, had functions of supreme importance in furnishing the "creeping barrage," in following up before the "heavies" could be moved, and in shelling the enemy as soon as he left his permanent entrenchments.

The daily ration was therefore raised to 50 rounds per gun per day, while the 6-in., 8-in., and 9·2-in. howitzers, whose rations had been 20, 15 and 12 rounds respectively, were raised to a uniform 30. Though these increases added 50% to Mr. Lloyd George's programme, they did not involve any changes in manufacturing policy. They did, however, call for more complete control over materials and processes subsidiary to the ammunition programme, and made necessary increasingly drastic restrictions of non-war work by means of priority certificates, while the growing shortage of labour involved a constant extension of the principles of dilution. These changes involved a tightening of the centralized control of the Ministry over industrial conditions, and made it increasingly difficult for private industry to continue or for other departments to get their contracts fulfilled. It was largely on this account that the Ministry took over a number of additional services, of which the chief were the supply of aircraft, railway material, agricultural machinery and motor vehicles, the last of which was placed in the charge of Sir Albert Stanley.

When the Ministry took over the supply of aircraft, which was placed in the hands of Sir William Weir, the supply of aeroplanes was at the rate of 675 per month and of engines 721 per month. These figures rose to 1,117 and 1,083 respectively per month in the next five months, as new firms came into production and the difficulties with materials were overcome. For the rest of the war, however, it was necessary to give a very high priority to aircraft production, particularly with regard to skilled labour, although the novel character of the work and its consequent freedom from restrictive trade-union practices permitted female labour to be introduced from the outset to a greater extent than in other sorts of munition work.

The progress of "dilution" generally throughout this period is shown by the fact that while in July 1916 employers reported that 336,000 women had replaced men, in July 1917 654,000 women had replaced men. In Government establishments, which had only employed 2,000 women before the war, 69,000 women had replaced men by July 1916 and 191,000 by July 1917.

Control of Steel and Other Materials.—The development of the steel department into one of the most vital sections of the Ministry belongs to this period. Prior to the formation of the Ministry of Munitions the War Office had enlisted the services of a steel expert (Mr. McLellan) to assist them in buying the multitudinous variety of products covered by the contracts department, and in the spring of 1915 the Government bought, on behalf of the Sheffield trade, considerable quantities of Swedish bar iron which they held as a reserve against the possibility of Swedish supplies being cut off. Action had already been taken regarding some of the more rare metals used for ferro-alloys, an arrangement having been made, for example, by the Government to take all the wolfram of the Empire until after the end of the war. But in the first year of the Ministry's history the steel problem was not of critical importance, and the steel section was a branch only of the materials department, separate sections being organized to deal with high-speed and carbon tool steel and with metallurgical coke. In the spring of 1916, as the shell factories began to get to work, and the demand for shell steel to assume large dimensions, three aspects of the steel problem came to the front: namely, the necessity for an increase in the total steel production of the country, the restriction of commercial or less essential war uses of steel, and the regulation of prices. The first scheme for increasing the steel plant was prepared in March 1916. In June 1916 plans for developing pig-iron production by converting and modernizing old blast furnaces and building a few new ones were prepared, while in May 1916 the first control order fixing the maximum prices of iron ore, pig-iron, steel, coke, bricks, etc., was passed. These arrangements were supplemented by the placing of orders for shell steel in the United States, and in June 1916 a representative was sent to that country to arrange for supplies. During this first year some assistance in meeting demands was obtained by a modification of the War Office's specifications. By April 1916 the Army Council had approved the use of steel in shell containing up to ·07% of sulphur and phosphorus. This figure was subsequently increased to ·08%. One other problem which had given rise to difficulty was the supply of foreign ore, as a result of the increase in freights. A committee of ore merchants was summoned in the spring of 1916, and decided upon a uniform freight basis from Bilbao to Great Britain of 17s. per ton, an official ore broker being appointed to take entire charge of chartering ore tonnage. The centralization of chartering had a wholesome effect, and though the price subsequently rose to 38s. the demoralization of the market was prevented. Such was the position when in Aug. 1916 it was decided to form a separate steel department under Sir John Hunter.

The first action of this department was to press forward the plans already prepared for building new steel works and bringing new blast furnaces into operation. These programmes were subsequently enlarged at various times, and ultimately amounted to 166 new steel furnaces and 22 new blast furnaces in addition to the 40 old blast furnaces modernized. At a later date large rolling-mills were commenced, chiefly for increasing the supply of steel plates for ships, tanks, etc., and from time to time substantial improvements were made in the equipment of existing rolling-mills. In all these developments the Government shared the financial burden, not by direct subsidy but by allowing firms a deduction from their excess-profits-duty payments. A substantial percentage of these extensions were completed before the end of the war, but the programme was considerably delayed by insufficient labour and by difficulties in securing materials.

The problem of foreign ore supplies became increasingly difficult. The new department dissolved the existing committee and created a section for dealing with this problem. The purchase of Spanish ore remained in the hands of merchants, but they had to obtain the permission of the Ministry before placing orders, and thus in effect, though not in form, the purchase was centralized. This action, together with the fact that Germany was no longer in the market, prevented the price of ore in Spain from being unduly raised. Freight rates, however, and the cost of insurance rose to enormous sums; but as the Government bore the excess over the official rate, ore was delivered to British works at a fixed price. This became an important factor in stabilizing the price of steel. As regards Swedish ore large quantities were bought, and supplied to British makers.

The difficulty in securing shipping from Spain and the Mediterranean led to two internal developments. (1) The Cumberland ore mines, which were the only substantial source of non-phosphoric ore in Great Britain, were taken over on the basis of a guarantee to the owners and developed to their maximum output. (2) Under the most favourable conditions, however, no more than a small proportion of acid steel from British ore could be expected. A great effort was accordingly made to develop the manufacture of basic at the expense of acid steel, which had hitherto constituted the larger part of the output of Great Britain. This involved in the first place an attempt to increase the output of the low-grade phosphoric ores of Oxfordshire, Northamptonshire and elsewhere, and in the second place a modification in the programme of steel works extensions, which first had been planned mainly for acid steel.

This question of basic steel, though a technical one, was potentially of great political importance. In peace-time, Great Britain had been content to be dependent on foreign sources of relatively high-grade ore for more than half her steel. The problem in 1916 was whether it was either possible or desirable to become self-dependent in this vital matter. There was much to be said for and against each of three possible courses:—(1) making basic steel from low-grade British ore, (2) making acid steel from imported ore, or (3) importing pig-iron or steel from America. The difficulty of importing ore which required a large tonnage on a submarine-infested area was obvious; but the use of low-grade British ore involved a larger consumption of fuel and therefore of man-power in the coal-mines, and an increased congestion in internal railway transport. Imported American pig-iron, on the other hand, utilized neutral labour and economized tonnage, since two tons of Spanish ore are needed to make a ton of pig-iron, but until America came into the war the difficulty of financing purchases and the desire not to become too dependent on the United States caused the Ministry to persevere with home supplies, and even after America joined the Allies the policy could not be materially changed, owing to the large scale of the war demands of the American Government, which left little margin for export. Hence the production figures (Table II) show a steady development in basic output.

Table II.

	Acid Steel Output (Ingot tons)	Basic Steel Output (Ingot tons)
1913	4,860,000	2,804,000
1914	4,478,000	3,357,000
1915	5,111,000	3,439,000
1916	5,468,000	3,523,000
1917	5,772,000	3,945,000
1918	4,992,000	4,547,000

The total of 36,700,000 ingot tons of steel for the four war years 1915–8 (toward the production of which there were imported 26 million tons of ore and over ½ million tons of pig-iron) represents about 28 million tons of finished steel, to which must be added 2¼ million tons of shell steel imported from the United States and Canada, and a million tons of general steel.

In Nov. 1916, a control order restricting steel consumption for less urgent uses was passed, under which the department was entitled to obtain itemized returns of steel deliveries from every works, and to insist that the orders in hand should be carried out in order of urgency. These returns showed how much steel was being used for each branch of war production; and although at first it was difficult for the various departments of the Government to reduce their demands to a fixed programme and to convert these demands into terms of steel, a system was gradually evolved in which it was possible to balance deliveries against requirements. From July 1917 onwards steel allocations were made at monthly meetings of departments presided over by the controller of steel production.

By this time, however, the balance of needs had been substantially altered. The shell programme had been in effective operation for nearly two years. Stocks of empty shell and of shell steel had accumulated, the orders placed in America had materialized, and it was now possible to deal with the supply of ammunition without providing large margins for contingencies; hence the actual monthly allocation was substantially reduced. On the other hand, a very urgent demand for steel for shipbuilding had arisen, and with increasing demands for tanks, aircraft, military railways and other needs the supply of shell steel dropped to a relatively minor position. The figures for the allocation of steel for the first six months of 1918 (Table III) show the balance between the various departments.

Table III.—*Steel Programme for First Six Months of 1918.*
(*Weekly average in tons.*)

Admiralty (mainly plates and sections)		37,076
War Office Contracts Department		10,016
Ministry of Munitions		
Explosives	556	
Guns, large	2,760	
Machine-guns and S. A.	900	
Trench warfare	924	
Mechanical warfare	3,480	
Mechanical transport	1,376	
Aircraft	3,536	
Steelworks extension	1,428	
Factory construction	—	
Machine tools and cranes	1,176	
Railways, U.K.	4,536	
Railways, overseas	4,924	
Electrical power supply	676	
Total M. of M.		26,272
India Office		492
Other Government Departments and Priority		19,804
Allies:—		
France		6,940
Italy		1,092
Shell steel:		
Great Britain land service and Admiralty		21,448
France		900
Italy		3,360
Tubes		7,672
Wire rods		4,808
Grand Total		139,880

The actual realization was fairly close to the estimated figures, but in addition an average of 16,400 tons of shell steel was imported from the United States and Canada.

In regard to prices the Government, after attempting in 1915 to regulate prices by agreement, found that costs were rising to such an alarming extent that it was faced with the necessity either of raising the price of steel, and so altering the basic figure of vast numbers of Government contracts, or of keeping prices fixed and making good the balance to manufacturers in the form of direct or indirect subsidies. The change in prices would ultimately have been very large, as the subsidies finally amounted to no less than £10 per ton on steel made from imported ore. Of this sum, ocean insurance amounted to £5. The event thus justified the decision of the Ministry to adopt the policy of subsidies, for otherwise it would have been faced not merely with the readjustment of numberless contracts, but also with a rise in the general level of prices, involving increased middlemen's profits, wages variations, etc. Moreover, the Government was itself directly or indirectly the purchaser of 98% of the total produced, and, except as regards freight, the increases in steel cost were largely caused by wages advances, which were to a substantial extent controlled by the Government itself. The policy once started involved controlling the materials for production, including ore, coke, pig iron, scrap, ferro-manganese, and magnesite, fire, and silica bricks. Increases in wages in the steel works themselves were met by paying subsidies direct to the manufacturer, but the bulk of the subsidies were paid not directly to steel manufacturers but to shipowners and mine-owners, and in bearing the actual cost of submarine losses at sea. The total amount paid directly or indirectly as subsidy to steel production costs in 1918 reached 45 million pounds sterling.

The only other way in which the stabilization of prices could have been obtained was for the Government to have bought the whole output of iron and steel, and to have sold it to the user; and if the complete character of the control had been envisaged at the outset it is possible this plan would have been adopted; but as control was at first only partial, while the maintenance of private commerce remained important, it was impracticable.

The case of steel is the most representative example of the numerous controls exercised by the Ministry over a wide field, touching the economic life of the community at many points.

Before the Ministry came into existence, some measure of regulation had been adopted in the case of several non-ferrous metals and chemicals. At an early stage in 1915, for example, the Government purchased the whole output of wolfram (the ore used for making tungsten, which is the alloy used in high-speed steel) from imperial sources. The list was added to continuously throughout the war, until at the Armistice it included aluminium (the demand for which enormously increased owing to its use in aircraft, in fuzes, and as a chemical element in smoke powder), antimony (used as an alloy of lead for making shrapnel bullets), chrome ore (the material for the alloy in chrome steel), copper, brass, lead, nickel (for nickel steel and rifle bullets), mica (for magnetos), platinum, potash, resin, shellac, tin and zinc. The long list of the explosives department included acetate of lime, acetic acid, acetone, glycerine, bleach, chlorine, ether, benzol, coal tar, creosote, nitrate, pyrites and sulphuric acid. The new process for making cordite, which was developed at the Gretna factory, was one of the main causes which brought alcohol under control, and ultimately stopped its production for non-industrial purposes; while the control of sulphuric acid, together with the scarcity of nitrate, quickly brought the whole supply of fertilizers within the domain of the explosives department, since control of one or two materials inevitably leads to the control of competing materials. Thus the department became responsible for the supply of superphosphates and basic slag, nitrate and sulphate of ammonia, and potash.

Several of these commodities differed from the case of steel in the fact that the article was imported on a large scale in the form in which it was commonly sold in England. Regulation, therefore, commonly started in two ways: the fixing of a maximum price and the control of importation by licence. The Government early exercised a large influence on the market by reason of very large contracts which it placed abroad, but these were not always sufficient to give adequate control. Hence orders were made under D.O.R.A., giving the Government the right to commandeer all imports on private account. Even this was not always sufficient, since the existence in the country of a large stock of material made allocation difficult and created a small but free market which had a disturbing effect on price. Hence the further step was necessary of prohibiting purchase and sale except under licence. Finally, in all cases where home production was a substantial element, as for example in the case of alcohol, glycerine, etc., the Government commandeered the whole of the internal output. Certain cases, however, such as pyrites, followed the steel precedent, since the stabilizing of the price of sulphuric acid meant that, as the cost of transport and insurance of pyrites from Spain increased, the Government had to bear a large part of the cost of the material.

The period under consideration marked the transition in the great majority of cases from the looser form of control by maximum price to the more complete regulation of all dealings in the commodity and the commandeering on Government account of total available supplies.

Foreign Orders and American Intervention.—When it was decided to place new heavy-shell orders abroad, considerations of finance, together with the desire to avoid becoming too dependent on a country which at any moment might ban the export of munitions, led the Ministry to place as large a proportion of orders as possible in Canada. The failure of the new rifle plants erected in 1915 to make delivery in time to relieve the rifle shortage led to special negotiations for reduction in these contracts, and arrangements were ultimately entered into, under which the total to be delivered was reduced from 2,500,000 to 1,200,000. This, together with other orders, meant that in 1916 the British Government was buying large quantities of material but not much finished munitions from America. When America entered the war, representatives of the Ministry accompanied Mr. Balfour to the United States with the object of giving the U.S. Government the benefit of British munition experience, endeavouring to coördinate the programmes of the Allies, and arranging for any change that might be called for in the organization of the munitions office in America. The American departments were not in fact sufficiently organized as to personnel or duties to enable these objects to be carried very far at that date. In May 1917, Messrs. Morgan gave notice to terminate their commercial agency, and offered to place their organization at the disposal of the U.S. Government. As a temporary arrangement they offered to continue to place orders for the Allies at a reduced commission, but it early became evident that every order would involve negotiations with the Government for financial approval as well as for the necessary priority and export permits. It was clear that these duties could not be appropriately undertaken by an American organization, and on the recommendation of the Balfour mission a British munitions representative was sent out to take charge of a mission in Washington, whose duty would be to carry on negotiations with the American Government for the necessary supplies. This officer subsequently became part of the American war mission under Lord Northcliffe.

Assistance to Russia.—In the autumn of 1916, serious attention was devoted to the possibility of remedying the disparity in the material resources available on the Russian compared with the western front, the need being emphasized by the arrest of the successful offensive of Gen. Brusilov as soon as his troops came up against fortified positions which could only be overcome by heavy artillery. From the beginning of the war, Lord Kitchener had made great efforts to persuade the Russians to place orders abroad, and direct assistance in this task both in England and America was subsequently given by British organizations and British credit. But the possibility of direct material assistance was very limited. Russia was a non-industrial country taking part in a war which was being largely fought by mechanical appliances, and in particular, on the vast extension of the eastern front, by modern means of transit. Russia was ultimately defeated by the failure of her inadequate railway system, which was called upon (1) to provide mobility for the troops at the front, (2) to bring food from the interior of Russia for 15,000,000 men and large numbers of horses normally living on the local produce of the soil, (3) to supply coal and steel from the Caucasus to the munition areas of Petrograd and Moscow which normally got supplies *via* the Baltic or by the Polish frontier, (4) to carry imports from the ice-bound ports of Archangel and Vladivostok. From Vladivostok it required 120 locomotives to maintain one train a day to Moscow; and though new rolling-stock and engines were put on rail in the Far East, by Christmas 1916 there had accumulated 600,000 tons of war material, including tens of thousands of tons of barbed wire, though many miles of the front had no wire defence at all.

The munitions representatives who accompanied the Allied mission to Russia in Jan. 1917 found that, in spite of the completion of the railway from the ice-free port of Murmansk to Petrograd, the ports and railways of Russia could not deal with more than 3,500,000 tons of imports (including coal), compared with minimum demands for 13,000,000 tons. A careful programme based upon the former figure was drawn up, including a substantial supply of heavy artillery and aeroplanes, and a permanent mission was stationed in Petrograd to assist in transport and in the training of personnel, but the revolution prevented the programme from being carried out.

Internal Developments.—During this year, efforts were made to improve the internal organization of the Ministry, among whose various parts there was still a lack of coördination. Moreover, the increasing functions had led to still more heads of departments having direct access to the Minister. Mr. Montagu endeavoured to deal with the problem by setting up a committee whose chairman (Sir Arthur Duckham) and vice-chairman (Sir James Stevenson) were relieved of departmental duties; but its powers were purely advisory. At the same time a weekly meeting of heads of departments was inaugurated and continued until the summer of 1917. This was of value in giving all departments a knowledge of general policy; but the numbers were too large for it to be an effective instrument of administration.

More important developments were inaugurated in financial administration, in two directions. The first was the overhauling of all the past accounting transactions of the Ministry, with the view of recovering money that had been temporarily lost through the confusion and deficiencies of the earlier system of records. This bore fruit in "recoveries" to the amount of some £39,000,000. The second was the reconstitution of the accounting system on a commercial basis for the future, by substituting double-entry for the old single-entry system, in use before the war in nearly all Government departments. Since the method of departmental bookkeeping was dictated by the prescribed form of accounts rendered to the Treasury and Parliament, this reform led incidentally to proposals for a remodelling of the public accounts themselves. By 1917 the financial staff of the Ministry had established a system of contract-control by means of cost accounts.

Early in 1917 the control of the inspecting staff was reorganized as an independent department under Sir Sothern Holland. This period also saw a great increase in the size and duties of the priority department, under Sir Edgar Jones. The staff of the Ministry, which had risen to 5,000 under Mr. Lloyd George, rose to 13,000 by July 1917.

Inter-Allied Coördination.—The third and culminating period of the Ministry of Munitions (Mr. Winston Churchill being Minister from July 1917 to Jan. 1919) saw certain important though not fundamental changes in programme. The chief of these were growing aircraft demands, accentuated by the campaign of the Independent Air Force against German industrial centres; a sudden enlargement of the tank programme as a result of their successful employment in the attack on Cambrai in Nov. 1917; and, thirdly, the efforts to emulate the Germans in the production of mustard gas, and to find, if possible, new and more effective poisons.

Further, during 1918 plans were far advanced, in preparation for the 1919 campaign, for increasing the range of an offensive, (*a*) by adapting the caterpillar principle to the movement across country of troops and stores on a large scale, and (*b*) by entirely re-equipping the army with longer-range field and other artillery. These measures were carried out by adapting rather than by enlarging the munition-making resources of the country. Indeed, the adequacy of the supply was put to a severe test in March and April 1918, when the army lost 1,000 guns and 100,000 tons of ammunition in the retreat from St. Quentin, in addition to losses resulting from the intensive attacks made upon British munition dumps in France by bombing aircraft. The artillery and ammunition losses were made good by May, and only in the case of small-arms ammunition, the expenditure of which in machine-guns increased to quite unexpected figures, was any anxiety experienced.

This phase of munition history corresponded with the unrestricted submarine campaign, the active participation in the war by the United States, and an increasing shortage of man-power. It was, therefore, marked by increasing efforts to economize and coördinate effort, (*a*) within the Ministry, (*b*) between the Ministry and other British departments, and (*c*) between Great Britain and the Allies.

Departmental Reorganizations.—Mr. Churchill's first task at the Ministry was to deal with organization. The internal mechanism had never developed on a considered plan, but had been determined partly by personal considerations and partly by the kaleidoscopic changes in the relative importance of various activities as the drama of the war unfolded. Mr. Lloyd George's administration was a period when half a dozen departments of supreme importance were feverishly urging on production in a new field under new conditions. And the business men in charge of them utilized to the full their right of direct access to the Minister—thus making organization extremely difficult.

The complexity became much worse during the next period, as duty after duty was imposed upon the Ministry, and as the task of carrying out the old ones involved control in new directions and the creation of fresh administrative branches. Hence, by the summer of 1917, the number of departments had increased to over 50, and although the machinery was in existence for coördinating the programme itself, there was not sufficient coöperation or clear definition of responsibility between the departments. Various attempts had been made to meet this difficulty—as, *e.g.* by the proposal to attach to the Minister one or more staff officers who would act as liaison officers between the departments, many of which were housed at some considerable distance from headquarters. A more promising scheme was to increase the number of parliamentary secretaries and make all departments report through one or other of them. But this scheme broke down through the complications still caused by exercise of the right of direct access to the Minister on the part of the business heads.

Mr. Churchill solved the problem by the creation of a Munitions Council, consisting of the Minister, parliamentary secretaries and 12 members, including the secretary to the Ministry. Their duties were to deal in the first instance with all matters requiring decision in the departments entrusted to them; and although the heads of departments in theory retained the right of access to the Minister, in practice it was not exercised and the members of Council became in fact the heads of groups of departments. The reform was accompanied by the rehabilitation of the permanent civil servant. The position of the secretary was strengthened by insistence that papers should pass through his hands to the Minister, and still more by the attachment to each member of Council of a civil servant called a secretarial officer—whose duty was to see that the procedure worked smoothly and uniformly. This machinery came into being and worked with surprisingly little friction.

But in fact the Council did not often meet as such, its work being to a large extent done by a standing "coördinating" committee of the Council, which dealt with all matters arising out of the programme and its execution. A second standing committee of the Council dealt with and prepared plans for demobilization, while matters which did not fall within one or other of these spheres were dealt with by Council committees appointed *ad hoc*.

The organization of the Munitions Council in its final form was as follows:—

F.—Finance, contracts, controlled establishments finance, munitions works board, lands branch, central stores, salvage (Sir Gilbert Garnsey).

D.—Design, inspection, inventions (Gen. Sir Francis Bingham).

S.—Iron and steel production, factory construction (Sir John Hunter).

M.—Non-ferrous metals, scrap, railway material, optical munitions, potash, railway and sea transport of munitions and material (Sir Ernest Moir).

X.—Supply of explosives, propellants and chemicals (Sir Keith Price).

O.—Supply of artillery, gun ammunition, rifles, machine-guns, small-arms ammunition and trench-warfare supplies. Engineering department (Sir James Stevenson).

A.—Aircraft (Sir Arthur Duckham).

W.—Warfare, tanks, poison-gas, etc. (Gen. Seely).

L.—Labour regulation and supply (Sir Stephenson Kent).

Sec.—Secretariat, staff and establishment, legal department, etc. (Sir William Graham Greene).

R.—Requirements and statistics, American department, Allied requirements (Mr. W. T. Layton).

Allies.—Head of Paris office and one of the British delegates on Inter-Allied Munition Council (Sir Charles Ellis).

In addition the master-general of the ordnance (Gen. Furse) was made an honorary member representing the War Office.

At this stage of the war, coördination of the efforts of various departments of state was even more important than internal reorganization. The British Ministry of Munitions never absorbed the purchasing sections of the Admiralty; and the predominant need of naval supremacy, strengthened by the traditional rights of the senior service, had enabled naval requirements to retain a nominal priority over land requirements. This did not greatly affect munition output when once the munition movement was in full swing—except on occasions, notably, when a sudden decision was made to mount two guns on every merchant ship; when the losses of ships at sea placed the shipbuilding programme in front of all other demands and by its call upon steel prejudiced other branches of production; and to a less extent after the battle of Jutland, when the decision was made to replace the whole existing naval ammunition supply.

In the case of seaplanes, and a few articles connected with the anti-submarine campaign, anti-aircraft bombs, etc., the Ministry supplied naval as well as army requirements. But the Ministry did not supply the main needs of the Admiralty; and the plan of forming a single Ministry of Supply for both services, including all the goods supplied by the Army Contracts Department, though much discussed when Mr. Churchill came to the Ministry and though recommended by a Treasury committee, was never carried into effect. Moreover, control was gradually developed by the Ministry of Food, and by the mines, timber, paper and other departments, which still remained under the Board of Trade, dealing with various spheres of economic life. There was also a continued demand from the army for specialists to run the repair services, workshops, etc., which were built up behind the front.

Thus there arose keen competition between departments for man-power, for tonnage and for finance (especially dollar credits in the United States and Canada). There also remained the question of the order of priority of work to be done. But experience had proved that no absolute "priority" could be given to any single activity. The word continued in constant use until the end of the war, but in fact the increasing strain upon economic resources, combined with the greater accuracy of demands and forecasts, meant that the conception of placing demands in order of importance was largely superseded by the plan of rationing economic resources. Each of the three factors mentioned was dealt with by a Cabinet committee, which in one case became the province of a new Ministry—that of National Service. In the case of finance the allocation of American dollars was taken out of the hands of the Treasury and assigned to a standing committee called the American Board—an interdepartmental committee under the presidency of Mr. Chamberlain, who with Lord Buckmaster represented Great Britain on the Inter-Allied Committee of Finance. The problem of tonnage also passed out of the hands of a periodical meeting of departmental officers under the Parliamentary Secretary of the Ministry of Shipping into the purview of a Cabinet committee, and the programme so approved was coördinated with that of the Allies by the Inter-Allied Maritime Transport Council.

So far as they affected munitions, the three factors were intimately connected. It was cheaper to manufacture at home than to buy abroad, and a given amount of dollars would carry a larger programme if spent on raw material than if spent on finished articles. But the tonnage needed to import materials was greater than that required for importing articles such as manufactured explosives or ammunition, while there was obviously a saving in British man-power by buying the finished product. On the other hand, munition capacity at home was in a more highly advanced stage of development than in America, and was quickly adaptable, whereas British orders in America had to compete with the enormous programme of the U.S. War Department. Moreover, the reserve of man-power in the United States was intact, and it was evident that the most rapid and effective way in which America could make her weight felt in the world contest was to get that reserve into the field, with the help, if necessary, of British munitions and equipment. The balancing of these considerations, which occupied much of the time of Ministers during the last 18 months of the war, thus broadened out into the problem of coördinating the whole Allied effort. But the final decisions did not radically alter the proportions of British munitions production.

Man-power.—As regards man-power, 53,000 men were withdrawn between March and Nov. 1917 for the army from munitions work, by a continuous process of substitution and dilution without diminishing production. As a result of the German offensive in the spring of 1918, which created a man-power crisis and led to the raising of the age limit for general recruiting, it was decided to make an immediate "clean cut" in the munition factories of all men of 19 and 20 regardless of the nature of their employment, and to take all men of 21, 22 and 23 within a short period. A hundred thousand men were obtained by this plan before the middle of the year; but when the tide of battle turned, Mr. Churchill secured the suspension of the second part of the scheme. Indeed, he secured the release of some of those already enlisted for work upon the new tank programme, for the blast furnaces, and for the manufacture of scientific instruments, etc.

Throughout this period the employment of women steadily increased, and the lack of skilled men was met by pressing them to enroll as war-munition volunteers—thus increasing the reserve of mobile skilled men—and by rationing skilled labour to firms. Protection from recruiting was withdrawn from men not fully employed on skilled work. The embargo on employing more than a certain number of skilled men was at first resisted, and led to a strike at Coventry in July 1918. But the Ministry stood firm and the scheme was carried into effect.

Tonnage.—In the autumn of 1917 a drastic cut was ordered by the Cabinet in the import programmes of the different departments, since the Minister of Shipping, taking the best available estimate of losses from the submarine campaign, anticipated that the imports into Great Britain would drop by 10 million tons. The ration to the Ministry of Munitions was reduced from 12 million to 10 million tons, most of which had to be deducted from iron-ore imports. The steel budget was consequently reduced and pressure put upon the departments to minimize their programme. The Minister, however, took the view that, as other supplies might be uncertain and it would be foolish to keep ships waiting for a cargo, he should be allowed to maintain a surplus stock of metals, materials, etc., on the Atlantic seaboard of America ready for shipment at any moment. Owing partly to the success of anti-submarine measures, partly to the success of the policy of concentrating ships on the shortest (*i.e.* the Atlantic) route, and partly because other materials were not ready in time, the actual imports of munition materials during 1918 were at the rate of 12 million tons a year. In the autumn of 1917 an arrangement was made with the United States to supply American ships to convey material needed in Great Britain to replace material used in making goods for the U.S. army in Europe. But this scheme of hypothecating ships to convey particular replacement material was not, in fact, carried into effect, being superseded by the plan of reviewing and allocating the tonnage and material resources of the Allies as a whole through the machinery of the Inter-Allied Transport and Munitions Councils.

The orders for heavy shell placed by the Ministry in 1916, which were delivered during the early part of 1917, gave so large a stock that no further orders were necessary except in regard to 6-in.-shell orders, which were placed both in the United States and Canada for delivery in 1918. Apart from this, the main requirements from America were for shell steel, nitro-cellulose powder, copper, spelter, motor lorries and lubricating oil, while as the year progressed substantial orders were also placed for aeroplane spruce and for Liberty engines. The rate of dollar expenditure, however, in 1918 represented less than half of the maximum reached in the first quarter of 1917, while in Canada the purchases dropped to less than 60% of the maximum reached in the second quarter of 1917.

Inter-Allied Relations.—These discussions emphasized the necessity for agreement with the Allies. In the late summer of

1917 the difficulty of financing imports from the United States led to an agreement between the British and French Ministers of Munitions, under which the latter undertook to pay by dollars in America for goods bought in England which involved replacement in American material. Further discussion of the problem, moreover, led the British Minister to insist that the production of shell steel to French specification should cease and that M. Loucheur should buy his shell steel direct from America. France, from a very early stage in the war, had devoted her restricted steel production to the manufacture of more finished products, and had relied on England and America for the overwhelming proportion of her shell steel. The French Minister was anxious to retain some of his supply from European sources as an insurance against an interruption of sea communication; and to meet this difficulty Mr. Churchill agreed to retain a small output of shell steel of French specification. The bulk supply was, however, transferred to the United States. This example illustrates the kind of problem which arose under the conditions at the end of 1917, and which, together with the necessity of coördinating the American munition effort with the Allied needs, gave rise to the formation of the Inter-Allied Munitions Council. Prior to the formation of the British Ministry of Munitions the Allied delegates purchasing in Great Britain on behalf of their respective Governments had been brought together in an international commission under the supervision of an officer of the Board of Trade. This officer and his staff, however, could not keep in touch with the growing supply departments, and their function resolved itself into that of rendering assistance as liaison officers to the foreign purchasing agents in London. In particular their duty was to see that the purchases made were a proper charge against the funds loaned by the British Government to these various countries, and secondly that ships were available for transporting the goods purchased.

When the Ministry of Munitions started, Mr. Lloyd George took an early opportunity of holding a conference with the French Minister of Munitions, and throughout the war such conferences were frequent. In Nov. 1915, at one of these meetings, at which Italian and Russian delegates were present, it was agreed that an Inter-Allied bureau should be formed for the purpose of studying and coördinating the requirements of the Allies. The scheme, however, was never carried into effect, as the Allied nations were not at that time ready to declare the basis of their requirements. In the early summer of 1916 the competition of the Allies in the United States became accentuated, and a few months later it was decided to form a bureau the duty of which was to coördinate the demands made upon New York by the various Ministers of Munitions. The bureau was not, however, sufficiently strongly supported, and it was found that various departments were placing orders without consulting the organization. A third attempt at coördination was made in Nov. 1916, when the campaign of 1917 was discussed in London. At these conferences substantial progress was made in the direction of setting down the complete programme of the different Allies present, and it was agreed that an organization should be set up in Paris to which full information should be supplied, and from which a complete statement of the requirements in the field and the manufacturing requirements of each Ally should be circulated for confidential information to the various Ministers. This organization continued with fluctuating fortunes and with fairly full information about Great Britain and France, but very little about other Allies. Sufficient information was, however, forthcoming to afford a very valuable check upon the demands put forward from time to time by various countries.

Such was the position when a conference was held in Dec. 1917 in Paris to consider the position for 1918. At this conference the European Allies recommended America finally to adopt a European type of artillery, but no definite plan of coöperation emerged from this discussion.

In April 1918 Allied munition officers, including representatives of the American army, again discussed the munition situation in reference to the situation in America, and as a result M. Loucheur, at the suggestion of the British representative, sent out formal invitations for a conference to meet in June to consider a proposition for the constitution of a permanent Inter-Allied Munitions Council, with a standing secretariat and with authority to discuss and make recommendations upon the programme of the various Allies. This Council was organized into sub-committees dealing with artillery, explosives, tanks, aircraft, tonnage, steel and raw materials. This was nominally an advisory body, but as its chief members were the Ministers themselves it was of sufficient authority to take binding decisions and to negotiate with the Inter-Allied Transport Council and the Financial Council of the Allies as to the tonnage and finance available for munitions, and to arrange between the Allies for the allotment of such resources. It thus represented an important link in the final coördination of Allied efforts.

Its existence enabled a check to be put upon the basis for calculating the production programme of the various Allies, while the general survey which it gave enabled it to make a unanimous recommendation to the United States to give priority for French and British shell steel required over steel for American factories, in view of the depletion of British and French reserves, and the necessity of making them good before the 1919 campaign, which might be expected to start early in the new year. Finally, the representative of the American War Department on the Council, when he received instructions that an enormous increase was to be made in the size of the American army in the field, was able to organize a plan which, by using British and French gun-making capacity, would have enabled this enlarged army to be equipped many months earlier than would have been the case by depending upon American factories.

At the Armistice the numbers employed in the Ministry of Munitions amounted to over 25,000, of whom 60% were women.

Some Munition Statistics.—The development of the British munition effort may be illustrated by some additional statistics. The most striking are perhaps the expenditure of gun ammunition on the western front. The figures cannot suitably be shown in numbers of rounds, owing to the change from light to heavy shell during 1916 and 1917, and to a limited extent back to light shell when open warfare was resumed in 1918. The best index is therefore weight in tons.

TABLE IV.—*Munition Expenditure on Western Front* (*in tons*).

Eleven Months Aug. 1914 to June 30 1915	31,500	
1915 3rd Quarter	19,500	
4th "	21,800	
1916 1st "	28,500	
2nd "	96,700	
3rd "	327,700	*
4th "	239,200	
1917 1st "	174,100	
2nd "	575,000	
3rd "	600,000	†
4th "	425,500	
1918 1st "	285,000	
2nd "	485,000	
3rd "	641,000	‡
4th "	214,000	

* 1st Somme battle.

† Messines, Arras, Vimy, 3rd battle of Ypres, Paschaendale Ridge, 1st battle of Cambrai.

‡ St. Quentin, 2nd battle of Somme, general advance.

Table IV. shows that the expenditure of ammunition reached its climax in the autumn of 1918. More than 10,000 tons a day were fired on 15 successive days, and in the record week ending Sept. 29 3,383,700 rounds, weighing 83,000 tons, were fired.

On Sept. 29, when the Hindenburg line was broken, 943,837 rounds were fired, the cost of a single day's ammunition amounting to £3,871,000.

Table V. further shows the progress of the manufacture of guns and ammunition throughout the war; of the 217,000,000 complete rounds delivered, 126,000,000 were filled in new national filling factories built by the Ministry. Of the empty shells delivered during the war, 28% in number came from British

TABLE V.—*Guns and Gun Ammunition.*

	New Guns and Howitzers					Filled Ammunition (in thousands)				
	Light	Medium	Heavy	Very Heavy	Total	Light	Medium	Heavy	Very Heavy	Total
Up to June 30 1915	802	242	6	31	1,081	1,877·3	389·0	26·5	14·0	2,306·8
1915 2nd six months	1,895	493	4	33	2,425	4,461·7	976·7	134·4	74·5	5,647·3
1916 1st " "	1,180	969	205	116	2,470	10,287·1	2,919·2	432·1	213·8	13,852·2
2nd " "	1,045	679	495	258	2,477	25,204·3	8,392·6	2,492·7	1,654·7	37,744·3
1917 1st " "	1,547	408	570	253	2,778	30,004·2	9,887·1	4,480·6	2,145·8	46,517·7
2nd " "	2,488	603	762	450	2,303	22,556·7	9,528·8	6,693·1	2,381·1	41,159·7
1918 1st " "	3,990	966	1,164	264	6,384	18,474·6	8,363·1	6,734·6	1,625·4	35,197·7
2nd " "	3,056	797	875	270	4,998	19,067·7	6,421·0	7,647·3	1,479·5	34,615·5
	16,003	5,157	4,081	1,675	26,916	131,933·6	46,877·5	28,641·3	9,588·8	217,041·2

The classification is that adopted by the Inter-Allied Munitions Council. In the case of Great Britain it includes under "light" field guns (13-pdr. and 18-pdr.), mountain guns (2·75-in. guns and 3·7-in. howitzers), anti-aircraft guns (13-pdr., 3-in. and 4-in.) and tank and other miscellaneous small guns. The medium guns include the 60-pdr. gun and 4·5-in. howitzer. The heavy include the 6-in. howitzer and gun and the very heavy include 8-in., 9·2-in., 12-in. and 15-in. howitzers and guns.

TABLE VI.—*Production of Rifles, Machine-Guns, Small-Arms Ammunition, Aeroplanes, Aero-Engines, and Tanks.*

	Rifles	Machine-Guns	Small-Arms Ammunition (Thousands)	Aero-Engines	Aeroplanes	Tanks
Up to June 30 1915	364,246	1,486	507,758	1,025	902	..
1915 3rd Quarter	173,317	1,719	395,881	730	692	..
4th "	198,641	3,133	570,029	1,015	948	..
1916 1st "	217,631	5,582	626,566	1,569	1,137	..
2nd "	267,759	7,245	738,355	1,615	1,537	..
3rd "	457,732*	9,572	811,476	2,054	1,939	110
4th "	416,564†	10,801	803,607	1,989	2,020	40
1917 1st "	793,350‡	16,637	697,536	2,704	2,730	100
2nd "	717,000§	19,836	250,878	3,567	3,640	324
3rd "	324,423	18,958	355,280	4,342	3,720	506
4th "	323,542	24,007	401,408	6,052	4,742	347
1918 1st "	294,947	29,124	597,006	8,261	7,154	260
2nd "	293,039	33,884	954,362	7,873	7,870	507
3rd "	287,096	31,437	866,262	8,016	8,558	369
4th "	186,990	26,419	596,241	7,119	7,200	255
Totals	5,316,277	239,840	9,172,645	57,931	54,789	2,818

* Including 186,000 "Acceptances" of U.S.A. rifles.
† Including 154,000 "Acceptances" of U.S.A. rifles.
‡ Including 462,000 "Acceptances" of U.S.A. rifles.
§ Including 391,000 "Acceptances" of U.S.A. rifles.

contractors, 35% from national projectile or shell factories or through local munition committees, 12% from the United States and 25% from Canada.

Trench Mortars and Trench Ammunition.—When the war broke out, the British army was not furnished with any weapon especially adapted for trench warfare, and in the fourth quarter of 1914 only 12 trench mortars were delivered. The maximum production of trench mortars was attained in the second quarter of 1916 when 2,178 were delivered. The total number of trench mortars delivered during the war period amounted to 19,096 and the output of trench-mortar ammunition to over 17,000,000 rounds. The total number of grenades delivered amounted to 100,103,000, and of aerial bombs to 4,738,000.

Table VI. shows, further, the number of rifles, machine-guns, small-arms ammunition, etc., delivered during the war. Of the 5,316,000 rifles manufactured, 3,954,000 were made in Great Britain, and the army was entirely armed with rifles of home manufacture. The maximum home output of rifles was attained in the last quarter of 1917, when 324,000 new rifles were delivered. A total of 240,000 machine-guns were delivered, and output rose from a total of 211 in the fourth quarter of 1914 to 33,484 in the second quarter of 1918. The total number of rounds of small-arms ammunition manufactured amounted to 9,172,645,000, nine-tenths of which was manufactured in Great Britain.

The number of aeroplanes manufactured amounted to 54,789, the maximum output being attained in the third quarter of 1918. The number of aero-engines delivered was 57,931, the maximum output being attained in the first quarter of 1918. The first tanks were delivered in the third quarter of 1916 and numbered 110. Owing to changes in design, etc., only 40 were delivered in the following quarter and 100 in the first quarter of 1917. The maximum output was attained in the second quarter of 1918, when 507 were delivered. The total number of tanks manufactured amounted to 2,818.

Mechanical Transport, Railway Material, etc.—The Ministry became responsible for the supply of motor vehicles on Sept. 1 1916. From this date to the end of 1918 there were delivered 33,000 heavy lorries, 2,500 four-wheel-drive lorries, 4,000 light lorries, 4,700 motor-cars, 1,700 ambulances, 4,100 Ford cars, 1,400 Ford ambulances, 12,000 Ford vans, 2,200 caterpillar tractors, 27,700 motor-cycles, 7,000 motor-cycle combinations and 183 armoured cars.

The Ministry of Munitions became responsible for the supply of railway material in Oct. 1916, and from that date supplied 2,300 m. of 75-lb. rails, 4,200 m. of light rails, 750 standard-gauge locomotives, 800 locomotives for other gauges, 13,000 petrol tractors and 33,000 railway wagons of various types.

Workers on "Munitions."—It is impossible to state accurately the numbers engaged on the manufacture of munitions at various dates during the war period, because the term "munitions" has never been strictly defined, nor did the Ministry of Munitions undertake any comprehensive inquiry into the numbers of munition workers. The best approximation to the number of munition workers is found in the reports of the Board of Trade on the state of employment in the various industries, where the number engaged on Government work is also shown. The accompanying Table VII. shows the numbers engaged in Government establishments and on Government work in the metal and chemical trades, which may be taken as broadly covering "munition" work.

It will be seen that between April 1915 and July 1918 the number of males engaged on munitions more than doubled while the number of females had increased tenfold. By mid-summer 1916 more than 80% of the workpeople in the metal and chemical trades were on Government work, and by the summer of 1918 more than 90% were on Government work. No figures are available as to the number engaged on Government work prior to the war, but it is considered unlikely that they could have amounted to more than 50,000.

Allies.—During the war, Great Britain kept Italy and France supplied not only with coal, but with substantial supplies of iron and steel, which, until 1918, when the United States

Table VII.—*Numbers Employed in Government Establishments and on Government Work in the Metal and Chemical Trades.*

	Males	Females	Total	Percentage to total numbers employed in the metal and chemical trades and in all Government establishments.		
				Males	Females	Total
April 1915	1,009,000	78,000	1,087,000	55·9	33·5	53·4
July 1915	1,397,000	136,000	1,533,000	74·0	52·8	71·6
July 1916	1,752,000	375,000	2,127,000	84·0	70·8	81·4
July 1917	1,923,000	707,000	2,630,000	88·0	84·4	86·8
July 1918	2,046,000	825,000	2,871,000	91·2	89·4	90·7

assumed more of this burden, amounted to from 1,000,000 to 1,500,000 tons of iron and steel a year to France and 250,000 tons to Italy. Great Britain also kept France and Italy supplied with benzol, and Italy with T.N.T., picric acid and other explosives. As regards finished munitions there was a certain amount of interchange, Great Britain receiving aero-engines and some anti-aircraft guns from France and motor-cars from Italy, and supplying heavy artillery and ammunition, incendiary and other special small-arms cartridges for use in aeroplanes, and machine-guns. British assistance to Russia took the form almost entirely of finished products, including machinery.

The Last Stage.—Under Lord Inverforth, as Minister from Jan. 1919 to March 1921, the last stage was reached. Prior to the Armistice the Demobilization Committee had considered plans for dealing with the situation that would arise when the "cease fire" sounded, and the army in France would suddenly find itself unable to deal with the inflowing tide of munitions. The most difficult problem was to dispose of the daily production of explosives and filled shell from the filling factories. When the Armistice actually arrived immediate orders were given to stop work in these two classes of factories. Some latitude was allowed in the engineering shops, but, as arrangements had been made for paying benefit to men out of work, the rights of the Ministry under the Break Clauses were soon put into operation. Production, in fact, ceased—partly owing to the sudden loss of purpose in munition work and the unwillingness both on the part of the workpeople and of employers to continue making what were obviously useless articles. In the steel works, managers were loth to put material into articles which would clearly have to be put back into the furnaces, and everyone was anxious to get on to peace work. The Finance and Contracts departments did their utmost to come to friendly agreements with contractors in regard to cancellation, and every effort was made to clear the munition material from the shops.

A similar policy of encouraging a rapid return to peace conditions was adopted in regard to the raw materials controlled by the Ministry. Restrictions on importation and on purchase of steel were rapidly removed, and even where large stocks were held by the Government, control over the market was rapidly relaxed. In order that the metal and chemical markets should know how they stood, the stocks in Government hands were published, and in as many cases as possible bargains were made with trade organizations to take over and dispose of these surpluses, which in several cases amounted to two or three years' supply for peace purposes.

It was at first anticipated that the State would have to place substantial orders to enable industry to start, and large orders in particular were anticipated in connexion with the Government's housing scheme. The Cabinet therefore decided that the plan already discussed for converting the Ministry of Munitions into a Ministry of Supply, which should deal with purchases of all kinds for every department of State, including the Post Office, Office of Works, Admiralty, War Office and the Air Ministry, etc., should be carried into effect. The anticipation that large orders would have to be placed was, however, not fulfilled, and as the need for drastic economy in Government expenditure was slowly realized the scheme was dropped.

Immediately after the Armistice the labour department of the Ministry of Munitions was transferred to the Ministry of Labour, and the design department reverted to the War Office. The Ministry was thus left with two great tasks, that of closing up the accounts of the war and that of disposing of the enormous war stores in the hands of the Government. The surplus stores in Great Britain of the fighting departments were transferred to the charge of the Ministry, as well as the large stocks held abroad. At the end of the financial year 1920–1 these remaining duties were transferred to a liquidation and disposals commission under the direct supervision of the Treasury, and the Ministry of Munitions as a separate entity ceased to exist. (G. I. H. L.; W. T. L.)

II. United States

No accumulation of war materials in excess of the amounts required for the regular army, which numbered 127,588 on April 6 1917, was made by the United States in anticipation of entry into the World War; and the Director of Munitions, Benedict Crowell, subsequently stated that there were no plans in the War Department for the "necessary mobilization of industry and production of munitions, which proved to be the most difficult phase of the actual preparation for war" (*America's Munitions*, p. 18). After the declaration, all of the forces of Government, supplemented by voluntary endeavour of citizens, were turned towards the recruiting and supplying of the national army, which 19 months later (Nov. 11 1918) numbered 3,757,624, of whom 2,086,000 had been transported to France.

War Operations of Americans 1917–8

Men in France fighting	1,400,000
Men in France behind lines	600,000
Men in army in United States	1,700,000
Men in navy	550,000
Men in war work	7,150,000
Women in war work	2,250,000
Men and women not in war work	44,350,000
Aged and children	47,000,000
Total	105,000,000

The total number of American troops placed in the field was larger than could have been equipped with material of American manufacture; the speed in recruiting was made possible by the fact that the great European Allies had in 1917 reached, if not passed, their maximum man-power in the field, whereas their power to produce munitions was unimpaired and growing. They were able to guarantee their surplus for the use of American troops and thus ensure an earlier and more numerous American participation upon the firing line. American divisions were therefore assembled rapidly, even though they were ahead of the munitions programme. The war came to an end before many of the elements in this programme of procurement were expected to be ready in sufficient supply. Many items would have continued to be procured abroad regardless of the length of the war, for the double purpose of saving ocean tonnage and giving profitable occupation to Allied civilian workers. Some items were delayed by faulty estimates or mistakes at home.

Procurement in Time of Peace.—The pre-war agencies for the procurement of munitions in the United States were shaped by the needs of small and permanent armed forces. In the Navy Department there was an old-established system of bureaux in which the needs were estimated and the supplies procured so smoothly that the only requirement of war was to enlarge the personnel of existing offices. In the War Department there was no central system of purchases; in the lack of one, each bureau bought independently for itself, the most important of the purchasers being the quartermaster-general, the chief signal officer, the surgeon-general, the chief of ordnance and the chief of engineers. Each of these departments had its own system of specifications and rules of purchase. Moreover, the revolution in land warfare since 1914 had introduced new weapons of elaborate mechanism for which no department had any established precedents. When war began and efforts were made to expand the army in every direction the various procurement agencies developed duplication of work and inconsistency in standard, and by their competitive entry into the markets increased the scarcity of goods and raised the price.

Military Organization.—The inadequacy of the American military organization was recognized by the War Department as well as by critical observers on the outside, and after the outbreak of the World War numerous efforts were made to induce Congress to provide more completely for national defence. The reluctance of the people to assume military burdens in time of peace and the desire of the national administration to refrain from active war preparations while pressing its policies of neutrality retarded the movement for preparedness. In the winter of 1915–6 there was begun a serious attempt to correct deficiencies of the existing system, with the result that Acts of 1916 changed the basis of army, navy and civic coöperation for war. The National Defense Act (June 3 1916) and the Naval Appropriation Act (Aug. 29 1916) were in harmony with earlier American policies. The former left the army to be raised after entry into war, though providing in its officers' training camps a better means for training line officers than had prevailed in earlier wars, while the latter contemplated an effective navy. A naval building programme, covering a three-year period, was undertaken in the latter Act. It called for ten dreadnought battleships and six battle-cruisers; but it was not possible even to begin the construction of most of these until after 1918, and they had no effect upon the outcome of the World War.

Council of National Defense.—A Council of National Defense was provided for in an Act of Aug. 29 1916, constituting a new venture for the United States, based directly upon the experience of the European belligerents with the need to organize the whole of their social and industrial strength for the prosecution of the war. In no earlier war had the national effort involved so nearly the whole national strength as in this. The forces in the field were no more completely fighting the enemy than were the merchant marine, the manufacturers of war munitions, the producing farmers, and the civic agencies that saw to the rationing of national resources and their conservation. The Council of National Defense consisted of six members of the President's Cabinet, the Secretaries of War (chairman), Navy, Interior, Agriculture, Commerce, and Labour. It was not intended that these ministers, already burdened with the duties of executive departments, should personally undertake the task of mobilization of civic forces for war, but they were authorized to create an Advisory Commission of specialists in various fields of industrial activity who should direct the studies and coördination. As finally organized, the Advisory Commission of the Council of National Defense consisted of Daniel Willard, railway president and chairman; Bernard M. Baruch, an expert in raw materials; Howard E. Coffin, a manufacturer of motor-cars; Hollis Godfrey, an educator; Samuel Gompers, a veteran labour leader; Franklin H. Martin, an eminent physician; and Julius Rosenwald, a prominent merchant. Walter S. Gifford, an engineer, was selected as director of the Advisory Commission, and each member was made chairman of a committee according to his specialty.

The Council of National Defense did no important work until after the breach with Germany (Feb. 3 1917); between this date and the actual outbreak of war it sat in continuous session upon the problems of the procurement agencies of the Government, and more particularly those of the army, since the needs of the navy were less in amount and simpler in scope. Its special committees brought to Washington the men acquainted with the industrial resources of the United States and the available capacity for the manufacture of war material. There had been a voluntary survey of these resources conducted by a committee of the Naval Consulting Board, which the Navy Department organized in Oct. 1915. In the committee on supplies, of which Julius Rosenwald was chairman, numerous sub-committees were created at once to sit with officers of the Quartermaster's Department of the army in the scrutiny and award of contracts.

Munitions Types.—A large part of the munitions needed for maintaining an army of 4,000,000 men could be produced in the United States without difficulty because the articles needed were similar to those called for in time of peace. Such articles as shoes, socks, uniforms, blankets, food and food containers, camp utensils and equipage required only the drafting of specifications and the speeding-up of industry to produce the requisite amounts. Up to the point at which they called for more than the visible supply of raw materials they presented few problems different from those of ordinary manufacture. More difficult than these were the heavy manufactures of the material needed in transportation, beginning with ships, locomotives, and rolling-stock, and including the goods to be utilized by the engineers in France and by the construction division around the cantonments and factory towns. The Engineer Corps alone handled 3,225,121 tons of supplies during the 19 months of war; 1,303 locomotives and 18,313 freight cars were shipped to France; 1,002 m. of standard-gauge railroad track were constructed there. The manufacture of these goods was difficult, not because of their novelty but because it was often impossible to assemble rapidly the machinery with which to make them, and to build the new plants in which to construct them. In a war lasting only 19 months many of the preliminary processes could not be completed, nor quantity production be reached. Most difficult of all was the problem of manufacture of delicate or heavy ordnance, siege guns, field artillery, machine-guns, rifles, aircraft, tanks and motor transport, in which quantity production depended upon slow and painstaking preparation of the preliminary processes, upon the supply of labour and raw materials, and upon the wise selection of designs and types to be manufactured.

CLOTHING, ETC., PRODUCED AND SHIPPED TO THE A.E.F. BETWEEN APRIL 6 1917 AND NOV. 11 1918

	Produced	Shipped
Blankets	19,419,000	3,127,000
Coats	22,603,000	7,294,000
Drawers	71,884,000	14,701,000
Undershirts	69,764,000	15,693,000
Shirts	22,198,000	6,401,000
Stockings	89,871,000	29,733,000
Shoes	26,423,000	9,136,000
Breeches and trousers	17,342,000	6,191,000
Overcoats	7,748,000	1,780,000

Considerable experience in the manufacture of ordnance and other munitions had been gained by private firms during the period of American neutrality through the fulfilment of contracts placed in the United States by the Allied belligerents. In April 1917 every shipyard had its ways filled with vessels on foreign order. Most of the private capacity to make explosives, rifles, machine-guns and cannon was similarly in use. The experience thus gained was an asset for the United States, but its value was limited by the fact that few of these resources could be diverted to the supply of American armies without endangering the supply of Allied armies already on the firing-line in the common cause.

General Munitions Board.—The evolution of the American equivalent of a munitions ministry begins in Howard E. Coffin's committee of the Advisory Commission of the Council of National Defense. Here it was early learned that new factories must be erected for the construction of guns, aircraft, and other munitions of the elaborate type, and that a preliminary determination of standards must precede this in order that the types put into production should be as few in number and as useful as possible. On March 20 1917, the Munitions Standards Board came into existence to advance this work as a sub-committee of the Council of National Defense. Frank A. Scott, a Cleveland engineer, was chairman of this board, and directed its study of requirements with a view to standardization. Within a few days it was learned that the Board must do either more, or nothing, since unless it could get preliminary statements of the needs of the army and navy its work was fruitless. On April 9 it was reorganized as the General Munitions Board, because said Gifford, the director of the Advisory Commission, "it was necessary, if we were going to give intelligent advice, that somehow we should have a system for clearing the needs of the army and navy, and for having the needs brought before the people." The General Munitions Board included, at first, seven military and eight naval officers, and Baruch, Coffin, Martin and Rosenwald from the Advisory Commission. Its purpose was to coördinate army and navy purchases, to establish precedence of orders between the two departments and the industrial needs of the country, and to determine priority of delivery of materials. It was dependent for its success upon its powers of persuasion. The Secretary of War directed his supply departments to declare their needs to the General Munitions Board when time permitted, but reminded them that the full responsibility of the supply departments remained unchanged.

Within a few weeks of the declaration of war numerous special bodies were created to carry on parts of the munitions work. A Railroads' War Board (April 11) undertook voluntary direction of the operation of railway lines, retaining it until the inauguration of the Railroad Administration (Dec. 26) under Director-General W. G. McAdoo. The Emergency Fleet Corporation (April 16) was created as a construction agency of the U.S. Shipping Board, with Maj.-Gen. George W. Goethals in charge, succeeded in turn by Rear-Adml. W. L. Capps and Charles M. Schwab. The Aircraft Production Board (May 16) under Howard E. Coffin exercised indefinite powers, in conjunction with the Signal Corps of the army, over the designing and execution of the aeroplane programme. It undertook, said the Chief of Staff, in 1919, "an air programme entirely disproportionate to a properly balanced army and, as events showed, impossible of execution . . . practically independently of the rest of the army." Behind all these, the Council of National Defense stood in an advisory capacity, making suggestions, appointing other sub-committees, bringing citizens into contact with the Government bodies, but not generally administering the war agencies except in their initial steps.

The various parts of the munitions programme developed in accordance with estimates as to the number of men that could be put into the line in France. In the spring of 1917 it was hoped to have 1,000,000 men there by the end of 1918; but the Allied commanders did not believe that American troops could be of use for independent work even by that date. This programme was frequently revised, until in July 1918 the Chief of Staff recommended preparations to put 3,360,000 American troops in France before July 1 1919. The responsible departments, the special war bodies, and many civic agencies worked with abundant patriotic goodwill, and confusion was perhaps inevitable because of the undefined functions of the new war machines. Among the thousand of items to be procured, those that involved the country in the most uncertainty and controversy were ships, aircraft, gas and appliances for using it, heavy ordnance, artillery, rifles, and machine-guns.

Ships.—When the Emergency Fleet Corporation began work there were 256 shipways in the United States capable of constructing ships of 3,000 deadweight tons' capacity, distributed among 67 yards mostly along the Atlantic coast. The merchant tonnage of the United States was 3,569,675 gross tons.[1] An early phase of the shipbuilding work was the designing of standard wooden ships of 3,000–5,000 tons and steel ships of 5,000–8,000 tons. Contracts were placed, before the Armistice, for building 17,399,961 deadweight tons, of which 2,368 new vessels, aggregating 13,616,836 deadweight tons, were retained in the final reduced programme of June 30 1919. By this latter date 1,056 ships of 5,858,164 deadweight tons had been delivered, many of them from new yards or new ways erected in old yards. By the date of the Armistice the merchant tonnage had been increased, in excess of marine losses and enemy destruction, by 498 ships of 1,944,773 gross tons, without counting enemy ships seized or Dutch ships requisitioned.

The question of building the emergency ships of wood or steel aroused warm controversy between those who saw in the wooden ship a means of putting to use materials and labour that were relatively plentiful, and those who believed that only the steel ship could perform the work required. Contracts for steel ships of standardized design were let in large numbers to existing companies, or to new companies organized to receive contracts. In addition to these, provision was made for making separate parts of ships in numerous inland factories and assembling them in great Government yards, at Hog Island, on the Delaware river below Philadelphia, with 50 erecting ways; at Newark, N.J., with 28; and at Bristol, Pa., with 12. The contract for building the Hog Island yard, in an unimproved but accessible swamp, was signed Sept. 13 1917; the first ship assembled there, the "Quistconck," was launched Aug. 5 1918; a keel was laid on the fiftieth way in Nov. 1918; but in spite of all the speed that patriotic effort and lavish expenditure could produce, not one of the fabricated ships took on a cargo before the Armistice. The results of the ship-building programme could not have been realized before 1919. In addition to the increase of the merchant tonnage through the building of new ships upon contract of the Emergency Fleet Corporation, the Government requisitioned all American ocean-going vessels, seized enemy ships in American ports, chartered many neutral ships, and requisitioned Dutch ships lying idle in American waters and partly finished vessels that were under construction for foreign owners. The growth of shipping under the American flag (in vessels of 500 gross tons or over) is as follows:—

	Ships	Gross tons
Strength April 6 1917	1,614	3,569,675
New construction to Nov. 11 1918	704	2,287,034
Ships otherwise acquired to Nov. 11 1918	95	274,366
Enemy ships seized in United States	97	648,894
Dutch ships requisitioned	87	354,278
Total to Nov. 11 1918	2,597	7,134,247
Ships lost April 6 1917–Nov. 11 1918		
By enemy action	103	313,569
By other causes	213	416,578
Strength Nov. 11 1918	2,281	6,404,200

Aircraft.—Prior to April 6 1917, the United States had acquired in all 224 aeroplanes, which were controlled by the Signal Corps of the army, and none of which reflected in their design the lessons of the World War. The appropriations of Congress for military aviation are as follows:—

1912–6	$900,000
1916–7 (Urg. Def. Bill)	500,000
1917 (Army approp.)	13,281,666
1917 (Milit. aeronautics)	10,800,000
July 24 1917	640,000,000
1917–8 (Urg. Def. Bill)	43,450,000

The funds thus made available were expended first by the Signal Corps in conjunction with the Aircraft Production Board and the Aircraft Board which superseded it Oct. 1 1917; then by the Bureau of Aircraft Production of the War Department which was created May 20 1918 under John D. Ryan; and after Aug. 28 1918 by the Air Service of the War Department with the same director. The policy was to design a standard type of aeroplane engine, put it into quantity production, and have ready for the campaign of 1918 a fleet of 22,000 effective aeroplanes. By July 4 1917 the first experimental "Liberty Motor," as the standard engine was named, had been constructed. After further refinement of design it was turned over for production to the manufacturers of automobiles in the absence of large aircraft industries in the United States. The first finished Liberty engines were delivered in Dec. 1917, and 15,572 more followed within the next year. The first American squadron, completely equipped by American production, was reported by Gen. Pershing to have crossed the German lines on Aug. 7 1918. The A.E.F. was provided by the French Government with 2,676 aeroplanes, and received from the United States 1,379 planes of the De Haviland type. The delivery of aeroplane engines of all types to the Government in the United States began with 66 in July 1917, and rose to 5,297 in Oct. 1918, with a total of 28,509 to the end of Oct. 1918.

Toxic Gases.—Much of the preliminary work in gas warfare was done in the U.S. Bureau of Mines, which had already made studies in connexion with the safety factor in the operation of mines. The laboratories of leading universities took up experiments before the declaration of war, and there was gathered at the American University in Washington, D.C., a nucleus of experts in the investigation of problems in gas offence, gas defence, toxicology of gases, and the manufacture of gas and containers. The strictly military study of the use of toxic gases was made in the Trench Warfare Section of the Ordnance Department, but it was necessary to call into the work the officers of the Medical Department. There was no commercial equipment in America for gas manufacture upon the scale needed for the American programme, and the Edgewood Arsenal (3,400 acres) in Maryland was accordingly built to manufacture gas and fill gas shells. In June 1918 the various agencies concerned in gas warfare were consolidated by the President, under authority conferred upon him by the Overman Act, and became the Chemical Warfare Service of the army. Additional projects were developed to keep pace with experience in Europe, the programme of American production rising from 545 tons per week (March 1918) to 4,525 tons per week (Aug. 1918). German production of mustard gas, at the date of the Armistice, was believed to be not over 50 tons per week.

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[1] It was the practice of the Shipping Board to compute new tonnage in deadweight tons, representing the actual freight-carrying capacity of the vessel, instead of gross tons, which are derived arbitrarily by dividing the external cubic dimensions by 100 cubic feet. The ratio between deadweight and gross tons varies with the type of vessel; rough formula for conversion is, 1 gross ton equals 1·60 deadweight tons.

The manufacture of gas progressed so rapidly as to get far ahead of the manufacture of empty shells; and these were far ahead of the boosters needed to explode them and scatter the charge. Toxic materials, to the amount of 4,278 tons, were shipped in bulk to Europe to be there loaded into shells, and provided the full equivalent of the gas used in all the gas shells fired by the A.E.F. No American gas was fired in American shells.

Gas Manufacture and Shipment

1918	Toxic materials produced (in tons)	Grenades, shell, etc., filled	Toxic materials shipped overseas (in tons)	Shell, etc., shipped overseas
Jan.	10	—	—	—
Feb.	61	—	—	—
March	211	—	—	—
April	399	—	—	—
May	697	—	—	—
June	993	—	—	—
July	1,351	73,201	—	—
Aug.	1,548	354,962	—	—
Sept.	1,911	374,968	—	—
Oct.	2,726	459,895	—	—
Nov.	910	151,043	—	—
Total	10,817	1,414,069	4,278	868,664

Heavy Ordnance.—There were 97 officers at work in the Ordnance Department at the time America entered the World War, only 10 of whom were experienced in designing artillery weapons. While expanding this commissioned force to 11,000 during the 19 months of war, it was necessary also to design and direct the production of the ordnance for an army of 5,000,000 men. Only six Government arsenals and two private plants had had experience in producing heavy ordnance before 1914; the number was increased by "a score or so" by 1917, because of Allied contracts for artillery, ammunition, rifles, machine-guns, etc.; by Nov. 1918 there were nearly 8,000 plants at work upon ordnance contracts, light or heavy.

The heavy-gun capacity of American makers was all under Allied contract in April 1917, with a year's work ahead. Up to the Armistice 1,102 guns (from 3 in. to 9·5 in.) and 14,623 forgings (from which the finished guns are turned and bored) were thus made in the United States for the Allies. Fifteen additional heavy-gun factories were equipped to meet the American need, and all but three (whose machine tools were delayed) were producing forgings before the Armistice; the rate for Oct. 1918 was above 24,000 guns per year.

In mobile field artillery the French 75-mm. gun was accepted for the standard in quantity production, and its designs, with those for its intricate recuperator, were redrawn to meet American conditions in manufacture. The tolerances, which the French were in the habit of working out in the assembling plant, were reduced to figures and gauges in order to permit the American method of manufacture of separate, interchangeable parts. In Oct. 1918, 464 complete artillery units (guns, carriages and recuperators) were produced and delivered to the army by American manufacturers, with an accumulated total of 2,058 units to the end of the year. But no 75-mm. guns or 155-mm. howitzers of American manufacture were on the front at the date of the Armistice. The French Government provided the A.E.F. with equipment of this sort sufficient for 30 American divisions.

Rifles.—The rifle selected for use in the A.E.F. was the 1917 Enfield, a model adapted from the British rifle which had been developed in quantity production in American factories upon British orders, 1914–7. It was selected, not because it was believed to be superior to the 1903 Springfield (the standard then in use in the American army), but because the Springfields could be made only in the Government arsenals at Springfield, Mass., and at Rock Island, whose capacity had been determined by Congressional action and could not be expanded as rapidly as the emergency required. The factories built for the manufacture of Enfields, on the other hand, had completed their foreign orders and stood available for immediate American use. The decision of the War Department was to adapt the Enfield to shoot the standard rimless .30 calibre Springfield cartridge, to complete the standardization of the Enfield, and to produce it in these private plants. There was no shortage of American-made rifles for overseas use. For the purpose of training, until quantity production should begin, the American troops relied upon the pre-war stock of about 600,000 1903 Springfields and 200,000 of the older Mauser rifles which the Springfield had displaced. The arsenals were kept at work on the 1903 Springfields, raising their production to 2,500 rifles per day at the Armistice. The statistics of rifle production[1] are:—

	1903 Springfield	1917 Enfield
1917	128,475	302,887
1918 Jan.	31,570	153,499
Feb.	9,370	170,857
March	540	160,142
April	2,631	167,485
May	3,970	181,034
June	6,759	191,354
July	16,879	231,193
Aug.	28,617	191,769
Sept.	33,583	199,635
Oct.	39,176	187,477
Nov. (1–9)	11,308	56,097
Total	312,878	2,506,307

Machine-Guns.—A large appropriation ($12,000,000) for the purchase of machine-guns was made in the Army Act of Aug. 29 1916, and 4,000 Vickers guns (heavy) were ordered shortly thereafter, but the War Deparment had not completed its test of types or made its selection of a light machine-gun on April 6 1917. Before the World War the machine-gun did not play a large part in military equipment, and there were not in existence either patterns of completely satisfactory type, or facilities for wholesale manufacture. An American gun, invented by Col. I. N. Lewis, "was a revelation when it came to the aid of the Allies early in the great war," and capacity for its manufacture was developed in private American plants on Allied order. This, and other types, the Vickers, Benêt-Mercié, Maxim, and Colt, were under experiment by the Machine-Gun Board when America entered the war. The board continued its deliberations until satisfied. Since the whole capacity of the Lewis-gun factories was contracted for, it was certain to be several months before this or any other gun could be produced on a greatly increased scale. In May 1917, the Machine-Gun Board tested and adopted two newly designed guns, one heavy and one light, both the work of John M. Browning. The first light Brownings were accepted in Feb. 1918; the first heavy Brownings in the following April. Thereafter the new industry gained rapidly in volume, until during Oct. 1918 the War Department accepted 14,639 heavy and 13,687 light Browning guns. By the end of the year 226,557 machine-guns of all types had been accepted by the United States. The production of the Lewis gun was continued, it becoming the standard gun for aircraft. At the Armistice there were enough heavy Brownings in France to equip all American divisions there, but there had not been opportunity to issue them generally to the troops in exchange for the various other guns in use.

Naval Ordnance.—Naval ordnance presented fewer difficult problems than that for the army because the quantities needed were less staggering, and fewer weapons represented novelties in manufacture. The construction of battleships was practically stopped during the war, the whole strength of the navy yards being concentrated on smaller vessels, with destroyers and submarine chasers at the head of the list. The manufacture of the latter led to an experiment with quantity production of a fabricated steel chaser, the "Eagle" type, at a new Ford plant near Detroit.

Much delicate experimentation was done in search for new range-finders and submarine detectors, various listening devices being brought forward for the latter purpose. The construction of the North Sea mine barrage called for the development of a new mine and anchor and tested the ingenuity and capacity of manufacturers working in a new field. The formal approval by President Wilson of the plan to lay a barrage of anchored contact mines from the Orkney Is. to the Norwegian territorial waters off Udsire Light, a distance of 230 m., was given on Oct. 29 1917, after the British Admiralty had assented to the joint project. The Bureau of Naval Ordnance was already at work upon the mechanism, in advance of approval, and was able to summon the manufacturers to a conference early in November. Contracts for making the various parts were placed with a large number of plants, and the first mines were ready to test by March 1918. Orders were placed for 125,000 mines, of which 56,611 were laid in the barrage by American mine-layers operating from bases in the N. of Scotland, near Inverness. The whole barrage included 70,263 mines, of which 13,652 were British laid, covering a zone of sea from 15 to 35 m. in width, and to a depth sufficient to prevent submarines from diving under it. The complete barrier was in place by July 29 1918, although it was much tightened thereafter. The barrage is known to have destroyed 17 submarines and to have closed the North Sea outlet, particularly after Norway announced a determination to mine her own territorial waters adjacent to the barrage. (*Navy Ordnance Activities, World War, 1917–1918*, p. 125.)

Evolution of the War Government.—The evolution of the munitions programme, as the proportions of the American effort were extended, was simultaneous with the execution of its details. An attempt to give it unity and proportion was made from the start under disadvantages due to the newness of the administrative organizations and the uncertainties or difficulty of the work itself. Before the execution of the programme was far advanced further necessity for coördination was seen, as experience developed shortages in capital, labour, raw materials and transportation, and as it came to be recognized that the whole programme would stand or fall upon the proper adjustment of priorities among war and civilian needs. The disrupting haste due to the imminence of invasion was never present, but the object was to make the American addition to the Allied force sufficient in volume to crush the enemy armies.

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[1] *America's Munitions*, p. 186.

The General Munitions Board and the various committees on special commodities erected by the Council of National Defense proved themselves less than adequate before midsummer, 1917. A common ground for complaint was the fact that many of the committee-men were loaned to the Government by firms that were bidding for contracts, thus placing the committeemen in the embarrassing position of awarding contracts to themselves. Disappointed bidders complained that there was favouritism in the granting of awards. More than this, the powers of the General Munitions Board were too small to enable it to have the full knowledge essential to a scheme of priorities.

Purchasing Commission for the Allies.—Among the difficulties was the presence in the American market of buyers for all the Allies, spending funds loaned by the United States (under Act of April 24 1917), and bidding both against themselves and against the American army and navy. Allotments of the available supply of raw material were made, not according to needs but upon a competitive basis that produced uneven distribution and rising prices. In Aug. 1917 an agreement was reached with the Allies whereby their buying in the United States was concentrated in a Purchasing Commission (Bernard M. Baruch, Robert S. Brookings, and Robert S. Lovett), and discussions were started that led eventually to the creation of the Inter-Allied Council on War Purchases and Finance, which began work in London, Dec. 1917. Meanwhile the General Munitions Board had been reorganized upon a broader scale.

War Industries Board.—As early as July 1917 President Wilson served notice that price-fixing powers would be needed by the Government, and Congress conferred the necessary authority upon him by Act of Aug. 10 1917. On July 28 the War Industries Board superseded the General Munitions Board, under Frank A. Scott, head of the defunct organization. In addition to the chairman, the War Industries Board included men active on the Council of National Defense, and the whole personnel of the Purchasing Commission for the Allies. Baruch specially represented raw materials, Brookings was in charge of prices, Lovett concerned himself with priorities, Hugh Frayne represented labour, and there were additional representatives from army and navy. A great change in the civilian conduct of the war followed this reorganization. In Nov. Scott, who retired because of bad health, was succeeded by Daniel Willard, chairman of the Advisory Commission of the Council of National Defense; and Willard was in turn succeeded in March by Baruch. The terms of Baruch's authority were conveyed in a letter of March 4 1918 in which President Wilson directed him to make the War Industries Board the agent of the Government in all matters of supply. Between March and Nov. 1918 the War Industries Board became a sort of munitions ministry. It continued a part of the Council of National Defense until after the passage of the Overman Act, May 20 1918. This Act was demanded by the President in Feb., at a time when his critics were calling for a minister of munitions. He insisted that the full control of the war must be left in the hands of the executive, but urged that he be given power, for the good of the cause and the duration of the war, to make rearrangements in existing bureaus, to re-group or create new bureaus, and to transfer appropriations from one agent of Government to another as needed. The War Industries Board was instantly cut loose from the Council of National Defense upon passage of the Act; the Chemical Warfare Service was launched as an independent agency, and the aviation functions of the Signal Corps were transferred to new bureaus of Aircraft Production and Military Aviation, and later to the Air Service.

The chief divisions of the War Industries Board revolved around the Requirements Division, to which representatives of army, navy, emergency fleet, railway administration and Allies reported their programmes of requirement. In order to solve problems of priority in delivery, the board created a great series of Commodity Sections, under the direction of civilian experts who were required to divorce themselves from business, and these Commodity Sections encouraged the creation of War Service Committees by the manufacturers in every line of industry. More than five hundred such committees were finally organized, and brought their testimony as to the capacity of their industries to the Commodity Sections, and thence to the Priorities Division of the Board. After the several requirements were cleared by the Clearance Division, upon order of the Requirements Division, the Price-Fixing Committee was brought into action in cases where it was necessary to hold prices down or to raise them enough to stimulate the needed production. This committee, though interlocked with the War Industries Board, was not a part of it but was a separate creation by the President. The work of determining cost of production, as an element in the fixing of prices, was done for the Price-Fixing Committee by the statisticians of the Federal Trade Commission. A Conservation Commission was created to consult with Commodity Sections and War Service Committees upon the proper distribution of the raw materials remaining for civilian use after the military needs were met. A War Finance Corporation (April 5 1918) was created by Congress and authorized to advance funds to banks to cover loans made by them to munitions makers, in order that these might convert their factories or expand them in the public service. A Resources and Conversion Division made surveys of industries that could be converted to war use; a Facilities Division studied the possibilities of creating new establishments for the same purpose. Before the end of the war new construction for non-war use was stopped except in case of minor repairs, and Capital Issues Committees, attached to the Federal Reserve banking system, received authority to pass upon and veto private applications for loans of capital for non-war use. Other sections or divisions were added to complete the war organization of industry under the general supervision of the War Industries Board. (*Handbook of Economic Agencies of the War of 1917*, prepared in the Historical Branch, War Plans Division, General Staff, 1919.)

Other War Boards.—Except in the army and navy, the great agencies of procurement grew up outside the permanent departments of Government. The Shipping Board was the first of the new war boards to begin to function. It was followed by the Food Administration (Aug. 10 1917), under the direction of Herbert Hoover, who had conducted a voluntary Food Administration after May 19, while Congress was debating the projected Food and Fuel Control Act. On Aug. 23 1917, Harry A. Garfield became head of the Fuel Administration. The War Industries Board (July 28) was by no means as pervasive as it became in 1918, but was active from its creation. Under the Trading with the Enemy Act (Oct. 6 1917) the President created on Oct. 12 the War Trade Board, with Vance McCormick as chairman. The function of this body was to supervise imports and exports for the purpose of conserving tonnage, securing the necessary raw materials for the munitions programme, and preventing the enemy from deriving any advantage out of American foreign commerce. The Alien Property Custodian (Oct. 6 1917) transferred alien enemy property into the hands of a trust administrator to prevent the enemy from deriving advantage from American industry. The Railroad Administration (Dec. 26 1917) was the last of the great war boards to be created. During the spring and summer of 1918 the President held frequent conferences with the heads of the six great boards and the Secretaries of War and Navy, this body being spoken of informally as the "War Cabinet."

Centralization in the War Department.—The Navy Department made few changes in its basic organization during the war, but the War Department was in continuous readjustment. The several independent buying agencies were rearranged by functions, so that given commodities might be procured for the whole army by a single purchaser, and all military finance pass under a single eye. In Dec. 1917 Maj.-Gen. George W. Goethals was taken into the War Department as Director of Storage and Traffic of the General Staff. The General Staff did not find its wartime chief until Gen. Peyton C. March took charge (March 4 1918), being sent back for that duty from the A.E.F. His immediate predecessor as chief-of-staff was Gen. Tasker H. Bliss, who remained in France at the Supreme War Council; Bliss was preceded by Maj.-Gen. Hugh L. Scott, who was in office at the outbreak of the war, and accompanied the American mission to Russia in 1917.

Goethals reorganized all the procurement agencies of the War Department, taking many of them away from the former bureaus and building up a new organization under himself. In Jan. 1918 Brig.-Gen. Palmer E. Pierce was made Director of Purchase and Supply, while Edward L. Stettinius, a banker who had acted as buyer in America for the Allies, was made Assistant Secretary of War to coöperate with him. In April the Purchase, Storage, and Traffic Division of the General Staff took over the functions of both of these divisions, and, as "P., S. and T.," under Goethals became the most visible of the War Department agencies at the national capital. Stettinius was sent abroad to the Inter-Allied Munitions Council, and Benedict Crowell became Assistant Secretary of War and Director of Munitions. (Crowell, *America's Munitions, 1917-1918*, Washington 1919.)

The reorganization of the War Department, the expansion of the Navy Department, the creation of the War Boards, and the rise of the War Industries Board as the coördinating agency were simultaneous processes. The condensation of so much activity in a few months makes it difficult to award praise or blame to individual organizations; but at the date of the Armistice the new War Government was functioning, having converted the United States to the single purpose of winning the war.

Labour.—The six great war boards included all the fundamental elements except labour. By the adoption of the Selective Service Act (May 18 1917), the policy was established of permitting only those to serve with the colours who could be spared from the tasks of production, and before the end of the year the draft registrants were classified according to their industrial importance. Labour was brought into coöperation with the scheme of procurement through the various committees organized by Samuel Gompers for the Advisory Commission, and the Government agreed that, in consideration of an attempt on the part of Labour to keep the work moving, the United States would endeavour to preserve the standards and health of Labour as against the dangers of rising wages, labour scarcity and uneven housing conditions. In each of the larger war agencies some sort of Labor Bureau or adjustment commission was created, and Congress acted upon the initiative of a committee of the Council of National Defense by making appropriations for housing facilities in congested regions, which were administered in part by the U. S. Housing Corporation, and in part by the Shipping Board. Early in 1918 the Department of Labor created a commission of employers and labour to draw up a formal programme for labour treatment. As a result of the report of this body the President created (April 8 1918) the National War Labor Board, presided over by ex-President William H. Taft and Frank P. Walsh, to act as a supreme court for the adjustment of labour disputes. This was followed (May 13 1918) by the appointment of a National War Labor Policies Board, upon which all the producing agencies were represented, whose function was to determine standard policies and eliminate inequalities prevailing in the practices of the numerous production agencies. Within the Department of Labor various labour services were inaugurated or expanded, notably the Children's Bureau, the Woman in Industry Service, and the Employment Service. On Aug. 1 1918, by executive order, the Employment Service took over through its own offices the whole task of placing unskilled labour in American industry in order that labour priority orders might be respected and that the employees of one concern might be freed from "wage raids" made by other establishments. All private employment offices were closed, and labour was generally driven out of non-essential occupations by two orders: (1) a ruling of the Provost-Marshal-General denying deferred classification under the draft on grounds of dependency to men engaged in the occupations marked non-essential on his list (May 17); and (2) a classification of industries by the Priorities Division of the War Industries Board grouping industries in the order in which it was important and permitted that they be supplied with fuel, raw materials, transportation and labour (Sept. 3).

Government-Owned Corporations.—In the execution of the munitions programme a device relatively new to American practice was frequently used in the corporations whose capital stock was entirely owned by the Government of the United States. Government production was normally slow and expensive because of the red tape and lethargy inherent in civil service establishments. Financial operations were embedded in legal requirements adopted not to expedite work but to ensure honesty in expenditure. Private business, on the other hand, could make decisions and apply funds with the promptness desired of Government offices in time of war. The Shipping Board Act authorized the creation by the Shipping Board of a corporation all of whose stock should be subscribed by the board out of a fund appropriated by Congress. As stockholders the members of the board elected directors for the corporation (generally themselves); and the directors were at liberty to disregard Government red tape and to act as freely as any private directorate under the general laws of the state granting the charter. The Emergency Fleet Corporation was organized pursuant to this authorization, and the freedom of action thus obtained inspired other war boards to imitate the process. The U.S. Grain Corporation and the Sugar Equalization Board were created by the Food Administration to administer the work of stabilizing the price of flour, sugar and coffee. The Spruce Production Corporation was jointly owned by army and navy aircraft interests and the Allies, who were thus required to pay their share of the overhead charge in producing spruce lumber for aeroplanes. The War Finance Corporation was a subsidiary of the Federal Reserve Board, doing a banking business in buying war-loan paper from individual banks. The War Trade Board Russian Bureau was organized in the closing days of the war when it appeared that Government stimulation of trade with Siberia would be useful. The U.S. Housing Corporation was an operating subsidiary of the Department of Labor. (F. L. P.)

III. THE CENTRAL POWERS

No department of army supply gives so clear and comprehensive a picture of the whole war administration of the Central Powers as that of the munitions supply. The error of the peace-time preparations lay in the under-estimation of the length of the war and of the fighting needs, and in the inadequate provision for the mobilization of industry. With this naturally went deficient arangements for building up reserves of raw material. The difficulties were the greater, since, owing to the effects of the blockade, the supply of food for the army and for the civil population were largely parts of one and the same industrial problem, owing to the many points of contact between the respective demands. Quite apart from the question of coal—and taking, for instance, fats, sugar, and alcohol, all needed in the manufacture of explosives—in Austria-Hungary 50,000 tons of sugar had to be withdrawn for that purpose from the food supply in a single year, while in Germany during a like period 900,000 tons of potatoes were used in the production of alcohol for explosives. Military supplies of many other kinds were also greatly affected by the demands of the Munitions Department. Almost the whole of the national economic life had to be adapted to this particular necessity, and in this respect the situation was truly that of a beleaguered fortress. The home industries had to be specially developed in order to meet the pressing need; and it was here especially that Germany took the lead among her allies. Because of her superior strength she had to be responsible for such of their supplies as their own means were inadequate to provide. This amounted to practically the whole in the case of Turkey and Bulgaria. A consideration, either of the war economy as a whole or of the supply of munitions alone, may therefore be properly confined to the performance of the two great Central Powers.

At the beginning of the war, and even more in its earlier months, Austria-Hungary depended upon Germany's mightier and more complex production for various kinds of war material, and especially for certain important raw materials. The Danube monarchy was far from being so homogeneously organized as either Germany or France. In contrast to the highly developed and qualitatively important industries of Lower Austria, parts of Steiermark, Bohemia, Moravia, and a few small Hungarian centres, there were vast areas which were entirely impotent in an industrial sense. The form of the political system also prevented complete central control of the whole available strength of land and people. Regions of advanced culture existed side by side with immense tracts which were hardly at all developed. Austria-Hungary was always greatly inferior to Germany in the matter of raw materials. Her sole advantage lay in the naphtha wells of Galicia; and this ceased to exist soon after the beginning of the war, when the Russians invaded that region. The scarcity of coal was always a great difficulty; even in peace-time she was dependent on Germany for supplies. The Austro-Hungarian Empire possessed an iron and steel industry of the first rank as regards quality. Quantitatively, it could not compete with the German industry, chiefly owing to the above-mentioned lack of coal, but qualitatively the product was not only not inferior to that of Germany, but it ranked next to the English high-grade steels in the world-markets. The magnificent armament industry was second only to this well-developed, high-grade steel industry. What Krupp and Ehrhardt were to Germany, the Skoda works and the firm of Böhler were to Austria-Hungary; and eventually the Hungarian gun factory at Györ, which was under the management of Skoda, was added to these. For small arms and rifles Austria-Hungary possessed, in the front rank, the Steyr armament works. All these private sources of production in conjunction with the State factories which, since the time of Uchatius, had been capable of a large output, were soon in a condition to undertake the entire supply of the Austro-Hungarian army, and also to share in the equipment of her weaker allies with guns, small arms and shells.

The chemical industry was, however, totally inadequate, so that in this respect the Danube monarchy was very largely dependent upon Germany, and consequently had difficulty in producing the necessary explosives in sufficient quantity. In fact, the inadequacy of the powder and explosive production of Austria-Hungary made itself felt all through the war, and was the main cause of the crises which occurred from time to time in the munitions supply. The truth is that neither of the Central Powers was at first equipped for coping with the unexpectedly great and urgent demand for munitions, any more than were the rest of the belligerents.

The difficulties created in Germany by the blockade were increased by Austria-Hungary's lack of raw materials, which rendered her almost powerless to offer any compensation for the loss of overseas imports. Only after Gorlice (May 1915) did her petroleum industry begin to contribute to the common war economy, and besides this, strictly speaking, only her bauxite deposits, magnesium works and timber stocks were worthy of mention beside Germany's extensive contribution.

Nevertheless, Germany succeeded in carrying on the war, which was so largely one of materials, for 4½ years, and Austria-Hungary's contribution of material (for example, of guns and ammunition) was for a long time in the proportion of 1:3 to that of Germany. These facts afford a proof of the remarkable way in which Germany adapted herself to the war necessities, and also of the height of her technical accomplishment; they are no less a sign of the immense vitality of the Dual Monarchy, which was contrary to all expectation even in Austria-Hungary itself. The achievement of the much weaker Austro-Hungarian industries is perhaps the greater marvel, for the difficulties of obtaining raw materials, of finding the necessary workmen, the transport problem, and, lastly, the very different degrees of development in the various regions weighed heavily indeed. Both the Central Powers achieved seeming impossibilities in utilizing the entire productive capacity of their populations, the more so as all active classes of the people were called up during the war, as in the other belligerent States.

The actual organization of production is dealt with later in this article. Before coming to it, we will describe generally the character of the problem to be faced in respect of the forms of munitions employed by the Central Powers.

Artillery Ammunition.—The two empires had always been entirely independent of one another as regards the development of the whole artillery, small arms, machine-gun, and ammunition production. Only in course of the war did an active interchange of field and factory experience take place. Bulgaria and Turkey, until the war, competed for their weapons in the open market.

The shell, as the shooting agent, is so entirely dependent structurally upon the shooting apparatus, that ammunition can only be dealt with in relation to the guns concerned. The ruling consideration in the manufacture of guns must likewise be their conformity with the possibilities of shell construction.

The Central Powers—like the French on their introduction of the 75-mm. field-gun, which was believed capable of satisfying all requirements—endeavoured to unify the artillery weapons of the field army as much as possible; that is, to make one type of gun suffice. However, opinion soon came round to the view—the correct one, as the war showed—that both the light and the medium field-artillery required a high-angle gun. In Austria, particularly, where the mountainous nature of the country had led before the war to the production of conspicuously good high-angle guns and notably mountain guns, the view was held that even the light artillery must have shells of great penetrating power for vertical fire against the covered-in shelters and stone defences to be looked for in mountain warfare. In both the Central Empires judgment went against the artillery experts who were in favour of greater mobility and lighter ammunition. However, both armies possessed a medium artillery (up to and including 15 cm.) which was highly effective as regards the individual round. At the beginning of the war Germany already had modern light and heavy howitzers, and also the 21-cm. mortar. It is true that the Austro-Hungarian medium artillery was only equipped with the new patterns after the first few months of the war, the tests being then barely completed; the existing types of howitzer were, however, not inferior, either in shooting effectiveness or in the matter of shells. While the Austro-Hungarian super-heavy howitzers were undoubtedly superior in mobility and effectiveness to that of all the other armies, the German medium and heavy flat-trajectory artillery were immensely superior.

The weapons referred to are the 30·5-cm. mortar (380-kgm. shell; 11 kilometres' range), and the 42-cm. howitzer (1,000-kgm. shell; 12 kilometres' range) of Austria-Hungary, already existing in peace time, to which the 38-cm. howitzer and the 21-cm. mortar were added during the war. All three were designed for motor traction. The German long-range gun is also included. At the beginning of the war Germany had also her 42-cm. howitzer, which, however, was inferior in mobility to the Austrian.

The different lines of development of the German and Austrian artillery were determined by the form of their respective main theatres of war. Austria-Hungary, which had to adapt its artillery to the destruction of the enemy forts distributed through all the important mountain passes and the rocky shelters to be found in the hills, clearly had to make her gun and ammunition construction correspond to this necessity. There was thus more urgent need for shells with solid points, and therefore base-fuzes.

Reviewing the technical triumphs of the World War, it is clear that in the domain of artillery ammunition there was no advance—gas ammunition excepted—on the pre-war principles of construction. This applies to all the belligerents. In spite of the efforts at uniformity, the munitions equipment necessarily became very varied during the war, because it had to conform to the varied character of the fighting, of the ground, and, lastly, of the production, which was subject to the supply of raw material and to the capacity of the factories. However, the new products were almost always constructed on the old lines, and all new types which resulted from lack of the customary material appear, when closely examined, as no more than forced solutions of a difficulty. The ammunition, like the gun material, remained unchanged in principle, only tending towards a gradual intensification, without any change in essential character. No new propellant, no new explosive, no new body or driving-band material, not even a really new and better fuze, emerged from this unparalleled trial of strength, this world-wide competition in technical ability. In two directions only may real improvement be noted: the false-cup shell which increased range and brought up fresh ballistic problems in connexion with the upper air, and the shell of the Austrian 30·5 motor-mortar, which was the first high-trajectory projectile combining armour-piercing effect with mine-effect. This latter shell was the product of the very developed native high-grade steel industry. With an explosive charge of 38 kilogrammes, it had (like the mine-shells of the field howitzers) a 10% efficiency (proportion of explosive to total weight), and yet, with an initial velocity of about 300 metres a second, was able to penetrate 250 millimetres of reinforced nickel-steel armour without deformation. This necessitated a resisting capacity, taking pressure alone, equal to 21,600 kilogrammes to the square centimetre, and it was not a thick naval shell, but a thin-walled mine-shell, of which the point and shoulders had to be hardened. The material was a specially reinforced alloy of high-grade steel. The results obtained with this in peace-time had already induced the German army chiefs to place orders with Austrian works for shells for their 21-cm. mortars.

Developments in Manufacture.—In the case of guns and of ammunition alike, the war-developments in manufacture were of an industrial nature in both the Central Empires. The military authorities exercised an influence over this development through the orders they placed and the experiments they caused to be made.

In Austria-Hungary there was a special Artillery Staff, the officers of which were recruited, like those of the General Staff, from the General Staff School, and received, in addition, a special technical training. For this reason, and also because it was in constant touch with the troops, this corps was able to judge, from both a military and a technical standpoint, what demands should and could be made for any kind of military material. The ammunition—with the exception of special types, as, for example, the Ehrhardt "Universal" shell—was actually designed in the military bureaus of this staff. Hence the Austrian ammunition was from the beginning more uniform in construction, and the work done by the staff in peace-time considerably lightened the task of transforming the artillery equipment—which, excepting the field-guns and the heaviest high-trajectory guns, was not modern.

Projectiles: Material and Methods of Production.—The cores of modern artillery projectiles were made from Martin steel by the Ehrhardt pressure process. A material rich in manganese was desirable, and especially one which should be reasonably workable and not liable to cause much waste from rejections. This process of manufacture by means of shell-presses, and, for larger calibres, by drawing from rough billets of metal, required special establishments. The production was therefore confined to specially adapted factories.

In Germany, soon after the beginning of the war, a larger number of firms was available. Before the war, in the latter country, 13 firms were available for the manufacture of the pressed-steel shells for the newly constructed experimental guns. There were no more during the early months of the war.

When, after the first few weeks, the unforeseen extent of the demand for munitions was realized, both States had to depart in some measure from the approved methods of manufacture, because it became necessary also to utilize factories not equipped with presses. Between December 1914 and the middle of 1915 production began of shells of grey cast-iron for light, and of cast-steel for medium, calibres. About the same time began the greatly increased demand on the part of the troops for explosive shells in place of shrapnel, which was of very little use in position warfare. It was believed that the necessity of the moment was thereby satisfied, but; as might have been anticipated, production on this scale did not in the least respond to the demand. While the shells of Martin steel, formed by pressure, could sustain a firing stress of up to 50 or even 65 kilogrammes to the square millimetre without further treatment, the limit for the cast-iron shells was at the most 25 kilogrammes to the square millimetre. Moreover, the cast-shells could not be secured against faults occurring in manufacture. The so-called water-pressure test to which, in both Germany and Austria-Hungary, the finished cast-shells were submitted in the acceptance test, really served no purpose except that of silencing the bad consciences of the experts. The consequence was that these shells had to have their walls considerably strengthened, and to be shortened, thereby reducing the proportion of the explosive. Moreover, the risk of explosions in the bore forbade the employment of powerful modern explosives as filling, and caused the adoption of much less effective safety explosives such as dynamon, etc. These shells, therefore, proved entirely inadequate, and their production was in fact soon abandoned owing to the number of guns damaged by the splitting or bursting of the barrel. It was contrived, instead, to effect a substantial increase in the output of shells formed by pressure.

The ever greater demands made on the munitions industry, which had to share its raw material with other departments of war supply, made it necessary to employ Thomas iron in addition to Martin steel, and, as ferro-manganese was scarcer in Austria-Hungary after the loss of the Jakobeny mines, to reduce the proportion of manganese in the metal. The chief disadvantage of this was that more defects occurred in the manufacture and so many shells were rejected as seriously to reduce the output.

Nowhere did the harmfulness and illogicality of using inferior materials and cheaper processes manifest itself so plainly as in the manufacture of munitions. The war showed clearly that fewer munitions of good quality are much to be preferred to a larger supply of inferior stuff. For nothing so greatly strengthens the *moral* of the enemy and weakens that of the home army as ineffective ammunition. To this was added the great wastage of gun-barrels (from barrel explosions) with the attendant danger to the men serving the guns. The troops lost faith in their weapons, and were inclined to overestimate the enemy's artillery and underestimate their own.

Acceptance Conditions.—The kinds of material to be used in shell-manufacture (for test-pieces) were determined in peace-time. For shell-steel a tensile strength of 80 kilogrammes to the square millimetre and an elongation of from 7 to 15 per cent; for shrapnel-steel a tensile strength of 80 kilogrammes to the square millimetre and a 12-per-cent elongation. For shells subjected to high pressure for certain guns exceptional strength was required. In Germany particular attention was given in the tests to the limits of extension. As a rule, none of these specifications was modified in war, except in the case of cast-iron shells. Indeed, the testing of the shells was based even more than in peace-time on their shooting. This became, in fact, the only essential test for shrapnel. Any modification of the conditions laid down and tolerances admitted was only intended to facilitate the necessary mass-production, and no sacrifice of quality was accepted. Several over-careful peace-time stipulations could be dropped without scruple. In those cases in which alloy steel was prescribed as the shell material, unalloyed steel came to be admitted when the super-heavy howitzers began to be used for man-killing purposes (especially in the Carso), as such shells needed no hardening process.

An investigation into the causes of the explosions in the bore, which were the source of much anxiety, showed conclusively that they were seldom to be attributed to the shell-bodies as such, and were therefore usually due to set-up, which in many cases could be very simply obviated by machining down the body. This was the case, for instance, with the Austrian 10-cm. cupola howitzer. The great influence of the brevity of the single effort of resistance required of a shell was demonstrated in an experiment with shells weakened by having the greater part of the circumference sawn through; these were fired with very heavy charges, and all were successful, though the pressure on the dangerous sections must have been greatly in excess of the normal amount. Experiments showed that the calculated admissible pressure on the shell body was far less than that which occasionally occurred without rupture.

In reality, the behaviour of the shell in the bore is ill-understood. The pressures to which the shell is exposed cannot yet be mathematically formulated. The calculations made have only an empirical basis, albeit indispensable. The chief thing is that the material should be of uniform consistency throughout.

Form of Projectiles.—In peace-time the measurements—calibre-length, form of head, base—were usually alike in Germany and Austria for modern types of shell; *i.e.* average length, 4 calibres; radius of point about 2 calibres. Those of the medium field army artillery were not very different.

For newer types of gun, *i.e.* the Austrian medium 10·4-cm. and 15-cm., and the German 15-cm. more slender forms were adopted, and consequently the value of improvements in the projectile was more and more recognized, especially in Germany. In order to obtain, with a like weight of shell, the slenderer form and greater calibre-length and at the same time the distribution of mass best suited to rotation, the shells were fitted with ogival caps of thin sheet-metal. These could be removed for the manipulation of time fuzes. The gain in range was 30 to 40 per cent in Germany; in Austria, with the 15-cm. auto-gun it was only 12 per cent. The difference was due to the variations in the ballistic quality of the original shells. Similarly, good results were obtained by Germany for small calibres with the so-called C. shells. The form of these was very carefully defined, and incidentally incorporated a principle which was already being applied by some makers in peace time—the stream lined base. The tests carried out showed the influence of these improvements to be only sensible at muzzle velocities of 500 m/s and upwards.

In certain of the heaviest high-trajectory guns the shells used in field warfare were substantially lightened, so as to obtain a great range without over-straining the gun by use of a heavier charge.

Painting of Shells.—While the German shells were nearly always streaked with paint, those of the Austro-Hungarian army were left bare except for marks of identification. The painting appears to be more useful for this purpose than as a protection against rust. Before the war various experiments had shown that the formation of rust proceeded under the paint. Moreover, the lack of pigments enforced their economy in Austria-Hungary.

Driving-Bands.—Before the war copper was invariably used for driving-bands. Earlier experiments with cupro-nickel and other alloys led to no result. The size and number of the rings and bands employed are determined by the pressure. An effective pressure on the driving edge of from 400 to 600 kg/cm² was found to be best. The form of the rings was only governed by the necessity of good seating of the shell in the bore and by loading convenience. In the case of heavier direct-fire guns a backward strengthening of the bands towards the rear or a gascheck may be advantageous for sealing, according to the shape of the chamber.

The problem of material became especially important when the scarcity of copper began to be felt. The demand could not be met by the internal production, even with the addition of the metal of commandeered domestic articles.

None of the substitutes employed was really of much practical utility. In both Germany and Austria-Hungary the use of a very soft iron resulted in a wearing-out of the barrel after from 60 to 80 shots. Better results were obtained with a pure iron made by an electrolytic process (electrolytic iron), which Germany succeeded in putting to good use as driving-bands; it was, however, difficult to produce in large quantities, and its employment was limited to this one purpose, for which it ranked next to copper in suitability. The wastage of barrels was not excessive. Paper substances gave tolerably good results both in German and Austro-Hungarian experiments; but the fixing of the paper rings on the shell was very troublesome and not always certain. Besides, the paper had a grinding action on the interior of the bore and led to rapid wear.

A compressed zinc-aluminium alloy, very easily worked, was employed to a great extent, as a substitute for copper, with a thin ring behind or in front of the ordinary zinc band which was of the usual form. While in Germany an extensive use of these driving-bands was being made in 1917, Austria-Hungary from that year onwards effected an increased production by using a hollowed-out gascheck of copper behind the zinc. This, however, was not used in great quantities because at that time the output of ammunition was not sufficient to absorb the copper bands already in hand. The zinc alloy was not really satisfactory, or at most only with the small charges of light howitzers. With more powerful charges the zinc bands were considerably burned through, the sealing was inefficient, and the greatly increased dispersion seriously impaired shooting.

Shrapnel and Shell Shrapnel.—The equipment of the field-artillery guns with shrapnel and explosive shells respectively was based on the view prevailing before the war that shrapnel, with its more extended effect and lesser dependence on precision, was the best projectile for use against troops. For the light field-guns the proportion of shrapnel was very high. Various efforts were made to arrive at a "universal" shell, in order to simplify ammunition supply. From this attempt arose the various types of H.E. shrapnel, the fuze of which was so contrived that the projectile could be made to act either as shrapnel or shell. In the end the "universal" shell was accepted by Austria-Hungary alone of all the great States. The Ehrhardt H.E. shrapnel was found the best and was adopted. Three factories were set up for its manufacture before the war. The projectile had pressed into the shrapnel body a head acting like a shell. The bullets were packed in with *trotyl*. In time shrapnel fire the shell acted as ordinary shrapnel, and also, on the head striking, as a small explosive shell. The effect of this head against shields was very satisfactory; moreover, the bursting of the head considerably aided the ranging. In percussion fire the effect was not equal to that of a modern high-explosive shell, but greatly surpassed that of ordinary shrapnel. The manufacture was only slightly more troublesome than that of other shrapnel, and the shell effect of the head and the assistance it gave to ranging more than compensated for this, so that, on the whole, the shell was considered satisfactory. Universal shell, in any case, was no substitute for H.E. shell, and as time went on and the use of shrapnel became more and more limited to particular episodes of fighting, universal shell, like ordinary shrapnel, diminished in importance. In practice, however, in both armies and especially in the Austro-Hungarian, a large proportion of the ammunition had still to be in the form of either shrapnel or universal shell, owing to the lack of material, and particularly of explosives. And the practice of packing explosive between the bullets of the universal shell had to be abandoned.

Iron Bullets.—The want of lead caused a substantial falling-off in shrapnel production. In 1916 the manufacture of iron shrapnel bullets had already begun, and from 1917 onwards leaden bullets practically ceased to be made. The bullets were cast or pressed. The former displayed undesirable ridges and corners; the latter were more difficult to produce in large quantities. Another disadvantage was that not only did the lesser specific gravity of the iron bullets in relation to that of the lead-antimony bullets result in a lesser power of penetration, but a much smaller number of the former could be got into a shell than of the latter, which, being smaller and fitting closer together, permitted full utilization of the space. It followed from this that the total weight of the shell was less, so that shooting with the existing sight-graduations became complicated and produced different results. The packing in with explosive, in the Austro-Hungarian universal shell, became impossible with iron bullets, because of the danger of prematures.

Coloured Smoke-clouds.—The effort to render the smoke of exploding shrapnel more visible, even over snow-fields, led, in Austria-Hungary, to the use of a red colouring matter (oxyhydrate of iron), which made the smoke-burst half red. This colouring also facilitated the keeping of a due distance between the shots. In Germany various devices were employed for colouring the smoke of certain shells.

Fuzes and Ignition.—The fuzes ordinarily used by both armies in time shrapnel fire were T and P fuzes of the setting ring class. They were used both for shrapnel and for time fire with nose-fuzed H.E. shell. After the abandonment of H.E. time fire (which was dictated by the necessity of simplifying the mass-production of one of the fuze parts) a simple explosive shell fuze was adopted.

The Austro-Hungarian artillery employed base-fuzes much more than the German. That most in use was one of Krupp manufacture which had an effective ball-safety. The design of Austrian base-fuzes differed considerably from that of German as regards the transmission of ignition. Base-fuzes proved quite as satisfactory as nose-fuzes in the war. Explosions in the bore were no longer caused by fuzes, as they appear to have been in peace-time.

Soon after the war opinion changed regarding the relative merits of shrapnel and explosive shell. The estimate of the value of the explosive shells in percussion and time fire likewise varied from time to time according to the nature of the ground being fought over. While H.E. effect was almost entirely lost in the soft soil of Galicia and Poland, on rocky ground (and more especially on the Carso) the effect of this kind of fire was intensified by the splinter effect of the stones and, moreover, blinds seldom occurred. Efforts were directed towards the production of a sensitive instantaneous fuze, especially in the western and eastern theatres of war, where also time explosive fire was more in demand than in the Italian theatre.

Germany's *sensitive instantaneous fuze*, produced in 1916 and 1917 (*see* AMMUNITION), was of an extremely simple pattern and safe in the bore. It was not very satisfactory, however, for flat angles of descent, being apt to go blind in such cases. By the end of the war Austria-Hungary had also produced a sensitive fuze, constructed on similar principles and exhibiting similar defects. These fuzes were, of course, necessarily nose-fuzes. A device for bringing into the system a long or short delay element, or both, can easily be added; but the question of the instantaneous fuze is still open.

In the western theatre flat-trajectory ricochet fire with long alloy fuzes was very successful on suitable ground. It served as a substitute for H.E. time fire, and was indeed more effective when the burst occurred at the proper height. However, it depended on the coincidence of several favourable conditions. Experiments were made with *mechanical time-fuzes*, especially for use with anti-aircraft guns, in order that the igniting composition of the time fuzes should not be affected by atmospheric conditions. The best results seem to have been obtained with those made by the watchmaking firm of Junghaus, which brought out designs both in Germany and Austria-Hungary. The Krupp model was driven by spring power; the Junghaus by a centrifugal device. The success of these designs was not in proportion to the costliness and difficulty of manufacture. These fuzes were but slightly superior to the time-composition fuzes, and on the other hand introduced new sources of error. Moreover, their manufacture depended on the existence of a large-scale clock industry capable of mass production.

Substitute Metals.—The lack of brass, of which fuzes were nearly always made, necessitated the use of substitute metals for this purpose. The best results were obtained, for a number of the fuze parts, with an alloy of zinc and aluminium. Iron was also satisfactory for fuze bodies and other portions. Only certain especially delicate interior parts (such as safety-ferrules) were made of brass as before. Both Central Powers soon became very successful in the employment of other metals for fuzes, so that the use of these substitutes might well be continued without disadvantage even in peace-time, when normal supplies of raw material are available.

Explosive Charges and Their Filling.—Before the war *trotyl* (T.N.T.) had been completely adopted for shell fillings in both Germany and Austria-Hungary. This was inferior to *ekrasit* (picric acid) in explosive power, but its greater insensitiveness to shock, and also the fact that its preparation was both easier and less injurious to health, gave it a considerable advantage.

While Germany, owing to the high development of her chemical industry, already had, in peace-time, several establishments for the manufacture of *trotyl*, Austria-Hungary was dependent on Germany for this substance at the outbreak of the war. A few months later she began to make her own *trotyl*, and Germany set up a number of additional factories; nevertheless, the supply was soon outdistanced by the enormous demand, owing, once more, to the scarcity of raw material. Not only had recourse to be had to picric acid (known in Austria-Hungary as *ekrasit*), but a number of other explosives had to be produced from the available raw materials and used as artillery fillings. Some of these were difficult to work, some not over-safe, some inferior in effect. The demand continued to increase, for with the ever-growing multiplication of new fighting devices, such as trench mortars, grenades, air bombs, etc., the use of explosives was being continually extended.

In Germany the satisfaction of the immense demand was less difficult than in Austria-Hungary, where the army administration was dependent for its explosives upon two public and two privately owned factories. At the beginning of the war, with the exception of one privately owned *ekrasit* plant and one ammonal works, there were no factories for ammunition explosives in the country.

Trotyl was almost invariably poured directly into the shell cavity. To prevent crystallization the stuff was filled under pressure, and constantly stirred till solid. The exploded cavity was made by boring. The projectiles filled by this method proved highly satisfactory, and it was used up to the end of the war for all shells subjected to high stresses, as far as the supply of *trotyl* permitted. Complaints were made only against "crude *trotyl*," which contained insufficiently nitrated portions and was apt to "exude."

The manufacture of picric acid necessitated great precautions because of high melting-point, and was also very inconvenient by reason of the injurious nature of the fumes and dust. Hence *ekrasit* was not poured into the shell in a molten state like *trotyl*, but after the addition of a "phlegmatizer" (*e.g. mononitronaphthalin*) was filled in in large masses and pressed down with wooden stemming rods. Later on, in order to simplify the process, it was made into compressed blocks, and these were fixed into the shell with paraffin and resin. For the larger calibres a combined picric and cast-*trotyl* filling was used. Picric acid was thus restored to its earlier importance in shell-filling, and, in spite of less strictness in inspection conditions, proved as satisfactory as *trotyl* up to the end of the war.

The immensity of the demand soon made new expedients necessary. In Germany, *dinitrobenzol* was used to some extent. It answered well when a more vigorous substance was used with it to start detonation (*trotyl* blocks). Its troublesome idiosyncrasies in working were considerably lessened by the use of suction apparatus. *Trinitro-anisol*, more powerful than *trotyl*, but also more easily exploded, was also used in Germany. Because of its unpleasant physiological effects, it was, however, employed only for the projectiles of trench mortars and trench munitions, and for naval mines.

The most important of the measures taken purely for economy was the use of ammonium-nitrate explosives. These are made by mixing finely powdered ammonium nitrate into the molten mass of a nitrated substance. Hence the explosives of this class actually used[1] were based on *trotyl* or *dinitrobenzol* in Germany and *trotyl* only in Austria-Hungary. By this method explosives very little inferior to *trotyl* could be obtained and the total production considerably increased. Although the sensitiveness to shock was found to be rather greater, the manufacture was almost as convenient as that of *trotyl*. Picric acid could not be treated in this way.

In Austria-Hungary there arose a very extensive demand for *toluol-ammonal*, which consisted of ammonal with from 10 to 30 per cent addition of *trotyl*. The composition was first compressed into blocks, which were inserted into the projectile in cardboard tubes. Solid-filling by means of molten paraffin or *trotyl* poured into the interstices between those tubes did not prove satisfactory in the Austro-Hungarian base-fuzed shells, as set-backs occurred on discharge. For this reason the compressed blocks were inserted without the cardboard tubes, and were made to adhere to the shell-wall with a composition of lime, resin, and paraffin, or by means of cast *trotyl*. The best results were finally obtained by the use of pitch. Hot pitch, in the form of dust, was sprayed onto the shell walls (Fritzsch's process). In the case of a few large calibres *trotyl* was filled onto a short block of compressed *T. ammonal* secured by cast *trotyl*.

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[1] Called *amatols* in Great Britain.

In Germany the cardboard-tube method, on the contrary, answered very well indeed with *ammonal* explosives. The explanation lay in the very different design of the Austro-Hungarian base-fuzed shells, which made them very liable to accident when the explosive was badly settled in the shell cavity. However, *trotyl*, *ekrasit* and 60/40 *amatol* remained the most satisfactory explosives from the point of view of the manufacture, and hence the least open to objection.

As *substitute explosives*, *ammonium-nitrate explosives* and *chlorate explosives* were used. Among the former, *dynamon* was used in cast-iron shells, for reasons of safety as already explained. The scantiness of the smoke produced and the fact that ignition depended upon the density of filling caused this substance to be regarded with disfavour. However, *dynamon* and (in Germany) a number of similar safety explosives were used in trench-mortar shells and grenades, and for engineer munitions, with good results.

The chlorate mixtures, put out under various names (chiefly in Germany) and intended for various military uses, soon disappeared again in consequence of numerous disasters, which could be traced to over-sensitiveness on discharge, filling dangers, and their liability to disintegrate. The perchlorate explosives were satisfactory as regards safety. They were used with good results for certain trench-mortar bombs, but only in Germany. A radical measure of economy was found in the use of "economical filling." The portion of the shell cavity nearest the fuze was filled with the selected explosive and part of the remaining space with pitch. By the use of very powerful ignition this process gave far better results than might have been expected, but it was never used on a large scale.

Notwithstanding these comprehensive measures the lack of explosives, which, at all events in Austria-Hungary, was chronic, greatly hindered the supply of artillery ammunition, almost as much in fact as did the difficulties of propellant manufacture. Both deficiencies were due to the backward state of the chemical industry in that country. Although the needs of Germany were very much greater than those of Austria-Hungary she was always able to respond to them much more quickly.

Bore Explosions.—Special care was devoted to obviating the bore explosions which were so disastrous both from the point of view of the command and that of the troops. As has been said (except in the case of the unsatisfactory cast-iron shells), these could very seldom be attributed to the shell-material. In the case of very long high-pressure guns it is possible that shells on the high limits of tolerance were jammed by the action of the so-called *breath* of the barrel. More sources of defect were naturally to be found in the fuze, which must inevitably contain a very powerful igniting composition. In Austria-Hungary detonators were regarded as dangerous. The fear does not seem to have been justified, provided they were properly placed and secured, and due precautions observed, but they are yet another source of weakness in mass-production. At all events, there were few bore explosions with the Austro-Hungarian pressed-steel nose-fuzed shells, which had very simple fuzes without detonators—fewer, in fact, than occurred with the German shells. The Austro-Hungarian base-fuzed shells had the defect that absence of a detonator necessitated the adoption of a long exploder-gaine, which greatly increased the difficulty of securing the explosive charge against the shock of discharge. Herein also lay a cause of the above explosions, which at one period were occurring with disquieting frequency. It was at first very difficult, especially with *toluol-ammonal* fillings, to fix the compressed blocks to the shell-wall firmly enough to prevent their setting back, and disturbing the ignition arrangements. Later on, these causes were discovered and almost entirely eliminated.

These special factors being left out of the question the number of bore explosions cannot be considered to have been abnormal, either in Germany or Austria-Hungary. In peace-time it was reckoned that in every 10,000 H.E. rounds there would be at least one unpreventable "premature." For example, during the Austro-Hungarian gun-practice in the years 1912 and 1913 the percentage was as high as 0·04; whereas in July 1915, a particularly bad month, the percentage was only 0·023 and in June 1915 only 0·012.

These explosions may be ascribed chiefly to the impossibility, in quantity production, of superintending the work so minutely as to eliminate altogether the possibilities of error in the manufacture of the fuzes, the thorough sealing of the shell-bases, and the filling of the bursting charge. The proper handling of the ammunition, in the depots, during transport, and in loading, was also an important factor in safety.

Cartridge Cases.—Except in a few old types of gun the Austro-Hungarian artillery always used cartridge-case obturation. All flat-trajectory guns of small calibre used fixed ammunition. All mortars and howitzers, and especially all large calibres, had separate loading. The idea that this unfavourably influenced the rate of fire had led to the attempt, in peace-time, to use fixed ammunition for light howitzers. While the fore part of the case was joined to the shell the nether part was detachable. Later on this method of loading fell into disfavour because of its complication. When the demand arose for reduced charges for field guns, in order to spare the guns and also to adapt them for firing from concealed positions, this problem was taken in hand more seriously, and in Austria-Hungary a very simple and satisfactory contrivance was found, though never made in large quantities.

At first the cartridge cases were always made of sheet brass by drawing and pressing. The cases were recovered after firing and used again, re-manufacture seldom being necessary; but although this salvage enabled a large part of the need of cartridge cases to be met, it soon became necessary to resort to substitutes, owing to the universal lack of brass. At first the deficit was made good by the use of iron bases and brass sides, joined together in a very simple manner. Generally speaking, cartridge-case obturation proved much more trustworthy in practice than was expected. In fact the two-piece construction eliminated one of the greatest sources of defect in the single brass case, *i.e.* the weakness at the bend between the base and the sides. The danger of burning through in this region was insured against in the design. The kind of material used for the base was not of much importance, cast-iron proving quite satisfactory. In the end iron-plate was used for the cylindrical part, even up to the heaviest calibres, except for use in long-range guns. Conspicuously good results followed, especially in Austria-Hungary, where, finally, a simple case of sheet-iron bent round, with an inward flange at the lower end, was used for the cylinder. It would stand being fired from 10 to 15 times without re-manufacture. In Germany, also, iron shell cases fully satisfied the requirements, and could be fired 5 or 6 times.

These iron cases replaced the brass ones altogether. The manufacture was simpler. Only the junction of base and shaft needed careful working. Bruises and dents did not matter in the rolled cases; they were smoothed out in firing by the expansion of the gases.

The prevention of rust of course was a difficulty; but this was less important in war, owing to the short time that elapsed before the shells were used. Excellent results were obtained by dipping the cases in oil raised to a temperature of about 100° C., and repeating the process several times. The examination in Austria, in June 1921, of ammunition which had been stored without any special care showed that almost all the cases so heated were still serviceable.

The powder charge was inserted into the cartridge cases in bags of raw silk. As this expensive material soon became scarce, substitutes had to be employed in charges made up of separate elements (with cartridge cases the bag was omitted). Artificial silk proved a satisfactory substitute. Paper substances were also successful in the parts lying away from the primer. No exhaustive trials to determine the chemical effect of the powder on paper were carried out.

Propellant Powder.—The smokeless powder used in the German army as a propellant was almost invariably a nitrocellulose powder. Nitroglycerin was used only in small quantities. In Austria-Hungary, on the contrary, pure nitrocellulose powder was the propellant of small-arms ammunition only. All other propellants were nitroglycerin powders containing a high proportion of the nitroglycerin (up to 40%). The particular composition and the form varied with the purpose in view and the gun concerned.

The Austro-Hungarian guns had in general a smaller chamber space than the German, with a greater energy-content in their powders. The higher combustion temperature of the nitroglycerin and the stronger flash had an extremely bad effect on the interior of the bore, especially when substitute materials were used in the composition of the powder. The use of this powder in the field guns was the main cause of the great wastage in these compared with the German field guns. The Austro-Hungarian steel-bronze guns resisted better; not so, however, the steel guns which came into use because of the scarcity of metals, and of bronze in particular. When, later, a change was made to a powder poor in nitroglycerin, the unsuitable size of the chamber created great difficulties in determining the proper charges.

No new powders were used or produced during the war by either Power. Some simplification of processes was all that was effected. But the German chemical industry energetically attacked the problem of producing the basic products used in powder manufacture, and in this domain new combinations were made and new ways opened. Among partial novelties may be reckoned the development and improvement effected in the preparation of ammon powder, which had been experimented with in Austria before the war, and even used in her navy for a short time.

The use of substitute raw materials had a considerable effect on the production of powder, and some effect, also, on the results obtained by its use. Special importance attached to the nitration of wood cellulose as influencing the quality of the powder.

At first it was impossible to get rid of the papery consistency of the wood cellulose, but, later, direct nitration was successful. Variation in the viscosity of the wood cellulose or in the preparation of nitrogen-content necessitated variations in the dimensioning of the powder. The unequal nitration of the cellulose was particularly marked and produced differences in the degree of nitration which led to unequal gelatinization and a varying energy-content.

The nitrate difficulty disappeared when it became possible to obtain nitrogen from the air in large quantities; but the victory over the alcohol, ether and acetone shortage was won with more difficulty. These substances were required for gelatinization. The acetone obtained from wood distillation was mostly produced in Austria-Hungary, which partly supplied Germany.

In consequence of the great demand other products of wood distillation had to be brought into use, and the purity of the acetone suffered. Instead of the solvent method, therefore, the roller or ballistite method was adopted for nitroglycerin powder, and resulted in an economy of material.

Glycerin substitutes were the most difficult to procure. Glycerin made from sugar was inferior to that made from fats. Moreover, sugar also was scarce. But nothing else had quality requirements.

The inferior purity of the materials, already referred to, produced a number of evils. Some of these did not prove any particular drawback in use. A more serious matter, however, was deficient or unevenly distributed gelatinization of the wood cellulose. These irregularities were shown externally by the presence of little white spots, and resulted in the detonation of the powder on discharge. Only by the most drastic inspection could these mishaps be avoided.

A still greater disadvantage lay in the reluctance of these war powders to ignite, which endangered the lives of the gunners by hang-fires. For this reason, in Austria-Hungary, the use of a black powder-priming, which had been discarded in peace-time, was resumed, with certain precautions.

The lesser inflammability caused a quantity of unburned powder to remain in the fore-part of the bore after firing. This was especially the case with the slow-burning tubular powders. In certain guns this occurred in a regular manner; the same amount was always left unconsumed and the effect on the accuracy of the shooting was thus negligible. But if the amount varied the shooting was ineffective.

But the worst consequence of inferiority in the quality of powder was the increased number of barrel-burstings. For reasons already given this was most frequent in the Austro-Hungarian long guns. In the steel-barrelled field guns the length of the gun's life diminished from 1,800 shots to 800—an impossible state of things. The advantages of the howitzers and mortars here becomes apparent. The 15-cm. howitzer lasted out 14,000 shots, and the 30·5-cm. mortar as many as 2,500. The German guns manifested about the same endurance, thanks mainly to the less eroding nature of the nitrocellulose powder employed.

To find a remedy became an urgent necessity in Austria-Hungary. As one expedient reduced charges were introduced to be used in lieu of the service-charge when the nature of the fighting permitted; as another, following the German example, recourse was had to the preparation of a powder poor in nitroglycerin. The limited size of chamber did not permit the use of pure nitrocellulose powder; but finally success was obtained with powders containing only 13 % and 25 % of nitroglycerin. The life of the guns rose forthwith to 12,000 shots. But the output of powder declined, because a large number of the batches produced did not give the required density of loading. However, the method was advantageous owing to its economy of glycerin, which was so scarce.

In Germany good results were achieved with ammon powder, which, made by the new method, partly took the place of nitrocellulose powder. It was soon employed for all calibres. This highly hygroscopic powder could be easily made damp-proof in metal cartridge cases. Where—as, for instance, in certain of the foot-artillery weapons—the powder was made up in bags, the ammon powder was enclosed in a layer of nitroglycerin powder. Ammon powder had the great merit of producing little flame at the muzzle.

The bright flashes of the large calibres, which were so inconvenient at night, by means of anti-flash were reduced by "flash-dampers," *i.e.* layers of common salt in front of the powder, which covered the light by producing a large volume of smoke. These were added to the cartridges immediately before firing. The manufacture of black powder remained unchanged, and as the output was comparatively small the production was unaffected by the scarcity of raw material.

In Austria-Hungary, especially, all these difficulties, combined with the small output capacity, seriously interfered with extensive mass-production, and moreover, as the powder production nearly always lagged behind that of the other munitions, it was necessary to make use of insufficiently settled and ballistically unstable powder. Moreover, failure to issue the powder charges in batches according to manufacture was the cause of much bad shooting, which the troops erroneously attributed to defects in the guns or the shells.

Gas Shells.—The use of gas in artillery shells, and with special kinds of apparatus, was one of the novelties reserved for the World War. After a semi-experimental stage in the early months of the war the ultimately general and comprehensive employment of gas shell had its beginnings in the cloud method and in the trench-mortar gas shell. It was anything but popular with the German troops, who did not in fact appreciate its value until after-long experience.

It was inevitable that the inadequate chemical resources of Austria-Hungary should here play a subordinate part beside the fully matured industry of Germany, whose chemical development had, moreover, been powerfully stimulated by its activities during the war. The Danube monarchy was absolutely dependent on Germany in this respect. For this reason, and also because the enemies mainly confronting the Austro-Hungarians made but small and ineffective use of gas, this form of warfare was less developed on their front, and was not properly appreciated by the troops till nearly the end.

In the early months, to the middle, that is, of 1915, the Austro-Hungarian artillery was provided with lachrymatory shells in very limited numbers. The filling was *T-stoff*, a preparation of bromine. The troops did not understand their use at all; they were never fired in large quantities, and very little was achieved by their use.

In Austria-Hungary the issue of gas shells, *i.e.* of B. and C. shells, was begun in 1916 and 1917, when the newly constituted special battalion were seen to have obtained no appreciable results with cylinder gas.[1] The B-gas was *bromo methylketone* or *bromacetone*, corresponding to the German B-gas. The C-gas was *bromo-cyanide*. When C-gas was used the shell walls had to be coated with lead. But if the gas may be called efficacious the shells were not so. The chief cause lay in the fact that effect was not to be expected unless large quantities were used, and the available supply did not allow of this. The troops, therefore, thought very little of this means of fighting, and with reason.

The effect of the German gas-shooting in the West, and especially the brilliant results obtained with gas against the enemy artillery and even against high-sited positions by the German batteries in the combined offensive of Caporetto in 1917, spurred on Austria-Hungary also to the manufacture of gas shells in large quantities. Not only was the production of the B. and C. shells increased, but phosphorus shells were also made, and ultimately the gases adopted were those used by the Germans (*blue-cross—yellow-cross—green-cross*). As far as the use of these gases was concerned Austria-Hungary was dependent on Germany for her material to the end of the war. Except in the case of the shells previously referred to, the Austro-Hungarian gas shells were always filled in Germany, as the home establishments were not completed. Hence only Germany's procedure need be considered here. The following information is taken from Lt.-Gen. Schwartz's *Technik im Weltkriege.*

The first German shell with chemically active gas appeared in October 1914, and was the *Ni-geschoss* of the 10·5-cm. field howitzer; the filling consisted of double salts of *dianisidin* firmly pressed in between the bullets, and acted as an irritant when pulverized. The effect was inconsiderable, being limited in range and of short duration. In Jan. 1915 much more effective gases—such as *xylylbromide* (T-gas) and *mono-* and *di-bromethylmethylketones* (B-gas)—were used at first in the 15-cm. howitzer shells, afterwards for trench mortars. With these only local effects of limited scope could be obtained. The necessary mass-effect could not be attained because of the limited number of howitzers and trench mortars, but chiefly because the best method of working had not yet been discovered.

For the T-gas shells, which could not be used in very cold weather, were substituted the T- and B-gas in the "T-green" shells, partly because the mixture answered better. In the summer of 1915 began the use of K-gas—*chlormethyl-chloroformate*—which differed from the T-gas in its lower persistency and its greater irritant action on the organs of breathing. This indicates the reason of their respective uses in defence (T-gas) and attack (K-gas).

These shells, which were intended to have splinter effect as well, contained a 1·5-kgm. charge of *trotyl*. It was a drawback in the manufacture that in order to protect the shell-wall the gas had to be enclosed in leaden flasks secured in paraffin or magnesium cement. Later on porcelain was used. They contained 2 kgm. of the gas.

There followed the period of cylinder gas and of projectors which were first used by the British. Even on the western front the cloud-gas did not fulfil expectations; the gas-bombs of trench mortars, however, were used with satisfactory results throughout the war.

During the summer of 1916 the *green-cross* ammunition was introduced. In that year the German artillery, following the example of the French, at last turned to the manufacture of gas shells filled purely with gas. H.E.-effect being abandoned, mass-effects with gas then became possible.

The experiments made led to the adoption of green-cross shells for all calibres. *Per-stoff* (di-phosgene) was used for the filling, which was as poisonous as the phosgene used by the French, but was unaffected by iron and also stable on explosion. The manufacture and filling were both simple. From May 1916 until the end of the war *green-cross* ammunition was in use as offensive material. It permitted of large-scale gas effect without being dependent on the direction of the wind as was cylinder gas.

At first the French mask was ineffectual against it. But they soon contrived an efficient gas-mask, and Germany was obliged to bring forward other gases. These were *yellow-cross* and *blue-cross*. *Yellow-cross*, i.e. *Sym. dichlordiethylsulphide*, which had no actually poisonous properties, was a high-persistency gas and was used to "infect" the terrain for days on end. It was almost odourless and was proof against the action of iron and water. This was the famous "mustard gas." Strict precautions had to be observed in the manufacture of this gas, which was used in all calibres.

The combination of H.E. action with the *yellow-cross* gas action came to be desired for purposes of surprise. This brought into existence the *yellow-cross* H.E. shell, in which the chemical and the explosive charge were separated by a diaphragm.

Yellow-cross was at first used in combination with *blue-cross* in the defensive battle in Flanders in July 1917, and produced a great effect. The latter (*blue-cross, diphenylchloroarsine*) was an irritant which proved effective in penetrating gas-masks, the German one included. The effect was to force the enemy to take off his mask, and so expose himself to the effect of *green-cross*. The *blue-cross* irritant acted as a fine cloud, with which it was very difficult for the filter of the gas-mask to deal. *Blue-cross* also combined gas and H.E. effect, and the beginning of the gas attack was covered by the use of a diaphragm, as in the *yellow-cross* H.E. shells.

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[1] A gas attack, made from the region of St. Michele, near Gorizia, in the summer of 1915, had indeed (as was averred by the prisoners taken) a very great effect; the Italians lost a thousand either killed or overcome by the gas; the circumstances, however, prevented any extensive tactical results.

The German experience with gas-ammunition was excellent. On their side no instance is known of the enemy being able to advance over ground infected with *yellow-cross*. No attack ever made with "*parti-coloured-cross*" (*blue- and green-cross*) in a favourable wind failed to paralyse the enemy artillery either entirely or in great part, even when they were under cover, during the critical hours.

Special Ammunition.—At first the gas shells were also reckoned as "special" ammunition. Later on, however, they came to be considered as part of the ordinary artillery ammunition. The extent of their employment, at all events, in the case of the Germans, often equalled or even exceeded that of the ordinary explosive ammunition. The *ricochet* shells were used to obtain a specially retarded action.

Against tanks the German artillery used a shell with an armour-piercing head, rather more effective than the ordinary nose-fuzed shell. The projectile had a massive armoured-steel head which was fitted with the steel shell body, and was set in motion by a fuze placed beneath this—*i.e.* a central fuze.

For anti-aircraft purposes projectiles with tracers were used; experiments with these had been made in peace-time. Krupp produced a model which proved very satisfactory, especially in certain small anti-aircraft guns. The path of a 2-cm. shell was clearly visible from the gun muzzle, that of a 3·7-cm. to 1,500 metres. Tracers were not, however, much used with field guns and large calibres, and were not greatly liked by the anti-aircraft batteries.

Against airships and balloons inflated with gas, a balloon incendiary shell, also of Krupp manufacture, was employed. The projectile, which acted like shrapnel and was provided with a time-fuze, shot lumps of incendiary composition out of the shell-case. The old incendiary shrapnel was little used. For signal purposes—*e.g.* to demand the opening of fire on particular points—shrapnel with various-coloured-smoke producers were used.

In accordance with the demand of the troops message-carrying shells were made. These shells contained written communications, and, on exploding, gave off conspicuous smoke and flame; the message came to ground either by means of a parachute or in a receptacle which broke as it fell. They served to connect points cut off from one another by enemy fire or otherwise.

Minenwerfer Munitions.—The Wurfmine (thrown mine), *i.e.* the trench-mortar shell which was already included in Germany's equipment at the beginning of the war, differed from the artillery-shell principally in its considerably increased explosive charge. The "efficiency" rose from 30 to 40% of its total weight. Consequently the wall of the shell was thinner as the small propellant charge made less demands on its strength. The shape of the projectile was similar to that of the artillery-shell, except that the shape of the head was not of great importance. The shell material was, generally speaking, similar to that of artillery munitions, but economy was more in evidence here. Thus constant use was made of cast-iron in certain types of shells to the detriment of the essential feature, viz. the increased proportion of explosive. In order to economize the most valuable explosives for the artillery-shells, use was soon made of ammonium-nitrate explosive, "safety" explosives, and such like. In Austria-Hungary, for instance, hardly anything but dynamon was used. In Germany perdit for heavy bombs and perchlorate for light was resorted to. Such explosives answered very well for these projectiles. Unlike the artillery-shell, owing to their less accurate flight, they required a fuze which would be effective in every position of fall. This was a very difficult problem to solve, but eventually the Papenberg fuze used in both countries and the Skoda fuze in Austro-Hungary were evolved. In the first and simpler types of mortar a cord friction-lighter was used as time-fuze. The German standard pre-war minenwerfer had percussion fuzes.

The explosive charge was started in much the same way as in artillery-shell with picric-acid filling. Later on, to economize steel, the gaine was made of cardboard cases of several thicknesses. As the *minen* were not air-tight, the great hygroscopicity of the ammonium-nitrate explosive caused a dampness after a time, which affected the cardboard casing and caused a mixing of the two explosives, with the consequent danger of spontaneous explosion.

According to the type of mining weapon—pneumatic, smooth-bore, rifled muzzle-loader or rifled breech-loader as the case might be—the method of obtaining rotation was similar to that in the artillery-gun, or to old types of "stud" rotation, or were simply gas checks which had only to seal. Some types of muzzle-loader bombs had concertina-like compressible plates of thin iron which were forced or discharged through the grooves. Some few projectiles obtained stability in the flight by means of vanes. In the end it was the rifled mortar and, for the heaviest calibres, the rifled muzzle-loader which held the field. But a substitute material was always used for the driving-bands of *minen* mortar bombs—for a short time zinc-aluminium, and then only soft iron, less injurious to the bore.

For the propellant charge smokeless cube and flake powders were used, and in some types for a short time black powder. The charges were comparatively small. To meet the demand of the troops a propellant charge of compressed air was used in some types up to 20-cm. calibre. By this means all smoke flash was avoided and the report considerably lessened. Results, however, with regard to rapidity of fire and the weight of the bombs were not satisfactory, and the supply of compressed air was also very tiresome. In 1917 pneumatic mortars were therefore abandoned. Towards the end of the war an attempt was made to get full value out of the gas pressure by using a stepped chamber and stepped shell body.

While Germany even before the war had included both light and heavy *minenwerfer* in her equipment, it was some considerable time before Austria-Hungary adopted them as a normal weapon. The bombs were at first intended for the destruction of barbed-wire entanglements, but in the course of the campaign their true function came to be that of meeting the demand for additional artillery effect and for great mine effect at short distances. In the first instance various improvised models were made in the Pioneer Parks to meet these needs, particularly in Austria-Hungary at the beginning of the Italian campaigns. Improvised types were also used in Germany at the beginning to supplement the insufficient supply of standard trench-mortars. These types all disappeared when the regular types began to be produced in sufficient numbers. Nevertheless, the experience was a guide to future development.

Later on, trench-mortar bombs were charged with gas. In view of the small results gained by this form of gassing it was abandoned in 1917 in favour of gas "projectors." In the case of some special projectiles—*e.g.* illuminant and message-carrying—trench-mortar types proved more suitable than gun types.

The diminished strain on the body, smaller impact energy and comparatively large space available in the shell facilitated the fitting-in of the necessary components for these purposes. Another special bomb was the strongly built armour-piercing bomb which was effective against a 20-cm. armour plate. The difficulties experienced in the production of artillery-shell due to lack of raw materials were intensified in the case of the trench-mortar bomb, which in the table of priority for assignment of material was considerably behind the artillery munitions. And yet, although the conditions were comparatively less exacting as regards quality of material, flight conditions, precision of shooting and effect, their design involved comprehensive work in order to meet the very varied requirements with the simplest ballistic means, manufactured with the simplest tools. The employment of substitutes aggravated the difficulty. For this reason the help of private inventors, which had not answered in the case of artillery munition, here had most successful results.

Hand Grenades were practically unknown during the first months of the war; with the institution of trench warfare the need of a simple high-angle projectile was immediately recognized. Both in Germany and in Austria-Hungary the troops improvised hand bombs of a very varied character in the Pioneer Parks. All were time grenades.

Early in the autumn of 1914 the German Army Administration turned out a simple cast-iron ball grenade, which could be produced in any foundry. Later on, to secure improved range, a change was made to the "egg" hand grenade of similar construction. The latter, together with some other types, were in use until the end of the war. At the same time Austria-Hungary produced the "universal" hand grenade, which as early as October 1914 was used by the troops in trench warfare in Serbia. It consisted of a cast-iron body, serrated for fragmentation, and filled with *ekrasit*. Ignition was by means of a friction lighter and fuze length and detonation. This hand grenade could be conveniently thrown to a good distance by means of a stirrup-shaped wire "thrower," which could be attached to the waist belt. Later on the hand grenade was the chief weapon of the infantry "assault troops," and to a large extent deposed the rifle from its supremacy. The demand therefore was enormous and production had to meet it. In view of the great burden already placed upon the whole armament industry their design had to be of the simplest so as to bring fresh factories into the effort of production. The classes of explosive employed were the same as those of trench-mortar bombs. In addition to the ever-increasing numbers of "egg" hand grenades Germany also supplied her troops with the "Stiel" (handled) grenades. These stood the test right to the end. Austria-Hungary too proceeded to improve her "universal" hand grenade, and produced from 1915–7 two types of tubular hand grenade. A cardboard tube which served at the same time as a handle carried the friction-lighter, time-fuze length, detonator and burster cartridge. The top was surrounded by a heavy ring of cast-iron for fragmentation. These grenades were all timed for 7–8 seconds.

In March 1917 Austria-Hungary began to use the handled grenade, which formed part of her equipment until the end of the war. It was similar in principle to the German (separate transport of the detonator was, however, not considered necessary). The endeavour to absolutely safeguard the bomber from the effects of a premature explosion of the grenade led in Germany, for instance, to various methods of igniting the fuze length, including designs in which ignition took place after leaving the hand. On the other hand it was desirable to relieve the operator from the disturbing sensation of the burning grenade in his hand. The time-fuze hand grenade, moreover, on account of its slow combustion, allowed of a return throw by a specially adroit adversary. Both countries, accordingly, experimented with a succession of percussion grenades. The difficulty lay in stabilizing the flight to guarantee the right impact and avoid non-explosion. Streamers, parachute tails, etc., did not solve the problem satisfactorily. Later on always percussion-fuzes were tried. In Germany the Papenberg fuze answered best. In Austria-Hungary, a suitable model was found in the Goldmann fuze.

As the handled grenade was on the whole satisfactory, neither Power failed to keep the output at a high level during the war. Austria-Hungary, indeed, introduced towards the end of the war a percussion hand grenade which differed from the handled in having the Goldmann fuze, but its merits had no final judgment. A few hand grenades were also loaded with chemicals, *e.g. Stoff*.

Rifle Grenades.—At first rodded rifle grenades were used, but without really satisfactory results, and eventually Germany took to the discharger cup and a grenade of the V.B. class.

Grenade Throwers.—The grenade *werfer* (thrower), although not so simple, met much more fully the demand for a greater range. It was the connecting link with the *minenwerfer*, and indeed was more akin to the latter than to the rifle grenade. Early attempts with throwers of the most varied forms led to no useful results. The first serviceable model was constructed by an Austro-Hungarian inventor. This grenade thrower, called in Germany *Priesterwerfer*, threw cast-iron bombs with percussion-fuzes (usually of the vane class). It is described and illustrated under BOMBTHROWERS.

The fundamental idea of the construction was the same as that of an English invention of the early 19th century, but it seems to have been practically used for the first time in the World War. A much greater rapidity of fire than could be obtained with this otherwise satisfactory thrower was got with the *Granatschnellwerfer*, also an Austrian invention, in which the grenades were driven by compressed air through a tube.

Small-Arms Munitions.—Germany's normal infantry and machine-gun ammunition was a pointed bullet which, with a muzzle velocity of 900 m/sec., was ballistically superior to the round-nosed Austro-Hungarian bullet which had a muzzle velocity of 650 m/sec. The German cartridge case was cannelured, the Austro-Hungarian rimmed.

Cartridge cases were at first made of brass, but the consumption was so great, especially as the salvage of S.A.A. cartridge cases was small compared to that of artillery empties, that steps had to be taken to find a substitute for brass. This, however, was much more difficult than in the case of artillery munitions, and it was only in the very last stages of the war that it was achieved. The cupro-nickel envelopes of the German bullet were replaced by galvanized copper for the sake of economy.

In both countries a nitrocellulose disc powder was used for the propellant charge. This ammunition has answered well. Amongst the varieties of special ammunition should be noted the German A.P. ammunition (a pre-war design), and the Austro-Hungarian XX. cartridge, likewise armour-piercing. The German bullet, instead of a lead filling, had a core of alloyed (later on unalloyed) steel embedded in lead, the two filling up the interior of the steel-casing. The Austro-Hungarian envelope bullet was similar—a conical envelope with a steel pin in the lead filling. The German bullet penetrated a 9-mm. high-quality armour plate at a distance of 400 metres, the Austrian a 7·5-mm. plate at a distance of 350 metres. Germany possessed in her 13-mm. tank bullet (similar in design to her other A.P. bullets) a weapon which was effective at a distance of 400 metres against a 21-mm. plate. The U. munition of Austria-Hungary was another special munition. This was, however, soon withdrawn. It was designed to facilitate ranging by giving on impact a good visible grey smoke. However, the incidental explosive effect brought it under the ban of international law; it was therefore soon discarded.

Later on, for anti-aircraft purposes especially, a demand was made for a tracer-bullet. Both the German and the Austrian types of tracer-bullet were capable also of wounding effect. The German type showed the trajectory by means of a backward-stretching flame visible to about 1,000 metres. Austria-Hungary made use of different types, all constructed by the Adler firm; the F.Z. shell showed the trajectory between 100 and 600 metres.

A special development of infantry tracer-bullets was the phosphorus (P) bullets; they were primarily to set on fire the petrol tanks of aeroplanes, but effect was given in the indication of the trajectory on account of which incidentally they gave good tracer effect so that the old tracer-bullet could be discarded in its favour. The P bullet was not designed solely for air warfare; for short range up to about 1,000 metres it could be fixed on wires with ordinary ammunition. It had a filling of yellow phosphorus, which was heated by the friction of the shell in the gun-barrel. At 80 metres from the muzzle it burst forth from a small opening previously closed by wax or a thin solder and ignited in the air. This phosphorus effect extended to about 400 metres. Both the indication of trajectory and the incendiary effect against fuel tanks were quite satisfactory, but against balloons its value was not conclusively proved. The difficulties of producing small-arms ammunition never assumed great proportions. It was found that the real daily demand per infantry rifle remained considerably below the peace-time estimate. The variety of weapons issued and the almost uninterrupted continuance of trench warfare in fact left less and less work for the rifle. The machine-gun alone gained—and gained enormously—in importance.

The Production of Munitions.—The constructive development of munitions by the Central Powers shows how they succeeded in adapting the available raw materials and in finding substitutes. The behaviour of the ammunition remained good, and even the demands imposed by the ever-changing tactical methods were able to be met. What influenced production much more strongly were the difficulties due to shortage of imported raw materials and to the unexpected volume of the demand. The peace preparations were certainly insufficient, but even if the great demand and the long duration of the war could have been foreseen, it would have been frankly impossible to cover more than a comparatively small proportion of the needs. Had every workshop in the land been given over to the requirements of war, and even an approximately sufficient supply of war stores and imported raw material been accumulated, the national wealth would have been decimated. A higher state of peace preparedness would, indeed, without overstraining the national strength, have smoothed the initial difficulties of production and eased the first munitions crisis. But all else the actual stress of war had to bring about. It alone could force everything into its service. This happened at the moment it became clear that it had become a question of a struggle for economic existence. But both States had neglected to organize the war administration in peace-time and to bring science and industry into the mobilization plan, as had been done with the railways.

In proportion as it came to be recognized that not only the industries actually producing war material, but also all the other departments of economic life, were bound up together by countless veins and formed each a limb of one corporate body, central management came into force.

This did not take place all at once, however, and at first only those regions in which there was a deficiency from the very first were covered. Nor had the Central Powers agreed upon a joint war-industrial policy; indeed, even at the end of the war complete unity of economic control had not been achieved within each State itself. Here political reasons came into play. In Austria-Hungary it was especially difficult, as the Dual Monarchy comprised two economically independent States of different structure.

Of the war needs, the greatest in extent, as also the most imperative, was that of munitions. More and more the enormous consumption made inroads into all the departments of general economic life. Its needs embraced almost all the important raw materials. The peace-time preparation of munitions had been limited to maintaining the supply in the specialized State and private factories at a level sufficient to guarantee to cover the presumed needs of the first three months' campaigning. These selected factories were also kept at a standard level as regards installation, strength of skilled workers, and supplies of raw materials. In some State works arrangements were in existence for expansion. The peace-time supplies of munitions available, calculated on the basis of the numerical demands of the General Staff, were supposed to guarantee a continued supply to the army, for a several months' campaign, until war production should become effective. Before the war 600 to 1,000 rounds were considered sufficient for light guns and somewhat less for heavy guns. These figures were not in every case fully attained, especially in Austria-Hungary. The production which was intended to be secured within the first three months was approximately equal to the actual war-material stocks.

At the beginning of the war this proposed production was immediately put in hand. In Austria-Hungary, however, the output of the peace-time demand was not fully realized, because the proposed new works for the production of shrapnel were not yet ready and the arrangements for the production of explosive (*trotyl*) had not yet been taken in hand.

Later on the monthly production in Germany reached 1,000 rounds per light gun, that in Austria-Hungary about 600 rounds, and this though meantime the number of guns had multiplied. By the beginning of 1917 the capacity of the munitions industry had in fact increased enormously—it was twenty times greater than during the first months of the war. This was due to technical science, which succeeded in procuring substitutes for the most important raw materials which were lacking.

Central Management and Organization of Output.—In peace-time the production of munitions was under the different departments of the War Office. To supervise the construction and guarantee the specified quality an "*Artillerieprüfungskommission*" (A.P.K.) was attached to the Prussian War Office and the "*Technische Militärkomitee*" (T.M.K.) to the Austrian War Office, as supplementary departments. These institutions provided the technical-scientific service. The T.M.K in Vienna was, even more than the A.P.K. in Berlin, a link between the technical science and the army administration, since the manufacture of munitions was under this office itself. The supervision of the military industries, which even in peace-time represented very considerable establishments, was in Germany under the Ordnance Department (*Feldzeugmeisterei*) and in Austria-Hungary under the Inspector of Technical Artillery, who in the period just before the war was also responsible for keeping the principal war industries up to standard.

In Germany, at the beginning of the war, this organization was unchanged. The armament industry procured all its necessary raw materials itself. Industries which had no contracts to produce war material marked time. Their output was at a standstill. The most skilled portion of their workmen and officials hurried to the colours. In order to establish uniform policy and procedure German industry founded the "War Committee of German Industry." Very soon the leading industrial circles recognized the necessity of making a survey of the most important raw materials, and during the first months of the war the "Raw Materials of War Department" was established. Out of the original department composed of three collaborators a huge organization developed. Its activities consisted in regulating and supervising the economic use of raw materials necessary for the army's needs in which shortage was threatened, and it finally embraced almost all the departments of the State industry. With the long duration of the war more and more raw materials were absorbed, its sphere of activity increased, and at the end of 1917 this department, which in 1916 was attached to the War Office, employed over 2,000 people, and its subordinate "War Associations" (*Kriegsgesellschaften*) a further 5,000 employees. Of these "Raw Materials of War Associations" the first founded was "The War Metal Co." which was mainly occupied with the function of purchasing throughout the whole country all metals obtained by requisition, such as copper, zinc, etc. This was done in order to protect the small proprietors from the loss which they suffered through the lying-idle of their requisitioned goods, for which the Government did not pay until it actually used them. Subsequently the company also undertook the distribution of the metals to industry. The "Raw Materials Associations" were public utility organizations which did not work for profit. Ensuing profits were handed over to the Treasury. On the other hand losses, which were bound to occur on account of the tight hand kept on maximum prices, were met by the State. The great increase of outlay this occasioned for the State was amply compensated by the influence over prices of war munitions which it thus obtained. These companies were distinguished from other limited companies in that they were under the surveillance of departmental commissaries with a right of veto, and under the control of the War Department for raw materials.

At the outset of hostilities the War Ministries of the German States at once handed over control of the most important elements of war supply to the Prussian War Office, which transacted the business through its respective departments. The growing scale of these transactions and the recognized necessity of uniting more closely all the industrial organizations which had come into being, led in Nov. 1916 to the establishment of the "War Office" (*Kriegsamt*) within the Prussian War Ministry, to which all the departments concerned were subordinated and all the organizations and new offices extending throughout the whole German industry were attached. The establishment of the "War Office" marked the creation of a central direction whose task it was to focus all Germany's economic activity, so as both to pool and to allocate raw materials and labour resources. As this Office was required to act in the economic, technical, and social fields alike, it could not, naturally, be constituted on a purely military basis. Suitable representation in it was given to the technicians, the commercial world, and to the labour organizations. Naturally military control dominated, since provision for the army was the chief consideration; but along with this, the "War Office" had to take over provision for the civil population.

The War Office Departments (*Kriegsamtstellen*) distributed throughout the army corps districts and the different States, and the liaison organs between all departments of war industry were subordinated to the military and technical staffs at the War Office. These departments, etc., in their more limited spheres, had the same duties as, and were the representatives of, the offices affiliated to the War Office.

A very great proportion of the organizations that were, little by little, grouped round the War Office were concerned with the production of munitions. The most important ministry in this province was the "Arms and Munition Production Ministry" (*Waffen- und Munitionsbeschaffungsamt*—"*Wumba*"). Next in point of size to the Raw Materials of War Department, it was responsible for the production of the whole army's requirements in arms and munitions. It was created in 1916 out of the departments concerned which were already in existence. Its activities comprised both the equalizing of the existing machinery and adjustment of labour in the metal industry factories. In the already mentioned *Kriegsamtstellen* and its own *Maschinenausgleichstellen* the department had its organs distributed over the country. It was the duty of the *Wumba* to supervise the fixing of prices in its own province. It worked in touch with the *Artillerieprüfungskommission* (Inspection Department).

To obtain the greatest possible standardization in manufacture, simplification of types, fixing of tolerances, definiteness in acceptance conditions and determination by the Taylor method of the working movements which gave maximal output, the *Fabrikationsbüro* (*Fabo*) was set up in Spandau and subordinated to *Wumba*. The Standards Committee of German Industry (*Normenausschuss deutscher Industrie* [*Nadi*]) instituted by the Union of German Engineers also helped towards securing standardization and economy of labour in the construction of machine parts and tools.

Next in importance to *Wumba* in the creation of raw materials and munitions was the above-mentioned "Raw Materials of War Department." It was organized in five branches dealing with the various main groups of raw materials and these were subdivided into sections. The branches most important for the activities of *Wumba* included the Chemical Section with the attached Raw Materials of War Co., War Chemicals Co. and War Phosphate Co., the Metal Sections and the Metal Statistics Section, with the Metal Allocation Office, the Metal Mobilization Office (to which the War Metal Co. mentioned earlier was attached) and lastly the Iron Section, with its attached Central Iron Co., and the Manganese Co., and the Raw Steel Allocation Office. Among the other subdivisions may here be mentioned the Coal and Mineral Oil Section.

On account of the great importance of the coal and nitrogen production the management of these departments was at an early date combined by means of the Imperial Coal Commission and the Imperial Nitrogen Commission. In 1917 these two departments were also subordinated to the War Office.

As in the beginning the needs of the army and the war industry were supplied by the various departments of the War Office, so the care of the people, at this time not an important task, devolved upon the various civil departments. With the creation of the War Department and its branches, however, active contact was naturally maintained between these departments, the ministries concerned and all authorities. The occupied territories also came under the jurisdiction of the Central Administration, but only in so far as they had to contribute to the supplies of raw material for the Hinterland.

With the building-up of this comprehensive organization Germany amply satisfied the need for an all-inclusive Central

Administration. It was only in this way that the country could hold its entire forces together. It was complete, and yet all this could have been achieved sooner and with more successful results had the organization existed in peace-time in the form of a mobilization scheme.

The Supreme Command not only assumed control over the economic management of the occupied provinces by means of the L. of C. authorities of armies and the general Governments (which set up their own administrative departments for this) but also provided through the War Office of the War Ministry for the necessary coördination between provisioning the army and the people and the military operations.

Austria-Hungary.—In Austria-Hungary, a few weeks after war began, the Technical Artillery Inspector was entrusted with the entire munition production; and this corresponded to the later *Wumba* in Germany. He was directly subordinate to the War Minister, and was the organ of the Government in relation to both the State and the private munition industries, the adjustment of which to war production devolved on him. In order to secure uniformity in the conduct of transactions, the munition section of the Technical Military Committee was handed over to him. Already in 1914 this department combined under one head the functions of both the German *Wumba* and the German Inspection Department in all questions relating to the production of munitions and adaptations of design to available raw materials and to production. By this means the service was simplified. Provision by the State of raw materials for munitions was concerned at this time chiefly with explosives and their basic substances, which, like all other military requirements, devolved on the appropriate departments of the joint War Ministry in Vienna, just as was the case in Germany. At the beginning of the war the Austro-Hungarian industry was in the same unsettled position as the German. Its interests were safeguarded by the existing Unions of Industry, Chambers of Commerce and such-like institutions. There was at first no new organization upon an elaborate scale.

With the recognition of the dangerous situation regarding raw materials a great extension of the central organization was made in the ministries themselves. The number of departments in the Austro-Hungarian Joint War Ministry were increased and their duties could thus be differentiated. Industry now created organizations similar to the German *Kriegsgesellschaften* in the form of Central Metal, Leather and other Societies.

The conditions in Austria-Hungary were not favourable for forming a close uniform organization which should embrace the whole country. The two separate Governments in Vienna and Budapest were theoretically independent of each other. The Joint Ministries in this case, the *K. und K. Kriegsministerium* in Vienna, could of course take measures affecting the whole kingdom, but they could only do so within certain defined limits. The Hungarian Government especially considered that it could not ensure any full subordination to the common interest. So every central organization of the administration that attempted to take over any functions formerly devolving on the separate Governments came to a deadlock half-way. The result was that the administration of certain important raw materials, especially coal and foodstuffs, was carried out for the two States separately by the two Governments. Later on, it is true, it became possible to form a central administration for iron, (non-ferrous) metals and explosives in the *K. und K. Kriegsministerium.* The administration of coal and various other stuffs remained, however, in the respective departments.

To obtain closer cohesion of all the industrial departments directly connected with the production of munitions, the various sections of the War Ministry concerned here, in the beginning of 1917, united under the jurisdiction of the *I. de T.A.*, and reorganized as a *munition department* of the War Ministry.

In addition to the production of munitions this department was, like *Wumba*, responsible for questions of machinery and supply of labour for the munition industry, and, like certain sections of the German Raw Materials of War Department, for the administration of (non-ferrous) metals and raw material for the production of explosives, coal excluded. For the administration of iron an Austrian and a Hungarian Commission were formed which possessed official authority. In January 1917 a special department in the War Ministry was created to which the Austrian Iron Committee was united. This department undertook the allocation of iron for the Hungarian half of the empire through the Hungarian Iron Committee.

The administration of coal presented great difficulties on account of the extreme dearth from which Austria-Hungary, unlike Germany, suffered. The central distribution lay principally in the hands of the civil ministries in Vienna and Budapest until the end of the war. For each half of the empire a National Coal Commission was set up, similar to the Iron Commission; these were under the respective civil ministries. In 1917 a special section was created in the *K. und K. Kriegsministerium* to deal with the State and private works hitherto dependent upon various departments of the War Ministry. It could not, however, extend its operations over such a wide field as the Iron Commission. It was in this region that purely military interests most markedly clashed with those of the Hinterland. Thus the Austro-Hungarian organization in the various major branches of munitions production was by no means as uniform as the German. This made it all the more necessary for the Supreme Command, which was entrusted with the safeguarding of the joint war interests, to interfere if these seemed endangered, so that finally in 1918 all decisions relative to coal and iron lay *de facto* in the hands of the Supreme Command. The Austro-Hungarian Supreme Command, like the German, also controlled the industrial administration of the occupied territories by means of its own organs; for example, communication with the East and with Rumania was directed by the Eastern section of the War Ministry.

The Adaptation of Industry to War Services.—At the time of mobilization at the outbreak of war only those works actually supplying materials of war were given work. As it became clear after the first battles that the stocks of munitions could not last the specified time, and also that the existing armament industry could not satisfy the demand, all works which were in any way suitable for the production of munitions were brought in. Thus, the admission of cast-iron shells had as its only object the employment of the more simply equipped works. Later on the munitions industry included the metal and chemical industry. In Austria-Hungary, for instance, the number of works under the jurisdiction of the Munition Department had mounted to 500, in addition to which there were a large number of smaller businesses acting as sub-contractors to the large firms. The turnover from peace to war production was not achieved without friction. The difficulties in the allotment of labour and in the rational distribution and construction of machinery were only overcome with difficulty through the intervention of the War Ministry (Munition Department).

In spite of various measures, such as the production of the cast-iron shell, delays in output were inevitable.

Subsequently, however, the industry was only hindered in developing its full working capacity by the shortage of coal and certain raw materials, especially from the winter of 1917–8 onwards, when it was difficult to obtain sufficient food for the workers. The State administration on its side had, of course, in every direction possible, simplified munition design with a view to mass-production.

Legislation.—Simultaneously with the last great increase in the demands made by the Army Commands upon the resources of the Central Powers (Hindenburg programme), the Auxiliary Service Law was enacted in Germany and the War Work Law in Austria-Hungary. These made it possible in 1916 to absorb the entire resources of human labour, and the production of munitions reached its maximum at this time. Already in 1914 both States had gone far in the employment of women. From 1916 on, the larger half of the personnel of the largest munition factories consisted of women.

Raw Materials.—The effects of the blockade had, in the nature of things, a great influence on the provision of raw materials. The munition production was most affected, as it used by far the greatest proportion of them. The Central Powers had in no way prepared for the supply of imported raw materials; and only the rigid organization subsequently set up, the technical skill in adaptation, and above all the creations of German chemistry, rendered it at all possible for the Central Powers to continue the struggle after the first three months. This applies especially to the administration of nitrogen and the "husbanded" metals. The extension of the area administered by the Central Powers by the occupation of territory had, apart from the supply of mineral oils, only eased the situation principally in respect of foodstuffs. The production of coal and iron was subjected to the least change in relation to peace-time conditions, as these minerals were far from being purely import materials. Germany herself possessed sufficient coal and iron supplies. It is true that Austria-Hungary, whose peace-time requirements were 54 million tons—4 million imported from Germany—had a desperate struggle for the necessary quantity throughout the whole war, and the failure of supplies was bound to reduce her iron production.

It was particularly on these products that the demand rose in comparison to those of peace-time, and the output from the German mines was not such as to meet the needs of an ally in addition. The lack of coal in Austria-Hungary pressed heavily on all her war industries, but most heavily of all on her munition industry. Had the Supreme Army Command not been able to exploit the Polish coal-mines the production of munitions would have had to be reduced even in 1916. Germany's iron supplies could not everywhere in every case meet the demand for special quality. The substitution of inferior steel for high-quality kinds has already been mentioned. Similar conditions prevailed in Austria-Hungary, intensified by the coal shortage, and only the strictest economy prevented the break-down of the iron industry.

Finally in 1918 the coal shortage, due to the necessary demands of the food industry and the railways, forced such a reduction of iron and explosives production that several works had to close down, and the manufacture of products of a similar nature had to be concentrated in the best-equipped factories.

In both the Central Powers the production of the other metals—the "husbanded metals"—was inadequate. Germany's own production of copper in peace-time amounted to 2,000 tons per month; in war the expenditure rose to 15,000 per month; in Austria-Hungary the production amounted to 150 tons per month as against a war demand of 3,000 tons per month.

For this metal, as well as for nickel, lead, zinc, tin and aluminium, central administration began early. This, with the fact that, at the outbreak of war, supplies were to hand in the industry, and, later on, the requisitioning of all "husbanded" metals even to those used in household utensils, saved munition production from the breakdown that shortage of these metals would infallibly have produced. Even the church bells were utilized. Great electrolysing plants separated the pure copper. Consumption in the munition industry was opportunely reduced to a fraction through the above-mentioned use of substitutes in the designs.

The production of aluminium, of course, was substantially increased through the exploitation of the Austrian bauxite works.

At the outbreak of war the production of nitrogen threatened to be the most difficult. Both Powers had procured more than half their peace-time supplies from overseas in the form of Chile saltpetre. Nine-tenths of the whole consumption was consigned to agriculture. The yearly home production amounted in Germany to 110,000 tons free nitrogen held in ammonium sulphate from the coke and gas works, and 10,000 tons procured from the air in the form of "lime nitrogen" containing 20% nitrogen by the Caso-Frank method. The processes for obtaining nitric oxide through combustion of the air were, on account of the great demand they made upon electrical energy, dependent upon efficient water-power, and therefore never rose to great importance in Germany. Of minor importance also were the similar Austrian works at Patsch in Tirol.

The Austrian home production was 20,000 tons in peace-time from the coke and gas works, and a small quantity from a lime-nitrogen plant at Sebenico.

At the outbreak of war the situation was frankly deplorable. Both countries had just made their allocations to agriculture. Thus Germany, for example, had only 9,000 tons of nitrogen in hand in July 1914; on account of the lack of the most important raw stuffs the production of explosives seemed doubtful. Moreover, the stock of explosives themselves was extremely small—Austria, for instance, had hardly enough explosive for her 30·5-cm. mortar-shells. Apart altogether from this the lack of nitrogen manure must adversely affect the whole food production. Thus the chemical industry had before it a wide field of action and it was in this very sphere that most was accomplished. Of all the achievements of German chemistry during the war the production of nitrogen out of atmospheric air alone is of permanent importance.

The methods of obtaining nitric acid which were in operation at the beginning of the war were of small extent and by no means on an industrial footing. This, however, was put right in a short time, partly according to the Ostwald and Haber and other processes, but mainly according to the Caso-Frank method. Great plants were erected. Austria-Hungary likewise built a large plant.

Germany was able to obtain from the air by the lime-nitrogen method 110,000 tons of nitrogen yearly, and Austria-Hungary 40,000 tons; direct production by combustion of the air or by the method of Prof. Dr. Linde from liquid air was also very largely employed. The combined nitrogen production in both States was finally 2½ times the peace-time supply (imports included), and the agricultural industries as well as that of munitions could be kept supplied.

Of the remaining raw materials the most important in relation to production were glycerin, acetone and alcohol. Hitherto glycerin had been produced through the decomposition of fat stuffs. With the growing necessity of preserving these means of subsistence the employment of other methods became imperative; of these, however, only that of extraction from sugar was of importance, and sugar itself was also scarce; therefore, in the interests of economy, the use of powder rich in glycerin was restricted to the uttermost.

The acetone obtained from wood distillation (which had increased considerably, especially in Austria-Hungary) was economized by alterations in her methods of powder manufacture. The same was the case with alcohol. The attempt to produce these stuffs from cellulose certainly produced interesting results, but never attained to a vast production.

In these ways the production of munitions interfered seriously with the nation's food economy.

To increase the production of *toluol* necessary for the production of T.N.T., and obtained from the derivatives of coal-tar, the Edelmann method was applied, in which *toluol* was produced from mineral oil. In this way the chemical industry played a considerable rôle in the supply of explosives, quite apart from the importance it acquired with the coming of gas warfare.

Most of the technical achievements of the industries of the Central Powers in the war lost their significance with the termination of the war. Their great value lay in the wide experience gained in adapting everything to the imperative needs of the situation. But at any rate the setting of nitrogen extraction on an industrial footing was an achievement of permanent significance and value. (J. K.*; W. J.*)

MUNSEY, FRANK ANDREW (1854–), American publisher and newspaper proprietor, was born at Mercer, Me., Aug. 21 1854. He was educated in the public schools and became a telegraph operator in Augusta, Me. In 1882 he went to New York City and established *The Golden Argosy*, a magazine for children, later changing this to *The Argosy*, a magazine for adult readers. In 1889 he founded *Munsey's Weekly*, replaced two years later by *Munsey's Magazine*, the first monthly of its class to sell for the popular price of ten cents. He also founded *The All-Story Weekly* (1904) and *The Railroad Man's Magazine*

(1906) and purchased *The Baltimore News* (1908), *The New York Press* (1912) and the New York *Sun*, both morning and evening issues (1916). He merged the *Press* in the *Sun*. In 1920 he bought from the executors of James Gordon Bennett's estate the New York *Evening Telegram* and *The New York Herald*, together with its Paris issue. He combined the *Herald* and the morning *Sun* as *The Sun and The New York Herald*, but in Oct. 1920 changed the name to *The New York Herald*, at the same time continuing the evening paper as *The Sun*, thus perpetuating intact two names famous in American journalism.

MÜNSTERBERG, HUGO (1863–1916), German-American psychologist (*see* 19.12), died in Cambridge, Mass., Dec. 16 1916.

Among his later publications were *American Problems from the Point of View of a Psychologist* (1910); *Psychology and Industrial Efficiency* (1912); *American Patriotism and Other Social Studies* (1913); *Psychology and Social Sanity* (1914); *The War and America* (1914); *The Peace and America* (1915); *The Photoplay: a Psychological Study* (1916) and *To-morrow: Letters to a Friend in Germany* (1916).

MURKLAND, WILLIAM URWICK (1842–1899), American clergyman, was born Nov. 17 1842 in Demerara, British Guiana, where his father was a Scotch missionary. When a child he moved with his parents to Petersburg, Va., and later to Richmond. In 1857 he entered Hampden-Sidney College, but on the outbreak of the Civil War he enlisted, before graduation, in the Confederate army. With one exception he was the youngest member in his command. He was captured at Laurel Hill by troops of Gen. McClellan, but was soon paroled, and returned to Hampden-Sidney College, where he graduated with first honours in 1862. Having meanwhile been exchanged, he again entered the Confederate army. After the close of the war he entered the Union Theological Seminary of Virginia where he remained three years. After his ordination as a Presbyterian minister in 1869, he was pastor of Centre Church, Cumberland co., Va. In Jan. 1870 he was called as assistant to the Franklin Street church, Baltimore, Md., and the following June was chosen pastor, which position he held until his death, May 13 1899. While detained as a young prisoner of war he had won the affection of Gen. McClellan, who later, during his residence in Baltimore, became his parishioner. At Gen. McClellan's death, Dr. Murkland took part in the funeral ceremonies. In 1890 he was a delegate to the World's Peace Congress in London; in 1893 a delegate to the Ecumenical Methodist Council at Washington; and in 1894 a delegate to the Northern General Assembly at Saratoga. Dr. Murkland was one of the prominent figures in the Presbyterian Church in the United States, and long distinguished for his ability and influence. He was an extensive traveller and a man of fine literary attainments. On June 4 1895 the 25th anniversary of Dr. Murkland's pastorate was celebrated, and many distinguished clergymen from all parts of the country together with the highest state and city officials took part. Dr. Murkland was an eloquent speaker and one of the foremost orators in the South. He was chosen orator for the state of Maryland on Maryland Day at the Cotton States' Exposition, Atlanta, Ga., in 1895.

MURPHY, CHARLES FRANCIS (1858–), American politician, was born in New York City June 20 1858. He was educated in the public and parochial schools. He began work in 1876 as a street-car driver. Later with his small savings he opened a saloon, and as his business prospered became proprietor of several such establishments, in which he maintained good order. These, he declared, served as poor men's clubs. In 1892 he succeeded Edward Hagan as Tammany leader of the 18th assembly district, and from that time his political power grew rapidly. In 1897 he was appointed a member of the board of commissioners of docks and ferries in New York City, serving five years, the last as treasurer. In 1902 he succeeded Richard Croker, on the latter's retirement, as leader of Tammany Hall, a position he continued to hold for a longer period than any of his predecessors. In 1903 he secured the nomination of George B. McClellan for mayor of New York City, who was elected, and two years later reëlected. In 1906 he supported William Randolph Hearst, the unsuccessful candidate for governor of New York on the Independence League and the Democratic tickets. In 1909 he supported for mayor Judge Gaynor, who was elected. At the Democratic National Convention in 1912 he swung his followers to Champ Clark, who led on the earlier ballots. Thereupon William Jennings Bryan, who had looked with favour upon Clark, declared that he would not support him so long as he was backed by Tammany, threw his influence on the side of Woodrow Wilson and secured his nomination. The same year, as presidential elector, Murphy gave Wilson support, and in 1916 approved his renomination. He was a delegate at the Democratic National Convention in 1920, and it was in part through his influence that James M. Cox secured the nomination.

MURPHY, FRED TOWSLEY (1872–), American surgeon, was born in Detroit, Mich., Oct. 23 1872. He was educated at Phillips Academy, Andover, at Yale (A.B. 1897), and the Harvard Medical School (M.D. 1901). He was assistant in anatomy at the Harvard Medical School, 1903–4; Austin teaching fellow in surgery, 1905; visiting surgeon to the clinic, 1909–11, and assistant in surgery 1910–11. From 1904 to 1908 he was assistant surgeon at the Infants Hospital, Boston, and from 1907 to 1911 surgeon to out-patients at the Massachusetts General Hospital. In 1911 he was appointed professor of surgery at the Washington University Medical School and, in 1914, chief surgeon of the Barnes Hospital and consulting surgeon of the City Hospital, St. Louis, but resigned in 1919 to become a practising surgeon in Detroit. During the World War he was director and commanding officer of Base Hospital 21 in France (1917–8), and later was director of the medical and surgical department of the American Red Cross, representing the chief surgeon of the A.E.F., with the rank of colonel. He was awarded the D.S.M.

MURRAY, SIR ARCHIBALD JAMES (1860–), British general, was born April 21 1860 and joined the army in 1879. He served in Zululand in 1888, and as a staff officer and battalion commander during the S. African War, for which he received the D.S.O. A highly educated staff officer, he filled a number of important appointments during the next few years; from 1907 to 1912 he was at the War Office as director of military training, and he was promoted major-general in 1910. He then became inspector of infantry, and he was given the K.C.B. in recognition of his services. On the mobilization of the army in 1914 he was appointed chief of the general staff to the Expeditionary Force, and he held that position for the first five months of the war; after this he was employed at the War Office, and during the last three months of 1915 he was chief of the Imperial General Staff, having been promoted lieutenant-general in October. At the beginning of 1916 he was sent out to Egypt to command the field army in that country, and he shortly afterwards became commander-in-chief in that theatre of war. Under his auspices troops gradually pushed their way across the isthmus of Suez, inflicted two severe defeats upon the Turks who tried to stay their advance, and at the beginning of 1917 had gained a firm footing on the borders of Palestine. Successful operations had in the meantime been carried out against the Senussi on the western frontier, and Murray's good work was recognized by his being given the G.C.M.G. An attack delivered upon the enemy's position at Gaza at the end of March was, however, only partially successful, and when the effort was renewed three weeks later it met with discomfiture. General Allenby took over charge in the following July and Murray returned home. From 1917 to 1919 he was in command at Aldershot and he was promoted full general in the latter year.

MURRAY, CHARLES FAIRFAX (1849–1919), English art expert and collector, was born Sept. 30 1849. He early showed artistic talent, and became a member of the pre-Raphaelite group, being employed as a designer by the firm of William Morris & Co. He exhibited first at the Royal Academy (1867) and later at the Grosvenor Gallery (1879), but as he grew older he devoted himself to the collection of *objets d'art* of all kinds, and became a well-known connoisseur, entering the Bond Street firm of Agnew & Co. During his later years he disposed of many of his treasures, some of the more valuable of which were presented by him to the National Gallery, while his collection of drawings by the old masters was purchased by Mr. J. Pierpont Morgan. He died at Chiswick Jan. 25 1919.

MURRAY, GEORGE GILBERT AIMÉ (1866–), British classical scholar, was born at Sydney, N.S.W., Jan. 2 1866, but left Australia at the age of eleven. Educated at Merchant Taylors' school, London, and St. John's College, Oxford, he at once established his reputation as the most brilliant classical scholar of his day, winning both the Hertford and Ireland scholarships (1885), the Craven scholarship (1886), the prize for Latin verse (1886), and the Gaisford prizes for Greek verse and prose (1886–7), as well as taking first-classes in Moderations (1886) and in *Literae Humaniores* (1888). He was elected to a fellowship at New College, Oxford, in 1888, and next year to the professorship of Greek at Glasgow University, a position he held till 1899. In 1907 he was appointed regius professor of Greek at Oxford. In 1889 he had married Lady Mary Howard, daughter of the 9th Earl of Carlisle, and his sympathies were always strongly shown on the advanced Radical side in politics. He was parliamentary candidate for Oxford University at the general election of 1918 and at a by-election in 1919, but was unsuccessful. During the World War he prominently espoused the cause of the conscientious objectors, and later identified himself with efforts to ameliorate economic conditions in the enemy countries. He published a *History of Ancient Greek Literature* in 1897, but is more widely celebrated for his incomparable renderings of the plays of Euripides into English verse. Several of his versions were acted in England and America. He also published *The Rise of the Greek Epic* (1907; 2nd ed., 1911) and *Four Stages of Greek Religion* (1913). Amongst his works on other subjects are *Liberalism and the Empire* (part author, 1900); *The Foreign Policy of Sir Edward Grey* (1915); *Faith, War and Policy* (1918); *Religio Grammatici* (1918); and two early plays, *Carlyon Sahib* (1899) and *Andromache* (1900).

MURRAY, GEORGE ROBERT MILNE (1858–1911), British botanist, was born at Arbroath Nov. 11 1858. He was the younger brother of A. S. Murray (*see* 19.38), and was educated at Arbroath and at Strassburg University. As keeper of the department of botany at the British Museum his researches were principally devoted to algae and cryptogams, in the pursuit of which he made several voyages, notably in 1901 as scientific director to Capt. R. F. Scott's Antarctic expedition. He died at Stonehaven, Kincardineshire, Dec. 16 1911.

MURRAY, SIR JAMES AUGUSTUS HENRY (1837–1915), British philologist (*see* 19.40), died at Oxford July 26 1915, when the *New English Dictionary*, which he had spent 37 years of his life in editing, had reached its tenth volume. His fourth son, Oswyn (b. 1873), became permanent secretary of the British Admiralty in 1917, receiving a knighthood as K.C.B.

MURRAY, SIR JOHN (1841–1914), British geographer and oceanographer (*see* 19.42), was accidentally killed near Kirkliston, Scotland, March 16 1914. In conjunction with Dr. John Hjort he published in 1912 *The Depths of the Ocean*, which included the important scientific results of the expedition of the "Michael Sars" in 1910, but also formed an authoritative general statement of the position of oceanography.

MURRAY OF ELIBANK, ALEXANDER WILLIAM CHARLES OLIPHANT MURRAY, 1st Baron (1870–1920), British politician, known until 1912 as the Master of Elibank, was born at Elibank, Selkirk, April 12 1870, the eldest son of the first Viscount and tenth Baron Elibank (b. 1840). He was educated at Cheltenham, and in 1892 entered the Colonial Office. From 1893 to 1894 he was secretary to the governor of the Leeward Islands. In 1900 he was elected Liberal member for Midlothian, and in 1905 entered the Government as Comptroller of the Household and Scottish Liberal Whip. In 1909 he became Under-Secretary for India, and in 1910 parliamentary secretary to the Treasury and chief Liberal Whip, in which position he remained until 1912. In 1906 he retired from his Midlothian seat, and till 1910 represented Peebles and Selkirk. In this year he again stood for Midlothian, holding the seat till 1912. As Whip the Master of Elibank earned high praise for his energy and tact; but he was somewhat unfortunately mixed up with the "Marconi Scandal" in connexion with Mr. Lloyd George and Sir Rufus Isaacs, as having invested part of the Liberal Party funds in American Marconi shares in which he, with them, was speculating—a transaction hotly debated in Parliament in 1913. On his retirement from the office of Whip in 1912 he was raised to the peerage as Baron Murray of Elibank, and entered the firm of Messrs. S. Pearson & Co. as a partner, shortly afterwards proceeding to South America on business connected with negotiations for the granting of oil concessions in Ecuador, Colombia and Costa Rica. On Lord Murray's return to England in 1914 he found it necessary to make a statement in the House of Lords with reference to the part he had played in the Marconi episode, and a select committee, appointed to inquire into his action in the matter, reported that he had acted "without sufficient thought," but acquitted him of "dishonourable conduct." In 1915 Lord Murray became for a short time honorary director of recruiting for munitions work. He died at Elibank, Selkirk, Sept. 13 1920, the barony becoming extinct.

MUSIC (*see* 19.72).—The vast mass of new music produced between 1910 and 1921 cannot profitably be reviewed on any plan that should attempt to appraise the importance of individual composers and events. Such reviews may furnish posterity with examples of the blindness of contemporaries, and it will always be interesting to note that a Sebastian Bach may spend a lifetime making no other impression on even his most intimate circle of admirers than that of a scholar working on wholly antiquated lines; but there will never be any reason to suppose that the keenest observer of our own day will be any wiser as to what is now quietly coming into an existence which shall outlive all else that gains immediate fame.

The purport of the present article is therefore not that of a *catalogue raisonné* of modern music: its intention is to put forward certain general principles that seem to have become more clearly manifested within the decade. Any works and composers that are mentioned will be selected merely as the first convenient illustrations of these principles; and the convenience will be avowedly accidental. This method has, in the past history of criticism, always proved to give results far more interesting than those of an attempt to catalogue and estimate contemporary events and works: nor does the dearth of names and titles detract greatly from its interest. During the lifetime of Beethoven an English observer, by no means willing unreservedly to admire that already admittedly dominant and progressive master, dropped the remark that the future would reveal important musical developments in Russia. He mentioned no names, and if he had mentioned any he might not have hit upon such as would in any way add to the present interest of his prophecy. The truth is that the greatest art takes ample time before its impulses reach the main stream of historic tendency, so that the contemporary view of the main stream is naturally, and not unjustifiably, preoccupied with work that will not interest posterity; while, on the other hand, future historians will, as always hitherto, have great difficulty in finding any historic importance in the works which prove immortal.

But we are on solid ground if we fix our attention on prevalent tendencies shown by large bodies of work and of criticism, and on the conditions in which the work is produced and enjoyed. The contemporaries who thought Beethoven the greatest musician of his day deserve credit for their insight, though their reasons for their judgment were only the *Prometheus Overture* and the *Septet*. The awakening of European culture to the spirit of Greek art was mightily furthered by Lessing, though he chose in the *Laocoön* a work far from typical of the true Greek qualities which he so truly described. There are periods of artistic transition in which tendencies are too vague or too involved to be distinguished by the contemporary observer. If perhaps this was so in the beginning of the 20th century, things had become clearer by its second decade; and it was possible to draw an emphatic distinction between what is real and what is unreal in the music of the day.

It will be convenient first to deal with the unrealities. The most formidable of these arise from the unnatural conditions on which the modern musician acquires his reputation. At no period in history has an artist been able to make his living solely by his highest line of work; but the hardships of the classical artist's life were at all events not unnatural. They were mostly the effects of human nature, and not of an inflated self-consciousness among art critics. It has always been hard to struggle against a depressing prevalence of dull or vulgar tastes and pedantic conventions; but such a struggle is life, and victory in it is health. Far less certain is it that life and health can be found in the struggle for musical reputation under modern conditions; especially for reputation as a composer. The grounds on which new music is commonly criticized are no longer grounds of healthy and intelligible discussion. The critics, conscious of the proverbial persecution of genius by contemporary pedants and upholders of convention, are now unanimous in condemning all that is under suspicion of being "correct," and are desperately anxious that no *soi-disant* revolutionary tendency shall miss acclamation and that no dangerous outbreak of normality shall escape damnation. The music that is most written about and talked about is the music about which it is the easiest to say clever things. The clever things must be or seem to be intelligible to the general reader; and this means that they must not be musical facts, for musical facts are involved in musical technicalities. Yet the clever sayings must be impressive. The result is a special psychological jargon, mostly unknown to psychologists, which the general public believes to be a musical jargon. The public finds it fairly amusing, especially when the critics, having exhausted their stock of new musical discoveries and revolutions, are reduced to discussing each other. But it may be news to the public that the jargon is almost wholly unintelligible to real musicians, and nowhere more unintelligible to them than where it employs musical terms. Meanwhile real music struggles into existence, and even, occasionally, into recognition, while fashion follows the journalists, and awards fame without popularity 20 times a year to musicians of perfectly respectable character and intellect who are driven to pose as lunatics lest sanity should earn them the reputation of prigs. In such conditions it is not surprising that there is more genuine musical life in provincial districts than in the metropolitan cities. The musical life of the provinces is their own; the metropolitan public is so anxiously watching the jumping of the critical cat that even the formation of coteries is conditioned more by diplomacy than by enthusiasm. Popularity and healthily good music are driven to meet on new ground. Theatre music, apart from opera, is in Great Britain still in a state of squalor which must remain hopeless as long as British theatre-goers maintain the habit of drowning the musical *entr'actes* in talk. But the cinema produces a remarkably perfect silence in spectators, and in its not always fresh atmosphere many an excellent player finds a livelihood which he can ill afford to exchange for a good position in a permanent orchestra. The London music hall, especially since the advent of the great Russian ballet dancers, has drawn into its sphere of influence many a serious musician, among composers as well as performers; and the composers to whom it is still a strange environment may sometimes find that more than a pot-boiler impulse and technique are required of them if they are to distinguish themselves there. At all ages there have been heartsearchings as to the border lines of "legitimate" art, and the origins of the highest classical art forms have far more often been popular tendencies than critical doctrines. The health and fruitfulness of permanently valuable art demands two conditions: first, that artists shall have the inducement of a living wage for producing it; secondly, that audiences and spectators shall be accustomed to receive it so attentively as to induce the artist to refine his style. Art does not thrive in a state of public opinion and critical jargon in which nothing is allowed a right to exist except works of devastating genius; and genius itself stands less chance of recognition in such a state than in any other. A good period of art is that in which the ordinary styles are so good that the sensibilities of a child of genius are not starved or disgusted by them before he has had time to outgrow them as a genius must. Nothing good can be expected for genius or philistine from a state of art in which every style is ostentatiously paradoxical.

It is not impossible to distinguish between the fruitful and the unfruitful tendencies in contemporary music. The questions at issue are not primarily matters of taste or tradition. It may be assumed that vital art has deep foundations of taste and tradition, even if it professes to revolt from them all; but the signs of its vitality are neither in revolt nor in conformity, but simply in the variety and the coherence of the art in itself. And the variety and coherence are matters of discoverable fact. Principles which make for them are likely to be sound; principles which destroy them are, if correctly stated or imputed, certain to be unsound. We must, however, bear in mind that the creation of a work of art is an altogether different process from criticism and analysis. The craziest theory may be accepted by a composer as being his method of work, and it will do him not the slightest harm so long as it keeps his attention so poised that the depths of his mind are free to express themselves. But the same theory will be disastrous to most of his disciples, though some may share his luck with it. The classical art forms were not, in their origin and maturity, crazy theories, but shrewd generalizations from familiar experience. As that experience becomes remote the art forms lose their vitalizing expressive power. But there is more vitality in remote experience than in none at all; and a mere arbitrary contradiction of old artistic theories is, one would think, the most obvious sterilizing procedure that could be devised for future art. The procedure is seen at its worst when it is applied to some all-pervading category of music, such as harmony. Whatever may be the merits or the fecundity of the composer, we may be absolutely certain that when he explicitly promulgates a new system of harmony he is talking nonsense. A certain composer begins his career as a brilliant 20th-century Chopin, with an unmistakable power of composition in large and free form, besides a happy vein in the tiniest of preludes. In time certain harmonic mannerisms develop: the composer is also inspired to write for orchestra; his vigorous talent for composition not only stands the strain of this larger medium but remains traceable in works based each on some single artificial chord of which the original meaning is obviously a Wagnerian progression, but which the composer expounds to the gasping interviewer as the most perfect chord in music. And so the gasping interviewer goes on his way rejoicing in the possession of a profound technical mystery worthy of revelation together with the composer's theosophic doctrines and other matters of popular interest. There is no reason for doubting the composer's sincerity either in his theosophy or in his harmony. Artists are seldom also men of science, and even men of science keep some region of their minds in a state of holiday wherein they may be perfectly arbitrary and self-centred. Art originates from such regions of the mind, but it will be stifled, and those regions will be starved, unless it emerges and forages in the wide world of human life. Egocentric as is the nature of art, the confines of one personal life are not enough for sane self-development; and the personal note of the artist who retires into the recesses of his arbitrary domain will not long retain its power.

The untimely death of Scriabine left his art just at the point where it was beginning to alienate his enthusiastic supporters. Contemporary enthusiasm and hostility on theories of harmonic style may be left to the theosophists. The important fact is that Scriabine did, while he lived, produce compositions with a large flow and climax: nor do we know that his power to do so was likely to fail him. In all the chaos of modern experiment with discord and disordered rhythm, two questions alone are capable of permanently significant and truthful answers: the one concerns the composer and the other the listener. To the composer we may address Brahms's rude query, "Do you find this fun?" Of the listener we may ask, "Can you find a sufficient variety of coherent definite elements, events, qualities and forms in this art, quite irrespective of any question of novelty?" This question must be answered with regard to all the elements of the art from the oldest to the newest, and it is one of the few sound artistic questions which concerns an artist's whole output as well as individual works; *e.g.* any one of Bach's arpeggio-preludes will show a monotony of rhythm unbroken till near the end, and will present melody only in the negative form of an avoidance of awkward intervals on the surface of the chords; but such arpeggio-preludes cannot be created by a composer who could do nothing else; the very conception of their plan belongs to all musical time and existence.

Without comparing Scriabine to Bach or even to Chopin, we may on these lines eliminate matters of taste from our estimate of works like the *Poème d'Extase* and *Promèthée.* The enthusiast is carried away, like the players and the conductor, by the climax of the *Poème d'Extase*, and is apt to declare that it attains a sonorous power never reached before in music. To which the cynic replies that Scriabine has inherited the Rimsky-Korsakoff tradition of a grammar of orchestration as accurate as that of Palestrina's vocal writing; that with this as a background he has merely to instruct the first trumpet to indulge in a street-player's *vibrato* and so to lead up to a climax which is obtained by simply allowing the full organ to drown the orchestra in the fashion of an Albert Hall performance of *The Messiah.* There never was and never will be a new sensation in the fine arts which cannot be laughed down on these lines; but real composition can never be thus laughed down, and it is real composition alone which makes a street cornet *vibrato* and an Albert Hall organ peal capable of producing new sensations. Again, these effects are obviously essentially popular; a ground, no doubt, why the description just given should be bitterly resented by many of their admirers. Yet it is just their popular quality which, rationalized by power of composition, vouches for the reality of the art. Without the power of composition a popular new sensation cannot last, even if it can make its mark at all. With power of composition everything in art must some day find wide recognition, if it escapes physical destruction; for no composer attains such power without being driven by strong human impulses. Epigrams are not enough. Human experience vividly presented never loses point.

But the chances of producing permanently living work are heavily weighted against the composer if he concerns himself only with things which he alone can understand. The Russian ballet gave abundant vital impulses to music so long as it dealt intelligibly with drama, fairy-tale, fable and life; and the young Stravinski of *L'Oiseau de Feu* found in it inspiration for music that remains brilliant and intelligible apart from the ballet. In *Petrouchka* he still makes rhythmic and instrumental sounds that faithfully follow and enhance the moods of a fascinating pantomime; but the concert-goer who, knowing nothing of the ballet, affects to be moved by the music in an orchestral concert, is little wiser than the man who would rather say he preferred the wrong end of his asparagus than admit that he did not know which was the right end. The ballet is to the composer an easier and therefore more dangerous art form than the opera; in both cases the listener will always give the music credit for all the qualities of the scenario if the composer only manages not to interfere with them. Self-deception, loss of vitality, decadence and dry-rot set in when the designers of the ballet themselves retire into the arbitrary kingdom of abstractions which they call symbolic, and which common sense calls nonsense. There is a real kingdom of nonsense, and it will have none of your owlish aesthetic solemnity about morbid twists of mind. Lewis Carroll, trained logician, leaves it to later commentators to identify his Snark with the Absolute, or with the company promoter; his and Edward Lear's wonderland of nonsense is a school of manners in the light of which any explicit social satire and many fantastic flights of modern musical imagination appear almost equally convicted of grossness and heavy incongruity. For music, as for all arts, the fruitful path, and that which leads even to the sublime as well as the imperishable, is a path of unselfconscious childlike enjoyment of the matter in hand, with no petulant preoccupation with the stupidity of the outsider. Erik Satie is amusing enough with his *Vraies prêludes flasques pour mon chien,* his *Aperçues désagréables*, and all the rest of it; his works are announced with the challenge that, as to *les Aplatis, les Insignifiants* and other more Rabelaisian nonentities who will not enjoy them "*qu'ils avalent leurs barbes! qu'ils se marchent sur le ventre!*"

Domenico Scarlatti, in the days of Handel, was a master of one of the most personal and eccentric *genres* of music known to history, a *genre* which, for all its confinement to one small form and one instrument, had a profound influence on all later instrumental music; and his preface is a sincere and unaffected warning to the reader to expect nothing learned, but a playful indulgence of his art. If this represents only the manners of his day, those were evidently very good manners and conducive to artistic progress and freedom.

Prominent among the eternal questions which agitate the contemporary critics of all arts at all periods is the proportion of means to ends. The modern orchestra grows easily with the demands of the modern composer, for in spite of local and temporary difficulties, it is to the interest of players that orchestras should increase as well as multiply; and the most extravagant modern composer has never yet faced the problem of designing music for which the band and chorus of a Crystal Palace Handel festival would really be to the purpose. In other words, the Handel festival exists; but the music for an organization of even half that size has never yet been composed. Here, then, is material for a real aesthetic development; and herein lies the significance of the recent vogue in Holland of the enormous works of Gustav Mahler. That great Viennese orchestral conductor died almost a generation ago, and his symphonies owe much of their recognition to the personal zeal of their apostle, the eminent conductor Mengelberg. It is improbable that the music-lovers of other countries will ever readily receive these huge volumes of naïve sentimentality and boyish grotesqueness (to say nothing of more definitely oriental traits). But the works nevertheless demonstrate at least three vital things: first, that it is still possible for a composer to pile up structures of illimitable extent in the most unsophisticated harmonic and melodic style; secondly, that, whereas taste cannot even begin to express itself without some technique, an immense amount of technique may be learnt from work which cannot be said to show any taste at all; and thirdly, that whatever may be objected to Mahler's taste and form in this direction, he undoubtedly fulfilled his set purpose of working out the pioneer aesthetic and technical principles of music designed for a thousand performers and upwards. And this is no decadent proposition. Decadence, or barbarity, is entirely on the side of the Handel festival: the performance of music on a scale for which it was never designed. The real problems of music for a thousand performers are, as Mahler perceived, problems for a severely disciplined and accurate imagination; and nothing can be further removed from the world of arbitrary artistic egoism. They are not to be mastered by the methods of that kind of extravagance which now and then displays a revulsion in some absurd economy, like Meyerbeer's old trick of thin and inadequate harmony for one voice supported insecurely by one horn and a spasmodic gurgle on a solo violoncello. Meyerbeer in his day did work that was good enough to anticipate Wagner's discoveries and bad enough to ruin Wagner's cause. Mahler has none of Meyerbeer's worldly wisdom, and in his special field there is as yet no greater and more masterly idealist.

The main stream of music still flows within the Wagner-Strauss limits and seldom requires 150 instrumental players. Arnold Schönberg's *Gurre Lieder* (a large vocal and choral cycle, the great success of which is held by his disciples to be a serious hindrance to the spread of his later gospel of musical revolution) requires a huge orchestra; but the very fact that the score often employs 50 staves proves that Schönberg is by no means imagining the aesthetics of an unprecedented scale of performance; the polyphony that requires 50 staves for its notation rather implies detail than bulk. (This, by the way, may help us to understand why the Handel festival has always had an undeniable measure of success; Handel's style is almost massive enough to adapt itself to the monstrous organization which he never had in view. Conversely, that wonderful 16th-century monument, Tallis's 40-part motet, which remains unsurpassed for genuine complexity combined with rhetorical force, would probably prove more convincing with fewer rehearsals on 40 single voices than on a choir of 400 which could after all only give 10 voices to a part.)

The life work of Max Reger presents a strange study of artistic vitality working on methods the reverse of vitalizing. At first sight his productivity seems enormous; and since Orlando di Lasso in the 16th century we have had no other conspicuous instance of a composer who seems always able to sit down before a pile of blank music paper with a blank mind and work himself up into genuine inspiration by sheer interest in the weaving of rich musical texture. To the present young generation of German musicians Reger is the last of the classics; but there are few things in music less classical than Reger's art forms, rigidly orthodox though they seem. They are the direct result of extraordinary docility in the pupil of the most systematic musical scholar of recent times, and anyone who has groaned in spirit at the sight of one of Hugo Riemann's editions of a piece of classical music may easily recognize in Reger the traces of his teaching. Every external feature of the classical art forms is present without any trace of the classical reasons for it. Everything has been worked out from one detail to the next, without any first principles to account for the whole procedure. A facile contrapuntist, Reger writes untold numbers of fugues, all on one mechanical plan, mostly with some combination of subjects, but never a combination between subjects sufficiently contrasted to give it point. His instrumental works are for the most part cast in sonata forms; except for the incessantly modulating and chromatic style, the whole collection of works contains neither an unorthodox procedure nor the slightest reason for its orthodox procedures. Bach wrote great works for unaccompanied violin, and Reger does likewise. But he shows no sense of the principle that Bach's unaccompanied melody is its own bass; Reger's melodies cry loudly and ambiguously for harmonic support. You might as well cut out with scissors a full-face portrait of a judge in his wig and expect it to be recognizable as a silhouette. Whatever is to be learnt from Reger, it is not the meaning of classical art forms. And much is to be learnt from Reger. His texture is inevitably thick, for his rigidly systematic completeness vetoes any of that suggestiveness which is one of the secrets of the greatest art. But it is astonishingly sonorous, and, in its heavy literal-minded way, effects its purpose in the fewest possible notes, numerous though they be. Every instrument is profoundly studied and developed on the basis of its natural technique; and while the player who claims that he can read Reger at sight is probably mendacious, he will enjoy his instrument all the better for playing Reger well. Nor is this the only or the most important non-egotistic reality in Reger's work. The reality of Reger is that he is a consummate and impassioned rhetorician. His unreal art forms hinder and help him no more and no less than the alphabetical acrostic hindered and helped the poet of the *Lamentations of Jeremiah.* He extemporizes on paper, and is profoundly attentive to the nature of his instruments and to whatever text he is setting in his vocal music. In the history of art there can be no more conspicuous example of the difference between analytical theory and the practical conditions of creative work.

The only things that matter to the composer and to his posterity are the things that help or hinder him in creating his works. Posterity will not inquire whether Sebastian Bach, Granville Bantock, Richard Strauss, Busoni—whosoever you will—were reactionaries or revolutionaries, whether they followed classical forms, misunderstood them or abolished them. Nor will posterity pay any attention to the questions we so often ask as to whether such and such a composer's work had led to further developments or hindered them. This is a totally different question from that which is often confused with it, the question whether certain principles (such as a revolutionary but disciplinarian theory of harmony) do or do not interfere with a composer's capacity to write coherent and fluent works. Thus, when it is argued that Wagnerism was the cause of much mental paralysis among later musicians, the crushingly sufficient answer is that Wagnerism did not prevent Wagner himself from producing works that are among the most enormous achievements in all the records of music; and that the effect of such achievements on the sane musician is to enlarge his ideas of the range of his art. He is not obliged to cover that whole range himself; and the musician who, not being Wagner or Strauss, dooms himself to failure by working on their huge scale with inadequate resources, does not thereby show that his artistic balance would lead him to better success on a smaller scale. All great art may be accused of "leading to a blind alley" inasmuch as its achievements are always individual and unique. Yet every achievement that lives (and many live, like the works of Domenico Scarlatti and Couperin, that cannot well be called great) is a source of inspiration to right-minded artists. It is not a matter of taste; nor need it be an incitement to handle any particular art form or to imitate the style that has inspired the artist with Correggio's conviction "*Anch'io son pittore!*" It would be difficult, for instance, to name any composer whose style shows the influence of Granville Bantock; just as it is difficult to trace in his style, otherwise than by merely technical measurements, the influence of Strauss and of the schematic purity and brilliance of Russian orchestration. Yet there is probably nowhere in Europe a more radiant source of musical health. It is easiest for young composers to feel the stimulus of one who, like Bantock, has always been a keen upholder of the most modern music; nor is it anything but a healthy sign of the times that those who still find their interest in classical resources must plough a lonely furrow. They may contentedly do so, like Sebastian Bach, if like him they also maintain a hopeful interest in the present and future of the new movements which they do not feel drawn to imitate in their own work.

Another striking example of artistic vitality commands attention in the work of Gustav Holst, an English composer whose interest in oriental subjects is (like Bantock's) no whim for *chinoiseries* but a true expression of the nostalgia of the West. In every direction his work is masterly, independent, and indisputably real. *Savitri* is an oriental opera written with the slenderest of instrumental resources and with much singing that is not only unaccompanied but unharmonized. Holst has also produced beautiful songs for the strange combination of a solo voice accompanied only by a violin. At the other end of the scale we have his orchestral work *The Planets,* in which he shows his full musical freedom. Probably the work in which his design most accurately and tersely fills its space is his setting of the sublime ancient Byzantine *Hymn of Jesus.* Here the music seems indistinguishable from the text; and its primitive and drastic harmonic logic, which technically could not have been written before the time of Debussy and Ravel, is no more suggestive of the fashions of to-day, or of any day, than the awe-inspiring Eucharistic text which reverberates through it. No modern music is more utterly unsuggestive of outward and technical resemblance to the classics, and none rests on deeper foundations of musical scholarship.

Among the most significant signs of life in English music we must mention Rutland Boughton's remarkable musical festivals at Glastonbury, where (until interrupted by the World War) he produced English opera on a small scale, ranging from Purcell to his own and other contemporary works.

It is easy to ask what effect the World War has produced on music. The wisest answer is evasive. Few, if any, of the works written avowedly to commemorate the war can possibly succeed in meaning what they say or saying what they mean. And of the losses to music, who shall discriminate between the talents that had been given time just to reveal their promise and those that were cut off yet sooner? What now of Russia, where in 1921 world-famous composers were living in starvation without even paper to write on? If any musical work is destined to impress posterity as a noble expression and reaction of the World War, the choice, strange as it may seem, might most desirably fall on

Richard Strauss's *Die Frau ohne Schatten*. His *Alpen-sinfonie*, which, designed before the war, appeared in 1915, was a great disappointment, amiably commonplace in "programme" and sentiment, and hardly more than automatic in its characteristic "road-hog" technique. As to *Die Frau ohne Schatten*, Strauss's style is no longer a new sensation and it cannot be easily proved to be less automatic here than in the *Alpen-sinfonie*. The intention of the work as a whole must be ascribed to the poet Hofmannsthal; and so we still seem to leave room for the argument that Strauss, like other adroit opera-writers, has little more to do than to avoid hampering the poetry and action. But it is at least equally possible to assert roundly that Strauss is here at the height of his power and inspiration; that his mastery of composition and texture has never been seriously in dispute, whatever exception may have been taken to the extremes and licences of his style; and that, if the poet's intention is noble, the composer has made its realization vivid as no one else could imagine. The intention of the work is such as can be carped at only at the peril of the critic's rightness of thought. One of the real difficulties in the understanding of Wagner's art was, and still is, that whereas his mature music shows his strength, the ethics of his poetry often shows his weakness. For one person who appreciates the tragic nobility which drove Tristan and Isolde to drink what they took for a death potion, there are a dozen who get and mean to get from the whole music-drama nothing better than a view of life as the irresponsible intoxication of a *Liebestrank*. This is not fair to Wagner, yet it is largely his fault. But if the world will only allow itself to be emotionally stirred to the same extent by Strauss's *Die Frau ohne Schatten*, then a great musical work will have played a historic part in restoring the health of the nations. From the twilight of 19th-century and recent erotic art, and from its always selfish and sometimes abnormal sexual preoccupations, *Die Frau ohne Schatten* breaks away, and its plea for love is nature's plea for life. Musically it is, more copiously than any of Strauss's former works, an occasion for beauty; as a dramatic spectacle it is a gorgeous fantastic pantomime, of which the allegorical meaning leaves it hardly less childlike than *Die Zauberflöte*, which it in some points intentionally resembles. It is altogether a noble and heroic work, unassailable by any cavil that does not condemn itself as ignoble.

In the early summer of 1921 a new kind of double keyboard for pianofortes, invented by the eminent Hungarian composer Emanuel Móor, and manufactured by Messrs. Schmitt-Flohr of Berne, was demonstrated in Berne to large audiences. There is no reasonable doubt that it must soon render the ordinary pianoforte as obsolete as the harpsichord, and that it is by far the most important invention in musical instruments since the pianoforte itself. The principle is simple and might just as well have been discovered when the pianoforte was first invented: in which case Mozart's pianoforte-technique would have begun considerably beyond the point where Beethoven's now leaves off. Two manuals are placed, the one so slightly raised above the other that a perfect *legato* in rapid passages is obtainable between them by one hand. The second manual is an octave higher than the first. Thus the normal stretch of one hand is two octaves instead of one; and with the cultivation of a new set of movements of the hand, backwards and forwards as well as laterally, the possibilities of pianoforte-writing already seem limited only by pure musical aesthetics. But this is not all; the two manuals can be coupled together by a pedal, so that the instrument possesses much of the property of the organ and also of the harpsichord, in the power of doubling a whole mass of harmony or any part thereof in "four-foot tone." The restoration of harpsichord effects is completed by a lever which operates a kind of sordine, producing a surprisingly good representation of harpsichord tone.

The invention is conservative as well as revolutionary. The pianoforte does grave injustice to many aspects of harpsichord music, but this "Duplex Coupler" system leaves purists at liberty to play classical pianoforte music without even altering a fingering; they have but to refrain from using the back keyboard and the couplers. There is a vast new technique awaiting long study and exploration; but the merest rudiments of it produce astonishing results in a short time, for the pianist who gave the first public demonstration did so within six days of setting eyes on the instrument. It cannot fail to have an enormous effect on the future study of music. Doubtless, it will develop its own vices as well as resources, but it begins by depriving pianists of occasion for four-fifths of their worst habits, and sets a premium upon a Bach-like and Mozart-like cultivation of polyphonic *cantabile*. Many composers use the pianoforte in the act of composition far more than they are willing to admit. They know it to be a bad habit because it tends to cramp their invention in two directions: it confines phrasing to the obvious sequences that muscular memory best grasps, and it confines part-writing to the compass and convenience of the hands. The second limitation is now removed, and those composers who suffer from "pianistic" habits will speedily show greater freedom in their writing for other instruments and for orchestra. Thus there is no region of music which will remain uninfluenced by Emanuel Móor's Duplex-Coupler pianoforte, and this instrument will be a very important source of interest and inspiration in the music of the future. (D. F. T.)

MUSTAPHA KEMAL (1879–1922), Turkish pasha, was born of humble parents at Salonika. By his great energy and the political connexions that he formed as a leader of the Young Turks he rose to military eminence in the Turkish service. In spite of slight physique and a dissolute life, his reckless courage and ambition brought him into prominence in the war against the Italians in Tripoli; he was made aide-de-camp to Wahid-ed-din, afterwards the Sultan Mohammed VI. In Aug. 1915, as commandant of the Turkish detachments in Anaforta Bay (Gallipoli peninsula), he gave proof of his ability, and enjoyed the especial confidence of the German commander-in-chief, Gen. Liman von Sanders. In 1917 he commanded the III. Caucasian Army. In the winter of that year, after coming into violent conflict with Gen. von Falkenhayn, he resigned. When, however, a little later, Falkenhayn was recalled from Palestine after his complete failure there, Mustapha Kemal held a high command under Liman Pasha, and after the conquest of Palestine Mustapha Kemal took over from Liman Pasha in Adana the remnants of the Turkish forces. Out of these and a number of volunteers he organized the Nationalist army. He put himself at the head of the Nationalist Government, and won through in his strenuous campaign against the legal Government in Constantinople. He afterwards ruled with almost absolute power in Angora, and thence conducted the counter-offensive of the Turkish Nationalists against the Greeks when the latter, in 1921, made their ineffectual forward movement in Asia Minor, which was brought to a standstill in the autumn. A later counter-offensive in 1922 was eminently successful.

MUTSU HITO (1852–1912), MIKADO, OR EMPEROR, OF JAPAN (*see* 19.100), was represented in 1911 at the coronation of King George V. by H. I. H. Prince Higashi Fushimi, both Adml. Togo and Gen. Nogi being on the imperial staff. A year later the Emperor was stricken down by illness, and succumbed to it on July 30 1912. The simplicity of the Emperor's personal life, and the concern he had always displayed for the welfare of his subjects, had endeared him to his people. The obsequies took place on Sept. 13 and 14, with Shinto rites, at Moyayama, near Kioto, and, in addition to the presence of special ambassadors from the foreign Powers, a guard of honour from the British navy testified to the alliance between the two island empires of East and West. A profoundly touching impression was created throughout the whole world by the suicide of Gen. Count Nogi and of the Countess Nogi, at the moment that the body of the Emperor was leaving the palace.

NAMUR (*see* 19.159*).—In 1914 the pop. numbered 32,453. The manufacture of glass and glassware had been recently established. An athletic sports ground was laid out and a fine open-air theatre built before the World War in the park on the citadel hill. The Germans entered Namur on the evening of Aug. 23 1914, deliberately set fire to the town in five places, and gave way to looting. All the houses in the Place d'Armes and its vicinity were burned and the Hôtel de Ville destroyed; and between Aug. 23 and 25, 75 civilians were shot without motive. A war contribution of 50,000,000 fr. was levied and Namur became a cavalry headquarters and base.

The Siege of 1914

In the defence scheme of Belgium, Namur, with Liége and the small intermediate fort of Huy, had the rôle of barring the line of the Meuse against attack from the East. It had in addition to secure the left flank of the field army in case of an invasion by the French, and, further, as against eastern invasion, it supported the right flank of an army disposed on the line of the Gelte to resist an enemy who might have mastered Liége. The last named was the case which actually arose in Aug. 1914 and led to the attempt being made to hold Namur in spite of the disheartening experience of the power of the German heavy artillery which the Belgians had just suffered at Liége.

The permanent defences of Namur at the outbreak of war in 1914 consisted in a ring of nine forts catalogued here in clockwise, or E.—S.—W.—N., order—three (Maizeret, Andoy, Dave) in the great bend of the Meuse E. of the towns, two (St. Héribert and Malonne) in the angle of the Meuse and Sambre S. of it; two (Suarlée and Emines) on the open N.W. front astride the Gembloux road; two on the N.E. front covering the Tirlemont road (Fort Cognelée) and the St. Frond road (Fort Marchouelette) respectively. In each of the intervals between fort and fort, infantry and field artillery positions were constructed on mobilization, and included in the defence system of each interval were two, three or four infantry redoubts. The principal line of defence followed in general the imaginary perimeter of the fort-ring, but in the E., conforming to the requirements of the broken ground, the line of trenches redoubts was drawn back, notably near Fort Maizeret, where it passed at a distance of a mile behind the fort, and also at Fort St. Héribert on the S. front.

Although it was a ring-fortress, of Brialmont's design, similar in all respect to Liége from the technical point of view, the tactics of both attack and defence were very different from those employed in the earlier siege. Not being exposed to surprise, the garrison had ample time to protect the intervals of the forts with trenches, redoubts and wire, as well as to clear the foreground. Moreover, at the time of the attack, Namur was, so to speak, a strong salient point on the general line of battle of the field armies and not an isolated stronghold. To right and left of it, the German offensive was meeting, or about to meet, the French IV. and V. Armies and the British Expeditionary Force. The attack was carried out by those German corps which in the line of battle lay opposite to the fortress, and not by a special force. It was carried out not in two stages as that of Liége had been—*coup de main* on the intervals followed by methodical battering of the forts—but in one effort, the infantry attack and the siege artillery bombardment being simultaneous and interdependent. It is therefore, in some respects, the tactical prototype of the Verdun struggle of 1916, with the two important differences that in Aug. 1914 troops had not learned the strength of a trench-network or become familiar with the effects of super-heavy artillery, and that at Verdun the artillery had been removed from the forts, which were treated purely as infantry strongpoints.

The garrison of Namur, under Lt.-General Michel, consisted of the 4th Div. (3 mixed bdes.), four fortress infantry regiments, the garrison artillery and engineers appropriate, and various small units, and numbered about 27,000 combatants, reinforced during the defence by one French infantry regiment.

The attacking army consisted of four divs. (later five) (Guard Res. Corps, half VII. Res. Corps, XI. Corps) drawn from the inner wings of the II. and III. Armies, formed as a temporary Army Group under General von Gallwitz, and provided with a siege train which included one battery of 42-cm. and 4 batteries of Austrian 30·5-cm. howitzers as well as 21-cm. howitzers and medium guns.

During the defence of Liége, the Belgian army was concentrated along the Gelte line, facing E., waiting for the arrival of French and British forces N. of the Sambre. In this position Namur covered its right and Antwerp its left. But when the Germans had made good the passage through Liége and deployed their I. and II. Armies facing the Gelte, they manœuvred to cut off the Belgians from Antwerp, their main base, and the King therefore fell back gradually in that direction, giving up contact with Namur. At the same time the French V. Army was assembling in the angle of the Sambre and the Meuse, and thus the Belgian fortress came to occupy the centre of the French northern battle-line. The Germans, meantime, leaving a containing force in front of the positions around Antwerp, initiated the great wheel of their right wing which was to envelop the French or British left. The pivot of this wheel was not, however, Namur but Thionville, and thus Namur had to be tackled by open force during the progress of the wheel. During Aug. 18–19 the left of the German II. Army advanced slowly on Namur from the direction of Huy, clearing out of the woods and villages the very active outpost forces of the garrisons, while the right of the III. Army was still far back in the Ardennes. On Aug. 20 the union of the two portions of von Gallwitz's forces was completed and the XI. Corps stood with its right flank on the Meuse, west of Audenne, and its left about Florée. The 1st Guard Res. Div., which had hitherto followed the S. bank of the Meuse, had been switched to the N. bank when the XI. Corps became available, and after a fierce fight with the inhabitants of Audenne stood behind the sister div. (3rd Guard Div.) a few kilometres back of Audenne and E. of Hingeon. The right of the Guard Res. Corps, therefore, instead of reaching the region of Hemptinne, extended (evening Aug. 20) no further north than Pontillas.

This rightward movement, though its immediate cause was the arrival of the XI. Corps, marked the beginning of a change of plan. The original intention was to press the attack home on the E. and S.E. points of Namur. On Aug. 20 this was changed, owing ostensibly to the discovery that siege operations were extremely difficult in the woods and deep valleys of the S.E. front, but really to the arrival of large French forces on the Sambre which constituted a threat to von Gallwitz's exposed right wing, the weight of the attack being shifted to the N.E. and N. front. During Aug. 21, while the 3rd Guard Div. with one bde. of the 1st Guard Res. Div. continued to advance in the region of Hingeon and Vezin, and the rest of the 1st Guard Res. Div. completed its flank march to Hemptinne, the 38th Div. of the XI. Corps was taken out of the line and formed in reserve at and S. of Audenne. Thus there were two divs. N. and one div. S. of the river with one in reserve on the Meuse itself. Of the siege artillery, however, a considerable portion was and remained S. of the Meuse, for in order to avoid the delays that had been so serious at Liége, von Gallwitz had emplaced his heavy and super-heavy pieces at the very outset of the attack, before the change of plan. Thus the main attack, N. of the river, took the form of an "abbreviated siege" *à la* Sauer—full-force assault on the intervals combined with smothering and ruin of the forts—while the operation S. of it rather resembled the second phase of Liége, viz. methodical ruin of the forts in succession by heavy artillery under cover of an infantry screen.

During Aug. 22, while heavy fighting continued in the foreground of Fort Marchouelette, the rightward shift was com-

* *These figures indicate the volume and page number of the previous article.*

pleted by bringing the 38th Div. and the 1st Guard Res. Div. (somewhat intermingled) into the N.E. area, opposite forts Cognelée and Marchouelette. At the same time the 3rd Guard Div. condensed as much force as possible on its right, opposite the latter fort. A div. (the 14th Res. Div.) arriving from the II. Army was disposed on the N.W. side, to threaten Forts Emines and Suarlée. Thus 2½ divs. out of five were placed on the front selected for assault, which was little more than 3 m. wide. No general reserves were kept back. The artillery was in position and opened fire in the morning, except some of the super-heavy batteries which were not ready till the afternoon. On the morning of Aug. 23 the assault was to be made. According to the German official account, there were many misgivings, for it was evident progress had hitherto been slow, the intervals were known to be well prepared and manned, and it was thought that the time allowed for crushing the forts was too short.

Von Gallwitz, however, persisted in his decision and in reality the defence was on the point of collapse. Fort Marchouelette, bombarded by 21-cm. howitzers from 10 A.M. on Aug. 21 and by 42-cm. howitzers from the morning of Aug. 22, was almost incapable of resistance, and collapsed in ruin, with two-thirds of the garrison dead, at 1:40 P.M. on Aug. 23. Fort Cognelée, under bombardment by the Austrian 30·5-cm. howitzers on the previous evening, had given in some time before. But here the battle had already passed inside the fort ring. The unsuccessful fighting and notably a counter-attack in the evening of Aug. 22 had exhausted the defenders of the interval trenches and redoubts, many of which were lost before dawn of Aug. 23. To sustain the battle, moreover, Lt.-General Michel had expended practically all his reserves.

Thus the German assault of Aug. 23, delivered with very heavy forces and accompanied by an intensive bombardment of the forts by super-heavy and of the intermediate positions by heavy field artillery, was completely successful. The break occurred near Fort Cognelée where the French contingent began to retreat about 10:30 A.M. One by one, from left to right, the fighting groups of this front gave way; the rightmost, on the Meuse, being the last to conform, were mostly cut off and forced to surrender, though they had had no difficulty in maintaining the frontal defence against the weakened left of the 3rd Guard Div. The Emines–Suarlée sector troops, turned on their right after the break-through near Cognelée, withdrew in succession from right to left towards the Sambre bridge at Bauce, but the forts, intact, prevented any attempt to break through on the part of the newly arrived 14th Res. Div. outside this front and Fort Emines inflicted losses on the Germans as they pursued southward from Cognelée. Meanwhile, the bombardment on the E. front, where, as has been noted, a large part of the German siege artillery still remained, had destroyed Fort Maizeret before nightfall of Aug. 22, though the infantry in front did not realize the fact till 2 P.M. on Aug. 23, long after it had been evacuated. The artillery then turned upon Fort Andoy, but this fort repulsed a premature attack of the weak infantry forces in its front, and was unconquered at nightfall. Nevertheless, the collapse of the interval defence N. of them caused the commander of the E. sector to withdraw from his line of redoubts from about 12:30 P.M. and by 7:30 P.M. all troops except the garrisons of Forts Andoy and Dave had taken refuge in the southern sector, W. of the upper Meuse.

Once through the main line of defence von Gallwitz's attack-mass met only disconnected resistances on its way to Namur, and the Germans entered the town at 7 P.M. The Sambre bridges were however blown up, and the rest of the evening had to be given up to reorganization of the much mixed-up units which had converged on the narrow front Bouge–Namur–Pont de Bauce. On the morning of Aug. 24 von Gallwitz prepared to reduce the remaining forts; the 38th Div. by way of Bauce was to attack Fort Malonne, the 22nd Div. to continue its attack from E. to W. against Forts Andoy and Dave, and the 1st. Guard Res. Div. from Namur, the 14th Res. Div. outside, and the siege artillery which had reduced Marchouelette and Cognelée, were to capture Forts Emines and Suarlée. The 3rd Guard Div. remained in Namur, ready to support any of these three attacks as required, and to overawe the inhabitants, with whom there was sporadic fighting followed by house-burnings.

Lt.-General Michel, meantime, after collecting the disordered forces coming in from N. N.W. and E. in the area between the Sambre and Fort St. Héribert, had decided that it was impossible to remain there, the more so as on the one flank the French V. Army on the Sambre was already beginning to fall back, and on the other a German advance on Dinant was hourly threatened. The retreat of the Namur garrison began on the same night; it was not possible to carry it out according to a scheme, and each column had, in the main, to fend for itself. Part of the retreating forces narrowly escaped capture by troops of the German II. Army which were advancing in pursuit of the French. Finally, however, the remnant of the Belgian 4th Div. was reassembled and sent by train to Havre and thence by sea to rejoin the army at Antwerp. The total number of prisoners taken by the Germans was about 6,700.

The Germans had still to reduce the remaining six forts which barred the roads and railways necessary for the further advance of the German II. Army. This task was promptly taken in hand Aug. 24. On that day Emines and Suarlée, hitherto immune, were heavily bombarded, while from front and rear the infantry closed up on them. South of the Sambre, however, Fort Malonne fell without resistance to the bold summons of a Prussian Guard lieutenant with four men, and Fort St. Héribert capitulated after a short bombardment by field and medium calibres. Against Fort Andoy, the bombardment of Aug. 23 continued till the fort was surrendered, a heap of ruins, at 11 A.M. on Aug. 24. On Aug. 25 at 3 P.M. the last fort on the E. side, Dave, surrendered to bombardment by 21-cm. and medium artillery.

To the reduction of Emines and Suarlée, the whole power of the 42-cm. and 30·5-cm. artillery N. of the Meuse was devoted on the morning of Aug. 25. In a few hours their cupolas were pierced or jammed and their concrete galleries and chambers blown in, and both surrendered about 4 P.M. (C. F. A.)

NANSEN, FRIDTJOF (1861–), Norwegian scientist, explorer and statesman (*see* 19.162), carried out as professor of oceanography in Christiania University much important work on the variation of oceanic currents and the water of the Norwegian Sea (*see* OCEANOGRAPHY). During the World War he did much relief work, and interested himself with admirable results in the welfare of prisoners of war. His work was recognized by his appointment as High Commissioner of the League of Nations for the repatriation of prisoners of war. On the institution of schemes for the relief of the starving Russian populace in 1921, he was appointed one of the commissioners in charge of the project. His more recent works include *Northern Mists* (1911) and *Through Siberia* (1914).

NAOROJI, DADABHAI (1825–1917), Indian politician (*see* 19.167), died at Versova, near Bombay, June 30 1917. He had been indefatigable in proclaiming the long since discredited doctrine that the British connexion with India, with its concomitant of home charges without economic equivalent, constituted a drain upon India which kept her poor; and this, with the demand for increased Indian agency, was the keynote of his collection of writings and speeches *Poverty and Un-British Rule in India* (1901). While he kept firmly to constitutional agitation, condemning violent methods when they arose, his constant assertions of "the drain" and that Great Britain was breaking her pledges did much to generate beliefs from which sprang the extremist school of Indian political thought. In the moral strength given by the simplicity and purity of his manner of life, and his unselfish inflexibility of patriotic aim, rather than in exceptional intellectual or constructive power, lay the secret of the unrivalled position "the Grand Old Man of India," as he was called for a generation, held in the affections of his fellow countrymen of all classes. He finally left England early in 1907, and the last 10 years of his life were spent in retirement, from which he emerged only to receive the hon. LL.D of Bombay University in 1916.

NAQUET, ALFRED JOSEPH (1834–1916), French chemist and politician (*see* 19.236), died in Paris March 12 1916.

NARES, SIR GEORGE STRONG (1831–1915), English Arctic explorer (*see* 19.240). In later life he acted as one of the conservators of the river Mersey. He died at Surbiton Jan. 15 1915.

NAREW, BATTLES OF THE (1915).—The lower course of the river Narew, with, on the one hand, its affluent the Bobr, and, on the other, the line of the lower Bug into which it runs, forms, against an invasion of Poland from East Prussia, a barrier which played a considerable rôle in the eastern front campaigns of the World War. This barrier was reinforced by bridgehead fortresses at Osowiec on the Bobr, Lomzha and Rozhan on the Narew, and Zegrze and Novogeorgievsk (or Modlin) on the Bug—the last named, a ring-fortress, bestriding also the Vistula and the Wkra and standing in close relation to the fortress of Warsaw. The course of the Bobr–Narew–Bug water-line is marked throughout by marshes, which, sometimes on one side of the water and sometimes on the other, but generally on both, vary in width from half a mile to 2 m. and at certain points broaden out into wooded marsh-basins, 6–10 m. in width or breadth.

Between this barrier and the S. frontier of East Prussia, inside which the western Masurian lakes offer lines of defence against Russian invasion, there were constant advances and retreats of each side during the first campaigns of the World War. The first Russian advance culminated in the disaster of Tannenberg (*see* Masuria, Battles in), and was followed by a gradual advance of minor German forces to the region of Wloclawek on the Vistula, Plonsk, Ciechanow, Przasnysz and Chorzelle, in conjunction with the main campaigns in West Poland. Then, early in 1915, the Russians prepared a great offensive, which was to take the same general direction as that of Aug. 1914. The Germans, however, by seizing the initiative early in Feb. delayed the development of this offensive. Their main effort, the winter battle of Masuria, was made on the E. front of East Prussia, while the S. front was guarded by an army group under General von Gallwitz, who carried out his task offensively, driving southward into the area N. of the Narew, where the Russians were assembling. This move led to very severe fighting, notably at Przasnysz; and Gallwitz, though reinforced by degrees, maintained himself with great difficulty against the onset of the Russian XII. Army. Then, gradually, the battle became stabilized, and, the great Austro-German offensive in West Galicia having from May 1 transferred the centre of gravity to the other wing, the country between the Narew and the western Masurian lakes was quiet for two months. It is a country of poor communications, sandy soil, low elevations, and numerous N.–S. streams—affluents of the Bobr, Narew or Bug—which occasionally turn into the E.–W. direction and offer partial lines of defence to either side. It is wooded, heavily so in its eastern portion, where the Narew and the Masurian lake zones converge.

Thus the Narew–Masuria battle-field, as it may be called, is triangular in shape, limited on the E. by the woods of the Pissek (or Pissa) region, lying between the Prussian Lake Spirding and the Russian fortress of Lomzha, on the S. and S.E. by the course of the lower Narew and lower Bug, and on the W. practically by the river Wkra and the fortress of Novogeorgievsk. Across this battle-field, in July 1915, the Russians held a front line roughly parallel to the Prussian frontier and therefore oblique to the Narew. It ran from the outlying defences of Lomzha on the right, by Cieriozy and Lipniki to Berdowelonki on the river Omulew, and thence by Cierpienta and Jednorozec on the Orzyc to Mchowko in front of Przasnysz; thence it continued a short distance westward to Grudusk, and at that point turned southwestward to the Vistula. This line was duplicated by rear defences, notably the "Bogate position" between Ciechanow and Krasnosielc; a switch-line connected Ciechanow and Przasnysz, another the centre of the Bogate position, and yet another the right of that position with the bridgehead lines of Pultusk. On the Narew itself, Lomzha, Rozhan and Pultusk (which already possessed works in peace) had been developed into large bridgeheads, and the modern permanent works at Zegrze on the Bug had been extended to include Serock at the Bug–Narew confluence. Novogeorgievsk, already a great ring-fortress in peace, had been surrounded by two enveloping rings of outer defences.

When, after the break-through of the Russian positions at Gorlice–Tarnow, Radymno and Grodek (*see* Dunajec-San, Battles of the), Mackensen's armies swung northward to reach the rear of their opponents in Poland by way of the upper Bug, a similar blow upon the N. side was planned by Falkenhayn for the armies under Hindenburg. As to the direction of this blow, there was acute controversy between Falkenhayn on the one hand and Hindenburg and Ludendorff on the other (*see* Eastern European Front Campaigns, Part III.), and it was only by the pure assertion of authority that Falkenhayn imposed upon them the offensive on the Narew which is here described. Hindenburg and Ludendorff objected that, against so strong a series of positions as those of Przasnysz, Bogate and the Narew, there was no hope of such rapid progress as would enable Gallwitz to come in upon the rear of the Russians in West Poland in time to cut them off. The other arguments for and against a Narew offensive were of a more purely strategic character, and are not here considered, but it must be noted that each of these arguments, taken in itself, was proved by the sequel to be well founded. The view taken by Falkenhayn and that of Hindenburg and Ludendorff as to their relative importance in the *ensemble* differed fundamentally, Ludendorff's ideal being the cutting-off of the entire Russian army by the pincers closing from N.E. and S.E. on its rear, whereas Falkenhayn's object was more limited—to deliver a blow that would relieve pressure on Mackensen's front and so enable him to penetrate to Brest Litovsk from the south. To achieve this object, the offensive must, according to Falkenhayn, threaten the rear of the Russian positions in Poland at the earliest possible moment, and, therefore, by the nearest and shortest line of operations, since Mackensen was practically unable to start his movement along the upper Bug till the strength of the Russians in front of him had been materially reduced (*see* Brest Litovsk, Battles round).

Thus, although the record of Gallwitz's offensive on the Narew is one of slow frontal advances which aimed at the Russian communications but never reached them till the retreating enemy had passed on—although finally he could only join the German frontal armies in the general pursuit—the battles described below must be considered as successful or otherwise in relation to the object for which they were really fought. In the last analysis, they were, like the battles of the British army in Flanders in 1917, a relief-offensive, which in securing their object might, if fortune so willed it, secure other results as well.

Forces and Positions.—The portion of the front selected for attack by Gallwitz was that between the river Orzyc and the village of Grudok, in the middle of which lay Przasnysz; and the date chosen for the attack was July 12, afterwards changed to July 13. As already mentioned, the original cordon of troops along the S. front of East Prussia had grown by reinforcements during the spring battles in the Przasnysz region to the strength of an "army group," and for the July offensives it was given additional forces, though it was not till later that the title XII. Army was assigned to it. It consisted, from left (river Skwa) to right (river Vistula), of the I., XIII., XVII., XI., XVII. Res. and Dickhuth's Corps. Of these, the XIII., XVII., and XI. lay opposite the selected front with their divisions thus disposed. On the XIII. Corps front were the 4th Guard, the 3rd and the 26th Divs., with, on the left astride the Orzyc, a liaison detachment of the I. Corps under von Falk. On the XVII. Corps front, which extended from the Murawka stream to opposite Pavlovo–Koscienie, were the 36th Div.—its left facing Przasnysz—and the 1st Guard Res. Division. On that of the XI. Corps, which ran from the Russian salient N. of Pavlovo–Koscienie to Grudusk, the 86th Div. (of Landwehr and Ersatz units) and the 38th Division. From Grudusk southwestward, astride the Mlawa–Ciechanow–Novogeorgievsk railway lay the 14th Landwehr Div. and 85th (Landwehr units) of the XVII. Res. Corps. In army reserve were the 35th Div., Pfeil's Bde. of the 14th Landwehr Div. and (after the first day) the 50th Res. Div.; later the 83rd Div., Menges's Div. and the 54th Div. were placed at Gallwitz's disposal by Hindenburg.

In the attack sector between Orzyc river and Grudusk the

Russians had at the outset only three divisions, and Mackensen's earlier battles had shown that they were probably ill equipped with munitions. Nevertheless, owing to the strength of the positions, the battle was planned purely as a "trench warfare" offensive, with technical equipment on the full scale regarded in 1915 as adequate.

Przasnysz (July 13–14).—On July 13, after a bombardment of 3½ to 6 hours, according to the circumstances of each sector, the infantry attacks of the XI., XIII. and XVII. German Corps were launched on either side of Przasnysz, on a total active frontage of about 20 miles. The defences in front of Przasnysz itself were threatened, but not attacked in earnest, by the 36th Div., the intention being to break through on both sides of the strongly fortified point and reduce it by envelopment. Everywhere the first line of the defence was carried. On the right of the XVII. Corps front the 1st Guard Res. Div., and on the right of the XI. the 38th Div., attacking the faces of a small salient, cleared the way for the central division, the 86th repeating the same tactics at the second line. East of the Murawka the centre of the XIII. Corps (3rd Div.), after carrying the first line, was, unlike the XI. and XVII. Corps, met by a series of fierce though small counter-attacks, which hampered progress all along the line.

In the afternoon the German effort received a fresh impulse. On the XVII. Corps front the hitherto reserved 35th Div. was put in on the left of the 1st Guard Res. Div., and this increment not only enabled the XI. and XVII. Corps to break through the right and the left of the Russian third line between Lysakowo and Choinowko but also to prepare to invest Przasnysz on the S.W. side. In the night of July 13–14 the Russians evacuated the few trench-elements that they still held and retired on the Przasnysz–Ciechanow switch-line. To the E. of the Murawka, the whole XIII. Corps front took up the offensive initiated by the 3rd Div., but progress remained slow, and at night only the first line and the western half of the second were in the hands of the Germans.

Nevertheless, the Russian strength did not yet permit of the large-scale counter-attack which alone could give them back the lost positions; and, rather than prolong, E. of Przasnysz, a third-line resistance which would be taken in flank and rear as soon as the victorious XVII. Corps should force the Przasnysz–Ciechanow switch-line, they decided to go back to the Bogate position forthwith. Thus the progress of the German XI., XVII. and XIII. Corps met with only rearguard resistance on July 14. Neither Przasnysz nor the switch-line was defended, while, to the W. of the battle-field, the German XVII. Res. Corps was able to advance, with no more than skirmishing, up to the outer defences of Ciechanow. The day's advance brought the infantry, but not the heavy artillery, of the attack group close up to the Bogate position, the eastern half of which the XIII. Corps in vain tried to carry with a rush at nightfall.

Bogate (July 15–17).—In two days the Germans had advanced over nearly half of the 24 m. of ground which separated them from the Narew line, and as yet the Russians had shown no important reserves—indeed, as late as July 12 troops were being withdrawn for the Mackensen front. The problem before the Germans was therefore to reach the Narew and master its crossings, if possible, before the enemy's reserves arrived and at the least to absorb these reserves in the defence of the river line. Speed was imperative, and the Bogate position had to be attacked with a minimum of preparation.

The Russian position was carefully laid out. On the right it followed the obstacle formed by the Orzyc from above Krasnosielc to Podos, whence it followed the edge of a wood to Bogate on the Wengierka. From Bogate a N.–S. switch-line, and from Podos a second switch, ran to Karniewo, whence along a convenient stream the barrier continued to the Pultusk works. The W. half of the position—three to four parallel lines close to one another—was strong about Bogate and in the neighbourhood of Opinogora and Ciechanow. In the Opinogora sector, a night attack on July 14–15 gave the German 38th Div. possession of some advanced works and also a foothold in the first line itself near Zalozce Potory, but the advantage could not be exploited, and during the morning of July 15, while the artillery of the attack was still ranging, Gallwitz fixed upon the centre of the E. half—on both sides of Zielona—as the break-through front. Here there were put in, besides the 36th, 1st Guard Res. and 86th Divs., the newly arrived 50th Res. Div., while on the right of the 86th Div. Pfeil's Bde.—the only army reserve remaining—was to follow *en échelon.* The break-through force was to penetrate well to the S., then swing outward on both flanks, so as to force the evacuation of Ciechanow on the one side and to attack the Bogate–Karniewo switch-line on the other. The attack of the XIII. Corps and of Falk was to be frontal; and from the strength of the Russian position and the relative weakness of the attacking forces (three and one-half divisions as compared with five and one-half W. of Bogate) no more than local gains were expected till a break-through further W. succeeded.

It was not until after midday on July 15 that the attack could be launched after a brief artillery bombardment. But it was successful on the lines intended. The three and one-half divisions on the assault front broke through all the defences, and penetrated so far S. (the 38th and 35th Divs. conforming on the flanks) that the Russians evacuated Ciechanow during the night of July 15–16. Further W., the XVII. Res. Corps and Dickhuth's Corps progressed considerably toward the N. front of Novogeorgievsk, against no great opposition. But the Bogate–Podos–Orzyc river front of the defence held firm, as also did that part of the western position adjacent to Bogate.

On July 16, while the W. half of the break-through force—substantially, the XI. Corps—pushed on southward, driving the Russian rearguards before them to the line Sonsk–Golymin Stary, and the XVII. Res. Corps and Dickhuth's Corps advanced along and W. of the Ciechanow–Novogeorgievsk railway, the XVII. Corps, now comprising the 50th Res., the 1st Guard Res., 35th and 36th Divs., wheeled in against the Bogate–Karniewo switch-line, while the XIII. Corps and Falk assaulted the Bogate–Povos–Orzyc front in earnest. Both front and flank positions were stubbornly held. Local gains by the attack were nullified by local counter-attacks, and these were followed by new assaults. The 50th Res. Div. had not succeeded by nightfall in coming within several kilometres of Karniewo—the point at which the whole of the Russian position could be turned on their left; and on the other flank Krasnosielc, which equally afforded a gateway to the rear of the defensive system, was too strong to be reduced by direct attack. But between Bogate and Podos the Russian front line was forced along its whole length by the German 26th and part of the 3rd Divs., and the village of Podos, at the re-entrant angle of the position on the Orzyc, after changing hands more than once, was finally secured by the Germans about 11 P.M. Further N. the attackers had reached, but not passed, the Orzyc. But on the switch-line Bogate–Karniewo the 36th Div. broke in at Krasne, 2½ m. S. of Bogate; and N.E. of Krasnosielc the I. Corps, hitherto passive, was now actively conforming to the advance of the XIII. and Falk, and at the same time condensing its forces on its right. The general idea of the situation formed at Hindenburg's and Gallwitz's headquarters was that the last Russian counter-attacks were meant only to gain time for another evacuation under cover of night—this time to the Narew and the bridgeheads. Accordingly, the German orders for July 17 not only directed the XI. (and part of the XVII. Res.) southward into positions for the attack of Pultusk, but deflected the 50th Res. Div. there as well.

The Advance to the Narew (July 17–21).—The impression of the situation formed by the German headquarters on the evening of July 16 was only partially correct. On the morning of July 17 the whole Krasnosielc–Bogate position and the northern position of the Bogate–Karniewo switch-line were found to be evacuated, or held only by light rearguards. But the German follow-up encountered more resistance than the similar operation on July 15. The Russians had in fact received the first of the expected reinforcements (about three divisions) and stood to fight, not indeed a battle, but a connected and determined rearguard action, on a line which, had it been completed, would have formed a third line of defence, similar to the Przasnysz and Bogate positions. This line had its origin at the point where the Krasnosielc–

Karniewo switch-line crossed the Orzyc–Wengierka confluence; a little to the E. it followed the high ground of Gora Krzyzewskie, and thence, bordering a series of woods and minor valleys, it ran over the Ruz, past Mamino Nowawies and Prystan, into the woods some 5 m. N. of Ostrolenka. West of the Orzyc, the southwestern portion of the Karniewo switch-line itself belonged to the same general system. On this Karniewo–Prystan line, the German XVII., XIII. and I. Corps were engaged throughout July 17, while the XI. Corps and its western neighbours felt their way southwestward towards Pultusk. Particularly stubborn was the resistance on the Gora Krzyzewskie and at Karniewo. But in the evening the 35th and 36th Divs. broke through the less strongly held line W. of the Orzyc, and crossed that river behind the Russian lines, reaching Makow and threatening the Gora Krzyzewskie in flank and rear. At night, therefore, and in the morning of July 18th, the defenders evacuated the whole of these positions as far E. as the Ruz and fell back into the Pultusk and Rozhan bridgeheads and behind the river between and on both sides of these places. East of the Ruz, in front of the German I. Corps, the Russians held on for yet another day, retiring only on the night of July 18–19.

The Narew itself, at that season, was generally shallow, and fords could be found at most points. Moreover, the water-meadows and marshes were sufficiently dry to allow of infantry passing over them by selected tracks. In general, the defenders' bank dominates the other above Rozhan, while the reverse is the case at Rozhan and from Gnojno, a few miles above Pultusk, downwards. Between these points lies a great marsh basin, called on the defenders' side the Bagno Pulwy, and through this basin the Narew runs in a large bend. The policy of the defence was generally governed by these topographical considerations:—at Rozhan and Pultusk resistance in the bridgeheads of the right bank; above Rozhan, passive defence behind the river itself; and below Pultusk active counter-attack defence in advance of it, based upon the fortifications of Zegrze–Serock and Novogeorgievsk. In the basin of Bagno Pulwy the river was tactically neutral; crossing was not difficult either in attack or in counter-attack, but the absence of good communications made it useless for the Germans to force the passage here without at the same time mastering either Pultusk or Rozhan or both. General von Gallwitz decided that the XI. Corps reinforced (38th, 86th, 50th Res. and 1st Guard Res. Divs.) should storm the Pultusk bridgehead from the N. and N.W.; the XVII. Corps (35th and 36th Divs.) force the Narew between Pultusk and Rozhan at a point as near as possible to the former (substantially, in the region of Gnojno); the XIII. Corps (26th, 3rd and 4th Guard Divs.) storm Rozhan; the I. Corps press the remaining enemy rearguards back to the Ostrolenka portion of the river, and force the passage below Ostrolenka with the aid of a newly arrived division (83rd) which was assigned to it.

Meantime the weak VIII. Army (von Scholtz), starting from the positions about Lipniki and Kolno, facing Novogrod and Lomzha, in which the spring fighting of that front had died away, had conformed to the advance of the I. Corps, and by July 19 had pushed its immediate opponents behind the Narew and into Lomzha. The details of Scholtz's operations fall outside the scope of this article, and it will suffice to say that its "sympathetic" offensives followed the main attack of Gallwitz, stage by stage, up to and over the Narew, culminating in the passage of the river on July 26 near the Skwa mouth and on Aug. 2 between Novogrod and Lomzha.

More important than this coöperation on the E. side was the protection of the southwestern flank of the forces attacking Pultusk against the highly probable counter-attacks emerging from Zegrze–Serock. This duty was assigned to the XVII. Res. Corps,[1] the advance of which on July 16–17 had conformed to that of the XI. Corps' right wing. But since the first reconnaissances had shown the defences of Pultusk to be too strong to be taken at a rush, the XVII. Res. Corps (85th Div. and Pfeil's Bde.) was brought somewhat more to the E. and included in the attack-group to strengthen it. Only Pfeil's Bde. remained, facing S. as flank-guard.

During July 19 and on the morning of July 20, the heavy artillery was brought up, with its ammunition, over the sandy roads from Przasnysz, and the super-heavy artillery now assigned to von Gallwitz, even from railheads in East Prussia.

Meantime reconnaissances were pressed, and artillery registrations carried out, both before Pultusk and before Rozhan, and the XVII. Corps advanced into the southern part of the marsh-basin between the two. At Rozhan, on the morning of July 20, a sudden local attack by part of the German 26th Div. carried a salient on the S. front. But before this gain could be exploited, sharp Russian counter-attacks began without warning at several points between Rozhan and Pultusk. At the same time von Gallwitz's headquarters learned that large masses of Russians were arriving below Pultusk, with the evident intention of counter-attacking from the region of Zegrze. Gallwitz at once cancelled his preparations for the storming of the bridgeheads and began a rapid regrouping.

The Russian attack was especially heavy from Rozhan and from Dzbondz, just below that place, where the German forces consisted only of a liaison detachment that stretched across the marshes to join the XIII. and XVII. Corps. Weaker Russian forces crossed the Narew on the front of the latter, and sorties were made from Pultusk against the 50th Res. Div. and 1st Guard Res. Division. The danger S. of Rozhan was met by withdrawing the 36th Div. to bar frontally, and the 35th Div. to attack in flank, the Russian force which had crossed at Dzbondz. At the other points of contact the Russians were repulsed, and eventually the Dzbondz column also was forced to retire over the Narew. But Gallwitz, on the evening of July 20, judged it prudent to take the XVII. Corps out of the Narew bend, and to create a reserve group consisting of the 38th Div., a mixed Guard Cav. Bde. newly arrived, and the 85th Div. of the XVII. Res. Corps on his right, behind Pfeil's screen. The situation was indeed serious for the German projects, for the Russians were fighting under better conditions than they had had W. of the Narew or could expect E. of it. A battle on the Narew line would not compel the Russian Command to send thither those large forces which it was the primary object of the German scheme to divert from Mackensen's front. Moreover, if Gallwitz were definitely brought to a standstill on the Narew line, the Warsaw–Ivangorod stretch of the Vistula might still be held by the Russian front, without the necessity of further retreat.

The Russian Command had, however, already resolved, owing to losses and to shortage of arms and ammunition, to retire to the short line Kovno–Grodno–Brest; and all resistance, however fierce, in front of that line was intended only to secure time and space for evacuations. The counter-strokes in the Narew bend, therefore, were not continued after the repulse of July 20, and those S. and S.S.W. of Pultusk were not yet mature. Nevertheless, the gain to the Russians was considerable. Caution, and a delay of two to three days in the attack on the bridgeheads, had been imposed on the Germans, who were only able to begin the attack on Pultusk, Rozhan, and the river ten days after launching the attack on Przasnysz—an average progress of no more than 2–2½ m. a day. Even before the period of great counter-strokes had arrived on July 22 at Rozhan, and on July 23 at Pultusk, the German attacks, prepared in the manner of Namur and supported by super-heavy artillery, were launched. At that date, the grouping of the Germans, after the re-shuffles of July 20–21, was as follows:—XI. and XVII. Res. Corps combined as Plüskow's group (right to left, Pfeil's Bde., 85th Div., 86th Div., 50th Div., 1st Guard Res. Div.), for the attack of Pultusk; XVII. Corps (35th and 36th Divs. with 38th Div., a Guard cav. bde., in reserve) on the Narew just above Pultusk; XIII. Corps (26th Div., 3rd Div., 4th Guard Div.), investing Rozhan; I. Corps (2nd and 37th Divs. reinforced by newly arrived 83rd Div.), above the Ruz mouth; fresh reserves (Menges's Div. and 54th Div.) detraining in rear.

Pultusk (*July 23–25*).—The defences of Pultusk bridgehead consisted of an inner line of trenches—incorporating some old-pattern forts, and following generally the ridge on which the battle of Dec. 26 1806 had been fought—and a more important outer system of well-organized trenches, which rested its right on the Narew at Chmielewo, traversed the Pelta at Szwelice, curved southward at Wojty Trojany, followed an affluent of the Przewodowka stream to Przwedowo, and a line of woods thence to Winnica, where it turned E. to rejoin the Narew 5 m. below the town. Except along the marshes of the Narew itself, the country inside and outside this line is largely wooded, with low sandy heights and small streams.

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[1] Dickhuth's Corps was now drawn off to take part in the siege of Novogeorgievsk.

The weight of the attack was concentrated on two fronts: that adjacent to the Narew, where it was hoped to establish bridges and start an enveloping movement E. of the river as soon as the front Russian defences had been stormed; and that of the N.W. bend, where the super-heavy artillery, limited as it was to the good roads, could best take part. To the first of these attacks the 1st Guard Res. Div. near to the river, and the 50th Res. Div. above the village of Szlachekie, were assigned; and to the second the Landwehr and Ersatz units of the 86th Div., assisted by an active regiment lent by the 38th Division. The 85th Landwehr Div. and Pfeil's Bde. S.W. of Golymin Stary, was to flank-guard and eventually to take part in rolling up the Russian defence after the breach had been made. On the morning of July 23, after five hours' artillery bombardment, the assault was delivered. The 1st Guard Res. and 50th Res. Divs. carried all their objectives, after heavy fighting and—in some of the units of the 50th Res. Div.—fearful losses, and by noon had occupied all the area N. of the Pelta river. Here it was expected that the Russians would stand, but in the meantime the successful assault of the Landwehr and Ersatz on Wojty Trojany had broken down the left flank of such a defence, and the Russians were driven back, fighting with their characteristic group-stubbornness and lack of *ensemble*, to the inner line by nightfall. Here von Plüskow called a halt, suspending the storm of the forts till dawn on July 24. Meantime the 85th Div. and Pfeil, coming into the battle successively as planned, had made good a line from the right of the 86th Div. at Mosyn, on the Przewodowka brook, within the captured defences, to the Ciechanow–Novogeorgievsk railway near Klukowo, facing S.; and the 1st Guard Res. Div., falling out of the line as soon as the Pelta line had been reached, was crossing the Narew at several points both outside and inside the outer fortified line (Gnojno, Chmielewo, Lida) and forming bridgeheads and pontoon bridges for artillery. This threat of envelopment here induced the Russians to give up all hope of holding their last footing on the right bank, and during the night of July 23–24 they evacuated the inner line and the town, so that soon after dawn on July 24, the pioneers of the 50th Res. Div., instead of being engaged in wire-cutting before the forts as had been anticipated, were at work on the broken river bridge.

This crossing of the 1st Guard Res. Div., and its entrenchment of a large bridgehead in the Szygowiec loop, was only part of a large programme. To the left of it the 38th and 36th Divs. of the XVII. Corps effected passages at Zambski, Kalinowo and Rowy, without any great difficulty save at the first named, where the direct effort failed and the defence had to be dislodged by a flank movement from the Kalinowo crossing-place. The construction of artillery bridges was put in hand at once, in spite of the interdictive fire of the Russian artillery, for it was urgently necessary, from the defensive and the offensive standpoints alike, to push the XVII. Corps and 1st Guard Res. Div. southeastward so as to seize the line of the little river Prut which makes a barrier from the E. end of the Bagno Pulwy to the lower Narew, and incidentally to cut off as many of the defenders of Pultusk as possible. By the night of July 23, the 38th and 36th Div., like the 1st Guard Res. Div., had been able only to establish their bridgeheads firmly, but by that of July 24 the artillery bridges were mostly completed, and the German outposts to the right of the Bagno Pulwy stood on the line Rzonsnik–Sadykierz (38th Div.)–woods E. of Bartodzieje (part 50th Res. Div.)–E. of Gladczyn (1st Guard Res. Div.)–N. of Drwaly (86th Div.), whence the protective line of the 85th Div. and Pfeil, W. of the river, ran to near Nasielsk. East of Pultusk in reserve was the newly arrived Menges Division. Meantime, on the German left the 36th Div., from its crossings at Kalinowo and Rowy, had proceeded due eastward, in concert with an advance of the 35th Div. along the N. of the Narew, and by the evening of July 24th these units, guarded on their right by the Guard Cav. Bde. in the Bagno Pulwy, stood E. of the Narew between Adamowo and Ostrykol inclusive.

On July 25 the German forces E. of Pultusk advanced to the line of the Prut, while the Guard Cav. Bde. spread across the Bagno Pulwy, and the two divisions of the XVII. Corps pushed forward their bridgehead position of Adamowo–Ostrykol somewhat; on the left of these, the 26th Div. of the XIII. Corps extended the line to the Orz river. But at all points resistance to the advance became ever stronger, and it was evident that for further progress yet another break-through battle would be necessary. The Germans therefore halted, to gain time for their artillery and their transport to overtake the fighting line.

Rozhan and Kamionka (July 22–25).—The bridgehead of Rozhan possessed an inner line of permanent forts, more modern than those of Pultusk, and an outer line which, beginning at the river edge N. of Dysobaba, followed a sinuous trace by Miluny, the wood N.W. of Podbora, and Point 132 S. of Podbora, and rejoined the river opposite Prystan. But it differed radically from Pultusk in being smaller and also segmented internally by several switch-lines. The German XIII. Corps headquarters, therefore, in spite of the need of rapid action, decided to take the segments by successive efforts in each of which the whole artillery could be employed. Already, on July 20, the first of these efforts had carried the salient of Hill 132, as recorded above, before the Russian counter-attack suspended operations. On July 22, after a day's delay, the 4th Guard Div. made the next effort against the Miluny works, which, with the village behind them, were carried by assault before night. On July 23 it was the turn of the woods N.E. of Podbora, which fell to assault by the 3rd Division. Thus on the morning of July 24 all the outer segments were in the hands of the Germans, and the assault of the main line (lying in front of the fort-line) was prepared. But here also the Russians evacuated the bridgehead without standing an assault, and fell back into the woods lying E. of the Narew. Thenceforward the line from Prystan to Chelzy—continued thence northward by the dominant heights of the left bank to Ostrolenka and beyond—formed a position in which the Russians meant to make a prolonged defence.

The sudden cessation of resistance at Rozhan seems to have taken the Germans unawares, for, although the place was occupied in the early hours of the morning, no real effort was made to win a passage until late in the day, in spite of the command of the right bank over the left and the presence of three divisions of victorious infantry. The 26th Div., hitherto investing the S. front of Rozhan, was ordered to cross the Narew between Dzbondz and Bruzie Wielkie, but, being repulsed with heavy loss in an attempt at Dzbondz, it crossed further down at Bruzie Wielkie and so passed away into the scope of the XVII. Corps operations, divided from those of the XIII. by the marshes of the Orz–Narew confluence. The 3rd Div., pursuing through Rozhan, found, late in the day, a Russian bridge S. of Dysobaba, and began passing small forces over towards the wooded heights S. of Dombrowka. But it was not till daylight on July 25th that three battalions had been assembled on the other side, and a sharp action was necessary before the line Prystan–Dombrowka was secured at nightfall. The 4th Guard Div., after fruitless attempts on the afternoon of July 24 to cross at Dysobaba and at Sielun, passed small detachments over during the night of July 24–25, and gradually made good the line Dombrowka–Point 121 with an artillery bridge at Sielun, before daylight on July 26.

Above the Rozhan battle-field, on the front of the German I. Corps, the wide extent of the front (Sielun–Ostrolenka), and the commanding positions on the wooded left bank, made a crossing on a broad front impossible. The Germans had reached the river on July 20, unaffected by the Russian counter-stroke of that day, which did not extend N. of Rozhan, and after reconnaissance fixed upon a bend above Kamionka as the main crossing-place. Here the 2nd Div. was to make the venture, while the 83rd below and the 37th above were to make feints as far up as Ostrolenka. But the Russians were on the alert all along the line. In the night of July 23–24 the leading troops of the German 2nd Div., covered by an intense artillery fire, waded the Narew, under fire from the hostile machine-guns, by an imperfectly known ford. At the cost of heavy losses they secured a foothold on the further heights, but no reinforcements or supplies could reach them. The Russians—high-quality Siberian troops—counter-attacked fiercely, but, being armed in the main only with hand grenades, they were beaten down, time after time, by the rifle-fire of the small German force, though one reckless onset was nearly successful. In the night of July 24–25 more German forces were got across piecemeal, till in all there were six decimated battalions in a bridgehead 1,500 yd. wide and 500 yd. deep, unable to advance or retreat. The feint-crossings on the fronts of the other divisions had been discontinued, though at Modzele a small foothold had been gained by part of the 83rd Div.

Next day, July 26, while at Kamionka the isolated struggle went on as before, the long-expected Russian counter-attack in force broke out along the whole line from the Novogeorgievsk railway to Chelsty above Rozhan.

Battle of the Orz, or Goworowo (*July 26–Aug. 3*).—In accordance with orders from "General Headquarters, East," von Gallwitz had planned, for July 26, a general offensive against the line Wyszkow–Ostrow, while continuing to hold the line S. of Pultusk defensively. He intended that the XVII. Res. Corps (86th and 1st Guard Res. Divs.) and XI. Corps (50th Res. and 38th Divs.) should break out over the Prut, along the S. side of the Bagno Pulwy, while the XVII. Corps (38th and 39th Divs.) pushed E. from their Ostrykol bridgehead, and the 26th Div. by a flank movement from the S. assisted the rest of the XIII. Corps to clear the woods E. of Rozhan. Menges's Div. was in reserve and the 54th Div. due to arrive from France. The I. Corps' attacks—increasingly important in the general scheme of battle in proportion as the Russians in West Poland gave ground—were to be intensified by adding to them the expected 54th Division. But when, on the morning of July 26th, these movements had not reached the stage of infantry activity, some 16–18 Russian divisions rushed to the assault, covered by a fire which was made possible by a hitherto husbanded ammunition supply. On the Prut front, delivered by forces probably not greatly exceeding those of the Germans, the assault failed to penetrate except momentarily at Pniewo on the Pultusk–Wyszkow highroad; and on the dangerous W. flank of Gallwitz's Army, the line Karniewek–Blendostwo–Nasielsk, held only by the 85th Landwehr Div. and Pfeil's Landwehr Bde., the onset of three Siberian and Turkestan divisions was checked after a crisis near Blendostwo. The "sympathetic" attack of a division against the German 86th Div. on the lower Prut was equally heavy and equally unsuccessful. But the effort of the battle, and especially the risk of its renewal on the front W. of the Narew, made the Germans postpone their offensive from the Prut front for two days.

Against the front of the German XI. Corps and 26th Div. some two and one-half to three Russian divisions, attacking regardless of losses, promptly brought to an end the forward movement begun from the Ostrykol bridgehead, and prevented the German 26th Div. from intervening in the flank of the woods E. of Rozhan. There, so far from being able to progress eastward, the Germans were repulsed by the onset of three to four divisions assembled W. of Goworowo and were in danger of being thrown back on to their bridges, only 1½ m. behind the line of battle. An accidental reinforcement from the I. Corps, viz. the arrival of part of the 83rd Div. seeking a way round to the rear of Kamionka by using the 4th Guard Div.'s bridge at Sielun, enabled the German XIII. Corps to regain the lost ground at Dombrowo and Kaszewic and the Russian attack died away. At the bridgehead of Kamionka, infantry counter-attacks were less vehement, but artillery effect upon the gradually increasing mass of Germans in a confined space was terrible, and the Higher Command decided to discontinue the effort to push eastward from so unpromising a base. Already the commander of the 83rd Div. had—as noted above—sought a way round, and preparations were made to profit by this initiative by passing the uncommitted forces of the 2nd and 37th Divs. over a bridge to be thrown near Kolaki as soon as the 83rd Div. should have passed that point. Meanwhile, the newly arrived 54th Div. was to attempt another passage at Ostrolenka, while, further up, the VIII. Army was to force a crossing near the Skwa mouth, preparatory to an advance against the Lomzha–Bialystok region.

On July 27 the Russian attacks, instead of increasing in violence, began to break down into local and spasmodic efforts, though these efforts continued S., S.E. and E. of Pultusk till July 29. On this front the German Command decided, on July 27, to stand henceforth on the defensive, for Ludendorff, ever pressing for maximum results, was striving to keep the centre of gravity of the offensive well N. of the Bug, in spite of the smallness of the tactical gains that had been secured at Ostrykol, Lomzha and above. On this and the following days there was little change in the situation at Ostrykol bridgehead, but E. of Lomzha the Germans reacted with great vigour. In the centre the 3rd Div., on the left the 4th Guard Div. supported by part of the 83rd Div. of the I. Corps, and on the right the 26th Div. working its way N.E. from the Ostrykol line to rejoin its corps, swept the Russians back to the line Josefowo–Goworowo–Rembisze by nightfall on July 27, while the main portion of the 83rd Div. struck out northward according to its original purpose, and reached Cisk, Lipianka and even the S. edge of Kamionka village, thus opening the passage at Kolaki for the mixed forces of the 2nd and 37th Divs. gathered there, and freeing the worn-out troops in the Kamionka bridgehead.

From that point the battle N. of the Bagno Pulwy became, in the main, the slow driving of an enemy who, although his fighting energy was becoming exhausted by disaster, was holding ground to gain time for the safe passage of his retreating frontal armies. Besides this resistance, difficulties of communication and supply made the follow-up much slower than it had been from Przasnysz to the Narew. On July 28 the 54th Div. made its attempt at Ostrolenka and failed, and it was brought round next day to the Kolaki bridge, over which the mixed elements of the 2nd and 37th Divs. were then streaming to join the 83rd. On July 30, after the last Russian counter-attacks on the S. front had died away, Gallwitz withdrew the 1st Guard Res. Div. which was sent to join the forces N.E. of Rozhan. By July 31 there were between the Ostrykol and the Kamionka bridgeheads, on a line passing through Josefowo–Goworowo–Cisk–Narew below Kordowo, ten divisions against not more than four of the Russians. But some of these ten divisions were worn out; and a Russian counter-stroke on July 31, which at Cisk fell upon and broke the Landsturm and Ersatz units of the 83rd Div., which had already lost over 3,000 men, imperilled the whole German offensive for a time. Nor was it till the evening of this day that the Russians finally gave up the pressure on the Kamionka bridgehead.

This, however, was the last offensive effort of the Russians on the Narew front; and a continuance of the German movement northeastward led, on Aug. 3, to their giving up the defence at Ostrolenka, which was the less tenable as von Scholtz's VIII. Army had by this time crossed the Narew in two places higher up.

The final situation (Aug. 4) of the Germans after the Goworowo battle, which was also the initial situation of the battle of Ostrow, was as follows:—XVII. Res. Corps (Pfeil, 85th, 86th Divs.), Nasielsk–Pniewo; XI. Corps (38th Div. and Menges's Div.), Pniewo–Bagno Pulwy; Guard Cav. Bde., Bagno Pulwy; XVII. Corps (35th and 36th Divs.), 2 m. W. of Wyszkow–Ostrolenka railway, from Siezychy to Kobylin; XIII. and I. Corps (26th, 3rd, 4th Guard, 1st Guard Res., 50th Res., 54th, 83rd, 2nd and 37th Divs.), on the line Josefowo–Czernie–Nogawki–Troszyn–Kurpie Dworskie on the Ostrolenka–Bialystok railway. The left, on the Ruz, was in touch with the right of Scholtz's Army.

In the three weeks of the German Narew offensive (July 13–Aug. 3), the Gallwitz Army Group captured in all about 50,000 prisoners, and with them only 14 guns and 150 machine-guns—an unusual disproportion, which clearly indicates the way in which the Russians, in the summer of 1915, conducted their defence. (C. F. A.)

NAROCH LAKE, in Lithuania (formerly in the Russian Government of Vilna), the largest of the numerous lakes in which the tributaries of the Vilya and the Disna have their origin. It is nearly equidistant from Vilna (62 m.) and from Dvinsk (72 m.), and lies 37 m. N. of Molodechno railway junction. The lake, which measures 8 m. by 6 m. at its longest and widest, drains into the small river Naroch, which, receiving another stream from Lake Viszniev at the village of Naroch (21 m. S. of the lake), flows on to join the Vilya E. of Smorgon. In Sept. 1915 this region witnessed the last attempt of Hindenburg to reach the lines of retreat of the Russian armies, and the successful counter-attacks of the latter (battle of Vilna-Molodechno). Next spring it was the scene of the great battle described below.

Battle of Lake Naroch, or Postavy (*March 18–27 1916*).—The conclusion of the German advance in 1915 had brought the German forces in this quarter on to a general line that ran from Lake Drisvyaty—the limit of the Dvinsk front—by Bidsy and Postavy to Lake Naroch and thence to Smorgon on the Minsk–Molodechno–Vilna railway, from which place it continued through Baranovichi southward. Although, broadly, this line runs N. and S., its course was really somewhat sinuous, conforming as it did to natural lines of defence, which in the campaigns of the Russian front are of supreme importance owing to the fewness of communications and the low economic development of the country. From Drisvyaty to Smorgon (about 95 m.), along the sinuosities of the actual line, only five gaps of more than about three miles wide exist in the barrier of lakes, rivers and marshes. These gaps lie N. of Vidzy, near Postavy, and on the proximity of Lake Naroch; and it was naturally at these points that the military efforts about to be described focussed themselves.

In the region of Lake Naroch the German line, held defensively since the close of the 1915 campaign, broke out of the general N.–S. direction into a salient, which, though weakened by the circumstance of its having 4 of the 5 gaps above mentioned on its front and flanks, offered a strong protective water-line, and so required relatively few troops to hold it. This salient, having about 45 m. of trench or water front, and a depth at its centre of about 10 m., was in no sense a "pocket," and the chances of its becoming so by pressure on its flanks were limited by the narrowness of the gaps on these flanks that an assailant could use. Indeed, the higher authorities of the German east front seem to have expected an attack, not on the salient itself but further S., about Smorgon, where a rapid western advance by the Russians, with relatively good communications behind them, might have converted this flat salient into a really dangerous bulge. The Russian Command, however, chose otherwise.

In the N. the salient began at Vileity, where the course of the Komaika stream bends sharply westward and ceased to protect the German front. Between Vileity and Moscheiki is a gap 3½–4 m. wide, and at Moscheiki, taking contact with another stream, the Olsiza, the line of defence began to follow a chain of small lakes and streams that is only broken by very narrow gaps between lake and lake till the greater Lake Miadzol is reached. Thus the Vileity–Moscheiki gap was the only place between Vidzy and Lake Miadzol at which the conditions were favourable to a great offensive. The front available was narrow, and communications poor, but great forests were available for the concealment of the attack preparations and the artillery. Though the gap is partly marsh, the Germans had preferred to run their line nearly straight across it—close up to the edge of these forests—rather than withdraw it some miles back to higher ground and leave the Vileity positions, on the one side, and the Moscheiki position, on the other, as dangerously advanced salients. Given sufficient troops and means and an improvement of the routes within the forests, it seemed that the breaking of the German line could be ensured, and once it was broken a vigorous drive southwestwards would take the attackers on to higher ground, where they would envelop the left limb of the salient and reap their harvest of prisoners and *matériel*.[1] Further, by obtaining control of the railway line Postavy–Novosventsyany, they would be in a position, later, to push an advance against the Vilna–Dvinsk line, the artery of the German N.E. front. Lakes Miadzol and Naroch and the solid ground between them formed the flattened apex of the salient. In front of them, protecting the avenue to some extent, lie other lakes. Approximately at Lake Miadzol lies the watershed between the Disna and Vilya systems. The southern limb of the salient was short (7½ m. in a straight line). It began at Bliznika on the shore of Lake Naroch and ended on Lake Viszniev near Ostrovlani. But the trace of the line, dictated by the ground, was peculiar and considerably influenced the course of the battle. Between the two streams that connect Lakes Naroch and Viszniev with the Vilya basin lies a wide area of marsh, but this area is traversed by two long land-bridges of higher, sandy ground, each 3–4 m. in breadth, which, running in from the E. and the S. respectively, converge in well-marked hills near Nosovice. Between these land-bridges the marsh drives a deep wedge, so that both for attack and for defence the southern face of the salient was divided into two distinct areas, which were connected, for the defence, by a trench-line across the narrowest part of the marsh, and, for the attack, by various islands of dry ground in the midst of the marsh whence enfilade or oblique fire could be brought to bear on the ridge; for, in order to minimize the frontage of his marsh-trenches, the defender placed them far up the wedge, leaving his positions on the sand-ridges as salients. Specially dangerous for the defence was the position on the E.–W. ridge, which ran close to Naroch and could be enfiladed both from the "islands" in the marshes and from the opposite shore of the lake. Here purely local conditions—the need of securing possession of what, for the region, are commanding hills—brought the German line to a positive apex. On the other hand, though a successful Russian offensive could be pushed along either or both the land-bridges, as far as their junction about Nosovice, advance beyond that village was barred by the Perekop stream, which, rising close to Lake Naroch and emptying into Lake Viszniev, cuts right across the dry land avenue, while, further, a long lake lying behind Viszniev would cramp the left flank of the advancing victor and limit him for many miles to the same frontage as that of his original attack. Thus the most that he could expect from success in this quarter was the seizure of a barrier or anvil (the Perekop), against which the garrison of the salient might be driven by hammer-blows from the Moscheiki gap.

The military features of the Naroch salient, then, afford an excellent example of the way in which strategic and tactical values change according to the scale of the operation contemplated. In the case of quite small operations, the salient must be regarded as very strong, while for a grand offensive on the largest scale—the case considered by the German Higher Command—the centres of gravity lay not in the salient itself, but away to its flanks, where the possibility existed of converting it into a great strategic "pocket." But, for the intermediate type of operations—the large-scale effort aiming at tactical and moral rather than strategic results—the attack possibilities, even on the short flanks of the salient itself, were not inadequate; and it was against this type of attack—too heavy for the local troops to meet, yet not so heavy that the Higher Command could afford to expend its entire reserves in supporting them—that the defence was, in the *ensemble*, weakest. This was the case that actually occurred, and it imposed the maximum strain both on the German fighting troops, who were called on to make head against great odds, and on the German Higher Command, for which (as Ludendorff's memoirs show) the correct disposition of the reserves was a matter of extreme difficulty and anxiety.

The choice of this intermediate form of offensive by the Russians was, however, not deliberate, but imposed by unforeseen events. Their original intentions and their first preparations were based on the decisions of the inter-Allied conference, which fixed July 1 as the date at which great offensives would be launched simultaneously on all fronts. But in Feb. the Germans forestalled this plan by attacking Verdun with such power and fury that the western front was thrown into a state of acute crisis. Repeated calls were made by the French for a relief offensive in the east, and the Tsar decided that these calls must be answered. Preparations were therefore expedited, and concentrated upon the Naroch salient, an objective evidently suited for such an offensive, and one in which local gains would improve the prospects of the later, main offensive contemplated.

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[1] A switch-line was drawn across this higher ground from Goduzizschki, S.E. to the main position just N. of Lake Miadzol. But this line was incomplete at the time of the battle.

The technical and tactical fitness of the Russian army for a trench-warfare offensive, however, was still low—as indeed it remained throughout 1916. Guns and munitions were available on a larger scale than in 1915; new methods had been adopted from the French fighting regulations of autumn 1915; and the army was stronger than at any previous period, in spite of its appalling losses.

But, instead of five months in which to study the application of these new methods to Eastern conditions of armament and communications, and to inoculate the army generally with the doctrines thereby established, there were now only a few weeks available, and this handicap was the more important as the army was now, substantially, a new army. It was the product of the wave of patriotic fervour which had followed the defeats of 1915.

Hitherto, the army in the field had been practically the peace army with its reserves, the latter trained to the same ideas and broken to the same discipline as the active troops. No new creations had been put into the field corresponding to the German "new reserve" formations of Sept.–Dec. 1914, or the British territorial and new army divisions. Surplus resources of the peace-trained categories, and batches of war recruits as well, had been absorbed in the system of the old army to replace casualties. But from Sept. 1915, when the Tsar assumed personal command and proclaimed a war of liberation, moral forces which had been excluded from, or scarcely tapped by, the old army system came into play. Recruiting and war-work were galvanized by a new spirit, and the Russian leaders, habitually more reckless in the expenditure of human life than those of the Central and Western European nations, now found themselves in control of new masses which, in reality, stood in need rather of control and economical management than of driving.

Given those moral and technical factors, the course of the Russian spring offensive of 1916 almost explains itself. Hasty preparations in the hinterland, ruthless urging-on of enthusiastic and inexperienced troops in the front line, might suffice in the open-field shock of crises such as Ypres or Lodz; but in a trench-warfare offensive of limited scope, under peculiarly difficult conditions of ground and weather, they could only lead to costly defeat, except against an unusually weak opponent. Such an inferiority on the defender's side, however, the Russian staff was justified in assuming. Between Pinsk and the Baltic they had about 75 divisions, each of 16 battalions, to the enemy's 44, most of which had 9 battalions only; and it was possible with these proportions to keep numerically equal or superior forces on all parts of the line, while assembling very greatly superior masses at the points of attack.

The German dispositions were accurately known to the Russian staff. From the river Disna to Krevo (S. of Smorgon) was the point of von Eichhorn's X. Army. At the beginning of March 1916 there were, between these limits:—the 17th Landwehr Div., Bavarian Cav. Div., 3rd Cav. Div. from river Disna to Vileity inclusive, grouped under "No. 6 Cavalry Staff" (Gen. von Garnier); the 42nd, 115th, 31st and 75th Res. Divs. and 9th Cav. Div. (reconstituted as a normal infantry division) under XXI. Corps headquarters (Gen. von Hutier), round the Naroch salient to Lake Viszniev inclusive; the III. Res. Corps of two divisions, from Viszniev to Smorgon exclusive; and the XL. Res. Corps, at Smorgon and Krevo. Behind his centre, in the salient, Eichhorn placed his army reserve, the 80th Res. Div. Counting in the last named, this gave an average density of one battalion to the mile over the whole front (the equivalent of 87 battalions for 85 miles). In winter the front had to be fairly evenly held, as the lakes gave only a diminished protection till the thaw should set in. Nowhere did it reach a density of two battalions per mile, except at the most exposed point—the apex of the line on the land-bridge S. of Lake Naroch on the dangerous Vileity–Moscheiki front—where it was about one and one-half. As a comparison it may be noted that, at the Somme, von Below's I. Army had an average density of three battalions to the mile.

On the Russian side General Ragosa (commanding the II. Army in succession to Gen. Smirnov) disposed of 11 infantry divisions and one cav. div. in line, viz.—I. Corps of three divisions N. of Postavy (exclusive); XXXIV. and IV. Siberian Corps, four divisions, from Postavy (inclusive) to Lake Naroch (exclusive); and V. and XXXVI. Corps (four divisions) and Ural Cossack Div. facing the Naroch–Viszniev front, besides other forces in the same proportion opposite the German III. Res. and XL. Res. Corps. For the battle, these were reinforced by the I. Siberian, XV. and XXVII. Corps (six divisions), and 6th and 8th Cav. Divs. in the forests facing Vileity–Moscheiki, and by the III. Siberian and XXXV. Corps (four divisions) opposite the Naroch–Viszniev front. In all, then, there were 21 infantry divisions and 3 cavalry divisions, equivalent to about 345 battalions of infantry. Elaborate measures were taken to keep this concentration secret. Some of the combats initiated with the object of misleading the German command almost ranked as battles, notably the fighting of March 19–26 at Jakobstadt on the Dvina; and, although von Hutier kept "General Headquarters, East" informed as to the forces gathering on the Naroch front, the collation of his reports with those from other sources did not enable Ludendorff definitely to discern the real point of attack till the eve of the battle. Moreover, even within the salient itself, von Hutier was unable to accumulate his meagre forces on the flanks, for the lakes along this front were still frozen hard. At the last moment Ludendorff sent the XXI. Corps one fresh division, the 107th, and detailed others (86th Div., half 85th Div., 119th Div. and one regiment) to follow in succession, if required. The Russian surprise concentration, in short, was successfully achieved, in spite of all the handicaps of trackless hinterland, hurry and enemy vigilance. At 6 A.M. on March 18 the Russian artillery opened fire on the Naroch–Viszniev front—with an intensity that the Germans had never yet experienced on the eastern front—followed at 7 A.M. by that on the Vileity–Moscheiki front, which took under fire also the defenders N. of Vileity and those S.E. of Moscheiki as far as beyond Postavy.

The main lines of the struggle which followed were governed by the conditions of terrain and of *moral* above discussed. As in the case of the French offensive on the Aisne thirteen months later, the significance of the battle lies less in its incidents than in its general results. On the first day, after a bombardment which was at first very effective but fell away later as the Russian batteries were picked up successively by the German artillery, masses of infantry debouched to the attack on the Vileity–Moscheiki front and the Naroch land-bridge, the Viszniev land-bridge being at the same time attacked by smaller forces. In the night of March 17–8, and on succeeding nights, various attacks were delivered on the minor gaps in the lake barrier between Postavy and Lake Miadzol, and they had the effect of keeping von Hutier constantly anxious for the security of his front, and so—till the arrival of the fresh divisions—limiting the reinforcements available for the Vileity–Moscheiki and the Naroch–Viszniev fronts, on which the weight of the Russian offensive was concentrated

The Russian infantry attacks, which began after 3–4 hours artillery preparation, were extremely violent but disjointed. The defending artillery was worked to a well-prepared scheme, and (according to German accounts) assisted by sound-ranging posts. On the N. flank its counter-battery shooting into the forests had the effects of what later came to be called a "counter-preparation." In the débris of trees and bushes, the Russian infantry attacks lost unity and force, and were delivered at different times on different sections of the front. The available Russian artillery could thus devote itself to each objective in turn, but, on the other hand, the more efficient artillery of the defence could concentrate on each assault as it debouched over the glades separating the Russian forests from the woods in the German line across the marsh. Thus the German infantry, though very much inferior in numbers, was able to stand assault after assault, while suffering heavy losses under the Russian artillery fire and holding defences that were breastworks rather than trenches; and at nightfall the Russians drew back into the forests, having suffered enormous casualties without reaching the enemy's trenches at any point. Attacks on the village of Vileity, held by the right of the German 3rd Cav. Div., were equally futile. On the Naroch–Viszniev front also the assaults were fierce but disunited, and here too the artillery of the German 75th Res. Div. and 9th Cav. Div. could focus its efforts on each assailant in turn, even that of the III. Res. Corps S. of Lake Viszniev coöperating at times. In sum, the Russians, on the first day, suffered useless and terrible losses in regimental assaults delivered against steady infantry, uncut wire and skilfully handled artillery.

For the following night and day, the Russians changed their tactics. The artillery devoted itself to the demolition of trenches, to wire-cutting, and to the harassing of the billets in the villages behind the defenders' lines, with frequent small infantry attacks intended to force the defence to man its trenches and to march its reserves hither and thither. In this policy they were to some extent successful; the first of the German reinforcing divisions to arrive, the 107th, was put in piecemeal to stiffen the Vileity–Moscheiki front. Outside the battle-field, Russian threats at Vidzy, at Jakobstadt and elsewhere grew more serious. Then, in the night of March 19–20 massed attacks were delivered on the Vileity–Moscheiki front.

The weather conditions both for attackers and defenders had now become terrible. On March 15 a thaw had set in, which, but for Verdun, would probably have caused Ragosa to postpone the whole operation. By March 20 it had reached such a point that the ice on the lakes was covered by 2 ft. of water, while the German trenches in the marshes, no longer pumped out, were waist-deep, and the communications were mere mud. Exhausting as were these conditions for the German soldier, they were paralyzing for the Russian staff. In the forests, which were not seamed with tracks like an Argonne or a Bois le Prêtre, formation for attack and transmission of orders and supply became almost impossible. The night attack on Vileity and on the woods near Moscheiki was utter confusion for both sides. Part of the German defence system was overrun in the first assault, but in the haphazard, frequently hand-to-hand, fighting that followed, superior cohesion and coöperation defeated superior numbers, and the Germans regained the lost trenches, with the aid of parts of the 107th Div. On March 20 the Germans began to receive further reinforcements, the 86th Div. and half of the 85th Div. (170th Bde.). These, however, were held for the protection of the centre and the S. front of the salient, and only the 80th Res. Div. was moved somewhat to the north.

On the night of March 20–1 the night assault was repeated, this time with larger numbers and simultaneously on both the battle fronts. On the N. flank, the assault swept over parts of the defences as before and penetrated deep into the marsh-woods, seeking especially to drive S. and S.W. on to the higher ground behind Postavy. Again resolute counter-attacks stopped its progress, but this time the Russians retained possession of the captured front trenches. On the land-bridge S. of Lake Naroch, a wild assault swept completely over the German 75th Res. Div. holding the "apex," and it was with difficulty that the defenders' line was reconstituted some kilometres farther back. Only on the Viszniev land-bridge was the assault definitely repulsed. The situation for the Germans became extremely critical. But again it was saved by counter-attack. On March 21 the last forces of the 107th Div., with the exhausted 42nd Div., retook the marsh trenches from the equally exhausted Russians; and on the Naroch land-bridge the putting-in of the whole 80th Div. (brought back from the N.), with parts of the 170th Bde. and 86th Div., not only stabilized the defence but gave it the upper hand. Then it became possible to relieve the exhausted 42nd and 75th Res. Divs. by fresh troops.

The battle continued for a week longer, on the same lines as in the critical days, but with decreasing intensity on the part of the Russians. Presently the lost "apex" was recovered by the Germans, and nearly a month later a local attack still further improved the position on the Naroch land-bridge. But by that time the whole front had become quiet. The last severe battle-day was March 26; after that date the Russian relief-offensive expired without having caused one German soldier to be brought over from France. The German Eastern Headquarters had passed through a period of extreme anxiety, and it is arguable that on March 17–8 they were taken by surprise. But, if so, their recovery was instant, and they managed to meet the calls of the defence out of their local reserves. For the Russians, the first offensive of the new armies was a disaster of far-reaching importance. Prepared, up to the moment of launching, with great adroitness, it had been "choked in blood and marsh" with an enormous cost in mass-casualties and mass-disillusionment.

(C. F. A.)

NATAL (*see* 19.252).—At the 1911 census the pop. of Natal, S. Africa, was 1,194,043, of whom 98,114 were whites, 953,398 Bantu, 133,439 Asiatics and 9,092 of mixed or other coloured races. Compared with 1904 the white pop.—which between 1891 and 1904 had nearly doubled—was practically stationary; there was an actual increase of 1,005. In 1918 a census of the whites showed that they numbered 121,931, evidence that the check in their increase had been temporary only. Natal, though the smallest, is the most densely populated province of the Union, with 37·40 persons to the sq.m. in 1918. The white and Asiatic pop. is mainly concentrated in Natal proper; of the Bantu 214,969 lived in Zululand at the 1911 census. Of the total coloured pop. in 1911 only 13·84% were returned as Christians (compared with 44·20% in the Cape). The chief towns were Durban (89,998) and Pietermaritzburg (30,555; in 1919 35,322). Ladysmith ranked next with 5,594 inhabitants. Pietermaritzburg, the capital, has handsome public buildings, including those of the provincial council and Natal University College.

The change from the status of a self-governing colony to a province of the Union affected Natal politically more closely than any other province since in it alone were the great majority of the white inhabitants of British descent. In the first Parliament of the Union the Natal members took an independent position, and the firm attachment of Natalians to the British connexion continued an unchanging factor in the S. African situation. Provincial administration was, however, carried on upon non-party lines (for the provincial system of administration *see* CAPE PROVINCE). The first administrator was Mr. C. J. Smythe, who had previously held office as Colonial Secretary and as Prime Minister of Natal. Mr. Smythe, who was reappointed for a second term in 1905, died in 1918 and Mr. G. T. Plowman succeeded to the post. The revenue raised in the province, derived chiefly from transfer duties and licences, increased from £118,000 in 1912–3 to £172,000 in 1917–8, the subsidies from the Union Government varying from £361,000 to £375,000. Over half the total expenditure was on education, the sums spent for that object rising from £169,000 in 1912–3 to £285,000 in 1917–8.

Natal was deeply interested in the question of Indians in S. Africa. Of the 152,309 Asiatics in the Union in 1911, no fewer than 149,791 were British Indians and of these 133,048 lived in Natal, where they had rendered possible the development of the sugar, tea and wattle industries, as well as providing labour for the coal-mines, railways and other public works. Besides labourers, there were many Indians engaged in professions and commerce. White S. Africans in general opposed the further increase of Asiatics in the Union; while, in 1911, the Indian Government, long dissatisfied with the attitude of Natal to Indians, prohibited the recruitment of indentured coolies. The Indians both in Natal and the Transvaal complained of many grievances, among them of the poll tax imposed in Natal on all non-indentured Indians. Their cause was championed by Mr. M. K. Ghandi, then resident in S. Africa. Arising out of the agitation, riots and disturbances occurred in Natal in 1913. Some 2,700 Indians started to march to Johannesburg. About 500 were stopped on the border; the rest entered the Transvaal, but were eventually induced to return. In 1914 the poll tax on Indians in Natal was abandoned while the Union passed legislation designed to prevent, with some few exceptions, the entry of further adult male Asiatics into S. Africa and to restrict Asiatics to the provinces in which they were resident. The so-called Smuts-Ghandi agreement of the same year was designed to guard the vested interests of Indians already in the Union (*see*, further, SOUTH AFRICA).

A notable element in the progress of Natal has been the development of coal-mining. The output, which in 1910 first exceeded 2,500,000 tons, rose to over 3,000,000 in 1916, but fell to 2,600,000 tons in 1918, the decline being attributed to the effect of the influenza epidemic of that year. In 1919 the output was 2,800,000 tons. Natal coal is of excellent quality, and commands high prices—double that of Transvaal coal. In 1918 the output was valued at £1,358,000. (F. R. C.)

NATHAN, ERNESTO (1845–1921), Italian politician, was born in London in 1845, and died at Rome on April 9 1921. He was the son of an Englishman, Joseph Nathan, and of an Italian mother, Sara Rosselli, both Jews. His parents had befriended Italian political exiles in England, and on the death of Joseph Nathan in 1858 the widow and son settled at Pisa, where the latter attended the university. Soon afterwards they had to repair to Switzerland on account of Sara Nathan's republican sentiments; it was then that Ernesto Nathan became acquainted with Mazzini, whose views became thenceforth his chief inspiration and cult, and he devoted himself as a journalist, teacher and social reformer to their diffusion. A violent anti-clerical, he soon joined the freemasons and was elected "Grand Orient" for Italy in 1899, but resigned in 1905 owing to internal disagreements. He became an Italian citizen, and although he had been a republican in his early years, he gradually accepted the monarchy as the best *régime* for Italy, and ended by being received at Court. He showed great activity in organizing the "Unione dei Partiti popolari" in 1900, a *blocco* of the various radical and anti-clerical parties in Rome, and when at the municipal elections of 1900 the clerical administration fell, Nathan was chosen as mayor. That an English Jew and a militant anti-clerical and freemason should become mayor of Rome seemed indeed incongruous, but he was selected for his sterling honesty and business ability. Unfortunately he lost no occasion to offend Catholic sentiment and frequently made himself ridiculous, becoming a butt for the comic papers and *revues*. His plans for modernizing Rome did much to spoil its beauty for no useful purpose. Reëlected in 1910, he fell when the *blocco* broke up in 1913. On the outbreak of the World War, in spite of his 70 years, he volunteered for the army and actually served as a lieutenant of infantry for a time. In 1917 he was reëlected "Grand Orient" but resigned a year later. He was editor of the National edition of Mazzini's works.

NATIONAL DEBT.—The World War, 1914–1918, brought about a complete transformation in the size and composition of the world's national debts. Those of the belligerent countries were swollen to an enormous extent. The liabilities of the European nations were inflated to a degree which in the pre-war period would have been regarded as symptomatic of financial madness and world-wide collapse of credit. The British Prime Minister (Mr. Lloyd George), at the close of the war, estimated its cost at about 40,000 millions sterling, a figure which was accepted by a number of statisticians in Europe and America. Table I. is compiled from Paper No. IV on Public Finance, issued by the League of Nations for the International Financial Conference held at Brussels in the autumn of 1920. For purposes of comparison pre-war figures are also given, when they are available.

The increases shown in Table I., however, cannot be regarded as mathematically correct. Like is not compared with like; the unit of value has been changed in many cases, inconvertible paper currency having been made the legal measure of value in place of a definite weight of gold in all the belligerent countries except the United States and Japan. In order to make a proper comparison it is necessary to make a correction for the depreciation expressed in gold, in the value of money in the various countries. There is, however, no mathematical formula for making this correction, but the existence of a 20% discount in the gold value of the pound sterling (in May 1921) shows that the margin of error is a very material one. From the standpoint of national finance the importance of these national debt figures depends upon their ratio to national revenue. Ratios are shown in Table II., which expresses the debt as so many years' purchase of current revenue.

The countries are arranged in Table II. according to the post-war percentages. As the true burden of debt can only be determined by the relation which it bears to capacity to carry it, it follows that Table II. gives a truer picture of the world's national debt position in 1920 than Table I.

In the case of certain countries such as Austria, Hungary, Poland, and Russia, where the depreciation of the unit of value

TABLE I.

Country	1919	1913	Debt per head, 1919			Debt per head, 1913		
	£	£	£	s.	d.	£	s.	d.
United Kingdom	7,832,000,000	706,000,000	168	[£129]*		15	10	0
Australia	350,000,000	17,500,000	62			3	10	0
Canada	505,000,000	57,200,000	58			7	4	0
India	616,400,000	274,000,000	1	5	9		19	0
New Zealand	201,100,000	90,000,000	172	15	0	91	10	0
South Africa	173,800,000	126,200,000				44	8	0
Egypt	93,389,000	94,200,000	7			7	12	0
France	8,472,000,000	1,345,000,000	222	8	0	34	4	0
Belgium	784,000,000	185,000,000	99	8	0	21	8	0
Italy	3,124,000,000	611,000,000	79	3	0	17	12	0
Spain	480,000,000	382,000,000	21	5	0	19	10	0
Portugal	342,000,000	130,000,000	57	0	0	31	14	0
Holland	230,000,000	97,000,000	31	7	0	15	5	0
Switzerland	148,000,000	68,000,000	35	4	0	16	18	0
Norway	56,500,000	20,000,000	20	12	0	8	0	0
Sweden	87,000,000	36,000,000	13	18	0	5	19	0
Denmark	51,000,000	20,050,000	14	14	0	6	17	0
Finland	74,000,000	—		—			—	
Latvia	23,700,000	—		—			—	
Czechoslovakia	388,000,000	—		—			—	
Serb-Croat-Slovene	234,000,000	26,500,000		—		8	17	0
Greece	129,000,000	48,600,000	22			6	16	0
Poland	440,000,000	—		—			—	
Rumania	445,000,000	65,600,000	25	15	0	9	2	0
Germany	9,850,000,000	258,000,000	159	10	0	3	14	0
Austria	3,470,000,000	510,000,000		—				
Hungary	1,587,000,000	270,000,000		—		15	12	0
Bulgaria	218,000,000	35,000,000	22	0	0	9	18	0
Turkey	£T. 412,300,000	£T. 151,600,000	21	0	0	7	11	0
United States	5,096,800,000	205,800,000	45	[£26]*		2	8	0
Argentina	127,080,000	123,800,000	16	9	0	14	16	0
Brazil	179,600,000	194,000,000	7	6	11	8	9	0
Chile	49,620,118	32,800,000	12	8	0	12	4	0
Siam	6,700,000	6,300,000		14	6		14	0
Japan	352,700,000	271,940,000	6	1	0	5	1	0
China	171,906,000	130,000,000		10	0		7	0

*Figures in brackets denote net debt per head.

Table II.—*Ratio of Debt to Government Revenue.*

Country	Ratio of pre-war debt to pre-war revenue	Ratio of post-war debt to post-war revenue
Portugal	—	14·5 yrs. purchase
France	6·6 yrs. purchase	10·0 " "
Switzerland*	17·0 " "	9·7 " "
Australia	0·8 " "	7·7 " "
Italy	6·7 " "	7·5 " "
Germany	1·4 " "	7·0 " "
Canada	1·7 " "	6·9 " "
Spain	7·0 " "	6·5 " "
South Africa	7·9 " "	6·0 " "
United Kingdom	3·5 " "	5·5 " "
Belgium	6·6 " "	5·1 " "
Holland	5·0 " "	4·5 " "
U. S. A.	1·0 " "	4·2 " "
Japan	3·8 " "	2·9 " "
India	2·6 " "	2·8 " "
Denmark	2·9 " "	2·2 " "
Sweden	2·4 " "	2·2 " "
Norway	2·2 " "	1·5 " "

*The high figure for Switzerland is mainly due to the fact that big loans were incurred by the Federal Government for railways.

reduced its gold value to an infinitesimal figure, the factor of correction is a very big one. The clearing of the financial wreckage of the war, the resumption of wealth production and exchange, must have the effect of raising the unit of value expressed in gold, and thus increase the burden of debt expressed in gold money and commodities. But this is true only of countries in which the depreciation of the unit of value was less serious. In 1921 it was quite impossible to indicate what countries would be able to restore the gold value of their currencies to the pre-war parity. The countries mentioned above, however, were clearly not in a position to restore the pre-war value of their currencies. In fact Austria in 1921 drew up a plan (at the instance of the League of Nations' Finance Committee) providing for the creation of a new unit of value. This, if applied, would have the effect of reducing the burden of debt expressed in gold and commodities, and would, of course, facilitate the revival of Austria's economic activities. The establishment of a legal standard of value of lower gold value than existed before the war must, of course, involve loss to the creditor parties in respect of all contracts made before the war, while on the other hand it must prevent the further enrichment of the *nouveaux riches* who had acquired their wealth during the war period in terms of a low unit of value. On the whole a greater measure of justice to the people of Austria might be rendered by the stabilization of the unit of value at a low figure than would be secured by attempting to raise it, since the great bulk of property in Austria came into the possession of its present owners at a price which fully expressed the depreciation of currency.

British National Debt.—Vast changes had been effected in the British national debt. The great bulk of the debt of the United Kingdom no longer in 1921 consisted of the (practically irredeemable) annuities known as "Consols." For the first time in the history of the British Empire it had been compelled to borrow extensively abroad during the war. The first foreign loan was issued in New York in 1915, the French and British Governments jointly and severally issuing a 5% five-year loan for $500,000,000 in Oct. of that year, the proceeds of which were divided equally between the two nations. This loan was repaid on maturity on Oct. 15 1920, and its repayment had the effect of strengthening American confidence in British national credit. Later, during the war, the British Government issued its own loans in New York; the first for $250,000,000 in two-year 5% bonds, which fell due on Sept. 1 1918, the second for $300,000,000 in three and five-year bonds bearing 5½% interest, which fell due in Nov. 1919 and 1921. The third was for $250,000,000 in one and two-year 5½% bonds, which fell due in Feb. 1918 and 1919. Collateral security was provided for all these loans mostly in the form of dollar bonds, which the British Government either bought or borrowed from its nationals under the Dollar Securities Mobilization Scheme. Other credits were raised in America, including a British banking credit, bearing 5% interest, for $50,000,000, which matured in June 1917; a credit of $25,000,000 for wheat purchases, which was paid off in 1917; and Treasury Bills for three months which were issued up to a maximum amount of $150,000,000 by Messrs. J. P. Morgan & Co., acting as agents for the British Treasury. Prior to the entry of the United States into the war on April 7 1917, Great Britain raised loans in America totalling $1,131,400,000. After that date the United States Government lent money freely to the British Government direct. An arrangement was made in 1919 by which interest payments on the Government loans were deferred for three years, namely, until 1922, and at the close of the year 1920 the total advances amounted to $4,196,818,000. Loans were raised in Argentina, Uruguay, Spain, Holland, Switzerland, Japan, Chile, and Sweden. The bulk of these were rapidly repaid, but the great bulk of Britain's debt to America still remained untouched in June 1921.

In two years from April 1 1919 the British external debt was reduced by £203,000,000; in the financial year ended March 31 1921 the reduction was £117,000,000. On that date the total was £1,161,560,000 at par of exchange. In the year 1920–21 the British debt to America was reduced by nearly £75,000,000, and the debt to Canada by £20,000,000. On March 31 1921 the only debt owed to foreign nations apart from the United States was £826,000 to Sweden. On the same date the British debt to Canada was $125,000,000.

The 5% War Loan issued at the beginning of 1917 had become the premier domestic British security, the old consols being now of an inconsiderable amount comparatively and relegated to the background in the market. Cash subscriptions to the loan had amounted to £966,048,000, and conversions (of the earlier 4½% Loan and Exchequer Bonds) amounted to £1,103,797,000, making a total of £2,069,845,000.

In December 1915 the principle of "continuous borrowing" was adopted for British Government war-borrowing. On the 17th of that month 5% Exchequer Bonds were put on sale, and realized, in the period which terminated on June 1 1916, £237,829,469. Four series of these bonds, the last series bearing 6% interest, were put on sale down to Dec. 30 1916, when the sales were temporarily suspended in preparation for the issue of the 5% War Loan, the greatest loan operation of the war. On April 13 1917 the daily sales of Exchequer Bonds were resumed, 5% Bonds being again offered at par. Sales of Exchequer Bonds, however, were brought definitely to an end on Sept. 22 1917 (partly because, by Statute, this form of issue was limited to a six-year term), and on Oct. 1 1917 a new type of security called National War Bonds, of a character more appropriate for the Government's requirements, was offered for day-by-day subscription, bearing 5% interest and redeemable at a premium varying from £2 to £5%, according to the maturity of the bonds, which ranged from 5 to 10 years. A great deal of energy was imparted to the campaign for selling these bonds, and it achieved marked success. Down to March 31 1918 sales of these bonds amounted to no less than £616,193,692. The second series, sold between April 1 1918 and Sept. 30 1918, produced £483,224,088; the third, between Oct. 1 1918 and Jan. 18 1919, yielded £494,399,505; and the fourth, between Feb. 1 1919 and May 31 1919, £75,745,151. "Continuous borrowing" amply justified all that was expected of it. By withdrawing from active circulation large amounts of currency the daily borrowing had the effect of holding commodity prices in check, the tendency of the latter being strongly upward on account of the continuous inflation of currency and credit involved by unceasing Government borrowing from the banks. During the war period investors showed a marked preference for short-dated securities, and the Government accordingly offered securities redeemable within a comparatively few years. But with the cessation of hostilities and diminution of expenditure the Government decided to make an attempt to issue a fairly long-term loan with the object of reducing the floating debt, which was then in the neighbourhood of 1,000 millions. On June 12 1919 it issued the first Funding Loan, bearing 4% interest and redeemable at the earliest in 1960, and at the latest in 1990. The bonds were offered at 80% and produced only

£215,200,000. At the same time the Government sold 4% Victory Bonds at 85%, subject to drawings at par almost immediately and acceptable at par in payment of death duties. These bonds produced £216,900,000. The failure of this operation compelled the Government to defer the question of funding any further portion of the floating debt (which rose to about 1,300 millions) for an indefinite period, especially as the demand for capital was exceedingly active, and funding could only be effected at a high cost, the Bank Rate being for over a year (from April 15 1920 to April 28 1921) 7 per cent. The approaching maturity of the short-term bonds issued during the war period, however, began to be a pressing problem in 1921, for the bonds, as they became very short, found their way to the banks and became potential floating debt. In April 1921 the Government decided to invite holders of 5% National War Bonds maturing in the years 1922 to 1925 to exchange their holdings for 3½% conversion stock. Holders were offered £160 to £163 of new stock for every £100 bond, giving a yield in interest of £5 12s. od. to £5 14s. od. per cent., against £5 7s. 6d. on the bonds held. About £632,000,000 of bonds were affected by the offer, and if the whole had been converted the addition to the State's liabilities would have amounted to about 400 millions, and the addition to interest charges about 4 millions per annum. Applications for conversion amounted, however, to only about 160 millions. In July 1921 a further effort was made to convert the very short term bonds into eight-year Treasury Bonds bearing 5½% interest. These bonds were offered at 97%.

When the British 5% Loan was issued in 1917 a 4% "tax compounded loan" was coupled with it. It was an effort to meet an insistent public demand for a Government security exempt from the heavy rate of income tax. Another way of meeting this same demand was attempted in some degree by a departure from the practice of paying dividends less tax. The 5% War Loan, National War Bonds, and the Funding Loan all contained a provision that dividends should be paid without deduction, and that tax should be collected upon it in the holder's annual return. The 4% Loan was not really a tax-free security. It was an issue, the interest on which was reduced to a figure which represented a compounding of income tax at the then maximum rate, namely, 5s. in the £1. The interest on the loan was not exempt from super-tax, and for the purpose of calculating liability to it, and also for the purpose of computing total income for purposes of exemption and abatement, it had to be assumed that the 4% interest was the net income after the deduction of income tax at the full normal rate of income tax prevailing. This meant that the holders of the 4% Loan were placed in about the same position as regards super-tax as holders of the 5% Loan, and in a worse position as regards exemption and abatement, for

TABLE III.—*Issues of British War Loans.*

Issue	Amount of Issue	Price of Issue	Date of Issue	Cash credited to H.M. Exchequer
				£
3½% War Loan, 1925–28	£350,000,000	95%	Nov. 17–24 1914	331,798,408
3% Exchequer Bonds, 1920	50,000,000	Tender £95 18s. 1d. average	March 5–10 1915	47,942,345
4½% War Loan, 1925–45 . . .	Unlimited	Par	June 21–July 10 1915	592,345,604
5% Exchequer Bonds, 1920	Unlimited	Par	Dec. 17 1915–June 1 1916	237,829,469
5% Exchequer Bonds, 1919	Unlimited	Par	June 2–Sept. 27 1916	34,262,604
5% Exchequer Bonds, 1921	Unlimited	Par	June 2–Oct. 2 1916	62,495,527
6% Exchequer Bonds, 1920	Unlimited	Par	Oct. 2–Dec. 30 1916	160,951,700
5% War Loan, 1929–47 . . .	Unlimited	95%	Jan. 11–Feb. 16 1917	5% and 4% War Loans 941,476,710
4% War Loan, 1920–42	Unlimited	Par	Jan. 11–Feb. 16 1917	—
5% Exchequer Bonds, 1922	Unlimited	Par	April 13–Sept. 22 1917	82,110,000
National War Bonds—1st Series . . .	Unlimited	Par	Oct. 1 1917–March 31 1918	616,193,692
National War Bonds—2nd Series . . .	Unlimited	5% Bonds Par 4% Bonds Apr. 1–22 Par Apr. 23–Sept. 30 101½%	April 1–Sept. 30 1918	483,224,088
National War Bonds—3rd Series . . .	Unlimited	5% Bonds Par 4% Bonds 101½%	Oct. 1 1918–Jan. 18 1919	494,399,505
National War Bonds—4th Series . . .	Unlimited	5% Bonds Par 4% Bonds 101½%	Feb. 1–May 31 1919	75,745,151
4% Funding Loan .	Unlimited	80%	June 12–July 12 1919	215,200,000
4% Victory Bonds .	Unlimited	85%	June 12–July 12 1919	216,900,000

no claim to repayment of income tax was allowed in respect of the 4% Loan interest. At the time of issue the income derived from the 4% Loan was, for the purpose of super-tax, reckoned as £5 6s. 8d., or 1s. 5d. per cent. more than the income on the 5% Loan. In 1918, when the income tax was raised to 6s. in the pound, the holders of the 4% Loan, though exempt from the tax, found that for super-tax purposes their interest from the Loan was reckoned as £5 14s. 6d. per cent., while that on the 5% Loan remained at £5 5s. 3d. This shows that the terms of the tax compounded issue had been devised with much ingenuity. The right of conversion into any future War Loan which was attached to the 4½% Loan, floated in the middle of 1915, and also to subsequent issues of Exchequer Bonds, became operative in connexion with these two Loans, but it was considered inadvisable to attach a similar conversion option to the new loans. Instead, a device was adopted to achieve the same object, viz. protection of the loan against depreciation in price. The Treasury undertook to set aside monthly a sum equal to 1s. 8d. per cent. of each loan to be used in the purchase of stock for cancellation whenever the market price fell below the issue price, viz. 95 in the case of the 5% Loan and par in the case of the 4% Loan. Undoubtedly the operation of this fund contributed to the maintenance of the market price, but it wholly failed to prevent the stocks falling to a heavy discount, though about 30 millions were annually spent in the early years. In March 1918 an issue of nominative £5 bonds was made. Their chief distinction was the facility with which they could be purchased and sold. No filling of forms was required. The bonds could be bought like postage stamps, but they failed to become popular. The most successful means of raising money for the war from among small investors was by the issue of a security entitled War Savings Certificates (*see* SAVINGS MOVEMENT). This novel and important form of popular borrowing was introduced in Feb. 1916. The certificates were purchasable at post-offices, banks, and through Associations formed for the purpose of stimulating their sale. Subsequently they were placed on sale at shops and stores throughout the country. The certificates were issued at 15s. 6d. each, and could be paid for in instalments. They were repayable in 5 years from the date of purchase at £1; later, the period of maturity was extended to 10 years, and the redemption value raised to £1 6s. 0d. The increase of capital was equivalent to a yield of £5 4s. 7d. per cent. compound interest. This increase of capital was exempted from assessment to income tax, but no person was allowed to hold more than 500 at a time. Although these certificates were issued for a definite period, provision was made for their encashment at any time, but premature encashment was discouraged by the absence of any capital appreciation in the first year of their currency. But the certificates being repayable on demand at not less than the price at which they were issued, they could not depreciate in capital value like other marketable securities. A great development of propaganda methods took place in 1917, and more particularly in 1918, and resulted in a very great increase in subscriptions to Government securities. In Table III. are shown details of the various British War Loan issues, taken from a list drawn up by the Bank of England.

On March 31 1920 the British debt reached its highest total, namely, £7,829,000,000; on March 31 1921 it had fallen to £7,573,000,000. (C. J. M.)

NATIONALIZATION.—The fact that "Nationalization" had become in 1916–21 one of the burning political questions of the day is unfortunate as regards arriving at a clear appraisal of its principles, for, from the outset, it is difficult for a writer to avoid a certain bias in approaching its discussion. Yet Nationalization of some services and industries has been an accomplished fact for many years, without giving rise to any political controversy. In its narrow sense, Nationalization means taking over the ownership and control of an industry or service by the community, as opposed to ownership and control for the benefit of a person or a certain number of persons, be it in their individual capacity, or in corporate form in the shape of a company. The most familiar example of such a nationalized service in Great Britain and, indeed, practically every country is the Post Office.

The word Nationalization is, however, generally used to denote the principle of Public Ownership (to employ the much better term used throughout N. America) as opposed to that of private enterprise. For instance, in 1908, the three separate dock companies (one of them already an amalgamation of several companies) which owned and operated those undertakings in and around London were bought out, and ownership and management vested in a composite body known as the Port of London Authority, the Board of which is constituted as follows: seventeen members are elected by the payers of the dock dues; one by the wharfingers; four are selected by the Government (one representing Labour); two by the Corporation of the City of London, and two by the London County Council (one of them representing Labour). Strictly speaking, it would not be correct to say the Docks of London were "nationalized," for the taxpayers and ratepayers of Northumberland, for instance, are not in any way directly concerned with the undertaking, but the exploitation or the carrying on of the enterprise of the Docks of London has been converted from a number of private undertakings directed to the earning of profits for a certain number of proprietors, into a public undertaking the primary function of which is to render to the town of London, and the region dependent thereon, services connected with the provision of dock accommodation and of the things accessory thereto. This is not really Nationalization, but it embodies the principle meant by ninety-nine people out of every hundred who use the word, viz.: Public Ownership, be such ownership vested in a national authority, a municipal body or an *ad hoc* authority like the Mersey Docks and Harbour Board or the Metropolitan Water Board. It is, therefore, with this interpretation of Nationalization that we shall deal in this article.

Relation to Socialism.—A word must be said as to the relationship of Nationalization to Socialism. The two are by no means identical and although the nationalization of the means of production, distribution and exchange has long been a Socialist shibboleth, many modern Socialists oppose Nationalization as being merely "State Capitalism," a form of industry, they say, in which the workers might still be exploited for the benefit of those who control the national machine—probably the same governing classes as we now possess. The truth of the matter is that, although Nationalization is not Socialism, it is the most suitable economic machine whereby the aims of Socialism can be carried out, because, by eliminating the private *entrepreneur* and converting him into a *rentier* in receipt of fixed interest instead of being a participator in the profits, it removes one of the conflicting factors in industry, namely the owner, and reduces these factors to two, viz. the community in its dual capacity of owner and consumer, and all the workers in that industry.

It is the elimination of this private profit-making incentive which, in the minds of the advocates of Nationalization, is one of the principal arguments in its favour, and, in the minds of its opponents, is the chief argument against it. Nationalize industry, say the latter, and you do away with the desire of personal gain which is the dominant human motive leading to improvement, invention and efficiency; you stereotype existing conditions, you do away with competition and all the benefits arising therefrom, and you get wasteful management from a horde of Government officials who ride on the backs of the tax-payers.

Against this, the advocates of Nationalization urge that private enterprise, precisely because its dominant motive is personal gain, often fails to render the service that is its ostensible justification; it leads to adulteration, misdescription, and all sorts of chicanery, and while competition has its undoubted value as a stimulus to invention and new methods, our present system of industry does, of itself, run to amalgamations, absorptions and price agreements resulting in the abolition of real competition with its attendant advantages, so that we arrive at much the same result as if we had Nationalization, in the shape of monopoly, open or concealed, but with the profits arising from the elimination of real competition and the economies resulting from monopoly and unification going into the pockets of a small section of the community instead of being spread over the whole nation, either in the shape of a better or cheaper service, or both; and that, even if our present imperfect Governments result in too many officials, it is no worse for the community that a certain number of persons (officials) with their families should be enjoying a decent livelihood out of the industry than that a number of other persons (*entrepreneurs* and large shareholders) should derive fortunes from the same industry. Further, they allege that no system of private enterprise combined with Government regulation (the usual suggestion for meeting a tendency towards monopoly) will be satisfactory, as it results in just that multiplicity of officials of the most uneconomic nature, in that they do not produce anything, that is the bugbear of State control.

It is not for us to determine here which view is right; and the former, the anti-nationalization view, is certainly that expressed most frequently in the columns of the Press. Be this as it may, it is an undoubted fact that throughout the whole world—in the United Kingdom as well as elsewhere—the principle of public ownership, unpopular as it appeared to be in many quarters, was in 1921 steadily gaining ground, and it may be useful if we consider some of the developments in this direction and endeavour to find some guiding principles which account for its growth.

Factors making for Public Ownership.—Prominent among these is the fear of combination among suppliers of services leading up to a monopoly, open or concealed, which, "human nature being what it is," inevitably results, sooner or later, in excessive prices being charged to the consumer. When this occurs, or tends to occur, in the case of a service vital to most sections of the community, a Government, however hostile its individual members may be to further extensions of public ownership, finds itself compelled to make a public service of it. It may itself assume a monopoly of such service, as in the case of Italy and Uruguay, both of which countries, early in the present century, had nationalized life insurance and made of it a national monopoly; more frequently, however, a Government in such circumstances starts a State-owned and operated service in competition with existing services, with the view of setting a standard of services and conditions and preventing prices from mounting beyond a reasonable basis. Coming under this head are the Commonwealth of Australia shipping line, the New Zealand and Queensland State Insurance Departments, the hundreds of publicly owned grain elevators that are to be found throughout Canada, and, in the United Kingdom, the Imperial Cable Service.

The Commonwealth Government line of steamers (*see* also SHIPPING) was started by the purchase in 1919 by the Australian Prime Minister (Mr. Hughes) of the Strath Line of 13 steamships, and some other vessels. The Australian Government gave it to be understood that it established the line as a means to a special end, viz. the protection of the Australian shippers and public from possible adverse results of recent amalgamations of private shipping interests, and not with any idea of driving the shipping companies out of the field. One of the abuses against which the institution of a State-owned mercantile fleet was aimed was the rebate system adopted by some of the big shipping lines, whereby shippers who forwarded goods by any line outside the combine had to pay higher freights, these being charged in the first instance and a rebate allowed only, provided that the said line received all their cargo. In an official circular issued by the Manager of the Commonwealth Government line of steamers appeared the following passages:—

> "It is not the wish of the Commonwealth Government Line to originate a rate war. The freights charged are those current in the Australian trade at the time of shipment. Equal rates are quoted to all shippers, large or small, private firms or Government Departments, and in the event of a reduction taking place while a steamer is loading all shippers will benefit by it alike.
>
> "A cash discount of 5 per cent. off the net freight is given to shippers on payment of accounts. *No primage is charged and no deferred rebate granted.*
>
> "In the event of shippers taking advantage of the services of this Line, and being penalized therefor by the confiscation of accrued rebates by any Line through which they have shipped previously, the Commonwealth Government Line is prepared to guarantee them against such loss, if they will sign the annexed undertaking to give the Line the first offer of their future business."

The Commonwealth Government actively continued the development of its shipping business, by the construction of 18 new steamers, with the result that in 1921 it had a fleet aggregating 444,000 tons.

The point that the principal aim of a State-owned competitive undertaking was to protect the public from overcharge, was brought out by the Lieutenant-Governor of Queensland at the opening of the Queensland Parliament in August 1920 when, referring to the State Insurance Department, he said:—

> "While not intended to be revenue-producing, this office has since its inception shown a profit averaging over £60,000 per annum, and has at the same time saved many thousands of pounds to the insuring public. . . . Through the State entering into competition with fire insurance companies reductions in premiums ranging from 25 per cent. to 33 per cent. have been effected in favour of policy holders, which means approximately a saving of £20,000 to those who pay fire insurance premiums."

In the case of the Imperial cable which links the United Kingdom with Canada, West Indies and Australasia, the chief factor in building up a State-owned system was the value for political and defensive purposes of having a cable wholly under British control, and in its advertisements the Post Office boasted that "the Imperial Cable is Government owned and is the only Atlantic cable under purely British control." While the rates charged for ordinary telegrams were the same as for those sent by other Atlantic routes, the official advertisements stated:—

> "It is the only Atlantic route on which the deferred service at reduced rates has been restored. A deferred telegram to Montreal and other places in Eastern Canada costs 4d. a word: to Jamaica 1s. 3d. a word: to New Zealand 1s. 4d. a word: to Australia 1s. 6d. a word."

Here we have the case of a nationalized service affording more facilities than its privately owned competitor.

Another motive for the provision by the State of a service hitherto performed by private enterprise is that of protecting persons against the dishonesty of individuals in the shape of malversation of trust funds. As in many similar directions, New Zealand was the pioneer in appointing a public trustee, but in 1908, despite active hostility on the part of the legal profession, such an office was opened in the United Kingdom.

Its purpose was described in the official pamphlet published by the Public Trustee Office as follows:—

> "The Public Trustee Act, 1906, was passed with the express object of enabling the public to guard against the risks and inconveniences incidental to the employment of private individuals in trust matters, and it substitutes for them a trustee who will never die, never leave the country, and never become incapacitated, and whose responsibility is guaranteed by the Consolidated Fund of the United Kingdom."

Extensive use was made of this nationalized service, which exists in competition with professional people and companies performing the same functions (*see* PUBLIC TRUSTEE).

Yet another circumstance which drives State or municipal authorities into public ownership is the fact that certain public needs exist which are not filled by private enterprise on account of their not fulfilling the first condition of private enterprise, viz. profit. It is this incentive, rather than those already referred to as governing Australia's action in acquiring shipping, that caused Britain, the United States and Canada during the war to build and operate State-owned merchant fleets. With the disappearance of the emergency created by the war, the British Government rapidly disposed of its merchant ships to private owners, and its action in this respect was in 1921 apparently being followed by the United States Government.

For the same reason as that already mentioned, viz. the failure of private enterprise to supply the need, the national authority has in many countries had to arrange for the construction of houses and to let them at uneconomic rents.

Sometimes a Government finds itself compelled to nationalize an undertaking by reason of the fact that a privately owned concern of public utility fails financially and, if the State did not take it over, would become derelict. From this cause the Canadian Government has of late years found itself constrained to become the owner of the greater part of the railroads in the Dominion, the only other railroad owner of importance (but of very great importance) being the Canadian Pacific Railway Company. It requires no great stretch of imagination to picture the same development with the railways of the United Kingdom.

A perhaps less meritorious motive that causes many Governments to nationalize a service or industry is that of acquiring revenue thereby. When this occurs, the State undertaking is invariably made a monopoly, and is as much a means of indirect taxation as it is a business undertaking. Nationalized services of this description have hitherto been much rarer in the United Kingdom, as compared with other countries, although they are common enough in India and the British Crown Colonies. In India the working and sale of salt, in the Straits Settlements the sale of tin, and in many countries the manufacture and sale of tobacco in every shape and form are State monopolies, from which large profits are made or derived.

Services having to do primarily with the health and wellbeing of the whole community show a decided tendency towards public ownership. The sewerage systems of most countries are in the hands of public authorities, and in several departments of activity relating to the health and wellbeing of the community, one can see in operation throughout the world the transition stage from private to public ownership, both systems working side by side, but with an invariable tendency on the part of the publicly owned service to grow, not merely by the establishment of additional institutions, but by the absorption of privately owned undertakings. This process is steadily in operation in England in connexion with such services as asylums, hospitals, cemeteries and water-works, whilst education is rapidly being transformed from a private into a publicly owned industry. The growth of these public services is not confined in England to the provision of services imposed upon municipal authorities by law; for example, municipally owned lunatic asylums now make provision for private paying patients, and are made use of to an increasing extent, so that the private asylum is gradually dying out.

Another class of undertaking which is becoming more and more publicly owned is the service which is essential to the whole community or at least to most sections thereof. First and foremost comes the transmission of correspondence through the post-office, the most familiar form of nationalized undertaking. When one bears in mind the fact that the nationalized British post-office is the largest multiple shop concern in that country, having a branch in every village, it can readily be seen that such a network of Government shops lends itself most easily to an extension of duties. How convenient such a network of Government shops may be to meet a sudden emergency is shown by the duties placed upon the post-office at short or no notice during the war. When it was decided to collect from the nation magazines and books for distribution to the troops at the various fronts, it sufficed merely to notify the public that it could hand such publications over the counter at any post-office. In their capacity of Government shops, the post-offices of the United Kingdom, within 1908–21, had taken on additional work involved by the following new services:—

Payment of Old Age Pensions.
Payment of Army and Navy Allowances.
Sale and Encashment of Saving Certificates.
Sale of Government Loan Bonds.
Sale of National Health and Unemployment Stamps.
Sale of Entertainment Stamps.
Sale of Income Tax Stamps.

Nor are these new services all side-lines of small account; in hundreds of offices the actual sale of health and unemployment insurance stamps exceed the sale of postage stamps. With the increased tendency towards social legislation, there is little doubt that the services performed by means of the comprehensive post-office organization in every country will inevitably be extended still further. In the United Kingdom the Union of Post Office Workers had for some time before 1921 been carrying on an agitation for the provision of new facilities for the public which are in operation in other countries, such as the introduction of the postal cheque and transfer system, dispatch of parcels on the cash-on-delivery system, the collection of bills and subscriptions, etc. This agitation is worth noting by students of Nationalization, as indicative of fields of activity for trade unions composed of workers in a nationalized undertaking, additional to those concerned merely with their own betterment.

There are, however, other services which, being essential to all or most sections of the community, are gradually coming to be recognized as due to be transferred from the realm of private profit-making to that of public service. In most countries railway and canal transport are regarded as naturally falling within this category, and not a year passes without numerous water, gas and electricity undertakings in all parts of the world being transferred from companies to municipal bodies.

In the working out of the problem that has for some time been engaging the attention of engineers, of the most economical large-scale production and distribution of energy or power, the trend has been inevitably towards public ownership. The largest generator and distributor of hydro-electric power in the world was, in 1921, the Hydro-Electric Power Commission of Ontario, a publicly owned body formed on a coöperative basis by city and rural municipalities, through which the province of Ontario generated through hydro-electric energy over 95% of the total consumption of power within its borders from all sources. The Australian Government Morwell Power scheme will supply electricity to the greater part of Victoria, and in Sweden and Switzerland the respective Governments are developing electricity from water-power on a very large scale. In fact, throughout the world, almost all the great developments in this direction were in 1921 being carried out by, or on behalf of, Governments or municipal authorities, or combinations of both.

At first sight it might appear possible to draw a line of demarcation between these services which naturally fall within the sphere of public ownership and those which belong to the realm of private enterprise; but this is not so simple as it looks. It is easy to say that the community should carry on non-profit-making undertakings like the roads, sewers and public conveniences, leaving all other services, out of which profits can be made, to private enterprise, which, with the aforesaid profit-making incentive, is likely to give more facilities and be more receptive to new ideas. But it is only custom which makes us regard the provision of a drainage system, the collection of refuse, etc., as a non-profit-making service. In Rosario, the second most populous city in the Argentine Republic, and in Valparaiso, the second largest city of Chile, the drains belong to, and are operated by, the Rosario Drainage Company, and the Valparaiso (Chile) Drainage Company, respectively, both English companies. In Paris and Brussels limited companies make the business of supplying public conveniences pay handsomely.

Another argument might be that, as water, gas, electricity and tramway services cannot be carried on without disturbance to the publicly owned roads and bridges, it is natural that these undertakings should be owned by the same authority as is responsible for the roads. This might explain the fact that, gradually, such undertakings are becoming nationalized or municipalized, but one is constrained to ask why the roads and bridges themselves should be publicly owned; they were not always so, and practically every municipality now makes a monetary loss on bridges which at one time, under private enterprise, produced good profits to their owners.

Many people would agree that services directly connected with the health of the community should be carried on as public undertakings without regard to profit, *e.g.* isolation and general hospitals, ambulance services, sewers, extinction of fires and saving of lives in connection therewith. But here again it is difficult to draw a definite line of demarcation. If sewers are vital to the health of a city, so also is a supply of pure milk; and the extension of public ownership along this direction is shown by the fact that the town of Sheffield, since November 1918, has municipalized its milk supply, and its example was in 1921 likely to be followed by other British cities.

State Leases.—There is an intermediate form of Nationalization or public ownership which to a considerable extent bridges the gulf between those who consider that all services and industries vital to the community should be carried on by the community, and those who consider that Nationalization or public ownership leads to wasteful and bureaucratic methods and the disappearance of enterprise. This *via media* lies in the direction of the State or municipality owning an undertaking, but leasing it to a company under a concession for a fixed term of years, on a profit-sharing basis. The State or municipality, as representing the community, has control or a deciding voice in matters of principle, conditions of labour, etc., whilst the concessionaire company has the customary incentive to commercial efficiency. At the end of the concession the State or municipality is free to take over a complete service that has been organized on a commercial basis, or to grant a fresh concession. This system is becoming increasingly popular throughout the world, and appears preferable to the composite bodies, composed of municipalities and joint-stock companies, hitherto favoured in England.

Nationalization of Industries.—Detailed nationalization schemes for three separate industries in Great Britain had already been published by 1921, covering mines, railways and land respectively. That for mines was prepared in 1919 on behalf of the Miners' Federation of Great Britain, that for railways was prepared on behalf of the Railway Nationalization Society, and that for land was based upon an original draft made by the present writer for the Land Nationalization Society. The three schemes approximate more nearly to one another than might have been anticipated, having regard to the difference between the three services of coal mining, railway transport, and land ownership. Each provides for administration by a national council, appointed as to part by the Government and part by the workers engaged in the industry, with a Cabinet Minister at the head.

The miners' nationalization scheme (which covers coal and ironstone, shale, fire clay and limestone, but excludes sandstone, granite, slate, chalk, building clay, gravel and sand) provides for a National Mining Council consisting of a President and 20 members, 10 of whom are to be appointed by the Government, and 10 by the Miners' Federation.

The railway scheme provides for a National Transport Council consisting of the Minister for Transport, 3 persons nominated respectively by the Minister for Transport, the Board of Trade and the Treasury, and 3 representatives of the railway workers selected by the Transport Ministry from a panel of not less than 12 persons nominated annually for that purpose by the several committees of the 20 principal trade unions of which the membership is drawn wholly or in great part from persons engaged in the services of transport. This more complex method of providing for representatives of the workers in a nationalized transport system is due to the fact that, whilst practically all the workers in and about coal-mines are members of units making up the Miners' Federation of Great Britain, workers on the railways alone, apart from other branches of transport, are spread over a large number of trade unions. It will be further noticed that while the miners' scheme imposes upon the Minister for Mines ten members of the council definitely selected by the Miners' Federation, the railway scheme gives the Transport Minister some latitude of choice, by giving him powers of selection from a panel. This scheme not merely overcomes the difficulty of having to deal with a number of trade unions, but also enables the Minister to select as colleagues those on the panel with whom he considers he can best work, or who seem the most suitable.

In the case of land ownership—a totally distinct matter from the working of the land—there is no large body of workers which may justly claim representation on the management, and here representation of the various sectional interests has been aimed at by providing that the National Land Council should consist of the Minister for Lands; three members appointed by him, the Ministry of Health and the Ministry of Food respectively; one appointed by the Minister for Lands from a panel of not less than three persons nominated for the purpose by representatives of Farmers' Unions and Chambers of Agriculture; one appointed by the Minister from a panel of not less than three persons nominated by Associations of Smallholders and Allotment holders; and one appointed by the Minister from a panel of not less than three persons nominated by Agricultural Labourers' Unions.

In all three schemes provision is made for local or district councils, to which the National Council may delegate such powers as it thinks fit. The constitution of these district councils is analogous to that of the national councils, the proportion of workers' representation being the same, and in the case of the mines, provision is made also for the formation of councils for the separate pits. Members of all the councils are to receive such remuneration as the National Council, with the consent of the Treasury, may determine. The miners' scheme allows for the formation of a council to represent the interests of consumers, but such council has no executive powers and is purely advisory. In the case of the transport and land schemes no such provision is made, it being assumed that the members of the council nominated by the Government do, *ipso facto*, represent the general community, which in this case constitutes the consumer.

Another nationalization scheme for the coal industry was sketched by Mr. Justice Sankey, the Chairman of the Coal Industries Commission, 1919. This scheme provides for national ownership and, like the miners' scheme, aims at avoiding too bureaucratic a management by handing over the administration to district councils. While, however, the miners' scheme makes the National Mining Council of which the Minister of Mines is a member, the supreme authority, the Sankey scheme leaves the Minister of Mines in supreme control, with the obligation to consult the standing committee of the Mining Council on certain questions. Whereas the composition of the joint bodies in the miners' scheme is dual, representation being divided between the Government and the miners, in the Sankey scheme, it is tripartite, one-third representing the workers, one-third the consumers and one-third the technical and commercial side of the industry; the Government is not represented at all on this body, but, as stated, the Minister of Mines is not obliged to carry out recommendations of the National Mining Council, although that body is to meet regularly "for the purpose of superintending the operation of District Mining Councils."

All three schemes provide for compensation to the owners for the properties to be nationalized, and for payment to be made in Government stock bearing the rate of interest current at the time on that existing Government stock which most nearly approximates in length of time and conditions to the stock contemplated under the scheme. That is to say, if British Government 5% War Loan is quoted at a price at which it yields $5\frac{1}{2}$%, the stock issued in payment of the properties taken by the State is to be on the basis of $5\frac{1}{2}$% at par, it being immaterial from this point of view, whether in payment of a property worth £100, the owner receives £100 of $5\frac{1}{2}$% stock or £110 of 5% stock. In deciding the amount to be paid for each property acquired, there arises the thorny question of the basis of value and compensation. The miners' scheme provides for the appointment of ten commissioners for this special purpose, three of them to be nominated by the Miners' Federation and three of them by the owners' organization, the Mining Association. If a majority of commissioners cannot agree as to the purchase price of any property, the chairman (appointed by the Government) shall have power to determine the value. A coal-mine is to be valued on the average actual annual number of tons actually raised during the five years prior to August 4 1914, due regard being paid to the actual gross and net profits during that period and to the amount set aside for depreciation, renewals or development, to the probable life of the mine, and to the condition in which it is. Where a mine has not been fully developed, the amount which would be raised under full development without any increase of capital expenditure is to be taken as the average annual number of tons. The scheme, however, fixes a maximum purchase price, viz.:—

	Per ton s.	 d.
When 100,000 tons or less have been raised per annum on the average during such five preceding years, a capital sum equal to one such year's output at	12	0
When more than 100,000 tons have been raised per annum on the average during such five preceding years, a capital sum equal to one such year's output at	10	0

In the case of the railway nationalization scheme, the purchase price is to be a sum equal to the mean between the highest and lowest officially quoted price of each stock during the first 12 of the 18 months preceding the introduction of the bill, the idea of a buffer of six months being to prevent prices being forced up on the basis of stock quotations being made known.

In a Railway Nationalization bill issued in 1921 by two of the trade unions representing the railway workers, and sponsored by the Labour party, the price to be paid differs from that contemplated in the Railway Nationalization Society's scheme, on which the Labour party bill was largely based, in that the mean quotation of each stock during the year 1913 shall be taken as the basis, but shall be "subject to a reduction relative to the amount by which securities generally have depreciated in value in consequence of the war." This agrees with the policy under which the three Government Committees appointed to report upon State control of the Drink Trade unanimously recommended state purchase on the following basis:—

> "The profits to be so capitalized must be pre-war profits, and the effect of war conditions on profits whether favourable or the reverse, must be excluded."

The draft railway nationalization bill referred to suggests that this reduction on the 1913 stock exchange value should be in the neighbourhood of 30%, even that being less than the fall that has occurred on other investment stocks of the same description.

The land nationalization scheme puts forward two alternative bases for purchase, viz.:—

(*a*) Twenty times the rateable value of the property as existing at Dec. 31 1918, and, where no rateable value exists, the value put upon the property by the land valuation of 1910; or

(*b*) The value put upon the property by the valuation of 1910, and in any cases where such valuation shall not have been completed, it shall be valued on precisely analogous lines so as to make the value the same as if it had been fixed under the 1910 valuation.

In the case of the land being let on lease, the compensation is to be divided between the landowner and the leaseholder in proportions determined by an *ad hoc* tribunal.

The Government stocks to be issued in payment of the properties nationalized are all redeemable at par—in the case of the railway and land schemes by means of a sinking fund of ·5%, sufficient to redeem the entire loan within approximately 50 years, while in the case of the miners' scheme, no statutory sinking fund is provided, but net profits are to be applied to that purpose. Each scheme provides for the drawing up of separate accounts, showing fully the results of the year's operations, to be submitted annually to Parliament and there discussed.

Management.—There is no doubt that the principal problem in connection with Nationalization or Public Ownership lies in the direction of efficient management. The traditions of British Government Departments, which have been concerned primarily with the administration of legislative enactments and not with the management of trading concerns, is not conducive to efficiency as the business man understands it. This, however, applies more to national than to local government officials, the latter being in closer contact with the people for whom they act, and being more accustomed to act in an executive capacity. Mr. Justice Sankey in his Coal Industry Commission Report (Cmd 210), dated June 20 1919, wrote:—

> "The Civil Servant has not been trained to run an industry, but the war has demonstrated the potentiality of the existence of a new class of men (whether already in the service of the State or not) who are just as keen to serve the State as they are to serve a private employer and who have been shown to possess the qualities of courage in taking initiative necessary for the running of an industry.
>
> "Hitherto, State management of industries has on balance failed to prove itself free from serious short-comings, but these shortcomings are largely due to the neglect of the State to train those who are to be called on for knowledge and ability in management.
>
> "The experience of the last few years has, however, shown that it is not really difficult for the British nation to provide a class of administrative officers who combine the strongest sense of public duty with the greatest energy and capacity for initiative. Those who have this kind of training appear to be capable in a high degree of assuming responsibility and also of getting on with the men whom they have to direct."

The need for a wider training and the creation of a new type of Government official to carry on publicly owned undertakings is now fully realized, and the newer universities and such institutions as the London School of Economics are turning out men and women suitably equipped in a technical sense to carry on such services as will be taken over by the community. Moreover, as each service is taken over, so is the existing staff who, themselves, naturally carry on to a great extent the traditions of the service whilst under ordinary commercial management.

In conclusion, it may be said that the immediate future trend of Nationalization or Public Ownership would appear to be in the direction of internal services of public utility or health, rather than industries calling for trading abroad, and while all prophecy is dangerous, a survey of world tendencies leads to the conclusion that those industries which will gradually come to be publicly owned, be it nationally or municipally, will be found among the following: transport, insurance, banking, coal and oil, electricity and power generally, housing, liquor trade, tobacco. Where such a service or industry has a large foreign trade, *e.g.* coal, it may well be that the State will grant a concession to a company to carry on that particular department of the industry on a profit-sharing basis. Of the continued growth of the principle of public ownership there can be little doubt.

AUTHORITIES.—The three nationalization bills for Mines, Railways and Land are printed *in extenso* in *The Case for Nationalisation*, by A. Emil Davies (Allen & Unwin, 1920). See also the same author's *The State in Business*, 2nd edition (Bell, 1920), and the *Nationalisation of Railways* (Black, 1908), the *Problem of Nationalisation* by Lord Haldane (Allen & Unwin, 1921), *Land Nationalisation — The Key to Social Reconstruction*, by A. Emil Davies and Dorothy Evans (Parsons, 1921), *Municipal Ownership*, by Carl D. Thompson (B. W. Huebsch, New York, 1917). *Nationalisation of Industries: a Criticism*, by Lord Emmott (Unwin, 1920), *Where and Why Public Ownership has Failed*, by Yves Guyot (Macmillan, 1914), *The Nationalisation Peril*, by G. E. Raine (Butterworth, 1920). (A. E. D.)

NAVAL HISTORY OF THE WAR.—The tornado of war which broke upon the world in 1914 found the British navy at its post and ready for action. A review of all the seaworthy vessels of the fleet had taken the place of the customary annual manoeuvres, and by July 23 the ships had already begun to disperse. By the 26th the whole outlook had grown dark. The German Emperor was hastening back to Berlin, and Admiralty orders were sent by the First Sea Lord (Adml. Prince Louis of Battenberg[1]) to Adml. Sir George Callaghan to remain with his First Fleet at Portland, and to the ships of the Second Fleet to be ready near their crews at their home ports. Squadrons abroad were warned of the political tension, and on the 27th the commander-in-chief Mediterranean was told to concentrate at Malta. On the 28th Austria issued her declaration of war, and orders went out at 5 P.M. for the First Fleet to leave for its war base at Scapa Flow. It sailed at 7 A.M. on the 29th.

The British fleet at the time consisted of the Home Fleet and the squadrons on the various stations abroad (Mediterranean, East Indies, China, Australia, Cape, N. America and West Indies and S.E. coast of America), but the bulk of it was to be found in the Home Fleet. This fleet was divided into three categories in three successive stages of efficiency. The First Fleet (to be designated the Grand Fleet) comprised all the newest ships fully manned, and in permanent commission. The Second Fleet consisted of older but still efficient battleships and cruisers with nucleus crews amounting to two-fifths of their complement aboard. Last of all came the Third Fleet, a rather motley collection of obsolescent but serviceable ships in the basins of our naval ports with only a small "care and maintenance" party aboard. The constitution of these fleets is summarized in Table A, and it will be seen that practically the whole of the "dreadnought" strength of the fleet was concentrated in Home Waters.

Tables A and B shown in terms of units were the two forces

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[1] Later created Marquess of Milford Haven (d. 1921). This last service to Great Britain by one who had always been a fine naval officer was never forgotten, although he retired soon after rather than allow his German origin to compromise his position.

TABLE A.

Disposition of British Fleet, Aug. 1914.

	Dr.	Pre-Dr.	B.Cs.	Cr.	L.Cs.	T.B.D.	Old T.B. Bs.	S/ms.	Fleet Sweepers
First Fleet.									
Adml. Sir George Callaghan, then Adml. Sir John Jellicoe. 1st, 2nd, 3rd, 4th B.S.	19	8	..	..	4	..	..	..	9
1st B.C.S., 2nd C.S., 3rd C.S., 1st L.C.S.	..	..	4	8	6	..	..	..	..
10th C.S. (from Third Fleet)	..	..	..	8	..	..	..	..	..
Flotillas 2nd and 4th	..	..	..	..	2	40	16	..	..
Harwich Force.									
Commodore (T) Reginald Tyrwhitt									
Flotillas 1st and 3rd	..	..	..	..	2	40	..	..	..
Second Fleet (Channel).									*
Vice-Adml. Sir C. Burney									
5th B.S., 6th B.S.	..	15	..	3	2	..	..	..	..
(5th C.S. to Trade Routes)	..	..	..	..	..	..	..	..	..
(6th C.S. to First Fleet)	..	..	..	..	..	..	..	..	..
Third Fleet.									
Vice-Adml. Sir A. Bethell	..	..	..	..	..	..	..	..	..
7th and 8th B.S.	..	..	..	..	..	..	..	..	..
(6th, 7th, 9th, 11th, 12th C.S. to Trade Routes)	..	14	..	..	..	..	..	..	..
(10th C.S. to First Fleet)	..	..	..	..	..	..	..	..	..
(8th C.S. not constituted)	..	..	..	..	..	..	..	..	..
Patrol Flotillas.									
(Coastal Areas)									
Admiral Patrols.									
Rear-Adml. Ballard									
Flotillas 6th, 7th, 8th, 9th	..	..	..	..	8	73	23	..	..
S/m Flotillas Commodore (S)	..	..	..	..	..	..	..	..	..
Roger Keyes 3rd, 4th, 5th, 7th, 9th	..	..	..	..	..	..	..	old 31	..
S/m Flotillas 6th and 8th	..	..	..	..	..	..	..	new 23	..
C. in C. Home Ports	..	..	..	..	..	..	78	..	..
Cruiser Squadrons (Trade).									
5th (Cruiser Force D) (South Atlantic) Rear-Adml. A. P. Stoddart	..	..	..	4	..	..	..	..	..
6th (Escorts various)	..	..	..	4	..	..	..	..	..
7th (Cruiser Force C) (Narrows) Rear-Adml. A. H. Christian	..	..	..	5	..	..	..	..	..
9th (Cruiser Force I) (Finisterre) Rear-Adml. J. M. De Robeck	..	..	..	6	..	..	..	..	..
11th (Cruiser Force E) (West of Ireland) Rear-Adml. R. S. P. Hornby	..	..	..	5	..	..	..	..	..
12th (Cruiser Force G) (Soundings) Rear-Adml. Rosslyn Wemyss	..	..	..	4	..	..	..	..	..
Squadrons Abroad.									
Mediterranean (Vice-Adml. Sir Berkeley Milne) 2nd B.C.S., 1st C.S., 5th Flotilla	..	..	3	4	4	16	..	..	..
North America and West Indies (Rear-Adml. Sir Chris. Cradock) 4th C.S. (Cruiser Force H)	..	..	..	4	1	..	..	..	..
China (Vice-Adml. Sir Thos. Jerram)	..	1	..	2	2	8	..	..	..
East Indies (Rear-Adml. R. H. Peirse)	..	1	..	2	1	..	..	..	..
Cape (Rear-Adml. H. G. King-Hall)	..	..	..	3	..	..	..	..	..
Australia (Rear-Adml. Sir G. Patey)	..	..	1	1	2	3	..	..	..
S.E. Coast America	..	..	..	..	1	..	..	..	..

*Three battleships to Grand Fleet as " Minebumpers " on 7/8/17. 6th B.S. ceased to exist 8/8/17, and 7th was merged with 8th, leaving Channel Fleet composed of 5th and 8th B.S.

TABLE B.

Disposition of German Fleet.

	Dr.	Pre-Dr.	B.Cs.	Cr.	L.Cs.	D.	S/ms.
High Sea Fleet.							
Adml. von Ingenohl							
1st, 2nd, 3rd Squadrons	13	8	..	..	..	..	..
1st Scouting Group	..	..	3	..	..	..	..
Cruisers	..	..	..	..	7	..	..
Flotillas 1 to 7	..	..	..	..	..	77	..
Submarines	..	..	..	..	..	..	old 18 new 10
Reserve	..	14	1	5	20	86	..
Mediterranean (Adml. Souchon)	..	..	1	..	1	..	..
Ost Asiatische (Adml. von Spee)	..	..	..	2	3	..	..
West Indies	..	..	..	..	2	..	..

ranged against one another across the North Sea. In terms of gun-power the British fleet was decidedly superior; 13 of the British dreadnoughts were armed with 13·5 guns and the others with 12 in., while the Germans had 12-in. guns in only nine of their ships and 11 in. in the remainder.

On July 29, the day that the British Home (or First) Fleet left for the north, the First Lord (Mr. Winston Churchill) pressed the Cabinet for the initiation of the Precautionary Period, and the warning telegram went out to all squadrons abroad. By Aug. 1 the tension had increased. Germany had issued her ultimatum to Russia and had declared *Kriegsgefahr.* In Hamburg British ships were being detained. Immediately this news arrived the Admiralty issued orders at 2:15 P.M. to act on the instructions for mobilization, but the reserves were not yet called out. Late that night the news came in that Germany had declared war on Russia, and at 1:25 A.M. on Aug. 2 the Admiralty issued the order to mobilize. By 4 A.M. on Aug. 3 the whole fleet stood mobilized and ready for action.

The German mobilization had taken a somewhat different course. Arrangements had been made for the fleet to visit various ports in Norway, but on July 15, when the cruise commenced, the German Admiral Staff was already beginning to doubt the wisdom of its continuance. By July 23 the Kaiser had adopted the view that the fleet should be recalled, but the Chancellor was loth to do anything to aggravate the current tension and proposed to wait and see what England did. But no sooner had Adml. von Ingenohl anchored in Sogniefiord on July 25 and opened his mails than he became deeply impressed with the gravity of the situation. He went straight to the Kaiser and persuaded him to let the fleet sail for its home ports. It got under way on the 26th, and at 7 P.M. on July 27 had assembled off Stavanger. On the 30th the German ambassador at St. James's sent word that Sir Edward Grey had told him that the British fleet had sailed for the north of Scotland. Strained relations were notified to all commanders-in-chief that day, and on the 31st at 5 P.M. the telegram for *Kriegsgefahr* (Precautionary Period) went out. Everything was now hastening downhill. War was declared with Russia on Aug. 1. The 2nd and 3rd Squadrons came round from Kiel to the North Sea the same day and at 8 P.M. that evening the order to mobilize went out.

One important step had not been taken. The German Admiral Staff had asked for orders to be issued for armed merchantmen to proceed to the trade routes, but the Chancellor had demurred and only one proceeded to sea. Before any more could sail the British Grand Fleet was at its post and actually put to sea on the morning of Aug. 4 to circumvent movements of this sort.

Its old commander, Adml. Sir George Callaghan, was no longer with it. It was thought that a younger commander was required to face the heavy responsibilities of war. By 8:30 A.M. Sir George Callaghan had struck his flag, and the fleet put to sea on Aug. 4 under its new commander, Sir John Jellicoe. That night at 11 P.M. the eventful order went out to all ships and squadrons "Commence hostilities at once against Germany."

The Grand Fleet, for so it was to be designated, was already at sea engaged in a sweep to the south-east. These sweeps were an essential feature of the British war plans, which were primarily based on the concentration of the main fleet in the north to guard the northern exit of the North Sea. The closure of the southern exit was to be effected by flotillas supported by older squadrons and by the use of mines.

By its mere concentration at the outlets of the North Sea the British fleet performed all its principal tasks. It covered the trade routes, cut off Germany from the ocean, protected the coast line against invasion and secured the transport of the army. Further afield the focal and terminal areas of trade were guarded by cruiser squadrons. The protection of the coast was entrusted to patrol flotillas, under the Admiral of Patrols (8th Flotilla in Forth, 9th Flotilla in Tyne, 7th Flotilla in Humber, 6th Flotilla at Dover). This strategy was simple and effective. It offered ample opportunities for offensive tactics, survived the whole war, and was justified by the course of events.

The plans embodying it were only prepared in the latter part of 1913, and differed materially from those of the previous decade, which had favoured large landing operations on the German coast. The whole coastline of Great Britain stood behind the British plans, stretching like a colossal breakwater across Germany's path to the sea, and reproducing the geographical conditions of the Dutch wars.

This breakwater was 500 m. long. From the Shetlands to Norway (Sumburgh Head to Udsire) was 190 m., a distance well within the compass of a strong fleet. Dover Straits was only 21 m. wide, and though the concentration of the main fleet at Scapa 500 m. away left it exposed to attack, any British force south of 56° (*i.e.* the latitude of the Forth) threatened the flank of a force attacking the Channel, and Germany never actually took the risk of such a venture with any of her big ships.

So long as the enemy refrained from an attack in force, the dispatch of British troops across the Channel was almost as easy as sending them to Ireland or across the Thames. The length of the principal route from Southampton to Havre was only 100 m., and the average time of transport only 13 hours. No transport was, therefore, ever more than seven hours from port. The route was over 100 m. west of Dover Straits, and in these circumstances the whole transport system could be quickly and rapidly controlled.

But Dover remained the weak point of the war plans, and all the more so as the actual organization of the southern area was defective. In the north there was one command. In the south there were five, namely, the Channel Fleet, the Dover Patrol, Cruiser Force C, the Harwich flotillas and Commodore (S). There can be little doubt that a determined attack in this area at the beginning of the war would have severely shaken the whole fabric of British strategy, but the enemy never attempted it. British troops poured in a continuous procession across the Channel. With the exception of the "Goeben" and "Breslau" in the Mediterranean there was nothing to threaten the safety of the Channel to the westward, and on Aug. 10 this anxiety was removed by the news that the "Goeben," after a strange chapter of accidents, had entered the Dardanelles the evening before. (*See* GOEBEN AND BRESLAU.)

Germany's strategy was defensive. This was forced on her by her inferior strength and unfavourable position. It was based on the idea that the British fleet would enter the Bight, where it was hoped to wear it down by ruthless minelaying and submarine warfare. Then when the British fleet had been reduced to reasonable proportions and when an equilibrium of strength (the greatly desired *Kräfteausgleich*) had been attained, a decisive battle would be dared. First a policy of waiting, of sorties and attrition, then a decisive action. This was the substance of the German operation orders for the North Sea.

Movements during 1914.—In pursuance of these aims, at 8:30 P.M. on Aug. 4, an hour after orders to prepare for war with England went out, the "Königin Luise" of the Hamburg American Line was despatched to lay mines off the Thames. She fulfilled her task but never returned. While Jellicoe was carrying out his sweep in the north Comm. Tyrwhitt with the "Amethyst" and "Amphion" and the Harwich flotillas carried out a similar operation in the south. About 10 A.M. on the 5th the "Königin Luise" was sighted on her way back, and the "Lance" and "Landrail" followed hot on her trail. She could go only 21 knots, and was quickly overhauled and sunk about 50 m. east (true) from Lowestoft. But she had laid her mines off Aldeburgh, and the "Amphion" returning ran on one of them and went down in a few minutes with a loss of 150 men. This threat to the North Sea routes emphasized the necessity of minesweeping, and started the enormous expansion of that important service which became one of the principal features of the war (*see* MINELAYING).

Meanwhile the Germans had seen nothing of the British fleet, and on Aug. 6 10 German submarines, escorted for 100 m. by the "Hamburg" and "Stettin," went off into the North Sea to look for it, with orders to remain on the line between Stavanger and Scapa Flow till 6 P.M. on the 10th. Their first cruise was not particularly successful. A torpedo was fired at the "Monarch" and missed, U15 was rammed by the "Birmingham" (58° 26′ N. 1° 58′ E.), and U13 never returned. But the operation had an important bearing, for though reassuring enough from one point of view it gave the British commander-in-chief a sense of insecurity, and he asked permission to take the fleet to the west of the Orkneys as soon as the Expeditionary Force was across. That night (at 10 P.M. on the 6th) he received orders to take his whole force north-west of the Orkneys. The menace of the submarine was already working when the transports were assembling to take British troops over to France.

On Aug. 5 the British Government had decided to send the Expeditionary Force across the Channel, and Aug. 9 was finally fixed as the first day of passage. The question of transporting a British Expeditionary Force across the sea had been a subject of study for some years. Southampton to Havre was the principal route for troops, Newhaven to Boulogne for stores, and transports were already assembling at Southampton. It had been part of the war plans that, in the event of troops being sent to France, the Grand Fleet was to come down to a position south of the Forth (latitude 56° N.). But it was now to westward of the Orkneys, and remained north of Cromarty (58° N.) till Aug. 15, sometimes west of the Orkneys and sometimes east. The task of immediate protection fell therefore to the Channel Fleet. By Aug. 9 its 18 ships had assembled off Portland and were covering the lines of passage in the Channel. In the Narrows between Holland and Harwich, Tyrwhitt had a watching patrol of 12 to 18 destroyers on a 30-m. front. The "Bacchante," "Cressy," "Hogue," and "Aboukir" of Cruiser Force C were behind him in the Downs or off Dungeness keeping touch with the Channel Fleet. In the Straits were five destroyers of the Dover Patrol (increased to 12 at night) assisted by three light cruisers, and supported by 10 submarines of Comm. Keyes' force posted between the Goodwins and Ruytingen (near Calais). French submarines were on watch between Gris Nez and the Varne, and far to the westward cruising from Ushant to Land's End was Rear-Adml. Rouyer's force of 14 old French cruisers in touch with Wemyss' squadron of four "Talbots." This was a respectable force, and was in position by the 9th when the troops began to cross, and for a fortnight remained on the alert. A steady stream of transports passed across the Channel, sailing as soon as they were ready and waiting only for the tide. Their numbers rose to 44 on the 14th, and remained well over 30 per day up to Aug. 18. On Aug. 12 the Admiralty suggested to the commander-in-chief that the fleet should return to the eastward of the Orkneys, and it came back just when the flow of troops was at its height, and sweeping down to the latitude of the Forth (56° N.) on the 16th joined hands with the southern forces, and for a few hours made a complete ring round the German Bight. But nothing was seen of the enemy and the Grand Fleet returned to Scapa. It arrived there on the 18th, and the enemy for the first time ventured out a little way. Two light German cruisers, the "Stralsund" and "Strassburg," pushed into the Narrows that day. There they were sighted at 6:30 A.M. by the "Fearless," which gave chase and opened fire on the "Strassburg" (thought to be the "Rostock"). Tyrwhitt came hurrying to the scene followed by Cruiser Force C, and the enemy quickly decamped.

By the 20th four British divisions had crossed, but the news from France was bad and another division was hurried over. By Aug. 23 the movement was complete. Out of 240 transports employed not one had been lost by accident or enemy attack. A hundred thousand men were in France, and British divisions were already fighting against heavy odds at Mons.

In order to secure the position in the south and on the east coast, a squadron (Cruiser Force K) of two battle-cruisers, the "New Zealand" and "Invincible," under Rear-Adml. Sir Archibald Moore, was now stationed in the Humber and remained there for a time. Hardly had the passage been accomplished and the Watching Patrol been withdrawn for a short time than news came of a severe check in France, and the Admiralty was faced with the possibility of having to abandon the French Channel ports. So far did matters go that Boulogne was closed down on Aug. 24 and the army base was shifted to St. Nazaire. This would have meant a serious dislocation of British naval strategy, but before it reached a critical stage the German advance had been checked.

The retention of Ostend and the Belgian coast was now engaging naval attention. Marines were being hurried over there, and for nearly two days (from Aug. 26–28) the Channel Fleet and Cruiser Force C were carrying them and their stores across, and were lying off Ostend to support their landing. The operation was entirely abortive. No sooner had they been landed than they were reëmbarked. The landing offered an excellent opening for the German High Sea Fleet to attack, but for a time at least its attention was riveted to the Bight.

Commodore Keyes' submarines had been watching the German patrols round Heligoland for some time, and on the strength of their observations he had suggested a plan for cutting them off. The original orders provided only for a concerted operation by six of Comm. Keyes' submarines, and Tyrwhitt's flotillas supported by the five "Bacchantes" of Cruiser Force C and the "Invincible" and "New Zealand." But at the last moment Beatty and his battle-cruiser squadron were fortunately allowed to join in, and there followed on Aug. 28 Beatty and Tyrwhitt's dramatic swoop into the Bight (*see* HELIGOLAND BIGHT). The German patrols were driven in, the big ships failed to support them, and three light cruisers, the "Mainz," "Ariadne" and "Cöln" were sunk.

The action had an important ulterior effect. It confirmed the Kaiser, probably influenced at the time by the situation in E. Prussia and the Baltic, in his determination to follow a strictly defensive naval policy, though Tirpitz fought strenuously for an increased offensive.

German strategy now settled down to the two-fold form of submarine activity against ships-of-war and minelaying, varied by occasional raids against the English coast. The activity of the German submarines (or "U-boats") soon began to be felt. On Sept. 5 U21 entered the Forth and sank the "Pathfinder," a light cruiser patrolling outside, the first ship to fall a victim to an enemy submarine. Scapa's defenceless state became a source of acute anxiety to the British commander-in-chief, and the Grand Fleet itself was not immune from false alarms, which in the circumstances had to be taken seriously enough. On Sept. 1 the "Falmouth" thought she saw a submarine, and there ensued a feverish commotion in the Flow, which culminated in the battle-fleets weighing in thick weather and putting to sea at night. It anchored in Loch Ewe and was there on Sept. 7 when it was recalled to the North Sea to screen the passage of the 7th Division. Again Beatty's squadron and Tyrwhitt's flotillas swept the Bight from east to west on Sept. 10 with the battle-fleet behind them, but this time it was bare.

A week later (Sept. 17) an important conference assembled in the "Iron Duke's" cabin at Loch Ewe. The First Lord (Mr. Winston Churchill) was there with the chief of the war staff (Rear-Adml. Doveton Sturdee) and the Director of the Intelligence Division. Weighty matters were discussed, and the remains of the old war plans emerged in the form of a proposal to attack Heligoland and to enter the Baltic. It was decided that the former project offered no advantage, for when it was taken it could not be held, and that no operation on a large scale could be attempted in the Baltic without endangering British supremacy in the North Sea.

When the First Lord returned he found the German threat to the Belgian and French Channel ports beginning to develop, and orders went out on Sept. 19 for the Marine Brigade to be landed at Dunkirk as the nucleus of a larger force. The task of screening their passage fell on the southern forces. This was one of the functions specially allotted to them in the war plans, and it came as a severe shock to the Admiralty to find Cruiser Force C, one of its component squadrons, suddenly swept off the board. On Sept. 22, while patrolling at 10 knots off the Dutch coast, the "Cressy," "Hogue" and "Aboukir" were torpedoed between 6:25 and 7:30 A.M. by U9, and disappeared beneath the waves with a loss of 60 officers and some 1,400 men. This exploit produced a profound impression on both sides of the North Sea. It was the first striking success of the German submarine. For the moment something had to be found to cover the proposed operations on the Belgian coast, and it was decided to lay mines in the Narrows. The idea was no new one. It had been part of the British war plans in 1913, but the plans had outrun the performance, for the mines available at the outbreak of war required new pistols and new mooring-ropes, and could not be laid in the positions indicated on account of the tide. This had been pointed out in May 1914, and the work was now taken seriously in hand. A large area was notified on Oct. 2, and three lines of mines were laid between the Downs and Holland, but unfortunately the design of the mines was defective and their real utility small.

The commander-in-chief had hardly been informed of this new policy when on Oct. 2 he was ordered to take special measures to ensure the safety of the Canadian convoy, which was on its way across. For eight days a special watch was established, with the whole fleet stretching right across the waters between Fair I. and Norway. The convoy consisted of 31 ships, escorted by Adml. Wemyss and Cruiser Force G right across the Atlantic. The battle-cruiser "Princess Royal" went out into the Atlantic to meet it, and she and the old battleship "Majestic" brought it safely in to Plymouth on Oct. 14. The battle-fleet had retired, but the 10th Cruiser Squadron was still patrolling the next day at 10 A.M. on a line between Peterhead and the Naze 10 m. apart, when the "Hawke," which had stopped to get her mails from the "Endymion," and was going on again at 12 or 13 knots, was struck by a torpedo from U9. There was only time to lower two seaboats, and 500 lives were lost as she sank.

The losses were not all on the British side. The British submarine E9 (Lt.-Comm. Max Horton), lying off Heligoland, had sunk the small cruiser "Hela" on Sept. 12, and now one of the German minelaying enterprises came to a sudden and disastrous end. Four German destroyers of the 7th Torpedo Half Flotilla (S115, S116, S117, S119) left the Ems in the morning of Oct. 17 to lay mines off the North Foreland, but the "Undaunted" with some of the British 3rd Flotilla ("Lennox," "Lance," "Legion," and "Loyal") was waiting for them in the Narrows, and after a chase and sharp fight the last German boat sank off the Texel at 4:30 P.M. The success came very happily, for the guns were again busy on the Belgian coast. Dover had now became a separate command under Rear-Adml. the Hon. Horace Hood. A great German attack was gathering against Nieuport, and Joffre had asked on Oct. 16 for naval guns to act against the German right. Hood's light craft hurried across, followed by the monitors, and for nearly a week they maintained a heavy fire over the sand dunes against the German flank.

While the "Lennox" and "Lance" were sending their last shots into the German boats the British destroyers in the north were again engaged in a feverish hunt over the Flow. In the afternoon of Oct. 16 a German submarine was reported close to Switha Sound on the west side of the main entrance. Again the fleet had to raise steam and get to sea that night. There can be little doubt that these alarms were false, but they serve as a reminder that the British preparations for war were far from complete. The menace of the submarine had been recognized in 1912, and arrangements could have been devised for rapidly defending harbours by means of mines and booms. But the British mines were defective, and no suitable booms had been designed. The commander-in-chief proceeded to sea, and in view of the defenceless state of Scapa decided to take the fleet to Lough Swilly. Its arrival there on Oct. 22 meant a serious dislocation of the war plans, which were beginning to give way both in the north and south through the pressure of the German submarine. The proper reply, booms and a supply of efficient mines, had not been foreseen and was not forthcoming.

Oct. 1914 saw the sudden dispatch of the R.N. Division to Antwerp, and the landing of forces at Dunkirk and on the Belgian coast. The defence of Antwerp was a military and not a naval problem, but the extension of the transport routes to the Belgian coast and the landing of the 7th Division at Zeebrugge on Oct. 7 represented a considerable expansion of the original war plans, and brought a heavy strain on the Dover Patrol. The old battleship "Venerable" joined Rear-Adml. Hood's force, and lent the Belgian army the support of her guns in the German attack on Nieuport, which culminated on Nov. 2, when they fell back from the Yser as the waters rose.

On Oct. 27, when the Nieuport sluices were being opened, a bad piece of news arrived. The move to Lough Swilly had proved singularly unfortunate. Two days before the battle-fleet left Scapa, the "Berlin," a large Norddeutscher Lloyd of 17,000 tons, had left on a minelaying cruise, and laid mines on Oct. 23 some 26 m. north-west of Lough Swilly in the north of Ireland. On the 27th the "Audacious" going out to battle practice struck one of them, though she remained afloat for some hours. The White Star liner "Olympic," outward bound full of passengers, came up and tried to tow her, but found her unmanageable. At 9 P.M. she was still 15 m. from Lough Swilly when she settled, sank and blew up. With the Grand Fleet 300 m. from the North Sea, the whole groundwork of the British war plans was giving way, and the commander-in-chief left to confer with the Admiralty. It was a new board he met. Prince Louis of Battenberg (Marquess of Milford Haven) had resigned, and Lord Fisher had stepped into his place.

It was decided that the 3rd Battle Squadron of King Edward's should leave the Grand Fleet and reinforce the Channel Fleet, thus securing the situation in the south. Nowhere did naval activity on the part of the enemy seem so likely as off the Belgian coast, where a small number of old British ships were fighting, 1,000 m. from the Grand Fleet at Lough Swilly, and barely 300 m. from the Bight. To secure the approach to Dover and the Belgian coast it was decided to lay mines in the North Sea, which was declared a military area on Nov. 2. The notification was hardly issued when news came in on Nov. 3 of a German raid on the east coast. This was made by the battle-cruisers "Seydlitz," "Moltke," "Von der Tann," "Blücher," the armoured cruiser "Yorck," and three light cruisers, with the object of covering the light cruiser "Kolberg" in laying a minefield some 15 m. from Yarmouth. Commodore (T), whose flotillas were patrolling in the Narrows, sent them off in chase. The Admiralty thought the raid was a prelude to something bigger, and ordered the Grand Fleet to proceed to Scapa and Beatty to put to sea, but by 4 P.M. the Germans were well on their way home and the orders to the Grand Fleet and Beatty were cancelled. The Germans did not get home scot-free. The "Yorck" struck a mine off the Jade and sank.

The commotion had barely died down when early in the morning of Nov. 4 a telegram arrived from the British consul-general at Valparaiso with news of Coronel (*see* CORONEL). Cradock's squadron had been wiped off the board, and the whole system of trade defence began to tremble under the menace of von Spee's approach. This marks a milestone in the war. Steps were instantly taken to retrieve the situation; but to understand it we must leave home waters for a time.

Cruiser Warfare, 1914.—Outside home waters the principal task of the British navy was the protection of trade, and cruiser squadrons were stationed for this purpose at the focal points of maritime traffic, a system which may be termed the "Squadron" or "Patrol" system as compared with the "Convoy" system adopted later against the submarine. The number of German cruisers abroad was comparatively small. The largest squadron was von Spee's, consisting of the armoured cruisers "Scharnhorst" and "Gneisenau" (each 8 8·2-in., 8 5·9-in., 20½ knots), and the light cruisers "Emden," "Nürnberg" and "Leipzig," which threatened China, Australia and the East Indies, and gave rise to reactions which were felt over the whole world. In the East Indies was the "Königsberg," a German light cruiser with 10 4·1-in. guns, able to steam 22 or 23 knots, and in the Atlantic the "Dresden" and "Karlsruhe," armed with 12 4·1-in., and with a full seagoing speed of 25 to 26 knots. This completes the tale of German cruisers abroad.

As soon as war broke out the introduction of a Government

Insurance Scheme had a great steadying influence on British trade, but over all the four seas the Admiralty was confronted with the problem of reconciling the squadron system, which was intended to hunt down enemy cruisers, with insistent demands for convoy which could not be denied. These demands arose all over the world, for a great imperial concentration was bringing the legions of the Dominions home at the very time when an attack on the German oversea possessions was sending them farther afield. In the east the convoys from India absorbed the whole of the East Indies Squadron; in the west the Canadian convoy in Oct. 1914 took away Rear-Adml. Wemyss and all his four cruisers (Force G) from the mouth of the English Channel. The expeditions to New Guinea and Samoa monopolized the whole Australian Squadron for a time. The Cape, Cameroon, and British East Africa all made similar demands on the squadrons, and the system was constantly threatening to break down.

When war broke out the "Karlsruhe" had just relieved the "Dresden," and both were still in the West Indies. In New York, too, were several fast German merchant cruisers, but the "Kronprinz Wilhelm" was the only one which actually put to sea. On Aug. 6 the "Suffolk" (Cradock's flagship) came suddenly on the "Karlsruhe" arming the "Kronprinz Wilhelm," some 120 m. N.E. of Watling I. (off Cuba), but after a long chase and an action in the moonlight with the "Bristol" the "Karlsruhe" got away. Then came news of her and the "Dresden" to the southward, and on Aug. 22 Cradock, who had transferred his flag to the "Good Hope," went off after them and began his fateful journey to the south. The "Karlsruhe" remained in the West Indies and South Atlantic. The "Kaiser Wilhelm der Grosse," which had succeeded in slipping out of the North Sea on Aug. 5, was trying to get in touch with her, but on Aug. 26 was caught by the British cruiser "Highflyer" (Capt. Henry T. Buller), coaling at Rio del Ore, a desolate anchorage on the Sahara coast, and after a short action was sunk. The "Karlsruhe" (Capt. Kohler) continued to disturb British trade for some months, and had sunk 15 ships up to Nov. 4, when she suddenly blew up in the West Indies, leaving the survivors to get home to Kiel in the "Rio Negro."

The depredations of the "Karlsruhe" and "Dresden" led to Rear-Adml. Sir Christopher Cradock being appointed in command on the south-east coast of America on Sept. 3. He was given the three armoured cruisers "Good Hope," "Monmouth," and "Berwick," the light cruisers "Glasgow" and "Bristol," and the armed merchantmen "Otranto," "Carmania" and "Macedonia." Then ensued a hunt down the coast for the "Dresden." The "Carmania" (Capt. Noel Grant) went off to Trinidada, a tiny islet 600 m. out in the South Atlantic, and, though she did not find the "Dresden," she came upon an armed merchantman, the "Cap Trafalgar," coaling there on Sept. 14. An action ensued, the "Cap Trafalgar" was sunk and the "Carmania" limped back to Gibraltar to repair damages. Meanwhile the "Dresden" (Capt. Lüdecke) had been joined by the German s.s. "Baden" with 13,000 tons of English coal, and had coaled at the Rocas Is. and Trinidada. Then with the "Baden" and "Santa Isabel" she sped southward to a little harbour, Orange Bay, hidden among the glaciers of Hoste I. in the vicinity of Cape Horn. There she lay from Sept. 5–16 before she ventured into the Pacific. In the Atlantic she had sunk only two ships, and allowed five to go on. Cradock was still on the south-east coast. The menace of von Spee had begun to loom in the west, and the British armoured cruiser "Defence" (Troubridge's late flagship) had been ordered to join him from the Mediterranean, but was detained there with defects.

Von Spee had been last located at Ponape in the Carolines on Aug. 9, and on Sept. 15 a message arrived from the Admiralty definitely informing Cradock, then at Santa Caterina (Brazil), that there was strong probability of the German squadron proceeding to Magellan, and that the "Defence" and "Canopus" were being sent to him. He was to concentrate a squadron strong enough to meet von Spee, then search Magellan Straits, break up German trade and destroy the German cruisers. The fact that his force could only muster 2 9·2-in. against von Spee's 16 8·2-in. was apparently lost sight of. Hardly had the telegram been sent than another followed on Sept. 16 to say that von Spee had appeared off Samoa on Sept. 14, that the situation had changed, Cradock need no longer concentrate his cruisers, and German trade on the W. coast was to be attacked at once. This second telegram was the beginning of a chapter of misfortunes, and its motives remain obscure. The situation had indeed changed, but in a sense precisely opposite to that intended. Concentration and reënforcement were more necessary than ever, but someone had apparently become obsessed with the idea that von Spee was making for North America (apparently on the sole ground of his very commonplace ruse of steering N.W. when he left Samoa), and the Admiralty abandoned their original opinion that he was making for Magellan. The order for the "Defence" to proceed to the S.E. coast was cancelled, though Cradock was not even informed of this, and remained under the impression that she was on her way out to reinforce him. For another reason Sept. 15 is a red-letter day in the story of cruiser warfare, for on it the news arrived of the German cruiser "Emden's" incursion into the Bay of Bengal, which immediately reacted on the China and Australian squadrons.

Von Spee's memorable journey can only be described here in the briefest terms of place and time. When war broke out he was at Ponape, the German capital of the western Carolines. Thence he went to Pagan in the Mariana Is., where he was met by the "Emden" and a dozen supply ships, the latter leaving for her great venture in the East Indies on Aug. 14. Thence the squadron proceeded eastward to Enivetok, another atoll in the Marshall Is.; then on to Majuro in the same group, arriving on Aug. 26. There von Spee had heard (probably by wireless via Honolulu and Nauru) of Japan's entry into the war, and abandoned all thought of return. His next port of call was Christmas I., a small islet right in the middle of the Pacific, where he arrived on Sept. 7. On his way he had heard of the capture of Samoa, and after coaling at Christmas I., proceeded on Sept. 9 straight to Samoa, where he arrived at 3 A.M. on Sept. 14, hoping to surprise a British naval force there, but found the harbour empty. A landing was out of the question, and he withdrew. The report of his visit went out by wireless to Suva in Fiji, and thence by cable to New Zealand and London. The squadrons directly and immediately affected by the news, besides Cradock's, were the China and Australian, for in China it left Adml. Jerram free to hunt the "Emden" down, and in Australia it relieved Adml. Patey's mind as to the expedition to New Guinea and the homeward-bound Australian convoy.

A short survey of events on these two stations will now be given. In China Rear-Adml. Jerram's effective force consisted of the old battleship "Triumph," the armoured cruisers "Minotaur" (4 9·2-in., 10 7·5-in.) and "Hampshire" (4 7·5-in., 6 6-in.), and the light cruiser "Yarmouth" (8 6-in.). Japan's entry into the war on Aug. 23 secured the China seas, and Rear-Adml. Jerram took his force south, to bar any attempt on the part of von Spee to break back into the East Indies. The Admiralty ordered him on Aug. 23 to proceed in search of the "Scharnhorst" and "Gneisenau," and keep in touch with Rear-Adml. Patey in Australia, but there was no news of von Spee, and accordingly on his arrival at Singapore on Aug. 30 the British admiral sent his cruisers to search the Dutch East Indies, where 22 German merchant ships had taken refuge. This search lasted till Sept. 13, but already demands for convoys were beginning to dislocate his plans. On Sept. 8 the Admiralty ordered him to send the "Minotaur" and "Hampshire" to meet the Australian convoy, due to leave Fremantle for Europe on Oct. 3. The commander-in-chief decided to send the "Minotaur" in the meantime with two Japanese ships, the "Ibuki" (4 12-in., 8 8-in.) and "Chikama" (8 6-in.), to Rabaul in New Britain, to cover Australia, when suddenly the situation was changed on Sept. 15 by the news of von Spee's appearance at Samoa, and more imperatively by the simultaneous appearance of the "Emden" in the Bay of Bengal. Till the "Emden" was finally run down by the "Sydney" at Cocos I. on Nov. 9 the

China Squadron was almost wholly engaged in her pursuit in the East Indies. The station boundaries had entirely broken down under the stress of war.

In Australia the same influences had been at work. At the outbreak of war Rear-Adml. Patey had decided to take up a position at Port Moresby in the Gulf of Papua, covering Australian waters and not too far from the enemy's two principal harbours, Rabaul (or Simpsonhafen) in New Britain and Friedrich Wilhelmshaven in New Guinea. Like the commander-in-chief on the China station he thought rightly that it was useless to search in the spaces of the Pacific for an unlocated enemy, but in his case demands for convoy began even sooner to dislocate his plans. New Zealand's expedition to Samoa was ready on Aug. 18 and the Admiralty approved of its starting, telling Patey on Aug. 13 to give it naval support. But he was at sea at the time with poor wireless connexion, and only received news of the expedition on Aug. 16. No sooner had he arranged to meet it with the battle-cruiser "Australia" and the cruiser "Melbourne" 450 m. south of Fiji on Aug. 24, than the Australia Navy Board complicated matters by asking that their New Guinea expedition should be taken first. Finally it was decided to take it second, and that the "Sydney" in the meantime should take the New Guinea force as far as the Barrier Reef and then wait for the "Australia" and "Melbourne" to return from Samoa. The "Australia" arrived at Samoa on Aug. 29, the force was landed, the British flag hoisted and she left the next day to join the New Guinea force. But now the demands of the European convoy came cranking in and upset Patey's plans. On Sept. 3 the Admiralty ordered the "Melbourne" and "Sydney" to be detached for it, and on Sept. 10 asked for the "Australia" as well. She was then engaged with Patey in the New Guinea operations. Rabaul was occupied on Sept. 13 but German forces still remained active, and Patey, not liking to leave, suggested that the China squadron should help in a search for von Spee. Then on Sept. 15 came the important news of von Spee's appearance at Samoa, clearing up the situation. The "Australia" and "Montcalm" were left to cover the New Guinea operations while the "Sydney" joined the "Minotaur" and "Ibuki" to escort the Australian troops to Europe and to cause the "Emden's" destruction.

While these events were happening in Australia and the East Indies, Cradock had gone on to the southward, and by Sept. 28 his ships were in the Magellan Straits, searching the gorges of Tierra del Fuego. On Oct. 3 the "Glasgow" and "Monmouth" went on to the W. coast in accordance with the Admiralty telegram of Sept. 16, but the "Good Hope" remained in the Falklands area, waiting for the "Canopus." Von Spee had been reported off Tahiti in the Society Is. on Sept. 22, and on Oct. 5 was again located by an intercepted wireless to the "Dresden," which stated that he was on the way to Easter Island. No shadow of doubt could remain that he was on his way across, and the Admiralty sent word to Cradock to be prepared to meet him, adding that the "Canopus" should accompany the "Glasgow" and "Monmouth" and "Otranto" in their search. It was not a practicable idea. The "Canopus" could go only 12 knots, and the conception of a cruiser squadron relying for its safety on a slow old battleship was both tactically and strategically unsound.

Cradock received the message on Oct. 7 1914, and on the 8th sent a message to say he was concentrating at the Falklands, and suggesting the formation of a strong second squadron on the E. coast to intercept the German squadron if it should succeed in evading him. The telegram reached the Admiralty on the 11th, and steps were immediately taken to carry out the Admiral's proposal by the dispatch of the "Defence" and "Kent" to reinforce Adml. Stoddart on the E. coast. The First Lord (Mr. Winston Churchill) was also in favour of postponing Cradock's cruise to the W. coast, but the reply actually sent to him merely took the form of a concurrence in the "concentration" of his vessels "for combined operations." The concentration at the Falklands never materialized. The "Good Hope" left for the W. coast (via Cape Horn) on Oct. 22, leaving the "Canopus" to follow with her colliers (via Magellan). Cradock's intentions will never be precisely known. He probably felt it incumbent on him to support the "Glasgow" and "Monmouth." There was a vagueness at both ends of the wire. Cradock spoke of concentrating at the Falklands when half his squadron had already been sent to the W. coast. The Admiralty expressed their concurrence in his concentration there for combined operations (whatever that might mean). But their readiness to reinforce Stoddart at Cradock's suggestion indicates that they would have been equally ready to reinforce Cradock himself if he had pressed for it. But neither in his telegrams nor in his letter of Oct. 12 did he suggest, much less definitely state, that his squadron was too weak to face the foe. There was one vessel which could have saved the situation, namely the "Australia," if Cradock had been told to wait for her, but she had been retained off Fiji to guard against von Spee's possible return, and was left there straining on her leash.

Von Spee was now at Mas-a-fuera (Oct. 18–26), a small island 450 m. from the coast of Chile, and the two squadrons were approaching one another, for Cradock had joined the "Glasgow," "Monmouth" and "Otranto" at Vallenar in the Chonos Archipelago on Oct. 27. The two forces met off Coronel towards evening on Nov. 1. The battle had been von Spee's for over a month. Cradock's flag, still flying gloriously, went down into the Pacific. The "Monmouth" sank with the "Good Hope." The "Glasgow" and "Otranto" got away. The "Canopus" was 300 m. off, toiling northward at 12 knots (*see* CORONEL).

The news arrived in England in the morning of Nov. 4, and fell on the country like a thunderclap. Lord Fisher was now First Sea Lord and every effort was made to redeem the situation. The battle-cruisers "Invincible" and "Inflexible" were taken from the Grand Fleet, and sailed on Nov. 11, with Vice-Adml. Sir Doveton Sturdee, late chief of the war staff, in command. Rear-Adml. Stoddart waited for him at Abrolhos Rocks with the "Carnarvon," "Cornwall," "Defence," and "Kent." The West Indies Squadron went off to watch the Panama Canal. Von Spee meanwhile had visited Valparaiso, and, unaware of the thunderbolt launched at him, was on his way southward. The "Canopus" had returned to the Falklands and was organizing the defences there.

Adml. Sturdee coaled at Abrolhos Rocks, and rushed on with his ships ("Inflexible," "Invincible," "Carnarvon," "Cornwall," "Kent," "Glasgow," "Bristol," and "Orama") to the south, arriving at Port Stanley, Falklands, in the forenoon of Dec. 7. Meanwhile the "Australia" had been unleashed, and was speeding across the Pacific, and a Japanese squadron had moved down to Fiji to take her place. Von Spee had passed the Horn in bad weather at midnight on Dec. 1. The next day his squadron met a three-masted Scottish barque, the "Drummuir," with 2,800 tons of coal on board, and put back into Picton I., near Beagle Channel, to transfer her coal. On Dec. 6 the work was finished. The "Drummuir" was sunk, and with her sank von Spee's hopes of getting home. He had decided at Picton I. to make a raid on the Falklands. On Dec. 8 1914 at dawn the islands were in sight, and the "Gneisenau" and "Nürnberg" were sent in towards Port Stanley. In the battle which followed (*see* FALKLAND ISLANDS BATTLE) the "Scharnhorst," "Gneisenau," "Leipzig" and "Nürnberg" were sunk, and von Spee and his two sons perished. The battle stands out as one of the great beacons of the war at sea, for it marked the collapse of German naval power beyond the seas.

The "Emden's" career in the East Indies had already come to an end, with a tale of 15 ships. She had ranged the Bay of Bengal from Sept. 7–25, bombarded Madras on Sept. 22, worked in the approaches to Colombo till Oct. 21, coaling in the Maldives and at Diego Garcia, and raided Penang on Oct. 28. The "Hampshire" and "Chikuma," "Empress of Asia" and "Yarmouth," had searched for her in vain, though the latter on Oct. 9 had sunk her two supply ships at Pulo Tapak on the west coast of Sumatra. At dawn on Nov. 9 she appeared off the cable station at Cocos Keeling I., and the operator flashed the news to Singapore. The big Australian and New Zealand convoy of 38 transports homeward bound, which left Albany on Nov. 1, escorted by the "Minotaur," "Melbourne," "Sydney," and "Ibuki," was approaching Cocos. It was only 55 m. off when the news reached it, and the "Sydney" went off to Cocos I. at full speed. An action ensued between the "Sydney" (Capt. J. C. Glossop, 8 6-in.) and the "Emden" (Capt. von Muller, 10 4·1-in.). By 11:30 the latter was driven ashore, blazing.

With the destruction of von Spee's squadron there remained only, as regards German naval forces at sea, the "Dresden" hiding in the creeks of Tierra del Fuego, and the "Königsberg" shut up in the Rufiji river (German East Africa), both of them powerless for harm. The ocean passages were again secure for Great Britain and her Allies. Samoa and New Guinea had fallen, and a Japanese guard stood at the gates of Tsingtau. In Cameroon, Duala, Buea, and Victoria had been occupied. The naval operations under the conduct of Capt. C. M. Fuller had contributed largely to this success, and the "Cumberland" now joined the stream of British cruisers homeward bound.

Operations in 1915.—The year 1915 saw a heavy blow dealt at the German battle-cruisers in the North Sea. An impression prevailed in Germany at this time that the British fleet was preparing to block the Jade and it was decided to send Rear-Adml. Hipper's battle-cruisers as far as the Dogger Bank to reconnoitre on Jan. 24, but the Admiralty had intelligence of this and dispatched Beatty with his battle-cruisers on the 23rd to join hands with Tyrwhitt. They met Hipper's forces on the morning of Jan. 24 and the battle of the Dogger Bank ensued in which the Germans lost the "Blücher" and were driven back to port (*see* 30.848). The battle reacted at once on German naval strategy. Von Pohl, chief of the staff, replaced von Ingenohl in command of the High Sea Fleet with instructions to use extreme caution. The successes of von Weddingen had inclined the German naval staff more and more to submarine warfare which opened with the declaration of a war zone round the British Isles on Feb. 4. Their tendency in this direction was strengthened by the final collapse of their cruiser warfare abroad. News of the "Dresden's" destruction arrived in March 1915. For two months after the battle of the Falklands she had lain hidden in the innermost recesses of the Magellan Straits with half a dozen British cruisers looking for her, and it was not till Feb. that she ventured to creep back into the Pacific in order to meet a German collier south of Juan Fernandez. The "Kent," searching the Barbara Channel (Magellan Straits) with the "Glasgow" at the time, got the news and hastened after her. On March 7 1915 she reached the rendezvous but the "Dresden's" speed enabled her to get away. It was not for long, however. The "Glasgow" had made out the words "Juan Fernandez" in a message the "Dresden" had sent and there, on March 14, the "Kent," "Glasgow" and "Orama" found her and brought her career to an end.

From the lonely islets of the Pacific we must return to Europe for a time. There the centre of interest had shifted from the Grand Fleet to the Dardanelles. After the Dogger Bank action the German fleet became more wary in its excursions and the work of the Grand Fleet was confined to periodical cruises enlivened only by an occasional attack by a submarine. The battle of the Falklands had released a number of older battleships and cruisers but in the North Sea the war was settling down into a state of equilibrium. The Germans rarely came out of the Bight and we could rarely go into it. On sea and land a deadlock had arisen, giving rise to the belief that a better outlet for energy could be found in the Mid East. In this way the idea of the Dardanelles came cranking across the original plans of naval strategy, challenging even the Grand Fleet in its insistency, swallowing at a gulp the Channel Fleet and wrecking Lord Fisher's plans for a Baltic campaign.

The general conception was sound for it was a matter of first-rate importance to gain free access to Russia and the scheme offered strategic political and economic advantages of the first magnitude, but it was begun in a haphazard way and its direction was marred by an inability to distinguish clearly between a naval bombardment and a combined naval and military operation and by a failure to appreciate that two operations unless conducted simultaneously must prejudice one another. The history of the naval side of the subject can only be briefly sketched. Petrograd had asked on Jan. 2 for a diversion to relieve the pressure of the Turks in the Caucasus. The idea of the Dardanelles was broached. Vice-Adml. Sackville Carden, the senior officer in the Mediterranean, gave his opinion on Jan. 11 that a progressive attack on the defences, step by step, was practicable. The First Lord (Mr. Winston Churchill) waxed enthusiastic over it and pictured the forts falling in succession before the "Queen Elizabeth's" guns. There can be little doubt that had plans and preparations for a combined operation been made on a sufficient scale, a great success might have been gained; but the refusal of Lord Kitchener to supply the troops led to the proposal to force the Straits with ships alone. This was an entirely different operation and the war staff failed to put its difficulties in a clear enough light. It was and is a truism of naval warfare that ships are handicapped in engaging forts. A ship cannot be concealed; a fort, and much more a modern movable battery, can. Aerial reconnaissance and the increased range of naval guns were supposed to have altered these conditions, but aerial spotting in conjunction with naval artillery was still in its infancy, and the limitations of naval bombardment were insufficiently appreciated.

The First Lord had a wofully extravagant estimate of the capacity of the "Queen Elizabeth's" guns, and thought of her creeping relentlessly forward, destroying each fort in turn with five or six 15-in. shells. Lord Fisher was absorbed in his project for a campaign in the Baltic, and it was allowed that the proposition was worth a trial.

The result was an endeavour to perform a task of first-class magnitude with second-class material and with insufficient preparation. Had a force for the purpose been segregated and thoroughly trained on the lines afterwards followed for the much smaller project of Zeebrugge, the chances of success would have been much greater. It would have required a nucleus of the best artillerists, the best minesweeping officers and the best minesweeping vessels in the fleet and at least two score of first-class airmen to evolve and apply a sound scheme of air-spotting. Given these necessary adjuncts and approximately six weeks of intensive specialized training to groin the whole into a solid arch, the Dardanelles could probably have been forced. But here the strategical weakness of the conception would have revealed itself. The forcing of the Straits in itself could do little unless it precipitated a revolution. In default of a revolution the fleet would have been left in the air in the Sea of Marmora, for its ships could hardly pass and repass through a channel a mile wide whose shores were in hostile hands. But the principal objection lay in the fact that any premature bombardment must inevitably wreck or at least imperil the prospects of a combined operation and anticipate surprise where surprise was the essence of success.

But by Feb. 1915 the idea of merging the two operations had crept in. A military force was to be available "to reap the fruits" and was being assembled in Egypt. The opinion found favour that if the navy failed, the army should help—a fatal conception which ignored the real relativity of the two operations. Meanwhile Lord Fisher's attitude of lukewarm acquiescence had changed to one of definite disapproval, but his position was weakened by his adherence to a scheme for landing in the Baltic, much more difficult and dangerous. The War Council definitely approved of the project on Jan. 28, bringing Lord Fisher to the verge of resignation.

The force collected for the purpose consisted of the "Queen Elizabeth" (Capt. George Hope) and "Inflexible" (Capt. R. Phillimore) with a heterogeneous collection of old battleships drawn from the Channel Fleet or which had come home from abroad after von Spee's defeat. In command was Vice-Adml. Sackville Carden who had been admiral superintendent at Malta Dockyard when the war broke out, with Comm. Roger Keyes as his chief-of-staff. Operations against the outer fort

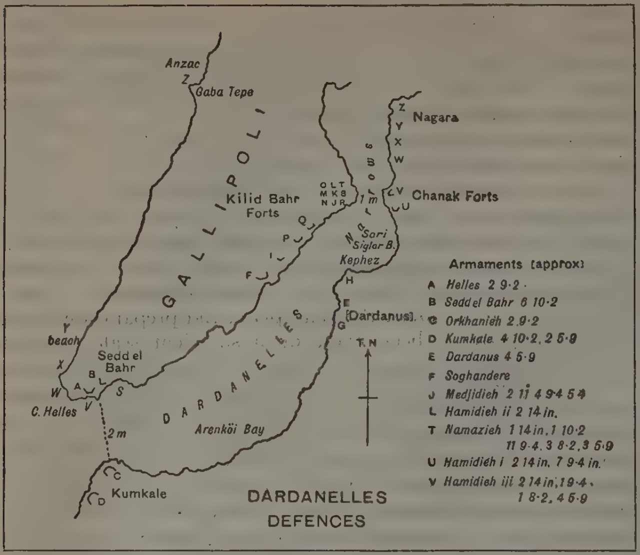

DARDANELLES DEFENCES

were begun at 8 A.M. Feb. 19 by the "Inflexible" (8 12-in.), "Agamemnon" (Capt. H. Fyler 4 12-in., 10 9·2-in.), "Cornwallis," "Vengeance" (both 4 12-in., 12 6-in.), "Triumph" (Capt. Maurice Fitzmaurice 4 10-in., 10 7·6-in.), "Bouvet" (2 12-in., 2 10·8-in.), "Suffren" (4 12-in., 10 6·4) and "Gaulois" (4 12-in., 10 5·5-in.). The forts were apparently silenced, but when the ships closed in at 2:45 P.M. reopened fire, and were still firing on the Asiatic side when failing light put a stop to the operations. On Feb. 25 the operations were resumed with better results. The "Queen Elizabeth" (8 15-in.) assisted by the "Agamemnon" put both guns of Cape Helles out of action and the "Vengeance" (Capt. Bertram Smith) and "Cornwallis" (Capt. Alex. Davidson), running in, engaged it at close range. The Kumkale forts on the Asiatic side were silenced by the "Irresistible" (Capt. Douglas Dent), "Gaulois," "Suffren" and "Charlemagne," and by 5:15 P.M. all the outer forts were effectually reduced. The minesweepers proceeded in and swept a channel four miles up. The entrance was now clear and the "Albion" (Capt. Algernon Heneage), "Majestic" (Capt. H. F. Talbot) and "Vengeance" entered on Feb. 26 and engaged Fort Dardanus (E) on the right-hand side halfway up to the Narrows. But the outer forts were merely the outworks of the defences. The real obstacle loomed ahead at the Narrows, where a channel only a mile wide was commanded by a score of batteries, mounting at least 9 14-in. guns and three times as many 10-in. and 9-in.

March 3 to March 17 was occupied with attempts to sweep the channel by night and reduce the forts by day. On March 3 the "Irresistible," "Albion," "Prince George" (Capt. Alex. Campbell) (all 4 12-in., 12 6-in.) and "Triumph" resumed the attack on Fort E and the sweeping operations continued. It was here, however, that the principal shortcomings arose. The minesweeping force had neither the training nor the vessels required for their colossal task. On March 5 the "Queen Elizabeth" opened indirect fire on the Kilid Bahr forts, shelling them overland from the western side of Gallipoli and apparently putting Hamidieh ii. out of action. Indirect fire was continued the next day on Hamidieh i. and ii. at 21,000 yd. while the "Vengeance," "Albion," "Majestic," "Prince George" and "Suffren" inside the Straits engaged Forts E and F halfway up the Narrows. The weakness in aircraft and trained observers began to show itself when three officers were injured and two seaplanes disabled in two days. On the 7th the "Gaulois," "Charlemagne," "Bouvet" and "Suffren" engaged Fort E (Dardanus) while the "Agamemnon" and "Lord Nelson" (Capt. J. W. McClintock) went up and engaged Medjidieh and Hamidieh i. in the Kilid Bahr group on the north side of the Narrows at 14,000 yd., apparently silencing both. Meanwhile the progress of the minesweepers was poor. The trawlers unable to go more than four knots against the current were an easy target for the guns. On March 10 the minesweepers went up at night supported by the "Amethyst" (Comm. G. J. Todd) and "Canopus" (Capt. H. S. Grant). Two trawlers were hit by 6-in. shell and one sunk by a mine. At home the First Lord was growing impatient and on March 11 sent a telegram to Vice-Adml. Carden urging a decision and suggesting that the forts at the Narrows could be overwhelmed by the fire of the fleet. It was clear that in his case the idea of a gradual reduction of the defences had given place to that of a shock attack. Everything now hinged on clearing the minefields. The trawlers could not face the fire but on the night of the 13th seven of them and five picket boats manned by volunteers made a determined effort, as far as their lack of training would permit, to sweep the channel, supported by the "Amethyst" and "Cornwallis." They steamed up in line ahead on the European side, and at 3:50 A.M. were shooting their sweeps when six powerful searchlights shone out on them. The "Amethyst" opened fire on the searchlights and came under a heavy fire. A 6-in. shell carried away her wheel shafting, and after receiving nine hits she was forced to retire with 22 killed and 38 wounded. The trawlers were driven back under a tornado of fire. This effectually demonstrated the difficulty of sweeping under fire by night and it was decided to attempt it by day under cover of a bombardment. Vice-Adml. Carden's health had broken down and the final attack took place on March 18 under Vice-Adml. John de Robeck. He had with him the "Queen Elizabeth," "Inflexible," "Agamemnon," "Lord Nelson" and 14 older battleships.

It was a clear sunny day when the force mustered for the final attempt. At 10:45 the "Queen Elizabeth," "Inflexible," "Agamemnon" and "Lord Nelson" engaged the Kilid Bahr and Chanak batteries while the "Triumph" and "Prince George" engaged the forts halfway up at Soghandere (F), Dardanus (E) and Kephez. After a bombardment of about an hour and a half the French battleships "Bouvet," "Charlemagne," "Gaulois," and "Suffren" advanced as far as Kephez and engaged the Narrows forts at about 9,000 yards. The forts ceased firing for a time. The "Vengeance," "Irresistible," "Albion," "Ocean," "Swiftsure" (Capt. C. M. Lefroy) and "Majestic," after relieving the six old battleships previously engaged, renewed the attack at 2:36 P.M. while minesweepers continued their operations. Up to this point the day had been going fairly well though the "Inflexible" had been badly hit at 1:15 P.M., her fo'c'sle set on fire and her control station put out of action. Then came the *dénouement* within one short hour. As the "Bouvet" was retiring, she was struck by a mine or shell and in two minutes turned turtle and sank with most of her crew. At 4 P.M. the "Inflexible" struck a mine and was forced to retire. At 4:15 the "Irresistible" struck another; the "Ocean" went to help her and struck another at 6:05 P.M. and both went down, though their crews were saved. All this happened in Arenkoi Bay four or five miles from the entrance on the Asiatic side, where mines had either been laid by a Turkish minelayer on March 8 or may have drifted down from the minesweepers.

The "Suffren" and "Gaulois" were also injured so severely as to require docking. Three ships had been sunk and three disabled, putting one-third of the force out of action before the minefield had been swept. De Robeck had attempted too much. To force a channel defended by a strong minefield and heavy batteries remained to the end of the war a tactical proposition of the first magnitude which was too much for the Germans in the Gulf of Finland and was beyond the compass of the force at De Robeck's disposal. The minesweeping force was an extemporized force of trawlers which attempted to perform a task of exceptional difficulty with no special experience, no special vessels, no special appliances and no special training for the work. The minesweepers and minesweeping talent required for the task had been retained at home. Success at the Dardanelles was sacrificed to the integrity of the Grand Fleet. Lord Fisher would not agree to a renewal of the attempt and there is no reason to believe that a further attempt with the same force would have been any more successful. The war staff had not risen to the height of the First Lord's conception and the First Lord had no conception of the technical difficulties involved. This was the end of the purely naval enterprise and should have been the end of the whole project. But Lord Kitchener, who had hung back at the critical moment, now pressed forward when it was too late. Both at the Admiralty and the War Office the lack of a competent staff was painfully evident. On March 23, after a conference with Gen. Sir Ian Hamilton, Sir John de Robeck abandoned the attempt. A month elapsed before the army could make their attack, and Gen. Liman von Sanders converted the peninsula into a fortress.

It was now the task of the navy to prepare to support the landing. This did not take place till April 25. The naval force acting in support numbered 18 battleships, 12 cruisers, 29 destroyers and 8 submarines, and there gradually collected at Port Mudros in Lemnos a great armada of transports, supply ships, munition ships and auxiliary craft. The whole shore was carefully surveyed. Six beaches were chosen for the landing on the 12-m. strip of coast stretching northwards from Sedd-el-Bahr (on the north side of the entrance to the Straits) to Gaba Tepe. S beach was in Morto Bay inside the Straits a mile or so east of Sedd-el-Bahr. Then following the coast from Sedd-el-Bahr to the west and north came V beach just under the old castle at Sedd-el-Bahr and between it and the high lighthouse of Cape Helles; a mile or so further on came W beach between Cape Helles and Cape Tekeh; then X beach just north of Cape Tekeh, and Y beach close to it, and then at last 10 m. to the north came Z beach near Gaba Tepe, christened in its baptism of fire with the new and splendid name of Anzac. It is only possible to give the names of the ships which supported the landings. The landings at the nose of the peninsula, that is at S, V, W, X and Y, were under Rear-Adml. Rosslyn Wemyss with seven battleships, the "Lord Nelson," "Swiftsure," "Implacable," "Cornwallis," "Vengeance," "Albion" and "Prince George," and four cruisers, the "Euryalus" (Capt. R. Burmester, 29 2, 12 6-in.), "Talbot" (Capt. F. Wray, 11 6-in.), "Minerva" (Capt. P. Warleigh, 11 6-in.) and "Dublin" (Capt. J. D. Kelley, 8 6-in.). The landing at Anzac was under Rear-Adml. Cecil Thursby with five battleships, the "Queen" (flag., Capt. H. A. Adam), "Prince of Wales" (Capt. R. Bax), "London" (Capt. J. Armstrong), "Triumph," "Majestic," and one old cruiser the "Bacchante" (Capt. Hon. Algernon Boyle, 29 2, 12 6-in.). All six left Port Mudros on the afternoon of the 24th, and the ships and transports went their respective ways.

At Gaba Tepe by a fortunate accident the landing was made at Sari Bahr a mile and a half farther north. Four thousand troops were ashore in an hour; the Australians rushed the Turks up the hills and out of them. At Y beach the troops were heavily attacked and had to be reëmbarked. At X beach the captain of the "Implacable" (Capt. Norman Lockyer, R.N.) dropped anchor close in, veered till the ship was almost aground, then let go with all her guns just over the beach, raising such smoke and dust and din that the troops landed there with scarcely any casualties. W was a beach about 300 yd. long, bristling with wire to the water's edge, flanked by steep cliffs honeycombed with guns. The "Euryalus" supported the landing here, but her 6-in. guns were too light to make any impression on the entanglements and the Lancashire Fusiliers had a terrible time. V beach, about 500 yd. long, just under the old castle of Sedd-el-Bahr, was another fortress, and there things were even more desperate. The old collier "River Clyde" had been prepared for the landing and it had been arranged to run her ashore and push a bridge of lighters out from her side on to the beach. But the lighters broke adrift though Comm. Unwin with his gallant companions made heroic efforts to get them into place. At S beach in Morto Bay the landing was made in trawlers covered by a heavy fire from the "Cornwallis" and "Lord Nelson" and the 2nd South Wales Borderers got ashore with a very few casualties. Such was the famous landing at Helles, but another danger was looming on the horizon. Otto Hersing, one of the most skilful German commanders, was on his way out in U21. Already on May 13th the "Goliath" (Capt. T. L. Shelford), anchored in Morto Bay just inside Sedd-el-Bahr, had been attacked by a Turkish destroyer, the "Muavenet-i-Millet," which came down on her in the mist, and hit by three torpedoes she had sunk in a few minutes with a loss of over 500 men. Lord Fisher now insisted on the recall of the "Queen Elizabeth," and in the ill-advised decision of the War Council on May 24 to persist in the campaign he saw his great alternative scheme doomed. Faced with the progressive frustration of his plans, he left the Admiralty and Adml. Sir Henry Jackson took his place as First Sea Lord. On May 25 Otto Hersing made his presence felt. The "Vengeance" was fired at and missed. The "Triumph" was hit and capsized in twelve minutes and on the 27th the "Majestic" suffered the same fate. The movements of ships were now severely restricted but the fleet successfully maintained the army's passage by sea and remained its "father and mother" right up to the amazing night of Jan. 8 1916 when swiftly and silently it gathered into its arms the men of those tremendous legions and bore them home. But the passage of the Dardanelles, impenetrable to big ships, had been made by submarines—though not without severe loss. All together nine British and three French submarines passed the Straits, of which four British and the three French never returned. From July 1915 to the end of the year there were usually two British submarines working in the Sea of Marmora which seriously interfered with Turkish transports and supply.

The end of the year saw the end of the great crusade, leaving behind a trail of glory and bitter disappointment, for there can be little doubt that it had in it the elements of a splendid success had it been properly handled from the beginning. But there was no real staff at the Admiralty or War Office to grip the fundamental aspects of the problem, the Grand Fleet and the army in France were urgent in their insistency, and Lord Fisher unfortunately clung persistently to his Baltic plan, which was a far more extravagant conception than that of the Dardanelles. It was based on the idea of a big landing on the German coast near Rugen, and on the far-fetched assumption that the Russian general staff could be persuaded to coöperate in the scheme. The War Office would not listen to it. From a naval point of view it must be regarded as impracticable. It might have been possible with a specially trained and constituted force to force the Great Belt. But what was to be done then? The same question confronted the British at the Dardanelles. The Great Belt stretches for 80 m. and is only 10 to 15 m. wide; farther on come the narrow Fehmarn and Cadet channels with the impregnable fortress of Kiel only 30 m. on their flank, and any attempt to maintain a passage through these waters must sooner or later have developed into an investment or blockade of Kiel, where there would only be German granite to bite instead of Gallipoli sand. And yet it must be confessed that the assistance given the Russians in the Baltic was not very great. There, as in the Dardanelles, British assistance was limited to submarines, which did magnificent work after their kind but could do no more. It is certain that at the beginning of the war any rumour of an attack in the Baltic sent a quiver of trepidation through the German Admiralty. The Sound was not passable to big ships, and Germany at the beginning of the war had agreed with Denmark to the closure of the Great Belt by Danish minefields at the northern and German at the southern end. The defence of the Baltic had been entrusted to the older German ships, but in the East Baltic the Germans did not have it all their own way, and the Russians from first to last showed themselves no mean antagonists.

In the summer of 1915 after the capture of Libau, German naval forces were engaged supporting the army as it closed round Warsaw. At attempt was first made on June 28 to land troops at Windau (Courland) under an escort of old battleships, four cruisers and torpedo craft, but the opening bombardment was ineffectual, and while the troops were landing, a swarm of Russian destroyers appeared, and drove off the supporting ships and transports, bringing the operation to an abrupt close. On July 2 the Russian armoured cruisers "Admiral Makaroff" and "Bayan" (both 2 8-in., 8 6-in.), and the cruisers "Bogatyr" and "Oleg" (both 12 6-in.), all old ships, met the light cruiser "Augsburg" (12 4·1-in.) and minelayer "Albatross" off the coast of Courland and drove the latter ashore at Ostergarn on the E. coast of Gothland (Sweden). The German armoured cruisers "Roon" (4 8·2, 10 6-in.) and the "Lübeck" (10 4·1-in.) proceeded to reinforce them but were chased off by the "Rurik" (4 10-in., 8 8-in.), and when the old armoured cruiser "Prinz Adalbert" (4 8·2-in., 10 6-in.) was hurrying to the spot, she was torpedoed and seriously damaged by E9 (Comm. Max Horton) in the Gulf of Danzig. In Aug. 1915 a strenuous attempt was made by the German Baltic squadron to force the Gulf of Riga, whose possession would have enabled them to take the Russian army in rear, and the 1st and 4th Squadrons were assembled in the Baltic for the purpose, but the Russian minefields offered a serious obstacle and British submarines were again active. On Aug. 19, E1 (Comm. Laurence) torpedoed and seriously injured the German battle-cruiser "Moltke," and she had to return to Kiel at 15 knots. Next day the order came to abandon the operations; all the High Sea Fleet ships were sent back, and there ensued a long period of minor activity in the East Baltic, though British submarines still remained there and did much to disturb the important German iron-ore trade with Sweden during the latter months of 1915.

Meanwhile the Grand Fleet had been carrying out occasional sweeps into the North Sea. The 3rd Cruiser Squadron with the "Nottingham" and "Birmingham" left the Forth on June 18 1915 for a sweep of this sort towards the Skagerack, and crossed the path of a line of four German submarines stationed off the Forth. Five torpedoes were fired at them, but all missed except one on the 20th from U38, which hit the "Roxburgh" and sent her into dock for a time. Some three weeks later came the last echo of the cruiser warfare, when news arrived from the East Indies of the destruction of the "Königsberg" in the Rufiji river on July 11 1915.

After sinking the "Pegasus" off Zanzibar on Sept. 20 1914, she had hidden herself on the E. coast of Africa in the swampy delta of the Rufiji river opposite Mafia I. and the light cruisers "Chatham," "Weymouth" and "Dartmouth" had been sent from the Mediterranean to look for her. The papers of a captured German ship, the "Praesident," gave the first clue to her position, showing that coal had been sent 6 m. up the Rufiji for her use. The "Chatham" (Capt. S. R. Drury-Lowe) arrived off the Rufiji on Oct. 30 and learnt from the natives that a ship was lying up the Suninga branch of the river. The river was blockaded and a blockship sunk in the mouth of the creek. A supply ship, the s.s. "Rubens" (formerly British), had been sent to her from Germany and had made the long journey round Africa in safety, but exact intelligence had been received of her, and the cruiser "Hyacinth" (Rear-Adml. King-Hall) met her off Mansa Bay (near Tanga) and set her on fire. The monitors "Severn," "Humber" and "Mersey" (under Capt. E. J. Fullerton) were sent out later with an aeroplane, and their final attack was made on July 11 1915. Fire was opened by the "Mersey" at 9,500 yd., and hitting was established with the aeroplane's help after the eighth salvo. An explosion was followed by a dense cloud of smoke, and the last German cruiser was left a blazing wreck in the swamp of an African jungle. The ship sunk by the "Hyacinth" in German E. Africa was not the only one which ventured into the North Sea. The "Meteor" slipped over to the Scottish coast in Aug. 1915 and on the night of Aug. 7–8 laid a large minefield of 380 mines off the Moray Firth, sinking the patrol vessel "Ramsey" and taking the survivors of her crew prisoners. Intelligence came of her movements, and the "Harwich" destroyers went off at full speed to intercept her, but her captain sunk her and escaped in a Swedish vessel.

In Germany the submarine warfare controversy had reached an acute stage. After the sinking of the "Arabic" on Aug. 19 1916 by U24, orders were issued that no passenger steamers were to be sunk without warning and rescue. The chief of the admiral staff resigned, to be succeeded by Adml. von Holtzendorff. Tirpitz sat at his "lonely table" at Great Headquarters, discontented and furious, and all submarine activities in the Channel and to the westward ceased for a time.

The pressure of the blockade was beginning to be felt (*see* BLOCKADE). It was the British navy's part to intercept all shipping entering the North Sea, in itself an immense task lost to sight in the greater immensity of the war. In the north this work was performed by the 10th Cruiser Squadron, but the New Year of 1916 saw the "Moewe" (Lt.-Comm. Count Nikolas zu Dohna-Schlodien), one of the most notable German raiders, slip through its weather-beaten lines and get safely out to sea, after laying a large minefield on the west side of the Orkneys, where the "King Edward VII." was lost Jan. 5 1916.

Operations in 1916.—The year 1916 saw an important change in German naval policy. Adml. von Pohl had been seriously injured in an accident, and his place was taken on Jan. 18 by Adml. Scheer, a strong advocate of an offensive strategy at sea. He received his appointment as commander-in-chief on Jan. 18, and after a conference with the chief of the naval staff, Adml. von Holtzendorff, it was decided to adopt bolder measures.

One of the first fruits of the new policy was the dispatch of the German 2nd, 6th, and 9th Torpedo Flotillas to the Dogger Bank on Feb. 10 1916, where they attacked the 10th Sloop Flotilla belonging to the Humber Patrol and sank the "Arabis." Meanwhile the safe passage of the "Moewe" had induced another raider, the "Greif" (4 5·9-in. and two torpedo tubes), to try and get to sea. The commander-in-chief Grand Fleet had received intelligence of some project of the sort, and his patrols were posted between the Shetland Is. and Norway to intercept her. The "Greif" (with a crew of 306) was sighted by the "Andes" of the 10th Cruiser Squadron on Feb. 29 some 90 m. N.E. of the Shetlands, and the "Alcantara" (Capt. Thos. Wardle) joining in the chase got within 6,000 yd. of her at 9:15 A.M. and ordered her to stop. She was then flying the Norwegian flag and gave the name of the Norwegian s.s. "Rena" from Rio to Trongjhem, but when the "Alcantara" lowered a boat to board, the German ensign fluttered out at the main and she opened fire. A hot action ensued, in which the "Greif" was sunk but the "Alcantara" was hit by a torpedo and went down as well. That same night the "Moewe" managed to slip through the dislocated patrol line and reach home. Directionals had been received that night at 2:53 A.M. of an enemy vessel off Ekersund, but unfortunately, on the assumption that she was coming westward, the patrols had been redisposed to the westward and missed her. Her cruise in mid-Atlantic in the regions of trade winds and flying fish had been a great and successful adventure. She had captured 15 ships of 57,835 tons, of which 14 were sunk. Her most important capture was the "Appano" (Jan. 15, 135 m. east of Madeira), an Elder Dempster liner of 7,781 tons, with the governors of Sierra Leone and Nigeria and a cargo worth £2,000,000 on board. She was sent in to Newport News, where she arrived on Feb. 15, but the German Government's claim was disallowed by the U.S. Supreme Court in March 1917, on the grounds that she arrived without convoy and was sent in with the intention of being laid up indefinitely.

A weightier matter than the return of the "Moewe" was now engaging the attention of Great Headquarters. Scheer when he took over the command had fully expected to see the inauguration of unrestricted submarine warfare in March 1916. Von Tirpitz and von Holtzendorff had appeared at a council of war on March 4 1916 and pressed for a decision, but the Chancellor had again carried the day. Von Tirpitz, unable to bear the constant frustration of his schemes, resigned, and Adml. von Capelle took his place.

The German air raids on England had instigated a counter-attack and on March 24 1916 the Harwich flotillas sailed with the "Cleopatra," "Undaunted," "Penelope" and "Conquest" in support of an aerial operation carried out by the "Vindex" and five aeroplanes against the Zeppelin sheds at Tondern.

The German outpost forces, which had just been reorganized by Scheer, were caught napping, and two outpost trawlers were sunk, but fog and snow interfered with the aerial attack, which was driven off, and only two planes got back. The only naval result was the ramming of G194 by the "Cleopatra" (Tyrwhitt's flagship, Capt. F. P. Loder Symonds) on the way back and the loss of the British destroyer "Medusa" by collision with the "Laverack."

A month later, signs of Scheer's activity were clearly apparent in the resumption of coastal raids. A sortie had already been made into the Hoofden (the narrows between England and Holland) on March 5, but on April 24 a more ambitious operation was attempted. This time the objective was Lowestoft. The whole High Sea Fleet was to take part in conjunction with submarines stationed off the Forth and eight of the newer airships. The actual bombardment was to be carried out by the five battle-cruisers of the 1st Scouting Group, attended by the light cruisers of the 2nd Scouting Group and the 6th and 9th Flotillas. The force put to sea on the 24th, but on its way past Nordeney encountered a nasty setback by the "Seydlitz" striking a mine laid by the "Princess Margaret" in Nov. 1915 and having to put back. Intelligence of these movements had been received, and by 10 P.M. the Grand Fleet had put to sea and was on its way south. During the night the German airships taking part bombed Norwich, Lincoln, Harwich and Ipswich. The German battle-cruisers were seen shortly after 4 A.M. on April 25 by the Harwich forces, consisting of the "Conquest," "Cleopatra," and 16 destroyers, who engaged the "Rostock" and "Elbing," but were driven off by the German battle-cruisers, the "Conquest" being hit by five 12-in. shells and suffering heavy casualties. At 5 A.M. the Germans were off the coast and bombarded Lowestoft and Yarmouth for half an hour. Beatty's battle-cruiser fleet struck down at them towards Terschelling and were off it at 12:30 P.M., but the enemy had passed him and gone home.

The raid had little naval significance, but in order to strengthen the position of the Harwich force in the south, which had been weak ever since the Channel Fleet had been swept off to the Mediterranean, it was decided to station the 3rd Battle Squadron in the Thames ("Hibernia," "Commonwealth," "Zeelandia," "Dominion," "Africa," "Britannia," "Hindustan," all 4 12-in., 9 4·2-in., 10 6-in.) and it sailed for Sheerness on April 29.

The day that saw the bombardment of Lowestoft saw a barrage being laid by the Dover Patrol off the Belgian coast to cope with the German submarines there, which was completed by May 7 (*see* SUBMARINE WARFARE). On May 5 1916 Adml. Jellicoe launched another attack against Tondern sheds. The 1st L.C.S. and 16 destroyers escorted the seaplane carriers "Vindex" and "Engadine" to Horn's Reef. Three submarines were posted there, and the "Abdiel" laid a line of mines (one of which was to catch the "Ostfriesland" on the night of Jutland), while the battle-cruiser fleet waited ready in support with the battle-fleet behind it. Only one seaplane would rise off the water, but the "Galatea" and "Phaeton" damaged a Zeppelin, L7, forcing her to descend near E31, one of the submarines on watch, which completed her destruction and rescued seven survivors.

The attack on the "Sussex" on March 24 1916, with the 80 casualties caused by it, had led to a strong American protest, and as Scheer was on his way across to the Lowestoft raid on April 24 he received a message that submarine warfare was to be carried on in accordance with Prize law (that is, by warning and examination). He at once recalled all the submarines of the High Sea Fleet, and announced that the submarine campaign against commerce had ceased so far as his submarines were concerned. This set free a number of submarines for work in conjunction with the fleet, and Scheer set to work to devise a plan to entice the British fleet out. This was ready by the middle of May. Twenty-two submarines were to be stationed off the British ports, two off Scapa, one off Cromarty, seven off the Forth, one off the Tyne, two off the Humber and one south of the Dogger Bank. The High Sea Fleet was then to appear off the coast of England or Norway in the hope that the Grand Fleet would rush out and be torpedoed by the submarines. Such was the plan of the Jutland operations. The submarines were off their ports by May 23; and U75, after laying mines off the Orkneys on May 29 which were to sink the "Hampshire," proceeded home, the only submarine to achieve any measure of success.

The weather was too bad for air reconnaissance, which was essential for approaching the English coast, so it was decided to try the less risky advance to the Norwegian coast. But the British Admiralty was on the alert, and the Grand Fleet had put to sea on May 30 before the German ships had cleared the Jade. There followed the battle of Jutland (*see* JUTLAND, BATTLE OF). The British lost three battle-cruisers, three cruisers and eight destroyers. The Germans one older battleship, one battle-cruiser, four cruisers and five destroyers. Scheer, threatened with envelopment and destruction, succeeded in making good his escape, and the High Sea Fleet, driven back to harbour, became the buttress of the submarine campaign. It remained intact, a fleet "in being" barring the road to the Baltic and access to Russia with all the consequences which that involved, guarding the Bight and insuring safe entry and exit to its submarines, circumventing British attempts to mine them in and forcing the British Government to keep a mass of craft still locked up in the Grand Fleet when they were wanted for convoy and the tremendous struggle against the submarine.

A single success was achieved by the submarines engaged in the Jutland operation. On June 5, H.M.S. "Hampshire" on her way to Archangel struck one of the mines laid by U75 and went down off the Orkneys, bringing Lord Kitchener's great career to an untimely end. He had arrived at Scapa that day with the weather growing steadily worse, and by the afternoon a gale was blowing from the north-east. Lord Kitchener insisted on sailing, and to give the "Hampshire" a lee it was decided to send her up the west side of the Orkneys instead of the east and she sailed at 5:30 P.M. But the wind had backed to N.N.W., and the destroyers, unable to make head against the gale, had to put back. The "Hampshire" was alone when about 7:50 P.M. she struck one of the mines laid by U75, one and a half miles from shore, between the Brough of Birsay and Marwick Head, and sank in 15 min., losing all but 12 men.

The disposition of submarines adopted for the Jutland operations had met with no success, but in August Scheer devised another and more successful plan, which led to the loss of the "Nottingham" and "Falmouth." This time, the submarines, instead of being stationed off the ports where patrols were constantly on watch, were disposed in lines in the North Sea on the expected track of the British fleet. One line of six submarines was posted off Blyth, another off the Yorkshire coast, and two lines of Flanders submarines off Terschelling. The High Sea Fleet put to sea in the evening of Aug. 18 1916, leaving the 2nd Squadron this time to guard the Bight, and shaped course from Heligoland in the direction of Hartlepool, intending to bombard Sunderland, at sunset the next day, if the British fleet were not encountered.

The battle-cruisers of the 1st Scouting Group were reinforced by the new battleship "Bayern," and by the "Grosser Kurfürst" and "Markgraf," in place of the "Derfflinger" and "Seydlitz," which were still under repair; and to permit of rapid concentration they were stationed only 20 m. ahead of the battle-fleet, with eight Zeppelins, to assist in air reconnaissance. They did not get across unscathed. E23 was waiting for them halfway, and sent two torpedoes into the "Westfalen," forcing her to put back, but Scheer held steadily on. Admiral Jellicoe had ample intelligence of the German movements, and had put to sea at 5 P.M. on Aug. 18. After meeting Beatty's force he was on his way down the East Coast with the battle-cruisers, 30 m. ahead, when the 2nd L.C.S. ran into the first line of German submarines in the latitude of the Farne Is. at 5:55 A.M. on Aug. 19, and though going 20 knots the "Nottingham" was struck by two torpedoes from U52. Admiral Jellicoe immediately turned round and made to the northward for a time. The "Nottingham" struggling home was hit by a third torpedo at 7 A.M. and sunk. Meanwhile the Harwich forces had sighted the enemy at 6:30 A.M. and proceeded northeast to get in touch with him. But the German forces were too strong for Tyrwhitt's flotillas to attack, and Scheer held steadily across, receiving a succession of reports from his Zeppelins, submarines and the German intercept station at Neuminster, which enabled him to locate exactly the position of the British forces. By 10:30 A.M. Adml. Jellicoe had ample information of Scheer's movements and decided to make for a position off Newcastle to cover the coast. At noon he was some 95 m. east of the Farne Is. steering S.S.E. down the coast, with Beatty's battle-cruisers ahead of him, and the German fleet about 90 m. east of Whitby steering to the westward on a converging course. By 12:30 P.M. Beatty's squadrons were level with Newcastle and only 42 m. from the German fleet, when Scheer turned to the southward, made a push against the Harwich forces and turned home at 2:35 P.M. Adml. Jellicoe, thinking it unwise to follow on account of the danger of submarines, ordered Beatty to turn back at 4 P.M. and directed Comm. Tyrwhitt to proceed to a position off Terschelling to deliver a night attack. At 3:20 P.M. the commander-in-chief received the report of a submarine and ordered Beatty to turn back at once. At 4:52 P.M. while returning, the "Falmouth" of the 3rd L.C.S. was hit by two torpedoes from U66, though going 23 knots at the time. She managed to reach Flamborough Head, where she sank, and U66, though heavily depth-charged by the destroyer "Pelican," got safely away. The Harwich flotillas kept in touch with the enemy fleet till 7:30 P.M., but unsupported by the Grand Fleet dared not press home an attack, and as conditions were unfavourable for a night attack abandoned the pursuit. This was one of the most successful of Scheer's operations, and he intended to repeat it, but in Oct. orders were received to resume the submarine warfare against commerce (under conditions of visit and search), and U boats were no longer available for fleet purposes.

The resumption of the submarine campaign called for a clear passage down Channel, and the 3rd and 9th Torpedo-boat Flotillas were dispatched to Zeebrugge under Comm. Michelsen, the Commodore of Torpedo Flotillas, to raid the Dover Straits barrage. A line of mines and nets had been laid off Zeebrugge in April 1916, and a similar line had been begun across the Straits from South Goodwin towards Snouw Bank and Dunkirk. This was the first serious attempt to attack patrols off Dover, and merits special attention. The barrage in course of construction at Dover consisted of a line of nets fitted with mines, divided into sections marked by light buoys and patrolled by a force of 23 drifters, supported by an armed yacht, an armed trawler, and an old destroyer, the "Flirt." Information of the arrival of the flotillas in Flanders had been received, and the vice-admiral at Dover, expecting an attack either on the Downs or Belgian coast, distributed his destroyer forces to meet it, four in the Downs, eight at Dunkirk and six tribals at Dover. The night of October 26–27 was dark and favourable to the enemy. The Germans attacked in two divisions of five and six boats each. One attacked the centre of the patrol about 10 P.M. and sank three drifters. The "Flirt" had seen them about 9:30 P.M. but took them for the British destroyers from Dunkirk. Hearing the gunfire she thought a submarine was being chased, hurried to the spot, found a blazing drifter, and sent a whaler to save the crew when a heavy fire was opened on her and she sank at once, about 11 P.M. The yacht "Ombra" heard the firing, guessed the cause and gave the alarm, but before the patrols could be withdrawn another division of drifters ran into the enemy and two more were sunk. The destroyers at Dover and Dunkirk were now ordered out, and those in the Downs got under way.

The second section of attackers had proceeded westward, stopped the empty transport "Queen" off Gris Nez and set her on fire. The news of this incident came in at 12:30 A.M. The six destroyers at Dover ("Viking," "Amazon," "Nubian," "Cossack," "Tartar," and "Mohawk") had put to sea at 11:15 P.M., but leaving by different entrances got separated. The "Nubian" sighted destroyers at 12:40 A.M., took them for the Downs division, challenged them and received in reply a heavy fire and a torpedo which blew off her bows and left her blazing. A few minutes later the enemy met the "Amazon," and sent a shell into her boilers. At 12:50 A.M. he met the "Viking" and two destroyers, was challenged, and after giving the usual reply of a broadside disappeared in the night. The Downs division had got to sea at 12:30 A.M. and the Dunkirk division by 11:30 P.M., but neither saw the enemy though the latter heard the gunfire of the "Viking's" action. The Germans got back to Zeebrugge safely, after sinking seven drifters and two destroyers. This was the first of a series of attacks on Dover intended to assist the passage of submarines.

In the north the "Moewe" had got safely to sea again in the winter nights Nov. 23–25, and was followed by another raider, the "Wolfe" (Capt. Karl Nerger), on Nov. 30.

Submarines were again at work, and on Nov. 5 U30 and U20 (which had sunk the "Lusitania") ran ashore off Bovsbjerg (Denmark) in a fog, and Scheer sent a half flotilla of destroyers supported by the "Moltke" and the 3rd Squadron to get them off. J1 (Comm. Lawrence) got there too, and torpedoed the battleships "Grosser Kurfürst" and "Kronprinz," driving them both back into harbour. The Kaiser remonstrated with Scheer for risking two valuable battleships in this work, but Scheer maintained that sooner or later German naval strategy must resolve itself into a *guerre de course*, leaving only one task for the fleet to perform—to get submarines safely out and safely home again.

Unrestricted warfare (that is, sinking at sight without warning) was now being urged by the general staffs of both navy and army in Germany, but at a council of war held on Oct. 16 it was decided to postpone it till a last effort had been made to negotiate for peace. On Dec. 12, after the capture of Bucharest, a note went out to the Allied Powers inviting them to enter into negotiations to avoid further bloodshed. It was the first symptom of Germany's defeat, but it was based on the conception of her indestructible strength and was rejected by the Allies. The peril of the submarine was growing more and more acute, and on Nov. 29 1916 Adml. Sir John Jellicoe was summoned to the Admiralty to take the post of First Sea Lord, and his command passed to Adml. Sir David Beatty.

Operations in 1917.—The new year of 1917 saw the controversy which had so long raged in Germany decided in favour of the submarine. In her growing need she was forced to have recourse to unrestricted warfare, and on Jan. 9 an Imperial Order went out to commence it on Feb. 1. The war at sea had now to adjust itself to the new conditions; but though the High Sea Fleet had only to ensure a safe entry and exit to its submarines, it continued indirectly to exercise a potent influence on the campaign, for as a "fleet in being" it compelled the Grand Fleet to remain concentrated and ready for action, and prevented its units and flotillas being dispersed to escort convoys and hunt the submarine.

The activity of the destroyer flotillas did not diminish. In the Hoofden, a short sharp destroyer action took place in the early morning of Jan. 23, when a Harwich force of three light cruisers and some 14 destroyers met the German 6th Flotilla of eight destroyers on its way from Zeebrugge to the Bight. It was a cold dark night and a general mêlée at short range ensued, which developed into two encounters. In the first, V69, the flotilla leader's boat, was badly hit and driven into Ymuiden, and S50 had to put back. In the second, which took place off Schouwen Bank, a British destroyer, the "Simoon," was hit in the bow by a torpedo and sunk. Feb. 1 saw the beginning of the momentous campaign followed by the rupture of diplomatic relations between Germany and the United States. The operations of the German fleet were now directed towards supporting their submarines, and with this in view a succession of raids was made on Dover Straits.

The first took place on the night of Feb. 25 and accomplished nothing. The barrage patrol at the time consisted of five L-class boats, patrolling on courses S.W. and N.E. about 2 m.

apart. The German destroyers appeared, and after opening fire on the "Laverock" retired. March 17 1917 saw a more successful attempt. This time the barrage patrol consisted of four destroyers, the "Laertes," "Laforey," "Llewellyn" and "Paragon," patrolling on separate beats running S.W. and N.E. about 2 m. apart. Off Deal were lying the "Canterbury," "Faulknor" and four destroyers; the "Broke" and five destroyers were in Dover. At 11:50 P.M. the "Paragon," on patrol at about the centre of the barrage on a N.E. course, sighted three or four destroyers, challenged them, received a heavy broadside and a torpedo, broke in two and sank. The "Laforey," 2 m. off, under the impression that the "Paragon" had struck a mine, was on her way with the "Llewellyn" to pick up survivors when the latter was hit by a torpedo, which was attributed at the time to a submarine. The destroyers at Dover went out but saw nothing, though the Germans were seen at 2:35 A.M. off Broadstairs, where they sunk a merchant ship and disappeared. The "Moewe" had slipped out to the north again, and while these events were happening in the Straits got back to Kiel after capturing 27 ships, one of which she had succeeded in sending in to Swinemunde. But another raider on the way out had not been so fortunate. At 4 P.M. on March 17 the a.c. "Achilles" (Capt. F. M. Leake) and the a.m.s. "Dundee" (Comm. S. M. Day, R.N.R.) had intercepted the "Leopard" disguised as the Norwegian s.s. "Reina Norge," 200 m. N.E. of the Faroes, and after a short action had sent her to the bottom.

April 20 saw another raid at Dover, but this time the raiders did not escape so easily. The system of patrols had been changed since the last attack. Instead of patrols of single destroyers, two patrols were maintained, one called the Western Barrage Patrol of two flotilla leaders patrolling on the N. and W. side of the Straits as far as the S. Goodwin Light vessel. The other, called the E. Barrage Patrol, consisted of a division of destroyers, patrolling on a line S.W. from a buoy approximately halfway between Dover and Calais. Reserves were available at Dover and Deal as before, and on the night in question the W. Barrage Patrol consisted of the "Broke" (Comm. E. R. G. Evans) and the "Swift" (Comm. A. Peck). The German force, consisting of the 2nd Flotilla, which comprised their best and fastest boats, was in two sections. One went off to the S. and appeared off the French coast. The other of about six boats hugged the northern shore and fired at the English coast off Dover in an aimless sort of way. The night was dark, and at 12:45 A.M. they were on their way home about 3 m. E. of the S. Goodwin on an easterly course when they were sighted on the port bow about 600 yd. off by the "Swift" and "Broke," steering an opposite course. This time there was no challenging. The "Swift" fired a torpedo, put her helm hard-a-starboard and attempted to ram, but passed through the enemy's line and went off in pursuit of the leader. The "Broke" fired a torpedo, turned hard to port and crashed into G42, the third boat in line. A hand-to-hand fight ensued in the darkness with German boarders, who were driven back by the fo'c'sle gun's crew led by Midshipman Donald Gyles. The "Broke's" engines were disabled by a shell, but she shook herself clear and completed the destruction of another destroyer, G85, already disabled by one or both of the torpedoes previously fired. The reserve division which had put to sea from Dover, only arrived in time to help to pick up the German survivors. This ended the raid of April 20, which made the "Broke" and Comm. Evans famous, and with the exception of two ineffectual sorties on April 25 and May 2, when the Germans shelled Dunkirk and Ramsgate, stopped such ventures for nearly a year.

On April 6 the United States entered the war, and Vice-Adml. W. S. Sims was dispatched to determine the best methods of coöperating with the Allies. This was a black month for merchant shipping. At sea the war developed into a protracted struggle with the submarine, which became by degrees the dominant aspect of the war (*see* SUBMARINE WARFARE), while the battle-fleets were active as breakwaters behind which the submarine and its antagonists fought out the issues of the war at sea. The reply to the submarine took three forms, the reorganization of the naval staff, the institution of a convoy system (*see* CONVOY), and the development of antidotes in the form of mine barrages and technical devices such as hydrophones and depth charges. In these spheres the United States navy was able to render valuable assistance: convoys required for destroyers, which the Grand Fleet could not supply. The U.S. destroyers, the first six of which under Comm. J. K. Taussig arrived at Queenstown on May 4, eased the situation and proved a welcome and necessary reinforcement.

In the Mediterranean the war had become more and more a war of flotillas. There the Straits of Otranto took the place of the Straits of Dover and a force of some 50 vessels, chiefly drifters, patrolled it to prevent the passage of German and Austrian submarines from their base at Cattaro. These little ships were attacked by a force of Austrian cruisers and destroyers on May 15, and as they stoutly refused to surrender, 14 were sunk, the skipper of the "Gowan Lea" receiving a V.C. for his gallant efforts to engage an overwhelmingly superior force. In the "Floandi" the wireless operator, Harris, was hit, but continued to send out messages till he fell dead at his post. The light cruisers "Dartmouth" and "Bristol" heard the call, and on their approach the enemy fled back to Cattaro; though the "Dartmouth" (Capt. A. P. Addison) was hit by a torpedo but got safely back.

At Dover Adml. Sir Reginald Bacon had endeavoured to extend the war against the submarine to the land and to attack it in its base by bombarding the locks at Zeebrugge and Ostend. These bombardments were carried out in summer by the monitors "Lord Clive," "General Wolfe," "Prince Rupert," "Prince Eugene" (all 2 12-in.), "Marshal Soult," "Erebus" and "Terror" (all 2 15-in.). The two latter joined the force in 1917 and took part with the "Marshal Soult" in an important bombardment off Zeebrugge on May 12 1917, carried out at a range of 28,000 yards. Though these bombardments did not actually prevent the Germans using the ports, they damaged the dockyards and made it more difficult for them to do so, besides adding largely to British experience of bombardment work. During a shelling of Ostend on June 5 six German destroyers sallied out but were engaged by the Harwich Flotilla and driven back to port with the loss of S20. It was only now that the British authorities woke up to the extent to which the enemy continued to ply his trade along the coast between Rotterdam and German ports. The Harwich Flotilla began to harass it and succeeded in sinking some 24 ships during the year, capturing four on July 16 and driving two others ashore. The traffic between Sweden and Germany could no longer be checked, for with the collapse of Russia the Baltic had passed completely under German control. On July 9 the British battle-fleet received a severe blow in the loss of one of its dreadnoughts, the "Vanguard" (Capt. Jas. D. Dick), by an internal explosion, in the same terribly sudden way as the "Bulwark" and "Natal." She was lying at anchor in Scapa when at 11:20 P.M. a great sheet of flame leapt up from her forward, and when the smoke cleared away she was gone. Seven Allied ships-of-war suffered this fate during the war—the "Bulwark" at Sheerness Nov. 26 1914, "Benedetto Brin" Sept. 27 1915, "Natal" at Invergordon Dec. 30 1915, "Leonardo da Vinci" Aug. 2 1916, "Tsukuba" Jan. 14 1917, and "Kawachi" July 12 1918.

Meanwhile a big project for mining Heligoland Bight had been given to the Plans Division as its first task, and preparations for it were steadily progressing, though its execution was delayed till Oct. by lack of mines. The enemy's outpost forces and minesweepers were not left immune from attack, and on Sept. 1, the 4th L.C.S. and 15th Flotilla made a raid on the Channel by Horn's Reef, driving four German minesweepers ashore off Ringkiobing. These minesweepers, working sometimes 150 and later 180 m. from Heligoland, formed an excellent target for attack, but as they always had heavy ships waiting in support and British heavy craft could not risk mined waters, British light-cruiser raids could not be carried out.

No big operation had taken place in the Baltic since 1915, and a German incursion into the Gulf of Finland, in Nov. 1916,

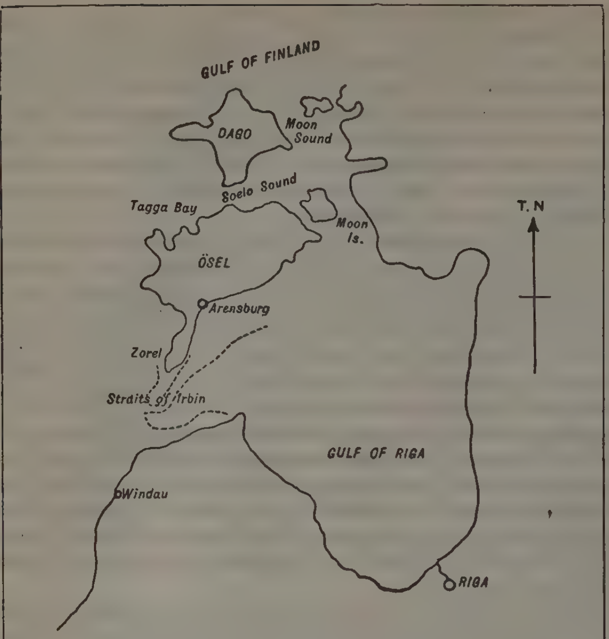

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had resulted only in the loss of seven destroyers by mines and the abandonment of the enterprise. But in Sept. 1917 the capture of Riga by the German army (Sept. 3) opened the way for a combined operation, which was to prove the death-blow of Russia, then in the throes of revolution. The German navy's task was to transport an infantry division to the island of Osel and effect a landing there, with the object of capturing the island and its batteries, and opening the Straits of Irbin so as to give direct access by sea to the Gulf of Riga. Transport was prepared for 23,000 men and 5,000 horses, and it was decided to land at Tagga Bay on the northward side of the island. The naval force detached for the purpose under Vice-Adml. Ehrhardt Schmidt consisted of the battle-cruiser "Moltke" (flag.), the 3rd and 4th Squadrons comprising ten of the latest battleships, and the 2nd Scouting Group, which with the Baltic light cruisers mustered eight light cruisers in all. A strong force of destroyers went with them, including the 2nd, 8th, and 9th Flotillas and the 7th, 13th and 12th Half Flotillas, numbering altogether 47 boats under Comm. Heinecke.

Nineteen transports were requisitioned for the purpose, with a tonnage of 153,664 tons. Preparations for the enterprise were begun on Sept. 12; on Oct. 9 the troops embarked and on Oct. 11 the fleet put to sea from Libau. Osel is an island of moderate size about 30 m. across at the entrance to the Gulf of Riga, with the Straits of Irbin running between it and the mainland. On the night of Oct. 11 the fleet was approaching Tagga Bay, with the minesweepers steaming slowly in front. But time was precious and rather than risk losing the chance of surprise at daylight Adml. Schmidt ordered the minesweepers out of the way and went straight in with his fleet. He reached Tagga Bay safely, and though the battleships "Bayern" and "Grosser Kurfürst" struck mines in taking up their positions for bombarding the batteries in the Sound of Soelo between Dago and Osel, they were able to perform their task. The advanced troops got safely ashore in motor-launches and three small steamers at 5:30 A.M., and the transports entered the Bay at 6:30 A.M.

The German fleet's next task was to penetrate into Moon Sound. The 2nd Flotilla and 12th and 13th Half Flotillas had pushed through Soelo Sound, and covered by the fire of the "Kaiser" and "Emden" had driven their enemy back with a loss of only one boat sunk by a mine, and three damaged. But the tables were turned by the appearance of the Russian battleship "Slava" which put up an obstinate fight and drove them back in turn, a good instance of the power of heavy guns working behind a minefield. The Russian small craft were still sheltered by their battleships in Moon Sound, which now had to be approached by the S. of Osel through Irbin Straits. This channel was commanded by the batteries at Zorel on the S. point of Osel, but these were bombarded and silenced on Oct. 14 by four battleships and blown up by the Russians. A chart of the minefields had been captured ashore, and with its help the Straits of Irbin were swept. By the morning of Oct. 16 the fleet was inside the Straits before Arensburg, and facing the southern entrance to Moon Sound that evening. The Russian battleships "Slava" and "Grozdani" engaged the Germans and an action ensued, in which the "Slava" was sunk and the Russians driven off to the northward. By Oct. 17 the German force was in complete occupation of Osel, and Arensburg was being organized as a base for the fleet. Dago I. was now captured, and Vice-Adml. Schmidt proposed to push on through a big minefield in the N. of Moon Sound into the Gulf of Finland.

The operation was analogous in some degree to that of the Dardanelles and British raids on the Bight, namely the attack of a large intact minefield protected by heavy guns or supported by a fleet in being. British submarines were beginning to show themselves, and the "König Albert," the "König" and "Kronprinz," had all been attacked. The detachment of so large a force had naturally given rise to some anxiety on the part of the German commander-in-chief in the North Sea, which had not been diminished by the mining of the "Bayern" and "Grosser Kurfürst." It was decided to recall the 3rd and 4th Squadrons and the 1st Squadron was sent to relieve them, but on Oct. 29, when the "Markgraf" struck a mine in Irbin Straits, an order was dispatched to bring the operations to an end, and the naval part of the campaign came to an abrupt conclusion.

This campaign offered a welcome opportunity of giving the fleet some active employment, for symptoms of the spirit which was to end in Germany's collapse were already beginning to appear. Sporadic outbreaks of mutiny had occurred in the 3rd Squadron as early as May 1917, and in Aug. the men in the "Prinz Regent Luitpold" refused to put to sea and were isolated with their ship in Schillig Roads. A mutiny broke out in the "Kaiserin" on the ostensible grounds of insufficient food and the "Kaiserin," "Kaiser," and "König Albert" were sent to Brunsbüttel for recreation and leave. The crew of the "Westfalen" were reported to have killed their captain, and a light cruiser was said to have made for Norway and been turned back by a torpedo-boat flotilla. Certain it is that the spirit and courage of the German fleet were beginning to flag, though it was still far from collapse, as British convoys had good cause to know before the year was out. The convoy system, as one of the most effectual replies to the German policy of submarine warfare, was a natural target of attack, and on Oct. 17 the Scandinavian convoy received a severe blow. This convoy sailed regularly from Lerwick to the Norwegian coast and back, and on this occasion was on its way to Lerwick, consisting of 12 ships (two British, one Danish, five Norwegian, three Swedish), under the escort of only two destroyers, the "Strongbow" (Lt.-Comm. Ed. Brooke) and "Mary Rose" (Lt.-Comm. Chas. L. Fox). It was about halfway across, going about eight knots, at dawn about 6 A.M. on Oct. 17, when two cruisers were seen two points before the port beam coming up at about 25 knots. These were the "Brummer" and "Bremse," two fast German light cruisers completed in 1916 and armed with four 5·9-in. The "Strongbow" challenged thrice, and the enemy opened fire at 6:15 A.M., overwhelming her with the first salvo. A shell entered the engine-room, cutting the main steam-pipe and brought the ship to a stop; the bridge was wrecked, the captain badly wounded. The "Mary Rose" was also sunk after a short fight. Neither of them had time to make a wireless signal, and the light-cruiser squadrons cruising to southward of the route knew nothing of the action, a clear instance of the necessity of an escort being within range of a convoy and not out of sight. The enemy went off at 8:20 A.M. after sinking nine of the merchant ships. The armed trawler "Elise" stood gallantly by the "Strongbow," and saved most of the survivors. The losses of the "Mary Rose" and "Strongbow" were 86 and 46, and as the armed trawlers "Elise" and "P. Fannon" had no wireless, it was not till 7 P.M., when they arrived at Lerwick, that any report of the action was received. This led to a general revision of the arrangements for convoy in the North Sea, but was also closely related to the general strategy of the war. There was a distinct disinclination both at the Admiralty and at sea to use the Grand Fleet to cover the convoys. But this was clearly their business. War is an endeavour to bring such pressure to bear on an enemy as to force him to submit to your will. In 1917 a grinding pressure was being brought to bear on Germany by the blockade. The enemy replied with a vigorous and effective attack on British maritime trade, not with surface craft, for these were held in check by the Grand Fleet, but with submarines. The British replied with convoy, and the German riposte was sudden and swift cruiser raids. The British answer to this was not to abolish convoys but to escort them in such strength as to force the Germans to bring their whole fleet out to attack, as actually happened in April 1918. This was the normal way of bringing about a battle at sea, but the use of wireless directionals had induced what may be called a policy of immediacy, in which the main fleet had to be held ready for immediate excursion and attack, and was jealous of any other use of its craft. But the opportunity of a great and decisive battle had been lost. The German operations in the Baltic in the autumn of 1917 clearly showed that they were not prepared to risk another fleet action in the North Sea, and in these circumstances the escort of convoys became one of the most important functions of the British fleet.

November was marked by light-cruiser raids both in the Cattegat and Bight. The Cattegat, a sort of "No Man's Sea" at the beginning of the war, had become more and more a sphere of German activity. The German-Swedish convention assuring free passage through the Sound had been denounced; minefields and guardships guarded the southern end of the Sound; ships proceeding to hostile ports were refused passage, and decoy ships cruised in the Cattegat to take the offensive against British submarines. One of these was the "Kronprinz Wilhelm" under command of Capt. Lauterbach, which was cruising off Kullen Light on Nov. 2 at 7 A.M. when several British destroyers swept down on her and opened a devastating fire. Her stern was blown off by the explosion of the after magazine, and in a few minutes she was burning fiercely fore and aft. This incident, small enough in itself, had a considerable effect in checking German activity in the Cattegat, and seems to have led them once again to confine their cruises to the Baltic and the Bight. In the Bight the British minelaying, which started in earnest in the last quarter of 1917, called for an immense expansion in the organization of German outpost and minesweeping forces, and necessitated constant trips by groups of minesweepers and barrier breakers (ships specially constructed with bows filled with concrete) along the swept channels. As the area of the minefields grew, the channels grew longer and longer, and the minesweepers became more and more exposed to attack, and had to be supported by light cruisers and battleships. These were the circumstances leading to an engagement on Nov. 17 1917 which affords an interesting illustration of the important part played by German battleships and battle-cruisers in keeping the Bight open for submarines.

Three German minesweeping half flotillas were making a test trip that morning, escorted by the 14th Half T.B. Flotilla and covered by the light cruisers of the 2nd and 4th Scouting Groups, supported by the "Kaiser" and "Kaiserin" lying off Heligoland. The group was on the point of starting when they were attacked at 7 A.M. by a force consisting of the "Courageous" (R.A. T. D. W. Napier) and "Glorious" (now forming the 1st C.S.), two battle-cruisers, the "Renown" and "Repulse," several light cruisers including the 1st and 6th L.C.S. with the "Caledon" and "Calypso," and a number of destroyers. The two former ships had been built by Lord Fisher for use in the Baltic, and were of special design, 786 ft. long over all, 22¼ ft. draught, 30 knots seagoing speed, with four 15-in. guns and a 3-in. belt. The horizon was misty and an action developed with the German light cruisers at about 12,000 yd. running to the south-east. The fight began to approach the minesweepers, which had made off at full speed to the S.E., while the "Nürnberg," "Pillau" and the German destroyers tried to screen them with a smoke cloud. At 8:50 A.M. a destroyer attack was made by the British on the 2nd Scouting Group without success and a counter-attack was made by the enemy in which the "Königsberg" and "Frankfurt" fired torpedoes without hitting. The former was hit by a heavy shell, which went through all three funnels, and landing in a coal-bunker started a fire. At 9:30 the "Kaiserin" and "Kaiser" came in sight, and Rear-Adml. von Reuter tried to draw the British down to them. The "Kaiserin" got within range and scored a hit, but on the arrival of the battleships the British withdrew before the "Moltke" and "Hindenburg," which were coming up, could reach the scene. Several hits were scored on both sides, and on the German side 21 were killed and 10 severely wounded, but only one outpost vessel was lost. On the British side the "Calypso" was hit and her captain (Capt. H. L. Edwards) killed. The coöperation of the German battleships in supporting their minesweepers, and the difficulty of joining battle on the edge of a minefield, were the principal features.

British attack on the German minesweepers was answered by another German thrust at the Scandinavian convoys made by the German 2nd Flotilla on Dec. 12. The 3rd Half Flotilla proceeded to the Tyne, and after going up the coast and attacking two or three steamers returned about 6 A.M. The 4th Half Flotilla under Lt.-Comm. Hans Holbe proceeded to the northward, and at 7 A.M. on Dec. 12 was in sight of Udsire on the Norwegian coast. Proceeding to the northward he sighted at 11:30 P.M. a British convoy of six steamers escorted by two destroyers and four trawlers, approaching Norway on an easterly course and about 35 m. from the coast. The destroyers were the "Pellew" and "Partridge," who left the convoy and engaged the German destroyers at about 5,000 yards. The four armed trawlers with the convoy were sunk. The "Partridge" received a shot in her main steam-pipe, which brought her to a stop. She fired her torpedoes, but one stuck in the tube and another which hit V100 did not explode. The "Pellew," pursued by three destroyers, managed to escape in a squall of rain. All was over in three-quarters of an hour, and the flotilla returned to Kiel with four officers, 48 men and 23 of the merchant crews as prisoners. Two armoured cruisers, the "Shannon" and "Minotaur," were at sea as a covering force, and receiving a signal from the "Partridge" for assistance steamed at full speed to the spot. But again it was too late. The 3rd L.C.S. was also at sea and actually 85 m. to the S.E., but it also failed to intercept the enemy—another illustration of the weakness of covering forces being out of sight of the forces they are intended to cover. The fact is that Grand Fleet cruiser forces were disinclined to be merely escorts. They preferred to be "covering" forces some way off, and the enemy eluded them. The raid led to the provision of stronger covering forces and to considerable changes in the Scandinavian convoy system, which had almost broken down under these successive blows.

The Dutch convoy in the S. suffered a little later an equally severe blow of a different kind. It was one of the principal duties of the Harwich Flotilla to escort the Dutch convoys, and on Dec. 23 at 3 A.M. four of its destroyers were steaming to the southward at 15 knots a few miles N. of the Maas Light buoy when they stumbled into a German minefield in that vicinity. The "Torrent," "Surprise," and "Valkyrie" all struck mines in rapid succession and sank before they could reach the shore.

The year was now drawing to a close, but before it closed Adml. Sir John Jellicoe had left the Admiralty, and his place as First Sea Lord was taken by Adml. Sir Rosslyn Wemyss. Adml. Jellicoe's departure was associated with that of Vice-Adml. Sir Reginald Bacon's from Dover about the same time. The Belgian coast had acted as a fatal magnet to the Dover Command. All through the summer of 1917 Dover had been absorbed in preparations for what was known there as the Great Landing, a project for landing a division on the flank of the German army in conjunction with a general advance. Enormous pontoons of a special design, each to be pushed by two monitors, had been devised by Adml. Bacon, who had devoted an immensity of labour and attention to the scheme. But events had taken a different turn. The army did not want divisions landed in Belgium. The Admiralty wanted Dover Straits closed to submarines, and when difficulties arose as to the execution of their plans, it was considered necessary to send the Director of Plans, Rear-Adml. Sir Roger Keyes, to Dover to close the Straits. This he did, and very effectually. The war at sea was gradually expressing itself more and more in terms of submarine warfare. Nothing else mattered. The Dover pontoons were ingenious, but they did not close the Straits. History was merely repeating itself. Sir Sidney Smith in earlier days had made the same mistake. He spent much of his time preparing plans and devising pontoons for a landing on the Flemish coast, till Lord Keith complained to the Admiralty that one-third of his force was employed in this way to the detriment of trade in the Channel, which was suffering from privateers.

Operations in 1918.—All this time the Black Sea had been the scene of a sporadic warfare between the Russian and Turco-German forces. Russia had a considerable force in these waters. She possessed at the outbreak of war two good pre-dreadnoughts, the "Ievstafi" and "Ivan Zlatoust" (1906, 4 12-in., 4 8-in., 12 6-in.), to pit against the "Goeben," and three dreadnoughts, the "Ekaterina II.," "Imperatriza Maria" and "Alexander II." (all 10 12-in., 20 5-in.), which were on the stocks at Nikolaieff. Her inability to face the "Goeben" with pre-dreadnoughts, and her military commitments, prevented her coöperating on a large scale against Turkey during the Gallipoli campaign, but by the end of 1915, after the completion of the three dreadnoughts, the control of the Black Sea passed into her hands and ensured her communication with the Caucasus. The collapse of Russia in 1917 and the mutiny of the Black Sea fleet led the "Goeben" to look to the westward, and on Jan. 20 she and the "Breslau" made a sortie from the Dardanelles directed against any Allied craft that might be cruising in its vicinity. The British force in the area consisted of the British Aegean Squadron under Rear-Adml. Hayes Sadler, a somewhat heterogeneous collection comprising the "Lord Nelson" (flag.) and "Agamemnon," 6 old light cruisers, 12 monitors, 7 sloops and 27 old destroyers. The only ships which could have opposed the "Goeben" (8 11-in.) were the "Lord Nelson" and "Agamemnon" (each 4 12-in., 4 9·2-in.); the former was at Salonika, where the rear-admiral had gone to confer with the British general and French admiral, and the latter (Capt. P. W. Dumas) was lying at Mudros in the island of Lemnos. The ships in the immediate vicinity were the destroyers "Tigress" (Lt. J. B. Newill) and "Lizard" (Lt. N. A. Ohlenschlager) of the 5th Flotilla, patrolling off the Straits, and the monitors "Raglan" (Comm. Visct. Broome) and M28 (Lt.-Comm. Donald Macgregor) anchored in Kusu Bay at the N.E. corner of Imbros some 15 m. from the Straits. The "Goeben" (Vice-Adml. von Rebeur Paschwik) and "Breslau," or to give them their Turkish names, the "Sultan Selim" and "Medilli," sallied out about 5 A.M. unobserved by the lookout station on Navro I. and steered for Imbros, shadowed by the "Tigress" and "Lizard." The "Raglan" sighted them at 5:35 and gave the alarm by wireless. She was engaged by the "Breslau" and set on fire, and after a few shots from the "Goeben" sank. The "Breslau" then opened fire on M28, which burst into flames and blew up with her captain at 6:27 A.M. The "Goeben" and "Breslau" went off to the southward, but about 3 m. off the S.E. point of Imbros the "Breslau" entered a minefield, and was sunk by mines at 7:07 A.M., 40 survivors being picked up by the "Tigress." The "Goeben" seems to have struck a mine about the same time, and after continuing south for some miles headed for the Dardanelles, followed by aircraft, and beached herself on the shoal off Magara. The "Raglan's" signal set the whole squadron in motion, and even the old cruiser "Europa" started to raise steam. The "Agamemnon" put to sea, and was on her way towards the Straits cleared for action when news arrived that the "Goeben" was returning to the Dardanelles. Almost simultaneously came a signal from the "Lord Nelson" ordering her to rendezvous off Cape Paliuri on the coast of Macedonia.

A series of air attacks were made on the stranded "Goeben," and in the course of the ensuing week more than 15 tons of bombs were dropped round her with several hits, but the 112-lb. bombs failed to inflict any vital damage. An heroic attempt was made to torpedo her by E14 (Lt.-Comm. Geoffrey White), but the defences of the Straits were too strong, and the E14 was sunk and her captain killed. The separation of the "Lord Nelson" and "Agamemnon" had been criticised, but even if we suppose that one had been on patrol outside the Straits and the other at Lemnos, the "Goeben" was more than a match for one and the sortie was made too quickly for the other to arrive in time. The "Goeben" was still too formidable an antagonist for a single ship of the "Lord Nelson" class, and in these circumstances the minefield provided the best solution of the problem, though in view of the overwhelming superiority of the Allied forces in the Mediterranean the episode does not reflect very great credit on the strategy of the Allied arms.

In the North Sea the increased activity in the Dover barrage led inevitably to another German raid. The barrage of deep mines which had been laid across the Straits was now patrolled at night by a strong force of drifters, and illuminated by brilliant flares and searchlights in trawlers and destroyers, in order to discover enemy submarines and force them to dive. The Germans sallied out against it on Feb. 15. The disposition that night was as follows: In the Downs—"Attentive" and three destroyers; West Barrage Patrol off S. Goodwins—"Swift" and "Marksman"; East Barrage Patrol (south and east side of Straits)—"Termagant," "Zubian," "Melpomene" and "Amazon." On the line Folkestone to Gris Nez there were stationed 58 drifters, supported by Monitor 26 off the N.E. Varne buoy and the old destroyer "Syren." All the conditions were favourable for a German raid; a moon three days old set at 11 P.M., and the east-going stream to assist the raiders home began to run at midnight. The light of the barrage could be seen a long way off. The flares and searchlights had a dazzling effect and the whole area was full of glare, varying in intensity as flares burnt up and died down and searchlights flickered and hovered. In such surroundings the flash of gunfire might be overlooked or might easily be mistaken for an attack on a submarine. If enemy destroyers were seen the general alarm for a surface craft raid was to be given; this was a green firework of any description, and on this signal all drifters had to evacuate the minefield and close the nearest land. The German 2nd Flotilla (B98, V100, G101, G102, G103, G104, B97, B109, 110, 111, 112) had again been chosen for attack and came straight from the Bight. At 11:30 P.M. on Feb. 15 it was off Sandettié Bank close to the Straits, where it split into two halves, one going towards Folkestone, the other towards Gris Nez. The northern force was sighted by the trawler "Sabreur" about 12:40 A.M. off Folkestone. She took them for British destroyers hunting a submarine, and made no sign. The minesweeper "Newbury" was burning a searchlight close by, and as the destroyers passed they opened a heavy fire and left her a blazing wreck. They then made off to the S.E. down the drifter line, sank two drifters, damaged a minesweeper and motor-launch, and disappeared to the N.E. about 1:15 P.M. It would appear impossible for all this to happen without an alarm, but no alarm went up. The motor-launch thought she had got mixed up in an attack by British destroyers on a submarine. No news was received at Dover, and the Western Barrage Patrol saw only a few faint flashes about 1 A.M. Meanwhile the German southern detachment had reached the southern end of the barrage about 12:55 A.M. There they opened fire on the trawler "James Pond," a searchlight vessel, and set her on fire; then proceeding slowly to the N.W. along the drifter line they sank the drifters "Cloverbank," "Cosmos" and "Jennie Murray." One of these seems to have sent up a green light, which led to a general retirement towards Dover, but two more drifters, the "Christina Craig" and "Silver Queen," were met and sunk by the enemy as he retired to the east. Meanwhile the monitor M26 and the destroyer "Syren" remained serenely at their posts under the impression that the firing was associated with an air raid. M26 saw a green light to the southward about 1 A.M., and without repeating the signal ran down there at full speed (9½ knots), and must have passed fairly close to the enemy, but finding everything quiet returned to the N.E. Varne about 2:10 A.M. By this time the firing had been heard at Dover and the rear-admiral asked for its reason at 1:28, but it was not till 2:52 that he heard that M26 saw a green light.

One more glimpse was caught of the enemy. About 2:20 the "Termagant," with the Eastern Barrage Patrol, was in about the middle of the Straits on a S.W. course, when the "Amazon" (2 4-in.), the last ship in the line, caught sight of three destroyers stealing past about 400 yd. off. She thought they were on their way to Dunkirk, and though they failed to reply to her challenge reported them as British. The senior officer (Comm. M. R. Bernard) was not satisfied, and asked if they had replied to the challenge, but by the time the question and answer got along the line the enemy were out of sight. By 2:30 evidence of a raid was taking shape. Reports of burning drifters and survivors were coming in, but it was not till 3:18 that the "Termagant's" report of passing three destroyers came in and banished all doubts. The losses inflicted by the enemy were seven drifters and one trawler sunk and three drifters and one minesweeper damaged. Had the alarm gone and been repeated immediately the enemy was seen the losses would have been less and the enemy might have suffered more.

They were not so fortunate, however, a month or so later. On March 21 the destroyers "Botha" (Comm. Roger Rede, 2 4.7-in., 2 4-in.) and "Morris" (Lt.-Comm. P. R. Percival, 3 4-in.) were lying in Dunkirk, with three French destroyers close by, when a burst of firing was heard off shore at 3:30 A.M. The British slipped, and passing through the Zuidcoote Pass, a narrow channel between the Dunkirk and Ostend roads, came upon the German destroyers retiring. The exploit of the "Broke" was repeated. The "Botha" rammed a German at full speed and cut it in half. Another was disabled by the fire of the two boats. A torpedo then hit the "Botha" in a coal-bunker and brought her to a full stop, while the enemy disappeared towards Ostend with the "Morris" in chase. She returned after seeing them enter Ostend Mole, sank the disabled boat burning close by, and took the "Botha" in tow. This was the last of the long series of Dover raids.

The war had become more and more a war of straits and passages, but it was not till 1918 that minelaying was carried into the Cattegat. It had been in the early part of the war a sort of "No Man's Sea," but Germany began gradually to reach out into it, and in 1917 her ships were regularly cruising there. The sweep on Nov. 2 1917 had revived all her old fears, but no minefields had yet been laid there. In Feb. 1918 a deep minefield was laid off the Skaw, and another on April 15 some 10 m. N.E. of Laesö. This was laid by the "Princess Margaret" and "Angora," supported by vessels of the 6th L.C.S. and 13th Flotilla, and escorted by the "Valentine" and "Vimiera," which sank 10 German trawlers off Anholt. The discovery of the mines seems to have caused serious apprehension in German naval circles, but the operation was not repeated.

At Dover a plan was maturing to supplement the closure of the Straits by the blocking of Zeebrugge and Ostend. This would seal up not only the Flanders submarines but the destroyers there as well, which formed a constant threat to the barrage and its patrols. The enterprise was a daring one, but the plans were carefully made and skilfully performed on the night of April 22-23. The "Vindictive" (Capt. Alfred F. Carpenter) went alongside the Mole to draw the fire from the three blocking ships, and though only two of the latter achieved their object, the whole attack remains a great and inspiring example of careful planning and heroic execution. At Ostend the attempt miscarried, and a second attempt made by the "Vindictive" on May 9 also failed (*see* ZEEBRUGGE).

As the "Vindictive" was returning from her Zeebrugge venture the German fleet was putting out to sea. This was its last excursion and was directed against the Scandinavian convoys. The fleet left at 6 A.M. on April 23; von Hipper led the way with his battle-cruisers, the 1st Scouting Group, the 2nd Scouting Group and 2nd Flotilla. Behind him came the battle-fleet, consisting of the 3rd, 1st and 4th Squadrons, mustering 17 battleships, with the 4th Scouting Group and 1st, 6th, 7th and 9th Flotillas. In the morning of the 24th von Hipper was off the Norwegian coast when one of the "Moltke's" propellers was flung off its shaft, causing the turbine to race; the auxiliary condenser discharge was penetrated by a large fragment of metal and the engine-room flooded. Von Hipper went on to the north with his squadron, sending the "Moltke," which could still go 13 knots, back to the battle-fleet. By 7 A.M., when she had reached a position 40 m. S.W. of Stavanger, her speed was reduced to 4 knots, and she sent out a signal for help. The battle-fleet sighted her at 9:40, and the "Oldenburg" took her in tow. Von Hipper had turned back on getting the "Moltke's" signal, but hearing of the arrival of the battle-fleet he turned north again and ran up as far as lat. 60° N. Nothing had been seen of the British convoy, and the battle-fleet turned back with the "Moltke." Covered by the fleet she reached List (some 55 m. from Heligoland) at 6:50 P.M., where she was torpedoed by E42 (Lt. C. H. Allen), but got safely home.

A worse day for the excursion could not have been chosen. The homeward-bound convoy of 34 ships had left Norway on April 22, and at 8 A.M. on the 24th, when von Hipper was off the Norwegian coast, was within 50 m. of the Forth, while the outward-bound convoy of 47 ships was getting ready to leave the river. Not a single ship was anywhere near the Norwegian coast, and the sortie was futile. It had, however, many ramifications, and an important conference on the subject of convoys was held in the Forth on April 29, attended by the C.N.S. (Adml. Sir Rosslyn Wemyss), the D.N.I. (Rear-Adml. Sir W. R. Hall), and the Director of Plans (Capt. C. T. M. Fuller). There it was decided to alter the Scandinavian route to the northward of 61° N. so as to increase the chance of intercepting an attack on it. The incident had another interesting aspect. Up to the moment when the "Moltke" began to ask for help, no indication had been received by wireless directionals of the German fleet being at sea. Submarine J4 had seen it at 7 P.M. on April 23, but the report had not reached the c.-in-c., who was disturbed at finding the whole of the German fleet off the Norwegian coast without his knowledge. The disadvantages of relying too exclusively on wireless directionals was clearly demonstrated, and the utility of the submarines in reconnaissance work confirmed.

This was the last excursion of the German fleet, and ranks in importance with that of Jutland and Aug. 19 1916. In the north a stupendous effort was being made with the help of the U.S. navy to close the northern exit to submarines, and during the remainder of 1918 the Grand Fleet was largely occupied in escorting and covering the minelaying squadrons.

One of the last important operations in the North Sea was the bombing of the Zeppelin sheds at Tondern, near Sylt (Schleswig-Holstein), on July 19 1918. This was made by the aircraft carrier "Furious," supported by five battleships of the First Battle Squadron ("Repulse" class), and escorted by the 6th L.C.S. and a number of destroyers. The "Furious" was an immense cruiser (20,000 tons, 30 knots) of the same type as the "Courageous" and "Glorious," originally designed for Lord Fisher's Baltic campaign, and she had been converted into an aircraft carrier. The attack was made by seven aeroplanes—130 H.P. single-seater "Camels"—flown off her deck, each carrying two 50-lb. or 65-lb. bombs. One machine went wrong soon after starting and was picked up. The others reached their objective and set fire to a double Zeppelin shed which was burnt out. Two got safely back; one fell into the sea and the pilot was drowned; three came down in Denmark where the pilots were interned. The attack is interesting as representing the stage of development reached by naval aircraft during the war. On Aug. 11 a coastal motor-boat and aircraft operation was carried out in the Bight on the Frisian coast supported by a strong force. A Zeppelin was brought down by the aircraft, but enemy aircraft overpowered the coastal motor-boats, three of which were sunk and three more lost.

In the Mediterranean the summer of 1918 saw one of the most brilliant exploits of the war by Comm. Luigi Rizzo, which seriously depleted Austria's already scanty tale of battleships.

Mediterranean.—The course of the war in that sea may be briefly summarized. In its main features the situation was analogous to that in the North Sea. The Straits of Otranto (40 m. wide) corresponded to the Straits of Dover, and had been closed by the arrival of the French fleet on Aug. 16 1914.

The Austrians then had three dreadnoughts (" Viribus Unitis," " Tegetthof," " Prinz Eugen ") to oppose to France's two (" Courbet " and " Jean Bart "). The torpedoing of the " Jean Bart" by the Austrian U12 on Dec. 21 1914 led to the withdrawal of the battleships; and the sinking of the a.c. "Leon Gambetta " on April 26 by Austrian U5 with the loss of 614 men had much the same effect as the loss of the " Hogue," " Aboukir " and " Cressy " in the North Sea. France withdrew her forces from the Adriatic and posted them outside the Straits.

The intervention of Italy on May 24 1915 gave the Allies eight dreadnoughts (" Jean Bart," " Courbet," " Paris," " France," " Cavour," " Giulio Cesare," " Leonardo da Vinci," " Dante Alighieri ") against the Austrian three. The situation was, however, complicated by the contiguity of three Allied forces in the same area. The French c.-in-c., Adml. Boué de Lapeyrère, exercised the supreme command, but the Duc d'Abbruzzi, c.-in-c. of the Italian fleet, directed operations in the Adriatic, where he was reinforced by four British light cruisers, twelve French destroyers and seven French submarines. When Italy declared war on Austria in May 1915 she withdrew her dreadnoughts from the Adriatic and stationed them at Taranto. The advent of the Dardanelles campaign led to the appointment of the British Adml. de Robeck as Vice-Admiral Eastern Mediterranean, and in this area and that of Egypt the French c.-in-c.'s virtual authority was actually exercised by the British admiral. In Syrian waters the responsibility was not so clearly defined. There one of the principal objectives early in the war had been the 10-m. stretch of coast road running through Alexandretta on the main road from Adana to Aleppo. It was shelled by the British cruiser " Doris " (Capt. Frank Larken) in Dec. 1914, but after the commencement of the Dardanelles operations the observation of the Syrian coast was taken over by the French. The dominant feature of Mediterranean strategy lay in the closure of the Straits of Otranto by the overwhelming force of the Allies. The Austrian fleet never dared to try and pass it, while in the Adriatic the control was enforced by the submarine, and in its narrow waters both sides were deprived by its menace of the use of their principal instrument of war.

When Serbia collapsed in 1915 under Mackensen's hammer-like blows, the remnants of the army fell back on Albania, and its transport to Corfu formed the principal naval operation of that year. An army of 110,000 men was carried 90 m. by sea without the loss of a single transport. The attempt to close the Straits of Otranto led to a repetition there of the Dover raids (June 1, July 1, Dec. 22–3 1916, May 15 1917, April 12–3 1918). On Dec. 9 1917 a bold attack was made by two little Italian torpedo craft (Comm. Rizzo) on Trieste, and the old battleship " Wien " (5,600 tons, 4 9·6-in.) was sunk. This was followed on May 14 1918 by a similar exploit, when Comm. Mario Pellegrini penetrated the roads at Pola with a little vessel, the " Grillo," designed to climb the net defence like a tank, and apparently torpedoed an Austrian warship. Under Vice-Adml. Count Thaon de Revel, the Italian c.-in-c., the Otranto barrage was greatly strengthened, and its pressure was being severely felt by the German submarines in 1918. The conditions there were very different from those at Dover. At Dover tides were strong and depths comparatively small, varying from 16 to 30 fathoms; in the Straits of Otranto the tide was inappreciable but the depths were great, varying from 200 to 500 fathoms and making mining, except in the form of a net barrage, impracticable. The Austrian battle-fleet, spurred on by Germany, sallied out on June 10 1918 to make a raid on it in force, but were met by Comm. Luigi Rizzo with two small motor-craft off Premuda I., some 50 m. from Pola. Evading a strong escort of destroyers he sent two torpedoes into the dreadnought " Szent Istvan " (" St. Stephen "), reducing the scanty number of Austrian dreadnoughts from four to three, and sending them disconsolately home. In spite of the preponderance of the French and Italian fleets there was a tendency in the Mediterranean, as in the North Sea, to think too exclusively in terms of battle squadrons. The French fleet, now mustering seven dreadnoughts, lay at Corfu, and carried out manœuvres and target practice which would have been immensely useful if there had been an enemy to fight. Meanwhile the direction of the war against the submarine drifted largely towards Malta, where it was exercised by the British c.-in-c. (Vice-Adml. Hon. Sir Somerset Gough-Calthorpe). Early in the war the Mediterranean had been mapped out in geographical sectors for anti-submarine work, in much the same way as the coastal areas allotted to auxiliary patrol flotillas at home. Useful for purposes of administration and supply, the system was a vicious one strategically, for it impeded unity of command and made it difficult to establish uniformity in work affecting the whole area, such as convoy. To ensure better coördination it had been decided at Paris on Nov. 29 1917 to create an Allied Naval Council. This consisted of the naval representatives of the Allies—Sir Eric Geddes, Adml. Wemyss (British), Vice-Adml. de Bon (France), Vice-Adml. di Revel (Italy), Rear-Adml. Funakoshi (Japan), Vice-Adml. W. S. Sims (United States)—and its influence was particularly beneficial in the Mediterranean. When a possibility arose of the Russian dreadnoughts in the Black Sea being used by Germans, the situation was met by the dispatch of the " Superb " and " Temeraire " from England and of four French pre-dreadnoughts to Lemnos (Aegean).

An attack was made on Durazzo, the Austrian naval base, 50 m. from the Straits, on Oct. 2 by a considerable Allied naval force, including a number of American submarine chasers, and an enemy destroyer was sunk in the harbour. On the night of Oct. 31–Nov. 1 1918, when the Austrian navy was already in the hands of the Yugoslavs, an Italian boat entered Pola and sank the dreadnought " Viribus Unitis."

On the Syrian coast, a naval force of French and British ships had coöperated in the bombardment of Gaza on Oct. 30 1917, and had maintained the army's communications by sea from Egypt to Haifa, Beirut and Tripoli, with the loss by submarine attack of the monitor M15 and the destroyer " Staunch " on Nov. 11 1917.

Mesopotamia, Archangel, Cameroon, British East Africa.—In three great river expeditions, too, the navy played an important part; one up the Dvina in the icy waters of the White Sea, another up the Tigris in the torrid marshes of Mesopotamia, and the third in the swampy creeks of the Duala in Cameroon. In the first Mesopotamia campaign, which ended with the investment of Gen. Townshend in Kut on Dec. 2 1915, the naval force consisted at first of the sloops " Espiegle " (Comm. Wilfred Nunn, 6 4-in., 2 3-pdr.) and "Odin" (4 4-in., 2 3-pdr.), the Indian Marine paddle-ship "Lawrence" (4 4-in., 4 6-pdr.), and three small armed vessels, the "Miner," "Lewis Pelly" (a small yacht, 2 3-pdr.), and "Shaitan" (1 12-pdr. 8 cwt.) under Capt. C. Hayes Sadler of the " Ocean."

The principal base was at Basra (or Bussorah), the old emporium of the Indian overland route, 70 m. up the Shatt el 'Arab and accessible to ocean steamers drawing 19 feet. Above Basra the river was uncharted, but vessels of 11 ft. draught could get to Qurna, 40 m. farther up, a port of great importance as the point of junction of the Euphrates and Tigris.

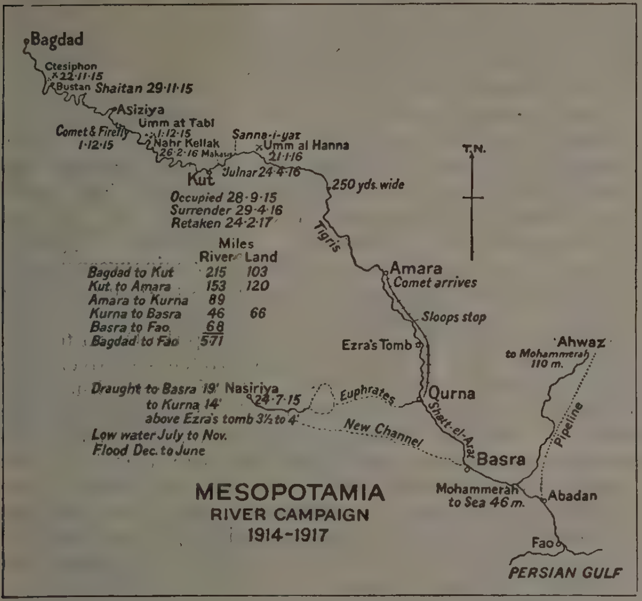

The flotilla helped the troops to land in Nov. 1914, and its formidable appearance hastened the retirement of the Turks from Basra. After negotiating a nasty obstruction in the shape of a German ship sunk in the river, it pushed on to Qurna. Six miles below it, the sloops were held up for a time by a shallow bar, but the "Shaitan," "Lewis Pelly" and "Miner" went on. The "Miner" was badly hit (Dec. 3), and on Dec. 4 the "Shaitan" was struck by a shell which killed her captain (Lt.-Comm. F. J. Elkes, R.N.R.) and wounded the helmsman. The "Espiegle," ploughing through the mud in their wake, had found deeper water off Qurna, and was now on the scene. The flotilla took part in the attack on Qurna, which was captured by a turning movement on Dec. 9 1914, and a sound strategical position secured. The difficulties of a river transport were not as yet very severely felt, and in any case the navy had nothing to do with this sphere of work, which was under military control. The flotilla acted merely as a river battery or pursuing force under the G.O.C.

From Qurna the sloops pushed up the Tigris, but 8 m. above Ezra's Tomb (*i.e.* some 35 m. from Qurna) were held up by a long shallow stretch of not more than 5 to 6 feet. The "Ocean" had left for the Mediterranean on Dec. 13, and Comm. Wilfred Nunn was now senior naval officer. The Turks were entrenched at Bahran, about 6 m. above Qurna. Gen. Townshend arrived in April, and on May 31 1915 there followed the amphibious battle of Qurna, fought in punts over flooded marshes in a temperature of 113° in the shade. Gen. Townshend was on board the "Espiegle" (Capt. Wilfred Nunn), which was supported by the sloops "Clio" and "Odin," with the "Lawrence" and "Miner" and the two small armed launches "Shaitan" and "Lewis Pelly" minesweeping in front. The Turks were driven back and the flotilla followed hot on their heels, shelling the Turkish gunboat "Marmaris," which ran ashore and was abandoned. Some 8 m. above Ezra's Tomb, where the "Espiegle" and the sloops were held up by their draught (10 to 11 ft.), Capt. Nunn embarked with Gen. Townshend in the "Comet," the British residents' yacht (1 6-pdr., 3 3-pdr.), and pushed boldly on with the "Shaitan," "Sumana" and "Lewis Pelly" up to 'Amara, where they anchored on June 2 1915, and so disconcerted the Turks that a regiment of 1,000 men surrendered to the "Comet's" crew of 22. The following month an advance was made in the S. up the Euphrates, and the "Espiegle," "Odin," "Miner" and "Sumana" played a large part in the capture of Nasiriya on that river (July 24 1915). There followed the advance to Kut, 143 m. farther up, supported by the "Comet," "Shaitan" and "Sumana," with 4 4·7-in. guns in horseboats. The victory of Sept. 27–28 1915 was won, where Lt.-Comm. Cookson of the "Comet" was killed, gallantly trying to cut the wire hawser of an obstruction under heavy fire.

The army was now in Kut, 240 m. up the Tigris. On every ground of strategy a further advance was indefensible, but political reasons and the glamour of the name of Bagdad drove Townshend forward through the baking marshes, and led to the battle of Ctesiphon on Nov. 22 1915. There his total force numbered 14,000 combatants. The flotilla consisted of the "Firefly," a new paddle-steamer (1 4-in., 1 6-pdr. and a 3-ft. draught), "Comet," "Shaitan" and "Sumana," but it was held up by heavy artillery at Bustan, a hairpin bend some 6 m. from Ctesiphon, and was not able to join action at close range. The S.N.O. (Capt. Nunn) arrived the same day. The Turks counter-attacked, and Townshend fell back on the 25th, with the flotilla toiling behind covering his rear trying to shepherd the army's river craft and salve its stranded barges. The "Shaitan," strained with heavy towing, sprang a leak and sank on Nov. 29 about 8 m. above 'Asiziya. At the battle of Umm at Tabl about 10 m. below 'Asiziya on Dec. 1 the "Firefly" and "Comet" poured lyddite shell into the serried ranks of Nur-ed-Din's army at 2,000 yd., but the "Firefly" was crippled by a shot in her boiler, and the "Comet," which went to help her, grounded and had to be abandoned. The "Sumana" saved the crews, and after towing off a lighter with all the divisional ammunition got in touch with the rear of the shattered force as it staggered into Kut on Dec. 2 1915. All the river craft except the "Sumana" were sent down-stream by Gen. Townshend before the enemy closed round the town. In the first advance by Gen. Sir F. J. Aylmer to relieve Kut, a heroic attempt was made by the paddle-steamer "Julnar," under Lt. H. O. Firman and Lt.-Comm. Chas. Cowley on April 24 1916, to reach the beleaguered town with 270 tons of stores, sufficient to feed the garrison for three weeks. She ran a terrific gauntlet of fire, and nearly got through, but at Makasis, within 8½ m. of the town by river, was held up by a wire and captured. Lt.-Comm. Cowley and Lt. Firman, who were killed, were awarded the V.C. Kut surrendered on April 29 1916. The river transport of the relief expedition was notoriously bad, and scores of wounded lay in dirt and filth on the bare decks of lighters on the long weary journey down to Basra.

Gen. Sir Stanley Maude's campaign was carried out on a very different scale. The whole service of river transport, with all its ancillary branches of quayage, repair and dredging, was placed on an adequate basis. Scores of barges were sent out in parts and assembled at Abadan and Basra. The port of Basra was equipped with piers, and the river dredged so as to make Qurna accessible to steamers of 14 ft. A whole fleet of river craft was created, including all sorts and types of paddle-steamers, tugs, barges, lighters, motor-boats, Arab dhows and Arab punts. Lynch's river paddle-steamers, carrying 400 tons on a 4-ft. draught and able to ply all the year round, were assembled by the dozen. The river traffic was organized on a definite basis, and the whole system placed under the Inland Water Transport, a service largely consisting of experienced R.N.R. officers in military uniforms. The naval flotilla under Comm. Wilfred Nunn had been strongly reinforced, and consisted of three of the "Insect" class, "Tarantula," "Mantis," and "Moth" (armed with 2 6-in., 2 12-pdr. and 6 machine-guns, drawing 4 ft.) and five of the "Fly" class (1 4-in., 1 12-pdr., 1 3-pdr., 1 2-pdr. pom-pom, drawing 3½ ft.). It advanced with the army, reaching Kut on Feb. 24 1917. The "Tarantula," "Mantis," "Moth," "Gadfly" and "Butterfly" pushed on at full speed, and at the Nahr Kellak bend, some 50 m. above Kut, came under a heavy fire from the Turkish rear-guard. The pilot and quartermaster of the "Mantis" were killed and her captain (Comm. Bernard Buxton) wounded, and the "Moth"

(Lt.-Comm. Chas. Cartwright) was badly hit. But the flotilla forced its way through, and opening a heavy fire with its 6-in. guns at close range on the Turks converted the retreat into a rout, recapturing the "Sumana" and forcing the "Basra," "Pioneer" and "Firefly" aground. Asiziya was reached on March 1 and the Union Jack hoisted at Bagdad on March 11 1917. Shortage of river transport was at the root of the British troubles in Mesopotamia, and the failure there and in the Dardanelles was largely due to the glamour of a possible victory concealing the technical difficulties in its path. In Mesopotamia, when these were realized, victory was achieved.

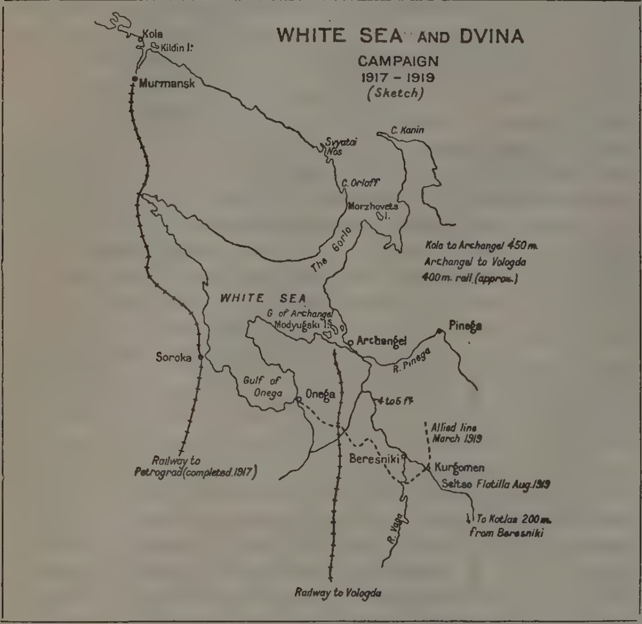

The expedition to Archangel and up the Dvina was of a different nature. It began only in 1918 and survived the war. The closure of the Baltic and the Black Sea had enormously enhanced the importance of the Arctic coast, and a stream of munitions for Russia passed daily along that track. There were two ports there, Murmansk in Kola Bay and Archangel, the former ice free, the latter accessible to ships of 24 ft. from July to October. From Lerwick to Kola Bay was 1,152 m., and from Murmansk a railway was being built to Petrograd, but it was not completed till 1917. Archangel remained the only port of entry on the Russian railway system, and to establish direct telegraphic connexion a cable 1,427 m. long was laid from Peterhead to Murmansk in Jan. 1915. At both ports British patrol flotillas were stationed, but up to 1917 they were engaged only in minesweeping and escort work. In 1917 when Russia collapsed the whole position became precarious. Vast quantities of supplies were lying at Archangel. In 1917 some 600,000 tons of warlike stores had entered the port in addition to 600,000 tons of coal. As it was thought possible that the Germans might send a force against Murmansk, the British cruiser "Cochrane" and the French cruiser "Admiral Aube" were sent in Feb. 1918 to reinforce the old battleship "Glory" there. It was then merely a question of retaining the hold on the coast. By May 1918 the Germans were in Finland, and it was decided to send a force of 600 British and 2,000 other troops to Archangel and 1,500 British and 5,000 others to Murmansk. In June 1918 Sir Eric Geddes arrived, to gain an idea of the situation on the spot. It was then decided by the Supreme War Council to send 5,000 troops to occupy Archangel and push on down to Vologda, join hands with Kolchak's force and endeavour to reëstablish Russia's resistance to Germany. The Archangel force arrived at the end of June 1918. The cruisers "Admiral Aube," "Attentive" and "Nairana" (aircraft carrier) pushed on to Archangel, and the town was occupied with little resistance on Aug. 2 1918.

The campaign resolved itself into the Allied troops (French and British) under Gen. Poole advancing up the railway, which ran 400 m. to the southward to Vologda, in conjunction with a flotilla working on the river Dvina. The latter consisted of two monitors, M23 and M25, four Russian river gun-boats, and two Russian motor-launches, under Capt. Ed. Altham. Beresniki, some 200 m. from Archangel, was reached on Sept. 3 1918, and the enemy were driven up the river, but by Oct. 19 the flotilla had to retire when the river began to freeze.

The campaign survived the war. In March 1919 it was decided to withdraw all forces from the N., and the North Russian Relief Force, consisting of a couple of brigades, was sent in May 1919 to facilitate the retirement. The flotilla now consisted of 6 monitors (M23, 25, 26, 27, 31, 33), four Chinese gunboats ("Glowworm," "Cockchafer," "Cicala," "Cricket" 2 6-in., 2 3-in., 6 maxims), four minesweepers and six coastal motor-boats, and a last push was made up the river in June. Then suddenly the plans at home were altered. It was proposed that Gen. Ironsides should push up the Dvina to Kotlas, 200 m. above Beresniki, through stretches of river little known and with little more than 3½ ft. of water. But at the end of June the river commenced to fall. By July 7 there was only 4 ft. of water between Archangel and Beresniki. The general's hope of reaching Kotlas fell with the river. His Russian troops mutinied, and it was only the arrival of the relief force which saved the situation. The flotilla gradually fell down the river, blowing up M25 and M27, which could not be got down in time. By Sept. 27 1919 the evacuation was complete,—leaving N. Russia to the Bolsheviks and winter.

In conjunction with Capt. Cyril Fuller's expedition in Cameroon, these two river expeditions supply an almost inexhaustible store of experience in river warfare. The work of the navy in the latter expedition consisted in the sweeping of the Duala estuary and the establishment of a base, the clearance of the enemy from its tortuous and narrow creeks, the transport of the military up the various branches of the river, and the seizure of the port of Victoria, Nov. 14 1914, on the coast. The vessels which took part in it were the "Cumberland" (Capt. C. M. Fuller), "Challenger" (Capt. C. P. Beatty Pownall), the gunboat "Dwarf" (Comm. F. E. Strong, 2 4-in., 4 12-pdr.), the "Ivy," a Nigerian vessel, and a number of smaller craft. Duala was occupied by Sept. 27, when eight of the Woermann line were captured, and though the final surrender did not take place till Feb. 28 1916, the colony was virtually captured by the end of 1914.

Things did not go so happily in E. Africa. Early in Aug. 1914 the German governor at Dar es Salaam had agreed to regard the ships there as British prizes, but when the boats of the "Goliath" and "Fox" entered the harbour on Nov. 28 1914, to disable them, a heavy fire was opened in total disregard of the governor's agreement. Comm. Peel Ritchie was severely wounded in bringing the boats out of harbour, and won a V.C. Far inland on Lake Tanganyika two motor-launches, the "Mimi" and "Tou-tou," arrived in Dec. 1915, and after an action with the German craft secured British communications there. They were under Comm. Spicer Simson, who brought them all the way from the Cape by land, a long journey of 2,000 miles. Early in 1916 another German ship managed to get out of the North Sea, and in March slipped into Sudi, a port in the south of the colony, bringing von Lettow Vorbeck, the German military commander, an invaluable cargo of munitions and stores, which enabled him to continue the campaign.

The coastline of German E. Africa remained in the enemy's hands till June 1916, when Tanga was occupied by the cruisers "Talbot" and "Severn." Bagamoyo was occupied by the old battleship "Vengeance" and the cruiser "Challenger" on Aug. 15 1916, and by the end of Sept. Rear-Adml. Edward Charlton, with his flag flying in the "Vengeance," could report the whole coastline in British hands. But in the interior fighting dragged on till the Armistice.

In Sept. 1918 there came news of the last German raider, the "Seeadler" (Capt. von Luckner), which left Bremen on

Dec. 21 1916, and slipped through the blockade line disguised as a Norwegian schooner laden with timber. Armed with 2 4-in. guns and manned by 68 men she had cruised off S. America and sunk six British ships (" Gladys Royle " Jan. 9, " Lundy Is." Jan. 10, " Perce " Jan. 28, " Pinmore " Feb. 19, " British Yeoman " Feb. 26, " Horngarth " March 11), and then rounding Cape Horn disappeared into the Pacific. There she anchored off Mopiha, a small atoll in the Society Is. 265 m. W. of Tahiti, but had dragged on to a reef and broken her back. The captain set off with five men in one of the ship's motor-boats for Cook Is., and was captured by a small British steamer. The rest of the crew captured a small French schooner, the " Lutece," calling at Mopiha for copra, and set off in it leaving their 48 prisoners to their fate, only to be wrecked on Easter I. and rescued by the Chilean schooner " Falcon." Capt. Smith, one of the prisoners, steered a leaky whaler from Mopiha to Tutuila in the Samoa Is., and a French schooner was sent from Papeete for the remainder. Out of six attempts by German raiders to pass the blockade, four were successful; their cruises were unstained by the incidents which marred the German submarine campaign, and might rank as the brightest exploits of the German navy during the war.

Conclusion.—The war was now drawing to a close. In July 1918 Adml. Scheer was summoned to Great Headquarters and on Aug. 11 took Adml. von Holtzendorff's place as chief-of-staff, von Hipper replacing him as commander-in-chief. In Sept. the hammer blows of Marshal Foch in France were beginning to tell, and on Sept. 18 Scheer was told to be ready to evacuate the Flanders coast. On Sept. 29 the Bulgarian front collapsed, and on Oct. 5 Germany was suing for peace. Soon immense explosions heralded the evacuation of the Belgian coast. On Oct. 17 their troops evacuated Ostend. Two days later they were in full retreat from Zeebrugge. Eleven destroyers and nine torpedo-boats succeeded in retiring safely to the Bight. The submarines left there were blown up. Scheer was anxious to continue the warfare against shipping to the bitter end, but on Oct. 21 the submarines received orders to cease the campaign and return home. He then set to work to prepare a great final sortie of the High Sea Fleet. The submarines were ordered on Oct. 22 to assemble off the Scottish coast. It was hoped to make a last great raid on the Channel while the submarines attacked the fleet on its way down. A large minefield had been laid outside the Forth to meet such a contingency, and Adml. Scheer included it unwittingly in his plan, not knowing that it had been swept up. But the plan was never to be fulfilled. Scheer saw the weapon he trusted break in his hands. On Oct. 29, when the signal was made to prepare for sea, a great clamour arose, and a mutiny broke out which reached such dimensions that Adml. von Hipper was compelled to abandon his project. The torpedo flotillas and submarines remained true, and the commodore of submarines was joined by 16 boats off Heligoland and on Nov. 8 took refuge in List. But the end was at hand. Revolution flamed up everywhere. The troops sent to quell the disturbance proved untrustworthy. The navy passed into other hands. The war was over.

Under the terms of the Armistice, 10 German battleships, 6 battle-cruisers, 8 light cruisers, 50 destroyers and all submarines were to be surrendered. On Friday, Nov. 15, Adml. Hugo von Meurer arrived in the " Königsberg " in the Forth to make the final arrangements with Adml. Beatty. On Wednesday, Nov. 20, the submarines began their sorrowful journey to Harwich, to be met by Rear-Adml. Sir Reginald Tyrwhitt 35 m. from the Essex coast. Their old enemies passed in to Harwich in dead silence. Not a sound was heard from the crowds watching them on shore or sea. On Nov. 21 the battleships of the proud German navy passed into Beatty's hands. It was a misty day, and the Grand Fleet stood waiting off the Forth in two long lines 6 m. apart. The light cruiser " Cardiff," flying Rear-Adml. Alexander Sinclair's flag, led the remains of Germany's navy up the lines.

The naval conditions of the Peace terms, signed in June 1919, comprised 17 articles and provided that the German navy was not to exceed 6 battleships of a pre-dreadnought type, 6 light cruisers, 12 destroyers and 12 torpedo-boats, and was not to include submarines. Within two months of signature the 8 dreadnoughts still in German possession (" Oldenburg," " Thüringen," " Ostfriesland," " Heligoland," " Posen," " Westfalen," " Rheinland," " Nassau "), 8 light cruisers, 42 modern destroyers and 50 modern torpedo-boats, were to be surrendered, disarmed but with all guns on board. At the expiration of one month all German submarines building were to be handed over; such as could proceed or be towed were to be taken to Allied ports indicated; the remainder were to be broken up. No warships were to be constructed or acquired other than those intended to replace the previously specified strength, and units were only to be replaced in the case of battleships at the end of 20 years, in the case of destroyers at the end of 15. The personnel, including reserves of the fleet and coast defences, was not to exceed 15,000 officers and men.

The disposal of the German ships gave rise to lively argument. Great Britain was in favour of destroying them. France wished to add her share to her fleet. The question was complicated by the scuttling of the ships at Scapa on June 21. There were interned there 11 battleships (" Baden," " Bayern," " Friedrich der Grosse," " Grosser Kurfürst," " Kaiser," " Kaiserin," " Kronprinz Wilhelm," " Markgraf," " Prinzregent Luitpold "), 5 battle-cruisers (" Hindenburg," " Derfflinger," " Seydlitz," " Moltke," and " Von der Tann "), 6 light cruisers (" Emden," " Frankfurt," " Nürnberg," " Cöln," " Dresden," " Karlsruhe," " Brummer " and " Bremse "), when at 11:15 A.M., on a signal from the " Emden," the ships were scuttled and began to sink. Only four were salved, the " Baden," " Emden," " Frankfurt " and " Nürnberg." Germany did not gain much by this act. She had to hand over in default of the battleships 400,000 tons (reduced later to 300,000) of floating docks, her remaining light cruisers (" Graudenz," " Königsberg," " Pillau," " Regensburg," " Strassburg "), to replace the light cruisers, and 42,000 tons of floating cranes, tugs and dredgers, instead of the destroyers; these were more useful than what was sunk.

The terms of peace were no mere formality. The destruction of the submarines and vessels building was entrusted to a naval section of the Inter-Allied Commission, under Vice-Adml. Sir Montague Browning (subsequently under Vice-Adml. Sir Edward Charlton), and was strictly executed. The fortifications of Heligoland were razed to the ground. The destruction of Germany's sea-power was complete. It had been achieved by economic pressure and the imminence of a great military defeat, engineered by the maritime power excited by a superior fleet. Strangled by sea-power, and with a vast military spearhead launched at her heart, Germany collapsed. The year 1920, which had been intended to see the fulfilment of her Navy Law of 1900 embodied in a fleet of 61 capital ships, 40 cruisers and 144 destroyers, saw the fabric of her naval aspirations shattered, her proud fleet sunk beneath the waves in a bleak harbour of the north, her Emperor, who had inspired its creation, a fugitive in a foreign land, and foreign admirals sitting in her capital superintending the destruction of its shattered remnants.

The fleets of the Allied and Associated Powers covered every sea, and their immense superiority is shown in the following figures:—

	Dread-noughts.	Battle Cruisers.	Light Cruisers.	T.-B. Ds.	Sub-marines.
Allied and Associated Powers	64	16	138	477	356
Germany and Austria	21	6	41	134	239

The Grand Fleet was now almost twice as numerous as when it had steamed N. on its fateful way in Aug. 1914. Its two destroyer flotillas had increased to eight, its single light-cruiser squadron had become six. It mustered, with Rear-Adml. Rodman's squadron, 38 battleships, making with Rear-Adml. T. S. Rogers' B.S. squadron at Berehaven (" Nevada," " Oklahoma," "Utah") a total of 41 in British waters. It had 9 battle-cruisers and 39 cruisers and light cruisers, and attached to it were no less than 7 destroyer flotillas, mustering 167 destroyers (11th, Capt. Roger Rede; 12th, Capt. H. M. Leveson-Gower; 13th, Capt. Arthur B. S. Dutton; 14th, Capt. H. R. Godfrey; 15th, Capt. R. Rowley-Conwy; 3rd, Capt. Ed. Rutherford; 20th, Capt. Berwick Curtis, and 21st), and 5 submarine flotillas (10th, 11th, 12th, 13th, 14th) with 48 submarines.

The British losses had not been small. They amounted to 254 vessels, of which the greatest number had fallen to enemy submarines.

sea was kept open for the troops and trade of the Allies, and the shores of Great Britain and France were kept safe from invasion. Germany's path to the ocean was barred. It may be said that the path of German submarines was not barred, but German submarines merely attempted to do laboriously and slowly what a couple of German battle-cruisers appearing unopposed in the Channel could have done at once. And though the submarine was powerful against merchant shipping, it accomplished much less against the fleet. Not a single dreadnought was sunk by it during the war, and except in the narrow waters of the Adriatic no battle-fleet was ever kept in harbour by fear of submarines. The submarine, like the mine, must be regarded as an adjunct of the capital ship and not a substitute for it. It was countered by anti-submarine flotillas and convoys working under the aegis of the battle-fleet, which except in the case of the raids on Dover preserved them immune from attack. Again, the unrestricted use of the submarine involved the defiance of neutrals, an attitude which after the experience of this war few Powers will care to adopt. Each class of ship has its virtues, and naval strength cannot be expressed in terms of any single type. The various types are complementary to one another. The capital ship represents the highest synthesis of guns, protection and speed which the level of technical knowledge can supply. The submarine can attack the battle-cruiser, but the destroyer and aircraft can drive off the submarine, and the former can be driven off by the light cruiser, which in its turn can not approach the battle-cruiser.

British Warship Losses.

A, Action; B, Submarine; C, Mine; D, Destruction to avoid capture; E, Block-ship; F, Internal explosion; G, Collision; H, Wreck; J, Accident; K, Unknown.

	A	B	C	D	E	F	G	H	J	K	Total	Tonnage (dead-weight)
Dreadnoughts			1	..		1					2	200,735
Pre-Dreadnoughts	1	5	4	..		1					11	
Battle-Cruisers	3			..							3	63,000
Cruisers	5	5	1	..	..	1		1	..	..	13	158,300
Light Cruisers	1	3	2	..	6						12	46,255
Aircraft-Carriers	1	1		..	..	..	1	..			3	27,488
Minelayers		1		..		1					2	11,000
Gunboats		1	1	..	..		2	2		..	6	4,235
Monitors	3	1	1	..	..				..	..	5	8,125
Coast Defence Ships	..	..	..	..	..	1	..		..		1	5,700
Sloops	1	11	5	..						1	18	22,630
Flotilla Leaders	1	1		..		1					3	5,204
Destroyers	16	7	20	..	..		12	8	..	1	64	52,045
Torpedo-Boats	..	2	1	..	..	..	4	4	..	..	11	2,230
Submarines	3	4	4	9	1	..	4	4	4	21	54	43,649
Patrol Boats			1	..			1				2	1,226
Armed Merchant Cruisers	1	11	1	..	..	..		2		2	17	179,169
Armed Boarding Steamers	1	9	1	..	..	..	1	1	..	..	13	23,799
Coastal Motor-Boats	5	..	..	2	..	..	2		3	1	13	85

Of auxiliary craft 815 had been sunk, including 246 trawlers, 244 colliers, 130 drifters, 44 oilers, 24 motor-launches and 18 minesweepers. Of the total 289 (35·4%) had been sunk by submarine, 225 (27·7%) by mine, and 77 (9·4%) had been wrecked. The losses of the other Allied navies were not so heavy in comparison.

Comparative Naval Losses.

	Dread-noughts.	Pre-drs.	B. Cs.	Cr.	L. Cs.	Destroy-ers.	Sub-marines.
Great Britain and Dominions	2	11	3	13	12	64	54
France	..	4	..	5	..	13	12
Italy	1	3	..	1	2	9	7
Japan	1	..	1	..	2	1	..
United States	..	..	..	1	..	2	2
Russia (to 1918)	2	2	..	2	..	18	15[1]
Germany (to Nov. 11 1918)	..	1	1	6	17	68[1]	200
Austria	2	1	..	..	3	6	11[1]
Turkey	..	2	..	..	1	3	..

[1] Approximate.

Though the figures give a very meagre picture of the colossal ramifications of the war, they leave ample room for comment. The submarine inflicted and suffered most of the damage done in the war. It was the most active and most dangerous service. In the North Sea Great Britain and the United States maintained a force of 46 capital ships (battleships and battle-cruisers) against the German 23, in numbers a twofold, in gun-power a threefold superiority. In the Mediterranean, France and Italy could muster 12 dreadnoughts against Austria's scanty three. What was the use of this immense superiority in battleships if it could not bring the German navy to action? The answer is that it represented the outlook of 1913, not of 1918. The French, Italian and U.S. dreadnoughts had been laid down before the war, and could not be converted into destroyers at a moment's notice.

The work wrought by sea-power, envisaged as a whole, was evident enough. German trade was swept off the sea. The

The fact that there was no great decisive battle has made some doubt the further use of the battleship. It is true that the opportunity lost at Jutland was never wholly redeemed. The battle in war represents the economy of the decisive blow. Vast resources of personnel and material had to be kept locked up in the Grand Fleet, which a decisive battle would have released for the war against the submarine. The German fleet remained, too, something much more than a "fleet in being," for by guarding its minesweepers from attack it kept the Bight open for its submarines and took an active part in their campaign. The Grand Fleet still barred its way to the west but in conjunction with the minefield the German ships held the door of the Baltic and exercised an active command there. But though the capital ship still retains its place in naval war its particular design and its relative status leave large room for discussion. One may well ask why millions should be spent in giving it bulges to render it unsinkable. The "Moltke" was hit twice by torpedoes and did not sink. Again, do we not strain too much after the heaviest possible gun? The "Von der Tann" had 11-in. guns and the "Queen Mary" 13·5-in., but the former blew up the latter. These questions, however, belong rather to gunnery and tactics than to naval strategy.

The war left the world still on the horizon of other potentialities. Submarines and aircraft never actually coöperated in a fleet action, though the value of the former in reconnaissance work was clearly demonstrated in the later stages of the war. In deep and narrow stretches of waters, however, it became almost supreme. Thus in the Adriatic the Austrian battleships dared not venture out and the Allied battleships dared not venture in. The power of the mine was one of the lessons of the war, and the combination of a minefield supported by the heavy guns of a fleet or by forts remained insurmountable to a fleet alone; the mines prevented ships approaching the fort or fleet, and the forts and fleet prevented minesweepers approaching the mines. This problem can only be solved by capturing the forts as the Germans did at Ösel in 1917, but even there three battleships were severely injured by mines. The mine must not be regarded as a purely defensive weapon. It can be and was very offensive, and at the Sound and Dardanelles was too strong for the stronger fleet.

Certain outstanding lessons remain from the war. Invasion becomes more hazardous than ever in the face of numerous and powerful aircraft, while aircraft carriers with opposing aircraft are necessarily enormous vessels and very vulnerable to attack. The truism that ships cannot engage forts was proved to be true. The power of the minefield was clearly demonstrated. Certain fallacies in evidence before the war received a severe shock. One of these used to be embodied in the expression that the sea is all one, but the war showed that the North Sea was one and the Baltic another. Maritime geography remains a dominating factor in naval war.

When the war broke out, grave doubts arose as to the advisability of sending a British army to France in the face of an undefeated German fleet. Maritime geography and the Dover Straits permitted this to be done in safety. The war was dominated by the fact that Germany's path to the ocean was barred by the solid bulk of Great Britain, and that both navies were working close to their main magazines of repair and supply. The full strength of all the combined weapons, air, sea and submarines, can only be exerted within a reasonable distance of one's own bases, and the navy fights with greatest advantage that fights in the vicinity of its great bases and industrial centres. Very different would be the conditions of a war 5,000 m. away. The development of aircraft, and the necessity of a host of auxiliary craft, tend to produce what may be called areas of maximum control for each power. Within its own area a navy tends to be supreme. The farther away it goes the heavier becomes its task. A war at a great distance would be waged under a heavy handicap, and would tend towards the conditions existent between Venice and England in the 15th century. They were too far apart to go to war.

It is barely possible for a single mind to envisage all the aspects of so colossal a war, or to gauge precisely the relative parts played in the victory by economic, naval and military pressure. But this at least may be said. If the British navy in 1914–8 had an even greater task to face than anyone dreamt of when King George had described it as the "Sure Shield" of its country at the outbreak of war, it could feel that this confidence had not been misplaced when the memorable day came for Beatty to receive the surrender of the German fleet under the Cross of St. George and the Stars and Stripes. (A. C. D.)

NAVIES: *see* SHIP AND SHIPBUILDING.

NAVY, DEPARTMENT OF THE (United States): *see* ADMIRALTY ADMINISTRATION (section *United States*).

NEAL, DAVID DALHOFF (1838–1915), American painter (*see* 19.320), died in Munich, Germany, May 2 1915.

NEBRASKA (*see* 19.323).—The pop. in 1920 was 1,296,372, an increase of 104,158, or 8·7%, over the 1,192,214 of 1910, as against an increase of 11·8% in the preceding decade. The foreign-born whites decreased from 176,662 in 1910 to 149,652 in 1920. The density of pop. was 16·9 per sq. m. as against 15·5 in 1910. The urban pop. (in places of 2,500 or more) was 405,306, or 31·3% of the whole, as against 310,852, or 26·1% of the whole, in 1910; the rural pop. was 891,066, or 68·7%, as against 881,362, or 73·9%, in 1910.

The five cities having in 1920 a pop. over 10,000 were:—

	1920	1910	Increase per cent
Omaha .	191,601	124,096	54·4
Lincoln	54,948	43,973	25·0
Grand Island	13,947	10,326	35·1
Hastings	11,647	9,338	24·7
North Platte	10,466	4,793	118·4

A conspicuous feature of the census returns was the continuing decrease of farming pop. in the older counties. Out of 93 counties 33 showed a decrease in total pop. and 43 showed a decrease in rural pop. during the decade. This rural decrease was in the part of the state where land sold at the highest price. The increase of pop. was almost entirely in three localities: Omaha, the chief industrial centre; Lincoln, the state capital; and the Scottsbluff irrigated region in the North Platte valley.

Agriculture.—In the decade 1910–20 farms tended to become fewer and larger, as shown by the following figures:—

	1920	1910
Farms, total number . .	124,417	129,678
Total ac. in farms	42,225,475	38,622,021
Average size of farm (ac.) .	339·4	297·8
Improved land	23,109,624	24,382,577

The decrease in the number of farms was due to improved machinery (especially farm tractors), making the farming of larger units more economical, and to the higher price of land, making more difficult its purchase by persons of small means. The increase in size of farms was partly due to homesteads of 640 ac. taken in the sandhill part of the state under the Federal Kinkaid Homestead Act. All but a few thousand rough acres of the public domain in Nebraska had been claimed by settlers by 1921. In 1920 Nebraska ranked sixth among the states in area of cultivated lands. It was first in production of hay and of alfalfa; second in production of winter wheat; third in corn; third in combined production of wheat, oats and corn. About 1,000,000 ac. were in woodland, of which half or more had been planted by settlers.

Production of the principal crops for the years 1910 and 1920 is shown in the following table:—

	1920		1910	
	Ac.	Bus.	Ac.	Bus.
Corn . .	7,560,355	255,544,816	6,595,088	178,925,128
All wheat .	3,592,995	60,560,416	2,732,166	45,151,052
Oats . .	2,400,062	83,037,162	2,543,858	71,562,877
Barley . .	255,503	7,424,615	115,957	2,333,199
Rye . .	264,370	3,751,104	71,339	822,648
Potatoes . .	85,439	8,435,554	98,483	5,330,138

Great progress was made in the decade in production of alfalfa and sugar beets. The comparative figures are as follows:—

	1920		1910	
	Ac.	Tons	Ac.	Tons
Alfalfa . .	1,232,947	3,527,689	701,455	1,883,661,
Sugar beets .	78,675	750,000	8,517	105,369

Growing potatoes on a commercial scale became a large industry in western Nebraska during the decade, about 8,000,000 bus. being produced annually.

The number of live stock on farms was:—

	1920	1910
Horses . .	961,396	971,279
Mules . .	99,847	79,652
Cattle . .	3,154,265	2,567,392
Hogs . .	3,435,690	3,435,724
Sheep	573,217	240,116

Farm tenantry increased during the decade as follows:—

	1920		1910	
Farms occupied by owners . .	69,672	56	79,250	61·1
Farms occupied by renters . .	53,430	42·9	49,441	38·1

The percentage of tenants is greatest in the richer agricultural counties. About three-fourths of the tenants are renters for share rent. The landlord's share of grain crops is usually one-third of the small grain, two-fifths of corn, one-fourth of potatoes, one-fifth of sugar beets, one-half of the hay in stacks. In 1920 the total number of farm mortgages filed was 19,838 and their amount $116,440,626. The total number released was 17,514 and their amount $78,654,818. Most of these transactions arose from purchase and sale.

The Farmers' Coöperative and Educational Union became an organization of about 35,000 members in Nebraska during the decade. Its leading purpose is collective buying and selling. From it developed the Grain Growers, Inc., an organization covering all the states, with the purpose of handling the whole grain crop of the United States and securing better returns for the producer.

Minerals.—Of the pumice produced in the United States 97% is mined in Nebraska. Limestone, sand and Portland cement are increasing in production. Potash is found in alkali lakes in the sandhill region of western Nebraska. The World War shut out importation from Germany, and commercial potash rose to 10 times its former price. The result was that a new industry sprang up; large amounts were invested, and over 2,000 men were employed. In 1918 Nebraska shipped about 150,000 tons of potash—three fourths of the total production in the United States. When importation from Europe was resumed the Nebraska production decreased and the future of the industry became uncertain.

Industries.—The progress of manufactures during 1909-19 is shown in the following table:—

Manufactures.

	1919	1914	1909
Number of establishments	2,884	2,492	2,500
Wage-earners (average)	36,521	25,144	24,336
Capital	$245,256,684	$121,007,944	$ 99,901,089
Salaries and wages	61,808,692	24,010,977	19,438,719
Value of products	596,042,498	221,615,848	199,018,579
Value added by manufacture	115,268,376	47,502,164	47,937,608

Slaughtering and meat-packing, the chief manufacturing industry, in 1919 employed 10,122 wage-earners in 16 establishments and the products were valued at $303,849,000. Receipts of live stock at the Omaha stockyards indicate the growth of that industry in the past decade:—

	1919	1910
Cattle	1,874,996	1,223,533
Hogs	3,179,166	1,894,314
Sheep	3,789,188	2,984,870
Horses and mules	22,600	28,817
Total	8,865,950	6,131,534

Banking and Finance.—The Bank Guaranty law of 1909 and its amendment in 1911 provided for a fund from all state banks for protection of their depositors. The extraordinary growth of banking business which followed is shown in this table:—

	1919	1910
Number of state banks	999	666
Number of national banks	189	238
Capital and surplus: state banks	$32,282,000	$14,823,000
Capital and surplus: national banks	26,434,000	21,940,000
Deposits: state banks	270,050,000	70,454,000
Deposits: national banks	180,596,000	87,663,000

In 1919 Omaha ranked 13th among cities of the United States in respect of its volume of bank clearings, though 34th in population. The amount was in 1919 $3,058,973,348; in 1910 $832,971,607. The total legislative appropriations for the biennium 1909–11 were $6,248,362; for 1919–21 $15,963,392; for 1921–3 $26,513,771. The cash balance in the treasury Nov. 30 1920 was $2,089,631. There was no state debt. The total assessed value of the state (one-fifth actual value as prescribed by law) was in 1910 $412,138,607; in 1920 $775,949,730. The total state levies amounted to between six and seven mills on the dollar of assessed valuation. Under the new budget law of 1921 the date of the fiscal year was changed from April 1 to July 1. Heads of departments and institutions must make quarterly estimates in advance for expenditures of each quarter, which must be approved by the governor.

Education.—The total number of persons of school age in 1920 was 392,592; of these 311,821 were enrolled in school. The Nebraska law requires attendance of all children between 8 and 14 during 6 months of each year. There were 250,689 such children in the state, of whom 211,101 complied with this requirement. There were 7,168 school districts in the state. There were 12,705 women teachers and 1,084 men teachers. The total amount voted for school purposes in 1920 was $24,935,102. There were 100 consolidated school districts. The average monthly pay of men teachers was $134.42, of women teachers $86.26. The total value of school district property of all kinds was $142,145,280.

History.—The chief political issues in Nebraska during the period 1910–20 were prohibition, woman suffrage, initiative and referendum, reconstruction of the state Government and extension of public ownership. The first four issues were determined in the affirmative. The last mentioned was the subject of much controversy. The Democratic party carried the state in the elections of 1912, 1914 and 1916. The Republican party overwhelmingly carried the elections of 1918 and 1920. Party lines had been very much broken since 1900. Each of the leading parties developed a conservative wing and a progressive wing. The Non-Partisan League effected an organization in Nebraska. It was reported to have 25,000 members, but up to 1921 had succeeded in electing only a few of its candidates to office, its policy being to concentrate its votes in the primary of whichever party seemed to promise the greatest results.

A new political issue, that of language and religious instruction, arose out of the World War. About 200,000 Nebraskans were German-born or children of parents born in Germany. In many communities religious services and instruction were given in other languages than English. Through the efforts of the German-American Alliance, the Mockett law was enacted in 1913, providing for teaching the German language in the common schools upon petition of school patrons. The war caused antagonism toward everything connected with Germany. A general movement was inaugurated to drive foreign languages out of the schools and churches. The Mockett law was repealed. In its place was enacted the Siman law forbidding the use of any foreign language as a medium of instruction. The substance of this law was embodied in the state constitution Sept. 21 1920. The Legislature of 1921 amended the Siman law, making it more stringent. Out of more than 40 newspapers printed in foreign languages before the war, there remained only 10 in 1921.

Consolidation of some 20 state bureaus and organizations into 6 departments was enacted by the Legislature of 1919. A convention to revise the constitution met Dec. 5 1919. It submitted 41 amendments, all of which were adopted at a special election Sept. 21 1920. The most important were those providing for future amendment of the constitution by a majority of those voting on the question, provided such majority is 35% of total vote; providing for new executive offices by two-thirds vote of the Legislature; for classification of intangible property for taxing purposes; for the creation of a state industrial commission to administer laws relating to labour disputes and profiteering; making alien property rights wholly subject to the Legislature. The Legislature of 1919 provided a special tax and appropriated the proceeds to the amount of $5,000,000 for construction of a new state capitol. The erection of the building was entrusted to a State Capitol Commission.

The state furnished 49,614 men for service in the World War, of whom 3,021 lost their lives. To the Liberty and Victory loans and war charities Nebraska paid $264,760,000. Nebraska was first in *per capita* purchase of war savings stamps and her membership in the American Red Cross was 585,156—49% of the population.

The governors after 1910 were: Chester H. Aldrich (Rep.), 1911–3; John H. Morehead (Dem.), 1913–7; Keith Neville (Dem.), 1917–9; Samuel R. McKelvie (Rep.), 1919–21.

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(A. E. S.*)

NEGRO (*see* 19.346*).—As a result of the publication of preliminary returns for the American census of 1920, it became possible in June 1921 not only to record the growth of the negro pop. of the United States during the decade 1910–20, but to compare the growth during 60 years of slavery with that during almost 60 years of freedom. In 1920 the negro pop. was 10,463,013, as compared with 9,827,763 in 1910, an increase of 635,250 or 6·5%. In the preceding decade the increase had been 993,769, or slightly over 11%. In the period between 1800 and 1860 the negro pop. increased from 1,002,037 to 4,441,830 or 343%; in the period between 1860 and 1920 it increased from 4,441,830 to 10,463,013 or 136%. The increase under freedom, although nearly twice as great numerically, was at only about four-tenths of the rate under slavery. Much of this difference is to be attributed to the negro's participation in the slackening rate of the country's growth. The white pop. of the United States, notwithstanding its reinforcement by more than 28,000,000 immigrants in the later period and only about 5,250,000 in the earlier, increased in the second 60-year period less than half as fast as between 1800 and 1860. The figures for the negroes show, however, that their emancipation has not stimulated the growth of population as emancipation of the Russian serfs did and as many Americans of a generation ago anticipated. During the

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** These figures indicate the volume and page number of the previous article.*

first period negroes increased about two-thirds as fast as whites; during the second little more than half as fast.

For a fuller examination of the changes in pop. growth, each of these 60-year periods has been divided into 3 of 20 years each, a method which neglects the admittedly inaccurate count of 1870 and the probably inaccurate count of 1890.

	Increase of Negroes: Number	Per cent	Increase of Whites: Per cent	Per cent of Negro Increase to White (= 100)
1800–20	769,619	76·8	82·7	93
1820–40	1,101,992	62·2	80·5	77
1840–60	1,568,182	54·6	89·7	61
1860–80	2,138,963	48·2	61·2	79
1880–1900	2,253,201	34·2	53·9	64
1900–20	1,629,019	18·4	41·9	44

The numerical increase rose period by period to a maximum in the last 20 years of the 19th century and then decreased, so that between 1900 and 1920 it was little more than it was 60 years before. The rate of increase, on the contrary, diminished steadily from period to period. At each period the rate of negro increase was less than that of the white. Apparently the immediate result of the Civil War and emancipation was to raise the relative rate of negro increase between 1860 and 1880 to nearly four-fifths of that of the white, a change due to the sharp check of white increase and a much slighter check in negro increase. But since 1880 the rate of negro increase has fallen much the more rapidly, and between 1900 and 1920 it was about four-ninths of that of the more numerous race. As a result of these changes negroes, who in 1800 were 18·9% of the country's pop., in 1920 were only 10%. If each race should increase through the present century at a rate identical with that prevailing between 1900 and 1920, as of course it will not, the pop. of the country in 2000 A.D. would be over 400,000,000, of which about 20,000,000, or one-twentieth, would be negro. The rate of increase of each race is likely to fall, but the difference in favour of the white race is unlikely to diminish.

The Census Bureau has compared the rates of increase of negroes and whites after correction for the probable inaccuracy of certain recent census figures. Those rates are reproduced below, with the addition of figures for 1920 and slight changes to allow for the fact that the intervals between the censuses of 1900, 1910 and 1920 were less than ten years.

	Rate of Decennial Increase		Per cent of Negro Increase to White
	Negroes	Whites	
1860–70	21·4	27·5	78
1870–80	22·0	26·4	83
1880–90	17·6	26·7	66
1890–00	13·8	21·2	65
1900–10	11·4	22·3	51
1910–20	6·5	16·5	40

In the decade 1910–20 the percentage increase of negroes was two-fifths of that of the whites. Since 1880 the darker race has been relatively and rapidly losing ground.

In the years immediately following the Civil War a belief was commonly held that under freedom the negroes would rapidly distribute themselves over the country. At every census before 1870 between 91% and 93% of the negroes resided in the southern or slave states. Between 1860 and 1910 this proportion fell only from 92·2% to 89·0%. But between 1910 and 1920 it fell to 85·1%. During that decade the increase in the number of negroes living in the northern and western states was greater than the increase during the 30 years between 1880 and 1910. As a result of this outflow the negro pop. of the southern states increased only 2%, while that of the northern states increased 43% and of the western 55%. The movement cannot yet be thoroughly studied, but what information is available indicates that the migration has been almost exclusively to the northern and western industrial districts. Whether it is a temporary dislocation of population due to war-time conditions or a persistent drift cannot yet be foreseen.

The remarkable fall in the rate of negro increase and the rapid distribution of negroes over other parts of the country than the South are the striking changes revealed by the preliminary census figures. How is the fall in the rate of increase to be explained? Has it any connexion with the growth of interstate migration? To get light upon these questions we turn from the census figures of living population to the registration figures of births and deaths. Since 1900 the United States has been developing towards a national system of vital statistics by voluntary coöperation between the Federal Government and the Governments of the states and cities. For five years, 1915–9 inclusive, the births and deaths of negroes in a number of northern states, including the New England states, New York, Pennsylvania, Michigan and Minnesota, and for a shorter period the same facts for several other northern and a few southern states, are known.

The figures for the northern states are as follows:—

Births and Deaths of Negroes in Certain Northern States, 1915–9.

	Births	Deaths	Natural Decrease	Deaths to 100 Births
New England	8,634	9,101	467	105
New York	19,088	20,342	1,254	107
Pennsylvania	24,924	30,786	5,862	124
Michigan	2,971	3,488	517	117
Minnesota	525	870	345	166
Totals	56,142	64,587	8,445	115 (average)

In each of these divisions negro deaths outnumbered negro births by an average of about 15%, and in consequence the increase of negroes in all these states, and probably in the other northern and western states, has been wholly due to immigration.

In the southern states the following compilation of all available figures shows results which are widely different:—

	Years Covered	Births	Deaths	Natural Increase or Decrease	Negro Deaths to 100 Births	White Deaths to 100 Births
Maryland	1916–9	25,418	25,407	11	100	68
District of Columbia	1915–9	11,042	13,280	−2,238	120	81
Virginia	1917–9	57,244	42,971	14,273	75	48
Kentucky	1917–9	12,460	17,410	−4,950	140	51
North Carolina	1917–9	67,724	42,633	25,091	63	41
South Carolina	1919	22,599	14,439	8,160	64	39
Totals		196,487	156,140	40,347	79	52

While in each of the northern states for which the information exists negro deaths outnumber births, in the southern states the conditions are reversed: but to this rule there are exceptions. Kentucky and the District of Columbia resemble the North rather than the South. Maryland holds a middle position, births equalling deaths and the farther south the state the greater the excess of negro births over deaths.

The difference between the District of Columbia and the two states adjoining it suggests that an excess of deaths over births may be found in cities, whether northern or southern, rather than in northern states, whether mainly urban or not.

Births and Deaths of Negroes in Cities and Rural Districts of Registration Area, 1915–9.

	Births	Deaths	Natural Increase or Decrease	Deaths to 100 Births
Cities	100,203	121,306	−21,103	121
Rural districts	169,353	122,565	46,788	72
Total	269,556	243,871	25,685	90

Clearly the difference between conditions in cities and those in rural districts is almost as influential upon race increase as the difference between South and North, which in this case closely parallels it. Further analysis shows that throughout the North and in the cities of the South deaths are more numerous than births.

	Births	Deaths	Natural Increase or Decrease	Deaths to 100 Births
Northern cities	58,921	68,698	−8,777	115
Northern rural districts	14,148	19,033	−4,885	135
Southern cities	41,282	52,608	−11,326	127
Southern rural districts	155,205	103,532	51,673	67
Total	269,556	243,871	25,685	90

The figures show as conclusively as their incompleteness permits that the conditions under which negroes live in the North are unfavourable to the natural increase of their race and that in this regard no important difference appears between city and country. They show also that southern cities are even more unfavourable than those in the North to natural increase. The great reservoir for the natural increase of negroes is the rural districts of the South, in which apparently there are about three births for every two deaths. This evidence seems to answer our questions. The sharp check in the growth of negro population between 1910 and 1920 was due primarily to the flood of migration from the agricultural districts of the South largely to the cities and industrial districts of the North, but partly also to the cities of the South, and the exposure of negroes in their new homes to conditions tending to raise the death-rate or reduce the birth-rate, or both. The census of 1920 showed that about 19·9% of the negroes were living in states other than those in which they were born. But contrary to popular belief the proportion of those who had migrated from the South to the North and West was only about one-fourth larger than that of those who had migrated from the North and West to the South.

The white race is not equally burdened. In the cities of the registration area in 1915–9 there were only 62 deaths among whites for each 100 births, the corresponding figure for negroes being 121. In this regard the negroes of the United States are in somewhat the same position as the whites on both sides of the Atlantic a century or more ago, when cities were in a sense parasites upon the surrounding rural districts, at whose expense alone they could grow or even maintain themselves.

(W. F. W.)

NÉNOT, PAUL HENRI (1853–), French architect, was born in Paris in 1853, and when only 13 years old, was placed in the studio of M. Lequeux as architectural pupil, coming there under the influence of J. L. Pascal. Thence, when 15, he went to the École des Beaux-Arts, breaking off his studies in 1870, immediately on the outbreak of war with Germany, to enlist in an artillery regiment. Here he gained, as his first distinction, the Military Medal, and at the conclusion of the war, it was with difficulty that his patriotic enthusiasm allowed him to reassume a non-military life. He continued, however, his course at the École des Beaux-Arts, and in 1877 gained the Grand Prix de Rome. During these years he was working in the office of C. Garnier of the Opera House, Paris, and after the winning of the Grand Prix he travelled for a considerable time in Italy, Greece and Egypt. While holding this prize in Rome, he competed for the Victor Emmanuel monument in that city, receiving for his design the premium of 50,000 francs, the work itself being entrusted to an Italian. On his return to France, he entered for the great competition for the rebuilding of the Sorbonne, in which he was successful, and in 1882, despite discussion as to entrusting to so young a man such an important commission, he commenced in 1885 a work that was to occupy him for the next 17 years. He did not, however, undertake it till after a prolonged tour of inspection of the universities of Germany, Austria, Holland and Belgium. The building forms a huge parallelogram of over 900 ft. in length by 325 ft. in width, and its plan is brilliantly conceived, taking as its dictating condition the retention of Richelieu's chapel of the Sorbonne. Throughout the whole of his consideration of the treatment of this, as indeed of his other buildings, Nénot relied steadfastly on the assistance of the sculptor and the painter, and the grand amphitheatre gave him the opportunity he absolutely insisted on of employing for its decoration Puvis de Chavannes, whose mural painting of the "Sacred Grove" is his masterpiece. The hall itself, used as a *salle des conférences*, is an admirable example of the D-plan carried by a series of alcove recesses to an ultimate development. Nénot's other work gives evidence in equal manner of the tradition he carried forward from the school of which half a century before, Duc, Labrouste and Dubon were the founders and upholders, and shows a similar tendency to breathe fresh and revitalizing inspiration into the vernacular architecture of France. His other buildings, mostly in Paris, include the Institut Océanographique, the offices of the Compagnie Générale and those of the Compagnie Nationale des Wagons-Lits. He received many distinctions, becoming a member of the Institut in 1895, and being later elected president of the Société des Artistes Français. He was awarded the gold medal of the Royal Institute of British Architects in 1917.

NERVOUS SYSTEM (SURGERY).—The purpose of this article is to give a general view of the scope and limitations of surgery as applied to injury and disease of the nervous system. It is essentially concerned therefore with the principles of modern surgical neurology rather than with clinical, pathological or technical details.

The nervous system (*see* 19.400) is unique among the various systems into which the body is conventionally divided by the descriptive anatomist in being everywhere sharply marked off by definite anatomical and physiological boundaries from all the other tissues. It is a system in the strictest sense of the term. Its substance is elaborately insulated from contact with non-neural tissues except at the minutely limited points where contact is necessary for function, and correspondingly its pathology comprises principles which are characteristic and peculiar to it. In the mechanisms of injury or disease, in the processes of recovery and repair and in the response to the action of drugs the nervous system displays qualities which are special to it and not to be found elsewhere. It is natural therefore that the general principles of surgery need to be qualified in certain ways before they can be applied satisfactorily to surgical neurology.

The three great divisions of the nervous system—brain, spinal cord and peripheral nerves—coincide nearly enough with differences of surgical principle to allow the surgery of them to be dealt with under corresponding heads.

Surgery of the Brain.—The brain differs from all other organs of the body in being enclosed in a capsule of bone, and in a capsule therefore which is incapable of being stretched by any physiological force. The normal response of other organs to injury or disease is swelling, and this possibility of the occurrence of swelling allows of the presence of inflammatory products, of extravasated blood or oedema fluid without the circulation of blood through the organ being grossly impeded. In the case of the brain swelling the result of injury or disease is strictly limited by the skull, with the result that products of inflammation (or extravasated blood) or oedema fluid press on the vessels of the brain—veins, venules and capillaries according to the amount of exudation—and limit the circulation through them. The consequence is that any intracranial lesion other than a purely degenerative one is always accompanied by more or less wide-spread circulatory disturbances in the brain.

Now the functional activity of the brain is immediately dependent on blood supply, so that a cerebral lesion, as it necessarily interferes with blood supply, must always produce disturbances of function by this mechanism. In the case therefore of a given lesion such as a tumour or a haemorrhage the symptoms will be produced in two ways. First there will be symptoms due to loss of the function of the piece of brain occupied and destroyed by the tumor or haemorrhage, and secondly there will be symptoms due to disturbance of function in the surrounding region of brain where the circulation is impeded by pressure.

This dual causation of symptoms is a fundamental principle in cerebral pathology, and there are two corollaries of it of equal importance. In the first place the loss of function due to circulatory disturbance may be and frequently is as complete as if it were due to actual destruction of the brain substance; and in the second place the symptoms due to circulatory disturbance are in the majority of cases more conspicuous and more important than those due to the directly destructive effect of the lesion. It follows from these considerations that in many cases in which surgery is unable to deal curatively with the actual diseases itself it can produce benefit by dealing with secondary circulatory disturbance through the relief of pressure. Since the secondary pressure effects of many cerebral tumours are extremely distressing (severe headache, persistent vomiting and failure of vision), the merely palliative relief of abnormal intracranial tension is an important function of cerebral surgery.

While disturbance of function due to circulatory embarrassment can be got rid of if the abnormal intracranial tension can be completely relieved, loss of function due to destruction of the brain substance is permanent. There is no such thing as regeneration of the brain tissue, or the taking over of the actual function of a destroyed part by another part, and surgery can do nothing to restore a piece of brain that has been destroyed.

Having defined the general limitations within which the surgeon works in dealing with injury or disease of the brain we may next indicate in a summary way the chief procedures he is called upon to undertake.

Curative Operations.—By this term is meant procedures which are intended to do away with the primary cause of the symptoms in a given case, but it is of course to be understood that any element in the symptoms that may be due to destruction of brain tissue is necessarily irremediable.

(*a*) *Operations Curative by Relief of Intracranial Tension.*—When the brain has been severely bruised either locally or diffusely—a common result of head injury in civil and military practice—the subsidence of the contusion is very slow, and may be indefinitely delayed owing to the effects of the rigid encapsulation by the skull. In these circumstances the patient is apt to suffer for many months or even years from severe and disabling symptoms of which the most conspicuous is headache. Such symptoms can be arrested by the making of an opening in the skull and dura mater, which allows the brain to expand and the contusion to subside. Apart from injury certain cases occur in which increased intracranial tension develops in a way that suggests the existence of a cerebral tumour. An operation, however, discloses no tumour but a great increase of pressure, which subsides after an opening is made in the skull.

In these two types of cases the mere relief of tension is curative and when the opening in the skull has done its work it can be closed by a plastic operation.

(*b*) *Operations for the Removal of Extravasated Blood.*—When as the result of injury a large collection of blood forms on the surface of the brain, death necessarily follows unless the blood clot is removed by operation. If the blood remains fairly localised and the diagnosis is made early, treatment by operation is often brilliantly successful. Haemorrhage into the brain not due to injury—apoplexy—can occasionally be evacuated by operation with success. Unless, however, the patient is relatively young and otherwise healthy the prospect of success in a given case is very small. Most of the symptoms of haemorrhage of all kinds are due to secondary circulatory disturbance, but in so far as they are due to destructive disorganization they are beyond remedy, so that while a successful operation for apoplexy may save a patient's life it may leave him permanently paralyzed.

(*c*) *Operations for Abscess of the Brain.*—Abscess in the brain is due to the entry of pus-forming micro-organisms as the result of injury such as bullet wound, to extension from an infective focus near the skull such as inflammations of the ear and nose, or to micro-organisms reaching the brain through the blood stream from an infective focus elsewhere in the body, especially in the chest. In the two types first named the evacuation of the abscess according to the general principles of surgery is frequently successful; in the third type evacuation usually fails, because there are multiple abscesses or because the patient is too enfeebled.

(*d*) *Operations for Tumour of the Brain.*—Intracranial tumours are of three principal types of structure according to the situations in which they arise—tumours of the brain substance are gliomas, tumours of the membranes of the brain are endotheliomas, and tumours of the cranial nerves are neuro-fibromas. The *glioma* grows in the brain substance which it usually infiltrates; sometimes it is partially differentiated from the surrounding brain by an imperfectly formed capsule. If it is to be removed with any prospect of freedom from recurrence it must be taken out with a margin of apparently healthy tissue about it. Thus in extirpating a glioma a considerable amount of gross and irrecoverable damage is as a rule necessarily inflicted on the brain. It is in fact rarely the case that the prospect even then of securing permanent freedom from recurrence is good enough to justify the disability that the operation of itself is likely to cause. *Endothelioma* of the membranes does not infiltrate the brain substance, and can therefore be removed without the necessary infliction of any serious damage to the brain. When in an accessible situation and recognized fairly early it is the tumour which offers the best chance of cure with the least risk. *Neuro-fibroma* is almost confined to one situation, the auditory nerve in its course between the brain and the temporal bone of the skull. It thus lies in close relation to the cerebellum, is usually associated with cerebellar symptoms, and being separated from the surface of the skull by the lateral lobe of the cerebellum is in an extremely inaccessible situation. The tumour in itself is benign and slow growing, and owes its seriousness solely to the great technical difficulties of the operation to remove it. In favourable circumstances, however, the operation may be satisfactory.

These three representative neoplasms if untreated necessarily cause death; the only curative treatment of them is operative removal; the surgery of them while always difficult and frequently discouraging yields a sufficient number of wholly successful results to make application of it imperative in every case. At the present time the greatest obstacle to success is the difficulty of early and precise diagnosis. The dangers and difficulties of operations are greatly increased by the onset—sooner or later inevitable—of a severe and widespread increase of intracranial tension. Unfortunately it is often only on the evidence of this complication that a diagnosis is now made. Two lines of investigation are being pursued to-day which offer some hope of greatly improved diagnosis in cases of cerebral tumour. These are the radiographic examination of the ventricles of the brain after air has been injected into these cavities, and the artificial and temporary intensification of states of cerebral disturbance so that latent symptoms become manifest.

Palliative Operations.—In a large proportion of cases of cerebral tumour the surgeon is unable to carry out a radical operation. This may be because the tumour cannot be found, because its situation is inaccessible, or because the attempt at removal would involve too serious a risk or too serious a mutilation. In such cases, however, it may be possible to give great and prolonged relief of symptoms by an operation directed solely to the reduction of intracranial tension. This is the operation known as cerebral decompression. It has already been pointed out that the pressure effects of a cerebral tumour on the circulation in the adjacent brain substance are usually the source of its most distressing symptoms. These secondary circulatory symptoms are due to the rigidity of the skull, and can therefore be relieved by the making of an adequate opening in it. In favourable cases the relief given is immediate and very great, especially in regard to headache and vomiting and to the ocular changes (optic neuritis), which if allowed to progress cause blindness. The completeness and duration of such relief depend on the rapidity of the growth of the tumour and on its situation. It occasionally happens, moreover, that the rate of growth of a glioma seems to be checked indefinitely by the operation.

When the situation of the tumour is known the decompressive operation should always be made directly over it; when unknown, the opening is best made in the temporal region on the right.

The opening in the skull should be of an area not less than four or five sq. in., and the dura mater exposed in it should be freely incised. The effect of the operation is due to the brain expanding freely into the opening and forming a swelling under the skin.

The relief of suffering and the prolongation of life that may with reasonable confidence be expected from a decompressive operation are such that the operation should always be used in cases where the removal of the tumour is not possible.

Plastic Operations.—The function of the skull is not only that of protection but also that of support, so that after any considerable opening has been made in it the brain, if the intracranial tension has become normal, tends to become depressed, and also to undergo a good deal of movement with changes of bodily posture. Thus it comes about that the mere presence of an opening in the skull may be the cause of symptoms, and it may be necessary that the opening should be closed. This should never be done unless it is certain that the intracranial tension is normal, so that the operation is practically limited to cases in which the opening has been made for the treatment of the results of injury. The actual closure is effected by embedding some foreign material in the gap or by the use of flat bone grafts.

Surgery of the Spinal Cord.—To avoid unnecessary detail the spinal cord may be regarded simply as the great channel of communication between the brain and the rest of the body, and the problems of spinal surgery as concerned with the way in which interruptions of conductivity through this channel can be influenced by surgical measures. Interference with conductivity at a given level will produce a corresponding impairment of function in all the parts of the body connected with the spinal cord below that level, while a complete interruption of conductivity will cause a complete voluntary paralysis and insensibility in the same parts.

The spinal cord is enclosed in a strongly walled tube—the spinal canal—lying in the spinal column and mostly made up of bone. Its seclusion within the spinal canal protects the cord very thoroughly against all ordinary violence. At the same time, however, since the size of the cord is not very much less than that of the canal, any injury whereby the walls of the latter are broken or displaced, or any abnormal substance growing within it, can scarcely fail to impinge upon the cord and damage it. These then are the two sources of impaired conductivity which come before the surgeon—injury of the spine and intraspinal swellings in the nature of tumours or inflammatory deposits.

With regard to the resources of spinal surgery it is essential that it should be understood that there is no process of regeneration in the spinal cord; any destructive damage is permanent and incapable of remedy, so that if for example a part or the whole thickness of the cord is cut across conduction is finally interrupted at the divided place, and no suturing or grafting operation can restore it. Wherein, then, it may be asked, is the field of usefulness of the surgeon? The answer lies in the fact that conduction is frequently interrupted by pressure on the spinal cord without destruction of its substance, and in so far as an interruption is due to pressure only and has not been in existence long enough to produce secondary destructive effects it can usually be relieved and function restored by operation.

Spinal Injuries.—When an injury is severe enough to break the wall of the spinal canal (falls, severe blows on the back, bullet or shell wounds), the total body of spinal cord symptoms is made up of three factors. First, shock to the cord which may abolish its functions, though there may be no corresponding gross and visible injury; this shock effect tends to pass off within a period extending to three or four weeks. Secondly, destructive injury of the cord by crushing or laceration, which in so far as it is destructive is permanent. Thirdly, interference with the cord by compression; the cord may thus be pressed on by a foreign body (bullet or shell fragment), by displaced bone of the spine, by swelling of the soft tissues (including the cord itself), from bruising, and at a later period by the results of scar formation in the injured tissues.

The surgeon has to take these three factors into account before undertaking an operation for spinal injury, and he must always remember that it is the third alone that he has any power favourably to influence. He will, therefore, necessarily wait until the shock element has passed off, and will determine this by the reappearance of reflex activity in the cord. He will then have to decide whether the probabilities are in favour of any considerable proportion of the symptoms being due to compression rather than to destruction of the cord. The difficulty is that there is nothing in the actual symptoms themselves to decide this, but experience shows that when very gross interruption of conductivity remains complete after the shock effect has passed off the proportion of symptoms due to the factor of compression is likely to be very small. The most hopeful field in the surgery of spinal injuries lies therefore where interruption of conductivity is manifestly incomplete.

Spinal Tumours and Inflammatory Swellings.—These conditions interrupt conduction in the spinal cord by slowly developing compression, so that there is nothing in the actual state of the cord inconsistent with recovery provided the compression has not lasted too long. Complete recovery may follow the removal of a compression that has caused total interruption of conduction for several months. When the compression has lasted very long incomplete recovery is the rule. The actual lesions that may occur are as follows: (1) Malignant tumours of the bones of the spine, primary or secondary, and much the more commonly the latter. Radical removal of the tumour is impossible, and operation for the relief of the pressure it is exercising on the cord is justifiable only in very exceptional cases. (2) Benign tumours of the spinal bones (osteoma, chondroma), of the spinal membranes (endothelioma, ammoma, fibroma), of the spinal vessels (angeioma), of the nerves (neurofibroma), and of the substance of the cord itself. Radical removal of the tumour can be carried out in most cases of this class. In early cases when the operation is successful complete recovery is the rule, and the results are brilliantly satisfactory. Spinal angeioma and tumours of the cord substance are not usually removable. (3) Inflammatory swellings. Chronic localized meningitis (meningitis circumscripta serosa) produces a loculated collection of fluid in the arachnoid membrane and causes pressure on the cord in much the same manner as a benign tumour. The results of operative treatment are usually satisfactory. Tuberculosis of the spine by extension of the granuloma or of an abscess into the spinal canal frequently causes compression of the cord. If the condition persists in spite of adequate treatment of the primary disease operation may be necessary to relieve the pressure on the cord.

The application of surgery to the relief of compression of the spinal cord by disease is on the whole, then, very satisfactory. When secondary malignant disease of the spine has been shown not to be present, the surgeon is able to enter upon an operation for compression paraplegia with the practical certainty of being able to give relief and the fair probability of attaining a cure.

Surgery of the Peripheral Nerves.—This department of surgery is almost wholly concerned with the repair of nerves which have been injured, and the relief of certain diseased conditions of which the principal symptom is pain. Outside of these two fields of activity the occasions on which surgery has to deal with the peripheral nerves are not many. There is only one common tumour of nerves and that is the neuro-fibroma. When this occurs on the auditory nerve within the skull or on a spinal nerve within the spinal canal its situation gives it an importance it does not in itself possess, which has already been referred to. Occurring elsewhere it is important only if it causes pain or tenderness, when it should be removed by operation.

Treatment of Nerve Injuries.—It is only in the peripheral nerves that the nervous system possesses the power of regenerating after destructive injuries. The common form of such injury is the division of a nerve by an accidental wound or a wound of war. After such a division the essential part of the nerve beyond the seat of the injury disappears, leaving only the framework of protective and supporting tissue by which it had been surrounded. After such a divided nerve has been stitched together a new growth of nerve fibres pushes out from the original cut surface downwards into the surviving old framework, and ultimately reëstablishes the functions that have been lost. This process of regeneration is by no means always fully accomplished even in favourable circumstances, and is very easily interfered with if the conditions are at all unfavourable. Favourable circumstances are that the divided ends should be sutured together early and with the proper operative technique, that the wound remain free from infection, and that the affected limb be kept in a state favourable for the resumption of its temporarily lost functions. Any deviation from these conditions greatly increases the normal uncertainties of the regenerative process. No limit, however, can be set to the time within which suture must be carried out in order to give some hope of effective regeneration. When so much of the length of a nerve has been destroyed that the ends cannot be brought together by any device short of a grafting operation, the chances of a satisfactory return of function are much reduced. In certain cases when recovery after nerve suture has failed to occur, or is extremely improbable, a limb satisfactorily useful from the motor point of view can be obtained by redistributing such motor power as remains by an operation of tendon transplantation. The maintenance of a healthy condition in the affected limb during the abeyance of function is an essential part of the treatment. The neglect of this aspect of the case may deprive a technically satisfactory operation of nerve suture of ultimate success.

The Treatment of Neuralgia.—The term neuralgia is used here to indicate the rather indefinite group of conditions in which pain is the sole or the wholly predominant symptom. To bring a given case within this group it must be shown that the cause of the pain does not lie outside the affected nerve. Only when this requirement has been satisfied can the appropriate surgical measures directed to the nerve be justifiably undertaken. This precision of diagnosis is indispensable, because the treatment to be used consists in the destruction by one means or another of the affected nerve, and it is plain that such a procedure would leave unaffected any condition of disease outside the nerve.

Injuries of nerves are a fruitful source of persistent pain of the neuralgic type under consideration. Any injury of a nerve is a potential starting point for neuralgia, but the division of nerves in an amputation is perhaps the commonest, especially in cases where the wound has become infected. Of neuralgias not associated with injury the dreaded trigeminal or trifacial neuralgia (tic douloureux) is the most frequent and most formidable. In both conditions three types of surgical procedure are in use—the removal of the terminal and affected part of the nerve, the injection of alcohol into the nerve above the affected part, or the division of the nerve close to its origin from the spinal cord or brain. The last-mentioned type of operation is not usually effective in the treatment of pain due to nerve injury, but it is curative in trigeminal neuralgia, and in spite of its gravity has in suitable circumstances to be undertaken.

(W. T.)

NETHERLANDS INDIA (*see* 17.466; 15.284; 26.70; 4.256; 5.596).—Netherlands India is divided into territories under direct (Dutch) rule and under native self-government subject to Dutch regulation. As regards the self-governed territories, the elaborate individual agreements originally made between the Dutch and native princes have in recent years been replaced in large measure by a form of political contract known as the "short declaration," which has helped to simplify relations between the parties. In the Outer Possessions or Outposts (*i.e.* the islands other than Java and Madura) there were in 1919 about 280 territories self-governed under the short declaration and only 19 under more detailed contracts; in Java (Surakarta and Jokyakarta) four native principalities remain, with little power. To the Dutch colonial system of government there has been recently added a people's council (Volksraad) of at least 39 members, including a chairman appointed by the Crown, five native and 14 European and foreign oriental members appointed by the governor-general, and 10 native and five other members elected by local councils. This body opened its first session on May 18 1918. The governor must consult it on the budget and certain other financial questions, on any question of general military service, and on any other matters indicated by general Crown ordinance; and he may invite its opinion on other topics. The Dutch home Legislature, however, remains supreme in regard to financial, as to other colonial questions. The governor has now, in connexion with his executive functions, an advisory council consisting of the nine heads of administrative departments.

Netherlands India was in 1921 divided, for purposes of administration, into 35 provinces comprising three governments, 33 residencies, and one independent sub-residency. These are:—

In Java and Madura: Bantam, Batavia, the Preanger regencies, Cheribon, Pekalongan, Semarang, Rembang, Surabaya, Pasuruan, Besuki, Banyumas, Kudu, Jokya, Solo, Madiun, Kediri, Madura.

In Sumatra: Sumatra West Coast, Tapanuli, Benkulen, Lampong, Palembang, Jambi, Sumatra East Coast, Acheh (Achin) and dependencies.

Others: Riouw and deps., Banka and deps., Billiton, Borneo West Coast, Borneo South and East Coasts, Menado (in Celebes), Celebes and deps., Amboina and deps., Ternate and deps., Timor and deps., Bali and Lombok.

The native powers of administration, so far as capable of development, are carefully fostered by the Dutch. In 1918 an ordinance permitted various duties, in provinces determined by the governor-general, to be delegated by the provincial governors to native officials: this practice, started in part of the Preanger regencies, is in process of extension elsewhere in Java, but not, as yet, outside it. The Government maintains certain Chinese and Arab officials to advise it on administrative matters connected with the foreign oriental element in the population. In 1914 a civil service college was established at Batavia for the training of natives as well as foreigners in administration, and in 1918 a course of training for natives as civil servants was established in the S. of Sumatra.

Population.—The pop. of the principal islands or divisions of Netherlands India was given for the year 1917 (Dec.) unless otherwise stated:—

	Native.	Foreign Oriental.	European.	Total.
Java & Madura	33,652,230	393,723	111,430	34,157,383
Sumatra	4,816,243	196,019	14,791	5,027,053
Riouw & dependencies	177,602	21,628	419	199,649
Banka & dep.	81,923	71,714	541	154,178
Billiton	38,351	20,762	368	59,481
Borneo	1,427,021	83,634	2,448	1,513,103
Celebes & dep. (inclu. Menado)	3,081,758	28,093	4,223	3,114,074
Amboina & dep. (1912)	354,754	2,999	3,181	360,934
Ternate & dep.	198,465	1,193	477	200,135
Timor & dep.	1,085,875	4,821	653	1,091,349
Bali & Lombok	1,336,485	8,081	314	1,344,880

Amboina in the above table includes southern and western New Guinea, and Ternate includes northern New Guinea. The total pop. for the Outer Possessions was given as 12,579,897 natives, 438,944 foreign orientals, and 27,451 Europeans, and the percentage rate of increase since the census of 1905 is as follows:—

	Natives.	Foreign Orientals.	Europeans.	All.
Java & Madura	13·2	24·1	71·5	13·5
Outer Possessions	72·1	37·6	69·9	70·4

It is clear, however, that the apparently large rate of increase in the native pop. of the Outer Possessions is to be attributed in part to more effective measures of enumeration at the later census.

Recent census figures for certain large towns are:—Batavia (1917), 231,464; Surabaya (1918), 160,801; Surakarta (1918), 139,882; Semarang (1918), 106,852; Jokyakarta (1918), 97,058; Bandung (1918), 58,649.

It is no longer correct to regard Netherlands India as a "colony of officials," as it has sometimes been termed; there were in 1917 less than 9,000 Europeans in official positions, and the majority of the total European pop. were traders, tenants of plantations, officers of mining companies, and the like. Probably over nine-tenths were Dutch, though Germans appeared to have increased in numbers during the World War, finding the colony a convenient refuge and, it is said, a centre for intrigue against India and elsewhere. A few hundred British and Belgians were the other most important elements in the European population. Among foreign orientals Chinese were far the most numerous, numbering about 295,000 in Java, and 385,000 in the Outer Possessions; Arabs numbered about 19,000 and 10,000 respectively, and Hindus 24,000, mainly in the Outer Possessions.

Religion and Instruction.—Some 35,000,000 of the population were professedly Mohammedans, though not necessarily strict followers of Islam. The pilgrimage to Mecca was made in 1913 by 17,655 persons from Java, 5,318 from Sumatra, 1,485 from Borneo, and 629 from Celebes. In 1914 Christianity was represented among the natives by about 660,000 Protestants and 52,000 Roman Catholics; the Dutch Protestant Church had 41 pastors, with assistants. Protestant missionary bodies were united in representation by a consul at Batavia, who acts on their behalf in relations with the Government. They had 349 missionaries in 1915. The Protestant missions were mainly Dutch and German. Both they and the Roman Catholic missions succeed chiefly in the Outer Possessions where Islam is less powerful than in Java; notably in Celebes, Amboina and the Moluccas generally, Timor and New Guinea.

Education was systematically, if slowly, extended among the natives. Broadly speaking Government schools and native schools under Government supervision greatly outnumbered private schools in Java, whereas the contrary was the case in the Outer Possessions, where the missions (whose schools are reckoned as private) do most of their work. There were 15 secondary schools in Java, including the *Hoogere Burgerscholen* at Batavia, Surabaya, and Semarang. A school for the training of native orators was opened in 1913, and a second school of agriculture in 1917. Other establishments included a school for native female teachers in Java (1918), and a new class of elementary trade schools (the former craft schools having left the native handicrafts almost unaffected), opened at several points in Java in 1915 and subsequently. The foundation of a technical university, primarily for civil engineers, was in hand.

The total State expenditure on education was estimated in 1920 at 20 million guilders (7½ millions on European and 12½ millions on native education). The following figures are for the year 1917:—European primary schools, 198; pupils 26,817 (including 5,852 natives and foreign orientals); Dutch-Chinese schools, 31; pupils 6,717; advanced primary schools, 14; pupils 1,615; private primary schools, 50 (34 State-subsidized); pupils 8,141. Dutch native schools, 115; pupils 21,690; native schools (2nd class), 989 in Java, 490 in Outer Possessions; 142,415 and 72,875 pupils respectively; native (" peoples' ") schools, 4,185 in Java, 1,372 in Outer Possessions; 299,516 and 83,127 pupils respectively; 14 special schools for natives, 3,132 pupils; 2,506 private schools for natives (145,505 pupils); 220 for Chinese (12,636 pupils), 32 for Arabs (1,928 pupils). Native law school, 65 pupils; native civil service training schools, 922 pupils; training schools for native teachers, 735 pupils; native trade schools, 316 pupils.

Justice.—While the distribution is maintained, as concerns the administration of justice, between (1) Europeans and persons "assimilated" with them, and (2) natives, Chinese, Arabs, etc., there is a general tendency to unify the civil code as the criminal code was already unified, and thus to bring such sections of the pop. as the Chinese under the same code as Europeans; as concerns natives, and foreign orientals in regard to their family law, the *adat* (native law) is respected so far as compatible with European standards. A general civil code was in preparation in 1921, with the object of admitting differences in legal practice only so far as the customs of various creeds and different native social views render them imperative. For Europeans there were in 1921 three courts of justice in Java, two in Sumatra, and one in Celebes. The *landgerecht* is the court for minor criminal offences among all sections of the pop. in Java and Madura, and these courts were in 1921 to be extended to the Outer Possessions (*e.g.* Macassar and Eastern Sumatra), where the residency courts act in the case of Europeans, and magistrates' courts in that of natives. A similar system of unification was in preparation as regards minor civil cases.

Finance.—Revenue and expenditure is shown thus for recent years (in thousands of guilders):—

Year.	Revenue.	Expenditure.
1910	221,516	231,427
1915	309,734	347,887
1916	342,968	373,199
1917	360,759	419,275
1918	384,694	490,859

The deficits were covered by loans raised in each year 1915–9 in the name of, and chargeable upon, the colony (previous loans having been contracted by the mother-country), amounting to 372,500,000 guilders. The deficits were due not merely to indirect results of the World War, but to the extension of Dutch rule in the Outer Possessions, improvements in the administration of law, education, and public health, promotion of industries, and extension of public works, and a total sum of 287,000,000 guilders was reckoned as extraordinary expenditure in 1913–8. Increased expenditure was for the most part met by increase of ordinary taxes rather than imposition of new taxes, but a war profit tax, retrospective to Aug. 1 1914, was established in 1917. A complete reissue of the Tariff Act was made in 1910; several revisions were afterwards made, and the Dutch extended their customs territories, partly by buying out the right of native rulers, until they covered almost the whole colony. In the budget for 1920 provision was made for an export duty on staple products, taxes on the profits from their production, an increase in excises, a special tax upon the working of petroleum, and a tax on transport.

Agriculture.—Sugar remained the chief agricultural product for export. War conditions affected the direction of commerce in this commodity: from the beginning of the century down to 1914 China and Japan and Australia were the chief customers for Javanese sugar; in 1915–8 England and India; later China and Japan reëntered the market. The production in Java in 1918 was 1,778,207 tons.[1] The sugar manufacturers united into a general syndicate with headquarters at Surabaya. The Government cultivation of coffee was abandoned in 1918–9, but the State began to exploit several rubber estates in Java and one in Sumatra, while the State Rubber Development Service was separated from the Forestry Service in 1919.

The following shows the number of estates, cultivating the leading products named, in 1918:—

	Coffee.	Rubber.	Tea.	Coconuts.	Cinchona.
Java & Madura	310	393	268	95	104
Outer Possessions	98	284	27	131	4*

* Sumatra West Coast.

Among cultivations developed or considerably extended were those of kapok and sisal hemp, mainly in Java, manilla hemp in the Lampong districts of Sumatra, and the oil palm, principally in the Outer Possessions. It was estimated in 1917 that Java and Madura contained 63 million coconut palms, the Outer Possessions 44 million, of which 60 million were yielding nuts. The estimated annual production of copra was 368,000 tons in Java and Madura, and 213,000 tons in the Outer Possessions; in Java about 200,000 tons were used in the local oil factories. The large estates are not extensively planted with coconut palms: the production is almost wholly from native sources; but the Government started cultivation in 1913. The rice harvest in Java and Madura in 1919 was estimated to yield 3½ million tons of hulled rice: information for the Outer Possessions is lacking. But the export of rice, maize, and other foodstuffs was prohibited, for the demand was in excess of the supply.

In 1919 there were 24 important irrigation works under construction in Java; no irrigation works on a similar scale existed elsewhere in the islands, excepting Bali, although, following upon an enquiry by the Government in 1910 in Sumatra and Celebes, some lesser works had been carried out.

Live stock.—Estimated numbers in 1918 were:—40,000,000 cattle, 2,500,000 buffaloes, 300,000 horses, 3,000,000 goats, 2,500,000 sheep, 1,000,000 pigs.

Teak Forests.—The area of these in Java and Madura was estimated in 1918 at 730,000 hectares, of which 36 % was organized in forestry districts under the State Forestry Service. The export of teak, 38,277 cubic metres in 1912, fell to 50 c.m. in 1917 and 1,185 c.m. in 1918, though the amount felled was not greatly lessened. The teak forests are of such outstanding economic importance that all other forests are classed in contradistinction as "wild," but the Forestry Service extended its supervision over them, and an experimental forestry station was established in 1913.

Mining.—The Ombilin collieries near Sawa Lunto and those of Bukit Asem near Tanjong in Sumatra, those in the island Pulo Laut off the S.E. coast of Borneo, the Banka tin-mines, and gold and silver workings in the Benkulen district, Sumatra, were worked by the Government, which in addition received five-eighths of the profits of the Billiton tin-mines. Private concessions for working coal and oil and associated products ceased to be obtainable in 1919, except under special contract with the Government. The production of the coal-mines in 1918 was as follows:—Ombilin, 504,201 tons; Pulo Laut, 121,421 tons; Bukit Asem, 50,300 tons, but the last was more fully developed after the Government took over the concession in 1919, in which year production reached 100,000 tons. Over half the total output from Ombilin and Pulo Laut was used in Government services; the rest was sold for bunkering at the ports of the respective fields, Emmahaven and Stagen, or exported thence as freight coal for bunkering at other ports in the archipelago.

Petroleum concessions had been granted to the number of 61 down to 1918, and 26 were sanctioned. The principal oilfields were in Surabaya and Rembang (Java), Muara Enim and other points in Palembang and Langkat and Perlak (Achin) in Sumatra, Tarakan I. and the Mahakkan delta in S. and E. Borneo, and Ceram. The Royal Dutch, Shell and subsidiary companies controlled the trade and working. In 1918 crude oil was produced to the amount of 1,764,203 tons, and among exports were benzine and gasoline, 317,073,000 litres; kerosene, 379,044,000 litres; residues, 291,057,000 litres; turpine (a substitute for turpentine), 2,556,000 litres; paraffin wax, 21,045 tons; candles, 4,080 tons; lubricating oil, 24,529 tons; asphalt, 1,719 tons; greases, 232 tons.

The production of gold, principally from Benkulen, Padang (central Sumatra) and the northern peninsula of Celebes amounted to 3,893 kgm. in 1917, and that of silver to 34,014 kilograms. The value of diamonds produced (in Borneo) in 1917 was 55,300 guilders, and in 1918, 116,360 guilders.

Manufacture.—The disturbance of international commerce during the World War resulted in some extension of home manufacture in Netherlands India, and the same effect was produced by the increasing difference between the high wages in European and other manufacturing countries and the low wages paid to native workers in Netherlands India, though this was partly counterbalanced by the low scale of production in the latter. Among manufactures noted for special development were ironfounding (but mechanical works suffer from the lack of skilled labour), and those of edible and essential oils, bricks and tiles, cardboard, rubber wares, cigars and cigarettes, chocolate, etc. A special division of industry was established in 1918 in the Department of Agriculture and Commerce, and the first official annual fair for Netherlands India was organized in 1920 in a building erected at Bandung.

Commerce.—Exports and imports (exclusive of bullion, etc.) were valued as follows: in 1913, exports, 627,000,000 guilders; imports, 462,000,000 guilders; in 1918, exports, 676,000,000 guilders; imports, 537,000,000 guilders. The number of foreign firms maintaining representatives in Netherlands India has increased considerably, and the Government has extended its measures for fostering commerce, as for example, by maintaining sample departments or exhibitions in European countries, the U.S.A., Australia, S. Africa, and Japan. The following figures of quantity of some of the chief exports show how the effects of the war operated favourably or adversely:—

	1913.	1918.
Sugar	1,471,423 tons	1,574,201 tons
Tea	26,548 "	30,452 "
Rubber	7,134 "	44,096 "
Coffee	28,939 "	7,357 "
Tobacco	87,832 "	8,050 "
Copra	229,339 "	68,578 "
Coconut Oil	1,682 "	33,237 "
Pepper	18,965 "	25,899 "
Tapioca & Cassava products	105,532 "	28,129 "
Kapok	10,145 "	9,253 "
Ground-nuts	20,141 "	8,080 "
Tin	27,645 "	11,584 "
Petroleum	466,529,000 litres	379,044,000 litres

Examples of the manner in which the destination of exports altered have been mentioned above: many exports were diverted during the war from the mother-country as *entrepôt*, and went direct to their destinations. The chief imports are soft goods, machinery, iron and steel, hardware, food-stuffs, and artificial manures.

Communications.—Java has long possessed an excellent road-system, and it is a settled policy to use the road as a first means of opening up new districts in the Outer Possessions. In 1918 1,738,587 guilders were spent in Java and Madura, and 3,889,580 guilders in the Outer Possessions, on the construction and maintenance of roads and bridges. The Government maintains a number of motor services, as in Palembang, Benkulen, and Sumatra West Coast, as well as in Java (Cheribon-Kuningan). The length of State railways in 1920 was: in Java 1,568 m. of standard gauge (1·067 metre), and 65 m. of narrow gauge (0·6 metre); in Sumatra West Coast 153 m. standard gauge; in S. Sumatra 151 m. standard gauge; in Achin and dependencies 320 m., gauge 0·75 metre. Private lines amount to 156 m. in Java, 260 in Eastern Sumatra (Deli Co.); and in Java there are about 1,375 m. of steam tramways under private management. Water power plants were established in the Chatur valley for the service of the State railway workshops at Madiun (Java) in 1917, and another power station has been set up at Lake Tais to supply the gold-mines in Benkulen (Sumatra). Extensive works were in construction or planned. The chief ports in 1920, according to tonnage of vessels using them, were Tanjong Priok (the port for Batavia), Surabaya, Semarang, Cheribon, and Tegal in Java; Padang, Belawan Deli, and Sabang in Sumatra; Balikpapan in Borneo, and Macassar in Celebes.

Recent History.—Slow methodic progress in development, very thoroughly carried out, continued as the characteristic of Dutch administration in Netherlands India. It is probably correct to indicate, as the most difficult internal problems, the reconciliation of European with native interests with justice to both, and the relations between Mohammedanism and the State. As for external relations, concern is sometimes expressed as to the relatively defenceless position of the colony against aggression: a commission reported on this matter in 1913. It was partly this consideration which dictated the strict neutrality of the Netherlands during the World War (for obviously the Dutch possessions were at the mercy of the British fleet): but so far as apprehension found expression as regards any particular Power, that Power was Japan, a fact doubtless associated with the marked development of the economic position of the Japanese in the archipelago. The internal condition of the Outer Possessions was for the most part peaceable: the long-standing strife in Achin was almost stilled by 1912, though sporadic outbreaks have occurred since; the warfare in Gowa (Celebes) since 1905 was brought to an end in 1911 and the country annexed. In 1914 there was a revolt of Young Chinese in Mampawa (Borneo), and slight native disturbances in Sumatra and Lombok, the latter apparently arising out of rumours of a Dutch defeat at the hands of Japan. Military garrisons had to be maintained in parts of Bali till 1914.

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[1] Metric tons are quoted throughout this article.

Disputes arose with Portugal when it was endeavoured to delimit the frontier between Dutch and Portuguese territory in Timor according to the treaty of 1904. The Dutch claims were allowed by M. Lardy, a Swiss member of the Hague Court of Arbitration, acting as arbitrator in 1914. (O. J. R. H.)

NEVADA (*see* 19.450).—The pop. in 1920 was 77,407; in 1910, 81,875, a decrease of 4,468, or 5·5% as against an increase of 93·4% for the preceding decade. The native whites in 1920 numbered 55,897; foreign-born whites 14,802; Indians 4,907. The density of pop. in 1920 was 0·7 per sq. mile. The urban pop. (in places having more than 2,500 inhabitants) was 19·7%, the rural 80·3%. Reno, with a pop. of 12,016, an increase of 10·6% over the 1910 figures (10,367), was the only city having more than 5,000 inhabitants.

Agriculture.—The number of farms in 1920 was 3,163. The value of farm property increased 1910–20 from $60,399,365 to $99,779,666. The value of crops harvested more than doubled from 1915 to 1920 largely owing to higher prices. In 1919 and 1920 the value of agricultural products surpassed mineral production with every indication that this predominance would continue. Sheep and cattle form Nevada's most important agricultural output. The Agricultural Experiment Station at the university of Nevada, the Department of Range Management, a state Board of Stock Commissioners, the state Veterinary Control Service, the Agricultural Extension Division of the university and the Federal Bureau of Animal Industry—all show rapid development of experimental research as to poisonous plants, the handling of live stock on white-sage ranges, the haemorrhagic disease of cattle which is peculiar to the Pacific slope and inter-mountain country, tuberculosis control, particularly among dairy herds and pure-bred beef herds, and the control of rabies. Predatory animals are abundant in so thinly settled a state and rabies infection from them, especially the coyote, is a constant menace to domestic stock. A state Sheep Commission enforces quarantine laws. Nevada honey has a high reputation but is limited in amount because alfalfa, the chief honey plant in Nevada, is cut before it has fully bloomed.

The better utilization of water supply for irrigation and power is one of the most pressing needs. The riparian law, common to England and the eastern states, was found to be ill-suited to Nevada. Early state laws, therefore, gave vested rights in water to those who used it for irrigation. Increase of settlement led to difficulties of adjudication and during the decade 1910–20 many of these have been settled by the courts. The result will be to make available more irrigable land and thereby to increase the population which can comfortably be supported thereon. The fuller use of Lake Tahoe for storage was in 1921 a subject of negotiation with California. The Colorado river project includes five other states with Nevada. The first unit proposed by this plan to provide for irrigation, flood control and power is a great reservoir to be created by building a 700-ft. dam at Boulder Canyon, Nevada. Legislation for this purpose was being considered by Congress early in 1921. The development of underground waters has been encouraged by the state since 1915 through study by commissions, through Irrigation District and Drainage District laws and through enactments favouring the sinking of artesian wells. The Pittman Act of Congress offers favourable conditions for the acquirement of public lands in Nevada through the development of underground waters. Since 1919 California and Nevada have maintained a coöperative snow survey.

Minerals and Manufactures.—From 1907 metal production steadily increased until it reached its peak in 1917, in which year gold, silver, copper, lead and zinc were produced to the value of $54,424,580. In 1919 production decreased more than 50% from that of 1918, owing to a variety of causes which included exhaustion of ore bodies, scarcity of labour, decline in metal prices and high operating costs. Exhaustion was so rapid that the production of gold declined from 551,683 fine oz. in 1915 to 219,695 in 1919. During the same period production of silver declined from 14,459,840 fine oz. to 6,863,580. Until 1918 copper production increased remarkably, being 68,636,370 lb. in 1915 and 122,794,704 lb. in 1917. This had declined in 1919 to 52,331,175 lb., chiefly owing to the sharp fall in market value.

From 1914 until 1918 extensive developments were made in tungsten producing mines. At the time of the signing of the Armistice in 1918, it appeared the Nevada could supply the United States with that metal. When the World War terminated the price of tungsten dropped below the cost of production, resulting in the suspension of all tungsten mining in the state. Mining in Nevada in 1920 and 1921 was in a greatly depressed state. All copper-mines suspended production, as did most lead and zinc operations. Production of gold and silver materially decreased, and those metals were the only two the state continued to produce extensively. The high price of silver which prevailed well into the middle of 1920 kept alive the production of that metal. Although in 1919 there were produced only 6,863,580 fine oz. as compared with 10,000,599 in 1918, the gross value for 1919 was not greatly diminished because of high market price. In 1919 silver averaged in value $1.12 per fine ounce. In 1920 oriental purchases so largely declined that the market dropped below the price fixed in the Pittman Silver Purchase Act. This law then enabled producers to sell their silver to the U.S. Mint at the fixed price of $1 per fine oz., and to continue production which otherwise would have ceased. Much attention was devoted to the so-called commercial minerals. While statistics were not available, it was known in 1921 that gypsum, fluorspar, diatomaceous and fuller's earths, alum, potash, sulphur and other rock products were being produced in commercial quantities.

Other minerals commercially developed were quicksilver, antimony, manganese and platinum. The principal silver-producing district is Tonopah, Nye county, but there is also extensive production at Virginia City, Storey county; Rochester, Pershing county; Eureka, Eureka county; and Pioche, Lincoln county. Most of Nevada's gold comes from Tonopah, Manhattan and Round mountain in Nye county, Goldfield in Esmeralda county; Virginia City, Gold Hill, and Silver City in Storey county; and Jarbridge and Gold Circle in Elko county. Copper is produced chiefly in the Ely district in White Pine county. The Mason Valley district in Lyon county and the Luning district in Mineral county have extensive deposits. Lead mines are located principally in Eureka, Mineral, Clark and Lincoln counties. Zinc comes almost entirely from Clark and Lincoln counties. The larger tungsten deposits are in Pershing, Humboldt, Mineral and White Pine counties. Quicksilver is found principally in Nye and Mineral counties. Platinum is mined at Good Springs in Clark county. Since 1919 extensive developments have been carried out at Gold Hill on the Comstock Lode in Storey county, and give promise of an extensive revival of precious metal output in that district, which was formerly of great importance.

The value of all manufactured products increased 35·3% between 1909 and 1914 and 42·2% between 1914 and 1919, but the value added by manufacture in 1919 showed a decrease from 1914 of 5·7%, due to the decrease in the smelting and refining of copper.

Transportation.—Since 1910 the Western Pacific railway has acquired a part of the Nevada-California-Oregon line and has altered it to broad gauge, thus making connexion with Reno, the largest town in the state. Several short lines have been built. The Las Vegas and Tonopah Railway Co. discontinued operation from Beatty to Las Vegas in 1918. The Legislature of 1919 designated the line as part of the state highway system and the Highway Department acquired the road bed, which in 1921 was being converted into a modern highway. Under the Federal Aid Road Act of 1916 $962,684 became available for use in Nevada, and by the amendment of 1919 an additional sum of $2,564,591. The state took steps to provide its quota and the Overland Trail Club received promises of further aid from California and from the Lincoln Highway Association. The frequency of waterspouts in some areas and of drift sand in others presented difficulties which were being overcome by the state Highway Commission. A scenic highway was opened on the W. side of Walker lake as a part of the North–South highway. The Phipps Highway bill, before Congress early in 1921, provided for Government aid in proportion to area of public lands in the state, and should greatly promote road building in Nevada, since 90·6% of the area of the state was still at the time Federal property. The Railroad and Public Service Commission of Nevada was seeking to render permanent the elimination of the "back-haul rates" removed by the Interstate Commerce Commission in March 1918. The intermountain region was asking for "graded rates" in 1921. The 25% increase in freight rates, in Aug. 1920, resulted in the cessation of much mining activity and a loss of markets for live stock.

Government, Education and Finance.—State social service has been extended through numerous commissions and a few new departures, such as the industrial school and the grant of state aid to the Florence Crittenton Home. The Nevada Historical Society, made a state institution in 1907, has published six volumes of historical papers besides numerous pamphlets. The Orphans' Home is noteworthy in that it educates its children in public schools and does not dress them in uniform. The necessity of securing increased public revenues and equalizing the burden of taxation gave rise to the Tax Commission in 1913. Nevada was one of the first states to have industrial insurance. An extensive building programme for state institutions was begun in 1917. It includes new prison and asylum structures, a Heroes' Memorial Building, additions to the Orphans' Home and the Nevada School of Industry, and several new buildings at the university of Nevada. A branch of the Federal Bureau of Mining Extension was removed in 1920 from Colorado to the university of Nevada. All Federal experimental work relating to rare and precious metals is conducted at this station, which works coöperatively with the Mackay School of Mines at the university. A Federal wireless station was installed to serve the air mail service. Several public service divisions have been added to the extension work of the University, which joined the Association of American Universities.

The salary of Nevada teachers advanced about 50% between 1914 and 1920, reaching an average of $1,362 in the latter year. Retirement salary provision, consolidation of schools, standardization of small schools, evening schools for Americanization, vocational education including part-time training, industrial rehabilitation and thrift education were among the progressive movements undertaken. The bonded debt of the state, Jan. 1 1921, was $1,382,500. In 1915 the constitution was amended to permit a state debt amounting to 1% of assessed valuation of property. The state receipts for 1920 were $1,874,447, and the assessed valuation of all property in the state was $213,421,398.

History.—The Progressive party maintained an organization in Nevada in 1912 which polled a vote second to that of the Democrats. The Democratic party continued in undivided power until the election of 1920 gave many important offices to Republican candidates. Emmet D. Boyle, Democrat, was elected governor in 1915 and re-elected in 1919.

Amendments to the constitution of Nevada were made in 1909, 1911, 1913, 1915, and 1919. The most important were those for the recall and female suffrage in 1911 and 1913. The state prohibition law was enacted, pursuant to a direct vote of the people cast Nov. 5 1918. The Legislature ratified the 16th Amendment (income tax) to the Constitution of the United States in 1911, the 17th (direct election of senators) in 1913, the 18th (prohibition) in 1919 and in the same year endorsed the proposed woman suffrage amendment. In a special session held Feb. 7 1920 it ratified the 19th Amendment (woman suffrage). Legislative sessions are limited to 60 days. Budget legislation was adopted in the session of 1919 and amended in 1921. The state is divided into 17 counties, two new ones having been created in 1911 and 1919. In 1921 a four-year term of office was provided for county officers. The same session provided for criminal execution by use of lethal gas.

In the World War Nevada furnished 5,535 men to the army, navy and marine corps, of whom 3,211 were inductions, 2,324 volunteers. Only one state, Montana, surpassed Nevada in the percentage of men contributed. Nevada gave 160·4% surplus of volunteers, one out of every 9 men of military age, one out of every 33 inhabitants. A surplus of 304·7% above the true proportion was given to the draft, and the selected men were turned over to the military authorities without expense to the Federal Government. The following figures show the amount subscribed in the five Liberty loans: First, $2,943,750; Second, $3,472,200; Third, $4,793,400; Fourth, $5,996,150; Fifth, $3,668,700; a total of $20,874,200, nearly five millions more than the state's quota. In 1919 the Legislature passed a land settlement Act providing a bond issue of $1,000,000 for soldier settlement work in coöperation with the Federal Government. (J. E. W.*)

NEVILL, LADY DOROTHY FANNY (1826–1913), English writer, was born in London March 1826, the daughter of Horatio Walpole, 3rd Earl of Orford. She married in 1847 Mr. Reginald Henry Nevill (d. 1878), a grandson of the 1st Earl of Abergavenny. She travelled widely, and had a very large circle of acquaintances, including Disraeli, of whom she was a great admirer, Richard Cobden and Joseph Chamberlain. She was noted for her amusing conversation and powers as a hostess, was a member of the first committee of the ladies' branch of the Primrose League, and was the author of various volumes of entertaining reminiscences: *Recollections* (1906); *Leaves from the Notebooks of Lady Dorothy Nevill* (1907); *Under Five Reigns* (1910); *My Own Times* (1912). She died in London March 24 1913.

Her daughter, MERESIA DOROTHY AUGUSTA NEVILL (1849–1918), was also a devoted and energetic worker for the Primrose League. She was for many years treasurer of the Ladies' Grand Council. She died in London Oct. 26 1918.

See Ralph Nevill, *Life and Letters of Lady Dorothy Nevill* (1919).

NEVILLE, SIR RALPH (1848–1918), English judge, was born at Esher Sept. 13 1848, the son of Henry Neville, a surgeon. He was educated at Tonbridge school and Emmanuel College, Cambridge, where he took his degree in 1870. In 1872 he was called to the bar, and established himself in Liverpool, where he built up a large practice. In 1888 he became a Q.C., and returned to London, where he made a marked success. From 1887 to 1895 he sat as Liberal member for the Exchange division of Liverpool, and in 1906 was raised to the bench and knighted. He died at Ventnor Oct. 13 1918.

NEWBOLT, SIR HENRY JOHN (1862–), English poet (*see* 19.463), was knighted in 1915 and was made a Companion of Honour Jan. 1 1922. His *Poems New and Old* appeared in 1912; *Drake's Drum and other Sea Songs* (1914) and *Aladore* (1914). During the World War he was engaged on naval records for the British Admiralty, and in 1902 he published a *Naval History of the War*. His *Tales of the Great War* (1916), *The Book of the Happy Warrior* (1917) and *Submarine and Anti-Submarine* (1918) were written primarily for the young. He also published *A New Study of English Poetry* (1917); *Poetry and Time* (1919). His chief contributions to war poetry appeared in 1918 as *St. George's Day and other Poems.*

NEW BRUNSWICK (*see* 19.464).—The pop. of this Canadian province, which was 351,889 in 1911, increases but slowly. The former exodus to the United States and the western provinces of Canada has been largely arrested. The only towns having over 5,000 inhabitants in 1911 were Fredericton, the capital, 8,000; Chatham, 5,500; St. John, the chief shipping and commercial centre, 63,000; and Moncton, a large railway centre, 25,000.

The province sends 10 senators and 11 members of the House of Commons to the Federal Parliament. The Legislative Assembly consists of 48 members, and the executive of seven.

The various grades of schools are supported by legislative grants supplemented by local taxation. Schools in the cities are managed by boards of trustees, one half appointed by the Government and one half by the city corporation. School attendance has varied but little since 1910: in 1917 about 65,000 pupils were enrolled, with about 2,000 teachers. The three degree-giving universities are the old university of New Brunswick at Fredericton; Mount Allison University at Sackville, and St. Joseph's College at St. Joseph.

Industries.—It is estimated that there are about 22,000 sq. m. of arable land in New Brunswick, the greater part of which has not been brought into cultivation. In fact, the actual area under cultivation had been for some time slowly decreasing until the outbreak of the World War. Wheat-growing, which had become unprofitable, was then stimulated by prices and the demand for production for overseas consumption. Other agricultural products were stimulated in the same way, and a gratifying increase was noted for several years. Over 7,000 sq.m. had been taken up in 1921, of which 2,260 sq.m. were under crop. The production of wheat increased from 267,000 bus. in 1915 to 464,400 in 1920, with an average for the five years of 452,850; oats from 5,600,000 bus. to 9,118,000 with an average of 6,437,200 bus.; potatoes from 5,772,000 bus. to 15,510,000 bus., with an average of over 8,000,000 bus.; hay from 791,000 tons to 871,700 tons, with an average of 854,400 tons. Over 6,000 ac. in the Blue Bell tract were for sale in 1921, and along the Bay of Fundy are very large areas of reclaimed marsh land famed for their productivity year after year without the use of fertilizers. There are also extensive areas of naturally suitable land for production of wool and mutton, so that there was altogether room for large agricultural development. Dairying is encouraged by the Legislature. Cheese and butter factories are scattered throughout the province. A maritime dairy school is maintained at Truro, and cheese and butter boards have their headquarters at Sussex.

Of the 7,500 ac. forest land still in the hands of the Crown, over 73% supports merchantable timber, of which about 40% is a hardwood stand. The value of the lumber cut in 1918 was $12,190,000. The total pulp production was 66,619 tons, valued at over $5,000,000.

The value of the fisheries in 1919 was approximately $5,000,000, a decrease of $1,320,000 as compared with the previous year.

Though not a manufacturing province in the sense of Ontario and Quebec, New Brunswick has made very steady progress. In 1900 the capital invested was $20,750,000, and in 1918 $74,500,000, with an increase of output from $21,000,000 to $68,333,000. New Brunswick has 300,000 H.P. available, of which only about 15,000 had in 1921 been developed. At Grand Falls is the largest undeveloped water-power in eastern Canada.

Communications.—The roads have been greatly improved, the province taking advantage of the appropriations of the Dominion Government in connexion with the general movement in Canada for good roads. The Inter-colonial Railway, a part of the Canadian National Railways system, is still the main line of communication, The Canadian Pacific also runs through the province, with a terminus at St. John, and the National Transcontinental from Winnipeg has its terminus at Moncton. By means of the C.P.R. and Maine Central the province has communication with the United States. Various lines of steamers run, chiefly from St. John, to American and Canadian ports. St. John is also one of the Atlantic ports for transatlantic lines of steamers. (W. L. G.*)

NEWCASTLE-UPON-TYNE (*see* 19.472).—The pop. increased from 266,603 in 1911 to 274,955 in 1921. The borough returns four members to Parliament. To the list of degrees granted by the college of science incorporated with the university of Durham has been added a degree in commerce. During the World War the shipbuilding industry and the production of ordnance and ammunitions showed very marked activity and development.

NEWFOUNDLAND (*see* 19.478).—The census of 1911 showed 242,619 inhabitants, including 3,949 residing in Labrador, an increase for the decade of 21,635, or 9·79%, against 9·37% for the previous decade. Denominationally the distribution was: Roman Catholic, 81,177; Church of England, 78,616; Methodist, 68,042; Salvation Army, 10,141; others, 4,643. The pop. of St. John's, the capital, was 32,292, a 9% increase. The Registrar-General's estimate of total pop. at end of 1919 was 264,569, but a reduction was expected for 1920 because of abnormal emigration due to economic depression, the figures being: inward 10,996; outward 15,422.

Economic Conditions.—Few countries prospered more during the decade 1910–20 than Newfoundland, thanks to increasing prices for her fishery products (especially during the war period, due to scarcity of food-stuffs in Europe, and despite the withdrawal of 10,000 young men from her industries to undertake active service with the army and navy); to the development of her pulp and paper industry and her iron mining; to the corresponding growth in subsidiary local industries, farming, logging, manufacturing, etc., and to the increased purchasing power of the people to which, besides the above factors, the war expenditure, some $15,000,000, or one-third of her total debt, contributed materially. Unfortunately this favourable condition no longer exists.

Finance.—Each of the four years from 1917 showed a marked increase in revenue with a handsome surplus, that for 1918–9 being $2,853,000. The figures for 1919–20 were: revenue $10,597,575, expenditure $9,247,006, leaving a surplus of $1,350,509 notwithstanding that large additional grants were made to various public services because of the then existing prosperity. The public debt as at June 30 1920 was $43,993,035. The imports for 1919–20 were $40,533,388, exports $34,855,447. Distribution of imports was: from Britain $4,637,074; Canada $18,767,238; United States $15,414,067; other countries $1,715,009. Distribution of exports was: to Britain $6,411,967; Canada $2,802,859; United States $4,426,142; other countries $21,424,479. Figures of revenue, imports and exports, represented a three-fold increase in the decade 1910–20 but imports from Britain remained almost stationary owing to proximity and more aggressive trade methods of the United States and Canada.

During the latter half of 1920 depression became manifest, emigration increased, business difficulties arose, fishery prices declined, imports lessened and the economic sky became overcast. Conditions in the spring of 1921 were very serious; customs revenue, representing nine-tenths of the total, had declined $2,500,000, roundly, in ten months; a shortage of nearly $2,000,000 for the fiscal year was feared; and financial embarrassments otherwise were thought to threaten the national solvency. This condition was due in part to world depression, but also to an attempt of the Government to enforce a policy of "control" over the marketing of codfish in foreign countries, by regulations fixing minimum prices for the sale of the commodity, and also restricting the times at which fish might be sent, the quantities forwarded and the terms of sale in different countries. This policy, after being operated from Nov. 1919 to Dec. 31 1920, or over part of two marketing seasons, was virtually abandoned. Its opponents contended that it was economically unsound, because it violated the law of supply and demand; its advocates could only plead that because of world depression it did not have a fair chance to prove its merits. It was estimated that incidentally through falling markets in Greece, Italy, Spain, Portugal, West Indies and Brazil, where Newfoundland codfish principally goes, and the workings of the Government policy, losses estimated at $3,000,000 to $4,000,000 would be suffered in marketing the catch of 1920, valued at $12,000,000, causing heavy losses to banks, business people and others interested, and reacting seriously on the whole community.

Fisheries.—The fisheries continue to be the mainstay of the country as in years gone by, and in 1921 still represented nearly 80% of the exports, furnishing $25,000,000 out of $28,000,000 for 1919–20. The chief is the codfishery, prosecuted mainly by boats, smacks and large schooners around the coast of the island, along the seaboard of Labrador, and off the Grand Banks, the product being salted and dried in the sun and exported in that condition. Attempts at the development of a cold-storage industry have been made, and a large warehouse for this purpose has been erected in St. John's. During the World War a cargo of cold-stored fish was taken to England by the auxiliary cruiser "Bayano" and was said to have given much satisfaction. Similar shipments were not continued but regular liners plying to Britain enlarged their cold-storage capacity to take larger quantities; British capital was also introduced into the business, and the smoking of fish for the British markets has been promoted as an important adjunct. The seal fishery has declined in scope in recent years, because of the withdrawal of several of the larger and more powerful steamers for war work, which have not returned, the loss of others through ocean perils, and the excessive cost of building new ships during the war. The fleet, moreover, met misfortune after 1918 for three successive seasons, and to induce the small flotilla of nine ships to operate in 1921 the Government removed all restrictions on the conduct of the industry, and a catch of 101,452 seals valued at $171,243 resulted, representing about two-thirds of a normal catch for such a fleet. The herring fishery, which enjoyed an increase in values like the codfishery during the later years of the war, suffered afterwards from the reaction caused by the competition from British and other markets not then active. The whale fishery had been gradually declining, and in 1920 no whalers operated at all owing to low prices for the products. The lobster-canning industry also declined, owing to depletion of the species, which being slow in reproducing, suffered from overfishing in the past. The Government inaugurated a campaign for better methods of curing and packing fishery products, hoping thereby to secure better prices. The value of the fishery products for 1919–20 was: codfish $23,274,666; cod-oils $2,162,724; seal-skins $170,331; seal-oils $262,353; herrings $1,235,864; lobsters $325,769.

Forest Resources.—The forest areas are estimated at about 15,000 sq.m., and are chiefly used for making pulp and paper, as spruce is the main growth. Formerly pine was cut and exported, finding a good market in South America, but several areas were depleted and in more recent years the pine has been absorbed altogether by the local demand. The paper-making enterprise of Lord Northcliffe and his associates at Grand Falls midway through the interior, with about 3,500 sq.m. of territory, steadily expanded. In 1920 it produced 215 tons of newsprint paper daily, with 25 tons of ground-wood and 25 tons of sulphite pulp, and plans were being made for enlarging it to double its capacity. Pulp mills at Bishop Falls, 10 m. distant, formerly held by separate owners, were absorbed, and it was estimated that a pulp output of 200 tons daily would be manufactured at Grand Falls after the works were enlarged. A company with capital raised in Norway put under construction for starting operations in the autumn of 1921, mills on the Terranova river which empties into Bonavista Bay, which would produce 50 tons strong sulphite pulp daily. It controls an area of 1,250 sq.m., and was later expected to double this output. The export in 1920 was 19,864 tons of pulp valued at $334,276, and 80,719 tons of paper valued at $4,725,660. In addition 292 saw-mills cut during the year, for local consumption, 25,155,776 ft. of lumber, valued at $1,006,251.

Mineral Resources.—Mining operations of late years have been devoted almost entirely to the winning of hematite iron from deposits at Bell I. in Conception Bay, 18 m. from St. John's, owned by the Dominion and Nova Scotia Steel Cos. and forming the basis of the proposed "British Empire Steel Corporation" into which these concerns are to be merged. Copper mines were worked in a small way until 1919, but after that, owing to various causes, nothing was done for two years, though a revival in this industry was expected. The Anglo-Persian Oil Co. contracted with the Government to begin during the summer of 1921 a scientific exploration of oil-bearing areas in the country and their practical working if warranted, and the Government undertook to develop coal beds on the W. coast to secure fuel for the railway service, as all the coal required for every purpose in Newfoundland had had to be brought from the adjacent island of Cape Breton. In Newfoundland can be found evidences of the occurrence of almost all known minerals, but through lack of an efficient Geological Survey, and in consequence the want of prospecting and other researches in the interior, and because of the difficulty in attracting capital to the country, little progress had been made in developing them. In the past iron pyrites have been mined at Pilley Is., on the N. coast, chrome iron at points on the W. coast, silver-lead ore in Placentia Bay, coal at Grand Lake, in the interior, and petroleum at Parson's Pond on the N.W. seaboard; petroleum is still being worked and the produce is used at the gas works in St. John's. The export of iron ore for the five years to 1920 averaged 750,000 tons, valued for export purposes at about $1.25 per ton; 16,000 tons of copper ore, valued at $205,000, were shipped in 1916–7, but only one-third of this quantity was sent out in 1917–8.

Communications.—In addition to the 614 m. of railway previously existing, the Morris Government in 1909 contracted for the construction of six branches, aggregating 354 miles. Four of these branches, totalling 277 m., were completed by 1917, but the remaining two had to be abandoned owing to the war, and seemed, in 1921, unlikely to be built in the near future unless under some revision of the entire railway problem which the Squires Government had in hand. Messrs. Reid, who operated the railway under a contract, claimed that conditions similar to other parts of the world had applied here, making their enterprise unprofitable, and at the 1920 session of the Legislature the Government provided for a commission (half chosen by the Government and half by the Reids) to study the problem; and it arranged for a loan of $1,000,000 to be applied for the purchase of rolling stock and equipment. Subsequently the Government took a more direct part in the actual operating of the road, and the railway question promised to be of first importance at the 1921 session.

Telegraph extension has been gradually carried out until almost the entire seaboard of the island is girdled with lines, the whole being operated as a public utility under Government control. Wireless stations at important points around the Newfoundland coast, and along the coast of Labrador, have been constructed or previously existing ones improved, and plans were in 1921 being made for directional wireless stations at points where shipwrecks are frequent. During the war period the British Admiralty built a high-power station at Mt. Pearl, 6 m. W. of St. John's, which proved of great value and continued to be operated as a naval auxiliary. In July 1920 a wireless telephone installation was established on Signal Hill, St. John's, where Marconi had received his first wireless telegraph signals 18 years previously, and communication was maintained with the liner "Victorian" during her voyage across the Atlantic with the members of the Imperial Press Conference. Negotiations for a contract with the Newfoundland Government for permanent installations were in progress in 1921.

The telephone system at St. John's and an independent line operating on the N. side of Conception Bay were completed, an entirely new equipment provided for St. John's, and steps taken to link the whole of Conception Bay with the capital.

Steamship services with Britain, Canada and the United States were seriously dislocated during the war period, but were gradually restored, though pre-war efficiency had not been attained in 1921.

War Record.—On the outbreak of hostilities in 1914 the Government of Premier Morris took measures to ensure Newfoundland's active participation in the struggle. Simultaneously with Canada's offer of 30,000 men, Newfoundland offered to raise a military contingent of 500 men, and to increase the existing naval service (a branch of the British naval reserve formed in 1899) from 500 to 1,000; these offers were accepted by the Imperial authorities.

The first military contingent proceeded to England with the original Canadian force, being conveyed in the Newfoundland steamer "Florizel" and, being subsequently strengthened, became the Newfoundland Regt. and participated in the fighting in Gallipoli, then served in Egypt, fought in France and Flanders, and continued in the line until the Armistice, when it formed part of Gen. Plumer's army of occupation in Germany. During this period its membership was renewed three times and some 6,500 men, all told, were enlisted, while a forestry battalion of 500 was likewise formed and served in Scotland. Naval enlistment was also carried on and some 2,000 men were recruited for this force, which distinguished itself in every branch of British naval activities but especially in manning small craft and in furnishing boat crews for boarding purposes for the 10th Cruiser Squadron, which enforced the blockade off the N. of Scotland. The fatalities in the regiment were 1,251 and in the naval reserve 187.

Political History.—The Government of Sir Edward (afterwards Lord) Morris was reëlected in Nov. 1913 for a four-year term, defeating an opposition party composed of the followers of Sir Robert Bond and Mr. William Coaker, the latter president of the Fishermen's Protective Union, a coöperative organization that developed greatly afterwards. A few months later Sir Robert Bond resigned his seat in Parliament, being dissatisfied with some statements of Mr. Coaker, and the opposition leadership was assumed by Mr. James Kent, previously Attorney-General in the Bond Cabinet (1909). A year later Mr. Kent was appointed to the Supreme Court Bench. After the outbreak of the World War party lines were largely abandoned and the opposition combined loyally in assisting in all measures to promote the colony's part in the war. After Mr. Kent's appointment to the Bench, he was succeeded as opposition leader by Mr. (afterwards Sir William) Lloyd, another legal member of the opposition group. In 1917 a National Government was formed, the Cabinet being increased to 12 members, Government and opposition taking 6 places each, Sir Edward Morris continuing as Premier and Mr. Lloyd becoming Attorney-General. A measure extending the life of Parliament, because of the war, was enacted, and twice extended subsequently, making two years altogether. At the end of 1917 Sir Edward Morris resigned the premiership and his seat in the Legislature. He left the colony and settled in England, being raised to the peerage as Baron Morris of St. John's and of Waterford. He was succeeded in the premiership by Mr. Lloyd, who during the ensuing year was created a Privy Councillor and made a K.C.M.G. On the formation of the Lloyd administration, the Hon. Richard Squires, Attorney-General under Sir Edward Morris and Colonial Secretary under the National Government, withdrew and opposed the administration. In May 1919, owing to differences between the Fishermen's Union wing of the Government and another wing, led by Sir Michael Cashin, Minister of Finance, the Lloyd Ministry was defeated and Sir Michael Cashin became Premier, the Fishermen's Union group withdrawing. Sir William Lloyd was subsequently appointed registrar of the Supreme Court. Later in the year the Fishermen's Union party joined with the followers of Mr. Squires, and at the general election in Nov. 1919 this combination carried 23 seats against 13 which fell to the Cashin party, and Mr. Squires succeeded to the premiership. Mr. Coaker, whose following was the strongest of any in the Legislature, took the portfolio of Fisheries, and inaugurated the new fishery policy described above, which continued to be the subject of bitter criticism and unceasing contention.

The legislative programme of the 1919 Government provided for measures for the promotion of the public health; the erection of working men's homes in St. John's; the enlargement of the Old-Age Pension scheme; a campaign against tuberculosis; the creation of a Department of Education and the improvement of this service; the organization of a Department of Trade and Commerce; the enlargement of the activities of the Fisheries Department; the grappling with the railway problem and improvement of the postal telegraph and postal service; promoting agricultural development; giving adequate recognition to labour; liberalizing the mining laws; remedying defects in the Prohibition law; caring for the returned soldiers, and reducing taxation.

See *Year Book of Newfoundland* (1921); *Newfoundland Guide Book* (1911, ed. D. W. Prowse); P. T. McGrath, *Newfoundland in 1911;* James P. Howley, *Mineral Resources of Newfoundland* (St. John's, 1909). (P. T. M.)

NEW GUINEA (*see* 19.486).—Exploration in Dutch (western) New Guinea was systematically continued after H. A. Lorentz had completed his journey to the Snow Mts. in the S. in 1909. The work was continued in 1910–1 by M. Moszkovski, in 1912–3 by A. Franssen Herderschee, and by subsequent explorers, and plans were laid in 1918 for extended exploration of the territory N. of the Snow Mts. and for a descent from them to the S. coast. The hitherto existing administrative division of Dutch New Guinea between the residencies of Ternate, which included northern New Guinea, and Amboina, which included the S. of the island, ceased to work satisfactorily, and in 1920 it was stated that the island administration would be centred in the hands of one official with headquarters at Manokwari.

Territory of Papua.—Pop. (est. 1918), 250,000 natives, 962 Europeans. For one year, 1918–9, revenue amounted to £72,121, expenditure to £102,962; exports were valued at £176,247, imports at £258,112. Mineral oil has been discovered in the territory; boring was begun under official auspices in 1912, and was continued more thoroughly in and after 1915; it was determined to keep the exploitation in the hands of the Government for a time, and the Commonwealth and Imperial authorities agreed to contribute £50,000 each toward the fuller investigation of the field at Vailala. Gold has been worked or is known to exist in parts of the territory and adjacent islands. From 1888 (when British New Guinea was proclaimed a colony) down to 1916 gold to the value of £1,436,249 was obtained. On Misima or St. Aignan I. in the Louisiade Archipelago gold was little worked until 1914, when it began to be considerably developed, about 70 whites being settled in the island, which became the most important source of gold in the territory. Agricultural industries are developing (*see* AUSTRALIA).

North-eastern New Guinea.—With this territory are included the Bismarck Archipelago (New Britain, New Ireland and other islands) and Bougainville and Buka of the Solomon Islands. The German administrative capital was successively shifted from Friedrich Wilhelmshafen on the mainland of New Guinea to Herbertshöhe (Kokopo) in New Britain and then to Rabaul on Simpson's Harbour (Simpsonshafen) in the same island, where a new town was laid out. On Sept. 11 1914 a force of the Australian naval reserve was landed at Kokopo, and on the following day the British flag was hoisted. The whole territory was subsequently assigned to Australian administration under mandate. In 1919–20 a Royal Commission of the Commonwealth was unable to agree whether the territory should be attached to that of Papua or administered separately. The European pop. of German New Guinea was estimated in 1914 at 300, and 16,800 ac. were cultivated, mostly under coco-nuts, and these are also the chief economic product of the islands. For one year, 1918–9, exports from the territory were valued at £300,766 (copra, £274,318); imports at £280,980. On the mainland the sago palm, rubber, rice, sisal-hemp and coffee have been cultivated, gold has been worked, coal reported in the Nusa valley, and in 1914 a German commission was instructed to investigate for oil. On the islands, rice, rubber and cacao have been cultivated; zinc, copper and gold reported in Bougainville, and phosphates on the Purdy Islands. The seas yield pearl, trepang and turtle.

NEW HAMPSHIRE (*see* 19.490).—The pop. in 1920 was 443,083; in 1910 430,572; a gain of 12,511, or 2·9% as against 4·6% in the preceding decade. The urban pop. was in 1920 279,761 or 63·1% of the whole as against 59·2%, in 1910. The pop. of the eight cities having more than 10,000 inhabitants was:—

	1920	1910	Increase per cent
Manchester	78,384	70,063	11·9
Nashua	27,379	26,005	9·1
Concord	22,167	21,497	3·1
Berlin	16,104	11,780	36·7
Portsmouth	13,569	11,269	20·4
Dover	13,029	13,247	1·6
Keene	11,210	10,068	11·3
Laconia	10,897	10,183	7·0

Agriculture.—The statistics for farm property, showing the changes from 1910 to 1920, are as follows:—

	1920	*1910*	*Inc.*	*Dec.*
Number of farms	20,523	27,053		24·1%
Value of farm property	$118,656,115	$103,704,196	14·4%	
Average acreage—all land	126·9	120·1	5·6%	
Average acreage—improved land	34·2	34·3		0·1%
Av. value per ac. (farm property)	$45.57	$31.91	42·8%	

Farms of from 100 to 499 ac. constituted 42·9% of the whole number. Farms of 20 ac. or less had the greatest proportion of land improved, 67·4%; farms of over 1,000 ac. had the least—13·5%. Of all farms 90·6% were operated by owners, 2·7% by managers, and 6·7% by tenants, these percentages being without substantial change from 1910. Native farmers decreased from 24,347 in 1910 to 20,509 in 1920. Percentage of farms mortgaged in 1910, 25·6; in 1920, 31. Increase in expenditures, so far as reported, was in 1920 34% for labour, 2·7% for fertilizer, and 89·1% for feed. Other statistics are:—

	1919	1909	Increase per cent
Dairy products sold	$ 9,627,286	$ 5,130,057	87·7
All crops	23,509,665	12,112,260	94·1
Cereals	1,456,628	879,631	65·6
Hay and forage	13,616,378	7,847,148	73·5
Vegetables	5,228,489	2,276,176	129·7
Potatoes	2,952,351	1,204,620	145·1
Miscellaneous crops	480,804	200,845	139·4
Orchard fruits and grapes	2,420,837	730,703	231·3
Maple sugar and syrup	440,250	182,341	141·4

Forests and Highways.—The White Mountain National Forest contained, June 30 1920, 433,179 ac. of which 27,860 ac. were in Oxford county, Me., and the remaining 405,319 ac. in Coos, Carroll and Grafton counties, N.H. This forest was in charge of a supervisor with headquarters at Gorham, with headquarters for rangers at Bartlett, Woodstock and Bethlehem. The State Forestry Commission was reorganized in 1909. The state reservations are small, widely scattered areas of about 12,000 ac., but including the important and beautiful Crawford Notch. Between 1910 and 1920 the state constructed approximately 1,000 m. of highways at a cost of $6,100,000.

Manufactures.—The state in 1914 produced, in value, ·8% of the total for the United States. The statistics were as follows:—

	1914	1909
Establishments	1,736	1,961
Employees	85,013	84,191
Salaries and wages	$ 46,523,733	$ 40,391,440
Value of products	182,843,863	164,581,019

The 10 leading industries were, in order of value of products, boots and shoes, cotton goods, paper and pulp, lumber and timber products, woollen and worsted goods, foundry and machine-shop products, hosiery and knit goods, leather, flour-mill and grist-mill products, tobacco and cigars, ranging from an annual value of over $46,000,000 in the case of boots and shoes to nearly $2,500,000 for tobacco and cigars. The values of all these products materially increased in the 5-year period, 1909–14, except those of woollen, hosiery and mill products. The proportion of female wage-earners, and of those under 16, decreased. The period displayed little fluctuation in the number of wage-earners employed, 93% of the maximum being the lowest. Manchester showed the greatest stability of employment; it employed by far the largest number of wage-earners, about 26,000; and Manchester, Nashua and Berlin produced about $86,000,000 of manufactured products, four-ninths of those of the whole state. The figures showed a tendency towards the concentration of manufactures in the larger establishments.

Legislation.—Important Acts were those establishing a state Board of Conciliation and Arbitration; employers' liability and workmen's compensation; regulating child labour and hours of labour; provision for medical and surgical devices in factories; safety and health of employees; and for reporting of occupational diseases. The Legislature of 1917 enacted a law prohibiting the manufacture and sale of spirituous liquors. The law took effect May 1 1918, superseding local option.

Finances and Taxation.—The following figures show the increase in expenditures during the decade:—

	1920	1910
Revenue	$4,344,322.20	$1,694,636.54
Payments	5,198,534.62	1,662,694.07
Debt	3,040,524.17	1,293,209.33
Bonded debt	2,589,500.00	1,071,070.00

The increase in expenditures was on account of increased cost of maintaining public institutions, and for highways. The increase in the bonded debt was nearly all due to the World War. In 1918 the state issued $500,000 of bonds to assist the Federal Government in the war; and in 1919 it issued $1,489,000 in order to increase the war service recognition from $30 to $100 for those who served.

The total valuation of property for purposes of taxation in 1920 was $511,456,583, amount of taxes collected $12,736,651, average rate of taxation $2.37 per $100. There were 115,169 persons paying a poll tax of $5 each, and 11,373 war veterans paying $3 each. The valuation of public service corporations was $52,085,125.

Education.—Important work was done in 1918 by the state committee on Americanization. In the parochial elementary schools the principle was established that instruction in designated branches and in administration should be exclusively in English; devotional exercises in any language desired. In the large industrial plants the plan was largely carried out by evening schools for adults. The system of public instruction was reorganized by the Legislature of 1919. In the bill "the work of Americanization in teaching English to non-English-speaking adults, and in furnishing instruction in the privileges, duties and responsibilities of citizenship is hereby declared to be an essential part of public-school education." The governor and council appoint a State Board of Education of five citizens who are not technically engaged in education. This Board has the powers formerly resting in the superintendent of public instruction, the trustees of the normal schools, and the State Board of Vocational Education; it appoints a commissioner of education and four deputy commissioners. For the progress of Dartmouth College during this period *see* DARTMOUTH COLLEGE. The State College of Agriculture and the Mechanic Arts made rapid progress; the student body increased from 266 in 1910 to 818 in 1920; the teaching staff from 37 to 78; the value of the buildings from $900,000 to $1,720,000; the number of acres in the farm from 380 to 500. During the same period departments of education, forestry, home economics, industrial engineering, and poultry were added, and the laboratory equipment greatly enlarged.

History.—The Ninth Constitutional Convention, held in 1912, submitted to the voters 12 amendments, of which four received the necessary two-thirds vote, namely disfranchisement for treason, bribery and deliberate violation of the election laws; the substitution of plurality for majority vote in the election of governor, councillors and senators; extension of the jurisdiction of police courts; the substitution of a basis of population for that of property in the election of councillors. The Tenth Constitutional Convention was convened in the summer of 1918, adjourned until the close of the World War, and reconvened in Jan. 1920. It submitted to the voters seven propositions, all of which were rejected. In 1915 the office of assistant attorney-general was created, and the number of bank commissioners was reduced to three, and their term of office was made six years. The Railroad Commission became the Public Service Commission in 1911, its powers were enlarged, and the term of office of the three members was made six years. In 1913 the Fish and Game Commission was reorganized and the number of commissioners reduced from three to one. The Department of Public Instruction was reorganized in 1913 so that the superintendent holds office indefinitely; it was again reorganized in 1919. In 1913 the Department of Agriculture was reorganized with a commissioner instead of a board, and in 1915 it was further reorganized. In 1911 the name Board of Equalization was changed to Tax Commission, the members were reduced from five to three, and the tenure of office was extended from two to five years. The Bureau of Labor was reorganized in 1911, and in 1913 a Board of Arbitration and Conciliation was organized to work with it. In 1913 the License Commission was reorganized; in 1915 it was again reorganized and its name was changed to Excise Commission. The Highway Department was reorganized in 1915 with a highway commissioner at its head appointed by the governor for five years. A Department of Institutions was created in 1913 and reorganized in 1919. The state institutions were managed by seven trustees consisting of the governor and one member of the council, *ex officio*, and five appointed trustees. The institutions governed by the Department were the prison, the hospital, the sanitarium, the industrial school, and the school for feeble-minded children. During the World War the state sent into the service of the Government 22,000 persons, of whom 7,971 were called under the Selective Service Act. The remainder, more than 60% of the total, volunteered. Liberty Loans were subscribed as follows:— First, $9,894,900; Second, $15,484,400; Third, $17,282,300; Fourth, $29,346,640; total, $72,008,240, about $164 for each person in the state.

The governors after 1910 were:—Robert P. Bass (Rep.), 1911–3; Samuel D. Felker (Dem.), 1913–5; Rolland H. Spaulding (Rep.), 1915–7; Henry W. Keyes (Rep.), 1917–9; John H. Bartlett (Rep.), 1919–21; Albert O. Brown (Rep.), 1921– .

(E. J. B.)

NEW JERSEY (*see* 19.501).—In 1920 the pop. was 3,155,900, as against 2,537,167 in 1910, an increase of 618,733, or 24·4%, as compared with 14·9% for the United States as a whole. The density of pop., exceeded only by that of Rhode Island and Massachusetts, averaged 420 to the sq. mile in 1920. The proportion of people living in places of 2,500 or more inhabitants increased from 75·2% in 1910 to 78·7% in 1920, the urban pop. in 1920 being 2,482,289, the rural, 673,611. The growth of pop. of the ten largest cities during the decade 1910–20 is shown in the following table:—

	1920	1910	Increase per cent
Newark	414,524	347,649	19·2
Jersey City	298,103	267,779	11·3
Paterson	135,875	125,600	8·2
Trenton	119,289	96,815	23·2
Camden	116,309	94,538	23·0
Elizabeth	95,783	73,409	30·4
Bayonne	76,754	55,545	38·2
Hoboken	70,324	68,166	3·1
Passaic	63,824	54,773	16·5
East Orange	50,710	34,371	47·5

Agriculture.—The trend toward city and industrial life is indicated by the decrease in the number of farms from 33,487 in 1910 to 29,672 in 1920, or 11·4%. Production, however, gained owing to the increased use of scientific and intensive methods, which in turn were largely due to the facilities afforded for agricultural education, as in the short and four-year courses in the State College; by the Farm Demonstration Act of the Legislature of 1913, under which farm bureaus have been organized in 18 of the 21 counties; by the Smith-Lever Act of Congress of 1914, providing for further extension of agricultural education, and the Smith-Hughes Act of Congress of 1917 with its provisions for vocational training. These and similar agencies have made a deep impression on farm life in New Jersey, especially in improved social and economic conditions.

Notable, too, are the results of agricultural research. A soil survey of the state has been made and has practically completed the classification and mapping of the soil-types. Fertility studies and the study of soil bacteriology, plant diseases and parasitic organisms, have developed methods by which production has been increased and losses diminished, especially those owing to the potato scab and to parasites of celery, sweet potatoes, peaches, apples and pears. The Japanese beetle and the gipsy-moth have recently entered the state, but the old insect foes of economic importance are coming under control. Through research in horticulture several new types of peaches, some of distinct value, have been developed, and experiments with fertilizers, insecticides and fungicides have benefited the horticultural industry.

The progress of experimentation in dairy and animal husbandry is evident in the number and quality of herds of pure-bred cattle, notably Holstein, Friesian, Jerseys, and Guernseys, in which New Jersey has become one of the leading states of the Union. Milch cows had in Jan. 1920 an average value of $128 per head, as compared with $110 in Rhode I., $107 in New York, $105 in Massachusetts and Connecticut and an average of $85.13 for the United States. While the number of dairy cows decreased in the decade 1909–19, the milk production rose from 68,000,000 gal. to 80,000,000. As New Jersey lies midway between New York and Philadelphia the demand in these great centres of population has caused the New Jersey dairies to abandon the production of manufactured dairy products in favour of market milk, the value of which in 1919 totalled $20,000,000.

Next in importance to dairying is the keeping of swine, the chief breeds being the Berkshires, for which New Jersey is noted, and the Duroc Jerseys. In poultry-farming the decade 1910–20 witnessed several important developments. Operation and management were placed on a commercial basis. The number of birds is over 3,000,000, of which one-third are in commercial plants, one-third in suburban and city back yards, and one-third in farm flocks. In 1920 poultry and eggs were produced to the value of $35,000,000.

Progress has been made also in adapting crops to soil conditions, particularly corn, alfalfa and soya beans. The acreage of alfalfa has increased from a few thousand to 30,000 acres. A system of cropping and green-manuring has been developed, which, with the use of commercial fertilizers, has improved the general fertility of the soil. Per acre average crop yields have increased during the period as follows: rye from 14½ to 18 bus., wheat from 15½ to 18½ bus., corn from 38 to 41 bus., potatoes from 105 to 130 bushels. A number of minor crops have been tested and included in the crops grown, such as sudan-grass, millet and vetch. Specialized types of farming have been largely localized in definite regions on definite soil-types; a white-potato section has been developed in the vicinities of Freehold, Bridgeton, Medford, Mount Holly and Camden; dairy sections in the northern portion of the state and elsewhere; poultry sections in the regions of Vineland, Lakewood and Tom's River. Coöperative organizations have been formed to meet the needs of these specialized sections, such as a state potato association, alfalfa association and others. The horticultural products in 1920 were valued at $50,000,000. Large plantings of apples and peaches in Burlington, Gloucester and Cumberland counties indicate the progress of commercial fruit-growing.

Mining.—New Jersey ranks fifteenth in the value of its mineral products and third in value per sq. mile. In the production of zinc Oklahoma alone surpasses it. The ore body of the two New Jersey zinc mines of Sussex county is unique in composition and is the largest and probably the richest of any known ore body in the world. Metallic zinc, zinc oxide and spiegeleisen are the chief products, amounting in 1918 to nearly 700,000 tons. The iron-mining industry, which from about 100 mines attained a maximum output of nearly 1,000,000 tons in 1882 and then declined, has been revived and the recent annual production has been about 400,000 tons. A few financially strong companies have expended large sums for the ore shafts, underground development and the erection of magnetic concentration plants, and a number of new ore bodies have been developed. In the mining of clays New Jersey in 1918 ranked third among the states, the raw clay production of that year being 286,474 tons. In the value of pottery products it stands second to Ohio. The total value of New Jersey's clay and clay products in 1918 was approximately $22,000,000. Brick and tile, terra-cotta, stone, cement, sand and gravel and miscellaneous items raised the value of the mineral production for 1918 to nearly $50,000,000. The state possesses in the green sand (marl) deposits vast stores of potash which, to be available for plant use, requires complicated chemical treatment. Efforts were made during the World War and after to recover the potash from these beds.

Manufacturing.—In variety of manufactures New Jersey surpasses any other state. It ranks sixth in the value of its annual product and second in the *per capita* value. About 17% of the population is actively engaged in manufacturing. It ranks first in the smelting and refining of copper, in the refining of oil, in the manufacture of linoleum and sewing-machines; second in the manufacture of silk, and in chemical and rubber products; third and fourth respectively in the production of electrical machinery and supplies and of toilet articles. In 1918 the capital invested in manufactures totalled $1,888,298,757; the value of stock used was $1,834,-

580,122; the selling value of goods was $2,990,939,855; total amount paid in wages $530,733,577. In the same year the average number of persons employed was 499,279; of these 377,328 were men (16 years of age or over), 115,143 were women, and 6,508 were from 14 to 16 years old. The average earnings per employee were $1,063; average number of days at work 289·06; of hours worked per day 9·25; of hours per week, 52·24.

Education.—The Russell Sage Foundation, after an exhaustive examination of the public school systems of the various states, ranked New Jersey in 1920 first among the states east of the Mississippi river, fourth in the whole country, and added that it was "the only state in the eastern division that has gained in relative rank during a period of 28 years, 1890–1918." An Act of the Legislature of 1911 made notable changes in school administration. The State Board of Education consisted in 1921 of eight members with increased powers of control. The Act replaced the superintendent of public schools with a commissioner of education, with enlarged powers. The report of this commissioner for 1920 gave the total enrolment of pupils as 623,284, an increase of 26,290 over 1919 and of 44,353 over 1916. The number of teachers was 18,873; of school buildings, 2,106. Over 600,000 children were furnished with books and supplies free of cost. Nearly 300,000 received manual or industrial training of some sort, and 13,000 some form of vocational training. There were 31,486 pupils in the evening schools, 40,282 in the kindergartens, 276,498 in the first four grades, 181,864 in the four higher grades, 55,243 in the high-schools as against 38,099 in 1914. The current expense for operating the schools during the year 1919–20 was $30,854,795.53, an increase over the previous year of $5,403,716.10. Of this total more than $20,000,000 was for salaries of teachers, superintendents and principals. The school moneys were derived as follows: state school fund, $250,000; appropriations by Legislature for general purposes, $696,006; appropriations from state railroad tax, $4,564,879; state school tax, $235,046; surplus revenue fund, $28,480; local appropriations, $24,155,265; other sources, $1,382,893. The school properties in 1911 were valued at $44,000,000; in 1920 at $102,000,000. The average salary paid to teachers in 1920 was $1,177.20. A third state normal school, that at Newark, was opened in 1916. Schools under private control are numerous throughout the state. The Catholic parochial schools numbered in 1919 189, with 83,524 pupils. A legislative Act of 1917 designated the state college (Rutgers) as the "State University of New Jersey." This institution had on its rolls in Jan. 1921: graduate students, 30; undergraduates, 678; college for women, 179; summer session, 559; short courses in agriculture, 149; extension courses, 589. A college for women affiliated with it was opened in Sept. 1918. Stevens Institute of Technology in 1921 had on its rolls 862 students; Princeton (*see* PRINCETON UNIVERSITY), 1920–1, 1,814 undergraduates, 149 graduates.

Legislation.—The general spirit of the time was clearly evident in the legislation of New Jersey during the decade 1910–20. The influence of the "Progressive" movement, reinforced by the activities of Gov. Woodrow Wilson, 1911–3, secured the enactment of several radical measures. For more than two generations New Jersey had, beyond any other state, sedulously fostered the aggregation of capital in corporate form, but this policy was reversed by the passage in 1913 of the series of Acts widely known as the "Seven Sisters," whose purpose was the elimination of the power of "trusts" to create restraint of trade, monopoly, limitation of production and price-fixing. Subsequent legislation repealed or greatly modified these laws.

The long-cherished policy of opposition to a state debt was changed in 1920, when the Legislature proposed and the people ratified an issue of bonds to the amount of $28,000,000 for the construction, as a part of the highway system, of a bridge across the Delaware and a tunnel under the Hudson river. At the same election the people approved a law to authorize an issue of bonds to the amount of $12,000,000 as a bonus to those who served in the World War. A budget system was introduced in 1916 and a central agency for the purchase of departmental supplies.

The laws governing elections were radically changed in 1911 and subsequently, by provisions extending the application of the direct primary law and providing the blanket ballot and safeguards against frauds. In 1911 also the commission form of municipal government was introduced, and by 1920 had been adopted by about 40 municipalities, including the largest cities. The Practice Act of 1912 is noteworthy as simplifying procedure in the courts. The legislation of this period further embraced the following subjects: the regulation and control of public utilities; jury reform; employers' liability; workmen's compensation; conditions and hours of labour; labour of women and children; juvenile courts; women as police officers; sanitary safety conditions; motor vehicle control; a state system of highways; inheritance and bank stock taxation; regulation of insurance; water-supply; food laws and storage of food; civil service in state and municipalities; state administration of municipal sinking funds.

The various war measures of the Legislature were in keeping with its Act of March 26 1917, 11 days before war was declared, directing the governor in aid of the nation's cause "to organize and employ any and all resources within the State." The number of men from New Jersey serving in the World War was 138,691; army, 114,534; navy and marine corps, 23,951; coast and U.S. guards, 206. According to the most recently compiled casualty statistics, 119 officers and 2,311 enlisted men lost their lives on foreign soil, while 37 officers and 856 enlisted men died in the United States and its possessions; the wounded were 7,620 (officers 219, men 7,401); prisoners 188 (officers 20, men 168). The records of the Navy Department show a total loss of 227, of whom 168 died of disease, 24 in enemy action, and 35 by accidents. In the marine corps 80 men lost their lives while serving with the U.S. Marines in France, 16 while serving in the United States and foreign stations other than the American Expeditionary Force. The subscriptions in New Jersey to the Liberty and Victory Loans were: first, $82,519,450; second, $140,209,300; third, $139,858,500; fourth, $236,826,600; Victory, $173,645,050; total $773,058,900.

Political History.—Woodrow Wilson was elected governor in 1910 as candidate of the Democratic party, receiving a plurality of 49,056. His success in the state campaign, and the character of his administration, attracted the attention of the whole country and led to his nomination and election to the presidency in 1912. In each of the seven presidential elections after 1892 the electoral vote of New Jersey was cast for the candidate of the Republican party except that of 1912, when Wilson, owing to the split in the Republican ranks, secured a plurality of 24,873. He lost the state to Hughes in 1916 by 57,707 plurality. In 1920 Harding, Republican, received 611,670 votes; Cox, Democrat, 258,229. In the elections for the state executive the Democratic party was successful in 1910, 1913 and 1919, the Republicans winning in 1916. The Legislature also varied in party affiliation during this period, but from 1914 the Republicans obtained the control of both Houses. In 1921, of the 21 Senators, 15 were Republicans, 6 Democrats; in the Assembly there was but one Democrat, the other 59 were Republicans, of whom two were women. In the sixty-seventh Congress of the United States both New Jersey's Senators were Republican, and of the state's 12 Representatives but one was a Democrat.

New Jersey's governors were: Woodrow Wilson 1911–3; James F. Fielder (acting), 1913; Leon R. Taylor (acting), 1914; James F. Fielder, 1914–7; Walter E. Edge, 1917–9; William H. Runyon (acting), 1919; Edward I. Edwards, 1920–

(A. Sc.)

NEW MEXICO (*see* 19.520).—The pop. in 1920 was 360,350 as against 327,301 in 1910, an increase of 33,049, or 10·1%, as against 67·6% in the preceding decade. The urban pop. (in places of 2,500 inhabitants or more) in 1920 was 18% of the total, as compared with 14·2% in 1910. The average number of inhabitants per sq.m. in 1920 was 2·9; in 1910 it was 2·7. The following table shows the growth of the principal cities for the decade 1910–20:—

	1920	1910	Increase per cent
Albuquerque	15,157	11,020	37·5
Santa Fé	7,236	5,072	42·7
Roswell	7,033	6,172	13·9
Raton	5,544	4,539	22·1
Clovis	4,904	3,255	50·7

Agriculture.—During the decade 1910–20 the number of farms decreased from 35,676 to 29,844, or 16·3%; all land in farms increased from 11,270,021 ac. to 24,409,653 ac., or 116·6 %; improved land increased from 1,467,191 ac. to 1,717,224 ac., or 17 %. The value of all farm property rose from $159,447,990 in 1910 to $325,185,999 in 1920. The average acreage per farm in 1920 was 817·9 ac.; in 1910 it was 315·9 ac. The average value of land per acre decreased from $8.77 in 1910 to $8.04 in 1920. Of the 29,844 farmers in 1920, 25,756 were owners, 433 managers, and 3,655 tenants. The increase in the chief agricultural products during 1909–19 is shown in the following table:—

	Acres	Production	Value
Corn 1919	227,167	4,737,182 bus.	$7,105,781
" 1909	85,999	1,164,970 "	984,052
Oats 1919	40,029	1,085,311 "	1,139,580
" 1909	33,707	720,560 "	459,306
Wheat 1919	135,185	2,437,213 "	4,874,426
" 1909	32,341	499,799 "	508,726
Beans 1919	112,419	850,334 "	2,976,176
" 1909	20,766	85,795 "	232,023
Hay and forage . . 1919	436,547	693,807 tons	12,852,751
" " " . . 1909	370,596	433,504 "	4,493,918

Of live stock on farms in 1920 there were 182,686 horses, valued at $9,696,377; 20,369 mules, valued at $1,874,836; 1,237,551 beef cattle, valued at $59,580,397; 62,794 dairy cattle, valued at $3,520,903; 1,640,475 sheep, valued at $15,413,670; 87,906 swine, valued at $1,462,470. The production of wool in 1919 was estimated at 15,076,000 lb. In 1920 the number of farms irrigated was 11,390; the area irrigated was 538,377 ac., or 31·4% of the improved land in farms. The capital invested in irrigation enterprises was $18,210,412, as against $9,154,897, in 1910.

Manufactures.—Between 1914 and 1919 the capital invested increased from $8,984,000 to $15,226,000 or 69·5%, and the value of products from $9,320,000 to $17,857,000 or 91·6 per cent. The average capital per establishment increased from $24,000 to approximately $39,000, during the same period. The value added by manufacture in 1919 was 56·7% of total value of products as compared with 52·5% in 1914. The chief manufactures are lumber and timber products; railway-car construction; printing and publishing; and gristmill products. The following table, compiled by the U. S. Census Bureau, shows the other manufacturing statistics for the period 1914–9:—

	1919	1914	Increase per cent
Number of establishments	387	368	5·2
Proprietors and firm members	336	325	3·4
Salaried employees	574	493	16·4
Wage-earners, average number	5,736	3,776	51·9
Salaries	$1,027,341	$577,243	78·
Wages	6,658,462	2,695,448	147·
Materials, cost	7,727,483	4,430,134	74·4
Value added by manufacture	10,129,119	4,889,933	107·1

Transportation.—In 1918 the railway mileage of New Mexico was 3,041, excluding switches and sidings. The Atchison, Topeka & Santa Fé railway owned 1,426 m. of track, almost half of the total. The other principal railways were the El Paso & Southwestern, 741 m.; the Denver & Rio Grande, 235 m.; the Southern Pacific, 167 m.; the Chicago, Rock Island & Pacific, 152 m.; and the New Mexico Central, 115 miles. During 1917–8 about 1,600 m. of highways were improved, involving the building of 1,200 culverts and 260 bridges, at a total cost of $1,500,000. In 1912 the territorial roads commission became a state highway commission in control of the state road fund; county road boards succeeded road supervisors. Counties may issue bonds for highways and bridges.

Mineral Products.—The total value for 1918 was $40,631,024, as compared with $18,072,919 in 1914. The chief products were: coal, 4,023,239 tons; copper, 98,264,563 lb.; zinc, 24,050,000 lb.; lead, 10,180,000 lb.; silver, 782,421 ozs. The value of the gold production was $683,000.

Education.—In 1916 a movement was begun to standardize and make more uniform the high-schools. In 1917 the state, taking advantage of the Smith-Hughes Act for promoting vocational education, received from the Federal Government $15,000, which was doubled by a like appropriation from the state. For the year ending June 1 1918 the total school enrolment was 62,422, of which number 31,538 were boys and 30,884 girls. The average daily attendance was for boys 19,807 and for girls, 20,000, a total of 39,807. The total number of children, age 7 to 14, in the state was 67,947. The number of school-houses was 1,289. The average monthly salary for men teachers was $71.52 and for women $67.66. Among the laws passed by the state Legislature in 1919 was one providing for compulsory school attendance between the ages of 6 and 16; children between the ages of 14 and 16 may be excused to enter employment. A child welfare department was created at the same time and placed under the jurisdiction of the Department of Education. The university of New Mexico, at Albuquerque, had in 1920 about 400 students and 35 officers of instruction. David Spence Hill was president. The museum of New Mexico, established at Santa Fé in 1909 in the historic palace, built about 1630, of the governors of the old Spanish province, contains a remarkable collection illustrating American archaeology and a notable library of works on general linguistics. The Archaeological Institute of America maintains there a special school of American Research. In 1918 the state spent $1,266,000 on its educational institutions, comprising the university of New Mexico, at Albuquerque; the State College of Agriculture and Mechanic Arts, at State College; the Military Institute, at Roswell; the Normal University, at Las Vegas; the Normal School, at Silver City; the Spanish-American Normal School, at El Rito; the School of Mines, at Socorro; the Deaf and Dumb Asylum, at Santa Fé; and the Institute for the Blind, at Alamogordo.

Finance.—For the first seven years of statehood, Dec. 1 1911 to Nov. 30 1918, the aggregate state expenditures were $15,573,817 and county expenditures $34,227,143, making a total of $49,800,960. State receipts amounted to $16,520,448 and county receipts $34,235,224, making a total of $50,755,672. At the end of that period the bonded state debt was $3,385,500; county, $2,972,335; city, town and village, $3,250,000; school, $1,800,000, making a total of $11,407,835. In 1918 the total assessed valuation was $360,961,891, as compared with $72,457,454 in 1912. There were in 1918 43 national banks with capital stock totalling $2,765,000 and resources of $45,000,000; 22 state banks with capital stock totalling $2,615,980 and resources of $19,110,000.

Legislation.—In 1913 the state Legislature ratified the Federal income tax amendment. Other legislation included a local option law; a "white slave" law; provision for an optional commission form of government for cities, towns and villages. In 1917 a workmen's compensation law was enacted; regulations concerning examination for admission to the bar were improved; and provision made for part payment of transportation expenses of normal school students from distant parts of the state. In 1919 legislative acts included the establishment of state mounted police; a Child's Welfare Bureau; an annual franchise tax on corporations; state inheritance and income taxes; fixing the maximum rate of interest at 10%; provision for teaching of Spanish in high-schools on petition; and the establishment of night-schools for illiterates. In 1914 an amendment of the state constitution was adopted, changing the terms of state and county officers from four to two years. In 1918 an article was added prohibiting the manufacture and sale of intoxicating liquors after Oct. 1 1918 (28,732 for, 12,147 against).

History.—The most important historical fact concerning New Mexico during the decade 1910–20 was its admission into the Union, June 6 1912, as the 47th state. Following the Enabling Act, passed by Congress June 20 1910, the territorial governor ordered an election of delegates to frame a constitution. The election was held Sept. 6 1910; the convention, consisting of 71 Republicans and 29 Democrats, assembled Oct. 3; and the adopted constitution was approved by the people Jan. 21 1911. The vote was 31,742 for, and 13,399 against. The chief opposition came from voters who favoured the inclusion of state prohibition. Certain provisions in the constitution made amendment difficult. These were not approved by President Taft, and Congress passed a resolution that at the election of Nov. 1911 the people should decide whether amendment should be made easier. The Republicans were pledged against such change, but favoured a repeal of the section requiring as a qualification for state office ability to speak and write English without the aid of an interpreter. Although as a territory New Mexico had been Republican, the Democratic candidate for governor, William C. McDonald, was elected, receiving 31,036 votes to 28,019 for H. C. Bursom, the Republican candidate. The governor was inaugurated Jan. 15 1912. The Republicans elected a majority of members of both Houses of the Legislature, the Democrats securing all state offices, excepting those of auditor and attorney-general. Two Republicans were sent to the U.S. Senate; one Republican and one Democrat were elected to the U.S. House of Representatives. An amendment to the constitution making it easier of amendment was carried by an overwhelming vote. One of the first two U.S. Senators to be elected was Albert B. Fall, who served by re-election until 1921, when he entered the Cabinet of President Harding as Secretary of the Interior. The presidential vote in 1912 was 20,437 for Wilson, 17,733 for Taft, and 8,347 for Roosevelt; in 1916 it was 33,524 for Wilson, and 31,152 for Hughes.

In 1916 the Elephant Butte Dam, under active construction since 1910, was completed by the U.S. Reclamation Service at a cost of about $5,000,000. It is situated 12 m. W. of Engle, Sierra county. Built across canyons of the Rio Grande, it governs the entire flow of the river and is the largest storage irrigation reservoir in the world. The average width of the reservoir is 1¼ m., maximum length 45 m.; the area of water surface, when full, 40,080 ac., the shore line 200 m.; the average depth 66 ft., and the maximum depth near the dam 193 ft. When full it holds 115,498,000,000 cub. ft., or 862,200,000,000 gallons. It irrigates 185,000 ac. of land, lying in New Mexico, Texas and Mexico (25,000 ac.).

About 15,000 men were inducted into service during the World War. The final allotments for the Liberty Loans, all heavily over-subscribed, were as follows: First, $1,392,850; Second, $3,860,100; Third, $5,903,300; Fourth, $5,898,100; Victory, $2,915,500.

The last territorial governor was W. J. Mills (Rep.), 1910–2. State governors were W. C. McDonald (Dem.), 1912–7; Ezequiel de Baca (Dem.), Jan. 1–Feb. 18 1917; W. E. Lindsey (Dem.), 1917–9; A. Larrazolo (Rep.), 1919–21; M. C. Mechem (Rep.), 1921–

NEWSPAPERS (*see* 19.544).—(1) GREAT BRITAIN.—The account of English journalism given in the earlier article brought its history practically down to the moment when in 1908 Lord Northcliffe had become chief proprietor of *The Times*. In later years the newer developments in daily and weekly journalism, which may be said to have begun with the establishment of the *Daily Mail* in 1896, were seen in extended operation. Every newspaper endeavoured to make a broader appeal than formerly in the desire to attract the ever-increasing body of readers produced by the Education Act, which wants matter served up in a fashion markedly different from that which was usual when, taken as a whole, the comparatively small newspaper-reading public was composed of educated people. As Mr. Gladstone remarked years ago, "The press, which was formerly the privilege of the educated classes, has become the patrimony of the people." Also, women had become regular readers, and, in order to increase circulation, it was necessary to cater to their tastes. The general tendency, consequently, has been to be less academic and more and more personal and "snappy." The use of the editorial "we," and all that it implies in the way of detachment, real or affected, is rapidly passing away, and the old-fashioned "leader" is going the way of all things. Most present-day readers want news, not opinions. The "tit-bits" style of presentation is apparently what is best liked by the majority, and as the majority pays the piper, proprietors for the most part let it call the tune. For instance, there have been very radical changes in parliamentary reporting. In 1909 practically every paper of importance had its own corps of reporters, but now most papers obtain their reports from a newsagency and few devote much space to them; and there is this justification for the change, that nowadays more people read the summary of parliamentary proceedings which is generally given than the full report. In nearly all London daily papers illustrations are inserted, either regularly or occasionally, and at least one paper with a very great circulation has given over its back page entirely to the reproduction of photographs of current events, except for a sprinkling of advertisements. Also, these papers usually devote a page or a column to gossipy paragraphs, fashions, and other topics specially interesting to women, and even other features likely to attract children, and so on. Further, they print serially from time to time books that have a wide interest, such as Ludendorff's *Reminiscences* and the memoirs of Mrs. Asquith and M. de Witte.

The struggle for existence of newspapers has been vastly intensified. As a result of the World War, the price of paper was very much greater, and so also the cost of printing, and the general upkeep. The salaries of the editorial staff have risen, and wages have gone up still more materially. This has been met only to a limited extent by the increase in the selling price of the newspapers—the halfpenny press has disappeared and now (1921) charges one penny, while the selling price of the former penny paper has been doubled.

The comparative statistics of British newspaper publications show the following growth between 1909 and 1920. In 1909 there were in the United Kingdom 2,322 newspapers, distributed as follows: London, 386, of which 31 were dailies; provinces, 1,365, including 125 dailies, without localized editions; Wales, 111, including 8 dailies; Scotland, 260, including 18 dailies; Ireland, 185, including 17 dailies; Isles, 15, including 4 dailies. In 1920 there were in the United Kingdom 2,293 newspapers distributed as follows: London, within the postal radius, 440, of which 25 were morning dailies and 7 evening dailies; the English and Welsh provinces, including localized issues, 1,425, of which 41 were morning and 83 evening dailies; Scotland, 235, including 9 morning and 10 evening dailies; Ireland, 179, including 10 morning and 6 evening dailies; Isles, 14, of which 5 were dailies.

The most notable events in the newspaper world during the decade 1910–20 were: (1) the rise of the cheap illustrated papers, due to the introduction of the half-tone block and improved photographic and reproduction methods; (2) the great increase in the circulation of Sunday papers; and (3) the great increase in the circulation of evening papers in London and the provinces. It is not generally realized what large quantities of evening papers are sold, and that the circulation of evening papers much exceeds the circulation of the morning papers, with the exception of the few morning papers that have national sales.

In the matter of the development of journalism as a profession or business, it is interesting to note how the principle of trade-unionism has crept in. In so far, the relations between a proprietor and his staff have materially altered. The proprietors are just as interested in their papers as ever, and keep a tight rein on the policy, a rein at least as tight as, and perhaps tighter in many cases, than a generation earlier. Then, such men as John Walter, the first Lord Burnham and Lord Glenesk were in regular touch with their editors and managers, and now such men as Viscount Northcliffe, Viscount Burnham, Viscount Rothermere, and Lord Riddell very definitely control their papers.

In other ways, however, there has come about a distinct, though not necessarily unfriendly, cleavage between the employers and the employees of all kinds, owing to the fact that the trade unions have become one of the most important factors in the newspaper trade at the present time. The owners of London daily, evening, and Sunday papers have formed the Newspaper Proprietors' Association, which deals as a body with questions in which they are jointly interested, such as labour matters, cable charges, and railway facilities. The association was represented at the Peace Conference, and acted through its representatives as a *liaison* between the British delegates and the British press. The owners of periodicals, magazines, and the trade papers are banded together under the style of the Weekly Newspapers and Periodicals Proprietors. In the provinces, the proprietors are linked up in the Newspaper Society, the Northern Federation of Newspapers, the Southern Federation of Newspapers, the Scottish Newspaper Proprietors' Association, the Irish Newspaper Society, and the Associated Irish Newspapers. Manchester has its Newspaper Federation, and Ireland its Irish Master Printers' Association. There is, further, a British Association of Trade and Technical Journals, Ltd.

The journalists, too, besides the old-established Institute of Journalists, have now another organization, the object of which is to better the position of the journalist, to secure for him a reasonable security of the tenure of his post, and to enforce minimum salaries for the different kinds of work, which minimum rate, however, varies according to the locality, London rates being distinctly higher than those in the provinces. This union keeps a very close control over its members, as is shown by a recent notice: "Members of the National Union of Journalists who accept any new position without first informing the General Secretary are liable to be expelled from the Union. This is necessary owing to the great variety of recognized local rates." There is also a Society of Woman Journalists. The British International Association of Journalists works on behalf of journalists of all countries, and has organized international press conferences; and the Empire Press Union works on behalf of the press of Great Britain, the Dominions and Colonies.

In the provinces the whole of the trades are represented by one body, called the National Printing and Kindred Trades Federation. In London each trade has its own union—the compositors, stereotypers, and so on—but they are all welded together for certain purposes in the London Printing Trades Federation. One of the most remarkable newspaper incidents of modern years was the Lancashire strike or lock-out in 1920, which resulted in the newspapers of that district suspending publication for nine days.

The newsagents have their organizations—the Federation of Wholesale Newsagents and the National Federation of Retail Newsagents. Other societies directly interested in newspapers are, on the one side, the Association of Advertisement Managers of the London and Provincial Press, Ltd., and, on the other side, the Incorporated Society of British Advertisers. In fact, the newspaper trade is most highly organized in all its branches, and, on the whole, its members are highly paid.

London Newspapers.—There were many changes between 1909 and 1921 in the London press. The morning daily paper, the *Standard*, which dated back to 1827, ceased to appear in 1911; in 1912 the *Morning Leader*, which was founded in 1892, was amalgamated with the *Daily News*; in 1921 the *Globe*, the oldest of the existing evening newspapers, was absorbed by the *Pall Mall Gazette*, which last now appears as the *Pall Mall and Globe*. In Nov. 1921 the evening *Westminster Gazette* was transformed into a morning Liberal paper, with Mr. J. A. Spender still as its editor, the former green paper being changed to white.

The *Morning Post* subsequently to 1911 was edited by Mr. H. A. Gwynne (who had been editor of the *Standard* from 1905 until that date), in succession to Mr. (afterwards Maj.-Gen. Sir) Fabian Ware, who had been in charge since 1905.

Mr. George Earle Buckle (b. 1854) resigned the editorship of *The Times* in 1912, when he was replaced by Mr. Geoffrey Robinson (afterwards Dawson; b. 1874), a fellow of All Souls', Oxford, who had joined the staff a year or so before, after having been editor of the *Johannesburg Star* in S. Africa, where he had originally gone in 1901 as private secretary to Lord Milner. Mr. Dawson resigned in Feb. 1919, and was succeeded by Mr. H. Wickham Steed, who had been a foreign correspondent of the paper since 1896 and had been foreign editor since 1914. In 1920 Sir Campbell Stuart, K.B.E., who had been second-in-command to Viscount Northcliffe in the Department of Enemy Propaganda, was appointed deputy-chairman and chief manager. Death claimed two valued contributors to the paper: Sir Donald Mackenzie Wallace (d. 1919), who, after acting as correspondent in Russia, Turkey and Egypt, was director of the foreign department from 1891 to 1899; and James David Bourchier, who had represented the paper in the Near East. *The Times* now publishes weekly an *Imperial and Foreign Trade Supplement*, and a similar publication monthly in Spanish. It has brought out "*The Times* History of the War," a new *Times Atlas*, and "*The Times* Documentary History of the War."

In 1912 the *Morning Leader*, founded in 1902, was incorporated with the *Daily News* (which owns the *Star*), and various changes were made in the board of directors. Mr. A. G. Gardiner retained the editorship which he had held since 1902, but he resigned in Sept. 1919. His successor was Mr. Stuart Hodgson, who had been assistant-editor of the *Morning Leader* and had transferred his services to the *Daily News*.

The *Daily Telegraph* suffered fewer changes than most London papers. After the death of the first Lord Burnham (1833–1916), his son, the second Baron and first Viscount, who had assisted his father in the general control of the paper, assumed complete control. The veteran managing editor, Mr. John Merry le Sage (b. 1837), was knighted in 1918.

The *Daily Chronicle*, together with *Lloyd's Sunday News*, was sold in 1918 to a syndicate, the United Newspapers (1918) Ltd., headed by Sir Henry Dalziel, Bart. The change in proprietorship caused no change in the policy of the paper, but its attitude was broadened so as to appeal to all sections of the Liberal party. On the sale of the paper, Mr. Robert Donald retired from the editorship, and was succeeded by Mr. Ernest Alfred Perris, who had been long associated with the paper. *Lloyd's Sunday News* in 1919 came under the editorship of Mr. W. S. Robinson.

In the case of the *Morning Advertiser*, Mr. H. C. Byssche succeeded to the editorship in 1911.

In 1919 a controlling interest was purchased by Messrs. William E. & J. Gomer Berry in the *Daily Graphic*, the weekly *Graphic* (editor, Mr. J. M. Bulloch), and the *Bystander* (editor, Mr. A. Spenser Allberry). The same firm in 1915 acquired the control of the *Sunday Times* (editor, Mr. Leonard Rees).

The *Daily Express*, founded in 1900 by a company of which Mr. (afterwards Sir Arthur) Pearson was chairman, was taken over in 1913 by a new company in which the principal shareholders were Lord Beaverbrook, Lord Faringdon, and Mr. R. D. Blumenfeld, who had been editor since 1904.

The *Daily Mirror*, founded by Viscount Northcliffe in 1903, was purchased 11 years later by his brother, Viscount Rothermere, who on March 14 1915 started the *Sunday Pictorial*, which marked a new departure in journalism, being the first Sunday picture-paper. Viscount Rothermere also obtained control of the *Leeds Mercury*, the *Glasgow Daily Mail*, the *Glasgow Sunday Mail* and the *Glasgow Weekly Record*.

Messrs. E. Hulton & Co., Ltd., of which the chairman was Sir Edward Hulton and the managing director Mr. James Heddle, was the first firm from the provinces to compete with the London daily illustrated newspapers through the *Daily Sketch*. In 1915 the same firm founded the *Illustrated Sunday Herald*. It owns in the provinces the *Daily Despatch* and the daily *Sporting Chronicle*, and two Sunday papers, the *Sunday Chronicle* and the *Empire News* (formerly the *Umpire*). This firm also acquired the London *Evening Standard*, which was until Jan. 1920 edited by Mr. A. H. Mann, who then resigned to take up the editorship of the *Yorkshire Post*. Mr. Heddle subsequently acted as editor-in-chief.

The *Pall Mall Gazette* was sold in 1915 by Major (afterwards the second Lord) Astor to Sir Davidson Dalziel, from whom Sir Henry Dalziel purchased it two years later. In 1920 the last proprietor transferred the major part of his shares to the Hon. Morton Weir, son of Lord Inverforth. In Feb. 1921 the *Globe* was amalgamated with it, and later in the year the proprietorship passed into the hands of Sir John Leigh, Bart. In 1912 Mr. Higginbottom, who had been editor since 1909, was succeeded by Mr. J. L. Garvin, and in 1915 by Mr. D. M. Sutherland.

As regards Sunday papers published in London, reference has already been made to the *Sunday Times*, the *Sunday Pictorial*, and *Illustrated Sunday Herald*. The *Observer* continued to be edited by Mr. J. L. Garvin, but in 1911 it was acquired by the first Lord Astor, and it passed on his death to his son. The *Sunday Express* was founded by Lord Beaverbrook, a principal shareholder in the *Daily Express*, and the first number appeared on Dec. 29 1918. It was edited by Capt. Bird until March 1920, when he was replaced by Mr. James Douglas, formerly editor of the *Star*. The *National News* was founded in 1917, and purchased by Odham's Press, Ltd. In 1921 it was transferred to a syndicate, Sunday Publications, Ltd., the head of which was Mr. Horatio Bottomley, M.P., the founder and editor of *John Bull*, who also founded the *Sunday Illustrated* in July 1921.

The *Sunday Evening Telegram*, the only Sunday evening paper, was started during the war by Sir Henry Dalziel, and purchased by Odham's Press, Ltd., in Oct. 1919. In 1921 it was transferred to the Sunday Publications, Ltd. These last two papers were edited, under Mr. Bottomley, by G. C. H. Read.

During recent years a Labour press has come into prominence. The *Daily Herald* was started in 1911 by Mr. T. E. Naylor and members of the London Society of Compositors, who were then on strike and set up their own paper as a means of getting their case stated in a way in which they believed they could not get it stated in the general press. Its total capital was about £2,000. When the strike was over it attempted to develop itself from a strike sheet into an ordinary daily paper, with a strong political programme of what was then the extreme Left. Presently Messrs. George Lansbury, Ben Tillett, and others became directors, but it never secured a very large circulation, and in the autumn of 1914 it was changed into a weekly paper, under the editorship of Mr. George Lansbury. It was revived as a daily paper in March 1919, Mr. Lansbury remaining editor, Mr. Gerald Gould, well known as a poet, being associate-editor. Considerable sums of money were raised as debentures from the trade-union movement, and a trade-union committee, a purely advisory body, was appointed. In 1920 an outcry concerning the proposed acceptance of money from a Bolshevik source resulted in the retirement from the directorate of Mr. Francis Meynell. The *Daily Citizen* appeared in Nov. 1912, and continued until June 1915, when it ceased publication for financial reasons. Mr. Frank Dilnot was the editor, and there was a controlling board, on which were Messrs. Arthur Henderson, Ramsay MacDonald, W. C. Anderson and other official representatives of the Labour party, of which it was the official organ. The paper was financed by the trade unions.

There have been numerous weekly and monthly Labour papers, amongst which may be mentioned the *Labour Leader*, the official organ of the Independent Labour party, and the *Communist* (edited by Mr. Francis Meynell), the official organ of the new Communist party of Great Britain.

In the weekly periodicals there have been comparatively few changes. The *Saturday Review* changed hands in 1917, when Mr. A. A. Baumann (at one time a London M.P.) succeeded Mr. Harold Hodge as editor, and directed it until the spring of 1921, when he retired. The paper was then purchased by Sir Edward Mackay Edgar, and Mr. Sidney Brooks was appointed editor, but later in the year various improvements were made and Mr. Filson Young became editor, with Mr. Hartley Withers (previously editor of the *Economist*) as financial editor. The old-established *Athenaeum* ceased to appear as a separate publication in 1921, when it was amalgamated with *The Nation*. Newer papers that have appeared are the *New Witness*, founded in 1912, and edited by Mr. Cecil E. Chesterton until his death in 1919, when his brother, Mr. Gilbert Keith Chesterton, took his place. The *Review of the Foreign Press* is the continuation as a private enterprise of a paper founded and issued by the General Staff of the War Office during the war. It was still edited in 1921 by Capt. W. E. Barber, who was mainly responsible for it since its inception. Among illustrated weekly papers *Black and White* has ceased to appear; Mr. Clement Shorter in 1921 still edited the *Sphere*, but he had retired from the editorial chair of the *Tatler*, where he was succeeded by Mr. Huskisson. Several women's papers have appeared, including *Vogue*, *Femina* (edited by Lady Diana Cooper), and "*The Times* Woman's Supplement." In 1921 the last-named and the *Lady's Pictorial* were incorporated with *Eve* (published by the Sphere and Tatler, Ltd.), edited by Mr. Huskisson. The monthly *Englishwoman* ceased to appear in 1921. The improvement in the illustrations in the higher type of weekly has been very marked. Several of these papers now present illustrations in colour.

The industrial press has vastly increased in numbers, especially publications concerning the motor, wireless, cinematograph, and aerial trades.

(2) IRELAND.—In Dublin the *Irish Times*, with the *Evening Irish Times* and its subsidiary publications show no special changes as Unionist organs since 1907, when Mr. W. Algernon Locker, the editor, resigned and Mr. J. E. Healy was appointed editor. The *Daily Express* and the *Evening Mail*, on the death of the proprietor, Lord Ardilaun, were sold to Mr. H. L. Tivy of Cork in Feb. 1915, and Mr. H. S. Doig continued to act as editor until 1919, when he went to the management department of the *Freeman's Journal*.

Mr. Yeates was in 1921 acting editor. The *Freeman's Journal*, the *Evening Telegraph*, and associated publications have had a chequered history. Before the Easter rebellion of 1916 they were carried on as the official Nationalist newspapers under the direction of Mr. Thomas Sexton, ex-M.P. During the rebellion the offices in Princes' Street were destroyed by fire together with the entire plant and machinery. Until Feb. 1917 the papers were produced for the company by Messrs. Cahill, printers. New offices were then opened in Townsend Street, under a reconstructed board of directors. In Oct. 1919 the debenture-holders of the *Freeman's Journal* foreclosed, and the papers were put up for sale and purchased by Messrs. Martin Fitzgerald and Hamilton Edwards, Mr. P. J. Hooper, who had been appointed in 1916, remaining editor. On the disappearance of the Redmondite Nationalists at the general election of Dec. 1918, the *Freeman's Journal* became frankly Sinn Fein. The *Irish Independent*, the *Evening Herald*, and associated newspapers remained in the possession of the family of their founder, Mr. William Martin Murphy (d. June 1919), under the editorship of Mr. Timothy Harrington. Before the election of Dec. 1918 they were Independent Nationalist in politics, and after Dec. 1918 they became Sinn Fein. A few days after the attack on the Lord Lieutenant, Viscount French, between Ashtown station and the Phoenix Park, in Dec. 1919, a party of some 50 men, armed and provided with crowbars and hammers, held up the office and smashed the machinery, doing damage for which £35,000 compensation was afterwards awarded to the proprietors, to be levied on the city of Dublin. The publication of the newspapers was not seriously interfered with.

Before the rebellion in Easter week, 1916, the Sinn Fein doctrines had no direct representation in the daily press of Ireland, and it was not until the Nationalist party was swept out of existence in the Dec. 1918 election that the policy was advocated and supported by daily newspapers in Dublin, Cork and Belfast. The best literary work of Sinn Fein was done in the monthly magazines, such as the *New Ireland Review;* but there was a host of small weekly papers published in Dublin (many of which were suppressed by the authorities only to appear in a few weeks under new names), and through these both sections of the party—Liberal and Labour—reached their supporters and carried on an active propaganda.

The following is a fairly full, but by no means complete, list of weekly Sinn Fein organs, which appeared before and after the Easter rebellion of 1916: *The Leader* (Mr. Arthur Griffith); *Young Ireland* (Mr. Arthur Griffith); *Watchword of Labour* (Liberty Hall), defunct; *Nationality* (successor to *Sinn Fein;* Mr. Arthur Griffith, June 1915 to March 18 1916); *Nationality*, Feb. 17 1917 to 1921; *Phoenix*, published in Kilkenny from Dec. 9 1916 to 1917; *Young Ireland* (Young Republican's literary paper), April 21 1917 to 1921; *Irish Nation*, June 24 1916 to March 1917; *Irish Opinion* (Larkinite Labour), June 19 1916 to April 1917; *Irish Opinion* (new series), Dec. 1917 to 1920; *Irish Opinion, the Voice of Labour*, Feb. 1918 to 1920; *Irishman* (Herbert Pim's paper), Jan. 1916 to 1920; *Irish World* and *Industrial Advocate* (Labour), Sept. 17 1918 to Dec. 1920; *New Ireland* (literary moderate Irish National), May 15 1915 to Dec. 1920; *Irish Citizen* (Mrs. Sheehy-Skeffington's paper), 1912; *Ireland* (Mr. Arthur Griffith), Oct. 16 1914 to Dec. 4 1914; *Liberator* (Independent Labour), Aug. to Nov. 1913; *Irish Freedom* (Mr. Dalton's Labour paper), Nov. 1910 to Dec. 1914; *Irish Looker* (Larkinite), May 27 1911 to Oct. 1914; *Toiler* (anti-Larkin), Oct. 1913 to Dec. 1914; *Dialogues of the Day* (Sheehy-Skeffington), July to Sept. 1906; *Honesty* (scurrilous), Oct. 16 1915 to April 22 1916; *Hibernian*, Nov. 6 1915 to April 22 1916; *Worker's Republic* (Larkinite), May 29 1915 to April 22 1916; *Gael* (Mr. Walker of Liffey Street), Jan. 29 to March 18 1916; *Scissors and Paste* (Mr. Arthur Griffith), Dec. 1914 to Feb. 1915; *Gaelic Athlete* (Mr. Walker of Liffey Street), Jan. 1912 to April 15 1916; *Spark*, Feb. 7 1915 to April 16 1916; *Searchlight* (anti-Larkinite), 1915–6; and *Fianna*, 1915 to Jan. 1916.

In Belfast, the *Belfast News Letter* remained the leading Unionist organ in Ulster, and was still in 1921 owned by the Henderson family and edited by Mr. W. G. Anderson. The *Belfast Evening Telegraph* and its subsidiary publications remained Democratic Unionist, under the direction of Mr. R. H. H. Baird and the editorship of Mr. W. Stewart. The only changes are in the case of the *Northern Whig*, also Unionist in its politics and catering for the support of the mercantile element. The interest in the paper formerly held by Mr. Kerr Smiley was acquired by the Rt. Hon. Samuel Cunningham and his brother, Mr. Josias Cunningham. The editorship was in 1921 in the hands of Mr. R. J. Lynn as managing director. The evening *Ulster Echo* was merged in the *Witness*, the weekly organ of the Presbyterian Church, published by the Belfast Steam Printing Co., Ltd. The daily *Irish News* was still in 1921 Constitutional Nationalist, a supporter of the old Irish Nationalist party and of Mr. Joseph Devlin. It was in 1921 the only daily paper in Ireland flying the old Nationalist flag.

In Cork, the proprietorship of the Unionist *Cork Constitution* remained as before; and it was edited in 1921, in succession to the late Mr. W. J. Ludgate, by Mr. J. J. Sullivan. It was owned by the same company, of which Mr. H. L. Tivy is managing director, as the Dublin papers, the *Daily Express* and the *Evening Mail*. The *Cork Examiner* and the *Cork Evening Echo* were still in 1921 owned by the Crosbie family. In 1912 the editor, Mr. Michael B. O'Neill, died and was succeeded by Mr. John C. Healy. The *Cork Examiner*, after the election of 1918, became a moderate Sinn Fein organ. In Dec. 1919 it published a denunciation of murder and outrage by the Roman Catholic bishop, but it refused to insert a reply from the leaders of militant Sinn Fein. On the night of Dec. 24 the office was invaded by armed men who put most of the printing and typesetting machinery out of commission. The *Cork Examiner* did not stop publication, but the *Cork Echo* was reduced to one edition a day for several weeks and the weekly *Cork Examiner* stopped for one week. The proprietors, Messrs. Crosbie & Co., Ltd., were awarded £14,970 for malicious damage.

The following Dublin papers were published during the rebellion of Easter 1916:—

April 24 1916—*Irish Times*, *Freeman's Journal*, *Express* and *Independent*.
April 25 1916—*Irish Times* and *Independent*.
April 26 1916—*Irish Times* only.
April 27 1916—*Irish Times* only
April 28 1916—No paper.
April 29 1916—No paper.
April 30 1916—Sunday.
May 1 1916—*Irish Times* only.
May 2 1916—*Irish Times* only.
May 3 1916—*Irish Times* and *Express*.
May 4 1916—*Irish Times*, *Express* and *Independent*.
May 5 1916—*Irish Times*, *Express*, *Independent* and *Freeman's Journal*.

The Press and the War.—The effect of the World War on the press in all countries was tremendous, though perhaps in Great Britain it was felt less than in any other of the belligerent nations. Proprietors, like everyone else, were alarmed, not knowing what might happen, and in some cases as a precautionary measure staffs were reduced to a minimum. Economy in working expenses was essential, for it could be prophesied with certainty that if the war lasted for any considerable time paper would become scarce, and the scarcity would result in a very heavy rise of the cost. When this happened newspapers reduced their size, and presently, perforce, raised the selling price. The halfpenny press entirely disappeared. There was, naturally, a great outbreak of "propaganda" in the press. In neutral countries the papers had a difficult course to steer, for they had to stand for the war aims of their country, and were wooed by propagandists on either side. Some of the belligerents went so far in their efforts to secure public opinion as to purchase existing organs or to found new ones. For instance, an interesting chapter could be written on the German activities in this connexion, which were especially rampant in Holland and the Dutch Indies, Spain and the S. American republics. In the belligerent countries, proprietors and editors were confronted with a different, but equally difficult, task. They, for the most part, realized that it was their duty—and on the whole admirably they did it—to keep up the spirit of the people at home and to discourage the enemy. As a rule, British proprietors and editors acted with great discretion and did invaluable service in many ways, putting their duty to their country before their own interests. In the early days of the war the Newspaper Proprietors' Association acted as a medium between the Government and the press. Presently a very important body was formed by this association called the "Newspaper Conference," which included every newspaper interest in the United Kingdom. Of this Viscount Burnham and Lord Riddell, both of whom did most admirable work during the war in connexion with the press, were president and vice-president respectively. The conference met week by week and carried on the whole of the negotiations between the Government and the press. Its sphere of usefulness was presently extended. It is well worth while to note that during the whole period of the war the British press was represented by a voluntary organization, which rendered most valuable and important services to the country. This was the first time that the whole press acted together, and its unanimity, when the diverse interests and opinions are considered, was remarkable. The "Newspaper Conference," was, of course, an emergency measure, and dissolved when the war was over.

In the British Isles, as in other countries, an Official Press Bureau was established (*see* CENSORSHIP). The regulations regarding the press defined what might not be published. It was open to any paper to publish what it thought fit, subject to liability to prosecution. The Press Bureau had no power to prevent publication. It issued news; it censored cablegrams and certain telegrams; it would read articles submitted to it and approve them for publication or refuse to give sanction. The effective steps taken by the Government to ensure accuracy in the press and the non-publication of dangerous matter were (1) the regulations, (2) the Press Bureau, and (3) the censors at the front. The main object of the regulations was to prevent information unwittingly being given to the enemy; a secondary purpose was to prevent inaccurate information being given to the public at home. In these matters the press certainly required guidance. No journalist, however able, could from his chair in Fleet Street form an accurate judgment of the value of, say, a certain action in Flanders or France or on the other fronts, which might or might not be a part of a concerted plan or even a feint. The printing of an apparently harmless piece of news might be of the greatest value in one way or another to the enemy, who studied the press of all countries with the greatest care.

Some newspapers printed statements or articles that were indiscretions, and some few papers and a journalist here and there were prosecuted. It was in the nature of an anomaly that the power of prosecutions rested, not with the directors of the Press Bureau, but with the director of Public Prosecutions. All that the directors of the Press Bureau could do, as, indeed, any citizen could, was to call the attention of the director of Public Prosecutions to an apparent breach of a regulation. A detailed account of the Bureau appeared in 1920, under the title of *The Press in War Time*, written by the late Sir Edward Cook, who, during the greater part of its existence, was a co-director with Sir Frank Swettenham. Immediately on the cessation of hostilities the Bureau ceased to operate.

War Correspondents.—At the beginning of hostilities the British military authorities would not allow newspaper correspondents in the war-zone, but they appointed an official "Eye-witness," whose report was furnished to the press. Owing to the representations of Lord Riddell, who was supported by Viscount Northcliffe and Viscount Burnham, Lord Kitchener, then Secretary of State for War, consented to allow six press correspondents to be accredited to G.H.Q. in France during the first week in May 1915. The original intention was that they were only to be there for a limited period, but, as a matter of fact, they remained until the Armistice. The reports of the correspondents were, of course, subject to censorship, and, though mistakes were made by the military censors, it is, as Lord Riddell has said, surprising that the system worked as well as it did, considering that the work was done by people without any previous experience and without any established principles to guide them. In France the supervision was especially strict. The correspondents were entirely in the hands of officers delegated for the purpose, who arranged everything for them, sending them in cars, always accompanied by a staff officer. Facilities on the other fronts were more easily obtained. On the Italian front, for instance, the accredited correspondents had cars, and went where they chose, without press officers in attendance. Everyone wore officer's uniform, with Sam Browne belt, and without rank badges, but with an ornamental "C" on the service cap. The principal war correspondents at the British front in France were Sir H. Perry Robinson and Sir W. Beach Thomas (*Times* and *Daily Mail*), Sir Philip Gibbs (*Daily Chronicle*), Sir Percival Phillips (*Daily Express*), and Sir Herbert Russell (Reuter's Agency). These gentlemen received the honour of knighthood for their services at the front. The above were known as "The Big Five," and were there most of the time, whereas the other papers had representatives there only occasionally, such as Messrs. H. W. Nevinson and H. M. Tomlinson. On the French front in France were Mr. Gerald Campbell (*Times* and *Daily Mail*), Mr. H. Warner Allen (*Morning Post*), Mr. Martin H. Donohoe and the late Mr. G. H. Perris (*Daily Chronicle*), and Mr. Lester Lawrence (Reuter's Agency). On the Italian front were Mr. J. M. N. Jeffries (*Times* and *Daily Mail*), Mr. H. Warner Allen (*Morning Post*), Mr. Percival Gibbon (*Daily Chronicle*), Mr. G. Ward Price (Newspaper Press Association), Mr. E. H. Lacon Watson (Reuter's Agency), and Mr. Julius Price (Central News Agency). Other war correspondents were Mr. Ashmead-Bartlett, Mr. W. T. Massey, Mr. Prevost Battersby and Mr. Guy Beringer.

AUTHORITIES.—Mitchell's, Sell's and Willing's Press Directories; H. Simonis, *The Street of Ink* (1917); Sir Edward Cook, *The Press in War Time with some account of the Official Press Bureau* (1920); Paul Dehn, *England und die Presse* (Hamburg, 1915); *The Newspaper World* (weekly); "The Relation of the Press and the Army in the Field," an address delivered by Lord Riddell at the Royal United Service Institution, March 25 1921; private information.

(3) FRANCE.—In recent years the French press, though its technical advance has in certain respects been comparatively small, its printing being on the whole inferior to English, and photographic reproduction having not made such improvement as in England and the United States, has shown a remarkable statistical progress. By the end of 1916 there were in France 3,780 newspapers, as compared with 1,800 40 years previously. Of these, four, namely the *Petit Parisien* (about 2,000,000), the *Matin* (1,870,000), the *Journal* (1,400,000), and the *Petit Journal* (1,050,000), reached, by the end of 1920, the exceptionally large circulation of over one million copies daily—a figure which one or two other papers, such as the *Echo de Paris* (850,000), nearly approached.

In 1910 the pioneer illustrated daily *Excelsior* was founded, but although well produced it did not attain the popularity of similar papers in England, its circulation at the end of 1920 being 200,000. Other leading papers established between 1910 and the beginning of the World War were: *L'Homme Libre* (1913), established as the personal paper of Georges Clemenceau; *La Bataille Syndicaliste* (1910), the Syndicalist daily; *Le Bonnet Rouge* (1913), also an extreme Socialist paper; and *Paris Midi* (1912), a paper which quickly obtained a large boulevard circulation.

The part played by French journalism during the World War forms a very interesting story. The opening of hostilities naturally created very great difficulties. Before a shot was fired the *Humanité* lost its director, Jean Jaurès, assassinated on Aug. 1, and in the Paris press in general for the first two weeks the utmost confusion prevailed. Several newspapers suspended publication. The general mobilization robbed them of their staffs, and the German threat to Paris and the measures for evacuation which were taken added to the difficulties, although the *Temps*, it may be noted, succeeded in moving its entire production to Bordeaux. It was only towards the end of 1914 that the position could be in any degree reëstablished. In 1915 publication went on practically unhindered, but from 1916 onwards the growing shortage of paper and the scarcity of metal for printing-presses resulted in numerous ministerial decrees curtailing the size of papers and fixing prices. All this added to the great difficulties under which newspaper production went on. Nevertheless, on the journalistic side the traditions of French writing were brilliantly maintained by several well-known writers. (*See* A. de Chambure, *Quelques Guides de l'Opinion en France pendant la Grande Guerre.*) Such outstanding writers as Maurice Barrès and the military critic, Marcel Hutin, in the *Echo de Paris;* Charles Maurras and Léon Daudet in the *Action Française;* the military critic, formerly dramatic critic, Henri Bidou, in the *Journal des Débats;* Auguste Gauvain in the *Journal des Débats;* Joseph Reinach (d. April 1921), writing over the signature "Polybe" in *Figaro*, all accommodating their party views to the *union sacrée*, guided French opinion daily on the political and military situation. Gustave Hervé, preacher of the class war, became a fervent patriot, and the title of his paper was changed from *La Guerre Sociale* to *La Victoire*. Georges Clemenceau, early in difficulties with the censorship on account of his outspokenness and his attacks on the Government's preparations for the war, changed the title of his paper to *L'Homme Enchaîné*, from which it was re-transformed to *L'Homme Libre* on his succession to the presidency of the Council.

What party activity there was in France as regards the press during the war centred round the extreme socialist papers and the person of M. Caillaux. In June 1917 this politician, or a number of persons favourable to his policy (the *Ligue Républicaine*) founded a daily paper, *Le Pays*, with the object of furthering his ideas. Its editor was Dubarry, formerly of the *Bataille*, and in general the paper stood far to the Left. The radicalism and pacificism of the *Bonnet Rouge*, with which M. Caillaux' name had also been associated, were even more pronounced, and a series of sensational revelations was followed by a press campaign by papers of the Right, the burden of whose charges was that the paper was in German pay, which ended with the death in prison, in Aug. 1917, of the editor, Almeyréda, a former anarchist. Equally sensational revelations were made concerning the alleged German attempt during the war to buy *Le Journal* from the French senator, Charles Humbert, who acquired control in 1915 and acted as economic and financial editor until Dec. 1917. This scandal ultimately ended in the execution of the principal German agent in the affair, Bolo Pasha.

Apart from the papers mentioned the principal French newspapers founded during the war were the *Journal du Peuple*, a weekly paper from Feb. 1916 to Jan. 1917, when it became a daily; *Le Populaire du Centre*, a weekly published at Limoges, turned into a daily in April 1918, under the editorship of the Socialist leader, Jean Longuet. Both of these papers represented the minority Socialists, that is to say, the Zimmerwaldian or anti-Nationalist view. The patriotic Socialist group founded *La France Libre* in 1918; and in Sept. of that year there was established the extreme Nationalist *Démocratie Nouvelle*, a paper which distinguished itself for its violent anti-German campaign and advocacy of further occupation of German territory in 1920 and 1921.

Among French reviews the *Revue des Deux Mondes*, the *Mercure de France* (monthly instead of fortnightly), the *Revue Hebdomadaire* and *Le Correspondant* appeared throughout the war. The important literary review *Nouvelle Revue Française*, in which works of leading writers such as Paul Claudel first appeared, was forced to suspend publication, but reappeared after the establishment of peace. In 1920 was established the Nationalist review *La Revue Universelle*, and in 1921 *La Revue de France*.

AUTHORITIES.—A. de Chambure, *À Travers la Presse* (Paris, 1914); *Annuaire de la Presse française et étrangère et du Monde Politique* (Paris, 1920); private information.

(4) GERMANY.—The practice which Bismarck began of maintaining close relations with certain German papers and using them to further his policy was continued under Caprivi, who even extended it, since, although Bismarck confined his attention to papers of the Right, his successor on occasion used the Democratic papers. It is true that, apart from the official *Reichsanzeiger* (corresponding to the *London Gazette*), the *Norddeutsche Allgemeine Zeitung* was the only openly acknowledged governmental paper, but numerous other papers were constantly to be found expressing Government policy in their columns. This was brought about, when the occasion demanded, by the supply of material for articles from the particular Government department concerned. The Foreign Office, although playing by far the most important part in this inspiration of the press, was not by any means the only Government department with a newspaper side to its organization.

This system, by which all leading departments of State were kept in touch with the press, was greatly extended after the outbreak of the World War. The institution of the censorship and the penalties which attended the infraction of the regulations gave the Government very wide negative powers, and, in addition, positive work with the press was very much more thoroughly undertaken. The Government press organization was centralized in the *Kriegspresseamt*, and there presided over it until 1916 Herr Otto Hamann (see his reminiscences, *Der Neue Kurs* and *Zur Vorgeschichte des Weltkrieges*), who had served in a similar capacity under Bismarck and Caprivi. It was the function of this central office not only to control the working of the censorship, but also to supply material for articles, give the "directives" to the German newspaper press as a whole, and ensure, so far as seemed desirable, the uniformity of treatment of all current political, military, naval and economic questions. The party political sympathies of individual papers were, as a rule, not interfered with, and throughout the war such a paper as the *Berliner Tageblatt*, for example, found opportunity of expressing views on such questions as the annexation of Belgium, which appeared to be opposed to the policy of the General Staff, and in any case in violent disagreement with the papers of the Right. Certain individual reviews, also, such as Maximilian Harden's *Zukunft*, took—and at times seemed deliberately to be allowed to take—views which might have seemed almost subversive of the Government's policy. But on the whole a certain general discipline was maintained practically until the end of the war. (For a full account of the way in which the system worked, see *Wie wir belogen wurden*, by Dr. Kurt Mühsam.)

There was increasing complaint against the censorship and governmental control generally in the Radical and Socialist papers, but the majority of the press accepted the restraints patiently, and several, as, for example, the *Hamburger Fremdenblatt*, of which an edition in numerous languages was produced for propaganda purposes, lent themselves or their correspondents readily to that elaborate German propaganda organization during the war, whose ramifications were to be found in every country.

As might be expected, the lines of party divisions in the press were not so sharp during the war as before, but they were by no means obliterated. The interests of the Conservatives were principally represented by the *Deutsche Tageszeitung* (Berlin), with its preoccupation with the East and the claims of the German landowning classes, and the *Neue Preussische Zeitung* (or *Kreuz Zeitung*, Berlin). The chief Free Conservative paper was *Die Post*. Nonparty Nationalism and Annexationism were voiced by the *Tägliche Rundschau* (Berlin); the annexation policy was also advocated, for obvious reasons, by the *Rheinisch-Westphälische Zeitung*, which in party politics is National Liberal. Other National Liberal organs were: the *Kölnische Zeitung*—the most important of them all, the *Leipziger Neueste Nachrichten*, *Hamburger Nachrichten*, *Berliner Neueste Nachrichten*, and *Düsseldorfer Neueste Nachrichten*. Among newspapers with no particular party axe to grind, although mainly reactionary and jingo in foreign politics, were the *Deutsche Zeitung* and the *Lokal-Anzeiger* (Berlin), which has a second daily edition published under the title, *Der Tag*, chiefly noteworthy for its sensational news stories and the open platform it provided for the expression of all kinds of opinions; other papers of the Jewish Ullstein group were the *Berliner Morgenpost*, *Berliner Zeitung am Mittag* and the *Vossische Zeitung*. This last, under the foreign editorship of Georg Bernhard, chiefly distinguished itself by its advocacy of the so-called "*Kontinentalpolitik*," that is, the formation of a continental *bloc*, under German leadership, against Great Britain and the United States.

During the war, and afterwards, the Centre party continued to be represented principally by *Germania* (Berlin) and the *Kölnische Volkszeitung*, and by the *Bayrische Kurier* (Munich) in Bavaria. The *Frankfurter Zeitung* and the *Berliner Tageblatt* held their place as the two chief Radical papers, the former maintaining its technical excellence, the latter continuing under the editorship of Theodor Wolff. In both Jewish influences remained predominant. The Social Democratic press shared in the difficulties and dissensions of the Social Democratic party during the war. *Vorwärts* was suppressed for a short time by the censorship, but was later allowed to reappear conditionally. When the divisions between the majority and minority increased, the staff of the paper sided with the latter, and it was only after a struggle that the majority succeeded in recapturing the paper for their views. At the end of the war, the division in the ranks not having been closed up, the minority or Independents founded *Die Freiheit*, while their members still further to the Left—later to issue as the Communist party—established *Die Rote Fahne*. Other after-the-war changes worth noting were the disappearance of the *Norddeutsche Allgemeine Zeitung*, which reappeared as a non-official paper entitled *Deutsche Allgemeine Zeitung*, later to be drawn, with several other papers, into the orbit of the industrialist magnate, Hugo Stinnes.

The chief German reviews at the end of 1920 were: the *Preussische Jahrbücher* (from the editorial chair of which Dr. Hans Delbrück retired in 1920), the *Neue Rundschau*—predominantly literary; but with occasional important political articles, the Conservative *Deutsche Politik* and *Grenzboten*, the Democratic *Demokratisches Deutschland*, the Radical *Hilfe* (whose editor, Friedrich Naumann, died during 1920), the Socialist *Neue Zeit* and the Nationalist-Socialist *Sozialistische Monatshefte* and *Die Glocke*.

A very considerable number of German newspapers were produced by the German armies on all fronts during the war, of which the best known was the *Liller Kriegszeitung;* the *Gazette des Ardennes* was a German propagandist newspaper issued for the population in the occupied French districts. A complete hand-list of German newspapers, with particulars of place, date of publication and so forth, was issued by the *Kriegspresseamt* in 1917 under the title *Handbuch Deutscher Zeitungen*, edited by Oskar Michel, a supplement to which appeared in 1918. For the Socialist press reference may be made to Mr. Edwyn Bevan's book, *German Socialism during the War* (1919).

(5) ITALY.—From 1911 onwards the press in Italy increased largely in numbers and influence. In 1917 there were 807 political newspapers, of which 119 were dailies. Most of these were, it is true, chiefly of local importance and not read widely

outside the city in which they were published, as, for example, *Il Lavaro* in Genoa, *Il Mattino* in Naples, *La Nazione* in Florence, and *Il Reste del Carlino* in Bologna. It is further true that, on the whole, the *Corriere della Sera*, which had by 1917 increased its circulation to 600,000 copies, remained the only universally read paper in Italy. Of late years, and in particular during the World War, the provincial character of a large part of the Italian press, arising from the fact that Italy's unification was of so recent a date, certainly tended to diminish. Certain newspapers, well established in their own cities, attempted to extend their distribution, as, for example, the *Giornale d'Italia* and *Messaggero* of Rome, both of which issued South Italian editions, while at the same time new papers were founded and took their place in the ranks of those journals most entitled to represent the various elements of Italian public opinion.

Shortly after the beginning of the war, for example, the *Idea Nazionale*, which was established in 1911 as the weekly organ of the Nationalist party, was turned into a daily, and later became the principal advocate in the press of the far-reaching claims on the Adriatic and elsewhere, associated with Gabriele d'Annunzio. The opposition of the official Italian Socialist party to participation in the war led also, at the end of 1914, to the foundation of *Il Popolo d'Italia*, which played a prominent part in the Inter-Conventionist campaign in 1915. Two other daily papers established during the war are *Il Tempo* and *L'Epoca*, both published in Rome.

The classification of the Italian press according to party divisions is not practicable. Only two parties, the Socialist and the Catholic *partito popolare*, founded shortly after the end of the war, are organized to any considerable extent and each has its party organs, the former having the *Avanti* of Rome and Milan for a daily and *La Critica Sociale* (Milan) as a fortnightly review; the latter, the papers of the so-called Catholic Trust, chief of which are the *Corriere d'Italia* (Rome), *Italia* (Milan), *L'Avvenire* (Bologna), and *Il Momento* (Turin).

The remaining Italian newspapers can in general only be distinguished individually or according to the politician they support. Thus, in Rome, *La Tribuna*, which was Giolittian, was opposed by *Il Giornale d'Italia*, which upheld the policy of Baron Sonnino; and in Turin the Giolittian *Stampa* had as a rival the *Gazzetta del Popolo*. The most important Radical paper is *Il Secolo* (Milan), whose Roman counterpart is *Il Messaggero*.

In addition to the newspapers already mentioned, the following deserve notice: In Milan, *La Perseveranza*, *La Sera* and *Il Sole*, the last of which specializes in economics and finance; in Venice, *La Gazzetta de la Venezia;* in Genoa, *Il Secolo XIX*.

There are a considerable number of excellent Italian reviews, of which the most important are the fortnightly *Nuova Antologia*, the Catholic literary review *Vita e Pensiero*, *La Critica* of Naples, the philosophical, historical and literary review edited by the philosopher Benedetto Croce, the political review *L'Unità*, the political and literary *Rassegna Italiana*, the cultural paper *Il Marzocco* of Florence, and the two purely literary reviews, representative of the younger Italian writers, *La Voce* and *La Ronda*.

A complete list of Italian papers, together with other information concerning the Italian press, is given every year in the *Annuario della Stampa*, published at Rome.

(6) SWITZERLAND.—During the World War Switzerland became an important centre from the point of view of the press. The geographical position of the Confederation made it the propagandist cockpit of Europe, and not only the leading nations but all the small peoples with a cause to advocate, such as Georgians, Lithuanians, Ukrainians, took care to see that their arguments were presented in the Swiss press or in newspapers specially established for the purpose. After the war had been proceeding for some time the Federal Council found it necessary to curtail the supplies of paper and prohibit the foundation of new papers, while their Government regulations sought to prevent the Swiss press from controverting the official policy of strict neutrality with regard to the various Governments engaged in the war. This did not prevent open expression of sympathy with one side or the other on the part of practically all Swiss newspapers. The French-Swiss were on the whole pro-French and pro-Entente generally, although certain of the more important—such as the *Journal de Genève*, whose wide continental circulation and reputation were even more increased—did not forget to be Swiss first. In German-speaking Switzerland German propaganda was from the beginning extremely active in the press, but the most responsible papers, in spite of a certain admiration for German institutions and culture, remained, generally speaking, open-minded. The *Neue Zürcher Zeitung* in particular deliberately adopted the policy of opening its columns to both sides, and was in consequence widely read outside Switzerland, particularly in Germany and Austria, a statement which may be applied also to the *Basler Nachrichten*, *National Zeitung* (Basel) and the *Bund* (Bern).

In addition to those named the following were the most important Swiss papers at the end of 1920: *Tribune de Genève*, *Gazette de Lausanne; Züricher Post*, *St. Galler Tagblatt*, *Vaterland* (Lucerne), the leading German-Swiss Catholic papers; *Berner Tagwacht*, *Zürcher Volksrecht* and *Basler Vorwärts* (three of the most important Social Democratic daily papers); *Gazzetta Ticinese* (Lugano), *Il Dovere* (Bellinzona).

The chief reviews were, in French-speaking Switzerland: *Bibliothèque Universelle* (Lausanne), *Semaine Littéraire* (Geneva), *Revue Romande* (Lausanne), and the *Revue de Genève*, founded in 1920. During the war, too, the *Revue Politique Internationale*, which numbered among its contributors distinguished writers from all countries and was founded in Paris a few months before the war, was transferred to Lausanne, where it continued to appear until the Armistice in 1918. Among German-Swiss reviews may be named the fortnightly *Wissen und Leben* (Zürich) and the monthly review of literature and art, *Schweizerland* (Coire).

L'Annuaire de l'Association de la Presse Suisse (*Jahrbuch des Vereins der Schweizerischen Presse*) is the standard work of reference on the subject. (L. M.)

(7) UNITED STATES

In 1920 there were fewer newspapers in the United States than in 1900, but their circulation was very nearly twice as great. It was estimated in 1920 that there was then published every day one copy of a daily newspaper for every fourth inhabitant, including children, illiterates, and the mentally incompetent. The first decade of the century had been one of constant growth in the number of newspapers as well as in circulation; it was also the period which saw the culmination of the conditions introduced into American journalism by the sensational or "yellow" press.

In 1921 it could hardly be said that confidence in the press had largely increased among American readers, or that it had regained that older editorial influence, the loss of which was so generally admitted. The older generation, to whom the New York *Tribune* meant Horace Greeley, the New York *Sun* Charles A. Dana, or the Chicago *Tribune* Joseph Medill, had seen the golden age of American journalism. With the growth of the newspaper audience, both the character and influence of the newspaper had altered. The dominant factor in successful newspaper editorship had become either the exploitation of news or the promotion of profits, principally through advertising. Where the newspapers had become corporate properties with what might be called "absentee" owners, these conditions were aggravated. Nevertheless a reaction for the better was already noticeable during 1910–20. One of the influences which helped it was the very agency to which much of the demoralization of the press was commonly attributed, namely advertising.

In 1914, according to the Government census figures, the total amount derived by American newspapers from subscriptions and sales was $99,541,860, while the advertising revenues were nearly double this amount, the exact figure being $184,047,106. One of the clearest evidences of the actual influence of advertising was in the changing attitude towards circulation. Mr. Whitelaw Reid, for many years editor-in-chief of the New York *Tribune*, wrote in 1900 that a great circulation, no matter among what classes, was then regarded as the only evidence of success and the only way to make a newspaper sold below cost ultimately a source of profit. That was perhaps a natural theory to adopt in the days when the potency of advertising on a large scale was first being tested and exploited. Its fallacy was discerned even then by far-sighted publishers and advertisers. That the interests of advertising did not lie exclusively in a large circulation was perceived as early as 1891 by Mr. Adolph Ochs, who not only profited greatly by his discovery, but in his administration of the New York *Times* set an example which was of salutary effect throughout the country. In a speech delivered before the National Editorial Association, Mr. Ochs, then the proprietor of a newspaper in Chattanooga (Tenn.), said: "It is not alone the circulation that the newspaper has that fixes its value as an advertising medium. It is more the character and standing of its readers, the appearance of the paper, its news features, its editorial ability and its general standing in the community." That was in 1891, the very moment when the "yellow" press was making its first success. Five years later Mr. Ochs acquired the New York *Times*, and set about to rebuild it, a task of formidable proportions, for the *Times*, in spite of an honourable history, was then struggling along with a circulation of hardly more than 10,000. Within 20 years the *Times* had built up a circulation of 325,000 (1916) and its total annual revenue was in the neighbourhood of $5,000,000, two-thirds from advertising.

The encouraging example of the New York *Times* and a few other newspapers, notably the Chicago *Daily News* and the Kansas City *Star*, was coincident with an advance in the theory and practice of advertising which had widespread results. It came to be seen that the effect of an advertisement was influenced to a large degree by the character of the newspaper in which it appeared, and that an incredulous reader of the news columns was likely to be an incredulous reader of the advertisements. Experience also showed that the character of the circulation was quite as vital as its extent.

Thus the influence of advertising, coupled with a natural desire for prestige and authority, served to act as a corrective for some of the worst evils that had been noted in the American press. Towards the end of the decade there was a marked improvement in the accuracy and impartiality of the news columns.

During the World War, most valuable work, particularly in aiding the Government, was done by the American press. In promoting the draft and Liberty Loans, the newspapers gave notable assistance. Mr. J. M. Lee (*American Journalism*, 1917) notes that the outbreak of the war temporarily at least revived an interest in the editorial; he adds that "once again American journalism found itself divided into two groups, one which was pro-Ally, the other which was pro-German." As a matter of fact, the English-language pro-German press was relatively insignificant and lacking in influence, even at the beginning of the war, and to speak of the other press, the truly American press, as pro-Ally in the same sense that the pro-German newspapers were pro-German is false. The pro-German press put German interests above all other interests, American as well as Allied, while it could not be said that the American newspapers, even though largely committed to the Entente cause, ever proposed a sacrifice of American rights and principles. The distinction is important, because it explains why much German propaganda failed. German interests, for example, advanced funds for the purchase of an English-language newspaper in New York, but as soon as the heavy hand of German propaganda was seen in its news and editorial columns it fell into disrepute.

The German-language press, which during the period of neutrality had sorely tried American patience, became after the United States entered the war a positive menace. "The bulk of the German-American press in this country," said the *Atlantic Monthly* in July 1917, "consists frankly of enemy papers," and there was a very natural demand for their suppression. Congress, however, preferred to rely on regulation, and various powers to this end were concentrated in the hands of the Postmaster-General by the laws of June 15 1917 (the Espionage Act) and Oct. 6 (the Trading with the Enemy Act). Under these laws seditious matter was made non-mailable, besides subjecting the publisher to heavy penalties, and the Postmaster-General was given extraordinary powers to determine what was mailable and under what circumstances. Foreign-language periodicals, for example, were required to file with the Postmaster-General translations of all articles commenting on the war unless by special licence they were absolved from this obligation. Another agency was also created to deal with questions of war news and opinion. This was the Committee on Public Information, appointed by the President shortly after the United States entered the war, which sought at the outset to impose a "voluntary censorship" on the press. Its activities, however, were chiefly devoted to spreading propaganda for the American cause.

Most of the German-language press avoided suppression or prosecution by adroitly disguising its known sentiments. The Espionage Act was, as a result, invoked mainly in cases such as that of the Milwaukee (Wis.) *Leader*, an English-language newspaper edited by Victor Berger. The Postmaster-General revoked the permit under which the paper was mailed as second-class matter on the ground that it had frequently violated the Espionage Act. In March 1921 the U.S. Supreme Court upheld the action of the Postmaster-General, and asserted the doctrine that this official was empowered at any time to deny future mailing rights to any periodical which had in the past contained articles that seemed to him unmailable. There was no question as to the anti-Government tendency of the *Leader*, but advocates of free speech saw in this and similar decisions a possible menace to the liberty of the press, especially if the same powers were to be exercised by the Postmaster-General in times of peace. The subject was exhaustively treated by Professor Chafee, of the Harvard Law School, in his *Freedom of the Press*, 1920 (see also Professor Chafee's article in 112 N.Y. *Nation* 428).

According to the census of 1914, the number of foreign language publications in the United States was about 1,450, of which the dailies had a combined circulation of 2,600,000 per issue, and the weeklies a circulation of 4,240,000, as against 1,786,000 for the dailies and 2,544,000 for the weeklies in 1909. There were in 1914 160 daily newspapers printed in more than 20 languages and dialects. Of these the German newspapers were most numerous. At the outbreak of the World War there were 55 German-language dailies with a circulation per issue of 823,000. Toward the close of the decade there was a marked decrease in the number of foreign-language papers, especially those printed in German. The total number of German papers declined from 490 in 1918 to 278 in 1920, but this decline was due in part to conditions which affected the entire newspaper industry.

The following table shows the extent of the foreign language press in 1920:—

The Foreign-Language Press.—(United States.)

Language	Total No.	No. of Dailies	Dailies, Total circulation per issue (Estimated)	No. of Weeklies	Weeklies, Total circulation per issue (Estimated)
Arabic	7	4	15,000		
Armenian	7	2	10,000	3	6,000
Bohemian	48	9	125,000	19	150,000
Chinese	7	4	25,000	3	15,000
Croatian	10	2	30,000	5	50,000
Czechoslovak	5	1	10,000	3	40,000
Finnish	24	6	50,000	6	40,000
French	47	9	50,000	22	75,000
German	248	26	500,000	166	1,000,000
Greek	15	2	67,000	10	50,000
Hollandish	13			11	40,000
Hungarian	28	3	105,000	18	90,000
Italian	103	11	300,000	80	325,000
Japanese	14	11	50,000	1	8,000
Lithuanian	17	4	50,000	8	40,000
Norwegian & Danish	52	2	30,000	36	200,000
Polish	77	18	400,000	53	600,000
Portuguese	23	1	4,000	9	25,000
Russian	9	2	70,000	4	55,000
Serbian	7	2	20,000	5	50,000
Slovak	28	6	75,000	20	225,000
Slovenian	15	3	26,000	7	45,000
Spanish	94	6	60,000	47	125,000
Swedish	55	..		40	525,000
Swiss	6			3	10,000
Ukrainian	10			4	15,000
Yiddish	37	13	600,000	22	375,000
Miscellaneous*	21	3	11,500	9	35,000
Total	1,027	150	2,683,500	614	4,214,000

* Includes Albanian (3), Bulgarian (1), Esthonian (1), Belgian-Flemish (2), Lettish (2), Hebrew (4), Ladino (Spanish Jew) (2), Persian (1), Rumanian (3), Welsh (2).

The war years brought about a serious crisis in the supply of newsprint. This commodity, which in 1873 cost 12 to 13 cents a pound and in 1880 6·92 cents, could be purchased in 1897 for 1·5 cents. Even in 1915 it could be bought for 1·91, but after that it went to higher prices than had obtained for 20 years, as the following table shows:—

Prices of Newsprint (cents per pound).

1913	2·01	1917	3·17
1914	1·95	1918	3·72
1915	1·91	1919	3·65
1916	2·03	1920	6·50

The newsprint manufacturers justified these prices on the score of increased cost of production, but to a large extent they were undoubtedly famine prices due to the inadequacy of the supply to meet an unparalleled demand. There were charges also of a conspiracy on the part of the producers to maintain high prices, and the Federal Trade Commission endeavoured at various times to ameliorate these conditions. A canvass made by a trade organ early in 1920 showed that only 25% of American newspaper publishers were then assured of an adequate supply of newsprint for the ensuing year. Of the remainder 20% could look forward to ¼ to ⅔ of their requirements, while 55% had no assurance of being able to get the newsprint they needed. Yet the production of newsprint in the United States and Canada was constantly increasing as the following figures indicate:—

Production of Newsprint.
(Tons)

1904	913,000	1915	1,728,000
1909	1,326,000	1916	2,000,000
1914	1,698,000	1919	2,183,000
1920	2,395,000		

Clearly the scarcity was created by the great increase in circulation following the outbreak of the war and by the enormous demand for advertising space. Not only had circulation doubled, but the number of pages in the average newspapers had been largely increased. In order to protect themselves certain newspapers began to acquire properties for the production of newsprint, but this was only possible for the strongest journals.

Shortage of newsprint was not the only difficulty encountered. To give a basis of comparison it is of interest to note some of the figures on cost of production for the New York *Times* for the year 1916. In that year, according to the publisher, the *Times* was employing 1,200 persons and had a pay-roll of $32,000 a week, which was about equally divided among the mechanical, the news and editorial, and the business and executive departments. With a circulation of 325,000 the paper consumed 100 tons of newsprint a day. Telegraph and cable expenses averaged about $100,000 annually, not including the cost of messages received through news agencies, nor of salaries and expenses of foreign correspondents. Cost of newspaper delivery exceeded $5,000 a week. In May (31 days) the combined issues of the *Times* aggregated 926 pages, of which 47·67% was advertising. As already noted the revenue from sales was about $1,500,000 annually, or approximately one-half the revenue from advertising. The total receipts from a single issue of the Sunday *Times* frequently amounted to $50,000. At this period the rise in production costs was just beginning to be felt by the newspaper industry. In 1921 it seemed possible that the figures of 1916 might again be typical if wages and prices, especially of newsprint, continued to decline. But in the period beginning somewhat before 1916 and ending with the close of the decade, there was the sharpest advance in prices ever known in the newspaper industry. These advances were summarized by the president of the American Newspaper Publishers' Association as follows: Newsprint, 232%; cost due to increased circulation, 28%; news and "features," 300%; ink, 75%; machinery, 50 to 100%; delivery service, 400%; printers' wages, 108%; pressmen, 102%; stereotypers, 94%; office help, 84%; drayage, 75%; freight, 107%; printing-press blankets, 150%; telephone, 15%; electric power, 90%; fuel, 40%. Costs as a whole were said to have risen 200%. To offset these increased costs both the selling price of the newspapers and advertising rates were advanced. After 1916 nearly all newspapers that had been one cent were advanced to two cents, and in 1919 and 1920 a great number of dailies, chiefly evening newspapers, went to three cents, a price which had not been general for more than 20 years.

Curiously enough these increases seemed to have had only a temporary effect in restricting circulation. It was thought that the close of the World War would cause a marked decline, but the increasing popularity of the newspaper seemed to have had less temporary foundations. New readers had been taught the newspaper habit, and many people began to buy more than one paper. These habits persisted even after the immediate occasion had disappeared.

This extraordinary circulation was rather a burden than otherwise until advertising rates could be adjusted to cover the expense. Ultimately, however, advertising rates were advanced nearly, if not quite, 100%, and in the meantime some newspapers, partly to save newsprint, arbitrarily restricted the size of their circulation. The stronger newspapers undoubtedly profited greatly during this period. On the other hand, the high production costs, coupled with the scarcity of newsprint, were the chief reasons for the decline in the number of newspapers and periodicals which began in the years 1916 and 1917. This decrease, together with circulation figures for the period, is shown in the following tables:—

Number of newspapers and periodicals in the United States.
(Based on Ayer's newspaper directories.)

	Daily	Weekly	Semi-Weekly	Monthly	Semi-Monthly	Miscellaneous*	Total
1810	27	282	37	..	..	15	361
1850	254	1,902	31	100	95	144	2,526
1900	2,200	15,681	515	2,328	261	256	21,235
1910	2,470	16,269	620	2,767	264	197	22,587
1913	2,483	16,266	601	2,879	361	387	22,977
1914	2,502	16,323	616	2,981	348	397	23,167
1915	2,494	16,091	605	3,064	341	445	23,040
1916	2,514	16,165	590	3,250	353	515	23,387
1917	2,465	15,635	532	3,261	358	591	22,842
1918	2,428	14,771	483	3,073	345	564	21,664
1919	2,398	14,008	487	3,156	360	603	21,012
1920	2,374	13,894	476	3,183	390	624	20,941

*Includes tri-weekly, bi-monthly, quarterly and other periodicals not included elsewhere in this table.

The number of towns and cities in which these publications were issued was as follows in the years indicated: 1914—10,985; 1916—11,035; 1918—10,461; 1920—10,160.

Circulation of daily newspapers in the United States.

		No. of dailies	Circulation per issue
1850		254	758,454
1900		2,235	15,102,156
1909		2,467	24,211,977
1914	Morning	794	11,692,368
	Evening	1,786	17,085,086
	Total	2,580	28,777,454
1920	Morning	625	11,700,000†
	Evening	1,749	18,300,000†
	Total	2,374	30,000,000†
1920—Sunday		600†	15,000,000†

† Estimated. The figure for the total number of daily newspapers in 1914 is that of the Government census and differs slightly from that given in the previous table. The circulation of weekly newspapers in the United States was in 1920 about 20,000,000.

The decline in weekly newspapers, for the most part published in country towns, was greatest, but many daily newspapers were also forced to suspend or to effect mergers with rival journals. In some instances the opportunity was grasped by men who had made a success in other fields to acquire newspaper properties. Thus, Frank A. Munsey, proprietor of *Munsey's Magazine* and other periodicals, purchased in New York the *Sun* (1916), the *Herald* and the *Evening Telegram* (1920). Eventually Mr. Munsey discontinued the *Sun* as a morning paper, that title being given to what was hitherto known as the *Evening Sun*, which he had also acquired. In 1919 the publishers of the Chicago *Tribune* started a daily illustrated paper in New York, the *News*, which in 1920 attained a circulation of more than 300,000. In Chicago the movement toward consolidation had begun earlier. The Chicago *Inter-Ocean*, which lost public support through its espousal of the Lorimer cause (*see* ILLINOIS), was purchased (1913) by the Chicago *Record-Herald*, and the two papers were consolidated under the name of the Chicago *Herald*. Later the *Herald* encountered financial difficulties and was purchased by William Randolph Hearst, who merged it with his morning newspaper under the name *Herald and Examiner*. For a time this left Chicago with only two morning newspapers, Mr. Hearst's organ and the *Tribune*. In 1920 a morning business daily, the *Journal of Commerce*, was started.

The changes occurring during the latter part of the decade might have been expected to foster a tendency toward grouping large numbers of newspapers under one ownership. Broadly speaking, no such development took place, and there was in 1921 no newspaper owner in America except William Randolph Hearst whose journalistic ventures were comparable in extent with those of (for example) Lord Northcliffe in England. Mr. Hearst established his group of newspapers largely between 1895 and 1910, and did not materially add to the number in succeeding years, although in 1913 he purchased the Atlanta *Georgian* and in 1917 the Boston *Advertiser*. Within the decade 1910–20 Mr. Hearst also entered the field of periodical journalism; by 1920 he had become proprietor of the *Cosmopolitan Magazine*, *Hearst's Magazine*, *Good Housekeeping*, *Harper's Bazar*, *Motor Magazine* and *Motor Boating*, as well as the 13 newspapers which constituted the Hearst group. The Scripps-McRae League, comprising about 22 newspapers in the middle west, was not increased between 1911 and 1920.

On the other hand, there was a marked tendency to form associations of newspapers for sharing the expense of gathering news and procuring pictures, "features," and similar material. The possibilities in this direction were illustrated somewhat earlier by the development of an enterprise known as the newspaper syndicate, which first acquires the material, usually fiction, special articles and comic pictures, and then sells publication rights to newspapers all over the country. S. S. McClure, who subsequently established *McClure's Magazine*, is said to have started the first newspaper syndicate about 1885. Besides these private enterprises many were undertaken by individual newspapers, while still others were controlled coöperatively.

Mechanical improvements in the production of American newspapers were largely in the direction of greater refinements of those inventions, such as the linotype composing machine and the rotary press, which had made the modern newspaper possible. One process, the rotogravure, introduced from Germany in 1912, afforded the means whereby the larger newspapers could produce supplements containing pictorial reproductions of excellent quality. It is a photomechanical process by which the illustrations are etched on a copper cylinder; impressions resembling photogravure can then be run off at the rate of 3,000 or more an hour. There were approximately 50 newspapers in 1920 which published rotogravure supplements, usually as part of their Sunday editions. With the multiplication of supplements of various kinds it became customary to print and distribute to dealers practically all of the Sunday edition except the distinctively news sections before the date of publication. After receiving the news sections the dealers would assemble them with the supplements which had been distributed in advance. In obtaining news great use was made of the wireless, especially as a substitute for the cable in transmitting messages from Europe.

The mechanical difficulty of making a rapid distribution over very large areas has been the chief factor in America in preventing the development of newspapers having a wide national circulation. It takes at least 20 hours for a New York newspaper to reach Chicago by railway, and to reach the Pacific coast requires several days. There have been, in addition, certain transportation difficulties imposed by the railways themselves; special newspaper trains are much less common than in England. The result has been the development of a strong newspaper press in practically all large cities, and this press naturally places more emphasis on local or sectional news than it would if its circulation were less restricted in area. A few journals are, of course, read beyond the local limits of quick distribution; some of them, indeed, enjoy a prestige that is nationwide. Yet even the New York *Times* had in 1921 a circulation throughout the country at large of only 73,600 (less than one-quarter of its total circulation). The percentage of outside circulation in the case of the Chicago *Tribune* was somewhat higher, but it was largely confined to the states immediately surrounding Chicago. If, however, papers of this character could be placed on sale in smaller cities everywhere at approximately the same time as the local newspapers, it is clear that they could enormously increase their circulation in all parts of the country. A national rather than a sectional circulation would ultimately have the effect of broadening the newspaper's scope and strengthening its editorial independence. The establishment of the Government airplane mail service after the close of the World War gave promise that this method of distribution might enable certain newspapers to achieve a truly national circulation. Such a development might conceivably be regarded at some future time as the greatest single advance in American journalism.

Periodicals.—The magazines and periodicals in the United States do not suffer from the handicap which has limited the circulation of even the great newspapers. A magazine can be printed several days and even longer before the date of publication; it can therefore be placed on sale all over the country at the same time. As a consequence American periodicals have taken the whole nation for their field, and a single magazine will have nearly as large a circulation in the west as in the east. In this development the magazines were favoured greatly by an extremely low second-class mailing rate, which up to 1917 was a cent a lb. though the expense in carrying this matter was rarely less than eight cents a lb., at which rate books were carried. The result was a loss to the Government amounting to many millions annually on magazines alone, a loss which was defended on the score of fostering education and national unity. The War Revenue Act of 1917, however, largely increased the rates applicable to periodicals, in spite of considerable protest. The new rates were graded according to the proportion of space devoted to advertising, and annual increases were provided for each year up to 1921, when a maximum was reached. This maximum involved a general rate of one and a half cents a lb. for reading matter, and special rates for that part of the magazine devoted to advertisements ranging from two cents for the first and second zones to 10 cents for the eighth zone, these zones being fixed according to the distance from the post-office at which the magazine was mailed. Even these rates had not, in 1920 at least, materially affected the prosperity of the magazines, though efforts were still made to change them. In the meantime the conditions favourable to the establishment of national magazines likewise tended to discourage local efforts, with the result that at the close of the decade 1910–20 nearly all the more important magazines were published in New York. The most notable exceptions were the *Atlantic Monthly*, published in Boston, and the Curtis publications, *Ladies' Home Journal*, *Saturday Evening Post* and *Country Gentleman*, in Philadelphia.

The development of the popular magazine in the United States was almost coincident with the development of the sensational newspaper. In both instances cheap paper, machine production and an ever-increasing number of readers were determining factors. The cheaper magazines benefited particularly by the invention of the process of photo-engraving which came into general use between 1890 and 1895; illustrations that had previously cost $100 and required a month's time could now be had for $10 and in one day. That period saw the beginning of a large number of magazine ventures, many of which, after various turns of fortune, still survived in 1920.

Had it not been for the national audience which the magazine could command it is quite probable that the popular monthly of the type of *Everybody's* (established 1899), *McClure's* (1893), and *Munsey's* (first issued as a monthly in 1891), would have seriously endangered the existence of the older and more distinctive literary magazines such as the *Atlantic*, *Harper's*, *Scribner's* and the *Century*. Yet of these periodicals the *Atlantic* was the only one to show a marked growth in circulation between 1900 and 1920. *Harper's*, for example, had less circulation in 1920 than in the latter part of the 19th century, although the quality and attractiveness of its contents showed no diminution. But magazines as a whole suffered no such neglect, for in the United States no home in which there is any pretext of intellectual interest is without magazines.

During 1910–20 a five-cent illustrated weekly, the *Saturday Evening Post*, began to surpass all others both in circulation and advertising returns. (In 1920 the *Post* had more than 2,000,000 circulation.) It was therefore widely imitated in the hope of duplicating its success. That success was apparently founded chiefly on a special variety of popular fiction, of which it publishes large quantities. In no previous period was so much space given to fiction by American magazines, and in no previous period were American magazines so thoroughly given over to mere entertainment. The editors seemed to have concluded with one accord that the public was tired of argument and instruction. As if to fill this void, there were started during the decade a number of weekly journals of opinion, of which the *New Republic* (1914), the *Weekly Review* (1919) and the *Freeman* (1920) may be mentioned. The *Nation* (founded in 1865), which had long occupied a unique position as a politico-literary weekly, entered into a new and distinctly radical phase during the decade; it was avowedly to combat these radical tendencies that the *Weekly Review* was undertaken by a group of men, some of whom had served on the staff of the old *Nation*.

Two serious reviews, comparable in character to the reviews of Great Britain, were started after 1910, the *Yale Review* in the following year and the *Unpopular Review*, later named the *Unpartizan Review*, in 1914. Both are quarterlies. Another new magazine of value to the student of affairs was the *Current History Magazine*, established in 1914 by the New York *Times*. The *North American Review*, among whose editors were some of the most famous names in American literature, celebrated its first centennial in 1915. Professor Brander Matthews expressed the opinion, 1918, that the literary level was higher than 50 years before.

A distinctive feature of the later development of American periodical journalism was the extraordinary success achieved by women's magazines. These enjoyed a steady growth without experiencing those vicissitudes of fortune which marked the history of other ventures. The *Ladies Home Journal* was a successful pioneer in this field. Characteristic also of the period was the growth of technical and trade organs, and the decline of the religious press.

REFERENCES.—Besides the works already referred to, the following may be mentioned: George Henry Payne, *History of Journalism in the United States* (1920); Upton Sinclair, *The Brass Check* (1920); W. G. Bleyer, *The Profession of Journalism* (1918); Jason Rogers, *Newspaper Building* (1918); Phil C. Bings, *The Country Weekly* (1917); Algernon Tassin, *The Magazine in America* (1916); James Bryce, *Modern Democracies* (1921) and Chapters on American Opinion. (H. B.*)

NEWTON, ERNEST (1856–1922), English architect, was born Sept. 12 1856. After having been at school at Uppingham, he entered the office of Norman Shaw, with whom he spent the following six years. Here in the company of a gifted band of young students the influence of this talented teacher made—as was evidenced more especially in Newton's earlier days—a strong impress on his trend of design, and helped to imbue him with that appreciative feeling for, and grasp of, English Renaissance domestic architecture which characterize his work. Established on his own account there fell to him much work of this special nature, for his province consisted almost entirely in the designing of new country houses or modifying or adding to existing ones. His few excursions into architecture of an ecclesiastical nature include the house of retreat and chapel for the Sisters of Bethany, and St. Swithin's church, Hither Green, the latter an interesting and successful departure from the normal plan, with a choir diminishing in width towards the east end. Newton's domestic work shows in its later phases more than in his first essays the influence of the architecture of the 18th century. Still, neither then nor earlier is it rigidly bound by tradition, but speaks an educated individuality. Amongst his houses are Buller's Wood, Chislehurst; Redcourt, Haslemere; Steephill, Jersey, a house set in an old and typical Jersey garden; and Ardenrun Place, Blindley Heath. His literary work includes *A Book of Houses* and—his particular *spécialité*—*A Book of Country Houses*.

In the first year of the World War, Newton's position as president of the Royal Institute of British Architects and his professional acquirements were utilized by the Government, and under the Ministry of Munitions and its Labour Department he was largely responsible in 1916, and entirely so in 1917, for dealing with the control of every type of constructional work, including such important undertakings as railways and electric schemes. He also, as expert adviser, considered claims for exemptions in the building trades generally—a post of great responsibility. He became R.A. in 1919, and was awarded a C.B.E. in 1920. He died in London Jan. 25 1922.

NEW YORK (STATE) (*see* 19.594).—The pop. of the state was 10,385,227 in 1920 as compared with 9,113,614 in 1910, a gain of 14% or 0·9% less than that for the United States. The average pop. per sq. m. in 1920 was 217·9 as compared with 191·2 in 1910 and 152·5 in 1900. In 1920 the urban pop. (in cities with 2,500 or more inhabitants) was 8,589,844 or 82·7% and the rural pop. 1,795,383 or 17·3 per cent.

The cities having a pop. of over 20,000 in 1920, and their percentage of increase 1910–20, are as follows:—

	1920	1910	Increase per cent
Albany	113,344	100,253	13·1
Amsterdam	33,524	31,267	7·2
Auburn	36,192	34,668	4·4
Binghamton	66,800	48,443	37·9
Buffalo.	506,775	423,715	19·6
Cohoes.	22,987	24,709	7·0*
Elmira . . .	45,393	37,176	21·9
Gloversville.	22,075	20,642	6·9
Jamestown .	38,917	31,297	24·3
Kingston	26,688	25,908	3·0
Lockport	21,308	17,970	18·6
Mount Vernon . . .	42,726	30,919	38·2
Newburgh	30,366	27,805	9·2
New Rochelle	36,213	28,867	25·4
New York	5,620,048	4,766,883	17·9
Niagara Falls . . .	50,760	30,445	66·7
Olean	20,506	14,743	39·1
Oswego	23,626	23,368	1·1
Poughkeepsie	35,000	27,936	25·3
Rochester . . .	295,750	218,149	35·6
Rome	26,341	20,497	28·5
Schenectady . . .	88,723	72,826	21·8
Syracuse	171,717	137,249	25·1
Troy	72,013	76,813	6·2*
Utica . .	94,156	74,419	26·5
Watertown	31,285	26,730	17·0
White Plains . . .	21,031	15,949	23·1
Yonkers	100,176	79,803	25·6

*Decrease.

According to the census report of 1916 there were 4,315,404 church members in the state, distributed as follows: Roman Catholic, 2,745,552, or 63·6%; Methodist Episcopal, 328,250, or 7·6%; Protestant Episcopal, 227,685, or 5·3%; Presbyterian, 222,888, or 5·2%; Baptist, 182,443, or 4·2%; Jewish, 113,924, or 2·6%; Lutheran, 73,581, or 1·7%; Reformed, 66,773, or 1·5%; Congregational, 65,021, or 1·5%; others, 289,287, or 6.7 per cent.

Agriculture and Stock-raising.—In 1919 New York ranked thirteenth among the states in the crops produced, the total value of farm products being $498,179,000. The state ranked first in the production of hay and potatoes. In 1910 the total number of farms in the state was 215,597 and the acreage 22,030,367, of which 67·4% was improved. In 1920 the number of farms had decreased to 193,060. In 1919 the state produced 6,579,000 tons of hay; 35,260,000 bus. of corn; 11,178,000 bus. of wheat; 29,580,000 bus. of oats; 2,486,000 bus. of barley; 1,932,000 bus. of rye; 5,126,000 bus. of buckwheat; 39,567,000 bus. of potatoes; 16,800,000 bus. of apples; 1,530,000 bus. of pears; 1,648,000 bus. of peaches; and 3,483,000 lb. of tobacco. The number of sheep in the state has been steadily decreasing. In 1910 there were 953,908; in 1920, 824,000. The state produced 4,022,000 lb. of wool in 1919. The dairy business is one of the most important. In 1920 there were in the state 1,493,000 dairy cows, a larger number than in any other state except Wisconsin. Other cattle numbered 909,000. There were 560,000 horses and 920,000 swine.

Minerals.—In 1916 New York ranked twentieth among the states in the value of minerals produced. The mineral products were valued at $45,783,230, as against $34,317,594 in 1911. The clay products were valued (1916) at $11,755,012; cement, $5,752,809; iron ore, $5,571,429; stone, $5,342,954; natural gas, $2,524,115; petroleum, $2,190,195; salt, $3,698,798; sand and gravel, $2,644,829. In 1918 the values were $6,568,746, cement; $5,673,131, natural gas; $5,802,870, iron ore; $3,307,814, petroleum.

Manufactures.—New York ranks first among the states in the value of manufactured products, and during the five years following 1909 the output increased rapidly. The 1914 census reported 48,203 establishments (1909, 44,935) with 1,057,857 wage-earners (1909, 1,003,981), receiving $631,042,000 and with a capital of $3,334,278,000. The cost of materials was $2,108,607,000 (1909, $1,856,904,000); the value of the product, $3,814,661,000 (1909, $3,369,490,000); and the value added by manufacture, $1,706,054,000 (1909, $1,512,586,000). The industries whose products were valued at more than $100,000,000 were:—

	Wage-earners		Value	
	1914	1909	1914	1909
Clothing	189,763	189,467	$583,942,000	$538,593,000
Printing and publishing . .	64,020	63,120	257,268,000	216,946,000
Foundry and machine shops . .	66,690	64,066	173,429,000	154,370,000
Slaughtering, meat-packing . .	6,641	6,110	148,105,000	127,130,000
Sugar refining	4,899		124,941,000	
Bread and bakery products	27,002		109,227,000	

There were in 1914 17 industries with products exceeding $50,000,000 in value, 21 with products between $25,000,000 and $50,000,000 in value, and 25 with products between $10,000,000 and $25,000,000—a total of 63 industries each with products valued at more than $10,000,000. The report showed 161 industries, each of which had a product valued at more than $1,000,000. In 1914, 87%, in 1909, 86·8% of the value of the manufactured products of the state was reported from cities and villages with 10,000 or more inhabitants. Of the 48,203 industrial establishments in the state in 1914, 29,621, or 61·5%, were located in New York City. More than one-half of the wage-earners and more than three-fifths of the value of the state's manufactured products were in both 1909 and in 1914 reported from New York City. Other important manufacturing centres were: Buffalo, with products in 1914 valued at $247,516,000; Rochester, $140,696,000; Yonkers, $67,222,000; Syracuse, $52,163,000; Schenectady, $48,762,000; Niagara Falls, $44,816,000; Troy, $39,929,000; Utica, $30,490,000; and Albany, $25,211,000.

Transportation and Commerce.—In 1915 the operated railway mileage was 8,824, the most important lines being the New York Central; the Delaware and Hudson; the Lehigh Valley; the West Shore; the Erie; the New York, Ontario and Western; the Pennsylvania; the Delaware, Lackawanna and Western; the Rutland; and the Long Island. In 1917 there were in the state 4,893 m. of electric railway which gave employment to 61,434 persons. These lines carried 2,492,325,233 revenue passengers. In 1920 there were 13,453 m. of improved roads in the state. During the previous year $17,761,545 was spent for highway construction and $6,219,190 for highway maintenance.

New York spent large sums for canal improvements. The improved Erie Barge Canal was opened from Troy to Buffalo in May 1918. The Champlain and the Oswego Barge Canals have also been completed. Up to April 1 1920 the total expenditure for canal improvements, under bond issues, since 1902 amounted to approximately $150,252,499. The canal mileage of the state in 1920 was: Erie Canal, 361; Champlain Canal, 81; Black River Canal, 89; Oneida Lake and Canal Feeder, 7; Oswego Canal, 77; Cayuga-Seneca Canal, 23; total, 638. The commerce on the canals suffered a rapid decline during the decade 1910–20. In 1910, 3,073,412 tons of products valued at $59,042,178 were carried; in 1915, 1,858,114 tons valued at $30,610,670; in 1917, 1,297,225 tons valued at $24,757,077; and in 1919, 1,238,844 tons valued at $43,972,603. New York ranks first among the states in commerce. In 1920, 5,014 vessels, with a total tonnage of 15,049,744, entered the port of New York and 4,588 vessels, with a total tonnage of 14,275,455, cleared. In that year the value of merchandise imported was $2,904,844,143. The value of domestic exports was $3,293,304,084.

Education.—The university of the state of New York, a supervising and examining institution, not one for teaching, is the State Department of Education. It is governed by 12 regents, one elected each year for a 12-year term by a joint ballot of the two Houses of Legislature. The board of regents elects the president of the university and the commissioner of education, both offices being held by the same person. According to the 1910 census there were in the state 2,454,428 persons between the ages of 6 and 20. Of these, 1,563,374 or 63·7% were attending school. In addition to these there were in school 55,773 children under 6 years of age, and 31,716 persons 21 years old and over, a total of 1,650,863.

The Thirteenth Annual Report of the Education Department, for the school year ending July 31 1916 contains the following summary of school attendance: common elementary schools, 1,454,514; special elementary schools, 940; common high-schools, 171,263; special high-schools, 4,152; academies, 53,461; normal schools, 8,125; teachers' training classes and schools, 4,422; universities, colleges, professional schools and other higher institutions, 56,116; private schools of all grades, exclusive of academies as enumerated above, estimated, 275,000; Indian schools, 842; evening schools, 173,878; evening vocational schools, 27,688; trades and vocational schools, 17,861; total, 2,248,262. The total number of teachers was 63,954, of whom 42,957 were employed in the common elementary schools. The net value of school property was estimated at $462,698,843.

During the school year ending June 1918 there were enrolled in the public schools 1,666,589 pupils. The daily average attendance was 1,299,535, and the average duration of school was 187 days. The total number of teachers was 59,187, of whom 52,508 were women. The total state expenditure for public schools was $81,058,361 (*see* also section *History* below).

Charities and Prisons.—The number of inmates in state institutions, almshouses, homes, reformatories, and schools for the blind and deaf, for the year ending June 30 1919, was: number in all institutions, July 1 1918, 62,540; number received during the year, 96,082; total supported, 158,622, of which number 142,417 were supported by public funds and 16,205 by private funds. The number discharged was 97,842. The number in state asylums and reformatories on June 30 1919 was 9,545. The State Hospital Commission, consisting of three members appointed by the governor and the Senate for 6-year terms, has the supervision of the state hospitals for the insane. On June 30 1919 there were 37,607 patients in the civil state hospitals; 1,422 in hospitals for the criminal insane; and 916 in private institutions; a total of 39,945. Of the 37,607 patients in the civil hospitals, 33,721, or 89·7%, were entirely supported by the state. The State Commission of Prisons, consisting of seven members appointed by the governor and the Senate, has supervision of all penal institutions. The pop. of the state prisons, reformatories, penitentiaries, county jails, and New York City institutions, on June 30 1919, was 11,016, and the total number of commitments to the various institutions during 1919 was 85,175. The state appropriated $36,604,579.57 for penal, charitable and curative institutions for the fiscal year ending June 30 1921.

Finance.—The total state debt June 30 1920 was $238,860,017, and the sinking funds amounted to $69,499,475, making the net debt $169,360,542. In addition, authorization had been granted for bonds amounting to $76,800,000, consisting of $45,000,000 soldiers' and sailors' bonus bonds, $6,800,000 barge canal bonds, $20,000,000 highway improvement bonds and $5,000,000 state forest bonds. According to Gov. Miller's message to the Legislature in Jan. 1921, the financial operations for general budget purposes for the fiscal year ending June 30 1920 were as follows:—

Revenue:	
General property taxes	$ 15,058,317.01
Special taxes	93,018,032.15
Other general revenues	7,515,257.83
Total	$115,591,606.99
Expenditures:	
Administration, maintenance and operation	$ 47,902,427.19
Fixed charges and contributions	39,699,757.53
Capital outlays	6,422,030.75
Total	$ 94,024,215.47
Excess of receipts over expenditure	$ 21,567,391.52

Early in 1921 the comptroller made the following estimate of revenues for the year 1921–2:—

General property taxes:	
Sinking funds, etc.	$ 13,702,340
School-teachers' salaries, etc.	19,935,000
Court and stenographers' tax	650,000
Special taxes:	
Excise (liquor tax)	$ 200,000
Corporation tax	30,330,000
Personal income tax	16,500,000
Organization of corporations	1,500,000
Transfer (inheritance tax)	17,500,000
Stock transfer (stamp tax)	8,520,000
Mortgage tax	2,750,000
Motor vehicles	4,635,000
Other revenues and receipts	7,613,900
Total estimated revenue	$123,836,240
Estimated surplus, July 1 1921	18,745,595
Total estimated resources	$142,581,835

When the Legislature assembled in Jan. 1921 there were submitted requests for appropriations amounting to the sum of $201,644,292.43. However, under the leadership of the governor, who demanded rigid economy, these estimates were materially reduced. The rapid increase in the cost of the state government during 1912–21 is shown by the following table of budget appropriations:—

	Appropriations	Per Capita
1912	$43,074,192.58	$4.61
1913	52,366,582.35	5.53
1914	59,465,690.97	6.21
1915	47,899,527.74	4.94
1916	63,997,271.86	6.51
1917	59,103,450.08	5.93
1918	79,742,834.21	7.89
1919	81,525,271.31	7.95
1920	95,840,983.77	9.22
1921	145,219,906.60	13.79

Two of the most important laws relative to financial administration were the Sage-Maier budget law of 1916 and the income tax law of 1919.

Government.—Although the constitution adopted in 1894 has been frequently amended, the government of New York underwent no fundamental alterations between 1910 and 1921. The most important change was the adoption in 1917 of the woman suffrage amendment. The Constitutional Convention of 1915 adopted far-reaching changes in organization, but all its proposals were disapproved by the electorate. The number of administrative boards and commissions has been greatly increased as the activities of the state have been extended into new fields. In 1919 these agencies, according to the governor's Reconstruction Commission, numbered 187. One of the pressing reforms advocated both by the Constitutional Convention and by the Reconstruction Commission was the reorganization of these miscellaneous administrative agencies into a smaller number of coördinated departments under the governor's control. Another movement was directed toward the establishment of an executive budget system. Neither of these reforms was adopted. One of the most important changes in local government was the adoption by the Legislature of an optional charter law for cities.

History.—On Oct. 6 1910 Gov. Charles E. Hughes resigned to accept a position as associate justice of the U.S. Supreme Court. He was succeeded by Horace White, the lieutenant-governor. Among the outstanding accomplishments of Gov. Hughes's term of office may be mentioned: the enactment of a progressive inheritance tax law; the creation of a Public Service Commission with large powers; the passage of a law prohibiting race-track gambling; and the strengthening of the state child labour laws. Gov. Hughes had persistently advocated the enactment of a thoroughgoing direct primary law, but because of the opposition of the leaders of his party to this reform, the convention system survived his term of office and furnished one of the most important issues of state politics throughout the following decade. In the elections of Nov. 1910 the Democrats elected not only the governor, John A. Dix, and the other state officers, but also a majority of the state Legislature. Dix received 689,700 votes; Stimson, his Republican opponent, 622,299.

The 1911 Legislature passed a direct primary law which was a compromise, retaining the party convention for the nomination of the state ticket but providing for the nomination of most other officers by direct primaries. The Wagner-Levy election law provided that only registered and enrolled voters might make independent nominations by petition; that there be uniform registration days throughout the state; that bi-partisan election boards be established in each county; that the name of a candidate might appear only once on the ballot; and that in rural districts voters who had not voted at the previous election must register personally. Obviously one of the chief purposes of this law was to make fusion tickets and independent voting as difficult as possible. The two last-mentioned provisions were declared unconstitutional by the Court of Appeals. In the autumn elections the Republicans secured a large majority in the Assembly.

The 1912 Legislature passed a number of important measures. An amendment to the primary law allowed party organizations to make the Assembly district, instead of the election district, the unit of representation. This permitted absurdly long ballots and practically prevented everything but straight voting. Another amendment restricted the payment of money to any person for securing signatures to a designating petition. The Rapid Transit Act was amended so as to allow the building of new subways in New York City. Large appropriations were made for state and county highway construction. An amendment to the labour law restricted the hours of labour for minors in factories.

In the autumn elections of 1912 the Democrats carried the state. The vote for president was: Wilson, Democrat, 655,573; Taft, Republican, 455,487; Roosevelt, Progressive, 390,093; the vote for governor was: Sulzer, Democrat, 649,559; Hedges, Republican, 444,105; Straus, Progressive, 393,183. The Democrats elected a majority in both Houses of the state Legislature. The newly-elected governor was inaugurated Jan. 1 1913. He had for many years received the support of Tammany Hall, first as a member of the Assembly and then for 18 years as congressman.

Among the important laws enacted in 1913 were: several measures designed to insure greater safety in factories; a law establishing an eight-hour day for employees on public works; a law limiting to 54 hours a week the time that women and children under 16 might work in certain industries; a law reorganizing the Labor Department and creating one of Efficiency and Economy.

Early in April 1913 the governor sent a special message to the Legislature urging the enactment of a direct primary law which would abolish the party convention. The disagreement between the governor and Tammany Hall, which had begun over the question of appointments, developed into an open conflict over this new issue. The Legislature by large majorities refused to pass the bill which the governor favoured and substituted a measure which he in his veto pronounced an insult to the electorate. The Senate refused to confirm many of the governor's appointments. After the adjournment of the Legislature on May 3, Gov. Sulzer entered on a strenuous campaign throughout the state to arouse public sentiment for his defeated primary bill. On June 16 he convened a special session of the Legislature, but his primary bill was again defeated by large majorities and the substitute bills adopted were promptly vetoed. In the meantime, a joint legislative committee, appointed before the end of the regular session to inquire into the affairs of the several state departments, began an investigation into the governor's campaign fund. Witnesses testified that he had made false returns as to the campaign contributions he had received. Evidence was presented to the effect that a part of the fund collected had been used for speculation. When the Legislature took a recess, July 23, the governor declared the special session adjourned; but the Legislature reassembled Aug. 11. Two days later the Assembly voted, 79 to 45, to impeach the governor on eight counts. Mr. Sulzer denied the authority of the Assembly to impeach him during a special session and claimed that even a legal impeachment would not prevent his continuance in office during the trial. The governor's contentions were overruled by the Court of Impeachment composed of the 51 Senators and the 9 justices of the Court of Appeals. The trial lasted until Oct. 17, when the governor was removed from office by a vote of 43 to 12, having been found guilty on three counts: that he had filed false statements relative to his campaign receipts and expenditures; committed perjury by swearing to such false statements; and suppressed evidence before the joint investigating committee, thus committing a misdemeanour. Martin H. Glynn, lieutenant-governor, succeeded.

The elections of Nov. 1913 resulted in an overwhelming defeat for Tammany. William Sulzer, nominated by the Progressives of the Sixth Assembly District in New York City, was elected by a large majority over his Democratic and Republican opponents. Many Democratic assemblymen who had previously voted for his impeachment were defeated.

A constitutional amendment authorizing the Legislature to pass laws to protect the lives, health, or safety of employees, and permitting the enactment of workmen's compensation laws was approved by a large majority. The special session of the Legislature, which had taken a recess after the trial of Gov. Sulzer, reassembled on Dec. 18. Gov. Glynn recommended the enactment of five important measures: a direct primary law abolishing the state conventions; a ballot law modelled on that of Massachusetts; the enactment of measures to carry out the Federal constitutional amendment providing for popular election of U.S. Senators; the submission to the voters of the question of calling a state constitutional convention; and the passing of a workmen's compensation law. The Legislature adopted the entire programme. The new primary law, state-wide in character, provided for a primary ballot with the candidates grouped according to the office sought; no party columns or party emblems were allowed; designations were to be made by petition and the state convention was abolished. The new ballot law required the use of a modified Massachusetts ballot on which the first place in each office group was to be given to the candidate of the party which received the largest number of votes in the preceding election for governor. The party emblem was permitted. The workmen's compensation law was made to cover specified hazardous employments. It fixed rates and periods of compensation. A state workmen's compensation commission of five members appointed by the governor was created.

The 1914 Legislature enacted an optional charter law for cities of the second class (with pop. between 50,000 and 175,000) and of the third class (with pop. below 50,000). Among the seven types of charters authorized were those providing for the city manager and the commission. In accordance with a law enacted in Dec. 1913, an election was held April 7 1914 to determine whether a state constitutional convention should be called. Less than one-fifth of the qualified voters participated in the election, but of these a small majority favoured a convention.

In the autumn elections of 1914 the Republican party was successful. The vote for governor was: Whitman, Republican, 686,701; Glynn, Democrat, 541,269. The new Legislature was strongly Republican in both branches. Of the delegates to the Constitutional Convention, 116 were Republicans, 52 Democrats.

The new Legislature passed a widowed mothers' pension law providing for the creation of county boards of child welfare, with authority to grant allowances to widowed mothers with dependent children under 16 years of age. The inferior criminal courts of New York City were reorganized and a board of city magistrates with one chief magistrate was created. The law gave a magistrate the right to sit as a judge of Special Sessions and to dispose summarily of minor misdemeanours. Another law authorized parole commissions in cities of the first class (with pop. of 175,000).

The outstanding event of 1915 was the Constitutional Convention, which met at Albany on April 6 and lasted until Sept. 10. Elihu Root was chosen president. Although the proposed new constitution embodied many highly desirable reforms it was overwhelmingly rejected by the voters at the Nov. election. The vote was: for the constitution, 400,423; against, 910,462. Two amendments, relating to legislative apportionment and to taxation, were likewise defeated. The woman suffrage amendment proposed by the Legislature failed by almost 200,000 votes. The new Assembly was strongly Republican.

The Legislature of 1916 established a military training commission to coöperate with the State Board of Regents in regard to physical training for pupils in elementary and secondary schools, and to give military training to boys between the ages of 16 and 19 during the school or college year. The Sage-Maier budget bill provided for a legislative budget. The Finance Committee of the Senate and the Ways and Means Committee of the Assembly were required, by the new law, to submit to the Legislature, not later than March 15, a detailed budget. The two committees were authorized to sit continuously and to appoint sub-committees to gather the data needed in the preparation of the financial programme. This work actually devolved on the clerks of the two committees. The Legislature passed also the Whitney-Brereton resolution providing for the submission of a woman suffrage amendment in 1917.

In Nov. 1916 Gov. Whitman was reëlected. He received 835,820 votes as against 686,862 for Judge Seabury, Democrat. For president, the Republicans carried the state, Hughes receiving 869,066 votes as against 759,462 for President Wilson. The New York Legislature was strongly Republican in both Houses. The legislation of 1917 and 1918 was influenced decidedly by the entrance of the United States into the World War. On the governor's advice, the Legislature enacted a compulsory military training law for boys between the ages of 16 and 19. School-children were allowed to work on farms between April 1 and Nov. 1. A state constabulary was created; and, under authorization of law, a census and an inventory of the military resources of the state were taken. The governor was empowered to require the registration of aliens. Numerous changes were made in the public-health laws of the state. The Legislature accepted for the second time the woman suffrage amendment. In the autumn election 703,129 votes were cast for the amendment and 600,776 against it. Another amendment, providing that debts incurred by any first-class city for water-supply purposes shall not be included in determining the debt limit, was likewise approved. This amendment extended to Buffalo and Rochester, an exemption previously enjoyed by New York City alone.

The 1918 Legislature was in session from Jan. 2 to April 13. A considerable number of war-emergency measures were adopted.

It was made a felony to injure or destroy military stores. A compulsory work law, applicable to able-bodied men between the ages of 18 and 50, was passed. The Food Commission established in 1917 was authorized to limit the margin of profits in retail sales of the necessaries of life. Contracts for the building of state and county highways were suspended for the period of the war. Teachers in the public schools were required to be citizens, and text-books containing seditious or disloyal statements were excluded from the schools. Absentee voting by those in the army and navy was authorized. The provisions of the workmen's compensation law were extended to cover practically all employments except farming and domestic service. A Central Supply Committee was created to make purchases for state departments, boards, and commissions. The Legislature partly repealed the "pay-as-you-go" law enacted in 1916, which made necessary the financing of all non-revenue-producing improvements in New York City through the annual tax levies, by the passage of a law allowing the city to issue annually during the war and one year thereafter $15,000,000 of bonds for certain kinds of improvements. A law provided for the enrolment and registration of women to participate in the 1918 elections. The Federal prohibition amendment failed of ratification.

In the Sept. primaries, 1918, Gov. Whitman was renominated for a third term. Alfred E. Smith, president of the New York City Board of Aldermen, was his Democratic opponent. Smith received 1,009,936 votes; Whitman, 956,034. The Republicans elected the other state officers except the lieutenant-governor. The Legislature remained Republican. In his message to the Legislature, Gov. Smith recommended important social and welfare legislation, most of which failed of passage because of the hostility of the Republican Legislature. The governor advocated health insurance, the minimum wage, and the eight-hour day for women and minors.

Several highly important laws were enacted. The income tax law provided for a tax of 1% on incomes up to $10,000; 2% on incomes up to $50,000; and 3% on incomes of over $50,000. Single persons were exempt up to 1,000; and married persons up to $2,000. An additional exemption of $200 was allowed for each dependent. The salaries of school-teachers were increased. An appropriation of $1,000,000 was made toward the building of the proposed New York-New Jersey vehicular tunnel. The employment of women on city railways was restricted. Children under 16 years of age were prohibited from working in factories longer than 48 hours in any one week. The Public Service Commission with jurisdiction over New York City was abolished and two new commissions were established in its place. One commissioner was given the regulatory functions of the former commission. The rapid transit construction work was transferred to a transit construction commissioner. The Legislature ratified the Federal prohibition amendment.

Shortly after his inauguration, Gov. Smith appointed a non-partisan Reconstruction Commission to inquire into and report on retrenchment and reorganization in the state government. This commission in its report of Oct. 10 1919 recommended an executive budget and the reorganization of the administrative departments of the state, following closely the proposals of the 1915 Constitutional Convention. The 1920 session of the Legislature devoted itself largely to the suppression of radicalism. It expelled five Socialist members of the Assembly and enacted a number of repressive measures designed to curb "revolutionists." These provided for the licensing of schools and school courses; additional certificates of loyalty from teachers; and machinery for testing the eligibility of members of the Legislature. All these measures were vetoed by Gov. Smith.

The most constructive work of the session was the passage of a number of bills designed to relieve the rent situation. The more important of these laws prevented the recovery of premises by landlords from "hold over" tenants until Nov. 1 1922, except where the tenants were objectionable, the premises were needed as residences by the owners, or the owners were desirous of putting up new buildings. It was also provided that in proceedings for the non-payment of rent, where the rent had been raised, the tenant might defend on the ground that the new rent was excessive. In such cases the landlord was required to file a bill of particulars showing the reasonableness of the increase. The courts were to pass upon reasonableness. It was further made a misdemeanour not to furnish normal service. The Legislature made additional appropriations for the New York-New Jersey tunnel. The salaries of school-teachers throughout the state were substantially increased.

The Republicans carried the elections in 1920 by overwhelming majorities. The vote for president was Harding, Republican, 1,868,240; Cox, Democrat, 781,485; Debs, Socialist, 203,400. The Republican candidate for governor, Judge Nathan L. Miller, was elected by a plurality of less than 75,000. Gov. Smith, his opponent, ran almost 500,000 votes ahead of the national Democratic ticket. The state Legislature for 1921 contained large Republican majorities in both Houses. The voters by a large majority approved a bond issue of $45,000,000 for a bonus to soldiers and sailors in the World War.

Gov. Miller, in his message to the 1921 Legislature, dealt chiefly with finance, urging rigid economy, and opposing the creation of new positions and salary increases. He favoured the completion of authorized construction projects before undertaking others. Later the governor sent a special message to the Legislature in which he outlined a programme for the reorganization of the Public Service Commission and the solution of the traffic problem in New York City. He recommended that all public utilities be placed under the jurisdiction of one state commission, except that a commission of three be established with complete jurisdiction over the one subject of transit in New York City. The Legislature passed measures carrying out the governor's recommendation. Other laws of importance, many of them sponsored by the governor, provided for the enforcement of the prohibition amendment directly by local police officers; the repeal of the daylight saving law; the return to the convention system of nominating state and judicial officers; the reorganization of the State Industrial Commission; the reorganization of the State Tax Commission and the transfer to it of most state tax-collecting agencies; the creation of a Board of Estimate and Control consisting of the governor or his agent, the chairmen of the Senate Finance and Assembly Ways and Means committees and the comptroller; and a treaty with New Jersey for the development of the port of New York. The anti-sedition laws adopted were designed to compel teachers to take an oath of loyalty and to empower the state Department of Education to license all private schools. Provision was made for a legislative investigation into the affairs of the New York City administration and for another to study the problem of charter revision in that city. Although the Republicans elected a majority of the members of the Assembly in the autumn elections of 1921, their strength was materially reduced by Democratic gains.

The World War.—New York led the states in the number of troops supplied for the World War. The total number from the state (including Regular Army, National Army, National Guard, navy, Marine Corps, Coast Guard, and U.S. Guards) was 493,892, or 10·37% of the total. The number of casualties was 40,222. The subscriptions to the Liberty and Victory loans in New York State were: First Liberty Loan, $1,112,389,700; Second, $1,413,107,150; Third, $985,559,600; Fourth, $1,826,448,250; Victory Loan, $1,607,199,250; total $6,944,703,950. (E. D. G.)

NEW YORK (CITY) (*see* 19.610).—The pop. of New York City in 1920 was 5,620,048, as against 4,766,883 in 1910, an increase of 853,165, or 17·9%. The pop. of the separate boroughs was: Manhattan, 2,284,103 (in 1910, 2,331,542); Bronx, 732,016 (in 1910, 430,980); Brooklyn, 2,018,356 (in 1910, 1,634,351); Queens, 469,042 (in 1910, 284,041); Richmond, 116,531 (in 1910, 85,969). There were 5,459,004 whites, 153,088 negroes, and 7,956 others (Chinese, Japanese and Indians). The figures for 1910 were 4,669,162 whites, 91,709 negroes and 6,012 others. The white pop. constituted 97·1% in 1920 and 98% in 1910, while the negro pop. constituted 2·7% in 1920 and 1·9% in 1910. The increase in the white pop. since 1910 was 789,842, or 16·9%, while the corresponding increase in the negro pop. was 61,379, or 66·9%. The total foreign-born white pop. in 1920 was 1,989,216, as compared with 1,927,603 in 1910, an increase of 61,603, or 3·2%. The numerical increase was less than 10% of that of the preceding decade. Foreign countries furnishing the greatest number were Russia, 479,481; Italy, 388,427; Ireland, 202,833; Germany, 193,558; Poland (for the first time listed separately), 145,257; and Austria, 126,447. Of the total pop. in 1920 the males numbered 2,804,884, or 49·9%, and the females 2,815,164, or 50·1%. For the entire borough of Manhattan the average density was 162·5 inhabitants per ac., but in the Fourth Assembly District on the lower E. side (245 ac.) in which a great proportion was foreign born, the density was 420·3 per acre. In 775 tenement blocks in 1920 the density was over 1,000, the maximum being 3,869. In spite of overcrowding the city was healthy; for 1919 the average death-rate was 12·39 per 1,000.

The most important enlargements of public services provided since 1909 are the addition of the Catskill water to the city system, and the additions to the rapid transit system.

The Catskill system, secured by developing the Esopus watershed, was put in service in May 1917. It furnished a supply estimated to yield a minimum of 300 million gal. per day and with normal rainfall 325 million. Even before this the increased consumption of water had necessitated the undertaking of the development of the Schoharie watershed in 1916. This source, which is expected to be available in 1926, will provide an additional 300 million gal. per day, making a total normal supply at that time of 1,170 million gal. per day. The consumption of water is increasing so fast that, in view of the inevitable growth, the city already faces the problem of securing additional sources of supply. In April 1921, Blackwell's Island—the seat of the City hospital and of the Metropolitan hospital, as well as of the N.Y. County Penitentiary and of the Corrections hospital—was renamed Welfare Island, by the Board of Aldermen.

Rapid Transit Development.—As a means of meeting the demand for additional rapid transit facilities, the city by the Public Service Commission for the First District in March 1913 entered into separate contracts with the Interborough Transit Co. and the N.Y. Municipal Railway Corp. for the construction, equipment, and operation of a system of rapid transit lines known as the dual system. At this time the Interborough Rapid Transit Co. operated the subway lines in Manhattan, Bronx and Brooklyn, and under lease the elevated lines owned by the Manhattan Railway Co., *i.e.* the Second Ave., the Third Ave., and the Ninth Ave. lines, the last including the Sixth Ave. The N.Y. Municipal Railway Corp. was formed in the interest of the Brooklyn Rapid Transit Co. for the operation of various lines constructed or to be constructed as outlined in the dual plan. The N.Y. Railway Co., which operates most of the surface lines in Manhattan and the Bronx, is the only large traction system not included in the dual system. The operating contracts made with each company run for a period of 49 years from Jan. 1 1917, at the end of which time all leases and agreements will terminate and the city will have complete ownership and control over the constructions included in the dual plan. Provision is made in the contract for the sharing of profits with the city after the operating company has paid all necessary expenses and taken out an amount designated as a preferential, which represents an average of past earnings on old lines over a period of years. The contracts also specify that in the territory allotted to each company the rate of fare for a continuous ride shall be five cents. The dual plan provided for the construction of 322 m. of new track, making the total mileage of the completed system 618·7. While the plan as outlined approximately doubled the existing mileage it tripled the facilities then available, as the third tracking and extension of existing elevated railways materially increased the carrying capacity. For the Interborough these extensions comprised subway construction N. and S. of 42nd St., Manhattan. North of 42nd St. the new subway extended up Lexington Ave. and connected with the existing Fourth Ave. subway. New subway construction S. of Times Square extended the W. side subway down Seventh Ave. to lower Manhattan and by tunnel under the East river to Brooklyn. This construction provided independent through N. and S. rapid transit lines for the E. and W. sides of Manhattan Island. The addition of a third track and extension of existing elevated lines brought the added mileage to 167·7, a total for the Interborough system of 358·7. The main feature of the extension of the lines of the N.Y. Municipal Railway Corp. was the subway beginning at the Queensboro' Bridge and extending W. by 59th and 60th Sts. to Seventh Ave., thence S. by Seventh Ave., Broadway, Vesey St., Church St. and Trinity Place to a connexion with a tunnel under the East river at Whitehall St. This construction and other extensions make a total for New York of 105 m. and a total for the N.Y. Municipal Railway system of 260 miles.

At the end of 1920 all but 2·2 m. of the Interborough system and 15·3 of the N.Y. Municipal Railway system was completed. A continuous ride of 26·63 m. for five cents then became available on the Interborough system and one of 18·5 m. for the same fare on the Brooklyn lines. The anticipated cost of constructing the new lines provided under the Dual plan amounted to $337,000,000, which was to be distributed as follows: City of New York, $171,000,000; Interborough Rapid Transit Co., $105,000,000; N.Y. Municipal Railway Corp., $61,000,000; in addition to the above the city had already invested about $56,000,000 in the construction of the Fourth Ave. subway, and the Interborough Rapid Transit Co. had expended about $48,000,000 for the equipment of the line. Up to Jan. 1 1921 expenditures by the city and the operating companies amounted to approximately $435,000,000, including sums to be paid for work completed or nearing completion. Of this amount the city's part was about $214,000,000, the operating companies' $221,000,000. It was anticipated that the system when completed would be able to carry more than three billion passengers per annum. During the year ending June 30 1920 there were carried 2,364,775,067 passengers. The main rapid transit lines were operating in 1921 to the point of saturation and the situation demanded immediate provision for additional facilities.

Manufactures.—The N.Y. City Metropolitan District (a district of 616,928 ac. including in addition to New York City the neighbouring cities and towns both in New York State and New Jersey) is by far the largest industrial district in the United States, more than one-seventh of the entire industrial productions of the United States being credited to it. In 1914 it had 36,410 manufacturing establishments; these gave employment to an average of 1,031,815 persons during the year, 842,103 being wage-earners, and paid out $711,085,669 in salaries and wages. The value of the manufactured products was $3,428,223,150, the materials utilized $1,984,842,079, the value added by manufacture $1,443,381,071. The district represented 12·5% of the persons employed, 11·5% of the capital and 14·1% of the value of products for the whole country. Clothing ranked first with a value (1914) of $546,682,000. Printing and publishing, with products valued at $230,961,000, ranked second. Smelting and refining of copper, with a value of $207,752,000, ranked third, yet it listed but five establishments while clothing listed 6,229 and printing and publishing 3,647. The boroughs of Manhattan and the Bronx produced in 1914 goods valued at $1,577,852,000, or more than two-thirds of the total.

Port of New York—Commerce.—The port of New York was in 1921 in many respects the most important in the world. The value of the imports received increased from $891,614,678 in 1909 to a total of over $2,064,654,000 in 1919, or 131·6%. The value of exports in 1919 exceeded $3,456,329,000 as compared with $627,782,767 in 1909, an increase of $2,728,546,233, or 435%. The vessel tonnage entering and clearing during 1919 aggregated 15,049,000 and 14,275,000 tons, respectively. These totals far exceeded the commerce handled through any other port in the world. The increase in port facilities has by no means kept pace with the growth of business. Such improvements as have been completed during the years 1909–19 inclusive have been limited to more or less haphazard development work carried out under the supervision of the U.S. Government, the completion of the N.Y. State Barge Canal, and the execution of a limited number of enterprises by the city, providing additional docking and wharfage facilities. Among the more important of the projects carried out by the Federal Government are the East river improvement work and the completion of the Ambrose Channel. The East river improvement includes extensive dredging to provide a channel 40 ft. in depth between the Upper Bay and Brooklyn Navy Yard, and also through Hell Gate. Work done before 1921 comprised not alone dredging, but also the removal of reefs and ledge rocks, notably Coenties Reef and Shell Reef which had been a menace to shipping and restricted the development of an important part of the port. Expenditures on these improvements have aggregated $8,172,734, and it is anticipated that $6,350,000 additional will be required to complete the work. The most marked effect of this improvement will be to enable ships with a draught of 40 ft. to unload and take on cargoes at the piers instead of from lighters, and ultimately to follow the shorter and safer inside route through Long Island Sound in approaching or leaving N.Y. harbour. In 1914 the dredging and construction work incidental to the widening of the Ambrose Channel was completed. This waterway extends in a general N.W. direction from deep-water through the Lower Bay. It provides a channel about 7 m. in length, 2,000 ft. in width, with a depth of 40 ft. at mean low-water, and is the ordinary route taken by large vessels whose destination is N.Y. harbour. The Erie Canal has been improved and reconstructed at a cost to 1921 of over $154,500,000. It is popularly known together with various extensions and improvements as the N.Y. State Barge Canal. A greatly increased traffic is expected from it and elaborate terminal plans for N.Y. harbour were under way in 1921.

Notable port development projects carried out by the City of New York since 1909 include the following: North river—Improvement of water-front between 42nd St. and 59th St., involving the construction of four passenger steamship piers each 1,000 ft. long and with a dock area of 797,904 sq. ft. Only one of the piers had been built by 1921. East river—Three new city piers located at the foot of 29th, 30th and 35th Sts. respectively, South Brooklyn, were completed during 1916. These piers add 9,380 ft. of wharfage space and 568,500 sq. ft. of dock space to the city's dock properties. They form part of a logical plan of port organization which assigns to the Brooklyn water-front the heavier cargo business. Upper Bay—In 1918 the city initiated a project involving the development of the water-front of Staten Is., near Stapleton, by the construction of 12 large piers. This location afforded opportunity for the construction of piers over 1,000 ft. in length if desired with a natural depth of more than 40 ft. at the pier-head line. Also for the first time the city had the chance to effect track railhead connexions between its piers and all but two of the railways entering the port of New York, and to construct terminal warehouse and industrial plants in connexion therewith. The question at first arose as to whether the steamship companies would lease piers so far from the centre of commercial activity on Manhattan Island. Then the city laid down the policy that the moneys necessary to carry out the proposed improvement would only be appropriated when the dock commissioner secured leases from responsible lessees for the proposed piers at a rental equal to 7½% of the total cost of acquiring the land and lands under water and of making the improvement. In July 1919 11 duly executed leases, each accompanied by a bond, for a term of 10 years with two renewals of 10 years each were presented to and approved by the commissioners of the sinking fund, it being determined at the same time to build a twelfth pier and maintain the same for public wharfage.

These piers will be built in accordance with the particular requirements of the respective lessees. They will range in length from 1,000 to 1,160 ft.; eight are to be 125 ft. in width and covered by single-story steel freight-sheds with railway tracks down the middle of the pier; two will be 130 ft. in width and covered by two-story steel freight-sheds with railway tracks; two will be 209 ft. in width including side platforms equipped with railway tracks and a complete mechanical installation such as cranes, monorail cars, etc., together with elevators for transfer of motor-trucks to the second deck. On the upland in rear of the piers will be laid out comprehensive terminal facilities with ample tracks for storing an adequate number of freight-cars. It is estimated that this Staten I. improvement will cost upward of $25,000,000, of which $18,000,000 will be for pier and shed construction; it will provide more steamship wharfage than any other one improvement undertaken by the city. When this is finished, Richmond will have more wharfage facilities for overseas steamships than are in use at present for similar purposes on the entire island of Manhattan.

One of the main causes that have militated against a comprehensive development of the port of New York is the division that exists with respect to the water-front included within the limit of New York State and that within the adjoining state of New Jersey. The situation is further complicated by the fact that of all the railways entering the port only three have direct rail connexion with New York City: the New York Central in Manhattan, the New York, New Haven and Hartford in Manhattan and Queens, and the Baltimore and Ohio in the borough of Richmond. All other railways have their freight terminals on the New Jersey shore. The need for remedying this condition has long been recognized and in 1917, pursuant to concurrent legislation by the two states, the governor of each appointed a commission of three members to recommend jointly a policy to be pursued by the state of New York, the state of New Jersey and the United States, in the development of the port. The legal problem was unique on account of the dual state sovereignty involved. This necessitated the adoption by both states of a treaty as a prerequisite to undertaking any comprehensive plan of development. The recommendation of the joint commission was embodied in a statute introduced in the Legislatures of the two states. The statute was passed by the N.J. Legislature in 1920 and by the N.Y. Legislature in April 1921.

Communications.—Two important enterprises in providing additional direct lines of communication with New York City are the N.Y. connecting railroad across the East river and the proposed vehicular tunnel under the North river. The N.Y. connecting railroad provides direct rail connexion with the New York, New Haven and Hartford line for the boroughs of Queens and Brooklyn. The main features include a reinforced concrete arch viaduct extending from the connexion with the New York, New Haven and Hartford railroad in the Bronx to a point on Wards I., in the East river, a steel arch spanning that section of the East river known as Hell Gate, and connecting with a similar reinforced concrete viaduct in the Astoria section of Queensboro'. Surface construction provides direct passenger rail connexion with the Sunnyside Yard of the Long I. railroad and thence access to the Pennsylvania railroad terminal in Manhattan, while another branch for freight only extends to the Bay Ridge section on the water-front of South Brooklyn. The entire length of the connecting railway is 12 miles. The total amount expended was approximately $30,000,000. The bridge itself, the largest steel arch in the world, cost $18,000,000. Its massive granite piers rise to a height of 240 ft. and are 2,000 ft. apart. The steel arches which support the deck of the bridge rise 300 ft. above the water and the clearance for vessels at mean high-water is 140 feet. The bridge carries four tracks, two of which are used for passenger service as well as for freight.

The vehicular tunnel under the North river which when completed will connect Manhattan I. with Jersey City, is designed to provide a means of handling the traffic now forced to use ferries. Its construction was undertaken under the joint jurisdiction of the N.Y. Interstate Bridge and Terminal Commission and the N.J. Interstate Bridge Commission in accordance with the terms of a contract entered into by the two states Dec. 30 1919. The tunnel section includes twin tubes of cast iron 29 ft. in external diameter. The mean length of the cast-iron ring is 7,345 ft. while the distance between grade points is 9,300 ft. Each tube will have a 20 ft. roadway with an overhead clearance of 13 ft. 6 in. The N. tube is to be used for west-bound traffic, the S. tube for east-bound. The estimated yearly traffic in 1924, the date when it is anticipated the tunnel will be put in service, is approximately 5,610,000 vehicles. This is about equal to the traffic over the Williamsburg bridge across the East river during 1920. In 1934 it is estimated that the traffic demand will reach 12,900,000 vehicles annually. The anticipated total cost of the improvement is $28,669,000. It is estimated that the average charge for motor vehicles using the tunnel for the first 20 years will be 45 cents and for horse-drawn vehicles 20 cents. The revenues from the use of the tunnel on the above basis during that period would amortize the cost in 11 years and accumulate a surplus of $67,330,000, half to go to each state.

Streets and Buildings.—The construction of the new traction system involved some changes in the streets, the extension of Seventh Ave. being an example. The principal shopping district has shifted rapidly northwards, deserting in succession the 14th St. and 23rd St. sections. Its boundaries, broadly speaking, in 1921 were 31st St., Broadway, 59th St. and Madison Ave., and it was steadily continuing northward. The principal shopping streets were Broadway, 34th St., 42nd St. and 5th Avenue. Park Ave., N. from the Grand Central Station, was rapidly superseding Riverside Drive as the well-to-do apartment district, and there was a distinct movement of the finer residential section to the eastward, reaching in one instance as far as Ave. A.

Between 1909 and 1921 there was considerable addition to the number of the tall buildings, which made the sky-line of the city an impressive spectacle. The Woolworth Building (792 ft.) is the highest structure in the world excepting the Eiffel Tower. It is a remarkable example of the adaptation of the Gothic style to the "sky-scraper," is faced with cream-coloured, glazed terra-cotta and is crowned by a huge lantern, brilliant at night, under which is an observation gallery, from which on a clear day a 50-m. view may be obtained. Other notable new buildings are: The Bankers' Trust (539 ft.); Equitable (485 ft.); Adams Express (424 ft.); Whitehall (424 ft.); American Express (415 ft.); American Telephone and Telegraph (403 ft.); 112 Park Ave. (390 ft.); Liberty Tower or Hanover National Bank (385 ft.); American Bank Note (374 ft.); 201 Broadway (362 ft.); 60 Wall Street (346 ft.); Candler (341 ft.); Allied Printing Trades (340 ft.); 37 Wall Street (346 ft.); 80 Maiden Lane (315 ft.); Columbia Trust Co. (306 ft.); Sun (306 ft.); and Cunard (335 ft.). The newer hotels include the Pennsylvania, with its 2,200 rooms, the largest hotel in the world; the Commodore, with 2,000 rooms; the McAlpin, Biltmore, Chatham, Vanderbilt, Ritz-Carlton and Claridge. The Knickerbocker, Holland House and Manhattan, formerly three of the best-known hotels, have been converted into office buildings, as has Sherry's restaurant.

Finance.—The city's budget grew from $163,130,270.37 in 1910 to $345,530,039.77 in 1921. The assessed value of its taxable property, real and personal, grew from $7,416,837,499 in 1910 to $8,922,628,742 in 1920, when the real estate was valued at $8,626,122,557. The net funded debt in 1920 was $1,033,878,359, the gross bonded debt being $1,238,260,597. The floating debt was $42,350,400 and the sinking fund $204,382,238. Among the large items of the 1921 budget were $50,720,880 for education; $105,528,527 for redemption and interest of the city's debt; $10,029,222 for county purposes; $28,349,407 for police; $17,409,649 for borough governments; $17,033,082 for fire protection; $16,790,036 for street cleaning; $8,706,947 for water supply and public lighting; $8,146,850 for charitable institutions; $4,074,637 for parks; $14,592,413 for public welfare; $5,655,868 health; and $5,419,850 plant and structures.

History.—During the administration of Mayor Gaynor, which began in 1910, there arose an increased interest in administration on the part of the citizens. The mayor, known locally for certain whimsical characteristics, had gained a hold on popular sympathy as a result of his attempted assassination. Later he became ill, and while on a steamer to Europe, travelling to regain his health, died Sept. 10 1913. Adolph L. Kline (b. 1858), president of the Board of Aldermen, succeeded to the office for the remaining few months of the term. A fusion ticket led by John Purroy Mitchel (1879–1918), who had made an enviable record in public office as Commissioner of Accounts, Collector of the Port and president of the Board of Aldermen, easily defeated the Tammany ticket. Mitchel, but 35 years of age, undertook a complete reorganization of administration, and obtained remarkable results, making his mayoralty a period of unprecedented efficiency in the city's government. Of especial note were the improvements in police, street cleaning, charities and corrections, and the establishment of high standards and expert service in taxation, purchasing and the selection of personnel. Though admittedly efficient, economical and honest, this administration saw itself at the end of four years buried under the greatest majority for Tammany on record. The causes were many. Mayor Mitchel antagonized one powerful group after another; certain real estate interests by the "pay-as-you-go" plan of financing; the German group by his pro-Ally sympathies; a large manufacturing group by refusal to remove trade refuse free of charge; the upper W. side by the unfortunate W. side plan for removal of the New York Central surface tracks; the Catholic vote by his procedure regarding certain charities; the borough of Richmond by locating a garbage incinerator plant in that section; and Brooklyn by his rigid policy of centralization. The result was that John F. Hylan (b. 1868), a candidate from Brooklyn, led a complete Tammany ticket into office, with a platform of outspoken opposition to almost everything the Mitchel administration had done. Subsequently, however, upon the election of the president of the Board of Aldermen, Alfred E. Smith, to the governorship of the state, and the death in office of the president of the borough of Manhattan, Republicans were elected to the vacancies so created. Mayor Hylan's régime was marked by continual wrangling among the members of the Board of Estimate, resulting in many cases in distinct disturbance of administrative machinery. The outstanding features were the fight of the city against increased fares for the traction lines, the declaration of receiverships for practically all of the traction companies of the city except the Manhattan elevated and subways, the dissolution of the companies into a number of independent lines, the operation by the city of the Staten I. traction lines and the introduction of motor-bus lines by the city in competition with the traction systems.

Among the notable bequests to the Metropolitan Museum during recent years have been those of Francis L. Leland, $1,000,000; Joseph Pulitzer, $900,000; Benjamin Altman, collection of paintings, sculpture, Chinese porcelains, etc., with a fund for their care; William Henry Riggs, collection of arms and armour; Harris B. Dick, collections and funds over $1,000,000; Isaac D. Fletcher, collection of paintings and objects of art and fund over $3,400,000; and John Hoge, over $1,000,000. (R. B. F.)

NEW ZEALAND (*see* 19.624).—The pop. of the Dominion of New Zealand (exclusive of Maoris), as enumerated at the taking of the census, was as follows: 1911 (April 2) 1,008,468 (531,910 males, 476,558 females); 1916 (Oct. 15) 1,099,449 (551,775 males and 547,674 females). The 1916 figures were of course affected by war conditions. At the end of 1916 females were estimated to be in a majority for the first time in the history of the country, and the majority steadily grew until at the end of 1918 they were more than 24,000 ahead. But with the return of the troops the preponderance of males was restored, though not to the same degree as before. On Dec. 31 1920 the official estimate of the pop. (excluding Maoris) was 1,194,844, of whom 604,751 were males and 590,093 females. If the 49,776 Maoris and the 12,797 inhabitants of the Cook and other Pacific islands annexed to New Zealand be added, the grand total is 1,257,417.

The pop. of the principal cities on Dec. 31 1919 was estimated as follows, the bracketed figures indicating the totals if suburbs are included: Auckland 73,852 (144,646); Wellington 81,301 (100,898); Christchurch 61,104 (104,747); Dunedin 57,935 (72,084). The proportion of the pop. living in towns of over 1,000 inhabitants in 1878 was 31·47; the proportion living in towns of over 3,000 inhabitants in 1916 was 42·28.

In 1916 72·34% of the pop. was New Zealand born; 25·83 was born in the United Kingdom or other British territory; and only 1·70 was foreign-born, Germany and Austria-Hungary, with 0·27 and 0·22 respectively, taking the lead.

In 1916 the number of "race aliens" in the Dominion, *i.e.* persons not of European or Maori descent, was 3,204; of these 2,147 were Chinese, 459 Syrians and 181 Indians. In 1896, when the poll-tax on Chinese was increased from £10 to £100, they numbered 3,711, but since then the number had steadily declined till 1920, when the arrival of 476 Chinese and 174 Indians during the first six months of the year led to a drastic measure which, without relaxing existing restrictions, left the regulation of foreign immigration in the hands of the Government.

Births and Deaths.—The birth-rate fell from its maximum of 41·96 per 1,000 in 1878 to 25·12 in 1899, the lowest figure reached before the war. In 1913 it stood at 26·14, and the average of the next four years was 25·74; then followed a sharp drop to the lowest figures yet reached: 1918, 23·44; 1919, 21·54.

The decline in the birth-rate continues to be partly compensated by an abnormally low death-rate, which in 1912 reached its lowest recorded point of 8·87 per 1,000, and in 1919 was 9·51. Only once since 1907 has the rate been as high as 10 per 1,000, and that was in 1918, when the epidemic of pneumonic influenza caused 5,516 deaths (exclusive of approximately 1,200 among the Maoris) and brought the death-rate up to 14·84. The effect of the low death-rate is to give the Dominion one of the highest rates of natural increase in the world, the figures for 1913–7 being 16·4 per 1,000.

The death-rate per 10,000 from the four principal causes during 1919 was as follows: organic heart disease 13·53; senility 9·29; cancer 8·23; pulmonary tuberculosis 5·30. The averages for the two last-named causes during the ten years 1910–9 were: cancer 8·23; pulmonary tuberculosis 5·58. The death-rate for all forms of tuberculosis has been declining for many years, but that from cancer is steadily rising.

Trade.—External trade rose from £37,372,000 in 1907 to £45,275,024 in 1913. In "special" trade per inhabitant New Zealand with £41 14s. 3d. was in that year second to Belgium alone (£48 18s. 1d.); and in exports of domestic produce (£21 3s. 8d.) she stood first. The course of the Dominion's trade during and since the war is shown by the following figures:—

	Imports	Exports	Total
1913	£22,288,302	£22,986,722	£45,275,024
1914	21,856,096	26,261,447	48,117,543
1915	21,728,834	31,748,912	53,477,746
1916	26,339,283	33,286,937	59,626,220
1917	20,919,265	31,587,547	52,516,812
1918	24,234,007	28,516,188	52,750,195
1919	30,671,698	53,970,075	84,641,773
1920	61,595,828	46,441,946	108,037,774
1921*	15,658,502	13,196,514	28,855,016

*March quarter.

The favourable balance of trade, which had averaged a little over £2,000,000 in the five years before the war, averaged in 1915–9 £11,043,314. It increased to £23,298,467 in 1919, but the adverse balance of £15,153,882 in 1920, when the previous year's "record" imports were doubled, combined with the fall in the price of wool and meat, indicates a severe check to the prosperity of the war period.

On ten principal exports, representing in value more than 80% of the whole, it is estimated that in the four years ended March 31 1919 the Dominion gained £34,410,144 through the appreciation of its produce since 1913, the proportion being 45·98 per cent.

During the years 1909–13 the United Kingdom supplied 60·07% of the Dominion's imports and received 80·43% of its exports. The contributions of the British Empire were 83·87% of the imports and

94·35% of the exports. Foreign countries supplied 16·13% of the imports and took 5·65% of the exports, the United States coming first with 8·80% and 3·04% respectively, and Germany second with 2·66% and 0·99% respectively.

In the five years covering the World War (1914–8) the United Kingdom took 77·94% of the Dominion's exports, other British possessions 10·43%, and foreign countries 11·63%. The imports, classified according to the countries of origin (shipment figures alone being previously available), were contributed as follows: United Kingdom 46·60%; British Empire 72·54%; foreign countries 27·36%.[1] The United States and Japan are the two foreign countries with which trade developed most rapidly during the war. The exports to the United States, which amounted to £714,063 in 1907 and £912,051 in 1913, rose to £2,006,507 in 1915, £4,045,648 in 1918 and £4,200,861 in 1919. The Dominion's imports from the United States during the same years were: 1907 £1,425,596; 1913 £2,107,990; 1915 £2,600,248; 1918 £4,980,748; 1919 £7,576,314. The United States in 1919 supplied 26·3% of the imports and in 1918 took more than 14% of the exports. The Dominion's imports from Japan increased from £151,106 in 1913 to £304,322 in 1915, £1,214,865 in 1918 and £1,313,205 in 1919; but this was due to war conditions.

Production.—The dependence of New Zealand's prosperity upon the pastoral industry shows no signs of being weakened by her progress in other directions. Though wool, which in 1897 formed 47·9% of the total value of the exports, provided not much more than a third in 1920, it was still the most important export; and its decline in relative importance was merely the result of the rapid development of other pastoral products. Between 1895 and 1914 the pastoral industry's contribution to the exports had actually increased from 70·3% to 85·8%, and in the best of the war years (1916) it went as high as 90·7%. The exports of dairy produce rose in these twenty years from £378,510 (57,964 cwt. butter and 76,743 cwt. cheese) in 1895 to £4,902,701 (434,067 cwt. butter and 863,776 cwt. cheese), or from 4½% to 19% of the total, the actual increase in value being 1,198%. The increase of frozen meat in the same period from £1,262,711 (1,134,097 cwt.) to £5,863,062 (3,229,869 cwt.), a rise in value of 364%, is proportionately a small matter. The following table shows the advance of the chief pastoral products:—

Exports of Pastoral Produce.

Year	Wool	Frozen Meat	Butter	Cheese	Skins, Hides, Pelts, Tallow, etc.
	£	£	£	£	£
1895	3,662,131	1,262,711	227,601	150,909	534,993
1900	4,749,196	2,123,881	740,620	229,111	732,260
1905	5,381,333	2,694,432	1,408,557	205,171	1,023,087
1910	8,308,410	3,850,777	1,811,975	1,195,373	1,885,882
1914	9,318,114	5,863,062	2,338,576	2,564,125	2,011,941
1915	10,387,875	7,794,395	2,700,625	2,730,211	2,231,104
1916	12,386,074	7,271,318	2,632,293	3,514,310	2,453,018
1917	12,175,366	5,982,404	2,031,551	3,949,251	2,414,833
1918	7,527,266	4,957,576	3,402,223	4,087,278	3,493,482
1919	19,559,537	9,628,292	3,080,128	7,790,990	6,119,474
1920	11,863,827	11,612,829	3,022,335	6,160,840	4,064,445

There were 25,828,554 sheep in the Dominion in 1919 and 3,035,478 cattle, of which 863,588 were kept for dairying purposes; 2,409,214 cattle and 14,211,944 sheep were in the North Island.

Of the total area of land in occupation in 1919–20 (43,473,079 ac.) 18,004,776 ac. were in cultivation, 16,125,265 being in English grasses. In agriculture the Dominion does little more in normal years than provide for its own needs. During the years 1910–9 agricultural produce only averaged 1·77 per cent. of the exports. The acreages and yields of the principal crops in 1919–20 were: Wheat 139,611 ac., 4,559,934 bus. (32·66 per acre); oats 179,800 ac., 6,967,862 bus. (38·75 per acre); potatoes 24,933 ac., 144,705 tons (5·79 per acre). During the years 1910–20 the area in wheat averaged 230,070 ac., with a yield per acre of 28·02 bus. and a production of 5·82 bus. per head of population. In the years when production falls below 6 bus. per head importation is necessary, usually from Australia.

Mining.—The gold industry, which fifty and sixty years ago supplied more than half the colony's exports, is of small importance now. The quantity and value of the export were as follows in the years named: 1866, 735,000 oz., £2,844,000; 1906, 563,843 oz., £2,270,904; 1916, 292,620 oz., £1,199,212; 1920, 212,073 oz., £883,748.

The proved coal resources of the Dominion (610,000,000 tons) are estimated to last about a century. The output during the years 1900–16 rose by fairly regular increments from about 1,000,000 to about 2,000,000 tons. The maximum of 2,257,135 tons was reached in 1916, but since then there has been a steady decline to 1,847,848 tons in 1919. This decrease, which originated in a labour shortage arising from the war, was continued by the miners' "go-slow" policy, and but for special importations the stoppage of many important industries would have resulted. The local supply has always been supplemented by imported coal, chiefly Australian, averaging about 300,000 tons a year, or one-seventh of the total consumption in the years 1909–13. In 1919 and 1920 imports of 391,434 tons and 476,343 tons respectively relieved the local shortage. S. Africa provided a small part of this supply, and in 1921 the Government let a contract in South Wales.

Hydro-Electric Power.—New Zealand is well endowed with water-power, 23 sources of supply in excess of 1,000 H.P. being enumerated in the North Island and 46 in the South Island. Little use had been made of this asset before 1900, but the actual horse-power in use in 1912 was 18,353. This had increased to 43,016 by March 31 1915, the total in 1920 being 47,983 horse-power.

The main sources of supply selected for the Government's North Island scheme are Mangahao in the Wellington District (24,000 H.P.); Arapuni, Auckland District (96,000 H.P., capable of extension to 162,000 H.P.), and Waikaremoana, Hawke's Bay (40,000 H.P., capable of extension to 136,000 H.P.), and work on the first of these was well in hand in 1920. The South Island has already the two largest of existing installations, but the outlines of the general scheme for the island had not been laid out. At Lake Coleridge in the Southern Alps, 65 m. west of Christchurch, the Government had erected a plant of a capacity of 8,000 H.P., and an ultimate extension to 58,000 H.P. will be possible. From this source the electric lighting and tramway systems of Christchurch and a large number of workshops and factories are supplied, and in addition to its far greater efficiency, the new method, by the saving of 45,000 tons of coal and other economies, is estimated to have saved £300,000 in the first five years of its working. A similar service is performed for the city of Dunedin by its city council's power station on the Waipori river 32 m. away.

The total capital outlay on electric-power supply up to March 31 1920 was £3,253,870. Loans totalling £1,980,000 had at that date been voted in five of the electric-power districts. The total cost of the Government's scheme will considerably exceed £20,000,000.

Manufactures.—Between the census of 1906 and 1916 the number of manufactories and works increased from 4,186 to 4,670; the number of hands employed from 56,359 (males 44,946; females 11,413) to 57,823 (males 43,970; females 13,853); the wages paid from £4,457,619 (males £3,979,593; females £478,026) to £6,654,504 (males £5,868,788; females £785,716); the value of all manufactures or produce (including repairs) from £23,444,235 to £45,454,184. By far the most important of these industries are the meat-freezing and meat-preserving works and the butter and cheese factories, which, with outputs valued in 1919 at £4,852,732 and £10,056,782 respectively, accounted between them for nearly half the aggregate value (£58,374,507). Most of the other manufactures are for local consumption only and could not exist without the help of the tariff. The increase in wages per head per annum was from £79 2s. (males £88 10s.; females £41 18s.) in 1906 to £135 16s. (males £159 8s.; females £68 16s.) in 1919.

Land.—The area of the Dominion, excluding the Cook and other islands annexed in 1901, is 66,292,232 ac., which from the standpoint of occupation and tenure was in 1919 broadly classified as follows:—

	Acres
Private freehold	19,255,874
Public reserves, etc.	13,591,041
Crown lands leased, etc.	19,411,473
Crown lands undisposed of	3,414,568
Native land	5,066,197
Barren and worthless country	3,307,515
Roads, rivers, lakes, etc.	2,245,564
Total	66,292,232

Noticeable features are the small area awaiting disposal by the Crown and the large area owned by the Maori people. During the last ten years 2,380,000 ac. of native land have been sold, over 1,000,000 ac. having been acquired by the Crown. Of the 5,000,000 ac. retained by the natives about 3,000,000 are leased, and much of the remainder is poor or worthless. The areas held from the Crown under the principal tenures on March 31 1920 were as follows: pastoral runs, 10,174,236 ac.; small grazing runs, 2,740,032 ac.; leases in perpetuity, 1,752,876 ac.; renewable leases, 1,744,903 ac.; occupation licences with right of purchase, 1,507,814 acres. The area resumed by the State for subdivision under the Land for Settlement scheme up to March 31 1920 was 1,891,011 ac., at a cost of £11,434,055; 6,167 selectors were holding a total of 1,631,163 ac., for which the annual rental was £462,941, and 160,325 ac. had been sold for cash or made freehold, the total purchase money being £597,169.

The unimproved value of the land of the Dominion on April 1 1920 was assessed for the North Island at £182,956,317; South Island £107,923,947; total £290,880,264. Capital value (including improvements): North Island, £302,178,759; South Island £167,914,938; total, £470,093,697.

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[1] The scope of the preferential tariff, which was established in 1903 and extended in 1907, was further extended in 1917. In 1919 the Imperial imports affected by the preference were valued at £19,519,619 and the foreign imports so affected at £11,152,079. The proportion of foreign imports affected was 21·57% in 1904 and 42·99% in 1919. The principle of the preferences is not the reduction of the duties on goods produced or manufactured in the British Dominions, but an increase of the duties on foreign goods.

Education.—The census of 1916 showed that 83·53% of the population were able to read and write, and 15·79% unable to do either. The expenditure on education from the public funds has increased rapidly in recent years, as the following figures show: 1898–9 £519,000; 1904–5 £679,000; 1913–4 £1,301,000; 1917–8 £1,814,000; 1918–9 £1,986,000; 1919–20 £2,544,000. The increase during these 21 years was from 13s. 4d. to 41s. 10d. per head.

The rapid increase had been due in part to the greater demands in all grades for free education, but chiefly to the provision of better salaries for teachers, the increased cost of maintaining buildings, and incidental expenditure. As the result of Acts passed in 1914, 1917 and 1918 respectively, the annual cost of State school teachers' salaries rose 66% in five years. The average salaries paid to these teachers in 1919, including house allowance or value of residence, were: Male head-teacher £380; female head-teacher £319; male assistant £301; female assistant £197; sole male teacher £221; sole female teacher £193.

The total number receiving instruction in 1919, excluding the pupils of private schools not inspected by the Education Department, was 255,320, made up as follows: Primary 218,174; secondary (including technical high schools) 16,084; technical and continuation (excluding technical high schools) 17,950; university colleges 3,060; Lincoln Agricultural College 52.

The average weekly roll of the State primary schools in 1919 was 193,658, with an average attendance of 90·3 per cent. Physical exercises based on the syllabus of the English Board of Education are practised in all these schools, with corrective classes for children with physical deformities. A staff of 10 school medical officers and 15 school nurses examine the children, notifying parents when medical or dental treatment is required. The number of schools visited in 1919 was 704, and about 30,000 children were completely examined. A director of school dental services has recently been appointed to superintend the treatment of dental defects and the training of children in the preservation of their teeth. A bureau of infant welfare, with Dr. Truby King as director, has also been established, with functions which include the supervision of the health and well-being of the children from birth until they enter school.

Of the 34 secondary schools 32 provide free places; the holders of these places in 1919 represented 94% of the roll number and cost the Government £111,000. The total number of pupils receiving free secondary instruction in 1919 was 12,620.

Liquor Licensing.—Local option was established in 1893, and from 1896 to 1914 inclusive the poll was taken triennially on the day of the general election in 76 licensing districts co-terminous with the parliamentary electorates. Thirteen of these districts are "dry," as the result of polls taken between 1894 and 1908 at which the three-fifths majority needed to carry no-licence was obtained. In 1910 Local Option was supplemented by National Option but a three-fifths vote was again made a condition of prohibition and its operation was to be postponed about 4½ years. The two national polls taken under these conditions resulted as follows: In 1911: Licence 205,661; Prohibition 259,943; proportion of prohibition vote to total, 55·83 per cent.; no proposal carried. In 1914: Licence 257,442; Prohibition 247,217; majority for Licence 10,225.

In 1918 the National Efficiency Board, which was appointed in 1917 to advise the Government on, *inter alia*, the enforcement of public and private economy and the promotion of national efficiency during the war, recommended total and immediate prohibition in the interest of national efficiency, but with compensation—a principle which had not been applied to the liquor trade before—for the abolition of the time-limit. The result was the Licensing Amendment Act, 1918, which abolished local option and provided for a special poll on national prohibition with compensation in lieu of the time-limit, and for triennial polls thereafter on the three alternatives of licence, prohibition without compensation, and state purchase and control, the issue in each case being determined by an absolute majority of the votes cast. The two polls taken under this Act in 1919 resulted as follows: April: Licence 264,189, Prohibition with compensation 253,827; majority for licence 10,362. Dec.: Licence 241,251, State purchase and control 32,261, Prohibition 270,250. As none secured an absolute majority no change resulted.

POLITICAL HISTORY.—The closing years of the Liberal régime which had ruled New Zealand since 1891 were not distinguished by any of the daring experiments in social, industrial and agrarian legislation which had marked its opening years. The pace had indeed been too fierce to last. It had slackened long before the death of Seddon, the enterprising and all-powerful Liberal leader, in 1906, nor was it in the power of his successors to reverse the process. Most of those early experiments had justified themselves in the public estimation. The Liberal-Labour legislation was generally accepted, but new applications of its principles were not forthcoming in sufficient force to arouse either supporters or opponents to the enthusiasm with which the original measures had been advocated and attacked. The result of this slackening of Liberal enterprise, synchronizing with the removal of that masterful personality which for thirteen years did "bestride our narrow world like a Colossus," was that during the six years of Sir Joseph Ward's administration (1906–1912) politics became relatively tame and the old party lines less distinct, though many of the old catchwords survived. At the same time Labour, dissatisfied with the alliance with Liberalism which had for many years been so fruitful, and finding the Opposition still less to its liking, began to aspire to independence.

Among the legislative achievements of the Ward Ministry may be mentioned the Land Settlement Finance Act 1909, which enabled the Government to finance associations of private buyers in the purchase of freehold estates for subdivision and settlement; the Public Debt Extinction Act 1910, which provided for the creation of sinking funds for the extinction of the public debt in 75 years; the National Provident Fund Act 1910, which encouraged the provision of annuities in old age, with supplementary benefits for the protection of the family from birth to old age, by a voluntary scheme which the State was to subsidize to the extent of one-fourth of the contributions; the Licensing Amendment Act 1910, which amended the local-option legislation and supplemented it by providing for a poll on total prohibition for the whole Dominion on the day of the triennial general election; and the Widows' Pensions Act 1911, which granted to indigent widows an allowance for each child under the age of 14.

Defence.—But the most distinguished achievements of the Ward Government were the gift of a battle-cruiser to the navy and the introduction of compulsory military training. The speeches delivered on March 16 1909 by Mr. McKenna and Mr. Asquith in the debate on the navy estimates caused much anxiety in New Zealand because, as Sir Joseph Ward expressed it, "no room is left for doubt that England feels that her supremacy on the sea is seriously threatened by the amazing naval activity in the German dockyards." The offer was accepted, and the battle-cruiser "New Zealand," built at a cost to the Dominion of £1,701,000, received her commission on Oct. 12 1912.

The establishment of compulsory military training by the Defence Act 1909, though a more serious undertaking than the gift of a battle-cruiser, did not demand the same strong initiative on the part of the Government. A movement in favour of universal military training had been in progress for some time, but at the general election in Nov. 1908 it had failed to make any material impression. Even in June 1909, when Sir Joseph Ward left to attend the Defence Conference, its position was not strong, but on his return in Oct. it had gathered irresistible force, and by Dec. 24 the reform was on the statute-book. A well-organized platform campaign, which had exploited the German peril to the full and had received the powerful help of Mr. R. McNab, a leading member of the Ward Ministry before his defeat at the general election of 1908, had carried all before it. The Defence Act 1909 provided for the compulsory military training of all able-bodied males (*a*) from 12 to 14 years of age in the Junior Cadets; (*b*) from 15 to 18 years in the Senior Cadets; and (*c*) from 18 to 21 years in the General Training Section, from which transfers were to be made to the Territorial Force if voluntary recruiting failed to keep it up to the required strength.

In 1910 the Act was amended to make the scheme fit in with the recommendations of Lord Kitchener, who in that year visited Australia and New Zealand in order to report upon their defence systems. For Australia he recommended an army of 80,000 citizen soldiers between the ages of 18 and 25 years, and a reserve in which they would serve for an additional 5 years; and for New Zealand, to which the report was made applicable *mutatis mutandis*, the number would be about 20,000. The Defence Amendment Act 1910 accordingly extended the age-limit to 25 years, with a further period of 5 years in the reserve. The extension of the age-limit involved a cutting down of the universality of the scheme, as only about half of the number eligible was required. The minimum amount of training for the Territorials and Senior Cadets included 30 drills, 12 half-day or 6 whole-day parades, and 7 days in camp.

Sustained by a strong public enthusiasm which valued the moral and physical even more highly than the military effects of the system, and tactfully guided by Maj.-Gen. (afterwards Lt.-Gen. Sir Alexander) Godley as commandant, the administration gave surprisingly little trouble; but the Ward Government, on the eve of the elections of 1911, showed less determination in the face of some recalcitrant defaulters than did either of the two succeeding Governments after the elections had passed. In 1913-4 the strength of the forces was: Permanent forces 578; Territorials 25,902; Senior Cadets 25,659. The expenditure on military defence was £519,294.

Reform Movement.—The general election of 1911 turned largely on questions of personnel and administration. The old Liberal-Labour enthusiasm had not been revived. Sir Joseph Ward, who had stated a few years before that a slackening of the pace of legislation was desirable, had no striking legislative programme to submit to the electors. The Opposition, which had lately adopted the name of Reform party, concerned itself chiefly with attacking the administration of the Government, especially in regard to partisan appointments to the public service and the Legislative Council and partisan dispensation of public works. For each of these alleged abuses the Reform party proposed a legislative remedy. They also proposed to concede to most of the Crown tenants the right to purchase the freehold—a proposal which appealed very strongly to the rural electors and took the Government at a disadvantage by dividing its followers. The Liberals were further embarrassed by the growing hostility of Labour. The independence which Labour had begun to display in Seddon's lifetime had steadily developed since, and now threatened the Government with more serious consequences by better organization, a more determined hostility, and a larger supply of Labour candidates. The alliance of small landowners and workers which had made the Liberal-Labour combination irresistible was thus threatened in both its branches.

The great weakening of the Government revealed by the polling of Dec. 7 1911 came nevertheless as a general surprise, the figures being: Government (Liberals) 37; Opposition (Reform party) 37; Labour 4; Independent 2. The new Parliament was summoned for a special session on Feb. 15 1912, and the no-confidence motion moved by Mr. W. F. Massey, the leader of the Opposition, was rejected on Feb. 27 by the casting vote of the Speaker, the voting being 39 to 39. Parliament was then prorogued, and, pursuant to a promise which he had given during the no-confidence debate, and which had saved the Government from defeat by inducing two of the Labour members to violate their election pledges, Sir Joseph Ward resigned the premiership. He also declined to take any other office. A new Liberal Ministry was formed by Mr. (afterwards Sir) Thomas Mackenzie, which included no member of the Ward Ministry except himself, but on the reassembly of Parliament it was defeated on the first test division by 41 votes to 33 (July 6). The Liberal regime which had ruled the country for 21 years without a break, and during the greater part of that time with an absoluteness which was good neither for the country nor for the party itself, was at an end. It was significant that three-fourths of the Opposition majority was accounted for by secession from the Government, who gave the land question as the reason for their change.

Mr. Massey was sent for and on July 10 the Mackenzie Ministry resigned, and the names of the new ministers with their principal portfolios were as follows: Mr. W. F. Massey, Prime Minister, Lands, Agriculture and Labour; Mr. (afterwards Sir) James Allen, Finance, Defence and Education; Mr. W. H. (afterwards Sir) William Herries, Railways and Native Affairs; Mr. (afterwards Sir) William Fraser, Public Works, Mines; Mr. A. L. Herdman, Attorney-General, and Justice M. B. Fisher, Customs and Marine; Mr. F. H. D. (afterwards Sir Francis) Bell, K.C., Internal Affairs and leader of the Legislative Council; Mr. R. H. (afterwards Sir Heaton) Rhodes, Postmaster-General and Public Health; Mr. Maui Pomare, Cook and other islands and member of Executive representing the native race. The new Ministry made good progress in its first session with the measures which the Reform party had promised on the hustings. The Public Service Act 1902 placed a large part of the service under the sole control of a Commissioner and two Assistant Commissioners to be appointed for the term of seven years, responsible only to Parliament, and removable only for misconduct or incompetence. A salutary restraint was placed upon the activity of the politicians by a clause which rendered anybody liable to a £50 fine who sought to interfere with the Commissioner's decision in regard to any appointment, promotion or dismissal, a principle which Sir Joseph Ward had in 1907 declared his willingness to accept in its application to members of Parliament. The completeness of the measure was seriously marred by the exclusion of the railways, one of the largest of the departments, from its operation. Another, the Post and Telegraph Department, was excluded in 1918 when the National Government was in office; but Mr. Massey afterwards declared the intention of the present Government to extend the scope of the Act. The measure certainly enhanced the independence of the service, as its members fully appreciated, and the Liberals, who strongly opposed the passing of the bill, appear to have accepted the principle. In a country where, according to the estimate made by a Liberal minister, Mr. J. A. Millar, as long ago as 1909, about one-eighth of the people are directly dependent on the State, the importance of this principle is obvious. No attempt has been made to deal with what the Reform party justly denounced to the electors as a much more powerful instrument of political influence—the ministerial control of Public Works, which in judicious hands may determine the votes of a whole countryside in favour of the Government. A measure of decentralization which will delegate much of this power to an improved local Government system seems to be the remedy required.

The reform of the Legislative Council was undertaken in 1912 in a drastic bill which was read a second time by the Council and then shelved. As finally passed two sessions later, after the Government had appointed new Councillors for the purpose, the Legislative Council Act 1914 provides for the popular election of a Council of 40 members—half the number of the members of the House. For the purposes of the Council election the 76 single-member electorates which elect the European members of the House will be grouped in 4 electoral divisions, 2 for each island, and each division will return its quota of Councillors under the Tasmanian system of proportional representation. The quota will be readjusted after each census in accordance with the population, but it will always be an odd number, and it is fixed for the present at 11 for the North Island divisions and 9 for those of the South Island. Though the Act was passed in 1914, it was not yet in operation in 1921. As it had sharply divided the parties, its suspension was made a condition of the war coalition, and in 1920 its operation was further postponed by an amending Act. Mr. Massey shared the widespread opinion that the power of nomination to the Council should not be entirely abolished. The measure never attracted any general enthusiasm, and the higher standard observed by the Reform Government in its nominations much weakened the case that the party made for a change in the law when in Opposition.

Land Agitation.—The land question, which had contributed more to the Reform party's success than any other legislative issue, was also dealt with during the Massey Government's first session. In 1907 Mr. R. McNab, who was then Minister of Lands in the Ward Government, had done good work by procuring the abolition of the "eternal lease." That a tenure which alienated Crown land for a 999-years' term on a 4-per-cent. rental without revaluation—thus seeking to settle the battle of the tenures by a compromise which combined the vices of both—should have remained on the statute-book during 15 restless years, is one of the wonders of New Zealand politics. Mr. McNab's Land Act substituted for this absurdity a perpetually renewable lease—a lease for 66 or 33 years, with a continuous right of renewal subject to revaluation, and gave the holders of existing perpetual leases the option of converting them into renewable leases or purchasing the freehold. The right of purchase, however, did not extend to "settlement land"—*i.e.*

land generally of an improved character, acquired by the Crown under the scheme for the purchase and subdivision of large estates. Mr. Massey's Land Act of 1912 extended the right to settlement land and also authorized the sale of any such land for cash, besides making the terms of the purchase more favourable to the tenants; but the 9,000,000 ac. set aside by Mr. McNab's Act as a national endowment for education and old-age pensions were not interfered with. A long-standing controversy was thus determined, and perhaps finally settled, in favour of the freehold. The attempt to make the retention of the fee-simple by the State a touchstone of Liberalism had never succeeded, and if the statesmen of an earlier generation who pioneered the proposal were here to-day they would doubtless admit that the political power of Crown tenants clamouring for concessions is a danger which their theories had overlooked. There is wisdom in the saying, "In time of trouble the State will look to the freeholder, but the leaseholder will look to the State." It is to taxation that the reformer must now look for the revenue which he had once hoped to get from rents and unearned increment.

Labour Difficulties.—Industrial troubles soon claimed the attention of the Massey Government. The Court of Arbitration was very popular with the workers during the first 11 or 12 years of its existence because, in a period of expanding industry, it rarely sent them away empty-handed. There were no strikes during those years (1894–1905), and only one in 1906, but in 1907 and 1908 the dissatisfaction of the workers found expression in 24 strikes and in denunciation of the Court as an ally of the capitalists. The power which the Court exercised of attaching the funds of a union guilty of promoting an illegal strike also led some of the unions to escape its jurisdiction by cancelling their registration as industrial unions under the Arbitration Act. This policy was encouraged by the New Zealand Federation of Labour, to which, under the banner of revolutionary socialism, a strong minority of militant unions, including those of the miners, seamen and waterside workers, was affiliated. The Miners' Union at Waihi was one of those which had cancelled their registration under the Arbitration Act, and in 1912 some 150 of its members, disliking the methods of the executive, seceded, formed a new Engine-drivers' and Winders' Union and applied to have it registered under the Act. The granting of the application was the signal for the members of the original union to "down tools." A strike which was unique among New Zealand strikes, both in its origin and in its duration (May 13–Nov. 30), resulted in complete defeat.

A much more formidable strike occurred in the following year. On Oct. 22 1913, as the result of a dispute arising from their sympathy with a grievance of the shipwrights, the Wellington Waterside Workers' Union struck. Under the conduct of the Federation of Labour the strike spread to most of the other ports, to the coastal and intercolonial shipping, and to the coal-mines; but the attempt of the Federation to make the strike general had little effect except in Auckland. Both there and in Wellington the strikers seized the wharves, and for about ten days blocked the ports except to passenger traffic. It was the dramatic intervention of the farmers, many of whom were brought face to face with ruin by the stoppage of the export of their butter and cheese, that saved the position. In Wellington they supplied 1,000 mounted men, to act with the same number of special constables on foot, enrolled from the citizens, in recovering the wharves and restoring order. The farmers also supplied the new Waterside Workers' Union, which was formed and registered under the Arbitration Act, with most of its members; and the despatch of the "Athenic" on Nov. 18 with a full cargo of produce was recognized as the turning-point of the struggle. On Dec. 20 the whole strike was declared off except in the mines, and the following month the miners also accepted the inevitable. In the case of all the principal unions the employers had been able to make registration under the Arbitration Act a condition of the settlement. The Government, and especially Mr. Massey, the Premier, and his Minister of Justice, Mr. Herdman, gained great credit for the resolution and the energy with which they faced Labour dictation.

The War.—Britain's declaration of war against Germany was read in Wellington from the steps of Parliament House on the afternoon of Aug. 5 1914 by Lord Liverpool.[1] The news was received with enthusiasm, and the country threw itself eagerly into the work of recruiting, equipping, raising war funds and the like. The New Zealand Advance Expeditionary Force (1,419), destined for German Samoa, left Wellington on Aug. 15, and the Main Expeditionary Force (7,761) on Oct. 15. Parliament, which had assembled on June 25, and before the outbreak of war was for the third successive session dealing with the Legislative Council Bill above described, put the measure through, but otherwise there was little controversial legislation. The characteristic work of the session was the passing of 13 war measures. A Banking Amendment Act empowered the Governor in Council to make bank-notes legal tender. By the Regulation of Trade and Commerce Act the same authority was enabled to fix maximum prices of goods, to prohibit exportation, and to suspend or modify the Labour laws. The Mortgages Extension Act[2] prevented a mortgagee from calling in or exercising his power of sale except with the leave of the Court.

The War Regulations Act empowered the Governor in Council to make regulations prohibiting acts "injurious to the public safety, the defence of New Zealand, or the effective conduct of the military or naval operations of His Majesty during the present war." In the discussion of these measures and of the other issues presented by the war the spirit of party was kept creditably in abeyance. There was, however, no strong feeling in the House and little more in the country against proceeding with the general election on its due date at the end of the year. But no election campaign was ever more languidly conducted. With most of the old issues out of the way and the shadow of the war over everything, the dividing line between the principal parties was less distinct than ever, and the fact was emphasized by the gulf that divided both from the socialism of the Labour party. The polling took place on Dec. 10 1914, and the result, as modified by sundry election petitions and the by-elections arising therefrom, was: Government (Reform party) 41; Opposition (Liberals) 32; Labour 7. A position which would leave the Government in a majority of one after the election of the Speaker plainly presented the alternatives of deadlock and dissolution, with the grave weakening and possible paralysis of the country's war effort in either event.

Trentham Camp.—When Parliament met on June 24 1915 the fierceness of the party storm which raged round the defence administration, especially in regard to the alleged mismanagement of Trentham Camp, made the outlook very black, but wise leadership on both sides averted disaster. The announcement of the success of the negotiations for coalition on the first anniversary of the declaration of war contributed not a little to the success of the celebrations. The National Government was sworn in on Aug. 12 1915, the members with their principal portfolios being as follows: Mr. W. F. Massey (Reform), Prime Minister, Lands and Labour; Sir Joseph G. Ward (Liberal), Finance and Postmaster-General; Mr. (afterwards Sir) James Allen (Reform), Defence; Mr. W. H. (afterwards Sir William) Herries (Reform), Railways and Native Affairs; Mr. A. L. Herdman (Reform), Attorney-General; Mr. R. McNab (Liberal), Justice and Marine; Mr. (afterwards Sir) William Fraser (Reform), Public Works; Mr. G. W. Russell (Liberal), Internal Affairs and Public Health; Sir Francis H. D. Bell, K.C. (Reform), leader of the Legislative Council; Mr. A. M. Myers (Liberal), Customs, Munitions and Supplies; Mr. W. D. S. Macdonald (Liberal), Agriculture and Mines; Mr. J. A. Hanan (Liberal), Education; Mr. Maui Pomare (Reform), Cook and other islands, member of Executive representing native race. In 1917 Mr. McNab died and Mr. T. M. Wilford (Liberal) became Minister of Justice and Marine; and after Mr. Herdman's resignation on Feb. 4 1918 to take a seat on the Supreme Court bench, Mr. H. D. Guthrie (Reform) joined the Government as Minister of Lands, Sir Francis Bell taking the attorney-generalship. With these changes the National Government remained in office throughout the war, the life of Parliament, which in ordinary course should have expired in Dec. 1917, being extended for two years. The Government was never popular, and during its last year was extremely unpopular. But by enabling the country to concentrate its energies upon the prosecution of the war, and to make the necessary provision for meeting the cost, it accomplished a great work which dwarfed that of every other government in the history of the Dominion and would have been beyond the power of either of the parties standing alone.

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[1] Lord Islington, who was appointed governor in 1910, was succeeded by Lord Liverpool in 1912. The title was changed to governor-general on June 28 1917. Lord Jellicoe succeeded in 1920.

[2] The operation of this measure, subject to various amendments, has been extended to Dec. 31 1922. Legislation to restrain the increase of rent was not passed till 1916, and remained in force until Dec. 31 1921.

Nearly 63,000 voluntary recruits had been accepted for service or registered as medically fit in 21 months of war, and more than 46,000 had been despatched oversea, before it became necessary to think of conscription. The patriotism of the people and the suspension of party government saved the National Cabinet from any serious difficulty in making the change. The Military Service bill was wisely brought in while the voluntary system, though weakening in its appeal, was still giving excellent results. The justice of compulsion commended it to popular sentiment almost as much as its necessity, and the bill, which was introduced by Sir James Allen on May 24 1916, passed its second reading in the House of Representatives by 49 votes to 5, and became law on Aug. 1 1916. Except from some of the Labour members the bill met with no opposition. The men who were selected in the first ballot under the Act taken on Nov. 23 1916 went into camp without trouble or hitch of any kind, and the Act worked for the most part with remarkable smoothness throughout—a result in large measure due to the quiet determination of Sir James Allen, upon whom, both as Minister of Defence throughout, and as acting Prime Minister during the long absences of Mr. Massey and Sir Joseph Ward on War Cabinet and Imperial Conference business, the whole burden fell.

His most serious difficulty was a coal strike in April 1917, which was avowedly inspired by hostility to conscription, despite the fact that miners were being treated by the Military Service boards even more indulgently than the farmers as persons engaged in an essential industry. A settlement which apparently recognized this right to exemption as absolute and condoned an illegal strike was generally considered to have purchased peace at too high a price, but the fear that the trouble would recur was not realized. A few months later the opponents of conscription received encouragement from an unexpected quarter. In July 1917, shortly after their return from the first Imperial War Cabinet meetings, it was suggested by both leaders that it was time to consider how many more men the country could send. But Sir James Allen, who had already called up 10,000 men under the Military Service Act and was then proceeding with his ninth ballot, made it clear a few days later that the suggestion implied no faltering with the compulsory scheme, and a united Cabinet saw it through. Class C of the Second Division of the Expeditionary Force Reserve—married men with two children—had just received their summons when Germany collapsed. The total number of men provided was 124,211, of whom 91,941 were volunteers. A country 10,000 m. from the main theatre of war had, from a population of 1,090,000, sent 100,444 soldiers and nurses across the seas.

War Finance.—The first three of Sir Joseph Ward's four war budgets placed the burden of the new taxation in an increasing degree on incomes. That of 1915 effected no drastic increase but established an important change in principle which seems likely to be permanent. The exemption from income-tax which income derived directly from land or mortgages of land had hitherto enjoyed, on the ground that land and mortgages were liable to land-tax on their capital value, was removed. In 1916 a tax of 45% on excess profits arising during the war was tried, but its operation proved to be so inequitable that it was not renewed. In 1917 the land-tax, which before the war had ranged on a graduated scale from 1d. to 7d. in the pound on the unimproved value, with an exemption of £500, was increased 50%, with an additional 50% in the case of absentees. The exemption of incomes not exceeding £300 was retained, but on higher incomes the tax, which before the war began at 6d. for persons and 1s. for companies and rose to 1s. 4d. when the income exceeded £2,400, was made to range from 1s. 3d. for persons and 2s. 3d. for companies to a maximum of 7s. 6d. on incomes exceeding £6,700. Additional revenue was also obtained from increased stamp duties, customs duties, postages, railway fares and freights and in other ways, but these items were small in comparison with the income-tax. The total revenue derived from taxation rose from £5,918,084 in 1913–4 to £13,801,643 in 1918–9, the contributions of land-tax and income-tax being £767,451 and £554,271 respectively in 1913–4, and £1,512,683 and £6,219,336 respectively in 1918–9. The taxation per head was £5 10s. in 1913–4 and £12 7s. 8d. in 1918–9; the estimate for 1920–1 was £15 7s. 6d.

No attempt was made, however, to meet the cost of the war from revenue, and in 1916, with the war expenditure approaching £1,000,000 a month and the London market no longer able to supply all the Dominion's needs, the Government was compelled for the first time to float a large loan locally. The £8,000,000 asked for in Sept. 1916 was over-subscribed to the extent of £1,250,000 within the eleven days allowed, and shortly afterwards the subscriptions totalled £11,000,000. Subsequent loans were less eagerly taken up, but there were no failures. The success was due in part to the provision which from 1917 onwards enforced contributions to these loans from taxpayers whose taxable income exceeded £700. Between March 31 1914 and 1920 the gross debt of the Dominion rose from £99,730,427 to £201,170,755. The net indebtedness per head on the dates named was £84 2s. 8d. and £165 3s. 1d. respectively. Of the gross increase of £101,440,328 no less than £85,157,459 had been raised in the Dominion, £80,089,025 being for war loans. The percentage of the total debt raised in each of the money markets and outstanding on March 31 1910 and 1920 respectively was: 1910—London 77·09, New Zealand 17·42, Australia 5·49; 1920—London 47·58, New Zealand 50·74, Australia 1·68.

Imperial Government War Supplies.—New Zealand was well able to bear the drastic increase in taxation and to find the loan moneys needed, owing to the high prices ruling for her produce throughout the war and the terms on which the greater part of it was disposed of.[1] Not merely did the British navy keep the sea-ways open for her trade, but the British Government supplied the tonnage to take her produce away and paid for it almost regardless of the risks of ocean traffic in time of war. Through the agency of the New Zealand Government, all the Dominion's exportable mutton, lamb and beef were purchased by the Imperial Government as from March 3 1915, and contracts for other produce followed, viz. scheelite (Sept. 20 1915); cheese (Nov. 4 1915); wool (Dec. 1 1916); sheepskins (Feb. 5 1917); hides (March 31 1917); freezing companies' slipe wool (March 31 1917); and butter (Nov. 20 1917). The Imperial Government Supplies Department, which the Dominion Government organized for the purchase and control of all this produce, was one of the most efficient of its business enterprises. The prices paid for the wool were fixed at 55% above those ruling in 1913–4; the Imperial Government also undertook to return to the wool-growers half the profits in wool sold for other than military purposes.[2] In other cases the schedules of prices were revised from time to time. In the case of frozen meat advances had been made since June 1918 to the extent of 75% of the value after the meat has been in store six weeks. In the case of butter and cheese 90% of the value was advanced on any remaining in store for fourteen days before shipment. Half of the profits arising from the sale of butter in the United Kingdom was returnable to the producers. The price paid by the Imperial Government for creamery butter, first-grade, was 157s. per cwt. in 1917–8 and 181s. in 1918–20. First-grade cheese was purchased at 7¼d. per lb. in 1915–6; 9½d. in 1916–7; 10d. in 1917–8; and 10¾d. in 1918–20. By various extensions most of these purchases were continued till the end of July 1920, but the contract for butter did not lapse till March 31 1921. The total amount paid to the producers of the Dominion by the Imperial Government down to the end of the month which covered the Armistice (Nov. 30 1918) was £74,658,816. By March 31 1921 the total was £156,022,005, the principal items being: wool £60,377,260; frozen meat £53,039,535; cheese £21,158,968; butter £16,283,650.

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[1] The bank returns illustrate the Dominion's war prosperity. The deposits, which were £25,733,187 in 1913, rose subsequently as follows: 1915 £31,433,653; 1916 £37,757,917; 1917 £42,930,713; 1918 £45,562,939; 1919 £50,489,444; 1920 £59,405,341. The ratio of advances to deposits in 1916 was 71·48, the lowest yet recorded. On the other hand, the effect of excessive importing and the lower prices of produce is shown in the withdrawal of £11,775,290 during the Dec. quarter of 1920, and in the excess of advances over deposits during the March quarter of 1921, amounting to £5,290,610. The deposits in the Post Office Savings Bank increased from £17,131,414 in 1913 to £38,393,131 in 1919.

[2] Of some 2,000,000 bales of wool purchased by the Imperial Government only 9,668 were lost in transit, representing less than 0·1% of the war-time purchases. In 1920, when the wool-growers

Through the generosity, regularity and promptitude of these payments the period of the war, which must otherwise have been one of financial stress or even disaster for the Dominion, became "an era of guaranteed prosperity"; and it is unfortunate that the arrangement has closed in circumstances which have tended to blind the producers and the people to the extent of their obligation.

The sudden reverse of fortune which the world-wide depression of 1920–1 brought upon the farmers of the Dominion was aggravated by the congestion of produce held for the Imperial Government in the ports of the Dominion and by the holding of wool, mostly in the United Kingdom, to the value of about £22,000,000, until it became a drug on the market, and the responsible authorities were severely criticized in consequence. But when the trouble has passed the Dominion's indebtedness to the mother country for the absolute security and the unique prosperity which it enjoyed during the war will stand out once more in true perspective.

War Pensions and Repatriation.—The first War Pensions Act was passed in 1915. By this and various amending measures the weekly pension in case of death ranges from 30s. for the widow of a private to £3 10s. for the widow of a brigadier-general or major-general, with the addition, if there are any children, of 10s. payable to the widow, regardless of rank, and 10s. for each child. In the case of disablement the maximum weekly pension is £2 for a private, £1 for his wife and 10s. for each child. For a brigadier-general or major-general the maximum is £3 5s. with £1 12s. 6d. for the wife and 10s. for each child. The number of war pensions in force on March 31 1920 was 34,571 (24,661 temporary, 9,910 permanent), of the gross annual value of £1,869,365.[1]

By a series of Discharged Soldiers' Settlement Acts (1915–8) liberal provision was also made for the settlement of discharged soldiers on the land or for financing them in the purchase of houses in the towns. A Repatriation Department was also established early in 1919 "for the purpose of helping every discharged soldier requiring assistance to secure for himself a position in the community at least as good as that relinquished by him when he enlisted for war service." The help rendered has been under three main headings of employment, training, and financial assistance. Under the first head it was found that only about 25% of the discharged soldiers desired help from the Government. By March 20 1921 the Department had in the first twenty-five months of its operations dealt with 50,181 cases. Suitable employment had been found for 22,902 discharged soldiers; vocational training with sustenance or subsidy had been arranged for 5,584 men; the after-care officers had dealt with 1,114 chest cases and 1,040 others. Loans for acquiring or establishing businesses had been granted to 5,516 applicants, and for the purchase of furniture, tools, etc., to 11,370 others, while financial assistance of other kinds had been given in 4,187 cases. The total of these advances was £1,801,883 against which instalments of £475,351 had been collected.

The total expenditure on repatriation to March 31 1921 was as follows:—

Discharged Soldiers' Settlement Act:	
Advances for stock and purchase of houses and private land	£18,130,964
Land Settlements Act:	
(*a*) Capital value of 293 estates, comprising 489,915 ac., purchased, subdivided and offered to soldiers	£5,423,253
(*b*) Cost of 15 estates, comprising 40,511 ac., purchased and now being subdivided and prepared for settlement	£364,195
Repatriation Act:	
Financial assistance for establishment of businesses, for purchase of furniture, tools, etc., and for sustenance, etc.	£1,801,883
	£25,720,295

The number of discharged soldiers thus settled on the land was 7,341; and 1,601 more had taken up leases of Crown land. The total area of their holdings was 2,872,574 acres. In addition 9,200 were helped to purchase or erect town dwellings under provisions which authorize advances up to £1,150 for the purpose, making the total number of discharged soldiers enabled by the Department to acquire land 18,142.

The Repatriation Department has certainly been one of the most efficient and economical of the enterprises enforced by the war. The land settlement policy, on the other hand, has been too generous to be businesslike. The bounty of the State to its defenders has not been limited by the ordinary canons of prudent lending, and advances have sometimes been made up to the full value of the land. The "boom" prices of land, and especially of dairying and grazing land, during the period 1917–21 presented a serious obstacle to the scheme, nor had the utmost caution prevented a department which had had to make large purchases of land from aggravating the evil. The soldier who had bought at the prices then ruling and borrowed most of the purchase-money was faced with the project that he might be sorely tried if hard times continued.

Cost of Living.—As in other countries, one of the main charges against the Government was its failure to check the steady rise in the cost of living; yet New Zealand probably suffered as little from this world-wide malady or from the negligence of its Government as any other country. The Government relied chiefly on the Board of Trade, which was appointed in March 1916, under the Cost of Living Act 1915, to deal with the questions covered by the title of the Act and to advise the Government generally on the development and protection of trade, industry and commerce. This Board fixed the prices of wheat, flour, bread, milk, groceries, timber and other articles from time to time; arranged in 1918 (in view of the expected local shortage) for the purchase by the Government of 4,000,000 bus. of wheat in Australia, for the guarantee to the Dominion farmers of a minimum price for their wheat, and subsequently for the purchase of the crop by the Government. It also devised a scheme in 1916 for fixing the price of butter at about 1s. 7d. per lb. throughout the war. The scheme was abandoned in the following year and the price fixed at 1s. 9d. In 1917–8 the half-share of profits (£307,919) from the sale of New Zealand butter in the United Kingdom, which, by arrangement with the Imperial Government, was returnable to the producers, and for the two following seasons a grant of £340,000 from the Consolidated Fund, were applied towards the equalization of prices as between factories

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received £1,620,000 for their share of the surplus profits, a large number of them, after the tide of their prosperity had already turned, displayed a due sense of their obligations to those who had made this wonderful result possible. Under a scheme initiated by Mr. E. Newman, M.P., himself a sheep-farmer, £214,209 (less income-tax amounting to £31,340) was set aside for the benefit of seamen of the navy and mercantile marine disabled during the war and the dependents of those who had lost their lives.

[1] On the same date there were 19,993 old-age pensions in force and 3,444 widows' pensions. The expenditure on the former during the year 1919–20 was £732,968, representing a cost of 12s. 6d. per head as against 7s. 7d. in 1913–4. The normal amount of an old-age pension is now £39 per annum. The expenditure on widows' pensions in 1919–20 was £136,815.

which exported and those which supplied the local markets at the prescribed price.[1]

In June 1918 the Board of Trade arranged with the Colonial Sugar Co. for the supply of sugar (No. 1A) from Fiji to the New Zealand market at a price of £21 per ton f.o.b. Auckland till June 30 1917. The price was afterwards increased to £22 10s. and remained at that figure till the end of the war. Even after a later increase had brought the price up to £23 15s. for the nine months ending March 31 1920, it was believed to be the lowest then being paid anywhere.

In its report issued in Sept. 1917 the Board of Trade expressed the opinion that probably 90% of the population had benefited to some extent by the prevalence of war-prices, even after allowing for depreciations in the purchasing power of the sovereign. The extra millions that poured into the Dominion through the appreciation of its produce were, of course, a great boon to the country as a whole, but the rise in retail prices was naturally more clearly perceived. The increase % in the prices of the three principal food groups for the month of July in each of the six years over the prices prevailing in July 1914 is officially estimated as follows: 1915, 12·15; 1916, 19·25; 1917, 26·82; 1918, 39·35; 1919, 43·85; 1920, 67·38. The rapid advance between July 1919 and July 1920, which almost equalled that of the first three years combined, was fully maintained during the following five months, the figure for Dec. 1920 being 78·97, but there was afterwards a slight decline. On Feb. 15 1921 the increase of food prices over the level of July 1914 was 75·05%, as against 149% for the United Kingdom on March 1. During the six months ended Feb. 1921 the cost of living, as measured by the prices of food, rent, fuel and light combined, showed a rise of 59·52% above those of the six months before the war (Jan.–July 1914). There was little economy during these years except what was involuntary. The amount invested by the public on the totalizator at the race meetings rose from £3,538,188 in the racing year 1912–3 to £8,788,788 in 1919–20. The expenditure on alcoholic liquor, which was £4,137,653 in 1913, amounted to £7,587,229 in 1920.

Another of the instruments by which the Government sought to deal with the cost of living was the Court of Arbitration. Established for the purpose of adjudicating upon industrial disputes which the machinery of conciliation had failed to compose, this tribunal had tended more and more to the position of a court of first instance dealing with questions of wages. It was at first suspected by the employers and afterwards hated by a large section of the workers, and in recent disputes it has sometimes been ignored by the Government itself in favour of special tribunals. The war kept the Arbitration Court busy with applications for increased wages, but it did not always pass the whole burden of increased prices on to the employers, and the miners, who stood outside the Arbitration Act, could boast of a 27% increase in wages, while unions which relied on the court had to be content with 10 to 15%. The president (Mr. Justice Stringer) said that "the court raised wages in sympathy with the cost of living and after a year found that the wages were farther off than ever from being in correspondence with the increased cost of living. The court also realized that there must be a limit to the amount paid in wages, especially in a community competing with other countries." Nevertheless an Act passed in Dec. 1918 empowered the court to review current awards and directed it in so doing to take into consideration any increase in the cost of living since its last award. This enactment the court accepted as a mandatory instruction, in the absence of any countervailing consideration, to raise wages in correspondence with the cost of living, and the subsequent applications for bonuses have been determined on figures supplied by the Government statistician. In short, "as has been said, the court now considers that its main function is the maintenance of real wages." Parliament passes on to the Arbitration Court a task which is beyond its power and the court wonders that Parliament, which has the necessary power, does not take on the work itself. In 1920 Parliament withdrew its mandate and gave the court a discretion in the matter, but it has not yet found the cure for profiteering.

End of Coalition Government, 1919.—Mr. Massey and Sir Joseph Ward, who had left the Dominion on Dec. 12 1918 in order to represent New Zealand at the Peace Conference, returned on Aug. 6 1919. Parliament had been summoned for the 28th. The question about the coming session, which had excited the keenest interest, was determined a week in advance by the resignation of Sir Joseph Ward, promptly followed by that of all his Liberal colleagues. Formed on Aug. 12 1915, the National Government had come to an end on Aug. 21 1919. The news was received with deep regret by independent men, who feared that the division of the constitutional forces and the general unrest and discontent would give revolutionary labour a unique opportunity. But the enthusiasm of the Liberals, whose fighting men had long been chafing under the restraints of the Coalition, was unmistakable. The fulfilment of the purpose for which the National Government was formed was the reason given by Sir Joseph Ward for his action, but he also complained that he had not been properly consulted.

Mr. Massey's position was one of great difficulty. Within a week of the session and within four months of the general election he had to form a new party Cabinet and, with no assured majority, make a start with the work of reconstruction. But he faced the position boldly, and emerged from the session not only with his new Cabinet unbeaten but with a large number of useful measures to its credit and with his own prestige as a leader much enhanced. Apart from this personal success, the striking features of the 1919 session were, first, Sir James Allen's budget (Sept. 23), which provided for an ordinary expenditure of £22,441,057 and loans totalling £30,325,000, all but £1,000,000 being for the benefit of discharged soldiers and which gave a genuine earnest of economy by reducing departmental expenditure outside the Education Department by £400,000; and, secondly, the unfortunate party competition of which the soldiers' gratuities became the subject. The Government proposal amounted to 1s. 6d. per day, the Liberal leader proposed 2s., and the Labour party 4s. The competition illustrated in a striking way the dangers which a non-party control had averted during the war, but the fear that it would be renewed on the hustings was not realized. The Government's proposal, which involved an expenditure of £6,050,000, was carried, and the question was not reopened.

In the campaign which followed the rising of Parliament on Nov. 5 1919 the dividing line between the Reform party and the Liberals appeared to be more arbitrary than ever. Except that the Liberals advocated a state bank, the nationalization of coal-mines and flour-mills, and proportional representation—subjects in which the electors displayed no great interest—there was little in the generalities of either programme that might not as well have been in the other. Labour, on the other hand, was in the field with a thorough-going programme of nationalization and socialism, and under leadership which inspired more distrust and alarm than the programme itself.

The Rise of Labour.—For the first time since it had helped the Liberals to victory at the general election of 1890, Labour had become a really formidable force in New Zealand politics, and it was now both independent and revolutionary. In July 1913 negotiations for reconciling the antagonism between the old trade-union ideals and methods and those of direct action and class warfare had resulted in the prefixing of "United" to the title of the Federation of Labour, with a constitution which left the burning question of registering under the Arbitration Act to the option of each union. But the result was in the main a triumph for the revolutionaries, nor was their power more than temporarily checked by the crushing defeat of their policy in the great strike of 1913. Through varying phases of organization they gained steadily throughout the war at the expense of the moderate elements. A notable development on the industrial side was the grouping in 1919 of some of the more militant unions in the National Industrial Alliance of Labour, which has superseded the Federation of Labour. A check was administered to the amalgamation of industrial unions in 1918 by an important decision of the full court that only those unions can amalgamate whose members are engaged in the same industry. The direct march towards the ideal of "one big union" is thus barred, but the way left clear for organization on a national basis, and this organization is proceeding. The aim of the National Alliance of Labour, which was approved by a representative conference in 1920, is to have all the industries nationally organized, and to federate these national organizations. The Alliance is to be a "Federation of National Federations." With the federations of the freezing workers, waterside workers, seamen, drivers, tramwaymen, miners and railwaymen linked up, and the number still growing, the Alliance of Labour claims to be already the most powerful Labour organization ever established in the Dominion. It is noteworthy that the Amalgamated Society of Railway Servants, upon whose loyalty the Government was able to rely in the great strike of 1913 and in other troubles, has now thrown in its lot with the direct actionists. Industrially the Labour party thus promises to be better organized for war than ever before, and it is in a warlike mood. The litigious spirit fostered by the machinery of compulsory arbitration, which has made New Zealand singularly barren of such experiments in mutual goodwill and understanding between capital and labour as the Whitley Councils, is now yielding to a more aggressive policy on the part of the workers which will make peaceful coöperation still more difficult.

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[1] In 1920, when the Imperial Government had offered 2s. 6d. per lb. for the coming season's butter, Parliament voted £600,000 to enable the producers to supply the local market at the retail price of 2s. 3d.

Politically also the Labour party has made a great advance. The violence of its anti-patriotic and anti-military propaganda was restrained during the war by the stringency of the war regulations against seditious language and language calculated to interfere with recruiting; but war-weariness, the cost of living, and all the shortcomings, real and imaginary, of the National Government gave the party towards the close of the war a great opportunity as the most convenient vehicle for popular discontent. In 1918 three of the revolutionary leaders who had been convicted of offences in relation to the great strike or against the war regulations were successful at by-elections,[1] and two of the seats were captured from the Government. The inertness of a Government which regarded its position as secure was largely responsible for this result, but the success of a party whose attitude to the war had been described by one of its own leaders as that of "dignified neutrality" was a strange paradox in the last year of the war. Its choice of candidates indicated the complete political ascendency of the revolutionary element in the party. At the general election of 1919 the prospects of Labour were improved by the disruption of the Liberal-Reform Coalition, and it had candidates in 50 of the 76 non-Maori constituencies, the contest in 34 cases being triangular.

As one of its leaders said, the Labour party had thus "the chance of its life," but the fact that outsiders could see this as clearly as its own members was probably the turning-point of the election. Hatred of the party's war record, distrust of its leaders, and the fear that it might at least be strong enough to secure the balance of power set large numbers of electors seeking the most effective method of voting against Labour. By their prejudice no less than by their principles the Reform party were more widely separated from Labour than the Liberals, and Mr. Massey's declarations against coöperating with Labour were rather more emphatic than the Liberal leader's. Disapproval of the way in which the Liberals had broken up the Coalition, and admiration of the manner in which Mr. Massey faced the crisis thus forced upon him, must also have helped the swing of the pendulum in the direction of the Government. The polling took place on Dec. 17 1919 and resulted as follows: Government (Reform) 47; Opposition (Liberals) 20; Labour 8; Independent Labour 2; Independent 3. The thoroughness of the Reform party's victory, which excited general surprise, was in part due to the chances of an unscientific electoral system. The second ballot had been tried at the elections of 1908 and 1911, but the collective bargaining for votes which it induced was the main cause of its repeal in 1912. The hope that the Massey Government, which repealed it, would provide some better remedy for the anomalies produced by three-cornered fights in single-member districts was disappointed. The official Opposition estimate of the voting in the European constituencies, after amending it by transferring from the Liberals the votes cast for the three Independent Labour or Liberal-Labour candidates to the Independents, is as follows: Government (Reform), 206,461; Opposition, 182,426; Labour, 127,024; Independent Labour, 14,411; Independents, 12,345. On a proportionate basis the Government would have had approximately 30 seats, the Opposition 26 and Labour 18, instead of 44, 22 and 8 respectively, with 2 to apportion among the Independents. These calculations relate to the European constituencies only. The four Maori electorates gave three supporters to the Government and one to the Opposition. Next to Mr. Massey's personal triumph and the rise of the Labour vote, the defeat of Sir Joseph Ward, the Liberal leader, in a constituency which had stood by him in the 32 years of his political career, was the outstanding feature, and none was more widely regretted.

Between the general election and the meeting of Parliament in June 1920 Labour troubles and the Prince of Wales's visit kept the Government fully occupied. Discontent had been rife in the coal-mines throughout the war, and in April 1917 Sir James Allen had been compelled to settle a threatened strike by concessions for which the need for maintaining the Dominion's military efforts undiminished during the acutest crisis of the war was held to be the only sufficient plea. But the truce did not last long and the rejection by the mineowners of the men's demands led in Aug. 1919 to the adoption of a "go-slow" policy in all the mines. The output, which before the war had averaged some 2,250,000 tons per annum, was reduced by about one-third. The supplies for both household and manufacturing purposes were very short; public services, such as railways, tramways, and gasworks, were embarrassed and curtailed; and a system of rationing was established for the first time. In Feb. 1920 Mr. Massey convened a meeting of the parties and succeeded in effecting a settlement. The principal demand of the men, which was for the replacement of the contract system by one of fixed wages, was rejected, but a minimum payment of 12s. per shift averaged over each fortnightly period was conceded and also a general increase of wages.

Another long-standing trouble was handled in a way that brought the Government less credit. The railway workers, to whom the country was especially indebted for industrious and loyal service during the war, had not been rewarded by the advantages which other sections of labour had obtained by militant tactics. After a long delay their grievances were referred to a commission presided over by Mr. Justice Stringer, which in March 1920 recommended a bonus of 6s. a week, representing an advance of 44% to cover a 42% rise in the cost of living. The railway men, who were able to quote the statement of the Premier himself that the cost of living had increased 62%, described the report as an insult and pressed their demand with redoubled vigour. As the Government still temporized, the Engineers', Firemen, and Cleaners' Association struck and were followed by the Amalgamated Society of Railway Servants. After it had lasted three days (April 29–May 1) the strike was settled on the basis of the immediate resumption of work and the reference of the claims to arbitration, which resulted, as was inevitable, in substantial concessions to the men.

Public opinion censured the Railway Department for the procrastination which had inflamed genuine grievances and the men for spoiling a good case by bad tactics. The sting of the performance was that it was timed for the close of the first week of the Prince of Wales's visit and threatened it with disaster. But the Prince himself treated the incident with his usual tact turned it to profit among the strikers no less than among their critics, and received abundant evidence of their personal loyalty and goodwill. Nor between his arrival in Auckland on April 24 1920 and his departure from Lyttleton on May 22 was there anything else to mar the brilliant success of his visit. Speaking broadly, it may be said that the advance of democracy in New Zealand and the development of her national spirit have merely intensified her loyalty to the Crown as an essential link of Empire. She has, of course, her revolutionaries, who profess that one flag is as good for them as another and no better, but the English doctrinaire who toys with republicanism has no analogue in a Dominion where Radical and Conservative alike can see in the Crown the symbol and guarantee of the Imperial unity upon which "all that we have and are" depends. The Prince of Wales quickened this opinion and sentiment with a personal enthusiasm unparalleled before. None of his compliments was more heartily appreciated than the remark in his speech at the parliamentary luncheon (May 7) that "there is certainly no country more stolidly and unrepentantly British than this Dominion of New Zealand." The stolidity and unrepentance of the Dominion's attitude to its parent stock have been powerfully fortified by the Prince's visit.

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[1] The vacancy in one of these constituencies was caused by the forfeiture of a Labour M.P.'s seat through his absence from Parliament owing to his conviction and imprisonment for disobeying the call to military service.

During the recess the Government and the country suffered a severe loss in the retirement of Sir James Allen, who resigned in March in order to take the High Commissionership in succession to Sir Thomas Mackenzie, whose tenure of the office since 1912, and especially during the war years, had given great satisfaction. It was nevertheless with a strong team that Mr. Massey was able to face Parliament on June 24. The names and chief portfolios of the reconstructed Ministry were as follows: Mr. W. F. Massey, Prime Minister, Finance and Railways; Sir William H. Herries, Native Affairs and Labour; Sir William Fraser, Mines; Sir Francis H. D. Bell, Attorney-General and leader of Legislative Council; Mr. D. H. Guthrie, Lands and Repatriation; Mr. W. Nosworthy, Agriculture and Immigration; Mr. J. G. Coates, Public Works and Postmaster-General; Mr. E. P. Lee, Justice and External Affairs; Mr. C. J. Parr, Education and Public Health; Mr. C. J. Anderson, Internal Affairs and Mr. Maui Pomare, Cook and other islands and member of Executive representing native race. Sir R. Heaton Rhodes was shortly after appointed Minister of Defence. Without retiring from the Ministry Sir William Herries and Sir William Fraser later resigned their portfolios, which were distributed as follows: Mines to Mr. Massey, Native Affairs to Mr. Coates and Labour to Mr. Anderson. In March 1921 Mr. W. Downie Stewart joined the Government as Minister of Internal Affairs.

The Opposition's official amendment to the address in reply was rejected by 45 votes to 23, the minority including eight Labour members; and the Government were not seriously challenged throughout this session. The death of the newly elected Liberal leader, Mr. W. D. S. Macdonald, on Aug. 31 greatly increased the difficulties of the Opposition. Internal dissensions in an attenuated party have made the task of his successor, Mr. T. M. Wilford, a very embarrassing one.

Mr. Massey's first budget sounded a note of caution, but in providing for a revenue of £27,712,700, and an expenditure of £26,893,497 (the figures for 1919–20 being £26,081,340 and £23,781,924 respectively), and for loans which, including £10,000,000 for renewals, amounted to £24,800,000, it gave no clear indication of the tapering off which it recommended. There was no general increase of taxation, but a more equitable adjustment of its burdens, which recognized for the first time in New Zealand the distinction between earned and unearned income, was effected. Defence is apparently one of the departments in which efficiency is to be sacrificed to economy. The leading features of the new scheme, which is to cost about £600,000 per annum when fully established, are the reduction of the period of Territorial training from seven years to four, the limit now being fixed at the recruit's 22nd year instead of the 25th; the establishment of "recruit" or "general training" period in the 18th to 19th year for both fit and unfit youths; and an increase in the camp training (47 days in all) with greatly reduced half-day and evening parades. The scheme is not yet in operation, and there may be no training camps for two or three years. The session passed without any hint of a naval policy.

Though the expiry of the Imperial Government's contracts for the purchase of the Dominion's produce, and the danger threatened to the coming season by that Government's inability to clear the immense accumulations of meat in the cold storage of all the chief ports of the Dominion or to dispose of the wool accumulated in England, had attracted a good deal of attention during the session, the gravity of the approaching crisis was not generally perceived. The suddenness with which the world-wide depression hit the Dominion towards the end of the year surprised not a few even of those who had prophesied trouble. The sheep-farmers were the most serious sufferers from the collapse of prices which the war had "boomed," but butter and cheese to some extent saved the position. The effect of the depreciation of exports was aggravated by an unprecedented glut of imports. Importers had been ordering freely to meet the shortages of recent years, and as orders had usually been only filled *pro rata* they were often sent sufficiently in excess of requirements to provide for the estimated deduction.

The unexpected filling of these liberal and long-standing orders resulted in immense importations from Britain and the United States and at high prices. The imports, which had averaged about £20,000,000 in the four years before the war, rose from £30,671,439 in 1919 to £61,595,828 in 1920—about £60 a head and £15,153,882 in excess of the exports. Some of the chief items were: Boots and shoes 1919 £442,901, 1920 £1,189,575; woollen goods 1919 £527,468, 1920 £2,412,428; motor vehicles 1919 £1,135,320, 1920 £2,934,239. The returns for the first quarter of 1921 show that the process had been checked, but the balance was still adverse. The merchant and the banker were having their full share of the farmers' anxieties, and unemployment had begun to show its head. A country which profited for so many years from the troubles of the world could not complain if it was compelled to share them for a while.

External Affairs.—The impulse which induced the Ward Government in 1909 to offer a dreadnought to the Admiralty, and the country to confirm the offer, has been justly described as a spasm rather than a policy, and it cannot be said that the Dominion has even yet evolved a policy in these matters. The military defence of the country was put on a reasonable basis by the establishment of compulsory training in 1909–10, but naval policy made no comparable advance. The £20,000 which New Zealand agreed to pay towards the maintenance of a British Squadron in Australasian waters was increased to £40,000 in 1903 and to £100,000 in 1908. At the Imperial Defence Conference of 1909 arrangements were made for the establishment of a Pacific fleet, with the Dominion's gift ship as the flagship of its China unit, and 7 vessels of this unit, manned and officered as far as possible by New Zealanders, were to be stationed in peace-time in New Zealand waters. The concentration of the Empire's naval strength in European waters, which was dictated by the growing pressure of the German competition, upset this arrangement, and in 1912 the Mackenzie Government, with the entire approval of the people, assented to the transfer of New Zealand's battle-cruiser to the North Sea. Sir James Allen, who became Minister of Defence in the same year, was a strong advocate of a policy of naval self-reliance, and in 1913 a Naval Defence Act was passed which provided for the establishment of a New Zealand naval force which in time of war was to be at the disposal of the British Government. The scheme was opposed by Sir Joseph Ward on the ground that what the Empire needed was a single undivided navy and that New Zealand did not want and could not afford a navy of her own, and the division on the measure followed party lines. It is certain that public sentiment would have condemned the scheme if it had not provided for the automatic transfer of the force to the Admiralty in the event of war.

In 1919 Lord Jellicoe, who visited New Zealand in that year (Aug. 23–Oct. 2) on his naval mission, and whom the Dominion was proud to welcome back in 1920 (Sept. 27) as its governor-general, proposed that Britain and Australasia should join in forming a Far Eastern fleet; that New Zealand should contribute, man and control a unit to be called the "New Zealand Division of the Royal Navy"; and that the whole fleet should pass into the control of the Admiralty in time of war. The fact that each party welcomed this solution as a finding in its favour was a sufficient proof of its wisdom, but pending joint Imperial action on the subject the country marked time. Meanwhile it discontinued the naval subsidy and expected to pay £260,000 for the upkeep of its only vessels, the light cruiser "Chatham" and the training-ship "Philomel," during the year 1920–1.

There was not the slightest drift towards separation from the Empire or even towards the quasi-independence which desires a foreign policy of its own under the same Crown. The admission of the Dominions to the League of Nations excited no elation in New Zealand, and the revolution which it was supposed to have worked in their constitutional relations to the United Kingdom was generally regarded as a step in the wrong direction. Mr. Massey's statement in the House that, if he thought the League of Nations would weaken the Imperial connexion in any way, he would prefer to see the Dominion out of it, squared exactly with public sentiment. New Zealand considered that one foreign policy was enough for the Empire, and, while hoping that some kind of representative control might be ultimately evolved, it would much prefer the control of the British Foreign Office, informed by the fullest consultation practicable, to any division of authority.

Incidentally the difference of attitude which the issue of the Pacific Mandates revealed, supplied the Dominion with another argument against federation with Australia. The New Zealand Government was advised by its law officers from the first that it should receive its mandate for Western Samoa from the Imperial Government, and the advice was in accordance with the sentiment of the country. The more assertive nationalism of Australia claimed the right to deal direct with the League of Nations. As there was nothing to suggest that this divergence of ideals and tendencies was decreasing or likely to decrease, John Ballance's declaration in 1891 that "the whole weight of the argument is against New Zealand entering into any federation except a federation with the Mother Country," seemed in 1921 still to be nearer the mark than the prophecy in 1912 of Mr. Andrew Fisher, then Prime Minister of Australia, that "New Zealand will probably be in the Federation within twenty years." But the problem of putting the Imperial partnership upon a business footing by a federal scheme or otherwise received no close and consecutive attention. Neither the project of an Empire Parliament, which Sir Joseph Ward submitted to the Imperial Conference of 1911, nor Mr. Massey's advocacy of an Imperial Executive in the New Zealand Parliament in 1921 (March 16), was the outcome of careful thought, public discussion or popular demand; nor did either of these proposals contribute anything to the education of public opinion.

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(A. R. A.)

NICARAGUA (*see* 19.642*).—The estimated pop. in 1913 was 689,891; by Dec. 31 1917 it had risen to 746,000. In 1920 about 75% of the people lived in the western half of the country, where the inhabitants are predominantly white or native Indian. In the E. are large numbers of Sambos, Caribbean negroes and Indians, and some Americans. Communication between the two coasts is difficult; passenger traffic usually goes by way of Costa Rica, and freight by way of the Panama Canal.

Social and Economic Conditions.—There were in 1929 356 elementary schools, ten secondary schools, and the three universities at Managua, León and Granada. Educational activity had been great since 1917. Until recently all public instruction was in the hands of the religious orders, and in 1920 two normal schools were still directed by the Church. The Jesuit school in Granada was built with state funds and received Government aid. The secondary schools were subsidized by the State, and instruction in the universities was free. Special scholarships were established, by means of which students are sent to the United States for training in teaching and horticulture.

Agriculture has increased in recent years, but is retarded by labour shortage. In the E. bananas are the chief crop; coco-nuts and rice are also grown. Wheat grows in Nueva Segovia and tobacco in Masaya. In the W. coffee is the chief crop, sugar, cacao, corn, and beans also being raised. Tropical products excepted, most of the food for eastern Nicaragua comes from the United States. From the W. a little surplus food is exported. There are about 1,200,000 cattle. The coffee crop is usually about 22,500,000 pounds. In 1921 the coffee crisis was acute; the 1918–9 crop had sold well, and some advances were made on the 1919–20 crop in expectation of prices as high as $.30, but as the market fell those who had obtained advances of $.14 were fortunate. High duties in France limited the market to the United States. The 1920–1 crop was large, trading was light, the price being one-third the cost of production. The chief forest products are mahogany and cedar, with some production of dye woods and medicinal plants. American and British interests are engaged in gold and silver mining. Copper and precious stones are also obtained. The only railway on the W. side is the Pacific line, 171 m. long, from Corinto to León, Managua, Granada and Diriamba, with short branches. There are a few private lines in the east. A New Orleans syndicate obtained a concession for 10 years, beginning in 1918, to build from Bluefields to Lahone Grande. Americans hold 51% of the stock in this enterprise and have escrow control of 49%, which secures a loan of $1,060,000. In the spring of 1921 a loan was made of $9,000,000 for constructing the Atlantic railway, repurchase of the Pacific railway and payment of the 1909 bonds. Work began on a line from Chinandega to Playa Grande and the Honduran frontier, which is to be part of the International Railways on the Honduras and Salvador boundaries.

Imports and exports in pounds sterling for five years were as follows:—

	1914	1915	1916	1917	1918
Imports	826,865	631,843	955,519	1,278,613	1,185,961
Exports	991,010	913,440	1,056,972	1,195,051	1,550,988

Customs receipts, 1918, were £199,629; 1919, £294,961. Imports in 1918 of cotton goods were worth $1,580,037; iron and steel, $709,990; wheat flour, $356,705. Exports consisted of coffee, timber, bananas, hides and sugar. Trade with the United States amounted to $4,630,457 in imports and $6,412,921 in exports. The remainder of the trade was distributed among England, France, Chile, Panama, Mexico and Canada.

The revenues and expenditures for four years in pounds sterling were:—

	1915–6	1916–7	1917–8	1918–9
Revenues	418,019	460,479	480,321	598,547
Expenditures	357,883	396,159	351,553	424,167

The debt on Oct. 20 1917 was $21,390,521; it had been reduced by Jan. 1919, through amortizations and negotiations, to $10,238,589. In Jan. 1920 it was $9,884,023. The internal debt in Sept. 1916 was 10,000,000 cordobas (nominally equivalent to U.S. dollars and fluctuating very little). In 1917 the bonded debts were reëstablished, deferred interest was provided for, the floating debt settled, and the annual budget limited. Surplus revenues which have been over $600,000 have been applied equally to the foreign debt, the floating debt and public improvements.

History.—José Madriz, elected president in 1909, failed to win recognition from the United States. He seemed for a time to be about to defeat his enemies in the field, but his unsuccessful expedition against Bluefields, during which the U.S. marines intervened to protect American property, resulted in the success of the revolutionists. Madriz left Managua on Aug. 20, 1910, the forces under Juan M. Estrada entering it next day. Estrada, though of the artisan class, was backed by the conservative families of Granada as well as by some liberals. His Government was soon recognized by the United States, relations being resumed in January. The public treasury was immediately emptied to pay revolutionary debts. By the autumn of 1911 some 25,000,000 pesos of depreciated paper currency had been circulated, much

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**** These figures indicate the volume and page number of the previous article.***

of it going to members of the party in power. These pesos were later retired on a basis of $.08 each. This ruinous finance, added to the prostration begun by internal war, was disastrous to agriculture, commerce and transportation. The conservative Government, aided by the U.S. Department of State, effected on Nov. 5 1910 an agreement providing for Estrada's continuance in the presidency, for a commission containing Americans to adjust revolutionary claims and those arising from cancellation of concessions granted by Zelaya (*see* 19.645), and for a treaty with the United States providing for a loan. Estrada was elected Dec. 31 for a term of two years, and was promptly recognized by President Taft. But troubles with Emiliano Chamorro's faction over the constitution, and with Gen. Mena's faction over control of the army, resulted in Estrada's resignation. The United States intervened, and with the consent of Gen. Mena, who was for some months in actual control, Adolfo Diáz succeeded to the presidency. The plan for financial rehabilitation, arranged for by treaty on June 6 1911, was checked by failure of the treaty in the U.S. Senate. However, a private loan was effected and the currency reformed by the adoption, on Nov. 12 1912, of a monetary unit, the cordoba having the value of the U.S. dollar. The loan was secured by the customs duties, and control of the national railways was obtained by an American corporation. In 1912 the customs collectorship was entrusted to Col. C. D. Ham, formerly of the customs service in the Philippine Is., who served the interests of Nicaragua, the U.S. State Department, and the holders of the national debt. The interest rate on the debt was reduced, and much of the debt itself paid. A Claims Commission, sitting from May 1 1911 until late in 1914, awarded $1,840,432 out of the $13,808,161 demanded; U.S. claims of $7,576,564 were scaled to $538,749. In Oct. 1911 Gen. Mena induced the Assembly to elect him president for the term beginning Jan. 1 1913, whereupon Diáz removed him from the Ministry of War, and he fled, his place being given to Emiliano Chamorro. Mena's faction, really the old Zelaya party, led by Gen. Zeledón in the illness of Mena, was opposed by the United States in the interests of the banking firms which had undertaken the reform of Nicaraguan finances. At the instance of Diáz, U.S. marines kept open the lines of communications, protected American lives and property, and sustained the Government. On Nov. 2 1912 Diáz was reëlected for the term 1913–7, and was maintained in power by American marines. He ruled under the Constitution of March 1 1912, as amended in Articles 168 and 170 on April 5 1913. In the latter year an additional loan of $1,000,000 was obtained in New York, but during the World War it became necessary to issue unsecured paper currency. This caused depreciation, which was checked in 1915. In Feb. 1913 a treaty was signed whereby Nicaragua gave to the United States, for $3,000,000, exclusive canal rights, with accessory control over the entrances on the Corn Is. and in the Gulf of Fonseca. An effort to extend the treaty to limit Nicaraguan foreign relations failed, but a treaty providing for a loan was finally ratified, and proclaimed on June 24 1916. Protests by Costa Rica and Salvador against alleged infringements of their sovereignty by this treaty were heard before the Central American Court of Justice, which sustained the complaints. Its decision has been ignored by both parties to the treaty, in practical derogation of the Washington Conventions of 1907, which were intended to safeguard the interests of all Central American countries and to promote the settlement of difficulties through arbitration. The policy of the United States caused resentment in many parts of Central America, where guarantees of American investments are considered evidence of imperial designs. Police control, even though maintaining a minority in power, has improved public and private finance, and given peace to the country. In 1919 Nicaragua became involved in the troubles of Honduras by allowing troops to gather on her border to invade her neighbour; after warning from the United States, Nicaragua desisted from the enterprise. She broke relations with Germany on April 18 1917, and declared war on May 8. She was represented at Versailles as an original member of the League of Nations, and ratified the Treaty on April 5 1920, but up to the middle of Dec. had not deposited her ratification in Paris. Nicaragua did not enter the Central American Union organized in 1921.

In Oct. 1916 Emiliano Chamorro, the candidate committed to the American financial programme, was elected as president, and inaugurated Jan. 1 1917 for the term ending Dec. 31 1920. On Jan. 1 1921 Diego Manuel Chamorro, retiring minister to the United States, was inaugurated as president. (H. I. P.)

NICHOLAS II. (1868–1918), Tsar of Russia (*see* 19.655). In view of the tragic end of the Tsar Nicholas II. and his family, in the Russian revolution, it may be noted that, even in the lifetime of his father, Alexander III., his mind had been deeply imbued by mystic belief in divine rights and providential guidance, and he was prepared to suffer and to endure, if necessary, in carrying out the duties of his office. His intellectual preparation as heir to the throne was decidedly insufficient, especially considering the position he would ultimately hold. He was left in the background for some time and even later no special efforts, such as would naturally be expected, were made to prepare him for his future extraordinary task by any elaborate and well-considered teaching. An English tutor, Mr. Heath, taught him indeed good English, and inspired a love of sports and healthy exercise, while a Russian general, Danilovitch, supervised his military training, but there was no attempt to provide him with the comprehensive knowledge required from one whom fate had destined to rule an immense empire. The only occasion which was offered to the young Tsarevitch to acquaint himself with the problems of the world was his journey to the Far East, so abruptly cut short in Kioto by the sabre cut of a Japanese fanatic. It is not to be wondered at that Nicholas II.'s range of ideas was not very wide or profound, although he was by no means unintelligent and possessed in high degree the royal habit to move with ease and tact in complicated personal surroundings. His disposition towards fatalistic mysticism made him particularly amenable to the promptings of superstitious and irrational suggestion. He told Stolypin on one occasion, when he had to take an important decision, that he was loth to do so, because he was sure that his interference would be accompanied by bad luck; he saw a warning in the fact that he had been born on May 6, the day when the Church honoured the memory of Job; he was predestinated to say with Job: "As soon as I apprehend a danger, it occurs, and all the misfortunes dreaded by me come over me." His career was bent with many dismal predestinations of every kind. He wedded Princess Alix of Hesse, at the deathbed of his father; at the festival of his Coronation more than three thousand people were crushed to death through the negligence of the officials who had to arrange a distribution of bounties; and during the Coronation itself the imperial chain on his breast fell to the ground. Such impressions contributed strongly to inspire him with a mystic resignation, especially unsuitable for a monarch who had to lead the nation through times of great crisis at home and in foreign affairs.

Nicholas II.'s political outlook was dominated by a kind of theocratic or hieratic spirit; he was looking back for inspirations to the ideas and customs of the Moscovite period; he was induced to impersonate the figure of Alexis Mikhailovitch, the father of the western reformer Peter the Great; in 1913 the tercentenary of Michail Feodorovitch's accession to the throne after the "Great Troubles" was celebrated with great splendour and emphasis. Pilgrimages were performed with great devotion and circumstance.

The courtiers and bureaucrats in the immediate surroundings of the Tsar, men like Sipiaguin, Nicolas Maklakov, and Sabler, took advantage of these prepossessions in order to keep up a constant hostility against progressive reformers and western adaptations. But the most dangerous representative of mystic reaction was the Tsar's consort, the Empress Alexandra Feodorovna. Of German descent on her father's side and of English descent on the side of her mother (Princess Alice, the daughter of Queen Victoria), she had received her education in England, but, on coming to Russia, she surrendered completely to the most extreme form of theocratic exaltation. While her sister, the widow of the Grand Duke Sergius, killed by a terrorist, had devoted herself to an almost monastic life at the head of a community of hospital nurses, Alexandra Feodorovna, highly strung and hysterical, sought providential guidance in the midst of unbalanced women and false prophets like the French medium Philippe and the famous Rasputin. The latter obtained a hold on her through the hypnotizing influence he exercised over her son, the Tsarevitch Alexis, a boy affected by the rare disease of hereditary haemophilia. But the crafty peasant had contrived to obtain gradually a psychical domination over the Empress and her friends which made it possible for him to distribute political favours and to have his say in the most important affairs of State. The Empress considered him as the God-sent representative of the Russian nation, of that mass of peasants which, as she was convinced, was the firm mainstay of autocracy in Russia. And in the later years of Nicholas II.'s reign, the years of great trial and danger, Alexandra Feodorovna stepped in more and more often to direct the Tsar's choice of his ministers and to prevent him from making concessions to the spirit of the time.

The suspicion that Alexandra Feodorovna was secretly favouring the cause of Germany and revealing military secrets to the Kaiser—a suspicion often expressed abroad and popularly accepted in Russia—is, according to most competent witnesses, devoid of any basis in fact. The Empress was intensely patriotic in her own way, opposed to the aggressive policy of the Hohenzollerns, and never advocated a treacherous compromise with the Central Powers. A former lady-in-waiting, Princess Vassiltchikov, who towards the close of 1916 brought the project of such a compromise from Germany was promptly ordered out of Petrograd. Nevertheless, Alexandra Feodorovna proved to be the evil genius of the Russian dynasty, by her blind and obstinate support of reactionary tendencies and of worthless adventurers, at a time when a wise and firm policy of reform was more needed than ever. All the better representatives of the dynasty—the Dowager Empress Maria Feodorovna, the Grand Duke Nicholas Mikhailovitch, the Grand Duchess Victoria, warned the Empress Alexandra Feodorovna of the imminent danger of that regime of fleeting ministerial shadows which set in after the catastrophe of the War Office in 1915.

The Emperor remained passive as commander-in-chief at headquarters while the Empress Alexandra spurned all advice with contempt and continued to pull the strings by dismissing men like Sazonov and Palivanov, and appointing timeservers like Sturmer, Protopopov, or Galitzin. The assassination of Rasputin did not frighten but enraged her; she erected a kind of shrine over the body of the prophet and sent the Grand Duke Dmitry Pavlovitch, who had taken part in the murder, into exile. Her power was broken only by the revolution.

The thread of the Romanov dynasty was cut without much resistance. When in March 1917 the Emperor received at headquarters a telegram from the president of the Duma informing him of the events of Petrograd and demanding his abdication, and MM. Gutchkov and Shulgin arrived with the act of abdication itself, he submitted with fatalistic composure. He refused to give up his crown to his son with Grand Duke Michael as regent, because he did not wish to trust the boy to the danger of a political storm; and his abdication was made in favour of the Grand Duke Michael, who in his turn refused to accept the crown unless it was tendered to him by the will of the people. The last chance of a regime of constitutional monarchy was cut short. Proposals were made on behalf of the British Government to allow Nicholas II. and his family to take up their abode in England; but the Provisional Government in Petrograd did not accede to that plan. Kerensky and Milyukov declared that the imperial family were in safety in Russia. Later on the Emperor submitted meekly to be transferred from Pskov to Tsarskoe Selo and then to Tobolsk, where he was interned with his family—his wife, his son and his four daughters for months.

The life in Tobolsk has been described by a French tutor, M. Gillard, who followed the imperial family into exile. All the qualities of the unfortunate prisoners of State came to the fore in these sad times. The Tsar taught his son history and Russian literature, the family circle assembled in the evening to read and converse, they prayed and attended the church services with touching devotion. In Ekaterinburg, where they were transferred by the Bolsheviks in 1918, their captivity assumed an oppressive form. They were huddled together in an apartment consisting of two bedrooms and one sitting-room. Their guard consisted mainly of Lettish soldiers, while Russians were kept on the outskirts of the house; they had to listen to the uproar and the ribald songs of their watchmen; the walls of the sitting-room were covered with obscene drawings and inscriptions; the head gaoler, Yourkovsky, was a fanatical communist, a Jew, who harboured feelings of fierce hatred against the potentates of Holy Russia.

The end came in connexion with Kolchak's advance on the Ural in 1918. The Soviet of Commissaries in Moscow enjoined the greatest vigilance to the Ekaterinburg commissar, Yourkovsky, and the commander of the guard, Medvediev, without indicating any means for removing the prisoners from the threatened zone. The communists of Ekaterinburg held a secret meeting in which they decided to put the Tsar and his family to death, and sent an order in this sense to Yourkovsky. The latter demanded that it should be duly signed, and 16 signatures were affixed to it. On the night of July 16 Yourkovsky roused the prisoners and conducted them into a cellar of the house. Medvediev, with the Lettish guards, entered the room while some Russian soldiers were looking in from the staircase. Yourkovsky placed the seven doomed persons at one end of the room and read the sentence hurriedly by torchlight. The Tsar stepped forward and said something indistinctly, when Yourkovsky drew his revolver and shot him in the head. A general fusillade followed, and not content with this, the executioners pierced the bodies with their bayonets and struck them with the butt-end of their rifles. The Grand Duchess Tatiana is said to have recovered consciousness for a while, but she was struck down once more and for ever. Besides the seven members of the imperial family four of their attendants were probably slaughtered the same night. In the course of the next few days the corpses were removed to an isolated spot in the neighbourhood of Ekaterinburg and destroyed by fire, after having been soaked with petroleum. A few objects of apparel were later picked up on the spot. (P. Vi.)

NICHOLAS (1841–1921), King of Montenegro, was the last member of the House of Petrovich Njegosh to reign over a separate Montenegrin realm, his dominions being now merged in the kingdom of the Serbs, Croats and Slovenes. The story of the last twenty years of his life is very largely the contemporary history of Montenegro (*see* MONTENEGRO). His grant of a constitution in 1907 was followed by a period of violent internal conflict between him and his opponents, whose position had been strengthened by the elections to the Skupshtina, whom he sought to discredit by the Cetinje bomb plot mystification. His assumption of the kingly title in 1910 marked a further stage in the evolution of his plans, of which it constituted a public notification, and aroused hostile comment among his own people as well as in Serbia. The Balkan wars resulted in a marked *diminutio capitis* for Nicholas, who failed to play a conspicuous part in them and was forced to call in Serbian aid before Scutari. At this time already the survival of a Montenegrin throne appeared a doubtful problem. In the World War the breach between him and his people was complete, and even before the final act the old monarch was apostrophized derisively as Nicholas the first and Petrovich the last. He died at Antibes March 1 1921, and was buried at San Remo.

NICHOLAS (NIKOLAI NIKOLAYEVICH), (1856–), Russian Grand Duke, grandson of the Tsar Nicholas I. and first cousin of the Tsar Alexander III., was born Nov. 6 1856. As a junior officer he passed through the General Staff College. During the war with Turkey in 1877–8 he was on the General Staff, and won the Cross of St. George for his courage and energy during the crossing of the Danube near Zimnitza. His further military service was passed in the Guard Hussar regiment of which he became commander in 1884. He then commanded a brigade and, in 1900, the 2nd Guard Cavalry Division. His brilliant capacities assured his rapid advancement. At the manoeuvres of 1890 he already commanded four cavalry divisions, and in 1895 he became Inspector-General of the Russian cavalry. He held this post for ten years, a period which is regarded as a bright epoch in the history of the Russian cavalry. With a firm hand he carried through the reform of the cavalry schools, the cavalry reserve, the cavalry remount service, and improved the method of instruction and direction of the cavalry units. In 1902 he was selected to command the Russian forces in case of a war with Germany. On the creation of the Council of National Defence in 1905, the Grand Duke was appointed its President, and the same year he received the command of the Guards and of the St. Petersburg Military District. In 1908 he left the Council of National Defence.

At the outbreak of the World War the Grand Duke was nominated to the Supreme Command of the Russian armies. Thus suddenly called on to assume the highest responsibility, the Grand Duke undertook it under particularly difficult conditions. He had to work with people with whom he had never worked before, and who were almost unknown to him. Since 1909 he had not taken part in the preparatory defence of the country; the principal work, after mobilization, the deployment of the armies, had been done without him, without his ideas. In fulfilling a plan not formed by himself he was at first overcome by the force of events. But in the later development of operations after the first battles his personal will and generalship were able to assert themselves, notably in the transfer of operations to the left bank of the Vistula in Oct. 1914. In the campaign of 1915, hampered as he was by the want of material resources, he was unable to maintain the front of the Narew–Vistula–San–Carpathians against the formidable effort of the Germans and Austrians, but, heavy as were the losses of the Russian army, he managed to withdraw it without anywhere incurring a Sedan, to a line which, substantially, it maintained throughout 1916 and 1917. In August 1915, the Tsar having assumed personal command on the main front, the Grand Duke was sent to the Caucasus as governor-general and commander-in-chief. Here, with Yudenich's assistance, he carried out the successful offensive campaigns of Erzerum and Trebizond, and his work contributed greatly to relieve the situation of the Allies in the East. After the Revolution he retired to his villa in the Crimea, where he remained until its occupation by the Bolshevik forces in 1918.

NICHOLSON, EDWARD WILLIAM BYRON (1849–1912), English scholar and librarian, was born at St. Helier March 16 1849. Educated at Tonbridge and Trinity College, Oxford, in 1873 he became librarian of the London Institution, and in 1877 founded the international conference of librarians and the Library Association. In 1882 he succeeded H. O. Coxe as Bodley's librarian. He published commentaries on the *Gospel according to the Hebrews* (1879) and *St. Matthew* (1881), *Keltic Researches* (1904), papers on philology, etc., and wrote the article "Mandeville" in the *E.B.* He died at Oxford March 7 1912.

NICHOLSON, MEREDITH (1866–), American writer, was born at Crawfordsville, Ind., Dec. 9 1866. He was educated in the public schools of Indianapolis, and for many years he was engaged in journalism in that city. His works include: *The Hoosiers* (1900); *The Main Chance* (1903); *Zelda Damaron* (1904); *The House of a Thousand Candles* (1905); *The Port of Missing Men* (1907); *A Hoosier Chronicle* (1912); *The Provincial American* (1912); *Otherwise Phyllis* (1913); *The Madness of May* (1917); *The Valley of Democracy* (1918); *Lady Larkspur* (1919); *Blacksheep! Blacksheep!* (1920); and *The Man in the Street* (1921).

NICHOLSON, WILLIAM (1872–), English painter and engraver, was born at Newark Feb. 5 1872, and was educated at the Magnus school, Newark. He studied at the Académie Julien, Paris, and about 1894 began experimenting in wood engraving, producing some admirable work in that medium, characterized by the use of bold masses of black and white or of sombre greys and browns, relieved by touches of bright colour. In this manner he illustrated *An Alphabet* (1898); *An Almanac of Twelve Sports* (with Rudyard Kipling; 1898); *London Types* (with W. E. Henley; 1898); *Characters of Romance* (1900); *A Square Book of Animals* (with A. Waugh; 1900), and engraved some well-known portraits, including that of Queen Victoria. He also collaborated with James Pryde under the name of "The Beggarstaff Brothers" in designing some remarkable posters. To the set of lithographs entitled "Britain's Aims and Ideals," published during the World War, he contributed "The End of War." As a painter he is best known for his interiors and still-life pictures, such as "The Hundred Jugs" (1916), "Souvenirs de Babette," "Miss Simpson's Boots" and "The Striped Shawl"; but his work also includes landscapes—for example "The Hill above Harlech"—generally in a low key, and many portraits, including those of W. E. Henley, the painter's mother, Sir W. C. Pakenham (for the Imperial War Museum); Ursula Lutyens, and "The Girl with the Tattered Glove." He is represented in the Luxembourg, Paris; the Tate Gallery; the Walker Art Gallery, Liverpool; the Glasgow Gallery; and the Fitzwilliam Museum, Cambridge.

NICHOLSON, WILLIAM GUSTAVUS NICHOLSON, 1ST BARON (1845–1918), British field-marshal, was born March 2 1845, and joined the Royal Engineers in 1865. He served in the Afghan War, 1878–80, for which he was given a brevet majority, and he took part in the Egyptian campaign of 1882. For service on the staff in Burma in 1885–6 he was promoted brevet lieutenant-colonel, and he reached the rank of colonel in 1891. He next served as chief of the staff in the Tirah campaign, for which he received the K.C.B., and as adjutant-general in India. In 1899 he went out to South Africa as military secretary to Lord Roberts, but on arrival he was placed at the head of the transport service and was promoted major-general. He was appointed Director of Mobilization and Intelligence at the War Office in 1901 and was shortly afterwards promoted lieutenant-general; this position he held till early in 1904 when he went to the Far East as chief military attaché with the Japanese forces. At the end of 1905 he was appointed quartermaster-general; in 1906 he was promoted general and in 1908 was transferred to the post of Chief of the Imperial General Staff, which he held during the important period of the Haldane reforms. He was promoted field-marshal in 1911 and, on vacating his appointment at the War Office in the following year, was raised to the peerage as Baron Nicholson of Roundhay. In 1913 he went out to the East as chairman of a commission on Indian military expenditure, and in 1916–7 he was a member of the Dardanelles commission; this was his last public service. He died on Sept. 18 1918. Lord Nicholson was a man of high intellectual attainments and, although somewhat given to controversy, a successful military administrator.

NIGERIA (*see* 19.677), the largest British possession in W. Africa, has an area of some 335,700 sq. m. and a population of approximately 17,000,000. The crown Colony of Nigeria, which was formerly known first as Lagos and later as the Colony of Southern Nigeria, has an area of 1,400 sq. m., the rest of the territory being the amalgamated Protectorates of Northern and Southern Nigeria which, with effect from Jan. 1 1914, were brought under a single administration. The task of effecting this amalgamation was entrusted to Sir Frederick Lugard, who in 1912 was transferred from Hong-Kong for the purpose, and assumed charge of both Southern and Northern Nigeria, succeeding Sir Walter Egerton as governor of the former and Sir H. Hesketh Bell as governor of the latter. He bore, as personal to himself, the title of governor-general. Under the scheme of amalgamation, the Colony retained its status, but the authority of its Legislative Council was confined to the small area enclosed within the colonial boundaries, and a post of Administrator was created, the occupant of which was entrusted with the control of the Colony and its affairs under the direction of the governor-general. Mr. F. S. James was appointed to this office, but on his transfer in June 1916 to the post of Colonial Secretary, Straits Settlements, the appointment was not again filled, the duties attaching to it being thereafter discharged by the officer for the time being acting as lieutenant-governor of the Southern Provinces.

The Protectorate of Nigeria was divided into two groups of provinces, each group being placed under the immediate charge

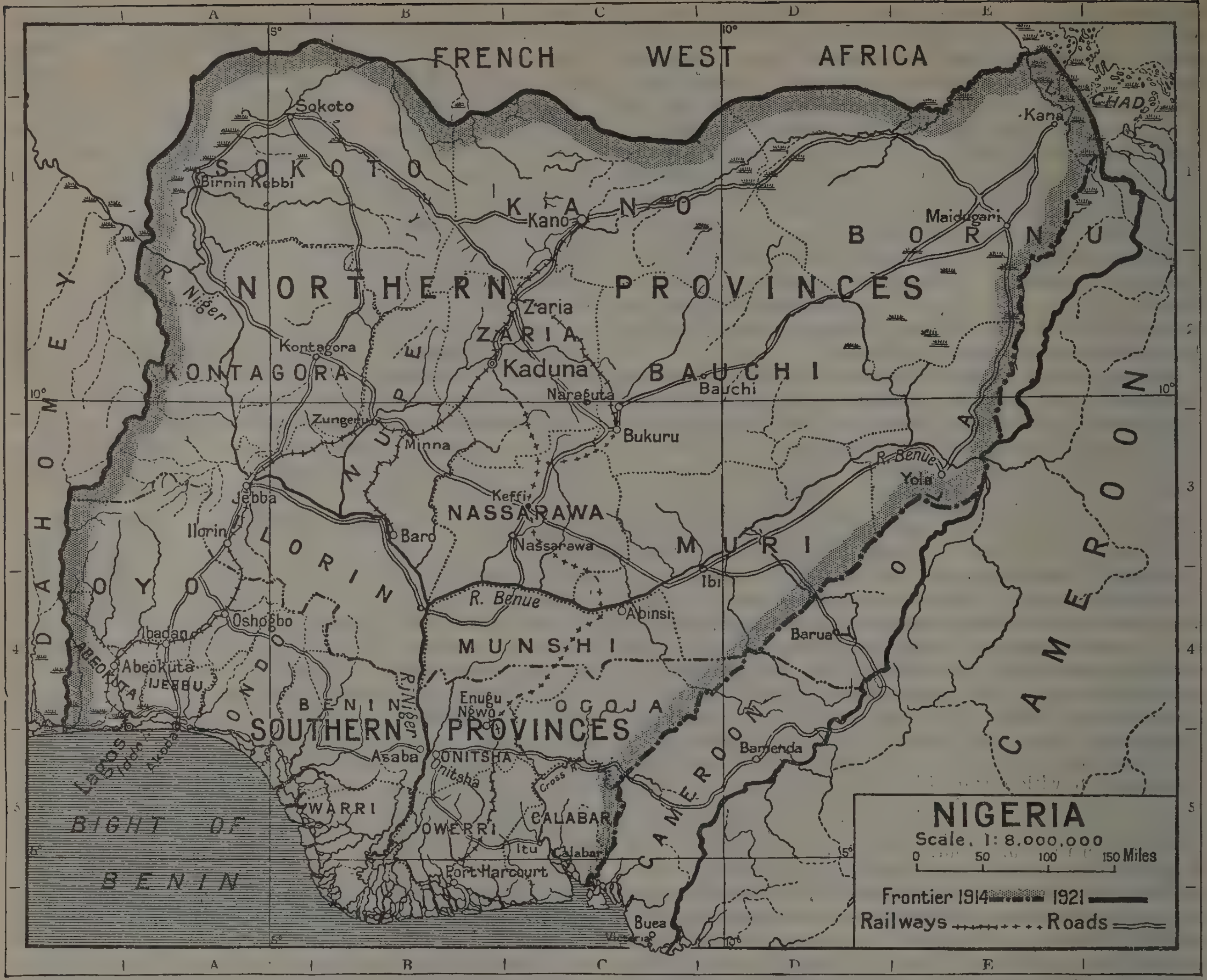
FRENCH WEST AFRICA
CHAD
Kana
Sokoto
SOKOTO
Birnin Kebbi
KANO
Kano
Maidugari
BORNU
NORTHERN PROVINCES
R. Niger
Zaria
ZARIA
Kontagora
KONTAGORA
Kaduna
BAUCHI
Bauchi
Naraguta
Bukuru
Zungeru
Minna
NUPE
DAHOMEY
Jebba
Keffi
NASSARAWA
Nassarawa
R. Benue
Yola
YOLA
Ilorin
ILORIN
Baro
MURI
Ibi
OYO
Oshogbo
Abinsi
Ibadan
MUNSHI
Barua
Abeokuta
ABEOKUTA
IJEBBU
ONDO
BENIN
R. Niger
Enugu
Newo
OGOJA
SOUTHERN PROVINCES
Lagos
Ijebu-Ode
Asaba
ONITSHA
Onitsha
Cross R.
Bamenda
CAMEROON
WARRI
OWERRI
CALABAR
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BIGHT OF BENIN
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NIGERIA
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of a lieutenant-governor. The provinces forming each group are as follows: Northern—Bauchi, Bornu, Ilorin, Kano, Kontagora, Munshi, Muri, Nassarawa, Nupe, Sokoto, Yola and Zaria; Southern—Abeokuta, Benin, Calabar, Ijebbu, Ogoja, Ondo, Onitsha, Owerri, Oyo, Warri and Cameroon. The last named of these provinces (*see* CAMEROON) comprises the southern portion of the mandated ex-German territory, the more northern districts of which are incorporated, for administrative purposes, with the provinces of Yola and Bornu respectively, of which they form natural and political parts. The accounts of all the mandated area are kept separately from those of the rest of Nigeria, but an annual grant-in-aid from the Government of Nigeria (£67,000 in 1921) is required in order to square its budget. Each lieutenant-governor is provided with a secretariat, and under the original scheme separate departments were maintained in each group of provinces wherever this was possible. A later development has led to the establishment of single government departments for the whole of Nigeria, the Education and Science Departments, and the police forces of the Northern and Southern Provinces respectively, alone remaining separate. Each lieutenant-governor is directly responsible to the governor for the administration of the group of provinces under his charge; and each province is administered by a Resident who, in his turn, is directly responsible to the lieutenant-governor under whom he serves. Under the original scheme, a small central secretariat was created to assist the governor in dealing with the various departments—*e.g.* the Treasury, the Railway, etc.—which were common to the whole of Nigeria; but the system whereby three wholly unconnected secretariats dealt independently with questions requiring the consideration of the governor was not found to work well, and as from Jan. 1 1921, a Nigerian secretariat was established through which all work submitted to the governor now passes. This office is presided over by a Chief Secretary to Government, who acts for the governor when the latter is absent on leave; and in this department all work of a political character is dealt with by a Secretary for Native Affairs. Mr. C. L. Temple was appointed lieutenant-governor of the Northern Provinces on Jan. 1 1914. He was succeeded in 1917 by Mr. H. S. Goldsmith, who, on his retirement in June 1921, was succeeded by Mr. W. F. Gowers. Mr. (afterwards Sir) Alexander Boyle was lieutenant-governor of the Southern Provinces from Jan. 1 1914, until his retirement in 1920, when he was succeeded by Lt.-Col. Moorhouse. Sir Frederick Lugard held the post of governor-general from Jan. 1914 until his retirement in June 1919, when he was succeeded by Sir Hugh Clifford, the governor of the Gold Coast, as governor of Nigeria. Mr. D. C. Cameron, who has held the post of Central Secretary since the inauguration of the amalgamation, was appointed Chief Secretary to Government on Jan. 1 1921, with precedence over both the lieutenant-governors.

Administration.—The system of administration in force in the Northern Provinces is one of indirect rule, the Native Administrations in the Mahommedan emirates, which were in existence at the time of the conquest, having been maintained intact. Each emirate, however, has been divided up for administration purposes into a number of districts, each of which is under the immediate charge of a district head, who is responsible to the emir. Justice is administered by the Mahommedan courts, an *Alkali*, as he is locally called, being the chief magistrate in each emirate. The operations of the Native Administrations are supervised by the British political officers, who also exercise revisory powers over the decisions of the Mahommedan courts. Capital cases are tried by the emir with the assistance of his Judicial Council, and death-sentences are submitted to the governor and to his Executive Council for confirmation or revision. Every effort is made to support, strengthen and purify the Native Administrations, which continue to be the *de facto* governments of the Mahommedan areas; and even in the pagan districts the more primitive tribal organizations are put, as far as circumstances permit, to a similar use. An annual tax based upon the income of the tax-payer, which has the authority of Mahommedan law, is in force throughout the Northern Provinces. The work of assessment and collection is carried out by the Native Administrations under the close personal supervision of the political officers. Half the proceeds furnish the funds for the Native Administrations, many of which have large balances to their credit. The remainder is paid into the public Treasury, which annually derives from this source revenue of about half a million sterling.

The system of indirect rule through the Native Administrations has been extended with a fair measure of success to the Yoruba States which occupy the western portion of the Southern Provinces, and here a system of direct taxation, similar to that in force in the Northern Provinces, has been introduced since the amalgamation was effected in 1914. Owing to the primitive character of the tribal organizations existing in the remainder of the Southern Provinces, however, action on these lines has not there been found possible, and the administration of the country has accordingly to be conducted more directly by the political officers.

History.—The outbreak of war, following so closely upon the amalgamation of the Northern with the Southern Provinces, retarded the completion of the scheme, and for a period paralyzed the activities of the Government of Nigeria. The Nigeria Regiment, which consists of four battalions, a battery, and two companies of mounted infantry, took part successively in the Cameroon and E. African campaigns, in both of which it greatly distinguished itself; and at the time of the signing of the Armistice, a brigade was in readiness for immediate service in Palestine. Officers belonging to the civil department were seconded in large numbers for military service; the local financial position during the first two years of the war occasioned acute anxiety; and the impossibility of obtaining material of all descriptions caused progressive deterioration in the railway and in other similar departments. During 1915 all enemy subjects in Nigeria were deported to Great Britain for internment or repatriation, and their properties in Nigeria, after their businesses had been wound up by an official receiver, were sold by auction in London toward the end of the following year.

In 1914 the treaty with the Egba United Government, which had its seat at Abeokuta, was abrogated with the consent of the *Alake*, and the country, which it had administered and which had hitherto enjoyed a *quasi* independence, was placed upon the same footing as the adjoining Yoruba States. In 1917 a serious rising occurred in Egbaland, in the course of which much property was destroyed and some miles of track on the western railway were torn up by the insurgents. The insurrection was suppressed by the Nigeria Regiment without difficulty; and with this sole exception the peace of Nigeria remained unbroken throughout the whole of the World War. The Mahommedan emirs, the Alafin of Oyo and all the principal chiefs throughout Nigeria evinced from first to last the most unswerving loyalty, and notable contributions to the funds of the Red Cross were made.

Communications.—The railway system of Nigeria consists of the western line running from Iddo island in the neighbourhood of Lagos, to Kano, a distance of 705 m. and passing through the important towns of Abeokuta, Ibadan, Oshogbo, Ilorin, Kaduna and Zaria. From Minna, the point at which the junction between the railways of Northern and Southern Nigeria was originally effected, a branch line 111 m. in length runs to Baro on the Niger, which river is spanned at Jebba by a fine railway and road bridge which was completed and opened to traffic in 1917. From Zaria a branch line of 2 ft. 6 in. gauge runs 144 m. to Bukuru on the Bauchi plateau, which is the centre of the tinfield. The railway from Port Harcourt to Enugu Ngwo, a distance of 151 m., was however completed in 1916, thus tapping the colliery at the latter place, which was thereafter able to supply all the fuel required for the whole railway system and for the river and other marine services of the country. The output in 1921 exceeded 800 tons *per diem;* and the cost of production until late in 1919 was approximately 8s. per ton at the pit's mouth, but it had increased by 50% in 1921. This eastern railway was in 1921 being extended to the Benue river, the principal affluent of the Niger, which it will cross at a point a few miles above Abinsi. The railway bridge which is to be here constructed will be the third largest cantilever bridge in the Empire. From the Benue the line will traverse the Nassarawa and Bauchi provinces to a point some 40 m. E. by S. of Bukuru, to which place a branch line is to be constructed, the main line effecting a junction with the western system at Kaduna, the administrative capital of the Northern Provinces. With the exception of the Bauchi Light Railway from Zaria to Bukuru, the gauge throughout the system is 3 ft. 6 in.

A fine system of motor roads links up the Southern Provinces, and it is now possible to motor from Lagos through the Abeokuta, Oyo, Ondo and Benin provinces to the Niger at Asaba, and from Onitsha, on the left bank of the river, through the Onitsha, Owerri and Calabar provinces to the Cross river at Itu. In the Northern Provinces, Ilorin can be reached by motors from Ibadan, and dry-season roads permit their use from Naraguta, on the Zaria-Bukuru railway, through the Bauchi and Bornu provinces to the shores of Lake Chad; from Maidugari, the capital of Burnu, to Kano; from Kano throughout the province of that name; from Zaria to Sokoto, and thence through Birnin Kebbi and Kontagora to Zungeru on the western railway. The road from Zaria to Sokoto is being permanently constructed; and a good motor road has recently been built from Zaria to Kaduna.

River services are maintained by means of shallow-draft sternwheeler steamboats on the Niger as far as Baro, and during the wet season on the Benue as far as Yola, by the Government and by the Niger Company. Messrs. John Holt & Co. also run steamboats on these rivers.

Trade.—During the last two years of the war, during 1919 and until the autumn of 1920, a great boom in local trade was experienced in Nigeria, the prices offering for produce of all descriptions attaining to unprecedentedly high figures. This was followed by a "slump" of great severity which temporarily paralyzed the commerce of the country and reacted strongly upon the public revenue. The following table shows the revenue and expenditure and the principal trade statistics for the years 1913 to 1919 inclusive:—

	Revenue	Expenditure	Value of Imports	Value of Exports	Total Value of Trade
	£	£	£	£	£
1913	3,362,507	2,916,801	6,331,751	7,197,646	13,529,397
1914	3,048,381	3,596,764	6,276,957	6,420,461	12,697,418
1915	2,703,257	3,434,215	4,983,728	4,946,228	9,929,956
1916	2,943,184	3,609,638	5.174,474	6,029,546	11,204,020
1917	3,492,738	3,219,957	5,808,592	8,602,486	14,411,078
1918	4,014,190	3,459,774	7,423,158	9,511,971	16,935,129
1919	4,959,428	4,529.176	10,798,671	14,675,789	25,474,460

Figures for 1920 were not yet available in July 1921, but the revenue for that year exceeded £6,800,000, and the value of imports and exports beat all previous records.

As from Feb. 1 1919, the importation of "trade" spirits into all the W.A. Colonies and Protectorates was prohibited, causing to Nigeria an annual loss of revenue amounting to about 1½ millions sterling. Partially to compensate for this, export duties on produce, which had been originally imposed as a temporary war measure, were retained after the Armistice and were substantially increased during 1920. During that year approximately three quarters of a million sterling was derived from this source.

The value of the principal imports in 1913 was: cotton goods £1,529,361; spirits £452,939; tobacco, cigars, cigarettes £230,962; cutlery, hardware, etc. £154,857; fish £134,998; grain and flour £125,192; kola nuts £117,324. The first half of 1914 showed a great expansion of trade, which, however, was checked by the outbreak of war; and the value of the imports for the years 1915, 1916 and 1917 fell far below the pre-war level, the largest falling off being in the value and quantity of spirits imported. A recovery was made in 1918, in which year the value of the imports exceeded that for 1913 by more than a million sterling. In 1919, notwithstanding the fact that the importation of "trade" spirits was prohibited as from Feb. 1 of that year, the value of the principal imports was as follows: cotton goods £3,262,933; spirits £99,739; tobacco, etc. £631,531; cutlery, hardware, etc. £295,670; fish £17,300; grain and flour £130,693; and kola nuts £236,848. New items of importance among the imports of this year were coopers' stores (£917,896); bags and sacks (£580,338); salt (£510,839); iron, steel, etc. (£405,791); machinery (£166,680); and kerosene (£159,917).

The values of the principal exports for 1913 were: palm kernels £3,109,818; palm oil £1,854,384; tin £568,428; hides and skins £197,214; ground nuts £174,716; cotton lint £159,223; cocoa £157,480; and timber £106,050. The corresponding figures for 1919 were: palm kernels £4,947,995; palm oil £4,245,893; tin £1,324,074; hides and skins £1,262,140; ground nuts £698,702; cotton lint £484,745; cocoa £1,067,675; and timber £116,820. These increases are in part due to the inflated prices ruling in the produce markets of the world, but the quantity of palm kernels exported had risen from 175,000 tons in 1913 to 216,913 in 1919; of palm oil from 83,000 to 100,913 tons; ground nuts from 19,000 to 39,334 tons; and cocoa from some 5,000 to 25,711 tons.

Bibliography.—The best list of books and reports relating to Nigeria will be found in Prof. A. B. Keith's *Historical Geography of the British Colonies* (vol. iii., *West Africa*). See also Capt. C. W. J. Orr, *The Making of Northern Nigeria* (1911); C. Martin, *Les Possessions Britanniques en Afrique Occidentale* (1917); *Nigeria Handbook* (1917); Sir F. Lugard, *Report on the Amalgamation of Nigeria* (1919); *Red Book of West Africa* (1920); *Reports in the Blue Book of Nigeria* (1914–20). The annual addresses of the governors of Nigeria contain much that is of interest. (H. Cl.)

NILSSON, CHRISTINE (1843–1921), Swedish singer (*see* 19.701), died at Copenhagen, Denmark, Nov. 22 1921.

NITROGEN FIXATION (*see* 19.714).—Important progress was made after 1910 in the commercial fixation of nitrogen for industrial use. The economic importance of nitrogen fixation is to be found in the possibility of preparing fertilizers from the air, in place of being dependent on the nitrate deposits of Chile, or on ammonia obtained by the carbonization of coal. In addition to the artificial production of agricultural fertilizers, the synthetic manufacture of nitric acid becomes of the utmost importance in time of war, by virtue of the part played by this body in almost every explosive. It is certain that the Central Empires, in the World War, could not have continued fighting, by reason of their economic isolation from normal sources of nitric acid, but for the gigantic nitrogen-fixation factories which were erected at Oppau and elsewhere.

Nitrogen, in its ordinary form, combines directly with the following elements:—lithium, calcium, strontium, barium, magnesium, boron, aluminium, various rare earths, titanium, zirconium, cerium, thorium, silicon, vanadium, niobium, tantalum, chromium, uranium, manganese. In each case a nitride is formed, from which ammonia may be produced by the action of steam, but the commercial fixation of nitrogen as a nitride is, for technical and economic reasons, only possible in one or two instances, namely in the case of aluminium, and possibly also of silicon. Aluminium nitride is manufactured on a considerable scale in France by the Société Générale des Nitrures, by means of the Serpek process (Brit. Pat. 13086/1910). Finely ground alumina (bauxite) is preheated by means of flue gases and, after being mixed with powdered coal, is allowed to pass slowly along an inclined tube containing an electrically heated portion, by means of which the temperature of the charge is raised to about 1800° C. Producer gas, passed through the inclined tube in counter-current to the bauxite, forms the source of nitrogen, and reaction takes place according to the equation: $Al_2O_3+3C+N_2=2\,AlN+3CO$. The aluminium nitride is usually subsequently decomposed by means of caustic soda, with production of ammonia and of alumina.

From a commercial aspect, four processes of nitrogen fixation, namely the synthesis of ammonia, the arc process for the manufacture of oxides of nitrogen, the formation of calcium cyanamide (nitrolim) by the interaction of calcium carbide and nitrogen, and the synthesis of alkaline cyanides by the Bucher process, are all of special interest.

Ammonia Process.—The technical synthesis of ammonia, in particular, constitutes one of the great landmarks in chemical technology. The method employed consists in circulating a highly compressed mixture of hydrogen and nitrogen through a heated chamber containing a catalyst, by the action of which a small percentage of ammonia is formed according to the equation $3H_2+N_2=2NH_3$. This ammonia is subsequently removed from the uncombined gas, either by treatment with water at room temperature or by a process of refrigeration. The gaseous residue, after removal of the ammonia, is circulated once more through the heated catalyst chamber, fresh nitrogen and hydrogen being added to compensate for that transformed into ammonia and to maintain the pressure. In order to economize energy an elaborate system of heat exchangers is provided, by means of which the hot gases leaving the synthesizing bomb are used to heat the incoming gas. The formation of ammonia from its elements is accompanied by a considerable evolution of heat, and the production may, under favourable conditions, become autothermic when once started; that is to say, the heat of reaction may, in the presence of efficient heat exchangers, suffice to maintain the temperature required without the necessity for the supply of extraneous heat. The heat of formation of ammonia increases somewhat with the temperature. Haber, Tamaru and Oeholm (*Zeitschr. für Elektrochem.*, 1915, *21.* 191, 206) give, as the molecular heat of formation at constant pressure, 10,950 calories at 0° C., 12,670 cal. at 466° C., 12,900 cal. at 554° C., and 13,150 cal. at 659° C. By means of this process of circulation alternately through the catalyst chamber and through an ammonia absorption apparatus, the gas mixture treated becomes transformed into ammonia.

The percentage of ammonia formed each time the compressed gas passes the catalyst chamber depends partly on the speed of circulation, that is to say on the time of contact of the gas with the catalyst, and partly on the conditions of equilibrium between nitrogen, hydrogen and ammonia at the temperature and pressure employed, a subject which has been investigated in detail by Haber and his pupils. This equilibrium may be represented by an equation of the usual type,

$$K_p=\frac{P_{NH_3}}{P_{H_2}^{\frac{3}{2}}\times P_{N_2}^{\frac{1}{2}}}$$

obtained by applying the law of mass action to the formation of a gramme molecule of ammonia by the process: $\frac{3}{2}H_2+\frac{1}{2}N_2 \rightleftarrows NH_3$.

The value of K_p, from which the equilibrium ammonia percentage for any required pressure may readily be calculated from the relation given above, varies with the temperature according to the thermodynamically derived equation:—

$$\log_{10}K_p=\frac{2098}{T}-2{\cdot}5088\log_{10}T-0{\cdot}0001006T+0{\cdot}186\times10^{-6}T^2+2{\cdot}1.$$

For an approximate calculation of K_p, the abbreviated form: $\log_{10}K_p=\frac{2888}{T}-6{\cdot}134$ may be used.

The equilibrium ammonia content of a gas mixture, containing nitrogen and hydrogen in the ratio of 1 : 3 by volume, is given in the following table:—

Temperature ° C.	Equilibrium Percentage of Ammonia			
	At 1 atm.	30 atm.	100 atm.	200 atm.
200	15·3	67·6	80·6	85·8
300	2·18	31·8	52·1	62·8
400	0·44	10·7	25·1	36·3
500	0·129	3·62	10·4	17·6
600	0·049	1·43	4·47	8·25
700	0·0223	0·66	2·14	4·11
800	0·0117	0·35	1·15	2·24
900	0·0069	0·21	0·68	1·34
1000	0·0044	0·13	0·44	0·87

From the above figures it will be seen that the equilibrium ammonia percentage decreases rapidly with increase in temperature, but is capable of being raised by working under an increased pressure. The most usual working pressures are from 100 to 200 atmospheres, but an attempt has recently been made by Claude to operate the process at pressures greatly in excess of this.

Of the catalysts employed, osmium, uranium, and iron are of special importance, the interest of the first two being mainly historical, in that the first successful synthesis of ammonia by Haber and his pupils was carried out with their aid. In the case of iron the activity of the catalyst is usually increased by incorporating secondary constituents termed "promoters."

While the formation of ammonia begins at as low a temperature as 360° C., the velocity of the reaction is exceedingly slow under such conditions, in spite of the advantageous effect of a relatively low temperature on the equilibrium ammonia percentage, and a working temperature of 500° or over is usual commercially.

The output of a plant having a catalyst chamber of a given size is obviously governed by the percentage of ammonia formed during the passage of the compressed gas through the catalyst, and by the speed of circulation. It is found advantageous in practice to employ a relatively high speed of circulation, rather than to circulate slowly and to obtain a high ammonia percentage in the gas issuing from the catalyst chamber. The quantity of ammonia produced is measured by the space-time-yield (abbreviated S.T.Y.), this being the number of kilogrammes per hour per litre of catalyst space. For purposes of comparison, it is conventional to express the speed of circulation of the gas in litres per hour, at room temperature and pressure, per litre of catalyst space (space-velocity, abbreviated S.V.).

The efficiency of certain catalysts, under the conditions stated, is exemplified by the figures (*see* p. 1137) for osmium (Haber and Le Rossignol, *Zeitschr. für Elektrochem.*, 1913, *19.* 69), uranium (Haber and Greenwood, *ibid.* 1915, *21.* 241), and iron (Maxted, *Ammonia and the Nitrides*, p. 34).

As already stated, the formation of ammonia in the synthesizing chamber is followed by the elimination of ammonia from the circulating gases either by refrigeration, in which case pure anhydrous ammonia is obtained, or by absorption in water. For use as an agricultural fertilizer, the ammonia has to be converted into a suitable salt, usually the sulphate or chloride. In order to avoid the use of sulphuric acid for neutralization, it has been proposed to allow the ammonia to enter into reaction with calcium sulphate in the presence

Catalyst	Temperature ° C.	Pressure in atmospheres	S.V. of gas 10³×	Percentage of ammonia formed	S.T.Y.
Osmium . . .	585	166	24	7·0	1·46
	"	"	80	6·2	3·6
	"	"	160	4·2	4·8
Uranium carbide	515	113·6	5·2	7·63	0·28
	"	"	28·5	6·42	1·3
	"	"	74·4	4·78	2·5
	"	"	174·9	4·18	5·2
Iron . . .	505	150	10	11·1	0·8
	530	"	50	6·9	2·5
	"	"	100	5·6	4·3
	"	"	200	4·3	6·2
	"	"	300	3·8	8·2
	"	"	400	3·2	9·2
	"	"	500	3·0	10·8
	"	"	600	2·7	11·6

of carbon dioxide, whereby ammonium sulphate is produced, calcium carbonate being precipitated. For the production of the chloride, several modifications of the well-known Solvay ammonia-soda process have been suggested, by means of which ammonium chloride is formed from common salt, ammonia and carbon dioxide.

The direct synthesis of ammonia constitutes probably the most economical method of fixing nitrogen at present known. The cost of production is regulated principally by that of the hydrogen, the cost of compression being relatively low. On the other hand, the technical difficulties are probably more severe than in any other known industrial chemical operation. The high pressure, combined with a temperature sufficient to render steel of ordinary composition rapidly weakened by the hydrogen contained in the gas employed, has made necessary the construction of furnaces of special design. Further, all raw materials must be of a high degree of purity, by reason of the readiness with which the reaction is impeded and stopped by the presence of traces of catalyst poisons such as sulphur, arsenic, phosphorus, etc. Nitrogen also combines directly with hydrogen at the temperature of the electric arc and, further, under the influence of the silent electric discharge, but these methods have not up to the present given yields sufficient to justify their commercial application.

Immediately previous to and during the World War extensive factories were erected in Germany, at Oppau and Merseburg, for synthesizing ammonia, the tons of nitrogen fixed in this way being reported to have increased from 4,000 in 1913 to 100,000 in 1917. In Great Britain, Synthetic Ammonia & Nitrates, Ltd., was registered by Messrs. Brunner, Mond & Co., Ltd., in 1920 with a capital of £5,000,000. In the United States, the synthesis of ammonia has been taken up on a large scale by the General Chemical Co., and plants exist at Sheffield, Alabama.

Cyanamide Process.—A second highly important method of fixing nitrogen consists in forming calcium cyanamide (nitrolim), by the interaction of nitrogen with calcium carbide, $CaC_2+N_2=Ca:NCN+C$. Absorption of nitrogen takes place readily at 1,000° to 1,100° C., with carbide of commercial quality. By the addition of catalysts such as calcium fluoride or calcium chloride, the combination may be carried out at 800° C. The reaction is exothermic, and the temperature of the charge rises considerably owing to the heat produced. Temperatures exceeding 1,400° C. have a marked inhibitive effect on the yield, by reason of the reversible nature of the reaction.

Two types of plant are employed in practice. In those at Odda in Norway, the charge of carbide is reduced to fine powder by grinding and placed in cylindrical firebrick furnaces, which are heated internally to the required temperature by means of carbon resistance rods, nitrogen being admitted under slight pressure. A period of about 36 hours is required for the completion of the reaction, at the end of which time the product contains upwards of 20% of nitrogen. The charge shrinks away from the walls and forms a solid block, which is easily removed. It is the practice at certain other works, particularly those in Germany and Italy, to employ externally heated horizontal retorts. With these, the temperature of reaction is stated to be less easily controlled and trouble is experienced from the adhesion of cyanamide to the walls. Calcium cyanamide, in a finely ground condition, may be used directly as an agricultural fertilizer, ammonia being produced in the soil by hydrolysis: $CaN{\cdot}CN+3H_2O=2NH_3+CaCO_3$.

The above hydrolysis is also effected by the action of superheated steam, as an industrial operation for the manufacture of ammonia. The fixation of nitrogen by the cyanamide process is of considerable extent and importance. Factories exist at Odda (Norway), Piano d'Orta (Italy), Niagara, Wittenberg, Chorzow, Piesterloh and other places. It is stated that the total world production of cyanamide in 1916 amounted to nearly 1,000,000 tons, while Germany alone, owing to war-time extensions, is reported to have manufactured 886,000 tons in 1917.

Bucher Process.—The synthesis of sodium cyanide by the interaction of sodium carbonate, carbon and nitrogen in the presence of iron as a catalyst, according to the equation $Na_2CO_3+4C+N_2=2NaCN+3CO$, constitutes a promising method of nitrogen fixation, the commercial development of which is still in its infancy. The catalytic effect of iron in promoting this formation of cyanides at relatively low temperatures (800–1,000° C.) was noted by Thompson in 1839. Bucher (*Jour. Indust. and Eng. Chem.*, 1917, *9*. 233) drew renewed attention to the process, which has recently been developed industrially in the United States by the Nitrogen Products Co. According to the procedure adopted at Saltville, Virginia (*Jour. Indust. and Eng. Chem.*, 1919, *11*. 1010), coke is ground to a fineness of 200 mesh, and after the admixture of a small quantity of iron the required quantity of soda ash is added. The charge is moistened slightly, kneaded, and extruded in the form of briquettes, which are dried by the action of flue gases. The briquettes are placed in vertical iron or nichrome retorts, which are heated externally in firebrick furnaces to a temperature of 900 to 1,000° C., a current of nitrogen being led through the retorts. The briquettes, after treatment, contain about 20% to 30% of cyanide, which, in the plant in question, is removed in a somewhat novel manner by subsequent extraction with liquid ammonia, in which sodium cyanide is readily soluble. During this extraction process, the main structure of the briquette remains undestroyed, and the uncombined residue may be used for further treatment with nitrogen. The chief technical difficulty lies in the rapid deterioration of the iron retorts at the temperature employed for fixation, the life of these being about 7 to 12 days. Nichrome retorts last longer, but are more expensive to replace. It has been proposed to use an electrically heated type of furnace in which the charge itself forms the resistance. Further, pure nitrogen, although conducive to a high yield of cyanide, is not essential for commercial success. Ferguson and Manning (*Jour. Indust. and Eng. Chem.*, 1919, *11*. 946), in reviewing the replacement of nitrogen by producer gas containing carbon monoxide, state that at 1,000° C. the presence of 15% of carbon monoxide in the nitrogen reduces the yield of cyanide by about 30%, while, if the producer gas contains 60% of carbon monoxide, the yield is one-half of the value obtained with pure nitrogen. This inhibitive effect of carbon monoxide, the reason for which lies in the reversibility of the equation $Na_2CO_3+4C+N_2\rightleftarrows 2NaCN+3CO$, is even more pronounced at lower temperatures.

Numerous attempts have been made to synthesize barium cyanide industrially from barium oxide or carbonate, carbon and nitrogen. Margueritte and Sourdeval in 1860 (Brit. Pat. 1,027/1860) appear to have been the first to suggest the process which was subsequently improved by Mond (Brit. Pat. 433/1882) and by Readman (Brit. Pat. 6,621/1894). The optimum temperature is about 1,400° C., reaction taking place according to the equation: $BaO+3C+N_2=Ba(CN)_2+CO$. The above synthesis of barium cyanide was at one time worked on a considerable scale, but was not successful commercially, by reason of the deteriorating action of the fused cyanide on the walls of the furnace. It may be noted that the cyanides may readily be hydrolyzed to ammonia by means of superheated steam in an analogous manner to calcium cyanamide. G. W. Heise and H. E. Foote (*Jour. Indust. and Eng. Chem.*, 1920, *12*. 331) state that on treating briquettes containing synthetic sodium cyanide with steam at a pressure of 300 to 330 lb., a yield of ammonia amounting to over 90% of that theoretically possible was obtained in 30 to 45 minutes.

Arc Process.—The final method to be considered consists of the synthesis of nitric acid, either by the action of a high-tension electric arc on air or by the explosion of compressed mixtures of air and a combustible gas in the cylinder of an internal combustion engine (Häusser's process). The production of oxides of nitrogen by either method depends on the reaction of nitrogen with oxygen at a high temperature, according to the reversible equation: $N_2+O_2\rightleftarrows 2NO$. The equilibrium percentage of nitric oxide formed by heating air to various temperatures has been measured by Nernst, Jellinek and Finckh (*Göttinger Nachr.* 1904, p. 261), *Zeitschr. f. anorg. Chem.*, 1905, *45*. 116; 1906, *49*. 212, 229; *Zeitschr. f. Elektrochem.*, 1906, *12*. 527), the results being summarized in the following table:—

Temperature °C.	Equilibrium Percentage of NO by volume (from air)
1,538	0·37
1,604	0·42
1,760	0·64
1,922	0·97
2,307	2·05
2,402	2.23
2,927	5·00

Nitric oxide is formed, and consequently also decomposed, at a very high velocity, less than one-thousandth of a second being required for the attainment of equilibrium even at 2,000°, so that, in order to preserve the products formed at arc temperature, these must be removed as quickly as possible from the arc flame; otherwise a less advantageous percentage, corresponding to a temperature lower than the maximum, is obtained. In practice, this rapid cooling is effected by employing a rapid flow of air, which is injected into a specially spread-out arc. Even with these precautions, however, the concentration of nitric oxide preserved in the issuing gases does not usually exceed two parts per cent by volume, nitric oxide being capable of existence in an undecomposed but metastable condition at temperatures below 1,000°, by reason of the extreme slowness with which decomposition then proceeds.

Of the commercial plants employed, that due to Birkeland and Eyde has been described in 19.714. In the Schönherr type, the arc is struck between an internal electrode placed at the base of a tall vertical metal tube, which forms the second electrode, air being injected with a whirling motion vertically through the furnace. The arc is thus blown out into a flame, the length of which may be as much as 7 yards. The yield of nitric acid is stated to be about 75 grammes per kilowatt hour of energy used. The concentration of the nitric oxide in the issuing gases is 2–2·5%. A further type of "blown arc" furnace, due to Pauling, employs special lighting knives for promoting the formation of the arc.

The exit gases from any of the above types of furnace are cooled to about 50°, and passed into a so-called oxidation chamber, in which the excess of oxygen combines with the nitric oxide, forming nitrogen peroxide, $2NO+O_2=2NO_2$. The nitrogen peroxide is subsequently absorbed by means of water in large granite absorption towers, nitric acid being produced. The process is operated principally in Norway at Notodden and Christiansand.

In the Häusser process, the requisite high temperature is obtained by the explosion of compressed air with a fuel gas in the cylinder of an engine. Enrichment of the air with oxygen is stated (Greenwood, *Industrial Gases*, p. 107) to increase the yield of nitric acid. Thus, air containing 26% of oxygen gave a yield of 10 lb. of nitric acid per 1,000 cub. ft. of combustible gas, compared with a yield of 6·4 lb. with normal air. (E. B. M.)

NITTI, FRANCESCO SAVERIO (1868–), Italian statesman, was born at Melfi (Potenza) in 1868. He had already become known as a barrister and as professor of financial science at the university of Naples, when he first entered Parliament in 1904. He made his reputation as an authority on economic and financial questions, and was Minister of Agriculture, Industry and Trade in the Giolitti Cabinet of 1911–4. When the United States entered the World War in 1917 he was entrusted with an economic mission to that country, and certain of his utterances and acts in this connexion were severely criticized. He became Minister of the Treasury in the Orlando Cabinet from Oct. 1917 to Jan. 1919. On the fall of Orlando he succeeded him as premier, but his administration was a weak one, the Socialists and Communists being allowed to commit innumerable acts of criminal violence with absolute immunity. He was closely associated with the post-war policy of *svalutamento*. The exasperation of the majority of the country at his policy, and the indignation aroused by his treatment of the Dalmatians in Rome, as well as his failure to secure a settlement of the Adriatic problem, led to his fall in June 1920, thus leaving the way open for the return of Giolitti. On his retirement from office he returned to journalism and business.

NIVELLE, ROBERT GEORGES (1856–), French general, was born at Tulle (Corrèze) on Oct. 15 1856. He became a student at the École Polytechnique on Nov. 1 1876 (after having been entered at St. Cyr) and in 1878, as a sub-lieutenant, went through the course at the school of artillery and engineering. He was made a lieutenant in the 19th Regt. of artillery in Oct. 1880 and was promoted captain on Dec. 29 1887. He became major (*chef d'escadrons*) in July 1901 and served on the China Expeditionary Corps staff during 1900–1. In 1908, while serving at Ozan, he was made a lieutenant-colonel, and three years later, while serving as chief of staff with the Algiers Div., was promoted colonel. In Dec. 1913 he assumed command of the 5th Regt. of artillery at Besançon and was so employed at the outbreak of the World War in Aug. 1914. At the head of this unit he took part in the operations of the 7th Corps in Alsace (including the battle of Dornach) and was specially mentioned in army orders. On Sept. 6 1914 on the 7th Corps front he again distinguished himself. The German pressure had compelled a French withdrawal and it seemed as if the 7th Corps would have to cross the Ourcq. Col. Nivelle, however, swiftly reorganized his artillery and massed it at a vulnerable point. By the intensity of his fire he checked the German advance and enabled the French to recover the ground they had lost. Two weeks later, on the Aisne, he again saved a French withdrawal by skilful disposition of the artillery under his command. On Oct. 27 1914 he was promoted general of brigade. He commanded successively the 44th and 60th Inf. Bdes. on the Aisne, and in Jan. 1915 was responsible for the check of the enemy before Soissons. On Feb. 19 following he took over the command of the 61st Div.; becoming on Dec. 23 a substantive general of division and commander of the III. Army Corps. He went to Verdun at the end of March 1916 and a month later took over the II. Army. He planned the operations (executed by Gen. Mangin) which resulted in the reconquest in four and a half hours of the country S. of the line Thiaumont–Douaumont–Vaux–Damloup, country which the Germans had taken six months to capture and in the taking of which they had sacrificed some of their best troops. On Dec. 12 1916 he was made commander-in-chief of the armies of the N. and N.E.

The choice was inspired by a variety of motives, amongst which the most important were the objections, political and military, raised against more obvious candidates (such as Castelnau, Foch and Pétain), and the feeling that a younger man might solve the problem of break-through which had defeated Joffre. Nivelle was put in command to break traditions, and to win the war in the one great effort of which France, after all her losses, was still capable. He was the embodiment of the wave of optimism which swept over the Allied Governments, armies and peoples in the spring of 1917. The story of his failure to realize these expectations need only be summarized here. Accepted by Mr. Lloyd George's Government as commander-in-chief not only of the French but also of the British front, he asserted his authority from the first moment in such a way as to antagonize Sir Douglas Haig's headquarters. When this difficulty had been officially smoothed over, he allowed himself to be taken aback by the sudden withdrawal of the German centre in March 1917, which disconcerted nearly all the preparations for the Franco-British offensive. Next, persisting in a sanguine and grandiose offensive scheme to which many of his generals openly took exception, he found himself regarded with suspicion by his Government, and it was in the midst of a series of councils of war, inter-governmental negotiations, and internal incidents that he launched the attack of April 16 1917, a half victory which was the ruin of his hopes. Some weeks later he was dismissed from the command of the French armies. With the suspension of the offensive (which had already taken place), his command over the British forces had automatically ceased.

Later, Gen. Nivelle served as governor-general of Algeria.

Controversy of peculiar violence has naturally arisen in connexion with Nivelle's command and his offensive. On the general's side, Commandant de Civrieux's work is the principal source; on the other Jean de Pierrefeu's *La verité sur l'affaire Nivelle* criticizes his actions from the standpoint of the Pétain school. Less definitely critical works, which contain the most important documents and deal with the political aspects of the case, are H. Galli, *L'offensive de 1917* and Mermeix, *Les Crises du Commandement* (pt. ii. *Nivelle et Painlevé*).

NIXON, SIR JOHN ECCLES (1857–1921), British general, was born Aug. 15 1857 and joined the army in 1875. He was transferred to the Indian cavalry in 1878, and he served in the Afghan War, the Mahsud Waziri expedition of 1881, the Chitral relief expedition in 1895, for which he was promoted brevet lieutenant-colonel, and the Tochi operations of 1897–8. He was promoted colonel in 1899, and he commanded a column during the later stages of the South African War and was given the C.B. for his services. Promoted major-general in 1904, he was inspector-general of cavalry in India from 1906–8, and he then held various higher commands in that country (being promoted lieutenant-general in 1909 and general in 1914) till in April 1915 he was sent to Mesopotamia to take charge of the campaign there. Under his auspices Gen. Townshend advanced successfully up the Tigris to Kut; but Nixon was largely responsible for the subsequent abortive attempt to reach Bagdad, which led to the retreat from Ctesiphon and to the investment of Kut. He fell ill towards the end of 1915 and quitted the theatre of war. In 1919 he was given the G.C.M.G. in recognition of his services four years earlier, and he retired in that year. He died at St. Raphael, France, Dec. 15 1921.

NOBLE, SIR ANDREW, Bart. (1832–1915), British physicist and artillerist (*see* 19.730), died at Ardkinglas, Argyllshire, Oct.

22 1915. He was succeeded in the baronetcy by his eldest son George (b. 1859), two other sons, Saxton (b. 1863) and John (b. 1865), becoming prominently associated as directors with the management of their father's great engineering firm of Armstrong, Whitworth & Co. of Newcastle.

NOGI, MARESUKE [**KITEN**], COUNT (1849–1912), Japanese general (*see* 19.733). After the campaign of 1904–5 he was decorated with the Imperial Order of the Rising Sun with Paulownia and the first-class Military Order of the Golden Kite, in recognition of his distinguished services. He and Countess Nogi committed suicide on Sept. 13 1912, when the state funeral of the Emperor Mutsu Hito was taking place, in sign of their devotion to their imperial master.

NOLHAC, PIERRE DE (1859–), French scholar and author, was born at Ambert, Puy-de-Dôme, Dec. 15 1859. He was educated at the *lycées* of Puy and Rodez, and afterwards studied at Clermont and in the École des Hautes Études at Paris. He entered the Bibliothèque Nationale in 1885, became professor of philology at the École des Hautes Études in 1886, and was in 1892 made curator of the palace of Versailles, becoming hon. curator on resigning this post in 1921. He produced a series of works dealing with its history and associations, of which the chief are *Le Musée National de Versailles* (with A. Pératé, 1896); *Le Château de Versailles sous Louis XV.* (1898); *Les Jardins de Versailles* (1905); *Histoire du Château de Versailles* (1911); *Le Trianon de Marie Antoinette* (1914) and *Madame de Pompadour et des Arts* (1920). His other works, which deal with a great variety of subjects, include *Le Dernier Amour de Ronsard* (1882); *Lettres de Joachim du Bellay* (1883); *Erasme en Italie* (1888); *Petrarque et l'Humanisme* (1892; new edition 1907); besides several volumes of poems, and works on Nattier, Fragonard, Hubert Robert, Boucher, and Madame Vigée-Le Brun. He was made an officer of the Legion of Honour.

See P. Bouchaud, *Pierre de Nolhac et ses travaux* (1896).

NOMOGRAPHY.—The methods of graphic calculation may be divided into two main groups. (*a*) Those in which a more or less complicated geometrical construction is performed for the solution of an isolated problem. *Graphic Statics* (*see* 17.960) may be instanced as an example of this group. (*b*) Those in which all the solutions of a formula which are likely to be required are embodied in a permanent diagram with figured scales, drawn once for all, and read simply by the intersection of lines or the alignment of points on it.

The methods grouped under (*a*) do not lend themselves readily to concise and useful generalization; they can in fact only be dealt with satisfactorily as they occur in direct connexion with a particular subject. Those of group (*b*), however, the application of which in scientific and engineering work generally has developed considerably in recent years, can be successfully generalized, and they form the subject of this article.

It was M. d'Ocagne who, in his *Nomographie: Les calculs usuels effectués au moyen des abaques* (1891), invented the word *Nomographie*—*i.e.* the graphical presentment of laws—to describe the theory, and the word *Nomogramme* to describe the diagrams resulting from the application of these methods.

The English forms *Nomography* and *Nomogram* have now come into general use with similar meanings.

Although the invention and introduction of some of the methods utilized date back to a remote period, there can be no dispute as to the predominatingly important position to be assigned to the work of d'Ocagne as far as the generalization and systematization of the modern treatment are concerned.

The exposition of the main principles given in this article follows the lines laid down in his works.

1. *Notation.*—Following d'Ocagne the different variables appearing in an equation or formula will be denoted by z_1, z_2, z_3. . . ., and the letters f, g, h, with appropriate subscripts, will be used to denote functions of these variables. Thus f_1, g_1, h_1, will denote different functions of z_1; f_2, g_2, h_2, different functions of z_2; f_{23} a function of z_2 and z_3, and so on.

2. *Graphic Representation of a Two-Variable Formula in Cartesian Coördinates.*—With the functional notation explained above, the most general expression for an equation connecting two variables z_1, z_2, is,

$$f_{12}=0.$$

In the case of a practical formula, supposing z_2 to be the quantity which usually has to be determined for values of z_1, we as a rule have the equation in the *explicit* form,

$$z_2=f_1.$$

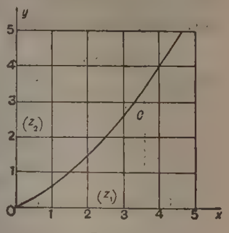

Fig: 1.

Taking the rectangular axes Ox, Oy (fig. 1) we construct the curve C, the "graph" of

$$z_2=f_1$$

the abscissa x and ordinate y of any point on this curve representing corresponding values of z_1, z_2 respectively.

Suitable scales are selected for z_1 and z_2, according to the size of the diagram and the range of values of z_1, z_2 required.

Then, denoting by μ_1, μ_2 the units of the scales (z_1), (z_2),

$$x=\mu_1\,z_1$$
$$y=\mu_2\,z_2$$

define the graduations of the scales (z_1), (z_2) along Ox, Oy.

If any two corresponding values of z_1, z_2 are taken and parallels to Ox, Oy drawn through the appropriate graduations on their respective scales, the intersection of these two straight lines gives a point on the curve.

Proceeding in this way with different corresponding values of z_1, z_2, the necessary number of points on the curve to enable it to be constructed with sufficient accuracy are obtained.

Having constructed the curve in this manner, the value of z_2 corresponding to any value of z_1 is obtained by following the parallel to Oy through the given value of z_1 on the scale (z_1) till it cuts the curve, and then following the parallel to Ox through this point till it cuts the scale (z_2) at a certain graduation. This graduation gives the value of z_2 required.

In order to save the trouble of having to draw the parallels on the diagram each time a reading is required, we construct a sufficient number once for all through the graduations of the scales (z_1), (z_2) so that the eye can follow them and, if necessary, interpolate between them to read the corresponding values.

Looking at the matter in a slightly different way,

$$x=\mu_1 z_1$$
$$y=\mu_2 z_2$$

may be considered as defining two systems (z_1), (z_2) of parallel straight lines at right-angles to each other, forming a *rectangular network*, the vertical and horizontal "meshes" of which are "figured" to correspond with the graduations of the scales through which they are drawn.

For any two values of z_1, z_2 which satisfy

$$z_2=f_1$$

we will then have two corresponding straight lines in this network which will intersect on the curve

$$z_2=f_1.$$

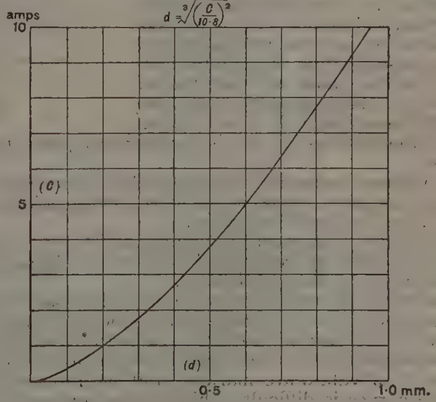

Fig: 2.

In practice the familiar "squared paper," already prepared with rulings at intervals of a millimetre or a tenth of an inch, is largely employed for work of this sort. Fig. 2 shows such a diagram constructed for the electrical formula

$$d=\sqrt[3]{\left(\frac{C}{K}\right)^2}$$

giving the current (C) in amperes which will fuse a wire of diameter d mm., K being a constant depending on the metal of the wire. In this case the diagram has been constructed for lead wire (K = 10·8) of thickness up to 1 mm., and

$$z_1=d, \qquad \mu_1=50 \text{ mm.}$$
$$z_2=C, \qquad \mu_2=5 \text{ mm.}$$

3. *Graphic Representation of a Two-Variable Formula by Means of Two Adjacent Scales.*—The method described in §2 is the most

straightforward way, from the point of view of construction, of representing the formula graphically, but in practice it will frequently be found that two rectilinear scales side by side are more convenient, as they are more compact and quicker and easier to read, the eye not having to follow the line up from one graduation to the curve, and then along to the other graduation.

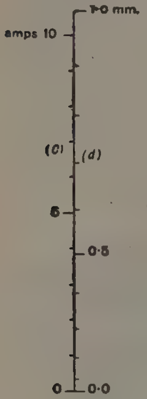

Fig: 3.

Fig. 3 has been constructed from fig. 2 to bring out these points. The scale (z_2) is the same, while the position of any graduation of the scale (z_1) is obtained by dropping a perpendicular to the scale (z_2) from the point on the curve in fig. 2 where the vertical line through any value of z_1 cuts it.

The two adjacent scales can, however, be constructed directly without the intermediary of a diagram in cartesians, by introducing the idea of the *functional scale*, which also figures largely in subsequent applications.

If u is the distance of any graduation of the scale (z_2) from the zero, μ the unit employed,

$$u=\mu z_2$$

gives the graduations of the *regular* or *evenly divided* scale (z_2), in which for equal intervals between the values of z_2, the intervals between the graduations on the scale are equal.

For the distance of any graduation on the scale (z_1) from the zero we have

$$u=\mu f_1$$

defining the *functional scale* (z_1), in which the graduations are no longer equally spaced for equal intervals in the value of the variable z_1, but the segments cut off are proportional to the function f_1, although figured with the corresponding values of z_1.

4. *Graphic Representation of a Three-Variable Formula in Cartesian Coördinates.*—The equation connecting the three variables z_1, z_2, z_3 of a formula dealing with three variable quantities may, with our notation, be written, in its most general form

$$f_{123}=0.$$

We take one of the variables, z_3 say, and give it in turn different values, starting with the lowest value required, and increasing by equal intervals. For each of these values we can construct a curve, as in §2, traced on the network defined by

$$x=\mu_1 z_1$$
$$y=\mu_2 z_2$$

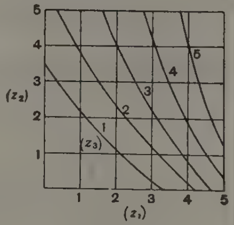

Fig: 4.

Proceeding in this way for a suitable number of values of z_3, a system of *isoplethic curves* or *isopleths* is obtained. Along each of these curves z_3 has a constant value, and we mark this value against the curve. Such a diagram is seen schematically in fig. 4.

In order to find the value of z_3 corresponding to given values of z_1, z_2 we take a vertical line through the value of z_1 and a horizontal straight line through the value of z_2. We then note on what line of the system (z_3) the intersection of these two straight lines falls; if it falls between two lines, interpolation by eye is necessary to judge the intermediate value.

To put it more generally and concisely—*for values of* z_1, z_2, z_3 *which satisfy the given equation, the three corresponding lines of the systems* (z_1), (z_2), (z_3) *meet in a point.*

Hence the term "Intersection Nomogram" used to describe diagrams of this class, as contrasted with the "Alignment Nomogram" which will be dealt with later.

The systems of figured lines which it is necessary to employ in diagrams of this sort will in practice be found to render the reading troublesome in comparison with the reading of a simple graduated scale. The intersection of three lines has to be followed back to the place where their values are marked, and the interpolation by eye between the curves is difficult, while if the number of lines is increased to facilitate interpolation, the complication and confusion of the whole diagram are increased.

For these reasons, where the form of the equation renders it possible, it is frequently preferable to employ the methods of representation which will be described later.

5. *Principle of Anamorphosis.*—In the method of representation of the equation

$$f_{123}=0$$

described in 4, we took, corresponding to the variables z_1, z_2, evenly divided scales along ox, oy.

Suppose that instead of this we take the functional scales

$$x=\mu_1 f_1$$
$$y=\mu_2 f_2.$$

Instead of the network with evenly spaced meshes corresponding to the evenly divided scales previously employed, we shall now have a network with unevenly spaced meshes on which the lines of the system will be altered in shape.

Such a transformation, known as an *anamorphosis*, is only of advantage when it leads to a better arrangement or simplification of the diagram. Thus it may be resorted to to space out the isopleths which would otherwise be too close together, or to make the curves which constitute them easier to draw, and more convenient for interpolation. A particular case of frequent practical importance is that in which an anamorphosis can transform the isopleths into straight lines. This is best illustrated by an example.

Consider the formula

$$R=3\cdot34\,\frac{V^2}{D}$$

connecting the retarding force in percentage weight of a train (R), with the speed in miles per hour (V), and the distance of the stop in feet (D).

Taking

$$z_1=D$$
$$z_2=V$$
$$z_3=R$$

(*a*). Fig. 5 shows the representation on the lines of §4, the system (R) consisting of the parabolas

$$\left(\frac{y}{\mu_2}\right)^2=\frac{R}{3\cdot34}\left(\frac{x}{\mu_1}\right)$$

arranged on the regular network

$$x=\mu_1 D$$
$$y=\mu_2 V$$

with $\mu_1=0\cdot25$ mm., $\mu_2=0\cdot625$ mm.

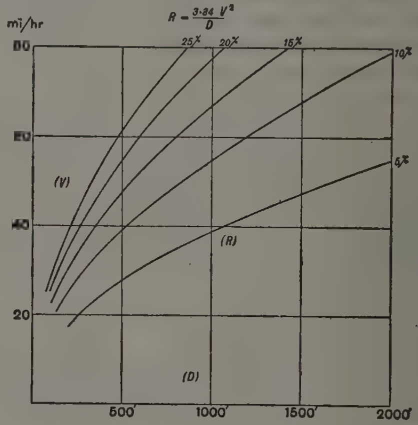

Fig: 5.

(*b*). If now instead of the network in (*a*), we employ the network

$$x=\mu_1 D$$
$$y=\mu_2 V^2$$

we obtain for the system (R) a system of straight lines

$$\frac{y}{\mu_2}=\frac{R}{3\cdot34}\left(\frac{x}{\mu_1}\right)$$

radiating from the origin (fig. 6).

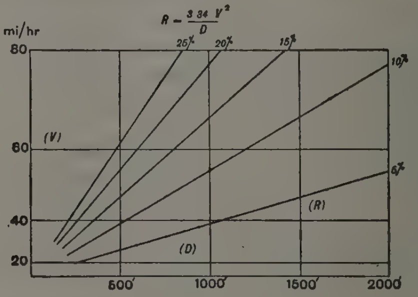

Fig: 6.

(*c*). Writing the formula

$$\log D-2\log V+\log R-\log 3\cdot34=0$$

and employing the network

$$x=\mu_1\log D$$
$$y=2\mu_2\log V$$

we obtain (fig. 7) for (R) a system of parallel straight lines

$$\frac{x}{\mu_1}-\frac{y}{\mu_2}+\log R-\log 3\cdot34=0.$$

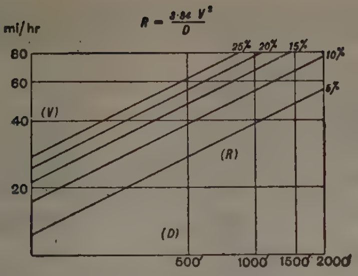

Fig: 7.

A logarithmic anamorphosis as illustrated in (*c*) is so frequently resorted to in practice that paper already ruled with a logarithmic network can be obtained commercially and is largely employed.

6. *Graphic Representation of a Three-Variable Formula in Parallel Coördinates.*—The preceding sections have dealt with Intersection Nomograms in which the answer is read from the intersection of lines in a point. For certain types of formulae, however, a representation is possible in which the three variables are arranged along three scales, and the answer is read by the alignment of points on these scales. Such an arrangement, an "Alignment Nomogram," is possible only when a diagram for the formula can be constructed, in cartesian coördinates, which consist of three systems of straight lines.

Defining the three systems of straight lines in cartesian coördinates by

$$xf_1+yg_1+h_1=0$$
$$xf_2+yg_2+h_2=0$$
$$xf_3+yg_3+h_3=0$$

corresponding to the three variables z_1, z_2, z_3, we arrive at an equation for the formula which is most conveniently expressed in determinant notation

$$\begin{vmatrix} f_1 & g_1 & h_1 \\ f_2 & g_2 & h_2 \\ f_3 & g_3 & h_3 \end{vmatrix}=0 \text{———————} (1).$$

For further investigation it is necessary to introduce the idea of *Parallel Coördinates* referred to two *parallel axes*, so that a point is represented by an equation of the first degree.

These coördinates are defined as follows:—If a straight line MN (fig. 8) cuts two parallel axes A*u*, B*v* (A and B being the origins of the axes) in M and N, the coördinates of the straight line are

$$u=\text{AM},\quad v=\text{BN}.$$

Any equation of the first degree

$$au+bv+c=0$$

will represent a point, and to determine this point it is sufficient to know two solutions of the equation, and take the intersection of the straight lines resulting from these two solutions.

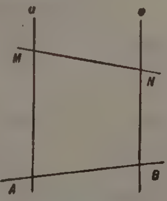

Fig: 8.

$$\text{Putting } v=0,\quad u=-\frac{c}{a}$$

$$u=0,\quad v=-\frac{c}{b}$$

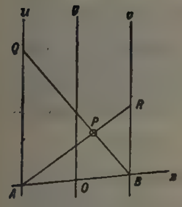

Fig: 9.

Along the axes A*u*, B*v* (fig. 9) take

$$\text{AQ}=-\frac{c}{a},\quad \text{BR}=-\frac{c}{b}$$

The intersection of the straight lines AR, BQ in P will then give the point required, the point

$$au+bv+c=0$$

This correspondence of points to straight lines and *vice versa*, according as to whether cartesian or parallel coördinates are employed for the geometrical interpretation, is an example of the *Principle of Duality*. As an alternative to a diagram composed of straight lines there is a correlative diagram composed of points, and if three straight lines intersect in a point in the first diagram, the three points in the second will lie on a straight line.

Effecting such a *dualistic transformation* the three systems of straight lines

$$xf_1+yg_1+h_1=0$$
$$xf_2+yg_2+h_2=0$$
$$xf_3+yg_3+h_3=0$$

will now be represented by three systems of points

$$uf_1+vg_1+h_1=0$$
$$uf_2+vg_2+h_2=0$$
$$uf_3+vg_3+h_3=0$$

forming three scales arranged along a straight line or a curve, according as to whether the straight lines of the correlative system meet in a point or not,[1] and when three points are taken on these scales whose graduations correspond to three values of z_1, z_2, z_3 satisfying (1), the three points will lie on a straight line, since the correlative straight lines meet in a point.

Hence to use such a diagram (shown schematically in fig. 10) we join any two values of two of the variables on their respective scales by a straight line, and the point of intersection of this straight line with the third scale gives the corresponding value of the third variable.

It will not be necessary actually to draw the straight line on the diagram; a piece of thread stretched across it will give the alignment, or a strip of transparent celluloid, having a straight line engraved down the centre, may be employed for the same purpose.

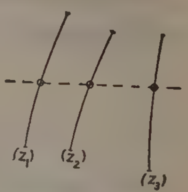

Fig:10.

Given a diagram consisting of straight lines only, representing a three-variable formula in cartesian coördinates, the correlative diagram representing the same formula in parallel coördinates can be constructed geometrically without knowing the analytical expression of the formula represented.

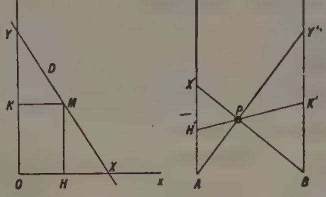

Fig: 11.

Let D (fig. 11) be a straight line of the left-hand diagram. Take a point M on this straight line whose cartesian coördinates are OH, OK.

The correlative straight line H′K′ will be one whose parallel coördinates are

$$\text{AH}'=\text{OH},\quad \text{BK}'=\text{OK}.$$

Taking in this way the correlative straight lines to any two points on the straight line D, we get by their intersection the point P, correlative to the straight line D.

Thus we might take BX′, AY′, the correlatives of X and Y, the points where the straight line D cuts the axes O*x*, O*y*, making

$$\text{AX}'=\text{OX},\quad \text{BY}'=\text{OY}.$$

Proceeding in this way we can replace all the straight lines of the intersection diagram by points.

As an example we have taken the Intersection Nomogram, fig. 6, and constructed from it an Alignment Nomogram, fig. 12.

Suppose, for instance, we want to know the value of R for V=70 m./h., D=1,100 ft. All that it is necessary to do in fig. 12 is to join 70 on the (V) scale to 1,100 on the (D) scale. This straight line will be found to cut the (R) scale at 15 % (see transverse line in fig. 12), the required value of R.

Comparing the two figures the advantages of the Alignment Nomogram will be evident. The disadvantages referred to in §4 have disappeared, for there is no tracing back along a line to read its graduation, and any interpolation by eye is only necessary on simple graduated scales.

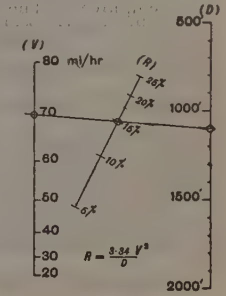

Fig: 12.

Proceeding to the direct construction of Alignment Nomograms, without the preliminary construction of an Intersection Nomogram, certain types will now be considered which are particular cases of the general equation (1).

Type A—Nomograms with Three Parallel Rectilinear Scales. If the formula to be represented can be put in the form

$$f_1+f_2+f_3=0 \text{———————} (2)$$

the three systems of points (z_1), (z_2), (z_3) can be arranged on three parallel straight lines.

For the systems (z_1), (z_2) we take the functional scales

$$u=\mu_1 f_1 \text{———————} (3)$$
$$v=\mu_2 f_2 \text{———————} (4)$$

along the two parallel axes A*u*, B*v* (fig. 13).

Eliminating f_1, f_2 between (2), (3) and (4) gives us for (z_3)

$$\mu_2 u+\mu_1 v+\mu_1\mu_2 f_3=0 \text{———————} (5).$$

It is now convenient to revert to cartesian coördinates, taking as origin O, the midpoint of AB, the axis of x along AB, the axis of y parallel to A*u* or B*v* (*see* fig. 9). Also let OB be denoted by λ.

With these axes (5) will denote the system of points,

$$x=\lambda\frac{\mu_1-\mu_2}{\mu_1+\mu_2},\qquad y=\frac{\mu_1\mu_2 f_3}{\mu_1+\mu_2}$$

---

[1] Parallel straight lines of course fulfil this condition and lead to a rectilinear scale as they have a common point at infinity.

The expression for x being constant we see that the points are arranged along a straight line Cw parallel to Au, Bv, and this straight line cuts AB at a point C such that

$$\frac{\text{CA}}{\text{CB}} = -\frac{\mu_1}{\mu_2}$$

Then writing for the scale (z_3) on Cw

$$w = -\mu_3 f_3$$

as w is the same as y we have

$$\mu_3 = \frac{\mu_1 \mu_2}{\mu_1 + \mu_2}$$

or

$$\frac{1}{\mu_3} = \frac{1}{\mu_1} + \frac{1}{\mu_2}$$

In the particular case where $\mu_1 = \mu_2$ we will have

$$\mu_3 = \frac{\mu_1}{2} = \frac{\mu_2}{2}.$$

To recapitulate, the practical procedure is shortly as follows:— Select suitable axes Au, Bv and suitable units μ_1, μ_2. Draw Cw dividing AB in the ratio $\frac{\mu_1}{\mu_2}$, and determine the unit μ_3 by the relation

$$\frac{1}{\mu_3} = \frac{1}{\mu_1} + \frac{1}{\mu_2}$$

Construct along Au, Bv, Cw, respectively the scales

$$u = \mu_1 f_1$$
$$v = \mu_2 f_2$$
$$w = \mu_3 f_3$$

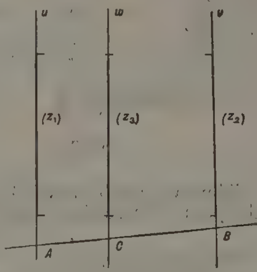

Fig. 13.

Any straight line drawn across these three will then cut them at corresponding values of z_1, z_2, z_3 as defined by (2).

As a rule we arrange the diagrams so that the scale of the variable, which has generally to be determined in terms of the other two, lies between their scales, as this conduces to greater accuracy in reading.

It is not necessary for the origins A, B, C, to appear on the diagram unless they are required for the range of the variables for which the formula is to be employed. The scales can be quite easily constructed without them, starting from the lowest value required. It will be seen that the freedom of choice of axes and units renders this method an exceedingly flexible one. Examining the range of the variables required for the practical use of the particular formula, we can arrange the scales and the size of their graduations to the best advantage.

Among other things, we wish to avoid the reading straight line making too acute an angle with the scales, as this leads to inaccuracy. Practice will soon enable the best disposition to be seen, but it will most frequently be found convenient to make the useful parts of the scales (z_1), (z_2) about the same length and about the same distance apart, so that the complete diagram is roughly contained in a square.

As an example of Type A, the formula

$$d = \sqrt[3]{\left(\frac{\text{C}}{\text{K}}\right)^2}$$

already referred to in §2 can be taken, supposing that it is now desired to construct a nomogram to show different values of K, instead of a single curve for a constant value of K.

The formula can be reduced to Type A by writing it

$$\log d + \tfrac{2}{3} \log \text{K} - \tfrac{2}{3} \log \text{C} = 0$$

and taking

$$z_1 = d, \quad f_1 = \log d$$
$$z_2 = \text{K}, \quad f_2 = \tfrac{2}{3} \log \text{K}$$
$$z_3 = \text{C}, \quad f_3 = -\tfrac{2}{3} \log \text{C}$$

the scales are all logarithmic scales, differing only as regards their unit.

Take any convenient logarithmic scale that may be available (say that of a slide rule) and by means of it graduate the scales (d) and (K) on two convenient parallel axes (fig. 14).

We can then determine the point C = 10 on the scale (C) by the cross alignments

$d = 1$, K = 10
$d = 2{\cdot}5$, K = 80

for both of which C = 10.

The support of (C) is then a straight line parallel to the axes through this point, and we can graduate it by noticing that for C = K, we always have $d = 1$.

The alignment of $d = 1$ with K = 20, 30, 40, 50, in turn, then gives the points C = 20, 30, 40, 50, ...

Suppose now that we want to know the current which will fuse an aluminium (K = 59) wire 0·3 mm. diameter. The straight line joining 0·3 on the (d) scale to 59 on the (K) scale (see dotted line, fig. 14) cuts the (C) scale at about 9·5 amp., the required current.

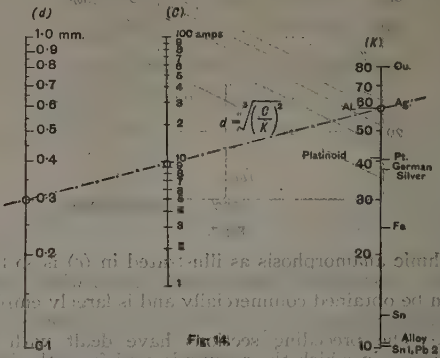

Fig. 14.

Type B.—Nomograms with three rectilinear scales, two of which are parallel. If the formula to be represented can be put in the form

$$f_1 + f_2 h_3 = 0 \qquad (6)$$

it can be represented by two systems of points (z_1), (z_2) arranged along two parallel straight lines, and a third system arranged along a straight line making an angle with the other two.

As before, we take the functional scales

$$u = \mu_1 f_1$$
$$v = \mu_2 f_2$$

along the parallel axes Au, Bv (fig. 15).

We then have for the system (z_3)

$$\mu_2 u + \mu_1 h_3 v = 0$$

which with our usual axes defines the system of points

$$x = \lambda \frac{\mu_1 h_3 - \mu_2}{\mu_1 h_3 + \mu_2}, \quad y = 0$$

so that the points of the system are arranged along AB.

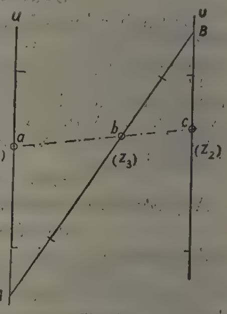

Fig. 15.

The scale (z_3) can be graduated by the use of the above expression for x, or from a double-entry table of corresponding values of z_1, z_2, z_3, by successive alignments of pairs of values of z_1, z_2 corresponding to any graduation z_3. Thus if a and c are a pair of values of z_1 and z_2 which correspond to the value b of z_3, we join ac to cut AB at b, which gives the graduation of the scale for the value b.

If A and B do not appear on the diagram the support of the scale (z_3) can be drawn by making use of the relation, that if δ_1, δ_2 are the distances of a point on (z_3) from Au, Bv, we have

$$\frac{\delta_1}{\delta_2} = -\frac{\mu_1 h_3}{\mu_2}$$

On the completed diagram any straight line drawn across the three scales will cut them at corresponding values of z_1, z_2, z_3 as defined by (6).

The scale (z_3) will lie between or outside the scales (z_1), (z_2) according as to whether h_3 is positive or negative, and, as in the previous type, it is as a rule best to arrange that the scale of the variable, which generally has to be determined in terms of the other two, lies between their scales; h_3 can always be made positive or negative as desired, altering if necessary the signs of both f_2 and h_3.

As an example of Type B take Sir Benjamin Baker's Rule for the weight of rails

$$\text{W} = 17\sqrt[3]{(\text{L} + 0{\cdot}0001\ \text{L}v^2)^2}$$

where L = Greatest load on one driving wheel in tons.
v = Maximum velocity in miles per hour.
W = Weight of rails in lb. per yard.

Writing the formula

$$\text{L} - \left(\frac{1}{1 + 0{\cdot}0001 v^2}\right)\left(\frac{\text{W}}{17}\right)^{\frac{3}{2}} = 0$$

and taking

$$z_1 = \text{L}, \quad f_1 = \text{L}$$
$$z_2 = v, \quad f_2 = -\frac{1}{1 + 0{\cdot}0001 v^2}$$
$$z_3 = \text{W}, \quad h_3 = \left(\frac{\text{W}}{17}\right)^{\frac{3}{2}}$$

construct the scales

$$u = \mu_1 f_1 = \mu_1 \text{L}$$
$$v = \mu_2 f_2 = -\mu_2 \left(\frac{1}{1 + 0{\cdot}0001 v^2}\right)$$

along two convenient parallel axes. The scale (L) is an evenly divided scale, and to graduate the scale (v) a series of values of v and f_2 are calculated

$v=$ 20	30	40	50	60	70	80
$f_2=-0{\cdot}961$	$-0{\cdot}917$	$-0{\cdot}862$	$-0{\cdot}800$	$-0{\cdot}735$	$-0{\cdot}671$	$-0{\cdot}610$

The support of the scale (W) is the straight line joining the zero of the (L) scale to the zero of the f_2 scale. This latter zero is at an inconveniently great distance from the top graduation on the (v) scale, but the support can readily be obtained without the actual use of the zeros of the f_1 and f_2 scales by the use of the formula

$$\frac{\delta_1}{\delta_2}=-\frac{\mu_1 h_3}{\mu_2}$$

referred to above, or by a cross alignment in the following way:—Take W = 100 and work out L for $v=60$ and 80. The straight lines joining these two values of L and v will intersect at the point 100 on the W scale. Joining this point to the zero of the (L) scale gives the support, and the remainder of the scale can be graduated by taking $v=50$ say, and working out L for W = 20, 30, 40, 50, . . . Joining 50 on the (v) scale to these values of the (L) scale in turn, will give an intersection on the support for the corresponding graduations of the (W) scale.

The completed diagram is shown in fig. 16. To use it suppose, for instance, we require the value of W for L = 7 tons, $v=70$ m./hour. The straight line joining 7 on the (L) scale to 70 on the (v) scale (see dotted line, fig. 16) cuts the (W) scale at about 82 lb./yd., the required value.

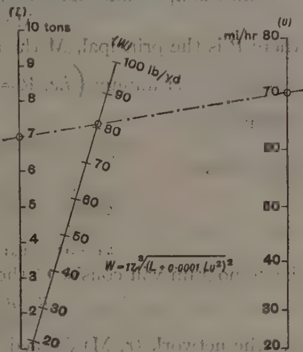

Fig. 16.

Type C.—Nomograms with two parallel rectilinear scales and one curvilinear scale. If the formula to be represented can be put in the form

$$f_1 g_3+f_2 h_3+f_3=0 \text{———} (7)$$

it can be represented by two systems of points (z_1), (z_2), arranged along two parallel straight lines, and the third system (z_3) arranged along a curve.

As in the preceding types we take functional scales

$$u=\mu_1 f_1$$
$$u=\mu_2 f_2$$

along the parallel axes Au, Bv (fig. 17).

We then have for the system (z_3)

$$\mu_2 g_3 u+\mu_1 h_3 v+\mu_1\mu_2 f_3=0$$

which with our usual axes defines the system of points

$$x=\lambda\frac{\mu_1 h_3-\mu_2 g_3}{\mu_1 h_3+\mu_2 g_3},\quad y=\frac{-\mu_1\mu_2 f_3}{\mu_1 h_3+\mu_2 g_3}$$

and we can determine any number of points on the system (z_3) by means of these equations, or by a series of cross alignments. This latter method is especially indicated in cases in which a double-entry table of corresponding values of z_1, z_2, z_3, is already available.

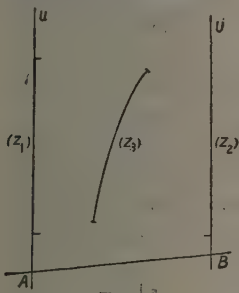

Fig. 17.

Proceeding by whichever of these ways is most convenient, we can obtain the complete scale (z_3), tracing the curvilinear support through the points determined.

As before it is advantageous, where the variable z_3 is generally the unknown, for the scale (z_3) to lie between the scales (z_1), (z_2). This will be the case if

$$\frac{h_3}{g_3}$$

is positive, and this can always be arranged, if necessary, changing the signs of both f_2 and h_3.

Having constructed the scales (z_1), (z_2), (z_3) as described above, any straight line drawn across them will cut the three scales at corresponding values of z_1, z_2, z_3 as defined by (7).

As an example of Type C take the formula used for the thickness of cast-iron pipes in waterworks,

$$t=0{\cdot}000125\,\mathrm{P}\,d+0{\cdot}15\sqrt{d}$$

where

t = Thickness of metal in inches.
P = Pressure of water in pounds/inch.
d = Internal diameter of pipe in inches.

Writing this,

$$0{\cdot}000125\,\mathrm{P}\,d-t+0{\cdot}15\sqrt{d}=0$$

and putting

$$z_1=\mathrm{P},\quad f_1=\mathrm{P}$$
$$z_2=t,\quad f_2=t$$
$$z_3=d,\quad f_3=0{\cdot}15\sqrt{d},\ g_3=d,\ h_3=1$$

we see that it is of type C.

We construct the scales

$$u=\mu_1\mathrm{P}$$
$$v=\mu_2 t$$

along two convenient parallel axes (fig. 18).

We then determine sufficient points on (d), by cross alignments, to draw the curve and graduate the scale.

When P is zero,

$$t=0{\cdot}15\sqrt{d}$$

giving us an easily calculated series of alignments for $d=5$, 10, 15. . .

For the cross alignments it will be convenient to take P = 100, and calculate t for d = 5, 10, 15, . . . as before.

Suppose now we wish to know the thickness of a pipe of 30-in. bore to stand a pressure of 130 lb./in. Joining 130 on the (P) scale to 30 on the (d) scale, and producing the straight line to cut the (t) scale (see dotted line, fig. 18), we get, at the point of intersection, the required value $t=1{\cdot}3$ in.

7. *Graphic Representation of Formulae with more than Three Variables.* (i.) *Double Alignment Nomograms.*—Certain types of formulae containing four variables can be dealt with by breaking them up into two or three variable formulae with a common auxiliary variable.

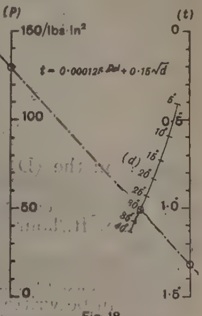

Fig. 18.

Consider for instance a formula which can be written in the form

$$f_1+f_2=f_3+f_4 \text{———} (8).$$

Introducing an auxiliary variable z_5 we can construct two partial nomograms

$$f_1+f_2=z_5 \text{———} (9)$$
$$f_3+f_4=z_5 \text{———} (10)$$

of Type A, having the scale (z_5) in common.

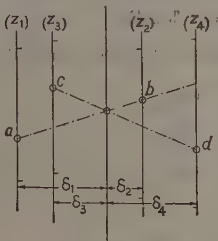

Fig. 19.

Such an arrangement is shown schematically in fig. 19, the central line representing the auxiliary scale.

If we take values of z_1, z_2, z_3, z_4 satisfying equation (6), the alignment of z_1 with z_2, and of z_3 with z_4 will intersect on the scale (z_5). The central line need not be graduated as it is only required as a *reference line*, the nomogram being read in the following way:—

Suppose we require the value of z_4 for

$$z_1=a,\quad z_2=b,\quad z_3=c.$$

Join a on (z_1) to b on (z_2) cutting the reference line at e. Join c on (z_3) to e and produce to cut (z_4) in d, which will give the corresponding value of z_4.

Such a nomogram from the way in which it is read is termed a Double Alignment Nomogram.

It will be noticed that as the unit of (z_5) is the same in both (9) and (10) we must have the relationship

$$\frac{1}{\mu_1}+\frac{1}{\mu_2}=\frac{1}{\mu_3}+\frac{1}{\mu_4}$$

while the distances of the scales from the reference line (fig. 19) will be given by

$$\frac{\delta_1}{\delta_2}=-\frac{\mu_1}{\mu_2},\quad\frac{\delta_3}{\delta_4}=-\frac{\mu_3}{\mu_4}$$

Hence for the practical construction we graduate any of the three scales, (z_1), (z_2), (z_3), say, from three conveniently chosen origins on the supports of their scales. We then determine a point on the scale (z_4) by means of four values of z_1, z_2, z_3, z_4, (a, b, c, d, say) which satisfy equation (8).

The alignment of c and the intersection of the alignment ab with the reference line then determine the point d on the scale (z_4), and as we know μ_4 we can construct the scale (z_4) completely.

As an example take the formula for the discharge of gas in pipes,

$$\mathrm{Q}=1350\,\mathrm{D}^{2\cdot5}\sqrt{\frac{\mathrm{H}}{0{\cdot}45\mathrm{L}}}$$

where

L = Length of pipe in yards.
D = Diameter of pipe in inches.
H = Head of water in inches equivalent to the pressure.
Q = Quantity of gas discharged in cub. ft. per hour.

Writing it

$$\log\mathrm{Q}+\tfrac{1}{2}\log\mathrm{L}=2{\cdot}5\log\mathrm{D}+\tfrac{1}{2}\log\mathrm{H}+\text{const.}$$

We put

$$z_1=\mathrm{Q},\quad z_2=\mathrm{L},\quad z_3=\mathrm{H},\quad z_4=\mathrm{D}.$$

Fig. 20 shows the resulting nomogram constructed with

$$\mu_1 = \tfrac{1}{2}\mu_2 = \tfrac{1}{2}\mu_3 = \mu_4$$

Suppose now that we want to know the rate of discharge from a 100-yd. pipe of 1-in. bore, with a head of water of 1 in.

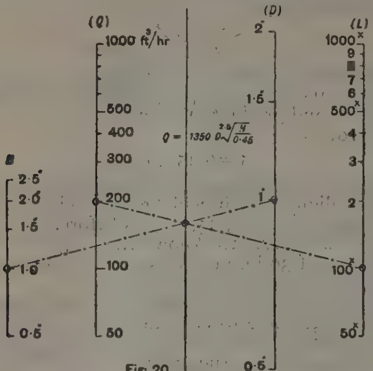

Fig. 20.

Join 1 on the (D) scale to 1 on the (H) scale. Join the point where this straight line cuts the reference line to 100 on the (L) scale, and produce the straight line backwards to cut the (Q) scale at 201 ft./hour (see dotted lines, fig. 20), the required rate of discharge.

These Double Alignment Nomograms can be constructed by combining any two of the types, A, B, or C where the four-variable formula can be written in the appropriate form.

Take for instance the formula

$$H = 18{,}400\ (\log B_1 - \log B_2)\ (1 + 0\cdot003367\theta)$$

giving the difference in level (H metres) between two stations at which the barometric readings are B_1 and B_2 mm. respectively, the mean temperature being θ°C. $\left(\theta = \frac{t_1 + t_2}{2}\right)$

Writing it

$$\frac{H}{18{,}400\ (1 + 0\cdot003367\theta)} = \log B_1 - \log B_2$$

it can be broken up into two partial nomograms of Type B and A respectively.

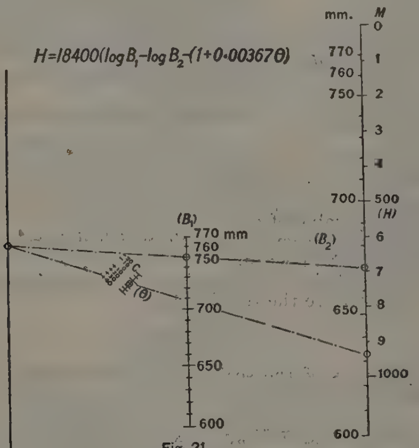

Fig. 21.

Fig. 21 shows the resulting nomogram, and, to illustrate its use, suppose $B_1 = 750$ mm., $B_2 = 670$ mm. and it is required to find H.

Join 670 on (B_2) to 750 on (B_1), and produce to cut the reference line. Join the point thus obtained on the reference line to +20 on (θ). This straight line produced will cut (H) at 935 mm. (see dotted line, fig. 21), the required difference in height.

(ii). *Combination of an Alignment Nomogram with a Network.*

Suppose we have a network (z_1, z_2), composed of two systems of figured curves (z_1), (z_2) crossing each other (fig. 22).

If we take any point on this network, a curve of both systems will pass through this point, and we may assign to the point a value of both z_1 and of z_2, taking the values from the curves of the systems (z_1), (z_2) which intersect in the point. The point has thus in a sense two values and is termed a *binary point.*

The general equation in parallel coördinates of such a binary point will be of the form

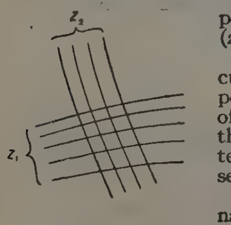

Fig. 22.

$$f_{12} + g_{12}u + h_{12}v = 0$$

and its coördinates in cartesians with the usual axes will be

$$x = \lambda\frac{h_{12} - g_{12}}{h_{12} + g_{12}}, \qquad y = -\frac{\mu f_{12}}{h_{12} + g_{12}}$$

We can obtain the equations of the systems (z_1), (z_2) forming the network (z_1, z_2) by eliminating in turn z_2 and z_1 between the above expressions for x and y.

Consider now a formula that can be put in the form

$$f_1 g_{34} + f_2 h_{34} + f_{34} = 0$$

This can be represented by the rectilinear parallel scales

$$u = \mu_1 f_1$$
$$v = \mu_2 f_2$$

and the network

$$\mu_2 g_{34} u + \mu_1 h_{34} v + \mu_1\mu_2 f_{34} = 0$$

or

$$x = \lambda\frac{\mu_1 h_{34} - \mu_2 g_{34}}{\mu_1 h_{34} + \mu_2 g_{34}}, \quad y = \frac{-\mu_1\mu_2 f_{34}}{\mu_1 h_{34} + \mu_2 g_{34}}$$

As an example take the Compound Interest Formula

$$M = PR^n$$

where P is the principal, M the amount, R the amount of £1 for one year at r % per annum $\left(i.e.\ R = 1 + \frac{r}{100}\right)$, n the number of years.

Writing it

$$\log P + n \log R - \log M = 0$$

and taking

$z_1 = P,\quad f_1 = \log P$
$z_2 = n,\quad f_2 = n$
$z_3 = r,\quad f_{34} = -\log M$
$z_4 = M,\quad g_{34} = 1,\quad h_{34} = \log R$

the nomogram will consist of the parallel scales

$$u = \mu_1 \log P$$
$$v = \mu_2 n$$

and the network (r, M) defined by

$$\mu_2 u + \mu_1 \log R v - \mu_1\mu_2 \log M = 0$$

or in cartesians

$$x = \lambda\frac{\mu_1 \log R - \mu_2}{\mu_1 \log R + \mu_2}, \quad y = \frac{\mu_1\mu_2 \log M}{\mu_1 \log R + \mu_2}$$

The expression for x is independent of M, so that we have for (r) a system of straight lines parallel to (P) and (n).

For the system (M) we have, eliminating R between the above expressions for x and y,

$$2\lambda y = \mu_1 \log M\ (\delta - x)$$

hence (M) consists of straight lines radiating from the point $x = \lambda$, $y = 0$ (*i.e.* the zero of the n scale), and cutting the straight line $x = -\lambda$ (*i.e.* the P scale) at the points

$$y = -\mu_1 \log M$$

so that the lines of the system (M) are easily drawn from the graduations of (P).

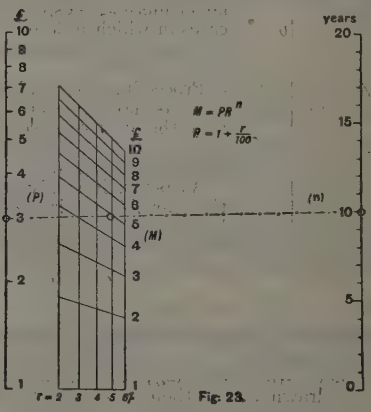

Fig. 23.

Fig. 23 shows the completed diagram. Suppose, for instance, we want to know the amount of £300 in 10 years at 5% compound interest. Joining 3 on the (P) scale to 10 on the (n) scale, this straight line cuts the 5% line (see dotted line, fig. 23) at a point corresponding to the line £490 of the system (M).

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(R. K. H.)

NORDICA, LILIAN (1859–1914), American operatic singer (*see* 19.741), died in Batavia, Java, May 10 1914.

NORFOLK, HENRY FITZALAN HOWARD, 15TH DUKE OF (1847–1917), English statesman (*see* 19.744), died in London Feb. 11 1917. He was succeeded by the son of his second marriage, Bernard Marmaduke Fitzalan Howard (b. 1908).

LORD EDMUND TALBOT (b. 1855), brother of the 15th duke, became deputy earl marshal during the minority of the 16th duke. He had assumed in 1876 the name and arms of Talbot instead of Howard, and for many years was a prominent member of the Conservative party in the House of Commons, being Chief Whip from 1913 to 1921. In 1921 he was appointed Viceroy of Ireland and created a peer as Viscount Fitzalan; and he then resumed the family name of Howard.

NORTH, SIR FORD (1830–1913), English judge, was born at Liverpool Jan. 10 1830, the son of a solicitor. He was educated at Winchester and at University College, Oxford, where he took his degree in 1852. He was called to the bar in 1857, and became a Q.C. in 1877. In 1881 he was raised to the bench of the Queen's Bench division, but in 1883 was transferred to the Chancery division. He retired in 1900 and was created a privy councillor, but continued to sit as a member of the judicial committee of the privy council. He died at Carron, Ross, Oct. 13 1913.

NORTH CAROLINA (*see* 19.771).—The pop. in 1920 was 2,559,123, as compared with 2,206,287 in 1910, a gain of 352,836, or 16%. Somewhat fewer than one-third were negroes and 7,099 were foreign-born whites, representing 43 different nationalities. There was less foreign admixture than in the population of any other state. There were 490,370 persons living in cities of 2,500 or more, 240,753 in villages, and 1,828,000 in the open country, so that the state was still predominantly rural, 71% of the pop. living outside of incorporated towns, as against 76% in 1910. This is emphasized by the absence of any large city.

The following table shows the cities having a pop. in 1920 of 15,000 and their gain for the preceding decade:—

City	1920	1910	Increase
Winston-Salem . .	48,395	22,700	113·2
Charlotte . . .	46,338	34,014	36·2
Wilmington . . .	33,372	25,748	29·6
Asheville . . .	28,504	18,762	51·9
Raleigh . . .	24,418	19,218	27·1
Durham . . .	21,719	18,241	19·1
Greensboro . . .	19,861	15,895	25·0

In 1914 the Legislature passed a law providing for the registration of births, deaths, and their causes. Subsequently the death-rate steadily decreased, notably in the case of typhoid fever, where it fell from 35·8 per 100,000 to 10·6 in 1920. In the same period the death-rate from diphtheria was reduced from 22·3 per 100,000 to 9·5. The total death-rate was 12·9 per 1,000 in 1920, a rate lower than that of any of the older states. This was accompanied by the highest birth-rate of any registration state, 32·8 per 1,000 in 1920.

Agriculture.—The decade saw great improvements in agriculture, both in methods and crop yields. The tendency noted in 1910 toward smaller holdings continued. The number of farms in 1920 was 269,763 as against 253,725 in 1910, but there was a greater average value per farm. In 1919 the values of farm products were greatly inflated, but those of 1920 were not far from the average for 1915–20. The following table presents the more striking figures for 1920 as estimated by the U.S. Department of Agriculture:—

Crop	Acres	Yield (bus.)	Value
Corn	2,784,000	64,032,000	$72,356,000
Wheat	724,000	8,471,000	17,789,000
Oats	180,000	3,960,000	3,802,000
Rye	96,000	912,000	1,733,000
Potatoes . . .	56,000	5,040,000	7,157,000
Sweet Potatoes . .	101,000	10,605,000	12,090,000
Tobacco . . .	582,000	384,120,000*	97,182,000
Hay	897,000	1,310,000†	30,130,000
Cotton	1,518,000	840,000‡	60,900,000
Peanuts	113,000	3,955,000	5,418,000

* Pounds. † Tons. ‡ Bales.

The value of all crops in 1920 was estimated to be $412,374,000 as against $142,890,000 in 1909. The state in this respect stood eleventh in 1917, rose to fifth in 1918, to fourth in 1919, and dropped to sixth in 1920. Farm land increased in the average value per acre from $6.24 in 1900, $15.29 in 1910, to $63.00 in 1920. Trucking and fruit growing showed marked increase.

Live stock showed no striking increase except in the case of mules. The following table gives the comparative figures:—

FARM ANIMALS

	1920		1910	
	Number	Value	Number	Value
Mules	236,000	$44,840,000	174,711	$23,700,000
Horses	183,000	27,999,000	166,151	18,428,000
Milch Cows . . .	328,000	25,584,000	308,914	7,839,000
Other Cattle . .	394,000	13,908,000	391,947	4,711,000
Swine	1,575,000	31,500,000	1,227,625	4,638,000
Sheep	144,000	1,368,000	214,473	559,000

Manufactures.—The notable industrial development of the two preceding decades was continued between 1910 and 1920. In 1914 the industrial capital of the state was $253,842,000, and the value of manufactured products $289,412,000. No later figures were available in May 1921, but both the capital and the value of products were greatly increased by 1920. Cotton and tobacco manufacturing led. In 1920 there were nearly 550 cotton-mills in operation with 5,321,450 producing spindles. In tobacco manufacturing Winston-Salem and Durham held first and second places respectively among the cities of the world. The volume of the industry can be estimated from the fact that for the year 1919–20 the Federal stamp tax in the state yielded $108,457,156. The manufacturing of the state was highly diversified and there was a notable absence of concentration, there being many small establishments. The syndicating of cotton-mills was a pronounced movement during the years 1916–20. It followed the syndication of tobacco factories, fertilizer plants, and cotton-seed oil mills. Steam power was generally employed in the decade 1910–20, but there was increasing use of hydro-electric power. In 1920, 330,000 H.P. had been developed, and it was estimated that a million more were available for development.

Forests and Mines.—The total value of lumber and timber products in the state in 1914, the last year for which accurate figures were available in June 1921, was $39,631,573. It increased largely during the remainder of the decade. In spite of the ruthless lumbering operations of the past 40 years, it was estimated in 1920 that there was standing timber ready for the saw to the value of $167,450,000, with young growth valued at $192,500,000. Mineral products in 1917 were valued at $5,246,391, the more important being clay products and stone.

Transportation.—Railway development in the years 1910–20 was checked in 1914 and stopped completely in 1917 by the World War. Only 357 m. of new line and 217 m. of sidings were built, making a total mileage in 1920 of 4,997. In 1917 there were also 172 m. of electric road in operation. Marked improvements were made in the public highways. The Legislature of 1921 undertook the creation of a great state system by providing for the issue of $50,000,000 in bonds. The details of construction were in the hands of a highway commission established in 1917 and enlarged in 1921.

Finance.—The revenue of the state for general state purposes in 1919 was $7,647,482, while state, county, and school taxes together yielded a total of $18,912,000. The bonded debt of the state in 1920 was $9,603,000; of the counties, $23,198,226; and of the cities, $28,877,000, making a total of $61,678,226. In addition, there had been otherwise issued $12,000,000 for school buildings, and $24,000,000 voted for roads. The Legislature of 1921 authorized the bond issue already mentioned of $50,000,000 for state highways, as well as $6,000,000 as a state-aid loan fund for consolidated schools, and $6,745,000 for permanent improvements in the state's hospitals and institutions of higher learning. It also authorized the issue of $25,000,000 in local bonds, and $5,500,000 was issued by small cities prior to May 1 1921. The total indebtedness, actual and authorized, was on May 1 1921 about $200,000,000, nearly all incurred after 1910. This showed the willingness of the people of the state to tax themselves for community and commonwealth prosperity, a remarkable revolution in sentiment.

The taxation system of the state had long been condemned as ineffective and inequitable, and the Legislature of 1919 passed a law providing for assessment for taxation of all real and personal property at its actual value. This Act was accompanied by the submission to the people of constitutional amendments authorizing a general income tax, limiting the rate of combined state and county property taxes to $.15 per $100 of valuation, permitting a segregation of taxes for state purposes, and abolishing the existing equality between the tax rate on property and the poll tax. The requirement of payment of poll tax as a prerequisite for voting was abolished. Revaluation was accomplished in 1920 and the property in the state was assessed at $3,539,000,000. More than a million ac. of land not hitherto on the tax books were included. The *per capita* taxable wealth was increased 183%. The amendments were ratified by large majorities and the state seemingly assured of equitable taxation, but a reaction became strongly manifest in the Legislature of 1921 endangering the results of revaluation.

Education.—The state made creditable educational progress between 1910 and 1920. The public school funds increased from approximately $3,000,000 in 1910 to $15,066,487 in 1920. A constitutional amendment ratified in 1916 increased the minimum school term from four to six months. Teachers' salaries showed an upward tendency at the close of 1920, and steps were being taken to secure better equipped teachers. The most notable educational achievement was the rapid growth of a state high-school system. In the case of the state institutions of higher learning, appropriations for maintenance and permanent physical improvements increased largely, and their growth was steady. The sectarian schools and colleges were also more adequately supported and showed a similar growth. The state support of its benevolent and charitable institutions became increasingly generous and several new ones were established in the decade, including the Caswell Training School at Kinston for the mentally defective, an institution for fallen women at Samarcand, a tuberculosis sanitorium at Sanitorium, a Confederate women's home at Fayetteville, and an orthopaedic hospital at Gastonia.

History.—The state Government throughout the period 1909–21 was under the undisputed control of the Democratic party. In 1913 Locke Craig succeeded William W. Kitchin as governor, and in 1917 was succeeded by Thomas Walter Bickett. In 1920 Cameron Morrison was elected governor. The Legislature at every session had large Democratic majorities. One Republican member of Congress was elected in 1914. So confirmed was the Democratic faith of the people of the state that alone of all the states it increased the party majority in the election of 1920. There was little of purely political interest during these years. The striking fact was the influence exerted upon politics by the steady development in the state of a social consciousness which manifested itself in demands for advanced social legislation. The result was a greater body of progressive legislation than that of any other southern state for the same period. During the World War the state furnished to the armed forces of the nation 88,168 men; casualties were 1,610 killed and 4,128 wounded. The subscription to Liberty and Victory loans was $138,095,400, besides $21,085,388 for war stamps. (J. G. de R. H.)

NORTHCLIFFE, ALFRED CHARLES WILLIAM HARMSWORTH, 1st Visct. (1865–), British newspaper proprietor and statesman, was born July 15 1865 at Chapelizod, Dublin, the eldest of a family of fourteen. His father, Alfred Harmsworth (1837–1889), descended from an old Hampshire family, was a barrister-at-law of the Middle Temple and one of the standing counsel for the Great Northern Railway Company. His mother, Geraldine Mary (b. Dec. 24 1838), a woman of remarkable intellect and strong character, was a daughter of William Maffett, well known in Ireland in his time as a banker and land-agent, of Ulster-Scottish descent. Of the seven sons, the two eldest, Alfred and Harold, became members of the House of Lords as Lord Northcliffe and Lord Rothermere respectively; the third, Cecil Bisshopp (b. 1869), became in 1915 Under-Secretary for Home Affairs and in 1919 Under-Secretary for Foreign Affairs, having entered the House of Commons as Liberal M.P. for Droitwich (1906–10) and subsequently sitting for S. Beds. (from 1911); while the fourth, Robert Leicester (b. 1870), who was created a baronet in 1918, entered the House of Commons in 1900 as Liberal M.P. for Caithness, a seat which he still retained in 1921. The other three sons were Hildebrand Aubrey (b. 1872), from 1901 to 1904 editor of the *New Liberal Review;* St. John (b. 1876), the creator of the "Perrier" mineral-water business; and Vyvyan George (b. 1881).

It was in 1867 that the Harmsworths moved to London, and the family means were then small. Alfred, the eldest child, was exceptionally energetic, studious and thoughtful. At 11 he went to Stamford grammar school and at 13 to Henley House school, West Hampstead, where in 1878 he started the first of his journalistic adventures, a school magazine. This was originally issued in MS. but was afterwards printed and sometimes set up by himself in his spare time. At 15 he did some work for Mr. Jealous, then editor of the *Hampstead and Highgate Express*, from whom he received his first very modest payment in journalism. In 1881 he began to work under a tutor for Cambridge, while contributing as a "free-lance" writer to the *Bicycling News, Globe* and the publications issued by James Henderson for boys and girls, in one of which Stevenson's *Treasure Island* made its first appearance. As secretary and companion to one of the third Lord Lilford's sons, he travelled extensively in Europe. On his return to London Sir William Ingram (of the *Illustrated London News*) made him assistant editor of his paper *Youth* at the age of 17; and he continued "free-lance" work for the press, contributing leading articles to various newspapers, among which was the *Morning Post*, and articles to the *St. James's Gazette*, where his work attracted the attention and praise of Frederick Greenwood. But his health temporarily broke down in 1884. Ordered to live out of London, he went to Coventry in 1885 and worked for the firm of Iliffe & Sons, owners of many publications, including the *Midland Daily Telegraph*. With them he remained till 1886. He subsequently regarded his experience during this period at Coventry as specially valuable. He declined the offer of a partnership made him by Mr. Iliffe before he was 21; and having saved nearly £1,000 went back to London, where he joined a general publishing business. This from the first had a promising existence. Among other ventures he started on June 16 1888 *Answers to Correspondents*, a weekly periodical intended to be a more popular form of *Notes and Queries.* Ere long it turned the corner and, as *Answers*, laid the foundation of what eventually became the largest periodical publishing business in the world, the Amalgamated Press. In 1889 larger offices had to be acquired. Alfred Harmsworth had already been joined by his second brother, Harold (*see* Rothermere, Lord), to whom he ascribed a great share of the success of the undertaking, particularly on the business side. He himself wrote much, outlined serials, trained young editors, discovered new writers and artists, and revolutionized the current methods of periodical journalism. The profits of the accumulated publications soon soared to £50,000 a year. In 1892 he published the first "net sales" certificate, showing that the actual sales of the various Harmsworth periodicals were over a million copies a week; and in that year Mr. Gladstone praised *Answers* for its "healthy and instructive reading." In the next few years Alfred Harmsworth travelled much in Europe, India, Africa, Canada and the United States; he was a good athlete, excelling in lawn tennis, and in the days before the motor-car, which as far back as 1894 became one of his chief interests, was a great lover of horses, fond of cycling, and devoted to fishing. On April 11 1888, he had married Mary Elizabeth, daughter of Robert Milner, a West Indian merchant, and to her sure judgment and quick brain he always attributed much of his subsequent success.

On Aug. 31 1894 he and his brother Harold acquired the London *Evening News*, in which the Conservative party had sunk some £300,000. It was then losing money heavily, but it was at once reorganized by himself, his brother, Mr. Kennedy Jones and Mr. W. J. Evans, with such effect that the first working week yielded a profit of £7, and the first year one of £14,000. In the same year he fitted out an Arctic expedition under Mr. F. G. Jackson, which explored Franz Josef Land and assisted in the rescue of Nansen. In the general election of 1895 he stood unsuccessfully as a Conservative candidate for Parliament at Portsmouth. On May 4 1896 a new halfpenny morning paper, the *Daily Mail*, was launched, "the busy man's newspaper," as he called it. It embodied many innovations, a very full service of cables, the employment of numerous famous writers, condensation of unimportant topics, and costly and daring enterprises of various kinds. A comparison of past files of the London press shows how it revolutionized daily journalism. The most rapid machinery was used to the utmost; a system of arrangement was introduced which enabled the reader to know where to find the news he wanted. It was characteristic of the foresight which, with initiative, courage and tenacity, was among the secrets of its chief proprietor's success that one of the three leading articles in the first number dealt with the then almost unknown motor-car, in the future of which Alfred Harmsworth had a firm belief, being himself already a qualified driver. The *Daily Mail* rapidly attained an enormous sale, rising to 600,000 copies a day in the Boer War, and this gave him great influence on policy at home and abroad. In 1903 he founded the *Daily Mirror;* it was at first a complete failure, losing £1,500 a week, but after being soon transformed from a penny paper for women into a halfpenny illustrated morning journal, became as signal a success. In 1905 a Continental edition of the *Daily Mail* was established, with headquarters in France. In the same year Alfred Harmsworth was created a baronet, and in 1905 he was raised to the peerage as Baron Northcliffe. In 1906 he and his brothers acquired for their companies about 3,000 sq. m. of forest land in Newfoundland, with lakes, rivers and water transport, for the manufacture of paper and wood-pulp, the result being the formation of the Newfoundland Development Co., a gigantic enterprise with its works at Grand Falls—where 23,000 H.P. turbines produce large quantities of mechanical pulp and 200 tons of paper daily—two lines of railway, a port, and Atlantic and other steamers.

In 1908 Lord Northcliffe obtained control of *The Times*, to own which had always been one of the aims of his life. New machinery was installed, and the size of the paper greatly increased; in March 1914 he reduced the price to one penny, with the result of a large increase in circulation, though the enormous rise of 600% in the cost of paper during the World War forced a return to the old price of threepence. Meanwhile Lord Northcliffe had acquired the *Weekly Dispatch;* disposed of the Sunday *Observer*, which he for some time owned; and sold the *Daily Mirror* to his brother, Lord Rothermere; so that at the outbreak of the war "the Northcliffe Press," so widely mentioned and abused by contemporaries, consisted of *The Times; The Times Weekly Edition; Daily Mail; Overseas Mail; Evening News* and *Weekly Dispatch.*

Among the reforms which Lord Northcliffe introduced into newspaper management were the five-day week for editors, sub-editors and reporters, a more generous payment of journalists and a system of profit-sharing by the chief members of his staffs.

From 1900 onwards, through his newspapers, he had exercised an ever-increasing influence on politics. He had at one time been anxious, like Edward VII. and Cecil Rhodes, to obtain a friendly understanding between England and Germany, but the Boer War caused him to abandon that idea as impracticable. His newspapers consistently pleaded the cause of a strong navy, and as consistently warned the nation for 20 years of the peril from Germany. From 1902 he sought to effect an entente with France, and also to promote agreements with Russia and the United States, whose sentiments and prejudices he had learnt in many visits. He opposed in 1911 the Declaration of London—a code of sea law which most naval officers condemned as "made in Germany"—and finally assisted in securing its rejection. This rejection enabled the British fleet to blockade with effect in the war. Through the *Daily Mail* he gave large prizes for airmanship, in which, from 1906 onwards, he took the warmest interest; the offer of a prize of £10,000 in 1906 for the first aeroplane flight from London to Manchester was received in some quarters with a good deal of derision, which vanished, however, when in 1910 the prize was won. His maiden speech in the House of Lords was devoted to the pressing claims of aircraft. He was a strong believer in the future of flying and a daily advocate of the value of aircraft in war. He was also interested from the first in submarines, in one of which craft he made an early and hazardous descent. For many years he was a strong supporter of his friend, Lord Roberts, in the campaign for national service.

In the World War he took the lead in advocating almost every measure of reform that was carried through in Great Britain, usually weeks or months before it was introduced. He was indeed described by Mr. L. J. Maxse as "the great driving force in our country during the war" (*National Review*, July 1917). He aimed at the most vigorous possible conduct of the struggle, and was from the first of opinion that the war would be long and desperately contested. The chief newspaper campaigns which he carried out, always with the aims of victory and close union between the Allies, were: (1) for the removal of Lord Haldane from the War Office in Aug. 1914; (2) for the organization of the munition supply and provision of high-explosive shells in April and May 1915, when he did not hesitate to lay the responsibility for the shortage of ammunition on Lord Kitchener in leading articles written by himself in the *Daily Mail* of May 19 and 21, the second of which was publicly burned on the London and other stock exchanges; (3) this campaign was one of the causes of the formation of the Coalition Ministry by Mr. Asquith; (4) throughout 1915 and early 1916, in the teeth of storms of abuse, he urged the necessity of introducing compulsory service as the sole means of winning the war; (5) he protested continuously against the excessive optimism of Mr. Asquith's Government and of its press supporters, and against the whole system of official secretiveness by which grave failure was concealed; (6) he called for the strict enforcement of the blockade and the stoppage of the supplies which were reaching Germany through neutral countries; (7) he pointed out the impossibility of conducting a successful war with a debating society of 23 or 24 persons, such as formed the Cabinet; (8) so far as the censorship would allow, he resisted the "side-shows," such as the Dardanelles and Salonika campaigns, which absorbed so large a part of the national forces; (9) he continued his pre-war demand for the construction of aircraft and "the right kind of aircraft"—on the largest possible scale, and he called for effective measures against Zeppelins and for warnings in the case of imminent air-attacks; (10) he urged the necessity of creating a strong naval war staff and taking offensive measures against the enemy submarines; (11) he insisted on the need for a system of compulsory food rationing.

While always active with his pen and through his press, he went repeatedly to the various battle-fronts, British, French, Belgian, Italian and American, and kept in close touch with the various staffs. Thus in 1916, at the crisis of the battle of Verdun, he visited Verdun (March 4), conferred with Gen. Pétain, watched the struggle, and the same night motored back to Paris and wrote a long dispatch which was reproduced in whole or part by 3,000 Allied or neutral newspapers, giving the welcome and unexpected news that Verdun was "unlikely to be taken." He paid other visits—to Spain, whence he sent warning of the activity of the German propaganda, and to Switzerland, where he investigated the condition of the British interned prisoners. With his daily assistance, Sir R. Hudson raised through *The Times* fund a sum of approximately £21,000,000 for the British Red Cross, while Lady Northcliffe (who in 1918 was created G.B.E.) maintained a private hospital and took a prominent part in the control of Red Cross finance and operations. So wide was Lord Northcliffe's influence and so greatly feared by the Germans that they published a special periodical, the *Anti-Northcliffe Mail*, devoted entirely to clumsy attacks upon him as the chief Allied energizer in the war. In 1916 they issued their bronze "hate" medal of him. There is reason to believe that when Broadstairs was shelled on Feb. 24 1917, and Elmwood, his own house (where he was then staying), was hit, and three near-by deaths occurred, he was intentionally one of the targets of this German destroyer attack. In Dec. 1916 he gave his support to Mr. Lloyd George in the political crisis which led to the fall of Mr. Asquith's Government, and dealt the final thrust which brought that Government down, though after the Armistice, by reason of his objection to the long-drawn-out after-war negotiations with the Germans, he became Mr. Lloyd George's most persistent critic. He was offered office but declined, believing that it was his duty to keep his hands free and hold the Government up to the mark. He did, however, because the office was strictly non-political, accept the chairmanship of the Civil Aerial Transport Committee, on the establishment of that body in 1917.

Before the United States entered the war he was offered and declined the post of British ambassador at Washington. He received, however, an urgent call to go to the United States on May 30 1917. The War Cabinet had greatly desired him, after conference with leading Americans, to go to the United States as chairman of the much-needed British War Mission. He accepted this appointment, though with some reluctance. After an audience with the King, he left England on June 2, arriving in New York on June 11, with the understanding that he should not remain more than three months. During the next few months he coördinated the work of the numerous British departmental missions; controlled an expenditure of £10,000,000 to £15,000,000 a week; maintained the closest and most friendly relations with President Wilson and the American Government; and in a series of speeches and visits to the Middle West and eastern Canada he set forth the work that had yet to be done if the war was to be won, and the immensity of the British effort. Having prolonged his stay far beyond the original three months, he returned to London on Nov. 12 1917, when he was created a viscount, as Visct. Northcliffe of St. Peter-in-Thanet, for his services.

In a letter dated Nov. 15 1917 he declined Mr. Lloyd George's offer of the post of Air Minister, on the ground that he was indisposed to enter an administration with the energy of which he was by no means satisfied. But on Feb. 13 1918, on the distinct understanding that he was to remain free to criticise and suggest, he accepted the office of Director of Propaganda in Enemy Countries. To pave the way for operations among the nationalities subject to the Habsburgs, he secured an agreement between the Yugoslavs and the Italian Government, which played an important part in the defeat of the Austrian army and was subsequently embodied, in substance, in the peace terms. The evidence of numerous German generals, statesmen and writers is that the skilful direction of his propaganda against Germany destroyed confidence in the German people and weakened the German army on the eve of its last offensive (July 15 1918), when it seemed on the verge of decisive success. Gen. Ludendorff himself says: "Lloyd George knew what he was doing when, after the close of the war, he gave Lord Northcliffe the thanks of England for the propaganda which he had carried out. Lord Northcliffe was a master of mass-suggestion." The deadliness of his propaganda lay in its veracity—in emphasizing such facts as the rapid movement of United States troops to Europe, the failure of the U-boat campaign and, when the Allied victories began, the enormous captures of guns and prisoners. An account of this work was given in Sir Campbell Stuart's *Secrets of Crewe House* (1920).

At the Armistice Lord Northcliffe was ill, suffering from an adenoma of the thyroid gland, for which, in June 1919, he underwent a serious operation, and it was only after some months that he gradually made a complete recovery. During the Peace Conference his press and the *Continental Daily Mail* in particular exerted a powerful influence on the British Government, extracting from Mr. Lloyd George a promise to fulfil his election pledges and striving to maintain the closest and most cordial relations with France.[1] In July 1921 he went for a prolonged tour of the world.

In golf and motoring Lord Northcliffe found his main relaxations in later life, and he remained a keen and skilful fly-fisherman and salmon-angler. He was the author of volumes in the Badminton series on *Motoring* and *Tarpon Fishing*, and he also published a collection of letters, telegrams and accounts of his visits to the various fronts (*At the War*, 1916), of which 60,000 copies were sold. Simple and direct in style, his own writing was always marked by pugnacity and humour. His Verdun despatch has indeed been praised as a model for war correspondents, and throughout his newspaper organizations he was accustomed to insist on economy of words and the employment of straightforward Anglo-Saxon diction. It was his regular practice to issue the frankest reports on his various papers to their staffs, abundantly illustrating the far-reaching character of his initiative in suggestion, severity in criticism and warmth of appreciation.

(H. W. W.)

NORTH DAKOTA (*see* 19.779) had in 1920 a pop. of 645,680, as compared with 577,056 in 1910 and 319,146 in 1900, an increase in the latter decade of 68,624 or 11·9%; in the earlier of 257,910 or 80·8%. The state remains essentially rural, as is indicated by the following table giving the pop. of the chief cities in 1920 and 1910, and the percentage of growth.

	Pop. 1920	Pop. 1910	Increase Per cent
Fargo	21,961	14,331	53·2
Grand Forks . .	14,010	12,478	12·3
Minot	10,476	6,188	69·3
Bismarck . . .	7,122	5,443	30·8
Jamestown . . .	6,627	4,358	52·1
Devils Lake . . .	5,140	5,157	0·3*
Valley City . . .	4,862	4,606	·05
Mandan . . .	4,336	3,873	11·9
Williston . . .	4,178	3,124	33·8
Dickinson . . .	4,122	3,678	12·08

* Decrease.

Agriculture and Industries.—The following table shows agricultural and industrial conditions:—

	1920 (estimated)	1910
Total farm acreage . .	30,000,000	28,426,650
Value of farm property .	$1,810,876,000	$974,814,205
Total value of all crops .	$ 192,248,000	$180,630,520
Wheat, bus. . . .	68,400,000	116,781,886
Oats, bus. . . .	59,640,000	65,886,702
Barley, bus. . . .	22,680,000	26,365,758
Rye, bus. . . .	9,340,000	689,233
Corn, bus. . . .	17,064,000	4,941,152
Flax, bus. . . .	3,896,000	10,245,684
Potatoes, bus. . .	7,110,000	5,551,430
Hay and forage, tons .	2,946,000	3,010,401
	Jan. 1 1921	1910
Value of live stock on farms .	$99,876,000	$106,761,317
Horses	49,600,000	83,461,739
Cattle	42,251,000	17,711,398
Swine	5,628,000	3,152,909
Mules	765,000	1,149,001
Sheep	1,632,000	1,257,737
Dairy products . .	30,000,000	4,872,304
Mill products . . .	25,600,000	11,685,116 (1909)
Mine products . . .	2,166,168	564,812 (1909)
No. of mine employees .	1,268	903
No. of operators of mines .	136	53
No. of acres irrigated . .	12,000	10,248 (1909)
Cost per acre[1] . . .	$2.50	$38.17

[1] In 1920 this cost was for operation only; in 1910 it included the outlay for experiments and installation.

Education.—A state normal school was opened at Minot in 1913 and another at Dickinson in 1918. The number of children of school age in 1920 was 204,887; the number enrolled in public schools in 1919 was 162,358; the average daily attendance, 156,495. The state appropriations for rural schools for the biennium 1909–11 were $225,000 and for the biennium 1919–21 $425,000.

Finance.—A state budget system, effective in 1915, created a budget board with the duty of preparing a biennial statement of all state needs for the Legislature. This board consists of the governor, treasurer and auditor, and the chairmen of the appropriations committees of the Senate and House. In 1919 a single tax commissioner replaced a board of three members. Important changes in taxation were the exemption of farm improvements, the reclassification of property for assessment and the enactment of a classified and graduated income tax. The state bonded debt July 1 1920 was $2,442,300. The receipts for the biennium ending June 30 1919 were $7,958,439 and the expenditures $6,499,849. For 1920 the income tax yielded approximately $550,000. New sources for revenue created since 1911 are: the inheritance tax, capital stock tax, oil tax, income tax and motor-vehicle licence tax. The rate of levy for the state on the estimated true value of property in 1919 was in mills 1·07, and the *per capita* general property tax levy was $2.21. In 1920 22·7% of the state tax was for education.

Government.—A state Board of Administration was created in 1919, consisting of the superintendent of public instruction and the commissioner of agriculture and labour as *ex-officio* members and of three members appointed by the governor for six years. This board, exercising the functions formerly vested in the state Board of Control, administers the state educational, penal and charitable institutions. The state Supreme Court was by constitutional amendment increased to five members in 1908, and by a further amendment adopted in 1918 the power of the court to declare legislation unconstitutional was limited to cases in which four of the five judges concurred. In three of the six judicial districts there are three judges each and in three two judges each, all elected for four years. In 1914 by constitutional amendment the initiative and referendum were made applicable to all legislation and provision was made that a constitutional amendment could be initiated by popular vote. Further changes in the system of state government are described below.

History.—The political and social history of North Dakota during the period 1911–21 attracted a good deal of outside attention. Serious abuses in grain grading and marketing had been pointed out by the State Bankers' Association as far back as 1906. The Legislatures in 1909 and 1911 passed an amendment to the constitution, ratified by popular vote in 1912, which made it legal to provide for a state-owned terminal grain elevator. A second amendment for a terminal elevator within the state became effective in 1914. The Legislature of 1913 laid a tax to create a fund to build a terminal elevator and the Board of Control was authorized to prepare plans. In 1915 the Board reported against the whole plan, the tax was repealed and no appropriation made.

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[1] It may be noted that, shortly after President Wilson first arrived in Paris, Lord Northcliffe obtained from him a statement of his views, expressing *inter alia* a modification of his earlier attitude on the "freedom of the seas." Mr. C. H. Thompson, the American correspondent of the Associated Press, in his *Peace Conference Day by Day* (pp. 306–7), says that "this was one of those quiet but inestimable services which Lord Northcliffe rendered to his country and to the Prime Minister, who at that time was his close friend."

In the spring of 1915 a movement was begun to organize the farmers politically upon the following platform: (1) state ownership of terminal elevators, flour-mills, packing-houses and cold-storage plants; (2) state inspection of grain and grain dockage; (3) exemption of farm improvements from taxation; (4) state hail insurance on an acreage basis; (5) rural credit banks operated at cost. The movement was so successful that by Nov. 26,000 members had joined the Non-Partisan League.

The first state convention was held at Fargo March 28 1916, and a full state ticket was nominated. At the primary election in June all the nominees supporting the League were elected, with the exception of the state treasurer. The Legislature was divided; the House was controlled by the supporters of the League, the Senate by its opponents.

The 1917 Legislature provided for: (1) state grain grading; (2) Torrens title registration; (3) state guarantee of deposits in state banks; (4) reduction of assessments on farm improvements to 5%; (5) a state highway commission; (6) a tripling of the former appropriation for rural schools.

After the United States entered the World War the state prepared to take its part and a special session of the Legislature was called for Jan. 1918. A Seed and Feed Loan Act was passed to relieve drought-stricken farmers in the western part of the state. Special county bonds could be issued under this law to provide funds, and possible conflict with the work of the Federal Land Banks was obviated by a special issue of state indemnity bonds to protect Federal loans to farmers. A moratorium was laid on all debts of men in the national service and a State Council of Defence created.

The adoption of a new industrial programme by the farmers of the state in 1918 was not the result of any sudden impulse or mere theory. The investigations of the faculty of the state Agricultural College supplied the foundation for the new system of grain marketing. For instance, President E. F. Ladd of the college gave scientific proof of the loss of fertility that followed the constant shipping of grain out of the state. The annual loss to the soil he estimated at 46,018,440 lb. of nitrogen; 44,648,760 lb. of phosphoric acid; 10,700,200 lb. of potash and 1,787,280 lb. of lime. He showed, also, by experiments in the model flour-mill at the college that the grain grades in force in St. Paul and Minneapolis were not based on the flour-producing quality of the various crops handled by them, but were arbitrary, and that they tended to deprive the farmer of any possibility of raising grain at a profit. The methods used by the wheat buyers and millers at Minneapolis, St. Paul and Duluth had been carefully studied by the same investigators and their conclusions were well known throughout the state.

On this solid foundation of research and practical experience was built the programme of legislation carried through after the election of 1918.

At the same election several important amendments to the state constitution were ratified. The first subject dealt with in these amendments was the power of the people to pass on or to initiate legislation and a similar power to propose and adopt constitutional amendments without the action of the state Legislature. The specific provisions in these amendments require the signatures of 10,000 voters to a petition calling for a referendum on any law. A majority vote at an election is required to pass or repeal a law so initiated or referred. An amendment to the constitution may be proposed by a petition signed by 20,000 voters, and if approved by a majority of the votes cast on the measure at the special election, it becomes a part of the constitution. The second subject dealt with was the power of the state or of a municipality to engage in any industry or business. The third subject was the debt limit of the state, at that time $200,000; the amendment authorized the state to borrow up to $2,000,000 on state bonds, all above that amount to be secured by first mortgages on real estate at not more than one-half its value or upon the full value of state-owned utilities or industries. If state-owned public utilities or industries are offered as security for bond issues, the amount of the issue must not exceed $10,000,000. Other amendments gave the Legislature power to exempt from taxation all personal property and to levy an acreage tax on farm-land to provide funds for a state system of hail insurance. These amendments were adopted at the elections in Nov. 1918 by an average vote of over 48,000, and opposed by a vote of about 32,000. At the same elections the Non-Partisan League obtained control of both Houses of the Legislature and elected their candidates for all but one of the state offices.

With the whole machinery of the state in the farmers' hands, their legislative programme was enacted into law at the following session. There was created an Industrial Commission, consisting of the governor, the attorney-general and the commissioner of agriculture and labour, which was given power: (1) to manage, operate and control all state-owned utilities, industries and business projects created by law; (2) to purchase or lease sites for these industries; (3) to sell all such property and to fix prices of all products of these industries; (4) to provide funds by the sale of bonds for the carrying-on of the state-owned industries and other business undertakings.

There was also created a Mill and Elevator Association placed under the Industrial Commission. In Aug. 1919 a small mill and elevator were purchased at Drake, in McHenry county, on the Soo railway. In Nov. 1919 Grand Forks was chosen as the site of the projected three-unit mill and elevator and in the following spring construction began. The structure was planned to cost approximately $1,500,000, with a daily producing capacity of 3,000 bar. of flour, and a storage capacity of 1,659,500 bus. of grain and 70 carloads of flour. The annual grinding capacity of the mill was to be 900,000 bar. of flour, which would fully supply home consumption. The production of a corresponding amount of mill-feed for live stock was to be one of the most important results of the new project, since it would tend to overcome the loss of fertility which always overtakes a producing area that rests its prosperity upon a single crop manufactured and consumed elsewhere. The grain-grading law marks the culmination of a long struggle on the part of the farmers to secure fair grading of grain. It provides that elevators buying grain in North Dakota shall grade it rather according to its milling and baking value than according to its physical characteristics. It has been estimated by experts of the North Dakota Agricultural College that this law should save growers in the state about $11,000,000 annually.

Another state institution vitally connected with the industrial programme of 1919 is the state Bank of North Dakota, which began business July 28 1919 as an institution founded, owned and controlled by the state. It is the legal depository of all state bonds issued for the purposes of all the business enterprises under control of the Industrial Commission. It was originally the legal depository of the funds of all local governments such as cities, counties and school districts, but this provision was repealed by an initiated law adopted at the state election in Nov. 1920. The bank pays from 2 to 3% interest on the checking accounts of all public funds and from 4 to 6% on time deposits, but these rates are subject to change. The public funds are redeposited in the banks of the state with special reference to local needs.

Up to 1921 the bank had not been opened to private depositors but early in that year the policy was changed so as to make the bank a general bank of deposit, with branches to be established throughout the state as needed to carry on this phase of its work. It is authorized to loan on first mortgages on real estate in North Dakota up to one-half value of the security, providing funds for the purpose by the sale of real-estate mortgage bonds. Loans are also authorized on warehouse receipts issued by the Industrial Commission or by any licensed state warehouse up to 90% of the value of the property covered. The amount of the real-estate loans is limited to 30% of the bank's capital and 20% of its deposits. The loans require payment of fixed annual instalments. In 1921 these annual instalments were 7% of the loan principal, 6% for interest and 1% for principal. The unpaid balance is added to the 30th instalment of interest and principal in liquidation of the loan. The state guarantees all deposits of this bank and also all bonds that are handled for the state. The average rate of interest in the state is fixed by the operation of the state bank as a loan agency at 6% or at 6·25% plus commission, while the previous average rate in 1916 was 8·7% on farm mortgages, plus commission.

The laws providing for the Industrial Commission and for the Bank of North Dakota were carried at a referendum election in June 1919 by an average vote of over 61,000 against a little over 49,000. The constitutionality of the laws was tested by two suits, appealed to the U.S. Supreme Court. The decision of this court, given June 1 1920, upheld the lower courts in declaring the laws constitutional. In its decision the court said: "Under the peculiar conditions existing in North Dakota, which are emphasized in the opinion of its highest court, if the state sees fit to enter upon such enterprises as are here involved, with the sanction of its constitution, its legislature and its people, we are not prepared to say that it is within the authority of this court, in enforcing the Fourteenth Amendment, to set aside such action by judicial decision."

The Industrial Commission is responsible also for the Home Building Association. The funds for the project came from the sale of state bonds and the deposits made by those desiring to invest in homes. Any individual or organization may deposit with the state 20% of the cost of constructing a home and the state undertakes to build it and turn it over to the investor in full ownership, securing the balance by a mortgage calling for annual payments through a period not exceeding 20 years. The cost of a town home may not exceed $5,000 and the limit of $10,000 is placed on the cost of a farm home, including the usual accompanying buildings. The Hail Insurance Department created by law in 1919 insured in 1920 over 12,000,000 ac. of farm-land at an average rate of $.28, effecting a very large saving for the farmers. At the special session of 1919 a Dairy Association law was passed, authorizing counties to issue bonds for the purchase of dairy cows to be sold to farmers, in order to utilize the extensive areas in the state not fitted for crops.

One of the most interesting features of the farmers' programme is the alliance established with organized labour. The state enacted in 1919 a law establishing a Workmen's Compensation Bureau, consisting of the commissioner of agriculture and labour and the commissioner of insurance *ex officio* and three members appointed by the governor representing respectively labour, the employer and the public. It is based upon the Iowa law, and of all such laws now in force in 42 states of the Union is the most liberal in its provisions for compensation and the number of classes of employees included. The funds are derived from annual payments by the employer, the rates being graded according to the hazards of the employment. The Act provides completely for all injuries received in the course of employment. In the intent of the Act is included the restoration to industry of those injured and this purpose is to be secured by coöperation with the Federal Board of Vocational Education. Under the minimum-wage law the bureau has held hearings in various parts of the state and has fixed the minimum wage of women and minors as well as proper conditions of employment. Other labour legislation passed includes: (1) a complete coal-mining code; (2) a full-crew law; (3) an eight-hour day for women; (4) limitation of the use of injunctions in labour disputes; (5) authority to the Board of Railway Commissioners to compel all public utilities to furnish, provide and maintain all service, instrumentalities, equipment and facilities so as to promote the safety, health and comfort and convenience of its patrons, employees and the public.

During 1920 and the early months of 1921 45 state banks in North Dakota failed, of which one had reopened before May 1 and 10 more were then expected to reopen. The capital of these banks aggregated $960,000, an average of a little over $21,000 each; their loans and discounts totalled $9,425,543, their bills payable $2,150,464. It is apparent that these bank failures were due chiefly to successive crop losses and the heavy slump in 1920 farm prices, with consequent inability of the banks to collect their loans. This conclusion is borne out by the fact that banks in the Southern states showed the same relative number of closings, due to the drop in prices of staple farm products there. Another factor contributing to the financial stringency in North Dakota was the smaller volume of rediscounts from the Federal Reserve Bank, as compared with accommodations to other sections of the same district. Statements issued by the Federal Reserve Bank of Minneapolis show that rediscounts for member banks in North Dakota were relatively less than rediscounts in any other state of the Ninth District, whether on the basis of population or of production. The *per capita* figures were: Minnesota, $27; South Dakota, $18; Montana, $14; North Dakota, $8. Opinions differ as to whether this small ratio of rediscounts in North Dakota is to be ascribed to the failure of member banks in North Dakota adequately to take care of their patrons by presenting paper for rediscount; or to the relative absence of discountable loans, owing to the great shrinkage of values in North Dakota, on account of crop losses and reduced prices.

The recall election of Oct. 28 1921 resulted in the recall of the three Non-Partisan League officials who composed the Industrial Commission, the governor, the attorney-general and the commissioner of agriculture and labor.

At this election, also, the constitutional amendments and initiated laws which were proposed for the purpose of changing or overturning the programme of the Non-Partisan League were all defeated by substantial majorities.

The World War.—The total registration of the state was 160,392 men; of these 27,253 were called to service in the army or navy. The state sent two regiments overseas, the First and Second North Dakota Infantry, and these regiments were attached to the 41st Division. The Liberty Loan subscriptions totalled $65,476,000, or over $100 *per capita*. The increased crop acreage of 1918 was confined to the chief agricultural needs of the war period, wheat and rye. Wheat showed an unusually heavy increase of 11%, rye acreage showed an increase of 100% over the harvested acreage in 1917, notwithstanding the fact that slightly more than 10% of the acreage planted in the fall had been ploughed down in the spring of 1918. North Dakota led the United States in the season of 1918 in the harvested acreage of wheat, barley, rye and flax.

The state governors were: John Burke (Dem.), 1907–13; L. B. Hanna (Rep.), 1913–7; Lynn J. Frazier (Rep.), 1917–21; R. A. Nestos (Rep.), 1921– (O. G. L.)

NORTHUMBERLAND, HENRY GEORGE PERCY, 7TH DUKE OF (1846–1918), British politician, was born May 29 1846, and succeeded his father in 1899. He sat in the House of Commons as Conservative member for northern Northumberland from 1868 to 1885. He was treasurer of the Royal Household from 1874 to 1875, and as lord high steward bore the crown of St. Edward at the coronation of King George V. in 1911. The duke was known throughout life as an ardent Conservative and opponent of modern democratic ideas. He died at Alnwick May 14 1918.

His eldest son, HENRY ALGERNON GEORGE, EARL PERCY, of whose political career much was expected (*see* 19.788), died prematurely in Paris Dec. 30 1909; and on the 7th duke's death he was succeeded as 8th duke by his fourth but eldest surviving son, ALAN IAN, EARL PERCY, born April 17 1880. As one of the largest coal-owners in the north of England, he was summoned to appear as a witness before the Sankey Coal Commission (1919), and came much into public notice owing to his prolonged controversy with Mr. Robert Smillie, the leader of the miners, and subsequently to his anti-Communist campaign. He married in 1911 Lady Helen Magdalen Gordon-Lennox, youngest daughter of the Duke of Richmond and Gordon.

NORTH-WEST TERRITORIES, Canada (*see* 19.796).—In 1912 that part of the Canadian North-West Territories known as Ungava was incorporated in the province of Quebec and its name was changed to New Quebec. At the same time that part of Keewatin S. of 60° N. Lat. was divided between the provinces of Ontario and Manitoba. The North-West Territories now consist of the provisional districts of Keewatin (N. of 60° N. Lat.), Franklin and Mackenzie, and include that part of Canada which is N. of the 60th parallel, N. Lat., and between the Hudson Bay on the E. and Yukon on the W., including the islands in James Bay, Hudson Bay, Hudson Straits and other northern waters.

The territories are administered by a chief executive officer called the Commissioner of the North-West Territories, assisted by a council of four, all appointed by the Governor in Council of Canada, and for purposes of administration a separate branch of the Department of the Interior, whose minister advises the Crown, has been formed. Law and order throughout this immense extent of country are enforced by members of the Royal Northwest Mounted Police.

Special interest now attaches to the whole of these territories owing to the discovery of oil at Fort William and the existence of minerals throughout most of their area; also because of the experiments in breeding reindeer and the musk ox for economic purposes. They cover an area of approximately 1,250,000 sq.m. of which about 35,000 sq.m. are of water. The Mackenzie district has a total area of about 525,000 sq.m., the most noteworthy physical features being the Mackenzie river, 2,525 m. in length, including its tributaries, and the Great Bear and Great Slave lakes. The total area of the Mackenzie basin is 682,000 sq.m., the largest on the American continent next to that of the Mississippi. The Indian population in the southern portion is classified by Father Morice as Dene, sometimes called Chippewyans, and in the northern portion Eskimos. The climate is Arctic in its characteristics, severe in winter, and during the short summer the temperature occasionally reaches 90°F. and sometimes exceeds it. The western portion is much milder than the eastern. Continuous daylight is experienced for three months in most parts of the three districts, and N. of the Arctic circle the "midnight sun" is a feature of note. Agricultural possibilities are limited to the Mackenzie district. The large amount of sunshine gives a rapid growing season, enabling vegetables, grains and grasses to reach maturity in a remarkably short time. At Fort Smith, Resolution, Hay River, Providence and Simpson wheat, oats and barley, wild and domestic grasses and vegetables of nearly every variety common to western Canada have been successfully grown for over 50 years. Native flora is characteristically Arctic. Trees grow small and ill-formed, although there is a uniform mantle of forest in the western part. Sedges abound covering a larger area than grasses; mustards are abundant and saxifrages plentiful. Mosses and lichens occur everywhere. The animals are chiefly fur-bearing. There are large herds of musk ox, now to be bred and used commercially for the meat market, and vast flocks of wild ducks, geese and other migratory birds spend summer in these northern wilds.

Two routes lead into the Mackenzie district, the one from McMurray, to which a railway has been constructed, via the Athabasca, Slave and Mackenzie rivers; the other from the Peace river via the Peace, Slave and Mackenzie rivers. River boats ply during the summer on the rivers and in winter travel is confined to dog trains. Ingress from the E. is via Hudson Bay and northern waters.

(W. L. G.)

NORWAY (*see* 19.799).—The population of Norway, according to the preliminary results of the census of Dec. 1 1920, had increased to 2,646,306, from 2,393,906 in 1910. Of the 1920 population, 1,863,300 (70·34%) were resident in the country districts and 785,700 (29·66%) in the towns. The urban population forms a constantly increasing percentage, a phenomenon which reflects the advancing industrialization of the country.

Emigration has always been greatest from the country districts and has deprived the land first and foremost of a large part of the peasantry's young manhood. During 1901–10 63% of the emigrants were males, and of these 72% were single. The incidence of emigration was greatest between the ages of 20 and 25 years, and next in the age-class of 15–20 and third 25–30. During 1910–20 emigration slightly but steadily decreased owing to the better opportunities of work at home, and the many hindrances to travel caused by the World War. The number of emigrants was as follows:—1911, 12,447; 1912, 9,105; 1913, 9,876; 1914, 8,522; 1915, 4,572; 1916, 5,212; 1917, 2,518; and 1918, 1,226. The greatest number of Norwegians emigrate to the United States, a few to Canada. The respective figures for these two countries are: 1911, 11,122 and 1,304; 1912, 7,776 and 1,287; 1913, 8,568 and 1,281; 1914, 7,723 and 775; 1915, 4,388 and 169; 1916, 4,865 and 320; 1917, 2,344 and 168; 1918, 1,179 and 30. It was estimated in 1921 that Norwegians outside the homeland numbered about 1,600,000, making a total of about 4,300,000 of Norwegians and descendants of Norwegians in Norway and America. The average yearly percentage of increase in the Norwegian population in 1900–10 was 0·66, and in 1910–20 was 1·02; for the country districts it was respectively 0·62 and 1·04, and for the towns 0·74 and 0·96.

Norwegians are, as a nation, of a comparatively pure race. Until the World War only two foreign races had domiciliary rights in the country, *i.e.* Lapps (or Finns) and Quains (*Kvaenerne*) or Finlanders. The first belong to the historical, ancient race of northernmost Norway, the last have immigrated from Finland during the last 200 years. The Lapps (speaking strictly, the Swedish description of folk who live in northern Norway are called "Finns") belong to the Mongolian race, and the Quains are derived from the scattered tribes of the population of Finland.

In 1910 18,590 Lapps were found in Norway, 0·79% of the whole population; and 7,712 Quains, 0·30% of the population. The majority of both these races live in the two northernmost provinces, Finmark and Tromsö, where their number, in comparison with the total population, is large. Of the 39,126 inhabitants of Finmark in 1910 (43,997 in 1920), 10,330 (26·4%) were Lapps, 5,398 Quains (13·8%). Of the population of Tromsö, 80,772 (90,637 in 1920), 6,279 (7·8%) were Lapps and 1,618 (2·0%) Quains. The figures of the proportions between the Norwegian and the immigrated population in 1920 were not available in 1921, but it can be said with certainty that they have not appreciably altered since 1910. Neither of these two small groups show any inclination to become fused with the Norwegian-born majority. As regards the Lapps there is even a movement in force to assert a separate national culture on the basis of the national tongue of the race and its own traditions by accentuating their ethnical solidarity and by defining the land boundaries of the Lapps. The Norwegian Lapps held meetings in 1920 and 1921 of representatives of their different tribes, at which they discussed common interests, and laid their claims before the Norwegian Government. They wished no longer to be called Lapps or Finns, but *Samer*, which they consider to be the original name of their race (*Suomi* being the Finnish name for the Republic of Finland). As the organ of their efforts towards emancipation they commenced the issue of a paper *Samealbmug* ("the same people") at Vadso in Sept. 1921. This propaganda for Lapp political aspirations, being hostile to Norway, could not be ignored, and has caused considerable unrest, particularly in northern Norway. In addition to Lapps and Quains, there were about 56,000 foreign-born residents in Norway in 1910, some of them of Norwegian descent. The number of foreigners was appreciably added to during the World War, principally by the entry of Russian and German fugitives, but also by French and English emigrants. The majority of these established themselves in Christiania and near by, and helped to increase the already too pressing house shortage. Not a few returned to their native country at the termination of the war.

According to the general census of Dec. 1 1920, the following towns had over 10,000 inhabitants:—Christiania, 260,920; Bergen, 91,081; Trondhjem, 54,520; Stavanger, 43,883; Drammen, 26,174; Haugesund, 16,563; Aalesund, 16,547; Christiansand, 16,543; Skien, 16,503; Fredrikstad, 15,579; Christiansund, 15,183; Tonsberg, 12,583; Larvik, 11,391; Fredrikshald, 11,218; Sarpsborg, 10,881; Horten, 10,413; Arendal, 10,358; Tromsö, 10,071. The boundaries of towns are fixed by law, and they do not always coincide with town-built areas. In addition to the actual towns there were many town-like rural centres which differed from the typical country community of a single farm, with its buildings occupied by a peasant with his family and servants. These areas with buildings are of a town type called "house collections" in the census, and in 1910 232,154 people, or nearly 10% of the total population, lived in such; towns and "house collections" together accounted for 39% of the population of Norway, while 61% lived scattered about the country, for the greater part in single farms and cottages.

Although 106 boys for every 100 girls are born in Norway yearly, women are in a greater majority than they were in most countries before the World War. In 1902 there were 1,076 women per 1,000 men, and this proportion has remained fairly constant. The reason for this ratio is to be found in the greater mortality and emigration of the men. The excess of women varies in different parts of the country; it is greatest in the towns, which have 1,206 women to 1,000 men, while in the country there are 1,058 women to every 1,000 men. Only in Finmark are there more men than women.

In Norway the oldest and youngest age-classes are the strongest numerically, while the age-class 15–40 is less than in most other countries. This is the result of emigration and of the high mortality in the middle age-classes of the male population. Of the 1920 population 35·4% were under 15 years, 35·8% between 15 and 39, 17·8% between 40 and 59, 11% 60 and over.

The average number of marriages contracted annually during the period 1911–15 was 15,320. During 1915 they were 15,940; (1916) 17,312; (1917) 18,086; (1918) 20,031; (Jan.–Sept. 1919) 15,608; (Oct. 1919–Sept. 1920) 18,032—or an average of 6·66 per 1,000 inhabitants yearly. The lowest marriage rate during this period was 6·10 in 1912 and the greatest (in 1918) was 7·77 per thousand. The number of divorces is increasing; while in 1896–1900 it was only 0·76 per 100 marriages, it was 3·32 in 1912, 3·28 in 1913, 2·69 in 1914, 3·52 in 1915, 2·06 in 1916, and 3·11 in 1917. In the later years somewhat over 60,000 children were born annually, representing a birth-rate of about 25 per 1,000. The birth-rate is comparatively low, and has been decreasing during the whole of the century. In 1896–1900 it was 30·44 per 1,000; the figure sank gradually to 23·42 in 1915, but increased a little during the following years, except in 1919 when it was only 22·47 per 1,000. About 7% (1896–1900 average 7·44%, 1911–19 average 6·93%) of the births were illegitimate.

Mortality has always been comparatively low in Norway, and in the long run its rate has fallen. The yearly deaths amounted to from 30,000 to 35,000. The yearly average death-rate per 1,000 inhabitants was: (1896–1900) 15·70, (1911–15) 13·34 (with the lowest figure in 1911, 12·98), (1916) 13·62, (1917) 13·35, (1918) 16·7—the great influenza epidemic,—(1919–20) 13·48. The Norwegian mortality rate for men varies from the general rule. It shows a falling mortality to 12 years of age, and thereafter a marked rise to 22 years; the rate then falls to 34 years and then again rises. While infant mortality (under 1 year) is lower in Norway than in any other European country and the mortality among the very young, and those over 50 years, is very low, the mortality between 20 and 30 years is higher than in any other country. The cause of this has not been determined, but tuberculosis is a strongly contributing factor. Mortality is higher in the towns than in the country, except among males of 17–25 years, and females 15–39, at which ages the country population has a higher rate of mortality than the town population. The total number of deaths in 1917 was 31,613. The principal causes of death, besides senile decay with 15·26% of all deaths, were pulmonary tuberculosis 13·47%, cancer and sarcoma 7·84%, apoplexy (apoplexia et embolia cerebri) 5·65%, organic heart disease 5·24%, inflammation of the lungs 5·17%, chronic bronchitis—catarrhal inflammation of the lungs 3·75%, and congenital debility 3·66%. In the terrible mortality year 1918, with 41,228 deaths, influenza was given as the cause of 7,248, 17·58% of all cases. Tuberculosis, which yearly carries off 2 per 1,000 of the population, prevails most seriously in Finmark, where the deaths from that disease in 1917 were 4·40 per 1,000, in Tromsö province the figure was 2·93, in Nordland 2·77, in North Trondelag 2·34, and in South Trondelag 2·34 per 1,000, while a high figure prevails in all the provinces of northern Norway. Energetic efforts to check this disease have been made by the Norwegian Anti-Tuberculosis Association, founded in Christiania on June 29 1910. On July 1 1920 this Association comprised, besides 2,287 life members, or industrial contributing members, 591 local associations with a total membership of 78,500, and 535 town and district corporations. The National Association, which is under the patronage of the king and queen, receives a State subsidy (for 1900–21, 25,000 kroner). It publishes a quarterly journal, of which over 20,000 copies are issued. The secretariat is in Christiania. For the combat of tuberculosis the Norwegian Government has established five sanatoria—Reknes sanatorium at Molde, Landeskogen sanatorium in Seteadalen, Vensmoen sanatorium in Saltsal, and coast hospitals near Fredriksvaern (on the eastern side of Christiania Fjord) and in Vadsö (Finmark). The work against tuberculosis in the large towns has been much hindered by the shortage of housing accommodation. Official communications from the communal offices in Christiania alone in Sept. 1921 reveal the fact that 15,000 people were without accommodation. The poorer classes were crowded into rooms which were too confined; many had already been condemned as insanitary. The tuberculosis section of the Christiania Health Committee state in their report for 1921 that 40% of the accommodation which had already been condemned as unfit for human habitation had again been put into use. Out of 381 newly reported tuberculosis families in 1920, 8·14% lived in rooms without kitchens, 37% in quarters of one room and kitchen, 35·43% in two rooms and kitchen, and 11% in three rooms and kitchen; only 18·64% of this accommodation was found to be satisfactory from the point of view of health. Only 22·75% of the sick had their own room, 77·25% shared a room with others, up to 8 or 10 sick in the same room. A proposal for house rationing, which was rejected by the Christiania Town Council in 1919, therefore came to the front again in the autumn of 1921. Similar housing conditions existed in Bergen and Trondhjem.

Railways.—Norwegian railways underwent great development after 1910 when the plan adopted by the Storthing on July 9 1908 for the extension of the railways of the country was being carried out as far as the more important lines are concerned. The total length of railways in operation in July 1920 was 3,286 km. (2,041 m.). To this must be added the Dovre railway between Domaas in the northernmost part of Gudbrandsdal over the Dovrefjell to Trondhjem, opened for traffic on Sept. 19 1921, which has a length of 158 km. (98 m.) from Domaas south over Dovre to Storen station on the old Hamar–Trondhjem line. The total length of the Norwegian railways was therefore 3,444 km. (2,139 m.) late in 1921. Of the total rail length 2,290 km. (1,423 m.) are standard gauge (1·435 metres between rails); the remainder, exclusively branch-lines or small private railways, are narrow gauge, for the greater part with a gauge of 1·067 metres. Among the newest railways is the line between Kongsberg and Hjuksebö, opened February 11 1920, quite a short line (37 km. or 23 m.) but of great importance because it was the first section of the projected trunk-line through Norway's "Sørland" (southern part) between Christiania and Stavanger.

After the completion of the Bergen railway in 1909, no event in the railway field attracted greater attention than the opening of the new railway across Dovre. The trunk-line between Christiania and Bergen (492 km., 306 miles) constitutes Norway's main connexion with the outer world. The trunk-line (553 km., 343 m.) between Christiania, Eidsvoll and Domaas 214 m.; Domaas and Stören 98 m. and Stören and Trondhjem 32 m., constituted in 1921 the main connexion between South and North Norway. It was in fact the spine of the railway system, and no later line of importance can be constructed without having some reference to the Dovre railway. Its importance from an economic and military as well as from a traveller's point of view is obvious. In 1908 the cost was estimated at about 17,000,000 kroner (£944,000), and the final cost is estimated at 61,000,000 kroner. The Dovre railway was officially opened on Saturday Sept. 17 1921 by the king at Hjerkinn, the highest point of the line, 1,017 metres (3,334 ft.) above sea-level, and was marked by great celebrations at Trondhjem. On Sunday night, Sept. 18, when a special train left Trondhjem for Christiania a serious collision with the north-going express from Christiania took place not far from Trondhjem. Six persons, all men of prominence, were killed, and thirteen injured.

The Rauma railway starts from the southern terminus of the Domaas–Dovre railway and was under construction in 1921 between Romsdal and Aandalsnes, a tourist centre at the outlet of the Rauma into Romsdals Fjord. It was intended to carry this railway westward to Aalesund. The Domaas–Björli section of this railway, the eastern half, was ready for working about the end of 1921. Domaas had already become an important junction. In the westlands districts, interest in the development of railway construction had increased considerably during 1920–1, and two railway committees were working in Bergen on the investigation of several plans. One of these relates to a connecting line between the Dovre railway and the Bergen line, and a probable solution inclines to the laying of a broad-gauge line of about 200 km. between Torpe station on the Bergen line (274 km. east of Bergen) and Kvam station 66 km. south of Domaas, the estimated time of construction being 10 years and the cost 36,000,000 kroner. This railway is not, however, included in the scheme worked out by one of the chief railway authorities for a construction period of 12 years (starting 1922) at a total cost of 273,000,000 kr. (£15,000,000). The railway authorities have also worked out a general scheme for the future development of the railways of the country at an estimated cost of 1,300,000,000 kroner. This scheme was to be brought before the Storthing in 1922. The Storthing had, however, in 1921 already approved the immediate commencement of work on the construction of the Sunnan–Grong section of the proposed great trunk-line, Norway's greatest railway project through Nordland. Up to July 1920 an invested capital of 412,120,000 kr. had been sunk in constructed railways. The interest-earning capacity of this capital has shown a falling tendency in recent years, and in the working-year 1917–8 the working expenses for the first time in the history of the railways of Norway were greater than the traffic receipts. The railways afterward worked with a deficiency which was for the period mentioned 7,550,000 kr., in 1918–9 2,510,000 kr., 1919–20 3,530,000 kroner. The reason for this deficiency is first and foremost the extraordinarily increased expenditure on wages, and secondly the high price of coal during and after the World War. Although all rates had been more than doubled, yet it had not been possible to cover expenditures. Freight increases finally brought strong protests from traders, and at the third Scandinavian Trades Meeting held in Christiania on Sept. 13–14 1921 the traffic question was one of the principal topics of discussion; an urgent appeal was made to the authorities concerned to look into the matter of traffic between the three Scandinavian countries as regards relief by reductions of charges and freights. The general director of the Norwegian State Railways immediately promised to comply with this appeal.

Work on the conversion of railways to electrical power was resumed, after having been practically stopped during the World War. The line between Christiania and Drammen, the first electrically operated railway in Norway, and the section from Christiania to Asker (23 km.) with heavy local traffic, was to be worked on this system from Jan. 1 1922.

Roads.—The Norwegian system of roads is being steadily expanded by new construction and by rebuilding. A thorough revision of highways legislation (which dated from 1851) was made by the Highways Law of June 21 1912, which came into force July 1 1913. Public roads are either high roads or parish roads. By high roads are understood (1) the more important highways which connect Norway with neighbouring states or provinces, (2) roads which, within a province, convey through traffic between two or more districts or form the principal means of access to towns. All other roads are considered as parish roads. The high roads are controlled by a Director of Highways for the whole country, who is directly under the Department of Public Works. In addition there is a provincial Direction of Roads for each province, consisting of the head of the province and two elected members of the provincial council. Norway's high roads in 1915 had a total length of 13,146 km. (8,165 m.), parish roads 20,139 km. (12,510 m.), a total of 33,285 km. (20,675 m.) of public driving roads. There were in 1921, on the average, 110 km. of such roads for every 1,000 sq. km. of the total land area of Norway.

Simultaneously with the Highways Law of 1912 a "Law for the use of Motor Vehicles" was passed, which opened all the roads and avenues of the country to automobiles. Including motorcycles, the total number of motor vehicles in Norway in Jan. 1921 was about 14,000, while 30,000 licences had been issued to motor drivers. About 270 motor routes have been opened up over the whole country and these play a big part both in general passenger and goods transport, as well as in tourist traffic. Among the most important routes which connect areas of the country where railways do not exist are the following:—Otta–Geiranger–Stryn–Domaas–Aandalsnes; Fagernaes–Tyin–Laerdal; Fagernaes–Bygdin; Gol–Laerdal; Dalen–Haukeli–Odda; Christiansand–Aaseral–Mandal; Christiansand–Arendal; Osebykle (Setesdalen)–Arendal–Evje; Kragerø–Tørdal; Notodden–Kviteseid; Elverum–Trysil–Faemund; Stenkjaer–Namdalseid; Sjøveien–Saetermoen–Finsnes; Vardø–Vadsø–Tanen.

There were two Norwegian automobile factories in 1921, but both imported finished parts.

State-Subsidized Steamer Services.—In the inland State-subsidized steamer services it was necessary during the war to make restrictions from 1915, and in 1917 freights had to be materially increased, both on coast and local routes. These restrictive measures especially affected northern Norway (the provinces of Nordland, Tromsö, and Finmark) whose communication with the rest of the country became greatly restricted. In 1917 it became necessary to impose very considerable extra taxation on the public to maintain the necessary service, especially on the northernmost portions of the country. From Feb. 1917 to the end of Nov. 1918 steamer services between Bergen and Newcastle were entirely stopped, and the same was the case with the Christiania–Fredrikshavn route from the end of April 1917 to the end of Oct. 1918. When the contracts with the coastal service companies expired on July 1 1921 the State contribution to this service was materially reduced. For the financial year 1921–2 the State contribution to the northern Norway routes was placed at about 11,500,000 kroner. The Bergen Steamship Company in 1921 established an express route between Newcastle-upon-Tyne and Bergen with railway connection to London and Christiania, so that travellers between these two places were able to do the journey in 70 hours, of which 22 were on the sea.

Tourist Traffic, which prior to the World War had been a source of revenue of no little importance, was practically entirely suspended during the World War. It failed in 1915, revived a little in 1917, but in 1918 was again less and the few foreign travellers were practically all Danish and Swedish. There were many of these in 1919 and 1920 and besides them, as before the war period, a large proportion of inland travellers. But in 1921 the character of the traveller traffic changed, in that it consisted again of a great stream of foreigners, Americans, Englishmen and Hollanders, the latter due no doubt to the fact that in Aug. 1921 the Queen of Holland travelled through the tourist centres of Norway. In April 1921 a Norwegian State Railways Travel Bureau was opened in Norway House, London, which acts as a central office for tourist traffic to and from Norway and England. The big English "floating hotels" in 1921 resumed their visits to the westland fjords of Norway.

Telegraphs and Telephones.—Telegraphs and telephones have been very thoroughly developed during recent years, especially wireless. The management of the State telephones is combined with that of the State telegraphs, at the head of which there is a Director of Telegraphs, who is under the direct jurisdiction of the "Trade Department" (properly "The Department for Trade, Sea Transport, Industry and Fisheries," established by decree of the Storthing of June 28 1916). In 1912 the Storthing approved a plan submitted by the then Director of Telegraphs (Thomas Heftye, born 1860, killed in the railway disaster at Trondhjem Sept. 19 1921, Director of Telegraphs from 1905, formerly a minister of State, senior lieutenant in the engineer service), whereby in the course of a few years by an extraordinary appropriation a telephone trunk-line would be constructed from Trondhjem to Vadsö. At the end of 1919 the main line was ready northwards to Tromsö and lines were extended for local telephone service from different points in East Finmark, with branch-lines to the islands and fishery properties and northwards to the regions inhabited by the Lapps. In 1921 the Storthing made an extraordinary appropriation, outside the usual construction budget, for district lines in the few parts of the country still without telegraph or telephones. In 1921 there was a telephone on nearly every farm.

The first two radio-telegraph stations, Sørvagen and Røst, were opened in 1908 in the Lofoden fisheries district; in 1910 the Telegraph Service took over from the navy the Tjöme station in the outer part of Christiania Fjord, and Flekkerøy, a little southwest of Christiansand. In 1911 came the more powerful stations, on the Rundemanden in the neighbourhood of Bergen, and at Ingøy, a little to the north of Hammerfest. In connexion with this, the Norwegian Government in 1911 erected a post-office and radio-telegraph station at Ankershavn, on the eastern side of Green Harbour, Spitzbergen; later a mining company erected four smaller stations in West Spitzbergen, which are connected with Norway through this Spitzbergen central station. In Aug. 1919 a wireless station was erected at Ostervaag on Björnöya (Beeren Island), also by a private mining company. And in Sept. 1921 a station of the Norwegian Radio Company established mainly for daily weather forecasts to Reykjavik, Ingøy, and Fauske was opened on Jan Mayen. All these stations are comparatively small. However, Norway obtained one of the world's largest wireless stations (Marconi system) in the autumn of 1919 in Stavanger, intended for direct communication with stations in North America. Lastly there are powerful new stations on Tryvanshøiden near Christiania, Udsire on the island of the same name south-west of Haugesund, at Bodö in Fauske province, a little to the east of the town Bodö, and in 1921 the construction of a large station close to Trondhjem was begun. The stations at Tromsö and in the neighbourhood of the head of Varanger Fjord have been taken in hand and with the Bodö, Trondhjem and Christiania stations will form a trunk system of wireless telegraphy over the whole country.

Shipping.—Before the World War the Norwegian merchant fleet ranked fourth in the world with a total gross registered tonnage of about 2,600,000. In proportion to the population Norway's commercial fleet was greater than that of any other country. The war has essentially altered this position. Nearly half the Norwegian fleet was sunk and 1,200 non-combatant Norwegian seamen perished. Nevertheless the Norwegian fleet was in 1921 about as big as before. In the second year of the war several hundred thousand tons of new and old ships had already been purchased from foreign countries, and new vessels were contracted for in various parts of the world. It is calculated that between one-third and one-half of Norway's tonnage in 1921 has been built within the three or four preceding years. This new fleet was constructed without Government subsidy. The sudden and violent derangement of values in 1920, however, brought many of the ship-owning firms, who had to replace their war losses at top prices, into serious financial embarrassment. Before the war only 10% of the Norwegian fleet was engaged in traffic with Norway; the majority ran on more or less regular routes between foreign ports. Regular liner traffic on fixed routes had developed rapidly, but was stopped by the war. After the war the lost ground was quickly regained, and the tonnage owned by the liner companies increased by the addition of new vessels especially built for regular-line service. Several new lines were also started. The tonnage of vessels engaged in regular-line traffic was 130,340 gr. reg. tons in 1910, 298,275 gr. reg. tons in 1916 and 400,000 in 1920. The development of the regular-line trade was thus satisfactory, but nevertheless the total tonnage owned by the liner companies was in 1921 not more than ⅕th of Norway's total ocean-going tonnage.

The greater part of the Norwegian tonnage was operated on a time charter (tramp) basis before the war. The war brought a change also in this respect and in other ways altered the conditions of employment. Norwegian ships were withdrawn from trades which had previously absorbed a great deal of Norwegian tonnage, as for example the trade between India and China, the West Indies trade, the Black Sea trade, etc. The British coal trade laid claim to most of this tonnage. Thus in the summer of 1916 no less than 159 Norwegian ships with a total tonnage of 173,119 gr. reg. tons were constantly running in the coal trade between England and France alone, and national supplies required three times as much Norwegian tonnage as was necessary before the war.

Over 26,000 men (sailors, firemen etc.) and officers (masters, mates and engineers) were in 1921 employed aboard the vessels of the Norwegian merchant fleet, and about 17% (more than 112,000) of the entire male wage-earning population (about 660,000) earn their living directly or indirectly by the sea.

Norway's maritime laws are in advance of the legislation of most other countries. This applies in particular to provisions concerning the crews and their conditions of work. An act of July 11 1919, which came into force Jan. 1 1920, established the daily hours of labour on board Norwegian ships in harbour at eight hours, in the tropics seven hours, between 7 in the morning and 5 in the afternoon. At sea the work of the deck is divided into watches throughout the 24 hours in the usual manner. The work of the engine-room crew was, however, to be divided into three watches in the 24 hours to such extent as the number of men permits. By an Order in Council of May 31 1918 a manning schedule for Norwegian vessels was established, giving the number of mates, engineers and hands according to the size of the vessel. The two-man cabin system has also been adopted, and sanitary arrangements to meet the strictest hygienic requirements are obligatory.

In several Norwegian ports (especially in Christiania, Christiansand, Stavanger, Bergen and Trondhjem) the harbours have been considerably extended and modernized. The question of establishing a free harbour has been discussed in all these cities and on June 20 1919 the Government appointed a committee to examine whether a Norwegian free harbour ought to be established and if so, where. This committee reported in Oct. 1921. It recommended the construction of a free harbour, calculated to cost 31,000,000 kr., between two of the islands in the fjords near Christiania.

Water-Power.—Since electrical power transmission opened the way to bringing great quantities of power to suitably situated industrial centres, it has become possible to utilize Norway's greatest natural asset, water-power. It has been the foundation for the industrial development of the 20th century in Norway. Though Norway itself lacks coal, she has come forward into the front rank of power-producing countries. No country in Europe has nearly as great wealth of water-power, not only in proportion to the population, but absolutely. And this power is the cheapest and most conveniently distributed in the world. The total water-power of Norway is estimated to amount to at least 15,000,000 H.P., which with reasonable regulation and development can be utilized the year round, day and night. More than half of this power is admirably situated for big industries, as the fall of the water in many cases is direct into deep fjords, where power stations, factories and quays can be erected in ice-free, well-sheltered harbours, available for the largest ships. As a result of the sharp steep slope on the west of the country, the Cascades in the Westland and northern Norway not infrequently have a fall of 1,500–3,000 ft., often in connexion with large high-lying inland lakes, which permits of practical and effective storage of water and renders the regulation of the flow economical and convenient.

Of the 15,000,000 H.P. available the Norwegian Government owns about 2,000,000, of which about 75,000 H.P. is developed, and a corresponding amount of power is owned by Norwegian communes, but the rest are in private ownership, either of single persons or companies. About 1,200,000 H.P. had been developed by 1921, of which 250,000 H.P. are used to supply the general requirements of lighting, household purposes, agriculture, trade, small industries, tramways, etc., while about 95,000 H.P. are used in large industries. A further 250,000 H.P. were under development in 1921 primarily for public and communal purposes. The increase in the requirements of the country is shown by the following figures: in 1907 about 250,000 H.P. had been developed, in 1913 about 750,000 H.P. and in 1920 upwards of 1,200,000.

A portion of this store of power will be available for transmission to central Europe, poor in water-power. The scheme was in 1921 so far advanced that already the Governments of Norway, Sweden and Denmark had appointed a commission of experts to investigate the question of the transmission of power from Norway, through Sweden to Denmark. And from Denmark, it is not a long extension to Germany. The distance from Norway to Denmark and Germany is 300 and 450 miles respectively. The fact that in 1914 five times as many water H.P. were employed as steam H.P. in metal industries and mechanical workshops is evidence of the part water-power already plays in the industries of Norway as compared with imported coal. In the textile industries likewise about 5 times, in the paper industry 10 times, in the foodstuffs industry 4 times, and in mine workings double as many water H.P. as steam H.P. are employed, and in the chemical industry water-power is employed (about 400,000 H.P.) almost exclusively. The total installation of the country for electric light and power in 1921 represented over 800,000 water H.P. as against only 40,000 steam H.P.

Industrial Use.—For the electro-chemical and electro-metallurgical industries in particular, water-power is of the utmost importance in the utilization of the raw products of the country. Systematic investigation has revealed that raw materials are relatively abundant, and especially has it been established that the country is far richer in iron ores than was supposed. This wealth formerly could only be partly utilized, as the ores were low-grade. The steadily increasing need for raw material, together with improved technical methods of production, gives hopes, however, for the utilization of poor or contaminated ores by economical working. The introduction of the electric smelting-oven opened up the possibility for development of an iron and steel industry in Norway based on the country's own metals. The importance of this appears when it is considered that Norway possesses iron ore roughly calculated to amount to about 1,500,000,000 tons—mining to a depth of from 500 to 600 ft. below the surface. By surface-working about 350,000,000 tons of ore can be obtained. The ore in northern Norway is, however, poor—containing only 30–37 % of iron. In middle Norway there are about 20,000,000 tons of ore with 55 % iron and in the south about 5,000,000 tons with 45–48 % iron. Norway also possesses a large supply of low-grade zinc ores, which, in the future, will certainly be used. Even now the country has a not unimportant zinc industry based on imported raw material. Norway also has an aluminium industry supplied with imported raw material (bauxite). As, however, Norway possesses a vast supply of aluminium silicate and other deposits rich in aluminium, it can be assumed that an important aluminium industry will be developed on the country's own raw material. The most important mining industry of the country before the war was the mining of copper ore and iron pyrites, large deposits of these minerals occurring in middle and northern Norway. These ores were exported as raw material, but the extraction of the metal should form a new industry. A large nickel refinery has been established near Christiansand. Among other ores found which are important in connexion with the development of new branches of industry—either independently or in relation to the iron and steel industry—are those containing chromium, silicon, nickel, titanium, and others. There was a great increase in the production of molybdenum during 1920.

Already by 1921 the results attained in the chemical industries in the course of a few years were impressive. Particularly in the manufacture of artificial fertilizers such as Norwegian saltpetre, calcium nitrate and cyanamide. The raw materials for the manufacture of saltpetre are atmospheric nitrogen and limestone. The greatest electro-chemical establishment is Norsk Hydro-elektrisk kvaelstof-aktieselskap at Rjuhan; this factory was using over 200,000 water H.P. in the preparation of Norwegian saltpetre, nitric acid, nitrate of ammonia, nitrate of soda and other products. The new synthetic saltpetre industry which was originated and developed in Norway on the Birkeland-Byde'ske methods also supplies raw material for the explosive and dye-stuff industries. The production of carbide of calcium has also made great strides. The value of the country's products in the electro-chemical and electro-metallurgical industries reached in 1918 to over 180,000,000 kroner.

Finance.—Since 1905 the Norwegian State budget has been divided into two chief sections, one embracing the ordinary, the other the extraordinary revenue and expenditure. By a measure adopted by the Storthing in 1907 the financial year was altered from April–March to July–June. In 1911 the Storthing passed an amendment to the constitution by which Norway was under ordinary conditions to have a fixed unassailable reserve of 40,000,000 kr. (at that epoch estimated to have a value of £2,222,222).

The eight budget years July 1 1906 to June 30 1914 in all but one period (1909–10) gave a surplus, which altogether amounted to 55,900,000 kr. at the end of this period; the greater part of this amount being applied to various defensive measures. During these 8 years the national debt increased by only 15,000,000 kr., from 342,400,000 to 357,400,000 kroner. At the end of the budget year 1913–4 the cash reserve of the national exchequer amounted to 50,200,000 kroner. These figures show that the financial position of Norway was sound at the outbreak of the World War. For the budget year 1914–5 the State revenue amounted to 197,000,000 kr., of which 167,800,000 was on the ordinary, and 29,500,000 on the extraordinary budget; expenditure amounted to 186,400,000 (ordinary 156,100,000, extraordinary 30,200,000) and the remaining surplus was therefore 10,600,000 kroner. In this connexion it should be noted that expenditure incurred for the maintenance of neutrality was not included in the budget, but during the whole war was provided for apart from it. The national exchequer cash reserve at the end of this budget year amounted to 35,700,000 kroner. In 1915–6 revenue increased to 240,400,000, and expenditure to 191,200,000, showing a surplus of 49,200,000. Under the pressure of the general panic which was prevalent during the first year of the World War at the increase of the budget, measures were taken to reduce the budget expenditure; but the gloom was only of short duration, and was succeeded in 1915 by a period of prosperity, which caused the national revenue to increase far beyond the estimate. Income and property taxes that year realized 24,600,000 more than had been estimated, customs 7,700,000 more, etc. The exchequer surplus on June 30 1916 amounted to 57,100,000 kroner. This progress continued the following year, 1916–7, when the national revenue rose to 394,700,000 while the expenditure was only 268,700,000, and a clear surplus remained of 126,000,000 kr., treble the amount of the national budget a few years earlier. Income and property tax for that year together yielded 86,300,000 more than estimated, customs 13,800,000, and a war-period tax added to the revenue on the extraordinary budget realized 36,600,000 kroner. The treasury had at the expiration of the budget year a reserve of 80,800,000 kroner. The budget for the financial year 1917–8 was balanced at an amount of 446,400,000 kroner, 250,300,000 on the ordinary, 196,400,000 on the extraordinary. But the ordinary revenue attained 406,200,000 and the extraordinary 213,600,000, a total of 619,800,000 kroner. At the same time the expenditure increased to a total of 501,800,000 kr. (ordinary 296,100,000, extraordinary 205,600,000), and a surplus remained of 118,000,000 kroner. Among the assets on the ordinary budget income and property taxes showed an amount of 150,700,000 (against an estimated 58,600,000), stamp duties (principally from stock transactions) 40,100,000 (against an estimated 12,000,000). On the extraordinary budget, war tax showed 160,300,000 (against 114,200,000 estimated), and among the expenditures on this part of the budget appeared 31,300,000 kr. for increased cost-of-living bonuses to State officials, with 106,600,000 for other expenditures in connexion with increased costs; the extraordinary expenditure on defence was 26,000,000 kr., which was entirely met by the war tax and tonnage duty. The Treasury reserve at the end of the budget year amounted to 187,100,000 kroner. The budget for 1918–9 was balanced at 625,000,000, 333,300,000 on the ordinary and 291,700,000 on the extraordinary. The ordinary revenue however reached 463,000,000 and the extraordinary 324,600,000, together amounting to 787,600,000 kr.; the expenditure rose to 672,200,000, a surplus therefore accruing of 115,400,000 kr. Among the expenditures on the extraordinary budget the cost-of-living bonuses increased to 89,500,000, and other measures in connexion with increased costs 139,300,000 kr. The Treasury reserve was 260,200,000 kroner. For the financial year 1919–20 the budget was balanced at 726,500,000 (392,400,000 on the ordinary and 334,100,000 on the extraordinary). On the extraordinary budget credit-side that year were presented loans (for railway, telegraph and telephone construction, also purchase and development of waterfalls) 60,300,000, war tax 236,300,000 and tonnage duty 17,400,000 kroner. Among the expenditures on the extraordinary budget were:—cost-of-living bonuses, 100,700,000; other State expenditure caused by increased costs, 88,000,000; losses by emergency measures affecting industries, 25,000,000; and measures against unemployment, 8,000,000 kr.,—a surplus of 42,300,000 remained. The ordinary budget for 1920–1 was balanced at 492,400,000 and the extraordinary at 267,400,000 kroner. The preceding figures are gross totals derived from national accounts and budgets, while the surplus stated is estimated and does not quite correspond with the actual reserve. The net figures, *i.e.* the figures which show the difference between the revenue and expenditure relating to the various State purposes, present a somewhat different picture. The extraordinary budget was in 1921 swollen more than the ordinary; before the war this part of the budget included especially expenditure on railway construction, carried out by means of loans. During the war this budget included expenditure on extra defensive measures, and the greater part of the expenditure caused by the increased costs. The expenditure incurred in the maintenance of neutrality, on the other hand, was not included in the budgets. Taking this expenditure into account also, the following were the amounts used extraordinarily:—1914–5 61,000,000; 1915–6 59,300,000; 1916–7 139,800,000; 1917–8 272,500,000; 1918–9 351,200,000; 1919–20 334,000,000. For the six budget years dealt with above 1,218,000,000 kr. were therefore devoted partly to expenses normally raised on the extraordinary budget, and partly to emergency expenditure,—for example, shortage on herrings, fish and fats which the State took over, shortage on corn and shortage caused by the assumption of war risks for fishing and whaling vessels. The surplus for 1914–9, totalling 385,900,000 kr., was used for meeting current State expenditure.

The Norwegian Government had the following "war income" at command:—(1) the afore-named surplus on the ordinary budget, 385,900,000 kr.; (2) war-period tax, total 653,200,000 kr.; (3) tonnage duty, a special tax on shipping, 75,200,000 kr.; (4) other extra revenue, 12,000,000 kr.: altogether, 1,126,300,000 kr. The total amount of the tax revenue in 1914–5 was 178,600,000 kr., and in 1917–8 it was 639,400,000 kr. In order to increase the revenue, the Government took refuge during the war in a series of new taxes and, in part, greatly increased those already in existence. Thus in 1915–6 a material increase in income and property tax was decreed, with heavier incidence on larger incomes and property, stamp duty was also increased, and, as new taxes, a stamp duty on tobacco and a match tax. All these taxes were later increased and remained in 1921, except the match tax which was abolished in 1917. In its place a transient luxury tax was imposed, which however proved to be disappointing. In 1915 a war-time tax was introduced which produced 236,300,000 kr. in 1919–20. In 1916 a tonnage duty was imposed on shipping as a special tax, and this up to July 1919 had realized about 75,000,000 kr., which was used for measures against scarcity. The expenses-of-neutrality service (maintaining the neutrality of the country, principally along the coast with the aid of the navy) cost in 1914–5 21,800,000; in 1915–6 27,200,000; in 1916–7 41,300,000; in 1917–8 55,800,000, and in 1918–9 35,300,000 kr.; or a total of 181,400,000 kr.

On June 30 1914 the Norwegian national debt amounted to 357,400,000 kr., for the greater part long-period (50–75 years) loans with 3, 3½ and 4% interest. Of this debt 336,500,000 was in foreign countries and 20,900,000 in Norway. Up to the end of 1919 four fixed loans were adopted, three with a total amount of 225,000,000 in the country itself, and one—18,600,000 kr. in amount, repayable in 1923—in the United States. There were in addition some short-term repayable loans of smaller amounts taken up in America and England. On Dec. 31 1919 the fixed national debt had increased to 594,300,000 kr. To this must be added the cash credits opened in 1918–9 by the different Norwegian banks for the purposes of financing trade, which brought the floating debt of the State at the end of 1918 up to 422,500,000, a total national debt therefore of 1,016,800,000 kr. The yearly installment and interest on the fixed national debt, which in 1914–5 amounted to 17,500,000 kr., had in 1920–1 increased to double, 34,700,000 kr. A new loan in 1920–1 brought the national debt on Dec. 31 1920 up to a total of 1,167,000,000 kr. or 440 kr. per head of the population. During the war period it was maintained as an invariable principle that fixed loans could only be applied to reproductive purposes—construction of railways and telegraph lines, building of power stations, purchase of waterfalls and industrial construction. To such purposes nearly 500,000,000 kr. was applied in 1921. In addition the State possesses all goods purchased and stored for the provisioning operations and not liquidated, up to Oct. 1921 to an amount of at least 100,000,000 kr. Finally the amount the State was owed abroad (especially by Germany) was at least 150,000,000 kr. for goods supplied—principally fish.

The Norwegian communes occupy a very independent position as regards the State, not only in political constitution but in economic finances. They have, practically speaking, full self-government. The approval of the Government is only required for the putting into operation of such economic measures as bind the finances of the commune for a long period of years, *e.g.* all communal loans. Taxes in the communes have increased to an extraordinary extent. For all corporate townships and cantons together they amounted in 1910 to 45,840,000 kr.; in 1914–5 to 65,190,000 kr., and 1919–20 to 322,280,000 kr. In 1920 new communal loans to a total of 350,000,000 kr. were adopted, or about as much as the whole of the total communal debt on June 30 1917. In 1921 the total communal debts amounted to 1,000,000,000 kr. This money has however been used mainly for reproductive purposes—electric works, gas and water supply and the like. In 1914–5 every taxpayer in the towns paid 130·90 kr. in communal taxes, which amounted to an average of 50·07 kr. per head of the inhabitants. In the budget year 1918–9 these figures increased to 579·34 kr. and 247·69 kr. respectively. In the cantons the corresponding figures were (1914–5) 49·60 kr. and 16·61 kr., (1918–9) 133·75 kr. and 46·02 kr.

A measure of how property and incomes have increased in Norway is afforded in the assessments of the position of the whole population as regards income and property, which are compiled every year in every town and in every canton by a specially appointed local commissioner, who critically investigates the taxpayers' own statements regarding their economic position, or independently estimates it. The "tax list" compiled in this manner contains the names of all the taxpayers, with a statement of the "presumed" income and property and the "rated" tax for each individual. Though punishments for incorrect "personal declarations" are very stringent and appraisement can often be defective, especially in the country by underestimation of the taxpayers' economic ability, the reflection of the economic assessment of the whole country as shown by the total amount of taxation must, roughly regarded, be just.

The figures only apply to the portion of the population which comes under the taxation laws, but the additions for the persons who are without the scope of this are not important. On these calculations the following statement may be given of the total national property and income:—

	Number of Taxpayers	Property Million Kr.	Income Million Kr.
1911	732,158	2,693·4	609·2
1913–4	808,113	3,852·0	830·7
1917–8	919,494	7,332·5	2,273·4
1918–9	976,252	10,153·6	2,827·7
1919–20	998,413	11,819·2	3,173·4
1920–1	1,032,537	12,678·9	3,701·8

(K. V. H.)

Agriculture.—According to official statistics for 1917 (the latest issued in 1921) the agricultural area amounts to 2,430,000 ac. and the area suitable for agriculture to some 1,740,000 ac. Between 1918 and 1921 at least some 50,000 ac. were laid under the plough, the percentage being highest in the counties of Rogaland (5,000 ac.), Nordland (nearly 5,000 ac.), and Hedmark (4,000 ac.), and lowest in Finmark (with only about 250 ac.). During these years the Storthing devoted over 26,000,000 kr. to new cultivation. The characteristic feature in Norwegian agriculture between 1900 and 1920 was the constant increase of small freeholders having for their speciality the cultivation of root crops and feeding of cattle.

The cultivated area in 1917 was made up as follows:—612,560 ac. fields, 1,100,000 ac. meadows on cultivated soil, 24,000 ac. gardens. In 1919 the crops amounted to the following figures: 29,000 tons wheat, 25,000 tons rye, 115,000 tons barley, 220,000 tons oats, 22,000 tons mangcorn, a total of 411,000 tons of grain, together with 1,000,000 tons of potatoes and 1,700,000 tons of hay.

The total holding of live stock in the country for the dates given was:

	Dec. 31 1907	*Jan. 1 1918*
Horses	170,325	208,219
Large stock	1,027,520	1,085,707
Sheep	991,211	939,940
Goats	222,717	185,800
Swine	163,467	127,230

According to the prices obtaining in Norway in 1918 the live stock holding for that year had a value of 1,038,000,000 kr. (horses 317,000,000 kr., large stock 567,000,000 kr., sheep 84,000,000 kr., goats 12,000,000 kr., swine 47,000,000 kr.). To this must be added, reindeer 11,000,000 kr., feathered stock 14,000,000 kr., bee stock 1,500,000 kr., and rabbits 500,000 kr.

The following are the figures for dairies and milk-condensing factories:—

	1913	*1919*
Number of dairies and factories	677	460
Milk received in millions of kilograms	308·15	212·49
Amount paid for milk, in million kroner	33·13	94·87
Amount paid for milk per kgm. (in öre)	11·35	45·22

The total area of forests is approximately 26,640 sq. m. (69,000 sq. km.), representing a value of about 1,000,000,000 kr. Upwards of 61·4% of the forests are grown with pine and fir trees. The export value of forestry products in 1911–5 averaged annually 92,300,000 kr., and in 1916–9 186,000,000 kr. Exports of planed, cut, shaped and round timber in 1913 amounted in value to about 34,000,000 kr., exports of wood-pulp and cellulose to about 52,000,000 kr., and of paper to about 32,000,000 kr., or altogether about 120,000,000 kr. for forest products. In 1920 there were exported 386,000 tons of wood-pulp as against 496,000 in 1913, 211,600 tons of cellulose against 211,000 tons in 1913, 194,000 tons of paper and pasteboard against 184,000 in 1913, and a total of about 940,000 cu. metres of timber of all kinds against 1,044,000 cu. metres in 1913. Forestry progress is largely due to the Norwegian Afforestation Association (founded 1898), which has planted annually between 10 and 15 millions of new trees since about 1906.

Fishing Industry.—The fisheries are among the principal economic resources of Norway. It is calculated that nearly 100,000 men (1917) are engaged in them. Up to the close of the 19th century Norwegian fisheries generally retained the character of coast fisheries which they had had for centuries. Since then a great change has taken place and the great bank fisheries, carried on by fishing steamers and motor vessels chiefly from Aalesund (about 16,500 inhabitants), have become important. The Norwegian fishing fleet consisted in 1917 of 267 steamers, 11,048 motor vessels and about 40,000 sailboats, with an approximate total value of 100,000,000 kr. In 1917 the total yield of the coast fisheries was valued at 135,000,000 kr.

By law of Aug. 1 1919 the Storthing decreed that a Norwegian State Fisheries Bank should be established to finance the Norwegian fisheries, with a State-provided capital amounting to at least 5,000,000 kr. and a reserve fund of 750,000 kr. The object of the bank was (1) to grant loans for providing, rebuilding or repairing fishing vessels, (2) to arrange mortgages on fishing vessels, (3) for constructing or rebuilding icehouses, refrigerators, drying works, or making similar arrangements for the protection or improvement of fish products, (4) for the consolidation of fisheries by the provision of fishery appliances, equipment, etc. In terms of the law the bank is required to have its head office in the town where the Fisheries Directorate has its seat (therefore in Bergen), but loan offices may be established in such places as the king (Government) may decree. It is stipulated that in such places a union must be constituted of at least 50 members who hold themselves jointly and wholly responsible for the amount loaned to members. The administration of the bank consists of three members, with the Director of Fisheries as permanent adviser. The Fisheries Bank commenced operations in Nov. 1921. A State loan of 15,000,000 kr. was granted for the purpose.

Whaling Industry.—Scandinavians have recently taken a leading place in the whale-fishing industry. The pioneer was Svend Foyn (1809–1894), who introduced new methods into the industry; and since the discoveries of fishing fields in the Antarctic in 1906–7, whaling has developed in the South Atlantic and in several other parts of the world as well. The total production of whale-oil by Norwegian whaling stations amounted in 1908 to 69,000 bar., in 1911 to 344,000 bar., in 1913 to the "record" of 600,000 bar., in 1915 to 475,000 bar., in 1917 to 231,000 bar., in 1919 to 163,000 bar., and in 1920 to 212,000 bar. (6 bar. = 1,000 kgm. = 1 ton). The number of fishing companies was greatest in 1912, when there were 60, with 34 land stations and 39 floating boiling plants and 160 whaling vessels. The total value of oil from the different fields (S. Shetland, S. Georgia, N. and S. America, E. and W. Africa, and the northern seas,—Ireland, Hebrides, Faroes, W. coast of Norway and Spitzbergen) was (in millions of kr.) 4·5 in 1908, 15·8 in 1910, 29·1 in 1912, 34·5 in 1914, 35·5 in 1916, 28·5 in 1918, and about 60,000,000 kr. in 1920. Whaling is operated chiefly from the towns of Sandefjord, Tonsberg and Larvik. The share of Norway in the world's production of whale-oil amounted to nearly 50% in 1920.

Mining.—Norway is not an especially rich mining country, the ores and minerals being mostly of poor quality. The oldest and most important branch of mining industry is the working of copper ore and sulphuric pyrites, large quantities of which are extracted at Löken in the district of Meldalen, at Roros and at Sulitelma, while more scanty supplies are met with at many places, especially S. and E. of the Trondhjem Fjord. The production of iron ore increased rapidly after the beginning of the 20th century, and in 1915 it exceeded in weight that of copper ore and pyrites; in 1906–10 the production of the former was 72·3% and of iron ore 24·5% of the total mineral production in weight, whereas in 1911–5 the proportions were 46·3% and 48·4% respectively. On the other hand the value of the copper ore and pyrite products in 1906–10 was 81·3% and of iron ore 10·5% of the total value of production, and in 1911–5 the proportions were 63 and 29% respectively of the value produced. However, the production of iron ore will doubtless play a steadily increasing part, partly because of the extensive deposits of iron, chiefly in N. Norway, estimated by official experts at 175,000,000 tons, yielding about 100,000,000 tons of iron, partly because of the rapid development of the electrolytic methods for the smelting of iron ore, two important plants having actually been laid down for this industry, one at Ulefoss (1910), another at Tinnfoss, both in Telemark county. During 1914–6 the latter had an average yearly production of 6,300 tons of iron. For the present the exportation of iron ore has a far greater importance than the production of iron, export taking place from the vast deposits in northern Norway between Pasvikelven on the E. and Langfjorden in the W., with the great undertaking in S. Varanger, E. Finmark. During the period between 1905 and 1910 separation works were constructed here with quays, railways, etc. for export on a large scale, which commenced in 1910 and already in 1913–5 amounted to about 550,000 tons of slack and briquettes yearly. The number of workers employed at that period was 1,350.

In addition to copper and iron, silver is found in Norway at Kongsberg, nickel at Evje in Setesdal a little N. of Christiansand, titanium ore at Kragero, Arendal, Ekersund and Tvedestrand, while there are stone quarries of different kinds in many places, but mainly round about Fredrikstad and Fredrikshald, Östfold county; from here stone is supplied to the quays at Rosyth. Roofing slates are quarried in Valdres and at Voss. Digging and stone industries in 1914 occupied 6,556 workmen and in 1918 8,424. The weight of the total production of minerals and ore in 1914 was 1,210,000 tons and in 1918 540,000 tons, the values being 22,720,000 kr. in 1914, and 37,130,000 kr. in 1918. The value of the production from the mining works from the beginning of the century up to and including 1918 amounted to a total of 375,000,000 kroner.

Manufactures.—Norwegian industry was up till about 1890 essentially based on home consumption. But when the problem of the conversion of water-power into electric power was solved, it began to develop on an export basis. A rapid development during the ten years following 1890 was followed about the end of the century by a period of decline, which continued till 1904, when the first indication of a new and still greater advance manifested itself. The culminating point was reached in 1917, and during 1918 a period of depression again set in, which was still prevalent during 1921. A scale for the growth of industry is provided in the number of work-years (of 300 working-days) indicated by the aggregate of the country's industries, the figures being 92,000 in 1897 and 214,000 in 1918, an increase of about 133%. Progress, however, more clearly appears from the statistics of the amount of wages paid, which amounted in 1897 to 72,000,000 kr. and in 1918 to 619,000,000 kr.; the increases here were up to 1910 103%, to 1914 225%, and to 1918 756%. The average yearly wage of a workman was 785 kr. in 1897, 987 kr. in 1908, and 2,886 kr. in 1918, per working-year. After 1918 wages rose to treble what they were that year.

In 1897, out of 9,422 industrial works 3,799 or about 30% had mechanical motive-power; in 1917 about 55% of the 20,375 industrial works possessed mechanical motive-power, electric motors included; while during 1897–1918 the population rose 23%, the average number of persons engaged in all groups of industry rose 98·8%.

Numbers of persons employed in industries (in thousands)		Increase %	Population of the country (in 1000's)	Increase %
1897	70	. .	2,157	. .
1905	87	25	2,315	7
1910	112	60	2,395	11
1915	136	94	2,509	16
1917	148	112	2,629	22
1918	139	99	2,655	23

In spite of the immense growth of Norwegian industry, the annual value of imports increased during 1911–5 to a yearly average of 596,000,000 kr., while in 1915–8 it reached an average of 1,400,000,000 kroner.

Value of Imports.

	For consumption %	For production %
1896–1900	58·4	41·6
1906–1910	52·9	47·1
1918	36·8	63·2

The most important industrial commodities exported are: (1) pulp, cellulose and paper, (2) products of the mining industries, (3) electro-chemical and electro-metallurgical products, (4) canned goods. In 1913 the products of these branches of industry represented 89% of the export trade. The following tables show in which direction the various branches of industry developed during the World War:—

Industrial Exports: in million kroner.

	Total value	Pulp, Cellulose, and Paper	Ores	Electro-chem., Electro-metal. prod.	Canned Goods
1913	193·6	83·9	18·5	45·0	25·7
1916	536·1	169·7	32·5	182·7	51·3
1917	520·0	137·5	26·1	216·0	63·5

Distribution of Imports and Exports.

Countries	Percentage of Norway's imports		Percentage of Norway's exports		Percentage of total trade of Norway	
	1913	1918	1913	1918	1913	1918
Germany	29·80	11·01	20·84	11·27	26·02	11·11
Great Britain & Ireland	24·76	28·96	24·31	41·45	24·57	33·65
Sweden	14·35	17·66	6·19	12·84	10·91	15·84
United States	6·64	15·94	7·95	0·93	7·19	10·30
Other Countries	24·45	26·43	59·29	33·52	31·31	29·11

How the turnover of Norwegian trade increased during the present century appears from the following table (some figures for the previous century being given for comparison):—

	Imports million kroner	Exports million kroner	Total	Value per inhab. in kr.		
				Imports	Exports	Total
1861–5	75·0	54·5	129·5	45·75	33·22	78·97
1881–5	158·2	114·8	273·0	82·40	59·80	142·20
1901–5	289·0	183·5	472·5	127·89	81·19	209·08
1911–5	596·4	422·7	1019·1	246·96	175·02	421·98
1916	1353·7	988·3	2342·0	542·11	395·81	937·92
1917	1661·8	791·4	2452·7	647·93	308·65	956·58
1918	1252·6	755·0	2007·6	477·35	287·75	765·10
1919	2583·7	782·1	3365·8			
1920	3029·9	1241·8	4271·7	. .	. .	. .

The import value of the most important goods in 1920 was as follows (in million kr.):—grain 260, meat and pork 53·6, eggs 14·3, sugar 113·7, coffee 31·5, clothing 66·7, shoes and boots 44·2, woollen ware 128·9, cotton goods 128·4, silkware 19·2, coal and coke 343·5, petroleum and benzine 65·4, metals 310·6, fertilizers 10·6, machinery 102·2, ships 367·2, automobiles 45 and wine 46·2.

The values (in million kr.) of the most important exported goods in 1920 were:—fish 158·9, canned goods 40·4, fish-oil 26·2, condensed milk, etc., 13·1, timber 109·8, wood-pulp and cellulose 224·6, paper 222, artificial fertilizers (Norwegian saltpetre) 60·4 and ships 42·2. In addition, foreign goods to the value of about 59,000,000 kr. were reëxported.

A calculation of the value of foreign trade based on the prices obtaining in the normal year of 1913 gives the following results:—

	Imports million kroner	Exports million kroner	Imports Index fig.	Exports Index fig.
1913 . . .	339·3	252·9	100	100
1920 . . .	518·3	218·5	153	86
8 months 1921 (Jan.–Aug.)	263·2	137·5	78	54

From this it will be seen that there was a very striking decrease of exports as compared with the last normal year before the war. The greatest decline occurred in such groups as fish, canned goods, timber, wood-pulp and cellulose, paper and cardboard and unworked metals,—the most important articles of the country's export trade. As regards imports, industrial raw material showed a special decrease as compared with 1913.

The industries of Norway were organized into a national confederation in 1919, the Norwegian Industrial Confederation, after the dissolution in 1918 of an earlier (1886) union, the Norwegian Mutual Trade and Industry Association. The organ of the Confederation is the *Norwegian Industry*, which since 1919 has been published weekly in Christiania. Another organization for safeguarding industrial interests is found in the Norwegian Employers' Association, established in 1900. In 1921 it included about 2,200 undertakings, employing about 85,000 workmen. The administrative headquarters are at Christiania, and its organ is *The Employer*, which appears twice monthly in Christiania.

Insurance.—Private insurance work is carried out in Norway partly by mutual companies and partly by private joint-stock companies. During the war the number of companies, especially stock companies, as well as the amount insured, premiums, etc., increased very greatly. Prior to the war there were 25 joint-stock companies which carried out insurance against loss or damage; in 1915, 11 new companies were established, 12 in 1916, 27 in 1917, and 40 in 1918. The total number of insurance companies in 1921 was about 120, with a nominal share capital of 160,000,000 kr., of which half was paid up. There are 8 life insurance joint-stock companies, with a total capital of something over 6,000,000 kr. in addition to 3 mutual life insurance companies. Besides these companies there is the Norwegian Fire Office (*Brandkasse*), which has always taken the leading part as regards the insurance of houses and buildings. The companies which made the greatest progress during the war were those doing marine insurance, the number of which increased from 17 in 1913 to 77 in 1918. The total capital of Norwegian insurance companies at the end of 1920 was estimated to amount to about 500,000,000 kroner.

Recent Political History.—On the dissolution of the Union between Norway and Sweden in 1905 the internal party strife, which for a generation had exhausted the best energies of the country, ceased. It had been carried on between the Conservative party—chiefly an official party, which up to the severance of the union with Sweden sought to maintain this union so long as it could be carried out in a form in accordance with Norwegian national feeling—and the old Left, which still maintained its traditions dating from the 'eighties of the 19th century, when Johan Sverdrup (*see* 19.813) was all-powerful in Norway's domestic politics. The negotiations with Sweden under successive Governments had in 1905 reached a deadlock, and a crisis in the union presented itself at the same moment when the Norwegian parties were prepared to unite for common action. It was the fortune of Chr. Michelsen (b. 1857) to find this concord. With the liquidation of the union, and the consequent revision of the constitution as his sole programme, he formed in 1905 the so-called "7th of June Government," which practically had the whole Storthing and the whole of the people behind it. Meanwhile a new electoral party had entered into politics. From 1890 Labour had begun to separate itself from the Radical Left, and had formed the Social Democratic party, which subsequently increased in numbers and influence at succeeding elections, both in the Storthing and municipal councils. Although this party was not represented in the 1905 Government, it was nevertheless capable of forming a group which afterward had to be reckoned with. Simultaneously the new trade-union movement continued to progress, and gradually secured a separate influence in politics. On June 22 1906 the coronation of the new Norwegian King took place at Trondhjem, and thereby the mandate of the joint Government was consummated. The Storthing, however, continued its functions until a new National Assembly should be elected in the autumn. Chr. Michelsen personally opened the election campaign on June 26 with an address at Trondhjem outlining his programme. In it he recommended continued coöperation between the parties in order to "safeguard and consolidate the results of 1905." The Government programme involved the maintenance of the coalition, with a leaning towards the Left, and provided a basis for the "new labour day" which was now to be inaugurated. This standpoint so far secured the adhesion of the electors that there were elected 77 Liberals and Left of all shades, the majority being Coalitionists, while 36 Conservatives were elected who would only promise a conditional support to the Government, and 10 Socialists who stood in direct opposition to them. The position of the Government was therefore weakened after the meeting of the new Storthing, and its opponents combined themselves into a constantly more aggressive opposition. Attacks on the Government were notably strong during the spring session of the Storthing in 1907, when the question of establishing by law one of the "concessions" recommended by the Radical Left—for the purpose of conserving the natural resources of the country—came into the foreground.

In fact, the pivot of Norway's politics during 1906–12 was the so-called "Concession-case," *i.e.* the right of foreigners as well as of natives to hold, by Government concession, real property in Norway, especially waterfalls, mines and forests. This question came to the front during the second half of 1906, and in 1907 it gradually became obvious that it was about to cause a split in the majority *bloc*. However, this did not take place until after the withdrawal of Michelsen from public life in Oct. 1907, when the Cabinet was reconstructed by Jörgen Lövland (b. 1848), Minister for Foreign Affairs in the Michelsen Government. It was Mr. Lövland who negotiated the treaty guaranteeing the territoral integrity of Norway, signed on Nov. 2 1907, by Norway, France, Germany, Great Britain and Russia. One section of the large Government majority was in sympathy with the liberal "concession policy" of the Government, whereas the radical wing of the same majority claimed the issuing of laws that would limit the invasion of foreign capital. This conflict on one of the greatest problems of national economics finally led to a rupture, the result of which was the establishment of two different parties, the Radical or "Consolidated Left," and the "Liberal Left." In March 1908 Lövland's Cabinet, backed up by the Conservatives, and the Liberal Left, was driven to resign by the opposition of the Radicals and the Socialists. Gunnar Knudsen (b. 1848) formed a new Cabinet (March 18 1908). Besides being Premier he held the portfolio of the Minister of Finance. In his Government the radical Minister of Justice, Johan Castberg (b. 1862), attained great influence, especially as regards the elaboration of the new Concession Laws, which were passed in 1909. These laws, concerning (1) waterfalls, mines and other real property, and (2) forests, were sharply opposed by the Conservatives and the Liberal Left, as representing too severe an encroachment upon private property. In consequence of this opposition a reorganization of the Liberal party took place in March 1909, initiated by Chr. Michelsen, the former Premier. The coöperation between the reorganized Liberals and the Conservatives resulted in a new majority for these parties at the next general elections (Oct. 1909). This majority included 63 Conservatives and Liberals, as against 47 Radicals, 11 Socialists and 2 Independents.

In the meantime an old question of controversy between Norway and Sweden had been settled. From olden times the suzerainty over a certain group of submarine skerries (shelves) in the Kattegat, the *Grisebaaer* (Swedish: *Grisbadarne*), situated between the Norwegian group of islands, the *Hvaler*, and the Swedish islands of *Koster*, in the waters south of Fredrikshald, had been a matter of dispute between the two countries. The Grisebaaer, on account of the lobster fisheries in these waters, are not without a certain economic value. On March 14 1908 a convention was concluded between Norway and Sweden, by which the question of the right drawing of the border-line between these skerries was submitted to arbitration by the Hague Tribunal. The decree of the Tribunal, on Oct. 23, decided that the border-line be drawn in such a way that the Grisebaaer proper fell to Sweden, and a group of smaller submarine rocks, the so-called Skjöttegrunder, to Norway.

When the new Storthing met in Jan. 1910, Mr. Gunnar Knudsen tendered the resignation of his Ministry. It was with some difficulty that a new Government was formed, but finally, on Feb. 1 1910, the leader of the Liberals, Wollert Konow (from Fane, near Bergen, b. 1845), succeeded in constituting a Cabinet, consisting of Liberals and Conservatives, the former being preponderant within the Government, although the latter represented the majority in the Storthing. Women, having obtained in 1907 conditional rights of Parliamentary voting, were, in June 1910, granted by this Government the unrestricted Municipal vote. While the Konow Cabinet was in power a new Concessions Act and a new municipal taxation law were passed, both in 1911. In the same year, a new cable communication was established between Norway and Great Britain (Arendal–Newcastle).

The disproportionate representation of the parties in the

Government caused friction between the two allied groups and ultimately brought about a crisis resulting in the resignation of Konow and some of his Liberal colleagues (Feb. 1912). The Government was reconstructed by Jens Bratlie (b. 1856), with Conservatives as its chief element. Among the members of the Konow Government who passed into the Bratlie Cabinet was the Foreign Minister, Johannes Irgens (b. 1869), formerly Norwegian Minister in London, and after 1916 Minister in Copenhagen. When Mr. Bratlie became Premier he had to resign his seat in the Storthing and was replaced by the vice-deputy member,[1] Miss Anna Rogstad (b. 1854), who had been in the Storthing during the temporary absence of Mr. Bratlie in 1911. The case attracted general notice, as Miss Rogstad was the first woman representative in any independent National Assembly outside that of Finland, which admitted women in 1907.

At the general elections of 1912 a Radical wave swept the country, the final results being 76 Radicals, as against 24 Conservatives and Liberals and 23 Socialists. The Government, however, decided to remain in office till the Storthing met in Jan. 1913, when a new Cabinet was formed under the leadership of Gunnar Knudsen as Premier, with Niels Claus Ihlen (b. 1855; owner of a great foundry, and between 1908–10 Minister of Public Works) as Foreign Minister. This Cabinet remained in power until 1920.

Although the new Storthing, the outcome of the general elections of 1912, included no women, universal suffrage was extended to women in 1913. By an amendment of the constitution adopted in that year, Cabinet ministers were entitled to hold seats in the Storthing.

When war broke out in 1914 an extraordinary Storthing was called into session to decide upon the measures to be taken for the maintenance of the neutrality, or possibly for the defence, of the country. The sum of 10,000,000 kr. was voted for military purposes. A provisional moratorium was decided upon, and the right to redeem the Bank of Norway notes in gold was suspended for the time being. However, it was felt that the World War meant difficulties and dangers to each and all of the northern nations. The continual maintenance of neutrality was, to all of them, a matter of vital interest. Already on Aug. 1 1914, acting in coöperation, the authorities of the three countries passed resolutions binding the respective nations to take up and maintain an attitude of strict neutrality in the conflict between Austria-Hungary and Serbia. On Aug. 4 this declaration was repeated and extended so as to form a general rule of conduct during the war. On Aug. 8 a separate agreement was signed, in Christiania, on behalf of the Norwegian and Swedish Governments, embodying binding assurances from both sides, the purpose of which was to remove any possibility of either of the two kingdoms preparing hostile actions against the other.

The outcome of this desire for joint action in the political and diplomatic fields was a number of official meetings held during the war between the Monarchs, the Premiers and the Foreign Ministers of the Scandinavian countries. The first of these took place Dec. 18–19 1914, when, invited by the Swedish King, the two other Scandinavian Sovereigns met him at Malmo, where joint action was agreed upon in regard to solving a number of diplomatic questions, and questions appertaining to international law. In accordance with resolutions arrived at during this inaugural meeting, conferences were held in Copenhagen (March 9–11 1916), in Christiania (Sept. 19–20 1916), and in Stockholm (May 9–11 1917), where the Premiers and the Foreign Ministers of the three countries met. On Nov. 28–30 1917, the Kings of Sweden and Denmark paid an official visit to the Court of Christiania. King Haakon, on Sept. 16–18 1918, in Stockholm, returned the official visit of the King of Sweden. During June 26–28 of the same year, in continuance of the previous conferences of Scandinavian Cabinet ministers, a fresh meeting was held in Copenhagen. The last in this series of conferences took place in Stockholm (May 26–28 1919), in Christiania (Feb. 1–4 1920), and in Copenhagen (Aug. 28–30 1920). Besides these diplomatic and political conferences, a number of inter-Scandinavian meetings were held for the purpose of looking after common interests in the field of legislation, communication, commerce, administration and science. This new "Scandinavianism" differs essentially from the old ideological "University-Scandinavianism" of 1860. The adherents of the new movement acknowledge an absolute equality of rights in the relationship between the three nations, and presuppose a feeling of sympathy between these peoples, thrown upon each other through geographical propinquity, historical development and kindredship of race. The recognition of this fact gives rise in the three countries to a parallel "movement" for the purpose of organizing, in regular and permanent forms, inter-Scandinavian coöperation. The feeling grew steadily stronger that a similar organization would be of great import even in post-war times and on Feb. 24 1919 a great number of representative men in the three countries addressed the Public with an invitation to form a new society, the *Norden* (the North), having for its programme the defence of Right and Peace and common interests. The society has established a separate section and sub-sections for each of the three countries, having each their own management. The Norwegian section was founded on April 12 1919. A year-book is issued for the whole of the society. Its title is *Norden.* Two volumes, 1920 and 1921, have been published (Stockholm and Christiania).

A memorable year in the history of Norway was 1914, one hundred years having then elapsed since the country broke from Denmark to start as an independent state, sharing with Sweden, until 1905, her King and the administration of foreign affairs. The jubilee year was celebrated with a general Norwegian retrospective exhibition, at Christiania, embracing industry and fine arts. This exposition proved that in all fields of economic, industrial, technical and social activities, and not less in the spheres of intellectual life, science and art the country had progressed in a wonderful degree. Even financially the exhibition would have been a success, had it not been interrupted by the war.

The critical situation evoked by the outbreak of war in the industries of the country rendered emergency measures necessary in order to secure supplies, especially food-stuffs and coal. On Aug. 2 1914 a limitation was put on the amount of bread allowed to be sold, and mill owners suspended all orders. On Aug. 3 a panic set in, and the population of the towns stormed the shops to buy up goods. On Aug. 4 a Victualling Commission for the whole country was established. The task of this commission was to regulate the purchase from abroad of all the more important food-stuffs and necessaries of daily consumption, and to control their sale. On Aug. 5 a Royal decree was issued ordering the establishment of local victualling councils in all communes. The extraordinary Storthing which assembled on Aug. 8, however, helped to allay the feeling of panic, and a more tranquil condition came about by degrees. On Aug. 18 1914 war insurance for the Norwegian merchant fleet was established, and on Sept. 8 a private joint-stock company, the Norwegian Goods War Insurance Co., was instituted. At the close of Sept. the maximum prices already introduced for food-stuffs were provisionally abolished, except for certain kinds of bread. In place of them the Victualling Commission received authority to control prices and imports. This arrangement later involved a division of such administrative work, a Price Directorate being established in the following year to exercise control over the prices of all goods in retail trade. On Sept. 26 the Norwegian Government was authorized to take up a loan from Hambro & Son, London, of £600,000 (at 7% interest), so as to pay for two warships which were under construction for the Norwegian Government in English shipyards. These ships were, however, never delivered, since the British Government laid an embargo on them before their delivery. On Nov. 3 1914 England declared the whole of the North Sea to be a war zone, and Norwegian shipping was restricted to a small passage, Lindesnes–Farnesland; and on Nov. 5 the British Government stopped the passage N. of Scotland, though permission was given for ships of the Norwegian-American Line, as from Nov. 7, to go that way. In 1915 and 1916 a considerable quantity of corn, meal, sugar, forage and fertilizing stuffs was bought in and contracted for by the Victualling Commission, which took over the whole trade in these articles. In 1915 a special commission was set up for dealing with the question of the national corn-supply in the event of the creation of a State monopoly. From 1916 all prices began to increase tremendously. The rise in prices kept pace with the ever-advancing increase in wages and salaries, and the pressure of high prices was rendered more acute by the high freights on all supplies from abroad. Thus from 1916 steadily increasing difficulties arose for most of the industries of the country, and the greater part of the population was affected, though an exception was found in the case of shipowners, whose profits were large. From March 8 1916, the Bank of Norway once again became obliged to redeem its bills with gold, but practically no advantage was taken of this, the population remaining passive as regards the facility of again obtaining gold. In 1916 it became necessary to introduce rationing of all the more important food-stuffs, especially all grain and meal products, meat, sugar, coffee and tea. The increasing difficulties of transport from abroad during 1917 rendered it necessary on Jan. 13 1918 to introduce a complete rationing of sugar, coffee, corn and meal goods. In the spring of 1919 the abolition of emergency regulations commenced, but it was carried out very slowly and with great caution, as all economic and social conditions had been deranged.

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[1] In Norway every member of the Storthing had at that epoch a "vice-deputy member," elected in the same way and at the same time. This vice-deputy had to sit in the place of the actual member if he were prevented from attending through illness, etc., or if he were included in the Government. This way of substituting members of the Storthing was altered in 1920.

In June 1916 a heavy struggle in the labour market arose. It involved 120,000 industrial and transport workers and gave rise to some very frenzied demonstrations. On July 9 1916 the Storthing, as an urgent measure, and against Socialist protest, adopted a law compelling arbitration in industrial disputes. The last of the great labour conflicts of that time (mine-workers) was settled under the new Arbitration Law on July 22 1916.

The destruction of Norwegian merchant shipping by sinking and torpedoing commenced in the first days of the war, and increased steadily later until nearly the close of the war. In the autumn of 1916 even the Arctic Ocean became involved in the danger zone. Nevertheless, from the first day of the war till the last, Norwegian shipowners and seamen maintained their shipping on all the seas, though for a long time the heavy losses in ships could not nearly be replaced by new tonnage. The total loss of the country on the sea was 831 ships, of which 652 were steam or motor and 179 sailing ships, making a total of 1,238,300 registered tons. One thousand two hundred men were slain by torpedo or mine. These facts made a great impression in the Entente countries, and testimony hereto was provided by the presentation of a commemorative tablet for the Norwegian seamen lost through the war, which was placed on the masonry of the old fortress in Bergen. The memorial tablet was unveiled with great ceremony on Oct. 2 1921 by the vice-president of the Norwegian Club in London, Mr. Slingsby. The inscription reads: "To honour the memory of that great Company of free Norsemen, who, though at peace with all men, dared to defy the perils and horrors of War, and in rightful service endured fearlessly to the end, this monument is set up by their friends and admirers in Great Britain." (S. C. H.)

Norwegian Literature

The first decade of the twentieth century was memorable in Norwegian literature for the passing away of the four great classics of the preceding epoch: Ibsen, Björnson, Lie and Kielland. After their death Knut Hamsun (b. 1857), Hans E. Kinck (b. 1865), Arne Garborg (b. 1851) and Gunnar Heiberg (b. 1857) became the leading literary figures, the first two chiefly as novelists, Garborg as a social and religious philosopher and poet, Heiberg chiefly as a dramatist and essayist. After the constitutional crisis of 1905, economic and social problems came to the forefront in Norwegian public life, and new ideas became prominent also in the field of fiction. There was a continuation, too, of the *maal* controversy (*see* 19.818), *i.e.* the effort to create an entirely independent Norwegian literary language based upon the peasant dialect (*landsmaal*), descended from the old Norse, in place of the Dano-Norwegian *rigsmaal*.

Hamsun had now become the most prominent representative of autobiographic fiction in Norwegian literature. His earlier productions in novels (especially *Victoria*, 1898), and particularly in his trilogy of dramas, *Rikets port* (1895), *Divets Spil* (1896) and *Aftenröde* (1898), were more especially occupied by the play and problems of eroticism, while his volume of verse, *Det Vilde Kot* (1904), contained emotional lyrics, including elegant poems of homage to Björnson and Byron. He then turned back again to self-absorbing psychological analysis in a series of narratives, *Under höststjernen* (1906), *Benoni* (1907), and *Rosa* (1908), which combine a curious bitter-sweet irony of life with cool epic presentation. These narratives formed a stepping-stone to his cycle of social romances, *Den siste glaede* (1912), a satire on tourist traffic which he denounces as demoralizing the Norwegian people, *Börn av tiden* (1913), *Segelfoss By* (1915), *Markens gröde* (1917), *Ny jord* (1918) and *Konerne ved vandposten* (1920). In these mature works, Hamsun has unrolled his picture of modern Norway; he here finds that industrialism has displaced agriculture, unhealthy speculation the honest, unassuming, but ethically invigorating toil of the day. Many of his books have been translated in England and America, such as *Growth of the Soil* (1920), *Pan* and *Mothwise* (1921; originally published in 1904 under the title of *Svärmere*). *Markens gröde* (*Growth of the Soil*) in 1920 secured him the Nobel prize. Hamsun's collected works have appeared in many editions, but the most complete is in the Jubilee Issue, published during the winter of 1921–2.

In Hans E. Kinck a strange, sombre, bitter and mocking romanticism is accompanied by a distinct strain of mystic horror. But no writer has excelled him in knowledge of the characteristics of the people of Norway. He himself grew up in Setesdalen and Hardanger, where tradition is still fresh and living. He displays his talents best in small peasant stories; one of his chief types is a man who is half dreamer, half horse-dealer. His series of romances, *Sneskavlen Brast* (1919), is remarkable for its weird realism. His dramas exhibit a fantasy which suggests the inspiration of Victor Hugo; *Den sisste gjaest* (1911) and *Mot Karneval* (1915) introduce Aretino and Machiavelli respectively, and his interest in historical personalities is also shown in the arresting essays *Reconnaissancemennesker* (1916). Kinck's profuse use of dialect words and self-coined expressions makes his works somewhat difficult even to his own countrymen; but he has found an inspired American interpreter and translator in Alfred E. Henderson, whose version of *Dr. Gabriel Jahr* was published in New York in 1921.

Arne Garborg had already written a cycle of lyrics in the *landsmaal*, *Haugtussa* (1895), which cleverly pictured a young peasant girl's natural emotions, her belief in subterranean and supernatural beings. In later years he showed his poetic ability in masterly translations into that tongue,—*Odysseuskvædet* (1918), a selection from the *Mahabharata* (1921), Holberg's classical comedy *Jeppe paa Berget* (1921). The last named was for presentation at a theatre established for the *landsmaal*, in the founding of which he took part together with his wife, Hulda Garborg (b. 1862), who has also written a volume of romance (*Frau Evas Dagbog*, 1905) and several plays. A jubilee edition of Arne Garborg's collected works, *Skrifter i samling*, was appearing in 1921–2.

Gunnar Heiberg has produced a series of effective dramatic works, mostly dealing with scenes in Norway. In a series of political and social plays, with relentless mockery, he pursues rhetoric when he encounters it,—the Björnson ethical imperative in *Kong Midas* (1890), nationalism in *Folkeraadet*, journalistic self-importance in *Harald Svan's mor*, philanthropy in *Kjaerlighet til naesten*, patriotism in *Jeg vil verge mit land* (a play on Norwegian politics at the dissolution of the union between Norway and Sweden in 1905), and, above all, with Aristophanic mockery in the comedy *Paradesengen*, which aroused a great sensation by aiming directly at Björnstjerne Björnson and his family. Some of his journalistic articles from Paris, where he resided for many years, were later collected in *Parisbreve* (1909), *Set og hört* (1917), *Ibsen og Björnson paa scenen*, *Franske visiter*, *Norsk teater* (1920).

The realistic romance in vogue during 1870–80 retained some talented votaries in Norway, above all in Johan Bojer (b. 1872), who discusses modern problems in the romances *Liv* (1911), *Den Store Hunger* (1916), *Verdens Ansigt* (1917), *Dyrendal* (1919), *Samlede romaner og fortaellinger* (1917), and also in the plays *Troens magt* (1910) and *Sigurd Braa* (1916). Bojer's works are translated into English (*The Great Hunger*, *The Power of a Lie*), French and German; and a collection was published in America (Gade, *Johan Bojer*, *The Man and his Work*, New York, 1920). Nils Collett Vogt has continued the tradition of Wergeland and Björnson. For the centenary celebration he wrote an impressive cantata swelling with patriotism. His poetic collection *Hjemkomst* (1917) gives a beautiful expression of joy at returning home after many years' exile.

The more modern school of romance has two typical writers in Sigbjörn Obstfelder and Thomas P. Krag. Of these Obstfelder is the more piquant and original. His books were little noticed during his lifetime. His whole works only comprise two volumes (standard edition, 1921). All his writings are characterized by a peculiar artlessness, and the profundity of a solitary thinker. Thomas P. Krag (1868–1913) is better known. His stories have a delicate lyricism which lends them charm. In his religious romance *Gunvor Kjeld* he displays his first character-painting. His brother Wilhelm Krag has also displayed considerable productivity.

Of the younger lyric writers who came to the front during 1910–20, Herman Wildenvey, Olaf Bull and Arnulf Överland are the best known. Wildenvey (b.1886) heralds a new flowering in Norwegian lyrics. His graceful and captivating buoyancy secured him public favour from the outset (*Digte*, 1908). Olaf Bull's poems (*Samlede Digte*, 1919) are virile and reflective. Arnulf Överland is characterized by a strongly self-critical spirit.

Most of the newer Norwegian novelists have deserted "problems" for realistic delineation. Peter Egge (b. 1869) began with pictures of folk-life in the form of narratives, *Nordfra*, *Tröndere*, *De graa haar*, and plays, *Faddergaven* and *Jakob og Kristoffer*. From these pictures of folk-life he went on to romance in *Hjerter* (his chief book, 1907), *Laenken*, *Villaen*, *Unge dage*, and the witty comedy *Kjærlighet og venskap*. Later plays are *Felen*, *Idyllen*, *Brist* and *Narren*, soul-dramas recalling Ibsen.

Tryggve Andersen (1867–1920) is a narrator of high rank. His first book, *I cancelliraaden dage* (1897), was a series of lively interiors from the broad country of Mjösen at the commencement of the 19th century. His second, *Mot kvæld* (1900), deals with the last struggle of a poor and homeless soul-sick man to attain the balance and substance of life. His stories *Gamle folk* (1904), *Bispesönnen* (1907) and *Hjemfærd* (1913), with other writings, are collected in *Samlede fortællinger* (3 vols. 1916).

Kristian Elster, the younger (b. 1881), is a writer of a different style, but a robust artist. His best work is in the three consecutive narratives *Ilaere*, *Landeveien* and *Mester*, which give expression to his warm sympathy with the poor and oppressed. His critical essays are collected in *Fra tid til anden* (1920).

The popular humorist Jacob Hilditch maintained his reputation during later years, the best of his work being collected in *Sjöfortællinger* (1906) and *Fortællinger fra folklivet* (1908).

Hjalmar Christensen (b. 1869) has produced a series of narratives, *Fra Vestlandet*, *Fögedgaarden* (1911), *Brodrene* (1912), *En gamle bygd* (1913), *Den nye bygd* (1914), *Far og sön* (1915), *Et liv* (1916), *Tuntræet* (1917), *Deemring* (1918), which are collected in *Samlede Romaner* (1920). Together with F. E. Christensen (b. 1872) he also wrote *Fædrelandet i verdenskrigen lys* (1916), a frank historico-political account of Norway's position in the World War.

Among the younger generation an outstanding figure is Johan Falkberger (b. 1879), a mine-worker who became editor of a Socialist paper, in which he wrote many sketches from the lives of the workers. He then produced in rapid succession a series of narratives, *Svarte Fjelde* (1907), *Urtidsnat* (1909), *Fakkelbrand* (1909), *Eli Sjursdotter* (1913). His *Lisbet paa Jarnfjeld* (1915) is remarkable for its power and pathos. Oskar Braaten (b. 1881) in like manner worked himself up from a lower station, and his subject is the working population of the suburbs of Christiania; he writes in a popular language of Eastlands colouring, resembling the *landsmaal*.

Gabriel Scott (b. at Leith, Scotland, 1874), who had already made his *début* at the close of the 19th century, came to the front again with his comedy *Himmeluret* (1905), an excellent piece of psychology in *Camilla Dyring* (1906), and the witty *Babels Taarn* (1910), depicting the struggle between the *landsmaal* and the *rigsmaal*. *Det Flyvende Börd* (1906) is a story of adventure; and the romances *Jernbyrden*, *Enok Rubens Levnedslöb* and *Kilden* deal with life in olden times on the coast of southern Norway.

The gifted authoress Ragnhild Jölsen (1875–1908), in her narratives *Ve's Mör*, *Rikka Gan*, *Fernanda Mona*, *Brukshistorier*, *Hollasas Krönikel*, has left some characteristic pictures of the Norwegian eastern countryside. And among the women writers who have followed her the most important is Sigrid Undset, whose stories and romances have been collected in five volumes (1921).

As a wit and satirist, Nils Kjær (b. 1870) has taken a leading place, notably through his dramas *Regnskapets Dag*, and *Det Lykkelige Valg*. A complete edition of Kjær's dramatic and critical works was being issued in 1921–2. Sigurd Mathiesen (b. 1871), whose earlier stories *Unge sjæle*, *Hide Unas* and *Nag* were followed in 1919 by the romance *Francis Rose*, showed himself to be a true poet in his collected verse, *Gjennem aarene*.

The cosmopolitanly inclined Seblein Lieblein (b. 1866), son of the famous Egyptologist, J. D. C. Lieblein (1827–1911), has written a number of entertaining stories, notably *Den sisste av sin slegt* (1910) and *Peter Flytt's haendelser*. Another author international in thought and choice of material is Eilert Bjerke (b. 1887), among whose works are the novels *Mennesker og fauner* (1909), *Fri Fugle* (1910), *Meteorer* (1918), *Livsfyrsten* (1914) and *Sværmere i Solen* (1917).

Sigurd Wesley Christiansen (b. 1891), beginning with *Seiren* (1915) and *Thomas Hergel* (1917), proved his talent for fiction by *Vort Eget Liv* (1918), and for drama by *Offerdöden* (1918). Ronald Fangen (b. 1896) likewise in 1915 produced his first romance *De Svake*, following it with *Slegt föder slegt* (1916) and *En Roman* (1918). His essays, *Streiftog i digtning og taenkning* (1919), show him also to be a subtle critic of literature. In 1921 his first play, *Syndefald*, was produced at the National theatre in Christiania.

Jens Tvedt ranks highest among the *landsmaal* writers, with his sketches of western Norway country life. Among other writers in *landsmaal* Olav Dunn (b. 1876) takes a leading place with his romances *Paa Lyngsoia*, *Juvikingarne*, and *I Blinda*. The chief lyricist of the *landsmaal* is Anders Hovden (b. 1860), and the younger generation is well represented by Kristoffer Uppdal (b. 1878).

(S. C. H.)

NOSKE, GUSTAV (1868–), German Socialist leader and former Republican Minister of National Defence, was born July 9 1868 at Brandenburg. He was by occupation a worker in wood, but took to writing for Social Democratic newspapers, and was from 1897 to 1902 on the staff of the *Königsberger Volkszeitung* and afterwards on that of the *Volksstimme* at Chemnitz. At the end of the latter year he returned to Brandenburg, where he was elected a member of the municipal council and in 1906 a member of the Reichstag. Throughout the World War he belonged to the Governmental section of the Socialists, and voted in the Reichstag for the war credits. When in the first week of Nov. 1918 the mutiny, which had broken out in the navy at Kiel, developed into sanguinary street fighting and the naval authorities were unable to restore order, Noske was sent to Kiel with the Democratic Secretary of State, Hausmann, and, after a conference with representatives of the sailors and dockyard workers, arranged a suspension of hostilities on the basis of the sailors', soldiers' and workmen's demands. This triumph of the mutiny was the beginning of the German revolution, and the sailors from Kiel and other northern ports carried the idea of Workmen's and Soldiers' Councils throughout the north of Germany and ultimately to Berlin. Noske was appointed governor of Kiel, where he remained until he was recalled on Feb. 11 1919 to assume the office of Minister of National Defence (*Reichswehrminister*) and to organize military forces for the suppression of the Communist insurrections in the capital. In his book *Von Kiel bis Kapp* (1920) he gives an account of the difficulties which he encountered in getting together an efficient army for home defence. He had to accept the services of many ex-officers whose hearts were with the old régime, and he also found it difficult and, in some cases impossible, to dissolve reactionary Free Corps like those which returned from the Baltic provinces or like Ehrhardt's Marine Brigade. His dependence upon troops and leaders of this character facilitated the military insurrection under Gen. von Lüttwitz which supported the Kapp *coup* of March 13 1920. Noske appealed in vain to the troops in Berlin to resist the occupation of the capital by the forces which Lüttwitz led from the camp at Döberitz. He was one of those ministers who, with President Ebert and Chancellor Bauer, fled from Berlin to Dresden, and afterwards to Stuttgart. After the suppression of the Kapp troubles and the return of the Ministry to Berlin it was impossible for Noske to remain in office, as the labour masses, who by the general strike against the Kapp "Government" had for the moment obtained a decisive influence upon affairs, regarded him as having been too tolerant of reaction in the army and as having manifested excessive ruthlessness in the suppression of the Communist bands. Noske, notwithstanding the genuineness of his Republican and Social Democratic opinions, enjoyed considerable popularity in the new army and with the reactionary friends of law and order, as a man of decided character, great energy and resourcefulness in times of crisis.

NOVA SCOTIA (*see* 19.830).—The pop. of this Canadian province increased from 459,574 in 1901 to 519,000 in 1911, including 122,084 in Cape Breton, representing an average density of 24·2 to the sq. mile. During the decade 1911–20 the growth of industry in towns like Sydney tended to compensate for the loss of rural population by emigration to the eastern States and to the Canadian N.W., which has largely ceased. About 80% of the pop. are of British descent. The chief towns of Nova Scotia, with their pop. in 1911 and 1920, are as follows:—

	1911	*1920*
Halifax (capital)	46,619	65,000
Sydney	17,723	21,400
Glace Bay	16,562	18,600
Amherst	8,973	9,250
Sydney Mines	7,470	8,700
New Glasgow	6,383	7,400
Truro	6,107	7,600
Yarmouth	6,000	6,600
Springhill	5,713	6,400
North Sydney	5,418	6,780
Dartmouth	5,058	6,400

The Legislative Council of Nova Scotia consists of 21 members appointed by the Executive Council of the province, a Legislative Assembly of 43 members elected by the people, and an Executive Council of eight members chosen from the Legislative Assembly and the Legislative Council. The province is represented in the Dominion Parliament by 16 members of the House of Commons and 10 Senators. The revenue is chiefly made up of the Dominion subsidy and of royalties on mining concessions, chiefly those on coal. As a consequence the direct taxation which the people of Nova Scotia have to pay is very small, and is limited to the local rates which they levy on themselves for municipal and school purposes.

Each county has its high school or academy, and there are several universities. The province supports a normal school and agricultural and horticultural schools at Truro. Dalhousie College and University at Halifax is undenominational. Halifax has also a school for the blind and an institution for the deaf, and is the seat of a Presbyterian theological college. The universities of King's College at Windsor, Acadia College at Wolfville, and St. Francis Xavier at Antigonish are under the jurisdiction of the Anglicans, the Baptists, and the Roman Catholics respectively. A technical college maintained by the Provincial Government is in operation at Halifax, and technical night-schools are conducted in every industrial town in the province. The Executive Council is the supreme governing body and acts with the superintendent of education. It appoints a board of examiners for teachers and a staff of school inspectors. The province is divided into school districts, for each of which a board of school commissioners is appointed by the Government. The districts are subdivided by the commissioners into school sections, and these are administered by a board of three trustees elected by the ratepayers. The schools are supported by Legislative grants, supplemented by a statutory municipal taxation. In 1918 there were 2,859 schools, 3,037 teachers, 108,094 pupils; the total expenditure on education was $1,818,155, having doubled in 15 years.

Agriculture was in 1921 the leading industry of Nova Scotia, the annual production exceeding $27,000,000. The value of field crops for 1919 was over $22,000,000, or about $11,000,000 more than in 1915. There is abundance of fertile land in Nova Scotia for general farming, and especially for the small holdings which should supply the needs of the larger towns, the manufacturing and mining centres, and the summer visitors. Hay and cereals are largely grown, and all root crops in the province are heavy. Rich soils abound in the 700 sq. m. of the Annapolis and Cornwallis valleys, of which one-tenth is planted; also in dyke lands and in a network of intervals. From the wild clover pasturage comes the finest Canadian wool. The produce is marketed in Canada and the West Indies, on the U.S. seaboard and overseas. The 50,000 ac. of dyke marshlands reclaimed from the sea, lying mainly at the head of the Bay of Fundy, have for a century or more produced crops of hay up to 3 tons per acre. Their continued fertility is due to the rich mud brought in by the tide and either deposited on the land by flooding or spread on the higher level. In the seven northern counties, including Cape Breton Island, conditions of soil, climate and topography have resulted in a greater proportion of good land, and, therefore, of wider clearings, than on the Atlantic slope. In the southern and western counties one of the most fertile intervals is that of the Musquodoboit river, the upper branches of which run through a limestone formation. This valley has been opened up by a recent 80-m. extension of the Canadian National railways to a point 40 m. E. of Halifax. In the slate formation also there are rich intervals such as the Tusket valley between Kentville and the sea, and the valley of the Lower Sissiboo. As a rule, the cultivated lands in these counties lie along the seaboard, for the interior granite areas do not invite settlement. The Annapolis and Cornwallis valleys are notable for their apples, several varieties of which are the best in the world and find a large market in Great Britain. Peaches, pears, plums and cherries are also grown. Dairying also has become an important industry; about $950,000 worth of creamery butter is produced annually. Travelling dairy schools supported by the Provincial Government visit all parts of the province to give instructions to the farmers. The Provincial Government has also established 35 model orchards throughout the province. Agricultural education receives stimulus not only from the Government but from various agricultural societies.

Lumber.—It was estimated that in 1920 the province had about 12,000 sq. m. of good timber land, all privately owned, but well looked after by a thorough system of fire protection. A large export trade is carried on with Great Britain, the United States, the West Indies and South America. The value of the lumber cut in 1918 was $4,092,039. Eight pulp mills were in operation in 1920 the output of which was valued at $243,451.

Fisheries.—The fisheries of Nova Scotia are next to those of British Columbia, the most important in Canada, and the value of their products was $9,166,851 in 1915 and $15,171,929 in 1919. The value of fishing boats, vessels, nets and other materials amounted to over $16,000,000. The catch was greatly stimulated by war demands for cheaper food. The total number of men employed is about 26,000; the vessels are manned with about 9,500 men and another 16,000 are employed in curing, canneries and allied industries.

Mining.—The annual production of bituminous coal amounts to about 6,000,000 tons, chiefly from Cape Breton, the N.E. portion of the province. The mines in Cape Breton county yielded 3,992,733 tons in 1920 out of a total for Cape Breton of 4,237,065 and for Nova Scotia of 5,087,744. In that year the province consumed 2,445,195 tons and 896,404 tons were exported to New Brunswick, 297,434 tons to Newfoundland, 240,701 tons to Quebec, 527,727 to Europe and bunkering accounted for 485,609 tons. The exports to the United States, which amounted to 532,684 tons in 1915, had sunk to 27,439 tons in 1920. Iron and copper are found but not largely produced, the chief supply of the best iron ore for blast furnaces coming from Newfoundland. Of the 20 blast furnaces in operation in Canada 8 belong to Nova Scotia. These have a capacity from 250 to 350 tons per day each. The average yearly output of gold for 50 years has been $200,000, the highest in any one year being $400,000. In 1919 850 oz. were produced, valued at $19,130. A valuable deposit of rock shale discovered under a farm near Malagash, Cumberland county, may prove of great importance to the Maritime Provinces, where the fishing industry alone consumes 50,000 tons a year. The amount of deposit here is estimated at millions of tons, and some of the samples have shown high percentages of potassium salts. The strata in Nova Scotia are said not to be favourable for oil or gas, but in Pictou county there is an area of about 10 sq. m. of oil shales. Antigonish and Colchester also contain valuable areas of oil shales. The report of the fuel controller for Canada estimated that these shales will yield 400,000,000 bar. of oil and 7,000,000 tons of ammonium sulphate.

Commerce and Manufactures.—The shipbuilding industry has shown a strong forward tendency. In 1916, 60 wooden vessels representing 12,000 tons were completed, and the war stimulated the yards to such full and effective work that, in 1917, 20,000 tons were completed without any Government aid to the builders. The war demands for shipping proved the possibility of building steel ships in Canada, and an arrangement was made with the Dominion Iron & Steel Co. of Sydney by which the latter undertook to build the first plant in Canada capable of producing heavy plates. At Halifax and Dartmouth a modern shipbuilding yard was at work in 1921. The Halifax Shipyards, Ltd., took over the existing repair plant and dry-dock at Halifax and the marine railways at Dartmouth, and undertook to provide for building ships up to 12,000 tons.

The manufactures of the province include sugar refineries, textile and boot and shoe factories, pulp and paper mills, canneries, iron works, machine and agricultural implement shops, and iron furnaces. The principal manufacturing centres are Halifax, Sydney, New Glasgow and Amherst.

The value of Nova Scotia's production for 1919 was estimated at $192,197,300, of which coal contributed $25,000,000, iron and steel products $19,000,000, fisheries $14,350,000, manufactures, ships and freights $56,260,000, products of the farm $51,034,000, products of the forests $16,965,000.

Roads and Railways.—Nova Scotia is sharing in the general movement towards the construction of good roads. Roadmaking machines are employed for the improvement of the ordinary highways and steel bridges have replaced the wooden structures. The Canadian National Railways, formerly the Intercolonial, is the chief means of communication with the other provinces and for the carriage of local traffic. Halifax is connected by that line with Windsor and Truro at the heads of the two great arms of the Bay of Fundy. The same line connects with Pictou and Sydney, Cape Breton, and in passing over the isthmus, to connect with the main Canadian system, the line traverses the Cumberland mining district. There is a line of railway from Halifax to Chester, Lunenburg, Shelburne and Yarmouth; also from Truro to Windsor and down the Annapolis valley to Digby and Yarmouth, and a branch connects the valley with the Atlantic coast at Lunenburg. There is a spur from the Springhill coal-mines to Parrsboro, their shipping port, on the Basin of Minas. One connecting Oxford Junction with Pugwash, River John and Pictou, another connecting the Cape Breton coal-mines with Sydney and Louisburg. The Joggins coal-mines are reached by a spur of the Intercolonial railway from Maccan near Amherst. The C.P.R. has running rights over the Government system from St. John, N.B., to Halifax and similar rights are granted to the National Transcontinental from Moncton to Halifax. Halifax is in communication with Europe by several lines of steamship. There is also a line to New York and one to Boston and lines of coasting steamers run to Canso and ports in the Gulf round the coast westwards. Steamers also ply regularly to St. Johns, Newfoundland and Sydney. The Atlantic cable stations are at Canso and Sydney. The Canadian Government radio-telegraph stations are at Glace Bay (trans-Atlantic only), North Sydney, Pictou, Camperdown (Halifax), Cape Sable, Barrington and Sable Island. (W. L. G.*)

NOVELLI, ERMETE (1851–1919), Italian actor and playwright (*see* 19.838), died at Naples Jan. 29 1919. His tragedy *La Masque*, written in collaboration with Signor Bonaspetti, was produced in 1911.

NOYES, ALFRED (1880–), English poet, was born in Staffs., Sept. 16 1880. He was educated at Exeter College, Oxford. His first volume of poems, *The Loom of Years*, appeared in 1902, and his *Collected Poems* in 1910. His *Forty Singing Seamen* (1907) and *Drake* (1908) were characteristic of his patriotic note as a poet of the sea. During the World War he did work for the English Foreign Office. A volume of lectures given in America, *The Sea in English Poetry*, was published in 1913, and in 1914 he was elected to a professorship of modern English literature at Princeton University. During the war he published *The Wine Press* (1914); *A Salute from the Fleet* (1915); *Rada*, a play (1915); and a volume of stories, *Walking Shadows* (1917). In 1920 he issued a new volume of poems, *The Elfin Artist.*

NOYON, BATTLE OF.—The battle of Noyon, in the course of the last German offensive on the western front, was fought on June 9–13 1918.

The operative situation of the Germans between the Oise and the Marne was at that time as follows. The new wedge-like German positions, won in the battle of Soissons-Reims, and pushed southwards, afforded favourable targets for hostile attacks with their deep flanks at Reims and opposite the wooded heights of Reims, and also S.W. of Soissons and opposite the wooded district of Villers-Cotterêts. Strategically, therefore, it was desirable to bring the German positions on both sides of the Oise into the general line Montdidier–Château-Thierry, at least on the right wing, by the capture of the wooded heights between the Oise and the Aisne and N. of Villers-Cotterêts, thus improving the strategic situation on the front between the Marne and the Oise. The capture of Reims and its wooded heights also became a more pressing operative necessity on account of the difficulties of bringing up supplies to the troops standing on the Marne.

From the operative point of view it would have been desirable for the XVIII. Army to have advanced to the attack simultaneously with the VII. Army, but this had not been possible on account of the want of sufficient material for the attack. The attack of the XVIII. Army could be carried out only in succession to that made by the VII. Army; it was to be delivered from the front Montdidier–Noyon with the right wing against Méry, with the middle and left wing against the very strong positions on the heights W. of the Oise, and to be supported by a simultaneous attack by the VII. Army from the country S.W. of Soissons, and in this way to compel the French to give up their positions between the Oise and the Aisne. The attack, commencement of which was originally fixed for June 7, had to be put off to June 9, as the artillery preparations could not be finished in time. This was the more disadvantageous as the French (to whom, as appeared later, the whole undertaking in all its details had been betrayed some days earlier by deserters) gained time, by bringing up and placing sufficient reserves, to prepare themselves for the attack and to disturb the German preparations by systematic artillery fire.

Of the XVIII. Army the IX., XVII. and VIII. Army Corps and the XXXVIII. Res. Corps, with a total of 18 attacking divisions, were to take part in the attack. The IX. Corps, standing on the right wing of the attacking troops, was on its part to maintain the connexion with the III. Army Corps and its own old positions, while the XXXVIII. Res. Corps advancing on the left wing was to advance first along the Oise and later to attempt to cross the river in an easterly direction. The fighting task of the centre corps, the XVII. and VIII. Army Corps, was a determined push straight against the enemy. In spite of the hindrance caused by the French artillery fire the preparations for the attack were successfully completed on the evening of the 8th. The attack itself began in the early morning of the 9th.

The German artillery preparation was on this occasion also fixed for the night hours. The French response, in consequence of their expectation of the German attack, was considerable over the whole front, stronger than at the attack on the Chemin des Dames. At 4:20 A.M. the infantry advanced to the attack. They met with stiff resistance, especially on the right German wing, where the French had brought up strong reserves. In spite of the prevailing thick mist and the impossibility of observation in the forest country, which made the disposition and leading of the infantry very much more difficult, the whole French system was successfully penetrated in the course of the day and progress made beyond it. On the right wing the IX. Corps on the evening of the 9th retained the village of Rubecourt, temporarily lost, in spite of the most violent French counter-attacks. The two centre corps had reached the line Courcelles–Cuvilly–Mareuil, while the XXXVIII. Res. Corps had established itself in possession of the woods S. of Orval. June 10 saw a remarkable success on the left German wing, due to the wheeling-in of sections of the VIII. Corps against the flank of the French troops standing opposite the XVIII. Corps, which opened up for this corps the advance to Cambronne and Ribécourt. Weak sections of this corps pushed forward from here eastwards over the Oise, while the two centre corps, after the capture of Marquéglise, pushed forward to both sides of Antheuil. Under the pressure of the attack of the left wing of the XVIII. Army, the French in the night of June 10–11 evacuated the woods of Carlepont before the right wing of the VII. Army.

The right wing of the XVIII. Army fought fiercely on June 10 at Courcelles and Méry without being able to make further progress, as the French had more and more made this front the centre of their resistance.

The course of the German attack up to this point, and the information of airmen and prisoners, had shown that the opposing army had placed very strong reserves in readiness before the German right wing, and that further advance was to be achieved only with extreme loss of life and by the throwing-in of strong reserves. The German Supreme Command, therefore, determined to content itself with the successes achieved, and to break off further fighting, especially as on the morning of the 11th on the right wing, heavy French counter-attacks, with the support of strong artillery and numerous tanks, had begun against the front Courcelles–Méry–Belloy. In front of Courcelles they were shattered indeed; but between Méry and Belloy the French had scored transient successes; both places were lost and the French had pressed forward in the direction of Cuvilly; a German counter-thrust undertaken with fresh reserves repulsed them towards evening as far as the eastern edge of Méry.

The Supreme Army Command on the 11th ordered the German right wing to suspend the attack and to restrict itself to the defensive. On the next day this order was extended to the whole front of the XVIII. Army. All the repeated French attacks, made with great masses and supported by strong artillery preparations and tanks, were repulsed before the front of the XVIII. Army with heavy losses. The Germans retained the positions captured during the engagements of the 9th and 10th on the general line of the heights S.W. of Montdidier–Courcelles–Antheuil–northern bank of the Matzbrook.

The German attack undertaken from the district S.W. of Soissons by the VII. Army to relieve the pressure on the XVIII. Army had led to no substantial successes. The flanking artillery fire falling behind the lines and on the French forces fighting E. of the Oise had indeed inflicted severe losses; but the French had placed such strong reserves in readiness on this front that the German attack undertaken between the southern slopes of the Aisne and the forest of Villers-Cotterêts had been able to make substantial progress only in the centre and to penetrate into the north-eastern section of the forest of Villers-Cotterêts. It was, however, clear on the 12th that the attack begun here would not penetrate farther; very violent Franco-American counter-attacks began on this day, especially opposite the VII. Army and particularly at Château-Thierry and W. of the wooded heights of Reims.

In the battle of Noyon the Germans took 15,000 prisoners and 150 guns; but the engagements between June 9 and 13 had not substantially altered the German strategic situation on this section of the front between Soissons and the woods of Villers-Cotterêts. (H. v. H.)

NURSING (*see* 19.914)—United Kingdom.—The modern nursing movement has developed from the introduction of a new type of woman. One of the principal points of Florence Nightingale's organization (*see* 19.684) was that the hospital matron should have complete authority in regard to her own sphere and not be under the direction of the male hospital staff in regard to the training and management of the nurses, and this is now the recognized English system under whose influence the movement for educated nurses has during the last 50 years proceeded apace. Thus nursing has gradually become a fully organized profession. Hospital work is now divided into many sections, and in large training schools not only are there nurses performing administrative work alone, but nurse instructors and tutors form part of the staff. There are likewise specialists in electric and other technical work, but these (and also those who take fever and other special trainings) are often postgraduates, while, on the other hand, young women sometimes nurse in children's hospitals as well as in cottage and convalescent hospitals before they are old enough to begin their regular training. The age for commencing training in recognized training schools (which are roughly those having over 100 beds and a resident medical officer) used often to be 25, but in many hospitals it has been reduced to 21 since there is difficulty in getting older probationers. The length of training varies from three to four years, and examinations are held at stated intervals. The nurses usually occupy a nurses' home within the precincts of the hospital, though there has been a movement towards allowing at least some of the staff to live out. The "sister" probably retires at 50 or 55, and a pension is frequently provided, with or without contribution. Postgraduate teaching is developed in the best schools.

District Nurses.—If a nurse in England wishes to take up district work on completing her training she may have her district training and be placed on the roll of the Queen's Nurses (established to commemorate the Jubilee of Queen Victoria), a body which has done much to ameliorate the lot of the sick poor in the United Kingdom. These nurses are supported and controlled locally but supervised from headquarters where they are trained, and a high standard of efficiency is maintained. In Ireland a special fund was raised to assist in the support of these nurses. Another type of nurse is named the "Cottage Nurse." These district nurses only receive a short training, usually under what is called the "Holt-Ockley" scheme, and the idea is that they should reside in the houses of their patients and be somewhat of their class. It is considered advisable that district nurses should hold the certificate of the Central Midwives' Board, more especially as these nurses are frequently employed in infant and child welfare work.

Public Health Nurses.—Public health nursing has developed largely since 1910. Child welfare work is only one of these developments. In Great Britain a large number of nurses are employed under the county, borough or city schemes for this work and also for tuberculosis visiting. Then education authorities require a large staff for following up the cases of children who have been inspected under their health schemes. There are also nurses in connexion with industrial welfare work. Fever and isolation hospitals supply another form of public nursing work. This form of nursing is sometimes undertaken after graduation, and sometimes the probationer takes her fever training before going on to work in a general hospital. The full course of fever training is usually three years.

There are many large Poor Law infirmaries which give excellent training and are recognized as training schools. The advantage claimed for them over hospitals which are also training schools for the medical profession is that at present, being without students, there is more left for the nurses to do. On the other hand there is a large number of chronic cases, and the number of patients per nurse which in general hospitals may be three is in Poor Law infirmaries much larger. The nursing in small infirmaries (called Poorhouse or Parish hospitals in Scotland) is done by a superintendent with nurses under her. In the case of there being a single nurse she may be placed under an untrained matron or governor, and this has been the source of complaint. The nursing of the sick poor has greatly improved, but various further recommendations were made by the Royal Commission on the Poor Law (appointed 1905) which involve changes in administration.

Private Nurses.—Private nursing in England has expanded enormously during recent years, and though there are some "visiting nurses" who come in for the day they are mainly residential. The nurses who undertake this kind of work are to be had either from a hospital which sends out its nurses after they gain their certificate and allows them to return to the wards when free, or from an Institution or Home. There are very few independent nurses working by themselves, but many belong to a "Coöperation," to the headquarters of which the nurse returns after her case is completed, and to which she contributes a percentage of her earnings. There are many private nursing homes for the well-to-do where nurses are employed. The qualifications of these nurses vary according to the quality of the home.

Mental Nurses.—The training for mental nursing is usually conducted in a recognized institution for the treatment of mental disorders, where the candidates serve for three years. At the end of this time they may obtain the certificate of the Medico-Psychological Association. The nurses and attendants are of both sexes, but though male patients are usually nursed by male nurses, women are being increasingly made use of even for men, more especially in Scotland, where what is called the "Hospitalization" of institutions for the mentally affected is becoming common. It is claimed that the result of employing women (with some male assistance) has been proved to be very satisfactory. When the nurses in training have already taken their certificate in a general hospital they are allowed to enter for their examination at the end of two years instead of three, and are exempt from the examinations at the end of the first and second years. The training is very thorough, and a careful register is kept of those who qualify and in case of misdemeanour the name is erased.

Masseurs and Masseuses.—There is a Chartered Society of Massage and Medical Gymnastics (amalgamating the Incorporated Society of Trained Masseuses and the Institute of Massage and Remedial Gymnastics) which grants a diploma to those who have taken their preparatory course at a recognized school or hospital, or who have passed an examination. Soon examination in massage alone will cease, and candidates will be required to sit for a conjoint examination in massage and medical gymnastics, after scheduled training under recognized teachers.

Midwives and Maternity Nurses.—Midwifery is controlled by a Central Midwives' Board established in London and having jurisdiction in England and Wales. There are separate Boards for Scotland and Ireland. The number of midwives now appearing on the Roll in England and Wales is approximately 48,600. This Board, which was established under the Midwives Acts of 1902 and 1918, submitted certain rules to the Privy Council, which were approved by them. Its business is to regulate the issue of certificates and the conditions of admission to the Roll of Midwives, as also to regulate the course of training and the conduct of examination. It has likewise the power to remove a name from the roll, or restore a name removed. In addition it gives directions to midwives in their work.

Though the Act came into operation in 1905 it was only after 1910 that it was forbidden to attend women in childbirth for gain otherwise than under the direction of a qualified medical practitioner, unless certified under the Acts. Certification depends on compliance with the rules and regulations laid down in pursuance of the Act. The midwife acts under the local supervising authority. The number of midwives has of course increased largely; but still demand exceeds supply, as their emoluments are not sufficiently large to make the work of district midwife attractive unless supplemented by public or private funds. There is an incorporated midwives' institute which has been useful in promoting the interests of midwives. A large number of trained nurses take the certificate after training and work as "Queen's" district nurses or otherwise. Other qualified midwives have a short general training. There are also maternity or monthly nurses who can be engaged, as required, by members of the more opulent classes, and they frequently have a midwifery training as well as some general training; but their qualifications vary.

Nursing Organization.—As regards the organization of nurses, the British Nurses' Association was set on foot under the presidency of Princess Christian in 1888. The goal of the advanced party was to establish a minimum of training, and to do this through a central governing body appointed by the State and thus to prevent untrained women claiming the position of trained. Those who opposed the view asserted that in the nursing world efficiency could not be tested by examination nor its continuance guaranteed. The Association obtained a Royal Charter in 1892. But serious dissension soon arose, which emanated from those who were strongest in affirming the necessity of the registration being carried on by the State, for at first the British Nurses' Association was content with advocating a voluntary register. In 1894 a Matrons' Council of Great Britain and Ireland was set on foot by the advanced party, and in 1902 a Society for the State Registration of Trained Nurses was established. A bill for State registration was introduced into the House of Commons in 1903, and another the following year. As there was strong opposition to the project a select committee of the House of Commons was appointed to investigate it, and its findings were more or less favourable to the scheme. After it reported in 1905 the warfare continued with extreme vehemence (on the registration side later on with the help of a central committee founded 1910) until the outbreak of war, when a truce was declared. In the year 1916 a College of Nursing was established which was designed to form a centre for all nursing activities and to direct nursing education on proper lines. It has branches throughout the United Kingdom, and in 1921 had 20,000 members. The College supported a scheme for registration somewhat different from that of the central committee, and as it proved impossible to obtain agreement the long struggle over registration was brought to an end by the Minister of Health deciding that the Government would bring forward its own bill. This was done, and the Nurses' Registration Act became law in the end of 1919.

The nursing profession, after a long time of controversy, was thus in 1921 entering into a new phase in which it had obtained powers of self-government. It had already through its organization claimed and secured a considerable increase in pay and decrease in hours of duty;[1] but it considers that there is much work before it, if wholly satisfactory conditions are to be obtained. It is estimated that there are about 40,000 fully trained nurses in the United Kingdom, although there may be double that number eligible for State registration during the period of grace. The Act of 1919 establishes a General Nursing Council for England and Wales and another for Scotland. Of the 25 members of the English Council 16 must be registered nurses elected by persons registered under the Act. It provides for three supplementary registers (for male, mental and sick children's nurses) as well as the general register, and it regulates the admission to and removal of names from the register, as well as the training of registered nurses. The Act thus gives to the nursing profession a status and power which it never had before. So far there has not been much connexion between the nurses' training schools and the universities in Great Britain, though this is being discussed, and in 1921 the university of Leeds decided to grant a university diploma in nursing.

Nursing in British Dominions.—Nursing in the Overseas Dominions is developed on lines similar to those in the United Kingdom; but there is a Colonial Nursing Association which sends trained hospital and private nurses to the Crown Colonies and small British communities in foreign countries. There is also an Indian Nursing Association (Lady Minto's) for Europeans in India.

In most civilized countries in Europe and elsewhere the Nightingale tradition has taken root, but in very many cases the idea of a controlling matron with executive powers has not been developed, and this militates against the success of the hospital as a professional training school. During the year 1920–1 the League of Red Cross Societies sent 16 nurses of different nationalities to study in a course specially arranged at King's College for Women, and this experiment may be expanded.

British Military Nursing.—In 1901, during the South African War, the Secretary of State for War (Mr. St. John Brodrick) appointed a committee to consider the reorganization of the Army and Indian Nursing Service and advise as to its reconstruction, he himself being chairman. From it originated Queen Alexandra's Imperial Military Nursing Service (1902). Hitherto the service had been under a lady superintendent at Netley, and the power and responsibilities of the women nurses were much restricted, since it was considered that male nurses would be paramount in time of war. Under the new constitution a Nursing Board was established with the Queen as president and the director-general of the Army Medical Service as chairman, and it advised the Secretary of State on all matters connected with the service and its organization at home and in India. The India Office, however, decided to carry on its own service, and therefore references to India are thereafter omitted. There had been a service called the Indian Nursing Service since 1881, and this remained separate from the home service. It is now named Queen Alexandra's Military Nursing Service in India, and numbers 95 members.

Queen Alexandra's Imperial Military Nursing Service was organized with a matron-in-chief at its head, and principal matron, matrons, sisters, and staff nurses subordinate to her. The duties and pay of the various grades were laid down at the time of its foundation, and regulations made as to the qualifications for entry into the service. A scheme was also formed to develop the training of orderlies for the R.A.M.C. The responsibility for carrying out the recommendations of the Nurses' Board rested with the director-general of the Army Medical Service, whose principal officer in the nursing branch of the War Office was the matron-in-chief. Reports on the nursing equipment and requirements in the various hospitals were also made by the matron-in-chief and the principal matron. Ward masters were abolished and the wards were managed by the sisters. A scheme was drawn up for the training of non-commissioned officers and men of the R.A.M.C.

In 1897 an "Army Nursing Reserve Service" was also established; it was associated with the name of Princess Christian and constituted by Royal warrant. This reserve was absorbed into the Q.A.I.M.N.S. Reserve in 1908. The principle of a standing reserve of nurses was not originally adopted by the Nursing Board as it was believed that civil hospitals and nursing associations would provide the necessary means when required, and a further reserve of this kind was established in 1910. The number of nurses in the Q.A.I.M.N. Service (Regular or First Line Nursing Service) was 290 in 1914 at the beginning of the war. Of the Reserve 200 were enrolled individually as members of the Q.A.I.M.N.S. Reserve and 600 were provided by civil hospitals and associations. Later on all became one reserve, and this reserve was expanded as required. In the first year of the war there were 2,323 fully-trained reserve nurses enrolled, and the number reached 10,304 by 1918. These were distributed throughout all the areas of war and in hospital-ships.

Queen Alexandra's Military Families' Nursing Service.—The Q.A.M.F.N. Service was set on foot in 1921 with the view of taking over the permanent nursing establishment of the military families' and military isolation hospitals, and it consists of matrons, sisters-in-charge and staff nurses, the rates of pay and pension being the same as those laid down for the corresponding ranks in the Q.A.I.M.N.S.

Territorial Force Nursing Service.—This service was established in 1907–8 in connexion with the Territorial Army that was then established, and it supplied the largest number of British nurses available at the outbreak of the World War. The purpose of the service was to maintain a staff of nurses willing, in the event of mobilization of the Territorial Army, to serve in the general hospital of the district to which they were attached. Of these hospitals 23 were instituted in various centres in England and Scotland under the scheme for medical organization. They were buildings earmarked for the purpose, though at the time used for other objects. The staff were engaged in civil pursuits, but were ready to serve whenever called upon to do so. The service had at its head an advisory council at headquarters, in order to provide for the establishment of a similar system of control in each hospital. It framed rules and made recommendations for the administration of the service, and the appointment of matrons, sisters and nurses thereto. At the head of the service is a matron-in-chief. Each hospital centre had a local committee to receive the names of nurses wishing to join the service and an organizing principal matron. The Territorial Force Association of the county was requested to assist in the appointment of this committee. The roll of sisters and nurses for each hospital was forwarded for approval to the advisory council, which was composed of professional and lay members equally. Queen Alexandra was president. The understanding as regards the Territorial Force Nursing Service was that, like the rest of the Territorial Force, it would serve only in case of invasion, or when the Territorial Force was called up. The period of training necessary for a nurse was the same as for the Q.A.I.M.N.S., *i.e.* three years. The uniform is blue-grey material edged with scarlet, and a silver T is worn as well as the service badge.

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[1] Recommendations on this subject were issued after full enquiry by a committee appointed by the College of Nursing.

The scheme for a Territorial nursing service was taken up with enthusiasm both by matrons and nurses, and when war broke out in 1914, and the nurses were called up along with the Territorial Force, the staffs of the hospitals were in their places as soon as the hospitals were ready to receive them, *i.e.* within ten days. The scheme provided for each hospital having 520 beds, and 2,783 nurses were required, but it was not long before it became evident that the number would have to be increased. After nine months of the war the original staff had to be increased to 4,000, and by the end of the war 8,140 had been enrolled, of whom 2,280 served abroad. In order to supplement the trained staff "assistant nurses" holding certificates of special training (fever, etc.) were brought in, as well as members of Voluntary Aid Detachments (*see* RED CROSS). Trained nurses were dispersed throughout the hospitals where they were most needed, and two V.A.D. members replaced each trained nurse taken away. For the future the general hospitals will be much larger than before, and there will be units ready to proceed abroad requiring nursing staffs (casualty clearing stations, hospital ships, etc.). The total number required for foreign service will probably be about 4,000. The system of giving short training in military hospitals during peace-time will be further developed.

Queen Alexandra's Royal Naval Nursing Service.—This service is not a large one, being composed of three head sisters, seven superintending and 65 nursing sisters, all ranking as officers and taking a position immediately after the surgeons. There is also a reserve carried on through the civil hospitals which are asked to guarantee a number of nurses who will be available on the outbreak of war. The number recruited is 250. The nursing sisters are assisted in the wards by stewards and attendants of the sick-berth staff, and they give them what instruction in nursing is necessary. The latter serve on board ship. The duties of the sisters are limited to the hospitals to which they are attached, but they may be transferred to other naval hospitals at home or abroad as well as, in exceptional cases, to hospital-ships. It may be mentioned that there is not much opportunity for male nurses (excepting mental nurses and masseurs) obtaining training unless they get it through the services. It may, however, be also obtained through the National Hospital for the Paralysed and Epileptics.

Royal Air Force Nursing Service.—This service was established in Jan. 1921, and consists of a matron-in-chief, matrons, senior sister, sisters and staff nurses. A certificate of training for at least three years in a large civil hospital is required from candidates. Members must be over 25 and under 35 on entry and they may retire at 50: retirement is compulsory at 55. (E. S. H.)

UNITED STATES

Increased interest in preventing disease and promoting health; the war; the influenza epidemics; the organized efforts of the nurses themselves; all contributed to the rapid development of nursing in the United States in the years 1910–21. The number of trained nurses has greatly increased; they have done good service in positions of many new kinds; standards of training have been raised and opportunities multiplied.

By 1920 about 1,600 accredited training schools were connected with hospitals, with an annual enrolment of 40–50,000; and at least 120,000 "registered" nurses were entitled by the registration laws of their states to use the designation "R.N." The usual educational requirement for admission to training in 1921 was one year of high school or its equivalent. To encourage preparation by more mature and better educated girls many universities (beginning with the university of Minnesota in 1909) established schools of nursing as part of their curriculum, and there were in 1920 ten which offered to high school graduates a five-year course combining work for the Bachelor's degree with specific training in nursing.

Trained nurses were classified in 1920 according to the kind of work done by them in three groups: (1) those who attended private patients; (2) those attached to hospitals and other institutions, for service to the patients in the institution; and (3) "public health nurses." While no exact statistics were available, it was obvious that all three groups had increased in numbers and had shared in the rising standards and growing prestige of the profession. The services of a private nurse were no longer regarded as a luxury, but were more and more recognized as a necessity in serious illness among families of moderate means. The surprising growth of provision for the sick in hospitals greatly increased the number of positions for nurses in institutions; while differentiation and specialization among hospitals, together with advances in methods of treatment, created specialized positions for nurses in connexion with X-ray work, electrotherapy, hydrotherapy, massage, anaesthetization, occupational therapy, mental illness, tuberculosis, the care of children, and other classes of patients for whom differentiated institutional provision was made. It is the third group, however, which especially demands consideration, because of the novelty of much of its work, and because of its vitality and promise of further extension.

The term "public health nursing" covers all the forms of nursing by which social action endeavours to promote health whether such work by nurses is undertaken by a private society or settlement, a hospital or clinic, or the Board of Health or Board of Education or other public authority. It may thus be supported by public funds or by private contributions, and some part of its cost is defrayed by fees from patients. It includes actual care of the sick, but is more generally an educational and preventive service, extending to members of the patient's family and designed to improve their general health. It includes the sub-divisions summarized below which deal with services of no little importance.

District, or *visiting* nursing, which provides service for the sick in their homes, is the oldest form, dating from 1877 in New York City. Most charitable organizations of importance now have one or more nurses attached to their staff. The visiting nursing associations usually charge a fee, according to the circumstances of the patient, based on the cost of the service (in 1921 50 cents or $1.00 a visit).

Industrial nursing provided for employees of manufacturing and commercial establishments was introduced in the last decade of the 19th century; it commended itself by its results and was stimulated by the workmen's compensation legislation, which indirectly puts a premium on safety and health-promoting conditions. In recent years one or more nurses have come to be regarded as an essential element in the staff of a well-organized factory or business which employs many persons; there is every reason to expect that this service will become more and more common. It is still far from standardized, being in some places limited to first-aid during working hours; in others extended to a complete visiting nursing system both for employees and for their families. In 1920 it was estimated that there were about 1,320 industrial nurses, employed by mills, factories, department stores, hotels, laundries, mining operators, insurance companies, and banks.

Nursing service for policy-holders was instituted as an experiment in 1909 by the Metropolitan Life Insurance Company of New York, and rapidly extended to cover all its millions of industrial policy-holders. This service usually is provided by arrangement with existing organizations, the Company paying for the cost of the visits made on its behalf. In 1918, after the system had been in operation nine years, a careful statistical study was made, which convinced the officers of the Company that the innovation had been a marked factor in the decrease of mortality among policy-holders and had more than paid for itself.

Public school nursing, beginning with an experiment in New York City in 1903, had become by 1920 common in the large cities, sometimes under the educational, sometimes under the health authorities.

A plan for providing visiting nurses for *rural* districts was made by the American Red Cross in 1912, and there were some 1,300 nurses engaged in this kind of work in 1920.

Other specialties in public health nursing were the care of tuberculosis patients at home, pre-natal and maternity work, child welfare and infant welfare, work with mental disorders, with venereal disease and in connexion with the bureaus of communicable and contagious disease in departments of health. The special nurse for tuberculosis, appearing with the anti-tuberculosis movement early in the present century, is coming to be the general guardian of the health of all members of the household into which she goes, and this is more or less true of other specialized visiting nurses. The development of public health nursing has been rapid, the number of nurses so engaged having increased from 130 in 1890, to 1,413 in 1909, to 6,019 in 1916 and to 11,000 in 1921, an increase out of proportion to that of population.

Nurses have three professional organizations of national scope: the American Nurses' Association, with a membership of 45,000; the National League of Nursing Education, including about 1,200 of the teachers and educational leaders in the profession; and the National Organization for Public Health Nursing, organized in 1912 to assist in the development of public health nursing, especially along the lines of education and legislation; to this lay members are eligible as well as nurses, and it has a membership of over 7,500. These organizations have had a large part in arousing public interest, in securing registration laws, in increasing and improving opportunities for training, and otherwise raising and maintaining the standards of the profession. (X.)

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NYASALAND PROTECTORATE (*see* 4.595.)—The pop. at the 1911 census was: natives 969,183, Europeans 766, Asiatics 481. In March 1920 Europeans numbered 1,015 and Asiatics 515. The natives were estimated (1919) at 561,600 males and 664,400 females, a total of 1,216,000. Blantyre, the chief town, had some 300 European residents. There were 30 persons per sq. m., the latest surveys giving the protectorate an area of 39,573 sq. miles.

During 1910–21 the country made considerable economic progress, though much hampered by inadequate means of communication with the outer world. Up to 1915 the southern terminus of the railway was on the Shire river at Port Herald, which place steamers were unable to reach in the dry season owing to insufficient water. In that year an extension of the line (61 m. long) to Chindio, on the north bank of the Zambezi, was opened. The Zambezi itself is, however, unsatisfactory as a waterway, and the direct connexion of Nyasaland with an ocean port was at length undertaken in 1920, with the building of a railway (170 m. long) from Beira to Chindio. The line progressed rapidly, and by the end of 1921 only the bridging of the Zambezi remained to be accomplished. From Beira to Port Herald the railway runs through Portuguese territory, but the Nyasaland Government guaranteed interest for 25 years on the capital (£1,200,000) of the company which built the Beira–Chindio section. In the north the Nyasaland railway ended at Blantyre, 120 m. short of Lake Nyasa with its 350 m. of waterway. In 1914 the British Parliament authorized a loan to continue the line to the lake, but owing to the World War nothing had been done up to 1921 beyond the survey of a route. On the extension of the railway to the lake depended the development of a large area suitable for cotton.

Only in a few districts is the climate suitable for Europeans, most of whom live in the Shire Highlands. But their influence, especially that of the missionaries, is felt in every part of the protectorate, and in few parts of equatorial Africa have the natives more readily responded to European influences. Education is wholly in the hands of the missionaries. Over 2,000 schools are maintained, with, in 1920, some 125,000 scholars on the roll. There are several industrial schools where agriculture, horticulture, carpentry, printing and other trades are taught. Up to 1921 an annual grant of £1,000 was the only contribution of the Government to education; no provision was made for the instruction of white children. Large numbers of the natives profess Christianity, and native churches independent of missionary control were founded under the influence of Ethiopianism.

Cotton-growing was the chief industry, though from 1918 onward it was being supplanted by tobacco. In 1916–7 the export of cotton reached 3,462,000 lb.; it fell to 866,000 lb. in 1917–8 (largely owing to shipping restrictions), rose again to 2,670,000 lb. in 1918–9, but in 1919–20 dropped to 930,000 lb. Increasing attention was given to tea, while coffee was largely discarded. (The export of coffee which was 748,000 lb. in 1909–10 had fallen to 113,000 lb. in 1918–9.) The disfavour into which cotton fell was partly due to the neglect to use selected seed and to other errors in cultivation, but also to the fact that, where soil and climate suited both crops, tobacco-growing was more profitable. After some unfortunate experiences arrangements were made in 1917 for the fumigation of the tobacco before shipment, with the result that the crop thereafter, in normal circumstances, commanded a high price in the markets of Great Britain. The export of tobacco was 4,304,000 lb. in 1916–7, fell to 2,025,000 lb. the following year, was 5,800,000 lb. in 1918–9 and 4,340,000 lb. in 1919–20. Both cotton and coffee were largely cultivated by native farmers as well as by the European planters.

The growth of trade between 1909–10 and 1913–4, the five years preceeding the World War, was marked. Exports of produce of the protectorate increased in value from £97,000 to £200,000, imports for home consumption from £111,000 to £189,000, the transit trade from £20,000 to £34,000. In the first war year (1914–5) exports fell to £182,000; they increased to £289,000 in 1916–7, fell to £144,000 the following year, but rose to the unprecedented figure of £511,000 in 1918–9, a value due in part to inflated prices. In 1919–20 the exports were valued at £430,000. Imports which in 1914–5 were valued at £181,000 were worth £648,000 in 1918–9 and £606,000 in 1919–20. Over 95% of the export trade was with the British Empire, whence came over 70% of the imports.

Revenue was £76,000 in 1909–10, had risen to £118,000 in 1914–5 and was £186,000 in 1919–20. The expenditure in the three years named was £108,000, £143,000 and £217,000. For the first time since 1914–5 expenditure exceeded revenue in 1919–20. The public debt in March 1919 was £3,190,000, nearly all (£2,998,000) advances made by the British Government to meet the expenses of the local campaign against German East Africa.

History.—Steady progress was made in the development of the country and the increase of well-being and civilization among the natives in the five years preceding the World War. The most powerful influence was that of the Livingstonia Mission of the United Free Church, whose destinies in Nyasaland were guided for many years by Dr. Robert Laws.

Sir Alfred Sharpe, who had served in Nyasaland since 1891 and had been governor since 1897, retired in 1910 and was succeeded (Feb. 1911) by Sir W. H. Manning, the officer who had raised the Central Africa regiment and had already served as acting-governor of the protectorate. On Sir William Manning's transference to Jamaica in 1913, Mr. (later Sir) George Smith (b. 1858) was appointed governor. The appointment of Mr. Smith, like Dr. Laws an Aberdeenian, was highly popular with the Nyasaland settlers, who are mainly Scots. Sir George proved a capable and energetic governor. When in Aug. 1914 the World War broke out Nyasaland was in an almost defenceless condition, and lay open to and was attacked by the Germans of East Africa. The governor met the crisis with promptitude and resolution, and he had the whole-hearted support of the Europeans and natives. Practically every Briton of military age in the country was enrolled in the Nyasaland Volunteer Reserve. The disablement of the only German boat on Lake Nyasa by Comm. Rhoades of the "Guendolen" on Aug. 13 1914 gave the authorities free use of its waters to send such small forces as were available to Karonga, at the north end of the lake and near the German frontier. Karonga was attacked on Sept. 9 1914, but the assailants were decisively defeated and no second invasion of Nyasaland was attempted. The arrival of an Imperial Service contingent, 1,000 strong, from South Africa in Sept. 1915 amply provided for the defence of the protectorate. Later on Nyasaland became the base for Gen. Northey's operations against the Germans. The Nyasaland battalions of the King's African Rifles served under him, while over 150,000 natives were employed as carriers.

Early in 1915, while the situation in the protectorate was still perilous, a revolt of natives occurred in the Shire Highlands. This revolt was a symptom of Ethiopianism. The leader was John Chelembwe, a full-blooded negro who had been trained as a teacher by the American Baptist Mission and sent to the United States to take a university course. On his return he had built a church and had preached the independence of Africans. His followers, about 500, were mainly persons who had recently emigrated from Portuguese Nyasaland. On Jan. 23 1915 they attacked the house of the Magomera estate. In the house were a Mr. Livingstone (a descendant of David Livingstone), his wife, and other Europeans, in all three men, three women and five children. The three men were murdered and the women and children carried off. Mr. Livingstone was killed by a blow from an axe and decapitated in the presence of his wife. Mr. Livingstone's head was taken to Chelembwe's church, and the rebel leader preached a sermon with the head placed on the pulpit. Meanwhile Mrs. MacDonald, one of the women taken captive, aided by her native servant, escaped, and barefoot and in her nightdress ran through the jungle to another planter's house. A force of 40 British volunteers and 100 natives (K.A.R. recruits) under Capt. L. E. Triscott was speedily gathered and met and defeated the rebels. Chelembwe, who took to flight, was tracked down and shot dead (Feb. 3) by the native police of Mlanje station. With Chelembwe's death the rising was at an end.

The revolt was not a reflection of the attitude of the natives. Their loyalty remained unaffected. But a weakening of the authority of chiefs was apparent, and in 1912 an ordinance was passed aiming at the concentration of scattered huts, thus bringing the people more under control of their headmen. The ordinance gradually applied, worked satisfactorily.

A considerable number of men who came from South Africa or Great Britain to serve against the Germans remained in Nyasaland as planters, and the area under cultivation largely increased. In the last half of 1920 the great fall in prices, at a time when the administration had placed heavy export duties on cotton, tea and tobacco, caused a financial crisis. In April 1921 the export duties were removed. While market fluctuations might be tided over, the future of Nyasaland remained very much dependent upon the completion of through railway communication from the ocean to Lake Nyasa.

See the annual reports issued by the Colonial Office, London, and the special report on the mineral survey (C.O. Miscellaneous No. 80) by Prof. W. R. Dunstan; Sir A. Sharpe, "Geography and Economic Development of British Central Africa," *Geog. Journal* Jan. 1912; N. Maclean, *Africa in Transformation* (1913) and "*The Times*" *History of the War* (vol. x., chap. 155). (F. R. C.)

OBREGÓN, ALVARO (1880–), Mexican President, was born in Nogales, Sonora, Mexico, in 1880, of Basque and Yaqui parentage. He engaged in farming, trading, and stock-raising in Sonora. He took part in the Madero revolution when Pascual Orozco threatened invasion of his state, driving the rebels out with a troop of 400 Yaquis. He joined Carranza against Huerta in 1913, winning general's rank by defeating the latter. In 1914, leading Constitutionalist forces in the West, he took Sinaloa, Culiacán and Guadalajara in July, entering the capital Aug. 15. He sided with Carranza against Villa, took Puebla in Jan. 1915, and held the capital when the generals of the Convention left for Aguascalientes Jan. 27, but moved out March 10. He won victories over Villa at Celaya April 19; at Léon, where he lost his right arm, on June 4; and at Torréon and Saltillo in Sept. As Carranza's Minister of War he negotiated with Gens. Scott and Funston for the withdrawal of Pershing's expedition in 1916. Disagreeing with the President, he resigned and returned to his estate May 1 1917. There he accumulated a fortune by control of the *garbanzo* (chick-pea) crop of the W. coast. In June 1918 he became a candidate for the presidency against Gen. Pablo González and Ignacio Bonillas. In the same year he visited the United States. In March 1920 Carranza's attempts to control Sonora against Obregón's candidacy, and the arrest of the latter charged with rebellion, led him, on escaping from Mexico City, to raise a revolt which began in Sonora under the Plan of Agua Prieta on April 9. After rapid successes Obregón entered Mexico City May 8, Carranza having fled on the 5th. Adolfo de la Huerta, Obregón's lieutenant, was made provisional president, Obregón being elected President in Sept. and inaugurated Dec. 1. (*See* MEXICO.)

O'BRIEN, PETER O'BRIEN, 1ST BARON (1842–1914), Irish lawyer and Lord Chief Justice, was born June 29 1842, the fifth son of John O'Brien, M.P. for Limerick from 1841 to 1852. He was educated at Trinity College, Dublin, and was called to the Irish bar in 1865. He became a Q.C. in 1880, was in 1883 made Crown prosecutor and serjeant-at-law, and in 1884 became a bencher of King's Inns. In 1886 he opposed the Home Rule bill, and joined the Unionist party, becoming in 1887 solicitor-general and in 1888 attorney-general for Ireland, in which capacity he conducted many political prosecutions. He earned at this time his nickname of "Peter the Packer." In 1889 he was made Lord Chief Justice of Ireland, was created a baronet in 1891, and was raised to the peerage in 1900. He retired from the office of Lord Chief Justice in 1913, and died at Stillorgan, co. Dublin, Sept. 7 1914, his title becoming extinct.

OCEANOGRAPHY (*see* 19.967*).—The period following the year 1910 was not productive of notable additions to knowledge of general oceanography. Several expeditions were made just before that year and in the period between then and the World War. The most important were: the Australian Antarctic expedition of 1911–4 under Sir Douglas Mawson; the Danish Oceanographical expeditions in the Mediterranean and adjacent seas of 1908–10; a short cruise made by Sir John Murray and Dr. Johan Hjort in the Norwegian Fishery exploring vessel "Michael Sars" in 1910, the general results of which were published as *The Depths of the Ocean* (1912) by the leaders of the expedition; and a short special cruise made by the "Scotia" in 1913 (after the loss of the "Titanic") under the leadership of Dr. Matthews, which made observations upon the distribution of ice in the North Atlantic.

Generally, oceanographic work at sea was brought to a stop by the outbreak of war in 1914. A good deal of special investigation relating to naval and especially submarine warfare was carried on during 1914–8, but the results of this confidential work were not published. The very important activities of the Conseil Permanent International pour l'Exploration de la Mer were suspended during the war except in a few local seas. Fortunately the continuity of the organization was maintained, largely through the mediation of the British Government, and the council held its first post-war meeting in London in 1920. Its work is primarily that of the investigation of the fisheries of northern Europe, but its general methods are oceanographical, and its published results have formed an immense contribution to the science. Germany and Russia had, temporarily at all events, withdrawn from the coöperation, but France came in for the first time in 1920, and it was understood that the United States was likely to join in the scheme of investigation. An entirely new project was an international survey of the Mediterranean and adjacent seas, from the fishery and oceanographical standpoints, by France, Italy, Spain and Portugal, but in 1921 no definite programme had been put in operation. The International Research Council formed just after the war constituted a section for Physical Oceanography, which held its first meeting in Paris in 1921. In 1920 a very influential movement began, in England, for the despatch of a new "Challenger" expedition on a great scale, but it was suspended in 1921 for lack of funds. On the whole, oceanographical research was being taken up most actively in Europe, but much important work was also begun in America, for instance the fine hydrographical research in the Pacific by the Scripps Institute of the university of California.

Methods of Investigation.—Little change occurred subsequently to 1910 with regard to the methods of oceanographical investigation except a continual refinement and an increasing improvement in the apparatus used: in this direction the activities of the Central Bureau of the International Council were very noteworthy. The instruments—current-meters, sounding apparatus, water-collecting bottles, thermometers, hydrometers, etc.—were all elaborated and improved. Hydrodynamical methods received increased attention and the investigation of the movements of the ocean by means of physico-mathematical devices developed as a result of the older work of Bjerknes, continued chiefly by Helland-Hansen and Sandström. It became fairly certain, however, that theory had outrun observational work, and that the latter must again receive renewed attention.

The empirical data on which the hydrodynamical investigations are based are: (1) observed velocities and directions of oceanic currents and drifts; (2) salinity; (3) density; (4) temperature of the sea water *in situ*; (5) oceanic soundings. Given that such observations at the surface of the sea, at intermediate levels and at the bottom are sufficiently numerous and are of a high degree of precision, general conclusions as to the movements of the ocean may be deduced from established theorems in hydrodynamics. But detailed studies of the circulation of the water in any small area show deviations from the calculated results that are to be expected: thus Nansen's investigation of the Norwegian sea shows that the main directions of streaming of the water are broken up by numerous large and small vortices. So also any exhaustive survey of the temperature and salinity of the sea at a great number of points on and below the surface reveals a complexity of conditions that may defy mathematical analysis and could not easily be predicted. A very large amount of local detailed observation in the various sea-areas must be the next important work to be undertaken: this means current-observations by direct readings of metres, by the employment of drift-bottles and numerous determinations of temperature and salinity at all seasons.

Variations in Oceanic Circulation.—The general scheme of oceanic circulation was made out prior to 1910. The excess of heat received in equatorial regions expands the water, but at the same time excess of evaporation concentrates it, so that the density increases. The heating effect is, however, the more significant, and so the water of the ocean tends to flow N. and S. from the equator towards the poles. In intermediate latitudes there is a loss of heat and then the increased density due to equatorial concentration becomes a factor. The water sinks below the surface and continues to flow along the sea bottom back towards the equator. In the polar areas the melting of sea-ice and of ice formed by precipitation lowers the density of the seawater and causes a difference of level which sets up streaming movements towards the equator. This surface drifting water is cold and as it enters into intermediate zones it remains colder than the water *in situ* there and is therefore denser; it sinks below the surface and continues to flow along the bottom either back to the polar regions or towards the equator.

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* *These figures indicate the volume and page number of the previous article.*

This main scheme is complicated in various ways: (1) by the rotation of the earth, which continually deflects currents of water or air to the right in the northern or to the left in the southern hemisphere; (2) by the conformation of the land masses (as in the case of the equatorial stream which is banked up in the Gulf of Mexico and flows out through the Straits of Florida); (3) by the varying depth of the ocean, for currents tend to flow more readily through deep than in shallow waters (as in the case of the main Atlantic drift, which flows most strongly through the deep channel between Shetland and the Faroe Is.); and (4) by the driving force of the winds acting on the surface of the sea (thus the drift of water from the equator is not N.E., as one might expect, but from E. to W., because of the impelling force of the N.E. and S.E. trade-winds).

All ocean currents vary from year to year in their strength of flow and the main interest of physical oceanography in recent years has been the tracing-out of these variations and the search for the causes. The variations themselves are detected by the method of seasonally repeated hydrographic soundings. Samples of water are collected periodically from a number of places in a large sea-area (the North or Norwegian seas, or the English Channel, for instance) at the surface, bottom and a number of intermediate levels. At the same time temperature observations are made. Stations which are placed in a straight line across a sea are then connected and "sections" are made. These show the magnitudes of the layers of different salinity and temperature beneath the surface, and when a number of sections are compared the differences from season to season and from year to year can be seen. So far only the North Atlantic has been at all well studied and evidence of seasonal and periodic variations extending over a number of years has been obtained in this area. Water drifting into the North Atlantic from the equatorial stream has a relatively high salinity (from 36‰ to 36.5‰) and a high temperature (from 15°C. to 20°C.), and when the distribution of salinity from season to season is studied it is seen that the area of dense water (salinity 36‰) extends farther to the N. in Nov. than in March. A large area of the North Atlantic is thus covered with relatively warm and dense water and this would slowly drift N. until it cooled sufficiently to sink beneath the surface. The prevailing W. and S.W. winds, however, drive it towards the N.E., where it impinges on the shallow seas and shore of northern Europe.

Taking such an easily surveyable area as the North Sea, the quantity of relatively warm and dense Atlantic water entering it from year to year can be estimated by the method of hydrographic sections. It can thus be seen that Atlantic water enters the North Sea round the N. of Shetland and (to a far less extent) through the English Channel. The flow culminates about March in each year, when a considerable part of the North Sea is covered with water of 35‰ salinity, but in Nov. the area so covered is very much less. Therefore the inflow waxes and wanes from season to season throughout the year, but it also varies in the same season in different years. There is no doubt about the latter variation, but with regard to its periodicity—that is, the number of years elapsing between one maximum and the next—much still remains to be done.

Farther to the N. of the British Isles the *superficial* drift of Atlantic water ceases, the temperature having fallen so much that the inflowing water becomes denser than that *in situ*, so that it sinks beneath the surface. It still flows on, however, as a deep current and it then becomes a factor of immense importance with regard to the fisheries in the regions into which it penetrates. The sinking-down occurs in the Kattegat when the inflowing Atlantic water enters the Baltic as an undercurrent which is both warmer and denser than that on the surface. The same thing occurs as the Atlantic stream rounds North Cape: there it breaks up into branches which are irregularly distributed and, sooner or later, sink below the surface and flow on as submarine currents. Entering the Barents Sea (that is, the area between the ice and the northern coast of Europe), these currents flow along the bottom. The inflowing Baltic undercurrent carries with it herrings and other fish from the North Sea outside, and the submarine current entering the Barents Sea also carries with it such fish as plaice. It is mainly because these fisheries are seasonal that the periodicity has been noticed, and because of the economic interests involved the study of the seasonal and longer periodicities has become very important.

As to the causes of the changes in the strength of the current from year to year much investigation has still to be made. The connexion that seemed to be first established was between variations in the quantity of water transported from the tropical to the sub-polar Atlantic and variations in the intensity of solar radiation. Helland-Hansen and Nansen traced a periodicity in the flow of Atlantic water along the W. coast of Norway: every ten to twelve years this flow appeared to reach a maximum and a graph of the variations showed a certain resemblance to the well-known graphs showing the numbers of spots on the sun from year to year. Not only so, but a similar variation was traced in the productivity of the great Lofoten (Lofoden) cod-fisheries. It was difficult to be sure as to the variations in the actual number of fish caught, but it was easy to show that there was a real variability in the yield of cod-liver oil (an important product of the fishery). Tracing, then, the quantities of oil given per 1,000 fish from year to year, they seemed to establish a connexion between the variation in "condition" of the fish, the variation in the inflow of Atlantic water, and the variation in the number of sun-spots from year to year.

The relation appeared, however, to be far more complicated than was at first supposed. Helland-Hansen and Nansen showed later that it was improbable that variations in the northerly drift of Atlantic water could be traced directly to variations in the quantity of heat received by the sea from solar radiation. Of the total quantity of energy incident on the earth about 40% is reflected back from the earth's atmosphere. Of the 60% that penetrates only about one-third actually heats up the surface of the land or sea and the rest is absorbed by the atmosphere. The heating of the latter causes great differences of pressure, which in turn set up changes of atmospheric circulation. Now it is probable that the main cause of oceanic circulation is the driving force of the winds upon the superficial layers of water; hence periodic and irregular changes in the direction and velocities of ocean currents are probably due to changes in atmospheric circulation traceable to changes in the quantities of heat absorbed from the sun by the earth's atmosphere.

Later still Hjort showed that the study of the variability in the productivity of a fishery is always a complex matter—far more so than was formerly supposed. It appeared that the quantity of oil contained in the liver of a cod (per unit of weight) increases with the age of the fish. Detailed study of the cod shoals also showed that their composition was continually changing; in some years the shoal is composed of younger or older fish than the average and with this latter variation there are changes in the quantities of oil yielded per 1,000 fish. The changes in the composition of the shoals, as regards the proportions of the various "year-classes," are to be correlated with oceanographical changes (see below). It is proper, however, to point out at once how very complicated may be the relationships between oceanographical and strictly biological phenomena, though, of course, the latter are ultimately dependent on the former.

Long-range Periodicities in Oceanographical Changes.—More and more the science seeks to discover periodicities and to correlate these with others. In these attempts new methods are elaborated and in their criticism contributory phenomena are discovered. An interesting example is the discussion, by Otto Pettersson, of the effects of long-range fluctuations in the tide-generating force: this memoir was published about 1914, but has only recently become available to English readers.

The tide-generating force is due to the attraction of the waters of the ocean by sun and moon. There are two gravitational fields which sometimes reinforce and at other times diminish each other and the effect is always a resultant one. There are therefore maxima and minima in the value of the tide-generating force, depending on the relative positions of the sun, earth and moon. The orbits of earth and moon are elliptical, so that the earth is sometimes nearer, sometimes farther away from the sun, and the same is the case with the moon in relation to the earth. The orbital planes of earth and moon are inclined to each other at an angle of 50·8° and at two points only in its orbit can the moon be situated in the plane of the ecliptic: the line joining these two points is called the "line of nodes." A line joining the moon in perigee and in apogee is called the "line of apsides." Now such a constellation as the following must sometimes exist: the earth is in perihelion; the line of nodes coincides with the line of apsides and both lie in the line joining earth and sun. The line of nodes rotates in a period of 18·612 years and the line of apsides in a period of 8·84 years. Such a constellation can be shown to occur at intervals of about 1,800 years and about those times the tide-generating force will be at an absolute maximum. Working out the calculations, Pettersson finds that the favourable constellation occurred and will occur in 3500 B.C., 1900 B.C., 250 B.C., 1433 A.D., 3300 A.D., and so on. In addition to these there are subsidiary maxima at intervals of 4½, 9 and 84–93 years.

Given, then, that the variations in tide-generating force are big enough, the periods when the maxima occur will be critical with regard to oceanographical and meteorological phenomena. About the time of the maxima there must be a longer tidal range (that is, a greater rise and fall than the average); the difference between neap tides and spring tides will also be increased, and as results of these conditions there must be great tidal floods breaking over low-lying coasts and producing extensive denudation. Pettersson further deduces sharp extremes of climate and great temperature contrasts. Far inland he supposes there will be devastating droughts. An effect of the greater tide-generating force will also be instability of the liquid magmas underlying volcanic areas, leading to violent eruptions and earthquakes. There will be great outbursts of polar ice, but this will melt at higher latitudes than in the periods when the tide-generating force is minimal.

It is shown to be probable that such effects actually occurred about the time of the last maximum (A.D. 1433). There is evidence that, towards the close of the mediaeval period, great storms and tidal inundations occurred on the shores of the North Sea and Baltic, and in the course of these floods, culminating in 1297, the Zuider Zee was formed from a lake that existed in its neighbourhood, by the breaking down of dykes. (Similar effects can be seen on a small scale, even in our own times, as the result of exceptionally big tides.) Severe winters were experienced and the Baltic was frequently frozen over so that there was solid ice communication between Sweden and Denmark across the Belts and Sound: this happened in the 13th, 14th and 15th centuries but not in the 16th. There have been great differences in the seas round Iceland and Greenland with regard to the presence of ice: from the 9th to the 12th centuries there is no evidence (in contemporary accounts) of the presence of much ice in the sea off Greenland, nor was much ice carried by the Labrador current, but from the 13th century onwards we do have evidence that there was very troublesome ice off Greenland. Hence from the 10th to the 12th centuries there was great intercourse with Iceland and Greenland on the part of the English, Swedish and Danish, but at the end of the 13th century some change occurred, resulting in the southerly emigration of the Eskimos and the extinction of European civilization in Greenland. At the present time the S. and E. coasts are icebound, and the W. coast, though icebergs are present in the adjoining sea, is clear. Many economic changes probably occurred in consequence of the variations in tide-generating force, as, for instance, the decline in the mediaeval Baltic herring fisheries controlled by the Hanseatic League.

Hydrobiology.—The study of marine life has in recent years become more general, and has become associated with very precise investigations into the chemical composition of sea-water, changes in chemical equilibrium, the effect of variations in salinity and temperature, the processes set up by marine bacteria, and so on. The investigation of the microscopic pelagic life of the sea has also developed to a great extent. Several decades ago all marine organisms became grouped together in three great categories: (1) the *Benthos*, or bottom-living, rooted or sedentary forms; (2) the *Nekton*, or actively swimming animals; and (3) the *Plankton*, or drifting (usually) microscopic organisms, which have little power of locomotion (*see* 21.720). The plankton is divided into (*a*) the *Zoö-plankton* (such as the minute crustacea and the eggs and larvæ of fishes and many other marine animals); and (*b*) the *Phyto-plankton*, that is, the minute algae, diatoms, peridinians, some flagellate protozoa, spores of algæ, etc. The investigation of the plankton from a new point of view, begun by Hansen in 1889, was continued by Lohmann at Kiel, by Cleve in Sweden, by Gran and Ostenfeldt in Norway and Denmark, and by Herdman, Allen and others in England. Hansen's early results were much criticized and the original methods very greatly modified and improved. It became clear that only very rough estimates of the numbers of planktonic organisms in a volume of sea-water as large as (say) 10 cubic metres could be made, but that these estimates could nevertheless be trusted to show very marked regional and seasonal differences.

Distribution of the Plankton.—In general the plankton—and especially the phyto-plankton of the polar and temperate seas—is much more abundant than is that of the sub-tropical and tropical zones. All forms of plankton are more abundant in the shallow coastal waters of relatively low salinity. Finally, the plankton (and again the vegetable forms in particular) are practically restricted to the upper hundred fathoms or so of the sea. Deeper than this, microscopic life is scanty; there is practically no reproduction and growth. These facts of distribution are due to certain conditions that govern the production of organic substance in the oceans.

Holozoic and Holyphytic Organisms.—These terms relate to the modes of nutrition. Typical animals are holozoic, that is, they obtain their food by eating the tissues of other animals and plants: they take their food substances in the organized forms of proteids, fats and carbohydrates. Typical plants are holophytic, that is, they obtain their food substances from purely mineral sources. Water and carbonic acid are synthesized, under the action of sunlight, to form sugar, starch or some other carbohydrate and this is then combined with simple nitrogenous salts to form proteid. Fats doubtless originate by the "cleavage" of the synthetically formed proteids, or from carbohydrates. Now dead animal substance and the excreta of animals decompose in the long run into carbonic acid, water and mineral salts, and so there is a continual destruction of animal substance both on the land and in the sea. Animals cannot make use of these decomposition products, but the plants can. Therefore all life in the sea (as on land) depends on the power which the holophytic organisms possess of synthesizing mineral substances into organized tissues. This is mainly effected, in the sea, by the phyto-plankton.

Ultimate Food Substances in the Sea.—These are the materials which are utilized by the vegetable plankton in the synthesis of living material: they are water, carbonic acid, nitrates and nitrites of calcium, magnesium and other earthy and alkaline metals, phosphates, silica, traces of salts containing iron, sulphur, potassium and a few other elements. Except the water, all are present in the sea in exceedingly small proportion. The source of the carbon of organic tissues is carbonic acid; that of the nitrogen in the proteids is the nitrates, nitrites and salts of ammonia dissolved in sea-water; the material of the shells or other skeletons is the silica, phosphate and calcium of the salts of sea-water (and, in rare cases, the salts of strontium). All these substances exist as only a fraction of one part or, at most, a few parts, per million of water. Carbonic acid is the most abundant and it may be contained in sea-water in the proportion of about 50 milligrammes per litre (that is, 50 per million). All of this is not available, for carbonic acid is present as such in solution, as bicarbonate (of magnesium mainly) and as normal carbonate. Only the "free" carbonic acid and that of the bicarbonate can be utilized in the process of photosynthesis by the diatoms and algæ.

Mineral nitrogenous compounds (nitrates, nitrites and ammonia) are much more rare. The distribution is very interesting and it has been shown that the water of the Antarctic Ocean contains about 0·5 part per million of nitrogen in the above forms. The North Atlantic contains, on the average, about 0·15 part per million and the equatorial seas little more than about 0·1 part per million. The proportion varies with the temperature. There is more inorganic nitrogen in the sea near the land than in mid-ocean and there is more at the sea bottom than near the surface; finally, there is more in the later winter than at any other season. Silica (which is required for the skeletons of diatoms, radiolaria, peridinians, etc.) is present in about the same concentration, but it is now suspected that a source of this substance may be clay washed down from the land and present in the sea in the colloidal form. Phosphates, necessary for the formation of skeletons and also for the nucleo-proteid of cells, are about as scarce as nitrogen. In the case of all these substances the quantities involved are so very small, and the difficulties of estimation are therefore so great, that the information we possess is by no means satisfactory. Clearly, however, the vast quantity of living substance in the ocean is built up from materials that are present in the sea-water as an exceedingly dilute solution, and the solution is dilute just because organisms are incessantly utilizing it. It follows, too, that when there is a number of substances, all essential for the elaboration of living material, and when one of these is present in minimal proportion, that one substance rules the production, just as the effective strength of a chain depends on the weakest link. This is Liebig's "law of the minimum."

Seasonal Periodicities of Life in the Sea.—In the temperate seas the two great features are: (1) the outburst of vegetable life in the spring; and (2) the vernal or summer phase of reproduction among animals. The low temperature of the winter allows (indirectly) an accumulation of the essential nitrogenous mineral salts, but as the minimal temperature is passed (in Feb. or March) and the days begin to lengthen the phyto-planktonic organisms begin to reproduce. Carbonic acid is taken from the water and synthesized (by the mediation of light energy) into carbohydrate. The carbonic acid is taken from solution and then bicarbonate (usually that of magnesium) dissociates into carbonic acid and normal carbonate, and the process of photosynthesis ceases when there is no more bicarbonate in solution. The result of this is that the *alkalinity* of the sea-water increases and the hydrogen-ion concentration decreases. Perfectly pure distilled sea-water dissociates, to an infinitesimal degree, into hydrogen (H) and hydroxyl (HO) ions, so that one litre of such water contains 1×10^{-7}, or $\frac{1}{10,000,000}$ part of a gram-molecule of either hydrogen or hydroxyl (a gramme-molecule of hydrogen is 2 grammes, or of hydroxyl 17 grammes). Pure water, then, has a hydrogen-ion concentration of 10^{-7} but sea-water gives (because of the mixture of the salts in solution) the concentration $10^{-8\cdot2}$ and when photosynthesis by the larger algæ, or diatoms, is very active this figure falls to about $10^{-9\cdot1}$. That is, the concentration of H-ions decreases and that of the HO-ions increases; the water becomes more alkaline because the carbonic acid of the bicarbonate has been abstracted by the phyto-plankton to the extent that normal carbonate is left. When that condition is attained photosynthesis slows down and ceases.

The spring outburst of plant life in the sea culminates about April, just about the time when the temperature of the water begins to rise rapidly. The increasing temperature raises the rate of animal metabolism, while the higher alkalinity is a stimulus to cell-division. Therefore the animal organisms, as a rule, reproduce in the spring or early summer just after the vernal phyto-plankton maximum. From then onwards the plant organisms diminish because they are eaten by the animal larvæ.

The numerical values are, it is to be noted, exceedingly small. Experiments made by Moore and Whitley at Port Erin in the Isle of Man show that the hydrogen-ion concentration falls from about $10^{-8\cdot1}$ in Dec. to about $10^{-8\cdot4}$ in April. This corresponds to an increased alkalinity represented by about 2 c.c. of N/100 standard alkali, and that difference means that the carbon of about 8·8 milligrammes of carbonic acid has been built up (by photosynthesis) into carbohydrate during the period during which the change in alkalinity proceeded. If it occurs uniformly over the sea to a depth of only one metre it leads to a production of about 6 tons of carbohydrate per sq. km. of sea.

Following the great spring production of plant substance there is, therefore, a summer outburst of animal life. Following that again is a less well-marked maximum of phyto-plankton in the autumn, occurring just after the period of highest sea temperature. The temperature then falls rapidly and there is a gradual slackening in the production of organic substance and a general lethargy of life. The plankton, both animal and vegetable, attains its minimal values and many of the larger forms of animal life pass into a kind of condition of hibernation.

The Transport of Essential Food Substances.—First of all we consider inorganically combined nitrogen (as nitrates and nitrites chiefly), since upon this depends all the life of the ocean. The concentration of these substances is least in the warm equatorial seas and greatest near the poles. The temperature is, however, only an indirect cause of this variation and the direct cause is now known to be the activity of the nitrogen-bacteria. The nitrogen-bacteria that concern us here are of two main categories: (1) those that assimilate elementary nitrogen from its solution in sea-water, building it up into combination with carbohydrate as proteid; and (2) those that break down nitrate into nitrite, nitrite into ammonia and ammonia into elementary nitrogen. Two antagonistic processes proceed simultaneously, the fixation of atmospheric nitrogen and the reverse change, and either process is accelerated by an increase and retarded by a decrease in temperature. It is maintained by Brandt and others belonging to the Kiel school of marine biologists that the process of denitrification is, on the whole, more significant in the sea than that of nitrogen-fixation.

If this is admitted the poverty of tropical sea-water in mineral nitrogen compounds is explained by the higher temperature, which accelerates the activity of denitrifying bacteria. Since there is less of the indispensable food material in the warmer seas there is, therefore, less phyto-plankton. This is really the case, for all observations show that the Antarctic and Arctic ice-bound seas are enormously rich in diatom life when compared with temperate and tropical regions: the great Antarctic zone of sea-bottom deposit, in which the skeletons of diatoms predominate, covers some ten millions of square miles. The relative abundance of nitrates and nitrites at the bottom of deep oceans as compared with the surface can be explained in the same way, for at the bottom the temperature is about zero Centigrade and the activities of the denitrifying bacteria are practically suspended. The dead bodies of organisms fall down from the surface and are slowly resolved into products of putrefaction, which gradually pass into the mineral forms, nitrates, carbonic acid and ash. The bottom water is relatively rich in these substances as well as in decaying organic matter, and would become progressively richer but for the slow drift towards the equator and the welling-up of bottom water to the surface in these latitudes.

It would seem that, on the whole, nitrogen compounds in the ocean (whether existing in the organic or inorganic forms) remain constant in amount. Nitrogen is always being synthesized from the atmosphere (by plants, and by electrical discharges which combine nitrogen and oxygen), and this combined nitrogen is either utilized by land organisms or is washed down into the sea in the water of the rivers. In the end much inorganic nitrogen salts must be added to the sea both in the above way and as the result of the putrefaction of the dead substance of terrestrial animals and plants.

As a general rule the sands in the immediate vicinity of the shore contain organic matter resulting from land drainage (particularly near great centres of human population) and from the remains of dead plant and animal organisms. At the same time the denudation of rocks sets free iron compounds which dissolve in the sea to a slight extent and permeate the littoral sands which contain organic matter. The putrefaction of the latter sets free sulphuretted hydrogen, which then acts on the iron compounds, precipitating ferrous sulphide. The latter discolours the sand and so one finds, round the coast and towards the upper margin of the zone between high- and low-water marks, an under layer of black sand formed in this way. On the surface, where the sand is bathed by the tidal water, the ferrous sulphide becomes oxidized and the sand is bleached, but underneath it is dense black or grey, as the case may be.

A considerable degree of denitrification must, therefore, take place in the ocean, for the concentration of combined nitrogen is always excessively small. The regional differences, as we have seen, can be explained by the regional difference of temperature.

The quantities of oxygen and carbonic acid in the sea are nearly constant so far as we can determine. The former gas is continually being evolved by the plants and absorbed by the animals, and precisely the reverse actions occur in the case of carbonic acid. Further, the ocean and the atmosphere stand in equilibrium with each other; if there is excess of carbonic acid anywhere in the sea it is absorbed by the atmosphere and vice versa, and so also with the oxygen. Differences of temperature and atmospheric pressure must disturb this equilibrium, but the movements of both ocean and atmosphere lead to a high degree of uniformity in both envelopes as regards their gaseous constitutions.

Silica is continually being added to the ocean. Land masses are denuded and minerals containing silicates are carried down to the sea as sediments. The coarser particles of the sediments are deposited near the shore as gravels, sand and muds, but the very fine particles remain in suspension in the colloidal form, and some of this may be acted upon by marine bacteria or (it is surmised) even utilized by diatoms as a source of silica. The silica, in the form of diatom or radiolarian skeletons, is eventually deposited on the ocean floor after the death of the organisms. Most of the fine colloidal clay is, however, deposited as river-sludges when the fresh water carrying it mixes with denser sea-water. The colloidal particles are electrically charged and become discharged by the ions of sodium, magnesium and calcium present in the sea-water. This "coagulation" leads to the formation of the river-sludges that form deltas.

Lime is transported in solution as sulphate and bicarbonate, both of which salts are soluble to some extent in water. The water of the ocean is usually nearly saturated with calcium salts, which must continually be removed since they are always being added in the water brought down from the land. Lime is, in fact, absorbed to an enormous extent by fishes, molluscs, crustacea, calcareous algæ and sponges, starfishes, sea-urchins and feather stars, many polyzoa and a multitude of protozoa (mainly the foraminifera). All these animals have calcareous skeletons or shells of some form and they secrete the calcium from its solution as sulphate, converting it into carbonate. Some unicellular organisms are said to segregate salts of strontium from sea-water.

Coral Formations.—Coral reefs remove calcium from solution in the sea on a vast scale. During recent years the controversies with regard to the modes of formation of these structures have entered on a new phase. The theories of Darwin, Agassiz, Dana, Semper, Murray and others had led to apparently interminable discussion, and the great boring experiments at Funafuti atoll, which were expected to be crucial, gave results that backed both the rival theories of Darwin and Murray. On the other hand, Wayland Vaughan (see *Annual Report of the Smithsonian Institution*, 1917) has shown clearly that the problem is essentially a biochemical one and may finally be solved by the methods of the latter science.

It is not at all certain that the masses on which coral reefs are built consist entirely of the remains of the skeletons of reef-forming organisms and it is probable that chemically precipitated carbonate of lime predominates. The water in shallow seas, off the shores of islands or in lagoons, is saturated with calcium bicarbonate and if the amount of carbonic acid in solution be reduced by any means, normal carbonate must be precipitated. Therefore a reduction in the partial pressure of the gas in the atmosphere, or a rise in the temperature of the water, or a violent agitation of the sea itself, will lead to precipitation of calcium carbonate. Evaporation of the water and anything that lowers the hydrogen-ion concentration have the same effect.

Therefore an increase in photosynthesis caused by the multiplication of plant microörganisms will lead to the precipitation of calcium carbonate, for carbonic acid will be withdrawn from solution to take part in carbohydrate synthesis by the plants. Denitrifying bacteria will raise the alkalinity (or reduce the H-ion concentration) by forming ammonia, which will combine with the carbonic acid in solution and so throw down normal carbonate of lime. Drew found as many as 160 millions of denitrifying bacteria per c.c. of sea-water on the W. side of Andros I. in the Bahamas. There are, therefore, a number of agencies, all of which operate in shoal waters on the lee side of islands, or in shallow lagoons in such regions as the Bahamas, and the result of all these is to throw down calcium carbonate from solution in sea-water as minute needle-shaped crystals or little balls of aragonite. Such material, it is suspected, may form the massive bases on which barrier or fringing or atoll reefs are built up.

The "Glacial Control" Theory.—Interesting speculations as to the periods of origin of great coral reefs have been made by Wayland Vaughan, Andrews and Daly and Humphreys. (The causes or conditions of glaciation, it may be noted here, are no better known than in 1910. It has been suggested, however, that a prolonged period of volcanic activity may reduce the air temperature to a marked degree by throwing large quantities of dust into the atmosphere: this will act by preventing the penetration of solar radiation.) During a period of prolonged glaciation water becomes withdrawn from the ocean, for rainfall goes to form solid ice-caps that accumulate upon polar and continental land areas. Daly estimates that the maximum lowering of ocean level due to this cause would only amount to 36 fathoms, but even that would be the cause of very marked geological effects. In Pleistocene times, then, when there were prolonged glacial ages, the sea-level was lowered and at the same time there was a reduction in sea temperature, so that the rate of reproduction of the coral polypes, and so the growth of reefs, was diminished. The protection of the shore may therefore have been decreased, with the result of increased land erosion and the formation of extensive shallow submarine plateaux. When the warmer interglacial periods recurred the polar and continental ice-caps melted and the sea-level became raised again—that is, there was submergence of the eroded plateaux formed as indicated above. Corals would now grow luxuriantly in these shallow coastal waters of increasing temperature, forming reefs and extensive coral flats. These new structures would rest uncomfortably upon eroded formations and this, Wayland Vaughan points out, is what we actually observe in the case of living and fossil coral reefs. In so far as it depends on solution of calcareous rock the Semper-Murray theory of coral reefs is unsatisfactory.

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OCHS, ADOLPH S. (1858–), American newspaper proprietor, was born in Cincinnati March 12 1858, of Jewish parentage. His father, who had left Bavaria for the United States in 1846, settled in 1865 with his family in Knoxville, Tenn., where the son studied in the public schools and during his spare time delivered newspapers. At the age of 15 he became a printer's devil on a Knoxville paper, and advanced so rapidly that in 1878 he gained control of the reorganized Chattanooga *Times*, which soon assumed a high position among the papers of the South. The following year he founded a commercial paper called *The Tradesman*. He was one of the founders of the Southern Associated Press and served as president. In 1896 he obtained control of *The New York Times*, then in financial difficulties and with circulation greatly diminished. He formed the New York Times Co., placed the paper on a strong financial foundation, and became the majority stockholder. With a daily issue on Aug. 18 1896 of 18,900 (of which over half was returned unsold), the circulation increased rapidly, reaching an average of 352,500 in 1921. Annual receipts exceeded $15,000,000, probably equalling those of any other American paper. On Aug. 18 1921, the 25th anniversary of reorganization, the staff of *The New York Times* numbered 1,885. It was classed as an independent Democratic publication, and consistently opposed William Jennings Bryan in his presidential campaigns. By its fairness in the presentation of news, editorial moderation and ample foreign service, it secured a high place in American journalism, becoming widely read and influential throughout the country. Beginning with 1896 there was issued weekly a supplement eventually called *The New York Times Book Review and Magazine.* Gradually other auxiliary publications were added: *The Annalist*, a financial review appearing on Mondays; *The Times Mid-Week Pictorial* on Thursdays; *Current History Magazine*, a monthly, started during the World War. *The New York Times Index*, started in 1913 and published quarterly, forms an invaluable guide to contemporary events, to be compared only with the similar *Index* to *The Times* of London. In 1901 Mr. Ochs became proprietor and editor of the Philadelphia *Times*, later merged in the Philadelphia *Public Ledger*, of which he was sole owner from 1902–12, when he sold it to Cyrus W. K. Curtis.

ODLING, WILLIAM (1829–1921), English chemist, was born in Southwark Sept. 5 1829, the son of George Odling, surgeon. He became a medical student at Guy's Hospital, and graduated M.B. of London University in 1851. He next went to Paris, where he studied chemistry under Gerhardt, and on his return to London he was appointed director of the chemical laboratory at Guy's Hospital. In 1859 he became F.R.C.P., and in 1863 lecturer on chemistry at St. Bartholomew's Hospital. In 1868 he succeeded Faraday as Fullerian professor of chemistry at the Royal Institution, and in 1872 he was elected, in succession to Sir Benjamin Brodie, Waynflete professor of chemistry at Oxford, a chair he occupied for 40 years. He was successively fellow, secretary and president of the Chemical Society and was elected F.R.S. in 1859. His published works include a *Manual of Chemistry* (1861); *Lectures on Animal Chemistry* (1866); *Outlines of Chemistry* (1869); *Chemistry* (1884), etc. He died at Oxford Feb. 17 1921.

OHIO (*see* 20.25).—In 1920 Ohio still held the fourth place among the states of the American Union, with a pop. of 5,759,394, an increase of 992,279 or 20·8% for the decade 1910–20. This was the largest rate of increase since the Civil War. The density of pop. rose from 102·1 per sq. m. in 1900, to 117 in 1910, and 141·4 in 1920. There was a marked increase in the negro pop. of the cities by migration from the far South, and of the foreign element from other states and from abroad. More significant was the drift from rural districts to cities. In 1900 the urban pop. in cities and incorporated villages of 2,500 inhabitants or more formed 48·1% of the total, in 1910 55·9% and in 1920 63·8 per cent. Virtually two-thirds of the people of Ohio in 1920 lived in urban communities. The largest change was in the strictly rural, that is, unincorporated territory. Each successive decade since 1900 has shown an absolute decline in the rural population. The number of cities containing more than 25,000 inhabitants increased (1910–20) from 14 to 22, of those of more than 100,000 from five to seven.

The following table shows the pop. and percentages of increase of all cities of over 30,000 inhabitants:—

	1920	1910	Increase Per cent
Akron	208,435	69,067	201·8
Canton	87,091	50,217	73·4
Cincinnati	401,247	363,591	10·4
Cleveland	796,841	560,663	42·1
Columbus	237,031	181,511	30·6
Dayton	152,559	116,577	30·9
Hamilton	39,675	35,279	12·5
Lakewood	41,732	15,181	174·9
Lima	41,326	30,508	35·5
Lorain	37,295	28,883	29·1
Portsmouth	33,011	23,481	40·6
Springfield	60,840	46,921	29·7
Toledo	243,164	168,497	44·3
Youngstown	132,358	79,066	67·4

The largest increase was in the cities forming a belt about Cleveland. Except in the case of Akron, none of the cities having more than 100,000 inhabitants increased at as high a rate during the decade 1910–20 as during the preceding one.

Communications.—A flood in 1913 (*see History*, below) wrecked the two principal canals, the Miami and Erie from Cincinnati to Toledo and the Ohio and Erie from Portsmouth on the Ohio river to Cleveland. Though they have not been restored and are not likely to be in the near future, the state derives a larger income from land rentals on the old right of way and the sale of water rights from the fragments of the old system than it did from the canals when they were in full operation. In fact the state is receiving (1921) a fair return on the capital invested. In recent years the lower part of the Muskingum river and that part of the Ohio bordering the state has been canalized. The chief development in transportation has been the expansion of interurban traction service and the establishment of motor-truck lines. In 1919 there were 4,223 m. of electric railway; only New York and Pennsylvania had more. In steam-railway mileage there was no significant change between 1900 and 1920. In order to meet the demand of the motor-car for improved roads large state expenditures have been made. During 1918 only three states, Iowa, New York and Pennsylvania, spent a larger sum on improving roads; only four, California, New York, Pennsylvania and Iowa, had spent more during the period of statehood. As a result at that time 31,800 m. or 36·8% of the rural public roads had been surfaced. No state had so large a total of surfaced mileage.

Agriculture.—The total value of all farm property in 1920 was $3,095,666,336, as against $1,902,694,589 in 1910, an increase of 62·7 per cent. The total for 1920 included land and buildings, $2,661,435,949; implements and machinery, $146,575,269; and live stock, $287,655,118. There had been slight change in 10 or even 20 years in the proportion of farms cultivated by owners and by tenants; about 70% are worked by the owners or part-owners; 63% contain less than 100 acres, 99% less than 500 acres. The size of the average farm is about 80 acres.

The statistics of Ohio crops in 1920 showed an increased productivity of farm land. Corn and oats are the only grains which show a decline in the total output. In 1918 Ohio was the fourth state in the production of hay and tobacco, fifth in the production of corn and oats, and sixth in wheat. Ohio also ranks high in the quantity of its dairy products, the value of which was $81,148,586, an increase of 184% over 1909.

The following table shows the quantity and value of Ohio's agricultural products according to U.S. census of 1920:—

AGRICULTURAL PRODUCTION (1919)
(U.S. Census Reports)

Crop	Quantity	Increase Per cent over 1909	Value	Increase Per cent over 1909
All crops . . .			$607,037,562	174·6
Cereals, total (bus.)	259,547,851	4·8	391,834,355	184·1
Corn (bus.) . .	149,844,626	−4·9	217,274,709	163·9
Oats (bus.) . .	46,818,330	−18·7	39,795,590	71·4
Wheat (bus.) . .	58,124,351	89·6	127,873,574	311·0
Beans, peas, peanuts, flaxseed, sugar-beet seed . .			281,767	558·4
Seeds: Clover, alfalfa, timothy, etc. (bus.) . . .	309,968	7·4	5,978,760	321·2
Hay and forage (tons) . . .	7,661,890		130,187,929	
Vegetables . . .			43,365,158	107·7
Miscellaneous, total			20,216,824	90·4
Tobacco (lb.) . .	64,420,472	−27·3	13,528,302	50·3
Fruits and nuts . .			15,172,769	93·1

The total for cereals includes barley, rye, buckwheat, and mixed crops besides corn, oats and wheat. "Miscellaneous" includes tobacco, sorghum, sugar-beets, maple sugar, broom corn, hemp, ginseng and minor crops. The total acreage harvested in 1919 was 11,780,554, an increase of 3·1 % over 1909.

Mineral Products.—In 1918 Ohio ranked fifth among the states in the value of the products of mining industries in general, fourth in the amount of bituminous coal produced. From 1900 to 1918 there was an increase in the annual output of bituminous coal from 16,900,000 short tons to 40,900,000, an increase of 142 % which was about the rate of increase in other coal-mining states. Ohio produced 7·6 % of the bituminous coal of the United States in 1917. Of this 85·7 % was mined by machinery, mostly electrically driven. The coal of Ohio is produced mainly in the south-eastern part of the state, in Belmont, Athens, Jefferson, Guernsey, Perry and Hocking counties. The fire-clay mines of Tuscarawas, Jefferson, Columbiana, Stark and Carroll counties supply the raw material for a rapidly rising industry. In coke Ohio ranked third (1917) with a production of 3,694,302 net tons; in the value of its natural gas output (1918) it was fourth, $24,234,741. As a producer of crude petroleum Ohio has fallen far behind in recent years; the total for 1918 was 7,285,005 bar. with a value of $23,465,197.

Manufactures.—According to the preliminary report of the census bureau for the year 1919, manufactured products were valued at $5,100,298,728; the average number of wage-earners was 730,733, and the value added by manufacture, $2,189,460,420. The pig-iron tonnage, 8,700 tons in 1918, was nearly as great as that of Great Britain at the same time. The most notable advance in the decade was in the production of motor-cars, in which Ohio ranked next to Michigan, and in the manufacture of motor-car tires. The following table shows the relative importance in 1914 of leading manufacturing industries the value of whose products exceeded $25,000,000:—

Industry	No. of Wage-Earners	Value of Products	Increase Per cent 1909–14
All industries . . .	510,435	$1,782,808,279	24·0
Iron and steel . . .	46,397	205,023,391	3·7
Foundries, machine shops	73,103	178,855,069	22·6
Rubber goods . . .	21,705	109,658,605	103·4
Automobiles, etc. . .	18,752	85,710,585	120·7
Blast furnaces . . .	5,786	72,969,368	12·8
Meat-packing . . .	3,619	66,674,379	31·2
Printing and publishing .	18,070	55,608,924	33·5
Flour-milling, etc. . .	2,363	45,171,200	6·1
Brick and tile products .	27,334	38,667,374	26·6
Electrical apparatus . .	12,695	36,120,978	92·4
Boots and shoes . . .	14,674	33,641,705	6·6
Railway cars, etc.* . .	21,639	33,286,205	16·0
Bakery products . . .	7,665	30,560,881	32·8
Liquors, malt . . .	5,340	31,990,274	26·3
Timber products . . .	11,921	31,852,694	7·9
Tobacco manufactures .	13,282	28,467,079	1·5
Men's clothing . . .	10,758	27,621,829	11·1
Food preparations . .	1,523	27,346,187	152·3

* Includes only operations of steam railways in building their own equipment.

The true value of all property in Ohio was estimated in 1912 at $8,908,432,943, but with all its varied industries the *per capita* wealth ($1,868) was below that of other manufacturing states such as New York, Pennsylvania, Illinois, New Jersey, Connecticut and Michigan, and that of agricultural states such as Minnesota, Iowa, Nebraska, Kansas, Oklahoma and California.

History.—The chief political advance in the decade 1910–20 was the progress in adapting the constitution and the system of administration to the new needs of the state.

The constitution was made in 1851 for a frontier agricultural community, and no important changes had occurred in 60 years. A revision of the constitution in 1874 was defeated at the polls, largely because of the clauses on taxation. It was, however, the beginning of a struggle for the readjustment of the system of taxation to meet more complex social conditions. A proposal to hold a convention in 1891 was rejected by the voters. As the end of another 20 years approached, the Ohio Board of Commerce, which was conducting the campaign for tax reform, started a movement for a general constitutional convention. Several groups, like the Ohio Direct Legislation League, which advocated the initiative and the referendum, and the liquor interests that saw an opportunity to secure a licensing system, supported the movement, which was endorsed by both political parties. At the election of 1910 a convention was almost unanimously approved. Delegates were chosen in Nov. 1911, and the convention sat Jan.–June 1912. The delegates, of whom the majority were Democrats, represented the progressive elements of both major parties. Forty-two amendments were submitted to the voters on Sept. 3, 1912, of which 34 were ratified. Among the proposals defeated were those for the abolition of capital punishment, woman suffrage, the use of voting machines, and $50,000,000 bond issue for a state system of roads. In the convention itself the tax reformers lost their main battle for a classification of property for purposes of taxation. Indeed the convention and the voters approved a clause which was intended to make it more difficult for supporters of tax reform to succeed. The tax reformers did secure for the General Assembly the power to impose, if it would, inheritance, income and franchise taxes as well as taxes upon the production of coal, oil, gas and other minerals. A tax commission of three created in 1910 did succeed in bringing out for taxation the property of corporations at something near a true valuation, and in obtaining the adoption of the 1 % rule as the maximum rate for taxation. The League for Direct Legislation secured the initiative and the referendum, the liquor interests a licensing system. Many of the amendments expressly enlarged the powers of the General Assembly. Several sought by the labour element were intended to spur the Legislature to action for industrial and social betterment. Amendments affecting the judiciary and the jury system were designed to expedite the work of the courts. A home-rule amendment gave the cities freedom to adjust themselves to the new economic conditions. The old rule that amendments to be ratified must be approved by the majority of those voting in the election gave way to a new one requiring only a majority of those voting on the amendment. An attempt in 1913, following the convention of 1912, to introduce the short ballot by making a large number of state, county and township officers appointive, failed. In 1918 the effort which had continued for nearly 50 years to give the Legislature power to classify property for taxation was approved by the people, only to be declared unconstitutional by the courts, on a technicality. At the same time, on the eve of Federal prohibition, an amendment incorporated state prohibition in the state constitution.

More significant of the purpose to adapt state government to the needs of the time is the legislative history. In 1909 Ohio had the customary administrative system composed of special boards, commissioners, bureaus and departments created to meet special problems as the Legislature had recognized them, but with overlapping jurisdiction and uncertain responsibility. In hardly any respect was the state service adequate or modern. In charge of the charitable and penal institutions, for example, were 18 or 19 separate boards, competing for support, maintaining as many accounting systems, failing wholly in coördination. Successive Legislatures took up during the following decade the problem of reorganization. For a time, chiefly during the years 1909–15, the legislators seemed to be working towards a commission type of administrative organization. Then followed a period of hesitation in which party politics interfered with progress, 1915–7. The third stage of opinion, following 1917, strongly favoured a single executive officer, appointed by the governor.

A law of 1910 centralized the taxing power in a small State Tax Commission, bringing to an end an expensive system of decennial boards of equalization. The following year all the charitable and penal institutions were placed under a Board of Administration. Four commissioners took the place of 57 trustees. A single fiscal agent replaced 19 stewards. In 1911 the old Railroad Commission became the Public Service Commission. In this case, largely for personal reasons, the duties of state commissioner of railways and telegraphs, created in 1867, had been transferred to a commission of three members (Act of 1906). The law of 1911 gave the Public Service Commission the same power over public utilities in general which the Railroad Commission had had over railways and telegraphs. In 1913 the Legislature changed the Public Service Commission to a

Public Utilities Commission. The duties of the commission were redefined, emphasizing the procedure in the valuation of property and the determination of the reasonableness of rates and charges for public utilities. At the same session of the General Assembly a State Industrial Commission of three members was created to assume the functions of the Board of Awards in industrial accidents, the Bureau of Labor Statistics, the Bureau of Mine Inspection, the Department of Inspection of Workshops, Factories, and Public Buildings, the Board of Examiners of Steam Engineers, and the Board of Arbitration, together with the new duties of regulating hours and conditions of labour. This Act was a part of the legislative progress of industrial insurance in Ohio. In 1911 the Workmen's Compensation Act had substituted "a system of compensation for industrial accidents, which compensation is to be paid out of a state insurance fund, to which both employers and employees contributed (90% and 10% respectively) in lieu of the civil action for damages." This first plan of state insurance was optional. The Act applied only to employers with five or more employees. A State Liability Board of Awards, with one member representative of labour, one of employers, and another of the public, was created to administer the system of compensation. The law of 1913 made the system compulsory. Employers were required to guard the safety of employees and also to arrange reasonable hours of work. Employers with less than five employees might take out workmen's insurance and have the benefit of the cheap state rates and of the protection from civil suits for damages which the system gives the employers. Ohio under the Act maintains its own state insurance fund. Every employer pays into the fund an amount proportioned by the State Industrial Commission to the amount of the pay-roll and the hazards of the occupation. The employer may carry his own compensation insurance, but in that case he must give the state a bond. By 1918 the premium income to the state fund amounted annually to $9,000,000. At a cost of $4\frac{1}{2}\%$ of the premium receipts the Industrial Commission gave protection to more than 1,500,000 workmen.

In the days when the interests of Ohio were chiefly agricultural there were three especially important institutions: the Department of Agriculture, the State Experiment Station and the College of Agriculture. There was, however, confusion regarding the specific duties of each, and duplication of work. To remedy this the reform Legislature of 1913 brought the three institutions, together with the dairy and food commissioner and the fish and game commissioner, under a small agricultural commission with four members. Two years later, with a change of administration, the Legislature undid the reform in part, making the Experiment Station and the Agricultural College independent institutions, and restoring the large Board of Agriculture of 10 members without a salary. A change in political parties occurred again in 1917 and the Legislature, while retaining the large Board of Agriculture, made its functions those of an advisory council. The position of Secretary of Agriculture was created, and responsibility put upon him as director of the department.

The same type of organization was applied in 1917 to education and health. There had been an elective state commissioner of common schools since 1853. One of the constitutional amendments of 1912 instructed the Legislature to make provision for a state-wide public-school system, and substitute for the commissioner elected by the people a superintendent of public instruction, appointed by the governor. The Legislature appointed a special commission to survey the needs of the rural schools and in 1914 enacted a Rural School Code; three years later it created a State Board of Education. A state superintendent of public instruction appointed by the governor became secretary and executive head. The reorganized Department of Education was instructed to emphasize rural agricultural education, and to coöperate with the Federal Government in vocational education. The old State Board of Health was at the same session subjected to a similar reform. In caring for the health of its people Ohio had been notoriously backward. Successive legislative Acts increased the power of the State Board of Health and prepared the public mind for the reorganization of 1917–9. In the Act of 1917 a State Commissioner of Health was supported by an Advisory Public Health Council of four members. The statute of 1919 created a state-wide system of municipal and general health districts. Cities of 25,000 constituted municipal health districts; townships and smaller cities general health districts. The law provided for local commissioners of health and an Advisory Council modelled on the state organization. The powers of the Department of Health were greatly increased, and each district received power to employ physicians and nurses so far as necessary to protect the health of the community. The interest in roads led the General Assembly in 1915 to create a State Highway Commissioner. The following session of the General Assembly added a State Highway Advisory Board to serve without compensation. An Act of 1919 established a state highway levy of 5/10 of a mill per $100, and authorized the development of a state system of highways and coöperation with the road-making enterprises of the Federal Government.

With a change of administration in 1921 the further reorganization of the state system of administration was made the principal policy. An Act was passed which combined the numerous departments and commissions which had grown up in recent years by legislative enactment into nine departments—finance, commerce, public works, agriculture, health, industrial relations, examinations, education and public welfare. At the head of each is a director, appointed by the governor. Each director is authorized to appoint, with the governor's approval, a purely advisory board. If the Act stands the test of constitutionality Ohio will have a system of administration analogous to that of the Federal Government. The state directors of departments correspond to the heads of the national departments. The secretary of state, auditor, treasurer, and attorney-general are still elected by popular vote. A change in the method of choosing them can only be made by a constitutional amendment, although in some cases the Act of 1921 transferred their duties to the new departments.

The General Assembly of 1913 authorized civil service reform and a budget system. A civil service commission of three, subsequently reduced to two, was established. Another statute authorized a commission or commissioner of budget, but made no direct specifications regarding the organization. From 1914 to 1921 there was a budget commissioner, and the foundations of modern budget procedure were laid. In 1917 the governor presented his budget to the Legislature, meeting both Houses in joint session and explaining the items of the budget and answering questions from the floor. Other progressive legislation included a children's code (1913), providing a state-wide juvenile court and a mothers' allowance system, and a pension system for teachers in the public schools (1919), supported in part by contributions from the teachers and in part from the school boards.

A disastrous flood in 1913, affecting especially the inhabitants of the Miami, the Scioto, and the Muskingum river valleys, led to a most thoroughgoing measure for the protection of the river valleys from future damage of the kind. The following session of the Legislature authorized the inhabitants of a danger area to form themselves into a "conservancy district" and appoint a "conservancy board" which should have adequate powers to secure funds by assessing the property of the affected area and to carry out such measures of protection as the board might adopt. By 1921 the Miami Conservancy District had practically completed a series of dry reservoir dams costing $25,000,000. The flood of 1913 cost more than 500 lives and in property an amount estimated from $250,000,000 to $350,000,000. At an expense of one-tenth of this amount one of the three valleys most liable to damage has removed the menace.

The municipal home-rule amendment of 1912 gave cities of over 5,000 inhabitants the privilege of adopting charters with very large powers of local self-government and with a great degree of freedom from legislative interference. The chief limitation was the failure to give the cities home-rule in levying taxes or in incurring debts. The state reserved the control of elections, of education, of the general police powers and all matters affecting the welfare of the state as a whole. However, the courts of Ohio have liberally interpreted the amendment so that the cities came into the possession of a really broad grant of local autonomy if they chose to claim it. Of the 82 cities qualified to adopt home-rule charters about one-fourth had done so by 1921. Fourteen—Akron, Ashtabula, Dayton, Cleveland, Cleveland Heights, East Cleveland, Gallipolis, Lima, Painsville, Sandusky, South Charleston, Springfield, Westerville, and Xenia—had adopted the city-manager plan of municipal government.

In order to mobilize more effectually the war resources and to aid the war policies of the national Government after the entry of the United States into the World War, the governor appointed, June 1 1917, an Ohio branch of the Council of National Defense. It constituted a sort of governor's cabinet on the war, although without legal status. It worked through committees of finance, food conservation, labour and industrial relations, publicity, transportation and the like. A state employment service, organized before the war, performed the important war task of supplying labour for the construction of the cantonment at Chillicothe. As many as 2,760 men were furnished within 24 hours. The total number of men furnished by the state to the army, navy and marine corps was 200,293; the number of deaths 4,982; the amount raised in Liberty and Victory loans $1,324,545,750.

Recent governors have been Judson Harmon (Dem.), 1909–13; James M. Cox (Dem.), 1913–5 and 1917–21; Frank B. Willis (Rep.), 1915–7; Harry L. Davis (Rep.), 1921– (E. J. B.*)

OHNET, GEORGES (1848–1918), French novelist and man of letters (*see* 20.35), published in 1908 *La Route Rouge* and in 1912 *La Serre de l'Aigle*. His last work was *Journal d'un Bourgeois de Paris pendant la Guerre de 1914* (1914). He died May 5 1918.

OHRWALDER, JOSEPH (1856–1913), Roman Catholic missionary, was born at Lana, near Meran, Tirol, May 1856. In 1880 he went out to the Sudan as a missionary, and was in 1882 taken prisoner by the Mahdi. In 1892 he managed to escape, and the same year published an account of his experiences under the title of *Ten Years' Captivity in the Mahdi's Camp*. He died at Omdurman Aug. 8 1913.

OKLAHOMA (*see* 20.57).—The pop. of Oklahoma in 1920 was 2,028,283; in 1910 it was 1,657,155; an increase of 371,128 or 22.4% as compared with 866,764 or 109.7% in the preceding decade. The urban pop. increased from 19·3% of the total in 1910 to 26·6% in 1920. During the same period the density of pop.

increased from 23·9 per sq. m. to 29·2. Indians decreased from 74,825 to 57,337. Negroes increased from 137,612 to 149,408. The pop. in 1920 of the larger cities of the state was:—

Oklahoma City	91,295	Bartlesville	14,417
Tulsa	72,075	Ardmore	14,181
Muskogee	30,277	McAlester	12,095
Okmulgee	17,430	Guthrie	11,757
Enid	16,576	Sapulpa	11,634
Shawnee	15,348	Chickasha	10,179

Industries.—The most interesting fact in connexion with the state between 1910 and 1920 was the development in the production of oil and gas. In 1920 there were 25,000 wells producing either oil or gas or both, and 36 counties were classed as oil and gas producers. Tulsa is the centre of the oil and gas area of the state. Its pop. increased from 18,000 in 1910 to 72,075 in 1920. The production of oil increased from 52,028,700 barrels of crude oil in 1910 to 103,087,420 barrels in 1920, and its value from $19,227,000 in 1910 to $347,355,445 in 1920. In 1920 Oklahoma produced 3,900,000 tons of coal, 70,000,000,000 cub. ft. of gas, 130,950,500 lb. of lead, 6,275,560,500 lb. of zinc, and 125,500 tons of gypsum. The total value of Oklahoma's mineral products increased from $33,000,000 in 1910 to $400,000,000 in 1920. Of almost equal importance was the increase in the value of agricultural products. In 1909 the total value of all crops was $131,522,220, in 1919 it was $549,249,277; but, due to the drop in prices, in 1920 the total value was only $294,715,000. Corn, cotton, live stock and wheat are the most important farm products. The growth of manufacturing also has been large. The chief industries are the manufacture of flour and meal, smelting, oil-refining, and meat-packing. The following table prepared by the U.S. Census Bureau gives a comparative summary for 1914 and 1919:—

	1919	1914
Number of establishments	2,445	2,518
Proprietors and firm members	2,320	2,464
Salaried employees	6,491	2,793
Wage-earners	29,503	17,443
Capital	$277,034,318	$ 65,477,654
Salaries	11,961,191	3,202,332
Wages	35,025,942	11,011,043
Cost of materials	312,605,829	70,969,750
Value of products	401,362,869	102,005,693
Value added by manufacture	88,757,040	31,035,943

Education.—During the decade 1910–20 great progress was made in education. The public schools employed 8,315 teachers in 1910 and 15,711 in 1920. The number of teachers holding first-grade certificates increased from 2,095 to 9,906. The enrolment of pupils in 1910 was 415,116, in 1920 it was 589,282. The number of graduates from the eighth grade increased from 3,725 in 1911 to 11,465 in 1920. The number of accredited four-year high schools increased from 29 in 1912 to 269 in 1920. The total expenditures for public schools in 1910 were $8,600,450.32 as against $22,826,947.57 in 1920. Similar growth has been shown in the higher educational institutions supported by the state. The six state normal schools, the Agricultural and Mechanical College and the secondary agricultural schools, as well as other state secondary schools, have made progress. The university of Oklahoma, which in 1907–8 had 40 instructors and 790 students, had in 1920–1, 215 instructors and 3,965 students, inclusive of the summer session, but exclusive of correspondence and extension work. In 1916 the Industrial Institute at Chickasha was reorganized and renamed the Oklahoma College for Women; it is the only school maintained by the state that is not coeducational. The following colleges are maintained by their respective churches:—Kingfisher College, Kingfisher (Congregational); Oklahoma City College, Oklahoma City (successor to Epworth; Methodist Episcopal); university of Tulsa, Tulsa (Presbyterian; formerly Henry Kendall College); Phillips University, Enid (Christian); Oklahoma Baptist University, Shawnee (Baptist); Oklahoma Catholic University, Shawnee (Roman Catholic). The following junior colleges are maintained by church interests:—Oklahoma Catholic College for Women, Guthrie; Oklahoma Nazarene College, Bethany; Oklahoma Presbyterian College for Girls, Durant.

History.—In 1910 the state capitol was moved from Guthrie to Oklahoma City. In 1913 an effort to move it back to Guthrie was defeated by popular vote. The state adopted in 1910 an election law designed to keep negroes from voting. This law contained the "Grandfather Clause," but was declared unconstitutional by the U.S. Supreme Court in 1915. In 1918 an amendment to the constitution was adopted granting equal suffrage to women. The state steadily maintained a law guaranteeing depositors in state banks against loss. This law has been so far successful that not a single depositor has met loss through the failure of a state bank. At the time of its admission in 1907 Oklahoma contained more than one-third of the Indian population of the United States. These Indians came from numerous tribes that had been moved to Oklahoma in the 19th century. The absorption of the Indians into the general body of citizens has gone on increasingly since 1910. The Indians of Oklahoma had by 1920 practically no separate history, and such tribal organizations as were maintained were not for governmental purposes but were business corporations for the control of tribal property. The great mineral wealth of Oklahoma has made many of the Indians extremely wealthy. The Osage tribe in particular continued to hold much of its land as tribal property, and its members receive very large royalties. This was not true of certain other tribes, as the lands assigned to them are valuable only for grazing purposes, and the individual allotments under such circumstances bring small incomes.

The governors of Oklahoma after 1910 were:—Lee Cruce (Dem.) 1911–5; Robert L. Williams (Dem.) 1915–9; James Brooks Ayres Robertson (Dem.) 1919– .

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OKUMA (SHIGENOBU), MARQUESS (1838–1922), Japanese statesman (*see* 20.61). In the spring of 1914, the old statesman emerged, at the age of 76, from his retirement at the special behest of the Throne, to take up once again the reins of Government, as, owing to some unfortunate scandals arising out of a contract for a battleship, public confidence in Government probity had received a severe shock. The veteran guided the country safely through the opening months of the World War. In Dec. 1914, the Government suffered a defeat on the army estimates and the Diet was dissolved. Count Okuma himself conducted a vigorous election campaign, which resulted in a great triumph for the Government at the general election in March 1915. Charges of bribery at the elections were later brought against the Home Minister, Visct. Oura, with the result that a Cabinet crisis arose, and Count Okuma resigned on July 30. He was pressed to remain in office, however, and, finally consenting, constituted a new Cabinet on Aug. 10, temporarily taking over the portfolio for Foreign Affairs until this was accepted by Baron (afterward Visct.) Ishii. During 1916, treaties were concluded with France, Russia and China. On Oct. 3 1916, Count Okuma announced his intention to retire, owing to his failing health; and on Oct. 9, Marshal Terauchi formed a new Ministry. Previous to his resignation the Count received a marquessate, in recognition of his eminent services to the State, since the restoration, as a Genro or elder statesman. He died at Tokyo Jan. 10 1922.

OLLIVIER, OLIVIER ÉMILE (1825–1913), French statesman (*see* 20.89), died at St. Gervais-les-Bains (Savoy) Aug. 30 1913.

OLNEY, RICHARD (1835–1917), American statesman (*see* 20.91), died in Boston, Mass., April 8 1917. Because of his age he declined, in 1913, President Wilson's offer of the ambassadorship to Great Britain, and likewise in 1914 that of the governorship of the Federal Reserve Board. In 1915 he was a member of the International Commission created under the treaty between the United States and France, "looking to the advancement of the cause of general peace."

O'NEILL, NORMAN (1875–), British musical composer, was born in London March 14 1875. He was educated in London and afterwards at Frankfort-on-Main. His compositions include songs and chamber music; much incidental music including that to *Hamlet* (1904); *A Lonely Queen, A Tragedy of Truth* (1906); an overture *In Spring Time* (Birmingham Festival 1906); *The Last Heir* (1908); *King Lear* (1909); *The Blue Bird* (1909); *The Golden Doom* (1912); *The Pretenders* (1912) and *Mary Rose* (1920). In addition to music for the theatre O'Neill wrote the overtures *In Autumn, In Spring Time, Hamlet,* a series of Miniatures for small orchestra and another for a large orchestra; a piano quintet, two piano trios, a Scotch rhapsody for orchestra; the ballad, for baritone solo and orchestra, *La Belle Dame sans Merci* and much instrumental music in the smaller forms. He edited *A Golden Treasury of Song,* and the *Ethical Hymn Book.*

ONNES, HEIKE KAMERLINGH (1853–), Dutch physicist, was born in 1853. He studied mathematics and physics in his native town, Groningen, where in 1879 he took his doctor's degree on presenting a dissertation entitled *New Proofs of the Earth's Rotation.* He became professor at Leiden in 1882, and devoted himself especially to the study of properties of matter at low temperatures. As director of the Cryogeen Laboratory, founded by him at Leiden, he succeeded, in 1908, in liquefying helium. In 1913 the Nobel prize for physics was conferred upon him. His published work includes *Algemeene Theorie der Vloeistoffen* (General Theory of the Fluids, 1881).

See J. P. Kuenen, *De Toekenning van den Nobelprys aan H. Kamerlingh Onnes* (*Chemisch Weekblad*, 1913).

ONTARIO (*see* 20.113).—The area of this Canadian province was increased in 1912 by the addition of the district of Patricia, 146,400 sq.m. in extent, bringing the total up to 407,262 sq. miles. Ontario can now reckon 600 m. of seaboard along Hudson and James bays and over 1,600 m. of continuous fresh-water shore-line along the Great Lakes, bays and rivers to the south.

Old Ontario, which is subdivided locally into W. and E. Ontario, is the portion of the province S. of the Ottawa river and Lake Nipissing, lying between lakes Ontario, Erie and Huron. Northern or New Ontario is mainly a vast region of forests, mineral lands, rivers and lakes. It contains nearly 200,000 sq.m. of forests, abounding in game, rich in timber, and possessing incalculable resources of pulpwood, and it has already made Ontario an immense producer of minerals, although the resources of the country in this direction are still largely unexplored. New Ontario also possesses many millions of acres of fine farming land. Considerable districts are already well farmed, and have proved that this great northern country is well adapted for the production of general farm crops, dairying and the raising of live stock. At Kapuskasing the Ontario Government has established a soldiers' settlement scheme, and many veterans of the World War are making a success of farming on grants of 100 ac. given them free by the Provincial Government. The Timiskaming and Northern Ontario railway, 253 m. long, passes through the new country from North Bay to Cochrane.

The pop. was 2,523,274 (1,299,290 males and 1,223,984 females) in 1911; and, according to estimate, 2,799,000 at the beginning of 1919. Nine-tenths of the pop. lives between the Great Lakes, the Ottawa and the St. Lawrence, and more than half is urban. The Indian pop. numbered 23,044 in 1911.

Government.—The lieutenant-governor is assisted by an Executive Council whose members have seats in and are responsible to the local single-chamber Legislature, which is made up of 111 members elected by universal suffrage. Ontario sends 24 senators and 82 members of the House of Commons to the Parliament of Canada. The Conservative Government of 1905 and 1908 was again successful in the general elections of 1911 and 1914, being returned with a majority of 60. Upon the death of Sir J. P. Whitney in Sept. 1914, shortly after the war broke out, Mr. (afterwards Sir) William Howard Hearst succeeded as Premier. His Government was badly defeated in Aug. 1919. The defeat was attributable to two things: the decision of the farmers of Ontario to organize for political purposes under the name of the "United Farmers of Ontario," whereby Sir William Hearst lost practically the whole of his rural support, and the defection of many of his Conservative supporters on account of the passing of the Ontario Temperance Act. The "United Farmers of Ontario" grew to extraordinary proportions during the years 1919 and 1920, embracing practically the entire agricultural population, and became one of the most distinct phases of modern political tendency in recent years. The movement has extended to practically all the other provinces of the Dominion. In the elections of 1919 the successful U.F.O. candidates, in alliance with Labour members, formed the dominant group in the Legislature so that the subsequent Government of Ontario was known as "the Farmers' Government." The municipal system, though based rather on the simple English model than on the more complicated municipal governments of the United States, has certain features of its own, and is revised from time to time. The principle of municipal ownership was not readily accepted in the larger cities, and for long the powers of certain large corporations tended to cause friction, but such matters as the provision of electric power and light and traction have been gradually taken in hand both by the municipalities and by the province. The Hydro-electric Commission of Ontario, which controls a system of electric railways and power and light for a large portion of western Ontario, is a striking example of the tendency towards municipal government and ownership and control of public utilities. During the nine years before 1921, the operations of the Commission rapidly extended, and in 1919 about 143 Ontario municipalities derived electrical power from the Niagara Falls and other sources. The total cost of the plant erected was $20,077,491; the cost of operations for the year 1917 was $5,077,491; and the revenue was $6,070,065, leaving a surplus of $992,574, less a depreciation charge of $607,206, making the net surplus $385,368. The total number of consumers in 1917 was 170,916 and the total taken was 157,043 H.P. for 143 municipalities. Large additions were made to the scope of the Commission after 1917, and in 1921 many extensions were in contemplation, the whole question being under investigation by a Royal Commission.

Toronto, the capital of the province, is the chief manufacturing city of Canada. Ottawa is the capital city of the Dominion. Of the other principal towns of Ontario, Hamilton had a pop. of 108,143 and London 59,100 in 1919.

Education.—As in other provinces, education in Ontario is controlled by the Provincial Government and administered by a Minister of Education with a subordinate staff. The cost of public education in Ontario increased from $4,720,310 in 1901 to $14,111,835 in 1918. In 1917 there were 6,651 public schools providing free education, which between the ages of 6 and 16 is compulsory. There were 12,762 teachers with 527,664 pupils. The falling-off in the rural population of Ontario caused a corresponding diminution in school attendance, but this has been more than compensated for by the rapid growth of the cities. Although many Roman Catholic children attend the public schools the number of separate schools is steadily increasing. Government inspectors visit these schools (of which the teachers must be certificated), and keep them up to legal standard, but are not concerned with religious teaching.

The university of Toronto, with its affiliated colleges, had in 1918 a staff of 525 and 3,356 students, and in the faculty of applied science and engineering alone had seven distinct departments. The number of students in all the universities greatly increased after the close of the war.

Finance.—The indebtedness of the province has shown a tendency to increase. It began with the construction of a provincial railway to aid in the development of the northern districts; and more recently costs incidental to the World War, the building of roads under a good-roads system aided by the Dominion Government, the extension of the schools system, housing and other modern improvements have greatly increased the public liabilities. A large share of the burden of local administration is borne by municipalities. Revenue and expenditure were respectively $11,121,382 and $11,819,311 in the financial year 1913–4 and $19,870,123 and $17,460,404 in 1917–8.

Agriculture.—Ontario is, above all, the province of Canada where agriculture has been most scientifically carried on, and the greatest results achieved. The total area under field crops in Ontario in 1918 was in round figures 10,000,000 acres. A much larger area of good land is actually owned and occupied, and in northern Ontario there were 20,000,000 ac. of virgin agricultural land as yet untouched. The market value of the 1918 crop was $384,000,000; oats, wheat, barley, peas, beans and corn were the principal yield. Grain-growing, however, by no means represents the whole field of agriculture in Ontario. Mixed farming and dairying in all its branches are really the backbone of the industry. Ontario produces practically half the butter and cheese made in Canada. The annual output of the cheese factories is approximately 120,000,000 lb. valued at $25,300,000, while the creameries manufacture upwards of 28,000,000 lb. of butter valued at $11,000,000. To this must be added the dairy butter, milk powder, condensed milk and milk used for city trade, the total annual value of which is approximately $50,000,000. There are 990 cheese factories with 42,066 customers and 172 creameries with 45,944 customers. The Provincial Government's staff of dairy instructors maintains a uniform high standard of output from all factories and creameries. Immense quantities of butter and cheese are exported annually.

The live-stock industry of Ontario is very important, and some of the best horses, cattle and sheep on the continent are raised in the province. The official reports showed that there were in 1920 in Ontario 732,977 horses, 2,872,722 cattle, 972,341 sheep and lambs, 1,656,386 swine, and poultry to the number of 12,271,105. In the Niagara fruit belt, and along the shores of Lake Erie, Ontario possesses one of the most beautiful and fertile fruit-growing districts in the British Empire. The manufacture of wine from native grapes is one of the flourishing industries of this belt. Tobacco is extensively grown in the counties of Essex and Kent along Lake Erie where the soil and climate are found to be suitable, and tobacco grown from the right varieties of seed is pronounced to be comparable with that of the southern states. Most of the tobacco raised is manufactured within the province for home consumption but an effort is being made to reach the British and other markets. The cultivation of sugar beet is also becoming of importance and large sugar refineries are located at Chatham and elsewhere. The yield in 1919 was 240,000 tons, the product of 24,500 acres. The area of sugar-beet growing constantly tends to expand. The growing of flax, both for seed and fibre, is attracting a good deal of attention.

In addition to the "United Farmers of Ontario," the objects of which are primarily political, many active organizations are maintained by the farmers themselves to advance the interests of the agricultural community, including the Ontario agricultural and experimental unions, farmers' institutes, women's institutes, coöperative societies, etc. The provincial department of agriculture also maintains a corps of district representatives, all skilled agriculturists resident at important farming centres, whose whole time is devoted to assisting the farmers. In the year 1919 the yield and value of the principal field crops in Ontario were as follows: wheat, 20,698,500 bus., $40,701,000; oats, 78,388,000 bus., $71,378,000; barley, 13,803,000 bus., $17,215,000; rye, 2,219,000 bus., $3,279,000; peas, 1,818,500 bus., $4,180,000; beans, 288,500 bus., $1,039,000; buckwheat, 4,072,000 bus., $5,534,000; mixed grains, 19,735,300 bus., $26,672,000; corn (maize), 15,152,500 bus., $18,790,000; potatoes, 15,145,000 bus., $20,820,000; turnips, etc., 42,756,000 bus., $14,027,000; hay and clover, 5,589,000 tons, $115,161,000; fodder corn, 4,414,000 tons, $25,304,000; alfalfa, 314,400 tons, $6,351,000; sugar beet, 241,000 tons, $2,606,000.

Forests.—Although Quebec has larger timber areas, the lumber industry of Ontario exceeds that of any other portion of Canada. The forest lands are estimated at 200,000 sq. miles. There are great areas of white pine, and of almost equal value with the making of pulpwood are spruce and poplar trees which occupy large districts in northern Ontario. The total amount of red and white pine still standing on lands belonging to the province exceeds 12,000,000,000 ft., while there are more than 350,000,000 cords of pulpwood on lands still in the hands of the Government. The largest pulp mill in the world is in operation at Sault Ste. Marie, and many others, almost equally large, are scattered over the northern section. Other valuable trees which are still plentiful are oak, beech, maple, elm and basswood; the whole of Old Ontario in its primitive state was heavily forested with these trees. The most important lumbering districts are on the upper Ottawa, west of Lake Superior and north of Georgian Bay, and the finished lumber not only finds a large local market but has a wide foreign distribution. Ottawa is still the most important lumber centre of the province. The Provincial Government recognizes the necessity of forest protection and reafforesting. Fire rangers patrol the forest during the summer and fall and five great areas, with a total extent of 17,860 sq.m., have been set apart as reserves for timber conservation and the preservation of water-supply. Algonquin Park, 2,000 sq. m. in extent, set apart as a national park, also contains valuable uncut timber.

The quantity of timber cut in Ontario in 1918 was 1,110,062,000 ft., valued at $34,168,754. Although the quantity cut was less than that in British Columbia, the value exceeded it by nearly $6,000,000. Over 52 % of the output was white pine, 11 % hemlock, 8 % red pine and about 6 % spruce. The returns made to the Dominion Bureau of Statistics in 1918 by 603 milling firms showed that the capital invested in logging plants amounted to $6,697,923 in land, buildings, machinery and tools, and in mills $10,527,006. The value of materials on hand was $18,846,365; cash trading and operating accounts $10,791,050, making a total capital employed of $46,862,344. The Ontario mills employed 16,804 persons in the manufacture of lumber, to whom $12,926,710 was paid in wages. In the same year the pulp-mills made for sale pulp to the value of $9,711,840 and the pulp and paper mills made 312,459 tons of pulp for their own use, total output of pulp being valued at $13,613,639. The value of all kinds of paper produced in 1918, including news-print, book and writing paper, wrapping-paper, boards and other products was $63,908,247. About $46,000,000 of this was for news-print alone.

Fisheries.—The fresh-water fisheries of the province, including the Great Lakes and the Lake of the Woods and Lake Nipigon, are extensive and valuable. The principal fish caught are herring, whitefish and trout, but the catch also includes pike, pickerel, dore, sturgeon, eels, perch, tullibee, catfish, carp and coarse fish. The fisheries of the province are under Dominion regulation and provincial control. For the purpose of restocking the waters and increasing the fish supply the Dominion Government maintains several fish hatcheries. A promising new field lies in the rich fisheries of Hudson Bay which have not yet been developed owing to lack of transport facilities. The total value of the catch for Ontario in 1919 was $3,410,750 and included herring $657,042; mixed fish $134,312; perch $152,440; dore $259,470; pickerel $167,419; pike $139,636; trout $772,174; whitefish $857,492.

Mining.—Ontario, originally almost exclusively an agricultural province, has taken the lead in mineral production, the output for 1919 being valued at about $66,000,000, almost double that of British Columbia (which formerly stood at the head of the list), while the output for 1918 was valued at as much as $94,694,093. Almost all the economic minerals are found except coal.

The mining of the silver ores discovered at Cobalt in 1903 reached its greatest activity about 1912. Shipments from the camp and outlying silver areas up to Dec. 31 1918 were 292,385,866 oz., valued at $169,292,351. The total figures for the province in 1918 showed an output of 17,738,153 oz., valued at $17,415,882, and in 1920 5,308,852 ounces. As far back as 1896 the occurrence of gold in the Porcupine district, the prospecting of which was a natural outcome of the explorations in Cobalt, was noted by Government surveyors, but the district was not seriously considered until the spring and summer of 1909, when prospectors rushed to the district. By 1910 the country for miles around was staked and recorded, and the producing stage was soon reached. For 1918 the output of the province was 411,878 oz., worth $8,502,480—the largest in the Dominion—and for 1920, 564,959 oz., 73·7 % of the total in Canada.

It was expected in 1921 that the tributary regions E. and W. of the chief existing mines would prove to be amongst the richest in the world. The nickel mines at Sudbury constitute the most important source of supply of this metal. Copper is mined in the same district in large quantities. A large iron-mine is located at Michipicoten and there are iron and steel works at Midland, Deseronto, Hamilton, Sault Ste. Marie, Port Arthur, Owen Sound and Ottawa. Corundum occurs in the townships of Farrday, Dunganan, Monteagle, Carlow, Ragland, and adjacent townships, of Hastings and Renfrew counties in southern Ontario, and within the Haliburton–Bancroft area. There are many gas-producing wells in Ontario, the principal fields being, in order: Welland county, Haldimand and Norfolk, and Essex and Kent. Practically the whole output of petroleum in Canada is produced in Lambton county and from the newer oil-fields of Mosa, Tilbury, Romney, Bothwell, Leamington, Dutton, Thamesville, Comber and Onondaga townships in the extreme south of Ontario. The four chief oil refineries belong to the Imperial Oil Co., Sarnia; the Canadian Oil Co., Petrolea; the British-American Oil Co., Toronto; and the Empire Refining Co., Wallaceburg. There are extensive salt deposits in the western part of the Huron–Erie peninsula, some of great thickness. Salt is produced at Windsor, Sarnia, Golderich, Kincardine, Wingham, Stapleton, Elaston, Exeter and Parkhill. Feldspar, graphite, marble, quartz, pyrites, granite, sodalite, talc and zinc, as well as clay and its numerous products, together with limestones and excellent sandstones, are among the mineral resources.

In 1919 the statistics of mineral production were as follows:—gold, 505,964 oz., value $10,451,709; silver, 11,363,252 oz., $12,904,312; nickel, 22,035 tons; copper, 12,099 tons; iron ore exported, 5,953 tons; pig-iron (from Ontario ore only), 46,769 tons, $1,200,793; total pig-iron, 632,586 tons, $16,010,537; portland cement, 2,022,575 bar., $3,659,720; petroleum, 7,703,515 gal., $632,789; natural gas, 11,085,819 mill. cub. ft., $2,583,324; salt, 148,112 tons, $1,395,368.

Manufactures.—With abundance of raw material, cheap power and ample facilities for transport Ontario has come to be the chief manufacturing province in the Dominion. The chief products are iron and steel machinery, electrical apparatus, agricultural implements, carriages, wagons, automobiles, pianos, organs, flour, oatmeal, pulp, paper, furniture, woollen and cotton goods, clothing, sugar, wire fencing, paints, leather goods, boots and shoes, carpets, cement, canned goods, glass, biscuits, confectionery, and meat products. Nearly every village and town has its manufacturing plant of more or less importance, but the chief industries are concentrated in the larger cities like Toronto and Hamilton. In 1918 15,337 industrial establishments with a capital of $1,442,221,000 employed 320,808 hands and paid $302,399,000 in salaries and wages. Raw materials cost $905,153,000 and the products were valued at $1,640,772,000.

Communications.—One of the national lines of railway passes through the northern part of the province, opening up the Clay Belt for settlement and cultivation. A branch connects the main line with Port Arthur. Running north from North Bay the Timiskaming and Northern Ontario railway, 253 m. long, owned and operated by the Provincial Government, joins the national line at Cochrane. In addition to the steam railways there are hundreds of miles of electric lines running through the rural districts, connecting the principal towns and cities. With the development of electrical power more and more such railways are being built, mainly under municipal ownership.

Apart from the great highway of the St. Lawrence, the Rideau canal between Ottawa and Kingston, the Trent Valley canals from Trenton through the Kawartha Lakes to Georgian Bay, and the Murray canal separating the peninsula of Prince Edward county from the mainland are of high commercial importance to Ontario.

(W. L. G.*)

OPTOPHONE.—The optophone is an instrument for enabling totally blind people to read ordinary letterpress, such as a printed book or newspaper, without the necessity of printing it in raised type to be read by touch. The instrument was invented in 1914 by Dr. E. E. Fournier d'Albe, then a lecturer in physics in the university of Birmingham. It is based upon the properties of selenium, an element which is a better electrical conductor in light than in darkness. A beam of light is rendered intermittent by the interposition of a revolving siren disc and is then concentrated into a small bright point on the paper to be read. If the point on the paper is white, it will reflect the light; if it is black it will not. A selenium cell placed close to the paper, on receiving the reflected beam of intermittent light, will respond to each flash by a change in conductivity, and if the frequency of the flashes is of the "musical" order (between 30 and 30,000 flashes per second), a telephone receiver connected with the selenium and a battery will sound a musical note. A blind person could thus tell whether the paper is black or white.

That is the principle of the optophone. In practice a small row of luminous points is substituted for a single point, and each point in the row is given a different frequency by suitably perforating the siren disc. The row, usually of five or six points, just fills up the size of the tall letters of the print to be read. When the whole row falls upon the black stem of a letter there is silence in the telephone. As the letters pass their various shapes are indicated by the sounding or silence of the different notes, and after some practice the blind person learns to recognize letters from their sounds, and so to read ordinary type.

The first reading test was given by the inventor in March 1917, the matter read being a leading article in *The Times*. In Aug. 1918, Miss Mary Jameson, a blind pupil from Norwood, gave the first public reading demonstrations, reading an unknown page from a book at a speed of about two words per minute. Later, with an improved instrument, she attained a speed of about 20 words per minute. A new type of optophone was brought out in 1920 by Barr & Stroud, of Glasgow. In this instrument two selenium cells were used, balanced against each other in such a manner that white paper produced silence, and the black letters themselves made the musical sounds. Reading demonstrations were also given with this instrument, but any advantage in the way of ease of reading was found to be counterbalanced by a greater delicacy and complexity of adjustment. The new type is known as the "black-sounder," and the original type is termed the "white-sounder." The latter type was approved by the Inventions and Research Committee of the National Institute for the Blind in 1921 after an exhaustive series of tests. The optophone is intended to place the world's printed literature once more within reach of the blind. It is applicable, without special preparation, to any language, and can also be used for reading typoscript, but not handwriting.

See "A Type-reading Optophone," *Roy. Soc. Proceedings* (1914); "The Optophone," *Journal of Roy. Soc. of Arts* (1921); "The Optophone," *St. Dunstan's Review*, No. 55 (1921).

(E. E. F. D'A.)

ORANGE FREE STATE (*see* 20.151), a province of the Union of S. Africa. At the 1911 census it had a pop. of 528,174 compared with 387,315 in 1904—an increase of 26·67 %. Whites numbered 175,189, coloured 352,985. In 1918 the white pop. was 181,678. The increase in pop. since 1904 was very largely due to the development of agriculture and stock farming, the province being essentially a pastoral region.

The only big town is the capital, Bloemfontein (pop. in 1911 26,925). While new settlers included many of British origin, the white inhabitants remained predominantly of Dutch descent. Nearly all the coloured people are Bantu and in 1911 the province had only 108 Asiatics. A higher proportion, 50·77 %, of the natives professed Christianity than in any other province of the Union.

There were in 1918 only 5,588 persons (all races and both sexes) engaged in factories in the province, but in Jagersfontein it possesses one of the chief diamond mines in S. Africa, and there is a group of small but rich diamond mines in the Boshof area, proclaimed in 1906, 1910 and 1912. There are coal mines by the Vaal at Vereeniging, which produced 469,000 tons in 1910 and 838,000 tons in 1919.

Dr. A. E. W. Ramsbottom was the first administrator, being succeeded by Mr. H. C. Wessels. Both had been members of the Ministry during the brief period (July 1907–May 1910) while the province had been a self-governing colony. The provincial administration at first continued the system of compulsory bilingual education enforced in 1908, but the struggle conducted by the English-speaking part of the people over the medium of instruction came virtually to an end in 1912, the provincial council having adopted, in the main though still with a bias in favour of the Dutch language, the proposal suggested by the Union Parliament that up to standard IV. instruction in the schools should be given in the "home language" of the scholar. In 1920 an ordinance was passed recognizing "Afrikaans," *i.e.* the Taal or colloquial Dutch, as equivalent to Netherlands Dutch as a medium of instruction, and its adoption, for Dutch scholars, was very general. In most respects the provincial administration was progressive and was conducted on non-party lines. (For the administrative system see CAPE PROVINCE.) Provincial expenditure rose from £511,000 in 1912–3 to £611,000 in 1917–8, the amount spent on education in the years named being £250,000 and £473,000 respectively.

The province was the stronghold of the Dutch Nationalists. Up to his death in 1916 ex-President Steyn, who lived near Bloemfontein, though he held no office, exercised very great influence on public affairs. In the crisis caused by the World War Steyn opposed operations against German S.W. Africa. There followed the rebellion of Gen. De Wet, the Free State being the principal theatre of the campaign. Gen. Hertzog, the parliamentary chief of the Dutch Nationalists and after Steyn's death their undisputed leader, carried the Free State in the elections of 1915, 1920 and 1921. In Feb. of the last-named year, when he had declared for the secession of the union from the British Empire, his party won 16 out of the 17 constituencies into which the province was divided (*see* SOUTH AFRICA). (F. R. C.)

ORDNANCE[1] (*see* 20.189.)—(I.) PRINCIPLES OF DESIGN. The principal requirements from a gun are accuracy, high muzzle velocity and high remaining velocity at any given range. These points are dependent on the ballistics, or power, of the gun, on the twist and form of the rifling, and on other factors outside the gun, such as the weight and shape of the projectile and the design of the driving-band on the projectile.

At the same time as definite conditions are laid down for these main requirements, certain limitations are imposed upon the designer in connexion with the working pressures in the gun, the length and weight of the gun, the feasibility of repair, and the length and weight of the projectile. These various factors must be considered from the point of view of their relation to each other as they are to a very large extent interdependent, and variation in any one of them will react on one or more of the others. The limiting factor in the working pressure is the strength of the gun to resist the firing stresses, and any increase in these beyond a certain limit will necessitate a corresponding increase in the strength of the gun, that is, in the amount of material employed in its construction, which obviously entails an increase in the weight of the gun, a very important consideration. The length of the gun has an important effect on ballistics, and any increase in this respect not only is accompanied by increased weight but also affects the question of the space occupied, another important consideration. Further, any variation in the weight or length, or both, of the gun will affect the position of the centre of gravity, and so affect the design of the mounting or carriage. Another aspect of the question of length is its effect upon the "girder strength" of the gun. In modern ordnance efforts are made to place the centre of gravity as near the breech as possible, and, the gun being supported on its mounting at or near this point, with long guns a considerable proportion of the total length remains unsupported, and therefore has a tendency to "sag" due to its own weight. Theoretically a longer gun gives better ballistics, but in practice the length of modern guns is usually 45 to 50 calibres; though this has been sometimes exceeded in what may be termed "freak" guns, and may in future be exceeded in hyper-velocity guns. The possibility of repair, when worn out, has considerable bearing on design, for where this is required the inner tube, or barrel, is made in two parts, one inside the other, so that when necessary the inner one can be removed and replaced. The British practice is that all guns, except very light guns, are built with an inner "A"-tube. The probable life of a gun is estimated by the number of rounds it can fire before being worn out and depends on many factors, the principal of which is the action of the powder gas. In the actual design it is affected by the material to be used for the inner tube and by the shape and size of the chamber.

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Problem of Design.—The problem before the gun-maker is to build a gun under defined limitations of weight, etc., that will withstand certain definite pressures at various parts of the bore. Steel is practically the only material now used in gun construction; but there are several classes or kinds of steel, and experience has taught which particular class can be obtained and used for the various parts of the gun. In addition to considerations connected with the design of the gun proper, there are two important points which require to be considered and embodied, namely, ease and rapidity of loading and firing. These two points necessarily involve the determination of the kind of breech-mechanism and the class of obturation to be employed. The weight of the moving parts of the breech-mechanism has a serious bearing on the ease of manipulation; and the mechanical device chosen for opening and closing the breech and the complication of the mechanism for holding and firing the means of ignition regulate very largely the rapidity of the service of the gun.

Carriages.—An artillery carriage must be designed primarily to provide a support from which the gun is fired; but in some cases the carriage is required to perform also the function of transporting the gun to the firing position. The demand is, therefore, for either a fixed or mobile carriage; and in the latter case it is accepted as a necessity in modern mountings that the under-portion, or basic structure, should remain immobile on firing. Since guns vary greatly in calibre, power and weight, the mobility of the carriage and the method of draught adopted must vary accordingly, because the weight and size will be determined largely by the gun for which it is designed; but, consistent with the functions required of it, the weight of a carriage should be a minimum and its mobility a maximum. The ideal of providing the travelling as well as the firing support in the carriage of any mobile gun is possible of attainment only with light and medium guns, owing to the limitation in weight for travelling; and the various designs of mobile carriages are a direct outcome of the necessity for mobility of loads varying from about 2 tons upwards.

Movements Necessary.—From the firing aspect, the modern requirements of any carriage necessitate that the gun shall be laid (*i.e.* aimed) quickly and accurately without any movement of the basic structure, and that the basic structure shall remain completely immobile during firing. Thus any carriage must be designed to permit of three distinct movements of the gun:—

(*a*) A movement in the horizontal plane—termed "traverse"—to give direction to the gun. This movement is limited with all mobile carriages, due to the fact that the side stability of the carriage must be maintained. Generally, the heavier the gun and carriage, the more extended must the traverse be, in order to avoid the necessity for frequent realignment of the basic structure for changes of target. With fixed mountings it is obviously necessary to have very wide and, indeed in most cases, all-round traverse, and this is obtained, so far as the constructive limitations of the mounting permit, by mounting the superstructure upon a central pivot under its centre of gravity.

(*b*) A movement in the vertical plane—termed "elevation." The elevation permitted to a gun determines its range and is, therefore, a determining factor in the design of the carriage. In recent years, increased range has been obtained with existing ammunition by removing from new designs those constructive limitations which limited the elevation in earlier types. With guns, the maximum range is obtained at about 43° of elevation; and with hyper-velocity guns (muzzle velocity about 5,000 f.s.) at about 55° of elevation; with howitzers, elevations up to 70° may be required, to give steep angles of descent; while an anti-aircraft mounting should be capable of giving elevations up to 85 degrees.

(*c*) An axial movement of the gun—termed "recoil"—the reverse of which, the returning of the gun to the firing position, is termed "recuperation." The latitude it is necessary to allow here depends on the type of carriage. All mobile carriages require a relatively long recoil in order to maintain stability at the lower angles of elevation. With fixed mountings a long recoil is not so necessary, and the length is relatively short (being fixed at from 3 to 4 calibres), while the mounting itself is designed to withstand the resulting stresses, since conditions of stability do not arise.

Design Elements.—In the designing of a gun—system or "equipment" as it is called—the controlling elements depend upon the particular purpose for which the gun is required. The gun may be for a mobile mounting or for a fixed mounting. The mobile mounting may be horse drawn or tractor drawn, or it may be carried by pack transport.

So far as the gun for field equipments is concerned, it is immaterial to the design whether the traction is by horse or tractor or whether the mounting travels as an entity or in parts. The gun is nowadays designed for a long recoil, and in itself is employed as a shield for the vulnerable recuperator which is carried in a cradle below it,[1] and above which the gun recoils along slides. For light field guns, in the interest of rapidity of fire, obturation is generally by means of a metallic cartridge case, and percussion firing is always used. To enable extraction of the cartridge case, an extractor must be embodied in, and be worked by, the breech-mechanism. As regards the breech-block for guns firing fixed ammunition, this may be either of the swinging type or a sliding wedge; but if fixed ammunition be not used, the block must be a screw and the obturation effected by an obturator-pad in the breech-mechanism, since the only practical means of obturation with a sliding wedge is by use of a metallic cartridge case.

With pack transport, the weight a mule can carry is the determining factor in the design of the gun. After deductions for the weight of the saddle equipment, etc., about 250 lb. is all that can be allowed per mule for the gun. Since the gun must be heavier than that amount in order to obtain the required power, it must be designed to be transported in two parts which can be readily and easily put together with a gas-tight joint; and the breech-mechanism must be capable of being quickly detached and reassembled.

With fixed mountings there are not the same restrictions as with mobile mountings; but the breech-mechanism must be arranged so as to allow of the use of electric, as well as percussion, firing apparatus.

As regards carriages, from the travelling aspect, it has to be remembered that the weight influences the draught, and the draught influences the design of the carriage. The general travelling conditions are as follows. For *horse transport*, in the case of a reasonable degree of mobility and manœuvre, six light-draught horses should not be exceeded. For heavier loads, eight heavy-draught horses may be employed, as they would be rarely required to move faster than at a walk. Pole-draught is now used universally. It follows that the limiting weights are 2½ tons for light field equipments, and 6 tons for medium field horse-drawn equipments when assembled for travelling. For *pack transport* an equipment must be capable of being split up into loads (usually from 6 to 8) no one of which exceeds 250 lb., and in addition fulfil the same functions as a field carriage, when assembled. Other conditions besides the weight limit have to be taken into account in designing pack artillery equipments, *e.g.* the centre of gravity of the load as it lies on the pack-saddle should be as low as possible, for stability. For *tractor transport*, if the travelling weight exceeds 6 tons, tractors must be used. A load up to 12 tons can be travelled tractor-drawn as an entity on two axles, for 6 tons is the maximum average axle-load. The total load behind a tractor should not exceed 20 tons, and steering requirements limit the number of units in the train. If it be desirable to travel super-heavy equipments by road, they must be so designed as to be capable of being dismantled and split up into loads to conform to the necessary conditions. For *railway transport*, the railway mountings must be of the standard gauge[1] and conform to the railway load-gauge, which imposes limits as to width, height and shape of load. Any mounting must be able to travel on a curve of 150 feet radius, which governs the total length. The total weight is not limited as such, but it is governed by the span over which it is distributed; it must be supported on such a number of axles that the maximum load per axle is not more than 19 tons; and the total load divided by the length of the wheel-base over the buffers is not more than 2¼ tons per foot run.

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[1] Most British guns of pre-war design, used in the World War, had the buffer and recuperator above the gun. In types designed during the war this practice has been given up.

Practically all modern mobile carriages at present have as their basic structure a gun carriage—consisting of a pair of wheels, an axle-tree, a trail and a limber consisting of a box mounted on an axle and two wheels, provided at the rear with a hook for connexion to the trail-eye, and at the front with the draught fittings. This method of transporting mobile artillery is universally employed both with horse-drawn and tractor-drawn carriages which can be travelled as entities. At the present day, however, caterpillar mountings are in use or under experiment in many countries.

Regarded from the firing aspect, the requirements of a field carriage demand as extended a traverse and elevation as possible, consistent with the requisite mobility. The main general designs may be given as follows:—

Three-Point Support Carriages.—In the usual form of carriage, the firing system, resting on the ground by its two wheels and the point of the trail (which is secured by a tract spade embedded in the ground), forms a three-point support. To preserve the side stability of this type, the force of recoil must be nearly coincident with the centre-line of the trail; consequently only a relatively small angle of traverse—4° either way—is allowable. The amount of elevation possible is affected by the form of the trail.

Four-Point Support Carriages.—This is a modification of the three-point support, consisting in the use of a split trail, the halves of which can be splayed outwards to form two struts, instead of one, in the firing position. In effect, this type has two trails and gives the advantage of an extended traverse—20° each way—without change of position. The amount of elevation obtainable is controlled by the balance of the gun and its height above the ground.

Temporarily Fixed Mountings.—When a road-mobile carriage cannot be travelled as an entity, there is no need to retain the wheels as part of the firing support; consequently such carriages must have embodied in the design some arrangement to allow of large traverse—at least 30° each way—in order to obviate subsequent alignment of the basic structure. The basic structure consists in a platform temporarily secured to the ground with the superstructure mounted above it in such a manner as to be pivoted. The transporting carriages are designed to facilitate mounting and dismounting. Elevation is affected by the shape of the superstructure.

Railway Mountings.—These are super-heavy carriages travelled as entities but restricted to the use of a permanent way.

Factors in Design of a Gun.—The main object in the design of a gun is to ensure sufficient strength at all parts of the gun to withstand firing stresses, with a considerable margin of reserve strength to provide accidental abnormal pressures or deliberate increase of pressure that may subsequently be found necessary.

In the design two important principles must be observed—(1) the tube in actual contact with the powder gases must be relieved of all longitudinal stresses; and (2) the work must be distributed over all the various parts of which the gun is built up. The pressure developed when the gun is fired acts in all directions; therefore the force acting upon the face of the breech-screw is equal to that acting upon the base of the projectile. In order to give effect to (1) above, it is always arranged that the breech-screw shall not gear direct into the inner "A"-tube, but into one of the outer parts of the gun; the only longitudinal stress, then, to which the inner tube is subjected is that caused by the projectile passing along the bore. As regards (2) above, the longitudinal stress is transmitted from the breech-screw through the various intermediate parts to the jacket or outer part of the gun (fig. 1).

In the case of wire-wound guns, requirements of longitudinal and "girder" strength present certain difficulties, because the wire coils do not give any strength in the direction of the axis of the gun. The practice is to make the parts outside the wire take the whole of the longitudinal stress, while they take little part in resisting radial stresses. "Girder" strength, or stiffness, is provided by the inner tubes as well as the outer parts; but in all long guns, more especially when wire-wound, there is a tendency for the unsupported part to sag.

The radial stresses are taken by the inner tubes and the wire in wire-wound guns. Since these stresses are not equal at all points in the bore, it is necessary to arrange the wire-winding accordingly. The firing stresses are greatest in the chamber, and as the projectile travels along the bore they gradually decrease. With a heavy gun, the chamber-pressure is about 18 to 20 tons per square inch, while the muzzle-pressure is only from 5 to 7 tons. The greatest strength, therefore, is required over the chamber; the number of layers of wire is greatest at that part, and gradually decreases along the gun towards the muzzle. In addition to regulating the amount of wire, the tension at which the various layers are to be wound must be calculated; these winding tensions are so arranged that, when the gun is fired, the whole of the wire is, theoretically, equally stressed. In all designs the circumferential strength is calculated with a margin beyond any anticipated stresses; this "factor of safety" is usually between 1·5 and 2.

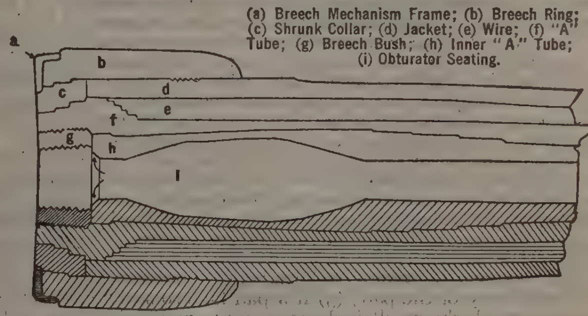
(a) Breech Mechanism Frame; (b) Breech Ring; (c) Shrunk Collar; (d) Jacket; (e) Wire; (f) "A" Tube; (g) Breech Bush; (h) Inner "A" Tube; (i) Obturator Seating.
a
b
c
d
e
f
g
h
i

FIG. 1.—Breech end of B.L. 15-in. gun.

The longitudinal stresses are taken by the outer parts of the gun, viz. the jacket and "B"-tube, being transmitted to the former from the breech-screw through the breech-bush, shrunk collar and breech-ring. In order to provide for stretching of the inner "A"-tube and to prevent the formation of "steel-choke" in the bore, there must not be external shoulders, or steps, on this tube, except those at the rear end and immediately in front of the chamber which are provided to prevent bodily forward movement of the tube.

Further, the "girder" strength of the gun must prevent it from bending under its own weight when supported on its mounting, which normally affords support for only a small portion of the length near the breech end. For this reason the inner and outer tubes must be of sufficient thickness. Practically all tubes are of greater thickness than is theoretically necessary.

Rifling.—Exhaustive trials at various times have been carried out for comparing various systems of rifling for high-velocity guns. The general considerations are: the greater the number of grooves and the slower the twist the narrower can the lands be, owing to the reduced pressure on each driving edge of the grooves; shallow grooves weaken the bore of the gun less than deep grooves, but in a worn gun the latter allow the power of rotating a projectile to last longer; the broader the grooves in comparison to the lands, the greater the unengraved portions of the driving-band, and consequently the greater the resistance to shearing the band, with less danger of the band wearing smooth; the edges of the grooves should be normal to the surface of the bore so that the rotational pressure may be applied by the driving-edge at right angles to the radius of the projectile; the form of grooves should be as simple as possible, and the lower angles rounded to avoid any tendency for cracks to develop.

The form of groove in favour in Great Britain is a slight modification of the P.P.S. groove, so that the number of grooves per inch of calibre is increased by 5–8, and the width of the grooves as compared with that of the lands is increased, the lands being reduced to the lowest limit necessary to withstand shearing. The advantages of this system are that less copper is cut away by the lands, thus leaving more to withstand the wear in rotating the projectile; and that the total bearing surface of copper against the lands is larger, due to the larger number of grooves.

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[1] During the war period numerous equipments were designed for employment on narrow-gauge lines, notably by the French. But these were not railway mountings in the true sense, as they did not both travel and fire from the line. Their transport to the narrow-gauge track might be either by road or by rail.

Theoretically the same twist should be suitable for high and low velocities with a given projectile; but the determination of the appropriate twist must, to a large extent, be settled by experiment. In the British service, a twist of one in 30 cals. is adopted for guns, and a sharper twist varying from one in 15 to one in 25 cals. for howitzers. In the French service it is considered that with an angle of rifling[1] larger than about 7°, the projectile would be given too much spin-stability, and would find difficulty in adapting itself to the trajectory when it commences to fall.

In American field guns the rifling has approximately 8 grooves per in. of calibre and is about 0·02 in. deep. In Germany, on the other hand, the changes in rifling appear to have been in the direction of narrower grooves and wider lands while the number of these has been increased; the twist of rifling is uniform.

Obturation.—In the British service, ordnance are divided broadly into two classes: (1) breech-loading (B.L.) and (2) quick-firing (Q.F.). Originally the division was in accordance with the rate of fire; but developments in breech-mechanisms and mountings have been such that, generally speaking, a modern B.L. gun is capable of a rate of fire as high as that of a Q.F. gun of equal calibre; so that, though still used, the terms B.L. and Q.F. are applied to guns according to the obturation, *i.e.* means adopted for preventing escape of gas at the breech. With B.L. guns the obturation is effected by the de Bange system (*see* 20:206). With Q.F. guns the sealing is performed by a metallic cartridge-case.

The principal advantages of the Q.F. system are: (1) the charge being in a metal case "fixed" ammunition can be used, thus increasing the speed of loading; (2) the cartridge contains its own means of ignition, again tending to increase the speed of loading; (3) if one case fails to obturate correctly, subsequent rounds are not necessarily affected. On the other hand, the disadvantages are: (1) it is not suitable for guns of large calibre owing to the excessive weight and length of the cartridge-case required; (2) the chamber must be of a definite shape and size and must be very accurately machined; (3) some form of cartridge-case extractor is required.

The advantages of the de Bange system (pad obturation) is its simplicity, no preparation of the gun being required beyond the machining of the obturator-seating. Its disadvantages, apart from the slower rate of loading, are that (1) pads are liable to lose their shape unless constantly attended to, and are susceptible to changes in temperature, becoming soft in hot weather, and hard and inelastic in cold weather; (2) prolonged firing causes overheating, softening and inefficiency of the pad; (3) if a pad fails to seal completely on any one round, the result is damage to the pad and scoring of the obturator-seating, which will increase with every subsequent round unless immediate steps be taken to remedy the defect.

Breech-Mechanisms.—The essential features of the breech-closing arrangements are safety, efficiency and rapidity; and the breech-mechanism must be so arranged as to embody these features as well as, at the same time, convenience in handling, which must also be studied, to admit of the mechanism being operated with a minimum amount of effort. A point of importance, as regards safety when a breech-screw is used, is to ensure that there be sufficient effective bearing surface of the screw in bearing with the breech-bush to enable the screw-threads to withstand the pressure on firing. This point affects the length of the screw and consequently the length of the breech, the heaviest part of the gun. Rapidity of action and ease of operation are chiefly mechanical questions and do not affect the design of the gun as such to any appreciable extent.

As regards carriages for light and medium field equipments, the factors which require consideration as affecting mobility or lightness of draught are as follows:—

Weight.—The draught necessary varies directly as the weight and inversely as the wheel-diameter. Thus the weight must be a minimum consistent with strength.

Wheels.—The wheel-diameter should be as large as possible within practical limits, and the breadth of tire sufficient to prevent the wheel from sinking deeply into soft ground. When possible, similar wheels should be used on gun-carriage and limber to ensure interchangeability; but this is impracticable as a rule in the heavier-wheeled carriages, in which the limber-wheels support only a small proportion of the weight. The wheels must be designed for the load they have to support. In the British service the latest light field wheel is 4 ft. 3 in. in diameter; earlier equipments used wheels 4 ft. 8 in. or 5 ft. in diameter; the heavy field wheel is 5 ft. in diameter. Other wheels of both wood and steel, and of larger diameter, are used with heavier tractor-drawn equipment. The mean diameter of the axletree-arm should be a minimum consistent with strength in order to reduce friction.

Wheel-Tracks.—Generally, the wider the track, the larger the upsetting angle and the greater the lateral stability, but a wide track tends to increase the draught, permits of side-play of the pole, and adversely affects wheeling or reversing operations. Thus the track should be narrow, consistent with lateral stability. The track of the limber and carriage-wheels should be the same, so that the limber-wheels may make the tracks for the carriage-wheels which support the greater weight; this tends to lighten the draught.

Limber and Coupling.—The trail in travelling acts simply as a connector. It should be short for compactness, thus enabling the carriage to be reversed within a small space; and narrow towards the trail-eye, allowing a large angle of lock and thus ease of manœuvre. The coupling must, for travelling over rough country, permit of limited vertical and twisting movements of the limber with respect to the carriage, or *vice versa;* and it must preserve the balance of the pole. The coupling in general use is the trail-eye and limber-hook which allow of free play of one with respect to the other; sometimes the eye is swivelled to permit of a rocking movement which further increases the flexibility of connexion.

For ease of draught there should be a slight reduction in weight on the limber-wheels as compared with that on the carriage-wheels, the ideal proportions varying between 2 to 3 and 5 to 6. With light equipments the total load is not rendered excessive by carrying ammunition in the limber, and this gives a suitable distribution for travelling. With medium horse-drawn equipments, it is undesirable to add weight with ammunition, but by hauling back the breech of the gun to a travelling position upon the trail a suitable distribution is obtained without increasing the load. With tractor-drawn carriages particular distribution is not necessary.

Balance of Pole.—It is important to take the weight of the pole off the horses as much as possible, and the limber is designed with this object in view. With medium equipments, the balance must be preserved while the gun is transferred to the travelling position; this necessitates a special coupling, known as a limber-connector, which is flexible and also supports the weight centrally on the limber-axle. The load is pulled from and supported by the limber-axle, so that the variation produced when distributing the load will not disturb the balance of the pole.

Other necessary elements of a carriage design are brakes which serve the usual purposes in travelling, and travelling clamps which lock the portions of the superstructure to the travelling support in order to reduce play.

To permit of the necessary three movements of the gun in action, a superstructure must be built up on the basic structure of the carriage. For traverse a component, known as an intermediate carriage, is pivoted vertically to the basic structure, so that lateral movement can be obtained through traversing gear. With light and medium carriages the intermediate carriage is pivoted near the front of the trail, with others to the platform. The most notable exception is the case where cross-axle traverse is embodied in the design, when the intermediate carriage is dispensed with. The front of the trail is moved bodily along the axle by suitable gearing; the sides of the trail are extended upwards to support the cradle. This method has an advantage in that the direction of recoil is always coincident with the centre-line of the trail; but the necessary wheel and axle movements tend to render traversing difficult.

For elevation, the intermediate carriage must be designed to carry, pivoted on a horizontal axis, a cradle which, under the control of elevating gear, can give the required elevation to the gun; the cradle is carried by trunnions in plain or roller bearings at the top of the intermediate carriage.

For axial movement, the cradle must provide a support on which the gun can slide, but must prevent it from having twisting movement; it must also carry the recoil system. Thus the cradle and gun must have guides, and the gun also a lug for attachment to the recoil system.

The superstructure thus consists in an intermediate carriage, a cradle, a recoil system, and gears for traversing and elevating.

During action, complete immobility of the firing support is required; this means that the carriage must be secured against backward, forward, side and turning movements. In a typical light carriage, backward movement is prevented by the spade; forward movement by using the brakes in conjunction with the spade; the side movement by limiting the traverse. For turning movement the standard aimed at is that the wheels shall not lift during recoil, nor the trail during recuperation.

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[1] The angle of rifling is the angle which the twisting groove makes with the direction of axis of the gun. It is given by $\frac{\pi}{x} = \tan.\ \theta$ when x is the number of calibres in which a complete turn is made. Thus a uniform twist of one turn in 30 cals. means an angle about 6°.

Conversion.—An existing gun design does not as a rule lend itself very successfully to conversion to another pattern, though the expedient is sometimes, from force of circumstances, resorted to. It is seldom that the power of a gun—that is, its range and accuracy—can be improved by alteration; but by altering the breech-mechanism or adapting the gun to suit a new carriage it may be possible to augment its tactical, if not its ballistic, power. As examples of conversions which have been carried out in recent years in various countries may be cited: the conversion of field guns from B.L. pattern to Q.F. pattern in order to avoid the expense of complete rearmament; the conversion of old-model guns and howitzers by cutting down and boring out, during the World War; and the very frequent expedient of remounting the piece on a new type of carriage.

As the requirements demanded of a carriage in the field become more exacting, so the design becomes less simple, and any adaptation of an earlier design more difficult. At certain limits it becomes more economical to build a new design.

In recent years, changes in design have been more frequent and far-reaching than during many years previously. Consequently, formerly the question of obsoleteness of an equipment was one which did not have a very definite meaning. The task imposed on a gun in the past was neither so severe nor so definite as at the present time; and so the idea of what constitutes obsoleteness has only lately required to be expressed explicitly. It may be taken nowadays that an equipment is designed for a certain definite purpose, and that when it can no longer perform the duty required of it, it has become obsolete. Nevertheless, to apply this proposition as a test in any given case is much more difficult than to enunciate it. Thus, during the World War, so many new designs of carriages were built on quite new lines and embodying quite new ideas, that it might be said that all carriages of earlier date are now obsolete. But such a conclusion does not necessarily apply to all natures of carriages; for instance, though with light field carriages any spring-recuperator is obsolete, it does not follow that with a fixed mounting spring-recuperation is not efficient. It is difficult to draw any decided line or define obsoleteness to cover all classes of carriage and mounting. All that can be said is that a system or mechanism, formerly employed, which no longer satisfactorily and fully fulfils the ruling conditions of any class of carriage, may be considered as obsolete for that particular class.

Nevertheless, though a method or design may become obsolete, the question of stocks has an important bearing on whether the equipments of obsolete design may be discarded; and this final decision rests almost entirely on the capability of the equipment to give reasonable satisfaction in the ballistic requirements.

From all the above it will be seen how intimately the elements of a design react upon one another, and how in its final version the design becomes a compromise between conflicting requirements and limitations. The table below collects some of these requirements in the case of field carriages. Juxtaposed, they indicate the nature of the designer's problem without the need of further comment.

(II.) MANUFACTURE

General Method of Building a Gun.—In the general methods of building a British gun very little change has taken place in recent years. The gun is either built wholly of steel tubes shrunk together, known as the “ all-steel ” construction; or the inner tube is reinforced by winding on layers of steel wire and the whole encased in an outer jacket, known as the “ wire-gun ” construction. This latter construction is that now generally favoured and the number of layers of wire and the distance from breech towards muzzle covered with wire depend upon the particular class of gun.

The 60-pdr. gun may be taken as an example in the process of gun design. In the Mark I. gun there is an “ A ”-tube, lined with an inner “ A ”-tube extending from the seat of the obturator to the muzzle and secured longitudinally by means of corresponding shoulders and a breech-bush screwed into the “ A ”-tube at the rear; the breech-bush is prepared for the reception of the breech-screw; the layers of wire cover a portion—about one-half—of the “ A ”-tube, extending from the breech end; the jacket covers the wire and extends towards the muzzle along about one-half the unwired portion of the “ A ”-tube, and is secured longitudinally by corresponding shoulders; the breech-ring is fitted over the rear end of the “ A ”-tube and is screwed to the jacket; the breech-ring is prepared for the reception of the breech-mechanism and is provided on the upper side with lugs for the attachment of the hydraulic buffer and running-out springs of the carriage; longitudinal ribs on each side of the jacket form guides for the gun in the cradle.

In the next mark of 60-pdr. the “ A ”-tube was made thicker and the inner “ A ”-tube omitted; and this was also the case in the Mark II. which was introduced as a more powerful gun, being some 5 cals. longer than the Mark I. The last mark, however, has an inner “ A ”-tube extending from the seat of the obturator and slightly projecting from the muzzle; the interior of the “ A ”-tube is prepared with longitudinal grooves to prevent any turning movement of the inner “ A ”-tube when in position; a lug is provided on the under-side of the breech-ring for the attachment of the hydro-pneumatic buffer of the carriage; and projections on the under-side of the jacket are formed to fit the slides on the cradle.

The measurements of the chamber of the 60-pdr. are: largest diameter, 6 in.; smallest diameter, 5·3 in.; length 21·926 in.; and the total length of the latest pattern gun is 192·25 in.

Recently another method of building a gun, termed “ auto-frettage,” originating with the French, has been tried as an alternative to shrinkage, but it is still in an experimental stage.

The rule hitherto has been to limit the greatest strain developed in a gun-body to the value corresponding to the strain produced by a tensile stress equal to the elastic limit of the material. Beyond that limit permanent deformation takes place. But it is now argued that with any static load less than that which produced an existing permanent deformation, the total deformation will remain less than the maximum reached under the latter, and the permanent strain does not increase; so that a member statically stressed to a point quite beyond the natural elastic limit would be entirely safe under any static load extending below that point, and that the point may be considered as a new elastic limit and adopted as such for practical purposes. As applied to a hollow cylinder or a gun, auto-frettage consists in applying an interior pressure, preferably by hydraulic power, of such intensity as to cause deformation of the inner layers much beyond that corresponding to the natural elastic limit. The permissible interior deformation is based upon the ratio of outer and inner diameters, upon the physical qualities of the steel, and particularly upon the paramount condition of keeping the inner layers free from fissures and breaks. Precautions must also be taken so that, upon removal of pressure, the material of the inner fibres, which will then be under intense compression, will not be further deformed and weakened by these compressive stresses. In action—*i.e.* under interior pressure—all the layers are in a state of tension varying, of course, with the radial position of any given layer. On returning to rest, all the layers tend to return to original lengths, but because of the permanent deformation, intentionally produced,

Element.	Travelling requirements.	Firing requirements.	Governing factors.
Weight	Small for mobility.	Large for stability.	Travelling.
Trail—length.	Short for compactness when limbered up.	Large for stabiltiy.	Firing.
Trail—width	Narrow at end for angle of lock.	Wide on axle to reduce intensity of shock.	Firing.
Wheels—diameter	Large for mobility.	Small for stability.	Travelling.
Centre of gravity Centre of height	Affected by diameter of wheels.	Low for stability, high for command of fire.	Stability and command of fire.
Axle—length	Long for lateral stability, short for other points.	Sufficient to give required traverse.	Travelling.

the inner layer, for instance, would be set to a new length greater than the original and smaller than that developed in action; it is then compressed by the combined efforts of all the surrounding layers. The result is that the whole body of the solid hollow cylinder is in a state of compression greatest at the interior wall and least at the exterior wall. As a gun has a tube of thickness diminishing from chamber to muzzle in order to conform to the variation of the powder gases, it is not possible to employ a uniform auto-frettage pressure throughout the length of the tube. With auto-frettage, though the elastic strength may be raised, the point of rupture must remain the same. The advantages claimed lie principally in economy of time, labour and material.

Big Bertha.—The method of manufacture of the German long-range gun, "Big Bertha," might be cited as an example of special adaptation. The gun was constructed from worn-out 38-cm., 45-cal. naval guns, used merely for the sake of the forgings. The converted gun was built in two parts, a main section about 30 metres long and a forward part about 6 metres long. The old gun was bored out and a very heavy tube of 21 cm. inside diameter inserted. Some 13 metres projected beyond the end of the original gun and over this portion another hoop was shrunk and locked to the forward hoop of the old gun. The main portion was rifled with uniform twist; the forward section, attached by means of interrupted threads and heavy outside collars as flanges, was not rifled but of a diameter larger by the depth of the grooves. The reason for the extra smooth-bore section was probably to align the axis of the projectile more perfectly with the axis of the gun and so to reduce to a minimum any irregularity of the projectile as it left the muzzle. The inner tube was made of such a thickness that, when worn too far, it could be bored out, *in situ*, to a larger diameter and the gun again used with a larger projectile; and this operation could be carried out twice.

With the 60-pdr. gun the rifling in the Mark I. was of polygroove plain section of uniform twist, one turn in 30 cals., with 24 grooves. In the latest mark of gun the rifling is the same shape and twist, but there are 32 grooves.

Whereas, in England, formerly the method of cutting the rifling was to cut one groove at a time, the tendency now is to cut two or three grooves at a time, as it is found that sufficient accuracy can be maintained during the working; thereby time and cost are saved. But it is thought that to cut more than three grooves at once is dangerous to the required accuracy. In America the practice of cutting all the grooves at the same time is favoured in certain instances, and with the 75-mm. field gun the method of rifling the bore enables the whole 24 grooves to be worked upon at the same time.

Recent Developments in Breech-Mechanisms.—As regards breech-mechanisms, that known as the "pure couple" mechanism is practically the standard type for all heavy and most medium guns in the British service. Greater ease is ensured by its use, as the breech-screw is balanced by equal and opposite forces applied to the two studs on the breech-screw, thus eliminating any tendency to lateral translation of the screw, and so reducing wear and friction.

With the French "mortier de 293 mm.," automatic withdrawal of the breech-screw is effected by power stored up by the recoil of the piece. The screw is of the Welin class, and is prolonged to the rear by a tail-piece with steep threads fitting with an attachment from which an arm passes ending in a sleeve movable about an extension of the recuperator piston rod. This extension is fixed to a carrier between the arms of which lies the sleeve attachment from the breech; a toe-piece on the movable part engages with the recuperator body and can move in a cam-groove. As the gun recoils, the recuperator body, with the sleeve interior, moves with it; the carrier sliding along the cradle passes over a pawl. On recuperation the carrier is arrested by the pawl, and the arm between the breech-block and carrier is held while the gun continues to complete the run-up; on account of the screw-thread on the breech-block tail-piece, the screw is obliged to turn and is thus withdrawn from the gun. After loading, the pawl is put out of action and the pressure of the recuperator, by forward and turning motion combined, effects the breech-closing.

With the Schneider 105-mm. gun of 1913 pattern, the breech-mechanism has a special rapid movement. The screw is of the swinging type. Plain and thread segments alternate as usual, but the dividing lines between them, instead of being parallel to the axis of the gun, are drawn to a curve and the breech-block is hollowed on the side nearest the pivot. The carrier-ring is cranked and pivots on an axis somewhat displaced to one side. The combined effect of these arrangements is that the block can swing into and out of the breech-opening without a separate movement of translation. The necessary motion is imparted by a lever actuating a rack on the breech-face of the breech-block which rotates teeth on the breech-block; one-quarter turn locks or unlocks the breech. The extractor arm lies in front of the breech-block pivot and is operated by it through a cam system.

The breech-mechanism for light field guns has followed generally on the lines of those for heavier B. L. guns. The British 18-pdr. Mark I. equipment contained a novel feature, in that the breech-screw was coned throughout its whole length, the *larger* diameter being in front, so that when the breech was closed it had a wedge-action which precluded any possibility of the block being blown out.

Another form of breech-closure is the Canet system adopted in the French 240-mm. coast gun of 1903. In this a semicircular block prepared with screw-threads is pivoted transversely in the body of the gun. In the closed position the block is above its axis, and it is maintained there against gravity by special mechanism. On recoil, this mechanism disengages itself automatically, and the breech-block, no longer supported, swings down into the open position.

A recent type of breech-mechanism—known as the Asbury mechanism—has been introduced into the British service, being intended primarily for howitzers. The distinctive features of this are a vertical or fore-and-aft motion of the breech-mechanism lever, an arrangement whereby increased mechanical power is gained at the final moment of closing the breech and at the first moment of opening it (thereby avoiding forcing and slamming); and a form of catch which prevents the breech-screw from revolving during the swinging motion of opening and closing. This type of mechanism has proved very satisfactory, and has been applied to howitzers of heavier natures, as well as to light and medium field guns. The advantages claimed for it are: (1) it facilitates the service of the gun by placing the breech-mechanism lever in a more convenient position; (2) it prevents slamming of the breech and eliminates damage to the threads of the breech-screw due to rebound of the mechanism; (3) it has a positive unseating action on the obturator.

With sliding wedge-mechanisms the two main types still remain the vertical or falling block and the horizontal sliding block. It is necessary with the sliding block that the guide ribs along which the block slides should be inclined so that the block, as it moves to the closed position, has also a forward movement, thus forcing the cartridge into its seating in the chamber of the gun. The method of operating the block, in the main, remains the same as in early designs, but additional mechanism has been introduced to enable the mechanism to be worked semi-automatically, particularly in connexion with firing at aircraft at high angles of elevation, when it is necessary to adopt some mechanical means to assist in loading, and to prevent the cartridge slipping back while the breech is being closed.

With the latest type of mechanism, the practice is to use separate locks for electric and percussion firing. These locks follow generally on the lines of the combined lock, but a much lighter mainspring is used in the electric lock; and the percussion lock is usually so arranged that it is automatically cocked during the opening of the breech. Guns and howitzers fitted with the Asbury type of mechanism were originally intended for firing with a vent-sealing friction tube, no lock being required; but this method proved unsatisfactory chiefly on account of the excessive erosion of the vent. As a temporary expedient, the Martini rifle-firing mechanism was adapted to the vents of these pieces, and fired a percussion tube similar to the small-arm cartridge. It has been superseded by a lock and slide-box.

With 18-pdr. field guns the striker is designed for percussion firing only, having a trip action in which the striker is cocked and released by a continuous pull on a lanyard or a firing lever on the carriage.

Carriage Elements.—The kinds of trails in use for mobile equipments may be classed as pole, box and split.

The pole trail is merely a steel tube and favours travelling rather than firing, being light, a simple connector, and permitting of a large angle of lock; its greatest defect is the limitation it imposes on the elevation of the gun.

The box trail consists of two bracket sides connected at either end; its main feature is to permit of increased elevation, as the gun can move down between the side brackets, and it is the standard type for use with modern 3-point-support carriages. This type, on the other hand, does not favour travelling so much as the pole trail, as it is heavier and is necessarily wider at the travelling front, thus diminishing the angle of lock. When used with an axle-traverse equipment the trail can be narrower, since it traverses with the gun.

The split trail consists in two similar legs attached at the front by ball and socket joints to the axletree, and a crossbar; the legs are splayed outwards for firing; the flexible connexion allows of a limited vertical movement to accommodate the legs on uneven ground. This construction is necessarily heavier and hence adversely affects the mobility; its great advantage is provision of an extended traverse. The first practical example of the split trail was the Deport Q.F.

field gun used in the Italian army. The principle is applied also in the British 3·7-in. mountain howitzer. No German guns used in the war had split trails. Perhaps the best-known split-trail weapon is the French 155-mm. G.P.F. gun used also by the Americans.

The *spade* is secured to a sole-plate and the latter to the under-side of the trail at the rear; the spade prevents rearward movement of the carriage while the sole-plate prevents the trail from sinking into the ground. Spades are generally broad and shallow, for a deep-pointed spade is likely to be damaged when bedding and may not give sufficient clearance for travelling. With axle-traverse equipments the spade must be more pointed, as the trail pivots about it, and it must also prevent lateral movement of the trail.

The spike is a special form of detachable spade, which requires to be driven through a slot in the trail; the point of the trail is in fact nailed to the ground. Spikes differ from spades mainly in that there is no limitation within reason to their depth; their removal facilitates travelling; they have to be driven in in taking recoil, whereas the ordinary spades bed themselves; they prevent forward movement during recuperation, and braking is unnecessary.

The axletree, which must be made to withstand the downward blow due to firing, may be either straight or cranked.

The straight axletree is usually a steel tube having the ends tapered to form arms to receive the wheels; straight axletrees must of necessity be used with axle-traverse equipments. The cranked axletree is favoured by the modern 3-point support carriage. It consists in a hollow steel forging, the extremities of which are cranked upwards, and to which are attached tapered arms for the wheels; the central or low portion supports the front of the trail. Cranked axles generally have to be made heavier than straight axles. Their great advantage is that they enable the firing height to be lowered and so increase both the travelling and firing stability. Thus, with a given wheel-diameter, a cranked axle admits of a shorter and lighter trail, and stability is maintained with a more compact carriage.

During firing, the function of a brake gear is to prevent forward movement of the carriage during recuperation if spades be used; with spikes brakes are not necessary. All brakes must be provided with a form of quick release for use when a new line of fire is to be taken up, and also, in the case of cross-axle traverse, when the traversing gear is operated.

The typical intermediate carriage consists in two bracket sides suitably connected; it is pivoted near the front to the trail, slides over the trail at the rear under the control of the traversing gear, and has trunnion bearings forward at the top. Holding-down clips are normally provided at front and rear to prevent lifting on firing; and stops to limit the traverse to the designed amount each way. With a split trail a different pattern is necessary owing to the splaying of the legs; it is therefore pivoted to the centre of the axle, the upper portion is forked and provided with trunnion bearings, while the lower portion in the form of a stem passes through the axle tree and fits into a ball-joint in the cross-bar beneath.

The traversing gear is generally of the nut-and-screw type; in the main it consists in a screw with hand-wheel supported in a bearing pivoted to the trail and engaging with a nut pivoted to the rear of the intermediate carriage. With split-trail carriages, the screw is supported by the intermediate carriage and engages with a nut pivoted to the left of the axle. With axle-traverse equipments, either the central portion of the axle is threaded to form the screw and the nut carried within the front of the trail or a separate screw and nut parallel to the axle are employed; in the latter case, rollers support the front of the trail on the axle, and ease in traverse is obtained by the incorporation of ball-bearings.

Cradles may be distinguished as of the ring and trough types. The ring cradle is in the form of a short hollow cylinder in which the gun is supported and through which it recoils; chambers are formed on top or below to accommodate the recoil system; and the cradle is pivoted transversely to the intermediate carriage by means of trunnions. This type is used principally with heavy howitzers and fixed mountings in which relatively short recoil-length is given. It is not a good design for long-recoil field guns because of its shortness, and relatively bulky construction. The trough cradle is shaped like a trough, trunnions being formed on either side to pivot it to the intermediate carriage; the recoil system is housed within the trough, while the gun is supported on slides above. The trough forms a suitable casing for the recoil system and is less bulky than the ring type and assists rearward extension; on the other hand, it tends to bend during firing and necessitates the carrying of the recoil system below the gun.

Elevation is given by means of a screw and arc, or arcs, which causes the cradle to pivot about the trunnions. The screw may be single or telescopic to give aggregate motion; its lower end passes through a nut supported by the intermediate carriage and operated through a bevel drive. Generally, with light equipments the gear is designed to embody the principle of the "independent line of sight." Any elevating gear should support the cradle either centrally or equally on either side so as to reduce torque and wear. The modern method is to employ either a central arc, or one on either side, operated through a worm-and-arc-pinion drive. Owing to the high elevation for which equipments are now designed, with light and medium natures an arrangement to facilitate quick loading is necessary to permit of the cradle being depressed by hand from a high elevation to a convenient position for loading without disturbing the elevating gear or sight; when this is embodied, the arcs are sleeved on the trunnions, while the arrangement provides the means for locking them to or unlocking them from the cradle; with heavier equipments quick and slow motion gears are installed.

Shields are provided for light horse-drawn equipments, and give protection against shrapnel and rifle bullets only. Such protection is not considered necessary with heavier equipments; and the weight of a shield to give protection against shell-fire would be prohibitive. The typical shield is supported on the axle and trail, and is provided with hinged flaps at top and bottom to give additional protection; these flaps are folded up for travelling.

Heavy mobile equipments which cannot be travelled as entities are split into loads—generally three—the gun, the cradle, and the firing platform. For the gun a special travelling carriage is provided; for the cradle and platform axle-arms are attached upon which wheels can be placed, and a light limber keyed to the load.

The latest pattern of 60-pdr. carriage embodies most of the modern ideas; it is a typical 3-point-support carriage, and its main features are: a travelling load of 6 tons drawn by 8 heavy-draught horses or by tractor as an alternative; wheels of 5 ft. diameter with 6-in. tires, and extension felloes fitted to increase the tread for travelling over soft ground; a 79-in. track to give a large upsetting angle and the necessary traverse; a distribution of the load in the approximate proportion of 5 to 3 on the carriage and limber wheels respectively, obtained by transferring the gun to a travelling position on the trail; a special limber connector to preserve the balance of the pole; a cranked axle to give greater lateral and firing stability; brake gear cross-connected and operated from either side; a box trail to permit of 35° of elevation; a wide trail for 4° of traverse each way; a long trail for stability; a shallow and broad spade; an intermediate carriage with holding-down clips; nut-and-screw traversing gear with spur drive and ball-thrust bearings; an extended trough cradle, mounted on roller-bearings, to support the centre of gravity of the recoiling parts even at full recoil; a single centrally placed elevating-arc operated by worm-and-arc-pinion gearing; hydro-pneumatic recuperator and controlled recoil; a recoil of 54 in. at the horizontal, reduced to 24 in. at 35° of elevation; replaceable bushed bearings for all working parts. (F. M. R.)

(III.) Wear and Life of Guns

Erosion is a general term applied to the effects produced by the action of the powder gas on the bore of a gun. These effects are of two kinds: (1) the gradual enlargement of the bore and smooth wearing-away of the surface by the action of the gas behind the projectile; this is termed "wear," and is independent of the sealing of the bore by the projectile; (2) the irregular eating-away of the surface of the bore in holes and gutters; this is called "scoring," and is mainly due to imperfect sealing of the bore. These two actions may occur separately or conjointly, and with cordite charges the differences are marked.

In the latest high-velocity B.L. guns, in which the sealing is nearly perfect, wear occurs with very slight or no trace of scoring until towards the end of the life of a gun. When a new gun is taken into use with cordite charges, wear begins at once; the lands near the breech end of the bore are worn down rapidly, while the grooves are also worn, but not to the same extent as the lands. The wear is always more with cordite than with gunpowder and is much more rapid with Mark I. cordite than with M.D. cordite. The rate of enlargement increases greatly with the weight of charge and pressure, and a heavy gun wears much more quickly than a light gun; for example a 9·2-in. can fire only about 600 rounds with full charges, whereas an 18-pdr. Q.F. gun can fire 10,000 or more rounds during its life. The "wear" per round is greater at first than subsequently.[1]

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[1] The following figures as to the "life" of German land service ordnance during the war have been published (Schwarte, *Militärische Lehren des grossen Krieges*):—

	Average	In some cases
7·7-cm. field gun	15,000	20,000
10·5-cm. field howitzer	10,000	13,000
10·5-cm. gun	10,000	15,000
13·0-cm. gun	3,500	6,000
15·0-cm. heavy land howitzer . . .	15,000	20,000
15·0-cm. gun, model 1916 Ehrhardt .	2,200	3,000

The table makes no distinction between the 96 n.A. and the 16 patterns of field gun, nor between the various patterns of 10·5-cm. field howitzer and gun.

"Scoring," once it begins, increases very rapidly and grows at an increasing rate as firing progresses. A tool-mark in the vicinity of the seat of the projectile is likely to start scoring; but its importance is lessened the further it is from that point. Scoring is chiefly found on the front incline of the chamber, and thence for a few feet down the bore. So long as it continues to increase only gradually in proportion to the number of rounds fired it may be considered normal and of no great consequence while it remains within certain limits.

In addition to the eventual unserviceability of the gun, the effect of wear and scoring is shown during the life of the gun by a gradual falling-off of muzzle-velocity and accuracy.

During the World War, in which ammunition expenditure far exceeded what was foreseen, several new expedients were used to augment the life of the guns. To this requirement is largely due the lengthening of howitzers, the increased use of reduced charges, and the development of new projectile forms which in comparison with the old gave equal results with and smaller strain on the gun, or brought a given target within the range of a smaller (and longer-lived) gun.

Apart from these indirect methods, various expedients were applied to the gun itself, notably by the French. For instance, in the 145 new heavy field gun provision was made in the design for boring out to 155 mm. after a first life at the normal calibre, and the 155 G.P.F. when worn had its chamber lengthened, the rearmost 12 in. of rifling being removed. (X.)

(IV.) BUFFER AND RECUPERATION DESIGN

On firing the recoiling gun acquires kinetic energy which must be absorbed by a resistance acting over the recoil permitted; this resistance is provided by the buffer, recuperator and friction. To reduce the recoil velocity and energy, particularly with field carriages, the heavier portion of the recoil system is generally made to recoil with the gun, the lighter portion being fixed to the cradle. The recuperator returns the gun to the firing position after it has come to rest under the action of the recoil resistance. It must be designed with a reserve of power, and so it assists in checking recoil.[1] The buffer must absorb the energy not accounted for by the recuperator and friction, and must adjust the total resistance as required by the carriage. With field carriages stability must be kept during its action.

The buffer consists of a cylinder filled with oil in which works a piston and rod; either the cylinder or, more usually, the rod is fixed, the remaining portion recoiling with the gun. A flow-space for the liquid, arranged to decrease during recoil, is provided between the piston and cylinder. The hydraulic resistance of the liquid to being forced through the flow-space causes pressure on the face of the piston and a pull on the rod. The greater the flow-space the less is the pull on the rod, so that by a suitable arrangement the resistance can be varied.

Modern buffers are tension buffers, the piston-rod being withdrawn during recoil. A compression buffer, in which the rod is pushed in, has the disadvantage that the free space in the cylinder cannot be fully occupied by liquid, as room must be kept for the volume of the rod when it enters. One compression buffer, however, is in use, in which the rod is extended beyond the piston and passes out of the cylinders through packing, thus permitting the cylinder to be completely filled.

At full recoil, a length of the piston-rod is withdrawn leaving a partial vacuum; on recuperation the liquid must be banked up against the face of the piston remote from the rod before the buffer resistance can take effect. At this instant the gun has its maximum recuperative velocity, and the larger the ratio of diameter of piston to rod the sooner will the buffer resistance act as a control. The flow-space in the buffer increases during recuperation, and the resistance is not sufficient to absorb the surplus energy. A further controlling device is therefore provided to ensure that the gun comes quietly to rest in the firing position.

The stability of a field carriage increases with the elevation, and at the horizontal it demands that $R \times H$ must be less than $W \times L - w_r \times X$.

Further, not only must the carriage be steady, but it must have a definite stability-margin throughout recoil; thus, if N represents the percentage increase in R to reach the stability limit—

$$\left(1+\frac{N}{100}\right) R \times H = W \times L - w_r \times X$$

or

$$R = \frac{100}{100+N} \cdot \frac{W \times L - w_r \times X}{H}$$

throughout recoil. The stability-margin of N per cent should be at least 25, and in modern carriages approximates to 50.

Methods of Control.—From these conditions it is seen that the resistance to recoil must decrease uniformly with recoil, and hence the system of graduated resistance is employed with field carriages. While the gas is acting on the gun, the recoil should be as unrestricted as possible, in order to preserve the aim of the gun and to reduce the couple on the recoiling parts. Frequently the maximum buffer resistance does not come into action until the gun has moved from 10 to 15% of the total length of recoil. A typical resistance-space diagram for graduated recoil is shown in fig. 2.

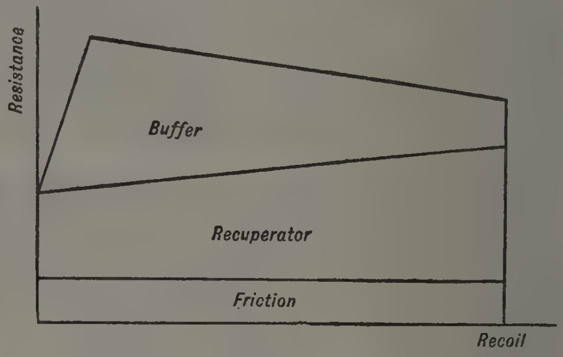

FIG. 2.—Resistance-space diagram. Graduated recoil.

The condition to determine the length of recoil is that the maximum recoil energy with free recoil (which can be calculated from the ballistics of the gun) must be equal to the work done by the total resistance to recoil, that is, to the area of the resistance-space diagram. Thus the working length of recoil, which for a light field carriage varies from 40 to 45 in., can be determined; and the buffer resistance can be obtained from the diagram, for the recuperative and frictional resistance can be calculated with reasonable accuracy.

The system of "controlled" resistance—shortening the recoil as elevation increases—is employed with many modern field guns and howitzers on account of firing at high elevations, as there is not space to permit of the same length of recoil as at the horizontal. Since stability increases with the elevation, it is possible to increase the buffer resistance with the elevation and thus shorten the recoil. A typical resistance-space diagram for this system is shown in fig. 3. Comparing fig. 3 with fig. 2 it can be seen how the proportion of energy absorbed by the buffer increases greatly with the elevation.

With a fixed mounting the question of stability does not arise. Consequently the recoil is fixed at from 3 to 4 cals. depending on the working stress on the mounting. As the recoil must not be exceeded at the greatest elevation, the component of the recoiling weight must be allowed for. The design must be such as to absorb the energy at the greatest elevation. Further, the total resistance will be a minimum when maintained constant throughout recoil. "Equalized" resistance to recoil is adopted with fixed mountings. A typical resistance-space diagram for this is shown in fig. 4.

Buffer Dimensions.—The buffer dimensions depend on the following considerations. The length of the buffer must allow of a metal-to-metal recoil slightly greater than the working length determined.

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[1] In certain modern equipments the energy stored in the recuperator during recoil is used not only to run the gun up but also to actuate the mechanism which unlocks the breech-mechanism of the gun, holds it back while the gun runs forward, and then, after reloading is completed, brings the breech-block up to and into the breech opening and locks it. A French example is given above. (C. F. A.)

The diameter of the piston-rod must withstand, with a safety margin, the tensile and compressive stresses to which it is subjected. The rod must be capable of being effectively packed and easily handled in manufacture. With light equipments the diameter as calculated is usually too small for effective packing, for which about 1 in. is the minimum diameter; with heavier equipments the calculated diameter increases and is used in the design.

The diameter of the cylinder is determined, within limits, by the design of the carriage. The larger the cylinder, the less the pressure required to act on the face of the piston and the sooner will the control of recuperation become operative; but a large cylinder has to be made proportionately stronger, and therefore heavier to withstand the bursting stress to which it is subjected. The ratio of the diameters of cylinder and rod usually adopted is about 2 to 1. The necessary thickness of the cylinder is then determined from the pressure it must stand.

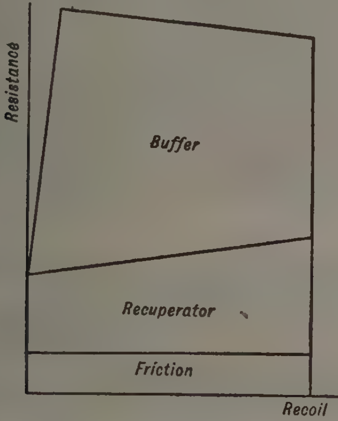

Fig. 3.—Resistance-space diagram. Controlled recoil.

The ratio of the areas of the piston and rod is 4 to 1; consequently the control to recuperation becomes operative at $\frac{3}{4}$ of the total run-up. This must be in accordance with the stability requirements, and the sooner it becomes operative the greater stability-margin will be preserved. With some equipments the ratio is less, so that the control becomes operative at a slightly later stage; but the ratio should be such as to give a stability-margin.

Flow-Space.—The area of flow-space can be calculated from a knowledge of the resistance-space curve, the velocity-space curve during recoil, and the piston area; the calculated area requires to be corrected experimentally.

Typical velocity-space and flow-space curves are shown in fig. 5.

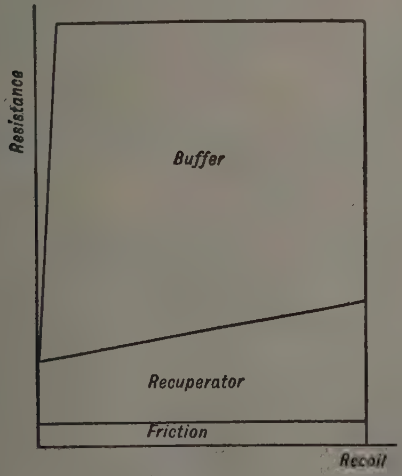

Fig. 4.—Resistance-space diagram. Equalized recoil.

The experimental correction of the flow-space is carried out in two ways: (i.) by taking practically a velocity-space curve for the recoil and altering the apertures until this curve corresponds with that obtained theoretically; (ii.) by taking a pressure-space curve by means of an instrument known as the buffer-gauge. To obtain good pressure curves the maximum flow-space should correspond with the maximum velocity of recoil.

The modern methods of varying the flow-space are as follows:—

(*a*) A circular piston and longitudinal grooves, usually of constant width and varying depth, cut internally in the cylinder. The piston tends to become fluted with wear, for which no ready means of compensation exist. Some pre-war field carriages use this system.

(*b*) Rectangular slots or ports in the piston, sliding over one or two longitudinal valve-keys,—metal bars of such contour as to leave the required flow-space during recoil—fixed to the cylinder walls. This system is simple, but, owing to the difficulties of accurately cutting the valve-keys, it is suitable for only relatively short recoils.

(*c*) A hollow piston-rod with circular piston sliding over a tapered rod, holes being cut in the piston-rod near the piston for the passage of the liquid. This system is more suitable for short than long recoils owing to the difficulty in accurately tapering a long rod; with it control to recuperation becomes operative from the first instant. It is used with the systems of equalized and graduated resistance.

(*d*) A rotary piston, with two or more ports cut in it, fitting loosely on the rod, rotation being governed by ribs fitting into grooves in the cylinder, and a valve with corresponding ports, against which the piston rotates, fixed to the piston-rod. This method is used with modern field carriages with combined systems of graduated and controlled resistance to recoil; it is the method of variation which best lends itself to controlled recoil. It has advantages, in that a slight turn of the piston-rod regulates the flow-space, and that wear of the piston or valve can be compensated for in a smaller manner.

(*e*) A modification of (*d*), in which grooves form the flow-space, is found in the latest German equipments. This consists in a hollow piston and rod with an extension tube carrying intermediate and stop rings; corresponding ports are cut radially in the piston, intermediate ring, and extension tube, while ribs on the intermediate and stop rings engage respectively with straight and rifled grooves in the cylinder. When elevating, the piston and tube are rotated to reduce the flow-space, eventually cutting off the intermediate ports; the variation in flow-space is obtained by the rifled grooves passing gradually off the ports.

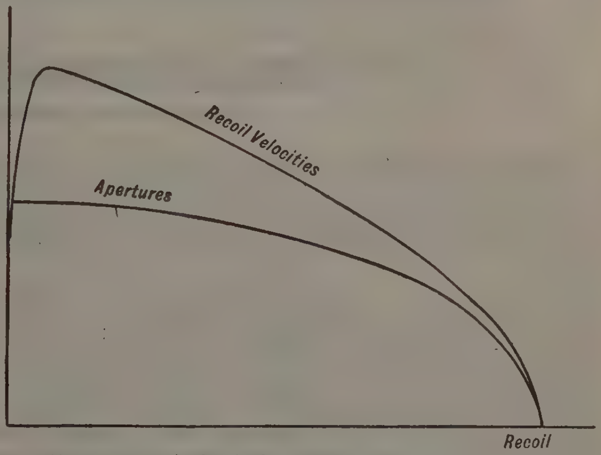

Fig. 5.—Typical velocity-space and flow-space curves.

Controlled recoil necessitates cut-off gear to rotate the piston-rod automatically with the elevation. This gear consists in link or cam-gearing placed between the cradle and the intermediate carriage, and rotates the rod through a bevel drive as the cradle is elevated. This rotation causes an overlap of the piston and valve ports as the piston is held stationary by the grooves, thus reducing the flow-space, so that the cut-off may take place earlier in the recoil stroke.

Control of Recuperation.—As the buffer flow-space is greatest at the termination of recuperation, some check is required to prevent a metal-to-metal blow. To produce this final control, the main devices in use are:—

(*a*) The control plunger and chamber. The plunger may be an extension of the piston-rod and the chamber a recess in the cylinder into which it fits; or the plunger may be fixed to the cylinder and the chamber a recess in the piston-rod. The flow-space is formed by cutting a tapered flat on the plunger, and in modern designs the construction provides for a further adjustable exit for the liquid so that the control may be regulated according as the elevation is low, medium or high. The recess becomes filled with liquid during recoil, and, before the gun can run up and the plunger return to the recess, the liquid must be forced through a small flow-space by the entry of the plunger. With this device recuperation takes place in three stages—first, unresisted except for friction, secondly, resisted by the buffer and friction; thirdly, resisted by the buffer, control plunger and friction.

(*b*) Separate recoil and running-up valves as used with the rotary piston buffer. The recoil and running-up valves which are on opposite sides of the piston are permitted slight longitudinal movement but prevented from rotating on the rod; the running-up valve is pressed against the piston during recuperation and a clearance obtained between the piston and recoil valve which renders the latter inoperative. The rotation of the piston decreases the flow-space between it and the running-up valve and provides the necessary control. Recuperation takes place in two stages: first, unresisted except by friction, and secondly, resisted by the running-up valve of the buffer and friction. This method was largely used in America.

(*c*) A rod working inside a hollow piston-rod used with the tapered rod buffer. The end of the tapered rod is fitted with a slide-valve which permits liquid to pass over it and fill the piston-rod during recoil; on recuperation the valve closes, and before the tapered rod can enter the piston-rod it must displace the liquid over the valve and through a groove, or grooves, of decreasing depth cut internally in the piston-rod. As the piston-rod is designed to fill during recoil, the control becomes operative from the commencement of recuperation.

(*d*) A modification of (*c*) is the principal German method. The piston-rod is designed to fill during recoil, the liquid having to pass out through a shallowing groove cut in a cylindrical control rod. A spring-loaded valve, which permits the piston-rod to fill during recoil, has its periphery shaped further to regulate control.

General Arrangement.—With field equipments, the buffer and recuperator cylinders are bored in a steel ingot which is supported in a trough cradle and is lugged to and recoils with the gun; the piston-rods are secured to the cradle cap (fig. 6). The main features of this type are a rotary piston for variation of flow-space, a control chamber with an adjustable liquid exit to provide recuperative control according to the elevation, a tank for reserve oil supply, a cut-off gear for controlled recoil, and a valve to release any air that may be sucked into the cylinder during recoil. The cylinder at the point where the piston-rod enters is closed by a stuffing-box, soft packing, and gland.

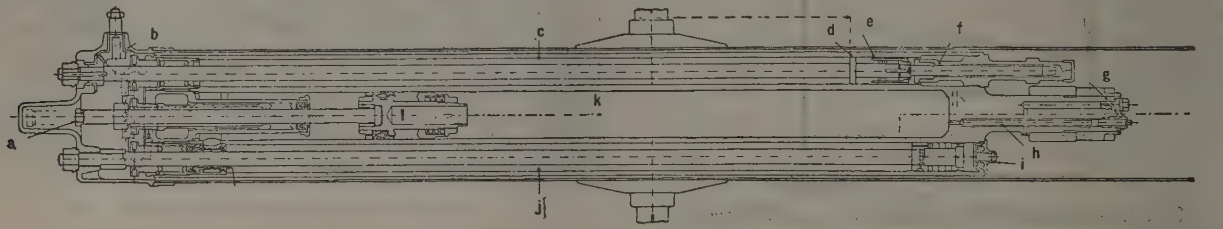

(a) Tail Rod (Leakage); (b) Cut-off Gear Segments; (c) Buffer-Cylinder; (d) Cut-off Valve; (e) Buffer-Piston; (f) Control-Plunger; (g) Air-Filling Plug; (h) Air Valve; (i) Dust Cover; (j) Recuperator Cylinder; (k) Air Reservoir; (l) Floating Piston.

FIG. 6.—General arrangement of buffer and recuperator.

With fixed mountings the buffer cylinder is secured to the underside of a ring cradle, the piston-rod being lugged to the gun. The features are a valve-key, a control-plunger protruding inwards from the closed end of the cylinder and working inside a hollow in the piston-rod, and a tank for oil supply. The open end is closed by a self-tightening ring of L-section, stuffing-box, packing and gland.

Recuperation.—Recuperation may be by means of steel springs or compressed air. Whichever the method, the recuperator must possess sufficient initial pressure to return the gun to, and hold it in, the firing position at the greatest elevation.

The life of springs is limited; according to the calibre and weight of gun with which they are used so their weight increases and they suffer from fatigue. In single columns they are unsuitable for long-recoil guns, due to the large deflection necessary. The springs used are cylindrical spiral springs of round or rectangular-section wire; wire of flat rectangular section permits of greater deflection before the spring is crushed metal to metal and hence is that usually employed; but circular-section wire gives a spring of minimum weight. To obtain the best results, the length of initial compression should be equal to the deflection produced by recoil.

Spring design consists in determining, consistent with the limitations of the carriage, the section of the wire, the mean radius of the coils, the number of coils, the free length, and the initially compressed length of the spring; this can be done from known formulae, and as a spring when compressed is subjected almost to pure torsion the deflection is proportional to the load producing it.

Spring systems may be either single or telescopic columns; in Great Britain the former arrangement is used with short-recoil and the latter with long-recoil guns.

A typical single column is mounted on a compressor rod with end plate secured to the gun, and is carried in a spring-box secured to the cradle; it is subdivided into springs, placed end to end and separated from one another by parting plates. On recoil, the rod is withdrawn from the spring-box, between which and the end plate the springs are compressed; subsequently the springs extend and recuperate the gun.

In the telescopic system, the springs are divided into inner and outer banks and arranged to surround the buffer-cylinder which recoils with the gun; they are subdivided for convenience. The two banks are separated by a concentric tube, flanged to connect with the inner bank at the rear and with the outer bank at the front; the buffer-cylinder is flanged to bear against the inner bank at the front, whilst the outer bank bears at the rear against the casing secured to the cradle. On recoil, the system works telescopically, the total deflection, equal to the recoil, being divided between the two banks; it has the advantage that the deflection per column is reduced, and stiffer springs of shorter free length can be used.

An air recuperator consists in a quantity of air under compression in a container and in contact, either directly or through liquid, with a movable piston. On recoil relative movement is given to the piston and container and the air further compressed. The air subsequently reacts on the piston and recuperates the gun. The difficulty of sealing compressed air accounts principally for the use of liquid with field-carriage recuperators, for the liquid seals the air and is itself sealed by packings. Thus air-recuperators may be classed as pneumatic, in use with field carriages; and hydro-pneumatic, in use with fixed mountings. Hydro-pneumatic recuperators may be further subdivided according as the liquid is in direct contact with the air, or is separated from it by a floating piston.

With hydro-pneumatic recuperators one cylinder contains liquid which acts on the face of a packed piston connected by its piston-rod to the cap of the cradle, and communicates through a throttling valve, port and pipe with the other cylinder containing liquid and compressed air; the throttling valve permits a free passage for the liquid during recoil, but closes to control the rate of recuperation at the commencement of run-up; the outlet of the pipe is designed to be below the liquid level at all elevations and depressions to prevent air from passing into the lower cylinder.

It is necessary that the correct quantity of liquid be in the system, so that the designed ratio of compression and terminal pressure of the air may not be disturbed. The initial air-pressure varies from 500 to 700 lb. per sq. in. according to the equipment.

A disadvantage with those systems in which the air is in direct contact with the liquid is aeration (*i.e.* frothing or churning). Thus in a later type the upper cylinder is fitted with a packed floating piston to separate the air from the liquid to prevent aeration. The floating piston has a tail-rod projecting into the cradle-cap, which has the effect of increasing the pressure on the oil in front above the air-pressure in rear so that there is no tendency for air to leak past the piston; whilst the position of the tail-rod—visible from outside—acts as a simple tell-tale to indicate correct filling, and consequently any leakage of liquid. Leakage may be replaced by a screw-actuated force-pump until the tail-rod is correctly positioned.

The working length of the recuperator is the length of recoil, and the total initial pressure required is determined as previously indicated. The diameter of the piston-rod is obtainable from the maximum stress it has to withstand, but must not be less than 1 in. for convenience of packing.

The ratio of compression of the air—*i.e.* the initially compressed volume divided by the finally compressed volume—should be low, to reduce the terminal pressure and heating effect; little is gained by exceeding 2, and it is best taken between 1·5 and 2.

The larger the area of piston head, the less the initial pressure required, and it is desirable to keep this low for convenience in sealing and charging; but, relatively to the air-cylinder, the piston area must be small to give a low ratio of compression. Consideration of piston packings leads to the decision that they must be capable of withstanding a steady pressure up to the maximum initial pressure and a momentary pressure as high as the maximum terminal pressure.

From a knowledge of the ratio of compression, the piston area, and the length of recoil, an estimate of the volume of the initially compressed air can be arrived at; this decides relatively the sectional area of the air-cylinder, and the initial pressure when a floating piston with tail-rod is used.

The whole design, as regards bulk, is limited by the constructive arrangement of the cradle; but the desiderata are a low initial pressure and a low rate of compression, both of which entail bulky construction, more particularly of the air-cylinder. With field equipments the initial pressure is generally higher than with fixed mountings owing to the greater limitation imposed as regards bulk.

General Remarks.—The advantages of air recuperators when compared with springs are, first, that an increase in power can be readily obtained without increasing materially the weight of the equipment; secondly, the recuperator in addition to the buffer acts to control run-up; thirdly, the troubles consequent on springs breaking or taking a permanent set are obviated. On the other hand, air recuperators require the services of a skilled artificer for their maintenance, and as they absorb relatively a greater proportion of the recoil energy than springs a loss of pressure is likely to overload the buffer much more than a spring breakdown; the correct charging of the system is, therefore, absolutely necessary.

The air used in recuperators must be dry and free from dust to prevent rust and abrasion; at high temperatures, moist air is the cause of pitting. An inert gas—nitrogen—is used by the French, and tends to preserve the "mirror" surface necessary with the cylinders. The liquid used in buffers and recuperators is usually a mixture of certain percentages of neat's foot and hydro-carbon oils, and must have certain qualities, namely, non-freezing in any climate; freedom from acid for preservation of packings, cylinders and working parts; a slight viscosity not greatly affected by considerable changes in temperature; non-inflammable. The buffer flow-space is designed for a specific liquid of certain viscosity, and therefore only that specified should be used. In emergency, however, glycerine will serve.

Packing.—Packings may be distinguished as joint-rings, soft packings, and self-tightening rings. Joint-rings—copper, leather or vulcanized fibre—are used with plugs, stuffing-boxes, etc. Soft packings, composed of asbestos, lead and hemp, and moulded to shape, are used in stuffing-boxes to retain liquid at normal pressures and to centre the piston-rod. Self-tightening rings, of leather or hydraulic rubber, U- or L-section, are employed to seal liquid under pressure. Frequently a combination of soft packings and self-tightening rings is used; the shock pressures are resisted by self-tightening rings whilst the soft packings prevent leakage when travelling or at rest.

Differential Recoil.—This system, which dispenses with a buffer for absorbing recoil energy, has been tried by the French and Germans. In the first round the gun is hauled back against the recuperator by pinion and rack-gearing to the extreme recoil position, retained by a catch, loaded and laid; on releasing the catch, the gun is driven forward by the recuperator and fired by a catch when nearing the forward position. Thus a forward movement is in progress at the moment of firing, and acts against and diminishes the recoil energy; when firing is in progress the gun is driven back by the recoil at each round. If a miss-fire occurs, the carriage would be liable to upset against the front; to obviate this, forward buffers are provided to stop the gun.

Recoil Absorbers attached to the muzzle, by which the muzzle blast is utilized to force the gun forward and thus diminish the resultant backward force producing recoil, were tried in 1921.

Combined Buffer and Recuperator.—The system of a separate buffer and recuperator is that which normally obtains; the only known exception in which they are combined and dispense effectively with a buffer is the French 75-mm. field equipment.

The recuperator—in principle a hydro-pneumatic recuperator of the floating-piston type—also acts as the recoil brake, for which purpose the air-pressure must be high, about 1,200 lb. per square inch. A guide-rod of the floating piston passes centrally through a hollow rod with pistons at either end; one is equal in size and adjacent to the floating piston, whilst the other is smaller, to work in a chamber having graduated grooves to vary the flow-space—in effect, a control-plunger and chamber.

The energy of recoil is absorbed by the recuperator and by the throttling of the liquid in passing through one-way valves. On recuperation, the one-way valves close and the forward movement of the floating piston forces liquid over the small piston through the graduated grooves, whence it reaches the other cylinder and reacts on the recuperator piston; the control is provided by the decreasing flow-space due to the graduated grooves. Thus the system consists in a recuperator combined with a buffer to control the run-up only.

The energy of recoil is utilized for hydraulic power in the 9·2-in. fixed mounting. Hydraulic cylinders, called compressors, are fixed to the cradle, and in them work rams which recoil with the gun. The compressors are connected with a spring accumulator by pipes filled with liquid. On firing, the liquid in the compressors is forced through the pipes and a non-return valve into the accumulator; a relief valve fitted to the accumulator acts when the latter is fully charged, the liquid then passing through the valve to a tank. On recuperation, a vacuum tends to form in the compressors, so that liquid is sucked into them from the tank through a valve and pipe in preparation for the next round. The accumulator is connected by pipes with two hydraulic hoist cylinders, the pressure to which is controlled by valves operated by levers; and the liquid in the hoists returns through an exhaust-pipe back to the tank when the rams descend.

(F. M. R.)

(V.) Types of Ordnance

At the beginning of the World War, the first matter that engaged the technical branches of the artillery of the fighting nations was the mobilization of all available guns. Old siege, fortress, naval and coast-defence pieces, and even modern pieces not immediately required in their existing situations, were mounted on improvised field carriages or railway mountings and sent to the front. The vast increase in the production of ammunition that soon became necessary was at first an administrative rather than a technical question. As the war progressed, new material and new designs were required to meet the exigencies that arose. The development of artillery material during and after the war came under two principal headings:—(*a*) simplification in design of existing equipments and ammunition to admit of mass production; (*b*) design and production of new equipments to meet the altered conditions of warfare.

A gun equipment of 1914 was a highly specialized engineering product. The cost of the gun was small relatively to that of the personnel of the army, and it was possible to spend time, labour and money on producing an ideal machine in which every ounce of weight should serve a useful purpose. Expensive materials such as high-grade steel and bronze were freely used without regard to any possible difficulty in procuring them during a long war, and complicated designs such as that of the bronze cradle of the British 18-pdr. were adopted without considering the difficulties of mass production.

In every country, when vast quantities of guns and ammunition had to be made, and when non-military factories had to be turned into arsenals, the first task of the technical branches of the artillery was to simplify and standardize designs. Common steel, of stouter section, was used in place of high-grade steel; cast iron replaced brass where possible, and rigid limitations of weight were relaxed. The general result was a relatively simple and almost clumsy design, easy to manufacture, highly finished in essential parts only, and capable of rough usage.

The alterations in the design of existing guns, other than those intended to facilitate manufacture, were mostly directed towards obtaining longer range, the main reason for this being the increase in depth of a system of defences from a single trench line to a series of defensive zones several miles deep. The Germans met the situation boldly, in spite of their manufacturing difficulties, by the issue of a new long barrel for their field-gun equipment, and an upper carriage which enabled elevation up to 40° to be given. Similarly they lengthened the light field howitzer, the 4-in. medium gun, and the 6-in. gun. Their heavier natures did not lend themselves to conversion, and new equipments had to be designed. However, streamline shell (*see* Ammunition) were issued which enabled longer ranges to be obtained. The French bent the trail of their field gun to allow a few degrees more elevation. They had only 105 field howitzers, so these had to be manufactured. They met the shortage of long-range howitzers by using old guns bored out to 8-in. cal. and mounted on high-angle carriages as howitzers. The British improved the carriage of the 18-pdr. field gun and issued a new 6-in. howitzer. The British army had no heavy guns or howitzers except those mounted for coast defence, and the heavy guns for the war were at first taken from the navy.

New Equipments made during the War.—Speaking generally, these were neither novel nor original. There was no time to test new ideas, and artillery authorities fell back on old and approved designs, modified in the direction of greater power (at the expense of lightness) and simplicity of manufacture. Even the British 18-pdr. Mark IV. field gun, which looked very different from its predecessor, was only a reversion to established Continental practice. The German "75-mile" gun was not a new design, though it came as a surprise to laymen and even to most artillerists. Before the war, artillery scientists had advocated a new system of differential recoil, known in different countries as the *dynamic cradle*, the *canon lancé*, and the *Vorlaufgeschütz*. In this system a Q.F. gun was fired while in rapid forward motion under the impulse of the recuperator, thus reducing its recoil-energy so that a much lighter carriage could be used. Although a French mountain gun of this type already existed, this new system was not even tried in any of the equipments brought out during the war, and complications such as the automatic and semi-automatic breech-mechanisms gave place to simplicity and "fool-proof" gear.

Post-War Equipments.—All the nations which took part in the war have now a complete armament of guns, and none of them is likely to bring out a new equipment, except on a small scale, for some years to come. Experimental models, to meet the anticipated requirements of the future, are being designed. The ruling considerations are:—

(*a*) Railway mountings for all mobile heavy guns, motor transport for all medium guns, and, in a few years' time, for field guns as well. This allows of a considerable increase of weight and power, but a field gun must still be light enough to manhandle and small enough to conceal.

(*b*) Heavy flat-trajectory guns will be superseded to a great extent by heavy howitzers, throwing a shell to the same distance with less effort, and consequently less wear of the bore.

(*c*) The range of field guns and of howitzers will be materially increased, partly by the introduction of high-angle gun-carriages (such as the split-trail carriage described below), partly by lengthening the barrel, and partly by the use of streamline shell for long-range fire.

(*d*) All artillery will be designed principally for use from the covered position, and will have all-round panorama sights for the purpose of indirect laying.

(*e*) All high-velocity guns, even field guns, will use reduced charges as well as full charges, in order to avoid excessive wear of the bore. They will also use "super-charges" when extra long range is required. Practically, therefore, every gun will require three sets of sighting graduations, and three range tables, like a howitzer. This will probably imply either separate or separable ammunition. Powder must be flashless as well as smokeless.

(*f*) Calibres will be as few as possible, and ammunition, component parts, sights, and fittings will be standardized wherever practicable to facilitate supply.

(*g*) Equipments will be designed with a view to mass production under war conditions.

(*h*) Shrapnel shell will be used only in field guns, field howitzers, and mountain guns, on account of the difficulty of manufacturing shrapnel shell and time fuzes on a war scale. Practically all land service pieces will fire H.E. shell with percussion fuzes, and special projectiles such as gas shell (if their use is admitted), smoke shell, and incendiary shell.

All new equipments have panorama sights. In the graduation of these sights, degrees and minutes are being superseded by "mils," the mil being the angle subtended by 1/1000 of the range. Since all guns will have to fire two charges, and in most cases three charges, the range-drums will require several sets of graduations, masked so that only the set in use is visible. The French have set the example of deciding that all sights in the service are to be uniform as regards the method of setting, so that a layer from a field battery will be able to lay a 14-in. gun without special instruction. This is necessary in view of the constant interchange of personnel in time of war.

Artillery Motors.—Artillery of all calibres up to, and even including, 8-in. guns is now moved by road and across country by motor transport. The Austrians even moved 16·5-in. howitzers by road, as will be seen. But it is considered that in future all guns over 8 in. will be transported by rail. Although horse draught is still maintained for field artillery, at any rate in part, the post-war field guns are being designed to weigh 32 cwt. in action, which is some 10 cwt. more than was considered permissible in a gun which had to be drawn across country by horses at a trot. That is to say, they are designed primarily for motor transport. Artillery motors are described here only from the technical artillery point of view.

Motor Tractors.—The old-fashioned steam traction engine with its 8-ft. wheels was used at the beginning of the war for slow road draught, notably in the transport of the heavy German howitzers to Antwerp. This was practically incapable of moving anywhere off the road. A more generally useful type was the F.W.D. (four-wheel drive) petrol tractor, with each wheel separately driven. This was capable of moving over easy ground, but could not cross obstacles. This type is by no means extinct; and a good specimen of it is the small Pavesi tractor. The Austrians used a 100-H.P. Daimler F.W.D. tractor, and they afterwards used 8-wheeled carriers with every wheel driven by electricity generated by a 150-H.P. petrol engine and dynamo on a separate vehicle. The French used the ordinary petrol-driven motor lorry for the rapid transport of field guns for long distances by road. In some instances the gun was carried on the lorry, but latterly the men and ammunition were carried on the lorry, and the gun was limbered up to it. As the gun-carriage, on ordinary artillery wheels, soon broke up when drawn at a fast pace over paved roads, they fitted special wheels with thick rubber tires. No success has yet been attained in fitting road springs to a gun-carriage, as these will not stand the strain of firing and travelling across country. The Russians, however, in their 1903 equipment, fitted india-rubber block springs to their limbers and ammunition wagons. The method of drawing guns behind motor lorries was used by the French for reinforcing troops in the fighting line, and the divisional artillery limbers and teams were used to transport the guns from the road to their positions. The principal artillery transport motor used during the war was the caterpillar tractor, with two linked steel belts called "tracks"—bearing on the road instead of wheels. These were mostly of the Holt pattern. They were efficient tractors, both on the road and across country, but they were subject to the disadvantage that they cut up the road surface badly; if all artillery vehicles were of this pattern, the roads would soon become impassable.

The 2½-ton Holt tractor used for the American field guns during the war was 9 ft. 6 in. long and 4 ft. 10 in. wide, the extreme height being 6 feet. It was driven by an 8-cylinder motor giving 70 H.P. at 2,500 revolutions, and traversed 15 m. an hour on a good road.

In Italy, the lack of draught horses suitable for artillery has caused the authorities to take the lead in converting the field artillery, both of the divisions and the reserve army formations, to motor artillery. The divisional artillery is to be drawn by agricultural tractors; that at present favoured is the Pavesi tractor. This is shown in fig. 7, but the military pattern has smooth wheels with "grousers" which can be attached for cross-country work. The tractor has a 4-wheel drive, and weighs 2·35 tons only. The motor gives 25 H.P.; the road speed is 4 m. an hour and the cross-country speed about 2 miles. This is a much less powerful machine than the American 70-H.P. 2½-ton tractor, but it is intended to draw a gun weighing only 20 cwt. against 32 cwt. for the new American gun.

The reserve army field artillery will be drawn by fast motor lorries, and the present proposal is to carry the gun on a low travelling platform with road springs, rubber-tired wheels, and a spring draw-bar. This platform is to be drawn by a road lorry, which can on emergency draw two such platforms. On the battlefield the divisional artillery tractors will convey the army batteries from the road to their positions in action.

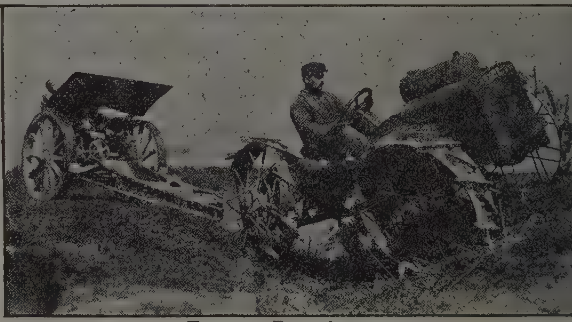

FIG. 7.—Pavesi tractor.

A problem now being studied in all countries is that of producing a caterpillar tractor or carrier that shall be able to work across country and shall travel on the road without injuring the surface. The most probable solution lies in the production of smooth-faced, preferably india-rubber-faced, caterpillar tracks which shall have sufficient adhesion not to slip on wet ground. The United States is now trying smooth-centred bands made of steel scales curved so that only the centre bears upon the road. The sides of the scales are cockled or indented so as to form a gripping surface; in soft ground the centre sinks in and the sides take hold of the ground and prevent the track from slipping.

Another possible means of combining a road carriage and cross-country carriage is to fit the caterpillar with road wheels. It is possible to extend the axles of the drums which drive the caterpillar tracks, and to mount road wheels on these extensions outside the tracks. The mechanical difficulties could be overcome, but this solution is not viewed with favour by motor designers. The resulting vehicle would be cumbrous. Thus the Schneider automobile mounting for the 220-mm. gun is 9 ft. wide; if fitted with road wheels the width would be 11 ft. 6 in., and even with the wheels removed the projection of the axletree arms would be such as to render it impossible for another vehicle to pass it on a narrow road. If the road wheels were fitted in front of the vehicle and behind it instead of outside the caterpillar tracks, they could not well be motor-driven, and the whole vehicle would have to be towed by another motor. Power-driven road wheels inside the caterpillar tracks are possible but entail considerable complication in the mechanism, and would be too close together for stability.

Some of the French caterpillar vehicles were fitted with railway wheels inside the tracks, so that they could be drawn along the railway to a point near their destination. This was not a satisfactory solution as the vehicles were not strong enough to be included in a train. Conversely, the 240-mm. railway-truck mounting was fitted with lorry wheels to enable the truck to be conveyed by road.

The Austrian motor carriers for heavy guns, driven by electricity from a separate power vehicle, had railway wheels as well as road wheels. The latter were fixed to the railway wheels when the vehicle left the railway for the road. The power vehicle also had railway wheels, and, with the carrier, formed a small independent railway train. The carrier could be included in an ordinary train if desired, but not the power vehicle which, in that case, had to be loaded on a truck.

The American Christie motor overcomes the difficulty of combining a road vehicle with a cross-country vehicle in another way. This motor has rubber-tired road wheels, four on each side. It can travel on the road at a fast pace on these wheels, or rather on the fore and hind wheels, the centre pairs being raised clear of the ground. To cross country a caterpillar track is put on round the four wheels on each side, the centre pairs of wheels being lowered to take their share of the weight. To put on the tracks, one-half of each track is laid out on the ground and the vehicle run on to them; the top halves of the tracks, which hang from the framework, are dropped on to the wheels and the ends pinned together so that the tracks are continuous. It is stated that this takes 15 min., and it is expected that the time will be reduced to 10 min. by improvements in the gear.

Motor Carriers.—A tractor is usually expected to carry the gun-detachment and a "first supply" of ammunition, besides pulling the gun. But the platform carrier is a separate type, performing the duties of an ordinary lorry, and also capable of carrying heavy weights across country. When a carrier is used for transporting a gun it is fitted with a ramp to enable the gun to be run up on to the platform and run down when it has to come into action. Some carriers have power winches for hauling the gun up. Light guns can, on emergency, be fired from the platform in a fore-and-aft direction, but not across it, since a modern field gun measures 10 ft. 6 in. from the lowest point of the wheels to the spade. The advantages of the carrier over the tractor are that the gun is not damaged by fast travelling on the road, and that in very deep boggy ground it is sometimes possible to carry a gun on caterpillar tracks, but impossible to drag it on its wheels. The principal disadvantage of the carrier is that the gun takes up so much space on the platform that there is no room for the men and the ammunition, and an additional vehicle is required to carry them. The tractor is therefore generally preferred to the carrier, as being a more economical form of transport.

The British tried a caterpillar platform-carrier fitted to take a 60-pdr. or 6-in. howitzer. It weighed 35 tons with the gun and 24 tons empty. It was too heavy to cross bridges, and was discarded as an artillery vehicle; it was afterwards used to carry up stores over the crater-field on the Somme.

The largest road carriers used were the Austrian 8-wheel-drive howitzer wagons, driven by electricity from a separate carriage. These are described below. They weighed 35 tons loaded, which is the limit of weight even for bridges on the great "national" roads. This method of propulsion reduces the weight of the carrier, as the engine is transferred to a separate vehicle; the Austrian carriers weighed 15 tons and carried 20 tons. Since, however, they are quite incapable of moving across country, the caterpillar type of carrier is now preferred to them, especially as this type also can be lightened by driving by electricity from an accompanying power vehicle.

The Automobile Gun-carriage.—This is quite distinct from the tractor and the carrier. It is a motor vehicle of the caterpillar type with the upper gun-carriage built into it, so that the gun and vehicle are inseparable. Several of these mountings, both of the ordinary and Christie pattern, are described with the guns for which they are designed. They admit of elevation up to about 40° being given to the gun, but not of traversing it; the gun is layed for direction by turning the whole mounting by means of the caterpillar tracks. In the heavier mountings, a small auxiliary motor is fitted for this purpose. A special pattern is the St. Chamond automobile gun-carriage described below, which has an electric drive, the power being supplied by a motor and dynamo in a trailer which follows the gun.

The automobile gun-carriage is mechanically efficient and the objections to it are tactical rather than technical. It is too big; it is conspicuous and difficult to conceal; it offers too large a target; and it requires an immense amount of labour and material to make a covered emplacement for it. While the gun is in action the expensive and vulnerable motor is exposed to fire, whereas it would be much better employed behind the line bringing up ammunition. On this account most artillerists prefer the tractor to the automobile carriage. Moreover, as regards field artillery, the administrative point of view decides the matter. No nation can afford to keep up in peace-time the number of military motors required for the field artillery of a national army; it must depend on civilian motors. And of these the only ones capable of moving across country are the agricultural tractors. These are the machines that will have to be developed so as to suit both civil and military requirements, and they are essentially different from the special type built for an automobile gun-carriage.

Armoured Motors.—Automobile gun-carriages can be fitted with ordinary bullet-proof shields, but they cannot well be armoured so as to resist direct hits from artillery. A field gun of pre-war pattern, at a range of about 3,000 yd., will pierce a $1\frac{1}{2}$-in. armour plate with ordinary shell, or a 2-in. plate with armour-piercing shell. A modern high-velocity field gun, firing armour-piercing shell, will pierce about 3 in. of armour at the same range. But a 3-in. plate weighs 1,150 lb. per sq. yd. If the automobile carriage were armoured in front only, it would require some 8 sq. yd. of armour, weighing over 4 tons, and would then be proof only against field guns firing from the front at ranges greater than 3,000 yd.

Transport of Artillery Motors.—The present types of artillery caterpillar tractors, carriers and automobile carriages are not suited to long journeys by road. The vibration caused by the ribbed steel tracks shakes them to pieces. Future motors will no doubt be better built, with spring-centred rollers and probably with smooth tracks. But all motors should be designed so that they can be transported by rail for long journeys. The practical limit of weight is the 40-ton commercial truck used on European railways; the limitations of height and breadth comply with the local loading gauge.

For road transport the extreme width ought not to exceed 8 ft., but some of the automobile mountings are 9 ft. wide. The principal limitation is that of weight, and is generally taken at 25 tons for main roads and 20 tons for by-roads, though many country bridges will carry only 15 tons. On the other hand, the bridges on the great main roads of the continent of Europe are mostly equal to 35 tons; much depends on the length of the wheel-base or the tread of the caterpillar tracks. Practically, a 15-ton tractor was the largest size commonly used in the war, though the Germans used some 20-ton F.W.D. Daimler tractors, and the Austrians used 8-wheeled carriers up to a gross weight of 35 tons.

All road motors are liable to be stopped by the destruction of bridges, though it is anticipated that military motors will in future be built so that they can cross fords, and some will even be made to float. These are described under BRIDGING, MILITARY.

Field-Gun and Howitzer Equipments.—The British 18-pdr. (*see* 20.221), owing to its heavy shell, proved to be admirably suited to trench-warfare conditions, and remained the standard British field gun throughout the war. It underwent several improvements. In 1915 the spring-case was filled with oil, so that the running-up springs worked in an oil-bath; this reduced the vibration in running up and made the carriage steadier. In 1916 the springs were replaced by an air recuperator fitted into the old spring-case; this change was made on account of the number of springs crushed during rapid fire and the difficulty of replacing them. In 1918 a new barrel was issued, which had an improved Welin screw breech-mechanism, with the actuating lever pivoted horizontally instead of vertically, so as to work with a downward instead of a lateral pull.

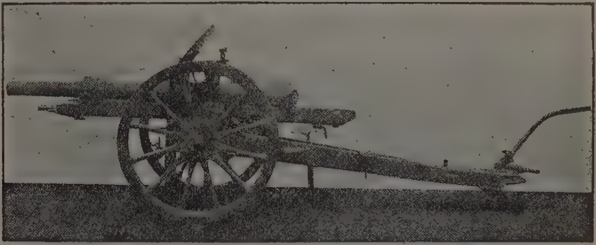

FIG. 8.—British 18-pdr. gun and carriage, 1918.

The carriage issued with this gun (fig. 8) is a reversion to the normal type, with a trough cradle under the gun in place of the ring cradle which was a characteristic feature of the original 18-pdr. equipment. The lateral guide-ribs on the old gun had always been a source of trouble, as the unsymmetrical section of the gun caused it to bend after continued firing. In the 1918 gun these are done away with and replaced by guide blocks which slide on the cradle. The cradle is extended to the rear beyond the breech, so as to give good support when the gun is in the recoil position. It contains the hydraulic buffer of ordinary variable-recoil construction and the hydro-pneumatic running-up gear now called the "recuperator." The lower carriage has a box trail instead of the old tubular trail, with an opening in it which allows the breech to be depressed to give 30° (later patterns, 37°) of elevation, thus obtaining a range of 9,000 yd. with ordinary shell or nearly 11,000 yd. with streamline shell.

The carriage traverses on the axle as in the French equipments. The shield is fixed to the axle, and there is a small inner shield fixed to the cradle which closes the port in the main shield in which the gun traverses. The upper part of the shield is made to fold over. The weight of the whole equipment is not materially greater than that of the previous model, and the gun in action weighs 26 cwt.

Only one 18-pdr. battery of the above pattern was actually used in the war. The equipment did well, but the latest developments in field-artillery design, which are discussed below, made it undesirable to continue the production of this type, and a new gun and carriage, adapted either to horse or motor transport, was designed in 1920–1.

The French field gun is the 75-mm. (2·95-in.) Q.F. gun, well known as the *soixante-quinze* (fig. 9). It fires a 16-lb. shrapnel with M.V. 1,740 f.s., and an 11·68-lb. H.E. shell, M.V.

2,050 f.s. It did remarkably well in the war, and the only alteration made was to bend the trail so as to give room for 5° more of elevation beyond the 12° for which the carriage was built. The simple *collimateur* sight was replaced by a panorama telescope for all-round laying from the covered position. The gun was originally fitted with an arrangement which necessitated raising the trail shoulder-high on coming into action to allow the brake-blocks to fall under the wheels and then lowering it ("*abatage*"), but a modification which rendered this unnecessary had been brought out in 1914.

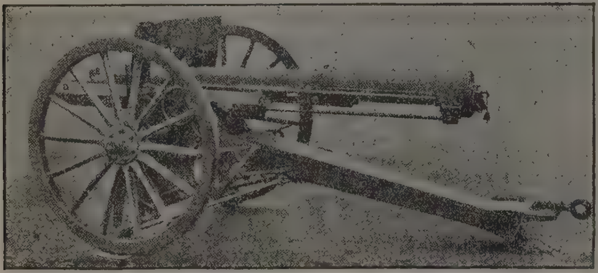
FIG. 9.—French 75-mm. field gun.

A new French field gun was in 1921 under trial. This fires streamline shell with super-charge at long ranges, and ordinary shrapnel and H.E. shell at medium ranges. A reduced charge is also provided, partly to save unnecessary wear of the gun and partly because, during the war, the flat trajectory of the French gun caused trouble when the artillery had to fire over the heads of the infantry. The 1921 gun is fitted both for horse draught and for traction by cross-country agricultural machines.

A very interesting modern equipment is the Schneider field gun shown in fig. 10. This was designed in 1918 to comply with the requirements of the French Government, but was not brought out till after the war. It is a 16-pdr. firing a streamline shell with M.V. of 2,000 f.s. and ranging 13,200 yd. at 40° elevation. It marks a new departure in axle-traversing equipments in that the carriage affords a traverse of no less than 15 degrees. The shape of the shield is such as to clear the wheels at extreme traverse. The buffer and recuperator are of the well-known Schneider pattern, but compressed nitrogen is normally used instead of compressed air as being less liable to corrode the recuperator reservoir. The cradle extended to the rear is a pattern which has come into favour since field-gun carriages have been required to give high angles of elevation. Its weight partly balances the gun and allows it to be set farther forward so that it has more room to recoil without striking the ground. Moreover, the open trough cradle is constructionally simple and suited for mass production in time of war. The cradle alone is not heavy enough to balance the forward preponderance, and balance springs are used enclosed in cylinders, one on each side of the cradle; one of these is visible in the illustration. The wheels, 4 ft. 7 in. in diameter, have stout solid-rubber tires, and it is claimed that the gun can be drawn over paved roads behind a motor lorry at 8 m. an hour without injury. The weight in action is 30 cwt., against 22½ cwt. for the French service field gun. This illustrates the modern tendency to increase the weights of field artillery in view of the introduction of motor traction.

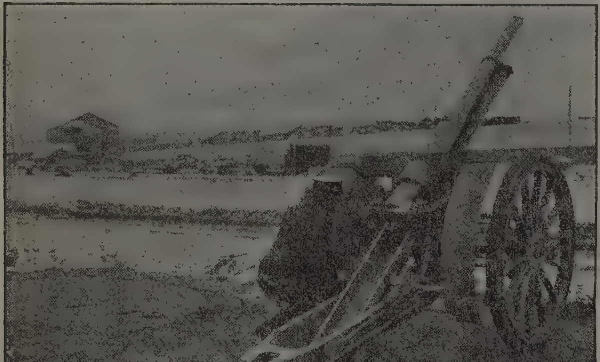
FIG. 10.—Schneider field gun.

Although this gun is a great improvement on any field gun used in the war, it would be unwise to accept it as the last word in field artillery. For instance, it is doubtful whether the traverse of 15° would nowadays be accepted as sufficient for firing from a gun-pit or for engaging tanks. For these purposes the split-trail equipment invented by the French Col. Deport (one of the designers of the original *soixante-quinze*) would appear to be the most suitable.

The Italian Deport split-trail field gun was issued in 1912 (see fig. 11). The gun itself is not remarkable; it was designed to take the same ammunition and give the same ballistics as the Krupp field gun already in the Italian service. It is a 14·3-pdr., M.V. 1,670 f.s., with a semi-automatic breech action. The peculiarity lies in the carriage. The trail is divided longitudinally, and each half is attached by a vertical hinge to the axle bed so that on coming into action the two halves can be opened out laterally at an angle of 60° to each other. Instead of the ordinary spade, there is a stout spike at each of the two trail ends which can be driven down by a hammer, so that the trail ends are nailed to the ground. The cradle with the gun is pivoted on the axle bed and can be traversed 30° right or left. In ordinary field equipments, in which the upper carriage traverses on a pivot, the gun traverses only some 2½° right or left; if it were traversed much out of line with the spade, the carriage would overturn sideways on firing. Axle-traversing gives somewhat more traverse, but even this is inadequate for modern tactical needs. In the split-trail equipment the carriage is perfectly steady so long as the line of recoil is between the two halves of the trail.

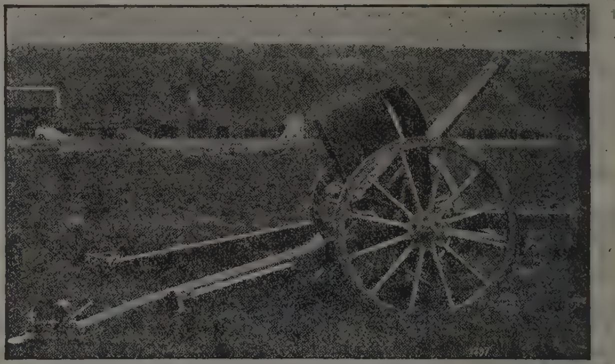
FIG. 11.—Deport field gun.

This enlarged lateral field of fire is of great value in modern warfare. In the first place, the gun may have to command a considerable arc of fire from a cramped gun-pit, and, to do so, an ordinary field gun must be traversed on its wheels. Being usually out of sight of the enemy it is layed by a distant mark in flank or rear or by aiming-posts. For accurate shooting the gun must be traversed without shifting it laterally; any displacement of the gun would mean a considerable error in direction. Under these conditions the split-trail carriage is of great advantage, since it offers a fixed pivot, about which the gun can be traversed without moving the trail or wheels. In the second place, a field gun must now be capable of hitting a moving tank, and this, especially at short range, implies rapid traversing through a wide arc. A split-trail gun can keep up rapid fire on a tank crossing its front, while the fire of an ordinary gun would be checked and delayed by the necessity of constantly lifting the spade and swinging round the trail.

A further peculiarity of the Deport gun is the high angle of elevation obtainable with the split trail, since there is nothing in the way of the recoil. The Italian gun can be elevated to 50° to the horizontal. The inventor introduced this feature for the purpose of firing at aircraft, which in those days were expected to fly within 3,000 ft. of the ground. Even so, a low-velocity gun with curved trajectory such as the Italian field gun would not have been of much use. But the increased elevation has proved valuable as a means of obtaining the long range which is now required of a field gun.

The Deport field gun has double recoil gear. That is to say, the gun is not mounted directly on the cradle containing the main recoil gear, but on a pedestal sliding on the main cradle, which has a small buffer and recuperator of its own. This arrangement has the advantage of keeping the recoil gear cool, since the hot gun is at some distance from the main buffer and the heating due to the friction of the liquid in the buffer is divided between two buffer-cylinders. Otherwise this duplication of the recoil gear constitutes an undesirable complication, especially with regard to considerations of mass production in war-time. The gun and carriage proved quite serviceable during the war; no alterations were made in them, and in spite of the somewhat low power of the gun the equipment was retained in the service afterwards.

The Schneider split-trail field gun of 1914 is a great improvement on the Italian gun, since it fires a streamline shell of 16 lb. with M.V.

1,700 f.s., and ranges over 10,000 yd., while the weight in action is only 19½ cwt.

The Russian field gun was considered by many artillerists to be an injudicious combination of ballistic elements, as its 14½-lb. shrapnel was too light for its very high M.V. of 1,930 f.s. However, it was a fairly efficient shrapnel gun and did well in the first campaigns of the war, till trouble in the Russian factories and the destruction of Putiloff arsenal by fire reduced the output of ammunition and entirely stopped that of shrapnel and time fuzes.

The American Post-war Field Gun.—The United States' pre-war field gun was an early pattern of quick-firer by Ehrhardt of Düsseldorf. In 1916 a split-trail equipment was designed, but the American artillery used the French 75-mm. gun during the war. An American 75-mm. equipment is under trial (1921), the specification for which was originally as follows:—Range 15,000 yd. with 15-lb. H.E. shell; split-trail carriage to give 30° traverse and 80° elevation; M.V. 2,175 f.s.; variable controlled recoil; smokeless and flashless powder; weight in action, not more than 32 cwt. The gun has been made and approved; it gives ballistics slightly in excess of those required. The carriage was made, but was found rather too heavy. The split-trail carriage had been intended for a "universal" field carriage to take either the field gun or the field howitzer, and to give 80° of elevation with the latter; this made it heavier than it need have been to take the gun only. A box trail carriage was therefore brought out; this gives only 10° traverse and 45° elevation, but is well within the limits of weight.

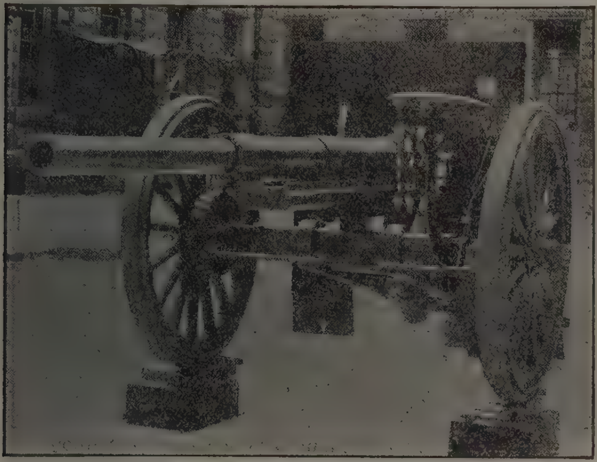
FIG. 12.—American field gun, 1920.

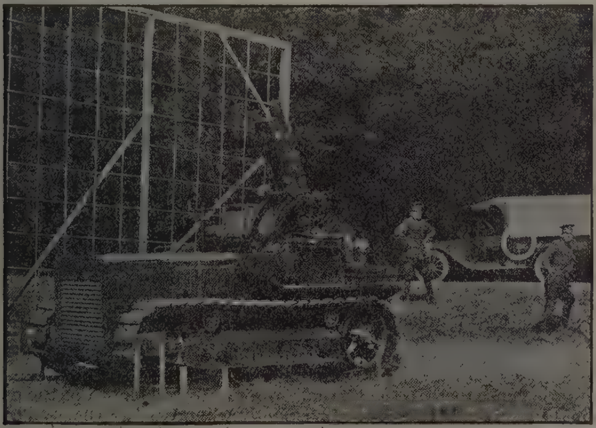
FIG. 13.—Holt caterpillar automobile carriage, mounting 105-mm. howitzer, 1920.

The gun on box trail carriage is shown in fig. 12. It is known as the 75-mm. gun, model 1920. The gun is said to weigh only 7·37 cwt., which is remarkably light for its power. It is 42 cals. long, has a horizontal sliding-block breech action, and has constant recoil (42 in.). It fires a 15-lb. H.E. shell ranging 15,100 yd. with super-charge, which gives a M.V. of 2,175 f.s. With the ordinary charge the M.V. is 1,500 f.s., this low velocity being purposely adopted to save the wear of the gun. The shrapnel is heavier than the H.E. shell, weighing 17 lb., and should be a very efficient projectile with the super-charge, with which its M.V. is about 2,040 f.s. With the ordinary charge the velocity would probably be too low and the trajectory too curved for good bullet-effect. Both the shrapnel and the H.E. shell have a forward centring band. The shrapnel has a clockwork fuze made by the Waltham Watch Co., and the H.E. shell is of the thick-walled class with base percussion fuze.

The cradle trunnions are set far back, giving a forward preponderance which is supported by a balance-spring called in America an "equilibrator." This feature is met with in almost all carriages giving high angles of elevation. The carriage traverses on the axle 5° each way. The wheels are only 4 ft. in diam., as against 4 ft. 8 in. in the pre-war equipment; this reduction is necessary to keep the carriage steady in firing without the use of a very long and heavy trail. Solid-rubber tires 3½ in. in diam. are fitted, to enable the gun to be drawn at a fast pace behind a motor without injury.

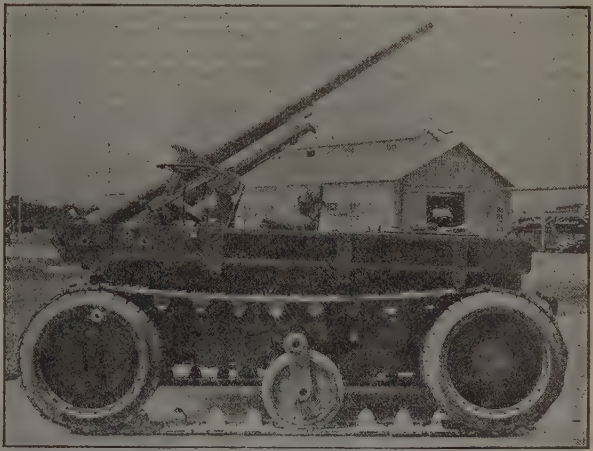
FIG. 14.—Christie automobile carriage.

The main shield of the American field gun is fixed to the trail and traverses with the gun; there is a folding top-shield and a hanging shield under the trail. The gun has the independent line of sight and is sighted with the panorama sight. The Americans graduate their sights in "mils," a mil being the angle subtended by 1/1000 of the range, which is about 3·6 minutes. This method, first introduced by the Swiss, afterwards adopted by the French, and now employed by the artillery of almost all nations, is a great improvement on the cumbrous system of degrees and minutes.

During the war an improvised automobile carriage for field guns was made by mounting the gun on a 5-ton Holt caterpillar tractor. This mounting allows of 45° elevation and 28° traverse; it weighs 6 tons complete. The power is the same as that of the 2½-ton tractor, and the highest road speed is 9 m. an hour.

FIG. 15.—German 77-mm. field gun, 1896.

This was followed by the 1921 Holt caterpillar automobile carriage for field gun and field howitzer shown in fig. 13. It is capable of 30 m. an hour on the road—an unprecedented speed for a caterpillar as these machines, as hitherto built, are subject to violent vibration and consequent damage when run at speeds beyond a walking pace. In this case the entire mounting is spring-supported, the drums carrying the caterpillar tracks are rubber-cored and rubber-covered, and rubber is used on the track shoes, track rollers, front idlers, and drive sprockets. The tracks are as light as possible, even the connecting-pins being hollow. The main frame is supported on coil-springs in rear and a plate-spring in front; the latter acts as an equalizer between the two front track drums, so that one track can rise 15 in. higher than the other. Removable shields are carried.

The field gun lies along the top of the carriage when travelling. For firing it is elevated on the cradle trunnions, which are set well to the rear, the resulting forward preponderance being balanced by springs. It is probable that the new pneumatic balance springs will be used, as described below for the 6-in. carriage. Owing to the position of the trunnions, the gun recoils down the rear of the mounting, not between the frames, and it is therefore necessary to use outriggers projecting to the rear, with spades which are bedded in the ground before firing. At low elevations the gun can be fired without using the outriggers. The illustration (fig. 13) shows the carriage with the 105-mm. howitzer at the moment of recoil. The photograph taken with $^{1}/_{25}$ sec. exposure, indicates by its sharpness the steadiness of the carriage.

The 1921 Christie automobile carriage for the U.S.A. field gun and howitzer is shown in fig. 14. It is of the type described under *Artillery Motors*, travelling on wheels when on the road and as a caterpillar across country. In other respects it is similar to the Holt 1921 automobile carriage.

German Field Guns.—The 77-mm. field gun "96 n.A." (fig. 15) was a 15-pdr. with M.V. of only 1,525 f.s., and range of only 5,800 yd. Its best feature was its light weight, namely, 18½ cwt. in action, and in open warfare it did fairly well, but as soon as trench warfare began it proved nearly useless. In 1915 a long pointed fuze for the H.E. shell increased the range by about 700 yd. As the range was still insufficient, in 1916 they issued a new field gun (fig. 16). The calibre was the same as before, but the gun was lengthened from 27·3 to 35 cals., and an upper carriage was added which allowed the gun to be elevated up to 40 degrees. This enabled a range of 11,700 yd. to be attained with a streamline shell weighing 13 lb., M.V. 2,007 f.s. As this shell had two driving-bands, the new gun had to be rifled with uniform twist. Three charges were used: a reduced charge, an ordinary charge for the 16-lb. shell, and a super-charge for the streamline shell. Owing to the use of the three charges, the fixed ammunition was replaced by separate ammunition. During the open warfare of 1918 the long field gun, which weighed 27·5 cwt. in action, was found too heavy, and was partially withdrawn in favour of the old shorter and lighter "96 n.A."

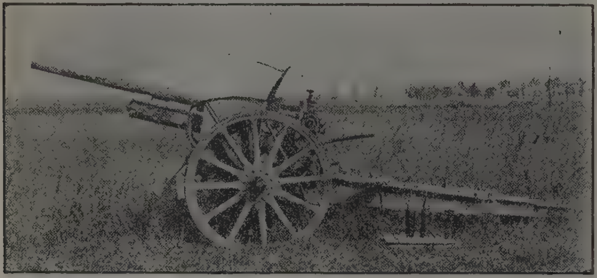

FIG. 16.—German 77-mm. field gun, 1916.

The field guns used by the other nations engaged in the war were of no special interest; all were light 15-pdr. of moderate power, and all except the Austrian gun were ordinary Krupps or Schneiders.

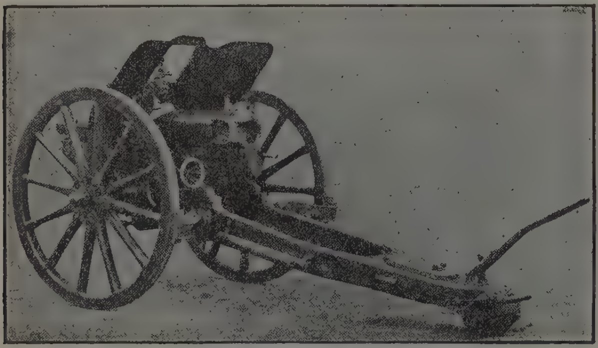

FIG. 17.—British 4·5-in. field howitzer.

Field Howitzers.—A field howitzer is a piece equal in mobility to the field gun, capable of throwing a shell of 30 to 40 lb. It was formerly expected to attain the same range as the field gun, namely about 6,000 yd.; but now that field guns fire at 45° elevation and range 15,000 yd. it is obvious that field howitzers of equal mobility cannot throw their heavy shell to the same distance. The pre-war field howitzer had already attained its limit of range, except for such increment as could afterwards be attained by the use of streamline shell, and if the post-war field howitzer is to range farther it will have to be heavier than before. It already has been seen that in some of the new field-gun equipments, intended primarily for motor traction, the weight in action has been increased to 30 and even 32 cwt.; and with a slight increase on the latter weight it is now possible to build a howitzer throwing a 33-lb. shell 12,000 yd.

The British 4·5-in. field howitzer was designed by the Coventry Ordnance Works and was considered to be the best weapon of its class used in the war, though it will no doubt be superseded in course of time by a weapon of longer range. It fired a 35-lb. shell and ranged 7,200 yd.; the weight in action was 24 cwt. The recoil was controlled by rotating valves in the piston of the hydraulic buffer and was shortened at high elevations to prevent the breech from striking the ground. The howitzer was originally designed to fire shrapnel only and gave excellent results. During the war the issue of shrapnel was discontinued owing to difficulty of supply. Thereafter the howitzer fired H.E. shell with sensitive fuzes and proved a most valuable weapon for cutting belts of barbed wire.

The French had no field-howitzer equipment in 1914 and during the war they relied mainly on howitzers of the 155-mm. class for high-angle fire. A certain number of Schneider 4·2-in. howitzers were, however, used. This fired a 35-lb. shell, ranging 6,000 yd. It was of simple construction, with constant long recoil and a long cradle extended to the rear as in the 1918 Schneider gun. It weighed only 22½ cwt. in action. The new French field howitzer will be heavier with a split-trail carriage and range about 11,000 yd.

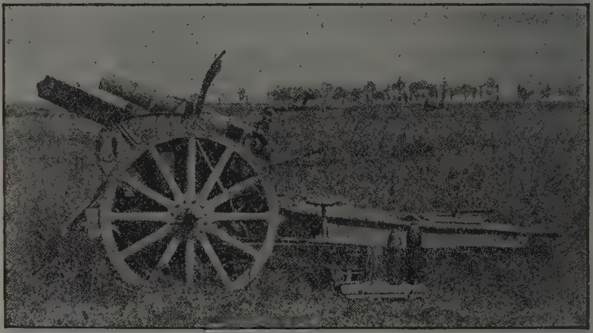

FIG. 18.—German 105-mm. field howitzer, 1898–1909.

The U.S.A. likewise had no light field howitzer, and in the war its divisional artillery consisted of French 75-mm. guns and 155-mm. howitzers. The 100-lb. shell fired by the latter is too heavy to be transported in sufficient numbers for a divisional field howitzer, and the U.S.A. is now bringing out a 4·2-in. (105-mm.) howitzer to fire a 33-lb. shell, M.V. 1,500 f.s., to range 12,000 yd. The howitzer is about 25 cals. long, and weighs 11½ cwt. It has hydro-pneumatic controlled recoil on the St. Chamond system; the recoil is decreased from 45 in. at zero elevation to 33 in. at 80 degrees. The carriage has a split trail and gives 30° traverse; it has a high shield. The wheels have rubber tires to allow it to be drawn by a tractor at 10 m. an hour without injury. The weight in action is 33 cwt. This piece is also mounted on a caterpillar automobile carriage.

The pre-war German field howitzer (fig. 18) was of 105 mm. (4·2 in.) cal., firing a 34-lb. shell to a range of 7,600 yd. It had rear trunnions and balance spring, which in this case was not a satisfactory arrangement as the spring was liable to give on discharge, causing bad shooting. In 1916 the Germans increased the length of the piece from 12 to 22 cals., with a corresponding increase of the weight in action from 22½ to 27 cwt. The lengthened howitzer, shown in fig. 19, ranged 9,200 yd. with ordinary shell and 10,500 yd. with streamline shell. It was rear-trunnioned like its predecessors.

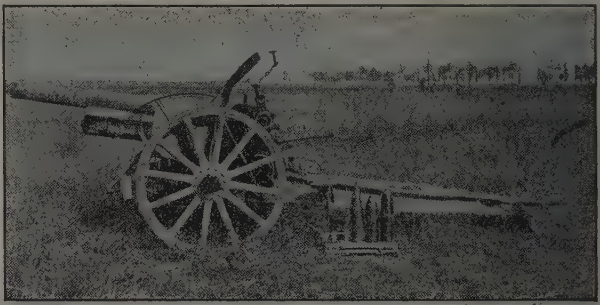

FIG. 19.—German 105-mm. field howitzer, 1916.

The field howitzers used by the other nations were mostly similar in power to the Schneider 4·2-in. field howitzer mentioned above.

Horse Artillery Guns.—These are at present in a stage of arrested development, pending further experience with motor guns. A horse artillery gun must be capable of keeping pace with cavalry on the road and across country, and it is as yet uncertain whether the horse-drawn gun, the motor-drawn gun, or the gun on automobile carriage is best adapted to the purpose.

The British 13-pdr. horse artillery gun was a small edition of the 18-pdr.; the French and the Russians had similar guns, namely, Schneider guns weighing about 19 cwt. in action. The French gun fired the same ammunition as the 75-mm. field gun, with one-third of the powder charge withdrawn. The Germans used their "96 n.A." field gun, with slight modifications, as a horse artillery gun.

Mountain Guns.—Even before the war, the principal gun-makers produced 15-pdr. mountain guns light enough for pack transport, namely, with the heaviest top load not exceeding 250 lb. net. However, the guns used in the war were mostly 11-pdr., though the Greek Schneider-Danglis gun was a 14·3-pdr. The British pre-war mountain gun was a 10-pdr., and a 12½-pdr. was issued in 1914. It is now considered that a mountain gun should fire a 15-lb. shell, and new equipments are under trial in several countries. The new U.S.A. equipment is styled a mountain howitzer, and is described below.

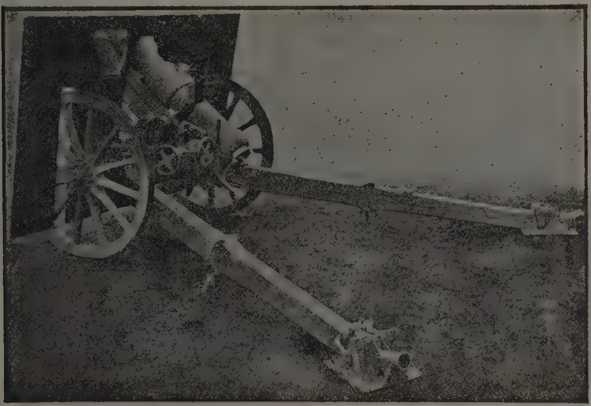

FIG. 20.—British 3·7-in. mountain howitzer.

The British 12½-pdr. mountain gun is in two pieces, joined by a nut; its calibre is 2·75 in. It fires a bare charge, not fixed ammunition, and its range is 5,800 yd. at 15° elevation. The carriage has a cranked axletree, which can be revolved to bring the cranked portion uppermost when firing, to allow room for the gun to recoil. The buffer and running-up springs of ordinary pattern are contained in the trough-shaped cradle; the top of the cradle is closed by the "slipper" (corresponding to the Krupp "sleigh") which slides on the cradle-guides during recoil and run-up. The gun when put together is secured to projections on top of the slipper. This gun will be replaced by a 15-pdr. on the same lines as the new U.S.A. mountain equipment, fitted for draught as well as pack carriage.

Mountain Howitzers.—These are subject to the same limitations of pack loads as mountain guns, but have to be heavier as a whole in order to fire a shell weighing 20 to 25 lb. The extra weight is obtained by increasing the number of loads. A good specimen of pre-war equipments is the British 3·7-in. mountain howitzer, which is noteworthy as being the first split-trail equipment introduced into the British service (see fig. 20). It fires a 20-lb. shell and ranges 5,800 yd. The howitzer is in two parts. It has controlled recoil gear similar to that of the 4·5-in. field howitzer described above. The equipment forms 8 mule-loads.

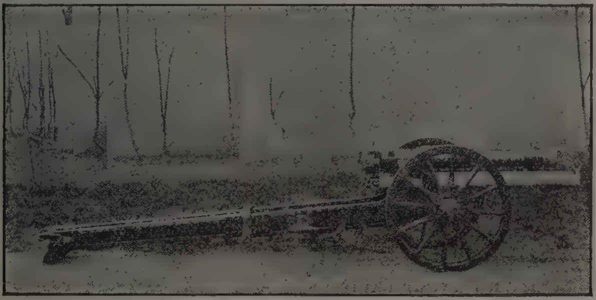

FIG. 21.—U.S. pack howitzer, 1920.

A more modern specimen is the 1919 French Schneider 105-mm. (4·2-in.) mountain howitzer. This is a 26·4-pdr. ranging 9,000 yd. at 40 degrees. Unlike the British mountain guns, it is not divided halfway down the bore; the division is in rear of the powder-chamber. The gun, 13 cals. long, consists of the barrel and the breech-piece, the latter being prolonged into a jacket which fits loosely round the gun and serves the purpose of increasing the recoiling weight so as to reduce the recoil. This construction has been used in the Greek Schneider mountain gun and has stood the test of war. The cradle is of the same length as the gun, and contains the ordinary Schneider hydro-pneumatic gear, charged with compressed nitrogen instead of compressed air. The gun recoils on a slipper as in the British mountain gun. The cradle trunnions are set far to the rear, giving a forward preponderance, but no balance spring is used; the height of the line of fire is 31 in. with 36-in. wheels, and this gives room for the full recoil of 33½ in. at 40° elevation without the breech striking the ground. The piece traverses on the axle as in most French equipments, and the total traverse is 160 mils or 9·6 degrees. Six of the seven pack-loads are above the 250-lb. limit observed in the British and American services.

The U.S.A. pack howitzer, Model 1920, fig. 21, replaces the U.S.A. mountain gun. It fires the same 15-lb. shell as the field gun, M.V. 900 f.s., ranging 6,600 yd. It has the St. Chamond recoil gear referred to above. The howitzer has rear cradle trunnions and balance spring, the latter being a torsion spring coiled round the axle. The carriage is on 29-in. wheels and gives 45° elevation and 2½° traverse, but a split-trail carriage is under trial. The howitzer and carriage form 4 loads of 235 lb. net. This equipment is to serve as a gun of accompaniment as well as a mountain gun, in addition to the "infantry howitzer" described below.

Guns of Accompaniment.—These are required to accompany the infantry, to deal with machine-guns and strong points that have escaped the barrage, and to protect the infantry against tanks that may attack them. The necessity for some form of gun of accompaniment was generally recognized during the last two years of the war; in the absence of specially designed weapons the infantry used anything they could get. Thus the German infantry used their field gun on 3-ft. wheels, captured Russian horse-artillery guns, field guns on semi-mountain carriages borrowed from the Austrians, German and Russian mountain guns, light trench-mortars adapted to direct fire, and German 57-mm. 6-pdr. taken from fortresses. The British used the few 3·7-in. mountain howitzers available, the 6-in. Newton trench-mortar on an improvised carriage, and captured German light trench-mortars. Further, the British detailed sections of 18-pdr. and the Germans batteries and sections of 77-mm. field guns to accompany the infantry.

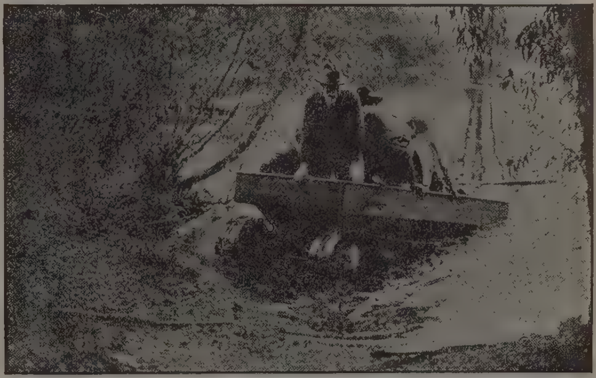

FIG. 22.—U.S. Christie reconnaissance tractor, 1920.

The Germans brought out a gun of accompaniment in 1918, but only a few were ready in time to take part in the fighting. This was the "*infanteriegeschütz 18*," a reduced copy of the "96 n.A." field gun, and capable of firing the same 15-pdr. ammunition with part of the charge withdrawn. The length was 23 cals. against 27½ for the field gun; the M.V. was 1,170 f.s. and extreme range 5,500 yd. The weight in action was 13·7 cwt. This weapon seems to be not powerful enough for a regular field gun, and not mobile enough for an infantry gun; it was a compromise to which the Germans resorted in preference to introducing a special calibre and complicating their ammunition supply. The Germans have chosen to retain this gun in the small peace establishment permitted by the Peace Treaty.

The only nation which has brought out a special gun of accompaniment since the war is the United States. This piece is styled the Infantry Howitzer. It is of 2·24-in. cal., and has two projectiles, a 6-lb. H.E. shell for direct fire, M.V. 700 f.s., and a 10-lb. shell for curved fire. This piece is to supersede the 37-mm. infantry gun used by the French and Americans during the war, and to supplement the 15-pdr. pack howitzer. It is mounted on a wheeled carriage with cranked axle, which can be turned inwards when the piece is used for curved fire. The equipment is divisible into man-loads, the heaviest —the howitzer itself—weighing 80 lb.; this is carried by two men. The total weight is 300 lb. The howitzer is to be taken forward as far as possible by a Christie motor-cart (fig. 22), a small cross-country vehicle weighing only 600 lb.; thence the howitzer is run forward by hand, and the cart follows with ammunition.

Medium Guns.—Medium guns are long-range guns sufficiently mobile to march with an infantry division and to come into action in support of the infantry without any preparation such as building platforms. In the British service the medium gun is the 60-pdr., weighing about 5 tons and drawn by a team of heavy horses. The first model of this was a very useful gun in its time, and was remarkably accurate; it fired both shrapnel and H.E. shell, and ranged 10,000 yd. A new pattern with under-cradle was issued in 1918, which ranged 15,000 yd. with a pointed shell with 8-calibre head. The Germans had the 13-cm. (5·1-in.) gun of 1910, which threw an 88-lb. shell 15,700 yd., as well as various patterns of 10·5 cm. Their pre-war 10·5-cm. (4·13-in.) medium gun was 30 cals. long and ranged 12,200 yd. Their 1914 pattern was 35 cals. long, range 14,300 yd.; and their 1917 pattern was 45 cals. long, range 21,300 yd. with false cap. It was on a field carriage of simple construction, with 4 ft. 4-in. wheels, resembling an enlarged field gun. It had rear trunnions, variable recoil (95–155 cm.), air recuperator and pivot traverse. The carriage gave 45° elevation. The weight was about 3¼ tons.

In the World War, all parties used medium guns of 10-cm. (4·2-in.) and 12-cm. (4·7-in.) calibre. These were largely not model guns belonging to siege trains and fortress armaments but some powerful naval guns and also some new models (*e.g.* the French 105-mm. of 1913) were amongst them. Since the war a few types have been brought out, but for the reason mentioned below the history of the medium gun seems to be closed.

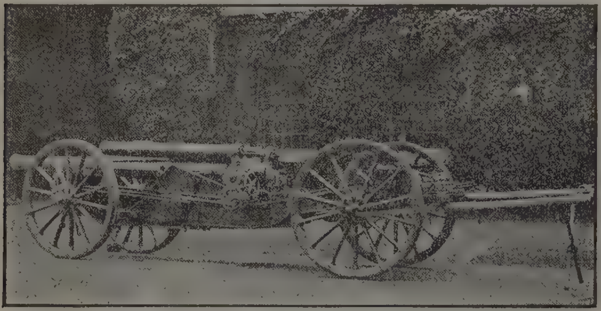

FIG. 23.—British 60-pdr. gun.

The French (St. Chamond) carriage for 4·7-in. guns or 6·1-in. howitzers is noteworthy as a successful attempt to simplify equipment by using one pattern of wheeled carriage which will take either a medium gun or a heavy howitzer. The carriage has hydro-pneumatic recoil gear of the "floating" piston class. The recoil is controlled, *i.e.* automatically shortened at high elevations to prevent the breech of the gun from striking the ground. This is effected by throttling the passage through which the liquid passes from the buffer to the compressed-air reservoir, by means of a valve actuated, through the left cradle trunnion, by a cam attached to the carriage. The relative motion of the cradle with regard to the carriage, as the gun is elevated, partly closes the valve. This is the gear which has been adopted for several of the new U.S.A. equipments, as mentioned above. It is simple and efficient, and is better adapted for mass production than the pattern in which the recoil is controlled by revolving the buffer piston.

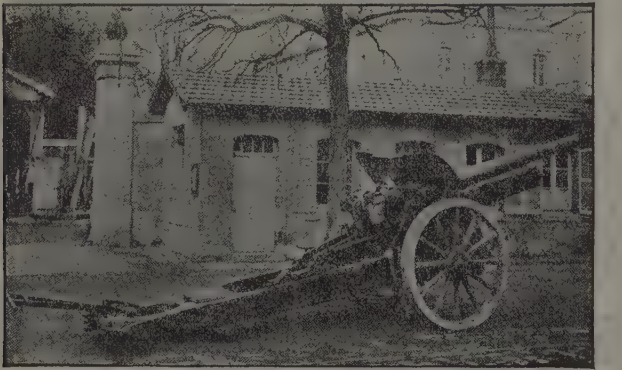

FIG. 24.—German 10-cm. gun, 1914.

The 4·7-in. gun and 6·1-in. howitzer made by the St. Chamond firm have the Canet "revolving block" breech action and have rear trunnions, the forward preponderance being held up by a pneumatic balance spring. In other respects the wheeled carriage is of the ordinary construction. Since the gun, or the howitzer, weighs only 3·46 tons in action, it can be transported on its own wheels by a team or a tractor. However, to increase its mobility, it is usually transported in two loads, the gun travelling on a special wagon.

Although medium guns have been of great service in the past, it seems doubtful whether any more of them will be made. They represented the maximum power, subject to the limitations of horse draught, that was compatible with mobility sufficient to march with an infantry division. With the advent of mechanical traction, they are likely to be superseded by the far more powerful 6-in. gun.

Medium Howitzers.—During the period of trench warfare, the principal weapon employed by both sides was the 6-in. howitzer, throwing a shell of 95 to 100 lb. This was capable of penetrating the strongest artificial cover commonly met with in the trenches, and nothing short of a semi-permanent concrete structure was proof against it. Practically all belligerents employed weapons of this class, both old models (adapted to new mountings or left on their old carriages) and new. In 1914 the British had none of these pieces except a few of the old siege howitzers described and illustrated at 20.224, but the 6-in. Q.F. howitzer designed in January 1915 began to be issued in the latter part of the same year, and by the end of the war 3,633 of these had been delivered. It proved a serviceable weapon, though far inferior in power to those made since the war, as its weight was restricted by the limitations of horse draught, and was only 86 cwt. It ranged 10,000 yd. with a 100-lb. shell, or 11,600 yd. with the streamline shell afterwards introduced. The carriage was of simple construction with a long cradle. Future equipments of this nature will be made with a split trail to avoid the delay incurred by traversing such a heavy piece.

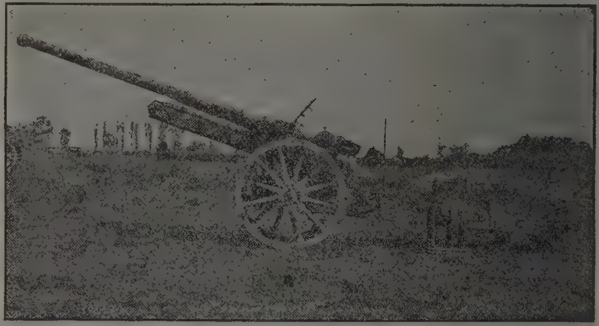

FIG. 25.—German 10-cm. gun, 1917.

The French in 1914 had only 105 mobile 6-in. howitzers. These were of the Rimailho pattern, designed by Commandant Rimailho, who like Deport had been one of the creators of the 75-mm. gun. This piece was remarkable in its day as being the first medium howitzer designed to be drawn across country by a team of horses at a trot. This degree of mobility was secured by conveying the howitzer itself on a special light wagon, while the carriage travelled empty. This wagon formed a slide which could be adjusted in prolongation of the cradle, so that the piece could be shifted from one to the other by means of a winch, an operation which took only ten minutes. Other features which were then novel were a semi-automatic breech mechanism actuated by the recoil, an automatic loading system in which the shell and cartridge were driven home by the breech block, elaborate sight mechanism, and rear trunnions with a pneumatic balance spring. The wagon with the piece weighed 2·75 tons, and the empty carriage 2·5 tons. The extreme range was 6,500 yd., as the piece itself was an old model.

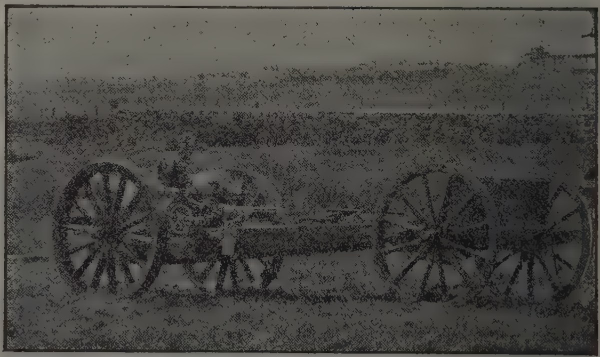

FIG. 26.—British 6-in. Q.F. howitzer, 1915.

As the Rimailho was not sufficiently powerful, and as only 105 existed, Schneider and St. Chamond weapons of the same class were brought in to replace it. The powerful Schneider 155-mm. (6·1-in.) howitzer throws a 95-lb. shell, M.V. 1,500 f.s., to a range of 13,300 yd. The peculiarity in its construction is the counterweight on top of the breech. This was added in order to enable the makers to get a greater length of the piece forward of the trunnions while maintaining a breech preponderance. In ordinary times they might have put in a pneumatic balance spring,[1] but in war-time the simpler expedient was preferred.

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[1] Balance springs and pneumatic equilibrators are introduced to take the weight of the gun and cradle when trunnioned behind the centre of gravity. This rear trunnioning is necessary with long-recoil high-elevation guns because, if the cradle were on central trunnions so as to balance the gun, then, when elevated, the breech would strike the ground on recoil. But this gives the gun a heavy muzzle preponderance which has to be balanced. The usual method was

The original model of 1915 was altered in 1917 to take a bare charge, owing to shortage of brass for cartridge cases; this involved the use of an obturating breech mechanism and added 55 lb. to the weight. The ballistics remained as before.

The 155-mm. howitzer is transported on its own wheels with a limber fitted for horse draught, or may be limbered up to a tractor. It travels in the extreme recoil position to distribute the weight. The weight in action of the 1917 pattern is 3·3 tons, and the weight with limber 3·7 tons, so that it is sufficiently mobile to accompany troops. It can if desired be divided into two units weighing 2·5 tons for the howitzer and 2·6 tons for the empty carriage. It was used by both the French and the Americans as part of the divisional artillery.

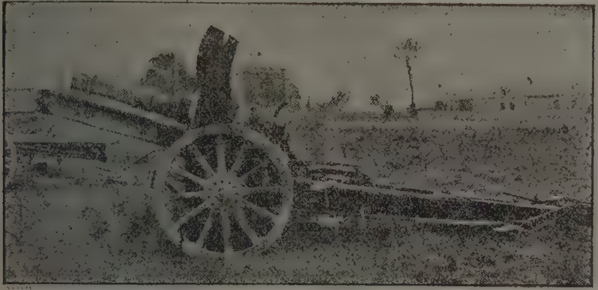

FIG. 27.—German 15-cm. heavy field howitzer, 1913.

The U.S.A. 155-mm. (6·1-in.) howitzer, 1920 model, is $24\frac{1}{2}$ cals. long, and fires a 95-lb. shell, M.V. 1,850 f.s., ranging 16,000 yd. The carriage has a plain trail, and gives 65° elevation and 10° traverse on the axle. It has hydro-pneumatic controlled recoil gear. A split-trail carriage giving 60° traverse is also being tried. This piece is an example of the changes made in howitzer equipments since 1914. The 6-in. howitzer of that date was some 12 cals. long, M.V. 950 f.s.; the modern howitzer is twice as long and has double the muzzle velocity and double the range, and would formerly have been classed as a gun.

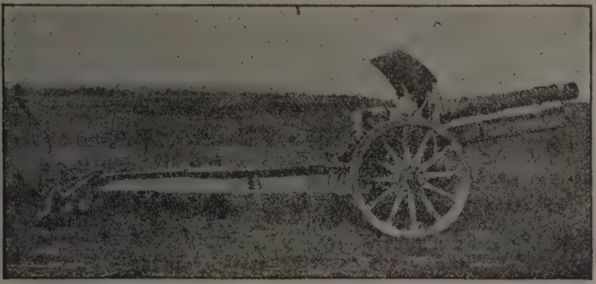

FIG. 28.—German 15-cm. howitzer, long pattern, 1913.

The German 15-cm. (5·9-in.) howitzer, 1902 pattern, was a light horse-drawn weapon weighing only 44 cwt. in action. It fired a 95-lb. shell and ranged 7,000 yd. It was 11 cals. long, of ordinary Krupp pattern with variable recoil, and the carriage gave elevation up to 65° in order to obtain a steep angle of descent at short ranges.

formerly by a pair of compression springs set forward of the cradle trunnions. The action of these is not very satisfactory, as if the thrust of the spring is sufficient to support the gun at a high elevation, when the spring is fully extended, then it is excessive at a low elevation. Telescopic springs were used in the Krupp mountings to give a more uniform thrust. But these balance springs are now being superseded by compressed-air "equilibrators." This device, in principle, was used in the French Rimailho howitzer; in its present form it was first brought out in the British Armstrong railway mountings, and has since been adopted for caterpillar mountings. It consists of two steel tubes fitting one into the other, the outside ends of the tubes being closed. The telescopic vessel thus formed is filled with compressed air, which tends to force the tubes apart. It is prevented from escaping by a double packing, with a recess beween the two packings which is filled with grease, constituting a "grease seal." The compressed air gives a more regular thrust than a spring, and can be connected to the cradle with suitable leverage so as to balance the gun at every elevation. The gun can then be elevated and depressed by the handwheel with comparatively slight effort. When the compressed-air equilibrator is used in the heavy railway mountings described later, the construction is slightly different; the telescopic vessel is filled with oil or glycerine instead of air, and is connected by a tube to a reservoir of compressed air so that the air has no access to the packings. The reservoir is of such a size relatively to the cubic contents of the equilibrator as to give the desired variation of thrust at different elevations. This gear is known as the "hydro-pneumatic balance spring."

The 1913 pattern gave somewhat better ballistics; this had rear trunnions and balance spring, and was 14 cals. long; it had an air recuperator. This was superseded by an improved pattern, 17 cals. long, giving M.V. of 1,270 f.s. and a range of 9,400 yd. with 95-lb. shell. This howitzer fired without a platform, using mats under the wheels in soft ground. It weighed about 61 cwt. in action, and was easily transportable. Though inferior in power to the French 155-mm., it was an excellent weapon, and was the principal piece employed by the Germans in trench warfare, besides being mobile.

Heavy Guns and Howitzers. The 6-in. Gun.—The authorities of all the military nations concur in considering this gun as one of the most important types used in land as well as in naval warfare. The pattern developed in the latter part of the war throws a shell of 100 lb., containing 12 lb. of H.E., a distance of 15 m. The shell, while not too heavy for transport or handling, is powerful enough to do great damage to buildings, bridges, and similar targets, and it is practically impossible to build cover proof against it without recourse to armour plates or masses of concrete.

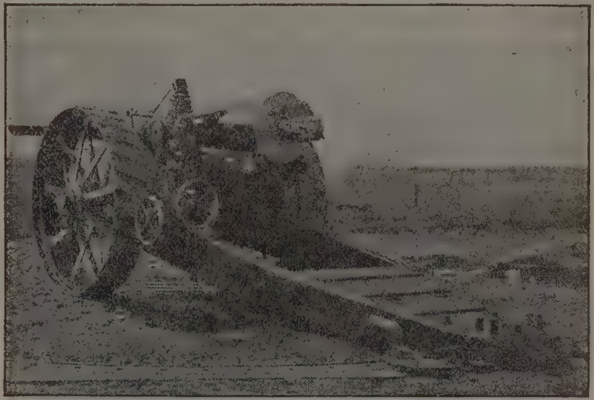

FIG. 29.—British 6-in. gun, Mark XIX., 1916.

At the beginning of the war the British had no 6-in. mobile guns. The Mark VII. 6-in. was taken from coast defence and mounted on a simple carriage with traction-engine wheels. On firing, the carriage ran back up inclined planes, and ran forward again into position. This gun ranged only 17,700 yd. In 1916 a later pattern, Mark XIX., was mounted on the 8-in. howitzer carriage, with cradle and buffer (fig. 29), which much increased its rate of fire. The 6-in. Mark XI. naval gun, a much more powerful weapon, was on a railway mount similar to those described below.

The Germans, in addition to old-model siege guns, had a 15-cm. naval gun, 40 cals. long, mounted with its naval ring cradle and short-recoil buffers on a heavy-wheeled carriage. This was replaced towards the end of the war by the 1916 pattern, 43 cals. long, which had a maximum elevation of 42° and range of 25,000 yd. There were two patterns; in the lighter the weight of the gun unit in travelling was $6\frac{1}{4}$ tons, that of the carriage unit $5\frac{1}{4}$ tons. In action the gun and carriage weighed $9\frac{1}{4}$ to 10 tons according to mark. Beds were provided for soft ground.

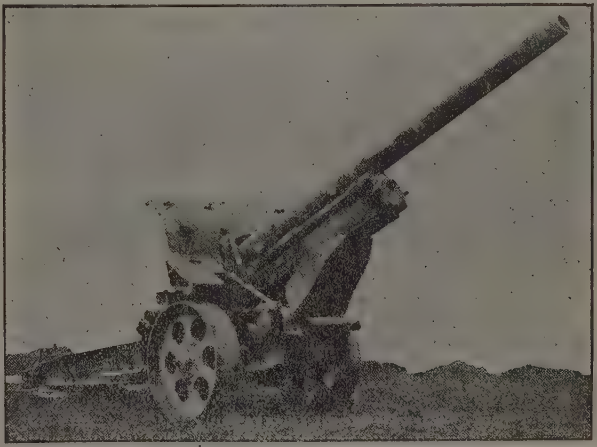

FIG. 30.—French 155-mm. G.P.F., 1916.

The French, after using up the 6-in. de Bange guns of their fortresses on various mountings, old and new, and bringing in naval and other guns of 14, 14·5, 15·5 and 16 cm., adopted as standard the design of Colonel Filloux known as the 155-mm. (6·1-in.) G.P.F. (*grande puissance Filloux*). This gun, which was also used by the

Americans, was a longer gun, namely 38 cals., throwing a 100-lb. shell, and ranged nearly 20,000 yd. with streamline shell. The French had a variety of automobile and tractor-drawn mountings for this gun. One of the latter had a split trail, giving 60° of traverse; to transport it, an extra pair of wheels was placed under the point of the trail, and the gun run back so as to divide the weight between the two pairs of wheels. In another form the gun was carried on a motor lorry. In 1918 the French used a 10-ton Renault caterpillar tractor with the gun mounted on it for all-round fire. This was a powerful machine with 110-H.P. motor. It carried outriggers which were fixed when the gun fired across the vehicle. One object of putting an all-round mounting on a caterpillar, which itself can be easily turned about, is that when the gun is in a position where it has to stay for days or weeks it is much easier to camouflage a mounting which does not have to be shifted to lay the gun. Such a mounting can be sunk in the ground, or a protecting roof can be built over it. At the end of the war a number of St. Chamond automobile mountings with electric drive from a power trailer were under order for the 155-mm. gun. An enlarged G.P.F. of 104 more calibre was brought out and used towards the end of the war.

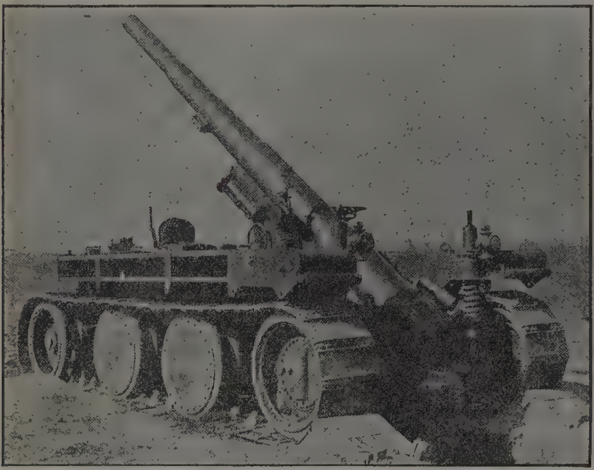
FIG. 31.—155-mm. G.P.F. on Christie automobile mounting.

Fig. 31 shows the 155-mm. G.P.F. on Christie automobile mounting. This has 8 double-tired wheels with 36″ x 6″ tires. The two front wheels are fixed, the two rear wheels pivoted for steering. When working as a wheeled carriage, on the road, the two centre pairs of wheels are raised off the ground; when used as a caterpillar, with a "track" round the four wheels on each side, the centre wheels are let down so as to take their share of the load; the vehicle is then steered by varying the relative speed of the two tracks. The engine (120 H.P., 6-cyl.) drives the front pair of wheels. The total weight with the gun is 17 tons, and the ground pressure 6·1 lb. per sq. in. The length of the vehicle is 20 ft., or 17 ft. without the gun; the width is 9 ft. 4 in., the height 6 ft. 8 in., and it has 13-in. clearance under. The speed is up to 17 m. an hour on wheels, and up to 12 m.p.h. (or 14¾, if breech first) as a caterpillar. Forty gallons of fuel are carried. This vehicle is too wide to pass the British railway loading gauge, but is within the limits allowed on the Continent. As it weighs only 17 tons with the gun, it is well adapted for road travelling.

The same gun on an ordinary caterpillar weighs altogether 27¼ tons, and its road speed is 5 m. an hour.

A good example of the after-war 6-in. gun is the U.S.A. 1920 model, which is 45 cals. long, M.V. 2,800 f.s. with super-charge, and ranges 26,000 yd. with 100-lb. shell. It is stated that a range of 30,000 yd. can be obtained with false cap shell. The gun weighs 79 cwt., and the weight on wheeled carriage is 10·7 tons, so that this gun cannot be transported by horse draught. It can on emergency be fired from its own wheels, with girdles of linked plates round them to increase the bearing surface, but for continuous fire it requires a platform, or it will probably be used principally on a railway mounting.

A long gun of these characteristics may be looked upon as approaching a limit, both as regards travelling and as regards firing. At about the calibre of 17 cm. begins a class of long guns which requires a platform for firing and sub-division for travelling. Both platforms and sub-division may be and frequently are desirable at the 6-in. level, but beyond it there is no choice in the matter so far as wheeled mountings are concerned. At the level of war-time 17-cm. and post-war 15-cm. long guns commences also the class of all-round railway mountings to be described presently.

The provision of platforms formerly caused considerable delay in opening fire; a wooden platform is suitable only for field and medium guns and a concrete platform takes at least a month to set before it is ready to fire from. "Caisson" platforms consist of cellular boxes of iron plate which are sunk into the ground, bolted together on the spot, and filled with concrete or in some cases merely with earth. Since the concrete is used chiefly to weight the platform, it is not necessary to wait till it has set hard. When the gun is moved to another position, the caisson platform is abandoned, with the exception of the top plate carrying the fittings for the attachment of the gun-mount. During the course of the war these platforms were improved so as to afford support only where required, and so to require less excavation. For this purpose the caissons were made of special shapes, as afterwards described. They were known as "earth-boxes," and in some instances they were not even buried, but erected on the surface of the ground. In some cases the gun or howitzer remains on its travelling wheels for fire, in others it travels in parts and is assembled on the platform.

The German 17-cm. (7-in.) Gun.—This was a 40-cal. naval gun, throwing a 140-lb. shell, M.V. 2,500 f.s., to a range of 30,000 yd. The gun weighed 10·8 tons. Some of these pieces were used on railway mountings, others were fitted for road transport. The gun was mounted, in its naval cradle, on a carriage of ordinary field construction, with massive broad-tired steel wheels 6 ft. in diam. The platform from which it was fired consisted of five "caissons" or steel boxes, buried in the ground in the form of a cross. The fifth caisson, which bore the pivot, was in the centre of the cross and connected the four arms together. A horizontal framework with a pair of steel girders extended back from the pivot; the gun wheels rested on plates fixed to these girders on either side of the pivot, and the trail abutted against the cross-piece connecting the rear ends of the girders. The whole girder frame, with the gun and carriage, could be revolved about the pivot when it was required to traverse the gun through a large angle; for angles up to 5° each way the carriage could be traversed within the girder frame by shifting the trail along the cross-piece. The rate of fire was one round per minute. The equipment was easily transportable by road in 3 loads, namely, gun on special wagon, carriage, and platform.

This was a powerful long-range gun which could travel by road or rail and could come into action and open fire within 48 hours. The railway mounting for this gun was the same as the platform mounting, and the same horizontal girder frame was used, mounted on a railway truck instead of a caisson platform. The traverse obtainable was 26 degrees.

The French Schneider 220-mm. (8·66-in.) gun, model 1917, was used in the war with a road-mobile mounting, and has since been mounted on a caterpillar automobile carriage. The gun is 35 cals. long and weighs 9¼ tons; it ranges to 24,500 yd. with a 200-lb. streamline shell, M.V. 2,580 f.s. It is fitted with double recoil, having both a cradle system (nitrogen recuperator) and an upper-carriage system which recoils against gravity and a buffer.

The road-mobile mounting was sub-divided into two loads, but could be moved as a unit for a short distance. In the firing position the gun, cradle, upper carriage and lower carriage rested on a platform (which was permanently fixed to the lower carriage). The platform was pegged down in rear and connected to an earth anchorage in front. The lower carriage was pivoted to the platform and could be traversed 25° each way. The weight in action was 25 tons exclusive of the anchorage, and the travelling loads were 16 tons for the carriage and platform unit and 14 for the gun unit.

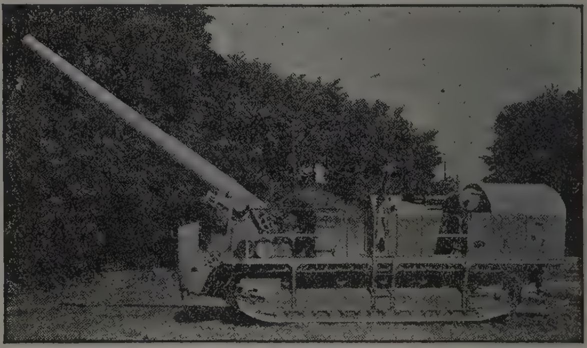
FIG. 32.—French 220-mm. Schneider, caterpillar carriage.

The gun on caterpillar carriage is shown in fig. 32. The upper carriage is supported on rollers with springs, and recoils on a slide, so that there is a double system of recoil gear. The upper carriage gives 37° elevation; traversing is effected by turning the whole mounting by means of the caterpillar tracks, which are worked by a 10-H.P. auxiliary motor.

The caterpillar carriage is 26 ft. long, or 35 ft. including the muzzle of the gun in travelling position; the width is 9 ft. and height 10 ft. The road speeds are from ½ m. to 5 m. an hour; the low gear is very powerful, and the caterpillar will climb a slope of 1 in 2. The weight of the gun and carriage is 14 tons, caterpillar 26 tons, total 40 tons. This is too heavy for road bridges, but the weight and dimensions are such as just to admit of its being carried on a French 40-ton railway truck. The height and width are in excess of the limits of British railway loading gauge.

This mounting marks about the limit of possible weight for an automobile gun-carriage. In fact, it is only fit to travel by rail to a point near its destination, and thence to travel by main roads and across country, avoiding by-roads and country bridges. It may be noted that the 60-pdr. gun-carrying caterpillar tried by the British weighed 35 tons with the gun and had to be discarded as too heavy. The ordinary road bridges of a country, other than those on the main "national" roads of western Europe, will not carry more than about 20 tons, and ordinary road culverts are liable to be crushed. The simplest solution of the difficulty is to transport the gun and carriage separately, as with the German 15-cm. 43-cal. gun.

The 8-in. Howitzer.—Early in the war it was found necessary to introduce for field service a howitzer firing a shell of about 200 lb., for the destruction of fortified buildings, railway stations, and bridges. Non-mobile weapons of this class were already in existence as siege pieces, and these were employed with modified mountings, as a makeshift. But the Germans in particular had developed wheeled mountings for 21-cm. "mortars," and the appearance of these as mobile heavy artillery obliged the Allies to follow suit.

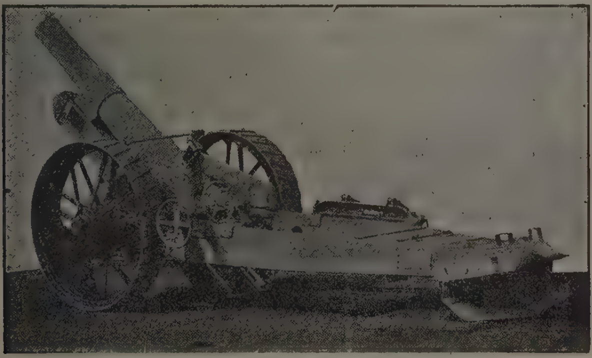

FIG. 33.—British 8-in. howitzer, Mark VII.

The British at first issued an old-pattern 6-in. gun with the muzzle cut off, bored out to 8 in.; this was superseded by the Mark VII. 8-in. howitzer shown in fig. 33. Some of these British pieces were used by the French and Americans. The howitzer was 18·5 cals. long and weighed 69 cwt., or 10·3 tons on wheeled carriage. It was an enlarged edition of the 6-in. howitzer, and ranged 12,500 yd. This piece could be transported by road, the carriage travelling empty; this weighed 6·8 tons. A platform was provided for use in soft ground. The Americans, when they adopted this piece, mounted it on an automobile carriage (which also took the 6-in. gun) made by putting the upper carriage of the howitzer on an 80-H.P. Holt caterpillar. This mounting gives 45° elevation and 8° traverse, and weighs 26 tons complete. The road speeds are 1 to 4 m. an hour.

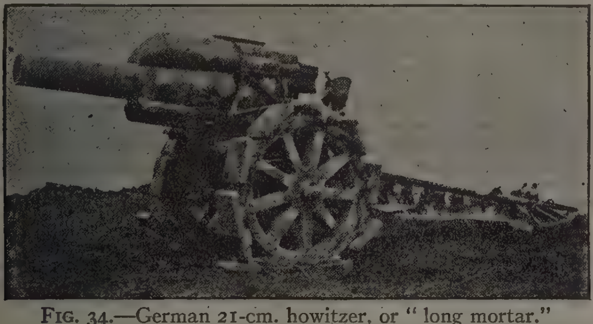

FIG. 34.—German 21-cm. howitzer, or "long mortar."

The U.S.A. 1920 model 8-in. howitzer is more powerful than the British Mark VII. It is 25 cals. long and weighs 80 cwt.; it fires a 200-lb. shell, M.V. 1,950 f.s., ranging 18,000 yd. The wheeled carriage, which also takes the 6-in. gun, gives 65° elevation and 10° traverse on the axle; it has variable controlled recoil, the full recoil being 6 ft. The elevating gear consists of 2 toothed arcs which can be released from the cradle trunnions so that the howitzer can be swung to the horizontal position for loading. The weight is 11 tons.

The French had no mobile 8-in. howitzer before the war. They issued a certain number of 19-cm. guns bored out to 8-in. calibre (not cut short) to fire British 8-in. ammunition. These guns on high-angle carriages made good long-range howitzers and were used on railway mounts, but were too heavy for road transport. For a mobile piece the French introduced the Schneider 22-cm. (8·27-in.) siege howitzer, 13 cals. long, firing a 216-lb. shell, M.V. 1,120 f.s., and ranging 9,600 yd.; the method of transportation was peculiar to the French artillery, the howitzer itself being fitted with road wheels and a perch instead of being carried on a special wagon like the German heavy howitzers. The howitzer with wheels weighed only $2\frac{3}{4}$ tons, and the empty carriage $3\frac{1}{4}$ tons, making loads which could be transported by horse draught or by a small tractor. This howitzer is fired from its wheels, and can be fired from the bare ground, but requires a platform for continued fire.

The German 21-cm. (8·3-in.) howitzer, styled a "mortar," was of several patterns. The very earliest fired from a bed, but the pieces which played a conspicuous rôle in the war were the ordinary or short mortar 12 cals. long, which ranged 9,800 yd. with 265-lb. shell (M.V. 1,120 f.s.), and the long mortar was 15 cals. long and ranged 11,200 yd. with 261-lb. pointed shell. The recoil gear consisted of 2 oil buffers and an air recuperator, placed above the piece, allowing 43-in. recoil. The carriage gave 70° elevation and 4° total traverse. The short mortar weighed 2·6 tons, the long pattern 2·8 tons; the weights in action were 6·3 and 6·5 tons respectively.

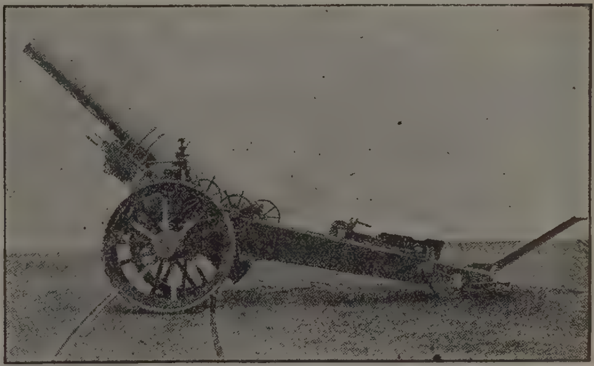

FIG. 35.—British 9·2-in. Mark II. howitzer ("Mother").

9·2-in. and 9·45-in. Howitzers.—The British 9·2-in. howitzer was a pre-war design, and the first of these equipments were sent to France in November 1914. Fig. 35 shows the general construction. It fired a 290-lb. shell ranging 10,000 yd., but with a pointed shell a range of 12,700 yd. was afterwards obtained. This was the first British equipment to be provided with a floating piston.

The howitzer was 14·6 cals. long and weighed 3·1 tons; the carriage weighed 5·3 tons, but this weight could be reduced for travelling by carrying the cradle separately. This wheeled mounting allowed the howitzer to be fired at angles between 15 and 45° elevation. This feature, namely, restricting the fire to the higher angles of elevation, is found in most heavy howitzer equipments on wheels; the object is to avoid the extra weight and extra length of recoil which would be necessary to keep the carriage steady if the howitzer were fired point-blank. The howitzer traversed on the axle, $2\frac{1}{2}$° either way. It could be fired from the bare ground, but a platform was generally laid for it. Some of these howitzers were mounted on beds instead of firing from their wheels; the platform for these had a pivot in front, an arc in rear to support the rear of the bed, and a pit into which the breech of the howitzer recoiled.

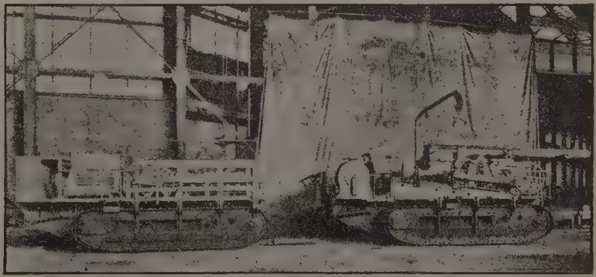

FIG. 36.—U.S. Mark IV. carriage for 9·45-in. howitzer.

The true 240-mm. howitzer was not much used in the war; it is an intermediate piece which lacks the shell-power of the larger calibres and is nearly as troublesome to transport and to emplace. However, the U.S.A. has a new howitzer of this calibre, 36 cals. long, M.V. 2,350 f.s., which ranges 25,000 yd. with 356-lb. shell. This is really a gun, though called a howitzer. Many old, short naval guns of this calibre were used by the French during the war practically as long howitzers.

A very interesting automobile mounting for a 240-mm. howitzer was brought out by the French firm of St. Chamond during the war. This consists of a caterpillar mounting drawing a power trailer behind it. The trailer carries a petrol engine and dynamo which supplies current to the electric motors, both of the mounting and the trailer. These two may be connected mechanically and electrically, or electrically only by a cable. Thus if the drawbar be disconnected the trailer may remain behind under cover and drive the gun-mounting forward as far as the cable extends; 500 metres of cable can be carried, though only 50 metres are normally used. The advantage of this system is that the gun-mounting is simplified and lightened by the absence of the motor, and that it is easier to find room for the gun between the sides of the mounting. The trailer carries a load of ammunition nearly equal in weight to the gun.

The most recent equipment of this type is the U.S.A. Mark IV. carriage for the 1918 pattern 9·45-in. howitzer, built to St. Chamond designs. The trailer carries a 150-H.P. petrol engine driving a 70 K.W. 400-volt compound-wound dynamo, which supplies the current to 2 independent 400-volt motors, each driving one track of the gun-mount, and to similar motors on the trailer.

This howitzer is 21½ cals. long and fires a 356-lb. shell ranging 17,500 yd.; it weighs 97 cwt. The mounting gives 60° elevation, but no traverse; this is given by traversing the whole caterpillar mounting with a small auxiliary motor. The mounting is 30 ft. long, 8 ft. 6 in. wide, and 13 ft. high, including the ammunition crane. It weighs 13 tons complete; the trailer is of the same size and weight, and carries 42 rounds of ammunition. The average speed of the combination is 6·5 m. an hour.

This type of power-trailer mounting has great capabilities, but has not been tried thoroughly enough to warrant its general acceptance. It would appear difficult to steer across bad ground when mechanically connected; however, there is the possibility of sending the gun-mount forward across a bad place, and then halting it while the trailer follows. One advantage claimed for it is that the trailer can be used to bring up ammunition while the gun is in action.

Super-heavy Guns and Howitzers.—The British regulations now apply this term to all guns heavier than the 8-in. and all howitzers heavier than the 9·2-in. Super-heavy pieces are now fired almost exclusively from railway mountings, and therefore are not transported by road. The Germans in 1914 transported 11-in., 12-in. and even 16½-in. howitzers by road, but the increased range of modern pieces of this calibre renders it possible to bring them up by rail to within effective distance of any target that they are likely to be required to engage. The types of super-heavy, road-travelled equipments evolved during the World War were very numerous, and only certain representative models can be described.

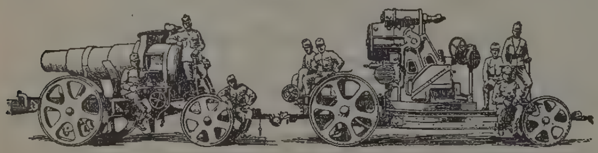

FIG. 37.—Austrian 12-in. howitzer on its way through Belgium.

The 11-in. Howitzer.—The Krupp 28-cm. (11-in.) howitzer was brought out in 1912. It was remarkable in its day as being the heaviest weapon that could be fired from its wheels without a permanent platform. This was due to the long recoil of 6 ft., and to the weight of the howitzer itself, which reduced the recoil-energy. Girdles of linked plates were fixed round the wheels to enlarge the surface bearing on the ground, and mats of sandwiched layers of wickerwork and steel plates were laid under the wheels. The howitzer fired a 750-lb. shell ranging 11,200 yd., M.V. 1,130 f.s.; it weighed 6·3 tons, and the weight in action was 14·8 tons. The carriage had hydropneumatic constant recoil gear, and gave elevation up to 65 degrees. This piece could be divided into loads easily transportable by road, the heaviest, 9·27 tons, being the howitzer itself on its special vehicle. It was very effective in its day, but a modern 11-in. howitzer would be expected to range at least 18,000 yd., and would probably be on a railway mounting.

The 12-in. Howitzer.—A number of pieces of this calibre were used on railway mountings by the different nations. The British 12-in. howitzer was used both on railway and on road mobile mountings. Of those transported by road, the most notable was the Austrian 12-in. howitzer (fig. 37). Several of these pieces were borrowed by the Germans to assist in the sieges of Belgium and northern France, and in Sept. 1914 they travelled 150 km. from Givet to the Moselle in a day. This howitzer fired an 858-lb. shell, M.V. 1,100 f.s., range 10,600 yd. The weight of the piece was only 5·9 tons, or lighter than the Krupp 11-in. howitzer, which was made extra heavy to reduce the recoil. The weight in action was 21¾ tons. This piece could only be fired from a platform. It was easily transportable by road. In addition to the borrowed Austrian pieces, the Germans had 305-mm. mortars of their own, the first pattern dating from 1898.

The French 370-mm. (14·6-in.) Howitzer.—This equipment, designed by Colonel Filloux, was brought out during the war. It is remarkable for its extreme simplicity and the ease with which it can be manufactured.

The howitzer is 8 cals. long, with plain interrupted screw breech-mechanism; it fires a 10-cwt. shell ranging 8,900 yd. or an 8-cwt. shell ranging 11,500 yd. It is mounted on trunnions in a small upper carriage or saddle, which slides on guides inclined at 6 degrees. The saddle rests on spring-supported rollers, so arranged that the springs give under the downward blow of discharge, allowing the saddle to come down on the guides. In checking the recoil, the friction of the guides is assisted by 2 plain hydraulic buffers. The lower carriage of which the slides form part is a single steel casting which traverses 12° on rollers on the platform. This is of steel, raised at the rear end, and has 4 rows of spades fixed to its lower surface; the whole platform is sunk in the ground, and the spades prevent it from moving. The howitzer is loaded "down-hill" from the raised end of the platform, by means of a small shell-trolley which runs on rails fixed in continuation of the saddle guides.

The equipment can be transported by road, rail, or narrow-gauge railway. Whichever is used, the 3 parts of the equipment (howitzer, carriage, and platform) are each suspended from an arched girder, called a "transporter." For road transport, the ends of this rest on two 4-wheeled road trucks, one following the other, which are drawn by a tractor. For ordinary rail transport, the transporter rests upon a single 20-ton truck, and for narrow-gauge transport the ends rest on 2 trucks.

For mounting and dismounting the howitzer the narrow-gauge railway is always used. A line is laid past the rear of the emplacement, parallel to the front. Two short lengths of rail are laid at right angles to the first line, connected to it by turntables. On arriving at these, the trucks carrying the ends of the transporter are each turned through a right angle, so that they can now move forward abreast, carrying the transporter between them. On reaching the emplacement, the platform is lowered from its transporter into the hole dug for it, and the process is repeated for the carriage and for the howitzer. The weights are: howitzer, 9·27 tons; carriage, 9·4 tons; platform, 9·9 tons; transporter, average, 2·5 tons. The transporter is 26 ft. long; the time required to mount the piece, not including laying the lines of rail, is under 2 hours.

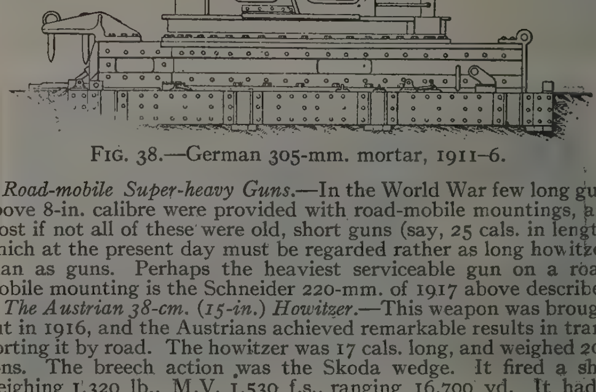

FIG. 38.—German 305-mm. mortar, 1911–6.

Road-mobile Super-heavy Guns.—In the World War few long guns above 8-in. calibre were provided with road-mobile mountings, and most if not all of these were old, short guns (say, 25 cals. in length) which at the present day must be regarded rather as long howitzers than as guns. Perhaps the heaviest serviceable gun on a road-mobile mounting is the Schneider 220-mm. of 1917 above described.

The Austrian 38-cm. (15-in.) Howitzer.—This weapon was brought out in 1916, and the Austrians achieved remarkable results in transporting it by road. The howitzer was 17 cals. long, and weighed 20·7 tons. The breech action was the Skoda wedge. It fired a shell weighing 1,320 lb., M.V. 1,530 f.s., ranging 16,700 yd. It had a ring cradle with the usual hydro-pneumatic recoil gear. The upper carriage, which weighed 16·6 tons, was fixed to a base plate which turned 360° on a central pivot and roller ring, which formed part of the top plate of a caisson platform. This was 22 ft. long, 17 ft. wide, and 4 ft. 6 in. deep, and weighed 43·4 tons empty before it was bolted together and filled with earth or concrete.

The interesting feature of this equipment was the means of transporting it. The howitzer was carried on a platform wagon mounted on 2 bogies of 2 axles, or 8 wheels in all. Each wheel was driven separately by an electric motor, the current being furnished by a 150-H.P. petrol engine driving a dynamo giving 90 K.W. at 300 volts. This engine and dynamo were carried by a power vehicle weighing 9·7 tons complete, which either preceded or followed the platform wagon. The latter weighed 15 tons, or 35·7 tons with the howitzer. The equipment consisted of 5 power vehicles and 5 platform wagons, carrying respectively the howitzer, upper carriage, sections of the platform, and 16 rounds of ammunition. The average gross weight was 35 tons.

Each of these 10 vehicles was fitted for transport by rail as well as by road. The wheels were composite, consisting of an inner railway wheel and an outer broad-tired road wheel of larger diameter, namely, 42 in. When the vehicle was run on to the rails, the road wheels were taken off, and the power vehicle and the platform wagon then constituted a unit capable of travelling by rail under their own power. If it was desired to use a locomotive, the platform wagons could be coupled together to form a train, or could be embodied in an ordinary train. However, the power vehicle was not built stoutly enough to be coupled up as part of a train, and when a locomotive was used the power vehicle was carried on a truck.

To mount the howitzer a hole was dug for the caisson platform. The sections of the platform were dismounted from the wagons by screw-jacks and by winches worked from the power vehicle; they were bolted together in position, filled with earth or concrete, and the top plate, with roller ring and pivot, bolted down. A line of rails was then laid across the platform, and the wagon with the upper carriage was brought up on these rails. The ends of the wagon were jacked up, the bogies removed, and the upper carriage lowered through the bottom of the wagon on to its pivot. The howitzer was then lowered into its cradle in the same way.

The Austrian 42-cm. (16·5-in.) Howitzer.—This was designed as a coast-defence weapon in 1914, and must not be confused with the German weapons of the same calibre used in the Belgian sieges of 1914. In 1916 at least one of these Austrian pieces was equipped for transport by rail, and in 1917 a road-and-rail travelling equipment similar to that of the 15-in. howitzer was built for it.

The howitzer was 15 cals. long and weighed 25·9 tons with the breech mechanism. It was rifled with 84 grooves, uniform twist. It fired a shell weighing one ton, containing 198 lb. of H.E. in a brass cartridge case. There were 5 charges of from 64 to 120 lb., and the extreme range with the 20-cwt. shell, M.V. 1,380 f.s., was 14,100 yd. There was also a 16-cwt. shell ranging 16,200 yd. In 1918 the Austrians, who favoured heavy shrapnel, were designing a shrapnel for this howitzer, but it was never fired.

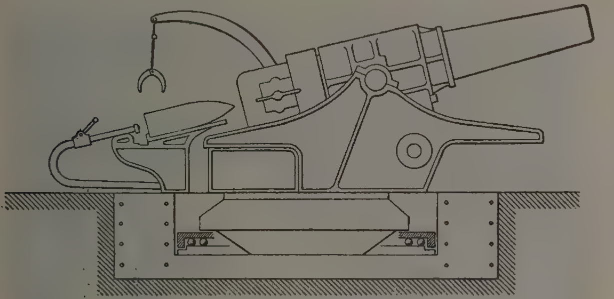

FIG. 39.—Austrian 42-cm. howitzer.

The mounting was of the same pattern as that of the 15-in. howitzer, but heavier. The upper carriage weighed 22·6 tons; there were 2 hydraulic buffers and 2 compressed-air recuperators, working at a pressure of 60 atmospheres. The howitzer could be fired only between 40° and 70° of elevation; thus the range was shortened by increasing the elevation. Fire at any elevation over 65° is unreliable, as the shell tends to come down base foremost or sideways.

The platform was built up of caissons, and measured 25 ft. by 21 ft. by 4 ft. 6 in. deep. It weighed 57 tons empty. The power vehicle and platform wagons were similar to those used with the 15-in., but the wagons weighed 18½ tons, and the heaviest load was 44 tons gross. This equipment was certainly transported by rail, but whether it ever travelled by road is uncertain.

The Krupp 42-cm. (16·5-in.) Howitzer.—A heavy pattern of this piece existed as early as 1911; the light or road-mobile pattern was a surprise brought out by the Germans at the beginning of the war, and intended especially to overpower quickly the resistance of permanent forts in a minimum of time.

The heavy 42-cm. howitzer was transported by rail. It fired several kinds of shell; the heaviest weighed 18 cwt. and contained 200 lb. of explosive; the lightest, which was fitted with a long false point, weighed only 8 cwt. and contained 110 lb. of explosive. The extreme range was 15,500 yd. The weight of the howitzer was 25 tons; it was transported by rail, but was not fired from a railway mounting. A portable platform had to be laid for it, and it was mounted by means of a gantry. With carriage and platform, the equipment formed 7 truck-loads of about 25 tons.

The light or road-mobile 42-cm. howitzer weighed about 21½ tons. It was 12 cals. long, rifled with 120 grooves, uniform twist, and had the Krupp wedge breech action. It threw a shell of 15·7 cwt., containing 302 lb. of explosive and ranging 10,300 yd. There was also an 8-cwt. shell as for the heavy 42-cm., which ranged 13,600 yd. This howitzer required 13 heavy steam traction engines to move it by road. The howitzer itself, on special wagon, was drawn by three traction engines, with a fourth in reserve for hills. The cradle formed a second load, and the empty carriage a third; the fourth and fifth loads were the platform, and the sixth was a wagon fitted with a heavy gyn and windlass for mounting the howitzer. This 42-cm. howitzer was fired from its wheels, and was the heaviest wheeled equipment ever built. It could not be fired from the bare ground; it used a portable platform under the wheels and a trail abutment. It was fired only between 40° and 60° of elevation. The carriage had a ring cradle with hydro-pneumatic recoil gear, giving 6 ft. of recoil, which was mounted on central trunnions on the lower carriage. The massive steel-disc wheels were provided with girdles. The platform was a steel casting in one piece, and extended under the wheels only. The trail abutment consisted of steel caissons or boxes, bolted together to form a curved caisson 7 ft. from front to rear, 10 ft. 6 in. wide, and 5 ft. deep. The caisson was shaped to form a step in front, which supported the point of the trail and formed an abutment behind it. This caisson was sunk into the ground behind the howitzer. A pinion on the point of the trail engaged with a rack on the abutment, and the piece was traversed by turning the pinion. The downward blow on firing was divided between the steel platform and the caisson under the trail. The caisson was made wide enough to allow about 60° of traverse.

The road-mobile 42-cm. howitzer fulfilled its strategic purpose well. The essence of the German plan of campaign was speed; they wanted a powerful siege howitzer which could be brought into action in the first few days of the war and which must therefore be independent of the railways in case these were found to be partly destroyed or otherwise unavailable. They therefore built a "superheavy" short-range weapon just within the limits of weight for transportation by main roads, and capable of opening fire in a few hours without waiting for a permanent platform to be built.

It will be noted that the German 42-cm. howitzer is less powerful both as regards range and weight of shell than the Austrian 42-cm. already described, which piece also is claimed to be transportable by road, and it seems probable that the Austrian rather than the German pattern will be adopted in future construction.

Railway Mountings.—These are of great importance where the country is covered with a close network of railways. Irrespective of the great 100-mile guns, ordinary heavy guns on mobile railway mountings range about 18 m., so that numerous positions are available for them within range of any desired target. Taking London as an instance, a circle with 18-m. radius drawn from Charing Cross passes through Redhill, Weybridge, Watford, Hatfield, Epping, Dartford, and Oxted, and crosses no less than 29 railway lines.

Railway mountings are of two main types: the all-round mounting, with which the gun can fire in any direction from its truck; and the curved siding, or gun-spur mounting. With the latter the gun is layed for direction by running the gun-truck along the curve till it points in the direction of the target. A variant of the second type is that in which the gun can fire from the truck only in the direction of the rails, while for all-round fire it is lowered on to a specially laid platform, and becomes a non-mobile gun.

The present tendency is to develop the all-round railway mounting. This has the advantage that the gun can be fired from any point on the railway; it can follow up the troops during mobile warfare or it can shift from day to day during non-mobile warfare, opening fire from fresh places. The curved-siding mounting takes time to prepare, and then ties the gun down to one position, unless alternative spurs are laid. It makes the fire slow, especially with mountings that run back along the track at every shot. Moreover, the curved siding and the track leading up to it are difficult to conceal. On this account the Germans, at the beginning of the war, used the permanent platform type, in spite of its immobility. They had no satisfactory all-round railway mountings, and, since they objected to the curved siding, they used to build a temporary line to a permanent gun-platform laid in a wood or other place suitable for concealment. Having mounted the gun, they took up the temporary line and removed all traces of it.

The main difficulty in designing a railway gun-mounting is to keep its height and width within the limits allowed by the railway loading gauge. The British loading gauge is 13 ft. 1 in. above rails in centre and 10 ft. 11 in. at sides; the width allowed is 8 ft. 6 in. on some lines and 9 ft. on others. The Continental loading gauge is approximately 14 ft. high and 10 ft. wide. Since the platform of the lowest commercial truck in use is 3 ft. 9 in. above the rails, this leaves little headroom available for a gun and mounting. There is practically no limit to the length permissible, as the girders constituting the mounting itself are carried on 2 or 4 bogies; nor to the weight, as railway bridges are quite strong enough to carry 15-in. gun-mountings. Neither is there any limit to the downward stress on the rails caused by firing, provided that it is taken by a sufficient number of wheels or a large enough bearing-area of platform. Some makers, however, require an extra set of rails laid, or even 2 extra sets (6 rails in all) for their heaviest mountings to fire from. These extra rails are especially necessary with those mountings in which the gun does not recoil on its carriage but the whole truck slides back along the rails on firing and has to be run up again after every shot; the recoil is absorbed by friction along the rails.

Experience shows that the track resists the downward pressure due to firing so long as this is within 3 kgm. per sq. cm., or 42 lb. per sq. in., on the ballast under the sleepers; that is, the resistance depends on the area of the sleepers. When the firing stress is locally high, owing to its being borne by some 12 baulks under the centre of the mounting instead of by 32 or more bogie wheels at the ends, the sleepers are laid at half the usual interval, and extra long sleepers are used. Sleepers laid in good ballast offer sufficient resistance to displacement by stress acting in the general direction of the line of rails, but, as was found in Flanders, a track laid in wet clay is liable to shift, and has to be anchored by driving in stout pickets.

Guns on British "rolling" mountings, as opposed to the French "sliding" types, are fired from the springs. That is, the downward firing stress, reduced by the hydraulic buffer, is taken on the ordinary truck springs. Messrs. Krupp, in their heavier mountings, jacked up the gun-mounting at every axle, so that the stress of firing came directly on the axle-boxes and not on the springs. Messrs. Schneider use wooden baulks under the central part of the mounting, which are jacked down before firing so as to bear on the 3 pairs of rails. In some American mountings the gun-mounting is jacked up and then lowered on to wooden baulks inserted between it and the rails.

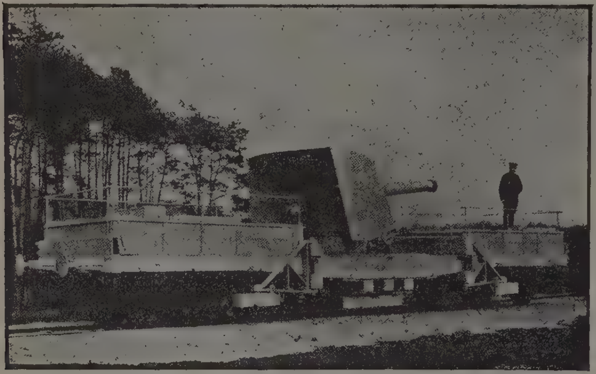

Fig. 40.—French 155-mm. Schneider, on railway mounting.

On account of the limitations of height imposed by the loading gauge, all the heavier mountings have to be of the general type illustrated, namely, a pair of massive girders bent down in the centre nearly to rail level, with the ends supported on pairs of bogie trucks.

The lateral stability of a railway mounting supported on a line of rails of ordinary 4 ft. 8½ in. gauge is small, and it would be impossible to fire a heavy gun across the line of rails without some special support. Therefore all-round-fire mountings have lateral outriggers to take the firing stress. Modern improvements are in the direction of improving the efficiency of these outriggers.

All recent railway mountings allow of the gun being elevated to at least 40°, and to ensure room to recoil at high elevations rear-trunnions are usual, the resulting forward preponderance being balanced by counterweights or by compressed-air gear. Thus the German 11-in. gun had a box on the rear end of the cradle which was loaded with 4·5 tons of iron pigs. This box was dismounted for travelling, as it was too high to pass through tunnels. This was a clumsy device and entailed heavy labour in shifting the pigs. British and American makers use the hydro-pneumatic balance spring described earlier in this article.

In order to reduce the effort required to elevate heavy guns relieved trunnions are usually fitted to the cradle, or to the gun when no cradle is used. (This device is, of course, not peculiar to railway mountings.) The trunnions which support the piece when firing are necessarily of large diam. causing considerable friction. They are therefore fitted with projecting secondary trunnions of small diam., supported by rollers resting on leaf springs. These springs are adjustable by screws at their ends so that they take nearly the whole weight off the bearings of the main trunnions. This reduces the friction so that the piece can be easily elevated by hand gear.

In France there is an extensive network of metre-gauge railways built as feeders to the main lines, and these again connect with 60-cm. tramways. The latter were often joined up to the system of trench railways. In order to utilize this network of railways to the full, many French mountings are built with additional narrow-gauge bogies. These can be lowered and the main bogies raised so that the mounting can travel on its narrow-gauge wheels, but no attempt has ever been made to fire from them. They are used to convey the mounting to a prepared platform on to which it is lowered.

The heavier French, German and American railway mountings are provided with an electric power plant for running the gun-truck into position on the curved siding, hoisting the shell, ramming home, elevating, and closing the breech. The British mountings have usually power winches, run by small petrol engines.

Ammunition supply to a gun on railway mounting is by means of a trolley, running from the ammunition truck to the gun along a small tramway laid on top of the intervening trucks. For small calibres such as the 6-in. a long trough is used. The shell is hoisted by a crane and loaded by a power rammer; the gun is usually depressed to the horizontal position for loading. In all-round-fire equipments the loading platform traverses with the gun, so that the gun has not to be traversed to the fore-and-aft position after every shot.

In the French mountings which slide along the rails on recoil, the ammunition truck has to be uncoupled from the gun truck during firing. Ammunition has then to be brought up by a trolley running on a light railway laid by the side of the main track.

Roving railway guns were often used in Flanders. These were field guns or naval 12-pdr. mounted on trucks with all-round fire, and were run out by night to positions in the open whence they could enfilade German trenches and advanced works. They used to fire 50 rounds of rapid fire and withdraw before they could be located. But this was annoyance rather than serious warfare.

A heavy railway gun requires an attendant train, including ammunition trucks, workshop, trucks with materials and tools for building sidings and emplacements, and trollies (preferably motor-driven) for bringing up ammunition at night. The train is usually kept well back or camouflaged or both. But the real difficulty lies in concealing the specially laid sidings, and the places where they leave the main line.

German Methods.—The Germans used few if any railway mountings till 1916, although Messrs. Krupp had a 12-in. gun on truck mounting in 1913. They brought up heavy naval guns by rail and mounted them on permanent concrete platforms with central pivots; later they used steel caisson platforms bolted together on the spot and weighted with earth. The gun was brought up on a 40-ton commercial truck, or two such trucks for the heavier pieces. To mount it two temporary lines of rail were laid, one on each side of the platform and a third line up to the centre of the platform. A horizontal crane or gantry, consisting of a girder capable of carrying 40 to 100 tons according to the size of the gun, was supported at the ends on trucks run on to the two lines, so that the gantry was over the platform. The gun-truck was run up on the third line, the gun lifted, the truck removed, and the gun lowered on to its platform.

Later on, the Germans developed a new system which enabled the gun to be fired either from a railway mounting or from a platform. The railway mounting was of the ordinary type, consisting of two heavy girders bearing the gun-carriage, supported at their ends on trucks, and bent down in the centre so as nearly to touch the rails. The mounting was run on to a siding built across the platform, jacked up, the trucks removed, and the gun-mounting lowered on to the central pivot of the platform. The siding was then taken up and all traces of it were concealed.

In 1916 the Germans, impressed by the mobility of the French railway guns on the Somme, began to use travelling railway mountings more freely. However, they never developed a satisfactory traversing mounting, and their guns were nearly all on non-traversing rolling or sliding mountings layed by means of curved sidings. To save time in running the gun-truck forward after recoil, they used a scotch clamped to the rail, behind each wheel. By Nov. 1917 they had 9·45-in. guns of 30 and 40 cals., and 11-in. guns, long 9·45's, and, finally, 15-in. guns on truck mounts. In 1918 they had long 9·45-in. guns of 45 cals., and by July 1918 they had 15-in. guns on truck mounts.

A representative of the lighter nature of railway guns designed for all-round fire is the Schneider 155-mm. (6·1-in.) gun shown in fig. 40. This was a 28-cal. siege gun of only moderate power, but it proved very useful in the early days of the war. The railway mounting is of simple construction. The gun recoils up inclined guides and returns to the firing position by its own weight. The carriage is on a roller ring fixed to the platform of the truck, and gives all-round fire. The truck is supported when firing by screwing down the baulks underneath it upon the rails; the outriggers seen in the plate are used when firing across the rails. This gun fires from the ordinary permanent way, no extra rails are required, and only a few minutes are spent in coming into action. Another example is the French 19-cm.

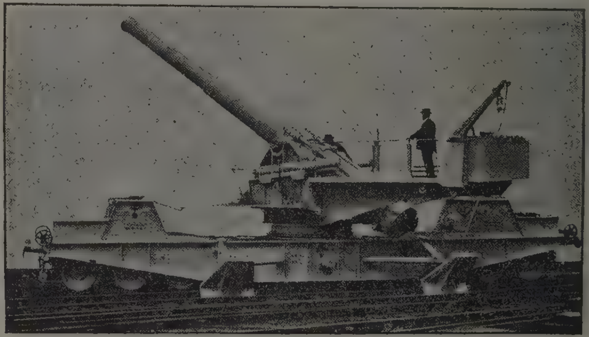

Fig. 41.—British 9·2-in. gun, on railway mounting.

The British 9·2-in. Gun on Railway Mounting.—The 9·2-in. gun formed the principal armament of the British coast defences. In 1914 a number of old guns of this calibre were sent to France, and these were afterwards replaced by Mark X. guns from coast defences, and later by Marks XIII. and XIV., which were more accurate at long ranges. The gun weighs 30 tons and fires a 380-lb.

shell ranging 26,000 yd. at 40° elevation. The weight with mounting is 92 tons. The Armstrong railway mounting for this gun is shown in fig. 41. The gun has no cradle; to adapt it for the railway mounting a trunnion ring is shrunk on and a balance weight added to the breech. It is mounted on a small upper carriage, recoiling on the main carriage; the recoil is checked by a hydraulic buffer, and the upper carriage returned to the firing position by springs.

The main carriage traverses on a roller ring on the upper surface of the platform girder which is of the usual type, supported at each end on a pivot carried by a six-wheeled bogie truck, the centre pair of wheels being flangeless.

Four outriggers, which are shown in the raised position in the plate, are pivoted to the sides of the main girder. Before firing, the main girder, with the gun and carriage, is lowered by means of hydraulic jacks which are embodied in the pivots which support the ends of it, so that it rests upon the sleepers of the permanent way. The outriggers are swung out, stayed, and bedded in the ground, and the gun is ready to fire. The operation takes half an hour.

This mounting requires no preparation of the permanent way; the gun can be fired from any point in the open line, at the rate of about one round in 50 seconds. The outrigger system would require modification to admit of heavier guns than the 9·2-in. being fired from it; even with this gun reduced charges have to be used when firing across the rails at angles of elevation below 15 degrees.

It should be noted that all outrigger mountings block both lines of rail when in position, so that no traffic can pass. This is one argument in favour of the curved-siding system.

The largest all-round railway mounting used in the war was a St. Chamond mounting, originally made for a 12-in. gun, but as this proved too violent, actually issued for service with the 240-mm. "Colonies" coast-defence gun. The gun is 40 cals. long, with trunnions, and fires a shell of 356 lb., M.V. 2,800 f.s. The mounting consists of an upper carriage recoiling against gravity and a buffer. The slide is pivoted on the main girder and traverses through a complete circle; it is extended to the rear to form a loading platform. The track requires preparation in the form of extra sleepers, to which are bolted 4 longitudinal baulks, these forming the bed to which the main girder is firmly secured. The horizontal stress due to the recoil is taken by long outriggers, 2 on each side and 2 at each end, which abut on massive shoes buried in the ground.

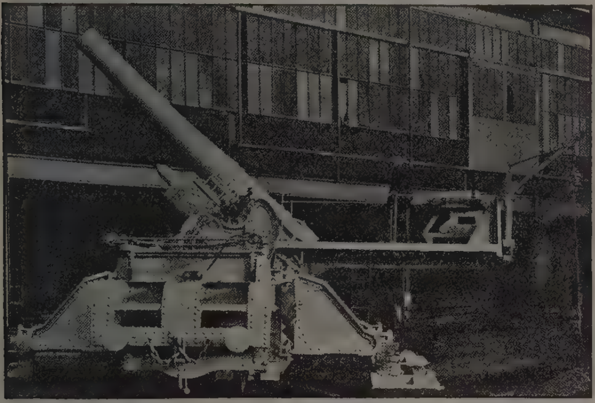
FIG. 42.—British 12-in. howitzer, on railway mounting.

The British 12-in. howitzer on railway mounting is shown in fig. 42. The howitzer is 18·6 cals. long, weighs $10\frac{1}{2}$ tons, and throws a 750-lb. shell about 16,000 yd. The mounting is very similar to that of the 9·2-in. gun, but has a cradle with hydro-pneumatic recoil gear. In this plate the outriggers are seen bedded in the ground.

The 274-mm. (10·5-in.) French Gun.—This gun is shown in fig. 43 on a Schneider sliding railway mounting. This is a good specimen of the French mountings designed early in the war. The French had a number of coast-defence guns with trunnions, mounted on slides, with no cradles or hydraulic buffers. It would have taken a long time to make hydro-pneumatic recoil gear for these guns, and the Schneider sliding mounting enabled them to be used at once. The gun fires a 561-lb. shell, M.V. 2,717 f.s., and ranges 29,000 yd. It is mounted on its trunnions on a girder supported at both ends by trucks. The mounting gives 40° elevation, and no traverse; the gun is layed for direction by shifting the whole mounting along a curved siding. For this purpose a winch actuating the two leading axles is fitted on the front truck. The gun weighs 38·4 tons, and the whole mounting with the gun weighs 152 tons. The curved siding is specially laid for firing. The sleepers are extra long, and are at half the usual distance apart. Four extra rails or I-shaped girders are laid. The siding is built to a radius of 100 metres;[1] if the mounting is shifted approximately 100 metres along the siding, this gives a change of direction of 60 degrees. Under the main girder is a set of heavy transverse baulks (the ends of which can be seen in the illustration). Before firing these are jacked down on to the rails so that the weight of the system rests on the rails and the truck-springs are eased. On firing, the whole truck mounting slides back along the rails for about 2 metres. Its motion is checked by the transverse baulks.

This type of mounting has the advantage of ease and simplicity of manufacture; it can be made in any engineering works, and there is no complicated hydro-pneumatic recoil gear, which requires special tools and experienced workmen to make. The siding is an ordinary piece of railway construction. Once it is built, no special preparation for coming into action is required, and the gun can take up its position and open fire within one hour. Tactically this mounting is inferior to one which allows firing from the open line.

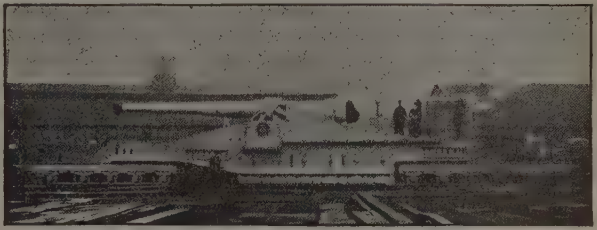
FIG. 43.—French 274-mm. gun, on Schneider sliding railway mounting.

The 30·5-cm. (12-in.) French Gun on Batignolles Railway Mounting.—This mounting is of a type intermediate between the all round and the curved siding mounting. The gun recoils in a cradle, with hydro-pneumatic gear; the characteristic feature is that it traverses 5° each way on the mounting. A special platform is laid for it, consisting of a framework of which the transverse members (with spades on their under-sides) rest on and bite into the ballast between sleepers, and the longitudinals come under the main girders of the carriage. The mounting being run over the platform, wooden wedges are then driven between the beams and the bottom of the girders, so that the mounting is firmly supported on the platform. Recesses are formed in the lower edges of the mounting and the upper edges of the platform, to prevent the wedges from shifting. The platform provides a base nearly 10 ft. wide, this being the limiting width of the main girders of the mounting, imposed by the railway loading gauge.

The platform does not, it is stated, interfere with ordinary traffic when laid. It is therefore possible to provide several platforms on the open line for the same gun, provided that places can be found where the line points within 5° of the target.

Where a definite target is to be engaged, and where consequently only a small amount of traverse is required, the Batignolles mounting has great advantages over the type requiring a curved siding, which takes a week or more to build.

When worn, the gun is bored out to 370 mm., mounted on almost the same way as before and used as a howitzer.

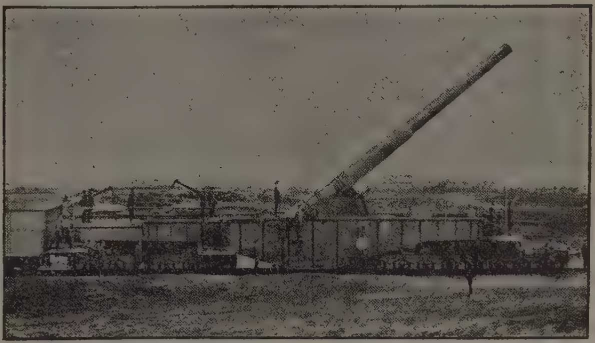
FIG. 44.—British 14-in. gun, on Armstrong rolling mounting.

The French Schneider 520-mm. ($20\frac{1}{2}$-in.) Howitzer.—This fired the heaviest shell used in the war, weighing 1 ton 8 cwt. The muzzle velocity is only 1,640 f.s., and the range 20,000 yd. Unlike the French heavy guns, this piece was specially made as a railway gun. The mounting is of the Schneider sliding type above described, but the gun has a ring cradle and hydro-pneumatic recoil gear, for without this the downward blow on firing would have been too severe on the mounting and the rails. It has electric gear and the breech block is worked by a cylinder containing air which is compressed by the recoil. The howitzer weighs 44 tons and the mounting with howitzer weighs 265 tons.

The British 14-in. Gun.—This gun fires a 1,400-lb. shell ranging 35,000 yd. Fig. 44 shows it on an Armstrong rolling mounting. The whole mounting rolls back along the rails on firing, and is hauled forward again by two power winches and tackles attached to holdfasts beside the line. The gun recoils in a cradle with ordinary hydro-pneumatic gear; the upper carriage traverses 2° each way. Traverse beyond this limit is given by a curved siding.

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[1] For heavier calibres, Schneider lays down 150 m. as the radius.

This gun has rear trunnions and the hydro-pneumatic balance-spring already described. The advantage of the mounting is that the gun can be fired from the ordinary permanent way without any preparation; no extra rails are required, there is no platform, and the downward stress of recoil is taken on the truck-springs without the necessity for jacking them up. (H. A. B.)

(VI.) RAILWAY PIVOT AND FIXED MOUNTINGS

German designers during the war showed a marked preference for railway mountings which could be utilized both on the rails and in a prepared emplacement. Since the war, the development of mountings of this class has been taken up in the United States. The British did not favour mountings of this class. In the French service the pioneer mounting of the rail-and-platform type was a 240-mm. equipment on Tournier carriage with double recoil gear. In this the truck, on arrival by normal-gauge railway, received under its ends two light railway bogies, on which it was brought to a prepared firing platform with pivot. When in position it was jacked up bodily, with ordinary and light-railway wheels still attached and lowered over the pivot. The gun travelled separately and was mounted after the carriage had been got into position. A much more powerful mounting, which, though it gave only a limited traverse, must be regarded as a true pivot-mounting, was the 45-cal. 340-mm. (13½-in.) gun mounted on St. Chamond truck. This, like the preceding, was fired only from a prepared platform, but it travelled complete and the platform was prepared (for a traverse of 10°) on the railway track itself. It will be seen from the illustration that the travelling truck was brought over a pivot prepared in the line and jacked up. The long bogies were run clear and the main girder then rested in its centre on the pivot and at its ends, by jacks, on two platforms prepared in the line. The rear platform was connected with the pivot seating by girders, and the rails between them were removed and a recoil pit dug. The weight of the equipment (bogies included) was 166 tons, and the range of elevation from 15° to 42°. Unlike these, the German and American mountings now to be described were all capable of being used as indifferently rolling (or sliding) mountings and as immobile pivot-equipments.

German Railway Mountings.—The railway mounting of the German 11-in. gun was a good specimen of the German pattern intended to fire either from the truck or from a platform. The gun was a 40-cal. naval gun weighing 45 tons; it threw a shell weighing 630 lb., M.V. 2,740 f.s., to a range of 30,800 yd. It is possible that a streamline shell with supercharge, ranging about 35,000 yd., was also used. The gun had ordinary recoil gear, with an air recuperator working at 85 atmospheres, allowing 38 in. recoil. It had rear trunnions and counterweight as already described. The mounting had electric power gear throughout, enabling a rate of fire of 2 rounds a minute to be attained, at any rate, with platform mounting.

In the railway mounting, the weight was taken by jacking up the springs so that the axle boxes (20 in all) transmitted the strain to the rails, and recoil so far as not absorbed by the buffer and recuperator, was taken up by scotches behind each wheel. A total traverse of 2½° could be given.

The platform gave an arc of fire of 180 degrees. It consisted of 2 transverse caissons 24 ft. long, on which were laid 3 longitudinal caissons 36 ft. long. These were laid, bolted together, and filled with 45 tons of earth. The central longitudinal caisson carried the steel top plate of the platform with roller ring; and the main girder of the railway mounting, with the gun, was lowered on to the pivot, and traversed on rollers which travelled round the roller ring. The platform was laid, and the gun mounted on it, by means of 3 temporary lines of rail and a gantry, as described above, or by means of screw-jacks by which it could be raised to remove the bogie trucks, and then lowered on to the roller ring. In the later equipments auxiliary machinery was fitted, driven by the electric power plant, used in working the gun. The work of laying the platform, not including the temporary railway, took from 4 to 7 days, and the gun could be mounted in one day.

The German 380-mm. (15-in.) Gun was used in the field in 3 ways—as a railway gun pure and simple, as a railway gun with fixed pivot, and as an immobile gun in a semi-permanent emplacement. The gun itself was a 15-in. naval gun 45 cals. long and weighed 77½ tons. It threw a comparatively light false-cap shell weighing 785 lb. with a buster of 69 lb. and 3 driving bands, the design of the projectile being generally similar to that of the 75-mile gun which bombarded Paris (see below). In this case the maximum range was 28 miles. The gun had a ring cradle with buffers and recuperator admitting of a 50-in. recoil. It had a counterweight over the rear of the ring cradle to lighten the work of elevating.

As a railway gun it was mounted on a truck of the usual type, but an intermediate carriage between the cradle and the girders enabled 1° of traverse to be given either way. The position of the trunnions was such that in firing from the open track no more than 17° elevation was possible, representing a range of less than 27,000 yd.—only one-half of the range which could be obtained with the gun emplaced. In the firing position, the weight was taken and the shock not absorbed by the cradle transmitted by the axle boxes of the bogies, as in the 11-in. mounting above described. The total of axles in this case was 18. The gun was layed for direction by movement along a curved siding of 180-in. radius. The total weight was 270 tons. This was the largest railway mounting used in the war.

When the railway mounting was used with an emplacement, the latter was provided by a number of caissons 7 ft. deep, bolted together so as to form a ring 40 ft. in diam., leaving a central pit recoil. The caissons were laid on a foundation of 3¼-in. iron plates resting on I-girders. On top of the caissons was the platform plate, with a roller ring about 36 ft. in diam.; the main girder of the railway mounting was supported by rollers on this ring. The gun was let down to the platform by jacks permanently fixed in the main girder, and no gantry was required. This mounting allowed of 55° elevation; the range was 52,000 yd., and the rate of fire was one round in 3 minutes. The total weight of the gun and platform, besides the concrete filling of the caissons, was 270 tons. The platform took 3 weeks to build, not including the line of rails leading to it. Under favourable circumstances the gun could be mounted in one day.

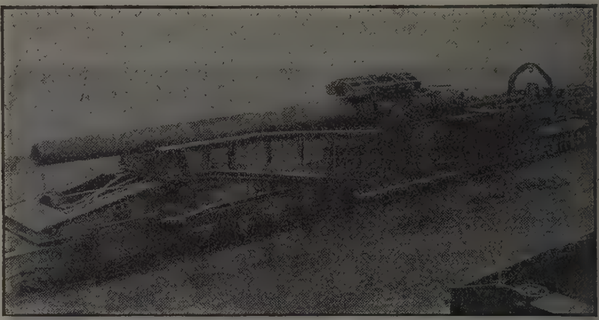

FIG. 45.—German 380-mm. gun, on railway mounting.

The fixed mounting was of a type peculiar to this equipment known as the "bridge mount." It can be used only with a gun which, like this one, has a low recoil-energy due to the abnormally light weight of the shell compared to the gun. The bridge mounting consisted of a quadrant-shaped pit spanned by a bridge formed by a pair of massive girders between which the gun was mounted on its cradle trunnions. The bridge was pivoted at the front end, and the rear end traversed on rollers round the quadrant arc at the back of the pit, giving a total traverse of 90 degrees. The cradle trunnions were 1 ft. 6 in. in diam. and rested in trunnion bearings on top of the girders, 11 ft. 6 in. from the front ends. The girders were 35 ft. long, 6 ft. 6 in. deep, and 6 ft. apart. The pivot at the front of the bridge was 7 ft. in diam. and 6 ft. 3 in. high, carried by a cast-steel base bolted down with 3-in. bolts to a steel platform 20 ft. square. The sides of the square were formed by steel box girders 4 ft. broad and 6 ft. deep, produced towards the back of the pit. This was formed by a quadrant-shaped steel caisson to which the ends of the box girders were bolted; the caisson was 3 ft. 6 in. from front to rear and 7 ft. deep. It carried the roller quadrant, 32 ft. in radius, along which the rollers supporting the rear end of the bridge rolled. The pit was 10 ft. deep. The gun was mounted by means of a gantry carried by 2 trucks on 2 temporary lines of rail, one on either side of the pit.

The German 75-mile Gun (called "Big Bertha").—In March 1918 the Germans bombarded Paris from a distance of 75 m. The tactical aspect of the question of fire at this and at longer ranges is discussed under ARTILLERY, this article being concerned with the gun itself. The 100-m. gun, so called, was not a new invention; designs for similar weapons had been prepared by the British and French Governments some years before the war, but had not been carried out, as the advantages were not considered sufficient to warrant the expense. A design, due to Col. Maitland-Addison, is shown.

The principle on which the gun depends is that if a shell be fired so as to pass through the dense layer of air next to the earth's surface and to emerge into the very thin atmosphere which exists at a height of 10 m., its flight will be practically unimpeded until it descends again, and therefore its range will be very considerably increased. The German shell in question rose to a height of 24 m. during its flight, and more than 50 m. of its trajectory lay in air of a density less than one-tenth of that at the earth's surface. To obtain this result the shell must be fired at an angle of 55° to the horizontal, and with a high velocity, so as to get through the layer of dense air as quickly as possible. In this case the velocity was about 5,000 f.s., or a mile a second.

The gun was made by boring out a 15-in. naval gun, 56 f.t. long. An inner tube 98·3 ft. long was inserted into the gun, so that 42·3 ft. of it projected from the muzzle, and this projecting portion was covered by a "hoop" or outer layer of steel locked to the muzzle of the original gun. Further, a smooth-bore section of tube, 19·7 ft. long, was attached to the muzzle. This was put on with a screw collar, like the muzzle of the British mountain gun, and was removed for transport. The inner tube was of 21 cm. (8·27 in.) cal., and was thick enough to be bored out to 24 cm. (9·45 in.) and again to 26 cm. (10·24 in.) as it became worn. It was rifled with 64 grooves, uniform twist. The powder-pressure was 19·64 tons per sq. in., which is rather higher than that allowed in ordinary heavy guns. The original breech mechanism was retained. The total weight was 142 tons.

The shell used with the gun, at its original 21-cm. cal., weighed 264 lb. It had to be light to obtain the high velocity required.

The object of the smooth-bore section at the muzzle is not very clear; this feature is not embodied in the guns of this type built or designed by other nations. The object of lengthening the muzzle was to increase the range; the object of making the muzzle section detachable was to facilitate the transport; and the object of making this section smooth-bored instead of rifled may have been either to reduce friction or to steady the shell after leaving the rifled portion. Being smooth it would naturally wear less than if rifled and would maintain the accuracy of the gun longer.

The recoil mechanism of 2 hydraulic cylinders and one spring pneumatic recuperator cylinder was attached to the bottom of the cradle. To the top of the cradle was attached a counterweight, the 2 sections of which were raised and locked together for the purpose of raising the centre of gravity to such an extent that the gun might be elevated and depressed more easily. The cradle was on central trunnions, so that the gun was balanced without forward preponderance. A pit in the ground about 18 ft. deep gave room for recoil.

The elevating mechanism was extremely heavy and unique in design as screw mechanism was not used. Straight racks moved in ways parallel to the inclined lower face of the forward end of the side girders of the mounting; at the lower end they were connected with each other by a heavy shaft to which were attached 2 connecting rods running up to the bottom of the cradle. A 2-speed transmission was provided permitting operation at high or low speed.

The railway carriage body was made up of 2 single web-girders connected at front and rear by heavy structural steel transoms, and reënforced in front by a heavy cast-steel housing for the elevating gear. Owing to the great weight of the 75-mile gun compared to that of its shell the recoil energy was very low, and was considerably less than that of the 15-in. gun.

The dimensions of the gun (without muzzle section) and of the truck were not such as to present any special difficulty in movement by rail. The arrangement for bolting the carriage to the emplacement was in 2 main sections, one a base and the other a rotating section. Each section was built up of steel girders and plates. The rotating section was supported on steel balls. At right angles to the direction of the track of the rotating section were 2 girders on the ends of which were key-plates.

The mounting was run on to the emplacement with the rotating section in position and then raised by 4 jacks.

When raised, the bogie-trucks were removed and the rotating section of the emplacement turned through 90 degrees. On lowering the mounting, key-plates fixed under the carriage were fastened to corresponding key-plates on the emplacement. A circular traversing rack of angle and steel pins was bolted to the structural base.

The supposed position of the 75-mile gun was bombarded by the Allies, but it was never hit nor even exactly located.

The guns wore out quickly, owing to the large powder charge employed, and the accuracy soon fell off. The first 21 rounds fired at Paris on March 23 1918 showed that the 50% length zone was about 2 m. and the 50% breadth zone about ¾ m. The fall of the 21 shells fired next day showed an increasing dispersion, and the 6 shells fired on the following day were still more erratic. The gun then stopped firing, and, as was afterwards ascertained, was found to be worn out, and was sent home to be re-bored. Four days later a second gun had been mounted, and the bombardment began again, with similar results as regards accuracy. Altogether the Germans used 7 of these guns, and by Aug. 9, when the Allied advance obliged the Germans to withdraw, all 7 had been re-bored to 24 cm. After the Armistice it was learned that these guns were at Krupps, being re-bored a second time to 26 cm. The 3 guns building at Skoda for the Germans were never finished.

At the end of the war, the British, French and Italian Governments were each building at least one gun of this type. Few details of them have been published. The Italian gun is of 7·87 in. calibre, 65·6 ft. long. It fires a shell of 231 lb. with M.V. 4,920 f.s., and ranges 87 m. The greatest height of the trajectory is 25 m. It is stated that the British and French guns are of rather larger calibre, and range further. Both are said to be 104 ft. long, and to be rifled throughout, with no smooth-bore section at the muzzle.

The 100-mile gun is relatively an inaccurate weapon, owing to the variable atmospheric conditions which the shell may encounter during its flight, which was about 3 min. for the German gun. Improvement in this respect is not probable unless it be possible to obtain meteorological reports from high-flying aeroplanes at both ends of the trajectory, or unless a gun of far greater power, firing a shell of at least half a ton, be used. Such a degree of inaccuracy renders the 100-mile gun, as used in the war, nearly useless at any target smaller than a city, and a few shells distributed over such a large area can do little material damage, and can only serve the purpose of annoying or intimidating the civilian population.

American Railway Mountings.—The United States had 144 heavy guns on railway mountings in France, including five 14-in. guns. The latter were on sliding mountings of the French type but had central trunnions and no balance springs, and consequently could not be elevated beyond 15 degrees. The U.S. 16-in. howitzer was on a rolling mounting which allowed 5° of traverse each way, but it could not be fired with full traverse at elevations under 40 degrees. Since the war, the United States has been considering the question of substituting mobile railway guns for fixed guns in its coast defences. Such guns require a large arc of fire, usually 180°, and a high rate of fire, namely, at least one round a minute; consequently curved-siding mountings would not answer the purpose. It is therefore desired to develop the all-round-fire type of mounting so as to take as heavy a gun as possible, and to open fire as quickly as possible. Guns which are too violent for an all-round truck mounting, such as the 12-in. and over, will have to be let down on to a platform to fire. As it would be difficult to provide permanent platforms in every place where they might be required along the seaboard of the United States, the endeavour is to design temporary platforms which can be laid when required with the least possible delay.

The U.S.A. 12-in. Howitzer on Railway Mounting.—This howitzer is 20 cals. long and ranges 22,000 yd. with 700-lb. shell. It is on an all-round-fire mounting with 8 outriggers. Instead of being lowered on to the sleepers as in the Armstrong pattern, it is jacked up high enough to insert 6 wooden baulks between the main girder and the rails which are doubled by I-beams, and then let down on to them. The howitzer recoils in a cradle and traverses 360° on a roller ring. This mounting can be used for howitzers up to 12-in. and guns up to the 8-in. inclusive, but not larger, as the size of the roller ring is limited by the loading gauge.

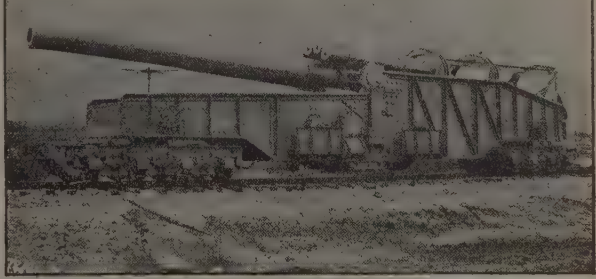

Fig. 46.—U.S. 14-in. gun, on railway mounting. Travelling position.

The U.S.A. 14-in. Gun on Railway and Platform Mounting.—This gun ranges 22 m. at 50° elevation with 1,560-lb. armour-piercing shell, or 29½ m. with streamline shell. It is mounted in a cradle with the usual hydro-pneumatic recoil gear; the cradle is on central trunnions so as to balance the gun, and the breech projects so far to the rear that the gun cannot be elevated beyond 15° when fired from the railway. The main girder and bogie trucks are of the ordinary type, allowing a traverse of 2° each way.

This gun is fired from a curved siding, and the mounting then slides back at each shot and has to be hauled forward again. When either the full range or a large arc of fire is required, the main girder, with the gun, is let down on to a platform. This is of simple design, and consists merely of a circular platform plate laid on the ground and held in position by about 60 steel stakes 18 in. long which are driven round it. The platform plate weighs 34 tons; it is in 2 pieces, bolted together on the spot, and it constitutes the pivot plate and roller ring. The steel stakes take the horizontal thrust of the recoil. The centre of the main girder of the railway mounting rests on the roller ring; the rear end is supported by screw jacks embodied in it, which rest upon circular steel castings laid on the ground. These have to be shifted when the mounting is traversed. It is stated that on sound level ground this platform can be laid in 8 hours, and the gun can be lowered on to it in one hour.

The 1920-pattern mounting for the 14-in. gun is an improvement on the model just described. It has a top carriage pivoted on the main girder, giving 3½° of traverse each way. To prepare the gun for firing, the mounting is jacked up and lowered on to cross baulks as in the 12-in. howitzer mounting. Outriggers are provided in rear to take the horizontal thrust and the mounting is not allowed to slide back on the rails. The steel platform for all-round fire differs from the earlier pattern in that it has a roller path upon which the rollers supporting the rear end of the main girder travel; this is an improvement on the method of supporting it with jacks and circular castings (see fig. 47). This gun has a complete electric power plant, furnished by a 25-K.W. petrol engine and dynamo. The same mounting is used for the 16-in. 25-cal. howitzer.

The simple steel platform used with the American 14-in. gun is in marked contrast to the elaborate platform, consisting of a ring of caissons sunk in the earth, used by the Germans for their 15-in. gun. It is stated that the American platform answers its purpose well. It remains stable, and, even if it does not maintain its level accurately, the resulting error is eliminated by the reciprocating sight. If it be possible to lay a platform for a super-heavy gun in 8 hours, instead of the 3 weeks required for the German pattern, and to mount the gun on it in one hour instead of 24, then this enables the gun to open fire from any desired point on the railway, or close to it, quickly enough for all practical purposes of land warfare, though hardly quickly enough for emergencies that might arise in coast defence. So far as land warfare is concerned, it would seem that the introduction of an 8-hour platform will render it superfluous to build all-round railway mountings for anything heavier than the 11-in. or 280-mm. guns. For even if it were possible to produce an all-round-fire railway mounting for a 14-in. gun, such that it could fire from any point on the open line without a platform, it would probably take 2 hours to fix and bed the outriggers, and the gain in time would hardly compensate for the increased cost and complication of the mounting as compared to the simple American type.

In the design for fixed mountings proper—that is, mountings and emplacements deliberately prepared in peace-time with the aid of concrete and armour—the conditions of the World War brought about little change. The types described and illustrated at 20.226 are still maintained in principle, improvements having been made in details only. A very general review, therefore, will suffice here.

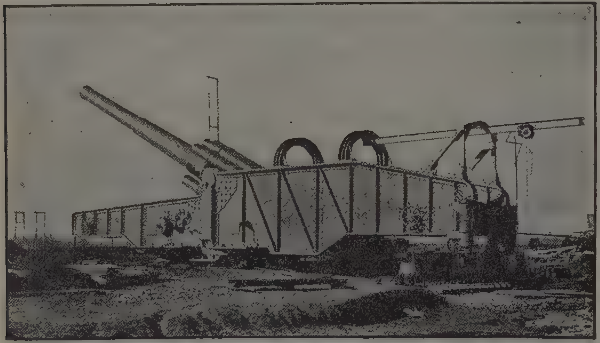

FIG. 47.—U.S. 14-in. gun, on railway mounting. Firing position.

Disappearing mountings are now no longer made, though some remain in service in America. These give the best possible protection against hostile fire, but naturally involve a very complicated mounting; and further, should the lowering and raising arrangements go out of order, the gun is rendered useless. High-angle mountings are still utilized in some places, mounted in deep pits for protection. They are largely used by the United States.

The utility or otherwise of cupola mountings in land fortifications is a question which the experience of the World War has made more controversial than ever. The answer lies, however, in tactical, not technical, considerations.

Coast-defence guns in permanent emplacements are now usually mounted on pedestals *en barbette*, as shown in figs. 84–87 at 20.229, 230. These mountings give all-round fire with breastwork protection as high as the gun level and armour in the form of a thick gun-shield above that level. All barbette pedestal mountings are generally similar in design. The emplacement is prepared by embedding anchoring plates in the concrete foundation and to these a coned pedestal is bolted down. Arrangements are made for levelling the pedestal as required. The pedestal supports the superstructure consisting in intermediate carriage, cradle, gun and gears. The intermediate carriage is capable of revolution in a horizontal plane about the centre of the pedestal and means are usually fitted to prevent it lifting on firing. Fixed to the pedestal is a graduated arc, correctly oriented, and to the intermediate carriage a pointer to indicate the training or traverse of the gun. The cradle carries the gun and recoil system, and is supported by trunnions on the intermediate carriage; the gun and cradle are elevated about the trunnion axis by elevating gear, whilst both the elevating system and the sights—the latter usually being fitted to each side of the mounting—are provided with scales to indicate the corresponding range.

With medium and heavy guns a platform is suspended on the intermediate carriage for convenience in loading and laying. All are provided with shields which cover the upper portion of the mounting and traverse with it. The intermediate carriage fits in or on the pedestal, and to lessen the friction consequent on traversing various devices are employed.

With light mountings, the lower portion of the intermediate carriage is formed with a stem projecting downwards into the pedestal; hardened steel studs let into the bottom of the stem and the recess in the pedestal support the whole weight of the superstructure. With medium mountings, the intermediate carriage is supported on a ring of hardened steel balls carried in a recess at the top of a pivot fixed into the pedestal.

The intermediate carriage of a heavy mounting is supported on a live roller ring; the rollers take the load on their circumference, not on their axles, and can move independently of the mounting. The rollers are kept equidistant by being mounted on axles between concentric rings, and are arranged to run between upper and lower roller paths; they are coned to give circular rolling motion without skidding, and are flanged to fit over the roller paths. The intermediate carriage is centred and steadied by a pivot fixed to the centre of the pedestal. The hardened studs give a form of point contact, the ball race gives circular line contact, and the roller ring circular ring contact. Thus the area in contact is kept at a minimum consistent with the weight of the superstructure for the mounting to be traversed with the greatest possible ease.

So far as circumstances permit, the same principles of support are employed in the semi-fixed and railway-pivot mountings dealt with above. How far improvements in railway-pivot mountings will enable guns fired from them to rival the accuracy of guns fired from the fixed and bedded mountings hitherto used in coast defence is an open question. All mountings (except the lightest which can be easily moved by hand) are provided with traversing gear.

Prior to the World War fixed mountings were designed to permit of a maximum elevation of about 20°; but they are now being designed to give elevation up to about 40 degrees. This necessitates a taller intermediate carriage and longer arcs on the cradle. To reduce the work of elevating the heavier guns the trunnions are mounted in ball or roller bearings. With ball-bearings, which give a point contact, the bearings are supported on springs to support the trunnions only when elevating; on firing, the spring supports give and allow the trunnions to bear upon the intermediate carriage, thus relieving the balls from the firing stresses. In the design of elevating (and also traversing) gear provision is made for relieving the mechanism of shock strains.

The ring type of cradle, being suitable for short recoil, is in general use. The recoil system is usually carried underneath the cradle and consists in a buffer of the valve-key type and springs or compressed air for recuperation. Springs are now being superseded except for light mountings, and the pneumatic recuperator is coming into general use with the increased elevations for which mountings are being designed. With very heavy guns a slipper is employed to support the gun in the cradle, recoil with it, and connect with the recoil system. Hand-loading obtains with light and medium guns, but with heavy guns machinery is employed with hand-gear as a standby in case of breakdown. (X.)

(VII.) NAVAL ORDNANCE AND GUNNERY

The many lessons learnt from the World War as to the results obtainable by naval artillery, and the multitude of improvements in material and in the methods of using it, were in 1921 still in process of digestion by the leading naval Powers. In so far as they reflected upon the design of future warships, from the point of view of naval ordnance, these lessons were still kept as closely guarded secrets in official quarters. The chief factors can, however, be stated in general terms.

The outstanding factor is the long range at which the naval actions of the war were fought by all types of ships. This was due primarily to the great destructive power of modern shells, and partly also to the increased range of the torpedo. It is true for all types of ships, from the capital ship to the destroyer and submarine. In each type the tendency has been to increase the size of the gun armament and to demonstrate the paramount importance of carrying guns of the largest possible calibre. This general increase in the size of the guns has been common to all navies. The British navy will, however, be taken here as typical of the changes that had already taken place before 1921 and of the further developments in progress.

Before the war, 10,000 to 12,000 yd. was considered to be the probable fighting range between squadrons of heavy ships, and it was not thought likely that these ranges would be greatly exceeded. It had now been proved that 12,000 yd. was about the minimum range at which any heavy ship action had been fought during the war, while the maximum range extended to 20,000 yd. and even beyond that. This range approaches the limits of vision at sea, except under abnormal conditions of visibility. If we take into account the use of aircraft for observing, there appears to be no likelihood of the range being reduced in the future. In fact, it seems not improbable that future naval actions will be fought between fleets at extreme ranges and out of sight of one another, either on account of smoke screens or of the prevailing limit of visibility on the surface. This will produce an entirely new set of conditions, both from the point of view of the effects of gunfire and of the methods by which the guns are used.

Let us consider first the effects of gunfire. At extreme ranges the angle of descent of the projectile is very steep, and the target presented by the vertical armour of a ship becomes small in proportion to that offered by the thinner horizontal armour. Again, the large angle of descent means that the vertical armour will be hit at a considerable angle to the normal and is therefore more difficult to pierce. An excessively thick belt of side armour, therefore, tends to become so much deadweight. In the long race for supremacy between gun and armour, the gun had forged a long way ahead when the attack was made so that the projectile would hit at right angles or normal to the surface of the plate. Modern armour-piercing shells are now capable of piercing the heaviest armour carried afloat, even when fired at long range and striking at moderate angles to the normal. Moreover, these shells can carry their bursting charge of H.E. through the armour in a condition to explode and so do the desired damage to the vitals of the enemy. Moderately thick horizontal armour is, however, capable of keeping out the heaviest projectile, even at the steep angles of descent which occur at very long ranges, since the angle to the normal at which the armour is hit is very much increased when the plates are presented horizontally to the line of fire. It therefore appears certain that a considerable increase in the horizontal protection must be one of the features of the designs of future warships, with a corresponding decrease in the area covered by the thick vertical armour. Again, the development of attacks upon ships by aircraft with bombs must lead to a desire for increased horizontal protection. The great destructive effect of H.E. points to the necessity of a more extensive subdivision of the ships internally, in order to localize the effects of shell bursts; and protection against torpedoes will have the same tendency.

The problems with which the control officers are faced become much more complicated as the range is increased. At ranges that approach the limits of visibility, the observation of the fall of the shot becomes very difficult, and it is practically impossible to decide whether the shot are falling over or short, unless they are directly in line with the target. As the range increases, errors caused by the roll, yaw and pitch of the ship, which are not so serious at moderate ranges, become accentuated, and have to be taken into account. The trajectory reaches a very high altitude, and the conditions of wind in the upper atmosphere cannot be known with sufficient accuracy to enable a correct forecast to be made of the effect on the projectiles. The effects of the variations in muzzle velocity of the guns, due to the wear of the guns, changes in the temperature of the charges, and other more obscure causes, become more pronounced. Range observation, even with the best-trained observers, becomes unreliable when the visibility is poor, and the errors in the range-finders themselves become greater as the range increases. From all these considerations it is evident that it is a matter of great difficulty to make an accurate forecast of the initial gun range and deflection. It has become the practice to obtain the hitting range by a process of "trial and error," using the gun as its own range-finder and obtaining what assistance is possible, under the prevailing conditions, from the available "instruments of observation." This can be done as long as the fall of the shot can be observed, but becomes impossible as soon as this condition ceases to exist. The use of aircraft to assist the spotter, or to carry out the whole of the observation of fire, naturally suggests itself; and it is in this direction, followed by the possible introduction of some form of indirect fire, that future developments are to be looked for. This must inevitably lead to complication and to the introduction of new instruments and methods of working. The increasing of the range must very much reduce the percentage of hits to be expected. This reduction in the probable number of hits, together with the increasing horizontal armour protection to be defeated, form the main arguments in favour of carrying larger guns.

Recent years have brought about a steady increase in the calibre of the guns that are mounted in capital ships; and in all the naval actions fought during the war experience has been in favour of the larger gun. There is still a trend towards further increasing the calibre of the guns, since victory will always rest with the side that can hit the harder at the longest range. The heavier the gun the greater the damage done by its shell, and the better its accuracy at extreme ranges. A limit in the size of the gun must, however, be reached when the weight of the ammunition begins to interfere seriously with the rapidity of fire. When this happens the call comes for an increased number of guns, and a limit is then imposed by the size of the ship.

The size of the guns in the secondary armaments has generally increased to meet the development of the destroyer and submarine. To obtain the necessary rapidity of fire, these guns must be hand-worked, and this fact places a limit on their size. It appears therefore that no increase in calibre is likely beyond the 6-in. and 5·5-in. guns that are now in general use in all navies.

In the decade before the war the 12-in. gun, firing a shell weighing between 800 and 900 lb., was the heavy gun that was almost universally mounted in the battleships of the world. The hitting power of these guns had been gradually increased by improving their ballistics, and no increase in calibre was made until after 1911. By this date the 12-in. gun had reached the limit of its development in the British navy in the 12-in. Mark XI. (50 cal.) gun.

The following summary shows how the gun armaments of warships of all classes gradually became heavier during 1910–20. The battleships of the "Colossus" class were armed with 10 12-in. Mark XI. guns, and 8 of the same guns were mounted in some of the contemporary battle-cruisers of the "New Zealand" class. The "Colossus" class were the last of the so-called "12-in. Dreadnoughts," and the midship turrets were placed *en échelon*, so that all the guns could be used on either broadside. This disposition of the main armament marks the transition stage to the centre-line arrangement, which by 1921 had been adopted in the capital ships of all navies. The secondary or anti-torpedo-boat armament in all these ships consisted of from 12 to 14 4-in. Q.F. or B.L. guns. The main armament of contemporary ships in foreign navies also consisted of 12-in. guns, but both the United States and Japan increased the number of the guns in their battleships to 12 as against the 10 in British ships. The secondary armament of the foreign ships was, at this period, usually heavier than the British, the Japanese having a mixed armament of 6-in. and 4·7-in. guns and the United States employing the 5-in. gun.

In 1912, the B.L. 13·5 Mark V. gun became the standard heavy gun for the capital ships of the British navy. It was introduced in order to increase the hitting power and also to obtain greater range, the demand for which was already being felt. This gun weighs 68 tons, and originally fired a shell of 1,250 lb. with a velocity of about 2,700 f.s. This was afterwards altered to a 1,400-lb. shell, with which a velocity of about 2,500 f.s. was obtained. Ten of these 13·5 guns formed the main armament of the battleships of the "Orion" and "King George V." classes, which were completed in 1912 and 1913 respectively. The battle-cruisers of the "Lion" class, which were completed at the same time, mounted 8 13·5 guns, and in both the battleships and the battle-cruisers all the guns were mounted on the centre line of the ships, so that all could be used on either broadside. As a secondary armament all these ships carry 14 or 16 4-in. B.L. guns. In the battleships of the "Iron Duke" class and the battle-cruiser "Tiger," which were completed in 1914, the main armament remained the same as in the previous ships, but an advance was made by increasing the secondary armament to 12 6-in. guns in the place of the 4-in. guns.

In both the U.S. and Japanese navies the 14-in. gun was mounted in all ships completed since 1914. This gun remained the standard weapon, in both navies, up to the ships that were building or projected in 1921, wherein a 16-in. gun was being adopted. The United States had retained a secondary armament of 5-in. guns, but in the American ships building in 1921 the 6-in. gun was to be mounted. Japan on the other hand, after having adhered to the 6-in. gun as the standard secondary-armament weapon for her later ships, was in 1921 adopting a 5·5-in. gun.

The year 1915 marked further progress by the introduction of the 15-in. gun into the British navy. This gun weighs 100 tons and fires a 1,920-lb. shell with a muzzle velocity of about 2,500 f.s. These guns were used for the main armament of the 10 battleships of the "Queen Elizabeth" and "Royal Sovereign" classes. These ships mount 8 15-in. guns and have a secondary armament of 12 to 14

6-in. guns. The later battle-cruisers were also armed with the 15-in. gun, the "Renown" class having 6, with a reversion to the 4-in. gun, mounted on triple mountings, as a secondary armament. The "Hood," the latest type of battle-cruiser built after the battle of Jutland, mounts 8 15-in. guns with a secondary armament of 16 5·5-in. guns.

In the German navy the earlier battleships and battle-cruisers of the "Dreadnought" era were armed with the 11-in. gun, which for many years had been the heaviest gun employed in the German fleet. After 1912 the 12-in. gun became the standard weapon for the capital ships, and remained so until after the battle of Jutland. The secondary armament of all the earlier ships consisted of the 4·1-in. gun, but this was replaced in the later ships by the 5·9-in. gun. A few ships, designed to mount a 15-in. gun, were commenced for the German fleet in 1914, their armament being very similar to that of the British "Queen Elizabeth" class; only 2, the battleships "Baden" and "Bayern," were actually completed, but not until after the battle of Jutland. After the events of 1916, no outstanding developments in naval ordnance occurred in the German navy.

The battle-cruiser has replaced the armoured cruiser of the past, which has consequently disappeared from all modern navies. Similarly the "scout" and "3rd-class cruiser" type has developed into the modern light cruiser and this latter class has replaced the protected cruiser of the early years of the 20th century. The changes that took place in the armament of light cruisers during the war demonstrate the same constant demand for an increased armament as was apparent in the case of the capital ships. The first light cruisers proper, built for the British fleet, were the 6 vessels of the "Active" class, whose armament consisted of 10 4-in. B.L. guns. This class was followed by the larger "Bristol" type in which a pair of 6-in. guns were added. Then followed the 12 ships of the "Chatham" and "Birmingham" classes, again larger than their predecessors and mounting 8 or 9 6-in. B.L. and no 4-in. guns. The full speed of all these ships had remained constant at about 25 knots, but for tactical reasons smaller and faster ships became necessary. This resulted in the building of the "Arethusa" class, in which the armament was sacrificed to speed, and was reduced to a pair of 6-in. and 6 4-in. guns. These ships entered the fleet at the outbreak of the war in 1914 and were rapidly followed by the 12 "Calliope" class. In these latter ships the upward trend in armament commenced with the addition of a pair of 4-in. guns on each broadside. War experience soon demonstrated that the 4-in. gun was not powerful enough to inflict severe damage and was completely outranged by the 6-in. gun. Therefore the "Calliope" class were altered to mount 4 6-in. guns in the centre line, all the 4-in. guns being removed. At the same time a third 6-in. gun was added to the armament of the "Arethusa" class in the place of a pair of 4-in. guns. A similar process of rearming light cruisers was carried out simultaneously in the German fleet, by replacing the original 4-in. with 5·9-in. guns. All the light cruisers designed for the British fleet during the war had an armament of 6-in. guns only, mounted on the centre line. In the "Centaur" and "Carlisle" classes 5 of these guns are carried, and the "D" and "E" classes mount 6 and 7 respectively. The "Hawkins" class forms the extreme development of the light cruiser, for in these ships 7 7·5-in. B.L. guns are mounted, 6 of which can be fired on either broadside. These vessels are, however, of a special type. They are nearly twice the size of the previous light cruisers, being of about the same tonnage as the old armoured cruisers of the "County" class, though much faster and more powerfully armed. Another special type of ship, classed as light cruisers, were the 3 vessels of the "Courageous" class. These remarkable ships approached the capital ships in displacement, their weapons were of the same class, and they attained a speed of over 30 knots. To obtain this speed the armament and armour protection were reduced. Only two turrets, with 4 15-in. guns, were carried, with a secondary armament of 4-in. guns.[1]

In the case of the torpedo-boat destroyers the same gradual increase in gun armament is observable. Until 1910 the 12-pdr. gun was regarded as the heaviest gun that was necessary for a destroyer's armament, but after that date the 4-in. gun began to be used, on account of the increased size of the vessels themselves. At first one or two 4-in. guns were mounted in combination with the 12-pdr. but finally the 4-in. gun became the sole armament. The "K" and "L" classes, built in 1912–3, and the "M" class of 1914 all carried 3 4-in. guns. The "K" class mounted the 4-in. B.L. Mark VIII. gun and the "L" and "M" classes were armed with the 4-in. Q.F. Mark IV., which became the standard weapon for the many destroyers that were built during the first 3 years of the war. In the "V" class the armament consists of 4 4-in. Q.F. Mark V. guns, which are similar to the Mark IV. but more powerful. In the "W" class, which was built in 1918, a further advance was made by mounting 4 4·7-in. B.L. Mark I. guns.

Owing to the avoiding tactics invariably adopted by the Germans, most of the destroyer actions of the war developed into long-range combats rather than the short-range *mêlées* that had been expected. A number of alterations were therefore made in the armaments of British destroyers, to increase the elevation of the gun-mountings and the range at which the guns could be fought. All British destroyers are provided with one anti-aircraft gun. In the smaller vessels the Q.F. 2-pdr. Pom-pom is used for this purpose, but all the more modern destroyers carry a 3-in. H.A. gun on a specially designed mounting. The increase which took place in the armament of destroyers during the war is remarkable. Starting with the "L" class, with the 4-in. Q.F. Mark IV. gun (31-lb. shell), and a maximum range of 7,900 yd., successive advances have been made to the "W" class, with 4 4·7-in. B.L. Mark I. guns (50-lb. shell) and a range of 16,000 yd. Thus the weight of the broadside and the maximum range of the armament of the destroyers were more than doubled during the war.

The gun armament of British submarines was not developed on any very definite lines during the war. The submarines were used for attacking the enemy surface craft and submarines upon the high seas, and for scouting duties in the approaches to the enemy ports. For these duties no gun armament, other than a small H.A. gun for defence against aircraft, was usually necessary. In the German navy, on the contrary, guns were mounted in submarines for the specific purpose of attacking merchant ships, and the size of the guns was gradually increased, first from 3-in. to 4·1-in., and finally to 5·9-in. Before the war 12-pdr. guns had been mounted in British submarines, chiefly for high-angle fire against aircraft. During the war, guns up to 5·5-in. calibre were mounted in British submarines, in isolated cases for special operations in the Dardanelles, Black Sea and Baltic, but as a general rule the guns carried by these craft were confined to those required for defence against aircraft. When a gun armament is required for a submarine, the 4-in. Q.F. Mark XII., on a special mounting, is the normal gun now employed, in addition to a suitable H.A. armament. Several submarines have been built for the British navy which mount a single 12-in. gun. These vessels may be regarded as submersible monitors rather than true submarines, but this proves that it is technically possible to mount guns of practically any calibre in submarines, and undoubtedly the gun armament of future vessels of this type will depend on the development of the vessels, and the rôle they are designed to fill.

Monitors were a type of vessel that were built for a special purpose during the war, and their armament deserves a brief mention. The ships were designed solely for bombarding and for in-shore work. They were of shallow draught and slow speed, and were provided with special protection against damage by torpedoes. The armament consisted, in the larger vessels, of a pair of 12-in., 14-in. or 15-in. guns,[2] supplemented by a small anti-aircraft armament, and subsequently, in some of the ships, by a secondary armament of 6 to 8 6-in. or 4-in. guns. The smaller monitors had a single 9·2 or 7·5-in. gun, or a pair of 6-in. guns, with the addition of a small anti-aircraft armament. The guns and mountings in these ships were usually of an old pattern, alterations being made to allow for high angles of elevation in order to obtain the long ranges required. Special sighting and fire-control arrangements were also fitted to enable the ships to carry out bombardments by indirect fire. All these monitors were built in a very short time, to meet a special set of circumstances brought about by the war. They are a type of vessel not likely to be maintained during peace-time.

During the war a large number of small vessels were fitted out as patrol craft for anti-submarine work, and also for mine-sweeping and mine-laying. The majority of these were commercial craft (such as trawlers, drifters, tugs, etc.) which were converted and armed for their new duties; but a few types of ships came into being, which were specially built for this work. The armament was generally a small one, consisting, at first, of 3 and 6-pdr. guns and afterwards of 12-pdr. and 4-in. guns. At the end of the war a 4-in. gun was mounted in all patrol craft that were capable of carrying so large a gun, and a small anti-aircraft gun was also mounted when possible. Owing to the difficulty of inflicting serious damage on a submarine with a low-trajectory high-velocity gun, howitzers and bombthrowers (*see* p. 1212) were mounted in many of the vessels employed upon anti-submarine operations.

Heavy Gun Mountings.—Recent years have not brought about any very drastic changes in the main principles employed in the design of the turrets in which the heaviest guns are mounted in ships of war. The most recent designs of twin turrets in the British fleet show no very great difference in the general arrangements from those in which the 12-in. guns were mounted in the earlier battleships of the "Dreadnought" class. Such changes as have occurred have been caused by the general increase of the weight of the guns and ammunition that now have to be handled by the turret machines. The following description of the arrangement of a 15-in. turret can be taken as typical of modern British turrets for 12-in. guns and above. The salient features in which the turrets of other navies differ from the British are also pointed out.

The universal practice is to carry the moving turret structure inside a fixed circular armoured barbette on a ring of rollers which run upon a roller path built into the structure of the ship. The armour of which this barbette is built varies in thickness from about 6 to about 12 in., according to the class of the ship, it being thicker in battleships than in battle-cruisers. The barbette extends, in depth, from a few feet above the level of the upper deck downwards through the various decks, and rests upon one of the horizontal armoured decks, usually at about the level of the load waterline of the ship. The lower tiers of the barbette armour are thinner than the upper ones, as they come behind the protection of the side armour of the ship. The turret structure is made to train round inside the barbette by a large pinion, carried in the revolving turret, which gears into a circular rack fixed to the structure of the ship. The revolving part of the turret is composed of 3 chief divisions:—(i.) the armoured gunhouse, in which the guns are mounted; (ii.) the working chamber, immediately below the gunhouse, in which the ammunition is worked; (iii.) the trunk, which extends down to the level of the magazines and shell rooms and is used for the transfer of the ammunition up to the working chamber.

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[1] In the first two of the class. The third, the "Furious," was originally designed for 2 18-in. guns in 2 turrets, but during construction was altered to serve as an aircraft-carrier, and the forward turret was removed. Later the after turret was also removed, a secondary armament of 5·5-in. guns only being retained.

[2] The 18-in. guns released from the "Furious," as mentioned in footnote 1, were mounted under shields on 2 monitors.

The power used in the British navy for working the turrets is, at present, entirely hydraulic, supplied by hydraulic pumps which are situated outside the revolving structure of the turret. The Japanese and some of the German ships follow the British system, but in other navies electrical power has been used almost entirely for working the turret machines. Electrical turrets were tried in H.M.S. "Invincible" in 1912–3, but as they were not entirely satisfactory they were converted to the hydraulic system in 1914. The hydraulic system successfully withstood the severe test imposed upon it by the war, in the very large number of turrets afloat in the British fleet, and any other system will have to be proved to be very reliable before it can be expected to supplant it. Electrical machines have, however, made great strides in efficiency and reliability in recent years, and the combination of electric motors with hydraulic transmission (of the type of the Williams-Janney and Hele-Shaw machines) has rendered electric power peculiarly adaptable to turret machinery. This system has been used in all recent American and German turret designs, and the increased use of electrical power for the auxiliary and possibly for the main engines of warships may lead to the electro-hydraulic system being generally adopted in power-worked gun mountings.

If we take the before-mentioned 3 divisions of the turret separately, the detailed construction is as follows:—

(i.) *The Gunhouse.*—On the circular structure, which revolves on the roller path, is carried the shield of heavy armour for the protection of the guns and their mountings. The front and side plates of this shield are usually from 10 to 12 in. in thickness and sometimes even heavier. The rear plate is generally from 7 to 9 in. thick and the roof and floor plates from 3 to 5 in. The floor is extended to the rear, over the circumference of the barbette, in order to make room for the machines used for the loading operations and also to balance the turret. The guns are mounted, side by side, on separate slides, each gun being capable of moving independently of the other in elevation. Two pairs of very strong side transoms are built up on the floor of the gunhouse, and these carry on their upper parts the trunnion bearings for the gunslides. The gunslides are stiff girder structures, upon the upper surfaces of which the guns (trunnionless) are carried in cradles to which they are secured by steel straps. At the fore end of the slide are built 2 cheeks which carry the trunnions, and these latter work in the trunnion bearings of the transoms. The weights of the gun, cradle and slide, are so distributed that, when the gun is loaded and run out ready for firing, the whole is practically balanced about the trunnions. The elevating cylinder is fixed to the floor of the gun well, immediately under the slide, the piston rod being connected by a link to an arm which projects downwards for the lower part of the slide. The cradle, in which the gun rests, works in the direction of the axis of the gun, upon the upper surface of the 2 side girders of the slide. The recoil is controlled by 2 cylinders, fixed to the cradle one on each side of the gun, which contain a fluid, usually a mixture of glycerine and water. The piston rods are attached to the gunslide, and the piston head has a port cut in it which works over a valve key of varying depth. The flow of the liquid from one end of the cylinder to the other is thus gradually restricted during the recoil of the gun, which is thus brought to rest. The gun and cradle are replaced in the firing position by pneumatic cylinders in the latest mountings, hydraulic power having been previously used for this purpose. Some automatic arrangement is always fitted for bringing the gun to rest gently, at the end of the running-out motion. The breech of the gun is operated either by hand or by an hydraulic cylinder mounted on the rear face of the gun, the power being supplied by means of telescopic pipes under the slide. A high-pressure airblast system is fitted, which automatically admits a blast of air into the gun as the breech is opened. This prevents the dangerous backflame that is liable to occur when firing to windward, when the breech is opened. A jet of water, under high pressure, is also blown into the gun as the breech is opened to quench any smouldering remains of the charge. An extension, called the loading arm, is bolted on to the rear end of the gunslide and carries a chain rammer and the machine for working it. The gun-loading cage, on coming up from the working chamber, is locked to the loading arm and moves with it as the slide is elevated. This admits of the gun being kept laid on the target whilst it is being loaded. In the rear of the gunhouse a small hydraulic crane is fitted for alternative loading. This crane can pick up shells from either of two positions, and place them upon a loading tray which can be secured to the loading arm when required. These two positions are the shell bins in the gunhouse behind each gun, where about 5 rounds per gun are stowed, and the shell bins in the working chamber below. The position of the officer of the turret is in the centre of the rear of the gunhouse, in an enclosed cabinet. Here the turret range-finder is mounted and the various instruments for control of fire and communications are situated. The gun sights are mounted on the slide trunnions, one on each side of each gun. The sighting ports are formed by 3 low hoods in the roof of the turret, the centre one containing the inner sights of both guns and the side positions the outer ones. Elevating and training control wheels are fitted in all the sighting positions, but the turret is usually trained from the centre, and each gun is laid for elevation at its own sighting position.

(ii.) *The Working Chamber.*—The working chamber is a circular space, usually from 10 to 12 ft. deep, immediately below the gunhouse. Its roof is formed by the gun wells, in which are the elevating cylinders and the telescopic pipes for taking pressure on to the gunslides. Below the floor of the working chamber is a compartment known as the walking pipe space. In this are situated the swivel or walking pipes by which the duplicated supply of pressure is taken from the fixed structure of the ship to the moving part of the turret. On the walls of the working chamber are arranged the leads of pressure piping and the groups of stop valves which control the admission of pressure to the different machines in the turret. In the working chamber are situated the 2 training engines, the presses for working the gun-loading cages, the alternative hand gear and other small machines for various purposes. There are also 2 shell bins in which about 8 shells for each gun are stowed, and holes are cut in the roof of the working chamber to enable these shells to be picked up by the crane in the gunhouse. The centre of the working chamber is occupied by the top of the trunk in which the ammunition is brought up from below. At each side of the top of the trunk are waiting positions, on to which the shell and cartridges are automatically discharged from the ammunition cages working in the trunk. From these waiting positions the ammunition is transferred, by hydraulic rammers, to the gun-loading cages; these latter, when in the down position, are in rear of the waiting trays and in line with them. The gun-loading cage consists of a tray upon which the shell is carried, and above this tray and to one side of it are 2 compartments, each of which carries a half-charge of cordite. The cage travels on a curved guide rail, and on being hoisted to the loading arm remains attached to it during the loading operation. When attached to the loading arm, the projectile tray of the gun-loading cage is in line with the bore of the gun, and the projectile is rammed into the gun by the hydraulically worked chain rammer carried on the loading arm. After the projectile has been rammed home the rammer is withdrawn, and the two half-charges of cordite are dropped in succession on to the tray which has been vacated by the projectile, and are pushed into the gun by the rammer. When the rammer is withdrawn after placing the last half-charge, the gun-loading cage is lowered to the working chamber in readiness to receive another round of ammunition from the waiting trays. A complete system of flashproof doors and screens is fitted between the gun-loading cage and the working chamber and also around the waiting trays and the top of the trunk. As far as possible, the whole path of the cordite, from the handing room to the gunhouse, is closed, so that the effects of an explosion in the gunhouse shall not be communicated, by way of the working chamber and the revolving trunk, to the magazines.

(iii.) *The Revolving Trunk.*—The trunk hangs from the floor of the working chamber, and, passing through circular holes in the different decks, is steadied at its lower end by lateral rollers. The lower end of the trunk is entirely free and supports no weight. At the centre of the bottom of the trunk, the electric and high-pressure air leads and also the voice pipes are passed from the fixed structure to the moving part of the turret. The trunk is divided into 5 compartments. In 2 large ones at the sides work the main ammunition cages, the space between them being occupied by the hydraulic presses for working these cages and by high-pressure-air bottles. In the rear compartment an auxiliary cordite hoist is fitted, and the front one forms an auxiliary shell hoist, which is also used as a ladder way for giving access from the shell room to the working chamber. At the magazine level there are openings in the trunk leading into the handing room, and the cordite compartments of the main cages are opposite these openings when they are in the lowest position. In the handing room, attached to the revolving trunk, are two loading hoppers which are fitted with flashtight doors. The cartridges are placed by hand into the hoppers, from which they are discharged into the cordite compartments of the main cage when the hopper doors are opened. The shell tray of the main cage comes opposite to openings in the trunk, at the shell-room level, to which sliding doors are fitted. Two shell bogies travel on racks round the outside of the trunk in the shell room, and are so arranged that they can be locked, either to the floor of the shell room, or to the revolving trunk. The shell are placed on the bogies by hydraulically worked grabs, and the bogies are then trained round by hand, until they are opposite the shell doors in the trunk. When the shell doors are opened, stops which hold the shell are released, and the shell rolls through the door on to the projectile tray of the main cage. In the shell room the shell are stowed in bins, lying on their sides with their axes fore and aft. They thus start from rest in nearly the same position in which they are required for loading into the gun, and remain in this position during the whole of their course to the gunhouse. This is an important point when the shell that are being dealt with are over 5 ft. in length and weigh nearly a ton. Throughout the mounting elaborate interlocking gear is fitted between the working levers and the moving parts or the working valves of the different machines. This is to ensure that the various operations shall only take place in their proper sequence. Accidents are thus prevented, which, on account of the high speeds at which the heavy weights are worked, would be serious.

American Varieties.—The Japanese turrets follow generally upon the British model, but in the American designs there are essential differences, amongst which the following are the most noticeable. Electric power with hydraulic transmission is almost entirely used for working the machines, and no power other than the electric supply is brought into the turrets from outside. Inside the gunhouse the arrangement of the guns and slides is generally similar to that of the turrets of other navies, but the methods by which the various operations are performed are different. For instance, springs are almost invariably used for returning the guns to the firing position, and a large screw is used for elevating instead of an hydraulic cylinder. The breech is usually worked entirely by hand, and in the loading arrangements there are considerable differences from those of other turrets. The shell and cartridges are sent up to the guns separately: the former vertically in tubes on the outsides of the guns, and the latter by a central hoist placed in rear of and between the guns. The shell are transferred by hand to the horizontal position on arrival at the top of the vertical tubes, and are then rolled on to loading trays in rear of the guns. The cartridges are transferred by hand from the cartridge hoist to the same loading trays. Power-worked rammers are used for loading, which operation can only be carried out at a fixed elevation. The central part of the turret below the gunhouse is occupied by the arrangements for passing up the cartridges. This operation is carried out, to a great extent, by hand, and complete precautions against the passage of flash are fitted between the different compartments.

The shell arrangements differ entirely from those adopted by any other navy. The shell rooms consist of circular compartments which are built into the ship, just below the level of the lower part of the barbettes. The shells are stowed standing on their bases, instead of horizontally as is the custom in the turrets of other navies. The shell chamber in the turret, which is in the same relative position as the working chamber in British turrets, forms a revolving platform in the centre of the circular shell room. The shells are passed, still standing on their bases, from the fixed to the revolving part of the floor. From the shell chamber to the gunhouse the shells are carried up the vertical tubes in buckets. These buckets when loaded are balanced about their centres of gravity. On arrival at the top of the tubes the buckets are turned by hand into a horizontal position, and the shells are thus placed in the position required for loading into the gun. A noticeable feature of these turrets is the number of operations for which alternative hand gear is provided, and also the large number of small compartments into which the structure below the gunhouse is divided.

German Varieties.—The German turrets did not differ very greatly, in their main essentials, from the British, but were noticeable for their large gunports and for the somewhat cramped space inside the gunhouse. The loading arrangements differed, because, except in the case of the ships with 15-in. guns, the Krupp type of breech mechanism is used. With this type of mechanism the obturation entails the use of a brass cylinder for the rear cartridge of the charge. The projectile is supplied separately from the charge, in a cage on the outer side of each gun, whilst the cartridges come up to the gunhouse in cages between the guns. Both shell and cartridge cages are loaded in a working chamber under the gunhouse, the ammunition being supplied to the working chamber by cages working in a revolving trunk. The system of placing the rear cartridge in a brass cylinder has the disadvantage that, owing to their heat, the cylinders are heavy and difficult to handle after firing, and special arrangements have to be made for passing them out of the turret. These disadvantages are partially compensated for by the increased protection from flash which is given to the ammunition; and a very noticeable feature in the German turrets was the absence of flash-tight doors and other such arrangements for the prevention of the passage of flash to the magazines. The loading operation is carried out at a fixed angle of elevation. In the earlier German turrets ramming was carried out by hand only, but in the more modern designs a power rammer is fitted. The rate of fire that could be obtained with the German turrets appears to have been slightly greater than that with the British for short periods, but for prolonged firing the British system is surer and probably the quicker. The power used in the German turrets is hydraulic, supplemented by electrical gear to a greater extent than in the British service.

Triple Turrets.—In most foreign navies the triple turret has appeared, but the British navy has been slow to adopt this innovation. This development is due to the desire to increase the gun power of the capital ships, without unduly increasing the size of the ships themselves. Six guns mounted in 2 triple turrets occupy less of length of the ship, which is the important factor, than do the same number of guns mounted in 3 twin turrets. Designs of quadruple turrets have been produced, but it does not appear likely that the number of guns in a single turret will exceed three. It is not clear that economy of space would result from mounting more than 3 guns in one turret, on account of the large space that must be found immediately below the guns for the stowage of the ammunition. In the existing designs of triple turrets, the guns are placed side by side on the same level, and the loading and working of the breech of the centre gun present difficulties which must be solved if the rate of fire of this gun is to be the same as that of the other two. The methods of firing the guns mounted in multiple turrets, and the control of the fire, also present new problems which need investigation, but there seems little doubt that in the near future the triple turret will be adopted by all navies, for economy in space.

Medium-heavy Guns.—Few modern ships now mount a medium-heavy gun in either their main or their secondary armament. Guns of from 10 to 7 in. in calibre are not powerful enough to be of any real use as long-range weapons against armoured ships, and since their ammunition is too heavy to be man-handled they cannot be used for rapid fire and are consequently out of place in secondary armaments. The 10-in. gun has never been much used in the British navy, but at one period the 9·2-in. B.L. gun attained a high degree of favour. It formed the main armament of the armoured cruisers that immediately preceded the battle-cruisers, supplemented in some cases (*e.g.* the "Minotaur" class) by the 7·5-in. B.L. gun. The 9·2 B.L. gun also formed the secondary armament of the battleships of the "Lord Nelson" class, which was designed just before the "Dreadnought." Ships having a mixed armament of heavy and medium-heavy guns appeared in foreign navies at the same time as the "Lord Nelson," but since that time guns of medium calibre have not appeared in the armament of any capital ship. During the war, therefore, the 10-in. gun was scarcely used at all, and 9·2 and 7·5 in. guns were only mounted in a number of ships that were rapidly becoming obsolete, and also in a few small monitors, in which they were specially mounted for bombarding at moderate ranges. The relative weakness of the medium-calibre gun was well illustrated at the battle of the Falkland Is. when the German ships, armed with 8-in. guns, speedily fell victims to the greater range and hitting-power of the 12-in. guns of the British battle-cruisers.

The 7·5-in. gun has, however, been revived as the main armament of the "Hawkins" class, which is the largest type of modern British light cruiser. It was originally intended that the guns in these ships should be entirely hand-worked, and special arrangements were made for handling the 200-lb. projectiles. In the trial stage, however, it was found necessary to add power for working the elevating and training gear, in order to compete with the rapid motion of the ships. The gun is carried in a cradle through which it recoils, and the usual recoil cylinders and spring or pneumatic running-out arrangements are fitted. The trunnions of the cradle are carried in trunnion bearings on 2 side transoms built up on the floor of the mounting. The turntable is carried on a roller ring, and there is no vertical communication between the mounting and the lower part of the ship. All the ammunition arrangements are entirely separate and in general follow the usual practice for 6-in. guns. The shell and cartridges are brought up in separate hoists from below and from the tops of the hoists are carried to the guns by hand. A swinging loading tray is fitted on the rear part of the cradle and on to this the projectile is placed and the whole of the loading operation is carried out by hand. This is most fatiguing work with projectiles of this weight and there is little doubt that the mounting for any gun larger than 6 in. must be largely power-worked to be entirely satisfactory.

As the result of war experience, the mountings for the 6-in. and 5·5-in. guns have undergone a change in design, from the old pedestal (P.) mounting to the central pivot (C.P.) type. This has been caused by the necessity for increasing the elevation in order to obtain greater range. Also, mountings of the C.P. type have the added advantage that the base, which is fixed to the deck, is larger in diam. than is the case with P. mountings, and the severe stresses on firing are thus more evenly distributed to the structure of the ship. In the P. mountings the elevation was limited to from 15° to 20°, as the bottom of the cradle fouled the carriage and the breech of the gun hit the deck when firing at higher elevations. The elevation in this type of mounting can be increased either by lengthening the arms of the carriage or by raising the whole pedestal off the deck on a packing ring. Both these methods are objectionable, as they tend to raise the breech of the gun so far off the deck as to make loading a difficult matter when firing at moderate angles of elevation. But many such alterations were made to P. mountings during the war.

In the C.P. mountings a circular plate is bolted to the deck which has a low pivot in its centre. The circumference of the plate is shaped to form the lower roller path of the mounting, and inside this roller path a fixed circular training rack is fitted. Working round the pivot and carried on the rollers is the revolving platform of the mounting. The whole of the weight of the gun and mounting is taken on the rollers, the pivot being used only to prevent any lateral motion. Two side transoms are built up on the revolving platform, and at the top of these transoms are the trunnion bearings. Strengthening plates are built across the front of the transoms, but the rear side is left open to allow the gun and cradle to swing in elevation. The cradle is fitted with trunnions, and the gun works axially through it on recoiling. The recoil is controlled as usual by a recoil cylinder containing a fluid and a piston with a gradually restricted port.

The gun is run out after firing, either by springs or by pneumatic recuperators. The elevating arc is attached to the centre of the lower part of the cradle (instead of to one side as in the P. mountings), and into it gears a pinion carried on a shaft working through bearings in the side transoms. This shaft is geared to the elevating control wheel, which is fitted in the gunlayers' position. The mounting is trained by a pinion which works in the circular rack on the inner side of the lower roller path, and which is geared to training wheels at the gunlayers' and trainers' positions. All the voice pipes and electrical cables are brought on to the mounting through the central pivot. In this particular the C.P. mountings are much more convenient than the P. mountings, as the number of these leads has been much increased during recent years. An extreme elevation of 30° or more is obtainable on the latest C.P. mountings, and the breech of the gun is between 50 and 60 in. off the deck when the gun is horizontal. To facilitate loading a swinging loading tray, having a motion parallel to the axis of the gun, is usually attached to the left rear end of the cradle. Special platforms are provided for the loading numbers for use when the gun is being loaded at moderate angles of elevation.

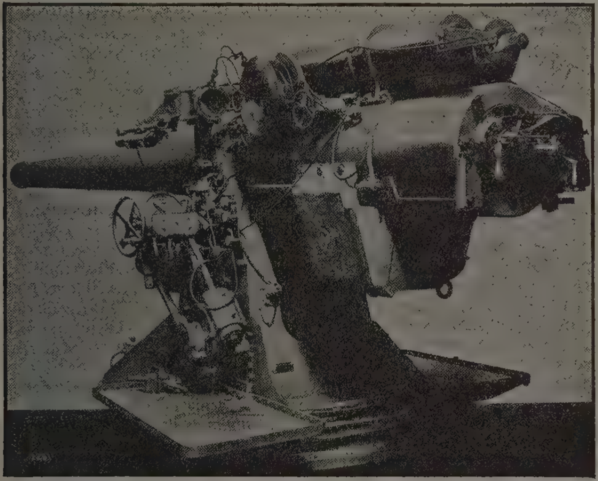

FIG. 48.—British 6-in. B.L. Mk. XII. gun on a Mk. XIV. C.P. mounting.

Typical mountings of this pattern are the British 6-in. C.P. XIV. and 5·5 C.P. II. The former is mounted in modern light cruisers and the latter is used in H.M.S. "Hood." Fig. 48 illustrates the 6-in. C.P. XIV. mounting.

Guns of Lesser Calibre.—The gun mountings used for the 4-in. and 4·7-in. guns have undergone a change from the P. to the C.P. type, similar to that which has taken place with the heavier guns, and for the same reasons. Guns of these calibres were used in large numbers during the war for two main purposes: (*a*) for the armaments of destroyers and other small craft; (*b*) for the defensive armament of merchant ships and auxiliaries.

For the destroyer armaments the guns that were used in the British service were the 4-in. Q.F. Marks IV. and V. and the 4·7-in B.L. Mark I. The two 4-in. guns are of the semi-automatic type, in which the recoil of the gun opens the breech and ejects the fired cartridge leaving the breech open, and the insertion of a new cartridge automatically closes the breech and puts the gun in the firing position. With these guns a rate of fire of from 15 to 20 rounds per min. can be obtained with a well-drilled crew. The 4-in. Q.F. Mark IV. gun was originally mounted on the P. IX. mounting, which is of the usual pedestal type with a maximum elevation of 20 degrees. The C.P. Mark III. mounting, which was subsequently introduced for this gun, is constructed on the same general principles as the C.P. mountings for the heavier guns, and admits of an elevation of 30 degrees. Certain modifications are introduced to suit the particular type of gun, and there are alterations in detail to meet the severe conditions that gun mountings are bound to be subjected to in destroyers. Both these mountings and all others designed for use in destroyers allow of a very long recoil, usually approaching 36 in. This is in order to minimize the deck stresses, which become serious when guns of this size are mounted in such lightly built craft. The 4-in. Q.F. Mark V. gun, which is heavier and more powerful than the Mark IV., is mounted on the C.P. Mark II. mounting, which is heavier than, but very similar in general design to, the C.P. III. and admits of an elevation of 30 degrees. The 4·7-in. B.L. Mark I. gun is mounted on the C.P. VI. mounting, which is a central pivot mounting very much like a small edition of the 5·5 C.P. II. The 4·7, being a B.L. gun, has its cartridges made up bare, with no brass cartridge case. A considerable saving in the weight of the ammunition is thus made but the rate of fire of this gun is less than that of the 4-in. Q.F. guns.

The very large numbers of guns required for the arming of merchant ships at the beginning of the war at first taxed the resources of the British navy to their utmost; in fact, at one period it became necessary to mount obsolete army guns on improvised naval mountings in order to provide some sort of armament. In the first two years of the war any guns of 6-in. calibre or smaller, that could be spared from other services, were adapted for defensively arming merchant ships. Subsequently the production, in bulk, of the 4·7-in. Q.F. Mark V. and the 4-in. B.L. Mark IX. guns provided a standard armament for this purpose. Both the mountings for these guns were made as simple as possible, as they had to be handled to a great extent by unskilled men. The 4·7-in. gun is mounted on the P.V. mounting, a simple mounting of the pedestal type, without a shield, which gives the gun an elevation of 20 degrees. The 4-in. B.L. Mark IX. gun is mounted on the C.P.I. mounting upon which an elevation of 30° can be obtained. The gun on this mounting can be protected by a shield, but when it was first used in merchant ships this shield was not used. Subsequently, however, the shield was added in these ships, partly for moral effect and partly for protection against the weather, but the mounting was shorn of all other complications (see fig. 49).

The usual control of fire fittings and a more elaborate sight than was found necessary in the merchant ships can be fitted to this mounting, and in this form it was used for arming sloops and other small ships. Large numbers of these two guns were produced in the last year of the war and they were used to replace the less efficient weapons that had been mounted in merchant ships. A triple mounting was made for the 4-in. B.L. Mark IX. gun and was used in the secondary armament of the battle-cruisers of the "Renown" class. In this mounting the guns are carried side by side in cradles which move together in elevation, on a mounting of the C.P. type. A few special mountings for 4-in. guns have been made for arming submarines. These are usually of the pedestal type, are constructed of non-corrosive metals and are specially designed to offer small resistance to the water when the submarine is submerged.

With regard to the smaller guns, the 3-pdr. and 6-pdr. may be considered to be obsolete except in very small craft. It is true that large numbers of these guns were used in the early part of the war because they were in existence and there was nothing at the time to take their place. Later they were replaced, almost entirely, by the 12-pdr. Q.F., large numbers of which were used for arming patrol craft, small merchant ships and auxiliaries. Several different pattern mountings were used for 12-pdr. guns, but all are of the pedestal type and most of them admit of an elevation of 30 degrees. The 12-pdr. gun is usually laid, trained and fired by one man, elevating gear being fitted and the training being controlled by a shoulder-piece.

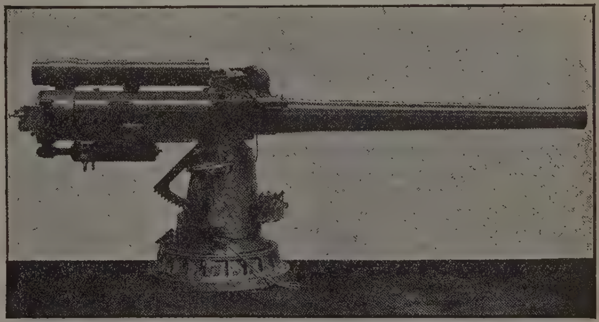

FIG. 49.—British 4-in. B.L. Mk. IX. gun on a Mk. I. C.P. mounting.

High-Angle Mountings.—The rapid development of aircraft has called for a new type of armament in the form of a high-angle gun. The commencement of the war found all nations unprepared to meet the new forms of attack that were quickly developed by the aircraft; and although the menace had been realized none of the belligerent nations had advanced much beyond the trial stages in the development of an anti-aircraft armament. The problem of hitting an airship or aeroplane is a difficult one, since the target is moving in 3 planes and at great speed. A vast amount of experience was obtained on shore during the war, but the problem is still far from being entirely solved. It is true that the high-angle gunfire succeeded in making the aircraft fly at a greater height, and therefore the attainment of their objectives has been rendered more difficult. At sea, much less experience has been gained and the problem is a much more difficult one, since the platform upon which the guns are mounted is a moving and unstable one and this adds immensely to the complications. The attack of aircraft necessitates the use of special shell and very accurate fuzes, and it is with the latter that a large number of difficulties have occurred. At the outbreak of the war high-angle armaments were called for at short notice and in large numbers. There was no opportunity of carrying out prolonged programmes of trials and consequently the ammunition used at first was faulty. Experience improved the material and the methods of using it, and by the end of the war the anti-aircraft guns were a factor to be seriously considered by the aircraft, although the problem at sea remains a very difficult one.

In 1914, a 3-in. Q.F. semi-automatic gun on a mounting capable of 85° of elevation had been completed for the British navy. This equipment, in slightly varying forms, became the chief anti-aircraft gun used in the British service, both ashore and afloat, during the first 3 years of the war. The gun is mounted on a roller-path mounting of the central pivot type, the trunnions being carried high enough to allow the gun to be fired at extreme elevation without the breech fouling the deck on recoil. The semi-automatic gun, with the cartridge and shell fixed together as one element, is used in order to obtain an extremely rapid rate of fire. Several modifications have been made to the original mountings to enable them to be used in small vessels such as destroyers and submarines. In these mountings the sight and the recoil and running-out cylinders are placed below the level of the gun and the mounting itself is simplified and made suitable for submersion in salt water by using non-corrosive metals. The running-out springs of all high-angle mountings have to be considerably strengthened to deal with the increased stresses at high angles of elevation and in some cases pneumatic recuperators are used instead of springs.

At the outbreak of the war, in order to provide a high-angle armament of some sort, a large number of gun mountings was rapidly converted so as to be able to fire at high angles of elevation. Within a few months all important ships in the British fleet were provided with two H.A. guns each, either proper equipments or conversions. The latter were, in no case, satisfactory and they were all replaced by proper H.A. guns as soon as these became available. In 1916 the increased activity of the enemy aircraft, and their more frequent appearance at sea, led to a demand for a larger H.A. gun than the 3-inch. The 4-in. Q.F. gun was brought into use, and was at first mounted on mountings designed for the 3-in. gun, which were suitably strengthened. The 4-in. H.A. Mark II. mounting was eventually introduced for the Q.F. Mark V. gun and this is at present the standard H.A. armament for all capital ships of the British navy. The mounting is, in general arrangement, a large edition of the original 3-in. H.A. mounting.

The indications are that the size of anti-aircraft guns will tend to increase. The first essential, however, of an efficient anti-aircraft gun is extreme rapidity of fire, and a limit is imposed on the size of the gun by the weight of the ammunition. A round of "fixed" ammunition for a 4·7-in. gun weighs about 80 lb. and this is as much as can be handled by one man with any degree of rapidity. It does not appear, therefore, that H.A. guns will increase much above this calibre, unless a complicated power-worked mounting is adopted. The chance of hitting the aircraft must be improved, and the extent of the menace of the aircraft to the capital ship will have to be more clearly defined before it can be anticipated that this step will be taken by any navy.

Fire Control.—The installation used for the control of the gunfire of warships had become increasingly intricate in the years before the war, and the experience gained during the war has made the addition of further complications necessary. Little can be said as to the details of the many instruments used, as the majority of them are confidential, and the functions, and even the existence, of some of them are kept as secret as possible. All nations are very reticent as to the actual systems employed in their ships. But the main problems are the same for all, and can be considered in 3 divisions:—(i.) the communications between the control stations and the guns, (ii.) the apparatus for obtaining the range and deflection and keeping them both correct, (iii.) the arrangements for firing the guns and observing the fall of the shot. These 3 sections must work in unison to form a perfect organization, and the system that is employed to make them do so must be able to withstand the stress of action conditions without breaking down. The methods employed to attain this are kept secret by all navies, and these methods are continually being altered and improved in detail, as the result of experience gained in practice and by the invention of new apparatus. In the following paragraphs a brief outline will be found of the principal instruments used in each section.

Communications.—The positions between which communication must be maintained are the observing positions aloft, the principal control position, which is usually in the vicinity of the conning tower, the turrets or other gun positions and the transmitting station. Communications must be rapid and sure as most of the information sent is only of value at the moment of transmission and loses its significance if any delay occurs. Hence several lines usually exist between important stations, any of which can be instantly used in the event of breakdown in the others. All lines of communication are usually concentrated from the outlying stations into the transmitting station. This station is situated in the centre of the ship, below the armoured deck, in the quietest position that can be selected and it forms the centre of the whole control organization.

Voice pipes are used to a great extent between stations that are permanently manned and are moderately close together. Their acoustic properties, however, become poor when the distances are increased beyond certain well-defined limits for each diam. of pipe or when there are bends in the lead of the pipes. Voice pipes are also difficult to make watertight or gastight.

The telephone is generally used between all stations, often in addition to the voice pipe. There is usually a telephone exchange, either in or near the transmitting station, for the sole use of the fire-control organization and independent of the general telephone system of the ship. Between important stations direct telephones, not connected to the exchange, are sometimes used. The actual transmitters and receivers are of many patterns, specially designed for operators who have other duties to perform or who may have to use the instruments in positions exposed to the weather. Electro-mechanical transmitters and receivers are used for passing range, deflection, bearing, orders and other information of a standard character between the control positions and the guns. There are several different patterns of these instruments, the most commonly used being the Barr and Stroud "step by step" and the Vickers "counter" types, both of which are in use in the ships of all navies. Frequently, with both these types a single transmitter is arranged to work a number of receivers in outlying stations and the uses to which the instruments can be put are manifold. A development of these instruments is found in the "follow the pointer" method, which is commonly used for transmitting ranges from the transmitting stations to the guns. Here the transmitter is in the form of a sight dial upon which the desired range is set by moving a pointer to the required setting. The motion of the pointer is transmitted electrically to a pointer on the gunsights. A mechanical pointer, geared to the mechanism which works the sight, is kept in line with the electric pointer and the sight is thus kept set without the sight-setter having to watch the movements of a separate instrument. This greatly simplifies the work of the sight-setter and eliminates errors. The large clock-faced dials and other similar arrangements that are often seen about the upperworks of warships are used for communicating the range and deflection in use to consorts who may be firing at the same target. Their place will probably be taken in the future by wireless telegraphy or telephony.

Range Finding and Keeping.—The transmitting station forms the centre of the whole control organization. In it are situated the majority of the calculating instruments, and through it are passed all the orders from the control officer to the guns. The functions of the majority of the instruments in the transmitting station and their details are, naturally, confidential. Broadly, they consist of arrangements for deducing the course and speed of the enemy from such data as may be available, and for calculating from this the change of range and deflection that should be applied to the gunsights. In the British service a calculating table, invented by Capt. F. C. Dreyer, is in general use, and to this improvements are continually being added to meet the changed conditions brought about by the increasing range at which the guns are used. The principles upon which this table is worked are secret, but there are other sets of apparatus, notably the Argo and the Ford, which have been patented and which aim at achieving the same results. Apart from the calculating apparatus, some form of which is in use in all navies, there are certain instruments employed generally for obtaining the required data, and a few of these can be mentioned.

Range-Finders.—The range-finder most commonly used in all navies is the Barr and Stroud coincidence instrument which has been in existence for a number of years (*see* RANGE-FINDERS). In the British navy this instrument proved its value during the war. To obtain greater accuracy at long ranges the length of the base of the range-finder has been increased from the original one metre to as much as 30 ft. The one-metre instrument is now employed only for navigational work and a 4½ or 9-ft. instrument is used in destroyers and other small ships. In light cruisers 9-ft. and 12-ft. instruments are used, and the 15-ft. instrument is in general use in capital ships. In some of the latest ships the base length has been increased to 30 ft., these instruments being usually mounted in turrets. The Barr and Stroud range-finder has been found to give generally satisfactory results, and any man with normally good eyesight can be trained to obtain accurate observations with it. In this it has a great advantage over the range-finders constructed on the stereoscopic principle, as used in the German and in some other navies.

To use one of these instruments it is necessasy for the observer to have stereoscopic vision, a rare gift and one which varies in quality from day to day. A range-finder constructed on the sextant principle (Waymouth-Cooke) has been used to a considerable extent in destroyers. The instrument is small and handy, but the results obtained have been far from accurate and it is being superseded by the short-base Barr and Stroud instrument. At present there are at least 6 range-finders mounted in a capital ship for the use of the gunnery control, and this number is reduced proportionately in the light cruisers and smaller ships. In a capital ship one instrument is mounted in each turret and 2 others in positions aloft or above the level of the guns. The results of the observations of all the instruments are transmitted electrically to the transmitting station, where apparatus exists for rapidly obtaining a mean of the observations, thus giving what is called the "mean range-finder range." To this it is necessary to apply corrections for the density of the air, the effect of wind, the temperature of the charges and the nature of the projectile, the change in the range during the time of flight of the projectile and for several other variables, in order to obtain the "gun range" with which fire is opened.

Change-of-Range Calculators.—When two ships are moving at high speed on different courses, the range between them is constantly changing at a varying rate. This rate of change of range can amount to upwards of 1,500 yd. per min. under action conditions, and it therefore is of great importance that it should be correctly known. The elements upon which the rate of change depend are the course and speed of the firing ship and the bearing, course and speed of the target. The first two of these are known, the third can be easily observed, but the last two are not known and can only be judged approximately. To obtain the rate at any given moment involves the solution of two triangles, the functions of which have just been mentioned. Several different types of calculators are in use for this purpose and that universally used in the British service is the Dumaresq, invented by Rear-Adml. L. S. Dumaresq. In this instrument the known and unknown elements are set graphically and the resulting rate of change of range, corresponding to the combination of the settings, is read off in "yards per minute," which is what is required. The speed of the enemy must always be guessed in the first place, but instruments known as inclinometers are being experimented with whereby the angle between the course of the target and either the line of fire or the course of the firing ship can be observed with fair accuracy at any moment.

Range Clocks.—Some type of clock which can be made to run at the rate of change of range is in use in all navies. In the British service the Vickers clock is used. This consists of a powerful clockwork escapement which drives a horizontal circular plate at a constant speed. Above this is a similar plate, the speed and direction of whose motion are controlled by the position of a friction roller mounted between the two plates. This roller is arranged to travel along a common diameter of the two plates. The motion of the upper plate can be varied from zero, when the roller is at the centre, to the maximum in either direction when the roller is at the ends of the radii. The pointer of the clock is geared to the upper plate and the face of the clock is graduated in yards. By altering the position of the roller the speed and direction of the pointer, in yd. per min., can be adjusted at will. Arrangements are made so that large corrections in range can be put on the perimeter of the clock without interfering with the motion of the pointer, so that the clock can always be run at the "gun range" that it is desired to transmit to the guns. This is the simple method of using the clock, but there are many other uses to which it can be applied.

Deflection Calculators.—It is a difficult matter to calculate the correct deflection for hitting a target at long range. The deflection depends, first, on the lateral motion given to the projectile by the speed of the firing ship. This is at its maximum when firing on the beam and vanishes when firing right ahead, but it is known and can be allowed for. Next comes the adjustment necessary for the movement of the target across the line of fire, between the moment of firing and the arrival of the projectile at the target. The amount of this correction depends on the distance and speed of the target and the angle between its course and the line of fire. This adjustment can be obtained with a fair degree of accuracy by calculation from the data that are used for obtaining the change of range, and a variety of deflection calculators are in use for this purpose. There is, however, a variable component caused by the effect of wind on the projectile. Allowance can be made for the wind at the firing ship, but at long range the wind effect at the target may be entirely different. Also the direction of the wind in the upper air, through which the trajectory of the projectile passes, is an unknown factor. All deflection calculators, therefore, have their limitations, and the usual practice is to calculate the proper setting as far as is possible and then to correct it by observation of the fall of shot.

Bearing Indicators.—These instruments are mounted in the control positions and are sometimes, as in the Evershed type used in the British navy, arranged to transmit the bearing of the target electrically to the guns and to the transmitting station. The instrument consists of a bearing plate, mounted with the zero adjusted to the fore-and-aft line of the ship, and graduated in degrees from 0 to 180 on each side. On the plate is mounted a telescope or binoculars. The movement of the telescope in azimuth, as it is kept trained on the target, works an electrical transmitter. The bearing of the target with reference to the fore-and-aft line of the firing ship is thus transmitted to the different stations. This forms a ready method of indicating the correct target to the guns, and from the observations the rate at which the bearing is changing can be obtained. This rate of change of bearing is used for calculating the course and speed of the enemy, and is also a measure of the deflection due to the relative movements of the firing ship and the target.

Methods of Firing.—Before the range at which heavy guns are used at sea became so extended, it was the practice to use a single gun for ranging before opening fire with the whole broadside. The differences between the shooting of individual guns, due to the wear of the guns, the temperature of the charges and a variety of other causes, become accentuated at long ranges and no two guns can be built that will always shoot precisely the same. This leads to a pattern or spread always resulting when a number of guns of the same size are fired at the same elevation. This "spread of the salvo," as it is called, can be reduced by making careful adjustments, but it can never be entirely eliminated. It can be made, however, an approximately constant quantity, known to the control officer of each individual ship. To base the corrections for the whole broadside on the result of the fall of the shot from a single gun, which may differ from the remainder, is obviously liable to lead to large errors. Also, at extreme ranges, the splash made by the fall of a single shot is difficult to see, even when using the best glasses. It is now the general practice to range with a salvo of several guns, usually half the broadside, and to continue firing alternate salvos of an equal number of guns. The object of the spotting officer, who knows the approximate spread that his salvos will give, is to apply such corrections as will bring the mean point of impact of his salvos on to the target. He then knows that he is obtaining the maximum hitting effect from the armament that he is controlling.

Directors.—Practically all navies have now adopted some form of master sight or director, whereby all guns that are loaded and laid at a prearranged elevation and training can be fired by a single gunlayer. Such a system of firing the guns has many obvious advantages, chief amongst which are the elimination of smoke interference of one gun with another, the reduction of the personal errors in laying and the fact that it is much easier to correct for the fall of a salvo that falls "all together" instead of being spread out over an irregular time interval. In the British navy the director installation invented by Adml. Sir Percy Scott is used. In this system a director sight is mounted aloft, or in a director tower well separated from the guns themselves. The sight is similar to the gunsight and all the usual settings can be made on it. The sight is carried on a mounting which is capable of being moved in elevation in the same manner as a gun mounting, but the efforts required for moving the sight are naturally much smaller than in the case of a mounting carrying a gun. The motion of the director mounting is communicated electrically to training and elevation receivers in the turrets or gun positions, thus causing the electrical pointers on the receivers to indicate the position of the director mounting. Mechanical pointers are fitted in the director elevation and training receivers at the guns, which are geared on to the moving parts of the gun and mounting.

The position of the gun in elevation and training is thus also indicated on the director receivers. By working the elevation and training control gears of the gun so that the mechanical pointers are kept in line with the electrical pointers, the guns are made to follow the motions of the director mounting. When the director is being used the range and deflection are set on the director sight and the director telescope is kept laid on the target by the director layer and trainer. The gunlayers and trainers at the guns keep their pointers in line for elevation and training, and the guns are thus laid to correspond with the position of the director sight. The firing circuits of all guns are brought to a single trigger at the director sight, so that all guns that are ready can be fired simultaneously by the director layer. This brief description indicates the principal functions of the director, but in actual practice there are many complications. The vertical and lateral distances of the director sight from the guns have to be allowed for and compensation has also to be made for any differences in the levelling of the gun mountings and of the director mountings. Arrangements are also necessary to compensate for the errors of the individual guns due to wear and other causes. On the whole the installation is an intricate one but the results that have been obtained have rendered it invaluable. In capital ships there are 2 director sights, which can be used alternatively for the main armament, one mounted aloft and the other in a position just above the level of the guns. A director sight is also fitted for use with the secondary armament. Light cruisers are fitted with a director for their main armament, and a modified form of director is in use in destroyers.

Sights.—The principles upon which the sights of naval guns are constructed have not been altered in recent years, but a great many alterations in the details have naturally been introduced to meet the requirements of the different types of gun mountings that have come into use. Telescopic sights are invariably used for all modern guns, the telescope being so arranged that, when the sight is set at zero, the axis of the telescope is exactly parallel to that of the bore of the gun. The telescope is carried in a carrier on a sight bracket and has two motions controlled by the adjusting mechanism of the sight. The angle between the axis of the telescope and the bore of the gun can be altered in the vertical plane to the angle of elevation for the required range. The range dial of the sight is graduated in yards to correspond to these angles of elevation; and when the telescope is laid on the target, its axis being horizontal, the axis of the gun is laid at the required angle of elevation. Similarly the telescope can be moved in the lateral plane through the number of degrees required for deflection; and when the telescope is then pointed at the target the gun is laid at the required angle to the right or left. The graduations of the deflection dials are sometimes in degrees and sometimes in knots, to the right or left, the latter being only exactly correct at a particular range.

Allowance is made for the permanent angle of drift of the projectile by fixing the whole sight bracket at a permanent angle to the vertical. The telescopes used are generally of variable power; that is, their magnification can be adjusted from about 3 to perhaps 20 diam., the high power being used for good visibility and the low power for bad conditions. In the field of the telescope some mark is arranged to indicate the point to be brought on to the target in taking aim. The most usual form is a vertical and horizontal cross wire, across the diam. of the field, though in some cases arrows or circles are used. In telescopes intended for use at night, small electric lamps are fitted for illuminating the cross wires so that they and the target are shown up on a dark background. All telescopes are arranged so that they are not affected by the recoil of the gun and are placed as close as possible to the trunnions of the gun, or cradle, so that the motion of the gunlayer's head is limited although the gun may be moved through large angles of elevation.

In turrets the sight brackets are usually bolted directly on to the trunnions of the slide and rock with it, so that all backlash is eliminated. The sight bracket carries an arc upon which the telescope-carrier travels, and the position of the carrier on the arc determines the angle between the axis of the telescope and that of the bore of the gun. This angle is expressed in yd. on a dial which is geared to a rack on the arc of the sight bracket. The lateral motion for adjusting deflection is given to the telescope by pivoting its carrier at the front end of the bracket, and moving the rear end by gearing which is attached to the deflection dial. The whole of the deflection-setting gear is arranged to move in elevation with the telescope-carrier. Means are provided for adjusting the sight for the M.V. of the gun and for the temperature of the charge. This is usually effected by moving the zero position of the setting pointer of the sight.

At all hand-worked guns (except the smallest) 2 sights are fitted, one on the right and the other on the left of the gun. One of these sights, usually the left one, is used by the gunlayer, who fires the gun, for laying the gun in elevation, whilst the other is used by the trainer, whose duty it is to keep the vertical cross wire trained on the target. The two sights are cross-connected so that both can be set simultaneously for the range and deflection adjustments. The sights are mounted as close to the trunnions as possible to avoid undue motion of the heads of the gunlayer and trainer. In the most modern sights the telescope-carrier travels on an arc in much the same way as has been described for turret sights, but some types of sight are still in existence in which the front end of the carrier is pivoted and the rear end is given a vertical motion by suitable gearing.

A more complicated type of sight is needed for use with high-angle guns against aircraft. The target in this case is moving in 3 planes; that is, horizontally and laterally for range and deflection, and also vertically, this latter being usually described as the vertical deflection. The great speeds at which aircraft move in these 3 planes render the design of an accurate and easily set sight a difficult matter. During the war a number of high-angle sights were produced, most of them being of a makeshift character adapted for use with converted mountings. The problem of obtaining accurate gunfire at aircraft from guns mounted on the unstable platforms afforded by ships still remains to be solved, and the type of sight which will be adopted for this purpose still awaits the result of further investigation. Meanwhile many devices are in use for applying the range and the vertical as well as the horizontal deflection, but none of them can be said, up to the present, to meet all the conditions required.

Director sights are of the same general type as those of the guns that they are designed to fire, but there are additional devices fitted to compensate for various errors introduced by the distance of the master sight from the guns and to suit the details of the director mounting itself.

The electrical "follow the pointer" system of transmitting ranges and deflections to the guns, which is in general use and has been previously referred to, adds complications to the details of the design of the sights, but does not affect the principles.

Naval Howitzers and Bombthrowers.—A new class of naval ordnance was introduced in the latter part of the World War for use against submarines. This was the naval howitzer or more particularly, bombthrower.

The early submarines were small in size, had little or no gunpower and were liable to damage by gunfire when on the surface. Consequently the first anti-submarine measures took the form of arming vessels with small guns. This had the effect of forcing the submarine to dive when within range of an armed vessel, and thus their movements were handicapped and successful torpedo attack was made more difficult. The submarine rapidly increased in size and commenced to carry larger guns, thus becoming much more formidable when on the surface. This led to the mounting of anti-submarine guns of larger calibre, but the submarine at all times offers a small and difficult target. Also, all but the very earliest boats are built with double hulls and are consequently very difficult to damage seriously by direct attack with the gun, owing to the "pressure" or inner hull being below the waterline.

From early days it had been realized that some form of underwater attack would be called for to counter the submarine and as early as 1912 attempts were made to produce a diving shell. Extensive trials were carried out without success with the object of obtaining a projectile that would dive at low angles of descent when fired from a high-velocity gun with a flat trajectory.

Howitzers and bombthrowers were first tried during the investigation of the diving-shell problem in 1912, but the ranges obtained were considered, at that time, to be too small to be of value at sea. The question of the use of howitzers was reviewed at the outbreak of war, but the development of the submarine at that time was not such as to demand this form of weapon as a necessary counter-measure. It was not until after the pronounced increase in the size of the submarines in the latter part of 1916, that the question was seriously considered. It was at this time that the Sutton-Armstrong 3·5-in., 200-lb. stick bombthrower was developed as the first purely naval weapon of this type. The early part of 1917 produced an urgent demand for a simple form of howitzer for use afloat, to fire a shell or bomb which would dive and which could be rapidly manufactured in large numbers. This led to the introduction of the 5-in. howitzer, the 7·5-in. bombthrower, the 7·5-in. howitzer, the 10-in. bombthrower and the 11-in. howitzer, and at the same time experimental work was carried out with several naval weapons proposed by various inventors. The final development in the use of these weapons was their adaptation to fire the heavy external stickbomb, of the same type as that used in the 3·5-in. S.B.T. This greatly increased their effectiveness as anti-submarine weapons, and the use of these projectiles from all howitzers and bombthrowers was being extended when hostilities ceased.

The *3·5-in. Sutton-Armstrong stick bombthrower* was evolved from a model already in existence which had been designed for trench warfare. The bombthrower consists of a single tube with a trunnion ring screwed on to it. The tube screws into a spherical explosion chamber on which is a lateral extension carrying a simple swinging breech mechanism. To facilitate manufacture an improved design was introduced at a subsequent date, in which the spherical explosion chamber was replaced by a cylindrical one with an axial, instead of a lateral, breech mechanism. The original bombthrower was fitted with a Temple silencer, with a view to preventing flash and noise when in the trenches. This being of no importance in naval conditions, the silencer was removed, but it had to be replaced by a "blast cone" and a "blast screen" was embodied in the design of the mounting, as without these accessories the gunlayer's seat was untenable owing to muzzle blast.

The bombthrower is carried in a revolving bracket which is mounted on a fixed pedestal. The extreme elevation obtainable is 55° and the low limit in the earlier mountings is 18°, but this was afterwards altered to 5 degrees. A simple aperture sight is carried on a bracket bolted to the right trunnion and the bombthrower is elevated by the usual rack-and-pinion gear worked by a hand-wheel. A downward blow of some 80 tons results from firing the bombthrower on this rigid non-recoil mounting, and the strain caused damage to the base plates and ship's structures when the bombthrowers were first mounted. This defect was remedied by increasing the base plate to 60 in. sq., thus distributing the blow on firing over a greater area.

The charge is contained in a small brass cartridge cylinder fitted with a percussion primer. The bomb when loaded rests in the blast cone at the muzzle. The stick occupies practically the whole length of the tube of the bombthrower, and is fitted at its lower end with a gas check. The accuracy of the bombthrower is excellent, a mean error of 30 yd. being obtained at 45° elevation and of only 20 yd. at 30° elevation. When the development of the submarine campaign called for a larger bursting charge in the bomb, a 350-lb. bomb was supplied for this bombthrower, which was fired with the same charge as the 200-lb. bomb. The accuracy with this heavy bomb is extraordinary, mean errors of 7 yd. at 45° elevation and of 19 yd. at 30° having been observed. A considerable number of these bombthrowers were mounted in small craft during the war, and they proved to be one of the most efficient of the anti-submarine weapons of this type employed.

The *5-in. breechloading howitzer* was a small single-tube breechloading howitzer, designed for army use by the Elswick Ordnance Co., and adapted for use afloat. Their 50 and 40-lb. projectiles were too small for anti-submarine purposes, and the few of them that were mounted afloat were eventually withdrawn. Nevertheless they were the first weapons of the howitzer type that were actually mounted afloat for anti-submarine purposes.

Early in 1917 the necessity arose for a howitzer or bombthrower, for use afloat, which could be produced rapidly in large numbers and which was simple to handle and capable of a rapid rate of fire. The design chosen, from amongst others, was that of Messrs. Vickers for a *7·5 bombthrower.* This design was subsequently altered to a *7·5-in. rifled howitzer.* Eventually a small number of bombthrowers and a large number of howitzers were made of this pattern, the non-recoil mountings in both cases being identical. In the design and supply of these two weapons, the overruling question was rapidity of production, and no time could be spared on refinements of design or finish. The result (fig. 50) was a roughly finished equipment which, although it served its purpose at the time, would not be repeated. It is extremely simple in construction and consists of a rifled "A" tube, with screwed breech and trunnion rings. The breech mechanism is of a simple B.L. type with a rifle-lock firing gear. The weapon is in reality a very simply constructed low-power breechloading gun. The *7·5 M.L. bombthrower* is similar in construction to the howitzer but is smooth-bored and a breech plug is used instead of a breech ring. A simple sliding breech mechanism is fitted and the charge is contained in a small brass cartridge case. The bomb is loaded from the muzzle and is fitted with vanes.

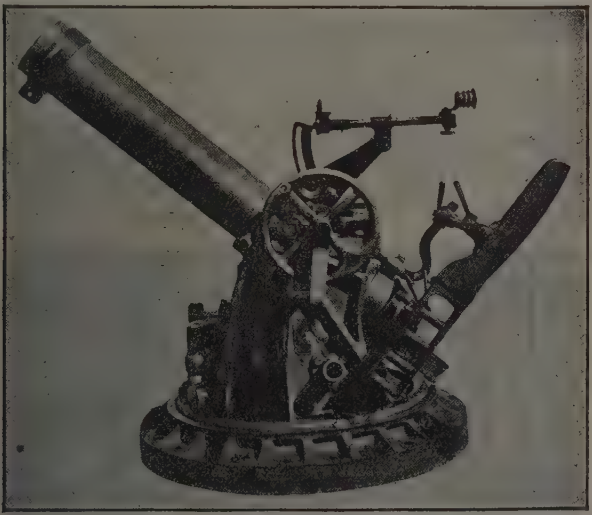

FIG. 50.—British B.L. 7·5-in. howitzer.

The mounting of both the howitzer and the bombthrower consists of a cast steel carriage, carrying recesses for the trunnions, which rests on the fixed pivot of the base plate. The lower surface of the carriage and the upper edge of the base plate are machined to form a training surface and the base plate is bolted to the deck. A strong all-round clip ring is fitted over the flanges of the base plate and the revolving carriage to hold the mounting to the base plate on firing. The effective blow transmitted to the deck on firing the howitzer on this rigid non-recoil mounting is large and necessitates very considerable strengthening to the ship's structure under the mounting. The elevating gear, as at first designed, consisted of a vertical screw, secured to a band round the breech of the gun and operated by suitable mechanism connected to the elevating wheel on the left of the mounting. On account of the distortion of the elevating screw by the firing stresses it was abandoned and a simple shoulder piece fixed to the gun itself, was adopted. A simple form of aperture sight is fitted. A rate of fire of 4 to 5 rounds a min. could be maintained with this howitzer; at one trial 20 aimed rounds were fired in 3½ min. with an untrained crew.

The main object for which these equipments were designed was achieved, as no less than 650 of them were actually mounted afloat within a year of the design being called for.

The *10-in. R.M.L. bombthrower* was a bombthrower of novel type which was evolved from a design produced by Messrs. Thornycroft (fig. 51). The bombthrower consists essentially of 2 parts, the explosion chamber and the barrel, the former being placed on top of the latter and secured to it by steel straps. The charge is burnt in a perforated combustion chamber secured inside the front end of the explosion chamber. The gases, after expansion in the explosion chamber, pass downward through a dowel in its rear end into the rear end of the barrel. The charge is contained in a small brass cylinder and is loaded at the front end of the explosion chamber, which is fitted with a simple sliding breech mechanism. The bomb is loaded from the muzzle and is fitted with six studs which engage in the rifling grooves in the barrel. The 10-in. bombthrower which was used in the British navy (the actual design of which was produced by Messrs. Vickers) is built up of a number of parts. This was done in order to make use of the shell-making plant which was available at the time. The non-recoil mounting is similar to that of the 7·5 howitzer in general design but is fitted with a stronger clip ring and powerful elevating gear. At the trials of the first of these weapons difficulty was experienced in determining a satisfactory charge. Very high pressures, which appeared to follow no known laws, were experienced in the explosion and combustion chambers, and it was only after a long series of trials that a suitable charge and design of combustion chamber were obtained by "trial and error." Though designed especially for rapid production to fulfill an emergency requirement, manufacturing difficulties rendered the results disappointing.

The *11-in. howitzer* was introduced in order to provide armed merchant cruisers and large vessels generally with a quick-firing anti-submarine gun of considerable size and firing a heavy projectile. The howitzer is built up and consists of an "A" tube, jacket and breech ring. The breech mechanism is of the Asbury type and is fitted with a rifle-firing mechanism. The mounting is a recoil one of more elaborate type than those of the other howitzers and bombthrowers, it being a roller-path mounting with cross-connected sights, hydraulic recoil, spring run-out and a loading tray geared to a quadrantal rack. The accuracy is very good, a mean error of only 17 yd. being obtained at 44° of elevation; and the errors in range at the lower angles of elevation are even smaller. Two reduced charges are used which also give good accuracy, and by using suitable charges the projectile can be made to dive at a minimum range of 225 yd. A considerable number of these equipments were mounted in vessels employed on convoy duties during the war.

The 6-in. Newton bombthrower was mounted on gymbals to give free and elastic support to the gun. The gun rode in a spherical cast-iron dish, the breech end of the gun being just clear of the dish. On recoil the gun set back hard on the inner surface of the dish and, the latter being very massive, the blow on recoil was largely absorbed by it, only a light stress being transmitted to the deck structure. A central stud was fitted at the bottom of the barrel to form a stop for the bomb when loaded. The barrel was mounted in a sleeve which formed the trunnions and attached to the barrel was a control arm carrying the laying handles and sights. This equipment as a whole proved unsuitable for service afloat, but the bombthrower itself was an unsatisfactory weapon and this fact possibly obscured any good points which might have appeared in the principle of the mounting.

Heavy Stick Bombs.—Early in 1918 it became increasingly evident that projectiles with a heavier bursting charge than those in use in the existing howitzers and bombthrowers were necessary if any real damage was to be done to submarines. A heavy projectile which would dive at short ranges was required and this led to the introduction of the heavy stick bomb. A hydrostatic fuze is used in these bombs, to fire the bomb when it arrives at a prearranged depth below the surface. In all trials the accuracy was very good and it was found possible to use the same charge as when using the internal projectiles in the same weapon, thus eliminating complications in supply and drill. The trials were extended with each weapon by firing the lighter bombs, with the same full charge, down to the bomb which contained a burster approximating to that of the internal projectile of the particular weapons. Many trials were carried out to perfect the fuzes and detonating arrangements of these large bombs, and supply in bulk was about to be made to the service afloat when hostilities ended.

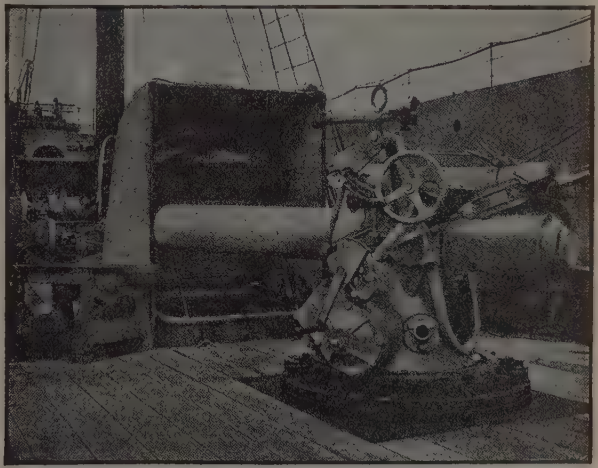

FIG. 51.—British 10-in. R.M.L. bombthrower.

During the last six months of the World War it became increasingly necessary to introduce some method of throwing a heavy explosive charge to a distance of 150 yd. or more. The use of the stick bombs was therefore applied to the smaller guns, and a series of trials, carried out in June and July 1918, showed that the same stick bombs as were used in the howitzers and bombthrowers could be fired from guns of 4·7-in. calibre and below. It thus became possible to supply to these guns a projectile which contained a burster of the same order as that of a depth charge. Measures were at once taken to supply these projectiles generally, but unavoidable delays occurred in manufacture, and it was not till Nov. 1918 that issue of bombs of this class began on a large scale. (S. T. H. W.)

(VIII.) Anti-Aircraft Equipments

On the advent of aircraft in practical offensive operations, it was found that the existing types of artillery equipment, both mobile and fixed, were hopelessly deficient in the essential qualities necessary for effective results. The speed and height at which aircraft operate are factors of great importance, as they combine to cause a considerable angular displacement during the time of flight of a projectile. The essential characteristics required in a gun are high velocity, high rate of fire and capability of being loaded at any angle of elevation, including means to prevent the round slipping back after loading. And the carriage must be designed to permit of the gun being loaded, laid and fired at all angles of elevation and traverse. The design must ensure a level platform so that, for accuracy of fire, the gun may pivot truly in the vertical and horizontal planes.

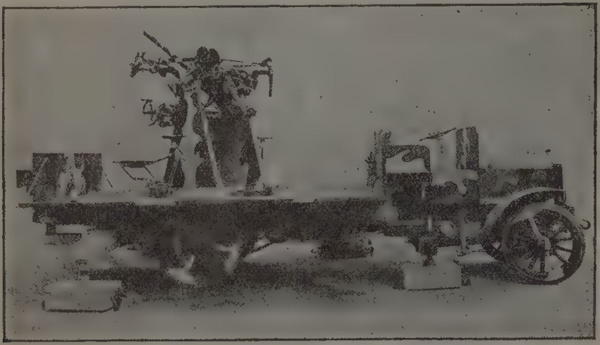

FIG. 52.—British 3-ton lorry, with 12-pdr. gun.

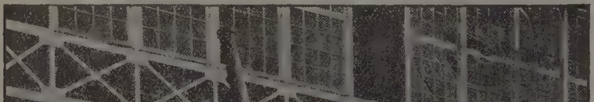

FIG. 53.—Schneider 105-mm. gun, on anti-aircraft mounting. Firing position.

Few specially designed A.A. equipments existed in any country and of these the greater part were constructed for fixed emplacements. In some countries these were augmented by makeshift mountings which usually consisted in a framework of pivot and platform in which the service field gun and carriage could be placed bodily. Soon, however, it became apparent that mobile as well as fixed guns were required.

To meet this need the British adapted a certain number of 13-pdr. and 18-pdr. guns, which were mounted on motor lorries. These answered the purpose for a time, but in view of the necessity for a gun having a higher M.V. than these, the 13-pdr. of 9 cwt. was evolved. This gun was practically a combination of the two: externally, its dimensions were those of the 18-pdr., and internally it had the bore of a 13-pdr. and chamber of an 18-pdr.; that is to say, it fired the 13-pdr. shell with the 18-pdr. charge. The breech mechanism was practically the same as that of the 18-pdr. field gun with the addition of a cartridge-retaining catch, but the striker was modified so as to be cocked automatically on opening the breech.

With fixed mountings the requirements of the carriage can be met by designing the intermediate carriage to permit of the high elevation, and mounting it on live rollers on a base ring to give all-round traverse. The base ring is secured by bolts to anchoring plates embedded in a concrete emplacement, additional nuts for levelling being provided.

The design of a mobile carriage is limited principally as regards weight. The pre-war attempts to design a mobile anti-aircraft carriage were largely adaptations of the field carriage, for example the Deport 75-mm. combined field and anti-aircraft equipment.

But the limited traverse and elevation which are inherent drawbacks in a field carriage prevent the mobile anti-aircraft equipment from being built up on the basic structure of a trail, axletree and wheels, and travelled with a limber like a field carriage. The design must be essentially the same as that of the fixed mounting, but the base ring must be mounted on a wheeled structure; further, road mobility as an entity is desirable, and, horse-draught not being up to the weight, mechanical traction must be resorted to.

The form of track as defined by rail, road and cross-country naturally assumes great importance. For railway travelling self-propelled unit-vehicles could be readily constructed; but restriction to a permanent way renders their use impracticable on a fluid front, while, for permanent defences, fixed mountings would be used.

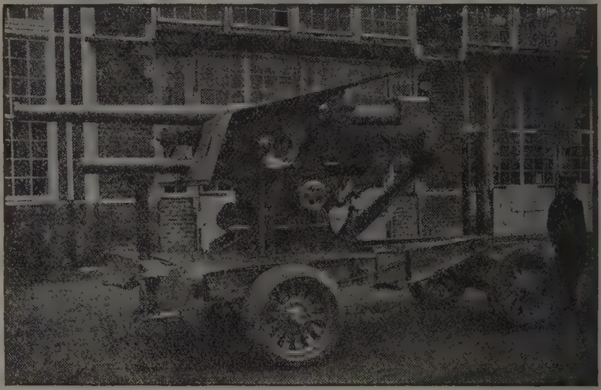

FIG. 54.—Schneider 105-mm. gun, on anti-aircraft mounting. Travelling position.

For road mobility there are two alternatives: a self-propelled vehicle such as the motor-lorry or a tractor-drawn vehicle. In accordance with the law governing the maximum axle-load, the weight restricts the use of the lorry to comparatively light equipments. Thus, for the mounting of medium guns a special type of travelling platform, lorry-drawn, is generally employed.

For cross-country travelling ordinary wheels are useless, the prevailing method being to employ caterpillars or wheels running on chain tracks. In this connexion the automobile type of vehicle may be utilized for light guns; but for medium guns the base ring of the mounting would probably be supported on a framework pivoted on the axles of a tractor-drawn, caterpillar mount.

The types of wheeled structure which have been evolved may be given as follows: the motor-lorry, the travelling platform with detachable axles and rubber-tired wheels, the caterpillar truck.

The 3-ton lorry (fig. 52), the first type of wheeled structure to be used, was employed as a travelling and firing platform for the 12-pdr. coast-defence gun and the 13-pdr. horse-artillery gun, both of which were adapted to a suitable pedestal mount fixed to the lorry.

With intent to maintain approximately a constant load on the steering wheels whether the vehicle be empty or loaded, the lorry is designed on the cantilever principle. This ensures easy steering, but entails the whole of the useful load being borne by the rear axle. To preserve this principle, the pedestal was fixed to a steel base plate bolted to the chassis frame directly over the rear axle. When travelling the springs of the lorry act to reduce travelling stresses; but as a stable and level platform is necessary for firing, the gun cannot be fired off the lorry wheels. For this purpose, the lorry is supported on 4 adjustable screws mounted at the ends of steel beams fitted to the underside of the chassis; the screws rest on packing pieces, and are manipulated until the weight is taken off the wheels and the platform levelled.

For light equipments and travelling on good roads, the lorry is a convenient platform, as it provides the tractive power and carries the gun, ammunition, stores and personnel within one vehicle. The latest equipment to be mounted on a 5-ton lorry is the 3-in. mounting modified to take the 13-pdr., 9-cwt. gun.

The travelling platform proper was designed to render mobile a mounting which was already in use in fixed defences; it is limited to the use of good roads. The platform, a rectangular steel structure, is mounted for travelling on a pair of detachable axle-arms carrying rubber-tired wheels. Adjustable screws pass through nuts at the extremities of arms hinged to each corner, and these arms are swung outwards to extend the base for firing; while, for travelling, the arms at one end are removed, the others being swung inwards and coupled to a motor-lorry. For firing, the platform is first raised by the screws and the wheels and axles removed; it is then lowered on to the ground and levelled. The underside is fitted with anchoring plates which, in conjunction with steel pickets, fix the platform for firing. The mounting is traversed on a circular base ring bolted to the platform.

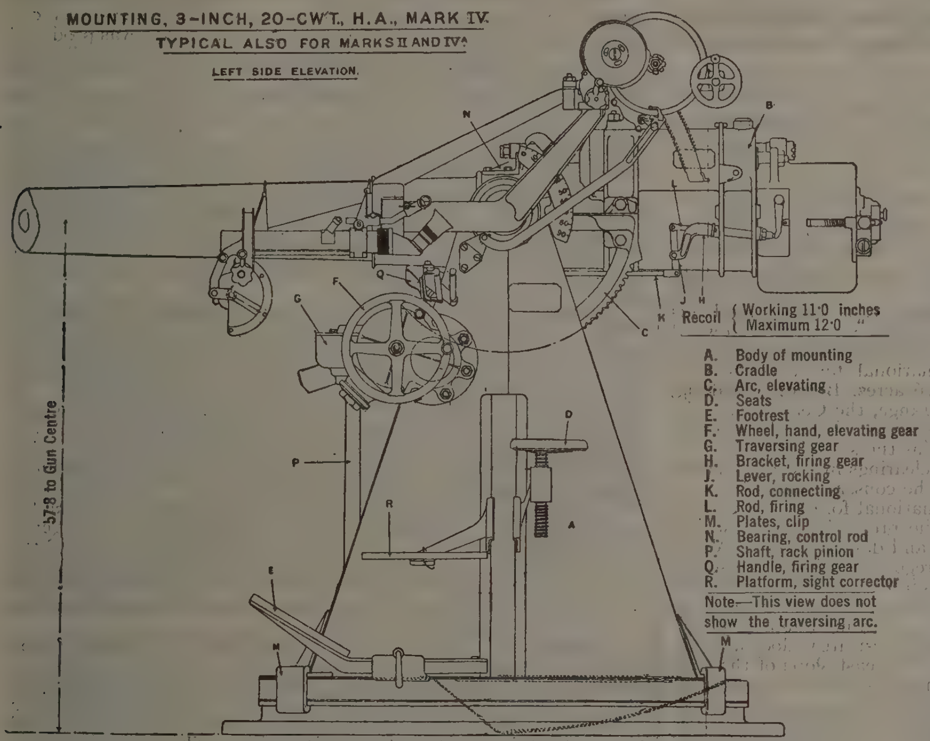

FIG. 55.—British anti-aircraft mounting for 3-in. gun.

FIG. 56.—3·6-in. anti-aircraft mounting, on caterpillar truck.

Figs. 53 and 54, showing the Schneider 105-mm. (4·2-in.) equipment, model 1918, illustrate this form of anti-aircraft mounting. In fig. 53 the gun is in the firing and in fig. 54 in the travelling position. The ballistic and other particulars of this gun are as follows: calibre 105 mm.; length overall 42½ cals.; weight of shell 37½ lb.; M.V. 2,760 fs.; range 15,400 yd.; weight of gun 36 cwt.; travelling weight of gun and mounting (inclusive of limber perch) 9½ tons; weight of system in action 8 tons, including shield.

The caterpillar truck as a travelling and firing support owes its introduction to two reasons: first, the need for travelling an equipment over other than good roads; and secondly, to enable a heavier and more powerful mobile gun to be employed.

The truck used with the British 3·6-in. gun described below is approximately 15 tons in total weight and is tractor-drawn (fig. 56.)

The truck frame or platform, which consists of 4 transverse and 2 longitudinal girders, is adjustably mounted to permit of 9° longitudinal and 5° transverse levelling. A screw-operated steadying arm is hinged to each corner of the truck for use when firing; these arms are swung outwards and operated until they bear on the ground, the weight being then distributed over the arms and roller chains. A base ring is bolted to the top of the frame.

The caterpillar truck is least mobile of the 3 types, but does not restrict the equipment to road travelling. It has an advantage in that the gun is fired off the roller-chains and steadying arms—unlike the platform proper, with which the wheels and axles must be removed for firing; while the levelling arrangements, though more complicated, are an improvement on the earlier adjusting screws.

As regards the mounting itself, the general principles of design may be illustrated by the British 3 in. (fig. 55). This may be either fixed or mobile, and the gun can be loaded and fired at any angle up to 90° of elevation, the height of the trunnions (nearly 5 ft.) giving clearance for the breech of the gun when firing at high elevations. The carriage is traversed on a live roller-ring which runs on the base ring, and is controlled by suitable gear. The ring cradle has a hydraulic buffer, spring recuperators, and is pivoted on trunnion roller-bearings at the top of the intermediate carriage; the elevation is controlled through gearing in mesh with two arcs underneath the cradle. Seats, foot-rests and trays for the convenience of the layers are adjustably attached to the intermediate carriage. The sights are of the rocking-bar type, and cross-connected to permit of dual control. When mounted in fixed defences, a training indicator, correctly oriented, is fixed to the emplacement floor.

The 4-in. mounting is generally similar to the 3-in., but, on account of weight, is used for fixed defences only. The gun can be fired up to 80° of elevation but must be depressed to 60° for loading. It has a tapered rod buffer and a hydro-pneumatic recuperator consisting in one liquid and two liquid-and-air cylinders.

The 3·6-in. mounting, designed on the rear-trunnioned principle, permits of all-round traverse and a maximum elevation of 90°. It may be either fixed (when it is mounted on a pedestal), or mounted on a caterpillar truck as here shown in fig. 56. By adopting the rear-trunnion system, employing a ring-cradle, and rearwardly extending the intermediate carriage at the top, the gun is carried in a relatively low position which permits of loading from the ground, gives a maximum clearance for recoil, and increases the stability. Balancing springs are fitted under the front of the cradle to overcome the muzzle preponderance; and to balance the intermediate carriage, when on a caterpillar mount, an extension to carry a counterweight is formed at its front end. The traversing gear is a 2-speed worm-and-rack drive. The elevating gears, of which one is operated on each side to embody the principle of the independent line of sight, are worm-and-arc-pinion drives. The recoil and recuperative arrangements consist in a rotary piston buffer with separate recoil and running-up valves, and a hydro-pneumatic recuperator of the floating piston type. The buffer is fitted with a spring-loaded tank and the recoils are controlled according to the elevation of the gun.

(F. M. R.)

OREGON (*see* 20.242*).—The pop. of Oregon in 1920 was 783,380 as against 672,756 in 1910, an increase of 110,624 or 16·4% as compared with an increase of 62·7% during the preceding decade. The average number of inhabitants to the sq. m. in 1920 was 8·2 as against 7 in 1910. The sparsely settled areas, other than the national forests, are the plateau region of the south-eastern counties and the extreme south-western county. In all the south-eastern counties, excepting Malheur county lying along the Snake river, there was a decrease in pop. during the decade. The density of the rural pop. in the nine south-

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** These figures indicate the volume and page number of the previous article.*

eastern counties, comprising an area of 47,737 sq. m., or about one-half the state, was less than 2 per sq. mile. The urban pop. of the 23 cities and towns with more than 2,500 inhabitants each numbered 391,019 or 49·9% of the total pop. as against 45·6% in 1910. The farm pop. in 1920 was 293,432 or 37·5% of the total in the state; in 1910, 41 per cent.

The following are the cities of over 7,000 inhabitants with their pop. in 1920 and 1910 and percentage of increase for the decade:—

	1920	1910	Increase per cent
Astoria	14,027	9,599	46·1
Baker	7,729	6,742	14·6
Eugene	10,593	9,009	17·6
Pendleton	7,387	4,460	65·6
Portland	258,288	207,214	24·6
Salem	17,679	14,094	25·4

Forestry.—The total wooded area of the state in 1920 was 41,111 sq. m., or 43% of the land area; there were 14 national forests with a total area of 24,086 sq. miles. However, as some of the lands within the boundaries of the national forests are privately owned or classified as chiefly valuable for agricultural purposes and open to homestead entry, the net area of national forest lands June 30 1920 was 20,472 sq. m., or 13,106,676 acres. Broadly speaking, the national forests cover the Cascade range, the Coast range, the Blue Mountains, and other mountainous areas. From the coast to the eastern base of the Cascade Mountains the state is heavily timbered, except for the farming lands and clearings in the Willamette, Rogue river and other minor valleys. The conservation policy carried out through the establishment of national forests had in view not only permanent forestry but also the protection of the water-supply for power, irrigation, navigation and domestic uses. While the large forest area of the state gives Oregon one-fifth of the standing timber in the country, it also ensures it 11% of the total hydro-electric power capable of development. The estimate for the state is a potential maximum of 6,500,000 H.P. and a minimum of 3,000,000 H.P. The reservation of the national forest areas does not preclude large utilization for stock-raising. The east slope of the Cascade Mountains and the mountainous regions of the eastern part of the state are grazed by both sheep and cattle, over 2,900 permits being issued by the Forest Service in 1920 for 120,000 head of cattle and 690,000 sheep. The seasons for grazing in the forests are comparatively short, but the feed is excellent and is available at a time when the live stock must be removed from farm lands to permit crops to grow, and therefore these Government-owned ranges are an economic asset of much importance.

Agriculture.—Of the total land area of the state 22·1%, or 13,542,318 ac., were included in 1920 in the 50,206 farms. Of this land, 36·5% was improved. There was an increase during the decade of 10·37% in the number of farms, 15% in their total acreage and 14·9% in the improved acreage. The personnel operating the farms included 49,633 white farmers and 573 of non-white races. Of the white farmers 40,484 were native and 9,149 were foreign-born, 31,569 of the native white farmers being owners, 802 managers and 8,113 tenants. The 573 non-white farmers included 15 negroes, 300 Indians, 224 Japanese and 34 Chinese; 358 were owners, 8 managers and 207 tenants. Eighty-one per cent of the Oregon farms were operated by the owners. During the decade 1910–20 the value of the farm property increased 55%; of land and buildings 48·2%; implements and machinery 214·8%; and live stock 71·2%. The average value of land and buildings per farm was $13,449 as compared with $10,012 in 1910; the value of the land alone per acre was in 1920 $43.29 as against $35.23 in 1910. Of the farms from which mortgage reports were obtained the mortgage debt was 31·2% of their value as against 22·6% in 1910. The average rate of interest paid was 6·5%. In 1910 33·7% of all farms operated by their owners were mortgaged while in 1920 the proportion had risen to 49·7%. The debt per farm was $3,622 in 1920. The crop values in 1920 were 192·7% higher than in 1910. The conspicuous increases were in the production of forage, of ensilage, and of fruits of every kind adapted to Oregon conditions. In 1920 the principal field crops with their values were as follows:—

Winter wheat	$33,213,659	Potatoes	$ 7,829,867
Spring wheat	9,366,703	Corn	2,429,132
Oats	8,162,649	Rye	1,778,474
Barley	2,503,536	Hay	32,906,225
		Hops	3,960,000

The total field crops were worth $106,185,746.

The principal fruits raised, with their values, were as follows:—

Apples	$3,210,653	Loganberries	$1,953,720
Pears	1,236,980	Strawberries	1,260,000
Prunes	4,126,950	Raspberries and blackberries	1,800,000
Cherries	1,234,500	Nuts	600,000

The total for all fruit was $15,787,803.

The numbers and values of domestic animals were as follows:—

Horses and mules	286,000	$23,266,000
Milch cows	205,000	15,375,000
Other cattle	651,000	24,412,000
Sheep	2,270,000	15,663,000
Swine	272,000	3,482,000

Mining.—The production of gold was $633,407 in 1911, but increased to $1,902,179 in 1916, to drop again to slightly over one million dollars in 1919. Silver to the value of $250,597 was produced in 1919. The copper output in 1919 amounted to 2,808,017 lb. fine. Iron has been mined and smelted in Clackamas county and considerable bodies of a good grade of limonite have been discovered and are being developed in the northern Coast range in Columbia county. Some manganese was produced during the World War, the chief occurrence being manganese oxides in a reddish volcanic tuff in Jackson county. The production of chrome ore was also stimulated by the war conditions and an output of 18,454 long tons of chromite brought $855,050. Nickel ore occurs in Douglas county and both tungsten ores and molybdenite in Wallowa and Baker counties. Although there are coal outcroppings in different sections of the state the output in 1918 had dropped to 13,328 short tons. Common clay wares in 1918 brought $232,564.

Industries.—Oregon has two important advantages for manufacturing: an abundance of such raw materials as timber, live stock, wool, wheat and fruit, and also readily available hydro-electric power. A relatively high transportation cost to reach a large body of consumers has been the factor handicapping development. In 1914 Oregon's manufactured products were valued at $109,761,951 and the average number of wage-earners employed was 28,829. The chief industries arranged in order of value of products were lumber and timber products, slaughtering and meat-packing, dairy products, printing and publishing, canning and preserving. The annual lumber production is from 2,250,000,000 ft. to 3,000,000,000 ft. and is rapidly growing. During the war, in connexion with the emergency shipbuilding programme, 44 steel hulls, with a total tonnage of 345,700 dead-weight, were launched and 13 hulls were on the ways. Beginning with the launchings in 1916, by Dec. 31 1918 145 wooden hulls, with a total tonnage of 446,100 dead-weight, were placed in the water and 50 hulls were on the ways.

Transportation.—The marked improvement in transportation facilities during the decade 1910–20 comprised the opening of the main waterways, extension of the railways so that the mileage increased by more than one-half, and a relatively extensive construction of highways. With the completion of the Celilo canal by the Federal Government in 1915 the Columbia and its tributary, the Snake, were made navigable to Lewiston, Idaho. Through the construction of this canal above the city of The Dalles a fall of 80 ft. in a stretch of 9 m. was overcome. With the transference to the national Government in 1915 of the canal and locks around the Willamette Falls at Oregon City, the free use of the upper Willamette was secured. As already stated, the coöperation of the Federal Government and the port of Portland secured a deep-water channel in the Columbia from Portland to the sea. The railway construction during the decade has provided: (1) lines to the Pacific coast, from Portland to Tillamook and from Eugene to Coos Bay; (2) extensions into central Oregon with parallel lines up the Deschutes river to Bend and westward from Vale in the Snake river valley; (3) construction on the gap between Natron and Klamath Falls as part of a double line for Oregon-California traffic; (4) electric lines from Portland to Eugene and from Corvallis to Eugene. The railway mileage in the state in 1910 was 2,413·61; in 1920 3,626·77.

The total of the sums apportioned to Oregon for highway construction by the Federal Government was $6,206,799.27. Bond issues by the state for the construction of a state highway system were authorized, beginning with the year 1917, to the amount of $40,000,000. During the biennium 1919–20 the cost of state highway work under construction was $28,479,981.94. Appropriations for market roads by the state of nearly another million were matched by the counties with an equal amount. In the amount of state funds available for highway work in 1920 Oregon stood fourth among all the states. In 1920 counties were authorized to issue bonds to the limit of 6% of assessed valuation for highway improvement, and since 1913 32 counties have bonded themselves for $17,599,704.

Education.—Oregon ranks second among the states measured by the collective educational standard of the Russell Sage Foundation. As this standing was attained with relative expenditures below those of 25 other states, it indicates a high standard of service among teachers and careful administration by school officials. The minimum length of the school sessions has been extended to eight months for every district. The amount of money which the poorest district in the state must have for school expenditures was in 1921 $940. The requirements for certification to teach in the elementary grades include the work of a standard high school and in addition an elementary teachers' training course. After 1925 the teacher will be required to have had one year of normal-school work in addition to high-school preparation. In 1920 the total enrolment of grade and high-school pupils was 148,412, of whom 22,954 were in high schools. As the pop. of the state was 783,380, nearly 19% were in school; and 2·9% of the entire pop., or 15·4% of the school pop., were enrolled in high school. The largest city, Portland, leads all cities of the nation with 3·6% of its pop. in high school.

History.—The percentage of Oregon's contributions of men to the World War without awaiting the operation of the selective service law was the highest among the states. The ratio of its enlistments to the first gross quota was 157·84 per cent.

During 1910–20, recourse was freely had to the "Oregon System" of direct legislation to enact projects of constitutional amendment and statutory law. A total of 174 proposals was submitted to the people through initiative petition, referendum petition or by vote of the Legislature and 73 were approved.

The people of Oregon by this procedure established prohibition, woman suffrage and the rural credit system. Citizenship qualification for the franchise, the right to veto single items in appropriation bills, the abolition of the poll tax, classification of property for taxation, and state-wide limitation of the rate of increase of taxation and indebtedness were also thus enacted. But the most striking achievement through this procedure by popular vote was the regular and liberal support of institutions of higher education as well as of the public schools in the form of continuing state millage taxes. These were granted by an overwhelming majority vote of the people. There has been a change in the attitude of the people with respect to direct legislation; a project submitted by vote of the Legislative Assembly has fared better in recent years than one submitted by initiative petition. Clearly demonstrated advisability is required to secure the approval of an initiated project, whereas originally there was a prejudice in favour of such a measure. Probably the most important new departure has been the liberal authorization of the use of the public credit, both state and county, for road-building, of the credit of port districts for harbour improvement, and of the credit of irrigation and drainage districts and of deforested land districts for reclamation. Additional legislation included the establishment of the minimum wage, workmen's compensation, "blue sky law," licensing sales of corporation securities, and widow pensioning.

While three-fifths of the voters usually vote with the Republican party, so that as a rule only 10 or 12 Democrats are elected to any Legislative Assembly, the representative leaders of the Oregon public during 1910–20 were two Democrats, George E. Chamberlain as U.S. senator and Oswald West as governor. Mr. Chamberlain was promoted from the governorship to the Senate; and in the Senate he was distinguished for his independence, especially during the war as chairman of the Senate Committee on Military Affairs. Oswald West, as governor (1911–5), deserves high credit for leadership in achieving much of the progressive legislation enacted during this period, and for his administration of the state penitentiary and the selection of those placed in charge of other state institutions; also for his application of the honour system among convicts and his insistence on a regimen of industry and cleanliness in the Oregon penitentiary.

During the decade 1910–20 the people of Oregon began to demand more active progress in their state government. While there had been before 1910 a half-hearted venture in railway regulation, later repudiated, and institutions of higher education had been receiving meagre support for some decades, the spirit of the constitution of 1857 was still dominant. That document had been drafted by men with whom the disastrous experiences of the Mississippi valley states in canal and railway building with borrowed money were fresh in mind. In recent years, however, the desire of an early realization in Oregon of an adequate highway system, and the assured prospect of regular revenues from automobile licences, led to the authorization in 1917 of a state bond issue for the building of a state highway system. The limit then fixed was 2% of the assessed valuation. This limit was raised in 1920 to 4% for the state. With the bonds voted by the Legislature at the 1921 session this limit was reached. The counties are authorized to borrow up to 6% of assessed valuation to secure funds for highway improvement. Oregon's contribution to the U. S. forces in the World War was 41,671 officers and men, and the amount raised in Liberty and Victory loans $28,409,350.

The recent governors were: Oswald West (Dem.) 1911–5; James Withycombe (Rep.) 1915– . (F. G. Y.)

ORELLI, HANS KONRAD VON (1846–1912), Swiss theologian (*see* 20.251), died at Basel Nov. 6 1912.

ORKNEY and SHETLAND (*see* 20.279 and 24.853).—Before the World War, British naval bases in the conflicts with France, Spain and Holland had been ports in the south of England, but the rise of the naval power of Germany in the first years of the 20th century created a new situation; the northern coasts became the important naval front, and the North Sea the probable scene of naval operations. Before the outbreak of war Scapa Flow was selected as a forward base, and in Aug. 1914 it became the headquarters of the Grand Fleet. The entire Orkney and Shetland region was an important military area throughout the war, and the ports of Kirkwall, Stromness and Lerwick proved to be of the utmost value for the conduct of the blockade. After the adoption of the principle known as "the continuous voyage," first for contraband of war and then for all goods, the cargoes of neutral vessels had to undergo a careful scrutiny in order to ascertain if Germany was the ultimate destination of any of the goods carried in a ship. The large cargoes carried by modern steamers rendered it impossible to conduct this examination at sea, and they were sent into port. For this purpose, Kirkwall, Stromness and Lerwick were very frequently employed. The large and temporary naval population brought great commercial prosperity during the war years; travel to Orkney and Shetland was prohibited except under special permits.

ORLANDO, VITTORIO EMANUELE (1860–), Italian statesman, was born in 1860. Becoming a barrister and a law professor, he was first elected deputy for Partinico in Sicily in 1898. He was Minister of Education in the Giolitti-Tittoni Cabinet of 1903–5, and of Justice in the Giolitti Cabinet of 1907–9, and again under Salandra in March 1914. Although a Giolittian at heart, he was in favour of intervention in the World War at a time when many other politicians still hesitated and most of his party were decided neutralists. On the resignation of the Salandra Cabinet in July 1916 he remained in office under Boselli as Minister of the Interior. His administration of that department left much to be desired, as he permitted the Socialists to conduct a defeatist propaganda which was largely responsible for Caporetto. But on the resignation of Boselli, Oct. 29 1917, Orlando was entrusted with the formation of the new Cabinet, and the course of events imposed on him a somewhat more energetic internal policy. He was Prime Minister at the time of the peace treaty, but his Cabinet fell June 20 1919, owing to his failure to secure a settlement in Paris. On Dec. 3 he was elected President of the Chamber.

ORPEN, SIR WILLIAM (1878–), British painter, was born at Stillorgan, co. Dublin, Nov. 27 1878, and studied at the Dublin Metropolitan School of Art and at the Slade School, London. He was elected A.R.A. in 1910, and R.A. in 1919. He first exhibited at the New English Art Club, of which he became a member in 1900, his early work being marked by preoccupation with spacing and silhouette and the use of quiet harmonies of grey and brown, with a note of vivid red or blue. He soon turned to the use of bright colour and the study of light, seen in a series of brilliant portrait interiors such as the "Hon. Percy Wyndham" (1907), "Myself and Venus" (1910, now in Pittsburg Gallery, U.S.A.) and the "Countess of Crawford and Balcarres" (1914). At this time he produced a series of figure compositions, mainly of a satiric and fantastic character, such as "The Passing of his Lordship" and "A Western Wedding" (1914), and became well known for his vigorously characterized portraits, generally marked by the use of much reflected light in the shadows, recent examples of which are "Lady Bonham Carter" (1917), "M. Clemenceau" (1921), and "The Chef" (1921 R.A. Diploma work). To landscape he paid comparatively little attention. During the World War he received a special appointment as official artist, and in 1918 an exhibition of his war pictures was held in London. The same year he was created K.B.E. Many of these pictures were subsequently presented by the artist to the nation, and are now in the Imperial War Museum. They consist of a large number of military portraits, and a series of landscape and figure studies from the western front, marked by extreme competence in the choice and employment of means, but representing the reduction of previous experience into a skilfully handled recipe. Orpen's satiric bent and summary method sometimes bring his portraits near to caricature; and his predilection for silhouette and bizarre pattern is apt to reduce his figure and landscape work to a series of flat shapes without substance and weight, as may be seen in his two Peace Conference pictures, exhibited in 1919 at the Royal Academy. He is represented in the Tate Gallery by three typical portraits, and a water-colour drawing.

ORTHOPAEDIC SURGERY.—The branch of surgery known as Orthopaedic (Gr. ὄρθος, straight, and παῖς, child) has long outgrown its etymological meaning. It now deals with the adult as well as the child. Until comparatively recently it embraced only congenital deformities of children, lateral curvature, acquired deformities of the feet, deformities due to rickets and infantile paralysis, and to certain types of ankylosis. More recently it has included tubercular and other infective diseases of joints, both in children and in adults. The experiences of the World War of 1914–8 considerably broadened its definition, and revealed the fact that the teaching of orthopaedic surgery had been very deficient—more particularly in the treatment of injuries of the extremities. Visits to command depots and certain military hospitals convinced the British authorities of the necessity of starting a series of large hospitals all over the British Isles; these were first called "orthopaedic centres" and later "special military surgical centres." They were situated in London, Liverpool, Manchester, Leeds, Newcastle, Oxford, Reading, Cardiff, Bristol, Bath, Edinburgh, Glasgow, Aberdeen, Dublin and Belfast. These hospitals were staffed by men trained in orthopaedic surgery, by general surgeons and neurologists, and were equipped with every modern facility for the practice of reconstructive surgery, including physiotherapy departments, gymnasia and vocational curative workshops. The group of cases treated at the orthopaedic centres consisted of:—fractures (recent, malunited and ununited); paralyses due to injury of the peripheral nerves; paralyses due to injuries of the central nervous system; diseases, derangements and disabilities of joints, including the spine; deformities due to the contractions of scars and to injuries of muscles; functional diseases requiring reëducation. Later, limb-fitting centres were attached to several of these hospitals.

The wisdom of creating these centres was soon apparent. Derelicts poured in from all parts of the country, and soldiers who had been discharged with deformity were readmitted for treatment. The value of segregating cases in masses under surgeons specially trained for the work was clearly demonstrated. The experiment started in Liverpool with 250 beds, and the expansion was so rapid that in less than 12 months 21,000 beds were under orthopaedic control.

After the war there was a movement in all parts of Great Britain to improve the training in orthopaedic surgery, and to increase in scope and number the special departments attached to universities and medical schools, and to simplify and make more thorough the treatment of fractures. The fact that 50% of the wounded in the war of 1914–8 received injuries resulting in impairment of locomotor function and usefulness of limbs, brought the importance of orthopaedic principles and methods of treatment into great prominence.

Orthopaedic surgery may now be said to include:—(*a*) Congenital and acquired deformities of the spine and extremities; (*b*) infantile paralysis after the acute stage; (*c*) the deformities of adult paralysis; (*d*) stiff and ankylosed joints; (*e*) torticollis ("wry-neck"); (*f*) diseases of joints and disabilities, such as rupture of crucial ligaments, injuries to semilunar cartilage, snapping hip, slipping patellæ, and those conditions which are included under the aggressive title of "bonesetting."

The war enabled surgeons to formulate conclusions based on the observation of large groups of cases, and to obtain information likely to be of great value when dealing with industrial cases. The suture of divided peripheral nerves will serve as an example. In pre-war days, an experienced surgeon in the course of a life-time rarely saw more than 20 cases. During the war many surgeons sutured over 500 nerves, and the successful issue was due largely to the experiences gained by orthopaedic surgeons in the treatment of the paralysis of infants. From the nature of the injuries and the prolonged suppuration that followed, operation often had to be postponed for many months, and only after the removal of all cicatricial tissue was it safe to operate owing to what is called latent sepsis. Germs which remained quiescent, when disturbed by the knife assumed activity —often of a very virulent type. In other cases, muscle had to be freed and developed, and diseased areas of bone drastically extirpated before a nerve could be sutured. These operations required great delicacy and judgment. It was found by experience that in most cases it was possible to bring the nerve-ends together even after the destruction of a considerable area. This was sometimes effected by posturing the joints in order to lessen tension. In other cases the nerves were transposed from their bed and made to take a shorter course. In other instances the operation was done in stages in order gradually to stretch the nerve. Many methods which were formerly used to protect the injured nerve from injury during healing by adhesions were discarded in favour of surrounding the sutured ends by living tissue. Nerve grafting—*i.e.* utilizing a portion of a cutaneous nerve to bridge the gap in a motor nerve, proved a failure. Equally abortive were all attempts at grafting foreign material, nerve anastomosis, and the turning down of flaps. The great lesson learnt was that end-to-end suture is the only method to adopt in the immediate future.

A very remarkable adaptation of orthopaedic experience to injuries of the war was the transplantation of tendons in conditions of irreparable injury to the nerve. This was most useful in the cases where the musculospiral nerve was so destroyed as to render suture impossible. As a result of this injury the function of the hand was greatly impaired. The musculospiral nerve governs the motion of all the muscles which extend the wrist and the fingers. Destruction of the nerve paralysed all the muscles, and the victim, if he wished to extend the wrist and fingers, had to do it by using the other hand.

Orthopaedic surgeons had been accustomed for many years to utilize any spare active muscles, in cases of infantile paralysis, in order to take the place and assume the action of the muscles which were paralysed. For instance, a muscle group whose function was to evert the foot (*peronei*), if found paralysed, would be replaced by one of the invertors of the foot (*tibialis anticus*). This muscle would be dissected from its insertion halfway to its origin, and taken from the inner side of the foot and planted into the bone on the outer side. The child would then be trained to use the muscle so that when it acted it would assume the function of the paralysed muscle. This principle was adopted on a very large scale in all the orthopaedic centres to supply a remedy for the paralysed extensors of the wrist and hand. Certain muscles would be taken from the front of the forearm, one of which would be attached to the paralysed thumb, another to the extensors of the wrist, and another to the various extensors of the fingers. In this way, some hundreds of cases experienced a complete restoration of the function of the hand.

The influence of physiology or psychology as it affects the transplanted muscle deserves comment. It is very difficult to explain how a muscle which has always acted as an invertor should respond to a command to evert. After a little education, however, the will becomes the master of the situation, and the transplanted tendons display an admirable functional adaptation. A few soldiers suffered from the destruction of the obdurator nerve with a resulting paralysis of the quadriceps—a muscle whose function it is to extend the leg. In order to regain that function, two of the muscles from behind the knee are brought to the front of the thigh and fastened into the knee-cap to replace the quadriceps. In this way again, muscles, which normally bend the knee, take up a new action and straighten it.

Another orthopaedic principle derived from the treatment of infantile paralysis and utilized for war injuries is known as tendon fixation. An example can be given by an irreparable injury of the sciatic nerve. All the muscles below the knee are paralysed. There are therefore none that can be transplanted, and the foot remains flail. In such cases, the paralysed tendons are utilized to sling the foot to the bones of the lower leg. Certain tendons in front of the foot are cut below their origin and fixed in a tunnel bored into the bone, while the tendo Achillis at the back is treated in a similar manner. The foot is thus slung into a good carrying position, and cumbersome braces discarded.

The history of damaged joints is hardly less interesting. The wounds of the war were often so extensive that joints were not only destroyed but large pieces of bone were carried away, so that the arm or leg dangled in flail fashion. As an example, the case of the shoulder will serve to illustrate our procedure in dealing with other joints. The arm lies limp at the side—there is no power to lift, laterally deflect or rotate it. Experience in treating infantile paralysis in children has supplied an idea by which the limb can be made useful. The procedure is known as arthrodesis. Although the arm cannot move, the shoulder-blade can. The surgeon attaches the bone of the arm (humerus) to the shoulder-blade and allows both bones to become united. The arm is fixed in the most useful position in relation to the shoulder-blade; the muscles which hitherto only moved the shoulder-blade will now move the arm also. By this device the patient is able to feed himself, lift his arm from his side, put his hand in his pocket and perform many useful functions.

Again, the orthopaedic surgeon may have to deal with a stiff or ankylosed joint. In the case of the hip, shoulder or elbow, there are at his command methods to mobilize them by forming new joints. The hip-joint will serve as an example. The destroyed joint is cut down upon, the socket reconstructed, the head of the thigh-bone reshaped, and soft muscular and fascial tissue utilized as a buffer between the bones in order to imitate nature. The war has brought about the perfection of such methods, enabling flail joints to be stiffened, and mobilizing those which are ankylosed.

Bone grafting has been much simplified, and has been largely used in the surgery of the jaws and in ununited fractures of every kind. Gaps of four and five inches have been remedied by this means, and certain technical details have been perfected which have given the transplanted bone greater viability. It has been most useful in fractures below the knee and in the forearm. Cases are on record where the graft has been broken and has united again, as in the case of a simple fracture. Grafts have also lived in the presence of suppuration. The shin-bone (tibia) is the favourite quarry from which the grafted bone is taken. A point of great interest is that the grafted bone often develops until it assumes the thickness and contour of the bone which it supplants.

No branch of surgery has been so much advanced by the war as fractures. Before the war, the treatment of fractures in England was little less than a reproach. Fractures of the femur, unless operated upon, generally displayed a shortening of about two inches. This was largely due to faulty education of the student, and the early evacuation of fractures from hospital wards. There was usually no considered after-treatment. Few surgeons knew the uses of the Thomas splint which, for simplicity and efficacy, surpassed any appliance in any of the armies. There was no effort in the first stage of the war to standardize this splint or to segregate fractures. This resulted in a great mortality, and filled the orthopaedic centres with appalling deformities. Fractures of the femur will serve as an example. In the early phases of the war the mortality from these fractures was 80%. Later, when fractures were segregated at the base and the Thomas splint applied in the firing line, this mortality was reduced to 20%. The standardization of the Thomas splint, the education of men in its use, and its application on the field of battle, secured for the fracture immobilization and simplified treatment; it minimized shock, and it prevented the perforation of vessels by securing the alignment of the broken ends. Its use had to be understood from the field to the base hospitals, for continuity of treatment was imperative. At the base hospital it might be necessary to apply modifications in more leisurely fashion. At a later date these fractures were admitted directly into orthopaedic centres, and, as a result of investigation, it was found that out of several hundreds of cases the average shortening did not exceed half an inch. These results in the British army were incomparably better than those in any of the other armies. The important lessons learnt from these experiences are: The necessity of better training of students, the standardization of the most efficient splints, the segregation of cases under men versed in mechanical principles, and the securing of efficient orthopaedic after-care in order to obtain function.

Further experiences gained in orthopaedic hospitals included the radical treatment of the chronic sinuses leading to diseased bone. Instead of simple procedures to remove dead bone, a very extensive operation was generally performed. All unsound bone, not merely dead bone, was removed, and the edges of the large cavities bevelled down in order that the soft tissues might fill the cavity. This thorough treatment often reduced healing to weeks instead of years. Malunited fractures again formed a large group in the orthopaedic centres. Surgery has now sufficiently advanced that, under favourable conditions, deformity should not occur. The orthopaedic teaching emphasizes the fact that good function is its end and any operation performed should have this as its aim. Aesthetic and other objects are of minor importance. Correct alignment is the most important factor governing success. Unless this be secured erroneous deflection of body weight upon the joints above and below the fracture results. A meticulous end-to-end union with a lateral deviation is not so successful as even a little over-riding accompanied by a good alignment. Many hundreds of fractures which violated this axiom were re-broken and the limb reconstructed. Surgeons were often able to lengthen the limb by five inches or more.

Orthopaedic surgery emphasizes the after-treatment of all these chronic cases. All joints have to be kept mobile, muscle-wasting hindered, reëducation courses attended, and all the modern advantages of physiotherapy utilized.

Artificial Limbs.—In the early stage of the war it was found very difficult to keep up any adequate supply of artificial limbs. All the English limb-making firms suffered from the fact that their staffs were at the front. The authorities were so firm that it was impossible to recall them, although the shortage of limbs had become appalling. An exhibition, to which all limb-makers were invited, was held at Roehampton House, and artificial limbs were sent by both English and foreign makers. The Americans, however, were alone prepared to start work with full staffs, so that the bulk of limbs supplied were of the American pattern, and were made in ever-increasing numbers on the hospital grounds. They were strong and very reliable, and, at that time, they represented all that was best and up-to-date. Later, in 1919, a parliamentary committee was constituted in England to study the question of standardizing limbs in order to lessen the cost and expedite production. After much deliberation they fixed upon certain standardized patterns suited to the more frequent sites of amputation. They were based upon the most reliable features of both the American and English types. They were manufactured in wood and leather with steel joints, and, although on the whole satisfactory, complaints were often made that they were too heavy. In consequence, a standardized leg has been in course of being perfected, which combines lightness with durability, and the weight of which will not be more than four or five pounds. There can be no doubt that artificial limbs for high-up amputations had previously been far too heavy, and the introduction of a light metal or wooden splint will supply a reasonable demand.

It can be said without entering into any technical details that, as an artificial limb has to transmit the weight of the body to the ground, it should be stable, painless, and permit the patient to walk in a natural, easy manner. The weight of the body in certain cases is carried directly on to the artificial limb through the end of the stump (end-bearing). In other cases a portion only of the weight is carried through the end of the stump—the rest of the weight being distributed through other anatomical points (partial end-bearing). Sometimes it is transmitted through the bony points about the joint above the amputation—*i.e.* round the hip-joint in cases of amputation through the thigh (ischial bearing). The complete end-bearing distribution of weight is the ideal condition, but can only rarely be secured. It is best exemplified in a Symes' amputation which is performed when the front part of the foot is removed and the skin over the heel forms the flap. The skin has to be thick and the end of the bone expanded, otherwise ulceration may result.

While artificial legs have on the whole given very general satisfaction, artificial arms have been very disappointing. The leg is comparatively a simple proposition—it merely has to bear weight and perform the act of walking. The arm, on the contrary, is expected to perform diverse and complex acts. Too many arms have been merely ornamental, and have been discarded early, only to be worn for aesthetic reasons. When the war broke out only very primitive types of arms existed. They consisted of a bucket, a hinge automatically locking elbow and a dummy hand, which could be taken off and replaced by a hook or a ring. Later, certain arms were introduced which displayed great inventive ingenuity. These limbs were worked by certain movements of the body assisted by the stump. In an amputation above the elbow, for instance, the forearm could be fixed and supinated and the fingers opened and closed. They were, however, not a success owing to their weight and complexity, and the movements were not those which could prove useful in daily life. Mechanical arms of various types followed, some of which have proved useful. They are included in the class known as the "worker's arm," and consist of an apparatus where the external shape of the arm is sacrificed to utility. Various tools and other mechanical devices are attached to the end of the arm and, with training, patients are able to do very useful work. It must be admitted, however, that fully two-thirds of the men have discarded their artificial arms. Doubtless, with encouragement and better and more prolonged training, men would obtain much more satisfaction from their artificial limbs.

Temporary limbs have been employed regularly in Great Britain for the lower limbs in order to bring the leg into action at the first available moment to exercise the muscles of the stump, to avoid the evil of crutches and to allow the shrinkage of the stump to take place —an essential preliminary to the final fitting of a bucket. The bucket is usually made of plaster of Paris, moulded very accurately in order that shrinking may take place from pressure. Many excellent fibre temporary or peg legs were made by amateurs and supplied by the Red Cross Society.

The Belgians and French used temporary arms in order to keep the muscles active and the joints mobile from the time the stump healed. Schools were started in order to teach the men their possibilities and limitations. In England, owing to rapid evacuation, very little time was spent in training men to adapt their arms to their own special trades. This is perhaps one of the main reasons of failure.

One of the most interesting developments in connexion with amputations has been the so-called operation of cinematization of amputation stumps. A considerable length of muscle is preserved at the time of the amputation, and the opposing groups are separated and covered with skin. By exercise these rival groups can be trained to retract often two inches, and can thus be utilized to work an artificial hand by direct volition. Experiments are being continued and the prospects are encouraging.

Deformities.—The aim of the modern orthopaedic surgeon is to prevent the occurrence of deformity, and to insist upon early treatment. In the case of children there are four groups of cripples. They consist of (*a*) surgical tuberculosis; (*b*) rickets; (*c*) congenital deformities; (*d*) deformities due to injuries and infections of bone. Rickets and surgical tuberculosis account for nearly 50% of the deformities of children, while congenital deformities and infantile paralysis will account for the remaining cases. In the group of surgical tuberculosis are included spinal caries and diseases of the various joints. Amongst the rickety cases are found knock-knee, bow-legs, spinal deviations, flat-feet, deformities of hip, etc. Amongst the congenital group there are the various types of club-feet, wry-neck and allied affections.

Most of the deformities due to these various conditions may be altogether prevented, and the cases grouped under tuberculosis and rickets should in time be eradicated, given reasonable State facilities. In the prevention of tuberculosis nothing is more important than the provision of milk free from tubercle bacilli. Until the menace of cattle affected with tubercle is removed, one of the chief origins of infection will persist. The etiology of rickets is sufficiently known to merit some organized method of control. Recent investigations with regard to vitamine have served to confirm the belief that it is largely a dietetic disease intensified by insanitary conditions. With a better education of the student as to the origin of deformities, many of the dangers of rickets would be eradicated, such as the evils of superincumbent body-weight as applied to soft bone.

Orthopaedic surgery is largely the surgery of the extremities, and the aim of the surgeon is the removal of disability. He effects this by a scientific application of the lessons to be learnt from anatomy, physiology, pathology and mechanics. In his reconstructive efforts he places the restoration of form as secondary to the restoration of function. (R. Jo.)

ORZESZKO (or ORSZESZKO), **ELIZA** (1842–1910), Polish novelist (*see* 20.343), died in 1910.

OSLER, SIR WILLIAM, 1ST BART. (1849–1919), British physician and professor of medicine, was born at Bond Head, Can., July 12 1849, the son of the Rev. F. L. Osler, a missionary. He was educated at Trinity College School, Port Hope, Trinity University, Toronto, and McGill University, Montreal, where in 1872 he took his degree of M.D. He then went to Europe and studied medicine in London, Leipzig and Vienna, afterwards returning to Canada, where he was appointed in 1874 professor of medicine at McGill University. From 1884 to 1889 Osler was professor of clinical medicine in the university of Pennsylvania, and from 1889 to 1904 professor of medicine at Johns Hopkins University; it was during this period in the United States that his international reputation was made. In 1905 he was appointed regius professor of medicine at Oxford. In this position he greatly developed the medical school at Oxford, and used all his influence towards the furtherance of advanced research. While at Oxford he served as a curator of the Bodleian library, as a delegate of the University Press, and as one of the Radcliffe trustees. He was created a baronet in 1911, and died at Oxford Dec. 29 1919. Sir William Osler was not only a great medical consultant, and one of the wisest advisers of his day on practical affairs of all sorts, but was the author of many medical works, of which the most important, *The Principles and Practice of Medicine* (1892, latest ed. 1916), has been translated into many foreign languages.

OSTEND (*see* 20.356).—Pop. (1914) 43,196. The extensive harbour and dock works, begun in 1900, were practically completed before the war, and 1,795 vessels of 1,155,000 aggregate tonnage entered the port in 1913. Ostend was occupied by the Germans from Oct. 15 1914 to Oct. 17 1918. The entrance channel to the harbour and to the Grand Canal connecting with Bruges and Ghent was blocked to all craft except the smallest submarines by the sinking of the "Vindictive" on the night of May 9–10 1918. During the occupation over 2,000 bombs were dropped on the town; 400 of the inhabitants were killed and several hundred injured, and 1,250 houses were either destroyed or damaged.

OSTEOPATHY.—According to its advocates, osteopathy is that system of the healing art which regards the structural integrity and adjustment of the mechanism of the body as the most important single factor in maintaining the organism in health, in contrast to the older systems which regard the chemical intake of the body as the most important factor. In other words, osteopathy is based on the recognition of the human body as a vital mechanism, a living machine, which, given wholesome physical and mental environment, good food, proper exercise, pure air and pure water, will be healthy, that is, will function properly, so long as all the cells and parts of that vital mechanism are in normal adjustment. Osteopathy teaches that structural derangement of the body is the predisposing cause of disease. It causes functional perversion of the vascular and nervous systems, weakening the nutritional processes and lowering the powers of resistance of the body; on the one hand, producing congestion, either general or local, active or passive; on the other, depriving tissues of an adequate blood and lymph supply. This perversion impairs the rebuilding of cells after waste due to active functioning and retards the elimination of waste products through body drainage, thus making the body unable to withstand climatic changes or unhygienic and insanitary surroundings, and offering a hospitable medium for the invasion and propagation of pathogenic germs. For example, as Dr. Still, the founder of osteopathy (*see* below), said, "A disturbed artery marks the beginning to the hour and minute when disease begins to sow its seeds of destruction in the human body. The rule of the artery must be absolute, universal and unobstructed, or disease will be the result."

If a machine is complete in its structure, and the structural relation of all its parts is perfect, it performs its function perfectly; if, however, it is not "plumb," if some of its parts are ill-adjusted, if friction is increased, it will not function properly—it will not perform its proper work. So it is with the human body. If the structural relations of the various cells, tissues and organs of this vital mechanism are in perfect harmony, and if there is an unobstructed supply of blood, lymph and nerve to all these cells and tissues, then the purposes for which these cells, tissues and organs are designed will be carried out; but if the structure is perverted in any manner the functioning also will be perverted. Integrity of mechanical structure determines the normality of functioning. That this structural perversion is the basic cause of functional disturbance or disease is a distinctive and fundamental principle of osteopathy.

Centuries old is the idea that man is a machine, and that his operations are dependent upon mechanical laws; but to Dr. A. T. Still is due the honour of recognizing the unity of the body and the law that any derangement of its mechanical structure is followed by disordered functioning or disease, and that the vital mechanism possesses the auto-protective power to restore normality of function, without pharmaceutical, chemical, electrical, or any other extraneous and artificial stimulation, as soon as complete alignment and adjustment of such derangements have been made. These structural derangements of the body are technically called "lesions." A lesion is defined as "any structural perversion which by pressure (or irritation) produces or maintains functional perversion." All the tissues of the body are subject to such perversions. They are produced by both external and internal forces. External causes are mechanical violence, such as falls, blows, strains, ill-fitting clothing and the like, and changes of temperature. Internal causes are postural influences, abuse of function, and nutritional disturbances.

A gross, frequent, palpable and easily distinguishable lesion is that of the sacro-iliac articulation. It is highly productive of functional perversions of the sciatic nerve, pelvic viscera, and the body equilibrium. Before Dr. Still's founding of osteopathy in 1874, anatomists described this as an immovable joint. He demonstrated the opposite by recognizing it as a movable joint, and correcting its derangements. This disturbance was among his first citations and teachings as an example of the osteopathic lesion. Only within the past two decades have other schools of medical practice recognized that this articulation is subject to this lesion and its resulting pathological disturbances. The more frequent, and consequently the more important, lesions are those of the bony, muscular and ligamentous tissues. Owing to their intimate mechanical relation with the nervous and vascular systems, particularly the vasomotors which control the rate of blood-flow, these tissues along the area of the spinal column are those most subject to lesions of far-reaching influence. Clinical experience also proves that a large majority of lesions are found in the spinal region. Hence the importance of maintaining the integrity of this area, both as a prophylactic and as a curative measure. And nowhere is it of such supreme importance as with children, subject as they are to the thousand-and-one stresses and strains of tumbling about from morning to night. Osteopathy teaches that nothing will contribute so much to the health of children as to see that they are examined every few months for the purpose of detecting lesions, just as they have their teeth examined by the dentist to detect lesions there. As contributive factors in the etiology of disease, osteopathy recognizes germs, abuse of function, unhygienic and insanitary surroundings, climate, etc.

Osteopathic diagnosis has but one aim, to find the cause. It includes the complete examination of the whole body and its excretions, especially the articulations and alignments of the vertebrae, ribs and pelvis. Symptoms are noted, and all chemical, microscopic, hygienic, sanitary, and other findings are studied to aid in determining the existing conditions of tissue, viscera and function. Of supreme importance, however, is the physical examination to discover existing mechanical tissue lesions. In this respect osteopathy stands alone among schools of medicine.

Osteopathic therapeutics has but one aim, to remove the cause. This may require the employment of one or more of many means. It may, and it usually does, consist in the specific manipulative removal of the lesion or structural perversion, by effecting tissue adjustments, which free the remedial anti-toxic and auto-protective resources of the organism itself; or it may consist in correcting hygienic, dietetic, environmental and psychic conditions; or in the application of operative surgery for fractures, lacerations, and the removal of abnormal growths or organs so diseased as to be dangerous to life; or it may be the administration of antidotes for poisons and other dangerous substances. In osteopathic therapeutics the fundamental principle is, "Find the lesion, adjust it and let it alone."

Some confusion has arisen in the minds of those unfamiliar with osteopathic practice as to the exact nature of osteopathic treatment. It consists in specific correction by manual adjustment of the several tissues involved in the lesion and no others. This corrective work should be of the highest technical order, and based upon knowledge of the tissues involved and their mechanical relations, both in health and in abnormal conditions. Some have confused it with massage. For this confusion osteopathists hold there is no justification. The principles of osteopathic treatment are as different from those of massage as are the principles of surgery. Nor does osteopathic treatment mean simply "bone-setting." Correction of bony lesions is a large and important part of the treatment, but osteopathy goes further. Whatever the cause osteopathy tries to find and remove it. If abuse of function is a contributive factor, that must be corrected. If there are insanitary surroundings, they must be removed.

Osteopathic prevention or prophylaxis comprises systemic examination for incipient lesions, and their correction before function becomes disordered; individual hygiene and right living; public education in so using the body as to avoid injury, and in sanitation.

Osteopathy teaches the self-sufficiency of the normal vital mechanism. In other than normal conditions this principle powerfully manifests itself; the hypertrophy of the heart muscle in valvular insufficiency, the healing of a wound, the recovery of the body from "light attack" diseases without any treatment, all are instances of the self-sufficiency of the body to repair pathological conditions, traumatic and otherwise. Every healed wound, every hunchback, every particle of cicatricial tissue, every adhesion, shows a successful effort of nature to heal disease, and bears further witness that only the severe and persistent impairment of the mechanism made complete repair impossible. The discovery of opsonins and antibodies and their efficacy, together with that of the active principle of the thyroid and other glands forming the internal secretions, is a mark of gradual recognition and acknowledgment of this self-sufficiency when normalized and mechanically stimulated to the maximum exhibition of its reparative and auto-protective processes. Osteopathy aims at so normalizing and stimulating the vital mechanism that it will manufacture in the necessary abundance its normal supporting and protecting chemical compounds.

Many osteopathic physicians specialize in certain branches, such as surgery, obstetrics, gynecology, defective and feeble-minded children, mental and nervous diseases, conditions involving the lymphatics, and eye, ear, nose and throat affections. The results secured through osteopathy with defective and under-developed children are such that judges in juvenile courts in many cities have designated osteopathic physicians to give these unfortunates professional care in a sincere effort to reclaim them before committing them to an institution. The success attending the efforts of those physicians specializing in nervous and mental diseases has been so marked that several sanatoria have been established for the exclusive care of persons so afflicted. The field of the eye, ear, nose and throat has, however, attracted by far the largest number of osteopathists who practise as specialists.

The special "technique" employed, variously known as "finger surgery," "finger technique," and "finger treatment," first developed and first given to the profession by an osteopathic physician in 1911, has been described as a system of digital manipulations of these regions whereby the physician adjusts the bony, ligamentous, nervous and muscular lesions, and breaks up any adhesions and masses of lymphoid tissue that interfere with drainage and with ventilation in any of the apertures, and by such technique restores the normal functional activity of the parts. This method was first used in catarrhal deafness, but is now employed in a number of other pathological conditions of these organs. Catarrhal deafness, hay fever and tonsillitis are the diseases most amenable to this treatment.

Osteopathic practitioners soon felt the need of institutional care for certain kinds of both acute and chronic pathological conditions. This need was all the more important on account of their being denied the opportunity of caring for their patients in the existing institutions controlled by the dominant school of therapy. Therefore, within recent years a number of general hospitals and numerous sanatoria under control of the osteopathic profession have been established.

Much excellent experimental research has been done by members of the profession under the direction of the A. T. Still Research Institute at Chicago. The work is chiefly along the line of osteopathic fundamentals, such as the production of lesions; the study of perverted function and the pathological conditions resulting therefrom; the correction of the produced lesions, and the study of the results following such corrections. These experiments, through clinical observations and post-mortem dissections on various animals, have demonstrated, among other things, that when a spinal lesion is produced, pathological changes in the tissues of the various viscera involved result (for example in that of the stomach, kidney, liver, intestines, pancreas and thyroid gland); and that abnormal functioning of these viscera also results (for example diarrhœa, constipation, nephritis, glycosuria, increased susceptibility to infection, and formation of goitre). The experiments have further demonstrated that the correction of the produced lesion is followed by a return to normal functioning. The produced lesions also showed profound pathological changes in the vascular mechanism of the posterior ganglion, the cells of the grey matter of the cord, and in the sympathetic ganglia, all of which affected their functioning. The experimental and clinical use of radiography in research and practice has demonstrated the existence of bony lesions and their non-existence following osteopathic adjustment.

The founder of osteopathy, Dr. Andrew Taylor Still, was born in Virginia Aug. 6 1827, and died at his home in Kirksville, Mo., Dec. 12 1917. He was a practising allopathic physician at the beginning of the American Civil War, served as a Union officer during that struggle, and at the close of the war returned to his home in Kansas and resumed the practice of his profession. Gradually his confidence in the efficacy of drugs as a means of healing weakened, and his faith in the inherent curative power of the body strengthened, until June 22 1874, when he publicly announced that he would henceforth discard the use of drugs as a curative measure and would dedicate the remainder of his life to aiding nature in the alleviation of disease by the mechanical readjustment of the disordered body. The American School of Osteopathy was opened at Kirksville, Mo., in 1892. There were in 1921 over 7,000 graduate practitioners of osteopathy in all parts of the world.

In addition to the school at Kirksville, there were in 1921 six others in the United States devoted to the teaching of osteopathy: The Philadelphia College of Osteopathy at Philadelphia; The Des Moines Still College of Osteopathy, Des Moines, Ia.; The College of Osteopathic Physicians and Surgeons, Los Angeles, Calif.; The Chicago College of Osteopathy, Chicago; The Massachusetts College of Osteopathy, Boston; and The Kansas City College of Osteopathy and Surgery, Kansas City, Mo. The student enrolment is second only to that of the allopathic colleges. The matriculant must have had at least a four-year high-school course or its equivalent. The curricula of the osteopathic colleges embrace all the subjects taught in other medical schools, except "Materia Medica," in place of which there is included "Principles and Practice of Osteopathy" and "Osteopathic Therapeutics." The course of study is four years of at least eight months each spent in actual attendance in one of the above recognized colleges. Osteopathy was by 1921 recognized and regulated by law in 47 states of the United States. The one remaining state, through court decisions, makes its practice legal. There is an international organization, the American Osteopathic Assn., having some 3,200 active members; an osteopathic association in each state in the Union; associations in Canada; the New England Osteopathic Assn., the Western Osteopathic Assn., the Eastern Osteopathic Assn., the South Atlantic States Osteopathic Assn, Osteopathic Women's National Assn., a British osteopathic association, the Academy of Osteopathic Clinical Research, and the American Society of Ophthalmology and Oto-Laryngology. There are 10 or 12 magazines and periodicals published by the profession.

(G. W. Ri.)

OTTAWA (*see* 20.369), the capital of the Dominion of Canada, had with its suburbs a pop. of 135,154 in 1920, according to a local census. The pop. in 1911 was 87,062. It is probable that the 1920 figures were greatly exceeded during the years of the World War, when a large influx to the city was occasioned by the Government's war organization. The Dominion Parliament buildings were almost completely destroyed by fire on Feb. 3 1916. The magnificent library and the senate house fortunately escaped destruction. Reconstruction was undertaken at once through a special committee representative of both Houses of Parliament, which were then in session. John A. Pearson of Toronto and J. O. Marchand of Montreal were the architects. The corner-stone of the new building was laid in September 1916, by the Duke of Connaught, then Governor-General, the stone being the same as that laid by his brother, the late King Edward VII., when he visited Canada as Prince of Wales in 1860. The corner-stone of the new tower was laid by King Edward's grandson, Edward, Prince of Wales, in 1919. The main front of the new Parliament buildings is 470 feet long and nearly 100 feet high, the length being the same as that of the former buildings but the height double as great. The main tower of the new buildings, still under construction in 1921, was to be 300 feet high, about 100 feet higher than the old tower.

Other buildings erected since 1911 include the Grand Trunk Union Station, on the east bank of the Rideau Canal and on the south side of Rideau Street—a large structure replacing a previous inadequate building—and the Chateau Laurier in Major's Hill Park facing the Parliament buildings. The Chateau Laurier is a large and luxurious hotel owned and operated by the Grand Trunk Railway system, by whom it was built at a cost of $2,500,000. It is connected with the railway station by a subway under Rideau Street. Under the Ontario provincial housing scheme a colony of new houses for the use of Ottawa's civil servants was in course of erection close to Rockcliffe Park in 1921.

In 1920 Ottawa had 388 industrial establishments of various kinds—iron works and foundries and large factories for the production of paper, cardboard, tents and awnings and cement—giving employment to 11,873 persons and paying out in annual wages $8,938,170. It has one of the largest individual lumber factories in the British Empire. The district output of lumber in 1918 was 350,000,000 feet, board measure. In 1921 Ottawa was consuming about 54,000 H.P. of electric energy, most of which was generated at the Chaudière Falls. Nearly 200,000 H.P. available for commercial purposes was still undeveloped within a radius of 30 m. of the city.

OTTOMAN EMPIRE (*see* 27.426).—The Turkish Revolution of 1908 was thought, at the time, to promise an era of genuine reformation and revival for the Ottoman Empire; a few years showed that it had opened, instead, the final brief period of that empire's existence. Long declining, long owing its continuance to the jealousies and conflicting policies of the great European Powers, the Ottoman Empire may be said to have ended, as the result of defeat in war, when its delegates signed the Treaty of Sèvres on Aug. 10 1920. From that treaty emerged a Turkish State with every attribute of empire gone.

The first constitutional Government which came into power in Turkey after the revolution speedily found itself opposed by the "Young Turk" Committee of Union and Progress—the same occult body which had organized and carried through the revolution. The hope had been general that the Committee would cease their activities when once parliamentary government was established; but the hope remained unfulfilled. The Committee transferred their attention from the Sultan Abdul Hamid to the Ottoman Parliament—which assembled on Dec. 17 1908—as the new means to power, and continued as active as ever. Within a few weeks they had procured the downfall of Kiamil Pasha, the first Grand Vizier of the constitutional period.

The Committee had, in fact, a definite policy before them for execution; a policy by no means in harmony with the professions of liberty and equality for all Ottoman subjects upon which the revolution had been accomplished. Briefly stated this policy was the complete "Turkification" of the empire. Non-Turkish ethnical elements—Albanians, Macedonians, Armenians, Greeks, Arabs, Kurds, Druses—were to be moulded as far as possible into uniformity with the dominant Turkish element. Racial and national ideals, characteristics, laws and languages of these subject peoples were to be suppressed, by force if necessary, and an Ottoman population created which, outwardly at least, should be homogeneous within the empire's wide confines. Nor did the Turkish Moslem population escape the reforming purpose of the Committee. Taking a detached view of Turkish civilization, even of the faith of Islam itself, for the two are inseparable—the Committee saw much wanting, much existing that was cumbersome and useless, much that provided a fatal handicap to the progress of the Ottoman State.

For the good of the Turkish race and the ultimate Ottoman State the Committee intended reformation in these directions as well. But various of the changes proposed touched exceedingly delicate matters, going to the deepest foundations of Turkish belief and prejudice: so much so that some of the desired reforms could not be openly advocated as yet. The reforms proposed included the adoption of European time, the European calendar, and the Latin alphabet; the abolition of veiling of women—as a practice of far-reaching, injurious influence upon the race; the abolition of the annual, month-long fast of Ramazan, and of the Feasts of Bairam. In other directions, too, the teachings of Mahomet were to be judiciously revised, on the principle that the Prophet himself would never have allowed observance of any of his precepts to put his followers at a permanent disadvantage in competition with infidels. That many years, perhaps two generations, must elapse before the more serious of these changes would be accepted by Turkish Moslems was well understood. But the "Turkification" of non-Turkish populations was on another footing. The sooner it was begun and the more thorough were the measures adopted, the sooner would its advantages be reaped. Reorganization of the army and navy was regarded as imperative, not only against external possibilities, but for execution of the policy of "Turkification." Financial reform and reorganization of the customs service were found equally necessary, if only to provide means for the increased cost of the army and navy. These matters therefore were taken in hand. Djavid Bey, Minister of Finance, called a French adviser to his assistance; a British adviser, Mr. R. F. Crawford, was engaged to reorganize the customs; a number of German officers, selected by General von der Goltz, were brought in to reform the army; and the work of restoring the navy to efficiency was entrusted to a British adviser, Rear-Admiral Gamble, and a small British staff.

Though the Committee of Union and Progress took no open part in governing the country, and remained an unseen mysterious power, they had their nominees in the Ministry, and at the beginning of 1909 could already influence the policy of the Government. Opposition to the Committee became, therefore, opposition to the Government as well. The revolution had given birth to a strong nationalistic spirit in Turkish Moslems and a desire to restore the empire to something of its former power, but had not diminished their religious zeal. Devout Moslems became alarmed at the tendencies of the Committee; at the free-thinking professions of members and their general rejection of the Prophet; still more at the innovations advocated in Turkish customs and in the Mahommedan faith. The Mahommedan Union was formed to oppose the Committee and its dangerous projects, and declaring that Islam was in danger, the Union became active early in April 1909.

The Sultan Abdul Hamid has been charged with being the chief instigator of the counter-revolution of that month; it is more probable that he did nothing except oppose it. The counter-revolution was chiefly the outcome of religious zeal played upon by the Mahommedan Union. The troops in the capital were won over (the same troops who had effected the revolution of the previous year), and on April 12 they demanded that the constitution should be subject to Mahommedan sacred law, and great demonstrations, attended by fighting, taking place against the Government. The Grand Vizier resigned, leading members of the Committee fled from Constantinople and the Sultan pardoned the troops who had taken part in the movement. But the counter-revolution had no organized strength behind it. The Committee retained the support of the two army corps stationed at Salonika and Adrianople; and from these garrisons a force of 20,000 men was dispatched against Constantinople. It occupied the city on April 24, and crushed the rising after much street fighting.

The Committee had ever regarded the Sultan Abdul Hamid with deep suspicion, which the counter-revolution was held to have justified. The counter-revolution provided, therefore, a favourable excuse for removing him from power. He was deposed on April 27, and sent to Salonika for internment and safe-keeping; and his successor, as Sultan Murad V., was proclaimed the same day. After the prompt suppression of this rebellion, the Committee became sovereign in the direction of Ottoman affairs. It had, however, learnt the danger of outraging the national and religious susceptibilities of Turkish Moslems. For the future they showed more deference to these sentiments, and, recognizing the forces behind them, gave more and more prominence to Pan-Islamism as a feature of the Committee's policy. Soon after the events of April, Talaat Bey, destined to fame as a sinister figure largely responsible for the downfall of the Ottoman Empire, became Minister of the Interior as one of the Committee's nominees in the Government. After the Committee had suppressed the counter-revolution, and was firmly seated in the saddle, events moved by regular and rapid steps to the end of the empire.

During the first two weeks of April, while Constantinople was in the throes of revolution, serious events were taking place in Adana, the prosperous capital of the Cilician plain. Racial hatred between Turks and Armenians there came to a head on April 9 in the so-called "Adana Massacres." These soon extended over the whole of Cilicia and, before they had ceased, involved the death of some 20,000 Armenians and a lesser number of Moslems. Both the Government and the Sultan Abdul Hamid have been charged with responsibility for the outbreak; but instigation to the deed, though not perhaps directly from the Government, appears to have come from the Committee. It well may be that these massacres were, in fact, an abrupt and premature step in the policy of "Turkification," which the Government had in view.

In its various forms, this policy gave rise to the chief internal preoccupations of the Government during the years 1909–12. In 1909, as part of the same policy, a law was passed imposing compulsory military service on all Christian subjects of the empire for the first time. In the same years, stern military suppression accompanied by much bloodshed was applied in Albania and Macedonia; taxation and conscription were enforced, the national schools closed, and Turkish decreed as the official language. In Syria too, Turkish was made the official language, and Arabic forbidden in the schools.

A local quarrel in the Hawran was seized as a pretext in 1910 for dispatching thither some 30,000 men, with artillery, to crush the Druses. The operations, however, did not result entirely to the advantage of the Turks, who suffered at least one serious reverse, and a compromise followed under which the Druses accepted conscription for the Ottoman army.

South-western Arabia, where the Imam Iahya of the Iemen and the Idrisi of Asir rebelled at the end of 1910, was another region marked down for "Turkification." Military operations to this end were undertaken on a large scale during 1911; but again without definite success. Some 50,000 Turkish troops were employed, but, though able to relieve beleaguered Turkish garrisons, they could not penetrate the mountainous region forming the Arab stronghold and were unable to establish Turkish domination.

The Ottoman Government took these experiences to heart. They recognized that the "Turkification" of distant provinces containing no Turkish population was a task beyond their power, and the policy was therefore relaxed in certain districts. In the Iemen, in fact, a measure of local independence was granted to the Imam Iahya, though not to the Idrisi of Asir. "Turkification" was now reserved for Turkey in Europe and for the great compact territory of Asia Minor, the fastness of the Turkish race, by systematic and thorough processes, it being intended to make this wide area Turkish in population and spirit beyond question or doubt. For the time being, however, it seemed that the empire might hope for a period of comparative freedom from internal disturbance.

But external difficulties now arose. Italy had long shown designs on Tripoli, the remaining African province of the Ottoman Empire. During 1911 various matters had created friction between the two countries and caused the exchange of bitter articles in the press, but war had appeared unlikely. On Sept. 29 1911, however, the Italian Government presented an ultimatum stating that, Turkish obstruction and hostility to Italian interests having become so great, the occupation of Tripoli had been decided upon. The ultimatum required Turkish acquiescence to this course within twenty-four hours. The Turkish reply did not accept the occupation, and Italy declared war on Sept. 30. The Turkish garrison was small; it could not be reinforced owing to Italian command of the sea; the Turkish defence in Tripoli therefore had to rely chiefly upon Arab forces locally raised. Italian troops landed on Oct. 12 and the bombardment and capture of towns along the coast began. No serious operations were attempted far inland; and though severe fighting took place effective Italian occupation never extended far from the sea. Italian warships blockaded and bombarded Turkish ports on the Red Sea coast of Arabia and supplied arms and munitions to the Idrisi of Asir, to the great advantage of that ruler. Various Turkish islands in the Aegean Sea, including Rhodes, were occupied by Italian troops in the spring of 1912. A naval demonstration against the Dardanelles was also made. This affair prompted the Ottoman Government to close the Dardanelles and Bosporus against all shipping, a course which caused immense loss and inconvenience to neutral Powers and produced such vigorous protest, particularly from Russia, that the straits were reopened in May. The war, hopeless from the first, continued for another six months, marked only by unavailing efforts in Tripoli by Enver Bey—the well-known member of the Committee of Union and Progress—at the head of Arab irregulars. But difficulties of finance, the impossibility of undertaking effective operations against Italy, and signs of impending trouble in the Balkans at length compelled the Ottoman Government to peace. Under the Treaty of Ouchy, signed on Oct. 18 1912, Tripoli, the last Ottoman territory in Africa, passed into Italian possession. Rhodes and other Turkish islands were retained by Italy for the time being.

Balkan unrest had shown itself in unusually ominous form as early as the beginning of May 1912. Following the general elections in April for the Ottoman Chamber, in which the Committee of Union and Progress had exhausted every method of corruption and violence to secure the return of their candidates, 30,000 Albanian clansmen, exasperated by "Turkification" and repression, mustered in organized rebellion. Their purpose was the overthrow of Committee Government, to which end they demanded new elections. The Government temporized and took inadequate military measures; meanwhile a rebellion grew, and Turkish and Christian hatred became more and more inflamed. At the close of July, the massacre of Christians at Kotchana deeply excited Balkan opinion. It was followed by a similar massacre of Christians at Berana, and events now moved rapidly toward war. The Turkish Government saw nothing for it but compliance with Albanian demands, at least in form; and on Aug. 6, to the rage of the Committee, their hardly won majority vanished in the dissolution of the Chamber by imperial decree. As a further concession to the insurgents, reforms on the widest scale were promised; but their application required time, even if the good faith of the Government could be trusted.

Matters had gone too far, however, for any Turkish concessions to avail. The Balkan States—Bulgaria, Serbia, Greece and Montenegro—regarded themselves as the dispossessed owners of Ottoman territory in Europe. They deemed that now, with organized rebellion afoot in the Turkish Balkans, was the opportunity to recover Macedonia and Thrace for division among themselves. They judged, further, that should their attempt by any chance miscarry, the Great Powers, more particularly Russia, protector of the Slav peoples, would not allow them to be crushed, or their present territories to be diminished. For the execution of their purpose, Bulgaria, Serbia, Greece and Montenegro had already formed an alliance. Bulgaria began her mobilization at the end of September, followed immediately by her allies; Turkey ordered mobilization on Oct. 1; by Oct. 18 1912 the four Balkan States were at war with the Ottoman Empire.

When war broke out the Ottoman forces in Europe numbered less than 250,000 men, dispersed over Macedonia and Thrace; they were thus at great numerical disadvantage. The Anatolian troops, ever the bulk of Ottoman armed strength, had to be conveyed great distances by inadequate means of transportation. The full strength of the empire could not be exerted in Europe until months had elapsed; and the outcome of the war was decided in the first two weeks.

The war was fought in two chief theatres of operations—the less important in Macedonia, against the Serbian, Greek and Montenegrin armies, assisted by two Bulgarian divisions; the more important in Eastern Thrace against the Bulgarians, later assisted by a considerable Serbian force.

In the Macedonian area the Turks were defeated by the Serbian army at Kumanova on Oct. 24–25, and lost Uskub in consequence. Another Serbian force, uniting with Montenegrins, had occupied northern Albania the end of October. The main Turkish army retreated on Monastir, where, on Nov. 14–18, it was again defeated by the Serbians, who outnumbered them in the proportion of 5 to 2.

The Greeks meanwhile, who crossed the frontier with six divisions on Oct. 18, had made Salonika their objective.

They easily defeated the comparatively weak Turkish forces opposing them; and arrived before the city on Nov. 8, anxious to forestall a Bulgarian column aiming at the same objective. The Bulgarians, who took Serres on Nov. 5, reached Salonika at about the same time as their rival; but the Turkish commander chose to capitulate to the Greeks, who occupied the city the next day. Within four weeks the Ottoman Empire had lost Macedonia and Albania except the fortress and district of Yanina whose garrison as yet lay outside the area of operations.

These were rapid and remarkable triumphs, but they did not affect decisively the outcome of the war; they took from Turkey two outlying provinces; they did not strike at the heart of Turkish resistance. The weight of Turkish resistance lay in Eastern Thrace, concentrated there for the defence of the capital and the straits. Turkish reinforcements could not reach Macedonia by sea as fast as rail and steamer could bring them. They were poured into Eastern Thrace from Anatolia. The heavy and decisive operations of the war were carried out by the Bulgarian army.

The main Bulgarian advance was made south-eastward through Eastern Thrace. During Oct. 21–25 the Turkish armies commanded by Abdulla Pasha were driven back in confusion and retired to positions passing through Bunar Hissar and Lule Burgas to the railway. The fortress of Adrianople, containing a large Turkish garrison, was thus isolated and left to Bulgarian investment. Between Oct. 29 and Nov. 3 the issue of the war was decided at the great battle of Lule Burgas, in which the Turkish army was heavily defeated, and retreated in disorder to the Chatalja lines, in front of Constantinople. Abdulla Pasha was superseded, and the defence of the capital entrusted to Nazim Pasha, at the time Minister of War in the Turkish Cabinet.

A great attack by the Bulgarian army on this last defence of the capital took place on Nov. 17–18. It was pushed with determination, but achieved no success, and no further attempt was made. Bulgarian losses were great, and the army ravaged by cholera; on Dec. 2 an armistice was concluded which remained in force until Jan. 1 1913. During this period the Turkish Government, with Kiamil Pasha as Grand Vizier, was overthrown by a *coup d'état;* and Nazim Pasha, the commander-in-chief, who like Kiamil had been in favour of peace, was assassinated in Constantinople. In consequence of these events, originating with the Committee of Union and Progress, hostilities were recommenced at the beginning of February. Subsequent Bulgarian operations were confined to resisting Turkish attempts to advance from Chatalja; to the occupation of Thrace down to the Sea of Marmora; to resisting an attack on the Bulgar lines across the isthmus of the Gallipoli Peninsula; and to the capture of Adrianople. This great fortress was taken by assault, in which Serbian troops bore a part, during the last days of March, and a second armistice was arranged soon afterwards.

To these armistices Greece did not subscribe. She continued naval operations and occupied all Turkish islands not under the Italian flag; and on Jan. 17 1913 a Greek squadron roughly handled the Turkish fleet in serious naval encounter.

Peace negotiations had been in progress in London since Dec. 1912, but made little headway owing to Turkish obstinacy. The hope of advancing from Chatalja and relieving Adrianople—of in fact changing the whole course of the war—was sufficient to prevent all but small concessions on the part of the Turkish Government. The fall of Adrianople on March 26 ended these unrealities; and on May 30 1913 the Ottoman delegates signed the Treaty of London. The Treaty provided for the cession by Turkey to the allied Balkan sovereigns of all European Turkey west of the line Enos–Midia, but excluding Albania; for the delimitation of Albania's frontiers by the Great Powers; for the cession of Crete to Greece; and for the destination of other Turkish islands being left to the same Powers.

Within a month of the signature of the treaty, the second Balkan War broke out between Bulgaria and her allies over the division of territory wrested from Turkey. The Bulgarian armies were on the Greek and Serbian frontiers; the force left in Thrace was weak, and the Turkish Government saw their opportunity. Two months after the same Government had signed away their European provinces, Enver Bey at the head of a Turkish army overran Eastern Thrace and reëntered Adrianople almost unopposed. Bulgaria herself was helpless; the Powers would not assist her; her late allies—now her enemies—were not opposed to the Turkish aggression; and in the end Bulgaria executed a treaty restoring the province to the Ottoman Empire. For the Committee of Union and Progress it was a triumph beyond expectation. They were again the power behind the Government and now had not only justified but confirmed their position.

It is necessary now to glance at the growth of German influence in the Ottoman Empire as being closely connected with the Turkish downfall. A definite German policy of penetration had been at work for many years. German commercial undertakings had been encouraged and assisted by the German Government to acquire immense and valuable interests within Ottoman domains; among them the construction and working of the great line of railway designed to connect Constantinople with Syria, Arabia and Bagdad. In fact the economic development of Asia Minor, a backward but richly endowed land, great in area as Germany herself, had been secured for German enterprise when the first Balkan War intervened. Much more than commercial advantage lay behind Germany's aims; political advantages of incalculable importance were also in view. In the great vision of world domination which had gradually unfolded itself before German Imperialists, the high-road to be followed ran through Constantinople and Asia Minor—thence the East and the chief waterway to it, the Suez Canal, would come within reach. In prosecution of these political designs, Turkish officers were ever welcomed in the German army. They were attached to it in numbers; they returned imbued with professional admiration for German military organization and science; with a conviction of German power; they became the conscious or unconscious agents of German policy. The bond thus established caused German advice and assistance to be sought in reorganizing the Ottoman army. It led also to relations between Germany and the Committee of Union and Progress. And because each found that much might be got from the other, Germany and the Committee worked more and more in alliance. German influence eventually became so great that when the time came, the Committee leaders were willing and able to bring their country into the World War on the side of Germany.

To complete German political preparations in the Near East, and to make her Turkish Alliance effective, it was necessary to secure the support of Bulgaria. This country lay across and completely barred the German route to Constantinople. The prospect of revenge upon her enemies of the Second Balkan War—Serbia, Greece and Rumania—and of attaining her large territorial ambitions at their expense, proved sufficient, after prudent hesitation, to attract Bulgaria to the side of Germany.

After hostilities broke out in Europe in Aug. 1914, Turkish public opinion, such as it was, desired nothing so much as the avoidance of war by the empire. That was the supreme desire, but no effective means of enforcing it existed. The Committee was all-powerful in the Government, and a small group of leaders—Enver, Talaat, Djemal Pasha and others, supported by the presence at Constantinople of two German warships, the "Goeben" and "Breslau," were able to commit the country to hostilities, by the bombardment of Russian Black Sea ports by these vessels under the Turkish flag. At the beginning of Nov. 1914, Great Britain, Russia and France had all declared war on the Ottoman Empire.

In justification of their action, and to enlist the support of the Turkish people, the Government made much of the facts that the war was against Russia, the traditional and inexorable enemy of the empire, and that Great Britain and France were in alliance with Russia. The war policy of the Government was declared to be primarily the protection of Islam, particularly Turkish Islam, against the hostile and dangerously subversive policy of Great Britain. The recovery of lost Ottoman territory, the furthering of Pan-Islamism, and the freeing of the empire from all exasperating fetters of European control, were given as additional and important purposes in view. In support of the policy, and to emphasize the religious character of Ottoman war aims, a Jihad or Holy War was proclaimed by the Sultan as Caliph of Islam.

Turkish entry into the war on the side of Germany profoundly affected the course of the war. Coupled with similar action on the part of Bulgaria it isolated Russia and Rumania from the Western Powers, and was a potent influence in producing the collapse of the Russian Empire. It compelled the Allies to gigantic military efforts far from their own territory and bases, as the only means of countering the advantages Germany gained from Turkish and Bulgarian support. It prevented food supplies from southern Russia reaching the peoples of western Europe who needed them. It came within a narrow margin of setting the Mahommedan world ablaze against Great Britain and France—on which Germany had counted—a catastrophe averted by the accident that the Sherif of Mecca opposed the Jihad and divided Islam. Participation in the war involved the Ottoman Empire in hostilities on every front of her territory; it was the penalty of her action and her geographical situation.

During the spring and summer of 1915 a British and French Expeditionary Force attacked the Dardanelles. It was recognized that in Constantinople lay the heart of the whole Eastern theatre, and that if the Straits were forced and the Ottoman capital occupied, the war in Europe itself would be greatly shortened. The campaign failed directly to achieve its purpose, but nevertheless, the Turkish regular army, irreplaceable in so far as it had been brought to a high state of efficiency by German reorganization and training, was destroyed during the operations. Foiled at the Dardanelles the Allies next attempted to attain their ends by a much greater expedition to Salonika. Its aim was to sever German communications with Constantinople by knocking Bulgaria out of the war. The Salonika area became at last the third chief zone of Allied military effort, but no great success attended the expedition until near the close of 1918. In these operations no Turkish troops took part, but in 1916 Turkish divisions had to fight in the great invasion of Rumania.

With the empire at war and the Committee in power, the Turkish Government resolved to execute their cherished scheme for the complete "Turkification" of Asia Minor. Under Talaat Bey, the Minister of the Interior, the process was begun in ruthless fashion during the spring of 1915. Greek elements of the population were deported in tens of thousands from coastal regions where they had become unduly numerous, and taken into the interior; and many were killed. But "Turkification" was aimed chiefly against the Armenians, who were to be exterminated. During 1915–6 organized massacres and deportations were carried out systematically, to the extent of almost uprooting the Armenian race from Asia Minor. Hundreds of thousands were slaughtered; hundreds of thousands set marching for Syria and Mesopotamia perished on the way by hardship, disease, starvation; those who escaped became fugitives; from first to last at least three-quarters of a million Armenians perished in Asia Minor in a population of less than two millions. Only in the Turkish provinces bordering on Trans-Caucasia did massacre and deportation fail. In these districts the Armenian inhabitants were able to escape into Russian territory or were saved by the advance of Russian armies.

In this Turko-Russian frontier the Turkish Higher Command had expected to do the greater part of their campaigning. It was one of the empire's historical fronts; beyond it lay the traditional Russian enemy; on the hither side was the Ottoman fortress of Erzerum, the greatest place of arms in Asia Minor. In this mountainous region, between the Black Sea and the Persian frontier, the war was carried on with fluctuating fortune. Erzerum was captured by the Russians on Feb. 16 1916; and the Russian armies advanced westward till they held 30,000 sq. m. of Ottoman territory. On the collapse of the Russian Empire in 1917 the Turks were able to recover ground; and under the Treaty of Brest Litovsk between Germany and Russia, signed on March 3 1918, Turkey's claims to the provinces she had lost to Russia in 1878 were recognized. Turkish troops occupied these provinces of Ardahan and Kars during 1918, and penetrated still farther into Trans-Caucasia.

In Mesopotamia from 1915 onward the Ottoman Empire had been faced by serious British military operations, here, too, with various changes of fortune. But eventually the British captured Bagdad and overran Mesopotamia from the Persian Gulf to the borders of Syria. At the end of 1914 a Turkish army from Syria made an attempt to reach the Suez Canal and cut British sea communications with the East. A battle was fought on the Canal banks, and some Turkish detachments succeeded in launching pontoons on the Canal itself. But the attack failed; subsequent attempts were defeated far from the waterway, and at the end of 1917 the British had reached southern Palestine, and the Turkish army was on the defensive, with other matters than the Canal to engage its attention.

Much had been hoped for from Arabia by Turko-German leaders, both as giving opportunities for offensive operations against the British line of communications passing along the Red Sea, and as the seat of a great spiritual influence in Islam to be exerted against the Allied Powers. In Arabia were the Holy Cities of Mecca and Medina, governed by the Sherif of Mecca, a dignitary and ruler of great influence in the Mahommedan world. He had already declined to support the Jihad. In June 1916 he rose in rebellion against the "Young Turk" or "Committee Government" of Turkey, and obtained British support. From this time onward, Arabia, instead of being a possible source of strength to the Ottoman Empire, became the theatre of hostile operations which presently extended northward to southern Palestine and endangered the left flank of the Turkish army threatening Egypt. By the end of 1917 the British under Lord Allenby had reached and occupied Jerusalem. And in the brilliant campaign during the autumn of 1918 they destroyed or captured nearly the whole Turko-German army in Syria, and only stayed their advance N. of Aleppo. This campaign ended all Ottoman resistance. The Armistice of Mudros, signed on Oct. 30 1918, terminated hostilities between the Allied Powers and Turkey, gave the Allies control of Constantinople and the Straits, and ensured the evacuation of Trans-Caucasia by Turkish troops. It marked, too, the end of "Young Turk" Government in Constantinople, for the leading members of the Committee of Union and Progress fled the country. The Armistice between the Allies and Germany, signed on Nov. 11 following, confirmed the final triumph of the Allied Powers in all the various theatres of war.

The remaining history of the Ottoman Empire up to Dec. 1921 has chiefly to do with the deliberations of the Allied Conference in determining the conditions of peace. The treaty embodying the terms of the Allied Powers was eventually signed at Sèvres by the Ottoman delegates on Aug. 10 1920. The territorial provisions of the Treaty reduced the empire to a nation little larger than Spain. Eastern Thrace and a considerable territory around Smyrna were assigned to Greece. Mesopotamia, Syria, Palestine, and Turkish Arabia were likewise forfeited; and the southern frontier of Turkey became a line running roughly E. and W. from the Persian frontier to the head of the Gulf of Alexandretta. The Dardanelles, Bosporus, the Sea of Marmora, and the adjoining coastal areas, both in Europe and Asia, were demilitarized, and, to the extent necessary to ensure the freedom of the Straits, were placed under the control of an International Commission. Constantinople, however, remained the Turkish capital. The frontiers of an Armenian state, so far as the state should include Turkish territory, were referred to the delimitation of President Wilson, whose decision the Treaty bound the Turks to accept. The line he subsequently laid down gave some 30,000 sq. m. of eastern Asia Minor to Armenia, including the Black Sea port of Trebizond.

Turkish history after the Treaty of Sèvres was signed belongs to Nationalist Turkey, the State established by Turkish Nationalists, with its capital at Angora, to resist the execution of the Treaty. (*See* Turkey, Nationalist.) (W. J. C.*)

OWEN, EDMUND (1847–1915), English surgeon, was born at Hinchingfield, Essex, April 7 1847. He received his medical education at King's College, London, and St. Mary's hospital, taking his surgical and medical degrees in 1868 and 1872, and afterwards studied in Paris. He was consulting surgeon to many institutions, including the French hospital, St. Mary's hospital, and the Hospital for Sick Children, Great Ormond St., and wrote many important works, among them being *The Surgical Diseases of Children* (1885, 3rd ed. 1897); *Cleft Palate and Hare Lip* (1904, new ed. 1914); *Appendicitis* (1914), besides the surgical articles in the *E.B.* He also gave the Bradshaw lecture on cancer in 1906. He died in London July 23 1915.

OXFORD (*see* 20.405).—The population of the city increased from 53,048 in 1911 to 57,052 in 1921. Apart from the disappearance of the horse-trams in 1914, in favour of motor-buses, and the starting of the "Garden Suburb" in the Cowley Road in 1921, the municipal progress for the decade, as apart from the university, has few features of special interest.

The University.—During the World War 14,561 Oxford men served in the British military and naval forces, this total including prospective members of colleges who fell in the war, and also those who joined the university after the war, in which 2,660 Oxford men lost their lives. This was the number "commemorated" at the university memorial service at St. Mary's in June 1919.

The most important service rendered by the university was in the supply of officers for the new armies. The O.T.C. in Oxford was a flourishing body before the war, and, thanks mainly to it, nearly 2,000 Oxford men had received commissions by the end of Sept. 1914. After that date Oxford became one of the main training grounds for officers: all the colleges but one gave up the larger part of their space for military purposes, especially for the training of cadets, of whom there were, for the last three years of the war, nearly 2,000[1] always in Oxford. The examination schools in the High Street were ready as a hospital in the second week in Aug. 1914, and remained in military occupation till the summer of 1919.

As a natural result of the war the numbers of the university fell rapidly: there were 3,097 in residence in Jan. 1914, 1,087 at the same period in 1915, 550 in 1916, 460 in 1917, 369 in 1918. With the Armistice the tide turned, and there were 1,357 men up in Jan. 1919. For Oct. 1920 the university calendar gave the names of 5,002 men and 687 women as undergraduates; the first figure probably indicates an actual number of nearly 4,500 men in residence. As the university did not elect to its scholarships and prizes during the war, and also did not fill up the professorships that fell vacant, a considerable fund (about £50,000) was accumulated, in spite of the falling-off in the ordinary revenue. This fund was also built up in part by the voluntary gifts of members of the university.

In 1920 women students were admitted to full membership of the university. It had long been generally felt that the two old British universities must soon follow the example of all the modern ones, in admitting women to equal privileges with men. No doubt, however, this concession was hastened by the success of women's work in the war.

Another old burning question was settled by the passing of a statute in 1920 admitting to the Oxford theological degree scholars who are not members of the Church of England.

Important changes have also been made of a less revolutionary nature in the university constitution and its educational facilities. The Hebdomadal Council is no longer evenly divided among heads of colleges, professors and ordinary M.A.'s; three of the seats previously reserved for heads are now thrown open. A further change affecting the Hebdomadal Council is the institution (in 1913) of a general Board of the Faculties, which has power of initiating legislation on all subjects connected with the studies of the university. Oxford finance, too, has been provided with more efficient machinery, first by setting up (1912) an outside finance board to advise the university Chest, and then in 1920 by the reconstitution of the Chest itself. In the development of the organization for research, the tentative step taken in 1895 by the setting-up of the degrees of B.Litt. and B.Sc. has been followed by the creation (1917) of a Ph.D. degree, involving two to three years of independent work, for graduates of Oxford or of other universities.

A new engineering laboratory was opened in 1912, and a new chemical laboratory in 1915; this last has been munificently endowed by Mr. Dyson Perrin's gift of £25,000. Several colleges have extended their boundaries by taking in adjacent houses, and the Oxford Union Society opened its new block in 1913. Another addition to university buildings is Barnett House, opened in 1914, as a memorial of Canon Barnett, the founder of Toynbee Hall (died 1913), to be a centre of social studies.

Among recent university benefactors chief place is taken by Mr. Walter Morrison, who in 1920 crowned his previous gifts (of £20,000 at least) by one of £50,000 to the Bodleian. Biological science in Oxford profited to an almost equal amount by the Welch bequest in 1915, while the study of modern languages has been encouraged by the foundation of the Zaharoff professorship of French and the Serena professorship of Italian.

The part of Oxford in the World War is best sketched in Craig's *Roll of Service*, with preface by Sir W. Raleigh (University Press, 1920); perhaps the most interesting short account of the changes in Oxford during the war period may be found in the *Oxford Magazine* for Dec. 8 1916. (J. We.*)

OYAMA, IWAO, Prince (1842–1916), Japanese field-marshal (*see* 20.424). In 1914 he was nominated Lord Keeper of the Privy Seal, and in this capacity he attended the accession ceremony of the Emperor Yoshihito, which took place in Kyoto in Nov. 1915. In Dec. of the following year the Prince died, being accorded a State funeral by the imperial court. In him Japan lost one of her "Elder Statesmen."

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[1] This estimate includes men training for the Air Force.

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VOLUME XXXII

PACIFIC OCEAN ISLANDS to ZULOAGA

ALSO SEPARATE INDEX AND LIST OF CONTRIBUTORS COVERING THE NEW VOLUMES
XXX, XXXI AND XXXII

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E. T.	Elihu Thomson, A.M., Ph.D., D.Sc. Consulting Engineer of the General Electric Company. Originator of Resistance Electric Welding (Thomson Process).	**Welding, Electric.**
E. T. D.	Edward Thomas Devine, Ph.D., LL.D. Associate Editor of *The Survey*, New York. Author of *Misery and its Causes*; *The Normal Life*; *Disabled Soldiers and Sailors*; etc.	**United States: *Social and Welfare Work* (*in part*).**
E. T. d'E.	Sir Eustace Henry William Tennyson d'Eyncourt, K.C.B., F.R.S., D.Sc. Commander of the Legion of Honour. Distinguished Service Medal (U.S.A.). Director of Naval Construction and Chief Technical Adviser to the British Admiralty. Chief Adviser on Tanks to the Ministry of Munitions during the World War. Vice-president of the Institution of Naval Architects.	**Ship and Shipbuilding.**
E. Vi.	Ethan Viall. Editor of *American Machinist*. Member A.S.M.E., A.I.E.E., A.S.T.M., S.A.E. Author of *Broaches and Broaching*; *Electric Welding*; *Gas-Torch and Thermit Welding*; *United States Rifles and Machine Guns*; *United States Artillery Ammunition*; *Manufacture of Artillery Ammunition*; etc.	**Thermit and Thermit Welding; Welding: *Gas Torch*.**
E. v. W.	Eduard von Wertheimer. Emeritus Professor of History in the University of Pressburg.	**Szell, K.; Szilagyi, D.; Tisza.**

F. B. M.	Major-General Sir Frederick Barton Maurice, K.C.M.G., C.B. Commander of the Legion of Honour. Croix de Guerre. First Class Orders of St. Stanislas of Russia. Director of Military Operations, Imperial General Staff, 1915–6. Author of *Forty Days in 1914*; *The Last Four Months*; etc.	**Western European Front Campaigns** (*in part*).
F. C. E.	Franz Carl Endres. Major, late General Staff, Turkish Army. Author of a *Life of Moltke*; *Die Ruine des Orients*; etc. Member of Committee, German League of Nations Union.	**Turkish Campaigns:** ***Caucasus.***
F. C. S. S.	Ferdinand Canning Scott Schiller, M.A., D.Sc. Fellow and Tutor of Corpus Christi College, Oxford. President of the Society for Psychical Research, 1914. Author of *Formal Logic*; *Humanism*; *Studies in Humanism*; *Riddles of the Sphinx*; etc.	**Psychical Research.**
F. F.	Frank Fox, O.B.E. Author of *Australia*; *Problems of the Pacific*; "*G.H.Q.*" Served in the World War as British Artillery officer and as Staff officer.	**Supply and Transport, Military.**
F. H. Br.	Frank Herbert Brown, C.I.E. On the Staff of *The Times* for Indian Affairs. London Correspondent of *The Times of India*. Formerly Assistant Editor of the *Bombay Gazette* and Editor of the *Indian Daily Telegraph*, Lucknow.	**Tilak, B. G.**
F. H. H.	Franklin Henry Hooper. American Editor of the *Encyclopædia Britannica* (12th Edition).	**Public Assistance:** ***United States.***
F. M. B.	Major Frederick Marshman Bailey, C.I.E. Indian Political Department. Gold Medallist of the Royal Geographical Society, 1916.	**Turkestan, West.**
F. M. R.	Lieutenant-Colonel F. M. Rickard. Royal Artillery. Chief Instructor, Artillery College, Woolwich (assisted by Instructional Staff, Artillery College).	**Propellants.**
F. R. C.	Frank Richardson Cana, F.R.G.S. Editorial Staff, 11th edition of the *Encyclopædia Britannica*. Editorial Staff of *The Times*. Author of *South Africa from the Great Trek to the Union*; *Problems of Exploration: Africa*; *The Sahara in 1915*; *The Great War in Europe*; etc.	**Portuguese East Africa; Rhodesia; Senussi; Sierra Leone; Somaliland; South Africa** (*in part*); **Sudan** (*in part*); **Suez Canal; Tanganyika Territory; Togoland; Transvaal; Tripoli; Uganda; Zanzibar.**
F. T.	General Frédéric Thevenet. General of Division, French Army. Formerly Governor of Belfort. Commander Belfort region in the World War. Author of *La Place de Belfort*.	**Vosges, Battles in the.**
F. W.	Major-General Sir Fabian Ware, K.B.E., C.B., C.M.G. Chevalier of the Legion of Honour. Commander of the Order of the Crown (Belgium), etc. Vice-chairman of the Imperial War Graves Commission. Formerly Editor of the *Morning Post*.	**War Graves.**
F. W. Mo.	Sir Frederick Mott, K.B.E., M.D., LL.D., F.R.S. Director of the Pathological Laboratory of the L.C.C. Asylums. Consulting Physician, Charing Cross Hospital. Late Member of the Royal Commission on Venereal Diseases.	**Shell Shock; Venereal Diseases.**
G. A. S.	Sir George Augustus Sutton, Bart. Chairman of the Amalgamated Press, Limited. Hon. Director of Publicity to the British Treasury, 1917–9.	**War Loan Publicity Campaigns.**
G. C. S.	Gilbert Campbell Scoggin, M.A., Ph.D. Sometime Scholar of Harvard University. Formerly Assistant Professor of Greek at the University of Missouri. Associate Editor of *The Classical Journal*. Member of the American Editorial Staff of the *Encyclopædia Britannica*.	**Tennessee.**
G. Dr.	Geoffrey Drage, M.A. President of the Central Poor Law Conference, 1906. Vice-president, Royal Statistical Society, 1916–8. Attached to the War Office, Military Intelligence Section, 1916. Author of *The State and the Poor*; *Reorganization of Official Statistics and a Central Statistical Office*; *Pre-war Statistics of Poland and Lithuania*; etc.	**Poland; Public Assistance** (*in part*).
G. D. H. C.	George Douglas Howard Cole, M.A. Formerly Fellow of Magdalen College, Oxford. Hon. Secretary, Labour Research Department. Author of *The World of Labour*; *Self-Government in Industry*; *Guild Socialism Restated*; *Social Theory*; etc.	**Socialism; Wage System in Industry.**
G. E. B.	George Earle Buckle, M.A., Hon. LL.D. Formerly Scholar of New College and Fellow of All Souls College, Oxford. Editor of *The Times*, 1884–1912. Author of *Life of Disraeli* (vols. 3, 4, 5, and 6). See biographical article: Buckle, George Earle.	**Rhondda, Viscount.**
G. E. F.	George Emory Fellows, A.M., Ph.D., L.H.D., LL.D. Professor of History and Political Science in the University of Utah. President of the University of Maine, 1902–11. Author of *Recent European History*; *Outline Study of the Sixteenth Century*; etc.	**Utah.**

G. G. G.	George G. Groat, Ph.D. Head of the Department of Commerce and Economics, University of Vermont. Author of *Attitude of American Courts in Labor Cases*; *Introduction to the Study of Organized Labor in America*.	**Vermont.**
G. K. S. M.	Major-General Sir George Kenneth Scott-Moncrieff, K.C.B., K.C.M.G., C.I.E., Hon. M.Inst.C.E., Late R.E. Director of Fortifications and Works, War Office, 1911–8. Author of *The Water Supply of Barracks and Cantonments*; *The Principles of Structural Design*; etc.	**Training Camps, Military** (*in part*); **Water Supply, Military.**
G. P. D.	Major-General Guy Payan Dawnay, C.B., C.M.G., D.S.O., M.V.O. Formerly Brigadier-General, General Staff, Egyptian Expeditionary Force, and Director of Staff Duties, G.H.Q., France.	**Turkish Campaigns:** *Sinai.*
G. S.	George Saunders, O.B.E., B.A. (Oxon.), Hon. LL.D. (Glasgow). Correspondent of the *Morning Post* in Berlin, 1888–97, and of *The Times* in Berlin, 1897–1908, and in Paris, 1908–14.	**Tirpitz, Alfred von.**
H. A. W.*	Colonel H. A. White. Judge Advocate, United States Army Department.	**United States:** *Military Law.*
H. B.*	Herbert Brande. Formerly Editorial Writer, *The Chicago Tribune.*	**Railway Stations.**
H. Be.	General Henri Berthaut. Sub-Chief of the General Staff of the French Army, 1903–12. Author of *La Carte de France*; *Topologie*; *De la Marne à la Mer du Nord*; *L'Erreur de 1914*; etc.	**Western European Front Campaigns** (*in part*).
H. Ch.	Hugh Chisholm, M.A. Formerly Scholar of Corpus Christi College, Oxford. Editor of the 10th, 11th and 12th editions of the *Encyclopædia Britannica.* Financial Editor of *The Times*, 1913–20. See the biographical article: Chisholm, Hugh.	**World War:** *Introductory.*
H. C. P.	Henry Clemens Pearson, F.R.G.S. Editor and Publisher of the *India Rubber World*, New York. Author of *Crude Rubber Compounding Ingredients*; *Rubber Machinery*; *Pneumatic Tires*; *Rubber Country of the Amazon*; *What I Saw in the Tropics*; etc.	**Rubber.**
H. D. B.	Captain Henry Dalrymple Bridges, D.S.O., R.N.	**Submarine Mines** (*in part*).
H. E. A. C.	Henry Evan Auguste Cotton, C.I.E., L.C.C. Formerly Scholar of Jesus College, Oxford, and Advocate of the High Court at Calcutta. Author of *Calcutta Old and New.* Late Editor of *India.*	**Tagore, R.**
H. F. O.	Henry Fairfield Osborn, LL.D., D.Sc. Honorary Curator of Vertebrate Palaeontology in the American Museum of Natural History, New York City; and Vertebrate Palaeontologist, United States Geological Survey.	**Palaeontology.**
H. I. P.	Herbert Ingram Priestley, M.A., Ph.D. Associate Professor of Mexican History and Librarian of the Bancroft Library, University of California. Author of *José de Gálvez, Visitor-General of New Spain*; etc.	**Panama;** **Salvador;** **Villa.**
H. J. G.	Sir Henry Gauvain, M.A., M.D., M.Ch. (Cantab.). Medical Superintendent, Lord Mayor Treloar Cripples' Hospital and College, Alton and Hayling Island, Hants. Hon. Consulting Surgeon to the Welsh National Memorial Association. Consultant in Surgical Tuberculosis to the Essex and Hampshire County Councils.	**Tuberculosis** (*in part*).
H. M. M.	Harold Medway Martin, A.C.G.I. Whitworth Scholar. Member of the Nozzles Research Committee, appointed by the Institute of Mechanical Engineers. Member of the Lubricants and Lubrication Enquiry Committee, appointed by the Department of Scientific and Industrial Research (London).	**Turbines, Steam** (*in part*).
H. O'L.	Major Herbert O'Leary. U.S. Army. Chief of Small Army Division, Ordnance Officer, Washington.	**Pistol; Rifles and Light Machine-Guns** (*in part*); **Sights:** (*Rifle* and *Pistol*).
H. P.-G.	Harry Pirie-Gordon, D.S.C., M.A. Served in the World War. Editor of *A Brief Account of the Advance of the Egyptian Expeditionary Force.*	**Palestine; Syria; Transjordania; Turkish Campaigns:** *Palestine.*
H. P. D.	Captain Henry Percy Douglas, C.M.G., R.N., F.R.A.S., A.M.I.C.E. Assistant Hydrographer of the British Navy, 1919–21.	**Surveying:** *Nautical.*
H. Sa.	Hirosi Saito, M.A. Secretary of Embassy and Consul in the Japanese Diplomatic and Consular Service. Member of the Japanese Delegation to the Peace Conference in Paris, 1919, and to other Inter-Allied and International Conferences in Europe and America, 1919–21.	**Sakhalin.**
H. S. L. W.	Harold St. John Loyd Winterbotham, C.M.G., D.S.O. Ordnance Survey, Great Britain. Victoria Medallist of the R.G.S., 1920.	**Surveying** (*in part*).
H. Wf.	Humbert Wolfe, C.B.E.	**Trade Boards.**

H. W. C. D.	Henry William Carless Davis, M.A., C.B.E. Professor of History at Manchester University. Fellow and formerly Tutor of Balliol College, Oxford. Sometime Fellow of All Souls College, Oxford. Member of Advisory Staff of British delegation to the Peace Conference.	**Peace Conference.**
H. W. K.	H. W. Kaye, M.D. (Oxon.). Director of Medical Services, Ministry of Pensions. Late Personal Assistant to Chief Commissioner of Medical Services, Ministry of National Service.	**United Kingdom:** *Medical Examination of the Nation.*
H. W. M.	Henry William Mardon, F.R.G.S. Commander of the Mejidieh. Formerly Lecturer in Geography and Education in the Tewfikieh and Dar el Ulum Colleges, Cairo. Author of *A Geography of Egypt and the Anglo-Egyptian Sudan*; etc.	**Ukraine.**
H. W. W.	Herbert Wrigley Wilson, M.A. Sometime Scholar of Trinity College, Oxford. Author of *Ironclads in Action.* Contributor to *The Cambridge Modern History.* Assistant Editor of *The Daily Mail.*	**Rothermere, Lord.**
I. M. T.	Ida Minerva Tarbell, M.A., Litt.D., LL.D. Former Associate Editor of *The Chautauquan, McClure's Magazine, American Magazine.* Author of *Life of Abraham Lincoln*; *The History of the Standard Oil Company*; *The Tariff in our Times*; *New Ideals in Business*; etc.	**Women's War-Work:** *United States.*
I. O. A.	Irene Osgood Andrews, A.B. Assistant Secretary, American Association for Labor Legislation. Author of *Working Women in Tanneries*; *Irregular Employment and the Living Wage for Women*; *Economic Effects of the War upon Women and Children in Great Britain*; etc.	**Women:** *United States*; **Women's Employment:** *United States*; **Women Police:** *United States.*
J. A. F.	John Ambrose Fleming, M.A., D.Sc., F.R.S., M.Inst.E.E. Professor of Electrical Engineering in the University of London. Fellow of University College, London. Sometime Fellow of St. John's College, Cambridge. Author of *The Principles of Electric Wave Telegraphy and Telephony*; *The Propagation of Electric Currents in Telephone and Telegraph Conductors*; *The Thermionic Valve*; *The Wonders of Wireless Telegraphy*; etc.	**Wireless Telegraphy and Telephony.**
J. A. G.*	James Andrew Gunn, M.A., M.D., D.Sc., F.R.S. (Edin.). Professor of Pharmacology, University of Oxford. Formerly Assistant in the Department of Pharmacology, Edinburgh University.	**Pharmacology.**
J. A. K.	J. A. Kay. Editor of the *Railway Gazette.*	**Railways:** *British.*
J. A. Ro.	James Alexander Robertson, Ph.B., L.H.D. Chief of the Near Eastern Division Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D.C. Managing Editor of *The Hispanic American Historical Review.* Co-editor of Blair and Robertson's *The Philippine Islands, 1493–1898* (55 Vols.). Compiler of *Bibliography of the Philippine Islands*; etc.	**Philippines.**
J. A. T.	John Arthur Thomson, M.A., LL.D. Regius Professor of Natural History in the University of Aberdeen. Author of *The System of Animate Nature*; *The Wonder of Life*; *The Biology of the Seasons*; etc.	**Zoölogy.**
J. B. Bi.	Joseph Bucklin Bishop. Secretary to the Panama Canal Commission, 1905–14. Author of *The Panama Gateway.*	**Panama Canal.**
J. C. P.*	John Clagett Proctor, LL.M. Member of the Bar of the District of Columbia. Author of the *Hines Family.* Historian of the Society of Natives of the District of Columbia.	**Washington (D.C.).**
J. C. Van D.	John C. Van Dyke, L.H.D. Professor of the History of Art, Rutgers College. Author of *Art for Art's Sake*; *Meaning of Pictures*; *History of Painting*; etc.	**Painting:** *United States.*
J. D. P.	John Danvers Power, M.V.O. Vice-chairman, British Red Cross Society. Editor of the Report by the British Red Cross Society and the Order of St. John on their joint war work, 1914–9.	**Red Cross Work:** *British.*
J. E. C.	Janet Elizabeth Courtney, O.B.E., J.P. (Mrs. W. L. Courtney). Author of *Free Thinkers of the Nineteenth Century.* Joint-author of *Pillars of Empire.* Joint-editor of Index to the 11th edition of the *Encyclopædia Britannica.*	**Women:** *United Kingdom*; **Women Police:** *United Kingdom.*
J. E. Ha.	James E. Hale, S.B., M.S.A.E. Technical Development and Sales Engineer, Goodyear Tire and Rubber Company, Akron, Ohio.	**Tire.**
J. H.	John Hilton.	**Strikes and Lockouts;** **Unemployment:** *United Kingdom Statistics.*

J. H. Ho.	Jacob H. Hollander, Ph.D. Professor of Political Economy in Johns Hopkins University. Author of *David Ricardo*; *The Abolition of Poverty*; *War Borrowing*; etc. Treasurer of Porto Rico, 1900–1. Financial Adviser of the Dominican Republic, 1908–10.	**Porto Rico;** **Santo Domingo.**
J. H. Je.	James Hopwood Jeans, M.A., LL.D., F.R.S. Secretary of the Royal Society. Author of *The Dynamical Theory of Gases*; *Problems of Cosmogony and Stellar Dynamics*; etc.	**Relativity.**
J. J. C.	Brigadier-General John Johnston Collyer, C.B., C.M.G., D.S.O. Late Chief of the General Staff, Union of South Africa.	**South Africa:** ***Defence.***
J. Mo.*	Rt. Rev. Mgr. J. Moyes, D.D. Canon of Westminster Cathedral. Formerly Editor of the *Dublin Review*. Domestic Prelate to His Holiness Pope Benedict XV.	**Pius X.**
J. M. C.*	James Morton Callahan, A.M., Ph.D. Professor of History and Political Science and Dean of West Virginia University. Author of *Neutrality of the American Lakes*; *Cuba and International Relations*; *History of West Virginia*; etc.	**West Virginia.**
J. M. R.	John Morgan Rees, M.A., F.R.Econ.S. Lecturer in Economics and Political Science in the University College of Wales, Aberystwyth. Author of *Wages and Costs in South Africa*; *South Wales Iron, Steel and Tinplate Industries as affected by the War*; etc.	**Syndicalism** ***(in part).***
J. O. P. B.	John Otway Percy Bland. Author of *China*; *Japan and Korea*; *Houseboat Days in China*. Joint-author of *China under the Empress Dowager*. Served in Chinese Maritime Customs, 1883–96. Shanghai Correspondent for *The Times*, 1897–1910.	**Shanghai;** **Tibet;** **Tientsin.**
J. P.*	Joseph Proudman, M.A., D.Sc. Professor of Applied Mathematics, and Hon. Director of the Tidal Institute, in the University of Liverpool. Fellow of Trinity College, Cambridge.	**Tides.**
J. R. Co.	John Rogers Commons, A.B., A.M., LL.D. Professor of Economics, University of Wisconsin. Author of *Documentary History of American Industrial Society*; *History of Labor in the United States*; *Principles of Labor Legislation*; etc.	**Profit-Sharing and Co-Partnership:** ***United States;*** **Strikes and Lockouts:** ***United States;*** **Trade Unions:** ***United States;*** **Unemployment:** ***United States;*** **United States:** ***Labor Movement;*** **Wages:** ***United States.***
J. R. R.	Right Hon. Sir James Rennell Rodd, G.C.B., G.C.M.G., G.C.V.O. Grand Cross of St. Maurice and St. Lazarus. Commander of the Osmanieh. Grand Cross of Polar Star. Late Ambassador to the Court of Italy. Member of Lord Milner's Mission to Egypt, 1920. Special Envoy to King Menelek II., 1897. Author of *Customs and Lore of Modern Greece*; *Poems in Many Lands*; etc.	**Sudan** ***(in part).***
J. S. F.	John Smith Flett, M.A., D.Sc., LL.D., F.R.S. Director, and formerly Petrographer, of the Geological Survey of Great Britain. Author or Part-author of many Geological reports and memoirs.	**Petrology.**
J. S. Ha.	Major Julian Somerville Hatcher. Ordnance Department, U.S. Army. Member of the American Institution of Mining and Metallurgical Engineers. Life Member of the National Association of America. Experimental Engineer at the Government Small Arms Plant, Springfield Armory. Formerly Chief of the Machine-Gun and Small Arms Section, Ordnance Department.	**Sights** ***(in part).***
J. S. Nc.	Joseph Sinclair Nicholson, M.A.	**Unemployment:** ***United Kingdom.***
K. H.*	Karl Hildebrand, Ph.D. Member of the Swedish Debt Board. Chief Editor of the daily paper *Stockholms Dagblad*, 1904–13. Member of the Swedish Parliament, 1907–18.	**Sweden.**
L. A. M.	Lionel Alfred Martin. Director of Henry Tate & Sons, Limited, Sugar Refiners, London and Liverpool. Vice-president of the London Chamber of Commerce. Member of the Port of London Authority.	**Sugar.**
L. A. W.*	Laura A. White, Ph.D. Professor of History in the University of Wyoming.	**Wyoming.**
L. Br.	Lilian Brandt, M.A. Author of *Social Aspects of Tuberculosis*; *Causes of Poverty*; *Deserted Families*; etc.	**United States:** ***Social and Welfare Work (in part).***
L. H. H.	Lewis Henry Haney, B.A., M.A., Ph.D. Bureau of Markets, U.S. Department of Agriculture. Formerly Director, New York University, Bureau of Business Research. Member of the Economic Advisory Board of the Federal Trade Commission, 1916–9.	**Prices:** ***United States;*** **Profiteering:** ***United States.***

L. H. H.*	Colonel Lucius H. Holt, B.A., M.A., Ph.D. (Yale). Professor of English and History at the United States Military Academy, West Point. Author of *Introduction to the Study of Government.* Joint-author (with Major A. W. Chilton) of *History of Europe, 1789–1815*; *History of Europe, 1862–1914.*	West Point.
L. J.	Major-General Sir Louis Jackson, K.B.E., C.B., C.M.G. Commander of the Legion of Honour, Knight of St. Stanislas. Late Royal Engineers. Formerly Director-General of Trench Warfare Supply, and Controller of Chemical Warfare Research, British War Office.	Poison Gas Warfare.
L. M. F.	Leonard M. Fanning. Director of Publicity and Statistics, American Petroleum Institute. Formerly Editor of the *Oil Trade Journal.*	Petroleum.
L. Si.	Leon Simon, B.A. (Oxon.). Author of *Studies in Jewish Nationalism.*	Zionism.
L. T.	Lorado Taft, N.A., L.H.D. National Academy of Arts and Letters. Sculptor, Lecturer, and Professorial Lecturer, University of Chicago. Non-resident Professor of Art, University of Illinois. Author of *History of American Sculpture*; *Modern Tendencies in Sculpture.*	Sculpture: *United States.*
L. Wi.	Leonard Williams, M.D.	Vitamines.
L. Wo.	Major Leonard Wood. Chief-of-Staff, United States Army, 1910–4. See the biographical article: Wood, Leonard.	Training Camps: *United States.*
M. B.*	Mareu Beza, L. ès L. Lecturer at King's College, London. Author of *O Viata*; *Din Anglia*; *Papers on the Rumanian People and Literature*; etc.	Rumania: *Literature.*
M. G. F.	Millicent Garrett Fawcett (Mrs. Henry Fawcett), J.P., LL.D. (Hon. St. Andrews and Birmingham). See the biographical article: Fawcett, M. G.	Woman Suffrage.
M. H.	Lieutenant-Field-Marshal Maximilian Hoen. Director of the Austrian Kriegsarchiv, Vienna. Part-author of the Austrian Official History of the First Silesian War. Author of *Der Krieg 1809*; etc.	Rovno, Battle of.
M. I. C.	Margaret Isabel Cole (Mrs. G. D. H. Cole). Correspondence Secretary of the Labour Research Department, London, 1917–20.	Profit-Sharing and Co-Partnership (*in part*); Trade Unions (*in part*).
N. J.	Nicolas Jorga, Dr. Juris. Professor at the University of Bucharest. Member of the Académie Roumaine. Correspondent of the Institut de France and of the Académie Serbe. Author of *Die Geschichte des Osmanescher Reiches*; *The Byzantine Empire*; etc.	Rumania: *History.*
N. M.*	Major-General Sir Neill Malcolm, K.C.B., D.S.O. General Commanding British Army of Occupation in Germany. Formerly Instructor in Military History at the Staff College, Camberley.	Tactics.
N. N. G.	Lieutenant-General N. N. Golovine. Russian Cross of St. George. British Military C.B. French Croix de Guerre. Commander of the Legion of Honour. Formerly Professor in the Russian General Staff College.	Sukhomlinov.
O. B. K.	O. B. Kent, B.S., M.S., Ph.D. Professor of Poultry Department of New York State College of Agriculture at Cornell University. Managing Editor *Poultry Science.* Secretary Treasurer of American Association of Instructors and Investigators of Poultry Husbandry.	Poultry: *United States.*
O. J. R. H.	Osbert John Radcliffe Howarth, O.B.E., M.A. Assistant Secretary of the British Association. Sometime of the Geographical Section, Naval Intelligence Department. Editor of the *Oxford Survey of the British Empire.*	Pacific Ocean, Islands of; Straits Settlements and Dependencies; United Kingdom: *Statistics.*
P. A. F.	Percy A. Francis, M.B.E., N.D.A., N.D.D. Technical Head of the Small Livestock Branch, Ministry of Agriculture and Fisheries, London. Late Senior Agricultural Inspector to the Board of Agriculture for Scotland. Superintending Instructor in Poultry-Keeping and Dairying to the Irish Department of Agriculture and Technical Instruction. County Instructor in Poultry-Keeping to the Antrim County Council.	Poultry (*in part*).
P. A. Me.	Philip Ainsworth Means, M.A. Investigator for the Smithsonian Institution, Washington, D.C. Author of *History of the Spanish Conquest of Yucatan and of the Itzas*; *A Survey of Ancient Peruvian Art*; etc.	Peru.
P. A. S.	Percy Alfred Scholes, B.Mus., A.R.C.M. Music Critic of *The Observer*, London. Editor of *The Music Student.* Author of *The Listener's Guide to Music*; etc.	Scriabin, A. N.

P. C. M.	Peter Chalmers Mitchell, C.B.E. (Military Division), F.R.S., D.Sc., LL.D. Secretary, Zoölogical Society of London. Attached to Directorate of Military Intelligence, War Office, 1916–8. Liaison Officer with British War Mission, 1918. Editorial Staff of *The Times*.	**Propaganda.**
P. de T.	P. de Thomasson. French Delegate to the Saar Commission.	**Saar Valley.**
P. M. H.	Peter Martin Heldt. Engineering Editor of *Automotive Industries*. Author of *The Gasoline Automobile*.	**Tractors.**
P. M. S.	Brigadier-General Sir Percy Molesworth Sykes, K.C.I.E., C.B., C.M.G. Formerly British Consul-General, Persia. Late Inspector-General, South Persia Rifles. Author of *History of Persia*; *Manners and Customs*; *Glory of the Shia World*; etc. Gold Medallist, R.G.S., 1902.	**Persia.**
P. Vi.	Sir Paul Vinogradoff, M.A., D.C.L., LL.D., Dr. Hist., Dr. Juris. Corpus Professor of Jurisprudence, Oxford. Author of *Villainage in England*; *The Growth of the Manor*; *Outlines of Historical Jurisprudence*; etc. See the biographical article: Vinogradoff, Sir Paul.	**Russia;** **Trotsky, Lev;** **Tschaikovsky, N. V.;** **Wrangel.**
R. A. V.	Rolland A. Vandergrift, M.A. Assistant in History in the University of California.	**San Francisco.**
R. B. D. A.	Sir Reginald Brodie Duke Acland, M.A., K.C. Judge Advocate of the Fleet. Member of the British Government Committee on the Treatment by the Enemy of Prisoners of War, and of the Committee on the Breaches of the Laws of War.	**Prisoners of War.**
R. D. O.	Richard Dixon Oldham, F.R.S., F.G.S., F.R.G.S. Author of numerous papers on various aspects of Geology and kindred subjects.	**Seismology.**
R. E. G.	Colonel R. E. Golightly.	**Volunteers.**
R. E. P.	Major R. E. Priestly, M.C., B.A. Author of the *Official History of the Signal Service during the European War, 1914–8*; *Breaking the Hindenburg Line*; *The History of the 46th, North Midland, Division*; etc.	**Signal Service, Army** (*in part*).
R. H. P.	Robert Hodson Parsons, A.M.I.C.E. Member of the Engineering Institute of Canada.	**Turbines, Steam.**
R. M. Wi.	R. McNair Wilson, M.B., Ch.B. Fellow of the Royal Society of Medicine. Editor, Oxford Medical Publications. Late Research Worker in Cardiology, Medical Research Committee. Consultant to the Ministry of Pensions in Trench Fever.	**Tetanus;** **Trench Fever;** **Yellow Fever.**
R. N. R. B.	Robert N. Rudmose Brown, D.Sc. Member of the Scottish National Antarctic Expedition, 1902–4, and of the Scottish Arctic Expeditions, 1909, 1912 and 1914. Lecturer in Geography, University of Sheffield. Author of *Spitsbergen*, etc. Joint-author of *The Voyage of the Scotia*.	**Siberia;** **Spitsbergen.**
R. Po.*	Roscoe Pound, Ph.D., LL.D. Carter Professor of Jurisprudence and Dean of the Faculty of Law in Harvard University. Sometime Commissioner of Appeals of the Supreme Court of Nebraska.	**Women, Legal Status of:** *United States.*
R. S. R.	Robert Sangster Rait, C.B.E., M.A., LL.D. Historiographer Royal for Scotland. Professor of Scottish History and Literature in the University of Glasgow. Author of *The Scottish Parliament*; *History of Scotland*; etc.	**Scotland.**
R. Th.	Ralph Thicknesse. Barrister-at-Law. Author of *Digest of Law*; *Husband and Wife*; etc.	**Women, Legal Status of:** *United Kingdom.*
R. van O.	Capitaine-Commandant R. van Overstraeten. Aide-de-Camp to H.M. The King of the Belgians. Graduate of the Staff College. Order of Leopold. D.S.O. Legion of Honour.	**Ypres and Yser, Battles of:** *Part IV.*
R. W. S.-W.	Robert William Seton-Watson, D.Litt. (Oxon.), Hon. Ph.D. (Prague and Zagreb). Lecturer in East European History at King's College, University of London. Author of *Racial Problems in Hungary*; *The Southern Slav Question*; *The Rise of Nationality in the Balkans*; etc. Editor of *The New Europe*.	**Serbia;** **Yugoslavia.**
S. B. McC.	Samuel Black McCormick, A.B., M.A., D.D., LL.D. Chancellor Emeritus, University of Pittsburgh, Pa.	**Pittsburgh.**
S. de M.	Salvador de Madariaga. Author of *Shelley and Calderon, and other Essays on Spanish and English Poetry*; *Romances de Ceigo*; *Manojo de Poesias Inglesas*; etc.	**Spanish Literature.**
S. H.	Sydney Herbert. Lecturer in International Politics, University College, Aberstwyth. Author of *Modern Europe, 1789–1914*; *Nationality and its Problems*; *Fall of Feudalism in France*.	**Syndicalism** (*in part*).

S. L. M.	Susan Langstaff Mitchell. Author of *The Living Chalice*; *Aids to the Immortality of Certain Persons in Ireland*; etc.	**Russell, G. W.**
S. McC. L.	Samuel McCune Lindsay, Ph.D., LL.D. Professor of Social Legislation in Columbia University. President of New York Academy of Political Science. Editor of American Social Progress Series. Author of *Railway Labor in the United States*; *Financial Administration of Great Britain*; etc.	**Prohibition.**
T. C.	Theodore Collier, Ph.D. Professor of European History in Brown University, Providence, R.I.	**Rhode Island.**
T. G. Ch.	Sir Theodore Gervase Chambers, K.B.E., Assoc.R.S.M., F.S.I., F.G.S. Vice-chairman and late Controller of the National (War) Savings Committee, Great Britain.	**Savings Movement.**
T. S. A.	Thomas Sewall Adams, Ph.D. Professor Political Economy in Yale University. Advisor on Taxation, U.S. Treasury Department.	**United States:** *Finance*; **United States:** *Taxation.*
V. L. C.	Varnum Lansing Collins, A.M. Secretary of Princeton University and Clerk of the University Faculty. Author of *The Continental Congress at Princeton*; *Guide to Princeton*; etc.	**Princeton University.**
V. L. E. C.	General Victor Louis Émilien Cordonnier. See the biographical article: Cordonnier, V. L. E.	**Woevre, Battles in** *(in part).*
V. L. K.	Vernon Lyman Kellogg, M.S., LL.D. Permanent Secretary, National Research Council, Washington. Sometime Professor in Leland Stanford Jr. University. Director in Brussels of Commission for Relief in Belgium. Assistant to U.S. Food Administrator. Member of the American Relief Administration.	**Red Cross Work:** *United States*; **Y.M.C.A.:** *United States.*
W. A. B. C.	Rev. William Augustus Brevoort Coolidge, M.A. (Oxon.), Hon. Ph.D. (Berne). Fellow of Magdalen College, Oxford. Author of *Swiss Travel and Swiss Guidebooks*; *Josias Simler et les Origines de l'Alpinisme jusqu'en 1600*; *The Alps in Nature and History*; *Alpine Studies*; etc. Editor of the *Climbers' Guide.*	**Switzerland.**
W. A. N.	William A. Neilson, LL.D. President, Smith College, Northampton, Mass.	**Smith College.**
W. A. P.	Walter Alison Phillips, M.A. (Oxford and Dublin). Lecky Professor of Modern History in the University of Dublin. Member of the Royal Irish Academy. Author of *Modern Europe*; *The Confederation of Europe*; etc.	**Putumayo;** **Round, John Horace;** **Self-Determination.**
W. Bn.	William Bateson, M.A., F.R.S. Author of *Materials for the Study of Variation*; *Mendel's Principles of Heredity*; *Problems of Genetics*; etc. See the biographical article: Bateson, William.	**Sex.**
W. B. St.	Walter Barlow Stevens, B.A., M.A., LL.D. President, State Historical Society of Missouri. Author of *History of St. Louis*; *Centennial History of Missouri*; *Missouri's Travail for Statehood*; etc. Director of Exploitation, St. Louis World's Fair of 1904.	**St. Louis.**
W. C. M.	William Clinton Mullendore, A.B., J.D. Attorney-at-Law. Late Assistant Counsel and Liquidator, United States Food Administration. Representative, American Relief Administration, Berlin, Germany, 1920.	**Rationing:** *United States*
W. E. El.	Walter Elliot Elliot, B.Sc., M.B., Ch.B., M.P. Secretary, Medical Committee, House of Commons.	**Pensions Ministry.**
W. E. P.	W. E. Preston.	**Silver.**
W. F.	Lieutenant-Colonel Wolfgang Foerster. Late General Staff, German Army. Chief Ober-Archivrat of the Reichsarchiv. Formerly member of the Historical Section of the Great General Staff. During the World War, General Staff Officer with troops. Chief of the General Staff of the XI. Corps, 1918. Author of *Prinz Friedrich Karl von Preussen*; *Graf Schlieffen und der Weltkrieg.*	**Western European Front Campaigns** *(in part).*
W. G. C.	William George Constable, M.A. Fellow of St. John's College, Cambridge. Barrister-at-Law. Lecturer at the Wallace Collection.	**Painting** *(in part).*
W. H. B.	Sir William Henry Beveridge, K.C.B., M.A., B.C.L. Director of London School of Economics and Political Science. Formerly Permanent Secretary of the Ministry of Food. Author of *Unemployment: A Problem of Industry*; etc.	**Rationing** *(in part).*
W. H. W.	Sir William Henry Willcox, K.C.I.E., C.B., C.M.G., M.D., F.R.C.P. Consulting Physician to the Mesopotamia Expeditionary Force, 1916-9. Physician to St. Mary's Hospital, London.	**Persia:** *Medical Conditions*; **Persian Gulf:** *Medical Conditions.*

W. J. C.	William James Cunningham, A.M. Connected with several American railroads in operating and executive capacities, 1900–16. Professor of Transportation at Harvard. Assistant Director of Operation, U.S. Railroad Administration, 1918–9.	**Railways:** ***United States.***
W. J. C.*	W. J. Childs. Late of the Intelligence Department of the British Admiralty (Geographical Section).	**Straits (*Dardanelles and Bosporus*);** **Turkey (*Nationalist*).**
W. K. B.	William Kenneth Boyd, A.M., Ph.D. Professor of History, Trinity College, Durham, N.C. Joint-editor of *The South Atlantic Quarterly.* Author of *A History of North Carolina, 1783–1860*; etc.	**Virginia.**
W. K. M.	William Kirkpatrick Magee. Second Librarian, National Library of Ireland. Pseudonym, "John Eglinton." Author of *Anglo-Irish Essays*; etc.	**Synge, J. M.**
W. L. B.*	Walter Langdon Brown, M.A., M.D. (Cantab.), F.R.C.P. Physician, with charge of Out-Patients, to St. Bartholomew's Hospital (London). Physician to the Metropolitan Hospital, etc. Author of *Physiological Principles in Treatment*; *The Sympathetic Nervous System in Disease*; etc.	**Sympathetic Nervous System.**
W. L. G.*	William L. Griffith. Permanent Secretary, Office of the High Commissioner for Canada, London. Author of *The Dominion of Canada*; article on "Canada," *Oxford Survey of the British Empire.*	**Prince Edward Island;** **Quebec;** **Saskatchewan;** **Yukon Territory.**
W. L. M.	Winthrop Lippitt Marvin, A.B., Litt.D. Vice-president and General Manager, American Steamship Owners' Association. Author of *The American Merchant Marine: Its History and Romance.* Former Secretary of U.S. Merchant Marine Commission.	**Shipping:** ***United States.***
W. M. B.	William Maddock Bayliss, M.A., D.Sc., LL.D., F.R.S. Professor of General Physiology in University College, London. Author of *Principles of General Physiology*; *Nature of Enzyme Action*; etc.	**Physiology;** **Shock.**
W. M.-Lo.	Lieutenant-Colonel Wilhelm Müller-Loebnitz. Late General Staff, German Army. Ober-Archivrat in the Reichsarchiv. Formerly in the Military History Section of the Great General Staff. During the World War served on the General Staff of XII. Corps and VI. and "A," Armies, and as a Regimental Commander. Author of *Der Wendepunkt des Weltkriegs* and other monographs.	**Somme, Battles of the** (*in part*).
W. M. Le.	William Mather Lewis, M.A. Formerly Director of the Savings Division U.S. Treasury Department. Author of *The Voices of Our Leaders*; etc.	**Savings Movement:** ***United States.***
W. M. M. R.	Commander William Malcolm Martyn Robinson, R.N.	**Torpedo.**
W. No.	Sir William Noble. Engineer-in-Chief, General Post Office, London. Knight of the Order of the Cross of Belgium.	**Telegraph;** **Telephone.**
W. R. Ma.	William R. Manning, Ph.D. Economist, Latin-American Division, U.S. Department of State. Author of *Nootka Sound Controversy* (Justin Winsor Prize Essay of American Historical Association, 1904); *Early Diplomatic Relations Between the United States and Mexico* (Albert Shaw Lectures, Johns Hopkins University, 1913); etc.	**Virgin Islands.**
W. S. L.-B.	Walter Sydney Lazarus-Barlow, M.D., F.R.C.P. Professor of Experimental Pathology in the University of London. Director of the Cancer Research Laboratories at the Middlesex Hospital. Author of *General or Experimental Pathology*; *Pathological Anatomy and Histology*; etc.	**Radiotherapy.**
W. S. Ro.	William Spence Robertson, Ph.D. Professor of History in the University of Illinois. Author of *Francisco de Miranda and the Revolutionizing of Spanish America*; *Rise of the Spanish-American Republics*; etc.	**Venezuela.**
W. v. B.	Wilhelm von Blume, Dr. Juris. Professor of Law in the University of Tübingen. Author of *Familienrecht des Bürgerlichen Gesetzbuchs*; *Erbrecht des Bürgerlichen Gesetzbuchs.* Coöperated in the drafting of the Constitution of Württemberg, 1919.	**Thuringia;** **Württemberg.**
X.	Initial used for anonymous contributors.	

ENCYCLOPÆDIA BRITANNICA

VOLUME XXXII

THE THIRD OF THE NEW VOLUMES

PACIFIC OCEAN, ISLANDS OF.—For the oceanic islands of the Pacific *see* generally 20.436*, and also the separate articles on the principal groups and islands there referred to. Supplementary information is given below, and also under GUAM, HAWAII, etc.

The so-called Four-Power Treaty was signed Dec. 13 1921, with prospects of early ratification, by France, Great Britain, Japan and the United States, the contracting parties agreeing "as between themselves to respect their rights in relation to their insular possessions and insular dominions in the region of the Pacific Ocean." A map, showing the mandate claims and sovereignties proposed, and zones of restricted fortification, will be found in the article WASHINGTON CONFERENCE.

America Islands.—Christmas I. was leased by a company from the British Government and planted with coco-nuts in 1904–5, but the working lapsed during the World War, and in Oct. 1919 Lord Jellicoe on H.M.S. "New Zealand" found three men who had been confined there for 18 months, ignorant of the cessation of war. The Pacific "all red" cable station on Fanning I. was wrecked by a German landing party from the "Nürnberg" Sept. 7 1914, but communication was restored by the operator. Fanning and Washington Is. belong to a coco-nut company and had in 1920 populations of a few whites and about 120 and 100 native labourers respectively. These islands are administered under the Gilbert and Ellice Is. Colony, of which Ocean I. is the administrative centre.

Auckland Islands.—A depot of provisions and clothes has been established here by New Zealand for shipwrecked sailors.

Caroline and Pelew Islands.—Japan is mandatory for these formerly German islands,[1] having occupied them in Sept.–Oct. 1914. The administration of Yap, which has a pop. of about 8,000 and a cable and wireless station, was at first in dispute between Japan and the United States; but in Dec. 1921 these countries reached an agreement (a formal convention to be drawn up later for signature) whereby the United States secured the same opportunities as Japan or any other nation in all that relates to cable and wireless service on the island. The pop. of the group was in 1919 about 40,000.

Cook Islands.—These islands, which belong to New Zealand, had a pop. of 8,764 in 1916, including 197 whites and half-castes. Eight Government schools were maintained in 1919. Revenue (year 1918–9) £13,847; expenditure £12,344, but this latter figure excludes certain salaries, etc., and about £7,500 has been contributed annually by New Zealand toward the expenditure. In 1919 exports were valued at £142,925 and imports at £127,729. Copra (to United States) and other fruit (to New Zealand) were chief exports.

Easter Island.—Pop. (1915) about 250, all native except an English manager. The island was visited by Mr. and Mrs. Scoresby Routledge in 1914–5 for the investigation of the ancient remains. These and other recent investigators have shown that the islanders, formerly considered to be of Polynesian race, possess an admixture of Melanesian (negroid) characteristics, and their culture reveals the same influence, notably in the bird-cult with its carved figures, partly human and partly of bird form, and in the practice of distending the ear-lobes. A close association with the bird-cult of Easter I. is found in the Solomon Is., far distant in the western Pacific. It is suggested that the Melanesian immigrants who carried this cult to Easter I. were followed by Polynesians, who fought but did not exterminate them, and there remain indications of a division of the island between the two stocks. While it is impossible to assign any date for the Melanesian immigration, it has been suggested that the Polynesian took place about the beginning of the 15th century A.D., but the further evidence collected on Easter I. in 1910–20 has not determined to which group of immigrants the megalithic remains are to be attributed, or cleared up the origin of the ideographic script found on tablets in the island.

Fiji.—The pop. of the Fiji Is. was estimated on Dec. 31 1918 at 163,416, including 87,761 Fijians, 2,100 natives of Rotumah, 2,709 natives of various Polynesian islands, 61,745 Indians, 4,748 Europeans, 2,803 half-castes and 913 Chinese. The revenue in 1918 was £371,189, and the expenditure £342,140. Exports in 1919 amounted in value to £1,871,062, of which £882,574 went to New Zealand and £584,067 to the United States of America. About half the exports (by value) consisted of sugar, most of which went to New Zealand. There has been shortage of labour, the importation of Indian contract labour having been stopped in 1916; but arrangements are made to admit free Indian labour. Prices have ruled low in comparison with expenditure and planters have expressed dissatisfaction with the fixation of the price for one year only, by the controlling exporting company. Copra, bananas, molasses and rubber are the other chief exports. Imports were valued in 1919 at £1,060,314, of which £513,547 came from Australia, but the goods thus indicated were in great part reëxports and largely of British origin.

Down to 1916 the education of the natives was wholly under missionary control, save for the Government high school at Nasinu, Suva, and the native high school at Lakeba. But in that year an Education Act rendered all schools complying with certain conditions eligible for Government aid. Suva has a high-power wireless station, and there are four inter-insular stations.

Gilbert and Ellice Islands.—These became a British colony in 1915–6, having been previously a protectorate. Estimated pop. Gilbert I., 30,000; Ellice I., 3,000. Revenue (year 1918–9) £24,450; expenditure £30,734. In the year 1917–8 copra of the value of £63,465 was exported from the colony, and 82,845 tons of phosphates, valued at £83,000, from Ocean I.; but this latter export was expected to reach 200,000 tons in 1920–1. Ocean I. is the headquarters of the Government, and a wireless station was opened there in 1916. The administration includes the America Is. and the Tokelau (Union) Is. between 8° 30′ and 11° S. lat. and 171° and 172° W. long. The Tokelau Is., total area 7 sq. m., had a pop. of 912 natives and 2 Europeans in 1911. The Gilbert islanders have lost their warlike reputation, and are all, at least nominally, Christian.

Lord Howe Island, belonging to New South Wales, was placed under a board of control with office at Sydney, as the result of the report of a Royal Commission on the trade of the island in Kentia palm-seeds in 1912. A local advisory council assists the board.

The *Lord Howe Group*, also known as Ongtong Java, has a Polynesian pop. estimated at 1,200 (5,000 in 1905), and produces copra.

Loyalty Islands (dependency of New Caledonia), pop. (est., 1919), 11,000.

Macquarie Island is annexed to Tasmania. In connexion with the Mawson Antarctic expedition (*see* 21.968) a meteorological and wireless station was established there.

Manihiki Archipelago.—Of the scattered islands mentioned under this heading, Caroline, Vostok, and Flint are leased from the British Government by a coco-nut company; the rest are dependencies of New Zealand. Suvarov has a fine harbour, though with a shallow

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[1] Statistics of the separate ex-German possessions in the Pacific are not available. Exports for them all, excepting Samoa but including New Guinea, were valued in 1913 at £595,000; imports at £450,000.

* *These figures indicate the volume and page number of the previous article.*

entrance, and a part of Anchorage Islet on the reef is held by the Lords Commissioners of the Admiralty. The island is leased to a coco-nut company, but producing little owing to destruction by hurricane, and the pearl fishery has deteriorated. At Manihiki I. (pop. in 1916, 775) the pearl beds were closed when almost worked out, and at Penrhyn I. (pop. in 1916, 312) production fell off.

Marianas.—The former German islands (excepting Guam [*see* GUAM], which belongs to the U.S.A.) were occupied by the Japanese in 1914, and were given to them under mandate in 1918.

Marquesas Islands.—The Polynesian pop. has continued to diminish, and was estimated in 1920 to be less than 3,500. The French administration (established at Hivaoa) was stated to neglect the commercial development of the islands, though in 1913 a German trading company was established there.

Marshall Islands.—These islands, formerly German, were acquired by Japan under mandate in 1918. From 1888 to 1906 they were administered by the Jaluit Trading Co., of Hamburg, under agreement with and subsidized by the German Government. The Government itself subsequently administered them down to 1914. A recent estimate indicates a decreasing pop. numbering 9,200.

Nauru.—This island, in 0° 33′ S. lat., 166° 55′ E. long., was administered along with the Marshall Is. by the Germans, but the phosphate deposits for which it is important were worked by a British company under agreement with the Jaluit company. The island surrendered to a vessel of the Australian navy in Sept. 1914 and came under British mandate in 1918. Pop. (1916), 1,284 natives, 449 Caroline islanders, 278 Chinese, 90 whites. The white settlement is at Yangor, where the phosphate company had its stores and drying plant. The deposits on the high ground (78 to 88% phosphates) are transported by light railways worked by steam, gravity, or electricity, and are shipped by surf-boats from two wharves. Under the Nauru I. agreement, 1919, between the British, Australian and New Zealand Governments, it was enacted that the Australian Government should appoint an administrator for a term of five years, that each of the three Governments should appoint a member of a board of commissioners, that the phosphate company should be bought out by the three Governments and the deposits and their workings should be vested in the board, and that the expenses of the administration, so far as not otherwise met, should be paid out of the sale of the phosphates. The island also yields copra. A wireless station was established by the Germans in 1913.

New Caledonia.—Pop. (census of 1911), 50,608, including 28,075 natives, 19,319 whites, and 3,214 Asiatic immigrants. Nouméa contained 8,961 inhabitants, including 5,207 free whites, 1,245 convicts, 1,999 natives and other coloured people, and 396 troops. Among other centres of population, Thio on the E. coast is the chief nickel-mining centre, and Paagoumene on the W. coast the chief chrome-mining centre. Exports from New Caledonia and dependencies were valued in 1913 at £633,536 (copra, £67,932); imports at £708,316. The guano workings of Walpole I., 150 m. E. by S. of Nouméa, have been recently developed by a company.

New Hebrides.—The pop. has been recently estimated at 65,000 natives and 800 Europeans. Exports in 1919 were valued at £364,000 (copra, £134,300; cocoa, £79,000); imports at £166,847. The Anglo-French condominium is not generally regarded as successful. According to a report of 1918, the confusion between the operations of this tribunal, the French and British courts, and the joint naval commission for native litigation, gave rise to complaints.

French settlers are said to hold the best land as a rule, though in the Banks and Torr Is. British interests are the stronger; trade has been fostered mainly by French interests. The volcano of Ambrym Is. was in eruption on and after Dec. 6 1913, and caused damage.

Niué.—Pop. (1919), 3,664, including 20 whites and 160 half-castes. Exports (about six-sevenths copra) were valued in 1919 at £35,977, and imports at £21,783. The New Zealand Government contributes about £3,000 a year to the administration. A hurricane in 1915 severely damaged the coco-nut plantations, but 15,000 nuts were planted in the course of peace celebrations.

Norfolk Island.—Pop. (Dec. 1918), 815. The executive council now consists of six elected members and six members appointed by the administrator. It was reported in 1919 that the Melanesian Mission established here in 1867 was contemplating the removal of its headquarters. Exports were valued in 1919 at £5,238 (lemons, passion-fruit pulp, fish and whale products); imports at £13,398.

Paumotu or Tuamotu Archipelago (the latter is the proper form, and is used throughout this part of the Pacific).—Pop. (1911), 4,581. Makatea (pop. 866) has become the most important island, owing to the working of phosphates, and is administered separately. It is an elevated coral island, unlike the other coral islands, which are atolls. From these, copra and pearl-shell are the chief exports. The dependent Gambier Is. yield the same commodities, but poorly, and their inhabitants are decreasing in numbers and physique.

Phoenix Islands.—The majority have been leased to the Samoan Shipping and Trading Co., for coco-nut planting.

Rotumah (to Fiji).—Pop. (1918), 2,263.

Samoa.—The former German islands of western Samoa were occupied by a New Zealand expeditionary force on Aug. 30 1914. Although it was stated that there was some feeling in the islands against permanent administration by New Zealand, a mandate for them was given to that Dominion in 1919. The native pop. in 1918 was 30,636 after the epidemic of influenza in that year, which caused over 8,000 deaths. There were also 1,660 white men and half-castes, and 1,166 labourers imported under indenture. The shortage of labour is particularly acute. The Deutsche Handels- und Plantagen-Gesellschaft (German trading and plantation company), which held 8,820 ac. under the German Government, went into liquidation in 1916, and its holdings and other German plantations were taken over by the Government of New Zealand. Exports in 1919 were valued at £532,500, over four-fifths of the total value being in copra, which went chiefly to the United States. In 1918 exports were valued at £306,640; imports (mainly from the United States and New Zealand) at £319,521. Revenue for one year 1919–20 was estimated at £80,215, and expenditure was expected to balance this. Apia has a wireless station. The pop. of the American Samoan islands was estimated in 1920 at 7,550. Copra is practically the only export. There is a high-powered wireless station at Tutuila.

Society Islands.—The pop. of the whole of the French establishments in Oceania in 1911 (including the Society, Tubuai, Tuamotu and Marquesas groups) was 31,477, including 2,656 French, 484 British, 237 Americans and 975 Chinese: there appears to have been a large influx of the last since that date. A later estimate ascribes 11,000 inhabitants to Tahiti alone, but 4,000 lives were lost in this and adjacent islands in the influenza epidemic of 1918. Papeete, the capital (pop. in 1911, 4,099), was bombarded by German cruisers on Sept. 22 1914. Exports were valued in 1917 at 11,997,461 francs (chiefly copra, pearl-shell, and vanilla), and imports at 7,806,294 francs. Papeete has a wireless station.

Solomon Islands.—The native pop. has been recently estimated at 150,000, the whites at 800, and there are a few Chinese. For the year 1918–9 revenue amounted to £29,476; expenditure to £30,205; exports were valued at £170,125; imports at £188,408. The natives are for the most part wild and backward, and the labour question is serious. For the (formerly) German Solomon Is. *see* NEW GUINEA.

Tonga.—Pop. (1919), 22,689 natives, 350 Europeans. The influenza epidemic of 1918 is said to have caused 1,000 deaths. The native government, under the king, consists of 32 nobles and the same number of elected members. The land is vested in the sovereign, but all his subjects hold some of it, and there is no pauperism or public debt. British officials assist the administration. The revenue in 1918 amounted to £58,340, and expenditure to £35,865. The value of exports in 1918 was £169,758, nearly the whole consisting of copra. Imports in 1918 were valued at £177,152. The copra is chiefly exported to America; imports are received mainly from Australia and New Zealand.

Tubuai Islands.—Pop. (1911): Ravaivai, 432; Tubuai, 543; Rurutu, 911; Rimitara, 415; Rapa, 183. Rapa, possessing a fine natural harbour in Ahurei Bay, has been spoken of as a possible trans-oceanic port of call, for which purpose it was used in 1867–9. The island is volcanic, and the bay represents the old crater. The natives are noted sailors and are in demand for the crews of vessels.

Wallis and Horne Islands.—These, formerly a French protectorate, have been declared a colony. When this annexation was proclaimed in 1913, opposition to the proclamation was fomented by Roman Catholic missionaries in Fotuna (Horne Is.), and even in Uvea (Wallis), where the native chiefs had asked for the annexation, a retention of native law was stipulated, and native law could be only gradually replaced by French law. (O. J. R. H.)

PADEREWSKI, IGNACE JAN (1860–), Polish pianist and diplomat (*see* 20.443), after the outbreak of the World War in 1914 gave numerous benefit concerts in America for Polish sufferers and delivered addresses in their behalf. He was appointed plenipotentiary in America for the National Polish Committee, which early had won official recognition by the Allies.

Among the Poles in America—some millions—there was great dissension as to the means of gaining independence for Poland. With rare skill he induced the stubborn factions to accept the authority of the National Polish Committee, of which he was the most influential member in Paris. In the words of Mr. Robert Lansing, who, as a peace delegate, came into constant contact with him there, he was "an able and tactful leader of his countrymen and a sagacious diplomat." He was among the statesmen, who, in Paris, Dec. 1918, formulated the terms of the Peace Treaty. Meanwhile discord had arisen between the Polish Government and the National Committee. At the close of the year Paderewski returned to Poland and was received in triumph. In Jan. 1919 an agreement was reached with Gen. Pilsudski, whereby Paderewski headed a new coalition cabinet as premier and minister for foreign affairs. In this capacity he signed, June 28 1919, the Treaty of Versailles. He resigned as premier in Dec. 1919. It was generally felt that he had been more successful as a diplomat than as an administrator. In an interview given to newspaper reporters after his return to America in Feb. 1921, he asserted that he would never again appear in piano recitals. His last professional appearance as a pianist had been at the Metropolitan Opera House in New York, May 9 1917.

PAGE, THOMAS NELSON (1853–), American author and diplomatist (*see* 20.450), was appointed ambassador to Italy by

President Wilson in April 1913. In 1914 he announced his discovery of the house, 66 Piazza di Spragna, in which Byron had lived at Rome in 1817. In 1915 he induced the Italian Government to raise the ban on the reëxportation of cotton goods routed by American shippers via Italy to other countries. He earned the gratitude of the Italians by his relief work during the Avezzano earthquake in 1917. After America entered the World War he defended Italy against the charge of backwardness in conducting her campaign by pointing out the obstacles confronting her soldiers in the Alps.

He resigned as ambassador in April 1918 and returned to America. His writings after 1910 included *Robert E. Lee, Man and Soldier* (1912); *The Land of the Spirit* (1913); *Tommaso Jefferson, Apostolo della Libertà* (1918, prepared for an Italian series); *Italy's Relation to the War* (1920) and *Italy and the World War* (1921).

PAGE, WALTER HINES (1855–1918), American editor and diplomatist, was born at Cary, N.C., Aug. 15 1855. After graduating from Randolph-Macon College, Va., in 1876, he was appointed one of the first 20 fellows of the newly established Johns Hopkins University. He taught for a time in Louisville, Ky., and then accepted the editorship of the St. Joseph, Mo., *Daily Gazette.* After two years (1881) he resigned to travel through the South, having arranged to contribute letters on southern sociological conditions to the New York *World*, the *Springfield Republican* and the *Boston Post.* These letters were helpful in educating the North and the South to a fuller understanding of their mutual dependence. In 1882 he joined the editorial staff of the New York *World* and wrote a series of articles on Mormonism, the result of personal investigation in Utah. Later in the same year he went to Raleigh, N.C., where he founded the *State Chronicle*, but returned to New York in 1883 and for four years was on the staff of the *Evening Post.* From 1887 to 1895 he was, first, manager and, after 1890, editor of *The Forum*, a monthly magazine; and from 1895 to 1900 was literary adviser to Houghton, Mifflin & Co., and for most of the same period editor of the *Atlantic Monthly* (1896–99). When the house of Doubleday, Page & Co. was organized in 1899, his duties were divided between editorial and publishing work, for he was not only a partner in the publishing house but also editor of its magazine, the *World's Work.* In March 1913 President Wilson appointed him to succeed Whitelaw Reid as ambassador to England.

Mr. Page was hardly known in England when he was appointed, but during his tenure of office he gradually established himself as one of the great line of American ambassadors. None had ever worked more assiduously than he did for Anglo-American solidarity, and his speeches—though he was no orator—were always marked by absolute sincerity and by well-informed appeals to history. His position was a delicate one after the outbreak of the World War, when German and Austrian interests in England were placed in his hands. He was thoroughly loyal to his country in his conduct, although sympathetic with the Allies. Among the problems with which he had to deal were the British claim of the right to stop and search American ships, including examination of mail pouches; the commercial blockade (1915) and the "blacklist," containing the names of American firms with whom all financial and commercial dealings on the part of the British were forbidden (1916). He had the satisfaction of seeing the United States through its period of neutrality without friction, and then representing it as a partner in the war. In Aug. 1918, finding his strength exhausted, he resigned as ambassador and returned to America in September. He was critically ill on arrival, and after a short rally died at Pinehurst, N.C., Dec. 21 1918. No man ever served his country, or the cause of Anglo-American friendship, more strenuously. While in Great Britain he was honoured with degrees by the universities of Aberdeen, Edinburgh, Sheffield, Cambridge, and Oxford. He was the author of *The Rebuilding of Old Commonwealths* (1902) and *The Southerner, a Novel: Being the Autobiography of Nicholas Worth* (1909).

PAGET, FRANCIS (1851–1911), English divine, was born March 20 1851, the second son of the surgeon Sir James Paget (*see* 20.451). His brothers, Sir John R. Paget, 2nd Bart., the lawyer (b. 1848), the Rt. Rev. Luke Paget (b. 1853), who was Bishop of Stepney, from 1909 to 1919, and was then translated to the see of Chester, and Stephen Paget, the surgeon and author (b. 1855), all became well-known men. Francis Paget was educated at Shrewsbury and Christ Church, Oxford, where he had a distinguished career, taking first classes in classics, winning the Hertford scholarship (1871) and the chancellor's Latin verse prize (1871); he was elected senior student of Christ Church (1873) and tutor (1876), taking holy orders in 1875. In 1885 he was appointed regius professor of pastoral theology, and in 1892 dean of Christ Church. He contributed the essay on the sacraments to *Lux Mundi.* He became Bishop of Oxford in 1901, and was a member of the Royal Commission on Ecclesiastical Discipline 1904–6. He died in London Aug. 2 1911.

PAGET, LOUISA MARGARET LEILA WEMYSS, Lady (1881–), was born in London Oct. 9 1881, the daughter of Sir Arthur Henry Fitzroy Paget (b. 1851), a descendant of the 1st Marquess of Anglesey. She married in 1907 a connexion of her own, Sir Ralph Spencer Paget, who had a distinguished career in the diplomatic service, and was from 1916 to 1918 minister to Denmark and from 1918 to 1920 first ambassador to Brazil. In 1915 Lady Paget organized a Red Cross hospital for service in Serbia, and was stationed at Uskub, having to remain there when the town was occupied by the Bulgarians, Oct. 1915. She was allowed to use her stores for the relief of refugees, and relieved a great deal of suffering. In Feb. 1916 she was transferred to Sofia, and in April returned to England. In 1915 she was invested with the order of St. Sava by the Serbian Government and in 1917 received the G.B.E.

PAINTING (*see* 20.459).—The end of the 19th century saw in painting the triumph of "impressionism" in its widest sense and the reproduction of visual appearance as a whole accepted as the main business of a painter.[1] But with the heterodoxy of the 19th century become the orthodoxy of the 20th, another movement has arisen in revolt against impressionism, giving to painting between 1900 and 1921 its distinctive character: and just as the victory of impressionism was a French victory, so this new movement is mainly French in origin, though its manifestations elsewhere have taken colour from national characteristics. The change in the centre of gravity of art has, however, been greater in appearance than reality. The older academic traditions still survive; and advances by official bodies and the public have been met by concessions to orthodoxy among some followers of 19th-century heretics.

Across these main movements has cut the influence of the World War. At first it threatened to limit artistic output severely, but the check was only temporary. A huge demand arose in the belligerent countries from individuals and public bodies for illustrative, propagandist or commemorative work, which bore fruit in posters and cartoons; in the formation of official collections such as the Canadian War Memorials and a section of the Imperial War Museum; and in decorative paintings for memorial purposes, such as have been commissioned in France by the State and municipalities. The chief interest of this work is that of a document, showing what men did, felt and thought during the war, and of giving a summary of the condition of art at the time in various countries. The aim of the British and Canadian official collection was definitely to preserve a pictorial record of the war in all its aspects, and, consequently, much of the work is only the skilful application of a technique to a set task, and not the expression of a new vision. The same applies to most of the memorial decorations produced in France; only some etchings and lithographs produced independently of official action show any really personal emotion. Similarly, though in all countries the posters were the work of prominent artists, little really notable work from an aesthetic point of view appeared. Designed as they were to excite hatred, cupidity, pity and self-sacrifice, their appeal could only in part be aesthetic, and, like the paintings, they showed little more than the application of familiar and matured methods to a special end. Yet by putting the production of the poster into the hands of artists, and by helping to revive and stimulate wood engraving and lithography, the war has had real influence on the graphic arts. Otherwise, its immediate effects have been small. It has quickened a movement towards expression of a national spirit in art, by throwing countries back upon their own resources, and by increasing a desire to assert national superiority. It may also have given a new impulse to the modern search for structure and design, by reducing life so much into terms of machinery and organization; and because of the depth and variety of the emotions it aroused, may have stimulated the tendency to use form and colour for the expression of personal feeling rather than for the reproduction of nature. Probably, too, by making a definite breach with 19th-century ideas, the war has cleared the way for the development of new aesthetic standards. But the most important modern movements in art were in being before the war.

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[1] Unfortunately for clarity of exposition, the term "impressionist," originally applied to the group of artists round Claude Monet, painters in a high key using a palette limited to white and the spectral colours, has been given a wider meaning, especially in England. To avoid mistake, the term is here used throughout to describe that group and their followers, and does not cover painters such as Monet in his early period, or Whistler, whom the wider signification might include.

Impressionism.—Of movements which attained full development in the 19th century, impressionism in its purest form was still represented in France in later years by Claude Monet, in Belgium by Emil Claus, and in England by Lucien Pissaro. Of its many developments and adaptations, neo-impressionism—based on the analysis of colour in nature into its constituent elements, which are then placed by means of juxtaposed spots of paint upon the canvas, to be recombined by the eye—survived in 1921 only in modified form. Paul Signac, one of its original exponents, had substituted for spots brick-like rectangles in his oil paintings, and increased use of line in his water-colours; while its conversion into pointillism (simply a method of applying in spots colour already mixed on the palette) was represented by Henri Martin and Henri le Sidaner. Paul Albert Besnard showed impressionism adapted to deal with such complicated problems as a mixture of twilight and artificial light; but with Wilson Steer the expression of subtle tone relations with a limited palette including black had superseded an impressionist technique. In England, indeed, the spectral palette and high key has been only a passing phase with most painters, and it is the impressionism of Whistler and the earlier Manet, with its study of tone and decorative arrangement of silhouette, which has obtained most adherents. This was seen in its purest form in France in the work of Jacques Émile Blanche; but it provided a common basis for the members of the Glasgow school, such as Sir James Guthrie, E. A. Walton, Sir John Lavery and D. Y. Cameron; and brought into relation with them Sir William Orpen, whose use of colour and study of light otherwise connect him with the impressionists. Similarly J. S. Sargent's portraits carried on one side of the Manet tradition, though elsewhere he showed impressionist influence. Of the group of painters who, under the influence of Millet and Bastien-Lepage, carried the realism of Courbet and Manet into the field and workshop, the chief survivors in 1921 were Lucien Simon and Charles Cottet in France, Max Liebermann in Germany, Joaquin Sorolla in Spain and Ettore Tito in Italy. In England the once prominent Newlyn group had fallen by 1921 into obscurity; in Sweden Anders Zorn, best known by his portraits and etchings, was dead; and the Hague School of Holland had no important living representatives.

Transition Painters.—Between these representatives of the 19th-century outlook and those of the modern movement stand many painters combining in varying degrees characteristics of both groups, such as Sir C. J. Holmes (Director of the National Gallery from 1916), whose landscapes are marked by simplification and emphasis on structure. Transition to the modern point of view is also represented by the decorative painters, who have necessarily never fully accepted impressionism and realism. As early as 1892 the *Rose Croix* group had urged that painting should be idealist and monumental in character, with myth and allegory as its subject. These ideas survive, despite impressionist influences, in the balanced and harmonious compositions of René Menard, whose descent is from Puvis de Chavannes, in the mural decorations of Henri Martin, and in the work of Aman-Jean, whose flowing arabesque relates him to the 18th-century decorators. Akin to these painters, but closer to the modern movement and more purely decorative in intent, is the broadly handled work of Jules Flandrin (b.1871). Another group of decorative painters take realism as a starting-point. Among these is Frank Brangwyn (b.1867), one of the few English painters with considerable European influence and reputation. His later work—such as the eight mural paintings, symbolizing the dynamic forms of nature, for the 1915 Panama Pacific Exposition—shows how his dexterous and schematized art combines romantic and allegorical treatment of material drawn from the daily life of commerce and industry with a sensuous materialism. A comparable figure is Ignacio Zuloaga (b.1870), the leader of a group of Basque and Castilian painters, including Ramon and Valentine de Zubiaurre, Gustavo de Maeztu and Federico Beltran-Masses, representing the regionalist and consciously national character of modern Spanish art. Here a romantic conception of subjects drawn from contemporary Spanish life is given decorative form by emphasis on silhouette, simplification of form and broad masses of colour, often combined with a low horizon and a panoramic background; though sometimes the realism degenerates into caricature and the decorative treatment into the production of cardboard figures against a stage drop-scene. Augustus John (b.1879) in England is not romantic, but combines with the realism which finds most complete expression in his portraits a strongly decorative aim in the use of contour to enclose definite areas of colour, and distortions of the human figure in the interests of design. Similarly, the Munich decorative school, still represented in 1921 by its most important product, Franz Stuck (b.1863), inherits from Böcklin the realistic treatment of mythological and allegorical materials. Its once important and widespread influence has waned; but it forms part of the bridge between the archaeological and historical painting which formerly dominated Germany, and more modern movements. Allied thereto is the Swiss, Ferdinand Hodler (1853–1918), by the emphasized contours and calculated distortions of his later work. But in his symbolic mystical outlook he resembles another important forerunner of the modern movement, Hans von Marées (1837–1887), neglected in his lifetime but now the object of much adulation, who turned from Courbet and Manet to Rubens and Delacroix in developing a monumental decorative art based on three-dimensional form.

Another important divergence from the main trend of later 19th-century art is represented in France by H. G. E. Degas (1834–1917) and Pierre Auguste Renoir (1841–1919). Their close association with the impressionists was reflected in the choice of subjects from contemporary daily life and at times in their use of colour; but here the connexion ends. Degas is a descendant of the great classic draughtsmen. A convinced realist, bitterly opposed to the romantic and symbolic, he never sought the ideal beauty of Ingres, but turned to use the more absurd and bizarre attitudes of everyday life. But his realism is synthetic, and represents the building-up, from many sketches and from a retentive memory, the essential character of a form or movement; and his vision is classic in its impersonal, almost ironic, quality. So with his design, which, despite its apparent disregard of the rules of classical composition, yet shows a complete balance of strains and stresses round a pictorial centre, revealing the influence of Chinese and Japanese art. Round Degas centres a group of realistic draughtsmen, such as Henri de Toulouse-Lautrec (1864–1901), whose fevered and excited vision has inspired much modern work, Louis Legrand and J. F. Raffaelli. Jean-Louis Forain (b.1852), chiefly known for his political and social cartoons, has the critical and ironic spirit of Degas, but less power of design and feeling for colour. The later work of T. A. Steinlen (b.1859), likewise well known by his journalistic work, is significant of modern tendencies in the increased emphasis given to the third dimension and the use of simplified forms. In England the realism and irony of Walter Sickert (b.1860) connect him with Degas, though his search for atmospheric unity by study of tonal relations, and an incursion into the use of the spectral palette under the influence of Spencer Gore, bring him nearer the impressionists. He has played an important part in English art by transmitting French influence, coloured by his own personality, to a number of younger men. Henry Tonks (b. 1862), professor at the Slade School, London, has also played an important part in moulding the younger generation. His realism and draughtsmanship relate him to Degas, his choice of subject at times to Renoir. Renoir, unlike Cézanne, to whom he is most immediately comparable, has inspired no particular group who call him master. He was first and last a painter, not the exponent or founder of an aesthetic creed. Rejecting Monet's principle of unconditional submission to nature, and holding that the work of a painter was not to reproduce a natural effect but to compose and construct, he grafted impressionism on to the tradition based on the Venetians and Rubens and revivified by Delacroix; forming an art in which solid form, simplified to its most expressive elements, and rhythmic flow of contour unite to give his work the plastic quality of a bas-relief. His colour, always daring and exuberant, in his later work becomes less naturalistic, and is dominated by the famous Renoir carnation, which gives his canvases a radiance in accord with his vision.

Etching and Engraving.—In etching and engraving, broadly, the 19th-century tradition originating in Rembrandt and Goya still holds the field, represented by Georges Gôbo in France, Otto Fischer in Germany, Sir Frank Short, Muirhead Bone and D. Y. Cameron in England. Confined as a rule to landscape or architectural work, their work is chiefly notable for technical mastery. Representatives of the modern school, on the other hand, rarely realize the full possibilities of the medium. In Odilon Redon (1840–1916), however, a modern aim is united with the older craftsmanship in his search for a plastic equivalent of his emotion and dreams. He was one of the pioneers of that revival of lithography in which bodies such as the Senefelder Club, whose members include Joseph Pennell and Brangwyn, played a part. A more important revival is that of engraving upon wood, with which Auguste Lepère (1849–1918) was closely associated. His later woodcuts show a return from a technique imitating etching or engraving on metal to the older method of treatment in broad masses, the lights being obtained by cutting away the wood. In Paris and London societies of wood engravers have been formed whose members practise this traditional use of white upon black, which is also much favoured by such modern artists as Derain, Dufy, Friez, and Franz Marc in their book illustrations.

Contemporary Movements.—The modern movement, some of whose characteristics appear in the transition painters already discussed, has been given various labels, such as post-impressionism and expressionism, but its manifestations are so various that no one term can satisfactorily describe it. But these manifestations have a common origin and character, in being a reaction against impressionism, with its aim of representing superficial appearance as a whole at a given time, without reference to shape or appearance as they are known to exist under the conditions; and in proposing to substitute form arranged into a coherent design, so making a new and independent reality and not a reproduction of nature. In this the modern movement claims to be a return to the tradition in painting represented by Raphael, Poussin, David and Ingres, as opposed to the romantics and realists; and to be breaking away from subordination to external and visible things, which are to serve only as a means towards expressing the artist's emotions. From this latter aspect of the movement arises the term "expressionism"; and divergence as to the kind and quality of emotion to be expressed is one cause of the differences between various modern groups. This general character of the movement helps to account for other distinctive features. Colour becomes less naturalistic, and is either used to emphasize the solidity of objects, is purely decorative, or assumes a mystical and symbolic character; and anxiety to avoid a transcript of nature has stimulated return to the subject picture, which calls for constructive effort. But the modern movement owes much to the impressionists. It was they who helped to discredit the formulas and aims of academic art; put powerful weapons in the painter's hands by applying to art scientific discoveries regarding light and colour; and won recognition of the artist's freedom to express his personal vision of things. It was on this basis that the chief initiators of the movement built. These fall into two groups, the one including Cézanne, Seurat and Henri Rousseau, whose emphasis tends to be on structure and organized design; the other including Gauguin, Van Gogh and Gustave Moreau, in whom symbolist and expressionist elements are more marked.

Paul Cézanne (1849–1906) gives the key to understanding of his aims and methods by his own words, that he wished to remake Poussin according to nature, and to make of impressionism something solid and durable like the art of the museums. His sympathies were all with the later Venetians, Rubens, Poussin, and the baroque masters such as the Caracci and El Greco, whose craftsmanship, bravura and well-organized design he admired. These sympathies found expression throughout his life, but are most evident in his earlier work. In this he used little colour; but under the influence of the impressionists, especially Pissarro, he extended his palette considerably (though still retaining black and the earth colours) and turned to a more intimate study of nature. But for him nature was only a starting-point. Contemplation of her, he held, reinforced by reflection and study of underlying causes, creates in the artist's mind a vision of the structure underlying the external, visible world, which to him becomes a series of organic relations between solid forms, which it is his business to realize on canvas. Cézanne's method was to establish the relations between the planes enclosing an object or group of objects by recording all the subtle differences in their colour due to differences in their relation to the light. But it is the form, not the light around it, which interests Cézanne. He worked slowly and painfully; but such was his desire for keeping every element of his work in correct relation that one alteration would often lead to complete repainting. The legend of Cézanne's technical incompetence is partly due to his constant self-depreciation and to the amount of work he left unfinished in despair or disgust. Though his ultimate rank as a painter is still in the balance, his influence underlies much of modern art.

Georges Seurat (1859–1891), like Cézanne, found in the 16th- and 17th-century masters the inspiration to recreate on canvas a world of three dimensions rather than copy that before his eyes. At the same time modern scientific research into colour led him to develop his well-known neo-impressionist technique, which has rather obscured his power of expressing structure and of welding form into balanced and monumental design. But he has exercised much influence, especially on the cubists, whose studio walls often carried reproductions of "Le Chahut," one of his last pictures.

Henri Rousseau (1844–1910), "le douanier," a very different figure was once an octroi official in Paris (whence his nickname). He is the true type of the primitive who tries to paint things as he knows them to be rather than as they appear. He used, for example, to measure his sitters with a footrule, and transfer these measurements to canvas. His work, which includes portraits, views of the suburbs of Paris, exotic landscapes based on recollections of military service in Mexico, and figure compositions, is marked by emphasis on solidity, precision of handling, adjustment of the relative size of objects according to their importance as elements in design, and at times by a symbolic element.

In contrast to Rousseau is Gustave Moreau (1826–1898), a strange figure bred in the strictest academic tradition, whose romantic spirit borrowed fire from Delacroix and Chasseriau, and who fed his imagination upon the myths of Greece and the East. He emerged from many years' retirement to become at the end of his life professor at the École des Beaux Arts, where his influence helped to breed a group of young painters with symbolist tendencies. As a teacher Moreau always encouraged self-expression based on close study of the old masters. In his own work Moreau stood for the use of the plastic arts to express the emotions, and built up a decorative art, combining sombre rich colour and rhythmic linear arabesque.

Paul Gauguin (1848–1903) was more definitely a *chef d'école* than any of the group now under consideration. After an impressionist phase, he became in Brittany the centre of the famous Pont Aven group, and there developed the theory of synthesis which was to govern all his later work. In 1891 he went to Tahiti and, except for a brief return to France, spent the rest of his life there. Admiration of the primitive was at the base of Gauguin's art. Rejecting impressionism as a mere reproduction of nature not inspired by thought, he held that study of nature awakes emotions in the artist which he has to express by bringing into organized relation symbols, consisting of forms and colours, supplied by nature. Primitive art alone, he considered, proceeds from the spirit, and uses rather than mimics nature; and he justified going to Tahiti on the ground that there only was his imagination sufficiently stirred by nature. Though the colour and forms in his pictures might not actually exist in nature, he claimed them to be the pictorial equivalent of the grandeur, profundity and mystery of Tahiti. His latest work most completely embodies this conception of art in its design based on boldly simplified contours enclosing areas of rich purples, greens, reds and oranges. To the end Gauguin's colour showed impressionist influence. Otherwise his art is primarily decorative, with colours keyed to express the painter's mood, and shows a less passionate search for solidity than Cézanne's. His symbolism, though not primarily literary, towards the end moved somewhat in that direction.

Akin to Gauguin in his outlook and use of colour is Vincent van Gogh (1853–1890). Born in Holland, his early work shows the influence of the Hague School; association with the impressionists in Paris led to his settling down at Arles to the use of heavy masses of vivid colour arranged indefinite patterns, emphasized by black outlines and writhing arabesques of paint. A passionate lover of nature and a mystic and idealist by temperament, Van Gogh believed that the artist's creative power was given to him to make men happy. Vehement personal passion is the note of his work. His colour ultimately became quite non-naturalistic, and was solely directed towards expressing his emotions; and his surface texture was designed to increase the arresting, disquieting quality of his work. The third dimension did not play a dominant part in Van Gogh's work. His design, in which decorative simplification became increasingly marked, shows very strongly the influence of Japanese art.

Symbolism and Fauvism.—The characteristic elements of the preceding group of painters—rejection of naturalistic representation, emphasis on solidity and structure, organized design, and the symbolic use of form and colour—are united in varying degrees in the work of their successors. The influence of Cézanne, which has modified or supplanted that of others, took some time to develop, and the first well-marked group to appear was that round Gauguin at Pont Aven. Among these was Paul Sérusier (b.1864), who was one of the first to formulate a doctrine based on the ideas of Gauguin, Cézanne and Odilon Redon. He drew round him a group of *symbolistes* which included Maurice Denis (b.1870), Pierre Bonnard, K-Xavier Roussel and Edouard Vuillard. This doctrine declares that a work of art must aim at the expression of an idea. Since it uses form for this purpose, it must be symbolic; and since the form has to be organized, it must be synthetic and decorative. At the basis of this is a belief in correspondence between external forms and subjective states—not, however, by association but direct. Sérusier and Denis have given these ideas a mystical and religious application, largely under the influence of the *quattrocento* Italians. In Bonnard (b.1867) and Vuillard (b.1867), however, the purely decorative element is uppermost, in a graceful and refined but over-precious treatment of material drawn from everyday life, influenced by Japanese art, and marked by elusive and delicate harmonies of green, blue, rose and yellow combined with grey. Closely akin to this *symboliste* group is another whose best-known members were pupils of Gustave Moreau. The religious symbolic pictures of Georges Desvallières (b.1861) are characterized by the use of arabesque and rich exotic colour; the more realistic art of Charles Guérin (b.1874) by its decorative aim and search for tonal rather than linear unity. The influence of Moreau, modified only by the pupil's own temperament, is well seen in the fantastic, savagely distorted nudes, and mysterious, sombre landscapes of Georges Rouault. Far better known is his fellow-pupil Henri Matisse (b.1869), who represents the expressionist side of symbolism in its most extreme form. Academic and neo-impressionist phases never obscured his very personal use of line and colour whose decorative quality relates him to the Chinese and Japanese. His arbitrary distortions of the human figure, partly based on the study of negro art, marked a stage towards the abstract, non-representative art of the cubists. These distortions, his apparently anarchic design and his colour earned for Matisse the title of "Chef des Fauves," though he has not formed the centre of a well-marked group, despite his wide influence. It is difficult to acquit him of sometimes painting *pour épater les bourgeois;* but his latest work, while retaining delicacy and sensitiveness, shows increased discipline and restraint. Both in his drawing and painting Matisse is notable for his use of a pure unaccented contour, which nevertheless generates solid form. Somewhat the same power is seen in the Italian painter and sculptor Amédée Modigliani (1884–1920), though he is far more mannered than Matisse and lacks his feeling for colour.

Kees van Dongen (b.1877, in Holland) mingles the influence of Matisse with that of Toulouse-Lautrec, and mainly shows the application of a *fauviste* recipe to the painting of fashionable Parisian society. Different from the *symbolistes* and *fauves*, but equally a reaction against impressionism, are the painters who return to the outlook and methods of the *quattrocento* Italians. Among these are Jean Frélaut (b.1879), notable for his sincere, thoroughly realized interpretations of the country and people round Morbihan in Brittany; and Félix Vallotton (b.1865, at Lausanne), whose angular, precise contours and definite colour pattern relate him to the primitives, and have won him the nickname of the Cabanel of the Salon d'Automne. This Pre-Raphaelite tendency is represented in England by Joseph Southall, head of the Birmingham School of Art, whose work is akin to that of Benozzo Gozzoli; and by Henry Lamb, Stanley Spencer and Gilbert Spencer, who in 1921 were the most prominent of a group of younger men in London of undoubted sincerity but inclined at times to use a rather elementary formula. Their work is also interesting as illustrating a tendency in British art towards decorative design suitable for mural painting. Similar, though more academic in outlook, is Eric Kennington, whose war paintings attracted much attention, their sentimental interest obscuring their mannered draughtsmanship and pretty colour.

Cubism.—To all the manifestations of the modern movement so far considered cubism is a marked contrast. It was a reaction not only against impressionism but against fauvism, and stands for the introduction of order and discipline into painting. So much was this the case that some opponents of the movement professed to see therein a return offensive of the academics. It owes its name and in part its origin to Matisse, from whose association with Picasso and others the movement took shape in 1908. This group coalesced with another working on similar lines, and represented by Albert Gleizes and Jean Metzinger, to win cubism its first public victory in the Salon d'Automne of 1913. To the influence of Cézanne and Seurat, which was mainly behind the movement, was joined that of Negro and Polynesian art, in which the cubists found a simplification of the human form emphasizing its bulk and solidity, and a complete disregard of normal appearance in the effort to express a conception. The central point of cubism is its entire rejection of the reproduction of natural appearance, which, cubists hold, merely serves to awaken in the artist emotions which he expresses by a series of abstract forms, ordered and arrayed by his will. Thus cubism aims at creating a kind of visual music. In its most austere form it avoids curved lines and colour as pretty and sentimental; and even holds that a picture is not a decoration since that term implies dependence upon external objects. From the first, great emphasis was laid on the expression of volume and its arrangement in space. This aroused difficulties, which have separated the cubists into distinct groups. The representation of a third dimension introduced an element of resemblance to nature. Some painters accepted this, so that their pictures are little more than arrangements of realistically painted cubes and cylinders: others rebelled against such a restricted art, and made of cubism merely an exercise and discipline in the expression of three-dimensional form. The purists, however, hold that art is not concerned with Euclidean space but with a special pictorial space, which we feel by our whole personality expanding or contracting before a picture; and that it is not the painter's business to create an illusion of a third dimension but to make live on a two-dimensional surface a reality of three dimensions. Further difficulties have been caused by development of a theory of simultaneity which justifies presentation on the same canvas of several aspects of the same object; this often only comes to a mechanical arrangement of a number of separate impressions, whose disentanglement may be a source of interest, so that cubism is descriptive rather than pictorial.

Pablo Picasso (b.1881, at Malaga) has been the dominating force in the movement, but by no means typifies it. With him cubism has been only a phase. To a realistic period, mainly influenced by Toulouse-Lautrec, succeeded a group of reddish nudes, solidly constructed from simplified planes, which ushered in the cubist period. The earlier work in this showed some conformity to natural appearance, and was mainly in *grisaille*. Later the forms became more abstract, the design more arbitrary and the colour brilliant, sand and similar substances being embedded in the paint to give relief and variety of surface. Picasso's latest phase shows the influence of Ingres, especially in his drawings. Some of these show a delicate, unbroken contour, others the use of shading; but all conform closely to natural appearance, with only enough distortion to give flow and rhythm. The chief characteristic of Picasso is his versatility. There is no method he has tried which he has not mastered. But whether he has yet achieved more than a series of exercises in different manners is open to question. The work of other cubists is remarkable for its sameness and impersonal quality. Georges Braque's rigid adherence to abstract forms, straight lines and sombre browns and greys make him the purist of the movement; Gleizes and Metzinger, by their more graceful use of line and colour and by their writings, are its popularizers; while Fernand Leger and Auguste Herbin are mainly makers of attractive patterns in bright colour. The use of colour is, however, pushed furthest by the Orphists, such as R. Delaunay, whose rejection of all rules is really a protest against the formal side of cubism, which he has translated into terms of curves and circles decked with vivid colour.

Between the extremes of cubism and fauvism stands a considerable group of artists who derive something from both, but represent the direct and increasing influence of Cézanne. Of these Albert Marquet (b.1875) is primarily a painter of Paris and of the Seine, whose use of well-defined planes, with their tonal relations very accurately expressed, is apt to degenerate into an ingenious system of notation. Jean Puy (b.1876), in his landscapes of wide-stretching countrysides, brings many scattered elements into harmonious relation by his feeling for subtle variations in colour and tone. With Othon Friez (b.1879) the organizing constructive instinct is uppermost, but he shows considerable power of retaining fresh and unspoiled his original conception. More consciously decorative than Cézanne, his mural paintings sometimes show the influence of Gauguin. Jean Marchand (b.1883) and Dunoyer de Segonzac (b.1884) represent a younger generation to whom cubism has been a gymnastic to develop understanding of form, but who now rely on colour and tone to give solidity and a sense of space. Marchand, taking for his material the most ordinary objects of daily life and the countryside, and using a simple, sober palette, gives his work distinction by his dignified design; Segonzac, with similar constructive power, works in a thick impasto with free use of the palette-knife in colour which has become increasingly sombre. His war paintings express a very personal emotion awakened by experience, and are the colour of the mud which dominated the battlefield. André Derain (b.1880) is one of the most influential of younger painters who, after a period influenced by Van Gogh and the neo-impressionists, produced a series of truculent nudes and landscapes, which showed cubist and fauve influence in their simplified and distorted forms. His recent work is more sober and severe, and reflects a study of Ingres. At times Derain's technical accomplishment threatens to lead him into the mannerism which marks the dramatic landscapes of Maurice Vlaminck (b.1876), with their heavy skies and contrast of sombre greens with vivid reds and pinks.

Futurism.—Modern art in other countries is mainly an extension or adaptation of French ideas and method. Spain, it is true, has produced Picasso; but cubism is entirely Parisian in origin, and so much of the modern spirit as appears in Catalan painters such as Sunyer and Casals is derived from France. Futurism, however, is indigenous to Italy. The term has been loosely used, especially in England, to denote the modern movement as a whole; but it has a definite and limited application to the doctrines of a group of Italian poets, sculptors and painters, first presented to the world in 1909 in a manifesto signed by F. T. Marinetti, the poet and high priest of the movement. These doctrines apply to art a general philosophy of life, with its origin in modern scientific theories which express all matter in terms of energy, and are based on denunciation of all that the past has done (whence the name futurism) and on the worship of movement and conflict as the dominant characteristics of modern life. Cubism, as based on tradition and dealing only with the static aspects of life, it rejects; impressionism it claims to have surpassed, but takes as a starting-point. The futurist's aim is to represent, not the appearance of objects at some particular point in their course, but the sensation of movement and growth itself. One method, which connects futurism with cubism, is to combine on one canvas not only what the artist sees, but what he knows and remembers about an object. Another, peculiar to futurism, is the use of "force lines." Every object, it is argued, is at a given moment the temporary outcome of continuously acting forces, whose character is indicated by the lines and planes enclosing it. Thus an object becomes simply the beginning or prolongation of rhythms conveyed to the artist by contemplation thereof; and these he represents in his picture by lines arranged to clash, harmonize, or interplay in order to express states of mind such as chaotic excitement, happiness or interest. Colour the futurists use arbitrarily to assist in conveying these sensations.

Luigi Russolo is the most logical and orthodox of the futurists. The work of others, such as Carlo Carra, is little more than a catalogue of information about a number of different objects; though Umberto Boccioni, who has applied futurist theories also to sculpture, sometimes redeems his work by an interesting design. The gaily coloured, tapestry-like patterns of Gino Severini are among the most attractive futurist paintings; but his recent work has been modified by cubist and academic influences. His career typifies the fate of futurism, which has found no new recruits, and has had but transient influence.

Modern English Painting.—The English vorticists share some of the futurist doctrines; but the main forces shaping the modern movement in England are French. This movement first took shape in the studio of Walter Sickert, and resulted in the formation of the Camden Town group under the presidency of Spencer Frederick Gore (1878–1914), which developed into the more eclectic London group, whose first president was Harold Gilman (1876–1919). At the same time Roger Fry (b.1866), by his writings and by assisting to organize post-impressionist exhibitions in 1910 and 1912 at the Grafton Galleries, did much to make known the character of the modern movement in France, and to assimilate more closely thereto the English movement. Gore and Gilman represent the movement in its earlier stages. Gore's earlier impressionism was modified under the influence of Cézanne and Van Gogh by increased attention to structure and design, which for a time obscured his charming sense of colour. This reappeared in his latest and most important work, done mainly at Richmond. Gilman emerged from a period influenced by Whistler and painters of the Vuillard type to one which gave increased emphasis to the third dimension and showed the influence of Van Gogh in the use of brilliant, clear colour and the handling of paint. Charles Ginner, whose work is closely akin to Gilman's, describes their art as aiming at "the plastic interpretation of life through intimate research into nature." The emotions aroused by nature in the artist he must express by deliberate and objective transposition of nature on to canvas, so that he reveals the qualities in her which have moved him. The variety of line and colour in nature, joined to the artist's personality, will produce a decorative composition. This neo-realism (as Ginner calls it) is based on the attitude of Cézanne and Van Gogh towards nature; but gives an English turn to that attitude by emphasizing the part played by nature as compared with that of the artist. The French point of view is more evident in the work of the London group. Some of its members are still slaves to a French formula; others have based on French teaching a more individual art, notably W. B. Adeney, F. J. Porter, Roger Fry and Duncan Grant, whose sense of colour gives his art characteristic quality. C. R. W. Nevinson, having explored in turn impressionism, futurism and cubism, subsequently abandoned the geometric convention which marked his war paintings, to reveal the academic art masked by his previous experiments.

Vorticism.—Distinct in character is the vorticist movement, with which Nevinson was once associated. This had its origin in 1913 among certain members of the Camden Town group, and had as its leading figures the painters Percy Wyndham Lewis, Cuthbert Hamilton, Frederick Etchells, Edward Wadsworth and William Roberts, the poet Ezra Pound, and the sculptor Henri Gaudier-Brzeska (1891–1915). Like futurism, it holds that modern art must be based on the character of modern industrial civilization, whose features are complexity and dominance of the machine; and since England is preëminently the type of the modern industrial country, this art will be an English art. But it rejects futurism as merely the cinematographic representation of a series of impressions; and joins the modern movement as a whole in basing itself on tradition, and claiming that the artist's work is not to copy nature, but to create new realities. Every phase of emotion has its appropriate means of expression in some particular form of some particular material, whose appeal is direct and not by association or allegory. These forms take shape and proceed out of the artist's "vortex" (hence the name of the movement), which is a general conception of relations in the universe through which ideas pass and take concrete shape, just as the general equation of a circle in analytical geometry becomes one particular circle when definite quantities are substituted for the algebraic symbol. In 1920 the vorticist movement issued in a secession from the London group to form the X group. But though mainly composed of vorticists, its first exhibition showed some modification if not in doctrine, yet in practice. The earlier vorticist work was geometric and abstract, and owed much to cubism. Hamilton still represented this phase in 1921; but others had turned in the direction of expressing the structure and essential character of natural forms in the way exemplified by the work of Wyndham Lewis. Much of the interest of the earlier vorticist painting lies in disentangling in sequence the elements from which it is constructed; and to this extent it is descriptive and literary. Otherwise, though sometimes showing new and interesting combinations of shapes and colours, it presents only a barren world of geometrical forms.

Modern German Painting.—In Germany the modern movement has been mainly inspired by that side of modern French art represented by Matisse and Derain. Cubism has not gained a real footing there; though the Russian Jew, Marc Chagall, shows cubist influence in the sharply defined planes and angular design of his fantastic, vividly coloured, decorations; and Lyonel Feininger has adopted the cubist method of extension and development of planes. Arbitrary distortion and writhing arabesque are more congenial means of expression in an art always tending towards the romantic and symbolic; native influences, such as Hans von Marées and the Munich decorative school, joined to the study of El Greco and Matthias Grünewald, have paved the way for an expressionist art in the fullest sense of the term—one which gives vent to every kind of emotion with unrestrained and brutal vehemence. A mystical temper and a mass of confused aspirations induced by the war have stimulated this development; but the movement was in being before the war, chiefly under the leadership of Wassily Kandinsky (b.1866, at Moscow), a prominent member of a Munich group of painters, poets and musicians, whose aim was the expression through art of the "*innerer Klang*"—the *soul* of nature and humanity. According to Kandinsky, colour and form have the power of producing spiritual vibrations quite apart from their ordinary meaning and associations; and a picture consists of an arrangement of form and colour whose spiritual values are in harmony, and unite to express the artist's spiritual conceptions. Thus painting ceases to have representation as its purpose, and becomes analogous to music in its rhythmic arrangements of forms and colours. These may be borrowed from nature, but must have no external associations and may be freely adapted and distorted to suit the artist's aim. Thus Kandinsky has points of contact both with the *symbolistes* and cubists; but he criticizes the latter for reducing the construction of a picture to rules and formulas, and for paying over-much attention merely to representing three-dimensional form. Kandinsky's own work has become increasingly abstract in character and consists of some early flat decorations, combining Russian and Munich influences; a group of more or less direct impressions of nature, inspired by Matisse; "improvisations" which represent spontaneous expressions of inner character; and "compositions" which express a slowly formed and mature spiritual feeling. His most important disciple is Franz Marc (1880–1916), whose animal compositions boldly designed in arbitrary colour are his most typical work. Less abstract but more brutal is a group which has come into special prominence during and after the war. Most prominent of these is Oskar Kokoschka (b.1886, in Austria), whose early work showed the free distortion, sharp contrasts of light and shade, bold contours, and thick impasto worked into arabesques, by which he conveys his excited and very personal vision. In his later work emphasis by these means is even more emphatic and merciless. The heads of his figures are balanced on tiny bodies, bizarre monsters are introduced, and the paint is literally thrown on the canvas, with great channels made therein to mark the dominant lines of the design. Painters of similar tendencies are Emil Nolde, Karl Hofer, and Karl Schmidt-Rottluff. The last, under the influence of negro sculpture, has become a coarser Matisse. The influence of an earlier generation of Frenchmen is seen in Max Pechstein, whose work owes much to Gauguin, and in Albert Werszgerber and Carl Caspar, both of whom base their design and use of colour on Cézanne. Edward Munch (b.1862, in Norway) stands somewhat apart in his combination of realism, fantasy and power of monumental design derived from Manet, Toulouse-Lautrec and Seurat, which excited violent controversy in Berlin when first exhibited, and led to the split in the Kunstverein there which marks the rise of the modern movement.

Modern Russian Painting.—In Russia the influence of French art has been no less marked than elsewhere, but has taken peculiar and characteristic shape. Towards the end of the 19th century Western and in particular French influence was represented by the realistic historical painters such as Ilya and Repin and a group of *plein-air* landscape painters. In reaction against their naturalism a decorative school developed, corresponding somewhat to the English Pre-Raphaelites, basing its work on old Russian art, and represented by Vassily Surikov (1848–1916) and Victor Vasnetzov. Of this reaction the modern movement is really a development. One form it has taken is represented by Mikhail Vrubel (d.1910), whose mystical symbolism recalls that of Gustave Moreau in its search to express things of the spirit in pictorial form; while Petroff-Wodkin is nearer to the French fauves in his simplified and distorted nudes and arbitrary use of colour. More important is a Petrograd group, consisting of historical painters whose aim is to reconstruct in decorative form a past epoch, not from living models dressed in costume of the period, but from the close study of every form of contemporary record. Thus, the movement is primarily intellectual and literary and has produced an art which, for all its refinement and delicacy, is inclined to be precious and a mere *réchauffé* of already-used material. Within the movement one group looks to the West. Alexander Benois has concentrated on the age of Louis XIV.; Konstantine Somov, the most charming and individual of all, upon the period of 1830; and Eugéne Lanceray upon the court of Elizabeth and Peter the Great. Stelletsky and Count Komarovsky, on the other hand, have gone to old Russia for their motives. Stelletsky is the purist of the group, his reconstructions of Russian mediaeval life being based upon minute archaeological study of ikons, service books and similar sources. Nicolas Roerich has departed from strictly documentary methods in seeking to reconstruct primeval and prehistoric Russia in his fantastic flat decorations based on Russian legends, and thereby joins hands with the group represented by Vasnetzov. Rather apart is Boris Anrep (working in 1921 in England), who studied Byzantine art and the ikon, not in an archaeological spirit, but as exemplifying a means for the expression of human emotion. His work is principally in mosaic, submission to whose limitations, he holds, makes for the simplicity and directness which are often lost amid the technical possibilities of oil paint. The close connexion of modern Russian art with the theatre is another important characteristic, which has grown directly out of the decorative reaction against realism. Leon Bakst represents one side of this. Originally associated with the Petrograd historical group, he came into touch with Serge Diaghilev and became one of the chief designers of settings for the Russian Ballet. His use of line and colour relates him to the East; but, like Benois and Somov, his outlook and method are those of the West. Distinct in character is the art of Nathali Gontcharova and M. Larionov. Using the methods of the Petrograd group, they took their material from Russian peasant art, as represented in the decoration of articles in daily use and in the "lubok," the Russian equivalent of the "images d'Épinal," which gives their earlier work notable simplicity and directness. The West was not to be denied, however, and Gontcharova's setting for the 1914 production of the "Coq d'Or" and Larionov's "Les Contes Russes" of 1915 mark the invasion of the theatre by cubist ideas. The colour scheme was still that of Russian peasant art; but the design was based on abstract forms, and aimed at a rhythm in harmony with the music and the dances. To this development the name of *rayonnisme* has been given.

Much of the criticism levelled at the modern movement, like that once directed against impressionism, is merely a violent statement of personal preference. Weightier arguments point out that the emphasis given in the modern movement to the third dimension merely exalts one element in natural appearance, and urge that ultimately design must be based on the play of contour and shapes on the picture plane. Also, it is said, modern methods of simplification and distortion tend to become formulas which prevent sincere and spontaneous expression no less than older conventions. But contention chiefly centres round the question of representation. It is argued that a purely abstract art, which takes no account of the ideas and emotions conveyed by the objects represented, is a limited and empty affair. Rhythm in the plastic arts, no less than in literature, must emphasize some meaning; and form takes on a significance by association, if not with specific objects, yet with general ideas of mass, space and movement.

See also: Maurice Denis, *Theories 1890–1910* (1912); W. H. Wright, *Modern Painting* (1916); R. Fry, *Vision and Design* (1920); A. Salmon, *L'Art Vivant* (1920); G. Coquiot, *Les Indépendants* (1920); P. Westheim, *Die Welt als Vorstellung* (1918); Fritz Bürger, *Cézanne und Hodler* (1913); Ambroise Vollard, *Paul Cézanne* (1914); Charles Morice, *Paul Gauguin* (1919); Vincent van Gogh, *Lettres à Émile Bernard* (1912); Kandinsky, *The Art of Spiritual Harmony*; A. Gleizes, *Du Cubisme* (1920). (W. G. C.)

UNITED STATES.—Between 1910 and 1921 many of the painters mentioned in the earlier article (20.518) had passed away, and some of their younger contemporaries had also laid down their brushes: Ryder, Bunce, Blakelock, Duveneck, Alexander, Smedley, Millet, Cox, Beckwith, Alden Weir. Abbey, who died in 1911, left no followers, but La Farge and Chase wielded great influence over a host of pupils. With the development of American art-schools and the increasing number of capable instructors, the trend towards European art-centres had by 1921 grown less. There was already promise of a school with distinctly American characteristics. This was to be seen most clearly among the painters of landscape. Twachtman and Robinson, among the older men who were trained abroad, brought back some of the light of the so-called Impressionist School, and their example in raising the colour-pitch was of great benefit. Crane, a pupil of Wyant, and such men as Tryon, Murphy and Ben Foster, ably carried on the tradition they received from their American masters. Dewing, Metcalf and Childe Hassam developed individual ways of looking at their subjects. Carlsen, Dougherty and Waugh found the sea an ever-changing theme for their brushes, and they produced canvases not behind those of the landscape men.

With the passing of the Society of American Artists, the men who made this organization a force were merged with the members of the older National Academy and became conservatives in their turn. Thayer, Brush, Blashfield, Tarbell, Mowbray, Melchers and Simmons were still in 1920 painting pictures which showed their sound technical training and their artistic point of view. Some of the later men who developed original ways of doing things were Robert Henri, Jonas Lie, William Glackens, Rockwell Kent, John Sloane, George B. Luks, C. C. Cooper, A. B. Davies, Jerome Myers, George Bellows, Gardner Symons, Everett Shinn, W. E. Schofield and Randall Davey. Abundant manifestations of vorticism and cubism came to be seen in American painting. The followers of Cézanne, Matisse, Gauguin, Van Gogh and Picasso were many, but chiefly the younger men whose work was still in the experimental stage. There was a steady advance in mural painting. Sargent added to the decorations for the Boston Public Library, and the example set there and elsewhere was followed in many of the larger cities, in state capitols, municipal courts, churches and theatres. Pittsburgh, Harrisburg, Baltimore, St. Paul and Minneapolis have important buildings decorated by such mural painters as La Farge, Blashfield, Alexander, and others. There has been remarkable growth at the art museums, especially at the Metropolitan Museum of New York, the Boston Museum of Fine Arts, the Carnegie Institute of Pittsburgh (whose international exhibitions draw many exhibits from overseas), and the Chicago Art Institute. No less remarkable has been the formation of important collections in cities whose size would often afford no reason for expecting their presence. Worcester, Providence, Cleveland and Minneapolis have excellent museums. Washington now possesses three collections of paintings—the Corcoran Gallery, the National Gallery and the Freer Collection. Moreover, private collections of importance have increased in number and quality, and native artists are often given there the high place they deserve. Some of the universities offer courses in the History of Art and in the elements of design. In time this should produce a body of intelligent criticism which should still further stimulate artistic effort in America. (J. C. VAN D.)

PALAEONTOLOGY (*see* 20.579).—During the period 1910–21 the science of extinct forms of life made remarkable progress, especially in North America, where explorations and studies were less interrupted by the World War. The contact of palaeontology with other sciences—even those apparently remote like astronomy, physics and chemistry, less remote like comparative anatomy, or very intimate like geology—was one of the outstanding features of the synthetic work accomplished. Of transcendent interest, however, was the contact between mammalian palaeontology and anthropology, especially through the researches of William K. Gregory of the American Museum of Natural History, and also of G. Elliot Smith of London University to whom is due the article on ANTHROPOLOGY in these New Volumes.

Principal Synthetic Works of 1910–21.—Chief among the synthetic works in pure palaeontology are those of the Austrian palaeontologist Othenio Abel, *Grundzüge der Palaeobiologie der Wirbeltiere* (1912), *Die Stämme der Wirbeltiere* (1919), and *Lehrbuch der Palæozoologie* (1920), which give masterly reviews of the whole fossil history of the vertebrates, especially in analogous and convergent adaptation. In invertebrate palaeontology the reader is referred to Amadeus Grabau's *Principles of Stratigraphy* (1913) and *Textbook of Geology* (1920-1), in which are summed up the principles derived from the teachings of Waagen and Neumayr in Germany, of Hyatt and Beecher in America, in pure palaeontology and in application to geology. A broad synthetic treatment of climate and time in relation to the evolution of life is that of the late Joseph Barrell (1917) in his *Rhythms and the Measurements of Geologic Time.* The best synthetic treatment of climate, time and geologic change in relation to the geologic origin and the migration of the different vertebrate groups is William Diller Matthew's *Climate and Evolution* (1915). The subdivisions of geologic time and the successions of faunas and climates are broadly reviewed in the *Textbook of Geology* by Louis V. Pirsson and Charles Schuchert (1915; revised edition, vol. 1, 1921). The latest summary of the geology, past physiography and palaeontology of the world is found in the French edition of the great work of Eduard Suess, *Das Antlitz der Erde*, translated and annotated by Emmanuel de Margerie as *La Face de la Terre* (1902, 1918). The comparative evolution of the mammalia of the eastern hemisphere and of North America is broadly treated in Henry Fairfield Osborn's *Age of Mammals* (1910); while the mammals of North and South America are compared in W. B. Scott's *History of Land Mammals in the Western Hemisphere* (1913). A broad treatment of the whole subject of invertebrate and vertebrate evolution is given in Richard S. Lull's *Organic Evolution* (1917) and a synthetic review of the earth's history, from its solar beginnings to the Age of Man, in Osborn's *Origin and Evolution of Life*.

Life Epochs of Geologic Time.—The time scale in the accompanying table is taken from the work of Pirsson and Schuchert of 1915, modified by the substitution of geologic *time units* for *years*. There is a growing indisposition to reckon past time in terms of years, and a growing tendency to substitute a relative term like *time units*, because of the enormously wide discrepancy between the older estimates of geologists, based on sedimentation and the thickness of the various assemblages of rocks, which, taken together, make up the whole geologic time scale, and the estimates of physicists, based on the slow liberation of radium from radioactive minerals. The radium estimates of the age of the earth range as high as 1,400,000,000 years for the oldest known rocks, according to Barrell, who has adopted the calculations of Rutherford and others based on the "rate of disintegration" of radioactive minerals. The contrast between the two methods is exemplified in the following table:

	Walcott (1893) Years	Barrell (1917) Years
Age of Man and of Mammals—Cenozoic	3,000,000	55,000,000– 65,000,000
Age of Reptiles—Mesozoic	9,000,000	140,000,000–180,000,000
Age of Amphibians, Fishes, Invertebrates—Palaeozoic	18,000,000	360,000,000–540,000,000
Precambrian Time—Evolution of Invertebrates and of Unicellular Life .	30,000,000	600,000,000–800,000,000
Minimum Total	90,000,000 (Geikie, 1899)	1,200,000,000
Maximum Total	400,000,000 (Geikie, 1899)	1,400,000,000

The most original part of Barrell's contribution was the measurement of time from the base of the Palaeozoic to Recent time by new palaeophysiographic methods, taking into account particularly the rhythms or cycles of dry and moist climates and of elevations and depressions, theories which were originally interpreted by T. C. Chamberlin and popularly treated by Ellsworth Huntington, the physiographer of Yale University.

A few decades ago the physicists and mathematicians, especially Kelvin and Tait, insisted that the earth could not be more than 10,000,000 to 20,000,000 years old; now the physicists are extending the age of the life period to 1,400,000,000 years, as estimated by Barrell (1917). The most recent determination by physicists, as reviewed by Lord Rayleigh (1921), takes into consideration the transmutation of chemical elements, for example, in the bröggerite of the Precambrian rocks at Moss, Norway: "Taking the lead as all produced by uranium at the rate above given, we get an age of 925 million years. Some minerals from other archaean rocks in Norway give a rather longer age. . . The helium method is applicable in some cases to materials found in the younger formations, and proves that the ages even of these are to be reckoned in millions of years. Thus the helium in an Eocene iron ore indicated 30,000,000 years at least. . . The upshot is that radioactive methods of research indicate a moderate multiple of 1,000 million years as the duration of the earth's crust as suitable for the habitation of living beings, and that no other considerations from the side of pure physics or astronomy afford any definite presumption against this estimate." Applying this estimate to the evolution of a familiar mammal like the horse, it might be said that the four-toed horse (*Eohippus*) existed 30,000,000 years ago, a somewhat larger estimate of the life period of the horse than that demanded by palaeontologists. In the same discussion W. J. Sollas comments on the expansion of time estimates proposed by physicists: "The age of the earth was thus increased from a mere score of millions to a thousand millions and more, and the geologist who had before been bankrupt in time now found himself suddenly transformed into a capitalist with more millions in the bank than he knew how to dispose of."

In this connexion we may recall the fact that as early as 1859 Charles Darwin pointed out that the high degree of evolution and specialization seen in the invertebrate fossils at the base of the Palaeozoic, namely, the Cambrian, proved that Precambrian evolution occupied a period as long as, or even longer than, that of Cambrian to Recent time (*see* Table I on p. 11). Poulton, the leading disciple of Darwin in England (1896), declared that 400,000,000 years was none too long for the whole life evolution period; this would allow 200,000,000 years for Precambrian time and another 200,000,000 years from Cambrian to Recent time.

Walcott's Revelation of Precambrian and Cambrian Life.—Charles D. Walcott (1899, 1914) has discovered the remains of life in the Precambrian (Proterozoic) rocks of North America and has been able to give us a fragmentary picture of the fauna and flora of that very ancient period. In Montana at a depth of nearly 10,000 ft. below the earliest Palaeozoic rocks (Cambrian) he found evidence of ancient reef deposits of calcareous algae, which ranged upward through 2,000 ft. of strata. Above these reefs are 3,000 ft. of shales containing worm trails and the fragmentary remains of large crustacean-like organisms. From rocks of approximately the same age in Ontario, Canada, he has described sponge-like forms (*Atikokania*) which are of such generalized structure that it is difficult to decide whether they should be regarded as sponges or as archaic corals. These few plant and animal remains are all that are known from remotely metamorphosed rocks of Precambrian time, but the existence of annelids and possible arthropods marks a break into the hitherto unknown Precambrian. Walcott's most surprising discovery in Precambrian time is a monad or bacterium attributed to *Micrococcus* sp. indet. from the Algonkian of Montana, but probably related rather to the existing *Nitrosomonas*, one of the prototrophic or primitive-feeding bacteria, which derives its nitrogen from ammonium salts.

In 1910 Walcott discovered in the Cambrian (Burgess) shales of Alberta, Canada, a marvellously rich fauna whose preservation is so perfect that the setae of the worms, the jointed appendages of the trilobites, the impressions of soft-bodied medusae and holothurians, and even the alimentary tract and stomach of certain of the crustaceans can be seen on the shale surfaces almost as clearly as in living forms (Plate I.). This discovery fairly revolutionizes our knowledge of the anatomy of the delicately organized as well as the chitinous-armoured forms, like the trilobites. Including the new forms contained within these Albertan shales, the Cambrian marine fauna is now known to be far more abundant than even imagined by Darwin, comprising some 1,500 species, 1,200 of which occur in North America. From Lower as well as Middle Cambrian (Burgess) faunas, it appears that the Precambrian invertebrates had probably become completely adapted to all the life zones of the continental and oceanic waters, excepting possibly the abyssal. All the principal phyla—the jointed arthropoda (including the trilobites among the crustaceans and the merostomes among the arachnids), segmented worms (Annelida), echinoderms, molluscs (including pelecypods, gastropods and primitive cephalopods), brachiopods, medusae and other coelenterates, and sponges—were presumably established in Precambrian times.

Table I.—Progress in Palaeontology.

MILLIONS OF TIME UNITS						
	ROCKS CHIEFLY UNMETAMORPHOSED; SEDIMENTARY PREDOMINANT; IGNEOUS SECONDARY. ENTOMBED FOSSILS DIRECT EVIDENCE OF FORMER LIFE	3,000,000 TIME UNITS	AGE OF MAN	CENOZOIC		QUATERNARY
			AGE OF MAMMALS			TERTIARY
5		9,000,000 TIME UNITS	AGE OF REPTILES	MESOZOIC		UPPER CRETACEOUS
						LOWER CRETACEOUS (COMANCHEAN)
						JURASSIC
10						TRIASSIC
		18,000,000 TIME UNITS	AGE OF AMPHIBIANS	PALAEOZOIC	LATE PALAEOZOIC	PERMIAN
15						PENNSYLVANIAN (UPPER CARBONIFEROUS)
						MISSISSIPPIAN (LOWER CARBONIFEROUS)
20			AGE OF FISHES		MID-PALAEOZOIC	DEVONIAN
						SILURIAN
25			AGE OF INVERTEBRATES		EARLY PALAEOZOIC	ORDOVICIAN
						CAMBRIAN
30 MILLIONS OF TIME UNITS	ROCKS GENERALLY METAMORPHOSED; IGNEOUS PREDOMINANT; SEDIMENTARY SECONDARY; LIMESTONE, IRON ORE, AND GRAPHITE INDIRECT EVIDENCE OF FORMER LIFE. FOSSILS SCARCE.	"PRECAMBRIAN," 30,000,000 TIME UNITS	EVOLUTION OF INVERTEBRATES	PROTEROZOIC	LATE PROTEROZOIC (ALGONKIAN)	KEWEENAWAN
						ANIMIKIAN
35						HURONIAN
					EARLY PROTEROZOIC	ALGOMIAN
40						SUDBURIAN
45 50			EVOLUTION UNICELLULAR LIFE	ARCHAEOZOIC (ARCHEAN)		LAURENTIAN
55 60						GRENVILLE (KEEWATIN) (COUTCHICHING)

TABLE I. Life Epochs and Geologic Time Units of Europe and North America (After Pirsson and Schuchert, 1915; Issued by Osborn in 1918)

The Cambrian fauna has been made known to us in large measure through the field discoveries and monographic studies of Philip Lake (1906) for Great Britain, of Walcott (1909–21) for North America, and of Cowper Reed (1915) for India. The great variety and high specialization of the Cambrian marine forms, including representatives of all the known marine invertebrate phyla, is in harmony with the trend of discovery among the vertebrates, which is to put the origin of existing families very far back into the Age of Mammals and even into the Age of Reptiles (Mesozoic). In fact, the antiquity and persistence of modern types, as distinguished from modern genera and species, is an illustration of a very far-reaching principle, namely, that the *most stable form of energy in matter known is that of the heredity chromatin* on which this extraordinary preservation of the main features of the ancestral type depends. Next to the stability of the properties of the chemical elements, which are now known to pass into each other by transmutation, the most stable physicochemical properties are those which form the heredity basis of life.

Freshwater and Terrestrial Origins.—The eurypterids appear as contemporaries of the Cambrian trilobites and traces of them are found in Precambrian rocks; they attain to their acme in Silurian time and develop into the eight-foot giants of the fauna of the Devonian of Scotland and eastern North America, suffering extinction at the close of the Palaeozoic. In 1916 appeared Marjorie O'Connell's memoir, entitled *The Habitat of the Eurypterida*, giving as the summation of her studies that throughout their entire phylogenetic history the eurypterids lived in the rivers, a conclusion accepted in the main by Schuchert (1916), with the modification that they also appeared to have lived at times in the brackish waters of more or less large bays and possibly in limited numbers even in the seas. Many other origins formerly traced to the sea have more recently been traced to fresh water. T. C. Chamberlin (1900) proposed the hypothesis of a prevailing freshwater origin both for the ancestral backboned animals known as chordates as well as for the much more ancient arthropods, the eurypterids. His strong influence was needed to overcome the widespread notion that all forms of life originated in the sea; and, one after another, theories of freshwater and terrestrial origin have replaced the theory of marine origin. Early in 1916 Barrell pointed out the influence of Silurian-Devonian climates on the rise of air-breathing vertebrates and freshwater origin in Devonian time under seasonal rainfall.

Schuchert continues that the probable freshwater life of the eurypterids opens a vista into continental life as far back as the Upper Cambrian. Other merostomes related to the eurypterids radiated out from the fluviatile faunas of Cambrian, Ordovician and Silurian time, while in the Devonian rivers dwelt great spider-like eurypterids together with forms so similar to scorpions that they might be called river scorpions, and others that were active swimmers. O'Connell's argument regarding the freshwater eurypterids applies equally to *Limulus*, the horseshoe crab. In brief, the existence of freshwater faunas no less varied than the marine faunas is beginning to be traced back to Lower Cambrian time. O'Connell shows that the entire phylogeny of the eurypterids, which includes about 160 species from the Precambrian to the end of the Palaeozoic, distributed in 78 geologic horizons throughout the world, points to migrations like those of fishes from the headwaters of interlacing river systems, and, taken with other evidence, strongly supports the theory of Predevonian river life as opposed to the general assumption of marine life of all early faunas.

It now appears that beginning in Precambrian time the trilobites, by wide adaptive radiation, reached the acme of their development in the Cambrian, displaying a high degree of articulation and specialization of appendages, suffered a marked decline after the Silurian, and became extinct at the end of the Palaeozoic. James Perrin Smith, who has made a very exhaustive analysis of cephalopod evolution and especially of the Triassic ammonites, observes that the evolution of form continues uninterruptedly even where there is no evidence whatever of environmental change.

Principal Literature, Cambrian to Pleistocene.—A few of the major contributions to our knowledge of the life of the Palaeozoic are: *Cambrian Geology and Palaeontology* (1910) and *Cambrian Brachiopoda* (1912) by Charles D. Walcott; *Cambrian Fossils of Spiti* (1915) and other papers on the Palaeozoic of India by Cowper Reed; *A Monograph of British Cambrian Trilobites* (1906) by Philip Lake, and *A Monograph of British Graptolites* (1901) by Gertrude Elles and Ethel Wood. The foraminifera have been treated by E. Schellwien, *Monographie der Fusulinen* (1908–12); the bryozoa by R. S. Bassler, *Early Paleozoic Bryozoa of the Baltic Provinces* (1911) and G. W. Lee, *British Carboniferous Trepostomata* (1912); the echinoderms by R. T. Jackson in his memoir on the *Phylogeny of the Echini with a Revision of Palaeozoic Species* (1912), and by Frank Springer in his monograph *Crinoidea Flexibilia* (1920) and in numerous shorter contributions. The ancient arthropods, including, besides the trilobites, merostomes and other arachnids and also insects, have been described by J. M. Clarke and R. Ruedemann in their memoir on *The Eurypterida of New York* (1912), by Alexander Petrunkevitch, *A Monograph of the Terrestrial Palaeozoic Arachnida of North America* (1913), by R. I. Pocock, *A Monograph of the Terrestrial Carboniferous Arachnida of Great Britain* (1911), and by F. Meunier, *Nouvelles recherches sur quelques insectes du terrain houiller de Commentry* (Allier) (1906–12). The literature on the Mesozoic contains more references to ammonites than to other groups, because of their abundance and palaeontological importance. The ammonite faunas of the Triassic have been described by James P. Smith, *The Middle Triassic Marine Invertebrate Faunas of North America* (1914) and by Carl Diener, *The Trias of the Himalayas* (1912), *Japanische Triasfaunen* (1915), and other papers on the Triassic of the Himalayas and southern Europe (1915).

For the Jurassic there are the classic volumes by S. S. Buckman, *Yorkshire Type Ammonites* (1909–19) continued in the *Type Ammonites* (1920) and the memoir by C. Burckhardt, *Faunes Jurassiques et Cretaciques de San Pedro del Gallo* (1912) for Mexico. The studies on Cretaceous ammonites have been more local in character and include: E. Stolley's *Beiträge zur Kenntniss der Cephalopoden der norddeutschen unteren Kreide* (1911–2), D. N. Sokolov's *Zur Ammoniten Fauna des Petschoraschen Jura* (Russian) (1912), H. Yabe and S. Shimizu's, *Notes on Some Cretaceous Ammonites from Japan and California* (1921), and numerous papers by A. de Grossouvre, W. Kilian and E. Haug for France and the Mediterranean region. The silicious sponges which are so well represented in the Mesozoic have received the most careful microscopic study by the students and followers of Zittel. Pioneer work was done in England by the late George Jennings Hinde, *A Monograph of the British Fossil Sponges* (1887–1912), and this work was followed in Germany by A. Schrammen's *Kieselspongien der oberen Kreide von Nordwestdeutschland* (1910) and R. Kolb's *Die Kieselspongien des schwäbischen weissen Jura* (1911). Special works on other groups are: *A Monograph of the Cretaceous Lamellibranchia of England* (1899–1912) by Henry Woods, *Synopsis des Spirobranches (Brachiopodes) Jurassiques Celto-Souabes* (1915–9) by the Swiss palaeontologist Louis Rollier, and Clarke and Twitchell's *The Mesozoic and Cenozoic Echinodermata of the United States* (1915). Among the major contributions to Mesozoic stratigraphy and entire faunas or floras may be mentioned: Victor Uhlig's *The Fauna of the Spiti Shales* (1903), Carl Renz's *Die mesozoischen Faunen Griechenlands* (1911), G. R. Wieland's *American Fossil Cycads* (1906–16), and E. W. Berry's *The Upper Cretaceous Floras of the World* (1916).

For the Tertiary life especial reference should be made to the contributions on different groups made by Thomas Wayland Vaughan (corals), E. W. Berry (plants), J. A. Cushman (foraminifera), R. T. Jackson (echinoderms), Mary Rathbun (crustaceans), A. Pilsbry (cirripedia), and others in *Contributions to the Geology and Paleontology of the Canal Zone, Panama, and Geologically Related Areas in Central America and the West Indies* (1919). The bryozoa have been carefully described and beautifully illustrated by Ferdinand Canu and Ray S. Bassler, *North American Early Tertiary Bryozoa* (1920), while the foraminifera have been described in equal detail by Joseph A. Cushman in numerous contributions, and by H. Yabe (1921) and H. Douvillé (1911). For other groups we may note: J. Lambert's *Description des Echinides des terrains néogènes du bassin du Rhône* (1911–6), F. W. Harmer's *The Pliocene Mollusca* (1914–20), and papers by W. H. Dall on the mollusca. A general résumé of the Pleistocene vertebrate and invertebrate life is embodied in F. C. Baker's *The Life of the Pleistocene or Glacial Period* (1920). Stimulating general reviews of the progress of invertebrate palaeontology are the presidential addresses by F. A. Bather, *Fossils and Life*, British Association (1920), by Ruedemann, *The Palaeontology of Arrested Evolution* (1916), and by Clarke, *The Philosophy of Geology and the Order of the State* (1917).

Progress in Vertebrate Palaeontology

Personnel: Advent of the Fourth Generation.—The principal feature of the decade has been the advent of a new generation of explorers and workers in vertebrate palaeontology who, in a sense, constitute a fourth or "20th century" group. Beginning with Cuvier (1769–1832) as founder of the science and leader of the first group, the second group embraced the British anatomists Richard Owen (1804–1892) and Thomas Henry Huxley (1825–1895), the French leader Albert Gaudry (1827–1908), the Swiss palaeontologist Ludwig Rütimeyer (1825–1895), and the three great Americans, namely, Joseph Leidy (1823–1891), Edward Drinker Cope (1840–1897), and Othniel C. Marsh (1831–1899). These men marshalled the first positive proofs of vertebrate evolution in Europe and America; they worked more or less independently as pioneers and laid the entire foundation of the modern classification of the Vertebrata. The leader of the third group was the Russian, Waldemar Kovalevsky (1842–1883), who instituted intensive investigation of mechanical adaptation in relation to natural selection. Still productive members of the same period are Arthur Smith Woodward (b. 1864) and Charles W. Andrews (b. 1866) in England, Marcellin Boule (b. 1861) and Charles Depéret (b. 1854) in France, Louis Dollo (b. 1857) in Belgium, Max Schlosser in Germany, Giovanni Capellini (1833–) in Italy, and in America William B. Scott (b. 1858) and Henry Fairfield Osborn (b. 1857). This group includes also Samuel Wendell Williston recently deceased (1852–1918), and Ramsay H. Traquair (1840–1912). Scott treated chiefly mammals, Williston chiefly reptiles and amphibians, Osborn both mammals and reptiles. The principal accomplishment of this third school has been (1) to conduct world-wide exploration, (2) to correct, coordinate and firmly establish the great classifications proposed by the second school and (3) to fill out the details and principles of phylogeny or lines of reptilian, avian and mammalian descent. The leading explorer of this period was John Bell Hatcher (1861–1904), who brought together a large part of the materials for two great monographs of the United States Geological Survey, Osborn's *Titanotheres* and the Hatcher-Lull *Ceratopsia;* he also made the wonderful collection of South American fossils which forms the basis of Scott's monumental memoirs of the Princeton University Expeditions to Patagonia during the years 1896–9. Osborn's monograph *The Titanotheres* (an Eocene-Oligocene family of mammals), twenty-one years in preparation, has been completed but not published; others of his memoirs are the *Equidae of the Oligocene, Miocene, and Pliocene of North America* (1918) and *Camarasaurus, Amphicoelias, and other Sauropods of Cope* (1921). Williston's monographs are chiefly on the Cretaceous mosasaurs and the archaic Reptilia of the Perm-Trias, to which he made most notable contributions. Of this period were Florentino Ameghino (1854–1911), the distinguished vertebrate palaeontologist of Argentina, and Eberhard Fraas (1862–1915) of Stuttgart. Oliver P. Hay (b. 1846) is also of this group, author of the monograph of the *Fossil Turtles of North America* (1908) and of the invaluable *Bibliography and Catalogue of the Fossil Vertebrata of North America* (1902).

To the fourth group of vertebrate palaeontologists belongs the school trained by Professor Osborn in the American Museum of Natural History, of which the senior is William Diller Matthew (b. 1871), Walter Granger (b. 1872), Barnum Brown (b. 1873), William K. Gregory (b. 1876), Richard S. Lull (b. 1867), of Yale University, Lawrence M. Lambe (1863–1919), late of the Canadian Survey, and C. Forster-Cooper, Cambridge University. The chief intensive work of Matthew and Granger has been on the American Eocene mammalian faunas and in aiding Osborn to establish sixteen Eocene-Oligocene life zones of North America very closely coördinated with corresponding life zones of western Europe. Brown's explorations have added greatly to our knowledge of Cretaceous dinosaurs. Of the same group are the pupils of Williston, of whom the leader is Ermine C. Case (b. 1871), who has contributed treatises on Permian life. At the same time John C. Merriam (b. 1869) has led explorations on the Pacific coast of America and inspired a school of younger workers both in vertebrate and invertebrate palaeontology. In Great Britain D. M. S. Watson (b. 1886) has taken up the work of Owen and Huxley in primary groups of fishes, amphibians and reptiles; in Austria Othenio Abel, a pupil of Dollo, is the great exponent of vertebrate evolution; in Germany Friedrich von Huene and Ferdinand Broili are leaders in sauropsidan palaeontology, other notable palaeontologists of recent years being Franz Dre-

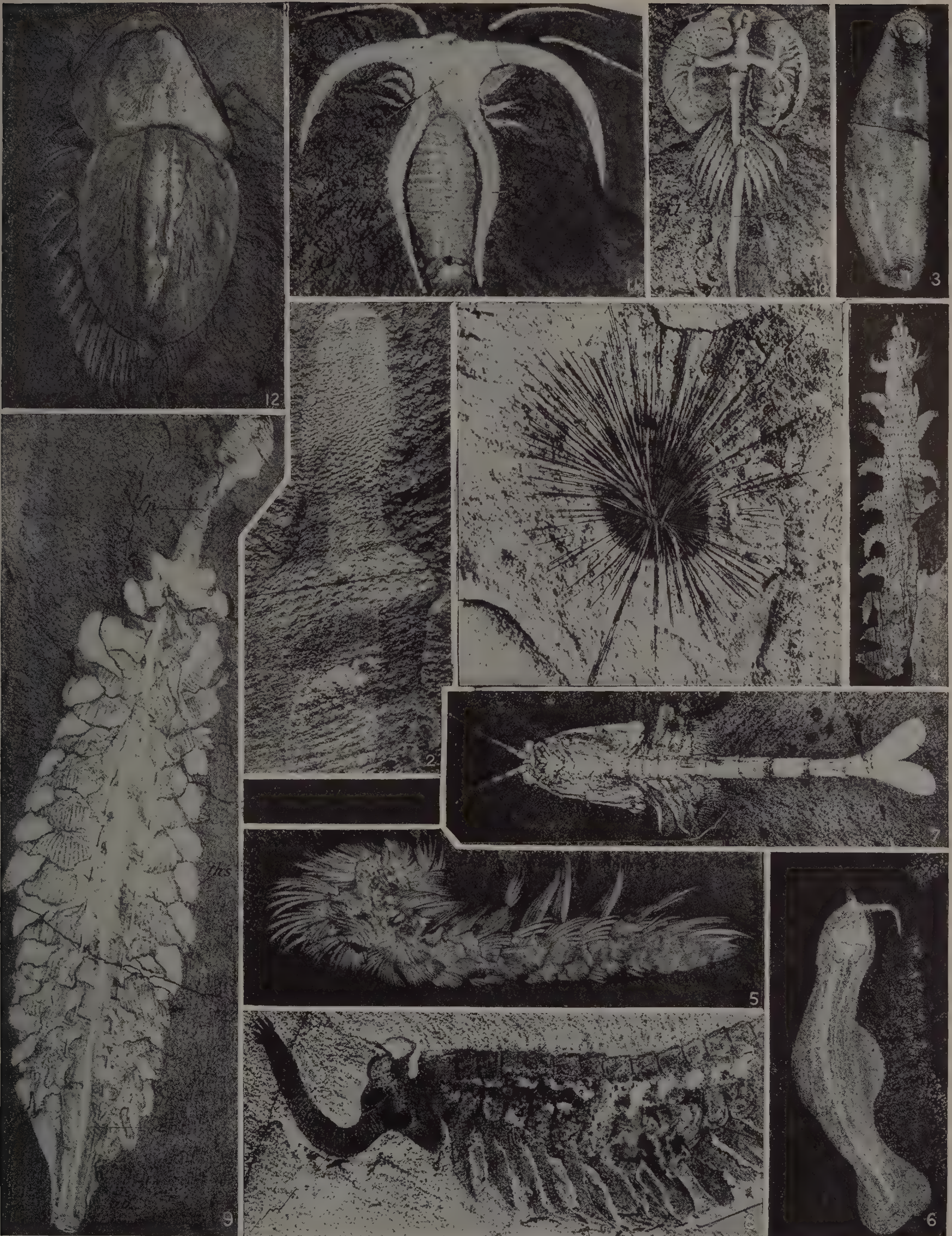

Middle-Cambrian invertebrate fossils, showing the diversity of the animal life of that period and the similarity of many of the types to recent forms. The specimens from which the photographs were taken are in the U.S. National Museum. (Illustrations reproduced by permission of the Secretary of the Smithsonian Institution, Washington, D.C.)

FIG. 1.—*Choia carteri* Walcott, a silicious sponge.
FIG. 2.—*Ottoia prolifica* Walcott, a gephyrean annelid.
FIG. 3.—*Ottoia minor* Walcott, another gephyrean annelid.
FIG. 4.—*Aysheaia pedunculata* Walcott, a *Tomopteris*-like annelid.
FIG. 5.—*Canadia spinosa* Walcott, a polychaete annelid.
FIG. 6.—*Amiskwia sagittiformis* Walcott, a chaetognath.
FIG. 7.—*Waptia fieldensis* Walcott, a *Mysis*-like crustacean.
FIG. 8.—*Opabinia regalis* Walcott, a *Branchipus*-like crustacean.
FIG. 9.—Another specimen of *Opabinia regalis* Walcott.
FIG. 10.—*Burgessia bella* Walcott, an *Apus*-like crustacean.
FIG. 11.—*Marrella splendens* Walcott, a simple trilobite.
FIG. 12.—*Naraoia compacta* Walcott, a curious crustacean.

PLATE II.

PALAEONTOLOGY

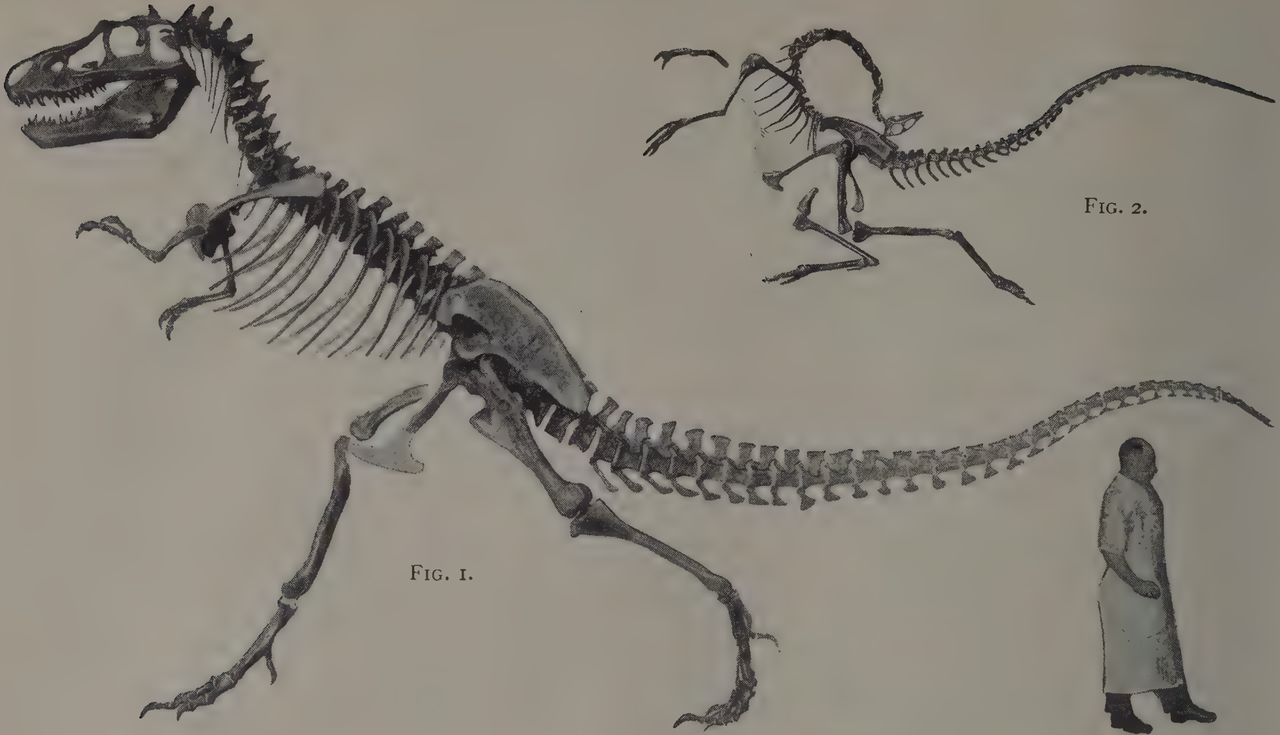

FIG. 1.

FIG. 2.

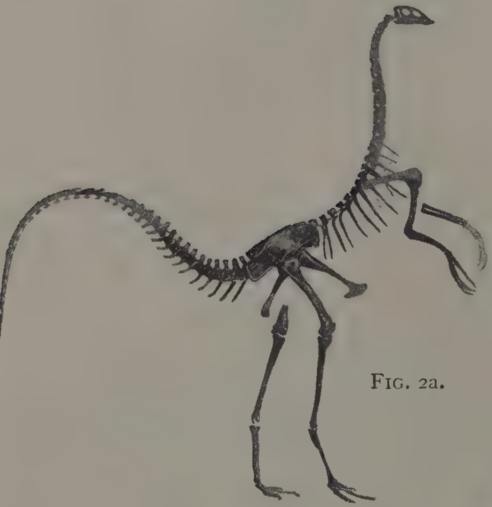

FIG. 2a.

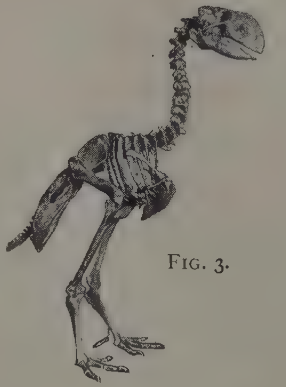

FIG. 3.

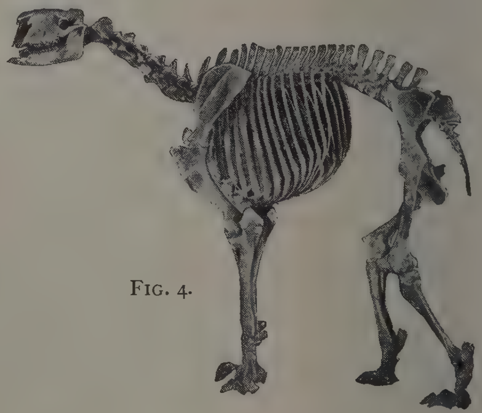

FIG. 4.

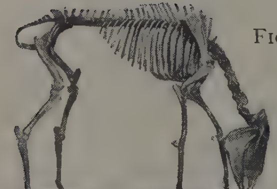

FIG. 5.

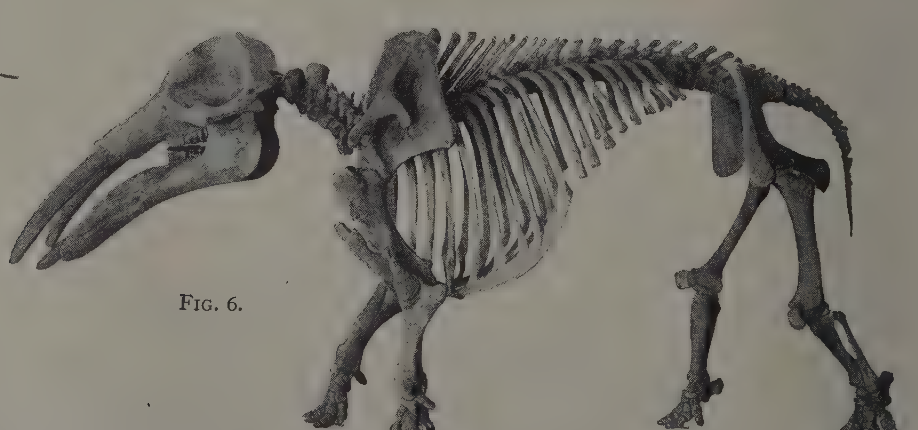

FIG. 6.

Notable vertebrate fossils, complete remains of which have been discovered during the last decade. The mounts from which the photographs were taken are in the American Museum of Natural History, New York. (Illustrations reproduced by permission of the President of the American Museum of Natural History.)

FIG. 1.—*Deinodon* or *Gorgosaurus*, a mid-Cretaceous carnivorous dinosaur from Alberta, Canada, mounted in running position.

FIG. 2, 2a.—*Struthiomimus*, the "ostrich mimic," a mid-Cretaceous browsing dinosaur, from Alberta, Canada, a toothless offshoot from the carnivorous dinosaur stock. Fig. 2 shows the complete skeleton in *rigor mortis*, while fig. 2a represents the same skeleton partly restored from fig. 2.

FIG. 3.—*Diatryma*, a gigantic mollusc-eating bird, from the Lower Eocene of Wyoming.

FIG. 4.—*Moropus*, an okapi-like herbivore, from the Lower Miocene of Dakota, related to the chalicotheres of Europe and Asia.

FIG. 5.—*Pliohippus*, direct one-toed ancestor of the modern horse, from the Lower Pliocene of Nebraska.

FIG. 6.—*Trilophodon*, direct descendant of *Mastodon angustidens* of Europe and North Africa, Lower Pliocene of northern Texas.

All the figures are on the same scale.

vermann, Ernst Strömer (b. 1871) and Otto Jaekel (b. 1863). At Upsala in Sweden Carl Wiman has inspired a remarkably progressive group of workers, while in Switzerland Hans Georg Stehlin (b. 1870) has continued in the great field of Rütimeyer.

For the principal contributions by palaeontologists of the third and fourth groups above described, the reader is referred to the Memoirs and Bulletins of the American Museum of Natural History, of the university of California, of the Carnegie Institution of Washington, to the Contributions from the Palaeontological Laboratory (Peabody Museum) of Yale University, to the Memoirs and Catalogues of the British Museum (Natural History), to the Palaeontographica, and to the Memoirs of the Société Paléontologique Suisse. It is upon the researches of these workers in field and laboratory that the great synthetic volumes referred to earlier are chiefly founded, and that the following generalizations of modern vertebrate palaeontology are chiefly due.

Origins of the Great Vertebrate Stock and Its Branches

Origin of Chordates.—No discovery has thus far lessened the gap between the modern Protochordates (*Amphioxus*, tunicates, etc.) and any of the known phyla of invertebrates. Some of the cephalaspid ostracoderms have been cited by Patten as favouring the view that the chordates have been derived from certain arthropods, but such resemblances are ascribed to convergence by Dollo and many others. The earliest ostracoderm remnant actually known is a dermal plate of a genus named *Astraspis* from the Upper Ordovician near Canyon City, Colorado; this represents a new family Astraspidae allied to the Psammosteidae of the Silurian and Devonian (C. R. Eastman, 1917). These chordates, heavily shielded and hence known as *ostracoderms*, were dominant in the Upper Silurian, radiating into six families and many genera, abundant in the Lower Devonian, diminishing in the Middle Devonian and becoming extinct in the Upper Devonian.

Origin of Fishes.—The earliest fish remnant actually known is the fin-spined *Onchus* from the Upper Silurian of Scotland, which appears to represent the group of acanthodian sharks, covered with fine quadrate scales like those of ganoids and with a skull structure distinctly elasmobranch. The elasmobranchs (shark and ray types) are still the oldest known gnathostomes or true jaw-bearing vertebrates, constituting (*a*) one of the four primary gnathostome groups, *i.e.* jawed groups, the others being (*b*) the fringe-finned ganoids (Crossopterygii), (*c*) the ray-finned ganoids and teleosts collectively known as Actinopterygii and (*d*) the lungfishes (Dipnoi). The fossil ancestors of the fringe-finned ganoids have not yet been discovered; so these animals are theoretically traced to unknown cartilaginous fishes of Silurian times. The oldest Crossopterygian actually known is the *Osteolepis macrolepidotus* of the Middle Old Red Sandstone of Scotland. There were two principal periods of adaptive radiation among the Crossopterygii, the first in Middle and Upper Devonian times, the second in Mesozoic times which produced the family Coelacanthidae, from which may have sprung the existing fishes *Polypterus* and *Calamoichthys* as degenerate offshoots. From the earlier Devonian radiation of the Crossopterygians is traced the theoretic origin of the Dipnoi or lungfishes, on the one hand, and of the oldest known amphibians on the other. The Devonian Crossopterygian skull and fins appear to be "archetypal," to the lungfish type, on the one hand, and to the amphibian type on the other. Cope's genius in separating the Actinopterygii is sustained, for there is as yet no fossil evidence of the connexion of this group with the Crossopterygii, other than the supposed community of origin in Silurian times. Here the reader should consult the writings of Smith Woodward, Joseph F. Whiteaves, Bashford Dean, William K. Gregory and the synthetic reviews of Osborn (1918) and Lull (1917).

Origin of Amphibians and First Tetrapods.—In this epoch-making transition from the fringe-finned fish type to the tetrapodal amphibian and terrestrial type, the prophecies of Huxley, Cope and Baur and other great anatomists of the second and third groups of palaeontologists appear to be fulfilled. The Silurian period marked the parting of the ways among the great primary groups of fishes and the first steps towards the frame of the terrestrial amphibians. Not until the Upper Devonian of Pennsylvania do we find a footprint (*Thinopus antiquus* Marsh), which may be referred to an amphibian tetrapod. The first known actual skeletons occurred in the Coal Measures (Upper Carboniferous) of Europe and America and represented four widely radiating groups. The structural gap separating the earliest tetrapod amphibians and fishes is perhaps the greatest known in the whole range of vertebrate evolution, but all modern authorities agree that the amphibians were probably derived from a Silurian or early Devonian type of fringe-finned fish. Even as far back as the Upper Carboniferous and even in the Lower Carboniferous the Amphibia were adaptively radiating into several orders and numerous families comprising highly specialized forms. During the Carboniferous we find numerous independent phyla of eel-like or burrowing, and of compressed, swimming, as well as of large-bodied, predatory forms. The latter culminate in the gigantic labyrinthodonts of the Triassic. The exact connexion of any of these forms with the modern Amphibia (urodeles and Anura) is doubtful. The Anura first appear in the Jurassic, and at the present time they retain many characters reminiscent of such Palaeozoic Amphibia as the branchiosaurs and the *Eryops* group. The urodeles are first known in the genus *Hylaeobatrachus* of the Lower Cretaceous of Europe. Both groups, especially the Anura, appear to have gone through a wide adaptive radiation during the Tertiary. The connexion of the modern caecilians with the ancient types is obscure. The reader is referred especially to the contributions of Williston, Case, Watson, Gregory, Broili, and the synthetic reviews of Osborn (1918) and Lull (1917).

Origin of Reptiles.—The oldest-known reptiles, solid-headed *Cotylosauria* of Cope, are regarded as amphibians which had eliminated the aquatic stages in development, the oldest reptile actually known being the genus *Eosauravus* from the Coal Measures of Ohio. In other words, the cotylosaur reptiles are traceable to solid-headed stegocephalian amphibians, which, in turn, are traceable to solid-headed unknown Crossopterygians of Silurian times. The oldest and most primitive reptiles (*Cotylosauria*) occurring in the Upper Carboniferous and Permian, are thus structurally very close to certain contemporary stegocephalian amphibians. The first great adaptive radiation of the reptiles into the two grand divisions, the solid-headed (*Cotylosauria*) and the temporal-arched (*Pelycosauria*), began in the Upper Carboniferous and still more widely diverged in Permian times. As early as the Permian, occurs a mammalian-like series of reptiles which exhibits an extensive adaptive radiation and gives off one branch, the *Cynodontia*, which, in turn, survives into Triassic times and clearly approaches the mammalian grade of organization. From the primary temporal-arched also appear the forerunners of the Mesozoic reptiles, the plesiosaurs, ichthyosaurs, dinosaurs and pterosaurs, widely separated from each other in the Triassic and thus having their branches deep down in the Permian and Carboniferous, each grand division giving rise to an adaptive radiation of its own. These have been traced in detail by such authorities as Andrews, Dollo, Abel, von Huene, Williston and Osborn.

Here the reader is referred to the writings of Williston, Hatcher, Osborn, Merriam, Lambe, Lull, and especially during the past decade to those of Charles W. Gilmore of the United States National Museum, Washington, and of Dr. Robert Broom of South Africa, as well as to the synthetic reviews of Osborn (1918) and Lull (1917).

The two greatest achievements of the decade are the clearing up of the relationships of the primitive South African terrestrial Reptilia of the Perm-Trias, beginning with the solid-headed types (pareiasaurs) and ending in their highest expression, the mammal-like types known as *Cynodonts* and *Theriodonts.* The field explorations of Robert Broom and the profound comparative researches of D. M. S. Watson and of William K. Gregory have given us a clear comprehension of the habits and relationships of this first terrestrial radiation group. Williston and Case have covered the same great period in America.

Origin of Birds.—Palaeontologists still agree in endorsing Huxley's opinion that birds are "glorified reptiles." The origin of birds, according to recent reviewers such as Osborn and Gregory, brings us close to the two-temporal-arched (*i.e. Diapsida*) reptiles, namely, to the stem which also gave off the dinosaurs, the pterosaurs and the smaller parasuchians (*Euparkeria*). Fossil bird remains are extremely rare. The earliest bird known is the famous *Archaeopteryx* of the Jurassic of Solnhofen, Germany. This is largely a bird, excepting in the tail, the simplicity of the feather arrangement and the possession of teeth. According to the four-winged hypothesis of origin advocated by Beebe, we should some day discover a bird with parachute-like action in both fore and hind limbs. Recent contributions of note on this subject are those of Gerhard Heilmann (1913) and of William Beebe (1915), and the synthetic reviews of Osborn (1918) and Lull (1917).

Origin of Mammals.—Evidence has been accumulating rapidly in favour of the theory that the origin of the mammals should be traced to the more progressive terrestrial mammal-like reptiles (the *Cynodontia*) of the Permian and Triassic of South Africa and Europe, as described in the studies of Broom, Watson, Haughton, Osborn and Gregory. Structurally related to these Cynodonts are the so-called *Protodonts* of Osborn, *e.g. Dromatherium* and *Microconodon* of the Triassic of North Carolina. But of equal antiquity are the multituberculates, *e.g. Plagiaulax* and *Microlestes*, widely spread over Europe and North America. No substantial additions have been made during the decade to our knowledge of this vague period; readers are referred to the reviews of Osborn (1918) and Lull (1917), also to the recent works of Gregory, *The Orders of Mammals* (1910) and *The Origin and Evolution of the Human Dentition* (1921).

Origin of Primates and of Man.—Combined palaeontological and anatomical evidence indicates that the source of the Primates is to be looked for among tree-living insectivorous mammals more or less closely similar to the modern tree shrews (*Tupaiidae*) of Africa. This view advanced with ability by Gregory is in general accord with the opinion that during the phase of arboreal life many of the psychic and anatomical characters of the Primates were acquired. It was not until the Lower Eocene of North America and of Europe that there appeared undisputed Primates of lemuroid affinity, *e.g.* notharctids and tarsioids in America, adapids and tarsioids in Europe. At this time the zoölogical relation of the two continents was close and it would appear that while the primitive horses were acquiring their cursorial characters on the ground, these primitive lemuroids were acquiring their distinctive characteristics in the trees. Actual ancestors of the existing *Tarsius* of Madagascar have been found in France (*Pseudoloris*). The attempt of Ameghino to trace the higher Primates to South American types, *e.g. Homunculus*, appearing in the Lower Miocene of Patagonia, is not supported, because these animals from the first are the true broad-nosed, *i.e.* platyrrhine, type still characteristic of South America. The Old World division of the catarrhines or narrow-nosed true Primates has been traced to the *Parapithecus*, described by Max Schlosser from the Lower Oligocene of Egypt. *Propliopithecus* is possibly ancestral to the true anthropoid apes and thus possibly related to the ancestors of man himself. Darwin's broad conclusion that man was derived from "some ancient member of the anthropomorphous subgroup of Old World Primates" is fully sustained by anatomical evidence, but the precise lines of descent are still in dispute. Some hold that the human line came from Middle Tertiary anthropoid apes allied to *Dryopithecus* of France and *Sivapithecus* of India, while others (including the present writer) regard the Hominidae as a widely distinct family separated especially by its upright walking gait, by the non-divergence of the great toe, and by the retention of its tool-making thumb. A series of masterly reviews of this whole question has appeared in the American Museum publications from Gregory, whose recent memoir *On the Structure and Relations of Notharctus, an American Eocene Primate* (1920) sums up our present knowledge of this whole subject. (*See* also ANTHROPOLOGY.)

The Dinosaur Fauna of Alberta, Canada.—The greatest new achievement in exploration is the revelation of the dinosaur fauna of Alberta in the fossil beds extending along the Red Deer river, which were first made known to science by explorers of the Canadian Geological Survey in 1897, 1898, 1901. The first general review of this wonderful fauna was that of Osborn and Lambe, *On Vetebratra of the Mid-Cretaceous of the North West Territory* (1902), based chiefly on the collections in the Ottawa Museum. The American Museum explorations under Barnum Brown, which extended over ten years, have resulted in the discovery of the entire fauna of the middle portion of Upper Cretaceous time, a complete revelation especially of the dinosaur world as it approached the height of its adaptive radiation into herbivorous and carnivorous, armoured and defenceless, swift-moving and slow-moving types, which severally imitate more or less fully the long subsequent adaptive radiation of the mammals. In 1914 the Canadians renewed exploration, so that at present the Ottawa and Toronto Museums have rich collections, part of which has been described by the late Lawrence M. Lambe, while Osborn, Barnum Brown and W. A. Parks have also made known a part of this wonderful fauna. Two of the greatest extremes of adaptation, namely, *Deinodon* or *Gorgosaurus* and *Struthiomimus*, are figured in the accompanying Plate II. In the same plate appear some of the outstanding American discoveries of the decade.

NEW DISCOVERIES AMONG FOSSIL VERTEBRATES

Fossil Fishes.—Dr. A. Smith Woodward's *Fossil Fishes of the English Wealden and Purbeck* (1915–8) is a beautifully illustrated memoir of the most thorough, systematic type, well sustaining the traditions set by Traquair and by the author himself in earlier works. The period dealt with affords an interesting cross-section of the stream of piscine evolution, at a time when many of the old Mesozoic ganoids were dying out and the teleost fishes were beginning their remarkable expansion. Other important systematic memoirs are those by Stolley on the ganoids of the German Muschelkalk (1920) and by Stensiö (1921) on Triassic fishes from Spitzbergen. The latter memoirs contain a wealth of material of great morphological interest concerning the early stages in the evolution of the skull of the fringe-finned and ray-finned ganoid fishes; this discussion also throws light on the origin of certain elements in the skull of higher vertebrates. In this connexion should be mentioned the brief but highly important paper on *Eusthenopteron* by W. L. Bryant (1919). This fringe-finned ganoid is of particular interest because the construction of its skull and paired limbs approaches the type which may be expected in the piscine ancestors of the land-living vertebrates. The arrangement of the elements on the under side of the skull of this fish raises morphological questions of wide general interest. Papers by Watson and Day (1916) and by Gregory (1915, 1920) deal with the ancestral relations of these fringe-finned ganoids with the land-living vertebrates (tetrapods).

The swarming fauna of Devonian arthrodires, ptyctodonts, cladodonts and other archaic fossil fishes from the vicinity of Buffalo, N.Y., is ably described by Bryant and Hussakof in their *Catalog of the Fossil Fishes in the Museum of the Buffalo Society of Natural Sciences* (1918). A serious difficulty encountered by all students of recent and fossil fishes is the getting in contact with the vast and scattered literature of the subject. The great *Bibliography of Fishes* by Bashford Dean and his associates Eastman and E. W. Gudger (1917) will undoubtedly stimulate research in this field.

Fossil Amphibians.—The outstanding publications in this field are *The Coal Measures Amphibia of North America* by R. L. Moodie (1916) and a memoir on *The Structure, Evolution and Origin of the Amphibia* by D. M. S. Watson (1919). Moodie's memoir is a valuable description and compilation of the extensive and varied fauna of swamp-living amphibians of the American Coal Measures. Watson's memoir is a brilliant and highly original contribution to the classification and phylogeny of the labyrinthodonts. Much detailed work on fossil amphibians appears in papers by von Huene, Broom, Williston, van Hoepen, Haughton and others.

Stem Reptiles.—In the field of the oldest reptiles, those of the Carboniferous and Permian, perhaps the most important contributions are those by S. W. Williston and D. M. S. Watson. The former, in his paper on *The Phylogeny and Classification of the Reptiles* (1917), traces the rise of the common amphibian-reptilian stock through the "Protopoda," which are so far known only from certain footprints of Upper Devonian age. According to Williston, who built on Osborn's system of 1903–4, the primitive reptilian stock early divided into the following series:—

Anapsida (Cotylosauria and their specialized descendants, the modern tortoises and turtles).

Synapsida (Theromorpha or pelycosaurs, etc.; Therapsida, or mammal-like reptiles, the latter giving rise to the mammals; plesiosaurs).

Diapsida (reptiles with two temporal arches, such as crocodiles, dinosaurs, rhynchocephalians; this stock gave rise to birds).

Parapsida (including the proganosaurs, ichthyosaurs, lizards, mosasaurs, snakes).

Watson (1917), in his *Sketch Classification of the Pre-Jurassic Tetrapod Vertebrates*, assigns a high value in classification to the characters of the brain-case. A general and conservative classification of the early reptiles is given by W. K. Gregory (1920). The most primitive known reptile, *Seymouria*, from the Permo-Carboniferous of Texas, almost bridges the gap between the Amphibia and the Reptilia. Watson (1919) gives a morphological description of this reptile, accompanied by valuable figures and reconstructions of the skull and skeleton.

The habits and environments of the teeming reptilian and amphibian faunas of the Permo-Carboniferous of North America are intensively considered in a memoir by E. C. Case (1919), which also deals with the stratigraphy, climatology and palaeogeography of the late Palaeozoic.

Mammal-like Reptiles.—In no other field of fossil reptiles has the progress of discovery been more satisfactory than in that of the mammal-like reptiles of South Africa, as set forth in numerous papers, especially by Watson (1913–4), Haughton (1918), Broom (1913–4), van Hoepen and others. The relationships of these animals with other reptiles and with the mammals have been reviewed by W. K. Gregory (1920–1).

Marine Reptiles.—These have always been of great interest on account of their secondary adaptations to aquatic life which have been ably discussed by Abel (1912, 1919). One of the outstanding contributions of new material in this field is the *British Museum Catalogue of Marine Reptiles of the Oxford Clay* by C. W. Andrews (1910–3). The origin and relationships of the plesiosaurs and their allies are treated by von Huene (1921).

Dinosaurs.—The Triassic dinosaurs of Europe are of particular interest because some of them tend to connect the very diverse carnivorous and herbivorous saurischian dinosaurs of later ages. Here the leading author is F. von Huene, in a long series of papers and memoirs. *Plateosaurus*, perhaps the most primitive of these reptiles, has been fully described both by von Huene and by Jaekel (1913–6). Primitive dinosaurs from the summit of the Karroo series in South Africa (*Gryponyx*, *Massospondylus*, etc.) are described by Broom and Haughton. During the long ages of the Jurassic the gigantic sauropodous dinosaurs attained their maximum in size and specialization. The leading feature in this field is the description of the strange and monstrous dinosaurs of the Tendaguru fauna of East Africa in the collections of the Berlin Museum, by Janensch (1914). One of the most remarkable of the North American sauropods is the genus *Camarasaurus*, which has been intensively described by Osborn and Mook (1921). *Barosaurus*, a gigantic relative of *Diplodocus*, with a tremendously heavy neck, has been described by R. S. Lull (1919). *Tyrannosaurus*, the greatest carnivorous reptile of all time, and *Struthiomimus*, a contemporaneous ostrich-like dinosaur, have been described by Osborn (1912–9). The highly varied and grotesque armoured dinosaurs, namely, the Ceratopsia and related groups, have been the subject of numerous papers by Gilmore, Brown, Lambe and others.

Pterosaurs.—The pterosaurs, or flying reptiles, have continued to excite the interest of students of flight, such as Abel (1912), Watson and Hankin (1914), Arthaber (1921). The greatest flying reptile, *Pteranodon*, is the subject of a memoir by Eaton (1910) of Yale University.

Chelonians.—An important memoir by O. Jaekel (1913–6) describes the skull, skeleton, carapace and plastron of *Triassochelys dux* from the Upper Triassic of Germany. Although widely differentiated from all other orders this reptile was the most primitive of all known chelonians. Of even greater interest is the *Eunotosaurus* from the Permian of South Africa which Watson (1914) describes as a veritable "Archichelone."

Fossil Birds.—*Diatryma*, a gigantic ground bird from the Lower Eocene of Wyoming, has been described by W. D. Matthew and W. Granger (1917) from a nearly complete skeleton, which is a most rare and valuable fossil. This bird, which has no near relatives, was about seven feet high and of massive proportions, with an enormous head and great compressed beak. The wings were vestigial. This high degree of specialization at such an early epoch indicates that the modernized groups of birds were differentiated during the latter part of the Age of Reptiles.

Monographs on Special Groups of Tertiary Mammals.—The fossil mammals of the basal and Lower Eocene of the western United States are represented in the American Museum of Natural History by collections numbering many thousands of specimens which are being described jointly by Matthew and Granger (1915). Besides describing many new or little known forms these authors also deal with the relationships and morphology of the various groups of early placental mammals. In the paper dealing with the edentates and their relatives, the "palaeanodonts," Matthew (1918) advances the view that the modern Pholidota (Pangolins) are an offshoot of the primitive "palaeanodonts" of the Lower Eocene. Other papers of the same series cover the Creodonts, Insectivores, Primates and Condylarths.

Several mid-Tertiary mammalian groups, such as chalicotheres, entelodonts and the diceratheres, have been revised in the publications of the Carnegie Museum, Pittsburgh, by W. J. Holland and by O. A. Peterson.

Baluchitherium, perhaps the most gigantic land mammal of all time, has been described by C. Forster-Cooper (1913) from a huge atlas, astragalus, cervical vertebrae and limb bones from the Upper Oligocene deposits of the Bugti Hills of Baluchistan.

The evolution of the Sirenia is treated by Abel (1921) and by Depéret (1920); that of the Cetacea by Abel (1919) and by Winge (1918–21). The phylogeny and evolution of the Proboscidea are considered in the researches by Schlesinger (1917), Matsumoto (1915) and Osborn (1918–21). The Eocene and Oligocene titanotheres have been dealt with in numerous papers by Osborn in preparation for his monograph on these extinct animals. The revision of the mid-Tertiary Equidae by Osborn (1918) affords an exceptionally full document on the exact course of evolution in the multitudinous phyla of a typical mammalian family. A most valuable expansion of our knowledge of the anthropoid apes of the mid-Tertiary is found in the work of Pilgrim (1915) on the fossil apes of India of the genera *Dryopithecus* and *Sivapithecus*.

South American Fossil Mammals.—The strange offshoots of the ungulate and edentate orders which swarmed in Patagonia during the mid-Tertiary and Pleistocene times are treated in the excellent memoirs of the Princeton University Patagonian expeditions by W. B. Scott. Herluf Winge has admirably monographed the fossil and recent edentates of Brazil. The mammalian fauna of the Deseado formations is described by F. B. Loomis of Amherst College. These and other investigations are correcting the erroneous correlations by Ameghino, in which the older mammal-bearing horizons of Patagonia were assigned to the Cretaceous. This more modern work indicates that the Pyrotherium beds are not older than Upper Eocene and that the Santa Cruz formation is of Lower Miocene Age.

The Pleistocene fauna of Tarija, Bolivia, is the subject of a beautiful memoir by Boule and Thévenin (1920), in which the anatomy and relationships of "*Mastodon*" *andium* and of the highly specialized horses *Hippidium* and *Onohippidium* are treated.

Pleistocene Mammalian Faunas (North America, Europe).—The Pleistocene represents the climax of the Age of Mammals in point of differentiation and richness of mammalian faunas. In Europe the Pleistocene faunas have been the subject of memoirs by Boule, Schoetensack and many others. In North America we have the teeming fauna of the Rancho La Brea, California, described by Merriam, Stock and their colleagues of the university of California. The correlation of the American Pleistocene faunas has been treated especially by Osborn and by Hay.

In the preparation of this article the writer is especially indebted for the entire invertebrate section to the coöperation of Miss Marjorie O'Connell, who has summarized the chief discoveries in Pre- and Postcambrian time and given a review of the outstanding literature in the invertebrate field. He is also indebted to Charles D. Walcott, chief authority on Cambrian and Precambrian life of the world, for the type figures assembled in Plate I.; to Curators Matthew and Gregory of the American Museum for a revision of the text relating to the evolution of the vertebrates; and to the President and Trustees of the American Museum for permission to reproduce the photographs which are assembled to the same scale on Plate II. (H. F. O.)

PALESTINE (*see* 20.600).—During the earlier years of the decade 1911–21 little of importance occurred in that country. Afflicted by the economic stagnation and financial strain which affected the whole Ottoman Empire in consequence of the war with Italy (1911–2), and the war with the Balkan States (1912–3), Palestine was unable to develop herself in any way before the outbreak of the World War in 1914. Yet to a section of her population the decision of the Palestinian Jews, in the autumn of 1913, to reject German and insist upon Hebrew as the language of instruction and to secede from the *Hilfsverein* and set up schools of their own, was momentous. The outbreak of the World War, besides leading to a renewed blockade of the coast, and fresh military requisitions, also involved the expulsion or internment of numerous ecclesiastics and laymen of Entente nationalities and the deportation of numbers of Jews. It was followed at the beginning of 1915 by one of the most destructive visitations of locusts recorded for a generation. Thereafter until the arrival of the British army in the autumn of 1917 the prosperity of the whole country slowly withered under the crushing burden of the war.

At the time of the British occupation of Jerusalem in Dec. 1917 the economic situation of southern Palestine was bad. Not only had the Turks requisitioned far and wide without repayment, or against inadequate payment, but they had cut down numbers of olives and revenue-producing trees and carried off the greater part of the agricultural and draught animals. The paper currency had depreciated some 84% and was no longer accepted by the producing classes—mostly outlying Moslem peasants—who would only discover their concealed stores of grain for gold. The civil population of Jerusalem, dependent ordinarily upon the pilgrim traffic or upon the offerings of pious Jews for its livelihood, was emaciated and reduced by starvation. The only products which Jerusalem had to sell were designed for the pilgrim trade and were unmarketable; consequently at the beginning of the occupation many shops were able to offer only cigarettes, picture-postcards and wild radishes for sale.

In view of this it was urgently necessary to provide food for the exhausted inhabitants of Jerusalem and Palestine, to provide work for the purpose of enabling them to earn money with which to pay for the food, and to re-start trade in order that the mercantile community should have something to barter against the gold hoarded by the peasantry and thus make it worth the peasant's while to cultivate and market his produce as he had for some time past realized that his gold was unable to buy the trade goods he required. But there were grave difficulties—the single line of railway by which alone food or trade goods could be brought from Egypt was very fully occupied with the paramount needs of the army. The daily tonnage of supplies alone—not including munitions or transport of men or guns—varied from 800 to 2,300. Ammunition was often 250 tons per day. The civilian population was unaccustomed to the Egyptian currency and more than suspicious of paper money, and Egyptian silver put into circulation was at once hoarded against the proximate return of the Turks, which was confidently predicted by enemy sympathizers who further assured every one that the Egyptian paper pound at par was worth no more than the depreciated Turkish paper lira and offered to prove it by readily exchanging Turkish for Egyptian pounds whenever possible—at a profit to themselves of 17s. 7d. on each deal. Yet without money the civilians could not buy food, without food they could scarcely walk from weakness, and there was every prospect of the establishment of a vicious circle.

Brig.-Gen. G. F. Clayton (afterwards Sir Gilbert Clayton), chief political officer to Gen. Allenby, was appointed chief administrator and began to construct such a form of government as is provided for in "The Laws and Usages of War" laid down by international agreements embodied in the Hague Convention. Transport for a few truck-loads of foodstuffs per week was secured from the military railway, and lorries brought it to Jerusalem until the army was able to reopen the narrow-gauge line from Ludd to the Holy City. Then a small consignment of trade goods came up from Egypt and merchants were permitted to import small quantities from Egypt independently of the over-burthened railway. The labour corps employed numerous civilians, paying them at first daily in Egyptian silver and paper, and then weekly in cash or kind at the choice of the labourer. In this way the new currency came to its own, helped by the stringent measures taken by the military administration to suppress trafficking in or artificial depreciation of Egyptian paper. With the arrival of trade goods in the towns the peasants began to spend their gold and sell their produce so freely that it became unnecessary to import so much food and more accommodation thus became available for other merchandise. But even so, 900 tons of cereals had to be imported monthly for the use of refugees alone. Gen. Clayton took other steps to restore public confidence and reëstablish the amenities of civilization. Bazaar gossip and rumour which for some weeks was hostile to the British was counteracted by the publication of Arabic and Hebrew editions of the newspaper, *The Palestine News*, which had been started by the army in March 1915, and intercourse with the greater part of the world was rendered possible by the restoration of the postal service, for which special stamps for the use of the civilian population began to be issued on Feb. 16 1918. Steps were taken to reassure the Moslems, who were much alarmed at reports sedulously propagated by the enemy, that all land was to be given to the Jews, and resident British officers were appointed to administer the various *kazas* of the old Turkish regime. Thus military governors were established at Gaza, with a deputy at Mejdel; at Jaffa, with a deputy at Ramleh; at Beersheba; at Hebron, with a deputy at Deir Aban; and at Jerusalem, with deputies at Bethlehem, Jericho and Ramalla. At first the Occupied Enemy Territory Administration ("O.E.T.A.") was at Bir Salem, near Ramleh, the general headquarters of the army, but later when it became impossible for Gen. Clayton any longer to combine O.E.T.A. with the work of the political mission, Maj.-Gen. Sir Arthur W. Money was appointed chief administrator in April 1918, and he removed the administration to the imposing and convenient Empress Victoria Hospice built by the Germans on the Mount of Olives just before the war. In March the country had so far recovered that it became possible to collect taxes once more, in May public confidence was greatly increased by the skilful and tactful handling of the great Moslem religious festival of the Nebi Musa pilgrimage, invented by the Turks as an artificial check on the great Christian gathering at Jerusalem for the Orthodox Easter, with which it always coincides regardless of the Moslem calendar, and by the successful way in which the dangerous, and often fatal, ceremony of the Holy Fire on the Orthodox and Gregorian Easter was conducted by Col. Storrs the military governor of Jerusalem, and Haddad Bey the Syrian chief of police.

During the summer the administration was able to resume the payment of revenues appropriated by international agreement to the service of the Ottoman debt, but the income of the Moslem Waqfs (pious foundations) was used for the benefit of Moslem beneficiaries in Palestine instead of being drained away to Constantinople. A local police force was built up, schools and law courts reopened and the country benefited largely not only by the roads and bridges built by the army, but from the wages paid locally by the army for labour and the transport system established by the army for the use of civilians. In the absence of the ordinary pilgrims the army furnished excellent substitutes, and Jerusalem began once more to flourish on the money freely spent by military visitors.

In April 1918 the Royal Engineers undertook a work of permanent utility to Jerusalem by way of compensating the inhabitants for the use made by the army of their carefully stored water supply. At that time the city depended upon an aqueduct yielding 1,650 gal. per hour and upon rain-water storage of about 360,000,000 gal. A new reservoir containing 200,000 gal. was built above the town and fed from the Wadi 'Arrub springs 12 m. S. (used for the same purpose in the days of Herod and Pontius Pilate by the Romans) at the rate of 12,500 gal. per hour. This system, opened on June 18, was subsequently improved by the British administration.

The visit of the Zionist commission under Dr. Chaim Weiszmann and the careful abstention from controversial topics of the only Palestine newspaper did much to abate the alarm of the Moslem population caused by Mr. Balfour's declaration. A further useful function was performed by the army in its sales of young camels and cast army beasts by public auction at Ramleh. According to local standards a "cast" army animal was in more than the prime of life and buyers came from the Hejaz and other parts of Arabia to buy the baby camels which had been born of unusually well-fed and healthy parents and had themselves been nourished on a scale of efficiency entirely unknown to native camel masters.

Later in the year when the Sept. advance had finally driven the Turks out of Palestine the O.E.T.A. was divided into three sectors—South (Jerusalem) East (Damascus) and North (Beirut). A little later, after the Armistice of Nov. 11 1918 and the subsequent occupation of Cilicia, O.E.T.A. North became O.E.T.A. West, and a new north sector was formed at Adana. In O.E.T.A. South, of which Gen. Money continued as chief administrator, British military governors were established at Nablus with a deputy at Hable; Jenin with a deputy at Beisan; Tul Keram; Haifa, with deputies at the Jewish colony of Zimmarin and Acre; and Nazareth with deputies at Tiberias and Safed. On August 15 1920 the system of governorships for Palestine was revised, Hebron was added to Jerusalem, Tul Keram was added to Jaffa, Nazareth and Tiberias were amalgamated to form Galilee, Haifa district became Phoenicia, and Nablus and Jenin were amalgamated to form Samaria. Thus Palestine is now administered by five district governors at £E1,200 a year each, with the help of assistant governors and by two district governors at £E850 each (Gaza and Beersheba).

In the spring of 1919 Sir Arthur Money was succeeded as chief administrator of O.E.T.A. South by Maj.-Gen. Sir Louis Bols, formerly General Allenby's chief of staff, who had to contend with a difficult situation. As no peace settlement had been arrived at, he still had to administer the country on Turkish lines in conformity with the "Laws and Usages of War," while on the one hand eager Zionists complained that nothing was being done to carry out the Balfour declaration as interpreted by its most extreme partisans, and on the other the Moslems protested against what they considered to be Jewish aggression, and various foreign powers sought to establish or revive their influence among the various Christian communities in the country. The Arab tribes beyond Jordan were not under proper control, as the Sherifian government in Damascus was not strong, and parties of desert freebooters revived the time-honoured custom of raiding the settled lands. This combined with the anti-foreign agitation which arose out of the difficulties and delays caused by the contradictory assurances given at one time and another on behalf of the British Government to the French and the Arabs led to serious trouble which was brought to a head soon after the Emir Faisal had been declared King of Syria in Damascus (March 10 1920). In Jerusalem the Moslem procession at the Nebi Musa celebrations was exploited as a manifestation of Arab Nationalist sentiment against the Zionist Jews, many of whom had excited the animosity of the Moslems by unwise and tactless propaganda. Public statements had been made which Moslems could easily misunderstand and represent as threats against their own undisturbed possession of their ancestral properties and sacred sites, and a counter-propaganda directed towards a general agreement of Moslem land-owners to refuse to sell or lease land to non-Moslems had played its part in inflaming the crowd against Jewish immigrants. Riots took place on April 4 and 5, and, as the Moslem police in many cases preferred to yield to religious enthusiasm instead of doing their duty impartially, order had to be restored by British and Indian troops. The casualties were 5 Jews and 4 Moslems killed, 211 Jews, 22 Moslems and 2 Christians wounded. A number of persons were arrested and among the Jews sentenced for "possessing firearms, instigation to disobedience by arming the populace, conspiracy and preparing means to carry out acts of riot" was Mr. Vladimir Jabotinsky who had played a distinguished part in helping to raise a Jewish battalion for the British army. Several Moslems were sentenced to long terms of imprisonment for rape or for possessing firearms. Mr. Jabotinsky's sentence was shortly afterwards reduced and he was released on July 8 under the amnesty which followed the introduction of civil government. Later in April, the Ghazzawiye Arabs raided Beisan on several occasions and carried off 119 head of cattle and 259 sheep and goats, and on April 24, 2,000 Arabs attacked the British garrison at Semakh, but had to retreat leaving 100 casualties behind them. Raids were also made further down the Jordan valley, and in the N. some 2,700 refugees, Christians and Jews, fled into Palestine in May to avoid the Metawali who were massacring in the hills above Tyre.

On July 1 1920 the Rt. Hon. Sir Herbert Samuel became first high commissioner of Palestine under the mandate which was in principle accorded to Great Britain at the San Remo conference in April, although the text of the document was not drafted until 1921 and its precise terms had not yet actually been confirmed by the council of the League of Nations. Civil Government was introduced, and for the first time, the British flag was hoisted over Jerusalem. An amnesty was granted (July 8), the censorship was abolished (July 19), and on August 31 an advisory council composed of seven Moslems and Christians and three Jews was created to sit with the high commissioner. At the same time Hebrew was declared an official language together with English and Arabic, and made obligatory for public notices in areas inhabited by 20% or more of Jews (Jerusalem City, and the kazas of Jaffa, Tiberias, Safed, Ramleh and Haifa). Drinking-bars were suppressed throughout Palestine, and the use of stucco and corrugated iron for new buildings or repairs within the walls of Jerusalem was prohibited.

At the end of 1920 the payments of various dues to the account of Ottoman Regie and the prohibition against the cultivation of tobacco in Palestine came to an end.

Frontier.—On Dec. 23 1920 the frontiers of Palestine towards French Syria were fixed in such a way as to include a small additional area, comprising Kades, Metulla and Dan, in Palestine, but retaining the whole of the Litani-Leontes watershed for Syria. In April 1921 the visit of Mr. Churchill, Secretary of State for the Colonies, to Jerusalem, afforded an opportunity for interview with the Emir 'Abdalla, brother of the Emir Faisal, which resulted in the recognition of Arab authority over the territories to the east of Jordan (*see* TRANSJORDANIA), thus fixing that river as the eastern boundary of Palestine except at Semakh on the Sea of Galilee.

Immigration.—During 1920, as transport became available, a number of expatriated Jews began to return to Palestine, as well as new Jew immigrants, many of whom (*Halutzim*) were employed by the Zionists in the work of opening up and reconstructing waste lands, for additions to which the Jewish National Fund raised £160,000 during the year. On Oct. 22 1920 the deported German colonists, chiefly from the Haifa district, were allowed to return.

Some of the new immigrants seem to have adopted communistic views before leaving Russia, and on May 1 1921 a party of these disturbed a Jewish labour meeting at Tell Aviv ('Afif), near Jaffa. A struggle ensued in which Moslems became involved, and this developed into a racial riot of so formidable a nature that the local police were unable to suppress it, and British troops had to be called in. Although the riot was stopped that evening, there was further trouble for two or three days. At no time, however, did the troops have to open fire in Jaffa, but the rioters killed 30 Jews and 10 Arabs and injured 170 Jews and 57 Arabs, before order was restored.

The police arrested 66 rioters, and the leading notables of both religions concerned coöperated with the authorities in calming the population. An inquiry was subsequently held by the Chief Justice of Palestine and two British officials, while Jewish immigration into the Holy Land was suspended for two months (until July 8).

Jewish Agricultural Colonies.—For many years past the piety of Jews all the world over has prompted them to contribute towards the support of the large numbers of Jews resident in or immediately outside Jerusalem on the understanding that the constant prayers and wailings of these—the Jews of the *Haluka*—should benefit also their benefactors. A more modern development of this system led to the foundation of a number of agricultural colonies in other parts of Palestine, which also were for many years dependent upon outside benevolence. With the growth of experience the agricultural colonists, unlike their brethren of the *Haluka*, tended to become more and more self-supporting under the guidance of Baron Hirsch's foundation, the J.C.A. (Jewish Colonization Association), which first began to treat the colonies as a commercial rather than a charitable or sentimental proposition. The earlier colonies had devoted themselves exclusively to viticulture and were embarrassed alike by the attacks of phylloxera and the difficulty of marketing their wine. After the introduction of almonds and oranges and other fruits prospects improved, but until the end of the Turkish period the colonies were much hampered by legal difficulties connected with the purchase and tenure of land, the status of the colonists and the lack of a definite policy. During the war the colonies suffered owing to the deportation of many of the colonists, the requisitions of the military, and the cutting down of large numbers of trees, as well as from the loss of all their foreign markets.

After the war the Zionist Commission greatly improved the prospects of Jewry in Palestine, which, under the Balfour Declaration of 1917, was to become once more a national home for the children of Israel, by organizing a new national life and arranging for the immigration of the *Halutzim*, or Pioneers, young and zealous workers from all parts of Jewry, who began to prepare the country for future arrivals. In 1920 the influx of Jews into Jerusalem was shown by the Immigration Department of the Zionist Commission as follows: Jan. 122, Feb. 139, March 124, April 122, May 98, June 105, July 107, Aug. 178, Sept. 237, Oct. 197, Nov. 218, Dec. 233; total 1,860, of whom 1,251 were men and 609 women, of whom again 1,169 were new immigrants and 696 returning refugees. Jaffa is the principal port of entry, 1,400 Jews having landed there in Sept. 1920. It is estimated that between Dec. 1919 and March 1921 some 11,000 Jews entered Palestine, of whom 3,000 were returning refugees. On the other hand some 3,000 persons emigrated from Palestine during the same period, among whom were many Jews.

The bulk of the new immigrants, up to the end of March 1921, came from Poland, Russia, Morocco, Austria, Syria, Bulgaria, Rumania, Egypt, Hungary, Persia, France, Greece, Germany and England. Each immigrant is provided with a certificate of origin from the Zionist Emigration Office (Palestine Office).

The table shows the area and population of the Jewish colonies founded before the British occupation:—

Land Transfer.—During the whole of the military administration and until Oct. 1920 the sale or transfer of land in Palestine was forbidden, partly because the Turks had removed all official land registers to which appeal could be made for the settlement of disputed titles, and partly to avoid internal trouble which might arise from the transfer of land from a vendor of one religion to a purchaser of another. When this order was rescinded there was no great activity in the estate market in Palestine as a strong movement had been set on foot among Moslems to retain land already owned by Moslems in Moslem hands, and also because the delay in issuing the Mandate and the world-wide financial crisis militated against the economic development of Palestine in general, and land purchase there in particular. Some small parcels of land belonging to Moslems were sold to Jews, but, apart from that, the Jews have acquired no land since the war, with the exception of the university site on Mt. Scopus from the executors of Sir John Grey-Hill.

Ecclesiastical.—In matters ecclesiastical the British authorities were able to steer a careful course between the various conflicting interests, and Col. Storrs, the governor of Jerusalem, was so far able to abate the customary tension between the representatives of the different creeds that the Orthodox at Bethlehem voluntarily removed the unsightly wall which had been built across the nave of the Church of the Nativity chiefly for the purpose of causing annoyance to the Latins; and the Gregorians invited the Anglican bishop, Dr. MacInnes, who had succeeded as bishop in Jersualem after the resignation of Dr. Blyth in Oct. 1914, to take an important part in their Easter ceremonies in 1918. After the final defeat of the Turks the Orthodox and Latin patriarchs who had been held prisoners in Damascus returned to Jersualem, when Mgr. Damianos, who had had difficulties with his Holy Synod, was reinstated by the chief administrator. Mgr. Camassei, the Latin patriarch, however, withdrew soon afterwards to Rome, where he became a cardinal, and in April 1920 Mgr. Louis Barlassina was appointed to succeed him in Jerusalem, while on Oct. 9 1920 Father Paschal Robinson was sent to Palestine as apostolic visitor. On March 20 1921 His Eminence the Grand Mufti of Jerusalem, Kamil Huseini Effendi, died, and after some delay his brother, Hajj Amin, was appointed (May 1921) to succeed him.

Population.—On March 31 1919 the pop. of O.E.T.A. South was 647,850, of whom 515,000 were Moslems, 65,300 Jews and 62,500 Christians. There were 150 Samaritans and 4,900 others. The present area of Palestine is larger than O.E.T.A. South.

The 1919 census figures for the pop. of various towns, showing Ruppin's 1914 estimate in each case in brackets, are as follow:—

	1914 Estimate of Ruppin	Census of 1919
Jerusalem . . .	(80,000?)	60,000
Jaffa . . .	(40,000?)	40,000
Nablus . . .	(30,000)	28,000
Haifa . . .	(20,000)	20,000
Hebron . . .	(20,000)	18,000
Gaza . . .	(30,000)	—
Nazareth . . .	(12,000)	15,000
Safed . . .	(24,000)	12,500
Acre . . .	(12,000)	10,000
Tiberias . . .	(8,000)	8,000
Bethlehem . . .	(12,000)	15,000

Gaza, credited with 30,000 inhabitants in 1914, was entirely depopulated during the war as a military measure by the Turks. The inhabitants were beginning to return slowly to the completely ruined town in 1921.

Of the three divisions of the pop. of Palestine 69% of the Moslems, 46% of the Christians and 19% of the Jews were engaged in agriculture in 1919. In 1918 taxes were paid on 139,000 domestic animals (Southern Palestine only), in 1919 on 531,000 animals (Northern Palestine as well) and in 1920 on 543,000.

Finance.—The budget for Palestine for the first year under British occupation, ending Oct. 1918, showed a revenue from direct taxes £E160,000, from customs and excise £E122,000 and from other normal sources £E54,000. The artificial revenue of £E324,000 drawn from the operation of the services of relief for refugees failed to balance their cost, £E331,000, thus the revenue for purposes of ordinary expenditure amounted to £E337,000 and the expenditure to £E407,000, which included £E141,000 of revenues mortgaged by the Turks for the services of the Ottoman Debt and to meet the kilometric guarantee on railways in other parts of the Empire. It should also be remembered that, while the cost of administering northern Palestine for six weeks is contained in the budget, no revenue at all was collected in that area, as the taxes had all been exacted in advance by the Turks. On the other side, however, it must be noted that the private charity of the American Red Cross and other funds contributed more than £E40,000 *per mensem* towards the maintenance of refugees and destitute civilians, which would otherwise have been a charge upon the Treasury.

In 1918–9 the actual receipts were £E748,000 from all sources and the estimated expenditure £E738,000. For 1919–20 the estimated figures were £E735,000 for both, exclusive of £E284,000 of revenue and £E162,000 of expenditure in the "Excluded Funds" assigned to municipalities, Waqf administration, the Ottoman Debt and railway guarantee outside Palestine. For the first nine months of civil administration ending March 31 1921 the total revenue, excluding that from railways and post-office, was estimated at £E776,000 and the expenditure at £E731,000, while the railways and post-office were expected to yield a net profit of £E30,000, thus showing a surplus of £E75,000. For the first complete financial year under civil administration, 1921–2, the total revenue—including railways and post-office—was estimated at £E2,214,000, and the expenditure at £E2,286,000.

The following table shows the detailed revenue from direct taxation and State domains for the two financial years 1919–20 and 1920–1:—

		House and Land Tax £E	Animal Tax £E	Tithe £E	State Domains £E	Stamp Duty £E	Total £E
Jerusalem	1919–20	29,089	7,399	28,173	1,437	2,743	68,841
	1920–21	29,500	8,000	36,000	2,000	4,000	79,500
Jaffa	1919–20	27,261	2,150	57,733	499	3,134	90,777
	1920–21	26,000	1,200	60,000	600	4,700	92,500
Gaza	1919–20	15,781	3,348	52,401	848	361	72,739
	1920–21	16,000	1,900	60,000	2,000	500	80,400
Beersheba	1919–20	338	5,020	1,556	171	187	7,272
	1920–21	370	6,700	39,000	500	400	46,970
Samaria	1919–20	15,190	4,214	28,158	6,837	633	55,031
	1920–21	14,500	4,300	40,000	2,000	1,200	62,000
Phoenicia	1919–20	26,499	6,975	39,753	452	1,517	75,196
	1920–21	22,000	7,700	80,000	1,600	3,200	114,500
Galilee	1919–20	12,643	3,680	36,555	4,160	534	57,572
	1920–21	11,630	4,200	60,000	15,300	1,000	92,130
Totals	1919–20	126,801	32,786	244,329	14,404	9,109	427,428
	1920–21	120,000	34,000	375,000	24,000	15,000	568,000

Names		Area in 1913			Population	
Hebrew	Arabic	Dunams*	Acres	Hectares	1913	1921
(1) JAFFA DISTRICT:—						
Pethah Tiqwah	Mulebbis	35,036	8,091	3,276	2,722	2,555
Divisions:—						
(a) Yehud	El Yehudiye					..
(b) Kefar Saba	Kefr Saba					96
(c) 'Ein Hai	Bir 'Adas					30
(d) 'Ein Gannim	El Fejja					194
(e) Mahane Yehudah						..
Rishon Le-Siyon	'Ayun Qara	12,342	2,771	1,122	1,200(?)	1,068
Divisions:—						
(a) Nahalath Yehudah						..
(b) Be'er Ya'aqob	Bir Ya'qub					145
Nahalath Re'uben or Nes Le-Siyonah	Wadi Hanin	2,794	627	254	199	199
Rehoboth	Khirbet Deiran	14,190	3,186	1,290	731	348
(a) Ezra						..
'Ekron or Mazkereth Bath-yah	'Aqir	12,716	2,855	1,156	316	960
(a) Na'amah	Na'ane					..
(b)	Mansura					..
Gederah	Qatra	5,632	1,244	512	167	182
(a) Sukkoth						..
Be'er Tobiyah	Qastine	5,621	1,242	511	150(?)	170
Ruhamah	Jemmame	5,500	1,235	500		34
Ben Shamen		2,343	526	213	120(?)	120
	Abu Shushe	6,996	1,570	636		..
Khuldah	El Khulde	1,969	442	179		30
Qiryath Moshe	Kefr Urye	4,785	1,197	435		30
Miqweh Israel Agricultural School (near Jaffa)		2,612	590	237	150	153
(2) JERUSALEM DISTRICT:—						
Har Tob	'Artuf	4,664	1,037	424	124	149
Mosa	Qaloniye	1,078	242	98	40(?)	40
Dilb	'Ain ed Dilbe					200
(3) PHOENICIA:—						
Zikeron Ya'aqob	Zimmarin	30,668	6,886	2,788	1,034	..
(a)	Shefeya					50
(b)	Umm el Tut					..
(c) Bath Shelomoh	Umm el Jemal					80
(d)	Khirbet Menshiye					..
(e)	El Burj					..
(f)	El Marah					..
Dor	Tantura	297	66	27	16	..
	Athlit	7,293	1,637	663	50	108
	Kerkur and Beidus	11,396	2,558	1,036		20
Khederah	El Khudheira	39,556	8,882	3,596	459	300
(a) Hefsi-bah						..
(b) Nahli-el						..
(c)	Khudheira Zeita					..
(4) GALILEE:—						
Rosh Pinnah	Ja'une	41,987	9,427	3,817	501	501
(a) Mahanayim						30
Mishmar Hay-Yarden and Gesher Hay-Yarden		7,590	1,704	690	93	93
Yesud Ham-ma'alah	Khirbet Zubeid	12,221	2,744	1,111	198	200
(a)	'Ain el-Mellaha					..
'Ein Haz-zeithim	'Ain Zeitun	5,599	1,257	509	30(?)	30
Metullah	El Mutalle	16,907	3,796	1,537	241	241
Shezerah	Shejera	17,710	3,976	1,610	192	235
Kefar Tabor	Mesha	16,016	3,596	1,456	235	289
Yabni-el	Yemma	32,505	7,298	2,955	330(?)	1,125
(a) Poriyah						
(b) Beth Gan	Beit Jan					80
(c) 'Atshi-yah						87
Melhamiyeh		9,471	2,126	861	86	128
Degan-yah	Umm Junye	3,069	689	279	130(?)	40
Kinnereth		9,273	2,082	843	70(?)	100
Mispah	'Ain Kateb	3,421	768	311	37	38
(a) Tiberias	Tabariye					..
Magdala	Mejdel	4,950	1,111	450		50
Merhab-yah	El Fule	9,416	2,114	856		..
Tel 'Ados						50
Sharona						11

*Dunam = 1,075·2 sq. yd.

The customs revenue collected at various ports of entry and railway and caravan centres for the same two years was as follows:—

	1919–20 £E	1920–1 £E
Acre	214	534
Beersheba	463	314
Gaza	10,092	6,695
Haifa	164,391	169,031
Jaffa	146,204	186,336
Jerusalem	93,779	71,161
Khan Yunis	645	586
Ludd	1,893	5,255
Tul Keram	5,094	5,642
Qantara	5,375	3,446
Total	428,150	449,000

Municipalities.—There are 22 municipalities in Palestine: Jerusalem, Ramalla, Beit Jala, Bethlehem, Hebron, Jaffa, Ramleh, Ludd, Gaza, Khan Yunis, Mejdel, Feluje, Beersheba, Nablus, Tul Keram and Jenin in Samaria; Nazareth, Tiberias and Safed in Galilee; and Haifa, Acre and Shefa 'Amr in Phoenicia. In 1919–20 their total revenue amounted to £E89,000 (Jerusalem £E29,500, Jaffa £E14,700) and their ordinary expenditure to £E89,000. They had a balance of £E9,000 from the previous year and obtained loans and grants from Government amounting to £E10,000, repaying debt to the amount of £E11,000.

Education.—Palestine before the British occupation contained numerous schools supported by religious bodies and charitable organizations abroad, some of which were undoubtedly supported more in the political interests of the countries concerned than for strictly religious or educational purposes, and it is possible that in the future certain institutions may suffer financially from the decay of that political driving-force. For the year 1919–20 the Military Administration granted £E46,000 for Moslem education, and for 1921–2 the Civil Administration has allotted £E103,000, and employs 443 teachers. In addition to this the Zionist Organization in 1920–1 provided for 135 educational institutions with 523 teachers and 12,830 Jewish pupils at a cost of about £E110,000. Christian schools in 1919–20, generally open to pupils of all denominations, provided for some 7,000 children, but many of these institutions had been adversely affected by Turkish requisitions during the war and had not recovered.

Defence.—Under the final rearrangement of the Ottoman army before the World War Palestine formed part of the recruitment area of the VIII. (Damascus) Army Corps, and after the war was held by a considerable army of occupation composed of British and Indian troops. This, consisting of three Army Corps with a ration strength of over 460,000 men and some 163,000 beasts at the time of the Armistice, was reduced to 23,000 men on April 1 1920, and to 7,700 men on April 1 1921. The scheme of local defence provides for the formation of two battalions of troops to be recruited in Palestine, and a police force has already been raised consisting on April 1 1921 of 78 officers and 1,392 other ranks, divided into four categories:—

	Mounted	Foot	Railway	Prisons
N.C.O.s	47	72	4	16
Men	397	712	50	85 and 8 wardresses
Total	444	784	54	109

Railways.—Although several schemes for railway construction in Palestine were proposed during the period 1910–4, nothing was done. On Oct. 14 1913 a Franco-Turkish agreement provided for an extension of the standard-gauge line from Rayak in Syria to Ludd in Palestine, where it would join the then existing narrow-gauge line from Jaffa to Jerusalem. By the same agreement a French firm was to obtain concessions for building harbours at Haifa and Jaffa, and a little later a concession was granted to the Perrier Bank to run a tramway from Jerusalem to Bethlehem. None of these proposals was carried out, but during the war the Turkish Government built an extension of the Hejaz railway from Jenin on the plain of Esdraelon through Messudiye (56 km.) to Nablus (15 km.) on the one hand, and on the other to Tul Keram (20·5 km.) and thence to Ludd (42·5 km.), and from Junction Station to Beersheba (83 km.), whence the line was taken on to El 'Auja (66 km.) for the attack on Egypt. A narrow-gauge branch line was run from Tine on the Junction Station–Beersheba railway to Beit Hanun (39 km.), near Gaza, with a branch from Deir Sineid to Huj (12 km.), and another from Tul Keram to the forest near Caesarea (24 km.), which was cut down for fuel. Owing to the shortage of railway material the lines between Damascus and Mezeirib (63 km.), Haifa and Acre (18 km.) and Jaffa and Ludd (20 km.) were stripped and the rails sent south to be used for the new extensions. Later the Beersheba–El 'Auja extension was stripped in its turn and the Tine–Beit Hanun–Huj branch was removed after the arrival of the British.

The British-built standard-gauge line laid across northern Sinai, Qantara–Romani (41 km.), opened July 1916; Romani–El 'Arish (114 km.) Jan. 1917, El 'Arish–Rafa (45 km.) Mar. 1917, reached Deir el Belah (219 km.) from Qantara in June 1917, and a branch from Rafa to Karm (34·5 km.) was opened Oct. 28 1918. This was later continued to Beersheba (24·5 km.) and opened May 3 1918. The metre-gauge railway from Ludd to Jerusalem, much damaged during the military operations in the autumn of 1917, was restored and reopened Jan. 27 1918. Meanwhile, the standard-gauge from Belah had been opened to Deir Sineid (28 km.) Nov. 28 1917, and to Deiran (43 km.) Jan. 8 1918. On Feb. 4 1918 it was opened to Ludd (15 km. or 305 km. from Qantara) and carried on to Rantie (9 km.) a little later in readiness for the next forward move. While waiting for this, the standard-gauge was opened to 'Artuf (31 km.) on March 31 and to Jerusalem (29 km.) June 15. This last section was laid by day, while the narrow-gauge which it superseded continued to work by night. The Turkish narrow-gauge between Junction Station and Irgeig (72 km.) on the Rafa–Beersheba line was converted to standard gauge between May 18 and July 8; thus Gen. Allenby was able to dispose of a double line of standard gauge from his advanced base at Ludd to Rafa, to which point the railway from Qantara had been double-tracked by April 17 1918. Later, in 1919–20, the sector Junction Station–Irgeig was dismantled. A number of narrow-gauge lines were laid behind the front between Dec. 1917 and Sept. 1918: Ludd to Jaffa (20 km.), Ludd to Ras el 'Ain (22 km.), Sarona (on the Jaffa line) to near Jelil (14 km.), Kefr Jinnis on the Ras el 'Ain line to Lubban (18 km.), Sheikh Muannis on the Sarona line to Carrick Hill (3 km.), and from Jerusalem to Bire (28 km.). The standard-gauge started north once more on the heels of the Sept. advance, and was superimposed on the Turkish line from Ras el 'Ain to Tul Keram (32 km. from Rantie) which was reached on Oct. 15. The extension to Haifa (66 km.; 413 km. from Qantara) was opened early in Jan. 1919 and soon afterwards the narrow-gauge Acre branch (18 km.) was restored. On Oct. 5 1920 the standard-gauge was opened between Ludd and Jaffa (20 km.).

Agriculture.—The crop returns for 1920–1 show the following figures in kilogrammes:—

	Kgm.
Wheat	62,897,017
Barley	27,233,948
Beans	2,061,306
Peas	3,441,525
Lentils	2,724,635
Kersenneh (Jilbaneh)	4,599,944
Durra	30,352,916
Sesame	2,488,229
Olive Oil	6,706,059
Grapes	5,490,306
Figs	5,419,878
Melons	16,351,022
Almonds	238,090
Total	Kgm. 170,004,875
Oranges, Lemons, etc.	537,043 boxes

Of this total of 170,004,875 kilogrammes the production according to districts was as follows:—

	Kgm.
Jerusalem	27,589,480
Jaffa	40,866,228
Gaza	11,170,179
Phoenicia	35,852,954
Beersheba	9,005,058
Samaria	17,686,452
Galilee	27,834,524

Of the 537,000 boxes of oranges and lemons the Jaffa district produced 498,000, Phoenicia being second with 36,000.

Trade.—The bulk of the sea-borne commerce of Palestine passes through its three chief ports of Gaza, Jaffa and Haifa. Of these Haifa, before the war, had begun to supplant Beirut to a certain degree as the port of Damascus, the Hauran and Gilead and, in virtue of its connexion by rail with Medina, handled goods in transit for that area as well; consequently its trade was Syrian rather than Palestinian and recovered sharply after the end of the Italo-Turkish War in 1912. Gaza was concerned almost entirely with an export trade of barley, chiefly used for making beer in England, while Jaffa, with all its drawbacks, served as the chief port for exports and imports of purely Palestinian origin and destination. The standard-gauge railway leading to Egypt is also a great trade route, more particularly for passengers and those classes of goods which suffer from the delays still inevitable in bad weather at Jaffa.

The total trade of Palestine for the first complete year during which the whole country was under British administration and at peace, April 1919–March 1920, was:—

	Imports	Exports
April–June 1919	£E1,098,938	£E130,463
July–Sept. "	861,869	129,719
Oct.–Dec. "	984,926	196,552
Jan.–March 1920	1,296,334	236,968
	£E4,242,067	£E693,702

Of this the respective shares of Jaffa and Haifa as compared with the last complete year before the war—both calculated in £E—were:—

	Imports	Exports
Jaffa	£E	£E
1913	1,279,785	726,775
1919–20	1,408,238	169,308
1920–21 (first 7 months)	1,186,079	127,360
Haifa		
1913	516,750	338,033 (1912)
1919–20	1,627,381	270,057
1920–21 (first 7 months)	950,155	116,795

From this it is apparent that while Palestine had to buy largely and at enhanced prices of those goods of which she was unable to procure adequate supplies during the war, she had not yet recovered her capacity for production after the dislocation of trade and ruin of agriculture caused by the war, with the consequence that the balance of trade was against her. It has been pointed out, however, that her exports are bulkier than her imports, and that had tonnage been available the exports would have been greater.

The deficiency of available tonnage is well shown in the following shipping figures for ports of Palestine:—

Flag	Number of Ships 1913	Number of Ships 1919–20	Tonnage 1913	Tonnage 1919–20
British	307	97	464,674	123,116
Russian	237	55	405,987	27,244
French	101	41	262,512	71,904
Italian	97	99	170,227	176,504
Austrian[1] and Other	496	65	658,302	67,946
	1,238	357	1,961,702	466,714

Currency.—The currency in Palestine, formerly Turkish, became Egyptian at the time of the occupation as the accounts of the Egyptian Expeditionary Force were kept in that medium. A vast quantity of British, Australian and Indian silver, however, came into circulation at fixed rates to supply the deficiency of Egyptian silver—of which a large consignment sent from the London mint for use in Palestine was sunk by enemy action at sea—and a good deal of gold, chiefly British, came into the country from Arabia where a large amount of the gold coin paid as subsidy to the king of the Hejaz passed into circulation. French silver, generally taken at full value in the larger towns before the war, is now seldom seen, and Turkish silver and billon money has also nearly disappeared, although legal tender at fixed rates. Turkish paper was never legal tender after the occupation.

Weights and measures still vary locally according to immemorial custom, but the civil administration is taking steps to introduce a standard system on European lines in order to facilitate trade.

Archaeology.—On Aug. 9 1920 the British School of Archaeology in Jerusalem was opened and participated in the excavations which were being conducted at Ascalon, with happy results, by the Palestine Exploration Fund. Important discoveries were made also in the Garden of Gethsemane, where the complete foundations of a 4th-century church were brought to light, and near Tiberias.

The duty of maintaining historical buildings in the Holy City has been entrusted to the Pro-Jerusalem Society—a pan-denominational body founded by the governor, Mr. Ronald Storrs. At Acre mediaeval crypts have been cleared of débris, the Tower of Ramleh has been strengthened and arrangements have been made for a resumption of the excavations at Tell Hum (Capernaum) by the Franciscans. Three universities in the United States have agreed to undertake important archaeological researches, that of Pennsylvania at Beisan (Beth Shan), that of Harvard at Samaria and that of Chicago at Megiddo (for which Mr. John D. Rockefeller, Jr., gave $60,000). Unauthorized excavations by persons unqualified as archaeologists are forbidden. In the Budget for 1921–2 a grant of £E1,000 was made for the conservation of historical monuments, and £E750 provided for the redemption of antiquities out of a total estimate for the Department of Antiquities of £E6,500.

(H. P.-G.)

PALGRAVE, SIR ROBERT HARRY INGLIS (1827–1919), English banker and economist, was born at Westminster June 11 1827, the son of Sir Francis Palgrave, the historian (*see* 20.629). He was educated at Charterhouse and entered Barclay's Bank at Yarmouth. There he rose to a position of such importance that in 1875 he was one of three representatives of the English issuing country bankers chosen to give evidence before the select committee of the House of Commons on Banks of Issue. He edited the *Economist* from 1877 to 1883, and published many works on banking, as well as *The Local Taxation of Great Britain and Ireland* (1871). He also edited the *Dictionary of Political Economy* (1894–1906). He was knighted in 1909. He died at Bournemouth Jan. 25 1919.

PALLES, CHRISTOPHER (1831–1920), Irish lawyer, last chief baron of the Irish Court of Exchequer, was born Dec. 25 1831. He was educated at Clongowes Wood school, and Trinity College, Dublin, where he graduated in 1852. He was called to the Irish bar in 1853, and became a Q.C. in 1865. In 1872 he became a solicitor-general for Ireland, and from 1872 was attorney-general. In 1874 he was made chief baron of the Court of Exchequer. The Exchequer division was in 1898 merged in the Queen's Bench division of the Irish High Court of Justice, and the chief baron from that time sat as one of the judges of the Queen's Bench division, and also as a judge of appeal. Palles retired from the bench at an advanced age in 1916. He was a great lawyer, of remarkably wide learning and power of argument. He died in Dublin Feb. 14 1920.

PALMER, ALEXANDER MITCHELL (1872–), American politician, was born of Quaker parentage at Moosehead, Pa., May 4 1872. After graduating from Swarthmore College in 1891 and admission to the bar in 1893 he practised law at Stroudsburg, Pa. He was a member of Congress from 1909 to 1915, was then appointed judge of the U.S. Court of Claims, but resigned four months later. In 1912 and 1916 he was a delegate-at-large from Pennsylvania to the Democratic National Convention, and from 1912 a member of the executive committee of the Democratic National Committee. At the convention of 1912 he was "floor leader" of the Wilson supporters, and the next year declined the post of Secretary of War in President Wilson's Cabinet. In 1917 he was appointed alien property custodian under the "Trading with the Enemy Act," and within 18 months was administering 32,000 trusts, valued at $503,000,000. In March 1919 he was appointed to the President's Cabinet as Attorney-General. The Senate refused to confirm the appointment until his record as alien property custodian had been investigated, on the ground that he had made his office a "political machine." It was furthermore charged that he was in contempt of the Senate in having failed to submit on request a complete report of the management of his office. A filibuster at the end of the 65th Congress caused the Senate to adjourn without confirming the appointment, but the President made him a "recess" appointee. Not until Aug. 30 1919 did the Senate Judiciary Committee hand in its report recommending the appointment. This was followed by confirmation. His career as Attorney-General was widely, and it was generally felt justly, criticized by the public at large and by competent legal authorities as being both arbitrary and inefficient. At the Democratic National Convention in 1920 he had strong support for the presidential nomination, standing second on the first six ballots. After a prolonged deadlock, extending through 38 ballots, he released his delegates, who swung to James M. Cox, nominated on the 44th ballot.

PALMER, SIR WALTER, 1ST BART. (1858–1910), English manufacturer, was born at Reading Feb. 4 1858. He was the son of George Palmer (*see* 20.644), founder of the firm of Huntley & Palmer, biscuit manufacturers, of Reading, and was educated at University College, London, and also at the Sorbonne, Paris. He became a director of the firm and was also the first chairman of University College, Reading. He sat in the House of Commons for Salisbury during 1900–6. In 1904 he was created a baronet, and he died at Newbury April 16 1910. His elder brother, GEORGE WILLIAM PALMER (1851–1913), was chairman of the firm and sat in the House of Commons for Reading from 1892 to 1895 and from 1898 to 1904. He was made a privy councillor in 1906. He died near Newbury Oct. 8 1913.

PANAMA (*see* 20.664).—The pop. of the South American republic of Panama at the end of 1911 was estimated at 336,742 for the area exclusive of the Canal Zone. The latter contained in that year 71,682 persons, the number decreasing to 31,048 in 1916 and to 21,707 in 1918. In the estimate made in 1911, whites and *mestizos*, those of mixed blood, numbered 238,200, and negroes and Indians 96,600. Foreigners included 3,500 Chinese and 55,000 British subjects from Caribbean islands. The cities of Panama and Colon in 1917 contained 61,369 and 26,076 inhabitants respectively; the estimated total pop. then being 401,554. A general census taken in 1920 gave a total pop. of 434,015.

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[1] Much tonnage formerly Austrian was in 1921 Italian.

Vital statistics for 1916, 1917 and 1918 showed respectively 11,593, 10,898, and 11,283 births, of which in each year respectively 7,827, 7,511 and 7,700 were illegitimate. Deaths in the same years numbered 6,218, 6,107 and 5,649 respectively. There are eight provinces, Herrera having been added in 1915. The area as determined by the White boundary award is 87,480 sq. km. (33,776 sq. miles).

In 1917 there were 398 Government-supported schools with an enrolment of 22,000, besides 1,721 pupils in Canal Zone schools. The Instituto Nacional, dedicated in 1911 with handsome buildings at Panama costing $1,500,000, gives instruction in high-school subjects, commerce and languages. A school of Law and Political Science offers a three-year course to graduates of the Instituto. Travelling scholarships to Europe and the United States are provided by the Government.

Finance and Economics.—Panama receives all the import duties collected, but the United States imports all canal materials and supplies for Government use duty free. Panama's revenues and expenditures 1915–20 were as follows:—

	Revenues	Expenditures
1915	£ 675,057	£ 635,820
1916	729,802	1,164,600
1917	793,882	732,171
1918	646,752	707,464
1919–20	1,490,385	1,490,385 (estimated)

Public finance is managed by a fiscal agent appointed with the approval of the United States. For nine months ending in March 1921, revenues received were $4,012,023, and expenditures $2,767,146; balance $1,244,877; of this sum $739,349 was set aside for road construction. The debt, begun early in 1915 with a loan of $3,000,000 from the United States, chiefly for railway construction, amounted in 1919 to $7,101,000.

Commerce is chiefly with the United States; but that with the United Kingdom, France, and Spain is important.

The totals for the years 1910–20 were:—

	Imports		Exports	
	Kgm.	Balboas *	Kgm.	Balboas *
1910	128,647,313	10,043,395.11	126,333,609	1,769,330.15
1911	128,331,874	9,896,987.85	165,180,189	2,863,425.30
1912	115,822,532	9,871,653.73	166,232,433	2,064,647.55
1913	153,057,605	11,060,088.24	187,330,063	5,101,960.45
1914	140,472,718	9,891,552.78	182,625,216	3,800,517.18
1915	126,244,629	9,032,977.17	152,594,343	3,422,455.10
1916	107,191,027	9,397,596.27	137,438,898	5,706,724.38
1917	82,798,113	9,223,170.00	177,484,046	5,624,176.00
1918	45,085,659	7,821,660.00	150,497,870	2,909,557.00
1919	48,960,768	11,406,880.15	162,476,039	3,757,028.24
1920	59,678,802	17,092,270.35	150,370,225	3,640,453.15

*A balboa is worth a dollar.

About 80% of the exports go to the United States. The chief articles are bananas, coconuts, hides, tortoise shell, cacao and *tagua* (vegetable ivory). All international commerce moves through Cristobal and Balboa, Bocas del Toro being reserved for local business. The Panama railway across the Isthmus, 47 m. long, is U.S. property. The United Fruit Co. has 150 m. of banana railway in Bocas del Toro province, running to Limón in Costa Rica. Only a small part of the territory is occupied, and little is under cultivation. The only highly organized industry is the banana business of the United Fruit Co., which exports over $2,000,000 worth of bananas yearly. In 1906 cattle numbered 65,000; in 1916, 200,000; there were then also 15,000 horses, 2,000 mules, 30,000 hogs, and 5,000 goats. Coffee grows in Chiriqui province, and in Cocle province a concern of German origin has raised cacao, coffee and rubber since 1895. Tobacco and sugar are increasing; the first sugar exported to the United States was in 1920. Other crops are corn, rice, yams and ivory nuts. The tropical woods of the forests are exported, as are medicinal plants. The pearl fisheries are famous. Metals are scantily represented. The Sinclair Oil Corp. of New York has concessions on Columbus I., and has drilled wells at Bocas del Toro.

History.—The successful candidate of 1908 for the four-year presidential term, Domingo de Obaldia, died in 1910, and Pablo Arosemena completed his term. In 1912 Belisario Porras, a Liberal, was elected. Ramon M. Valdez was elected in June 1916 amid riots and intervention by the United States. He died in 1918, and Ciro L. Urriola completed his term. Ernesto Lefevre was inaugurated Jan. 30 1920, but Belisario Porras soon succeeded him, being elected in Aug. of the same year, and inaugurated Nov. 1 for a four-year term. There are three vice-presidents (*designados*), and a Cabinet of five members. The constitution was amended Dec. 26 1918 so as to provide for a Chamber of 33 members, one for each 10,000 inhabitants. The president is chosen by direct vote, and is ineligible to succeed himself. Beginning in 1924 deputies of the Chamber are to be chosen by direct vote. Provincial governors became elective in 1920. Capital punishment is prohibited. Foreigners may not mingle in politics, and may be ejected for criticizing public officers or institutions. The independence of the republic was recognized by Colombia April 6 1914 by a treaty between the latter and the United States, ratified by Colombia in the same year and by the U.S. Senate April 20 1921. Panama ratified the Treaty of Versailles Jan. 8 1920, and is an original member of the League of Nations.

Boundary Dispute.—The constitution of Colombia of 1886 declared that its boundary with Costa Rica should be that which had existed between the viceroyalty of Nueva Granada and the captaincy-general of Guatemala in 1810, but that boundary lines might be located by treaties which might be negotiated without reference to the *uti possidetis* of that year. Colombia and Costa Rica endeavoured, by treaties negotiated in 1825, 1856, 1865 and 1876, to fix the line without success. In 1876 arbitration was agreed on, and Alfonso XII., King of Spain, was asked in 1880 to make an award, but he died before doing so. It was agreed in a treaty of Dec. 25 1880 that the arbitral award must lie within the specified limits of the conflicting claims. This provision was included in a treaty made at Paris dated Jan. 20 1886, and in another made at Bogotá on Nov. 4 1896. Under the last-named instrument, President Loubet of France rendered on Sept. 11 1900 an arbitral award which was accepted by Colombia and Costa Rica as final. Its demarcations were in general terms.

The state of Panama, which had been created by Nueva Granada in 1855 and made a department of Colombia in 1886, became independent on Nov. 3 1904, at which time it inherited the boundary controversy with Costa Rica. The Loubet line had not been made effective because of Colombian revolutions. On March 7 1905 Costa Rica and Panama by convention adopted a line interpretative of the Loubet award, but Costa Rica still considered the award unfair to her in respect of the valleys of the tributaries of the Sixaola river above the Yorquín. In fact, the treaty gave to each republic *de facto* right over territory belonging *de jure* to the other. Costa Rica considered, because of interpretations of the Loubet award by Panama, that the treaty of 1905 had lapsed, Panama not having ratified it. Through the good offices of the United States, which was interested in American land claims in the Sixaola region, the two republics agreed in 1910 to submit the Loubet award, which both had accepted, to the interpretation of Chief Justice White of the U.S. Supreme Court. In 1914 he rendered a decision adverse to Panama, and the latter refused to accept it, claiming that it went beyond interpretation, and gave territory not asked for to Costa Rica.

On Feb. 21 1921 Costa Rica forces seized Coto, in Chiriqui province, for the purpose of enforcing the White award, which favoured her there. Panama forces composed of volunteers and police at once moved to recover the territory invaded. Panama on Feb. 24 asked the good offices of the United States to prevent bloodshed. During late Feb. and early March the invasion, moving toward Bocas del Toro, was marked by light engagements and there were anti-American disorders in Panama. On March 5 President Harding requested both nations to cease hostilities and provide for an agreement based on the White award. They acceded, and on March 9 an armistice was announced. Panama had reiterated her dissatisfaction with the White award, and had made representations to the League of Nations denouncing the invasion of her territory by a fellow-member of the League. While withdrawing her military forces from Coto, as Costa Rica had done, Panama announced that she was leaving civil and police forces, and would demand reparation from Costa Rica. The U.S. Government insisted that Panama should acquiesce to the terms of the White award.

(H. I. P.)

PANAMA CANAL (*see* 20.666).—The construction period of the Panama Canal covered about 10 years, but the actual work of construction was accomplished in about seven years. The first three years were devoted mainly to the task of getting ready to work. During that time the thorough sanitation of the Canal Zone was accomplished, yellow fever was permanently banished, an operating plant was assembled, a working force gathered, living quarters erected and a food supply provided. Reservoirs were built which furnished an ample supply of pure water to the canal force, and to the cities of Colon and Panama, in which water and sewer-systems were built. An out-of-date railway-system was converted into an adequate one with a thoroughly modern equipment of rails, locomotives and cars. The first commission was in office only a year (1904–5) and accomplished little beyond formulating plans and ordering necessary supplies. The second, under the expert direction of John F. Stevens as chief engineer and afterwards as chairman also, reconstructed the railway-system, assembled the operating plant, collected an efficient working force and provided for it quarters, food and all necessary supplies. It also constructed wharves and docks at both terminals, and machine-shops in which the locomotives, cars, steam-shovels and other elements of the operating plant, which were shipped in parts from the United States, were put together. President Roosevelt paid a visit of three days to the Isthmus in Nov. 1906, inspecting the canal works at all points. His visit was notable as the first instance in which an American president had passed out of the U.S. territory while in office. Col. Goethals, of the Engineer Corps of the U.S. army, was appointed chairman and chief engineer of the third commission on the resignation of Mr. Stevens, and entered upon his duties April 1 1907. This commission was composed of four army engineers, one navy engineer and two civilians. It had been in office only a few months when President Roosevelt, who had from the outset of the work been convinced that the best results could not be attained through an executive body of seven members, issued an executive order placing supreme power in the hands of Col. Goethals, abolishing the commission as an executive body, and making its members, who were heads of departments, subordinate to him. By this order Col. Goethals became the absolute autocrat of the Canal Zone, holding in his hands all civil, military and other powers. For issuing the order President Roosevelt was sharply criticized in Congress, on the ground that he had exceeded the authority conferred upon him by law, but his course was subsequently approved in the Act of 1912 for the government and operation of the canal after its completion.

Excavation and "Slides."—Through the power thus given him, Col. Goethals pressed the work of construction forward with such vigour during the five years following the issue of the order that during that period nearly 75% of the entire excavation of the canal was accomplished. The original plans of the canal contemplated a channel with a bottom-width of 200 ft. through the nine m. of the Culebra (afterwards called Gaillard) Cut section and estimated the excavation in the Cut at 54,000,000 cub. yd., and that of the entire canal at 95,000,000 cub. yards. The entire cost of construction, exclusive of $40,000,000 paid to the French Canal Co., $10,000,000 paid to the Panama Republic, and the cost of sanitation and civil administration, was placed at about $190,000,000. The original plans also provided for locks 900 ft. long and 100 ft. wide. In 1906 President Roosevelt increased the length to 1,000 ft. and in 1908 the Canal Commission recommended and President Roosevelt approved changes in the plans which increased the bottom-width of the Cut channel to 300 ft. and the width of the locks to 110 feet. These and other changes increased the estimate of total excavation to nearly 175,000,000 cub. yd. and the estimate of total cost, including payments to the French Canal Co. and to the republic of Panama, to $375,210,000. In this estimated excavation there was included an allowance of about 8,000,000 cub. yd. for "slides" or breaks in the walls of the Cut. These had been active during the French operations, and had begun to be troublesome to the Americans in the wet season of 1905. In Oct. 1907 a movement occurred which carried about 500,000 cub. yd. into the canal prism, completely filling it and stopping the movement of dirt trains for a month. In Jan. 1913 another movement occurred carrying about 2,500,000 cub. yd. into the prism. One in Feb. 1920 carried in about 2,000,000 cub. yd. more. During the period of construction and subsequently there were about 30 slides of different kinds, covering an area aggregating 220 ac., and compelling an additional excavation of about 30,000,000 cub. yards. Because of this and other developments, revised estimates of the total excavation were made in 1912, 1913 and 1914, the last one placing it at nearly 240,000,000 cub. yd., or about 65,000,000 more than the amount on which the estimated cost of $375,000,000 had been based. When the canal was thrown open to commercial traffic on Aug. 14 1914, a total of 224,000,000 cub. yd. had been excavated, and when it was declared formally completed and opened by President Wilson July 12 1920, a total of about 240,000,000 cub. yd. had been excavated and yet the total cost of the canal up to that date was only $366,650,000, exclusive of expenditures for its military and naval defence. The excavation of slides alone cost about $10,000,000.

Gatun Dam.—The Panama Canal is a huge water bridge rather than a canal, for its surface for the greater part of its length is 85 ft. above sea-level and is held in place by dams at either end. Of these dams the largest and most important is that at Gatun on the Atlantic side. It spans the northern and lower end of a deep valley through which the Chagres river formerly flowed to the sea. It is nearly 1½ m. long measured on its crest, nearly half a mile wide at the base, about 400 ft. wide at the water surface, about 100 ft. wide at the top; and its crest is at an elevation of 105 ft. above sea-level. It is really two dams in one, for in its centre there is a natural hill of rock about 110 ft. in height. In this the spillway of the dam is constructed, and against its two sides rest the two sections of the great dam. The dam itself contains about 21,000,000 cub. yd. of material. Its outer portions are composed of rock and earth, mainly from the Cut, and its centre or core of material drawn by hydraulic process from pits above and below the dam. This material is a natural mixture of sand and clay which in a watery condition flowed into the interstices of the rock and clay of the structure, making the whole at the centre a rubble-wall firmly cemented together and thoroughly impervious to water. Of the entire length of the dam only 500 ft. are exposed to the maximum waterhead of the lake, which is 85 to 87 feet. In 1919, after an exceptionally light rainfall, the maximum level of the lake was 87·16 ft. in Dec.; and in May 1920, 81·65 feet. The spillway is a concrete-lined channel, 1,200 ft. long and 285 ft. wide, the bottom being 10 ft. above sea-level, sloping to sea-level at the lower end. Across the lake-opening of the channel is a concrete dam in the form of an arc of a circle, making its length 805 ft., although it closes a channel with a width of only 285 feet. The crest of this dam is 69 ft. above sea-level, or 16 ft. below the normal level of the lake. On the crest are 13 concrete piers with their tops 115·5 ft. above sea-level and between these are regulating gates of the Stoney type which move up and down on roller trains in niches in the piers. The gates permit a discharge of water greater than the maximum known discharge of the Chagres river during a flood. Near the N. wall of the spillway is a hydro-electric station capable of generating, through turbines which are supplied with water from the lake through a forebay, sufficient electricity to meet all demands, including the lighting of the canal and all Canal Zone towns and buildings; the machinery of the locks, the machine shops, dry-dock and coal-handling plant; and the telephone and telegraph systems. There is an emergency electric plant at Pedro Miguel, operated by steam.

Dams on the Pacific Side.—Dams much smaller than that at Gatun were erected on the Pacific side, one with one lock at Pedro Miguel and one with two locks at Miraflores. In both instances the lock structures themselves form the main portion of the dam. That at Pedro Miguel maintains the level of the water in Gatun Lake and in Culebra Cut, and is placed at the lower or southern end of the channel through the Cut. That at Miraflores holds back the water of a small lake which furnishes the supply of the locks at that point. The Pacific dams are constructed in part like that at Gatun and in part of concrete. That at Miraflores has a small spillway in it.

The Locks.—All locks of the canal are in duplicate, are constructed in the same manner, and their chambers, with walls and floors of concrete, have the same usable dimensions—1,000 ft. long and 110 ft. wide. There are six pairs, making 12 in all. The side walls are from 45 to 50 ft. wide at the surface of the floor, are vertical on the chamber side, and narrowed on the outside from a point 24⅓ ft. from the floor, by means of a series of steps each 6 ft. long, to a width of 8 ft. at the top. A culvert 254 sq. ft. in area of cross-section, about the area of the Hudson river tunnels of the Pennsylvania railway, extends the entire length of each middle and side wall, and from each of these large culverts, smaller culverts, 33 to 44 sq. ft. in area, extend under the holes in the floors. Fifteen ft. above the top of the culvert in the middle wall there is a space much like the letter U in shape, 19 ft. in width at the bottom and 44 ft. at the top. This space is divided into three storeys or galleries: the lowest for drainage; the middle for wires that carry the electric current to operate the gates and valve machinery installed in the centre wall; and the upper a passage-way for the operators. All lock walls are approximately 81 ft. high, except in the lower pair of locks at Miraflores, where they are 82 ft. to meet the requirements of the extreme tidal oscillation of about 21 ft. in the Bay of Panama. In the walls at Gatun there are about 2,000,000 cub. yd. of concrete, and in those on the Pacific side about 2,400,000 cub. yards. All lock walls rest on rock foundations. The approach wall at the N. entrance at Gatun, 1,031 ft. long, rests upon piles driven from 35 to 70 ft. into the earth; that at the S. or lake entrance, 1,009 ft. long, rests on piles reaching to rock, in some places over 100 ft. below sea-level. Cellular form of reinforced concrete is used in all approach walls except those of the lower locks at Gatun and Miraflores where mass concrete is used because of the effect of salt water on steel reinforcement.

Lock Gates.—The lock gates, each composed of two leaves, are 65 ft. wide, from 47 to 82 ft. high, 7 ft. thick and weigh from 390 to 730 tons. There are 92 leaves in all and their combined weight is 60,000 tons. They were carried in parts to the Isthmus and put together there. They are constructed to float like a ship. Each is a huge webbed steel box, the girders of which are covered with a steel sheathing. All portions of the interior are accessible, with watertight compartments providing for the adjustment of the buoyancy so as to control within limits the dead load on the bearings, making the leaf practically float in the water. This watertight compartment is subdivided vertically into three sections, each independently watertight, so that if the shell should be broken in any way, or begin to leak, probably only one section would be affected. An air-shaft, 26 in. in diameter, runs from the bottom compartment up to the top of the gate, and this also is watertight where it passes through the upper half of the leaf. The girders are made with manholes through the webs, providing communication from the top to the bottom of the leaf, and are connected by several sets of vertical transverse diaphragms of solid plates, running from top to bottom of the leaf, thus making a cellular construction, and dividing the spaces between the horizontal girders into small pockets, all of which are accessible through manholes. Each leaf rests at the bottom of its heel-post upon a hemispherical pivot of forged nickel steel, and is hinged at the top to the masonry of the lock wall. It swings free on the pivot like a door, without wheels or other support beneath it. Intermediate gates are used in all except one pair of locks, and are so placed as to divide the space into two chambers, one 600 and the other 400 ft. in length. This makes possible a saving of water and time in locking small vessels through, for about 95% of the vessels navigating the high seas are less than 600 ft. in length. The highest gates and the highest lock walls on the canal are those of the lower locks at Miraflores, and these locks are the only ones which have no intermediate gates. The total lift from mean sea-level to the level of Miraflores lake, 54⅔ ft., is divided equally between the upper and lower locks. The depth of water on the mitre sills is 40 feet. The locks are filled and emptied through the large and smaller culverts. The large culverts are controlled at points near the gates by large valves, and each of the small culverts feeds in both directions through the laterals, thus permitting the passage of water from one twin lock to another, effecting a saving of water if desired. The average time in filling and emptying a lock is about 15 minutes. The time to pass a vessel through all the locks is about two hours, one hour at each end of the canal. The time of passage of a vessel from ocean to ocean is from 8 to 10 hours, according to the ship's size and speed.

Passage of Locks.—No vessel is permitted to enter or pass through the locks under its own power. On arrival at Gatun or Miraflores, it is tied up to the approach wall and turned over to the absolute control of the canal authorities. These place a representative of their own on the bridge and another in the engine-room. They then connect the towing locomotives, or "electric mules," with the ship. These locomotives operate on cog tracks on the lock walls, and proceed at the rate of 2 m. an hour. The number of locomotives varies with the size of the vessel. The usual number required is four; two ahead, one on each wall, imparting motion to the vessel; and two astern, one on each wall, to aid in keeping the vessel in a central position and to bring it to rest when entirely within the lock chamber. They are equipped with a slip drum, towing windlass and hawser, which permit the towing-line to be taken in or paid out without actual motion of the locomotive on the track. The locomotives run on a level, except when in passing from one lock to another they climb heavy grades. Before a lock can be entered, a fender chain, stretched across the walls of the approach, must be passed. If all is proceeding properly, this chain is dropped into its groove to the bottom of the channel. If by any chance the ship is moving too rapidly for safety, the chain remains stretched and the vessel runs against it. The chain, which is operated by hydraulic machinery in the walls, then pays out slowly by automatic release until the vessel is brought to a stop. The chain, which weighs 24,098 lb., and is stronger than any previously made, is capable of stopping a 10,000-ton ship running at 4 m. an hour within 73 ft., or less than the distance between the chain and the first gate. If the vessel by a remote possibility gets away from the towing locomotives and, breaking through the chain, rams the first gate, there is a second gate 50 ft. away, protecting the lock, which is certain to arrest further advance. When the leaves of this gate swing open, the vessel is towed in, and the gate is closed behind it. Then, from openings placed at regular intervals in the lock floor, water pours in, lifting the vessel to the level of the lock above. This inflow, coming equally from all points, does not move the ship from a stable position. The gates are never opened or closed with a head of water on either side of them. The process of lifting is repeated until the vessel reaches the lake level. At all times the vessel is in full view of the men who are controlling it and as safe as if tied to a wharf. The gates are opened and closed by a powerful machine invented by Edward Schildhauer, an electrical engineer in the employ of the Goethals Canal Commission. It consists of a crank gear or wheel moving through an arc of 197°, placed horizontally in the lock wall. To the outer rim of the wheel is attached a strut or connecting-rod which is fastened to the top of a lock gate 17 ft. from the pintle or hinge. When the wheel turns in either direction the gate leaf is opened or shut, the operation taking two minutes. The crank gear, constructed of cast steel, is 19 ft. 2 in. in diameter and weighs approximately 35,000 pounds. It is connected with an electric motor, and a small electric switch sets it in motion. Every operation in the passage of a vessel through the lock, except the movements of the towing locomotives, is controlled by a single man so placed in a building at the top of the centre wall as to command an unobstructed view of every part of the locks. He has before him a control board table about 64 ft. long and 5⅓ ft. wide which is a complete model of the locks in duplicate with switches and indicators in the same relative positions the machines they control occupy in the lock walls. Standing by this board the operator throws the electric switches, and in response to his action he sees in the model the fender chains rise and fall, the gates open and close, the water rise and fall in the locks, and knows the exact position of the vessel at every stage of its progress. Each gate, each valve for letting in the water to the culverts, each fender chain, is operated by a separate motor mounted near the machinery in chambers in the lock wall. In each machinery chamber there is a starting panel containing contractors by which current is applied to the motor, and these panels in turn are controlled from a main unit in the central control-house. Some of the machinery chambers at Gatun are 2,700 ft. distant from the point of control, 90% of them are within 2,000 ft., and 50% within 1,200 feet.

The Canal Voyage.—The length of the canal from shore-line to shore-line is about 40 m. and from deep water in the Atlantic to deep water in the Pacific about 50 miles. The canal does not, as is generally supposed, cross the Isthmus from E. to W. It runs due S. from its entrance in Limon Bay, through the Gatun locks to a point in the widest portion of Gatun lake, a distance of about 11½ m.; it then turns sharply toward the E. and follows a course generally south-eastern till it reaches the Bay of Panama. Its terminus near Panama is about 22½ m. E. of its terminus near Colon. In passing from the Atlantic to the Pacific a vessel enters the approach channel in Limon Bay, which has a bottom width of 500 ft. and extends to Gatun a distance of seven miles. At Gatun it enters a series of three locks in flight which lift it 85 feet. It then enters upon Gatun lake, the water-bridge of the Isthmus. The lake covers an area of 164 sq. m. with a depth varying from 45 to 87 ft., and contains 183,000,000,000 cub. ft. of water. It has a channel varying from 500 to 1,000 ft. in width, for a distance of about 24 m. to Bas Obispo, where the Cut passage begins. Through the lake a vessel may steam at full speed. The channel through the Cut, a distance of about nine m., has a bottom width of 300 ft. and a depth of 45 ft., and extends to the locks at Pedro Miguel, the Pacific end of the water-bridge. At Pedro Miguel the vessel is lowered in the single lock 30⅓ ft. to a small lake, at an elevation of 54⅔ ft. above sea-level, through which the vessel passes, 1½ m. to the two locks at Miraflores. These drop it to sea-level, and through an approach passage 8½ m. long, with a bottom width of 500 ft., it passes into the Pacific. The Cut has eight angles and at these the channel is widened sufficiently to allow a 1,000-ft. vessel to make the turn. The smallest angle is 70° 36′ and the largest 30°. In the whole canal there are 22 angles, the total curvature being 600° 51′. The sharpest curve is 67° 10′. The canal is lighted from end to end by electricity and gas. There are concrete lighthouses for range lights on the hillsides, and beacons in the Cut, in which electricity is used. The channel through Gatun lake is marked with floating buoys lighted with compressed acetylene dissolved in acetone. The most powerful electric lights are those of the approach channels which are visible for from 12 to 18 nautical miles. The beacons and gas-buoy lights have about 850 candle-power. White lights are used throughout; and in order to eliminate the possibility of confusing the lights with one another, and with the lights on shore, all range-lights, beacons and buoys have individual characteristics, formed by flashes and combinations of flashes of light and dark intervals. The electric lights on the locks are suspended from brackets on concrete columns about 34 ft. high and are clustered under concrete hoods in such a way as to light the lock chambers and not penetrate along the axis of the canal.

Breakwaters.—Long breakwaters have been constructed near the approach channels in both oceans. One in Limon Bay, or Colon harbour, called the West Breakwater, extends into the bay from Toro Point at an angle of 42° 53′ northward from a base-line drawn from Toro Point to Colon light, and is 11,526 ft. in length, 15 ft. wide at the top and 10 ft. above mean sea-level. A second, also in Limon Bay, known as the East Breakwater, is without land connexion, is about one m. in length and runs in an easterly direction at nearly a right-angle with the canal channel. It has a lighthouse on the channel end. The purpose of the West Breakwater is to protect the harbour against "northers," very severe gales which are likely to blow from Oct. to January. The purpose of the East Breakwater is to prevent silting in the canal channel. The breakwater at the Pacific entrance extends from Balboa to Naos Is., a distance of about 17,000 ft., or a little more than three miles. It lies from 900 to 2,700 ft. E. of, and for the greater part of the distance nearly parallel to, the axis of the canal prism, varies from 20 to 40 ft. in height above mean sea-level, and is from 50 to 3,000 ft. wide at the top. It was constructed for a twofold purpose; first, to divert cross-currents that would carry soft material from the shallow harbour of Panama into the canal channel; second, to furnish rail connexion between the islands and the mainland.

Permanent Canal Buildings.—All permanent canal buildings, for civil or military use, are of concrete, replacing the temporary structures which were of wood. The headquarters of the canal force are in the large three-storey administration building, situated on a bluff about 75 ft. above sea-level and overlooking the Pacific entrance to the canal. Near this are the governor's residence and the dwellings of the other officials. On the plain below, which was formerly a swamp and was raised to an elevation of 20 ft. above sea-level by material from the Cut and hydraulic fill from excavation for terminal structures at Balboa, there is a town composed of concrete buildings erected after the canal had been completed. The buildings are arranged on either side of a central avenue. They include dwellings for different types of employees, a police station, post-office, fire station, chief sanitary office, dispensary, telephone building, clubhouse, hotel, lodge hall, schoolhouse and playground, church and commissary. All are of concrete blocks with roofs of red tiles, and of the same general style of architecture, and are connected with one another by a continuous arcade as protection against sun and rain.

Terminal Facilities.—In both oceans have been constructed terminal facilities adequate for the naval, military and commercial needs of the United States and attractive to the shipping of the world. Systems of concrete piers 1,000 ft. in length, with docks and wharves and sheds of concrete, have been built. On the Pacific side is a concrete dry-dock on a rock foundation, with a usable length of 1,000 ft. and an entrance width of 110 ft., and a subsidiary dock for vessels of a smaller type with a usable length of 350 ft. and an entrance width of 80 feet. There are also large repair shops of ample capacity to meet all demands. Dry-docks and machine shops are situated behind Sosa Hill and thus protected against naval bombardment. Basins of concrete for the storage of coal have been constructed below the water-line on both oceans, some of which are available for leasing to private coaling companies, all handling to be done by the U.S. Government plant. A fixed supply of coal for the United States naval use is maintained. From a single plant supplies of oil, food and other necessities are furnished to all vessels desiring them, as well as to the canal forces. A high-power wireless telegraph station is situated midway of the Isthmus, under the jurisdiction of the Navy Department, but open to the public under Government regulations.

Fortifications and Military Occupation.—The Canal Zone is a military reservation by Act of Congress. Fortifications have been built in the oceans at both ends of the canal, and a military force of about 10,000 men is maintained. Concrete barracks have been erected at both terminals, and adjoining the locks.

Canal Administration.—Under an Act of Congress, approved Aug. 24 1912, the Panama Canal is governed and operated and the Canal Zone is governed through a governor of the Panama Canal, appointed by the president, with the advice and consent of the Senate, for a term of four years, and until his successor shall be appointed and qualified, at a salary of $10,000 a year. In addition to the operation of the canal, the governor has official control and jurisdiction over the Canal Zone and performs all duties in connexion with its civil government, it being held, treated and governed as an adjunct to the canal. There is one U.S. District Court in the Canal Zone, with the same jurisdiction and procedure as the same courts in the United States, the judge of which is appointed by the president. Appeals are made to the Circuit Court of Appeals of the Fifth Circuit of the United States. In each town there is a magistrate's court, the judges being appointed by the governor. They have jurisdiction only within their towns and over minor cases. General Goethals was the first governor and served till Jan. 11 1917, when he resigned and was succeeded by Col. Chester Harding, U.S.A., who held the office till Jan. 11 1921, when he was succeeded by Col. Jay J. Morrow, U.S.A.

Canal Zone Population.—A census of the Canal Zone, taken in 1920, showed a total pop. of about 30,000 of which 21,650 were civilians and the remainder military. There were 3,434 male and 360 female American citizens; 5,652 male and 74 female aliens; the remaining 12,000 were mainly natives and transient West Indians.

Canal Force.—The average working force of the canal was in 1920 about 21,000, of which about 3,500 were Americans, chiefly in official and clerical positions, and the others alien labourers, mainly West Indian negroes. The apparent discrepancy between these figures and those of the Canal Zone census is due to the fact that many of the labourers live in the cities of Panama and Colon, which are not within the Canal Zone.

Tolls.—The Hay-Pauncefote treaty between Great Britain and the United States, abrogating and succeeding the Clayton-Bulwer treaty, was ratified on Dec. 16 1901. It contained this clause:—

> "The canal shall be free and open to the vessels of commerce and of war of all nations observing these rules, on terms of entire equality, so that there shall be no discrimination against any such nation, or its citizens or subjects, in respect of the conditions or charges of traffic or otherwise. Such conditions and charges of traffic shall be just and equitable."

In 1912 Congress passed an Act for the operation and government of the Panama Canal, which was approved by President Taft on Aug. 24 of that year, and which contained the provision that "no tolls shall be levied upon vessels engaged in the coastwise trade of the United States." A formal protest against this exemption was made by Great Britain on the ground that it was a violation of the Hay-Pauncefote treaty. In June 1914, under a special appeal from President Wilson, Congress passed a bill which repealed the Exemption Act of 1912. This was approved by President Wilson on June 15 1914. Under authority given to him by the Panama Canal Act of Aug. 24 1912, President Wilson issued a proclamation on Nov. 21 1913, fixing the canal tolls at $1.20 per net ton of net capacity as determined by the United States national rules of measurement. On Feb. 15 1915 President Wilson issued supplementary instructions that where application of the $1.20-per-net-ton rate produced a sum in excess of the sum produced by the application of the $1.25 rate on net registered tonnage as determined by the United States rules of measurement, the excess amount should be uncollectable. The effect of this ruling was to reduce by approximately 14% the revenue from tolls paid by ships of all nationalities using the canal. During the first six years of operation there was a marked increase in traffic through the canal notwithstanding the fact that the World War everywhere prevented the normal development of ocean-going commerce. After the entry of the United States into the war there was a decrease in commercial traffic, due to the diversion of certain lines of ships to trans-Atlantic service, which was more than offset by the increase in traffic growing out of the war, chiefly on account of the development of the nitrate trade with the Pacific coast of South America.

Canal Traffic.—The number of commercial transits, the amount received from tolls and other collections, and the current expenses of maintenance and operation for the fiscal years ending June 30 1915–20 are shown in the following table:—

Fiscal Year	Number of commercial transits	Tolls and other revenues	Current expenses of operation and maintenance
1915 . . .	1,072	$4,343,383.69	$4,123,128.09
1916 . . .	760	2,558,542.38	6,909,750.15
1917 . . .	1,806	5,808,398.70	6,788,047.60
1918 . . .	2,068	6,411,843.28	5,920,342.94
1919 . . .	2,028	6,354,016.98	6,112,194.77
1920 . . .	2,478	8,935,871.57	6,548,272.43

For the same period the number of canal transits by government vessels exempted from tolls and the total tonnage of cargo carried were as follows for each fiscal year:—

Fiscal Year	Number of Vessels	Cargo Tons	Fiscal Year	Number of Vessels	Cargo Tons
1915	16	43,647	1918	112	36,746
1916	43	76,675	1919	179	93,641
1917	100	147,405	1920	267	351,332

Over 25% of the cargo handled through the canal, from its opening to the end of the fiscal year 1920, was in transit between the United States and South America, and 14½% was between the Atlantic coast of the United States and the Orient. Among nations the chief users of the canal were the United States and Great Britain. The number of vessels passed each year for these nations and for all other nations was as follows:—

Fiscal Year	United States	Great Britain	All other nations
1915 . . .	470	465	153
1916 . . .	238	358	191
1917 . . .	464	780	632
1918 . . .	628	699	803
1919 . . .	786	602	637
1920 . . .	1,129	753	596

The following is the saving, in nautical miles, effected by the Panama Canal from European ports to ports on the W. coast of America, to Hawaii and to New Zealand.

To	From				
	Liverpool	Hamburg	Antwerp	Bordeaux	Gibraltar
Sitka, Alaska . .	5,666	5,528	5,528	5,376	4,950
Port Townsend, Wash. .	5,666	5,528	5,528	5,376	4,950
Portland, Ore.	5,666	5,528	5,528	5,376	4,950
San Francisco, Cal. . .	5,666	5,528	5,528	5,376	4,950
San Diego, Cal. . .	5,676	5,538	5,538	5,386	4,960
Acapulco, Mexico . .	5,874	5,736	5,736	5,584	5,158
San Jose, Guatemala .	6,128	5,990	5,990	5,838	5,412
Honolulu, Hawaii . .	4,403	4,265	4,265	4,113	3,687
Guayaquil, Ecuador .	5,198	5,060	5,060	4,908	4,482
Callao, Peru . . .	4,043	3,905	3,905	3,753	3,327
Valparaiso, Chile . .	1,540	1,402	1,402	1,250	824
Wellington, N.Z.	1,564	1,409	1,409	1,257	489

The following is the saving, in nautical miles, effected by the Panama Canal in length of all-water routes between ports of the Atlantic–Gulf U.S. seaboard and various Pacific ports.

To	From				
	Boston	New York	Norfolk	New Orleans	Galveston
Sitka, Alaska	7,676	7,873	8,020	8,868	8,940
Portland, Ore.	7,676	7,873	8,020	8,868	8,940
San Francisco, Cal.	7,676	7,873	8,020	8,868	8,940
San Diego, Cal.	7,686	7,883	8,030	8,878	8,950
Acapulco, Mexico	7,884	8,081	8,228	9,076	9,148
San Jose, Guatemala	8,138	8,335	8,482	9,330	9,402
Honolulu, Hawaii	6,413	6,610	6,757	7,605	7,677
Guayaquil, Ecuador	7,208	7,405	7,552	8,400	8,472
Callao, Peru	6,053	6,250	6,397	7,245	7,317
Valparaiso, Chile	3,550	3,747	3,894	4,742	4,814
Yokohama, Japan	3,435	3,768	4,116	5,705	5,777
Shanghai, China	1,543	1,876	2,224	3,813	3,885
Hong-Kong, China	351	18	330	1,919	1,991
Manila, P. I.	292	41	389	1,978	2,050
Adelaide, Australia	1,483	1,746	2,000	3,258	3,330
Melbourne, Australia	2,507	2,770	3,024	4,282	4,354
Sydney, Australia	3,669	3,932	4,186	5,444	5,516
Wellington, N. Z.	2,296	2,493	2,640	3,488	3,560

See Joseph Bucklin Bishop, *The Panama Gateway* (1913, revised edition 1915); George W. Goethals, *Government of the Canal Zone* (1915); W. L. Sibert and John W. Stevens, *The Construction of the Panama Canal* (1915); W. C. Gorgas, *Sanitation in Panama* (1915); Joseph A. Le Prince and A. J. Orenstein, *Mosquito Control in Panama* (1916); *Annual Reports of the Governor of the Panama Canal.*

(J. B. Bi.)

PAN-AMERICAN CONFERENCES (*see* 20.671).—The fourth Pan-American Conference was held July 12–Aug. 30 1910 in Buenos Aires. Many questions involving the common interests of all the American republics were discussed, including steamship service, sanitation, copyright, patents and trade marks. It was decided that the International Bureau of the American Republics should henceforth be called the Pan-American Union. The same year the Pan-American Union building in Washington was dedicated; it had been erected through a gift of $750,000 from Andrew Carnegie and additional funds provided by the various republics. During the three weeks following Dec. 25 1915 the second Pan-American Scientific Congress met in Washington. Eduardo Suarez, Chilean ambassador to the United States, presided. Among the speakers was President Wilson, who urged friendly settlement of international disputes by arbitration. The Congress appointed an International High Commission, which met at Buenos Aires in April 1916. Improvement and extension of cable, telegraph and railway service between the countries was urged. A permanent International High Commission was established to promote uniform commercial laws throughout Pan-America. In Nov. 1918 a Pan-American Federation of Labor Conference met at Laredo, Tex. Delegates were present from the United States, Mexico and Central America. An influenza epidemic interfered with South American attendance, Colombia alone being represented. A permanent federation was organized. Pan-American Child Welfare Congresses met at Montevideo, Uruguay, in Dec. 1918 and in May 1919; at the second meeting provisions were made for establishing at Montevideo an International Bureau of Child Welfare. In June 1919 a Pan-American Commercial Congress was held in Washington, and in the same city in Jan. 1920 a Pan-American Financial Congress.

PAN-ISLAMISM.—One of the results of the World War was to bring into new prominence, in connexion with Turkey and the Middle East, the movement known as Pan-Islamism, for uniting the peoples who profess the Mahommedan religion under one banner. The history of Pan-Islamism from 1910 onwards is analyzed below.

1. *Before the Italian War.*—The proclamation of the Ottoman Constitution in 1908 seemed to cut at the root of Pan-Islamism, since the idea of the former was to substitute for preëxisting religious and national divisions an Ottoman nationality, wherein the different communities of the empire should equally share. Writers of the year 1909 show many reasons why the "Young Turks" could never favour Pan-Islamism, which indeed they had officially repudiated. It was pointed out that the more conservative Moslem nations of Africa would never approve a Sultan in whose eyes all creeds were to be equal. By 1910 it was realized that this prospect was chimerical; Tal'at Bey, Minister of the Interior, in a speech delivered at Salonika on Aug. 6 of that year at a private meeting of the Committee of Union and Progress, asserted that, though according to the Constitution all Ottoman subjects were equal before the law, such an order of things was clearly impossible; this equality was in defiance of the *Sharī'ah* (religious code), and the Christians themselves had no desire to become Ottomans. At the Salonika Congress of 1911 a definite scheme of Pan-Islamic propaganda was adopted, and it was resolved that a congress of delegates from all the Moslem countries of the world ought to meet annually in Constantinople to discuss questions of interest to all Moslems. Emissaries appear to have been actually sent out during these years to win or to confirm adherents to the Ottoman Caliph wherever Moslems were subject to Europeans, even to remote parts of Africa, including Morocco; others worked among the Moslems of China. These missions seem to have been fairly effective, as a Pan-Islamic writer asserts that the *khutbah* (Friday sermon) continued to be pronounced in the name of the Ottoman Caliph in Tunis in spite of French objection; and that when, in 1912, a republic was proclaimed in China the Chinese Moslems signified their adhesion on condition that the rights of the Ottoman Caliph were not infringed thereby.

Attempts were also made to deal with the old difficulty which had confronted Pan-Islamism, the schism between Sunnah and Shi'ah. Early in 1911 a letter was published by a number of Ottoman and Persian jurists assembled at Nejef, asserting that there was no difference of principle between the two sects and urging coöperation between the two empires, Persia being at that time, it was supposed, menaced by England and Russia. The Agha Khan, head of a sect so heretical that 'Abdul Hamid II. had declined to admit him to an audience, made a tour in India to advocate the claims of a Moslem university. Articles advocating union appeared in various Sunni and Shi'i journals; indeed, the Moslem press as a whole was Pan-Islamic.

Nevertheless, as early as 1910 prominence had been given to a new antithesis, which may be said to have ultimately wrecked the schemes for reunion of the Moslem communities. In that year the Constantinople journal *Iqdam*, an organ of the Committee, adopted a tone unfriendly to the Arabs, whom it charged with readiness to sell their honour for gold—an accusation vehemently resented in the Arabic-speaking countries. But in fact the seeds of dissension between the Turkish and Arab elements in the Ottoman Empire had been sown in the Constitution, in Art. 68, par. 10 of which it is enacted that after the expiration of a period of four years a condition of eligibility to the Chamber of Deputies shall be ability to read and write Turkish. This rule definitely aimed at making Turkish the language of the empire; and in the resolutions in favour of Pan-Islamic propaganda the encouragement of the study of Turkish was recommended. The true Pan-Islamic view was that Arabic should be the common language of Islam; some, indeed, suggested that the empire should be bilingual, with Turkish for its secular and Arabic for its religious language; in any case, that every Moslem should learn Arabic in addition to any idiom which happened to be his mother tongue. Journals were started in the Turkish and Arabic interests respectively; the latter were represented in Constantinople by one called at first *Sirat Mustaqim*, afterwards *Sabil al-Rashad*. The Committee of Union and Progress more and more inclined to the Turkish side and to the substitution of Pan-Turanianism for the Ottoman nationality. In the races subject to the Russian Empire and speaking different varieties of Turkish they found their natural allies; and for these the Ottoman literature could count as classical, being in any case far superior to anything of their own. This policy of Turkification involved the Committee in wars in Albania, the Hauran and S. Arabia; they planned treating the Arab parts of the empire as colonies, to be ruled from Constantinople without the right of sending deputies to the Chamber; and they were charged with the design of disarming all Moslems in the empire except the Turks, and with advocating neglect of the ritual of Islam. Where military exercises interfered with religious the latter were to give way; devout officers were, it is said, dismissed and replaced by free-thinkers.

2. *The Italian War.*—To some extent this split was retarded by European aggression, which may be said to have culminated in 1911. The interference of Great Britain and Russia in Persia and the French scheme for governing Morocco as a protectorate had made it clear that Turkey was the only Islamic state which could compete with the European Powers on anything like equal terms. The Italian attack on Tripoli in Sept. of that year evoked widespread sympathy with Turkey among the Islamic communities. The Javanese press, *e.g.*, made no secret of its desire to see Turkey triumph, and the Mahommedan press of Egypt warmly espoused the side of Turkey. At a meeting held in Kabul the Amir of Afghanistan took part in a demonstration in favour of the Turks, and in India money was collected for their assistance. Care, indeed, had been taken by Italy to avoid all appearance of an attack on Islam itself, and the Pope himself warned Christian soldiers against considering the campaign as a crusade; but to the Moslem, Christian and European are not very clearly distinguished, and it was plausibly argued that Europe was not now satisfied with protecting Christians within the Ottoman Empire, but had resolved on partitioning that empire among non-Moslem Powers. In proclamations issued in Constantinople the Sultan whose dominions were thus attacked was described as the legitimate ruler of 300 million Moslems (swelled by some journalist to 400 million), and a demand was raised for the restoration of his arbitrary powers.

Islam was not united on this occasion in the defence of the Ottoman Caliph, for while the Iman of San‘a ceased hostilities, the Idrisi chieftain in Asir favoured the Italians. On the other hand, the Turks had the coöperation of the Senussis, who in the preceding century had kept aloof from their quarrels. The Committee of Union and Progress is said to have been astonished at the amount of sympathy which the cause of Turkey had evoked, having expected, *e.g.*, that the Tripolitans would be indifferent to the change of rule, whereas they in fact stubbornly resisted the invaders. The Committee in consequence proceeded to make certain concessions to Arab sentiment, without, it is said, actually altering their policy. A beneficent Islamic society was founded in Constantinople, under the patronage of the heir apparent, chiefly with Egyptian money; and an attempt was made to found a Moslem university in Medina. Schemes were started for promoting the study of Arabic under efficient instructors; and there were authoritative pronouncements that racial differences in the Ottoman Empire need not be suppressed.

3. *The Balkan War and its Consequences.*—This war, which broke out in Oct. 1912, demonstrated the military weakness of Turkey, though the recovery of Adrianople after the Armistice was greeted with telegrams of congratulation from all parts of the Moslem world. Clearly, however, up to this point Pan-Islamism had failed in its original design, that of arresting the progress of European aggression and eventually restoring Islamic rule in Asia and Africa. It had, however, aroused fairly general sympathy with Turkey and perhaps brought home to many Moslems the idea that someone claiming to be their Caliph existed. Subscriptions to the national defence fund of the Ottoman Empire flowed in from various quarters; owing to the efforts of a deputy of the Duma, Tas-pula ‘Abdul Jalil Oghlu, the Moslems of Samarkand sent a handsome subscription in Aug. 1913; and in Bosnia, which had quite lately formed part of the empire, the opinion was said to be general that the ruin of Turkey would be an immense disaster from the religious point of view. From this region, too, sums of money were sent to the Red Crescent and the national defence fund. In May the Moslems of Delhi sent the sum of £1,600 to the Ottoman Minister of Finance for the housing of immigrants who had lost their homes in the recent war. Subscriptions were also promised from Java and the Malay States. The talk about the need for union between Moslems was renewed in the Moslem press throughout the world; notably in the *Habl al-Matin*, a Pan-Islamic journal in the Persian language published in Calcutta; and societies with the object of either spreading Islam or producing unity among Moslems were founded in different regions; *e.g.* a *jam‘iyyat al-ittifaq*, "Society of Concord," founded in Muscat, a *khariji* state. An *anjuman-i-himaya-i-Islam*, "Society for the Defence of Islam," of Auckland, California, is also mentioned.

The language used by journalists caused some apprehension to the European governments responsible for great numbers of Moslems, and complaints were made that in the Islamic territories of Russia the charge of Pan-Islamism was easily leveled and resulted in frustrating the efforts that were being made for spreading education. The Islamic reactionaries, who dreaded the modern learning, obtained the imprisonment of modernist teachers by informing the authorities that the latter were engaged in Pan-Islamic propaganda. Any Moslem who took in the journals of Cairo or Constantinople, or had studied in either of those cities, was suspected of pursuing these schemes. On the other hand, the plan pursued by the imperial government in its scheme for enforced education was the Russification of all its subjects. One member of the Duma, Sadr ad Din Maqsudoff, had some years before defended his co-religionists from the charge of Pan-Islamism which the Moslem schemes for education had incurred; while claiming that the Russian Moslems were loyal to the Government, he maintained that their nationality was Islam.

In Syria and Mesopotamia nationalism at this time was developing, and Pan-Islamism making little way.

Two works issued in Constantinople in the year 1913 illustrate the ideas of Moslem publicists on the phase which the question had now assumed.

One of these is the *Ittihad al-Islam* ("Unity of Islam" or "Pan-Islamism") of Jalal Nuri Bey, of sufficient importance to be translated into Arabic in 1920, seven years after its first appearance. In the face of the weakness displayed by Turkey in her last wars it was no longer advisable to demand a general uprising of Islamic peoples to free themselves from European oppression; hence the author, while anticipating yet further defeats and losses, substitutes for a plan of coöperation a vague hope, to which Moslems should cling. This hope is not confined to proceedings in Islamic areas.

He hopes that China and Japan will become cordial friends and so prevent the further spread of European domination in Asia; and thinks that the republican Government of China will be better for the Moslems there than the imperial Government had been. He thinks that the Arabic-speaking people of Africa and Asia will one day form a single state, without indicating what the relation of that state to the Ottoman Empire is to be; the older Pan-Islamism had on the whole favoured "decentralization," *i.e.*, a confederation of Moslem countries under Ottoman hegemony. He advises the English to bestow on their Asiatic possessions the status of Canada or Australia, as in that case the inhabitants will coöperate cordially against their enemies.

In the matter of the sectarian divisions of Islam, which from the first have rendered Pan-Islamism impracticable, this writer's method is to some extent drastic: the minor sects in the Ottoman Empire (*i.e.* probably the Zeidis, Isma‘ilis, Nuseiris, etc.) should be wiped out. In the case of the more important Shi‘ah sect his advice is that the Moslem should forget that he is a Sunni or a Shi‘i and remember only that he is a Moslem. This probably means that the Shi‘is, who are in a minority, should abandon their system in favour of the other.

While asserting the superiority of Islam morally to Christianity as practised in Europe, he is anxious that European science should be adopted and its methods assimilated; and he advises the adoption of the distinction between the civil and the religious code, to the unification of which he attributes the decadence of Islam. Education should, he holds, be taken out of the hands of religious authorities and be secularized; thus mediaeval scholasticism will be abolished. What concerns the conscience should be left to religion, whereas commercial affairs should be regulated by codes which admit of improvement. These doctrines are so unorthodox that his Arabic translator has occasionally to register a protest. They look like Pan-Islamism with the Islam omitted.

This writer repeatedly speaks of the Moslems as a nation of 300 million individuals attached to each other by a bond of unique strength; indeed, the phrase *Union of Islam* is, he thinks, tautologous, as the word Islam of itself implies union. Whatever may be the truth of this as a theory, it is confirmed neither by ancient nor by modern practice. Some writers, in general favourable to Islam, speak of dissension and civil war as unavoidable in Moslem communities; and doubtless this has led to that loss of political power which gave rise to the Pan-Islamic movement.

The work called *Qaum Jadid* ("The New Nation"), by Ubaidalla Efendi, formerly member for Aidin, and at one time editor of an anti-Arabian journal in Arabic, which appeared about the same time, perhaps in the main advocated the same ideas, only it was far more outspoken. It demanded that every Moslem should give half his wealth to the Ottoman treasury in order to enable it to muster forces capable of recovering its lost provinces; anyone who declined to make this sacrifice was to be considered an apostate. Its idea of Islam was somewhat loose—there was no occasion to study Arabic, as the Friday sermon might be delivered in Turkish, and the Qur'an and other sacred books might be translated. The Sacred War was a duty incumbent on all Moslems, and such of them as lived contentedly under non-Moslem rulers were apostates, for by pleasing unbelievers they offended God. All Moslems in Ottoman countries who failed to enlist under the banner of the party of Union and Progress were to be regarded as apostates; as such the Albanians were to be branded. To follow the ritual prescribed in the books of the orthodox jurists was unlawful, for the new school had deduced five principles from the Qur'an. These were: 1, reason; 2, the Moslem formula of faith; 3, good character; 4, the duty of fighting with person and wealth; 5, that of striving to furnish the requisites of war by uniting under the banner of the Caliph.

Little could in fact be hoped from attempts to rouse men to make great sacrifices in the cause of Islam when all which constitutes Islam to the ordinary believer is abandoned; and Mr. Wyman Bury, in his acute analysis of the causes which militate against Pan-Islamism, gives the first place to the contempt shown by the Turks for the ordinances which Islam holds sacred. "Even before the war," he says, "Yemen Arabs talked of Turks and Moslems, a distinctly damning discrimination." The Turkish proclivity towards European dress and civilization, which he regards as another source of weakness, is scarcely to be distinguished from this, though the antithesis between civilization and its absence is to be found in other Moslem countries; and the Pan-Islamic encouragement of education as Europeans understand it, while in appearance rendering the movement formidable, has also rendered it suspect to large multitudes who would gladly emulate the ancient Islamic heroes. For the Islamic cult, which is thus so altered as to be unrecognizable, the Pan-Turanians endeavour to substitute a national ideal with a set of heroes, largely pagan, who are to displace the Prophet's family and the Four Pious Caliphs as objects of general reverence. This disrespect is naturally resented by Arab and other non-Turkish Moslems.

The former of the works described is far more characteristic than the latter of the general tone of Pan-Islamic journalism. It is full of accusations against the European Powers in control of Islamic territories, charging them with oppressing the Moslems, depriving them of elementary human rights, sowing dissension among them, and the like; yet rarely able to bring evidence justifying these charges, and compelled to ignore the fact that the Moslems prosper far more in countries protected by Europeans than where they are left to themselves. Its great hero is the Ottoman Sultan Selim I., whose chief title to fame is that he fought against and overthrew another Islamic sultanate, that of Egypt, and forcibly incorporated various Islamic countries in the Ottoman Empire. In places it is asserted that the unity of Islam is an undeniable fact wherewith Europe is confronted; in others, that the troubles of Islam are all due to its divisions. Hence the vagueness of both aim and method which characterized the earlier Pan-Islamism is conspicuous in this statement; and many a prophecy is uttered with regard to the future of European states which the years following its publication have falsified. To the latter work the term Pan-Islamism can scarcely be applied. Its programme is indeed clear enough—a general revolt of all Moslems against their European rulers in order to swell the armies of the Ottomans, the Ottomans meanwhile practically abandoning Islam. The summing-up of the situation in Arabia by Mr. Wyman Bury in 1914 would hold good of many other Islamic lands: "The Arab still acknowledges the Sultan as Caliph, but repudiates the Ottoman Government and all its works." Some Moslems of Java threatened to abandon the *khutbah* to the Sultan if the ideas of the Turkish extremists materialized. And indeed Pan-Islamism at this stage contained no practical formula which any but Turks would adopt.

4. *Pan-Islamism during the World War (1914–1918).*—Shortly after the Turkish Empire entered the war on the side of the German alliance the Grand Mufti declared a *jihad*, summoning all Moslems to arms in defence of their faith. General Liman von Sanders asserts that this call was absolutely without response; the reason, he holds, being that the pretext was obviously false, inasmuch as Turkey was itself in alliance with non-Moslem Powers and, indeed, fighting for their benefit and under their command. He quotes an Italian minister for the statement that the call was absolutely neglected by the Moslems of Tripoli. Further, the French Government issued a counterblast in a collection of expressions of loyalty from Moslem authorities of the French African Empire (*Collection de la Revue du Monde Musulman*, 1915, 1916, called *Le Salut au Drapeau*, in the English edition *Honour to the Flag*), wherein all Moslems are called upon to fight for France. The call seems to have been issued half-heartedly, even within the Ottoman dominions. When the official at the Mosque of Damascus had to proclaim the Sacred War from its pulpit, seeing a group of German officers among the congregation he said: "I am ordered to proclaim *jihad*. A *jihad* is, as you know, a Holy War to protect our Holy Places against infidels. This being so, what are those infidel pigs doing in our mosque?" This story is told by Mr. Wyman Bury (*Pan-Islam*, 1919, p. 81), who adds: "Those who forged the blade of this counterfeit *jihad* could not temper it in the flame of religious fervour, and it shattered against the shield of religious tolerance and good faith."

Doubtless the most serious blow which the unity of Islam received during the war was the entry into it of the Sherif of Mecca on the British side in 1916. The Sherif in his proclamations (published in his organ, the *Qibla*, and reprinted in the *Manar*, vol. xix.) made it clear that his quarrel was not with the Ottoman Empire, but only with the Party of Union and Progress, who had reproduced the worst atrocities of the *Umayyads* by firing at the House of God and slaughtering worshippers. As, however, this party represented the Ottoman Government, this act produced a definite division in Islam which is unlikely ever to be repaired. Uncertain as the sense to be attached to the title Caliph has ordinarily been, the idea has on the whole prevailed that he should have control of the sanctuaries and the access to them; there seems no means of devising a formula which should combine a Turkish Caliphate with an independent Hejaz. On the other hand, the removal of Turkish rule from Arabia, to which the events which followed the secession of the Hejaz led, has done little or nothing to realize the dream of Jalal Nuri of an empire embracing all the speakers of Arabic. The establishment of the Hejaz kingdom probably on the whole accentuated the sectarian differences which were already rife in the peninsula. A mission was indeed sent by the Emperor of Morocco to the Sherif of Mecca to congratulate him on his assertion of independence; but the legal authority who accompanied it gave it as his opinion that where Islamic countries were at a great distance from each other there was no objection to their being subject to different *Imams;* Morocco had at no time recognized the Eastern Caliphate, in whosesoever possession it happened to be; the independence of the Sherif therefore in no way affected the Moroccan Caliphate. Moreover, the history of Islam attested the frequent coexistence of numerous Caliphs (*Revue du Monde Musulman*, xxxiv., 1917–8, p. 140). The rise of this new power in the sanctuaries was not therefore to furnish a new principle of unity for Islam; it only helped to get rid of that round which the old Pan-Islamic ideas had been grouped.

In lieu of this there is some Pan-Arabian agitation; such at least is the purpose of a violent diatribe reprinted in the *Manar* for August 1919 from an Arabic newspaper appearing in Brazil called *Suriyyah al-Jadidah* ("New Syria"), for the preceding May, wherein the author urges the Arabs to unite and emulate the exploits of the early heroes of Islam. Apparently he contemplates an Arab federation, to be governed by an assembly which is to meet at one of "the great Arabian cities," with home rule for the separate states. This orator names the Turks with the English and the French among the oppressors of the Arabs, whence his proposed confederation is evidently not intended to include any who are not Arabs by race or adoption; and indeed he traces the servitude of the Arabs to the practice of the Abbasid Caliphs, who relied on Persian and Turkish retainers in lieu of depending on Arab forces exclusively. In addition to this he traces their downfall to the personal ambition of the Arabs, each one of whom aspires to be chief. Probably this is in the main intended as anti-French propaganda; but it would seem that quite early in the war some persons had aimed at establishing a union between the various states in Arabia itself, to be extended into the neighbouring countries with a view to resist the enforced Turkification with which they were threatened. It failed to materialize because the Sherif of Mecca had reasons for refusing to join it, and the course of the war by no means tended to allay divisions between the states of Arabia; indeed, in July 1918 the King of the Hejaz issued a proclamation declaring the Wahabis infidels and urging his subjects to resist them with force. This conflict "wounded the heart of every Arab who desired the unity of his race and every Moslem who disliked discord between his co-religionists."

The attempts that have been made during these years in other Islamic countries to propagate the idea of a Moslem union seem to have been ordinarily similar to those which preceded the Ottoman Constitution. They consist largely in the encouragement of education, and the founding of societies and journals whose purpose is to keep the Moslems together, and to maintain some sort of relations with their co-religionists in other parts of the world. Certain countries, indeed, appear to have been outside the reach of such efforts; and there are some wherein if attempted they have been unsuccessful. The general result of the war would seem to be to show that the Pan-Islamic idea was doomed to disappointment from the first. The European Powers against whom it was directed—England, France, Russia and afterwards Italy—received during the course of it great proofs of loyalty and attachment from their Moslem subjects; and even if we do not take every protestation at its face value, it seems clear that there was little sense of unity with the Turks on the ground of common religion on the part of these populations, in which, on the contrary, the sense of patriotism to the empires within which they are incorporated had been developed. The proclamation of a *jihad* with no response shows that the time for the employment of that instrument has passed, if indeed it was ever effective; the insertion of the Ottoman Sultan's name in the *khutbah* of so many peoples, to whom he was unknown, no more made him their real ruler in this century than that of an Abbasid in the 10th or 15th century secured for the Caliph any real power. Possibly the call attracted attention to the nature of and qualifications for the Caliphate, a subject which the Ottomans were imprudent in bringing to the forefront.

This is not, indeed, the view of some Moslems in India, who have established an *All-India Caliphate Committee*, with a series of publications on the *Question of the Caliphate*. The first of this series contains the presidential address of "Maulana Abul-Kalam," purporting to have been delivered at the provincial Caliphate Conference held in Calcutta Feb. 28 and 29, 1920. This treatise presents the most bellicose aspect of Pan-Islamism, and differs little from the *Qaum Jadid* described above. The *jihad*, according to it, is the primary duty of the Moslem; if the Turks are apt to be lax in their ritual, it must be remembered that for centuries they alone maintained the *jihad*, at a time when the Indian Moslems were enjoying peace and security. An endeavour is made to show that ever since the time of Sultan Selim I. the Caliphate of the Ottoman Sultan has been generally recognized. It is argued that there can be only one Caliph, and that it is the duty of every Moslem to be his obedient subject; and in particular to aid him in repelling invasions by unbelievers of Islamic territory and expelling them where they are already in possession; Islamic territory would appear to include the whole inhabited world. At the least the author claims that Arabia, Palestine and Iraq are the property of the Ottoman Sultan, which must be restored to him if the sentiments of the Moslems are not to be wounded. The Indian Caliphate Delegation sent to London went so far as to demand the cession of all the European lands which the Ottomans had ever occupied.

Ideas of this sort—not always carried to these lengths—are expressed by various authors and journalists in India, few of whose names are known in Europe. The best known of those who are claimed as advocates of them is probably the poet and philosopher Mohammed Iqbal, M.A., Ph.D. See this writer's *Secrets of the Self*, transl. R. A. Nicholson, London, 1920.

5. *After the War.* To what extent we can speak of Pan-Islamism since the Armistice is not clear. On the one hand it is evident that the occupation of Constantinople by foreign forces and the reduction of the Ottoman Empire to a comparatively small area have produced a feeling of depression among the Islamic peoples, who can no longer look with confidence to a great Islamic Power as the natural leader in some scheme for the recovery of hegemony in Asia and Africa; on the other hand, the feud between Sunnah and Shiʿah shows no signs of healing, and though an Arabian Caliphate may not yet have been formally proclaimed, the severance of the Arabs from the Turks appears to have been definitely concluded. Even within the Ottoman system there is at this moment a schism, since the authority in power at Angora acts independently of the Caliph of Constantinople, and appears to rely on Turanian support, so far as it obtains any from Islamic peoples; while its endeavour to obtain support from Bolshevism is calculated to wound the sentiment of orthodox Islam, which is far removed from the principles of that system. Further, it would appear that the tendency of recent events has been to emphasize nationalism, and create a desire in the various Arabic-speaking countries for complete independence rather than for absorption in an Islamic empire, even on the condition of decentralization, which was the catchword of the old Pan-Islamism. A Pan-Islamic tendency may perhaps be found in the Indian Caliphate agitation, but, even if it be taken at its face value, it is clear that it is making demands for the Ottoman Caliph which his former subjects do not back, and many who have made sacrifices for this idea have found no encouragement from Islamic rulers who at one time were supposed to recognize this title.

Conjectures are indeed at times put forward concerning the existence of agencies organizing simultaneous outbreaks in different Islamic countries against their European protectors; such may certainly exist, but the results hitherto achieved indicate little in the way of coöperation or clearness of aim; and indeed ʿAbdul Hamid II., who gave some encouragement to the Pan-Islamic idea, which was that Turkey should lead a *jihad* against the European possessors of Islamic countries, does not appear himself to have entertained such a project, though he thought the fear of it might help him in checking European interference with his internal government. The governments which have followed have probably hoped for greater results, but have obtained very much less, being unable either to maintain the independence of Moslem states outside their empire or to preserve the integrity of that empire itself. It would seem then that Pan-Islamism, should it again acquire importance, must seek some other *point d'appui* than the Ottoman Empire; but only the future can tell whether such a *point d'appui* will be found.

AUTHORITIES.—*Revue du Monde Musulman* (1911–1919); *al-Manar* (Cairene monthly) (1328–1338 A.H.); G. Wyman Bury, *Arabia Infelix* (London, 1915) and *Pan-Islam* (1919); R. Pinon, *L'Europe et la Jeune Turquie* (Paris, 1911). (D. S. M.*)

PAN-TURANIANISM.—Only a few years before the outbreak of the World War in 1914, a new political movement came into prominence in Constantinople. The awakening of a Turkish national consciousness began to aim at the purification of the

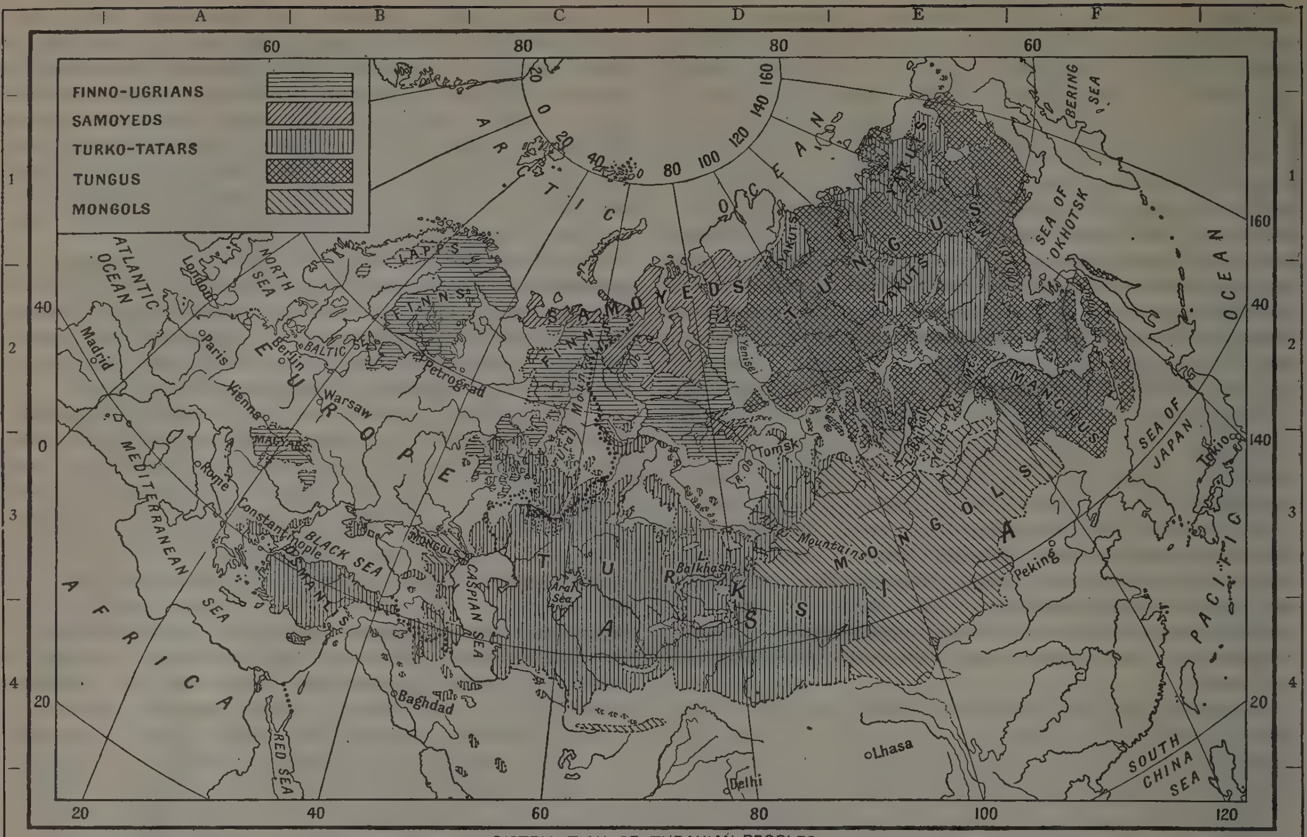
FINNO-UGRIANS
SAMOYEDS
TURKO-TATARS
TUNGUS
MONGOLS
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CASPIAN SEA
Aral Sea
Balkhash
MONGOLS
Baghdad
AFRICA
RED SEA
TURKS
ASIA
Tomsk
Yenisei
Mountains
TUNGUS
YAKUTS
MANCHU
MONGOLS
SEA OF OKHOTSK
BERING SEA
OCEAN
SEA OF JAPAN
Tokio
Peking
PACIFIC
Lhasa
Delhi
SOUTH CHINA SEA

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Turkish language by the expulsion of all foreign elements, especially Persian and Arabic, and the establishment of a civilization based entirely on old Turkish traditions. In this movement Ziya Bey, Shinassi Bey, and Namik Kemal Bey were particularly active. The researches of the Academy of Turkish Science, established after the Young Turk revolution, dealing with the original home and the pre-Mahommedan history of the Turks, were then artificially utilized greatly to widen the scope of the Turkish national movement. The goal was now the formation of a powerful and independent union of all the peoples of the world kindred to the Osmanli Turks and alleged to embrace a population of 50,000,000 (about double the actual number of those speaking Turkish dialects). For the national designation "Turk" was now to be substituted the more comprehensive "Turanian," and the Mahommedan crescent was to be abandoned for the pre-Mahommedan Turkish wolf as a racial emblem. Turkish writers began to speak of their ideal fatherland, their Turania, the cradle of their nation, and the home of their race. The poet Ziya Gök Alp, called by a countryman "the great Apostle of Turanianism," celebrates Attila, Jenghiz and Oghuz Khan as heroic figures that stand for the proud fame of his race, and describes the fatherland of the Turks not as Turkey or Turkestan, but as the "broad eternal land of Turania." This wider movement involves a policy of Irredentism which aspires not only to stimulate by moral and intellectual propaganda a feeling of racial unity among the kindred peoples, but under favourable circumstances to free those peoples from foreign rule. Curiously enough, the circumstances since the conclusion of the war seem to be more favourable to the realization of this ideal than they were before its outbreak. It is an ideal that is not likely to disappear, for its fulfilment is the only remaining prospect for Turkey of expansion as compensation for the great territorial losses that empire has sustained in recent times.

It now becomes necessary to inquire what possibilities this somewhat vague term Pan-Turanianism implies. The earliest form of the name "Turanian" occurs perhaps about 800 B.C. in the *Avesta*, the sacred book of Zoroastrianism, as *Tura*, to designate a country which was contiguous to Iran (Persia) and the inhabitants of which were in constant conflict with the Iranians. It is met with again about A.D. 1000 in the *Shahname* or Book of Kings, of the Persian poet Firdusi as Turān, the country beyond the Oxus (now the Amu Darya). Persian sources show that the ancient Turan (Turania) corresponded roughly to the Russian Turkestan of to-day. In the second half of the 19th century "Turanian" came to be used as a loose designation of Asiatic languages that were neither Aryan nor Semitic, and to be similarly applied in a racial sense to the nomadic peoples speaking those languages, as opposed to the agricultural Aryans. The term has more recently become synonymous with "Altaic" or "Ural-Altaic." "Turanian" is here treated in this definite sense.

Having spread in prehistoric times from the Altai mountains in the centre of Asia, this ethnic family at the present day occupies a broad belt of territory extending from Thrace across Asia to the sea of Japan and reaching from about 35° N. lat. to the coast of the Arctic Ocean. It consists of five main branches, the Samoyeds, the Finno-Ugrians and the Tunguses constituting the northern, and the Mongols and the Turks the southern division. The countries inhabited by the Turanians are Siberia, Mongolia, Manchuria, Chinese and Russian Turkestan, Asia Minor, parts of Persia and Afghanistan, the Caucasus, the Crimea, the Volga and Pechora regions of eastern Russia, Lapland, Finland, Hungary, and portions of the Balkans.

Down to the outbreak of the World War all the Turanian peoples were subject to foreign (Russian, Chinese, Persian, Afghan) domination except the Magyars and the Osmanli Turks. Only those sections of the Turanians that have come into close contact with the Aryans of Europe have succeeded in rising from their primitive state to a comparatively advanced degree of civilization: the Finns, the Magyars and the Osmanli Turks.

The Turanians in Europe number in round figures 22,000,000: 10,000,000 Magyars; 6,000,000 Samoyeds and Finns; and 6,000,000 Turks. In Asia there are 26,000,000: 115,000 Finns, Samoyeds, and Tunguses, all in Siberia; 6,000,000 Manchus, Mongols and Turks, all until recently under Chinese rule; 8,200,000 Turks in Asiatic Russia; 3,500,000 in Persia and Afghanistan; and 8,000,000 Osmanli Turks in Asia Minor. The Turks in Russia are usually called Tatars, and those elsewhere outside the Turkish Empire, Turco-Tatars. Their language is the most characteristic feature of the Turanians. As contrasted with the highly inflexional Indo-European and Semitic linguistic families on the one hand, and the monosyllabic Chinese on the other, the Turanian languages are typical examples of the agglutinative form of speech. Here unchangeable roots are combined with suffixes by means of what is called progressive vowel harmony, in such a way that the vowels of the endings are assimilated to that of the root. Thus the infinitive element *mak*, which appears in Osmanli Turkish *yaz-mak*, "to write," becomes *mek* in *sev-mek*, "to love."

The Mongolians best represent the Turanian physical type. They have broad faces, small, slanting eyes, high cheek-bones, broad, flat noses, thick lips and low foreheads: their complexion is yellowish brown, their hair straight, and their beards scanty. The various branches of the Turanians have intermingled to a considerable extent, but it was only on their western confines that they mixed much with aliens, expecially Slavs. Thus many Finnish tribes have been absorbed by the surrounding Russians: the Magyars and the Osmanli Turks, though they have retained their Turanian speech, have lost most of their physical Turanian characteristics; while the Volga Bulgars have no trace of their original Turanian language and physique left, their name alone having survived among the Bulgarians of to-day.

The primitive religion of the Turanians is called Shamanism because its distinctive feature is the agency of the Shaman, a wizard priest, whose services are required to influence the supernatural powers. Witchcraft predominates in this religion, it being the function of the Shaman to master all that in nature is hostile to man, to curb the elements, to conjure spirits, to produce health or disease, fortune or misfortune. The Shamanist operates mainly against demons, but he also believes in higher gods, whom he calls to his aid by means of prayer and sacrifice. Ancestor worship is, moreover, a characteristic feature of Shamanism. An important instrument in the rites of the Shaman is the drum, by means of which he can summon spirits, and compel them to give active assistance. Shamanism is still found in all the Asiatic branches of the Turanian family. But it is only general among the Tunguses, all the tribes of whom (except the Manchus) are devoted to their old faith. The Samoyeds, too, are still largely Shamanists. Among the Mongols, the Buryats on Lake Baikal are the only tribe in which Shamanism prevails. Among the Turks, the old religion survives only in the tribes that remained behind in the Altai range. From the rest of the Turkish peoples it has been extirpated by Islam, though single tribes of Turkish nomads show clear traces of their original beliefs. On the other hand, the Magyars and the Finns adopted Christianity many centuries ago.

The very primitive stage of civilization which the Turanians had attained when they first appear in history, has remained on much the same level, with the few exceptions caused by European contact, down to the present day. As the cultivable soil of the ancient world had already been occupied by the Chinese, the Aryans and the Semites, the Turanians, when driven by the expansion of population to migrate from their ancient homes in the Altai mountains, were compelled to wander in barren steppes in order to maintain themselves. Their civilization thus acquired the stamp of nomadism, in which the isolation of small communities caused by their mode of life prevented the patriarchal system of government from advancing to any higher stage of political organization. The struggle for existence naturally brought them constantly into predatory conflict with their settled and more prosperous neighbours, while boundary disputes tended to perpetual internal strife. The unsettled habits thus produced have, since the adoption of Islam by the Turkish branch, made that branch for many centuries the main cause of unrest in the history of the world, because the directing force of fanaticism has been added to their unorganized restlessness.

The above account of the various branches of the Turanians will supply the material on the basis of which the prospects of Pan-Turanianism may be judged. The movement in its wider aspect having in the years preceding the war been the product of the German-educated *Intelligentsia* of Constantinople, was, after Turkey joined the Central Powers, much used in support of the alliance between Turkey and Hungary on the strength of racial kinship, and as a lure for the Tatars of the Russian Empire. In the summer of 1918, Halil Pasha, an uncle of Enver Pasha, had an interview, reported in a Berlin journal in 1920, with a German commanding officer in Anatolia, to whom he expounded the aims of the Pan-Turanian movement. Placing the national policy in the foreground, he said it was necessary to unite all Turkish-speaking peoples. The beginning must be made with the conquest of Turkestan, the cradle of the Turkish Empire. The next step would be to establish a connexion with the Siberian Yakuts, the farthest outpost of the Turkish Turanians in the north-east of Asia. After that, the Tatars of the Caucasus were to be included. This nationally exclusive Turkish Empire must, he continued, as a Mahommedan supreme power, have a great attraction for the Turks of Afghanistan and Persia. The incorporation of Azerbäïjän, the richest Persian province, might thus be hoped for in the near future. When, on the conclusion of the war, Constantinople had been occupied by the Entente Powers, Halil Pasha was thrown into prison there by them, but, managing to escape, he continued his activities in favour of a Pan-Turkish Empire. Enver Pasha had previously been emphasizing the Pan-Islamic policy and been using Arabs as Turcophil propagandists in the Caucasus. The general plan of this double procedure was by fusing the religious movement of Pan-Islamism with the racial movement of Pan-Turanianism to establish a great Turkish Empire, with Constantinople as the centre of both.

Pan-Turanianism, from the point of view of practical politicians, does not go beyond the ideal of a Turkish Empire comprising all the divisions of the Turkish race, the numbers of which do not really exceed about 26,000,000. As the Ottoman Empire contains no more than 10,000,000 Turks within its present limits, the Irredentism of the Pan-Turanian movement embraces a population of 16,000,000. Before the war, 12,000,000 of these were under Russian and 4,000,000 under Chinese, Persian and Afghan rule. At that period Russia could scarcely be regarded as a very promising field for Pan-Turanian propaganda; for generally speaking the Russian Mahommedans had been loyal, conservative, and somewhat narrow in their political outlook. Had Russia emerged intact from the conflict, her Turkish territory could have been wrested from her only at the price of another war, which the Ottoman Empire would hardly have been willing to face. But the whole situation has been transformed by the Russian Revolution and the consequent break-up of Russia. The Irredentist ambitions of Pan-Turanianism have now been brought appreciably nearer the possibility of realization. A warmer sympathy has been developed among the Russian Mahommedans with the Mahommedans abroad. Russian Turkestan and the two Khanates of Khiva and Bukhara have asserted their independence; the Tatars of the Caucasus have become republics. These new conditions might render the voluntary incorporation of all these outside Turkish populations in the Ottoman Empire not unlikely. For the important unifying elements of general identity of language, religion, and civilization, besides contiguity of territory, are all present. The speech of the Turkish branch of the Turanians has changed so comparatively little that all the divisions may be said to speak one single language, Turkish, differing only to the extent of dialects. Islam is the religion of all the divisions of the Turkish branch, which, though it only adopted this religion, has been its main protagonist. The Turkish-speaking peoples, again, have a common civilization which, based on their primitive nomadism, has as its superstructure the ethics and the culture of the Koran. Finally, with the exception of the Yakuts in the north-east of Siberia, the Turkish peoples are practically in continuous geographical contact from Thrace eastward to the frontier of Mongolia and northward into south-eastern Russia. The connexion of eastern Asia Minor, by way of the Caucasus with Central Asia, which was closed by Tsarist Russia, is now open for the union of the Turks. This road to the East is of great importance both on political and economic grounds.

If the spirit of independence among the Turks of Central Asia, the Caucasus, and Azerbäijän could be overcome by the unifying power of common language, race, religion, and culture, Turkey might become a formidable political power based on the combined moral force of the Caliphate and of Turkish nationalism.

Pan-Turanianism, however, if pushed to extremes, is an artificial and a retrograde movement, and would then come into irreconcilable conflict with Pan-Islamism. Thus the attempt to carry out the proposal of some of the Turks of Constantinople to renounce the religion of Mahomet, or even to substitute Turkish for the sacred language of the Koran, would incense the fanatical Moslem. Again, the Turkish peoples outside the Ottoman Empire do not form coherent populations, containing as they do large nomadic elements. On the other hand, the Ottoman Turks, indolent by nature, have never displayed any ability or energy in state-building. It is therefore not likely that they will develop enough statecraft and driving-power to succeed in welding together the different Turkish peoples into a single strong united empire containing perhaps 25,000,000 of the Turkish race. The extension of Pan-Turanianism so as to include other branches of the Turanians can only be pronounced to be a purely visionary idea. The only connecting link between them and the Turks at the present day is the descent of their various languages from a single parent speech that existed in remote antiquity: but Lapp and Manchu are to-day farther apart than English and Sanskrit. The other four branches now differ from the Turks in religion and civilization, besides being separated from them by great and often immense distances. The Samoyeds are nominally Christians, but really Shamanists. The Tunguses, who inhabit a vast tract of north-eastern Asia as Shamanists and reindeer nomads, are slowly dying-out in Siberia while their most prominent tribe, the Manchus, are being entirely absorbed by Chinese civilization. The Mongols, who are the eastern neighbours of Turkish tribes, and were many centuries ago politically associated with the Turks as warlike invaders of the West, are nomads and for the most part adherents of Buddhism, which has transformed them into a peaceful and unenterprising people that at the present day has hardly anything in common with the Turks. The Finno-Ugrian branch, for the most part separated by long distances from the Turks, have with very slight exceptions been thoroughly Europeanized and Christianized for many centuries. The Magyars, conquered by the Turks in the 16th and 17th centuries, fought on the side of the Turks during the World War owing to the pressure of the German alliance; but there seems to be no permanent prospect of political association between these two racially and linguistically related races. It thus seems clear that at least 20,000,000 Turanians will never have the slightest inherent tendency to be drawn into union with the Islamic religion and civilization of the Turkish Empire.

AUTHORITIES.—Sarron, *La Jeune Turquie et la Revolution* (1912); Tekin Alp, *The Turkish and Pan-Turkish Ideal* (1916); *La Turquie et la Guerre* (1916); "Islam and the War," *Quarterly Review* (April 1918); Macdonell, *Turanians and Pan-Turanianism* (1918); *Eurasian Routes* (1920); *Berliner Tageblatt* (Jan. 24 and 28 1920).
(A. A. M.)

PARAGUAY (*see* 20.756).—The pop. of Paraguay in 1920 was supposed to be about 800,000. At least 60% of the inhabitants were illiterate, though President Franco during 1916–9 made an attempt toward educational progress. The school registration for 1916 was 80,142.

Of the imports of Paraguay 81%, and of the exports 40%, pass through the Asunción custom-house. The total foreign trade of Paraguay varied little between 1907 and 1918 though the proportion of imports to exports differed, as will be seen from the following table, showing the official customs values in Paraguayan gold pesos, equal to 4s. or $0.96 each:—

	Imports	Exports	Total
1907	7,512,502	3,236,110	10,748,612
1917	5,098,581	6,494,802	11,593,383
1918	5,201,726	7,171,319	12,373,045

The United Kingdom had first place in imports until 1908, when Germany passed her, supplying 29% of the total imports as against Great Britain's 21 per cent. A close competition followed. In 1913 the United Kingdom supplied 28·6% of Paraguay's imports as compared with 27·6% from Germany, but in 1914 the situation was reversed, Germany supplying 27% to the United Kingdom's 22·7 per cent. In 1915 and 1916 the proportion of imports from the United Kingdom rose to 33% and 38·5% respectively. There was in 1921 only one strictly British mercantile house, and only one American, as compared with five German houses.

History.—Manuel Gondra became President on Jan. 18 1911 but was overthrown by a revolution headed by Col. Albino Jara in July of that year. Jara was succeeded in turn by Liberato Rojos, who was overthrown Jan. 14 1912 by another "alteration of the legal order," as a consequence of which Pedro Peña was placed in the presidential chair Feb. 29. Considerable bloodshed accompanied these changes, which cost the country at least £400,000. On March 25 Emiliano Gonzalez Navero became President, retaining office until Aug. 15, when Eduardo Scherer succeeded him. Scherer actually completed his term of office, the first time this had occurred in Paraguay since 1870. His firmness prevented several outbreaks and disturbances, especially one at the beginning of 1915, which might have been most serious under a weaker executive. Scherer's successor was fortunately another able man, Manuel Franco, who retained his position from Aug. 15 1916 until his death on June 3 1919. Franco not merely forestalled revolutions, but brought Paraguayan finance to the best condition it had reached for years. During his administration the meat-packing industry became fully established in Paraguay. This was the greatest step forward that had occurred since 1870. By encouraging an industry which more than almost any other improves the lot of the individual farmer in a rather isolated agricultural country, the three United States packing-houses that established themselves in Paraguay during President Franco's administration were of great service. They caused a thorough survey of Paraguay's cattle-raising possibilities to be made and also studied the different grasses and areas of pasturage and their suitability for different breeds of cattle. In 1918 37% of the total exports of Paraguay consisted of the products of stock-raising and meat-packing as against 32·4% for the products of the forest industries (lumber, quebracho, etc.) and 30·2% for agricultural products.

José P. Montero filled the remainder of Franco's presidential term, from June 3 1919 to Aug. 15 1920, when Manuel Gondra again became President, having been elected while minister to the United States. The lessened demand from Europe and the United States for the chief exports of Paraguay at the close of the World War caused a decided setback to Paraguay's prosperity. On Jan. 1 1921 Paraguay was unable to meet the payments due on her foreign debts, and the largest banks in the country became seriously involved, further aggravating the commercial crisis. An American financial adviser was assisting the Paraguayan Government in 1921. On Nov. 17 1913 through rail communication was inaugurated between Asunción and Buenos Aires. This has done much to lessen the isolation of the country, for under normal conditions the journey between the two cities is made in 50 hours. Paraguay renewed direct diplomatic relations with the United States in 1913, sending a minister to Washington for the first time in eight years, while the United States created a separate mission for Paraguay in the same year, accrediting a minister to Paraguay alone, instead of to Uruguay and Paraguay jointly as formerly. Great Britain in 1921 still accredited one minister to both countries. The United States and Paraguay signed an extradition treaty on July 30 1913. In Nov. 1921, Pres. Gondra was ejected from office as the result of a revolution.

The Government remained neutral during the World War, though Congress adopted a resolution of sympathy with the Allies and of approval of the action of the United States in declaring war on Germany. The Government dismissed some of its German employees, and maintained a pro-Ally attitude.

The best recent book on Paraguay is: W. L. Schurz, *Paraguay, a Commercial Handbook*, published by the Government Printing Office at Washington, D.C., 1920. (C. L. C.)

PARAVANE, a naval device used in the World War first for attacking submerged submarines and subsequently for protecting vessels against mines and for cutting up hostile minefields. The name of Acting-Comm. C. D. Burney is especially associated with its design and development.

The explosive paravane in its final form consisted of a torpedo-shaped body carrying near its head a large steel plane which was set at a small angle to the centre-line of the body, and was in an approximately vertical position when the paravane was being towed. The thrust of the water on the plane carried the paravane away from the towing vessel, and with two paravanes, one on each side, a spread of sweep of about 200 ft. was obtained, *i.e.* the two paravanes were that distance apart. Horizontal and vertical fins near the tail increased the stability, and in the tail was fitted a depth-keeping mechanism consisting of a horizontal rudder actuated by a hydrostatic valve which responded to any difference in the water-pressure caused by a change of depth. The paravane carried a heavy charge of high explosive which could be detonated, by means of an electric current passing through the core of the towing-wire, in any one of three ways. If the paravane hit the hull of a submarine, striking-gear on its nose operated a switch which closed the firing circuit. This impact method would not become operative should the towing-line become entangled in the external fittings of a submarine, but in that case an extra load would be put on the line; apparatus was therefore provided such that when the load on the line exceeded a predetermined value a switch was tripped and the circuit closed. Finally a hand-switch on the bridge of the towing vessel enabled the charge to be detonated at will should the presence of a submarine be suspected.

It was soon seen that the explosive paravane could be adapted to protect vessels against moored mines. For this purpose the towing-lines were attached, not at the stern as with the explosive paravanes, but at a point as far forward and as low down as possible. Their outboard ends being kept about 100 ft. away from the central fore and aft line of the ship by the paravanes to which they were attached, they swept a wedge-shaped track in a horizontal plane at the level of the keel or slightly below it, and fouled the mooring-wires of any anchored mines lying in or near the course of the vessel. When this happened the mooring-wire was deflected along the towing-line until it reached the head of the paravane, where it was guided into the jaws of shears or scissors made of special high-grade steel, by which it was severed. The mine then floated to the surface and was exploded by rifle-fire. It was found that with a pull of about 7 cwt. the shears would cut a 1½ in. mooring-wire. The normal length of the towing-lines was 56 yd.; three-strand wire ropes were used, each consisting of 37 galvanized wires, 0·049 in. in diameter, with an ultimate breaking strength of between 100 and 120 tons per sq. in. There were three types of protector paravanes: (1) The merchant-vessel type, known as "otters," for ships with speeds below 16 knots; (2) the fast-liner type; and (3) the battleship type.

The mine-sweeping paravanes were towed from the stern of high-speed destroyers. As the point of attachment had to be on deck, an arrangement called a "depressor" was used to bring the virtual point of tow down to the required depth at the stern. Wide paths could be swept at speeds of 26 to 30 knots.

PARDO BAZAN, EMILIA (1851–1921), Spanish author (*see* 20.800), died in May 1921.

PARIS (*see* 20.804).—The population of the French capital, —2,847,229 at the census of 1911,—was 2,906,472 at the census of 1921. In view of the rapid German advance on Paris after the outbreak of war in August 1914, steps were quietly taken to evacuate as many as possible of the civilian population; and on the night of Sept. 2 the President and ministers left the city for Bordeaux, where the Government was temporarily transferred. But the victory of the Marne removed the peril from Paris, and in December the Government returned there.

Paris during the World War was bombarded by aeroplane, Zeppelin, and artillery; 746 bombs were dropped from the air, killing 266 persons and wounding 603; German long-range artillery fired 303 shells into Paris, killing 256 persons and wounding 620. The first air raid was made on Aug. 30 1914, by aeroplane and in daylight. The first Zeppelin raid took place by night on March 21 1915. The worst air raid was made on the night of Jan. 30–31 1918, when 91 bombs fell upon the city itself and 178 on the suburbs. The long-range bombardment began on March 23 1918, and continued until Aug. 9, with many intervals of calm, there being only 44 days upon which the Berthas were active. The existence of such long-range artillery being unknown when the first shells fell at an early hour of the morning, it was imagined that German aircraft, hidden high behind the clouds, must be engaged. All work in the city was at a standstill until noon, when the regularity with which the projectiles exploded at intervals of about 20 minutes, and an examination of some of their fragments, showed that a new engine of war was at work. The first two days of bombardment were the heaviest from the point of view of the number of shells fired, but from the number of casualties caused, March 29, when only one shell fell in Paris, was the most costly. That one shell fell during Good Friday service on the church of St. Gervais, bringing down with it a large portion of the roof; 88 people were killed and 68 wounded.

The air defences of Paris were not properly organized until March 1918. In fact organization had not been necessary, as German air services concentrated all their bombing raids upon England during the years 1916–8. The results obtained by the Paris system of air defences were as follows: on 13 different occasions, on which 107 aeroplanes all-told were employed, no single raider was able to reach Paris; of the 483 planes sent by the enemy to Paris in 1918, only 37 reached the city, and 13 were brought down; and only 11,680 kgm. of bombs were thrown upon the city.

The war being over, the work of demolishing the fortifications encircling the city was begun in 1919, in accordance with a grandiose scheme which would give Paris another ring of boulevards nearly 30 m. in length. It was intended that some of the ground thus made available should be used for building purposes, in the hope of solving the acute housing problem. It was proposed to keep much of it as garden, and to build numbers of well-equipped playing-grounds, and air stations round the city. One portion of the available space, S. of the city, was to be set apart for "University City," where accommodation would be provided for students of all nationalities; to include recreation and sports grounds, swimming-baths, etc. The site chosen is near the Parc Montsouris.

PARKER, ALTON BROOKS (1852–), American lawyer, was born at Cortland, N.Y., May 14 1852. He studied at the local academy and normal school, taught for a short time, read law in an office, and in 1873 graduated from the Albany Law School. He was admitted to the bar and began to practise law at Kingston, N.Y. In 1877 he was elected surrogate of Ulster co., and was reëlected in 1883. He resigned in 1885 on being appointed by the governor justice of the N.Y. Supreme Court to fill a vacancy, and the following year was regularly elected. He was a delegate to the Democratic National Convention in 1884 and in 1885 declined President Cleveland's offer of the first assistant postmaster-generalship. He was appointed a member of the second division of the N.Y. Court of Appeals in 1889 and a member of the general term in 1893. In 1898 he was elected chief justice of the N.Y. Court of Appeals. In 1904 he resigned on being nominated by the Democrats for president, but he was defeated by Theodore Roosevelt, the electoral vote being 336 for Roosevelt to 140 for Parker, the popular vote 7,623,486 for Roosevelt to 5,077,971 for Parker. He then resumed the practice of law in New York City. He was a delegate-at-large from New York to the National Democratic Convention in 1912. In 1913 he was counsel for the managers of the trial leading to the impeachment of Governor Sulzer of New York.

PARKER, SIR GILBERT, Bart. (1862–), English novelist and politician (*see* 20.827), was created a baronet in 1915 and a privy councillor in 1916. During the first two and a half years of the World War he was engaged on the work of publicity in

British interests in the United States, and he published *The World in the Crucible* (1915) and *The World for Sale* (1916). Amongst his later works of fiction are *The Judgment House* (1913); *The Money Master* (1915); *Wild Youth and Another* (1919) and *No Defence* (1920). He retired from Parliament in 1918 and did not seek reëlection.

PARKER, HORATIO WILLIAM (1863–1919), American composer and musician, was born at Auburndale, Mass., Sept. 15 1863. His talent for composition manifested itself early; before he was 15, for example, in less than two days he set to music the verses in Kate Greenaway's *Under the Window.* He studied first in Boston, but later attended for three years the Royal Conservatory in Munich. After his return to America in 1885 he was for two years professor of music in the Cathedral School of St. Paul in Garden City, Long Island. From 1888 to 1893 he was organist of Trinity church, New York City, and from 1893 to 1901 organist of Trinity church, Boston. In 1894 he was appointed professor of the theory of music at Yale. Cambridge University bestowed on him the degree of Mus. Doc. in 1902. Before leaving New York City he had completed his oratorio, *Hora Novissima,* which was widely performed in America. It was also given in England in 1899 at Chester and at the "Three Choirs" festival at Worcester, the latter an honour never before paid an American composer. While carrying out the duties of his position at Yale he composed much. His opera *Mona* (libretto by Brian Hooker) won the Metropolitan Opera Company's $10,000 prize in 1911, and in 1914 his opera *Fairyland* (also with Hooker) was awarded another prize of the same amount offered by the National Federation of Women's Clubs. His cantata *Morven and the Grail* was written in 1915 for the centenary celebration of the Handel and Haydn Society of Boston. His other works include the cantatas *King Trojan* and *The Kobolds,* the oratorios *St. Christopher* and *A Wanderer's Psalm,* besides numerous sacred and secular pieces. He died at Cedarhurst, Long Island, Dec. 18 1919.

PARKER OF WADDINGTON, ROBERT JOHN PARKER, Baron (1857–1918), English lawyer and lord of appeal, was born at Claxby Rectory, Alford, Lincs., Feb. 25 1857. He was educated at Eton and King's College, Cambridge, where he took his degree in 1880. In 1883 he was called to the bar and built up a large and important connexion, largely dealing with Government work. In 1900 he was appointed junior counsel to the Treasury, and was raised to the bench in 1906. As a judge he earned a high reputation for great shrewdness and learning, and in 1913 was made a lord of appeal in ordinary, being at the same time given a life peerage over the heads of the five sitting lords justices. In 1916 a special second division of the Judicial Committee of the Privy Council was constituted for dealing with Prize Court appeals, and over this Lord Parker presided until within a short time of his death at Haslemere July 12 1918.

PARKIN, SIR GEORGE ROBERT (1846–), British educationalist (*see* 20.831), published in 1912 *The Rhodes Scholarships,* an account of his work as organizing representative of the Rhodes Trust (*see* 23.257). He was knighted in 1920. He retired from the secretaryship of the Rhodes Trust in 1921, being succeeded first by Sir Edward Grigg, and then, on the appointment of the latter to be private secretary to Mr. Lloyd George, by Mr. Geoffrey Dawson, formerly (1912–9) editor of *The Times.*

PARMOOR, CHARLES ALFRED CRIPPS, 1st Baron (1852–), English lawyer, was born at West Ilsley, Berks., Oct. 3 1852, the son of Henry William Cripps, Q.C. He was educated at Winchester and New College, Oxford, where he had a distinguished career. He was called to the bar of the Middle Temple in 1877, in 1890 became a Q.C. and in 1893 a bencher. In 1895 he was appointed attorney-general to the Prince of Wales (being reappointed in 1901 and 1912). He sat as Conservative member for the Stroud division of Glos. 1895–1900, for the Stretford division of Lancs. 1901–6 and for the Wycombe division of Bucks. 1910–4. In 1908 he was made K.C.V.O. Sir Alfred Cripps was well known as a strong High-churchman. He was appointed chancellor and vicar-general to the province of York in 1900 and vicar-general to the province of Canterbury in 1902. He was chairman of the Canterbury House of Laymen and a member of its committee in 1910, and chairman of the House of Laity in the National Church Assembly of 1920. In 1914 he was appointed a member of the Judicial Committee of the Privy Council and raised to the peerage, and in 1917 he became treasurer of the Middle Temple. He was the author of two important works, *Law of Compensation* (1881, 5th ed., 1905), and *Law Relating to the Church* (6th ed., 1886).

PARRATT, SIR WALTER (1841–), English organist, was born at Huddersfield Feb. 10 1841. He was educated privately and at College School, Huddersfield. After some years as organist and choirmaster to various churches, he became in 1872 organist of Magdalen College, Oxford, and in 1882 organist of St. George's Chapel, Windsor. From 1908 to 1918 he was professor of music at Oxford, and in 1916 was appointed dean of the faculty of music in London University. He was knighted in 1892, was created M.V.O. in 1901, and C.V.O. in 1917. He wrote various important articles on musical subjects for Grove's *Dictionary of Music,* and other works.

PARRY, SIR CHARLES HUBERT HASTINGS, Bart. (1848–1918), English composer (*see* 20.865), retired from his professorship at Oxford in 1908. He acted during the World War as chairman of the Music in Wartime Committee, and did much to relieve the prevailing distress among poorer musicians. He died at Rustington Oct. 7 1918, and was buried in St. Paul's cathedral.

PARSONS, ALFRED (1847–1920), English painter, was born at Beckington, Som., Dec. 2 1847. He was educated privately, and in 1865 entered the General Post-Office as a clerk, but after two years his taste for painting decided him to adopt an artistic career. He was preëminently a painter of flowers and gardens. He was also interested in the designing of gardens, and was a judge at the Chelsea flower show. His picture of an orchard, "When Nature Painted All Things Gay," was purchased by the Chantrey fund in 1887, and he was a frequent exhibitor not only at the Royal Academy but at the Grosvenor and New Gallery exhibitions. Among the various special exhibitions held of his work was one of scenes from the Warwickshire Avon (1885). As an illustrator Parsons took a very high place, much of his work appearing in *Harper's Magazine,* while among the books he illustrated are *She Stoops to Conquer,* Herrick's *Poems* (with E. A. Abbey), and *The Danube, from the Black Forest to the Black Sea* (with F. D. Millet). He died at Broadway, Worcs., Jan. 16 1920.

PARSONS, SIR CHARLES ALGERNON (1854–), British engineer, was born in London June 13 1854, the fourth son of the 3rd Earl of Rosse. He was educated privately and at St. John's College, Cambridge, graduating 11th wrangler in 1876, and being elected in later life (1904) an hon. fellow of the college. In 1877 he entered the Armstrong Works at Elswick, having previously worked as a boy in his father's workshops at Birr Castle, King's co., Ireland, where the Rosse telescope was constructed (*see* 23.745). In 1883 he served for a year on the experimental staff of Messrs. Kitson of Leeds, and in 1884 entered into partnership with Messrs. Clarke Chapman & Co. of Gateshead. The partnership was dissolved in 1889, and Charles Parsons, whose invention of the Parsons steam-turbine was bringing him into continually greater prominence in connexion with the progress of shipbuilding, then built his own works at Heaton, Newcastle-upon-Tyne, for the making of steam-turbines, dynamos, searchlight reflectors and other electrical apparatus (*see* 25.845 *seq.*). Besides his chairmanship of C. A. Parsons & Co., he became managing director of several electric supply companies, notably at Newcastle, Scarborough and Cambridge, and also of the Marine Steam Turbine Co. which became the Parsons Marine Steam Turbine Co. of Wallsend-on-Tyne, owners of the turbine patents, with ramifications throughout the engineering world. He was elected F.R.S. in 1898, won the Royal Society's Rumford Medal in 1902, was president of the Institute of Marine Engineers 1905–6 and of the British Association 1919–20. In 1911 he was created K.C.B. During the World War Sir Charles

Parsons served on many Government committees connected with scientific research, electric power, aircraft, fuel research and the construction of tanks.

PASCAL, JEAN LOUIS (1837–1920), French architect, was born in Paris June 4 1837, and his architectural education was begun at the age of 16 when he became a pupil of Gilbert. Later, when in the studio of Questel, he entered the École des Beaux-Arts, where, amongst other distinctions gained, in 1866 he won the *Grand Prix de Rome.* On his return to Paris in 1870, after his four years at the Villa Medici, he was appointed inspector of works at the Louvre and the Tuilleries. In 1872 he became patron of his *atelier*, and thereafter was appointed assessor in public competitions, and subsequently received many distinctions. Amongst these was his election to the council of the Beaux-Arts and president of the jury, and to membership of the Institut de France, and finally he became *commandeur de la Légion d'Honneur*. In his long career the private, as apart from official, work of Pascal was of a very diversified nature, and covered a wide area of ground, domestic and civil, and particularly a long series of artistic memorial monuments such as those commemorating Col. d'Argy at Rome, Henri Regnault at the École des Beaux-Arts, and President Carnot at Bordeaux. Among his buildings are the Château du Doux, Corrèze, that for the Faculté de Médecine, Bordeaux—a design with much dignity and calm—the painter Perrault's house and studio, Paris, and several villas and châteaux in the provinces—at Pau, Beaulieu, Avignon and elsewhere. He lived long enough to see, at the close of his busy career of over 50 years, the completion of the Bibliothèque Nationale, Paris, a fine building characteristic of his learning and ingenuity, but speaking none of the modern note of a too conscious individuality. A man of untiring energy, Pascal's application to his *atelier* work and his many professional calls did not prevent his finding time for the literary side of architecture and he, with M. Gaudet, is responsible for the splendid edition of Blondel's *Architecture Française*, published under the auspices of the French Government. The celebrated *atelier* of which he was for so many years the greatly respected patron, was responsible in his time for the training of many architects to be found later on in every country in Europe, in the United States and in Canada. Among them were Sir John Burnet, Thomas Hastings of New York, Signor Beltrani of Milan and Henri Nénot of Paris. In 1914 he was awarded the gold medal of the Royal Institute of British Architects but his great age and state of health prevented his receiving this in person. He died in Paris in 1920.

PASCOLI, GIOVANNI (1855–1912), Italian poet, was born at San Mauro, Romagna, Dec. 31 1855. His first volume of verse, entitled *Myricae*, appeared in 1891, and his *Primi Poemetti* in 1897. His other volumes include *Odi ed inni* (1906); *Le Canzoni di Re Enzio* (1908) and *Nuovi Poemetti* (1909). He wrote also much elegant Latin verse, and was well known both as a prose essayist and for his Dante studies, which led to his appointment as professor of Italian literature at the university of Bologna. He died at Barga April 6 1912.

PASSY, FRÉDÉRIC (1822–1912), French economist and pacifist, was born in 1822 and was a nephew of the economist Hippolyte Passy, finance minister to Louis Philippe and to Louis Napoleon's Republican Government. Under his uncle's influence Frédéric devoted himself to economic studies, and to that end gave up the appointment as auditor of the Conseil de Droit, which he had held during 1846–49. In 1860 he began to teach political economy both in Paris and in the provinces. His first work on the subject, *Mélanges économiques*, appeared in 1857. True to his republican principles, he refused to be reconciled to the Second Empire, and remained, therefore, ineligible for any Government post. He was an ardent free-trader and an admirer of Cobden. In 1867 he founded the Ligue Internationale de la Paix, afterwards known as the Société Française pour l'Arbitrage entre Nations, and for the rest of his life he devoted himself to the promotion of international peace. From 1881 to 1899 he was deputy for the Seine department. In 1901 he received the Nobel Prize, sharing it with M. Dunant. His published works include *De la Propriété Intellectuelle* (1859); *Leçons d'économie politique* (1860–61); *La Démocratie et l'Instruction* (1864); *L'Histoire du Travail* (1873); *Malthus et sa Doctrine* (1868); *La Solidarité du Travail et du Capital* (1875) and *Le Petit Poucet du 19ième Siècle: George Stephenson* (1881). He died in Paris June 12 1912.

PATIALA, SIR BHUPINDAR SINGH, Maharaja of (1891–), head of the Sikh community in India, was born Oct. 12 1891, to the soldier-sportsman Maharaja Sir Rajendra Singh, whose death in Nov. 1900, at the age of 28, brought him to the *gadi.* He was carefully trained, and on receiving full ruling powers at the close of 1910 maintained and greatly developed the progressive policy of the council of regency, applying himself with great assiduity to the moral and material welfare of his people. Inheriting sporting and soldierly qualities, he was a skilful polo-player and batsman, becoming well known to British crowds when he captained the Indian cricket eleven in 1911. He also inherited the conspicuous loyalty of his house to the paramount Power. In the autumn of 1914 he set out with the Indian Expeditionary Force to France, but serious ill-health compelled his return to India after reaching Aden. The contribution of Patiala to the Indian army, including Imperial Service troops, was increased from about 4,000 men to 28,000, and as the recognized head of the Sikh race the Maharaja exercised an enormous influence in promoting recruitment from other parts of the Punjab. His subjects saw active service in nearly all the theatres of war, and won 125 battle distinctions. His gifts in material and money were constant and generous. He visited his troops in France, Palestine and elsewhere when deputed to England in the summer of 1918 with Sir S. P. (Lord) Sinha on selection as a member of the Imperial War Cabinet, being the second Indian prince to be called to Empire councils. In the Punjab disturbances in the spring of 1919 important responsibilities were assigned to him by the British authorities, and tranquillity was maintained throughout his state and adjacent British districts. In the third Afghan War which immediately followed he volunteered his personal services as well as the loan of his troops, and held a staff appointment in a trying hot-weather campaign, not returning from the frontier until an armistice was granted the Amir Amanulla. He took a prominent part in promoting the inauguration of the Chamber of Princes in 1921 and was elected to the small standing committee. He was raised to the rank of major-general, his permanent local salute was raised from 17 to 19 guns, and he held the grand crosses of the Star of India, the Indian Empire and the British Empire.

PATON, FREDERICK NOEL (1861–1914), British explorer and Anglo-Indian official (*see* 20.930*), died July 1 1914.

PATON, JOHN BROWN (1830–1911), British Nonconformist divine (*see* 20.930), died at Nottingham Jan. 26 1911.

PATTI, ADELINA JUAÑA MARIA [Baroness Cederström] (1843–1919), English singer (*see* 20.937), died at Craig-y-Nos Castle, Wales, Sept. 27 1919.

PAYNE, JOHN BARTON (1855–), American public official, was born at Pruntytown, Va., Jan. 26 1855. He was educated at Orleans, Va., read law, and was admitted to the bar in 1876. He moved to West Virginia and practised law at Kingwood from 1877 to 1882, during the same period serving as chairman of the county Democratic committee. In 1882 he was elected mayor of Kingwood, and the following year went to Chicago, where he was engaged in law practice until 1893. Then he was appointed judge of the Superior Court of Cook Co., Ill., but resigned after five years to resume the practice of law. In Nov. 1917 he was appointed counsel of the Emergency Fleet Corporation and also legal adviser to the Commissioner of Internal Revenue. In 1918 he was appointed counsel of the Director-General of Railroads and in 1919 chairman of the U. S. Shipping Board. In Feb. 1920 he was appointed Secretary of the Interior, to succeed Franklin K. Lane, and he served to the end of President Wilson's term.

PEACE CONFERENCE (1919).—The first plenary session of the Conference of the Powers assembled in Paris to settle the terms of peace after the World War was held on Jan. 18 1919, more than two months after the conclusion of the Armistice with Germany; and the Conference remained in being from

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**** These figures indicate the volume and page number of the previous article.***

that date until Jan. 21 1920, when the Supreme Council met for the last time. Even then the work of the peace settlement was incomplete. What remained to be done was partly delegated to a council of ambassadors at Paris, partly left to the Premiers of the principal Powers, who continued to meet in consultation at irregular intervals during 1920 and 1921. The Conference separated before the Hungarians had decided to sign their treaty, and before the terms of the partition of the Ottoman Empire were finally agreed upon. It left the Adriatic question in such a state that 10 months elapsed before Italy and Yugoslavia could compose their differences. The total sum to be demanded from Germany in the name of reparation had not yet been settled, nor had the principal Powers finally agreed in what proportions this sum should be divided between them. But the events of 1920 showed that most, if not all, of these questions could be arranged without the cumbrous mechanism of a conference. An even more momentous uncertainty, the problem of the future attitude of the United States towards the treaties, would obviously be solved at Washington and not at Paris. But the most urgent difficulties of the transition from war to peace had been met, so far as diplomacy could meet them, before the Conference was six months old; and, after the German treaty had been signed, the doings of the statesmen at Paris no longer excited the same interest as before. The most important of these statesmen, except the French Premier, M. Georges Clemenceau, soon made their exit. In the last days of June 1919 Mr. Wilson returned to the United States, Mr. Lloyd George to London. Sig. Orlando had fallen from power before the signing of the treaty, and his successor, Signor Nitti, abstained from visiting Paris. In July Mr. Lansing, the American Secretary of State, withdrew, leaving Mr. Polk, his under-secretary, to act for him. In Sept., after the signing of the Austrian treaty, Mr. Balfour departed and Sir Eyre Crowe became the chief British plenipotentiary. By June 28 the main outlines of the new map of Europe were drawn; the principles which were to govern all the treaties had been laid down; Germany had been rendered powerless for evil, and the Austro-Hungarian Monarchy had ceased to exist.

The Secret Treaties and the Pre-Armistice Terms.—The Allied and Associated Powers entered the Conference with a load of previous commitments.[1] The three chief European Allies had to consider many secret undertakings given at critical periods of the war. In April 1915 France and Great Britain had purchased Italy's coöperation by the Treaty of London, which gave very definite pledges regarding Istria, Dalmatia, Cisalpine Tyrol, the Dodecanese and Adalia. In May 1916 France and Great Britain had mapped out their future spheres of influence in the Ottoman Empire; and in 1917 there had been consequential arrangements with Italy. In Aug. 1916 all three Powers had given pledges to Rumania regarding her claims on Hungarian territory, pledges which Rumania at least did not regard as invalidated by her subsequent Treaty (of Bucharest, May 1918) with the Central Powers. In Feb. 1917 all three had agreed with Japan to uphold her claims on Shantung. Finally there were agreements of a less definite character with Serbia and with Greece. It remained to be seen how far these compacts could be reconciled with each other and with the views of the United States, who had not endorsed any of them and was officially unaware of them up to the opening of the Conference. There remained the pre-Armistice terms which were binding on all the parties to the Conference, and which indisputably must prevail wherever they came into conflict with treaties of prior date. Drafted at Washington, on the basis of a separate correspondence between Mr. Wilson and the German Government, they had nevertheless been considered and adopted (with certain amendments) by the Supreme War Council of the Allies as the foundation of the future peace. This meant that (with the exceptions which they or Mr. Wilson had specified in Oct. and Nov. 1918) the Allies were bound to impose no terms which clashed with Mr. Wilson's Fourteen Points (of Jan. 8 1918), his Four Principles (of Feb. 11), his Four Ends (of July 4) and his Five Particulars (of Sept. 27).

This peculiar obligation was the outcome of an offer, made by Germany on Oct. 4 1918, "to accept the programme set forth by the President of the United States in his message to Congress of Jan. 8 1918, and his later pronouncements, especially his speech of Sept. 27," as a basis for peace negotiations. A similar offer was made by the Austro-Hungarian Government on Oct. 7. From Germany the President required, as a condition precedent to negotiations, that "the military masters and monarchical autocrats of Germany" should be irrevocably deposed. To Austria-Hungary he intimated that in one particular he could no longer stand by the Fourteen Points. It was no longer sufficient that the Czechoslovaks and the Yugoslavs should be guaranteed autonomy within the Austro-Hungarian state. These peoples must now decide what action on the part of Austria-Hungary would satisfy their aspirations. A republican Germany and a partition of Austria-Hungary were thus indicated as fundamental conditions of the peace. The Central Empires accepted the fiat; and the European Allies then agreed to make peace with Germany "on the terms of peace laid down in the President's Address to Congress and the principles enunciated in his subsequent addresses," with two qualifications. They reserved judgment on the second of the Fourteen Points "relating to what is commonly known as the freedom of the seas." They pointed out that, in their opinion, the President's demand for the "restoration" of territories invaded by Germany should be understood to include "compensation for all damage done to the civilian population of the Allies and their property by the aggression of Germany by land, by sea and from the air." The President accepted explicitly this meaning of "restoration," and accepted *ex silentio* the demurrer as to the "freedom of the seas." After the Conference had begun, he stated to some American journalists (Feb. 14 1919) that the freedom of the seas was no longer needed, as in future (with a League of Nations in existence) there would be no neutrals. It will be noted that the reply of the Allies to the President only committed them with regard to the German treaty. The armistices signed by Austria (Nov. 3 1918) and Hungary (Nov. 13) were unconditional, and the Italian Government afterwards held that neither of these countries was entitled to the benefit of the Wilsonian terms. But the legal point was not pressed by the Allies in general, even against Bulgaria and Turkey with whom Mr. Wilson had not negotiated at all. The general view was that Germany had negotiated on behalf of both herself and her Allies; and indeed the Wilsonian terms which Germany accepted made explicit references both to Austria-Hungary and to Turkey.

Purport of the Wilsonian Terms.—The general principles contained in Mr. Wilson's manifestoes were not all of the kind that a Peace Conference could enforce or promote. Some were principles of international morality; others could hardly be realized in a world which was still convulsed by national and racial animosities, by the sense of intolerable wrongs and of crushing disillusionments. The time was not yet ripe for insisting that the victors, equally with the vanquished, should abstain from "private international understandings of any kind," should throw down all "economic barriers" and should guarantee "equality of trade conditions" (most favoured nation treatment) to their former enemies. Still less could the Allies agree at that date to give "adequate guarantees" that their armaments should be "reduced to the lowest point consistent with domestic safety" within any definite period of time. It was easier for the Allies to accept some other principles which made a strong appeal to the moral sense of mankind: as, for instance, that nations ought to be governed in their foreign policy by the rules of private honour and by respect for the common law of civilized society; that "every part of the final settlement must be based upon the essential justice of that particular case, and upon such adjustments as are most likely to bring a peace that will be permanent"; and that "no special or separate interest of any single nation, or any group of nations, can be made the basis of any part of the settlement which is not consistent with the common interest of all." These, and other similar rules, were valuable as a statement of the spirit in which the wiser heads of the Conference would approach their work. But the Conference could hardly do more for the propagation of Mr. Wilson's ideals than it did in approving the Anglo-American scheme of a League of Nations "formed under specific covenants" to ensure that "the combined power of free nations will check every invasion of right." When it provided that the Covenant of the League should form an integral part of each of the new treaties, and when it made the League responsible for supervising and revising many parts of the peace settlement, the Conference loyally accepted the conception of the League which Mr. Wilson had explained in his address of Sept. 27 and in several speeches of his European tour (Dec. 1918–Jan. 1919). The League was planned to be, as he had said at the Guildhall in London on Dec. 28, a permanent concert of Powers for the maintenance of the peace terms. It is easy now to blame the Allies for assuming that the Covenant, drafted by Lord Robert Cecil and Gen. Smuts in consultation with Mr. Wilson and Col. House, would be accepted without demur by the U.S. Senate. But their attitude towards the project of the League, when it was under discussion at the Conference, at least proves them honestly desirous of realizing Mr. Wilson's aspirations.

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[1] For the preliminaries leading to the Armistice of Nov. 11 1918, *see* under WORLD WAR. *See* also, for points unsettled at the Peace Conference, SILESIA and other appropriate headings.

The territorial terms which Mr. Wilson had formulated were comparatively simple, though not always easy to reconcile with his principle of self-determination, which required that "every question whether of territory or of sovereignty, of economic arrangement or of political relationship" should be settled on the basis of "the free acceptance of that settlement by the people immediately concerned." Mr. Wilson himself subsequently confessed that, when he put self-determination on his programme (in spite of Mr. Lansing's fruitless objections, since revealed), he did so in ignorance of the very existence of some of the nationalities which afterwards invoked his aid. Literally and unconditionally applied, the principle of self-determination would have reduced eastern Europe to a chaos of privileged enclaves and economically helpless states; nor was it easy to see how it could be applied with any useful results to the German colonies or to the non-Turkish portions of the Ottoman Empire. The first of these two difficult cases was hardly met by Mr. Wilson's demand (in the Fourteen Points) that colonial questions should be settled with equal regard to the interests of the populations concerned and to the equitable claims of the Government whose title was to be determined. The solution eventually applied to both cases was that of mandates, a device first suggested by Gen. Smuts in Dec. 1918, and readily endorsed by Mr. Wilson when it was brought to his notice. As for the minor European nationalities, Mr. Wilson himself had already, before the Conference, indicated that their aspirations could not in every case be satisfied "without introducing new or perpetuating old elements of discord and antagonism that would be likely in time to break the peace of Europe and consequently of the world." This at least made it clear that a plebiscite would not be assumed to be in every case the one unfailing criterion of the justice of national claims.

The following is a brief summary of the territorial terms to which the Allied and Associated Powers were committed by the pre-Armistice negotiations: (1) Germany was to evacuate all Russian territory, and (2) to recognize the independence of all territories inhabited by indisputably Polish populations. (3) Belgium and the occupied territories of France, Rumania, Serbia and Montenegro were to be evacuated. (4) Belgium was to be left in the position of a sovereign state. (5) Alsace and Lorraine were to be returned to France. (6) Poland and Serbia were to be given free and secure access to the sea. (7) The independence and territorial integrity of Poland and the Balkan states were to be assured by international guarantees. (8) The Turkish portions of the Ottoman Empire were to be allowed to form a sovereign state; but the Straits were to be placed under international control, and the non-Turkish nationalities were to be allowed "an absolutely unmolested opportunity of autonomous development." (9) The Czechoslovaks and the Yugoslavs within the Austro-Hungarian Monarchy were to determine their own political destiny. We may further mention Mr. Wilson's Ninth Point, demanding a readjustment of the frontiers of Italy along "clearly recognizable lines of nationality." To this limitation of Italy's ambitions Sig. Orlando had never agreed. But his protest was not, unluckily, made public till May 1919.

Opening of the Conference.—The invitations to the Conference were issued by the five principal and associated Powers, whose chief plenipotentiaries held consultations in Dec. and the early days of Jan. 1919, before they formally assembled at Paris. Mr. Wilson was in Paris from Dec. 13 to Dec. 25, in England from Dec. 26 to Dec. 31, in Italy from Jan. 3 to Jan. 6. M. Clemenceau, Sig. Orlando and Baron Sonnino visited London early in December. Finally, on Jan. 12, there took place at the Quai d'Orsai a meeting of the Supreme War Council (a body constituted in Nov. 1917) which was attended by Mr. Wilson and Mr. Lansing, M. Clemenceau and M. Pichon, Mr. Lloyd George and Mr. Balfour, Sig. Orlando and Baron Sonnino. On this occasion it was decided that only the representatives of the five chief Allied and Associated Powers (the fifth being Japan) should be entitled to attend all meetings of the Conference, and that other members should be summoned only when their special interests were involved in the discussion. The decision was taken without the other Allied and Associated Powers being consulted, but was in harmony with the practice of the Congress of Vienna (1815), and was defended on the ground that the five were "Powers with general interests." Membership of the Conference was accorded to 32 Powers in all. Enemy Powers were not admitted, and neutral Powers were only to attend, when specially summoned by the five, at sessions specially appropriated to the discussion of their claims. But all belligerents, and all Powers who had severed diplomatic relations with Germany, were entitled to appear at every plenary session. It had been originally proposed to put all "new states in process of formation" on the same footing as the neutrals with special interests. But the right of Poland and of Czechoslovakia to be represented in the Conference was conceded before the first plenary session. Croatians and Slovenians were in fact represented by the Serbians, but the enlarged kingdom of Serbia, owing to the opposition of Italy, was not officially recognized until the end of May. The five principal Powers settled the number of plenipotentiaries by whom each state might be represented, with special regard to the military importance of each Power and to the part which it had played in the war. The number of plenipotentiaries was a question of sentiment only, since no Power exercised more than one vote; but the question was not settled without some bickering. Finally five plenipotentiaries were assigned to each of the principal Powers; three apiece to Belgium, Brazil and Serbia; two apiece to Canada, Australia, South Africa, India, China, Czechoslovakia, Greece, the Hejaz, Poland, Portugal, Rumania, Siam; one apiece to New Zealand, Bolivia, Cuba, Ecuador, Guatemala, Haiti, Honduras, Liberia, Nicaragua, Panama, Peru, Uruguay. All the Powers were allowed to make use of the panel system in choosing their plenipotentiaries, and the representatives of the British Dominions did important work on more than one occasion by virtue of their position on the panel of the British Empire. These arrangements were complete before the first plenary session (Jan. 18), which was merely asked to transact some formal business, on lines settled in advance by the Five. It elected M. Clemenceau as president of the Conference; it sanctioned the appointment of a secretariat, and also of a drafting committee on which the Five alone were represented. At the second plenary session (Jan. 25) certain of the minor Powers, Belgium and Canada amongst them, protested against the degree of control which the Five had assumed over the proceedings of the Conference. These protests were bluntly answered by M. Clemenceau; but they could not be altogether ignored. The smaller Allies were by degrees allowed a larger representation on some of the commissions and committees; and in this way a use was found for the abilities and experience of some highly distinguished statesmen, such as M. Venizelos.

Organization and Procedure.—The original rules of procedure, drafted by M. Berthelot, do not throw much light on the methods of transacting business which were actually employed, and in some points they were quickly modified.[1] The conduct of affairs, until March 25, was in the hands of the Council of Ten, a body composed of two plenipotentiaries for each of the five Powers; it was simply the Supreme War Council adapted to new purposes. The plenipotentiaries were allowed to bring their expert advisers with them, and made free use of this permission; but the Council from the first availed itself of the power, accorded under rule 13, to refer technical questions to committees of experts. The proceedings of the Ten were secret; rule 8 provided for the publication of official *communiqués*, but these were usually so worded as to convey the minimum of information. Owing to the large numbers present at each session, the secrecy of the proceedings was seldom respected; and, while the unofficial reports published in the French press were severely censored, the correspondents of English and (more particularly) American papers were often successful in acquiring and transmitting important information. On Jan. 17 the Ten promised, in answering a protest from the correspondents, that the plenary sessions should be open to them, except in special cases. But these sessions were infrequent and, when they were open to the press, only transacted formal business. Those of May 6 and May 31, at which important differences of opinion became manifest, were held behind closed doors. The secrecy of the deliberations grew more complete after March 25, when the Council of Ten was superseded by the Council of Four (Mr. Wilson, M. Clemenceau, Mr. Lloyd George, Sig. Orlando). Thenceforward experts were merely summoned to answer questions; for over three weeks the only official continuously present was the interpreter (M. Mantoux); but in April Sir Maurice Hankey was admitted as secretary. The Four delegated certain questions to a council of five foreign ministers (Mr. Lansing, M. Pichon, Mr. Balfour, Baron Sonnino, Baron Makino), but this body did not become prominent until the end of June when the Four dispersed and left all current business to be transacted by the Five.

Each of the principal Powers, except France, provided its plenipotentiaries with a large staff of officials and other experts. These "delegations" served as panels from which was drawn the personnel of the innumerable commissions and committees appointed from time to time by the plenary sessions or by the Supreme Council.[2] Most of the earlier commissions were large and imposing bodies; each of the principal Powers contributed two or three representatives to each commission, while the other Powers were allowed to send, between them, five or ten. This was the constitution of the commissions on Reparations, on the Responsibility for the War, on the League of Nations, on International Labour Legislation, on Ports, Waterways and Railways, all of which were sanctioned by the second plenary conference (Jan 25). In Feb. and March five territorial commissions were constituted. On these only the principal Powers were represented. The subjects referred to them were the territorial claims of: (1) the Czechoslovaks, (2) the Poles, (3) Rumania and the Yugoslavs, (4) Greece and Albania, (5) Belgium and Denmark. On Jan. 27 the Supreme Council appointed a large economic commission to draft the articles of the German treaty which related to such subjects as commercial relations, shipping, industrial property, pre-war contracts, and the liquidation of enemy debts. On Feb. 12 a naval and military committee, under Marshal Foch, was created to draft the terms relating to disarmament and the surrender of naval and military material. The Council of Four, like the Council of Ten, constantly employed expert committees, but showed a preference for comparatively small bodies which could be trusted to work with expedition.

For business not immediately connected with the making of treaties the Supreme Council made considerable use of the Armistice Commission at Spa, of the military staff of the old Supreme War Council at Versailles, and of the Supreme Economic Council at Paris. The last named of these bodies was instituted, at the instance of Mr. Wilson (Feb. 8) to advise the Conference on any economic measures of a temporary character which might be necessary to ensure: (*a*) that the devastated areas were duly supplied with the raw materials and other commodities required for purposes of reconstruction; (*b*) that the economic life of other countries which had suffered from the war was promptly revived; (*c*) that the pressing wants of neutral and ex-enemy countries were satisfied without detriment to the Allied and Associated Powers. The Supreme Economic Council absorbed many of the functions of those inter-Allied councils which, during the later stages of the war, had been charged with special problems of food supply and relief work, finance, shipping and blockade. It also formed special sub-sections to advise on the reorganizing of inland communications by rail and water, and on the control of the raw materials required for reconstruction. Lord Robert Cecil, representing Great Britain, usually presided at meetings of the Supreme Economic Council. Mr. Hoover, who was one of the American representatives, made himself responsible for the Food and Relief section, which had to deal with the most urgent of all the duties referred to the Council. From Feb. 17 to the end of June the activity of the Supreme Council was unremitting. It was expected to see to the revictualling of Germany under the terms of the Armistice Convention. It organized relief work among the starving populations of eastern Europe. It reorganized the derelict transport systems of Austria-Hungary and Poland. Its German duties involved negotiations with a German finance commission, and the arranging of the Brussels agreement (March 14) under which Germany was supplied with foodstuffs up to the end of Aug. 1919. It was by successive recommendations of this council that the commercial blockade of Germany was partially relaxed in Feb., March and April; the most striking of these recommendations was that subjects of Allied countries should be free to trade with Germany, subject to any restrictions which their respective Governments might desire to maintain (April 24). In April the Council undertook to supervise the economic life of the left bank of the Rhine, during the period of occupation. After the German treaty had been signed the Supreme Economic Council was still utilized by the European Allies as an agent for the purchasing of foodstuffs in America and supplying Austria with coal. The last meeting was at Rome in Nov. 1919.

The Council of Ten, Jan. 18–March 25 1919.—The first section of the German treaty to be drafted in something like its final form was the Covenant of the League of Nations, which Mr. Wilson consistently regarded as "in a sense the most essential part of the peace settlement." By the end of Jan. the American and British delegates had agreed upon a draft. This was carefully discussed in the first fortnight of Feb. by the League of Nations Commission, on which were represented not only the five Great Powers, but also Belgium, Brazil, China, Portugal, Serbia, Greece, Rumania, Poland and Czechoslovakia. The most prominent personages who served on the commission, after Mr. Wilson who was its president, were Col. House (U.S.A.), Lord Robert Cecil and Gen. Smuts (British Empire), M. Bourgeois (France), Sig. Orlando (Italy) and M. Venizelos

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[1] English was recognized at the Conference as of full equality with French as the official language, so that all the proceedings were bilingual. The British Dominions were recognized not only as an integral part of the British Empire delegation (being, for instance, part of the panel from which British representations on the Supreme Council were chosen), but also as states on an equality with other small independent states. Thus Gen. Botha and Gen. Smuts sometimes sat in the Supreme Council in one capacity and sometimes in the other.

[2] "Supreme Council" was the generic name applied to whatever body—the Ten, the Four or the Five—happened to be in control of the proceedings.

(Greece). The Covenant passed its first reading at the third plenary session (Feb. 14), but was amended in details before it was finally approved by the fifth plenary session (April 28). The amendments were chiefly inspired by the wish to meet American criticism. One provided that members of the League might withdraw on giving two years' notice; another expressly guarded the Monroe Doctrine from attack. Among amendments which were considered but rejected it is enough to mention: (*a*) a Japanese proposal that there should be a clause declaring all members of the League, without respect of race or colour, to be equal; (*b*) an American proposal to forbid any discrimination "in fiscal and economic regulations" between one nation and another (which would have put an end to *Zollvereins* and to imperial preference); (*c*) a French proposal to endow the League with a general staff and with powers to supervise the process of disarmament. (*See* LEAGUE OF NATIONS.)

To the same period belongs the main work of the Labour Commission, which began to draft the Labour Convention on Feb. 1. The Convention was intended to convince the world that the interests of labour would be better served by supporting the Allies at Paris than by helping German Socialists to draft their Labour charter in the International Conference which sat at Berne in Jan. and February. The Commission, first proposed by M. Clemenceau, had an American chairman (Mr. Gompers); among the other prominent members were Mr. Barnes (Great Britain) and M. Vandervelde (Belgium). It contained no elected representatives of labour, but conferred with a number of labour leaders who were specially invited to Paris for the purpose. Its work proceeded smoothly and swiftly. The Convention enumerates nine fundamental principles, for drafting which Mr. Gompers was responsible; but otherwise it refrains from any attempt at remedial legislation. It is mainly concerned with outlining the organization, powers and procedure of a Labour Conference (an international labour parliament) and a Labour Office (a bureau of experts). The Convention links up the Labour Conference with the League of Nations, and provides that the original members of the League shall also be the original members of the Conference. The German delegates proposed (in May 1919) that the Convention should be revised by a conference of trade unions, in the light of the German Labour charter and of the Berne resolutions. This proposal was however rejected; the Convention in its final form owes nothing to German amendments. It forms section 13 of the Treaty of Versailles, and appears in all the other treaties with enemy powers. The Labour Conference met for the first time at Washington in the autumn of 1919, but was attended by no American delegates, owing to the fact that the U.S. Senate had not yet ratified the Treaty of Versailles. (*See* INTERNATIONAL LABOUR.)

The Labour Convention was not presented to the Conference until April 1, and for some weeks after the third plenary session (Feb. 14) it seemed as though the Ten and their satellitic commissions were making little progress. This impression was strengthened by the temporary absence of Mr. Lloyd George (Feb. 7–March 5) and of Mr. Wilson (Feb. 14–March 14), who departed on urgent business of different kinds to London and to Washington respectively. For a time the Supreme Council was also robbed of M. Clemenceau; he was wounded on Feb. 19 by a French anarchist and was not seen again in public until March 10. But in any case the Supreme Council was at this stage burdened with a mass of formal duties which could not be avoided or postponed. It was necessary, under the rules of procedure, to hear the views of the "members with special interests." Late in Jan. audiences were given to the claimants for the German colonies, among whom the British Dominions were conspicuous. Then came the turn of the minor Powers and the oppressed nationalities: Rumania, Greece, Czechoslovakia, the Hejaz, Belgium, the Syrians, the Druses, the Zionists, the Yugoslavs, Denmark, the Albanians, the Armenians and the Montenegrins. The ceremonial interviews rarely added anything to the case which had been already presented in writing; and all the claims, except those involving considerations of high policy, were referred, as the interviews concluded, to the five territorial commissions, and to a central commission which was appointed (Feb. 27) to coördinate the conclusions of the territorial experts. On a few questions there was substantial progress. A provisional agreement was reached as to the future of the German colonies. A Financial Drafting Commission defined the questions of finance and reparation which must be settled by the experts. Between Feb. 12 and March 3 the Military and Naval Drafting Committee prepared the first draft of the naval and military terms, and early in March Mr. Lloyd George persuaded the Supreme Council to accept the principle that all the enemy Powers should be obliged to abolish compulsory military service. By March 10 the naval, military and air terms were practically complete and on March 17, when Mr. Lloyd George was contemplating another visit to London, Mr. Wilson, M. Clemenceau and Sig. Orlando sent him a joint letter, begging that he would remain in Paris for the fortnight which, in their opinion, was the time required for completing the German treaty. Mr. Lloyd George agreed, but on condition that a more expeditious and more secret procedure than that of the Ten was adopted. He carried his point; on March 25 an official notice was issued that informal discussions by the delegates of the principal Powers would be substituted for the methods hitherto adopted. With this announcement began the period of the Council of Four. The Marquis Saonji, who might have claimed a seat in this conclave, abstained from doing so, except when Japanese interests were involved, on the ground of his ignorance of European languages.

Council of Four, March 25–May 7.—The Four worked at high pressure to complete the German treaty. They met two or three times a day; they confined their discussions to matters of principle and high policy; they left questions of detail and all technical subjects to the experts. But there were delicate and urgent problems, not all vitally connected with the treaty, which came up at many sessions, and some of these were never finally settled at Paris. The Four could never concentrate on one subject, to the exclusion of all others, until a definite agreement was reached; for each stage in a particular discussion involved a further reference to the experts, and a longer or shorter delay until the experts were ready with their report. Hence a chronological record of their debates, if such were available, would be a bewildering document. But it is known what were the more contentious topics debated in these six weeks, and what were the main issues in each case.

(*a*) The *guarantees* for Germany's compliance with the treaty were a special anxiety to France. She asked that there should be a prolonged occupation of the left bank of the Rhine by French, British and American forces; that the Rhine bridgeheads (Cologne, Coblenz and Mainz) should be included in the zone of occupation; that the left bank should be permanently detached from Germany to form a neutral and autonomous state ("Rhineland Republic"). Great Britain and America had offered France defensive treaties (the "Three Power Treaty") in lieu of these cumbrous precautions (March 14). M. Clemenceau accepted the treaties, but also pressed for the adoption of the French scheme. His colleagues would not hear of a Rhineland Republic; but they agreed that the left bank, and a deep belt on the right bank, should be denuded of fortifications (Art. 180); and, more reluctantly, that there should be joint occupation for 15 years. Still another concession was extracted from them—the last clause of Art. 429, which provides that, even at the end of 15 years, the occupation may be continued if in the opinion of the Allies France is insufficiently guaranteed against an unprovoked attack. This clause was intended to provide for the contingency of the British or the American defensive treaty being still unratified at that date.

(*b*) The *Saar valley* was claimed by France in compensation for her ruined mines. At first she had asked for complete political sovereignty on historical grounds; but this solution, which involved the subjection of 650,000 Germans to French rule, was rejected by her Allies, who would not even restore the French frontier of 1814 in this region. But they conceded to her the Saar coal-mines in full ownership, and, not without some hesitation, agreed that for 15 years the Saar valley should be withdrawn from the control of Germany and placed under the League of Nations. At the end of that time the inhabitants were to decide between three alternatives—the *status quo*, union with France, union with Germany. If they voted for Germany, then France was to receive the price of the mines from Germany or from the Reparations Commission.

(*c*) The *Reparations Clauses* were also of special interest to France. Her representatives insisted passionately on "integral reparation," the assessment of the damage actually done by Germany and by her allies, and the exaction of the utmost farthing. How otherwise, they asked, could France escape bankruptcy? Many English and American experts were impressed by the exhaustion of Germany, the danger of driving her to desperation, the unwisdom of leaving her liability indeterminate for the many months which would pass before a complete bill for damages could be presented; and they pressed for taking in final quittance whatever sum (20 or 40 milliards of marks at most) Germany could be compelled to pay at once. The French view prevailed, but there was another battle over the categories of damage, and Mr. Wilson was persuaded only with great difficulty to admit that pensions and allowances to combatants and to their families came within the terms of his pre-Armistice conditions. There were further debates on the capacity of Germany to pay and on the sum for which she might conceivably be liable. In the end the extent both of her legal liability and of the sum to be actually paid was left for future definition. Germany was to pay 20 milliards of gold marks in cash and kind by May 1 1921; and out of this sum the Allies would pay for any foodstuffs or raw materials which they considered indispensable to Germany. Two further sums, each of 40 milliards, were to be exacted later, bringing the total to 100 milliards; but this, in the words of the treaty, was only "a first instalment." The final account would be presented by the Reparations Commission before May 1 1921, and would be paid off by degrees over a period of 30 years, with interest at 5 per cent. On Sept. 5 1919 the French Minister of Finance encouraged the Chamber to expect that 300 milliards might be extracted from Germany. In Jan. 1921 the European Allies agreed to exact one-third of this sum, payable with interest over 40 years, and supplemented by a tax of 12 per cent *ad valorem* on German exports. This was rejected by Germany, but at the end of April the Allies presented an ultimatum which was accepted.

(*d*) The delimitation of the western frontier of *Poland* was not effected without serious debates. France desired to treat Poland liberally. Great Britain was impressed with the risk of creating a new *Germania irredenta* to trouble the peace of eastern Europe. The experts were anxious that due weight should be given to Mr. Wilson's Thirteenth Point, which stipulated that Poland should have a free and secure access to the sea. Poland (supported by France) asked for full sovereignty over Danzig and the approaches to that city. But the population of Danzig was almost wholly German, and the frontier demanded by Poland would have left 2,000,000 Germans under Polish rule—a solution which Mr. Lloyd George considered inadmissible. Thanks to Mr. Lloyd George a compromise was at last arranged which left Danzig a free city under the protection of the League of Nations with a very exiguous degree of freedom. The Polish frontier, in this compromise, was still drawn with more regard to the economic interests of Poland than to the rights of nationalities. But, before the German treaty was signed, the frontier was again modified, and other changes were introduced, in deference to the expostulations of the German delegates; in particular it was determined that in Upper Silesia a plebiscite should be held.

(*e*) *Shantung* was demanded by the Japanese plenipotentiaries under the treaties which China had concluded with Japan in 1915, but which, according to the Chinese plenipotentiaries, had been extorted by *force majeure;* also under a secret agreement of 1917 with the European Allies, to which the United States had never adhered. For a long time Mr. Wilson resisted the Japanese claim, but he finally accepted (April 30 1919) a compromise which the Chinese regarded with so much disfavour that they declined to sign the German treaty. The Japanese were allowed to keep the town of Kiaochow with the adjacent district, and the right of exploiting the mines and the railways in the Shantung peninsula; but they gave an oral understanding that they would restore the sovereignty of the peninsula to China "as soon as possible." Mr. Wilson subsequently (Aug. 19) told a committee of the American Senate that he would have preferred a different solution. But the Japanese claim was pressed at a time when Italy seemed on the point of seceding from the Conference; and a second secession would have made it difficult to conclude any treaty with the Germans.

(*f*) The *Italian claims* to Austro-Hungarian territories were continually under discussion during April. They were primarily founded on the Treaty of London; but Sig. Orlando claimed Fiume also, taking his stand in this case on the right of self-determination which he otherwise repudiated. Mr. Wilson at first argued that the Treaty of London was incompatible with the principle, enunciated in the Fourteen Points, that "a readjustment of the frontiers of Italy should be effected along clearly recognizable lines of nationality" (Point Nine). But Sig. Orlando objected that Italy was not bound by this principle, against which he himself had twice protested in the Supreme War Council, when the terms of the German Armistice were under discussion. His protests had been overruled at that time, on the ground that they were irrelevant to the discussions with Germany; but he had reserved the right to dispute Point Nine, and he asserted this right to the fullest extent in April. On April 14 Mr. Wilson gave way to the extent of intimating that he would accept the northern (Brenner) frontier assigned to Italy by the Treaty of London, and would admit Italy's claim (based on the same treaty) to Lissa and Valona; but he required that Fiume, as the natural outlet for the trade of Yugoslavia and Austria, should be made a free city within the Yugoslav customs area, and he held that, as regarded Dalmatia, Italy ought to be content with guarantees for the rights of the Italian minorities living in that province. Subsequently he rejected a proposal, made by M. Clemenceau and Mr. Lloyd George, that Italy should be awarded Fiume in exchange for a renunciation of her treaty claims upon Dalmatia; on April 20 he declined to discuss the Adriatic problem any further; and on the 23rd he created a sensation by publishing a statement of the grounds on which he resisted the Italian pretensions. Next day Sig. Orlando left the Conference, and Baron Sonnino followed him within 24 hours. On April 29 the Italian Chamber, after hearing Orlando's account of the negotiations, reaffirmed his definition of the Italian claims by an overwhelming majority. On April 30 the German delegates arrived at Versailles and the Council of Four (now reduced to three) had to face the possibility that Italy would not sign the treaty; at this time was drafted the ratification clause which stipulates that the treaty shall come into force as soon as ratified by Germany and any *three* of the principal Powers. But on May 4 Orlando relented. He and his colleagues reached Paris on May 7, a day too late for the sixth plenary session which approved the draft treaty, but a few hours before the draft was handed to the Germans at Versailles. The Council had not surrendered to Italy on the Adriatic question, but it was left open for future discussion.

The Draft Treaty and the German Delegates.—Two considerable sections of the treaty, the Covenant of the League and the Labour Convention, had been finally approved on April 28 by the fifth plenary session without much debate; the chief feature of the proceedings was that Baron Makino and M. Bourgeois expressed regret that the commission had not seen fit to accept the Japanese and French amendments. The sixth plenary session (May 6), which was held in secret to approve the treaty as a whole, revealed more serious differences. The Chinese protested against the Shantung clauses, the Portuguese against the African settlement, and Marshal Foch argued that the military guarantees for the submission of Germany were inadequate. His objection was met, to a certain extent, by the announcement, on May 7, that the United States and Great Britain were prepared to sign treaties with France, guaranteeing her against German aggression. But the session of May 6 was remarkable for the strong undercurrent of dissatisfaction among the minor Powers "with special interests" (including the British Dominions) who felt that their views had not been sufficiently considered. On May 7 at the Trianon the Conference saw the draft treaty handed to Count Brockdorff-Rantzau, the principal German delegate, and heard him deliver, without rising from his chair, a sharp attack upon their dilatory methods. He stated that, in the past six months, the blockade had been responsible for hundreds of thousands of deaths in Germany. "Think of that when you speak of guilt and punishment." He and his countrymen accepted the liabilities to which they were committed by the Armistice and Mr. Wilson's terms. They were prepared to play their part in restoring Belgium and the devastated areas of France. But he intimated that Germany did not hope for a just peace. "We are under no illusions as to the extent of our defeat and the degree of our helplessness; . . we know the power of the hatred that we encounter here."

Fifteen days were allowed the Germans for preparing their reply, but the term of grace was eventually extended to May 29. The German delegates, to expedite the negotiations, transmitted their criticisms by instalments, each dealing with one topic (League of Nations, Labour Charter, Saar Valley, etc.); in some cases they tendered several notes successively on the same subject. The Supreme Council had arranged that these notes should be considered by 13 committees, each of which was specially responsible for one section of the treaty, and interim replies were returned to the Germans very promptly. Consequently much of the disputed ground had been covered in preliminary correspondence before the German counter-proposals were presented as a whole; and M. Clemenceau was able to dispatch the reply of the Allies on June 16. Both documents were polemical in character. The Germans, besides criticising many particular articles of the draft treaty, argued that its general tenor was inconsistent with the terms of the pre-Armistice agreement; and the Allies repudiated this imputation with some heat. The main criticisms of the Germans are noted below. Their counter-proposals were numerous, and only the more striking can be given here: (*a*) *Reparation.*—They offered to pay a sum not exceeding 100 milliards of gold marks, partly in gold but mainly in commodities and services; but they claimed the right of appeal from the assessment of the Reparations Committee to a neutral arbitrator. They would pay the first 20 milliards by May 1 1926; but they claimed credit for all war material surrendered under the Armistice conditions, for state railways and state property ceded along with Alsace-Lorraine and the colonies, and for the share of the German public debts which, as they maintained, these territories ought to bear. No definite period was fixed for the payment of the remaining 80 milliards, though it was stated that Germany would allocate to this purpose annually a sum equal to the average *net* peace budget of the empire before the war and it was stipulated that no interest should be paid. (*b*) *Territorial.*—They demanded a plebiscite in Alsace-Lorraine which should give the inhabitants an option between union with France, union with Germany and complete independence. In lieu of the Saar valley they offered to France fixed annual supplies of coal, pending the reconstruction of the French mines. In lieu of ceding West Poland, Danzig and Memel they offered to make Danzig, Königsberg and Memel free ports (under German sovereignty). They demanded that Germany's claim to keep her colonies should be referred to arbitration. (*c*) *Commercial.*—They offered to the Allies "most favoured nation" treatment in German markets for a restricted number of years, upon condition of complete reciprocity; and "national" treatment to Allied goods passing over German railways (without a time limit) on the same condition. (*d*) *League of Nations.*—They offered to negotiate on this subject, taking the Allies' draft covenant as a basis. But, as conditions precedent to negotiation, they demanded that Germany should be admitted immediately to the League; that members of the League should be pledged to abstain from waging economic war; that the Allied Powers should, within two years, abolish compulsory military service and themselves disarm. (*e*) *Occupied Territory.*—They proposed that the armies of occupation should be withdrawn within six months after the signing of the treaty.

These proposals constituted a manifesto addressed to the public outside the Conference; but in some particulars they agreed with proposals which had been forcibly argued in the inmost circles of the plenipotentiaries. M. Tardieu and Mr. Wilson Harris have both stated, apparently on good authority, that the idea of mitigating the treaty in essential details was before the Supreme Council at various dates from May 23 to June 13, and that one reason for these discussions was a doubt whether the treaty, as it stood, could be enforced on a recalcitrant Germany. Mr. Lloyd George was now the spokesman of the critics; among these were counted the leading members of his Ministry, who, together with Dominion representatives, had been summoned to a special meeting at Paris on June 1. He protested against the idea of maintaining a large army of occupation for a considerable time. He was now (for a short while at least) in favour of a fixed indemnity; he advocated revision of the Polish frontier and the early admission of Germany to the League of Nations. But it was hardly possible to rewrite the treaty at this stage; the dangers of further delay were too serious to be lightly accepted. On June 13 the movement for revision came to an end. Its only consequences were some concessions on secondary points. On Reparation and Military Occupation the Allies stood by their original draft. They conceded some slight changes in the Polish frontier with the object of bringing it "into closer harmony with the ethnographic division." They agreed to a plebiscite in Upper Silesia. They intimated that they were opening negotiations at once for an eventual reduction of their own armaments. They withdrew a provision for internationalizing the Kiel canal. They promised that Germany, if she complied with the terms of the treaty, should be admitted to the League of Nations "in the early future." They invited Germany to offer, within four months of the signing of the treaty, a lump sum in settlement of the whole bill for reparation, but this suggestion was not accepted.

Signing of the Treaties of Versailles, June 28.—All arrangements had been made for a general advance of the Armies of Occupation in case the German Government refused to sign the treaty, and there were a few days of suspense while Count Brockdorff-Rantzau was conferring with his colleagues at Weimar. On June 20 the Scheidemann Cabinet resigned, ostensibly because it would not consent to sign, but actually from a well-founded consciousness that it no longer commanded the confidence of the German Labour party. On June 21 a new Premier, Herr Bauer, offered to sign on conditions: he stated that the articles requiring the surrender of war criminals and those declaring Germany to be the sole author of the war must be omitted. He was told that conditions could not be accepted, and on June 22 obtained the leave of the Weimar National Assembly to sign unconditionally. Formal assurances to this effect were given on June 23 at Versailles, through Herr Haimhausen who, on the previous day, had succeeded Brockdorff-Rantzau as head of the German delegation. During the last days of suspense the German warships interned at Scapa Flow were sunk by their commanders, acting, it was stated, on orders from the German Admiralty (June 21).

The new German Minister for Foreign Affairs, Herr Hermann Müller, and his colleague Dr. Bell signed the treaty on June 28 in the Salle des Glaces at Versailles in the presence of all the plenipotentiaries, except those of China, who absented themselves to emphasize their protest of May 6 against the Shantung articles. Before and after this ceremony several subsidiary treaties were signed: (*a*) Defensive treaties with France, by Great Britain and the United States, undertaking to defend France against unprovoked aggression. The British treaty was ratified by Great Britain on Nov. 20 1919, but it was not to become binding until the American treaty should be ratified;

and since American ratification was subsequently refused (*see* UNITED STATES: *History*), the British treaty became a dead letter. (*b*) A protocol defining certain ambiguous conditions in the German treaty. (*c*) An agreement between the United States, Belgium, the British Empire, France and Germany, which defines the nature of the military occupation of the Rhineland. (*d*) The Polish minorities treaty by which Poland contracts with the Allies and with Germany to respect the civil and political rights of racial and religious minorities within her jurisdiction. The idea of imposing such a treaty was first laid before the Conference by Jewish associations, whose fears were excited by the reports of Polish pogroms in the winter of 1918–9; but it was also of great importance for the protection of German and other non-Polish minorities. Similar treaties were afterwards concluded by the principal Powers with Czechoslovakia, with Rumania and with Yugoslavia. The main Treaty of Versailles was ratified by President Ebert, on behalf of Germany, on July 10; by the King of Italy, by King George V. and by President Poincaré in Oct. 1919. But it was not till Jan. 10 1920, when Germany at last signed a protocol agreeing to give compensation for the ships which had been scuttled at Scapa Flow, that the final exchange of ratifications took place at Paris, and the state of war between the European Allies (but not the United States) and Germany was formally terminated.

Treaty of Versailles—Territorial Terms.—Germany surrenders Alsace and Lorraine to France, free and quit of all public debts (Arts. 51, 55), and accepts the arrangements regarding the Saar basin which have been described above (Art. 45–50). Luxemburg ceases to form part of the German *Zollverein*, and Germany renounces all rights over the railways in Luxemburg (Art. 40). Belgium receives Moresnet *neutre* and part of Prussian Moresnet (Arts. 32, 33); also Eupen and Malmedy (Art. 34) subject to the result of a plebiscite, which was held in Sept. 1920 and resulted in the final reunion of these districts to Belgium, by whom they had been continuously claimed since 1815. These acquisitions give Belgium some valuable forests and railway stations and a population of about 70,000 souls. The frontier between Germany and Denmark is to be settled in accordance with the wishes of the population (Art. 109); these were ascertained by plebiscites held in North Schleswig (Feb. 10 1920) and in Central Schleswig (March 14 1920) when the former district voted for reunion with Denmark and the latter voted for Germany. Under Art. 87 Germany recognizes the complete independence of Poland and surrenders Danzig together with the territories received by Prussia under the partitions of Poland (Posnania, W. Prussia) and part of Middle Silesia; in 1910 these districts had a population of 2,931,000 souls of whom 1,087,000 were Germans. Article 88 provides for the plebiscite in Upper Silesia which had been conceded on June 16 1919; the voting (March 21 1921) seemed to prove that this clause was a concession of substance, and the subsequent award of the League of Nations (Oct. 1921), in favour of Poland, was correspondingly disappointing to Germany. By Arts. 94 and 96 plebiscites are ordered for the Masurenland region of East Prussia, and the West Prussian *Kreise* of Stuhm, Marienburg, Marienwerder and Rosenberg; in July 1920 both plebiscites produced substantial majorities for Germany. By Art. 99 Memel with the adjacent territory (total pop. 122,000 souls) is detached from East Prussia and put at the disposal of the principal Powers, who intended that Memel should be the port of Lithuania but had not, up to May 1921, given effect to that intention. Article 100 similarly assigns Danzig (pop. 200,000) to the principal Powers, who (in accordance with this Article) have recognized Danzig as a free city with an elected legislature under a high commissioner appointed by the League of Nations. But Poland will control the Vistula and the main railways within the territory of Danzig, and will be responsible for the foreign relations of the city, which is also to be brought within the Polish customs area (Art. 104).

Under Art. 156 Germany abandons to Japan her rights in the Shantung peninsula; she also renounces her concessions in Hankow and Tientsin (Art. 132), her privileges in Egypt under the Capitulations (Art. 147) and all her treaty rights in Morocco (Art. 141). By Art. 119 she renounces in favour of the principal Powers all her overseas possessions. These, in accordance with Art. 22 of the Covenant of the League of Nations, will be administered by mandatories of the League. The Supreme Council made, on May 6 1919, a provisional distribution of mandates for the German colonies. German E. Africa was allotted to Great Britain, by whom it was renamed Kenya Colony (July 8 1920); but on May 30 1919, Great Britain resigned the districts of Urundi and Ruanda, which border on the Belgian Congo, to be held by Belgium under a separate mandate. German S.W. Africa went to the Dominion of South Africa. France and Great Britain received a joint mandate for Togoland and Cameroon, with permission to delimit their respective jurisdictions by mutual agreement. German New Guinea was entrusted to Australia, German Samoa to New Zealand, the island of Nauru (a rich source of phosphates) to Great Britain, the German islands in the North Pacific to Japan. But the United States subsequently announced (Feb. 21 1921) that Mr. Wilson did not agree to the island of Yap, an important cable station, being included in the Japanese mandate, and this question was one of the matters considered at the Washington Conference. (*See* WASHINGTON CONFERENCE.)

Treaty of Versailles—Reparations and Financial and Commercial Terms.—The articles of the treaty which define the sums to be paid by Germany have been epitomized above. The annexes to the Reparations section specify some of the payments in kind which Germany is to make immediately on account of reparation: (*a*) She is to surrender all her merchant ships of 1,600 tons gross and upward; one-half of her merchant ships between 1,600 and 1,000 tons gross; also one-quarter of her fishing fleet and a proportion not exceeding one-fifth of her river craft. By Feb. 10 1920 she had surrendered vessels of over 1,000 tons amounting to 1,824,828 tons gross. (*b*) She is to furnish live stock, machinery, equipment, tools and building materials for the reconstruction of devastated areas. (*c*) During the next 10 years she is to find annually 7,000,000 tons of coal for France, 8,000,000 tons for Belgium, and for Italy deliveries amounting on the average to 8,000,000 tons per annum. Also she is to make good the difference between the actual output of the French pits in the Nord and Pas de Calais and their pre-war average output. But, since May 1920, her total liability for coal has been reduced to 2,000,000 tons a month. According to the Conference note of June 16 1919, the Germans might terminate this system of payment in kind as soon as they pleased after May 1 1921. "If Germany raises the money required in her own way, the Reparations Commission cannot order that it shall be raised in some other way."

The Reparations Commission is a body appointed, under Art. 233, with the duties of estimating Germany's liabilities and her capacity to pay, of insisting on the due performance of her obligations to pay in gold and in kind, and of seeing that the German scheme of taxation "is fully as heavy proportionately as that of any of the Powers represented on the Commission." The Commission is to consist of seven delegates representing the principal Powers, Belgium and Yugoslavia; but no more than five of these may vote at any meeting. The United States, Great Britain, France and Italy have a vote on every occasion; Japan and Yugoslavia only vote when their special interests are concerned; Belgium votes when neither Japan nor Yugoslavia is entitled to do so. On certain questions the unanimous vote of the meeting is required to make the decision valid; as, for instance, on the question of cancelling the whole or any part of the debt or obligations of Germany. The powers assigned to the Commission were severely criticised at the Conference by the German delegates, who said that they were greater than those which any German emperor had ever possessed in Germany. It remained, however, to be seen how those powers would be utilized afterwards. The Commission has considerable powers under the other treaties, being made responsible, directly or indirectly, for the execution of the Reparations clauses in each; and it was conceivable that it might remain in existence for the next 42 years, or even longer.

The financial clauses provide that Germany shall pay the costs of the armies of occupation (Art. 249). They safeguard the right of the Allied and Associated Powers to dispose of enemy assets and property within their respective jurisdictions (Art. 252)—a clause of great importance since the German assets held by Great Britain exceeded £120,000,000 sterling, and those held by the United States exceeded $500,000,000. On the other hand, ceded German territories, other than Alsace-Lorraine and the German colonies, are to be burdened with a due proportion of the German pre-war debt (Arts. 254, 255, 257). Germany transfers to the Allies any claims she may have to payment or repayment by Austria, Hungary, Bulgaria and Turkey (Art. 261).

The most striking feature of the commercial terms is that they impose on Germany a number of unilateral obligations for limited periods of time. For five years she must grant "most favoured nation" treatment to the Allies, in respect of both her imports and her exports (Arts. 264–7). For five years goods imported into Germany from Alsace-Lorraine, up to the average quantities of the years 1911–3, are to be free from German import duties; and imports from the ex-German provinces of Poland are similarly privileged for three years (Art. 268). The Allies may impose a special customs regime on the occupied territories "to safeguard the economic interests of the population" (Art. 270). For three years Germany may not raise the import duties on certain commodities (chiefly produced by Belgium and Italy) above the lowest rates to which these commodities were liable before July 31 1914 (Art. 269).

Treaty of Versailles—Military, Naval and Air Clauses.—Germany is required to abolish universal compulsory military service (Art. 173); her army is to be reduced, by a fixed date—which was originally March 31 1920, but subsequently altered to Jan. 1 1921—to a maximum total of 100,000 officers and men (Art. 160). The great general staff and all similar organizations are to be dissolved (*ib.*), and associations of all kinds are forbidden to instruct or exercise their members in the use of arms (Art. 177). The standing army is to be composed of volunteers recruited on a long-service system (Arts. 173–5). The stock of arms, munitions and military equipment which Germany may provide for this army is strictly limited; and the manufacture of such materials may only be carried out in factories approved by the Allies (Art. 168). All such materials in excess of Germany's legitimate requirements are to be surrendered within two months after the treaty comes into force (Art. 169). Germany is required to destroy all fortifications on the right bank of the Rhine within a distance of 50 km. from the river, and in the whole of her territory on the left bank (Art. 180). The size of her navy is defined; she may not keep more than 6 battleships, 6 light cruisers, 12 destroyers and 12 torpedo-boats; no submarines are allowed (Art. 181). She is to surrender 8 battleships, 8 light cruisers, 42 destroyers and 50 torpedo-boats (Art. 185), all her submarines (Art. 188), all military and naval aeroplanes and dirigibles (Art. 202). Warships and submarines still under construction are to be broken up. Germany's air forces are to be entirely disbanded by Oct. 1 1919 (Art. 199). The personnel of her navy, including officers, is not to exceed 15,000, and is to be recruited on a long-service system (Arts. 183, 194). The execution of these terms will be supervised by inter-Allied Commissions of Control armed with full powers of inspection and investigation (Arts. 203–210).

Criticisms of the Treaty.—One of the earliest critics was Gen. Smuts, who signed the treaty on behalf of South Africa, and on the same day issued a statement in which he spoke of "territorial settlements that will need revision" and "indemnities stipulated which cannot be exacted without grave injury to the industrial revival of Europe." He said that he had signed "because the real work of making peace will only begin after this Treaty has been signed." Mr. J. M. Keynes, till June 10 the chief finance expert of the British delegation, has argued (in his book on *Economic Consequences of the Peace*, published in Nov. 1919) that the claims of the Allies to reparation have been unjustifiably inflated by claims for separation allowances and pensions to the families of combatants, and for pensions and for compensation money paid to the wounded and disabled; and that the demands made on Germany are out of all relation to her capacity to pay. These points are naturally taken in the German counter-proposals of May 29, which accuse the Allies of desiring to fasten "a system of slave labour" upon Germany. "If," says this document, "they impose upon Germany a debt which robs her of every possibility of a future; if as a consequence every improvement of Germany's economic condition, which the German people might achieve by tireless diligence and Spartan thrift, would lead simply to this, that even greater payments for the discharge of this debt would be imposed upon us, then any delight in creative work, any spirit of initiative, would perish for all time in Germany." The experience of 1920 and 1921 showed that this prophecy was overdrawn, but it has suggested to more recent critics the reflection that the Allies might have obtained more, if they had demanded less. Experience has also shown the unreality of the terrifying picture which the Germans, and also Mr. Keynes, presented of the Reparations Commission as a despotic tribunal created "to exploit the labour of the German people for the benefit of the creditor states." Another subject which frequently recurs in the German note is that of the treatment accorded to German private property in the dominions of the Allies, in Alsace-Lorraine and in the German colonies. They objected to the general policy of liquidation and of referring the expropriated persons to the German Government for compensation. They argued that, by international law, private property ought to have been respected even during the war. They complained that the Allies reserved the right to liquidate German property in their own territories for an indefinite period after the war. They pointed out that Germany could only compensate the sufferers by printing more and more paper money, in which case "Germany with her currency constantly depreciating would be forced to flood the world market with goods at ridiculously low prices." But the greatest emphasis of all is laid on the complaint that the Allies, by the terms of their treaty, are violating the "innate rights of nation." The right of sovereignty is said to be infringed by the powers of the Reparations Commission and of the International Commission appointed to control the navigation of the Elbe, the Oder, the Niemen, the Rhine and the Upper Danube. The seizure of her colonies is represented as meaning that Germany is denied "the right and the duty to coöperate in the joint task which devolves upon civilized mankind of exploring the world scientifically and of educating the backward races." It is further alleged that the right of self-determination has been consistently overridden in the territorial settlement, inasmuch as the fate of the Saar valley (for 15 years), of Alsace-Lorraine, of Danzig and Memel, has been settled without a plebiscite, and Austria is virtually forbidden to throw in her lot with Germany, however greatly the populations concerned desire this union. On the topic of self-determination the Allies showed themselves particularly sensitive in their reply of June 16 1919. This principle, as we have seen, had already caused them some embarrassment; they had not all interpreted it alike; and Mr. Wilson himself had reluctantly waived its application in certain cases which were complicated by economic or strategical considerations. On the other hand the Allies absolutely declined to discuss the categories of damage for which they were demanding reparation, and merely asserted that this part of the treaty had been drafted "with scrupulous regard to the correspondence leading up to the Armistice of Nov. 11 1918."

The Austrian Treaty Negotiations.—The drafting of the Austrian treaty was begun some time before the German treaty had been signed, and the Austrian delegates arrived at St. Germain-en-Laye on May 14 1919. But there were unexpected delays in completing the first draft, which could not be submitted to the seventh plenary session until May 29. Even then the military, financial and reparation terms and part of the political terms were reserved; and in this incomplete form the draft was handed (on June 2) to Dr. Renner, the principal Austrian delegate. On the same day the Serb-Croat-Slovene state (Yugoslavia) was formally recognized by France and Great Britain, who thus at length followed the example set by Mr. Wilson nearly four months before (Feb. 5). Even in its incomplete state the draft showed the great concessions which had been made, at Austria's expense, to Italy and to Czechoslovakia. By May 29 Mr. Wilson had withdrawn his opposition to the Italian claim (under the secret Treaty of London) for a frontier which touched the crest of the Brenner Pass and gave Italy 200,000 German subjects. The draft showed this frontier. It also showed that the 3,000,000 Germans living within the historic boundaries of Bohemia, Moravia and Slovakia were to be included in the Czechoslovak state. Against these arrangements the Austrian delegates protested in vain. They were more successful when they claimed the German districts of western Hungary as being not only German in sentiment but also economically indispensable to Austria ("the kitchen garden of Vienna") and her natural bulwark against unprovoked attacks from the side of Hungary. This claim was granted on July 20, perhaps the more readily because of the defiant attitude of Bela Kun, the leader of the Hungarian Bolsheviks, who was still in possession of Budapest. The Austrian delegates asked the permission of the Conference for a plebiscite in western Hungary, but were told that this formality was needless, the sympathies of the population being unmistakable. Nevertheless western Hungary was still in the hands of the Hungarian Government till the autumn of 1921. A smaller, but still valuable concession, was that which restored to Austria the important railway junction of Radkersburg, originally assigned to Yugoslavia. The draft ordered a plebiscite to be taken in the Klagenfurt basin, which was claimed on ethnological grounds by the Yugoslavs and had been forcibly occupied by Yugoslav troops. Though the administration of the basin was provisionally assigned to Austria, the Austrians appear to have assumed that the plebiscite would be so managed as to ensure the victory of their rivals at the polls; and they lodged some protests on this assumption, which in fact was falsified. When at last the plebiscite was held (Oct. 10 1920), it was found that the whole of the disputed area preferred to remain under Austrian rule.

In the course of the negotiations with the Austrian delegates it became clear that the principal Powers as a whole were far more leniently disposed to Austria than the form of the Austrian draft treaty appeared to suggest. The draft had been constructed on the same lines as the German treaty, and the effect of the Austrian reparation clauses was to convey an impression of greater severity than was in fact intended. As in the German treaty, so in the Austrian, the total sum to be demanded was left uncertain. Austria was required to pay, by May 1 1921, "a reasonable sum" which would be assessed by the Reparations Commission (Art. 181); and her remaining liability was to be defined by that body after that of Germany had been fixed (Art. 179). But, out of the "reasonable sum" to be paid in the first instance, the commission were to pay for any supplies of food and raw material which it deemed essential to Austria; and the Conference soon discovered that Austria was quite incapable of paying, either in gold or in kind, for the relief that she required and received. Austria was obliged to resign all claims to the merchant shipping owned by her nationals. She was required to find a quantity of live stock for the devastated areas of Italy, Yugoslavia and Rumania. But, in 1921, the Allies decided to waive all their outstanding claims against her on account of reparation. This act of grace makes it unnecessary to dwell upon the insistence with which the Supreme Council in 1919 emphasized their right to treat the new Austria—a state of 7,000,000 souls—as the legal heir to the liabilities of the Austrian Monarchy. The chief advantage which the principal Powers derived from this attitude was that of a legal title to dispose of the severed lands of the Austrian Monarchy. These lands the new Austria renounces (under Arts. 36, 47, 53, 59, 89 of the treaty) in favour of the beneficiaries appointed by the Conference. Similarly she renounces the interests of the old Austria outside Europe (Arts. 95–117).

Several concessions, other than those enumerated above, were notified to the Austrian delegates between June 2 and the date of signature. (1) The Supreme Council promised to support Austria's claim to membership of the League of Nations as soon as she possessed a responsible Government which had both the will and the power to fulfil its international obligations. This promise was fulfilled, and Austria was admitted to the League late in 1920 at a session held in Geneva. (2) The Council also conceded that the property of Austrian nationals in the former territories of the Dual Monarchy should not be liable to detention or confiscation by the Governments of those territories (Art. 267). (3) They sanctioned a temporary system (to last for five years) of preferential customs duties between Austria on the one side and Hungary and Czechoslovakia on the other (Art. 222). (4) They reduced from five to three years the period during which the new states could claim "most favoured nation" treatment in Austria without reciprocity (Art. 232).

The second draft of the treaty was handed to the Austrian delegates on July 20 and was practically complete. The Austrians presented their final observations on Aug. 6; the Supreme Council gave its final reply on Sept. 2. On Sept. 8 the Austrian National Assembly, while protesting against the terms, authorized its delegates to sign; and this ceremony took place at St. Germain-en-Laye on Sept. 10. But Rumania and Yugoslavia refused to sign because by doing so they would have pledged themselves to accept Minorities Treaties, similar in character and intention to that which Poland had signed at Versailles on June 28, under the terms of the German treaty. The argument which the principal Powers stated in defence of the Minorities Treaties was forcibly put by Mr. Wilson at the eighth plenary session (May 31). These Powers could not be expected to guarantee the independence and integrity of the new states, unless the latter would on their side guarantee equality of rights to the minorities, racial or religious, which, under the terms of the peace settlement, were being transferred from the allegiance of ex-enemy Governments. But this argument did not fit the case of Rumania or of Yugoslavia so completely as that of Poland or of Czechoslovakia. Rumania and Yugoslavia were old states, and (though greatly enlarged by the peace settlement) denied the right of the Conference to limit their sovereignty by special stipulations. They might have accepted minority treaties applying exclusively to new territories acquired under the peace settlement; but the Minorities Treaties presented for their signature applied indifferently to old and new territories alike. Eventually they were obliged to give way; but they did not sign the Austrian treaty and the Minorities Treaties until Dec. 10 1919, after receiving an ultimatum from the Conference. The final ratification of the Austrian treaty took place on July 16 1920.

Summary of Austrian Treaty.—The new Austria includes the provinces of N. Tirol and Vorarlberg, Salzburg, Carinthia, Styria (N. of the Drave), a strip of western Hungary and Upper and Lower Austria. The treaty reserves for future determination considerable sectors of the frontier on the E. and S.E., but the Klagenfurt plebiscite has settled the most important of the doubtful points in Austria's favour. Unlike Germany, Austria has been obliged to give explicit guarantees of the rights of her minorities; these guarantees may, however, be modified with the assent of a majority of the Council of the League of Nations (Arts. 62–9). Under the military clauses the Austrian army may not exceed a total of 30,000 officers and men, and is to be constituted and recruited by voluntary enlistment (Arts. 119, 120). Stocks of guns, munitions and equipment are restricted as in the German treaty, and surplus stocks are to be surrendered, and no air forces may be maintained. A special section of the Reparations Commission is constituted to assess and to collect the payments due from Austria (Art. 179); it is to include representatives of the United States, Great Britain, France, Italy, Greece, Poland, Rumania, Yugoslavia and Czechoslovakia; but the four first named Powers have two votes apiece, and thus constitute a majority. Besides the "reasonable sum" to be paid before May 1 1921 (Art. 181), Austria is required to hand over all merchant ships and fishing-boats owned by nationals of the former Austrian Monarchy, and up to 20% of her river fleet; also animals, machinery and equipment, up to the limits of her capacity, for the restoration of devastated territories. Immediate delivery is required of specified quantities of live stock for Serbia, Rumania and Italy. Austria is made liable for so much of the Austrian war debt as is held outside the boundaries of the Austro-Hungarian Monarchy; but she is not liable for war debt bonds which are held by other states, or by their nationals, within those boundaries (Art. 205). All transferred territories of the monarchy are to be liable for their fair share of the pre-war Austrian debt (Art. 203). Austria renounces all claims to the state property, including royal property, lying within the transferred territories; but the states acquiring such property will be debited, and Austria will be credited, with its value by the Reparations Commission (Art. 208). The commercial clauses are similar to those of the German treaty. In the clauses relating to ports, railways and rivers, it is provided that the old Danube commission shall be revived, and that the Upper Danube (from Ulm downwards) shall be controlled by a new commission on which Great Britain, France, Italy, Rumania and the riparian states will be represented (Arts. 301, 302). Austria is guaranteed free access by railway to the Adriatic through the territories and the ports which have been severed from the monarchy (Art. 311).

The Austrian treaty is supplemented by two special agreements which were signed at St. Germain-en-Laye on Sept. 10 1919. By the first of these Poland, Rumania, Yugoslavia and Czechoslovakia agree with the other Allied and Associated Powers to make separate payments, not exceeding in the aggregate 1,500,000,000 gold francs, as a contribution to the costs of liberating the territories which have been transferred to them from the monarchy. By the second Italy agrees to make a similar payment, in consideration of the provinces assigned to her. None of these payments was to be made before 1926.

The Bulgarian Treaty, Nov. 24 1919.—The Bulgarian delegates, headed by M. Theodoroff, the Prime Minister, arrived in Paris on July 26, but did not receive the draft treaty until Sept. 19. The terms were not altogether unexpected, for M. Theodoroff had lodged objections against some of them on Sept. 2. But five weeks elapsed before the formal observations of the delegates were presented to the Supreme Council (Oct. 24). The Bulgarians demurred to the terms of the territorial settlement, which were thought by critics on the side of the Allies to be too lenient; they also complained that Bulgaria was harshly treated in not being immediately admitted to the League of Nations. They protested that Bulgaria could not afford to abolish conscription and maintain an army of volunteers, even on the small scale prescribed by the draft treaty. The Supreme Council in their reply (Nov. 3) promised speedy admission to the League, but made no other concession of substance. Further remonstrances from the Bulgarians merely led M. Clemenceau to intimate (Nov. 5) that the treaty as it stood must be either accepted or rejected within ten days. By this time M. Theodoroff had resigned office. His party had been severely defeated at a general election held in Aug., and he shrank from the invidious responsibility of signing the treaty. A new Government was formed by the leader of the Agrarian party, M. Stambolisky; and, on Nov. 13, Bulgaria's acceptance of the inevitable was notified to the Supreme Council. The treaty was signed at Neuilly-sur-Seine on Nov. 27, M. Stambolisky acting as the sole signatory for Bulgaria.

The general principle of the territorial terms is to restore the frontiers of 1914; but Bulgaria cedes to the principal Powers the share of Thrace which had been left to her by the Treaty of Bucharest; the Powers undertake to provide (by arrangement with Greece) outlets for Bulgarian trade on the Aegean. Certain districts are transferred (for strategic reasons) from Bulgaria to Yugoslavia; the most important of these districts contains the town of Strumitza. It is stated that further transferences of territory to Yugoslavia were considered at the Conference, but were rejected on ethnological grounds as they would have affected districts in which the Bulgarian nationality preponderates. The reparation terms are more definite than those of the German and Austrian treaties. Bulgaria is required to pay 2,250,000,000 gold francs by half-yearly instalments extending over a period of 37 years. An inter-Allied commission of three members (representing France, Great Britain and Italy) will remain in Bulgaria to see that the reparation terms are duly honoured. This body will decide how the half-yearly payments are to be raised. It will prepare a list of the taxes and other revenues which are to be appropriated to reparation. If Bulgaria makes default in respect of any instalment, the commission may assume the duty of collecting the appropriated revenues. The commission may also recommend the Central Reparations Commission to give a time of grace for any particular instalment, or to reduce Bulgaria's liability. Such a recommendation will take effect if it is endorsed by a majority of the Reparations Commission. Bulgaria must provide, by way of restitution, specified quantities of live stock for the devastated areas in Greece, Rumania and Yugoslavia. She must also supply Yugoslavia with 50,000 tons of coal annually for five years. The maximum size of the Bulgarian army is fixed at 20,000 officers and men, raised by voluntary enlistment; but Bulgaria may maintain gendarmes, customs officials, forest guards and some other kinds of police and frontier guards (all armed with rifles) up to the number of 13,000. All Bulgarian war-vessels (including submarines) are to be surrendered or broken up, except four torpedo-boats and six motor-boats. No air forces may be maintained, no submarines may be built or otherwise acquired. The importation of arms and munitions is prohibited; only one munitions factory is permitted. No new fortifications may be constructed in Bulgaria.

The Hungarian Treaty, June 4 1920.—The Hungarian delegates did not appear in Paris until Jan. 7 1920, and over six months elapsed before the Treaty of the Trianon was signed. But the main features of this treaty had been settled long before the Peace Conference dissolved. Except in the territorial terms it was closely parallel to the Austrian treaty. The Supreme Council had informed Bela Kun on June 13 1919 what territories would be transferred to Czechoslovakia and Rumania; and on July 20 1919 the German districts of western Hungary were promised to Austria. But some time elapsed before Hungary acquired a Government which commanded the confidence of the Allies. Late in July 1919 Bela Kun was overthrown by the Rumanians, whom he had attacked on the line of the river Theiss. The Rumanians then occupied Budapest, and permitted the Archduke Joseph to assume the title of Administrator, with the support of a number of ex-officers (Aug. 6). The Archduke applied to the Supreme Council for recognition; but the Council insisted that he should resign, and that steps should be taken to form a coalition Government (Aug. 22). The Archduke then effaced himself, but his Premier, M. Friedrich, remained in office until the Rumanians evacuated Budapest in November. At last on Nov. 24 a coalition Government was formed under M. Huszar, and M. Friedrich joined the new Cabinet as Minister for War. M. Huszar was promptly recognized by the Supreme Council (Dec. 1), in spite of the fact that the strength of his position had not yet been tested by a general election. This, however, took place early in 1920 and produced a National Assembly whose sentiments were comparatively reasonable. The draft treaty was handed to the Hungarian delegates on Jan. 15 1920, a week before the termination of the Conference; the negotiations were left to be conducted by the Council of Ambassadors. On Feb. 12 the Hungarians presented counter-proposals and observations which were the reverse of conciliatory. They argued that the position of the Magyars in Hungary was an exact parallel to that of the Czechoslovaks in Bohemia, and asked why the principle of self-determination had been differently applied to the two cases. They asked that the Szeklers of E. Transylvania should be left under Hungarian rule; that all the territories which Hungary was required to surrender should remain within the Hungarian customs régime for a period of years; that no territories should be transferred without a plebiscite, or, alternatively, that better safeguards should be provided for the rights of Magyar minorities. These requests came too late for serious consideration. All the ambassadors would promise was that the League of Nations should be free to consider any minor rectifications of boundaries which the frontier commissions might recommend on ethnological or economic grounds. It is remarkable that this reply, which only involved small alterations in the draft treaty, was not transmitted until May 6. There was one Hungarian pretension with which the Allies dealt more promptly. The Huszar Government claimed that Hungary was still a monarchy, though the royal dignity was in suspense; it was no secret that many Hungarians still desired a Habsburg dynasty. But on Feb. 2 1920 Great Britain, France and Italy declared that a Habsburg restoration in Hungary would violate the fundamental principles of the peace settlement. The Hungarian royalists did not even then abandon all hope; the monarchical character of the constitution was reaffirmed by the Government on March 23. But since the signature of the Treaty of the Trianon the three states of Czechoslovakia, Yugoslavia and Rumania have combined in a "Little Entente" which avowedly exists to defeat any Hungarian project for a Habsburg restoration.

The only parts of the Hungarian treaty which call for comment are those which fix the future boundaries of Hungary and the allocation of the transferred provinces. On the N. the new frontier gives to Czechoslovakia the southern slopes of the Carpathians, mainly though not entirely populated by Slovaks. To provide Czechoslovakia with a frontage on the Danube and to secure the economic unity of the Carpathian territories, the frontier line has been so drawn as to place large Magyar populations under Czechoslovak rule. Similarly Rumania receives not only Transylvania, in the E. of which there is a compact Magyar (Szekler) minority, but also a broad strip of the Hungarian plain to the W., in which the chief towns are Magyar, in order that Transylvania's railway communications with the Danube may be adequately secured. The Banat, which is divided between Rumania and Yugoslavia, has a mixed population, predominantly Slav in the western and predominantly Rumanian in the eastern half of the province. The German element in the eastern Banat is considerable and would no doubt have preferred to remain under Hungarian rule. But the chief difficulty which the Conference experienced in dealing with the Banat was the adjustment of the conflicting claims of Yugoslavia and Rumania. For the Allies, in their secret treaty of Aug. 1916 with Rumania, had promised her the whole of the Banat, without regard to the historic claims of Serbia. At the Conference M. Bratianu pressed for the fulfilment of the secret treaty. He was met with the reply that Rumania herself had cancelled it by making peace with the Central Powers in May 1918; but he continued to reiterate his demands until the terms of the partition of the Banat were irrevocably settled by the Conference and announced to the world (June 13 1919). To this incident were due the Rumanian occupation of Budapest, the intrigue with the Archduke Joseph (which seems to have included a plan for the union of the Rumanian and Hungarian crowns) and the delay of Rumania in signing her Minorities Treaty.

Like Austria, Hungary is precluded from alienating her independence, except with the consent of the Council of the League of Nations (Art. 73). She is required to pay a reasonable sum, fixed by the Reparations Commission, before May 1 1921; her total liability will be fixed by the same body (Arts. 163, 165) and the balance is to be paid in half-yearly instalments over a period of 30 years, unless payment is respited or remitted by the Allies. She is to surrender all her merchant shipping, up to 20% of her river fleet, and an indefinite quantity of live stock (at the discretion of the Reparations Commission) for devastated countries.

The Adriatic Question.—When the Italian plenipotentiaries reappeared at Paris in May 1919 they were offered by the American delegation the so-called Tardieu Compromise, under which Fiume and its hinterland would have constituted an independent state for 15 years, and a plebiscite would afterwards have been taken to ascertain the views of the inhabitants. To this compromise, it is alleged, Sig. Orlando gave his consent; but the Yugoslav delegates insisted on unacceptable amendments, and the American attempt at mediation was dropped at that time. Subsequently the Italian poet D'Annunzio, at the head of a band of volunteers, occupied Fiume (Sept. 12) while fresh negotiations were in progress (at Washington) between Mr. Wilson and the Italian Government. In spite of this *coup d'état*, which was disavowed by Italy, the American negotiations continued; by Oct. 27 Italy had agreed that Fiume should be a free state under the protection of the League of Nations and had resigned her claims on Dalmatia, while Mr. Wilson was prepared to recognize Italy's sovereignty over the Pelagosa group, Lissa, Lussin, Unie and the port of Valona. The Adriatic position was then examined more minutely at Paris by M. Clemenceau, Sir Eyre Crowe and Mr. Polk. These three proposed that Italy should be offered a protectorate over the Dalmatian city of Zara, but that she should be asked to abandon her demands upon the isle of Lagosta and the eastern part of Istria, and also her proposal that the city of Fiume should be made independent of the free state of Fiume. The offer did not satisfy Sig. Nitti, who intimated that Italy, in default of a more acceptable scheme for a compromise, would take her stand on the secret Treaty of London. To this Mr. Lloyd George and M. Clemenceau replied that they too were willing in the last resort to abide by that treaty, but on Jan. 14 1920 they offered new terms which were distinctly more favourable to Italy than those of Dec. 9 1919. The new terms were drafted after Mr. Polk had left Paris for Washington, and were presented to Sig. Nitti before the U.S. Government had been consulted regarding them. Accordingly Mr. Lansing intimated, on Jan. 20, that Mr. Wilson could not admit the right of France and England to modify, on their own responsibility, the only terms of compromise to which an American representative had subscribed. The French and British Prime Ministers argued, in reply, that their new proposals were actually more favourable to Yugoslavia than those of Dec. 9, and were intended to save France and England from the necessity of honouring the Treaty of London, to which, as was notorious, Mr. Wilson had always objected. But on Feb. 10 Mr. Wilson stated precisely his objections to the terms of Jan. 14. They gave to Italy the whole of Istria and the prospect of a future protectorate over Fiume. They also provided for the partition of Albania between Yugoslavia, Italy and Greece. Mr. Wilson stated that he could not coöperate with the European Allies if they allowed the admitted principles of justice to be overborne "by the country possessing most endurance in pressing its demands." The upshot of the controversy was that Italy and Yugoslavia were left to settle their differences, if they could, by separate negotiations, with the proviso that they must not come to terms at the expense of Albania. It took some time to reach this consummation. But on Nov. 12 1920 Italy and Yugoslavia concluded the Treaty of Rapallo, and on Jan. 2 1921 D'Annunzio's garrison at Fiume surrendered to the Italian Government. Albania, thanks to Mr. Wilson's intervention, has established an independent Government and has been admitted (Dec. 17 1920) as a member of the League of Nations. The Adriatic question was thus provisionally settled, nearly a year after the close of the Conference, but still on lines which the Conference had suggested.

The Turkish Treaty.—The Turkish question was discussed at Paris in May and June 1919, but the drafting of the Turkish treaty was not seriously taken in hand until the London Conference of Feb. 1920. This delay was due partly to the hope (unhappily falsified) that the United States would join in the treaty; but also to difficulties arising out of the allocation of mandates for the non-Turkish portions of the Ottoman Empire. The twelfth of the Fourteen Points provided that these territories should receive "unmolested opportunity of autonomous development." Article 22 of the Treaty of Versailles indicated that some at least of them would be recognized as independent nations, under such mandatories as they were willing to accept. The principal claimants for these mandates were France and Great Britain, who in May 1916 had come to an understanding about their future spheres of influence (the Sykes-Picot agreement), on the basis that the French sphere should include Cilicia, Southern Armenia and Syria (with autonomy under French protection for Damascus, Aleppo, 'Urfa, Deir and Mosul); that Palestine should be an international territory; and that Haifa and Mesopotamia should be in the British sphere. But Greece claimed the whole of Turkish Thrace, Smyrna (which she occupied with the approval of the Supreme Council in May 1919) and the Aegean Is.; while Italy claimed the Dodecanese (of which she had retained possession at the end of the Libyan war in 1912) and a sphere of influence on the adjacent mainland. There were difficulties connected with all these claims. The most notorious conflict of interests was that between France and the Hejaz (over the Arab districts of Syria), which came to a head in March 1920 with the proclamation by a "Syrian National Congress" of an independent Syria (to include the Lebanon, Palestine and Mesopotamia) and of Faisal, the heir apparent of the Hejaz, as the king of this state; but there were also doubts as to the wisdom of allowing Greece to assume responsibility for Smyrna, and as to the possibility of reconciling the French and Italian claims with Mr. Wilson's promise to respect the political unity of the Turkish race. The future of Constantinople was long in doubt. At last on Feb. 16 1920 the Conference of London announced that it would remain the Turkish capital; but, a month later, the Allies informed the Turkish Nationalists that this concession was conditional on their good behaviour, and Constantinople was temporarily occupied by Allied troops under the command of Gen. Milne. On April 24 the Conference of San Remo gave mandates to France for Syria, Cilicia and the Lebanon; to Great Britain for Palestine and Mesopotamia; a mandate for Armenia was declined first by the League of Nations (April 27) and afterwards by the United States Senate (May 27). At last on May 11 the draft treaty was handed to the Turkish delegates at Sèvres. Its terms produced considerable excitement among the Nationalists, and it was necessary for the Allies to call upon the Greeks to make armed demonstrations both in Asia Minor and in Thrace. But at the Conference of Spa (July) the last touches were put to the treaty and on Aug. 10 it was duly signed by the Turkish delegates.

Under the treaty Constantinople is left to the Sultan, with the proviso that it may be forfeited if Turkey violates the terms of settlement, especially those by which she guarantees the rights of minorities in her territory. In accordance with the Fourteen Points the Straits are neutralized and placed under the control of an international commission. Smyrna, with about half its *vilayet*, is left under Turkish sovereignty, but this sovereignty will be exercised by the Greek Government, and Smyrna may be incorporated in the Greek customs area. There is to be a local legislature, which may, if it so desires, petition the League of Nations (within five years) for the incorporation of Smyrna in the Greek kingdom. Greece also receives, in full sovereignty, Thrace outside the zone of the Straits, Imbros, Tenedos, Lemnos, Samothrace, Mytilene, Chios, Samos and Nikaria. But she may not fortify the first five of these islands (owing to their proximity to the Straits); and she engages to sign a minorities treaty. Armenia is declared a free and independent state; the boundary between Turkey and Armenia is to be referred to the arbitration of the President of the United States. Syria, Mesopotamia and Palestine are recognized as independent states; their boundaries will be fixed by the principal Powers, and they are to be administered by mandatories, on terms formulated by the principal Powers and submitted to the Council of the League of Nations for approval. The Hejaz is recognized as a free and independent state. Turkey cedes to Italy the islands of Astropalia, Casso, Scarpanto, Rhodes, the Dodecanese and Castelloryzo. The British protectorate over Egypt and the British annexation of Cyprus are confirmed. The chief feature of the military clauses is the proviso that Turkey may maintain no military forces except the Sultan's bodyguard, and gendarmes and frontier guards not exceeding 50,000 in number. The Allies waive their claims for reparation. But Turkey is to pay the costs of the armies of occupation since the Armistice of Oct. 30 1918, and to compensate civilian nationals of the Allies for loss or damage suffered in the war through the action or negligence of the Turkish authorities.

BIBLIOGRAPHY.—All the treaties have been published by the Stationery Office. Supplementary documents are printed in the *History of the Peace Conference*, vols. i.–iii., ed. H. W. V. Temperley (1920–1), which also comments exhaustively on the German treaty, and gives an account of proceedings up to June 28 1919. Three more volumes are in preparation; these will deal with the remaining treaties. A few more documents will be found in the *American Journal of International Law* (and supplements) for 1919 and 1920. The German *Comments on the Conditions of Peace* of May 29 1919 is published (in English) by the Amer. Assoc. for International Conciliation (Oct. 1919); the *Reply of the Allied and Associated Powers*, of June 16 1919, is published by the Stationery Office: Cmd. 258 (1919). For the question of Fiume see documents published by "Adriaticus" in *La Question Adriatique* (1920), and the Stationery Office paper: *Correspondence relating to the Adriatic Question*, Cmd. 586 (1920). Of books describing or criticizing the Conference the following are useful: Sir M. Hankey, "Diplomacy by Conference" (*Proc. Brit. Inst. of International Affairs*, 1921); H. Wilson Harris, *The Peace in the Making* (1920); J. M. Keynes, *Economic Consequences of the Peace* (1919); C. H. Thompson, *The Peace Conference Day by Day* (1920). Of capital importance is the series of articles by M. André Tardieu in *L'Illustration* for 1920, reprinted in his book *La Paix* (1921). See also R. Lansing, *The Peace Negotiations* (1921) and *The Big Four and Others* (1921).

(H. W. C. D.)

PEARCE, CHARLES SPRAGUE (1851–1914), American painter (*see* 21.24), died in Paris, France, May 18 1914.

PEARS, SIR EDWIN (1835–1919), British lawyer and man of letters, was born at York March 18 1835, and educated privately and at the London University where he took first-class honours in Roman law and jurisprudence. He was called to the bar at Middle Temple in 1870 and for a time was private secretary to Frederick Temple, afterwards archbishop of Canterbury, and secretary to various associations connected with social work in London. In 1873 he settled in Constantinople, practising in the consular courts and becoming president of the European bar there. He acquired in this way an intimate knowledge of the East which he turned to account in 1876 when, as correspondent of *The Daily News*, he sent letters home describing Moslem atrocities in Bulgaria which aroused popular demonstrations in England led by W. E. Gladstone (*see* 12.71). He was knighted in 1909. His works include *The Fall of Constantinople, a Story of the Fourth Crusade* (1885); *The Destruction of the Greek Empire* (1903) and, his most distinguished book, *Turkey and its People* (1911) in which he displayed his expert knowledge of Byzantine Constantinople. He died Nov. 27 1919 at Malta as the result of an accident on his journey home from Constantinople.

PEARSE, PATRICK HENRY (1879–1916), Irish educationist, author, and Sinn Fein leader, was born in Dublin on Nov. 10 1879. His father was an Englishman, a sculptor and worker in stone, who was himself the author of a pamphlet on *England's Duty to Ireland as it appears to an Englishman*. It is likely that it was from his father Pearse derived his love of liberty; and from his mother, whose people came from county Meath, he drank in memories of '98 and of the Fenians. He was educated at the Christian Brothers schools and graduated before he was 24 at the Royal University of Ireland as a B.A. and B.L. His first serious work was when he became editor of the *Claidheamh Soluis*, the weekly organ of the Gaelic League. When engaged on this work he made a tour through Belgium to study bilingual methods, and edited several *Fiana* tales from Irish manuscripts. He was a hard worker on the *Coisde Gnotha* or Executive of the League, and secretary to its publication committee. He was more interested in education than in any other subject, and it is remarkable that he was in favour of accepting Mr. Birrell's Irish Council bill (*see* 14.788) in 1907, because it gave the Irish control over their own education. In this attitude he stood almost alone. His first book was a slender volume containing *Three Lectures on*

Gaelic Topics, published when he was only 19, dedicated to the New Ireland Literary Society (an ephemeral body which he himself had founded) by its President. This little book contained the germs of much later and better work, including a plea for enthusiasm, and a prophecy that the Gael would "become the saviour of idealism in modern intellectual and social life." In order to carry out his educational schemes he founded a school at Cullenswood, in Dublin, which prospered. The idea was to give an Irish education such as he assumed would be given in a free Ireland. Much stress was laid on the Irish language and on religion. In 1910 he removed this school to the Hermitage, Rathfarnham, a few miles out of Dublin, and continued to run it until his death. He travelled in America collecting money for his schemes, and on his return threw himself into the Irish Volunteer movement. He was high up in its councils, and led in the revolution of 1916, of which he was commander-in-chief. At the same time he proclaimed an Irish Republic. After a week's fighting in Dublin he saw that further resistance was useless, and ordered the Volunteers to lay down their arms. He and Thomas MacDonagh, who had formerly been one of his assistant masters at the Hermitage, and other leaders were tried by court-martial and shot soon after their surrender. Pearse was an excellent orator, with a fine resonant voice. He was a pious Catholic, of irreproachable life, a great lover of children and of nature.

After his death appeared *The Collected Works of Padraic H. Pearse* (3 vols. 1917), containing plays, poems and stories in Irish, and one volume of English writing. (D. Hy.)

PEARSON, SIR (CYRIL) ARTHUR (1866–1921), English newspaper proprietor and philanthropist, was born at Wookey, near Wells, Feb. 24 1866, and was educated at Winchester. He early founded the business of C. Arthur Pearson, Ltd., newspaper proprietors and publishers; and after having made large profits with *Pearson's Weekly* and other periodicals he founded in 1900 the *Daily Express*, a halfpenny rival to the *Daily Mail*, and in 1904 purchased the *Standard* (*see* 19.560, 561). He was a strong supporter of Mr. Chamberlain's tariff-reform movement. In 1910 increasing—later complete—failure of sight obliged him to retire from the active direction of newspapers. Henceforth he devoted himself and his fortune with whole-hearted industry to efforts to ameliorate the condition of the blind. During the World War he established at his house, St. Dunstan's, in Regent's Park, London, a hospital for blinded soldiers, and became chairman of the Blinded Soldiers and Sailors Care Committee (1914). He also became president of the National Institution for the Blind. He was created a baronet in 1916 and G.B.E. in the first gazette of the new Order of the British Empire in 1917. He died in London Dec. 9 1921. Having been eager to encourage those among the blind who cannot command attendance, he had made it his practice to have his bath unaided, but on this occasion he accidently slipped, was stunned by striking his head on a tap and suffocated while unconscious, his face under water.

PEARY, ROBERT EDWIN (1856–1920), American Arctic explorer (*see* 21.30), died in Washington, D.C., Feb. 20 1920. Because of his discovery of the North Pole (1909) he was promoted rear-admiral in 1911 and received by special Act the thanks of Congress. The same year he was U.S. delegate to the International Polar Commission in Rome. During his later years he was much interested in aerial navigation and delivered many addresses in which he urged coast patrol by aeroplanes. In 1913 he was made Grand Officer of the Legion of Honour (France). He was the author of *The North Pole* (1910) and *Secrets of Polar Travel* (1917).

PEEL, ARTHUR WELLESLEY PEEL, 1st Viscount (1829–1912), English statesman (*see* 21.39), died at Sandy, Beds., Oct. 24 1912.

He was succeeded by his son, William Robert Wellesley Peel, who in 1916 was chairman of the Committee on Detention of Neutral Vessels, in 1919 became Under-Secretary for War, and in 1921 Chancellor of the Duchy of Lancaster.

PEKING, China (*see* 21.61).—During the first decade of the new Chinese Republic, great improvements were made in the matter of the maintenance, lighting and sanitation of the principal thoroughfares of the capital; the police were reorganized on western lines, and instructed in traffic control; and, as the result of the introduction of metalled roads, the old-type mule cart was rapidly replaced by carriages, motor-cars and jinrikishas. Many of these changes were due to the initiative of Chu Chi-chien, Minister of the Interior in 1913.

The conditions of railway traffic between the city and the outside world were also greatly improved by the location of the *termini* of the Peking-Moukden and Peking-Hankow lines at the Chien Mên, the great southern gate of the Tatar city, which lies between the palace and the Temple of Heaven. The wall adjoining this gate has been pierced with new passages for general traffic and broad thoroughfares thrown open to the public in the Forbidden City.

A large number of buildings in foreign style have been erected for Government offices, banks and business premises. In spite of these changes, however, chiefly conspicuous in the official and business quarters in the vicinity of the legations, the general features of the scene which the traveller sees from the walls remain much the same as in former times, a vast enclosure within which the yellow-tiled roofs of palaces and temples emerge here and there above the trees; and in the less frequented parts of the city, notably the Manchu quarter, there is but little outward evidence of change. The poverty-stricken appearance which the Chien Mên district and other business centres presented as the result of the destruction wrought by the Boxers in 1900 has gradually disappeared.

The trade of the city remains local as of old, and generally unconcerned with industrial enterprise, but during the first ten years of the Republic the citizens of the capital were able to recover a considerable measure of comfortable prosperity, because of the freedom with which money was circulated by the various political and military parties.

New macadamized roads running from the city in several directions (to the western hills, to Tongshan and to Tungchow) are amongst the most conspicuous manifestations of the Peking municipal council's activities. The number of foreigners resident at the capital has increased considerably in recent years, and, although the city has not been opened by treaty to foreign trade, a number of business houses have been established with the tacit consent of the Chinese authorities.

See E. Backhouse and J. O. P. Bland, *Annals and Memoirs of the Court of Peking* (1913); D. Mennie and P. Weale, *The Pageant of Peking* (1921); P. H. Kent, *The Passing of the Manchus* (1912); J. O. P. Bland, *China, Japan and Korea* (1921).

PÉLISSIER, HARRY GABRIEL (1874–1913), English comedian, was born at Finchley in 1874. His father was a Frenchman living in England—a descendant of Marshal Pélissier—and his mother was English. In 1911 he married Fay Compton, the daughter of Edward Compton, the actor. He became an "entertainer" and author of musical sketches and organized a troupe known as "The Follies," who gained a very great success in a special *genre* of musical entertainment, half song, half witty parody, at the Apollo theatre, London. He died in London Sept. 25 1913.

PELLETAN, CHARLES CAMILLE (1846–1915), French politician and journalist (*see* 21.69), died June 4 1915.

PENLEY, WILLIAM SYDNEY (1852–1912), English actor (*see* 21.99), died at St. Leonards-on-Sea Nov. 11 1912.

PENNSYLVANIA (*see* 21.105).—During 1910–20 there was a great increase in the industrial developments of Pennsylvania, largely as a result of the World War. From 1914 until American participation in 1917, the Allied Governments expended many millions of dollars among the steel, ammunition and other establishments, bringing to the state a period of prosperity the extent of which was apparent when the Liberty Loans and war taxes disclosed the accumulated wealth. The state maintained its rank as the second state in population and in industry.

The pop. of the state in 1920 was 8,720,017, an increase of 1,054,906 over 1910. The rate of increase, 13·8%, was considerably lower than that of the preceding decade, 21·6%. In 1920 the pop. of the 15 largest cities of the state was: Philadelphia, 1,823,158; Pittsburgh, 588,193; Scranton, 137,783; Reading, 107,784; Erie, 93,372; Harrisburg, 75,917; Wilkes-Barre, 73,833; Allentown, 73,502; Johnstown, 67,327; Altoona, 60,331; Chester, 58,030; Lancaster, 53,150; Bethlehem, 50,358; York, 47,512; and McKeesport, 46,781.

Agriculture.—A decrease of nearly $100,000,000 in the value of crops from 1919 to 1920 was reported by the state department of agriculture, but the state's farms showed an improvement in production during the preceding decade. The contrast is shown in the following table:—

	1909	1920
Wheat	26,265,000 bus.	26,774,760 bus.
Indian Corn	48,800,000 "	65,755,660 "
Oats	25,948,000 "	44,858,325 "
Buckwheat	5,665,000 "	4,952,860 "

The depreciation in the value of crops from 1919 to 1920 was due in part to reduced acreage, but chiefly to the heavy decline in prices. The average farmer in 1920 lost $434.20 as a result of depreciation. The price of the average dairy cow during the year dropped from $96.75 to $75.50, the dairy industry alone depreciating $20,890,774. Sheep depreciated $3.75 a head, falling from $10.25 to $6.50, and the total loss to sheep-raisers was $4,000,000. Hogs declined from $30.90 to $16.15 and farm horses from $111 to $102. The potato production for the entire state for 1920 was 29,158,435 bushels. The state department of agriculture valued the total fruit production of 1920 (20,825,000 bus.) at $18,742,500.

Mineral Production.—The following table shows the figures of the coal and coke industry during 1910–8, in tons:—

	Bituminous	Anthracite	Coke
1910	148,770,858	83,683,994	23,722,944
1911	142,189,329	90,917,176	19,984,320
1912	160,830,492	84,426,869	24,682,474
1913	172,965,659	91,626,964	24,718,238
1914	145,884,530	91,189,641	17,164,124
1915	157,420,068	89,377,706	22,012,945
1916	169,123,814	87,680,198	26,428,926
1917	171,074,411	100,445,299	23,240,777
1918	177,217,294	99,445,794	27,157,373

During these years an average of 190,000 persons were engaged in mining bituminous coal and 170,000 in mining anthracite.

Manufactures.—In the absence of final industrial figures for the U.S. census of 1920, not yet available in Dec. 1921, comparisons between the industries of 1909, 1914 and 1919 must be drawn from U.S. census figures for the first two periods and the survey made by the state department of internal affairs for the latter. In 1914 Pennsylvania became the foremost state in the value of silk production, displacing New Jersey. Her 1914 production was valued at more than one-third of the total for the United States, and the state had more than two-fifths of all the employees in the industry. In 1909 226 silk-producing establishments, with 36,469 employees, had a production valued at $62,061,000. In 1914 284 establishments, with an average of 44,755 wage-earners, produced material valued at $86,938,554. In 1919 347 establishments, with 57,079 employees, produced material valued at $238,422,600. Pennsylvania was the leading state in 1914 in hosiery manufacture, reporting 39·7 % of the national quantity and 41·2 % of the national value. In 1909 464 establishments manufacturing hosiery, employing 38,206 hands, produced a value of $49,658,000; in 1914 498 establishments, with 41,130 employees, produced a value of $64,163,449; in 1919 328 establishments, with 35,400 employees, $130,167,800. In the iron and steel industry in 1909 66 blast furnaces, with 14,521 employees, yielded $168,578,000, and in 1914, 52 with 11,518 employees a product valued at $135,806,067. Notwithstanding the decrease the state in 1914 employed 39·2 % of all the wage-earners and produced 42·8 % of the total product of the country. Steel works and rolling mills in 1914 also showed a decrease from 1909. In 1909 189 establishments, with 126,911 employees, produced $500,344,000, and in 1914 178 establishments, with 131,955 employees, produced $488,106,324. In the manufacture of tin-plate, Pennsylvania in 1914 led the nation. Comparative figures show:—

	Establishments	Employees	Product
1909	17	2,346	$ 25,234,066
1914	13	2,368	36,795,990
1919	8	12,311	115,642,300

The state census of 1919, for all industries, shows a total of 20,888 establishments in the state divided as follows:—buildings and contracting, 2,895; chemicals and allied products, 768; clay, glass and stone, 583; clothing, 1,398; food and kindred products, 2,404; leather and rubber goods, 395; liquors and beverages, 453; lumber and its remanufacture, 1,114; paper and printing, 1,740; textiles, 1,024; laundries, 273; metals and metal products, 3,432; mines and quarries, 1,564; public service, 1,005; tobacco and its products, 709; and miscellaneous 1,131. The total average number of employees was 1,691,171 (167,562 salaried employees, 1,523,609 wage-earners); the total wages, $2,176,449,100, and the total value of products, $8,853,047,600. The highest valuation was placed on metals and metal products, $3,675,971,500, more than 40 % of the whole value of production. Employees in this industry numbered 508,311. Next was a product of $722,515,300 from the mining industries, which employed on an average 329,179 men in 1919. The textile industry maintained third place with 125,291 employees and a production valuation of $646,683,000. The figures from 1915–9 are as shown in the following table.

	Establishments	Average No. Wage-Earners	Value of Production
1915	22,359	1,503,188	$4,180,790,500
1916	20,961	1,735,543	6,419,410,000
1917	22,101	1,802,813	8,336,984,800
1918	21,158	1,827,101	9,403,306,600
1919	20,888	1,523,609	8,853,047,600

Education.—Two progressive steps a decade apart mark the development of the public schools. The first was the adoption of the School Code of May 18 1911; the second the enactment of what is known as the Finegan programme (named after the State Superintendent of Public Instruction) by the Legislature of 1921. The School Code of 1911 was virtually a codification of all the laws governing the public-school system and a general unification, with many new features, of administrative measures. Its most important sections provided for independent control of taxation and borrowing by school boards with minimum and maximum tax rates varying according to the size of the school district; reduction of the number of members in school boards so as to simplify official business; establishment of a State Board of Education; establishment of a state school fund, and general provisions for the better selection of text-books and for the development of higher education. The measures of 1921 (the Finegan programme) are as follows: (1) Providing that after Sept. 1 1927 those persons who enter the teaching service must show evidence of graduation from a state normal school or an equivalent education and training; (2) requiring fourth-class districts to maintain schools for 150 days in 1921–2 and 160 days in 1922–3; (3) increasing the qualifications of county superintendents by providing that no one except college-trained persons or normal-school graduates with certain school experience shall be qualified for the position; (4) increasing the salaries of all assistant county superintendents from $1,800 to $2,500 per year and giving most of the county superintendents an increase in salary of $500 or $1,000; (5) establishing a state-wide salary schedule for teachers, fixing the minimum at $1,200. In cities annual increments are required, and proportionately higher salaries are provided for high-school teachers; (6) increasing the state aid to schools for each biennial period from $24,000,000 to $36,000,000 and establishing a new basis of apportionment; (7) encouraging consolidation by providing that for each school closed the district shall be entitled to receive an annual allotment of $200; (8) making sufficient appropriations for normal schools so that they may be supported without tuition fees and providing a salary schedule for the faculties; (9) creating a State Council of Education to consist of nine business and professional men and women, replacing the State Board of Education and the college and university council; (10) standardizing the elementary courses in public and private schools and requiring that they be taught in the English language and from texts written in English; (11) strengthening the compulsory attendance laws.

Finance.—The revenues of the state more than doubled from 1909 to the end of 1920. The receipts in 1909 were $28,945,210; in 1920, $62,071,293.97. This does not include $11,800,000 derived from the sale of state road bonds, a fund kept separate from the regular state moneys. Governor Sproul recommended to the 1921 session of the state Legislature an increase of about 10 % in the tax on manufactures and a small tax on mined coal, a combination which would add more than $30,000,000 to the treasury annually. The treasury disbursements in the fiscal year 1920 were $74,960,112.20, the highest ever known. The total was $18,000,000 higher than in 1919, the increase being due to road construction. During the 1920 season approximately 410 m. of concrete state road were built, and 350 m. were under construction in 1921. In two years, 660 m. of 18-ft. concrete roadway, some of which had a brick wearing surface and some asphalt, were constructed by the state. In 1920 a total of 337 m. of macadam highway were resurfaced and 1,400 m. of highway had surface treatment. The maintenance force of the State Highway Department in March 1921 was keeping up 9,503 m. of roadway, of which 463 m. were in boroughs and on state-aid roads. The total resources in 1919 of all the banking institutions within the state, whether organized under national or state laws, were $4,529,919,000. Of these the state banks had resources in 1920 of $3,615,244,850, divided as follows: savings banks, $314,256,637; banks of deposit, $331,759,257; trust companies: banking resources, $1,380,919,028; trust funds, $1,578,424,021; trust funds in banks, $9,885,906.

Constitutional Changes.—The first two constitutional amendments of the decade ending 1920, adopted in 1911 and 1913 respectively, had to do with the courts, the one of 1911 increasing the number in Philadelphia county and merging those in Allegheny county, the one of 1913 altering the judicial and municipal terms to conform with an amendment of 1909 which changed the date of the elections from Feb. to November. Another amendment of 1913 enabled municipalities, except Philadelphia, to embark upon the construction or acquisition of waterworks, subways, etc., even though their cost brought the indebtedness above the limit allowed, and permitted arrangement whereby the interest and sinking-fund charges were paid from the principal until the properties should have been completed and in operation for one year. A limit of 10 % of the assessed valuation of taxable property in a municipality was fixed for such indebtedness, three-fifths of the electors of the municipality having first to give their assent to the increase. On Nov. 2 1915 the people voted on four proposed amendments and adopted three of them. The first and the most important prepared the way for workmen's compensation. The second enabled Philadelphia to increase its borrowing capacity under conditions similar to those set forth in the amendment of 1913. The third enabled the general assembly to enact laws providing a system of registering, transferring, insuring and guaranteeing land titles by the state or the counties. Amendments passed by the Legislature in 1915 and 1917 were approved by the voters in 1918, one enabling the state to issue bonds to the amount of $50,000,000 for the improvement of highways, and the other enlarging Philadelphia's borrowing capacity by removing the previous restrictions which confined its increased indebtedness to the construction or acquisition of waterworks, subways, etc. An amendment approved at the general election in 1920 enabled the assembly to levy "graded or progressive taxes." The result of these numerous amendments was manifest in the session of 1919, when a bill was passed authorizing the governor to appoint a commission to study the constitution with an eye either to general revision or to amendment by sections. This commission held public hearings during 1920 and prepared a report to be placed before the session of 1921.

Legislation.—The number of boards, commissions, etc., functioning under the state government was greatly increased between 1919 and 1920. The Legislature in 1911 created a Bureau of Professional Education under the State Department of Public Instruction, its purpose being to regulate the education of physicians, dentists and pharmacists. The same year a State Board of Education was created, composed of six members, to report and recommend legislation needed to increase the efficiency and usefulness of the public-school system, to equalize educational advantages in all sections of the state, to inspect schools supported in part or in whole by the state, to encourage vocational training, to improve sanitary conditions and to promote physical and moral welfare. A Bureau of Medical Education and Licensure, under the Department of Public Instruction, was also created by Act of 1911, to examine into conditions in the medical schools and conduct the examination of students applying for state licences. In 1911 the office of state fire marshal was created, with general powers of investigation over all fires in the state and means of fire prevention. Another important change of 1911 was the reorganization by legislative enactment of the State Highway Department and the undertaking of an extensive system of highways to be built and maintained entirely from state funds.

In 1913 the Department of Labor and Industry was created, with the power to enforce the "laws relating to the safety, health and prosperity of employees and the industries." Under it were formed the bureaus of Inspection, Hygiene and Engineering, Statistics and Information, Mediation and Arbitration, Employment, and also an Industrial Board. A Workmen's Compensation Board was created, the state was divided into districts and the administration of compensation carried on through referees and members of the board. A State Workmen's Insurance Board was created the same year for the purpose of administering the insurance fund provided in the Workmen's Compensation Act. In the meanwhile the Legislature in 1913 did away with the old State Railway Commission and substituted a Public Service Commission, with powers far greater than those of its predecessor, and having jurisdiction over "all railroad, canal, street railway, stage line, express, pipe line, ferry, common carriers," etc., companies "doing business within the state."

The year 1915 saw the reorganization of the Department of Agriculture with the creation of a Commission on Agriculture to appoint all officers and employees of the department and prepare the budgets of the department and of the State Live Stock Sanitary Board. Other new boards of that year were the one on vocational training under the Department of Public Instruction; the Board of Censors, upon all motion pictures; the Prison Labor Commission, to supervise the manufacturing industries of inmates of penal institutions; and the Veterinary Medical Examining Board. The Bureau of Municipalities under the Department of Labor and Industry was a development of 1917 intended to classify and make available statistics and other information tending to improve the government of municipalities. Five boards were created the same year: the State Military Board which has the power to grant pensions not exceeding $12 per month to widows or minor children of national guardsmen killed on active duty while under the direction of the governor; the Board of Pharmacy; the Board of Optometrical Education, Examination and Licensure; the Board of Commissioners on Uniform State Laws and the Public School Employees' Retirement Board. The Legislature of 1917 also created a Commission on Public Safety and Defense, to which was appropriated $2,000,000 and which functioned during the two years of American participation in the World War, partly independently and partly through the State Committee of Public Safety and Council of National Defense. The Commission on Public Safety and Defense was succeeded in 1919 by the Commission on Public Welfare, which received an appropriation of $500,000 to carry on the work of reconstruction, Americanization, and collection of the records of the state's part in the World War. The session of 1919 also created a Bureau of Statistics and Information under the State Department of Internal Affairs, transferred the Bureau of Municipalities from the Department of Labor and Industry to the Department of Internal Affairs, and created a Bureau of Rehabilitation under the Department of Labor and Industry. The year 1919 witnessed the adoption of two Federal amendments, Pennsylvania ratifying the prohibition amendment, as the forty-fifth state, on Feb. 25, and the woman suffrage amendment, as the seventh state, on June 24.

More recent governors were John K. Tener, Republican, 1911–5; Martin G. Brumbaugh, Republican, 1915–9; William C. Sproul, Republican, 1919–

War Period.—Pennsylvania sent 297,891 men into the U.S. army, of whom 53,419 were regulars, 21,350 national guardsmen, and 223,122 drafted. There were 31,063 Pennsylvanians in the navy, 16,872 of whom enlisted in the naval reserve, 13,772 in the regular navy, and 419 in the national naval volunteers. The state was represented by 5,422 men in the marine corps, making a total of 334,376 men and women in the national armed forces. In addition it had 1,600 Y.M.C.A. workers, 147 Knights of Columbus secretaries, and 129 welfare workers under the Society of Friends. In the army Pennsylvania suffered 35,042 casualties, of which 7,898 were deaths. Financially, 559,936 Pennsylvanians subscribed $315,834,950 to the First Liberty Loan; 881,207 subscribed $549,963,700 to the Second Loan; 2,026,973 subscribed $467,758,550 to the Third Loan; 2,349,252 subscribed $812,217,400 to the Fourth Loan; and 1,289,764 subscribed $564,173,200 to the Victory Loan, making a total of $2,709,947,800 for the five loans, a per capita of $312.92 as compared with the per capita throughout the United States of $232.31. The war taxes of the state were: 1917, $589,056,143.20; 1918, $446,811,191. The American Red Cross in its two campaigns in Pennsylvania raised $27,283,990.90 or 10% of the total for the whole country. The Red Cross membership in the state at the close of 1918 was 1,669,758 adults and 1,451,057 juniors, the latter being 86·12% of the school population. Pennsylvania gave approximately $3,000,000 to the war welfare work of the Knights of Columbus. The two Y.M.C.A. drives in the state netted $6,562,516.23.

More than 85,000 men and women were employed in the six Pennsylvania shipyards on the Delaware river in 1918. The Hog I. plant near Philadelphia built 110 cargo vessels of 7,500 dead-weight tons apiece and 12 transports of 8,000 tons. The Harriman yard at Bristol, of the Merchants' Shipbuilding Corp., built 32 cargo vessels of 9,000 tons apiece; William Cramp & Sons at Philadelphia built four tankers of 10,000 tons apiece and nine steel ships, all but one of which were of more than 9,000 tons. Likewise it launched 35 destroyers during the war period and 13 subsequently. The Chester yard of the Merchants' Shipbuilding Corp. built 28 cargo ships and tankers averaging 8,000 tons apiece and several small naval vessels. The Sun Shipbuilding Co. at Chester built 14 ships averaging 11,000 tons apiece and four cargo ships of 10,000 tons apiece. It also constructed nine minesweepers for the navy. The yard for wooden ships of the Traylor plant at Cornwells Heights built eight vessels of 3,500 tons each. The Federal Government spent $46,396,266.80 in housing war workers in the state, $23,021,000 being spent by the Emergency Fleet Corp. for shipbuilders, and $23,375,266.80 by the U.S. Housing Commission.

The Remington Arms Co. at Eddystone manufactured 1,181,908 rifles up to two days before the Armistice, or 47% of the American rifles supplied to troops at home and abroad. The Baldwin Locomotive Works at Philadelphia and Eddystone contracted for 470 steam locomotives for the U.S. Railroad Administration and nearly 4,000 steam locomotives for the A.E.F. and the Allies. The Aluminum Co. of America, at Pittsburgh, manufactured 3,385,955 meat cans for mess kits, or two-fifths of the total made in America. The Edward G. Budd Co., Philadelphia, pressed and stamped 1,150,775 steel helmets, while a total of 2,707,237 helmets were painted and assembled in the Ford Motor Co. plant in Philadelphia. The entire cannon-forging output of the country during the war was 8,440 before Armistice Day, and Pennsylvania's contribution was 2,960, or almost two-fifths. One of the three American powderbag loading plants was located at Tullytown, Pa.; it employed 7,000 persons and had reached a capacity of 40,000 bags a day at the date of the Armistice. The Pittsburgh Plate Glass Co. at Pittsburgh had a total output of 81,845 optical lenses when the end of the war caused a general cancellation of contracts. (A. E. McK.)

PENNSYLVANIA, UNIVERSITY OF (*see* 21.114).—In 1910 the Henry Phipps Institute for the study, treatment and prevention of tuberculosis was transferred to the university. In 1912 the college was divided into three separate departments—the college, the Towne scientific school, and the Wharton school of finance and commerce. In 1914 the school of education was established, with a four-year course leading to the degree of Bachelor of Science in Education; since then there has been held every spring at the university "Schoolmen's week," and teachers from all over the state assemble to take part in conferences and discussions. By a merger in 1916 the Medico-Chirurgical College of Philadelphia became an integral part of the university as its graduate school of medicine, and in 1918 another merger was effected with the Philadelphia Polyclinic and College for Graduates in Medicine. In 1917 a course in military science was established to qualify students for commissions as reserve officers. In 1920 the laboratory of hygiene and public health became the school of hygiene and public health.

During the decade 1910–20 there were many developments in the widening of the university's usefulness to the community through the establishment of extension schools. In 1920–1 the university had 964 officers of instruction, of whom 302 were in the college, and 213 in the department of medicine. The enrolment was 11,182 students, including 2,652 women, of whom 753 were in the college (arts and science); 29 in biology; 780 in the college course for teachers; 1,281 in the summer school; 638 in the Towne scientific school; 2,277 in the Wharton school of finance and commerce; 1,439 in the evening school of accounts and finance; 996 in the extension schools; 760 in the school of education; 218 in the school of fine arts; 657 in the graduate school; 191 in the law school; 433 in the medical school; 101 in the graduate school of medicine; 735 in the school of dentistry; 30 in the school of veterinary medicine, and 6 in the school of hygiene and public health (duplications, 142).

Beginning with 1920 the tuition fees were raised from $200 to $250 in the college, the Towne school, the Wharton school, in education, law, dentistry, and hygiene; from $200 to $300 in medicine; and from $100 to $150 in veterinary medicine. In 1920–1 the income from tuition fees was $1,425,000; the payment for "educational salaries" amounted to $1,425,000, and for other salaries and wages $678,000. In June 1920 the excess of the university's assets over its liabilities was $26,000,000, and the donations for the year were $278,000. The total value of real estate (including the university's buildings) was $11,486,000; and libraries, museums, apparatus and furniture were valued at $3,645,000. The university library, including numerous special collections, contained about 500,000 bound volumes and 50,000 pamphlets. A question of paramount importance concerning the future policy of the university was settled in 1921, when the trustees, in accordance with the overwhelming sentiment of the alumni, resolved that the university should continue as a private institution and not surrender its independence, as had been proposed, by becoming a state university with consequent supervision by the official representatives of the state Government.

In 1921 Gen. Leonard Wood (*q.v.*) was elected "head of the university under such appropriate title as may be hereafter agreed upon." Later in the year Gen. Wood was appointed governor-general of the Philippines, and was granted a year's leave of absence before assuming his duties at the university. During the World War 9,204 students and alumni of the university saw service, of whom 7,411 were in the army, 856 in the navy, 827 in auxiliary service, and 110 in the armies of America's Allies. Of these 212 died for their country's cause. (E. F. S.*)

PENSION (*see* 21.118).—The following summary shows the chief pension legislation in the United States during 1908–20. Legislation in Great Britain regarding pensions is described in the article following this: PENSIONS MINISTRY. An Act of March 4 1909 provided that under direction of the Commissioner of Pensions the expenses of last sickness and burial of deceased pensioners should be reimbursed. An Act of May 11 1912 granted $30 per month to honourably discharged men who had served 60 days or more in military or naval service during the Mexican War. An Act of Feb. 19 1913 granted $20 per month thereafter to survivors of Indian wars named in earlier Acts. An Act of March 3 1915 provided double pension in case of death of an officer or enlisted man of the navy or marine corps, or for disability of an enlisted man, resulting from an aviation accident. An Act of April 27 1916 granted a special pension of $10 per month for life to persons whose names are entered on the "Army or Navy Medal of Honor Roll." An Act of Aug. 29 1916 granted double pension for disability or death of a student-flyer of the navy or marine corps due to an aviation accident. This Act also repealed Section 4716 of the Revised Statutes, which made disloyalty in the Civil War a bar to a pension. An Act of Sept. 8 1916 granted $20 per month to the widow of a Civil War veteran who was his lawful wife during the period of his service, and the same rate to the widow of a veteran of the Civil War, Mexican War, and War of 1812, on reaching the age of 70 years. An Act of Oct. 6 1917 provided a payment of $25 per month thereafter for widows of officers or enlisted men of army, navy, or marine corps, who served in the Civil War, in the Spanish-American War or in the Philippine insurrection; this Act was amended June 25 1918 making existing pension laws inapplicable to persons in active service on Oct. 6 1917, or entering it thereafter, except in so far as rights under any such law had theretofore accrued. An Act of July 16 1918 granted widows of officers or enlisted men, volunteers and regulars, who served 90 days or more in the Spanish-American War, Philippine insurrection, or Chinese Boxer rebellion, if without means of support other than daily labour and an actual net income not exceeding $250 per year, $12 per month and $2 per month additional for each child under sixteen. In case of death or remarriage of the widow, the whole pension goes to any child or children under 16 years of age. An Act of Dec. 24 1919 provided that no one should draw both pension and compensation under war risk insurance (*see* below). The War Risk Insurance Act was made effective as of April 6 1917. An Act of May 1 1920 granted $50 per month from that date to persons on the roll because of Mexican War or Civil War service; and $72 to those so nearly blind or helpless as to require personal aid and attendance; also increasing rates of pension for certain permanent specific disabilities. This Act granted $30 per month to widows of men who served in the War of 1812 or the Mexican War, also to widows, married prior to June 27 1905, of men who served in the Civil War and to certain remarried widows, with $6 per month additional for each child under 16 years. In case of death or remarriage of widow, the whole pension goes to any child or children under 16 years. This Act also increased the pension to army nurses of the Civil War, and dependent parents of Civil War soldiers, to $30 per month. An Act of June 5 1920 granted pensions ranging from $12 to $30 to soldiers and sailors who served 90 days or more in the Spanish-American War, Philippine insurrection, or China Relief Expedition, under certain conditions as to service, the rate depending upon degree of disability or age attained; this Act also increased rates of pension for certain permanent specific disabilities.

The following table, furnished by the Commissioner of Pensions, shows the number of pensioners on the roll at the close of the fiscal year, June 30 1921, together with disbursements of pensions for that year:—

	Soldiers	Widows, etc.	Total	Disbursements
Civil War	218,775	281,327	500,102	$246,584,639.64
Spanish-American War	31,066	8,216	39,282	6,171,569.82
War of 1812	—	64	64	24,160.21
Mexican War	109	2,135	2,244	888,024.64
Indian Wars	3,784	2,569	6,353	1,565,862.41
Regular Establishment	13,832	4,081	17,913	3,456,191.45
World War	63	32	95	25,394.37
Total	267,629	298,424	566,053	$258,715,842.54

By an Act of May 22 1920 provision was made for the retirement of Civil Service employees and for payment to them of certain annuities based on amount of salary, length of service and age or disability. The annuity fund is created in part by the deduction of 2½% from the salaries of employees. The minimum annuity is $180 per year, the maximum $720. This law is administered by the Commissioner of Pensions. On June 30 1921 there were 6,471 annuitants on the roll, to whom had been paid $2,913,547.

War Risk Insurance.—Soon after the outbreak of the World War, at the request of the Secretary of the Treasury, there was created, Sept. 2 1914, a bureau of marine insurance, under the Treasury Department, for protecting American vessels and cargoes against loss or damage. After America entered the war further legislation, enacted June 12 1917, enlarged the scope of the marine bureau to make provision for insuring against loss of life or injury masters, officers, and crews of American vessels. Under date of Jan. 4 1919, seven weeks after the signing of the Armistice, right to application was withdrawn and no further insurance issued to seamen. From

June 12 1917 to June 30 1919, the end of a fiscal year, the number of policies issued was 6,150; net insurance written, $322,429,408; net premiums received, $842,348; losses paid, $124,724.

By Act of Oct. 6 1917 further amendment made provision for granting allowances by the Government to the families and dependents of all enlisted men. To secure this allowance the enlisted man was required to make an allotment from his pay. Two classes of allotment were established: A. compulsory allotment to a wife, child, or divorced wife awarded alimony; B. voluntary allotment to parent, sister, brother, grandchild, or grandparent. To these allotments the Government added allowances, not exceeding $50 per month, as follows. Under Class A. $15 per month was deducted from the enlisted man's pay and addition made by the Government to bring the monthly payment up to $30 for a wife; $40 for a wife and one child; $47.50 for a wife and two children; and $5 for each additional child. Under Class B. the Government added monthly $10 for one parent, $20 for two parents, and $5 for each dependent sister, brother, grandchild or grandparent. If a man, in addition to the compulsory allotment, desired an allowance under Class B. he was required to make an additional allotment of $5 per month. In case of no compulsory allotment, the voluntary allotment under Class B. was $15. Class A. took precedence, and, if the entire Government allowance of $50 was required for this, no payment was made under Class B. From Oct. 6 1917 to June 30 1920 requests for allotments and allowances numbered 1,666,607; during the same period 2,807,093 application blanks were returned without such requests. For the fiscal year ending June 30 1920 allotments paid beneficiaries amounted to $20,748,709; Government allowances, $32,819,927.

The Act of Oct. 6 1917 also provided compensation for death or disability of all persons in service, including women in the army and navy nursing corps, in line of duty. The recognized beneficiaries include a widow until remarriage, dependent widower, children under 18 years, and dependent mother or father. Death compensation allowed was as follows: widow, $25 per month; widow and one child, $35; widow and two children, $42.50; widow and three children, $47.50; widow and four children, $52.50, with no further allowance for additional children. If the deceased were a woman, $20 per month was granted for the first fatherless child, $10 in addition for the second, $10 in addition for the third, $5 in addition for the fourth, and $5 in addition for the fifth, with no further allowance for others. A mother or father was allowed $20 per month, and, if both were dependent, $15 each. The maximum death compensation was $75 per month. Compensation for disability depended upon its seriousness and duration. For a man totally disabled it was as follows: unencumbered, $30 per month; if he had a wife, $45; if he had a wife and one child, $55; $10 additional each for a second and third child, with no further allowance; and $10 additional for each dependent father or mother. At the close of the fiscal year, June 30 1920, compensation was being allowed on 42,945 death claims, and on 134,408 disability claims, the latter involving a monthly payment of $5,036,103. In the case of disabled persons provision was also made that the Government furnish free medical service and supplies, including artificial limbs so far as "reasonably necessary."

A novel feature of the Act of Oct. 6 1917 was the provision for granting insurance at peace-time rates to any person, man or woman, in active military or naval service. Such insurance was wholly voluntary, and could be taken out, in multiples of $500, for any amount from $1,000 to $10,000 inclusive, at a monthly premium rate varying from 63 cents per $1,000 at the age of 15 to $3.35 at the age of 65. All persons in service Dec. 14 1917 were given until April 12 1918 to apply for policies, and those entering later were given 120 days. Among the beneficiaries allowed were wife, husband, child, grandchild, sister, brother, stepbrother, stepsister, adopted brother or sister, parent, grandparent, and step-parent. A man's fiancée could not be named as beneficiary. This insurance was issued on the yearly renewal basis, to be continued as term insurance for five years after the proclamation of peace, when it would automatically expire. Privilege, however, was granted for converting this temporary insurance, in whole or in part, into one of the permanent forms of Government insurance, including ordinary life, 20-payment life, 30-payment life, 20-year endowment, 30-year endowment, and endowment maturing at the age of 62. Premiums on converted policies may be paid monthly, quarterly, semi-annually, or annually. In the case of monthly premiums, 31 days of grace are provided. If term insurance is allowed to lapse, reinstatement may be secured within 18 months after discharge from service or 12 months after lapse, but health of the applicant must be as good as it was at the time when the premium was first withheld. Never before was insurance on such a large scale undertaken. The cost of administration was assumed by the Government and not included in the computation of the premiums for term insurance. The hazards of war were ignored and peace-time terms offered, such as no commercial company could have undertaken. The inevitable loss to the Government was regarded as part of the cost of the war. All converted insurance was to be administered by the Government and not handled through commercial companies. At the time of the Armistice, Nov. 11 1918, there were on file 4,152,787 applications for insurance. Between Oct. 6 1917 and June 30 1920 there were filed 4,631,993 applications for term insurance, requesting a total insurance of $40,284,892,500, an average of about $8,697. On the last-mentioned date there had been issued 4,610,185 certificates for term insurance. The amount involved exceeded that in all commercial life insurance companies and fraternal organizations of the United States combined. About 98% of the enlisted personnel had taken advantage of this unprecedented opportunity. Every effort was made to induce policy-holders to convert their war-risk insurance into some form of permanent Government insurance, but by far the greater number allowed their policies to lapse. In 1921 all the activities concerning the welfare of ex-service men were consolidated in the Veterans' Bureau.

PENSIONS MINISTRY (Great Britain).—Before the World War the Admiralty and the War Office were responsible in the United Kingdom for the award and payment of service and disability pensions. The commissioners of the Royal Hospital, Chelsea, acted for the War Office in respect of pensions to warrant officers, N.C.O.'s and men. Pensions to privates and N.C.O.'s were paid quarterly by the regimental paymaster, those to officers and warrant officers by the paymaster-general. In the financial year 1913–4 there were in round numbers 60,000 service and 25,000 disability pensions for the army (men), and for the navy 33,000 and 7,700 respectively. The total annual cost to the State was £3,695,000. In the subsequent changes the disability pensioners were transferred to the new organizations, the service pensions remaining unaffected.

The first war alteration was made in Sept. 1914. A Central Army Pension Issue Office was set up and weekly instead of quarterly payment of pensions was authorized. Next, by the War Pensions Act 1915, the local war pensions committees were set up, under a statutory central committee "for the purpose of administering supplementary assistance in case of hardship and providing for the after-care of disabled officers and men." These committees were appointed under schemes of local authorities, more than half the membership being nominated by these authorities. The Ministry of Pensions was subsequently set up by the Act of Dec. 1916. This transferred to a minister responsible to Parliament the powers and duties of the Admiralty, the War Office, and the Chelsea Commissioners "in respect of the administration and payment of pensions and grants to officers and men, to their widows, children and dependents and to persons in the nursing service of the Naval and Military forces," the administration of service pensions being left with the service departments. It was provided that the powers and duties of the statutory committee above referred to should be continued under the control of the minister, who should communicate through it with the local committee. This arrangement proved unworkable, and in 1917 a new War Pensions Act dissolved the statutory committee and transferred its powers to the minister. A pensions appeal tribunal was set up. In 1919 a further Act conferred a statutory title to pension, subject to the conditions of the royal warrant. Previously it had been, in theory, only an act of grace. Independent statutory appeal tribunals were also appointed.

In the Ministry of Health Act (1919) provision was made for the transfer by order in council of " all or any of the powers and duties of the Ministry of Pensions with respect to the health of disabled officers and men after they have left the service" to the Minister of Health, at a date " not earlier than one year or later than three years after the termination of the present war." A further addition to the series of the Pension Acts was made in 1920, when an Act was passed providing that after the termination of the present war fresh cases were not to be transferred to the Ministry of Pensions, but were to remain, as in pre-war days, under the care of the War Office and Admiralty respectively, to whom the Air Ministry must now be added. Finally under the War Pensions bill of 1921, it was proposed that the large proportion of temporary awards should be converted into permanent awards, a right of appeal being granted to the pensioner. The period was to be within four years of his discharge from the service or after the first award of a pension to him. The administrative functions of the local war pensions committees were also to be limited and the numbers of these bodies reduced.

Award of Pensions.—Pension finance, generously revised at the outbreak of the World War, was reorganized from time to time in accordance with the changing type of recruits and the rise in the cost of living. The scales of 1917 and 1918 were again considered in 1919 by a select committee of the newly elected House of Commons, which settled the rates governing payments till 1923. The principle of payment is that of compensation for disablement attributable to or aggravated by war service. "Disablement" is assessed by purely medical opinion, in terms of a percentage reduction from the standard of a normal healthy man. The pension is on a flat rate graded from 20 % to 100 %; below 20 % only a lump sum is awarded payable usually in weekly allowances. Pensions are in the first instance awarded temporarily—usually for 12 months—and remain temporary till the disability has reached its final and stationary condition, when they are made permanent. The patient is subject to periodical medical examination during this time, and at each "board" his disability is reassessed for the next period. In addition the principle was laid down in 1917 that no account was to be taken of the earnings of disabled men. The "alternative pension" was also provided whereby a man might obtain a pension (within certain limits) running up to his full pre-war earnings, which by the Warrant of 1919 were further loaded up by 60 % on account of the increased cost of living. Widows, also, may choose alternative pensions (husband's earnings plus 60 %), and this right has been exercised in a large number of cases. The new pension scales were not to be subject to revision before April 1923.

The following figures may be quoted from the Warrant of 1919:—

(1) Totally disabled (privates):	
Man	40s.
(+ attendance allowance up to 20s. if helpless)	
Man and wife	50s.
Man, wife and one child	57s. 6d.
Man, wife and two children	63s. 6d.
For each additional child	6s.
(2) Widows:	
Childless	20s.
(+ 6s. 8d. if aged 40).	
With one child	36s. 8d.
With two children	44s. 2d.
For each additional child	6s.

Although the assessment of disablement is a purely medical matter, the question of entitlement (*i.e.* whether due to war service) is decided by medical and lay opinion combined. The claimant has an appeal against the assessment of a medical board to a medical appeal tribunal; he may similarly appeal against refusal of entitlement to one of eleven statutory pensions appeal tribunals set up under the 1919 Act. These are appointed by the Lord Chancellor and are independent of the Ministry of Pensions.

Constitution.—In 1918 the Ministry consisted of the following branches: (1) Finance (including pensions issue office); (2) awards (men); (3) awards (men's widows and dependents); (4) awards (officers and officers' widows and dependents, and medical treatment and training of officers); (5) local administration; (6) medical services; (7) vocational training; (8) artificial limbs; (9) surgical appliances; (10) chief inspector; (11) special grants committee. The only important change in these divisions has been in the case of vocational training, which in 1919 was transferred to the Ministry of Labour (save for convalescent centres associated with medical treatment).

In April 1919 a scheme of regional decentralization was begun, and during the following 12 months 11 regions were set up. Each is governed by a director, assisted by a commissioner of medical services, a regional administration officer, an awards officer, a finance officer, a registrar, and staff. These regional offices carry on (1) medical examination; (2) awards of pensions; (3) control of Ministry hospitals; (4) supervision of the local war pensions committees.

The Ministry itself, whose staff had numbered at its inception in 1917 2,296, expanded with its work to 5,754 in its first year, and in 1921 had reached 26,000, which included 8,000 hospital staff. (Of the male staff at this date 94 % were ex-service men.) The local war pensions committees then numbered 349, with nearly 1,000 subcommittees. They had 27,500 members and a paid staff of 6,200 in addition to many voluntary workers. Space precludes more than a mention of the special grants committee, the chief function of which is to make supplementary and special grants where need exists, under regulations approved by the Ministry of Pensions.

Duties.—The machinery was great, but the burden was gigantic. By 1917 (when the Ministry came into being) 262,000 pensions in all had been granted. The number was doubled in the following 12 months. The increase continued rapidly; at one time as many as 35,000 new awards were made in a week. The pressure was greatest in the first six months of 1919, when demobilization was at its height. It was estimated at the beginning of 1921 that the crest of the curve had been reached; cessation or reduction of temporary pensions had begun to balance new awards, and medical treatment to be commensurate with the demand.

The subjoined figures have been taken as exemplifying the business of State pensioning at its maximum. (The figures are approximate and are taken from the estimates for 1920–1.)

Cost of administration 1920–1, including medical services, and local war pensions committees	£5,000,000
Cost of local war pensions committees (administration)	£1,150,000
Money disbursed through local war pensions committees 1920–1 (recoverable advances, treatment allowances, etc.)	£20,000,000
Estimated total cost of pensions including medical services and administration expenses	£123,000,000

From these sums were treated or maintained, partially or wholly, both the World War and pre-war disability pensioners (the awards of these last by the Royal Warrant of 1917 had been levelled up to the corresponding war scale). The total number of awards had increased from 262,000 in 1917 to 1,849,000 at Dec. 31 1920, made up as follows:—

Disabled men	1,216,000
Widows	226,000
Dependents	384,000
Children	23,000

The pensions, temporary and permanent, actually in payment on Dec. 31 1920 were:—

Disabled men	1,180,000
Widows	169,000
Dependents	362,000
Children	16,900

In addition the following first awards of disability retired pay or pension had been made:—

Officers	56,487
Officers' widows	10,408
Officers' children	11,302
Officers' other dependents	7,077
Nurses	2,045
Nurses' dependents	22

In payment on Dec. 31 1920 (approx.):—

Officers	38,850
Officers' widows	9,700
Officers' children	9,100
Officers' other dependents	6,500
Nurses	1,458
Nurses' dependents	22

Including wives' allowances, and children's allowances the total number of beneficiaries was nearly 3,500,000.

Medical treatment was being carried on in 84 hospitals and convalescent centres and 150 clinics. The Ministry controlled 14,000 beds in its own institutions and 10,000 in civil institutions (*cf.* the whole voluntary hospital system of the country, which has not more than 40–50,000 beds). There were under treatment at any given time 158,000 cases. The cost of this, including allowances to men under treatment, in excess of pension, amounted to £16,000,000 per annum. The doctors directly employed were 464, the hospital staff numbered 7,600; in addition, for assessment purposes, there were 450 medical boards, each of three members, examining over a considerable period from 21,000 to 25,000 men every week.

Special Features.—In addition to the mere mass of the task, many most baffling problems demanded solution. The Ministry, in addition to pensions work and medical treatment, had for example to undertake the supply and repair of artificial limbs and surgical appliances (a special division of the Ministry was organized to deal with this). There were in Dec. 1920 23,932 officers and men pensioned on account of amputations of the leg, and some 64,000 cases of wounds of the upper extremity involving amputation of arm or part of the hand. There were 8,000 cases of epilepsy, 114,000 cases of "heart disease" and 69,000 cases of nervous disease (under which are included both "shell shock" and "neurasthenia").

There was no medical staff in existence to cope with such numbers. In the case of the "nervous diseases" a special training school for psycho-therapy and other forms of treatment was established in London, where a four months' course was given. The problem of "heart disease" demanded specialist attention; a system of special cardiological boards and clinics for examination and diagnosis was started in London, and extended throughout the country.

For the concurrent treatment and training of the broken men six large centres had been opened by Jan. 1921, and it was intended to open two more, giving accommodation in all to between 3,000 and 4,000. The effects of concurrent treatment and training upon the health and prospects of the patients were extremely beneficial. Difficulties were experienced in their absorption in industry, and efforts were made to overcome this by the institution of a national Roll of Honour by which firms pledged themselves to employ a certain proportion of disabled men, while special treatment for the permanently unfit was being considered. (W. E. El.)

PERCIN, ALEXANDRE (1846–), French general, was born at Nancy (Meurthe) on July 4 1846. He entered the École Polytechnique on Nov. 1 1865, and two years later was appointed a sub-lieutenant of artillery. He was promoted lieutenant in 1869 and captain in 1870. He took part in the Franco-German

War and the commune fighting and was twice wounded—in Dec. 1870, at the battle of Patay, and again in April 1871 before Paris. He was made a major (*chef d'escadron*) in Jan. 1883, lieutenant-colonel in 1890, colonel in 1895, general of brigade in 1900, and general of division in 1903. In the period between 1900 and his retirement, Gen. Percin was a very active reformer and innovator in the tactics of the artillery arm. The typical field-artillery tactics of 1914, based on time shrapnel covering fire, and on the intimate liaison of infantry and artillery, were largely due to his work, and after his retirement he continued a very active student and critic of artillery operations. His marked personality, and his political opinions as a radical, however, made him many enemies. At the outbreak of the World War he was recalled to service, but only as commander of the Lille region, and he was involved in the controversies connected with the evacuation of Lille. Later he was employed for a short period as inspector-general of artillery units. In Jan. 1915 he was placed in the reserves. He was given the Grand Cross of the Legion of Honour in June 1917.

Amongst his more important works are *La Manœuvre de Lorlanges*, *L'Artillerie aux Manœuvres de Picardie* (English translation, War Office, 1912) and a psychological study of battle under the title *Le Combat* (1914).

PERCIVAL, JOHN (1834–1918), English divine, was born in Westmorland Sept. 27 1834, the son of William Percival, of a yeoman family. He was educated at Appleby and Queen's College, Oxford, where he took his degree in 1858. In 1860 he was ordained, and went to Rugby as an assistant master. In 1863 he went to Clifton College as first headmaster, remaining there for 15 years. He was elected president of Trinity College, Oxford, in 1878, and while in this position took much interest in the foundation of Somerville College for women. In 1887 he became headmaster of Rugby, and in 1895 was appointed to the bishopric of Hereford. His broad churchmanship placed him in opposition to the dominant tendency in the Church of England, and he was also a strong and militant Liberal in politics, being an ardent advocate of the disestablishment of the Church in Wales. He died at Oxford Dec. 3 1918.

PÉREZ GALDÓS, BENITO (1843–1920), Spanish novelist (*see* 21.139), died Jan. 4 1920. The final series of his *Episodios Nacionales* contained *España sin rey* (1908); *España Trágica* (1909); *Amadeo I.* (1910); *La Primera República* and *De Cartago á Sagunto* (1911); and *Canovas* (1912). He also published various plays and novels, including *El Caballero encantado* (1909), and *Santa Juana de Castilla* (1918).

See L. Olmet and A. Carraffa, *Los Grandes Españoles*, vol. i., *Galdos* (1912).

PERIODICALS: *see* NEWSPAPERS.

PERISCOPE.—An optical instrument used in land warfare and in submarine navigation, enabling an observer to see in all directions while remaining under cover or submerged. Essentially it consists in an optical system of lenses and mirrors, or mirrors alone, the upper part of which projects from cover, or from the deck of a submarine, while the observer looks into the lower end, receiving an image of the surrounding country or sea by reflection down a tube.

The use of reflecting mirrors for the purpose of observing from cover is no novelty, and during the trench warfare of the Crimean War 1854–5 a device was patented which scarcely differs from the simple mirror periscope of the World War. From the beginning of the 20th century, however, the practical introduction of submarine navigation brought about the development of new elaborate periscopes of great length and provided with an optical system of lenses, which were built into the structure of the submarine. At the same time, on land, the new necessities imposed on field artillery by the growing use of covered positions led to the development of scissors-telescopes (*see* RANGEFINDERS) and panorama-telescopic sights (*see* SIGHTS), in which the optical system was arranged with the tube of the telescope vertical and the object-glass and eyepiece systems at right angles to the axis of the tube. And in the World War, while optical instruments of this kind were elaborated and improved, the periscope as such came into use for the infantry garrisoning trenches. Manufactured in large quantities it soon became an essential part of infantry as well as of artillery and machine-gun equipment. In the present article, periscopes for land service and those forming part of the equipment of submarines will be described in turn.

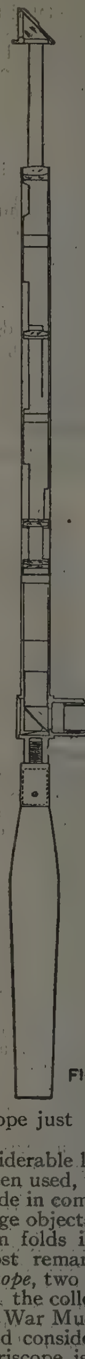

FIG. 1

(1) *Land-service Periscopes* vary much both in design and size, some being only a few inches long while others are as much as 80 ft. in length. The simplest form of periscope, and that most generally used by troops, consisted of a tube, rectangular in section, provided with two mirrors, the upper of which, inclined at an angle of 45° to the axis of the tube, reflected the image of the foreground vertically downwards to a second mirror, also inclined to the axis at 45° into which the observer looked. But in order to obtain an adequate field of view, the mirrors, and therefore the box, had to be made somewhat large, and in the close-quarters conditions of trench warfare even the few inches by which they projected over the parapet or other cover made them sufficiently obvious to draw fire. Less conspicuous periscopes were therefore designed, and these, in order to take in enough of the foreground, had to be provided with a magnifying as well as a reflecting system. In the British service half of the stereoscopic scissors-telescope used in range-finders was frequently employed as a periscope. Its lower end was fitted with a ball-and-socket joint to enable it to be laid in any direction, and beneath this is a screw which can be screwed by means of a small lever into a piece of wood embedded in the side of a trench.

In an ingenious periscope designed by Messrs. R. & J. Beck of London (fig. 1) the upper prism is supported above the telescopic system on a flat strip of metal which can be slid through side supports on the body of the periscope. When in use, the prism is supported some inches above the body and is the only part that can be seen by the enemy. If it is shot away, it can be replaced in a few seconds. When the periscope is not in use, the prism is lowered and protects the upper lens in the body.

Small German periscopes were usually 1 metre or ½ a metre in length and had two eyepieces giving magnifications 10 and 15 diameters. The optical system is shown in fig. 2. They could be either held in the hand or attached to a direction stand.

A neat rainguard made of sheet metal, to the same curve as the body of the periscope and almost 8 inches long, is attached to the upper prism box by two spring straps. When in use, it is held at right angles to the periscope above the upper window by a bayonet catch; when not in use, it is lowered and sprung round the body of the periscope just below the upper prism box.

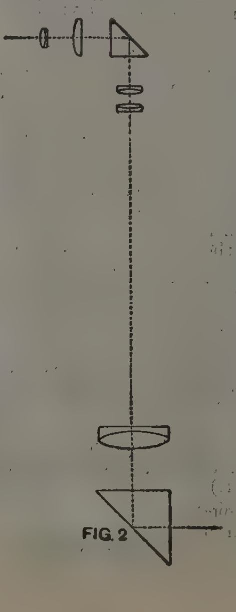

FIG. 2

Many periscopes of considerable length and special design have been used, to enable observations being made in comparative safety from behind large objects, *e.g.* houses, trees, etc., or from folds in the ground. Of these the most remarkable is the German *Giant Periscope*, two specimens of which exhibited in the collection of trophies in the Imperial War Museum, Crystal Palace, have excited considerable popular interest. This periscope is considerably larger than any others, and was designed for observing over obstacles of between 9 and 26 metres in height. It can be rapidly erected or taken down and transported on its carriage. It consists mainly of 3 parts, viz. a steel telescopic mast and upper and lower optical systems which are attached to it.

The telescopic mast is carried in trunnions on the carriage, and travels closed and in a horizontal position. Gears are provided for elevating, levelling, aligning the upper and lower optical systems, adjusting the inclination of the reflector and rotating the mast around a vertical axis so that observations may be made and azimuth angles taken in all directions. The telescopic mast consists of 8 tubes. The lower one is attached to the carriage, and the upper one is pulled out as far as it will go and retained in position by catches before the mast is raised. The other six are connected to each other and to the lowest one by wire cables and pulleys in such a way that when the cable which connects the two lowest tubes is wound in by means of a winch, each of the tubes except the fixed one will rise within the next one through the same distance. When erect, the mast is steadied by means of three guy ropes.

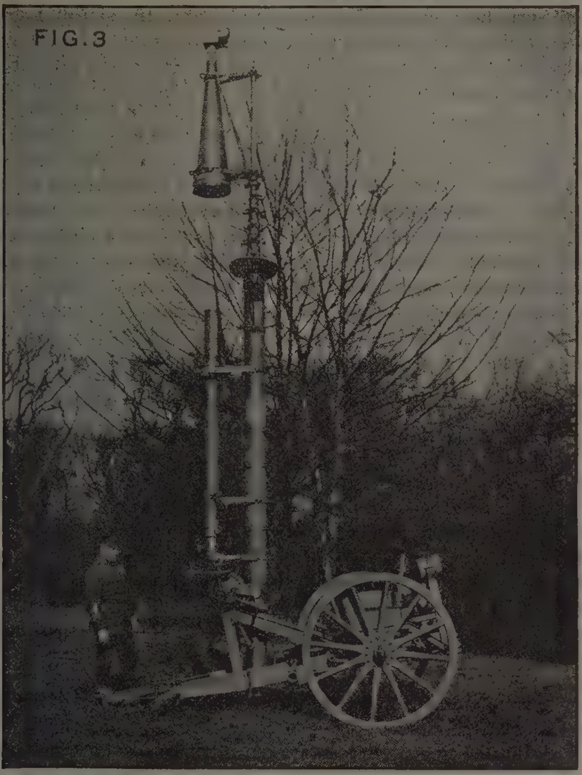
FIG. 3

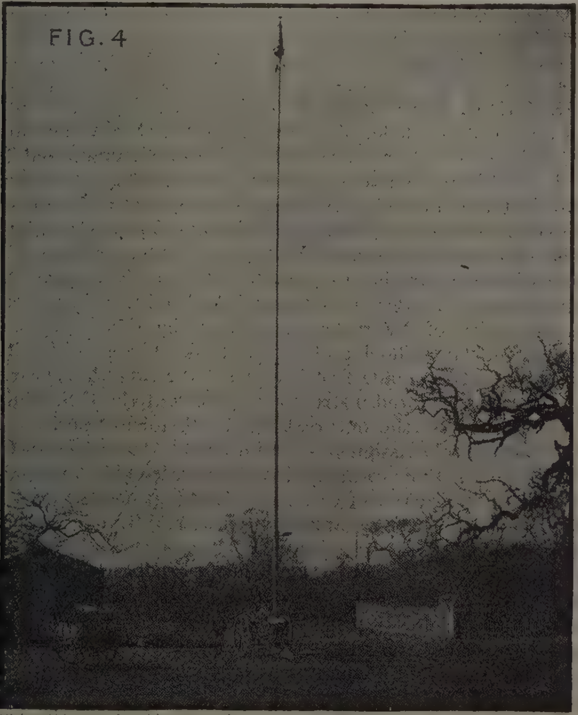
FIG. 4

The details of the optical systems are as follows: The rays from a distant object after passing through a protecting window A (fig. 5) are reflected by a mirror B down the centre of the conical casing which contains the upper optical system and is attached to the top of the mast. The two achromatic lenses, C and D, bring the rays to a focus on the plane surface of the large lens, E, forming an image there. Immediately above this plane surface and almost touching it is a system of wires which enables angular distances from the centre of the field to be read at the eyepiece below. The mirror can be elevated and depressed by means of a flexible shaft which passes up the centre of the mast and actuates gear attached to the mirror frame.

From the large lens, E, the rays pass through the open air for a considerable distance, depending upon how much the mast has been raised, to the lower optical system. Here they pass through the lenses and prism shown into one of the eyepieces, F. By moving the lens G up and down the image can be formed in the correct position for the eyepiece at all extensions of the mast.

There are three eyepieces which are mounted on a revolving sleeve in such a way that any one of them can be quickly brought into use, to give the magnification suitable to the height of the mast. (Low power from 3 to 8; medium from 5 to 14; high from 7 to 21.) Each eyepiece is provided with a dummy eyepiece which comes opposite to the eye which is not observing and permits of it being kept open. This lessens eyestrain. Coloured anti-glare glasses are provided.

(2) *Submarine Periscopes.*—When a submarine is completely submerged the occupants are not able to see through the water except under very exceptional conditions. In the Mediterranean on a sunny day it is possible to see for several yards through the water at about 25 ft. below the surface. In the North Sea, and usually, it might be said that once the boat is submerged, direct observation through the water is impossible. In the very earliest submarines a cupola was built on the top of the hull, which was kept just above the surface when it was desired to take observations. To reduce resistance, these cupolas were made telescopic in the French submarines "Gymnote" and the "Gustave Zédé," but the arrangement proved unsatisfactory. An optical tube replaced this cupola in the "Gustave Zédé," and comprised a short tube (on top of the submarine) with a lens to close the top end, which was kept just above the surface when running submerged. Horizontal rays of light entering at the top were reflected by a prism down the tube and focussed on to a sheet of paper in front of the helmsman inside the submarine. This gave him a limited view of what lay directly ahead. The word "periscope" was first applied to this instrument.

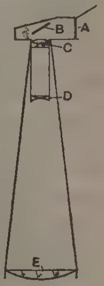

The modern submarine periscope consists essentially of a long tube, the top of which is just above the water when diving, while the lower end passes through a stuffing box on the shell of the boat into the control-room. The top is closed by a pressure-tight window, inside of which is a prism which reflects the light rays vertically down the tube to a prism at the bottom end, where they are reflected in a horizontal direction and focussed in an eyepiece attached to the bottom of the tube. Thus the commander can see what is happening on the surface when navigating the submarine some 20 ft. or more below it.

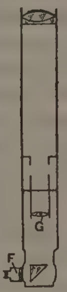

FIG. 5

The greater the depth of submergence the less the disturbance made by the submarine on the surface of the water, and the greater the immunity from gun-fire, ramming, etc.; also in a sea-way the deeper the submarine the more readily is it controlled. For these reasons the length of the periscope has steadily increased, and the dimensions of the upper end have as steadily decreased. Increased length necessitated an increase in the diameter of the main tube to limit the amplitude of the vibrations caused by being pushed through the water. A typical instrument in the British navy was 30 ft. long, with a 5·9 in. diameter main tube, and the top 3 ft. of the upper tube 2 in. diameter. For the German "U" boats Messrs. Zeiss made a periscope 7 metres long, main tube 150 mm. (5·9 in.), and about 2 ft. 6 in. of the top tube 30 mm. (1·2 in.) diameter.

The main tube must be accurately machined as it has to be readily trained in its stuffing-box as well as be water-tight in all positions, through a considerable range of vertical travel. The modern practice is to take rapid observations rather than to keep the periscope above the water all the time. To facilitate this mechanical lifting, gear is provided which is readily controlled, and can raise or lower the periscope at a speed approaching 25 ft. per minute.

The field of view is usually about 40° at a magnification of 1·5. It is therefore necessary to train the periscope round when taking observations on different bearings. This can be done in two ways, either by rotating the optical train inside the main tube, or, as is more usually the case, rotating the whole periscope. With the increase in weight and size the effort required has increased, and power training has sometimes been necessary. Where possible, however, by refinements in workmanship, etc., efforts are made to keep the torque required so low as to be within the power of the operator. Usually a revolving scale round the edge of the field shows the direction of the view. If the whole instrument moves, the operator also moves round with it in the boat, and knows at once in which direction he is looking.

Owing to proximity to the magnetic compass the whole of the tube must be non-magnetic. High-strength bronze was used in the earlier practice in the British navy. A special nickelchrome steel was manufactured and machined by Messrs. Krupp for use for the outer tube of the German navy periscope used before the war, and a similar steel was developed and used in the British service, but it is costly and more difficult to machine to the required accuracy than is the case with bronze.

The use of aircraft for anti-submarine work led to the demand for a periscope which could be used for looking overhead. In the sky-searching periscope the upper prism can be rotated by mechanism inside the periscope, so that aerial observations can be readily made before the submarine "breaks surface."

To enable a distant ship or other object to be examined more closely it is possible in some periscopes to change the magnification from a normal power of 1.5 to a power of 6. This, and the sky searching previously mentioned, means increased internal gearing and a larger upper tube. As a rule every submarine has at least two periscopes, one unifocal with a small upper tube and the other bifocal and sky-searching with a larger upper tube.

Whilst in the British service sky searching up to right overhead was arranged for, German periscopes as a whole are limited to 20° above the horizontal. In each case 10° depression is allowed for to follow the roll of the submarine.

For special purposes other features are added, such as range-finding attachments, etc. A "night" periscope for use at dusk has been developed. It is much shorter than the typical instruments described, so that the maximum brightness of image is obtained.

The periscope when installed in the submarine is used for two purposes: (*a*) general observation for submerged navigation; (*b*) for correctly aligning the submarine when firing a torpedo at a target. In connexion with (*a*) the principal requirement is clearness of field. Continuous use of a periscope is very trying for the observer's eyes, and for use in bright weather light-filter screens are provided to reduce the glare. It has also been found that in foggy and misty weather suitable colour screens are of assistance. These screens are usually embodied in the eyepiece. For purposes of torpedo attack the periscope is used as a range-finder to determine the distance the target is away, and also in connexion with tables to determine the correct time to fire the torpedo, allowing for the speed of the enemy, course, etc. Officers of submarines have devised various mechanical devices to avoid calculations, and these have been added to the periscope. Although two periscopes are provided when attacking, one only would be shown for short periods to get check observation so as to prevent the wash of the upper tube revealing the proximity of the submarine.

PERKIN, WILLIAM HENRY (1860–), English chemist, was born at Sudbury, England, in 1860, eldest son of Sir William Perkin, founder of the aniline dye industry. He received his general education at the City of London School, and his scientific education at the Royal College of Science, South Kensington, and at the universities of Würzburg and Munich. During 1883–6 he held the position of *Privatdocent* in the university of Munich. In 1887 he returned to England and became professor of chemistry at the Heriot-Watt College, Edinburgh. In 1892 he accepted the chair of organic chemistry at the Victoria University, Manchester, which he held until 1912. During this period his stimulating teaching and brilliant researches attracted students from all parts, and he formed at Manchester a school of organic chemistry famous throughout Europe. In 1912 he succeeded Prof. Wm. Odling as Waynflete professor of chemistry at Oxford. He soon made his influence felt there—new and more extensive laboratories were built, and for the first time in England a period of research became a necessary part of the academic course in chemistry for an honours degree. Prof. Perkin was president of the Chemical Society from 1913 to 1916. He was awarded the Longstaff medal of the Chemical Society in 1900, and the Davy medal of the Royal Society in 1904. The main results of his work are embodied in a very numerous and brilliant series of papers in the *Transactions* of the Chemical Society. The earlier papers deal chiefly with the properties and modes of synthesis of cloud chain hydrocarbons and their derivatives. This work led naturally to the synthesis of many terpenes and members of the camphor group; also to the investigation of various alkaloids and natural colouring matters. In addition to purely scientific work Prof. Perkin always kept in close touch with chemical industry. His text-books on practical chemistry, inorganic and organic chemistry, written in conjunction with Prof. Kipping, are in general use.

PERNERSTORFER, ENGELBERT (1850–1918), Austrian politician, was born on April 27 1850 at Vienna, the son of a small master tailor. While still a lad at the *Gymnasium* he had to earn his living by giving lessons. At the *Schottengymnasium* he struck up a close friendship with Viktor Adler, and became interested in the Pan-German political movement. While still at the *Gymnasium* he gave courses of lectures at the Workmen's Education Union. At the university he came into contact with Schönerer, to whose intimate circle he belonged. He collaborated in the preparation of the so-called Linz programme of the Left National party, and for a quarter of a century, from 1881 onwards, he edited the periodical *Deutsche Worte*. He separated from Schönerer as the latter adopted an increasingly reactionary and anti-Semitic attitude. He was also the inspirer and one of the founders of the German School Union. In 1885 he was elected to the Austrian Parliament as independent candidate for the manufacturing centre of Wiener-Neustadt. From that time, with the exception of the electoral period 1897 to 1901, he sat in Parliament until his death, and from 1907 onwards was its vice-president. In 1907 he became president of the parliamentary Social Democratic party, which had in the meantime increased in number to 87 in consequence of the adoption of universal suffrage. He died, after a rather long illness, in Vienna on Jan. 7 1918.

PERRY, JOHN (1850–1920), British mathematician, was born in Ulster Feb. 14 1850 and educated at Queen's College, Belfast. Though he took a post as a schoolmaster in 1870, he also qualified as an electrical engineer and devoted much of his time to turning mathematics to practical account. He served for a time as assistant to Lord Kelvin. Later he was associated with Prof. Ayrton and together they were responsible for many inventions in electrical apparatus (*see* 3.76, 8.782 and 783, 9.236, etc.). In 1881 he became professor of engineering and mathematics at the City and Guilds of London Technical College and in 1896 professor of mathematics and mechanics at the Royal College of Science, retiring in 1914. He published many books on applied mathematics and did much to further scientific engineering, especially by his lectures to operatives and by such works as *The Steam Engine* (1874), *Spinning Tops* (1890), *The Calculus for Engineers* (1897), etc. During the World War he was an adviser on gyroscopic compasses. He died in London Aug. 4 1920.

PERSHING, JOHN JOSEPH (1860–), American soldier, was born near Laclede, Mo., Sept. 13 1860. He studied at the Kirksville (Mo.) Normal School (B.A. 1880); graduated from the U.S. Military Academy in 1886; was commissioned second-lieutenant and immediately assigned to the 6th Cavalry in a campaign against the Apaches in Arizona. His conduct won the praise of General Nelson A. Miles, and in 1890, during an uprising of the Sioux, he was sent to Dakota, in charge of the Indian scouts. In 1891 he was appointed military instructor at the university of Nebraska, remaining there four years. He entered the law school and received the degree of LL.B. in 1893, having been made first-lieutenant the preceding year. In 1897 he was appointed instructor in tactics at the U.S. Military Academy, but on the outbreak of the Spanish-American War (1898) asked to be assigned to active duty. He served in Cuba through the Santiago campaign, was appointed chief of ordnance with the rank of major of volunteers, and in June 1899 assistant adjutant-general. He organized in Cuba the Bureau of Insular Affairs of which he was head for several months. In Nov. 1899 he was sent to the Philippines as adjutant-general of the Department of Mindanao, and in 1901 was honourably discharged from volunteer service. The same year he was made captain in the regular army and later conducted a campaign against the Moros, which he completed with success in 1903. The same year he returned to America and was appointed a member of the General Staff. In 1905 he went to Japan as military attaché to the American embassy, and during the Russo-Japanese War spent several months as military observer with the Japanese army in Manchuria. As a reward for his success in the Philippines President

Roosevelt in 1906 finally secured his promotion from captain to brigadier-general, passing him over 862 senior officers. Soon after he returned to the Philippines as commander of the Department of Mindanao and governor of the Moro Province. Here again he was engaged in quelling the insurbordinate Moros until his decisive victory at Bagsag June 12 1913. He was then placed in command of the 8th Brigade at San Francisco. While he was temporarily absent in 1915 on duty at the Mexican border his wife and three young daughters lost their lives in a disastrous fire, but his son was rescued. In March 1916 he was put in command of the punitive expedition into Mexico against Francisco Villa, and the same year was made major-general. After the death of Maj.-Gen. Funston in 1917 he succeeded him as commander of all the American troops on the Mexican border. This position he held until America's entrance into the World War, and was then chosen to command the A.E.F. in Europe. With his staff he reached England June 9 1917, and four days later landed in France to prepare for the coming of the American troops. In Oct. 1917 he was made general, U.S.A. In some quarters it was felt that as the American detachments arrived they should be hastily trained and then distributed among the Allied forces already in the field, but from the start General Pershing insisted upon the integrity of the American army, though willing in cases of emergency to place detached American units in the different Allied armies. He was convinced that the presence of an independent American army would be a serious blow to German *moral.* In Dec. 1917 he forbade American soldiers the use of alcoholic drinks, excepting light wines and beer, allowing these only in deference to French customs. As Commander-in-Chief of the A.E.F. he planned the American attack at the Marne salient in 1918, as well as American operations at St. Mihiel and in the Meuse-Argonne. His management of the A.E.F. is clearly described in his succinct *Final Report* (less than 100 pages), issued by the Government Printing Office, Washington, Dec. 1919. His nomination by President Wilson to the permanent rank of general was confirmed unanimously by the U.S. Senate Sept. 1 1919, a grade held previously by only four Americans—Washington, Grant, Sherman, and Sheridan. In 1921 he was appointed Chief-of-Staff. By King George V. he was given the decoration of G.C.B.

PERSIA (*see* 21.187).—The autumn of 1909 was a turning point in Persian history. The despotic Shah had abdicated, thus ending the bad old order. Great Britain and Russia were sympathetic to Persia, the latter Power not only appointing a minister with liberal ideas, but withdrawing her troops gradually from Kazvin and Tabriz. In other words the field was clear and Persia had every chance of setting her house in order. The new Assembly met in Nov., when Sipahdar read a speech from the throne, full of good intentions. Nor did his Cabinet fail at the first difficult task. When the question of disbanding the *mujahidin* or "warriors of the Holy War" arose, these soldiers of fortune, for the most part, assumed a menacing attitude and threatened to mutiny unless their exorbitant demands for pay were granted, but the matter was finally settled without bloodshed. Far more dangerous was the discord that raged among the Nationalists, who again broke up into two parties, the "Revolutionaries" (now mis-named "Democrats") being bitterly hostile to the Moderates. Unfortunately the former party, by its activity, its violence, and its secret organization, gained the ascendent. Nor were the leaders any better, Sardar-i-Assad, the Bakhtiari chief, intriguing with the "Revolutionaries" against Sipahdar. The raising of a joint loan of £500,000 from the two Powers, mainly to provide the pay due to the police and soldiers, encountered stormy opposition in the Assembly and was not carried through. The "Revolutionaries" forced their way into the Cabinet, with the result that no progress of any kind was made.

Sipahdar ultimately resigned and a "Democrat" Cabinet was formed under the influence of Sardar-i-Assad, whose nominee for the premiership was a Kajar prince, Mustaufi el Mamalik. It was hoped that office would sober the "Democrats," but little sense of responsibility was shown, together with an intense craving for the sweets of office. Generally speaking the Majlis made Cabinet rule impossible. It was broken up into several parties swayed by passion, intrigue or greed for money, and would lightly pass votes of censure whenever an incident which appeared to be unfavourable to Persia was reported, without giving the minister concerned the chance of explaining matters. Moreover, the hostility of the Majlis and of the Cabinet towards Russia was exasperating to the northern Power.

Chronic Disorder.—In the autumn of 1909 M. Passek, Russian consul-general, was attacked by tribesmen, when travelling to Shiraz with an escort of Cossacks. A few months later, the British consul was attacked near Abadeh and two Indian sowars of his escort were killed. The authority of the governor-general of Fars was threatened by the Kashgais. In the N., adherents of the ex-Shah drove the governor from Ardebil, and Russia was suspected of being implicated in this plot—probably with justice. Elsewhere in northern Persia there was little disorder compared with the unsatisfactory state of affairs in Fars, which gravely threatened British commerce and other interests. So much was this the case that Great Britain began to consider the situation as one that might demand British intervention, and, in the autumn, the Persian Government was notified that, failing the restoration of order within three months, Persian levies under British officers would be raised to guard the trade routes.

In the autumn of 1910, Nasir el Mulk was elected regent in the place of the deceased 'Azud el Mulk, and reached Teheran at a critical time. Mustaufi had been obliged to resign; Sipahdar again formed a Cabinet and Sardar-i-Assad had left for Europe. The new Cabinet was settling down when the ex-Shah, who had passed across Russia with munitions labeled "Mineral Waters," suddenly landed near Asterabad. At first, there was a panic at Teheran. Sipahdar, whose loyalty to the constitution was suspect, was induced to resign, his place being taken by the Bakhtiari chief Samsam es Sultaneh. The ex-Shah marched on Teheran while Salar ed Dauleh simultaneously advanced on the capital from Kermanshah. The Russians undoubtedly favoured the ex-Shah, but his troops were defeated, as was the horde of tribesmen under Salar. Finally the ex-Shah retired to Russia, mainly because Great Britain declined to consider the question of his return to the throne.

American Financial Mission, 1911.—The financial troubles of Persia were mainly due to the all-pervading corruption and irresponsibility of the governing class. It is to the credit of the "Democrats" that an effort was made to deal with the situation by engaging the services of Mr. Morgan Shuster, an American, as financial adviser. Upon examining the situation, Mr. Shuster realized that, without extraordinary powers, he could do little. He therefore demanded the powers of a dictator, which were granted him by the "Democrats," with whose views he found himself in sympathy. Russia regarded his actions with hostility. He was advised by the regent to reorganize everything else before interfering with the comparatively model organization of the customs under its Belgian officials. Instead of following this sound advice, he began work with the customs, exciting deep animosities. Indeed, in many ways, he ignored the realities of the situation. To take an important instance, Shuster wished to organize a Treasury gendarmerie and offered the task to Maj. C. B. Stokes of the Indian army, whose appointment as military *attaché* was expiring. Stokes was a Russophobe, owing to his strong pro-Persian proclivities, and Russia firmly objected to an appointment which would give him control over men stationed in every part of Persia. The matter caused much stir and was finally settled by Maj. Stokes being ordered to leave Persia and return to India. This was a rebuff to Shuster, but worse was to follow. The Russian Government was determined to oust him, but took action on a weak case. The Treasury gendarmes seized the principal property of Shu'a es Sultaneh, the young Shah's uncle, who had taken part in the ex-Shah's attempt. Actually he was a Turkish subject. However, the Russian consul-general, under the flimsy pretext that Shu'a owed money to the Russian Bank, sent some Russian Cossacks, who ordered the Treasury gendarmes to retire under threat of opening fire on them. A guard of Persian Cossacks was subsequently posted by orders of the Russian consul-general. On the following day Shuster dispatched a much stronger body of Treasury gendarmes who ejected the Persian Cossacks. Russia regarded this foolish act as a challenge and presented an ultimatum demanding an apology for the insult offered to her consul-general. When this had been accepted, she demanded the dismissal of Shuster. The Majlis at first refused with cries of "Death or Independence," while at Tabriz and Resht attacks were made on the Russians, who dealt sternly with the incidents, hanging the leading ecclesiastic and other notables at Tabriz. Russian troops supported the ultimatum by marching on Teheran, and the Persians, recovering from their fond illusions, submitted. The failure of Shuster was disappointing. His selection was, perhaps, unfortunate, but, in any case, Russia would hardly have permitted him to succeed.

Bombardment of the Meshed Shrine, March 1912.—There were few acts more discreditable to Russia or more harmful to her true interests than the bombardment of the shrine of the Iman Riza, the chief centre of pilgrimage in Persia. The Russian consul-general at Meshed, who was determined to play a hostile rôle in Persia, had taken advantage of local disturbances to bring in a large Russian force under a major-general. There was no need for this, and the population, cowed by its arrival, was peaceful. This state of affairs, however, was not allowed to continue, as it meant no honours and no loot for the Russians. A notorious *agent provocateur* was sent to the shrine, where he soon collected large crowds to listen to his incendiary speeches. This was all that was necessary and the shrine was bombarded by the Russians, nominally to expel the agitators. Actually they were taken away by night in a waggon under a Russian escort. Many innocent men and women were killed and wounded; the sacred tomb-chamber in which lie the remains of Persia's saint, close to those of Harun al Rashid, was repeatedly struck by the shell-fire; and the treasury, which contained the rich gifts of countless pilgrims, was removed, but was afterwards restored, although by no means intact. The outrage excited intense feeling in Persia and, to a lesser degree, throughout the Moslem world. It demonstrated beyond all doubt the sinister policy of Russia, and was the chief cause of the hatred with which the northern Power was regarded. In England the bombardment passed almost unnoticed, as it occurred simultaneously with the disaster to the "Titanic," which entirely absorbed public attention.

Persia in 1913.—The year before the outbreak of the World War found Persia in a miserable plight. Russia was constantly strengthening her hold on the N. by seizing on, or creating, pretexts for further intervention. Great Britain was bound by the Anglo-Russian Agreement to coöperate with the northern Power, but did her best to help Persia to maintain her independence, a task which native incapacity, intrigue and corruption rendered very difficult. In her sphere of influence in the S. she supported the organization and development of the Swedish gendarmerie by advances of money and by other means, and tried to secure capable governors for Fars and Kerman. The position in Fars, the storm-centre of southern Persia, remained thoroughly unsatisfactory. The Kashgai tribe, the most powerful in southern Persia, defied the governor-general and raided in Fars as did the Boir Ahmadis; the Khamseh Arabs raided the caravan routes in the Kerman province; and other tribes raided in the Fars, Yezd or Kerman provinces from time to time. It was generally realized that the evil was beyond the powers of the Persian Government to cure, but in pursuance of the British determination to avoid any increase of commitments—a decision that was eminently sound—action in the form of unsatisfactory palliatives was alone taken. Throughout this period, no Persian Cabinet would assume office without applying for a considerable advance of money from the two Powers. Money was given, the question of repayment was arranged, and there were practically no results. Much of the money was embezzled and the balance was spent to small advantage. The case of Capt. Eckford, who was killed by a raiding party of Boir Ahmadi tribesmen between Shiraz and Dasht-i-Arjan, is typical. The governor-general of Fars, Mukhbir es Sultaneh, who played a sinister rôle in the World War, took advantage of the incident to press for large sums of money, with which he proposed to raise a force of over 1,000 men, and expressed his confidence that he would be able to punish the Boir Ahmadis and other evil-doers without difficulty. The Swedish gendarmerie was already being organized in the province, but had the fatal defect from the point of view of a Persian governor-general that the money for their pay did not pass through his hands. At Teheran the Treasury was empty. A Cabinet bent on reform was being constituted with a programme which entailed a loan of about £5,500,000. Meanwhile, in order to support the governor-general of Fars in his unsuccessful attempts to restore order and punish the Boir Ahmadis, the British legation advanced a sum of £15,000 for three months and, later on, £100,000 for twelve and a half months. In Feb. 1913, the two Powers advanced Persia £400,000. The negotiations for a larger loan were connected with that of railway concessions of which some account is given below.

Salar ed Dauleh.—Among the many difficulties of the Persian Government, that of Salar ed Dauleh was particularly irritating. That troublesome prince had rebelled against his brother Mahommed 'Ali Shah, had been defeated and had been kept under honourable arrest. When Mahommed 'Ali Shah made a bid to regain the throne in 1911, Salar had, as mentioned above, organized a movement from the S.W. and proclaimed himself Shah but, again, had been decisively beaten. In 1912, the irrepressible prince reappeared on the scene and, after occupying Kurdistan, threatened Hamadan. Farman Farma, appointed governor-general of Kurdistan, held Kermanshah against him, inflicting a repulse which drove Salar to take to flight. He then proceeded to lead the life of a brigand chief, fomenting local troubles and blackmailing any wealthy landowner or merchant who was unfortunate enough to fall into his hands. After the formation of the Cabinet of 'Ala es Sultaneh in 1913, it was decided to make terms with the prince who, mainly through Russian support, was nominated governor of Gilan. The regent realized the danger of appointing this "stormy petrel" to a post where he controlled the main route between Russia and the capital, and refused to sanction the appointment. The Russian Government, for a while, declined to permit it to be cancelled, but finally at the repeated request of the British, induced Salar to accept a pension and leave Persia. During the same period there was considerable anxiety as to the movements of the ex-Shah who, it was feared, was intending to make another bid for the throne, but the enquiries made by the British Government tended to show that there was no real cause for anxiety on the subject.

The Swedish Gendarmerie.—The general condition of Persia is one of chronic anarchy which is more intense the nearer any particular locality may be to the powerful raiding tribes. This anarchy the Persian Government is impotent to stop until there is a radical change of character and a movement towards virility and honesty in the governing class. A study of the Blue Books from one point of view is a summary of outrages and of ineffectual measures taken for their punishment, the British minister making the best of an almost hopeless situation and staving off a total collapse by a hand-to-mouth policy of doles, warnings and good advice. In view of the fact that Russia had organized a Persian Cossack brigade in the N., it would have been only befitting that Great Britain should organize a force for the restoration of order in the S., but so afraid of increased commitments was the British Foreign Office that it agreed to the Persian Government engaging Swedish officers for the formation of a gendarmerie and, in the summer of 1911, a mission composed of 20 officers reached Persia under Col. Hjalmarson. The Swedes had no knowledge of the country, the Moslem people, the language or oriental intrigue. The Russians eyed their mission unfavourably and would have rejoiced at its failure. They considered that, if successful, the gendarmerie would certainly become a dangerous rival to the Cossack brigade, which was only nominally controlled by the Persian Government and was actually under the orders of the Russian legation. The Persian Cabinet, although anxious for the success of the gendarmerie, was generally apathetic and also irregular in making payments. The British legation, on the contrary, helped and supported the new force in every way, realizing that unless it succeeded in its very difficult task of restoring order, Persia might well break up into a number of robber-infested provinces. The Swedish officers who were drawn from the regular army, worked hard to train their men. At first, they enlisted the riff-raff of Teheran but gradually recruited a better class of men. Their ignorance of how to deal with Moslems led them to make many mistakes, but this was after all only natural. Generally speaking, they made good progress at the capital and in its neighbourhood.

The British legation, which was watching the dwindling of trade in Fars and the increasing lack of law and order, constantly urged the necessity for sending a force of gendarmes to that province and, in Feb. 1913, the first detachment left for Shiraz. Col. Hjalmarson's scheme for Persia was to place 1,500 men as road guards in Fars supported by a mobile column of 1,800 men. A contingent at Isfahan would form a link with headquarters at Teheran. He also intended to organize stations for the Qum-Sultanabad, for the Hamadan-Kermanshah, and the Samnan-Damghan routes. These schemes would require about 8,000 men and would bring up the number of instructors to twenty-eight. The cost would have been about £400,000 for the first year and, later on, considerably more. The problem of Fars was very difficult, owing both to the power and disposition of the Kashgais, Boir Ahmadis and other tribesmen, and the rugged nature of the terrain. The Swedes made an unfortunate start at Bushire where they enlisted 168 men locally, many of them noted bad characters. These men, owing to two of their number being stripped naked and flogged, all resigned. Probably it was fortunate that they did so, for had they escorted a caravan of arms and ammunition to Shiraz, as was the original intention, it is hardly likely that it would have reached its destination with its contents intact. The gendarmerie marched into Fars and on the way made a successful attack on some Arab robbers, recovering a certain amount of looted property. Owing to the men belonging to N. Persia it was found impossible to take over the route near the coast, as the heat overpowered them, but they occupied it as far as Kazerun. At first the newcomers were not attacked, although the petty chiefs, who lived by blackmailing caravans, realized that if they remained their profits would cease. They were however afraid to move and the gendarmerie gradually established themselves and engaged a number of tribesmen as levies. In the vicinity of Shiraz, a detachment was taken out to attack the Kashgais before it was sufficiently trained, with the result that the men behaved badly and allowed themselves to be disarmed. However, they had constructed posts along the route and these they held at the outbreak of war.

The Bakhtiari Domination.—The chief rôle in the Persian revolution had been played by the Bakhtiari tribe which, entirely owing to the influence of Sirdar-i-Assad, had marched on Teheran and secured the abdication of Mahommed 'Ali Shah. During the years that followed, not only had they held the chief posts but their tribesmen had been the mainstay of the constitution. Whenever an expedition had been sent out, they drew money, arms and ammunition, most of which ultimately reached the Bakhtiari country. Sirdar-i-Assad had undoubtedly cherished the ambition of founding a new dynasty, but while events were favouring his designs, he became blind. However, his tribe continued to dominate Teheran and assumed a provocative attitude towards the gendarmerie. The Swedish officers took prompt action, surrounded the Bakhtiari quarter with machine-guns and artillery, and put an end to an intolerable state of affairs from which Europeans as well as Persians had suffered. The chiefs, perforce, agreed to dismiss the greater part of their contingents and felt the humiliation so keenly that they never again attempted to dominate the capital.

German Activity before the World War.—For some 20 years before the war, Germany had made strenuous efforts to increase her influence and interests in Persia. Perhaps the most definite success gained at the capital was the opening of a college staffed by German professors, to which the Persian Government was induced to contribute a handsome annual grant.

But to realize the persistence with which her policy was conducted, attention must be turned to the Persian Gulf. Before 1896 Germany had no representative or trade in that torrid region but, in that year, the campaign opened by the firm of Wonckhaus establishing itself at Lingeh where it began dealing in mother-of-pearl; and, in 1897, a German vice-consulate was founded at Bushire. Three years later Germany made great efforts to purchase a site for the terminus of the Bagdad railway at Kuwait, but the astute Sheikh Mubarak had previously concluded a secret treaty with Great Britain by the terms of which, in return for protection, he agreed not to sell or lease any of his territory without the consent of that Power. Germany did not accept this rebuff as final and induced Turkey, members of Mubarak's family, and the Wahabis to take a hand in the game, but all direct attacks were foiled by British sea-power. A more successful plan was to induce the Turks to establish posts in Khor 'Abdalla, an inlet running from behind Bubiyan Is. to within 30 m. of Basra. The fact that the creek was situated in Mubarak's territory mattered nothing, and these posts were occupied until the outbreak of the World War. Five years after its foundation at Lingeh, the firm of Wonckhaus, supported by German subsidies, opened its headquarters on the Bahrein Is. with branches at Basra and Bandar 'Abbas. The reason for the change of headquarters was soon evident as the islands are situated among the pearl banks, of which Germany attempted to gain control through a lease derived from the Sultan, whose claims in the Persian Gulf were shadowy. The little island of Halul, which is situated in the centre of the banks, was particularly aimed at, but Great Britain intervened and spoilt the new scheme. Germany was indefatigable in her efforts. Foiled entirely as regards the pearl fisheries, she attempted to control the working of the red oxide deposits of Abu Musa. The Sheikh of Sharja, a Trucial chief, bound by treaty with Great Britain not to enter in an agreement with any other Power, had granted a concession for working these deposits to three Arabs, two of whom lived at Lingeh, while the third partner was his own subject. Wonckhaus acquired the concession which the Sheikh promptly cancelled, sending a large body of his subjects to expel the concessionaires. This action raised a storm in the German press, but the case was too weak to be supported and merely a formal protest was made. The last attempt to be recorded was to secure a large piece of land along the river bank at Mohammerah, with the object of creating a German settlement, quays, etc., but again British vigilance was too strong. Much credit is due to Sir Percy Cox, the British Resident, for foiling every German attempt. In spite of these failures, in 1906 the Hamburg-Amerika Co. started a service to the Persian Gulf. The first steamer created a sensation, lavish hospitality being dispensed to all comers, who also welcomed the novelty of a band. Trade was small at first and native passengers were not encouraged, but shipments of railway material helped matters and ultimately a flourishing trade was established. Great Britain, at the actual outbreak of war, was engaged in negotiations with Germany and Turkey. So far as the former Power was concerned, but for the war she would have secured a strong position at Basra, the destined terminus of the Bagdad railway. The suzerainty of Turkey over Kuwait was also acknowledged. In other words British predominance in the Persian Gulf would have been weakened. So far as this important problem was concerned, the results of the war have been beneficial.

Persia at the Outbreak of the World War.—The regent left Persia for more than a year in 1912, merely returning to arrange the coronation of the young Shah. This took place with due pomp and circumstance in July 1914 and, as Nasir el Mulk left Persia again after the ceremony, the young monarch had hardly taken up his duties when the war broke out. His Majesty summoned the Majlis and duly proclaimed the strict neutrality of Persia. The position was, however, very difficult. The grandees were, in many cases, only anxious to receive money from one or more sides; the masses hated the Russians and disliked and mistrusted the British for being friends of their enemies. There was sympathy in some quarters for the Turks and "let the Christians devour one another" was frequently heard. But the outstanding feature was the powerlessness of Persia. Her military forces included the Cossack brigade 8,000 strong, the Swedish gendarmerie 7,000 strong, and the useless Persian troops under Persian officers.

At first sight it would seem unlikely that remote Persia should become a war theatre, but actually this was bound to be the case, unless she could defend her neutrality. A reference to the map will show that Azerbaijan, the N.W. province of Persia, marches with Turkey on the W. and with Russia to the N. Furthermore an advance by either belligerent through Persian territory would enable that Power to outflank the other and operate in open country, whereas a direct attack could only be made across the very high range which runs from the shores of the Black Sea to Mount Ararat. This strategical fact had been realized by Russia and Turkey before the outbreak of the World War, and both Powers, taking advantage of the impotence of Persia, had established themselves in Persian territory in the vicinity of Lake Urmia, the Turks holding the chief passes on the Perso-Turkish frontier which was only finally delimitated just before war began.

Russo-Turkish Operations in Azerbaijan.—At the outbreak of hostilities the Russians, in this section of the war theatre, assumed the offensive and drove the Turks back on Van. However, the Kurds on both sides of the frontier rallied to the Turks and, finding Tabriz undefended, entered it in Jan. 1915. They then moved northwards along the road to Julfa, only to be repulsed by a Russian detachment which subsequently reoccupied Tabriz. At Urmia the Kurds, driving in front of them the Christian tribesmen of Targavar, assaulted the town, hoping to massacre its Christian inhabitants. But, aided by a small Russian detachment and the tribesmen of Targavar, the townspeople drove off the enemy. The Russians, in view of the Turkish invasion of the Kars province, were obliged to draw in their outlying detachments, and this was followed by the exodus of 10,000 Christians.

In the spring of 1915, after the crushing defeat of the Turks at Sarikamish, the Russians reoccupied Urmia and advanced to Van. They were joined by the Assyrian Christians of Kurdistan, who, when left alone to bear the brunt, actually migrated with their families and flocks to the neighbourhood of Urmia, whence they raided their enemies the Kurds and generally did good service to the Russians, until the disintegration of the Russian army.

Operations in S.W. Persia.—Before war was declared by Turkey, the Government of India took the wise precaution of despatching a brigade of Indian troops to the Bahrein Islands. At the outbreak of hostilities, this force pushed up the Shatt al 'Arab to protect the important refineries of the Anglo-Persian Oil Co. on the island of Abadan. This brigade was rapidly increased to a division which, after defeating the Turks at Sahil, a few miles above the oil refineries, occupied Basra on Nov. 23. The occupation of Basra effectually protected the oil refineries, but these works in their turn depended on the oil-fields at Maidan-i-Naftun and the vulnerable pipe-line which was laid through Ahwaz and was 150 m. in length. The neighbouring tribesmen, partly through propaganda and partly through fanaticism, had breached and fired the pipe-line in several places. The Bakhtiari tribe, with which the British had maintained friendly relations for many years and which owned the ground on which the oil-wells were being worked, was generally hostile, the arrangement sometimes being that the fathers professed pro-British sympathies while the sons were fighting for the enemy. To protect the pipe-line, a brigade was despatched to Ahwaz, where it was faced by a considerable number of Turks supported by thousands of tribesmen. A reconnaissance in force found the enemy much stronger than was expected and was obliged to retreat with heavy losses, but the enemy showed no inclination to attack the main body of the British who, for some time, maintained a defensive attitude. In the spring, Maj.-Gen. Sir G. Gorringe was ordered to attack the Turks with the 12th division. The enemy retreated and Gorringe, after dealing with the hostile Beni Tauf, drove them back on Amara, which had meanwhile been captured by Maj.-Gen. Sir Charles Townshend. As a result of these operations, Persian soil was cleared of the enemy, the local tribes made their submission, the pipe-line was repaired, and the valuable oil again flowed along it.

German Activity in Persia.—It is interesting to study the policy of Germany in the Middle East after the outbreak of the World War. Its object was to embarrass Russia and, still more, Great Britain, by forcing Persia and Afghanistan into the war on their side, and by creating disturbances on the frontiers of India and inside India. The scheme was sound, for, if Persia alone had declared for the Central Powers, the claim that Islam was on their side might have brought in Afghanistan. As it was, with comparatively small forces and at a relatively small cost, Germany certainly drew forces to Persia, which would otherwise have been available for other fronts. Had it been possible to march a Turkish brigade across Persia to Afghanistan, the Amir would probably have been obliged to join in an invasion of India or would have been killed. India at that time was weakly held, while the "Emden" had cut her sea communications. In the many arguments shown for and against the advance on Bagdad, this important question is apt to be neglected.

The plan of operations in Persia was two-fold. Agents well-furnished with arms and money were sent to enlist levies and to march across central and southern Persia, murdering British and Russian officials, and plundering and driving out the small English colonies. These groups were to form supports to missions destined for Afghanistan and Baluchistan. These latter bore letters on vellum written to the address of the Amir of Afghanistan and the ruling princes of India, and signed by the German Foreign Secretary. They also had various German decorations for distribution. They carried on a propaganda which was anti-Christian, giving out that the Kaiser and his people had become converts to Islam and that the former was now known as *Hajji* Wilhelm. The most successful German agent and the earliest in the field was Wassmuss, who before the war was consul at Bushire. He succeeded in organizing a strong anti-British confederacy in Tangistan, Dashti and Dashtistan, although there was also a pro-British party in these districts. The attacks on Bushire forced the British to increase the small number of troops that normally sufficed to guard the important wireless installation and the cable. Its defence suffered from the fact that the cable station was at Reshire, six m. distant, while the residency and other houses occupied by the British covered a large area outside the town. The Tangistanis made several daring raids, in one of which two British officers were killed. The strongly anti-British attitude of the Persian Government, which made no effort to protect the British colony, resulted in the temporary occupation of Bushire by the British, a step that afforded German propaganda a real chance that was fully exploited. Generally speaking, the activity of Wassmuss detained troops at Bushire, which were sorely needed elsewhere. In Fars, too, Wassmuss was equally successful. He found Mukhbir es Sultaneh, the governor-general, strongly pro-German owing to his education at Berlin. He also found the Swedish officers of the gendarmerie equally friendly and, through their instrumentality, he won over that force to his side. As a result, in the autumn, the British vice-consul was murdered and, shortly afterwards, the consul and the entire colony were arrested and taken to the coast, the men being held prisoners by the Tangistanis, while the women were sent to Bushire. Qawam el Mulk, chief of the Khamseh Arabs, who was acting governor-general, was driven out and retired to Lingeh, thus leaving the German consul supreme in Fars.

The main route by which German parties entered Persia from Bagdad was through Kermanshah and Hamadan. In April 1915, the Turks advanced on Kermanshah with a force mainly composed of levies which expelled the British colony. The German consul at Kermanshah engaged levies and carried on a vigorous propaganda; he also drove back the British and Russian consuls when they sought to return under Persian escort. At Isfahan, Pugin, dressed as a Persian, with the profession of Islam on his lips, persuaded the credulous citizens and their religious leaders that the Kaiser was indeed a *hajji* or pilgrim to Mecca. Assassination was deliberately employed. First the Russian vice-consul was murdered and, later, the British consul-general was wounded and his Indian orderly killed. A letter from a German official, Seiler, was subsequently intercepted, in which he gloried in having arranged this cowardly stroke. Farther E. at Yezd, enemy parties looted the treasury of the Imperial Bank of Persia, a British company, and drove out the colony; and, at Kerman, similar action was taken, together with the assassination of a prominent British subject. At the end of 1915, seven out of the seventeen branches of the Imperial Bank were in enemy hands and the British colonies had been expelled from central and southern Persia. Only the Gulf ports remained safe, thanks to British sea-power and garrisons.

In the N. the position was very different. Owing to the danger to which the Allied legations were exposed, Russian troops had landed at Enzeli in May and had marched to Kazvin whence, as the situation grew more menacing, they had advanced to the Karaj river, some 25 m. W. of Teheran. This movement produced a crisis. The enemy ministers perforce had to leave Teheran and, as the Persian Foreign Minister was on their side, they felt sure of persuading the young Shah to follow them. Indeed, the dilemma of Sultan Ahmad was painful. On the one side, the enemy ministers warned him that Teheran would be stormed by the Russians, who would seize and probably kill him; on the other side the British and Russian representatives pointed out to His Majesty that if he left the capital and broke his neutrality by joining the ministers of the Central Powers, he might lose his throne. Finally the Shah decided to remain at Teheran. The enemy ministers retired to Qum, where they employed their forces in somewhat aimless raiding. This was soon stopped by Russian columns, and, before the end of the year, Russian troops had occupied Kashan and were threatening Isfahan.

German Mission to Afghanistan.—One of the dangers to be guarded against was that of German missions to Afghanistan and Baluchistan. Efforts were made to intercept such parties, but it took time to make the necessary arrangements, and it was not until 1916 that the eastern Persian cordon was in working order with the Russians patrolling the frontier as far S. as Kain, from which centre the British, with some regular troops and a number of locally raised levies, were responsible to the borders of Baluchistan. Persia being a land of vast distances, it is not surprising that a German mission was able, by means of very long marches, to reach Herat in safety. It was received with every honour, but displayed extraordinary lack of tact by openly decrying everything of Afghan manufacture, the arms manufactured at the arsenal at the capital, for instance, being criticized contemptuously. At Kabul too, the same behaviour brought the mission into trouble. The Amir, who had received it courteously, delayed matters by summoning a council representative of all the tribes and by lengthy meetings with the mission and his own advisers. The Germans gradually realized that, without a Turkish force, their efforts were wasted. They were finally dismissed, the Amir pointing out that he could hardly break with the Government of India until a large, well-equipped army reached Kabul from the west. The mission broke up into small parties, most of which successfully evaded the cordon. Other missions travelling farther S., including one to Bahram, Khan of Bampur, had no success whatever, the greedy Baluch in the last-named case stripping the enemy agents who were glad to escape with their lives.

Russo-Turkish Struggle in Western Persia.—In 1916 the ebb and flow of the struggle were very marked in western Persia. At first the Turks, shortly after the retreat of the British from Ctesiphon, occupied Kermanshah and pushed forward towards Hamadan. The Russians in their turn, justly elated at their astounding feat of arms at Erzerum, advanced and drove the enemy off the plateau, while a second force swept the hostile Bakhtiaris out of Isfahan and brought back the British and Russian communities. The capture of Kut again transformed the military situation and, in the summer, the Turks, 16,000 strong with 54 guns, gradually drove back the Russians who could only oppose them with 12,000 men and 19 guns. Kermanshah was evacuated and then Hamadan, the retreat continuing as far as the Sultan Bulak range which covered Kazvin and threatened a force marching on Teheran. This situation remain unchanged until the end of the year.

Raising the South Persia Rifles.—In 1916, it was decided, in consultation with the Persian Government, to organize a force of Persian troops to restore order in southern Persia and take the place of the Swedish gendarmerie. This force was to be 11,000 strong and the Cossack brigade was to be raised to a similar strength. Brig.-Gen. Sir Percy Sykes, who had spent many years in S. Persia, was appointed to undertake this task and landed at Bandar 'Abbas in March, with three other British officers and a few Indian instructors. The state of affairs was most unfavourable as, apart from the defeat of Qawam, the British agent and his escort were assassinated at Lingeh and two British officers were assassinated in Makran about the same time, both murders being due to German instigation; and finally this terrible month of April saw the grave disaster of Kut al Amara. Many experienced men expected a wave of fanaticism to sweep across Persia and there was certainly cause for deep anxiety, especially in Makran, but British coolness undoubtedly saved the situation. Recruiting operations at Bandar 'Abbas were started immediately after landing and, in spite of a strong anti-British party, men were rapidly enlisted and, before the end of a month, the Persian flag was hoisted with ceremony over a camp. The force, handled with much tact and patience by its British and Indian instructors, never looked back and was soon able to protect Bandar 'Abbas and an important section of the caravan route from the raiding tribesmen.

The Success of Qawam el Mulk and his Sudden Death.—Qawam was aided by the British with money and munitions, and an exaggerated report of the means placed at his disposal led to the rebel Arab headmen kissing his feet. With their aid he defeated the Swedish gendarmerie, and was marching in triumph to Shiraz when he was killed by a fall from his horse. His son, a man of 28, was however able to restore Persian authority in Fars.

The March of Sir Percy Sykes to Kerman.—The success of Qawam and the landing of the mission at Bandar 'Abbas made the position of the German parties at Kerman decidedly insecure. The governor-general became hostile to them and they decided to retire westwards to Fars, the route farther N. being dangerous owing to the Russian advance southwards. They fled in two parties, and after suffering some losses from attacks on the road, were all captured by Qawam and imprisoned at Shiraz to the number of 60 Germans and Austrians, a dozen Turks and a few Afghans. A small force of Indian troops, consisting of a section of mountain guns, a squadron of cavalry and 500 rifles, was sent to Bandar 'Abbas and Sir Percy Sykes marched inland a distance of 280 m. to Kerman, where he was received with much cordiality. The various pro-German elements who had created a state of insecurity fled, the bank and telegraph offices were reopened, and the normal state of affairs was very quickly reëstablished. At Kerman, recruiting for a brigade of the S. Persia Rifles was started with much success, and, before long, it was dealing effectively with the robber bands which were destroying life and property in the province. The column, after halting for some weeks, marched on to Yezd, where the British colony had only recently returned. News being received of the Turkish advance and of a probable attack on Isfahan, the column, instead of marching direct to Shiraz as originally intended, proceeded to Isfahan and joined the force of 600 Russian Cossacks at the ancient capital of Persia. The Turkish force had reached Dunbeni, 60 m. to the N.W. of Isfahan, but had not advanced any further, and it appeared that exaggerated rumours as to the size of Sir Percy Sykes's force had been the cause of this change of plan. During the halt at Isfahan, the column marched out for 50 m. along the Ahwaz route, attacked Jafar Kuli, a noted brigand, who was holding it, and provided an escort for loads of British merchandise that had been lying at Kava Rukh for many months. Altogether 16,000 loads were brought in, and incidentally several merchants were saved from bankruptcy. When it finally became evident that the Turks would not advance on Isfahan, the column marched S. to Shiraz, which it reached in Nov., thereby completing a march of 1,000 m. through the heart of Persia.

Taking over the Swedish Gendarmerie in Fars.—At Shiraz the question of the gendarmerie had to be settled. The Persian Government had not actually given its consent to it being incorporated in the S. Persia Rifles, but was unable to pay or equip the force. Spread over the route for a distance of 300 m. from the borders of Fars in the N. to Kazerun in the S. and numbering some 3,000 men, the problem which confronted Sir Percy Sykes was one of extreme difficulty. He had no staff to administer or train such large numbers and he was aware that it was this force which had seized the British consul only a year previously and that many of the officers were pro-German in sentiment. But he also realized that, if the gendarmerie broke up into well-armed bands of robbers and devastated the country, few supplies would reach Shiraz. He consequently addressed the officers, explained to them that they were to be absorbed into the S. Persia Rifles, and expressed the hope that they would serve Persia loyally by helping to put down the brigandage that was slowly but surely extirpating the sedentary population. In March 1917, this action was indirectly approved by the Persian Government, which officially recognized the S. Persia Rifles. The men were in rags, half-starved and undisciplined. It was impossible to take them off the road immediately, as there were no barracks for them at Shiraz. It was a case of feeding, clothing and paying the men at first and of gradually restoring the discipline that appeared to be almost lost. With only three or four British officers available, much was done, and when a proper staff reached Shiraz in the spring of 1917, rapid progress was the order of the day.

The Restoration of Order in Southern Persia.—Since the assassination of Nasir ed Din in 1896, the authority of the Persian Government had weakened year by year, and in Fars the governor general had been at the mercy of the powerful Kashgai tribe. Under their capable chief, Solat ed Dauleh, these powerful nomads numbering 130,000 tribesmen, and moving in their migrations from the Persian Gulf to Qumisheh, dominated the province, of which Solah (Solat) was the "uncrowned king." They were armed with Mausers, had plenty of ammunition and displayed great bravery in the field. Solah collected the revenue in full from his tribesmen, but paid nothing to the Persian Government. He also sent powerful raiding parties throughout the greater part of the province, which looted and levied blackmail. If a governor-general attempted any opposition to Solah, the latter promptly prevented supplies and goods from reaching Shiraz. The result was scarcity in the bazaars and discontent, followed by riots, and the governor-general returned to Teheran. It was obvious that Solah would be hostile to the British. The Kashgais considered that raiding was their right and would combine against anyone who attempted to put an end to it. Generally speaking, they held western Fars at their mercy and, farther E., lay the territory of the Khamseh Arabs, who were 70,000 strong. Under their chief, Qawam el Mulk, they ranged from the neighbourhood of Bandar 'Abbas and Lar to the vicinity of Niriz and Dehbid. The Arabs were less well-armed than the Kashgais but were equally brave. They were also equally addicted to looting. The marked difference between the two chiefs was that Qawam was a polished Shirazi, anxious to improve the state of Fars, although he could not immediately stop looting, whereas Solah lived with his tribesmen all the year round and had the same mentality. Sir Percy Sykes met Solah, with whom an agreement was made to prevent his tribesmen from looting, and, although it was realized that he was thoroughly untrustworthy, he refrained from attacking the British during 1917, and allowed them time to open up communications and construct forts at Saidabad (Sirjan) and Niriz. With Qawam good relations were maintained throughout.

In the summer of 1917, a force of Indian troops was stationed at Dehbid which, by the infliction of a single salutary punishment, made the main route safe, and caravans once again began to pass. In the autumn, combined operations against tribes marked down for punishment were undertaken by the Fars and Kerman columns. So successful were they that, had there been no interruption, S. Persia would have rapidly settled down to comparative prosperity. But the reaction of the World War was destined to be felt still more strongly than before in remote Fars.

Successful Russian Campaign in Western Persia.—The saddest year in Russian history opened with military success in Persia. As already mentioned, at the end of 1916, the Turks were occupying Hamadan and facing the Russians at Kazvin. During the winter, however, the position in Mesopotamia entirely changed. Instead of weak, ill-equipped columns, severely handicapped by unfavourable climatic conditions, failing before Kut al Amara, there was the pleasant picture of overwhelming forces under the inspiring leadership of Gen. Sir Stanley Maude recapturing Kut in Feb. 1917 and following this up by the signal success of the surrender of Bagdad to the British. The position of the Turks in Persia became more and more difficult as the British advanced. On the day Bagdad was occupied they evacuated Kermanshah and, pursued by the Russians, reached the Persian frontier at Qasr-i-Shirin on March 31, worn out and hungry but not wholly demoralized. Meanwhile the British had despatched two brigades to the Jebel Hamrin, but found the range occupied in great force by the Turkish 18th corps, which did not retire until the 13th corps had evacuated Persian soil intact, when the united forces moved northwards. On April 2, a squadron of Cossacks met the British at Qizil Ribat, but marched back the same night. There was no question of maintaining contact, but the British helped their allies to establish themselves firmly on the Diala river.

The Russian Collapse in Persia and its Results.—March 1917, which witnessed the capture of Bagdad, also saw the abdication of the Tsar. Gradually the Russian troops in Persia became demoralized and, during the winter of 1917–8, the rot had set in and hordes of Russians made for home, plundering the villages for food, pulling down houses to secure timber for fuel and selling arms, ammunition and equipment for a meal. Horses went for a few shillings, but this movement had completed the denudation of western Persia, already suffering from serious scarcity of forage, so that there were few buyers. Briefly, famine conditions prevailed in W. and N.W. Persia, and indeed in the other provinces. Such was the local position, but the world-results were still more serious. While Russia was fighting on the side of the Allies, her army stretched southwards from the European front across the Caucasus and N.W. Persia until, as we have seen, its extreme left flank, in 1917, touched the right flank of the British army in Mesopotamia, and thereby effectually prevented our enemies from approaching the frontiers of India. The ambitions of Germany to reach the Persian Gulf and India by that potent instrument, the Bagdad railway, had been rendered nugatory by the capture of Basra, but the collapse of Russia opened up a completed line of northern advance across the Caucasus and the Caspian Sea to 'Ashqabad, Merv (the junction for Kushk, within striking distance of Herat), Bukhara, Samarkand, and Tashkent, the administrative centre of Russian Turkestan. Over 100,000 German and Austrian prisoners were in Central Asia and, when through communication had been established, it would have been easy to reorganize these veterans and march on Kabul, with an invitation to the Afghans to share in the plunder of India.

When the Russian Empire proved to all the world its utter rottenness, Georgia and Armenia decided to claim their independence, and a third state came into being under the title of the republic of Azerbaijan, with Baku as its capital. In connexion with efforts made to ward off this terrible threat to India, British troops entered western Persia.

The Dunsterville Mission.—It was out of the question to dispatch large bodies of troops to support the Georgians or Armenians, as Bagdad was 800 m. distant from Baku. The authorities therefore decided to dispatch a military mission to reorganize the sound elements of the country into a force that would prevent the Turks and their German masters from reaching Baku. It was hoped that these small states would fight for their homes, but the Armenians absolutely failed to do this. Maj.-Gen. L. C. Dunsterville was appointed to command this mission, and, in Feb. 1918, he started off from Bagdad with a party of officers in 40 cars to cross N.W. Persia. Enzeli was his objective, and he hoped from that port to be able to proceed to Baku and Tiflis. He reached Enzeli only to find that the port and its shipping were in the hands of hostile Bolshevists, while the neighbourhood was dominated by Mirza Kuchik Khan, an ambitious brigand who had recruited some 4,000 followers, nicknamed *Jangalis* or "Forest Dwellers," to the cry of "Persia for the Persians" and who robbed his countrymen if they refused to join him. Dunsterville quickly realized the situation, and, before his opponents had concerted their plans and had overcome their fear of the armoured motor-car, the mission had retired to Kazvin and Hamadan, which latter city became its headquarters. During this period, Dunsterville was brought into close relations with the Russian generals Baratov and Bicherakov. The former had commanded the Russian troops in northern Persia and was now helplessly watching their disintegration. The latter, on the contrary, had kept his command of 1,200 men practically intact. By March, the last of Baratov's men had left, but Dunsterville had been able to keep Bicherakov's command at his side. Without its aid, the Jangalis, elated by the retirement of the mission which was magnified into a great victory over a British army, would have been able to march on the capital. There they would probably have introduced a reign of anarchy and have forced Persia into the war on the side of the Central Powers, with whom Kuchik Khan had close relations, and also German, Austrian and Turkish instructors, well supplied with machine-guns. When the Jangalis marched on Kazvin, Bicherakov forestalled them and drove them back to the forests with heavy losses. He then embarked at Enzeli. Dunsterville, who had received reinforcements consisting of a regiment of cavalry, a battery and two regiments of infantry, followed behind Bicherakov and took over the road. The Jangalis, under their European officers, attacked a detachment at Resht, but suffered heavy losses, and Kuchik Khan made terms and became a contractor for supplies. About this time, the Bolshevist Government at Baku was overthrown and replaced by the Central-Caspian Dictatorship, which asked for British assistance. Dunsterville took his force to Baku, held it for some weeks against overwhelming Turkish numbers, denying the use of the oil wells to the enemy, whom he also kept away from the Caspian Sea, and finally evacuated the town and returned to Enzeli, thus ending a very gallant episode of the war.

During the early autumn of 1918, more troops were moved up into N.W. Persia to prevent the threatened Turkish advance from Azerbaijan, the plan being to hold the Sehneh Bijar-Zenjan-Enzeli line. Actually the threat came to nothing, but a brigade of British troops was kept at Kazvin to protect Persia against the Bolshevists and to prevent the main route into Persia being closed. In March 1921, it was under orders to withdraw.

The Flight of the Assyrian Christians from Urmia.—Among the picturesque incidents of the World War, the rallying of the Assyrian Christians to the Russians, their migration to Urmia and their determined bravery in the face of enemies threatening to overwhelm them, have already been described. In the summer of 1918, an attempt was made by the British to help them with munitions and money, and a party of the refugees broke through the weak Turkish lines to receive the proffered aid. Unfortunately, false rumours of a disaster reached the main body of tribesmen who, collecting their families and flocks, fled panic-stricken to Bijar, pursued by Persians, Turks and Kurds. Every effort was made by the British to aid the refugees, but many fell on the road, by the sword and from hunger and fatigue, before the tribe, reduced to half its original number, was in safety. This flight eclipsed in dramatic interest that of the Torgut Mongols, so vividly described by De Quincey.

Military Mission of Maj.-Gen. Sir Wilfrid Malleson.—Not content with trying to head off the Turks at Baku, a second mission was despatched along the newly completed Nushki-Duzdab railway and then through Seistan and Meshed to Transcaspia to support the Turkoman and Russians who, under the title of Menshevists, were attempting to stem the flood of Bolshevism. Eastern Persia constituted part of the lines of communication of the mission, and there were no hostilities with the inhabitants, who, on the contrary, appeared to have realized the advantages of having a good route opened up through their country by a force which paid fair prices for everything it bought. Many gallant deeds were done by the small British detachments fighting along the Central Asian railway, and also by the force under Commodore D. T. Norris who, operating from Krasnovodsk, drove the Bolshevist flag off the Caspian Sea.

The Investment of Shiraz by the Kashgais.—In the spring of 1918, the Persian Government, in reply to a British note, denounced the S. Persia Rifles as a foreign force and a threat to Persian independence and integrity. It also expressed the hope that the British Government would withdraw its troops and allow Persia to commence her cherished reforms. Characteristically enough, while denouncing the conditions, it readily accepted the proffered financial help. The Cabinet was under the impression that Germany was winning the World War or else such a curt note would have never been penned. This reply was published all over southern Persia to the discouragement of our friends and the elation of our enemies. The results were speedily shown in serious desertions from the S. Persia Rifles and culminated in the formation of a confederacy under the Kashgai chief to annihilate the British in southern Persia. The date of an attack on the Indian troops at Shiraz was fixed by the grazing which would allow the nomads to keep their flocks in the neighbourhood, and, as there was a month to spare, Sir Percy Sykes despatched a column to deal with some raiding tribes in the vicinity of Niriz, which were known to have joined the Kashgai confederacy. These operations were successful and the small Indian detachment at Niriz was unmolested when the storm broke.

The day the column returned to Shiraz, Solah wrote that, by the orders of the Persian Government, he was about to take action for the defence of Islam against the "unauthorized force" of the S. Persia Rifles. He had at his disposal 4,500 Kashgais and 1,500 Kazerunis and this number was reinforced by contingents from Dashti, Dashtistan and elsewhere, and reached about 8,000 fighting men. The tribesmen were well armed with Mausers, had plenty of ammunition, and fought both bravely and cunningly. The British force at Shiraz was 2,200 strong, one-third being recruits. The S. Persia Rifles slightly outnumbered the Indian troops and, owing to propaganda and the proclaimed hostility of the Persian Government, were a danger to the British. The detachments in the outposts mutinied and surrendered or deserted. Qawam had collected 2,000 Arabs in and about Shiraz, who were ready to attack the beaten side. On May 24, the day after the return of the column, it marched out under Col. E. F. Orton, 1,600 strong, and attacked the Kashgais in the hilly country to the W. of the city. The resistance of the enemy was obstinate, but the Indian troops gradually moved forward, defeating rush after rush and, after 14 hours' fighting, occupied Solah's camp on the bank of the Qara Aghach river. The Kashgais fled headlong at the end of the action, in which they had suffered some 700 casualties, as against 51 in the British column. About ten days later the enemy returned in still larger numbers, and the Kazerunis occupied the garden quarter, which almost touched the fortified perimeter constructed by the British outside Shiraz. In June, the investment became closer, as the British withdrew an outpost which was dangerously isolated. The inhabitants of Shiraz were incited against the British by the *mullas*, some of whom preached *jihad* or Holy War. Sir Percy Sykes learned that the Kashgais were preparing to unite with the townspeople in a combined attack on June 17, and he determined to forestall them. Accordingly, on June 16, the column sallied out for 4 m. and then slowly retired drawing the Kashgais down on to the plain where they offered good targets to the guns. The column then returned to Shiraz. On the following day, Shiraz rose, its inhabitants attacking everyone suspected of being friendly to the British. But the Kashgais, whose losses had again been heavy, did not come to the support of the townspeople, who were overawed by the seizure at midnight of various key-positions by the British. The tide then turned. The governor-general appointed a new *Ilkhani* or "paramount chief" in place of Solah, whose followers began to break away, influenced by the heavy losses they had suffered. Qawam declared in favour of the new Ilkhani, and his example was followed by a brother of Solah who was followed by perhaps one-quarter of the tribe. The column marched out again, and Solah fled a broken man, pursued by Qawam, the new Ilkhani, and most of the Kashgai tribe.

The Siege and Relief of Abadeh.—Meanwhile the S. Persia Rifles at Abadeh, a town situated between Shiraz and Isfahan, had mutinied. The British officers took refuge with a company of 16th Rajputs, who held the small fort against overwhelming numbers. Within 36 hours of the final defeat of Solah, the victorious column marched northwards and, after a forced march of 180 m. in 169 hours, relieved Abadeh.

The Final Defeat of the Kashgais, Oct. 1918.—The new Ilkhani had no easy task in establishing his position and was besieged in his fort by the fickle tribesmen, who changed sides whenever it appeared to be to their interest to do so. The column rapidly marched S. and gave the Kashgais a final overthrow, the Burma Mounted Rifles counting 103 corpses. Solah fled weeping, and has been a refugee ever since. The night after this final success, both victors and vanquished were prostrated by the deadly influenza epidemic. The losses were appalling, 18% of the Shiraz force dying. The inhabitants of the city lost even more heavily. Indeed, the country generally suffered terribly, the scourge carrying off the young and able-bodied and sparing the old.

The Opening of the Bushire–Shiraz Route.—When Sir Percy Sykes was invested at Shiraz, the small force of Indian troops at Bushire was strengthened and arrangements were made for organizing a base with a view to an advance in October. In the autumn, influenza broke out, but the type was fortunately mild, the losses being only 2%. The force engaged in opening up the road included no fewer than 20,000 fighting men and followers and, as there was no fear of serious opposition after the final defeat of Solah, the operation was mainly one of constructing a good camel track up the infamous passes and of feeding the force. A railway was laid to Borazjan, 37 m. distant, across the level plain and thence carts plied to the foot of the passes. Kazerun was finally reached on Jan. 27 1919, the Shiraz column coöperating by marching over the passes to within a few miles of that town. The beneficent activity of the British was continued, and, when the troops withdrew in the spring of 1919, a good track, over which a car could run, albeit with great difficulty in a few places, had been constructed from Bushire to Shiraz. Unfortunately this route will require constant repair to keep it in good order, and it is unlikely that the Persian Government will do this. The result of these operations was entirely beneficent to the Persian Government. The Kashgais, who had had each successive governor-general at their mercy, were cowed and dispirited and it would have been easy to control S. Persia. But the Persian Government, as at present constituted, cannot maintain law and order.

Persian Delegation to the Peace Conference.—In 1919, a Persian delegation reached Paris in order to lay its claims before the Peace Conference. These claims were divided into three parts, dealing respectively: (*a*) with political, juridical and economic independence; (*b*) with right to territorial restorations; and (*c*) with right to reparations. Heading part (*a*) was the Anglo-Russian agreement of 1907, the abrogation of which was rightly demanded and was conceded so far as concerned Great Britain. Other demands, such as the abolition of consular courts and the withdrawal of consular guards, are entirely out of the question until Persia sets her own house in order and can guarantee order, security, and a pure administration. The territorial claims were extravagant, including Transcaspia, Merv and Khiva to the E., the Caucasus as far N. as Derbent and, westwards, Kurdistan, Diarbekr and Mosul. The claims for reparation stood on a different footing, as the W. and N.W. provinces of Persia undoubtedly suffered terribly from the ebb and flow of the contending armies, the retreat of the demoralized Russians and the flight of the Assyrian Christians. It is to be regretted that the delegation could not be permitted to lay its case before the Peace Conference, even though its claims were extravagant. Actually the Cabinet, which had despatched the delegation, fell and a representative of the new Cabinet laid the case of Persia before the Supreme Council.

The Anglo-Persian Agreement 1919.—In the summer, after negotiations extending over a period of nine months, two Agreements were signed at Teheran, the first of which was as follows:—

PREAMBLE: In virtue of the close ties of friendship which have existed between the two Governments in the past, and in the conviction that it is in the essential and mutual interests of both in future that these ties should be cemented, and that the progress and prosperity of Persia should be promoted to the utmost, it is hereby agreed between the Persian Government on the one hand, and His Britannic Majesty's Minister acting on behalf of his Government on the other, as follows:—

1. The British Government reiterate, in the most categorical manner, the undertakings which they have repeatedly given in the past to respect absolutely the independence and integrity of Persia.

2. The British Government will supply, at the cost of the Persian Government, the services of whatever expert advisers may, after consultation between the two Governments, be considered necessary for the several departments of the Persian Administration. These advisers shall be engaged on contracts and endowed with adequate powers, the nature of which shall be the matter of agreement between the Persian Government and the advisers.

3. The British Government will supply, at the cost of the Persian Government, such officers and such munitions and equipment of modern type as may be adjudged necessary by a joint commission of military experts, British and Persian, which shall assemble forthwith for the purpose of estimating the needs of Persia in respect of the formation of a uniform force which the Persian Government proposes to create for the establishment and preservation of order in the country and on its frontiers.

4. For the purpose of financing the reforms indicated in clauses 2 and 3 of this agreement, the British Government offer to provide or arrange a substantial loan for the Persian Government, for which adequate security shall be sought by the two Governments in consultation in the revenues of the Customs or other sources of income at the disposal of the Persian Government. Pending the completion of negotiations for such a loan the British Government will supply such funds as may be necessary for initiating the said reforms.

5. The British Government, fully recognizing the urgent need which exists for the improvement of communications in Persia, with a view both to the extension of trade and the prevention of famine, are prepared to coöperate with the Persian Government for the encouragement of Anglo-Persian enterprise in this direction, both by means of railway construction and other forms of transport; subject always to the examination of the problems by experts and to agreement between the two Governments as to the particular projects which may be most necessary, practicable and profitable.

6. The two Governments agree to the appointment forthwith of a joint Committee of experts for the examination and revision of the existing Customs Tariff with a view to its reconstruction on a basis calculated to accord with the legitimate interests of the country and to promote its prosperity.

Signed at Teheran, August 9, 1919.

The second Agreement defined the loan, which was fixed at £2,000,000 at 7%, redeemable in 20 years. There were two letters, in the first of which the British Government promised coöperation in securing a revision of the treaties actually in force between the two Powers, compensation for damage suffered during the war, and any justifiable rectification of frontiers. In the second it was laid down that Great Britain would not claim from Persia the cost of maintaining British troops in Persia for the defence of her neutrality, and asked Persia, in return, not to claim compensation for any damage done by her troops.

The Agreement was signed, but no immediate steps were taken to elect a new Majlis and submit it for ratification. In consequence, everything was held to be in suspense.

Finance.—In 1920 a British Financial Adviser was engaged by the Persian Government, a member of the Treasury staff being selected for the post. To a certain extent he could occupy himself with superintending the payment of money in connexion with the Cossack brigade and other matters in which help was given to the Persian Government, but his office was in suspense and the loan of £2,000,000 could not be made until the Agreement was ratified. With all overdue instalments paid up, the total debt of Persia as at Dec. 31 1920 was as follows:—

Loans	Original Amount	Outstanding
1. Russian 5% Loan of 1900, 1902 . . . . (Rubles)	32,500,000	31,223,170
2. Russian Consolidated 7% Loan 1911 . . . (Krans)	60,000,030	31,524,501
3. Indian 5% Loan	£314,281 16s.4d	£180,421
4. Imperial Bank of Persia 5% Loan of May 8 1911 . . .	£1,250,000	£1,223,061
5. British Advances of 1912–4, 7%	£490,000	£490,000
6. Russian Advances (Rubles)	1,891,500	1,576,250
7. British Advances 1915–7 . . .	£817,000	£817,000
8. " " (Krans)	1,000,000	1,000,000
9. " " 1918 (Krans)	—	92,500,000
10. British Loan, Aug. 9 1919 . . .	£2,000,000	Not yet received.

The Anglo-Persian Military Commission.—Among the important questions was the formation of a uniform force for Persia. An Anglo-Persian Commission was appointed and recommended a total strength of 60,000 men. As funds for such a force were not immediately available, it was decided to absorb the S. Persia Rifles, 6,000 strong; the Cossack division, 8,000 strong; and the Swedish gendarmerie, 8,400 strong. The total force would be gradually raised to 40,000 and all other troops would be disbanded. The Chief Military Adviser would be British and the Chief of the General Staff a Persian, although there was no Persian officer who possessed the qualifications. This scheme was in abeyance in 1921, pending ratification of the Agreement.

The Bolshevist Invasion of Persia.—In May 1920 the Bolshevist fleet from Baku bombarded Enzeli, took possession of the remnants of Denikin's squadron and leisurely occupied Resht, where a Provisional Government was formed under Kuchik Khan. The British detachment at Enzeli was withdrawn to Kazvin. At Teheran there was a panic and the British were blamed for not protecting Persia. The Cossack brigade recaptured Resht some months later, but finally retreated in a demoralized condition and took refuge inside the British lines. In March 1921 there was a considerable Bolshevist force in the province of Gilan, but it was thought unlikely to prove a serious threat to Persia until the brigade of British troops should be withdrawn from Kazvin.

Railways.—The question of railways has loomed large in Persia partly from the political and strategical and partly from the commercial point of view. For many years Teheran had been the unsuccessful hunting-ground of seekers for concessions, who had finally been replaced by the representatives of Great Britain and Russia. It may be readily granted that the only satisfactory solution of the problem of transport in Persia lies in the construction of railways. Their influence would probably help the country to pass quickly from the methods of transport used by the patriarch Job to those of the 20th century. But there are many difficulties to be surmounted before railways can be constructed in Persia, the chief obstacles being financial and political.

Persia is a vast but miserably poor country with a scanty population living in isolated villages, generally lying many miles apart. The towns are small and do not increase, and there is very little trade. In the N. the country is more fertile, owing partly to a heavier rainfall, and there are important exports as well as imports whereas in the S., if we except oil, there are practically no exports carpets, pistachio nuts, opium, hides and wool making a small total compared with the large imports. In other words, unless minerals are found which it is profitable to export, Persian railways, constructed in the S. or W., cannot pay.

Had the Russian Government continued on the old lines it is probable that money would have been found for the construction of a railway across Persia. The grandiose scheme appealed to the Tsar, while his ministers considered that it would secure their hold on the Russian sphere and also bring them closer to the Indian Empire, thereby enabling them to exercise pressure on Great Britain. These facts were fully realized by the British Government, which was, however, unable to refuse to discuss the scheme and, in 1912, a *Société d'Études*, including British, Russian and French representatives, was formed, with the object of constructing a Trans-Persian railway. It was intended, in the first instance, to build a line to Teheran, starting from Alyat, a station to the S. of Baku. Negotiations in connexion with this, the first section of the Trans-Persian railway, were carried on until the outbreak of the World War. In addition to this important scheme the Russian Government in 1913 obtained a concession for the construction of a line to Tabriz, starting from the terminus of the Trans-Caucasus system at Julfa. This concession included rights for a service of steamers on Lake Urmia to which a branch was to be run, and also a concession for an extension to Kazvin. The line to Tabriz was opened in 1916.

Meanwhile the British had not been idle, and a syndicate, of which Messrs. Greenway & Lynch were the leading members, submitted to the Persian Government a scheme for the construction of a network of railways in southern Persia: (*a*) from Mohammerah or Khor Musa to Khurramabad and Burujird; (*b*) from Bandar 'Abbas to Kerman; (*c*) from Bandar 'Abbas to Shiraz; and (*d*) from Bandar 'Abbas to Mohammerah. This far-reaching scheme for a monopoly of railway construction in S. Persia included the right to develop ports where necessary. It also involved the issue by the Persian Government of bonds secured on the railways and their earnings and on any other available sources of revenue.

The syndicate decided to begin work on part (*a*) of the scheme. The base would probably have been Khor Musa, an inlet of the sea, which ran inland for many miles towards the Karun river and possessed remarkable advantages in the way of deep water and safe anchorage. The alternative was Mohammerah. The line would have been constructed across the level plain of Arabistan to Dizful and would then have risen through the hills to Khurramabad. Survey operations were attempted in the hills in 1913, but the greedy tribesmen attempted to levy such enormous sums for protecting the parties that the work came to a standstill. The results of the World War have entirely changed the position and it seems that this scheme will be allowed to fall into abeyance.

There is no doubt that if railways are constructed into the interior from the Persian Gulf, the port of Bandar 'Abbas, or perhaps a new port some miles to the W., will be selected. The route running across the Rudbar district and thence to Rigan and Kerman, over the low Gishu pass, avoids the very high passes to the S. of Kerman and, once the plateau is struck at Rigan, the country is ideally suitable for railway construction right across Persia. Upon the whole, this is the most satisfactory alignment. The route from Bandar 'Abbas to Shiraz and thence to Mohammerah would violate the principle that lines should be built into the interior and not run parallel to the coast, where they could not compete with sea transport.

After the World War the question of railways was again taken up by a strong group, which included Sir Charles Greenway, the chairman of the Anglo-Persian Oil Company. The scheme included a railway to Teheran from the Persian frontier at Kuraitu, at which point was the terminus of a metre-gauge line from Bagdad. A survey was commenced via Kermanshah, Hamadan, Kazvin and Teheran. Surveys to Enzeli and Tabriz were also contemplated. It was agreed that, upon the completion of the surveys, the Persian Government would have the right to call on the group to construct the railway line or lines either as a Persian State railway or as a private company. No agreement as to terms was drawn up.

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Medical Conditions.—Persia is divided up into a great elevated plateau which occupies the chief part of the area of the country and which is separated from the Caspian Sea in the north by a low-lying narrow strip of land from 20 to 60 m. broad, and from the Persian Gulf in the south by a strip of land little above sea level and about 40 m. in width. The strip of country bordering the Caspian Sea has a very high rainfall, its climate is damp and very relaxing, the temperature being moderate. Marshy and swampy areas with luxuriant forests and vegetation occupy a considerable portion of this part of Persia. Mosquitoes, including the Anopheles varieties, are very numerous, and insect life is abundant. Malaria is very common, and few residents escape infection. The medical conditions prevailing here are those which are found in other damp relaxing climates with no great extremes of temperature. Tuberculosis is fairly common, and respiratory diseases such as bronchitis, pneumonia and influenza are prevalent. There is great overcrowding in the towns, and owing to the lack of adequate sanitation water-borne diseases such as dysentery, enteric fever and cholera are prevalent. Typhus and smallpox and the ordinary infectious fevers are common. Heat stroke does not occur, but owing to the high humidity the climate is very oppressive and trying to European residents.

The plateau region of Persia, occupying almost the whole area of the country, is divided into a mountainous portion which covers the whole of the western half of Persia, the general level being from 3,000 to 6,000 ft. above the sea, while the remaining portion of the plateau is chiefly desert and its general level is from 2,000 to 3,000 ft. above the sea. The climate of the Persian plateau is temperate, the summer temperatures not exceeding those of England. The winter temperature depends largely on the altitude, and extremes of cold are experienced. The atmosphere is invigorating and healthful, but in spite of this diseases of various kinds are prevalent owing to the lack of sanitary precautions. Water-borne diseases such as enteric, dysentery and cholera are prevalent, and this is largely due to the extraordinary fondness of the Persians for conveying water through numerous channels both above and underground in the towns and villages. The water usually comes from mountain springs and is clear and sparkling, but becomes contaminated in the course of distribution. No water should ever be drunk from these channels without previous boiling or chlorination; the remarks made in the article on MESOPOTAMIA relating to protection from water-borne diseases apply with equal force to Persia. Prophylactic inoculation with T.A.B. vaccine is essential as a protection against enteric. Malaria is very common owing to the breeding of mosquitoes in the various streams and water channels. The malaria is very frequently of the malignant type, and is often not controlled by the oral administration of quinine. The intramuscular or intravenous administration of the drug should always be adopted in such cases for the first few days of treatment, after which a full course of treatment by the mouth should be given. It is very remarkable to find malaria so prevalent and of so malignant a type at such a high altitude as that of the Persian plateau.

Overcrowding and herding together of the poorer classes of the population occur especially in the cold months, for housing accommodation is very insufficient. In consequence of this the common infectious fevers and smallpox are prevalent. Tuberculosis and influenza are rife, and the lice-borne diseases, typhus and relapsing fever, are of common occurrence.

A special type of relapsing fever occurs along the Zenjan-Tabriz route, which is spread by a large tick (*Argas Persicus*) known as the "Mianeh bug," which has a great predilection for foreigners; this disease is very common at Mianeh and resembles clinically the lice-borne relapsing fever.

Eye disease is as common in Persia as Mesopotamia, and is due to the same causes. Sand flies are common and sand-fly fever is of frequent occurrence. Oriental sores are very common and are known by the Persian name "Salek," meaning a year, which is an average time for their duration. Venereal diseases such as gonorrhoea and syphilis are common amongst the natives.

Diarrhoeal diseases are very common in Persia, being spread by contaminated water, and food infected by dust and flies. These cause a very high infantile mortality amongst the natives. Neurasthenia and mental breakdown sometimes affect residents in Persia, the high altitude of the plateau being probably a causative factor.

In consequence of the Civil War and the Turkish and Russian invasions of 1914–7 much destruction of the dwellings of the poorer inhabitants occurred, and the animal transport so essential for the conveyance of food was greatly reduced. The food supplies were largely used up, and a serious famine occurred in 1917–8. Starvation carried off large numbers of the poorer inhabitants, and those debilitated by lack of nourishment and insufficient clothing became ready victims to such diseases as malignant malaria, dysentery, typhus, etc. (W. H. W.)

PERSIAN GULF.—The term "Persian Gulf" is, strictly speaking, restricted to the landlocked sea which extends in a south-easterly direction from the mouth of the Shatt al 'Arab 460 m. to the mountain mass of the promontory of Oman, terminating in Ras Musandam, but, for the purpose of this article, it will be considered to include the Gulf of Oman to which it is joined by the Strait of Ormuz, 29 m. wide. The Gulf itself has an average width of 120 miles. It is tidal, spring tides rising about 9 ft.; the water is somewhat salter than the Indian Ocean, and seldom exceeds 10 fathoms in depth; with the exception of the Shatt al 'Arab, the Jarrahi and the Hindiyan rivers, which mingle their waters with those of the sea at the W. end of the Gulf, all the streams that flow into it are so salt as to be undrinkable. The Euphrates and Tigris have within historical times silted up their mouths to an extent that has materially altered the coast-line of the Gulf and these rivers seem destined in the future to unite El Hasa to Fao, just as in the past they produced the fertile plains of Mesopotamia. The Persian Gulf is lacking in good harbours, anchorage being mostly shallow and exposed.

N. Coast.—From the Indian Ocean the Gulf of Oman is entered approximately where Persian territory begins at the tiny port of Gwattar. From Gwattar the coast-line, running W., first to the Strait of Ormuz, next along the N. shore of the Persian Gulf, and finally to the mouth of the Shatt al 'Arab,[1] is nominally under the exclusive control of the Persian Government. The inhabitants of this tract are Persians or Arabs who by domicile and intermarriage with Persians have lost nearly all their racial and most of their social characteristics, but retain a dialect of Arabic as their mother tongue.

S. Coast.—The S. coast on the Gulf of Oman may be regarded as commencing from Ras el Hadd; it extends to the Ras Musandam. This coast is under the nominal suzerainty of the Sultan of Muscat, the principal ports from E. to W. being Sur, Muscat, Matra, Khabura and Sohar. From Ras Musandam westwards the Arabian shore is inhabited by tribes of Arab origin, which are independent and in treaty relation with Great Britain.

Up to 1913 the Turks exercised the right of suzerainty over the maritime districts of El Hasa and Hofuf, and claimed it in Qatar and Kuwait. The Emir of Nejd, 'Abd el 'Aziz ibn Sa'ud, ejected them from the first-named districts; the war has put an end to their claims elsewhere in the Gulf. The Trucial chiefs of the Arabian coast hold sway between the peninsulas of Musandam and Qatar. From E. to W. their headquarters run as follows:—Ras el Kheima, Umm el Qaiwein, 'Ajman, Sharja, Dibai, Abu Dhabi, Qatar. The Sheikh of Bahrein exercises no authority over the mainland, which from the S. extremity of the bay in which Bahrein lies to Jebel Manifa N. of Qatif is recognized as within the territories of the Emir of Nejd (*see* ARABIA).

The friendly attitude of Ibn Sa'ud on the outbreak of war with Turkey made it imperative that the British Government should come to a definite understanding with him, and he was recognized by a treaty dated Dec. 28 1915, as independent ruler of Nejd and El Hasa, and given a limited dynastic guarantee, with a promise of support in case of foreign aggression. Great Britain assumed control of his foreign relations outside Arabia. He on his part undertook not to alienate any territory to a foreign Power, except with the consent of the British Government.

Shortly afterwards a treaty was made with the Chief of Qatar, whereby his position was assimilated to that of the Trucial chiefs. The British Government undertook in addition to afford their good offices to the Sheikh in the event of unprovoked aggression by land.

Climate.—The prevalent winds in the Gulf follow the configuration of the coast, *i.e.* N.W., known as the *shamal*, and S.E., known as the *qaus*. The former wind, rising often to a gale in a few hours and falling as suddenly, is foretold by no change in the barometer. With the *qaus* the reverse is the case. This wind is much dreaded by native mariners as it strikes nearly all the sheltered anchorages.

Rainfall varies from 6 in. to 9 in. at the W. end of the Gulf to a negligible quantity at Muscat. As is to be expected, the rainfall on the peninsula is somewhat greater than on the Arab coast. The influence of the S.W. monsoon, which is marked at Muscat, is scarcely noticeable in the Persian Gulf proper, though recent upper-air investigations conducted at Bagdad give some reason to think that the effects of the monsoon can be observed even there.

The temperature at the W. end of the Gulf varies from a minimum of 4° or 5° F. below freezing point at night in winter to a maximum of 115° F. in the shade during a few days in summer; the humidity of the air at Muscat is greater and the climate is, in consequence, much more trying, but even here a maximum of 109° F. has been recorded, the lowest minimum being 55°. Snow has been known to fall at Bushire. (A. T. W.)

Medical Conditions.—The medical conditions prevailing in the Persian Gulf are largely determined by the peculiarly trying climatic influences to which the inhabitants are exposed. The Arabian desert forms the W. and S. shores, which are almost uninhabited except for the small centres of population around its few widely separated towns, Kuwait, noted for its pearl fisheries, in the N.W. corner, being the most important of these. The E.

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[1] The W. frontier of Persia was finally demarcated in 1914, a few months before the outbreak of war, by a mixed Anglo-Russian Perso-Turkish commission.

and N. shores are formed by the desert country of southern Persia, and are similarly very sparsely populated, Bushire, in the N.E. part of the Gulf, the port for the Shiraz district of southern Persia, and Bandar 'Abbas, at the entrance of the Gulf, being the chief centres of population. The hot season of the year is from May to October, July and August being the hottest months. The Persian Gulf has an unenviable reputation for its dangers from heat-stroke, and the sun's rays seem to have a peculiar deadly power in this region, for the risk of exposure is greater than in any part of the world, though other countries have a temperature which is equally high. The explanation is to be found in the extreme flatness of the country and the absence of trees or vegetation. The clear atmosphere is in its upper strata free from clouds and dust, so that the sun's rays undergo scarcely any absorption and strike down with full force on the light-brown desert soil, from which they are radiated and reflected to a great extent. The relative humidity of the air along the shores of the Gulf is high, so that exposure to the direct and reflected rays of the sun and radiation from the hot soil are encountered in a moist atmosphere.

So trying is the heat that some parts of the Persian Gulf are almost uninhabitable to natives in the hotter months. The greatest care requires to be taken by white races to avoid exposure to the sun and heat. Dwellings require careful construction, with thick walls and roofs of non-conducting material to keep out the heat-rays, and fans and punkahs are essential for the promotion of currents of air in the inhabited rooms. Personal protection, in the shape of thick pith topees, or cork helmets, and spinal pads, is necessary in the hot months, the clothing being light and loose and not too thin. Fatigue from physical exertion is a predisposing cause of heat-stroke, and constipation and alcoholic indulgence should be avoided.

Should a person be infected with latent malaria, heat exposure is very likely to induce an acute malarial attack and the combination is almost certain to lead to hyperpyrexia. On this account malarial subjects living in the Persian Gulf should take especial care to have an effective course of treatment in order to eradicate the disease as far as possible. The frequent association of heat-stroke with malaria is to be borne in mind in the treatment of heat hyperpyrexia, for, should the temperature of the patient not subside rapidly after treatment with cold sponging in a current of air or cold baths and ice, an intramuscular or intravenous injection of 10 grains of quinine bihydrochloride should be given without delay. In the case of white people exposure to heat of itself frequently causes heat-stroke, but probably in almost all cases of heat hyperpyrexia amongst natives the malarial complication is the exciting cause and therefore with them quinine treatment is all-important. Natives are generally immune to the effects of heat apart from other complicating causes of high temperature, such as malaria, etc., whereas white races may be affected with heat-stroke from heat exposure even if in perfect health. If a white person suffers in the hot months from any disease causing fever, *e.g.* enteric or sand-fly fever, etc., there is always a serious danger of hyperpyrexia, and this has to be guarded against.

The Effects of Heat.—The effects of exposure in the case of white races are not only manifested by the acute attack of heat-stroke, but, if this is avoided by proper care, it is nevertheless certain that long residence in the Persian Gulf causes a certain amount of tissue degeneration, owing to the exposure of the body cells to abnormal conditions of temperature. The highly specialized cells, viz. those of the nervous system, suffer most; and nerve-cell fatigue is shown by manifestations of neurasthenia. Lack of the power of brain concentration and severe inability to undergo the mental strain of arduous work are often the penalty which white races pay.

Beri-beri is a dietetic deficiency disease which manifests itself by cardiac weakness with shortness of breath, swelling of the legs and peripheral neuritis with numbness of the limbs and weakness. The climatic conditions of the Persian Gulf particularly seem to predispose to this disease, for it very frequently attacks white persons resident there, especially if they are exposed to dietetic hardships.

Residents in the towns along the Persian Gulf are exposed to the same dangers from disease as are experienced in similar places in Mesopotamia and Persia (*see* MESOPOTAMIA and PERSIA). Thus malaria and sand-fly fever, dysentery, typhoid and paratyphoid fever, cholera, smallpox, and occasionally typhus fever, eye diseases, oriental sores and indeed any disease conveyed by impure water, flies, contaminated dust or the contagion of sufferers from infectious diseases, are prevalent in the inhabited places along the Persian Gulf, and precautions must always be taken to guard against them.

(W. H. W.)

Geology.—Large portions of the littoral had not up to 1921 been examined geologically. Of the numerous islands that dot the Gulf many are partly at least of volcanic origin, notably Qishm and Ormuz.

The geological formations represented are the following in descending order:—

Recent or sub-recent	Shelly conglomerates and dead coral reefs of the littoral; red sandhills of the coast of Trucial Oman; alluvium of Turkish Iraq; river and lake deposits of Oman and the interior of Persia.
Pleistocene	Foraminiferal oolite or "Miliolite."
Pliocene	Bakhtiari series; grits and conglomerates.
Miocene	Fars series; marls, clays and sandstones with limestones and interbedded strata of rock gypsum.
Lower Miocene	Clypeaster beds of the Bakhtiari mountains.
Oligocene and Eocene	Nummulitic limestones of Persia; Muscat series; and Bahrein series.
Upper Cretaceous or Lower Eocene	Ormuz series; lavas and tuffs with interbedded clays and sandstones.
Upper Cretaceous	Hippuritic limestones of Persia and Oman.
Jurassic or Lower Cretaceous	Serpentinous and other igneous rocks of Oman.
Carboniferous to Trias	Oman series; limestones and slates with beds of chert.
Archaean	Hatat beds; schists and quartzites.

The latest movement to which the Gulf has been or is now being subjected is one of gradual elevation, of which traces are found in recent littoral concretes, now as much as 450 ft. above present level, and in the flat ledge which surrounds Muscat harbour.

Numerous "shows" of petroleum exist along a broad belt running N.W. and S.E. through Mesopotamia and down the Persian Gulf. These are the most abundant at the foot of a chain of hills where the oil wells of Daliki, Bebehan, Ramuz and Shushtar, Dizful, Pusht-i-Kuh, and Qasr-i-Shirin are situated. Oil has, however, been struck in paying quantities hitherto only at a point 30 m. E. of Shushtar. Experimental boring on Qishm I. in 1916 had not given any result up to 1921.

Among other mineral products, asphalt is found at Bahrein; coal 30 m. inland from Sur, and some seams of good coal in newer strata; sulphur occurs in a fairly pure state at Khamir and Bustaneh near Lingeh, and on Qishm I.; copper, as copper glance and malachite, occurs in the interior of Oman; copper-mines are said to have been worked in the neighbourhood of the coast near Lingeh by the Portuguese, but all trace of them has been lost. Red ochre, for which there is only a limited market, is mined on Ormuz, Abu Musa and other islands in the Gulf; salt, as deposits, on Ormuz and Qishm I., and by evaporation, near Mohammerah, Fao and elsewhere on both sides of the Gulf; gypsum is widely distributed throughout the Gulf; iron, as haematite and pyrites, widely found through the Ormuz series.

Earthquakes are frequent and sometimes severe in the Persian Gulf proper, especially on Qishm I. and on the coast in the neighbourhood. In 1865 an earthquake levelled the villages of Darveh Asul near Mugam; in 1880 an earthquake caused 120 deaths in Basra; in 1883 severe shocks were felt from Bushire to Tahiri; in 1884 an earthquake caused 132 deaths on Qishm I., which was in consequence deserted; in 1897 an earthquake destroyed Qishm town and caused over 1,000 deaths; further shocks were experienced at Qishm and Bandar 'Abbas in 1902 and 1905.

Agriculture.—Cereals are produced in considerable quantities in the hinterlands of Mohammerah and Bushire and in the intervening coastal strip; the rest of the Gulf largely depends on imports from this part of Persia or from India. Dates are grown for the European market at Muscat and for local consumption on both sides of the Gulf, but not in considerable quantities. The Muscat date reaches maturity sooner than the Basra crop, and is commercially valuable.

Live Stock.—Camels are abundant on the Arabian side of the Persian Gulf littoral and are also found on the Persian coast, especially where the country is open. Horses are scarce in Oman and few are kept in Trucial Oman or in Bahrein or El Hasa. But they are more common in Qatar and Kuwait. Nejd, or Central Arabia, is the principal horse-breeding country adjacent to the Persian Gulf, and is the only one in the world, except the adjacent Syrian desert, where the genuine Arab is produced on any considerable scale.

Sailing Craft.—The Persian Gulf is by tradition the home of sailing craft, for their skill in handling which the Phoenicians afterwards became famous in the Mediterranean. There are some 14 types of native craft which belong to the Persian Gulf proper. The same principle of construction applies to nearly all; as a general rule these vessels are remarkable for the beauty of their lines. They sail well and are weatherly craft. The principal shipbuilding centres in the Persian Gulf are now Kuwait, Sur in Oman and Lingeh.

Fisheries.—Few seas are more prolific in fish than the Persian Gulf and the Gulf of Oman; the great proportion of known species are edible and many have a commercial value for the isinglass or oil extracted from them. Fish are extensively used for manure, especially in Muscat, where they are also fed to cattle without unpleasant results. Sharks are caught in enormous numbers with hook and harpoon; the flesh is considered by some to have aphrodisiacal properties; the dried fins and tails are exported to China; the oil is used for smearing boats. The turtle is also found, the carapace being exported as tortoiseshell, the animal being gently roasted or boiled alive over a slow fire to facilitate the separation of the shell from the flesh. The whale is often seen in the Gulf of Oman; porpoises and swordfishes are common.

Pearling Industry.—The pearling grounds of Bahrein are in over six fathoms of water, mostly beyond the three-mile limit. The geological formation of the bottom of the Persian Gulf and the temperature and shallowness of its waters appear to be favourable in a high degree to the growth of the pearl oyster. The pearl banks which are known and actually worked occupy a very considerable proportion of the whole area of the Gulf, chiefly upon the Arabian side. The pearl banks on the Persian side are found chiefly on the coast between Lingeh and Tahiri, and again in the neighbourhood of Kharag Island. The largest and most productive of all the banks are situated on the Arabian side of the Gulf and are fished annually; the banks of the Persian coast are poor as well as small and are fished at infrequent intervals. The total value of pearls exported was estimated in 1905 at about £1,500,000, the value at current prices of the 1919 outturn was probably about £2,500,000. Mother-of-pearl was exported before the World War to the value of £20,000; after the war high freights and absence of demand from Hamburg, the principal market, killed the trade for the time being. Some 4,500 boats employing some 75,000 men are employed in the pearling industry during the season, which lasts for almost three months, and can do little else but fish for the rest of the year.

Commerce.—A summary of import and export values of trade in the Persian Gulf, excluding Mohammerah and Basra, is appended. It is, however, not possible to make reliable deductions from these figures taken by themselves. The normal value, for example, of the post-war exports of Bahrein should be more nearly £3,000,000 than £1,000,000, owing to the enhanced value in terms of money of pearls, and the export trade of Bandar 'Abbas should likewise be more in a normal post-war than in a pre-war year. Of the total imports from 1912–3, one-half come direct from India and a quarter from the United Kingdom direct, the balance from foreign countries, European and Asiatic, in about equal proportions. For the latest post-war statistics up to 1921 the proportions were respectively two-thirds, one-sixth and one-sixth, owing primarily to the almost complete cessation of direct shipments from Europe to the Persian Gulf.

Summary showing Import and Export Values of Trade in the Persian Gulf (excluding Iraq and Arabistan) in two pre-war years and in the latest post-war year available.

	Imports			Exports			Total
Arab Side	1912–3	1913–4	Post-War Year	1912–3	1913–4	Post-War Year	Post-War Year
Kuwait	£438,298	£370,817	£1,061,300	£132,260	£114,421	£276,092	£1,337,392
Bahrein Is.	2,239,527	1,877,630	1,414,423	2,295,136	1,740,008	946,344	2,360,767
Muscat	463,551	407,768	289,964*	301,477	271,536	242,188*	532,152
Total	£3,141,376	£2,656,215	£2,765,687	£2,728,873	£2,125,965	£1,464,624	£4,230,311
Persian Side							
Bushire	£951,720	£825,767	£2,723,357	£637,091	£601,765	£917,655	£3,641,012
Bandar 'Abbas	314,877	459,000	997,610†	283,942	266,700	279,945	1,277,555
Lingeh	164,325	180,120	159,283	193,895	126,381	99,858	259,141
Total	£1,430,922	£1,464,887	£3,880,250	£1,114,928	£994,846	£1,297,458	£5,177,708
Grand Total	£4,572,298	£4,121,102	£6,645,937	£3,843,801	£3,120,811	£2,546,264	£9,408,019

* 1918–9 in the case of Muscat, 1919–20 in other cases.
† Reckoning 55 Krans to the £.

Banks.—The Imperial Bank of Persia, in addition to branches all over Persia, has branches at Bushire, Bandar 'Abbas and Mohammerah. The Eastern Bank has a branch at Bahrein.

Currency.—Persian currency alone is legal in Persia, but the rupee is freely current in Persian ports. On the Arab coast the rupee is legal tender, and is almost exclusively used for commercial transactions, but the Maria Teresa dollar circulates freely, and is preferred by the inhabitants of the interior of Arabia. Persian currency is also in use, principally in Bahrein.

Lights and Buoys.—In view of the difficulties attending navigation in the Gulf, and the impossibility of arranging with the Governments of the littoral for the provision of lights and buoys except on terms which would have greatly hampered shipping, the British Government, in view of the great preponderance of British shipping in the Gulf, has established since 1912 a very complete system of lights and buoys, the cost of which is shared in equal moieties by the Government of India and H.M. Government in accordance with the recommendations of the Welby Commission. Lighthouses exist on one of the Quwain group of islands off Ras Musandam and on Tunb I.; light-buoys have been placed at Bushire in the outer and inner anchorages, at Bahrein and on the Shatt al 'Arab bar. Shore lights and unlighted buoys have also been provided where necessary. There is a lightship in the Shatt al 'Arab bar, which is very completely buoyed and lighted throughout its length from the lightship to Fao, where there is a fixed light.

Mail Communications.—The Persian Gulf was at the end of the 18th century the most rapid route between Europe and India, and it was not until 1833 that the Red Sea route was adopted by the East India Co.; from this date until 1862 the Gulf fell into an extraordinary state of inaccessibility—letters for India being sent from Bagdad and Basra via Damascus, and correspondence from Bushire for Bagdad via Teheran. In 1862 the British India Steam Navigation Co. undertook their first mail contract for the Persian Gulf, and simultaneously the Euphrates-Tigris Steam Navigation Co. agreed to run a subsidized line of mail steamers from Basra to Bagdad.

The British India Co. maintain weekly and fortnightly services between Basra and the Persian Gulf. The fast weekly steamer stops only at Karachi, Bushire and Mohammerah on its way to Basra. The slow mail steamers stop at every port in the Gulf, either on the upward or the downward voyage.

Posts.—The reopening in 1862 of direct communications between India and the Persian Gulf gave rise to a demand for properly organized post-offices, and the Indian Postal Department accordingly opened branches in 1864 at Muscat and Bushire. Every port of importance on both sides of the Persian Gulf has an Indian post-office transacting all classes of business.

The existence of these offices on Persian soil has occasionally been the subject of complaint by the Persian Government. The justification for their continued existence has been found in the climatic conditions of the Gulf, which make it difficult for the Persian Government to staff their own offices adequately, and in the fact that the rupee is the only currency common to all ports of the Gulf and to India, while the trade of these ports is mainly with India.

Telegraphs.—The inception of the Persian Gulf telegraphs, which formed the first links in an intercontinental chain, was dictated not by local interests, but by broad considerations of national advantage. The Crimean War of 1856 brought home to the Porte the slowness of communication between the Persian Gulf and the outlying provinces of the Turkish Empire, while the Mutiny of 1857 taught the British Government a similar lesson in regard to India. In 1857, after some unfruitful preliminary attempts, the Turkish Government agreed to the construction of a line from Scutari to Bagdad on their behalf; this was finished in 1861 and was extended to Fao by 1864, after further lengthy negotiations, when it was linked up with the cable from Karachi which had been laid meanwhile. The route of the cables has been several times altered. They now run from Karachi to Jask, whence a cable runs to Muscat; from Jask one cable runs to Hanjam, and thence to Bushire; another cable runs direct to Bushire. Hanjam is connected by cable with Bandar 'Abbas. A double cable connects Bushire with Fao. Bushire, Hanjam, Bahrein, Abadan and Basra are provided with wireless stations. Kuwait is connected by land line with Basra; Jask is connected by a land line to Karachi. Mohammerah is connected by land line and cable with Basra and Abadan and via Ahwaz with Bushire and with the inland Persian system. Bushire has its own telephone system; Mohammerah is connected by telephone with Basra. The whole system is under the control of the Indo-European Telegraph Department, whose director-in-chief is responsible to the Secretary of State for India. The Department, which also controls the principal international lines in Persia, is amply self-supporting.

Population and Religions.—In all the countries of the Persian Gulf, Islam in one or another of its forms prevails, almost to the exclusion of other religions. The Mahommedans of the Persian Gulf region belong to the following denominations:—Sunni, Shiah, Ibadhi, Wahabi and Khojah. The Wahabis may be regarded as a branch of the Sunnis and the Khojahs as a branch of the Shiahs. Shiahs predominate on the Persian coast except in the districts of Rud Hilleh, Shibkuh, Lingeh, Bastak, Biyaban, Jask, and on the islands of the Persian Gulf. The Persian province of S. Arabistan, which is under the hereditary government of the Sheikh of Mohammerah, is exclusively Shiah. The Sunnis are estimated at 100,000 out of a total population in the maritime districts of 300,000.

Persian Makran is exclusively Sunni except for the district of Jask. At Gwadar, Sunni, Khojah and Ibadhi rub shoulders. The Oman sultanate is predominately Ibadhi. In the territory controlled by the Emir of Nejd the official religion is Wahabi, but a few Shiahs are still to be found in the districts of El Hasa and Hofuf. Bahrein is Sunni, but has a large Shiah population of Persian origin. Kuwait is Sunni, with Wahabi leanings.

The Khojahs number some 2,000 souls and are distributed over the ports of the Gulf, mainly on the Arab side. They are descended from Hindus of Sind and Kach, who were converted from Hinduism to the Isma'ili form of the Shiah faith in the 15th century of the Christian era.

Hindus total about 1,500 and are to be found in all the principal ports of the Gulf, especially at Gwadar, where their presence gives rise to occasional fanatical disturbances. Panislamic ideas have obtained little hold in this region; in Persia and wherever people are Shiahs the pretensions of the Sultan of Turkey to the headship of the Mahommedan world are rejected, as also in Oman, where the bulk of the population are Ibadhi.

Missions.—Roman Catholic missions have at intervals worked in the Persian Gulf, on the Persian side since the beginning of the 17th century; they are still represented at Bushire. The first Protestant mission to the Gulf was initiated by Henry Martyn in 1811; his Arabic New Testament appeared in 1816. The American Arabian mission was founded in 1889 in the United States; the first agents of the mission were the Rev. J. Cantine and the Rev. S. Zwemer, who established a branch at Bahrein in 1892 and later at Muscat. Political complications arising out of the work of the Arabian mission have been singularly few, a happy circumstance which must be attributed chiefly to the missionaries themselves, whose general opinion is that for a Mahommedan country the Persian Gulf and eastern Arabia are peculiarly free from religious fanaticism.

Historical.—The Persian Gulf has figured in history from the earliest times. A myth (preserved by Berosus) records that Oannes (Hea) the fish-god came up from that part of the Erythraean Sea which borders on Babylonia, to teach the inhabitants of that country letters and sciences and arts of every kind. This seems to indicate the arrival, in ships, of strangers of a higher grade of civilization. These strangers may have come from China, but Sir H. Rawlinson considers they were a dark race not belonging to the Semitic family. Rawlinson also suggests that the Phoenicians may have originally come from the Bahrein Is. and extended westwards to the settlements on the Mediterranean at least 5,000 years ago. Though there is no direct evidence of this connexion, enormous numbers of tumuli, probably of Phoenician origin, exist on the Bahrein Is., which also contain tumuli of Babylonian age. Babylonian tumuli have also been found at Bushire. Col. Yule, from Chinese annals of the 7th and 8th centuries, says that Chinese ships came as far as Siraf (Tahiri) and the Euphrates, where they lay at Hira near Kufa, and adds that this trade fell off in A.D. 878 owing to civil war in China. From the records of Fa-Hian of the 4th century it is clear that ships from China exchanged merchandise with Arab vessels at Ceylon, and this is confirmed by the account of Cosmas, who wrote between 530 and 550 A.D. Along the shores of the Persian Gulf in 326 A.D. came Nearchus, the admiral of Alexander, on his way from the Indies to the Tigris delta; from Basra sailed Sindbad in the 9th century in one of the many Arab craft which traded thence to India, Ceylon and Zanzibar. Thousands of years before Christ the pearls of Bahrein were sold in Egypt; Bahrein still supplies 80% of the world's output of pearls. After the Phoenicians, Babylonians, and Arabs came the Persians; though they never aspired to command of the seas and are indeed not a maritime race, the Persian Gulf was no obstacle to them, and at one time or another they occupied Muscat and parts of Oman and Bahrein, and penetrated into the greater part of Arabia.

Commerce between East and West had from early times followed this route in preference to that of the Red Sea, and when during the 15th century Genoa and Venice successively lost their positions in Oriental commerce, through the capture of Constantinople by the Turks and by the hostility of the Mamelukes of Egypt respectively, the country which most earnestly devoted itself to the quest of a new way to India was Portugal. Albuquerque seized several towns on the coast of Oman, including Muscat in 1507, and soon afterwards established his authority on the I. of Ormuz, at the N. of the Gulf. Towards the end of the 16th century the Dutch made their appearance in Indian waters as rivals of the Portuguese; and in 1616 the first British "factories" of the East India Co. were established on the Persian coast. In 1622 the Portuguese were expelled from Ormuz by joint efforts of the British by sea and of the Persians by land; in 1650 they finally left Muscat. In 1664 the French made their appearance on the scene, but did little trade. It is, however, of interest to note that in 1698, in consequence of a nominal agreement, from which nothing resulted, among the principal Europeans in the East, the French undertook the policing of the Persian Gulf against pirates. The Dutch, who had played no part in expelling the Portuguese, now became increasingly predominant, and the wars that were waged in Europe between England and Holland had their counterpart in the Persian Gulf.

In 1674 hostility between Holland and England ceased, but the position was radically unsatisfactory owing to the prevalence of piracy, from which both England and other nations suffered heavily. At the beginning of the 18th century the improved state of affairs in India began to have an effect on the Company's branches in the Persian Gulf and by the middle of the 18th century the Dutch settlements had disappeared.

Henceforward the bulk of the trade was in British hands, but piracy was rife, the slave trade flourished, and the coast towns and islands of the Persian Gulf had fallen from their ancient prosperity to a lower level than they had experienced for some centuries. To restore this prosperity had for about a century before 1921 been the secular mission of Great Britain in these lands, the British resident in the Persian Gulf, acting as the representative of the Government of India, being the umpire to whom by long custom all parties on both coasts appealed and who had by treaties been entrusted with the duty of preserving peace.

Students of international politics are familiar with the claims of nations to a position of preference in certain regions, based upon historic, economic or geographical considerations. The claims of Great Britain to such a position in this region are unique. But beyond two brief occupations of the I. of Kharag, and the continuous possession of a few square miles of desert land at Basidu, the S.W. end of the I. of Qishm, she has at no time acquired territory in that region, although she has for generations borne an honourable burden there which no other nation has ever undertaken anywhere, except in the capacity of sovereign. British influence kept the peace amongst peoples who were not subjects of the King-Emperor; Great Britain lighted, buoyed, charted and patrolled for over a century waters over which it claimed no formal lordship; and kept in strange ports an open door, through which traders of every nation might have equally free access to distant markets. On the other hand, a steady and increasing market was gained for the products of the British Empire, and in particular for those of India; the ports of the Gulf were made safe, not so much for the British as for the Indian trader; nearly 75% of the trade of the Gulf ports was in 1921 with India, and an even greater proportion in the hands of Indians, Persians and Arabs. A good market had been created for Indian products, particularly yarns and cereals. But more than this, Great Britain had gained a reputation for patient and persevering efforts to promote the spread of civilization in these regions, a prestige which yielded profit during the difficult years of the World War, and was not without its effect in India. With the exception of local disturbances of old standing at Muscat, and at Bushire (where they were fomented by German gold), the Arab and Persian population of both shores maintained a friendly attitude to Great Britain throughout the war, although British gunboats were seldom, if ever, seen at that time in waters which in peace they had regularly patrolled.

The peculiar interests, strategic, political and commercial, of Great Britain in the Persian Gulf have never been denied; they are intimately connected with the welfare of India, with the security of its communication with the outside world, and of its internal tranquillity. The considered policy of the British Government was embodied in 1903 in Lord Lansdowne's declaration in the House of Lords that "we should regard the establishment of a naval base or a fortified port in the Persian Gulf by any other Power as a very grave menace to British interests, and we should certainly resist it by all the means at our disposal." This declaration was formally reaffirmed in 1907 by Sir E. Grey, in a despatch to the British ambassador at St. Petersburg, which further stated that "H.M. Government will continue to direct all their efforts to the observance of the *status quo* in the Gulf, and the maintenance of British trade; in doing so they have no desire to exclude the legitimate trade of any other Power." These declarations were never openly challenged, and in 1912–4 the British Government entered into far-reaching negotiations with the Turkish and German Governments with the object of regularizing the position. The resulting agreements had not, however, been ratified before the declaration of war in 1914.

The Arms Traffic.—During the 3rd Afghan War the trade in modern arms and ammunition in the Persian Gulf attracted the attention of the British and Indian Governments for the first time. In 1880 the Government of India took preliminary steps in the matter within its own borders; in 1881 the importation of arms and ammunition into Persia was made illegal, but with little effect. In Far Eastern countries firearms are widely possessed and used. In 1890 the General Act of the Brussels Conference struck a blow at the arms trade in Africa and diverted it to the Persian Gulf, which was not subject to the Brussels Act.

The stream of arms flowing from Zanzibar to Muscat continued to increase in volume, and in 1892 no less than 11,500 firearms were landed at Muscat, of which more than half were at once reëxported. The figure was doubled by 1895 and trebled in 1897; in spite of prohibitions, imports into Persia continued on a large scale. Moved at last by the great quantity of military material that was being found in the Gulf, the British Government urged the Persian Government to enforce the actual law and to confiscate the stores of arms which had accumulated at Bushire. The Persian Government, thoroughly alarmed, took action, but with only temporary effect. Somewhat similar action was taken at Bahrein. These seizures created much indignation and anxiety among firms in England whose interests were involved.

From 1898 to 1908 the attitude of the British Government towards the question was one of regular attention without the power to intervene directly or effectually. In 1900 the consignment of arms and ammunition to the Persian Gulf through Indian ports with or without transhipment was made illegal. This was reinforced by an Act of Parliament empowering the sovereign to prohibit by proclamation the export of arms and ammunition from the United Kingdom to countries or places where they might be employed against British troops and subjects.

The trade, blocked at Persian ports and later at all Gulf ports except Muscat, continued to flourish, in spite of a naval blockade of the Makran coast by Great Britain in 1910–1. At length, however, in 1912 the Sultan of Muscat issued a proclamation requiring all arms imported into Muscat to be placed in a special warehouse from which they could not be removed except on production of an import permit from the competent authority at their destination. This killed the trade at Muscat; the French Government, who had claimed that the Sultan's proclamation was inconsistent with his treaty engagements with them, accepted the accomplished fact with good grace after lengthy diplomatic negotiations, and the trade was by 1913 almost dead, except at the N. end of the Gulf, where it still flourished on a small scale. The arms traffic has been responsible for much of the prevailing anarchy of the Middle East and indeed of Arabia. The possession of firearms places irresistible temptations in the path of unsophisticated and quick-tempered tribesmen. For this result the European Powers signatories of the Brussels Act of 1892 are to blame for lack of foresight and to some extent of goodwill. Joint Anglo-French action at any time during 1902–12 would probably have been effective in stopping the traffic.

Slave Trade.—On board the fleet which in 1626 conveyed Sir Dodmore Cotton, a British ambassador, with his staff, from Surat to Bandar 'Abbas, there were more than 300 slaves bought of Persians in India, and the only remark which this circumstance suggested to Sir T. Herbert was that "ships, besides the transporting of richer varieties from place to place, consociate the most remote regions of the earth by participation of commodities and other excellencies to each other." In 1772 it was decided by the English courts that a slave as soon as he set foot on the soil of the British Isles became free; the slave trade, however, continued actively until 1807, when an Act was passed to prevent British subjects dealing in slaves; in 1811 the traffic in slaves was declared to be felony; in 1833 the status of slavery was abolished throughout the British Dominions. In defiance of her commercial interests and of her popularity with the Moslem population of the Gulf, Great Britain set herself to suppress the trade, and executed a series of agreements with the chiefs of the Arabian littoral with this object. The arduous task of enforcing the observance of these treaties fell upon the Government of India and involved great sacrifice of lives and money.

In subsequent years over 700 slaves were rescued at sea and more than 2,000 otherwise released; the traffic was by 1920 virtually dead in the Gulf, but slavery as an institution seemed likely to continue for many decades to come to flourish inland in Muscat, in Central Arabia, and in a modified form in part of Persia.

AUTHORITIES.—The chief source of information is the late J. G. Lorimer's *Gazetteer of the Persian Gulf*, published confidentially by the Government of India in 1908. See also Lord Curzon's *Persia* (1892); papers by T. J. Bennett, of *The Times of India* (Royal Society of Arts, 1902), and the late Comm. A. W. Stiffe, Indian Navy (*Jour. R.G.S.* 1897); and handbooks prepared during the war of 1914–8 under the direction of the Historical Section of the Foreign Office. (A. T. W.)

PERTAB (or **PARTAB**) **SINGH,** SIR (1844–), Indian soldier and statesman (*see* 21.259), relinquished his position as Maharaja of Idar in 1911 in favour of his adopted son Daolat Singh, in order to resume the regency of Jodhpur which he had previously held on the death of his brother in 1895, but this time for his grand-nephew Summair Singh, then 13 years of age. When the World War broke out Sir Pertab, in the words of Lord Hardinge the Viceroy, "would not be denied his right to serve the King-Emperor in spite of his 70 years." He came to France for service in the field with his young ward, then only 16, and commanded the famous Jodhpur Lancers. In the later stages of the war he served with them in Egypt and Palestine. Sir Summair Singh died in 1918, two years after receiving ruling powers, and Sir Pertab again became regent, assisted by a council.

PERU (*see* 21.264).—No accurate statistics for the pop. of Peru exist, but probably there are between 3,500,000 and 4,000,000 inhabitants besides the savage tribes, still partly independent, who inhabit the remoter *montaña* or eastern forest region. The racial proportions are approximately:—

Negroes, pure-blooded or predominantly African	6%
Various (including Asiatics, African-Indian mixture, etc.)	10%
Indians, pure-blooded or nearly so	52%
Mestizos (mixed Indian and white blood)	30%
Whites (entirely of Caucasian blood)	2%

The *negroes* are either descendants of slaves of colonial times or, in fewer cases, people who have drifted in during recent years from the Barbados, Trinidad, Panama, etc. Though the negroes of colonial times were notorious for their brawls and riots, those of to-day seem to be reasonably law-abiding. They are addicted to many vicious practices which are gradually causing the population of Lima and other coast cities to decrease in physical strength and intelligence. Most of the negroes live on the coast. The *Indians* fall into two groups: those who dwell in the highlands or *sierra* in the interior and still preserve their ancient language and customs, and those who live on the coast and speak Spanish, dressing more or less after the European fashion and observing but few customs that can be called pre-Spanish. The lot of the highland Indians is, in many districts, very bad. This is due to three chief causes: the abuse meted out by the great landed proprietors ever since the conquest (1531) and continued with some abatement to the present day; the use of far too much alcohol and coca; the lack of even rudiments of public or personal hygiene. There is much evidence, however, that the lot of the Indians will improve within a generation or two. The younger generation of the land-holding class are beginning to see that it will be to their advantage to improve the material and social condition of the Indians on their estates; there is an increasing agitation in favour of suppressing the sale of sugar-brandy and other harmful liquors to the Indians and of regulating the consumption of coca; at the present time the Peruvian Government is beginning to take serious measures for the sanitation of the country. The *mestizos* compose the middle class, the artisans, small shopkeepers, clerks, petty politicians, etc. They tend to congregate in the cities. They are mostly unintelligent, though a small percentage of them enjoy an improved social status, won usually by the exercise of an intellectual calling, the law, medicine or literature. The *whites*, though few in number, were, until the revolution of July 1919, the dominant class in Peru. They owned most of the land and controlled all the more important political posts. For the most part they are thoroughly modern-minded and progressive people, intellectual and agreeable. It is to be regretted that few of the older generation recognized their responsibilities with regard to their Indian tenantry, but the younger men, according to observations in 1921, were beginning to take an interest in sociological problems.

Since 1890 all the Government railways then in existence, and additions to them made later, have been administered by the Peruvian Corporation, chiefly owned by foreign investors, which took over the railways and a number of other national resources. In 1920 the railways administered by the Peruvian Corporation were the following:—

	Length (miles)	Gauge (meters)
Central railway	248	1·44
Pisco to Ica railway	46	1·44
Southern railway	535	1·44
Pacasmayo railway	82	1·44
Paita to Piura railway	60	1·44
Chimbote railway	35	·91
Trujillo railway	64	·91
North-western railway	132	·91
Lima-Lurin railway	22	·91

Besides these important lines there are a number of others neither owned by the Government nor administered by the Peruvian Corporation. Chief of these are the Cerro de Pasco railway from Oroya to Cerro de Pasco and a few local lines in various coast valleys.

In the 10 years, 1910–20, a certain amount of road-building was done. In many parts of the coast comparatively little has to be done to make the surface of the desert a good road-bed for motor traffic. During the rubber boom of the previous decade there was a considerable development, in the forest region, of river traffic. But since 1910 that has slowly been diminishing, and in 1920 the Peruvian reaches of the Amazon were served by but one steamer which made one round trip per month.

Coastwise traffic by steamers is well organized and efficient. Two companies, one British and the other American, maintain direct sailings from New York to Callao, through the Panama Canal, the run being made in 12 days. There is also good direct service with England, the Mediterranean and Japan. The smaller ports of the Peruvian coast are served by the steamers of the Peruvian line, the Chilean line, the British line and a number of less important steamers. A direct service for freight only was in Feb. 1921 about to be inaugurated between the Peruvian coast and California. The telegraphs, wireless included, were in 1921 owned and administered by the Government. Experiments were then being made with the wireless telephone, also under Government. Two privately owned cable companies give coast and foreign service.

Industries and Commerce.—The chief exports of Peru are sugar, cotton and copper. There should be many other articles. Petroleum is already produced in considerable quantities, but Peru could attain a production of vegetable oil fully as important. Castor oil, linseed oil, cottonseed oil and rapeseed oil are a few of the possibilities. Meats, hides and wool could easily be exported on a large scale. Lumber, in the lower or easterly parts of the country, might well be made to take the place of the lost rubber trade. Peru suffers from the unimaginative ultra-conservatism of her landowning class and of her business men. The fundamental need is capital, and the only people in the country who have sufficient initiative to undertake these developments lack capital. Vanadium mining has been undertaken with unusual energy, and it is said that Peru to-day produces 95 % of the world's vanadium.

Imports and Exports.
(In Peruvian pounds, equal to £ sterling.)

	Imports	Exports	Excess of Exports
1910	4,980,697	7,974,076	2,093,379
1911	5,438,245	7,422,027	1,983,782
1912	5,140,338	9,438,581	4,298,243
1913	6,088,776	9,137,780	3,049,003
1914	4,827,930	8,767,790	3,939,860
1915	3,095,544	11,521,807	8,426,263
1916	8,683,150	16,541,063	7,857,913
1917	13,502,851	18,643,414	5,140,563
1918	9,705,113	19,972,595	10,267,482

The effect of the World War upon Peruvian trade with Great Britain and the United States is displayed by the following table (in Peruvian pounds equal to £ sterling) :—

	Imports from G.B.	Imports from U.S.	Exports to G.B.	Exports to U.S.
1912	1,367,976	1,248,880	3,237,564	3,599,851
1913	1,598,605	1,755,251	3,403,109	3,033,259
1914	1,338,552	1,570,723	3,274,097	3,046,892
1915	662,546	1,488,264	3,621,624	6,390,282
1916	1,496,304	5,116,582	2,961,841	10,404,334
1917	1,934,665	8,792,710	3,792,750	10,942,407

Government.—The Government of Peru is one of the most highly centralized in the world. Every question has to be decided in Lima, by the supreme Government, and often by the president in person. Directly or indirectly the president appoints all the prefects, sub-prefects and governors who administer the provincial subdivisions of the country. All of these officers are removable at his will. The Legislature (Chamber of Deputies and Senate) controls the purse-strings of the nation and acts as a check on executive extravagances.

From 1860 to 1919 the supreme law of the land was the Constitution of 1860. That constitution embodied all the leading principles of the extreme centralization already referred to. There was, however, a pronounced movement toward "regionalism," in the southern departments between 1910 and 1919. That movement aimed not only at liberalizing the administrative machinery, but also at a systematic improvement of the condition of the Indians.

In Jan. 1920 President Leguía's Government brought into being the Constitution of 1919, prepared chiefly by Senator Mariano H. Cornejo and Don Germán Leguía y Martinez. That constitution makes concessions to the demand for regionalism by creating "Regional Congresses," three in number, one for the north, one for the centre and one for the south.

History.—From 1908 to 1912 was the first term of Augusto B. Leguía y Salcedo as president of Peru. A number of internal reforms and improvements were planned by him, but the collapse of the rubber market caused great financial stringency and had the indirect result of curtailing the Government's reforming activities. It was during this first term of Leguía that the Yale Peruvian expedition, headed by Prof. Hiram Bingham of Yale, conducted extensive geographical and archaeological explorations in Peru. The results were published and did much to direct the attention of foreign capitalists and others to Peru. Other Yale expeditions continued their work in Peru until 1915 when, as a result of misunderstandings, Prof. Bingham and his followers were ordered out of the country. Between 1912 and 1915 Guillermo Billinghurst and Oscar Benavides were presidents, each for a short term of revolutionary character. During this period there were diplomatic conflicts between Peru and Bolivia and Peru and Ecuador, neither of them going so far as to become military in character.

The outbreak of the World War in Aug. 1914 found Peru in an exceedingly bad state financially and economically. Until well into 1915 financial depression of the most acute kind continued. But about the middle of 1915 a great demand for Peruvian cotton, sugar, copper and other products came into being, with the result that exportations, at war prices, attained proportions never known before.

From July 1915 to July 1919 José Pardo y Barreda was President. In his time came the question which side was to be favoured by Peru in the World War. The then ruling class was inclined, at first, to be pro-German, partly because they were not fond of England (due to conflicts with the Peruvian Corporation), partly because they did not like the "democratic" atmosphere of President Wilson's various documents, and also partly because they had personal, financial and sentimental ties with Germany. On the other hand, many members of that class and the mass of the thinking element of Peru as a whole were strongly in favour of the Allies. Consequently, soon after the declaration of war by the United States in 1917, the Government of Peru severed diplomatic relations with Germany.

On July 4 1919 Don Augusto B. Leguía, who had been elected president to succeed Don José Pardo y Barreda (president 1915–9), seized the person of President Pardo by means of a revolutionary movement and himself became provisional President, being again duly reëlected to the presidency some time after. This movement caused profound consternation in Peru, where people were beginning to assure themselves that the day of revolutions was over. Leguía inaugurated an ambitious scheme of internal reform, including the sanitation of 31 Peruvian cities, the reorganization of the army by a French Military Commission, the reorganization of the navy by an American Naval Commission, the reconstruction of the educational system by American experts, and huge irrigation works built under the direction of an American engineer, C. W. Sutton.

The most important reforms brought about by the Government of President Leguía were those calculated to modernize the country. President Pardo had inaugurated the practice of calling in foreign expert advice by inviting to Peru Dr. Henry Hanson, of the department of public health of the Panama Canal zone. Dr. Hanson was first invited to study the malarial fevers in the vicinity of Lima, but in July 1919 a serious yellow-fever epidemic broke out in Piura, the northernmost coast department of Peru, and he was sent thither with full authority to stamp it out. He continued in Peru as director of sanitation, and his work was much widened so as to include the general sanitation of Callao and the stamping-out of a bad epidemic of yellow fever which broke out in the department of Lambayeque in Jan. 1921. The late Gen. William Gorgas was also invited to Peru in 1919 in order to supervise extensive projected improvements to be carried out by the Foundation Company of New York. Those improvements were to include the resewering of Lima, the repaving of many chief streets of Lima and the sanitation of 31 Peruvian cities. There was much opposition to the contract made between the Peruvian Government and the Foundation Company—Congress, for example, being largely of the opinion that the contract was derogatory to the dignity and probity of Peru. This, together with the death of Gen. Gorgas, practically nullified the projected improvements.

A French Military Aviation Commission, headed by Gen. Vassal, came to Peru soon after President Leguía assumed office. It was intended to instruct officers of the Peruvian army in the use of various types of aeroplanes, and a school was founded at Maranga, near Lima. Proper financial support was not forthcoming, however, and in the middle of Feb. 1921 the French mission resigned, complaining that the situation in which they found themselves was intolerable. An American Naval Commission, headed by Capt. Frank B. Freyer, U.S.N., was called to Peru in July 1920 for the purpose of reorganizing the sea forces of Peru. In Jan. 1921 Capt. Freyer was made chief of staff with powers practically equal to those of the minister of marine.

Educational improvements under the general supervision of the minister of justice and instruction were undertaken. A large number of American educational experts, under the leadership of Dr. H. Erwin Bard, went to Peru, and Dr. Bard was made director-general of instruction (1921). The National Museum of Archaeology, likewise dependent upon the minister of justice and instruction, was also placed under an American expert from the Smithsonian Institution. (P. A. Me.)

PÉTAIN, HENRI PHILIPPE BENONI OMER JOSEPH (1856–), French soldier, was born on May 24 1856. He was commissioned from St. Cyr 1878, passed in due course through the École de Guerre, filled various staff appointments, including that of instructor at the École de Guerre, and was promoted colonel in 1910. At the outbreak of the World War he was commanding an infantry regiment, but he was immediately given a brigade and then a division, and he acquitted himself so well during the opening weeks of the struggle that he was advanced to the command of an army corps in Artois in Oct. 1914. He greatly distinguished himself on the occasion of the French offensive near Arras in May 1915, where his corps completely broke through the German position, though exploitation proved to be impossible for want of reserves. Soon afterwards he was given command of the II. Army. When preparations were being made in the summer for the contemplated offensive in Champagne, he was called upon to aid Gen. Castelnau in framing the plans and in carrying them out. Then, when the Germans in the following Feb. were gaining ground very rapidly before Verdun and the safety of the place of arms hung in the balance, Castelnau was sent to stabilize the defence. A few days later, having provided for the indispensable, Castelnau handed over control of affairs to Pétain, who took the battle in hand with method and energy, fought the attack to a standstill and saved Verdun. He was rewarded by being made a Grand Officer of the Legion of Honour and was placed in command of the group of armies of the Centre.

During the following winter Gen. Nivelle succeeded Gen. Joffre as commander-in-chief. Pétain's group of armies was not embraced in Nivelle's offensive scheme, but it was known that he was thoroughly doubtful of its success, and after its failure Pétain was appointed, first on April 27 chief of the general staff of the army, and then on May 15 commander-in-chief of the French armies on the western front. This position he took up at a moment when his troops were discouraged and mutinies were breaking out owing to severe losses, disillusionment following on over-sanguine hopes, and war-weariness, when the effects of the Russian revolution and those of America's intervention were alike difficult to discern, and when his own country was losing heart. He saw clearly that, in view of the wastage in man-power caused by three years of devastating war, an offensive project on a great scale, such as his predecessor had adventured, was impossible for the time being, and he therefore resolved first to nurse back the army to a healthy state of *moral* and then to restore its offensive powers by one or two battles with limited objectives in which victory was made certain by careful and abundant preparations. It was in accordance with this policy that he fought the Aug. battle at Verdun and that of Oct. on the Chemin des Dames, for which he was given the Grand Cross of the Legion of Honour. He established and maintained a close understanding with Sir D. Haig, and when the British V. Army was virtually rolled up near St. Quentin in March 1918, his promptitude in despatching reinforcements to the point of danger did much to relieve the critical situation. After Foch became generalissimo, portions of Pétain's forces played the leading part in the decisive counterstroke near Soissons which first turned the scale, and during the subsequent victorious operations of the Allies, the French commander-in-chief was most successful in coördinating the advance of his forces at all points along a very extended front, maintaining his liaison with the British on the one flank and the Americans on the other, and in the case of the latter taking an active part in the preparation of their two offensives. He was created marshal of France on the conclusion of hostilities, in recognition of his brilliant services during the war, and he was the recipient of many high honours from the Allied Governments. He subsequently held the position of vice-president of the Conseil Supérieur de la Guerre.

PETERS, KARL (1856–1918), German traveller (*see* 21.300). In 1907–8 Peters, who had again taken up residence in Germany brought actions for libel against a Munich journal and the *Cologne Gazette*, seeking to clear his character in regard to his administration in E. Africa. These actions wrought no change in public opinion in Germany and Peters remained on the retired list. However, in April 1914, at the instance of the Imperial Colonial Office he was granted a pension. During the World War he supported the extreme pan-German programme. In Feb. 1918 he published an autobiography, and he died at Woltorf, Brunswick, on Sept. 10 of the same year. He had lived to see German E. Africa, which he founded, conquered by British and Belgian troops.

PETERSON, SIR WILLIAM (1856–1921), British educationalist, was born at Edinburgh May 29 1856, the son of John Peterson, a merchant. He was educated at Edinburgh high school and University, and after being for a short time at Göttingen, in 1876 obtained the Ferguson classical scholarship and entered Corpus Christi College, Oxford. On leaving Oxford he was at first an assistant master at Harrow, but in 1879 became assistant professor of classics at Edinburgh. In 1882 he was made first principal of the newly founded University College at Dundee, but in 1895 he was appointed principal and professor of classics at McGill University, Canada. During his 24 years' tenure of this important position the university greatly progressed, and the scientific faculties in particular advanced considerably. In 1915 he was made K.C.M.G. In 1919 he was incapacitated by a stroke, and resigned his position, and being taken to England died at Hampstead Jan. 4 1921.

Sir William Peterson was for some years chairman of the Carnegie foundation for the advancement of teaching in America. His published works include editions of Quintilian's *Institutes of Oratory* (1891); the *Dialogue on Orators* of Tacitus (1893 and 1914); the *Speech of Cicero for Cluentius* (1895 and 1899); the *Cluni MS.* of Cicero (1901) and Cicero's *Verrine Orations* (1907); besides *Canadian Essays and Addresses* (1915).

PETROLEUM (*see* 21.316*).—Under the stimulus of increased consumption and many new uses for petroleum products, the search for petroleum both in the older producing countries and in new territories, often remote from civilization, was rewarded by important extensions and discoveries and, in many instances, by subsequent development, with the result that between the years 1908 and 1920 the world's petroleum production more than doubled. The increase is shown in the following table from the U.S. Geological Survey:—

World's Production.

Barrels of 42 U.S. Gal.			
1908	285,552,746	1915	427,740,129
1909	298,616,405	1916	459,411,737
1910	327,937,629	1917	508,687,302
1911	344,174,355	1918	514,729,354
1912	352,446,598	1919	544,885,000
1913	383,547,399	1920	694,854,000
1914	403,745,652		

In the period 1908–21 many prolific fields in the United States were developed, enabling that country to keep its preëminent position; Mexico grew from unimportance to second position; Argentina, Venezuela, Trinidad, Egypt and Persia developed production of commercial importance; Russia added the Maikop and Ural-Caspian fields, and Japan the Akita prefecture. In 1920 the United States produced 63·8% of the world's output, and up to the end of that year had produced 62·1% of the world's total commercial yield. The rank of the various petroleum-producing countries is shown in the table given below:—

NORTH AMERICA

United States.—Petroleum production in the United States in 1920 totalled 443,402,000 barrels. The following table from the U.S. Geological Survey gives the production of the important divisions in 1920 and in 1908, stated in bar. of 42 U.S. gallons:—

	1920	1908
Appalachian	30,511,000	24,945,517
California	105,668,000	44,854,737
Lima-Indiana	3,059,000	10,032,305
Rocky Mountain	17,517,000	397,428
Illinois	10,772,000	33,686,238
Mid-Continent	249,074,000	48,823,747
Gulf	26,801,000	15,772,137
Others	—	15,246
Total	443,402,000	178,527,355

The Appalachian area extends across the Appalachian Plateaus from south-western New York to Tennessee. It includes Kentucky, W. Virginia, Pennsylvania, New York and eastern Ohio. Oil and gas sands occur throughout a long stratigraphic interval, including rocks ranging in age from Ordovician to Carboniferous. Petroleum from the Appalachian area is a high-grade paraffin oil, the average gravity being about 45° Baumé (0·8,000 sp.gr.). The average for Kentucky is not quite so high. The Appalachian district is the oldest oil-producing area in the United States (*see* 21.317), and while a gradual decrease in its production from 1912 was shown, high prices and great demand resulted in substantial increases in 1919 and 1920. That the rate of decline was so slow is due to the remarkable thrift of small producers who have found it profitable to operate leases where production is one-sixth of a barrel a day and sometimes even less. A factor which has tended to revive and increase production in certain Pennsylvania districts is the so-called "water drive," by which water pressure is put on the rock to supplement the exhausted gas pressure. An instance of the result of the water drive is shown by figures of an eastern pipe-line attached to nearly 18,000 wells in the Bradford and Allegheny pools; this line in 1909 ran 1,531,000 bar.; in 1913 1,267,000 bar., a decrease of over 17%; and in 1920 the amount had risen again to about 1,568,000 bar., showing an increase in eight years of 23·8 per cent.

The Lima-Indiana field covers north-western Ohio and north-eastern Indiana, the oil being obtained from lenses or discontinuous layers in Trenton limestone. The average gravity is about 39° Baumé (0·8,285 sp.gr.), although some of the oil is much heavier. The Lima-Indiana field is steadily declining.

The principal productive area in the Illinois field is in the south-eastern part of the state, but there are also small scattered pools in central and western Illinois. Most of the oil is obtained from beds of sandstone in the Pennsylvania and Mississippian series of the Carboniferous system. In gravity the oils range from 27° to 37° Baumé (0·8,917 to 0·8,383 sp.gr.). This field is also declining.

In the period between 1908 and 1921, the greatest increases in production in the United States occurred in the mid-continent field, embracing Oklahoma, Kansas, northern and central Texas, northern Louisiana and southern Arkansas. In 1920 the mid-continent field

United States Geological Survey—World Production of Petroleum.

Country	Production, 1920				Total production, 1857–1920				
	Barrels of 42 U.S. gal.	Metric tons	Cubic meters	Per cent of total by volume	Date of First Production	Barrels of 42 U.S. gal.	Metric tons	Cubic meters	Per cent of total by volume
United States	443,402,000	62,188,000	70,492,000	63·8	1859	5,429,693,000	729,640,000	863,213,000	62·1
Mexico	163,540,000	24,410,000	26,000,000	23·5	1901	536,524,000	80,047,000	85,287,000	6·1
Russia	25,429,600	3,471,130	4,042,800	3·6	1863	1,904,021,000	252,072,000	302,701,000	21·8
Dutch East Indies	17,529,210	2,365,347	2,786,840	2·5	1893	219,584,000	29,690,000	34,910,000	2·5
Persia	12,352,655	1,685,219	1,963,825	1·8	1908	48,070,000	6,558,000	7,642,000	·5
India	7,500,000	1,000,000	1,192,000	1·1	1889	122,583,000	16,343,000	19,488,000	1·4
Rumania	7,435,344	1,034,123	1,182,110	1·1	1859	165,462,000	23,013,000	26,305,000	1·9
Poland (Galicia)	5,606,116	764,818	891,260	·8	1874	171,263,000	23,700,000	27,228,000	2·0
Peru	2,816,649	373,280	447,797	·4	1896	29,797,000	3,968,000	4,737,000	1·7
Japan and Formosa	2,139,777	285,076	340,180	·3	1875	42,810,000	5,708,000	6,806,000	
Trinidad	2,083,027	289,712	331,160	·3	1908	11,356,000	1,580,000	1,805,000	
Argentina	1,665,989	242,502	264,859	·2	1911	7,225,000	1,043,000	1,149,000	
Egypt	1,042,000	152,120	165,660	·2	1907	6,990,000	1,017,000	1,111,000	
British Borneo (Sarawak)	1,015,949	146,285	161,516	·2	..	4,052,000	584,000	644,000	
Venezuela	456,996	69,539	72,653	·2	1913	1,335,000	203,000	212,000	
France (Alsace)	388,700	54,900	61,800		1880	723,000	102,000	115,000	
Germany	212,046	29,950	33,711		1880	17,120,000	2,318,000	2,722,000	
Canada	196,937	26,258	31,310		1862	24,864,000	3,315,000	3,953,000	
Italy	34,180	4,750	5,434		1860	1,042,000	148,000	166,000	
Algeria	3,916	609	623		1915	37,000	6,000	6,000	
England	2,909	382	462		1919	5,000	56,000	67,000	
Other Countries					..	416.000			
Total	694,854,000	98,594,000	110,468,000	100·0	..	8,744,972,000	1,181,111,000	1,390,267,000	100·0

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* *These figures indicate the volume and page number of the previous article.*

accounted for 249,074,000 bar., or 56·2% of the total U.S. production. Pools are scattered throughout the area and new pools are constantly being discovered. Most of the oil produced in Kansas, Oklahoma and northern Texas is obtained from beds of sandstone in formations of the Pennsylvanian series (Upper Carboniferous). The oil produced in southern Oklahoma is mainly from several pools in beds of sandstone of the Pennsylvanian series, though some oil is found in the "red beds" of the Permian series (latest Carboniferous). The oil found in northern Louisiana and central Texas is obtained from sandstone or other porous rocks of the Cretaceous and Tertiary systems. The average oil from the mid-continent field is of about 35° Baumé (0·8,485 sp.gr.), ranging from the thick black oil of some of the Louisiana fields, which has a gravity of 21° Baumé (0·9,272 sp.gr.), to the high-grade Cushing oil of above 55° Baumé (0·7,568 sp.gr.). The Glenn pool discovery in Creek county, Okla., in 1907 led to a great petroleum development in that state. This pool reached a maximum production of 125,000 bar. a day, sustained from Aug. 1907 to Feb. 1908. In 1912 the famous Cushing pool, also in Creek county, was discovered. In the latter part of 1913 a well in the Cushing pool was drilled to the Bartlesville sand at 2,600 ft., and resulted in a large gusher and the inauguration of an unprecedented drilling campaign. The oil was the highest-grade crude yet discovered W. of the Appalachian fields. Gusher wells were brought in with frequency, and the production of the pool, which at the end of 1913 averaged about 25,000 bar. a day, was averaging at the end of 1914 over 225,000 barrels. There was a temporary decline early in 1915, but in April production had increased to almost 300,000 barrels. Subsequently it reached a maximum of 320,000 bar., sustained for a 60-day period. The Cushing production was of such high grade and so large that it broke the oil market. In June 1915 the flush production of the field had been exhausted and a decline began. Cushing in 1915 yielded 17% of the total quantity of oil marketed in the United States. The Cushing pool early in 1921 was producing about 27,000 bar. a day.

In 1914 the rich Augusta pool in Butler county, Kan., was opened up, and in 1915 the El Dorado pool, also in Butler county, was discovered. In 1916–7 the Towanda extension of the El Dorado pool resulted in the district increasing its output from an average of between 15,000 and 20,000 bar. in the first five months of 1917, to 80,000 bar. in June and to nearly 100,000 bar. for a few days in September. The wells in the Towanda extension were of large capacity but proved to be short-lived, and the El Dorado-Towanda pool declined to about 50,000 bar. before the end of the year. The pool early in 1921 was producing about 29,000 bar. a day.

Late in 1917 the discovery of oil in a well 3,450 ft. deep, a mile and a half S. of the town of Ranger in central Texas, stimulated a most sensational development, covering possibly the widest "boom" area in the history of petroleum in the United States. This was generally termed a "deep sand" development, and opened up extensive pools in Eastland county, Stephens county and a portion of Comanche county in 1918. Oil in the deep sand pools is obtained from several different horizons in the so-called Bend series, which is of Pennsylvanian and Mississippian age. In July 1918 a prolific well was drilled in at 1,735 ft. in the Burkburnett field in Wichita county, northern Texas, and Burkburnett was the scene of another great oil boom. The Ranger field reached a maximum capacity of about 75,000 bar. a day in the middle of 1919, but declined thereafter. It was producing 57,000 bar. on Jan. 1 1920 and 14,000 bar. on Dec. 31 1920. The Stephens county pool (where development was slower) was producing about 37,000 bar. daily at the beginning of 1920 and had increased its production to close to 130,000 bar. at the end of that year, subsequently declining to about 90,000 bar. in May 1921. The Burkburnett pool, following the opening up of the Burkburnett extension, reached a maximum yield of over 100,000 bar. daily in 1919, from which peak it gradually declined in 1920. Early in 1921 it was producing about 60,000 bar. daily.

Another important development in the mid-continent field was the discovery in Sept. 1918 of oil in a shallow well near Homer, Claiborne parish, in northern Louisiana. A large gusher at greater depth was brought in in Aug. 1919, and the boom scenes of Ranger and Burkburnett were transferred to Shreveport, La. (the headquarters of the Claiborne parish development), where late in 1919 and early in 1920 other large wells yielding as high as 30,000 bar. daily were brought in in the Homer pool. From a production of about 25,000 bar. at the beginning of 1920 the Homer pool reached a production of over 100,000 bar. in a few months. This output declined rapidly because of the quick decrease in production of the larger wells, but an average output of about 50,000 bar. daily was maintained during the latter part of 1920 and the early months of 1921. Geologically the northern Louisiana producing area is in what is known as the Sabine Uplift, an uplift of considerable magnitude in the Coastal Plain sediments, the nature and age of which have not been definitely determined. One of the most important developments of the early part of 1921 was the discovery of oil in commercial quantity in southern Arkansas. The discovery well was brought in near El Dorado in Union county, and rapid drilling of subsequent wells increased the potential production of the new pool to between 40,000 and 60,000 bar. a day by April 1921.

Several important pools were opened up in the Gulf coast field, which first came into prominence in 1901 when the Spindletop pool in Jefferson county, Texas, was developed. The Gulf coast field includes southern Texas and southern Louisiana, and the petroleum is associated with masses of rock salt and gypsum in domes. The age of the oil-bearing strata ranges from Cretaceous to Quaternary. The field includes a great number of small scattered pools, some of which have developed wells of enormous productivity. The gravity of the oil ranges from 15° to 30° Baumé (0·9,655 to 0·8,750 sp.gr.), an average of about 22° Baumé (0·9,211 sp.gr.). Among the more important pools of the Gulf coast are the Goose Creek, Hull, Humble, W. Columbia and Damon Mound pools. West Columbia attracted attention in 1920 when on July 20 the pool was extended by a well flowing at the rate of 26,000 bar. daily. This flow was practically sustained until Aug. 28, when the well rapidly declined.

The Rocky Mountain field, which embraces the areas of production in Colorado, Wyoming and Montana, as well as prospective production in Utah and New Mexico, was stimulated by the drilling in of a large well in the Salt Creek pool, Natrona county, Wyo., in April 1912. This started a general boom in Wyoming, which state supplies the bulk of the Rocky Mountain production. Petroleum in the Rocky Mountain field is obtained from strata of the Carboniferous and Cretaceous age. Oils from older strata range in gravity from 18° to 24° Baumé (0·9,459 to 0·7,865 sp.gr.) and are of paraffin base. The development of the richest part of the Wyoming fields was restricted until 1920, pending passage of legislation and issuance of regulations with respect to Federal public lands. The Wyoming field includes a large number of small pools, and the greatest production is obtained from the Salt Creek pool, which early in 1921 was producing about 50,000 bar. daily.

The California field, one of the most prolific in the United States, is divided into two geographic groups, one occupying two sides of San Joaquin Valley and commonly known as the valley fields, and the other occupying a large area along the coast and commonly known as the coastal field. All the valley fields, except one, lie on the west side of San Joaquin Valley, and the oil in most of them is obtained from porous Tertiary sandstone. The conditions in the coastal fields are in many respects similar. A very small part of the oil produced in California is obtained from Cretaceous formations. The oils range in gravity from 9·09° to 54° Baumé (1·000 to 0·7,609 sp.gr.), and heavy oils, containing little sulphur, predominate. A fair average gravity is about 21° Baumé (0·9,272 sp.gr.). California for many years was the leading oil-producing state. It was supplanted by Oklahoma in 1907 and 1908 but regained first place in 1909. California held this position until 1915 when its production declined, while Oklahoma's output, because of the Cushing production, greatly increased, Oklahoma again taking first place. Oklahoma held first place through 1920 with California a close second. The principal producing districts of California are: the Kern River, McKittrick, Midway-Sunset, Lost Hills and Belridge districts, all in Kern county; the Coalinga field, in Fresno county; the Lompoc and Santa Maria fields in Santa Barbara county; the Ventura and Newhall fields in Ventura county; and the Los Angeles and Salt Lake and Whittier-Fullerton fields in Los Angeles county. The largest production is obtained from the Midway-Sunset field, which in 1920 produced 37,917,010 bar., a daily average of 103,598 barrels. The Los Angeles and Salt Lake field produced 28,694,163 bar., a daily average of 78,399 bar.; the Coalinga field 15,464,198 bar., a daily average of 42,252 barrels. Important addition to production in the Midway-Sunset field was made in 1920 and 1921 by the development of the Elk Hills district, where large wells ranging from 2,000 to 6,000 bar. were brought in. Production of this district increased from 25,000 bar. per month during Dec. 1919 to 1,500,000 bar. during Dec. 1920.

Oil shale deposits are found in Colorado, Utah, Wyoming, Nevada, Montana, California, Texas, Kentucky and W. Virginia in the United States, but while extensive experimental work has been done on retorting and much chemical investigation has been conducted as to the nature, properties and behaviour of oil shale, the establishment of the industry on a commercial scale has not yet been accomplished in the United States. By far the greatest attention has been paid to the oil shales of the western states.

Alaska.—Oil has been found in several localities in Alaska, notably in the district between Icy Cape and Cape Yatag, 400 m. N. W. of Sitka; in the Kayak field, several miles inland from Cape Suckling; in the Cook's Inlet field, between Itimma Peak and Itimma Lake; and in the Cold Bay field, opposite Kodiak Islands. Wells were drilled in the early 'nineties in the Kayak, Cook's Inlet and Cold Bay regions, but oil was not found in commercial quantity. In 1920 interest in Alaskan fields was revived, but no important drilling operations were reported. Production was 56,000 barrels.

Canada.—Canada's petroleum production declined steadily from 1908 to 1920. In 1920 the output totalled 198,425 bar. compared with 241,000 bar. in 1919 and 528,000 bar. in 1908. Virtually all of Canada's petroleum is produced in Ontario, and occurs in sandstone and limestone of Silurian and Devonian age. The gravity is about 30° Baumé (0·828 sp.gr.). A small production is obtained in New Brunswick and Alberta. In Aug. 1920 oil was discovered on the Mackenzie River, 150 m. S. of the Arctic Circle in the Canadian North-west Territory. The well was located N.W. of Fort Norman, and on Aug. 23 1920 it began to flow over the top of the mast from a depth of 783 feet. After an uninterrupted flow of 40 minutes the well was capped.

The oil was analyzed as 38° Baumé (0·8,333 sp.gr.). This development attracted prospectors, the Dominion Government promulgating new regulations to apply to the unorganized districts affected by the discovery. Drilling in the Peace River district of the Northwest Territory also attracted attention in 1920 and 1921.

Mexico.—Mexico's petroleum development has been sensational in its rapid growth. Although yielding oil as early as 1901 it was not until 1910 that the production became a commercial factor. In the latter part of that year the famous Juan Casiano No. 7 well was drilled S. of the Dos Bocas well, the latter an uncontrolled gusher S. of Tampico, struck July 4 1908, which went to salt water several months later. The equally famous Potrero del Llano No. 4 well came in Dec. 27 1910 with an estimated initial flow of 10,000 bar. daily, increasing to 160,000 bar., and establishing itself as the largest producer up to that time. Both the Casiano and del Llano wells were in the so-called southern field as distinguished from the northern or Panuco field, these two fields being part of the Tampico-Tuxpam region. This lies in the northern part of the state of Vera Cruz and the southern part of the state of Tamaulipas. Oil in the Tampico region occurs in the Oligocene, Eocene and Cretaceous formations and is found in numerous pools. Before striking the big wells mentioned a considerable production had been developed at Ebano, 40 m. W. of Tampico, in the northern part of the Tampico-Tuxpam area and in the Tehuantepec area. The Tehuantepec-Tobasco area extends along the Gulf coast in southern Vera Cruz and the state of Tobasco. Its oil-bearing rocks are of the Pliocene and Pleistocene age, and it had not developed a large production up to 1921. Mexican crude oil ranges from 10° to 43° Baumé (1·000 to 0·8,092 sp.gr.), and generally becomes lighter from north to south. In the Panuco (northern) field it is from 10° to 14° Baumé (1·000 to 0·9,722 sp.gr.); and from 15° to 29° Baumé (0·9,655 to 0·8,805 sp.gr.) in the southern districts. Oil in the Tehuantepec field has a gravity of 32° Baumé (0·8,642 sp.gr.).

Generally speaking, Mexico's petroleum has been found in a succession of great gushers. Where these wells are isolated they have produced for long periods and in great volume. Where there is close and competitive drilling the exhaustion of the pools comes as a natural consequence. The explanation of the great gushers seems to lie in the very great porosity of the rock. Oil collects in a net-work of caves and channels previously dissolved out of a bed of thick limestone. This condition allows the petroleum to move about freely, while still underground. Furthermore, the petroleum generally lies over water under an artesian head, and as a consequence the field pressure is largely hydrostatic, causing the oil to flow. In 1908 the country was credited with an output of 3,932,900 bar.; in 1920, 163,000,000 barrels. The following table shows the production during that period:—

*Petroleum Production of Mexico, 1908 to 1920.**

	Barrels	Metric Tons
1908	3,932,900	624,968
1909	2,713,500	431,175
1910	3,634,080	577,455
1911	11,552,798	1,994,640
1912	16,558,215	2,631,100
1913	25,696,291	4,083,141
1914	26,235,403	4,168,805
1915	32,910,508	5,229,480
1916	40,545,712	6,445,957
1917	55,292,770	8,790,583
1918	63,828,327	10,147,587
1919	87,072,954	13,843,077
1920	163,000,000	22,638,888

**Boletin del Petroleo;* 1920 estimated.

In Jan. 1914, in the Panuco pool, a well with an estimated initial flow of 100,000 bar. daily was brought in, and further attention was attracted to this district in 1915 by the completion of an offset well estimated at 60,000 bar. daily. Political disturbances in Mexico from 1914 to 1917 seriously interrupted operations in the southern field. On Feb. 10 1916, however, Cerro Azul No. 4 well in the southern district was completed. This well was credited with having flowed 260,858 bar. on Feb. 19 of that year, being estimated the largest producer ever drilled, and in May 1921 was continuing its steady yield. In Aug. 1914 seepages from Potrero del Llano were ignited by lightning, and the fire was not extinguished until March 1915. The completion of a good-sized well in 1915 in the Tepetate pool, a short distance N.W. of Casiano, was the precursor of the intensive lot-drilling campaign which this district saw in 1918 and 1919. In those years about 20 wells of large initial capacity were completed in this pool. The Alamo pool, the southernmost producing area in the Tampico-Tuxpam region, came into prominence in Oct. 1914, when the famous Alamo No. 2 well was brought in with an estimated potential production of 50,000 barrels. This well has probably produced 27,000,000 bar. of oil. The oil in the Alamo pool is from 16° to 22° Baumé (0·9,589 to 0·9,211 sp.gr.). Large wells of low-grade oil have been developed in the Molino field, just N. of Alamo. In 1919–20 large gushers were completed in the so-called Naranjos pool in the southern field. It was estimated that this pool produced 90,000,000 bar. in 1920, possibly the largest output in history. Potrero del Llano No. 4 suddenly went to salt water in Dec. 1918. This occurrence caused wide comment, as it was the first instance of the approximate exhaustion of any of Mexico's prolific pools, if Dos Bocas is to be excepted. This well had produced up to that time about 100,000,000 bar. of oil, including seepage oil. The Juan Casiano No. 7 well went to salt water in Nov. 1919, having produced about 80,000,000 bar. of oil. Many of the large wells in the Tepetate pool were affected by salt water in 1919 and 1920. Salt-water invasion was also reported as serious in the Panuco field. The Zacamixtle pool in the southern district was discovered in 1920, yielding several large wells. In 1921 important wells were brought in in the Toteco district of the southern field between Zacamixtle and Cerro Azul. In 1920 it is estimated that this field produced 120,000,000 bar., all in a strip of land 42 m. long and less than a mile wide.

Central America.—No petroleum production has been developed in Central America, but prospecting has been done and some drilling was under way in 1920. Test wells have been sunk on Columbus I., east coast of Panama, and in the Estrella Valley of Costa Rica. Exploration work has been done in Honduras and Guatemala.

South America

Argentina.—Argentina's commercial production dates from 1908, when petroleum was found in a well being drilled for water by the Government near Comodoro Rivadavia, Chubut province, on the coast of Patagonia. The Government immediately reserved part of the oil-bearing land for a monopoly, and Argentina's petroleum development has been almost entirely in the hands of the administration. Oil occurs in nearly horizontal, supposedly Cretaceous, beds which are covered by Tertiary beds. The oil is heavy and of asphalt base and ranges in gravity from 18·9° to 21·8° Baumé (0·940 to 0·922 sp.gr.). Much attention was attracted to Argentina in 1921, when in Feb. the first large gusher to be opened in the Comodoro Rivadavia field came in with an estimated initial flow of 25,000 bar. daily. Argentina's oil production was 1,665,989 bar. in 1920, compared with 1,183,000 bar. in 1919.

Venezuela.—Active prospecting in Venezuela began in 1910, and during the next four or five years wells were drilled in several areas with varying success. A well in the Mene Grande field, on the east coast of Lake Maracaibo, Sucré district, drilled in 1913, established the occurrence of oil in paying quantity, and by 1915 the field had developed a considerable production, furnishing up to 1921 practically all the Venezuelan output. Drilling in the district of Colón, state of Zulia, commenced in 1914. Four wells credited as good producers in the Rio Oro and Rio Tarra sections had been completed by 1916 and were shut in. Two wells reported as proven in the Bolivar district, state of Zulia, were also capped. Operations in Venezuela in 1920 and 1921 were active, particularly in the Lake Maracaibo district. Venezuela's production in 1920 amounted to 456,996 bar., compared with 425,000 bar. in 1919. In 1920 the Mene Grande field was credited with having seven flowing wells, the oil being of about 16° Baumé (0·9,589 sp.gr.). The capped wells in the Rio Oro district are said to produce a high-grade, paraffin-base oil of about 36° Baumé (0·8,433 sp.gr.).

Colombia.—Although not ranking as an oil-producing country, in 1920 Colombia was credited with three wells of potential commercial importance. These were completed in 1918 and were shut down awaiting marketing facilities. The wells were drilled on a concession in the Rio Colorado region in Santander del Sur. They are located about 30 m. S. of Barranca Bermeja, which is 350 m. from the mouth of the Magdalena river. Oil from these wells is reported to test 26° to 31° Baumé (0·8,974 to 0·8,696 sp.gr.). Preparations for opening the wells had been made early in 1921 upon the completion of a pipe line and refinery. Drilling was accomplished in 1920 and 1921 on other concessions along the Magdalena river in the vicinity of the pioneer Colorado development. Development work was also undertaken in 1920 on a concession in the Venezuelan boundary region in Santander del Norte, on the Rio del Oro, opposite drilling work in the Colón district of Venezuela. Considerable interest was attached to Colombia petroleum development in 1911 when drilling was undertaken near Cartagena. In 1913 and 1914 wells were drilled in the Lorico district near the Sinu river, but production was not encountered in commercial quantity. The Magdalena-Santander field occurs in the Cretaceous limestone and sandstone and the coal-bearing Lower Tertiary (probably Oligocene) beds. The rocks of the Caribbean fields are similarly described.

Peru.—Peru has the distinction of being the oldest oil-producing country in S. America, first being credited with production in 1896. Its production has been steadily maintained, the principal fields being Negritos, Lobitos and Zorritos. Another petroliferous district near Lake Titicaca has not developed any considerable production. Oil is found chiefly at the north end (Pacific coastal district) of Peru, and occurs in several horizons of soft sandstone and shale of early Tertiary age. The oil ranges from 32° to 48° Baumé (0·8,642 to 0·7,865 sp. gr.). Peru's production in 1920 was 2,816,649 bar.; 1919, 2,616,000 bar.; 1908, 1,011,180 barrels.

Bolivia and *Ecuador* have been actively prospected for oil, but oil in commercial quantity has not been developed. *Chile* had several oil booms, particularly those based on the oil deposits of the province of Punta Arenas, N.W. of Tierra del Fuego, without successful results. Prospecting has been undertaken in *Brazil* and *Uruguay*.

WEST INDIES

Trinidad.—The oil fields of Trinidad are mainly in the southern part, and the oil is obtained from lenses of sandstone of Tertiary age. Trinidad first appeared as an oil producer in 1908, although wells were known to exist N. of the famous Pitch Lake at Guayaguayare, in the extreme S.E. of the island, in 1902. This district came into real prominence in 1908 when a well at 700 ft. spouted oil over the derrick. A rapid development followed. Oil in the Pitch Lake district varies in density from 14° to 25° Baumé (0·9,722 to 0·9,032 sp.gr.). In the latter part of 1911 regular oil shipments from Brighton began. In that year several large gushers were brought in, but immediately clogged, owing to sand. In 1913 a well came in rated at 40,000 bar. daily, but sanded up, and in subsequent years other large producers have been reported, the initial production of which has soon fallen off on account of sand. Trinidad's production in 1920 totalled 2,083,027 bar., compared with 1,841,000 in 1919.

An oil boom in *Cuba* in 1917 failed to yield any considerable production. The principal development was in a field near Havana. Prospecting and a little drilling work have been done in *Santo Domingo*. There was exploration work in *Barbados* and in *Haiti*.

EUROPE

Russia.—While Russia, as a result of the World War and the revolution that followed, dropped in world rank as regards petroleum production, it remained the largest European producer. Production is found in Tertiary clays and sands. Baku oils are of about 27° Baumé (0·8,917 sp.gr.), while in the Suraghany district of Baku province the oil is as high as 48° Baumé (0·7,865 sp.gr.). The production in 1920 was estimated at 25,429,600 bar.; 1919, 25,498,000; 1918, 40,456,182; 1917, 69,960,000; and in 1908, 62,186,447. The relatively small area comprising the Baku field supplies the bulk of Russia's production. Other productive fields are the Grosny, Maikop, Ural-Caspian (Emba) and Tcheleken fields. The Maikop field in the province of Kuban on the north flank of the Caucasus, N.E. of the Black Sea, was discovered in 1910. The finding of high-grade oil in a well flowing at the rate of 37,500 bar. daily caused an extraordinary rush. In 1915 the sensation in this field was the completion of a gusher credited with an initial flow of 60,000 bar., which maintained a large, steady production from March 23 to the close of the year. Maikop oil is about 40° Baumé (0·8,235 sp.gr.). The Ural-Caspian field, covering a large area in the Emba-Uralsk region round the north end of the Caspian Sea, first became a commercial factor in 1913. The district came into prominence on the completion of a well in May 1911, which at a depth of 732 ft. gushed with great violence. It began to flow in Feb. 1912, was closed down and reopened in Oct. 1912, producing 120,000 poods (1,944 tons or 14,480 bar.), and then settling down to 50,000 poods. (One pood equals 36·112 lb.) This famous gusher is estimated to have produced from 8,500,000 to 9,000,000 poods. Emba oil is about 28° Baumé (0·8,861 sp.gr.).

For many years the I. of Tcheleken, off the Asiatic coast of the Caspian Sea near Krasnovodsk, was the scene of moderate operations, but from 1911 onwards large yields were obtained from wells sunk in the Ali Tepe district in the south-western part. Tcheleken oil is about 22° Baumé (0·9,211 sp.gr.).

Galicia.—No new pools of importance were discovered in Galicia during the period 1908–20. Galician production showed a declining tendency beginning in 1910, and during the World War this condition was aggravated, as the fields were battlegrounds. Galicia's largest output is obtained from Eocene beds. The chief producing districts are: in eastern Galicia, Boryslaw-Tustanowice, Bitkow; in western Galicia, Bobrka, Potok and the Gorlice district. The bulk of Galicia's production comes from the Boryslaw-Tustanowice district. Boryslaw oil is 32° to 34° Baumé (0·8,642 to 0·8,537 sp.gr.), and is the standard market grade for Galicia. Bitkow oil is about 53° Baumé (0·7,650 sp.gr.); Bobrka, about 31° Baumé (0·8,696 sp.gr.); Potok, 34° to 45° Baumé (0·8,537 to 0·8,000 sp.gr.). Galicia's production in 1920 totalled 5,606,116 bar.; 1919, 6,054,000. The peak of production was in 1909, 14,932,799 barrels.

Rumania, like Galicia, a battleground during the World War, suffered in petroleum production. Most of the oil is obtained from Miocene and Pliocene beds, but part is obtained from Eocene and Oligocene and possibly from Cretaceous beds. The principal fields are Bushtenari, Campina, Moreni, Filipeshti, Baicoi and Bauzau. The oil is from 25° to 45° Baumé (0·9,032 to 0·8,000 sp.gr.). Production in 1920 was 7,435,344 bar.; 1919, 6,614,000; and in 1908, 8,252,157. The peak was reached in 1913, 13,554,768 barrels.

Yugoslavia.—In 1921 drilling began on concessions in Croatia.

Germany.—Oil is obtained largely at Hanover, where it occurs in domes associated with rock salt. The rocks are chiefly limestone and sandstone of upper Jurassic age. Oil at shallow depths is heavy, gravity from 17° to 19° Baumé (0·9,524 to 0·9,396 sp.gr.); at greater depths the oil is lighter. The production is not large, and in 1920 was 212,046 bar.; in 1919, 234,000.

France.—Production in Alsace occurs in sandstone of Eocene and Oligocene age and is comparatively small. The gravity ranges from 25° to 29° Baumé (0·9,032 to 0·8,805 sp.gr.). In 1920 the output was about 388,700 bar.; in 1919, 344,000.

Italy.—Italy's production, relatively small, is chiefly in the Emilia district of Lombardy on the north-eastern slope of the Apennines. Oil occurs in sandstones of Eocene and Miocene age, and ranges from 31° to 48° Baumé (0·8,696 to 0·8,187 sp.gr.). Production in 1920 amounted to 34,180 bar.; in 1919, 35,000; and in 1918, 50,966.

Great Britain.—Apart from the shale-oil industry of Scotland and Wales, Great Britain took its place as a petroleum-producing country in 1919, when the Hardstoft well was brought in in Derbyshire. This was one of 11 drilling locations, seven of which were in Derbyshire, two in N. Staffordshire and two in the Midlothian district of Scotland. The Hardstoft well was started in Oct. 1918, and struck oil in May 1919 at 3,078 ft. At 3,100 ft. it produced 10 or 11 bar. daily. The well was still overflowing naturally at the end of 1920. Up to that time its production totalled 4,575 bar. or 590 tons, of which 2,909 bar., or 375 tons, were produced in 1920. At the end of that year progress on the other prospecting wells stood as follows: six wells had reached 3,000 ft. or over, the deepest, Ironville No. 2 in the Derbyshire area, being shut down at 4,500 ft. pending results of Ironville No. 1. One new well was started in 1920, Apedale No. 2 (Staffordshire), to replace Apedale No. 1, which had to be abandoned. This development is undertaken by the British Government, although the operations are managed by a private company. Oil from the Hardstoft well tested 40° Baumé (0·8,236 sp.gr.).

Considerable production of petroleum is derived from the Scottish shale-oil fields in the territory from Dalmeny and Abercorn on the Firth of Forth southward to the district of Cobbinshaw and Tarbrax. The oil-shale industry in Scotland has been in commercial operation since 1850, and in 1920 there were 25,000 persons regularly employed in this enterprise. In 1917 3,116,529 long tons of oil were produced from Scottish oil-shale. There is a small oil-shale production in England and in Wales.

AFRICA

Egypt.—Prospecting in Egypt resulted in the discovery of oil on the borders of the Red Sea and the development of small production in 1911. In 1913 several large wells were brought in in the Gemsah district on the west shore of the Red Sea, near the junction of the Red Sea and the Gulf of Suez. In Oct. 1914 oil was struck in the Hurghada district, S. of Gemsah, and up to 1921 Egypt's production had been confined to these districts. The oil occurs in sandstone and in cavernous, dolomitic limestone, associated with thick beds of gypsum of Miocene (Tertiary) age, accompanied in some places by thick beds of salt. The underlying Nubian (Cretaceous) sandstone also contains some oil. Egyptian oil is about 40° Baumé (0·8,235 sp.gr.). Difficulties from salt-water flooding have been encountered in the fields, shortening the life of the large wells. Exploitation has been restricted to a comparatively small area. While Egypt's production almost doubled in 1918 as a result of increased activities that year it fell off in 1919, and in 1920 showed a sharp decrease. Production in 1918 was 2,079,750 bar.; in 1919 1,501,000; and in 1920, 1,042,000.

French Colonies.—Some oil has been obtained in the Cheliff river area in the district of Oran, Algeria. Over 30 wells have been drilled in the M'Sila and Medjila districts, but during the World War operations were practically discontinued. Interest in Algeria revived after the war. The oil-bearing formation is probably Upper Miocene and its structure is complex.

Prospecting has been active in Angola and Ashanti (Gold Coast), in the Tertiary coastal plain formations. Tests have been drilled in Angola and the Alto Daude district near Loanda and at Ambrizette. Showings of oil were reported in test wells drilled in the Betsiriry Valley, Madagascar, but no commercial production developed.

ASIA

Persia is looked on as a new petroleum-producing country of unusual importance. Development has been virtually confined to the Maidan-i-Naphtun field in northern Arabistan, about 100 m. N. of the head of the Persian Gulf, where the first wells were completed in 1908. In 1914 10 wells were reported as being operated, and 20 more were shut down at the top of the sand. In the neighbouring Maidan-i-Naphtek field one well had been drilled and capped and a second begun. One test well had started in the White Oil Springs district. The following year a total of 12 wells had been completed in the Maidan-i-Naphtun field. The wells were reported to be prolific, with a combined capacity of 5,000,000 tons a year. Early in 1920 it was stated that the wells still maintained their high rate of yield. One well, which has been continuously flowing since Nov. 1911, was giving a larger production than ever, maintaining a steady daily average of 11,000 bar. with the well only partly opened. Persian production in 1920 was 12,352,655 bar.; in 1919, 6,412,000; in 1918, 6,856,063. Oil in the chief producing area occurs in the Miocene series. The gravity of the oil is about 21° Baumé (0·9,272 sp.gr.). In addition to the Maidan-i-Naphtun field, the Ahwaz-Pusht-i-Kuh and Gishon I. and the Persian Gulf regions are expected to yield petroleum.

Mesopotamia.—There are several petroliferous areas in Mesopotamia in the Tigris-Euphrates basin. Primitive development has yielded some oil in the Kirkuk–Mendali–Kasr-i-Shirin area north of Bagdad, in the Middle Tigris belt and in the Euphrates belt. Large-scale development of the Mesopotamian fields was interrupted by the war, but interest in them revived in 1920 and 1921.

Palestine.—The first drilling for oil in Palestine, S.W. of the Dead Sea, was interrupted by the war. Prospecting had previously been active in the area between the river Jordan and Deraa, adjacent to the Hedjaz railway.

India.—The principal source in India is the Yenangyaung field in Burma, about 272 m. N. of Rangoon on Yenangyaung creek. Other important districts are the Singu, Minbu, Pakokku and Upper Chindwin. The oil is in rocks of Miocene age and is about 30° Baumé (0·8,750 sp.gr.). Deep drilling was a feature of the development in this field after 1914. Some wells come in with a large initial flow but fall off rapidly as the territory has been intensively developed. Coal-bearing rocks of Eocene age have yielded oil in small quantities in Assam and in the Punjab. India's production in 1920 was 7,500,000 bar.; 1919, 8,735,000; 1908, 5,047,038.

Japan and Formosa.—Japan's principal oil production is found in the Echigo Province field. Since 1908 the most important development has been in Akita prefecture. The first gusher was drilled in this field in May 1914, flowing at the rate of 12,000 bar. daily. Many other large wells have been developed. The Akita gushers have declined rapidly. Oil is obtained from coarse sandstone layers, interstratified with sandy shale of Tertiary age. The oil is about 25° Baumé (0·9,032 sp.gr.). A small production is also obtained in Formosa. Production of Japan and Formosa in 1920 was 2,139,777 bar.; in 1919, 2,175,000; and in 1908, 2,070,145.

China.—A joint investigation of petroleum resources in the provinces of Shen-si and Chih-li was undertaken in 1914 by the Chinese Government and a private corporation. Drilling of six wells began in the Yen-chang field, Shen-si, where previously a number of primitive wells had been put down and a small production obtained. In 1916 the abandonment of the enterprise was announced. No oil in commercial quantity was struck.

OCEANIA AND THE EAST INDIES

Dutch East Indies.—Production of petroleum in the Dutch East Indies has shown a steadily increasing tendency. Production is obtained in Sumatra, Borneo and Java. Most of the oil-bearing rocks are associated with beds of coal and lignite of Miocene age. Oil of the Langkat district of Sumatra has a gravity of 33° to 55° Baumé (0·8,589 to 0·7,692 sp.gr.). Java oil is heavier, ranging between 23° and 40° Baumé (0·9,150 to 0·8,235 sp.gr.). Borneo oils from shallow wells have a gravity of about 14° Baumé (0·9,722 sp. gr.), and from the deeper wells a gravity of from 27° to 33° Baumé (0·8,917 to 0·8,589 sp.gr.). Production of the Dutch East Indies, including a small production from British Borneo, totalled 17,529,210 bar. in 1920; 15,428,000 in 1919; and 11,041,852 in 1908.

Papua.—Test drilling has been undertaken in Papua, and, while oil has been struck, difficulty has been caused by mud clogging.

Philippine Islands.—Prospecting and drilling work started in the Philippine Is. in 1920 in the Bondoc Peninsula district.

New Zealand and Australia.—Extensive prospecting and drilling work have been done in New Zealand, especially in the vicinity of New Plymouth; South Australia, in the Robe district, and in Queensland, in the Roma district. Exploitation in these districts has failed to develop petroleum production in commercial quantity. New South Wales has developed an oil-shale production amounting in 1918 to 32,395 long tons.

Oil in the World War.—Petroleum was a major essential in industrial, military and naval operations in connexion with the World War. Industrial plants required abnormally large quantities of lubricating oils and fuel oils. There was a rapid expansion in oil-burning fleets, and a new demand on petroleum was made by air craft, by the introduction of petrol-burning motor launches, by tanks used in military operations, and by the creation of the motor transport, which became a chief factor of a mobile army. Petroleum was a contraband of war, and German submarine warfare was largely directed against petroleum tank steamers. Military operations in Galicia and also in Rumania were dictated to a considerable degree by the condition of petroleum supply in the Central Powers. Galicia changed hands several times during the war, and after Rumania's entrance into the war in Sept. 1916 the oil fields of that country fell into the hands of the Austro-German armies. Considerable damage to the Galician and Rumanian fields was caused by military operations, and the output of these countries was reduced during the war. Before the capture of the Rumanian fields a systematic destruction of wells, derricks and oil supplies had been undertaken by an Allied military mission, and the Germans immediately installed a military commandant with trained assistants to rehabilitate the fields. The operations of Turkey against Russia had the Baku oil fields as their objective, and the early British operations in Mesopotamia were chiefly intended as a precautionary measure for the protection of the Persian oil fields.

In all the warring countries special Governmental departments were organized to handle petroleum problems, and in almost every country drastic restriction of home consumption was enforced. In England the Mineral Oil Production Department had jurisdiction over all questions of production of oil from home sources. The Pool Board attended to the distribution of oil in the British Is., and the Petrol Control Department acted on matters of petrol economy. The Petroleum Executive was formed in Aug. 1917 to handle matters of general policy. In France jurisdiction of petroleum matters was placed in the hands of a Commissioner-General of Petroleum, and a Petroleum Importing Consortium was created. During the last year of the war a Government commission for petroleum was formed in Italy, and throughout the war restrictions were placed on the importation and sale throughout that country. In Germany and Austria price and distribution were under control somewhat similar to that of food, and strict rationing was adopted. After the United States entered the war in 1917 a voluntary organization of the American industry was effected under the name of the National Petroleum War Service Committee, and in 1918 the Oil Division of the Government Fuel Administration was established. Restrictions on home consumption in the United States were confined entirely to voluntary methods. The Inter-Allied Petroleum Council, consisting of representatives of Great Britain, the United States, France and Italy, was formed in 1917. This Council arranged for the requirements of each of the Allies and for the transportation of the petroleum allotted.

America supplied 80% of the Allied petroleum requirements. The problem of transporting these great quantities was only secondary to the problem of production. Large additions were made to tanker fleets, principally of Great Britain and the United States, but as there was an inadequate supply of tankers early in the war, and as the German submarines sank many, this feature of the transportation problem was particularly serious. It became necessary to use the double bottoms of cargo vessels for transporting oil, and it is estimated that from 1917 to the close of the war 1,100,000 tons of fuel oil were so transported. The total quantity of fuel oil brought to British bases during the war exceeded 10,000,000 tons, of which 9,100,000 tons were issued to the British Admiralty. In addition American naval tankers imported 560,000 tons, which were distributed by small British craft to U.S. naval units along the British coast. The tanker-building programme, projected by the British Admiralty in the early stages of the war, resulted in the addition of 52 cargo tankers of 380,000 tons' capacity and 49 fleet auxiliaries of 95,000 tons' capacity. In 1918 there were 2,628,961 tons of fuel oil alone shipped from the eastern seaboard of the United States for the use of the Allied navies. In the same year more than 1,000,000 tons of distillates and other petroleum products also crossed the Atlantic, entailing more than 500 tank steamer loadings. The figures made public after the war showed that 48% of the British fleet was depending on oil for fuel. The maintenance of the blockade round the Central Powers involved the steady consumption of petroleum products. In the patrol around the British Is. the steaming of the fleet and other vessels averaged not less than 7,000,000 m. a month. At one time the situation as regards tank steamers was so serious that a single day's delay in any of the vessels caused considerable anxiety. In May 1917 stocks of oil were so low because of heavy shipping losses, due to submarines, that the fleet was unable to exercise properly and the army was frequently on a hand-to-mouth basis. At that date total stocks of oil in Great Britain amounted to only 900,000 tons, and the absolute minimum of safety was considered 1,500,000 tons. After 17 months stocks had been increased to 1,800,000 tons, and on cessation of hostilities the stock was considered satisfactory.

A campaign of intensive development in the petroleum fields, particularly of the United States and Mexico, brought about large increases in petroleum production, but requirements were so great that despite this increase stocks had to be drawn on heavily. At the close of the war American tankers afloat had increased 635,507 gross tons, and 51% of the total gross tonnage of tankers in service between America, Great Britain, France and Italy was American owned, while 49% was British owned. Because of the increased tonnage at the close of the war the United States was exporting each month for war purposes 2,200,000 bar. of fuel oil, 750,000 of motor gasoline, 500,000 of kerosene and 175,000 of aviation naphtha. The country's exports of fuel oil to Great Britain, France and Italy in 1918 represented an increase of 200% over 1914 and 23% over 1917. At the beginning of 1917 the total requirements of petroleum products for all British services reached a figure of about 3,500,000 tons per annum, nearly double pre-war requirements. By the end of 1918 the figure had increased to nearly 5,500,000 tons per annum. It is estimated that the maximum requirements of the Allies if the war had continued would have occurred in the spring of 1919, when 12,000,000 tons per annum (of which some 8,000,000 tons would have been absorbed by Great Britain) would have been required. During the last 18 months of the war the Inter-Allied Council dealt with between 12,000,000 and 13,000,000 tons of oil.

The British army in France used about 23,000 tons of motor spirit a month during the greater part of the war. The French army's monthly consumption of gasoline was 35,000 tons, of which 30,000 tons came from the United States. In Dec. 1917 the Allies had a scant month's supply of gasoline on hand, and between Dec. 25 1917 and Jan. 31 1918 90,000 tons of petroleum products were shipped to France from the United States, making possible the shifting of troops into threatened areas by motor lorries. Oil stocks in France, before the large shipments early in 1918, had gone down to 25,000 tons, less than the average held in France in normal times. During the days of most active fighting consumption reached as much as 2,000 tons a day. The British Ministry of Shipping was mainly responsible for the transporting of overseas supplies, and the Tanker Division of the Emergency Fleet Corps, U.S. Shipping Board, and a section of the War Trade Board had jurisdiction of the allocation of cargoes and of shipping belonging to the United States. The difficulties of getting production were accentuated by various specifications which each Government required as regards its oil supplies, and steps were taken by the Inter-Allied Council to effect some degree of standardization. In the United States the Committee of Standardization of Petroleum Specifications was formed to standardize petroleum products, requirements of the various Government departments, and also to recommend adoption by the states of standard specifications.

The war opened the eyes of all countries to the value of petroleum products. The Allied countries and the Central Powers conducted extensive investigations to provide substitutes. In Great Britain the Alcohol Motor Fuel Committee was formed to consider the fields of production of alcohol fuel, and its utilization either alone or in conjunction with fuels such as petrol and benzol. Efforts were successfully made to extract crude oil from cannel coal on a commercial scale at certain large gas works. The use of coal-tar oils as fuel oil was also considerably increased. Alcohol substitutes for petroleum were extensively experimented with in Germany and in the United States. In the latter country important experiments were made with colloidal fuel. The actual work of petroleum development in the British Is. was undertaken as a war measure, and, as already stated, the drilling of wells was started in Derbyshire, Staffordshire and the Midlothian district of Scotland on behalf of the British Government. Another war achievement was the construction of an 8-in. pipe line, 35 m. long, across Scotland from the vicinity of Glasgow to Grangemouth on the Firth of Forth. This pipe line was built so that tank steamers could discharge fuel oil for the Allied navies at Old Kilpatrick, near Glasgow. The pipe line then conveyed the oil to the Firth of Forth, where it was required by the navies. Tanker transportation to the Firth of Forth was very dangerous. The work of building the stations and ditching for the line was conducted by the British Admiralty, and the line laid by a U.S. naval unit. It was completed shortly before the Armistice was signed. The war also probably hastened the building and completion of the British navy's great oil reservoir at Rosyth. This was constructed of reinforced concrete, and is capable of storing 60,000,000 imp. gal. of liquid fuel. Concrete work on the first section began in July 1916, was completed in Aug. 1918, and oil was run into the tanks in Sept. 1918. Construction of the second section began in Aug. 1917, and was completed early in 1919.

Certain important producing and potentially productive oil areas changed nationality as a result of the World War, including parts of Galicia, formerly in the Austro-Hungarian Empire, now a part of Poland; Alsace, now French; Mesopotamia and Palestine, lost by Turkey, and placed under British mandate.

Financial and Industrial Progress.—The expansion of petroleum activity has involved a great increase in financial requirements. While the tendency has been toward consolidation and the perfecting of organizations of great size, there has also been, particularly in the United States, an extraordinary springing up and expansion of companies embracing one or two branches of the business, or often operating in almost every branch. The chief petroleum companies own or lease oil-bearing properties, work their own production, have pipe-line affiliations, own and operate refineries, own and lease tank cars and other marketing equipment, and own and operate tank steamers.

The nationalization of oil-bearing lands—the retention or vesting of ownership of subsoil rights in the hands of the State—has been a pronounced tendency in certain countries. In Russia petroleum lands were nationalized and were operated in part of 1919 and in 1920 by the Soviet Government. Argentina's petroleum development has been almost entirely in the hands of the Government since its inception. In May 1917 a new Mexican constitution provided for the nationalization of petroleum, and various decrees have been promulgated attempting to carry out the nationalization principle. In other Latin-American countries nationalization of petroleum lands is generally adhered to in working out new petroleum codes. Direct Government interest in petroleum development was brought about in Great Britain by the action of the British Government in becoming a majority shareholder in an oil company developing the Persian fields and active in other countries.

The importance of petroleum with respect to national security and industrial prosperity became generally recognized during the World War and resulted in intense investment and speculative interest in oil companies. Statistics compiled for 250 representative American oil companies showed capital invested as of Dec. 31 1919 to be $2,501,939,914. Of this group 142 companies were organized after 1912. The 108 companies in existence prior to 1912 showed a capital investment of $717,098,563 on Dec. 31 1911. The compilation showed that of the total increase in capitalization between 1912 and 1919, amounting to $1,784,841,351, $707,004,521 was added in one year, 1919. New oil companies formed in the United States in 1917, 1918, 1919 and 1920 represented an amazing capitalization. The records show that in 1920 1,712 companies were organized with an authorized capitalization of $2,787,000,000; in 1919, 1,629 companies with $3,786,000,000 capital; 1918, 820 companies with $1,430,000,000 capital; and in 1917, 512 companies with $840,000,000 capital.

Capital-borrowing by oil companies in the United Kingdom in 1919 totalled £15,852,600; in 1920 £13,004,600. The total capital of oil and kindred companies registered in the United Kingdom during 1920 was £33,105,050.

Four companies in Germany, classified under the head of "Petroleum, Mineral Oil, etc.," increased their capital in 1920 101,850,000 marks. There was a boom in the oil business in Rumania in 1919 and 1920. In the former year 128 new companies were organized with a total capitalization of 449,000,000 lei (nominal value 9½d. or $.19, but at that time much depreciated). Up to Oct. 1920 168 companies had been organized with an issued capital of 1,640,206,900 lei.

Well-drilling and Field Improvements.—Production is maintained and increased only by the constant drilling of new wells. A territory becomes "proven" after it has been demonstrated by test wells and by active development to have petroleum deposits. The search for oil in unproven territory is generally termed "wildcatting." The wildcatter is sometimes a small operator but more often in recent years a large company, for the operation entails large expenditure.

In the United States, which in 1920 supplied 65% of the world's production, it is generally estimated that from 25% to 40% of current output is "flush" production; that is, production from the large initial flow of new wells, which subsequently would decline to moderate "settled" production or become exhausted. There were about 35,000 new wells completed in the United States in 1920; 24,000 of them were rated as oil producers. At the end of that year there were 7,200 wells drilling and 2,100 rigs erected or building for drilling. The number of wells producing oil in the United States, Oct. 31 1920, was 258,600. The average per well was 4·9 barrels.

The principal drilling systems are: (1) percussion, which includes the standard cable tool (American system) and the pole tool (Canadian system); (2) hydraulic rotary system; (3) combination system; (4) hydraulic circulating system (*see* 21.319). In the Appalachian region of the United States wells are sunk by the standard or churn system, with a modified light rig, and range in depth from a few hundred feet to 3,000 or 4,000 feet. In many sections groups of wells are pumped from the central station. The yield of wells in the Appalachian field is small, the average for Pennsylvania being about 0·3 bar. per well; New York, 0·2 bar.; Kentucky, 3·1 bar.; W. Virginia, 1·1 bar.; and eastern Ohio, 0·8 barrels. Wells in the mid-continent field are generally drilled by standard tools. The cable system is used in central Texas, and the rotary system in northern Texas and in some districts of Oklahoma. The rotary system exclusively is used in northern Louisiana. The depth ranges from 200 ft. to 3,500 ft., drilling in recent years averaging more than 2,000 ft. Recoveries per acre from mid-continent pools have been generally higher than in the eastern fields, but less than in the Gulf coast and California. The average production per well in Oklahoma and Kansas is 6 bar.; northern Texas, 31·6 bar.; central Texas, 22·9 bar.; and northern Louisiana, 31·6 barrels. The rotary method is used exclusively in the Gulf coast field, the depth of wells ranging from 1,000 to 3,500 ft., and the production per well being 34·6 bar. in coastal Louisiana and 49·7 bar. in coastal Texas. In the Rocky Mountain field the standard and rotary systems are used, the shallow districts of this field also being largely drilled by the standard cable system with the portable rig. The depth of the wells ranges from 1,000 to 3,500 feet. The average production per well is 55·9 barrels. In California drilling is about evenly divided between the standard and rotary systems. The combination rig is also extensively used, and there is some drilling by the hydraulic circulating system. Well-depths range from 1,000 to 3,500 ft. and the average production per well is about 32·3 barrels. A well of average depth in the mid-continent field could be drilled and equipped for less than $13,000 in 1913. In 1915 the cost increased to about $14,000; in 1918 to $24,000; and in 1920 to about $32,000. A factor in the advance in cost was the increased depth of the average well. Drilling cost of an average well in central Texas in 1920 was from $44,000 to $68,000; in certain Gulf coast pools, $39,000; while in the Rocky Mountain and California fields it has risen above $100,000 per well.

In Mexico, where the wells usually have a great initial production and where the yield of individual wells is often restricted only because of inadequate marketing facilities or as a precaution against water inroads, the percentage of current production that might be termed "flush" is much higher than in any other producing country. Mexico's production is obtained from comparatively few wells. The country was credited on Jan. 31 1921 with 367 producing wells, but it is estimated that the bulk of the 1920 production of 163,000,000 bar. was obtained from about 200 wells. The wells average about 2,000 ft. in depth. In the Tehuantepec field the wells have been of shallow depth and short-lived. Drilling in Mexico is about evenly divided between the rotary and standard cable system, and the hydraulic circulating system is used to some extent.

The Canadian pole tool system is used in Canada, while the deeper drilling in the Calgary district has been done by the standard cable system and there has also been some rotary drilling. Wells in the Petrolia district, Ontario, are about 500 ft. in depth and yield from 5 to 25 bar. a month. The standard cable system is principally used in Venezuela, although there has been a good deal of drilling with the rotary method, and a combination of both. Wells in the Mene Grande fields range from 600 to 1,700 feet. Wells in Colombia have been drilled by the cable system and combination cable and rotary, the depth being 1,700 to 2,300 feet. In Peru most wells in the Zorritos field are between 600 and 2,000 ft. in depth; in Labitos from 2,000 to over 3,000 ft.; and in Negritos the average is about 2,500 feet. The standard cable system of drilling is generally used in Peru, but there has been some rotary drilling in the Zorritos field, where a total of 920 wells had been drilled up to 1919, the greatest number of producing wells at any one time being about 50. In Lobitos a total of 118 wells were producing in 1919; in Negritos 732 were active. Drilling in Argentina has been done by practically all methods, but the one in most general use is the Galician pole tool system, which is a modification of the Canadian pole tool system, the equipment providing for a larger and heavier rig. The American standard cable system is also in use in Argentina and there is some rotary and also hydraulic circulating drilling. Production in 1919 was obtained from about 72 wells. In Trinidad wells range from 700 to 1,740 ft. in depth. Rotary drilling is used almost exclusively.

The Russian free fall system, a modification of the Canadian pole tool system, is used in Russia. In this, there is a free fall of the tools, which are then picked up. The diameter of some of the Russian wells is unusually large, the starting diameter being in many cases 36–40 inches. In the Baku field the depth of the wells ranges from 2,000 to 2,500 feet. Baku wells are famous for their large initial flow and large total yield. In Galicia, as well as in Rumania, the Canadian pole tool system, modified and adapted, is generally used, but the hydraulic circulating system is also used. Galician fields require deep drilling, many wells in Boryslaw–Tustanowice being over 4,000 feet. The pole tool system is also extensively used in Rumania. Wells range from 1,000 to 2,500 ft. in depth, and in the Moreni district wells of great capacity have been brought in. The standard cable system with portable rig is used almost exclusively in Italy. The same system, without portable rig, is used in Persia, India and Egypt. The Galician pole tool system is used in the Dutch East Indies. Persian production is obtained at from 1,100 to 1,400 feet. Deeper drilling was resorted to in the Yenangyaung field of Burma with good results, previous drilling not having exceeded 300 or 500 feet. Wells more than 2,000 ft. deep are drilled in the Singu field of India. Wells in Japan range from 600 to 2,000 ft., and the rotary system, introduced in the Akita field in 1913, is used almost exclusively. The diamond drill, a "core" drill used in prospecting for coal, iron and copper deposits, has been introduced as a geological aid in oil-field work. Another means recently employed for drilling test holes and shallow wells is a combination rotary, core and churn drill. Petroleum development of recent years has entailed deeper drilling with consequent heavier demand on oil-field materials. In the United States and in other countries the shallow fields have become exhausted. Drilling to 2,500 and 4,000 ft. has demanded sturdier equipment, heavier and larger casing and improved designs in drilling machinery. Better methods of handling heavy wrenches and bits and of dressing bits have been adopted.

New mechanical devices to aid in well-drilling are constantly being introduced. In electrical rotary drilling, an electric device keeps a check on the drilling crews, indicating when and how long the rotary was shut down. A register giving the weight of pipe resting on the bit is being perfected by experimental tests. It is designed to enable the driller to determine the amount of speed to use in certain formations, with a view to lessening "twist-offs" and thereby lessening the number of fishing jobs. While derricks in most oil-producing countries are chiefly of timber, the all-steel derrick has appeared in certain fields of the United States, Rumania, Galicia, Trinidad, England and South America. Electric power has become a factor in field work and has been adopted for the pumping of wells and for drilling, for driving slush, water, oil and vacuum pumps and for air compressors, gas extractors, machine shops, field lighting and dehydration of oil. Electric power has made advances in Texas, in California and in the mid-continent fields. It has been adopted in Rumania and in the Balakhany–Sabоontchy–Romany–Surakhany area and the Bibi-Eibat field of Russia. Electrification of the Yenangyaung field of Burma has also been undertaken. The use of compressed air to increase oil extraction has been introduced recently in certain producing areas. The process consists of pumping compressed air or gas into some wells while others are pumped for oil. The advent of the internal-combustion engine has brought about the extended use of belt, chain and gear driven pumps, while previously single or duplex driven reciprocating steam pumps were mainly used. The turbine pump has also developed oil-field possibilities.

TRANSPORT AND STORAGE

Pipe Lines.—With its large crude-oil production obtained from fields often far from refining and consuming centres, the petroleum industry of the United States has developed pipe-line systems of great mileage and capacity (*see* 21.320). In the fields themselves there are networks of gathering lines connecting the wells with main trunk lines and railways, the trunk-line systems connecting the fields with the refining centres. It is estimated that pipe lines in the United States totalled about 35,000 miles. Practically all of the crude oil produced (1,300,000 bar. daily) is transported by pipe line, some of it only a few miles and some of it as far as 1,700 miles. About 150,000 bar. a day are taken from the eastern and mid-continent fields to the Atlantic seaboard through a connecting system of pipe lines. Mid-continent crude is also piped to the Gulf coast. It is estimated that the total U.S. production moves by pipe line an average of more than 500 miles. Pipe lines in Mexico have been constructed from the Pañuco and Topila fields to Tampico and from the southern fields to Tampico and directly from the southern fields to the Gulf coast, where sea loading lines are installed. There is an international trunk line running into Canada connecting with lines in Ohio. In Venezuela the production in the Mene Grande field is run by pipe line about 35 m. to a refinery at San Lorenzo where there is also a terminal from which crude oil is barged to a refinery on the I. of Curaçao. A pipe line of about 25 m. has been constructed from wells in the Colorado district of Colombia to a refinery at Barranca Bermeja on the Magdalena river. The Lobitos field in Peru is connected by pipe line to the port of Talara, 16 m. distant, where there is a refinery and a terminal for export shipping. Argentina has short field pipe lines. In Trinidad there are pipe lines from the Pitch Lake district to refineries at La Brea and Port Fortin and also from this field and the Tabaquite district to Claxton's Bay, where they extend into sea loading lines. Pipe lines run from the Galician fields to refineries located in and near the fields. Rumania's pipe-line system leads from the fields to refineries near and around Ploeshti. A few days before Rumania's declaration of war a Government-owned pipe line was completed from Baicai to Constantza on the Black Sea. Oil from the Balakhany–Saboontchy–Romany–Surakhany oil field is piped to refineries on the outskirts of Baku. Oil from the Bibi-Eibat field is barged to the same place. A kerosene pipe line from Baku to Batoum on the Black Sea was completed in 1905. Grosny oil is piped to refineries near the town of Grosny. The Ural–Caspian fields are connected by pipe lines with Bolshaya Rakushka, where refineries are located. Tcheleken oil is shipped to Baku refineries. Oil from the Maikop field is piped to Ekaterinodar and to the port of Tonapse on the Black Sea.

Oil from the Gemsah and Hurghada fields of Egypt is transported by pipe lines to a refinery at Suez. Pipe lines connect the Maidan-i-Naphtun field of Persia to a refinery at tidewater located at Abadan. Oil from Singu and Yenangyaung fields is piped to refineries near Rangoon, a distance of about 275 miles. Oil from the Langkat district of Sumatra is piped to refineries at Pangkalan on the Bay of Aroe. Southern Sumatra fields are connected by pipe lines to refineries at Pladjoe and Bagoes Koenig, both near Palembang. Java production is transported to refineries at Wonokrono and Tjepoe, Borneo oil by lighters to a refinery on the harbour of Balik Papan.

Pump Stations.—In the United States, pump stations are usually 30 to 40 m. apart in the eastern and middle states, but there are cases of long-continued operation of 120 m. with one pump station. A steam pump station usually consists of a pump house, boiler house, gate house, office and tanks. Diesel engines are being installed extensively in pumping stations.

Sea Loading Lines.—Sea loading lines have been installed and are operating in Mexico, Peru, Trinidad, Russia and other places. These lines make possible the loading of vessels several miles at sea and are usually installed where no deep-water harbours exist and where, because of the shallow water, the building of piers would entail prohibitive expenditure. The lines are submarine and are usually coupled ashore, stretched out on rails and drawn into the water by vessels. When it is impossible to couple the pipe ashore, this is usually done on barges or rafts and the line deposited as the work proceeds. The first sea loading line in Mexico was pulled in 1913 by the use of wooden dollies on a wooden track. At present numerous companies have sea lines along the strip of island beach between the Panuco and Tuxpam rivers.

Storage.—Crude-oil storage facilities, where steel tanks or reservoirs, are grouped together on what are generally known as tank farms, some of which in the United States have a capacity in excess of 24,000,000 barrels. Steel tanks are usually of 37,000 or 55,000 bar. capacity, placed about 500 ft. apart from centre to centre. Each tank is surrounded by a levee of sufficient height to hold the entire content of the tank and enclosed for the purpose of isolating fires. Crude oil is stored in steel tanks, concrete tanks and earthen reservoirs, while many of the lease tanks are wooden. There were held in the United States in pipe line and tank farm storage, at the end of 1920, 138,000,000 bar. of crude oil. In addition, 21,000,000 bar. of crude oil were stored at refineries. Tanks are installed at refineries for holding oil during the running at the plants and for storage preparatory to shipment to markets. Stocks of refined products held at U.S. refineries at the close of 1920 totalled 2,433,700,000 gallons. Investigation and experimentation are constantly directed to the reduction of evaporation losses of crude oil and refined products during storage. An investigation by the U.S. Bureau of Mines showed that in just one stage of handling of crude production in the mid-continent field, the volume of gasoline lost by evaporation equaled one-thirtieth of the total gasoline production of the United States. The loss occurred during a few days when oil was stored on leases before being taken by pipe line, and amounted in 1919 in the mid-continent field alone to 122,100,000 gallons. Insulated storage tanks of about 10,000 bar. capacity are being experimented with by a few mid-continent casing-head gasoline manufacturers.

Tanks are usually protected from fire by steam lines from the boiler house so that free steam can be turned into the tanks on the approach of a thunderstorm. This steam displaces the explosive mixture in the tanks. The water spray method is also used. At pipe-line stations, and tank farms and refineries where there is a large number of tanks, a fire protective system which utilizes a frothy or foam mixture is often installed. This mixture has as its ingredients water, aluminium sulphate (crystal), sulphuric acid, ground glue, glucose, sodium bicarbonate and arsenious oxide. The system entails a piping and pumping system and the equipment includes solution tanks and foam-mixing boxes. Each storage tank has a mixing box into which pipe lines leading from the solution tanks discharge. The boxes are outside the tanks and the foam is admitted to the tank through a raised hatchway. The substance spreads over the surface of the oil. To insure the foam reaching the surface of the blazing oil at whatever depth without the bubbles being destroyed by the impact of the drop, a series of baffles is used retarding the descent. Tanks covered with a jacket of asbestos supported by steel framework are being experimented with. Submarine storage tanks, which if required can be rested on sea bottom, have been devised.

Tank Vessels.—The tank vessel plays a large part in the modern petroleum industry. It is used for transporting crude oil from producing countries and districts to refining countries and centres and for carrying refined products in bulk to the markets of the world. The world's tonnage of tank vessels (including steam, gas, sail and barge) increased from 1,525,000 gross tons in 1914 to about 4,000,000 tons at the end of 1920, with 1,100,000 tons under construction.

Great advances have been made in tanker construction and the loading and unloading of oil from tank vessels. The typical modern tanker carries 16,000 tons of oil, is equipped with quadruple expansion engines and boilers fired with liquid fuel, has a complete shelter deck the whole length of the vessel, oil-tight hatches and two pump rooms with pumps capable of discharging 1,200 to 1,500 tons per hour. The Diesel engine is also used for propulsion in some tankers, while the oil-fired steam-driven turbine is gaining headway. Oil cargoes are now loaded and discharged in a few hours. Devices have been perfected enabling vessels to take on a supply of fuel oil from tankers while under way on the high seas.

Refining

Refinery Operations.—The rapid expansion of the internal-combustion engine which, as developed in motor vehicles, began to be of importance as a consuming agency of petroleum products in 1907, has elevated gasoline (petrol) to the ranking by-product of crude oil. More recently the conversion of coal-burning vessels and industrial plants to the use of oil and the extension of utilization of the Diesel engine (an internal-combustion engine which does not demand so volatile an oil as gasoline) in the marine and in the industrial fields has placed fuel oil in a position of great prominence. Even so great an increase in crude-oil production as was recorded between 1908 and 1920 could not have supplied these consuming agencies had not refining methods been improved, new processes developed, and refinery capacity greatly expanded. As in the case of crude-oil production, the greatest refinery expansion has been in the United States, where in 1915 it is estimated there were 302 refineries with a crude-oil capacity of 1,043,245 bar. daily. On Jan. 1 1921 there were 415 refineries with a daily capacity of 1,888,800 barrels. The types of plants represented in this total were: 35 complete, 302 skimming, 60 wax and lubricants, 7 asphalt and 11 topping.

United States refineries in 1920 ran 434,000,000 bar. of crude oil, and produced 4,882,000,000 gal. of gasoline; 2,320,000,000 gal. of kerosene; 8,861,000,000 gal. of gas oil and fuel oil; 1,047,000,000 gal. of lubricating oil; 541,000,000 lb. of wax; 576,000 tons of coke; 1,290,000 tons of asphalt; and 1,492,000,000 gal. of miscellaneous oil. The principal refining centres in the United States are in the mid-continent territory, in the Pennsylvania region, and along the Atlantic, Gulf and Pacific coasts. Every large producing area has developed a refining industry, while the seaboard plants, in most instances, owe their location to strategic advantages respecting large domestic and export markets. Mexico has built up a substantial refining industry, although the largest proportion of its crude-oil production is transported to the United States for topping and refining, in most part by Atlantic and Gulf coast plants. Most of the Mexican plants are topping plants (that is, they divide the crude into tops, distillates and gas and fuel oils), but there are a few more complete refineries. All the refineries are located along or adjacent to the Gulf of Mexico or the eastern seaboard, comparatively near the producing fields. In 1920 there were 12 refineries reported in operation in Mexico with a daily capacity of 19,600 cub. metres of refined products. Four of these refineries were classified as complete plants, six as topping plants and two as natural-gas gasoline plants. There were five plants under construction, two complete refineries, one a topping plant and one a natural-gas gasoline plant. In 1920 61,000,000 bar. of Mexican crude oil were run by U.S. refineries. Canada has developed a substantial refining industry, these refineries operating on Canadian, United States, Mexican and Peruvian crude oil. There are one or more refineries or topping plants in Venezuela, the I. of Curaçao, Colombia, Trinidad, Peru and Argentina, these operating on domestic oil or oil from nearby territories. Galician crude oil is handled by refineries located within a radius of about 150 m. from the city of Lemberg, in and near the oil fields, and also by the Continental refineries in Hungary, Austria and Germany. It is estimated that Galician refineries are capable of handling about 40% of the crude production. Rumania's refineries are mainly located in the Prahova district and also in the Bacau, Dambovita, Constantza and Neamt districts. In 1920 Rumanian refineries used 988,000 tons of petroleum, and produced 212,000 tons of benzine, 197,000 tons of lamp oil, 30,000 tons of lubricants and 473,000 tons of fuel oil. The output of the different refined products by Russian refineries in 1916 (last figures available) totalled 56,917 million poods of fuel oil, 6,926 million poods of lubricating oils, 135 million poods of solar oils, 944 million poods of benzine and 57 million poods of paraffin. Russian refineries are located at Blacktown, suburb of Baku, these running oil from the Baku fields, at Grosny and Bolshaya Rakushka and at Ekaterinodar and Shirvansky. There are local refineries in Egypt, Persia, India, the East Indies and Japan, and Persian oil is also being handled by a refinery at Swansea, Wales.

Continuous Distillation.—Continuous-process stills were first introduced by Norman Henderson, a British chemist, in connexion with the distillation of shale-oil. This system was subsequently adopted by many refiners of petroleum. A modification of Henderson's benches of stills was the addition to each member of the series of a fractionating column, endeavouring to carry out the fractionating in one stage so that the one-bench stills would provide finished products. Similar considerations led to the development in California of the Trumble process, introduced by M. J. Trumble, a California chemist, consisting of an elaborate series of heat interchanges. In this process, oil is heated in a tubular furnace. It is dropped down a tower where, by means of distributors, it is brought in contact with the hot side of the column still and so gives a film evaporation. A recent modification of stills is the Allan system, introduced by Hugh Allan, a British chemist, whereby the oil is vaporized in the ordinary kind of Henderson still, but in place of being subsequently redistilled, or being collected via a column, vapours are blown into a series of vertical pipes, getting a fractional condensation from member to member, the latent heat of the high boiling components being used to reëvaporate any condensed volatile oil, thus obtaining the fractions desired. Topping and skimming plants to raise the flash point and to dehydrate heavy oil have multiplied rapidly, particularly in the United States. The skimming industry is represented in all the major oil fields and has other purposes which give the plants practically a universal field in the oil industry, namely, to remove the lighter constituents of the oil for storage for a long period, thus reducing the losses from evaporation, to dehydrate or clean the oil and, in conjunction with a complete refinery, to remove the lighter fractions cheaply and quickly, leaving a residue to be re-run for lubricants, coke and other products.

Cracking Processes.—The commercial development of the cracking process subsequent to 1913 marked an epoch in the petroleum industry. The growing importance of the internal-combustion engine made necessary a higher yield of motor fuel from the limited crude-oil supply, if the demands of this consuming agency were to be met. Modern cracking dates back to the patent obtained in 1889 by the late Sir Boverton Redwood and Prof. Dewar, British chemists (*see* 21.322), but commercial development followed the first patent of Dr. W. M. Burton, an American chemist, in 1913.

The following classification of oil cracking processes (representative patents) is made by the Kansas City Testing Laboratory (*Bulletin No. 15*):

- I. Cracking in the vapour phase.
    - A. Atmospheric pressure.
        - Oil gas plants, very high temperature.
        - Pintsch gas plants, very high temperature.
        - Blaugas plants, 1,000–1,200° F.
        - Parker (W. M.) process at 1,000° F. with or without steam.
        - Greenstreet Cherry red with steam.
    - B. With increased pressure.
        - Rittman process above 950° F. and 200–300 lb. pressure.
        - W. A. Hall process 1,100° F. and about 75 lb. pressure.
- II. Cracking in the liquid phase.
    - A. With distillation.
        - 1. At atmospheric pressure.
            - Luther Atwood (1860).
            - McAfee process with aluminium chloride.
            - Russian and American practice for illum. oils.
        - 2. Above atmospheric pressure.
            - Dewar and Redwood (1889).
            - Bacon and Clark at 100–300 lb.
            - Burton (Standard Oil Co.) 650–850° F. and 60–85 lb.
            - Dubbs, J. A., over 10 lb. and over 300° F.
        - 3. Very high pressure (over 27 atmospheres).
    - B. Without distillation and with high pressure.
        - 1. Without vapour space for equilibrium (continuous processes).
            - Benton (1860) 700–1,000° F. and 500 lb.
            - Goebel-Wellman.
            - Mark (English).
        - 2. With vapour space.
            - (*a*) Intermittent.
                - Palmer (below 27 atmospheres for aromatics).
            - (*b*) Continuous.

Dr. Burton's process is now extensively used in the United States. The development of this patent and the large-scale adaptation of the cracking process marked an era in the history of petroleum refining.

The following is a summary of an address made by Dr. Burton in May 1918, on the occasion of the presentation to him of the Wm. Gibbs medal by the American Chemical Society.

Dr. Burton pointed out that in 1910 the demand for gasoline created by automobiles began to grow so rapidly that it was obvious that something would have to be done to increase the supply of naphtha products. In those days the average yields of various products of petroleum were about as follows: naphtha products 18%, kerosene or illuminating products 30%, lubricating products 10%, loss 3%, leaving about 40% which was sold for gas-making or fuel in lieu of coal. The problem was to convert the high-boiling fractions existing in fuel and gas oil into low-boiling fractions needed by the internal-combustion engine. Dr. Burton and his associates worked for almost two years trying to devise a practical method, first by superheating and dissociation at high temperatures, but at atmospheric pressure; and, secondly, by the employment of various reagents, but their efforts were not successful. Having tried everything else that suggested itself these engineers decided to attack the problem from the pressure distillation standpoint. In view of the fact that distillation must take place at temperatures ranging from 350°C. to 450°C., at which the tensile strength of steel begins to diminish very rapidly, and in view of the fact that steel at such temperatures, in the presence of carbonaceous matter (and even of free carbon, which often comes as the result of pressure distillation), is likely to absorb such carbon, become crystalline and lose its tensile strength, the practical refiner doubted the success and safety of this method.

The first large still built had a charging capacity of 6,000 gal. of heavy oil. Serious leaks were encountered, but this problem was finally solved, as the oil carbonized under the influence of the high temperature and the carbon deposits stopped the leaks. There were many puzzling problems to be solved, such as the devising of a safety valve that would operate freely in spite of the intense heat and the presence of carbonaceous matter. The entire apparatus had to be constructed in such a way as to insure ease of operation and freedom from excessive repairs. The production and disposition of the so-called "fixed gases" were troublesome. It was found that in some cases the heavy oil with which the operation began evolved more gas than was needed to maintain the desired pressure, whereas other oils evolved an insufficient amount of gas for this purpose. This obstacle was converted into an aid by arranging a large number of stills in parallel so that the superfluous gases from some stills were conducted to others that needed them. The plan gave a perfect method of securing uniform pressure and control.

By starting with fuel-oil products having boiling points ranging from 200° C. to 350° C., it was possible to secure a very substantial yield of a product having boiling points ranging from 50° C. to 200° C., and it was found that losses thus incurred were trifling, averaging less than 3 per cent. It was found that the high-boiling residues thus produced yielded a product almost identical with the natural asphalt.

Developed from the single 6,000 gal. still there were then (1918), Dr. Burton stated, over 500 stills of a larger capacity. During the preceding five years more than 20,000,000 bar. of gasoline or naphtha products had been produced by these stills in the United States.

It is estimated that cracked gasoline probably accounts for about 15% of all gasoline manufactured in the United States. Casing-head gasoline, manufactured from natural gas, the development of which ranks with cracked gasoline as one of the most important refining advances, is perhaps the source of from 12% to 15 per cent.

Natural Gas.—The United States and Canada produce all but a small fraction of the natural gas output of the world (*see* 21.321). The main areas of Pennsylvania, W. Virginia and Ohio have developed remarkable staying qualities, and these three states produced virtually two-thirds of the total production of the continent. The mid-continent field has shown a great increase in the natural gas production and the Wyoming field has proved productive. There is some natural gas production in Russia, Rumania, Persia, Galicia, India, Japan and Mexico. The total production of natural gas in the United States in 1918 was 721,000,000,000,000 cubic feet. It is estimated that no less than 14,000,000 inhabitants of the United States are enjoying this fuel as a source of heat, light and power.

Natural Gas Gasoline.—Although the foundation of the natural gas gasoline industry in the United States was laid in 1903 and 1904, the real expansion of this important phase of gasoline production began in 1909. In 1911, the first year for which statistics on the subject are available, 132 plants produced 7,425,839 gal. of raw gasoline from natural gas. In 1918 the industry included 1,004 plants which produced 282,535,550 gal. of raw gasoline. Of the total, 865 were compression plants producing 219,767,207 gal. and 139 absorption plants producing 62,768,343 gallons. A canvass made in 1921 showed a total of 444 casing-head gasoline plants in Kansas, Oklahoma and northern and central Texas, having a daily output of 1,101,155 gal. of raw gasoline. Prior to 1916 the greatest proportion of gasoline production from natural gas was obtained from casing-head gas, oil-well gas or "wet" natural gas by the compression and condensation method. The development of the absorption process has extended the field of the natural gas gasoline industry to include practically all of the natural gas production in the United States, for there is but little gas production that does not contain an appreciable percentage of pentane and hexane, the hydrocarbons of the paraffin series that are the principal constituents of gasoline. Much of the so-called "wet" gas obtained from oil wells when they are first opened and from gas wells that produce no petroleum, has been sufficiently rich in gasoline vapours to warrant treatment by the absorption process, though excluded from successful treatment by compression and condensation. The following extracts are from *Handbook of Casinghead Gas*, by Henry P. Westcott:—

"Casing-head gas received its name from the casing-head on the top of the casing through which it flows. It is the gas that flows from oil wells, coming out between the casing and the tubing. The volume varies from a few hundred cubic feet to several hundred thousand cubic feet per day. Invariably the gas becomes richer in gasoline content as the wells grow older. Generally a gasoline plant or property consists of a number of oil leases grouped around a main compressor station in which the actual making of gasoline takes place. The gas lines from different wells on each lease run to a main line in which is placed a meter to measure the gasoline from that lease. The main line runs to the compressor station or plant. There are a few plants extracting gasoline from a volume as small as 5,000 cub. ft. of gas per day, while some of the large plants are extracting gasoline from a volume of two and three million cub. ft. per day. The amount of gas necessary to make a profitable proposition is not only dependent upon the volume of gas but also on the quality of the gas. To further assist in the production, a vacuum pump or compressor is installed in the same building with the booster compressor. The object of the vacuum pump is to pump the gas from the wells and create a vacuum which materially increases the flow of the gas. Vacuum has been used in oil wells to increase the production even when gas could not be used for making gasoline.

"There are two processes for extracting gasoline. The one most commonly used is that of compression. The other is the absorption process, which is not only used with casing-head gas but also with natural gas, commonly called "lean gas," which carries as low as one-tenth of a gallon or less of gasoline per one thousand cubic feet. This process is used with gas at high as well as low pressure.

"In the compression process, the equipment consists of one or more two-stage compressors, coils, accumulating tanks, electric generator and other accessories. The casing-head gas is compressed to a pressure of from 50 to 300 pounds and then passed through a system of coils on which cold water is constantly dripping. This cools the gas, condensing the gasoline from it, the liquid being separated into respective accumulating tanks and the residue gas passing off to be used for power or heating purposes. After the gasoline is collected in the accumulating tanks, it passes into blending tanks, where it is blended with naphtha and other blending mediums to lower the gravity so as to permit of shipping without severe loss through evaporation and to make the shipping of it a safe matter.

"The absorption process is a method of passing the gas through oil and separating the gasoline vapour from it by absorption of gasoline into the oil. There are two general designs in absorption plants, one of which uses the horizontal and the other the vertical absorbers. With either system the oil is used over and over again."

Work of experimentation has been done on a process for extracting gasoline from natural gas by a method whereby natural gas is passed through absorbers containing charcoal, the gasoline absorbed by the charcoal and then distilled out.

Marketing of Products.—Expansion of the use of petroleum products has resulted in many improvements in marketing methods and great additions to marketing equipment and facilities. In the United States a large number of tank cars is used in transporting products from refineries to consuming centres and to ports for export shipment. The tank car is still used to some extent to carry crude oil from the field to refineries, but chiefly this is when a new field is opened up and before pipe-line connexions have been made. Tank cars are widely used in Europe for petroleum products.

There were 49,901 petroleum tank cars in the United States and Canada on Jan. 1 1914, and in 1921 the number had increased to 137,493. Rigid requirements are enforced in tank-car construction in the United States. Cars must be of steam boiler quality, and exceptional strength is prescribed for the frame. The insulated tank car to handle highly volatile casing-head gasoline has been successfully introduced and is also being adopted for transporting straight-run gasoline because it reduces loss by evaporation. The growth of motor-vehicle gasoline demand, particularly extensive and rapid in the United States, has created new distributing methods and devices. In that country and Canada gasoline filling installations for motor cars have been established in the cities and on every road of any importance. Thousands of filling stations have been built. Gasoline is delivered from tank wagons or steel barrels to the tanks built underground at the filling stations. The oil is lifted from these tanks by pumps (which measure the amount given by each stroke of the pump) and delivered through a hose into the automobile's tank. Lubricating oil at some stations is delivered in much the same way. An innovation is the visible pump at filling stations.

Fuel-oil bunkering stations have been established along the ocean routes to meet the increase in the oil-burning naval and merchant fleets of all countries. These stations include large storage tanks and berth and loading facilities in some cases, while in many instances they are simply storage reservoirs and oil is loaded on steamers from barges supplied from these stations. It is estimated that the number of fuel-oil stations for steamships located on trading routes approaches 300.

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(L. M. F.)

PETROLOGY (*see* 21.323).—During 1910–21 there was a steady advance in all departments of petrology, and new developments occurred which were not only interesting in themselves but gave promise of being important in the future. Up to a comparatively recent time petrology was in the main a descriptive science. The discovery of the application of the microscope to the study of very thin sections of rocks opened up a new field of investigation and showed how defective had been the means employed by the older geologists. It became possible to identify even the smallest mineral grains and to ascertain their relations to one another and the manner in which they were built together from the rock mass. For many years the description of the microscopic characters of minerals and rocks was held to be, if not the only, at least the most important, part of petrographical literature. The processes by which rocks are altered by atmospheric agencies and by underground water were revealed in detail. A great body of literature was accumulated, and a great diversity of rock types soon came to be recognized, some of them occurring in abundance in many parts of the world and others rare and exceptional either in their mineral composition or in their minute structures. Textbooks of petrography were in general a description of the recognized rock types, their composition, structure and the stages of their decay, with notes on their geographical distribution and their geological age. Chemical analyses were used principally as a means of identifying the classes to which individual rocks belonged and as a guide to the minerals of which the rocks consisted.

In time it came to be recognized that this aspect of the subject, if not unscientific, was at least incomplete. More attention of recent years has been directed to other problems connected with rocks—such especially as the conditions of their origin, their chemical classification and the physical laws which determine what minerals shall be formed, in what order they will crystallize and through what stages they will pass when subjected to cooling, pressure and metamorphism. In fact, the effect of the laws of physics and chemistry on the mineral composition and structure of rocks had become by 1921 a branch of petrology which was rapidly developing. It would be a mistake to regard this as wholly a new development, for many of the older geologists—such as Hall Gregory Watt, Daubrée, Fouqué and Lévy, Sorby, Morozewich—had carefully studied these problems and had made some notable discoveries. Essentially, however, it was necessary to attack these questions by experimental methods. The old charcoal furnace was very unsatisfactory and difficult to regulate; the gas furnace in all respects was much superior; but the advent of the electric furnace has placed in the hands of the experimentalist a weapon of enormously greater power and far more manageable. There is no difficulty now in attaining temperatures such as occur in the deeper parts of the earth's crust and in the interior of volcanoes and in maintaining these temperatures quite steady for several days or weeks if necessary. The electric pyrometer has replaced the gas thermometer and the older Seger and Wedgwood cones, and has reached such precision that an error of one or two degrees is all that need be expected in measuring temperatures up to 1600° Centigrade. By means of the electric arc, temperatures can be obtained which are beyond those which exist in the upper parts of the earth's crust, but furnaces of this type have been little used in these researches. Very high pressures can be easily obtained provided the temperature is low and there is no necessity to study the action of compressed gases. It is less easy, however, to perform experiments by which the action of steam and other gases on molten rock magmas at temperatures about 1000° and under pressures over 100 atmospheres can be exactly determined. More than one investigator has now been able to attain this, and a very correct reproduction of the conditions under which igneous rocks crystallize is consequently possible in the laboratory.

Descriptive petrology has been by no means in abeyance, though the five years of war turned the activities of many geologists to other fields. Exploring expeditions, such as those of Scott, Shackleton and Bruce in the Antarctic, have brought home large collections of rocks which have been examined and described, and the constant activities of geological surveys in all parts of the world, together with the researches of geological specialists, have added largely to our knowledge.

Igneous Magmas.—Of the three great groups into which rocks are naturally subdivided, the sedimentary, igneous and metamorphic, the first is on the whole best understood and presents the smallest number of unsolved difficulties. The manner in which sediments are laid down on the bottoms of seas and lakes, in river deltas and valleys and on land surfaces, at the present time is open to investigation by simple means, and, except in the case of the deposits of the deeper parts of the oceans, is reasonably clear. Igneous magmas, on the other hand, are essentially obscure in their origin and history, and they have been the subject of much investigation in recent years. The origin of magmas is a problem belonging to geology rather than petrology. They have been regarded as unconsolidated remnants of the primeval molten globe, which by geological changes, such as the secular contraction arising from cooling and the pressures by which mountain chains have been upheaved, have been afforded an outlet to the surface, where they appear as volcanoes, or have been forced between the rocks of the upper layers of the earth's crust where they may be laid bare by subsequent denudation as "bosses" of granite or gabbro or intrusive sills of porphyry or dolerite. Others have held that magmas may arise in whole or in part by the fusion of solid rocks (of any of the above three classes); the agencies producing fusion being rise of temperature, either through crushing and movement or by depression into those regions where a high temperature naturally prevails, or through penetration of gases from the earth's interior which are not only intensely hot but are capable of combining and setting free large quantities of energy. It is conceivable also that deep within the earth's crust masses of rock occur at temperatures so high that, if pressure be relieved by the vaulting-up of the overlying crust or by fissures opening to the surface, they may become liquid and rise through any available channels.

Hardly less obscure than the origin of magmas is the question of their variety or differentiation. The outstanding fact in this connexion is that no large developments of igneous rock are really homogeneous and even in small masses it is frequent to find that a great number of varieties or rock-species occur, differing in their chemical composition and their minerals. Granite, diorite, gabbro, norite and peridotite may all occur within a small outcrop not more than one or two square miles in area. The origin of differentiation has been much discussed. Some have ascribed it to diffusion or to a principle by which the heavier atoms in the molten mass will be concentrated either towards the bottom or towards the cooler edges or surfaces of contact with the surrounding rocks. Along these lines no satisfactory explanation has been found. More recent speculations have followed three lines; (*a*) subsidence or flotation of crystals; (*b*) absorption of sedimentary or other foreign rocks; (*c*) concentration of vapours.

(*a*) *Subsidence or Flotation of Crystals.*—When crystals form in a liquid they will, if heavier than the liquid, tend to subside and be collected near the base; and if lighter, they will tend to rise. If the crystals differ in composition from the liquid, as they usually do, consolidation will result in a mass which is not homogeneous. Thus, for example, olivine crystallizes early in a basic magma and, being heavy, will tend to sink; consequently magnesia and iron will be in excess (and silica will be less abundant) at the base, while felspar will predominate towards the top of such a mass. Instances occur showing this arrangement, but they are very exceptional; it is not the case that dolerite and gabbro masses as a rule have a pale-coloured felspathic top and a dark base rich in olivine and the oxides of iron. For such cases as do occur another explanation is often available. If now it were possible at an advanced stage in crystallization to drain away or force into another position the still liquid part of the magma a type of rock different from the original magma would be produced, because most of the heavy ferromagnesian minerals would have been abstracted.

The explanation is so simple and so well justified by experiment that it is difficult to believe it has no application in the differentiation of rock types. There is much evidence, however, that forbids us to accept it as important. For example, the study of great dolerite intrusions by means of bores shows that they are generally nearly homogeneous throughout. Top and bottom are very much the same as a rule; yet these masses must have cooled and crystallized with extreme slowness; and every chance was afforded for the accumulation of heavy crystals in their deeper parts. Again, it is the case that where many varieties of rock occur in one mass the densest are not generally in the lowest horizons. Still more important is the fact that field evidence often shows clearly that the more basic members of a complex intrusion have been injected in a liquid state into an earlier less basic mass already in position. In that case, if the more basic member was produced by the gravitational sinking of heavy crystals these must have been subsequently melted up, a process for which it is very difficult to suggest an explanation.

(*b*) *Absorption of Foreign Rocks.*—A second method of differentiation which has received much attention of recent years is by absorption of country rock. A gabbro mass, for example, may be supposed to dissolve a felspathic sandstone with which it is in contact and thus give rise to a more acid magma which might be represented by quartz-dolerite or even by granite. Intrusive masses of igneous rock, as they ascend from beneath, break across the overlying strata and may shatter them into many small blocks. On these and on the surrounding walls a solvent action is likely to take place. If the invaded rock is heavier than the intrusive magma its fragments will tend to sink, and as they are warmed up they will slowly disappear. There can be no doubt that this action is by no means unusual and many good instances of it are known, but there is little reason to believe that it is an important cause of differentiation. Where igneous rocks have absorbed sediment in any quantity they present in general an abnormal facies. Granites, for example, which have dissolved clay, slate or mica-schist usually contain andalusite, sillimanite, cordierite, garnet or corundum, minerals which do not normally occur in such rocks. The magmas are said to be "contaminated." Gabbros under similar conditions contain cordierite, garnet and an excess of hypersthene (forming cordierite norites) and are easily distinguished from normal gabbros. Absorption of limestone by some nepheline syenites is indicated by the presence of crystalline calcite in the igneous rock, and peridotites may contain corundum. Perhaps the diamond is an accessory of this type in olivine rocks which have dissolved graphitic matter. Even when igneous rocks are absorbed the result will as a rule be an abnormality. This is fairly evident in the majority of cases merely by a study of the analyses of true igneous rock types and ordinary sediments.

It is to be remembered, however, that a study of the crystallized igneous rocks exposed by denudation of the earth's surface reveals to us merely the last stages in their history when the upward propulsive force was spent, the fluid mass had come to rest, its temperature had fallen to such a point that crystallization had begun, part of its gases had escaped and the whole mass was encased in a solid envelope which had resulted from the rapid chilling of its external parts in contact with the cold surrounding rocks. At an earlier stage the magma was at a higher temperature and was in active movement. Constant stirring was going on and dissolved matter rapidly scattered through the whole mass. In the deeper parts of the crust the solid rocks may be mostly gneisses or old intrusive rocks different in character and in their relative abundance from the sediments of post-Archaean times, richer in alkalis and more nearly akin in composition to the igneous masses. These conditions would favour absorption and mask the consequences; and if it took place on a very large scale and time were given for diffusion a magma might be produced which would closely mimic a purely igneous magma. It has also been suggested that the absorption of foreign matter might upset the equilibrium of the original magma and give rise to partial magmas incompletely soluble in one another. It would be very difficult in such a case to determine the original nature of the rock or the amount and composition of the material dissolved.

(*c*) *Concentration of Vapours.*—The theory that differentiation of magmas arises from the formation of partial magmas during cooling, which separated because they became insoluble in one another (as phenol does with water), is favoured by many geologists, but a recent examination of the physical laws determining the production of such magmas has led to the conclusion that nothing is known that would make this process appear likely. Many geologists, however, who have a wide knowledge of igneous rocks in the field, hold that there is evidence to show that differentiation took place before crystallization began, and that the various types of rock were already distinct when they were injected in liquid form into the positions they now occupy.

It has been suggested, though it has not been clearly explained, that the gases dissolved in magmas determine the sequence of crystallization and may exert a powerful influence in differentiation. A magma rich in gases when it begins to crystallize yields crystals of anhydrous minerals. The gases, if they do not escape, must increase in relative amount in the liquid residuum. The early minerals are those like olivine and augite, which can be crystallized without difficulty from anhydrous melts; the later minerals, such as the alkali felspars and quartz, crystallize readily only in presence of steam and other gases (or of solvents of a nature not usually present in rocks). In some respects the crystallization of an igneous rock resembles the cooling and evaporation of a saline solution, the gases playing the part of solvent. The minerals appear in the order of their insolubility. It is probable that the history of magmas will never be clearly understood till a very careful study is made of the consolidation of rock-making silicates under high pressures of steam and other gases such as are known to abound in natural volcanic magmas.

Classification of Magmas.—The igneous rocks of one geological period and province have often so many peculiarities in common that they can be regarded as having resulted from the consolidation of a single reservoir of molten matter. The chain of volcanoes that fringes the shores of the Pacific Ocean from Tierra del Fuego to Alaska, and thence by Japan and the Philippines to Java and Sumatra, is characterized by rocks which have so much similarity in many important characters that they are certainly of allied origin, even if they have not proceeded from the one source. These rocks are all of Tertiary and recent age; their eruptions began in Eocene or Miocene time and have continued, with more or less frequent intermissions, up to the present day. For another example of this we may take the igneous rocks of the western and mid-Atlantic area, from Jan Mayen, through Iceland, the Hebrides, Canaries, Cape Verde Is., etc. All these volcanic centres have many rock types in common, and the whole assemblage is strikingly different from the Pacific igneous rocks. Each of these magmas has been taken as a type, and it has been found that in the older geological periods they are also represented; for example, the early Devonian eruptions in Scotland are distinctly of the Pacific type, while the Carboniferous eruptions in the same district are of the Atlantic type. If we seek for a precise definition of their respective characters it is not easy to give a complete answer. It may be said, however, that the Pacific suite has a great prevalence of hypersthene andesites, and andesites of all kinds. The Atlantic lavas, on the other hand, are predominantly olivine basalts, with trachytes and phonolites. Another feature which is especially striking is that practically all the rocks carrying nepheline and other felspathoids or "alkali minerals" are found in the Atlantic suites. This has been regarded as proving that the Atlantic magmas are richer in alkalis and the Pacific in lime, but it is by no means certain that this is the explanation. In fact, a full chemical discussion of the relations of these rock-series to one another has yet to be undertaken, but from the work of Becke it seems that the Pacific are essentially richer in silica, and in the "light" elements generally, while the Atlantic contain more of the "heavy" elements, such as magnesia, iron, chromium, titanium. Several authors have pointed out that the rocks of the Pacific group are associated with a folded mountain chain and consequently have appeared in a region undergoing lateral compression and upheaval; the Atlantic, on the other hand, are associated with a region of subsidence, with vertical dislocations along lines of fissure and faulting—in other words, a region subjected to lateral tension and depression. A third group of igneous rocks, very well characterized and distinct in many respects, is the pillow lavas or spilites, which are perhaps the most abundant volcanic rocks of the earlier geological periods and are very widespread in the Lake Superior district, middle Europe, Wales and Scotland. Among these lavas types rich in soda are common and albitization is a frequent pneumatolytic change. These rocks seem to accompany depressions formed in consequence of folding.

The attempt to classify volcanic magmas in groups which accompany definite types of earth movements, folding and faulting, is exceedingly fascinating. A general survey of the world's volcanics from this standpoint has been undertaken by Iddings and Stark, but the results are by no means conclusive. A great deal has yet to be done before we understand the full range of variation of many local magmas, their relation to one another and the approximate age of the intrusive types. It seems, however, that Atlantic, Pacific and spilitic suites are not in all cases sharply distinct. Harker believes, for example, that the Hebridean Tertiary magmas of Scotland are Atlantic with some Pacific affinities. He had formerly classified them as Pacific. Bailey and Clough have found in the same district a group of pillow lavas occupying a central volcanic subsidence or "caldera." In that case, accordingly, all three types occur in one narrowly circumscribed area. If so, they cannot be regarded as distinct types of magma, but rather as facies which may be developed or may appear as offshoots of a magma. Their connexion with definite types of telluric movement becomes doubtful. American petrologists also, from a study of the Tertiary magmas of the Western States, are by no means satisfied that the alkali rocks, such as phonolites, tephrites and leucitic lavas, may not belong to a definitely Pacific assemblage. In Australia, Atlantic and Pacific magmas seem to be intermixed, but in Africa Atlantic igneous rocks accompany fault-fissuring, and this extends into Arabia and Palestine. There is no doubt that on a broad scale the Atlantic and Pacific types have appeared again and again in the earth's history, and have maintained their distinctive characters. The distinction, however, is not absolute, and the rule has many exceptions. Recognition of a number of additional types has recently been proposed, and along this line it is probable that there may be considerable advance in the near future.

Experiments on Constitution of Binary Magmas.—A molten rock magma may be regarded as a liquid composed principally of oxides (mostly silicates). It crystallizes from a variety of causes, of which cooling is the most important, though relief of pressure and escape of gases may also play a part.

The laws followed in such a case have been very carefully investigated, not only for metals, salts and organic compounds but also for many minerals. It is generally true that a mixture of two substances will have a lower consolidation point than one of the pure substances, and, if mixed in certain proportions, they will consolidate at lower temperatures than either of the components. Thus salt and ice, if mixed in the solid state at temperatures a little below the freezing-point of water, will melt, forming a liquid which is colder than the ice originally taken; and aqueous solutions of salts have always a freezing-point lower than that of pure water. For each pair of substances there is a definite mixture which has the lowest temperature of consolidation and this is known as the *eutectic* mixture.

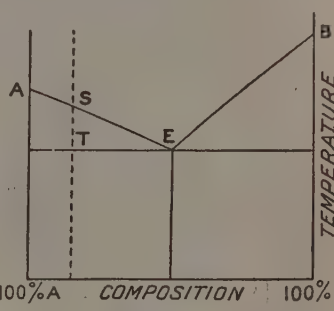

FIG. 1

In the diagram (fig. 1) the horizontal coördinate represents composition, the vertical represents temperature. A mixture of any given composition is represented by a vertical line and different points in that line represent different temperatures of the mixture. The two sloping lines AE and EB divide the diagram into two regions, of which the uppermost indicates substances in a purely liquid state; below the line the substance is in part or wholly in a solid condition. A vertical (composition) line, accordingly, when it cuts these lines shows where a substance begins to crystallize. The point where the curves meet is the eutectic point E, and shows the composition of the mixture which has the lowest freezing temperature and the temperature at which it consolidates. The horizontal line drawn through the eutectic point separates the diagram into two regions, a lower one in which the substance is entirely solid and an upper one in which liquid is present. If we take any vertical line in the diagram, it will indicate a mixture of definite composition ST and, followed downwards, it shows the changes taking place in such a mixture as the temperature falls. Above the line AE the mixture is a cooling liquid. At S crystallization begins. At T the last liquid portion disappears and consolidation is complete; below T the substance is a cooling solid. The diagram refers only to substances that crystallize on solidifying; glasses are solids which essentially resemble highly viscous liquids in their properties. When crystallization begins the substance which is in excess of the eutectic mixture will crystallize out first, the residual liquid becoming poorer in that component until it has reached the eutectic composition, when the two components will go on crystallizing simultaneously till all is solid. The composition of the liquid will travel along the line AE from S to the point E, where it will remain constant.

Such a diagram is based on a series of experiments in which a known mixture of two substances (very carefully purified) is heated in a furnace (generally electric) to a temperature well above its melting-point. The mixture is then allowed to cool slowly and steadily, and its temperature recorded at short intervals or continuously by some form of pyrometer or recording thermometer. The rate of cooling can be very accurately ascertained and plotted (fig. 2). Crystallization is attended by liberation of heat (the liquid losing its latent heat as it passes into a solid), and this involves a retardation of cooling. The simple liquid cools at a uniform rate; crystallization begins and the cooling slows down; at a certain point the liquid is all crystallized and the mixture, now a solid mass of crystals, will go on cooling uniformly. The change of slope in the curve of cooling accordingly corresponds to the passage of the substance from S to E in temperature (or from the purely liquid to the purely solid areas).

The physical condition of the substance at any given temperature can also be ascertained by the method of chilling. If the charge be taken from the furnace and plunged in water (or in some cases mercury) the mixture consolidates almost immediately, and any parts which were liquid will assume the form of a glass, or a very finely crystalline aggregate. This is especially the case with silicates, many of which crystallize with difficulty. Microscopic investigation will enable us to determine the nature and relative proportions of the crystals which were present. The results obtained can be checked by experiments on mixtures having a different composition, and in this way a complete diagram built up on a sound experimental basis. The case outlined above is the simplest known. Many complications may appear, requiring special precautions and elaborate investigation. Thus the liquid may not begin to crystallize at the proper point on the upper curve, as some substances crystallize with difficulty and the liquid becomes "undercooled." A heating-up experiment may be tried to check the cooling experiments; the same phenomena should appear in the reverse order if no complications are present. Many silicates crystallize with great difficulty in ordinary crucible experiments (such as the felspars, albite and orthoclase). Again, it may be impossible to melt the mixture we desire to investigate in any furnace which is suitable for experiments of this kind. Magnesia, alumina, and lime are examples of substances which cannot be fused at temperatures such as 1600° to 1700° C., which are the limits of accurate work in our laboratories at present; part of the diagram accordingly will be incomplete when substances like these are studied, but an approximate solution can generally be made by extrapolation. Another frequent complication is the appearance of transformations in the solid state. The first mineral to crystallize becomes unstable as the temperature falls and changes spontaneously into another crystalline form of the same substance. The change will be attended by an alteration in the slope of the cooling curve, for in such cases heat is either liberated or absorbed, and successful chilling tests can often be made by which the mineral transformation can be clearly demonstrated. Silica, for example, appears in three minerals, cristobalite, tridymite and quartz, the transition temperatures being 1470° and 870°. Each of these minerals occurs in two forms. Carbonate of lime has a high-temperature and a low-temperature form. Below 1190° calcium metasilicate crystallizes as wollastonite; above that temperature it forms another mineral, pseudo-wollastonite. Many of these "high-temperature" forms are not known as natural minerals, and as a rule they are very rare in rocks, probably because rock cooling is essentially a slow process, and the most stable forms at low temperatures are the only ones likely to be present when the mass has completely cooled. Some very interesting results have been obtained in this field of research; for example, it is known that quartz has two modifications, one above 575°, the other below that temperature, and it has been proposed to use quartz as a geological thermometer to show at what temperature it crystallized in a rock mass. If above 575° it would appear as quartz and on cooling would pass into α-quartz; and by various indications, such as crystalline form, cracks, etc., a record of this transformation may be obtained.

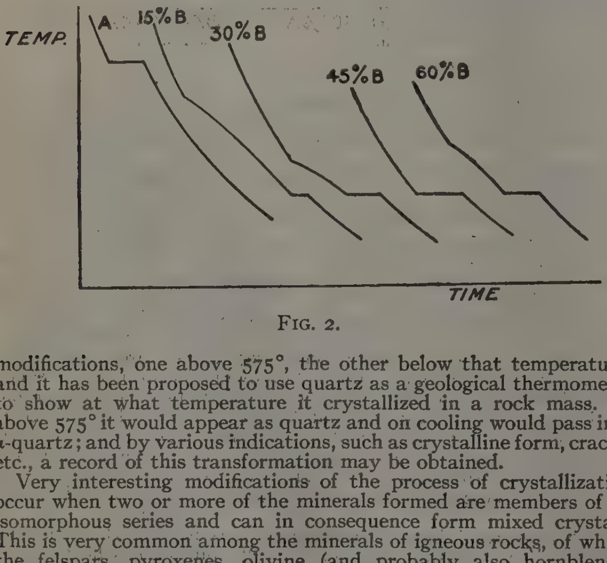

FIG. 2.

Very interesting modifications of the process of crystallization occur when two or more of the minerals formed are members of an isomorphous series and can in consequence form mixed crystals. This is very common among the minerals of igneous rocks, of which the felspars, pyroxenes, olivine (and probably also hornblende, mica, nepheline and the felspathoids) all belong to isomorphous series. If we have, for example, two components such as albite and anorthite, they will tend to form mixed crystals (known generally as plagioclase felspars). Anorthite has the higher melting-point (about 1550° C.); albite crystallizes in crucibles only with great reluctance at a temperature about 1100° C. A mixture containing equal proportions of anorthite and albite will melt at about 1450°, and on cooling will begin to form crystals at that temperature. These crystals will contain about 60% anorthite—that is to say, they are enriched in the less fusible component. As crystallization proceeds, the felspar that separates becomes gradually less rich in anorthite. The composition of the liquid also alters, because the crystallization is abstracting anorthite molecules more rapidly than albite molecules. This process may go on till the felspar has all crystallized, the last deposited being near albite in composition, and the crystals, examined microscopically, will show zones, of which the internal are rich in anorthite and the external are progressively richer and richer in albite. But if sufficient time is allowed, a reaction sets in between the crystals and the liquid; in other words, the felspars crystallized are not in equilibrium with the magma except at the moment of crystallization, and as the magma becomes richer in albite it will attack the early plagioclase, replacing it by a variety containing more albite. These phenomena are well known to petrologists as zonal structure of plagioclase felspars; and corrosion of the cores and internal zones of the crystals is almost universal in such rocks as basalt and andesite. Rocks of similar composition which have cooled very slowly, such as gabbro and norite, as a rule do not contain zoned plagioclase crystals, no doubt because equilibrium has been attained and homogeneous crystals formed by the process above described.

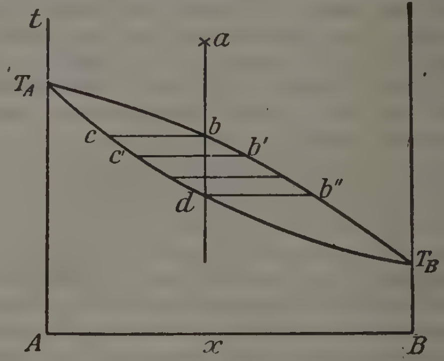

FIG. 3.

This may be illustrated by fig. 3. The horizontal line represents composition, the vertical temperature. A is 100% albite, B is 100% anorthite. The upper curve is the liquidus above which there is only liquid; the lower is the solidus below which all is crystallized: between these lines is a space representing stages in which crystallization is going on but still incomplete. Each point on the solidus has a corresponding point on the liquidus, which is found by drawing a horizontal line across the intervening space. A mixture of any composition, say *a* at *ab*, is completely liquid. As the temperature falls it begins to crystallize at *b*. The crystals formed have the composition *c*. Further cooling results in the formation of crystals at *b′* the composition being *c′*. At *b″* all is crystallized, the last crystals being *d*. If resorption is completely accomplished the final crystals have the composition *x*, but they are usually more rich in albite: this will depend on the rate of cooling, the number and size of the crystals formed, and on a variety of other factors.

The theoretical investigations of Roozeboom and Gibbs have shown that five types of crystallization of isomorphous substances may occur, in some of which the mutual solubility of the two components is unlimited, while in others it is limited so that only mixed crystals of certain types may occur. Several of these have been identified in rock-forming minerals, and others are suspected though not yet proved.

Ternary Magmas.—Magmas of three components (ternary) are much more complicated than binary magmas. To represent their behaviour a triangular diagram is necessary. Usually an equilateral triangle is employed and the distance from any point to the three sides of the triangle is made to represent the three components of any mixture in their true proportions; the sum of these three perpendiculars is constant and equal to the height of the triangle; if lines be drawn through the point, parallel to the sides of the triangle, they will cut the sides at distances which will represent the relative proportions of the components. Any mixture of three components can be represented by one point in this triangle. To represent temperature another coördinate is required which is perpendicular to the plane of the triangular diagram; and a solid model must be made, resembling a triangular prism with flat base and an irregular surface representing the consolidation temperatures as the top of the prism. Each of the three vertical surfaces of the prism represents the behaviour of the mixture of two of the components.

To enable us to construct such a model a very large number of experiments must be made, first with binary mixtures and then with mixtures of the three substances. Their exact temperature of first crystallization must be ascertained in each case and also the nature of the mineral which crystallizes. Simultaneous crystallization of two minerals will follow, and the temperature at which the second mineral appears is to be determined. Three minerals will ultimately appear, and the last process will probably be the formation of a ternary eutectic at which the temperature remains steady till the liquid disappears and finally the completely solid mass cools down.

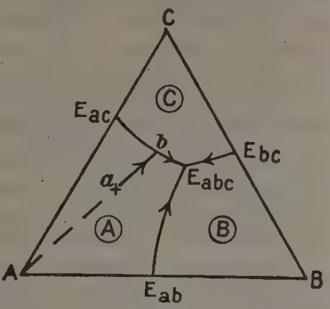

FIG. 4.

As a very simple case we may take the diagram in fig. 4. A, B and C represent the three pure substances. AB, BC and AC represent mixtures of two components. E_{ac}, E_{bc} and E_{ab} represent the three binary eutectic mixtures. The ternary eutectic is represented by E_{abc}, containing about equal quantities of C and B and a smaller amount of A. If *a* represent the composition of a certain liquid which is allowed to cool and crystallize, composition will change along the line A_{ab}. At a certain point the A component will crystallize out and the liquid will become poorer in A (richer in B and C), and the composition will change from *a* towards *b* (away from point A). After a time the liquid becomes saturated for *b* which will start to crystallize, and now the liquid changes composition along the line bE_{abc} as the temperature continues to fall; finally C also begins to crystallize, and the ternary eutectic point is reached at which the three components crystallize simultaneously in definite proportions (represented by the position of E_{abc}) until it is completely solidified.

It is probable that nothing quite so simple as this occurs in ordinary rock-forming minerals, at least the silicates, but some metallic alloys show this type. In considering silicates the following considerations must be kept in mind: (*a*) The liability to form compounds, which behave as new substances with their own fusion-points and eutectics. (*b*) The occurrence of isomorphous compounds is almost universal and these form mixed crystals unstable in the changing magma, and liable to resorption (this may upset the formation of a ternary eutectic altogether). (*c*) Compounds may appear at an early stage which subsequently become unstable and are replaced by different minerals (incongruent). (*d*) Many silicates refuse to crystallize in ordinary crucible experiments (except in presence of solvents which do not appear in the final product).

We must also keep in mind that in the crystallization of rocks certain conditions prevail which may modify the process to an unknown extent. Thus: (*a*) All magmas contain gases of various kinds which may have a very powerful influence in determining what minerals will form. (*b*) Intrusive magmas are under great pressure and the pressure diminishes as they rise to the surface; the pressure may act directly or by increasing the concentration of the gases dissolved in the magma. (*c*) Cooling in deep-seated magmas is extremely slow. This will tend to prevent supersaturation by undercooling and lessen the chance of the abnormality in the sequence of crystallization which may appear in rapidly cooled melts. It will also favour the complete transformation of early unstable minerals into stable permanent forms. Many varieties of minerals have already been obtained experimentally which are not known to occur in rocks. They are stable only at high temperatures (and possibly under low pressures).

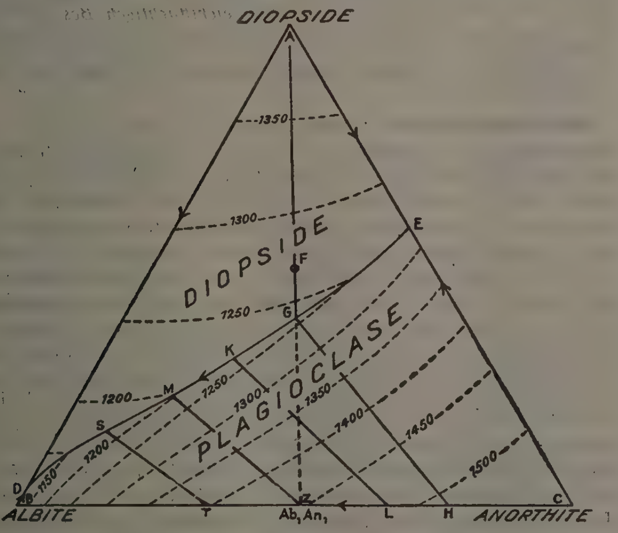

FIG. 5.

As an example of the effect of isomorphous minerals on the sequence of crystallization we may take a mixture consisting of 50 % diopside and 50 % plagioclase (containing equal proportions of albite and anorthite). The composition diagram (fig. 5) is a triangle with each mineral at one of the corners and the mixture is represented by a point (F). Crystallization begins with a separation of diopside (supposed to be a simple mineral and not an isomorphous mixture, as it would usually be in rocks) at about 1275°. At 1245° the excess of diopside (G) has separated out, and felspar begins to crystallize. It has about 75 % anorthite (H). Thereafter diopside and felspar both crystallize, but as the temperature travels along the line EGD from G to K the composition of the felspar changes from H to L (if we suppose that all the early felspar which is unduly rich in anorthite is stage by stage absorbed). The resulting rock has the mineral composition above stated; but if resorption of felspar is incomplete the last-formed felspar is richer in albite and has a composition T. The felspar crystals in that case are zonal with basic centres. If at any time crystallization is suddenly brought to an end, a glassy ground-mass will be formed, which is richer in soda and silica than the original magma and contains zoned felspar crystals. This is exceedingly like what takes place in many basaltic lavas. Again, if the original mixture had been richer in felspar, so that the composition point lay below the line DE, felspar would have crystallized out first. This seems to be in keeping with the structure of many dolerites, which contain felspar partly enclosed in augite crystals of later formation (ophitic structure), while others show that the augite appears in porphyritic crystals and began crystallizing before felspar. Another interesting feature of this diagram is that there is no tertiary eutectic point, and the liquid residue continually changes in composition up to its final disappearance.

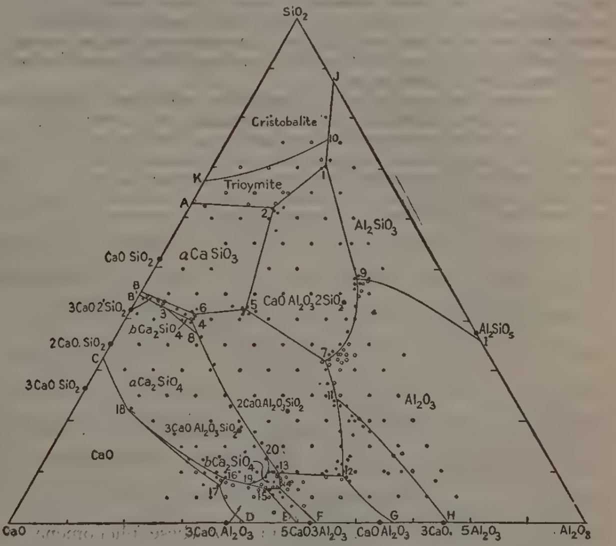

FIG. 6.

The phenomena of these component systems are extraordinarily varied. One of the best known is the system Al_2O_3–CaO–SiO_2 which has been very fully tested at the Geophysical Laboratory in Washington by Shepherd and Rankin. A copy of their diagram is given here (fig. 6). It is divided into fields, of which six are occupied by substances known to occur as minerals, cristobalite, tridymite, wollastonite, anorthite, sillimanite and corundum. In each of these fields the mineral named will crystallize if the temperature of the melt falls. The fields are separated by lines which show under what circumstances the two minerals whose fields adjoin will crystallize. Where three fields meet, the conditions exist at which three minerals will exist simultaneously (or, to express it otherwise, are in equilibrium with a liquid of the composition indicated). In no case do four fields meet in one point.

This system is also of much interest to technologists desiring to understand the chemistry of the manufacture of Portland cement. This is a mixture of lime, alumina and silica, with a fairly definite composition, and the compounds which form on fusing or sintering the mixture are indicated by the diagram. Similarly, the CaO corner of the figure shows what is the result of heating lime containing a little alumina and silica (impure limestone) to a very high temperature. Silica is also a refractory mineral and is used in silica-bricks and ganisters for lining furnaces. A little lime and alumina are mixed with it (either naturally or expressly to obtain certain results), and the behaviour of such mixtures is indicated by the appropriate corner of the ternary scheme. These investigations accordingly are of the greatest value in many industries such as pottery, steel-making, glass-melting, brick-making, cement manufacture, lime-burning and the quartz-glass industry. During the war the Carnegie Geophysical Institute at Washington, which has earned great fame for these researches, was able to direct the manufacture of chemical and optical glasses in the United States in a most successful manner, and performed very valuable services to American industry.

Theory of Ternary Mixtures.—The theory of ternary mixtures has been very fully worked out mathematically by Willard Gibbs, Backhuis Roozeboom, Schreinemakers, Smits, Kuenen, Tammann and others, and may be said to be well understood in its main applications. Experimental investigation has also made great progress. It is a laborious matter, requiring great skill and very elaborate appliances. The diagram we have given showing the tertiary system CaO, Al_2O_3, SiO_2, required over 7,000 experiments, in some of which the heating had to be continued for many hours and even for days; and the thermal results had usually to be checked by microscopic examination of the product. Other systems equally important have received very careful study. These are not so simple as the instance quoted, because mineral transformations, either during or after crystallization of the melts, often give rise to many complications. Thus, for example, $CaSiO_3$ crystallizes as pseudo-wollastonite at high temperatures, which may change to wollastonite at low temperatures. $MgSiO_3$ has four forms—kupferite, magnesia amphibole, enstatite and clinoenstatite. Where both these substances separate from the melt, none of the above-named minerals appears, but a diopside clinoenstatite solid solution or isomorphous mixture, which belongs to the common group of minerals known as the pyroxenes.

These facts are of the greatest interest to both mineralogists and petrologists. They have introduced many new minerals (artificial) to our knowledge, and taught us their relationships at atmospheric pressures in certain dry melts. They have also enabled us to understand many of the peculiarities of the minerals that occur in rocks, and the method of their origin.

As another instance we may quote the relations of forsterite (Mg_2SiO_4) and rustalite ($MgSiO_3$). Forsterite may crystallize from melts of suitable composition and after a time it may become unstable in the residual magma; then it is dissolved up or "corroded" and clinoenstatite replaces it. Again, if an enstatite ($MgSiO_3$) mixture be fused and allowed to cool, forsterite begins to separate out; it will tend to be reabsorbed and converted at a lower temperature to clinoenstatite, but if this be prevented the mixture solidifies as forsterite, clinoenstatite and quartz. To the petrologist this is of great interest, because forsterite is one of the constituents of olivine, a very common mineral of the basic igneous rocks. Now olivine generally occurs along with some member of the pyroxene group, and the olivine crystals show rounded outlines, which have been taken to indicate corrosion or resorption by the magma after crystallization with concurrent formation of pyroxene. In some rocks there is clear evidence that olivine crystallized early and subsequently was entirely dissolved. In other rocks olivine is found enveloped in clusters of enstatite crystals which have evidently formed at its expense; and it is a very frequent characteristic of the olivines of gabbro and norite that they are surrounded by "reaction rims" or "corrosion borders" consisting of enstatite, tremolite and other magnesian silicates that have a higher percentage of silica than olivine itself. The meaning of these phenomena was fairly well apprehended by petrologists, and now their conclusions have been confirmed by experimental evidence. Another feature of some interest is that, in the ternary system under consideration, it has been shown that forsterite may crystallize early, then disappear by corrosion, and a second generation of forsterite may subsequently crystallize. Whether this is a common phenomenon is not yet known, and its exact relation to the frequent appearance of minerals in two generations in rocks remains to be demonstrated.

The number of ternary systems that have as yet been fully investigated is small, though the results are of the highest importance. Those which contain the alkalis potash and soda present certain special difficulties, such as the volatility of part of the mixtures and the difficulty of crystallizing some of the minerals. Rapid progress is being made and it is unlikely that experimental difficulties will retard the advance of knowledge. A special case, of the greatest possible interest to the petrologist, arises where one or more of the components are volatile. Natural magmas are probably always richly charged with gases. The theory of such systems has been explored by Schreinemakers, Smits and others. Experiments with mixtures enclosed in steel bombs which can withstand great pressures at high temperatures have been very successful in certain cases, but as yet only the borders of this field have been explored. A good deal of work has been done on the dissociation pressure of sulphides of the metals, a subject of great importance as regards the paragenesis of natural sulphides and the conditions under which mineral veins have been formed. The effect of steam in the formation of silicates is under investigation and during the next few years will probably be the subject of much research.

Quaternary Mixtures.—We have seen that systems of three components are much more complicated than systems of two components; and the addition of a fourth component greatly increases the difficulties. The theory of such systems is not as yet fully explored; in fact, it is quite probable that many of the problems will not be solvable by mathematics. No four-component system has yet been completely studied, though parts of such systems have received investigation. As a diagram a solid figure bounded by three equilateral triangles may be used, and projections similar to those employed to represent the faces of crystals have been tried. Systems more complicated than the quaternary systems are at present beyond mathematical and experimental investigation.

Constitution of Rocks.—In rocks the least number of components that can be regarded as essential is seven (SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, K_2O and Na_2O). In rock analyses as a rule from 12 to 20 components are ascertained, but most of these are in small amount and may be regarded as unessential. To the seven main components we must add the volcanic gases (such as H_2O, F, Cl, HCl, SO_2, B_2O_3), most of which appear only in very small quantity in the crystallized rock, but are believed to exert a powerful influence in determining the crystalline phases that appear. High pressures must also be employed, and in some cases it is certain that the pressures were by no means constant. For these and other reasons it is clear that the genesis of such a rock as granite or basalt presents problems of the highest order of difficulty.

In the preliminary stages it may be possible to simplify the problem by considering rock magmas, not as a mixture of the seven oxides above named, but as mixtures of minerals. If three minerals be taken a ternary system is the result. For example, a granite might be regarded as consisting of orthoclase, quartz and albite; a nepheline syenite as consisting of nepheline, albite and aegirine; a basalt as composed of olivine, diopside, anorthite. Such systems, of course, are a mere approximation and it is already known that it may not be safe to treat them as simply ternary. In the system diopside-forsterite-silica, for example, it is proved that under certain conditions spinel crystallizes, and the reactions can only be regarded as those of a four-component mixture. Another difficulty that is bound to prove important is the occurrence of isomorphous minerals. In petrology this is practically universal. Except quartz, all the common rock-forming minerals are members of complicated isomorphous groups (felspars, nepheline, sodalite, micas, pyroxenes, amphiboles, olivines); and even in simple ternary systems, if two of the three minerals are isomorphous, there may be, strictly speaking, no eutectic mixture as the last stage of crystallization. It is not too much to say that the crystallization of rocks is very largely a problem of the formation of isomorphous crystals, and it is unsafe to apply to rocks the results derived from mixtures of minerals that do not show similar relations.

BIBLIOGRAPHY.—For the recent advances in physico-chemical and experimental petrology no English textbook is available. Harker's *Natural History of Igneous Rocks* (1909) gives a sketch of the subject from the standpoint of its time, but is now out of date. A more adequate work is Boeke's *Physikalische-Chemische Petrographie* (1915), which gives full references and is the best general account. Vogt's *Silikat Schmelzlösungen* (1904) is interesting but very speculative. His *Sulphid Silikatschmelzungen* (in course of publication) deals with some special aspects of the problem. The fundamental works on the theory of equilibrium are Roozeboom's *Heterogene Gleichgewichte* and its continuation (3rd vol.) by Schreinemakers. See also Bancroft, *The Phase Rule*, and Findlay, *The Phase Rule;* Tammann, *Krystalliziren und Schmelzen.* For English and American students the best authorities are the papers published by the workers of the Geophysical Institution in Washington. See also Niggli, *Lehrbuch der Mineralogie* (1920), *Die Leichtflüchtigen Bestandtheile im Magma* (1920); Daly, *Igneous Rocks and their Origin* (1914); Iddings, *Igneous Rocks* (1913); Holmes, *Nomenclature of Petrology* (1920); Stark, "Petrographische Provinzen" (in *Fortschritte der Mineralogie*, 1914). (J. S. F.)

PFLANZER-BALTIN, KARL, FREIHERR VON (1855–), Austro-Hungarian general, was born at Pécs in Hungary in 1855. He served in the cavalry and on the general staff, but in 1914 found himself, on account of precarious health, unattached, and it was only in the autumn of that year, when Rumania appeared to be turning against the Central Powers, that he was charged with the defence of Transylvania. But when the Russians at this period crossed the Carpathians, and there was immediate danger of their eruption into the plains of Hungary, Pflanzer-Baltin, with a division improvised by his brilliant talent for organization out of next to nothing, threw himself on this enemy, and conducted the defensive in the form of a series of daring offensive movements. After fighting with varying success in the southern part of Eastern Galicia and in the Bukovina the VII. Army under his command was driven back by Brussilov's offensive in June 1916, whereupon he was relieved of his command. In the summer of 1918 the Austro-Hungarian front in Albania yielded before the attack of the Entente army. Pflanzer-Baltin, entrusted with the command in this theatre of operations, won back, after a brief and powerful attack, the old positions southwards of Fjeri and Berat—the last considerable success which fell to the Austro-Hungarian army in the field. (A.-K.)

PHARMACOLOGY (*see* 21.347).—The science of experimental pharmacology is a product chiefly of the last half-century, and the subject has more recently made rapid advances, due largely to the creation of new laboratories and the institution of new chairs devoted to pharmacological research. The chief importance of the work lies in the application of the knowledge gained of the physiological action of drugs to the treatment of disease in man and animals; and, though there have been periods when this branch of therapy—in spite of its antiquity and persistence—has been suspect, recent research leading to new, more accurate, and more scientific use of drugs has placed the subject in a position so indubitable that the time is not in sight when the practice of medicine or surgery will be able to dispense with its services.

The main directions of recent advances in knowledge may be indicated. The action of familiar drugs becomes daily more accurately known, leading to a juster estimate of their value and greater precision in the use of them in disease. New remedies are being introduced and older remedies superseded. The enormous development of synthetic chemistry has furnished many potential remedies, all of which are now subjected to pharmacological investigation before they are used on man. One relatively recent development which has proved fruitful in results of great practical importance in the treatment of disease is that of experimental therapeutics, where the cure of disease artificially produced in experimental animals is investigated. So far this has been most successful in the case of experimental trypanosomiasis, largely owing to the ease with which a disease of this nature can be induced in laboratory animals and the constancy and certainty of its duration.

Here only such developments of pharmacology need be mentioned as have already passed from the by-way of mere academic interest into the highroad of practical application.

Of the simpler saline compounds the familiar Epsom salts—magnesium sulphate—has been found to have more interesting actions than that for which it is generally used. When given as a purgative very little of it is absorbed into the blood, owing to the difficulty which both magnesium and sulphate ions experience in passing through membranes like the lining of the gut. But if injected hypodermically or intravenously in sufficient quantity it has a powerful action on the nervous system, causing a kind of motor paralysis and anaesthesia. This effect of magnesium—for the sulphate ion takes no part in it—has been utilized in the treatment of tetanus, in which condition magnesium salts have been injected intraspinally, with benefit in many cases in so far as the relief of symptoms is concerned. This depressant action of magnesium on the nervous system is antagonized in a dramatic way by calcium salts; an animal paralysed by magnesium being restored, in suitable cases, to a normal condition in a few seconds by intravenous injection of a soluble calcium salt.

Of the heavy metals arsenic and antimony have in recent years claimed most attention. Both arsenic and antimony have been used empirically in the treatment of syphilis for over a century but without having any great vogue. When it was discovered that organisms of the trypanosome type are the cause of syphilis and of many tropical diseases, and that arsenic is a powerful poison for such organisms, an experimental justification for the employment of this substance in the treatment of syphilis was furnished. The drawback to its use was that it is so poisonous to higher animals that it is difficult to get into the blood a concentration of arsenic sufficient to kill the parasitic organisms there present without injuring the host. It was found, however, that certain organic compounds of arsenic could be made which were very much less poisonous for mammals though their toxicity for trypanosomes was retained or enhanced. Pursuing this line of investigation of a large number of arsenical compounds Ehrlich eventually discovered and recommended, as a result of animal experiments, salvarsan as a remedy for syphilis. The value of salvarsan and of nearly related compounds in the treatment of syphilis is now common knowledge. One interesting point in regard to this is that those unicellular organisms of that type which causes syphilis readily become immune to the action of arsenic. It is therefore possible that, with the almost universal use of salvarsan nowadays, strains of syphilitic infection may be developed which are immune to arsenic; and for people infected with syphilis from these sources arsenical compounds like salvarsan would no longer have any remedial value. The risk of this unfortunate sequel is small because usually salvarsan treatment renders the patient no longer liable to infect other people and only in this way could an " arsenic-fast " infecting organism be produced, but the risk would seem to be not negligible. Fortunately no such immunity to mercury occurs.

The fact that antimony belongs to the same chemical group as arsenic suggested the possibility that it, too, might be valuable in these diseases and pharmacological investigation showed that antimony has for trypanosomes a toxicity superior even to that of arsenic. Though no organic compound of antimony has been discovered comparable in advantageous properties with the salvarsan compound of arsenic, the familiar tartar emetic (potassio-tartrate of antimony) has been found, when administered intravenously, adequate for the treatment of two important diseases, Kala-Azar and Bilharzia—diseases due to organisms different from trypanosomes and for which no other effective remedy is known. These discoveries have led to a revival of the use of antimony in medicine; in the 17th and 18th centuries especially, antimony was regarded almost as a panacea, but later it lost a prestige which it is now regaining.

One of the established pharmacological actions of lead is to stimulate involuntary muscle of every kind, as exemplified in cases of industrial poisoning by the occurrence of colic caused by irregular and spasmodic contraction of the muscle of the bowel. While lead-poisoning tends to become less common, owing to trade precautions and earlier recognition of it, stress has been laid on the frequency with which lead is used, especially in industrial districts in the N. of England, to procure criminal abortion, which it tends to do—though only in poisonous quantities—by the irritant action of lead on the muscle of the uterus. For this purpose lead plaster, which is easily procurable by the laity, is frequently used by ingestion.

Of the simpler derivatives of benzol, carbolic acid itself, which was first employed by Lister as an antiseptic now over half a century ago, has gone largely out of use, especially as a surgical antiseptic, though certain closely related compounds have important antiseptic uses. Thus benzoic acid and benzoates are very widely used as antiseptics in preserved foods and are, so far as careful experiments have shown, harmless in the quantities used for this purpose. Salicylic acid has come to be a favourite antiseptic for many infective skin diseases.

The group of antipyretic derivatives of benzol continue to be widely employed not so much for reducing febrile temperatures as for their action in relieving pain, which they effect by a paralysing action on that part of the brain which is responsible for the perception of pain. A large number of new compounds of this type have been investigated but so far only one of them threatens to usurp the supremacy of the older phenacetin and antipyrine, namely aspirin. Aspirin is a compound of salicylic acid and acetic acid. Salicylic acid and its compounds have a very important, and partly specific, effect in rheumatic fever in which they relieve the pain and reduce the temperature; but aspirin is more effective in relieving non-rheumatic pain such as headache. It is a relatively harmless drug; but occasionally alarming, if not serious, symptoms are produced by it in people specially susceptible to its action, the most frequent symptom being oedematous swelling of the face, which, however, disappears when the drug is discontinued.

Though much new work has been done on the effect of moderate doses of alcohol, little has been added which was beyond the shrewd suspicion of those who have intelligently experienced its effects throughout the ages. That it has killed more than it has cured is more than probable; that, if the imperfection of human nature persists, alcohol, if it is banished, will be replaced by something worse is not unlikely. Numerous new artificial hypnotics have been investigated, of which veronal, legitimately used, has proved safe and efficient. Unfortunately cases of veronal habit have become increasingly frequent, and deaths from overdosage, of which the lay papers have afforded numerous examples in recent years, must have served to warn the general public of its dangers.

Of the general anaesthetics ether has steadily gained in favour for routine purposes. To get rid of its irritant action on the lungs and bronchi, it has been administered in limited cases intravenously and by rectal injection, but experiments are in progress which may result in the discovery of an anaesthetic ether deprived even of the slight drawbacks which at present attach to it.

With regard to the great group of alkaloids, much light has been thrown in recent years both on their chemical constitution and their exact pharmacological actions, and no apology need be made for taking the alkaloids of opium first. These can be divided chemically into two groups, of which morphine is representative of the one and papaverine of the other. The two groups differ considerably in their actions, as might be expected. The papaverine group has a much more pronounced action than the morphine group in relieving spasmodic contraction of smooth muscle—a pharmacological explanation of the clinically observed fact that preparations of opium, which contain a mixture of the alkaloids, are better for relieving colic, for example, than pure morphine. Preparations like tincture of opium have long been used for the relief of pain by external application, in spite of the fact that pharmacological evidence was against its having any action on the sensory nerve ends, but more recent and exact research has shown that some of the alkaloids have a distinct local anaesthetic action, apart from the effect they have in relieving pain by an action on the central nervous system.

The stimulant action of caffeine on the higher functions of the brain is recognized in the world-wide practice of consuming beverages, such as tea and coffee, which owe their stimulant action to the caffeine that they contain. But caffeine also stimulates the kidney and causes an increased flow of urine. Caffeine is chemically a tri-methyl-xanthine and two closely allied compounds, theobromine and theophylline—dimethyl-xanthines—are more powerful diuretics while having less effect on the central nervous system. They are used, in preference to caffeine, where diuretic action alone is desired.

Cocaine is another alkaloid which was discovered as the result of the use by natives of S. America of the leaves of the coca plant as a stimulant. The active ingredient of these leaves is the alkaloid cocaine, which was found to be a powerful local anaesthetic and which rapidly displaced from use the older and less efficient remedies for the prevention of local pain. But the stimulant action of cocaine on the brain has not been overlooked by civilized races; and the habit, insidious and disastrous, of indulging in cocaine as a stimulant has become a serious problem especially in America and in France and has necessitated restrictive legislation upon the sale of the drug in most countries. This is only one of the many drugs used as a stimulant-intoxicant, others being morphine and its derivatives and the various hypnotics. When drugs having this narcotic action are taken for a very few times the person rapidly develops a craving for them. If the practice is continued, larger and larger doses have to be taken to produce the same effect, and in no long period a habit is developed, always difficult and sometimes impossible to break off.

One disadvantage of cocaine as a local anaesthetic—for example in dentistry—is that it is a very poisonous substance if absorbed into the general bloodstream in sufficient quantity and with sufficient rapidity. This danger can be prevented to a large extent, as is now the general practice, by injecting with it adrenaline which causes such a powerful contraction of the blood-vessels in the region of the injection that the cocaine is absorbed very slowly; and, as it is being excreted continuously, the risk of a dangerously high concentration occurring in the blood is minimised. Artificial compounds resembling cocaine have been manufactured which are equally good local anaesthetics but are less generally poisonous. Such local anaesthetics act by blocking the passage of impulses through the nerves, so that painful sensations can no longer pass through the affected nerve. A similar effect can be produced on the spinal cord if the anaesthetic is injected so as to come into immediate contact with it. By this method of "intra-spinal anaesthesia" the whole of the lower limbs and of the lower part of the body can be rendered insensitive to pain, because conduction of pain sensations from this region to the receiving station (the brain) is blocked at the site of injection.

The plant belladonna is said to have been so named because it was used in by-gone days by ladies fair for the sinister purpose of dilating their pupils to enhance their charms. The chief active principle of belladonna—atropine—is still in daily use for dilating the pupil, usually under more prosaic circumstances. This effect is only one example of a general action of atropine in paralysing all parasympathetic nerve terminations throughout the body. Other closely allied alkaloids found in other plants of the order *Atropaceae* have a similar action. One such alkaloid, hyoscine, also called scopolamine, differs from atropine in its action on the central nervous system, having a depressant in place of a stimulant action, and hyoscine is now in common use as a hypnotic for certain conditions. In combination with morphine, it is used to produce general analgesia, with temporary loss of memory, in the treatment of child-birth, for which the romantic name of "twilight sleep" has come into vogue.

Hyoscine contains an asymmetric carbon atom and laevo-rotatory hyoscine is much more active than the dextro-rotatory form. This difference—a superior activity of the laevo-compound—has been found also in the case of other optical isomers, *e.g.* of adrenaline and hyoscyamine, and seems to be very generally true.

Ipecacuanha has been used as a remedy for dysentery with varying success for nearly three centuries. It is now known for certain that it is curative only in one form of dysentery, that due to an amoeboid parasite; and also that the curative effect is due to the fact that the alkaloid emetine found in ipecacuanha is, though possibly only indirectly, a specific poison for this parasite. Emetine is now given hypodermically in amoeboid dysentery and an artificial compound of it—emetine bismuth iodide—has been found superior to it in the treatment of chronic dysentery.

Consequent upon the advances in knowledge of the physiology and pathology of the heart, the cardiac tonics of which digitalis is the chief have been investigated more fully, and a considerable part of the advantageous action of digitalis in heart disease, especially in auricular fibrillation, is found to be due to its impairing the conduction from the auricle to the ventricle.

Drugs which cause the muscle of the uterus to contract are of great value in certain cases of labour, especially for preventing uterine haemorrhage. The extract of pituitary gland, which powerfully stimulates the contractions of the uterus, has now largely replaced the preparations of ergot so long used in midwifery practice for this purpose. The active principles of ergot itself have at last been determined and two of them found to be amines—tyramine and histamine—derivatives of the aminoacids tyrosine and histidine respectively. The discovery of the wide incidence of such amines, of their physiological action and of their chemical relation to adrenaline, has formed one of the most brilliant and fruitful chapters in modern biological research and has tended to bring into closer relation and coöperation the subjects of physiology, pharmacology and pathology.

(J. A. G.*)

PHILADELPHIA (*see* 21.367), retaining its rank as third city in the United States, had in 1920 a pop. of 1,823,779, an increase of 274,681 or 17·7 % over the 1,549,098 of 1910. The pop. of 1920 comprised whites, 1,688,313; negroes, 134,098, and Chinese, Japanese and Indians, 1,368. The increase in the white pop. since 1910 was 224,942 or 15·4 %, while the corresponding increase in the negro pop. was 49,639 or 58·8 %. In 1920 males were 908,067, or 49·8 %, and females 915,712, or 50·2 %.

Government and Finance.—The Bullitt Act, under which the city government had functioned since 1887, gave way in 1920 to the Woodward Act, which became effective with the beginning of the term of Mayor J. Hampton Moore, in Jan. 1920. The new charter differs greatly from its predecessor. Under it a dual council is succeeded by a single body composed of one member for each 20,000 assessed voters in each state senatorial district, the membership in 1920 being twenty-one. The councilmen serve for four years, and receive a salary of $5,000. In the executive department, the department of supplies is superseded by a purchasing agent, and the department of health and public charities is separated into two with a director for each, the title "Public Charities" giving way to "Public Welfare." Further provisions enable the city to do its own street cleaning and garbage and ash removal, and place the great majority of city employees under civil service rules. By this provision not only small office-holders but the police and fire departments are removed from the possibilities of political activity.

The cost of city operations has grown steadily since 1911, when, under provisions of the state school code of May 18 1911, the Board of Education was separated from the city government. The combined cost in 1911 was $33,846,875.91. With the school expenses eliminated the cost in 1912 of city government was $30,213,067.44; and, barring a slight decrease in 1913, has grown steadily until it reached $48,520,872.92 in 1919. The tax rate, with the school tax transferred to a separate item, was $1 in 1912, $1.25 in 1917, $1.75 in 1918 and $2.15 in 1920. This rate applied to real estate valued in 1919 at $1,805,494,000. At the close of 1919, the gross funded outstanding debt of the city was $173,473,450, of which the commissioners of the sinking fund held $31,898 400, leaving a net funded debt outstanding of $141,575,050.

Commerce and Industry.—As a distinctive manufacturing centre, Philadelphia shared the general depression of 1914, but advanced rapidly with the increasing European demand after the outbreak of the World War.

This is shown in the following table of the export values of the port of Philadelphia from 1910–20:—

	Exports		Exports
1910	$65,256,949	1916	$321,044,815
1911	70,869,648	1917	501,234,069
1912	72,769,617	1918	427,244,212
1913	72,236,967	1919	522,391,091
1914	66,256,811	1920	451,043,216
1915	132,437,556		

Importation figures also show a remarkable increase in the decade. The imports in 1910 were valued at $89,610,401; in 1915, $69,473.983; and in 1920, $282,157,831. In 1910, 9,871,667 gross tons of shipping arrived and 9,771,266 tons cleared; in 1915, 9,315,157 tons arrived and 9,377,901 cleared; and in 1920, 12,246,427 tons arrived and 12,820,377 cleared. The following table of coal exportation shows the increasing value of the product as compared with tonnage shipped:—

	Coal exported in tons	Value
1910	866,148	$2,505,745
1915	1,127,415	3,445,643
1919	1,072,773	6,434,581

This remarkable increase in the activities of the port was made possible by the completion of large parts of the 35-ft. channel from Allegheny Ave., Philadelphia, to the sea. The channel, about 800 ft. wide throughout, was 56 % completed on Dec. 31 1920 (the remaining sections having a depth of 30 ft.), while a similar channel in the Schuylkill river, from Passyunk Ave. Bridge to the Delaware, was 65 % completed. Both channels are national operations, authorized by Congressional action and carried on with biennial appropriations. The completion of more than half of the main channel opened the port to shipping of a heavier tonnage and the result was manifest in the increased number of lines plying from Philadelphia. In 1914 there were 27 transatlantic and 5 coastal lines; in 1918, at the close of the World War, 36 transatlantic and 4 coastal; and in April 1921, 49 transatlantic and 10 coastal lines. A survey of the Pennsylvania department of internal affairs shows that Philadelphia in 1919 had 4,454 manufacturing establishments, with 297,436 employees, and products of $1,951,998,000. The capital invested was $1,005,658,500. Metals and metal products were first with 946 establishments, 66,991 employees, and products of $366,780,000. Textile factories numbered 502, with 44,294 employees and products of $292,107,000. The values of other products were: food and kindred lines, $283,531,000; chemicals and allied products, $210,240,000; clothing manufacture, $189,629,000; paper and printing industry, $146,510,000; leather and rubber goods, $130,585,000; building and contracting, $70,344,700; lumber and its remanufacture, $41,747,700; and tobacco and its products, $27,648,000.

History.—Municipal history in 1910–20 was marked with few items of interest outside of the political aspect and the natural effect of American participation in the World War. The late John G. Johnson, the noted corporation lawyer, who died April 14 1917, gave the city his collection of 1,300 pictures, appraised at $4,445,802, but estimated to be worth $7,000,000. In May 1919 the art collection of Mrs. Emily L. Harrison was left to the Pennsylvania Museum and School of Industrial Art for permanent exhibition in Memorial Hall. In Oct. of the same year, the George W. Elkins collection of paintings, containing 110 masterpieces of the Dutch, Flemish and 18th-century portrait schools, and valued at approximately $2,500,000, was left to the city for display in the new Art Museum. In 1921 the late John Howard McFadden, a cotton broker, left to the municipality his collection of about 50 18th-century English paintings, estimated at $2,000,000. The collection includes the famous Gainsborough, "Lady Rodney," and a number of fine portraits by Romney and Raeburn. Under the will the collection was to be housed in the projected Art Museum in Fairmount Park, provided that it was completed by 1928. In March 1921, the architects announced that it would be completed within three years.

A free library was being built in 1921, and a convention hall was planned for the Parkway, a thoroughfare from City Hall to Fairmount Park completed in 1919. Three large municipal piers were completed between 1916 and 1920 and three more were under construction. An elaborate subway and elevated transit system was being built by the city, the first line of which, to Frankford, was expected to be in operation by 1922.

War Period.—Philadelphia sent 54,127 men into the National army through the draft, and nearly equalled that figure with volunteer enlistments in the regular army, National Guard and Marine Corps. The city supplied the personnel of two full regiments of the 28th Div. and practically the full personnel of two regiments of the 79th Div., National army.

The city subscribed to the different Liberty Loans and to the Victory Loan as follows:—

Loan	Apportionment	Subscribed	Per capita Subscription
First Liberty	$94,694,750	$145,172,950	$80
Second Liberty	139,499,950	234,901,000	130
Third Liberty	136,499,950	169,350,600	94
Fourth Liberty	259,198,000	311,306,250	172
Victory	186,209,450	208,482,200	115

(A. E. McK.)

PHILIPPINE ISLANDS (*see* 21.392).—The census of 1918 gave the pop. as 10,350,640, of whom 855,368 were classed as non-Christians. The 9,495,272 Christians were in 1918: Filipinos, 9,429,857; Chinese, 45,156; Japanese, 6,684; Americans, 6,405; Spaniards, 4,015; English, 1,063; all others, 2,092. The non-Christians were subdivided into Mahommedans and pagans. In 1917 H. Otley Beyer, of the University of the Philippines, estimated the Mahommedan pop. at 315,980, while the provincial governors of Mindanao and Sulu estimated it in 1919 at 402,799. Of the pagans, approximately 30,000 were Negritos, and most of the others belonged to Malayan stocks. Head-hunting among the pagans virtually ceased owing to vigilant Government control.

The Christians include eight races, namely, Tagalog, Sambal, Pampanga, Pangasinan, Iloko, Ibanag, Bicol, all inhabiting the island of Luzon and islands near it, and the Bisaya, inhabiting the southern islands, including part of Mindanao. Each race has a distinct language, which differs from the others as widely as the Romance languages differ among themselves. The English language is used currently in all parts of the islands, being spoken by more people than ever spoke Spanish. Literacy is high among the Christian population. The cultural position of the Negritos is about the same as when they were discovered by the Spanish in 1521. The so-called "wild" peoples (all pagans except for a few who have embraced Christianity) occupy about the stage of culture exhibited in the 16th century by the ancestors of the Christian Filipinos. The culture of the Christian Filipinos is distinctly occidental and is unique in the Orient.

Manila, the capital, and Baguio, the summer capital, located in the uplands, in the Mountain province, are the only two chartered cities. Manila, the metropolis, which coincides with Manila province, had in 1918 a pop. of 283,613, or 20,858 to the sq. m., and Baguio had 5,462. In the 55 provinces and sub-provinces, there were in 1918 881 municipalities, 80 municipal districts, and 15 other subdivisions. The largest municipalities in 1918 were: Cebú with 65,300 inhabitants; Albay (Luzon), with 53,105; Iloilo (Panay), with 49,808; Batangas (Luzon), with 41,182; Ormoc (Leyte), with 38,247; Laoag (Ilocos Norte), with 38,294; and Baybay (Leyte), with 36,934. The most important are Cebú and Iloilo. The most populous provinces are: Cebú, with 857,410 inhabitants; Leyte, with 597,995; Pangasinan, with 567,644; Iloilo, with 508,272; Occidental Negros, with 397,325; Sámar, with 380,211; Bohol, with 359,600, and Batangas, with 340,195. The most densely populated provinces, apart from Manila, are Ilocos Sur (Luzon), with 217,410 inhabitants, or 492 to the sq. m.; Siquijor (Oriental Negros), with 56,695, or 461 to the sq. m.; Cebú, with 459 to the sq. m.; La Unión (Luzon), with 160,575, or 459 to the sq. m.; Cavite (Luzon), with 157,347, or 339 to the sq. m.; Pampanga (Luzon), with 257,641, or 313 to the sq. m.; Pangasinan (Luzon), with 292 to the sq. m.; and Laguna (Luzon), with 195,371, or 271 to the sq. mile. The Batanes Is., a sub-province lying N. of Luzon, have the smallest pop. of any provincial division (8,214), and a density of 111 to the sq. mile. The least densely populated is the sub-province of Apayao (Mountain province, Luzon), which has 11,123 inhabitants, but only 6 to the sq. mile. The majority of the people are engaged in agricultural and allied pursuits, and among the professional classes are men of considerable attainments.

Agriculture.—Between 1913 and 1918 the cultivated area of the Philippine Islands (total area, 73,585,583 ac. or 115,026 sq. m.) rose from 5,859,877 ac. or 7·96% of the whole, to 7,294,159 ac., or 9·91% of the whole. The Filipino *tao* or peasant, naturally a good farmer, has been slow to adopt modern and more efficient methods, but through the efforts of the Bureaus of Agriculture and Education a beginning has been made in some places. In 1918 the value of the agricultural output was $183,479,158. The nine most important crops were those of which the following table shows the area, production and value in 1910 and 1918:—

	Acreage		Production (tons)		Value	
	1918	1910	1918	1910	1918	1910
Rice	3,379,305	2,944,588	1,539,186	810,786	$67,581,687	$31,300,133
Abacá (manila hemp)	1,265,894	1,175,585	166,863	168,452	46,246,612	13,476,171
Coco-nuts	828,936	405,556	1,506,796,110 (number)	937,927,927 (number)	28,266,896	19,470,813
Sugar-cane	507,612	205,412	396,242	152,639	20,579,389	7,631,966
Indian corn	1,033,413	1,432,026	309,798	392,484	10,509,324	11,774,525
Tobacco	193,754	132,456	61,555	28,006	7,609,577	3,780,915
Cacao	2,820	3,151	566	74	252,335	33,406
Coffee	1,896	2,637	721	85	222,991	34,378
Maguey (aloe)	80,524	21,237	16,664	4,628	1,853,606	277,700

The production of rice fails to meet demand, and imports are necessary. In 1910 imports amounted to 184,620 tons, and total consumption to 712,674 tons; in 1918 imports and exports were, respectively, 159,130 tons and 47 tons; and consumption, 1,161,344 tons; in 1919 imports and exports were respectively 148,724 and 296 tons, and total consumption, 1,067,699 tons. To prevent profiteering in so vital a commodity, the Government has, in times of scarcity, purchased rice abroad, and sold it at a fair price. The cultivation of abacá has been given a new impetus by a law (No. 2380) which grades the product according to the cleaning of the fibre. Sugar is raised in almost all the islands, but chiefly in Negros, Panay and Luzon. The construction of up-to-date sugar "centrals" in many localities is redeeming Philippine sugar from the evil reputation which the "muscavado" sugar formerly bore. Corn is raised chiefly in Cebú, where the soil is especially fitted for it, and where this grain, instead of rice, is the chief crop. Tobacco is raised especially in Luzon and Cebú, the product of the Cagayan valley in Luzon being that most esteemed. Cacao comes chiefly from the provinces of Albay and Camarines in Luzon; coffee from Mindoro I. and the Mountain province (Luzon); and maguey (introduced from America) from Cebú and the province of Ilocos Sur (Luzon). An effort is being made to encourage the raising of sisal instead of maguey, the former being the better fibre. Abacá is a natural monopoly in the Philippine Islands, for it can be grown commercially nowhere else. It is grown in many of the islands, but in recent years extensive plantations have been laid out in Mindanao, where the constant moisture needed for its growth is afforded. For many years, this fibre formed one-half the exports from the islands, and is still one of the leading exports. The export of 89,438 metric tons in 1900 rose to 164,754 tons in 1910, and to 165,129 tons in 1918. Exports for 1919 fell to 131,898 tons valued at $26,861,526, while exports for 1920 were 139,250 tons valued at $35,862,000. The timber resources are important, virgin forests covering about 40,000 sq. miles. About 99% of all timber lands belong to the Government. Much of the timber consists of valuable hard woods. Timber land is not sold, but is developed under the licence system, small operators being granted a licence for one year, and large operators for 20 years. During 1919, 2,950 licences were issued, some of which were for gathering firewood. About 100,000,000 bd. ft. of lumber is used annually in the Philippines. Exports of lumber in 1918 were 4,178,520 bd. ft., valued at $219,397, and in 1919, 4,503,304 bd. ft., valued at $259,592. Modern forest products include charcoal, nipa, from which sugar and alcohol are made, various rattans and fibres, copal, tan barks, dyewoods, gutta percha and rubber, paper pulp, a soap bark, pili nuts, wax, wood-oil and medicinal plants. A school of forestry is maintained by the Government in which up-to-date, scientific lumbering instruction is given. The chief animal is the carabao or water buffalo, of which there were 1,047,164 in 1913 and 1,271,208 in 1917. Other domestic animals for these two years numbered respectively: cows, 418,114 and 603,107; horses and mules, 179,089 and 214,204. During most years of American occupation, the carabao was assailed by rinderpest, and the archipelago in 1920 was slowly recovering from its effects. The heavy mortality of carabao hampered agriculture, especially the cultivation of rice which was much retarded at times. The Government employed various methods in its efforts to eradicate the disease, including inoculation with a special serum, strict quarantine, and even the killing of whole herds.

Minerals.—Mineral products include gold, silver, iron, copper, manganese, coal, petroleum, shale, sulphur, asphalt, asbestos, clay products, lime, sand and gravel, stone, salt, and mineral waters. The total value of the mineral output in 1907 was $117,046; in 1917, $3,018,225; and in 1918, $3,276,677. Between July 1 1902 and Dec. 31 1918, 10,943 mining claims were taken out, of which 6,683 were for gold, 1,893 for petroleum and 607 for copper. The gold output in 1908 was valued at $217,250; in 1913 at $868,362; in 1917 at $1,408,309; in 1918 (from 24 mines) at $1,287,985 and in 1919 at $1,309,724. Iron-ore deposits in Surigao province, estimated to contain about 500,000,000 metric tons, with 45 to 50% iron, have been reserved for the Government. Other rich deposits are said to exist in Bukidnon province in Mindanao. The manufactured iron all came from the mines of Angac in Luzon and was chiefly used for the making of plough points. Copper is found especially in Luzon at Mancayan, where it has been mined and smelted many years by the Igorot by primitive methods. Deposits of coal are found in many localities, although much of it is lignite. Attempts have been made to develop the deposits in the eastern part of Batan I., and in 1920 the Philippine Coal Mining Co. was said to be producing about 300 tons daily. In 1919 the output was 32,892 metric tons, valued at $411,000. Much attention has been given to the development of the coal deposits by the Government, and no little money was lost, but the industry seems at last to be on a good basis. Deposits of fair steaming coal are said to cover 58 sq. m. and to contain 61,788,000 metric tons. The National Coal Co. was organized in 1919, with Government capital, to exploit Government deposits.

Manufactures.—The Philippines have passed beyond the initial stage of manufacturing, although it is probably true that the manufacturing industries will long be limited in number. Embroideries and laces, the making of which has been fostered by the Bureau of Education as well as by some private schools, find a ready market, and during the World War when Belgium and Switzerland were unable to supply their markets, demand for the Philippine product was stimulated. The industry is still largely one of the home. Rope is made from abacá, both by the old rope-walk method and by modern machinery. Much of the abacá is stripped by machinery, although fibre cleaned carefully by hand is still the best. Saw-milling is increasing in importance, some of the mills being equipped with modern machinery. In 1910 there was only one sugar "central" in the archipelago for the production of centrifugal sugar. In 1920 there were 28, and the reputation of Philippine sugar was rising in consequence. The war gave a great stimulus to the expressing of coco-nut oil, because of the impossibility of obtaining sufficient shipping for the export of the bulky copra. There were in 1920 more than 30 oil-mills, which produced over 100,000 tons of oil, the value of the product having increased in five years from about $1,000,000 to about $30,000,000 and furnishing about one-fourth of the export trade of the islands. The Philippines are the third producing coconut region in the world, there being over 800,000 ac. with about 68,000,000 trees, of which some 40,000,000 were bearing in 1920. The output of cigars in 1910 was 285,561,328; in 1913, 282,096,996; in 1918, 367,022,982 and in 1919, 517,343,450. The output of cigarettes for the same years was respectively 4,173,507,249; 4,384,807,247; 4,720,005,675 and 5,203,331,200. In 1918 there were 82 factories manufacturing cigars and 23 manufacturing cigarettes. In 1916 a tobacco inspection law was enacted by the Philippine Legislature providing for the improvement of the leaf and for inspection of leaf tobacco and of manufactured products, and prohibiting export to the United States unless certain fixed standards were met. In 1918 there were 10,583 factories in the archipelago, of which 1,047 were in Manila. Of the 182,117 employees, 21,828 were in Manila.

Communications.—In 1908 there were only 246 m. of first-class roads and bridges in the archipelago; in 1913, 1,303 m. of the first class; 1,264 m. of the second; and 1,937 of the third; and in 1919, 2,796; 1,235; and 1,984 m. respectively. Third-class roads are as a general rule fit only for carts and animals, and then only during the dry season. In 1919 cost of maintenance of old roads and bridges was $1,959,780. The archipelago has two railway systems, namely the Manila Railroad Co. operating in Luzon, and the Philippine Railway Co. operating in the islands of Cebú and Panay. The first had in 1913 517 m. of tracks and in 1918 640 m. This company, under contract with the Government, partly completed a line to the summer capital, Baguio, but could not carry the project to a successful end. In Jan. 1917 the Government of the Philippine Islands purchased the company's holdings and since that period the lines have been undergoing reconstruction. The Philippine Railway Co., an American concern, had 60 m. of track in 1910 (the first year of operation), and 133 m. in 1918. Under authority of an Act of Congress, approved Feb. 6 1905, the Insular Government guarantees 4% interest for a period not to exceed 30 years on the first lien bonds issued by the Manila Railroad Co. for new construction in southern Luzon, and the same to the Philippine Railway Co. The combined issues of both companies totalled $22,263,000. The lines in southern Luzon and those in Cebú and Panay have opened to active trade large stretches of territory and are affecting the industry of their districts. During recent years the number of motor vehicles has increased markedly, and they are now seen in almost all parts of the islands. An up-to-date electric street-railway system is operated in Manila. Post-offices increased in number from 540 in 1908 to 828 in 1918, and municipalities with free delivery service from 31 in 1908 to 462 in 1918. Telegraph offices (Government owned and operated) increased during the same period from 161 to 320. The inter-island cables are also owned and operated by the Government. Manila has an efficient telephone service.

Shipping.—Manila is the chief port, but the ports of Iloilo, Cebú, Zamboanga, and a few others share to some degree in the domestic and foreign trade. In 1911 there were 906 entries of foreign ships and 854 departures, with net tonnage of 1,849,475 and 1,787,650 respectively; and in 1918, 652 entries and 659 departures, with net tonnages of 1,412,871 and 1,544,648 respectively. The United Kingdom, which had uniformly occupied first place in the total foreign carrying trade of the islands, lost that position to Japan in 1917, but regained it in 1919, when British bottoms carried 525,000 tons. In the latter year, British and Japanese vessels carried 63% of the total foreign trade. Ships of the United States, which moved only 44,000 tons in 1916, moved 441,000 tons in 1919, while Philippine shipping engaged in foreign trade rose from 80,000 tons in 1916 to 128,000 tons in 1919. In value of cargo, British bottoms led in the import carrying trade up to and including 1917. In that year British ships carried cargoes valued at $25,865,273; Japanese, $18,964,331; and United States, $9,731,816. In 1918, Japanese ships carried import cargoes valued at $29,304,836; United States, $28,041,294; and British, $24,406,231. In the export trade, British bottoms also took first place up to and including 1917. In that year, British ships carried exports valued at $28,903,609; United States, $27,599,076; and Japanese, $24,657,632. In 1918 U.S. vessels carried exports valued at $53,389,398; British, $36,093,713; and Japanese, $24,544,204. In 1918 ships of the United States took first place in the total value of the foreign carrying trade, moving goods valued at $81,403,692, with the United Kingdom and Japan taking second and third place respectively. In recent years new piers and warehouses have been built in Manila.

Foreign Trade.—Imports rose from $29,186,120 in 1908 to $149,400,000 in 1920. Exports were $32,601,072 in 1908; $151,100,000 in 1920. The balance of trade was in favour of the Philippines during 1914–8, and in 1920. Import trade with the United States rose from $35,813 in 1874 to $92,289,773 in 1920. Exports to the United States rose from $2,657,333 in 1874 to $105,216,263 in 1920. In 1874 the import and export trade with the United Kingdom was valued respectively at $1,737,487 and $3,032,950; and in 1918 at $2,764,407 and $19,481,698 respectively. Imports from and exports to Japan were valued respectively at $13,104,055 and $7,968,304;

China, $6,576,962 and $3,249,290; French East Indies, $6,978,043 (mainly rice) and $1,302,376; Hong-Kong, $56,877 and $5,051,664. Total trade with France was valued at $1,785,167 in 1918; Germany, $366,534; Spain, $3,940,167; Australasia, $4,431,883; British East Indies, $3,515,885; Switzerland, $607,870; Italy, $189,152; Netherlands, $45,463; Hawaii, $479,436; Siam, $1,219,673 and all other countries, $1,494,421.

Government.—In 1913, upon the occasion of the appointment by the President of the United States of a new governor-general of the Philippines, majority membership on the Philippine Commission was given to the Filipinos by presidential appointment. On Aug 29 1916 the U.S. Congress passed the Jones Act. The short preamble declared that "it has always been the purpose of the people of the United States to withdraw their sovereignty over the Philippine Islands and to recognize their independence as soon as a stable form of government can be established therein." The Act created a Senate to supersede the Philippine Commission, 12 senatorial districts being established, each of which is represented by two senators elected by duly qualified voters except the 12th district (consisting of the Department of Mindanao and Sulu, the Mountain province, Baguio, and Nueva Vizcaya), whose senators are appointed by the governor-general. The Philippine Assembly was replaced by the House of Representatives, the membership of 81 of the Assembly to be increased in the new body by three representatives from the Mountain province, one from Nueva Vizcaya, and five from the Department of Mindanao and Sulu. Senators are required to be over 30 years of age, able to read and write English or Spanish, and to have been residents of the Philippines for at least two consecutive years and actual residents of the senatorial districts from which elected for at least one year immediately preceding election. Representatives must be over 25 years of age, and have the same residential qualification.

Senators are elected for six years, representatives for three. The Act extended the suffrage to males of 21 or over, to include those who under previous law were legal voters and had exercised their right; those who owned real property to the value of $250; those who annually paid $15 or more of the established taxes; and those who were able to read and write either Spanish, English, or a native language. Two resident commissioners with three-year terms were provided for, and paid by, the United States, to be over 30 years of age and *bona fide* electors; these commissioners to have seats in the House of Representatives at Washington, with right of debate but no vote in that body. The Legislature convenes on Oct. 16, but it may change that date within certain limits if it choose. A governor-general, vice-governor, auditor, and deputy auditor are appointed by the President of the United States, by and with the consent of the Senate. The vice-governor is in control of the Bureaus of Education and Health, but the remainder of his former bureaus and his subordinate duties were shifted to the Interior Department. Power is given to the Legislature to reorganize the other departments and bureaus of the Government. The chief justice and associate justices of the Supreme Court are appointed by the President of the United States by and with the consent of the Senate, and the judges of the courts of first instance are similarly appointed by the governor-general by and with the advice of the Senate of the Philippine Islands. The awards of the Supreme Court are reviewable by the Supreme Court of the United States.

The Government as reorganized consists of the following groups of departments, bureaus, and offices. On the governor-general depend directly the Bureau of Audits, the civil service, and all other offices and branches of the service not assigned by law to any department. On the Department of the Interior depend the Bureau of non-Christian tribes (provided for in the organic Act), the Philippine general hospital, Boards of Pharmaceutical Examiners, Medical Examiners, Dental Examiners and Dental Hygiene, Optical Examiners, examination for nurses. On the Executive Bureau depend the Philippine constabulary, and Bureau of Dependent Children. On the Department of Public Instruction depend the Bureau of Education, the Philippine Health Service, and Bureau of Quarantine Service. On the Department of Finance depend the Bureaus of Customs, Internal Revenue, Treasury and Printing, the general supervision over banks, banking transactions, coinage, currency, and (except as otherwise specially provided) over all funds the investment of which may be authorized by law. On the Department of Justice depend the Bureau of Justice, the courts of first instance and the inferior courts, Philippine Library and Museum, Bureau of Prisons and Public Utility Commission. On the Department of Agriculture and Natural Resources depend the Bureaus of Agriculture, Forestry, Lands, Science, Weather, and matters concerning hunting, fisheries, sponges and other sea products. On the Department of Commerce and Communications depend the Bureau of Public Works, Posts, Supply, Labor, Coast and Geodetic Survey, and Commerce and Industry. The secretaries of the several departments form the Cabinet.

There are in all 46 provinces, 34 of which are regular provinces and the rest special or sub-provinces. The chief executive of a province is the provincial governor, who is elective. He together with two other members, also elective, forms the provincial board or legislative branch of the provincial Government. In the special or sub-provinces, with the exception of Mindoro, Palawan, and Batanes, the provincial governor is appointive. The chief official of a town or municipality is the municipal president. The municipal council or legislative branch of the municipal Government consists of from 8 to 18 councillors, according to the size of the municipality.

In Oct. 1918 the governor-general, by an executive order, created the Council of State as an advisory body. This body, composed of the heads of all the executive departments and the presiding officers of the two Houses of the Philippine Archipelago, has become an integral part of the governmental system and is frequently referred to in legislation. The meetings of the Council have practically superseded those of the Cabinet, and it has been entrusted by the Legislature with certain executive functions. Policies decided on in the Council meeting are assured full consideration in the Legislature. Among other things the Council prepares and submits the budget.

Education.—Special attention has been paid to public education by the Government. Each of the 49 school divisions of the archipelago follows in general provincial boundary lines, except that of Manila and four insular schools, namely Philippine normal school, Philippine school of arts and trades, Philippine nautical school, and Central Luzon agricultural school, each of which is considered a distinct division. The public-school system, which aims at the creation of a staff of English-speaking Filipino teachers, is under the director of education, with central offices in Manila. There are seven elementary grades (four primary and three intermediate) and a four-year high-school course. Much attention is paid to industrial training, and to recreational athletics. Baseball and other games have had great influence throughout the islands. Each school division is in charge of a division superintendent and each of the several districts in a division of a supervising teacher. In 1908 there were 3,932 public schools, with a total enrolment of 486,676. In 1919, 749 new primary schools and 111 new intermediate schools were opened, with an increase during one year of 104,560 pupils in the elementary grades, and a record enrolment of 776,596 pupils in all public schools. During that year, 2,963 additional elementary teachers were appointed, and 300 primary schools constructed. Tuition fees were abolished in all intermediate schools. In 1908 $2,563,553 was spent for public education, and in 1918 $5,365,105. The Philippine normal school, in Manila, draws its pupils from all parts of the islands. There were in 1920 50 provincial high schools, 20 provincial trade schools, 14 provincial shops, 13 large agricultural schools, 15 farm schools, and 162 settlement farm schools. The farm schools ranged in size from about 125 to 2,000 ac. and the settlement farm schools from about 40 to 125 acres. School gardens, which have become an essential part of the public educational system, number about 4,000, and home gardens, the result of this instruction, over 100,000. A standard type of school buildings has been evolved, and there were in 1920 865 satisfactory school buildings (many constructed of concrete) and 2,170 buildings of semi-permanent and permanent types. In 1910 the Government began the systematic supervision of private schools, requiring courses in English and harmonizing the work with that of the public schools. New methods, courses, and text-books have been introduced, and all private schools complying with requirements have been given the same standing as Government schools. In 1920 there were about 300 accredited private schools with a total enrolment of 38,544 and a teaching force of 1,600. Higher education is provided for by the university of the Philippines, a Government institution, and by the Dominican University of Santo Tomás. The university of the Philippines in 1920 had 31 buildings of permanent materials. The total enrolment for 1919–20 was 3,427. Its three presidents were, successively, an American, a Filipino and an American. The university of Santo Tomás, the oldest university under the flag of the United States, has departments of law, medicine, pharmacy, civil engineering, philosophy and letters, and theology. It has five buildings including a dormitory, and for the year 1919–20 had an enrolment of 701. Between the years 1914 and 1919 its graduates numbered 347. The educational programme of the islands has from the first had the hearty endorsement of the Filipino people, and Filipino legislators have at all times supported almost unanimously any movement looking toward the improvement of educational conditions. In Dec. 1918, $15,000,000 were appropriated by the Legislature for the extension of public schools. Instruction is being extended rapidly among the non-Christian population. In addition to the education supplied in the Philippines, some 9,000 Filipinos are attending schools, colleges and universities in the United States;

some of these receive Government aid, but the majority are paying for their own instruction. The work of the Philippine library and museum is largely educational in character. This institution was first founded as the Philippine library, May 20 1909. After the passage of the Jones Bill of 1916 it was amalgamated with the Philippine archives and the museum. It has charge of all the books owned by the Insular Government. The manuscripts of the library number several millions, the books in all over a quarter of a million.

Finance.—Philippine currency in circulation on June 30 1908 amounted to 40,337,982 pesos or 4·82 *per capita;* on Dec. 31 1913 to 50,697,253 or 5·53 *per capita;* and on Dec. 31 1919 to 146,500,000, or 14·16 *per capita.* The Philippine peso, nominally equivalent to $0.50 U.S., was in June 1921 quoted in New York City at $0.46 and has even reached much lower levels; in Nov. 1921 it was quoted at $0.4975. The total revenues and expenditures of the Insular Government for the year ending June 30 1908 were respectively, $10,899,261 and $11,469,785; and for 1919, $39,843,461 and $43,371,294. The great increases in revenues began in 1916 simultaneously with the large trade balances in favour of the Philippines. Revenues are mainly from customs collections, internal revenues and receipts from land taxes and leases. Customs collections for the year 1919 were $7,712,653 and for 1920, $8,878,932; and collections of internal revenues for 1919 $26,641,373. The latter collections come mainly from the excise tax, licence, profession and occupation taxes, cedulas, franchise taxes, income tax, documentary stamp tax, and inheritance tax. The bonded indebtedness for the Insular and municipal Governments as of June 30 1919 was $20,125,000, that for the former being $16,000,000. Commercial bank assets rose from $31,872,964 in 1913 to $177,293,860 in 1919. In 1908 postal savings bank deposits were $774,105 and withdrawals $512,839; and in 1918 $2,942,762 and $2,599,775 respectively; in 1919 there were 417 postal savings banks in operation. In 1919, operations of the eight banks in Manila reached a total of $4,197,682,000. The Philippine National Bank, the sole depository of the Government, with headquarters in Manila, has 11 branches and 41 provincial agencies in the Philippines, and branches in Shanghai and New York. Its assets on June 30 1920 amounted to $118,749,138. More recently reverses, due, it is reported, to poor management and the business crisis, overtook the institution.

History.—W. Cameron Forbes was appointed acting governor-general in May 1909, and on Nov. 11 of the same year governor-general, succeeding James T. Smith. During his term, which expired on Oct. 6 1913, many public improvements were made, and the principle of the Filipinization of the civil service was carried out consistently, although comparatively few Filipinos were appointed to the higher offices.

The Taal volcano, which had been quiescent for a century and a half, erupted on Jan. 30 1911. Some 1,300 lives were lost. The outburst was accompanied by violent earthquakes, of which 1,014 were registered in Manila in about a fortnight. Earthquakes are of frequent occurrence in all parts of the islands, but are rarely of magnitude. During Governor-General Forbes's term no general appropriation measure for the expenses of Government was passed after that of 1910, because the two Houses could not agree upon the method of drawing it. In consequence, the provision of the organic Act of 1902 which declared that in the event of the failure to pass a general appropriation measure, the sum appropriated last should be considered as reappropriated, was declared to be in effect, and proclamation was so made each year. The breach between the two Houses tended to widen, and much constructive legislation that should have been enacted failed of passage. Educational measures, however, were generally assured of enactment and one is continually struck by the number of measures of this kind passed by each session of the Legislature. During this period also the demand for political independence by certain Filipino leaders, especially by Manuel Quezon, for part of the time resident commissioner in Washington, was constant and insistent. The Americans in the Philippines, regarded as appointees of the political party in control in the United States, were skilfully made to appear hostile to Filipino interests, and that administration was represented as withholding an inherent right of the Filipino people. The desire of the Filipinos for independence was and is real, and has grown with each succeeding year; the whole course of American administration has fostered that aspiration, and continually greater autonomy has been granted, although differences of opinion have been manifest as to the safety with which this could be done.

The change of administration in Washington in 1913 was hailed with delight by the Filipinos, in the belief that it would soon lead to political independence. On Oct. 6 1913 Francis Burton Harrison, who had been appointed governor-general by President Wilson, arrived in Manila, and immediately assumed office. By presidential appointment the majority on the Philippine Commission passed to the Filipinos. Various changes were made by the new governor-general in the personnel of several of the bureaus, the chief innovation being that Filipinos were appointed to a number of the higher posts. On Jan. 1 1917 there were 31 Americans and 22 Filipinos acting as chiefs and assistant chiefs, and on July 1 1920, 20 Americans and 30 Filipinos. On the latter date there were 760 Americans and 12,047 Filipinos connected with the Government, while in 1913 there had been 2,623 of the former and 6,363 of the latter. This increased rapidity in the Filipinization of the civil service after 1913, especially of the higher offices, has been criticized on the ground of decreased efficiency, but while this was necessarily the result to a considerable extent, it was not universally so, and the policy led, as a natural corollary, to a greater official harmony than had reigned previously. In Feb. 1916 an Act of the Legislature, providing a temporary pension for employees who had been in the service of the Philippine Government for from six to ten years or longer, gave an impetus to many Americans to request retirement under the terms of that Act. While technically the provisions of the Act apply to Filipinos as well as to Americans, it has been the policy of the Government to retire eligible Filipinos only because of age or physical disability. Upon the declaration of war against Germany by the United States, many Americans resigned to enlist, and it was felt that Americans were leaving the Philippine service too rapidly, especially the teachers. A very earnest effort was made after the war to recruit American teachers.

The virtual Filipino autonomy resulting from the above-mentioned changes was increased by the enactment by Congress in Aug. 1916 of the Jones Act, by which the Philippine Commission was replaced by an elective Senate (see *Government* above). The era of good feeling, inaugurated in 1913 by the change of Government, was seen almost immediately in the passing of an appropriation measure for the general expenses of Government—the first to be enacted since 1910. Such measures have been passed annually since. One of the early Acts of the Legislature was to reduce certain salaries, especially those of the Philippine commissioners and of certain bureau chiefs; but, as in the United States, a bonus system was later adopted because of the increase in the cost of living and the governor-general recommended that salaries be increased. In 1915 the Philippine National Bank was created, taking over the former Agricultural Bank owned by the Government, which had never functioned acceptably. In the same year the Code Committee, after several years' work, finished the administrative code of the islands, which was passed by the Legislature. Among the first Acts of the all-Filipino Legislature of 1916–7 was the reorganization of the several departments of the Government, the result being that the Department of Public Instruction came to be the only one directly under an American.

The period was marked by generous appropriations for educational purposes, the most notable of these being the appropriation of $15,352,912 for the extension of free elemental education (see *Education* above). A previous Act prohibiting the display of the Philippine flag was repealed, a measure desired most ardently by Filipinos.

Upon the declaration of war against Germany by the United States, the Filipinos offered to supply a division of troops for the U.S. army and to supply funds for the construction of a destroyer and submarine for the U.S. navy, and there was a generous subscription to the Red Cross and to Liberty bonds. A volunteer National Guard was formed, which was joined by many of the Filipino youth, this being disbanded in 1919. There were also many Filipinos who served in the army and navy of the United States. In this connexion it should be noted that Filipinos have been admitted to West Point and Annapolis. Some 22

German ships, which had been interned in Manila harbour at the beginning of the World War, were seized after the American declaration of war, and the crews sent to an internment camp in the United States after a partly successful attempt had been made to damage the machinery and scuttle the vessels. Business during the war was brisk, notwithstanding the lack of shipping; but after the war, a depression developed from which the islands had not recovered in 1921. Governor-General Harrison resigned his post, as from March 3 1921, because of the change of administration in the United States, and Vice-Governor Yeater became acting governor-general. Shortly after assuming office, President Harding despatched Maj.-Gen. Leonard Wood and W. Cameron Forbes to the Philippines to make a complete survey and report on conditions. On Oct. 5 1921 Gen. Wood took oath of office as governor-general of the islands.

The Wood-Forbes report recommended, among other things, "that the present general status of the Philippine Islands continue until the people have had time to absorb and thoroughly master the powers already in their hands," and "that under no circumstances should the American Government permit to be established in the Philippine Islands a situation which would leave the United States in a position of responsibility without authority."

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(J. A. Ro.)

PHILLIMORE, WALTER GEORGE FRANK PHILLIMORE, 1ST BARON (1845–), English judge, was born in London Nov. 21 1845, the eldest son of Sir Robert Joseph Phillimore, 1st bart., a distinguished judge and authority on ecclesiastical and international law (*see* 21.405). He was educated at Westminster and Christ Church, Oxford, where he had a distinguished career, obtaining first classes in classics and law, winning the Vinerian scholarship and being elected to an All Souls fellowship. He was called to the bar in 1868. In 1885 he succeeded his father as 2nd bart., and in 1897 was made a judge of the Queen's Bench division, being in 1913 appointed a lord justice of appeal. He retired from the bench in 1916, and in 1918 was raised to the peerage.

As an authority on ecclesiastical law Lord Phillimore carried on the tradition of his family. He published a revised edition of J. H. Blunt's *Book of Church Law* (1872), besides a second edition of Sir Robert Phillimore's *Ecclesiastical Law* (1895), and also contributed the articles *Ecclesiastical Jurisdiction* and *Canon Law* (in part) to the *E.B.* He was from 1905 to 1908 president of the International Law Association, and has published *Three Centuries of Treaties of Peace and their Teaching* (1917), besides issuing (1889) a third edition of vol. iv. of Sir Robert Phillimore's *International Law*. In 1918 he was appointed chairman of the naval prize tribunal. He was English representative on the commission which sat at The Hague (1920) to prepare the scheme of a permanent Court of International Justice, and was also chairman of the Foreign Office committee on the League of Nations.

PHILLIPS, STEPHEN (1868–1915), English poet (*see* 21.407), died at Deal Dec. 9 1915.

PHILLPOTTS, EDEN (1862–), British novelist, poet and dramatist, was born in India Nov. 4 1862, and was educated at Plymouth. He was a clerk for ten years in the Sun fire insurance office, then studied for the stage, but turned his attention to literature, producing a number of successful novels with a Devonshire setting. They include *Some Everyday Folks* (1893); *Children of the Mist* (1898); *The Human Boy* (1899); *Sons of the Morning* (1900); *My Devon Year* (1903); *The Mother* (1908; dramatized 1913); *Orphan Dinah* (1920) and a play, *St. George and the Dragons* (1919). His play, *The Secret Woman* (dramatized from his novel of that title), was refused a licence but, after a public protest by twenty-four authors, it was performed six times at matinées in 1912 under the management of Mr. Granville Barker. He also published single poems such as *The Iscariot* (1912), and two collections of poems, *Plain Song* (1917) and *As the Wind Blows* (1920).

PHILOSOPHY (*see* 21.440).—At the opening of the decade 1910–20, the ground covered by the philosophical sciences was so vast that any one writer could see only a small portion of it in clear perspective; and even within the partial field where he was most at home, he might well find it hard to catch the real drift of tendencies which had not fully disclosed their ultimate scope.

Among the leading philosophers of that date three distinguished representatives of already established types of thought, William James, Shadworth Hodgson and Alfred Fouillée, were shortly to pass away. In Shadworth Hodgson there passed from the scene perhaps the last survivor of the classic "British" succession of thinkers, whose characteristic method in philosophy was the direct psychological analysis of the given "moment of experience" as distinct from metaphysical or epistemological inquiry into the "transcendental" implications of Being or of Thought. His philosophy seems likely to be the last attempt to develop a system in entire independence of the influence of Kant's "Copernican revolution," unless, indeed, the recent work of Prof. S. Alexander should prove capable of development into something like a system. William James's work in general philosophy exhibits three distinct strains, none too closely connected with one another: (1) a fundamental *metaphysical* pluralism; (2) a radical empiricism in *method;* (3) the adoption in *logic* of a purely utilitarian theory of truth and falsehood. It was this peculiar view of truth as "that which works" or "that which produces practically useful results" which, from its apparently paradoxical character, made the principal sensation among James's contemporaries for the moment, and from which he chose the name ("pragmatism") for his type of thought; but it is open to question whether his abiding place in the history of philosophy will not depend primarily on his brilliant defence of pluralism against the singularism of philosophies of the "one substance" and "absolutist" types.

The outstanding event in 1910–2, as far as philosophy is concerned, was certainly the rapid rise of Bergson to a European reputation. *Les Données Immédiates de la Conscience* had been published as long ago as 1889, *Matière et Mémoire* in 1896, and *L'Évolution Créatrice* had reached a fourth edition in 1908, but the author's ideas can hardly be said to have attracted universal attention much before 1910. The English translations, *Time and Free Will, Matter and Memory* and *Creative Evolution* all belong to 1910–1. A great amount of work in various European languages appeared in exposition or criticism of Bergson's special tenets. Special reference may perhaps be made to H. W. Carr's *Henri Bergson, The Philosophy of Change* (1911), and J. McKellar Stewart's *A Critical Exposition of Bergson's Philosophy* (1912). Without attempting to pronounce on the permanent value of Bergson's ideas, it may at least be said that his works contain the most systematic and brilliant exposition of Irrationalism since Schopenhauer, and that his presentation has the advantage of exhibiting the irrationalist position unencumbered by Schopenhauer's temperamental pessimism.

Bergson's main doctrine may perhaps be briefly summarized as follows. The human intellect is itself a product of evolution, a tool fashioned by natural selection for the purpose of enabling mankind to find their way about among the inanimate bodies which make up their physical surroundings. Hence the crowning achievement of the intellect is the creation of the science of geometry, which therefore furnishes the ideal model to which human science in general is everywhere striving to approximate. The aim of all sciences is to become exact sciences, *i.e.* sciences of number and measure. But the only magnitudes which we can measure directly are straight lines. Consequently all measurement of other magnitudes has to be effected by artifices which enable us to substitute lengths for the various "intensive" magnitudes (lapses of duration, degrees of temperature, electric charges, and the like), which meet us in the "real world" of actual life. In particular, the measurement of time only becomes possible by the artifice of representing the real duration through which we live by the image of a line on which we can measure off different lengths. This device, though indispensable to science, inevitably falsifies the facts of living experience. For it gives rise to the belief in a "Newtonian" time, which is homogeneous, like the straight line, and "flows equably," whereas the "real duration" of experience, which is the very stuff of which our inner life of feeling and conation is made, is non-homogeneous and "flows" with very varying rapidity according as we are well or ill, interested or bored, pleased or pained, and the like. From the initial substitution of the unreal "uniform" time of science for the infinitely varying "real duration," out of which the processes of life and consciousness are made, further arise all the illusions characteristic of a mechanical theory of the universe. It is our tendency to envisage time under the form of a line, which leads to the belief in permanent "substances" or things, as the bearers or supports of change, and further conducts us to the notion of a rigid determinism by producing the illusion that what happens in the various moments of time is all completely "given" at once, as all the points on a straight line are given "simultaneously." This again leads to a radically false conception of "evolution." It creates the belief that nothing radically new is ever produced in the evolutionary process; whatever emerges in the course of the process, on a determinist theory, must be already completely contained in its antecedent conditions, and adequate knowledge of those conditions must enable you to say beforehand exactly what will emerge from them. Hence for science, which to be true to its geometrical ideal must be strictly mechanical, the whole process of evolution can be nothing but the rearrangement, according to mechanical law, of selfsame and permanent units. Real life, as we know it at first hand in the act of living it, is of a wholly different kind. It is a single continuous process of becoming, in which there is no permanent substratum; it presents us at every moment with the emergence of the qualitatively new, fresh qualities, fresh adaptations to environment, which could never have been anticipated from any knowledge of what had gone before, until they had actually emerged. You cannot expect to know the direction this *élan vital*, as Bergson names the impulse which Schopenhauer had called the "will to live," will take until it has been actually taken; life is thus essentially contingent. (It follows, of course, that determinism is false as regards that special manifestation of the *élan vital* which we call will or choice. To speak of our decisions as necessitated or determined by our pasts is virtually to think of them as already made *for* us before we make them.) Instinctive or impulsive activity is thus but a manifestation of the forward-going *élan vital*, the tendency of the process which is life to exhibit itself in ever newer forms. Science is the inevitably unsuccessful attempt of the intellect to reconstruct the process in "geometrical" form by reversing its sense. It looks back at a process which has culminated in the appearance of something new (*e.g.* a new modification of an animal species), notes what the earlier stages of the process have been, and then assumes that it could have predicted from a knowledge of antecedent conditions the new manifestation of the *élan vital* with which it had, in fact, to be already acquainted before it could think of the antecedent events as conditions of *this* result. Hence, if philosophy is to understand life, its method must be the reverse of that of the scientific intellect. It must renounce the intellect and its logic, which latter is indeed merely the abstract schematism of the "geometrical" procedure, and surrender itself without reserve to the intuitions and presages which attend on complete immersion in the stream of the *élan vital*.

It may perhaps be suggested that the real test of Bergson's ability to construct an irrational philosophy on this basis must be sought in the success with which it can be applied to the interpretation of the spiritual life of humanity, a task with which Bergson has not as yet fully grappled. Meanwhile, there appear to be some reasons for doubting whether the foundations of his thought are themselves securely laid. The condemnation of the intellect is based upon the assumption that because it is a "product of evolution" it can have no function but that of enabling us to find our way about among *things*; this is why geometry, which deals with the "surfaces of solid things," is declared to be its highest achievement, and why it is denied all value for the interpretation of life. But it might reasonably be contended that from the dawn of time men have had to occupy themselves at least as much with reaching a common understanding of one another as with learning their way about among "solid bodies," and that we should therefore expect an intellect which is a "product of evolution" to be competent to deal with life as well as with the surfaces of solid bodies. Again, it is plain that the alleged necessity for science of a spatial schematism, which inevitably misrepresents the facts of "real duration," depends entirely on the results of the one chapter (*Données Immédiates de la Conscience*, ch. 1) which expounds the author's peculiar theory of measurable magnitudes. Now this chapter bears evident marks of hasty construction. The author seems to have forgotten that even in geometry straight lines are not the only measurable magnitudes. It is indispensable that we should be able to measure angles, a consideration which of itself should have given the author pause. In fact, the whole treatment of the distinction between "extensive" and "intensive" magnitudes, upon which so much depends for Bergson's development of his theory, is, as it stands, at least perfunctory. Again, the very language employed to distinguish "real duration" from the unreal time of science, viz. that the portions of real duration flow with varying *rapidity*, seems to imply that these varying rapidities are comparable with one another, and consequently that "Newtonian" time has, after all, the significance for real life which Bergson refuses to allow.

There has been much discussion in philosophical quarters of Bergson's place in the classification of philosophers. William James, in his latest works, claimed him as a pragmatist; and it has been maintained on the continent of Europe that his doctrine is not only a form, but the one really coherent form, of pragmatism. There is, of course, a real affinity between Bergson and the pragmatists, which rests on their common distrust of the intellect. On the other hand, whereas pragmatism, at least in its inception, made it a fundamental point to insist on a pluralistic theory of the world, Bergson's doctrine of the *élan vital* is definitely singularist. Thus he touches Bradley on one side of his doctrine as closely as he touches James on the other. In fact, the complaints which pragmatists used to make a few years ago of the miraculous feats ascribed by "idealists" to the Absolute might easily be urged *totidem verbis* against the *élan vital*. According to another view, Bergson is most correctly described as a "mystic," though he can hardly be called so if the word is used with any precision. Mysticism is primarily not a peculiar way of thinking but a peculiar way of being. What the great mystics of the past have aimed at is first and foremost a transformation of human character by which it becomes responsive to stimuli from a "transcendental" world, inaccessible to ordinary perception. Since no such transcendental world is recognized in the Bergsonian scheme, it seems merely misleading to speak of his philosophy as mysticism.

A second feature of the philosophical movement in the earlier days of the decade was, in Great Britain and America, the rise of the so-called "New Realism." This also may be regarded as a conscious reaction against the idealistic doctrines of the last generation which go back for their inspiration to Fichte and Hegel, but it was a reaction which was in many ways the direct antithesis of the movement represented by Bergson. The new realism, though it manifested itself in a great variety of forms, was in all its various guises definitely intellectualistic. This was shown by the general dissatisfaction of its representatives with the Kantian strain in the thought of their older contemporaries. What is particularly objected to, as the source of "idealistic" or "mentalistic" fallacies, is the Kantian view that both sense, in virtue of the pure forms of intuition, and thought, in virtue of its scheme of categories, are in part constitutive of the objects they apprehend. The tendency common to all the writers who may be classed together as typical of the latest forms of realism is to regard both sense and thought as simply apprehensive of data which do not depend on the percipient mind, either for their existence or for their apprehended qualities and relations. The degree of consistency with which this doctrine is held varies with its individual representatives, but, thought out consistently, it plainly tends in the direction of ultra-intellectualism, since it leads to the view that the specific task of philosophy is simply to apprehend as completely as possible objects and relations which exist and have the characters which they are discovered by science to have quite independently of the perceiving or knowing mind. On the psychological side this tendency shows itself in its extreme form in the doctrine that known relations between objects are purely non-mental, not the "work of the mind," as T. H. Green had taught. The function of the intellect is not to create relations between its objects, but simply to discover what the relations between them are. On this point there seemed to be general agreement between such writers as Alexander, Russell, and Moore in England, Woodbridge, Fullerton, Montague and others in America, and Couturat in France. It is a natural development of the same view that the attempt should be made to deny the existence of what are commonly called "presentations," and to hold that in sense perception we have only two distinguishable factors, an extra-mental presented thing and the process of apprehending it. Presentations, *i.e.* mental "contents," which psychologists have usually regarded as immediate objects of cognition from which we may go on to infer propositions about the extra-mental things which are their exciting causes, are then dismissed as unnecessary fictions. This is the point of view adopted by Prof. Alexander, according to whom there are, strictly speaking, neither contents of cognition nor cognitive states or processes. The contents of the mind consist solely of conations of various types, and the universe is thus reduced to conative tendencies and the objects in which they terminate and find their satisfaction.

This extreme view, that presentations had no existence, was not shared by all the writers who exhibited the realistic tendency. Thus, in his *Problems of Philosophy* (1911), Mr. Bertrand Russell maintains that apart from the general predicates of things and the relations between them, which are universal and must not be said to *exist*, what we know is composed of minds, physical things and sense-data, *i.e.* what are more usually spoken of as sense-qualities: red, sweet, salt, and the like. Sense-data are neither mental (processes of consciousness) nor physical. We are *acquainted* directly with our own minds and also with sense-data. But we have no acquaintance either with physical things or with minds other than our own. Any knowledge we have of the minds of others or of physical things is merely knowledge by *description*, and its possibility depends on the truth that things with which we have no acquaintance can be indirectly known if it is possible to describe them in terms of sense-data with which we *have* acquaintance. Since Mr. Russell accepts the familiar arguments against the physical reality of sensible qualities, it follows on his theory that we have no acquaintance with physical things. I know a physical thing only by inference, as, *e.g.*, "the cause of such-and-such a definite group of sense-data." This is a description obtained by a combination of sense-data which I know at first hand by acquaintance with the universals "the" and "cause of," and with these universals I have also immediate acquaintance. My acquaintance with the meaning of "the" secures that the otherwise unknown physical thing signified by the descriptive phrase shall be strictly individual. Thus my knowledge through sense-data of physical objects is like the knowledge I have, *e.g.* about the "magnates of the Education Department," when I know that there is such a body, and what it does, but have never met any of its members. For science, the most important point in the theory of knowledge is that we can be directly acquainted with relations and universals, though these entities do not properly exist. Immediate knowledge of this kind is what we mean by *a priori* knowledge, *i.e.* knowledge which does not involve awareness of any proposition about what actually exists. As the principles of inference are among the relations with which we have acquaintance *a priori*, we are able to have a derivative *a priori* knowledge of all truths which are deduced by correct inference from *a priori* principles with which we are directly acquainted. This covers the whole domain of the sciences of logic and pure mathematics, as, contrary to the Kantian opinion, all pure mathematics can be shown to consist of propositions deduced logically from premises which involve only logical concepts and relations with which we are directly acquainted. It is added that we must also include under *a priori* knowledge our direct acquaintance with the relative intrinsic worth of various goods. This is why there can be a science of ethics. The chief special work of the particular type of realism represented by Mr. Russell and his associates was done, in close connection with the earlier work of mathematicians like Peano and Frege, in the field of mathematical logic, with a view to the exhibition of pure mathematics as a vast body of deductions from the principles of the logic of relations, first treated with due elaboration in the third volume of E. Schröder's *Algebra der Logik* (1895), and applied with particular thoroughness to arithmetic in Frege's *Grundgesetze der Arithmetik* (1893–1903). The *magnum opus* of Messrs. Whitehead and Russell, *Principia Mathematica*, represents the fullest development of logic as a calculus of relations. The most brilliant account of the principles and methods of the mathematical logicians is, perhaps, that of Couturat (*Principes des Mathématiques*, 1905).

Russell and also G. E. Moore made some application of their doctrine to ethics (see G. E. Moore, *Principia Ethica*, 1903; *Ethics*, 1912; and Russell, *Philosophical Essays*, 1910), but without any very satisfactory results. From their point of view the principal business of ethics is to discover true propositions about the relative intrinsic worth of different "goods." As both writers assume that there are a plurality of such propositions, and that each of them is known *a priori* independently of the others, the impression they leave upon a reader not previously committed to their theory is that they have really no better standard for determining the worth of various goods than their own personal preferences. It is characteristic of both writers that they assume without serious inquiry that *conduct* can only be good in a derivative sense as leading to the production of some good other than itself. Hence, though both reject the older forms of utilitarianism as ascribing a fictitious worth to pleasure, their own doctrine is itself utilitarian in its general character. Beyond discovering true propositions concerning the relative worth of goods, ethics seeks to furnish rules of right conduct, *i.e.* conduct which produces good results, but these rules are always of the most rough-and-ready sort and constantly require modification to suit special cases. Hence the ground is left open in practice for an enormous development of reflective casuistry. Messrs. Moore and Russell have furnished us with some acute observations on the relative goodness of various objects, but because of their refusal to look at human life as a whole they cannot be said to have advanced the study of ethics as an interpretation of life. In their ethical writings, slender as they are in bulk, one cannot see the wood for the trees; they are too much occupied with the search for true propositions about "goods" to develop a satisfactory theory of "*the* good."

Besides the irrationalism of Bergson and the atomistic intellectualism of the new realists, one may mention as characteristic of the years preceding the World War a third tendency, which held in some respects a middle place between the former two. This was the revival of philosophical Theism, in connection with which important work was done, especially by Prof. James

Ward, Dr. Rashdall and Prof. Bernardino Varisco. Ward and Varisco agree in refusing to accept the unfavourable verdict of pragmatism and Bergson on the worth of the intellect in philosophy, and are so far pronounced rationalists as to require of any philosophical theory of the world that it should be able to justify itself before the bar of reason; neither is, however, an "intellectualist," since neither ascribes to cognition a primacy in importance for the philosophical interpretation of the world over feeling and conation; and both admit, like Kant, our right to believe what we cannot demonstrate, provided that such belief, if accepted, would form the natural completion of the conceptions to which strictly logical analysis of the contents of science points. Both hold in common with Bergson and the pragmatists the reality of contingency and the production of the genuinely "new," but both deny that there is anything irrational or repugnant to the intellect in these conceptions. Ward's views find their development in his *Realms of Ends* (1911), Varisco's in *I Massimi Problemi* (1910) and *Conosci te stesso* (1912). Both thinkers show very markedly the influence of Lotze, whose final results in the main agree with theirs; Ward is, on the whole, Kantian, Varisco Leibnitzian in manner.

Ward's starting point is afforded by the contrast between the unity which thought demands of its world and the apparent plurality which meets us in the world of sense perception. The problem which philosophy has to solve is, according to him, on what lines the world of experience can be thought of as one without our ceasing to recognize that it is also truly many. The history of the post-Kantian "idealist" schools has demonstrated that the problem is insoluble if we attack it from the side of the "one." Since the world of perception is not primarily given to *us* as one but as many, *we* have to start from its given multiplicity and work toward such a final conception of its unity of plan as our data will permit. Ward thus begins by a tentative inquiry how far the metaphysical assumptions of pluralism will allow us to recognize the experience-world as exhibiting unity. This leads him, *inter alia*, to a brilliant criticism of the concepts of mechanism and "evolution" as they figure in singularist philosophies. The result of the criticism is much that of Bergson's critique of the "geometrical" bias ascribed by him to the intellect. A mechanistic monism must reduce "evolution" to a process by which things unfold what has all along been in them in an "incapsulated" form; but the process known to genuine science by the unhappy name of evolution is really more properly "epigenesis," the growth of the qualitatively new, and therefore unpredictable, out of the old. Starting with an original pure pluralism which resolves the course of things into interactions between agents, each of whom is independent of any other, we can see that a pluralistic universe would develop a tendency to unity in the very process by which its members establish a *modus vivendi* among themselves, but it is uncertain whether such a tendency would give us the amount of unity we presuppose in the real world when we assume the validity for it of general laws, and it certainly does not warrant our ascribing to it such a unity as would justify the belief that the universe is such as to permit the realization of our moral and spiritual ideals. *If*, however, the pluralist should modify his hypothesis by regarding one member of his universe as a God from whom the rest derive their real but dependent existence, we could find in the existence of such a God good ground for faith in the persistence of spiritual life after bodily death, and the final victory of good over evil; the alleged difficulties of Theism, in particular the alleged impossibility of reconciling the goodness of God with the presence of evil in His world, have no conclusive force. Thus we are free, as Kant held, to exercise a reasonable faith in God and in immortality; and such a faith, while meeting the demands of morality and religion, involves no breach with the intellect, as it amounts only to a further step along the road which the pluralist is forced to tread in accounting for the presence of even so much unity of plan as he has to admit in the visible world.

Varisco reaches a very similar position as the result of a polemic against the empiricist metaphysic of the ordinary Comtist. He begins with an analysis of the actual moment of sense perception. The objects apprehended in such perception stand at once in two sets of relations. On the one hand, they are connected in various ways with one another, and as so connected they form a system which lies open to the perception not only of the special "I" who speak of apprehending them, but to the perception of innumerable other beings, each of whom can equally say "I apprehend" them. Considered from this point of view the system of sense-data and their interconnections may be said to form the common perceived world of mankind at large. But also a given sense-datum which I apprehend is, at the moment of its apprehension, present along with experiences (feelings, conations) which are intimate and private to me and directly accessible to no other being which calls itself "I." In this sense the perceived objects may be said to be *my* objects. Thus there is a sense in which the whole world of fact to which the individual has to adjust himself in action is inseparably bound up with the individual's inner life. Varisco develops this idea in a way which may remind us strongly of T. H. Green, but is at least equally reminiscent of Leibnitz, the one great philosopher whom Green persistently misunderstood. It is fatal to the empiricist theories which regard the "external world" as simply given in sensation that the world reveals itself to science as a complicated network of relations between terms, and neither the universals which pervade it nor some at least of the terms they connect are sense-data. The universals are apprehended by thought, and the self to which they are known, the only thing which we apprehend directly as it is, is also no sense-datum. It is our immediate non-sensuous apprehension of the self which owns its "states" that supplies us with our standard of real Being. Hence Varisco is led to postulate as indispensable factors in the scheme of the universe not only the sense-data and the system of relations between them, but the plurality of persons whose sense-data they are and whose thought apprehends their complicated relations. From these considerations follows the reality of freedom and contingency. For each individual has its unique qualitative character, by which it is distinguished from every other, and the course of phenomenal events thus depends on two factors, the unique characters of individuals and the universal relations between them, and the former factor is obviously incalculable with certainty just because it is what is not common to two or more individuals. Hence the actual course of things is only partly calculable, and this admission of contingency, or spontaneity in the individual, involves no breach with the principle that it is for philosophy to satisfy our intellectual demands. We may call the element of spontaneity a logical (since logic is concerned solely with the universal laws of interconnection and interaction), but not irrational.

At this point arises the supreme issue for a philosophical interpretation of the universe, an issue which is one of value or worth. The question is whether we regard the principle of organization in the universe as immanent, and manifesting itself in an endless succession of individuals which are all transitory; or whether we are to think of it as itself a transcendent individual, and of the finite individuals in which it exhibits itself as permanent factors in the universe. In the former case, the values of the individuals will be all relative, and there will be no meaning in attaching value or purpose to the world-order itself, as it is only the individual which properly has either; in the second case, there will be a meaning in regarding the values we ascribe to human personalities as absolute, and we shall be able to ascribe value and purpose to the universe as a whole, no less than to its various members. Varisco's view is that philosophy as such cannot decide this issue between an impersonal immanent principle of order and "the traditional Christian conception of God." Our decision will turn upon the intensity of our faith in the correspondence between the order of facts and our spiritual ideals. His own preference is for the Christian solution, as an expression of personal faith.

In the sphere of ethics, the attention of modern philosophers of all schools has seemed to be more concentrated on the inquiry into the presuppositions and methods of science than on the interpretation of our inner life. "*Erkenntnistheorie*" is more in the fashion than "discourses on conduct." This is, as has always been the case, specially true of the work of the Neo-Kantians. Special notice is perhaps due to the important volume, *Substanzbegriff und Funktionsbegriff* (1910), by the distinguished Neo-Kantian writer, E. Cassirer, which is specially valuable for its insight into the real character of the universals, or laws, of exact physical science, and for its criticism of the work done on the philosophy of mathematics by distinguished "new realists." In the sphere of "philosophy of religion" one may perhaps give special commendation to Evelyn Underhill's brilliant attempt to make a thorough study of the meaning and worth of the mystic "way of life" (*Mysticism*, 1910), as well as to the important and elaborate restatement of the principles of "idealism," with special application to the problems of religion, by Prof. B. Bosanquet in his *Principles of Individuality and Value* (the Gifford Lectures at Edinburgh for 1911) and its sequel, *The Value and Destiny of the Individual* (Gifford Lectures, 1912).

It was not much easier in 1921 than it might have been in 1910 to detect a single main stream of tendency in latter-day philosophical thinking. Perhaps, however, it may be said that some of the issues were slowly clarifying. Except possibly in Italy, where the Hegelian influence was marked in the work of Croce and Gentile, "absolute idealism" of the Hegelian type seemed to be losing ground. The veterans of the movement continued to produce impressive work. (It may be sufficient to mention, in addition to B. Bosanquet's two volumes, F. H. Bradley's *Essay on Truth and Reality*, 1914, and J. M. E. McTaggart's *The Nature of Existence*, vol. i., 1921.) But, at least outside Italy, the school no longer seemed to attract recruits among younger men. "Pragmatism" (or "Humanism") seemed also, since the death of William James, to have taken its place definitely as a movement which had "done its do," and Bergson to be on the way to that canonization as a "classic" which means, among other things, that the canonized is felt to belong to the past rather than to the present. Nor had the philosophy of pure mathematics produced any work of absolutely first-rate importance since the third volume of the monumental *Principia Mathematica* of Whitehead and Russell. In 1920–1 the remarkable developments given to the doctrine of "Relativity" in physics by Einstein and others seemed to have caused a displacement of the centre of gravity of "epistemological" discussion. For some time to come the most topically interesting problem for the "epistemologist" and the metaphysician was likely to be the evaluation of the new physical ideas from the standpoint of general philosophy, and perhaps the most significant fact in quite recent philosophical literature in the English language was the impression which had been produced by Whitehead's two remarkable volumes, *Principles of Natural Knowledge* (1919) and *The Concept of Nature* (1920). The future would show whether these works might not give rise to a new and brilliant *Naturphilosophie* with marked affinities to Plato in the *Timaeus* and to Berkeley. For the present, physics seemed likely to occupy the same sort of central position in philosophical speculation which mathematics had held since 1900.

As far as could be discerned in 1921, the main directions in contemporary philosophy seemed to be three.

(1) Theism of a strongly ethical kind with a metaphysical basis of "monadism" or "personal idealism" and definitely hostile to that depreciation of human individuality which was common among the religiously minded idealists of the latter part of the nineteenth century. The theists of this type commonly call themselves "idealists" and hold fast to the conception of a real unity of the world of persons in a supramundane God, whom the world would not refuse to speak of as "personal," though some of them would hesitate to call him a "person." Striking examples of valuable works from this standpoint are James Ward's *Psychological Principles* (1918—the most philosophical treatment of psychology so far produced in Great Britain or perhaps in Europe); W. R. Sorley, *Moral Values and the Idea of God* (1918); A. S. Pringle-Pattison, *The Idea of God* (1917); C. C. J. Webb, *God and Personality* (1918); *Divine Personality and Human Life* (1920).

(2) "Neutral Monism" in its various forms, all agreeing in the attempt to deny that disparateness of mind and matter upon which Descartes taught modern philosophy at its very inception to insist, and the desire, speaking generally, to reduce the importance of mind, "consciousness," "the subject" in the scheme of things, to a minimum. This tendency has, perhaps, been most marked in the United States of America, where it has given rise to a whole school of young metaphysicians calling themselves "New Realists" (in contradistinction from the older realists of the Aristotelian tradition) and has been carried into psychology, with some exaggeration of its distinctive point of view, by the so-called "Behaviourists."

In Great Britain the same tendency has been shown in the later work of B. A. W. Russell, but its most striking product was perhaps S. Alexander's *Space, Time and Deity* (1920), where the principles of "New Realism" are combined with the speculations of Minkowski, Einstein and others on "Relativity" in an attempt to take stock of the universe and its contents. As the result is to represent these contents as an hierarchical order in which mind, however low its real rank, at least holds the highest rank with which we are acquainted, it is perhaps not unfair to say that, in Mr. Alexander's construction, relativity is at any rate "relatively" more prominent than "new realism." There is a certain community of temper between the work of the "New Realists" and one or two important works on special topics which do not commit themselves unreservedly to any metaphysical standpoint, though they may fairly be said at least to be not "idealistic," such as C. D. Broad's *Perception, Physics and Reality* (1914) and J. Laird's *Problems of the Self* (1917). J. Laird's later work, *A Study in Realism* (1920), is much more decidedly in line with the "new realism," though (as might be expected from an author whose earlier book was chiefly notable for the vigour with which it defended the position that the self, while unquestionably real, is neither the body nor any part of it) free from the tendency of many "new realists" to depreciate the importance of mind in the scheme of things.

It was as yet too early in 1921 to feel sure what the value of this revival of "realism" was. As against the older tendency to regard Nature as very largely the creation of the human mind and, in fact, something of an "illusion" which happens unaccountably to be shared by every one, it may fairly be said to be largely justified, and it seems also likely to prove a serviceable ally to the moralist who believes in "objective" obligation against the perennial endeavour of the mere anthropologist to confound moral distinctions with capricious "personal" likings and dislikes. It is a strong point of the doctrine that it refuses to regard the universals of science and ethics as "figments" (like the older sensationalism), or (like Kantianism) as "creations of the mind." They are genuinely there "in the facts," and have to be accepted no less than the deliverances of sense as "part of the facts." In so far as the "realistic" tendency seems likely to deliver us in natural philosophy from the belief in a "material substrate" and the rejection of the wealth of "sensible qualities" to the realm of illusion, and in ethics from the theory that moral values are purely "subjective," it promises to do admirable work for the clarification of thought. But it may be suspected that some of the protagonists of the movement are too much in a hurry to philosophize with due discrimination. The "neutral monism" to which they seem to tend in metaphysics is no new thing, and one may doubt whether it really deserves to survive its drastic criticism by J. Ward at the end of the last century (*Naturalism and Agnosticism*, 1899). It seems probable that some of the dialectical victories of the "realist" are easily won by substituting the alleged dualism of matter and mind for the very different duality of knower and known. To deny that the universe consists of two classes of substances, radically distinct and disparate in all their properties, is one thing; to maintain, as some, if not all, "new realists" do, that minds might disappear from the universe and yet leave it with all its colours, tones, odours, perhaps with all its "values," unaffected is quite another. Reference to the "subject" of knowledge may be irrelevant to the discussion of particular problems in nature precisely because the "subject" is equally relevant to the whole of Nature. To the present writer, at least, it seems that none of the "realists" of the moment has so clear an insight into the real significance of the "subject" and the real character of "Nature" as was shown long ago by John Grote in his remarkable, but unfortunately not very readable, work *Exploratio Philosophica*.

(3) The third tendency which calls for note is what one may call "Spiritualist Pluralism." According to this view the universe consists in the end of a vast plurality of minds, but there is no one central and supreme mind controlling its destiny. Anti-materialism and atheism are thus conjoined. The view itself is, indeed, not a new one. It has been long upheld, as an interpretation of Hegelianism, by J. M. E. McTaggart, and is, of course, not so very different from the "theism" of those "personal idealists" who make a point of objecting to the traditional doctrine of the Divine Omnipotence. But the pluralistic universe of spirits, as conceived by these thinkers, is, of course, an orderly one. The believers in a "finite God" have always stipulated that the limits of their Deity's knowledge or power shall be so widely drawn as to leave Him in a position to act as an overruling Providence to the rest of us. McTaggart's scheme does not include a God at all, but, for reasons which he has, perhaps, not made fully apparent, he is persuaded that it is in the nature of spirits to fall into line with one another and even to advance inevitably by a natural law to complete fruition of perfection and happiness. His world, to use an illustration of his own, is like the senior common room of a college without a master. (Have we here a last vestige of the old, comfortable Godwinian dogma of the "perfectibility of human nature"? There is a distinct flavour of the 18th-century optimism, against which *Candide* was a protest, about this metaphysic. The times of violence, it is taken for granted, lie behind us in the dim past; "culture" and "enlightenment" are a sufficient guarantee against their return, exactly as was thought by those representatives of the French *noblesse* who came up to Paris for the meeting of the States-General in 1789.) Naturally enough, the events of the recent years of world-wide war (1914–8), which made even the most optimistic feel how very insecure the foundations of our "moral civilization" are, were not favourable to spiritualistic pluralism of this easy-going and cheerful kind. Aerial bombardments and poison gases brought it home to all of us that the world is as "dangerous" as Nietzsche could have wished it to be. But an anarchic version of spiritualistic pluralism was enunciated with great vigour at the end of the war by the brilliant Italian philosopher, A. Aliotta, who had formerly professed a theistic "personal idealism," in his small but striking manifesto *La guerra eterna ed il dramma dell' existenza*. According to Aliotta, what the "real world" of spirits resembles is not a college in the long vacation but one of the fronts of the recent war. Spirits are ingenerable and indestructible, and their life is an unending warfare for incompatible ideals. The issue of the conflict is unknown and unknowable, and, indeed, it is just the fact that it is unknowable which makes the fight worth while. It seems even to be held that good would not really be good unless there was some one to hate and resist it. *Arma amens capio nec sat rationis in armis.* Aliotta, in his later phase, rejects Theism with disdain. His reasons appear to be primarily ethical. If there is a "God above," it is argued, we know already that the issue of the secular warfare of good with evil is decided. Good is going to win and we know it; the battle is thus as good as over already, and there is no more heroism in playing a man's part in the world than there is in charging an unloaded battery on a day of field manœuvres. Aliotta's zeal and energy have created, apparently, a whole band of enthusiasts for a pluralism of this kind among the younger Italian philosophers. The weak points in the intellectual construction are, however, obvious. The alleged ethical objections to Theism only hold good on the assumption that Divine Providence is absolutely incompatible with human freedom, and no serious attempt is made to justify this assumption that Theism means hyper-Calvinism. That in a theistic universe good will be triumphant "in God's good time" may be certain, but it does not follow that it will triumph without our efforts or that it does not depend largely on us when that "good time" shall be. Again, it must not be forgotten that the Theist does not commonly profess to be able to demonstrate his creed with mathematical certainty. He lives by faith and hope and usually professes to *prove* no more than that the scheme of things leaves him room to hope. It is probably impossible to reason an intellectually alert but morally frivolous man into belief in God. Still more unreasonable does it seem to hold, as Aliotta and his followers sometimes appear to hold, that the very meaning of "good" is "something which one has to fight for." If this were so, evil would clearly become very good if it were so generally hated by most men that its partisans were compelled to fight very hard on its behalf. It must always be more than a meaningless form of words to ask the question: "Is what you propose to fight about worth fighting for?" To put it differently, the proposition "that for which I am fighting is good" is always a synthetic proposition in Kant's sense of that phrase.

The years from 1918 to 1921, at all events in Great Britain, seem to have been rather barren in works of practical philosophy of outstanding importance. There were, of course, many reasons for this: the disturbance, by the war, of the ordinary avocations of the class by whom such works are chiefly produced, the rise in the cost of living which lowered the demand for books, and above all the great increase in the cost of paper and labour. Mention should, however, be made of one admirable work, L. T. Hobhouse's, *The Metaphysical Theory of the State* (1918). Hobhouse's work is a hostile criticism of the Hegelian tendency to deify the State as a sort of "super-person," which he takes as exemplified by B. Bosanquet's *Philosophical Theory of the State*, and a reassertion of the traditional "liberal" conception of the State as a system of machinery for the promotion of the welfare of individuals. The criticism of the Hegelian adoption of Rousseau's conception of the "general will" is severe but illuminating. It may be that Hegelianism tends to make men conservatives (though our own Hegelians have as often been socialists), and that Hobhouse's personal political inclinations at times run away with him. He seems so convinced of the antecedent probability that any governmental enactment will be a bad one as almost to hold that any "rebel" (a Marat or an Hébert?) may be presumed to be in the right until it is proved that he is in the wrong. But in view of the dangerous tendency of present society to "look to Government" for everything, and of the serious moral abuses to which the metaphor of the "personality" of the State may lead when it is taken to be more than a metaphor, the book must be regarded as a singularly timely contribution to philosophical politics.

In pure logic perhaps the most important English publication of very recent years has been the issue in 1921 of the first volume of W. E. Johnston's long-expected *Logic*. Mention should also be made of B. Bosanquet's *Implication and Linear Inference*, a welcome appendix to the more voluminous logical work of the veteran philosopher which throws a good deal of fresh light on his fundamental position.

The years of war and uneasy reconstruction have not been barren of useful work in the history of philosophy. In N. Kemp Smith's *Commentary to Kant's Critique of Pure Reason* (1918), we have at last in English an adequate historical and exegetical companion to the most famous of all German works on metaphysics and the theory of knowledge which will be indispensable to all serious students and may take rank with anything which the Germans themselves have done for their illustrious philosopher. If Smith's work is not quite on the gigantic scale of Vaihinger's great German commentary, it has the advantage of covering the whole of the *Critique*, whereas Vaihinger breaks off at the end of the *Transcendental Aesthetic*. In all other respects the British commentator may fairly sustain comparison with his Continental predecessor. Another very welcome contribution to the history of modern thought is J. Gibson's *Locke's Theory of Knowledge* (1917), which should do a great deal towards making the real greatness of Locke as a rationalist philosopher clear to his countrymen and dispelling the strange conception of him as a sensationalistic empiricist made current among us in the 'seventies of the last century by T. H. Green's *Introduction* to the Green and Grose edition of Hume. It were much to be wished that some competent scholar would do for Hume, a philosopher who has been no less strangely misunderstood, what Gibson has done for Locke. We still need to have it established by a really historical study of the *Treatise* and the dialogues on *Natural Religion* that Hume was neither an empiricist, as Green would make him, nor a positivist, as Huxley represents, but precisely what he calls himself, an "academic or sceptical" philosopher, and that the true measure of his intellectual greatness can only be taken when this simple fact is kept steadily in mind. A gap is also filled in our philosophical literature by the appearance of W. R. Sorley's *History of English Philosophy* (1920), which begins with Alcuin of York and carries the story down to the end of the 19th century. The veteran J. T. Merz completed his masterly *History of European Thought*, a work to which it would be hard to find a parallel in its scope and the accuracy of knowledge in many fields which it displays, by the issue of the fourth volume in 1914. He has since given us an interesting addendum, containing an outline of his own philosophical interpretation of experience in *A Fragment on the Human Mind* (1919), where it is interesting to see how profoundly a thinker at home in all the developments of French and German thought has been influenced by our own Berkeley and Hume. The *Fragment* is one of many signs that there is possibly a great future before a really critical Neo-Berkeleyanism. Berkeley received scant justice at the hands of the Anglo-Hegelian "Idealists" of the late 19th century, who seem to have been under the impression that his best-known doctrine was meant as a kind of "subjectivism." The 20th century seems likely, by laying stress on the very real element of "*naïf* realism" in his work, to arrive at a more intelligent and more generous estimate of its permanent value. We should not omit to chronicle the real service done to philosophical literature by the Open Court Publishing Company in the reissue (1916) of the epoch-making work of Boole on the *Laws of Thought*, the original edition of which had become very scarce. It is a great misfortune, owing presumably to the deaths of Dr. Paul Carus and Mr. P. E. B. Jourdain, that the complete republication of the logical writings of G. Boole and his great contemporary Augustus De Morgan has not been proceeded with. A reprint of De Morgan's *Formal Logic*, his contributions to the logic of relatives, and *Trigonometry and Double Algebra*, if of no other of his works, is badly needed by the student of the history of modern exact logic.

It is gratifying to note that the study of the great Greek founders of science and philosophy is still zealously prosecuted in Great Britain and in other countries, notably in Italy, which has been remarkably fertile in recent years in all departments of philosophical literature. It may be recorded that all through the war the issue of the great Oxford translation of Aristotle provided for by the will of Jowett slowly proceeded, the last part issued up to the middle of 1921 being the revision of Jowett's own version of the *Politics* by W. D. Ross. The Aristotelian student may be excused if he feels a little impatient at the continued non-appearance of just those Aristotelian works which are at once the most interesting and the least adequately represented in English, the *Organon*, *Physics*, *De Caelo*, *De Generatione* and *Meteorologica*. But for these logical and cosmological writings the English Aristotle was in 1921 well-nigh complete. Another most valuable work which progressed steadily after 1914, and in 1921 needed only one more volume to be completed, is the handsome edition of Kant's works with that indispensable *subsidium*, a full collection of variant readings edited by the eminent scholar, E. Cassirer. If, in binding and quality of paper, the later volumes inevitably fall off to some extent from the high standard of the earlier, this edition is in all other respects what an edition of a great classic ought to be. It was at last possible to read Kant with pleasure to the eye and with full certainty whether what one had before one was what Kant himself actually allowed to be printed or a (good or bad) conjecture of some modern Kant-scholar. We have too long acquiesced, and that not only in philosophical works, in a standard of textual accuracy where modern writers are concerned which would be rightly deemed barbarous in editions of the Greek and Latin classics. It is to be hoped that this bad practice will not be tolerated much longer by self-respecting scholars.

The changes in the third edition (1921) of J. Burnet's *Early Greek Philosophy*, the most critical and careful study of the beginnings of Greek science, are an interesting indication of the advance our knowledge of classical antiquity had made since 1908. No contemporary work on the primary Greek philosophers is of quite such first-rate importance as L. Robin's important *La Théorie Platonicienne* of 1908, the one modern work which systematically and in detail begins the investigation of Plato's philosophy with the proper initial question, what Plato was understood to mean by men like Xenocrates and Aristotle, who heard his doctrines from his own lips. J. Burnet's *Greek Philosophy, Thales to Plato* (1914) proceeds on similar lines, but the writer is limited by the facts that Plato is only one part of his subject and that he has perforce to give most of his space to the exposition of the dialogues. His actual interpretation of Plato was deferred to his second volume, not yet published in 1921. But Robin had issued a brief but important appendix to his main work, *Études sur la signification et la place de la Physique dans la Philosophie de Platon* (1919). Mention should also be made of the admirable Platonic studies of Adolfo Levi, *Sulle interpretazioni immanentistiche della filosofia di Platone* and *Il Concetto del Tempo nella filosofia di Platone* (1920). These are contributions of first-rate importance to the recovery of the genuine tradition of the first generations of the Platonic Academy. It ought to be clear that it is on the recovery of this tradition, for which there is ample available evidence, that our hopes of definitely ascertaining the real meaning of the first and greatest of all philosophical writers must depend.

The Neo-Thomist movement in the Catholic universities of the Continent still continued, in 1921, to flourish vigorously and to show its vitality in the general excellence of the work in such journals as the Italian *Rivista di Filosofia Neo-Scolastica* and the *Revue Neo-Scolastique de Philosophie* issued by the philosophical faculty of the university of Louvain. Among the actual books produced quite recently by the movement, mention may be made of the brief but highly condensed and valuable study of St. Thomas's thought in its entirety, *Le Thomisme*, by E. Gilson of the university of Strassburg. The English reader will get an admirable introduction to a great philosophy too little known among us by combining the study of this general introduction to Thomism with that of the very sympathetic exposition of Thomist natural theology by P. H. Wicksteed, *The Reactions between Dogma and Philosophy Illustrated from the Works of S. Thomas* (1920). The appearance of works like this last leads one to hope that it might soon be impossible for the average historian of philosophy among us to write as though nothing of any significance had been thought or said in philosophy between Plotinus (or even Aristotle) and Descartes. Two other recent contributions to the study of ancient and mediaeval thought may be mentioned. G. M. Stratton's *Greek Physiological Psychology* (1917) is a painstaking and laudable attempt to edit the important fragment of *Theophrastus de Sensu* with a translation and full explanatory commentary. In *Opera hactenus inedita Rogeri Bacon fasc. V.* (1920), A. G. Steele happily resumed the task, interrupted by the war since 1913, of providing a complete edition of Roger Bacon's writings.

In U. von Wilamowitz-Moellendorff's two large volumes entitled *Platon* (vol. i., 1917; vol. ii., 1919), the veteran German professor makes some interesting and valuable suggestions, but he is debarred from acting as a competent interpreter of Plato partly by complete lack of training in philosophical thought, partly by a habit of treating ingenious guesses of his own about the motives of a classical writer and the circumstances in which his various works were composed as certainties, partly by a curious want of finish in verbal Greek scholarship which makes his long series of conjectural emendations, in spite of a few felicities, into a systematic depravation of the Platonic text.

During the decade, many of the familiar figures of the philosophical world were removed by death. This was only to be expected in the case of octogenarians like Wundt and Windelband and J. F. Brentano, still more in that of a nonagenarian like the Italian positivist, R. Ardigo (1828–1920). In Great Britain there were few losses among the elder philosophers since the death of the nonagenarian, A. Campbell Fraser. Of the elderly, but not old, the United States lost their leading philosopher, Josiah Royce; France, Gaston Milhaud and Émile Boutroux (1845-1921); and Austria, Alexis Meinong. Still more regrettable was the death of men who were still young or in their intellectual prime, as Louis Couturat in France and Oswald Kulpe in Germany.

(A. E. T.)

PHYSIOLOGY (*see* 21.554).—Since 1910 increased attention has been paid, in physiological research, to phenomena common to living beings in general, and recent investigation has added considerably to our knowledge and corrected earlier theories.

As distinguished from *Morphology*, the science of the form and structure of living organisms, *Physiology* may be said to be concerned with their activities, chemical and physical. But there can be no hard and fast line between the two bodies of doctrine. A function depends on the way the machine is made. And many provinces of modern research, such as those depending on changes of general form in response to external agents, combine morphology and physiology. For convenience of research, physiology is often divided into *biochemistry* and *biophysics*. But this distinction can scarcely be regarded as a scientific one, since in all vital processes both chemical and physical factors intervene. It is true that some of the problems of the biochemist consist in the elucidation of the chemical nature of vital products, and might be looked upon as the chemical side of morphology; but the methods of investigation distinguish them from those of the organic chemist.

Animal and Plant.—There is no real or fundamental difference between the animal and plant organism. Great as may appear to be the external differences between a dog and a tree, when we proceed to examine the physiological factors of which their life is made up, we find that the elementary processes are essentially alike. The most striking contrast, that of movement, does not exist in the simplest members of the two kingdoms. While certain plants, such as algae and bacteria, are motile in some stages, certain polyps and ascidians become fixed in the later periods of their life. Other instances might be given. The difference between the net result of the chemical changes occurring in the green plants and those occurring in animals is due to the presence in the former of the green pigment, chlorophyll, and does not show itself in fungi. By the aid of chlorophyll, the energy of the sun's light is used to build up the carbon dioxide, formed in the combustion of food by all cells, into sugar and oxygen. These again become available as sources of energy to living matter. In this connexion, it may be noted that the work of Willstätter and Stoll has made it practically certain that carbon dioxide and water become attached in some way to the chlorophyll particles, a molecular rearrangement takes place with addition of energy when light is absorbed, a peroxide of formaldehyde is produced, and this is then decomposed into gaseous oxygen and formaldehyde by the agency of an enzyme (catalase). From formaldehyde the higher sugars are readily produced by polymerization. The precise chemistry of the reactions is not yet clear—it may be that formic acid and hydrogen peroxide result from the action of water on the formaldehyde peroxide. In this case, catalase splits up hydrogen peroxide into water and oxygen, while the formic acid is reduced by light (absorbed by chlorophyll) to formaldehyde. However this may be, the final result of the process is that, in the light, green plants take up carbon dioxide and give off oxygen. In the dark, they behave like animals, giving off carbon dioxide by combustion. Such combustion, of course, is actually proceeding in the light also, although obscured by the opposite phenomenon.

Vitalism.—Some discussion, not very profitable as far as physiology is concerned, has taken place as to the existence of a form of energy, or, as held by some, of a kind of directing agency peculiar to living beings. The aim of all physiological experimentation is to express vital processes in terms of physical and chemical laws. We call this "explaining" them. The methods used, moreover, are those of physics and chemistry. Owing to the complexity of the phenomena, we have to be content in many cases with expression in terms of simpler *physiological* laws, leaving the further analysis of these laws to the future. As Claude Bernard pointed out, the laws of physics and chemistry manifest their action in systems of a special kind, differing from those familiar to workers in the former sciences, so that the separation of a biological group is quite justified. At the same time, there is intimate connexion and overlapping, a process subject to continual increase.

As to the existence of a peculiar form of "vital" energy, it is to be admitted that we have no direct method of measuring the energy contained in a given mass of carbon and oxygen, although we know that a definite quantity of work can be obtained by allowing them to combine. Thus, the energy of living things cannot be looked upon as altogether peculiar. Indeed, measurements of any form of energy are usually made by converting them into other forms. The first law of energetics tells us that this is permissible. The striking fact that any organism behaves as a unified and coördinated set of activities has led to the assumption of a directing agency of some kind. We shall see later that notable progress has been made in the explanation of the factors responsible for many aspects of this integration.

The position of consciousness in physiological processes is by no means clear. While it may be held that the province of physiology is to investigate what can be made out experimentally in the nervous centres, it does not seem impossible that consciousness may ultimately fall into place as one of the functions of nervous tissue.

Relation to Physical Chemistry.—One of the most striking aspects of the development of modern physiology is the important part played by considerations derived from physical chemistry. The osmotic pressure of solutions, the action of the various inorganic ions arising from the electrolytic dissociation of salts, acids and bases, especially the hydrogen ion, and the maintenance of the neutrality necessary to the normal function of the cell, together with the properties of matter in the colloidal state and of heterogeneous systems in general may be mentioned. The absorption of substances at the surfaces of contact of phases that do not mix has been found to explain many otherwise puzzling facts, and is doubtless a prominent factor in the formation of the membrane covering the surface of cells in general and regulating the passage of dissolved substances into and out of the cell protoplasm.

This is perhaps the most appropriate place to refer to the relation of vital processes to the second law of energetics. In one of its aspects, this law points out how the transformation of heat energy into other forms is limited, owing to our conditions of existence being at a temperature so far above absolute zero. The properties which we recognize as "vital" are especially manifested during the change of one form of energy into another. In this process, it is of much importance from the point of view of economy that the free chemical energy of our food should not be "degraded" to heat before utilization in muscular work, and so on. Similarly, the energy of the sun's light must be converted to chemical energy by the green plant as directly as possible, without passing through the stage of heat. Accordingly we find that arrangements are made to ensure that loss from such causes shall be as small as possible.

Nature of Protoplasm.—As usually seen in such organisms as the amoeba or the leucocytes of the blood, protoplasm exhibits the properties of a liquid. It contains numerous particles in Brownian movement, a fact which shows the absence of obstacles holding them in place. This liquid, however, is itself a colloidal solution and can be seen under special modes of illumination to be closely packed with extremely minute particles. Under some states of activity, as in dividing cells or when electrically stimulated, this "hydrosol," to use Graham's word, becomes a "gel," in which the particles have joined together to form minute closed chambers in which liquid is confined, the whole mass then possessing the properties of a solid. This process occurs when a warm solution of gelatin solidifies on cooling. It will be clear that if protoplasm contains many-formed solid structures, as in highly differentiated cells, together with comparatively little free water, it may be scarcely possible to detect its liquid nature. However difficult it may be to conceive the way in which different chemical processes can occur at different places in a liquid, this must be the case, and suggestions have been made as to the temporary formation of separating membranes or other less mechanical means of isolation. The notion of protoplasm as a giant molecule in the chemical sense, with numerous side-chains of a variety of composition capable of reacting together, is held by but few physiologists at the present time. A view of this kind is contained in the theory of "biogens," to which reference will be made later.

The *cell-membrane* is evidently formed by surface condensation of some constituents of protoplasm. In ordinary circumstances, it is impermeable to salts, to glucose and to amino-acids. But since these substances must obtain access to the interior as foods at certain times, it is clear that the membrane must become more permeable when required. The constituents of the membrane being deposited at the surface owing to their properties of reducing surface energy, the actual chemical composition of this layer must be of a complex nature. It is probably, for the most part, an intimate mixture of fatty substances with watery proteins. These may form two kinds of colloidal systems—minute droplets of fat may be surrounded by a continuous solution of protein, like islands in a sea, or they may themselves run together and enclose droplets of protein, similar to the land surrounding a number of lakes or ponds. The properties of these two systems, as regards the passage across them of materials, will not be identical. Thus, rabbits cannot get through the system of islands, fish can do so; while the reverse will be the case with the other kind of system. Familiar instances of the contrast are well known in the forms of cream and butter. The former is a suspension of droplets of oil in a watery solution, the latter consists of droplets of the watery solution in a continuous medium of fat. The investigations of Clowes have shown how, by the action of electrolytes, particularly of calcium ions, one system can be changed into the other. A difficulty is sometimes felt as to how a membrane which refuses passage to sugar allows visible solid particles to pass through, as can be seen in the amoeba and leucocytes. The explanation lies in the manner in which a needle can be dropped through a soap film without breaking the film. A continuous film of the membrane is formed over the point as it enters and again over the eye-end as it leaves. Thus the membrane is never actually broken. A further point to be remembered in the modifications of the cell-membrane is that, being formed of materials present in the cell, it is an integral part of this and must change in correspondence with functional changes in the cell itself. Thus it appears that it becomes more permeable in states of activity, as in the contraction of muscle and in the secretory process of gland cells. If the surrounding medium itself contains substances that lower surface tension, these no doubt contribute to the structure of the membrane. Such is usually the case in the cells making up the animal body, less so in the plant.

Certain substances, proteins and others, become more or less solidified in the process of concentration in surface films, as Ramsden has shown. This fact must also play a part in the formation of the cell-membrane.

As to the *chemical nature* of protoplasm itself, it seems very questionable whether it can be regarded as a uniform chemical compound. Although proteins take a large share, various other substances, such as the complex fats known as *lipoids* or *lipines*, are important components. All the constituents are interconnected in a highly heterogeneous system, partly chemical, partly physical, of many phases and intersected by semi-permeable membranes forming and disappearing at intervals.

Attention may here be called to the special properties of the *carbon atom* as forming the basis of the chemical changes associated with living matter. Compounds of carbon do not naturally react otherwise than slowly. They are, therefore, subject to ready modification in this respect by the agency of the catalysts called "enzymes." Owing to the capacity of carbon atoms to unite together in long chains or rings of a relatively stable nature, along with the possession of four valencies capable of union with four different groups, we have the possibility of the production of highly complex large molecules. Another property of importance in the carriage of energy is the power of combining with elements of opposite character, such as hydrogen and oxygen. The hydrocarbons give up energy on oxidation, while the carbon dioxide can be reduced and built up again by addition of energy to form stores of potential energy for future use.

Although such large complex molecules are of great importance, the view of the essential nature of protoplasm as a further growth of the chemical molecule, the "biogen" hypothesis, cannot be accepted. According to this view, food material is combined chemically, as a side chain, with a giant molecule, while certain other side chains consist of oxygen. In oxidation, to give energy, combination takes place between these side chains. It follows from such a view that oxygen must be stored up in living cells in an "intra-molecular" form. Now, investigations from many points of view have failed to obtain evidence of the existence of such reserve oxygen. There is no proof that an organism possesses any store of oxygen beyond that contained in the lungs or dissolved in the fluids. It appears that the mechanism of living matter is more analogous to that of a petrol engine, in which the fuel does not form part of the structure previously to its combustion, but that this combustion takes place in intimate relation with the moving parts and that it is owing to the special arrangement of these that the chemical energy of the fuel is converted into the mechanical energy of motion. It is true that such cells as those of muscle and secreting glands have been shown to prepare during rest a store of some kind of system possessing potential energy, ready for use on stimulation to activity. But the process of conversion of this system to one of lower energy content is not associated with the consumption of oxygen or evolution of carbon dioxide. Thus the system is not comparable with a "biogen" and may probably be rather of a physical than a chemical nature. The energy necessary to form it is obtained by the combustion of some food material, apparently carbohydrate, with the giving off of carbon dioxide and involving some loss in the form of heat. The state of activity and the actual combustion process are therefore separate phenomena and the conception of giant molecules throws no light on their nature. It is rather as if the combustion of the fuel in our petrol engine were used, through some mechanism, to pump water to a high level, from which the energy could be obtained by allowing it to run down when required.

The Nucleus of the Cell.—Although this component is present in all the more highly organized cells, it is obvious that it cannot be essential in this actual form. Bacteria, for example, do not appear to possess a nucleus, although the materials out of which it is made are probably present distributed through the cell. If, as Morley Roberts suggests, the nucleus is a store of enzymes, the tools of the cell, it might be supposed that, in the absence of the nucleus, these tools are not kept in a special receptacle. Although statements have been made that oxidative processes are especially carried out by the nucleus, the evidence is unconvincing.

The nucleus undergoes a remarkable series of changes in the course of the subdivision of one cell into two daughter cells. This process, known as "karyokinesis" or "mitosis," exhibits a complex play of directed or polar forces. The inheritance of the Mendelian characters of organisms is conveyed by the nuclear constituents. The general characters are held by some to be transmitted by the cytoplasm. But, although it is difficult to believe that the cytoplasm plays no part, it would appear that if all the general characters are thus carried, those of the male parent would be practically unrepresented, since the spermatozoa are almost devoid of cytoplasm. Further evidence is needed.

When a nucleated cell is cut into two parts, one alone containing the nucleus, this part can continue to exist, whereas the other part degenerates and dies. Thus, the nucleus is essential to the life and growth of a cell in those cases where it has become a specially differentiated part. The fact is particularly manifest in the case of the cells called *neurones*, which make up the nervous system. Here there is a very long fine fibre arising from a nucleated mass. This is a "nerve-fibre," and if cut away from its nucleated origin, it degenerates and ceases to be able to conduct nerve impulses.

Nutrition.—During 1910–21 much attention was given to problems of the phenomena of nutrition, necessitated in great part by the conditions brought about by the World War of 1914–8. Since the chief use of food is to supply energy and energy cannot be created, it must always be kept in mind that a given amount of food can only provide a certain definite quantity of energy. For convenience of measurement, this is expressed in terms of heat units, calories. An adequate diet must have a certain minimal calorie value, or energy value, differing according to work done, age, weight, etc. Whatever else may be necessary, and whatever may be the composition of the diet, this energy value must be provided. The fact must not be allowed to be obscured by recent work on the importance of special constituents, such as "vitamins" or the presence of particular chemical compounds.

Further, food is obviously required in the growing organism to make new tissue and in the adult to replace wear and tear. Although the actual quantity needed for these purposes is not great, it is clear that it must contain all the chemical elements making up the constituents of the new tissues. There are moreover certain rather complex chemical compounds that must be supplied, since the higher animals are unable to make them. Nitrogen is needed for the production of proteins, and is in fact taken in food in this latter form, although afterwards broken down into its constituent amino-acids in the process of digestion. A certain minimal amount of protein food is therefore a necessity. When burned, protein gives energy, and might therefore be used for this purpose, if taken in sufficient quantity. But such a proceeding would be costly and wasteful. Accordingly, we make up the greater part of the energy value of our food by non-nitrogenous compounds, fats and carbo-hydrates. The latter appear also to be necessary for proper assimilation of protein. Some discussion has taken place as to the actual necessity of fat, since it has been shown that in the organism fat can be made from carbo-hydrate. Careful experiments indicate that it is not indispensable. Its chief value, physiologically, lies in its high energy value, greatly owing to the very small amount of water contained in the forms used for food.

On account of the fact that the nitrogen of protein appears to be needed only or mainly for the construction of new body substance, there has been a tendency to reduce the consumption of protein. This is advocated chiefly on grounds of economy. Although excessive consumption of this or any food is physiologically harmful, there does not appear to be satisfactory reason for supposing that protein is particularly injurious. On the other hand, it has been stated that a consumption of protein in considerable excess of the minimum requirement is of advantage in conferring greater resistance to infection. Apart from the ill effects of any diet deficient in energy value as a whole, no satisfactory evidence has been brought in support of the statement. It may be said that if any reasonable diet of animal or vegetable structures, including fruit, be taken, it will only be necessary to take account of its energy value. Sufficient proteins and vitamins will be automatically obtained. The dictum of the present writer " Take care of the calories, the proteins will take care of themselves " may indeed be read " Take care of the calories, other things will take care of themselves."

It may be useful to give the composition of the diet put forward by the Royal Society Food Committee as a standard for a man of 70 kilos weight, doing moderate work:

Protein	70 grammes =	280 calories
Fat	90 grammes =	810 "
Carbo-hydrate	550 grammes =	2200 "
	Total	3290 calories

It is understood that this refers to that part of the diet actually utilized and does not include undigested components.

In addition to the above-mentioned, there are certain things which, although they do not contribute to the energy value of a diet, are nevertheless indispensable for the proper working of the cell machinery and the utilization of the material presented to it. Water is needed for the carrying on of chemical reactions and for the conveyance of products from place to place. The colloidal systems of the cell are maintained and modified by salts, especially those of sodium, potassium and calcium. This adjustment, as Macallum has pointed out, is doubtless an inheritance from adaptation to the composition of the ocean in early geologic times, from whose inhabitants the present land animals are descended. We find, moreover, certain metals, such as iron, manganese, copper and magnesium, present in small amount in living organisms. We know that iron is a constituent of the red pigment of the blood corpuscles, by which oxygen is supplied to the tissues. In certain invertebrate organisms, it is replaced by copper. Magnesium is a corresponding element in the green pigment of plants, chlorophyll, without which life would come to an end owing to the using up of the oxygen of the atmosphere. Iron and manganese are of importance in the mechanism by which food is burned and its energy obtained. Certain moulds will not develop completely without zinc. It is more than likely that many other metals present in traces are more than mere accidental contaminations. Calcium, as we have already seen, plays an important part in the adjustment of colloidal systems. Potassium, although we know it to be indispensable, presents difficulties. Zwaardemaker maintains that its importance rests in its radio-activity, but other workers have not been able to replace it by other radio-active elements. Sodium salts, at the present time, serve chiefly to make up the osmotic pressure of the blood and tissue fluids. The occurrence of iodine in the internal secretion of the thyroid gland must not be overlooked.

Vitamins.—Not the least interesting of those constituents of a diet whose presence is absolutely necessary, although small quantities suffice, are the accessory food factors called by this name. The name " vitamine " was originally given owing to a mistaken view of their chemical nature. But, since it has come into general use and is conveniently short, objection to it may be removed, as Drummond has pointed out, by omitting the final " e " and using it merely as a name, without implication of chemical structure.

So far as known at present, they are three in number, distinguished by the addition of the letters A, B and C. Vitamin-A is commonly found in association with certain fats, such as butter and cod-liver oil, but it is also present in fresh vegetables. It is essential to normal growth and maintenance and its absence appears to be responsible for rickets in children. Vitamin-B is found in the germ of seeds, such as wheat and rice, but it is widely spread. Its absence from polished rice results in beri-beri, when this food material is the only one taken. Vitamin-C is required for normal nutrition, although the precise manner in which it acts is unknown. In its absence, the disease known as scurvy makes its appearance. This vitamin is much less stable than the preceding ones and is found only, to any notable extent, in fresh fruit and vegetables. Although all of these factors occur in animal products, they are present there owing to the vegetable food taken by animals. Their ultimate source is the plant, since animals are unable to make them. It is more particularly Vitamin-C that is defective in animal products. Fresh meat contains it in a very small amount. Owing to the minute quantities that are physiologically sufficient and are alone accessible for investigation, their chemical nature is as yet unknown. They do not undergo change in the course of their activity, but are excreted or destroyed more or less rapidly. Thus, their activity appears to be of a catalytic nature, but nothing very definite can be stated at present.

The normal growth of plants is also dependent on similar accessory factors. The " bios " of yeast, and Allen's work on diatoms may be referred to here. Bacteria, also, require in many cases special materials, such as haemoglobin, or particular amino-acids, for satisfactory culture.

It should be noted that certain products formed by organs in the body itself have powerful effects on the chemical changes of growth and nutrition. To these " internal secretions " or " hormones " reference will be made below.

Anabolism and Catabolism.—It was held at one time that all food materials, previous to further utilization, must be built up into the actual constitution of complex protoplasmic molecules such as " biogens." And that the activities of organs typified by muscular contraction and glandular secretion consisted in the breaking down of such complex chemical individuals. The former process was spoken of as "anabolism" or "assimilation," the latter as "catabolism" or " dissimilation." More recent work has led to a somewhat different point of view, as already indicated above. It appears that glucose, for example, is burned without becoming a part of the protoplasmic structure and, although the energy thus available is used for the storing up of potential energy in some complex system, to be used up in subsequent contraction or secretion, this system may not necessarily be of a purely chemical nature. If the anabolic and catabolic processes are opposite chemical reactions in the sense of the building up and breaking down of the same compounds, it is natural to suppose that while the former process is taking place the latter is *ipso facto* decreased. Hence, the view that the nerves producing a reduction of activity (inhibition) are anabolic in action. Investigation, however, has failed to give confirmation of such a view of the nature of the inhibitory process.

Allied to the above problem is that of the existence of nerves influencing the growth or repair of tissues. Although definite statements cannot yet be made, evidence of any such influence, apart from changes in blood supply, is inconclusive.

Enzymes.—These catalytic agents are of great importance in the chemical changes of living organisms. It is generally recognized that they are colloidal and that the reactions accelerated by them take place on their surfaces. Thus, a preliminary absorption of the components of a reaction occurs preparatory to the actual chemical change. Whether this increased concentration or close approximation by molecular forces is in itself sufficient to account for the effects or whether there is an intermediate compound formed between the material of the surface of the enzyme and the substances to be acted upon is not yet clear. No such compound has been prepared, but its existence may be so brief as to elude detection. It is evident, however, that the chemical nature of the surface of the enzyme particles may be held responsible for the variety of limited and special activities met with amongst these substances. At the same time, it is not to be forgotten that the physical properties of this surface depend on its chemical nature. In this connexion the views of Langmuir on the orientation of molecules in surface layers may be referred to. In regions of molecular forces, no valid distinction can be drawn between chemical and physical forces.

Much discussion has taken place as to whether enzymes have synthetic as well as hydrolytic powers. In the majority of cases we are dealing with undoubted reversible reactions, which attain an equilibrium position other than complete change in either direction. But the two opposite reactions which determine the equilibrium point proceed naturally at a very slow rate. If an enzyme were to accelerate one of these without the other, the equilibrium position would consist in practically complete change in one direction. If this position as reached under the action of an enzyme is anywhere but at the extreme in one or the other sense, it follows that the enzyme has quickened *both* the hydrolytic and the synthetic reactions. Many cases of this kind are now known. The actual position of the equilibrium depends on the concentration of water in the system. Thus, in order that the synthetic activity may be preponderant, arrangements are required by which this concentration of free water may be decreased. This may be effected in the cell by colloidal imbibition by absorption on surfaces, or by osmotic action. If the products of synthesis are rapidly removed either by being deposited in an insoluble form, as for example starch or glycogen are, or by being carried away in the blood stream, the synthetic process may be continuous, since equilibrium is not reached.

Oxidation.—As is well known, the living organism is able to burn food materials, such as glucose, fat and so on, which are only oxidized with such extreme slowness by atmospheric oxygen that combustion appears to be absent in many cases. The mechanism by which oxidation is effected in the organism consists in making use by enzymes of products of oxidation of certain materials which are attacked by atmospheric oxygen. Although details of the mechanism are not altogether clear, the main facts are as follows. When a substance, such as an unsaturated fat or lecithin, is oxidized by oxygen as it exists in the air, it is said to undergo *autoxidation.* In this process, *pari passu* with the formation of the ordinary oxide, which of course affords available energy, a peroxide is formed by the aid of this energy. It appears also from Mrs. Onslow's work that the autoxidation may be hastened by an enzyme, thus affording a larger supply of the peroxide. But while a peroxide in itself has greater oxidizing power than oxygen in the molecular state has, or in other words its oxidation potential is higher, this potential is not sufficiently high to attack glucose or lactic acid. If, however, a small amount of a ferrous salt be added, a catalytic separation of oxygen in an " active " state occurs and such refractory materials as lactic acid are then oxidized (Fenton's reaction). Whether active oxygen is atomic or whether it is in the process of changing its valency, as Ramsay used to teach, is uncertain. The important fact is that we find in living organisms an enzyme, " peroxidase," capable of acting on peroxides in the same way as the iron in Fenton's reaction. Indeed, it seems likely that either iron or manganese is the responsible constituent of the enzyme.

Oxidation or reduction may also be brought about by substances which remove hydrogen from water, thus leaving reactive oxygen. As Hopkins has shown, a sulphur group (S-S) may take up hydrogen to form HS-SH, while this compound in its turn may hand on hydrogen to an " acceptor," and so reduce it.

Integration.—Organisms behave as coördinated systems, not as collections of separate cells. There must accordingly be means of inter-communication between all parts. In the animal, the most obvious of these is the nervous system, which makes its appearance at a very early stage of evolution. It may be compared to the telephone system of a city, by which any part can be connected up with any other. This comparison is in many ways an instructive one. Any one subscriber can be put into communication with any other and his line is a " final common path " for messages from various sources. Thus, the nerve supplying any particular muscle is made use of in many various movements, since it can be connected up in the brain with different nerves conveying their respective messages from the sense-organs.

Details of researches on the activities of the central nervous system are beyond the scope of this article. In general it may be said that the conception of a series of alternative parallel arcs at different levels in the hierarchy has shown itself an illuminating one. When the higher arcs come into use, those of lower levels fall into disuse and become relatively resistant to the passage of impulses. These lower arcs still remain potentially active and when the higher parts are removed gradually become functional again, to a greater or less degree. In some cases, their activity is kept in check by the higher arcs and liable to become more or less excessive when the influence of these is removed. Such " release " phenomena play an important part in the manifestations of the nerve centres, especially in abnormal states.

Pavlov's method of " conditioned reflexes," by which physiological, objective, research on the cerebral cortex can be made, has already led to many valuable results. The part played by inhibitory processes has been shown to be a very important one.

As animals grow in size and complexity, some system analogous to that of mechanical transport by roads or railways becomes necessary. Oxygen has to be conveyed to all parts of the body from the place in which it is obtained from the air. The carbon dioxide and other products of chemical change require removal for the purpose of elimination by the organs devoted to this purpose. Food has to be taken from the alimentary canal to other organs in which it is burned or used for repair. As is well known, it is by means of the blood flowing in a voluminous network of tubes that this aspect of integration is effected. Thus, materials in quantity are carried from one organ to another. As regards oxygen and carbon dioxide, further remarks will be found below.

Much attention has naturally been given to the pump, known as the heart, which serves to keep the blood flowing through the vascular system. The most important recent work is that of Starling embodied in the *Law of the Heart.* It was found that all the responses of this organ to the demands of the circulation, apart from the effects of nervous reflexes upon it, could be explained on the basis of a certain property common to all muscle. This property, which was clearly brought out by the work of A. V. Hill, is that the magnitude of any given contractile effort depends on the *length* of the fibres when the contraction begins. Hence, the more blood enters the heart during rest the greater is the force expelling it in the next following beat. The property of muscle referred to shows that the source of the contractile stress must be sought in certain *surfaces* arranged longitudinally or in the direction of the pull exerted. (For recent work on the capillaries, *see* SHOCK.)

But the system of mechanical transport of a town serves to carry letters in addition to materials for actual use as such. The chemical substance of these letters is not utilized, but they contain messages by which a supply of something or other is ordered to be sent from its source to a place where it is wanted. The so-called " internal secretions," " chemical messengers " or " hormones " correspond to the letters of the postal system. These are produced in some organ and carried by the blood to other situations in which they set various processes into activity. Thus, for example, adrenaline is sent out from the suprarenal glands into the blood. Reaching the liver, it causes a supply of glucose to be set free and supplied to the body generally. It has, of course, other actions as well. We know many of these chemical messengers at the present time. They are formed in the thyroid, pituitary, pancreas, sex-glands and so on. In one or two cases their chemical nature is known, but for the most part this is not yet the case. It seems very probable that every tissue in the organism has its influence on other tissues. In the culture of tissues under the microscope,—a method of investigation which has now reached much perfection,—it is found that the growth and differentiation of one kind of tissue is greatly influenced by the presence of other tissues.

In the higher plants, this effect of one part upon another is well shown by the inhibitory effect of the apical growing tip upon the growth of other buds. The work of Child suggests that this effect is of the nature of a protoplasmic transmission of some influence rather than the diffusion of an actual inhibiting hormone, as was supposed by the previous workers.

Carriage of Oxygen and Carbon Dioxide.—Although it has been known for some time that it is the haemoglobin of the red corpuscles that carries oxygen from the lungs to the rest of the body, there is still much to learn about the mode in which this gas is attached to the haemoglobin. There are some puzzling phenomena, not the least of which is the fact that we know of no other chemical compound that takes up and gives off oxygen in a way similar to that of haemoglobin. In particular, one which combines with oxygen in proportion to the pressure of the gas up to a saturation point which appears, in the case of the blood pigment, to correspond with one molecule of oxygen to each molecule of haemoglobin. Much valuable work has been done on the relationship referred to, especially by Barcroft and his coadjutors, more especially on the way in which it is affected by changes in the conditions present in the blood and tissues. The problem is one of paramount importance in the life of the higher organisms.

The problem of the carriage of carbon dioxide is in a more disputed state. While some hold that it is effected by the proteins of the blood acting as acids and driving off carbon dioxide from sodium bicarbonate when the tension of carbon dioxide is lowered, others hold that this gas is carried by haemoglobin in the same way in which oxygen is carried. The decision necessitates difficult measurements and is still uncertain.

Regulation of Reaction.—Whether the sodium bicarbonate of the blood acts as a carrier of carbon dioxide or not, there is no doubt that it has an important function in preserving the neutrality of the blood. As would be expected from the fact that the various chemical processes take place with the intervention of colloids, they are very sensitive to changes in hydrogen-ion concentration. This is particularly the case with enzymes. The blood contains sodium bicarbonate, which in itself has an alkaline reaction, owing to hydrolytic dissociation, together with carbon dioxide which forms an acid when dissolved in water. The reaction or hydrogen-ion concentration of the blood is thus controlled by the relative proportion of these two constituents, and is normally at a very slight degree of alkalinity. If acid is formed anywhere and passes into the blood, it combines with part of the bicarbonate, driving off carbon dioxide and thus raising the acidity. But the respiratory centre is enormously sensitive to such a rise and removes carbon dioxide by increased ventilation of the lungs until it is reduced to a level corresponding to the reduction of the bicarbonate. It has been held by some that the proteins assist in the process, but it is very doubtful whether this effect is more than very trifling, if present at all.

Excretion of Waste Products.—The removal of one of the chief of these, carbon dioxide, has been discussed. The most important of the non-volatile products is urea, most of which is derived from the ammonia of the amino-acids absorbed in excess of the amount required for repair. There are a number of others in small quantity, some nitrogenous, others not, which, although not really of a toxic nature, are of no value. These are all non-colloidal and therefore pass freely through the wall of the blood-vessels. The colloidal constituents of the blood, mainly proteins, and the blood corpuscles do not normally pass through, except in a few places, such as the liver, where the membrane is incomplete. Owing to the pressure produced by the heart, there is a tendency to a continuous filtration through the walls of the blood-vessels of a solution containing all the diffusible constituents of the blood. But the proteins of the blood do not diffuse and, since they are such as to have an osmotic pressure of about 30 to 40 mm. of mercury, they may be regarded as attracting water with a force of this magnitude. Unless the blood pressure exceeds this value, therefore, no filtration occurs, and where it is below, reabsorption takes place. The pressure in the arterioles and beginning of the capillaries exceeds the osmotic pressure of the colloids, whereas it is lower than this in the rest of the circulation. In the greater part of the body, the filtered fluid escaping reabsorption is known as lymph. In the kidneys, the glomeruli are arranged so as to filter a large amount of fluid, which is the first stage of the production of urine. This process as described would suffice to remove all the waste products. But if the whole filtrate were allowed to escape from the kidney, not only would a large quantity of water be lost, but with it such valuable substances as salts and food materials, sugar and amino-acids. What we actually find is that the filtrate is caused to pass along a system of tubules, in the course of which a large part of the water, together with useful solutes, is reabsorbed, while the useless waste products are left in more concentrated solution. It has been shown by Cushny that if it be supposed that the fluid absorbed has invariably the normal composition and concentration of the blood plasma as regards diffusible substances, but without the waste products, all the phenomena of renal function can readily be explained.

It would appear that the chief function of the plasma proteins is to confer a colloidal osmotic pressure, so that excessive filtration is avoided. In the absence of such an osmotic pressure, not only would a large amount of liquid be exuded into the tissues, but there would be no force available for its reabsorption and a dropsical state would result. In fact, this is what happens when a simple salt solution is introduced into the circulation (*see* SHOCK).

On the basis of the theory given above, it will be noted that the energy for the actual production of the glomerular filtrate is provided by the blood pressure, that is, by the contraction of the heart. On the other hand, the cells lining the tubules have to do work against osmotic forces, since they remove a dilute solution from a more concentrated one. This work increases as the fluid passing along the tubules becomes more concentrated. It must be provided by some cellular mechanism analogous to a pump, requiring the provision of energy to actuate it. The investigations of Tamura indicate that this consumption of energy per unit time is unchanged, whatever may be the amount of urine produced by the kidney. Hence, the more concentrated the glomerular filtrate, the less fluid is reabsorbed from it.

Stimulation and Environment.—The capacity of an organism to respond in an appropriate manner to changes in its environment clearly depends on its power of properly appreciating such changes. Hence, the more richly endowed is an organism with means by which it is enabled to be affected by the various forms of energy impinging upon it, the better it is fitted to profit, both materially and intellectually, by knowledge of the outer world.

In order to understand the essential character of a receptor or sense-organ, as we call the structures by which such information is obtained, one or two fundamental facts brought out more clearly by investigations in recent years have to be considered.

Receptor organs are connected to the brain each by its own set of nerve fibres. These fibres proceed to special regions in the brain, and it appears that whatever the manner in which impulses are set in motion along the fibres, the process in them is the same. So that the fact that the sensations aroused are in one case light, in another taste, and so on, depends on the terminus in the brain. And from whatever source this terminal "centre" is aroused to action, the effect in consciousness is the same. If, for example, the trunk of a nerve of taste is stimulated, either electrically, mechanically, or chemically, a sensation of taste is evoked. A further fact that has been made clear by Adrian's experiments is that the nerve-impulse itself cannot be made other than of a definite magnitude by varying the strength of the stimulus. In any particular state of the nerve, if it is excited at all, the maximum response possible is obtained. In the case of the heart muscle, this fact has long been known and was given the name of the "law of all-or-nothing" by its discoverer, Bowditch. This law has now been shown to hold for voluntary muscle and for nerve. It is true that the work of Adrian was done on motor nerves, but no difference between these and sensory fibres in other respects has been shown to exist, and there is some direct evidence that the law holds in the case of the optic nerve. It appears then that the impulses travelling along nerves are the same in all cases and that their various results are due merely to the structures in which the fibres end. The statement applies also to efferent nerves, in that there is no difference in nature between nerves which have excitatory and those which have inhibitory action on the structures in which they end. The difference, as Langley pointed out, is in the manner in which their final connexion is made. The question is indeed an aspect of Müller's law of specific sense-energies. The name is not very explicit, but the law states that the excitation, however produced, of each nerve of special sense gives rise to its own peculiar sensation.

We see then that what is required in a receptor organ is that some process shall be set going in it on the incidence of a particular form of external energy, and that this process shall be such as to stimulate the nerve fibres arising from the organ. It is clear that receptors of a different kind are necessary in the cases of light, sound, heat, touch and so on. While the nerve fibre itself can be stimulated by pressure or by heat of sufficient intensity, it is insensitive to light or sound waves, and even in the former case its sensibility to direct action is far too small for the appreciation of the fine degrees of touch, temperature, etc., which is required. The state of affairs is well shown by the properties of the heat and cold spots on the skin. There are distinct receptors for temperatures above that of the skin and below it. The former give a sensation of heat, the latter of cold, and a temperature that feels warm to a heat spot has no effect on a cold spot and *vice versa*. Thus each is especially sensitive to its own appropriate stimulus. If an electrical stimulus or a temperature high enough to affect the nerve fibres directly is used, the sensation from a heat spot is one of warmth, the opposite from a cold spot. But the intensity of stimulus necessary is much greater than that required in the stimulus for which the particular organ is adjusted. The paradoxical fact that a temperature of 45°C. feels hot to a heat spot and cold to a cold spot is readily explained on the basis of stimulation of the nerves of the organ and the operation of the law of specific sensation. Although it is not easy to prove the fact directly, there is every reason to believe that, at all events in the higher senses, each separate nerve fibre has its own special connexion in the brain and its own individual sensation.

It was remarked above that, so far as evidence goes, all nerve impulses are alike. There is, however, a possibility, pointed out by Keith Lucas, that these impulses may, within the limits imposed by the refractory period, follow one another at different intervals of time. Then, if a particular nerve fibre is connected with two or more neurones in the centre, and if the properties of transmission or refractory periods of these "synapses" differ, it may happen that a rapid series of impulses may be able to pass one and not the others. In this way, a single nerve fibre may serve more than one purpose.

For further details the following books may be consulted: Starling, *Principles of Human Physiology* (3rd ed., London, 1920); Bayliss, *Introduction to General Physiology* (London, 1919); Bayliss, *Principles of General Physiology* (3rd ed., London, 1920). In the latter, references will be found in the "bibliography" to special monographs and original papers. (W. M. B.)

PICKERING, EDWARD CHARLES (1846–1919), American physicist and astronomer (*see* 21.582), died in Cambridge, Mass., Feb. 3 1919.

PINERO, SIR ARTHUR WING (1855–), English dramatist (*see* 21.625). Amongst his later plays are *The Mind the Paint Girl* (1912); *The Big Drum* (1915); *Mr. Livermore's Dream* (1917); *The Freaks* (1918); and a wordless play, *Monica's Blue Boy* with accompanying music by Frederic Cowen.

PIRRIE, WILLIAM JAMES, 1st Viscount (1847–), British shipbuilder and engineer, was born at Quebec May 31 1847, and educated at the Belfast Royal Academic Institution. In 1862 he entered the shipbuilding firm of Messrs. Harland & Wolff of Belfast, and by his industry and talent he rose to be its head, becoming partner in 1874 and later chairman. His success was particularly associated with the building by his firm of the White Star Line steamships, the first of the line, the "Oceanic," being launched in 1870. From 1896 to 1897 he was

Lord Mayor of Belfast, and in 1898 the freedom of the city was conferred upon him. In 1906 he was raised to the peerage as Baron Pirrie, and was for a time comptroller of the household of the Lord Lieutenant of Ireland, and pro-chancellor of Queen's University, Belfast. Towards the close of the World War, in 1918, he was made controller-general of merchant shipping. In 1921, on the King's visit to Belfast to inaugurate the new Parliament of Northern Ireland, he was created a viscount.

PISSARRO, LUCIEN (1863–), Anglo-French painter and engraver, was born in Paris on Feb. 20 1863, the son of the painter Camille Pissarro (*see* 21.652). He studied art under his father, and at the suggestion of Auguste Lepère took up wood engraving. In 1891 he came to England, and there began his studies in typography. In 1894 he started the Eragny Press and published a series of books, using until 1903 the Vale type designed by Charles Ricketts and afterwards the Brook type designed by himself. The initial letters, borders and illustrations engraved on wood were throughout mainly from his own designs, and sometimes show very skilful and refined use of colour and gold. Among the most notable productions of his press are *L'Histoire de Soliman Ben-Daoud* (1907); *Le Livre de Jade* (1911) and *La Charrue d'Erable* (1912), with illustrations engraved in colour from drawings by Camille Pissarro, one of his son's few essays in reproductive engraving. He also produced a considerable number of isolated woodcuts. As a painter, he uses the "spectral palette" of the impressionists, and works in a high key. He early devoted himself to the study of subtle gradations and variations in colour, and adopted a pointillist technique, afterwards modified into a broader method of handling, with more emphasis on design. His work is almost entirely English landscape, notable recent examples being "Coldharbour, Teatime" and "Crockhurst Lane, Coldharbour." He became a member of the New English Art Club, was a member of the Camden Town Group, and was the principal founder of the Monarro Group. He became a naturalized British subject in 1916. He is represented in the Tate Gallery, and in the art galleries of Leeds and Manchester.

PISTOL (*see* 21.654).—During recent years the automatic pistol has been gradually perfected and adapted to replace the revolver as a military side arm, despite the fact that there are many who maintain that the revolver is the more dependable weapon. The automatic pistol, like all complicated mechanisms, occasionally malfunctions, usually due to a defective magazine or cartridge. This disadvantage is, however, offset by the fact that from the pistol about three times the number of shots per minute may be fired as from a revolver; its magazines are changed instantly, thus giving sustained fire while loaded magazines are at hand. This gives a great advantage to the user of a properly working pistol, as a revolver is often useless at close quarters, such as obtained in trench raids, after its six shots have been fired. In such positions the volume of fire from a group of pistols is much greater than that from an equal number of revolvers even if a pistol is occasionally disabled by a jam.

Owing to its simpler mechanism, the revolver is more reliable for civilian self-defence where more than two or three shots are seldom required; the weapon then being unused and often neglected for long periods. The revolver is also considered superior to the automatic pistol in safety. In the latter, the loaded cartridge automatically inserted in the chamber after each shot is liable to be forgotten and left there when the magazine is taken out. To prevent accidental discharge from this source, some of the newer models have a "magazine safety," which prevents the pistol from being fired when the magazine is out. In addition, a "grip safety," which prevents discharge unless the rear part of the grip is pressed in at the same time the trigger is pulled; and a safety catch, which locks the slide and hammer, are often used. Recent models of revolvers show no improvements of note, and it is probable that with the attention now being given to the design of the automatic pistol, that weapon will eventually be made as reliable, safe, and quick to get into action as a good revolver.

In European armies previous to the World War, the pistol was used almost exclusively as an officer's side arm. Their weapons were of small calibre, ranging from 7·63 mm. to 9 mm., and lacked stopping power. During the war the use of the pistol and revolver was extended to include many branches of the service not armed with rifles, particularly by the United States, British and German armies. The large calibre weapons of the former armies gave them a great advantage in pistol fighting, and their use confirmed previous opinions that a large calibre heavy bullet of short range and low velocity is more effective in a pistol than a high velocity, small calibre bullet.

Automatic pistols have now been adopted by the armies of the United States, Belgium, Spain, Italy, Denmark, Portugal, Switzerland, Germany and Austria. The British navy has adopted the Webley automatic pistol. In the table on page 107, details are given.

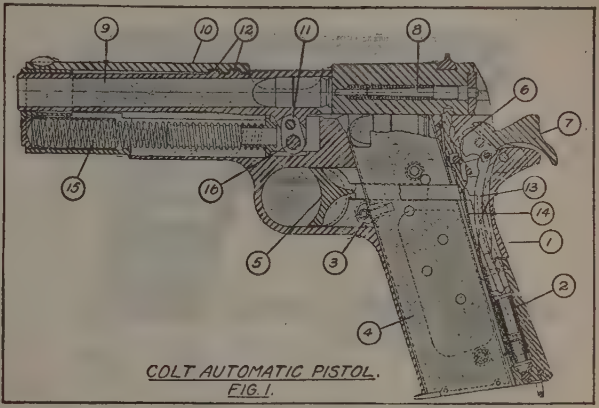

COLT AUTOMATIC PISTOL.
FIG. 1.

Colt Automatic Pistol.—The Colt automatic pistol, calibre .45 (fig. 1), was adopted by the U. S. army in 1911. This pistol differs radically from older Colt models in that it has a sloping handle, grip safety (1), spiral mainspring (2), an improved method of locking the barrel and breech, also an improved slide action and magazine catch (3). The magazine (4) has a capacity of seven cartridges. The ammunition for this pistol has a muzzle velocity of 800 f.s. with a 230-grain bullet. The striking energy is 329 ft. lb., which gives a penetration of 6 in. of white pine at 25 yards. The pistol is capable of great rapidity of fire, 21 shots having been fired in 12 seconds beginning with the pistol empty.

The action of the .45-calibre pistol, assuming that it is cocked and ready to fire, is as follows: When the trigger (5) is pulled, the sear (6) is released, and the hammer (7), actuated by the mainspring (2), goes forward and strikes the firing-pin (8), which transmits the blow to the primer of the cartridge. The pressure of the gases generated in the barrel (9) by the explosion of the powder in the cartridge, is exerted in a forward direction against the bullet, and in a rearward direction through the cartridge case against the face of the slide (10), driving the slide and the barrel to the rear together. The link (11), one end of which is fixed to the frame and the other to the barrel, causes a downward pull on the barrel when it recoils, which disengages the barrel lugs (12) from the slide, and the barrel is then stopped in its lowest position. The slide continues to move to the rear, opening the breech, and cocks the hammer (7) which moves the hammer strut (13) downward, compressing the mainspring (2). The sear (6) actuated by the sear spring (14) engages in the notch on the hammer (7). Extracting and ejecting of the empty shell are accomplished and the recoil spring (15) compressed until the slide reaches its rearmost position, when another cartridge is raised into loading position. The cartridge is forced into the chamber of the barrel by the return movement of the slide under pressure of the recoil spring. The slide during its forward motion encounters the rear extension of the barrel and forces the barrel forward; the rear end of the barrel swings upward on the link (11) to the normal firing position. When the slide and barrel reach their forward position they are positively locked together by the locking lugs on the barrel and their joint forward movement is arrested by the barrel lug encountering the pin on the slide stop (16). The pistol is again ready for firing.

The inertia of the slide augmented by that of the barrel is so much greater than the inertia of the bullet that the latter has been driven from the muzzle of the barrel with its maximum velocity before the slide and the barrel have recoiled to the point where the barrel commences its unlocking movement. This construction delays the opening of the breech of the barrel until after the bullet has left the muzzle and therefore practically prevents the escape of any of the powder gases to the rear after the breech has been opened.

This factor of safety is further increased by the tension of the recoil spring and mainspring, both of which oppose the rearward movement of the slide.

The U.S. army uses the pistol as the standard side arm. All officers and enlisted men in the cavalry, field artillery, tank corps, signal corps and machine-gun companies, and most of the officers and non-commissioned officers in other branches are armed with it.

In the shortage of pistols incident to the World War, Colt and Smith & Wesson revolvers of the same calibre, chambered for the same rimless cartridges, were used. The use of the rimless cartridge in the revolver was accomplished by providing semicircular loading clips which hold three cartridges by lugs which fit in the cannelure of the cartridge. The ejection is accomplished by this means. The clips make the loading much faster.

The Colt automatic pistol is also made in ·22-in., ·25-in., ·32-in., ·380-in., and ·38-in. calibre military models.

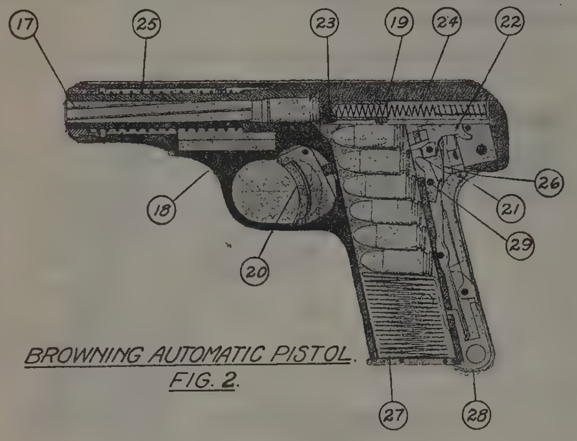

BROWNING AUTOMATIC PISTOL.
FIG. 2.

Browning Automatic Pistol.—The new model Browning automatic pistol (fig. 2) made by the Fabrique Nationale, Belgium, is representative of modern automatic pistols of pocket size. This pistol is made in 7·65-mm. (·32) and 9-mm. (·380) calibres. A military model of 9-mm. calibre is also made which is used by the Belgian army. The pistol shown is of the "blow back" type, the barrel (17) being locked to the frame (18), the slide (19) being free to recoil. On pulling the trigger (20) and pressing in the grip safety (21), the sear (22) revolves on its axis and releases the firing-pin (23), which actuated by the coiled firing-pin spring (24), moves forward and fires the cartridge. The inertia of the slide assisted by the recoil spring (25) delays the rearward motion of the slide until the bullet passes through the barrel. The slide then recoils, compresses the recoil spring and the firing-pin spring and ejects the empty cartridge case. When the notch in the under side of the firing-pin passes over the sear nose, the latter actuated by the sear spring (26) rises and holds the firing-pin in a cocked position. When the effect of the recoil is overcome, the slide moves forward in the usual manner feeding a loaded cartridge in the chamber. The magazine (27) is released by the catch (28), and when the magazine is taken out the magazine safety (29) locks the sear and prevents discharge.

Webley Automatic Pistol.—The Webley, the only automatic pistol manufactured in Great Britain, is made in ·25, ·32, ·380, ·38 and ·455 calibres (fig. 3). The latter size, which fires a 220-grain bullet, has been adopted by the British navy. The action is unique in that a flat recoil spring (30), situated in a recess in the right grip and compressed by the recoil lever (31), absorbs the recoil and returns the slide (32) to firing position. In the larger calibres, the barrel (33) is locked to the slide at the moment of firing and these parts recoil together a short distance; the barrel then rises upon diagonal cam-shaped lugs which unlock the slide and permit it to travel back alone. During this rearward movement, the empty case is ejected and the hammer (34) cocked. The forward motion of the slide then feeds a cartridge from the magazine in the chamber in the usual manner. The trigger (35) is connected with the sear (not shown) by means of a trigger auxiliary lever (36) and sear tail (37). The magazine is situated in the handle and holds eight cartridges.

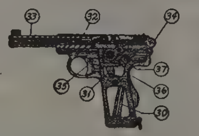

WEBLEY AUTOMATIC PISTOL.
FIG. 3

The ·32 calibre Webley pistol is used by the London metropolitan police. A ·25 calibre hammerless model has recently been brought out which has a spiral recoil spring parallel to the barrel in a recess in the slide.

Savage Automatic Pistol.—This pistol (fig. 4), which is extensively used in the United States, and has been adopted by the army and navy of Portugal, is made in ·32 and ·380 calibres. The magazine for the former holds ten cartridges; that for the latter, nine. The 1917 model differs from the previous one in that an outside cocking lever is added, and the shape of the grip changed to facilitate aiming. There is no grip safety or magazine safety on this pistol, the cocking lever indicating whether it is in firing position. The barrel and breech are locked at the moment of firing by means of a locking lug on top of the barrel which engages with an angular locking slot in the bolt and makes it necessary for the barrel to rotate about one-eighth of a turn to the right to unlock. The resistance of the bullet to rotation in the rifling tends to twist the barrel to the left and prevents the bolt from turning it to the right until the bullet leaves the barrel. The momentum of the recoil then forces the bolt back, the angular slot rotates the barrel and the rest of the cycle of operations is performed much as in the pistols already explained.

SAVAGE AUTOMATIC PISTOL.
FIG. 4

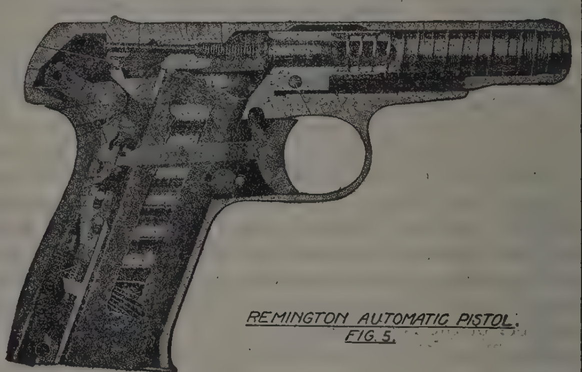

REMINGTON AUTOMATIC PISTOL.
FIG. 5.

Remington Automatic Pistol.—The newest (1920) model automatic pistol to be placed on the market is the Remington ·380 calibre automatic (fig. 5). In general this weapon follows the usual lines of automatic pistols. The breech closure is of the positively locked recoil-operated type. The recoil spring is held in a sleeve concentric with the barrel, and the magazine, which holds seven cartridges, is in the stock. The weapon has three safety devices: a grip safety, a side safety catch which also indicates whether the weapon is cocked or not, and a magazine safety which prevents the pistol from being fired when the magazine is withdrawn. The recoil when a shot is fired forces a movable breech block in the slide backward for about $\frac{3}{16}$ in., and into contact with recesses in the frame, this movement accomplishes primary extraction and transmits an initial thrust to the slide which is free to move backward against the recoil spring. This movement of the slide through a camming action lifts the breech block out of engagement with the frame and carries the breech back, cocking an internal hammer and ejecting the empty case. The chamber is reloaded in the usual manner on the return stroke. There are no screws in this pistol and it may be disassembled without tools other than the firing-pin.

European Pistols.—The German Parabellum (Luger) and Mauser pistols have been little changed from those described in previous editions of the *E.B.* The Parabellum 9-mm. calibre is the standard German military arm, but during the shortage, incident to the World War, they used a great variety of weapons, the principal ones being the Mauser, Bayard, Browning, Borchardt, Bergman, Pieper, Sauer and Dreyse. There were reported to be 28 different models of pistols and revolvers in use in the German army. The Parabellum is also used by the Swiss and Bulgarian armies.

A drum or "snail" magazine (fig. 6) holding 32 cartridges was applied to the Luger pistol during the war. This magazine consists of a straight section similar to the ordinary pistol magazine with a round enclosed drum at the bottom. There are two springs, one functioning as an ordinary magazine spring, and a flat drum spring resembling a clock spring which with its casing fills the drum except for space for a single row of cartridges around the edge. There is a lever and catch on the outside for winding this spring and a rotating feeding lever inside which fits in the cartridge space between the inner casing and drum. The magazine spring is compressed between the last cartridge and this lever, which being revolved by the drum spring pushes the magazine spring and cartridges around the drum as the pistol is fired. When the drum is empty the magazine spring functions in the usual manner. This style of magazine was also applied to the Bergman pistol gun and the Mondragon semi-automatic rifle. It destroys the balance of an arm and is of doubtful value.

The Bayard automatic pistol 9-mm. calibre is used in the Danish army. The commercial pistols of this make in ·32 and ·380 calibres are the smallest automatics of these calibres on the market. The Victoria is the smallest ·25 calibre. The Mannlicher is used by the Austrian army.

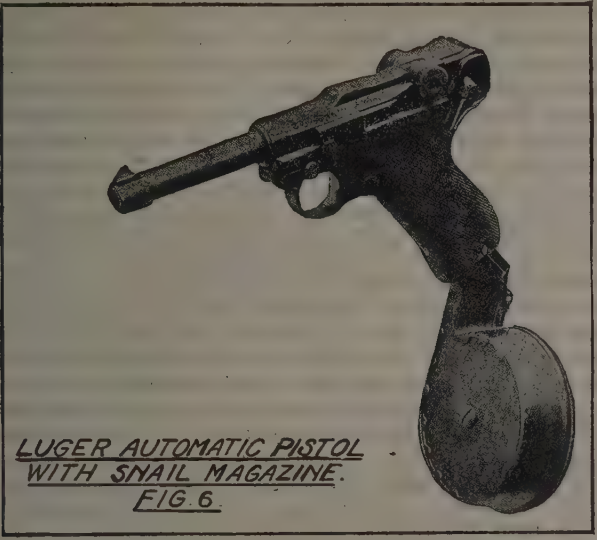

LUGER AUTOMATIC PISTOL WITH SNAIL MAGAZINE. FIG 6.

The Campo-Giro automatic pistol 9-mm. calibre was adopted by Spain in 1914. The principal merit claimed for it is that a special recoil check lessens the shock and permits more accurate firing.

Automatic Pistols and their Cartridges

Cartridge	Barrel Length, Inches	Weight of Bullet, Grains	Muzzle Velocity, Ft. Seconds	Energy of Bullet, Ft. Lb.
·22 Long rifle rim fire	..	..	..	..
·22 Colt Auto. target model	6½	40	765	51·8
·25 Auto. Colt, Webley & Scott, Harrington & Richardson (also interchangeable with 6·35 mm. Browning [Fabrique Nationale], Mauser, Pieper, Clement, Steyr, Victoria).	3⅛	50	733	59·7
7·63 mm. Mauser, Borchardt	5½	86	1,397	373
7·65 Luger	4⅝	93	1,173·5	284·3
·32 Auto. Colt, Webley & Scott, Savage, Harrington & Richardson (also interchangeable with 7·65 mm. Browning [Fabrique Nationale], Bayard, Mauser, Pieper, Schwartzlose, Clement, Steyr, Frommer).	4	74	964	152·4
·35 Smith and Wesson	3½	76	809	110·5
9 mm. Luger	4	125	1,039·2	299·8
·38 Auto. Colt, Bayard	5¾	130	1,146·3	379·4
·380 Colt Auto., Savage, Webley, Browning 9 mm. (Short), Remington, Bayard	3¾	95	887	116
·45 Colt Auto.	5	200	910·2	368
·45 Colt Auto., U.S. Government	5	230	809	335
·445 Webley Naval Automatic	..	220	710	..
·455 Colt Automatic	..	..	..	..

(H. O'L.)

PITTSBURGH (*see* 21.678) had, according to the U.S. census of 1920, a pop. of 588,193. The increase over 1910 was 54,288 or 10·2%. After the 1920 census was taken the township of Chartiers, with a pop. of 5,000, was annexed, petitions were filed for the annexation of the borough of Homestead with a pop. of 20,452, and a movement was on foot for the merger of the boroughs of Wilkensburg (24,403), Ingram (4,000), Grafton (5,934) and others. Within the metropolitan district of a 10-m. radius, but outside the city limits proper, there was a further population equal in number to that within the municipality itself. In Allegheny county, of which Pittsburgh is the county seat and business centre, there were in 1920 1,184,832 persons, 13·6% of the total pop. of Pennsylvania.

The sesqui-centennial of Pittsburgh, elaborately observed in 1908, marked the beginning of a new period of corporate, educational, social and material development. By legislative enactment (1911) the former Common and Select Councils gave way to a small council of nine members, elected by general vote of the entire city. The mayor continued to appoint the heads of departments (safety, works, health, charities, supplies, property, water, treasury). The comptroller also was elected as formerly by popular vote. The expanding of public business in the city and county, exceeding the capacity of the city hall and the court-house, led to the erection by joint action of a new City-County Building, a fine structure of nine stories. The county in 1920 was completing a twin tunnel under Mount Washington to connect the southern hill district with the city by a high level bridge over the Monongahela river, which will bring that district within 15 minutes' transit of the centre of the city. In 1919 the taxable valuation of Pittsburgh was $1,113,667,425, and the tax rate in 1921 was, for the city, 20 mills on land, 14 mills on buildings and 8·50 mills for school purposes. In 1919 a bond issue of $22,500,000 was voted by the people for subway, boulevards, playgrounds, bridges, parks, etc.

The value of Pittsburgh's products in 1919 was $602,582,300, compared to $246,694,000 in 1914. In 1920 it held sixth place in bank clearings ($8,982,887,399) and first place in *per capita* deposits (total $817,013,249) and in the manufactured products—iron, steel, glass, electrical machinery, steel cars, tin-plate, air brakes, fire-brick, white lead, pickles and preserves, corks and aluminium. The production of pig iron in the city in 1919 was 31,015,364 tons and in the surrounding district 7,440,746 more, a total of 38,456,110 tons. Metal and metal products were valued at $324,261,900; chemical products $2,045,800; clay, glass and stone products $4,345,500; clothing manufacture $7,122,800; slaughtering and meat-packing $21,134,700; confectionery $6,490,500; leather and rubber products $5,589,700; cork-cutting $4,016,500; oil-well supplies $3,678,100. The production of radium in 1920 (18 gr.) probably exceeded that of the rest of the world. The sum of $970,072,700 was invested in 2,580 industrial plants, mills, foundries and furnaces, in which were employed 221,621 men, with a daily pay-roll (1920) exceeding $2,500,000. The annual tonnage of Pittsburgh is 2½ times the combined tonnage of New York, London and Hamburg. As a port of entry the value of imports in 1918 was $6,391,960. The city's contribution to the Liberty and Victory loans was $625,429,600, to the Red Cross $10,194,765, and to the seven relief agencies $13,909,000, making a total of $649,533,365.

In 1911 the Legislature adopted a new school code for the entire commonwealth, coming into operation Nov. 11 1911. Under this code a Board of Education, consisting of 15 members appointed by the Common Pleas judges, took control. Separate school districts were abolished; a new city superintendent, with associate superintendents, was appointed; the scattered and unrelated school agencies were consolidated; new high schools and junior high schools established and buildings erected, such as the Schenley high school, built in 1916 at a cost of $1,500,000 and accommodating 2,000 students. New ward schools of modern construction were established. The teachers numbered in 1920 2,015 in 133 grade schools and 494 in 11 high schools, and the enrolment of pupils in grades was 74,654 and in high schools 12,169. There were in evening grades 198 teachers and 6,245 pupils, and in evening high schools 148 teachers and 5,090 pupils. The public-school system was supplemented by parochial schools which had in 1920 650 teachers and 33,000 pupils. In addition to the high schools there were a number of academies and other schools, 77 in all, on private foundations. The development of higher education during the decade was notable. The Holy Ghost College became Duquesne University, and in 1920 had 2,129 students, including department of law, 86 students, and evening school of accounts and finance, 1,120 students. The Carnegie Institute in the decade increased the extent of its service to the community; its central library, with 464,313 volumes, had 8 branches, 16 stations, 128 school stations, 10 club stations and 8 playground stations, with a circulation of 1,363,365 books; both the scientific museum and the art department added greatly to their collections; in the school of technology the enrolment grew from 2,102 students in 1909 to 4,982 students in 1920, including those in the departments of science and engineering, arts, industries and the Margaret Morrison school for women. The university of Pittsburgh, established in 1908 by assembling the scattered departments of what was the Western University of Pennsylvania, and taking over 43 ac. near the Carnegie Institute for a campus, grew rapidly in its new location, and in 1920 numbered 4,979 students. In the same year there were in the city 227 social, health, religious and welfare agencies.

After careful study of playground systems a bond issue of $800,000 was voted (1919) to initiate a constructive development of parks and playgrounds at public expense. Another civic improvement was the plan that a permanent committee of citizens should be engaged in the solving of the housing problem, and that the chamber of commerce, coöperating with the state, should employ a director in charge of the Americanization programme in which the public schools and corporations coöperate. The Society for the Improvement of the Poor, constructed and opened (1921) the Wayfaring hotel to accommodate 500 men. The 20 hospitals, modern in construction and equipment, with 4,500 beds, included special hospitals for children, eye and ear, maternity, tuberculosis, and contagious diseases. The Magee hospital, established by legacy of $3,500,000 under will of the late C. L. Magee, by agreement the maternity hospital of the university of Pittsburgh, is perhaps the most modern and complete maternity hospital in America. (S. B. Mc.)

PIUS X. [Giuseppe Sarto] (1835–1914), Pope (*see* 21.690), died Aug. 20 1914. Although the pontificate of Pius X. lasted only 11 years (Aug. 4 1903—Aug. 20 1914), it has been said that his work for the Church, reconstructive and reformative, surpassed that of any of his predecessors since the days of Sixtus V., who died in 1590. In the defence of the Faith, his condemnation of the 65 propositions of Modernism in 1907 will rank in Catholic theology as a parallel to the condemnation of the 68 propositions of Molinism by Innocent XI. in 1637 or the 101 propositions of Jansenism condemned by Clement XI. in 1713. The activity of the pontificate may be judged by the fact that its output of papal Bulls and greater official papal documents (counting only those published) exceeded 3,322. These bear upon undertakings and reforms of the first importance—the codification of canon law; the protection of the liberty of the Conclave by the abolition of the Exclusiva; the simplification and security of the conditions of marriage by the *Ne Temere* legislation; the restoration of the Rota as the supreme Court of Appeal; the regulation of the triennial or quinquennial visits of bishops to Rome; the legislation as to Church music; and the decree as to First Communion, and the encouragement of international eucharistic congresses; the reform of the Roman breviary; the founding of the biblical institute for the work of Scriptural research; the regulation of studies in the seminaries; the creation of the commission for the great work of editing the true text of the Vulgate; the reconstruction of the official machinery of the Roman Curia; the transfer of the English-speaking countries from the propaganda or missionary régime to the normal government of the Church. To these may be added in the domain of discipline the unflinching vindication by Pius X. of the Church's right to depose delinquent bishops, carried out even at the cost of rupture of diplomatic relations with France; an apostolic visitation rigorously carried out through the dioceses of Italy, resulting in four bishops being caused to resign on account of neglect or inefficiency; a further regulation by which no one can be proposed for a bishopric unless his promotion receives the visa of the Holy Office, which means that his past life has been free from ecclesiastical censure or reproach.

The well-known personal characteristics of Pius X. were his piety, charity, deep humility, simplicity, pastoral zeal, combined with great charm of manner to all who approached him. For war he had nothing but horror and it was the shock of the outbreak of the World War that hastened his death. It is said that one of his last acts was to refuse the request of the Austrian Emperor to bless his soldiers, saying, "I do not bless war: I bless peace." (J. Mo.*)

PIUS XI. [Achille Ratti], elected Pope on Feb. 6 1922 at the Conclave following the death of Benedict XV., was born May 30 1857, at Desio, near Milan. He came of a middle-class Italian family, his father, Francesco Ratti, being manager of a textile factory. Achille was the third of six children, and was educated for the priesthood at the seminary of Milan and the Lombard College in Rome, becoming deacon in 1877 and priest in 1879. Devoting himself to study, he took doctorates in philosophy, theology and canon law in Rome, and in 1882 became a teacher in the major seminary at Milan. In 1888 he was chosen one of the college of doctors of the Ambrosiana Library in Milan, where he worked assiduously, becoming librarian in 1907, and attaining so high a reputation as a scholar that in 1910 he was also appointed by Pius X. vice-prefect of the Vatican Library. He was prefect of the Vatican Library from 1913 to 1918, and in this capacity was made a monsignor. During the war years his exceptional gifts as a diplomatist impressed themselves on Benedict XV., who, in the spring of 1918, sent him as Papal Nuncio to Poland, where his success led to still further distinctions. In June 1919 he was created Archbishop of Lepanto, in April 1921 Archbishop of Milan, and in June 1921 cardinal.

PLENER, ERNST, Freiherr von (1841–), Austrian statesman, was born on Oct. 18 1841 at Eger in Bohemia, the son of the excellent Austrian statesman Ignaz von Plener (1810–1908). He began his diplomatic career in 1865, and served in the Paris and London embassies until 1873. In the latter year he was elected by the Chamber of Commerce of his native place to the Chamber of Deputies of the Reichsrat, where he was soon reckoned among the most conspicuous members of the Constitutional party. In the Taaffe period (1879–93) he was one of the leaders, and from 1888 the acknowledged head of the German-Liberals in their struggles against the Slav-Conservative majority in the Chamber. Consequently he represented Germanism on the nationalities question, but was not averse to concessions compatible with the maintenance throughout the whole monarchy of the position due to the German Austrians. He sought to compromise the quarrel between Germans and Czechs, and the so-called "points" of 1890, a summary of the bases for a German-Czech understanding, were essentially his work. In the Windischgrätz Coalition Ministry (1893–95), Plener took over the portfolio of Finance. Soon after his retirement from the Finance Ministry, Plener was appointed president of the Supreme Audit Department (*Oberste Rechnungshof*). He became a member of the Upper House in 1900.

Plener wrote a series of economic and political works, among others *Die Englische Fabriksgesetzgebung* (1871); *Englische Baugenossenschaften* (1873). His speeches were published by his friends in 1911. He himself published *Erinnerungen* (3 vols., 1911–21). (A. F. Pr.)

PLUMER, HERBERT CHARLES ONSLOW PLUMER, 1st Baron (1857–), British field marshal, was born March 18 1857, and entered the army in 1876. He served on the Red Sea Littoral in 1884, and in 1896 commanded a mounted regiment in the Matabele Campaign, for which he was promoted brevet lieutenant-colonel. Before the outbreak of the South African War in 1899 he was sent out to the Cape on special service, and he raised the Rhodesian field force, which he commanded during the early months of the contest. He assisted in the relief of Mafeking, and was promoted colonel, appointed A.D.C. to the Queen, and given the C.B. In the later stages he was constantly in command of a column or a group of columns, and he was promoted major-general on the conclusion of hostilities. He commanded a brigade at home from 1902–4 and was then appointed quartermaster-general at headquarters, a position which he vacated at the end of 1905; shortly afterwards he was appointed commander of the 5th Division. He was promoted lieutenant-general in 1908 and in 1911 was placed in charge of the Northern Command.

In May 1915 Sir Herbert Plumer was selected to lead the II. Army on the western front, and shortly afterwards he was promoted general. His army was not very actively engaged during the remainder of 1915, nor yet in 1916, in which year he was given the G.C.M.G. for his services. But on June 7 1917

Plumer gained a signal victory at Messines on the opening of the Flanders offensive, for which he was given the G.C.B. Three months later he assumed charge of the operations east of Ypres, which had been making slow progress, and his dispositions were for a time highly successful; but the recovery of the whole of the high ground could not be accomplished owing to the lateness of the season. Then, just as the Flanders offensive concluded, he was in Nov. selected to take charge of the British troops that were being sent to the basin of the Po after the Italian defeat at Caporetto. He commanded them until March; but he was then summoned back to Flanders to resume leadership of the II. Army just before the great German offensive started. During the later stages of the hostile effort his troops were forced back some miles, but they succeeded in checking the enemy. Then, when the general advance of the Allies began in Aug., his army took a very prominent part in the operations by which Belgian Flanders was recovered from the invaders. For his services in the war he was raised to the peerage as Baron Plumer of Messines and of Bilton, was promoted field marshal, and received a grant of £30,000. He subsequently commanded the British forces on the Rhine for a short time, and in June 1919 went out to Malta as governor and commander-in-chief.

PLUNKETT, SIR HORACE CURZON (1854–   ), Irish politician (*see* 21.857), after his retirement in 1907 from the vice-presidency of the Irish Agricultural Department, took no prominent part in politics till the crucial year 1914. In Feb. of that year, when suggestions for an agreed settlement of the Irish difficulty were pouring in from all sides, he came out, in a long letter to *The Times*, with a scheme of his own, under which Ulster should accept the Home Rule bill, but should have a right to secede after a term of years, while the Ulster Volunteers should become a Territorial Force, partly as an ultimate safeguard of the Ulster Unionists. Hitherto he had been regarded as a moderate Unionist, but this suggestion rendered him suspect in Ulster eyes, and the suspicion was confirmed when he published in the third week of July a pamphlet entitled *The Better Way: an Appeal to Ulster not to Desert Ireland*, in which he announced his conversion to Home Rule and appealed to Ulster to give Home Rule a chance, re-stating the arguments of his previous letter, and suggesting a conference of Irishmen on the bill. This was his attempt to avert civil war; but the situation was revolutionized by the outbreak of the World War. Once again, in 1917, a year after the Dublin rebellion, he took the lead in an honest attempt to solve the Irish question. When Mr. Lloyd George set up a comprehensive convention of Irishmen to consider the matter, and report their conclusions, there was great difficulty in finding a suitable chairman; but the first meeting unanimously chose Sir Horace for the post. He was himself sanguine, and worked at his task with singular devotion; but the absence of Sinn Fein from the gathering, the impossibility of reconciling the views of the Ulstermen and the southern Unionists, and the occurrence of a number of tragic events in Ireland, prevented the adoption of any report with colourable unanimity. In 1920–1 he was a prominent advocate of "Dominion Home Rule" (*see* IRELAND: *History*).

PODMORE, FRANK (1856–1910), English psychologist, was born at Elstree, Herts, Feb. 5 1856. Educated at Haileybury and Pembroke College, Oxford, he became interested in psychical research, and was closely associated with Edmund Gurney and F. W. H. Myers in the telepathic and psychical investigations described in their joint publication *Phantasms of the Living* (1886). He also published *Apparitions and Thought Transference* (1894); *Studies in Psychical Research* (1897); *Modern Spiritualism* (1902) and other works on the subject. He was found drowned near Malvern Aug. 15 1910.

POINCARÉ, JULES HENRI (1854–1912), French physicist (*see* 21.892), was born at Nancy April 29 1854, and educated at the *lycée* in that town. As a boy he served in an ambulance corps during the Franco-Prussian War of 1870, and later passed with distinction through the École Polytechnique in mining, becoming a mining engineer, but soon abandoning practical work for teaching, first at Caen and later in the university of Paris. He won the King of Sweden's open prize for a mathematical treatise in 1889, and in 1908 was elected to the Académie Française. He was a voluminous writer on his own special subjects. Some details of his contributions to science are given in 19.859, 25.786 and 26.947. He died in Paris July 17 1912.

POINCARÉ, LUCIEN (1862–1920), French physicist (*see* 21.892), was born at Bar-le-Duc July 22 1862. After a distinguished academic career he became in succession inspector-general of physical science in 1902, director of secondary education at the Ministry of Public Instruction in 1910, director of higher education in 1914 and rector of the Académie de Paris in 1917. In that capacity he received President Wilson at the Sorbonne on the occasion of his visit to Paris for the Peace Conference. He died in Paris March 9 1920.

POINCARÉ, RAYMOND (1860–   ), French statesman and writer (*see* 21.892). After the fall of the Sarrien Ministry in 1906 M. Poincaré ceased for some years to take an active part in politics. On Dec. 9 1909 he was made a member of the French Academy. In 1911 he was invited to join the Monis Ministry, but refused. His opportunity came at the beginning of 1912, and on Jan. 13 he became head of what was popularly known as the "great" or "national" Ministry, in which he also held the portfolio of Foreign Affairs. As Prime Minister Poincaré aimed at safeguarding the interests of France abroad, especially against the menace of the Triple Alliance, and at strengthening her at home by firm government and the restoration of social discipline. In this he was helped by the revival of a strong national feeling in France, provoked by the international crisis of 1911. The fact that he was a Lorrainer prejudiced public opinion in his favour, and his popularity was increased by his foreign policy—especially the successful establishment of the French protectorate over Morocco and the conclusion of the naval agreement with Russia. In Aug. 1912 Poincaré went to St. Petersburg to confer with the Tsar and his ministers about the Franco-Russian Alliance and the new developments of the Eastern question, a visit which countered the somewhat depressing effect in France of the meeting of the German and Russian Emperors at Baltic Port on July 4. The Balkan Wars, and Poincaré's attitude towards the problem raised by them, greatly increased his prestige; he declared on Dec. 4 to the Foreign Affairs Committee of the Chamber that he was determined to secure respect for the economic and political interests of France, not only in the Balkan Peninsula, but in the Ottoman Empire generally, and especially in Syria.

At the beginning of 1913 he became a candidate for the presidency. This action excited strong personal as well as political feeling, and his election was hotly contested, the second and third ballots showing a majority for his most serious competitor, M. Pams. On appeal to the National Assembly, however, he was ultimately elected by a majority of 187 votes over M. Pams, his inauguration taking place on Feb. 18 amid great demonstrations of popular enthusiasm. Two days later he showed that he intended to exercise the right of the President to address Parliament direct—a right which had fallen into desuetude—by sending a message to the Chambers, in which he stated that it was his function as President "to be a guide and adviser for public opinion in times of crisis" and "to seek to make a rational choice between conflicting interests." His activities as President were still directed to strengthening the internal and external position of France. In June 1913, after inspecting the fleet at Toulon, he paid a State visit to England (24–27), during which he enlarged on the necessity of the perpetual association of the two nations "for the progress of civilization and the maintenance of the peace of the world." In the autumn he made a motor tour of the south of France,—being greeted everywhere with popular acclamation, the bands playing the irredentist march "Sambre et Meuse,"—and attended the army manœuvres at Toulouse. His State visit to Spain followed in October.

The President's activity and enormous popularity roused the anger of the Opposition parties, and the Radical-Socialist congress at Pau, on Oct. 17, passed a resolution condemning "the aspirations of personal policy." This had no effect, however, on public opinion, and Poincaré's popularity was undiminished during the months immediately preceding the outbreak of the World War. On the very eve of the war, immediately after the rising of the Chambers on July 15 1914, Poincaré set out on a State visit to Russia and the Scandinavian countries, arriving at Kronstadt on July 20. His visit to Sweden was, however, interrupted by the serious news from France, and on the 29th he was back in Paris. He now made a personal appeal to King George V. to use his influence in favour of peace, while the Ministry asked for the armed intervention of Great Britain. After the outbreak of war his activities were mainly directed to stirring up the patriotic spirit of the people, as in his messages to the Chambers of Aug. 4 1914 and Aug. 5 1915, or his speech on July 14 1915 on the occasion of the transference of the remains of Rouget de Lisle, the composer of the "Marseillaise," to the Invalides. On Oct. 4 1914 he also visited the French head-quarters.

After the conclusion of the Armistice Poincaré made a tour in Alsace and Lorraine, his official entrance into Metz taking place on Dec. 4 1918. On Jan. 18 1919 he opened the Peace Conference in Paris with a short speech, in which he emphasized "justice" as the guiding principle of the victorious Allies. His term of office expired on the following Feb. 18. He subsequently accepted the presidency of the Reparations Commission, which he resigned in May 1920 as a protest against what he considered to be the undue leniency shown to Germany. This became the text of a violent press campaign which he carried on, against the policy of the Supreme Council in general and of Mr. Lloyd George in particular (*see* FRANCE: *History*). During 1920 and 1921 it was Poincaré's influence that was mainly dictating the aggressiveness of French feeling in international politics; and during the latter part of Briand's premiership, culminating in Briand's visit to the United States for the Washington Conference at the end of 1921, it was Poincaré who was fomenting the criticism that French interests were being undermined. The result was seen when, in the midst of the Cannes Conference in Jan. 1922, the proposal for an Anglo-French treaty of defence led to Briand's hasty return to Paris to answer interpellations with regard to his policy in the Chamber, and to his sudden resignation on Jan. 13 without facing discussion on a vote of confidence. Poincaré was at once entrusted by President Millerand with the formation of a new Cabinet, which he completed on Jan. 15, and French policy under his premiership was now given a definitely Nationalist orientation.

Poincaré's published works include *Du droit de suite dans la propriété mobilaire* (1883); *Idées contemporaines* (1906); *Questions et figures politiques* (1907).

See Henry Girard, *Raymond Poincaré* (1913); *Raymond Poincaré, a sketch* (1914); *Larousse Mensuel*, No. 158 (1920).

POISON GAS WARFARE.—The use of poisonous gases in warfare, as started during the World War, was only made possible by modern progress in chemistry. From a purely objective point of view, and apart from all ethical considerations, it should be observed that fighting-men have, at some time or other, adopted any means of making war, however ruthless. Poisoned weapons and poisoned wells are as old as history. The ancient Greeks indeed used sulphur fumes, and the Byzantines "Greek fire"; and in mediaeval sieges carcasses of dead animals were thrown over the defences from mangonels, in order that their putrefaction might spread disease. Underground warfare in all times has been marked by attempts to drive the enemy from his galleries with smoke and suffocating fumes. The usages of chivalry, while prescribing courtesy to prisoners, imposed no limit on means of destroying life. Only in the 18th century, when war in western Europe became a very formal affair, did a tendency appear to set such limits. Both Louis XIV. and Louis XV. declined the use of "infernal liquids" offered to them by chemists. Later the tendency to impose moral restrictions became more definite. Lord Dundonald's proposal for the use of asphyxiating smoke-clouds at the siege of Sebastopol was rejected by the British Cabinet. In 1865 at Châlons experiments with asphyxiating shells were made on dogs before Napoleon III., who stopped the trials and declared that such barbarous means of destruction would never be employed by the French army because they were against the "law of nations." In the S. African War of 1899–1902, the Boers thought they were justified in complaining of the injurious effects of the gases given off by the British high-explosive shells. It was only indirectly that the Hague Convention limited the use of gas. It forbade, by Art. 23 (e), the use of weapons calculated to cause unnecessary suffering; "poison or poisoned weapons" by Art. 23 (*a*). A separate declaration had, some years before (July 29 1899), forbidden the use of projectiles whose "sole object it was (*qui ont pour but unique*) to spread deleterious or asphyxiating gases." The method which actually arose in the World War—that of a fixed apparatus which propels liquid gas in a jet—had apparently not then been generally foreseen. If it had been, the use of poisonous gases would, no doubt, have been more explicitly forbidden.

It is one of the ironies of history that the first great war after the Hague Convention should have witnessed its entire uselessness to limit human suffering. Gases of a nature to cause lifelong injury, liquid fire, molten metal, burning phosphorus—all were employed with a prodigality limited only by the inventive powers of the combatants.

There was, of course, no objection to the use of gases and substances of the lachrymator class. The object of these is to cause temporary incapacity by violent smarting of the eyes, sneezing or retching, while the effect passes off when the subject is removed from the radius of action of the gas. Probably the earliest example of this class is the Chinese "Stinkpot"; and it is interesting to note that as the Chinese were before the Western nations in the use of gunpowder, so they also were in this early form of what, in the World War, came to be known as "Chemical Warfare," a term which in itself is really too wide for "gas warfare," since chemistry enters into explosives also.

At the time of the Russo-Japanese War the subject of lachrymators was taken up by the Japanese, and later by the British War Office. It was also investigated by the French for police purposes. The British experiments covered a wide range of compounds based mainly on iodine, bromine and picric acid. The chief subjects of inquiry were effectiveness, keeping qualities and the effect of the liquid on the container. Nothing very highly effective was found, and it appeared that most of the liquids required a container of lead, glass or porcelain, on account of their action on steel or cast iron. The experiments were dropped some years before the World War, probably because, in the kind of warfare that was then anticipated, it did not appear that there would be much use for lachrymators.

In 1913 the question was submitted again to the British War Office. The Hague Convention was always kept in view, and it was considered that the term "deleterious" applied only to gases which caused permanent harm. As one chemist pointed out, poisons were prohibited by the convention, but disagreeable fumes were not. A few experiments were made with compounds of the lachrymator class in shells, and the question remained alive until in Sept. 1914, after the outbreak of war, it was decided not to use chemical shell of this type for the British army or navy.

Quite early in the World War stories began to be current on each side of the employment of gas shells by the other. In Dec. 1914, upon a semi-official suggestion from the British G.H.Q. in France, a section of the War Office, working with Sir William Ramsay's Chemical Sub-Committee of the Royal Society, took the question up again. By this time trench warfare was fairly established and the armies of both sides were immobilized in trenches, facing each other in some places at a distance of only a few yards. All possible means of trench fighting had to be considered, and among other things it was thought that, if a sufficient number of lachrymating grenades could be thrown from the British front trenches into those of the enemy, he might be forced to evacuate them temporarily, or might at least have his fighting power considerably reduced by being forced to the constant use of a protective mask.

In Jan. 1915, an idio-acetate compound was brought forward which caused such smarting of the eyes that it was impossible to remain in its neighbourhood. By that time catapults were available which could throw a 2-lb. projectile 200 yards, a distance which brought the enemy's trenches within range in many parts of the line. A tinned iron cylindrical grenade was therefore designed to hold 2 lb. of liquid, which by means of a 5-second time-fuze and detonator was made to burst and distribute the lachrymator in a fine spray. The British War Office and G.H.Q. approved of this grenade, and the manufacture was put in hand. At the same time many other substances were considered, mostly lachrymators and sternutators. Some of these compounds appeared to be very effective under experimental conditions, but were not so in the field.

While these modest tentatives were proceeding, always within the limits laid down by the Convention and the Declaration, the first German gas attack took place on the Ypres front on April 22 1915. This immediately altered the whole situation, as it was obvious that in using chlorine—an asphyxiant—the Germans had transgressed, if not the letter of the Declaration and the Convention, certainly their spirit. Accounts of the sufferings of those who had been exposed without protection to this new form of attack roused great indignation, but its effectiveness could not be ignored, and after a few days it was decided by the British authorities that preparations at least must be made to reply to the German gas offensive in the same manner. The section of the War Office that had been dealing with lachrymating grenades was instructed to take up the question, and with the aid of two or three chemists of the highest standing a small council was formed which sat continuously to discuss ways and means and consulted all the most prominent chemists and manufacturers. It soon became evident that the Germans had employed chlorine gas discharged under pressure from cylinders placed in the front line of trenches. A rapid review of all possible means of reply showed that chlorine was the easiest gas to begin with, but the position of Great Britain in this matter was very different from that of Germany. For the ordinary processes of the dye industry, the Germans produced in peace-time very large quantities of liquid chlorine. In England only one or two firms produced it, and that in very small quantities. Moreover, the available containers for transport of the chlorine were not only very few but were much too bulky and heavy for use in the field. The problem therefore was twofold: first, to install apparatus for an enormously increased supply of liquid chlorine, and secondly to design and manufacture suitable cylinders or dischargers for its use in the field. In both cases many initial difficulties were encountered, which were overcome in due course, and on Sept. 25 1915, at Loos, the first British gas attack with chlorine took place.

Meanwhile a very large range of possible gases had been passed under review with the object of discovering substitutes for chlorine. Obviously the thing to aim at was something which was more directly lethal than chlorine, and at the same time would cause less suffering by its effects. It was also realized from the first that the discharge of gas from the front trenches necessitated waiting for suitable weather conditions, which was very inconvenient for the arrangement of tactical operations; and it appeared to be necessary to release the gas in the enemy's lines, so as to be independent of wind, which could best be done from gun shells or trench-mortar bombs. The principle was approved and a new class of problems had now to be faced.

Effects of Gases.—At this point it will be convenient to consider the effects produced by different varieties of gases, and the methods of employing them.

When considered from the point of view of their physiological effect, war gases may be classed in two main divisions, (*a*) Lethal, and (*b*) Irritant. The lethals fall under the two heads: those whose action is instantaneous or practically so (specific); and those whose action is more or less delayed, and is generally of an asphyxiating character.

A gas is classed as immediately fatal when death follows exposure for a period of two minutes to a certain concentration (*i.e.* a certain proportion in the air breathed). A higher concentration may cause instantaneous death. The only known compounds which, in concentrations practically obtainable, produce immediate death, are those containing cyanogen. The chief disadvantage of these is that when the concentration is not sufficient to cause death they have no effect at all, or only temporary faintness, headache or heart trouble. The other lethal compounds may have immediate injurious effects, such as headache, nausea, etc., and in high concentrations may cause death in a short time. In concentrations which are not strong enough to kill, they may cause casualties, which have the disadvantage that as the action is delayed a man may be able to continue fighting for some time after exposure. Thus in the case of phosgene, a man who does not notice that he has been gassed may die suddenly as much as 48 hours later.

The irritant gases are divided into (*a*) Lachrymatory (affecting the eyes), (*b*) Sternutatory (causing sneezing), (*c*) Vesicatory (blistering).

Lachrymators, on account of the extreme sensitiveness of the eye, can produce an effect in extraordinarily weak concentrations, such as 1 in 1,000,000 parts, or even less. Protection can be given by well-fitting goggles, but goggles cannot be used when there is a chance of exposure to lethal gases, because they would interfere with the gas-mask. The presence of lachrymators therefore entails the wearing of the complete mask, with all its disadvantages. The principal bases for lachrymators are iodine and bromine.

The sternutators were originally considered from the point of view of putting a man temporarily out of action by a violent fit of sneezing. A more important use suggested itself later, namely, that a man could be prevented by sneezing from adjusting his gas-mask, and would thus be exposed to the action of lethal shell. Similarly, if a sternutator could be found to penetrate the gas-mask it would be impossible for the wearer to keep it on. Early in the war there were many reports of the intended use by the Germans of red pepper and capsicine. Many experiments were tried by the British with capsicine and similar agents, but they did not give good results. In the summer of 1917 the Germans introduced shells filled with diphenyl-arsenious chloride (Blue Cross shell). They used a great many of these, especially on the French front, but not with any great success. In view of their effect on the wearing of the gas-mask, these irritants require further investigation.

Vesicants are only practicable when they act in vapour form. In that case they are by far the most effective of all the irritants, as they attack the skin and all the mucous surfaces. Those first considered were effective only when they reached the skin as liquids, a condition difficult to secure, and they were therefore dismissed. But the German "mustard gas," also known as Yellow Cross and Ypérite (Sym. dichlordiethylsulphide), acting as a vapour, was immediately successful. It first appeared in July 1917. It attacked the skin through the clothing, causing burns and irritation which might last from a fortnight to two months. Acting on the eyes it caused blindness, usually temporary. Acting on the bronchial tubes it might cause bronchial pneumonia. It might affect the heart, and also the stomach, causing vomiting and diarrhoea. These effects were sufficiently serious, in view of the large numbers of casualties which were produced, although the proportion of fatal cases was small, being no more than about 3%. In this connexion it should be noted that substances of the irritant class may also be lethal in high concentrations, *i.e.* in concentrations higher than those necessary to produce the characteristic temporary disablement.

A very important consideration in the use of gas is what is known as "persistence." Cylinder gas, travelling with the wind, is effective over a particular area only while it passes; but liquid gas splashed on the ground in minute particles from a shell, or left in the ground by the smothered burst of a shell, may be effective for some time, and gases are classed as of "high persistence" or "low persistence" according to the time during which their effect remains. This depends on the rate of evaporation. A strong lachrymator may be effective on the surface for perhaps twenty hours; other irritants, such as mustard gas, may remain effective for days in suitable meteorological conditions. Left under the surface they may remain latent for still longer periods, and take effect when disturbed by digging. It will be understood at once that this is a question of great tactical importance. For instance, a bombardment with "high-persistence" shells of trenches shortly to be attacked would be an obvious mistake, since the attacking troops after capturing the trenches would not be able to occupy them. On the other hand, in a raid on trenches which it was not proposed to retain it would be correct to burst bombs of "high-persistence" gas in trenches and dug-outs. So also in using a gas barrage or in bombarding an area, high-persistence shells should not be used if it is intended shortly to attack over that ground. The use of vesicatory shells especially will deny a given area to both sides, or "nullify" it. Gas shell is now classified not according to its physiological effect, but according to tactical use, viz. as persistent or non-persistent, the former being used for neutralization (*e.g.* mustard gas) and the latter for surprise destructive bombardment (*e.g.* phosgene).

The questions may be asked—why use the irritant type of gases at all if lethals are available? and among the lethal gases, why not use only the most powerful, namely, those which produce immediate death? In both cases the answer is found in the question of quantity. The specific lethal gases will only produce their effect in very high concentrations, which means that a large number of shells must be used simultaneously over a certain area. Shells of other types, though they may not kill at once, will produce casualties in very much lower concentrations. The question of the number of shells to be fired to produce a given effect is of great importance, not merely from the point of view of expense and the call on manufacturing resources, but still more in the field, as regards the number of guns required to fire the shells, the exertion of the guns' crews, and the question of transport. Again, an effective lachrymator will produce an atmosphere that cannot be endured in one-thousandth part of the concentration which the lethal shell would require for its purpose. This is a matter of great importance, especially in neutralizing enemy batteries. Lachrymators rather went out of fashion towards the end of the war, not only because the great munition efforts of both sides had produced an enormous quantity of lethal shell, but still more because the neutralizing effects and harassing effects which were their *raison d'être* could be obtained better by mustard gas.

Vesicating shells, which are of high persistence and whose effect is often delayed, are specially useful against targets behind the front line. Although a trench or strong point which it is intended physically to occupy cannot be subjected to mustard-gas bombardments, the use of this substance in combination with an attack round the flanks proved very valuable in reducing defences which could not have been carried either by assault or by explosive bombardments. The possibilities also of mustard-gas barrages in defence are very great. They should be used against communications, depots, railway stations, and especially staff offices, telephone exchanges and everything that affects the enemy's organization. An entirely odourless vesicator and one which does not produce a smoke easily recognizable will be particularly effective in this way.

As a general rule both lethal and irritant shells should be used in scientific alternation. With lethals, of course, the object is to catch the enemy unprotected by his masks, and in order to get a good effect a large number of shells must be fired at once. Such effects may be specially aimed at when large numbers of troops are known to be concentrated in certain places, previous to an assault. But it is also an important object to force the enemy to wear masks as long as possible, not only to fatigue him, but to exhaust the protective powers of the mask. This can be effected with irritants, and after some hours of bombardment with these, fresh bursts of lethal shells may be tried.

Methods of Employment.—The study of the characteristics of gas-clouds is very complicated. The cloud may consist of true gas, or minute drops of liquid, or infinitesimally divided solid particles. The last are known as "particulate clouds," and in their behaviour resemble a colloid vapour. Their action has to be studied physically and electrically as well as chemically.

The production of cylinder clouds, of course, is simple. The critical temperature of the gas employed must be above normal temperature. The liquefied gas is filled into a cylinder with a nozzle on the principle of a soda-water syphon. The cylinder is placed in position in the trench, and the nozzle is provided with a short length of pipe, which is placed on the ground in front of the trench, and ensures that the gas on issuing is well clear of it. The valve being opened, the liquefied gas is discharged with some force, and as its evaporation causes a fall of temperature a heavy cloud is formed which travels with the wind. The necessary density of cloud is obtained by opening simultaneously a sufficient number of cylinders per unit of length of trench, other cylinders being held in reserve to continue the discharge for the time considered necessary. At first the cylinders were placed in groups against the front wall of the trench. This method had the disadvantage that a cylinder might be burst at an inopportune time by an enemy shell, and later the Germans placed their cylinders under the floor of the trench, protected by sandbags, etc., while the British placed theirs in chambers excavated at some depth below the parapet.

The earliest cloud discharges lasted only twenty or thirty minutes, or at most an hour, the necessary concentration being calculated at ten tons of the chemical per km. of front attacked per hour. By the end of 1916 the French were using 100 tons per km. per hour, and the emission was continued for three or four hours. In the course of 1918 the British Special Brigade was using 200 to 250 tons of gas per km. per hour, and keeping up the cloud for eight, ten or even fourteen hours. The transport of gas cylinders up to the front trenches was naturally extremely laborious. It was very difficult to avoid attracting the enemy's attention to the carrying and emplacement of them, and there was always the risk of cylinders being burst by the enemy's shell. The results that were achieved under such conditions testify in the highest degree to the devotion and courage of the troops employed. The enormous discharges of 1918 were effected by loading the cylinders on trolleys and running them up to the front trenches on light railways just before they were to be used. The nozzles were opened by an electric device.

On the other hand the use of gas in shells presented all sorts of difficulties from the outset. It was first necessary to find gases that could withstand the shock of discharge from the gun and the effect of bursting the shell. Some of the most lethal gases could not be utilized because they were chemically unstable, and were liable to become decomposed into their constituent elements by shock. The cyanide compounds were to some extent of this nature, so that the Germans never used them. The French discovered a stable cyanide compound in which they had considerable faith, and the British used them to a certain extent.

Some stable lethal gases were found in due course, in addition to the irritants, and a whole series of problems presented themselves. The first question was the possible effect of the gas on the material of the shell. Some gases, such as phosgene, had no action on steel or cast iron. Others required containers of lead or porcelain; the French had a very effective method of blowing a glass lining into shell. The methods of sealing the shells and of filling and closing them offered merely technical difficulties, though these were considerable. The most suitable means of opening the shell was the next question, which had to be first considered, and then practically tested. The first gas shell used by the Germans contained a large proportion of high explosive; it is not known whether the idea was to follow the Hague Declaration in that the sole purpose of the shell should not be to spread deleterious gases, or to have a "double-purpose" shell, destructive and toxic. The result, however, was to produce an inferior explosive shell, while most of the gas was dissipated by the explosion.

The British efforts were directed at first to getting the maximum amount of gas into a shell and releasing it with as little disturbance as possible. The gas-cloud would issue in the form of an oblate spheroid which travelled down the wind, gradually enlarging and being diluted by the air. Without wind the gas would remain on the surface, settling down in trenches or depressions of the ground. For opening with the least amount of disturbance cast-iron shells were indicated, as they required practically no bursting charge; but cast-iron shells have the drawback that they hold much less liquid than steel shell, because the shell wall has to be very much thicker to resist the shock of discharge. It was eventually found that not only every gas but every nature and every calibre of shell required a different bursting charge, and sometimes a different explosive. These all had to be determined experimentally. Later it appeared that certain liquids required a more powerful burster in order that they might be distributed in a fine spray. When a solid was introduced, in the shape of diphenylchlorarsine, a still more powerful burster became necessary in order that the solid might be atomized and dispersed as a cloud. Thus the German 77-mm. shell contained only 125 gr. of this solid enclosed in a glass container, the space between the container and the shell being filled with 600 gr. of explosive.

While the output of chemical shells remained very small the question of cloud formation by lethal shells was of high importance. Not enough shells being available to charge the whole atmosphere over a certain area with a fatal concentration, it was necessary to rely on the effect of each individual shell cloud, which ought to pass over a man or group of men while still at full strength. With the very large quantities of shell that were available later this question was of less importance, as it became possible to produce and maintain very high concentrations over a given area or length of trench. This was facilitated by bringing the larger natures of shell into service, and also by the use of Stokes' bombs and trench-mortar shells, but still more by the Livens projector.

Since gas shells were intended to be used without considering the direction of the wind, the possible effect of a bombardment on one's own troops had to be considered, and a further range of experiments became necessary. The kind of precautions required are indicated in an extract from German Army Orders of June 30 1918:—

> The following regulations for gas bombardment are made known.
>
> Minimum distance of the objective from our first line:—
>
> (1) Wind normal or oblique towards the enemy: for all natures of gas shell the least distance must be 300 metres; below that distance projectiles fired short may fall in our lines. When the wind is steady and the ground favourable, this distance may be reduced if only a small number of projectiles are being fired.
>
> (2) Still weather, or wind normal or oblique towards our lines:—
>
> (a) Heavy bombardment (several thousand projectiles), ground favourable for the return of the gas towards our lines:—
>
> Blue Cross shells (Diphenyldichlorarsine—sternutators) . . . 1,000 metres (offensive).
>
> Blue Cross shells . . . 500 metres (defensive).
>
> Green Cross shells (Trichlormethylchloroformate—lethal) . . . 1,000 metres.
>
> Yellow Cross shells (Sym. dichlordiethylsulphide—vesicatory) . . 1,000 to 2,000 metres according to the number.
>
> (b) Light bombardments (some hundreds of projectiles), when our troops have been warned and the ground is favourable:—
>
> Gas shells of all natures: 300 to 500 metres. These distances are given for general guidance; they may be reduced or increased according to local conditions.

The influence of the state of the atmosphere and ground conditions on the use of gas is naturally of great importance. The first consideration is the wind. Lethal shells will produce the best effect with a wind of three miles an hour or less; with a wind of over seven miles they cannot be used effectively. Lachrymators can be used in higher winds up to twelve miles, but with diminishing effect. Heavy rain destroys gas effect. Dry weather and a bright sun tend to dissipate the gas quickly. The most favourable atmospheric conditions are little or no wind, moist atmosphere, and no sun. The night usually offers the best conditions for gas. As regards the effect of ground, it will be obvious that anything which protects the gas from the effect of wind assists concentration. Hollow ground, valleys, woods, areas covered with undergrowth, and villages make therefore good targets.

Field Organization.—The earliest British experiments on a field scale were made with extemporized appliances on the nearest open ground to the source of production of gases under trial. Some experiments not involving danger were made on a ground that had been acquired for flame-projector and explosive trials at Wembley, and at the Clapham School of Trench Warfare, but it was soon evident that a properly organized experimental ground was essential, and after much search a site was found at Porton near Salisbury. Here trenches and dugouts were made, artillery ranges prepared, and gradually a complete installation provided of laboratories, mechanical workshops, magazines, filling-rooms, gas-chambers, etc. It was now possible to experiment on a really scientific basis, while the ground available gave space for trial of many other trench-warfare requirements, among which smoke and incendiary shells and light signals were of great importance. Porton thus became the headquarters of the practical study of gas warfare. The laboratory experiments there were confined, however, to examination of the results of trials. Other laboratory work was done at the Imperial College, at Cambridge and other universities, and in private laboratories.

The first British experiments with gas-projectors showed the difficulties that were likely to arise with defective apparatus, or from changes of wind in the trenches; and it was realized at once that, for the handling of the new weapon, it was necessary to have some chemists in the front line who should be trained in the handling of the material, and who could also advise the troops on the effects of it. The suggestion of raising a Chemical Corps was put forward and approved; and as a result all the universities were invited to nominate students of chemistry, while at the front chemists were withdrawn from the ranks for the new corps. This was the beginning of the Special Brigade R.E. in which a certain number of selected students and officers already serving were given commissions, while others were appointed as non-commissioned officers to give them the necessary authority and position.

A certain number of officers and men were also appointed to it who were not chemists but had experience at the front. Thus the officer commanding the Special Brigade suggested working the men at cylinder emplacements in the trenches in pairs; one a chemist and the other an old hand from the infantry. The importance of having trained scientific men in the brigade was shown by the number of valuable suggestions that emanated from the officers, as well as by their extraordinary keenness and effectiveness in the field. After a short time selected officers from the brigade were appointed as chemical advisers at headquarters of armies and corps, and a central laboratory at General Headquarters was started for examining enemy gas and anti-gas appliances and dealing with urgent problems.

Organization in England.—In June 1915, upon the formation of the British Ministry of Munitions, the personnel hitherto engaged on chemical warfare was transferred to the ministry. The time had come for rapid expansion, and a Trench Warfare Department was created by the minister which was responsible for both design and supply, not only of chemical war material but grenades, trench mortars and projectiles, smoke shells, signals and the countless other requirements that modern trench warfare had made necessary. The staff, rudimentary hitherto, was increased in proportion to the requirements of experiment and manufacture, and a scientific advisory committee was formed of eminent specialists in chemistry, physics and physiology. This new department was unique in combining the functions of research, design and supply. The other departments of the ministry were concerned with supply only, in response to the demand of the War Office. It was decided after much discussion that this exception should be made for the Trench Warfare Department, because it was recognized that in dealing with so many entirely new products, the manufacture of most of which was attended by considerable danger, it was essential that the designers should be in the closest possible touch with the manufacturers, should be able to explain what was being aimed at, and should advise on difficulties as they arose. The resultant close contact enabled them also to modify their designs during manufacture when necessary; to take account of facilities for supply and manufacture; and to order supplies in advance as soon as a new production was foreseen.

There is no doubt that this was the right procedure, as was proved by the rate production up to the end of 1915. The weak points were that the department had to communicate with the front through the War Office, which caused delays and mistakes, and that defensive arrangements, the provision of gas masks, etc., so intimately connected with offensive research, remained with the War Office. But, for the rest, the department had only to obtain the approval of the War Office for new designs and material, with an indication of quantities to be provided, and could then make its own arrangements. To this, however, one very important exception had to be made; they were not allowed to design or manufacture gas shell, and as other branches were not in a position to design them this led to serious delays. These delays were accentuated by the fact that in 1915, when shells were scarce and the value of gas shell had not been proved, the authorities responsible for shell generally were very unwilling to allocate shells to gas.

Gas warfare both in France and Russia began with divided control, and as this gave very unsatisfactory results, in each country after some time a separate organization was formed with complete control of design and supply. In the autumn of 1916 for instance, when the British were scarcely beginning to produce gas shell, Russia with her poor manufacturing resources was already sending to the front a steady supply of 25,000 gas shells a week for field guns. The British on the other hand, having begun on the right path, had left it. Within the ministry, at the end of 1915, research and supply were separated. It was assumed that they would work together as closely as before; but in fact, the Supply Department immediately and inevitably drifted away, and not only lost the advantage of supervision by the designers, but began to research on its own account, thus causing overlapping and confusion. Early in 1916 a Department of Munition Design was formed, and the Trench Warfare Research Department passed under the control of that department. Their work was then much restricted, and was directed by a department which knew nothing of it, and which intervened between them and the War Office. The confusion and friction that followed had a serious effect both on progress and output.

In the summer of 1917 the large number of casualties caused by the German mustard-gas shells occasioned some anxiety on the British front, and it was asked why the British army had not something equally effective. The reason was that since 1915 research in irritants had been discouraged; and as the Chemical Research branch was not in direct touch with G.H.Q. the question had never been properly discussed. In the result, in Oct. 1917 the Chemical Warfare branch was reorganized and considerably expanded. It had more direct communication with the front, and the Defensive organization from the War Office was amalgamated with it. The Supply Department was however kept separate.

In April 1918 the Trench Warfare Supply Department was broken up. This was the opportunity to restore the supply of gas and gas shells to the Chemical Warfare branch, especially as they already had supply on the "anti-gas" side; but the manufacture of gas went to the Department of Explosives Supply, and the filling of shells and bombs to the Department of Gas Ammunition Filling. This continued until the Armistice.

Objects of Gas in Warfare.—It must be clearly recognized that in the use of gas a new weapon of war has been found, which supplements without displacing the existing arms. Explosive and shrapnel shell have their limits. A very small amount of cover will give entire protection against shrapnel, and deep dugouts will protect against the most powerful explosive shell. When the enemy has provided cover and such shell become ineffective, gas becomes effective. A gas heavier than air will settle in trenches and remain in them; it will drop down the approaches to the deepest dugouts and permeate them. According to the nature of the gas, whether lethal or irritant, the enemy, if unprovided with gas-masks, will then be either killed or driven up into the fresh air. In the latter case, he comes once more under the action of the ordinary artillery shell. If he has masks he can remain under cover, but the masks must be worn, not only until the bombardment stops, but afterwards until the shelter is cleared of gas.

In trenches also, and in the open, as long as there is gas, masks must be worn, and the troops fight under a heavy handicap. This condition may be kept up indefinitely with a slow bombardment of irritants and occasional bursts of lethals. In the case of a smoke-cloud discharged for eight or ten hours continuously the protection afforded by the mask with its refills will be exhausted, and the troops attacked have three alternatives: to counter-attack, which without prearrangement and the necessary supports is hopeless, to die at their posts, or to retire.

The effect of gas differs fundamentally from that of ordinary shell in its persistence. A bombardment with explosive shell is effective only while it lasts. The moment it is over troops can move freely over the area of bombardment. With gas, on the other hand, troops cannot cross the area without masks until the gas has been dissipated.

Again, a shrapnel bullet or splinter of explosive shell may hit or may miss; troops may pass through such a barrage with considerable losses, but still in sufficient numbers to attack. The gas cannot miss. If enough has been discharged over a certain area to give the necessary concentration, every man passing over that area without a mask will be affected.

In clearing up a captured line of trenches during an advance, gas bombs are most effective for bringing the enemy out of deep dugouts. For this purpose a non-lethal irritant of low persistence, which will penetrate the enemy's mask, may be used.

There is also the question of the effect of gas behind the lines. Such a discharge of cloud-gas as has been described may travel for miles before it is sufficiently diluted to lose its destructive effect. A long-range bombardment of an artillery or engineer depot will make it impossible for some days to handle the material without good protection.

That gas shell had a real military value as compared with ordinary shell is proved by the fact that both combatants used them so freely in the last year of the World War. Thirty per cent of the total American casualties were caused by gas, and no estimate can even be attempted of the general loss of efficiency brought about by the necessity for wearing respirators. Sillevaerts gives the following German order for the proportion of different shells to be used in the bombardment before the attack on the Aisne on May 27 1918:—

Object	Explosive	Blue Cross	Green Cross
1. Counter-battery and long-range bombardment	20 %	70 %	10 %
2. Bombardment of infantry positions			
(*a*) Moving barrage	60 %	30 %	10 %
(*b*) Back barrage	30 %	60 %	10 %

Experience showed also that batteries attacked by gas shell were generally put out of action for several days.

Future of Gas Warfare.—Such then is the new weapon. Its potency is undeniable, as is the fact that it is effective where other weapons fail. The question is, will its use be continued? The answer, from a military point of view, may be found in the fact that, if one belligerent uses gas and the other does not, the former will in all probability win. Since experience has shown that conventions made in peace-time are not always respected when war comes, the argument that no nation can allow its existence to depend on the security of a convention prohibiting the use of such a weapon, is even strengthened by the fact that, after the lessons of the World War, nobody in 1921 could predict what further chemical or physical developments scientific investigation might produce in the future. Great advances might well be made in the discovery of gases that would penetrate any mask hitherto designed, and in the utilization of them. The nation that cares for its safety must therefore keep pace with such discoveries and with the means of protection against them. To prevent the production and the study of toxic gases is impracticable, because many of them are either necessary elements or by-products of manufactures essential to modern industries in peace-time.

As for the ethical side of the question, it must be considered dispassionately. Every new means of warfare, intensifying its effectiveness, has caused an outcry when first introduced. Gas warfare, *per se*, is not necessarily or exceptionally cruel. For instance, if it were conducted on both sides with cyanides, successfully adapted to war purposes, the resultant deaths would be the most merciful that history has ever known. It is to be noted that in the World War less than 3% of the total gas casualties were deaths, whereas some 20% of casualties due to other weapons resulted in death either on the field or in hospital. The use of gases may be guarded by future conventions so as to prevent unnecessary suffering, just as explosive bullets were barred. Thus chlorine might be forbidden, because there is no death more painful than that by suffocation. But the utmost that seems possible is to limit by convention the use of poison gases in such a way that a breach of the convention will not place the offending combatant in a definite position of superiority.

It is infinitely to be deplored that gas warfare was ever introduced. It certainly adds a new horror to war. It imposes fresh burdens on the soldiers, who may ultimately be forced to spend most of their time in gas masks, even when far behind the lines. The most terrible thing perhaps about it is that, since it is impossible to remove all non-combatants from a zone of war, and equally impossible to provide them with masks, thousands of them must inevitably perish. For this reason alone it would be well if gases were forbidden. To forbid them, however, is one thing; to prevent their use is another. And unless more effectual means than were within sight in 1921 can be devised to make this (or any other) form of warfare impossible, considerations of national security must inevitably prevail.

Gases used in the World War.—The following are some of the more important gases used during the World War:—

Cyanogen Compounds.—Effect, in concentrations of as much as 1 in 1,000, immediate death. In weak concentrations, giddiness, headache and pains about the heart, but ultimately complete recovery. Used by the French and the British in shells as a mixture of 50% hydrogen cyanide, with arsenic trichloride, stannic chloride and chloroform.

Chlorine.—Attacks the respiratory tracts, forming in contact with moisture hydrochloric acid which destroys the tissues. Has a reflex action on the system generally, causing vomiting and diarrhoea. In high concentration may cause immediate death by spasm of the glottis. Only used as cloud-gas from cylinders.

Phosgene (Carbonyl chloride).—A very dangerous gas because the effect is delayed, and the victim is often not aware that he has been gassed. May cause sudden death as much as 48 hours after exposure. Very much used both in shells, and with chlorine as cloud-gas.

Diphosgene (Trichlormethyl chloroformate).—Effect similar to that of phosgene. Much used in shells, both alone and with other gases.

Chloropicrin.—Acts on the respiratory system like chlorine but more strongly. Is also a lachrymator. Much used in shells generally in combination with other gases.

Bromine.—Action similar to that of chlorine. It can be used conveniently for gas-clouds on account of its high boiling-point, but it forms the basis of a large number of powerful lachrymators. It was much used by the Germans as a lachrymatory shell-filling in the form of benzyl or xylyl bromide and brominated ketones.

Ethyl iodoacetate.—British lachrymator. Very marked action on the eyes, ceasing the moment the neighbourhood of the gas is left. High persistence.

Bromacetone, Chloracetone and Brommethylethylketone.—Much used in shell. Powerful lachrymators, and asphyxiating or lethal in high concentrations. Moderate persistence.

Diphenylchloroarsine.—Solid, dispersed in clouds of fine particles. Cannot be kept out by ordinary masks. Powerful sternutator, producing also coughing and sickness; in strong concentration, causing insupportable headache. Much used in Blue Cross shells by the Germans.

Diphenylcyonoarsine.—Similar to diphenylchloroarsine, but with a more powerful action. It superseded the latter as a German Blue Cross filling.

Mustard Gas, Ypérite, or Yellow Cross.—(Sym. dichlordiethylsulphide). Vesicant. Attacks the skin even through the clothing with a blistering or burning effect. Affects all the mucous surfaces. Acting on the eyes causes blindness, usually temporary. Acting on the respiratory tracts may cause death by bronchial pneumonia. In favourable weather remains effective for several days.

Livens Projectors.—The use of lethal-gas shells, which require a very high concentration, implies the necessity of bursting a large number of shells simultaneously along a given length of trench or over a given area. With artillery shell this necessitates a concentration of every available gun within range on the point of attack, and needs a certain amount of preliminary arrangements. With Stokes or trench-mortar bombs whose contents are much larger, and especially with a Stokes gun which can be fired very rapidly, a smaller number of pieces can be used. But probably the most effective means of obtaining a high concentration was the projector devised by Captain Livens, R.E. This consisted originally in using an old gas cylinder, with its top cut off, as a mortar; a hole is dug in the ground and the projector placed in it, resting on the ground at an inclination of 45 degrees and pointing in the required direction; the breech of the cylinder is backed up with a strong base-plate about 12 in. square. The propelling charge is contained in a tin box placed at the bottom of the projector and divided into compartments; the propellent explosive is placed in the compartments in bags, the number of bags being varied according to the range required. The projectile is a steel drum with rounded ends, 21 in. in length and just fitting into the cylinder, which has a bore of 8 in.; within the drum is a central tube running down its length, about 1 in. in diameter, which contains the bursting charge. The projector is fired by an electric fuse, about 20 of them being connected up with an exploder. These 20 may all be placed side by side in the same trench, and will constitute a battery. By these means as many as 4,000 of these projectors have been placed in position behind the front trenches in a night and fired simultaneously. Naturally, neither range nor direction are very accurate, but they are sufficiently so to give a very high concentration of gas over a small area, in some cases sufficient to kill men even when wearing their respirators. These projectors proved so useful that they were employed also for incendiary and high-explosive charges, and were immediately copied by the Germans, who feared them more than any of the other chemical warfare methods of offence employed by the Allies.

Incendiary Materials.—The beginning of the war showed nothing particularly new or useful in the incendiary materials used by either side. Quite early in the war a German incendiary shell was found to contain white phosphorus and a very inflammable celluloid mixture. In England petrol bombs were tried and containers filled with rags soaked in petrol. The results were not important. Phosphorus by itself was not a reliable incendiary agent, though a shower of molten phosphorus descending from a shell burst in the air had a good moral effect.

The first demand for incendiary materials for the British army arose from the necessity of burning the long grass in No Man's Land during the summer of 1915, to prevent the enemy from using it for cover. To meet this demand a small catapult grenade filled with phosphorus and petrol was supplied, it being found that a small addition of phosphorus gave a more certain ignition of the petrol. Phosphorus, however, was far more useful as a smoke-producer than as an incendiary. A very important advance was made when a method of utilizing thermit in shell was discovered. Thermit is a mixture of iron oxide and aluminium which when ignited by a suitable primer burns with an intense heat, which has been estimated at 5400° Fahrenheit. It is used commercially for welding, and has been used in the army for such purposes as destroying guns, a small quantity of it being placed in the bore and ignited; the result of this is to make the gun useless, as when the thermit cools it is found to be firmly welded to the surface of the bore.

The ordinary ignition, however, is too slow for the purpose of an incendiary shell. Experiments were made with special ignition powders in Stokes shells but without good result. In Jan. 1916, however, thermit was tried with a bursting charge of ophorite which gave excellent results, the thermit being instantly raised by the discharge to melting-point so that when the shell was burst in the air it let fall a shower of molten metal. Ophorite was an explosive that had recently been discovered by Professor Thorpe, which while less powerful than the ordinary high explosives, had the advantage that it could be fired by a fuze without a detonator.

Thermit employed in low-velocity projectiles such as Stokes gun shells became a very valuable incendiary agent; with artillery shells it was not so useful, as satisfactory ignition was difficult to obtain.

Experiments were also tried with fine coal-dust distributed in the air but the results were not practical.

Anti-gas Defences.—About the end of March 1915, in consequence of the increasing rumours that the Germans intended to use poison gases, the British War Office asked Sir William Ramsay's committee to consider what gases might possibly be used, and what would be the best means of protection. Before the committee reported, the cloud attack of April 22 was made. The circumstances were explained to Sir William Ramsay by telephone, with the remark that the gas was probably chlorine, and the next morning he came to the War Office with several sample mouth-pads made of flannel or wool soaked in hyposulphite of soda. An appeal was made through the Press to British women to furnish 1,000,000 of them at once, and thanks to their response and the efforts of the Red Cross the necessary quantity came in two or three days, so that within a fortnight every man in the British army at the front was supplied with this form of respirator. Although rudimentary, it gave useful protection.

Meanwhile chemists and physicists were at work on both the French and British fronts investigating the facts and advising on temporary protection. The day after the first gas attack, instructions were issued to keep buckets of solution of bicarbonate of soda in the trenches; the men were to dip their handkerchiefs in the solution and tie them round their mouths in case of gas attack. More efficient respirators were considered, also the use of large fans for clearing the trenches of gas, and direct fighting of the cloud by spraying neutralizing agents into it. Thousands of Vermorel sprayers were sent out, for clearing trenches and dugouts. The dispersal of clouds by shelling and by explosions was tried, also lighting fires in front of the trenches to heat the cloud and cause it to rise. None of these methods were really effective in stopping clouds, and attention was gradually concentrated on direct defence by masks.

The first improvement on the respirator, which was introduced in the War Office a few days after the attack, was known as the Smoke helmet or Hypo helmet, a kind of Balaklava helmet made of flannel or thin serge, covering the head loosely and reaching below the neck, round which it was tied. The eye-pieces were made of mica. This helmet was impregnated with hyposulphite, soda and glycerine solution, and carried in a waterproof bag. It gave satisfactory results for some time. Pending the complete supply, the increasing use of lachrymating shells by the Germans gave rise in June to a demand for goggles.

During 1915 the helmet was improved by the introduction first of phenates to protect against phosgene (when it is called the P helmet) and later by the further addition of Hyomine (when it was called the P.H. helmet), to ensure protection against phosgene and prussic acid. A respiratory valve and mouth-tube was also inserted in the P. and P.H. helmets, and this added to their comfort and efficiency.

As the use of other gases was foreseen, such as phosgene and hydrocyanic acid, a more effective protection than could be put into cloth became necessary. Thus the "box respirator" type was developed, and gradually issued during 1916. The general type of these consisted of a mask or face-piece into which entered a flexible tube issuing from a metal container which held chemicals, through which the air was breathed. In the earlier patterns the air passed through the tube into the space between the mask and the face; but as it is very difficult to get the mask to make an airtight fit round the face, the tube was extended and ended in a mouth-piece which fitted closely to the lips, while the nostrils were closed by a nose-clip. The container and mask were carried in a knapsack. The mica eye-pieces were replaced by celluloid, and eventually by triplex glass, which does not splinter when broken and remains airtight.

The introduction of a container for the neutralizing and absorbing agents gave free scope to chemists to provide against all kinds of poison gas. In this connexion it is worth recording that the British gas-mask did in fact give efficient protection from its introduction to the end of the war.

The containers were filled with alternate layers of charcoal and composition granules. The charcoal absorbed gases, and the granules, whose composition could be varied indefinitely, absorbed and neutralized them. The container had the further advantage that its contents could easily be renewed.

This type of respirator continued in use until the end of the war but was subject to continual improvement. No effort in this direction could be spared seeing that any defect in the manufacture or adjustment of the mask might mean death to the wearer. Constant progress was made with the British and French patterns, and the Americans when they entered the war took up the question very thoroughly. They, like the French, had the advantage that their chemical service was a separate branch of the army with the offensive and defensive sections working under the same head. Among other defects the air-tight fitting of the mask to the face needed a great deal of study and experiment. The eye-pieces gave trouble because moisture would condense on them both outside and in. This was partly cured by using a soapy solution on the glass. The whole apparatus had to be made as little cumbrous as possible, and so adjusted with its knapsack that it could be very quickly taken out and put on. The use of the mouth-piece and nose-clip was very trying when worn for long periods.

In 1918, the Tisset mask was introduced in France, which did away with the mouth-piece and met the difficulty of condensation by causing the cold air from the inlet-tube to pass across the eye-piece in entering the mask. This type, which was adopted and improved by the Americans, was known as a "single-protection" respirator. Its weak point is that if the face-piece is torn, or does not fit properly, protection is lost.

The provision of the charcoal for the containers opened up a wide field of investigation. For absorbent purposes a very dense charcoal was required. Experiments made in the United States showed that coconut-shells gave the best form of charcoal for the purpose, but their preparations were on such an extensive scale that they calculated that they would require a supply of 400,000 tons per day of coconut-shell, which were obviously not obtainable. After coconut-shells the best carbon was obtained from fruit-stones such as peach, cherry, etc., and Brazil and other nut-shells. Carbon obtained from hard wood, such, as the ironwood was of less efficiency.

The scale on which the United States worked is shown by the following figures given by Farrow of the production of protective materials up to the date of the Armistice, the great bulk of which were produced in the last four months of the war:—

Material.	*Production up to Nov. 11 1918.*
Respirators	5,276,515
Extra canisters	3,144,485
Horse masks	366,529
Bleaching powder (tons)	3,677
Extra antidimming (tubes)	2,855,776
Sag paste (tons)	1,136
Dugout blanket oil (gallons)	95,000
Protective suits	500
Protective gloves	1,773
Dugout blankets	159,127
Warning devices	33,202
Trench fans	29,977

The sag paste mentioned in this list was an ointment used for the skin to protect it against mustard gas, the protective suits and gloves being for the same purpose. The blankets, which were to seal the doors of dugouts, were made of specially woven cotton treated with a specially heavy oil. The warning devices were mainly watchmen's rattles and Klaxon horns.

From the beginning gas schools were established on all army fronts, where men were taught the use of the masks and made to enter gas chambers with masks on to get proof of the protection afforded. Similar schools were established by all the nations at their gas defence headquarters, where experiments could be tried. The result of such work is well shown by the following extract from Farrow's description of the American gas service:—

> "There was a special field-testing section of the Gas Defence Division composed of about 150 men who were trained to the minute in field manœuvres and did most of their work in gas-masks. They were constantly in and out of gas with regular production and experimental masks. They played baseball in them, they dug trenches, laid out wire, cut wires, and fought sham battles at night, both with and without actual gas. The work of this section even went so far in the case of the later design as to include a test where six men worked, played and slept in the masks for an entire week, only taking them off for 30 minutes at each meal-time, and each day entering high concentrations of the most deadly gases without any ill effects whatsoever to the wearers. When it is remembered that eight hours was the limit of time which a strong man could wear the old-type mask, something of the efficiency of the new mask may be realized."

These of course are experimental results with selected men, which generally differ widely from those obtainable in the field. They only show the great improvement made in patterns of respirators before the end of the war. The fact remains that any efficient respirator is a source of fatigue as well as a great inconvenience. British experiments have shown that in hill-climbing with and without respirators, there is a marked difference in the increase of heart rates and rates of breathing under the former condition. Up to 1921 what had been done gave good protection with reduced inconvenience. But much yet remained to do; indeed, complete protection both at the front and in the rear areas might well be unattainable. (L. J.)

POLAND (*see* 21.902*).—The partition of Poland was the one great crime of the 18th century for which no redress was afforded by the settlement of Europe after the Napoleonic wars, and it eventually proved one of the causes of the World War in 1914, though the Poles had become apparently more or less reconciled by that date to working out their destiny under Russia, Prussia and Austria. In the earlier article their history has been sketched up to 1863, but it is necessary here to make some brief reference to former times as well as to give the outlines of its development from then up to 1914.

RUSSIAN POLAND.—"The insurrection of 1863," says Stanislaus Kosmian, "helped the greatest enemy of Poland and the Polish cause to success. On the ruins of the Polish revolution rose . . . the system of Russification in the Empire of the Tsar." Under the new name of the Governments of the Vistula the Polish provinces formerly known as "Congress Poland" or the "Kingdom of Poland" were placed in the hands of military governors whose duty it was to suppress every tendency towards Nationalism and to ensure complete subservience to Russia. Russian became the official language of the country and it was enforced in all public business. In 1869 it was adopted as the official language of higher and secondary education and in 1885 the use of the Russian language became compulsory in the primary schools. The publication of articles in Polish was forbidden and the teaching of the language was punished by fine and imprisonment. In 1876 Russification was extended to the courts of justice and Polish officials were replaced by Russians. It cannot however be said that the policy was consistently enforced; it was for instance mitigated under Count Berg who succeeded Milyutin in 1867 and devoted himself to conciliating Polish society, and again by Count Schuvalof and Prince Imeritinsky, successors to the Draconian Gen. Gurko who reigned from 1883 to 1894. Roman Catholicism was, however, from the first recognized as "the backbone of Polish Nationalism" and consistently attacked. At the outset the monasteries were closed, the ecclesiastical lands confiscated and the Union with Rome assailed by compelling Uniates to become Catholics. This religious persecution was carried on with very slight intermittence until 1905, when religious freedom was first permitted.

The most interesting feature in the process of Russification, however, was the attempt made to break the power of the old historic families and bring the peasants into close union with Russia. The emancipation of the peasants which had been urged before the revolution was effected by the Ukases of 1864. Each peasant, whatever his tenure had been, and the mass of the landless became freeholders, which was a constant cause of class friction, and they were allowed to retain their right of free access to the forests and pastures of the landlord. To the landlords compensation was given in the form of Treasury Bonds so that they might have a lasting interest in the maintenance and solvency of the Russian Empire. Village affairs were placed in the hands of a Commune (*Gromada*) consisting entirely of peasants, who from ignorance and inexperience soon fell under the influence and mastery of the officials; while the landlords were represented in the organization of the district.

The basic idea of the system was the accentuation of class divisions, for it was hoped thus to create a class independent of, and antagonistic to, the Polish landlord and bound by ties of gratitude to Russia. These hopes were not realized for it was these peasant communes which provided centres for the educational movement at the end of the century and foci for the spread of the idea of Polish nationality.

From the emancipation of the serfs can further be traced the economic changes which took place in the latter half of the 19th century. By the splitting-up into small parcels of the large estates an ever increasing class of peasant proprietors was instituted because the small freeholders, who included in their numbers members of the smaller gentry or *Schlachta*, as well as the former serfs, desired to increase their holdings and found themselves more and more able to pay the prices demanded by the landlords. Though the kingdom of Poland was and remains essentially an agricultural country, a great industrial change has also taken place. Whereas in 1863 the towns were still in a primitive state of development, by the end of the century great industrial centres had appeared. Competition with Russian industry was a different thing to competition with German industry, especially under the protection of the Russian tariff wall. Hence the growth of a strong middle class in which the Jews took a considerable part, some of the leading Jewish families even marrying into and being received as part of Polish society in Warsaw. The economic development became a strong bond of union with Russia and Polish textiles penetrated through the empire as far as Turkestan.

The practical exclusion of the Poles from the Russian army and administration threw back the abler and more ambitious of the upper classes among them on other employment, and strengthened this middle class and brought a new influence to bear on national life in Congress Poland. Hence practical economic reform improvement became the order of the day and the habit of theorizing on the subject of political independence fell into the background. But these improvements again could not long avoid a political aspect and hence the formation of Socialist and Democratic associations.

These Socialist societies, however, had always a Nationalist tendency because capital was largely in German and Jewish hands. The most noteworthy was the National Democratic party which came into existence before the end of the century, after several earlier revolutionary societies had failed, and set to work by means of private educational efforts to oppose Russification and definitely awaken the spirit of nationality. During the troubles which succeeded the Russo-Japanese War this party, under the leadership of M. Dmowski, formed "the army of the national movement" and in the First Duma held an important and in the Second a controlling position, but its influence was diminished by the reduction of the membership at the election of the Third Parliament. Outside Russia an important movement took place in 1908, thanks to the rise of the Neo Slav party, which aimed at effecting a reconciliation between Russia and Poland, and this platform was adopted at Pan Slav Congress held at Prague in 1908, for it was felt that the Poles would be the first victims of a victorious advance of Germany, now the most dangerous enemy (it was held) of the Polish cause.

The Russian Government was, however, recovering from the blows of the revolution of 1905 and unwilling to consider the grant of autonomy for Poland, and in the Duma even the support of the Constitutional Democrats was withdrawn when the Polish Club in the Austrian Reichsrat encouraged in 1908 the incorporation of Bosnia and Herzegovina with the Habsburg dominions. The failure of its plans caused the break-up of the National Democratic party. Its place was taken by Socialist societies antagonistic to Russia. Hence at the outbreak of the World War feeling in Russian Poland was divided.

PRUSSIAN POLAND.—The Congress of Vienna in 1815 had stipulated that the Poles should receive "a representation and national institutions." In the duchy of Posen the national rights of the Poles were recognized and for some years the policy adopted by Prussia was one of conciliation rather than oppression, while the needs of the country, such as those as to education and communications and the emancipation of serfs, were efficiently provided for. It was not till 1830 that any system of Germanization was introduced and even that was enforced with no great severity for the twenty years after 1851. But when Bismarck was able to turn his attention from Austria and France to Poland he found that under the mild rule that had prevailed the Poles had been able to develop a national movement which had indeed a parliamentary group in Berlin and had to be reckoned with in the Reichstag, but the strength of which lay in societies such as that founded by Marcinkowski in 1842 which had brought an educated class of Polish doctors, lawyers, merchants and tradespeople into existence. By means of propaganda this movement

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*** These figures indicate the volume and page number of the previous article.**

had increased rapidly to a position more formidable than that previously engineered by the historic families and was in fact "undermining the foundations of the Prussian State." As a counter-stroke to an organization which he realized was strengthened and to some extent led by the priests, Bismarck in 1872 undertook the *Kulturkampf*, hoping thereby to crush out the growing conception of Polish nationality. The Archbishop of Gnesen-Posen, the chief leader of the Roman Catholic party, was imprisoned, the liberty of the pulpit was denied, the use of the Polish language was prohibited in the schools and attempts were made to forbid its use at public meetings. The *Kulturkampf* was continued till 1885 and in spite of its failures Bismarck's policy seemed assured of success when Dinder was appointed Archbishop of Gnesen and the onslaught of the schools began.

The history of Prussian Poland in later years turns to a great extent upon the economic question. The industrial development of Germany had brought about a great immigration of Polish labourers to work as agriculturists in eastern Germany and as miners in Westphalia. Bismarck descried danger here and after unsuccessfully trying to prevent it by expelling the immigrants essayed to counteract it by further Germanization of Poland. The appointment of the Land Commission in 1886 with £5,000,000 to buy land from Poles in Posen and W. Prussia and sell it to German colonists was the first step in the policy of German colonization which was pursued till the outbreak of the war. It is true that under Caprivi the severity of the anti-Polish policy was relaxed, but under Prince Hohenlohe it was reinforced and in 1894 the *Ostmarken Verein* was founded to obtain the trade of the eastern provinces exclusively for Germans and undermine the Polish element. Under Count Bülow the culminating point was reached in 1908 when the compulsory expropriation bill was passed with the bill prohibiting the use of Polish at ordinary public meetings. More colonists were now introduced and the sale of their land to Poles was forbidden. There were signs all through of the failure of this policy, such as the strike of the school children in 1906 against the use of the German language in religious instruction, and these signs were multiplied in the economic sphere. For here the Poles, acting on the principle that they would be masters when they were "better, more educated and richer than the Germans," had definitely set themselves to the task of defeating the Germans economically. The land that was bought for colonists was poor land and bought at high prices. The German colonists were boycotted to such an extent that they were forced to withdraw or become Polonized and the Polish position actually seemed to grow stronger as the legislation became more severe. The incorruptible Prussian official, the inexorable Prussian schoolmaster and the brutal Prussian drill sergeant had disciplined a talented people hitherto uncultured and rendered them capable of organizing and acting for themselves. By means of their coöperative societies which dealt with agriculture, finance, industry and commerce they obtained complete control of the resources of the country to the exclusion of the Germans and the Jews. They also founded unions of landowners, social, athletic and political associations. The heads of all these societies before the war formed a sort of secret Cabinet which exercised the chief power in Prussian Poland with a preponderating influence in the local Press, with power to control the supply of immigrant labour and secretly direct the boycott both of Germans and of Jews. In fact when victory came the assumption of political supremacy was not the first but the last step to complete independence.

The success of the Poles of Prussia may have been one of the elements which led Pilsudski to put his money on the wrong horse at the beginning of the World War, believing that Germany would be obliged to make of Poland a buffer State against the eternal menace of the Russian Empire.

AUSTRIAN POLAND.—The lot of the Poles in the Austrian Empire with its purely non-national basis was preferable to that under Prussia or Russia. In the former they had by fighting obtained a tolerable position. In the latter the severities were intermittent and could be mitigated by bribery. In Austria there was always a certain amount of *bonhomie* or *Gemütlichkeit* which made official harshness tolerable. The history, however, of Austrian Poland from 1863 to 1914 can be understood only by reference to certain governing facts, namely the imperialist opportunism of the monarchy and the racial problem presented by the rise of the Ruthenian movement in Galicia.

During the years immediately following the revolution of 1863, the Galician Poles, under the influence of bitter disillusionment, resolved to concentrate all their efforts not on recovering political unity with the boundaries of 1772, but on preserving and strengthening national unity within the Austrian Monarchy. German culture and the German language constituted the unifying and predominant force in the Habsburg Monarchy, but after the war of 1866 and under the constitution of 1867 Austrian Germans had to look for allies amongst the other nationalities. The Poles had to decide whether they would support the aims of the Federalist party with its disruptive tendencies or whether they would favour the German element and adhere to the Vienna Government. They followed the latter course and promised loyalty in return for practical concessions. Having 57 votes in the Reichsrat they were able to secure useful privileges for Galicia. In 1867 they obtained a special minister for Galicia in the Austrian Cabinet; a separate board for Galician education; the use of the Polish language in secondary schools; the use of Ruthenian being restricted to elementary schools; the use of Polish instead of German in administration and the law courts. In the following year Polish became the official language for the university of Cracow, whilst a year later it was enacted that Poles alone should be teachers in the universities of Cracow and Lemberg. From 1877 onwards the "Polish Club" in the Reichsrat became a governmental party and used all its influence to build up piecemeal the fabric of Polish autonomy in Galicia. On the whole the Poles did not use their power well. By the establishment of an academy of science at Cracow they did indeed encourage learning, but they did nothing to improve the economic condition of the people. The peasants remained ignorant and the towns were neglected. No Polish middle class was created and hence the Jewish element predominated in trade and commerce. Galicia was rapidly Polonized but only at the expense of the Germans and the Ruthenians, and on their oppression of these last the history of Austrian Poland up to and after the war to a great extent depends.

The Ruthenians have been described by Prof. Alison Phillips as a compact body of 30,000,000 occupying the country "from the north-eastern district of Hungary across the Carpathians and E. Galicia" and eastwards as far as the Dnieper. They were then ruled partly by Russia and partly by Austria, but have always been claimed by the Russians as part of their race. Indeed little doubt was expressed on the subject till a movement was started about the middle of the 19th century by certain Ruthenian scholars, who set out to prove they had a right to a separate national existence. The real impetus of the movement was economic and arose from the discontent of the peasant with the oppression of their Russian and Polish landlords. It was some 20 years before the importance of the danger of the movement was realized. From the Polish point of view it was dangerous because it challenged their supremacy in "the annexed provinces" in Podolia, Volhynia and Eastern Galicia. From the Russian point of view it was disastrous because it threatened to break up the Russian Empire. In Galicia, where in addition to the language the Greek Uniat Church formed a strong bond of union, the movement prospered in spite of the Polish efforts to suppress it, which were at first supported by the Austrian Government. This support continued as long as Austria desired good relations with Russia, that is until in 1884 it was desired to weaken the Russian colossus. Then concessions were made to the Ukrainians and the result was that in 1891 Ukrainophil deputies appeared in the Reichsrat with the development of an Ukrainian State within the monarchy inscribed on their banner. This policy had the effect of promoting a reconciliation between Russia and the Galician Poles, who thought it better that the Galician Ruthenes should be absorbed by Russia than that a Ruthene State should be set up at the expense of both Russians and Poles. To retain their ascendancy, therefore, the Poles proceeded to encourage the Russophil Ruthenians, with the result that the latter were successful in 1907 in the election which followed the establishment of universal suffrage in the Austrian half of the Dual Monarchy.

In 1908 the Neo Slav Congress definitely declared that Russian Neo Slavs and Poles should act in conjunction to suppress the movement, a decision which met with no approval from the Austrian Government because Russia and later Austria were then at daggers-drawn in the Balkans and a new viceroy was appointed in Galicia who was definitely anti-Russian. The culminating point was reached in 1914, when it was discovered that the Ukrainian party was and had been for ten years past in close touch with the Prussian *Ostmark Verein* which was opposed to everything Polish. The Galician Poles had realized the complete subservience of Austria to the German Emperor and this produced a great change in their attitude to the Habsburgs, so much so, that the murder of the Archduke was received with almost indecent expressions of satisfaction, because to him was ascribed the success of the Ukraine movement in 1913.

Poland During the World War.—Thus the declaration of war in 1914 found the Poles with no definite national policy. The various political parties were united in that they had one common end in view, the restoration of an independent Poland, but their opinions were divided as to the means of attaining this end. In Galicia the majority of the Poles were pro-Austrian. In Russian Poland the National Democrats, under the leadership of M. Dmowski, were strongly in favour of working for an autonomous Poland under the Russian crown, and this policy seems to have been supported by the majority of the Russian Poles. In opposition to this party was a strong anti-Russian element, of which the most notable supporter was Pilsudski. Having been forced to flee from Russian Poland in 1907 Pilsudski had taken refuge in Galicia, where he had utilized the *sokols* (athletic clubs) and shooting clubs for the purpose of organizing an efficient military force to use against Russia in case of war. At the outbreak of war he mobilized his forces, as the Polish Legion, and, advancing across the border, seized Kielce. The actual military result was of no great importance, but "it soon became clear that his bold decisive action had powerfully impressed the national mind."

On Aug. 14, in answer to the anti-Russian campaign which the Germans had been organizing in Warsaw, the Grand Duke Nicholas issued a proclamation announcing Russia's intention of establishing a united Poland "under the sceptre of the Russian emperor," a Poland which was to be "free in faith, language and in self-government." By the National Democrats this proclamation was welcomed as being the first stage towards the fulfilment of their aims. By the followers of Pilsudski, however, the proclamation was received with no favour: proposals for conciliation with Russia tended only to emphasize Polish divisions.

Polish resistance to the Russians took a political as well as a military form. On Aug. 16 two existing Polish organizations, the Confederation of Independent parties and the Polish Military chest (*skarb*), were merged in the Supreme National Council of Galicia, which contained representatives of all parties in the Galician Diet and Reichsrat. Though the National Council was formed with the object of offering political resistance to the Russians, it was not altogether in agreement with Pilsudski and his legionaries. It was inclined to be monarchical whilst Pilsudski was Socialist Republican. Accordingly the Council laid down the following regulations: The Polish legions were to form a separate Polish command but to be subject to the Austrian Army Command. The Polish language was to be used. Legionaries were to take the Austrian Landsturm oath and F. M. L. Durski, a Pole in the Austrian service, was placed in command. Pilsudski, having taken the oath under protest, was given the command of the first regiment.

At first both the Austrians and the Germans distrusted the movement as they stood to lose should Pilsudski achieve the national independence for which he was working. Austria moreover was hostile to any idea of Polish union and to anything which might lead to increased autonomy in Galicia. Recruiting, therefore, was forbidden. Later the Germans, realizing that the strength of Russia would be decreased as the strength of the Polish legions was increased, allowed recruiting to take place among the Russian Poles.

The Galician situation, however, was somewhat changed by the Russian advance. On Sept. 2 Lemberg was taken by Russian troops and for the moment "the Austrian solution was at a discount." The divisions among the Galician Poles became apparent. By some, who had ties of blood and religion with the Russians, the invasion was welcomed and the new rule accepted with alacrity. The most noticeable effect of the pro-Russian sympathy is to be found in the dissolution of the E. Galician Legion, which took place in Oct. and which caused an estrangement between the Conservatives of the National Committee and the E. Galician Conservatives. Bobrinsky was appointed governor of Lemberg, his policy being that of systematic Russification.

In 1915 the Polish situation was again changed by the military campaigns. On June 22 Lemberg was retaken from the Russians and on Aug. 5 the Germans entered Warsaw: thus German power was established in Russian Poland and Austrian power reëstablished in Galicia. Among the Poles themselves, in 1915, party differences seemed to decrease. In Dec. the Radical Socialist elements formed a central national committee. It was composed of the Peasants' party; the Union of Workers; the Polish Socialist party and the Club of Polish Statehood (*Studnicki*). The aim of the league was to work for independence; it was dissolved in Feb. 1917.

By the beginning of 1916 the Polish Legion was well equipped and in June the brigades totalled 18,000. When the Polish independence parties at Warsaw asked for the nomination of Pilsudski as the commander-in-chief of a Polish army all the concessions previously granted by the Germans were withdrawn. Pilsudski then appealed to the Austrians. The Austrians' ideas with regard to Poland had undergone a slight change, and though suspicious of Pilsudski and his legionaries, the Government decided to encourage them in the hope that a union might be effected of the Polish kingdom and Galicia under Austrian protection. In July Pilsudski felt himself in a position to appeal for concessions regarding the substitution of Poles for Austrians as officers in the legion and for the use of the Polish uniform and colours. There was some delay in considering the question of these concessions and as a protest Pilsudski, together with other officers, retired. The Austrians did make and were prepared to adhere to certain concessions. They therefore negotiated with Pilsudski to withdraw his resignation. At this point, however, the German command interfered and Pilsudski was dismissed on the grounds of insubordination. In Oct. the legions were withdrawn from the front.

The Germans and Austrians were in the meantime trying to arrive at some satisfactory solution of the Polish question. The tendency of the Poles themselves was on the whole pro-Austrian, this tendency being strengthened by the union of the province of Chelm (Kholm) to Poland. The first solution proposed by the Germans was that of an independent Polish state under a Habsburg king. This state was to consist of Russian Poland, Galicia, and those parts of Posen where the Poles exceeded 65% of the population. This solution the Austrians would not accept. It was not clear how much of Poland the Germans were willing to give up, but it was clear that their sacrifice would not be so great as that of the Austrians who were to lose all Galicia. The solution proposed by the Austrians was that of a genuinely independent Poland consisting of Galicia and Russian Poland. This new Poland was to be a third co-equal state with Austria-Hungary. The German Chancellor then issued new proposals and after a Polish deputation had been sent to Berlin to discuss the terms an agreement was brought about and the result was the Decree of Independence of Nov. 5. By this decree the Polish districts "snatched from Russian power" were to form an independent state which was to have a hereditary monarchy and a constitution. The organization, training and command of the Polish army were to be settled by mutual agreement.

From the point of view of the Germans the Polish state was to be closely united to the Central Powers, "especially in military matters." Their ultimate aim was to secure additional man-power against Russia. This settlement was not welcomed by Austria. She "had accepted unwillingly the German scheme as to Poland . . . but she hoped by her scheme of Galician autonomy so to embarrass the German settlement as to revive the Austrian solution which Berlin had rejected."[1]

The independence of Poland was acknowledged on Dec. 20 by a joint Allied note and later in 1917 it was acknowledged by the Revolutionary Government in Russia.

The first attempt of the German Government to organize the new state was not successful. General von Beseler (primarily a *savant* and geographer), who as military governor held the chief power, issued a decree arranging for the election of 70 members of the Diet in the German sphere of occupation; eight members of the Council of State were to be chosen by these 70, whilst four others and the chairman were to be chosen by the governor-general; all resolutions of the Council of State were subject to the assent of the two governors-general. The unpopularity of this proposed organization was so great that certain modifications were introduced, and the following scheme adopted: the two Governments were to nominate immediately a council of 25, 15 from the German sphere and 10 from the Austrian; they were to elect their own chairman; they had power to regulate internal affairs and economic reconstruction and were to coöperate in the formation of a Polish army. The Council was composed eventually of 11 Conservatives, but no National Democrats, 8 of the Central party (pro-Austrians) and 6 of the Left (Socialists). It was liable to be over-ruled by von Beseler.

The powers of the Council were fairly extensive. "Education and justice were handed over to them practically without reserve; and for the first time for many years the native tongue was again heard in the schools and in the courts of law. Local representative bodies were called into being in the towns and in the country; and in Warsaw the municipality received control of all the public services, including police, prisons, posts (municipal), public sanitation and hygiene."[2] The finances were handed over to the Council "except in so far as the costs of the occupation" were concerned. A Minister of Political Affairs was appointed but he might hold official relations only with the Central Powers.

One of the first problems facing the new Council in 1917 was that of the economic reconstruction of the country. In his *History of the War*, John Buchan gives the following description of the condition of Poland under the German domination—"The German policy demanded a wholesale destruction and . . . Poland was methodically laid waste. . . . Only blackened ruins marked the site of villages, and since the German army ate up all supplies, famine stalked through the land. . . . The material damage can scarcely be estimated . . . all labour and industry have been swept away." In addition to the devastation, the currency was depreciated and the Customs, which might have provided revenue, were to go to Germany and Austria.

The Council was responsible for the drawing up of a constitution. A committee was formed in which all shades of opinion were represented. It was decided that a Ministry and a Senate should hold office until a genuine National Assembly could be established. As regards political matters the Council demanded that there should be a regent: that they should be given more control over local government: and that existing ordinances should be modified. These demands were not accepted by von Beseler.

The chief question which occupied the Council was that of the army. Pilsudski was attempting to raise a strong national army which would give the Council more chance of enforcing its decisions, but he was not prepared to raise it for German use.

The meeting of Council in which the political demands were formulated took place on May 1. Only unimportant concessions in education and justice were made, therefore on May 17 the Council suspended its functions, though through German intimidation it was forced to resume them on June 9. At the beginning of July three resolutions were passed: proposals for a regency, a Cabinet and a Senate were accepted; a military oath was to be taken exacting loyalty to the Central Powers and to the future king of Poland (thus excluding a republic); and a recruiting appeal was made. These resolutions proved the submission of the Council to Germany, and in protest Pilsudski and five of his supporters resigned.

After the passing of these resolutions on July 3 the Council was discredited. It had failed to cope satisfactorily with the economic crisis and it had failed to produce a practical settlement with regard to the army. As matters stood the army could be used against the Russians but not against the Austrians or the Germans. Finally the Council was discredited by the attitude of the Austrian Poles. The Government had delayed the grant of increased autonomy to Galicia and on May 28 the resentment of the Galician Poles culminated in a conference of Polish members of the Galician Diet and of the Austrian Reichsrat, in which they declared that "the desire of the Polish nation was to have restored an independent and united Poland with access to the sea." On July 30 Polish discontent was further increased by the arrest of Pilsudski, and a month later the Council resigned.

After the failure of the Council a regency project was introduced. By this scheme there was to be a regency of three, a Cabinet and Premier and a Council of State. The Premier and the Council of State were to be chosen by the Regency Council subject to the approval of the Central Powers. The functions of the Polish authorities were limited to education, justice, public welfare, agriculture, and finance as far as it concerned the departments assigned to their care. They might legislate on matters handed over to them but the German and Austrian governors-general had the right of veto within a fortnight of the completion of the bill. The regency had no control over the army.

Such was the position of the Polish Government at the beginning of 1918. The German domination seemed more complete than it had ever been before. In 1916 the Poles could extract concessions from the Germans in view of the fact that their help was needed against the Russians. That help was no longer necessary, therefore concessions were no longer forthcoming.

When the negotiations opened at Brest Litovsk the Polish Government asked the Central Powers to admit its representatives. In spite of "weighty declarations" made at Berlin the demand was ignored and the Poles were excluded from the conference. On Feb. 9 the Treaty of Brest Litovsk was signed. As far as Poland was concerned the important clause of the Treaty was that which ceded Chelm to the Ukraine. On Aug. 17 1917 the Provisional Government of Russia had recognized Ukrainian autonomy. The Ukrainian state was composed roughly of the following territory: the western parts of the Governments of Lublin and Grodno, and the whole of the Governments of Kiev, Poltava, Kherson, Volhynia, Kharkov, Podolia, Yekaterinoslav, and Chernigov and excluded the Austrian Ukraine. On Nov. 20 1917 the Ukraine declared itself to be a republic and on Jan. 11 1918 the delegates of the Ukrainian Republic were formally recognized at Brest by the Central Powers. The territory of Chelm, which was ceded to the Ukraine at this Treaty, had been handed over to Poland by Austria only in June 1916, but its ownership had been disputed for many years and it had already before been in the possession of the Poles.

As a protest against the lack of consideration shown them at Brest the Cabinet, under Kucházewski, resigned and the Poles issued a formal protest against the violation of their rights. This, however, made little difference to the German policy, which demanded that Poland should "completely give over all those greater hopes which might be inconvenient to Germany." This policy was emphasized later in the year when Adml. von Hintze in a speech to the Reichstag proposed an economic union with Poland on the basis of a Customs union or *Zollverein*, that is to say on the basis of free trade between Poland and Germany.

In April the Poles made a statement of their programme at the Congress at Rome. They declared their aim to be "Reunion into one independent state of all the Polish lands, including those which the Central Empires are refusing to restore to Poland and those which they are bestowing as largess on their vassals." It was not, however, until the autumn that it seemed possible for them to achieve the end at which they were aiming. In Oct. it became clear that the union of the Poles no longer depended on the wishes of Vienna and Berlin, but rather on the will of the Polish people. In the same month a national Polish Diet was convoked, and in Austria all the Polish parties left the Reichsrat and formed the National Council in Cracow, until there should be "a freely elected Parliament of a United and Independent Poland." On Nov. 10 Pilsudski, having been released from Germany, arrived in Warsaw and the Council of Regency proclaimed that the German occupation had ceased to exist.

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[1] Nelson's *History of the War*, xviii., 123.

[2] Butler's *The New Europe*, p. 113.

AFTER THE ARMISTICE.—The predominating figure in the evolution of the new Polish state was that of Pilsudski, who, on the abdication of the Council of Regency, took the Government of the country into his hands and succeeded in overcoming the internal and external dangers which faced the country after the German collapse.

Pilsudski was by birth a Lithuanian Pole. In 1885 as a student of medicine at Kharkov University he became connected with the Socialist movement and three years later was banished for complicity in the attempt on the life of Alexander III. though in reality he had been strongly opposed to the plot. In 1893 he returned to Poland and became one of the chief founders of the Polish Socialist party in Russian Poland. The aim of this party was the independence of Poland. In 1900 he was arrested on account of his socialistic writings but he escaped to London, after simulating madness, and two years later returned to Poland. At this time he and his associates "adhered to Socialism because they recognized in it the only powerful revolutionary and democratic force of our time and their supreme aim was, by revolutionary means to win Polish Independence."

In about 1904 Socialism in Poland became a wide popular movement. Pilsudski was responsible for organizing the military element in the new party. Primarily this took the form of the "Fighting Organization" but later systematic military instruction was given by means of Rifle Clubs, with the object of establishing a force which would be used in armed revolution against Tsarist Russia. The war gave them their chance and at its outset they fought against Russia, for "the fight against Tsardom had become to them a second nature." In 1915, however, Pilsudski stopped recruiting for his Legions, his aim being not to raise an army which was to be used for the purposes of Germany and Austria, but one which would ultimately become the army of an independent Poland. With this object in view Pilsudski created the "Polish military organization." This organization was carried on secretly and was concerned chiefly with spreading propaganda in favour of a struggle for a Poland independent both of Russia and of the Central Powers. In 1916 after conflict with the Austrian commanders Pilsudski sent in his resignation. The Austrians refused to allow his resignation but when he withdrew his brigade from the front without any previous warning, the Germans insisted upon his dismissal.

After the declaration of Polish independence Pilsudski was called upon to help in the formation of a Polish army, but this he refused to do, on the principle that a Polish army must not be formed without a true Polish national Government to direct it. In the summer of 1917 he demanded concessions from the Germans, and, in view of the feeble attitude taken up by his colleagues, he withdrew from the Council, at the same time ordering his followers in the Legions to refuse to take the oath. As a result about four-fifths of the Legion were disbanded. He was arrested subsequently by the Germans and imprisoned at Magdeburg. During his imprisonment the Polish military organization continued to develop secretly and when Pilsudski was released by the German Revolution in Nov. 1918 this organization formed the basis of the Polish army.

When Pilsudski returned to Poland in Nov. he found the country confronted with serious dangers. There was no effective Government, the Council of Regency having been dependent upon German control; the anarchy in Russia threatened to spread into Poland, and finally the danger was augmented by the 30,000 rebel German troops which were still in the country. On Nov. 14 the Council of Regency abdicated, leaving the supreme power in Pilsudski's hands. His first work was to establish an army on the foundations laid by the Polish military organization. Through the prompt formation of the army the danger from the German troops was removed and the Bolsheviks were temporarily held back. Pilsudski's next work was to constitute a Government. "Only a Left government," it was well said, "with a programme of constructive democratic reform, could retain authority in the State. Pilsudski therefore formed the Labour Government of M. Moraczewski, and so forced the Left in this critical hour to undertake positive work instead of fruitless opposition and chaotic revolt."

At the end of 1918, therefore, Pilsudski had become the head of the Polish State. The fundamental principle which underlay his policy throughout this period was that of pushing on the Polish State in the "path of modern organic social and political life." He realized that it was social reconstruction, not social unrest, which would consolidate the new state and enable it to hold its own against the anarchic elements which threatened its existence. In the *New Europe* in June 1920 Pilsudski's achievements were thus described: "Socialist, agitator and Leader: Brigadier-General in the Austrian Army: Head of the Polish State: the changes are kaleidoscopic. He has now undoubtedly ranged behind him the great majority of the Polish people, including some of his old enemies, the National Democrats; and this success is one of the greatest tests of his ability, because Poland contains at least a score of political parties."

The first political event of importance in 1919 was the formation of a new Cabinet under M. Paderewski. At the beginning of the year there had been elements of discord between the Government at Warsaw and the Polish National Council which had been formed during the war in Paris, and of which M. Paderewski was the most prominent member. At the beginning of Jan., however, an agreement was made and when M. Moraczewski resigned his office as Premier, Paderewski succeeded him. The chief difficulties which faced the new Cabinet were that of the Bolshevik advance and the economic condition of the country of which the worst feature was famine.

At the beginning of Feb. a general election for a Constituent Assembly was held, and resulted in a victory for the non-Socialist parties, supporting Paderewski. The actual figures are reported to have been: Ministerial party 400, Socialists 80, and Jews 15.

In the summer of 1919 Paderewski, as Premier, was responsible for laying the Treaties of Peace before the Polish Parliament. The terms concerning Poland were briefly as follows:—Poland received the larger part of Posen and part of W. Prussia. A plebiscite was to determine the settlement of Masuria and Upper Silesia. Danzig was to be a free city under the protection of the League of Nations. This city was to be included within the Polish customs frontiers and its foreign relations and the protection of its citizens abroad were to be entrusted to Poland. "Poland also received the right of freely using and of developing and improving all water-ways, docks, and wharfs within the territory of the free city; and the control and administration of the Vistula river, and, subject to some restrictions, of the railway, postal and telegraph systems of Danzig." The actual details were to be settled later by a treaty between Poland and the free city. A provisional boundary was laid down between Poland and Russia, roughly corresponding to the course of the Vistula. In addition to these territorial changes, it was agreed to embody in "a treaty with the Allied and Associated Powers such provisions as may be deemed necessary by the Powers to protect the interests of inhabitants of Poland who differ from the majority of the population in race, language or religion," and also "such provisions as they may deem necessary to protect freedom of transit and equitable treatment of the commerce of other nations."

The clauses concerning Danzig, and the plebiscites for Masuria and Upper Silesia could not fail to be met with disfavour in Poland as the territories were claimed as being Polish either historically or ethnographically. Moreover, the Poles resented the suggestion that they would oppress the national minorities in the country, and felt that the inclusion of this clause was unnecessary.

In spite of these objections, the Peace Treaty was passed by the Parliament on Aug. 1 by 285 votes to 41.

At the end of Nov. a bill was drafted with proposals for a new constitution. It was proposed:—that the vote should be given to all citizens of both sexes over 21; that the National Assembly should be elected every four years; that there should be a bicameral form of Government, the Senate being quite small; that the President should be elected every seven years and that his powers should be considerable. The actual constitution was not finally drawn up, however, until March 1921.

In Dec. a political crisis took place, resulting in the resignation of M. Paderewski. It was decided by the Allied and Associated Powers that Eastern Galicia should be given autonomy for 25 years under the protection of Poland, after which settlement was to be made by plebiscite. Although the majority of the inhabitants of Eastern Galicia were Ruthenians the Poles claimed the territory and this decision of the Powers caused an outcry in Warsaw. Paderewski's explanations carried no conviction and he was forced to resign. On Dec. 15 it was announced that M. Skulski would form a Ministry.

During 1919 the Poles, with Gen. Pilsudski as their commander-in-chief, were engaged in three wars. Two of them, with the Ukrainians and the Czechoslovaks, were not of great importance. Hostilities were started with the Ukrainians on account of the disputed territories in Galicia. At the beginning of the following year a settlement was made after which the Poles and the Ukrainians joined forces to fight the Bolsheviks. The dispute with the Czechoslovaks was also on the subject of disputed territory. The duchy of Teschen, though small, is valuable because of its coking-coal and thriving industries, and for this reason both Poles and Czechs were anxious to possess it. In the summer of 1920 the dispute was settled by a decision of the Council of Ambassadors, which awarded to the Czechs the whole mining region and the chief railway running through the territory. As a result the town of Teschen is cut in two.

The third and most important war was that with the Bolsheviks. The war was caused by the German troops evacuating the eastern territories in a way which was contrary to agreement and which allowed the Bolsheviks to occupy the territory before the Polish troops could be brought up. The local population in the occupied zones appealed to the Poles for aid and, as a further advance seemed imminent, the Poles were forced to fight. The Poles have been accused of entering into this war with the Bolsheviks with imperialistic and aggressive aims. It seems clear, however, that this was not the case. The Polish army was small and was engaged in hostilities elsewhere and the financial and industrial condition of the country was such that unnecessary war would not be undertaken.

The policy of the Allies throughout 1919 was vacillating. At first direct military intervention was attempted but was given up. Later ammunition and war materials were sent to Denikin and Kolchak. Finally the "barbed-wire" policy was suggested, in which Poland was to play a leading part among the states which were to act as a barrier round Russia. This policy, however, lasted only 28 days.

In the autumn the Bolsheviks were prepared to make peace, on Poland's terms, and an armistice was suggested. M. Paderewski was advised by the Allied Powers to refuse these terms and to continue fighting. By the end of the year no further negotiations had been proposed.

During 1920 Poland "served as the centre of the resistance to the spread of Bolshevism," and her political history is very much bound up with her military history. In the spring there were some more peace negotiations, but as before these came to nothing. On April 27 a strong Polish offensive was begun, chiefly to the S. of the Pripet marshes. The Poles advanced rapidly, capturing guns and war material, and on May 8 they entered Kiev. The Bolsheviks, owing to the defeat of Kolchak and Denikin, were now able to concentrate all their forces against Poland and in May opened a counter-offensive campaign. There was serious fighting between the Dnieper and Dvina and the Poles were forced to retreat.

In June a change of Government took place, a non-party Government being formed by M. Grabski. In view of the continued retreat of the Poles the Premier was sent to the Spa Conference to ask for help from the Allied Powers. In July Lord Curzon, as representative of the British Government, proposed negotiations on the basis of the acceptance of the provisional boundary laid down by the Peace Conference, corresponding roughly to the boundary of the Governments of the Vistula. On July 20 these terms were refused by the Bolsheviks.

In Warsaw another change took place in the Government, a War Cabinet being formed, which consisted of M. Witos, M. Daszynski, M. Grabski, M. Skulski, with Prince Sapieha as Foreign Minister. The policy of the new Cabinet was "to defend the full independence of the Polish Republic and conclude a just and lasting peace."

The Bolshevik advance had, in the meantime, been steadily continuing and by Aug. 14 they were within 12 m. of Warsaw. Even if Warsaw had fallen it is possible that the Poles might have made a successful resistance, based upon the western province of Posen, which is in many respects the most important province of the new state. The end of July and the beginning of Aug. saw further attempts for peace. On July 30 Polish officers were allowed to cross the Russian lines to conclude an armistice but they were forced to return with nothing accomplished as they were not authorized to sign the preliminaries of peace with which the Bolsheviks presented them. At the beginning of Aug. a peace conference at Minsk was arranged. As made known to Mr. Lloyd George the chief terms proposed by the Bolsheviks were: the reduction of the Polish army to 50,000, together with a small civic militia; the surrender by the Poles of all arms and war materials with the exception of those necessary for the reduced army; and the demobilization of all war industries.

Owing to Russian procrastination the peace conference was not held until Aug. 17, by which date the military situation had changed with remarkable rapidity. The Russians had advanced too fast and too far and were not prepared for any sudden counter-offensive. When Gen. Pilsudski, therefore, organized a general counter-attack the Bolshevik armies collapsed and retreated in disorder. By Aug. 21 the Poles had entered Brest Litovsk.

When, on Aug. 17, the conference opened at Minsk it was discovered that there was a difference between the terms actually offered by the Bolsheviks and those previously transmitted to Mr. Lloyd George. The terms relating to the civic militia were considerably enlarged. It was in reality to take the form of a force of armed trades-unionists, 200,000 strong and organized after the regular Soviet pattern. In short it was an attempt to foist Bolshevism on to Poland. The military situation, however, made it impossible for the Russians to enforce their terms.

In Sept. negotiations were moved to Riga, where on Oct. 12 the final treaty was signed. In the N. Poland obtained direct access to Lettland on the Dvina above Dvinsk. The Poles obtained Baranovichi, Pinsk, Kovel, Rovno and the whole extent of the Baranovichi-Rovno railway. With these boundaries the area of the new state is about 148,000 sq. m., and the population about 30 millions, but of this no accurate estimate can be yet formed. Poland ranks as the sixth state of Europe in size and population, and is by far the most important of the new states which the war has produced in eastern Europe.

In addition to the war with the Bolsheviks Poland was concerned with other foreign affairs. The treaty between Poland and Danzig was signed in 1921 but in the meantime there was "an unhappy amount of friction between the Poles, the Germans of Danzig and the British High Commissioner representing the League of Nations." The Poles in Danzig were frequently mobbed and in the summer of 1920, during the crisis in the Bolshevik war, guns and war material sent from the Allied Powers were held up in the port by the people of Danzig.

After Sept. 1920 there was friction with Lithuania. When the Bolsheviks retreated from Vilna both the Poles and the Lithuanians claimed the city, the Poles on the grounds of the language and population, the Lithuanians on the grounds of historical tradition. The Lithuanians at first took possession of

Vilna but later Zeligowski with an army of White Russians turned out the Lithuanians and established an independent Polish Government.

THE JEWISH QUESTION.—One of the most important questions to be considered by the new Polish State is that of the Jews. Numerically they form roughly one-seventh of the population. In Warsaw a third of the population are Jews: in many provincial towns four out of every five inhabitants are Jews and in some nine out of ten, and of these the vast majority are Eastern Jews who in language, religion and customs differ from the population. Their language is Yiddish, a Middle-High German dialect; for the purposes of writing, Hebrew characters are used. Their dress is peculiar to themselves and their unclean habits and low standards of conduct "are neither European nor modern." The Western Jew is the more civilized type which is generally found in western Europe, speaking the language and conforming to the habits of Western civilization.

The Eastern Jew is essentially a business or commercial man, but rarely a producer. He is usually a middleman or intermediary. In towns the majority of the shops are owned by Jews, but they are a race apart, hated and despised by the rest of the population, devoted to their religion, which is a primitive type of Judaism.

The Jews have been settled in Poland between 800 and 1,000 years so that they can hardly be considered "strangers" in the land, in fact the Slavs cannot be considered very much more native than they. It was not, however, until about 20 years ago that the present quarrel between the Jews and the Poles began. The Tsarist Government drove the Jews out of Russia but gave them exceptional advantages in Poland. These Litvaks (as they were called) openly professed themselves the partisans of Russia and founded the Jewish press which set to work openly to fight against Polish autonomy. The Poles attacked the Jews before the war by means of a national boycott, the only means by which one subject race could attack another. During and after the war the hostility to the Jews was increased by the fact that in the German occupation the Jew was the willing tool of the invader, and by the close connexion between the Jews and Bolshevism. The hostility to the Jew was marked in 1918 and 1919 by excesses in which some 200–300 have in fact been killed, but which have been enormously exaggerated by the Jewish press.

The following recommendations for the future treatment of the Jews in Poland were made by Sir Stuart Samuel in his report on his mission to Poland (Cmd. 674, 1920):—That the Polish Government be urged to carry out the clauses of the Minority Treaty of June 28 1919, in a spirit of sympathy with its Jewish subjects. That a genuine and not a "masked" equality be accorded to the Jewish population of Poland. That all outrages against the person and property of the subject, irrespective of race or religion, should be promptly punished and the names of the delinquents published. That the Jews in E. Galicia be restored to their official positions in the same manner as non-Jews have been. That no restrictions should be placed upon the number of Jews admitted to the universities. That a decree be published declaring boycotts illegal, and ordering all publications advocating boycott to be suspended. That all prisoners in internment camps be brought to immediate trial, and that humane treatment be assured to all interned prisoners. That facilities be afforded for the introduction of new industries into Poland with a view to converting a larger proportion of the Jewish population into producers. That the British Government should assist Jews wishing to emigrate from Poland by providing facilities to proceed to countries such as Palestine, Canada, S. Africa, Algeria and S. America, or any other country desiring to receive them. That banks be established possessing the confidence of the Jewish public, so that money might be deposited therein instead of being carried on the person or concealed in dwellings. Finally, that the desirability of a secretary who understands and speaks Yiddish being added to the staff of H.M. Legation at Warsaw be considered.

Capt. Peter Wright, in his very valuable and interesting report states (Cmd. 674, 1920, pp. 17–36) that the great majority of the poor Jews are of the Eastern type and extreme orthodoxy (Chassidin). They form an immense mass of squalid and helpless poverty and Capt. Wright's only recommendation is that the richer Jews should study the condition of the poor Jews who either trade as small middlemen, as hawkers or touts, or labour as unskilled, or almost unskilled, and fill the sweating dens as sweaters or sweated when they emigrate. They are driven into all sorts of illicit and fraudulent practices and in England, in the East End of London, too large a proportion of convictions for such offence can be laid to their account. They are unfit for the modern economic world for want of education and for Western society because of their habits and want of cleanliness. They are devoted to their strange old religion but as they grow rich their piety, as the Chief Rabbi told Capt. Wright, is destroyed by wealth and they take too little interest in their poorer brethren. No one who knows Poland can be surprised at the Polish attitude or the desire of the Poles to be rid of this corrupting influence.

POLAND IN 1921.—It was still impossible in the autumn of 1921 to make any final or definite statement with regard to the boundaries of Poland; as regards Lithuania the situation remained unsettled, and it was only in Oct. that a decision favourable to Poland in respect to Upper Silesia resulted from the award of the League of Nations (*see* SILESIA).

Working on the principle of national rights it was attempted at the Peace Conference to make the boundaries of Poland conform to ethnographic divisions. A commission was appointed, under M. Cambon, which was to deal with the Polish question and submit drafted proposals to the Supreme Council. The first report of the commission concerned the western boundaries, the proposals being as follows:—The larger part of Posen and Upper Silesia should be transferred to Poland, "leaving Germany the western, predominantly German-speaking districts of both territories." According to the German census of 1910 the Poles formed about 65% of the population in the two areas ceded to Poland. In addition Poland was to be given "the central and eastern zones of the province of West Prussia, including both banks of the lower Vistula and Danzig," though racially the latter was distinctly German. The settlement in the case of the district of Allenstein, that is to say the southern zone of E. Prussia, was to be referred to a plebiscite.

These proposals were not accepted without modification, as it was urged by Mr. Lloyd George that they were terms to which the Germans would never agree. In the first place a modification was made with regard to the territory round Marienwerder on the E. bank of the Vistula. Instead of being transferred to Poland outright this territory was to be subjected to a plebiscite. More important, however, was the change introduced in the matter of Danzig. It was decided that Danzig and the small adjacent district were to form a free city under the protection of the League of Nations. Poland received the right of freely using all the waterways, docks and wharfs and was to have the control and administration of the Vistula river. Later a third modification was made with regard to Upper Silesia, when it was decided that in this territory too there should be a plebiscite.

The results of the plebiscite in the Marienwerder and Allenstein districts were in favour of Germany, a result which was largely due to the number of Germans who were imported into the territory. The plebiscite in Upper Silesia was likewise in favour of Germany as a whole, though in many districts there was an immense Polish majority.

The southern boundary of Poland is that of Galicia. In the N.E. the boundary between Poland and Lithuania was still unsettled in 1921 and the Poles were still in possession of Vilna, the capital of Lithuania.

With regard to the eastern boundary between Poland and Russia nothing definite could be settled at the Peace Conference as there was no recognized Russian Government with which to carry on negotiations. In order to facilitate the work of the Warsaw Government in organizing local administration in the part of Russian Poland which was certain to be ceded by Russia, a provisional eastern boundary was proposed which would include all the territory which might be regarded as having "an indisputably Polish ethnic majority." All the territories to the W. of this line were to belong unconditionally to Poland, whilst the territories to the E. were to be settled by future negotiations with Russia. Roughly speaking this provisional boundary corresponded to the old boundary of the Governments of the Vistula. This provisional boundary has since become known as the "Curzon Line." When the Poles appealed, in the summer of 1920, for help against the Bolsheviks an attempt was made by the British Government to secure peace. Lord Curzon, acting on behalf of the Government, proposed the acceptance of this line as the basis of the peace terms. The Poles being unwilling to sacrifice lands which were inhabited by an incontestably Polish population would not agree to this settlement and were later, at the Treaty of Riga, able to conclude peace with the Bolsheviks on more advantageous terms.

As finally settled at Riga on Oct. 12 1920 the line of the eastern boundary is as follows: Starting from the border of Latvia the line takes a south-easterly direction to Dzisna (Disna), thence S. passing very slightly to the W. of Dokszyce (Dokshitsi); it passes some 30 km. W. of Minsk and, farther S., 90–95 km. E. of Pinsk; it proceeds almost due S. and then slightly S.W. to Ostrog; for some 40 km. it continues in a south-westerly direction and then goes almost due S. again till it reaches the river Zbrucz; the boundary follows the line of this river until it reaches the Dniester, which separates Poland from Rumania.

Constitution.—Poland is a Republic. The legislative power is given to a Diet and a Senate, which are summoned, adjourned and dissolved by the President. The Diet is composed of paid members elected for five years, upon a system of proportional representation. Suffrage is universal—all who enjoy full civic rights and who are over 21 being qualified to vote, but, since voting is personal, soldiers on active service are excluded. Citizens over 25 are eligible for election to the Diet with the exception of members of the Civil Service, who cannot be elected for the district in which they hold office. The minimum age for voting in senatorial elections is 30, whilst no one under 40 is eligible for election.

Bills go to the Senate after being passed by the Diet and if no objection is raised within 30 days the bill becomes law. Amendments are considered and voted on by the Diet. With regard to finance—a budget is fixed each year for the following year; taxes and customs duties can be established only by law and a supreme court of control superintends the management of state finance.

The executive power is exercised by the President and a council of ministers who are responsible for his official actions. He is elected for seven years by the National Assembly, that is, the Diet and Senate acting together. Laws are to be signed by him and by the President of the Council and the minister concerned. The President has the supreme power in the army, except in time of war when the Minister for War is responsible for all military affairs. The President can declare war and make peace only with the consent of the Diet. He has the right of pardon.

For purposes of administration Poland is to be divided into palatinates, districts and urban and rural communes, these forming the units of local government. Economic autonomy is established by means of chambers of agriculture, commerce, industry, etc., which will together form the Supreme Economic Chamber of the Republic, the competence of which required further legislation.[1]

Judges are nominated by the President whilst justices of the peace are popularly elected. Judges can be removed from office only in certain legal cases and following a judicial decision. All citizens are equal in the eyes of the law, protection of life, liberty and property being assured to all inhabitants. State protection is given to labour and insurance for unemployment, illness and accident is guaranteed. Roman Catholicism is the recognized religion of the country but others are allowed provided they are in accordance with the law.

Land must be cultivated from the point of view of public utility. The law is to decide to what extent citizens and independent associations may cultivate the land and exploit its mineral wealth, and in what cases the state may repurchase property to improve the value of its production.

POLAND IN 1921

Population.—It was still impossible in 1921 to give any accurate statistics with regard to the Polish population of Poland, etc., since the establishment of the new state. The following are the statistics of 1910.

Russia:—	
Kingdom of Poland	9,100,000
Lithuania and Ruthenia	2,438,000
Empire	460,000
	11,998,000
Austria Hungary:—	
Galicia	4,672,000
Spioz Orava, etc.	200,000
Teschen	235,000
Bukovina	36,000
Other provinces	36,000
	5,179,000
Germany:—	
Posen	1,291,000
W. Prussia	604,000
E. Prussia	286,000
Silesia	1,338,000
Westphalia, etc.	580,000
	4,099,000
Different countries of Europe	100,000
Europe	21,376,000
Outside Europe:—	
N. America	3,100,000
S. America	100,000
Other parts of the globe	30,000
	3,230,000
Grand total	24,606,000

Economic Development.—In considering the economic development of Poland the following territories are included: the kingdom of Poland, parts of E. and W. Prussia, Posnania, Silesia and Galicia.

Agriculture.—The majority of the people of these lands, with the exception of Silesia, were engaged in agriculture before the war; the percentage being 56·6 in the kingdom of Poland, 54·1 in Posnania, 49·9 in W. Prussia, whilst in Galicia there were 71 agriculturists per square kilometre.

Arable land predominated. The most important crops were rye, oats, barley, potatoes, wheat and sugar-beet. Agriculture was most highly developed in Prussian Poland where the latest agricultural implements and scientific manures were employed. The breeding of domestic animals, especially horses, showed distinct progress before the war. In the kingdom of Poland pig-breeding was particularly encouraged. Cattle and pigs were most numerous in Posnania and W. Prussia while in Galicia the horned stock were well up to the average for Austria in general.

Of the percentage of area under forest, there was in the kingdom of Poland in 1909 some 18 %, in Galicia (1912) 25 %, in Posnania 19 %, W. Prussia 22 % and in Upper Silesia 28 %. In E. and W. Prussia more than half the forest area belonged to the state, in Posnania about a third, in Silesia only about 12 per cent.

The kingdom of Poland had 17 agricultural syndicates in 1909, for selling agricultural products and buying machinery, manures, etc., the most important of these being the Central Society of Agriculture, founded in 1907. These societies were most developed in Prussian Poland, particularly in Posnania, where in 1913 there were 388 Polish agricultural societies. There were also numerous coöperative societies. Galicia also possessed agricultural, coöperative and mutual insurance societies.

Minerals.—The most important production in Galicia was that of petroleum, which was estimated, in 1914, as being 3 % of the world's output and 9 % of that of Europe, including Russia. The petroleum industry has attracted an abundant flow of international capital and has thus been able to adopt every device for profitable exploitation.

The chief coal-fields are those of Silesia where the production in 1911 was some 36 million tons, while that of Galicia was 1½, and that of Poland 5¾ million tons. Other notable mineral industries are those of iron, zinc and lead.

Manufacture.—Of industrial workers Upper Silesia possessed the largest number: 47·7 % of its population were engaged in industry (1907). In the kingdom of Poland this proportion was only 15·4 % (1897), in Galicia 8·8 % (1900), Posnania 23·4 %, W. Prussia 24·1 % (1907). In the kingdom of Poland the most important industry was the textile, which occupied about 150,000 workers. Cotton manufactures were the most important, wool being second. Before the war this industry was handicapped by the high tariff charged by the Russian Government for the transport of raw material. Second in importance was the metallurgical industry, the most important manufactures being machinery, boilers, materials for bridge building, nails, wire and sheet iron. The manufacture of machinery was of considerable importance in Silesia but less developed in Galicia.

Of other industries that of the potato by-products is most important. More than a quarter of the potatoes produced in Posnania and the greater part of those of Galicia were used for the making of alcohol. Before the war the wood industry was in a poor condition owing to severe German importation duties on manufactured wood, but these duties encouraged the development of the saw-mill industry in Prussian Poland. The coastal fisheries of E. and W. Prussia are of considerable importance; likewise the pond fisheries in Poland, but fishing is generally only a subsidiary occupation.

The industry of Poland was very much influenced by the Jewish population. In the kingdom of Poland before the war nearly 15 % of the population was Jewish and the following trades were more or less in their control: leather goods and the boot trade; stocking industry; manufacturing of the so-called "astrakan" caps; malt refuse breweries and small mead breweries; manufacture of paper tubes for cigarettes; and potato starch.

Towns.—The chief towns in the kingdom of Poland were Warsaw, Lodz and Sosnowice—which had over 100,000 inhabitants. The principal towns of Galicia are Lemberg (206,000), Cracow (154,000), Przemysl (54,000) and Kolomea (44,000). In 1910 E. Prussia had five towns with a pop. of more than 20,000; Königsberg, Tilsit, Memel, Allenstein, Insterburg. There were in W. Prussia three towns with upwards of 20,000 inhabitants: Danzig, Thorn and Graudenz. In Posnania there is an unusual number of small towns, but there are only nine with more than 10,000 inhabitants; the most important are Posen (154,811 in 1910), Bromberg (70,000), Schneidemühl (27,504), Lissa (17,156). Silesia has seven towns with a pop. of more than 50,000: Breslau (537,000), Görlitz (86,000), Königshütte (72,000), Liegnitz (69,000), Beuthen (67,000), Gleiwitz (64,000) and Zabrze (59,000).

Commnunications.—Of the natural water-ways in Poland the Vistula is the most important. It has 21 tributaries, of which the total length, with that of the river itself, amounts to 7,770 kilometres. In 1864 a convention was made between Russia and Austria for the regulation of the course of the river; in Austria 64·47 % of the work was completed by 1909, in Poland 39·7 per cent. Thus in Poland the Vistula is almost impossible for regular steamer traffic.

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[1] A law was passed by the Diet in 1919 providing that the state should buy land from the nobles and distribute it to the Polish peasantry. Owing to the want of money the law has hitherto been in suspense. The execution of this law might eventually fall under the Chamber of Agriculture.

The Niemen is navigable from about halfway between Grodno and Kovno to the Prussian frontier. The Pilitsa is navigable for rafts from a point near Novo Radomsk to its junction with the Vistula, so for a small portion of the year is the Bug from the point where it first touches Poland and likewise the Narew for a considerable distance. The Oder affords the products of Silesia an outlet not only to Stettin near its mouth, but also to Berlin and Hamburg with which it is connected by an extensive system of water-ways. The Dniester is used in Galicia only for rafting timber. The chief canals are the Dnieper-Bug Canal; the Augustowo Canal, uniting the Vistula to the Niemen through the Narew; and the Bromberg Canal, uniting the Brahe to the Netze and thus the Vistula to the Oder. Of these the latter is the only canal navigable for large boats and steamers. As regards railways, in 1912 the kingdom of Poland had 2·9 km. per sq. km., the Polish provinces of Prussia had 9·27 km. and Galicia (1911) 5·24 kilometres. As the railways were constructed for the most part from a strategical point of view, industry did not benefit so much from them as it might otherwise have done. The poor railway system between Russia and Danzig was one of the causes of the decline of the trade of that port.

Trade.—With regard to commerce—the kingdom of Poland was closely attached to Russia by the protectionist system introduced in 1877 and this made trade with other countries difficult. The interchange of goods with Russia was about 2½ times greater than that with other countries. The following were the chief exports: textiles, three-quarters of which went to Russia, though trade with countries further E., notably Persia and Mongolia, was increasing; clothing and boots, which found their chief markets in Russia; horses, poultry and eggs. The chief imports of the kingdom of Poland were:—raw wool and cotton from overseas and from Russian Turkestan; iron ore and pig-iron from Russia; cattle from the steppes; and flour from Russia. In 1909 over 1·4 million q.m. of Russian flour was imported, this forming a formidable competitor to Polish milling thanks to special transport rates.

Galicia was united to the fiscal territory of Austria in 1784 and her commercial interests were generally subordinate to the will of the more powerful states of the west. The principal customer of Galicia was Germany. In 1909 the exports of Galicia to Germany amounted to 10·6 million q.m.; the imports from Germany to 6 million q.m. The chief exports were salt and petroleum and wood. The chief imports were:—textiles to the value of about 300 million francs; iron and iron goods from Germany; coal, of which 7½ million q.m. was imported in 1908.

The industry of the Polish provinces of Prussia began to decline after they were assimilated to the German hinterland. On the other hand, the protective custom tariff acted beneficially on agriculture and the trade in provisions. The principal customers of Posnania were the other states and provinces of Germany. The chief exports were sugar, alcohol and cereals. There were exported annually from 1885–1908 250,000 q.m. of wheat, 2,000,000 q.m. of rye, 410,000 q.m. of barley and 210,000 q.m. of oats. The rye was sent to Bohemia, Austrian Silesia and the kingdom of Poland, rye meal to Scandinavia, Belgium, Holland and Finland. Except for the products of local agriculture and forestry these provinces were entirely dependent on outside sources.

Coöperative credit societies developed vigorously and by 1913 they had together over 75,000 members and deposits of over 202 million francs. The Coöperative Societies' Bank, founded in 1910, formed a financial centre for the societies. With regard to savings banks, by the end of 1912 there were in Galicia 53 banks with deposits amounting to 336 million francs. In Prussian Poland coöperative societies were established on the principles of Schulze-Delitzsch and on the Raiffeisen system—after 1900 buying and selling societies were founded. The Polish credit institutions in Prussia, deriving their capital solely from Polish sources, had at disposal the sum of 498,631,000 francs.

The war left Poland in "a pitiable economic situation." The country was devastated in the first years of the war and then its resources were drained by the German occupation. The mobilization of Polish industry depends on currency stability, improved transport conditions and an abundance of available coal. The following statistics show the number of industrial workers employed before the war and on Jan. 1 1920:—

	Before the war	Jan. 1 1920	Per cent as compared with pre-war figures
Mining . . .	28,300	36,900	130
Metallurgical . .	18,650	5,450	29
Metal . . .	52,415	7,151	14
Mineral . . .	40,900	12,200	30
Textile . . .	168,016	38,900	23
Paper . . .	7,000	4,000	57
Chemical . . .	8,550	3,220	38
Tanning . . .	8,020	2,614	32
Provisions . .	33,200	14,370	43
Wood . . .	9,540	. .	. .
Total	374,591	124,805	34

It will be seen that the coal industry has, in spite of housing and provisioning difficulties, increased from the pre-war standard. The production of coal in Congress Poland and Galicia does not suffice to cover the requirements of the countries at present constituting the Polish State. The Reparations Committee assigned to Poland only 250,000 tons of coal per month from Silesia; and the Polish Coal Sub-Committee has granted a lump sum of 450,000 tons of coal. This lack of coal is one of the most serious hindrances to the reorganization of Polish industry.

The oil industry was not much devastated by the war, but for the first five months of 1919 the Boryslaw-Truskawiec basin and that of Bikhov were under Ukrainian administration, and oil had to be used instead of coal for working the shafts. In 1920 about half the textile industry had been mobilized and many factories started in Lodz and also in Czenstochowa, Kalisz and Bielsk. In 1919–20 the output of sugar scarcely amounted to 65% of the expected output, *i.e.* instead of 500,000 q.m. only 350,000 q.m. were produced. The iron foundries came to a standstill during the war and no plant was left without some essential part wanting. In July 1919 the first blast furnace started work and by the beginning of 1920 a few others were in working order. Steel production is hampered by lack of coal.

Finance.—The revenue of the Russian Treasury of the Kingdom of Poland in 1912 amounted to about 609 million francs and the expenditure amounted to about 371 million francs. From 1905 to 1912 inclusive, the excess of receipts over expenditure in the Kingdom amounted to 1,034 million francs. State officials administered the finance of 116 towns in the Kingdom of Poland. The revenue of Warsaw according to the budget of 1914 was 39 million francs. The rural communes possessed a limited autonomy. In Galicia the largest item contributed to the Austrian State was from the taxes on consumable articles and monopolies. The total receipts were 42·37 francs per inhabitant and the expenditure 26·90 francs per inhabitant. As regards the finance of Galicia as an autonomous province, in 1911 the expenditure amounted to 66 million francs, derived mainly from taxes on articles of consumption and provincial surtax on direct contributions. In the 74 autonomous districts the income amounted to 12 million francs, derived from the surtax on direct contributions and the tolls of the districts. The budget of Lemberg was over 11 million francs and that of Cracow nearly 9 million francs. In Prussian Poland the finance of the Empire was based on indirect contributions, customs yielding the largest return. In Prussia direct contributions played the most important part, the income tax producing 9 million francs in Posnania in 1911, and 7 million francs in W. Prussia. The total of the autonomous taxation of the province, districts and communes amounted to 24 francs 35c. per head in Posnania and to 30 francs 01c. in W. Prussia.

In the Kingdom of Poland the chief bank was the State Bank. In 1914 there were 38 private branches accredited to it, five branches of Petrograd large banks and five branches of the Riga Bank of Commerce. In Galicia the most important were the Austro-Hungarian Bank, with 13 Galician branches and 20 branches of Vienna and Tchek Banks. Branches of the Reichsbank and of large German Banks protected the German element in Russian Poland. In addition to these there were joint stock banks for credit for short periods. In the Kingdom of Poland there were nine; the deposits amounted to over 296 million francs in 1914. In Galicia the Mortgage Bank was the largest joint stock bank, which in 1912 discounted bills of exchange for 178 million francs. In Prussian Poland the most important was the Bank of the Federation of Coöperative Societies, which had a capital of 29 million francs in 1916. Credit for long periods depended, in the Kingdom of Poland, on the Land Credit Society and the Peasants' Bank; in Galicia, on the Land Credit Society and the Commission of Rentengüter, and in Prussian Poland chiefly on coöperative credit societies.

Finally Poland was in a crippled condition financially. The mark which was at 40 to the pound sterling in 1919, touched a new low record on June 28, 1921—namely 6,400 to the pound, and after that fell for two days to 9,000 to the pound. This rate of exchange prevented Poland from trading internationally and consequently hindered her economic reconstruction. On July 30 the Polish budget for 1921, the first real balancing of expenditure and revenue produced by any Polish finance minister, was presented to the Diet and showed a deficit of 80,000,000,000 marks (the exchange on that day being about 8,000 to the £) for Russian and Austrian Poland without the Polish part of the Austrian duchy of Teschen. The former Prussian provinces which only came under the Ministry of Finance on Sept. 1 1921 have a surplus of 6,000,000,000 marks which reduces its national deficit to 14,000,000,000 marks.

The Ministry of War was responsible for 30% of the expenditure, railways for 21% of the expenditure and food supplies for some 10%. But it may be said that the existing low rate of exchange gave no real indication of the prosperity of the country. Polish indebtedness was not great (about £6,600,000 at the exchange of July 30 1921), the productive capacity of the country was increasing, and the harvest prospects were excellent.

REFERENCES.—The one indispensable introduction to things Polish for English readers is the little volume entitled *Poland* in the Home University Library by Prof. Alison Phillips. In that admirable summary there are but two lacunae. The Exodus to Paris after 1830 and the Jewish question are not adequately treated, but it contains a good bibliography for beginners, to which there are only a few additions to be made:—Geoffrey Drage, "Pre-war Statistics of Poland and Lithuania," published in the *Journal of the Royal Statistical Society* (March 1918); Bruce Boswell, *Poland and the Poles* (1920); Ralph Butler, *The New Eastern Europe* (1919); Erasmus Pilz, *Poland* (1916); Askenazy, *Danzig and Poland;* Bass, *The Peace Tangle* (1921); Mandell House Seymour, *What Really happened at Paris* (1921); Pernot, *L'épreuve de la Pologne;* Report by Sir Stuart Samuel on his Mission to Poland (Cmd. 674), 1920.

(G. Dr.)

POLICE (United States).—An interesting recent development as regards police in the United States has been the establishment in certain states of a state police, sometimes called constabulary. This body acts under state rather than local authority, is usually organized on a military basis, is widely distributed for patrol duty, but can be quickly mobilized for emergencies. Such forces are of special service for protecting life and property in country districts, made accessible to robbers and assassins by the introduction of the automobile. Since the adoption of national prohibition much of their time has been spent in suppressing illegal liquor traffic.

The largest state police force is that of Pennsylvania, consisting in 1920 of 415 officers and men. It was organized in 1905 somewhat after the model of the Canadian Northwest police. It is composed of five troops with posts in different parts of the state. Detachments are sent out to the 40 stations and from the stations small patrols operate in every direction. The posts and stations are in constant communication, and help can be rushed immediately to any point. They are empowered to make arrests for any violation of the law; at the same time they act as fish and game wardens and as fire patrols. When practicable they coöperate with the local authorities in preserving order. In some states their powers are somewhat restricted; in New York they cannot enter a city to suppress a riot unless so ordered by the governor or on request of the mayor with the approval of the governor. But in any state they may pursue a criminal and arrest him anywhere. In Pennsylvania applicants for appointment who have served in the army, navy or militia are given preference. The recruit serves a probation period of four months and makes a study of the state laws. The period of enlistment is two years. Another type of state police is seen in South Dakota, where the sheriffs and deputy-sheriffs form a state constabulary "for the purpose of detecting crime, apprehending criminals, suppressing riots, preventing affrays, and preserving and enforcing law and order throughout the state." In Idaho all state, county and municipal officers form a state constabulary under the direct control of the commissioner of the department of law enforcement. A third type is seen in the Massachusetts District Police, consisting of a detective and an inspection department. Appointments are made by the governor and his council. At the governor's command they suppress disorder anywhere in the state. They do not maintain a patrol. In 1920 a state police, or constabulary, was maintained in 12 states: Massachusetts, Texas, Connecticut, Pennsylvania, Nevada, New York, South Dakota, Michigan, Idaho, New Mexico, Tennessee, and West Virginia. At that time several other states were considering the establishment of such forces.

A special committee on state and metropolitan police, appointed by the American Institute of Criminal Law and Criminology, in a report submitted in 1920 urged active coöperation "in educating the people, and especially the Legislatures of their respective states, with respect to the nature, methods, and value of a state police force."

See this committee's report, "Metropolitan and State Police," in the *Journal of the American Institute of Criminal Law and Criminology*, vol. xi., No. 3 (Nov. 1920). An excellent account of the largest and best organized of the state police forces is given by Katherine Mayo in *Justice to All: The Story of the Pennsylvania State Police* (1917), with an introduction by Theodore Roosevelt.

POLLIO, ALBERTO (1852–1914), Italian general, was born at Caserta on April 21 1852. Before he was nine years old he entered the Naples military college, and he received his commission as a sub-lieutenant of artillery in April 1870. He served with distinction in various posts, and in June 1908 he was appointed chief of the Italian general staff, a position which he retained till his sudden death on July 1 1914. Pollio acquired a wide reputation as a writer on military subjects, his chief works being on Waterloo and Custozza. Both these books were translated into various languages.

POOR LAW in the United Kingdom (*see* 22.74).—During the decade following the publication of the Royal Commission's Reports in 1909 the English Poor Law system underwent some minor administrative reforms. The commissioners had laid bare many crying scandals, and their reasoned indictment of the whole system aroused immediate and wide-spread interest. An agitation was set on foot, and actively prosecuted for several years by the partisans of the Minority Report, who demanded the complete abolition of the Poor Law. Many M.P.'s, irrespective of party, were pledged to this, and the public generally was prepared for drastic legislation. It was expected that the Government would presently take the matter up, when the outbreak of the World War in 1914 shelved the question. Meanwhile the Reports and the agitation begun in 1910 could not be entirely ignored by the Poor Law authorities themselves. Mr. John Burns, the President of the Local Government Board, though a staunch defender of the Poor Law, was bound to admit that some amendments were necessary. But these, he claimed, could be carried out by his own department. What was wanted was not, as he put it, "reform by revolution, but revolution by reform in administration." The administrative revolution, however, did not produce any startling changes. A new Relief Regulation Order was issued, which did a little to improve the administration of outdoor relief, but left the fundamental objections untouched. Another Order (Poor Law Institutions Order 1913) was designed to consolidate the regulations governing indoor relief. This, too, effected slight improvements in classification, the quality of the nursing service, the paupers' dietaries and so on. It also insisted on the removal of children over three years of age from the general mixed workhouse into separate institutions or quarters. But many of the boards of guardians were apathetic, or openly defiant of the central authority, and a steady pressure was required to reduce the numbers of these children, whose condition had been shown by the Royal Commission in 1909 to be peculiarly scandalous. During the war this pressure was relaxed, and in 1921 there was still a residue of children between 3 and 16 years of age (besides the infants under 3) living in the general workhouse wards. In 1911 a Boarding-out Order emphasized the need of closer supervision and more adequate allowances for the pauper children lodged in private houses with "foster-parents." There was also an attempt made to deal with the problem of vagrancy in London, by putting all the casual wards of the Metropolis under the control of the Metropolitan Asylums Board, coöperating with the police and various philanthropic agencies. And rather late in the rest of the country most of the boards of guardians combined in county vagrancy committees, for the better coördination of their treatment of the tramps. "Way-tickets" and bread-stations were established, a number of casual wards were closed, and expenses were pooled. But these reforms scarcely amounted to a revolution, either in their conception or in their effects.

Of the later developments only two are of any importance. The Representation of the People Act 1917 removed the disfranchisement which had been one of the chief stigmata of pauperism. Hitherto the receipt of parish relief (other than medical relief only) "within the twelve months next preceding the last day of July in each year" had disqualified a man or woman from being registered as a voter. Now anyone may vote, provided he is not actually an inmate of a Poor Law institution at the moment of the election. In 1919 the Local Government Board ceased to exist, and was succeeded as the central Poor Law authority by the newly created Ministry of Health. This change made no outward difference, but it was generally taken to foreshadow a thorough reform of the Poor Law system, and the Ministry of Health Act 1919, sect. 3 (3), actually contains the significant words: "in the event of provision being made by Act of Parliament . . . for the revision of the law relating to the relief of the poor and the distribution amongst other authorities of the powers exercisable by boards of guardians." The removal of the pauper disfranchisement was in harmony with the growing democratic spirit of the time, and reveals clearly the enormous change in thought since the setting-up of the "New Poor Law" in 1834. The same softening tendency appears also in the trivial, but significant, alteration of the name of the workhouse: the workhouse is now officially known as "the institution," though the word "workhouse" must be retained for certain legal purposes.

Meantime, a different sort of reform was proceeding from outside the Poor Law, by the increasing inroads of the local authorities into the field of the guardians. On the removal of the "pauper disqualification" in 1911 many thousands of the destitute aged became entitled to old-age pensions and so passed out of the Poor Law. Similarly the National Health Insurance Act took a vast number of patients, or potential patients, from the Poor Law medical service. And later Acts, empowering the local health authorities to set up maternity and infant clinics, to provide midwifery, to supply milk to expectant and nursing mothers, to treat venereal disease or tuberculosis, have still further diminished the scope of the Poor Law. All this, however, desirable as it might be from the point of view of social progress, could hardly be regarded as "Poor Law reform" save in an ironical sense. In point of fact, it served to reinforce more and more strongly one of the principal charges made by the Royal Commission in 1909. For it meant in practically every department an increase of administrative disorder—overlapping, multiplication of machinery and waste. In the case of every class of the pauper host, infants, children of school age, the sick, the feeble-minded, the aged, the able-bodied, there is now at least one, and generally more than one, other authority set up as a rival to the board of guardians. There is little, if any, coördination between the work of the medley of public bodies engaged in giving various forms of assistance out of the rates and taxes. They are in many cases dealing on different lines, and for different reasons, with different members of the same family. So far as the Poor Law Guardians are concerned, it is often a mere matter of chance whether it is they or the local health or lunacy or education authority who become responsible for a sick or feeble-minded person or a school-child. And as regards the aged, it was found that at the beginning of 1920, out of a total of 46,846 paupers over 70 in England and Wales, no less than 9,345 were old-age pensioners, two-thirds of them receiving outdoor relief and the other third in institutions.

When, in the latter period of the World War, public attention was directed to the problems of social reform that would have to be solved after the peace, this question of "public assistance" inevitably bulked large. In July 1917 the Ministry of Reconstruction appointed a "Local Government Committee" to consider and report upon "the steps to be taken to secure the better coördination of public assistance in England and Wales and upon such other matters affecting the system of Local Government as may from time to time be referred to it." Its report—popularly known as the Maclean Report, from the name of the chairman, Sir Donald Maclean, M.P.—was presented at the end of 1917. Subject to reservations by certain members of the committee, it was unanimous on the main point. The existence side by side, it declared, of the boards of guardians on the one hand, and the county, municipal and other health and education authorities on the other, produced both overlapping functions and areas and conflicting principles of administration.

> "The resulting confusion has been aggravated by the growing popular prejudice against the Poor Law—a prejudice which does less than justice to the devoted work of the Guardians, and the continuous improvement in poor-law administration, especially in respect of the children and the sick. For the last decade Parliament has been unwilling to entrust the Boards of Guardians with new functions, and the provision for new services has had to be made by other Local Authorities—in some cases new Local Authorities—often to the increase of the confusion and overlapping. Further, the classification by institutions and the specialized treatment of recipients of assistance almost necessarily involve an enlargement of existing areas of administration."

The committee, therefore, recommended the abolition of the boards of guardians and the Poor Law unions. The scheme advocated may be summarized as follows:—

1. All the functions of the boards of guardians should be transferred to the councils of counties, county boroughs and boroughs or urban districts with populations exceeding 50,000.
2. Provision for all the sick and infirm (including the aged requiring institutional care, and maternity and infancy) should be made by these authorities under the Public Health Acts suitably extended.
3. The Ministry of Health should have power to put any borough with a population over 10,000 or any urban district with over 20,000, in the position of an autonomous health authority, with such reservations as might be desirable.
4. The children should be dealt with by the local education authorities, the mentally deficient by the local lunacy authorities.
5. Every county or county borough (or borough or urban district council with a population over 50,000) should set up: (i.) a prevention of unemployment and training committee (on the lines of the education committee, and including representatives of employers and trade unions); (ii.) a home assistance committee (on the lines of the education committee) to enquire into the economic circumstances of all applicants for public assistance, to supervise them, to administer all relief given in the home, to recover expenses of maintenance, treatment, etc., and to keep a private register of all such applicants and their families and of the assistance given.
6. County councils should appoint committees for districts or combinations of districts, to which various functions of the home assistance committee and the prevention of unemployment committee would be delegated. Such district committees would consist of: (*a*) members of the county council; (*b*) borough or district councillors; (*c*) persons experienced in the work to be done.
7. London should have a special scheme, in which the functions would be divided between the London County Council and the metropolitan borough councils. The borough councils would appoint home assistance committees, and would also be responsible for vaccination and registration of births and deaths. The London County Council would, through its appropriate committees, exercise the rest of the functions transferred. It would also appoint a central assistance committee, which would lay down a policy and rules of local administration for the home assistance committees in the metropolitan boroughs.
8. Poor Law officials should be transferred to the local authorities (provided both they and the local authorities agreed), and compensated for any pecuniary loss incurred by the change.
9. The cost of all functions transferred should fall on the new authority (the county, county borough, borough or urban district, and in London mainly on the county, but partly on the metropolitan borough).

Scotland, of course, was outside the committee's reference. But if their proposals were adopted, a Scottish scheme on similar lines would undoubtedly follow.

These recommendations were an endorsement of the principles advocated by the Royal Commission in 1909. The Maclean Report was, indeed, a compromise between the majority and minority of the Royal Commission, though leaning more heavily to the side of the minority, who, unlike the majority, had insisted above all on the abolition of the *ad-hoc* destitution authority. And the importance of the new recommendations was enhanced by the fact that they marked the actual reconciliation of the two parties, since Lord George Hamilton and Sir Samuel Provis, who had signed the Majority Report in 1909, and Mrs. Sidney Webb, who had signed the Minority Report, were unanimous on the Maclean Committee. The Government eventually pledged itself to legislate on the lines of the Maclean recommendations at the first opportunity. But no opportunity had been found by the session of 1921.

The Poor Law system, therefore, then remained still in theory as it was in 1834, when the famous "principles" were established—first, that relief should not be offered to able-bodied persons and their dependents except in a well-regulated workhouse; and, secondly, that the lot of the able-bodied should be made "less eligible" than that of the independent labourer of the lowest class. These principles had already worn very thin by the beginning of the 20th century, and the Royal Commission in its investigations from 1905 to 1909 discovered a wide-spread laxity. Nevertheless, whether the administration was, or is, lax or strict, its character is inevitably fixed by the fact that the Poor Law deals with the destitute. It is true that the guardians are entitled to interpret "destitution" fairly broadly—to treat it, in fact, as meaning "necessitous"; but in practice this amounts to little. Generally speaking, relief is only given to those who are in a grave state of want. This fact, with its natural consequences, especially in the domain of public health, has been increasingly emphasized in recent years. And there is no doubt that it has been one of the chief reasons why public opinion has favoured the sapping of the Poor Law by the local authorities, who are under no such restriction and are better able to apply preventive rather than palliative treatment. But the large increase of public assistance by these other bodies, while adding to the administrative confusion, still leaves a huge volume of pauperism and a huge expenditure by the Poor Law guardians.

The following figures show the total number of persons in England and Wales in receipt of Poor Law relief of all kinds on Jan. 1 of each year:—

1900	803,247	1917	637,327
1905	924,630	1918	586,785
1910	935,738	1919	554,617
1914	761,578	1920	576,418
1915	762,060	1921	663,667
1916	684,549	—	—

None of these figures of course represents the complete total of pauperism in any one year, for they only relate to one day, and allowance must be made for many other individuals—amounting to several hundreds of thousands—who will receive relief at one time or another during the twelve months. The figures do, however, afford an accurate basis for tracing the movements of pauperism. It will be seen that between 1910 and 1914 there is a large decline. This is mainly due to the causes noted above—the removal of a great number of the aged and of the sick from the Poor Law. On the declaration of war in Aug. 1914 there was a sharp rise in pauperism, owing to the rapid and widespread dislocation of industry. Within three weeks of the outbreak of hostilities the total of persons in receipt of relief was over 40,000 higher than that for the corresponding date in 1913, and a month later it had risen by another 115,000. Very soon, however, there began an equally rapid recovery, and with the absorption of men into the army or munition work and the influx of women into industry, pauperism declined month by month. Many of the workhouses and infirmaries were taken over by the War Office for military use, their inmates being moved to other buildings or boarded out in neighbouring unions. The volume of pauperism continued to fall progressively till the end of the war, under the influence of such causes as enlistment, the unsatisfied demand for labour of all sorts, both of men and women, the generally high rates of wages, and the steady income drawn from separation allowances and pensions by poor people whose earnings had previously been precarious or inadequate. Nevertheless, there was a permanent residue of sick and infirm, feeble-minded, aged and children. After the Armistice in Nov. 1918 the figures began to mount again. Demobilization brought in its train a renewal of unemployment, together with industrial disputes and reduced earnings. Throughout 1919 and 1920 the rise continued until, at the beginning of 1921, when the whole country was involved in a serious trade depression, the total was approaching the pre-war level.

The movement of Poor Law expenditure during the first twenty years of the 20th century shows little fluctuation; it increased continuously, as the following figures indicate:—

Total Expenditure on all Poor Law Services in England and Wales.

1900	£11,567,649	1917	£16,187,748
1905	13,851,981	1918	17,039,623
1910	14,849,584	1919	18,423,883
1915	15,804,073	1920	23,501,241
1916	16,085,586		

The reason for the paradoxical increase of expenditure on a decreasing number of persons during the war is, of course, to be found in the rising cost of maintenance, including food, fuel, medicine, salaries and so on. The average cost of maintaining a pauper in the general workhouse before the war was 13s. 8½d. per week in London and 10s. 10½d. elsewhere (1910). In 1918 it was 18s. 5½d. in London and 20s. 3½d. elsewhere, whilst the weekly cost of maintenance in the infirmary was 37s. 6¼d. in London and 30s. 4½d. elsewhere. In 1919-20 the cost had mounted to 24s. 5¾d. in London and 25s. 6d. elsewhere for maintenance in the workhouse, and to 46s. 7½d. in London and 40s. 3d. elsewhere for maintenance in the infirmary. In Scotland the figures, both of persons relieved and of expenditure, pursue much the same course, though they are naturally much smaller since the population of Scotland is less than one-seventh of that of England and Wales. In May 1920 the total number of legal poor of all classes in Scotland was 87,868. The majority were on outdoor relief. 16,175 were insane, maintained in asylums, lunatic wards or private dwellings. Of the sane, between 8,000 and 9,000 (including nearly 800 children) were in the poorhouses. The Scottish Poor Law expenditure for 1918–9 amounted to £1,667,536 and for 1919–20 to £2,093,523. The weekly cost of maintenance in the poorhouse in 1920 averaged about 23s per head. (C. M. L.)

POPPER, DAVID (1846–1913), Bohemian violoncellist (*see* 22.91), died in 1913.

PORTER, BENJAMIN CURTIS (1843–1908), American painter (*see* 22.113), died in New York City April 2 1908.

PORTER, HORACE (1837–1921), American diplomatist and soldier (*see* 22.116), died in New York City May 29 1921.

PORTO RICO (*see* 22.124).—Important developments in the affairs of Porto Rico—political, economic, social—took place in the decade 1910–20. Politically, the organic law was first amended and later materially changed. Economically, the agriculture and commerce of the island underwent notable increase. Socially, there was progress in the betterment of living conditions, in the spread of elementary education and in the reduction of poverty and disease. The Act of Congress approved April 12 1900 (the Foraker Act), under which the island had been administered for the first decade of its existence under the American flag, was amended by the Act of Congress approved July 15 1909 (the Olmsted Act). In so far as supervised by the United States, Porto Rican affairs were placed under the jurisdiction of an executive department to be designated by the president, the War Department being subsequently designated. To prevent recurrent deadlocks over the insular budget, provision was made that if the legislature failed to pass the appropriation bill for an ensuing fiscal year, the sums authorized for the current year should be deemed to have been appropriated and might be lawfully expended. Far more thorough-going were the changes effected by the passage of the Act of Congress approved March 2 1917 (the Jones Act). By its provisions citizens of Porto Rico are deemed and held to be citizens of the United States.

Six executive departments are constituted: justice, finance, interior, education, agriculture and labor, and health. The governor, the attorney-general and the commissioner of education are appointed by the President of the United States, subject to the approval of the U.S. Senate; the heads of the remaining departments by the governor of Porto Rico subject to the approval of the insular Senate. The law-making power is vested in a legislature consisting of a senate of 19 members and a house of representatives of 39 members, all elected by manhood suffrage for a term of four years. Acts of the legislature may be vetoed by the governor; but his veto may be overridden by a two-thirds vote. The President of the United States may nevertheless interpose a final veto. Matters relating to franchises and concessions are vested in a public service commission consisting of the heads of the executive departments, the auditor, and two elected commissioners. A resident commissioner to the United States, paid by the Federal Government, is elected by popular vote for a term of four years; he represents the island in the House of Representatives, with voice but without vote, and is recognized by all departments in Washington.

The economic experience of the years 1910–20 was the increased and more profitable production of sugar, tobacco, coffee and fruits, consequent in the first instance upon duty-free access to the American market, and aided by the completion of insular projects of irrigation. The increase of exports was accompanied by larger imports, by a reversal of the island's adverse trade balance, and by an appreciable though unequal diffusion of gain among the island's population, the growers of sugar and tobacco being specially benefited. The commerce of the island trebled in the decade, the combined value of imports and exports rising from $78,705,364 in 1911, to $247,199,983 in 1920. This amazing growth was uneven. The activity of 1911–2 was followed by reaction in 1913, accented by the dislocations consequent upon the outbreak of the World War. War demand for the island's staples made itself sharply felt in 1916–7 with some arrest in 1918–9. In 1920 came sensational developments, exports rising from $79,496,040 in the preceding year to $150,811,449, and imports from $62,400,360 to $96,388,534. The factors directly responsible were the world's runaway markets in sugar and to a less absolute degree in tobacco and coffee. Sugar exports in tonnage were actually less in 1920 than in 1916 and 1917; the price per ton rising from $75.81 in 1911, to $136.77 in 1919, and to $235.88 in 1920.

The visible trade balance in favour of the island rose from a previous maximum of $27,780,417 (1916) to $54,422,915 in 1920. The great bulk of this trade, 90% in 1920, was with the United States.

There was marked improvement during the decade in the island's material equipment. New schoolhouses were erected, and additional roads and bridges constructed. Even the remoter towns of the interior had in 1920 waterworks and electric-lighting plants, made possible through loans from the insular treasury. The increase in private wealth was reflected in the erection of many attractive residences, while the development of commerce and agriculture stimulated the extension of bank and transportation facilities. The basis of the insular revenue system remained the measure put into operation with the establishment of civil government under the American flag (the Hollander law), as modified and adapted to meet changing conditions. Ordinary expenditures for the fiscal year 1920 were $7,258,970.57, as compared with $3,685,613 in 1911. The total assessed valuation of all property for purposes of taxation in 1920 was $264,235,686, as compared with $133,817,931 in 1911.

The pop. of the island in 1920, despite appreciable emigration to the United States and Santo Domingo, was 1,299,809 (an increase of 181,797 in the decade), with a density distribution of 378·4 per square mile. In consequence of this continued growth, education and health remain grave problems. The total enrolment in all schools supported by public funds was 184,991. Of the 228,829 children of compulsory school age (8–14 years) only 61 % attended school. The death-rate for 1920 was 23·33 per 1,000 inhabitants as compared with 24·97 in 1911. But in 1920, tuberculosis, malaria and uncinariasis (hookworm), together with infant mortality, still accounted for 60 % of the total death-rate. The enquiries of a commission sent by the Rockefeller Foundation upon the request of the insular authorities confirmed the opinion that about 90 % of the people of the island were infected with uncinariasis. "Our population is one of the densest on earth," the insular commissioner of health, himself a distinguished Porto Rican, wrote in 1920. "More than 70 % are in the country, badly housed and fed, ill in health and ignorant of the first principles of hygiene. Until the people have learned to preserve and protect their health and have more ample means to provide better houses and food so as to reduce their miseries, no positive result, no recompense for all our efforts, can be obtained."

The governors were George R. Colton, 1909–13; Arthur Yager, 1913–21; E. M. Reily, 1921– . (J. H. Ho.)

PORTUGAL (*see* 22.134).—The effects of the Portuguese Revolution of Oct. 1910 fell most heavily on the poor of the country districts, who suffered from the loss of charities sustained by the expelled religious bodies and of the care of the sisters of charity, and from the exile of many of the richest families and the transference of capital abroad. In consequence, emigration in the years preceding the World War increased to an unprecedented extent, rising from 6·83 per 1,000 in 1910 to 14·85 per 1,000 in 1912. In one district, that of Braganza (Bragança), it rose to 6% of the population. In the towns unrest was less passive and discontent with the working of the Republic was prevalent; lavish promises had aroused impossible hopes among the people, and by many the Republic was regarded as but a first step towards a more Radical workmen's republic. Socialism and syndicalism developed rapidly. The right to strike at 24 hours' notice, conceded on Dec. 7 1910, was followed by strikes of all kinds, including several serious railway strikes. The disorders culminated in the demonstration against Parliament on Aug. 2 1911 and the general strike at Lisbon on Jan. 31 1912, when the city was placed under martial law and over 1,000 workmen suspected of syndicalism were arrested. The new governing class, largely composed of professional men, chiefly lawyers and journalists, had not the necessary authority to prevent excess.

The Provisional Government of the Republic consisted of Dr. Theophilo Braga, President, Dr. Antonio José de Almeida (Home Affairs), Dr. Afonso Costa (Justice), Col. Corrêa Barreto (War), Dr. Amaro Azevedo Gomes (Marine), Dr. Bernardino Machado (Foreign Affairs), Dr. Basilio Telles and, later, Dr. José Relvas (Finance), Dr. Antonio Luiz Gomes and, later, Dr. Brito Camacho (Public Works). It lasted till Aug. 24 1911.

The Constitution.—On March 18 1911 the new electoral law came into force. It gave the vote to all Portuguese over 21 years of age who could read or write, including priests and officers of the army or navy, but excluding naturalized Portuguese, officers on the active list and persons proscribed politically. Lisbon and Oporto (voting on the proportional system) were to return ten deputies each, the other districts four and the colonies one each. By a modification of Jan. 11 1915 Lisbon received 20 deputies, Oporto 10, the remaining constituencies between 1 and 4 each. By a decree of March 11 1918 universal suffrage for all citizens over 21 was established, but illiterates (75% of the pop.) were again disfranchized in 1919. By the law of 1918 the number of deputies was reduced to 155, returned by 51 constituencies, of which Lisbon returned 14, Oporto 6. The representation in the Senate, consisting of 77 members, was made regional and professional. By a decree of April 26 1918 soldiers and sailors on active service were allowed to vote. In the elections held on May 28 1911 many of the candidates were nominated by the authorities without opposition and, even where there was an election (in 28 out of 50 districts), the Government candidates were returned without difficulty, no Royalists offering themselves.

The Constitutional Assembly was opened on June 19 1911 and a decree was passed declaring the monarchy abolished and the House of Braganza forever banished from Portugal. On Aug. 20 the new constitution was voted. It provided for two Chambers, that of the Deputies, consisting of 163 members to be elected every three years, and the Senate, consisting of 71 members. The President of the Republic was to be elected by both chambers for four years and could not be reëlected. His salary was fixed at £3,600, with £1,200 for expenses. On Feb. 19 1920 he was given the right to dissolve parliament, after consulting a special council appointed for this purpose.

The first President under the new constitution was Dr. Manuel de Arriaga (born in 1840, at Horta, in the Azores), who, on Aug. 24 defeated the Radical candidate, Dr. Bernardino Machado, by 121 votes to 86, the Conservative candidate, Senhor Braamcamp Freire, having withdrawn. The members of the first Constitutional Ministry were: Dr. João Chagas, premier and minister of Home Affairs; Dr. Augusto de Vasconcellos (Foreign Affairs); Dr. Duarte Leite (Finance); Gen. Pimenta de Castro (War); Senhor João de Meneses (Marine); Dr. Celestino de Almeida (Colonies); Dr. Diogo Tavares de Mello (Justice); Dr. Sidonio Paes (Public Works). The Government was opposed by the Radicals under Dr. Afonso Costa and faintly supported by the other groups—the Evolutionist followers of Dr. Almeida, the Unionist followers of Dr. Brito Camacho and the Independents. One of the first measures was to vote the payment to each deputy of 17s. for each sitting of the assembly.

Church and State.—The anti-clerical policy of the Provisional Government had entailed serious difficulties. The bishops signed a pastoral letter of protest and on March 8 1911 the bishop of Oporto was removed from his see, with a pension of £240. The religious orders had been expelled by the decree of Oct. 8 1910, their property confiscated and the convents closed. By that of Oct. 22 the teaching of religion in the primary schools was forbidden. Marriage of priests became legal. The decree of separation between Church and State was drawn up, under the date of April 20 1911, by Dr. Afonso Costa, then Minister of Justice. It granted full liberty of conscience to all Portuguese citizens. The Roman Catholic religion ceased to be that of the State, which recognized all creeds as of equal authority, making no payment for their support. Among other proscriptions, public worship was to be open to the public and was held to include religious instruction, public or private. The congregation might only contribute to the expenses of their worship through the *misericordias* or other Portuguese charitable institutions. The churches were declared inalienable without the consent of the Minister of Justice and might be expropriated at any time. Local authorities were given full power to restrict or forbid processions, funerals or other external acts of worship. An inventory was to be taken (June–Sept. 1911) of all Church property, including churches and cathedrals, which became the property of the State. The clergy were granted a salary under certain conditions and all ecclesiastical property was made liable to taxation. The priests were forbidden to wear the cassock except at services. No foreigner or naturalized Portuguese might take part in any service except in the case of international agreement or ancient custom. Papal edicts might not be promulgated in Portugal without the consent of the Government.

This decree, in a country where over 90% of the inhabitants were Roman Catholic, was considered to be the subjection of the Church to the State rather than its separation, and contributed towards alienating the north of Portugal from the Republic. The patriarch of Lisbon and the bishop of Guarda published a pastoral letter forbidding the clergy to accept salaries from the State. For consistent opposition to the law of separation the bishop of Guarda and the patriarch of Lisbon were banished from their dioceses for two years.

The value of the Church property confiscated was £6,000,000. Owing to official protests on behalf of some of the foreign congregations a promise was made to revise the law of separation, a promise only partially redeemed in 1918. Claims for compensation were referred to the Hague Tribunal by an agreement signed July 31 1913 by Great Britain, France and Spain, the only countries which accepted arbitration. The claims, including those of Italy, Belgium and Germany, amounted to £2,000,000. By the award given Sept. 5 1920 Portugal was condemned to pay £21,800 to Great Britain and £80,000 to France.

After the promulgation of the law of separation, and the Pope's encyclical of May 23 1911, *Jamdudum in Lusitania*, relations between Portugal and the Vatican were broken off, and the Portuguese Legation at the Vatican was suppressed July 10 1913. The law was extended in Nov. 1913 to the Portuguese colonies, where the discouragement of Portuguese missions later gave rise to serious fears of the denationalization of the colonies through the activity of foreign missionaries. When Paes subsequently became president, one of his first acts was to redress some of the grievances suffered under the law of separation, and, by a decree of Dec. 22 1917, banishment imposed on the priests was annulled and the Cardinal Patriarch returned to Lisbon. In May 1918 conversations between the Papal Nuncio and the Portuguese Minister at Madrid resulted in a visit of the former to Portugal and he was received by President Paes, who informed him of the intention of the Government to send a Portuguese representative to the Vatican. Monsignor Locatelli was appointed Papal Nuncio in Portugal in April 1919. Relations with the Vatican were maintained after President Paes' death, and in 1919, and again in 1920, the Pope wrote Cardinal Mendes Bello and the Portuguese prelates congratulating them on the improved religious conditions.

The Royalist Invasions.—The main event of Senhor Chagas' premiership was the first Royalist invasion, commanded by Capt. Henrique Mitchell Paiva Couceiro. Small Royalist risings had been suppressed during the summer of 1911, but Capt. Couceiro still threatened the northern frontier. Representations were made by the Republic to the Spanish Government, which was itself suffering from the action of Portuguese Republicans in Spain. The Spanish authorities seized 4 Krupp guns and 1,000 rifles at Orense, and the German steamer "Gemma," with rifles and ammunition, was detained at Corcubión. The steamers, "Foam Queen" and "Arizona," with war material, ostensibly bound for Bahia Blanca, were detained by the customs authorities of London and Barrow in August. Couceiro crossed the frontier on Oct. 3 at the head of about 1,000 men, not a quarter of whom were armed with rifles. He advanced in the direction of Braganza and took the small town of Vinhaes, but evacuated it on Oct. 6 and, after maintaining himself for a fortnight in the hills, recrossed the frontier. A Royalist rising in Oporto, timed to coincide with this invasion, was brought prematurely to a head by Carbonario agents on Sept. 29, and this prevented the north from rising, except in the case of a few isolated villages.

King Manoel and the Pretender Dom Miguel met at Dover on Feb. 6 1912 to concert on common action, and the Royalist cause was strengthened by the great wealth of the Miguelists. On July 7 Couceiro again crossed the frontier, with a slightly larger force, but most of his arms and ammunition had been seized in Belgium and Galicia. The Royalist attacks on Valença and Chaves failed, and within a week they returned to Spain. Royalist risings in the northern provinces were speedily suppressed, and great excitement prevailed in the south, where the Carbonarios discovered a Royalist plot at Torres Vedras. D. João de Almeida and other prisoners-of-war were tried by court-martial and confined in the Lisbon Penitenciaria.

The Political Trials.—The arrests after the invasions of 1911 and 1912 were very numerous. Special tribunals were set up in Lisbon and Oporto in Jan. 1911 to try cases of political conspiracy, and in July 1912 Parliament voted still more stringent laws of defence. All persons suspected of reactionary opinions, religious or political, were in danger. Thousands of innocent persons were summarily arrested without the formulation of any definite charge and were confined for months in subterranean dungeons.

The chief instrument of this widespread system of espionage and terrorism was the organization of the Carbonarios. This secret society, the *Jov. Port.* (Young Portugal), founded or revived by Senhor Arthur Duarte da Luz e Almeida, forced through the Revolution of 1910 before the politicians were prepared for it. It assumed the functions of an unofficial police force and at times proved itself strong enough to attack the Republican Government and the army. Its members, who carried arms, were Republicans of the most extreme type; many had also joined its ranks in order to gratify some personal dislike or to secure the rewards given to successful informers. It was thus a body composed of dangerous fanatics. Completely blind to the political embarrassments which its actions might bring upon the Republic, it arrogated to itself the right of summary arrest. Senhor Chagas estimated that on Oct. 23 1911 there were 2,000 political prisoners awaiting trial, of whom 700 were innocent.

So notorious was the barbarity with which suspects were treated that a committee of prominent British residents was formed to investigate and, if possible, alleviate their condition. Several Portuguese Republican newspapers and prominent Conservative Republicans corroborated the findings of the British committee and diplomatic representations followed. But reforms were opposed by the Carbonarios and the Radical Republicans, and some of the worst outrages were committed under the weak Government which succeeded that of Senhor Chagas in Nov. 1911, with Dr. Augusto de Vasconcellos as premier, and under the third Coalition ministry formed by Dr. Duarte Leite in July 1912. One of the worst features was the intimidation of justice, the law courts being frequently filled with Carbonarios.

Hopes of improvement vanished when the Government resigned in Dec. 1912, and, after various attempts on the part of President Arriaga to form a moderate ministry, Dr. Afonso Costa, the Radical leader, came into power in Jan. 1913. In March of that year Adeline, Duchess of Bedford, with expert knowledge of prisons, visited the prisons of Lisbon, and meetings of protest against the treatment of the prisoners, held in London, advocated a general amnesty. Under the pressure of public opinion, the Minister of Justice in Jan. 1913 introduced a bill modifying the Penitenciaria régime, and in Feb. of that year 600 political prisoners and common criminals were excused from wearing the convict's hood, a pardon was granted to 300 prisoners, but the general amnesty was delayed till Feb. 1914.

The situation had become one of growing unrest and strikes were frequent. In April 1913 an attempted ultra-Radical *coup d'état*, in which a portion of the army and navy were implicated, was quelled and part of the crews of the "Vasco da Gama" and "S. Gabriel" were transported to Angra in the Azores. In June the Government decreed the suppression of the Lisbon Syndicalist Club. In July a movement similar to that of April was marked at Lisbon by attacks on the military barracks and was followed by numerous arrests. In Oct. 130 Republican prisoners were transferred to the fortress of Elvas, and a Monarchist movement at Lisbon and Oporto led to redoubled Carbonario activity. The amnesty bill became law on Feb. 22 1914 and in all about 1,300 prisoners (of whom over one-third had not been tried) and 1,500 exiles benefited by it, excluding Paiva Couceira among others. The courts martial, which had been active during two years, were abolished by a decree of Aug. 19.

Dr. Afonso Costa, who gave much of his attention to finance, resigned on Feb. 9 1914, and Dr. Bernardino Machado became premier and was in office when the World War began.

On Dec. 13 1914 Dr. Machado was succeeded in the premiership by the Democrat, Senhor Victor Hugo de Azevedo Coutinho, President of the Chamber of Deputies, with a view to holding the elections which were fixed for March 7, but the Government's purpose was prevented by a military movement, and President Arriaga appealed to Gen. Pimenta de Castro to constitute a government representative of a wider body of opinion in the country; he formed a ministry on Jan. 28, 1915. The action of the new Government was conciliatory and had the support of the moderate Republicans led by Dr. Antonio José de Almeida; the country's foreign policy remained unchanged, but the activity of the Carbonarios was checked, the so-called Committee of Public Safety abolished and the refractory municipal councils dissolved.

The general election was now fixed for June 6 1915. In April an amnesty emptied the prisons. The Democrats were, however, able to count on the support of the marines and on May 14 the sailors mutinied, shot the captains of the "Almirante Reis" and "Vasco da Gama" and bombarded Lisbon, about 100 persons being killed. Pimenta de Castro resigned on May 15, and was arrested next day and transported to the Azores. The revolutionary committee nominated Senhor Chagas as premier, but on May 16 he was shot at and wounded in the train, on his way to Lisbon by Senator João de Freitas, who was killed. Chagas resigned on May 24 and was succeeded by Dr. José de Castro.

In a message addressed to Parliament Arriaga resigned the presidency as from May 29 (he died on March 5 1917); and after a short interim presidency under Dr. Theophilo Braga, he was definitely succeeded as President on Aug. 6 1915 by Dr. Bernardino Machado. The Government resigned in June, Castro again becoming premier, but he resigned in Nov. and Dr. Costa returned to office.

The Revolution of Dec. 1917.—On Dec. 5 1917 a revolution directed against the internal policy of Costa and the Democrats broke out at Lisbon. The rebels entrenched themselves in the Parque Eduardo VII, and their artillery opened fire upon the fleet. After two days' fighting, Gen. Norton de Mattos and Capt. Leotte do Rego took refuge on board a British ship in the Tagus. Dr. Costa and Dr. Soares were arrested; President Machado was placed under arrest, and on the 15th was conducted to the frontier. Vice-Adml. Machado dos Santos was released from prison and, with Maj. Sidonio Paes, the leader of the movement, and Capt. Feliciano Costa, formed a revolutionary committee. A provisional government was now constituted, Maj. Paes becoming President and Minister for War and Foreign Affairs. The Radical sailors mutinied on Jan. 8 1918 and bombarded Lisbon, but the movement was easily quelled, and several hundreds were deported to Africa. On Jan. 12 Paes left for the north, and at Oporto was received enthusiastically, as also on his return to Lisbon. A visit to the south in Feb. was equally successful.

In March 1918 Paes reconstructed his ministry, and the elections, on an enlarged franchise, were held throughout the country on April 28. The election of the President was held by universal suffrage on the same day. Paes was elected by over half a million votes and was proclaimed President on May 9. The Powers recognized the new régime, and on May 27 Great Britain raised her legation in Lisbon to the status of an embassy. The President opened Parliament in July. In Oct. a new Government was formed. Under a new system the President became also premier and ministers were called secretaries of state.

The first anniversary of the revolution was celebrated with national rejoicings on Dec. 5–8 1918. But on Dec. 14 President Paes was shot at the Rocio station by José Julio da Costa, and died a few minutes later. On Dec. 16 Adml. João de Canto e Castro was provisionally elected president, and in Jan. 1919 Senhor Tamagnini Barbosa formed a ministry, reviving the office of premier.

The Oporto Monarchy.—The Radical and Carbonario elements, which had hoped to benefit by President Paes' murder, rapidly became impatient, and a Democrat rising now broke out at Santarem, but the town was besieged by Government troops and the rebels surrendered. On Jan. 19 1919 the monarchy was proclaimed at Oporto, Braga and Viseu, Capt. Paiva Couceiro becoming regent and acting also as premier and minister of finance. At Lisbon the Royalists occupied Fort Monsanto and bombarded the city, but they were overcome without difficulty by the marines and Carbonarios. A considerable Republican army was sent against Oporto, but, though part of the regular troops drafted from Lisbon deserted, the Royalist forces were weak and did not reach Aveiro. The fighting during the three weeks of civil war was not of a serious character. A counter-revolutionary movement at Oporto in Feb. led to the restoration of the Republic, and the main result of these ill-timed risings was to fill the prisons and bring the Radicals into power. At Lisbon the marines and Carbonarios, in Feb., demanded government by "soviets" and the abolition of the official police. Severe street fighting and serious outrages occurred, including the burning down of a block of government offices in Black-Horse Square and of the Limoeiro prison. This had the effect of forcing the new authorities to copy the disciplinary methods of President Paes.

Government by Groups.—Senhor José Relvas became premier on Jan. 27 1919, and was succeeded in March by the Democrat, Dr. Domingo Pereira. It now became possible to hold the elections, and in May a Radical majority was returned. On June 1 Adml. Canto e Castro announced his intention of resigning the presidency, the candidate of the Democratic party, Dr. Antonio José de Almeida, being subsequently elected President on Aug. 6. On June 28 the Democratic Col. Sa Cardoso constituted a more stable ministry, which lasted till Jan. 7 1920. There followed a succession of short-lived ministries, under Senhor Fernandez Costa, Dr. Domingo Pereira, Col. Antonio Maria Baptista, Dr. Ramos Preto, Senhor Antonio Maria da Silva, Senhor Antonio Granjo (July to Nov. 15), Dr. Alvaro de Castro, and Lt.-Col. Liberato Pinto (Nov. 29 to Feb. 1921); and on March 2 1921 a new Coalition ministry (composed of Democrats, Reconstituents, Dissidents and members of the Popular party, all offshoots of the original Republican Democrat party) was formed, under the premiership of Dr. Bernardino Machado. A military pronunciamento on May 20 caused the resignation of Dr. Machado. He was succeeded by a Liberal ministry under Dr. Barros Queiroz, who dissolved Parliament and held a general election on July 10.

The absence of a firm guiding hand had been especially felt after the murder of President Paes, and successive governments seemed to lose control over the finances. No government was strong enough to raise an internal loan, to revise the system of taxation or levy a war-profits tax, and, while the taxes were paid in worthless paper money, the Government had to buy wheat and pay the service on the debt in gold. Social unrest was chronic in March 1920; there was a general strike of civil, and post and telegraph, servants; a railway strike which began on Oct. 1 1920, lasted 70 days; and a newspaper strike in 1921 for over two months. The Royalists showed themselves willing to exchange revolutionary for constitutional opposition, and King Manoel had constantly deprecated any revolutionary movement in view of the grave crisis through which the country was passing. The death of his uncle, the Duke of Oporto in 1920, left King Manoel without an heir to the throne. D. Miguel, Duke of Viseu, and his father D. Miguel, Duke of Braganza, renounced their right to the throne of Portugal in favour of D. Duarte Nuno, the younger son of the latter, born Sept. 23 1907.

The World War.—At a special joint sitting of both Chambers on Aug. 7 1914 Portugal proclaimed her loyalty to the British Alliance, and on Nov. 23 formally committed herself to participation in military operations. She served the cause of the Allies effectively by furnishing munitions, guns, and a division of artillery, and acted in close coöperation with Great Britain. In Oct. a Portuguese military mission arrived in London and a commercial mission followed in November. On Sept. 11 the first expedition of Portuguese troops left for Africa under the command of Colonels Alves Roçadas and Massano de Amorim, and fresh contingents followed at intervals, 40,000 troops in all being despatched for the defence of the colonies. Germany had not waited to be at war with Portugal in order to attack them. As early as Aug. 24 1914 a raid was made on the Portuguese post of Maziwa on the northern frontier of Mozambique. On Oct. 19 the Germans attacked Naulila (on the Angola frontier), where more serious fighting occurred two months later, and on Oct. 30 they stormed the fortress of Kwangar and put the garrison to the sword. On April 11 1916 Portuguese troops occupied Kionga (S. of the Rovuma River), which Germany had seized in 1894, and on May 27 they crossed the Rovuma River. They were still coöperating with the British in rounding up the Germans when war ended.

The British Government had deprecated any unnecessary intervention of Portugal in the war, but agreed to the requisitioning of German ships lying in Portuguese ports, and this was carried into effect in Feb. 1916. Consequently, Germany retaliated by declaring war on Portugal on March 9, and the declaration of war between Portugal and Austria followed on March 16. The Government resigned in order to make way for a national ministry, constituted on March 15 under Dr. Almeida. Capt. Leotte do Rego was appointed commander-in-chief of the naval division. French and British military missions arrived in Lisbon in March, and a British naval mission arrived in April. In June a first division of 20,000 men was concentrated at Tancos, where training began. Of the Germans in Portugal many had already left and 400 were interned. German submarines were active off the coast of Portugal during the autumn, many ships being sunk in 1917; Ponta Delgada was attacked by one on July 4 1917, and attacks were also made on Funchal and Cabo Verde in December.

On the declaration of war in March 1916 the few Royalist journals still permitted to appear in Portugal made patriotic declarations, and a message from King Manoel in Nov. exhorted his followers to set country above party. In Dec. a revolutionary movement was suppressed at Thomar and its leader, Machado dos Santos, imprisoned. In April 1917 Dr. Costa formed a new ministry. By a decree of Jan. 17 1917 Gen. Fernando Tamagnini de Alorn was given command of the Portuguese Expeditionary Force, and by July there were over 40,000 Portuguese troops on the western front, with 20,000 in Portugal ready to reinforce them. On April 9 1918, on the river Lys, the Portuguese contingent were subjected to a formidable attack by the Germans, and they were compelled to fall back, leaving a large number of prisoners. Subsequently Portuguese troops took part in the victorious entry into Lille.

Dr. Egas Moniz (later replaced by Dr. Afonso Costa) was appointed to represent Portugal at the Peace Conference, and in Jan. 1919, at the instance of Great Britain, the number of delegates to the Conference was increased to two. Portugal came out of the war with a crushing debt, but her colonies were assured to her, and her economic future was promising. The Peace Treaty was ratified on March 30 1920. At the Spa Conference in July 1920 Portugal secured 0·75% as her share of the indemnity from Germany, and also received Kionga.

Legislation.—One of the first decrees of the provisional government (Oct. 29 1910) ordained that press offences should be tried before a jury, but the liberty of the press under the Republic was more nominal than real and no Royalist or clerical newspaper was left long unmolested. The law of divorce (Nov. 4 1910) allowed, among other grounds for divorce, insanity, a long term of imprisonment, desertion, inveterate gambling and mutual consent. Gambling, at first legalized, was totally prohibited in 1919. Duelling was forbidden in Jan. 1911. On May 30 1911 Greenwich time was officially adopted, all clocks being advanced 37 minutes at midnight on Dec. 31 1911. In Sept. 1911 the Marconi system of wireless telegraphy was adopted. On June 14 1913 Portugal and Great Britain signed an agreement regulating the opium monopoly in Macao and Hong-Kong. On Aug. 15 1914 administrative and financial autonomy was given to the colonies. The employment of native labour in the Portuguese colonies was regulated by a very elaborate decree of Oct. 14 1914, modifying and developing the law of May 27 1911 and the decree of Oct. 1 1913.

Legislation on the subject of education was voluminous, but comparatively little was achieved to replace the schools of the expelled religious orders. By the decree of March 29 1911 primary education became neutral, laic and compulsory. Each parish was to have at least one boys' and one girls' school, the cost to be shared between the State and the town councils. In the two following years 991 new schools were decreed, but in March 1913 556 were still non-existent. The sum of £40,000 destined in 1913 for the building of primary schools, was apportioned among 180 schools. By a decree of Sept. 11 1913, in order to encourage industrial education and relieve the lyceums of Lisbon, Oporto and Coimbra, the number of students admissible to these latter was limited to a total of 4,850. Secondary education was remodelled by decrees of July 14 and Sept. 8 1918. In May 1914 a military school of aeronautics was created. Other decrees dealt with agricultural credit (1914), accidents to workmen (1913 and 1914) and work of minors and women (1915). On March 9 1918 a Ministry of Agriculture was created, but the decrees stimulating production were of a tentative and contradictory character. Uncultivated land has to pay a small tax per acre and becomes the property of the State if still uncultivated in 20 years from 1911. In March 1921 a much-needed bill was introduced providing for the building of new roads and for the repair each year of 312 miles of existing roads during 1922–31.

Defence.—On Jan. 19 1911 a commission appointed to reorganize the navy recommended the acquisition from Great Britain of three battleships of the dreadnought type, similar to the "Minas Geraes" of the Brazilian navy. This recommendation was adopted in the new naval programme submitted by the Minister of Marine in Dec. 1911, which involved the purchase of 3 battleships of 20,000 tons each, 3 scouts of 3,000 tons, 12 torpedo-boats of 820 tons and 6 submarines. On May 1 1912 a bill was introduced fixing the naval force at 4,500 men, as compared with 5,687 in 1910. On Jan. 27 1913 a commission was appointed for the creation of a naval arsenal on the S. bank of the Tagus.

Finance.—The average annual revenue from 1907–8 till the revolution (1910) was £14,456,000, and the average deficit £500,000. After the revolution special attention was given to finance. A committee appointed to examine into various loans made by the State to the House of Braganza assessed the total to June 18 1912 at nearly £800,000, of which £720,000 had been advanced to King Carlos, £24,500 to the Duke of Oporto and £16,400 to Queen Amelia. The Government decided to reimburse itself from King Manoel's property in Portugal.

The budget for 1911–2 showed a deficit reduced to £435,000, but an increased expenditure of £1,026,800. The deficit for 1912–3, estimated at £710,000, was converted into a surplus of £33,400 in August. The 1913–4 budget showed a total revenue of £15,178,843 and a surplus of £195,778, of which £111,800 was destined for the new naval programme. These figures were obtained by adding to the debt. On Aug. 31 1913 the debt stood at £145,917,500, an increase of £1,596,000 over its amount on Dec. 31 1912. In presenting the 1915–6 budget, with an estimated deficit of £2,120,400, it was decided to separate ordinary and war expenditure, but in practice, although two budgets were presented, the expenditure was not kept strictly separate. The double budget of 1916–7 provided for an ordinary expenditure of £17,220,000, with £403,400 deficit, and a war expenditure of £15,000,000. The war added an average of £20,000,000 yearly to the debt, which reached £227,000,000 on July 1 1918. Portugal was further indebted to Great Britain to the extent of £16,000,000 advanced for expenses at the front and £2,000,000 for war expenses in Portugal. The 1920–1 budget, presented in Feb. 1920, before that of the previous year had been voted, showed a revenue of £26,581,000 and a deficit of £25,555,000, an increase of £7,333,000 over the deficit of the previous year. It was proposed to extinguish the deficit by a reduction in the cost of the civil service and a war-profits tax, calculated to yield £22,222,000, but the Government fell before the proposals could be carried into effect. In Dec. 1920 heavy property and industrial taxes were imposed. By the 1921–2 estimates, presented in Jan. 1921, the deficit was increased to £58,888,000 on a total expenditure of £106,610,000. At the end of 1920 the debt was unofficially estimated as follows: external £53,777,000, floating £123,939,000, internal £325,333,000—total £503,049,000. The paper currency, which at the end of 1910 stood at £16,000,000 (at par of exchange, namely, 4,500 reis = £1), had risen to £82,361,000 in Dec. 1919, and to £118,361,000 in Sept. 1920. A further increase of £44,444,000 was voted by Parliament in Dec. 1920. In that month the 3% external debt was quoted at 22. The agio on gold, which was 5 in Oct. 1910 and 16 in Aug. 1914, exceeded 1,100% in Feb. 1921, but fell to half that amount a few months later. The floating debt, which immediately before the war was £19,555,000 (at par of exchange), stood at £119,555,000 on Dec. 31 1919. The heavy depreciation in the exchange, however, must be allowed for.

In Feb. 1921 the Banco Nacional Ultramarino became the sole agent of the Royal Bank of Scotland and of some English banks.

Commerce.—Portugal's foreign trade, which in 1913 had reached £22,094,500 in imports and £11,355,000 in exports, further expanded during the World War, and in 1917 amounted (at par of exchange) to £37,391,700 imports and £19,121,500 exports. The trade between Portugal and her African colonies almost doubled between 1911 and 1917. In 1917 5,860 ships of 4,906,599 tonnage entered Portuguese ports, as compared with 10,638 of 24,368,120 tonnage in 1913. The total tonnage of German ships seized in 1916 was 242,441, of which 157,333 were handed over to the Allies. Portugal lost 28,637 tons of shipping by enemy action, and her merchant shipping at the end of 1918 stood at 100,000 tons.

A treaty of arbitration for five years, between Portugal and Great Britain, was signed at London on Nov. 16 1914. The commercial treaty between the two countries, signed at Lisbon on Aug. 12 1914, became effective on Sept. 23 1916.

Foreign Exchange.—After the war serious efforts were made to grapple with the problem of the exchange, which was aggravated by the decree of May 31 1919 placing the financial agency at Rio de Janeiro in private hands. A decree of April 27 1918 provided that when the exchange was at $29\frac{5}{8}$, 50% of the customs duties should be paid in gold at that rate and 50% at par, until the exchange reached $38^{3}/_{22}$, when the whole of the duties was to be paid in gold at par. A decree of Feb. 4 1920 totally prohibited a large number of imports, thus depriving the exchequer of an important source of revenue. Neither the Banking Consortium (Jan. 10–May 26 1920) nor the attempt to fix the rate of exchange officially, was effective in preventing a further rapid depreciation in Portuguese money, owing to the almost complete absence of gold (the reserve having fallen to under 2% in 1920) and to decreased production. As a result of the cost of labour and the fixed price of bread, cultivation of wheat diminished steadily from 1918, its best year. In 1918 the 248 million kgm. produced fell short of requirements by 56 million kilograms. The most important export trade—wine—suffered during the war from transport difficulties and, later, from the reduced demand in Great Britain and the loss of the markets of the United States, Canada, Russia and Norway. The wine trade attained its maximum in 1919, when the cost of transport fell from £15 to £4 a pipe and Great Britain imported 12,458,220 gallons. In 1920 Great Britain imported only 5,914,575 gal. and a huge stock was left on the hands of the merchants. Portuguese manufacturing industries, which expanded considerably during the war, despite the coal shortage, were similarly affected by decreased demand in 1920, for which the expansion of colonial trade did not entirely compensate.

Population.—The pop. of Portugal numbered 5,547,708 in 1911, not including the inhabitants of the Azores and Madeira, which amounted to 412,348 in the same year. The pop. of the chief towns (1911 census) were: Lisbon 435,399, Oporto 194,099, Setubal 30,346, Ilhavo 14,130, Póvoa de Varzim 12,115, Tavira 11,665, Faro 12,680, Ovar 11,416, Olhão 10,890, Viana do Castello 10,486, Aveiro 11,523, Loulé 19,688, Coimbra 20,581, Evora 17,901, Covilhã 15,745, Elvas 10,645, Portalegre 11,603, Palmella 13,318, Torres Novas 13,961.

Literature.—Literature in Portugal from 1911 to 1921 was marked chiefly by the death of prominent men of letters—of philologists, Gonçalvez Viana (1914), Epiphanio Dias (1916), Julio Moreira (1917) and Adolpho Coelho (1919); critics, Ramalho Ortigão (1917) and D. Maria Amalia Vaz de Carvalho (1921); novelists, Fialho de Almeida (1911), Abel Botelho (1917) and Teizeira de Queiroz (1919); the dramatist Marcellino Mesquita (1919); poets, Antonio Feijó (1917), João Penha (1919) and Gomes Leal (1921). But although the revolution was followed by no great literary revival, most useful work was accomplished, including much-needed and important reprints and editions of the classics. Among these may be mentioned the scholarly editions of Dr. J. J. Nunes and of Dr. Esteves Pereira, who in 1918 published the *Livro da Montaria* of King João I. from the original manuscript. Valuable material for the future historian of Portugal was brought together by the researches of several scholars, among whom Mr. Edgar Prestage specialized on the 17th century. The *Revista de Historia* has been published regularly since 1912. Senhor J. Lucio de Azevedo followed up his *Life of Pombal* with notable studies on Antonio Vieira. Dr. Leite de Vasconcellos' invaluable *Revista Lusitania* reached its 20th volume in 1917. In poetry a national tendency set in which is strongly marked in Dr. Lopes Vieira's *Ilhas de Bruma* (1917). The veteran poet, Senhor Guerra Junqueiro, published *Poesias Dispersas* in 1920. In the field of essay the glowing style and national fervour of Senhor Antero de Fiqueiredo in *Leonor Teles* (1916), *Jornadas em Portugal* (1918), *Recordações e Viagens* (2nd ed. 1916), and other works, are notable. The growing interest in Portuguese literature in England was marked by the foundation of a chair of Portuguese literature at King's College, London, in 1917.

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PORTUGUESE EAST AFRICA, or MOZAMBIQUE (*see* 22.163).—As the result of the World War in what was formerly the German territory adjoining, Portuguese East Africa has become bordered landward entirely by British, or British administered, territory. In 1919 "the Kionga triangle," some 400 sq. m. in size, and including the southern shore of the estuary of the Rovuma, was transferred to the province—having been part of German East Africa. The pop. in 1918 was roughly estimated at 3,000,000 to 3,500,000; no systematic census had been made and the inhabitants in areas not controlled by the Portuguese were not included. Europeans, exclusive of troops, numbered some 12,000; Asiatics (mainly Indian traders) 15,000–18,000. Lourenço Marques, the capital, with suburbs had about 20,000 inhabitants of whom 5,500 were white (700 being British).

Products and Trade.—An increase in the area under sugar, greater attention to the plantations of coco-nut palms (for copra), the introduction of sisal growing (from German East Africa) and the cultivation of maize for export were directions in which endeavours were made to increase the resources of the province in 1911–21. The sugar plantations were mainly in the region between Beira and the Zambezi, a region governed under charter by the Company of Mozambique, in which British capital was largely interested. Between 1911 and 1919 the area under sugar trebled and the output reached 35,000 tons yearly. Most of it was produced by the Sena Sugar Co. and shipped at Beira. Sisal was cultivated mostly in the Quilimane area; in 1916 the export was 2,200 tons of fibre.

Before the World War trade was mainly divided between British, Portuguese and Germans; the Germans financed the Banyans (Indian traders) who retailed "Kaffir truck" to the natives, a business worth £250,000 or more a year. In return the natives sold, principally, ground nuts of which some 2,000 tons were exported annually. North of the Zambezi German merchants had nearly all the trade, both import and export, and had begun to oust even the Banyan. In the S., at Delagoa Bay and Beira British firms held over 50% of the trade. The war eliminated the German trader.

No uniform system of trade statistics was adopted in the three administrative areas into which the province was divided. The following figures are approximations to accuracy:—in 1911 imports £8,250,000, exports £2,250,000. The imports include some £6,800,000, in and out transit trade through Delagoa Bay and Beira. For 1913 the imports (excluding transit trade) were given at £2,053,000; exports at £2,720,000. Portuguese figures for 1917 (excluding Beira) gave the imports at £2,800,000; the exports at £1,500,000, not reckoning transit trade or reëxports.

The imports for local use were mainly textiles, provisions and machinery. Large quantities of wine, "vinho colonial," are imported from Portugal for native consumption—in 1913 the amount received at Lourenço Marques alone was 1,620,000 gallons valued at £105,000. In 1920 alcohol was declared by the high commissioner of Mozambique to be the curse of the province. The great bulk of the trade was in transit to or from the Transvaal, Rhodesia or British Nyasaland. The import of most direct benefit to the province was coal from the Transvaal. From 1912 onward Lourenço Marques became important both for the export and bunkering trade. (For the relations of the province with the Transvaal *see* DELAGOA BAY.)

Communications.—During 1910–20 several short lines of railway were built from the seaports. The largest scheme was to connect Delagoa Bay and Inhambane. This line with a total length of 280 m. was planned in independent sections, and 160 m. had been completed by 1916; the central section had not been built in 1920. The building of a railway (about 170 m. long) from Beira to the Zambezi, opposite Chindio, was begun in 1920 under a guarantee of the British Nyasaland Protectorate, its object being to afford that protectorate an ocean gateway. From Chindio a railway, completed in May 1915, goes to Port Herald where it connects with the Shire Highlands railway. A route for a railway from Port Amelia to Lake Nyasa was surveyed in 1912. The line would have been built by a German company but for the outbreak of the World War. Up to 1921 a few miles only of rails had been laid from Port Amelia. Wireless telegraph stations have been erected at Delagoa Bay, Inhambane and Mozambique town.

Finance.—Revenue was obtained chiefly from a hut tax, customs and taxes on emigration, *i.e.* a poll tax paid to the provincial authorities for natives recruited for the Transvaal gold mines and other work. In 1913–4 revenue and expenditure were budgeted for £1,312,000; in 1917–8 at £1,809,000. "Cost of administration" was given as the chief item of expenditure, not unnaturally, as in 1917 there were over 10,000 persons in Government pay.

History.—The efforts made by chartered companies and reforming governors to develop the province left its vast natural resources up to 1920 scarcely touched. The Portuguese lacked capital with which to undertake large operations, the settler class was not on the whole of a satisfactory character, the administrative system was very defective, and up to 1914 the interests of the province were entirely subordinated to the assumed interests of Portugal. In that year following an agitation in which the then governor-general of the province, Senhor de Magelhãs, took the lead, Mozambique was granted partial autonomy and in 1920, when Dr. Brito Camacho was appointed high commissioner, further reforms were enacted. The general trend of events during 1910–20 was to show the province as of value chiefly as a passage-way to and from the Transvaal, Rhodesia and British Nyasaland. Partly because of the necessity of keeping this passage-way open it was in this period that Portuguese authority was first made fairly effective throughout the province. Moslem chiefs along the coast in the region opposite Mozambique Island were subjugated by 1910, after a four years' contest, and the hinterland tribes then submitted with little resistance. The occupation of the interior of Portuguese Nyasaland, begun in earnest in 1909, met, however, with strong opposition from the natives and was not completed till 1912, when Mataka, the most powerful opponent of the

Portuguese, fled across the Rovuma into German territory. In 1915 there was a widespread revolt in the Zambezi valley and farther S., which was not fully suppressed till the end of 1917.

The paramount economic interests of Great Britain in the southern part of the province, including the delta of the Zambezi, were recognized in the Anglo-German draft agreement prepared in 1913–4, but not signed owing to the outbreak of the World War. By that agreement the part of the province N. of the Liconga (Licungo) river (which reaches the sea over 100 m. N. of the Zambezi delta) was to be in the economic sphere of Germany (*see* AFRICA: *History*). The larger part of this northern area was governed, under a charter, by the Nyasa Company. That company, for lack of funds, had done little to develop its territory. In 1914 German capitalists succeeded, through a neutral intermediary, in obtaining control of the Nyasa Co. and by the aid of a German directorate they sought to acquire political control, and advance the scheme for the creation of a German Mittel-Afrika. The World War put an end to this design.

Early in 1917 German raiding parties entered Portuguese territory and in Nov. of that year Gen. von Lettow Vorbeck, to escape capture crossed into the province from German East Africa, carrying on the war there for nearly a year (*see* GERMAN EAST AFRICA). Von Lettow helped to prove the natural resources of the regions he traversed, while aerial reconnaissances by the British gave material for mapping.

See *A Manual of Portuguese East Africa* and *Portuguese Nyasaland*, both British Admiralty publications (1920); *Mozambique*, a handbook issued by the British Foreign Office (1918–9)—all with bibliographies; *The South and East African Year Book and Guide*, ed. by A. S. and G. G. Brown (London yearly); the *Anuario Colonial* and *Rivista Colonial*, both Lisbon publications. (F. R. C.)

POTIOREK, OSKAR (1853–), Austro-Hungarian general of artillery, was born at Blieburg, Carinthia, in 1853. He graduated from the Engineers' Academy as lieutenant in 1871. His career was chiefly spent on the General Staff, of which he was one of the most distinguished representatives. He held there the important post of Chief of the Section of Operations, later that of Deputy to the Chief of the General Staff, Count Beck. After Beck's retirement he was in command of the III. Corps, in 1911 Army Inspector and Governor (*Landeschef*) in Bosnia and Herzegovina. As such, he was officially responsible for countenancing the fateful visit of the heir to the throne to Serajevo, out of which the World War ensued. In the offensive taken by Austria against Serbia in the winter of 1914, which eventually broke down after great initial success, his judgment was also found wanting.

POULTRY (*see* 22.213).—During 1900–20 there were many changes and developments in the poultry industry, as carried on in Great Britain. New breeds were evolved or imported, while some of the older breeds have diminished in popularity and, except for small numbers kept by persistent breeders, have almost died out. Far more striking, however, has been the rapid evolution of the present-day utility breeds, the extension of public "laying trials" and the development of extensive commercial egg farms and breeding farms, accompanied by new mass methods of hatching, rearing, feeding and housing. The agriculturist has shown slowly increasing interest in poultry-keeping as a business branch of farm operations, and there has been a notable expansion of poultry-keeping by residents in urban and suburban areas. The view so strongly held for many years by the majority of people—who thought about the matter at all—that poultry-keeping was not a practicable commercial proposition except as a small side-line, and in circumstances where waste food for the birds was available at little or no cost, has been very much modified, for the reason that poultry-keepers, who have derived the main portion of their livelihood over a period of years from one or more branches of the industry, have so obviously increased in numbers. In addition numerous authentic instances of profitable results obtained from poultry-keeping as a subsidiary occupation have been made public. Hence in recent years increasing numbers of people have turned their attention to poultry-keeping, and in several instances the capital involved in well-known poultry farms amounts to several thousands of pounds. So far successful British poultry farming comprises one or more of the following branches:—Breeding laying strains of poultry; the production of exhibition stock; the sale of day-old chicks, eggs for hatching and stock birds; the production of eggs and poultry for consumption. The production of table poultry is in practically every case a subsidiary branch, and was particularly so during the war owing to the scarcity of feeding-stuffs.

It is not possible to form any reliable estimate of the value of the poultry-stock-breeding industry in the United Kingdom, as no complete figures are available. Every experienced observer knows, however, that the increase in the demand for and supply of eggs for hatching, day-old chicks, and pure-bred stock birds, has been very considerable during the past few years. Nor can any reliable estimate be made of the growth of table poultry and egg production, since there are insufficient data upon which to base an estimate. It is possible, however, to make a rough estimate of the total annual value of table poultry and egg production.

In 1908, in connexion with the Census of Production Act of 1906, the Board of Agriculture and Fisheries published a poultry census for Great Britain showing that the number of poultry kept by occupiers of agricultural holdings exceeding one ac. in extent was 36,728,000. In its report, however, the Board draws special attention to the limitation of the scope of the returns to holdings exceeding one ac., and points out "that poultry are very largely kept by cottagers and persons who do not come within the definition of agricultural holdings, while a further very large poultry population would no doubt be enumerated if the returns were extended to the towns."

In addition to obtaining this census, each occupier was asked to state the number of home-bred poultry of each description sold during the preceding twelve months, and special schedules were issued to all occupiers returning not less than 50 fowls or 10 ducks, geese or turkeys, asking for the number of males and females, respectively, hatched before 1908, the number of eggs produced, sold for consumption, or sold or used for hatching, and the number of young and adult birds sold. As a result the report states that there were 15½ million adult hens on farms in Great Britain in 1908, that the average annual egg yield per hen was 72, and that the total value of the output of eggs and poultry was calculated to be about £5,000,000. The report, however, emphasizes the fact that this sum "takes no account of poultry kept by cottagers, residents in towns and others not within the scope of the Agricultural Returns. The aggregate production thus excluded must be very large, though again it may be assumed that the greater part of it is consumed by the poultry-keepers themselves."

Since 1908 no poultry census figures for Great Britain are available, but interesting deductions may be made regarding British production by examining the returns published for the years 1908 and 1918 by the Irish Department of Agriculture regarding the Irish poultry industry. The Irish returns refer to all agricultural holdings including labourers' cottages built under rural housing schemes and are thus more comprehensive than those for Great Britain, though like the British returns they apparently take no account of town poultry-keepers. The number of such poultry-keepers in Ireland, however, would be insignificant as compared with the number in Great Britain. The total number of poultry in Ireland in 1908 is given as 24,031,095. The report estimates the average annual egg yield of Irish hens as 100, and calculates the total value of Irish poultry production in 1908 at £5,290,000. Of this amount £3,526,000 was stated to represent the value of the exports, £1,764,000 the value of the home consumption.

In 1918 the Irish returns give the total number of poultry in Ireland as 24,424,230, and state that the value of the exports of eggs and poultry was £18,352,578. No figures are given regarding the value of the home consumption, but in view of the value given in this connexion in 1908 it may be fairly assumed that £4,000,000 represents a reasonable estimate. Thus a total production value of £22,352,578 is arrived at for the Irish poultry industry in 1918. Now it is difficult to believe that the average yield of hens in Great Britain is less than that of their sisters in Ireland, and it is certain that the average price realized by British producers for their eggs and poultry have been greater than those obtained by Irish producers. Hence, if the incomplete British census for 1908 be taken, and even if it be assumed that there was no increase in the numbers in British poultry between 1908 and 1918, the total value of the produce from the 36,728,000 poultry in Great Britain would amount to approximately £33,000,000 for 1918, if calculated on the same unit production value as the Irish figures. But unit production value is almost certainly higher in Britain, if only on account of higher prices, and the total of £33,000,000 takes no account of the value of the produce of the large numbers of poultry kept in Great Britain by dwellers in urban and suburban districts. What this value may be can only be estimated, but it is practically certain to be well over £4,000,000 annually. A final estimate of £37,000,000 is thus arrived at as the value of British egg and poultry production in 1918, and if to this figure be added the corresponding one for Ireland a total of roughly £60,000,000 is obtained for the United Kingdom.

It is interesting in comparison to note that, according to an answer given by Sir R. Sanders for the Minister of Agriculture in the House of Commons on Feb. 24 1921, the estimated value of the total wheat crop of the United Kingdom in 1920 was £31,000,000. Also in a recent Report on the Trade in Imports and Exports at the Irish ports it was stated that the value of the Irish eggs, poultry and feathers exported was in one year greater by about £13,000,000 than the store cattle trade and nearly equal in value to the export in fat cattle.

There is a further important aspect of the effect of the demand for table eggs and poultry in the United Kingdom in the national finances, viz. the large sums paid annually to foreign countries for supplies to supplement the insufficient home production. Tables 1 and 2 show the annual quantities and values of these imports for the years 1913, 1919 and 1920.—

TABLE 1.—*Imports of Eggs, in Shell, into the United Kingdom.*

From	1913		1919		1920	
	Quantity	Value	Quantity	Value	Quantity	Value
	Gt. Hundreds		Gt. Hundreds		Gt. Hundreds	
Russia	11,453,277	£4,745,229	Nil	Nil	9,183	£ 14,420
Denmark	4,264,943	2,296,843	1,638,067	£2,776,116	3,939,437	7,032,357
Germany	513,740	215,816	Nil	Nil	6,960	11,112
Netherlands	977,350	490,717	620	1,180	48,474	73,748
France	702,281	326,102	6,584	7,065	15,160	24,836
Italy	845,789	420,914	Nil	Nil	Nil	Nil
United States	5,869	2,894	1,408,606	2,205,092	331,185	553,211
Egypt	1,096,539	356,627	758,728	930,674	566,498	597,208
Canada	1,950	957	1,476,962	2,230,422	807,281	1,478,933
Austria-Hungary	883,651	375,943	Nil	Nil	7,984	14,457
Sweden Belgium Portugal Spain Rumania Turkey, Asiatic Morocco China Other British Possessions Other Foreign Countries	834,561	358,560	354,828	462,777	1,338,104	1,778,814
Total	21,579,950	£9,590,602	5,644,395	£8,613,326	7,070,266	£11,579,096

TABLE 2.—*Comparative Imports of Poultry in Cwt.*

From	1913	1919	1920
	Cwt.	Cwt.	Cwt.
Russia	119,944	8	66
France	31,175	3,083	27,112
Austria-Hungary	26,674	Nil	1,396
U. S. A.	54,242	100,859	9,872
Other Countries	46,430	43,617	56,018
Total quantities	278,465	147,567	94,464
Total values	£954,540	£1,527,992	£817,872

The figures in Tables 1 and 2 show that in 1920, as compared with 1913, the total value of imported eggs and poultry had increased from £10,545,142 to £12,396,968, whilst the total quantity had decreased in the case of eggs from 21,579,950 great hundreds to 7,070,266 great hundreds; and in the case of dead poultry from 278,465 cwt. to 94,464 cwt. Thus, reckoning that the eggs averaged 14 lb. per 120, the imports in 1920 were less by 90,685 tons than in 1913, whilst the imports of dead poultry were less by 9,200 tons. It appears, therefore, that the total annual value of the eggs and poultry consumed in the United Kingdom had in 1920 reached the following approximate huge sum:—

British production	£37,000,000
Irish	22,352,578
Imported	12,396,968
Total	£71,749,546

From the foregoing it would seem that the opportunities for increasing the production of eggs and poultry in the United Kingdom were in 1921 greater than ever. Russia, the largest supplier in pre-war days, had practically ceased her exports, whilst Italy and the countries formerly included in Austria-Hungary would probably take some years to recover their former exporting capabilities. Much must depend, however, upon the capacity of the British people to adopt efficient methods of cheaper production. There is little doubt that the majority of British consumers would prefer to eat fresh British eggs and poultry rather than those of foreign origin, preserved or otherwise, provided the price of the home article is not too high. It is largely a matter of cost of production and methods of marketing.

One of the most interesting developments in poultry-keeping of recent years has been the growth of stock poultry farms whose main object is the production of pure-bred poultry of heavy laying capacity. This development was no doubt primarily due to the increasing appreciation shown by poultry-keepers of the commercial importance of high egg yield, and the consequent demand for stock, specially selected and bred for this quality. A great stimulus was given to this development by the introduction of public *laying competitions*, the object of which was to test the egg-producing capacities of various breeders' birds and also to gain information regarding the relative fecundity of existing strains and breeds. The introduction of these laying competitions in England was due to the enterprise shown by the Northern Utility Poultry Society of Burnley, Lancashire, and the Utility Poultry Club (now the National Utility Poultry Society), and at first competitions were conducted over four winter months, commencing in October. Thus the productive capacity of the birds was tested at the time of the year when eggs are most difficult to obtain, and competing breeders were compelled to hatch their birds early if they wished them to obtain a good place in the trials.

The introduction of these competitions marks an important epoch in the history of the poultry industry, as attention was thereby focussed upon the great variation in fecundity of various strains and breeds, whilst the commercial importance of high egg yield was forcibly demonstrated. For the first few years trap-nests were not used, records of the egg yield of each pen of four birds being taken. In 1902, however, trap-nests were introduced and the individual records were taken. In 1912–13 the competitions were extended to twelve-month periods, and a grant in aid of this work was given to the Utility Poultry Society in conjunction with the Harper Adams Agricultural College, Newport, Salop, by the Board of Agriculture and Fisheries. It was no doubt realized by the Board that the educational value of these competitions was very great. Not only was information obtained regarding the relative productivity of different birds, "strains," and breeds, but also regarding size and colour of egg, comparative seasonal production, period of brooding, cost of food per bird and net cost of egg production, value of different systems of housing, feeding, and general management. In fact it is open to question if the full educational value of laying competitions or trials had in 1921 been fully exploited.

The National Utility Society continued to organize trials annually, and after 1916–17 these were carried out for the Society by the Great Eastern Railway Co. at Bentley, Ipswich. This Company in conjunction with the Utility Duck Club also arranged in 1921 a laying trial for ducks. The trap-nesting arrangement for these birds is very ingenious as the ducks are enticed into the nests by regularly placing the food in small pens in front of the nests, but inside the traps. Only one duck can obtain admission to each pen or nest, and as the birds are plainly marked with distinctive rings very little handling is necessary.

Several other public laying trials were being conducted in 1921 in various parts of the United Kingdom: at Burnley, Lancashire, by the Northern Poultry Society; at Newport, Salop, by the Harper Adams Agricultural College; at Wye, Kent, by the South Eastern Agricultural College; at Birmingham by the Midland Fur and Feather Federation; at Trowbridge by the Wiltshire County Council; and in Ireland at Cork by the Irish Department of Agriculture. In the case of the trials at Newport, Wye and Trowbridge, financial assistance to the work is given by the Ministry of Agriculture.

TABLE 3

The gross production and general averages, etc., of the National Utility Poultry Society's twelve-month competitions during eight years. The Championship Section was instituted in 1918–19, and each pen consisted of 10 pullets instead of 5 as in the ordinary section.

	Total No. of Pullets Entered	Per Cent White Wyandottes	Per Cent White Leghorns	Total Eggs laid	Per Cent Grades of Eggs		Total Average per Pullet	Per Cent Pullets laying		Best Pens Average per Bird	Worst Pens Average per Bird	Food cost per bird	
					1st	2nd		over 200	under 140			s.	d.
1912–13	600	33	18	91,115	76·4	23·5	151·9	15	40	231	87	7	11
1913–14	300	48	15	56,184	90·2	9·7	187·2	43	17	223	102	7	0¼
*1914–15	300	30	38	50,562	87·4	12·5	168·5	19	21	212	124	8	10¾
1915–16	600	29	29	98,898	65·5	31·5	164·0	24	26	252	78	11	6
1916–17	354	30	30	52,438	58·8	41·2	148·1	8·4	42	249	89	Not Reported	
1917–18	575	32	41	84,477	75·4	24·6	142·2	..	..	233	63		
1918–19	720	31	48	112,162	84·4	13·6	155·7	..	..	204	81		
1919–20	1,440	30	39	231,777	78·6	21·2	163·3	19·1	25·62	207	72		
*Ten months only.					Championship Section								
1918–19	100	30	70	18,209	87·1	12·9	182·0	28·0	14·0	203	171	.	.
1919–20	120	33·33	58·3	22,320	73·3	26·7	188·8	47·5	14·1	215	184	.	.

As a brief indication of the results obtained at a few of the laying competitions the accompanying tables are instructive. (Tables 3 and 4 have been compiled by Mr. H. E. Ivatts, late Hon. Sec. of the National Laying Trials.)

Up to the 1916–17 competition awards were granted upon the basis of the market value of the eggs laid with a varying discount penalty up to 20% upon eggs weighing less than 2 ounces. Subsequent to 1916–17 the competitive value of a hen's production was determined in accordance with the following rule:—

"For the purpose of the test the eggs laid by each hen will be assessed and recorded according to their weight as first or second grade eggs. First grade eggs shall be those weighing two ounces or more. Second grade eggs during the first ten weeks shall be those weighing less than 2 ounces but not less than 1⅝ ounces, and for the subsequent period of the test not less than 1¾ ounces. Second grade eggs shall be accepted as of equal value to first grade eggs, but not more than 100 eggs shall be credited to the score of any hen in Sections 1 to 5, and in the case of Section 6 (Championship) 200 eggs."

The 1915–16 trials held by the Utility Society have a special interest, as 42 of the competitors' pens were retained for a second year in order to ascertain the yield of these birds for their second year. Table 4 shows the results obtained.

The stimulus given by laying trials to the breeding of highly fecund strains of poultry has been enormous. Not only has the spirit of competition set up by the trials urged breeders to devote much time and thought and energy to their breeding operations, but the fact that a win in a public competition is of great value as an advertisement led to the keenest efforts being made by competitors to obtain a high position in the prize list. It is perhaps not too much to say that success in the trials has been in several cases the foundation of many present-day successful stock poultry farms. Ordinary poultry-keepers wishing to buy birds either as a beginning or to improve existing stock apply to a large extent to successful competitors in the laying trials, and a considerable foreign demand at highly remunerative prices is not infrequently the direct result of success in the trials. This is certainly a mark of progress in the egg-producing industry as a whole, in the same way that the increasing demand for pedigree milking stock by the dairy farmer is an indication of progress in the dairying industry. A word of caution, however, may not be misplaced. There may be a danger in focussing attention too strongly on the development—possibly the abnormal development—of one function, or producing weaknesses in the bird in other directions. There is a certain risk of sterility, high mortality in rearing chickens and general lack of constitution in the adult stock. The really skilled breeder will know how to avoid these dangers, but nature is inclined to be severe on attempts to develop abnormal capacity in any one direction. Our knowledge of the laws of heredity is still very incomplete in spite of the considerable amount of empiric knowledge possessed by some of our present-day breeders. No doubt Mendel's discoveries and the investigations made by Bateson, Punnett, Pearl and others may give material assistance to the elucidation of the many problems involved in the inheritance of fecundity, but in the meantime stock breeders and commercial egg farmers would do well to remember that high individual egg yield may possibly be obtained at too high a cost in other directions and that high resistance to disease, low chicken mortality, and reasonably sized eggs are also matters of considerable importance.

The type of bird bred by the breeder of pedigree layers has drifted further and further away from the standard set up by the specialist exhibition clubs. So much is this so, that in the case of several breeds, particularly White Leghorns and White Wyan-

TABLE 4

Two-Year Egg-Laying Competition at Harper Adams Agricultural College, Newport, Salop, 1915–17. Each pen held 6 birds.

No.	1st Year		2nd Year		2 Years' Total		Score Value		
	Eggs	Avg.	Eggs	Avg.	Eggs	Avg.			
				Section 1. White Leghorns					
1	1,353	225	829	138	2,182	363	£18	10	7¾
2	1,265	210	720	120	1,985	330	16	1	7¾
3	1,125	187	745	124	1,870	311	15	17	2¾
4	1,196	199	686	114	1,882	313	15	12	10¾
5	1,092	182	811	135	1,903	317	15	12	7¾
6	1,261	210	619	103	1,880	313	15	7	2½
7	1,225	204	655	109	1,880	313	15	3	7¾
8	1,118	186	665	110	1,783	296	14	6	7½
9	1,003	167	688	114	1,691	281	14	0	1
10	948	158	679	113	1,627	271	12	19	0
11	1,091	181	503	84	1,594	265	12	17	7½
12	1,087	181	452	75	1,539	256	11	18	1½
13	1,449	241	837	139	2,286	380	19	2	4½
14	1,086	181	658	109	1,744	290	14	6	11½
				Section 2. White Wyandottes					
15	1,068	178	933	155	2,001	333	£17	9	8¾
16	1,177	196	755	125	1,932	321	17	0	7½
17	968	161	823	137	1,791	298	15	3	6¾
18	1,071	178	707	117	1,778	295	14	19	5
19	1,042	173	706	117	1,748	290	14	10	2½
20	997	166	722	120	1,719	286	14	4	7¾
21	938	156	706	117	1,644	273	14	3	0
22	905	150	719	119	1,624	269	13	8	9¾
23	949	158	549	91	1,498	249	12	10	5¼
24	1,513	252	809	134	2,322	386	19	10	9
25	1,169	194	846	141	2,015	335	17	8	8¾
26	1,109	184	841	140	1,950	324	17	3	11¼
27	1,210	201	798	133	2,008	334	17	2	5¼
28	1,168	194	604	100	1,772	294	15	11	10
29	1,093	182	733	122	1,826	304	15	10	4
				Section 3. Buff Plymouth Rocks Rhode Island Reds, White Orpingtons, Buff Orpingtons Barred Plymouth Rocks					
30	899	149	896	149	1,795	298	£15	9	6½
31	777	129	811	135	1,588	264	13	11	9½
32	1,000	166	534	89	1,534	255	13	1	7½
33	1,084	180	465	77	1,549	257	13	0	0¾
34	1,029	171	559	93	1,588	264	12	13	4
35	751	125	574	95	1,325	220	10	19	3¼
36	977	162	285	47	1,262	209	10	14	6¼
37	773	129	372	62	1,145	191	9	9	0½
38	732	122	388	66	1,120	188	8	18	1¾
39	471	78	455	75	926	153	7	5	10½
				Section 4. Light and Red Sussex					
40	915	152	752	125	1,667	277	£13	19	8¾
41	988	164	631	105	1,619	269	13	12	5½
42	892	148	623	103	1,515	251	13	1	5¾

dottes, the birds which win in laying competitions are of a type distinctly different from exhibition specimens and are indeed given a distinguishing designation such as Utility White Leghorns in contrast to Exhibition White Leghorns. Apparently the heavy layer develops a type of her own and if, as appears probable, the future demand for stock poultry should be increasingly for birds whose useful qualities, whether for egg or flesh production, have been highly developed, it is obviously desirable that British breeders of exhibition and utility poultry should take counsel together and if possible frame their breed standards to meet present-day requirements. Otherwise, confusion is likely to increase with resulting loss of trade both at home and abroad.

The Irish Department of Agriculture have held annual eleven-month laying trials in Ireland since 1913, and, as the results are published in a form which facilitates comparison, Table 5 is of interest:—

TABLE 5.—*Comparison of Results.*

Eleven Months ending Aug. 31	No. of Pullets	No. of Eggs Laid	Average No. per Bird	Average Value per Bird		Cost of Food per Bird		Average Price of Eggs per Dozen	Return per Bird over Cost of Food	
				s.	d.	s.	d.	d.	s.	d.
1913	318	38,199	120·1	11	2·3	5	8	13·05	5	6·3
1914	282	39,216	139·0	13	3·6	5	8·3	13·77	7	7·3
1915	264	39,764	150·6	17	6	7	0·5	16·75	10	5·5
1916	297	49,830	169·5	23	0·5	8	11·8	19·58	14	0·7
1917	210	36,660	174·6	32	7·2	13	10·7	26·89	18	8·5
1918	210	36,106	171·9	47	4	16	6	39·66	30	10·1
1919	306	55,124	180·0	53	3·4	20	0	42·59	33	3·4
1920	354	65,840	185·98	53	9	19	3·9	41·62	34	5·1

Most of the so-called "commercial egg farms," which have become more in evidence of recent years, are stocked with Utility White Leghorns, White Wyandottes, or Rhode Island Reds. The main business of these farms is to produce eggs for consumption though most of them do also a certain amount of trade in supplying eggs for hatching, day-old chicks, and stock birds. One of the largest British commercial egg farmers, however, who maintains a flock of 5,000 layers and rears some 5,000 to 6,000 chickens every year, states that nine-tenths of his produce is sold for direct consumption and that he regards the hatching egg and stock cockerel trade as comparatively unprofitable and troublesome. All hatching and rearing on this particular farm are done with broody hens, no incubators or foster-mothers being used, and this has been the practice for many years. It has proved commercially successful in this particular case, though other egg farmers use mammoth incubators and pipe brooder houses or anthracite stove hovers with apparently successful results. There is little doubt that the capacity for rearing large numbers of chickens with a low percentage of mortality is the crucial test of the commercial egg farmers' skill and management, and much has yet to be learnt regarding the rearing of chickens in large flocks. Considerable differences of opinion exist as to the comparative merits of pipe brooder houses, anthracite stove hovers, brooder houses with small portable oil hovers, outdoor portable brooders, and natural methods. When the pipe brooder system as practised in America was first tried in England many failures were recorded. Since then, however, improvements have been introduced and there is some evidence that the improved form of pipe brooder house may yet become popular in Britain. At least one large breeder has erected a brooder house of this type with a capacity of from 3,000 to 5,000 chickens and excellent results have so far been obtained. The anthracite stove brooder is now in use in considerable numbers, but opinions vary widely as to its efficiency in rearing a high percentage of vigorous well-grown chickens.

Methods of housing and feeding hens kept principally for table-egg production vary considerably. The usual practice is to keep the birds in comparatively large flocks of from 150 to 400 and to house them in open-fronted scratching-shed houses, the original type of which was probably introduced from America. These houses are not uniform in type, some being 14 ft. deep with special back ventilation whilst others are built only 9 ft. deep and depend for ventilation entirely on the open front. In Lancashire the open-fronted house is very little used, a span-roofed type with windows low down near the floor being preferred. The amount of run provided for the birds also varies. One well-known poultry farmer maintains 400 layers to the ac. but divides the acre into two portions, and whilst the birds occupy one portion forage crops, such as thousand-headed kale, which the birds later on consume, are grown on the other portion. On another farm the laying-houses are so placed on the farm and the wire fencing so arranged, that the birds can be given access to arable fields, fruit gardens or pasture, as the crops and the season permit.

In methods of feeding, too, there is also wide variation. The dry mash method is practised on certain farms whilst on others the wet mash method is preferred or a combination of the two. On some well-known egg farms large quantities of cooked vegetable food are regularly fed to the layers, whilst on other farms very little green food is given beyond what the birds gather for themselves on their runs.

From all this it will be gathered that methods are far from being standardized in the poultry industry, and this is indeed not a matter for surprise when the recent development of poultry-keeping as a business is considered. Unlike agriculture, which is man's oldest industry and has been for many years investigated both from the scientific and practical aspect by some of the best brains, there has been little scientific or even practical investigation into poultry-keeping methods in the United Kingdom. For the novice therefore, who may well feel doubtful as to the best system to adopt, the soundest procedure is probably to obtain information as to the methods practised on several successsful poultry farms and then to adopt a method which appears to combine the good points of several.

The keeping of poultry in England by urban dwellers, with gardens or even small backyards, and by allotment holders, received a great stimulus during the war, owing to the falling-off in supplies of imported eggs and the necessity for converting all the edible household and garden waste material into human food. It was soon realized that a limited number of laying hens could be maintained under intensive conditions in small backyards and gardens, at comparatively low cost. The necessary labour could be provided within the family, and first-class eggs produced at the point of consumption at much lower outlay than that involved in purchasing inferior shop eggs. Furthermore, eggs so produced were actually on the consumers' premises. Difficulties and expenses of transport did not affect the supplies, provided a limited amount of additional feeding-stuffs could be obtained to supplement the household and garden waste material. This development in urban poultry-keeping would no doubt have proceeded much more rapidly than it actually did had the supply of chickens, pullets, and hens been greater. Unfortunately, however, poultry-breeders were unable to obtain supplies of feeding-stuffs freely and hence were obliged to restrict their breeding operations. Consequently the demand for laying stock by town dwellers could not in many cases be satisfied, or was met by supplies of old hens which gave disappointing results. In any case urban poultry-keeping has taken a firm hold, so much so that local sanitary authorities and town property owners are showing concern as to possible interference with the amenities of properties in urban areas, and local by-laws and clauses in leases which were more or less ignored in many cases during the war are now being strictly enforced. It is to be hoped that town poultry-keepers will so regard the requirements of hygiene and sanitation in thickly populated areas that no serious cause for complaint with subsequent restrictive action on the part of local authorities may arise, as undoubtedly "backyard" poultry-keeping can give powerful assistance in reducing the necessity for large importations of foreign eggs.

For backyard, allotment and garden poultry-keeping the intensive system of housing is usually adopted, though in some cases where sufficient space is available open or covered runs for the birds may be provided in addition to the house. Under the strictly intensive system the birds are permanently confined to the house which should afford four or five sq. ft. of floor space to each bird. It is essential that the floor of the house be kept dry and some 4 in. to 8 in. of bedding should be provided amongst which grain should be scattered from time to time so as to induce the birds to take necessary exercise by scratching amongst the litter for the grain. The intensive house is usually of a lean-to open-fronted type so designed as to admit as much sunlight as possible on to the floor in the winter months and yet to keep out rain, snow and wind. It may be built of wood,—¾-in. tongued and grooved match-boarding is often used,—asbestos sheeting, or even mainly of felt. As a backyard or garden poultry house is often of a more or less permanent nature it is usually more economical in the long run to use sound materials which are likely to need little repairing. A house of this type, which should be high enough to permit of easy cleaning, may be built for six or eight hens in quite a small backyard, and provided it is kept quite clean and no male birds are kept no offence is likely to be caused to neighbours even in a crowded city district. In circumstances such as these, however, it is inadvisable to attempt hatching and rearing, and the egg supply is likely to be more satisfactorily maintained if fresh pullets are purchased at the end of each summer and the hens disposed of which have been kept intensively for about a year, and have temporarily ceased laying and commenced to moult. If space permit a covered run may be provided adjoining the house, but the floor material, especially if of soil or sand, must be kept scrupulously sweet and clean. The top surface should be raked off and renewed from time to time and occasionally a little disinfectant powder may be sprinkled in the run. Extra accommodation of this sort is, however, not really necessary for laying stock kept under proper intensive conditions for one year only, and most backyard poultry-keepers with limited space at their disposal will find an intensive house constructed on sound lines most suitable for their purpose.

The Sussex poultry-fattening industry, which had become of considerable importance in the three south-eastern counties prior to the war, has become almost extinct owing to the high price, and the difficulty in obtaining supplies, of the Sussex ground oats which were invariably used for cramming the birds. Apart from the fact that it was considered uneconomical in war-time scarcity to use concentrated feeding-stuffs for the production of the highly finished, crammed Surrey fowl, supplies of store chickens were difficult to obtain, feeding-stuffs were very short and were rationed, and, owing to the shortage of fresh meat, chickens found a ready market in almost any condition. Thus the old Sussex fattening industry gradually died out, though of course chickens continued to be reared as far as conditions would permit and were marketed as a rule without cramming or special fattening.

There have been some indications of a revival of the cramming practice, but Irish supplies of store chickens having been diverted for direct sale in London and elsewhere, and poultry-raisers having accustomed themselves to selling their birds for direct consumption without additional fattening, it may be that any general revival of cramming will be long deferred. Much will depend upon the public demand and this will no doubt revive to an increasing extent if supplies of the former high-quality crammed chickens become greater. The practice of trough feeding chickens in fattening coops for a week or so in order to give them a little extra finish is still continued to a certain extent during the late summer, and this practice has much to commend it. Less skill is required than in cramming; it is more economical of feeding-stuffs, and though the chickens cannot be as highly finished as by the crammer, good-quality table birds can be produced which are readily saleable at satisfactory prices.

Like the Sussex cramming industry, the old-established Aylesbury duck-fattening industry, as well as duck-fattening farms outside Buckinghamshire, became practically extinct during the war, but duck farms were bound to reappear as feeding-stuffs became cheaper and more plentiful. In 1921 the tendency appeared to be to keep the lighter breeds of ducks, such as the Indian Runner, the Khaki Campbell, and the Buff Orpington, for egg production rather than for table purposes, and much attention has been drawn to this aspect of duck-keeping owing to the laying competition for ducks conducted by the Great Eastern Railway Co. with the Utility Duck Club.

For many years the poultry industry received little recognition or assistance from the state authorities in the United Kingdom. Considerable changes in this respect, however, have been in evidence during recent years. State aid has been mainly directed to educational activities, and there are now few counties which do not possess an instructor in poultry-keeping, whose duties consist in giving instruction in this subject by means of peripatetic lectures, classes, and visits to poultry-keepers. Most of the agricultural colleges, dairy institutes and farm institutes also provide regular instruction in poultry-keeping to their pupils, and in some instances—such as at the Harper Adams Agricultural College, Shropshire; the Lancashire County Council School at Hutton; the Glasgow and West of Scotland Agricultural College Poultry School at Kilmarnock, etc.—courses of training are provided for students desiring to specialize in poultry-keeping.

Poultry-breeding centres have been established by the Board of Agriculture in coöperation with local authorities in almost every district in the United Kingdom, for the purpose of distributing good pure-bred utility poultry—usually by the sale of eggs for hatching or day-old chicks to smallholders, cottagers and allotment holders. This scheme has met with much appreciation and success. Table 6 shows the number of distributing stations established in England and Wales and the numbers of eggs and chicks distributed since 1919:—

TABLE 6.—*Distribution Stations.*

	Egg Stations	Egg & Chick Stations	Chick Stations	Incubating Stations	Total	Total Eggs	Distribution Chicks
1919	156	. .	3	4	163	52,980	2,974
1920	122	39	8	4	173	141,611	20,934
1921	138	84	9	4	259[1]	. .	. .

[1] Includes 24 stations which undertake distribution of ducks' eggs.

It is significant of the interest now taken by the State in the development of the poultry industry that the Ministry of Agriculture and Fisheries has created a separate Small Livestock Branch, on the staff of which technically qualified officers were appointed. One of the chief duties of the branch is to supervise the poultry educational work of local authorities in respect of which grants in aid are made by the Ministry. It is the duty of the technical head of the branch to advise the Ministry on matters relating to the industry.

Valuable work is done in Britain to assist the poultry industry by poultry societies and clubs, such as the National Utility Poultry Society, the Poultry Club, the Northern Utility Society, the Scientific Poultry Breeders' Association, the Midland Fur and Feather Federation, and many others. These clubs organize lectures, demonstrations, laying competitions and shows, and do a great amount of voluntary work in an advisory capacity. In 1920 a central organization known as the National Poultry Parliament was set up mainly through the efforts of Mr. Edward Brown, F.L.S., who was unanimously appointed the first president. This poultry parliament, which meets once or twice a year to discuss questions relating to the industry, is representative of societies, clubs, educational authorities and institutions and trading organizations. The parliament has appointed a smaller executive body known as the National Poultry Council, and one of the first important steps taken by the council was to set up a national examination board to conduct an examination and to award to successful candidates a national diploma, which is intended to be in the main a standard qualification for persons desiring to obtain appointments as instructors in poultry-keeping. (P. A. F.)

UNITED STATES

Profound changes took place in the American industry between 1900 and 1920. In 1900 "breeding-birds" and meat were the principal objects of poultry raising and furnished most of the profit. Eggs at that time were a by-product. Conditions had so changed by 1920 that eggs were the principal money producer and meat and breeding birds were the by-products.

Many factors contributed to this change. There had been a greater increase in the population especially in the cities, than in the number of hens kept. Consequently there was a greater demand for meat and eggs, especially eggs. Cold storage facilities and improved shipping methods had raised the average quality of the product marketed and by more nearly equalizing the supply and price, had increased the demand. The spring flow of eggs after the introduction of storage became profitable, although formerly it often had resulted in loss. The per capita consumption of eggs and poultry flock decreased because of the increase in price. The increase in price affected the consumption of meat more than of eggs because substitution of other meats was possible. Eggs, quickly and easily cooked, digestible, containing concentrated vitamines, clean, imparting their flavour and preserving qualities to cakes and pastries, remained in strong demand even at high prices.

During 1920 the total value of products placed the industry among the few of those connected with farming from which the 1920 return exceeded a thousand million dollars. The 1920 census showed more farmers reporting poultry than any other single crop, even apart from the large quantity of poultry raised in towns and villages not covered by the census reports.

Table 7 shows that, relatively, poultry-keeping rapidly declined in the east during the decade 1909–19. The west, especially the Pacific Coast states, continued to increase. The decline in the east was due largely to the high price of feed and the difficulty of obtaining it, particularly during 1917 and 1918, and the decrease in farm population and the number of farms. Opposite conditions obtained in the west. While feed was higher it was easily obtainable and relatively cheaper because of the freight congestion. During the decade there was an increase in the number of farms and farmers in the west particularly on the Pacific Coast. The poultry farms in New England that were making a specialty of producing meat were to a large extent put out of business owing to the increased cost of feed and labour without a proportionate increase in the price of meat during 1917 and 1918. The same was true to a lesser extent of the specialized egg farms and farm flocks in New England and the North Atlantic states. These farms had not returned to normal when the 1920 census was taken, but at the close of 1921 a rapid development was under way.

The general depression in the industry from 1916 to 1919 primarily affected those who were obtaining comparatively poor egg production due to faulty methods of management or to poorly selected or poorly bred stock. The poultrymen who obtained high egg yields made greater profits than for the years 1910–1915. This condition drew the attention of poultry-keepers to the necessity of getting a good egg yield and led to systematic breeding and selecting for egg production. Many farms, particularly those in the northwest, have bred their birds to the point where they are getting an average egg production of over 200 eggs per hen from large flocks of birds. From 1900 to 1915 an increasing number of commercial poultry farms were established primarily to produce eggs. These took the place of the broiler farms, which had been mainly failures. Through these farms and the value of the produce, poultry became a business or industry rather than a side-line for farmers' wives or a hobby for fanciers.

Perhaps the most rapid change that took place in the industry during the period 1910–20 was that in 1910 but few baby chicks were sold, but in 1921 millions were sold to the advantage of the breeder, the hatchery man and the farmer raising the chicks. If the rate of increase of the chick hatcheries for 1918–21 should be maintained until 1930 comparatively few hens then would be used for hatching, and comparatively few hatching eggs would be sold except to the hatcheries.

TABLE 7.—*Chickens on Farms in the United States, 1920 and 1910; and Eggs Produced and Chickens Raised, 1919 and 1909 by Geographic Divisions (from 14th Census Report).*

Division	Chickens on Hand		Chicken Eggs Produced[1] (Dozens)			Chickens Raised[2]			Chickens and Eggs[3]	
	Jan. 1 1920	Apr. 15 1910[4]	1919	1909	Increase Per cent	1919	1909	Increase Per cent	1919	1909
United States	359,537,385	280,340,959	1,656,267,200	1,574,979,416	5·2	473,923,935	460,605,709	2·9	$1,047,989,919	$509,195,232
Geographic Divisions:—										
New England	5,803,507	6,840,404	37,631,896	54,668,994	−31·2	8,477,360	10,756,947	−21·2	32,513,758	22,517,029
Middle Atlantic	27,452,439	24,448,840	151,453,438	159,465,468	−5·0	31,059,165	34,070,656	−8·8	108,751,458	59,034,629
East North Central	84,516,275	69,471,093	400,445,456	389,256,925	2·9	99,251,552	98,895,698	0·4	249,814,285	123,210,787
West North Central	105,348,098	85,192,266	474,659,948	442,167,894	7·3	126,630,427	118,998,060	6·4	270,158,753	129,830,507
South Atlantic	36,407,610	25,626,503	144,662,300	134,289,761	7·7	65,374,047	65,058,950	0·5	110,631,263	50,959,642
East South Central	34,091,878	24,495,050	138,152,110	127,308,625	8·5	51,071,455	55,683,712	−8·3	85,188,095	41,412,242
West South Central	39,918,963	29,176,267	157,369,356	163,644,118	−3·8	58,051,184	54,701,253	6·1	97,156,410	44,077,140
Mountain	9,524,240	5,467,234	51,786,515	35,233,191	47·0	13,069,329	8,426,030	55·1	30,635,751	12,955,691
Pacific	16,474,375	9,623,302	100,106,181	68,944,440	45·2	20,939,416	14,014,403	49·4	63,140,146	25,197,565

[1] The figures for both 1919 and 1909 include estimates for farms reporting chickens on hand but no eggs produced. The returns for 1909 included all eggs produced. To obtain figures for chicken eggs alone, deductions have been made for eggs produced by ducks, in proportion to the number of ducks on hand in 1910. Eggs from fowls other than chickens and ducks are considered negligible.

[2] The figures for both 1919 and 1909 include estimates for farms reporting chickens on hand on the census date but no chickens raised during the preceding year. The returns for 1909 included all kinds of fowls raised. To obtain figures for chickens alone, deductions have been made for fowls other than chickens, in proportion to the number of such fowls on hand in 1910.

[3] The products shown for 1919 include chicken eggs and chickens only, while the 1909 figures include the products of all kinds of poultry.

[4] Chickens 3 months old and over.

In 1900 there were few colleges or experiment stations in America teaching poultry raising or experimenting with it. By 1920 all the states were teaching and most of them were doing experimental work. Colleges and experiment stations have been of great assistance to farmers and poultrymen in showing them better methods. Egg-laying contests have shown the value of breeding for high production and of strains rather than breeds so far as egg production is concerned. The first egg-laying contest in America was at Storrs, Conn., under the supervision of the Connecticut Agricultural College in 1911–2. There were more than 10 contests in the United States and 10 in Canada in 1921–2. The highest average production in any contest was obtained by the Western Washington Experiment Station at Puyallup, Wash., for the year 1920–21. The 365 birds in the contest averaged 214 eggs per hen. The pen of five single-comb White Leghorns which led the contest and made the American record layed 1,384 eggs or an average of 276·8 eggs per hen.

During 1910–20 ornamental breeds and bantams so decreased that in 1921 few commercial breeds were maintained on a large scale. The chief breeds were White Leghorns, Barred Plymouth Rocks, Rhode Island Reds and White Wyandottes. There were also fairly large numbers of Anconas, Buff and White Orpingtons, Brown Leghorns, White Plymouth Rocks, Buff Wyandottes, Black Minorcas, Black Langshans and Light Brahmas.

Table 8 shows that imports and exports of eggs and egg products greatly increased from 1910 to 1920, the imports more rapidly than the exports, so that the United States seemed likely to become on balance an importing nation. The exports for 1920 consisted largely of shell eggs and went to Cuba, Canada, Mexico, Panama, England and Scotland. A considerable proportion of the eggs that went to Canada replaced Canadian eggs shipped to England. As Canada has a grading law, its eggs were exported to better advantage. The imports were mostly egg products from the Orient, particularly from China. In 1920 the imports consisted of 1,348,383 dozen of shell eggs, of which over 70% came from the Orient. The egg products amounted to 24,091,098 pounds, of which over 90% came from the Orient. Beginning about 1918 the large packing and egg handling houses began establishing egg-breaking and packing facilities in China and South America, so that in 1921 the imports seemed likely to continue to increase for some years unless tariff changes affected conditions. (O. B. K.)

TABLE 8.—*U.S. Exports and Imports; Eggs (Shell) and Egg Products, Fiscal Years 1910–20*

	Exports	Imports
1910	$ 1,264,043	$ 166,859
1915	5,083,825	1,236,889
1920	19,459,187	9,250,021

POWER, SIR WILLIAM TYRONE (1819–1911), British soldier and administrator (*see* 22.224), died July 24 1911.

POYNTER, SIR EDWARD JOHN, BART. (1836–1919), English painter (*see* 22.239), died in London July 26 1919. In 1919 he retired from the presidency of the Royal Academy, and was created K.C.V.O.

PREECE, SIR WILLIAM HENRY (1834–1913), British electrical engineer, was born in Wales Feb. 15 1834 and educated at King's College, London. He became a civil engineer but in 1853 joined the Electric and International Telegraph Co., whence in 1869 he reverted to the civil service. In 1877 he was appointed electrician to the Post Office, in 1899 engineer-in-chief and, after his retirement, consulting engineer. He was a pioneer of wireless telegraphy and his early experiments are described in 26.530. He died at Penrhos, Carnarvon, Nov. 6 1913.

PRESSENSÉ, FRANCIS DE (1853–1914), French politician and man of letters, was born in Paris Sept. 30 1853, the son of Edmond de Pressensé (*see* 22.299). He was educated at the Lycée Bonaparte, and at school had a brilliant career, earning many distinctions. He served on General Chanzy's staff during the war of 1870 and was taken prisoner at Le Mans, but after the war entered the public service. After a short period at the Ministry of Public Instruction, he entered the diplomatic service, and was appointed first secretary at Washington. In 1882 he returned to France and took up journalism. He was a contributor to many journals, including the *Revue des Deux Mondes* and the *République Française*, and in 1888 became foreign editor of the *Temps*. On the rise of the Dreyfus question (1895) de Pressensé identified himself with the cause of the prisoner. He wrote in support of General Picquart, and in consequence of his advocacy of Émile Zola's cause was struck off the roll of the Legion of Honour. This led to his resignation from the *Temps*, and he came forward as a socialist politician, being in 1902 elected socialist deputy for the Rhone. He was prominent in the debates on the question of the separation of Church and State, and a bill brought in by him formed the basis of the one finally carried by M. Briand. He died in Paris Jan. 19 1914.

De Pressensé published many articles of the greatest interest in the *Temps*, the *Revue des Deux Mondes*, *Aurore* and *Humanité*. He also produced *Le Cardinal Manning* (1896), an interesting study, and a work on Home Rule, *L'Irlande et l'Angleterre depuis l'acte d'union jusqu'à nos jours, 1800–1888* (1889).

PRETORIA (*see* 22.309).—Pop. (1911), whites 35,942, coloured 18,732, total 54,674; in 1918, whites 41,690. About a mile from the centre of the town on a commanding position on the slopes of Meintjes Kop are the Union Government Buildings, the finest public offices in South Africa. They were built 1910–3, from the designs of Herbert Baker, at a cost of £1,800,000, and consist of three main portions; a large central semicircular colonnaded building flanked east and west by rectangular blocks. At the junction of each wing with the central section is a domed tower 180 ft. high, and at the end of each wing is a projecting pillared pavilion. A feature of the building is the long low roof, with projecting eaves. The space enclosed by the building is laid out in terraces culminating in an open amphitheatre, in the centre of which is a stone rostrum. The buildings are of South African freestone, on a foundation of Transvaal granite. The laying out and planting of the terraced gardens was not completed until 1920. The principal approach lies 12 ft. below the main terrace, is 80 ft. wide and is planted with trees. Another road leads to the suburb of Bryntirion, where are Government House and the residences of ministers.

The foundation stone of Government Buildings was laid in Nov. 1910 by the Duke of Connaught, and the first public ceremony in the amphitheatre of the building was held in 1915 to celebrate General Botha's conquest of South-West Africa. In 1913 a statue of President Kruger was unveiled in the town. In April 1918 Pretoria became the headquarters of the newly created university of South Africa. One of its constituent colleges, the Transvaal University College (incorporated 1910), is situated in Pretoria.

The State Library and Museum (built 1913) are in Market Street. The former Transvaal Government Buildings, facing Church Square, which is the business centre of the city, are used by the Provincial Council. The Law Courts (completed 1914) are on the north side of the square; the Post Office (completed 1912) faces Church Square and Church St.

The municipality, which owns the sanitary, water, electric and tramway services, spent between 1902 and 1919 a sum of £1,675,000 on improvements, including the provision of a water sewerage system, electric tramways, parks, an open air swimming-bath and a golf course, reputed one of the best in South Africa. The rateable value of Pretoria in 1918 was £7,438,000, its revenue £366,000, and its indebtedness £1,716,000.

PRICES.—In the following article, which should be read in connexion with those under COST OF LIVING and WAGES, the changes in prices of commodities during the years 1910–20 are considered with special reference to the United Kingdom. An account of the American system for controlling prices in the United States is appended.

(I.) *Wholesale Prices in General.*—The movement of wholesale prices in general is measured by the method of index numbers. The prices of commodities for which definite market quotations for definite grades exist are selected as typical in their changes of prices in general, a year or longer period is chosen as base, the price of each commodity is equated to 100 at the base period and the price in other years expressed proportionately, such numbers being called price ratios. (Thus if the price of wheat in the base period was 60s. and in another year 45s., the price ratio in the latter year would be written as 75.) Then *either* factors are chosen expressing the relative importance of the commodities as determined by the total sum spent on them in a period or some other criterion, and each price ratio is multiplied by the corresponding factor, the sum of the products is divided by the sum of the factors and the resulting quotient is the index number of wholesale prices for that year; *or* the more important commodities are represented by two or more price quotations and the resulting price ratios are simply averaged to obtain the index number. There are many variants of method and there has been much controversy on every detail of the process; in fact, however, the precision of the result depends not to any great extent on the particular method followed, but principally on (i.) the number of independent prices included and (ii.) on the dispersion of the various price ratios in the year to which the index number refers, so that when prices are moving on the whole in the same proportion the index number is more accurate than when some are moving rapidly upwards and others are stationary or falling. In normal times when changes are moderate it has been shown both from theoretical considerations and by comparing the numbers obtained by various methods that the precision of the method is high, but during the war period the movements were rapid and unequal, the conditions of accuracy were lost and no very precise measurement could be obtained. The object of the method of index numbers is to average away the variations due to the special conditions of supply and demand of particular commodities, and to obtain a resultant which measures the effect on prices of general causes, such as the supply of currency.

It is found in practice that the necessity for restricting price quotations to those of commodities for which the same grade and quality is in the market in large quantities through a long period of years restricts the choice greatly, and limits it to raw materials or articles in an elementary state of manufacture. In some cases the price used is based on the average value of all grades of the commodities (*e.g.* of wheat, of tea, of coal), imported or exported, but this introduces a possibility of error since the average may change owing to a change in the relative quantities of high and low grades independently of any change in price. The three index numbers of wholesale prices in use in the United Kingdom are the Board of Trade's, the *Economist's*, and the *Statist's* (formerly Sauerbeck's); the first uses average values to some extent and applies factors to the price ratios to allow for the relative importance of commodities, the second and third use market quotations of definite qualities of goods and take a simple average of the price ratios.

Table I. exhibits the general movement in the twelve years before the World War, and shows how little the variation of method affects the result in this period. The year 1903 is taken as the starting point, since it is after the great fall of prices ending in 1896 and the subsequent rise and the inflation of 1900–1, and may be regarded as a normal year.

TABLE I.—Movement of wholesale prices in the United Kingdom 1903–13. (In each case the index number of 1913 is equated to 100.)

Year	Board of Trade Index No.	Sauerbeck's Index No.	*Economist* Index No.
1903	83	82	79
1904	84	83	81
1905	84	85	81
1906	87	91	88
1907	91	94	93
1908	89	86	83
1909	90	87	84
1910	94	92	90
1911	94	94	95
1912	99	100	108
1913	100	100	100
1914 Jan.–June	—	97	96

Sauerbeck's index numbers for 1903 on the same basis for separate groups of commodities were:—Vegetable food 90; animal food 85; sugar, tea, coffee, 86; minerals 74; textiles 79; sundry materials 83. Wholesale prices had therefore been rising from 1902–13 (with a short inflation and depression in 1906–8), but tended downwards in the first half of 1914.

TABLE II.—*Statist* monthly index numbers. Average Jan. to July 1914 taken as 100.

End of	1914	1915	1916	1917	1918	1919	1920	1921
Jan.		117	150	193	225	233	298	239
Feb.		122	154	199	227	227	317	220
March		126	158	205	228	224	316	215
April	100	128	163	209	230	224	323	206
May		130	164	212	231	235	316	196
June		129	159	218	233	242	311	189
July		129	158	214	233	250	309	—
Aug.	106	130	163	213	237	258	308	—
Sept.	108	131	163	214	239	260	302	—
Oct.	109	133	173	219	239	272	291	—
Nov.	108	137	183	222	237	280	272	—
Dec.	111	143	187	225	237	285	252	—
Average for year—								
Statist		131	164	212	233	249	301	—
Economist		128	167	212	234	244	298	—
Board of Trade		127	164	214	235	261	327	—

Immediately after the declaration of war in 1914 prices began to rise, and with certain interruptions continued to mount up till the spring of 1920, when the index numbers reached their maximum (*Statist* 323, end of April; *Economist* 326, end of March; Board of Trade 357, average of July). Till Oct. 1917 the increases showed a remarkable regularity averaging 2% monthly, equivalent cumulatively to 27% per annum; on this scale the index in the successive Octobers would reach in 1914 106, in 1915 135, in 1916 171, in 1917 217 and in 1918 258, numbers which (except the last) are in close agreement with those shown in the table. This was, however, a definite seasonal movement superimposed on this regularity; in the first three or four months of each year prices moved up with special rapidity, while in the summer the increase was slackened and in some cases was replaced by a fall. The check in the increase in the summer of 1917, following a specially rapid rise, is attributable to the control of prices which by that date was general. From Aug. 1917 prices continued to rise in spite of control till Sept. 1918, but the rise in these 13 months aggregated to only 13% (239 against 213). After the Armistice prices fell slowly for five months, during the season in which in previous years the increase had been specially rapid, but expectations of a permanent fall were not realized; in the year beginning April 1919 the index rose from 224 to 323 or 44%.

From the beginning of the war till July 1919 the *Statist* and *Economist* index numbers are in close agreement, except that the *Economist* shows a more rapid rise for twelve months from Oct. 1916 and less increase in the late autumn of 1917, but there is disagreement as to the dates and amount of the increase after July 1919. At that date the three index numbers agree in estimating the whole increase in five years at 148, 149 or 150%. The following table shows the divergence in subsequent months:—

TABLE III. Monthly index numbers, July 1919 taken as 100.

	Board of Trade	*Economist*	*Statist*
1919			
July	100	100	100
Aug.	106	101	103
Sept.	110	102	104
Oct.	115	105	109
Nov.	120	108	112
Dec.	123	114	114
1920			
Jan.	127	120	119
Feb.	131	127	126
March	133	130	127
April	133	128	129
May	132	128	126
June	140	122	124
July	144	122	123
Aug.	135	120	123
Sept.	137	119	120
Oct.	134	111	116
Nov.	129	102	108
Dec.	125	92	100

The earlier agreement is more remarkable than the later discrepancies, for the conditions of accuracy named above were not present during the war when prices were moving rapidly and quotations for the usual qualities of goods were often

TABLE IV.—Index numbers of wholesale prices.

	United Kingdom	Canada	U.S.A.	France	Italy	Japan	Sweden	Netherlands	Denmark	Norway	Australia
	Statist	Official	Bradstreet's	Statistique Générale	Bacchi	Bank of Japan	Svensk Handelstidning	Official	Finanztidende	Okonomiks Revue	Official
1913	100	100	100	100	100	100	100	100	100	—	—
1914	101	100	97	103	95	95½	116	106	134	100	100
1915	126	109	108	141	133	97	145	149	149	—	141
1916	159½	134	130	190	200	117	185	233	206	—	132
1917	206	175	172	263	306	148½	244	298	284	—	146
1918	226½	205	204	341	409	196	339	398	292	—	170
1919	242	216	204	358	366	239	330	306	340	—	180
1920											
Jan.	289	248	227	489	504	301	319	293	—	334	203
Feb.	306	253½	226	525	556	314	342	289	—	344	206
Mar.	308	258	225½	557	619	322	354	290	—	351	209
April	313	261	226	591	679	301	354	296	—	354	217
May	306	263	216	553	659	272	361	297	—	371	225
June	301	258	211	495	615	248	366	297	383	384	233
July	299½	256	205	498	613	239	363	301	385	411	234
Aug.	298	244	196	504	632	235	365	290	394	418	236
Sept.	293	241	184	528	660	231	362	288	398	427	230
Oct.	282	234	171	504	662	226	346	283	403	422	215
Nov.	263	224½	148	463	658	221	331	260	374	404	208
Dec.	244	214	138	437	634	206	299	233	341	377	197

The prices are of course measured in the currency of each country. In every case there is a fall in the last months of 1920.

unobtainable. It is important to emphasize this uncertainty, for it is the fact that exact measurements of general price changes cannot be made in times of disturbance, and indeed it is difficult even to define the quantity we wish to measure; tendencies can be observed clearly, but only rough measurements can be made and fine comparisons lead to error. The maximum level was reached in March 1920 by the *Economist* index number, in April by the *Statist*, in July by the Board of Trade. By Dec. 1920 the Board of Trade index was back at the level of the beginning of 1920, that of the *Statist* at the level of July 1919, and that of the *Economist* at the level of May 1919. The difference is mainly due to the varying proportions given to cereals and textiles, which had fallen rapidly, and to meat and minerals which had fallen little in the three numbers.

Table IV. (from the *Monthly Bulletin of Statistics of the Supreme Economic Council*, vol. ii., No. 5) shows the index numbers for several countries.

(II.) *Wholesale Prices of Selected Commodities.*—When we come to commodities separately, the measurements can be made more exactly subject to the two following qualifications. During the war period the ordinary sources of supply were so disturbed that pre-war kinds and qualities were no longer in the market (in the *Economist* index number only 19 out of the 44 quotations included were not subject to some modification of kind); and a statement of prices is generally taken as meaning the price at which a purchaser can obtain the goods he desires and at which a merchant is willing to sell, but in the time of control and rationing these conditions did not obtain, and the price was fixed by other conditions than those which influence a free market.

Table V. is based on the prices tabulated in the *Journal of the Royal Statistical Society*, July 1920, pp. 640–5, by the editor of the *Statist*. The index numbers have been recast, the average price in 1913 being taken as 100 for each commodity; the totals have been obtained by grouping together the separate entries on the same plan as in the original, but the change in base year affects the results, which thus differ from those given in Table II. in the same way as if the weights had been changed.

It is at once evident that the various prices have not followed the same course; the extremes in 1919 are tin, whose price rose only 28% in 6 years, and Russian flax, where the rise is 323%. This great divergence of itself shows that the general index number cannot have great precision; but in the absence of means of improving it, we cannot do better than take this number (shown in the line "Grand Total," in Table V.) as measuring the general inflation of wholesale prices.

The prices as recorded are the resultants of at least five nearly distinct forces, viz. the general inflation of prices, the conditions of supply and demand for the separate commodities, the control of supply, the control of prices, the change of quality. In 1915

TABLE V.—*Statist* index numbers. Averages for each year.

	1913	1915	1916	1917	1918	1919	1920
Vegetable food							
Wheat							
English Gazette	100	170	184	239	229	229	253
American	100	164	185	229	215	205	253
Flour, Town made white or G.R.	100	160	172	192	153	153	216
Barley, English Gazette	100	137	189	238	217	278	330
Oats, English Gazette	100	162	180	270	258	274	301
Maize, American mixed	100	175	223	304	332	334	383
Potatoes, good English	100	120	197	239	183	254	311
Rice, Rangoon	100	162	206	309	320	313	501
Total	100	156	192	252	238	255	319
Animal food							
Beef: Carcase, London Central meat market,							
Prime	100	134	150	194	191	200	231
Middling	100	139	157	206	211	220	257
Mutton: Carcase, London Central meat market,							
Prime	100	121	151	185	176	184	233
Middling	100	126	154	195	196	203	258
Pork: Carcase, London Central meat market	100	129	160	200	234	233	306
Bacon, Waterford	100	121	143	192	237	248	311
Butter, Friesland	100	118	161	181	208	212	253
Total	100	127	154	193	208	214	264
Tropical food							
Sugar							
West-Indian*	100	151 ‡	255 ‡	332 ‡	347	404	611
Beet*	100	180	239	267	279	361	689
Java	100	172	244	301	327	400	687
Coffee							
East India*	100	97	96	117	159	180	183
Rio*	100	84	94	109	130	215	210
Tea							
Congou, common*	100	167	160	338	418	270	225[a]
Indian, good medium†	100	127	130	185	194	182	114
Average Import*	100	122	125	162§	166	171	165
Total*	100	143	182	241	269	300	432
Total Food	100	143	186	228	233	250	322

Table V.—*Continued.*

	1913	1915	1916	1917	1918	1919	1920
Minerals							
Iron							
Scottish Pig*	100	109	137	146	154	215	326
Cleveland Pig*	100	112	142	154	163	235	357
Common Bars	100	136	177	177	181	249	366
Copper							
Chili Bars	100	107	170	183	170	135	143
English Tough Cake†	100	112	182	185	171	135	153
Tin, Straits	100	82	91	118	165	128	150
Lead, English Pig	100	125	170	169	169	154	209
Coal							
Wallsend in London	100	143§	128§	128§	156	211	149
Newcastle Steam†	100	136	266	194	216	293	332
Average Export	100	122	177	193	219	331	572
Total	100	118	150	160	174	205	276
Textiles							
Cotton							
Middling American	100	84	128	236	318	280	330
Fair Dhollerah	100	77	123	240	301	259	248
Flax							
Petrograd*	100	176	226	333	353[a]	353[a]	353[a]
Russian, Average Import*	100	161	207	368§	379	423	837
Hemp							
Manila, Fair roping*	100	120	172	266	313	185	207
Petrograd, clean*	100	159	187	278	439	388	385
Jute, good medium	100	80	117	149	148	189	169
Wool							
Merino, Port Philip*	100	119	182	258	262	372	444
Merino, Adelaide*	100	114	174	245	247	338	337
English, Lincoln half-hogs	100	140	162	169	152	183	178
Silk, Tsatlee	100	89	148	195	234	236	351
Total	100	112	156	214	269	272	320
Miscellaneous							
Hides							
River Plate, dry*	100	105	119	162	163	182	166
River Plate, salted*	100	116	139	167	149	206	192
Average Import price*	100	116	135	180	185	198	233
Leather							
Dressing hides*	100	147	145	179	168	187	223
Average import price*	100	113	140	179	170	211	370
Tallow, town	100	108	138	181	242	255	218
Oil							
Palm	100	98	126	130	127	197	198
Olive	100	104	120	234	400	404[a]	404[a]
Linseed*	100	122	167	228	257	375	356
Linseed*	100	126	176	247	288	306	345
Petroleum, refined	100	105	141	190	252	204	298
Soda, crystals	100	102	166	189	174	249	317
Nitrate of Soda	100	110	156	217	237	216	215
Indigo, Bengal	100	486	486	373	327	332	527
Timber							
Hewn, average import*	100	147	205	244	268	344	400
Sawn, average import*	100	150	236	333	430	369	416
Total	100	148	182	217	247	268	312
Total Materials	100	129	165	201	234	252	304
Grand Total	100	135	170	212	234	251	312
Silver†	100	86	114	151	172	207	223

*The entries in these cases of similar commodities are averaged before inclusion in the index numbers.

†These commodities are not included in the *Statist* index numbers.

‡Comparative values.

§Approximate prices. [a] Nominal prices.

and 1916 the principal increases may be traced to the diminution or difficulty of supply (cereals, sugar, flax) or to acuteness of demand (wool) or to both (timber). In 1917–8 the prices of nearly all commodities whose supply was threatened or for which the demand was increased were controlled. The quality was changed definitely in the case of flour and indirectly when the prices are averages of several grades as in the cases of meat, flax, leather and timber.

Food.—The price of wheat rose immediately after the beginning of the war, and with it the prices of flour, oats, maize and rice. The prices were checked by the establishment of a government system of purchase at the end of 1916 and by the control of the prices of home-grown cereals in 1917; with this system flour of mixed materials was substituted for wheat-flour and the product sold at a price kept constant and relatively low, by the help of a subsidy beginning in the autumn of 1917. In the case of wheat and flour the subsidy and control continued till the beginning of 1921 but the prices rose; the prices of other cereals increased very rapidly from the autumn of 1919. An attempt was made to control the consumption of oats in 1917–8, otherwise cereals were not rationed. The wholesale price of potatoes was fixed from time to time, the Government undertaking to make good growers' losses, but the price was changed so frequently that the control had little effect.

Early in the war the price of imported meat increased more rapidly than that of home-killed, till in 1917 there was little difference between their retail prices. On the whole the price of meat increased less than that of commodities in general. Prices were fixed in Aug. 1917 and consumption was rationed early in 1918; after the Armistice control was gradually relaxed; but prices of beef and mutton changed very little during the two years after the first fixing of them. The prices of Irish bacon quoted are hardly typical; in 1917 a great quantity of American bacon of inferior quality was bought by the Government, who had difficulty in selling it at a price which covered the cost. The demand for high-class bacon could not be met, and its price after 1917 rose more rapidly than that of butcher's meat. The line in the table relating to imported butter is perhaps misleading since the supply was insignificant, and its inclusion unduly depresses the average; for the records of milk and its products we must depend on retail prices. Taken together the prices of animal food increased at a lower rate than the general average of prices except in 1916–7.

The price of sugar was of course dominated by the cutting off of the continental supply, and its increase was greater than that of any commodity always obtainable included in the table. The Government took over the whole supply at the beginning of the war and issued it at a fixed price; the control continued till 1921. There was no shortage of supply of coffee nor of tea (except in the autumn of 1917), and their prices rose relatively little.

When all food prices are grouped together as in the table, it is seen that they rose till 1917 more rapidly than the average for materials, but that the increase from 1913 to 1918, and to 1919 was the same in the two groups.

Materials.—The prices of different kinds of coal increased at different rates prior to the general control of coal mines which took effect early in 1917; with the stoppage of export of coal the supply was adequate even for the increased use in the manufacture of pig-iron, and the restriction in consumption from 1917 was only necessary to economize labour in the mines. For domestic and manufacturing use the price rose but slowly till 1919 and generally less than for goods in general. Iron and steel began to come under control as early as June 1915 with the initiation of the Ministry of Munitions, and their use was severely restricted for all civil purposes, so that there was no free market for more than three years. The prices were actually fixed in Nov. 1917, a government subsidy being given to steel and to pig-iron makers to meet any extra costs. The subsidies were withdrawn early in 1919 and the price of pig-iron rose from £4 15s. to £8 a ton, the pre-war level having been £2 11s. Reconstruction and repairs, for many years in arrear, caused a great demand for iron and steel, and in July 1920 pig-iron was 320% and steel rails were 283% dearer than in 1914; prices fell slowly in the autumn of 1920 (Birkett: "Iron & Steel Trades during the War," *Statistical Journal*, May 1920). Copper, tin and lead showed no special inflation and were relatively cheap in 1919.

Cotton followed an exceptional course. With the cutting off of Germany from the market the price fell considerably in the first months of the war and was below the pre-war level till nearly the end of 1915. Presumably in consequence of the restriction of shipping, a rapid rise began in the autumn of 1916, and at the date of the Armistice cotton was at three times its pre-war price; then there was a perceptible fall for some months, but this was followed by a great increase, the reason of which has not been explained, which brought American cotton early in 1920 to more than four times its cost in July 1914; the reaction from this inflation gave the first indication in 1920 that the general index number was about to move downwards. Both yarn and piece goods rose more rapidly than raw cotton, especially in 1919–20.

The price of wool also fell after the outbreak of war, but the great demand for the Allied armies soon turned the scale and English wool especially became rapidly dearer in 1915. From June 1916 the Government took steps to assume ownership of all the wool it required and to control the rest; the distribution to manufacturers and prices was arranged by an intricate system involving the Government, wool-brokers and manufacturers (Zimmern: *Economic Journal*, March 1918). The price was very high in 1917–8 and rose rapidly in 1919 when the civilian demand for replenishing their wardrobes and households was acute, and the prices of yarn and manufactured goods outpaced even raw materials. There was no definite fall till 1920. As regards flax, the cutting off of the Russian supply and the Government demand for linen in airships caused linen to be practically unobtainable by civilians, and the shortage naturally continued long after the war. Jute and silk were less affected.

The variations in the movements shown under the heading "Miscellaneous" can in general be explained by known conditions of supply and demand. The supply of petroleum proved to be sufficient for war needs. The *Statist* index number is vitiated by the exclusion of rubber. Owing to the development of plantations before the war the supply was even excessive; the price was rarely more than 20% higher than in July 1914 and after the Armistice was lower.

(III.) *Retail Prices of Food in the United Kingdom.*—Accurate and useful statements of retail prices are in general only obtainable with respect to food, in part because most attention has been directed to recurrent and necessary domestic expenditure, in part because it is less easy to define the unit of purchase in the case of clothes and manufactured goods. The cost of other necessary items of expenditure is considered in the article COST OF LIVING, and this section deals with food alone.

The following tables show the average prices paid by the working classes in the United Kingdom, the result of the monthly collection of information by the Ministry of Labour (formerly by the Board of Trade) published in each issue of the *Labour Gazette*, and described in detail in the issue of March 1920. The general movement in retail prices was similar to that of wholesale, that is, a nearly regular increase (23% cumulatively per annum) took place for three years after the outbreak of war, then for more than a year the rise was checked by control and rationing; there was a temporary fall in the spring of 1919, followed by a rise which became rapid in the summer and autumn of 1920 and a fall after Nov. 1920.

TABLE VII.—Average of Retail Food Price-Changes in the United Kingdom as computed in the *Labour Gazette*.

(The average on the 1st or 2nd of each month is expressed as a percentage of the average in July 1914.)

	1914	1915	1916	1917	1918	1919	1920	1921
January	—	118	145	187	206	230	236	278
February	—	122	147	189	208	230	235	263
March	—	124	148	192	207	220	233	249
April	—	124	149	194	206	213	235	238
May	—	126	155	198	207	207	246	232
June	—	132	159	202	208	204	255	218
July	100	132½	161	204	210	209	258	220
August	—	134	160	202	218	217	262	—
September . . .	110	135	165	206	216	216	267	—
October	112	140	168	197	229	222	270	—
November . . .	113	141	178	206	233	231	291	—
December . . .	116	144	184	205	229	234	282	—
Average for year . .	—	131	160	198	215	219	256	—
Wholesale food index* (*Statist*) . . .	—	*142*	*173*	*225*	*231*	*245*	*308*	—

*Second quarter of 1914 taken as 100.

Table VII. shows the average of the movements as combined from the data in Table VI. (together with the prices of fish and eggs) by the Ministry of Labour, each item being given the importance estimated from a pre-war standard budget of expenditure. For the relation of this computation to the cost of living *see* COST OF LIVING. Except for making facile generalizations the detailed table is more important than the summary.

The price of bread rose intermittently, but on the whole rapidly till Sept. 1917, when its price was exactly double that of July 1914. The rate of extraction of flour from grain was controlled from the autumn of 1916, and government regulation flour containing an admixture of wheat, maize, rice and other cereals in varying proportions alone was used in the three years 1917–8–9, and during this period the price is not that of a commodity of constant quality. In Sept. 1917 the Government fixed the price at 9d. for the 4-lb. loaf, became the sole purchasers of the necessary cereals, regulated the price to millers and bakers and met the deficit by a subsidy. The price was raised to 9½d. in Sept. 1919 to meet bakers' increased expenses, and at subsequent dates again raised with the increasing price of wheat till it reached 1s. 4d.; when wheat fell in the latter part of 1920 the subsidy was gradually reduced to zero and the price of bread maintained; in 1921 the price fell, and was 1s. 1½d. from April to July. Flour followed nearly the same course as bread.

The retail prices of *meat* were determined by the wholesale prices already discussed. Imported meat remained for three and a half

TABLE VI.—Average Retail Prices in the United Kingdom of the Principal Foods as recorded* at the beginning of each month in the *Labour Gazette*.

	1914		1915		1916		1917		1918		1919		1920		1921
	July	Dec.	June	Dec.	June	Dec.	June	Dec.	June	Dec.	June	Dec.	June	Dec.	June
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s d.	s. d.	s. d.	s. d.
Bread 4 lb.	5¾	6½	8	8	8¾	10	11½	9	9	9	9	9½	1 0½	1 4	1 1½
Flour . lb.	10½	1 0	1 3	1 3¼	1 4½	1 7½	1 10	1 4	1 4	1 4	1 4	1 4	1 11	2 6¼	2 0¾
Beef															
British lb.	8	8¾	11¾	11¾	1 1¾	1 1¾	1 4½	1 3½	1 3½	1 5½	1 3½	1 6	1 6	1 9	1 8¾
Imported lb.	6	7¼	9	9¼	11½	11	1 1¾	1 1½	1 3½	1 5½	1 1½	1 2¾	1 0¾	1 0¾	1 0
Mutton															
British lb.	8¼	8¾	10¾	11	1 1½	1 1¾	1 5½	1 3	1 3	1 4¾	1 3¼	1 5¼	1 5¼	1 11	1 10
Imported lb.	5½	6½	8	8¼	11¼	11	1 2	1 1½	1 3	1 5¼	1 1	1 0	10½	11¼	11
Bacon lb.	11¼	1 0	1 1¼	1 2½	1 3½	1 5½	1 8¼	2 2¼	2 3	2 3	2 3	2 4½	2 6	2 9¾	2 2¾
Milk . qt.	3½	3½	3¾	4½	4½	5¼	5½	6¾	5½	8½	6½	10¾	7¾	10¼	7¼
Cheese															
Imported lb.	8¾	9½	11½	11¼	1 1¼	1 2½	1 7½	1 4¾	1 5	1 8	1 6	1 6	1 8½	1 9	1 7½
Butter . lb.	1 2¼	1 3½	1 4½	1 7	1 7	2 0	2 0	2 4½	2 5½	2 6	2 6	2 6¼	2 11¼	3 3¾	2 2
Margarine lb.	7¼	7¼	7¼	7½	8¼	8¾	11¾	11½	1 0	1 0	11¾	1 1	1 2	1 1¾	9
Sugar lb.	2	3½	3½	4	5¼	5½	5¾	6	7	7	7	8	1 2	10	7¾
Potatoes 7 lb.	4¾	4	4¾	4½	7½	10¼	11¾	6¾	7½	7¼	8¾	10½	1 3¼	11½	8¾
Tea lb.	1 6½	1 8¾	1 11	2 3½	2 3¾	2 3¾	2 8	3 1½	2 8	2 8	2 6¼	2 9¾	2 10¾	2 8¾	2 6½

*The prices from Dec. 1914 to Dec. 1918 are calculated from the percentage changes recorded.

NOTES.—The prices of meat are the means between two entries in each case and not the average prices of the carcases. They should only be used for comparative purposes, and not taken to be the average price of all meat bought.

In general the records are the average for the commodities as bought in shops and stores used by the working class.

years at 2d. or 3d. a lb. lower than British meat, but since the price of the latter was nearly doubled, the percentage increase of the former was much greater. The Ministry of Food fixed wholesale prices and the retailer's margin in September 1917 and subsequently the distinction in price between British and imported meat was removed. Rationing was gradually introduced, and was nearly universal from April 1918 to May 1919. Purchasers were restricted also to the kind of meat that was available from time to time. During the period of control and till the summer of 1920 prices fluctuated little, but after control was removed imported meat became cheaper than British, and with a rise in the latter in 1920 the pre-war proportion between the two was nearly restored. Home meat was at its maximum (at about two and a half times its pre-war level) in the autumn of 1920 and did not fall at all considerably till after May 1921.

Prior to 1914 the corresponding numbers, for London only, are 1910 and 1911 98, 1912 and 1913 103. (*See* article COST OF LIVING for further analysis, and for comparative figures for other countries.)

The price of *bacon* rose rather more slowly in the opening years of the war, but rapidly in the summer of 1917 till it was 140% above the pre-war price. In Nov. 1917 importers' and dealers' prices were fixed, and in July 1918 the regulations extended to retail prices; during this period large supplies of generally inferior bacon were received from America, and rationing was only necessary for a few months. The price after being stationary for two years rose during 1920 till it reached three times the level of July 1914.

After 1915 the price of *milk* was markedly seasonal, while before the war it was generally retailed at the same price nearly all the year round. No change took place till the autumn of 1915, when the price rose 1d. a qt., and in the following autumn another ½d., and in neither case was there a fall in the spring; in the autumn of 1917 it reached nearly twice the pre-war price, and in subsequent years fell in the spring and rose in the winter to successively higher points, the maximum (10¾d.) being reached in Jan. 1920. Maximum prices were in force from the autumn of 1917 till Jan. 1920, but they were not reached in all localities. The great rise in the price of milk must be attributed to the high cost of cattle food, which was very scarce in the period of restricted imports; elaborate arrangements were made to increase the supply by curtailing the consumption of cream and the manufacture of butter and cheese. Milk was not rationed except by informal local arrangements. Not much attention should be paid to the prices of *butter* and *cheese* after 1916, since during a long period they were not freely obtainable, and the Government having taken control distributed them at prices which would meet their cost. Butter was rationed with margarine.

The price of *margarine* rose little till 1917, while its consumption increased greatly owing to the want of butter. A shortage of supply was felt suddenly at Christmas 1917, and the Ministry of Food took control and presently assumed ownership of the supply of its constituents and the factories in which it was made. The quality was greatly improved, as compared with that in 1914, and its importance as food became very great in view of the difficulty of obtaining sufficient fatty substances from other sources. The price was fixed in Nov. 1917 at 1s. (1s. 4d. for oleomargarine) and changed little till the end of 1920. In May 1919 the price was left free.

The whole supply and distribution of *sugar* was taken over by the Government at the beginning of the war and control was continued till 1921. Sugar was distributed through the ordinary channels in such amounts as were available and traders began early to ration their customers. Official rationing (generally at 8 oz. per person) developed in 1917 and its success encouraged the Government to develop the general scheme of rationing meat, fats and some other foods in 1918; rationing of sugar gradually became obsolescent in 1919. The price rose considerably at irregular intervals as shown in the table till in Jan. 1920 it was seven times as dear as before the war.

Potatoes became dear after 1916 and afterwards fluctuated strongly upwards in sympathy with other agricultural produce and the price of manures, and in relation to the supply of each season. The high prices, however, were not universally felt owing to the development of the cultivation of private allotments especially early in 1918.

The supply of *tea* was ample except for a short period in the autumn of 1917. At that date the Government took control of the supplies and provided a uniform blend to be retailed at 2s. 8d. per lb. The rise in price was less on the whole than that of any other commodity shown in the table.

Other less important foods often showed a greater increase in price than those already named, especially since there was a run on them during the time of restriction and shipping facilities were given rather to the more necessary imports. Eggs in particular became scarce and dear owing to the failure of the European supply and the scarcity of poultry food.

No general comparison of wholesale and retail prices is possible, for want of adequate records of the wholesale prices of manufactured goods and of retail prices of articles other than food. In the case of food, however, the figures are sufficiently typical and accurate to allow of a general comparison, but not to permit accurate detailed measurements. The two index numbers shown depend on nearly the same range of foods, but the bread subsidy lowers the retail prices by about 10 points in 1918–20.

TABLE VIII. Wholesale and retail prices of food. (*Statist* and *Labour Gazette* index numbers.)

Year	Quarters	Wholesale (*Statist*)	Retail (*Labour Gazette*)
1914 . .	1st & 2nd*	100	100
	4th	118	116
1915 . .	1st	134	123
	2nd	144	130
	3rd	142	136
	4th	144	143
1916 . .	1st	159	148
	2nd	173	158
	3rd	169	164
	4th	195	183
1917 . .	1st	218	192
	2nd	232	201
	3rd	221	203
	4th	222	206
1918 . .	1st	230	207
	2nd	227	208
	3rd	234	221
	4th	247	231
1919 . .	1st	236	221
	2nd	233	207
	3rd	244	218
	4th	264	234
1920 . .	1st	292	234
	2nd	328	253
	3rd	326	268
	4th	290	284
1921 . .	1st	246	250

*July 1914 for retail prices.

In Table VIII. the retail prices for the first quarter of each year are the averages for the 1st of Feb., March, April and so throughout the year. Wholesale and retail prices include those of controlled goods, and in the case of wheat, flour and bread are affected by the bread subsidy. The table shows that retail prices rose in sympathy with wholesale prices during the first three years of the war, but the rise on the whole was less, and the accelerated rise in the spring of each year was only marked in wholesale prices. As prices became more and more rigidly controlled in 1917, and some commodities were rationed in 1918, wholesale prices fell or remained nearly stationary, while retail prices rose very slowly.

(A. L. Bo.)

PRICE-CONTROL IN UNITED STATES.—During the World War price-fixing agencies in the United States were numerous, and the arrangements made were often informal. Many prices were controlled indirectly; but when this control was to any degree international the result was a "fixed price."

Prices were more or less formally fixed by various departments or branches of the U.S. Government for at least 110 important products, each of which required a separate price-fixing operation. This was exclusive of repetitions or renewals at later periods, which often involved as much work and study as the original decisions. The following is a partial list of products for which prices were fixed by some government agency or sanction. They are arranged in general in the order in which the prices were fixed, although no pretence to accuracy in this regard is claimed. Food products are not covered in detail, and no attempt has been made to mention them in order:—

Hides
Coal, bituminous
Coal, semi-bituminous
Pig iron
Steel plates
Steel, structural
Wheat
Ship timbers
Pine, yellow
Steel billets
Sugar
Sardines
Bar iron
Pipe, cast-iron
Castor oil
Aluminium
Coal, anthracite
Coke
Copper
Molasses (imported)
Manila fibre
Retail lumber (eastern cities)
Platinum
Hemlock
Pine, white
Spruce, eastern
Paper, newsprint
Manganese ore
Copper, ingot, electrolytic
Copper wire
Iron ore
Nitric acid
Cotton linters
Cotton goods
Cotton yarns
Denims (Mass.)
Drillings (Mass.)
Ginghams, (Amoskeag)
Print cloths
Sheetings, bleached
Sheetings, brown
Hemp

Steel rails
Nickel
Tin plate
Wire, barbed, galvanized
Wire, plain, annealed
Ammonia
Douglas fir
Arsenic
Ammonium sulphate
Alcohol, wood
Acetic acid
Nitrate of soda
Silver
Zinc, grade "A"
Zinc, sheets and plates
Binder twine
Castor beans
Sashes and doors
Linters (munition)
Quebracho extract
Cement, Portland
Sulphur
Rubber
Wool
Acetate of lime
Quicksilver
Iridium
Hogs
Leather, harness
Prunes, California
Raisins, California
Carbon tetrachloride
Formaldehyde
Chlorine gas, liquid
Toluol
Phenol
Picric acid
Sulphuric acid
Tickings (Amoskeag)
Flour, wheat
Rice
Building tile
Crushed stone
Sand and gravel
Lead
Charcoal
Leather, sole
Glycerine (dynamite)
Cottonseed meal
Cottonseed oil
Wool grease
Burlap
Tin, pig
Tree nails, locust
Cotton compress rates
Birch logs
Brick, common
Wallboard
Food products

Without attempting a complete list, it may be stated that food products whose prices were regulated included flour, bread, sugar, live stock, meat, poultry, dairy products (including retail milk prices), oleomargarine, cottonseed and its products, canned foods, dried foods, rice and rice flour, feeds and coffee. The prices that were first formally fixed by the Government fall chiefly in the basic raw-materials group. A more shortsighted policy might have begun by regulating prices of articles which figure most conspicuously in public consumption.

In some cases prices were fixed for Government purchases alone, for example, nickel, quicksilver, sulphuric acid, cement, New England spruce and other lumber. In others the prices were fixed for the Government and made available to the public in a contingent way; for example, in the case of hemlock lumber it was provided that any quantity of the commodity which, in the judgment of the lumber director of the War Industries Board, could be released for the commercial market might be sold to the public, subject to the maximum price fixed for the Government. In still other cases—for example, copper and raw sugar—purchases by the Allied Governments were included in the scope of price-fixing for the U.S. Government; and in a few instances, as purchases for the use of the railways of the United States, the prices were specifically fixed, although they did not apply to the public. Prices were sometimes fixed for single branches of the Government, as in the case of oil products for the navy and cow-hide splits for the quartermaster's corps of the army. Prices were even fixed by the U.S. Government to apply to purchases by the Allied Governments only, as was the case with fuel oil, gasoline and kerosene.

The President, however, early took a firm stand for the principle that prices charged by producers should be the same to the public and to the Government, and, with the exception of prices on certain purchases made by Government departments, rapid progress was made during 1918 in carrying out this policy. Thus the prices fixed for pine, fir lumber and cement, which at first applied only to direct Government purchases, were extended to the public. It proved to be highly important as a practical matter that prices under similar conditions of purchase should be the same to all. The existence in the commercial market of prices that were higher than those paid for Government purchases made it difficult for the Government to secure prompt deliveries. Moreover, such a situation often defeated the purpose of price-fixing, because large purchases might be made by private concerns producing more or less directly for the Government.

The period of price-fixing began about the middle of 1917, and came to a nearly complete standstill with the signing of the Armistice. Among the earliest commodities to be affected by the price-fixing activities of the Government were lumber, coal, wheat, sugar and canned foods. Lumber prices for the Government alone were fixed by arrangement with the Council of National Defense on June 18 1917, and approved by the Secretary of War; coal prices for the navy were fixed on June 19 1917. The Food and Fuel Control Act on Aug. 10 1917 set a minimum price on the wheat crop of 1918. Bituminous coal prices at the mine were fixed by executive order on Aug. 21 1917. Nine days later came the President's announcement of a $2.20 basic price on wheat "to be paid in Government purchases." The price of copper was fixed in September. Relatively few prices were fixed after Nov. 1918, although those fixed prior to that time extended well over into 1919. Prices, as fixed, were allowed to expire in spite of the fact that in several important cases the representatives of the industry concerned asked that the existing price be continued. On Dec. 11 1918 the War Industries Board issued a statement to the effect that, since it would cease to function after Jan. 1 1919, no new price agreements would be entered into by the Price-Fixing Committee and that all prices theretofore fixed would be allowed to expire by limitation. Several commodities, the cost of which had not been immediately ascertainable, had been taken in large quantities by the Government at prices subject to later determination. For example, during the latter part of Jan. and the early part of Feb. 1919, the Price-Fixing Committee of the War Industries Board fixed prices on common brick and on wall board. Inasmuch as the Food and Fuel Administrations depended for their powers upon the Act of Aug. 10 1917, which applied "during the war," they functioned longer, but became practically inoperative early in 1919.

Of the various agencies through which prices were fixed the following are without doubt the most important: Congress, which by direct legislation fixed a minimum price for wheat and for silver; the President, acting under authority granted by Congress, who fixed prices for coal and wheat; the War Industries Board, created by the President July 28 1917, under authority from Congress, which Board through its Price-Fixing Committee fixed numerous prices from Sept. 1917 to Nov. 1918 (as late as Jan. and Feb. 1919 several cases of price-fixing for commodities bought at tentative prices were awaiting cost determination); the U.S. Food Administration, established in Aug. 1917, which fixed prices of hogs, meat, flour, sugar, binder twine, etc.; local food administrators and sub-agencies, such as the Sugar Equalization Board and the U.S. Food Administration Grain Corporation, which fixed many prices; the U.S. Fuel Administration, established in Sept. 1917, which fixed prices of coal, coke, etc.; the War Trade Board, which fixed prices of rubber, quebracho extract and manila fibre; the Federal Trade Commission, which fixed the prices of newsprint paper; the Emergency Fleet Corporation of the U.S. Shipping Board, which fixed the price of ship timbers and locust tree nails; the U.S. Shipping Board which fixed ocean freight rates; the International Nitrate Executive Committee, which fixed the price of nitrate of soda; the Food Purchase Board, which fixed prices of canned foods, etc., for the army and navy; various army and navy departments, which fixed prices of gasoline and fuel oil, zinc oxide, automatic sprinklers, sashes and doors, castor oil, etc.; the Appraisal Boards of the army and navy, which fixed prices in cases of dissent from prices named in commandeering orders; and the U.S. Railroad Administration, which took steps to fix reasonable prices of locomotives and cars. As time went on a tendency toward greater uniformity and centralization of procedure developed within the price-fixing mechanism. This tendency was seen in an increasing amount of work thrown upon the War Industries Board and the Federal Trade Commission, the former naming a price based largely upon the cost findings of the latter.

In initiating price-fixing no systematic plan was followed and prices were at first fixed sporadically. Various Governmental powers were resorted to and were applied by numerous agencies, using diverse means for carrying out the decisions or agreements which they reached. In some cases prices were fixed under special authority, conferred directly by Act of Congress, and limited by the provision of such Act to specified commodities. Thus by section 14 of the Act of Congress of Aug. 10 1917, already referred to, the President was empowered to fix "a reasonable guaranteed price for wheat." Accordingly on Aug. 30 the President, acting upon the recommendation of a committee appointed by himself, promulgated a price of $2.20 per bus. for No. 1 northern spring wheat at Chicago. The same law, commonly known as the Lever Act, authorized and empowered the President to license importers, producers or distributors of "any necessaries, in order to carry into effect any of the purposes of this Act"; and, if he found unreasonable any storage charges, commissions or profits, to revoke licences and make findings as to reasonable profits, etc. Section 10 of the Act authorized him to requisition necessary foods, feeds, fuels and other supplies. Section 11 gave him power to purchase and sell at reasonable cash prices wheat, flour, meal, beans and potatoes. The power under this Act ran to the President, and the Fuel Administrator and Food Administrator acted under "executive orders." On the other hand, the War Industries Board acted under less specific authority proceeding from the general war powers of the President. Thus the prices fixed for steel, copper, lumber and other commodities by the Price-Fixing Committee of the War Industries Board were in theory approved by the President before being publicly announced. In some cases, however, such as retail lumber prices in certain eastern cities, the prices were announced without formal approval by the President.

The means of enforcing prices when "fixed," whether determined by the price-fixing agencies or reached by agreement with the producers, were various, ranging from appeals to the patriotism of the trade to commandeering orders. In most cases there was in the background the possibility of the Government's taking over the industry; and in not a few the army or navy did commandeer plants or stocks of merchandise. In such cases a price was named which was subject to adjudication, first by the Board of Appraisers and then, upon appeal, by the courts. On Dec. 24 1917 all wood chemicals (acetic acid, alcohol, etc.) were commandeered for a period of six months and later the commandeering order was extended to cover the second half of 1918. Apart from purchases on army or navy account, however, price-fixing was effected chiefly by "licences" and control of "priorities." The Food Administration and the Fuel Administration, under the Act of Aug. 10 1917, put in force extensive systems of licensing, under which unlicensed producers and distributors were not allowed to engage in business, and licences were revoked, if the regulations were disobeyed. The War Trade Board also licensed importers of certain articles on condition that the prices which it fixed should be observed. The administration of priorities proved to be a major element in the price-fixing programme, and involved many important questions. Toward the end of 1917 a priorities division was established within the War Industries Board and a priorities commissioner placed at its head. Representatives of the Fuel Administration, the Railroad Administration, and the U.S. Shipping Board were placed upon a Priorities Committee. The War Trade Board, the Food Administration, and the army and navy were also represented. The Price-Fixing Committee of the War Industries Board and the Priorities Committee worked in harmony. This was of the utmost importance, as it made possible a substantial degree of unity of policy among the different Government purchasing departments; and, through the power of the Priorities Committee over fuel and transportation, pressure could be brought to bear upon a recalcitrant business concern for the purpose of compelling it to adhere to fixed prices. The Priorities Committee undertook whenever necessary to administer priorities in the production of all raw materials and finished products, save food, feeds and fuels. The distribution of fuel was, of course, under the supervision of the Fuel Administrator, and transportation service under the U.S. Railroad Administration, but the Fuel and Railroad Administrators were guided largely by the "preference list" issued by the Priorities Committee and by the recommendations of the division chiefs of the War Industries Board, and on the whole came to work in close relation to the committee's general policy. The Priorities Committee, then, exercised a general function of adjusting production to the needs of the nation at war by allocating the limited supplies of fuel and basic raw materials, and its powers were sometimes used as a club to reinforce the authority of the Price-Fixing Committee in particular cases. The Army and Navy Appraisal Boards were called to pass on prices in the case of commandeer orders issued for the requirements of those departments. When a commandeer order was to be issued the practice developed of having the chief in charge of that division of the War Industries Board which dealt with that commodity approve the order in which the price was named. If, as was frequently the case, the producers of the commodity were not satisfied with the price, the matter was brought before the Appraisal Board. It is important to observe that those members of the Price-Fixing Committee who represented the army and navy were also members of the appraisal boards of these two departments.

Various methods of applying price control were tried. Prices may be fixed both directly and indirectly. As a rule, each commodity the price of which it was desired to fix was taken up directly and a specific price made for its purchase; but in some cases reliance was placed upon indirect control of the price of one commodity through direct control of the price of another. A most interesting and important phase of indirect price-fixing activities lay in the attempts to restrain prices by controlling consumption, as in the cases of tin, platinum, coal, sugar, wheat and meat. These efforts culminated in rationing in the case of sugar and the requirement of purchase of substitutes in the case of wheat or flour. Steps were taken, also, to prevent waste and to improve methods of production, for example, cleaner threshing of wheat. Most of such "conservation" measures are to be approved without reserve. Closely connected with the conservation phase as seen in control of demand, rationing, etc., were stabilization and pooling. But pooling, while partly used to facilitate rationing (as in the case of sugar), may also be used to keep prices up, either locally or throughout the entire market. In at least three cases, wheat, sugar and tin, the Government entered upon a pooling programme for the purpose of stabilizing prices. Stabilization is a term which implies mixed motives, a considerable part of its purpose commonly being to maintain or keep up prices, at least in a part of the field. This was the case with the Sugar Equalization Board and the tin pool, and the Government's Grain Corporation.

The degree of precision with which prices were fixed varied widely from commodity to commodity, ranging from a loosely determined maximum price to a careful determination of the definite price to be charged for a particular commodity in the case of a particular purchase. As a rule, only maximum prices were fixed, although in a majority of cases the price named as a maximum was the one which actually prevailed. This was not infrequently taken for granted by the price-fixing agency. In some important cases, however, the actual market price fell below the maximum named by the Government. This was true of zinc plates and sheets and certain kinds of lumber. Also, in the case of rubber, a price was named by the War Trade Board as a maximum, which was considerably higher than the market price. As has been already noted, a minimum price was fixed for wheat, the reason being that it was desired to guarantee the market in this case and thus encourage production. The price of hogs was fixed on the basis of a positive minimum after the failure of the attempt to maintain the price on the basis of a fixed ratio to corn. Wheat also furnishes a case in which both a maximum and a minimum price were specifically fixed. Obviously a result similar to that obtained by naming a price may be gained by limiting profits or gross margins. Thus, an effort was made to restrict the profits of the meat-packers to $2\frac{1}{2}$% on sales, and in the case of the five largest packers a maximum margin on meat of 9% on investment was named. The flour millers were limited to a profit of 25 cents per barrel. Dealers in cotton-seed and peanuts, both ginners and others, were limited, beginning July 1 1918, to a margin of $3.00 per ton over cost (not replacement value). This method was also largely used by the Fuel Administration in an attempt to regulate the price of coal to consumers, and in Sept. 1917 this agency announced its plan for fixing the maximum gross margins of retail dealers in coal and coke. Each dealer was authorized to add to the average margin for 1915 between his delivered cost price of coal or coke and the price charged consumers, 30% to cover increased expenses provided the gross margin thus arrived at did not exceed his average for July 1917. Fixed rates of commission or margins of profit were imposed also on dealers in newsprint paper, retail lumber and other commodities.

In addition to the above methods, there was the attempt to fix retail prices directly by publishing fair prices, as was done for groceries by the local "price interpreting boards" set up by the Food Administration. Price-fixing by restricting margins passed into the realm of hopes and aspirations in such cases as the earlier regulation of the lake-forwarders by the Fuel Administration, and the cotton-ginners by the Food Administration, for in these cases the producers were merely urged to charge "reasonable" prices. Much the same may be said of the somewhat tentative moves made by the Oil Division of the Fuel Administration toward fixing the price of petroleum and its products. In July 1918 the Oil Director made some proposals with regard to fixing the differential between the prices of crude and those of refined products; and in Aug. he announced a plan to stabilize the price of crude oil, stating his belief that this would prevent radical changes in the price of refined products. It does not appear, however, that the plan had any appreciable effect.

From the foregoing it would appear that there were three chief types of price-fixing:—(1) *maximum prices*, in the case of basic staples which had wide public interest, often recognized as "pegged" prices when any scarcity or rapidly advancing cost existed; (2) *definite prices*, (*a*) to encourage production by guaranteeing returns, (b) Government purchases (direct or indirect) in the nature of single transactions; (3) *margins*, (*a*) absolute amount per unit, (*b*) percentage on sales, cost, or investment; this method being used when it was desired to cover the distribution of products, the marketing of which was not integrated with manufacture. The minimum price, strictly speaking, was the exception, but is logically associated with the definite price, which is both maximum and minimum.

Another distinction of some importance in fixing prices depended upon the place at which the price named was to apply. Some prices were made on an f.o.b. factory basis, while others were on a delivered basis. The practice prevailing in the industry was partly followed. The tendency, however, was to fix prices on an f.o.b. factory or mill basis, a natural tendency when the price is based on cost. In a majority of cases, prices came to be made f.o.b. the producer's plant. In many cases, however, prices were quoted f.o.b. some market basing point. This was notably true of copper, which was always quoted f.o.b. New York, although the metal was secured from mines in Michigan, Montana and Arizona, and refined at various seaboard points. In the case of commodities produced in several competing areas there was often a tendency to quote prices on a delivered basis. Prices delivered were fixed for New England spruce, Pennsylvania hemlock, cement, hollow building tile, iron and steel scrap, and oil products for the navy. The situation in the case of hollow building tile furnishes some explanation of this tendency. The chief producing area for this commodity was centred in Ohio, while there were other producing territories in the south, in New Jersey and elsewhere. In order to stabilize market conditions and to divide the market, the representatives of the industry desired to fix prices on a delivered basis. In this way, by fixing a delivered price sufficiently low, the low-cost producers in Ohio were prevented from coming too far east with their product; while, if the price had been fixed f.o.b. the plant, there would have been no limit to the area covered by the low-cost producer, except cost of freight and desire for profit. Had the war continued much longer, there can be little doubt that adjustments in railway rates would have become an important part of the price-fixing programme. Special railway service was given in a number of instances as a direct part of price-fixing, as, for example, the arrangements made to furnish transportation to the Douglas fir lumber mills for the purpose of relieving them of accumulations of low-grade lumber. In the case of price-fixing for manganese ore produced in the United States, an integral part of the scheme was the application of special railway rates.

When a controlling part of the supply of any given product is produced by concerns which are not completely integrated, especially as to the earlier stages of the industry, it is practically necessary, in price-fixing, to control the price of the chief semi-finished products; but when a controlling proportion of a product comes from producers who are more or less completely integrated, this necessity does not exist, although some protection may be required for independent producers in the earlier stages. Also when the object is to protect the consumer of products which are distributed by separate wholesale and retail agencies, it is necessary to control the wholesale and retail prices as well as the price f.o.b. factory or mill.

Prices were fixed for various periods of time, but in general it may be said that on account of changing conditions the periods were short. Perhaps the period most frequently chosen was three months. A much shorter period would have created too much risk and uncertainty in marketing, to say nothing of the strain upon the price-fixing machinery; while a longer period was not, as a rule, desired by the representatives of the industries, especially during a period of increasing costs. Various exceptions might be cited, such as the case of wheat, in which the price was fixed for the crop of a given season. The prices of meat and coal were fixed for indefinite periods, and the same was true of manganese ore. Various bases for determining the reasonable maximum price to be fixed were used, but it may be said that, on the whole, the prevailing tendency was to fix prices on the basis of cost, a reasonable allowance being added for profits. In this connexion the Federal Trade Commission did important work in ascertaining from the books of the producers the actual cost of production and the investment.

In the ordinary case of price-fixing, the gist of the method used by the Price-Fixing Committee was as follows:—First, some estimate was made of the probable quantity of the product wanted, which, of course, involved a knowledge of the stocks on hand. Second, the quantity which each producer could turn out was ascertained. Third, each producer's cost of production was computed for the most recent period available. Fourth, the average investment involved in the production of the commodity was determined and reduced to the basis of investment per unit of product. The first three of these items bear directly upon the determination of the representative or marginal producers for price-fixing purposes. The fundamental question in fixing prices that are based on cost, is the determination of what may be called the "marginal cost." This cost may be explained as follows: it is frequently the case that when the several individual costs for a group of producers are accurately ascertained and are ranged in their order from low to high, there will be a variation among them of 100%, the high cost being double that of the low cost. Ordinarily the bulk of the production comes from those producers whose costs are below the average, though this is not always the case. It does not follow, however, that the average cost gives the basis for a fair price. If 25%, or even 10%, of the production comes from high-cost producers and the entire output is needed, the average cost cannot be the basis of price. It is true that in many cases prices were fixed on the basis of average cost, both by the War Industries Board and by other price-fixing agencies; but as time went on methods were perfected, and the practice of taking a "representative cost" developed. This representative cost was very similar to what the economist calls the marginal cost, meaning the cost at which the highest-cost producer is able to produce without loss at a given price.

Of the conditions which facilitate the determination of a reasonable marginal cost for price-fixing, a knowledge of the requirements of the market, or in war-time a knowledge of the needs of the Government and its agencies, is most important. Price-fixing in the United States was handicapped by uncertainty as to the quantity which it

Yearly and Quarterly U.S. Fixed Prices, 1913–8.

Year	COAL, bituminous per ton	COPPER, electrolytic per lb.	LUMBER, Southern yellow pine timbers 6 in. x 8 in. x 16 ft. per M.	PIG IRON, Bessemer per ton	SUGAR, fine granulated in bags or barrels	FLOUR, standard patent bar. 196 lb.	BEEF, fresh native carcass (Chicago)	WOOL, Ohio fine unwashed per lb.	LEATHER shoe upper 2nd grade per sq. ft.
1913	$1.18	$0.15	$14.46	$17.13	$0.0428	$4.58	$0.1295	$0.238	$0.194
1914	1.16	.13	12.87	14.89	.0471	5.09	.1364	.250	.209
Quarters									
First	1.16	.14	13.21	15.04	.0389	4.57	.1300	.229	.205
Second	1.17	.14	13.42	14.90	.0395	4.55	.1322	.248	.205
Third	1.16	.12	13.14	14.90	.0583	5.34	.1402	.271	.218
Fourth	1.16	.12	11.71	14.71	.0523	5.86	.1435	.251	.215
1915	1.13	.17	12.90	15.78	.0556	6.66	.1289	.300	.205
Quarters									
First	1.16	.14	11.64	14.56	.0538	7.34	.1229	.298	.214
Second	1.12	.18	12.21	14.61	.0585	7.39	.1214	.291	.201
Third	1.11	.18	12.46	15.91	.0546	6.22	.1330	.301	.200
Fourth	1.14	.19	15.31	18.03	.0552	5.74	.1375	.308	.204
1916	1.24	.28	15.76	23.88	.0688	7.26	.1382	.352	.275
Quarters									
First	1.17	.26	15.92	21.61	.0610	6.32	.1375	.328	.216
Second	1.20	.28	15.21	21.95	.0729	6.05	.1388	.335	.246
Third	1.21	.27	15.21	22.05	.0696	7.37	.1388	.351	.265
Fourth	1.40	.31	16.71	29.93	.0712	9.26	.1375	.396	.375
1917	2.07	.29	21.75	43.60	.0771	11.39	.1672	.664	.385
Quarters									
First	1.47	.33	17.42	36.48	.0686	9.29	.1431	.485	.428
Second	2.40	.32	22.14	47.18	.0788	13.57	.1606	.598	.410
Third	2.24	.27	23.89	53.51	.0797	12.39	.1762	.745	.355
Fourth	2.17	.23	23.53	37.25	.0814	10.34	.1888	.750	.350
1918	2.56	.24	25.51	36.66	.0779	10.14	.2213	.740	.359
Quarters									
First	2.20	.23	25.14	37.25	.0735	10.15	.1750	.750	.351
Second	2.71	.23	25.92	36.21	.0730	9.79	.2227	.746	.350
Third	2.67	.26	25.42	36.60	.0769	10.39	.2423	.746	.360
Fourth	2.67	.25	25.57	36.60	.0882	10.21	.2450	.720	.375

was desired to have produced, which uncertainty was in some cases due both to ignorance of the available stocks and to uncertainty as to future requirements. While prices were generally fixed on the basis of cost, there were necessarily many exceptions. Sometimes no costs were available. Sometimes cost was only partly available as a basis, as in the case of "joint products" and of products for which complete cost data did not exist. Sometimes, again, no effort was made to use cost, as in the case of substitutes whose prices were fixed on the basis of the commodity in the place of which they might be used. In a few instances the price was fixed without regard to cost, merely on the basis of preëxisting prices, such prices being taken for what was presumably a normal period. Perhaps the chief difficulty in most cases was to ascertain a fair return on investment. This phase of the matter was never satisfactorily dealt with by any U.S. price-fixing agency during the war. The Federal Trade Commission in connexion with its cost findings frequently reported to the Price-Fixing Committee of the War Industries Board a figure representing the investment, but time did not permit the careful investigation that would have been necessary to ascertain the actual money invested, nor was the attitude of the price-fixing agency, as a rule, one which favoured the strict construction of "investment." In general, it may be said that in a majority of the price-fixing operations of the War Industries Board, some consideration was given to the estimated investment, and that in such cases the figure used was one which lay somewhere between the book value claimed by the companies concerned and the actual net investment made. On the other hand, a majority of the price-fixing operations of such agencies as the Food Administration appear to have been made on the basis of a margin (interest and profits) per unit of product, determined upon with reference to past experience. And of course, exceptions to any usual practice were at times necessary.

In general there were three chief purposes in fixing prices: (1) to secure production of needed commodities; (2) to prevent social unrest by checking profiteering, coördinating food prices and wages, and stabilizing industrial conditions; (3) to assure Government economy of purchase. The greatest success was attained with regard to the first purpose. The accomplishment of the second, which was more vague, is difficult to measure, but appears considerable. The most that can be said concerning the third is that things might have been worse had there been no price-fixing.

The table on page 148 shows the yearly and quarterly average prices of important articles whose prices were regulated.

On the whole, it may be said that price-fixing in the United States suffered from the lack of a programme. No adequate study was made of interrelations between commodities or of the various complicated factors affecting demand and supply. No general principles were formulated. Too frequently, each step was taken up as a separate proposition. Much trouble would have been saved by a better understanding among the different price-fixing agencies and by the adoption of certain broad fundamental principles, such as the basis for determining marginal cost and the basis for determining investment. There should have been a general board of strategy to supervise the entire price-fixing programme and to coördinate it with the Government's fiscal arrangements and with the various steps taken to control the production and consumption through priorities and rationing. Some progress was made in this direction, but it remains true that the price-fixing operations were not sufficiently correlated with taxation and borrowing (inflation) on the one hand, and with rationing and priorities on the other. (L. H. H.)

PRINCE EDWARD ISLAND (*see* 22.344).—The pop. of this Canadian province in 1911 was 93,728, having sunk from 109,078 in 1891. It is the most densely populated province in Canada, with 42·92 persons to the square mile. In 1911 the origin of the people was: Scots 36,772; English 22,176; Irish 19,900; French 13,117; all other nationalities 1,763. Charlottetown, the capital (pop. 11,198 in 1911), standing on one of the best harbours in America, is celebrated as the birthplace of the Canadian Confederation, the first conferences having been held there in 1864.

The Legislative Assembly is composed of 15 councillors elected on a property qualification, and 15 members elected on a popular franchise. The Executive Government consists of nine members.

The superintendent of education acts as secretary to the board and administers the system through school inspectors. In 1920 there were 468 schools, 597 teachers, and a total enrolment of 17,861 pupils; the expenditure was $268,547 in 1919.

Prince Edward Island has been aptly described as the garden province of the Dominion, more resembling an English shire than a Canadian province. The population is almost entirely agricultural, and practically the whole island has been cleared and brought under cultivation. The soil of the island is best suited for oats and potatoes, which are the staple crops. Wheat is grown for local purposes only. Maize, for fodder, and barley are grown. Cattle and hogs flourish. The total value of field crops in 1920 was $18,530,400. Poultry-raising and dairying are extensively and profitably carried on. Beef and bacon, as well as fruit, poultry, butter, cheese, eggs and potatoes, are exported in large quantities to neighbouring provinces, Newfoundland and the New England states. Coöperative dairying was begun in 1891 and the growth of the industry has been rapid. A new source of revenue began in 1910 with the breeding of black foxes and the industry of fur-farming was developed. About $10,000,000 had already been invested in this industry in 1918, in which year the sale of fox pelts realized over $750,000. In 1919 300 fur ranches sold skins and live animals to the value of $1,500,000, and in 1920 there were approximately 11,000 pairs of black foxes on the ranches of the island.

The once celebrated Malpeque oyster has almost become extinct through disease. The lobster industry is also on the decline. The value of the fisheries in 1919 was $1,536,844, the catch including cod, herring, mackerel, oysters and lobsters. The men employed in the industry numbered about 6,000.

No mining is carried on. Manufacturing is connected chiefly with the preparation of foods such as butter and cheese. Pork-packing and lobster-canning are large and growing industries. The value of manufactured products was $3,136,470 in 1911.

The strait of Northumberland separates Prince Edward Island from the mainland, the distance across varying from 9 to 31 miles. At the narrowest point a railway-car ferry established in 1918 by the Dominion Government connects the Canadian National railway system of the mainland with that on Prince Edward Island, and affords continuous connexion summer and winter across the strait. This is the principal highway of transportation to and from the island province, but the ferry service is occasionally interrupted by ice and the substitution of a tunnel has been advocated. (W. L. G.*)

PRINCETON UNIVERSITY (*see* 22.347).—In Sept. 1910 President Wilson accepted the Democratic nomination for governor of New Jersey and resigned the presidency of the university. In Jan. 1912 Prof. John Grier Hibben, of the faculty, was elected president. His administration was marked by further development of student self-government, the conducting of discipline and general student activities and the regulation of athletics being in 1921 shared by undergraduate representatives and university officers. Especial attention was paid to the scientific safeguarding of student health and physical fitness by careful periodical examinations and required supervised athletics. The potential effectiveness of the alumni organization was increased by the formation of a National Alumni Association, whose working administrative centre was the Graduate Council of about 100, representing the graduate classes, the alumni associations, and different regional districts of the country. The national character of the university was expressly recognized by the addition of regional trustees to the governing board, and also by the establishment of a large number of regional competitive scholarships.

On the scholastic side, the entrance requirements and the undergraduate curriculum were completely revised. To put the university into closer touch with American secondary education, especially the high schools, Greek was no longer required (although strongly advised) for the A.B. degree. The Litt.B. degree was discontinued. The elective principle was broadened so as to bridge the gaps between preparatory school and college, and underclass and upperclass years, giving the student in his underclass years a broad general training in subjects deemed fundamental to real education, and in his upperclass years requiring him to follow continuous work in one of three divisions of studies, the literary-philosophical, the historical-economic, or the mathematical-scientific. The regulations governing admission to the graduate school, and in particular to candidacy for the competitive fellowships, the awards of which depend entirely on scholarship and ability, attracted to the school an increasing number of select advanced students in liberal studies. The erection of the residential graduate college in 1913 rendered permanent what had previously been an experimental and, in America, an unique feature of the Princeton graduate school, namely, the provision of adequate living quarters for graduate students, who there shared a common scholarly life amid attractive conditions. The graduate college accommodated in 1921 about 100 students.

During the World War over 5,000 undergraduates and graduates were in Service; about 3,000 receiving commissions, and 284 receiving 293 decorations and citations. The honour roll of those who gave up their lives numbered 149. The entrance atrium of Nassau hall was converted into a memorial to these men, and a scholarship has been founded in memory of each. During the war nearly half of the faculty was on leave of absence, either in military and naval service, or in the scientific war service of the American, British or French Governments. The student body was cut more than half; buildings were occupied by a Government school of aviation and a naval paymasters' school, while the laboratories were turned over to Government use. With the institution of the student army training corps, and the naval training unit, virtually the entire university and its equipment were devoted to national purposes, the number of civilian students being about 75, rejected from service for physical disabilities. After the return of peace, effort was concentrated on increasing the inadequate endowment of the university, and the sum of over $8,000,000 was raised. A bequest from the late Henry C. Frick, not yet received in 1921, was expected to amount to about $5,000,000. In the year 1920-1 the faculty numbered 213, the undergraduate body 1,814, the graduate students 149, as against, in 1909-10, 169 faculty members, 1,266 undergraduates and 134 graduate students. Besides the graduate college, which includes the Cleveland tower, a national memorial to President Grover Cleveland, a trustee of Princeton, the buildings erected beween 1912 and 1921 were Holder hall (a dormitory), Madison hall (the university dining halls, where all underclass men are required to take their meals), Cuyler hall (a dormitory), the Palmer Memorial football stadium, and the University boat house (headquarters of the rowing activities of the university). In May 1920 Dickinson hall and Marquand chapel were destroyed by fire. (V. L. C.)

PRISONERS OF WAR (*see* 28.314*).—The procedure laid down by international agreement for the treatment of Prisoners of War under the Hague regulations was tested during the World War under unprecedented difficulties. These arose not only from the passions and prejudices inevitably engendered in the course of such a vast conflict between the entire manhood of the nations concerned, but also from the facts that unexpectedly large numbers of combatants were taken prisoners, and that the captors had to deal with men of different nationalities, of varying characteristics and with widely different views as to the accommodation and food requisite for a prisoner of war.

Probably few people realized during the war how vast was the number of combatant prisoners taken by one side or the other, or how small was the proportion of the British prisoners to the whole number. Though the final figures cannot be given otherwise than approximately, it is certain that they amounted to several millions. To name only the principal belligerents (excluding Russia), Great Britain claims to have taken just under half a million, France just over that number, Italy nearly one million, Germany two and a half millions and Austria nearly one and a half millions. With regard to Russia the numbers have never been even approximately ascertained, but some idea of them may be gathered from the fact that Austria alone admitted to having lost to the Russians not less than one and a half millions. To the list must be added the prisoners captured by the Americans (48,000 in number), and by the Turks, Bulgarians and the other lesser belligerents. Of this vast host only about 200,000 (probably not much more than 2%) were British, and about 185,000 of these were in the hands of Germany.

When it is further remembered that sometimes in the course of a single operation tens of thousands of men, many of them wounded, were added to the number captured earlier, it will be understood how great was the strain placed on the captors' resources in the matter of transport, care and feeding. Moreover, prisoners were taken in almost every part of the globe in every kind of climate, and in conditions in which the means of supply and transport varied from being comparatively complete to being almost non-existent. Even if all the belligerent Governments had been actuated by the most earnest desire to apply strictly the provisions of the Hague Convention it was inevitable that there should be much suffering and, owing to the difficulty of effective supervision, cases of cruelty and ill-treatment at the hands of individuals.

It must be recognized that, speaking generally, the administrative problems in relation to the treatment of prisoners were not so serious in Great Britain as in most of the belligerent States, but it is satisfactory to be able to record that they were humanely and for the most part satisfactorily solved as they arose. It is on the other hand unfortunately true that, quite apart from the misery inseparable from prolonged confinement, numbers of British prisoners underwent gratuitous and grievous suffering, especially in territory merely occupied by the enemy and at some of the working camps in Germany, in Bulgaria and in Turkey.

While something is said below with regard to the treatment of prisoners by the Bulgarians and Turks, it is impossible here to attempt to deal with the whole area of hostilities and with the multitude of questions relating to prisoners which arose between the belligerents. This article, therefore, will deal chiefly with the lot of prisoners in Great Britain and Germany, and the application of the Hague regulations in those countries.

Though discussions arose as to the position of such persons as reservists and officers of merchant ships, prisoners of war may be divided into two main classes: (1) Civilian, (2) Combatant.

(1). *Civilian.*—It is quite certain that the framers of the Hague Convention had not in view the treatment of persons other than combatants, but such large numbers of civilians were interned during the war that the arrangements made for them must shortly be considered.

The internment of civilians in both Great Britain and in Germany was, as a system, possibly due to two accidental but different causes. In Great Britain it arose first from the widespread belief, justified probably only in a relatively small number of cases, that the German civilian population in England were either spies in the service of the German Government or an advance guard of a German army of occupation. After this feeling had died down, and release from internment had become general, the system had again to be resorted to after the sinking of the "Lusitania," largely in deference to wide-spread indignation at that outrage and for the protection of the Germans themselves. Even then, however, internment was not general. Every enemy alien had a right to have his case dealt with by an advisory committee, of which Mr. Justice Sankey was chairman and Lord Justice Younger was a member, and by this committee many exemptions were granted.

In Germany, on the other hand, the internment of civilians—ultimately much more indiscriminate than in the United Kingdom—resulted from popular indignation in Germany at the entry of Great Britain into the war.

Thus it was that in both countries—in England by end of Oct. 1914 and in Germany by Nov. 1914—nearly every male enemy national of military age was interned, and the system, as applied to civilians, became established in both countries, although its working in Great Britain was later modified in the manner referred to above.

Accommodation.—The accommodation in both countries was bad in the beginning. In Great Britain some prisoners were at first placed on board ships, but this was found to be unsatisfactory for many reasons. Considerable numbers of aliens were sent to the Newbury race-course, where they lived in loose boxes without any beds and without any adequate sanitary or cooking arrangements; as numbers increased tents were added and various improvements made, but the place was never satisfactory, and it was closed soon after the weather broke in the autumn. It is only mentioned because it seems more than probable that, characteristically enough, Ruhleben (itself a race-course) was selected by the Germans for the internment of British civilians as a reply to Newbury. The problem of finding adequate accommodation was difficult in England where there were eventually some 29,000 Germans interned out of a considerably larger number not interfered with. In Germany the difficulty must have been even greater, as in addition to two and a half million combatants there were nearly 112,000 civilian internees of different nationalities to be provided for; of these only between 5,000 and 6,000 were British.[1]

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[1] There were in addition to German civilians interned in England a comparatively small number of internees of other nationalities and nearly 20,000 more in other parts of the Empire. The whole of the prisoners in German hands were of course confined in Germany or the occupied districts.

* *These figures indicate the volume and page number of the previous article.*

After the early unsatisfactory camps in England were closed, civilians were confined in large institutions of different kinds, but eventually far the largest number was placed in the Isle of Man, where there was created at Knockaloe a huge camp containing at last some 23,000 prisoners. There were also two "privilege camps" at Douglas and Wakefield, where those possessed of means could, upon payment, secure a certain amount of privacy and comfort, and employ as their servants other prisoners desirous of earning a little money. There was also Islington Workhouse, perhaps the best place of all, where enemy civilians with British-born wives, or some other claim to consideration, were interned.

In Germany the lot of those who were first arrested was worse than in England. They were cast into the ordinary prisons and treated like convicted criminals. After no long time, however, most of them were transferred to Ruhleben, which, with the exception of Schloss Celle, where a certain number of elderly civilians, whose status was somewhat uncertain, were placed, became the place of confinement for all British civilians.

Ruhleben was a race-course near Berlin, with stables, grandstand and all the usual appurtenances of a race-course. The prisoners were housed in the loose boxes and attics without at first any beds, though eventually ships' berths were fitted, six to a box. As the numbers grew, huts were added. The washing and sanitary arrangements, at first rudimentary only, were never satisfactory. No arrangements were made by the Germans for the housing of the prisoners according to their vocational or social affinities—a real boon in the case of civilians. They were allowed, however, ultimately to some extent to sort themselves.

Management.—At first in both countries the camps were conducted on military lines, but eventually the interned persons were left to manage the internal affairs of the camps very much by themselves. A camp captain was elected by them, and captains of huts or other divisions. The camp captain was the official medium of communication with the authorities.

Work and Recreation.—It was recognized in both countries that civilians might not be forced to do any work beyond what was necessary for the orderliness of the camp. This was a doubtful privilege, and the prisoners' want of occupation led to difficulties in maintaining discipline. In the latter stages of the war, at all events in England, a small proportion of prisoners volunteered to work in order to escape the ennui of camp life, and for some 1,500 out of the whole number, useful work was found, mainly in agriculture. No British civilians did any work outside the camps in Germany.

But much was done by the prisoners themselves. Workshops were organized and equipped with the assistance of the Y.M.C.A. (British and American), and other similar organizations. The difficulty in England was to find a market for the produce of the workshops, owing to the objections raised to the prisoners competing with British workmen. This was overcome by sending the articles manufactured to neutral countries.

Besides this form of manual occupation, classes were formed and lectures delivered, and students were enabled to continue their studies so far as their circumstances permitted, and a small number were employed in administrative work.

Medical Care.—Provision was made in England for the civilian prisoners by small hospitals in each place of internment, for the treatment of minor and urgent cases, while some who had been residents in Great Britain before the war were treated in outside institutions.

At Ruhleben a lazaret to which any prisoners could go was established at the Emigrants' Railway Station, close to the camp. The place had previously been used by a low class, and was filthy. The sanitation was bad, and the accommodation of the roughest description, while the attention given to the patients was, to say the least, perfunctory; a doctor came once a day, and there were no nurses or orderlies. After the first disorganization was remedied, there was what was called the Revier Barracke, with a waiting and consultation room, in which the doctor examined those requiring advice. The place had accommodation for emergency cases and those suffering from accidents, and persons were kept under observation till it was decided what should be done with them. From here patients were drafted either to the lazaret above mentioned, or to Dr. Weiler's Sanatorium outside but near the camp, established at the suggestion of the American ambassador for the better treatment of the prisoners, in return for a substantial payment made either by the British Government, or by the patients themselves.

Besides these there was the Schonungs Barracke, a place for convalescents and the ailing. Though the building was provided by the German Government, the place owed its existence and all its amenities to the self-denying labours of Mr. Lambert, himself a British prisoner. It proved a real home of rest for those who were not ill enough to require hospital treatment.

One great defect in the arrangements made for the sick prisoners here was that the German Government, as in the camps where combatant prisoners were confined, provided no diet suitable for them. The ration was the same as for men in good health. A proper diet was provided in Dr. Weiler's Sanatorium in return for the substantial payment made by or on behalf of the patients, and in the Schonungs Barracke by Mr. Lambert with the assistance of friends in England.

Lastly, one further fact should be mentioned. In a few exceptional cases persons were allowed to proceed to places far removed from Berlin to complete "cures" which had been interrupted by the outbreak of war.

The position with regard to the care of sick civilian prisoners may be summed up as follows: The German Government provided some, but inadequate, accommodation for the very poor, and did not put any great obstacles in the way of prisoners who could themselves afford, or for whom the British Government or others were willing, to pay for better treatment.

(2). *Combatant Prisoners.*—In considering the application of the Hague Convention to the combatant prisoners, it is impossible to deal with all the subjects mentioned in it. It is proposed to deal at length only with the principal matters, viz. accommodation, food, the application of the military law of the captors, and after touching on a few less important subjects, to consider how the great general principle enunciated in Article 4, that prisoners must be "humanely treated," was acted on.

Accommodation.—German officers in Great Britain were interned in large country houses and public institutions adapted for the purpose, to which, as necessity arose, additions were made, usually in the form of wooden huts. The necessary furniture and everything reasonably required for messing, as well as fuel and light, was provided free of charge. In Germany, however, the housing was in many cases bad and unsuitable. British officers were confined in the casements of fortresses, as at Ingolstadt; in the men's barracks, as at Crefeld; in disused factories as at Halle; or in huts which had been previously occupied by the rank and file of other nations, as at Holzminden. The best accommodation was in some of the hotels, as at Augustabad, where, until the place became crowded, conditions were comfortable. The British prisoners had to provide, at their own expense, cutlery and everything required for the table, as well as fuel and light, which last caused considerable hardship in winter, for some of the camps were established in summer resorts slightly constructed and at a high altitude.

The actual position of the German places of confinement was undoubtedly chosen in some cases with ulterior objects in view. Thus, the quarters provided right in the middle of the Badische Anilin und Soda Fabrik at Ludwigshafen, and in the centre of Karlsruhe, were undoubtedly chosen in the hopes of warding off air attacks on those places or for the purpose of involving nationals of the raiders in the results.

The men's camps fall into two classes—the large main camps and the working camps.

In both countries the arrangements in the main camps were similar. The camps consisted of groups of huts, either attached to some barracks or similar place, or quite independent, with the necessary cook-houses, baths, latrines and administrative block, all surrounded by a barbed wire fence. There were frequent and justifiable complaints of overcrowding in the German camps. At Wittenberg, for instance, there was, when the camp was full, a population of from 15,000 to 17,000 on an area of about 10 acres. There was usually a building set apart for religious services and recreation in the form of concerts and theatrical performances. The sleeping accommodation consisted of bunks arranged in two or sometimes three tiers. The camps were divided by barbed wire into compounds containing about 1,200 prisoners—camps within a camp.

Working Camps.—The housing of the prisoners sent out to work is more difficult to deal with comprehensively, for it depended so much on the locality and nature of the work, quite apart from the goodwill or otherwise of the employer. According to the German regulations, there ought to have been five cubic metres of internal capacity for each prisoner of war. This regulation was by no means always observed. The accommodation provided in Germany varied from a single very-well-lit and ventilated bedroom in a farm to crowded filthy quarters in verminous draughty buildings in mines, quarries and brickyards. In the larger working camps, buildings were sometimes erected for the express purpose of housing the prisoners, and, though not infrequently overcrowded, were generally suited for this purpose. These buildings were sometimes of brick, more usually of wood, set up somewhat above the ground level. In E. Prussia, however, and in a few other places, a construction common in the neighbourhood was used. The huts were sunk into the ground and were in fact something like large lined dugouts roofed over. They were not satisfactory for considerable numbers, but had the advantage that they were in that bleak district warmer in winter than if they had been erected wholly above ground. In other cases, the prisoners lived in the quarters which at many mines and large industrial works the employers provided for their own bachelor workmen. Such quarters were usually satisfactory. The situation of these quarters, of course, depended on the conditions existing locally, and the nature of the work. In mines they were usually in the mine compound, in some places they were situated at a distance from the actual place of working, and thus was added to the day's labour a walk of occasionally as much as 5 km. each way—a serious addition if the work was severe. But in the majority of cases there were no workmen's quarters, and it was impracticable to build barracks for only a few prisoners. Accommodation was then provided in village recreation halls, inns, theatres and similar places. They were not well adapted for the purpose, but where a little goodwill was shewn on both sides, were often made reasonably comfortable.

In a few cases, at Kiel and elsewhere in that neighbourhood, the prisoners lived on board ship where the accommodation, according to the neutral reports, seems to have been satisfactory.

In the places dealt with above, good provision was usually made for bathing, personal washing and laundry; in many mines and industrial works the men were able to get a hot shower-bath daily. In some places, on the other hand, the quarters provided were disgusting. To take two instances out of many which might be given. At Fangsläuse, attached to Döberitz, where the men were engaged in refuse sorting, the barracks consisted of a wooden building divided into two rooms, which were very dirty, in a verminous condition, and overrun with rats and mice. There were no arrangements for bathing or washing; the only opportunity the men had for washing being afforded by a canal near by. At another place, a coalyard, the men were housed in an archway under one of the main lines running into Berlin, and bathing arrangements were *nil.*

In Great Britain, prisoners of war sent to work were either housed by the military authorities or, in some cases, when engaged in agriculture, by the employer, who was bound to supply housing accommodation, straw for filling palliasses, cooking utensils, crockery, facilities for washing and artificial light. As in Germany, it was not always found possible in England to house prisoners near their work. Any time required to reach and return from their work in excess of one hour was deducted from the hours of labour. One rest day a week was allowed in both countries.

Work.—The construction placed during the World War by the belligerents upon Article 6, which enables the captors to employ the labour of prisoners of war and to authorize them to work for the public service or private persons, probably caused more ill-feeling than any other cause, for the result was to reduce hundreds of thousands of men temporarily to virtual, if not nominal, slavery. In the war of 1870-1 the Germans took some 400,000 French as prisoners. They were permitted, but in no way forced, to work in factories and elsewhere. During the World War, with many exceptions, it is true, practically all able-bodied prisoners, except officers and non-commissioned officers, were ultimately forced to work.

Early in 1915 the British prisoners in German hands were invited to volunteer for work outside the main camps. They refused almost to a man. Then by degrees pressure was applied, and soon men who refused were punished for their refusal, and, eventually, as mentioned below, a formal pronouncement on the subject was made by the German Military Courts.

Meanwhile, a question arose as to the employment of non-commissioned officers. As early as February 1915, the German Government suggested certain privileges for superior non-commissioned officers, and eventually an agreement was come to, that non-commissioned officers should not be compelled to work, except as superintendents, unless they volunteered to do so. A camp was formed for non-commissioned officers at Grossenweder Moor, in the notorious X. Army Corps district, and steps were taken to obtain volunteers for work by withdrawing all privileges and forcing the men to march on parade for nine hours a day. The men did not volunteer and eventually the conditions were improved.

The question of the nature of the work which could be properly demanded of prisoners of war was early found to be a difficult one. In a war of nations such as the World War every able-bodied man replaced by a prisoner is a potential soldier, and, in these circumstances, any work in the enemy country might be said to be "indirectly connected with the operations of war," especially in cases in which the prisoner was engaged in any step in the manufacture or transport of any one of the multitude of articles necessary for an army in the field.

The position first taken up by the German authorities was that so long as prisoners did not actually handle the finished product—arms, ammunition and such like—there was no infraction of the rules of international law. This, however, did not really cover the whole ground, and the matter was eventually formally considered by the German Military Courts, and the following principles were laid down:—

(1) The work on which a prisoner of war may be employed can only be judged on the merits of each particular case.

(2) It is illegal to employ prisoners of war in the manufacture of munitions intended for use against their native country or its allies.

(3) They may be employed in agricultural or forestry work, as well as on military property, *e.g.* the improvement of parade and drill-grounds and of rifle ranges.

(4) They may be employed on preparation work, *e.g.* the transport of coke or of ores for the manufacture of shells, because there is no *direct* connexion between such work and military operations.

(5) They can only claim exemption from such work as stands in *direct* relation to military operations in the area of hostilities.

These principles were accepted by the British War Office and the commanders-in-chief of the British armies, and seem on the whole to have been fairly acted on by the German authorities except behind the lines on the eastern and western fronts, though in some cases individual commandants attempted to force men to take part in the actual manufacture of such things as shells, parts of fuzes and the like.

There seem to have been a large number of them employed in labouring work, handling the actual material for guns, shells, etc., in places where munitions were made, and some cases in which they had to take an active part in the manufacture of the finished article certainly did occur. At Krupp's Germania wharf at Kiel, prisoners were employed in riveting ships, including the outsides of submarines, while at Mannheim a number of British were made to work in the manufacture of sulphuric acid in the middle of a large munition factory.

The authorities naturally reserved to themselves the right to say what work the prisoners could be forced to do, but, at all events in the early years of the war, they promised to give to the prisoners certificates that they had been forced to do the work to which they objected in order to protect them against proceedings in their own country. The promise seems to have been very seldom kept.

Setting aside work directly or indirectly connected with the operations of war there seems to have been no kind of work which prisoners were not called on to perform. They were employed in every kind of manual labour, including work in mines, from skilled engineering to scavenging. This last seems to transgress the principles laid down in the German War Book, that "these tasks" (to which prisoners can be put) "should not be prejudicial to health nor in any way dishonourable."

In Berlin prisoners were sent to work in a slaughterhouse; at three places they were obliged to do scavenging in the public streets, while at two places at Kiel, and at four places near Berlin they had to collect and sort the rubbish of the town. The visitor of the protecting Power says in his report of one of the places at Kiel where only British prisoners were employed, "the work the prisoners are called on to perform is of a particularly revolting character."

In Great Britain, the principles above stated having been accepted, prisoners were employed in accordance with them, but none were employed in mines, nor were such degrading tasks as scavenging and refuse-sorting imposed on them. A large number were employed in France in various capacities not directly connected with the operations of war, and, after the Armistice, in general salvage work.

The organization of the working camps was much the same in both countries. Each working camp was connected with a main camp, which was the centre for all administrative purposes and upon its books the prisoners were borne.

In Germany the working camps were divided into three classes:—(*a*) those which the representative of the protecting Power might visit freely and see the men at their work and in their quarters; (*b*) those in which he might see them in their quarters but not at work; and (*c*) those in which he was admitted neither to the work nor to the quarters but was allowed to see one or more prisoners outside. It has been suggested that this classification was due to the influence of some of the great industrial magnates who objected to their works being visited by outsiders, but, however this may be, the third class was a very small one, and the prohibition with regard to the second and third classes does not appear to have been very strictly enforced.

Pay.—The provisions of the Hague Convention with regard to pay are too vague to be of any real value.

In the II. Army Corps district the German regulations, which may be taken as typical, seemed to contemplate a payment by the employer of the customary local wages, of which the military administrative department took three-quarters for board, lodging, guarding, etc., and the prisoner was credited with one quarter, which he received in token money. In practice, a prisoner working on the land generally himself received 30 pf. a day, in mines from 75 to 90 pf., and in industrial works from 50 pf. to even several marks a day. In some cases a premium was paid to prisoners who did more than the minimum.

Prisoners of war in British hands, when employed by the Government, received the same rate of pay as that given to British soldiers as working pay. When employed by private persons or corporations the employer in England was obliged to pay the full current rate of wages to the Government by whom the prisoner was paid. Piece-work or task-work was adopted where possible and extra pay given where the task was exceeded. The rates were so adjusted that a man of moderate industry could earn the equivalent of time-work earnings, and a very industrious man could earn more. Time-work was paid at rates which ranged according to circumstances from 1s. 4d. to 8d. a day. These sums were credited to the prisoner, but power was reserved to the commandant to decide the amount actually issued to the prisoner.

Food.—Article 7 imposes on the captor State the duty of maintaining its prisoners, and provides for their being treated as regards rations, quarters and clothing on the same footing as its own troops. This article is difficult to understand; it is not clear whether prisoners are to have the same rations as soldiers in the field or at home; or whether they are to be placed in barracks with the same space and conveniences as the captor's soldiers. How this last matter was actually dealt with has been already explained. Whatever may be the true construction of the article, none of the belligerents observed the letter of it with regard to food. Difficulties arose, not merely from the steadily decreasing supplies, owing to the submarine war on one side and the blockade of Germany on the other, but also from the difference in the kind of food appreciated by the subjects of the two countries. At a time when the Germans interned in England were receiving the full peace-time rations of the British soldier, they were complaining of the insufficiency and unpalatable nature of the food. On the other hand, the British prisoners—even when supplies were sufficient in Germany—complained of the brown or black bread, and of the soup, which is liked by the continental working man.

In England, after a short time, no rations were issued to officers. Canteens were established, and subject to regulations for the prevention of undue luxury, the German officers could provide such food as they wished, which was prepared for them by cooks of their own nationality.

In Germany it was different. Rations were issued, though not always partaken of. The British officers, at all events after the war had continued for some time, lived almost entirely on supplies obtained from home. The rations in Germany were issued according to a scale based upon a scientific analysis of the composition of the food given, which showed a daily average in grammes of albumen, fat and carbo-hydrates, and the number of calories. These, as determined by the Kriegs ministerium for the last week in Sept. 1916 at Parchim Camp, averaged daily 75·6, 24·5, 368·4 and 2,019·4 respectively.

It perhaps throws some light on the sufficiency of this ration that in July 1918, nearly two years later, it was agreed between the representatives of Great Britain and Germany, who met at The Hague, that the combatant prisoners of war should receive as far as possible the same allowance of rationed articles of food as the civil population, and that in no case should the daily calorific value fall below 2,000 calories for non-workers, 2,500 for ordinary workers, and 2,800 for heavy workers.

It may be doubted, however, whether at any time in German camps the prisoners received even these moderate amounts of food; and as the supplies became more difficult to obtain, they probably received considerably less, even in the working camps. Even if they did, such things as fish roe, soya flour, soya oil, buckwheat and "blutwurst" do not appeal to a British soldier, however admirable they may be from a scientific point of view as articles of food, especially when they are all boiled together and given in the form of soup.

In England the scales were not drawn up in exactly the same way. If we take the principal articles of food, up to the middle of 1916 the German prisoners received a daily ration of 1½ lb. of bread, 8 oz. of fresh or frozen meat or 4 oz. of preserved, 2 oz. of cheese and 1 oz. of margarine. By Dec. 1917, the ration had been much reduced. The bread ration was 13 oz., for 4 oz. of which broken biscuit was substituted when obtainable. Meat was given on three days a week only, but a ration of 10 oz. of herring was added on two days. The 2 oz. of cheese and 1 oz. of margarine were given till Oct. 1918, when both were reduced. In the case of non-workers, the bread in Oct. 1918 was reduced by a quarter of a pound, the cheese omitted, and the margarine further reduced. In England, as in Germany, the prisoners had to share in the privations of the civilian population.

In both countries the rations were supplemented by parcels of food which were sent to the prisoners. At first they were sent from England by individuals and associations, but before long great abuses arose. Some British prisoners received large numbers of parcels, not infrequently far beyond any possible requirements. Others received nothing, and there can be no doubt that in not a few cases gross fraud was practised on sympathetic persons. Early in 1915 the Prisoners of War Help Committee was established in London. It tried to coördinate the work of the different associations and individuals, but failed as it had no powers, and was dissolved in Sept. 1916, when the Central Prisoners of War Committee of the British Red Cross and Order of St. John was officially established and without its authorization no individual or body could send a parcel to a prisoner.

Amongst its functions were (1) to authorize committees, associations and approved shops to pack and despatch parcels to prisoners of war, (2) to control and coördinate the work of all such committees, associations and shops, and (3) to act as a care committee for all prisoners who for any reason were without a care committee, for all civilian prisoners, and, after Oct. 1917, for all officer prisoners.

Under the presidency of Sir Starr Jameson, Bart., and, after his death, of the Earl of Sandwich, the committee of which Sir P. D. Agnew was vice-chairman and managing-director, not only organized the whole of the despatch of parcels of food and other things to the prisoners of war by 181 care committees, 81 local associations and 67 shops, but packed and despatched parcels to individual officers and men, numbering, at the date of the Armistice, no less than 47,500. Three parcels of 11 lb. weight were sent each fortnight to every prisoner and contained, together with 13 lb. of bread sent once a fortnight from Copenhagen or Berne, sufficient, without other food, to maintain a man doing reasonably hard work. Officers did not come under the scheme till the autumn of 1917.

At first the scheme was very unpopular, because it interfered with the power of individuals to send what they liked to their friends, and in April 1917, a Joint Committee of both Houses of Parliament was appointed to enquire into it. The report was published in June of that year, and while paying a high tribute of praise to the work accomplished made certain suggestions which did much to allay the discontent, as they provided for the introduction of the personal touch into the parcels. In its main features the scheme continued till the end of the war.

Besides the despatch of parcels to individuals the Committee sent food, either in bulk or in the form of emergency parcels, to the larger camps in Germany, for newly captured prisoners.

Though it is obvious that the despatch of parcels of food on the great scale indicated above relieved the German Government of a very great responsibility, yet it must be recognized that credit is due to the German nation for the fact that all but a small percentage reached the addresses to which they were sent, notwithstanding that they contained articles unobtainable in Germany, except by the very rich.

Though it is true that the parcels arrived, it is also true that in some camps the German commandants as a punishment delayed or prohibited for some days or even weeks their issue to the addressees, and that there were complaints as to the way in which the censoring of the contents of the parcels, necessary of course to prevent the introduction of prohibited articles, was carried out. Latterly, however, in all good camps the parcels were opened in the presence of the addressee, and the tinned food was stored and not opened till it was required.

Owing to the increasing shortage of food in Germany, and to the fact that the rations in England for a long time were maintained at a reasonable level, the number of parcels sent to German prisoners was far smaller than that sent to British prisoners. At first a considerable amount of food was sent into the German prisoners' camps in England from their relations and friends residing in Great Britain, but when the shortage became acute it became necessary to prohibit this practice.

The Hague Convention also requires the captor to treat his prisoners as regards clothing on the same footing as his own soldiers. The German Government claimed that it strictly observed this article and forbade the sending of clothing by the British Government. The article was not observed at all in some German camps, and great trouble was caused by the claim, in at all events some army corps, that boots were part of a soldier's military equipment, and that the captors were entitled to take them. The clothing in any case supplied by the Germans was quite insufficient, and arrangements were made by which an adequate supply was despatched according to a regular scale. Some of it went astray and some was stolen, although a good proportion reached the addressees. In England clothing was issued when necessary to enemy prisoners, other than officers, on a regular scale, which provided for them having a sufficient change of clothing, while in both countries officers made their own arrangements for the supply of the necessary clothing.

Application of the Military Law of the Captors.—Article 8 enacts that prisoners of war are subject to the laws, regulations and orders in force in the army of the captor State, a provision which gave rise to a good deal of trouble, owing, in England, to the difficulty of carrying it out strictly—while in some cases, as in Bulgaria, punishments were allowed—such as flogging—for ordinary breaches of discipline—which were quite alien to British ideas of what is permissible.

The German military law is in general far more severe than the British, and there is this further great difference, that in Germany officers as well as men may be summarily sent to cells or awarded other severe punishments for trivial offences, while in the United Kingdom, strictly, any offender above the rank of private should have been tried by court-martial, a provision amended during the war by the substitution of military courts.

In another respect the German code is more severe in that all sentences of arrest involved solitary confinement, while one of close arrest, which was limited to four weeks, meant that the prisoner was confined in a dark cell, with a plank bed and bread and water diet, though these aggravations of the punishment were omitted on the fourth, eighth and subsequently every third day, the prisoner receiving the ordinary camp diet on these days.

One punishment officially termed "field punishment," but more generally known in England as the "post punishment," caused a great outcry in that country and much resentment among British prisoners in Germany. It is provided in the German *Manual of Military Law* that the punishment is to be inflicted in a manner not detrimental to the health of the prisoner, who is to be kept in an upright position with the back turned to a wall or a tree in such a manner that the prisoner can neither sit nor lie down. These last words were construed to mean tying the prisoner to a post; sometimes his feet were placed on a brick which was removed after he was securely tied, and sometimes his hands were secured above his head. Apart, at all events, from these aggravations, this punishment was in strict accordance with the military law of the captors; indeed it corresponds to the field punishment No. 1 authorized by the British military law and described in the rules for field punishment for offences committed on active service made under Sec. 44 of the Army Act. These rules authorize the keeping of the offender in fetters or handcuffs or both, and when so kept he may be attached by straps or ropes for a period or periods not exceeding two hours in any one day to a fixed object during not more than three out of four consecutive days nor more than twenty-one days in all.

In Germany all prisoners are liable to be treated as "in the field," *i.e.* on active service.

In one respect, viz. the punishments for attempted escape, the German military law was less severe than the British, the greater severity of the latter having apparently arisen from a misunderstanding of the expression "peines disciplinaires" in the second paragraph of the 8th Article of the Hague Convention. This seems to have been understood on the Continent as a punishment which could be awarded summarily: that is, arrest, open, medium or close, for a period not exceeding six weeks. In Great Britain the punishment was limited to 12 months' imprisonment; in Germany it was far less for the simple offence, though it was frequently added to by the addition of charges for damaging Government property, and the like. The matter came under discussion between the British and German Delegates at The Hague in 1917 and 1918, and an agreement was arrived at by which the punishment for a simple attempt to escape was to be limited to fourteen days, or if accompanied with offences relating to the appropriation, possession of or injury to property to two months' military confinement.

In addition to the summary punishments, there were, of course, in both countries the punishment of death and imprisonment, which could only be inflicted by court-martial. In some cases the German code lays down minimum punishments of great severity, and in many of those cases, in which the infliction of very severe punishments properly raised a great outcry in England, the German court-martial had no option but to pass them. The British military law on the other hand has only one offence —murder—for which there is a fixed punishment; for others it is "such less punishment as is in the Act mentioned."

In one respect the prisoners of both countries never were satisfied. Neither understood or appreciated the procedure of the other. The British never understood the long delays, sometimes it is to be feared deliberate, which occurred in bringing them to trial for alleged offences, and during which they were kept under arrest, nor, owing to their ignorance of the German military code, could they understand the very severe sentences necessarily passed by courts-martial (which seem usually to have been conducted with fairness), nor the right of the prosecutor to appeal against a sentence which he considered to be inadequate.

On the other hand, the Germans never appreciated the British procedure, nor could they understand the absence of any right of formal appeal from a sentence, for which ample provision is made in Germany, even against the award of a disciplinary punishment, a right which, oddly enough, by Sec. 52 of the Regulations relating to it, the accused shared with the prosecutor "only when the sentence has been carried out."

Parole.—Articles 10, 11 and 12 deal with the subject of parole. In the World War no combatant prisoners, with one exception, were allowed to leave Germany or Great Britain on parole, or to reside outside the camps. The only cases in which questions arose were with regard to the temporary parole given when officers left their camps for a walk, and the parole given by those who were interned in neutral countries. According to the custom of the British Army no officer ought to give his parole, it being his duty to escape and rejoin his unit if he can, nor can anyone below the rank of officer give a parole. In both countries, however, officers were eventually allowed to go out for a walk in parties accompanied by an officer, each giving in writing a temporary written parole that he would not attempt to escape, nor during the walk make arrangements to escape, nor do anything to the prejudice of the captor State. The parole was given on leaving the camp and returned on reëntry.

The case of those interned in neutral countries was different. The British officers of the Royal Naval Division interned in Holland after the fall of Antwerp were permitted to choose their own residence in Groningen on parole, the men being interned close by. This privilege was withdrawn for a time, and the officers were interned in a fortress, but it was restored later.

As time went on, the Netherlands Government permitted officers to return to England and Germany on parole, on proof of the serious illness of a near relative, a concession which was afterwards extended so that regular periods of leave were enjoyed by both officers and men, the former giving a formal parole and the latter a promise to return on the expiration of their leave, while the British Government gave its assurance that the men would not be employed on any work to do with war, and would return at the end of their leave. Similarly, the Danish and Norwegian Governments granted leave to British and German combatants interned in their countries.

No parole seems to have been taken from those officers who were interned in Switzerland or Holland under the agreements made in 1917 and 1918 with the German Government.

Relief Societies.—Article 15 deals with societies for the relief of prisoners. An immense amount of valuable work, impossible here to particularize, was done by such societies. The American branch of the Y.M.C.A. especially did much for the prisoners in England and Germany, being permitted to work on the following conditions, substantially the same in both countries.

A building or tent might be erected in the camp with the consent of the general officer in command of the district or army corps, but nothing might be sold in it nor could any one be employed there other than a prisoner. A member of the association might visit the camp once a week for a definite time. He might hold services, provide materials for games, entertainments and employment, arrange instructional courses, provide books (subject to censorship) and writing materials other than writing paper and envelopes. Nothing might be given to or received by a prisoner without the commandant's consent.

Recreation.—No express provision is contained in the Hague Convention relating to the occupation of prisoners in their leisure time, but much of the good work done by the societies had to do with the recreation and education of prisoners. In both countries, and in nearly all camps, provision was eventually made for sufficient space for recreation and exercise, but this was not the case at first. At Halle, for instance, a German camp for officers, established in a disused factory, the only place for exercise was the space enclosed by the three buildings, in which some 500 officers lived. It measured about 100 yards by 50, and in winter was a morass of water and mud; in summer deep in dust. In some of the men's camps the space was very confined, and organized games of any kind were impossible. But later things improved, and in most provision, sometimes at the prisoners' expense, was made for sufficient room for tennis, football and other games.

In England, facilities were provided by the War Office. To take two typical instances, it may be said that at Donnington Hall for German officers, there was a considerable space in front of the house, and at Dorchester, for men, there was a large field where any games could be played.

As time went on, walks outside the camp were permitted for officers on their giving a temporary parole, and in Germany, in some of the larger working camps, the men were allowed out for walks on Sunday.

With regard to educational facilities, in England both officers and men made their own arrangements, as they did in Germany, with the full concurrence of the authorities. At Münster, for instance, the general officer commanding excused all students from work, and much was done by some of the prisoners in the organization of classes and lectures. The neutral organizations, such as the American and Danish Y.M.C.A.'s, also did a great deal in this direction, as did certain of the German civilians in the neighbourhood of the great camp at Göttingen. Professor Stange and some of his colleagues interested themselves in the prisoners and organized the educational work in the camp, and he himself had an office there where he was accessible to prisoners, and assisted them with his advice on educational matters. He used even to obtain the requisites for games through the Red Cross in Switzerland. Unfortunately for them, all the British prisoners were ultimately removed from Göttingen, which had become something of a model camp.

Some of the larger employers were also very considerate in this respect, providing recreation halls and fields for playing games, and even musical instruments. At Mulheim the Dutch visitor found the employers had paid the expenses of the prisoners' Christmas festivities.

Letters.—Article 16 was observed by both countries, except that at one time in some of the camps in Germany customs duties were charged on the contents of parcels, but this seems to have been due to some misapprehension, and was soon abandoned. Prisoners were as a rule allowed to write two letters a month and a postcard every week, and, in addition, a postcard in the prescribed form acknowledging the receipt of a parcel. But later in the war a "first capture postcard" was introduced, by which on a printed form a prisoner was allowed to notify to his relatives his capture, his state of health and his address.

Pay.—Article 17 provides for officers receiving the same rate of pay as officers of the corresponding rank in the army of the captors. This provision was not observed by the German Government, who paid subalterns 60 marks a month and other ranks rather more. Accordingly, the British Government declined to carry out the terms of the article and paid the German subalterns 4s. a day and other ranks 4s. 6d., naval officers being paid according to their relative rank. Out of this an officer was required to pay for his food, laundry and clothing, a deduction being made if he was in hospital (where, of course, he was provided with everything necessary). By an arrangement made later the German Government was allowed to make a small addition to these daily rates of pay. Medical officers employed in the care of sick and wounded prisoners of their own nationality received the full pay of medical officers of corresponding rank in the army of the captors.

Religious Exercises.—Article 18 is designed to secure to prisoners complete liberty in the exercise of their religion, and during the World War no real complaint was made on either side.

In the United Kingdom German pastors who had been resident in the country were allowed to hold services in the camps, but difficulties arose and the permission was withdrawn. Thereupon some pastors elected to be interned, with a view to ministering to the prisoners. Later, however, the permits were issued in a modified form, and English and American clergy and laymen and members of the Danish and Swiss Student Christian Movement were allowed to visit the camps, the necessary funds being provided by the American Branch of the Y.M.C.A. The Roman Catholic prisoners were usually attended by the priest of the district in which the camp was situated and every facility was given to them. Where no German-speaking priest was at hand the Cardinal Archbishop of Westminster charged the German priests of his archdiocese to visit the camps every now and then in order to enable the prisoners to go to confession and to hear a sermon in their mother tongue.

In Germany, at first, the Rev. F. Williams, who had been in charge of the English Church in Berlin, was allowed to visit the different camps and hospitals. But this permission was withdrawn and the prisoners were left to conduct their own services, to which, except at Grossenweder Moor, no objection was raised. A few British chaplains were captured, and did good work until they were repatriated. Great assistance was given also by the American branch of the Y.M.C.A., and by Archdeacon Nies, an American clergyman at Munich, until the United States came into the war.

The German clergy also did what they could for the prisoners in many camps and hospitals. Some of them were spoken of very warmly by the British prisoners.

The needs of the Roman Catholics were more easily met owing to the presence among the French prisoners of many priests who did excellent work, and the Bishop of Paderborn (afterwards Archbishop of Cologne) did much for the prisoners. Moreover, Father Crotty was sent from Rome and was permitted to minister at Limburg and Giessen, partly perhaps because he was an Irishman, and it was hoped his influence might be useful to the Germans.

In the German working camps there was no regular provision for religious services, though Mr. Williams seems to have visited some of the larger places, and in one district a German pastor is said to have travelled around the small camps and ministered to the prisoners. There was a standing order of the Kriegsministerium that, at all events in the country districts, the prisoners should be allowed to attend the local churches. This, though of value to Roman Catholics, was not much use to the Protestants, owing to the difficulties of language.

At Zossen the Germans built a mosque for Mahommedan prisoners, and generally arrangements seem to have been made to avoid hurting religious and caste prejudices.

Medical Treatment.—Up to this point an attempt has been made to show how the provisions of the Hague Convention were applied in Great Britain and Germany. But this Convention does not deal with everything which affects the well-being of prisoners of war. The Geneva Convention of 1906 requires the belligerents to respect and take care of the wounded and sick without distinction of nationality, and leaves them at liberty to agree for the restoration of wounded left on the field, the repatriation of wounded after rendering them fit for removal or after recovery, and for handing over the sick and wounded to a neutral State to be interned by it till the conclusion of hostilities. What was in fact done must be considered under three heads: the attention given (1) in the regular hospitals, (2) in the main camps and (3) in the working camps.

Hospitals.—In Germany at first there seem to have been inadequate arrangements made for the reception of seriously wounded prisoners, but later well-arranged and well-equipped hospitals were available, the principal being in Berlin, at Cologne and Paderborn, though of course there were a large number elsewhere. As time went on and the pressure on Germany became more and more acute, the supply of medical requisites became deficient, bandages were made of paper, drugs and anaesthetics were less plentiful, but, though naturally British prisoners would fare worse than the wounded Germans, there is no evidence that the former were intentionally deprived of anything necessary for them if there was an adequate supply.

The conduct of the German doctors to the prisoners in the regular hospitals is one of the bright pages in the sad history of the World War, and is worthy of their great profession. Most of the returned British prisoners reported that the doctors were kind and humane, while many of them spoke of them in warmest possible terms and told how the doctor had said that when a prisoner was wounded or ill he no longer looked on him as an enemy, or how, though he hated the English, he did his very best. There were exceptions, who formed a very small minority. The large majority of German doctors worked hard, often with infinite kindness, in the interests of those in their charge, and unreservedly placed such knowledge and skill as they possessed at the disposal of the prisoners.

The nursing in Germany was carried out by orderlies, by trained nurses or by sisterhoods. It seems to have varied very much. In some cases it was good and kind, in some indifferent, and in some rough and bad. But there appears to be no reason to think that in any case it was intentionally less good than circumstances permitted.

Main Camps.—The same satisfactory account of the medical arrangements in the main German camps cannot be given, even after the first disorganization was overcome. There was in each camp a lazaret providing accommodation for a number proportionate to the number for which the camp was designed, but the arrangements were often very incomplete.

There seem to have been a large number of Russian doctors employed in the German camps, while in a few, for short periods, English medical officers were employed—though in all cases a German seems to have been responsible. The nursing was in the main done by prisoner orderlies, many of whom of course were quite untrained, though they seem to have done their best. It is impossible to generalize as to the conduct of the German medical staff in hundreds of camps over a period of four years, but the general impression produced by the evidence is that the staffs were humane and did all they could.

There is reliable evidence that the nature of the food provided in the German camp hospitals, as distinguished from the regular hospitals, where, until supplies became very short, it seems to have been satisfactory, was quite unsuited for invalids. A sick prisoner was a non-worker, and therefore received the ordinary camp ration, less 10 per cent. This was even the case in the typhus camps, where the requisite milk and light food for the fever-stricken patients had to be provided by the British and Allied medical officers themselves.

There seems to have been insufficient care, at all events in the early stages of the war, to prevent the spread of tuberculosis by the segregation from the healthy of those suffering from that disease. Later, however, steps were taken to effect this, and more than one place was established exclusively for tuberculous patients, while the arrangement made for their internment in Switzerland did still more to deal with this evil.

It must not of course be said that this mingling of the sick and healthy was deliberate. It was probably due to want of thought, an excuse which cannot be made for the policy adopted by the German Government of mixing all the Allies together, although this was bound in the circumstances to lead to an excessive amount of illness. This policy was quite deliberate. Mr. Gerard, the American ambassador to Germany, in 1915 raised the question with the German authorities with regard to officers, and reported: "I was told that this was a political move ordered for the purpose of showing to the French, British, Belgian and Russian officers that they were not natural Allies." The commandant of the Gardelegen camp tried to enforce the observance of this regulation during the height of the typhus epidemic at that camp, but his direct order was deliberately disobeyed by the British doctors, with excellent results.

Though this policy did not produce any ill effects upon the health of the prisoners in the officers' camps in Germany, its results, assisted by the insanitary condition of many of them, were disastrous in the main men's camps. Typhus is endemic in Russia, and the Russian prisoners, herded together with those of other nationalities, spread the disease till in some camps appalling epidemics were produced. At Ohdruf, Langensalza, Zerbst, Wittenberg and Gardelegen the fever raged with great virulence. At Wittenberg the camp was overcrowded and insanitary, the washing arrangements were nothing more than troughs in the open, which, with the supply pipes, were during the hard winter of 1914 frequently frozen. In these circumstances, a serious epidemic broke out in Dec. 1914. As soon as this was recognized, the whole German staff, military and medical, left, and never came inside again till Aug. 1915, by which time all the patients were convalescent. For his services in combating the epidemic Dr. Aschenbach, the German principal medical officer, received the Iron Cross. Many Allied and British medical officers had been improperly detained in Germany after their capture, and were dispatched to take the place of the German doctors, who (it is charitable to believe, in obedience to superior orders) had deserted their charges. In Feb. 1915, six British medical officers were sent to the camp which they found in a state of misery and disorganization. Of the six, three died of the fever, as did several French and Russian doctors. Notwithstanding the fact that there seem to have been ample supplies of medical necessaries available, the difficulty of obtaining sufficient drugs and dressings was extreme. There was not even any soap till one of the British doctors obtained a supply at his own expense from England, nor, till April 1915, were beds or bedding for patients requiring hospital treatment improvised in one of the barracks. There were between 700 and 800 British prisoners among at least 15,000 in all, who, incredible as it may seem, were confined in an area not exceeding 10½ acres. Of the British about 300 were attacked by the disease and 60 died.

At Gardelegen the same story was repeated. As soon as it was apparent in February 1915 that something was wrong, captured medical officers were dispatched to Gardelegen, where the conditions were favourable for the propagation of disease. Though there were empty huts in the camp, the commandant refused to allow them to be used, and the prisoners' rooms were very overcrowded, the nationalities, as usual, being all mixed up together. To each company of 1,200 men was allotted for washing one outdoor trough, which was often frozen, and there was a small hut containing at the most thirty showers for 11,000 men. The place was bitterly cold, the heating arrangements entirely inadequate, consequently the huts were kept closed, and the atmosphere therein became foul. Four days after the arrival of the Allied medical officers every German had left the camp, and the commandant, standing outside the barbed wire, informed the medical officers that no person or thing was to pass out, and that they were responsible for the discipline and general internal arrangement of the camp, and for the care of the sick. Dr. Wenzil, the German principal medical officer, left the camp with the rest, but soon afterwards died of typhus. His two successors never came inside the camp. But the third, Dr. Kranski, a civilian, came in March and devoted himself seriously to the welfare of the camp, and, though he took no part in the care of the sick, did much to improve the sanitation, and in that way to aid the medical men in their work. It is unnecessary to go through the whole story of the struggles to obtain the barest requisites in the way of food, drugs, dressings or furniture. The plague was stayed after four months, during which over 2,000 cases were treated out of 11,000 prisoners, the mortality being about 15% of those attacked. Of the 16 Allied medical officers, 12 took the disease and 3 died, while of 10 French priests, who devoted themselves to the care and nursing of the sick, eight were attacked and five succumbed.

The epidemics at Wittenberg and Gardelegen in these circumstances of gratuitous suffering and official callousness made a world-impression never likely to be entirely effaced, but it is only just to add that the German authorities, having learnt their lesson at the cost to others of so much suffering and death, did their best, too late indeed, to remedy the defects, and Gardelegen and Wittenberg eventually became, if not model, at all events fairly satisfactory camps.

German Working Camps.—In mines and large industrial places, there was generally a small sick-bay containing from two or three beds up to perhaps a dozen, in charge of a German Sanitäter. There was no resident doctor, but a civilian practitioner called in well-managed camps daily, in others at intervals varying from twice a week to four weeks. In case of accident he was summoned as soon as the *Feldwebel* in charge thought fit. In the smaller camps reliance was placed simply on the local practitioner, which ordinarily was sufficient provision, though in some places, such as the large land reclamation camps in Hanover, the nearest doctor might live at any distance up to 20 kilometres. A prisoner seriously ill or injured was either taken to the hospital at the main camp to which his commando was attached, or sent to the local hospital, military or civil.

The real defect in the medical arrangements in these places was that too much power was left in the hands of the person in charge to decide whether a man reporting sick should see the doctor or not. The regulations in the II. Army Corps district provided that there must be a clinical thermometer in each commando, and the guard was to be instructed in the use of it. No prisoner was to be sent to work who had a temperature above 38° (100.4° Fahrenheit). This seems to have been construed as meaning that the prisoner was to be sent to work unless he could show that temperature. Armed with his thermometer the *Feldwebel* in charge often declined to allow the prisoner to see the doctor. The test was in some cases sufficient, in many it was no test at all, and the results were sometimes fatal.

British Medical Arrangements.—In the United Kingdom the arrangements for the treatment of sick and wounded prisoners did not differ in essentials from those made in Germany. At first there were no special hospitals for them, but in Sept. 1915 a large hospital was opened at Dartford. This accommodation, however, soon became insufficient, and at the time of the Armistice there were seven hospitals entirely set apart for prisoners. In addition to these large hospitals there was a hospital with beds to the number of about 2% of the prisoners, for the treatment of minor and urgent cases; while in the working camps the services of the local practitioner were given as required. In exceptional cases prisoners requiring special treatment were sent to an ordinary military or civil hospital.

Repatriation.—Closely allied with the matter of medical treatment is the question of repatriation and internment in a neutral country. As early as Jan. 1915, an agreement for repatriation of incapacitated officers was made. There was at first no agreement as to the degree of incapacity sufficient to entitle an officer to repatriation, but in August of that year an agreement was arrived at, which was slightly amended in October. It included 13 injuries or complaints entitling a person to be repatriated, which may be summed up as being such that the person was permanently, or for a calculable period, unfit for military service in the army, or in the case of an officer or non-commissioned officer, from service in training or office work.

But besides this direct repatriation of totally incapacitated persons, many prisoners were sent to Switzerland or Holland.

In the spring of 1916 an agreement was made with the German and Swiss Governments by which prisoners whose disabilities fell within an agreed schedule but were not sufficient to justify direct repatriation should be transferred to Swiss custody. They were selected by mixed travelling boards composed of Swiss medical men and medical officers of the captor State, those selected being afterwards examined by a Control Board, whose decision was final. After the Conference at The Hague in 1917, these travelling boards were abolished, and the first selection made by the camp medical officer, an arrangement subsequently modified at the meeting of 1918.

The guiding principles for internment in Switzerland were stated in 1917 as follows:—

"The following shall be interned:—(1) Sick and wounded whose recovery may be anticipated within a year, and whose cure will be more speedily and surely brought about by the facilities obtainable in Switzerland than by a prolongation of imprisonment. (2) Prisoners of war whose health in the opinion of the medical authorities appears to be seriously menaced either physically or mentally by the prolongation of captivity, and who would probably be saved from this danger by internment in Switzerland."

If the person's disabilities increased so as to bring him within the category entitled to direct repatriation, he was to be sent home.

In 1917 the Netherlands Government offered to receive in all 16,000 persons, British and German, divided into three categories: (1) invalid combatants (7,500); (2) officers and non-commissioned officers who had been in captivity for 18 months (6,500); and (3) invalid civilians (2,000). This offer formed the basis of the agreement made between the British and German Governments at The Hague in June 1917. By that agreement the schedule of disabilities for the invalids was the same as in the case of Switzerland, except that the British Government insisted with the assent of Switzerland that tuberculous patients should go to that country. Much resentment was felt in consequence of the exclusion of privates who had been 18 months in captivity from the benefit of this agreement. But the British delegates were powerless. Every attempt to induce the German delegates to agree to their inclusion was vain.

The provisons of the agreement arrived at in 1917 were largely extended at a further meeting in 1918, by which all warrant and non-commissioned officers, as well as men who had been prisoners of war for more than 18 months, should, with exceptions, be repatriated, head for head and rank for rank.

General Treatment.—So far an attempt has been made to show how the principal articles of the Hague and Geneva Conventions relating to prisoners of war were applied in Great Britain and Germany during the World War. It remains to be considered how far the over-riding principle laid down in Article 4 of the Hague Convention was observed. That article requires first, that prisoners must be treated with humanity; and second, that all their personal belongings, except arms, horses and military papers, shall remain their property.

With regard to the second requirement charges were made against both armies that this obligation was not observed, and it cannot be doubted that on both sides the wounded were sometimes on their first capture relieved of valuables. But this was not due to any official action; it was due to the unauthorized and wrongful acts of individuals. In respect of one matter only was there anything which could be treated as an authorized disregard of this article. British prisoners often had their boots taken from them by the Germans, either at first capture or later even in the camps in the interior of Germany. This was justified by the Germans on the ground that a man's boots were as much a part of his military equipment as his arms, and that therefore they were entitled to take them away. This claim seems only specious; the practice it sought to support or excuse certainly had the most cruel results in many cases, as men were forced to go about without any covering on their feet, or, if the boots were replaced, as they sometimes were, by wooden clogs, the men suffered much, especially during the winter or in mines from that unaccustomed footwear. However, in other respects this part of the article appears to have been fairly observed, though a somewhat liberal construction was placed on the expression "military papers" by both sides.

We turn now to the other part of the article, which enjoins that the prisoners must be treated with humanity. There existed during the war much misconception with regard to the treatment of prisoners in Germany, partly owing to the fact that only stories of horrors were published in England and the Allied countries, partly owing to the prominence given to this subject as a method of Allied war-propaganda, in the dramatic form of cinematograph films, and notably in the pictures relating to the work of Mr. Gerard, the American ambassador.

Some of the stories thus circulated were untrue. As an instance, it may be recorded that every story as to the tattooing of prisoners by the Germans, to which great prominence was given, pictures of the alleged victims being produced in the cheap illustrated papers, was, as far as possible, carefully investigated and was in no case shown to have any foundation. But the stories had their effect, for an idea got abroad that a prisoner once in the hands of the Germans was subject to every kind of indignity and cruelty.

It is possible now to weigh all the evidence, and express a judicial conclusion unaffected by the passions of war. The materials for doing so are ample. In the summer of 1915 a committee, presided over by Lord Justice Younger, was appointed by the British Government to enquire into the treatment by the enemy of British prisoners of war. As far as possible, each escaped or repatriated prisoner was examined by a person experienced in taking evidence, and arrangements were also made by the committee for examining the prisoners interned in neutral countries. In all, over 3,500 persons who had been prisoners in Germany, including 445 officers and 90 medical officers, were examined by this committee during the war, and most of their statements were printed and all indexed. After the Armistice the committee was asked to arrange that every returned prisoner should have an opportunity of making any complaint he wished. A questionnaire was carefully prepared and handed to every returned prisoner on his arrival at one of the dispersal camps to which all prisoners were sent before being allowed to return home. Each company of returning men was addressed by the person in charge of the investigation, and he impressed on the men the importance of stating frankly whether there was any complaint that they desired to make, and, if so, what it was. The result was remarkable. Out of not less than 170,000 forms issued only some 59,000 were even returned, and of these only about 22,000 contained information of any value whatever.

While this information was being collected, the then Attorney-General, Sir F. E. Smith (afterwards Lord Birkenhead), appointed a further committee to enquire into the breaches of the laws of war, the sub-committee dealing with prisoners being under the presidency of Mr. Justice Peterson. This sub-committee carefully considered the whole of this mass of evidence, and, in addition, the reports, nearly 2,000 in number, of the American and Dutch representatives who visited the camps. The German military law was also carefully studied.

Information was thus obtained with regard to 57 camps for officers and 78 main camps for men, besides the working camps, the number of which, shown by lists (admittedly not quite complete) from time to time furnished by the German authorities to the Netherlands minister, was 7,157. There were certainly not less than 7,500 places in all where one or more British prisoners were at one time or another confined, in addition to the camps on the eastern and western fronts, which are left for separate consideration.

The result of the investigation was that complaints, some uncorroborated, some trivial and some very serious, were received as regards 929 places, in only 349 of which—rather less than 5% of the whole—did a first study of the evidence seem to call for further examination.

It is clear, therefore, that no general charge of inhuman treatment is well-founded; it is, however, true that, apart altogether from the camps on the eastern and western fronts, there were actually, if not proportionately, a large number of cases in which the German treatment of British prisoners was certainly bad, and, in some cases, very bad.

To form a just estimate of the gravity of the situation so disclosed, consideration must be given to the differences of the military law and disciplinary practice of the two countries, and to the personal characteristics of the two peoples. With regard to the former, it is not necessary to repeat what has been said before about the severity of the German military law, and in actual practice the officers and non-commissioned officers in the German army are accustomed, apparently without lawful authority, to ill-treat their men physically in a way which would not be tolerated in England. Moreover, the German is naturally more amenable to strict discipline than the average Briton. Much of the ill-treatment complained of in the camps resulted from one or other of the causes above indicated; for the rest a disregard of the German military law or the regulations made for carrying that law into force was the main contributing cause.

In this connexion the attitude of the civilian population cannot be ignored. The anger aroused by the entry of Great Britain into the war induced on the part of German men and even German women cruelties which any decent person must look upon with disgust. It was inevitable that the passage of wounded prisoners from the battle-front to the interior of Germany should be attended with suffering. But that men grievously injured should be subjected to insults and physical ill-treatment is horrible, and that women bearing the Red Cross should throw water on men crying in agony for a drink, or should show to famished men soup and then pour it on the ground rather than allow them to partake of it is conduct almost incredible in its brutality. But such things occurred, not once or twice, but frequently in the early months of the war, and even later the conduct of civilians outside the prisoners' camps is worthy of the severest condemnation. Happily, however, passions were allayed, and after the first year of the war prisoners passed through from the front without being subjected to the insults and ill-treatment which unhappily were common at first.

Again, it was inevitable that, owing to the state of unpreparedness and want of experience of all the belligerents, much discomfort and suffering should be caused to those captured early in the war. This is passed over as being practically unavoidable, and in what follows, unless otherwise clearly stated, the conditions recorded are those after the organization was or ought to have been fairly complete.

Officers.—The treatment of officers in a camp depended very much on the commandant, and, to some extent, on the personality of the general of the army corps district in which the camp was situated. As officers were under no obligation to work, one grievance which was so fruitful a cause of trouble in the men's camps did not exist in their case.

In some camps where, as at Crefeld, the commandant was a gentleman, no valid complaint can be made of the treatment. In others, especially in the X. Army Corps district, where the malign influence of Gen. von Hänisch was paramount, some of the commandants were neither gentlemen nor capable of understanding the feelings of gentlemen, and there was continual trouble. At Clausthal and Holzminden, of which the two brothers Niemeyer were commandants, the state of affairs was intolerable. There were continual arrests for trivial offences and endless pinpricks on both sides. But, worse than this, the guards had orders to use their bayonets and rifles without adequate cause. On one occasion an officer, for looking out of a window, was shot at by order of the commandant at Holzminden, but fortunately not hit. At Strohen, another camp in this district, two officers were seriously wounded in a bayonet charge ordered personally by the commandant because a knot of them had gathered near a prohibited part of the camp.

One matter gave rise to much resentment. It was right and proper for the Germans to make occasional strict searches in view of the continual attempts to escape; but their method of carrying them out with detectives from Berlin assisted by police dogs which prowled round the completely stripped officers was offensive in the extreme.

But these were exceptional places and incidents. In general, the officers commanding were gentlemen, who treated their charges with courtesy and consideration, though in most cases there was occasional friction owing to the propensity of the young officers to attempt to escape, and, in some measure perhaps, owing to the inability of German officers to understand the exuberance—even in captivity—of British subalterns.

Men in the Main Camps.—In the main camps the treatment on the whole seems to have been reasonable, and in some cases more considerate than might have been expected. There was the usual trouble from the enforcement of a discipline far more severe than that to which the prisoners had been accustomed in their own army; from the violence with which the German non-commissioned officers treated offending prisoners, and, up to quite late in the war, from the use of savage police dogs in the camps, which the German Foreign Office declared to be "a military necessity, in view of the large number of prisoners of war in Germany," adding that, "having regard to the inferior number of prisoners in England no comparison can be drawn between conditions in the two countries." Trouble, and even loss of life, was caused by the too frequent use of firearms in some camps, as, for instance, at Wittenberg, where on one occasion men were ordered to return to their huts on a given signal and the laggards were fired on. But such incidents were not general, and occurred only in camps where the commandant was quite unfit for his post. In most cases the prisoners were treated fairly, if strictly; in a few, of which Friedrichsfelde may be taken as an example, at all events in its later stages, everything seems to have been done to make the prisoner's lot as little irksome and unpleasant as possible. An exception must be made in the case of Langensalza, where the treatment was from first to last rough in the extreme, a roughness which culminated just after the Armistice in the shooting by the guard, hurriedly called upon the scene, of a number of prisoners who were pulling down a building, a proceeding condemned by the German Court of Enquiry as a breach of Article 4 of the Hague Convention.

Working Camps.—Still leaving out of consideration the camps in the occupied districts on the eastern and western fronts, the great bulk of the ill-treatment occurred in the working camps, and by a curious paradox, it is in them that the best treatment is to be found. The ill-treatment was due to two main causes: first, to the fact that, except in very large working camps, the person in charge was a non-commissioned officer, and, second, to the passive resistance and in some cases the active insubordination of the British prisoners.

The non-commissioned officers, trained in the school of the German army and unrestrained by the presence of a superior officer, treated the prisoners in the way in which the rank and file of the German army have so often been treated. Men who refused to work, or in the opinion of the guards did not work hard enough, were kicked, spat upon, beaten with sticks, whips, clubs, rubber tubing, mining hammers and the butts of rifles. Those who escaped and were recaptured not infrequently received severe beatings before they were reported as recaptured and were formally punished for their offence. And all this was done notwithstanding the regulations, which, after laying down rules in the main reasonable enough for the use of arms by the guard, continue as follows (the quotation is from the instructions in force in the II. Army Corps district):—"Blows with the hand or fist or with sticks or clubs and kicks are forbidden. Except in the most exceptional and unusual cases it is inexcusable to lay hands on a prisoner."

Even where the non-commissioned officer was lawfully inflicting punishment, he would often by his perverse ingenuity add to its severity. Men were made to stand at attention on hot asphalted roofs, or before coke ovens, where they were nearly roasted, or sometimes in exposed positions without an overcoat in the freezing atmosphere of a winter's night. At more than one mine, the dark cells, in which, according to the German law, prisoners of war under punishment were obliged to pass their periods of close arrest, were constructed in close proximity to the main steam pipe and became so hot that the men had to strip themselves almost to the skin.

For all this there is no excuse or palliation possible; happily, however, there is another side to record. At some large German works the employers seem to have taken a real interest in their prisoners, and to have done whatever in them lay to make their lot endurable and even comfortable.[1] On the farms and similar places, the relations between prisoners and their employers were frequently, as in Great Britain, even cordial, and more than one repatriated British prisoner has spoken warmly of the kindness and consideration with which he was treated, though such cases were, of course, not common.

The impression produced by the study of all the available material is that there was neither in the main nor the working camps in Germany any officially recognized ill-treatment of prisoners; that there was, nevertheless, in many cases much cruelty by individuals, and that when as occasionally, but far too infrequently, happened, a prisoner could bring home to the authorities that some individual had exceeded his powers and acted outside the regulations, the offender was punished, sometimes by being sent away to the front, sometimes by a sentence to a term of imprisonment. On the other hand, it is also clear that in some cases the prisoners were treated, not only with humanity, but with kindness.

The reason for these contrasts is to be found in two things. First, the personal character of the man in charge, and, second, the independence of the army corps commanders, and even to some extent of the camp commandants, who not only placed their own interpretation on the regulations, but sometimes acted in deliberate defiance of them.

Men in the Occupied Districts.—While the above represents the considered opinion which results from the study of the very voluminous material available with regard to the camps in the interior in Germany, the same conclusion cannot be reached when the evidence dealing with the camps in the occupied districts is examined.

The cruelties inflicted on the prisoners in these places had their origin, and from the German point of view, their justification, as reprisals for alleged ill-treatment of Germans in British hands. It is not proposed to give here an account of the reprisals enforced on one side or the other, more than to allude to the severe conditions under which the first captured German submarine officers were interned in Great Britain, which resulted in the German Government retaliating by selecting from among the officers in their hands who bore well-known names (including among them the son of the former British ambassador to Berlin) and imprisoning them under exceptionally rigorous conditions. Most of the reprisals, while unpleasant enough for the victims, were not such as to amount to real cruelty.

But it is not too much to say that the treatment of the prisoners of war on the eastern and western fronts must, so long as the terrible story is remembered, bring indelible disgrace on the German nation, and on those responsible for the appalling cruelty inflicted on defenceless men. It was quite deliberate, as the following facts will show.

Eastern Front.—In the spring of 1916, German prisoners of war were sent to work at Rouen and Havre, and in May the German Government informed the British Government that it had in consequence decided to send 2,000 British prisoners to the occupied Russian territory to work under similar conditions to those existing at Havre and Rouen. They were accordingly sent, divided into four companies of 500 each, to four main camps, from which they were sent in smaller parties to work on numerous farms and in road-making and tree-felling. There is no serious complaint to make of the central camps, but at the others the conditions were very hard, the accommodation bad, and the *unter-offiziers* rough.

On Feb. 7 1917, the British Government received a German *note verbale* in which complaint was made that a considerable number of Germans were detained behind the British front in France, where it was alleged the "prisoners suffered from inadequate food, defective accommodation . . . as well as being subjected to hard work and irregularities in the matter of mails," and that they were exposed to German gunfire which "has resulted in several of them being killed." The Germans required that their men should be removed to a distance of at least 30 km. behind the firing-lines and "provided there with accommodation in accordance with the season of the year and hygienic needs." In default of the British Government notifying their compliance with these demands by Feb. 1 (the *note verbale* was dated Jan. 24 and received on Feb. 7), "a number of British prisoners will be transferred from camps in Germany to the area of operations in the western theatre of war where, in respect of employment, accommodation, food, and the question of mails, they will be treated in a manner corresponding to the practice of the British military authorities"—which means, of course, the practice alleged by the Germans, *i.e.* insufficient food, defective accommodation (only tents), hard work and irregular mails.

The British Government, in a *note verbale* for transmission to the German Government, dated Feb. 8 1917, gave the explicit assurance that the prisoners received the same food as the British troops, that 75% were in huts, the remainder being like many British troops in specially warmed tents with floor boards, that strict orders had been given against their being employed within the range of German gunfire though it was regretted that one man had been wounded by a shell which must have been fired at exceptionally long range, this being the only casualty which had occurred.

Within ten days of the date of the British reply, 500 men were sent, not to the western but to the eastern front, and they were "officially informed" that they would be sent to the trenches between Riga and Mitau and remain within the artillery zone by way of reprisal. On Feb. 25 these 500 men were forced to march 35 km. up the frozen river Aa, often through snow-drifts knee deep. Sledges followed to pick up the men who broke down from exhaustion, while the escort of Uhlans drove the stragglers on with lances and whips. Those who fell were robbed of their kit and property. Of the 500 who started, between 120 and 130 are said to have collapsed on the march. "They were brought in by transport later, but through their lying in the snow they were frost-bitten in the hands and feet."

Arrived at their destination, the men were kept waiting outside a "cavalry tent built on the ice of (marsh by) the river. It had wire beds on three racks, the bottom one being about one foot from the ground, so that the weight of a man's body weighed it down till he was lying on the snow or the ice."

The next morning they were paraded, and a notice was read out giving the reasons why they were there. The substance of this notice is given by one of the British prisoners who heard it, as follows:—

> "You are here on a reprisal because the English have German prisoners working in the firing-line in France. They have bad accommodation, bad food, bad treatment; they are under fire and 36 men have lost their lives. In return, you are to work here in the firing-line and will get bad treatment, bad food, bad accommodation, and 36 of you have got to die."

The way in which it corresponds with the substance of the *note verbale* of Jan. 24, already quoted, which the soldier who gave the evidence could not possibly have heard of, cannot escape notice, any more than the fact that the accommodation provided corresponds with the complaint that some of the Germans at Havre and Rouen were lodged in tents.[2]

The threats contained in the notice were carried out to the letter. The accommodation was bad, the treatment was bad, the food was bad, and numbers of men died, while more lost toes, fingers or hand through frost-bite.

The tent was a large cavalry tent pitched on the frozen marsh, with a foot or more of snow and ice inside and frequently under shell-fire. There were some small stoves, but no fuel or entirely inadequate fuel was provided. The "revier Stube" was a wretched peasant's cottage (in which the guard also was quartered) in charge of a brutal Sanitäter. Men in the last stages of illness were sent by sledge to Mitau. When the thaw came the tent was moved to Pinne, on the other side of the river, where deep mud took the place of snow and ice inside the tent. There was no water supply; such water as there was, was obtained by melting ice from the river or by digging down into the marsh, where filthy polluted water was obtained. Most of the men had no wash during the whole time they were there. The treatment was bad. Were it not established beyond the possibility of doubt, the story would be unbelievable. Men were driven out to work—breaking ice on the river, felling trees, making and repairing trenches under fire—when they could hardly stand, and had to be supported by their comrades to and from their work. One man died while being carried home; another, who had fallen exhausted on his way back to camp, was shot at point-blank range by the sentry; while a third man, who did not turn out quick enough one morning, was first abused and then attacked with a bayonet by the Sanitäter; further investigation disclosed the fact that he had been dead some hours, frozen in his bunk. The only punishment was tying to the post outside the tent for two hours after the men returned from work, under conditions hardly differing from crucifixion. A sergeant-major, having been urged by the interpreter to write home how they were being treated, eventually did so: "next day," he proceeds, "I got the letter back marked 'five days strong arrest.' After being hard at work from 6 A.M. to 6 P.M., I was tied to the pole from 7 P.M., during 36 degrees of frost." This is corroborated by several witnesses.

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[1] In some places the prisoners were even taken periodically to the local cinema, not always at their own expense.

[2] When the men had been in this place for a week the "German Government informed the Netherlands minister at Berlin, in a *note verbale* dated March 5, that British prisoners of war had not yet been sent quite close to the German firing-line on the Russian front."

That this treatment was deliberate and inspired by higher authority is evident from the fact that the sergeant-major says he obtained a copy of the orders from the guard, which stated "that no mercy was to be shown to us; we were men who had, every one of us, assisted in stopping the Kaiser's army from going to Paris; and they were to think of their comrades who were being brutally treated in France. Any soldier failing to carry out these orders was to be severely punished."

The guards were given three-quarters of a loaf each day, the prisoners, doing hard work, received one-sixth of a loaf. The guards were given good, thick soup; the prisoners, soup "that you could drink straight off." To such straits were the men reduced that it is recorded by more than one witness that the men became so ravenous that they would eat anything. "There were," says one, "many unburied Russian bodies lying round the camp. Some men were so reduced that when they saw any bones they would rush at them and eat them like a dog. It was pitiful to see men reduced to such an animal stage." No parcels were allowed before April, and no letters. When the remnants of this unhappy company returned to Mitau, 20,000 parcels were found stored. Had they been forwarded much suffering might have been avoided and lives saved.

The result of this inhuman treatment was what might have been expected. At the end of April 1917, there were 77 men left in the camp out of the 500 driven there in February. Of these, no fewer than 47 were certified by the German doctor as unfit to leave their beds. No less than 23 had died from exposure and starvation—some 16 in the camp, the rest in hospital at Mitau, besides those killed by the sentries or permanently injured by shell-fire or frost-bite.

There can be no doubt whatever that the sufferings endured by this unfortunate 500 were directly due to someone in authority in Berlin. The terms of the notice read out to the prisoners and of the orders given to the guard are in exact accordance with the terms of the *note verbale* of Jan. 24 1917.

Western Front.—The story of the treatment of the prisoners on the western front is not less terrible, indeed in some respects it is worse in that their sufferings were more prolonged, though they were not exposed to the same climatic conditions as their comrades in Russia. There is overwhelming evidence in this case also of the deliberation with which the suffering was inflicted.

In April 1917 it was agreed, after the communications of January and February mentioned above, that neither belligerent would employ prisoners within 30 km. of the firing-line, and on April 28 a telegram was sent by the British authorities informing the German Government that orders had been issued that all German prisoners were to be removed. On May 30 a further telegram was sent stating that they had all been withdrawn to a distance of 30 km. from the firing-line, and requesting immediate information that the British prisoners had been so withdrawn on the eastern and western fronts. No reply was received till July 4, when the British minister at The Hague transmitted a communication from the German Government stating that "there can be no question in any case of intentional retention or concealment of British prisoners," and on July 9 a further communication was received, dated Berlin June 15, saying "that the withdrawal of British prisoners of war in the German fighting zone to a distance of 30 km. behind the firing-line has been completed everywhere."

On July 2 the British and German representatives at The Hague had made the following important agreement:—

> "Reprisals against combatant and civilian prisoners of war may only be carried out after at least four weeks' notice of intention so to do has been given"; and second, "all captures are to be notified by the captor State to the other State with the least possible delay: every prisoner captured is to be allowed to communicate at once with his family and is to be provided with the means of doing so and the dispatch of his communication is to be facilitated: as soon as practicable after capture every prisoner is to be enabled to inform his family of an address at which they can communicate with him."

The statements with regard to the removal of the prisoners were not true. From early in 1917 up to the Armistice prisoners were kept by Germans within 30 km. of the front line and were there subjected to the most cruel treatment. After the above-mentioned agreement, and up to the date of the German offensive of March 1918, their number was probably not large, but after that date thousands were so detained under very bad conditions. No notice of the fact that they were to be so detained as a reprisal was ever given to the British Government.

In April 1917 a notice entitled "Conditions of respite to German prisoners" was handed at Lille to a British noncommissioned officer to be read out to his fellow-prisoners. It runs as follows:—

> "Upon the German request to withdraw the German prisoners of war to a distance of not less than 30 km. from the front line, the British Government has not replied; therefore it has been decided that all prisoners of war who are captured in future will be kept as prisoners of respite (sic). Very short food, bad lighting, bad lodgings, no beds, and hard work beside the German guns under heavy shell-fire. No pay, no soap for washing or shaving, no towels or boots, etc."

The notice proceeds to the effect that prisoners are to write home of their sufferings and that "no alteration in the ill-treatment will occur till the English Government has consented to the German request" and then the prisoners would be removed "to camps in Germany, where they will be properly treated, with good food, good clothing." Stationery would be supplied and "all this correspondence in which you will explain your hardships will be sent as express mail to England." Similar notices were read out at several other places. The threats were carried out to the letter. The accommodation was everywhere and always as bad as it could be. In the spring of 1917 prisoners were confined at Lille in conditions comparable only to those of the "black hole" of Calcutta, the crowding was terrible, there were no washing arrangements, and the only sanitary accommodation took the form of tubs in the rooms. The same conditions were renewed or continued in 1918; in the spring of that year the men were told that they were being badly treated as a reprisal. Prisoners were sent to places behind the lines, where they had to work for eight or nine hours on end and even longer on entirely insufficient food. The evidence of over 2,300 men has been obtained with regard to 78 of these places, at 20 of which they were exposed to Allied shell-fire which caused many casualties, while at 38 they were engaged in work directly connected with the operations of war, being required in some cases actually to take up ammunition to the German guns. They were forced to do this by brutal ill-treatment, and were worked till they could do nothing more and either died or were sent back to Germany mere wrecks of their former selves. Men died in the train, their bodies being taken out at stations on the way; many more died within 24 hours of their arrival at the hospital to which they were sent, and often a large percentage (up to 30 % it is said in some cases) within the next three or four weeks. Their physical condition is vouched for by 33 medical officers who were prisoners: 10 of them immediately behind the lines who saw what was going on, and the remainder detained in the interior of Germany who saw and tended the prisoners on their arrival there.

The under-feeding of the prisoners on this front was aggravated by three things: First, the Germans did not notify the capture of large numbers of them in obedience to the Hague agreement of 1917; second, the prisoners were forced to give as their address some camp in the interior of Germany to which parcels were sent for them and, except in a few cases, not forwarded; third, steps were taken to prevent the French and Belgians giving the prisoners any food.

The *Kommandantur* at Mons on April 4 1918 issued a notice in French of which the following is a translation:—

> "Conversation with prisoners is absolutely forbidden, as is giving them letters, food, or anything else. Breaches of this regulation will be punished by imprisonment for a maximum of three years or a maximum fine of 10,000 marks."[1]

This was repeated on July 28 and on Sept. 9 1918 the *Kommandantur* again called attention to the matter, the notice of the latter date containing a passage of which the following is a translation:—

> "Notwithstanding this warning, frequent breaches of the regulation have been reported. The Kommandantur, being responsible for strictly maintaining order, has instructed guards to use their firearms when it becomes necessary so to do."[2]

This was no mere threat. Many civilians, women among them, were shot for attempting to help the starving prisoners, and many prisoners were shot on the spot even for attempting to pick up the remains of food which they saw in the road as they marched along.

This treatment was continued right up to the Armistice, when prisoners in the last stages of exhaustion and starvation stumbled into the British lines hardly recognizable as British soldiers. The High Command had faithfully kept their promise of "very short food, bad lighting, bad lodgings, no beds and hard work beside the German guns under heavy shell-fire."

PRISONERS OUTSIDE EUROPE.—Something must be added with regard to the treatment of prisoners elsewhere than in Europe, if only because serious complaints were made on both sides as to their treatment with regard to accommodation and food, especially in East Africa. There can be no doubt that much suffering was endured by prisoners of both nationalities in this part of the world; but it was mainly due to the conditions of the campaign and to the climate, while on the British side there appears to have been much justification for the complaints which were made against individual Germans for their want of consideration for the devoted men and women missionaries whom the fortunes of war had brought into their hands.

Turkey.—Little can be said with regard to the application of the Hague Convention by Turkey, because the Government of that country made practically no attempt to conform to the regulations contained in it. Their treatment of prisoners varied from an almost theatrical politeness to the great, to complete indifference to suffering—almost to barbarism—in the case of men of little esteem.

These oriental characteristics may be best illustrated by the fate of the British prisoners captured on the fall of Kut el 'Amara at the end of April 1916, when, as Enver Pasha stated, they became "the honoured guests of the Turkish Government." The officers were sent by steamer to Bagdad and thereafter drafted to various camps in Anatolia. The men were marched 100 m. to Bagdad, in stifling heat, with no sort of organization for food transport or medical care of those worn out by the privations of the long-drawn-out siege. The Turkish commandant promised that the day's march should not exceed eight miles. He kept his promise for one day, and thereafter the men were forced to march from 12 to 18 m. a day, herded like sheep by mounted Arabs who flogged forward the stragglers. At night they lay out on the open ground without any shelter. Many fell out and died. At one point 350 men were left behind in a sort of cowshed, so sick as to be unable to move, and were picked up by the already overcrowded boats, where there was room only for the most desperately ill to lie down. Arrived at Bagdad, all but 500, who were too ill even for the Turks to force them forward, were sent on a 500-m. march to places where they were to work.

Out of a total of 13,670 of all ranks believed to have been captured at Kut, in the course of two and a half years 1,425 escaped or were repatriated, 2,611 are known to have died, while 2,200 were missing, and there were left in the hands of the Turks only 7,414, or little more than half of those captured.

Up to Dec. 1917 the Ottoman Government steadily refused to permit neutrals to inspect the camps, and though this concession was then made, it was so worded as in effect to be useless.

Bulgaria.—If due allowance is made for the backward condition of the country, it must be admitted that the treatment by the Bulgarians was correct, though complaint was made that British soldiers were flogged for disciplinary offences. This is permitted by the military law of Bulgaria but after representations were made on the subject the practice was abandoned in the case of British soldiers.

The food given the prisoners was the same as that given to the Bulgarian soldiers, and the hospital treatment was not less good than that given to their own men. The accommodation was rough but in general no worse than that of the inhabitants of the country. Every effort appears to have been made to improve conditions where they were remediable, and the authorities seemed anxious to treat their British prisoners with consideration. An unusual amount of liberty was accorded to the prisoners, and there is no little evidence of the kindness and friendliness of the Bulgarian civilians to the British.

Austria.—The few British prisoners captured by Austria were treated with consideration and in accordance with the provisions of the Hague Convention.

NEGOTIATIONS DURING THE WAR.—During the World War a notable step was taken in arranging for meetings between representatives of the belligerents for the discussion of matters relating to prisoners of war. In the spring of 1917 meetings had taken place between French and German representatives with useful results, and, largely owing to the insistence of Lord Newton, who was then in charge of the Prisoners of War Department of the British Foreign Office, a meeting between German and British representatives was arranged and took place at The Hague in June. Great Britain was represented by Lord Newton, Lord Justice Younger and Gen. Belfield, and Germany by Gen. Friederich and two others, the meetings being presided over by M. van Vredenburg on behalf of M. Loudon, the Netherlands Minister of Foreign Affairs. At this meeting arrangements were made for the repatriation of disabled combatants, for the internment of invalid interned civilians, for the repatriation of medical personnel still retained by the belligerents, and for the mitigation of certain punishments inflicted on prisoners of war. It was agreed that reprisals should only be carried out after a month's notice of intention to do so had been given and it was also agreed that all captures were to be notified with the least possible delay.

This meeting was followed by one which lasted from June 8 to July 14 1918, at which the British representatives were Lord Cave, Lord Newton and Gen. Belfield, the first-named being obliged to return before the agreement was signed. It contained no fewer than 60 articles with six annexes thereto, and dealt with the following subjects: the repatriation of invalids;

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[1] The original wording was:—

"Il est absolument interdit de parler aux prisonniers ou de leur passer des lettres, des vivres, ou d'autres objets quelconques. Les infractions à cette prescription seront punies d'un emprisonnement pouvant s'élever à 3 ans, ou d'une amende pouvant atteindre 10,000 mark."

[2] The original wording was:—

"Malgré cette défense, de nombreuses infractions ont été signalées. La Kommandantur ayant pour tâche de maintenir l'ordre le plus strict, les soldats de surveillance ont reçu l'instruction de *faire usage*, le cas échéant, *de leurs armes à feu*."

the internment in a neutral country of prisoners who had been a long time in captivity; the protection of prisoners after capture; prisoners retained in an area of operations; notification of capture; equipment and organization of camps; food; punishments; help committees; relations with protecting powers; parcels and postal services; and the publication of the agreements in the different camps. Much was done by these two meetings to translate into a concrete form the principles laid down in the Hague Conventions, and to mitigate the lot of the prisoners, though the full benefit of the second agreement was never realized as it was never formally ratified.

In Dec. 1917 Lord Newton and Gen. Belfield met Turkish representatives at Berne under the presidency of M. Ador, of the Swiss Political Department, and an agreement was drawn up on lines similar to those of the German agreements.

QUESTIONS FOR THE FUTURE.—The foregoing investigation of the operation of the Hague Convention during the World War leads one inevitably to ask whether it is desirable and practicable to make any substantial amendment to that Convention. It is a most difficult question to answer, for, although not generally recognized, the whole problem is military rather than humanitarian. While of course all active ill-treatment should be prohibited, the lot of a prisoner must not be made so attractive in comparison with that of soldiers in the firing-line as to afford a temptation to them to desert or to do anything incompatible with their military duty. Further, while it is possible for the voices of humanity and charity to make themselves effectively heard in times of profound peace, it is useless then to formulate regulations which public opinion, stirred to its depths by alleged misdeeds of the enemy, will not allow to be observed, and which the military authorities will disregard in time of war. All that can be usefully accomplished is to put into the form of rules those principles which the good sense of all civilized nations accepts as correct, and for this purpose to use the experience gained during the World War, of which not the least important part was the value of direct conference between representatives of the belligerents during active hostilities for the purpose of dealing with the detailed application of those principles.

But it does seem desirable that regulations should be made dealing with the case of civilians found in any enemy country at the outbreak of war, for it is improbable that in any future war of nations civilians will be allowed to return home or to remain at large in view of the means of communication which modern science has made possible.

The value of the inspection of prisoners-of-war camps by the accredited representatives of the protecting State has been made abundantly clear, and their right to visit the camps, which was the result of an agreement made early in 1915 between the British and German Governments should be made permanent. It will, however, be extremely difficult to reconcile the desires of the humanitarians and the military authorities with regard to camps within the area of hostilities, though it will probably be found possible to come to some agreement defining the nature of the work on which prisoners of war may not be employed, and an attempt should be made to make more clear than it is at present the obligation of the captors with regard to the feeding and clothing of the prisoners in their hands.

For military reasons there would be no chance of obtaining a general assent to the prohibition of reprisals, but provisions similar to those contained in the agreements with the German and Ottoman Governments requiring notice before reprisals are made might be accepted.

Finally, those agreements made during the war with regard to the repatriation of disabled prisoners, and the conditions on which a prisoner should be entitled to internment in a neutral country if accommodation could be found, might be made of universal application.

There remains the most difficult question of all: whether it is possible to provide penalties for the infraction of any regulation which may be made, and to establish a tribunal with authority to punish individuals and States. Articles 227–229 of the Peace Treaty with Germany, satisfactory from one point of view, savour too little of the calm administration of justice. They are not reciprocal, the vanquished are given no right to have judicially investigated any complaints they may have against the victors. It would be far more satisfactory to have an alleged "atrocity" investigated than that, for want of public investigation, an unfounded legend of brutality should grow up.

It is perhaps too much to expect that, at the conclusion of a war in which the victors have made great sacrifices and undergone great suffering, they should take steps to establish a court for the trial of charges against their own people, but if provision had been made in time of peace for the establishment of a court to investigate all charges of wrong treatment in time of war the victors would not depart from their agreement. The establishment of such a court may well occupy the attention of statesmen and international lawyers.

AUTHORITIES.—The following is a complete list of official publications:—Correspondence between H.M. Government and the U.S. ambassador respecting the treatment of prisoners of war and interned civilians in the United Kingdom and Germany: Misc. 7 (1915), cd. 7817; do. Misc. 5 (1915), cd. 7815. Reports by United States officials on treatment of British prisoners of war and interned civilians in Germany: Misc. 11 (1915), cd. 7861; Misc. 3 (1916), cd. 8161; Misc. 14 (1915), cd. 7959; Misc. 15 (1915), cd. 7961; Misc. 19 (1915), cd. 8108; Misc. 16 (1916), cd. 8235; Misc. 26 (1916), cd. 8297; Misc. 7 (1917), cd. 8477. Report on conditions existing at Ruhleben: Misc. 13 (1915), cd. 7863. Report by Dr. A. E. Taylor on the conditions of diet and nutrition at Ruhleben: Misc. 18 (1916), cd. 8259; Misc. 21 (1916), cd. 8262. The same, and on proposed release of civilians: Misc. 26 (1916), cd. 8296; Misc. 35 (1916), cd. 8352. Correspondence respecting the employment of British and German prisoners of war in Poland and France respectively: Misc. 19 (1916), cd. 8260. Correspondence with U.S. ambassador respecting transfer to Switzerland of British and German prisoners of war: Misc. 17 (1916), cd. 8236. Reports of visits of inspection made by officials of the United States embassy to various internment camps in the United Kingdom: Misc. 30 (1916), cd. 8324. Report on the treatment of prisoners of war in England and Germany during the first eight months of the war: Misc. 12 (1915), cd. 7862. Report on the transport of British prisoners of war to Germany Aug.–Dec. 1914: Misc. 3 (1918), cd. 8984. Report on treatment of British prisoners and natives in German East Africa: Misc. 13 (1917), cd. 8689; do. London 1918. Correspondence with German Government respecting the burning of G. P. Genower, A.B.: Misc. 6 (1918), cd. 8987. Correspondence respecting the use of police dogs: Misc. 9 (1917), cd. 8480. Correspondence with H.M.'s minister at Berne respecting reprisals: Misc. 29 (1916), cd. 8323. Report on Wittenburg typhus epidemic: Misc. 10 (1916), cd. 8224; do. Gardelegen, Misc. 34 (1916), cd. 8351. Report on the treatment of officers in camps under X. Army Corps: Misc. 28 (1918). Report on the treatment of British prisoners behind the lines in France and Belgium: Misc. 7 (1918), cd. 8788; do., Misc. 19 (1918), cd. 9106; do., Misc. 27 (1918). Report on the employment of British prisoners in coal and salt mines: Misc. 23 (1918), cd. 9150. Agreement between the British and German Governments concerning combatant and civilian prisoners of war: Misc. 12 (1917), cd. 8590; do., Misc. 20 (1918), cd. 9147. Report on the treatment of British prisoners of war in Turkey: Misc. 24 (1918), cd. 9208. Agreement between the British and Ottoman Governments respecting prisoners of war and civilians: Misc. 10 (1918), cd. 9024. Work of the Central Prisoners of War Committee 1916–1919: *Revue Internationale de la Croix Rouge* (No. 26, Feb. 1921). Report of the Joint Committee to enquire into the organization and methods of the Central Prisoners of War Committee, cd. 8615.

Up to Jan. 1922, neither the British Government Committee on the treatment by the enemy of British prisoners of war, nor the Committee on the Breaches of the Laws of War, had published any general report; nor had the Reports of the representatives of the Netherlands Government been published. (R. B. D. A.)

PROFITEERING.—The word "Profiteering" was introduced in 1919 into an Act of Parliament, and thus may be said to have obtained official recognition as part of the English language. It had become current colloquially quite early in the World War. The following implicit definition was given by Sir Auckland Geddes (as president of the Board of Trade) in Parliament on the second reading of the Profiteering bill (1919):—"To profiteer is to make an unreasonably large profit, all the circumstances of the case being considered, by the sale to one's fellow-citizens of an article which is one or one of a kind in common use by the public, or is material, machinery, or accessories used in the production thereof."[1] As an urgent social and economic prob lem the conception of "profiteering" was a new one as well as the name attached to it, since the possibility of unreasonably high profits being reaped on a large scale to the public detriment from the sale of articles in common use was a direct outcome of the conditions of disorganized trade and world-shortage of commodities which resulted from the World War. It is clear that under normal economic conditions high profits do not necessarily involve high prices, but may even be obtained as a result of greater efficiency of organization or production. It is probably true to say that before the war, as a rule, a free market and plentiful supplies afforded, in the case of most commodities in general use, an effective safeguard against excessive profits based on excessive prices.

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[1] Hansard, vol. 119, No. 114, Col. 545, Aug. 11 1919.

It was no doubt partly with this consideration in view that (to meet the demand for a clearer definition of the offence) a provision was inserted in the bill in Committee, laying down that a rate of profit not exceeding the pre-war rate should not be deemed "unreasonable." It is with profiteering in this technical sense that this article deals, and not with the wider economic problems affecting profits as such.

The Profiteering Act, 1919, was thus a temporary measure designed by the British Government to meet peculiar circumstances. It was a measure "to check profiteering," and accordingly was framed to avoid, so far as possible, any interference with legitimate commercial enterprise. The great difficulty presented by legislation of this kind is to design an instrument of such accuracy, and to use it with such precision, that it shall deal effectively with the evil against which it is directed, without hitting the sensitive organism of trade and industry, the recovery of which was in itself an essential factor in the removal of those conditions of shortage and high prices of which profiteering was to a large extent a symptom. How far the Profiteering Acts succeeded in solving this difficulty is a matter of opinion, but this was the problem they had to deal with.

The main powers conferred upon the Board of Trade by the Profiteering Act, 1919, may be summarized as follows:—(*a*) to investigate prices, costs and profits at all stages; (*b*) to receive and investigate complaints regarding the making of excessive profits on the sale of any article to which the Act was applied by the Board of Trade, and after giving the parties an opportunity of being heard either to dismiss the complaint or to declare the reasonable price for such articles, and to order the seller to refund to the buyer any amount paid in excess of such reasonable price. The Board also had power, where it appeared to them that the circumstances so required, to take proceedings against the seller in a Court of Summary Jurisdiction; (*c*) to obtain from all sources information as to the nature, extent and development of trusts, and similar combinations.[1]

The Act was applied by the Board of Trade by a series of orders to practically every article of ordinary everyday use, including all articles of wearing apparel, household utensils and requisites, articles for mending and knitting, furniture, building materials, drugs and medicinal preparations, medical and surgical appliances and dressings, mineral waters, all articles used for fuel and lighting, tools, weights, measures, weighing and measuring instruments, motor spirit, stationery, and, in agreement with the Ministry of Food, to practically all articles of food the price of which was not otherwise controlled, including milk, bread, fish, tea, coffee, cacao, margarine and meat. Further, in accordance with extended powers given by Section 2 (2) of the Profiteering (Amendment) Act, 1920, the following processes were by order brought within the operation of the Acts: the repairing, altering or washing of articles of wearing apparel and household linen, etc., the repairing, altering or cleaning of clocks and watches, and the repairing or altering of boots, shoes and umbrellas.

For administrative purposes the Act empowered the Board of Trade to establish or authorize local authorities to establish local or other committees to which the Board might delegate any or all of their powers under the Act (except the power to fix maximum prices). The work fell naturally into two broad sections, viz.: (1) the larger transactions of wholesalers or manufacturers which raise wide questions affecting whole trades or industries, and (2) retail trade, which is much more affected by local conditions. To deal with (1) the Board of Trade set up a Central Committee, with its headquarters in London; to deal with (2) the Board invited local authorities throughout the country to appoint local profiteering committees.

Local Committees and Appeal Tribunals.—Over 1,800 local committees were established in the United Kingdom, and the vast majority continued in existence until the expiration of the Profiteering Acts in May 1921. Their constitution, powers and procedure were defined by regulations made by the Board of Trade, who delegated to the local committees the bulk of their powers under the Act in relation to retail sales. The regulations provided among other things that labour, women, and the retail trade should be adequately represented on local committees; that complaints should, except in special cases, be heard in public; that any member who happened to be a trade competitor of the respondent or otherwise personally interested should be disqualified from adjudicating; that a complaint should be lodged in writing within four days of the sale, and a copy forwarded to the respondent within seven days of its receipt; that a preliminary investigation should first take place, after which if a *prima facie* cause of complaint had been disclosed at least three days' notice should be given to the parties of the date fixed for hearing the complaint; and that both complainant and respondent should always be given an opportunity of being heard. The object of the preliminary investigation was to weed out frivolous complaints. The rule was laid down that it should invariably be held *in camera* and that the names of the parties to any complaint should not be made public until such time as the complaint was heard in public. The Board of Trade also appointed 108 appeal tribunals, to which the seller had a right of appeal against the decision of a local committee. The total number of complaints investigated by local committees during the operation of the Acts (Aug. 1919 to May 1921) was over 4,700; of these some 73% were dismissed. Only 173 appeals were made, of which roughly two out of every five were dismissed. Only 202 prosecutions by local committees were reported to the Board of Trade; in these fines were imposed to the amount of some £1,786, and costs ordered against the seller to the amount of £455. Within the limits laid down by the regulations local committees had full freedom of action and were in no sense controlled by the Department. The Department, however, both by correspondence and through a small staff of six or seven travelling inspectors, kept in close touch with the committees' work, and helped them wherever possible with advice and information. Apart from the work arising out of actual complaints, the local committees had the power to hold general investigations into prices, costs and profit at the retail stage, but comparatively few committees undertook such investigations. The report of the county of London appeal tribunal, which dealt with a much larger number of cases than any other appeal tribunal, has been published as a Parliamentary paper.

Central Committee.—This body, about 150 in number, was widely representative, including among its members manufacturers, traders, consumers, trade-union representatives, economists, representatives of the coöperative movement, etc. Mr. McCurdy, its first chairman, was succeeded after about 10 months by Mr. John Murray, M.P. The Board of Trade made regulations laying down the constitution, powers and procedure of the Central Committee, to which the Board delegated the power (*a*) to investigate prices, costs and profit at all stages; (*b*) to investigate, consider and determine complaints regarding unreasonable charges arising out of the wholesale sale of any articles to which the Act was applied; and (*c*) to obtain information regarding trusts and trade combinations.

The Central Committee rarely met as a committee. Its functions were rather those of a panel, and the work was performed by three standing committees: the Investigation of Prices Committee, the Complaints Committee, and the Standing Committee on Trusts. Every member of the Central Committee was appointed on one at least of these standing committees, which in turn appointed from time to time small sub-committees. These sub-committees, through which the bulk of the work was done, were composed of members of the Central Committee with the addition often of outside persons appointed (in practice at the suggestion of the sub-committee or standing committee concerned) by the Board of Trade.

The Investigation of Prices Committee undertook the investigations into the cost of production of various articles in all stages of their manufacture where they considered it desirable to obtain such information for the benefit of the public or of the Board of Trade. The reports on these investigations were published from time to time as Parliamentary papers; they cover the following subjects: agricultural implements and machinery, aspirin, biscuits, boot and shoe repairs, brushes and brooms, clogs, costings in Government department, furniture, gas apparatus, matches, metal bedsteads, motor fuel, pottery, standard boot and shoe scheme, tweed cloth, wool and worsted yarns, wool, and the wool-top-making trade.

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[1] Powers were also conferred on the Board of Trade by the Principal Act to fix maximum prices, and to authorize local authorities under suitable conditions to buy and sell any article or class of articles to which the Act was applied. These powers were only intended to be held in reserve for use in an emergency. Neither power was ever exercised, with the single exception of the temporary fixing of the price of motor spirit during the railway strike in the autumn of 1919. Further provisions were embodied in the Act (or added by the Amendment Act of 1920) giving the Board compulsory power of obtaining information, providing proper safeguards for confidential information and for secret processes, providing against victimization of complainants by sellers refusing to sell, excluding from the scope of the Acts sales for export or sales by public auction or competitive tender, and laying down maximum penalties by way of fine or imprisonment for persons offending against the Acts.

The Complaints Committee undertook the investigation of specific complaints arising out of transactions or sales other than retail sales. In practice the Complaints Committee became, like the Central Committee itself, a panel, working almost exclusively through sub-committees or tribunals. The procedure was analogous to that of local committees, the complaint being first considered *in camera* by a sub-committee called the Preliminary Investigation Committee, who, if they were of opinion that the complaint did not give sufficient particulars or did not disclose *prima facie* grounds for hearing the complaint, had power (after giving the complainant an opportunity of being heard) either to dismiss the complaint forthwith or to require the production of further or better particulars or grounds of complaint within a stated period, failing which the complaint was dismissed. If the Preliminary Investigation Committee were satisfied that a *prima facie* cause of complaint was disclosed, a tribunal was appointed [1] to hear the case, seven days' notice being given to the parties of the time and place fixed for the hearing. The tribunal had power either to dismiss the case, or (if they were satisfied that an unreasonable profit had been made) to order the seller to repay to the complainant any amount paid by him in excess of the price declared by the tribunal to be reasonable; further, the tribunal might take proceedings against the seller before a court of Summary Jurisdiction. The hearing of all complaints before the tribunal was normally in public, subject to the discretion of the tribunal in particular cases, and the parties could conduct their own cases or be represented by counsel or otherwise. As in the case of local committees, trade competitors or persons otherwise personally interested were disqualified from adjudicating on the tribunal.

The Complaints Committee also investigated specific transactions brought to their notice, even where there was no formal complaint; *e.g.* cases referred to the Board of Trade by local committees where a complaint against a retailer had been dismissed, but it appeared probable that profiteering had taken place at some earlier stage of distribution or manufacture. The following figures show the number of matters referred to the Complaints Committee and the manner in which they were dealt with:—Complaints lodged or specific transactions referred to the committee, 607; profiteering found to exist, 73; number of prosecutions undertaken, 24; number of convictions obtained before the magistrates, 17; fines imposed, £815; costs ordered, £205.

The Committee on Trusts was charged with the duty of obtaining such information as is specified in Section 3 of the Profiteering Act, 1919, which required the Board of Trade to "obtain from all available sources information as to the nature, extent, and development of trusts, companies, firms, combinations, agreements and arrangements connected with mining, manufactures, trade, commerce, finance, or transport, having for their purpose or effect the regulation of the prices or output of commodities or services produced or rendered in the United Kingdom or imported into the United Kingdom, or the delimitation of markets in respect thereof, or the regulation of transport rates and services, in so far as they tend to the creation of monopolies or to the restraint of trade."

This section embodied a recommendation of the departmental committee appointed by the Minister of Reconstruction "in view of the probable extension of trade organizations and combinations, to consider and report what action, if any, may be necessary to safeguard the public interest," which reported in 1919. It is to be noted that the Act gave no power under which any coercion could be exercised on a trade combination except in so far as it brought itself within the penal clauses of the Act by charging unreasonably high prices. Parliament appears to have taken the view that powers of this kind ought to be the subject of further permanent legislation, and that the temporary powers of enquiry and publication given by the Profiteering Act should make it possible by preliminary investigation to get together a body of facts which would be of great value when permanent legislation on the question of trade monopolies was introduced. The numerous reports by sub-committees of the Committee on Trusts constitute in fact such a body of information. They show, on the one hand, that many of the big combinations now existing have been of public benefit; that by economies in working and efficient organization of manufacture, buying, and selling, they have been able to keep prices at a lower level than they must otherwise have attained. On the other hand, instances of abuse of monopoly power have been brought to light, and, in general, many of the reports are in favour of the provision of some kind of statutory power, under which action could be taken if a strong and close organization controlling the whole or nearly the whole of an essential trade or industry adopted a policy contrary to the public interest.

The following is a list of the investigations on which reports by the Committee on Trusts have been published as Parliamentary papers:—dyes and dyestuffs, dyeing, finishing, bleaching and printing, electric cables, electric lamps, explosives, farriery, fish, fixed retail prices, fruit, glassware, iron and steel products, laundry prices, meat, milk, oil and fats, pipes and castings, road transport rates, salt, sewing cotton, soap, tobacco, uniform clothing, vinegar and yeast.

Reports on the following subjects by sub-committees jointly appointed by the standing committees on Prices and Trusts have also been published:—bricks, cement and mortar, dyeing and cleaning, light castings, stone and clayware, slates and roofing materials, and timber.

The Profiteering Act was to remain in force for six months only. It was, however, continued for a further three months by the Profiteering (Continuance) Act, 1919, and again for a further twelve months (until May 19 1921) by the Profiteering (Amendment) Act, 1920. The Amendment Act was largely concerned with improvements of machinery in points of detail where experience of actual working had disclosed defects. It contained, however, in Section 1 an important new provision, the object of which was to encourage the various trades and industries to take into their own hands the business of checking profiteering.

Section 1 reads as follows:—

(1). Where any persons or associations of persons appearing to the Board of Trade to represent a substantial proportion of the persons engaged in the production or distribution of any article or class of articles to which the Profiteering Act, 1919 (hereinafter referred to as 'the principal Act'), is applied, submit to the Board of Trade a scheme limiting the profit to be allowed on the manufacture or distribution of the article or class of articles at all or any stages of manufacture or distribution, the Board of Trade may, if they think it expedient, approve the scheme, and, where any such scheme is so approved, any profit sought or obtained in connexion with the sale of any article to which the scheme relates, which does not exceed such profit as is allowed by or under the scheme, shall not be deemed unreasonable for the purposes of section one of the principal Act.

(2). If the Board of Trade are satisfied that any scheme so approved secures an adequate supply to the home market of any articles or classes of articles to which the principal Act is applied, the Board of Trade may by order exempt producers who comply with the scheme from any general investigation under section one, subsection (1) (*a*) of the principal Act in respect of those articles or classes of articles and any articles of a similar description.

The preliminary work of investigation and negotiation in connexion with schemes submitted under this section was undertaken by the Central Committee, the final approval or disapproval resting, of course, with the Board of Trade. Owing to the unexpectedly rapid fall of markets and alteration in the general trade outlook in the latter part of the year 1920, conditions were not very favourable for profit-limiting schemes. Very few were put forward; of these some were withdrawn or not proceeded with, and only two [2] (relating to men's ready-made and made-to-measure clothing and to the retail sale of coal in the London area) were actually approved by the Board of Trade.

The foregoing is a brief review of the principles on which the Profiteering Acts were based, the machinery by which they were worked, and the nature of the work. The Acts were denounced as harassing the small retail trader while enabling the profiteer on a large scale to escape; but complaints against the harassing nature of the Acts came from all quarters, wholesaler, retailer, and manufacturer alike. Although it is possible that investigations may in rare cases have caused hardship to particular interests, this can hardly be held to outweigh the valuable results in helping to dispel misconceptions and suspicions by publishing facts. The figures already quoted with regard to complaints would indeed seem a sufficient answer to the charge that trade was unduly harassed. On the other hand the deterrent effect of the Acts must not be overlooked. From the point of view of checking profiteering, the mere existence of the penal clauses of the Acts and of the machinery for their enforcement was undoubtedly of great value. As regards the absence of any definite standard of a reasonable rate of profit, the original Profiteering bill was criticized in Parliament on the ground that it gave no clear definition of the offence. This criticism was met to some extent by the proviso that a rate of profit not exceeding the pre-war rate should not be deemed unreasonable; and in the Amendment Act the position was further defined by making it clear that the standard of comparison to be aimed at was the percentage rate of net profit, not gross profit, thus ensuring that the seller should not benefit unduly by the fact that his oncost or establishment charges showed a smaller increase than did cost of wages and raw materials.

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[1] Originally by the Complaints Committee, but under the amended regulations of Aug. 7 1920 by the Chairman of Central Committee.

[2] Reports on these by joint sub-committees of the Standing Committees on Prices and Trusts, and also on the working of the standard boot and shoe scheme (which was not technically a scheme under Section 1), have been published as Parliamentary papers.

A word may be added with regard to anti-profiteering legislation outside the United Kingdom. The majority of European countries, including Belgium, France, Germany, Italy, Norway, Poland, Portugal, Rumania and Sweden, passed some form of legislation with a view to checking profiteering or speculation in the necessities of life. Legislation with this object was also passed in Australia, Canada, New Zealand, the Union of South Africa, and a number of the smaller British possessions. A number of foreign countries or British possessions studied through their representatives the working of the Profiteering Acts, 1919 and 1920, and several (as for example Italy, South Africa, Gibraltar and Sierra Leone) availed themselves largely of English experience in framing their anti-profiteering legislation. (E. R. E.)

UNITED STATES

"Profiteering," as the term has been used in the United States, may be roughly defined as consciously taking and retaining profits considerably in excess of the return necessary to equilibrate demand and supply, especially when such profits are the result of prices enhanced by the activity or policy of the recipient. Its meaning has therefore a direct relation to the current conception of a legitimate business "profit"—a point on which public opinion during the World War became peculiarly sensitive. Probably, conscious direct control of industrial processes never reached such development in the United States as during the World War. Prices were fixed and both supply and demand controlled. Income taxes were highly developed. An unusual mass of information concerning cost, production, consumption and stocks was obtained. As a result much became known of the profits made in different industries, and much information concerning them was given out—sometimes with the purpose of exercising a check. In the United States the chief sources of information are the cost reports of the Federal Trade Commission and data compiled from the income-tax returns. If it be remembered that not all that seems excessive is profiteering, it will be of value to recapitulate some of these data.

According to income-tax returns from some 7,000 corporations their net earnings of the pre-war years 1911–3 averaged 11% on invested capital. This corresponds well with the common judgment at that time that from 10% to 12% (depending on the risk) was a fair profit in most industries. Unfortunately, returns are not available in published material for these same corporations in 1917, but for 1918—a year of lower profits—they averaged 15%. The year 1917 was the time of maximum profits. We know that in that year the total net income of 31,500 corporations was well in excess of the total for all corporations in the country in 1913. These corporations made an average net return on investment of approximately 22%, and more than one-half of their net income was reported by those earning 30% or more. (It is to be noted that these figures do not include corporations earning under 15%. Nevertheless, it is probable that all corporations averaged approximately 18%.)

These income-tax returns are not conclusive. The padding of investment account and of costs was all too common, and the statistical treatment of the returns is not satisfactory. They do indicate, however, that average profits increased considerably between the pre-war period and 1918. More accurate and illuminating figures concerning particular industries were obtained by the Federal Trade Commission, and a few representative cases will give the best understanding of the situation. A study of the costs of 37 wheat-flour companies showed that the average earned on investment was 12·6% in the fiscal year 1913–4, 17% in 1914–5, 38·4% in 1916–7, and 34% in 1917–8. That this increase in profits was not due solely to increase in business is evident from the fact that the percentage earned on sales also increased, the rate being 3·4% in 1913–4 and 6·5% in 1916–7. In 1917 there was apparently no limit to the price purchasers were willing to pay, the condition being one of panic. The large profits of the year were partly due to the enhanced value of unsold stocks and to speculative profits derived from feed. In the next year profits were somewhat abated by Government regulation. The Federal Trade Commission, after noting that the margin of 25 cents per bar. allowed by the Food Administration was larger than the normal profit, said: "The Commission's investigations of costs and profits for recent months indicate that 25 cents a barrel is being taken by many millers as a guaranteed net profit after paying all income and excess profit taxes. . . ." In other words (1) taxes payable on net income were being wrongfully treated as expense, and (2) a maximum margin was being made the minimum. This course involved some fraud and showed concerted action. Depreciation and salary accounts were padded and capital charges were treated as operating expenses.

Twenty-two manufacturers of farm implements made at this time about 85% of the product in the United States. Their profits increased from about 9% on investment in the years just prior to the war to 16·6% in 1917 and 19·9% in 1918; and the rate of profit on sales increased several fold. There was no general shortage of farm implements and no unusual demand, for exports were cut off. The Commission says: "The large increase in the prices and profits of manufacturers in 1917 and 1918 was due in part to price understanding or agreements . . . and, to a more limited extent, the profits of dealers seem to have been due to similar activities."

From Senate Document No.248 (65 Cong. 2nd Session) further evidence of profiteering may be gained. It appears that oil companies circulated reports that the supply of gasoline was dangerously short, for the purpose of maintaining prices of that commodity while making "enormous" profits on fuel oil. Concerns bottling or canning vegetables, which had made future contracts, sometimes withheld portions of their output from delivery on such contracts and sold in the higher "spot" markets. In frequent cases licences were revoked by the Food Administration. The practice of such concerns in maintaining re-sale prices for jobbers contributed toward maintaining the general high level of prices and increased profits in some instances. According to the same document the steel companies in 1917, prior to Government price-fixing, made abnormal profits, and a number continued to make unusually heavy profits thereafter. The United States Steel Corp., which made 5% before the war, received 25% on investment in 1917; and 10 smaller concerns, such as begin their operations with the employment of steel furnaces, made from 30% to 319% on their investments. Certain sulphur companies took advantage of the war demand for sulphur to raise their prices to such an extent as to reap net profits of approximately $15 a ton, which meant over 200% on investment in one case. It further appears that "unnecessarily" large profits were made by the producers of yellow pine lumber in the South. A good margin per 1,000 bd. ft. had been considered to be $3, but in 1917 the average margin was over $4.80; and while the average profit on investment in 1916 was 5·2%, the figure was increased to 17% in 1917. The profits of tanners increased from two to five times, as they took advantage of the enormous demand for leather and exacted very high prices. The price of hides was rapidly advanced, notwithstanding that at the same time "great supplies were withheld from the public." Upon learning of approaching price control, one of the large packers took steps "quietly and promptly" to increase the appraised value of his tanneries.

Other figures indicating the general trend may be given as follows:—

	Percentage of net earnings to Investment		
	1914	1916	1917
Meat packers (large)	8·3	18·5	26·5
Tanners	12·9	33·8	25.7
Shoe manufacturers	15·1	26·1	24·7
Bituminous coal (Pa.)	—	6·0*	32·0*
Vegetable canners	—	9·0	32·0
Salmon canners	—	22·0	52·7
Petroleum refiners	15·0	—	21·0
Copper producers	11·7	—	24·4

*Percentage of net sales.

According to the annual report of the Attorney-General for 1920, since Oct. 1919 sentences had been imposed on 49 sugar dealers and 20 clothing dealers. This was under the anti-profiteering law, referred to below. In addition, six sugar dealers and one flour dealer had been convicted of hoarding, and two coal dealers had been sentenced under the provision as to fixing reasonable prices. In all there had been over 2,000 indictments, arrests and sentences, involving chiefly the commodities just mentioned, together with meats, potatoes, and meals at restaurants. The great majority could not be sustained under the law.

Without further evidence it may be concluded that profits in many industries increased in the earlier part of the war more than 100% above the pre-war level, and that this increase was in not a few cases due in part to profiteering as above defined. High prices do not necessarily indicate excessive profits, but there is reason to believe that profiteering was common in cement, petroleum, lumber (notably ship timber), wool, clothing, sulphur, naval stores, rice, sugar, sand and gravel, raisins and other products, in addition to those already mentioned. In most of these cases the Government reduced prices and profits through some form of control. Anyone who had experience at Washington during the war knows that many persons went there for the purpose of furthering profiteering schemes. In some cases the method was to secure contracts at excessive prices, perhaps by bribery, certainly by misrepresentation. Many such cases later came to light, some concerning articles of clothing for the army and involving collusion with army officers. In other cases the method was to induce the Government to abstain from fixing a reasonable price or to induce it to fix a high price. Thus, in the United States, oil companies succeeded in virtually preventing any price-fixing on the ground that the exorbitant prices that prevailed were necessary to stimulate production; while lumber, copper and cement associations by concerted and persistent activity obtained prices that were unnecessarily high. In still other cases every effort had been made to defraud the Government in respect of excess profits taxes, to enable a business to "retain" profits larger than lawful. Equally reprehensible was the action of hosts of retail dealers, such as those selling shoes and men's clothing, who maintained the same percentages of profits on sales although the great increase in prices meant greatly increased absolute margins and percentages on investments.

The U.S. Government attempted to deal with profiteering in three ways: (1) taxation; (2) price-fixing; (3) direct action under the Food Control Act. The first and the last methods proved largely ineffective.

By special taxes levied on profits, many thought that the spoils of the profiteers could be regained by the public. In 1916 a tax of 12½% was levied on the profits of munitions manufacturers; and a general "war profits tax" and an "excess profits tax" were imposed in 1917. In 1918 these taxes were combined. Under this measure profits of corporations organized for profits were liable either to (1) a progressive tax on profits in excess of 8% on capital; or to (2) a flat tax of 80% of net income over the average profits for the three pre-war years 1911, 1912 and 1913. Not a few legislators and economists hoped that these taxes would make regulation of prices or profits unnecessary. Let any concern make what it can, they said, we will take it as fast as they make it. But, unfortunately, it proved so easy for most corporations to increase their investment accounts, and to pad their expenses, that the worst profiteers often showed small excess profits. Moreover, a considerable part of the tax was shifted to consumers in the shape of higher prices, as was possible during the inflation period.

Government price-fixing, while it did not prevent profiteering, did moderate the evil, notably through such substantial reductions as were made in the prices of wool, coal, sugar, flour and sulphuric acid. Unfortunately, this means was not used as vigorously and thoroughly as it would have been had there not been an ill-founded reliance upon profits taxes.

On Aug. 10 1917 the Food Control Act became law. Section 4 of this Act made it unlawful for any person to hoard or to make any unjust or unreasonable charge in transactions relating to "necessaries" (foods, feeds, fuel, fertilizers, farm implements and machinery), but imposed no penalty. Sections 6 and 7, however, provided for penalties and seizure, in case of hoarding. Section 5 authorized the licensing of dealers in necessaries and the fixing of fair storage charges, commissions, profits, or practices. The fixing of prices for coal and coke was authorized in section 25. It was under this Act that the Food Administration operated, and, as already indicated, its control over prices was partly effective. On June 30 1919, however, the activities of the Food Administration were suspended; and as the agitation concerning the "high cost of living" grew in volume, the Department of Justice assumed the task of enforcing the law, which remained in force while a state of war was only technically in existence. Between Aug. and Nov. 1919, the Department made some 92 seizures of such food products as eggs, butter, sugar, flour and pork, under section 7, and secured several indictments under section 6, one indicted party pleading guilty. The chief agencies depended upon were the local "fair price committees" such as had been established under the Food Administration. Indeed, the wartime organization of local food administrators was partly revived, and an extensive publicity campaign was initiated. But the Attorney-General found his efforts limited by the absence of a penalty clause in section 4 and the restricted definition of "necessaries," and, at the President's request, Congress reënacted the law in Oct. 1919, with amendments to cover these defects. Encouraged by this action, and animated, it is charged by his critics, largely by political ambition, the Attorney-General proceeded vigorously under the Act, and in his annual report for 1920 stated that there had been 1,049 prosecutions under section 4 and 99 convictions.

Meanwhile, a growing hostility to the Act was apparent, and the courts in several jurisdictions declared it unconstitutional. This was true in five of the ten chief bituminous coal-producing states. Action concerning anthracite coal profiteering was also blocked by a decision of the Federal District Court in Pennsylvania. The upshot of the matter was a decision of the Supreme Court in Feb. 1921, which finally declared the Act unconstitutional. The case was that of *U.S. v. L. Cohen Grocery Co.*, and involved profiteering in sugar. The reasoning of the Court was that Congress alone had power to define crimes against the United States; and, therefore, because the Act was vague and indefinite, and fixed no precise standard of guilt, and because it did not inform the defendant of the nature and cause of the accusation against him, it was unconstitutional. Thus ended the anti-profiteering crusade of the Attorney-General. Meanwhile, from April 1920 prices began to decline, and with that decline came a loss of interest in profiteering.

In a sense the U.S. Government was to blame for much wartime profiteering. In the first place it was lax in letting contracts and making purchases, either directly, or indirectly, by placing authority in the hands of interested persons. The "cost-plus system" invited profiteering as well as inefficiency. In the second place its combination of excess profits taxes and price regulation was unfortunate. At the same time that it fixed prices on a cost basis it spread the idea that it made little difference if excess profits were earned, as such profits would be reached by taxation. Taxation, however, proved at best to be an inadequate means of reaching profits, and early laxity in defining cost and investment made this means nugatory. The system as it worked in the United States tended toward laxity both in fixing prices and in collecting taxes on income. (L. H. H.)

PROFIT-SHARING AND CO-PARTNERSHIP (*see* 22.423).—Profit-sharing was defined by the International Conference on Profit-Sharing held in Paris in 1889 in the following formula: "The International Congress is of opinion that the agreement, freely entered into, by which the employee receives a share, *fixed in advance*, of the profits, is in harmony with equity and with the essential principles underlying all legislation." This definition, which is accepted by nearly all writers on profit-sharing, excludes on the one hand distributions made by a firm to its employees, say at Christmas, the amount of which is not fixed in advance, and to which the employees have no definite right.

Such distributions are to industry what the Squire's coal and blankets are to village life, but they are not profit-sharing. It also excludes forms of "output bonus," etc., under which the individual employee (or the squad or gang) gets, or is supposed to get, a share of the money which he individually saves to the firm by working faster or better; this was formerly classed with it under the general term *gain-sharing*, and *profit-sharing* is still sometimes incorrectly used to cover such forms of bonus. Under true profit-sharing the share of the employees varies with the prosperity of the firm, and depends therefore not on their exertions solely but on the competence of managers and directors, the state of the market, and other considerations.

The Labour Co-Partnership Association in 1911 expressed its view that the co-partnership of labour with capital involved: (1) "That the worker should receive, in addition to the standard wages of the trade, some share in the final profits of the business, or the economy of production. (2) That the worker should accumulate his share of the profits, or part thereof in the capital of the business employing him, thus gaining the ordinary rights and responsibilities of a shareholder." To this in 1919 the Association added a further clause: (3) "That the worker shall acquire some share in the control of the business in the two following ways:—(*a*) By acquiring share capital, and thus gaining the ordinary rights and responsibilities of a shareholder. (*b*) By the formation of a co-partnership committee of workers having a voice in the internal management." The addition of the last clause is due to the belief, now rapidly gaining credence, that the smaller shareholders in the ordinary firm have in reality little or no voice in its management, and that other means are necessary to provide the employee co-partners with their share in control. It has not, however, been adopted by all, or nearly all, of the firms which have co-partnership schemes.

Profit-sharing and co-partnership are thus seen to differ in theory by the fact that the profit-sharer has a share only in the cash profits of his employer over a given period, and may take his share away in his pocket entire, whereas the co-partner must take some of his profit in the form of investment in the business, and receives also some share in the management. In some cases the co-partner does not actually have to invest, but is offered shares at par or at reduced rates, or even free, these shares generally carrying with them all shareholders' rights. In practice, however, there are so many possible variations that no general distinction is possible, and the terms are frequently interchanged. It will also be observed that both forms assume the existence in industry of two parties, the "firm" and its "employees." They are therefore not connected with the various coöperative experiments which have been made from time to time by groups of workers, forming themselves into a firm and dividing amongst themselves the profits or losses, with the coöperative colonies of Robert Owen in England, or the *ateliers* or self-governing workshops of Louis Blanc in France. Co-partnership, as now understood, is distinctly a "paternal" movement, the dominant "partner" in industry being moved to confer a favour on its junior; and though the ideals of Owen, Fourier and the Christian Socialists may have had some influence on the minds of the earliest co-partners, a truer descendant than the co-partnership of to-day is the working-class Coöperative Movement, which aims at the supersession of capitalism.

The earliest example of co-partnership comes from France. In 1843 a master painter of Paris, Edmé-Jean Leclaire, divided among his permanent hands (43 out of about 300 employed) the sum of 12,266 francs. The scheme met with approval and up till 1870 this "kernel," as he called it, of permanent workmen, who were members of the firm's mutual provident society, continued to take their share of the increasing profits. At no time did the members of the mutual provident society amount to more than a third of those employed. In 1870 the profit-sharing was extended to all the men employed, for however short a time, and upon this basis it has continued as "Brugniot, Cros et Cie. (ancienne maison Leclaire)." The arrangement for division of profits is as follows:—5% is first paid on the capital; of the remainder 15% goes to the managing partners (who according to French law have unlimited liability), 50% as a dividend to all workers in proportion to their time wages, and 35% to the mutual provident society—the "kernel"—which is now a partner in the business. The managing partners also receive a salary. This experiment, as it was the first, is also peculiar in the amount of control entrusted to the permanent workmen, the "kernel," who are very carefully chosen. Among their other privileges it falls to them to elect new managing directors among the employees, a privilege not, as far as the writer is aware, granted under any English scheme of co-partnership. The whole business, however, employs only between one and two thousand workers; its interest is, therefore, chiefly as an experiment. (For fuller accounts of this and other French schemes, including the *Familistère* of Guise, consult the publications mentioned at the end of this article.)

France, as it was the original home of co-partnership, has also been the country in which it has excited the most interest, and the comparative lack of trustification in French industry has made it easier for schemes established by individual firms to be accepted. The numerical weakness of French trade unionism has also made it easier to gain the adherence of French workers, for an established trade-union movement is generally hostile to co-partnership and profit-sharing.

United Kingdom.—In the British Isles, if we except a scheme inaugurated in 1829 by Lord Wallscourt for the farmers on his Galway estates and abandoned shortly afterwards, the movement begins in 1865 with the adoption of six schemes, of which five have since been abandoned, although one (adopted by Messrs. Jolly & Son, silk mercers, of Bath) survived until 1906. One of the five was the famous Briggs scheme, of the Whitwood and Methley Collieries, to which reference is made below. The movement then progressed very slowly for some years. Between 1865 and 1888 only 66 schemes in all were launched, of which all but fourteen had disappeared by 1920.

The International Congress on Profit-Sharing which drew up the definition quoted at the head of this article was held in 1889. In that year also the South Metropolitan Gas Co. adopted profit-sharing, and thus initiated it in the only British industry in which it has obtained any considerable hold. These two facts combined to stimulate an interest in profit-sharing, and during the four years 1889–92, 83 schemes were adopted, of which only 12 survive. A long decline in profit-sharing, owing partly no doubt to the trade depression which began in 1892, led up to rather less vigorous revivals during 1908–10 and 1912–4. The World War then practically put an end to the development of the system, until the phenomenal profits of the early months of the peace and the willingness of many firms to share some of them with their employees, led to an outburst of 42 schemes in 1919. The boom continued during the early months of 1920 (19 during the first six months); but during the subsequent industrial depression there was a marked slackening of interest in this direction.

Up to the end of 1919 the British Isles had given birth to 417 schemes, of which 198, or slightly less than half, have been abandoned for one cause or another. Of the remainder, 36 were run by gas companies (*see* below). These figures alone, however, would give a misleading impression of the size of the movement. Of the 144 schemes started up to 1918, only 15 are returned as affecting more than a thousand employees, while no fewer than 54 affect less than a hundred. Out of the 15 again, four are run by gas companies (the South Metropolitan, the South Suburban, the Gas Light and Coke Co., and the Liverpool Gas Co.), and of the remaining 11, four of the largest affect only a portion of the workpeople in the firm's employ. These are:—Messrs. Armstrong Whitworth & Co., (12,215 out of 69,000 employed); Messrs. Pease and Partners, of Darlington (2,243 out of 11,000); Messrs. Lever Bros. (3,542 out of 8,833); and the Bradford Dyers' Assn. (3,600 out of 9,800). The only really large concern whose profit-sharing affects nearly the whole of its workpeople is the Prudential Assurance Co., 18,500 of whose 20,000 employees participate in its scheme. Details of the number participating are not available for schemes started since 1918, but as out of the 42 firms only eight have a pay-roll of over 1,000, while ten employ less than 100, it would seem that the proportions would not be materially altered if they were all included. Neither do all the smaller firms include by any means all their employees in their profit-sharing schemes. The proportion varies from case to case, falling as low, in the case of one firm of manufacturers, whose scheme dates from 1889, as 50 out of 1,500, or 3⅓ per cent. It is clear that in this and similar cases the co-partnership is really a tiny experiment carried on with a few picked employees and is of infinitesimal significance in the industrial life of the country. Nor is it only the successful experiments that are of this type; the abandoned schemes tell the same tale, except that the number of participants is lower.

Apart from the gas companies, then, co-partnership in British industry has been confined, with one or two exceptions, to small firms, and these for the most part in minor industries. The food trades, such as cocoa, confectionery, jam, chocolate, etc., and the distributive houses provide a large number of experiments; tailoring, dress-making, boot and shoe manufacture, and printing and stationery are also considerable groups. In the great basic industries of the country, (mining, cotton, engineering and shipbuilding) and in transport, co-partnership has made practically no progress, nor does it seem to be making any.

What is the reason of this? An analysis of the reasons given for the abandonment of dead schemes may provide part of the answer. Forty-nine schemes were abandoned "for financial reasons," *i.e.* because there had ceased to be any profit to be shared. In 16 cases no cause can be assigned; and in about 40 the abandonment was due to changes connected with administration. There remain 91 schemes which were abandoned owing to the dissatisfaction of owners or men with their results. The men's dissatisfaction can generally be traced to a simple cause—the smallness of the dividend distributed. The average rate of bonus paid to workmen under all schemes varies within narrow limits and is generally about 5% per annum on the total of their wages. Translated into cash, this meant in 1918 that 105 firms paid to their workmen an average of £3 13s. 3d. per head, or, if the firms which paid nothing at all be excluded, of £5 15s. 2d. In 1919, the average bonus paid per head was £4 18s. 10d. It will readily be understood that so exiguous a cash benefit causes considerable disappointment to the worker who has been led to expect material advantages from being provided with an interest in the business; and this fact may also go some way towards explaining the failure of schemes which employers gave up owing to the "apathy" of their workmen. £3 13s. 3d. per annum, especially when paid in a lump at the end of twelve months, during which the workers have been working at ordinary rates, is hardly likely to provide a very strong incentive to better work.

This may account for the high mortality among profit-sharing schemes which have actually come into existence. More reasons, however, are needed to explain the smallness of their numbers and their comparative insignificance. This is undoubtedly due in part to the hostility of the consuming public, which tends to regard profit-sharing schemes as designed to keep within the industry money which should be used to reduce the price to itself. Thus the distributive Coöperative Movement, which is an association of consumers, has done very little in the way of profit-sharing or co-partnership, and that little is steadily growing less, and the English and Scottish Coöperative Wholesale Societies have both abandoned their schemes of profit-sharing, the former in 1886, and the latter in 1915.

The gas companies, to which reference has already been made, are not open to this criticism owing to their peculiar statutory position. All gas companies are regulated by Act of Parliament, and in most cases they are not allowed to increase their dividends unless the price of gas is correspondingly reduced. (In the other cases the dividend is limited to a fixed maximum percentage.) Thus the gas companies have never been able to make enormous profits at the expense of their customers, and moreover, since their accounts of capital and dividend must be regularly rendered to the Government, there is little or no cause for the suspicions which occasionally develop in co-partnership concerns, of "watered" capital and the like. Further, there was frequently before the war a considerable surplus which the companies did not wish to use in reduction of price, which, therefore, not being available for shareholders' dividend, could be distributed among the employees. This, by keeping up the workers' dividend, served to render the profit-sharing scheme popular. Since the war, surpluses have largely disappeared.

But the greatest bar to the success of the co-partnership movement has undoubtedly been the hostility of the organized labour movement. The trade unions are almost uniformly opposed to it as a policy, and in some cases even expel any member joining a co-partnership or profit-sharing scheme. This was the case in 1920 with the Amalgamated Society of Woodworkers, whose right to expel members joining Lord Leverhulme's scheme at Port Sunlight was contested in the courts, though the decision finally went against them. The earliest firms to adopt profit-sharing did little to allay the suspicions of the unions. They were generally as unfavourable to the unions as the unions were to them. The well-known experiment of Messrs. Henry Briggs & Co., which was launched in 1865, was avowedly intended to draw the men away from their union, and came to an end ten years later, after a somewhat stormy career, because the employees chose rather to uphold their union in resisting an attempt by the employers to reduce wages than to remain in the firm's employ and get what they could. The scheme of the South Metropolitan Gas Co., which nearly came to grief in its first year owing to the company's insistence that every workman should sign a yearly contract, dating from different days in each case (which would have rendered any concerted strike punishable at law), also required, until 1902, every workman to sign a declaration that he was not a member of the Gasworkers' union. Recently this attitude has been modified, and the most distinguished advocates of co-partnership, such as Mr. Aneurin Williams, now insist on the recognition of trade unions: but the unions nevertheless hold that it gives the workers in a single firm a sectional interest and so tends to divide them from their fellows in the same trade, and, further, that there is always a danger that workers in a profit-sharing firm may, in return for the profit-sharing, be induced to accept less than the rates of wages which it is the unions' business to maintain. As far as one can see, this attitude is not likely to be easily changed in the near future, and the co-partnership movement, therefore, is unlikely to spread beyond the small firms and the minor industries in which trade unionism is weak.

BIBLIOGRAPHY.—The Ministry of Labour's *Report on Profit-Sharing and Labour Co-Partnership in the United Kingdom* (Cmd. 544. 1920.) is indispensable. It contains nearly all the available information, and has an exhaustive bibliography. The best book giving the case for co-partnership is Charles Carpenter's *Industrial Co-partnership.* A useful book is *Co-partnership and Profit-Sharings*, by Aneurin Williams (Williams and Norgate, 1913); a good analysis is to be found in *Methods of Industrial Remuneration*, by D. F. Schloss (Williams and Norgate, 1907). Later Edition. The Labour Co-Partnership Association, 6, Bloomsbury Square, London, W.C.1., published a number of brochures dealing with particular aspects and particular experiments.

For the Labour point of view the best works are two pamphlets by Edward R. Pease: *Profit-Sharing and Co-Partnership; A Fraud and a Failure?* (Fabian Soc., 1913) and *Co-Partnership and Profit-Sharing* (Labour Party. 1921). See also chapters in *The World of Labour*, by G. D. H. Cole. (M. I. C.)

United States.—Profit-sharing, strictly defined, is a plan for increasing the ordinary remuneration of labour by amounts varying with the profits of the business. Popularly, the term is loosely used to describe a great variety of methods of wage payment. In this article it is used to describe an arrangement by which employees, other than managerial employees, receive, in addition to wages or salaries, a share of the net profits of the business, such share being distributed at the time of the declaration of dividends to stockholders. The arrangement may be expressed either by a formal agreement or an oral promise. Although the profits are contingent, the percentage of profits to be distributed is fixed and known in advance, and, like dividends, is paid sometimes in whole or in part in stock instead of cash. This definition excludes many forms of wage payment commonly associated and confused with profit-sharing, such as the bonuses sometimes measured by individual or collective output, length of service, attendance at work or employee savings, and sometimes given as Christmas gratuities, and such as sundry stock-purchasing schemes, none of which fluctuate directly with the net profits.

The term "co-partnership" is not generally used in the United States in this connexion, since the implied constituents, profit-sharing, stock-ownership and participation in management, are not often found in the same establishment. Many profit-sharing plans arrange for distribution of stock as a part of, or as an addition to, profit-sharing. There are also more than 60 known stock-purchasing schemes, besides many arrangements for "managerial" or "limited" profit-sharing, affecting less than one-third of the total employees. Probably fewer than ten of these varied plans provide for workers' committees as an integral part of the arrangement.

Related to the idea of co-partnership, but quite apart from profit-sharing, are a considerable number of schemes for labour's participation in management which have sprung up during and since the World War. These schemes vary all the way from representation on boards of directors, in a very few cases, to joint management through industrial and works councils, shop committees, grievance and welfare committees, shop chairmen and voluntary arbitration boards. The distinguishing characteristic of these management-sharing plans is that under them the management does not depend upon organized labour, but deals with its own employees collectively. They are distinct from profit-sharing, in that the employer retains all of the profits he makes, though the workers are given collectively a voice in determining the wages, hours and working conditions which to some extent affect the profits account. Without doubt labour's participation in management in such a sense is more usual than profit-sharing and co-partnership.

The pioneers of true profit-sharing in the United States, dating from 1886, are the Ballard and Ballard Co. of Louisville, Ky., engaged in flour-milling, and the N. O. Nelson Manufacturing Co. of St. Louis, Mo., manufacturers of plumbers' and steam-fitters' supplies. The years of greatest installation of new projects were 1901, 1906, 1909–11, 1914–6, and 1919. Fully 70% of all the known plans were started after 1910. These variations in the progress of profit-sharing in the United States correspond with those in England, where profit-sharing plans found favour during periods of ample employment and labour unrest. It is only natural, however, that periods of low profits should check the spread of profit-sharing and cause the abandonment of many plans, the average life of abandoned plans being two to three years. For this reason, and since no comprehensive study had been made in the five years preceding 1921, it is difficult to state with confidence the exact number of profit-sharing arrangements existing in that year, one of general business depression. On the basis of the Government report in 1916 and subsequent semi-official studies it is estimated that 86 true profit-sharing plans were in operation at the end of 1920. Of these plans more than one-half (53%) were in manufacturing establishments, 16% in mercantile concerns, 11% in banking institutions, 9% in public utilities and the remainder scattered. Approximately two-thirds of these concerns employed less than 300 people, and only one-seventh employed more than 1,000, so that the total number of employees was less than 50,000. The number of arrangements solely for stock purchasing is not accurately known but the inclusion of several large corporations, as the United States Steel Corp. and the International Harvester Co., raises the number of participating employees to a million or more.

In the determination of the divisible fund of profits, two general methods, subject to individual variations, are followed: (1) Setting aside a specific percentage of profits after all ordinary expenses of the business, such as depreciation reserves and interest on invested capital, are taken care of; (2) fixing a rate of dividend on employees' earnings coördinate with the rate of dividend on capital. Assume a corporation capitalized at $1,000,000 with an annual payroll of $100,000 and net profits of $220,000 a year. In most plans using the first method, the preferred and common stockholders first receive dividends (not to exceed a certain per cent, say 10%, or $100,000). The remainder of the profits fund ($120,000) is divisible and is shared with labour according to a fixed percentage, perhaps 50% to labour and 50% to capital, or 40% to labour and 60% to capital. Four of the more recent plans allow employee beneficiaries to send an accountant on their behalf to verify the company's computations. Under the second method, the divisible fund depends on dividends declared. Thus if a 10% dividend is declared, a fund equal to 5% or 7½% of the total payroll ($5,000 or $7,500) is distributed among workers. The advantage to the management of this method is that it may be found desirable to pass all dividends and use this amount for strengthening the business.

When the amount of divisible profits has been determined, there remains the apportionment of the respective shares to capital and labour. In most instances the employer determines this apportionment at the outset, announcing that perhaps 50% or 40% or 33⅓% of the divisible profits will be distributed among employees according to their earnings. Often, however, divisible profits are distributed according to the ratio of (1) total invested capital to total payroll or (2) interest on invested capital to total payroll. Assuming, in the example given above, that $120,000 remains to be divided, the ratio in the first instance is $1,000,000 (capital) to $100,000 (payroll) or ten to one, which allots $10,909 to labour and $109,091 to capital. In the second case, assuming 6% as a fair return on the investment, the ratio is $60,000 (interest) to $100,000 (payroll) or six-tenths to one, in which event labour's share is $75,000 and capital's share is $45,000. This latter method of division in 1921 was known to obtain in only one establishment.

An almost universal rule is that length of service shall be a condition of the eligibility of participants. In one or two cases the employee benefits as soon as hired. But most schemes require from three months to three years of continuous employment as qualification for a share in profits. Concessions from the specification of "continuous" employment are sometimes made to provide for such contingencies as sickness, unavoidable lay-off and accidents. Discharge for cause or quitting employment entails an automatic forfeiture of all claims to accumulated or accruing shares in profits; in one plan discharge for cause is the only occasion for forfeiture. The obvious intent of such regulations is to reduce labour turnover by rewarding the faithful. In this respect profit-sharing indirectly acts as a length-of-service bonus. A further rule as to eligibility in some plans is to require a written application from the employee who wishes to participate. In one such case employees are obligated to share in possible losses, not to exceed 10% of their earnings, 10% of their pay being held back by the employer each week to provide for this contingency. Loss-sharing in addition to profit-sharing is incorporated in four schemes. Still another restriction is as to the class of work performed, as shown by the amount of salary or wages or by classification of employment. Firms using this restriction evidently feel that the type of their workingmen is such that only a sharing limited to some of their employees would produce the desired results. Yet there is also the wish to experiment fully and the desire to extend the benefits of the plan, should limited participation be successful.

The form and time of payment of shares to employees are also important variants. Over three-fourths of the firms studied in 1916 paid their shares fully in cash, annually, semi-annually or quarterly. The others paid part in cash, part in company stock, or paid part into a common welfare fund or savings account. The stock-sharing or co-partnership plans provided many restrictions designed to encourage thrift, and to discourage speculation and absentee ownership. These restrictions take the form of prohibitions of sale of stock, sometimes only with the consent of an official of the company, or holding the stock in trust for the employee and paying him only the dividends, or of forfeiture of participating rights if such stock be sold.

Four plans provide for workers' co-partnership committees, though there are several strictly stock-purchasing plans which allow shareholding employees to acquire a voice in management through the exercise of the ordinary voting rights of shareholders. The extent of the co-partnership in these forms is negligible.

All these varying details (and the variations are by no means exhausted in this recapitulation) reveal in large measure the spirit and purpose of profit-sharing. As a rule the employer announces his plan without previously consulting his employees. There is virtually unanimous agreement among successful profit-sharing employers that the coöperation, loyalty and stability of working forces—the chief avowed purposes of profit-sharing—are obtained by all the plans which have been in operation for any considerable period. There are, however, varying opinions as to how far these plans attain the more specific objects of (1) economy of time and material, (2) improvements in quality and quantity of output, (3) inducement to thrift, (4) avoidance of industrial disputes, (5) attainment of social justice. On the whole there is a considerable body of employers' opinion supporting the value and practicability of profit-sharing in improving industrial relations.

On the other hand union leaders universally condemn profit-sharing for three general reasons: (1) Where profit-sharing exists, wages less than the market rates are paid; (2) workers prefer a fair, fixed wage scale rather than a part of their wages undetermined and subject wholly to the employer's decision; (3) labour organization is undermined, as obligations to the firm are made a first lien on the workers' loyalty. That these criticisms have some foundation in fact is proved by the high percentage of abandoned plans and the reasons for their failure. Most of the failures were due to apathy or open hostility on the part of the workers, expressed in strikes, to diminished profits, or to changes in ownership of the business.

The success or failure of profit-sharing plans depends on circumstances not touched by the profit-sharing principle. Where favourable results have been obtained, they were due, not to profit-sharing as a mechanical device, but to the confidence which the employees had in the management.

Bibliography.—A comprehensive bibliography will be found in Boris Emmet's report "Profit-Sharing in the United States"—United States Bureau of Labor Statistics, Bulletin No. 208, 1917. Other references are: C. D. Wright, *Profit-Sharing* (1886); N. P. Gilman, *Profit-Sharing between Employer and Employee* (London and New York, 1892); idem, *A Dividend to Labour* (London and Boston, 1900); A. F. Burritt, *Profit-Sharing: its Principles and Practice* (New York and London, 1918); National Industrial Conference Board, Research Report No. 29, "Practical Experience with Profit-Sharing in Industrial Establishments" (Boston, 1920); National Civic Federation, Profit-Sharing Department, *Profit-Sharing by American Employers* (New York, 1920). (J. R. Co.)

PROHIBITION.—In the earlier article (*see* 26.578) under TEMPERANCE, reference has already been made to the various methods devised for securing total abstinence from the consumption of intoxicating liquor, and in particular to the progress of the movement for legislative Prohibition in the United States up to the year 1910. This latter movement eventually culminated in the establishment of nation-wide Prohibition by the Eighteenth Amendment to the Constitution of the United States, as proposed by Congress, Dec. 3 1917, ratified by the necessary three-fourths of all the states, and officially proclaimed, Jan. 29 1919, as part of the Constitution, becoming effective, in accordance with its terms, one year from the date of ratification by 36 states, namely Jan. 16 1920.

In the separate article under LIQUOR LAWS the measures adopted in Great Britain for further regulating the liquor traffic during 1910 to 1921 are dealt with; and here it is only necessary to deal with the advent of complete national Prohibition in the United States, where its adoption forms one of the most interesting chapters in the social history of modern times. The movement for Prohibition was affected by new scientific knowledge, new views of industrial economics, and educational forces of great variety, considerably intensified, but not substantially changed in character, by the experience of the World War. The conviction had grown steadily in the United States that social and industrial efficiency, and national unity of purpose, could not be had at any cheaper price than the cost or sacrifices involved (whatever they might be) in national prohibition; and this belief had almost reached the point where it could be translated into effective governmental action even before the war necessitated a supreme effort for such efficiency. Surprising evidence of this was seen in the passage, by a majority vote (193 to 189) in the House of Representatives, of the Hobson amendment for national prohibition, Dec. 22 1914, two years and four months before the United States entered the war. Save for the war, the country would probably not have had constitutional (which means virtually permanent) national prohibition as early as 1920. Forces were, however, at work which would have probably brought it within another decade, and with it the "bone dry" enforcement contemplated in the National Prohibition Act (popularly called the Volstead Act), the significant title of which is "an Act to prohibit intoxicating beverages, and to regulate the manufacture, production, use, and sale of high-proof spirits for other than beverage purposes, and to ensure an ample supply of alcohol and promote its use in scientific research and in the development of fuel, dye, and other lawful industries."

Up to the wartime legislation of 1917 and 1918 and the Volstead Act of Oct. 28 1919 for the enforcement of the Eighteenth Amendment, there had been but little change since 1910 in Federal policy. Federal taxation of liquor was greatly increased for revenue purposes in 1917 and 1918. The increasing sentiment in favour of prohibition throughout the country was reflected, however, in other Federal measures. In 1913 the Webb-Kenyon Act was passed, over President Taft's veto. It was based on the constitutional grounds that the Act delegated power over interstate commerce, exclusively vested in Congress, to a state, by making illegal the shipment of liquor from a "wet" state to a "dry" state contrary to the laws of the latter. Some such measure seemed necessary in order that local prohibition might be enforced in "dry" territory. Another indication of national sentiment in favour of restriction is found in the same year in the passage of the Jones-Works Excise Bill for the District of Columbia, which reduced the number of licensed saloons by Nov. 1 1914 to not more than 300, about half as many as before. The Isthmian Canal Commission on July 1 1913, by an administrative order previously adopted, abolished 35 saloons in the Canal Zone by declining to issue any further licences for the sale of liquor. In 1915 absolute prohibition for the District of Columbia was proposed in a rider to an appropriation bill, and defeated in the Senate by a small majority, and in the same year a bill for that purpose was favourably reported in the Senate by the Committee on the District of Columbia. In 1916 the Judiciary Committee of the Senate reported, 13 to 3, a resolution proposing the National Prohibition Amendment to the Constitution. A similar resolution received a majority vote in the House of Representatives in Dec. 1914, though it failed to secure the two-thirds necessary for passage. During the years 1915 and 1916 many of the states had enacted statewide prohibition laws, and there was a considerable extension of dry territory under local option in wet states.

Early in 1917 Congress enacted the Federal Anti-Liquor Advertising Bill with the so-called Reed Bone-Dry Amendment, as an amendment to the Post-Office appropriation bill. This was a drastic prohibition of the use of the mails for advertising, or soliciting orders for, liquor in "dry" territory, and was an extension of the principle of the Webb-Kenyon Act. Congress also adopted prohibition for the District of Columbia, over which it has exclusive legislative power. It provided for prohibition in Alaska to be effective Jan. 1 1918, and in the Porto Rican Citizenship and Civil Government Act it made provision for a referendum in Porto Rico on prohibition. This was held in July 1917, and resulted in a vote of 99,775 for prohibition to 62,195 against. All this action by Congress took place before the declaration of war in April, 1917. Following that declaration came the enactment of wartime prohibition in the Food Control Act of Aug. 10 1917, the liquor restrictions of the draft law of

May 18, and the extension of their application in the Act to promote the efficiency of the navy, approved Oct. 6 1917. These measures are discussed later in the section on wartime legislation.

Quite apart, however, from war legislation, on Aug. 1 1917 the Senate adopted the resolution proposing to the states the National Prohibition Amendment by a vote of 65 to 20—more than two-thirds of the members present, and this resolution was adopted by the House with some amendments Dec. 17 by a vote of 282 to 128. On Dec. 18 1917 the Senate concurred in the amendments made by the House, and the resolution was thereupon submitted to the Legislatures of the several states for ratification. Ratified by the last of the necessary 36 states (Jan. 16 1919), and proclaimed by the Secretary of State (Jan. 29 1919), it became the Eighteenth Amendment to the Constitution, to go into effect one year from the date of its ratification, namely on Jan. 16 1920. The wording of the Amendment is as follows:—

> 1. After one year from the ratification of this article the manufacture, sale or transportation of intoxicating liquors within, the importation thereof into, or the exportation thereof from the United States and all territory subject to the jurisdiction thereof for beverage purposes is hereby prohibited.
>
> 2. The Congress and the several states shall have concurrent power to enforce this article by appropriate legislation.
>
> 3. This article shall be inoperative unless it shall have been ratified as an amendment to the Constitution by the legislatures of the several states, as provided by the Constitution, within seven years from the date of the submission hereof to the states by the Congress.

After Jan. 16 1919 the Amendment was ratified by all but three of the remaining states.

Whatever allowance may be made for the effect produced by the political activities of the Anti-Saloon League, an analysis of the vote in Congress for the submission of the Amendment showed a fair proportionate representation of the people residing in "dry" territory, and also the proportion of "dry" to "wet" territory in the United States. The subsequent votes in the State Legislatures on ratification of the Amendment corroborate this view. The accompanying table shows the order and dates of ratification by the several states, and the vote in each House of the State Legislatures by which ratification was enacted. The total number of votes in the state Senates or upper Houses, for ratification, was 1,297 in favour and 236 against, or 84% for national prohibition to 14% against; in the lower or more popular branch of the state Legislatures, the total vote for prohibition was 3,742, or 78%, to 1,001 or 22% against. It will be noted that in South Dakota, Idaho, Washington, Kansas, Utah and Wyoming no votes were cast against ratification.

The three states which had not ratified the Eighteenth Amendment to Sept. 1921 were Connecticut, Rhode Island and New Jersey. That the ratification of the proposed amendment failed in all three states by a very narrow margin is seen from the following facts. Rhode Island's State Senate by a vote of 20 to 18 on March 2 1918 postponed indefinitely the consideration of the ratification resolution; the resolution was presented again at the 1919 session, when the Senate voted 25 to 12 to postpone indefinitely its consideration. In Connecticut the Senate voted 14 for ratification and 20 against, and the House 153 for and 96 against. In New Jersey the House passed the ratification resolution, Jan. 24 1921, by a vote of 52 to 4, but the vote in the Senate on April 7 1921 was 10 in favour to 8 against, and the resolution failed because the state Constitution required at least 11 affirmative votes in the Senate as then organized.

Following the adoption of the Amendment came the Volstead Act, which was passed over President Wilson's veto on Oct. 28 1919. Before that, however, in addition to further war legisla-

Votes in Legislatures on Ratification of Eighteenth Amendment.

	Ratified by Upper House.	Ratified by Lower House.
(1) Mississippi	Jan. 8 1918, 28 to 5	Jan. 8 1918, 93 to 3
(2) Virginia	Jan. 10 1918, 30 to 8	Jan. 11 1918, 84 to 13
(3) Kentucky	Jan. 14 1918, 28 to 6	Jan. 14 1918, 66 to 10
(4) South Carolina	Jan. 18 1918, 28 to 6	Jan. 28 1918, 66 to 29
(5) North Dakota	Jan. 25 1918, 43 to 2	Jan. 25 1918, 96 to 10
(6) Maryland	Feb. 13 1918, 18 to 7	Feb. 8 1918, 58 to 38
(7) Montana	Feb. 19 1918, 35 to 2	Feb. 18 1918, 77 to 6
(8) Texas	Feb. 28 1918, 15 to 7	March 4 1918, 72 to 36
(9) Delaware	March 18 1918, 13 to 3	March 14 1918, 27 to 0
(10) South Dakota	March 19 1918, 43 to 0	March 20 1918, 86 to 0
(11) Massachusetts	April 2 1918, 27 to 12	March 26 1918, 145 to 91
(12) Arizona	May 23 1918, 17 to 0	May 24 1918, 29 to 3
(13) Georgia	June 26 1918, 34 to 2	June 25 1918, 129 to 24
(14) Louisiana	Aug. 6 1918, 21 to 20	Aug. 28 1918, 69 to 41
(15) Florida	Nov. 27 1918, 25 to 2	Nov. 27 1918, 61 to 3
(16) Michigan	Jan. 2 1919, 30 to 0	Jan. 2 1919, 88 to 3*
(17) Ohio	Jan. 7 1919, 20 to 12	Jan. 7 1919, 85 to 30
(18) Oklahoma	Jan. 7 1919, 43 to 0	Jan. 7 1919, 90 to 8
(19) Maine	Jan. 8 1919, 29 to 0	Jan. 8 1919, 122 to 20
(20) Idaho	Jan. 7 1919, 38 to 0	Jan. 7 1919, 62 to 0
(21) West Virginia	Jan. 9 1919, 27 to 0	Jan. 9 1919, 78 to 3
(22) Washington	Jan. 13 1919, 42 to 0	Jan. 13 1919, 93 to 0
(23) Tennessee	Jan. 9 1919, 28 to 2	Jan. 13 1919, 82 to 2
(24) California	Jan. 10 1919, 24 to 15	Jan. 13 1919, 48 to 28
(25) Indiana	Jan. 13 1919, 41 to 6	Jan. 14 1919, 87 to 11
(26) Illinois	Jan. 8 1919, 30 to 15	Jan. 14 1919, 84 to 66
(27) Arkansas	Jan. 14 1919, 34 to 0	Jan. 13 1919, 93 to 2
(28) North Carolina	Jan. 10 1919, 49 to 0	Jan. 14 1919, 93 to 10
(29) Alabama	Jan. 14 1919, 23 to 11	Jan. 14 1919, 64 to 34
(30) Kansas	Jan. 14 1919, 39 to 0	Jan. 14 1919, 121 to 0
(31) Oregon	Jan. 15 1919, 30 to 0	Jan. 14 1919, 53 to 3
(32) Iowa	Jan. 15 1919, 42 to 7	Jan. 15 1919, 86 to 13
(33) Utah	Jan. 15 1919, 16 to 0	Jan. 14 1919, 43 to 0
(34) Colorado	Jan. 15 1919, 34 to 1	Jan. 15 1919, 63 to 2
(35) New Hampshire	Jan. 15 1919, 19 to 4	Jan. 15 1919, 221 to 131
(36) Nebraska	Jan. 13 1919, 31 to 1	Jan. 16 1919, 98 to 0
(37) Missouri	Jan. 16 1919, 22 to 10	Jan. 16 1919, 104 to 36
(38) Wyoming	Jan. 16 1919, 26 to 0	Jan. 16 1919, 52 to 0
(39) Wisconsin	Jan. 16 1919, 19 to 11	Jan. 17 1919, 58 to 33
(40) Minnesota	Jan. 16 1919, 48 to 11	Jan. 17 1919, 92 to 36
(41) New Mexico	Jan. 20 1919, 12 to 4	Jan. 16 1919, 45 to 1
(42) Nevada	Jan. 21 1919, 14 to 1	Jan. 20 1919, 33 to 3
(43) Vermont	Jan. 16 1919, 26 to 3	Jan. 29 1919, 155 to 58
(44) New York	Jan. 29 1919, 27 to 24	Jan. 23 1919, 81 to 66
(45) Pennsylvania	Feb. 25 1919, 29 to 16	Feb. 4 1919, 110 to 93

*Repassed in Lower House to correct error Jan. 23.

tion affecting the liquor traffic, Congress enacted in 1918 prohibition for Hawaii and in 1919 a bone-dry law for the District of Columbia.

National prohibition was proclaimed Jan. 29 1919, and the year of grace allowed by the Eighteenth Amendment for it to go into effect was intended to give liquor manufacturers and dealers time in which to liquidate their business and dispose of their stocks. The so-called wartime Prohibition Act, however, which was enacted 10 days after active warfare had ceased (Nov. 21 1918), became effective on July 1 1919. The production of beer, except "near-beer," had been stopped at the beginning of the year as a food conservation measure, but even after wartime prohibition became effective, 2·75% beer was manufactured in some states on the assumption that it was a non-intoxicating liquor, and because Congress had not yet defined the quantity of alcohol a beverage might contain without coming within the meaning of the word "intoxicating," as used in the various laws, regulations and administrative orders. Rhode Island for example, enacted a state law declaring all liquors of less than 4% alcohol to be non-intoxicating.

The questions thus raised, together with the definitions of the Volstead Act declaring all liquors containing one-half of 1% of alcohol or more to be intoxicating and hence prohibited, were taken to the Supreme Court, which finally sustained both the Eighteenth Amendment and the Volstead Act's definition of intoxicating liquor, in two cases (*Hawke* v. *Smith* and *Rhode Island* v. *Palmer*, 253 U.S.) in which decision was rendered June 12 1920. The Court had previously sustained the War Prohibition Act and the one-half of 1% limit which it specified; but the liquor interests and the liquor-consuming public hoped that greater latitude would be given them by a narrower construction of the first section of the Eighteenth Amendment, which prohibited only intoxicating liquors, and therefore, it was argued, did not warrant legislation forbidding the sale and manufacture of any liquor which was, in fact, non-intoxicating, whether it contained more or less than one-half of 1% of alcohol. The Court, however, without stating or discussing this contention, cited the war prohibition cases in support of the conclusion that while "recognizing that there are limits beyond which Congress cannot go in treating beverages as within its power of enforcement, we think those limits are not transcended by the provision of the Volstead Act."

The Volstead Act provided for drastic enforcement, and arms the Government, through the Commissioner of Internal Revenue, with ample powers to punish and suppress any evasion. The regulations under this Act governing physicians' prescriptions and the procuring of wine for sacramental purposes are also drastic.

The Act supplementary to the National Prohibition Act approved Nov. 23 1921 contains still more strict enforcement provisions. It forbids physicians to prescribe for medicinal purposes other than spirituous and vinous liquor, and no physician may prescribe or any person sell or furnish on prescription any vinous liquor that contains more than 24% of alcohol by volume and not more than a quarter gallon or any quantity of such liquor containing more than one pint of alcohol for the use of any person within a period of ten days. This may seem to be an unnecessary and unwarranted interference with medical science, but it indicates that no power was likely to be refused that the administration authorities might find necessary to make enforcement effective. Other provisions giving the enforcing authorities control over importations for non-beverage purposes make it clear that both this Act and the National Prohibition Act apply to all territory subject to the jurisdiction of the United States and specifically continue in force all laws in regard to the manufacture and taxation of and traffic in intoxicating liquor and their several penalties as in force when the National Prohibition Act was enacted. Although the effectiveness and justice of these provisions cannot be accurately judged at present, they at least assisted materially towards enforcing national prohibition.

The question of the meaning of "concurrent power" to enforce the Eighteenth Amendment was also settled by the Supreme Court in *Hawke* v. *Smith*, in which the Supreme Court held that the provision of the Amendment in this connexion was within the amending power, was a part of the Constitution and "must be respected and given effect the same as other provisions of that instrument," was "operative throughout the entire territorial limits of the United States" and "of its own force invalidates every legislative act, whether by Congress, by a State Legislature, or by a Territorial Assembly, which authorizes or sanctions what the section forbids." The second section of the Amendment declared that "the Congress and the several states shall have concurrent power to enforce this article by appropriate legislation." The Supreme Court said that this "does not enable Congress or the several states to defeat or thwart the prohibition, but only to enforce it by appropriate legislation. The words 'concurrent power,' in that section, do not mean joint power, or require that legislation thereunder by Congress to be effective shall be approved or sanctioned by the several states or any of them; nor do they mean that the power to enforce is divided between Congress and the several states along the lines which separate or distinguish foreign and interstate commerce from intrastate affairs. The power confided to Congress by that section, while not exclusive, is territorially coextensive with the prohibition of the first section, embraces manufacture and other intrastate transactions as well as importation, exportation and interstate traffic, and is in no wise dependent on or affected by any action or inaction on the part of the several states or any of them." The prohibitionists could scarcely have hoped for a more sweeping endorsement, and the decision may be fairly considered further evidence of the widespread popular desire for effective national prohibition.

State Action.—Statewide prohibition had existed in 1910 in only nine states—one of them in New England (Maine); three in the middle-west (North Dakota, Kansas and Oklahoma); and five in the south (North Carolina, Georgia, Alabama, Mississippi and Tennessee). Not till 1914 did any greater tendency to statewide prohibition show itself, with the exception of an amendment of the state Constitution of West Virginia in 1912. But during the five years 1914–9 half the states adopted statewide prohibition, and these represented every section of the country, although they did not include some of the most populous states with large urban centres. In 1914 statewide prohibition was adopted by Colorado, Oregon, Virginia, Washington; in 1915 by Alabama, Arizona, South Carolina; in 1916 by Arkansas, Idaho, Iowa, Michigan, Montana, Nebraska, South Dakota; in 1917 by the District of Columbia, Indiana, New Hampshire, New Mexico; in 1918 by Florida, Nevada, Ohio, Utah; in 1919 by Kentucky and Texas.

From 1910 to 1914, and in lesser degree until 1920, there was meanwhile a continued struggle as to local option in states where statewide prohibition was not adopted with considerable fluctuation in the proportion of dry and wet areas or counties or towns, as the case might be, within the several states, and sometimes with the further fluctuation that the same area became dry at one election and wet at the next. Local option seems to have had its first trial in the United States in Indiana as early as 1832; when in 1881 Massachusetts adopted local option after extensive experiment with prohibition and ordinary forms of licence, that state became a model for other states in its local option law; local option in 1910 prevailed in 33 states. In Pennsylvania, where the licences were granted by the courts of quarter sessions and the judges elected by the people, local option virtually obtained, because elections of judges often turned on the question of whether or not licences should be granted in a given community; and in New Jersey some communities, by reason of the provisions of special municipal charters, enjoyed the privilege of local option. It was estimated in 1910 that the extent of the dry areas of the United States was to that of the wet areas approximately as seven is to five. The total pop., however, living in dry areas was approximately 41,500,000 to 46,000,000 in the wet areas.

Outside prohibition areas and local option areas there remained little territory in 1910 under other forms of licence or regulation, the most notable exception being the dispensary system in South Carolina, which was still in operation, however, in only six counties out of 22 that previously had state dispensaries; besides these there were 32 counties dry under local option.

Experiments with local option provided valuable tests of the spread of prohibition sentiment. A writer in the *National Municipal Review* for Oct. 1916, dealing with local option in the United States, stated that at that time 80% of the land area of the United States was under prohibition, affecting 54% of the pop. of the country; in other words that more than one-half of the pop. of the United States, spread over four-fifths of its area, was without licensed supply of intoxicants. In the 26 local option states the percentage of area made dry in that year by local legislation ranged from 18% in Rhode Island to 98·3% in Wyoming, with a median percentage of 78·5. Only three of those states had less than half their area under no licence; seven between one-third and three-fourths, and 16 more than three-fourths. Therefore, said this writer, "with 19 states wholly dry, 16 states more than three-fourths dry and 7 states more than half dry, it would appear from the map that national prohibition requiring the consent of 36 states is not far off."

Liquor Consumption.—Too much importance is often attached to actual statistics of the consumption of liquor as an evidence of the success or failure of local option, and of restriction or prohibition of manufacture and sale. They are by no means conclusive, and especially have slight bearing on the important question, involved in most local option and prohibition enactments, concerning the nature, character and number of saloons and places where intoxicating beverages are sold and consumed. The annexed official figures from the *United States Statistical Abstract* for 1920 give statistics for the consumption *per capita* of distilled spirits, wines and malt liquors for beverage purposes, from 1850 to 1920.

United States Annual Consumption per capita *of Distilled Spirits, Wines, and Malt Liquors, 1850 to 1920; in gallons.*

Year ended June 30	Distilled Spirits	Wines	Malt Liquors	All Liquors and Wines
1850	2·24	·27	1·58	4·08
1860	2·86	·34	3·22	6·43
1870	2·07	·32	5·31	7·70
1871–80*	1·39	·47	6·93	8·79
1881–90*	1·34	·48	11·37	13·20
1891–5 *	1·37	·39	15·20	16·96
1896–1900*	1·12	·36	15·53	17·01
1901–5 *	1·39	·47	17·34	19·20
1906–10*	1·43	·62	19·81	21·86
1911	1·46	·67	20·69	22·81
1912	1·45	·58	20·02	22·05
1913	1·51	·56	20·72	22·80
1914	1·44	·53	20·69	22·66
1915	1·26	·33	18·40	19·99
1916	1·37	·47	17·78	19·61
1917	1·62	·41	18·17	20·20
1918	·89	·49	14·80	16·18
1919	·80	·51	8·03	9·34
1920	·26	·12	2·63	3·01

*Average for the period.

Influences Behind Prohibition.—The facts and figures already set forth should help to indicate what were the influences which brought together the local, state and national forces, and led to the adoption of national prohibition in 1920, as well as to its virtual enforcement as a war measure July 1 1919, throughout the area of the United States and the territory subject to its jurisdiction. The movement was not to be ascribed, as some publicists have seemed inclined to believe, to a state of exaltation induced by the war. Neither was it due to the absence of many male voters engaged in military service and perhaps not able to make their opinions effective in the matter. Prohibition had its roots and causes outside of and far antedating these sentiments and experiences. The continuously rising standard of living of the masses in both urban and rural communities from 1910 to 1918 had much influence. The industrial demands for efficiency, and the growth of scientific knowledge about its requirements, had an important and increasing effect. Americans of all classes in increasing numbers perceived that, quite irrespective of their personal habits or desires with respect to the consumption of alcohol, they could not secure the advantages of abstinence, or of moderate and perhaps harmless consumption, on the part of the weaker and more numerous members of any community, unless they themselves were willing to forgo the liberty of personal consumption, even though they belonged to the minority whose efficiency might not in any case be seriously impaired. Enlightened opinion was also shown in the increasing regard for public health, and the measures which the nation as a whole, and the public authorities in most of its component divisions, were taking to promote it. The physiological effect of small doses of alcohol on physical strength and on mental processes had been studied by scientists for many years; and the activities of the leading life-insurance companies, during the decade here under review, in the dissemination of information with respect to personal and public hygiene, had also exerted a considerable influence upon the movement. The published statements of the life-insurance companies, analysing their mortality experience, have generally been regarded as unbiassed, but have not been unchallenged or free from conflicting interpretation. Their conclusions, however, steadily served to support the total abstinence arguments as to industrial efficiency and public health, and they were widely circulated by many of the companies in such a way as to exert an effective educational influence. Mr. Arthur Hunter, actuary of the New York Life Insurance Co., in a paper read before the National Conference of Charities and Correction in Indianapolis in 1916, presented a survey of this material in which he claimed that the American statistics, many of which were then only recently available in published form, corroborated the English data in indicating that total abstinence decidedly increased longevity. He said, "the experience of the seven American life insurance companies (and one Canadian company whose records had been studied) has proved that abstainers have from 10% to 30% lower mortality than non-abstainers, and there is no good reason for believing that if the other companies compiled their statistics there would be any different result, providing the companies exercised the same care in accepting abstainers and non-abstainers."

Lastly, and of as much weight, it would seem, as all the other reasons combined, there was among all classes a growing hostility to the liquor saloon, as a mischievous agency, largely controlled and dominated by anti-social influences, and by persons and corporations actuated by a strong motive of private profit. Furthermore, the liquor saloon was gaining a power in politics, and a control of matters affecting the social life and general welfare of the people, which made its growth disproportionate to that of any other social institution in the country. The public perceived the increasing political influence of the saloon, and the failure everywhere of the various experiments to develop a substitute for it, or, indeed, to organize any other successful centre of recreation, social intercourse and community life, in competition with saloons supported and controlled by the profits of the liquor industry. A formidable body of public opinion united many persons who were neither total abstainers nor wholly convinced by the economic efficiency and health arguments against alcohol. Nevertheless they were sure that drastic measures were necessary, even if they involved heavy personal sacrifice on the part of many persons, to rid the communities in which they resided, as well as those in which they did business, of the baneful results and by-products of the saloon. Thus many who never would have voted for state prohibition, and who were even disappointed with the general outcome of local option, were prepared, when the issue was presented, to support and defend national prohibition.

Results.—Various efforts were made between Jan. 1920 and the autumn of 1921 to appraise the economic results and the effectiveness of the enforcement of national prohibition. But there had not yet been time to get accurate and convincing statistics or to know how to make allowance for purely accidental factors. Adjustment to the new conditions was still going on, and the existence of old stocks of liquor and wine introduced an inevitable complication. In the case of war prohibition there was a tolerated delay of 7½ months, which the Supreme Court, in its decision upholding the war prohibition enactment, practically stated was a reasonable period, in lieu of compensation, to enable liquor dealers to dispose of liquors on hand. It was still necessary in the autumn of 1921 to depend largely upon the judgment of trained observers, who could be trusted to interpret partial but significant statistics. Of local and partial data there was no lack. *The Survey* for Jan. 17 1920, speaking of six months of the enforcement of war prohibition, said: "Thus the fact of national prohibition comes to pass without any of the dire disasters predicted—great bodies of men are not jobless; the breweries are not idle, but have turned to the making of soft drinks and ice cream; labor has not refused to work without beer. . . ; real-estate values have not slumped; in fact, the rentals charged to cigar stores, soda fountains, lunch counters, groceries and such like which are moving into the vacant saloons with all possible speed, are higher than they were; there has not been a reign of terror by outraged men demanding the return of their personal liberty." Another study made by *The Survey* and published Nov. 6 1920, of the city of Grand Rapids, Mich. (located in a state under constitutional prohibition since 1916), says that Grand Rapids in 1920 was practically free from drunkenness if not from drink; prohibition had all but emptied the county gaol; the county farm had run down for lack of prison labour; the police force had been greatly reduced; the withdrawal of liquor from dance and social halls had closed prolific sources of immorality and crime; and the number of arrests in two years had been cut in half.

A study under the direction of the Federal Council of Churches was made by the head of a social settlement in Buffalo, who visited eight cities, including three of the largest—New York, Philadelphia and Chicago—and the smaller cities of Washington, Harrisburg, Columbus, Detroit and Buffalo, examining the police returns, hospital returns, reports of lodging houses, charitable and community organizations, during the month of April 1920. Most of his material is from official sources and shows a decrease in the number of arrests in cities far apart, which cannot be explained by the operation of the usual causes of fluctuation. Apparently prohibition was the only factor common to all of these returns and operating upon them alike. Other reports, from many sources, of similar character show that throughout 1920 arrests for drunkenness and for all crimes in the principal cities diminished. In Philadelphia the total for the dry six months of 1919 compared with the wet six months of that year showed a decrease of 40% (47,000 to 28,530), and the chief resident physician of the Philadelphia General Hospital stated that there had been no increase in the use of drugs since prohibition.

Fifty-nine cities of the United States having a pop. of 30,000 or over and a combined pop. of over 20,000,000 (including New York, Chicago and Philadelphia) give the following official figures for arrests for drunkenness in the four successive years 1917–20: 316,842, 260,169, 172,659 and 109,768. Indiana shows 70% fewer arrests in 1920 for drunkenness than in 1917, the last year when the state was wet, for 39 cities with a combined pop. of nearly one million. Boston reports 5,000 fewer arrests in 1920 for all causes than for drunkenness alone in 1919; the state of Massachusetts reports 32,580 arrests for drunkenness in 1920 compared with 77,925 in 1919; Connecticut had 943 arrests for drunkenness in 1920 against 3,777 in 1919; New York City a decrease from 14,182 in 1917 to 5,813 in 1920; St. Louis a decrease from 2,605 in 1919 to 691 in 1920. A similar tendency in many cities is apparent in the returns for 1920.

Since prohibition, high wages and continuous employment came together during the year July 1 1919 to June 30 1920, it is difficult to state with certainty which of the three was the cause, or the major cause, of the increase in savings bank accounts, or of the decrease in industrial accidents reported during that period. An official statement of the Comptroller of the Currency given out in Washington Jan. 22 1920 stated that in national banks alone 880,949 new accounts were opened in the first 4½ months of the fiscal year beginning July 1 1919, and that the increase in the number of depositors in state and private banks, though not available, was known to be far greater than the increase of depositors in national banks. The Comptroller's official report (*48th Annual Report*) for the year ended Oct. 31 1920 states: "In the number of depositors or deposit accounts in national banks all previous records were exceeded, official reports showing that on June 30 1920 there were 20,520,177 deposit accounts in all national banks. This was an increase of 2,279,877 (12½%) over June 30 1919. There is now approximately one depositor in the national banks for every five of our population."

The most disinterested and intelligent observers, accustomed to judging public conditions and social facts, differed widely in their verdicts on prohibition, its economic results and general benefits or disadvantages to the public welfare in the first year of national prohibition. That is likely to be true for several years to come. The more authoritative opinion, however, seemed to be that the first effects had been generally beneficial; that the popular sentiment in support of effective prohibition was gaining in strength, and that the experiment would be continued and developed. The fears of lurking danger to social institutions or to the moral integrity of the people (which some critics believed to be inherent in prohibition), seemed likely to be outweighed by the economic and political advantages of freedom from the saloon, and the semblance, at least, of more orderly communities, less petty crime and less abject poverty. The majority of moderate drinkers seemed to be willing to sacrifice their personal liberty for these desirable results. The intemperate constitute a minority as compared with the total abstainers plus a majority of those who had been moderate users of intoxicating beverages, and their number may be expected to diminish from year to year. The business interests which were thought to be menaced by prohibition found, at the time when national and wartime prohibition went into effect, means of readjustment without great loss and without inflicting on the nation the burden of any scheme of compensation. The outlook for the future was in 1921 one of hope that new forces and new funds had now been released, which might be directed to providing normal recreation and facilities for social and community life which the saloon did not provide, but for which its very existence had precluded other provision being made.

U.S. War-emergency Measures.—After the entry of the United States into the World War, Federal legislation began with the Draft law of May 18 1917, Section 12 of which authorized the President to make regulations for the prohibition of the sale of alcoholic liquors in or near military camps and to officers and enlisted men of the army. An Act to promote the efficiency of the U.S. navy, approved Oct. 6 1917, extended these provisions to include the navy and all places for training and mobilization connected with the naval service. This section made it unlawful to sell or supply intoxicating liquors to any military or naval station, cantonment, camp, fort, or officers' or enlisted men's club, or to sell intoxicating liquor, including beer, ale or wine, to any officer or member of the military force while in uniform. The Food Control Act of Aug. 10 1917 prohibited the use of foods, fruits or food materials in the production of distilled spirits for beverage purposes, but authorized the President to prescribe rules for their use in the production of distilled spirits for other purposes. It provided also that distilled spirits should not be imported into the United States, and that whenever the President should find that limitation, regulation or prohibition of the use of foods, fruits or food materials in making malt or vinous liquors for beverage purposes, or that the reduction of the alcoholic content of such liquors is essential for food conservation, he should be authorized to prescribe and give public notice of such limitation, prohibition or reduction as might be necessary. This Act also authorized the President to commandeer and pay for distilled spirits needed for the manufacture of munitions or military supplies.

The so-called War Prohibition Act, enacted Nov. 21 1918, 10 days after the signing of the Armistice, was an amendment to the Agricultural Appropriation Bill, and provided that from June 30 1919 until the conclusion of the war and of demobilization, the date to be determined and proclaimed by the President, it should be unlawful to sell for beverage purpose any distilled spirits or to withdraw distilled spirits from bond except for export. It also provided that after May 1 1919 no grains, cereals, fruit or other food products should be used in the manufacture or production of beer, wine or other intoxicating malt or vinous liquor for beverage purposes, and after June 30 1919 no beer, wine or other intoxicating malt or vinous liquor should be sold for beverage purposes except for export, until the conclusion of the war and of demobilization, the date to be determined by the President. This Act also prohibited the importation, from the date of its approval until the period of its termination, of distilled malt, vinous or other intoxicating liquors. The President was further authorized by the Act to establish zones about coal mines, munition factories, shipbuilding plants or wherever necessary to facilitate war work, in which strict prohibition should be made effective under heavy penalties. This Act continued in force until national prohibition came into force by reason of the refusal of the President to declare demobilization to have been completed before that date, and the section of the Act authorizing the President to establish special zones as above described was incorporated from a joint resolution of Congress, having the force of law from the earlier date of Sept. 12 1918.

The Prohibition Enforcement Law or Volstead Act, enacted Oct. 28 1919, three months before national prohibition came into effect, provided for the enforcement of both the War Prohibition Act and the Eighteenth Amendment. The President exercised the powers conferred on him under the Food Control Act of Aug. 10 1917, and under it the manufacture of distilled spirits in the United States was prohibited on and after Sept. 8 1917. Through the Food Administration the President also stopped the use of food materials in the manufacture of beer on Dec. 1 1918. All these measures were strictly enforced and achieved their major purposes by securing conservation and the maintenance of discipline and sobriety in all places where men in uniform were stationed. They did not affect the civilian population because of the short period of prohibition of manufacture, and because of the existing stocks in territory where local or state legislation permitted its sale. No state legislation was necessary to carry out the purposes of the special war period restrictions. (S. McC. L.)

PROPAGANDA, the term applied to a concerted scheme for the promotion of a doctrine or practice; more generally, the effort to influence opinion; by a false analogy from such plural words as "memoranda," frequently applied to the means by which a propaganda is conducted. The objective of a propaganda is to promote the interests of those who contrive it, rather than to benefit those to whom it is addressed; in advertisement to sell an article; in publicity to state a case; in politics to forward a policy; in war to bring victory. This differentiates it from the diffusion of useful knowledge; the evangel of a mission; publication of the cure for a disease. In such objectives there may be a secondary advantage to the contriver, but to benefit the subjects of the effort is the leading motive. Similarly those engaged in a propaganda may genuinely believe that success will be an advantage to those whom they address, but the stimulus to their action is their own cause. The differentia of a propaganda is that it is self-seeking, whether the object be worthy or unworthy, intrinsically, or in the minds of its promoters.

Statements or arguments known to be self-interested tend to raise suspicion. A wide examination of propagandas supplies an empirical argument in justification of such an attitude. Indeed, casuistically considered, indifference to truth is a characteristic of propaganda. Truth is valuable only so far as it is effective. The whole truth would generally be superfluous and almost always misleading; the selections made range from a high percentage to a minus quantity. The time factor is vital. If a quick sale or a decisive victory is possible, opportunism may be more useful than exactitude. If a permanent market is to be opened or a protracted campaign is expected, caution is required in suppression or in misstatement. Although truth may thus be irrelevant to the success of a propaganda, it does not follow that those engaged in it are consciously unethical. Doubtless, in every effort to control opinion, there are persons either indifferent to justification, or who justify the means by the end. But the more the emotions are excited, whether by patriotism or by cupidity, by pride or by pity, the more the critical faculties are inhibited. It is a quality of propaganda, as of counter-propaganda, that high-minded persons on both sides commend their cause by identical arguments, and that high-strung persons soon come to believe what they wish to be true. Their character and their enthusiasm lend weight to many partial statements, or even make false coin ring true.

The suspicions aroused by an admitted propaganda lessen its effectiveness, from which it follows that much of the work has to be furtive. Part of the task, and that the more easy, is to whip up existing inclinations, but the more arduous and the more frequent duty is to reverse or to create opinion. Efforts are therefore made to present "tendencious" matter as impartial. The simplest case is seen in the familiar methods of newspaper advertisement. The crudest form is a direct printed recommendation of an object, obviously paid for. More subtle, but still plainly a paid advertisement, is a general paragraph in the "News" columns, with the letters *Adv.* at the foot. Best of all is commendation in the editorial columns or description disguised as news, these methods being seldom adopted in the responsible Press of the better kind, but familiar in organs subsidized to support an interest, possibly with a free hand on everything except that interest.

The methods of a propaganda are limited only by the resources and the ingenuity of its promoters. They may be studied in their most intensive form in the propagandist efforts during a war; the magnitude of the object secures the necessary funds, and at the same time attracts the services of persons of more intellect and character than would usually devote themselves to such a pursuit; in the atmosphere of war, moreover, truth, like many other fine qualities of humanity, is judged by expediency, with varying answers.

The use of propaganda in war dates from remote antiquity. It is plain that Herodotus, with his alert and modern mind, suspected the possibility of "working" the oracles whose pronouncements had so great an influence. But in Urania VIII., 22, he describes a propagandist effort made in the Persian War by Themistocles, son of Neocles, which in intention and method might have occurred in the recent World War:—

"Themistocles, having selected the best sailing ships of the Athenians, went to the places where there was water fit for drinking, and engraved upon the stones inscriptions, which the Ionians, upon arriving next day at Artemisium, read. The inscriptions were to this effect: 'Men of Ionia, you do wrong in fighting against your fathers, and helping to enslave Greece: rather, therefore, come over to us; or, if you cannot do that, withdraw your forces from the contest, and entreat the Carians to do the same. But if neither of these things is possible, and you are bound by too strong a necessity to revolt, yet in action, when we are engaged, behave ill on purpose, remembering that you are descended from us, and that the enmity of the barbarian against us originally sprung from you.' Themistocles, in my opinion, wrote this with two objects in view; that either, if the inscriptions escaped the notice of the king, he might induce the Ionians to change sides and come over to them; or, if they were reported to him, and made a subject of accusation before Xerxes, they might make the Ionians suspected, and cause them to be excluded from the sea-fights." (Herodotus VIII., Urania 22.)

Propaganda on similar lines has been conducted in almost every war in history, but until the World War (1914–18) chiefly as a subsidiary part of the actual military or naval operations. Clausewitz, the Polish-Prussian officer (1780–1831) whose works on the conduct of war were translated into most modern languages and formed the basis of most military theory, laid it down partly as a prediction and partly as a precept that war must be waged with the whole force of a nation. Military propaganda may therefore be defined as the attempt to add the psychological factor to the other resources of warfare. It may be considered formally under four heads:—(1) Control of Home Opinion; (2) Control of Neutral Opinion; (3) Control of Allied Opinion; (4) Control of Enemy Opinion. Counter-propaganda is the effort to counter the operations of the Enemy.

(1). *Control of Home Opinion.*—In modern times even the most autocratic ruler or state cannot hope to conduct a protracted war, or a war that brings a great burden on a nation, or a war that sways with doubtful success, unless public opinion is favourable. A large part of propaganda must therefore be for home consumption. It will proclaim the certainty of victory, describe actual and prospective military and naval triumphs, obliterate or explain reverses. It will vaunt economic strength, financial resources, power of organization; it will explain difficulties in the supply of food and raw materials, give the reasons for vexatious regulations and interferences with the ordinary routine of trade. When the war appears to be going unfavourably, it will urge the need of endurance. But it will not neglect the moral appeal. It will insist that the war is one of defence, or at least for an unselfish purpose; that victory will be for the good of the world, will be a permanent triumph of right over wrong. At the same time, according to the mentality of the nation, it will insist on historical military glory, on the pursuit of the national aspirations such as recovery of ancient rights, redress of old wrongs, material benefits to be derived from victory, appalling consequences of defeat. The outrageous conduct of the enemy, his unnecessary cruelty, his breach of international law are all important.

(2). *Control of Neutral Opinion.*—The propaganda addressed to Neutrals covers much of the same ground, with the least possible stress on the interested motives, much stress on the defensive and inevitable sides of the war, the certainty of victory and its benefit to all humanity. Very careful attention is devoted to explaining as necessities all the steps that have interfered with the rights of Neutrals or have been positively harmful to them. Much care is given to exposition of the thesis that victory would also be to the benefit of the Neutrals.

(3). *Control of Allied Opinion.*—This is of great difficulty and of increasing importance with the prolongation of a war. It is necessary to anticipate points of friction, gloss over points of diverging interest, pay very careful deference to the Allied contribution to the common cause and to the absolute identity of interest. In the World War many mistakes were made in this aspect of propaganda, but by none more conspicuously than by the Germans, whose treatment of their Allies was marked by compulsion rather than by persuasion.

(4). *Control of Enemy Opinion.*—The efforts in this direction fall under three main heads:—Insistence that victory is certain and that prolongation of the war is only increasing the inevitable disaster to the Enemy. Attempts to stir up disaffection amongst the Enemy's Allies; attempts to stir up internal trouble in the Enemy's country.

The four sub-divisions enumerated above cover the main purposes of both propaganda and counter-propaganda, but they are only formal, and it is of vital importance to remember that under modern conditions a propaganda cannot be limited to the group for which it was intended. The most rigid censorship and scrutiny at the frontiers did not retain within Allied Countries or in Germany what was prepared for home consumption, with the result that the propaganda of one camp was often used almost without alteration as counter-propaganda in another. Neutral countries were the battle-ground in which contending propagandas met, and where statements of alleged facts and arguments came in contact.

THE BRITISH EFFORT IN THE WORLD WAR.—In the usual British fashion propaganda in the World War came into existence by the extension of the normal duties of several different bodies, with the result that there was much overlapping, as well as many gaps and considerable diversity of aim and method. From time to time new bodies were created, partly absorbing, partly replacing and partly combining the agencies in operation. Even when the Armistice came, no complete organization had been achieved, and the very great success actually obtained may be ascribed to the flexibility of the methods, the devotion of those who conducted them, and a very remarkable unity of purpose which overbore such personal rivalries as are inevitable in human affairs. A logical and consecutive account of the British propaganda is impossible. No complete organization ever existed, and as much of the most successful work was necessarily conducted secretly, and much was done by private enterprise, for instance by the spontaneous patriotism of universities, publishers, newspapers and private persons, an exhaustive description is impossible. The official side of it was conducted at first chiefly by the Foreign Office, the War Office and the Admiralty, as extensions or side issues of their normal duties. Many special missions were inaugurated by these bodies, or directly by the Cabinet.

In the beginning of 1918 a special body, the Ministry of Information, under a Cabinet Minister, Lord Beaverbrook, was created to combine and extend British propaganda with special reference to the control of Home and Neutral opinion, and another special body, the Department of Enemy Propaganda (afterwards the British War Mission), under Lord Northcliffe, for the same purpose, with special reference to control of opinion in enemy countries. Under the energetic direction of these two great publicists and the brilliant staffs they assembled, British propaganda enlarged its sphere, increased its potential and began to approach coherence. The steps of most vital consequence, however, must be attributed to Lord Northcliffe and his staff. They were early impressed with the conception that propaganda must be closely linked with policy. With the willing coöperation of the Ministry of Information, they first secured a general unity of method and purpose in purely British work, and, next, by propaganda conferences in London, extended a similar unity to British, French, Italian and American propaganda. Still later, as the war appeared to be nearing its end, they formed a general committee containing representatives of all the great Departments of State and worked out a Peace Propaganda Policy, to which the assent of the British Cabinet was obtained and which was at once made the basis of all British propaganda. Arrangements had been made for another conference of Allies in which the British Peace Propaganda Policy was to be coördinated with the policy of our Allies, when the signing of the Armistice made further effort of this kind unnecessary. Later in this article the steps which led to this ultimate coördination will be described more fully, or will become more apparent as the scattered agencies which led to it have been explained. But it is pertinent here to observe that the final stage, reached by slow experience, should have been the initial stage. In any national propaganda, the national policy, if such indeed exist, should be within the cognizance of those who have to create and direct the machinery for endeavouring to control opinion.

From the outbreak of the war in 1914 to the end of 1915, the official organization of British propaganda was highly tentative. The task of creating and directing public opinion during war had never before been a function of British Governments and did not consort well with the national traditions. In the first months of the war, during Mr. Asquith's Ministry, a War Propaganda Bureau was set up in the National Assurance Offices at Wellington House; a Neutral Press Committee, with special reference to Cabling was established under the Home Office, and a News Department, to deal with the Press, was formed by the Foreign Office. Gradually these three departments came more under the authority of the Secretary of State for Foreign Affairs; but they operated to a large extent as independent agencies without central control.

The Admiralty and the War Office had to exercise strict control over the publication of news relating to actual or proposed operations and other matters relating to the navy and army. The censorship which they had to exercise strictly for military reasons, gradually acquired a wider purpose and passed into a dissemination of news essentially propagandist. The direct effect of this bias given to news was upon home opinion, but naturally passed from home countries to neutrals, and from neutrals to enemies. It had therefore the legitimate objects not only of concealing what it was useful to conceal, but of making suggestions which might deceive. From indirect or accidental propaganda, it passed over to deliberate propaganda. Similarly the official representatives of the Foreign Office in Allied and neutral countries quickly found that their routine duties of explaining the intentions of the British Government, and of assisting public and private British interests, necessarily acquired a propagandist bias. As there were obvious inconveniences in this course, the propagandist activities in foreign countries gradually became detached from the official diplomatic activities, and acquired direct relationship with special departments at home. A similar series of events took place in the case of the representatives of the British army and navy in foreign countries, especially those attached to the Secret Services. As their efforts became more propagandist, it was convenient to separate them. Thus in various ways a propagandist service crystallized out of normal services.

During this period, and, indeed, until the end of the war, the voluntary work of the great newspapers and publishing houses made an important contribution to British propaganda. It is perhaps necessary to insist on the voluntary side of this work. It has never been the tradition of the British Government to subsidize or to control the British Press, and although some efforts were made in that direction, they were signal failures. The great newspapers and the great publishing houses jealously maintained their independence and their right of criticism; they were willing to accept censorship so far as it was supposed to prevent the leaking of information that might be of service to the enemy. But they fought bitterly, and successfully, any attempts of the Censorship to overstep the bounds of military needs. (*See* CENSORSHIP.) The independence of their attitude and the strength of their patriotism combined to make their voluntary propagandist effort of the utmost importance.

Ministry of Information.—It will be convenient to deal first with the grouping of propagandist agencies under the Department, later the Ministry, of Information, as this body was the first to combine a number of scattered bodies under one direction, although, as will be shown later, the War Office, under the Directorate of Military Information, created earlier an extensive propagandist headquarters.

The Department of Information was formed by a resolution of the War Cabinet on Feb. 20 1917. According to that resolution its object was to take over and unify the various foreign propaganda activities, and to act as a general publicity bureau under the War Cabinet. Col. John Buchan was brought back from France and appointed Director of Information. Propaganda thus acquired its own specific organization separate from other Government Offices and directly under the Prime Minister. There was necessarily much overlapping with the War Office, but on the whole the Department of Information worked toward the control of civilian opinion, the War Office to that of military opinion; the former concentrated attention on political and general subjects, the latter on military subjects.

The Department of Information, during the time of its existence, covered the work of British propaganda in Allied, neutral and enemy countries. It was arranged in four sections:—

(*a*) An administrative section, divided into branches, corresponding to the different countries, each branch being under the charge of an official who was a specialist in that geographical area.

(*b*) A producing section which dealt with literature and art and was virtually a large publishing establishment.

(*c*) A producing section concerned with cables and wireless and the distribution of cinema films and press articles.

(*d*) A political intelligence section, which provided reports upon political and civil matters in foreign countries.

Foreign propaganda was conducted (*a*) among foreigners on a visit to Britain or resident there as correspondents, and (*b*) in the foreign countries themselves. (*a*) The first task involved hospitality to foreign visitors, the securing of facilities for Allied and neutral correspondents, and the arranging of visits to the British front, the British fleet and other centres of interest for writers and public men from Allied and neutral countries. Three châteaux on the western front were used for guests by the Department of Information—one for American visitors, one for the Allied and neutral press, and one for visitors in general. A large number of distinguished foreigners were invited to Britain, since it was held, with reason, that the best propaganda in any country was that done by the citizens of the country themselves. (*b*) Propaganda in foreign countries was conducted by the issue of a very large number of publications in different languages, including pictorial journals, pamphlets and books. The *War Pictorial* was issued monthly in eight editions with a circulation of over 700,000. Six oriental papers were published fortnightly in different languages, and the Department published fortnightly journals in Spanish, Greek, and Portuguese. Exhibitions of photographs and war films were arranged throughout the world. Over a million words of propaganda material a month were cabled by Reuter, and there were also daily cable and wireless messages sent from the Department. An average of 400 articles per week was sent out to the foreign press. Bureaux of Information were established in the different Allied and neutral countries, which assisted to distribute the material prepared by the Department, and also acted as intelligence centres. A special section dealt with propaganda in enemy countries by means of articles and cables printed in the newspapers of adjacent neutral States, and by aeroplane and balloon distribution on the different fronts.

The organization of the Department of Information obviously left much to be desired. In the first place it was not a ministry and had no ministerial head. This led to two disadvantages: the War Cabinet had little time to spare for the supervision and direction of its policy, and in dealing with other ministries it lacked the prestige necessary to safeguard its interests and enforce its requirements. Again, it had no single domicile, being housed in four different parts of London, and this led not only to a great deal of delay in its work, but prevented it being organized according to the normal plan of a Government office.

The Ministry of Information was constituted on March 4 1918, with Lord Beaverbrook as minister. It took over the whole organization of the old Department of Information, with the exception of the Political Intelligence branch, which was transferred to the Foreign Office, and the section dealing with enemy propaganda (excluding Turkey and the Middle East), which was transferred to Lord Northcliffe. The new Ministry was organized on the normal lines of a Government department, and was able to draw for its increased staff upon a large number of distinguished volunteer workers. The new Ministry had four main departments:—

(1). The Intelligence Department received and digested all information necessary to the efficient work of propaganda in the different countries, translating policy into terms of propaganda. The special cable and wireless messages which were issued daily were prepared under the direct supervision of this Department.

(2). The Propaganda Department was in charge of the actual administration of propaganda in foreign countries. Under its director there was a section for each important country, or group of countries. Each section was in charge of a "National" at the headquarters of the Ministry, and in each foreign area there was a corresponding organization which carried on the work in that area. Over each of the main sections there was a special officer called the controller, whose business it was to supervise the work of the "Nationals," more especially with a view to the expenditure of public money.

(3). The material for propaganda—apart from the cables and wireless, which were directly under the Intelligence Department—consisted of press articles prepared or arranged for at the Ministry's headquarters; literature in the shape of journals and pamphlets; and war photographs, films, pictures. The preparation of pictures, photographs and films, as well as their distribution, was directly controlled by the minister, and was no longer in the hands of War Office Committees, as had been the case with the old Department of Information.

(4). The Ministry gave special attention to what might be called "personal" propaganda, securing facilities for foreign correspondents to visit British centres of interest and to meet representative British public men, and, generally speaking, the widening of sympathy for Britain's cause by the personal and social contact of Britons with the citizens of other lands. In this direction the work was large and ramified. A Facilities branch arranged for visits and entertainments; an Overseas Press Centre acted as a clearing house between all branches of the Ministry and the correspondents of the Overseas Press in this country; a special organization dealt with the entertainment of American troops in Britain. Besides the work of personal propaganda done in Britain itself, much was done by representatives of the Ministry abroad, who acted as popular and democratic ambassadors, keeping in touch, not with official, but with unofficial powers.

The nature of its duties made it impossible for the Ministry of Information to be a rigid organization like an ordinary Government office. Propaganda is not a static thing and can never be standardized, and the constitution of a propaganda department had to be adapted to so fluctuating a subject matter. Constant revision was necessary, both in material and method. Moreover, the larger part of the work of the Ministry had to be done quietly and unofficially, and without advertisement, since popular opinion in every country is so delicate an instrument that attempts to play upon it in the name of a foreign government, even an Allied Government, would without doubt have been resented. The anomalous character of its duties was reflected in the curious variety of its staff. It is probable that never before in any Government department had there been so many distinguished men of a type so remote from that of the normal official. All varieties of talent were needed—the skilled journalist and the expert in publicity for the actual business of propaganda, the experienced business man for the control and expenditure of machinery, and the student of public affairs for Intelligence and Policy.

Directorate of Military Intelligence.—Until the end of 1915, the Intelligence Section of G.H.Q. (France), and the Director of Special Intelligence at the War Office, made somewhat casual efforts in the direction of propaganda at home, abroad and amongst the enemy forces, and did more in the direction of acquiring information about the propagandist activities of the enemy. The supreme military authorities, however, either attached little value to propaganda, or were more absorbed by their directly combatant functions, and gave no encouragement to the development of propaganda. In the beginning of 1916 Gen. Sir George Macdonough returned from France to become Director of Intelligence on the Imperial General Staff. Thenceforward until the end of the war, a branch of his directorate was devoted to propaganda with continually increasing intensity. Under his stimulation and with the encouragement and the active assistance of Brig.-Gen. Cockerill, his second-in-command, a small group of men, half of them regular officers and half distinguished civilians with temporary commissions, a very large and successful organization was built up. It worked in close coöperation with General Headquarters at the various fronts and with the propagandist agencies in England. Its command of material drawn from all the branches, open and secret, of the Directorate of Military Intelligence, and its close connexion with the fighting services, gave it very large opportunities, of which it took full advantage; on the other hand, the fact that it was a branch of the War Office, run on strict military lines, prevented the full extent of its activities being known, and the credit of much that it accomplished was assigned to organizations more accustomed to work before the footlights.

Reports, captured documents, photographs and any other matter with a possible propagandist use, were collected from all the fronts. Samples of all propaganda prepared by the enemy were obtained from neutral countries, through the postal censorship, by direct capture, from the navy and from all other available sources. Details of the actual fighting operations, stories from the fronts, and all matter tending to show the conditions of fighting on both sides were assembled. Letters written by prisoners of war were read in the special censorship and copies of any judged to be of utility were preserved for reproduction in *facsimile*. Illustrated booklets describing the happy conditions of enemy prisoners in British camps were prepared. The foreign press, especially that from enemy countries, was regularly read, and extracts taken. From these and similar materials propaganda was prepared for distribution, partly by the regular staff of the section, partly by distinguished civilians who gave their services, and largely by wounded or otherwise disabled officers of literary capacity seconded for the purpose. The propagandist material prepared in this way was first carefully censored from the military point of view, in case inadvertently it might contain information which it was desired to keep secret. It was next submitted, especially where it contained matter with any political significance, to the Foreign Office. It was then ready for use. A staff of linguists was maintained to examine and translate material from foreign sources which covered almost every known language. The prepared propaganda, if useful for other than English readers, was translated into foreign languages ranging from Urdu to Spanish, from Russian to Arabic.

A few examples may serve to illustrate the range covered by the War Office propaganda. A German Army Order captured in E. Africa showed contempt or ignorance of Mahommedan religious customs. It was reproduced in *facsimile*, with a translation into every known tongue spoken by Mahommedans. A pamphlet written by Dr. Liebknecht, the German socialist leader, suppressed in Germany, was reproduced in German. Photographs of German prisoners showing their miserable condition on capture, their reception in the British lines with food, chocolate and cigarettes, and their happiness in their ultimate quarters in British prisoner of war camps, were reproduced as a small album. Letters written home by German prisoners of war, describing the comfortable conditions under which they lived, were reproduced in *facsimile*. An erroneous account of the battle of the Marne, written in Spanish for circulation as German propaganda in S. America, was followed by a correct account with exact maps, written by a British general who had been actually engaged in the battle. Every effort of German propaganda was followed and promptly countered in the same language as that in which it had been written. Perhaps the quickest exchange and counter-exchange took place through a cable and wireless service. All the messages issued by the enemy by cables or wireless telegraphy were intercepted and transmitted at once to the War Office. They were followed by a special staff, and the replies to them often reached their destinations a few hours after the originals, more often than not in time for the same editions of foreign newspapers.

Increasing attention was paid to the unification of the propaganda issued by the Allies, and to the pooling of information useful for propaganda. Regular conferences took place at British and French military headquarters in France for the purpose of coördinating propaganda. With the same object constant touch was maintained between the military propagandist staffs in London and Paris. A weekly journal, *Le Courrier de l'Air*, was prepared and issued at the War Office for circulation in the part of Belgium under German occupation. It contained information as to the progress of the war, general news, political intelligence, and much ordinary magazine reading.

Articles suited for British newspapers were offered to editors, and were freely used. These for the most part consisted of descriptions of scenes in the war on various fronts, written by officers who had been engaged in them. Similar matter, and articles covering a wider field, were distributed to English newspapers in every part of the world. A special staff watched the newspapers to observe the kind of articles that were most freely taken by each, so as to suit the supply to the demand. In the same way articles on almost every subject connected with the war were translated into foreign languages and distributed to newspapers in foreign countries. Large quantities of matter were sent to the Department of Information for distribution by their agencies, especially in neutral and Allied countries. There were several military distributing agencies in the Near East, and farther away, of which the largest was an "Arab Bureau" in Egypt. Some of these had local presses at which copy sent from London was set up, but a very large bulk of matter, especially illustrated matter, was prepared and printed in London, and sent out in bulk. According to its objective, it was distributed through vernacular newspapers, or by special agents, who smuggled it into enemy countries.

As regards distribution to enemies, a certain amount of this important side of the propagandist effort was done through the Department of Information, but the War Office itself directed the greater part of the work, especially where it was desired to reach enemy soldiers directly, or the enemy civilian population through them. From the examination of prisoners of war and by the direct admission of the German authorities it became clear that this service was highly effective. Early in 1917 the decision was made to extend considerably the work of preparing and distributing propaganda for the enemy troops on the western front. A special sub-section was created under the charge of an officer who had just completed an analysis of over 2,000 books and pamphlets of enemy origin. At that time there was no objection to the use of aeroplanes for the distribution of literature over the enemy's lines. The sub-section prepared and had translated into German a large quantity of suitable literature, much of it written by the officer in charge of the section (the writer of this article), other matter selected from the work of the Department of Information or from other sections of the War Office. Some of these early efforts were too successful; in particular the Germans objected to a cartoon with the legend "A German Family that has had no losses in the War," depicting the Kaiser and his sons in uniform, on the ground that its distribution was an offence against military discipline

Captured flying officers accused of distributing propaganda were tried in Germany by court martial and received severe sentences. Although in fact the sentences were not carried out, after negotiations had taken place through a neutral Power between the British and German Governments, the Germans let it be known that any future cases would be treated with the utmost severity. The French continued the use of aeroplanes in spite of this threat. But the British Air Ministry opposed the use of aeroplanes, partly on the ground of the " bad psychological effect of working under such threats, on young pilots and aviators," and partly on the more valid ground that the supply of trained men and of machines was no more than sufficient for the direct purposes of this branch of the forces. After an attempt, obviously impractical, to distinguish between propaganda that could not be regarded as " inflammatory " and that therefore could be distributed by aeroplanes, and propaganda that could not escape this charge, British G.H.Q. accepted the position and decided against the use of aeroplanes for the distribution of literature. The stock of literature prepared for the western front, except such small parts of it as could be used by other army devices, was transferred to the Ministry of Information and to the French army.

The War Office Enemy Propaganda Section then turned to the devising of other possible methods for the distribution of literature by mechanical means. Information was collected from all possible sources, the methods of the enemy being carefully watched. With the assistance of the Aerial Inventions Board and the Munitions Inventions Department, many devices were tried, and as soon as any had reached a promising stage, the officer in charge took it out to France, to discuss its possibilities, and, with the assistance of the intelligence officers of the army, to test it under field conditions.

A section of G.H.Q. Intelligence had obtained great success in dropping homing pigeons and other means of carrying messages on known areas where they could be found by British agents behind the enemy lines. In this work fabric balloons with timing devices for dropping loads at the required localities were employed, but the apparatus on the one hand was unnecessarily exact, and, on the other, much too costly for the distribution of literature. The Germans were found to be using very large balloons of scarlet Japanese paper which carried bundles of newspapers and other matter long distances, sometimes releasing them by slow-burning tinder fuzes. It was clear, however, that this method was haphazard, as balloons and loads destined for the neighbourhood of Verdun not infrequently dropped in Kent. Experiments were undertaken to study the lifting capacity of light balloons, the load and degree of filling that would enable them to rise to an approximately known height, and the arrangement of time fuzes so that they would liberate weights at known distances varying with the strength of the wind. At the same time experiments were made as to the shape, economical mode of manufacture and dimensions of paper balloons, and on the treatment of the paper to lower the rate of diffusion of coal-gas or hydrogen.

A large number of devices such as rockets, grenades and shells were enquired into, but were not adopted because of various objections raised against their use by the military authorities. A device consisting of a fire-balloon, the fabric of which consisted of propaganda sheets joined by strips of touch paper, seemed promising, but did not reach success.

Extensive experiments were carried out with the object of adapting an apparatus invented to distribute light bombs to the distribution of literature. It consisted of a box-kite with an automatic conveyer which carried five-pound loads of propaganda up the cable, liberated them at the required height, and automatically returned for another load, the sheets when liberated being carried to their destination by the wind. The method was extremely good; it was cheap, easy to work, and had a range of upwards of ten miles according to the strength of the wind. But objection to its use at the front was taken by the Air Force on the ground that the cable of the kite would be a danger to aeroplanes.

In connexion with the last-mentioned apparatus, extensive observations were carried out on the wind-driftage of sheets of paper of different shapes and weights, and of the methods of releasing them at height. Experiments were made from aeroplanes and from captive balloons, and the range and conditions of falling were ascertained. It was found, for example, that in a wind of approximately ten miles an hour, a bundle of 150 sheets liberated at a height of 2,500 ft., came to the ground two miles away, scattered over an area 500 yd. square. In higher winds and from greater heights much more distant ranges could be attained. The War Office Propaganda Section accordingly suggested that aeroplanes might be safely used, flying at heights proportioned to the strength of the wind, and the distance of the enemy lines, by flights well within the British lines. But this proposal also was " turned down."

By the end of 1917 it became clear that the use of paper balloons was the only method which would encounter no opposition, and attention was therefore concentrated on producing them on a large scale and on applying the experience gained in other directions to them. By far the largest bulk of propaganda distributed by the Allies on the western front was released from balloons, and it may therefore be of historical interest to describe their final form. The propaganda balloons were made of paper cut in longitudinal panels, with a neck of oiled silk about 18 in. long. Their circumference was approximately 20 ft. and their height when inflated 8 feet. They were liberated inflated nearly to their full capacity—from 90 to 95 cub. ft. of hydrogen. The weight of the balloon was under one pound, the load of propaganda four pounds. The leaflets were attached to a fuze of treated cotton, similar to the tinder of flint pipe-lighters, and burning at the rate of an inch in five minutes. The string of propaganda was tied to the neck of the balloon, and just before liberation a slit was cut in the neck to permit the escape of gas, and the end of the fuze was lighted. The weight and lift were adjusted so that the balloon could rise several thousand feet into the air before the loss of gas due to expansion would have caused a state of equilibrium. At this point the first bundle of leaflets was set free, and the process was continued until, at the end of the run, the last bundle was released. The total time length of the fuze and the attachment of the bundles to it were calculated according to the area which it was desired to reach and the strength of the wind. Experimental improvement of the " dope," by which the rate of diffusion of the gas was lowered, and the manufacture of balloons of double the standard capacity, had made runs of upwards of 150 m. practical, before the Armistice suspended operations. But the bulk of the propaganda was actually scattered over an area of from 10 to 50 m. behind the enemy lines, rest camps and villages occupied by the troops being made the chief targets. Each distribution unit at the front consisted of two motor lorries which carried the balloons, hydrogen cylinders, and personnel to convenient positions, generally from 3 to 4 m. behind the front line.

Early in March 1918, the method of balloon distribution was in full working order, and the War Office Propaganda Section resumed the active preparation of material. The reproduction of selected letters written by prisoners of war was resumed, and *Le Courrier de l'Air* was enlarged and improved by the introduction of direct propaganda. A series of leaflets, known as the A.P. (Aerial Propaganda) was begun. The first of these, sent to France in March, was a complete German edition of the British Prime Minister's speech on British War Aims. This had been incompletely reported in the German newspapers, and in the new edition attention was directed to the portions which had been taken out by the German censorship; copy for other leaflets was selected from German and Austrian newspapers, was contributed by G.H.Q. (France), by the War Aims Committee, by the Ministry of Information, and by the new Directorate of Propaganda in Enemy Countries which had been established under Lord Northcliffe. But the whole series was selected, revised, edited, and produced by the War Office, and a very large proportion of the actual leaflets were prepared by the officer-in-charge. The first of the series was sent to France on

March 16, the last, number 95, on Sept. 4; of the whole series over 12 million leaflets were sent to France.

Later, in 1918, when, under the energetic direction of Lord Northcliffe, the machinery for propaganda in enemy countries was greatly increased, there was a further extension of distribution by balloons. The military successes of the Allies were being concealed from their troops by the Germans, and it was thought that quick and accurate information would further demoralize the Germans. In conference with the War Office, Lord Northcliffe's department arranged that the leaflets should be divided into two categories, "stock leaflets," the contents of which would not deteriorate by a little delay, and "priority leaflets" containing matter of urgent importance. The latter were printed three times a week and sent in editions of 100,000 direct to Messrs. Gamage, who were manufacturing the balloons and the "releases." They were at once prepared for distribution, handed over to the Military Transport Department and sent via Boulogne direct to the distributing stations. In favourable weather they were thus actually in the hands of the Germans 60 hours after being written.

But even with the best arrangements, distribution by balloon is subject to many delays from weather and other conditions. Lord Northcliffe continued to urge on the Cabinet the need of distribution by aeroplane, and was at last successful in breaking down the resistance. The writer of this article, then liaison officer between Lord Northcliffe's department, the Directorate of Military Intelligence and the Air Force, in the second half of 1918 carried through the final stages of the negotiations. The last obstacle was the fear of the Air Ministry that bundles of leaflets suddenly scattered in the air might foul the steering guys of the aeroplanes; he devised a simple mode of packing the leaflets so that they would fall as a solid bundle for 20 ft. before dispersing. On the morning of the Armistice, the first packets of propaganda made up on this system were delivered to the Air Force in France.

The methods of distributing propaganda by the Allies were ascertained in a conference held in August 1918 at Crewe House under the chairmanship of Lord Northcliffe. Aeroplanes were used by the British forces in the Near East, and by the Italians, French and Belgians on the western front. But it was clear that either lack of aeroplanes or of personnel limited their use even by those who had no objection to it. The Italians used special devices such as rockets and shells, the French were experimenting with shells and trench-mortars and were trying to manufacture balloons on the British model, and both the French and Belgians sent large quantities of newspapers and of other matter to be distributed by the British balloons. The Americans had hardly reached the actual stage of distribution before the end of the war, but they had developed a small rubber balloon with a very ingenious timing device for releasing the load. It is a reasonable assumption, however, that all these methods would be replaced by aeroplanes in any later war.

Lord Northcliffe's Directorate.—In Feb. 1918 the Prime Minister appointed Lord Northcliffe to be Director of Propaganda in Enemy Countries. Lord Northcliffe brought to the task a limitless faith in the possibility of controlling public opinion, a unique experience in the methods of publicity, and direct access to the Prime Minister and the War Cabinet. He selected a council of advisors and an executive staff of remarkable authority and talent, and Crewe House, in Mayfair, London, the headquarters of the new Department, quickly became the centre of far-reaching activity. A mere catalogue of the operations undertaken, and of the men who carried them out would occupy many pages.[1] But two names must be mentioned, as without them Crewe House would have been little more than a powerful addition to the existing propagandist agencies. Sir Campbell Stuart, a young Canadian who had been of great assistance to Lord Northcliffe on his mission to the United States of America, was selected as deputy-director of the department and deputy-chairman of the committee. Lord Northcliffe's choice was fully justified by the remarkable powers of tact and conciliation shown by Stuart, who rapidly disarmed all suspicion on the part of existing organizations, found out how to get the best work out of all of them and how to combine their efforts towards a single resolute purpose. Lord Northcliffe selected Mr. H. Wickham Steed as his chief political adviser. Steed at the time was foreign editor of *The Times*, and for many years had been the representative of that journal in Rome and Vienna. He had an exceptional knowledge of the political personalities of modern Europe, the open policies and the secret aspirations of all the nationalities great or small. He was an idealist, believing that truth and justice could bring ordered peace to chaotic Europe; a realist, conscious of the stubborn obstinacy that would yield only to force and of the ignorance that misled the accepted leaders of men. Steed provided the knowledge and lofty enthusiasm which shaped the policy of Crewe House, Stuart the conciliatory tact which made concerted action possible, Lord Northcliffe the swift judgment between contending views, the experienced instinct for what was practical, and the driving force to make the practical actual. The present writer assisted at many intimate deliberations at Crewe House; he desires to add his own observations to the varying estimates that have been made of Lord Northcliffe. The Director of Propaganda in Enemy Countries was patient in listening to the facts and arguments put before him, decisive in coming to a judgment on them, swift and powerful when action began. Steed's knowledge, Stuart's organizing tact, and Lord Northcliffe's driving force and far-reaching influence, made Crewe House different in quality and energy from any preëxisting agency.

The inspiring principle of the new organization was that propaganda should depend upon policy. It may be argued, although not convincingly, that a definite constructive Allied policy could not have existed in the earlier stages of the war, when fortunes were changing and the nature of the ultimate decision was uncertain. In any case, if a concerted policy did exist, it was unknown to those who were conducting propaganda. The wiser propagandists in most countries therefore endeavoured to limit themselves to a restricted field from which declared "war aims" and ultimate terms of peace were excluded. Rasher agents plunged, with results that were often ludicrous and sometimes disastrous. Dr. Lamprecht, the German historian, for example, confessed that the consequences of the German propaganda were often gruesome. Probably, he wrote, more harm came to the German cause from the efforts of the German professors than from all the efforts of the enemy. "None the less it was done with the best intentions. The self-confidence was superb, but the knowledge was lacking. People thought that they could explain the German case without preparation. What was wanted was organization." A single example will illustrate the results of lack of organization amongst the Allies. The French military authorities complained to the War Office that German propaganda appeared to be entering France in large quantities through England. They sent examples, and asked that precautions should be taken. On enquiry it was found that the incriminated documents were the product of one of the British civilian propagandist agencies. Doubtless it was a matter of opinion whether the French or English judgment of the efficacy of the leaflets was the more correct, but the real fault was the absence of harmonious effort. In 1918, the fifth year of the war, it became of vital importance that the Allied peace aims should be explained with a clear and unanimous voice to the war-weary enemy. It was to this purpose that Lord Northcliffe addressed himself. He used his influence first to extract from the British Government the broad lines of a definite policy, in order that the propaganda of his Department might not be in conflict with the casual and sporadic utterances of ministers, next to secure unity of purpose among the British and Allied propagandist agencies.

The first campaign was against Austria-Hungary. The British Government, hampered by the secret Treaty of London, hesitated between the policy of working for a separate peace with the Habsburg dynasty, leaving its territory almost untouched, and the alternative of trying to support and encourage all the anti-German and pro-Ally elements in the Austria-Hungarian Empire. The objective selected by Crewe House was to support the national desires of the Czechs, Southern Slavs, Rumanes, Poles and Italians for independence, so as to form a strong non-German chain of Central European and Danubian States, and thus to encourage the disinclination of these peoples to fight for their German masters.

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[1] *Secrets of Crewe House*, by Sir Campbell Stuart (London, 1920), gives an account of Lord Northcliffe's undertaking.

The chief obstacle to the policy of the British propaganda was the pledge given to Italy in 1915, to give her certain Austrian territories inhabited by Southern Slavs. In 1917, the Serbs, Croats and Slovenes had assembled in Corfu, and under the leadership of Dr. Trumbitch, president of the Southern Slav Committee, and M. Pashitch, prime minister of Serbia, had proclaimed the unity of the three Southern Slav peoples. Early in 1918, after recovery from the disaster of Caporetto had begun, the united Southern Slavs, on the initiation of Mr. Wickham Steed and Dr. Seton Watson, came into conference with leading Italians and agreed to settle amicably the territorial controversies in dispute. Lord Northcliffe took up the position at that point, and almost the first step of his campaign was to send Mr. Steed and Dr. Seton Watson to the Congress of Oppressed Habsburg Nationalities which took place at Rome with the consent of the Italian Government. Meantime he urged on the War Cabinet the need of coming to a decision between the alternative policies and of obtaining the agreement of the French, Italians and Americans to the choice. He got only a dubious and halting opinion from the British Foreign Secretary, who urged that the same propaganda could be adapted at least to the earlier stages of either policy. This indecision, maintained through the war and through the peace negotiations, led to the disastrous adventure of D'Annunzio, for the Italians, like other peoples, flushed with the unexpected joy of complete victory, forgot the wise concessions to which they had been willing when the issue was doubtful. But Lord Northcliffe's mission achieved a temporary and successful unity of purpose. A joint commission consisting of representatives of Italy, Great Britain and France, was established at the Italian general headquarters, with the special object of conducting propaganda directed to the oppressed nationalities in the Austrian armies. Representatives of committees of each of the oppressed nationalities were attached to the commission. A polyglot printing press was acquired, and large quantities of propaganda of all kinds were distributed by aeroplane, rockets, grenades and contact patrols. The latter consisted of deserters of Czechoslovak, Southern Slav, Polish and Rumanian nationalities, who volunteered for this service against their former oppressors. The effect was soon apparent. Deserters belonging to the subject races came over to the Italian armies in large numbers, so that the attack planned by the Austrians had to be postponed. Unfortunately, the complete success of the effort, apparently assured early in May, was prevented by the reactionary tendencies within the Italian Government, supported by the uncertain attitude of the Governments of France, Great Britain and the United States. But even in the face of this difficulty, the success was so great that, after the battle of the Piave, members of the Inter-Allied Propaganda Commission were received and thanked by the Italian commander-in-chief.

While this great campaign was taking place on the Italian front, the propaganda addressed to Germany was being intensified. On assuming office, Lord Northcliffe found the War Office propaganda department, described above, in full operation. Except that he at once began to press the Government to renew the original permission for the use of aèroplanes, he suggested no change in the War Office work. His committee at Crewe House, however, first with the assistance of Mr. H. G. Wells and after a few weeks with that of Mr. H. Hamilton Fyfe, set to work to frame a general propaganda policy directed against Germany, and to produce leaflets and other matter. Some of this material was given to the War Office Department; much of it was distributed by special means chiefly through neutral countries. In July, when the work in Italy had been established on permanent lines, and Mr. Steed had returned to London, it was decided to concentrate all the production of propaganda at Crewe House, with the object of bringing it more into line with a concerted policy. Accordingly, the writer of this article was transferred from the War Office to Crewe House, but kept in touch with the War Office as liaison officer, the army remaining the agent for distribution.

The General Committee met daily at Crewe House, receiving the reports of the different branches, collecting information from all possible sources, and stimulating the propagandist work against Austria-Hungary, Bulgaria and Germany. It became more and more obvious during the summer of 1918 that the spirit of the enemy was breaking on every front, that they were alert to every suggestion as to the approach of peace, and that the supreme necessity was a clear statement of the intentions of the Allies. Lord Northcliffe, with varying success, continued to press the Government for such a definition of policy as would serve as a true basis for propaganda. The fundamental principle on which he wished to act was that when a line of policy had been sanctioned as a basis for propaganda, the Allied Governments should be asked for their assent to it, so that their propaganda departments might act in concert. Failing to obtain a clear lead from the British Government, who at that time appeared to have no definite policy with regard to any issue of the war, Lord Northcliffe convened an inter-Allied propaganda conference at Crewe House. It was attended by Lord Beaverbrook, Minister of Information, representatives of the British Foreign Office, War Office, Admiralty and Air Ministry, and by delegates from France, Italy and the United States, the U.S.A. delegation, however, being instructed to attend only as observers. The conference, after a plenary session, divided into committees to discuss details of policy, methods of publicity and methods of distribution. At a final plenary session the reports of the committees were adopted, and it was agreed that they should be submitted by the heads of the four missions to their respective Governments for approval. The conference then constituted a permanent Inter-Allied Body for the conduct of propaganda in enemy countries. Steps were at once taken to secure the permanency of contact between the propagandist agencies which had been established at the conference, and these became increasingly effective until, when the Armistice came, there was almost complete unity of action amongst the Allies.

As the possibility of peace drew nearer, it became still more urgent that propaganda should be kept free from any trace of confusion. To secure this, a Central Body, called the Policy Committee of the British War Mission, was formed at Crewe House; it consisted of representatives of Lord Northcliffe's department and of the War Cabinet, the Admiralty, War Office, Foreign Office, Treasury, Ministry of Information, Air Ministry, Colonial Office, India Office, War Aims Committee and Official Press Bureau. It decided to undertake the following activities:—Study of peace terms, study of utterances by important enemy representatives, their real significance and the nature of the response to be made to them. It had to take action almost at once, since the German Peace Note, with its reference to the publication of President Wilson's "fourteen points," required immediate attention from British propagandists. Lord Northcliffe's committee had been studying the fourteen points with a very close attention. It was plain that they could not be understood as a full recitation of the conditions of peace, and that it was therefore a matter of honesty and of prudence to define the interpretation put on them by Great Britain before accepting the surrender of Germany. This view was accepted by the Policy Committee, and, after detailed discussion, a statement drafted by the Crewe House Committee was adopted in principle. It was approved, by a representative of the Government designated for the purpose, for unofficial use as propaganda policy. Each department henceforward made it the text of its productions. As this document is of historical interest, it is here printed in full.

Confidential.

PROPAGANDA PEACE POLICY

The following conditions are indisputable:—

In no sense shall restoration or reparation in the case of Belgium be taken into consideration when adjusting any other claims arising from the war.

1. The complete restoration, territorial, economic and political, of Belgium.
2. The freeing of French territory, reconstruction of the invaded Provinces, compensation for all civilian losses and injuries.
3. The restoration to France of Alsace-Lorraine, not as a territorial acquisition or part of a war indemnity, but as reparation for the wrong done in 1871, when the inhabitants of the two Provinces, whose ancestors voluntarily chose French allegiance, were incorporated in Germany against their will.
4. Readjustment of the frontiers of Italy as nearly as possible along the lines of nationality.
5. The assurance to all the peoples of Austria-Hungary of their place amongst the free nations of the world and of their right to enter into union with their kindred beyond the present boundaries of Austria-Hungary.
6. The evacuation of all territory formerly included in the boundaries of the Russian Empire, the annulment of all treaties, contracts or agreements made with subjects, agents or representatives of enemy Powers since the revolution and affecting territory or interests formerly Russian, and coöperation of the Associated Powers in securing conditions under which the various nationalities of the former Empire of Russia shall determine their own form of Government.
7. The formation of an independent Polish State with access to the sea, which State shall include the territories inhabited by predominantly Polish populations, and the indemnification of Poland by the Powers responsible for the havoc wrought.
8. The abrogation of the Treaty of Bucharest, the evacuation and restoration of Rumania, Serbia and Montenegro, the Associated Powers to aid the Balkan States in settling finally the Balkan question on an equitable basis.
9. The removal, so far as is practicable, of Turkish dominion over all non-Turkish peoples.
10. The people of Schleswig shall be free to determine their own allegiance.
11. As reparation for the illegal submarine warfare waged by Germany and Austria-Hungary, these Powers shall be held liable to replace the merchant tonnage belonging to the Associated and neutral nations illegally damaged or destroyed.
12. The appointment of a tribunal before which there shall be brought for impartial justice individuals of any of the belligerents accused of offences against the laws of war or of humanity.
13. The former Colonial possessions of Germany, lost by her in consequence of her illegal aggression against Belgium, shall in no case be returned to Germany.

The following conditions of Peace are negotiable:—

1. The adjustment of claims for damage necessarily arising from the operations of war, and not included amongst the indisputable conditions.
2. The establishment, constitution and conditions of membership of a League of Free Nations for the purpose of preventing future wars and improving international relations.
3. The League of Free Nations shall be inspired by the resolve of the Associated Powers to create a world in which, when the conditions of the Peace have been carried out, there shall be opportunity and security for the legitimate development of all peoples.

The action taken thereon by the Enemy Propaganda Committee at Crewe House was as follows: At their suggestion Lord Northcliffe made it the basis of an address to the United States officers in London on Oct. 22 1918. The Production Department of the Committee got to work on a series of pamphlets and leaflets dealing with the different points of the memorandum. The memorandum was sent to the French, Italian, and American members of the inter-Allied Body for Propaganda in enemy countries, with the request that they should take similar action on it to that taken by the British Policy Committee and bring it up for discussion at the next meeting of the inter-Allied body. Lastly they decided to prepare and give wide publicity to an article covering the whole ground of the memorandum, so that the policy could be presented in the same terms to the British people, to their Allies and to the enemy. The steps taken by Crewe House, and the corresponding action taken by other departments concerned, were reported and approved at a meeting of the Policy Committee at Crewe House on Oct. 28 1918, the last meeting actually held.

Events were moving swiftly, and Crewe House found that there was no time to carry out the original intention of circulating the general statement through one of the more important monthly periodicals. It was therefore decided to ask Lord Northcliffe to give the peace policy the wide and immediate publicity possible by the use of his name and by the sources of distribution at his command. He agreed at once, and so consummated the efforts of British propaganda. On Nov. 4 1918 an article under his name appeared in *The Times* and *The Daily Mail*, *The Paris Daily Mail*, and the leading papers in Canada, Australia, New Zealand, S. Africa, Newfoundland, India, the British Dependencies, the United States of America, S. America, France, Italy, Spain, Switzerland, Holland, Norway, Sweden, Denmark, Japan and elsewhere, and very soon afterwards in Germany. The arrangements for this wide publicity were made personally by Lord Northcliffe, and the cost of cabling was borne by him. The final form of the article was due to him, but its substance represented the unanimous views of his advisory committee, the members of which he had selected, and over whose deliberations he had presided.

ALLIED PROPAGANDA.—The principles and methods of propaganda have been so fully illustrated in the foregoing account of the British effort, that little would be gained by a detailed description of the operations of England's Allies. France went through a history much like that of Great Britain. In the earlier stages of the war, propaganda was conducted by a number of agencies, for the most part in extension of their normal functions. As the war proceeded, concentration and intensification were achieved, ending in the work being placed under the control of a single minister with a large staff. The control of home opinion was less difficult than in England, as it was already in the tradition of the Government to regulate the dissemination of information and of official views. As, however, a considerable part of the French population was in territory occupied by the Germans, there had to be an extensive distribution of propaganda through the army and by secret agents. An intensive campaign was conducted in Alsace and Lorraine, the services of distinguished Alsatians of French descent being employed with great success. Neutral opinion was influenced by special missions and by resident agents. Much care was given to French propaganda amongst the Allies. Distinguished civilians of British and American nationality were frequently invited to France, and given every opportunity of seeing the spirit in which France was making her prodigious effort and the enormous difficulties she had to face. French agents kept in close touch with British opinion of every class, and in every part of the Empire, not neglecting Ireland and Quebec. In one respect this branch of French propaganda was more far-seeing than most of the British work; it was not content with the actual problems of the war, but anticipated and prepared for many of the difficulties and possible causes of friction that might arise in the making even of a victorious peace. France early foresaw that, as German colonies were unlikely to be restored to Germany, it would be necessary for France and Britain to be in general agreement with regard to extra-European territories. The French effort to reach the enemy directly was on a smaller scale, but was similar to the work done by the British War Office. By exchange of views and materials a high degree of concord was reached.

Belgium was in the unfortunate position of being able to operate directly only in a very small part of her own territory. By direct effort, and with the willing coöperation of France and Britain, she was able to keep in close contact with her own people. The unmerited calamities which fell on Belgium secured her in advance the sympathy of neutral and Allied nations, so that special propaganda was unnecessary. Italy was rather a theatre for propaganda than a direct propagandist. She spoke with so many different voices that, except for a certain amount of direct propaganda addressed to the enemy, she was unable to explain her attitude very clearly either to neutrals or to Allies. On the other hand, she issued a series of magnificent photographic descriptions of her arduous campaigns, which explained well the immense difficulties of military operations on the Italian front, and the brilliant technical methods by which they were overcome. The Americans devoted the same energy to propaganda as to preparation for actual warfare. Representatives were at once sent to Europe to examine and report on the methods of propaganda employed by the Allies. By Sept. 1918, an American Propaganda Department had been established with branches in London, Paris and near Verdun. Much literature was produced, and its distribution by aeroplane and by balloon had been arranged when the Armistice came.

GERMANY.—It would be difficult to say how far the exaltation of the German spirit in 1914 was due to official inspiration, or how far the long campaign of German intellectuals and industrials, before 1914, for the aggrandizement of Germany, had inspired official opinion. In any event, the outbreak of the war let loose a flood of literature unanimous in sentiment and apparently spontaneous. Professors and pastors, politicians of every section, pan-Germans and socialists were united in proclaiming the necessity of the war and the certainty of victory. But even in these early days there were striking differences of opinion. One school urged that the war was defensive, forced on Germany by the "encircling policy" of her enemies. German militarism was a necessary consequence of a position surrounded by powerful enemies, of the Russian danger, and of English jealousy of her commercial success. As it was difficult to reconcile this theory with the actual German plan of campaign and with the fate of Belgium, much stress was laid on the theme that an offensive was only the best means of defence. When victory came, annexations were to be limited to what might be necessary for future security. Another school proclaimed the historic mission of Germany, her high culture and civilization, the advantage to the world of her victory. The great empires of the past had expanded and developed for selfish ends; Germany wished to free the seas for all the nations, and to open up the world so that all the peoples great or small could develop on their own lines. England, France and Russia had been the great oppressors of smaller nations and races; Germany would liberate them. The unification of Germany had been the first stage in a beneficent process which would lead, first, to a great federation of Middle Europe, and then to a federation of the whole world. A third school expounded a somewhat careful form of the Bernhardi and Treitschke doctrine. The great and expanding German people required land within the German Empire in which the surplus population might find room and yet remain German. Outlet must be found for German talent, organizing capacity, capital, manufactures, and the necessary supplies of raw material must be forthcoming. These objects Germany would have preferred to attain peacefully. But she was a late arrival on the world-scene, and her rapid development had aroused such envy, particularly from England, that her legitimate rights could be secured only by force. Yet a fourth school, relatively small in numbers but of great influence in the navy, army and among the big industrials, appealed directly to cupidity. The riches, natural resources and possibilities of all parts of the world in which German influence could be extended or which Germany could take from her enemies were described elaborately. The growth of the British Empire was displayed in almost affectionate caricature as an accomplishment of successful piracy; England, however, must now disgorge to the younger and stronger pirate. It was an odd but possibly significant circumstance that, in all these diverging views, little attention was paid to the events immediately preceding the various declarations of war.

So far we are dealing with the unofficial home propaganda of Germany. It consisted to a much larger extent than in Great Britain of books and pamphlets, some of which doubtless were subsidized, but most of which apparently were spontaneous. These served also for the German peoples in foreign lands, and were exported in very large quantities, often in their original form, often in translation so as to serve as propaganda for neutrals. It was a characteristic of German self-confidence that they appeared to think that explanations good enough for Germans were good enough for neutrals and even for enemies. But in addition to such private or at least apparently unofficial efforts, there was an official propaganda on a large and highly organized scale. The German Press was organized for war, with the object not only of influencing home opinion but neutral opinion, directly through the circulation of German papers in Switzerland, Holland, and Scandinavia, and by their effect on foreign editors. Dr. Theodor Wolff, the well-known editor of the *Berliner Tageblatt*, said that "German censorship passed news concerning facts, but forbade discussion of war events or internal politics and of many other subjects." The Government suppressed criticism or the giving of information with regard to the internal conditions of the country. Every two or three days the newspapers received printed orders indicating what they were forbidden to publish, the attitude they were to assume on particular topics, and the articles from other papers they were free to reproduce. Editors were usually allowed to produce their papers without a preliminary examination of the proofs, but transgression of the regulations was followed by prosecution or suspension. One form of punishment was to place a paper on "preventive censorship," under which all proofs had to be submitted, and any matter could be struck out, without, however, removing responsibility for what remained. The *Norddeutsche Allgemeine Zeitung* was a purely official organ, and several other papers, notably the *Kölnische Zeitung* and the *Berliner Lokal-Anzeiger*, were semi-official.

With regard to the Press generally, there were several agencies of direction and inspiration. The Press Department of the Foreign Office issued a regular news-sheet containing the statements and views the propagation of which was desired; it also acted directly on newspaper correspondents. The Admiralty had a very active publicity department, for some time under the direction of Mathias Erzberger and Paul Rohrbach. The Ministry of the Interior had a separate organization and also circulated "tendencious" sheets. The War Press Bureau, controlled by the Higher Command, was the most important propagandist organ. It issued commands to the censorship, laying down the prohibitions and the special attitudes which were circulated through the local authorities, and it had a special foreign section. Moreover, daily Press séances were held by three officials, representing respectively the Foreign Office, the War Office and the Admiralty, at which instructions and directions too delicate to be committed to paper were issued.

German propaganda in neutral countries was officially controlled by a branch of the Foreign Office, the *Zentralstelle für Auslandsdienst*. It issued material for propaganda and propaganda for distribution through the official representatives in foreign countries. Every Germany embassy or legation had at least one organ under its immediate control, sometimes published in German specially for German readers, more often in the language of the country in which it was issued. The material consisted of copies of a special newspaper, the *Nachrichten der Auslandspresse*, prepared by the War Press Bureau, a daily paper containing telegrams and notes on current events, and often selected news cuttings issued by the general staff. Another official agency, believed to be directed by the Admiralty, issued an attractive and well-illustrated periodical, the *Kriegs Kronik*, as well as the *Kriegs Nachrichten*, the latter consisting of prepared articles on war subjects and a "Berlin" letter, for the edification of the foreign Press.

In addition there were several highly important private organizations for foreign propaganda. The *Deutscher Uebersee-dienst Transocean* was a syndicate established before the war by big German industrials to supplement and correct the service of the official Wolff Bureau. It issued the daily German wireless, had a special foreign news-service consisting chiefly of selected cuttings from German and foreign newspapers, and a very fine illustrated monthly periodical in five languages—*Der Grosse Krieg in Bildern*. It had an intelligence division which reported on the standing and personality of newspaper editors in every country, and suggested means of influencing them. The *Kriegsausschuss der deutschen Industrie*, formed originally to represent industrialists in their controversies with the Government, became an extensive propagandist chiefly on trade matters. A bureau at Frankfort-on-Main, partly official, dealt chiefly with Latin countries. The *Deutsch-Südamerikanisches Institut*, and the *Hamburgischer Ibero-Amerikanischer Verein* were occupied chiefly with Latin and Latin-American countries, and had agents and usually press organs in every country where Spanish or Portuguese is spoken. The Far East was served through the *Ostasiatische-Lloyd*, which supplied a distributing centre in Shanghai.

Until the United States of America came into the war, there was a very active German campaign to influence American opinion in favour of Germany. A great part of it was conducted from the German embassy in Washington, and through the German consuls throughout the United States. Much work was done by special missions such as that of Dr. Dernburg, a former Colonial Secretary, and every German bank or trading corporation was a centre of organized effort. A very large number of serious books by well-known German authors were translated into English for American readers. These followed certain main lines. They drew contrasts between the peaceful progress of Germany since her unification, as compared with the violence of other Powers. They represented Germany as being engaged purely in self-defence. They offered veiled threats or bribes to the United States with reference to Japan. They insisted on the moral basis of German culture and civilization. Closely similar lines were followed by many leading Americans of German descent. Perhaps the most effective of these American-Germans was Hugo Münsterberg, professor of psychology at Harvard, who advocated the cause of his natal country with eloquence and apparent moderation. His main point was that the war was really a struggle between Russian barbarism and the western culture of Germany, France taking sides because of Alsace-Lorraine, England because of her commercial rivalry and desire for German colonies. If Germany were beaten, it would be a triumph of Asiatic Russia and of Japan over the culture of Europe and America. It was suggested that the task of America was to give Europe an honourable peace, which she could do only by the strictest neutrality, with a leaning to Germany. Some true Americans also engaged in propaganda in favour of Germany. Some of these, doubtless, were mere hirelings; the better were chiefly persons of standing in the literary, scientific and musical world, who had been much in Germany. Some of the exchange professors were leaders in this work, and very naturally advocated with zeal and knowledge the best side of the German character and the great part Germany had played in the arts and sciences. Still more vocal were the Irish-Americans, who devoted themselves with a malignant bitterness to propaganda against England.

As regards direct German propaganda against the enemy, comparatively little was done, as compared with other combatants, in the distribution of propagandist literature from Germany amongst the actual troops opposed to her. The *Gazette des Ardennes* was the most successful effort. It was a regular newspaper, written in French and often with an illustrated supplement. It was sent into France by balloons, and occasionally by aeroplane, and sometimes gained entrance through a neutral country. It was eagerly sought, as it was baited with genuine information as to French prisoners. Otherwise it consisted of well-arranged propagandist matter of the usual type. The *Continental Times*, written in English, was founded before the war as a genuine newspaper for Americans travelling in Germany and Austria. During the war, probably with the aid of a German subsidy, it developed into a propagandist organ, chiefly anti-English, and almost ludicrous in its exaggerated malevolence. It was freely circulated among English prisoners in German camps, where, fortunately, it was the occasion of a good deal of amusement. The *Russkiya Iszvestia*, written in Russian, was distributed to Russian prisoners of war, and to a smaller extent in Russia. It was a competent piece of work, addressed to the task of persuading the Russian peasant that his two chief enemies were England and his own Government, and that the victory of Germany would mean liberation.

Germany's greatest propagandist effort against her enemies was carried out by indirect means. Wherever she thought that there was opportunity, she endeavoured to excite the discontented subjects of her enemies. She sought to get in touch with Irishmen, Indians, Arabs, Egyptians, Boers, Algerians and Georgians, and with various black races. A special organization or committee in Berlin attended to each of these peoples, and to many others. Where possible, representatives were lured to Berlin, and, if thought useful, were provided with funds. Missions, sometimes accompanied by Germans, were sent wherever they could be sent with safety. On the negative side the effort had some success, and existing discontent was sedulously fomented. But on the positive side there was little gain, for the Germans were seldom able to persuade the actual or tentative rebels that their future position would be any better under the domination of Germany. (P. C. M.)

PROPELLANTS (*see* 10.83).—A propellant explosive should burn comparatively slowly, and thus allow the use of a suitable charge for the required muzzle velocity without causing a high chamber pressure, and enable the maximum pressure to be kept low while better sustained; it should burn regularly—which depends upon the area of surface exposed to burning—and the rate should be easily capable of regulation; it should be smokeless, without bright flash; it should not give excessive heat during combustion, but be easy of ignition and not leave any solid residue; it should have both chemical and ballistic stability while in storage. The method of manufacture and the proportionate mixture of cordite, the British smokeless propellant (*see* 7.138), have been very largely controlled by the postulated requirements, particularly as regards keeping qualities.

With cordite manufactured by the methods in vogue before the World War the nitrocellulose used was highly nitrated, necessitating the use of acetone as a solvent. This involved a serious disadvantage in that the supply of the solvent materially governed the output of cordite. The enormous amounts of propellant required and the demand for rapid supply during the war made this disadvantage seriously felt, and thoughts were turned in the direction of discovering some expedients in which a state of lower nitration would render possible the use of some other solvent, which could be more easily obtained, as well as the devising of new methods by which the time expended in manufacture might be materially reduced. At the same time it was postulated that disturbance of the ballistic and heat value of cordite M.D. was not to be incurred.

Experiments resulted in the introduction of a class of cordite known as R.D.B. (Research Department, mixture B.), with which ether-alcohol is used as the solvent. It consists in a percentage composition of nitroglycerine (42 %), nitro-cotton (52 %), mineral jelly (6 %). A larger percentage of nitroglycerine was included in this mixture in order to compensate for the lower nature of nitrocellulose, and a higher proportion of mineral jelly to reduce the higher temperature produced by the extra proportion of nitroglycerine. The appearance of this class of cordite, as compared with cordite M.D., is not so clear, generally warped, with a rougher surface. With this mixture, not only was there the advantage in employing a solvent, of which supply was assured, but also the time required for drying in manufacture was considerably reduced.

Originally, the tubular form was introduced for cordite in order to maintain an equal area of burning surface, and so permit a more equally sustained pressure during combustion. In the form of strips, cordite gives very similar action as in the form of tubes; this form in manufacture and otherwise has other advantages which favoured its use for cartridges. But since, when made up into charges, strip cordite is apt to become packed tight, and so practically form a solid bundle, the result on explosion may not be as desired.

The provision of cellulose for conversion into nitrocellulose depended during the war very largely on the obtainable supplies. In Germany different expedients were tried, amongst them an unsuccessful attempt to use an artificial silk made by dissolving wood-cellulose in suitable solvents. But practically all the nitrocellulose made in that country, during the war, was made from a certain kind of paper, probably from some form of wood-cellulose (*see* CELLULOSE).

The American service propellant N.C.T. (nitrocellulose tubular) is a soluble nitro-cotton powder gelatinized by ether-alcohol, and containing a small percentage of diphenylamine added to act as a stabilizer. The powder is practically a pure nitrocellulose powder, and consists of nitrocellulose (97 %), stabilizer (0·5 %), volatile matter (2·5 %).

The nitration of the cellulose is similar to the process in the case of cordite, but the drying of the powder is not carried so far, a considerable proportion of the solvent being retained. The stabilizer, being a substance with an affinity for nitrogen dioxide (NO_2), is intended to prevent the free presence of nitrous acid should any decomposition occur. It is claimed for the stabilizer that it at the same time acts as a detector and shows when decomposition is occurring, by means of the resulting discoloration; but this claim does not appear to have been clearly established. The shape of the powder is different from that of cordite. The mixture is extruded through dies, for charges for smaller guns in a tubular form, and for larger guns as a stick with several longitudinal holes; as it is extruded, it is cut into short lengths, the lengths having a proportionate relation to the diameter of the hole in the stick. This shape enables greater ease in making up cartridges than with cordite, requiring merely the weighing of the charge on scales as against cutting lengths of cordite according to size and weight. Nitrocellulose tubular is not so powerful as cordite, and therefore larger charges are required; it is hygroscopic, and consequently, if cartridges become damp, considerable variations in ballistics may result; it is not so stable in storage as cordite. On the other hand, it is more uniform in burning (at a slower rate and with a lower temperature than cordite), and so causes much less erosion in a gun; and, further, the loading temperature has less effect on ballistics than with cordite, and the regularity in worn guns is better. The colour of the grains varies very much and may be buff, brown, dark blue or even nearly black, perhaps owing to slight changes in the stabilizer present; but practically no difference in stability has been detected, except when the colour becomes brick-red, or rusty, when it may be concluded that corrosion has set in.

A flameless powder has been made in America for which it is claimed that, with field guns firing this kind of powder, it is possible for the eyes of the gunner to see the muzzle of the gun at the moment of firing, and that the flash is imperceptible at a distance of a mile. The composition of the American powder is approximately 60 % of nitro-cotton, stabilized only with potassium carbonate, 25–28 % of nitroglycerine treated in the same way, 5–7 % of diphenylphthalic diethylester of the phthalic acid obtained by esterifying phthalic anhydride with ethyl-alcohol in the presence of sodium bisulphate and 3–5 % of neutral potassium tartrate; vaseline or mineral jelly up to 5 % is used to balance the composition. The dimensions of the powder-sticks and the exact composition depend upon the form to be used and have to be calculated.

The German propellant used with the 77-mm. gun was in the form of tubular sticks, and was a ballistite containing a stabilizer of "centralite" type, the stabilizer being the thio-urea derivative corresponding to diphenyldimethyl-urea. This last substance has been found frequently in German powders; it is very resistant to the action of acids and alkalis and is oxidized by fuming nitric acid only after prolonged heating at a high temperature.

A ballistite containing 60 % of nitrocellulose and 38 % of nitroglycerine has been used by the Germans; and also a mixture of nitrocellulose (66·16 %), nitroglycerine (25·97 %), sym. diethyl-diphenyl-urea (5·64 %), volatile matter (0·91 %), mineral matter (1·32 %). With certain guns the Germans tried a mixture of ammonium nitrate (84·5 %), carbon (15·0 %), ammonium chloride (0·5 %), in a compressed block, in the shape of an annulus, which was inserted in the cartridge-case above a charge of ordinary nitrocellulose powder. What was the exact result of this combination is not clear.

Among sporting powders which were tried during the war as propellants might be quoted as an example E.C.3—a powder made by a private company—which was used rather largely in trench warfare. This also is a nitrocellulose powder, which after forming to required shape is treated with acetone so that the outer surface is hardened. It is claimed for this process that the pressure during burning is more evenly distributed and more regularly maintained, since the hardened skin of the powder allows of slow burning to commence with and the porous interior allows more rapid action later on. (F. M. R.)

PROTHERO, SIR GEORGE WALTER (1848–), English man of letters, was born in Wilts. Oct. 14 1848. Educated at Eton, King's College, Cambridge, and the university of Bonn, he became fellow of King's College, Cambridge, and was history lecturer there from 1876 to 1894, when he became professor of history at the university of Edinburgh 1894–9. He was a member of the Royal Commission for Ecclesiastical Discipline 1904–6. In 1899 he succeeded his brother Rowland (afterwards Lord Ernle) as editor of the *Quarterly Review*. He was also editor of the Cambridge Historical Series and co-editor of the *Cambridge Modern History*. During the World War he was head of the historical section of the British Foreign Office, and in that capacity attended the Peace Conference in Paris (1919). He was created K.B.E. in 1920. Amongst his publications are *Life and Times of Simon de Montfort* (1877), *Memoir of Henry Bradshaw* (1889), and various volumes of historical papers, as well as the *British History Reader* (1898).

PROTOPOPOV, ALEXANDER DMITRIEVICH (1864–1918), Russian statesman, was born in 1864 and educated in a military school. He served for some time in the army, but he soon left the service and went into business. As a big landowner of the Simbirsk province he took an active part in the Zemstvo life and was elected member of the executive board of the Simbirsk Zemstvo and marshal of the nobility of the Simbirsk province. In 1907 he was elected member of the third and subsequently of the fourth State Duma, where he joined the left wing of the Octobrist (Moderate Liberal) party. Later be became vice-president of the State Duma. The first unfavourable rumours with reference to him arose in connexion with an interview with Herr Max Warburg, the German financier at Stockholm. In March 1916 he visited the capitals of western Europe as one of the leaders of the Russian parliamentary delegation. On his return journey he privately met at Stockholm Herr Warburg, the head of the Scandinavian section of the German Committee on Food Supplies. The importance of the conversation was, however, greatly exaggerated by the press, and also by Protopopov himself. At the beginning of Oct. 1916 Protopopov was appointed, through the influence of the Emperor, Minister of the Interior, in succession to Khvostov, and thus entered the Sturmer Cabinet. A former leader of Liberals, he proved to be now the strongest upholder of reaction. He enforced the censorship with unexampled rigour, and his interference with the food-supply work of the Zemstvos and Towns Union created a serious danger to the activities of these organizations. At a stormy meeting held at the Duma he was asked by his political friends to resign his post, and when he refused to do so they struck his name off the list of members of the party. Hated by the Liberal circles and the Duma, Protopopov not only supported the reactionary policy of Sturmer and Prince Galitzin with the utmost energy, but he is said also to have been one of the secret organizers of the disturbances of Feb. 1917, which he proposed to suppress by military force, and which, unexpectedly for him, resulted in the overthrow of the Empire and of himself. He was arrested by the Provisional Government and committed for trial. He remained for many months in the Peter and Paul fortress and was executed by order of the Extraordinary Commission in Sept. 1918.

PROTOZOOLOGY (*see* 22. 479) is that branch of zoology which is concerned with the group of animals known as the Protozoa. It is not, as its name might seem to imply, a primitive form of zoology. As a science it is comparatively young, but, owing chiefly to the practical importance of some of the animals with which it deals, it had in 1921 already become one of the largest and most cultivated fields in biology. The Protozoa are very interesting animals, from both the practical and the theoretical standpoint. Nevertheless, they are all small, and most of them of microscopic dimensions. To the general public they are therefore invisible, and consequently unknown, except by the conspicuous results—such as diseases—which they occasionally produce. In common speech they are still nameless, though they are popularly included among "animalcules" and "microbes." But these are unscientific and unnatural groups, which comprise all microscopic creatures, both animals and plants; and consequently the Protozoa are still confused, in the popular mind, with other "microbes," such as the Bacteria, with which they have no connexion.

It will be evident that protozoology, as an independent science, must necessarily have arisen as a comparatively late offshoot of zoology. Its history is bound up with that of the microscope, an instrument which bears much the same relation to protozoology that the telescope does to astronomy. Before microscopes were invented no Protozoa could have been clearly visible. With the first lenses, the largest and most conspicuous of them were discovered; and as microscopes were improved, more and more minute creatures gradually became known. Out of the confusion of forms which the microscope has continued to reveal, the Protozoa have ultimately emerged as a well-defined group of animals, and, as a result, those who study these animals have slowly built up a new section of zoological science.

As an individual science protozoology only became self-conscious at a quite recent period. The name itself, though already in use between 1870 and 1880, only became current after the opening of the 20th century—that is to say, within the memory of many living zoologists. But the science was really born—though not baptized—when the first Protozoa were discovered. This far-reaching discovery was made in the latter half of the 17th century. It was made by a man who was neither zoologist nor physician, but who occupied the humble position of chamberlain to the sheriffs of the little town of Delft, in Holland—Antony van Leeuwenhoek (1632–1723), an amateur microscopist, who studied at no university, nor under any of the great professors of his day, but whose title to fame rests upon the simple and honest application of his own native genius. This remarkable man made his own microscopes, lenses and all, and turned them upon almost every object which suggested itself to his quick imagination. In the course of his work he examined the water from the leaden gutters of his house, from the well in his courtyard, and also fresh rain-water, snow-water and "the water wherein pepper had lain infused." He found that all these liquids, and many others, were not clear and empty when viewed by the microscope, but teeming with living creatures. The discovery was promptly communicated by letter to the Royal Society in London, who published a part of it in the year 1677. Some of the animals which Leeuwenhoek here described can now be identified as Protozoa, and his letter may therefore be regarded as the first page in the history of protozoology.

Leeuwenhoek, the father of protozoology, himself studied and described many Protozoa. His observations were soon repeated and confirmed by others, notably by some of the early Fellows of the Royal Society and his fellow-countryman Huygens, the great astronomer. But for many years protozoology made little progress, and remained essentially what it was originally, an amusement rather than a science. Although many good observations were made and recorded, they were always disjointed, and often distorted by fancy and speculation. Many good zoologists regarded with doubt and misgiving everything seen with the microscope, an attitude of mind which has not quite disappeared even in these days of perfect instruments. Even the great Linnaeus (1707–1778), who attempted to catalogue and classify all animals and plants, and thereby founded modern systematic biology, never really overcame his suspicions sufficiently to incorporate the Protozoa firmly in his system. His mental attitude is shown in the name "*Chaos infusorium*," with which, in 1767, he dubbed a mixed lot of questionable protozoal organisms—the term *Chaos* itself having been suggested, no doubt, by Ovid's "*rudis indigestaque moles.*"

But already at this period many workers were convinced that the Protozoa—or "Infusoria," as they were then called, from their occurrence in infusions—have a real existence. The once notorious John Hill (1716–1775), in the course of his journalistic, theatrical, medical, and botanical adventures, turned his attention to microscopes; and in 1752 he described and, for the first time, scientifically named, a number of Protozoa which he had seen in infusions. Up to this time writers had been content to call them by diminutives of the names of larger and more familiar creatures, or occasionally by names suggested by comparison with some common object. We thus find the early protozoologists describing their observations upon "little insects," "worms," "fishes," and even "reptiles," and upon "the slipper," "the sun," "the trumpet," "the gimlet," or "the bell animalcule." It was not until 1773 that a serious attempt was made to reduce the chaos to order by careful observation and description and classification of the "Infusoria." This notable work was done by the Danish naturalist, O. F. Müller (1730–1784); and his last book, published posthumously in 1786, is the first systematic treatise on protozoology. It is a remarkable work, full of shrewd observations, and showing astonishing insight, but containing, of course, many mistakes which were inevitable at that period. Many of the Protozoa described and sketched by Müller—mostly from observations made, as were those of Leeuwenhoek, with the aid of only a simple lens—are easily recognizable now by a protozoologist.

The circumstance that Müller was able to attempt a comprehensive systematic treatise on the Protozoa implies that a very considerable advance had taken place in biological thought since microscopic organisms were discovered. Many of the earlier workers, like the uneducated at the present day, believed in spontaneous generation. They believed, with Aristotle, that many "imperfect" animals were bred in mud, water, or decomposing matter; and so long as this view was tenable there was no reason why these misbegotten offspring of the superabundant vitality of the earth should display any particular constancy in their appearance or any fixity of form. Consequently, to attempt to describe and classify the "Infusoria" must have seemed a futile task to many men of science two hundred years ago. Spontaneous generation, as a scientific doctrine, was not really demolished by the admirable experiments of Redi (1668), as is often supposed, for he disproved it for only the larger and more obvious animals, such as insects; and the later discovery of microscopic organisms raised the whole problem once more, but presented it in a much more difficult form. It was Redi's countryman, Spallanzani, who, a hundred years later, extended his observations to microscopic animals, and showed by means of ingenious and exact experiments that the "Infusoria" spring from living antecedents, and live, grow, and multiply like larger creatures. Spallanzani helped to lay the foundations on which Müller built, though his own work was not firmly consolidated until, a century later, the last rivets were driven in by Pasteur and Tyndall.

In the latter half of the 18th century many minor contributions were made to protozoology, and although these were continued during the early part of the next century, no considerable advance was made until about 1830, when the Berlin zoologist, C. G. Ehrenberg (1795–1876), began to publish his researches. With amazing perseverance he studied, described, and named all the "Infusoria" that he could find: and as he pursued his investigations not only at home, but also in Egypt, Arabia, Siberia, and elsewhere, the forms which he discovered were not a few. His chief contribution to protozoology was published in 1838—a monumental folio volume of more than 550 pages, accompanied by an atlas of 64 coloured plates. This is still one of the classics of the science. It contained much that was new and much that was true, everything of note that his industrious reading could find in the works of his predecessors, and withal a mass of mistakes, to which he clung tenaciously—in spite of violent contradiction and criticism—to the end of his days.

Ehrenberg's most dangerous opponent was a Frenchman, Félix Dujardin (1801–1860). In 1841, with an octavo volume of some 680 pages, but only 23 plates, he undermined the foundations of the big folio, and thus overthrew, for all time, many of the favourite theories of his German antagonist. Dujardin's work is also a protozoological classic. Together with Ehrenberg's volume it marks the end of the old protozoology of the micrographers and the beginning of the new science as a special branch of zoology. Rarely does the modern worker, unless he be a historian, require to consult any earlier treatises than these.

Since the time of Dujardin only one really exhaustive work on the Protozoa as a whole has been written. This is the great monograph by O. Bütschli, of Heidelberg, published in 1880–9. It is significant of the vast modern development of protozoology that up to 1921 no work on a like scale, by a single individual, had been produced. It is now, indeed, impossible for any one man even to read all that has been written on the Protozoa, and the more recent workers have had perforce to devote their attention to some particular group of these organisms, or to some special branch of protozoology. To master a detail of the science is now the work of a lifetime. No one man could in 1921 claim to be an expert in all protozoology any more than in all mathematics or all chemistry. The territory already surveyed was so vast that the most he could hope to do was to cultivate his own small holding properly.

The Modern Science.—Since the middle of the 19th century biological theory and practice have undergone profound changes; and in more recent years protozoology, with the rest of zoology, has largely changed its character. This period has seen—to note but a few of its more striking developments—the establishment of the Theory of Organic Evolution, the rise of the Cell Theory, the foundation of Histology and Cytology, and the unfolding of Physiology and Embryology and Medicine as experimental sciences. Protozoology has been profoundly influenced by all these new growths, and has itself contributed not a little to them. An attempt has been made, and has already been partly successful, first, to discover all the Protozoa there are, both living and fossil; then to investigate their structure in the minutest detail, and to ascertain how they live and develop; and finally, to understand their relations to other organisms and their place in nature. Countless monographs have been written on individual species, on the larger and smaller groups into which these can be scientifically classified, on collections made all over the world, and upon the special physiological, medical, and other problems which the Protozoa, as a whole or in part, present. But we must content ourselves here with the merest sketch of the growth and status of modern protozoology.

Before proceeding, we must note some of the peculiar difficulties which differentiate protozoology from the rest of zoology. The animals with which it deals are, speaking generally, invisible to the naked eye. Consequently, they cannot be studied and anatomized by ordinary methods. The protozoologist has first to become a master in the use of the microscope, and to learn its limitations as an instrument of research. When he has become proficient he must learn or devise methods for catching, watching, breeding and preserving those Protozoa that he wishes to study, and must thus become familiar with a peculiar and varied technique adapted to the investigation of the lives and habits of animals invisible to the unaided eye. He must then acquire the power of correctly interpreting what he sees under these peculiar conditions. If he is an efficient microscopist and a good observer, endowed with abundant patience and ingenuity, and if, at the same time, he is a good zoologist and sound philosopher, then, with experience and diligence, he may hope some day to become a good protozoologist. From the very nature of the subject, therefore, it will be obvious that it is easier to make mistakes in protozoology than in most other branches of zoology; and there can be little doubt that the writings on the Protozoa, taken as a whole, contain a larger percentage of error than those on any other group of animals. Protozoology is, indeed, still in its infancy, and learning slowly and painfully by the method of making mistakes.

Protozoology, like most other sciences, is important from two different standpoints, which may be called the theoretical and the practical. On the theoretical side we have to consider its relations to the rest of zoology, and the value of its contributions to biological philosophy; on the other side, we must consider the utility of its practical applications, which are chiefly medical. In other words, we must look at protozoology as a pure science and as an applied science. It is necessary to distinguish these two aspects, although they are inextricably blended in reality. Protozoology was actually applied in medicine before it was ready; and this led not only to great confusion but almost to the severance of Medical Protozoology from the rest of the science. But progress on the medical side has now reacted beneficially upon the pure science, by bringing to light many new facts and setting many new problems.

The Pure Science.—The theoretical importance of protozoology is not what it appeared to be fifty years ago. It has not fulfilled some of the high hopes then entertained for its future. In the earlier period the writer of an article such as this would have begun, in all probability, by declaring that the study of the Protozoa would lead to the solution of most of the outstanding general problems of biology. He would have pointed out that these animals were of the greatest importance in connexion with the two chief biological generalizations of his time—the Cell Theory and the Evolution Theory—and he would probably have ended by saying that it was only lack of detailed knowledge which prevented protozoology from answering most of the fundamental questions of biology. Yet we have now an abundance of the sort of information then regarded as requisite, and the great problems are still, for the most part, where they were. It is both interesting and instructive to inquire how this has come about.

The cell theory was first definitely formulated, in Germany, by Schleiden (1838) and Schwann (1839), and was modelled into its modern form by Max Schultze (1861): that is to say, it took shape at the time of the reformation of protozoology by Ehrenberg and Dujardin, when the science was still feeling for a foothold. According to the cell doctrine, all organisms, both animals and plants, are built up of structural units, called "cells," in much the same way as a house is built of bricks. Schultze defined "a cell" as "a little lump of protoplasm with a nucleus inside it," and this definition was generally accepted. It should be noted that this proposition, so far as the larger animals and plants are concerned, is not a "theory" at all, but a statement of fact easily verifiable by means of the microscope. The body of a rabbit or a cabbage is, for the most part, actually composed of "cells" as conceived in the definition. The "theory" was introduced when the proposition was held to apply to all organisms at all stages in their development. Dujardin had shown that the Protozoa are soft-bodied animals composed of "sarcode"—the "protoplasm" of later workers—in which no constituent "cells" are discernible. Like "cells" Protozoa contain "nuclei," but, unlike the large animals, they show no internal differentiation into cellular units. It was thus necessary to introduce some new conception if the cell theory was to become universally applicable.

The extension of the theory, so as to enable it to include the Protozoa, was made by von Siebold. Each individual protozoon, he said, is itself a "cell." It is comparable with a single one of the innumerable units of which the bodies of large animals are built. The Protozoa are "unicellular" animals, all others "multicellular." According to this doctrine, therefore, a protozoon is not comparable, as an individual, with a whole multicellular animal, but with one of the cells in its body: or, the other way about, a multicellular animal is not an individual of the same sort as a protozoon, but a colony of such individuals.

This conception appeared so plausible—owing, it must be supposed, to the backward state of protozoology and cytology at that date—that it found ready acceptance; and, in spite of the cogent objections which have been raised against it by Huxley (1853), Whitman (1893), Sedgwick (1894), Dobell (1911), and others, it has prevailed down to the present day. The cell theory is still taught to almost every beginner in biology. He is still told that he is not an individual, but a community of individuals; and that the protozoon, which he can see with his own eyes leading an individual existence, is not an individual—such as he believed himself to be—but the equivalent of one little bit of his body.

When the cell theory was being founded, another great biological generalization was just emerging—the doctrine of Organic Evolution. Charles Darwin's great work, which appeared in 1859, created a revolution in biological thinking. Although Darwin's own work, and his statement of the theory, appear to be unexceptionable, the doctrine miscalled "Darwinism" developed along extravagant lines—chiefly, as is now evident, owing to the wild speculations and dominating influence of E. Haeckel and other German writers. The "cell theory" was immediately subpoenaed to give evidence for these "Darwinists." They wrongly believed that the evolution theory required the presence of some "most primitive" and "elementary" animals—from which all the "higher" forms had been derived—on the earth at the present day; and the shaky syllables let fall by the cell theory were eagerly seized upon, interpreted, and ultimately incorporated as incontrovertible facts in the case of the "Evolutionists." "Unicellular" organisms—such as the Protozoa—thus became the starting-point of evolutionary speculations. The Protozoa were obviously the "simplest" animals, since less was known about them than about the others; and they were clearly the "most elementary," each individual representing but one of the structural elements of which the others were composed. Their insignificant size made them the "lowest" forms on earth, and their position—according to the "theory"—at the bottom of the "*Scala Naturae*," made them the "most primitive." It thus became easy to show, by specious arguments and "question-begging epithets," that protozoology occupied a position of fundamental importance in biology. By studying the Protozoa the earliest stages in evolution would be revealed. The beginnings of life would be laid bare. Physiology and morphology would appear in their elemental forms, stripped of all confusing detail. And optimists were not wanting who divined that, by higher and still higher powers of the microscope, Nature's inmost secrets—such as the origin of life itself—would be divulged.

These fantastic dreams have been slowly dispelled by the "dry light" of reason. It has become clear that protozoology was placed in a false position by the devotees of the cell doctrine and the dogmatic evolutionists. Let us look at the fundamental conception of the "unicellularity" of the Protozoa from another angle, and see how it appears in the light of modern knowledge.

In the first place, it is clear that the Protozoa cannot properly be described as "unicellular." Every protozoal animal has an independent existence. It has its own peculiar structure, exercises its own proper functions, leads its own life—often, indeed, a very complex one. As an animal it is, from every standpoint, as much an "individual" as a man is. One protozoon is one whole animal, just as one man is one whole animal. From the standpoint of common sense, no less than from that of modern zoology, the whole organism is the unit of individuality. But when we examine a protozoon under the microscope we still see—as Dujardin saw—that its body is not differentiated internally into cells, as is that of a man. Its body is often surprisingly complex in structure, but it is never composed of cells. It is clear, therefore, that we can contrast the body of a man with that of a protozoon by saying that the one is cellular in structure, the other *non-cellular*. To call it " unicellular," and thus compare one whole animal with a minute differentiated fraction of another, is obviously absurd. It is as though a man who had only seen houses built of bricks were suddenly to encounter one constructed, all of a piece, of concrete; and then, being unable to find the familiar individual bricks in its fabric, were to declare that the concrete house is not a house—in the sense that the brick house is—but one large and peculiarly modified brick.

When once it is realized that the Protozoa are not, in any sense, " elementary " or " unicellular " animals, but a group of peculiarly constructed creatures, adapted in a special way to particular conditions of life, then it will also be realized that we have no reasons—apart from preconceived ideas derived from unsound generalizations—for believing that they represent " primitive " or " first " forms of life. That they are not " simple " we now know. It is true that they display, on the whole, less visible structural differentiation than most of the larger animals; but physiologically they are very complex. That they are able to perform all the chief functions of " higher " animals, but with fewer instruments, does not make their mechanism easier to understand; and it is thus hardly conceivable that the Protozoa can ever offer us the easiest way of approach to physiological problems. They offer us, indeed, the most difficult field in animal physiology, owing to their microscopic size and *apparent* simplicity of structure. As a great physiologist has well said: " Experience and reflection have shown me that, after all, the physiological world is wise in spending its strength on the study of the higher animals. And for the simple reason that in these, everything being so much more highly differentiated, the clews of the tangles come, so to speak, much more often to the surface, and may be picked up much more readily " (Michael Foster). Attempts to found a " general physiology " on the Protozoa as " cells " and " elements " are doomed to failure, for they are based upon an unsound philosophy; and the speculative and deductive efforts in this direction—such as that of Verworn in Germany—have slowly given way before the experimental and inductive methods of Jennings and others in America and elsewhere.

As a point of historic interest, it may be noted that the father of protozoology and his immediate followers had none of the extravagant later notions regarding the " unicellular " and " elementary " nature of the Protozoa. For Leeuwenhoek the Protozoa were animals like any other animals, but delightfully and marvellously little; and he thus saw more clearly and naturally than many of his later successors.

There are probably few biologists who now cherish any hopes of seeing the fundamental problems of biology solved by the study of the Protozoa, though the majority still speak and write in the optimistic language of last century. For these mental survivals there is a psychological basis, which seems worth noting before we go on to consider the true status and value of protozoology. There is a curious disposition, apparently inherent in the human mind, to suppose that by studying the most minute creatures we can come nearer to first principles. And it is the same with the study of the larger organisms. As the cytologist probes into the structure of an animal with higher and still higher powers of the microscope, he feels that he is gradually " getting to the bottom " of his problems. He feels that when his microscope has resolved the larger animals into their smallest component parts, and has revealed every detail of the smallest living thing, he will be face to face with fundamentals. It does not require much thought to realize that this is a fallacy. The deeper we delve, the more detail we discover. But it is all of the same sort: we add to the quantity and not to the quality of our knowledge. With the highest possible magnification we shall obtain no information which is qualitatively or fundamentally different from that to be derived from the study of large organisms, and their gross anatomy, with the naked eye.

The mental bias just mentioned seems to be responsible for many popular—and not a few " scientific "—notions about the Protozoa. It appears, for example, to be at the back of the unreasonable but common belief that the Protozoa are " elementary " and " primitive " animals. Although few biologists now believe in spontaneous generation, yet many are able to believe that living things must have been spontaneously generated from lifeless matter in the past; and to those who hold this belief it still appears self-evident that the organisms so generated were microscopic. Consequently, these biologists feel that the Protozoa must, in some way, be nearer than other animals to " the beginnings of life," and they find no difficulty in conceiving that the first animals were " Protozoa." In the same way, when these same biologists come to consider evolution, and the relations of living animals to one another, they find in the Protozoa the easiest starting-point for their speculations. The Protozoa are " the simplest " animals, and the human mind works most readily from simple to complex conceptions. Consequently, evolution is pictured as necessarily moving in the same direction—the simply constructed creatures coming first, and the complex developing from them. But it is surely a poor philosophy which would constrain Nature to order her infinite events in that particular sequence in which thoughts happen to follow one another most easily in the mind of man.

What, then, it may be asked, is the theoretical interest or value of protozoology? Clearly it is this. Biological theory is sound in proportion to the truth of its generalizations. When all the facts are known about all animals and plants, we shall be able to make true general propositions about them. Before we know the facts our generalizations can be but partial and premature—more or less lucky guesses, based upon incomplete knowledge. All biological theory is at present in this condition and therefore the careful study of any animal or group of animals—such as the Protozoa—will, if it yields new facts for generalization, be valuable ultimately as a contribution to biology. At present we cannot hope to do much more than collect facts, by means of accurate observation and apposite experiment. When we have collected and critically analyzed them, we can sometimes make tentative generalizations of a lesser order. But the larger and truer generalizations will come later.

It may be said that if this is all that can be expected from protozoology, then it is no more important than any other branch of zoology: there is no reason why we should study the Protozoa rather than any other group of animals. All this is quite true and reasonable; but there is also a reason why protozoology is likely to yield results of particular interest. The Protozoa are a group of animals organized on a different principle from the rest. They are, as we have just seen, non-cellular animals with peculiar lives and habits. Structurally and functionally they differ, in many ways, from all other animals. Now all the chief biological generalizations—almost all general propositions relating to such phenomena as birth, growth, development, sex, reproduction, heredity, variation, and death—have been derived from observations made upon the larger multicellular animals. When general ideas were formulated on such subjects the Protozoa were practically left out of account. When the more important facts about the Protozoa are firmly established, we shall be able to recast many of our biological theorems in a more satisfactory form. The Protozoa offer us, in other words, a new world of animals for generalization, and a new standpoint from which to survey our old-world zoological knowledge. The discovery of the Protozoa was to zoology what the discovery of America was to geography. But we are still, in protozoology, in the 16th century. For our knowledge of the new world we must still depend upon travellers' tales, upon reports of things ill-observed and misunderstood, marvels and myths and mysteries. But some day we shall have accurate and faithful records, and then protozoology will come into its own. As yet we are hardly on the threshold of the new biology, but for those who delight in the destruction of error and the advancement of true learning, the protozoological prospect is already full of hope.

The Applied Science.—The chief practical applications of protozoology are to medicine. Certain of the Protozoa live as parasites in the bodies of men and animals, and thereby cause diseases. Some of these are so important that they are widely known—for example, malaria and sleeping sickness—and the elucidation of such diseases is one of the most interesting and recent chapters in biology. Protozoology also has certain applications to agricultural science, because many Protozoa inhabit the soil, but their value is still doubtful.

The founder of protozoology was the first to find Protozoa inhabiting the living bodies of other and larger animals. In 1681 he described one such "animalcule" which was living in his own intestine. In 1683 he described and depicted others from the intestine of the frog. All these are recognizable, with fair certainty, at the present day. Leeuwenhoek did not suggest that these "parasites" were in any way concerned in the causation of disease, and it is probable, indeed, that the forms which he observed are not. But already at that date the "microbe" theory of disease-production was in existence, for it was guessed at long before any "microbes" were discovered; and consequently we find that, even in Leeuwenhoek's lifetime, the suggestion was put forward that his "little animals" might be the "causes" of certain disorders. We find, for example, an early fellow of the Royal Society remarking, in 1683, of a "murren" which had raged among the cattle in central Europe, and of which the cause was undiscovered: "I wish Mr. *Leewenhoeck* had been present at some of the *dissections* of these infected *Animals*, I am perswaded He would have discovered some strange *Insect* or other in them." Mr. Leeuwenhoek's successors have, on many a like occasion, fulfilled the expectations of "the ingenious Fred. Slare, M.D., and F.R.S.," but his "strange insects" they now call "Protozoa" or "Bacteria."

From the time of Leeuwenhoek to the present day the parasitic Protozoa have been studied with increasing attention. Their relation to diseases has been gradually elucidated, though we are still very far from finality in our knowledge of this absorbingly interesting subject. The history of our knowledge is long, and the discoveries have followed devious ways—too devious and intricate to be more than touched upon here.

Our knowledge of protozoal diseases—diseases colloquially said to be "caused" by protozoal parasites—really begins as recently as the middle of the 19th century, when Louis Pasteur (1822–1895) began his researches on a disease of silkworms called *pébrine*. Applying to the investigation of this disease the genius which stamps his work on "microbes" generally, Pasteur first discovered its causes, and then deduced methods for its prevention. The "cause" he found to be a microscopic parasite, now called *Nosema bombycis* and classified among the Protozoa. Although Pasteur did not know that the parasite was a protozoon, his work on *pébrine* and other microbic diseases was of fundamental importance for protozoology, because it demonstrated the *methods* by which such diseases can be studied and elucidated. Pasteur's scientific principles were impeccable, and equalled only by his own practical applications of them. It is common knowledge that he founded modern bacteriology; but in so doing he also laid the foundations of medical protozoology. To the casual reader it may seem strange that the study of silkworms can have any bearing upon medicine, or could in any way contribute towards the alleviation of human suffering. But there was another practical result of Pasteur's work which everyone will immediately appreciate, since it can be expressed in pounds, shillings and pence. Before *pébrine* attacked the silkworms of France the silk industry yielded an annual revenue of 130,000,000 francs to the State. After the disease had raged for a dozen years the revenue had fallen to 8,000,000, and the industry was on the brink of ruin. To have discovered the causes of the disease, and to have devised, as a direct consequence, means for its control, and, as a further consequence of this, to have rehabilitated the whole silk industry—these are practical results which everyone can understand. And one has but to remember that protozoal diseases may affect man himself and his larger domesticated animals—not merely silkworms—to realize the practical possibilities of protozoology.

Towards the close of the 19th century medical protozoology became linked up with another branch of zoology—entomology, the science which deals with insects. This connexion has nothing to do with the silkworms just mentioned, but arose through the discovery of the part played by certain other insects in the causation of protozoal diseases. The discoveries in this field began, once more, with the investigation of a disease of domesticated animals; but the pioneer was not, in this case, the Frenchman Pasteur, but the Scotsman David Bruce. His work is of such importance that we must notice it at this point.

The Work of Bruce.—Some parts of Africa are the home of certain large blood-sucking flies called "tsetse." The "Fly Country" is uninhabitable except for wild animals; and long before its full significance was understood, the fly itself was recognized as a serious obstacle to the opening-up of Central Africa. Livingstone, the greatest of all African explorers, was so impressed with the fly's importance in this connexion that he put a vignette of a tsetse on the title-page of his *Missionary Travels* (1st ed., 1857). Live stock taken into the "Fly Country" rapidly succumbs to a disease which is called "nagana" in Zululand, where Bruce's original investigations were made. The disease was also called "tsetse-fly disease," since it was believed by the European settlers to be caused by the bite of the fly. The natives believed, however, that it was "caused by the presence of large game, the wild animals in some way contaminating the grass or drinking-water."

Bruce began his work in Zululand—after an abortive attempt in 1894—in Sept. 1895 (the month of Pasteur's death). His full report on his researches is dated May 1896. In this almost incredibly short space of time he demonstrated that nagana is caused by a protozoal blood-parasite—since named *Trypanosoma brucei*, after its discoverer; that the parasite lives normally in the blood of big game, without harming them; and that it is conveyed from animal to animal by the tsetse. When the fly sucks the blood of an infected animal it becomes itself infected with the trypanosomes, which are subsequently re-inoculated into other animals by the fly when it sucks their blood. If these other animals are domestic stock, such as oxen or horses, they become infected with trypanosomes, contract nagana, and die. If they are wild game, such as antelopes, they also become infected, but develop no disease. In nature the trypanosome lives in the game and the flies alternately, the fly acting as an intermediary in the spread of infection from antelope to antelope. The big game—indigenous in the country—are habituated to and proof against the infection; domestic animals—foreigners, introduced by man—are not, and when infected usually die.

Bruce thus succeeded in extracting elements of truth from both the European and the native beliefs, and was able to combine them into a true theory of the causation of nagana. At the same time he threw a flood of light on many other protozoal diseases, and suggested all sorts of possibilities concerning their causation and prevention. He forged new links between protozoology and medicine and between entomology and protozoology. It is true there were other lights and other links before. Trypanosomes were known, and known to cause diseases, before Bruce went to Zululand. Timothy Lewis and Griffith Evans had observed similar parasites in India more than a decade earlier; and Theobald Smith and Kilborne, in America, had demonstrated in 1893 that the disease of cattle known as "Texas fever"—a disease also caused by a blood-inhabiting protozoal parasite—is transmitted from beast to beast by the agency of ticks. But Bruce's work was solid, complete, and demonstrative. By clean experiments and right reasoning he contributed more to science in a few months than hundreds who have followed up his work have since been able to contribute in many years. In work of this sort it is the quality, not the quantity, that counts. Later researches have but served to enhance the magnitude and difficulty of the problem which confronted Bruce in 1895; and to find a just parallel to the masterly manner in which he solved it, we must go back to Pasteur. There is, indeed, the same simplicity, the same directness, the same insight in the work of both these men. Their works are enduring demonstrations of the method of science: they are a delight to read, and illustrate on every page the favourite maxim of Boerhaave: *Simplex sigillum veri.*

The following-up of Bruce's discoveries and the working-out of details and consequences have led to the accumulation of an immense amount of new knowledge—protozoological, entomological, and medical. We can do no more than mention it here. We must, however, notice one of the first-fruits of his labours—the application of his results to the study of human diseases. This application was made mainly by Bruce himself. A few years after he had done his great work on nagana he attacked the problem of sleeping sickness, a human disease which has depopulated large areas of Central Africa. Bruce and his collaborators were able to show that this disease is similar to nagana. It is likewise caused by a trypanosome, which is conveyed to man by the bite of a tsetse-fly, and which is capable of living in other animals. In this case the parasite had been previously seen by Forde and Dutton, and by Castellani. But its relation to human disease and the part played by the tsetse in its transmission were first clearly demonstrated through the work of Bruce.

Malaria and Other Diseases.—We must now notice another disease, which is known by name to all—malaria, "the scourge of the tropics." This disease, as we now know, is also carried from man to man by the agency of a blood-sucking fly—in this case a mosquito, and it is also caused by a blood-inhabiting protozoal parasite, though it is one very different from that which causes nagana. Moreover, this parasite lives in men and mosquitoes only. After undergoing a peculiar development in the blood of a human being, it is sucked up with his blood by a mosquito when it feeds upon him. Provided that the mosquito is of the right sort, the parasites in the blood—if they are in the proper stage of development—undergo further remarkable changes in the mosquito's body. Thereafter the mosquito is able to infect other men with the parasites, which it injects into their blood in the process of sucking. And so the life of the parasite continues.

The foregoing is the briefest synopsis of a very complicated story, in which almost every event has been worked out in great detail. Hundreds have contributed to this work, though some of them can hardly be said to have coöperated in it. Indeed, such bitter fights have taken place among them that it has now become almost impossible to mention the names of some workers without offending others. The history of these discoveries would give an unpleasant shock to anybody simple enough to believe that men of science always labour for truth and the advancement of knowledge rather than for fame and personal gain. Fortunately the names of the leading discoverers are now known to almost everybody, and their individual achievements are no longer in dispute. Even the "general reader" is familiar with the name of Laveran, the great Frenchman who, in 1880, discovered the malarial parasites in human blood; of Patrick Manson, the founder of modern tropical medicine, who divined, in 1894, the part played by the mosquito; of Ronald Ross, who, inspired by Manson, first worked out in 1898 the complete development of the malarial parasite of birds, and thus solved the general problem; and of Grassi and his fellow-workers in Italy, who immediately confirmed Ross's work and extended and successfully applied his results to the study of malaria in man. When the 19th century ended the story was almost complete.

It will be evident that malaria, nagana, and similar diseases are not purely protozoological problems. It will also be obvious that such diseases might be stamped out and prevented by attacking either the protozoal parasites which "cause" them, or the insects which transmit them, though there could have been but little hope of success in coping with such diseases before the life-histories of the parasites were discovered. When protozoology, entomology and medicine have solved their respective parts of such problems, then many tropical regions which are now forbidden ground will become habitable for man and beast. The practical importance of protozoology in cases such as these is self-evident. The facts speak for themselves.

Malaria is a far commoner disease than nagana, and the discoveries relating to it have therefore made a far wider appeal to the public. It intrigues the public to hear that there would still be no Panama Canal but for the great discoveries in connexion with malaria. It would excite them but little to hear that some obscure tribe of Zulus could now keep cattle in places where it was previously impossible. But the advancement of science is not measured in such terms, and science values most highly those who discover and enunciate new principles. Already we can observe that the problems presented by nagana and malaria are similar, and that most of the generalizations which their solution can give us are, indeed, the same. We can see, too, that history, in the end, is generally just. Consequently, we may hazard a guess that in years to come the historian of science, in his impartial search for beginnings and great names, will not fail to note the sequence of the discoveries which we have just considered, and will apportion his praise accordingly.

The World War Period.—Medical protozoology, like many another branch of science, received a powerful stimulus from the World War of 1914–8. Not only was much of the previously acquired knowledge put into practice, but this practical application in turn revealed or emphasized the gaps, defects, and errors in many current conceptions, and so led ultimately to the prosecution of new researches and the acquisition of much new knowledge. Surveyed from the most general standpoint, the war appears to have taught us little that was new regarding malaria and the other protozoal diseases already mentioned. Its chief protozoological contribution has been to our knowledge of those Protozoa which live in the human intestine, and more especially to the elucidation of the disease called amoebic dysentery. We may therefore say a few words on this subject at this point.

The Protozoa known as "amoebae" form a large and interesting group. Most of the species live independently in such places as ponds, ditches, or the soil; but some of them live in the bodies of other animals, and one of them—called *Entamoeba histolytica*—was already known before the war to live in the human bowel and "cause" amoebic dysentery. The parasite was discovered by Lösch in Russia as long ago as 1875. Its real relation to dysentery, however, was not made clear, though much debated, until just before the war, when the admirable researches of two American workers in the Philippine Islands—E. L. Walker and A. W. Sellards—were published. During the war their results have been confirmed and greatly extended, chiefly by the investigations of British workers. As a consequence, we now know as much about amoebic dysentery as we do about malaria or the diseases due to trypanosomes. There are several points here which are worthy of mention.

We now know that no less than five different species of amoebae may live in the intestine of man, though only one of these—the "dysentery amoeba" already mentioned—ever does him any harm. Moreover, we now know also that amoebic dysentery is a comparatively rare disease. There are many different kinds of dysentery, and the kind due to amoebae is far from being the commonest. Before the war amoebic dysentery was generally recognized as a disease more or less restricted to the tropics, though certain other kinds of dysentery occur all over the world. The curious fact brought into prominence by the war is that the dysentery amoeba itself is very common almost everywhere. This parasite, which can cause, by its presence in the bowel, a violent and sometimes fatal form of dysentery, usually does no such thing. Very many people, in all parts of the world, are infected with it, but very few ever suffer any appreciable harm from its presence. The parasite and the person who harbours it are usually suited to one another in such a way that they can live together comfortably, oblivious of the existence of one another. There are, for instance, in the British Isles at this moment many thousands of people who are heavily infected with these disease-producing parasites, and yet enjoying perfect health.

Another curious feature of amoebic dysentery is the circumstance that it cannot be contracted from a person suffering from the disease. The people responsible for the spread of infection are those who harbour the parasite but themselves suffer no ill consequences from its presence. The explanation of these seemingly contradictory facts is really quite simple, now that we know the life-history of the amoeba and its relation to disease. It is a popular fallacy to suppose that any parasite is the sole "cause" of any disease. A disease is a joint result of many antecedent factors, and in the present case it would probably be nearer the truth to say that the person who harbours the amoeba, rather than the amoeba itself, is the "cause" of amoebic dysentery. For dysentery results only when the infected person happens to be abnormally sensitive to infection with the amoeba, and the condition is as harmful to the parasite as it is to the patient. Normally man and amoeba fit one another, and there is no trouble. Abnormally there is a misfit, and amoebic dysentery is the consequence. The disease is really an unimportant side-show in the life-history of the parasite, the result of its being planted in unsuitable soil.

The foregoing considerations will serve to show once more the value of protozoology in the study of human diseases. What hope could there ever be of eradicating a disease such as amoebic dysentery if we remained in ignorance of the life-history of the parasites connected with it? We might cure every case of the disease—we might conceivably prevent the death of every patient who contracted it; but even if we did, it is now clear that this would have no effect whatever upon the continuance and prevalence of the disease itself. Such procedure could not possibly stamp out amoebic dysentery, or even reduce by one the annual number of cases of this disorder. This is not to say that protozoology has yet enabled us to do either of these things; but it has enabled us to formulate the problem correctly, and has shown the uselessness of expending our energies in wrong directions. Greater results will follow when our knowledge is greater and more properly and consistently applied.

It has been supposed for so long that the parasites which produce protozoal diseases are peculiar to tropical or subtropical countries that the discovery of the dysentery amoeba in Britain may seem surprising. It is really not so surprising as the circumstance that nobody, until quite recently, had thought of looking for it here. And there are many equally remarkable parallels. To mention only those diseases and parasites which we have already noted, we can now say that malaria occurs indigenously in Britain—though this was hardly suspected until recently; and that parasites closely similar to those which cause nagana and Texas fever have now been discovered in the sheep and cattle of the United Kingdom. How far these observations are of practical importance the future will show, but already they clearly indicate that protozoology may be studied with profit at home no less than abroad.

Organization and Training of Workers.—In conclusion, we shall now note very briefly what has already been done for the promotion of protozoology as a branch of science.

As a profession it still hardly exists. Most of those who have enlarged the science have been zoologists or medical men engaged in teaching other subjects and in practising their professions. Many great discoveries have been made by men who cannot be described as protozoologists. But the science has now become so vast, from the amassing of myriads of complicated details, that it can no longer be regarded as an occupation for anyone but a highly trained specialist. The amateur toying with his microscope, the ordinary zoologist or physician working in occasional vacations or leisure hours snatched from practice, can no longer expect to make any solid contributions to protozoology. In future all great advances in knowledge must come from those who are bred up as protozoologists—who not only have the necessary physical and mental gifts for this most difficult study, but who also are prepared to devote their lives and energies to it, and to it alone.

Modern science has already developed to such unwieldy proportions that it has ceased to be coherent and has burst asunder into separate segments. The day of the "scientist," with all science for his province, is gone for ever. If men of science are to escape the fate of the builders of the Tower of Babel, it can only be by conscious coöperation. Each worker must do his own special work, but must do it with due regard for his fellow-labourers in adjoining sections, and with the plan of the whole building constantly before his eyes. Protozoology must, accordingly, develop along its own lines and by the labour of protozoologists, but it must remain in touch with the rest of zoology and with medicine and with all other sciences whose collaboration is likely to be mutually beneficial. We can already observe the bad effects of non-collaboration in the modern school of protozoology which originated with Fritz Schaudinn in Berlin. Over-specialization has there led—after beginning on an admirable foundation of fact—to fantastic speculation and the promulgation of doctrines which are biologically unsound.

One of the good results of the World War was to encourage the collaboration of workers in different branches of science, and in Britain the bonds which previously existed between protozoology and medicine have been greatly strengthened. One of the most obvious conditions necessary for the continuance of this alliance is the growth of protozoology itself. Unless the protozoologists can build solidly, and not too slowly, they will lose their advantages. Unfortunately, no adequate provision has yet been made for the training of workers in protozoology. At present there are in Britain and elsewhere few first-rate professional protozoologists and few competent teachers, but a large number of day labourers and dabblers from other sciences. Protozoologists are still mainly recruited from other professions. The remedy for this state of affairs will be found only when protozoology is recognized as a separate science—an occupation for specialists and not for smatterers; and when encouragement is given to its development by the founding of professorships in the subject—or similar appointments—in the larger universities. These professorships must be primarily for research, and secondarily for teaching purposes. The professor must have ample time and funds for teaching himself, and for carrying out his own researches. If he is sufficiently gifted to do both these things, he will be able at the same time to teach his science to others who would follow in his footsteps. But the time has now gone when the junior demonstrator in zoology or the lecturer on general parasitology in the medical schools can expect to "take up" protozoology for a term or two and thereby profit science or himself. Unfortunately, too little had been done up to 1921 to create the necessary facilities.

A professorship in the subject, founded on the right lines, was indeed instituted in London University some years ago, but it had remained unoccupied up to 1921 since the death of its first holder in 1915. At Cambridge the Quick professorship of biology, founded later, at one time appeared likely to develop into a chair of protozoology, but these hopes were not fulfilled. An assistant professorship, chiefly devoted to protozoology, recently existed in the Imperial College of Science in London; but no further appointment was made to this post after it was vacated by its first occupant. The medical schools of Great Britain have, in some instances, lecturers in protozoology, but these are mostly medical men with other work to perform and no special knowledge of the science as a whole. The schools of tropical medicine in London and Liverpool have been more fortunate, and have been able to appoint to their staffs protozoologists who can devote their undivided attention to the subject. But here again it is chiefly the practical side of the science, as applied to medicine, that is being fostered. Rothamsted Experimental Station has a protozoologist to study the subject in its agricultural aspects, and several universities and other institutions of minor importance have members who have specialized in protozoology. Veterinary medicine in Great Britain has, however, still done little for research or instruction in protozoology.

In the British colonies and dependencies things are no better. A chair of protozoology has recently been created in India;

but as a general rule protozoological research and teaching are still being carried out under unfavourable conditions by hard-worked professors of other subjects. The valuable work already done by many of these men is surely a sufficient pledge of the profits that will accrue when more adequate provisions are made.

If we turn to the United States we find that Columbia University has a professor of protozoology and Johns Hopkins an assistant professor. There is also an American professor of protozoology in the Philippines. But with these exceptions, and a few of lesser importance, protozoology is advancing in America and elsewhere by the labours of zoologists and medical men whose appointments were not primarily established for the furtherance of the science.

RECENT LITERATURE.—The most trustworthy of recent books dealing with the Protozoa as a whole are those of E. A. Minchin, *An Introduction to the Study of the Protozoa* (1912), and F. Doflein, *Lehrbuch der Protozoenkunde* (4th ed., Jena, 1916). See also D. Bruce and others (1903–1919), *Reports of the Sleeping Sickness Commission*, i.–xvii. (Royal Society, London); C. Dobell (1911), "The Principles of Protistology" (*Arch. f. Protistenkunde*, vol. xxiii., p. 269); C. Dobell and others (1921), *A Report on the Occurrence of Intestinal Protozoa in the Inhabitants of Britain* (Medical Research Council, Special Report Series, No. 59, London); C. Dobell and F. W. O'Connor (1921), *The Intestinal Protozoa of Man* (London); S. P. James (1920), *Malaria at Home and Abroad* (London); H. S. Jennings (1906), *Behavior of the Lower Organisms* (New York); A. Laveran and F. Mesnil (1912), *Trypanosomes et Trypanosomiases* (2 ed. Paris); E. L. Walker and A. W. Sellards (1913), "Experimental Entamoebic Dysentery," *Philippine Journ. Sci.* (B. Trop. Med., vol. viii., p. 253). (C. Do.)

PRYOR, ROGER ATKINSON (1828–1919), American jurist and politician (*see* 22.533*), died in New York City March 14 1919. In 1912 he published a volume of *Essays and Addresses*.

PRZEMYSL, SIEGES OF, 1914–5.—The Galician town of Przemysl (*see* 22.534) was first fortified in 1854, when Austria mobilized against Russia. The completely exposed position of the N.E. frontier made it imperative to lay out fortifications. The Archduke Charles had already, in 1824, called attention to this weak point. In case of an invasion of East Galicia by the Russians, the first natural obstacle capable of bringing them to a halt would be the river beds of the lower San and the Dniester, and the obvious thing to do was to strengthen this line by constructing a series of fortifications. On the San it was originally intended to build out Jaroslau as a fortress, but the decision in 1854 fell on Przemysl. In later years a row of smaller bridgeheads and *points d'appui* arose along the Dniester, which greatly increased its value as an obstacle. In the course of one year a fortified ring of no less than 65 forts had been erected round the town of Przemysl. The year 1870 saw the building of a permanent ring of forts finished, but the works were not a match for a bombardment by modern siege guns, owing to the very niggardly expenditure sanctioned. Although after 1888, and in the last years before the World War, the modernization of the fortress from a technical standpoint was begun and some modern self-contained forts were constructed, it was in 1914 still in a very unsatisfactory condition. The short time available for equipment between the first days of mobilization and the first siege by the Russians was indeed spent in feverish activity, but only a very small part of the neglect of the past 10 years could now be made good. The works on the ring of forts, which was 48 km. in circumference, were more or less out of date. Only 12 of them could be considered "bombproof," while all the rest were only "shellproof," and even so only against 24-cm. bombs and 15-cm. shells of old-fashioned construction. The *points d'appui* for the infantry and the battery emplacements lying between the forts were almost without exception only splinterproof shelters, and some were mere field fortifications constructed of wood and earth. The infantry line running through these was protected by wire obstacles, generally only three rows deep. In front of the line of the ring of forts one enormous task had to be undertaken in preparing for the defence—the clearing of the foreground. No less than 18 villages and from 7 to 8 km. of forest were levelled to the ground. Numerous barracks, ammunition magazines, communications, bridges and other buildings, had still to be erected within the ring. The armament of the fortress was also on a very low footing, consisting of about 1,000 guns in all, of which more than half were short-range weapons for ditch defence, and in *traditores*. These were 12- and 15-cm. cannon dating from 1861, 15-cm. mortars dating from the 'eighties, and 8-cm. cupola, disappearing cupola, and minimum port guns of old construction. About 450 of the guns were distant defence guns, being for the most part old 9-cm. field guns (M 75/96) with a range of only 6 km. Of modern guns the fortress at the beginning of the war had altogether only four 30.5-cm. mortars, with a range of 9·5 km., and 24 8-cm. field guns dating from 1905, effective up to 7·5 kilometres. The distant defence guns also included some 12-cm., 15-cm. and 18-cm. siege cannon, dating from 1880, 10 10-cm. and 15-cm. cupola howitzers made in 1899, 15-cm. mobile howitzers of the same year, and 24-cm. mortars made in 1898. As regards munitions the average provision was 500 rounds per gun, and not even that in the case of the modern mortars. For all the four 30·5-cm. mortars taken together there were 300 rounds in the fortress. Of machine-guns there were altogether 114, one-third of which were built into the forts, leaving two-thirds for mobile use.

For the purpose of provisioning the fortress an estimate of 85,000 men and 3,710 horses had been established. In peace time one month's supplies were stored in the fortress, with the understanding that an increase to three months' should be made during the arming period. The Austro-Hungarian Higher Command did its utmost at this time to increase the store of supplies, and, by making full use of the available railways and motor columns, succeeded in provisioning the fortress for four months and a-half. These precautions were all the more justified as, at the last moment, the garrison was augmented by the addition of the 23rd Honved Inf. Div., two field tramway sections and other minor formations, which brought up its strength to 130,000 men and 21,000 horses. At this strength the fortress was provisioned, not for four and a-half, but for three months.

The actual garrison of the fortress at the beginning of mobilization consisted of the Austrian 111th and the Hungarian 97th Landsturm Inf. Bdes., one reserve squadron, one reserve battery, 40 companies of garrison artillery, 44 Landsturm artillery brigades, 7 companies of sappers, and the essential sanitary and labour detachments. When the Austro-Hungarian armies retreated behind the San, after the breaking-off of the battle of Lemberg–Nawa Ruska, there were added to the fortress command (under Field-Marshal-Lt. Kusmanek von Burgneustädten) the Austro-Hungarian 93rd and 108th Landsturm Inf. Bdes. and the 23rd Honved Inf. Division. Earlier additions had been: two Hungarian march regiments, of which, however, one was handed over to Jaroslau and Radymno, one Hungarian Landsturm hussar unit, and lastly a group consisting of four battalions formed out of various Landsturm formations, auxiliary police and others, cut off from the main body. All in all, the fortress establishment, when the last man of the mobile armies had left the zone, consisted of: 61½ infantry battalions (of which 40½ were Landsturm), 7 squadrons, 4 field-gun batteries, 43 fortress-artillery companies, 48 Landsturm artillery brigades, and 8 sapper companies; also sanitary corps, military and Landsturm labour detachments, fortress and tramway formations, balloon detachments, telegraph, telephone and radio formations, and so forth. The value of the troops shut up in the fortress may best be judged by the facts that two-thirds of them were Landsturm, including therefore older and less trained men, and that the formations which had been fighting on the open field were reduced to nearly half their strength. There had been, since the beginning of the World War, only two brigades to take duty in the fortress, and one of these even was sent temporarily to the IV. Army Command. The rest of the troops in the fortress were therefore not over-familiar with the duty of the fortress.

The Russian siege army, commanded by Gen. Radko Dimitriev, consisted originally of the whole of the III. Army, with the IX., X., XI. and XXI. Corps and parts of the IV. and VIII. Armies. When the Austro-Hungarian forces resumed the offensive in the beginning of Oct. 1914, the Grand Duke Nicholas withdrew three divisions of the III. Army from the circle of

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** These figures indicate the volume and page number of the previous article.*

bombardment and sent them to the lower Vistula, with the object of enveloping the enemy. There were now nine and a-half infantry and two cavalry divisions left behind for the blockade of the fortress. Three of these divisions were posted on the N. front, half a division on the S., while the main force of six divisions encircled the E. and S.E. front, which was the point of attack actually fixed upon by Radko Dimitriev, and the two cavalry divisions were encamped on the W. and S.W. front. Counting the Russian infantry division at 16 battalions and the cavalry division at 24 squadrons, the Russians employed no fewer than 150 battalions and 48 squadrons, 800 guns of the field army and the heavy guns of the siege-artillery parks in the siege of Przemysl.

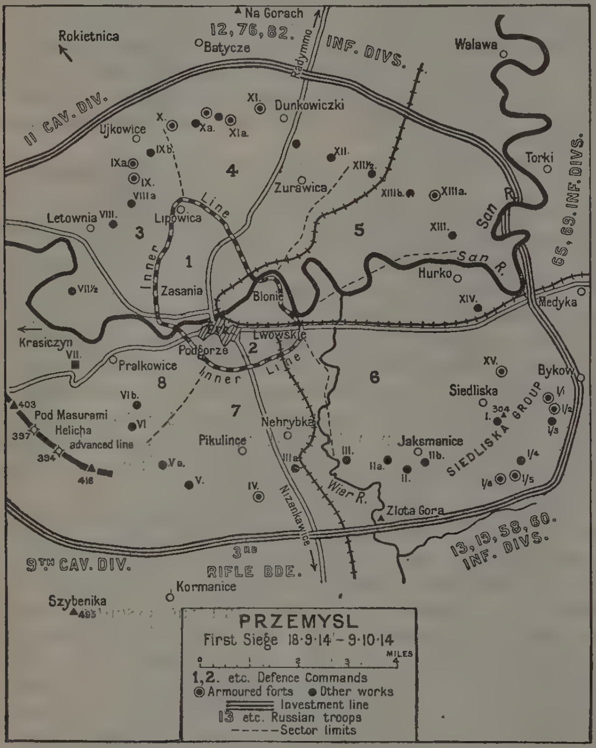
Na Gorach
12, 76, 82. INF. DIVS.
Rokietnica
Batycze
Radymno
Walawa
II CAV. DIV.
XI.
Dunkowiczki
X.
Xa.
XIa.
Ujkowice
IXb.
IXa
IX.
VIIIa
4
XII.
XII½.
Zurawica
XIIIb.
XIIIa.
Torki
65, 69. INF. DIVS.
Letownia
VIII.
3
Lipowica
Line
5
XIII.
San
San R.
Inner
1
Zasania
Blonie
Hurko
VII½
XIV.
Medyka
Krasiczyn
Lwowskie
Podgorze
2
VII.
Pralkowice
Inner Line
8
6
XV.
Bykow
Siedliska
VIb.
7
403
Pod Masurami
VI
Helicha
advanced line
397
394
416
Nehrybka
Pikulince
SIEDLISKA GROUP
I.
304
I/1
I/2
I/3
Jaksmanice
IIb.
III.
IIIa
IIa.
II.
I/4
Va.
V.
IV.
Wiar R.
I/6
I/5
Nizankowice
Zlota Gora
13, 19, 58, 60. INF. DIVS.
9TH CAV. DIV.
3RD RIFLE BDE.
Kormanice
Szybenika
495
PRZEMYSL
First Siege 18·9·14 – 9·10·14
0 1 2 3 4 MILES
1, 2. etc. Defence Commands
◉ Armoured forts ● Other works
Investment line
13 etc. Russian troops
-----Sector limits

The First Siege, Sept. 18–Oct. 9 1914.—On Sept. 18 1914, when the Austro-Hungarian armies had marched off westwards from the San and the area of the Przemysl fortress, the fortress was left to itself, with orders—issued to Kusmanek on the 16th—to resist "to the uttermost." The building of the ring of forts and the distribution of the fortress garrison in the defence zone had now been completed. Only one correction had to be made in the line of defence—on the S.W. front, where it lay too near to the town itself, thus exposing the town and the San bridges to the danger of a direct bombardment. Kusmanek therefore selected a position in the foreground, 2 to 3 km. in front of the ring of forts, running from Krasiczyn over the height of Pod Mazurami to that of Helicha, and had this rapidly fortified and occupied by four battalions. This measure obliged the Russians to fix their line of investment at a corresponding distance from the town at this point also.

The Grand Duke allowed only a very cautious pursuit of the retreating Austro-Hungarians by the Russian armies. The IV. and V. Armies advanced toward the N. of the fortress and across the San; the VIII. Army was ordered to push forward through the Chyrów and Sambor area, and S. of the fortress to the ridge of the Carpathians; the III. Army was to take up a position immediately in front of the E. front of the fortress. On Sept. 20 the first Russian detachments crossed the San at Walawa, to be followed at once by other troops coming from Radymno and Jaroslau, where the bridgeheads had been surrendered to the Russians. These troops surrounded the N. front of the fortress. Portions of the III. and VIII. Armies now advanced towards the S. and S.W. fronts, while on the W. front two cavalry divisions by Sept. 24 completed the hemming-in of the fortress. By means of numerous very vigorous sorties and by violent artillery fire, Kusmanek succeeded in his task, which was to draw as many Russian forces on to himself as possible. He turned the Russian investiture into an exceedingly difficult undertaking.

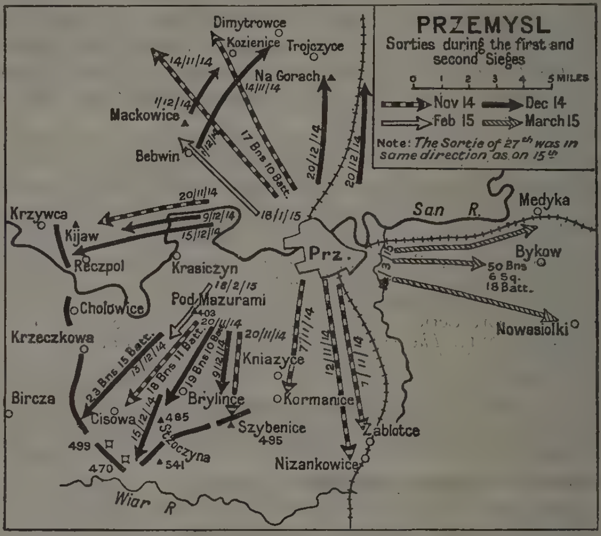
Dimytrowce
Kozienice
Trojczyce
14/11/14
Na Gorach
14/11/14
1/12/14
Mackowice
1/12/14
17 Bns 10 Batt.
20/12/14
20/12/14
Bebwin
18/1/15
20/11/14
Krzywca
9/12/14
15/12/14
Kijaw
Reczpol
Krasiczyn
Prz.
San R.
Medyka
Bykow
50 Bns 6 Sq. 18 Batt.
3/15
18/2/15
Pod Mazurami
403
Cholowice
20/11/14
20/11/14
7/11/14
Nowasiolki
Krzeczkowa
23 Bns 15 Batt.
13/12/14
18 Bns 11 Batt.
19 Bns 10 Batt.
9/12/14
Kniazyce
12/11/14
7/11/14
Bircza
Cisowa
485
15/12/14
Brylince
Kormanice
Szybenice
495
Zablotce
Stroczyna
499
470
541
Nizankowice
Wiar R
PRZEMYSL
Sorties during the first and second Sieges
0 1 2 3 4 5 MILES
Nov 14
Dec 14
Feb 15
March 15
Note: The Sortie of 27th was in same direction as on 15th

The first great sortie was executed by Maj.-Gen. Weher, Commandant of the VI. defence zone, with five battalions and two batteries, on the Grodek road and S. of it, to force back the Russian line of investment between Medyka and Byków. Taken entirely by surprise, the Russians fell back from the first position, and two infantry divisions brought up to their support suffered heavy losses from the artillery fire which now began.

Kusmanek's next opportunity was when he learned that considerable forces were concentrated in the Nizankowice-Kurmanowice-Fredropol area, with the intention of passing along the S. side of the fortress to push forward towards the west. On Sept. 29 he sent Field-Marshal-Lt. von Tamássy with the 23rd Honved Inf. Div. to attack them by way of Halicha in the direction of the Szybenica height. Here the result was the forced deployment of considerable Russian forces against the 23rd Honved Inf. Div., and consequently the delaying of the Russian westward advance.

Minor sorties on other fronts were also successful, and everywhere a lively artillery battle was kept up in order to rivet the enemy's attention on the fortress. The Russians, for their part, maintained a violent bombardment of the forts in the ring. On Oct. 2 an interruption occurred in the Russian gunfire on the E. front. A *parlementaire* distinguished by a white flag brought a message from Radko Dimitriev demanding the surrender of the fortress. He was sent back as quickly as he had come bearing Kusmanek's written answer to Radko Dimitriev: "Herr Kommandant, I consider it beneath my dignity to give your insulting demand the reply that it deserves." Thereupon the hail of steel on the forts began afresh.

Kusmanek's refusal had hit Radko Dimitriev hard. It was scarcely possible to fulfil the Tsar's wish and bring about the speedy fall of Przemysl. A *coup de main* was impracticable, because the siege artillery material was still too far away and could not be fetched up quickly enough on account of the bottomless roads. In the first days of Oct., too, the Austro-Hungarian offensive was launched, and this might within a very short time bring Przemysl the looked-for relief. Radko Dimitriev therefore found himself obliged to revert to a curtailed form of attack, and now tried to make up for the defectiveness of his artillery and technical preparations by reckless onslaughts. As the Austro-German general offensive had necessitated the removal of some of his N. front divisions to the mobile armies, he made up for lost numbers by making excessive demands on his remaining brave divisions which he sacrificed literally to the last man.

Kusmanek had tried to prevent the withdrawal of the Russian divisions by a sortie of the 23rd Honved Inf. Div. with 12 battalions and 7 batteries in the direction of Rokietnica. Radko Dimitriev's plan was, while keeping up the bombardment against the whole ring of forts, to make a demonstration on the N. front and direct the main attack on the S. front against the Siedliska group. The Russian infantry had gradually worked its way up to the ring of forts. The number of siege batteries had been successively augmented—mainly long-distance 10-cm. field-gun batteries, but also some 15-cm. and 21-cm. batteries.

When the Austro-Hungarian offensive had begun on Oct. 4 there was no more time to be lost. The bombardment was doubled in intensity, and on Oct. 5 a *coup de main* was attempted by a Russian division against the Siedliska group. But the attack was broken by the fire of the defenders, and the division streamed back to its positions, losing heavily. On the 6th three other divisions met the same fate, when, after a bombardment of the N. and S. fronts had increased to the utmost violence, they attempted to take the Siedliska group by storm. Kusmanek, not to be misled by the Russian demonstrations, had recognized in time the direction in which the main attack would be delivered and had raised the strength of the most exposed section of the defence (Section VI.) from 11 to 25 battalions and increased its artillery to some 350 guns.

The crisis came on Oct. 7. The 76th Inf. Regt. of the Russian 19th Inf. Div. had on the previous night crept up unnoticed to Fort I. and the infantry lines adjoining it. At dawn one battalion of the regiment succeeded in entering the fort. After a furious battle, heroically led by the commandant, Lt.-Col. Svrljuga, the 149 survivors of the Russians who had forced an entry laid down their arms. The courageous garrison had withdrawn to the interior of the fort, defending it section by section, and all attempts to smoke them out and kill them failed. The neighbouring flanking batteries at Hurko were able to prevent Russian reinforcements from coming in. While this attack was in progress the 69th Reserve Div. on the Grodek Road, the 60th and 13th in front of Jaksmanici, and the 3rd Rifle Bde. on the S. front had lost heavily by unsuccessful assaults.

In the night of the 7th to the 8th the Russians renewed their furious attacks but without penetrating at any point. A general attack, which was to have followed on the next day, did not take place; and only the Siedliska group was again the object of assaults by Radko Dimitriev's decimated divisions, both morning and evening. This last desperate effort also failed completely, and bled the Russians so severely as to put a complete stop to their attacks from that time onward. After more than 72 hours of embittered fighting a gradual *détente* set in, none too soon for the overstrained nerves and spirits of the defenders.

On the 9th the first effects of the approaching relief were felt. In the course of the night the Russian cavalry divisions on the W. front had withdrawn, and during the day the investing ring began to be opened by the troops on the N. and S. fronts, while those on the S.E. and E. fronts gradually retired to their positions in the line of investment. With the entry into the fortress of the first Austro-Hungarian cavalry patrol on the evening of the 9th and of infantry detachments on the 11th, the relief of Przemysl was accomplished.

Of the Austro-Hungarian armies the III., under Boroević, advanced direct on Przemysl. Three corps of this army forced a battle upon portions of the siege army N. of Przemysl, and, on the 11th, beat them back across the river, now greatly swollen by a downpour of many days, with enormous losses. The Russians thereupon entrenched themselves on the E. bank of the river. The Russian VIII. Army now established itself on the heights S.E. of Przemysl up to the Chyrów-Sanok area. The III. Army, at a good distance, faced the E. front of Przemysl.

Radko Dimitriev had imagined that he could subdue Przemysl in a very short time. But all these enormous sacrifices proved vain. During a siege of barely three weeks he had lost nearly 70,000 dead and wounded without having any results to show, for the works of the fortress had suffered very little, and the Austro-Hungarian losses were quite small. On the other side the brave conduct of the Austro-Hungarian defenders had saved a powerful fortress which, in the forthcoming battles on the San, afforded a good basis as a *point d'appui* for the field armies and was able to come to their aid when their supplies failed.

Period Between the First and Second Sieges.—When the Austro-Hungarian armies on the San and S. of the fortress as far as Chyrów advanced to attack along the whole front, the hope of an interval for reconstruction, which the fortress so urgently needed, was by no means realized. On the contrary, lying as it did in the centre of the battle front, it was obliged to take a most active part in the battle now developing, lending garrison troops to the field armies on the one hand and helping generously with the provisioning and supplies on the other.

Very soon after the relief the 23rd Honved Inf. Div. was withdrawn to reinforce the III. Army. It played a successful part in the hardest battles, especially distinguishing itself in the storming of the strong Magiera height.

Altogether there were taken from the garrison, which also made repeated sorties onto the foreground of the E. front, 22 battalions and 27 batteries. Further assistance was given by the artillery support from the ring of forts.

Even greater tean the active part taken in the battle, and far more lowering in its effect on the garrison, was the support in material given by the fortress to the field armies. During the long rainy period before the relief the lines of communication for the fresh drafts of the armies had become an absolute bog. In addition to this, the Russians in their retreat had systematically destroyed roads, bridges and railways (the railway termini were Rzeszow and Zagorz), to the great detriment of the system supplying the armies. It was only natural that every deficiency that arose in the armies, in so far as it could not be made good by transport from the rear, should be supplied by the fortress, which, in spite of all, possessed considerable reserves of material. The fighting armies, from whose attack far-reaching results were expected at the time, had at all costs to be maintained in good fighting condition until the railways were reconstructed.

As it was confidently expected that the borrowed stores—about 21 days' rations had been supplied by the fortress—and the munitions and other material could be replaced almost immediately, the fortress came in the end to be considered as, to all intents and purposes, the base of supplies for the armies. Presently the Army Higher Command realized the mistake that had been made in this matter, and not only forbade all further withdrawal of supplies from the fortress but, in the days immediately preceding the retreat, ordered the armies in their turn to provide it with supplies. On Oct. 28, too, railway communication was restored by way of Chyrów, after the repair of the bridge at Nizankowice, and masses of supplies began to be hastily poured into the fortress.

Yet another burden was imposed upon the fortress by the bringing into it of the wounded and of prisoners, in addition to the very large number of civilian inhabitants. The wounded, it is true, were evacuated almost at once into the interior, before the second siege, but during the second siege 2,000 prisoners were brought into the fortress, and 18,000 civilians had remained within it. So that, taking the average establishment at 128,000 men and 14,500 horses, there were, at the time of the second siege, 148,000 men and 14,500 horses to provide for. By eking out supplies to the utmost, and in the end slaughtering horses, the provisioning of the fortress would last until the second half of March. If the working of the railway coming up through Chyrów had started one week earlier, no supplies need have left the fortress, and its stores would undoubtedly have been replenished on such a scale that it could have held out until the spring offensive had come into effect. The starving-out of the fortress, which forced on its commander the heart-breaking decision to capitulate, and the setting free of the Russian armies investing it would then have been avoided.

Second Siege, Nov. 6 1914–March 2 1915.—On Nov. 5 the fortress was isolated for the second time, after the field armies had broken off the battle of Przemysl and the San in the night. Once more Kusmanek was confronted with the same tasks as in September. Shortly before the retreat of the field armies the fortress had been reinforced by the 85th Landwehr Bde. and a company of airmen. The strength of the garrison was approximately the same as at the beginning of the first investment. In order to extend the fortress's sphere of action, and to force the Russians to keep their line of investment at a greater distance from the actual ring of forts, at the same time obliging them to use more forces for the occupation of the longer line, Kusmanek had new foreground positions laid out. These formed a curve beginning at the Na Gorach height, and, passing 2–3 km. in front of the western ring of forts, came out S.E. of Krasiczyn at the old foreground position. From Helicha this position was extended to the S. of the fortress through Zlota Gora up to the Siedliska group. This measure secured a double advantage: it placed another obstacle in the way of the attacker, who would have to surmount it before he could assault the ring of forts; and the works would suffer far less from the bombardment, as the siege artillery would be forced to remain farther away from the fortress. On the 9th the investment of the fortress was completed for the second time. The Grand Duke Nicholas had selected the Russian XI. Army under Gen. Selivanov for the siege. This army, consisting of about four infantry and one to two cavalry divisions, had barely half the forces used in the first siege under Radko Dimitriev. This circumstance, and the comparatively small activity shown by the Russians at the beginning of the second siege, pointed to the conclusion that Selivanov was less concerned with a rapid seizure of Przemysl than with the idea of a regular siege, in which he would effect a saving of men on his own side while exploiting the scarcity of food supplies in the fortress, leaving the garrison to grow weak from starvation before he advanced to a serious attack. Kusmanek, on the other hand, displayed all the more activity. The months of Nov. and Dec. he employed in aggressive defence, and only desisted when the decimation of his forces by disease forced him to do so. In nine sorties he seized every possible opportunity of damaging the enemy, of preventing any withdrawals from his forces to the field armies; of destroying his supply trains and lines of communication, and finally of bringing into the fortress any food-stuffs—such as fruit and vegetables—which could be collected. In Dec., when the Austro-Hungarian armies took the offensive again, these sorties gained in importance, for each important action undertaken by the fortress with the object of containing Russian forces was necessarily a great disadvantage to the Russians defeated in the battle of Limanowa–Lapanow. Above all, in the case of a successful advance by the right wing of the III. Army, the possibility of coöperation between that wing and the sortie troops was not excluded.

On Nov. 7 and 12 further sorties were undertaken in the direction of Nizankowice and Kormanice. On the 14th, following on a report by the airmen of movements of Russian forces through Pruchnik to the W. and S.W., an assault was delivered on Rokietnica by 17 battalions and 10 batteries. For the same reason an equally powerful sortie was made from the S.W. front on the 20th, the main force moving on Cisowa, and the side columns towards Krzywcza and the Szybenica height.

In Dec. the Russians also became more active. Having let Nov. go by without doing more than prepare a more or less systematic siege, they now began their attacks and turned Dec. into a month of many battles. Quite at the beginning the 82nd Inf. Div. advanced against the N. front. Kusmanek delivered a vigorous counter-blow from the area of Mackowice against the enemy's right flank and repulsed the attack. On Dec. 9 this action was followed by yet another sortie by 19 battalions and 10 batteries from the S.W. front, with the object of preventing the departure of the Russian 81st Inf. Div.

In the middle of Dec., when the battle of Limanowa–Lapanow had reached its height, Kusmanek received an order from the Army Higher Command to deliver a fresh assault. In the hope of being able to join hands with Krautwald's group, advancing on the right wing of Boroević's army, Kusmanek prepared for a great undertaking. With 23 battalions and 15 batteries, commanded by Field-Marshal-Lt. von Tamássy, he pushed forward on the 15th in the direction of Bircza and Krzywcza. After four days of victorious fighting, the heights halfway between Cisowa and Bircza were captured, the enemy driven back along the whole of the S.W. front, and the road to Bircza laid open. But as Krautwald meanwhile had been forced back by the Russians, and as the hope of effecting a junction with him had become a forlorn hope on account of the great distance intervening, and as, further, a fresh violent attack had been launched against the northern foreground position, Na Gorach, Kusmanek found himself obliged to turn his attention to this latter, and to recall Tamássy on the 19th to the fortress.

Once more it was the Russian 82nd Inf. Div. which advanced on Na Gorach. Portions had already penetrated the advanced positions when Kusmanek's counter-attack set in on the 20th, and on the 21st threw them back to the line of investment.

At the end of Dec. yet another order from the Army Higher Command led to a fresh sortie. After the battle of Limanowa–Lapanow the Russians, taking advantage of their interior lines, had opened a counter-offensive against the troops of the III. and IV. Armies which had pushed forward into West Galicia. The proposal was for a sortie to be made in a south-westerly direction, falling in with the left flank of the Russian attack on the one hand, and on the other making a second attempt to effect a junction with the III. Army's right wing, which was pushing forward towards Lisko, Sanok and Rymanow. But with the suspension of the offensive on the 28th the sortie troops were brought back.

This sortie brought the offensive activity of the garrison to a close for the time being, in consideration of their ever-increasing losses through fighting and sickness. All forces were now to be reserved for the effort on a large scale to relieve the fortress, which was planned for the middle of February.

The month of Jan. saw the beginning of a period of great self-denial and sacrifice for the garrison, in consequence of the increasing scarcity of food. The commandant and his staff had in addition the difficult task of maintaining the striking power of the garrison with insufficient means, which involved exacting the maximum of service from each individual soldier in spite of his lack of nourishment. On Dec. 1 1914 Kusmanek, counting upon a delay in the relief operations, had ordered the first general reduction of rations for men and horses. At the end of the month the first horses were killed for the purpose of providing meat and saving fodder. Had the fortress been consuming its full rations it could not have held out beyond the end of Jan., but by the reduction of the ration and further slaughter of horses (up to 7,450), supplies were eked out until the end of March. The extension of the life of the fortress was in proportion to the establishment of horses it was necessary to keep up. For the projected break-through sortie and for the absolutely essential fortress duties a minimum establishment of 4,500 had to be allowed for. By means of further reducing the ration, resorting to incredible makeshifts, and sacrificing 3,500 more horses, the provisioning was made to last until March 24, but there was a rapid mounting-up of the sick list. By the beginning of March one-fifth of the fortress establishment had fallen. To the scarcity of food was added in the winter months that of clothing, footwear and all the other necessaries of life. The garrison had been equipped, for the most part, with summer clothing, and even this had been badly damaged in the fighting. In respect of technical and artillery supplies also, the fortress gradually lost its power of resistance. The barrels of the guns had been gradually burnt out by the excessive demands made on them, and the range of the guns declined accordingly. The stores of ammunition were also rapidly coming to an end, despite the utmost economy.

While the striking power of the fortress was suffering sensibly from all the unspeakable privations imposed by hunger, cold and want, the besiegers were gradually becoming more active. At first the Russians confined themselves to increasing the airmen's activity. Almost every day their airmen circled round the fortress, with very little hindrance from its quite inadequate means of defence, dropping bombs on the forts and the town. In the beginning of Feb. the systematic bombardment of the fortress set in. In the middle of the month the besiegers brought up the line of investment nearer to the N.W., W. and S.W. fronts. On the night of the 18th three regiments attacked the foreground position at Pod Mazurami, but were beaten back with heavy losses. It seemed to the Russians that the garrison's striking power was still too strong; and they let three weeks pass before equipping themselves for an important attack. On March 13 a powerful Russian force advanced against the N. foreground position Na Gorach–Batycze. Against so strong an attack, delivered by at least two regiments, the 35th Light Inf. Regt. could make no stand. As other powerful Russian forces were advancing against the N. front from Radymno, and as Kusmanek considered his own garrison too weak for a counter-blow and also wished to save his forces for the great final break-through, he gave up the foreground position and refrained from counter-attacking. At the same moment the Austro-Hungarian Higher Command had reached the conclusion that the II. Army's offensive would not be able to bring about the desired relief of the fortress, which was therefore inevitably doomed, since the food supplies would be exhausted by March 24.

A break-through from the fortress might conceivably save a portion of the garrison for the Austro-Hungarian army forces, and it had therefore to be attempted. In consideration of the state of supplies, March 19 was fixed as the latest time limit for its execution. Kusmanek had already made all the necessary preparations. He was free to choose the direction in which the sortie was to be made. His decision fell on the E., as it appeared to him impossible for his exhausted men to effect a junction with the II. Army through the mountainous area. On the E. the ground was practicable, and he might hope to have an opportunity there of destroying Russian railway lines and communications, and also possibly to have the good fortune to capture a Russian supply store. In case the break-through failed, he would then be able to take back provisions into the fortress and so prolong its life by a few days.

With two infantry divisions and three independent infantry brigades (50 battalions, 6 squadrons and 18 battalions) the break-through was begun on the morning of the 19th. After some opening success the troops, in a heroic seven-hour battle, fought their way up to the Medyka heights, coming to a stand here at 10 A.M. A flanking counter-attack by the Russian 58th Reserve Div., which had been brought up from the Carpathians, then forced them to return to the fortress, their losses being heavy on account of their exhaustion. The fate of the fortress and the garrison was now finally sealed. The Russians realized the aim of this last sortie, and they had captured on prisoners the order regarding it; they therefore knew that the fortress was almost at the end of its power of resistance. Kusmanek now awaited their attacks. All the sortie troops had returned to their old positions on the 19th. The same night the Russian masses made a violent assault on the E. front. Until the morning of the 22nd Selivanov exerted himself to the utmost to take the fortress by storm. An endless bombardment by the heaviest-calibre guns set in, and was followed by assaults on the N.W., N. and N.E. fronts, as well as on the E. front and the foreground position, Pod Mazurami. But the brave defenders held their ground and repulsed one attack after another. At last Kusmanek, armed with authority from the Army Higher Command, decided to destroy the fortress, since it was now quite impossible to save it. On March 22 between 5 and 6:30 A.M., just as renewed Russian attacks had begun, the works were blown up as far as possible; all guns, the small remaining store of ammunition and the technical arrangements were demolished, all arms broken, motors and other vehicles burnt, and the remaining horses shot. Kusmanek then sent a *parlementaire* to the Russian siege army. When the conditions for the surrender had been fixed the Russians entered the town to take over the administration.

Kusmanek betook himself at once with his staff to Selivanov's headquarters. The garrison,[1] which was allowed all military honours and looked upon even by the enemy as a model of military bravery, remained about another week in Przemysl, and was then removed in large detachments by way of Lemberg. On the 24th the Russian General Artamanov took command.

After four and a half months of heroic defence the fortress of Przemysl had fallen, through hunger and sickness. To the brave garrison, and in the first place to the determined commandant, Gen. von Kusmanek, and to Gen. von Tamássy, leader of most of the sorties, the highest admiration was due, and the victorious enemy, whose own courage was proved by the enormous tribute of lives sacrificed before the forts and ramparts of the fortress, recognized this in full measure.

Recapture of the Fortress, May 30–June 3 1915.—Soon after the fall of the fortress of Przemysl the Russians had taken in hand the reorganization of its works. Particularly after the visit of the Tsar, who inspected the destroyed works in the second half of April, the reconstruction was taken in hand with feverish haste. Numerous heavy guns, including French ones, were brought into the fortress, and a strong garrison was maintained. By the middle of May Böhm's and Puhallo's armies had advanced in a concentric attack on the positions S. of the fortress, as well as on the S., S.W. and W. fronts, while Mackensen's army pushed forward in the area N. of the fortress and over the San. While the Allied armies were thus advancing on Przemysl the Russians were undecided whether to hold the fortress or not. By the middle of May they had begun the work of evacuation and the withdrawal of troops. But in the second half of the month the idea of holding the fortress gained ground, and the Grand Duke finally ordered it to be held "to the last extremity." When Mackensen's army began its offensive on May 24 on both sides of the Szklo in a south-easterly direction, the fortress became more and more closely surrounded to the N. also by the ring of investment. By the 30th the necessary heavy artillery had also been brought up, in spite of the delay caused by the ruined roads and bridges, and the bombardment of the S.W. and northern fronts immediately began. These were the two fronts against which the attack was to be directed. While the X. Corps of Puhallo's army stormed the S.W. front, the Bavarians of the XI. Army, in conjunction with one Prussian infantry regiment, one Guard battalion, and the dismounted troops of the 11th Honved Cav. Div., executed the main attack on the N. front.

Misled by the violence of the attack of the Austro-Hungarian infantry regiments (the 9th and 45th of the X. Corps), who, on the 30th, stormed the Pralkowce fort, on the S.W. front, Work VII., the Russians awaited the main attack there and brought their whole strength into play against the X. Corps. But although they were able to force the Austrians to evacuate the fort, they could not themselves reoccupy it. Meanwhile the Germans had done good work on the N. front. Their bombardment was mainly directed against the forts, X., Xa., XIa. and XI., lying between Ujkowice and Dunkowiczki, and for this guns of all calibres, including the 42-cm. mortars, were used. On the 31st, after heavy fighting, ending in a *mêlée*, Forts Xa. and XIa. were taken, as well as the adjacent infantry positions, and Fort XI. capitulated. On June 1 the Russians brought up strong reserves, but not in time to avert the fate of the fortress. On the morning of the 2nd Fort X. fell into the hands of the attacking forces after its obstinate resistance had been overcome by a liberal bombardment. By the evening Fort XII. had also been captured, and Forts IXa. and IXb. surrendered to Maj.-Gen. Berndt's cavalry. The break-through of the ring of forts had succeeded. North of Zurawica the Russians made one more stand; but this line had also been forced by the evening of the 2nd, and the Russians betook themselves to their last line of resistance immediately in front of the nucleus. But the attack did not get as far as this, for the Russians abandoned the fortress on the night of the 2nd, influenced probably by the successes attained by the XI. and II. Armies. Their rearguards took up new positions on the E. front of the fortress on the line Medyka–Siedliska.

At 3 A.M. the Bavarians of Lt.-Gen. Kneusel's division entered the fortress from the north. Maj.-Gen. Berndt followed from the N.W. with the Austro-Hungarian 4th Cav. Division. By 6

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[1] In round figures 107,000 men, among whom were 28,000 invalids both fit and unfit for transport.

A.M. the Austro-Hungarian X. Corps had also come in. But the attacking forces did not remain long in the evacuated town. In a hurried pursuit they overran the Siedliska position and pushed forward to the E. of the town.

The fall of Przemysl fortress, which had been subdued in barely four days, meant for the Russians the loss of the most powerful pivot of their San front. Not without reason had the Grand Duke—who had tried to gain a success over the IV. Army by a violent assault at Rudnik during the hard struggle for Przemysl—ordered the fortress to be held "to the last extremity." By its fall the forces of the Austro-Hungarian III. Army and the German XI. Army were set free, and could go to the aid of the dangerously situated IV. Army. On the 4th the Russians abandoned the San front. Thus the recapture of Przemysl, apart from the great moral impression it made, was decisive also in a strategical sense. (E. J.)

PSYCHICAL RESEARCH (or SPIRITUALISM) (*see* 22.544).—The matters referred to under the general name "Psychical Research" are distinguished from ordinary subjects of scientific interest by two characteristics. They appeal to the sense of wonder and the love of the marvellous and are concerned with "superstitions," that is, with beliefs which, after being ingrained in the human soul by an immemorial past, are now disavowed by science, but still affect human action. Secondly, they seem to involve abnormal extensions of human faculty, and are readily taken to indicate a survival of human personality after death, and a possibility of obtaining authentic communications from the departed. They consequently arouse strong emotional reactions, provoke strong dislikes and are peculiarly susceptible of vitiation by self-deception, bias and fraud. Hence they are usually treated in a partisan spirit on both sides, like matters of politics, and not with scientific impartiality, and the good faith as well as the competence of the witnesses have always to be tested and every allegation has to be verified. In all these respects the subjects of psychical research are intimately bound up with the religions; but it would be a mistake, nevertheless, to relegate them to the "supernatural," and hastily to declare them unfit for scientific investigation. Their investigation is difficult, but not impossible, provided that in a given society it is favoured or permitted. Of course, if it is proscribed as "sorcery" and made a capital offence, as was the case all the world over until recently, investigation will languish, and it may well be that the practice of burning psychics as "witches," persisted in for many centuries, has effectively eliminated most of the possessors of unusual faculties. However, to begin with, the term "supernatural" should be discarded. It merely assumes what is the cardinal point at issue, viz. that the realm of nature has been completely explored; and only omniscience could assert this. The allegations to be inquired into by psychical research, therefore, should be described, neutrally, as "supernormal."

Nevertheless, the peculiarities of the subjects of psychical research condition further differences which should be noted in any account of their history. They render the influence of public opinion far more important than it is in the ordinary subjects of scientific inquiry. It is true, doubtless, that everywhere the progress of any subject of human interest depends on two factors, on the quantity and quality of human intelligence devoted to its elucidation, and on the social atmosphere, *i.e.* the attitude towards it taken up by public opinion. Of these the former is ordinarily more conspicuous and important, for it directly affects the progress made. The latter acts indirectly, by affecting the amount and sort of the attention paid to a subject, and its effects do not all lie on the surface. But if there is in a society a real desire for more knowledge on a subject, research into it will be organized; inquiries will be set in motion, adequately equipped and endowed, and the conduct of such inquiries will become a career. If, on the other hand, there is little interest, nothing will be done; as also if knowledge is supposed to be absolute or adequate, or if its absence is held to be inevitable and is acquiesced in. If, lastly, the knowledge sought is feared or disapproved of for any reason, various measures will be taken for effectively repressing interest in it; nor must it be supposed that such social taboos cease to operate merely because witch-burning has ceased to be a popular entertainment. In general, moreover, subjects which are inchoate and contentious are far more sensitive to changes in the social atmosphere than those which are recognized, established and endowed. For toward the latter the social attitude is fairly stable and changes only slowly, and they possess, moreover, a permanent organization, which provides for their cultivation (or is supposed to do so), and on which their progress mainly depends. In the case of the former, progress may depend chiefly on the social attitude, and indeed may even consist chiefly in a *change* of social attitude. It is unreasonable, for example, to expect progress in psychical research so long as the energies of researchers have to be devoted primarily to eluding the police or the officers of the Holy Inquisition.

The history of psychical research during the decade 1910–20 provides excellent illustrations of all these reflections. It is composed of a short pre-war period of obscure labour in the cold shade of social neglect, a short eclipse due to the complete immersion of all scientific workers in the pursuits and passions of the World War, accompanied by a grotesque ebullition of superstitions long supposed to have become extinct, and followed shortly afterwards by an astonishing revolution in social sentiment, which rendered psychical research popular and reputable as it had never been before, but is now slowly yielding and relapsing into the pre-war tone of feeling. Before the World War the great bulk of public opinion was either hostile to the subjects of psychical research, or at any rate indifferent to their scientific investigation. That, at least, seemed to be the obvious construction to be put upon the general indifference towards scientific psychical research, and was borne out by the results of a *questionnaire* intended to test the extent and depth of the desire to have knowledge of the most exciting of these subjects, viz. the individual's survival after death. The answers, as analyzed by the writer in the *Proceedings* of the Society for Psychical Research (pt. 49, 1904), seemed to indicate that such a desire was actively functional only in comparatively few minds at any one time, and that these were nearly always excited by the stimulus of a recent bereavement. This explanation seemed, moreover, to account sufficiently for the ordinary social attitude towards the subject. For it would follow that under normal circumstances the great majority, who were *not* animated by the bereavement-sentiment, would effectively repress the few who were, and would mould public opinion and social institutions accordingly—as had manifestly happened—both to scientific and to religious "orthodoxy." But it would also follow that if for any reason the bereavement-sentiment should become widespread, powerful and dominant, it might be predicted that there would ensue a great outburst of interest in psychical research, and a passionate demand for any method that held out to the bereaved human heart the immediate consolation of a direct communication with the departed.

Accordingly this is what happened in consequence of the World War. If we put aside, as mere "propaganda" for the benefit of the superstitious, the crop of bogus prophecies that accompanied the outbreak of war, and such successful appeals to primitive credulity as the legends of the "Russians from Archangel," and of the "Angels of Mons" (the latter, though published as *fiction*, was actually taken as *fact*), we find that at first the normal peace-sentiment persisted. It remained engrossed in mundane affairs and showed itself by a complete and exclusive absorption in the war. Nothing else seemed to matter, and scientific inquiries that did not minister to the war were simply dropped in an ecstasy of patriotic fervour. It seemed, therefore, the sheer waste of a guinea to continue to subscribe to an inquiry whether the human lives that were sacrificed so prodigally on the battle-fields were really dead and done with. No wonder the membership of the Society for Psychical Research in England went down from 1,205 in 1913 to 1,055 in 1916.

Meantime, beneath the surface of social convention, the bereavement-sentiment was growing to proportions unparalleled in civilized history. It was merely awaiting a signal to reveal itself. The signal was presently given, in a high academic

Sir Oliver Lodge's "Raymond."

quarter, by the courageous act of a bereaved father, who did not shrink either from exposing himself to academic ridicule or from divulging the private evidence which he had obtained of his son's survival and declaring that it had satisfied him. That a distinguished physicist at the head of the university of Birmingham should openly endorse spiritism was a remarkable event: yet Sir Oliver Lodge's *Raymond* (1916) was not in itself a remarkable book. Evidentially it did not show that Mrs. Leonard produced anything markedly more conclusive and better in quality than the evidence obtained long before through Mrs. Piper and other "psychics"; nor was there anything remarkable about the quantity of its evidential communications. Hardened sceptics should have had no difficulty in explaining away the "hits" it narrated, as they had dealt with its many predecessors. Nor did its version of the after-life differ markedly from the descriptions of the "summerland" that had been the staple of spiritist literature for the past 50 years, while its apparent crudities, *e.g.* of ghosts smoking "cigars" and drinking "whiskies-and-soda," were no less susceptible of a "symbolical" explanation.

But what turned out to be remarkably different was the reception of the book. It was found that patriotism paralyzed the voice of criticism. The scoffing reviewer, who had been accustomed to say that interest in psychical research was "morbid" and a sure passport to the lunatic asylum, or that the mystery of the grave was insoluble and that anyhow no sensible man had the slightest desire to solve it, was no longer regarded as the sort of person to express what the public wanted to hear about a book of that kind. So he was not allowed to touch it, or perhaps himself experienced a change of heart. Able editors perceived that, in war-time, consolations that appealed to millions of bereaved hearts must be treated tenderly, if only to keep the home front unbroken. So *Raymond* was reviewed respectfully and copiously, and enabled to break down the barrier of peace-time convention. A flood of lesser books followed, ascribed to the living or returning dead, and mostly composed of communications received by relatives of fallen soldiers, through automatic writing—not without an admixture of pious fraud. Unfortunately they were mostly written by people who paid little or no attention to the difficulty of getting evidential communications and of making their value apparent to their readers, and who considered the mere form of the communication as a sufficient authentication, being wholly ignorant of psychology and of the tricks they were, unconsciously, capable of playing on themselves. Nor did amateur automatism alone profit by this innovation. Professional "psychics" obtained an enormous vogue. The resignations from the Society for Psychical Research ceased, and accessions took their place. The membership went up from 1,055 in 1916 to 1,305 in 1919; and the new members were not only willing to pay the two-guinea subscription of a "member" instead of the guinea of the "associate," but insisted on a more active and enterprising policy, and came within measurable distance of "hustling" this eminently respectable society into an endorsement of spiritism.

Of course a change in the social attitude produced in this way cannot be permanent. The old influences persist, and will inevitably reassert themselves and produce a relapse into the former apathy, unless the exceptional opportunities are exploited, and the abnormal will to believe is fortified by positive achievements. In the long run, therefore, the status of psychical research will depend, not on the mere intensity of the desire to know and the amount of social approval it can secure, but on the amount of solid scientific work that will have been accomplished under the stimulus of the abnormal social conditions. It is necessary, therefore, to turn to the scientific side of psychical research, though the developments here will be found to have been relatively small and by no means commensurate with the volume of popular interest excited by the war.

Nevertheless a certain amount of scientific progress has been made, enuring both to the benefit and to the detriment of psychical research. It may be classified under the following heads: (*a*) Psychology, (*b*) Multiple Personality, (*c*) Telepathy, (*d*) Trance, (*e*) Automatic Writing, (*f*) Physical Phenomena, (*g*) Dowsing, (*h*) Thinking Animals.

Psychology during the war made considerable progress because numbers of academic psychologists were compelled to practise, and to apply their theoretical conceptions to clinical problems, while numbers of medical men, finding themselves unable to cope with the profound disturbances of mental equilibrium, inaccurately, but conveniently, designated as "shell-shock," were compelled to reckon with the psychical side of medicine. Thus were large bodies of intelligent men forced not only to apply their theories to concrete cases, and to correct them by their working, but also to recognize the power of the disordered mind to simulate the most various lesions and diseases of the body. As might have been anticipated, the older systems of academic psychology, being compiled out of aesthetic preferences, metaphysical prejudices, methodological assumptions, introspective observations of conscious states, and highly artificial and limited laboratory experiments, did not stand the test of application to the battle-field at all well.

The "psychoanalytic" method, however, devised long before by Dr. Sigmund Freud of Vienna, for tapping the unconscious depths of the mind and bringing their contents to the surface was found to be capable both of explaining the symptoms and in many cases of suggesting a cure. Hence though the psychological theory on which Freud worked had seemed (and been) improbable, extreme and crude, and had (justly) encountered the strongest emotional repugnance, there was no gainsaying the practical validity of his method, and the reality and importance of the mind's unconscious structure. The mind had to be conceived, like the spectrum, as having invisible (unconscious) extensions, as truly characteristic, as susceptible of investigation, and in some respects as important, as its visible (conscious) regions. It had in consequence to be admitted that psychic contents could be "repressed" into this unconscious region without thereby losing their identity and reality, and could thence continue to produce effects in consciousness, even by those who refused to follow Freud in assigning none but an erotic motive to this repression. These psychological discoveries had a considerable bearing on several branches of psychical research. They seemed to throw a flood of light on the mechanism of multiple personality. A "repressed complex" could explain the growth of a "secondary self." They also modified the notion of "fraud."

Not only was it clear, as had indeed already long been recognized by investigators, that a secondary or trance-personality might perpetrate a fraud of which the primary or normal self might be innocent, incapable and unaware, but a personality of either kind might *become* unaware of the fraud it had committed by "repressing" its knowledge thereof. Thus the problem of the fraudulent medium was enormously complicated, and it could be suggested, as by Dr. Culpin (*Spiritualism and the New Psychology*, London, 1920), that even the most honest mediums were frauds, who had cleared their consciences by "repressing" the knowledge of their delinquencies. Furthermore, this same process might be used to explain many errors and gaps in the narratives of observers of supernormal occurrences. Having "repressed," as unwelcome, the real facts, they might honestly deny that they had ever possessed or divulged the knowledge they were bent on regarding as supernormal: it would thereupon appear to be so. Hence repression of the truth would have to be added as a third to mal-observation and forgetfulness, as a very subtle source of error in testimony to the occurrence of the supernormal, and would further complicate the problem of what the evidence really proved. On the other side it is fair to remember that whatever goes to show how little we really know as yet about the functions of the mind should act as an encouragement to psychical research, and renders more credible *pro tanto* claims to unsuspected powers.

In the field of multiple personality Dr. Morton Prince has extended and confirmed his brilliant researches, attending particularly to the proof of the reality of "coconscious" secondary selves (*cf.* his *Unconscious*, 1914). It will doubt-

Multiple Personality.

less have gratified the readers of his *Dissociation of a Personality* (1906) to learn that "Miss Beauchamp" was afterwards happily and healthily married though her husband did not know what a heroine of psychological romance he had espoused. The most striking and substantial contribution to the subject is, however, contained in the admirably recorded and narrated story of the strange case of "Doris Fischer," for which science is indebted to the Rev. Dr. Walter F. Prince, who in consequence became interested in psychical research, and subsequently (1920) succeeded the late Prof. J. H. Hyslop as secretary of the American S.P.R. The record extends over three large volumes (1915, 1916, 1917) of the *Proceedings* of the American S.P.R., contains almost 2,500 pages of print, and is fully worthy of such elaborate treatment. It narrates how, as a little girl of three, "Doris Fischer" was thrown down violently by her drunken father, and so sustained a psychic fracture, which "dissociated" her into "Margaret" and "Real Doris," the former being a personage very similar to "Sally" in the "Beauchamp" case. But for 19 years no one discovered the dissociation, and even her mother only thought Doris a little odd and forgetful, when as "Real Doris" she displayed ignorance of what "Margaret" had just said or done. At the age of 16 another painful scene, at her mother's death-bed, led to a further dissociation and the mergence of a new personality. "Sick Doris" was born mature, grave, hardworking and conscientious, but totally ignorant of everything that had happened before her birth. Again the dissociation escaped detection, because "Margaret," whose "mental age" never rose above 10, undertook to instruct her uneducated partner, and succeeded, at the cost of all-night sittings and violent quarrels. Between these two the "Real Doris" was for six years almost completely crowded out. How she was restored by the skill and tact of Dr. Prince, after he had taken charge of the girl and discovered her condition and how first "Sick Doris" and then "Margaret" were weakened by being put to sleep whenever they cropped up, and grew younger and younger under this treatment, and in the case of "Sick Doris" actually infantile, until they finally evaporated, may be read in Dr. Prince's fascinating record.

Theoretically the case (which was fully reviewed by the present writer in *Proceedings* S.P.R., pt. 74: *cf.* also the article by Dr. T. W. Mitchell in pt. 79) is important also for two reasons. In the first place it brings out that the dissociations were plainly *protective*, and relieved the strain of an otherwise intolerable life. Secondly, they were attended by a considerable number of supernormal incidents which, though not unprecedented in other cases of dissociation (*e.g.* the "Watseka Wonder"), had not formerly been recorded properly. Indeed, if one can accept the record in vol. iii. of the sittings "Doris Fischer" had with Dr. Hyslop's medium "Mrs. Chenoweth," these incidents were the clew to the whole affair, and the dissociations were caused by, or complicated with, spirit-possession. But this interpretation is not apparently accepted by Dr. Prince, and is something of an excrescence on the main story.

Telepathy.—Little progress has been made in establishing telepathy as a process in nature. It remains a sort of half-way house for those who do not feel able to deny the supernormal altogether and yet shrink from the spiritist interpretation. It fulfils this function best if its nature and operation are left vague, so that anything and everything may be set down to telepathy of some sort. Hence believers in "telepathy" have not any strong motive for coming to close quarters with their theory, while the more intelligent spiritists dislike it as rendering any conclusive proof of spirit-identity practically impossible. The opponents of the supernormal first use it freely to disparage the evidences of spiritism, and thereupon frequently proceed, somewhat illogically, to cast doubts upon its own reality. Telepathy, however, has one great advantage, that of being susceptible of experiment. Unfortunately such experiments as are undertaken not only do not succeed in increasing our knowledge of its conditions, but hardly even confirm the earlier experiments on which the existence of telepathy is based. The most noteworthy of the experiments that have yielded positive results were those undertaken by Miss Miles and Miss Ramsden, published in the S.P.R. *Proceedings*, pt. 69 (1914). On the principle that anything supernormal may be attributed to some sort of "telepathy," one might perhaps chronicle here the very anomalous *Adventure*, experienced by two well-known academic ladies of Oxford in the gardens of Versailles, but not published until six years after the event, in 1911 (*cf.* the review in S.P.R. *Proceedings*, pt. 64).

On the other hand, elaborate attempts made by two psychologists in America to verify the existence of telepathy have led to results which at first sight appear to be wholly negative. Dr. J. E. Coover, of Leland Stanford Junior University, was specially endowed as a psychical researcher by the brother of its founder, and in due course produced in 1917 a book of 640 pages. Among its rather miscellaneous contents (it contains *inter alia* a pleasing account of the outwitting of a fraudulent "trumpet-medium" by hidden machinery) he describes 100 series of 100 experiments with cards (court cards omitted) made by 100 pairs of Californian students, for the purpose of testing the existence of telepathy as a faculty widely diffused in some slight degree among human minds. The "agent" was instructed to draw a card and to determine by casting dice whether to look at it or not, and in the former case to try to impress his knowledge (without contact) on the percipient; while the latter had to answer in both cases, but for about half the time would thus be really guessing at random. The results, when tabulated and added up, yielded in the first series of 5,135 genuine "experiments" 153 complete successes (most probable number, 128), in the second series of 4,865 control experiments or "guesses" 141 complete successes (most probable number, 122).

There was therefore a slight excess of successes, but Dr. Coover rightly argues that it was too small to be significant of anything beyond chance. He claims therefore to have disposed of the idea that telepathy may exist in minimal intensity in *all* minds, and evidently thinks that this disposed of the whole case. This, however, would seem to be going too far, on his own showing. For his figures do *not* dispose of the possibility that telepathy may exist in a faint degree in *some* minds. Indeed they rather suggest this possibility. For if we examine them with a view to testing this hypothesis, we may select, as *possibly slightly telepathic*, the series in which the "percipients" got 3 or more complete successes in their "experiments." There were 14 of these, in which 54 complete successes were scored in 711 experiments. The most probable number being 18, the excess is now large enough to be significant of something beyond "chance." But not, apparently, of telepathy, so much as of a sort of "lucidity" or "clairvoyance." For if we treat the (supposedly fortuitous) series of "guesses" similarly, we get still more remarkable results. The series with 3 or more complete successes once more turns out to be 14, and yields 49 complete successes out of 690 experiments (most probable number, 17). But curiously enough 5 of the 14 best "guesses" are identical with 5 of the 14 best "experiments." As the most probable number for such a coincidence is only 2, it can hardly be fortuitous. Moreover, if we add together the "experiments" and "guesses" of these 5 series, we get 41 complete successes out of 500 experiments, as against a most probable number of 12. Again something beyond "chance" is indicated. As, however, this something operates about equally well whether the percipient is trying to determine a card which was actually being thought or is only guessing, it can not be set down to conscious telepathy. This again accords with the other evidence that goes to show that telepathy, if it exists, is not greatly dependent on the conscious efforts of the mind; or otherwise, that if minds communicate telepathically, it is by way of the subliminal. For the rest, of course, the moral is that further experiments should have been conducted with the 5 successful pairs, in order to determine whether they would continue to produce a surplus of successes; but unfortunately this idea did not occur to Dr. Coover.

Dr. L. T. Troland also experimented in telepathy, with very elaborate apparatus, in the Psychological Laboratories of Harvard University (1917), in order to utilize an endowment given in memory of Richard Hodgson (*cf.* Review in S.P.R. *Proceedings*, pt. 80). He, too, got negative results, and did not go on long enough. In fact, he failed so completely that he failed even to prove that telepathy did not exist, or that at any rate he and his colleague were completely devoid of telepathic ability. Only 605 experiments were made, and only 284 complete successes were obtained. Now this is very sensibly *below* the most probable number (302); but, as Dr. Troland observes, an abnormal deficiency is quite as significant of something other than chance as an abnormal excess. It may mean the presence of some factor that *inhibits* success, and if this can be established, it is just as supernormal as one that *produces* success. However, Dr. Troland does not hold that in his experiments the deficiency is sufficiently great. He has not observed how it arose. His total figures were arrived at by lumping together two sets of experiments. In one of these the stimulus shown to the "agent," to which the "percipient" was to react by pushing an instrument either to the right or to the left, was exposed for 30 seconds; in the other, for 15 seconds. Now in the former series there was *no* deficiency of right reactions; 129 successes out of 249 experiments are slightly *above* the probable number, 124. The whole of the deficiency was incurred in the 15-second series, which yielded only 155 successes out of 354 experiments, instead of a most probable 177. As the only difference between the two series was in the duration of the exposure, the idea easily suggests itself that the 15-second exposure was too short to enable the percipient to react rightly. And not only that; it seems to have positively inhibited the right reaction, presumably by inducing an "anxiety-neurosis." In other words, if the "agent," or more probably the "percipient," got "flustered" by the shortness of the exposure, his very knowledge of the right reaction would lead him to make the wrong one. Thus a marked deficiency in correct responses over a long series might imply as much supernormal knowledge, and yield as good evidence of telepathy, as a marked excess; much as it is implied in the "negative hallucination" of a hypnotic subject that he both sees and does not see, the object of the hallucination, and indeed that he *must* see it (subconsciously) in order to avoid it. Again, however, the series of experiments was not long enough to make the appeal to the calculus of probabilities decisive. For the present, therefore, it is best to conclude that the reality of telepathy is not yet either proved or disproved: the evidence is just about enough to keep it alive as a hypothesis.

Trance.—The phenomena of trance continue to be studied, and although Mrs. Piper, the most famous "medium" of this type, was pensioned by the S.P.R. and retired so long ago as 1910, she has no lack of successors. Indeed, the great majority of the customers of "psychics" frequent trance-mediums. Their manifestations continue to be much the same; entranced psychics become obsessed by one or other of their regular "controls"—usually grotesque personages that cannot be identified, and may fairly be suspected of being creations, at least to a large extent, of the medium's subliminal imagination. There are poured forth (in the "good" sittings one hears about) masses of details about the sitters and their concerns, often hesitant, inconclusive, vague, sometimes wrong, often non-significant, but sometimes so startlingly apposite as to shake all but the sturdiest scepticism. The evidence presented in Sir Oliver Lodge's *Raymond* was obtained in this way; Miss Radclyffe-Hall and Lady Troubridge have recorded similar evidential sittings with Sir Oliver's chief medium, Mrs. Leonard, in S.P.R. *Proceedings*, pt. 78. Mrs. Sidgwick produced a final and monumental review of the Piper case in S.P.R. *Proceedings*, pt. 71 (1915).

As regards the theoretic interpretation of these trance-communications, the tendency, even among those most inclined to believe that they convey authentic messages from the departed, is to complicate the process of communication. It is recognized more and more that there have to be reckoned with, not only the medium, with his natural limitations of faculty and training, but the medium's "subliminal" or subconscious, the medium's "controls," who are supposed to transmit the messages from the communicator proper, and possibly the effects of abnormal conditions, not only in the medium (trance-personality) but also in the "control" and "communicator," owing to the effort to communicate. It is evident that these complications may account for many errors and obstructions; but they detract *pro tanto* from the authenticity of the actual communications.

Automatic Writing.—Automatic writing continues to flourish and to furnish psychical researchers with large masses of raw material. But its quality is not equal to its quantity, and its interest is for the most part psychological rather than evidential. Nevertheless a few cases of automatism laying claim to scientific importance may be noted. Undismayed by the failure of Mrs. Verrall to get, through automatic writing, at the contents of a sealed letter left, before his death, by Frederic Myers with Sir Oliver Lodge (*cf.* S.P.R. *Journal*, Jan. 1905), many of the leaders of the S.P.R. continued to work at cross-correspondences, and the results of their labours bulk large in the *Proceedings* of the society 1911–9. They discovered some curious cases among the writings of their automatists, the most remarkable perhaps being that entitled *The Ear of Dionysius* (1917), which was worked out by Mr. Gerald Balfour, and held to indicate the *post-mortem* agency of Prof. Verrall. But unfortunately the value of the coincidences on which the method relies is not capable of exact determination, and the whole method of proving spirit-identity by cross-correspondences is too literary and recondite to be appreciated without an intellectual effort, and so fails to impress the ordinary man. The automatic writing of a Dublin lady, Mrs. Travers Smith, excited some interest, both on account of the enormous speeds attained in its method of production (a planchette travelling over an alphabet under glass), and because of the claim that communications had been received from Sir Hugh Lane, before it was known that the *Lusitania* had been sunk, and that he had been one of the victims of this outrage. The case is narrated in *Voices from the Void* (1919).

Great interest was excited when Mr. Bligh Bond, in his *Gate of Remembrance* (Oxford, 1918), announced that he had been guided in his excavation of Glastonbury Abbey by the automatic writings of a friend who produced copious communications, largely in very debased Latin, from a number of the monks who had inhabited the Abbey from the 11th to the 16th century, and had revealed the correct location and dimensions of the Edgar Chapel, though all the extant antiquarian evidence had made these statements seem quite improbable. Mr. Bligh Bond also had the courage to print in the first edition of his book similar predictions about the Loretto Chapel, of which the remains had not then been found: when, after the war, excavation was resumed, these also were found to be correct substantially—*i.e.* allowing for the facts that the original script was in some points capable of more than one interpretation and that the excavators did not always hit upon the right one. Cases of practically valuable information received in a supernormal manner are extremely rare, and Mr. Bligh Bond's is one of the best of them.

Physical Phenomena.—To pass from automatic writing to physical phenomena is to pass from the least to the most contentious of the subjects that concern the psychical researcher, from a region where the facts are admitted and the interpretation alone is in dispute, to one where fraud has to be guarded against at every step and where *all* the facts are suspected by some to be due to it. Not that fraud is excluded in the former case: automatic writing can be simulated (like anything else) and with a little luck and ingenuity organized deception can be effectively practised with great success, as is amusingly shown in E. H. Jones's *The Road to Endor* (1920), describing how two British officers beguiled the tedium of their captivity and fooled both their comrades and the Turkish officials in charge of their prison camp. In fact, fraud is so easy that nothing depends on it; it is recognized by all competent inquirers that the whole value of automatic writing depends not on the mode of production but on the evidential character of the contents. In dealing with physical phenomena, on the other hand, the elimination or discounting of fraud is the primary consideration; the more so that fraud is certainly abundant, and that the conditions seem designed to facilitate it. This should be recognized by both sides, and should be no reason for refusing absolutely to investigate cases in which *prima facie* the evidence is good, and fraud is absent or, apparently, impossible. As for the conditions, it may conceivably be that just as photographs must be taken in the light and developed in the dark, so the curious growths to be described presently can only be developed in more or less complete darkness. But the inadequacy of the lighting, even in cases where red light is allowed sufficient to distinguish the hands and faces of the sitters, is a valid reason for demanding that the deeds done in the darkness of the séance-room shall be mechanically controlled by adequate substitutes for the sitters' senses of sight and touch, which the darkness puts out of action or renders untrustworthy. To secure this control, it would probably be necessary to construct a special laboratory in which extensive machinery (incapable of forgetting or being hallucinated) would record all the physical changes going on during the sitting. It reveals a curious lack of seriousness in the human attitude towards psychical research that no such laboratory had yet been provided anywhere.

In spite of these drawbacks, however, physical phenomena will not down. There have been plenty of frauds, and plenty of exposures, including that of an Italian medium of international fame, Eusapia Palladino, who began the decade well with a favourable Report by Mr. Everard Feilding and Mr. Baggally on a series of sittings she had given them in Naples (S.P.R. *Proceedings*, pt. 62, 1911). These investigators, though they rereported many movements of objects they could not account for, nevertheless emphasized that Eusapia needed continuous watching because she always cheated when she was given the chance. The chance was given her when she went to America in 1909, and the result was a very handsome and complete exposure, which eclipsed her reputation, even though many of her patrons continued to hold that nothing new had been proved against or about her mediumship, and that it was not wholly fraudulent. Still she died obscure (1918) and fashion took to other mediums.

At present a somewhat different type of physical phenomena is in vogue, in which puzzling movements occurring within the radius of the medium's arm or foot are no longer the staple of the performance, and which it is more difficult to set down to fraud, because the evidence is largely recorded in flashlight photographs, which seem on the face of it to involve the supernormal. In particular two or three cases of "materializations" seem to be deserving of further study. The first of these is connected with a French lady known as "Eva C.," whose mediumistic career goes back to 1906 and the "Villa Carmen" sittings at Algiers, which ended in the customary charges, and denials, of fraud. Some years later she turned up in Paris, living in the house of Mme. Alexandre Bisson, and her materialization phenomena speedily attracted attention. Early in 1914 the chief German psychical researcher, a medical man, Dr. von Schrenck-Notzing, published a lavishly illustrated book, *Materialisations-Phaenomene*, on the materializations of Eva and the similar performances of a Polish girl, Stanislava P.; owing to the war it was not translated into English until 1920. It describes the elaborate precautions taken against fraud and to secure the genuineness of the "materializations"; but the extraordinary flashlight photographs of the plastic substance out of which they were built up are even more convincing than the physiological reports on its character. It is shown exuding from various parts of the medium's body, chiefly the mouth (whether or not the head and the hands were enclosed in muslin bags), hanging about the body in festoons, and forming itself into fingers, hands and faces, which are often incomplete and usually flat and picture-like. This of course gives a measure of support to the only explanation which the sceptics have so far been able to excogitate, viz. that the pictures are first swallowed by the medium and then "regurgitated." This theory, however, hardly explains how they manage to reappear so unruffled, or how the "plasma" is got through the muslin bag when the medium's head is sewn up, and back again. Nor does the medical and microscopic examination of small samples of the plasma which Dr. von Schrenck-Notzing was allowed to take confirm a stomachic origin: its character appears to be epithelial. The reports of Mme. Bisson and Dr. von Schrenck-Notzing were subsequently confirmed by a French medical man, Dr. Gustave Geley, in a lecture given to the Psychological Institute at the Collège de France in Jan. 1918, on "Supernormal Physiology and the Phenomena of Ideoplasty," and in the summer of 1920 "Eva C." was very searchingly examined by a committee of the S.P.R. in a series of sittings held in London: phenomena were not as copious as in Paris, nor on so large a scale; but their general character was confirmed, and no trace of fraud was detected (*cf.* S.P.R. *Proceedings*, pt. 81).

The "materializations" of "Eva C." seemed at first to receive independent support from the mediumship of Miss Kathleen Goligher of Belfast. This medium, and the family circle in which she sat, were exhaustively studied by Dr. W. J. Crawford, a lecturer in mechanical engineering in the local university, who described his conclusions in a series of books; *The Reality of Psychic Phenomena* appeared in 1916, *Experiments in Psychical Science* in 1919, while the third, *The Psychic Structures at the Goligher Circle*, delayed by the author's sudden death, appeared in Feb. 1921. They formed a graduated series, growing more and more sensational in their results, and in the end actually represented as visible facts what had originally been suggested as hypothetical inferences. In his first book Dr. Crawford, while candidly admitting that he believed the directing intelligences concerned to be departed human spirits, set himself to study the mechanics of the phenomena observed, raps, levitations of the table, and other movements of objects, after establishing their supernormal character. For this purpose he used phonographs, manometers, spring balances and a variety of weighing machines, in a red light "nearly always" sufficient to show plainly the hands of the sitters, and proceeded to determine *exactly* the amount and incidence of the forces employed in producing the movements. As a result of his experiments, he came to the conclusion that the mechanical effects observed could only be explained by postulating hypothetical structures, with a definite shape, connecting the bodies moved with the body of the medium at her ankles. These structures, which he called "psychic cantilevers" and "psychic rods," though invisible and intangible, had a size, shape and position which could be mapped by observing at what points the phenomena could be stopped by interposing between the medium and the objects moved.

In his second book Dr. Crawford extended these results, and showed that ordinarily the weight the bodies levitated was added to that of the medium (as if she held them), while when this psychic substance was weighed in a weighing pan at a distance from the medium, her weight would simultaneously be reduced; he claimed to have observed a temporary loss in this way of as much as 54 lb., nearly half her normal weight. He also stated that he obtained impressions on clay of the ends of such a "cantilever column." Finally these structures became visible, and his last book is adorned with flashlight photographs appearing to verify the correctness of his deductions about their origin and application. Moreover, in appearance they curiously resembled the "plasma" issuing from "Eva C." By ingeniously applying moist dyestuffs to various points in the stockings and underclothing of the medium, Crawford claimed to have determined the course taken by this "plasma" in issuing from, and returning into, the body of the medium, declaring also that he had felt the collapse and recuperation of her muscles which accompanied these processes. As his narrative stood, the Goligher case appeared to provide the most impressive evidence ever obtained for the reality of "materializations." Dr. Crawford's premature death in 1920 made it temporarily difficult to pursue independent inquiry into the matter; but at the end of 1921 further investigation by Dr. Fournier D'Albe proved that the manifestations were fraudulent.

Observations of so-called "telekinetic" phenomena, *i.e.* movements of small objects such as celluloid or pith balls, matchboxes, teaspoons, balances, etc., without contact, in the presence of a Polish lady, Stanislava Tomczyk (now Mrs. Everard Feilding), who had been "dissociated" in consequence of experiences during the Warsaw riots of 1906, were reported by Prof. I. Ochorowicz of Warsaw in the *Annales des Sciences*

Psychiques (1909–12), and confirmed by Dr. von Schrenck-Notzing in 1913–4. Some of the photographs appeared to give a clew to the mechanics of these phenomena by showing very fine threads connecting the hands of the medium and passing beneath the object levitated. It is argued however, partly on the strength of the negative results of investigating the medium before and after the phenomena, partly on the ground of differences in the appearance of these threads and of cotton, silk and hair (illustrated), that the threads were of a psychic and supernormal character, and in fact plastic emanations similar to those of "Eva C." In the summer of 1914 the medium came to London to be examined by the S.P.R., but the outbreak of war prevented the continuation of the investigation.

Another branch of physical phenomena is represented by what is called "spirit-photography." In this, as in the (now extinct) method of "slate-writing," everything depends on the prevention of fraudulent substitutions in the plates (or slates). If this is neglected, the production of "spirit-photographs" becomes easy enough. One of the earliest practitioners of this art, William Keeler, has recently suffered annihilating exposure of his "Lee-Bocock" frauds at the hands of Dr. W. F. Prince (Am. S.P.R. *Proceedings*, vol. xiii. 2, March 1920), after having had his case stated in *Proceedings*, vol. viii. (1913), of the same society. Other cases of "spirit-photography" may be said to be still under investigation, and, though none had in 1921 been proved genuine, their detection is usually a highly technical matter. Dr. Prince has also convincingly shown by a critical study of the evidence that an old "poltergeist" case, "the Great Amherst Mystery" (1879), was in all probability due to the (unconscious) fraud of the medium, who had been "dissociated" by a shocking event in her personal history, which she had, apparently, "repressed" (Am. S.P.R. *Proceedings*, vol. xiii. 1, 1919).

"*Dowsing*," as a method of finding water in dry places, continues to be used with considerable success, and it is certainly impressive to find that certain firms of well-sinkers regularly employ dowsers, and are so confident about their skill that they are willing to make contracts on "no find, no pay" terms. It is said, however, that they then (not unreasonably) protect themselves by charging higher rates. The subject was somewhat actively debated in Germany shortly before the World War, because the German governor of South-West Africa had a cousin who was a water-finder, and employed him with great success (*cf. Des Landrat von Uslars Arbeiten mit der Wünschelrute in Südwest Afrika*, Stuttgart, 1912). A pamphlet by A. J. Ellis, issued by the U.S. Geological Survey (*The Divining Rod*, Washington, 1917), though it dismisses the matter dogmatically as a mere superstition, has a useful bibliography.

Thinking Animals.—Before the World War Germany was also the chief home of a vigorous dispute about "thinking animals," which must be noticed in this connexion, not only because allegations of supernormal faculty were made, but because the logical problems involved, the difficulties in ascertaining the facts and in guarding against deception, and the partisanship of the disputants, were identical. For though at first the issue appeared to be simply a question of zoölogical fact, to be decided experimentally by biological and psychological experts, it soon appeared that not only was there the usual divergence between conservatives and progressives, but that the experts were divided by the conflict between the tendencies to emphasize the unity of life and to affirm the supremacy of the human mind; moreover, when, as was soon the case, a considerable amount of *odium theologicum* was imported into the discussion, a similar division was observable among theologians. The result was a complete replica of a controversy in psychical research. The trouble began so long ago as 1904, when Herr von Osten produced a horse, his "Clever Hans," which he had taught to do simple sums by tapping with his hoofs. He had proceeded on the logically false assumption that mathematical thought is peculiarly arduous, and on the biologically false assumption that to discover unsuspected extensions of animal intelligence would be particularly cogent in directions remote from the natural interests of the beast. However, "Hans" indisputably tapped out the right responses in the presence of his master, and even (though rarely) in his absence, and the scientific scandal became so great that an inquiry had to be made (by order of the Ministry of Education); as a result the explanation was adopted, with the approval of the Berlin psychologist, Prof. Stumpf, that the observant animal reacted to slight, unconscious indications given by the experimenter. Thus there was neither thought nor fraud, but only visual hyperaesthesia (*cf.* Pfungst, *Clever Hans*, English translation, New York, 1911).

Officially this report was supposed to settle the matter. But an Elberfeld gentleman named Krall was not satisfied. He bought "Clever Hans" after von Osten's death, and examined his visual acuity, finding it to be 2½ times that of a man. He also trained up a whole stud of equine mathematicians, that became famous as "the Elberfeld horses." Among them one turned out to be a genius, "Muhamed," while another, "Berto," was blind, and so incapable of visual hyperaesthesia. Elberfeld became a place of pilgrimage; a multitude of books, pamphlets and articles appeared (*cf.* Krall, *Denkende Tiere*, Leipzig, 1912); a review was founded for the recording of the prodigies of animal thought (*Tierseele*, 1913). Presently, at Mannheim, an invalid lady took to exhibiting a thinking dog, "Rolf," who, though not so mathematically minded, appeared to be gifted with a rare sense both of philosophy and humour. True, the animal refused to "work" unless held by a chain, and this procedure naturally fostered suspicions that the natural brilliance of his mind might have been improved by a little judicious wire-pulling; but there arose plenty of reputable observers to testify that the chain was kept slack, and even some to declare that "Rolf" had been known to answer correctly in the absence of his owner and had furnished answers not known to any human mind: the opposition, therefore, could only attack the competence of the observers, and sometimes succeeded in showing that they had been laxer than they had imagined. Yet, despite the indignant protests of those who claimed to have vestiges of common sense or knowledge *a priori* of where the limits of the possible were laid down, the open-minded (like Darwin), not afraid of "fool" experiments, went to see, and were duly puzzled: even eminent psychologists, like Prof. Claparède of Geneva, reported favourably, more or less. A poet, Maeterlinck, came away from the horses with the conviction that the phenomena were supernormal; and was satisfied that horses, dogs and cats were by nature "psychics," while elephants, monkeys and asses were not and, unlike the former, could not tap the cosmic reservoir of potential knowledge. The said "reservoir" was hypothetical, but seemed to be needed to provide for the correctness of answers not known to any human mind, and so transcending "telepathy" (which had also been suggested) (*cf. The Unknown Guest*, Eng. trans., 1914, p. 267).

Clearly, this question of "thinking animals" exhibits the tantalizing perversity of other problems in psychical research. The truth about it is not a problem in pure science, and is not susceptible of settlement by its methods. For these demand that the good faith of the observers can be presupposed and that undistorted observation of the facts is possible, both conditions often far less completely fulfilled, even in the established sciences, than is usually assumed. In the unreclaimed borderland between superstition and science neither condition can be satisfied; every "fact" may prove to be real only as a hallucination is real, or to be distorted into a monstrous *mirage* by prejudice and bias, while the will to believe (and equally the will to disbelieve) is so free to select, to emphasize, to interpret, that it can create practically any "fact" it chooses. In short, truth in this region is unmistakably emotional; men's attitude towards it essentially resembles their attitude in religion or in politics; the abstraction from human feeling (or rather from every feeling but the desire for knowledge), which is postulated in the ideal of pure reason, is simply impracticable here. So long as every "fact" adduced on either side has to be treated as suspect, and every step is contentious, scientific progress, if it is possible at all, cannot be otherwise than slow. There is only one way for believers in the supernormal to shortcircuit this procedure: if they can apply their beliefs to the ordinary course of reality and show that they develop so much practical value that they must be reckoned with, they cannot in practice be treated as false. If, for example, secrets were regularly discovered, and information transmitted, by "telepathy," if fortune-tellers frequently told their clients how to make fortunes, and business "clairvoyants" were employed by financial houses, this pragmatic proof would be irresistible, and would suffice to convince the world. Actually, however, the pragmatic test rather tells *against* belief in the supernormal: for the supernormal knowledge believed in is not taken to be trustworthy normally; nor do believers in it act on it, thus betraying the fact, which they may not realize themselves, that they do not take their beliefs quite seriously. In this respect they are like very many other people. For, as Prof. Carveth Read (*The Origin of Man*, ch. viii., London, 1920) has shown, even among the most benighted savages believers in "magic" have always to behave sensibly, for all the extravagance of their beliefs. They pray, *but* they *also* keep their powder dry, and thus their action reveals which of their beliefs are only half-beliefs or make-believe.

In ultimate analysis the question becomes one of the place, function and significance of beliefs which are not quite matter-of-fact about what are not quite matters of fact. To appreciate these, we have to discard the illusion, traditionally fostered by logic, that there is no alternative to firm belief but whole-hearted disbelief. Actually the gradations and fluctuations of beliefs are infinite, and in many departments of life such unstable beliefs are normal and dominant. They can easily coexist with others, abstractly inconsistent with them, in a mind unwilling to abandon either, or perhaps unaware that it is entertaining them. Thus even Herbert Spencer showed that he had *some* belief in ghosts by his comical indignation when his hostess told him she hoped that so stalwart a disbeliever would not mind sleeping in the haunted room of a country house (*Autobiography*, i., p. 480). The only way of redeeming from this region of incomplete beliefs that are below proof a subject of general human interest—and no others ever fall into it—is to make it part of the ordinary routine of life, which every one accepts in practice (whatever the theoretic reason he may give to himself and others), simply because no one can ignore it and live. But if ever the objects of psychical research should be effectively subjected to such a transfer, this would clearly mean a spiritual revolution of the most far-reaching kind.

LITERATURE.—This is still largely contained in periodicals. In England those of the Society for Psychical Research must be mentioned in the first place. Both the *Proceedings* and the *Journal* maintain a high scientific and literary level, and contribute, record or review all the important developments of the subject. The addresses which are delivered by presidents of the society on coming into office form an interesting record of the attitude taken up towards the subject by a number of eminent thinkers (*e.g.* Henri Bergson, 1913; Gilbert Murray, 1916; L. P. Jacks, 1917; Lord Rayleigh, 1919; W. McDougall, 1920). But the society's publications do not notice all the tittle-tattle of the movement, for which it is necessary to consult the weekly *Light* and the monthly *Occult Review*. The former is the official organ of British spiritualism, and the latter is not sufficiently critical of the material it publishes, which, though entertaining enough, appears to be often (almost avowed) fiction. In July 1920 *The Psychic Research Quarterly* began to appear, which promises to be a high-class periodical, and in its Oct. number published the first photographs of Miss Goligher's "materializations." In America the *Proceedings* and *Journal* of the American S.P.R. have the same standards as the English society. But they were long edited by the late Prof. J. H. Hyslop (d. 1920), who soon became a convinced (though critical) spiritist, and reflect his work and his views in a very voluminous and somewhat one-sided way. They are now edited by his successor, Dr. W. F. Prince, the brilliant investigator of the Doris Fischer case, and the acute critic of sundry cases of fraud. In France the *Annales des Sciences Psychiques* have published some good material and continue to give a good idea of the movement in the Latin countries. The *Bulletin* of the Institut Général Psychologique used not infrequently to contain articles on psychical research, but now that an *Institut Métapsychique* has been founded in Paris, with an ambitious programme, it is probable that in future these will appear in its *Bulletin* (no. 1, Oct. 1920). In Germany *Psychische Studien* continue. In Switzerland the *Archives de Psychologie* used often to publish valuable studies bearing on psychical research, while it was edited by the late Prof. Theodore Flournoy (d. 1920), the author of the famous study on the automatisms of "Hélène Schmidt," *Des Indes à la planète Mars* (1900), *Esprits et Médiums* (1911), and of the very remarkable study of a modern mystic "Cécile Vé" (in no. 57, 1915).

As regards books, many have been referred to above. The outstanding importance of Sir Oliver Lodge's *Raymond* and of W. J. Crawford's works on the Goligher case has been already explained under "Trance" and "Physical Phenomena." William James's "Final Impressions of a Psychical Researcher" was reprinted from the *American Magazine* in *Memories and Studies* (1911) and should be consulted for the conclusions left in the great psychologist's mind by his prolonged interest in psychical research. As books of a general character taking a favourable view of the phenomena, there may be mentioned Sir W. Barrett's *On the Threshold of the Unseen* (1917); J. A. Hill's *Spiritualism, its History, Phenomena and Doctrine* (London, 1918); J. H. Hyslop's *Psychical Research and Survival* (1913), *Life after Death* (1919), *Contact with the Other World* (1919); H. Carrington's *Problems of Psychical Research* (London, 1914), *Modern Psychical Phenomena* (1919), *Psychical Phenomena and the War* (1919). Among hostile accounts the best are I. L. Tuckett's *The Evidence for the Supernatural* (1912); E. Clodd's *The Question, If a Man Die shall he Live Again?* (London, 1917) and J. McCabe's *Is Spiritualism based on Fraud?* and *Spiritualism: a Popular History* (both London, 1920). Prof. M. Dessoir's *Vom Jenseits der Seele* (1917, 4th ed. 1920) is also unfavourable in the main, though appreciative of the attitude and work of the S.P.R., and interesting as coming from an academic psychologist who has not disdained to investigate the phenomena alleged. Dr. A. von Schrenck-Notzing's works are important (*Materialisations-phaenomene*, Munich, 1914, 2nd. ed. announced for 1921, Eng. translation by Dr. Fournier d'Albe, London, 1920; *Der Kampf um die Materialisations-Phaenomene*, 1914; *Physikalische Phaenomene des Mediumismus*, 1920). Dr. G. Geley's *De l'Inconscient au Conscient* (Paris, 1919) is an attempt to form a theory of the supernormal physiology of "Eva C." A translation by S. de Brath came out in 1920 (London). Lastly A. J. Philpott's *Quest for Dean Bridgman Conner* (London, 1915) may be instanced as an instructive investigation of an automatic romance (communicated through Mrs. Piper), which, though plausible and partially correct, turned out to be essentially false, and to illustrate how untrustworthy information obtained through supernormal channels at present is. As medical works dealing with psychotherapy and dissociations of personality, those of Dr. Boris Sidis, who made his mark by narrating the strange case of the Rev. Mr. Hanna (*cf.* Sidis and Goodhart, *Multiple Personality*, New York, 1905), *The Foundations of Normal and Abnormal Psychology* (London, 1914), *Symptomatology, Psychognosis and Diagnosis of Psychopathic Diseases* (Boston, 1914) and *The Causation and Treatment of Psychopathic Diseases* (Boston, 1916), may be mentioned; also W. H. R. Rivers' *Instinct and the Unconscious* (London, 1920) and W. Brown's *Psychology and Psychotherapy* (London, 1920).

(F. C. S. S.)

PSYCHOTHERAPY.—The modern branch of medicine to which has been given the name of "psychotherapy" may be regarded as covering all attempts made to mitigate or remove such symptoms as may be attributed to the operations of an unhealthy mind. These symptoms may be mental, for instance confusion of mind, or delusions, or obsessions, and may not be associated with any bodily symptoms or only with such as are trifling. On the other hand the symptoms may be bodily, for instance paralysis, or some form of loss of sensation, or indigestion, and may not be associated with any but trifling mental symptoms. The treatment of symptoms due to mental ill-health by physical agents such as rest, exercise, change of climate, baths, electricity or drugs is not psychotherapy.

Psychotherapy has been practised in all ages, sometimes upon those patently suffering from mental or moral disorders, but perhaps even more often upon those whose symptoms in fact depended upon mental or moral weakness or disorder but in whom the affection appeared, from the superficial character of the medical knowledge of the moment, to be due to organic disease of the body. In such cases psychotherapy has enjoyed considerable success, whether practised in connexion with religion and philosophy or with superstition and charlatanism (*see* FAITH HEALING, 10.135). Under circumstances such as these there has always been, and indeed still is, a formidable admixture of the miraculous, and it is not intended here to examine systems like that of Christian Science or the miracles of Lourdes. The term "psychotherapy" is of comparatively recent origin and has received wide acceptance in that it usefully stands for treatment based upon scientific psychology, normal and morbid. Three methods of psychotherapy will here be considered, from the purely medical point of view: those of Moral Suasion, Suggestion and Psycho-analysis.

Moral Suasion is historically the oldest method, and was advanced to a high level of excellence by the Stoic Philosophers. Illness, whether mental or physical, involves, to an extent depending upon the circumstances of the case and the character of the patient, pain and discomfort, disability with the fear of its consequences upon economic and social position and the fear of death. It is principally in the relief of discomfort and pain that persuasion has its success. Many patients are seriously alarmed at any abnormal feeling in any of their organs, are apt to call such feelings painful and to colour their descriptions with such adjectives as "awful" and "terrible." Others will ascribe symptoms of a commonplace character to serious disease of some important organ,—for example, when flatulence is mistaken for heart disease or turbid urine or pain in the back is regarded as indicative of kidney disease. Merely to induce such patients to be more precise in language and then in simple terms to offer some proximate explanation of their symptoms will often, without the association of any remedial agent, place their ideas in better proportion and mitigate or abolish their pains. Therapeutics have, very naturally, up till quite recent times been dominated by the endeavour to treat the symptom of which the patient complains rather than to attack the disease which is producing the symptom. For the most part treatment has been either by frankly miraculous methods or by those which have been in part empirical and in part miraculous, that is, by those in which some wonderful and unknown factor has seemed to coöperate with the supposed remedy. It has more recently become increasingly apparent that remedial agents not uncommonly owe their seeming success firstly to the fact that most disorders pass away whether treated or not, and secondly to the fact that the mental attitude of the patient can in itself assist at his cure and that this attitude may in many persons be modified for good or ill by the physician or other attendants of the sick man. Galen long since pointed out that "when the imagination of a sick man has been struck by the idea of a remedy, which of itself is without efficacy, it becomes endowed with beneficent power." The method of persuasion seeks to use this recuperative power which lies in the patient's mental field and to set it to work either without or with the assistance of physical agents. It seeks by reasonable explanation to impress upon the patient that his symptoms are transient and that his malady is curable, that it is important for him to aid in his own cure by taking a balanced view of the ills which afflict him and to face them with hope and courage. There is not, as in treatment by suggestion, an endeavour to impose an authoritative assertion to be blindly accepted as a matter of faith, but an endeavour to secure the penetration of an idea by the power of reason, to discuss the situation with the patient and to obtain his acceptance of the case as put forward by the physician. The fear of the disabling effect of illness may also be dealt with by the physician, who may point out, where he is so justified, that on recovery the disability will pass away or that if any be left it will be of an entirely trifling character. In serious disablement and in cases of which the end is likely to be death, it becomes the duty of the philosopher and the priest to fortify the courage and resignation of the patient. Not infrequently, however, the physician, willing or not, has himself to assume their functions and to adapt his exhortations to the needs of men of various creeds and levels of culture.

That persuasion on these lines is of value as a therapeutic agent there can be but little doubt, but its chief disadvantage lies in its limited scope, in that its appeal is to highly developed and organized faculties, just those faculties with which the neuropathic are not for the most part particularly gifted and which are the first to be weakened in disease. In practice, persuasion is apt to degenerate into partial explanations authoritatively enunciated, in which the physician has to make the best he can of the ignorance of the patient and of his own necessarily meagre scientific acquisitions, and in which pure ratiocination plays a small part. In short, persuasion merges into suggestion.

Suggestion, as a formal method of therapeutics, is but of recent origin (*see* 26.48). In large measure it has been, from the earliest times, ancillary to miraculous, magical and professional modes of healing. Under other names it has often been the only curative agent and has been used uncombined with physical agents or ritual performances, but for the most part it has been practised in combination with these. Professional or scientific medicine, though seeing no way of escape, has often sought and still seeks to have as little to do as possible with so indeterminate and varying a mode of cure. It struggles after more exact and precise results, in the fond hope that at some distant date each disorder, psychic or somatic, shall either be prevented from occurring at all or if it occurs shall be met forthwith by some one rapidly acting and efficacious medicament.

The first great impetus to the use of suggestion as a formal method of therapeutics came from Mesmer during the latter part of the eighteenth century, and for well nigh a century suggestion, employed as such, was associated with hypnotism (*see* 14.201). The artificial induction, but not by drugs, of a state in some ways resembling sleep was first called by this name rather before the middle of the nineteenth century, and it was found that the hypnotized person was, in a great majority of cases, in a condition in which suggestions made to him were acted upon with astonishing accuracy either at once or at some subsequent time as determined by the hypnotizer, in short that his suggestibility or capacity for receiving and acting upon suggestion had been much increased. The word "suggestion" used in association with mental therapy has lost some of its precision. Few are agreed as to its meaning: no one can do more than speculate as to the mode of action implied by it. It is common to hear detractors of some cure, whether it be miraculous, or of the character of those relied on by Christian Science, or emanating directly from orthodox medicine, explain it as being "merely" due to suggestion. What is really meant by such an explanation is not always apparent, and it is desirable to restrict the meaning of the term "suggestion" as applied to therapeutics to the process in which it is sought authoritatively to instil an idea into the patient's mind with a view to the relief of some morbid process. From the catalogues of cases set forth by some practitioners it would appear that almost any affection is capable of amelioration or cure by suggestion. A more modest and a more generally held estimate would limit the cases amenable to this treatment to those of functional disorder and of organic disease in which super-added functional symptoms are a prominent feature. The difference between persuasion and suggestion, as indicated above, is that in the former an appeal is made, at least in theory, to the highest levels of the patient's mind, whereas in suggestion (and particularly is this the case when it is combined with hypnosis) directions are delivered to levels of which the patient is only partially conscious, or which he is not aware of as being concerned in the production of his symptoms, or which he does not hold to be capable of activation in their amelioration, or of which, indeed, he is wholly unconscious. In the endeavour to make use of such levels it is plain that it may be necessary to endeavour to inhibit the operations of those that are higher, since these are occupied largely and sometimes almost wholly by the miseries of the patient.

Suggestion suffers from the essential vice of the older therapy in that it is directed rather to the treatment of the symptom than to the disorder of which the symptom is but part. Movement may, for example, be restored to a paralysed limb, but the mental processes of which the movement is the outcome may nevertheless remain unhealthy. A coördinated purposive action is not wholly explained in terms of the movement of a limb, but involves preliminary sensual, perceptual, rational and volitional activities, one or several or all of which may be affected. Criticism has largely been directed against the method of suggestion in that it would seem to convert the patient into an automatic machine which responds to activation without knowing what it does or why it does it: there is obedience without reflection or judgment. Whether this be always so or not, the physician in any case is in ignorance as to which part of the whole psychological system he is operating upon; indeed he is ignorant as to which part of it is in a morbid state. Hysteria is held by many psychologists to lie in mental dissociation, that is that the various mental processes do not coöperate harmoniously and that some are active while others are dormant. Suggestion in the hypnotic state seems artificially to procure this very state of dissociation, and in fact is widely held to induce a mental state analogous to, if not identical with, that of hysteria. To avoid so unhappy a result of a therapeutic measure as the establishment of a morbid state, endeavours have been made to practise suggestion when the patient is not under hypnosis, that is, when he is awake. It is nevertheless usual to direct the patient to allow his mind to adopt an attitude of passive receptivity, and when, if he can, he has done this to make suggestions to him. Only so far as the critical faculties are dormant are such suggestions likely to be efficacious, and if the critical faculties are dormant the method is open to such objection as may be made to hypnotism. This mode of suggestion is probably but little removed from the method of persuasion, the physician hoping that his case may be accepted under the guise of suggestion with a minimum of adverse criticism.

The term "auto-suggestion" has been used to denote a process in which the patient himself attempts to exercise a salutary influence upon his malady by concentrating his thought upon the idea of his cure or by, as it were, commanding his symptoms to disappear. The operation may be assisted by the withdrawal of the patient to a quiet place, by his placing himself in an attitude of repose and by his endeavour to empty his mind of all ideas save the one which is curative. Given sufficient intensity of purpose a man may by such treatment of himself rise superior to the ills that afflict him, think or act in spite of them, and, indeed, in certain cases annihilate them. It is not, however, given to many to reach success on these lines. Afflicted man seeks two things, one to know what really is the matter with him and the second to obtain succour from forces external to himself; he ardently desires a diagnosis and a healer. The desire for correct diagnosis is necessarily shared by him who aspires to be a scientific physician, prompts the constant search for the cause of symptoms and inspires the hope that, a cause being discovered, treatment will be more radical and effectual. Such ideas have led to the inquiries which of recent years have been instituted into the development of the human mind, both from the racial and from the individual aspects, and have resulted in new methods of mental analysis.

Psychological analysis (or "psycho-analysis") has been practised by the method of introspection for centuries. It involves the examination of his mind by the individual himself and the attempt to differentiate between such mental operations as those of feeling, knowing, reasoning, wishing and willing. Such inquiries eventuated in difference of opinion and ceaseless controversy as to the spheres of these faculties, as they were called; nor was the introspective method, owing to the difficulty of getting it efficiently practised by patients, of much value in morbid psychology. The newer methods of analytical psychology as applied to morbid mental manifestations, or to such bodily symptoms as might be supposed to be due to disordered mental processes, have addressed themselves to the discovery of a presumedly basic causative idea, its association with other ideas, and its genesis.

The earliest signs of mind in the individual have the character of reflexes, that is, that upon the reception of a certain stimulus by the organism a particular series of movements ensues. Some of these pass by the name of instincts, are of a complicated character, and appear to occur without previous experience and without education or direction from without. Very early, however, in the history of the child the play of instinct is controlled, repressed or supplanted by positive injunctions from others, by the inculcation of habits, by lines of thought and conduct suggested to him by his observations of those about him, by his desire to imitate their doings and to repeat their sayings, and by his personal experience. The purely natural development of the child is interfered with in order that he may be fitted for life in a civilized society. During this process certain actions initially pleasurable come to be regarded as unconventional, or reprehensible, or shameful, or immodest, or all of these together, and so gradually rules of thought and conduct come into being. Almost all, and perhaps all, thoughts and actions are associated with some emotional tone, that is, with feelings of pleasure or displeasure or pain. Such feelings are of varying intensity, being in some cases so weak that they can scarcely be discerned and in others so powerful as to occupy and command the entire personality. During the education of the child a separation may be brought about between an action and the associated emotional tone or affect, as it is termed. If a child has learnt to regard a pleasurable act as blameworthy and in fact acts no longer in this particular way, the affect which was associated with the act may become partially or wholly detached from it and may perhaps be replaced by its opposite. It is one of the hypotheses of psycho-analysis that a dissociated affect of this character may produce symptoms at once or in later life, either because the affect has not been passed on to some other important or more legitimate object of activity and remains as a quantum of unused psychic energy, or because it has become attached to a substitute for its original partner of unworthy or ridiculous character. The gradual passing on of affects from lower levels of activity to those that are higher has been called sublimation, and their progress from the satisfaction of very lowly bodily wants to the highest ethical and aesthetic acquirements of the mind has been elaborately examined. The failure in attachment of an affect to any sort of substitute for its original partner may result in those indefinite emotional states, sometimes of a distinctly morbid character, in which the individual may be happy or miserable or excited or apathetic for no reason which is obvious to himself or to anyone else; while the attachment of affects to somewhat trifling and comparatively valueless objects is seen in the inordinate interest taken by some in domestic pets, bric-a-brac, pastimes, or fantastic and inane social entertainments. Sometimes, however, the affect remains unconverted and still attached to the original act, so that a conflict arises between the primitive and personal desires on the one hand and desires of later acquisition weighted with civilized, ethical, legal and religious authority, on the other. Many such conflicts are plainly carried on in full consciousness, and are examples of the lust of the flesh against the spirit and of the spirit against the flesh and of the contrariness of the one to the other, but others are by no means so obvious, and their existence may only betray itself by trifling, though odd, deviations from ordinary conduct, by unexplained prejudices and habits, or by symptoms of functional nervous disorder or by the yet more pronounced symptoms of insanity. The conflicts which lie in the field of consciousness may largely be dealt with, in so far as they come under the notice of the physician, in that field. The mere disclosure to another of the existence of a conflict may suffice to produce a therapeutic effect, and this may be further enhanced by the discussion of the subject and its illumination by another mind, but there are conflicts in which the opposing elements and their origin and genesis are not apparent or recognized or indeed discoverable without much labour. Such conflicts are said to lie in the field of the unconscious and to be due to the persistence in that field of repressions made at that time of life when the instinctive desires of the individual, tutored by early environment and education, have undergone a process of restraint. By a wide, and as it seems to some, unnatural extension of the term "sexual" the interest of the infant in its excretory functions and its relations with its parents is ascribed to the sexual instinct, and is that which, owing to existing social conventions, is most subject to repression. It is held that the relations of the child to his mother have an element of sexuality hitherto not determined. Hence the frequent occurrence of such terms as the "Oedipus Complex" and "incest" as descriptive of certain infantile affects. It is further held that the earliest interest of a child in itself is of a sexual character, that it is "auto-erotic." Progress is made from this stage to another in which the child's sexual admiration for himself is termed "narcissism"; then to one in which the interest is extended to other members of his own sex, and finally to one in which sexuality becomes centred upon the normal object, that is upon the opposite sex. This development may be arrested at any point, and the arrest may later in life be displayed in various sexual perversions. If a person in whom such an arrest has occurred, say, at the stage of homosexuality, is living in a civilized society, difficult internal conflicts are likely in later life to ensue between the strength of his desires and his fear of outraging both social convention and legal enactment; or, owing to the fixation of his affect upon an object, not the normal end object of the sexual instinct, he may find himself impotent in his relations with one of the opposite sex. The efforts of psycho-analysis are directed towards the discovery of repression, arrest of development and the conflicts which are thus generated. If these can be brought to light there is hope that further development may occur, that unattached or badly attached affects may find appropriate and fitting objects, and that conflicts may be resolved by the coordinating action of the conscious.

Analysts are not, however, in complete agreement as to whether sexuality is the sole or essential cause of functional nervous symptoms. Some find in the desire of the individual to express his influence upon others, or his "will to power," an active determining cause of the internal conflict which arises when he finds himself in opposition to social conventions and to such activities of those about him as tend to impede his progress. Others again seek to find conflicts not so much in the past development of the individual as in the difficulties which arise when he endeavours to attain such ideal ends as he has proposed to himself. But whatever the value attached to the elements of causation of morbid states there is general agreement that it is not only the conscious field with its obvious conflicts which has to be explored but that the unconscious field should also be examined in as much detail as is possible.

The form of the content of the unconscious and of the conscious mind appears to be determined by analogous processes. Perceptions are apparently not invariably noted by the conscious. It is not an uncommon experience to discover perceptions which must have been made at a certain time and place which only well up into consciousness at some later date, while the details of a perception which were not clear or even considered at all at the time they were received, may be placed in their true position by analysis. In certain morbid states, for instance, delirium and mania, memories of events and even of languages which have been forgotten for many years, may be recovered. Such memories lie in depths of mind to which the term "unconscious" alone seems applicable. Constructive ideation and ratiocination appear also to proceed in the unconscious mind. Problems which have been propounded and set aside for a while receive, as it were suddenly and unexpectedly, a solution; indeed such solutions are recorded as having been reached during sleep. Similarly the execution of works of art, pictorial, musical or literary, is, especially in the case of genius, often effected without immediately preceding conscious mental effort, while the ideas of preachers, orators, wits and ordinary conversationalists often seem voiced automatically. Indeed the obtrusion of conscious effort not uncommonly mars rather than enhances the value of artistic expression. Conventionally the term "subconscious" has become restricted to those states of mind which, though not at the focus of conscious thought, can be brought to that focus at the will of the individual, but the differentiation between such states and those which are brought to consciousness only at exceptional times or by analytic methods seems to be of a very indeterminate nature. A much more particular meaning is assigned to the unconscious by some who make of it a rather sharply defined collection of primitive and instinctive infantile affects. Whatever may be the view adopted on this point, there is but little division of opinion as to the view that the affects which impel conduct, whether primitive or elaborated and sublimated, lie to a great extent in the unconscious, and the search for and examination of these affects when brought into consciousness constitute the great merit of knowledge of self. Not only does the unconscious seem to contain the powers already alluded to, but it has been sought to establish that there is in it a something which has been termed the "censor" which seeks to prevent the emergence of unacceptable affects from the unconscious into the sub-conscious and thence into the conscious. To this "censor" is also attributed powers of transmutation of ideas and symbolization which render the crude and unpalatable operations of the unconscious less unacceptable to the conscious. The examination of dreams by the analytic method is held to have demonstrated the existence of such operations. The ideas of a given dream are one by one examined, with a view to the discovery of their associations, that is of their immediate relation with other ideas, and it is found that the manifest content of the dream is but a condensation of a much wider range of ideas and only indirectly and allegorically expressive of them. The dream is found to be the expression of an affect whose existence may perhaps not hitherto have been recognized and whose passage into the conscious has been prevented. On these points also there is not a complete consensus of opinion, and by some the analysis of dreams is held to disclose not only or so much the expression of the most primitive affects but also the ends which the individual in fact desires but of which he is but unconfessedly and dimly, if at all, aware. Indeed the interpretation of dreams seems not infrequently to depend not so much upon a thoroughgoing analysis as upon the psychological views and imagination of the interpreter.

Another method of exploration is that by free association. The patient is placed in a comfortable position and is directed to close his eyes and then to say whatever idea comes into his head, no matter how absurd or rude or otherwise offensive it may be. Ordinary volitional precautionary control being in this way relaxed, vent is given to the repressed content or at least various groupings of ideas are disclosed. Analogous results are obtained when, owing to intoxication or disease, patients reveal trains of thought remote from those to which in healthy states they give utterance, the very existence of which has been unknown to them and which when known is repulsive.

A third method of analysis is that by the "time-association" test. In this again the patient places himself in a comfortable position and relaxes his attention to what is going on or to any particular line of thought so far as is possible. He is directed to listen to certain words pronounced by the analyst, and on hearing one forthwith to say the word which first arises in his mind. The time between the signal word and the reply is noted. Normally the length of time is two to three seconds, and if it is prolonged or if after some 45 seconds no reply has been given the reaction is considered to be worthy of further examination and to indicate the existence of a group of ideas associated with a definite and perhaps marked emotional tone, that is, with a "complex," as such a group has come to be technically called. But the time element is in fact not the only one of importance in this test, since the character itself of the reply word is put to valuation. Test words may elicit replies of a rhyming character, or altogether commonplace, but on the other hand they may be so inconsequential and unexpected that a surmise at once arises that they imply the existence of a complex.

Such then are the methods adopted in analysis, and it must be plain that if carried out in detail they must necessarily occupy a considerable amount of time. Unhappily in practice analysis is apt, owing to the limitation of available time, to be slip-shod, while deductions are hastily drawn from hastily gathered data; this is by so much the greater a misfortune in that the outstanding merit of analysis lies in its claim to be something of an exact method of examination and thus to supply in psychotherapy a way of discovering, and so of treating, the basis of the symptoms complained of. Though an analysis may not be thorough or the results of a thorough analysis may be incorrect, yet some amelioration of symptoms may occur, and in such an event it is possible that the process of cure is somewhat similar to that obtaining in treatment by suggestion. Though in an impartial analysis the physician should be little more than a recording machine, it is extremely difficult for him to avoid making, or at least being the occasion of, suggestions. The patient seeks a cure at the hands of one whom he regards as having special knowledge; he is hopeful of a good result and is prepared to act upon the advice proffered. In a multitude of cases such factors seem to constitute the essentials of the cure, while the subsequent particularity of method is but of secondary importance; and however much analysis may scorn suggestion, and it does so quite ostensibly, it, like other methods, can hardly hope to escape such vitiations of its pure practice. In analysis the patient must necessarily feel a more than ordinary degree of confidence in one to whom, through a species of psychic vivisection undergone by himself, he is prepared to reveal such facts about himself as the penitent reveals only under the safeguards of the seal of confession, and indeed possibly to go further and reveal much more that is revolting and that is not present in consciousness. Such confidence in itself implies a faith which would move mountains and a mental state singularly receptive of suggestion. From deductions based upon their experience some analysts regard an examination as incomplete until and unless a sexual complex has been discovered. This probably accounts, at least in part, for the fact that the time occupied runs sometimes into years, and that even then the results are not wholly illuminating and satisfactory: while it almost certainly does account for an unfortunate persistence of thought along sexual lines which sometimes develops in patients treated by this method. It is, however, in the detailed elaboration of investigation and in the consequent establishment of unsuspected relationships between ideas and trends of thought and action that the undisputed merit of later psychological methods is to be found. Hitherto psychological examination of the normal mind has for the most part been by the subject of the subject, that is, the subject has been artificially objectified by itself; while examination of the abnormal mind has mostly been confined to the conscious superficies. Analysis has made examination both of the normal and of the abnormal a definite study of objective mental phenomena.

Many diseases in general and many functional nervous disorders and mental affections in particular get better or well by a natural process of cure, and it is difficult to distinguish among the antecedents of the process of betterment those which especially have a causal relationship with it. Some such are artificial and have been devised on various grounds,—religious, magical, philosophical and scientific,—for therapeutic purposes; but the essential difficulties in therapeutics are to determine the efficacy of such artificially introduced antecedents and whether the desired result might have been attained without them. Hence the remarkable discrepancies of opinion as to the value of modes of treatment, even when they have been originated and practised by those trained in scientific method and of ample knowledge. The frequent apparent absence of adequate physical factors in the causation of many functional nervous and mental diseases, the dualism which distinguishes between the spheres of action of mind and body, and the apparent potency of the psychic activities of one person directed upon the mental state of another, combine to justify the practice of psychotherapeutics. Nevertheless, even with a proper respect for most recent developments, it is still difficult to be sure as to which is the most successful method, or whether a combination of physico- and psychotherapeutics may not be better than either alone. It is strange to note how exceedingly exclusive the methods of therapy are apt to be. Those who perform miracles or heal by processes such as those of Christian Science claim no technical skill in medical diagnosis or any regard for it, but variation in treatment according to variation in diagnosis or at least according to the various aetiological factors discovered might be expected from the scientifically trained. Nevertheless too frequently the persuasionist, the hypnotist or the analyst apply their methods, much in the way that their precursors of long ago applied their nostra, with entire lack of discrimination. Perhaps lying behind their particular methods there is a common factor, one of personal influence, in which certain outstanding practitioners excel and which the remainder conspicuously lack. That there is such a factor is apparent when an ignorant practitioner is seen to be highly successful and one who is learned to be unsuccessful. In truth, however, the nature of this influence, like so many of the antecedents of improvement in cases of functional nervous and mental disorders, is at present unknown. There must be a very considerable advance before we obtain accurate knowledge of the relative value of the many therapeutic factors that are perhaps concerned. At present treatment is largely haphazard, and improvement is ascribed to the treatment, if any, immediately preceding it; treatment which, maybe, has nothing whatever to do with the improvement that occurs.

LITERATURE.—The most important works on psycho-analysis are four by S. Freud, the most prominent investigator of the subject, translated for English readers by Brill: *Collected Papers on Hysteria* (1912), *The Interpretation of Dreams* (1913), *The Psychopathology of Everyday Life* (1914) and *Three Contributions to the Theory of Sex* (1918). Brill has given a good account of these in his *Psycho-analysis*. Jung's deviation from Freud's position is set forth in *Collected Papers on Analytical Psychology*, edited by Constance E. Long (1917). *Dream Psychology* by M. Nicoll (1920) expounds an interpretation of dreams of a less sexual character than that given by Freud. P. Janet criticised the methods and findings of psycho-analysis in his report to the 17th International Congress of Medicine (*Proceedings* of the Congress, Sect. 12, pt. 1, p. 13). This criticism is somewhat elaborated in Janet's *Les Médications Psychologiques* (1919). On hypnotism the following works are good and ample: J. M. Bramwell, *Hypnotism* (1913); A. Forel, *Hypnotisme* (tr. by H. W. Armit 1906); C. Lloyd Tuckey, *Treatment by Hypnotism and Suggestion* (7th ed. 1921). On persuasion the following may be commended: Paul Dubois, *De l'Influence de l'Esprit sur le Corps* (Engl. tr. 1910) and *L'Education de Soi-même* (Eng. tr. 1911); J. Camus and P. Pagniez, *Isolement et Psychothérapie* (1904); J. Déjerine and E. Gauckler, *Psychonévroses* (1911). A book from a distinctively Christian point of view is the *Spiritual Director and Physician* by Rev. V. Raymond, tr. by Dom Aloysius Smith (1914). (E. D. M.)

PUBLIC ASSISTANCE.—A marked feature in the social-economic history of the 20th century, and one which became even more marked in its second decade, has been the growth in public expenditure in relief of private wants. "Public Assistance" is of two kinds, direct and indirect. Direct public assistance is the receipt of any benefit in money or in kind at the expense of the rates or taxes which is wholly or partly unpaid for by the recipient. Direct public assistance includes objects like old-age pensions, unemployed benefit, children's meals and medical assistance. Indirect public assistance includes cheap baths and wash-houses, main drainage, cheap railway tickets, sanitary inspection and regulation generally, the control and maintenance of water supply and roads. It is with direct public assistance only that this article deals.

In the form of general doles, public assistance has always exercised a most disastrous influence on the countries where it prevailed. In the ancient world the State was founded on slavery and the citizens were a minority. In Athens the payment of citizens for attendance at the public assemblies and religious ceremonies known as the theoric fund, exercised a corrupting influence on the democracy from the time of Pericles, and Aristotle lays down the general proposition: "Demagogues distribute surplus revenue to the poor. These receive them and are again in want. For such help to the poor is like 'the cask with holes in it.'" The free distribution of corn at Rome had the same results. At first it was sold cheap to the poor in 121 B.C.; then in 58 B.C. it was made free. At first only one-eighth of the citizens took part in the distribution, but within little more than a decade the proportion had increased six-fold, and the number reached 320,000. Cæsar reduced the number to 150,000, but in Augustus' time it rose again, and the rise continued till as Gibbon relates "in the age which preceded the fall of the Republic only 2,000 citizens were possessed of an independent substance." When the imperial granaries, namely Sicily and Carthage, were lost, the wretched people, by this time quite destitute of self-help and self-reliance, were thrown back upon voluntary charity and the Church.

GREAT BRITAIN.—In modern times England has been the "classic land" for State-regulated public assistance. The system dates from 1601, the 43rd year of the reign of Elizabeth. During the Middle Ages the poorer classes depended on the feudal chiefs and the Church. As the feudal system decayed the poor fell back on the ecclesiastical foundations, and in the oft-quoted words of Fuller, the abbeys "dispensed mistaken charity, promiscuously entertaining some who did and many who did not desire it: yea! these abbeys did but support the poor whom they themselves had made." With the dissolution of these abbeys these poor people were thrown back on the State, and under the Statute of Elizabeth, which lasted unimpaired till 1834 and in 1921 was still the basis of the Poor Law, a compulsory assessment was made "for the relief of the impotent and the setting of the able-bodied to work." (*See* under CHARITY and CHARITIES, 5.880 *seq.*)

The administration of the Poor Law proceeded for 230 years with variations of leniency and severity till 1785, when a period of excessive expenditure set in, which in some cases swallowed up the whole of the annual rateable value of the land and reduced the nation to the verge of bankruptcy, leaving the population in a state of complete demoralization. In 20 years from 1783 the Poor Law expenditure had more than doubled itself, and in 1817 it had reached the enormous total of £7,871,811 for a population of about 11,000,000. In 1832 a Royal Commission was appointed which conducted a thorough inquiry and collected striking evidence on the moral deterioration. It appeared from the evidence that the change made in the character and habits of the poor by once receiving public relief is quite remarkable. They are demoralized ever afterwards. "The disease is hereditary," it was contended, "and when once a family has applied for relief they are pressed down for ever." The receipt of relief by a man has been compared in its results to the loss of virtue in a woman. They are never the same again. The commissioners state that pauperism seems to be an engine for the purpose of disconnecting each member of the family from all others: of reducing all to the state of domesticated animals fed, lodged and provided for by the parish without mutual dependence or mutual interest.

The Commissioners showed that the bulk of the abuses and evils disclosed were the direct result of indiscriminate outdoor relief. They laid down the principles: (1) that the pauper's condition shall be less eligible than that of the independent labourer of the lowest class who has to bear the charge; (2) that the function of the State should be limited to the relief of destitution, such destitution to be tested by the willingness to enter a workhouse or institution; (3) that remedial relief as opposed to the relief of destitution should be left to voluntary charity. The main truth is that in all public relief there must be an element of deterrence and some check or test to prevent general pauperism.

On these principles the new Poor Law, the administration of which was handed over to the Commissioners, was based, and it was exercised with such efficiency that in 1871 with a population of 22,500,000 the cost was almost exactly the same as in 1817 with a population of 11,000,000; in other words the cost of pauperism per head of the population had sunk from 14s. to 7s. Between 1873 and 1883 the percentage of those in receipt of direct public assistance was slightly over 3% of the population, the lowest point reached being 2·9 in 1878 and 1879. In the meanwhile the working-classes had not only recovered their self-respect and self-reliance but had through their own organization, the trade unions, the friendly societies, the coöperative societies and the building societies, provided a complete answer to all the difficulties of the Labour problem. In these trade unions and friendly societies they themselves without help from the State had elaborated methods by which provision was made for sickness, accident and old age. Their coöperative societies provided them with the necessaries of life of excellent quality at little over cost price; their building societies provided them with the means to acquire their own houses. At the beginning of the 'nineties a complete survey of the whole problem was taken by the Royal Commission on Labour, and it appeared that the income of 542 trade unions was £1,790,000 and the membership 1,080,000. There were 29,742 friendly societies with a membership of 8,320,262 and funds of more than £26,000,000; also 1,624 coöperative societies with 1,119,000 members and £17,000,000 capital; the sale of foods amounted to £48,500,000 and the profits to £4,774,000; while the assets of the building societies (£50,700,000) brought the total capital funds traceable to the working-classes up to between £90,000,000 and £100,000,000, quite apart from their deposits in savings banks, etc., which a competent authority estimated at another £160,000,000 at the very least. So different was the position that Mr. Ludlow (the chief registrar of the friendly societies) could say in his evidence before the Commission: "Now the black spots in the country may I think almost be counted on the fingers. In former days it was very nearly black, with but few white spots." This wonderful development of self-help embraced all skilled labour and was gradually taking hold of the unskilled, giving the English workingman a knowledge of business and a training in self-government such as the working-man in no other non-English speaking country possessed in anything like the same degree, if at all.

The serpent however was in the grass. The politicians saw capital in the working-man as a voter. In 1886 the first breach was made in the Poor Law system by the institution of municipal distress committees which withdrew the unemployed to a certain extent from the workhouse test. In 1890 the fees for elementary education were remitted, that the poor might have more wherewith to pay for the food and clothing of their children, but it was not till the beginning of the 20th century that, to use Aristotle's expression, more holes were made in the cask. In 1905 the Unemployed Workmen's Act was passed. In 1906 the Children's Meals Provision Act was passed, in 1907 the Administrative Provisions Act, in 1908 Old Age Pensions were adopted and in 1911 the system of National Health Insurance was introduced with its famous bribe of "9d. for 4d." By 1913 it was no longer possible to form any idea of what proportion of the population was living on its exertions and what was depending on public subsidy, or what was the administrative cost. In January of that year therefore, the writer, with the support of friends on both sides of politics, began to ask for a return which would give the facts and figures. In 1919 the fourth edition of that return was published, and later information enables the following picture to be given in 1921.

In 1890 the expenditure on public assistance from rates and taxes was £25,000,000, in 1901 £40,000,000, in 1911 £68,800,000, in 1919 £172,800,000 according to a return which includes figures as old as 1916 (No. 160, 1920), and for the year ending March 31 1921 no less than £332,000,000 (including war pensions) as far as can be gathered from statements in Parliament. The beneficiaries from the last-mentioned return appear to number not fewer than 28,000,000 out of a population which cannot be put higher than 48,000,000. In other words 58% of the population in 1921 were receiving help from public funds, at a rate of about £6 11s. per head, as compared with 4·6% at a rate of 7s. per head in 1871.

With regard to the total of 28,000,000, on the one hand there is, as will be seen, a great deal of fraud and overlapping which may tend to reduce the number, but on the other hand there are a great many gaps in the figures of the return, the figures relating to the National Insurance Unemployment Act being given at 58,000—much too few for the year ending March 31 1921.

We must now say a few words as to some of the holes in the cask, and on the means, if any, of regulating the money poured in or stopping the leaks.

The principal British Acts concerned are (1) the Education Act with the Provision of Meals Acts, etc.; (2) the Old Age Pension Acts; (3) the National Health Insurance Acts; (4) the Public Health Act, (*a*) as to hospitals and treatment of disease, (*b*) as to maternity and child welfare; (5) War Pensions and Ministry of Pensions Acts; (6) Housing of the Working Class Acts; (7) Acts relating to the relief of the poor; (8) Unemployed Workmen's Act; (9) Unemployed Insurance Act. No account is here taken of the bread, coal and railway subsidies, which amounted in 1920–1 to about £87,000,000; they are omitted because they affected the whole population and were temporary.

The Education Act would not at first sight seem to fall under the heading of public assistance, but educationists take an entirely new view of their work to that of other days. "Formerly," says an education report of the London County Council in 1910, "education was in the main confined (1) to the growth of character, (2) to the growth of the mind. Now it looks increasingly at the social problems which present themselves for solution in the case of the individual child, the problem of physical deterioration, of under-feeding, of impoverished homes and unsuitable employment." In regard to necessitous children, the same authority remarks: "Necessitous children are not necessarily ill-nourished at the time of application, though they would become so if relief were withheld." Not a word is said about the duties of the parent. The same is true of the Public Health Acts, the administrators of which do not consider the character of the individual, but solely the health point of view.

With regard to the vast expenditure under the Education Acts, the select committee on national expenditure reported in Dec. 1918 that they had been impressed by the atmosphere of financial laxity in which questions involving education are apt to be considered, and state that under the Act of 1918 neither Parliament nor the Board of Education nor the local authorities can control education.

With regard to the Old Age Pensions Acts which were to diminish Poor Law expenditure and empty the workhouses, the minister who introduced the proposal in 1908 stated that no Chancellor of the Exchequer in his senses would think of adding £3,000,000 to the sum of £6,000,000 which he proposed. In 1921 the amount voted was £28,000,000, and a proposal to add £15,000,000 thereto was only defeated by a majority of 12, the proposer stating that this was but an instalment and that he was in favour of raising the amount of the pension from 10s. to 20s. and reducing the pensionable age from 70 to 60. As to the administration of those Acts it is noteworthy that Ireland with a pop. of 4,390,000 drew £3,329,000 for 181,000 pensioners, while Scotland with a pop. of 4,760,900 drew £1,664,000 for 90,000 pensioners. This looks as if there was a leak somewhere.

Old-age pensioners have from the first received medical relief from the Poor Law, and now, if necessitous, are entitled to receive other relief as well. The separation of the local administration from that of the Poor Law for political reasons has had unsatisfactory results, apart from the extra expense.

With regard to the administration of the National Health Insurance Act, Sir Arthur Newsholme, a well-known authority, has stated that "the system is not actuarially, financially or medically sound, and has involved expenditures in administration entirely incommensurate with the benefit received."

The overlapping of the insurance system with the Poor Law has involved endless difficulties, and it appears from the Return No. 160 (1920) that the annual expenditure for the year given (1919 is the latest available) was £4,294,000 out of a total expenditure of £20,311,000. It was stated as long ago as 1912 that overcoats, underclothing and food were given under sanatorium benefit, thus relieving public health and Poor Law funds, and sanatorium benefit was only a rechristened form of outdoor relief. As to the Poor Law, it may be observed in passing that its expense increased between the years 1911 and 1919 from £15,000,000 to £18,000,000 for England and Wales alone, and as old-age pensioners left the workhouse their places were filled by those under 70 years of age.

With regard to the unemployed insurance it appears that the reserve of £20,000,000 which existed after the World War was exhausted by June 1921, and that the Treasury was drawn upon for another £10,000,000, while as to the unemployed dole the magistrate at the Thames police court on May 18 1921 said: "It has been said from this bench over and over again that such doles lend themselves to and almost induce fraud."

All that can be said with certainty as to the national housing scheme is that the losses to the central and local Government on each house annually will amount to an enormous sum. Originally 1,000,000 houses were to be built. In May 1921 the annual loss to the State on each house was placed officially at £60 apart from loss to the rates. This makes an annual loss of about £18,000,000, or a total eventual loss at the end of 60 years of £700,000,000. Thus a privileged class of house-holders will be created at an enormous loss.

The attitude of Parliament to such expenditure gives little hope of a check from that quarter. There is a constant complaint of the apathy and slight attendance at debates on economy, and the late Speaker of the House of Commons pointed out that since 1900 there has been a great change in the attitude of the House towards economy and that now the advocates of economy "do not get a look in." The Chancellor of the Exchequer frankly said in March 1920 that with such items as old-age pensions, a national unemployment scheme and a national housing scheme, it was impossible to offer a blunt uncompromising refusal to proposals for new expenditure.

With regard to the central authority, economy is unlikely from that direction, for enormous increases have been made either in the shape of additional salary or temporary bonus by Whitley Councils consisting of civil servants to the lower grades and by the Government to the higher grades (including the Treasury), which in both cases, without previous knowledge or sanction of Parliament, the central authority has by circular invited local authorities to follow, and the central authority has a means in the Exchequer grants (which it can give or withhold at will) for stirring up the local authority to spend money.

On the whole then, there seem few weapons in the hands of those who would stop the progress of a democratic nation on the road to ruin. But they comprise, first, a complete statement of accounts showing how the money is raised, how it is spent, what is the administrative cost and who are the beneficiaries, whether worthy or unworthy. Secondly, the institution of a strong but small central commission, as in 1832, to ration the administration of the whole of the new system of public assistance, taking care not only to punish fraud and put down overlapping but also to make the position of the beneficiaries (apart from war pensioners) less eligible than that of the lowest class of independent workmen, and introduce some stringent and deterrent test. Lastly, to make it clear that all this vast expenditure from the rates and taxes, however carefully disguised, falls in the long run most heavily on the working-classes, by wasting the fund from which come new enterprises and increased wages on myriads of officials who make the poor man's life a burden to him.

(G. Dr.)

United States.—Owing to the fact that the United States is still a new country with a comparatively small number of poor, the need in its communities for public assistance in the relief of poverty and attendant ills has been much less urgent than in European countries. One consequence is that the "right to relief" has been recognized in the laws of only a few of the states. That every man ought to support himself and his family is, or has been, the working social theory of Americans of all classes. They have looked with disfavour on continued subsidies and other payments which might seem to be part of a routine, preferring to provide temporary assistance when necessary, treating each case as an emergency, in the expectation that the beneficiary will soon be able to shift for himself. They have declined to recognize formally the existence of a necessitous class. Hence much of the relief work in the United States up to 1921 was still done by privately supported agencies.

In the decade 1910–20 it became obvious, however, that a change had begun. Americans seemed to be losing their aversion to paternalistic government, and the newer proposals for social betterment tended to call for some kind of legislation involving an extension of state or municipal activity and for an appropriation. Among the more progressive states and cities it became the rule to establish departments of public welfare, which, though their duties and perhaps their theories were somewhat vague, nevertheless made incessant demands for further appropriations and for fresh welfare legislation. It is characteristic of the American point of view, however, that this welfare movement concerned itself less with the lowest forms of poverty or with the most helpless layer of the dependent than with improving the conditions of life among wage-earners in general.

The tendency to extend the range of Government activity in welfare work did not escape serious criticism. This criticism was perhaps most emphatic with respect to the ever-widening scope of the work undertaken by public health departments. The point was made that in so far as these bodies exceeded the limit of indispensable activities they were "pauperizing" the public. The accepted view was that the duty of sanitary authorities was not to help any one family to be healthy, but to prevent any one family from disseminating disease. But it is almost impossible to draw a line between necessary functions and those which are largely philanthropic. Thus many cities maintained a large staff of physicians and nurses whose duty it was to visit schools and even households, giving advice and treatment free. From the private practitioner's point of view this work was an encroachment on his legitimate sources of income, but free medical treatment in the case of school-children, for example, is merely an incident of free education, for the ability to receive education is in large degree dependent on physical fitness. It should be said, moreover, that in most cities free treatment was not given unless the recipient was unable to pay, and that in any case the community was only protecting itself by promoting the health of its individual members. The same question was involved in the establishment of sanatoriums in many parts of the United States for the treatment of tuberculosis and other communicable diseases, both aiding the sufferer and safeguarding the public from him, as had been done in the case of the insane for many years. In some of such institutions a nominal charge was made, but by far the greater part of the expense was paid by taxation. Hospitalization came to be expected as a right, regardless of the ability of the patient to pay the cost of treatment. Thus the American public was being taught to feel that the state or county or city was bound to provide certain kinds of public assistance which had been regarded as outside the scope of state subsidies.

Of the newer proposals for public assistance none gained more rapid headway than that for mothers' allowances or pensions. The first such law was passed by Missouri in 1911, and granted allowances to widows with children and to deserted mothers; by 1920 there were similar provisions in 39 states. These allowances ranged from $2 a week for each child up to $25 a month for the first child and $15 a month for each additional child. The age limit, after which the allowance was to cease, was placed at 13 years in some states and as high as 18 in others. Up to 1920 the aggregate of these allowances had not become so large as to alarm taxpayers, and in so far as the system saved the children from being committed to public institutions—orphan asylums and the like—it was undoubtedly beneficial. Legislation for mothers' allowances, no doubt, tends to create a demand for old-age pensions, but up to 1921 no state had yet undertaken this form of subsidy. Taxes for mothers' allowances were mostly levied and administered by the county governments.

Another form of public assistance which grew rapidly in the decade 1910–20 was that connected with the health of children, particularly those attending school. As early as 1892 New York City provided for the inspection by health officers of school-children, and by 1920 practically every city had organized some form of health examination for all pupils attending public schools. In later years the scope of the work was considerably expanded; skilled medical examiners were employed to give especial attention to eyes, throats and teeth, and, where necessary, treatment was often given at public expense. Special open-air schools were opened in many places for tubercular children; and proper conditions maintained for giving the children adequate fresh air, rest and nourishment. In many poorer districts, where the educational progress of the children was found to be retarded by under-nourishment, it became customary for the school authorities to provide a daily luncheon, which was served either free or at a nominal price. In 1919 cities having each a pop. of more than 30,000 expended an aggregate of $1,849,624 on medical work for school-children, and an additional amount of $908,742 on other child conservation work, such as the employment of trained nurses to visit mothers in congested districts and the establishment of infant welfare stations where mothers could obtain medical advice and free treatment for their babies.

To determine the aggregate amount of public assistance in the United States it is necessary to state that such items as those for sanitation, prevention of epidemics, protection to life and property cannot properly be regarded as public assistance. The following tables, based on U.S. Census Bureau reports, show the increase in public expenditures in the period 1913–9 for health conservation and maintenance of charities, hospitals and correctional institutions:—

HEALTH CONSERVATION

Expended by	1919	1913
States	$12,249,333 (1918)	$ 6,388,114
Counties	5,000,000 (est.)	2,815,466
Cities	20,208,615	12,000,000 (est.)
Total	$37,457,948	$21,203,580

CHARITIES, HOSPITALS AND CORRECTIONS

States	$118,084,025 (1918)	$ 87,585,903
Counties	60,000,000 (est.)	37,815,508
Cities	55,086,145	32,896,351
Total	$233,170,170	$158,297,762
Grand total	$270,628,118	$179,501,342

Thus the increase in expenditures for the purposes noted was somewhat more than $90,000,000 in six years. These figures, however, include the cost of certain activities which cannot rightly be classed as public assistance, and which are approximately one-third of the total. With respect to the more recent compilations of the Census Bureau, it is possible, because of the greater fullness of data, to exclude those items. Thus a tabulation of the expenditures by the states for public assistance in 1918 would include the following:—

HEALTH CONSERVATION.	
Treatment of tuberculosis—	
In institutions	$5,105,556
Elsewhere	643,981
Treatment of other communicable diseases	1,488,186
Conservation of child life	285,674
Other health activities	764,497
CHARITIES AND HOSPITALS.	
Supervision	849,727
Outdoor relief	517,827
Care of poor—	
In state institutions	211,995
Elsewhere	121,101
Care of children—	
In state institutions	1,328,441
Elsewhere	2,023,205
Care of blind, deaf and mute—	
In state institutions	4,458,758
Elsewhere	1,713,274
Other charities—	
State institutions	8,924,208
All other	530,862
Hospitals—	
General	2,613,951
All other	3,149,100
Hospitals for the insane—	
State	47,860,528
All other	2,091,304
Total	$84,682,175

The expenditures of cities for similar purposes in 1919 were as follows:

Prevention and treatment of communicable diseases—	
Tuberculosis	$5,145,280
Other communicable diseases in hospitals	4,427,510
Other treatment	2,271,364
Conservation of child life—	
Medical work for school-children	1,849,624
Other child conservation work	908,742
Charities and hospitals—	
General supervision	854,466
Outdoor poor relief	4,631,697
Poor in institutions	7,715,940
Care of children	7,125,436
Other charities	3,570,051
General hospitals	16,735,615
Insane hospitals	3,871,082
Welfare commissions	47,307
Total	$59,154,114

With respect to conservation of health, items representing general administrative expenses have not been included in the two preceding tables, although a certain percentage of these undoubtedly belongs under the heading "public assistance." Whatever their amount may be it is offset by the unavoidable inclusion of certain expenditures for preventive health measures, most of which are undertaken for the benefit of the community at large rather than with the definite purpose of aiding needy persons. Detailed figures showing the expenditure of counties were not available, and it is possible that if the aggregate expenditure for mothers' allowances were known, it would materially increase the totals given in this article.

The available data indicate that, exclusive of Federal provision for former soldiers and their families, and for other agencies for dependents which come under the jurisdiction of the Federal Government, the total expenditure for public assistance in the United States in 1920 was more than $200,000,000, the appropriations originating as follows: states, $90,000,000; counties, $45,000,000; and cities, $65,000,000. It seemed probable that these appropriations would rapidly increase as the more recent projects for public assistance became more fully developed and as the economic reaction following the World War spent itself.

(F. H. H.)

PUBLIC TRUSTEE (*see* 27.334).—The Office of the Public Trustee, created in Great Britain by the Public Trustee Act 1906, was opened at Clement's Inn, London, on Oct. 1 1907, under Sir Charles John Stewart, K.B.E. (1918), who organized and controlled the Department during a period of rapid growth until his retirement in 1919. He was succeeded in office by Mr. Oswald Richard Arthur Simpkin, to whom fell the equally difficult task of post-war reorganization. The other principal officers of the Department in 1921 were Mr. Ernest King Allen, Assistant Public Trustee (at Kingsway), and Mr. Thomas Moffat Young, Deputy Public Trustee, at Manchester. The staff in 1921 numbered 874 in London and 86 at Manchester.

The number of trusts and estates accepted for administration by the Public Trustee in the first year (1907–8) was 63, valued at £384,000. In 1913–4 the acceptances were 1,573 cases valued at £13,500,000, and at the end of that period the Office was administering 5,480 cases, representing a value of £43,500,000, and had distributed 450 cases and £5,834,691 of trust funds. Meanwhile the staff had grown in number from 19 to 370, the annual fee income from £502 to £55,283, and the expenses from £3,312 to £49,428. On April 1 1914 a Northern Branch of the Department was opened at Manchester (Northern Assurance Buildings, Albert Square) under a Deputy Public Trustee, and following on the Report of the Royal Commission on the Civil Service the Public Trustee's staff was made a part of the permanent Civil Service.

The outbreak of the World War found the Department manned almost entirely by officials of military age, and probably no Government Office suffered so much from the transfer of members of its staff to the fighting services. During the greater part of the war period most of its work had to be done by women clerks and by such temporary men as could be recruited under the existing conditions. In Sept. 1914 new and onerous duties were laid upon the Public Trustee by his appointment under the Trading with the Enemy Act and Proclamation as Custodian for England and Wales of enemy property. The Act provided that all sums payable to enemies by way of interest, dividends or share of profits should be paid over to the Custodian; that firms with enemy partners and companies with enemy shareholders should make returns to the Custodian disclosing such enemy interests, and that all persons holding or managing property on account of enemies should give particulars to the Custodian. Under the Patents and Designs Act 1907, the Public Trustee was also appointed to receive royalties in respect of patents avoided or suspended under the Patents, etc., Temporary Rules Act 1914. A separate "Trading with the Enemy" Branch was opened at 2, Clement's Inn on Nov. 30 1914. Further legislation in 1915, 1916 and 1917, and also the Peace Treaty, threw additional duties upon it, and in 1921 it employed a special staff of 327 persons at Kingsway and Cornwall House. The fees collected by the Public Trustee as Custodian from 1914 to 1921 amounted to £412,000.

In 1915 the Public Trustee Office was removed from Clement's Inn to new Government buildings in Kingsway, Sardinia Street, and Lincoln's Inn Fields, but the continued growth of the work and staff made it necessary to invade the adjoining buildings, Queen's House and Victory House.

The progress made during and after the war is indicated by the following table:—

Cases Accepted		Value	Fees	Expenses
1914–15 . .	1,543	£11,624,000	£65,390	£61,632
1915–16 . .	1,595	16,622,000	74,762	72,171
1916–17 . .	1,811	16,544,000	95,238	98,330
1917–18 . .	1,876	17,862,000	107,139	130,457
1918–19 . .	1,767	17,192,000	119,619	175,581
1919–20 . .	1,950	21,864,000	148,756	241,787
1920–21 . .	1,559	15,682,492	283,499	398,389
Total since Oct. 1 1907 .	18,030	166,164,701	1,074,109	1,345,652

Two facts stand out conspicuously from this record. The first is the large business annually brought to the Department by a "voluntary" public and the very large number and value of the estates under the Public Trustee's care. The second is that whereas the Department was apparently self-supporting from 1907 to 1916, after 1916 the fees earned under the Public Trustee Act were insufficient by an increasing margin to cover the cost of the work done under that Act. The explanation in a nutshell is that the scale of fees which was in force until April 1920 was nicely calculated to cover (without a profit) the cost of staffing, housing and working the Department under the conditions which existed before the war, with a non-pensionable staff of young men who were content to look to the future of a rapidly growing office, rather than to the immediate present, for adequate pay. Such a scale of fees was bound to prove too low when the Department had to pay (in part) the salaries of an absent staff as well as those of their temporary substitutes, to make provision for pensions, to meet the charges for larger and more expensive buildings, completely to reorganize its *personnel* after the war on an entirely new basis of salary values, and finally to conform with the new and much more generous treatment of Civil Servants in the matter of base salaries and "cost-of-living" bonus which followed the institution of Whitley Councils in the public service.

On the retirement of Sir Charles Stewart the Lord Chancellor appointed in April 1919 a strong Committee, with Sir George Murray, G.C.B., as chairman, to review the whole position of the Department and to report upon questions of staffing, pay, policy, decentralization and fees, and it did so in Nov. 1919. With one dissentient the Committee approved the general lines on which the office had hitherto been conducted and recommended as a basic policy that "trust estates should, while retaining the service of outside agencies, secure the further advantages afforded by a Public Department having at its disposal within its own walls independent experts capable of criticizing and possibly correcting or supplementing the advice received through the ordinary channels available to the private trustee." The Committee recommended the modification and strengthening of the internal organization in certain respects, and in order to restore the financial equilibrium, upset by the war, suggested a new scale of fees calculated to increase the income of the Department by about £120,000 a year. With regard to branch offices, the Committee recognized the successful and economical management of the Manchester office and approved the principle of decentralization, but hesitated to recommend further experiments in this direction "until the possible deterrent effect of the increased fees on new business has been ascertained." Mr. S. Garrett in his Minority Report advocated a restricted service and somewhat lower charges, and doubted whether "business would be obtained in the provinces at the fees proposed by the Majority Report." The Majority Report was accepted by the Lord Chancellor, and the new scale of fees became operative on April 1 1920.

The increase of fees was still too recent in 1921 for its effects to be accurately measured, and the calculations upon which it was framed had already been to some extent upset by unforeseen circumstances. It remained to be seen whether Civil Service conditions strictly applied to a Department which, like the postal, telegraph and telephone services, was essentially a business undertaking, but unlike them was not a monopoly, were compatible with commercial success in a field open to competition. The competitors of the Public Trustee are (*a*) banks, insurance companies and other corporate trustees, and (*b*) solicitors, who are the active managers of thousands of trusts and estates nominally administered by others. If the Public Trustee's charges were to rise beyond a certain level his services would not be sought, and his competitors, who as employers are entirely untrammelled, would be greatly stimulated and assisted. In 1921 there was as yet no indication that this level had been reached, and those who resorted to the Department had at any rate the satisfaction of knowing that the Public Trustee's fees, if and when they showed a commercial profit, would be reduced.

On the administrative side the Public Trustee Office may be regarded as an established success and an institution of great public utility in protecting beneficiaries against the loss of trust funds through incompetence and dishonesty. Its work has been brought up to a high standard of efficiency, and the system of organization under which every trust is administered by an individual trust officer, who is personally responsible for its proper conduct, disarms the criticism that the functions of a private trustee cannot be performed by a department of the State. Another fear, viz. that the aggregation of a vast body of investments under the control of a single official might be a public danger, has found no justification in experience. Although the Public Trustee is responsible for investments of one kind and another (apart from "enemy" property) of a nominal value exceeding (in 1921) £143,000,000, they are in fact so multitudinous in character, represented by so many separate earmarked holdings, governed by so many different trust instruments, and in so many cases controlled jointly by co-trustees, that it would be impossible to deal with them *en masse*. As a further safeguard the Public Trustee, from 1914 onwards, has enjoyed the advantage of the counsel of an Investment Advisory Committee composed of representatives of finance in the City of London; in 1921 it consisted of the Rt. Hon. Frederick Huth Jackson, Mr. R. Martin-Holland, C.B., Sir R. M. Kindersley, G.B.E., and Mr. J. A. Mullens, Junr. This Committee meets monthly to review and discuss with the Public Trustee all investments and sales for reinvestment made by him.

Public Trustee in Other Countries.—The first country to possess a Public Trustee was New Zealand (1872), and the Public Trustee of New Zealand had in 1921 offices at Auckland, Christchurch, Dunedin and Wellington. In Australia there are Public Trustees at Sydney (N.S.W.), Adelaide (S.A.), and Hobart (Tasmania), and Public Curators (with similar functions) at Melbourne (Victoria), and Brisbane (Queensland). In Canada there is a Public Trustee at Toronto. In India and Burma there are Administrators-General and Official Trustees (offices at Allahabad, Bombay, Calcutta, Madras and Rangoon) who have some of the functions of the Public Trustee in England. Ireland has a Public Trustee (at Dublin), who receives only purchase moneys paid under the Irish Land Acts.

PUCCINI, GIACOMO (1858–), Italian composer (*see* 22.632). His recent works include *La Fanciulla del West* (*The Girl of the Golden West*, 1910); *Le Rondine* (1916); *Il Tabarro*, *Suor Angelica*, and *Gianni Schicchi* (1918).

PULITZER, JOSEPH (1847–1911), American editor and newspaper proprietor, was born in Budapest, Hungary, April 10 1847. He came to America in 1864, entered the Union Army, and served to the end of the Civil War. In 1868 he became a reporter on the *Westliche Post*, a German newspaper in St. Louis, and in 1871 managing editor and part owner. In 1869 he was elected to the Missouri House of Representatives; in 1872 was a delegate to the Liberal Republican National Convention which nominated Horace Greeley for president; and in 1874 was a member of the Missouri Constitutional Convention. In 1876–7, during the Hayes-Tilden controversy, he was in Washington, D.C., as correspondent for the New York *Sun*. In 1878 he purchased the St. Louis *Evening Dispatch* and *Evening Post*, combining them as *Post-Dispatch*. In 1880 he was a delegate to the National Democratic Convention. In 1883 he bought from Jay Gould the New York *World* (*see* 19.569), which fearlessly attacked political corruption. In 1884 he was elected Democratic member of Congress from the state of New York, but resigned after serving a few months. In 1896 he allied himself with the "Gold" Democrats and opposed the nomination of William Jennings Bryan. During his later years he was blind and spent much of his time cruising about the world in his yacht, but to the end continued to direct his New York paper. He died on board his yacht in Charleston harbour, S.C., Oct. 29 1911. Interested in improving the profession of journalism, he worked out a plan for establishing a school for training journalists. In 1903 he set aside $1,000,000 for establishing a school of journalism at Columbia University. His own idea as to the object of such a school is set forth in an article, "The College of Journalism," contributed to the *North American Review* for May 1904. In Sept. 1912 the School of Journalism of Columbia was opened. He left $500,000 each to the New York Philharmonic Society and the Metropolitan Museum of Art.

His son, RALPH PULITZER (b. 1879), succeeded him in control of his newspaper properties. He married (1905) Miss Frederica Vanderbilt Webb of New York City.

PUTNIK, RADOMIR (1847–1917), Serbian general, was born on Jan. 25 1847 at Kraguyevats. Like many other prominent figures in the life of his country, he came of a family which had emigrated to the Banat during the Turkish conquest and returned to Serbia after the expulsion of the Turks. Passing through the artillery school (which afterwards became the Serbian military academy), he obtained his commission in a line regiment. In 1876 he commanded a brigade in the war against Turkey, and when war was renewed in 1877 became chief-of-staff of the Shumaja Division. In the Serbo-Bulgarian War of 1885 he held a similar post in the Danubian Division, and in 1889 was made deputy-chief of the general staff, and taught as professor at the military academy in Belgrade. Like many other brilliant officers, he suffered from the favouritism which Kings Milan and Alexander had introduced into the Serbian army and from the consequent atmosphere of intrigue and personal rivalry. He was placed on the retired list, and it was only after the military revolution which destroyed the Obrenović dynasty in 1903 that he obtained his real opportunity of service. In that autumn he was appointed general and chief of the general staff. In 1906 he succeeded Gen. Gruić as Minister of War, and again held that office in 1912, during the decisive period when the military convention with Bulgaria was being negotiated. On the outbreak of war with Turkey he was made *voivode* or marshal (being the first holder of that title) and commander-in-chief, and was responsible for the rapid success of the Serbian arms at Kumanovo, Prilep and Monastir. It was largely owing to his vigilance and foresight that the treacherous night attack by which the Bulgarians opened the second Balkan War (June 29 1913) was so complete a failure. In the preceding months of suspense he and his staff had worked out a careful plan of action, and when Gen. Savov on July 1 gave his amazing order for the cessation of hostilities, Putnik was able to launch a counter-offensive, which resulted in the long-drawn-out battle of the Bregalnitsa and the final retreat of the Bulgarians. When the World War broke out he was undergoing a cure at an Austrian watering place—a very practical proof that the Serbian High Command was not preparing for an armed conflict. At first placed under arrest, he was released by special order of the Emperor Francis Joseph and conveyed to the Rumanian frontier. His impaired health did not prevent him from resuming the position of Serbian generalissimo and organizing the resistance of the country to invasion; and he inflicted upon the forces of Gen. Potiorek three successive defeats—the battles of the Yadar (Aug. 16–20), of the Drina (Sept. 8–19) and of Rudnik, which ended on Dec. 14 1914 with an Austrian rout and the complete evacuation of Serbia. On the latter occasion Putnik's success was rendered definitive by the genius of Gen. Mišić, the commander of the I. Army. Putnik retained the supreme command during the triple invasion of Serbia by the German, Austro-Hungarian and Bulgarian armies in Nov. 1915, and shared the retreat of the Serbs through Albania. When, however, the exiled Government established itself at Corfu, he and most of his staff were placed on the retired list. He himself withdrew to France. He died on May 17 1917 at Nice.

PUTUMAYO, or ICA (*see* 1.788), one of the larger tributaries of the Upper Amazon, rising in Ecuador in the Cordillera of the Andes, near Pasto, flowing in a S.E. direction and joining the Amazon at a point somewhat S. of lat. 4° S. The middle reaches of the river are also known as the Caquetá, the lower reaches being called the Caquetá or Yadurá. The Putumayo, which gives its name to the whole region through which it flows—a wilderness of tropical forest of which the sovereignty has been long in dispute between the republics of Peru, Ecuador and Colombia—obtained an evil notoriety in 1912 after the publication by the British Government of the Blue Book containing the evidence, collected by Mr. (afterwards Sir Roger) Casement, of the atrocious methods employed in this district by the agents of the Anglo-Peruvian Amazon Rubber Co. in order to force the natives to collect rubber. These crimes, which recalled those of the Congo and covered the whole gamut of hideous atrocity (there were some too horrible to publish even in the Blue Book), were first denounced in *La Felpa* and *La Sancion*, papers published at Iquitos, in 1907, shortly before the Peruvian firm of Arana Brothers—who had exploited this territory since 1896—was merged in the Anglo-Peruvian Co., with its headquarters in London. It was not, however, till 1909 that the attention of the British Government was directed to this matter by the revelations of Mr. Hardenburger, an American traveller, in the British periodical *Truth*. Since certain British subjects, negroes from Barbadoes, were implicated in these charges, Mr. Casement, then British consul-general at Rio de Janeiro, was commissioned in 1910 to proceed to Iquitos and the Putumayo and institute inquiries on the spot.

As a result of the report submitted by him a Select Committee of the House of Commons investigated the matter, and its report was issued on June 9 1913 as a White Paper (148). This analysed the evidence with great care, and, as the result, decided that Señor Julio C. Arana (who had come over to give evidence), together with other partners of the firm, was responsible for the atrocities committed by his agents in the Putumayo. The Committee, however, was satisfied that he did not communicate his knowledge of them to the British directors of the company before the *Truth* revelations. These directors were severely censured for culpable negligence in respect of the labour conditions under the company, but it was found that they had not individually laid themselves open to any charge under the Slave Trade Acts. The Committee further reported that existing enactments might be extended so as to cover the gravest offences against the person and against the practices of forced labour which are akin to slavery. A committee, consisting of members of Parliament and others, subsequently met to devise and press forward legislation to this effect; but its labours were interrupted by the outbreak of the World War.

The Putumayo atrocities called attention to the whole system of "loan slavery" and forced labour as practised throughout Latin America. For it was clear that the treatment of the Putumayo Indians was exceptional only in the maddest demonstrations of its inhumanity, and that the slave-driving habit which made it possible was not confined to one region of the continent. The Putumayo region, though vast, is but a small part of the rubber-producing territory of the Amazon; and in all there was evidence that similar conditions prevailed to a greater or less degree. The root of the whole evil was the so-called *patrón* or "peonage" system—a variety of what used to be called in England the "truck system"—by which the employee, forced to buy all his supplies at the employer's store, is kept hopelessly in debt, while by law he is unable to leave his employment until his debt is paid. Not only natives but many foreigners—including British immigrants—have been caught by this system. The *peon* is thus, as often as not, a *de facto* slave; and since in the remoter regions of the vast continent there is no effective government, he is wholly at the mercy of his master. His main safeguard against the worst forms of cruelty is his commercial value; for labour is scarce and, as was said to the present writer by a planter from the Beni in Bolivia, "You do not kill a man who is worth £80."

This safeguard has, however, in effect, proved insufficient; for the rubber-gatherers have been more concerned to make rapid fortunes than to look to the future. One result has been a hideous wastage of labour. In 1906 the Indian population of the Putumayo was estimated to number 50,000; five years later Mr. Casement put it at 10,000 at most; while a writer in the *South American Supplement* of *The Times* (Feb. 25 1913) spoke of the labour difficulty in the Brazilian rubber districts, due to "the dying-out of the native races from disease and bullets."

That the same process of extermination was proceeding in other districts is shown by a pastoral letter "on the amelioration of the actual condition of our Indians," issued on March 14 1913 by Dr. Manuel Polit, Bishop of Cuenca in Ecuador:—

"Our Ecuadorian Oriente has nevertheless not been free from the man-hunts (*corrias*) and outrages of these inhuman traffickers, rubber-gatherers (*caucheros*) and others, who, ascending unhindered our navigable rivers, have despoiled of their poor possessions and of their liberty hundreds of savage Indians, torturing and killing those who resist. And if formerly the action of our missionaries, supported by the Government, was able to prevent or to remedy a great part of these evils, nowadays, when the missionary has been expelled, the hunters of men can operate unchecked; and the banks of the Napo, Aguarico and Curaray, of the Pastaza, Morona and Santiago, have more than once presented scenes similar to those enacted on the Putumayo."

Similar evidence is given in the reports of Padre Estanislao de Las-Corts, Apostolic Prefect of the Caquetá and founder of the Colombian settlement of Puerto Asis on the upper Putumayo, who speaks of "the arms of the devil for dragging the poor Indians down to hell, some with the title of *corregidor*, others calling themselves doctors, and all in league with the *caucheros*, who style themselves *patrónes*."

In addition to the martyrdom and partial extermination of the Amazon Indians, this savage exploitation of the wealth of the Amazon forests has produced another result—the rapid destruction of the wild rubber trees, tapped by unscientific methods, never replaced, and of late years deliberately destroyed by the Indians as the source of all their woes. Many solutions of the problem have been suggested, of which the most notable is perhaps the proposal of an international control of the whole rubber-producing region by a commission representing the Amazon States, and scientific exploitation of these regions by means of imported Chinese and Japanese labour. There are already Japanese colonies on the upper Amazon, and both Chinese and Japanese mix and intermarry freely with the more civilized native "Indians," whose ultimate affinity with the Mongol race is at least highly probable.

The Putumayo revelations led to movements for reform in Latin America itself. Apart from the devoted work of Capuchin Friars, Marist Fathers and Franciscan Sisters in the Colombian districts of the upper Amazon, by the Salesian Fathers in the recently established diocese of Cuenca in Ecuador, by the community of the "Discalced" Franciscans of Lima in Peru, or by the Franciscan missions of Guarayos in Bolivia,[1] lay effort has not been wanting. In Peru the Sociedad Pro-Indigena of Lima took up the cause of the natives with great zeal, and the Colombian and Bolivian Governments both passed remedial legislation. But the Colombian reforms were necessarily limited in scope—and, indeed, till the international boundaries are fixed all effective reform is impossible—while the Bolivian decree of Nov. 25 1913 regulating "loan slavery" remained a dead letter in a country whose vast distances made any effective supervision impossible. To provide that "all contracts between master and man shall be registered at the nearest police office" is not much use in a country where the police offices are scattered hundreds of miles apart, and "where a journey of 200 m. by launch is a serious undertaking, and much more so when runners and canoes are alone available."

AUTHORITIES.—Hardenburger, *The Putumayo;* G. Sidney Paternoster, *The Lords of the Devil's Paradise* (1913); N. Thompson, *The Putumayo Red Book* (1913), inspired partly by desire to vindicate the Colombian claims to the Putumayo region; Joseph F. Woodroffe, *The Upper Reaches of the Amazon* (1914), the outcome of eight years of personal experience; J. F. Woodroffe and H. H. Smith, *The Rubber Industry of the Amazon* (1915). Several valuable articles on the Amazon rubber industry, the peonage system, etc., were published in *The Times South American Supplement* during 1913 (see index, in the issue of Jan. 27 1914). (W. A. P.)

PYLE, HOWARD (1853–1911), American artist and writer (*see* 22.679), died in Florence, Italy, Nov. 9 1911.

PYROMETRY (*see* 22.693).—The term "pyrometer" is now applied to any device intended to measure temperatures beyond the upper limit of the mercury thermometer. The success of many metallurgical and other operations carried out in furnaces often depends upon correct regulation of temperature, and for this reason pyrometers are extensively used to control processes conducted at high temperatures. A number of different types of pyrometer are in use, each having its special advantages; and the choice of instrument depends upon the nature of the operation. In order that pyrometers of every pattern may agree in their readings, each is calibrated by reference to a number of fixed points, determined by the gas thermometer. The National Physical Laboratory scale is used in Great Britain, and represents the melting-points or boiling-points of a number of pure materials, chosen so as to be separated by convenient intervals of temperature. Suitable points for graduating pyrometers are the melting-points of zinc (419·4° C.), antimony (630°), common salt (801°), silver (961°), copper (1083°), nickel (1452°) and palladium (1549°). Above 1550° C. direct comparison with the gas scale is not possible at present, and instruments designed to read higher temperatures than this are calibrated by reference to the laws of radiation. The features of the different types may conveniently be considered in separate categories.

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[1] The work of these missions, actively supported by the Government at La Paz, has produced astonishing results. At Urabicha, a "model town," for instance, silverware and jewelry are made, and there are workshops for cutting and polishing ebony to be used in making fine furniture. At Yotau expensive machinery for crushing and refining sugar has been installed. At Ascension carpentry is taught on a large scale. The "Discalced" Franciscans of Lima conduct a flourishing school of agriculture. The Capuchins of Colombia, turned sappers and engineers, constructed a wonderful mule-road over the Andes from Pasto to Mocoa. These and other instances of effective zeal are, however, it must be confessed, exceptions which only serve to heighten by contrast the effect of the inertia of the Church in Latin America.

Thermo-electric Pyrometers.—These depend upon the electromotive force developed when a junction of two dissimilar metals is heated. The couple used should show a steady increase in E.M.F. with rise in temperature, and should not be destroyed or show an alteration in E.M.F. on prolonged heating. These conditions are best fulfilled by couples made of the platinum series of metals, but owing to the high cost of these, "base" metal couples are now largely used, which can be renewed when necessary at a trifling expense. The upper limit of temperature at which a thermocouple may be used must be some degrees below the point at which destruction or change in E.M.F. would commence. Thermocouples in common use are platinum and rhodio platinum (10 % Rh), which may be used to 1400° C. and generates an E.M.F. of 1·1 millivolts per 100° C.; iron and constantan, upper limit 900° C., E.M.F. 6·7 millivolts per 100° C.; and two different nickel-chromium alloys (Hoskin's alloys), upper limit 1100° C., E.M.F. 7·4 millivolts per 100° C. Various other couples are also used. It will be noted that the base-metal couples develop a much higher E.M.F. than those made from the platinum group. Most couples require protection from furnace gases, which would cause corrosion, and are provided with shields of silica, porcelain, fireclay, or other refractory material, which should be non-porous.

The indicator used with a thermocouple is usually a millivoltmeter, the range of which is determined by the couple used, and the temperature to be measured. The deflections shown when the couple is subjected to the standard temperatures enable the scale to be marked so as to read temperatures directly. Due allowance must be made for the temperature of the other junctions in the circuit, as the deflection, in general, depends upon the excess temperature of the heated junction over the "cold" junction or junctions. Errors in this direction may be avoided by (1) locating the cold junctions in oil in a thermos flask, so as to maintain a constant temperature; (2) by water-cooling the cold junctions; (3) by the use of compensating junctions (Peake and others); or (4) by compensated indicators (Bristol, Paul, Darling and others). For measuring special ranges—such as 500° to 1000°—an opposing E.M.F. from an external source is applied to the indicator, so that deflection does not commence until the junction has attained 500°. Instead of a millivoltmeter, the indicator may take the form of a potentiometer, in which the E.M.F. due to the junction is balanced against a known difference of potential (Northrup, Brown, Rosenhain and others), with the advantages that a delicate galvanometer may be used, and that the indications are independent of the resistance of the leads.

Continuous records of temperature may be obtained by photographic means (Roberts-Austen), a mirror galvanometer being used as indicator, and the spot of light directed on a sensitized paper moving at a known rate. Records in ink are obtained by depressing the pointer of the indicator at regular intervals, and causing it to make a dot in ink on a chart moving at a known rate, thus recording the deflection at any moment. In the "Thread" recorder (Cambridge and Paul Instrument Co.) an inked thread is pressed onto the chart; in Siemens' and Paul's recorders an inked ribbon is made to touch the paper; in Foster's recorder a special pen, at the end of the pointer, makes the dot. Recorders may be actuated by clockwork or electric motors.

The present practice is to employ thermo-electric pyrometers for all ordinary work up to 1100 or 1200° C., when an accuracy of 5 or 10° suffices. This range embraces the temperatures involved in the heat treatment of ordinary steel and other metals and alloys.

Resistance Pyrometers.—These instruments were introduced by Siemens in 1871, and are still in use. The principal utilized is the increase in resistance to electricity shown by elementary metals when heated, which, in the case of platinum, has been proved by Callendar to bear a definite relation to the rise in temperature. The working part consists of a coil of platinum wire, suitably shielded from furnace gases, and connected by platinum leads to one arm of a Wheatstone bridge, or to one branch of a differential galvanometer circuit. Compensation for the leads is effected by dividing the bridge at one end of the coil, so that the leads are in opposing arms (Siemens), or by dummy leads connected to the opposing arm of the bridge (Callendar). The reading consists in adjusting the bridge until a balance is obtained, when the resistance of the coil may be read, and the corresponding temperature deduced. For industrial use, indicators are provided in which the temperature is indicated on a dial when the bridge is adjusted to balance, so as to avoid calculation (Whipple, Siemens). Paul's indicator is a special form of ohmmeter, which requires no adjustment, and gives direct readings of temperature. Callendar's recorder is an automatic Wheatstone bridge, controlled by the galvanometer, a pen moving over the bridge wire giving an inked record. The Leeds-Northrup recorder achieves the same end by automatically balancing the pyrometer resistance against an opposing resistance in a differential galvanometer circuit. The resistance pyrometer is not now greatly used for industrial purposes, and is not suited for continuous use above 1000° C., owing to an alteration in its indications due to the vapourizing of the platinum (Crookes). It is more costly and difficult to use than a thermo-electric pyrometer, but is capable of giving closer readings under steady conditions.

Total-Radiation Pyrometers.—The energy radiated by a "black body" or full radiator is proportional to the fourth power of the absolute temperature, and if the energy be measured the temperature can be deduced from the above relation. An enclosure at a constant temperature, such as a furnace, gives black-body radiations, and enables the laws of radiation to be applied to measuring temperatures without serious error. In most existing forms of total-radiation pyrometers, the rays from the heated enclosure are directed on to a blackened thermal junction, the temperature of which is raised in the proportion of the energy received. A galvanometer in circuit with the junction serves to indicate, by its deflections, the relative amounts of energy absorbed by the junction, and its scale may therefore be marked to read temperatures directly by applying the fourth-power law.

In the form due to Féry, the rays are focussed by means of a concave mirror on to a small metal disc to which the junction is attached, a different focus being required for different distances from the furnace. In Foster's fixed-focus instrument a concave mirror is placed at the closed end of a narrow tube, the radiations being admitted through a diaphragm at the open end, and reflected on to a thermocouple. So long as the lines joining the extremities of the mirror with the edges of the diaphragm fall, if produced, within the heated source, the reading will be the same at any distance. In the form due to Thuring, and made by Paul, the rays are made to enter a polished cone, at the apex of which a thermal junction is placed. Various other modifications have been used by different makers. Records may be taken by attaching the junction to any form of thermo-electric recorder, and employing a chart divided in terms of the fourth-power law.

Radiation pyrometers are used for temperatures ranging from 800° to 2000° C., and are particularly valuable under circumstances which preclude the introduction of an instrument into the furnace, as in the case of rotary cement kilns.

Optical Pyrometers.—In the most reliable of these instruments the brightness of the red rays from the heated source is matched against a standard, and calibration effected by applying Wien's laws for the distribution of energy in the spectrum. The red rays from standard and source are obtained either by spectroscopic means, or by viewing through monochromatic red glass. In Wanner's pyrometer, and the Cambridge optical pyrometer, a polarizing device is used for matching the colours, the position of the analyser being made to indicate the temperature. In the Holborn-Kurlbaum type, made by Siemens, the filament of an electric lamp is placed in the focal plane of a telescope, and the image of the heated object brought into the same plane. The adjustment consists in increasing or decreasing the brightness of the lamp by means of a rheostat in its circuit, until the filament disappears into the background, the current taken by the lamp being then read and the temperature deduced from a law connecting this current with temperature. In Féry's optical pyrometer equality of tint of standard and source is obtained by means of absorbing wedges of glass which slide over each other. In all these cases experience is needed to secure an exact match. Optical pyrometers of the "extinction" type depend upon the complete absorption of the rays from the heated object, which may be effected by lowering a wedge of dark glass in front of the image as received in a telescope, as in the "Wedge" pyrometer, or by using a layer of densely coloured liquid, the depth of which may be adjusted, as in Heathcote's pyrometer. The temperature calibration in both these cases is obtained by taking readings at standard temperatures, and marking the instruments accordingly.

No satisfactory recording apparatus for optical pyrometers has yet been devised. Their chief advantages are the indefinitely high range—from 800° C. upwards—and the possibility of obtaining readings from a considerable distance, and under conditions which would make it difficult to use any other type of pyrometer.

Miscellaneous Devices.—Amongst these may be mentioned: (1) Fusion pyrometers, which consist of pieces of materials of progressive melting-points, which are placed in the furnace, the temperature of which is represented by the melting-point of the highest in the series that undergoes fusion (Seger cones, Sentinel and Watkin's pyrometers); (2) Calorimetric or Water pyrometers, in which a piece of hot metal taken from the furnace is dropped into a known quantity of water, and the temperature deduced from the extent to which the water is heated; (3) Expansion pyrometers, based on the linear expansion of solids; and (4) the Clay-Contraction pyrometer of Wedgwood. All these methods are at best approximate, and are not employed to the same extent as formerly, when accurate instruments were not available.

REFERENCES.—*Measurement of High Temperatures*, Burgess and Le Chatelier (contains bibliography). Transactions of the Faraday Society, vol. xiii., Part 3; discussion on *Pyrometers and Pyrometry*, with bibliography by Sir Robert Hadfield. *Pyrometry*, Darling (deals with industrial uses). Also accounts of research in pyrometry in the publications of the National Physical Laboratory, the U.S. Bureau of Standards, and the Reichsanstalt (C. R. D.)

QUARITCH, BERNARD ALFRED (1871–1913), British bibliophile, son of Bernard Quaritch, the famous book-collector (*see* 22.711), was born Jan. 13 1871. He was educated at Charterhouse, and afterwards went to Leipzig and France. He joined his father's business in 1889, becoming its head in 1899. He played a very important part in the development of the firm, and purchased many rarities. He paid several visits to America, exhibiting there a large number of valuable books and MSS., and was a prominent purchaser at the Hoe sale (1911). He died at Brighton Aug. 27 1913.

QUEBEC (*see* 22.724*).—Through the addition of Ungava in 1912 the area of the Canadian province of Quebec was doubled, and it became the largest in the Dominion. From 227,500 sq. m. in 1891 it had increased to 351,873 sq. m., which with the addition of 354,961 sq. m. of Ungava (known as New Quebec) gives a total area of 706,834 sq. m. (about one-fifth of Canada), of which 690,865 sq. m. are land and 15,960 sq. m. water.

The pop. was 2,003,232 in 1911. It was estimated in 1921 at 2,350,000. About 98% are Canadian-born, and of these over 80% are of French descent.

The number of Indians in the province (including Ungava) was 13,366. The principal tribes are: Iroquois at Caughnawaga, Lake of Two Mountains, and St. Regis (the Indians of Lorette are also of Iroquoian stock); the Montagnais, who are of Algonquin stock, at Persimis, Mingan, Lake St. John, and Seven Is.; the Abenakis, also of Algonquin stock, at Becancour and St. Francis; the Micmacs, of Algonquin stock, at Maria and Restigouche; and the Malecites, Algonquin, at Viger.

Quebec, the capital of the province, had in 1917 a pop. of 103,000. Montreal (pop. in 1917, 700,000) is the largest city in Canada.

Hull (pop. 28,392), just across the Ottawa river from Ottawa, is a lumber centre with a rapidly growing population. Three bridges connect it with Ottawa. The water-power of the Chaudière Falls furnishes power for electric railways and for the lighting system as well as for saw mills, pulp and paper mills and match factories.

Sherbrooke (pop. 22,583) is a close rival of Hull in industrial importance. It is located in the Eastern Townships, and its cotton and woollen factories and machine shops are amongst the largest in Canada. St. Hyacinthe (pop. 16,540) and Valleyfield have also large manufacturing establishments. Three Rivers (pop. 25,000) and Sorel have large shipping interests.

The Government of the province consists of a lieutenant-governor, a Legislative Council of 24 members appointed by the lieutenant-governor in council, a Legislative Assembly of 81 members elected by the people, and an Executive Council of 11 members chosen from the Legislative Assembly and the Legislative Council. The province is represented in the Dominion Parliament by 65 members in the House of Commons, and 24 senators. Either French or English may be used in addressing either House of Parliament, but French is the language largely used. The Civil law is the old French code existing prior to the conquest in 1760. The Criminal law is the same as exists throughout the Dominion.

Education.—Very difficult problems presented themselves to the statesmen of Canada in connexion with education in the province of Quebec, for not only are 85% of the population Roman Catholics but 80% speak French as their mother tongue; and had it not been for the wise provision made as a condition precedent to confederation the Protestant minority of 15% would have found themselves in a very uncomfortable position. The superintendent of education for the whole province, who is a non-political officer, is assisted by a council divided into a Roman Catholic and Protestant committee, each with a secretary who is the chief administrative officer for both classes of schools respectively. These committees meet separately as a rule, though they may, and occasionally do, meet together as a council. Each committee supervises the expenditure of the proportion of public money allotted to it, and each has its own normal school, appoints its own teachers and exercises control by inspectors over its own schools under the general law. The legislative grant for higher education is divided according to population, the Protestants receiving one-seventh; of the grant for normal schools the Protestants receive one-third, and the elementary school branch is divided according to population. This is supplemented by a local municipal taxation through trustees. In 1918 there were 6,103 elementary schools, with a teaching staff of 8,189 and a total enrolment of 247,531; the expenditure on education was $14,481,494.

A leading feature of the educational system is that all the public schools are denominational. Instruction in religion and morals given in Protestant schools is based on reading from the Old Testament, the Gospels and the Acts, and the children commit to memory portions of the Gospels and Psalms, together with the Apostles' Creed, the Decalogue and the Lord's Prayer. The religious instruction in the Roman Catholic schools is substantially part of the educational system, the Roman Catholic schools being controlled by the clergy, the episcopate forming, *ex officio*, one-half of the Catholic section of the council.

The chief universities are McGill at Montreal, founded in 1820; Laval (R.C.), founded in 1852, the headquarters being in the city of Quebec; and the newly founded university of Montreal, which was formerly the Montreal branch of Laval. McGill University stands very high academically, and has an especially well-equipped department of applied science. Laval has a professorial staff of 79, the university of Montreal 525, and McGill 322. The total numbers of students were in 1918 686, 5,460 and 2,444 respectively. Bishop's College, Lennoxville, is a small Anglican university in connexion with which is a school on the lines of an English public school. To McGill is affiliated the well-equipped agricultural college established at Ste. Anne de Bellevue by Sir William Macdonald, who is also noted for his liberal endowment of McGill University; and to Laval an agricultural school at Oka founded by the Trappist Fathers. There are numerous model and normal schools, the most important being that of Ste. Anne de Bellevue in connexion with Macdonald College.

Agriculture.—In recent years great progress has been made in agriculture, especially in dairying and live stock. The products of the soil are abundant, and large quantities of hay and oats are exported from Montreal and the city of Quebec; live stock, bacon, beef, eggs, butter, and especially cheese, to the value of millions of dollars yearly, are also shipped abroad. The field crops reach an annual value of $271,600,000. Apples, plums and melons are produced in large quantities, together with many varieties of small fruits. Nearly $7,000,000 is realized annually from the maple trees in sugar and syrup. In 1920 there were 813 butter and cheese factories in operation. More than 92,000,000 lb. of butter and cheese, worth over $35,000,000, are produced each year. Fully two-thirds of the tobacco grown in the Dominion comes from Quebec. The live stock of the province was in 1920 valued at more than $205,000,000, and the total annual value of the field crops, principally hay, oats, barley, and some wheat, at about $305,000,000.

Forests and Lumber.—Quebec, though second to Ontario in the production of lumber, exceeds it in the value of its pulp and paper products. Of the enormous forest area but a small portion has been cut over, and since Quebec has been a pioneer in scientific methods of forest conservation, copying the method of old France, the timber resources promise to be maintained indefinitely. In the N. the predominating trees are pine, spruce, fir, and other coniferous varieties, while farther S. appear maple, poplar, basswood, oak and elm trees and many other hardwoods. The value of the lumber cut in 1918 was $20,916,604, of which spruce formed 66·3% of the output and white pine 13·1, the other commercial varieties in a smaller way being hemlock, balsam fir, birch and cedar. The capital invested in the lumbering industry amounted to $57,201,820.

Fish and Fur.—The value of the annual catch of fish is estimated at $3,000,000, the industry employing more than 3,000 men. Fish hatcheries have been established by the Dominion Government at several places for the purpose of stocking the lakes and rivers of the province. With considerable tidal waters along its coast Quebec may be regarded as one of the Maritime provinces. The principal fish are cod, lobsters, herring, salmon and mackerel. The mainland waters abound in trout, pickerel, whitefish, pike and sturgeon.

The forests, especially in the northern part, abound in game, both fur-bearing and otherwise. Nearly 200,000 sq. m. of territory in

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*** These figures indicate the volume and page number of the previous article.**

Quebec have been set apart by the Legislature for forest reserve and for the preservation of fish and game. Quebec is scarcely surpassed in Canada in its interest for sportsmen. In the Laurentides National Park, a district of 2,640 sq. m. N. of Quebec, caribou, partridge and trout are found in abundance. Bear and moose are also numerous.

Minerals.—Of the economic mineral product, cement alone yields $3,000,000 annually. Molybdenite was mined extensively, during the World War, in the district of Quyon, Pontiac county, this mine becoming the largest producer in the world. Magnesite, found in the vicinity of Grenville, Argenteuil county, was also a valuable war-time mineral. The annual production of minerals in Quebec is valued at about $23,000,000.

Manufactures.—Quebec ranks next to Ontario in the amount and value of its manufactures. There is limitless water-power almost everywhere, and at Shawinigan and Valleyfield power is being developed for commercial purposes. The chief manufactures are sugar, woollen and cotton goods, pulp and paper, tobacco and cigars, furs and hats, machinery, leather goods, boots and shoes, railway cars, rifles, musical instruments, cutlery and gunpowder. The annual value of the manufactured products of the province has reached $920,000,000. The pulp mills in 1918 produced 288,952 tons valued at $12,018,258, and the total product of all mills, paper and pulp, was valued at $19,620,051. Paper of all kinds was manufactured to the extent of $27,546,791, of which $17,500,000 was newsprint. The total capital invested amounted to $24,490,175, and 11,793 persons employed in the industry received $11,546,596 in salaries and wages.

Communications.—The province is well provided with railways. The headquarters of the Canadian Pacific railway is at Montreal, and various lines of this railway connect Montreal with Toronto, Ottawa, Winnipeg, Vancouver, Quebec and St. John. The Canadian National railways connect Montreal with Halifax, passing across the St. Lawrence at the city of Quebec, and the line from Moncton, in New Brunswick, to Prince Rupert, in British Columbia, also crosses the St. Lawrence at the city of Quebec, and proceeds on its way through the northern part of the province. The National lines connect various local points, and by means of the old Grand Trunk system reach important centres in the United States, while there are a number of other railway companies, with lines running in various directions, especially in the extreme eastern section of the province.

Both Montreal and Quebec are connected by steamship during the summer months with all parts of the world. The St. Lawrence route, which by reason of its shortness is a favourite both for freight and passengers proceeding to Europe, has been rendered perfectly safe for navigation. During the summer season steamers ply on the rivers and inland waters, carrying a great deal of freight and taking care of the tourist trade. (W. L. G.*)

QUEBEC (*see* 22.727), the oldest city in the Dominion of Canada, had a pop. of 78,710 in 1910 and 116,850 in 1920. Quebec had for some years prior to 1911 been displaced by Montreal in the shipping trade, but after 1911 the older port steadily improved its commercial and industrial position. As a manufacturing centre Quebec has profited by the cheap electric power supplied from the Shawinigan and Montmorency Falls. The harbour has been improved, and the largest dry-dock in the world has been built at a cost to the Dominion Government of $7,000,000. Important factors contributing to the increased commercial importance of Quebec were the successful completion of the famous Quebec bridge, and the building of the Grand Trunk Pacific railway from Prince Rupert on the west coast of Canada to Quebec on the east. The distance from Quebec to Winnipeg by this railway is 145 m. shorter than that from Montreal to Winnipeg by any other line. The Quebec bridge, connecting the north and south shores of the St. Lawrence river at Cap Rouge, 9 m. from the centre of the city, was completed in 1917 by the St. Lawrence Bridge Co. for the Dominion Government. This achievement marked the end of more than 10 years of effort, two accidents to portions of the huge structure having delayed the work in 1907 and again in 1917. The Quebec bridge is larger than the Forth bridge in Scotland, which was previously the world's largest bridge. Its total length is 3,239 ft., the cantilever span is 1,800 ft. long and the suspended span 640 ft. long. The weight of the suspended span is 5,510 tons. The completion of the bridge made possible the running of six railways simultaneously into Quebec from the south shore. Quebec has always been a base of supplies for a large region of mines, lumber camps and farms, but has gained further importance in this regard of late years owing to the rapid development of the water supplies of the province for purposes of electric power, particularly for the manufacture of wood pulp. The Lake Saint John district north of the city, a centre for pulp-milling, finds its outlet through Quebec. Buildings erected recently in Quebec include a large Government technical school, the erection and equipment of which cost $150,000.

QUILLER-COUCH, SIR ARTHUR THOMAS (1863–), English man of letters (*see* 22.750), published subsequently to 1910 *The Vigil of Venus and other poems* and an anthology, *The Oxford Book of Victorian Verse* (1912), as well as books *On the Art of Writing* (1916), and *On the Art of Reading* (1920); a memoir of *Arthur John Butler* (1917); a volume of Shakespearean studies in 1918; *Hocken and Hunken, a new Tale of Troy* (1912); and various collections of short stories, including *Hicky-Nan, Reservist* (1915).

RACHMANINOFF, SERGEI VASILIEVICH (1873–), Russian composer and pianist, was born at Onega, in Russia, March 20 1873; his grandfather, an excellent pianist, had been a pupil of the Irish musician John Field. He began his studies under his mother, but at nine he became a pupil of Anna Ornadtskaya. In 1882, however, the Rachmaninoff family removed to St. Petersburg, and Sergei entered the Conservatorium, where he remained till 1885, when, on the family again removing to Moscow, he joined the Conservatorium there, and was on terms of friendship with Scryabin, Siloti, Taneyeff and Arensky. When, in 1892, Rachmaninoff left the Conservatorium, he won the large gold medal for a one-act opera *Aleka* and followed it by many other works. About 1893 he composed a pianoforte suite, another for two pianos, a dozen songs, his first piano concerto, the symphonic picture *The Rock* and the elegiac trio on the death of Tschaikovsky. Next there followed his first symphony, produced by Glazounoff at St. Petersburg. In 1897–8 Rachmaninoff became conductor of Mamoutoff's private opera, a post he resigned after the season, and in 1899 he came to London to conduct a Royal Philharmonic concert. A second piano suite, another concerto and a violoncello sonata were quickly composed, and were followed by the one-act opera *The Miser Knight* (Moscow 1900, Boston 1910) and *Francesca da Rimini* (Moscow, same evening); during 1904–6 he directed the Moscow Opera, and from 1906 to 1908 he lived in Dresden as composer and pianist, visiting Paris in 1907. In 1909–10 he visited the United States for the first time, and then returned to Russia, where he wrote *The Island of Death*, the D minor piano Sonata, and the third and fourth piano concertos (1909 and 1917). In 1912 he produced *The Bells*, which was produced in Liverpool by Sir Henry J. Wood in 1921. Among his other compositions *Spring*, for chorus and orchestra, is particularly noteworthy, and his devotional music includes a wonderful setting of the Liturgy of St. Chrysostom (1910). In 1917 Rachmaninoff left Russia, and in 1918 he settled in New York.

RADIOACTIVITY (*see* 22.793*).—Among points of special interest that have arisen since the earlier article was written may be mentioned the preparation of metallic radium by Mme. Curie and Debierne by electrolysis of a radium salt with a mercury cathode. Radium resembles metallic barium, melts at about 700° C. and is rapidly attacked when exposed to the air.

The atomic weight of radium was found by Mme. Curie to be 226·45, using for the purpose about 0·4 gram of pure radium chloride. A recent careful redetermination by Hönigschmid with about one gram of radium gave a value 225·9 and is probably correct to 1 in 1,000. An International Radium Standard consisting of about 22 milligrams of pure radium chloride has been prepared by Mme. Curie, and is preserved in the Bureau International des Poids et Mesures at Sèvres, near Paris. Secondary radium standards have been issued to all governments who wished to purchase them. These have been calibrated by γ-ray methods both in Vienna and Paris and are supposed to be correct within 1 in 200. During the last few years the purchase and sale of radium have generally been conducted on certificates given in terms of this international standard.

The wide use of radium for therapeutic purposes, and its high cost—from £25 to £30 per milligram element—have led to close search for uranium deposits. The amount of radium in an old mineral is always proportional to its content of uranium in the ratio of 3·3 parts of radium by weight to 10 million parts of uranium. Consequently an old mineral containing 1,000 kgm. of uranium should contain 330 milligrams of pure radium. Initially several grams of radium were separated from the uraninite deposits in Joachimsthal, Bohemia, and some of the material, which was the property of the Austrian Government, was generously loaned to representative workers in radioactivity in England. A part of this radium is in the charge of the Radium Institute of Vienna, which is specially devoted to radioactive investigations. The increasing demand for radium has led to the working of low-grade uranium ores on a large commercial scale. Much of the radium to-day is derived from the mineral carnotite, of which there are extensive deposits in Colorado and other parts of the United States. Although the carnotite contains only a few per cent of uranium and a correspondingly small quantity of radium, the separation of the latter is a profitable industry operating on a large scale. Large quantities of radium were employed by the Allies during the World War for night compasses, gun-sights, etc. The radium is mixed with phosphorescent zinc sulphide to form a paint which becomes continuously luminous, but, owing to the destruction of the zinc sulphide by the rays, this luminosity gradually decays.

Radium Emanation.—The atomic weight of the radium emanation is now known to be $226-4=222$, as was inferred earlier. This was confirmed by direct weighing with micro-balance by Ramsay and Gray.

The radium emanation has proved of great service not only in radioactive researches but also in therapeutic work. The radium salt is dissolved in an acid solution and the emanation is pumped off with the large quantity of hydrogen and oxygen liberated by the action of the radiations on water. After sparking the mixture, the emanation can be purified by condensation with liquid air. A very intense source of β and γ radiation can be obtained by introducing the purified emanation into fine capillary tubes. Such emanation needles have been widely used for therapeutic purposes, while the use of very thin-walled tubes provides a powerful line source of α rays. The β and γ activity of such tubes rises to a maximum about four hours after introduction of the emanation and then decays with the period of the emanation, viz. 3·85 days. The quantity of emanation liberated from one gram of radium is called a *curie* and from one milligram a *millicurie*. The quantity of radium emanation in a tube can be accurately determined by comparison of its γ-ray activity with that of a radium standard, since the penetrating γ rays, both from the radium and the emanation in equilibrium, arise mainly from the same product radium C.

As regards other radioactive substances large quantities of mesothorium have been obtained as a by-product in the separation of thorium from monazite sands. This substance, which is half transformed in about 6·7 years, emits only β rays, but gives rise to radiothorium and subsequent products which emit α rays and penetrating β and γ rays. As a source of powerful β and γ radiation, this substance is very analogous to radium and can be obtained in about the same concentration. Since radium and mesothorium are isotopic elements, they are always separated together. Most commercial sources of thorium contain also uranium and radium, and consequently radium is always separated with the mesothorium and in relative amount depending upon the proportion of uranium to thorium in the mineral. Since mesothorium has a radioactive life short compared with radium, it commands a smaller price. The amount of mesothorium is standardized by comparison of its γ-ray effect with a radium standard.

Mme. Curie separated the polonium from several tons of pitchblende and obtained an exceedingly active preparation of a few milligrams, but was unable to obtain it in a pure state, although several of its spectrum lines were detected. It was hoped by this experiment to decide whether polonium was transformed directly into lead, but this was found difficult to establish owing to the presence of impurities with the very small quantity of polonium.

The three types of radiation, known as the α, β, γ rays, emitted by radioactive substances are analogous in many respects to the types of radiation observed when a discharge passes through a vacuum tube, but are of much more penetrating character. It may be noted here that for the electrons in a vacuum tube to obtain the velocity of the swift β rays from radium, a potential difference of at least two million volts would have to be applied. The very penetrating γ rays are identical in all respects with X rays of very short wave-length. Intense γ rays are only observed in substances which emit swift β particles, and apparently owe their origin to the passage of the swift β particle through the distribution of electrons surrounding the atomic nucleus. To produce X rays as penetrating as the γ rays, about two million volts would have to be cut on the discharge tube.

The α rays, shown in 1903 by Rutherford to consist of a stream of positively charged atoms projected with high velocity, are now known to consist of charged atoms of helium which are projected with velocities of about 10,000 m. per second. While the majority of products break up with the expulsion either of an α particle or a swift β particle, in a few cases no detectable radiation has been observed. Such products were at first called "rayless" products, but the sequence of

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**** These figures indicate the volume and page number of the previous article.***

chemical properties, discussed later, shows that a β particle must be liberated but at too low a speed to detect with certainty. Actinium and mesothorium are examples of such products.

A number of new products have been discovered, particularly in the uranium and actinium series. The results are included in the appended table of radioactive elements.

TABLE OF RADIOACTIVE ELEMENTS

Element	Atomic Weight	Atomic Number	T	Rays	Range cms. α rays (15° and 760 mm.)
Uranium-Radium Series.					
Uranium I.	238·18	92	4·5 × 10^9 yrs.	α	2·50
Uranium X_1	234	90	23·8 days	β, γ	—
Uranium X_2	234	91	1·15 min.	β, γ	—
Uranium II.	234	92	about 2 × 10^6 yrs.	α	2·90
Uranium Y (3 per cent)	230	90	24·6 hrs.	β	—
Ionium	230	90	about 9 × 10^4 yrs.	α	3·07
Radium	226	88	1700 yrs.	α	3·52
Radium Emanation	222	86	3·85 days	α	4·16
Radium A	218	84	3·05 min.	α	4·75
Radium B	214	82	26·8 min.	β, γ	—
Radium C	214	83	19·5 min.	α, β, γ	6·94
Radium D	210	82	16 yrs.	β, γ	—
Radium E	210	83	4·85 days	β, γ	—
Radium F (Polonium)	210	84	136·5 days	α	3·83
Radium G (end-product uranium-lead)	206	82	—	—	—
Thorium Series.					
Thorium	232·1	90	2·2 × 10^{10} yrs.	α	2·72
Mesothorium 1	228	88	6·7 yrs.	β, γ	—
Mesothorium 2	228	89	6·2 hrs.	β, γ	—
Radiothorium	228	90	1·90 yrs.	α	3·87
Thorium X	224	88	3·64 days	α	4·30
Thorium Emanation	220	86	54 secs.	α	5·00
Thorium A	216	84	0·14 sec.	α	5·70
Thorium B	212	82	10·6 hrs.	β, γ	—
Thorium C	212	83	60 min.	α	4·80 8·60
Thorium D	208	81	3·2 min.	β, γ	—
Thorium E (end-product thorium-lead)	208	82	—	—	—
Actinium Series.					
Protoactinium	230	91	about 10^4 yrs.	α	3·31
Actinium	226	89	20 yrs.	β	—
Radioactinium	226	90	19 days	α	4·6
Actinium X	222	88	11·2 days	α	4·26
Actinium Emanation	218	86	3·9 secs.	α	5·6
Actinium A	214	84	·002 sec.	α	6·3
Actinium B	210	82	36 min.	β, γ	—
Actinium C	210	83	2·16 min.	α	5·15
Actinium D	206	81	4·76 min.	β, γ	—
Actinium E (end-product actinium-lead)	206	82	—	—	—

In the table T is the time-period of a product or the time required for the product to be half transformed. It will be seen that the value of T, which is a measure of the relative stability of atoms, varies between 2·2 × 10^{10} years (Thorium) and ·002 second (Actinium A). The atomic weights and atomic numbers of uranium, radium, uranium-lead, thorium, thorium-lead have been directly determined. The atomic weights and atomic numbers of the others are deduced on the assumption that the expulsion of an α particle (helium atom) of charge 2 and mass 4 lowers the atomic number of the succeeding element by 2 units and the atomic weight by 4. The expulsion of a β particle raises the atomic number by 1 unit, but it is not supposed to influence the atomic weight to a detectable degree.

Branch Products.—In the great majority of cases each of the radioactive elements breaks up in a definite way, giving rise to one α or β particle and to one atom of the new product. Undoubted evidence, however, has been obtained that in a few cases the atoms break up in two or more distinct ways, giving rise to two or more products characterized by different radioactive properties. A branching of the uranium series was early demanded in order to account for the origin of actinium. While the latter is always found in uranium minerals in constant proportion with the uranium, Boltwood showed that the activity of the actinium with its whole series of α-ray products in a uranium mineral was much less than that given by a single α-ray product of the main radium series. The head of the uranium series is believed to be uranium Y, the branch product of the uranium series first observed by Antonoff. The branching is supposed to occur in the product uranium X_1, 4% going into the actinium branch and the other 96% into the main uranium series. The atomic weights of actinium given in the table are calculated on this basis. The recently discovered product, *protoactinium*, is the hitherto missing link between uranium Y and actinium.

The most striking cases of branching occur in the "C" products of radium, thorium and actinium, each of which breaks up in two or more distinct ways. In the case of radium C, a new substance called radium C_2 was obtained by recoil from a nickel plate coated with radium C. This product emitted only β rays and had a period of 1·4 minutes. Fajans estimated that the amount of the product was only 1/3,000 of that of radium C. To account for these results, the following scheme of transformation has been proposed:—

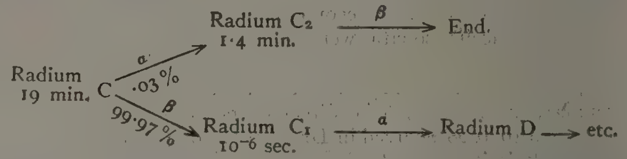

where in the main branch a β particle is first expelled, giving rise to radium C, which emits an α particle. The reverse process is assumed to take place in the other branch. Radium C_1, which emits a swift α particle, is supposed to have an exceedingly short period of transformation. It is uncertain whether the radium C_2 branch ends after the expulsion of a β particle. The resulting product is an isotope of lead like radium D in the main branch.

In the case of thorium C, two sets of α particles are observed, one-third of the total number of range 5·0 cms., and the remainder of range 8·6 centimetres. Recently another set of rays, about 1/10,000 of the total, has been found by Rutherford and Wood to have the great range in air of 11·3 cms. and has been shown to consist of α particles. These results suggest that the thorium C atom breaks up in three distinct ways, each marked by the expulsion of an α particle with characteristic but different velocity. Marsden showed that actinium C emits two sets of α particles, 99·84% of range 5·15 cms. and 16% of range 6·4 cms., indicating a dual transformation of actinium C. It is quite possible that a close examination of radioactive substances may reveal other examples of such complex methods of transformation, for, after the violent explosion that occurs during the breaking-up of an atom, more than one state of temporary equilibrium may be possible for the residual atom.

Relation between Range of α Rays and Period of Transformation.—We have seen that each α-ray product emits α particles of characteristic velocity which have a definite range in air. It was early observed that there appeared to be a connexion between the period of transformation of a product and the velocity of the α particles emitted. The shorter the period of transformation, the swifter is the velocity of expulsion of the α particle. This relation was brought out clearly by the measurements of Geiger and Nuttall, where it was shown that if the logarithm of the range was plotted against the logarithm of λ, the constant of transformation, all the points lay nearly on a straight line. A similar result has been observed for the thorium and actinium products. This relation is at present purely empirical and no doubt only approximate, but it is of great interest as indicating a possible relation between the stability of the radioactive nucleus and the velocity of the expelled helium atom. This relation has proved very useful in forming estimates of the period of transformation of ionium and other substances before the results of more direct determinations were available. From this relation also the change which gives rise to the swift α particle of radium C is believed to be exceedingly rapid, and a similar conclusion is drawn for the products emitting the very swift α particles from thorium C.

Chemistry of the Radioelements.—Apart from uranium and thorium and a few special cases like radium and polonium, the radioactive products of short life exist in too small quantity to examine by the ordinary chemical methods, but, by the use of the radioactive method of analysis, it was possible to form some idea of their chemical behaviour. Certain very interesting points soon came to light. Soddy found that the two elements, radium and mesothorium, although quite dissimilar in radioactive properties, were chemically so identical that it was impossible by chemical methods to separate one from the other. Other cases of this kind had long been suspected, viz. thorium and radiothorium, thorium and ionium, and radium D and lead. He named such inseparable elements isotopes, since they appeared to occupy the same place in the periodic classification of the elements.

Following the chemical study of the radioelements by Soddy, Fleck and von Hevesy, an important generalization connecting the chemical properties of the radioelements was announced independently in 1913 by Russell, Fajans and Soddy. After the expulsion of an α particle from a radioactive substance, the resulting product shifts two places in the direction of diminishing mass when the elements are arranged in families according to the Mendeleef classification.

The expulsion of a β particle causes a shift of one place in the opposite direction. For example, by the loss of an α particle from ionium of group IV., the resulting product, radium, belongs to group II., while the loss of another particle gives rise to the emanation which occupies the group O, and so on. By this method the chemical properties of all the known radioelements can be predicted from a knowledge of the radiations emitted from the products. This generalization can be viewed from another important standpoint. From the work of Moseley, the properties of an element are defined by the atomic number which is believed to represent the resultant positive charge on the nucleus. The loss of an α particle of mass 4, carrying two positive charges, lowers the atomic number by two units, while the emission of a β particle raises it by one unit. On looking through the table of the radioelements given above, it will be seen that many of them can be grouped under the same atomic number. These represent the radioactive isotopes, of which some of the more important are given below, preceded by the atomic numbers:—

81 Thallium (204), thorium D (208), actinium D (206).
82 Lead (207), uranium-lead (206), thorium-lead (208), radium D (210), thorium B (212), radium B (214), actinium B (210).
83 Bismuth (208), radium E (210).
84 Polonium (210), thorium A (216), radium A (218), actinium A (214).
86 Radium emanation (222), thorium emanation (220), actinium emanation (218).
88 Radium (226), thorium X (224), mesothorium (228), actinium X (222).
90 Thorium (232), radiothorium (228), ionium (230), uranium X_1 (234), uranium Y (230), radioactinium (226).

It will be seen that many of the radioactive elements are isotopic with known chemical elements. These radioactive isotopes differ not only in atomic weight but also in radioactive properties. The isotopes of lead are of special interest as they include the end-products of the uranium, thorium and actinium series—a question that will be discussed more fully later. It has been found that the X-ray spectrum of the γ rays from radium B is identical with that given by ordinary lead exposed to cathode rays in a vacuum tube, a result to be anticipated from the identity of their atomic number. It is of interest to note that polonium is a new type of chemical element which has no counterpart among the ordinary inactive elements.

Transformation of Uranium.—In 1900 the late Sir W. Crookes found that the β-ray activity of ordinary uranium could be removed by a single chemical operation and concentrated in an active residue. This is due to the separation of the product uranium X, of period 24 days, which emits β and γ rays. A complete analysis of the transformations of uranium has been a matter of much difficulty. Boltwood showed that the α-ray activity of uranium was about twice as great as that of a corresponding α-ray product in the uranium-radium series, indicating that uranium contained two successive α-ray products. This was confirmed by Geiger, who showed that the α rays from uranium consisted of two groups with ranges 2·5 and 2·9 cms. respectively. These two α-ray substances, called uranium I. and uranium II., are isotopic, with atomic weights 238 and 234 respectively. The latter, whose period is estimated at about 2 million years, exists in relatively very small quantity compared with uranium I. Following the generalization connecting the radiations and chemical properties of the series of radioelements, Fajans predicted the presence of a new product with properties analogous to tantalum, and promptly succeeded in isolating it experimentally. The new product uranium X_2, sometimes called brevium, has a period of 1·15 minutes and emits swift β rays. The series of changes is thus:—

$$\text{Ur. I.} \rightarrow \text{Ur. X}_1 \rightarrow \text{Ur. X}_2 \rightarrow \text{Ur. II.} \rightarrow \text{Ionium.}$$

We have seen that Antonoff discovered another β-ray substance called uranium Y, separated with uranium X_1, which has a period of 24·6 hours. This exists in too small quantity to be in the main line of succession, but is to be regarded as a branch product of uranium X_1 and is believed to be the first element of the subsidiary actinium series.

Rutherford and Geiger found the number of α particles emitted per gram of uranium per second to be $2{\cdot}37 \times 10^4$. From this the period of uranium is calculated to be about 6,000 million years.

Thorium.—The first product observed in thorium was the emanation of period 54 seconds, and this gives rise to the active deposit, which has been shown to consist of at least four successive products called thorium A, B, C, D. The emanation, after the emission of an α particle, changes into a product of very short life emitting α rays. Its period was found by Geiger and Moseley to be about 1/10 second. The succeeding product, thorium B, emits only weak β and γ rays with a period of 10·6 hours, changing into thorium C of period one hour. We have seen that thorium C breaks up in a complex way, emitting three distinct groups of particles. Thorium D is readily separated from C by the method of recoil. It emits penetrating β and γ rays with a half-period of 3 minutes. The active deposit as a whole decays ultimately with the period of thorium B, viz. 10·6 hours.

A special interest attaches to the product thorium X, first separated by Rutherford and Soddy, since experiments with it laid the foundation of the general theory of radioactive transformations.

A close analysis of thorium has led to the discovery by Hahn of a number of other important products. When the thorium X is separated from a thorium mineral or old thorium preparation, there appears with it another product called mesothorium 1, of period 6·7 years, which is transformed with the emission of weak β rays into mesothorium 2, of period 6 hours, which emits swift β particles and penetrating γ rays. This changes into an α-ray product, radiothorium, of period 2 years, which is transformed into thorium X.

Radiothorium is an isotope of thorium, while mesothorium 1 is an isotope of radium. The radiothorium can readily be separated from a solution of mesothorium and obtained in a concentrated form. Mesothorium when first separated would show a very weak activity, but in consequence of the growth of its subsequent product radiothorium, its activity would increase for several years. After reaching a maximum it would ultimately decay with the period of mesothorium, viz. 6·7 years.

Actinium.—Actinium of period about 20 years is believed to emit weak β rays changing into radioactinium, an α-ray product of period 19 days, first separated by Hahn. This changes into actinium X, an α-ray product of period 11 days, discovered by Godlewski. Then follows the actinium emanation of period 3·9 seconds, which gives rise to four further products named actinium A, B, C, D. Actinium A has the shortest life of any product whose rate of transformation has been directly determined. Its period, as determined by Geiger and Moseley and Fajans, is ·002 second. After emitting an α particle, A changes into B, a product of period 36 minutes emitting weak β and γ rays, analogous to thorium B. Actinium C of period 2·16 minutes undergoes a complex transformation, giving rise to two distinct groups of α particles. The main branch gives rise to actinium D of period 4·8 minutes, which is readily isolated by the recoil method. Actinium D, which emits β and γ rays, is analogous in all respects to thorium D.

In the discussion above on branch products it has been shown that the parent of actinium, called *protoactinium*, has been recently isolated by Hahn and Soddy. This substance emits α rays and has an estimated period of 10,000 years. We have seen that the actinium series is believed to have its origin in a dual transformation of uranium X. The first branch product, representing about 4% of the total, is believed to be uranium Y, a β-ray product of period one day. This is directly transformed into protoactinium.

While very active preparations of actinium have been made, it has not been found possible to separate it entirely from the rare earths with which it is mixed. Protoactinium exists in much larger amounts and should be ultimately obtained in a pure state.

End-products of the Transformations (re-stated).—After the radioactive transformations have come to an end, each of the elements uranium, thorium and actinium should give rise to an end or final product, which may be a known element or an unknown element of very slow period of transformation. Since the expulsion of an α particle lowers the mass of the atom by four units, and there are eight α-ray products, the atomic weight of the end atom should be $238-8\times4=206$. The atomic weight of radium by this rule should be $238-3\times4=226$, a result in good accord with experiment. The atomic weight of the end-product of uranium is close to that of lead, viz. 207, and Boltwood early suggested that lead was the end-product of radium. Since in old minerals the transformations have been in progress for intervals measured by millions of years, the end-product should collect and be an invariable companion of the radioelement. Boltwood showed that lead is always present in old radioactive minerals and in amount to be expected from their uranium content and geologic age.

In recent years this problem has been definitely attacked in the light of the chemical generalization already given. It was clear from this that the end-products of uranium, thorium and actinium should all be isotopes of lead but with atomic weights 206, 208 and 206 respectively. In other words, uranium-lead if uncontaminated with ordinary lead should show a smaller atomic weight than ordinary lead (207), while thorium-lead should give a higher value. By the work of Richards, Soddy and Hönigschmid, these conclusions have been definitely confirmed. The lowest value for uranium-lead is 206, and the highest for thorium-lead 207·7.

Since any admixture with ordinary lead tends to give a value nearer 207, these results may be considered as a definite proof of the nature and atomic weight of the end-products. In minerals containing both uranium and thorium the atomic weight of the mixture of the isotopes will depend on the relative amounts of these two elements and their relative rates of transformation. In unaltered minerals the determination of the amount of lead coupled with its average atomic weight allows us to determine the amount of uranium-lead even if some ordinary lead be present. In this way it should be possible to make a reliable estimate of the age of selected minerals and thus indirectly the age of the geologic strata. The amount of helium in the mineral gives a minimum estimate of its age, for, except in the most compact minerals, some of the helium must undoubtedly escape.

Nature and Properties of the α Rays (re-stated).—Although the α rays from active substances are of small penetrating power compared with the β or γ rays, they are responsible for most of the energy evolved by radioactive substances and contribute most of the ionization. Rutherford showed in 1903 that the α rays were deflected in a powerful magnetic and electric field and consisted of positively charged particles projected with high velocity. From the first it seemed probable that the α particle was an atom of helium and this was subsequently confirmed in a number of ways. The value of e/m—the ratio of the charge on the particle to its mass—and the velocity can be determined from observations on the deflection of the pencil of rays by a magnetic field and electric fields. In this way Rutherford and Robinson showed that the α particle, whether from the radium emanation, radium A or C, gave a value of $e/m=4820$ *e.m.* units, while the electrochemical value of $e/m=4826$, assuming that the mass of the helium atom is 4·00 and that it carries two unit positive charges. The magnitude of the charge carried by each particle was measured by Regener and Rutherford and Geiger and found to be twice that carried by the electron. The velocity of the α particles expelled from radium C (of range 7·06 cms.) was found to be $1{\cdot}92\times10^9$ cm. per second, or about $^1/_{15}$ the velocity of light. From this result the velocity of expulsion of all α particles can be calculated from the relation found by Geiger, that $V^3=KR$ where V is the velocity of the particle and R its range in air. The evidence indicates that the α particles from active products are in all cases atoms of helium. The α particles from a given product are all emitted with constant velocity which is characteristic for that product. We have already mentioned that the velocity of expulsion appears to be connected with the period of transformation of the element. The laws of absorption of the α particle were first worked out by Bragg and Kleeman. On account of their great energy of motion, the α particle travels in nearly a straight line through the gas, producing intense ionization along its track. The effects produced by the α particle, whether measured by ionization, phosphorescence or photographic action, vanish suddenly after the α particle has traversed a definite amount of matter. This definiteness of the end of the range of the α particle of given velocity is remarkable. The range of the α particle is usually expressed in terms of cms. of air traversed at 15° C. and 760 mm. pressure.

On account of its great energy of motion the effect due to a single α particle can be detected in a variety of ways. Sir William Crookes first noted that the α rays produce scintillations when they fall on a screen of phosphorescent zinc sulphide. It is now known that each of these scintillations is due to the impact of a single α particle. The number of scintillations can be counted with the aid of a suitable microscope, and this method has proved of great utility in many investigations. Scintillations due to α rays are observed in certain diamonds, but they are usually not so bright as in zinc sulphide. Kinoshita has shown that a single α particle produces a detectable effect on a photographic plate. When the α rays fall on a plate nearly horizontally the track of the α particle is clearly visible under a high-power microscope. By the expansion method developed by C. T. R. Wilson, the track of the α particle through the gas is made visible by the condensation of the water on each of the ions produced. In a similar way the track of a β particle can be easily shown. The photographs of these trails bring out in a striking and concrete way not only the individual existence of α and β particles, but the main effects produced in their passage through matter.

Properties of β and γ Rays (re-stated).—We have seen that the β particles, which are emitted by a number of radioactive products, consist of swift negative electrons spontaneously liberated during the transformation of active matter. The velocity of expulsion and the penetrating power of β rays vary widely for different products. For example, the rays from radium B are much more easily absorbed by matter than the swift β rays from radium C. Moseley showed that in the case of these two products each disintegrating atom gave rise on the average to one β particle.

There is undoubtedly a close connexion between β and γ rays, and swift β rays are usually accompanied by penetrating γ rays. For example, radium C, which emits very swift β rays, some of which reach a velocity more than 0·98 of the velocity of light, gives rise to the most penetrating γ rays observed in the uranium-radium series. There is one very notable exception, viz. radium E, which emits swift β particles but weak γ rays. Gray has shown that β rays in passing through matter give rise to γ rays, and that these in some cases correspond to the characteristic X radiations observed by Barkla. The absorption of the γ rays has been determined by the electrical method. Radium B has been found to emit several groups of γ rays which differ widely in penetrating power. The greater part of the rays from radium C consist of penetrating γ rays which are exponentially absorbed by matter. The ionization in an electroscope falls off according to the equation $I/Io=e^{-\mu d}$ where d is the thickness of matter traversed and μ the coefficient of absorption. When lead is used as an absorbing material the value of $\mu=0{\cdot}5$ for the most penetrating γ rays from radium C. The absorption coefficient for different kinds of matter is roughly proportional to the density, indicating that the absorption depends only on the mass of matter traversed.

The general evidence indicates that the γ rays consist of types of characteristic radiations which are excited by the passage of the β rays through the electronic system of the atom, but the γ rays from radium C are far more penetrating than any type of characteristic radiation observed in X rays generated in a vacuum tube.

Rutherford and Andrade have determined the spectrum of the γ rays from radium B and C by reflection from rock-salt. The most intense lines due to radium B are identical in wave-length with the X-ray spectrum of lead. This is to be expected, since radium B is an isotope of lead. The lines due to the "K" characteristic radiation are also observed. General considerations, however, indicate that the wave-length of the most penetrating γ rays is much too short to resolve or detect by the crystal method. In order to excite such rays in an X-ray tube potential differences of the order of two million volts will be necessary.

When the γ rays from a product like radium B or radium C are bent by a magnetic field and fall on a photographic plate, a kind of magnetic spectrum is obtained. Superimposed on the continuous spectrum due to particles of all velocities (between certain limits) certain sharp lines are observed, each of which represents a definite group of β rays which are emitted at the same speed. The velocity corresponding to each line in the spectrum has been determined for a number of β-ray products by Hahn and Miss Meitner. The magnetic spectrum of radium B and radium C was examined in detail by Rutherford and Robinson and more than 50 lines were observed, representing β particles projected over a wide range of velocity. The appearance of these lines in the spectrum appears to be connected with the emission of γ rays and is believed to be due to the conversion of the energy of the γ ray of definite frequency into the energy of an electron according to the quantum relation. When a thin layer of absorbing material is placed over the source, the primary β rays diminish in velocity and the lines become broad and diffuse. At the same time, however, new groups of β rays are formed by the conversion of γ rays into β rays in passing through the absorbing material, and these give well-marked bands on the photographic plate, occupying very nearly the same position as those due to the primary β rays before absorption. Results of this kind have an important bearing on the general problem of radiation, and give us indications of the facts to be accounted for in dealing with the conversion of swift β rays into γ rays of high frequency, and vice versa.

Production of Helium.—It was stated in the earlier article that, since the particle is an atom of helium, all radioactive matter which emits α particles must produce helium. This has been found to be the case for every α-ray product that has been examined. The rate of production of helium by radium in equilibrium has been measured with accuracy by Dewar, Boltwood and Rutherford. In terms of the International Radium Standard, the rate of production of helium by one gram of radium in equilibrium with its three α-ray products has been found to be 164 cub. mm. per year. This value is in excellent accord with that calculated from the rate of emission of α particles, viz. 163 cub. millimetres. The rate of production of helium by the radium emanation, ionium and polonium has been found by Boltwood to be in fair agreement with calculation. Soddy has observed the production of helium by purified uranium, while Strutt showed that the rate of production of helium in uranium and thorium minerals accorded with calculation.

Strutt has made a systematic examination of the amount of helium present in many minerals and rocks which contain minute quantities of radium and has utilized the results to estimate the age of the geological deposits. On account of the tendency of the helium to escape from minerals in the course of geologic ages, this method gives only a minimum estimate of the age of the mineral, except in the case of very dense and compact specimens. The measurement of the lead content should ultimately prove a more reliable method of estimating the age.

Heat Emission of Radioactive Matter.—As was stated earlier, there is no doubt that the evolution of heat by radium and other radioactive matter is mainly a secondary phenomenon, resulting mainly from the energy of the absorbed radiation. Since the particles have a large kinetic energy and are easily absorbed by matter, all of these particles are stopped by the radium itself or by the envelope surrounding it and their energy of motion is transformed into heat. The evolution of heat from any type of radioactive matter is thus proportional to the energy of the expelled α particles, together with the energy of the β and γ rays absorbed in the envelope. The energy supplied by the recoil of the radioactive atom after the expulsion of an α particle is about 2% of the energy of the α particle.

These conclusions have been confirmed by the measurements of Rutherford and Robinson, who found that each of the α-ray products gave a heating effect proportional to the energy of the α particle and absorbed β and γ rays. The emanation and its products when removed from radium were responsible for three-quarters of the heating effect of radium in equilibrium. The heating effect of the radium emanation, radium A and radium C decayed at the same rate as their activity. From their measurements they found that the total heating effect of radium in equilibrium surrounded by sufficient material to absorb the α rays was 134·7 gram-calories per hour per gram. Of this, 123·6 gram-calories were due to the α particles, 4·7 to the β rays and 6·4 to the γ rays. The energy of the β and γ rays comes from radium B and radium C, but on account of their great penetrating power it is difficult to measure the β energy with accuracy. The results, however, show that the energy of the γ rays is even greater than that of the β rays, and the two together are equal to about 28% of the energy of the α particles from radium C.

Measurements have been made of the heating effect of radium, uranium and thorium and of uranium and thorium minerals. In each case the evolution of heat is of about the magnitude to be expected from the energy of the radiations.

Radioactivity of Ordinary Matter.—Apart from the well-known radioactive elements of high atomic weight, only two other elements have been shown to exhibit the property of radioactivity to a detectable degree, viz. potassium and rubidium. Campbell showed that these elements emit only β rays and in amount small compared with uranium. This property appears to be atomic, but no evidence has been obtained of any subsequent changes. If the β particle comes from the nucleus of the atom, potassium should be transformed into an isotope of calcium, and rubidium into an isotope of strontium.

Radium and thorium have been found to be distributed, but in very minute amount, in the surface rocks and soil of the earth. The emanation from the soil diffuses into the atmosphere and causes a small ionization which can be readily measured. A penetrating γ radiation, no doubt due to the presence of radium and thorium in the earth's crust, has been observed near the earth's surface, but becomes very small over a lake or the sea.

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RADIOTHERAPY.—Since 1910 there have been notable developments, extending the practice of X-ray treatment (*see* 28.887) into the wider field now included in radiotherapy, a term which had not then come into general use. Strictly speaking, under this term should be included treatment by all kinds of rays; thus treatment by heat, by sun's rays, by ultra-violet rays, by X-rays and by the rays of radio-active substances, all come under the etymological term of radiotherapy. In practice, however, it is restricted to the application of ultra-violet rays, X-rays and radium rays. Amongst radiologists, the term has undergone an even sharper definition, so that radiotherapy is applied by them to treatment with X-rays alone, the terms radiumtherapy (or, in France *curietherapy*, in honour of the discoverer of radium) being applied to treatment with the rays of radium and other radio-active substances. Treatment by means of high frequency currents and diathermy are included rather under the term electrotherapy.

Ultra-violet Rays.—These rays to a large extent are the essential feature of those forms of medical treatment which depend upon exposure to sunlight (heliotherapy). Probably this is not the whole story. Even though heat rays may also play some part, experience of the treatment of wounds by sunlight in France during the World War indicated that a degree of benefit arises from exposure to sunlight which cannot be entirely attributable to warmth and ultra-violet rays. On the other hand, in the Finsen light treatment of lupus and in the treatment of tuberculosis at high altitudes, ultra-violet rays probably play a predominant part. It is uncertain how these rays act; they penetrate but a fraction of a millimetre into the epithelium and yet the fact that in tropical countries where sunlight is great, the white races show a proverbial irritability which does not characterize the pigmented native races, suggests that in the one, effects are produced by the ultra-violet rays which the pigment of the other is able to eliminate. Certain it is that under ultra-violet light, persons vary in the appearances they present, those who freckle or tan easily when exposed to sunlight showing the potential freckles or bronzing of their skin by dark marks which are absent from the skins of those who do not freckle or tan easily. In this connexion, it is noteworthy that those tuberculous persons are said to derive greater benefit from a sojourn at high altitudes who normally tan easily under sunlight, than those who do not. The rays are bactericidal, but whether part of their action lies in this direction, is unknown.

X-rays.—The X-rays which were discovered by Röntgen in 1895 are employed in medicine in two ways, firstly, as an aid to diagnosis when they form those branches of the subject known as radioscopy and radiography, and secondly, for the actual treatment of conditions when diagnosed. Thus by means of radioscopic or radiographic examination it may be found that there is a tumour in the chest, and as a result of that diagnosis it may be decided to institute treatment (radiotherapy) by means of X-rays or radium rays or the two combined.

X-radiation has the advantage that considerable doses can be employed. It has the disadvantage that the X-rays are frequently not of sufficiently penetrating power to serve for the treatment of tumours deep within the body. Three varieties of X-rays are used, the difference consisting in variations in wave lengths and in penetrating power. These varieties are known clinically as "soft," "medium" and "hard" X-rays, the soft rays being those of longer wave length and less penetrating power, and the hard rays being those of shorter wave length and greater penetrating power. The softest X-rays are not used clinically; those employed in the treatment of ringworm for example are "medium soft" since it is necessary for penetration to reach as deeply as the hair follicles. Medium hard and hard X-rays are used where a layer or mass of tissue some little distance beneath the surface is to be treated.

For the better treatment of new growths removed some distance from the surface of the body, there is a tendency at the present time (1921) to increase the hardness of the rays to the utmost extent with the object of producing a radiation that approximates in some degree to the gamma rays of radium in penetrating power. Chief amongst the new growths that are the subject of this "deep therapy" with intensely penetrating X-rays are uterine fibroids. The production of soft to medium X-rays requires an apparatus capable of generating about 100,000 volts, for deep therapy a voltage of about 200,000 is necessary and the aim of radiologists is to get a still higher voltage. The method employed is essentially use of a series of transformers.

It is unnecessary here to enter into a detailed examination of the methods whereby X-ray dosage is determined, but it is obvious that estimation of the dose is one of the most important points in connexion with radiotherapy. In the case of radium, the matter is relatively simple, for the output of rays from the radium is constant, but in the case of the X-ray bulb, quite apart from variations in the primary current, the conditions of the bulb vary within wide limits, and the output of the bulb in X-rays varies accordingly. An important advance has been made in recent years by the introduction of the Coolidge tube in which by means of a different working principle the output of X-rays can be kept fairly steady. Under all circumstances, the output of an X-ray bulb is heterogeneous, the bundle of rays emitted is partly penetrating, partly soft, and in order to produce a more or less homogeneous bundle of rays for purposes of treatment, it is necessary to eliminate the softer varieties by means of filters. These filters are of different kinds but the chief are aluminium, zinc, copper and lead. For absorption of the specific secondary radiations produced when gamma or X-rays impinge upon metals, such substances as rubber, gauze, cardboard are used.

When a more or less homogeneous beam has been produced, it is necessary to calculate the dose employed in any given case for comparison with other cases. Various means have been adopted to this end, of which the commonest is the Sabouraud's pastille which consists of barium platinum cyanide and changes colour from green to yellow under a certain dosage of the rays. It was thought at first that this colorimetric test would be generally applicable, but it was soon found that the change is not brought out by X-rays of all degrees of penetration and is fallacious as a guide to gamma radiation of radium. It is now largely employed as a test of dosage during the X-ray treatment of ringworm and other skin diseases, but it is recognized that it must only be employed with caution, with rays of medium hardness, and for superficial conditions. Another form of test is electrical (ionto quantimeter) in which the rate of discharge of a charged gold leaf forms a measure of the output of X-rays. Another method depends upon the chemical reduction of iodine from iodoform in a chloroform solution and is probably the most scientifically accurate of all the methods which have been devised. Yet other methods depend upon the correlation between the effects produced by X-rays on the one hand and the gamma rays of radium on the other. Here the production of identical degrees of fluorescence on the fluorescent screen or of silver deposit on the photographic plate or of biological effects on the animal cell has been aimed at in standardization.

So far as treatment is concerned, it is obvious that a biological test is the most satisfactory. The one commonly used is known as the "erythema dose," meaning thereby that dose of X-rays which leads to a reddening of the skin a few days after application and subsequently to slight bronzing, without blistering or other damage. On the other hand there is no doubt that the various cells of the body do not react to radiations in the same degree and partly on this account and partly because of the operation of the law of inverse squares, it is obvious that the skin over a tissue being irradiated may itself receive an injurious dose while the tissue in question is receiving the correct dose. Hence when a tissue some distance beneath the surface is under treatment it becomes necessary to irradiate it through different portals, so that each area of skin shall receive less than the erythema dose, although the tissue in question gets the full amount that the radiologist wishes to give it; this method of cross fire is largely employed.

Radio-active Substances.—Treatment by means of radio-active substances largely resolves itself into treatment by means of the beta and the gamma rays of radium or occasionally mesothorium. Just as X-rays vary in degree of penetration, so do the rays of radium. The so-called alpha rays are little penetrating, being stopped by about 3½cm. of air. The beta rays, which are particulate negative electrons, are more penetrating but their penetrating power varies over a wide field, some of the softest being as easily absorbed as alpha rays, some of the hardest approximating to the soft gamma rays in penetrating power. Gamma rays are aether vibrations and they, too, vary in degree of penetrating power. Their wave length is the shortest of any form of vibration known, and the most penetrating gamma rays can be detected through several inches of lead.

The alpha rays are but little used, the only methods of employment being in the way of radium emanation dissolved in saline solution, or of needles upon which "active deposit" from radium emanation has been collected. In either case the emanation water or the active deposit needles must be introduced into the system—whether intravenously or into the solid tissues—otherwise the alpha rays would have no power to act. In either case, too, they act along with the beta and gamma rays produced by the active deposit.

Beta radiation is always used in conjunction with gamma radiation, but inasmuch as the ionizing power of the beta ray is about 50 times as great as that of the gamma ray, it follows that when beta radiation is being employed, the gamma radiation may probably be ignored. Beta radiation is used for merely superficial conditions and the radium salt which supplies it is spread over a flat or curved applicator and is covered with a thin layer of varnish, mica or aluminium or is placed in a thin glass tube; the beta rays which traverse thin solid filters act upon the tissue in the neighbourhood of which the radium is placed. Instead of a radium salt one of its products, viz. radium emanation is often employed clinically. No essential difference is introduced by the use of this emanation excepting that its intensity undergoes a progressive diminution with time since it falls to half value in 3·85 days. Early rodent cancer, certain conditions of the eyelids, some cutaneous non-malignant tumours and birth-marks, are treated successfully in this way.

Gamma radiations are used where deep penetration is required, but the law of inverse squares approximately holds good in their case also, a matter of fundamental importance in treatment. The substances used as filters when radio-active materials are employed in treatment are not quite the same as those used along with X-rays. Since one of the main objects in employing radium is to utilize the highly penetrating gamma rays, the filters employed are generally of the higher atomic weights, silver, brass, gold, lead, platinum, and there is some reason for believing that the more highly penetrating the rays, (*i.e.* the denser the filter through which they have passed) the less is undesirable damage suffered by the tissues.

Mode of Action of Radiations.—The method by which X-rays and radium rays produce their effects are not thoroughly understood, but it is certain that dosage must vary according to the type of cell which it is desired to influence. Thus the vulnerability of skin is not the same in different individuals nor even in different regions in the same individual; the vulnerability of the squamous cell is not the same as that of the columnar cell; the vulnerability of renal cells differs in the convoluted tubules and in the conducting tubules. Even in the fur of animals it is possible to recognize a differentiation, for a certain amount of X-radiation will lead to a destruction of the pigment forming cells in the hair of a black rat, while a little more radiation will affect the cells themselves. In the former case there is no epilation but the hair comes white instead of black, in the latter the hair falls out and baldness results.

If the question be carried still further back and the behaviour of the cells themselves under radiation be considered, it has been found that the rays may act principally, though not exclusively, upon the nucleus or upon the cytoplasm or upon the cell membrane or upon any paraplastic material within the cell. The greater amount of work in this direction has been carried out with radium but there is little doubt that the effects of X-rays are similar. In part, changes are produced owing to the fact that the radiations break down complex chemical substances into simpler constituents. In this way, the osmotic tension of the cell or nucleus affected is raised and a dropsical condition results which can often be recognized microscopically. Other forms of degenerative change produced are fatty and mucoid. Thus radiation, if in great doses, will lead to fatty change in voluntary muscle of man and most animals or in renal cells of the cat. Under large doses of radium, mucoid changes are excessively common in all parts which normally produce mucus, but in addition, there is a great tendency for cells which ordinarily do not form mucus to undergo mucoid degeneration. Sometimes the cytoplasm of the cells disappears, though not obviously by way of either of these changes, with the result that the nucleus lies naked in the middle of the cell and separated from the cell membrane by a considerable distance. So far as the nucleus is concerned, changes produced by radiations may be intense. In cells such as those of testicle or intestine which are often found in mitotic division, mitosis is arrested or abolished. In other nuclei there may be evidence of vacuolation or the nucleus may be converted into a mere empty *sac*, or the nuclear membrane may disappear, or the entire nucleus may be represented by a few points of stained material or, finally, the nucleus may disappear altogether.

Thus in one or other way, changes are produced as the result of irradiation in the tissues upon which those rays impinge and the effects produced will depend upon (1) the type of cells affected, (2) the quantity of rays employed, (3) the length of time those rays have acted.

It must be remembered that the biological cell usually acts in one or other of two opposite directions when exposed to a physical agent according to the intensity with which the agent acts. Thus we distinguish between a stimulating or beneficial effect and an irritative or injurious effect. There is reason to believe that both of these may follow upon irradiation. In the case of malignant new growths, there is no doubt that death and destruction of the neoplastic cells occur where the rays act in all their intensity, but there is equally no doubt that because of the law of inverse squares and the specific absorption by the tissues a point is reached at which the injurious effect on the malignant cells which we desire passes into a stimulant effect which we may have reason to deplore. If this stimulus act on young and actively growing malignant cells at the periphery of the growth our irradiation will do more harm than good to the patient. There can be little doubt that in the early days of radiotherapy, some cases of malignant disease ran a more rapid course as the result of the irradiation treatment than otherwise they would have done. For this reason, the essential point of their treatment by means of radium consists in an endeavour to deal with the peripheral neoplastic cells.

On the other hand, changes may be produced in cells which we are unable to recognize microscopically. Recently the treatment of exophthalmic goitre has been largely and for the most part, successfully, carried out by irradiation and yet if the thyroid body be examined from animals exposed for many hours to the gamma radiations of radium bromide, it may be doubtful whether histological changes can be detected. Similarly, intense gamma radiation of the male frog produces no testicular changes that can be detected with certainty, and yet far less radiation produces marked changes in the tadpoles derived from normal *ova* fertilized by such radiated spermatozoa.

It follows from what has been said above, that radiotherapy is not without its special dangers. Amongst the disadvantages to which the irradiations may give rise, too extensive destruction of tissue on the one hand or stimulation of new growth on the other are relatively obvious but the dangers are more insidious. Recent work has shown that long continued exposure to minute doses of radiation (in addition to the well-known occasional production of skin cancer) leads to blood changes which in course of time become a pronounced menace to life. Not only are red and white blood cells destroyed, but the rays appear to exert a deleterious effect upon the blood-forming tissues with the result that an aplastic anæmia becomes established. Obviously, the protection of the personnel in hospitals and similar institutions where X-rays and radium are used becomes a matter of great importance.

It is probable that X-rays and radium will always continue to be employed side by side owing to the special advantage which each form of radiation possesses, and in some cases it is certain that the best results are obtained in combination.

It will have appeared from what has been said above that radiotherapy is largely—though by no means exclusively—concerned with the treatment of new growths. Irradiation by one or other method is used in cases of uterine fibroid and in cases of inoperable cancer, sometimes with astonishingly good results. It is also used in conjunction with operation for cancer with the object of warding off recurrences. Sometimes cancers, inoperable when they first come under observation, are rendered operable by treatment with radium. And, frequently, when surgery has done all that is possible a considerable degree of relief is given by irradiation.

In addition to their use in the treatment of new growths, X-rays and radium have been tried in most of the chronic forms of disease. When surgery or medicine fails to relieve a case, it is usual to try irradiation. Sometimes the results are surprisingly beneficial, but the limits of utility of the rays still need to be determined. (W. S. L-B.)

RAEMAKERS, LOUIS (1869–), Dutch cartoonist, was born at Roermond, Holland, April 6 1869. He received his education in art at various schools, and finally at Amsterdam, where he obtained several prizes. He subsequently became director of an art school at Wageningen, in Gelderland. About 1908 he started drawing political cartoons, but it was not until the outbreak of war in 1914 that his work attained world-wide reputation, by his anti-German cartoons, illustrative of the devastation of Belgium and Northern France. Many special exhibitions of his war cartoons were held, and his work had a great effect as propaganda. Several volumes of his work have been published: *The Great War in 1916; The Great War in 1917; Devant l'Histoire* (1918); *Cartoon History of the War* (1919).

RAILWAYS (*see* 22.819; *also* LIGHT RAILWAYS, MILITARY).—UNITED KINGDOM.—In 1910 British railways had reached a high standard of completeness and development, and, although a number of new lines were subsequently brought into use, two only are of primary importance in regard to through main-line traffic. One of these is the first section of the Enfield-Stevenage line of the Great Northern railway, opened for traffic as far as Cuffley on April 4 1910. On the same date the Ashenden-Aynho line of the Great Western railway was brought into use for goods traffic. The former was part of a new line designed to afford an alternative route into London avoiding duplication of the Welwyn Viaduct and, by adopting a new route, opening up a new district near London for suburban development. From 1916 onwards the northern portion was laid with a single line and used for goods traffic, and towards the end of 1920 a second track was laid. In June 1921 this section had not yet been opened for passenger traffic, but was already being largely used for goods and mineral trains. The Ashenden-Aynho line was, however, on July 1 1910, brought into regular use as part of a shortened main route between London and Birmingham, and a two-hourly schedule then came into force for the principal Great Western expresses.

Among other important new lines brought into use the following may be mentioned: June 1 1910, Filton Junction and Avonmouth Docks, and the Camerton and Limpley Stoke lines, G.W.R.; Armagh, Keady & Castleblaney railway, worked by G.N.R. (I.), completed December 1 1910; April 13 1911, Shropshire & Montgomeryshire light railway; May 12 1911, Lampeter and Aberayron line, G.W.R.; May 1 1912, Goole and Selby line, N.E.R.; June 3 1912, Dearne Valley railway (worked by L. & Y.R.); June 16 1913, Mansfield railway opened for goods traffic, and on April 2 1917 for passenger traffic (worked by G.C.R.); and July 1 1913, Kirkstead and Little Steeping Line, G.N.R. On July 1 1912 the London & North-Western railway brought into use a part of the "Watford new lines," and the branch to Croxley Green, the remainder being opened on Feb. 17 1913. On June 2 1913 the Great Western railway opened part of the remarkable series of lines designed to improve railway communication in South Wales and referred to generally as the Swansea District lines. Other sections were added at various later dates. On Sept. 26 1915 the North British railway brought into use a series of new lines in the Edinburgh district, designed mainly to facilitate mineral traffic working, known as the New Lothian lines. On May 22 1916 the Great Central railway opened the Keadby deviation line, including a new bridge over the Trent with a Scherzer rolling-lift bridge of 200 ft. span. In July 1915 a section of the old Ravenglass and Eskdale railway in Cumberland was reopened on the 15-inch gauge, using locomotives of model or "exhibition" types, but catering to public passenger and goods traffic. Extensive reconstruction works at Waterloo, L. & S.W.R., were nearing completion in 1921.

Electric Railway Extensions and New Lines.—On July 27 1912 the Central London railway was extended to Liverpool Street. On December 1 1913 the "Bakerloo" section of the London Electric railway was extended to Paddington, and on February 11 1915 to Queen's Park, there connecting with the L. & N.W.R. On April 6 1914 the loop under the river at Charing Cross on the "Hampstead" section of the London Electric railway was brought into use. On May 31 1915 the four-track section, from Finchley Road to Harrow, of the Metropolitan railway was completed over Kilburn Viaduct. On Aug. 3 1920 the Ealing and Shepherd's Bush railway, connecting the Central London railway at Wood Lane with the G.W.R. at Ealing Broadway, was completed and opened for traffic.

Railway Electrification (*see also* ELECTRICAL ENGINEERING).—Equipment of existing railways for electric working has been considerably extended. On May 12 1911 the L.B. & S.C.R. commenced to work electric trains between Victoria and the Crystal Palace. On March 1 1912 the London Bridge routes *via* Tulse Hill were added, the complete electric service becoming operative on June 1 1912. Since that date equipment of various other routes has been in hand but owing to interruption of the war no further sections are yet electrically operated. On the London & South-Western railway electric traction was inaugurated between Waterloo and Wimbledon, *via* East Putney, on Oct. 25 1915; on the Kingston "Roundabout" route Jan. 30 1916; on the Hounslow loop March 12 1916; to Hampton Court June 15 1916; and to Claygate Nov. 20 1916. Electric working on the North London and L. & N.W. railways was commenced between Willesden Junction and Earl's Court on May 1 1914, and between Broad Street and Richmond and Kew Bridge on Oct. 1 1916. On May 10 1915 the London Electric railway commenced to work through to Willesden Junction *via* Queen's Park, and from April 18 1917 this service was continued to Watford over the "Watford New Lines," though it was not until 1920 that the L. & N.W.R. was able to take its share in the working of this service, as the specially constructed joint rolling stock began to be delivered after the war from the makers. During 1919 L. & N.W.R. electric trains began to work from Broad Street to Watford *via* Hampstead Heath. Work was in 1921 well advanced upon the new "tube" tunnel under Primrose Hill and the entire reconstruction of L. & N.W.R. lines at Chalk Farm to enable "flying" or "burrowing" connexions to be made between the Euston and Broad Street routes and between the three sets of running lines, but electric operation could not be inaugurated *via* Chalk Farm and from Euston until this was sufficiently completed. On March 31 1912 Metropolitan railway electric trains commenced to work over the East London railway between Shoreditch and the two New Cross stations, with through trains, *via* Aldgate East, to and from Hammersmith. Principal developments in regard to electric traction in the provinces are the electrification in 1916 of the Newport-Shildon section of the North-Eastern railway to enable heavy mineral traffic to be operated by electric instead of steam locomotives, and of the L. & Y.R. route from Manchester (Victoria) to Bury, *via* Prestwich, in Feb. 1916, following the experimental high-tension electrification between Bury and Holcombe Brook which had been used from July 1913.

Mention may also be made of the installation in 1911 of escalators at Earl's Court, connecting the "Piccadilly" section of the London Electric railway with the Metropolitan District station above. Escalators were also provided at Liverpool Street on the opening of the Central London railway extension in July 1912, since which date these have been systematically adopted at all new tube railway stations. They have also been introduced at several existing stations, as at Oxford Circus, London Electric railway, and on the L. & S.W.R. at Waterloo to connect the Waterloo and City station with the terminus above.

Dock Improvements.—Principal developments in regard to dock and similar facilities affecting railways are the opening of Immingham Dock, G.C.R. (by the King and Queen) on July 22 1912; of the new Methil Docks, N.B.R., on Jan. 22 1913; of the King George Dock at Hull, H. & B. and N.E. railways (by the King and Queen) on June 26 1914; and the opening of a new lock entrance, designed to enable the largest vessels to enter at all states of the tide, at Newport, Alexandra Docks & Railway, on July 14 1914.

New Locomotive Works.—During 1910 and 1911 the new locomotive works at Eastleigh of the L. & S.W.R. were brought into use, and the old works at Nine Elms dismantled and the area thus cleared handed over to the Goods Department. The Great Eastern railway added several new workshops to the rolling-stock plant at Stratford in 1914–6.

Signalling.—Automatic and power signalling had already become well established in 1910, but only a limited amount of further development can be recorded. In Jan. 1911 two-position upper-quadrant electric signals were introduced on the Metropolitan railway, and have since been adopted where semaphores are retained on the "Underground" sections. On the Keadby deviation line of the G.C.R., already mentioned, three-position upper-quadrant signals have been in use since May 1916, while the Ealing & Shepherd's Bush railway is the first line in the United Kingdom to be opened with all signals of this type. In Jan. 1920 a complete power signalling installation on three-position upper-quadrant principles was brought into use at Victoria, S.E. & C.R.

Express-Train Running.—During the years 1910–4 express passenger-train facilities reached their highest level, and the timetables arranged for the summer of 1914 showed the following numbers of non-stop runs of 100 m. or more: *Caledonian railway* 10 runs, the three longest being between Carlisle and Perth, 150¾ m.; *Great Eastern railway* 7 runs, the two longest being of 131 m. between Liverpool Street and North Walsham; *Great Northern railway* 29 runs, the longest being from Wakefield to King's Cross, 175¾ m.; *Great Central railway* 6 runs, the longest being from London to Sheffield, 164¾ m.; *Great Western railway* 40 runs, the longest from Paddington to Plymouth (North Road), 225¾ m.; *London & South-Western railway* 4 runs, three of which were operated between Waterloo and Bournemouth (Central), 108 m.; *London & North-Western railway* 74 runs, the longest being between Euston and Rhyl, 209¼ m.; *Midland railway* 25 runs, the longest from St. Pancras to Shipley (a stop to change engines only, not advertised) 206 m.; *North-Eastern railway* 14 runs, all between Newcastle and Edinburgh, working through over N.B.R. north of Berwick, 124½ m. Average speeds for the best of these runs were respectively: C.R. 49·7; G.E.R. 49·7; G.N.R. 57; G.C.R. 55·85; G.W.R. 54·8; L. & S.W.R. 54; L. & N.W.R. 52·7; M.R. 50·86; and N.E.R. 54·1 m.p.h. On several of these lines, however, trains making somewhat shorter runs provided even higher averages. The following non-stop runs exceeding 55 m.p.h. may be noted:—

		Miles	Minutes	Average
N.E.R. .	Darlington to York .	44½	43	61·7
G.C.R. .	Leicester to Arkwright St., Nottingham .	22½	22	61·3
L. & S.W.R.	Dorchester to Wareham	15	15	60
G.W.R. .	Paddington to Bristol .	118½	120	59·2
L. & N.W.R.	Willesden to Coventry	88½	92	57·7
G.N.R. .	Grantham to King's Cross	105½	110	57·5
C.R. . .	Forfar to Perth . . .	32½	34	57·2
M.R. . .	St. Pancras to Kettering	72	76	56·8
G.E.R. .	Halesworth to Woodbridge	21¾	23	56·6
C.L.C. . .	Manchester to West Derby	31¼	34	55·1

It may be remarked that the short L. & S.W.R. run mentioned was due to an error in time-table compilation, but was worked to for some time. The S.E. & C.R., L. & Y.R., and G. & S.W.R. had runs exceeding 54 m.p.h., while the Great Southern & Western and the Great Northern railways in Ireland, the L.B. & S.C.R., the London, Tilbury & Southend section of the Midland railway, and the Hull & Barnsley railway also had runs averaging 50 m.p.h. or over.

Many of the runs mentioned had been operated for several years before the outbreak of war in 1914, but in two cases at least, the highest level was reached between 1910 and 1914. Thus, on the Great Western railway, the opening of the Ashenden-Aynho line, shortening the distance between London and Birmingham to 110¾ m., provided four down non-stop trains in the even two hours. These conveyed from one to three slip coaches, detached at Banbury, Leamington or Knowle, but the over-all time of two hours was also given to several up trains, though these had to include stops at Leamington or Banbury or both. On the London & North-Western railway a number of London-Birmingham trains were similarly accelerated to 120 minutes for the distance of 113 miles. On the London & South-Western railway two hours became the standard for Waterloo-Bournemouth non-stop trains as from July 3 1911.

Train Service Developments.—The following developments in train service facilities may be noted. On Feb. 1 1910 the L. & N.W.R. introduced "city-to-city" expresses between Wolverhampton and Birmingham and Broad Street. A novelty on these trains was the provision of a typewriting compartment, in charge of a qualified stenographer. In the following May similar arrangements were introduced on certain Birmingham-Euston expresses. In July 1910 restaurant cars were introduced on through trains between Manchester, Birkenhead and Bournemouth, L. & N.W., G.W., and L. & S.W. railways. In July 1910 certain Midland Anglo-Scottish expresses were diverted to run over the L. & N.W.R. between Penrith and Carlisle. At the same time several Caledonian expresses to and from Aberdeen began to use Glasgow Central Station instead of Buchanan Street. In Oct. 1910 the G.W.R. introduced through trains *via* the Ashenden-Aynho line between Wolverhampton and Victoria, S.E. & C.R. In July 1910 the L. & S.W.R. improved their Southampton-Havre route to the European Continent. In May 1911 the S.E. & C.R. Continental service from Queenborough to Flushing was transferred to Folkestone. On June 1 1911 tea cars were introduced on the afternoon expresses between London and Manchester and Liverpool, L. & N.W.R. From July 3 1911 through carriages forming parts of S.E. & C.R. Kent Coast and other expresses were run to and from King's Cross, G.N.R. On the same date the N.E.R. introduced hourly expresses between Newcastle, Sunderland, West Hartlepool, Stockton and Middlesbrough. In March 1910 Metropolitan District trains commenced to work through over the Metropolitan railway to Uxbridge, and in June of the same year through trains between Ealing and Southend were added. In July 1913 the G.W.R. introduced the "Devon and Cornwall Special" express (third class only) between London and the West of England.

Pullman Cars.—Hitherto used only on the L.B. & S.C.R., on March 21 1910 Pullman cars were added to certain S.E. & C.R. Continental expresses *via* Dover, and in the following December to those *via* Folkestone. In June 1910 they were adopted by the Metropolitan railway on the extension line to Aylesbury. In June 1914 Pullman cars were introduced on a considerable scale by the Caledonian railway, some of them replacing first- and third-class restaurant cars, while others were available only for first-class passengers on payment of a supplement as usual. In Sept. 1915 the L.B. & S.C.R. added third-class Pullman cars to certain trains. From June 16 1919 Pullman cars were added to Folkestone and Kent Coast expresses, S.E. & C.R. In July 1921 the S.E. & C.R. added a special Pullman express, the "Thanet Limited," between Victoria and Ramsgate Harbour on Sundays. From Nov. 11 1920 Pullman cars began to run on the G.E.R. Both first- and second-class cars now run on its Continental expresses, and first- and third-class cars on other routes.

Withdrawal of Second-Class Accommodation.—Several railways had already withdrawn second-class accommodation, partially or wholly, before 1910, but in Oct. of that year the G.W.R. discontinued provision for second-class passengers. From June 1 1911 the L.B. & S.C.R. adopted the same course; the L. & N.W.R., Cambrian, North Staffordshire, and Maryport & Carlisle from Jan. 1912, and from July 22 1918 the L. & S.W.R.

Season Tickets.—In regard to season tickets several interesting items may be referred to. In May 1910 the G.W.R. commenced to issue season tickets at stations on application. In Dec. of the same year the G.N.R. discontinued calling for deposits on season tickets, this practice being now general on most lines. From Jan. 1 1912 the Metropolitan railway issued "limited season tickets" to the wives of season-ticket holders, a corollary to the shopping tickets which had been issued from Jan. 1910, available only between 10 A.M. and 4 P.M., the first-class fares being little more than for third class.

Working Arrangements.—Several important working arrangements and agreements between leading railways were already in operation as between the L. & N.W., L. & Y. and Midland railways, and in May 1910 a similar working arrangement was entered into between the G.W. and L. & S.W. railways. In Aug. 1912 the London, Tilbury & Southend railway was taken over by the Midland company, being thereafter known as the L.T. & S. section. In Oct. of the same year the Great Northern & City railway was incorporated into the Metropolitan system, and in Nov. 1912 the City & South London and Central London railways were brought into the group controlled by the Underground Electric Railways Co. of London, Ltd. In Jan. 1915 a reorganization of the "Underground" companies, coordinating the several managements, was adopted. In April of the same year the Great Eastern railway adopted a reorganization of the chief departments, while the operating and commercial departments were separated as from July 1 1915.

Strikes, etc.—In Aug. 1911 there was a short strike of railwaymen which led to the appointment of a special Royal Commission. The principal result of this was the establishment of Conciliation Boards, including representatives of the respective managements, of the various grades of staff and of the Board of Trade, for the purpose of dealing with questions of pay, duties and other problems affecting railway staff. In Sept. 1911 there was a strike of Irish railwaymen. In March 1912 a coal strike entailed many difficulties upon the railways, the Great Eastern being the only large company which was able to maintain approximately full train services throughout. In Dec. of the same year there was a strike on the North-Eastern railway owing to the suspension of a driver named Knox, for alleged drunkenness, but this did not spread to any serious extent. Knox was actually fined for being drunk by the Newcastle magistrates on Oct. 26. He was off duty at the time. But eventually an inquiry by Mr. Chester Jones, the London police-magistrate, resulted in his reporting (Dec. 14) that Knox (though "not quite sober") had not been "drunk in the police-court sense," and he was then reinstated. In March 1913 the National Union of Railwaymen was formed from the Amalgamated Society of Railway Servants, the General Railway Workers' Union, and the United Signalmen's and Pointsmen's Society. In Oct. 1913 a Royal Commission on Railways began its sittings, which were not completed at the outbreak of the war.

Railway (Accounts and Returns) Act 1911.—Commencing Jan. 1 1913, the Railway (Accounts and Returns) Act 1911 came into force, from which date the methods of preparing the annual returns of all railway companies were unified and systematized, and the previous half-yearly periods, with their Scottish variations, gave place to accounts and returns for the calendar year, providing for annual meetings in Feb. in every case. The year 1913 is the only one for which complete accounts and returns were prepared in accordance with the Act, the conditions of railway control and guarantee during and subsequent to the war having prevented later returns being presented in complete form. Indeed, during the actual war period the accounts and returns were reduced to bare essentials, and some tables are still necessarily in abeyance.

"*Safety First.*"—In 1914 the Great Western railway adopted systematic "Safety First" propaganda, immediately followed by the London "Underground" railways, and since that date the matter has been closely followed up by other companies, several having issued publications to their staff setting forth "Safety First" principles. On Dec. 1 1916 the London "Safety First" Council was constituted, including representatives of several railways.

Locomotive Development.—Superheating was already recognized as a desirable feature of locomotive practice in 1910, and has since become firmly established as an essential part of almost every locomotive design, including tank and shunting as well as main-line passenger and goods classes. The Schmidt and Robinson types are both widely employed, the former in the hands of the firm known as Marine & Locomotive Superheaters, Ltd., and the latter in those of the Superheater Corp., Ltd. Both have been developed, and dampers or draft retarders are now seldom employed, improved designs of release, snifting and other valves or adjuncts, or the use of a steam circulating system, being found to meet the needs of the situation. The designs mainly used in each case are the types A and B of the respective firms. Several other designs are, however, now in considerable use; Mr. G. J. Churchward's "Swindon" apparatus on the Great Western railway; Mr. G. Hughes's "top and bottom header" and "twin plug header" designs on the Lancashire & Yorkshire railway; Mr. R. W. Urie's "Eastleigh" superheater on the London & South-Western railway; Mr. H. N. Gresley's "twin-tube" superheater on the Great Northern railway; Mr. R. E. L. Maunsell's special form of header (M.L.S. superheater, Type C) on the South-Eastern & Chatham railway; and Mr. E. A. Watson's design on the Great Southern & Western railway of Ireland. Mr. J. G. Robinson, of course, uses the "Robinson" pattern on the Great Central railway and his designs are largely used also on other railways. High-degree superheating is now invariably employed.

Feedwater heating is used to a limited extent on certain lines, and the Weir apparatus has been experimentally installed on several others, but the practice is still far from general. The use of oil for fuel continues to be the subject of experiment, but is still exceptional, though during the 1921 coal strike engines were adapted on many lines. Mention may be made of trials of the "Scarab" system on the L. & N.W.R. and other lines, while on the Great Central railway Mr. J. G. Robinson is stated to have obtained notable results from pulverized fuel and a "colloidal" mixture of pulverized coal and oil, also with the "Unolco" oil-burning equipment.

Recent locomotive practice tends towards the systematic adoption of the 4–6–0 type for express and ordinary passenger and fast-goods locomotives, while the 2–6–0 type has appeared on several lines for mixed-traffic duties. The former is often associated with the use of four high-pressure cylinders, and on several railways three-cylinder locomotives of various types have been placed in service, but the ordinary two-cylinder system is still the most general. Walschaert valve gear is becoming more and more widely used. On many railways large tank engines have been introduced, notably of the 4–6–2, 2–6–4, 4–4–4, 0–6–4, and 4–6–4 wheel arrangements, with 0–8–2 and 2–8–0 locomotives for heavy local goods and shunting work.

Rolling Stock.—In the carriage department there have been no special developments since 1910, though improvements in designs already in use have, of course, been made. To some extent, steel panels are being employed, and for electric rolling stock steel construction is now largely used. On the L. & Y.R. all-steel coaches are used on the Manchester-Bury electric route. To provide for rapid detraining and entraining of passengers at busy "Underground" stations, new designs of rolling stock have been adopted, including three sets of double doors on each side, one midway and the others towards, but some distance from, the ends. Steadying pillars and hand-holds are superseding the straps hitherto provided for the convenience of standing passengers. On the goods and mineral side no special developments in rolling stock need to be referred to, except that the use of high-capacity wagons up to 50 tons' capacity is extending, though as yet to a limited extent only.

Miscellaneous.—During 1910 express locomotives of the G.W. and L. & N.W. railways were exchanged for comparative trial; also between the Highland and North British, the L. & N.W. and North British, and the Great Southern & Western and Great Northern in Ireland. On April 4 1914 the well-known horse "Dandy," which had so long worked the Port Carlisle branch of the North British railway, at last gave place to a steam train. On Dec. 19 1915 occurred the disastrous landslide at "The Warren," Folkestone, necessitating the closing of the S.E. & C.R. main line between Folkestone and Dover throughout the war period. It was not reopened until Aug. 11 1919.

British Railways under War Conditions

Railway Executive Committee.—As far back as 1865 an Engineer and Railway Staff Corps had been formed to provide an organization of railway managers, engineers and contractors who, in the event of war, would, under the direction of the military authorities, superintend the operation of railways and carry out such additional works as might be necessary. In 1896 the Army Railway Council was constituted, this body being known from 1903 as the War Railway Council. From these bodies was formed in Nov. 1912 the Railway Executive Committee, comprising the general managers of certain leading railways. The work of the Committee was mainly advisory, but included certain preparatory measures which bore good fruit when, on Aug. 4 1914, on the declaration of war, nearly all railways in England, Scotland and Wales were taken over by the Government under the Regulation of the Forces Act 1871, and directed on behalf of the State by the Railway Executive Committee. It may be explained that this Committee was never intended to supersede the actual management of railways, but to issue directions and to coördinate the working of all lines concerned as required by the various emergencies as they arose. Otherwise, and notwithstanding the many uncontemplated developments in the scope and operation of the Committee throughout the war period, the ruling principle was always that the officers of the respective railways should continue to operate their lines without State interference.

Railway Control and Guarantee.—The Act of 1871 provided that, to avoid the complexities of payment for services rendered and other difficulties which necessarily would have arisen, the Government guaranteed to make up any ascertained deficiency in the aggregate net receipts of all the railways taken over as compared with the aggregate for the corresponding period of 1913. Throughout the war period, therefore, all ordinary financial arrangements on the operating side ceased, and the work of the Railway Clearing House in regard to the division of receipts according to ownership of lines and various arrangements between companies was discontinued. The original agreement provided for adjustment according to the conditions during the first half of the year 1914 as compared with the corresponding period in 1913, but, when the question of war bonuses to railway workers to meet the higher cost of living arose early in 1915, it was agreed that this proviso should cease to operate in consideration of the first 25% of the war bonus conceded in Feb. 1915 being borne entirely by the companies, though all subsequent increases were undertaken by the State. In Aug. 1915 the Government accepted the principle of making allowances to the railway companies supplementary to the periodical compensation payments in respect of deferred maintenance and renewal. At a later stage agreements were made as to the payment of interest upon various capital works unproductive at the time of the outbreak of war, or completed and brought into use during the earlier war period, and in regard to many other complicating factors which arose. Some of these agreements occasioned severe strictures by Lord Colwyn's Committee on Railway Agreements, whose report was issued early in 1921, but during the period of hostilities, and notwithstanding the very wide and to some extent undefined scope of control which was eventually forced upon the Railway Executive Committee, the arrangements made by the Committee on behalf of the State with the railway companies are generally regarded to have been reasonable and equitable.

The Government Profit on Railways.—It may be pointed out that, according to a Government return issued under date of April 30 1919, if all Government traffic had been charged for at authorized pre-war rates the amounts would have been as follows for the periods stated:—

Aug. 5 to Dec. 31 1914	£ 3,500,000
Year 1915	10,279,104
Year 1916	20,649,126
Year 1917	35,698,554
Year 1918	41,917,024
Total	£112,043,808

For the corresponding periods the amounts which the Government had to provide by way of compensation were:—

Aug. 5 1914 to Dec. 31 1915	£15,946,839
Year 1916	14,039,674
Year 1917	24,075,768
Year 1918	41,251,326
Total	£95,313,607

Beside the actual working of the railways, the use of railway steamers, docks, canals, etc., represented a value estimated at from £10,000,000 to £15,000,000, while munition and similar work done (to the value of about £17,000,000) in railway workshops at cost price and therefore without profit to the companies, also the provision of locomotives, rolling stock, permanent way, etc., for use overseas, indicate the complexities of the arrangements ultimately entailed and the tremendous scope the utilization of the home railways for war purposes eventually attained. The Irish railways were not concerned at first in the Government control and guarantee. They were, however, taken over under similar conditions from Jan. 1 1917. The appended table shows the manner in which the control of railways in association with the Government guarantee operated.

In other words, the aggregate of all the freight, munition, troop and passenger traffic carried on Government account, if charged for, would greatly have exceeded the sum payable by the Government to bring up the annual net receipts to the pre-war level. It has to be remembered, however, that arrears of maintenance and cost of replacement of stock, etc., apart from what was essential at the time, could not figure very prominently in the accounts until after the termination of hostilities. After the Armistice, however, heavy costs were entailed under these and other headings, while the reduction of Government traffic to the relatively very small figures of the post-war period converted the profit of the war years into a serious deficit. The fact remains, however, that while the war emergency continued the bargain made was a very good one for the State, and it was only in 1918 that the, by then, generous wage and war-bonus concessions to the railway staff tended to convert the profit to the State into a deficiency—even then a relatively small one.

War Bonuses and Concessions to Staff.—As showing the tremendous effect of these concessions it may be mentioned that for the financial year ended March 31 1920, as compared with 1913, the increased cost of working the railways was estimated at £57,000,000 on account of war wage and other concessions, and

Operation of Government Guarantee

	1915	1916	1917	1918
	£	£	£	£
Revenue earned by railways over expenditure[1]	45,171,403	49,420,063	53,885,849	44,068,105
Amount of compensation paid by Government to railway companies on basis of published accounts for 1913	46,130,000	46,319,000	46,515,000	46,576,000
Profit or Loss to Government	−958,597	+3,101,063	+7,370,849	−2,507,895

[1] Includes estimated value of services rendered by railways to the Government free of charge, as shown in White Paper, Cmd. 402, apart from value of services rendered to the Government in respect of steamboats, canals, docks, hotels, etc., estimated at from £10,000,000 to £15,000,000 for the war period.

from £20,000,000 to £25,000,000 due to the eight-hour day and further concessions then recently granted or under discussion. In the opinion of experts it is thought, however, that even these difficulties would not have arisen, at least in so acute a form, had it not been for the maintenance of pre-war rates and charges for goods traffic throughout the war period, while it was not until Jan. 1 1917 (June 1 1918 in Ireland) that ordinary passenger fares were increased by 50 per cent., and then mainly with the object of restricting travel rather than of raising revenue. Had adjustments been made stage by stage, as was done in the case of prices in general trade and industry, the financial situation in regard to railways would have been very greatly improved, and there would have been relatively little objection to the increase which became imperative in the post-war period.

Mobilization Traffic.—Very complete plans for mobilization had been prepared by the Railway Executive Committee long before there was any probability of war, and continually revised and brought up to date, so that everything was ready for the wonderful transportation achievements which followed the declaration of war. Thus between Aug. 10 and 31 no fewer than 670 trains, coming from all parts of the country and conveying horses, guns, baggage and stores, as well as approximately 120,000 men of all ranks, were dealt with at Southampton Docks with little interference with ordinary civilian traffic. Throughout the war period achievements of this character were regularly accomplished at all the chief embarkation centres and there is no instance on record of the breakdown of railway arrangements at any time, even when the tremendous volume of munition and other traffic conducted in national interests, but not directly for war purposes, was also placed upon the railways.

Public Railway Transport.—During the war period it was necessary to impose many restrictions upon both passenger and goods traffic. Excursion and many cheap-fare facilities were early discontinued, as also tourist and certain other classes of tickets carrying special facilities. Continental traffic was, of course, subject to special regulations and from the outbreak of war Dover became a closed area, such continental steamer services as were maintained being diverted to other ports. In fact, at all the great railway ports there were severe restrictions upon civilian traffic. During 1916 further regulations came into force for passenger travel, following a process of deceleration of express trains, partly due to the insertion of stops to enable them to serve the purpose of trains which were withdrawn in order to free the lines for Government traffic, and partly in view of the exceptional loading which became general, and to ease the strain on permanent way, bridges, etc., which could not be maintained to usual standards. From Jan. 1 1917 still further restrictions were imposed upon railway travel and conveyance of luggage; restaurant cars were withdrawn entirely on many lines and reduced on others, and passenger traffic was allocated to specific routes where alternatives had hitherto been available for the same journeys. An increase of 50 per cent. was made upon ordinary passenger fares and from 10 to 20 per cent. on season tickets, the issue of which was regulated, while it was required that they should be shown by each passenger on every journey made. Certain branch lines were closed, most of the rail-motor intermediate services withdrawn, and a large number of stations closed.

Release of Railwaymen.—An important object of these reductions in train services and facilities was to enable railwaymen to be released to serve with the forces, and altogether no fewer than 184,475 men were thus contributed. This figure represented 49 per cent. of the staff of military age in railway employ on Aug. 4 1914. Large numbers of men, apart from Reservists and Territorials, had, of course, joined voluntarily quite early in the war, but the general enlistment of railwaymen was not favoured until 1916, by which time a definite scheme of release had been adopted on a system which reduced inconvenience to the railway companies to a minimum and yet enabled reasonable proportions of men to be supplied.

Railway Officers in Government Service.—Throughout the war railway officers of many grades were freely utilized by the Government, some for special duties involving commissioned rank in the army or navy, and others for rendering expert assistance in civilian capacities to various Government departments. In fact, a considerable number of railway officers in high positions were given important Government appointments in connexion with various existing and new State departments. In other instances, railway officers were temporarily loaned to the Government.

Employment of Women.—Comparatively early in the war women were introduced into many ranks of the railway service, and in due course they were seen on a wide variety of work—at passenger and goods stations and depots, in engine sheds, on electric trains as "gatemen" and in a few instances as guards, on cartage and delivery vans, and in the railway workshops, in addition to more obvious employment as clerks, waitresses and in booking-offices. To some extent these measures were rendered practicable by the discontinuance of the more complicated travel facilities, the reduction of record-keeping to a minimum, the abolition of detailed statements between railway companies and Railway Clearing House work; but to a great extent women were employed in direct replacement of men who had been released with but little adjustment of their duties. A total of 55,000 women were thus employed in railway working, and about 6,000 on munition work in railway shops.

Goods and Mineral Traffic Allocation.—Goods and mineral traffic, especially when the manufacture of munitions on a very large scale was going on all over the country under Government direction, became of vital importance, and all other traffic was made subservient thereto. For the control of non-Government traffic a system of allocation was widely adopted, requiring consignors to despatch their goods by specified routes and from particular depots and sometimes on particular days, according to destination, while at times it was necessary to refuse to accept traffic for a time. Arrangements had already been made between the leading railway companies in regard to "common user" of wagons of ordinary type, while private owners' wagons were brought into the "pool."

Coal Control.—A system of coal control was adopted in 1917, partly due to the necessary discontinuance of a large proportion of the normal coastal water-borne conveyance of coal, by which each part of the country drew its coal supplies from specified colliery areas, and this traffic alone represented an enormous burden.

Military and Naval Traffic.—For the needs of the Army and Navy facilities on a very large scale had to be provided. Apart from the movements of troops for service overseas, continual streams of traffic passed to and from the training camps. Leave travel, however restricted, was inevitably a very big factor, and, as the war progressed, ambulance trains passed very frequently between the Channel ports and hospitals in various parts of the country. Among special facilities which had thus to be afforded may be mentioned the naval leave trains which ran regularly between the north of Scotland and London in connexion with the fleet in northern waters, while a continuous stream of coal trains had to be run between South Wales and other suitable coal areas and the far north of Scotland for the use of naval vessels. One of the chief difficulties, indeed, was the need for using the Highland railway for naval traffic on so large a scale, and parts of this were doubled during the war in order to relieve the congestion which necessarily followed the lengthy single-track mileage of this, as it proved, vitally important line.

Munition Traffic.—Widespread munition manufacture necessarily occasioned a great deal of civilian traffic directly and indirectly in national interests, while in a number of places ordinarily quiet stations or branches became very busy owing to the erection of army camps or of munition works. A few stations had to be specially erected and several new branch lines made.

Railway Docks and Harbours.—As owners of several of the best-equipped docks and harbours, including new ones such as Immingham, G.C.R., and the King George Dock at Hull, H. & B. and N.E. Railways, and the new lock entrance at Newport, Alexandra (Newport & South Wales) Docks & Railway, brought into use shortly before the outbreak of war, in addition to the older ones, such as Southampton, the railways provided the nation with some of the most complete embarkation depots. Most of these became closed areas, and all of them were used to their fullest capacity, either for direct war traffic or when the submarine menace diverted shipping traffic from its accustomed ports.

Railway Steamers.—Railway steamers also were widely used, and of a total of 218 vessels 126 were taken over and 36 lost from various causes. They were used as transports, for the maintenance of national supplies, as minesweepers, and as hospital ships. Frequently even those which remained on regular services had to assist in meeting emergencies, such as the evacuation of Belgian refugees.

Railways and Air Raids.—An important difficulty with which the railways had to deal was that due to the numerous air raids over Great Britain. Relatively little serious damage was done, but the fact that traffic had often to be or worked under difficulties, the reduced lighting generally maintained throughout the more vulnerable parts of the country, and the congestion which followed each cessation of traffic constituted serious hindrances to railway working.

Armoured Trains.—Throughout the war period, too, the possibility of invasion had to be faced, and many special arrangements made with a view to the possible need for transferring the civilian population from the coast towns to the interior. Several armoured trains were constructed in the railway workshops, though they were never called upon for use under service conditions.

Miscellaneous.—At many of the principal railway stations free buffets were installed for the benefit of soldiers and sailors, and in some cases these provided special facilities, as at Victoria, S.E. & C.R., where arrangements were made for the exchange of French for English money, the amount dealt with reaching a total of approximately £10,000,000. At one period the railways were severely congested by the traffic due to the evacuation of Belgium, and one result of this was the continual stream of Belgian soldiers coming to England on leave to visit their families, a total of 237,000 thus travelling. At many stations local bodies, such as the V.A.D., etc., made very complete arrangements for providing refreshments to soldiers travelling through and for attendance upon the ambulance trains. Frequently valuable assistance was given by the various ambulance associations belonging to the railway service.

British Railway Work in the War

During the war period British railways rendered essential services on a very large scale, both in regard to traffic requirements at home and those associated with active service in the various war areas. To some extent the former has already been covered by general reference, but further details must be given.

Military and Naval Special Trains.—Between the declaration of war and the date of the Armistice all the larger railways were called upon to run special trains conveying officers and men, frequently with guns, ammunition, horses and equipment, when passing to a port for embarkation to France or other theatres of war. There were also transfers of units between camps, leave travel and special events, such as the arrival of Canadian, S. African and other contingents from abroad and their journeys from ports of arrival to training centres, together with that portion of the American army which passed through the United Kingdom. In the aggregate the numbers of special trains operated by the leading railways were very great, and the following table shows, as far as information is available, the number of special trains mainly, if not exclusively, on the passenger side, run by the railways mentioned, with the numbers of officers and men who travelled:—

	Trains	Officers and Men conveyed
L. & S.W.R.	58,859	20,223,954
L. & N.W.R.	56,470	22,268,000
G.W.R.	33,615	—
N.E.R.	24,172	11,810,290
L.B. & S.C.R.	27,366	—
G.E.R.	13,000	6,231,293
G.C.R	5,663	2,656,726

Three other railways may be mentioned, though their totals include also ambulance trains, goods and other specials:—

	Trains	Officers and Men conveyed
S.E. & C.R.	163,000	12,141,933
M.R.	11,502	2,282,000
N.B.R.	45,000	—

The numbers of special trains required on the freight side are more indefinite, as they included many trains run to meet the needs of the Government munition undertakings and of coal traffic passing from the colliery areas to the Fleet bases, and, to some extent, in connexion with the coal control scheme. However, it may be mentioned that on the London, Brighton & South Coast railway no fewer than 53,376 special trains were run mainly for traffic to and from the ports on the system. On the Great Western railway the total was 63,349 and on the Great Eastern railway 11,000. To meet the needs of the Fleet several railways ran 20 or even more trains per day conveying Admiralty coal. The arrival of the American army in Great Britain entailed the running of 1,684 special trains on the London & North-Western railway and 1,139 on the Great Western railway. When the Canadian contingents first arrived in England the London & South-Western railway was required to run 92 specials from Plymouth alone.

Ambulance Trains.—For home service a total of 20 trains was equipped for army use: G.C.R. 3; G.E.R. 2; G.W.R. 4; L. & Y.R. 2; L. & N.W.R. 5; L. & S.W.R. 2; M.R. 2. There were also two in Ireland, one each equipped by the G.N. and G.S. & W. railways. Five naval ambulance trains were also in use, these differing somewhat in regard to internal arrangements and equipment. Many individual vehicles were also fitted for the purpose of conveying small numbers of men in ordinary trains, and there were nine other trains sufficiently equipped to be brought into use as emergency ambulance trains. For service overseas 30 ambulance trains were equipped by the home railways, each consisting of 16 bogie coaches. These were supplied as follows: G.C.R. 1; G.E.R. 4; G.W.R. 8; L. & Y.R. 3; L. & N.W.R. 7; L. & S.W.R. 1; L.B. & S.C.R. 1; M.R. 2; N.E.R. 1; L. & N.W.R. and G.E.R. 1 jointly; L. & N.W.R. and L.B. & S.C.R. 1 jointly. Two trains presented by the United Kingdom Flour Millers' Association were constructed by the G.E. and G.W. railways jointly, and the Lord Michelham (or "Queen Mary") presentation train was equipped by the L.B. & S.C. and L. & N.W. railways. A further train, known as the Princess Christian Hospital Train, was built by the Birmingham Carriage & Wagon Company. A majority of these trains was employed in France, but two went to Egypt and one to Salonika. When the American army came arrangements were made for 19 other trains, of the same general type as those previously supplied for overseas service, to be equipped by British railways for the use of the U.S.A. forces in France, as follows: G.C.R. 1; G.E.R. 1; G.W.R. 4; L. & Y.R. 3; L. & N.W.R. 4; L. & S.W.R. 1; M.R. 5. Twenty-nine others were on order at the date of the Armistice, when, of course, work was at once suspended. Including spare and extra vehicles, a total of 822 vehicles was thus adapted for the Government trains, and 304 for the U.S. trains.

The following numbers of journeys made by ambulance trains on various railways will indicate the enormous volume of this traffic, these figures applying, of course, only to the ambulance trains running on the home railways: L. & N.W.R. 13,318; L. & S.W.R. 10,173; S.E. & C.R. 7,515; G.W.R. 5,000; M.R. 3,982; N.B.R. 1,800; G.E.R. 1,172. This traffic was dealt with at various ports, but it is worthy of note that no fewer than 3,166 were despatched from the new Marine station at Dover, uncompleted at the time of the outbreak of war, but finished off at an early date sufficiently to serve for the transfer of wounded men.

Troop Movement and other Military Traffic.—The numbers of special trains given above will indicate the enormous dimensions which the traffic entailed by troop movement involved. At suitable places large numbers of both passenger and goods vehicles had to be kept in reserve to provide for movements of troops at short notice, and many of the cross-country or connecting lines proved of special value in enabling through journeys to be made from one system to another and by providing alternative routes to avoid congestion. The North London, Hampstead Junction, and North and South-West Junction railways carried nearly 14,000 special trains, and on several dates public traffic was entirely discontinued. The "widened" lines of the Metropolitan railway, through Farringdon Street and the connexion to the South-Eastern & Chatham railway at Ludgate Hill, were used by no fewer than 626,000 special passenger or goods trains, though this route was restricted by the limited loading gauge and could not, therefore, be used for ambulance trains and certain other traffic. The West London railway dealt with about 150 troop or special trains per month, and the East London a gross total of about 1,000. Bearing in mind that the magnitude of the forces involved a tremendous amount of leave travel, it may be mentioned that, during 1917 only, over 28,000,000 of H.M. forces travelled free by warrant on the home railways, while nearly 2,000,000 journeys were similarly made by civilians in Government service.

Traffic at Ports.—Dover was largely used as a centre for ambulance train traffic, but at Southampton a very large volume of stores, munitions and other material was dealt with, besides a considerable amount of shipping traffic necessarily continued. The Southampton train ferry to Dieppe was brought into use in Nov. 1917, that at Richborough, near Sandwich, being completed in Feb. 1918. Both enabled goods wagons to be sent across without transshipment, and they were especially useful for the conveyance of tanks, heavy guns, locomotives, etc. Avonmouth, Devonport and Liverpool were used as ports for supplying the Mediterranean and Mesopotamian forces. Immingham and other East Coast ports were largely used for supplying the fleets in more southern waters, while Leith, Aberdeen, Invergordon, Thurso and other Scottish centres were kept very busy in meeting the demands of the Grand Fleet. Newhaven and Littlehampton together dealt with nearly 7,000,000 tons of traffic on war account. In addition to the steamer traffic across the Channel the South Coast ports, including Richborough, sent over 1,000,000 tons by means of sea-going barges.

Munition and Admiralty Coal Traffic.—Besides the traffic directly required for the army and navy, the railways had to meet many other traffic requirements, as indicated by the following: The South-Eastern & Chatham railway alone conveyed nearly 200,000 tons of army mails, parcel-post packages and lighter stores not dealt with in bulk, *via* Dover and Folkestone. On the London & North-Western railway nearly 16,000 trains were run for the conveyance of Admiralty coal. In many parts of the country extensive forestry work was undertaken, and the conveyance of the cut timber amounted to hundreds of thousands of tons on many railways. On the North-Eastern railway the tonnage of goods conveyed on Government account amounted to 5,500,000, and of Admiralty coal nearly 12,000,000 tons, while to serve the numerous munition centres in the north-eastern area involved the conveyance of some 84,000,000 workpeople. On the Great Western railway at one time no fewer than 360 additional trains had to be run daily, solely for the conveyance of workers to the various war factories.

Locomotives and Rolling Stock sent Overseas.—A number of locomotives under construction for various colonial and foreign railways were commandeered by the Government and diverted for use in France and elsewhere, while large orders were given for the building of engines by British firms for use in France. A total of 247, of a contemplated order for 500 of the 2–8–0 type alone, was constructed. But to meet immediate needs it was necessary for British railways to supply considerable numbers of engines from their own stocks, mainly for France, though some went to Egypt, Mesopotamia, and Salonika. The total locomotives thus supplied numbered 675, of which the L. & N.W.R. provided 111; G.W.R. 95; M.R. 78; N.E.R. 50; G.C.R. 33; and G.N.R. 23; the remainder being sent by other companies. In addition, 30,000 goods wagons were sent overseas, together with 100 special wagons and 40 30-ton coal wagons. The Great Central railway constructed six engines to the design adopted for the War Department 2–8–0 locomotives which were, in fact, substantially to G.C.R. designs; 2,500 20-ton covered wagons were built in railway workshops.

Besides the standard-gauge rolling stock, large numbers of steam, petrol, and petrol-electric locomotives of small types, and wagons of various designs, for use on the light railways in France, were built by various firms, though not much of this work was done by the railway companies beyond the equipment of Ford cars as rail tractors at Crewe Works. A considerable amount of permanent way was, however, sent overseas by the home railway companies, partly by taking up certain light-traffic branch lines or by converting double lines to single track, and also to a considerable extent from stock. A great quantity of bridge parts, machinery, cranes and other material was also supplied from stock, while the equipment of the army railway workshops in France was largely provided by the various railway companies.

War Work in Railway Shops.—As already mentioned, this was undertaken to the value of about £17,000,000, and covered a wide range of products—from ambulance stretchers, road vans and gun-carriages to the repair of cartridge cases and the production of shell cases, frequently of large sizes. Several travelling workshop trains were also equipped in the British railway shops. In a number of instances, too, railway companies undertook the repair of Belgian and other locomotives sent over from France.

The Railway Troops.—As already mentioned, a total of 184,475 men was released from railway service to join H.M. forces. They were largely utilized in the formation of, or transferred to, the various sections known generically as the Railway Troops attached to the Royal Engineers. A number of the companies were recruited mainly from the men of a particular railway, especially in the case of the L. & N.W.R. (115th) and the G.W.R. (116th, 262nd and 275th), while the 118th was recruited chiefly from the G.E. and N.E. railways. There were two principal sections, the Railway Construction Troops and the Railway Operating Division, the former numbering 35 companies and the latter 42½ companies, including those dealing with the light railways. Besides these there were Labour, Roads, Canadian Overseas Construction, Canadian Operating, S. African and Australian companies, bringing the total to 118½ companies. The various camp railways were also supplied from these bodies.

The Post-Armistice Period

On the cessation of active hostilities the pressure of war traffic at once eased, though it was some weeks before Government traffic materially decreased in volume. Necessarily, for some time afterwards the completion of work in hand and the traffic occasioned thereby kept the railways fairly busy, though with less urgency and strain. Leave travel was even more freely given, and the demobilization of the forces for many months placed a big strain upon the railways on the passenger side. National traffic on the goods side, too, remained heavy, as systems of control of food-stuffs, coal and necessities could not at once be discontinued, and was further complicated by the public call for the return of unrestricted transit conditions, for improvements in facilities, and for a resumption of the relative freedom of pre-war conditions. There were also tremendous arrears of construction and maintenance of railway permanent way and rolling stock to be overtaken.

Demobilization of the Forces.—This traffic was a very big thing in itself, and numerous special trains had to be run between the ports and the demobilization centres. It was estimated that 40,000 men would be dealt with daily, and that was about the number realized. But the effect of public pressure caused great irregularity, and, as a result, the railways had to deal with much of this traffic—which also included the dispersal journeys of men from the demobilization centres—as best they could. One dispersal depot alone thus dealt with over 1,000,000 men. Horses had also to be conveyed in large numbers, many being brought back in through trucks *via* the Channel train-ferries. Their sale, also the large traffic occasioned by the return of rolling stock and material from overseas, and the sale of army stocks of all kinds under the direction of the Disposals Board, added appreciably to the work of the railways.

Arrears of Maintenance and Construction.—The work thus involved was necessarily of great volume and expense. It entailed relaying of lines, repair and reconstruction of bridges, completion of deferred new works, repair of locomotives and rolling stock, and the construction of overdue replacements. In addition certain war extensions had to be dismantled, and workshops cleared of special machinery, and not a few new machines added in place of those which had become worn out. Public opinion ceased to look quite so favourably upon the large expenditure thus incurred. The companies had, of course, placed to reserve large sums in view of this work, but as they had been limited to net receipts on a pre-war basis, these were necessarily on pre-war standards, though usually with increases as far as practicable, whereas when the money had to be spent costs of materials and labour had increased approximately threefold. Agreements made between the Government and the companies provided for the difference being made up, but the amounts involved became so great that in Oct. 1920 a Committee was appointed to report upon these agreements. In large measure this was little more than a sop to public opinion, for the report of Lord Colwyn's Committee, as it is generally called, took little account of the merits of the case, and appeared mainly concerned with a solution which presented very much the appearance of repudiation of agreements when they became unpleasantly expensive. However, it was generally realized that these costs were the inevitable corollary to the great benefits, and actual profit as shown in a previous section, obtained by the nation from the railways during the war period; and a settlement was ultimately arrived at in May 1921, providing for the payment in two instalments of £60,000,000, after the termination of Government control in Aug. 1921. Until then the arrangements already adopted for monthly payments in respect of arrears of construction and maintenance were continued. This solution avoided much prospective litigation and represented a reasonable degree of give-and-take on both sides. The Colwyn Report suggested that a total of £156,000,000 would thus be involved, but this was given without data and was almost certainly overstated. Payments already made must be considered in conjunction with the £60,000,000 accepted in settlement. The corresponding amount agreed upon in respect of the Irish railways was £3,000,000.

Railway Guarantee and the Subsidy.—As Government traffic diminished in volume, and more and more national traffics were returned with de-control to private enterprise, the effect of the high cost of materials and supplies, and the generous wage and other concessions, quickly resulted in the railways requiring considerable subsidies. At the end of 1919 belated action was taken to increase railway charges to an economic level, the lack of which action had largely caused the very serious position which arose after the conclusion of active hostilities. Thus, whereas the amount of Government compensation in 1918 was £46,576,000, and the receipts, including the estimated value of Government traffic, £44,068,105 on account of railway working alone, for the year ended March 31 1920 the realized deficit amounted to £41,349,530, even after allowing for certain increases in charges which came into force during that period. And for the 1920–1 period the net Exchequer liability was estimated at £54,500,000.

Wage Concessions and Increased Costs.—These provide the chief explanation for the large subsidies entailed, expenses having risen nearly 200% and receipts an average of only 80% as compared with 1913, the year upon which the Government guarantee of net receipts was based. Thus the gross receipts, expenditure and net receipts for 1913, 1919 and 1920 were:—

	1913	1919	1920
Gross Receipts .	£129,194,000	£226,363,000	£298,249,000
Expenditure .	£83,385,000	£180,098,000	£251,575,000
Net Receipts (Railway) . . .	£45,809,000	£46,265,000	£46,674,000

In the case of four representative railways, English, Scotch, Irish and Welsh, wages and salaries alone showed the following increases:—

	1913	1920
London and North-Western	£6,000,000	£20,000,000
North British	£1,660,000	£6,600,000
Great Northern (Ireland)	£357,000	£1,406,000
Taff Vale	£384,000	£1,187,000

War-time concessions consisted mainly of the flat-rate allowances of 33s. per week, reached by successive increases in view of the rising cost of living, but after the Armistice action was taken by the Railwaymen's Unions in respect of the eight-hour day (granted from Feb. 1 1919), standardizing of wages and grading. The eight-hour day caused many difficulties and is necessarily costly, especially as it had to be equalized for many men whose wages were not calculated on that basis. Throughout 1919 there were continual labour difficulties, and a serious strike lasted from Sept. 26 until Oct. 5, settled by an agreement that no reductions in wages should occur before Sept. 30 1920, and the whole matter thoroughly explored. In Oct. 1919 Central and National Wages Boards were set up. In Jan. 1920 an agreement was announced providing for an addition to the wages of each grade of 38s. per week and for cost of living allowances rising or falling in accordance with Board of Trade figures, with standardized rates of pay which should not fall below 100% over pre-war rates. This was at first objected to, but was accepted on Jan. 15 1920. Subsequent negotiations dealt with supervisory and other grades. Certain further advances were given in June 1920, and in view of the accompanying costs of materials and supplies it will be understood that these additions much more than balanced the alleged railway "subsidies."

Ministry of Transport.—An announcement, apparently unauthorized, by Mr. Winston Churchill in Dec. 1918, that nationalization of the railways was contemplated caused a great deal of misunderstanding. There were, however, many matters requiring attention, and these together resulted in the bill for establishing a Ministry of Ways and Communications presented to Parliament in Feb. 1919. As first introduced its contemplated scope and powers were considered to be too far-reaching, but in a modified form it was passed as the Ministry of Transport Act, receiving Royal Assent on Aug. 26 1919, the Ministry being established as from Sept. 23 1919. The Ministry took over several sections of existing departments, including the Railway Department of the Board of Trade and the Roads Board. The Railway Executive Committee continued as such until Jan. 1 1920, but most of its members were retained on the Railway Advisory Committee. Various other advisory and reporting committees have since been established.

Rates, Fares and Charges.—Apart from the 50% increase in ordinary passenger fares, and of 10 to 20% increases in season-ticket charges, railway rates remained as in pre-war years until the Ministry of Transport announced increases in demurrage rates as from Jan. 1 1920, and of 50% on goods rates as from Jan. 15 1920. These were followed on Aug. 6 by further increases bringing ordinary passenger fares up to 75% and season tickets 50% over pre-war rates, and from Sept. 1920 workmen's tickets were increased, and goods rates raised to substantially 100%. On Dec. 22 1920 the Rates Advisory Committee of the Ministry of Transport reported on the general question of rates and charges, and their recommendations materially influenced the Railway Bill placed before Parliament on May 11 1921.

Grouping and the Future of Railways.—One of the provisions of the Ministry of Transport Act was that a policy for the future of the home railways should be promulgated within two years. An outline of proposals was issued in July 1920, suggesting, *inter alia*, the amalgamation of railways into groups as follows: (1) *Southern*, combining the South-Eastern & Chatham, the Brighton, and the South-Western; (2) *Western*, the present Great Western system with the Welsh lines; (3) *North-Western*, combining the North-Western, the Midland and the Lancashire & Yorkshire, North Staffordshire and Furness; (4) *Eastern*, combining the Great Northern, the Great Central, and the Great Eastern; (5) *North-Eastern*, the present North-Eastern system and the Hull & Barnsley; (6) *London Group* (local lines); and (7) a *Scottish Group* for the whole of Scotland. These proposals were severely criticized, and the Railway Companies' Association adopted the following alternative: *Group 1*, London & North-Western, Midland, Lancashire & Yorkshire, North Staffordshire, Furness, Caledonian, Glasgow & South-Western, and Highland railways; *Group 2*, Great Central, Great Northern, Great Eastern, Hull & Barnsley, North-Eastern, North British, and Great North of Scotland railways; *Group 3*, Great Western and Welsh lines; *Group 4*, London & South-Western, London, Brighton & South Coast, and South-Eastern & Chatham railways; *Group 5*, London railways (local lines). On May 11 1921 the promised bill was placed before Parliament, and embodied the following modified scheme: (1) *Southern Group*, London & South-Western, London, Brighton & South Coast, South-Eastern, and London Chatham & Dover railways; (2) *Western Group*, Great Western and Welsh railways; (3) *North-Western and Midland Group*, London & North-Western, Midland, Lancashire & Yorkshire, North Staffordshire and Furness railways; (4) *North-Eastern and Eastern Group*, North Eastern, Great Central, Great Eastern, Great Northern and Hull & Barnsley railways; (5) *West Scottish Group*, Caledonian, Glasgow & South-Western and Highland railways; (6) *East Scottish Group*, North British and Great North of Scotland Railways. During proceedings in Committee of the House of Commons the 5th group was combined with the 1st, and the 6th with the 2nd, substantially as proposed by the Railway Companies' Association, and the Act, which received Royal Assent on Aug. 19 1921, therefore provides for four groups only:—Southern; Western; North-Western, Midland and West Scottish; North-Eastern, Eastern and East Scottish. Amalgamation is to become effective on July 1 1923. The proposed London group was dropped in view of proposals for the setting-up of a London Traffic Board. Provisions were also made for the inclusion of representatives of the Railwaymen's Unions in association with railway officers on advisory councils, etc. (not as directors as at first claimed), and for the continuance of the Central, National and local Wages Board. It was considered that these provisions, some of which represented agreements already made in conjunction with the fare and rate increases in force according to the proposals of the Rates Advisory Committee, would enable the railway companies to operate under solvent and economic conditions on the termination of control on Aug. 15 1921. In regard to amalgamation it may be mentioned that early in 1921 preliminary arrangements of this character had already been made in regard to the North-Eastern and Hull & Barnsley railways, and the London & North-Western and Lancashire & Yorkshire railways, in addition to several smaller companies to be absorbed by their larger neighbours. The chief difficulty, in fact, was in regard to Scottish railways, which, it was claimed, would be so seriously affected that they could not hold their own in a group by themselves, the alternative of amalgamation with appropriate associated English companies being favoured. Hence the altered grouping adopted by the Act as finally passed. Control was actually terminated at midnight on Aug. 15 1921.

Restoration of Facilities.—During the war many usual facilities of travel were withdrawn, but during 1920–1 a number were restored, as follows: pre-war luggage allowance for passenger-train traffic, June 14 1920; passengers' luggage in advance, July 1 1920; day excursion tickets, Aug. 12 1920; period excursion tickets, Dec. 24 1920; week-end tickets, May 11 1921 (deferred, owing to the coal strike, until Aug. 20, and Aug. 19 in the case of commercial travellers). G.E.R. continental services were resumed Feb. 25 1919; L.B. & S.C.R., June 1 1919; the Dover-Calais route, S.E. & C.R., Jan. 8 1920; and the Hull and Zeebrugge route, N.E. and L. & Y. railways, May 14 1920. Express-train running was rapidly restored to a good level during 1920, and though still below pre-war standards the main line services on all routes became very creditable in July 1921, both for speed and number. On some lines, indeed, pre-war schedules were definitely reinstated, and in certain instances facilities were even better than before the war. The suburban traffic problem was, however, still serious. On the "Underground" lines new rolling stock, when delivered, materially eased the inevitable congestion. An arrangement had been made during the war whereby the associated "Underground" railways, of which the

Metropolitan District only was controlled and subject to Government guarantee, should pool their receipts, including also the London General Omnibus Company. To meet the peculiar conditions of the situation a special Act of Parliament was passed, and from Sept. 26 1920 these lines were empowered to charge "revised fares," the Metropolitan District railway ceasing to come under the guarantee. Allocation of passenger travel to specific routes, already partly in desuetude, partially disappeared during the early months of 1921, and finally in July of that year.

Goods Traffic.—During 1920 most of the special regulations imposed under war conditions disappeared, though the common-user of wagons still continued, and by coöperative action it had become possible to realize a higher standard of wagon loading. Commencing with the four weeks ending Jan. 29 1920, the Ministry of Transport commenced to issue detailed statistics of goods traffic operation, and on the completion of twelve months these were altered to agree with the calendar months, in combination with corresponding passenger traffic statistics. (J. A. K.)

UNITED STATES

The decade 1910–20 was marked by many fundamentally important developments in organization, management, and public regulation of American railways. During the early part of the period a tendency, which had begun during the latter half of the preceding decade, toward a decreasing rate of return on the investment in railways caused serious financial distress and a marked decline from the normal rate of development of railway facilities, equipment and service. The years 1915 and 1916 brought large increases in freight tonnage through the transportation of war materials for the Allies. The active participation of the United States in the World War, beginning in April 1917, made even greater demands upon facilities already overtaxed. To meet these demands the railways tried the experiment of voluntary unification through a committee of railway presidents clothed with plenary power by the boards of directors of practically all railway companies to operate the railways as one national system during the war. In the national emergency, in which the closest possible coördination of the agencies of transportation with the several branches of the Federal Government was absolutely essential, the experiment of voluntary unification was not satisfactory, and on Jan. 1 1918, as a temporary war measure, the railways were taken over by the Government, to be operated by a director-general responsible to the President. Federal operation continued until March 1 1920, when the railways were returned to private operation under the terms of the Transportation Act of that year. That Act fundamentally amended the existing policy of national regulation of railways and extended the powers of the Interstate Commerce Commission. Principally because of the serious business depression of 1920–1, and the decline in the volume of railway traffic, the results of the first year of operation under the Transportation Act were disappointing. In the summer of 1921 the subject again was commanding national attention. A choice among three policies was then incumbent upon Congress: (1) to rely upon private ownership and operation under the principles of the Transportation Act (hereinafter described) to take care of the situation when business conditions became normal; (2) to make some compromise between a policy of private control and initiative and Government operation or ownership; and (3) completely to nationalize the railways.

Pre-War Conditions and Legislation.—The 1910 amendment to the original (1887) Act to regulate commerce (*see* 22.830) created the Commerce Court to act upon appeals from decisions of the Interstate Commerce Commission. The new court was intended to specialize in the technique of transportation and to expedite the determination of cases theretofore passed upon by Federal courts of general jurisdiction with crowded dockets containing cases of all kinds. In many of its early decisions the Commerce Court overruled the Interstate Commerce Commission and, because it appeared to limit the effectiveness of the Commission, the Court became unpopular. The public attitude toward railways at that time was unfriendly, and Congress responded to public pressure by abolishing the Commerce Court in 1913.

In response to an insistent public demand, growing out of the belief that the railways were being allowed to earn returns on fictitious capitalization, the Federal Valuation Act was passed in 1913. The Act required the Interstate Commerce Commission to determine the physical valuation of the railways individually, as of June 30 1914, and to cause records to be kept which would accurately reflect all changes in property values after that date. Three bases were prescribed tentatively: (1) original cost to date, in the cases where the information could be obtained; (2) estimated cost of reproduction, new; and (3) estimated cost of reproduction, new, less depreciation. The work of determining values had been in progress since 1914, but no final figures were available in 1921 or expected until 1923 at earliest, although tentative valuations of a few properties had been made public.

Another piece of legislation, known as the Clayton Act, of 1914, contains a section which has an important bearing upon railways. The Act was intended to strengthen the so-called Anti-Trust Act and to prevent collusion between directors and officers of railways and directors and officers of manufacturing and other concerns dealing in railway equipment, coal and other supplies. It requires that contracts for supplies which will cost more than $50,000 must be open to competitive bids invited by advertisements. A railway company is prohibited from having dealings in excess of $50,000 per year with a concern having a director, officer or agent who is also a director, officer or agent of the railway. The Act was to be in force from 1916, but because of war conditions the effective date was postponed until Jan. 1 1921.

About 1906 a downward tendency began to be apparent in the rate of return on railway investment. This change restricted the flow of new capital into railway development—new lines and improvements of existing lines. The traditional policy of American railways had been to keep their facilities well ahead of the demands of growing traffic. In view of the fact that the volume of freight traffic doubles about every 12 years, and that the numbers of passengers carried one mile doubles about every 15 years, the need of such a policy is apparent. The practice of the conservative railways was to "plough in" a substantial part of their net income each year by making improvements out of income instead of issuing new securities. Such a policy, however, could not be continued with constantly diminishing net income. The downward tendency in the rate of return was caused in part by a hardening of the rate structure through a more inflexible policy of public regulation, in part by steadily increasing costs of wages and materials, and in part by the greater difficulty of finding means through economies and new operating methods of overcoming increasing costs. With declining net returns, and a general lack of confidence on the part of the public toward railways, railway securities lost their attraction, and investors sought other fields. The railways experienced much difficulty in obtaining new capital for the additional facilities required to keep their plants in step with traffic growth, and many of the weak lines reached such financial straits that they could not maintain their solvency. The cumulative effect of these tendencies reached the climax in 1915 when 42,000 m., or about one-sixth of the entire mileage of the country, was in the hands of receivers, and when less new mileage was built than in any year since the period of the Civil War.

Effects of the World War.—This was the situation when the effect of the World War was first felt by American railways. The orders from the Allies for munitions and other war supplies caused a sudden increase in freight tonnage. The additional revenues acted as a stay against financial distress, but the railways found their traffic-carrying capacity taxed to the full. Then came the added traffic burden when the United States entered the war in April 1917.

To meet the emergency the railways, through the American Railway Association, organized a railroad war board and delegated to its five members complete control over operation. The purpose was to coördinate management under private ownership and control so that the railways, during the war emergency, would merge their merely individual and competitive activities in the effort to produce the maximum of transportation efficiency. The board did much to increase the capacity of the railways through unified operation and common use of facilities, and during the first six months following voluntary unification, the heavily increased traffic was handled satisfactorily. But during the late autumn and early winter of 1917 acute traffic congestion occurred at the Atlantic seaboard ports, through which the greater part of the war supplies was exported, and the blockade extended back to the important inland industrial centres. The congestion was caused by several factors, among which two were outstanding. One has already been mentioned—the financial inability of the railways to keep up their former programmes of providing additional facilities in advance of traffic needs. The second was the lack of effective coördination between the railways and the several branches of the Government, each of which demanded priority of movement for its freight, thereby creating great confusion. The congestion and its interference with traffic, the perilous financial condition of the railways, the spirit of unrest among railway employees because of the greatly increased wage rates paid by manufacturing and ship-building plants, and the need of better coördination of all agencies essential to the successful prosecution of the war, led to the President's proclamation of Dec. 26 1917, taking over the railways to be operated by the Government from Jan. 1 1918. The Government could advance the funds required to provide the additional facilities urgently needed for war purposes; by paying a rental equivalent to pre-war net operating income it could prevent further bankruptcy of railway companies; by paying higher wages than the railway companies were able to pay, it could remove the cause of unrest among em-

employees; by making the railways a branch of the Government it could more effectively coördinate transportation with other Government activities; and by the complete temporary elimination of lines of corporate interest a more effective unification of all facilities and equipment would be possible.

Federal Control in the War.—The Federal Control Act of 1918 provided that the railways should be operated for the President by a director-general of railroads. Practically all of the railways were taken over, and were operated, with little change in the individual units, by Federal managers (in nearly all cases the former operating executive) reporting to regional directors, seven in all, who in turn reported to the director-general. The latter was assisted by staff-directors in charge of the several divisions—law, finance, purchasing, traffic, operation, labour, accounting, public service and capital expenditures. With few exceptions the entire organization, from the Federal managers to the regional and division directors, was made up of men carefully selected from the railway service. Political influence had no play in appointment. The Act provided that the railways should be returned to their owners for private operation within 21 months after the signing of the treaty of peace. The Government during the period of Federal control was required to keep up the usual standards of maintenance, so that the properties would be returned at the end of Federal control in as good condition and as complete in equipment as when taken. Failing to do this, the railway companies were to be compensated for the deficiencies. The annual rental was set as a sum equal to the average annual net operating income earned by the companies during the three years ended June 30 1917. The principles of unification and consolidation of facilities and equipment were carried much further by the director-general than by the Railroad War Board. Terminals and other facilities, and locomotives and cars, were used in common. Advertising, soliciting, off-line agencies, and other normal competitive activitives were abolished. Traffic was routed by the most convenient lines, regardless of shippers' directions, or of the effect of diversions on the earnings of the individual units in the national system. The aim was to utilize every instrumentality of transportation to the highest degree of traffic-handling efficiency.

The results of Federal control during the year 1918 while the war was in progress were satisfactory in that they met the emergency. The traffic of that year, both in ton-miles and in passenger-miles, exceeded all previous records. What was more important, the coördination of railway management with other branches of the Government had the effect of producing the kind of transportation most necessary for war purposes. The congestion of the early winter of 1917 was quickly relieved. The heavy demands of troop movements were completely met. The loaded cars on hand at the seaboard were always a little ahead of the ocean-going tonnage capacity, and the railways, after May 1, kept up their part of the programme of moving export food supplies for the civilian population of the Allies. The insistent preference given to war traffic naturally entailed some curtailments in service for civilian population of the United States. These curtailments were patriotically accepted. A system of centralized control established priority for the various kinds of freight and controlled traffic at the source by requiring permits before freight would be accepted. Such permits were not issued unless transportation conditions at destination were such that the freight could be quickly unloaded. Manufacturers and dealers were asked to load cars with larger shipment units, or otherwise to conserve car space by changing methods of packing. One of the first acts of the director-general was to appoint a commission to make recommendations as to wage increases. The commission made its report in May and its recommendations were adopted and made retroactive to Jan. 1 1918. The increases in pay-roll expenditure were substantial. Coincident with the promulgation of the new wage scale, the director-general created the Board of Railway Wages and Working Conditions and later he appointed three Boards of Adjustment to pass upon disputes as to working rules and discipline. Both the wage and the adjustment boards were bi-partisan with equal representation from the officials, representing management, and from the executives of the labour organizations, representing the employees. During 1918 there were no strikes or other labour disturbances. The director-general was given almost autocratic authority to increase freight and passenger rates and other transportation charges or regulations. The Interstate Commerce Commission and the state commissions temporarily were shorn of power. An increase of 25% in freight rates and about 20% in passenger rates was made effective in June, a few days after the wage increases were announced. While in a general way it was hoped that the advances in rates, coupled with the expected economies in unified control, would offset the higher wage rates and other increases in operating costs, the net financial results were regarded as of secondary importance as compared with the increase of transportation capacity. The rate advances were insufficient to meet rising costs and the final result of the first year of Federal control, with no allowances for deficiences in maintenance or depletion in stocks of materials and supplies, was a deficit of over $200,000,000. In other words, the net operating income earned by the director-general was that much less than the rentals paid to the railway companies. This deficit, however, may properly be regarded as one item of the cost of carrying on the war. In view of the satisfactory transportation service, particularly during the summer of 1918 when the armies of the United States were at the height of their activities, and comparing the deficit with the expenditures of other branches of the Government, the cost was not great.

The second phase of Federal control was the period from the signing of the Armistice in Nov. 1918, until March 1 1920, when the roads were returned to private management. This post-war period of Federal control was not marked by results as satisfactory as those of 1918. It would have been much better if the period of Federal control had ended Dec. 31 1918. Immediately after the Armistice the moral factor of patriotism, which had been so effective during the first ten months of Federal control, almost entirely disappeared. As soon as the war was over the employees through their organizations began a campaign to hold and to extend further the concessions which had been made freely under the exigencies of war; the thoughts of the officers began to turn to their corporate and personal interests; and among a minority of the administration officials active steps were taken to bring about an indefinite extension of Federal control with the ultimate aim of nationalization. The public, however, had little patience with the director-general's proposal to Congress that Federal control should be extended five years, and the suggestion had little support outside of the labour organizations and the political forces aligned on the side of nationalization. Chambers of commerce, shippers' organizations, and the general public, in the natural reaction against perpetuating war-time governmental control of business, insisted that the railways should be returned to private control. This general attitude toward the subject, and the alarming deficits which were being added to that of 1918, influenced Congress to take active steps to restore the railways to their pre-war status, but great difficulty was experienced in agreeing upon a plan which would be satisfactory in detail to both the House and the Senate. While the hearings and the debates dragged throughout the year 1919, the transportation service suffered in efficiency and among the more radically inclined employees there were frequent and serious strikes. It was found necessary to grant further increases in wages and to enter into the so-called "national agreements" containing many burdensome and restrictive rules such as, for example, the abolition of piece-work in shops. Most of these national agreements were made almost on the eve of the return of the railways. They were drawn by the labour advisors to the director-general and were adopted over the protest of the railway operating officials. These national agreements were partially abrogated July 1 1921, by order of the Railway Labor Board created by the Transportation Act of 1920.

The final cost to the Government for the 26 months of Federal control was estimated by the director-general at a minimum of $1,200,000,000. It seemed probable that it would be much greater, as this estimate allowed only about $300,000,000 for under-maintenance and for differences in the quantities of materials and supplies on hand at the beginning and at the end of Federal control.

A great deal of controversy arose over the question of relative maintenance during and prior to Federal control, but the differences hinge mainly upon the degree of under-maintenance. There can be no doubt that the condition of the properties was not so good at the end of Federal control as at its beginning, but the exact degree of deterioration cannot be determined as no inspection or survey was made when Federal control began. The records show conclusively that the normal rate of renewals of rails, ties and ballast was not kept up during Federal control, and the universal complaint of the railway executives that freight cars were not maintained at normal standards is supported by the opinions of experts. On the whole, the conditions of locomotives did not suffer, but less than the normal amount of work was done on passenger cars. Bridges and buildings suffered because of neglect in painting, but on the other hand many improvements were made in shops and in engine-house facilities. Whatever may be the degree of under-maintenance it should be remembered that it was impracticable during the greater part of the period of Federal control to obtain the necessary amount of materials and full forces of men. These difficulties were partly removed in 1919, but in that year the serious decline in traffic and in earnings made it inexpedient, in the judgment of the director-general, to attempt to make up the deficiences. A proviso in the contract between him and the railway companies gave the director-general the option of measuring his maintenance obligations by the amounts actually spent by each company during the three years prior to Federal control, these amounts to be properly equated to allow for increases in the cost of wages and materials, and he chose to limit the expenditures so as to keep them within that obligation, leaving the accounting and the settlement to be worked out after the termination of Federal control. Instructions were issued, however, that nothing essential to safety in operation was to be left undone. An inspection of the amounts spent for maintenance, particularly for maintenance of equipment, indicates that even with a generous allowance for the higher wage rates and material costs, the director-general expended amounts which were equivalent to those spent by the railway companies prior to Federal control. This method of comparison, however, takes no account of the important factor of relative efficiency of labour. During 1918, when so many railway men were drafted or had volunteered for military service, the percentage of inexperienced employees was abnormally large, and during 1919 the general lowering of the morale and the frequent strikes of men engaged in maintenance work led to a much lower degree of efficiency. The director-general held to the view that the Federal Control Act and the standard contract based upon it did not require him to take account of relative efficiency—that his obligation ended when he had expended an amount equivalent, when properly equated for the higher wage rates, to that spent in the test period. The railway companies on the other hand insisted that if in the test period 100 man-hours cost $30 and produced 10 units of work, and if during the year 1919 the same number of man-hours cost $60 but produced, say, 8 units of work instead of 10, the spirit of the Act is not followed unless the director-general spent enough in excess of $60 to produce 10 units of work. This is the real point of difference. In the settlements made since the termination of Federal control this issue has been avoided by a policy of compromise and by lump-sum adjustments in which maintenance is but one factor, but it is probable that some of the companies which have large claims for under-maintenance pending may prefer to take the case to the courts for decision.

Too much emphasis, however, should not be placed upon the financial results of Federal control. Deficits might have been reduced or entirely avoided, and a surplus laid aside for the settlement of claims, if the 1918 advances in rates had been greater or if supplementary advances had been made in 1919 to take care of the further wage increases granted in that year. The attitude of the administration was that it made little difference whether the higher operating costs were met indirectly through taxes or were directly collected from shippers and passengers in higher rates. As between the two alternatives the administration chose the first on the ground that another rate advance would have a serious effect upon the already much disturbed business conditions, and would be made the excuse for further profiteering. Speaking in general terms it may be said that the policy of the Government in taking the railways and operating them while the war was in progress was vindicated by the favourable operating results which flowed from a centralized and unified control. On the other hand it may be said that the experience of the post-war period of Federal control was not such as to justify a peace-time policy of Government operation or ownership under a democratic form of Government which relies upon the free play of the forces of competition. The unfavourable reaction of public opinion may be traced primarily to the elimination of competition in service. The railways were finally returned in response to an overwhelming public demand that private operation be restored, and almost immediately after its restoration, the desire for competitive service caused the abandonment of practically all the innovations of unification under Government control and operation.

The Transportation (Esch-Cummins) Act of 1920.—The conditions under which the railways were returned, and the policies of public regulation as they existed in 1921 were fixed by the Transportation Act of Feb. 1920, amending the original (1887) Act to Regulate Commerce. Besides providing for the restoration of operating control to the owning companies the Act provided that during the first six months, the so-called transition period, while railway rates and wages were in process of further upward revision, the Government would continue the guaranteed rentals paid during the period of Federal control. A Railroad Labor Board was created to pass upon wage matters, and made substantial increases in July 1920. The Interstate Commerce Commission was instructed to establish rates so that on the basis of current costs and under honest, economical and efficient operation, they would yield net operating income sufficient to pay a fair rate of return upon the value of the railway properties held for and used in the service of transportation. For the first two years the fair rate of return was set at 5½%, with an extra 0·5% (6% in all) to make provision for improvements chargeable to capital accounts. This mandate to the Commission, however, applied to the railways as a whole, or as a whole in territorial groups. For the purposes of the Act the Commission later divided the railways into three general groups, the eastern, the western and the southern. The mandate did not apply to individual roads in a group. Obviously a rate scale which will yield 6% to all of the railways in a group will yield more than 6% to some and less than 6% to others. No relief is provided for the railways which earn less than 6%, but when more than 6% is earned by a railway, the excess is to be evenly divided with the Government. The railway is to hold its proportion of such excess in a reserve fund and the one-half which goes to the Government is to be held by it as a general railroad contingent fund to be administered by the Commission in assisting the weak roads by loans. The reserve fund created by a railway from its excess earnings is to be held for interest charges or dividends in lean years, but whenever that fund is more than 5% of its property value, the excess over 5% may be used for any lawful purpose.

The problem of the weak railway has been for many years the principal obstacle in the path of a satisfactory solution of the railway question. In the determination of competitive rates, for example, a scale which will give a reasonable return upon the value of a weak railway will give too much to the strong railway. Conversely, when the scale gives a reasonable return, but not more, to the strong railway, the weak one cannot live. In practice the regulating authorities have been forced to adopt a middle ground with, perhaps, a tendency to lean more toward preventing an unreasonably high return to the strong than an unreasonably low return to the weak. An attempt has been made to meet this problem in the Transportation Act which provides for the ultimate elimination of the weak railways by consolidation with the strong. The Commission is ordered to prepare and adopt a plan for the consolidation of railway properties into a limited number of systems. Such a plan is to preserve a reasonable degree of competition and to maintain so far as practicable the existing routes and channels of trade and commerce. The desiderata are that the several systems shall be so arranged that the cost of transportation as between competing systems, and as related to the values of the properties, shall be approximately the same, so that these systems can employ uniform rates in the movement of competitive traffic, and can earn, under honest and efficient management, substantially the same rate of return upon the value of their respective properties. The Commission in June 1921 was engaged upon the formulation of such a plan, but as the Act provided no way in which its recommendations might be enforced when objections were raised against its terms, there seemed likely to be long-drawn-out controversy and additional legislation before an ideal scheme of consolidation into a small number of systems of fairly equal financial strength would be made effective. The new Act enlarges the powers of the Commission over financial management and requires it to exercise a general supervision over all new issues of securities. The Railway Labour Board (consisting of nine members divided equally among representatives of management, labour and the public) is empowered to fix wages and working rules.

The foregoing outline mentions most of the important new features in the 1920 legislation amending the original Act to Regulate Commerce and the amendments up to 1920. The fundamental provisions of the original Act remained in force in 1921 and had been extended or otherwise strengthened. Briefly, the Commission is required to see that rates and charges are just and reasonable; to prescribe the rules under which rates may become effective; to prevent unfair discriminations between shippers, carriers or localities; to prevent, except when specifically authorized, the charging of a higher rate for a short haul than for a longer haul over the same route in the same direction; to prevent the pooling of freight or earnings; to require complete reports from carriers in prescribed form; and to prescribe and enforce uniform rules for accounting and for compilation of statistics of operation.

In addition to the Federal legislation just described, each state exercises its powers of regulating intrastate traffic and of exercising what may be termed "police powers" over railway management and service within its own borders. The line between Federal and State regulation is not clearly drawn, and controversies between the two authorities have been frequent. On the whole, the tendency of court decisions during the decade 1910–20 was toward according greater powers to the Federal commission and less power to the State commissions, as it has been shown that the states, when exercising control over intrastate rates and service, may indirectly discriminate against interstate traffic and service.

In addition to the changes in the Act to regulate commerce, new legislation was enacted during the decade which strengthened and extended the laws pertaining to safety appliances and accident prevention. These laws govern certain features of design and maintenance of locomotives and cars and of operating methods in train service. For example, the use of high-power headlights has been made compulsory, and the requirements as to boiler inspection and the general condition of locomotives have been made more rigid. The scope of the laws governing maximum hours of service was enlarged. The eight-hour basic day, prescribed for train service employees by the Adamson Act, passed by Congress in 1916, was extended during the period of Federal control to apply to practically all classes of railroad employees.

Statistics.—The salient features of mileage, investment, income and transportation production in ton-miles and passenger-miles, are shown in Table I. compiled by the Bureau of Railway Economics, Washington, D.C., under date of March 21 1921. The figures apply only to Class I. railways, *i.e.* those which have operating revenues in excess of $1,000,000 per year. These railways comprise about 92 % of the total main-track m., about 95 % of the total capitalization, and they earn about 97 % of the total operating revenues.

In interpreting the figures in Table I. it is necessary to bear in mind that the results of 1917–20 were very much affected by war conditions and by Federal operation of railways from Jan. 1 1918 until March 1 1920. The period was one of abnormally high operating expenses and of greatly diminished net income, notwithstanding the large operating revenues. Obviously a continuation of the low income of 1919 and 1920 would cause universal railway bankruptcy. The aim of the Transportation Act of 1920 was to restore the prewar earning power, to enable the railways to give better service, and to provide revenues which with reëstablished credit would permit expansion and improvements in facilities and equipment.

Details for 1917.—Instead of figures for a later year, those of 1917 are selected to give an indication of the normal characteristics—financial, operating and public service of American railways.

On Dec. 31 1917 the total route mileage of railways of all classes was 253,626 miles. This was equivalent to 8·53 m. of railway for each 100 sq. m. of territory, or 24·39 m. for each 10,000 inhabitants. The relation of route mileage to track mileage (for Class I. roads only) is shown in Table II.:—

TABLE II. ROUTE AND TRACK MILEAGE. CLASS I. ROADS, DEC. 31 1917

Item	Miles	Per cent. of route miles
First main track (route m.)	232,697	100·0
Second main track	29,913	12·9
Third main track	2,775	1·2
All other main tracks	2,190	·9
Yard tracks and sidings	101,108	43·5
Total all tracks	368,683	158·5

The total route m. for railways of all classes in 1917 was owned by 1,874 separate companies. Of these, 186 were railways of Class I. with route mileage as shown in Table II., made up of 178,707 m. owned and 53,990 route m. operated under lease or similar arrangement. The average route mileage operated per Class I. road was 1,251 miles. For railways of Classes II. (those with operating revenue $100,000 to $1,000,000 per year) and III. (those with operating revenues below $100,000 per year, including switching and terminal railways) the average was 44 miles. The greater part of the mileage owned by the large number of small companies is leased to and operated by Class I. roads.

Finances.—The total railway capital outstanding Dec. 31 1917 was $21,249,357,241. This, however, included certain duplications in securities of one company held by another company and used by the second company as the basis for additional securities. Eliminating the intercorporate holdings and other duplications, the net capitalization on that date was $16,401,786,017, or $66,699 per route mile. Of this net capitalization, $39,930 per route m., or 59·9 % of the total, was in capital stock, and $26,769, or 40·1 % of the total, was in bonds or other forms of funded debt. In that year the average dividend paid on all stock was 4·24 %, but no dividends whatever were paid on 36·7 % of the stock. The average dividend rate on the dividend paying stock alone was 6·81 per cent. The average rate of interest paid upon funded debt may be estimated as about 4 per cent. The number of stockholders was approximately 670,000 and the number of bondholders about 300,000.

Table III. gives the income account of all railways considered as one system, including switching and terminal companies, for the year ended Dec. 31 1917:—

TABLE III. INCOME ACCOUNT, ALL RAILWAYS, 1917

Railway operating revenues	$4,178,784,652
Railway operating expenses	2,956,770,809
Net revenue from railway operations	1,222,013,843
Railway tax accruals	227,301,093
Uncollectable railway revenues	711,879
Railway operating income	994,000,871
Equipment and joint facility rents (net deduction)	26,573,773
Net railway operating income	967,427,098
Other income (non-operating)	101,808,148
Gross income	1,069,235,246
Net interest charges	475,646,748
Other deductions from gross income	24,371,700
Net income	569,216,798
Net dividends (including dividend appropriations from surplus)	293,291,805
Income above dividends	275,924,993

Of the total operating revenues about 70 % came from the transportation of freight and about 25 % from passenger-train service including mail and express. The remaining 5 % was miscellaneous operating revenue. The operating expenses were divided as follows: maintenance of way and structures, 15·6 %; maintenance of equipment, 24·2 %; traffic (solicitation, advertising, etc.), 2·3 %; transportation (operation of stations, yards, terminals and trains), 53·6 %; general expenses, 3·4 %; and miscellaneous, 0·9 %.

On Dec. 31 1917 the equipment owned by railways of all classes was as follows:—

Steam locomotives	65,699
Other locomotives	371
Freight train cars	2,408,518
Passenger train cars	55,939
Company service cars	103,916
Steamboats and tugboats	411
Barges, car-floats and canal boats	1,868
Other floating equipment	163

The item "other locomotives" is made up almost entirely of electric locomotives. "Freight train cars" do not include private freight cars (numbering about 80,000) owned by meat-packers, oil companies and similar industrial concerns. "Passenger train cars" do not include parlour and sleeping cars owned by the Pullman Co., of which there were 7,706. "Company service cars" include ballast cars, construction cars, wrecking cranes, etc.

The average number of employees during the year 1917 for all railways was 1,833,732. For Class I. railways only, the number was 1,732,876, divided as follows:—

Class	Number	Percentage
General and divisional officers	18,446	1·1
Clerks, messengers and attendants	192,569	11·1
Maintenance of way employees	448,720	25·9
Maintenance of equipment employees	388,837	22·4
Traffic department employees	8,333	·5
Dispatchers and telegraphers	67,455	3·9
Station employees	132,562	7·6
Yard and engine-house employees	183,877	10·6
Train-service employees	226,936	13·1
All other employees	65,141	3·8
Total	1,732,876	100·0

TABLE I. MILEAGE, INVESTMENT, REVENUES, EXPENSES, 1911–20, INCLUSIVE, OF CLASS I. RAILWAYS

	Fiscal Years ended June 30.					Calendar Years ended December 31.				
	1911	1913	1914	1915	1916	1916	1917	1918	1919	1920
Miles of track operated — main track	244,300·77	254,821·20	259,139·53	262,424·88	264,920·40	265,802·97	267,574·12	269,174·54	270,556·62	*
Property investment — Class I. roads and their non-operating subsidiaries (investment in road & equipment, exclusive of materials and supplies)	$14,246,167,475	$15,284,763,489	$15,842,127,273	$16,257,146,632	$16,688,440,056	$16,884,440,038	$17,762,152,127	$18,213,629,613	$18,474,197,914	*
Total operating revenues	2,752,497,297	3,108,361,215	3,031,326,963	2,871,563,047	3,381,597,866	3,596,865,766	4,014,142,748	4,880,953,480	5,143,589,998	a$6,171,493,301
Total operating expenses	1,902,994,333	2,173,463,563	2,203,423,812	2,021,160,614	2,210,892,786	2,357,398,412	2,829,325,124	3,982,068,197	4,398,408,414	5,768,720,013
Operating ratio—%	69·14	69·92	72·69	70·39	65·38	65·54	70·43	81·58	85·51	93·47
Net operating revenue	849,502,964	934,897,652	827,903,151	850,402,433	1,170,705,080	1,239,467,354	1,184,817,623	898,885,283	745,181,584	402,773,288
Railway tax accruals	98,626,848	118,386,859	135,572,579	133,276,330	145,517,034	157,113,372	213,920,095	223,175,379	232,704,545	278,868,668
Uncollectable railway revenues	—	—	—	649,917	806,747	797,486	700,090	613,821	915,300	1,224,980
Railway operating income	750,876,116	816,510,793	692,330,572	716,476,186	1,024,381,299	1,081,556,496	970,197,438	675,096,083	511,561,739	122,679,640
Hire of equipment —net balance	Dr. 15,577,534	Dr. 15,611,817	Dr. 17,686,287	Dr. 19,128,943	Dr. 23,564,582	Dr. 23,767,262	Dr. 17,999,098	Dr. 15,676,577	Dr. 33,451,523	Dr. 33,086,318
Joint facility rents —net balance	Dr. 11,113,874	Dr. 13,288,541	Dr. 13,626,138	Dr. 14,242,410	Dr. 15,943,758	Dr. 17,704,717	Dr. 18,129,570	Dr. 20,850,903	Dr. 23,119,388	Dr. 27,664,696
Net railway operating income (Stand. ret. basis)	724,184,708	787,610,435	661,018,147	683,104,833	984,872,959	1,040,084,517	934,068,770	638,568,603	454,990,828	61,928,626
Rate of return on investment—%	5·08	5·15	4·17	4·20	5·90	6·16	5·26	3·51	2·46	b 0·34
Other income (including miscel. operating income)	272,638,887	241,629,540	243,768,847	186,232,946	192,709,534	210,066,879	233,252,283	309,067,492	265,261,955	*
Total income	997,952,317	1,029,239,975	904,786,994	869,337,779	1,177,582,493	1,251,151,396	1,167,321,053	947,636,095	730,252,783	*
Rent for leased roads	124,960,314	133,018,154	122,592,248	122,528,657	139,215,095	158,377,958	132,082,177	126,977,239	123,276,609	*
Interest on funded debt	345,843,570	368,134,889	373,296,354	387,029,566	399,348,125	406,667,567	403,305,438	396,465,997	404,430,691	*
Interest on unfunded debt	18,116,228	23,045,616	35,958,511	27,509,366	15,066,312	14,854,425	15,704,857	29,933,496	44,597,880	*
Other deductions	19,996,896	19,295,321	22,218,263	16,114,112	20,730,068	23,370,773	23,197,975	125,598,013	203,236,819	*
Net income available for dividends, etc.	489,035,309	485,745,995	350,721,618	316,156,078	603,222,893	646,880,673	593,030,606	268,661,350	Def. 55,289,216	*
Total dividends declared out of income and surplus	397,068,724	322,300,406	376,098,785	259,809,520	281,936,372	306,176,937	320,395,779	275,336,547	278,386,909	*
Revenue ton-miles	249,843,166,302	297,722,528,693	284,924,749,718	273,913,006,569	339,870,323,675	362,444,397,129	394,465,400,493	405,379,284,206	364,236,957,761	409,587,680,000
Revenue passenger-miles	32,371,444,793	33,875,085,958	34,566,985,414	31,789,928,187	33,645,908,150	34,585,952,026	39,476,858,549	42,676,579,199	46,351,863,983	46,686,275,000

*Not available in 1921. *a* Total operating revenues for 1920 includes approximately $55,000,000 of back mail pay collected in 1920 but applicable to services rendered in 1918 and 1919.
b Computed on investment of 1919.

NOTE: Net Railway operating income as shown above for 1918, 1919, and 1920 represents the actual earnings from operation of the Class I. railways. The "standard return" for these roads (*i.e.* the net operating income after collecting rental from the U.S. Government) amounted to approximately $898,500,309 for the years 1918 and 1919, and for 1920 amounted to approximately $825,000,000, taking into account two months of Government operation, six months of Government guarantee and four months of private operation.

The subsequent application, during Federal control, of the eight-hour day (instead of the former basis of 10 hours for a large proportion of employees) to practically all of the classified employees had the effect of increasing the number of men required to do a given number of hours of work. At the end of Federal control the total was about 2,000,000 employees, not including conductors and porters on Pullman cars employed by the Pullman Company.

Construction and Equipment.—The tendency in the decade 1910–20 was toward the use of heavier rails. On heavy traffic lines, using the most powerful locomotives, rails weighing 100 lb. per yd. were being replaced by rails weighing 105 to 110 lb. On other lines which had used 85-lb. rails, the tendency was toward 100-lb. rails. Greater attention was paid to the relative proportions of the chemical elements in steel and the mills were turning out rails of improved design and of greater strength and wearing qualities. The marked development in the weight of locomotives and cars placed much greater strains on the track superstructure and roadbed. In 1921 American Railway Engineering Association standards for depth of ballast had not been changed recently, but some of the heavy traffic roads were increasing the amount of ballast from 12 in. to 20 in. below the ties. The experiments in the use of steel and concrete ties as substitutes for wood ties (sleepers) had not given satisfactory results under the heavy axle loads of American equipment, and there was little inclination to use substitutes for wood, notwithstanding the marked depletion of the lumber supply. There was, however, a more general use of preservatives in treating ties chemically to strengthen their resistance to decay, and a more general use of tie plates, between the base of the rail and the top of the tie, to lessen the mechanical wear on the tie. The screw spike, in place of the cut spike, for fastening the rails to the ties, was having greater use, but was not common. The heavier axle loads required a general strengthening of bridges, and throughout the whole field of maintenance engineering the adoption of higher standards during the decade was noticeable.

There was a marked development in the art of signalling. The use of electrically controlled automatic block signals is distinctively an American characteristic. There was a steady tendency to substitute automatic block signals for the older type which are manually operated. In 1911 there were about 29,000 m. of main track equipped with automatic block signals. In 1920 the mileage so equipped was over 61,000 miles. The use of these modern signals not only increases the safety of train operation but it also has the effect of increasing the capacity per mile. In the interest of safety there was a popular demand that block signalling should be made compulsory by law, and the Interstate Commerce Commission has repeatedly recommended legislation which would require the railways to adopt an annual programme under which all railways would eventually be completely equipped with block signals. Congress, however, had not by Jan. 1921 legislated on the subject, mainly because of the difficulty of formulating a plan which would fit the varying needs of roads with differing degrees of traffic density, and because of the heavy financial burden which compulsory block signalling would place upon the railways. There was also a widespread demand for the adoption of a device of some kind which would automatically stop the train when the engineman failed to observe the signal and ran past one which was in the stop position, but Congress appears to take the position that it is more important first to extend the installation of block signals before insisting upon the expensive supplementary safeguard of the automatic stop.

In 1910 the average weight of all locomotives, exclusive of tender, was about 73 short tons. In 1920 it was about 90 short tons. The tendency was steadily toward the use of more powerful locomotives and the retirement of the lighter types. The locomotives ordered in 1920 weigh from 100 to 200 tons, with a few of the Mallet compound type of much greater weight. The use of steel passenger cars calls for larger locomotives in that class of service, and the American policy, consistently followed for years, of increasing the freight-train load, required the use of more powerful locomotives in freight service. The average freight-train load, in tons of freight, grew from less than 400 tons in 1910 to more than 700 tons in 1920. Not all of this increase is to be attributed to the heavier locomotive. Reductions in grades and curvature have made heavier trains possible. There was also a general improvement in the technique of tonnage ratings for locomotives. In addition there was a more general use of the superheater on locomotives. This device reduced the loss in steam pressure between the boiler and the cylinder and increased the drawbar pull. The use of automatic stokers on the most modern type of freight locomotive removed one limiting point: the capacity of the fireman in shovelling coal into the fire box. A recent device for increasing locomotive capacity is known as the "booster." It is a small auxiliary engine geared to the trailing axle (on locomotives which have a pair of wheels not connected with the main drivers) and may be used in starting the train or in giving an extra drawbar pull on the limiting grades.

While not so marked as in the case of the locomotive, there has been a steady increase in the weight and capacity of freight cars, particularly in those designed to carry coal, ore, or steel or iron products. The standard coal car of 1921 had a capacity of 100,000 lb., and in some cases cars of double that capacity were used locally on the owning road in coal or ore traffic. There was no appreciable increase in the capacity of box cars as the commercial standards do not call for larger units than 60,000 to 80,000 lb. per car.

Reference has already been made to the more general use of steel in passenger-car construction. Virtually no new wooden cars were built for passenger service after 1915. On Jan. 1 1911 the passenger-train equipment consisted of 50,201 wooden cars, 1,636 of steel underframe construction, and 3,133 of all-steel construction. On Jan. 1 1919 the numbers were: wood, 36,810; steel underframe, 8,805; all-steel, 18,652. The use of the old wooden cars was generally confined to local trains and branch lines.

Accidents.—A comparison of the latest available complete accident statistics (in *Bulletin 74, Interstate Commerce Commission*, published in Nov. 1920) with the statistics for 1907 and 1908 (*see* 22.832) indicate a gratifying improvement. The casualties in 1919 were less than those of 1907 or 1908, notwithstanding the fact that the volume of traffic in 1919 was nearly double that of 1907. The improvement may be attributed to several factors, but it is difficult to list them in the order of their importance as the influence of any one factor cannot be measured separately. Among them are (1) higher standards of construction and maintenance of way, structures and equipment; (2) enforcement of laws relating to safety appliances, boiler inspection, and hours of service; (3) extension of block signalling; (4) other improvements in operating methods; (5) the psychological effect of the "Safety First" movement, begun about 1910 (a nation-wide movement to interest railway employees in accident prevention); and (6) the publication of results of investigations made by the Interstate Commerce Commission in specific accidents. The data contained in the appended table were taken from *Bulletin 74.*

CASUALTIES TO PERSONS IN TRAIN ACCIDENTS AND TRAIN SERVICE ACCIDENTS

Item	1919 Killed	1919 Injured	1918 Killed	1918 Injured	1917 Killed	1917 Injured
Passengers:—						
In train accidents	110	4,549	286	4,655	131	4,460
In train service accidents	191	3,598	233	3,427	212	3,914
Total passengers	301	8,147	519	8,082	343	8,374
Employees on duty:—						
In train accidents	359	2,955	547	4,179	439	4,214
In train service accidents	1,334	33,325	2,212	42,782	2,177	48,022
Total employees on duty	1,693	36,280	2,759	46,961	2,616	52,236
Employees not on duty:—Total	66	321	169	595	165	544
Other persons, not trespassing:—						
In train accidents	9	61	117	433	109	473
In train service accidents*	1,873	5,134	1,878	5,268	2,091	5,514
Total other persons	1,882	5,195	1,995	5,701	2,200	5,987
Trespassers:—						
In train accidents	32	63	39	67	68	76
In train service accidents	2,521	2,595	3,216	2,738	4,175	3,753
Total trespassers	2,553	2,658	3,255	2,805	4,243	3,829
Grand Total	6,495	52,601	8,697	64,144	9,567	70,970

*Includes persons struck by trains at highway crossings.

The analysis of train accidents in 1919 shows that the total number was 25,596, divided as follows:—collisions, 6,904; derailments, 15,897; locomotive accidents, 674; and miscellaneous, 2,121. These figures include all train accidents, with and without personal injury. Collisions caused the death of 238 persons and the injury of 3,931. The casualties in derailments were 175 deaths and 2,979 injuries. The casualties in locomotive and miscellaneous accidents were relatively few. (W. J. C.)

RAILWAY STATIONS.—The improvements made during the decade 1910–20, especially in the United States, in the construction and operation of railway passenger stations, may be said to have revolutionized railway terminal construction; and the newer stations, of which the Grand Central terminal in New York is the outstanding example, demonstrated even after a short period of operation their superiority from practically every point of view. The substitution of electricity for steam as a motive power was the basic factor in the newer methods of construction. As long as steam was used little could be done to mitigate the noise or noxious gases that made the old-fashioned railway yard a public nuisance. It was virtually necessary to operate these yards on the surface where the products of combustion could make a free escape to the open air. In any confined space steam operation is not only dangerous, owing to the tendency of smoke to obscure the signals, but unpleasant for passengers. The use of electricity eliminates the noxious gases and reduces the noise of the locomotive. An electrified yard can be depressed and completely covered over. This permits the reclamation of streets and valuable areas hitherto obstructed by tracks, with the result that what was formerly a railway yard filled with steam and smoke can be utilized for public and private buildings of the finest character.

In Europe, the completion of the passenger station at Leipzig (1915) was practically the only terminal improvement that was not interrupted by the World War, although the Gare St. Lazare in Paris was somewhat enlarged, and in London, Waterloo station was partly reconstructed and a number of tracks equipped for electric operation. The Leipzig station was under construction from 1907 to 1915, and cost £6,500,000, of which, following the German practice, £2,900,000 was borne by Saxony, £2,550,000 by Prussia, £810,000 by the city of Leipzig and £240,000 by the imperial Post Office Department. The main building has a frontage of 984 ft. and occupies an area of 172,000 sq. feet. The train shed has a high roof of steel and glass, built in the form of six arches; it is 785 ft. long, with an area of 710,500 sq. ft., and covers 26 tracks. The station serves as a junction for the passenger traffic of Magdeburg, Thuringia and Dresden, and the larger part of the traffic between Prussia and Saxony passes through it.

At the close of the decade the Leipzig station was the largest, though not the busiest, station in Europe. It was smaller than the Grand Central and Pennsylvania stations in New York, and was in 1920 handling considerably less than half as much traffic as the Gare St. Lazare, the busiest station in the world. It was said in 1916 that the number of persons passing through the St. Lazare in a single month equalled the total number of soldiers fighting on all fronts. Plans were then undertaken to electrify the suburban traffic, which is very heavy, and to depress the suburban tracks to a level beneath the steam trains. Even without these increased facilities, the station furnished accommodations for 200,000 to 250,000 passengers a day, a record, however, very nearly equalled in London by Liverpool St. station. Both the Gare St. Lazare and Liverpool St. station handled on busy days twice as much traffic as the South station in Boston, the busiest American station.

TABLE I. *Largest Railway Stations.*

Station	Ac.	No. of Tracks	Trains per day	Passengers per day
Grand Central, N.Y. . .	80	67	600	110,000
Pennsylvania, N.Y. . .	28	21	500	75,000
Leipzig . .	20	26	400	—
St. Lazare, Paris . . .	12	31	1,700	200,000
Liverpool St., London . .	10	20	1,500	175,000
Waterloo, London . . .	9	18	1,100	100,000
South, Boston . .	10	28	1,000	125,000
Kansas City . . .	18	18	400	65,000
Northwestern, Chicago .	8	16	450	70,000

Outside of Europe and North America two important stations were erected, one in Argentina and one in Japan. The Retiro station of the Central Argentine railway at Buenos Aires, said to be the finest station in South America, was opened in the latter part of 1915. The terminal, including buildings, train sheds and approaches, occupies 744,000 sq. ft., and in point of size and design compares with any of the newer stations elsewhere. Much of its equipment was supplied by English contractors. The Central Railway station in Tokyo, completed in 1915, was erected at the very small cost of £270,000, although it is built on a scale which in the West would cost 10 or 20 times as much. The explanation lies in the extremely low price paid for Japanese labour, 10d. ($.20) a day (of 10 to 12 hours) for common labourers, and £5 a month for carpenters and masons. Estimated in days' labour, the cost was 730,000 labourer-days. The main building is of brick and granite, 1,104 ft. long, 66 to 132 ft. wide and 54 ft. high, with a dome (152 ft.) at either end. The terminal took the place of three stations which formerly served the three main-line Government railways.

In the United States and Canada a constantly increasing railway traffic made necessary the construction of a large number of new stations. Terminals that had been erected with the expectation that they would serve their purpose for 50 years or longer became inadequate in less than half that time. The result was that the newer stations were built on what would otherwise be considered too extravagant a scale. The designers were looking to the future.

One distinctively American contribution to the advance of terminal architecture was the invention of an improved roof to take the place of the great arched train shed, once considered the most necessary adjunct of a railway station. Cold in winter and hot in summer, these sheds were expensive to build and expensive to maintain. Even at the height of their popularity there were some designers who preferred the umbrella or butterfly types of shed, consisting of a series of low arches which, viewed in cross section, suggest the names by which they are known. After 1905 the Bush type of shed began to supersede all others, especially where steam was still tolerated in the terminal area. This shed was the invention of Lincoln Bush, who made the first installation at the Hoboken terminal of the Delaware, Lackawanna & Western railway, of which he was chief engineer. The Bush shed is similar to the butterfly and umbrella sheds; it differs principally in that it affords a continuous roof except for an overhead slot above the centre of each track for the escape of steam and gases from locomotives. A shed of this pattern affords protection from the weather, is free from smoke and dirt, and costs about one-half as much as the large arched shed. Within ten years after its invention the Bush shed had been adopted in 11 American and Canadian terminals, notably the Michigan Central station at Detroit, the Northwestern at Chicago, the Grand Trunk at Ottawa and the Canadian Pacific at Montreal. In England there was developed a somewhat different type known as the "ridge and furrow," of which the Snow Hill station of the Great Western railway at Birmingham, reconstructed in 1914, furnishes an example. The Snow Hill train shed consists of a series of transverse girders (275 ft. long with four supporting columns) spanning the entire width of the station. The best results, however, can be attained only where the smoke and dirt of steam operation are eliminated altogether. The problem of the train shed was most completely solved in the Grand Central terminal, New York, where electricity was adopted as a motive power. Here the "sheds" closely resemble the stations on a subway or underground railway.

Less successful in this respect, though of first-rate importance among the new stations of the period, was the Pennsylvania station in New York. Being of the so-called through-station type, this station is essentially a monumental bridge over the tracks, which traverse Manhattan Island in tunnels under the city. The main building was designed after the Roman Doric style of architecture and occupies two complete blocks (8 ac.), on Seventh Avenue from 31st to 33rd Streets. The general waiting-room is 277 ft. by 103 ft., with a height of 150 feet. The train yard or shed (340 ft. by 210 ft.) is an "undisguised example of modern engineering in glass and iron," and suggests somewhat the old-fashioned train shed. The station was built primarily to provide the Pennsylvania railway with a terminus in New York (before 1910 the terminus was in Jersey City), and the construction of the river tunnels, which were necessary to make a connexion with Manhattan Island, was an engineering feat of considerable magnitude. The improvement extends from Manhattan Transfer, 1 m. east of Newark (about 7½ m. from the terminal), to a connexion with the Long Island railroad at Woodside, L.I., which also used the Pennsylvania station as a terminus. At Manhattan Transfer incoming Pennsylvania trains change to electric operation and are hauled by electric locomotive, operating with a direct current of 600 volts from a third rail. At the New Jersey shore they descend into one of the two approach tunnels and proceed under the Hudson river and New York to the Pennsylvania station. As soon as empty they leave the station to the east, still travelling underground in one of four tunnels which pass under eastern Manhattan and the East river to Long

Island, where they emerge not far from the railway yards. The terminal was completed in 1910 at a cost of $115,000,000.

The Grand Central terminal, undoubtedly the most successful modern terminal of any type, was begun in 1903 and opened to the public in 1912. The primary purpose was to provide not only the necessary traffic facilities for an enormous number of passengers—ultimately expected to reach at least 250,000 a day—but to ensure pleasant and comfortable accommodations for every passenger, even at times when the crowds were heaviest. Subsequent development of the terminal area has made the Grand Central terminal not merely a railway station but a civic "center" of impressive beauty and utility. A railway station should form a harmonious unit in the architectural development of the city, but the designers of the Grand Central terminal accomplished something more than that: they actually transformed the architectural aspect of a very considerable section of New York. They achieved this result partly by setting a high standard themselves and partly by causing practically every property owner and builder within that section to measure up to it. The achievement was the more remarkable in that the entire project was conceived and carried out by the New York Central lines, a private corporation, without assistance of the city or state. The extraordinary architectural and economic success of this terminal was largely due to the intensive utilization of areas immediately adjoining the tracks and even over the tracks themselves—areas that were formerly incapable of being used or were suitable only for cheap dwellings or certain kinds of factories. Early plans did not contemplate buildings of a greater height than six stories in the immediate terminal area, but as soon as it was evident that noise, smoke and dirt had been successfully eliminated there arose a demand for hotels and office and apartment buildings of 25 and even 30 stories. This development was favoured by the fact that in constructing the terminal the engineers were able to restore to public use a number of streets that had hitherto been entirely done away with or existed only as foot bridges. The underground areas, yards, etc., occupy about 80 ac., which above the surface are covered with a great variety of buildings. It was not long before the enormous expenditure on the terminal, about $150,000,000, came to be economically justified by reason of the high return obtained from the lease of the space over the yards, etc., for building purposes, the so-called "air rights." In 1920 this return was sufficient to meet the fixed charges on the entire investment. The problem of building the station was extraordinarily complicated, and the closest coördination between the operating and engineering departments was necessary to carry out the new construction while tearing down the old station and at the same time keeping in operation some 800 trains a day, including those run for construction purposes. There were excavated 3,250,000 cub. yds. of material (more than two-thirds of which was solid rock), and in the construction there were used about 1,000,000 bar. of cement; and all this work was performed without interruption to the service rendered the public. The architects, Reed & Stem and Warren & Wetmore, adopted a modified Doric style. The "head house," or station proper, is of monumental proportions and the façade (on 42nd St.) consists of three great portals designed to carry out the idea of a gateway. The exterior is granite and Indiana limestone. The main concourse, with a length of 275 ft. and a width of 120 ft., can accommodate 30,000 people at one time. Its great height (125 ft.) gives it an effect of unusual spaciousness. From the concourse the passenger walks directly out on the same level to the "express" platforms. In winter the main concourse is kept warm by indirect heating, and the station platforms are protected against inclement weather so that even on the coldest days the passenger can board his train in comfort. The tracks occupy two levels. The express level is 20 ft. below the level of the street (Park Ave.) and occupies 45·4 ac.; the suburban level is 44 ft. below the street and occupies 32·8 acres. There are 42 tracks on the upper level and 25 on the lower; a special waiting-room (the suburban concourse) gives access to the latter. Leading from the main concourse are connexions with the incoming waiting-room (or station), the Commodore and Biltmore Hotels, the Yale Club, the Vanderbilt Concourse office building and various other buildings. The incoming waiting-room, located beneath the Biltmore Hotel, has separate passage-ways of its own leading to the concourse, the subways, the street, etc., so that passengers arriving in the terminal do not interfere with the flow of people to trains. The use of ramps, or inclined passage-ways, instead of stairways, facilitates the movement of passengers and lessens the danger of accident. Nearby hotels include the Belmont and Chatham.

A vital necessity in designing the Grand Central terminal was a signalling system for each level that could be operated by a director who could not possibly see the train movements which he controlled. Interlocking machinery, which in its simplest form is locking mechanism designed to control the signals so that they will automatically indicate the position in which the switch is set, was originated in England about 1856, but its use did not become general for many years. To operate the complicated network of trackage in a modern terminal requires interlocking machinery of an extremely elaborate character; the mechanism must safely control traffic and permit train movements with the greatest possible despatch. In the Grand Central terminal the interlocking machinery is of the all-electric type. Each track level is controlled by a director who is guided by a diagram on which the movement of trains is indicated by small electric lights. The largest of the signal machines is operated by 400 levers, each of which moves electrically a switch or signal, and to each 40 levers is assigned a man working under the instruction of the train director. The machinery is as nearly automatic as possible. Alternating-current track circuits are used to prevent the operation of switches while trains are moving over them and to indicate the presence of trains in proximity to danger zones. These circuits also operate electric locks which automatically hold the levers so that they cannot be moved except when the track is clear. Alternating current is used because of the 660-volt direct-current circuit employed for electric motive power. There are five main interlocking stations. The procedure in the case of an incoming train is as follows: At Harmon (33 m.) the steam locomotive is detached and an electric locomotive substituted. From Mott Haven Junction (5·3 m.) the train is announced to the director by telegraph or loud-speaking telephone (a telephone instrument with a horn similar to that of a gramophone instead of a receiver). After the train has passed 72d St. the director can trace its further progress by means of the electric buttons on his diagram, and he then decides upon which track to receive the train and gives his order to the levermen accordingly. When the incoming track is determined an announcement is made by means of the telautograph to various parts of the terminal. This instrument notifies the attendant at the incoming bulletin board and, in the case of through trains, serves to summon the station porters.

The Grand Central terminal was built by the New York Central lines under the direct supervision of W. H. Newman, then chairman of the board of directors. The terminal is owned 60% by the New York Central lines and 40% by the New York, New Haven & Hartford railway, and is used by both railways under a detailed operating agreement. In 1920 the traffic capacity of the station was far from being reached, yet more than 110,000 passengers used the station, arriving and departing on some 600 trains daily. Besides these there were every day from 50,000 to 100,000 people who passed in and out of the station without using the trains. Of the daily traffic about 65,000 were suburban passengers, and this kind of traffic was steadily increasing. From 1903, when the construction was begun, to 1920 the total passenger traffic very nearly trebled.

Reference to Table II. will indicate the more important new stations besides those already described. In addition to the terminals listed, two new stations of large proportions were planned for Chicago. One of these, the new Union station, was already under construction in 1921, while the designs for the other, the Illinois Central or 12th St. station, had been approved by the railway and by the city authorities.

TABLE II.—*Representative Railway Stations erected 1907–22.*

Station	Date completed	Dimensions: main building ft.	Cost*
Washington, D.C.	1907	663 x 211	$120,000,000
Pennsylvania, N.Y.	1910	430 x 430	115,000,000
Northwestern, Chicago	1911	320 x 218	24,000,000
Grand Central, N.Y.	1912	673 x 301	150,000,000
Ottawa, Quebec	1912	281 x 141	—
Michigan Central, Detroit	1913	345 x 266	7,000,000
Kansas City	1914	510 x 150	55,000,000
Havana, Cuba	1914	240 x 70	—
Buenos Aires	1915	850 x 606	—
Tokyo	1915	1,104 (Frontage)	1,350,000
Leipzig	1915	984 "	32,500,000
St. Paul, Minn.	1922	315 x 220	20,000,000

*Includes entire cost of terminal development.

Whether the expense of the more elaborate American terminals is justified in view of the limited profit obtained from passenger business is a question which gave rise to no little discussion. Estimates were made as to the number of miles of new track that could be laid with the money expended for terminals, and it was demonstrated in some instances that terminal charges were making serious inroads on passenger profits. "As showing what some railways are up against," said John A. Droege, general superintendent of the New York, New Haven & Hartford railway, writing in 1916, "it is worth noting that the New Haven has to pay 29 cents for each passenger it brings into the Grand Central terminal in New York."[1] The U.S. Interstate Commerce Commission, in its report in the Anthracite case (35 I.C.C. 270), under the head of "Unproductive Betterments," said: "The Pennsylvania has expended on its new passenger terminal properties in New York City approximately $114,000,000. These properties are operated by the Pennsylvania Tunnel & Terminal railway company, and the operations result in a deficit each year. The deficit in the year ended June 30 1913 was $2,087,000. . . . Thus the question is presented: Must the present effective freight rates of the Pennsylvania earn an annual return of 6 % on the investment in these terminal properties? The record shows that $47,000,000 of the expenditures in this property has been charged to profit and loss and to income of the Pennsylvania—that is, its past surplus income has already contributed $47,000,000 to the cost of this property." In answer to such criticisms Samuel Rea, president of the Pennsylvania lines, stated in 1917 that in seven years the traffic of the Pennsylvania station had increased from 9,862,434 to 18,135,311 annually, and that if the probable period of its usefulness was considered it could not be regarded as an unproductive betterment. He pointed out also that had the Pennsylvania waited longer to purchase a site in Manhattan the prices would have become prohibitive.

By leasing "air rights" and retail privileges within the station, the owners of the Grand Central terminal were able in 1920 to make an effective answer to criticisms of this sort. Following the example of the Grand Central, many railways sought to make their stations productive investments. Thus the Michigan Central constructed a seventeen-story office building in connexion with its station at Detroit, while the designers of the proposed Union station at Chicago, estimated to cost nearly $100,000,000, altered their plans to provide for a huge office building over the head house and train shed.

Closely connected with the criticism of expense was the criticism on the score of excessive size. Ironic references were made to the "magnificent distances" which passengers were compelled to walk between the street and trains. Examples of the distance walked by passengers purchasing tickets and checking baggage were given as follows: South station, Boston, 1,100 ft.; Northwestern, Chicago, 940 ft. and 20 ft. climb; Pennsylvania, New York, 480 to 950 ft., depending on the entrance used; Grand Central, New York, 450 ft.; Union, Washington, 1,200 feet. It should be said, however, that space is required if immense crowds are to be handled, and a slight extra walk is a small price to pay for freedom from the discomfort of crowded passage-ways. Nevertheless there were some leading railway men who believed that future development would be in the direction of more and smaller terminals located at various parts of a city. One proposal was to construct a system of subways, making each stop a Union Railway Station.

See J. A. Droege, *Passenger Terminals and Trains* (New York, 1916). (H. B.*)

RAINER, ARCHDUKE OF AUSTRIA (1827–1913), noted as one of the most cultivated and liberal-minded members of the Austrian imperial house, was born on Jan. 11 1827. His father, also named Rainer, the seventh son of the Emperor Leopold II. and of his consort Maria Luisa of Spain, was born in Florence in 1783, and from 1818–48 was viceroy of the kingdom of Lombardo-Venetia; his mother was the Princess Elizabeth, sister of Charles Albert, King of Sardinia. After serving in the army, the Archduke Rainer was in 1857 placed at the head of the permanent Imperial Council organized in 1851, which stood immediately under the Emperor and had among its functions the preparation of laws, and his experience in this office convinced him that the transition to a constitutional form of government on a liberal and centralized basis was necessary. In 1860 he conducted the negotiations for a strengthened Imperial Council; in 1861 he became head of the Government as president of the council of ministers of the Liberal Schmerling administration. His name is associated with the promulgation of the charter of the Constitution of Feb. 26 1861. In the same year Rainer became curator of the Academy of Sciences, a position which he filled till his death. In July 1865, when politics had shifted from the basis of the 1861 Constitution, he laid down office, and retired from public affairs. In 1872 he was appointed to the supreme command of the newly established Austrian *Landwehr*, to the organization of which he devoted many years of work. He continued to take a keen interest in art and science. As patron of the Arts and Crafts Museum (1862–98), and as curator of the Academy of Sciences, he won a high reputation. He greatly furthered the general knowledge of antiquity by the purchase of the papyrus discovered at Fayum, which was called, after him, the "Rainer papyrus." He married in 1852 Marie Caroline, daughter of the Archduke Charles, the victor of Aspern. There were no children of the union. He died on Feb. 27 1913.

RALEIGH, CECIL (1856–1914), English actor and playwright, was born Jan. 27 1856. He was the son of Dr. John Fothergill Rowlands, and took the stage name of Raleigh. He played for a time in musical comedy, but deserted acting for playwriting and, either alone or in collaboration, produced an immense number of melodramas, staged at first chiefly at the Comedy theatre, London, and in later years at Drury Lane. *Cheer, Boys, Cheer* (1895); *Hearts are Trumps* (1899); *The Best of Friends* (1902) and *The Whip* (1909–10) are typical examples. He also acted as dramatic critic to two or three London papers, and became secretary to the School of Dramatic Art in Gower St., London. He died in London Nov. 10 1914.

RALEIGH, SIR WALTER (1861–), English man of letters, was born Sept. 6 1861 in London, and was educated at University College, London, and King's College, Cambridge. He was professor of modern literature at University College, Liverpool, and professor of English literature at Glasgow, and in 1904 was appointed professor of English literature at Oxford. He was knighted in 1911 and elected to a fellowship at Merton College in 1914. His publications include *The English Novel* (1894); *The English Voyagers* (1904); *Six Essays on Johnson* (1910); *Romance* (1917) and many essays on literary subjects.

RAMPOLLA, COUNT MARIANO DEL TINDARO (1843–1913), Italian cardinal (*see* 22.877). When Pius X. was elected Pope, Cardinal Rampolla resigned all his appointments, retiring into the background. He had always been filled with a high sense of the dignity of his office, and while secretary of state had entertained in princely style; but personally he was a man of austere habits, and after his retirement he led the simplest life. A sound scholar, he devoted his last years to study, particularly to hagiography and Christian archaeology. He died in Rome Dec. 17 1913.

RAMSAY, GEORGE GILBERT (1839–1921), British classical scholar, was born at Fontainebleau July 19 1839, the third son of Sir George Ramsay of Banff and a member of a well-known family of scholars. He was educated at Rugby and Trinity College, Oxford, where he graduated first-class in *Literae Humaniores* (1861). He then became assistant to his uncle William Ramsay, professor of Humanity at Glasgow, and succeeded him in 1863, occupying the chair until 1906 and becoming a great teaching force in defence of a classical education. He was the first president of the Classical Association of Scotland which he helped to found. He was also a keen politician and a considerable athlete. His published work includes a *Manual of Latin Composition* (3 vols., 1st ed. 1884, 4th ed. 1897); an annotated version of *The Annals of Tacitus* (2 vols. 1904–9) and of the *Histories* (1915), as well as translations of Juvenal and Persius for the Loeb Library. He died at St. Andrew's March 8 1921.

RAMSAY, SIR WILLIAM (1852–1916), British chemist (*see* 22.880), died at High Wycombe July 23 1916. In 1904 he was awarded the Nobel prize, and in 1911 was president of the British Association. In 1913 he resigned his professorship of chemistry at University College, London. After his death a fund amounting to £53,772 was raised to perpetuate his memory by providing a laboratory of chemical engineering in connexion with University College, London, and founding Ramsay Memorial research fellowships of £300 a year each, tenable in any university in the United Kingdom for the advancement of chemical science.

RAMSAY, SIR WILLIAM MITCHELL (1851–), British archaeologist (*see* 22.880), resigned his professorship at Aberdeen in 1911, and subsequently published *The Imperial Peace* and *The Teaching of Paul in Terms of the Present Day* (1913); *Recent Research and the New Testament* (1914); *The Making of a University* (1915) and the *Life and Letters of William Black* (1918).

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[1] In 1921 36 cents (23 cents terminal entrance and 13 cents tollage), representing charges from Woodlawn (11 m.), not including cost of operation.

RANDEGGER, ALBERTO (1832–1911), musical composer and conductor, was born in Trieste April 13 1832. He settled in London in 1854 after holding various musical appointments in Italy. Both as an orchestral conductor, and as a teacher of music and singing he held for many years a leading position in London. Besides conducting on various occasions at the Royal Opera, musical festivals and elsewhere, he did much, as conductor of the Carl Rosa company from 1879, towards the popular revival of opera in England. He died in London Dec. 18 1911.

RANGE-FINDERS AND POSITION-FINDERS (*see* 22.888).—Recent improvements have rendered many of the earlier types of range-finders obsolete, and the following features are common to all modern coincidence range-finders. The range-finder usually consists of two main parts, viz:—a strong outer tube and an inner frame which supports the delicate telescopic system, any slight derangement of which would seriously upset the accuracy of the range-finder. The outer tube is made as strong and rigid as possible, having regard to the weight which can be allowed. The inner frame is supported in such a way that any slight bending of the outer tube will not affect it.

Some form of double end reflector is always used. This at one time consisted of a pentagonal prism, but large pentagonals are very costly; they absorb a good deal of light and are liable to slight distortion with changes of temperature. There is therefore a tendency to replace them by a combination of two silvered plane mirrors inclined to one another at 45°, and either fixed in a mount made of a metal having the same coefficient of expansion as glass, or rigidly attached to an upper and lower glass support, to prevent change in their relative positions.

The central reflectors usually take the form of two or more prisms balsamed together, and are known as the centre prism combination. Their object is to deflect the rays received through the two ends of the range-finder into the eye-piece, and to present the two images of the target in the field of view immediately above and below a thin separating line. Their construction is usually rather complicated. The fine separating line is as a rule obtained by means of a special separating prism; or by the edge of a silvered surface on one of the prisms, so arranged that the rays forming one image pass through the prism, and those forming the other image are reflected by the silvered surface.

The centre prism combination is also used for erecting or inverting the images, and for defining the limits of the fields of view received from each half of the range-finder. The arrangements of fields of view usually met with are the following:—

1. The field of view is divided into two equal halves and the images in both are erect. When a coincidence has been made, the separating line cuts straight through the image of the target. This system is used with naval and coast defence range-finders which have to deal with targets having long vertical features, *e.g.* masts and funnels. It is known as the "erect" system.
2. The field of view is divided into two parts by the separating line. One field (in field range-finders usually the lower) is erect, and the other one is a replica of it, being inverted up for down but not right for left. With this system it is much easier to make an accurate coincidence on small targets, but it has the slight drawback that the total actual field of view is necessarily considerably smaller than with the erect system, and a slight elevation or depression of the range-finder may cause the target to pass the separating line and disappear. This, however, is not of much importance if the target is a stationary or slowly moving one. The upper field is often made smaller than the lower, so that as much ground as possible may be seen in the field of view. This system is known as the "invert," and is used in many field range-finders.
3. The whole field is erect with the exception of a small central rectangle in which the image is inverted. The advantage of this system is that the field of view is as large as that of a range-finder of the erect type, except that the part covered by the rectangle is missing. It is known as the "invert rectangle" and is used in many field range-finders, especially in foreign armies.
4. The whole field is erect with the exception of a narrow horizontal strip which passes right across its centre. The field in the strip may be either erect or inverted. This system, known as the "strip" system, is used in the British height- and range-finder.

In early range-finders the axis of the eye-piece was horizontal when targets in the horizontal plane were being viewed. It is now usually inclined downwards at angles of 45°, 60°, or even 90° for anti-aircraft work, so that the range-taker can observe from a more comfortable position. Eye-pieces can be focussed for individual observers, the two images of the target and the separating line coming to focus simultaneously. Coloured and neutral tinted glasses are useful in cutting out excessive glare, haze, etc. In some range-finders, the magnification of the eye-piece can be altered so as to obtain the best effect under various atmospheric conditions. Astigmatisers are sometimes used for drawing out a point of light or small object into long lines or bands. Coincidence, which without their use would be almost impossible to effect, can then easily be made. They consist of two negative cylindrical lenses with horizontal axes, one being placed at each end of the range-finder between the pentagonal and the objective.

Range-finders are provided with halving and coincidence adjustment heads, which, when turned slowly, move the optical systems mentioned above. Correct adjustment is of course essential for accurate work.

Accuracy of One-man Range-finders.—The accuracy of the range-finder, other things being the same, depends upon its base length and magnification; but there are limits to the magnification which can be conveniently used. It is usually between 10 diameters (for the smaller range-finders) and 30 (for the largest). Under good conditions, two images can be aligned across a fine separating line, with an error of only a few seconds. There is little doubt that this degree of accuracy can be obtained under the best atmospheric conditions and when the target is stationary, as the mean result of several observations being taken as the range. If, however, the atmospheric conditions are bad and the target is moving rapidly, such accuracy cannot be expected.

The base lengths of range-finders used in the field usually vary between half a metre and two metres. The Barr and Stroud range-finder with a base of one metre, which is used for field artillery by the British and other armies, is typical.

German field coincidence range-finders, such as the Zeiss and Goerz, are used in a similar way to the Barr and Stroud, although their construction differs materially in details. Many of these were introduced to avoid infringements of earlier patents. The chief features of Zeiss coincidence range-finders are that they have only one eye-piece in which are seen a small rectangular inverted field in the centre of a large erect field and on the left of these a range scale. Coincidence is effected by revolving a working head which rotates two wedge-shaped prisms in opposite directions.

Stereoscopic Range-finders.—The principle of the stereoscopic range-finder is entirely different. Stereoscopic range-finders have not found much favour in the British services; but they have been extensively used by the Germans. Speaking generally, a stereoscopic range-finder contains the elements of a stereoscopic telescope rigidly mounted in a tube. It is very similar in outward appearance to a coincidence range-finder with two eye-pieces. Objects viewed through a stereoscopic range-finder are seen to stand out in stereoscopic relief; and it is comparatively easy for the observer to judge their relative distances. The actual distance of a target is obtained with the assistance of one or more marks which are seen in stereoscopic relief in the field of view. By means of suitable optical arrangements the stereoscopic relief of either the objects in the field of view or of the mark can be varied until the target and mark appear to the observer to be the same distance away from him. The range of the target can then be read off a range-scale attached. The mark which is seen in stereoscopic relief, really consists of two similar marks which are photographed on glass diaphragms mounted in front of the eye-pieces of the range-finder. If the two marks are on the optical axes of the two halves of the range-finder, they will appear to the observer as one mark at an infinite distance. If the two marks on the diaphragms are made to approach one another, the resulting single mark will appear to come towards the observer. In the later stereoscopic range-finders, marks in the eye-pieces are adjusted so as to appear to be at a fixed distance when seen stereoscopically. The view containing the target appears to approach or recede from the observer when the working head is turned; and the range is read off from an external range scale or drum.

Stereoscopic range-finders suffer from the disadvantages that very few people are able to see stereoscopically with sufficient exactness to obtain good results and the degree of accuracy obtained by a range-taker appears to vary from time to time. Under the same atmospheric conditions, stereoscopic range-finders do not appear to give such good results as coincidence ones. Owing to the marks on the diaphragms in the eye-pieces being more distinct than the image of the target, there is difficulty in deciding when they are at the same apparent distance. On the other hand, owing to both eyes being used, the target should be seen more distinctly than through a coincidence range-finder. Ranges of targets with the sky as a background, *e.g.* aircraft, masts of ships, and trees on a crest line, are comparatively easy to take with a stereoscopic range-finder; but those of comparatively indistinct objects, objects with near backgrounds and objects in a shadow, *e.g.* a gun under a tree, are very much more difficult to take.

Directors.—The director is an instrument employed chiefly for the measurement of azimuth angles and angles of sight. There are numerous patterns of these instruments. Some are of simple form; while others are complicated and are provided with quick and slow motion movements for their azimuth and altitude movements and for laying on a gun or target without the setting of their azimuth scales being altered. Some are used as directors pure and simple, whilst others are provided with powerful telescopes for observing fire. British directors are graduated in degrees and minutes, whereas those of nearly all other powers are graduated in millièmes. Instruments graduated in millièmes can be made much more compact than those graduated in degrees and minutes, as the main azimuth plate has only 64 divisions instead of 360. The azimuth scales of some German directors are graduated in 16ths of a degree and 16ths of a degree are also sometimes used for angle-of-sight scales.

The German director for field artillery is a good example of modern types of this instrument. Powerful telescopes like the stereoscopic or scissors telescope are often provided with fittings which enable them to be used as directors as well as for observing fire. Azimuth angles can be measured by means of an azimuth scale, and angles of sight by means of a small bubble and scale. In one pattern of German stereoscopic telescope, the angle of sight is measured by means of a device which is compactly placed between the two arms of the telescope, above its elevating gear.

The Field Plotter is an instrument used for obtaining the gun range when the range-finder is not near the gun. It consists of two similar nickel-plated steel plates, having azimuth scales and a scale of yards (upon which the distance of the gun from the range-finder can be set) engraved upon them, and two range arms which are pivoted at the centres of the azimuth scales and connected by means of a slider. The two plates are slid along one another until the distance between the gun and the range-finder is opposite the reader. The slider is then moved until an arrow upon it reads on the arm the distance from the range-finder to the target. The arm is then moved until another arrow reads the angle, recorded by the director, between the target and the gun. The plotter is then turned over, and the range from the gun to the target and the angle at the gun between the target and the director are read off. When fire has been opened, it is necessary to observe the results, so that corrections for both range and direction may be made. Also if time fuzes are used, the angular height above the target at which they burst the shell must be observed and corrected if necessary. Various instruments, *e.g.* graticuled binoculars, stereoscopic telescopes and periscopes, are used for this purpose.

The binoculars used in the British service are of the prismatic type having a magnification of six diameters and are fitted with a glass diaphragm in front of the right eye-piece on which are engraved the vertical lines $\frac{1}{2}^\circ$ apart; their heights above the horizontal line being alternately $\frac{1}{2}^\circ$ and 1°. The central line is longer, extending $1\frac{1}{2}^\circ$ above, and $\frac{1}{2}^\circ$ below the horizontal line. When observing fire, the point of intersection of the centre vertical line with the horizontal line is laid on the target; and, when the burst of the shell is observed, its angular distance to the right or left of the target and above it can be ascertained by noting its position with reference to the lines on the diaphragm. Graticules used by other continental powers vary very much in design and often consist of a very large number of short lines at definite distances from the axis of the telescope.

The stereoscopic or scissors telescope was very largely used in the World War, especially by the Germans. The British pattern has a magnification of 10 diameters and a field of view of 4°. The two arms can be used either vertically for observation from below cover, or in line with one another for observation from behind vertical cover.

FOR COAST DEFENCE

Coast defence range-finding instruments are usually either range-finders or position-finders. A range-finder measures ranges *from itself* to the target and may also record the bearing of the target. A position-finder measures ranges and bearings to the target *from the point for which it has been adjusted.* This would usually be a gun which may be many hundred yards away from the position-finder. The position-finder sometimes also records the range and bearing of the target from its own position. Coast defence range-finding instruments may be divided into classes, depending upon the nature of their bases, as follows:—

1. Depression instruments, having vertical bases (either range-finders or position-finders) the accuracy of which depends upon their height above the sea-level. They measure ranges with equal accuracy in all directions; and, if sufficient height is available, they are most reliable instruments. It is usually considered, that, to obtain ranges with an error not exceeding 1%, 100 ft. of height is required for every 5,000 yd. of range. All that the range-taker has to do is to keep a cross wire in the telescope of his instrument laid on the water line of the target.

2. Instruments having a fixed horizontal base (usually position-finders). Each usually consists of two instruments installed at the ends of a base which may be several thousand yards in length, the length required depending upon the range and arc of fire of the gun for which the instrument has been installed. The instrument at one end of the base is known as a transmitter and usually consists of a telescope mounted above an azimuth circle. It measures the bearing of the target and transmits it to the instrument at the other end of the base which is known as the receiving instrument. The bearings may be transmitted by telephone; or, as the telescope is traversed, electric impulses may cause some portion of the receiving instrument, *e.g.* a metal arm or a dial, to move automatically. The receiving instrument is usually an accurate, solidly constructed plotter, made to a certain scale, *e.g.* 500 yd. to an inch. In its simplest form it would consist of a base plate upon which two straight arms were pivoted, the relative positions of the pivots being, to the scale of the instrument, the same as those of the transmitter and receiving instrument. The first arm would be kept set to the azimuth angles received from the transmitter, and the second arm would be kept in line with the target by means of a telescope attached to it. The point where the two arms intersect would represent the relative position of the target. The arms being graduated in ranges and moving over azimuth scales, the range and bearing of the target from either end of the base could be read off. By means of a third arm, pivoted to the base plate in the position representing the position of the gun, the range and bearing of the target from the gun could be ascertained if the arm were brought above or below the point of intersection of the two other arms. Horizontal-base range-finding instruments are often designed to allow of several alternative bases being used, the pivots of the arms in the receiving instrument being set for the base which is most suitable for the conditions prevailing at the time. Thus for very long ranges a very long base would be used; but, if the visibility were bad, a much shorter one might be preferable. Horizontal-base instruments have certain disadvantages. For a definite range, their accuracy varies with the position of the target. It is greatest when the target is opposite the centre of the base, decreases as the target moves to the right or left, and disappears altogether when the target is in line with the base. It is somewhat difficult for the receiving instrument to indicate to the transmitter the target whose range is to be found. There are difficulties in passing azimuth angles from the transmitter to the receiving instrument. If they are telephoned, delay and errors are involved, and owing to the fact that they may

alter at greatly varying rates there is usually some uncertainty as to the most suitable intervals in which they should be called out. If they are electrically transmitted, so as to move some part of the receiving instrument, the mechanism must be capable of moving in small steps of, say, one minute, in order to obtain the required accuracy, and at the same time it must be capable of moving quickly through a large angle when getting on to a target.

3. *One-man Range-finders* used for coast defences are constructed on the same general principles as those used in the field; but, as their weight and size must not be limited to the same degree, many modifications to make them as accurate and convenient as possible are introduced. Their base lengths are usually between 9 ft. and 10 metres, but even longer bases have been considered. They are practically always of the coincidence type with both fields erect.

The Mark III Depression Range-finder (fig. 2) will be taken as a type of a depression instrument. In this range-finder the range-finding triangle is reproduced in the instrument on a small scale. Figure 1 shows diagrammatically how this is effected by means of two arms. AB represents the height of the axis of the telescope above the surface of the sea BC. Ab represents the distance between the pivot of the telescope arm Ac and the range arm bc, and this to the scale of the instrument, represents the height AB. When the instrument is level, the arm cb is horizontal, and therefore parallel to the surface of the sea. cb is subdivided and graduated in equal divisions to the scale of the instrument. Ac, which has a telescope mounted on it, is pivoted at A and can be directed on to the water-line of a target at C. The triangles ABC and Abc are similar, and the length of bc therefore represents to the scale of the instrument, which is 1,000 yd. to an in., the actual range BC. Similarly bd will represent the range BD of a target at D. If the instrument is required for use at any other height than AB, the telescope arm pivot A would be raised to a height above cb corresponding to the new height of the range-finder above the sea. In the foregoing, the surface of the sea has been considered as a plane surface, whereas it is really the surface of a sphere with its centre at the centre of the earth. Allowance for this curvature could be made by making the arm bc the arc of a circle instead of a straight line. It is, however, found to be more convenient to curve the telescope arm Ac in the opposite direction, the effect being the same. Corrections for mean refraction are made in the same way as those for the curvature of the earth, but in the opposite direction; the arm Ac being curved to allow for the combined effect of curvature and refraction.

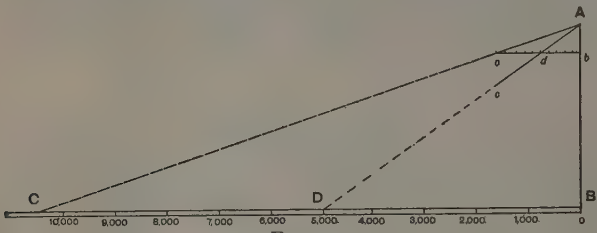

FIG. 1.

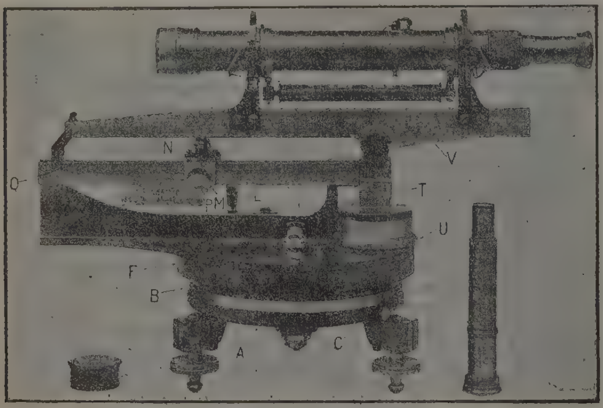

FIG. 2.—Depression Range-finder Mark III.

The Small German Position-finder may be taken as a typical position-finder. It was used during the World War for coast artillery on low sites. Very much larger instruments based on the same general principles were also used. Air communication was by telephone. Other nations often use automatic electrical transmission for moving parts of the receiving instrument when the transmitter telescope is traversed, and for actuating range and bearing dials on the gun mountings when the gun arm is traversed.

The Barr and Stroud Range-finder having a base-length of 30 ft. is typical of the one-man range-finder used for coast defences.

None of the range-finders or position-finders mentioned above is of any use if it cannot see the target; the position of a moving target can then only be ascertained by aerial observation.

Naval Range-finders, which must necessarily be of comparatively small size, are nearly always of the one-man type. They are generally similar to those used in coast defences, but in order to obtain better illumination their optical parts are often made larger. Their mountings are designed to enable the range-finders being kept on the target in a sea way. They are nearly always of the coincidence type with both images erect; but some stereoscopic range-finders have been used by the Germans. It is thought by some that a range can be more rapidly taken from a ship having considerable motion with a stereoscopic range-finder than with a coincidence range-finder; as with the latter it is difficult to keep the separating line across the target. The coincidence range-finder will, however, give more accurate results. Range-finders with a base-length of 10 metres are the largest which can conveniently be used on board ship. Base lengths vary with the size of the ships on which the range-finders are employed and the uses for which they are intended; one of less than a metre being employed for navigational purposes. Anti-aircraft range and height-finders used on ships must be provided with some form of pendulum to keep certain of the parts horizontal, as the mountings cannot be kept level. Certain small range-finders have been made which can measure the range to a ship if the height of its mast or funnel is known. This height is used as the base of the range-finding triangle, the angle of parallax being measured by the instrument and read off it as a range. Such a base is obviously longer than that of a range-finder which could be carried on a ship. This type, however, has not been generally adopted.

FOR AIR DEFENCE

Range-finders and height-finders used in connexion with anti-aircraft guns have a much more difficult task to perform than the range-finding instruments used in the field or in coast defences. In the latter cases the target, if it moves at all, will move in one plane only and its speed will not approach that of aircraft. As the result of experience, the range of an aerial target which may alter by several thousands of yards in a minute is not taken into account; but its height, which will not vary to the same extent, is used as the basis of laying δ and is measured by a height-finder. The rate of burning of the fuze has also to be considered, as it will not be the same for a definite range if the target is at different heights.

When laying a gun on aircraft, the setting of the sight is therefore based on the height and angle of sight of the target and on the setting of the fuze. At the beginning of the World War, no height-finders were available, so existing one-man range-finders, *e.g.* the Barr and Stroud, were used, and long base height-finders which could be rapidly made were introduced.

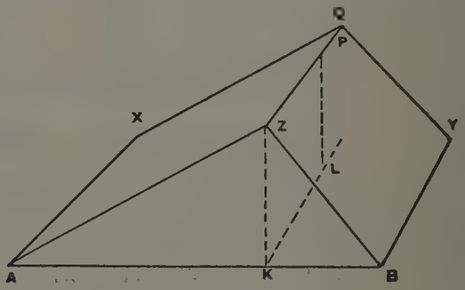

FIG. 3.

One-man range-finders were usually of two metres base length, and coincidences were made on the target in the usual way. In order to convert the ranges into heights, a slide-rule attached to the range-finder was employed. One scale of this slide-rule was automatically set to the angle of sight of the target, by means of a cam, as the elevation of the range-finder was altered. The other scale was set to the range recorded by the range-finder, and the height of the target could then be read off.

Long base height-finders usually consist of two instruments at the ends of a base about a mile in length. Sighting planes in these instruments are kept laid on the target; the triangle formed by the intersection of a vertical plane with three planes, one of which is a horizontal plane passing through the base and the other two are extensions of the sighting planes, is mechanically solved; and the height of the point where the two planes of sight intersect (*i.e.* the height of the target above the base) is plotted at the same time.

The principle of this method is shown in fig. 3. AX and BY are two horizontal lines, parallel to each other. The sighting planes of the instrument would be attached to axles whose axes were on any parts of AX and BY. AXQZ and BYQZ represent planes of which the sighting planes form small parts. It is obvious that QZ is horizontal, and that ZK, PL or any vertical line between QZ and the horizontal line KL (which is parallel to the axes of the sighting planes) represents the height of an aircraft in the line ZQ, say at P. In the simplest form of height-finder, the plotting is done on a board fixed beneath B, the triangle AZB being reproduced there on a small scale and upside down. A straight edge is attached to the sighting frame at B and consequently moved round B in front of the board as the elevation of the frame is altered. Another straight edge is pivoted on the right of B at a distance from it which represents AB to the scale of the instrument. It is kept set to the altitude angle which is measured at A and telephoned to B. The point where the two straight edges intersect consequently represents the point Z. Upon the board below B, a series of horizontal lines are marked, their distance from a zero line passing through the pivots of the straight edges representing heights above the ground, to the scale of the instrument. The height of the target can therefore be ascertained by noting against which of the horizontal lines on the board the intersection of the two straight edges comes. Such height-finders have serious disadvantages, the principal one being the difficulty in getting the two instruments on to the same target.

Height- and Range-finder.—Towards the end of the war Messrs. Barr and Stroud produced a most ingenious instrument which recorded both the height and range of aircraft, and which was at once adopted by the British Government.

It is used in a similar manner to an ordinary one-man range-finder, and the observer has only to keep the aircraft in the field of view and make coincidences. As will be explained later, if the height of the aircraft remains constant the coincidence will not alter as the range alters. The field of view is so arranged that the rays of light entering by the left window of the instrument form an erect image over the whole field, with the exception of a narrow central horizontal strip in which an inverted image is formed by the rays entering by the right window. The lower separating line is the one on which coincidences are made. The advantage of this "strip" system is that it is considerably easier to keep the aircraft in the field of view than if the field were divided into two equal parts, one of them being inverted. As in field instruments, the inversion of the image in the field above the separating line is found to facilitate making accurate coincidences.

The eye-piece of the range-finder is placed at right angles to the plane of triangulation, so that if the angle of sight to the target is 60° the observer looks down at an angle of 30°. It is provided with two lens combinations on a rotatable cap which give magnifications of 15 and 25 diameters, and also with light filters for varying atmospheric conditions. There is a window above and to the left of the eye-piece, through which the usual ivory range scale can be seen.

In a small casing on the top of the range-finder there is a most ingenious mechanism which converts ranges into the heights corresponding to them as the angle of sight varies. The ranges and heights can be read through two windows in close proximity to one another. This mechanism actually solves the trigonometrical formula $r \sin \alpha = h$; where r is the range of the target, α the angle of sight to it, and h its height. This formula may be written as: $\log r + \log \sin \alpha = \log h$; and it is mechanically solved as follows:—a differential gear is employed, the upper member of which is rotated in accordance with a logarithmic sine scale of angles of sight, and the lower member is rotated in accordance with a logarithmic scale of ranges, the jockey wheel accordingly revolving around the axis of the differential with a motion corresponding to a logarithmic scale of heights. It will be noted that the angle of elevation and the range are known, or rather are determined by the instrument, so that the duty of the gears is to convert the angle and range scales to logarithmic form and then to add them together by means of the differential gear as explained above. The conversion of the reciprocal range scale motion of the range-finder deflecting prism gear into logarithmic range scale motion, and the angular motion, of the range-finder in elevation into motion corresponding to a logarithmic scale of sines, is done in each case by means of toothed spiral gears.

The gearing is connected through three couplings to the working head, the elevation gear and the deflecting prism gear respectively. By means of suitable gearing the jockey wheel of the differential is driven from the working head, the upper member by the elevation gear, and the lower member by the deflecting prism gear. The range scale is connected to the lower member, and the height scale to a level wheel carrying the jockey wheel.

The advantage of arranging the working head to operate the jockey wheel is that in the frequent case of aircraft flying at a constant height the images in the field of view, when once set, can be kept in coincidence by simply elevating the instrument so as to keep the target in the centre of the field, without any rotation of the working head. The movement of the instrument in elevation automatically controls the position of the deflecting prism, the height scale remaining unaltered so long as the working head is not rotated. When the target rises or falls, the images will move out of coincidence and must be brought back into alignment by rotating the working head, thus altering the reading of the height scale by the appropriate amount. The working head and elevating gear may, of course, be worked at one time, in which case the combined effect of the spiral gears and the differential is that the two scales always read correctly as long as the coincidence is maintained.

The instrument has a base length of two metres, and is carried in the mounting forks in two eccentric bearing rings, the object of the eccentricity being to balance the weight of the height-scale gear box as the instrument is rotated in elevation. The elevating gear with a handwheel on the left of the observer, is of the worm-wheel type. The handwheel is provided with a two-speed clutch; the speed being changed by merely pressing in or releasing, with the palm of the hand, a small lever connected with the hand grip.

The azimuth training gear is also of the worm and worm-wheel type and has a two-speed clutch. Its handwheel is on the right of the eye-piece, and in a convenient position for the man who, looking through a small prismatic telescope near the right-hand end of the instrument, keeps it laid for direction on the target.

The worm wheels for movements in both azimuth and altitude are mounted on friction slip-bearings, so that the instrument can be rapidly moved and the target brought into its field of view. An elevating lever is fitted near the left-hand end of the instrument to allow of rapid elevation. An adjustable azimuth scale and reader are provided; and a means of levelling the upper part of the mounting. Before using the instrument, its correct levelling must be attended to and checked by means of two bubbles attached to the upper part of the mounting. The lower part of the mounting is a very rigidly constructed tripod with pointed feet having discs to prevent their sinking into soft ground.

Three operators are required for working the instrument, viz.: (1) The observer who makes "coincidences" by turning the working head on the top of the instrument with his right hand, and who also keeps the separating line on the target by turning the elevation handwheel with his left hand. (2) The operator for line who, looking through the prismatic sighting telescope, traverses the instrument with the handwheel and keeps the cross line in his telescope accurately laid for line on the target; and (3) the scale reader, who, standing in front of the instrument, reads heights off the height scale; and, if required, also reads the range and angle of sight scales.

In anti-aircraft gunnery, where the target may move at a speed of two or more miles a minute, there is great difficulty in ascertaining what deflections are required to compensate for the travel of the target during the time of flight of the projectile. There is not only the lateral deflection to be considered, as with a ship moving in one plane; but also a vertical one. It is obvious that if an aircraft is flying at a constant height, the angle of sight to it from the gun will not remain constant. Vertical deflection equal to the alteration of the angle of sight during the time of flight of the projectile must therefore be allowed for. Another difficulty arises in connexion with the setting of the fuze. The fuze will not burn at the same rate if the projectile is fixed at different angles of sight, owing to the variation of atmospheric pressures at different heights. To help to overcome these difficulties a most ingenious apparatus was brought out during the war by Messrs. Brocq of Paris, and was adopted by most of the Allied Powers.

The general principle of the instrument is as follows:—The height of the target must first be measured by a height-finder and set on the instrument. Two operators, who face one another, follow the target, looking through two telescopes which are rigidly connected. One keeps a vertical cross line in his telescope in line with the target by turning a traversing handle; and the other keeps a horizontal cross line in line, by turning an elevating handle. Connected with the traversing and elevating handles are the armatures of two magnetos which, when turned, generate electric currents, the voltages of the currents depending upon the speed at which they are turned. These currents are transmitted to two special voltmeters (attached to the gun mountings near the layers) from which the lateral and vertical deflections required can be read off, and then applied to the sights. On their way to the voltmeters the currents pass through rheostats which modify them in such a way that the deflections recorded are correct for the time of burning of the fuze. The exact length of fuze required to burst the shell at the target can also be read off another part of the instrument.

The general arrangement of the apparatus is shown diagrammatically in fig. 4. It consists of three main parts, viz.:—

1. The double telescope, which consists of a metal drum upon which are mounted, on the same spindle, the two right-angle telescopes referred to above. The traversing and elevation handles are placed conveniently for the two operators. Each has a quick and slow motion (four to one), the alteration from one to the other being effected by pushing in or putting out the handle. When a quick release knot at the top of the instrument is pressed down, the gears are put out of action, and the telescope can be quickly moved until the target is in their fields of view. Angles of sight and bearings can be read off conveniently placed scales, if required. When the handles are turned, the currents generated by the magnetos pass along

cables to the "fuze indicator and time rheostat" and thence to the "deflection voltmeters."

As the body of the "double telescope" traverses about a vertical axis, but laying is done in the plane of sight, it is necessary to multiply the angular velocity of the body of the instrument by the cosine of the angle of sight in order to obtain the angular velocity of the target. This is effected electrically by passing the current from the lateral magneto through a rheostat, whose resistance is varied by a rubbing contact passing along it, as the telescopes are elevated or depressed.

Another rheostat and an accumulator (connected to the fuze indicator and time rheostat) cause an angle of sight needle in the fuze indicating voltmeter to move to the same angle of sight as that of the telescopes; this needle is controlled by another circuit.

2. The fuze indicator and time rheostat consist mainly of the time rheostat, a fuze indicating voltmeter, a microphone and an external accumulator of three cells.

As explained above, the currents generated by the magnetos pass through rheostats on their way to the deflection voltmeters. These rheostats are situated beneath the time adjusting dial, and their resistance is altered as the dial is turned. The setting of the dial is dependent upon the height of the aircraft and the setting of the fuze, and is effected as follows:—A graduated height arm is moved by means of a milled head until it reads the height obtained from a height-finder. On its right-hand upper edge is a reader for reading the fuze curves on the time adjusting dial. The latter is turned until the reader of the height arm is on the fuze curve representing the length at which the fuzes have been set.

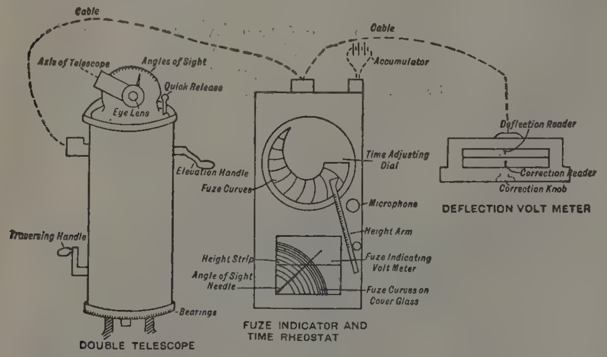

FIG. 4.—Arrangement of Brocq apparatus.

The angle of sight needle in the fuze indicating voltmeter is controlled by two circuits, viz,: that referred to in (1) which tends to set it at the angle of sight of the telescopes, and another in which are the vertical magneto armature in the double telescope, the rheostat beneath the time adjusting dial and another rheostat which automatically adds eight seconds to the time of flight. This eight seconds is an allowance for the time taken to set the fuze, load, lay and fire the gun. The angle of sight needle therefore makes with its zero or horizontal line an angle equal to the angle of sight to the predicted position of the target at which the shell will burst. When the height arm is moved, a height strip inside the fuze indicating voltmeter is also moved. Its height above the zero line of the angle-of-sight needle represents, to the scale of the instrument, the height of the target. The intersection of the needle and strip therefore represents the position of the target at the moment of the shell burst. Fuze curves are marked on the glass cover of the voltmeter, and the curve which is nearest to the intersection of the needle and strip will indicate the length at which fuzes are to be set. This fuze length is called down the microphone to the fuze setters, and is transmitted to the sight setter by the man taking up the shell.

3. The deflection voltmeters are of the dead-brat type and read to 10° on either side of zero. Two are provided for each gun; one for lateral and the other for vertical deflection. As a rule, two guns can be worked by one Brocq equipment, four deflection voltmeters being provided. The required deflection is read by the upper pointer. Corrections for wind are applied by moving the scale by means of a knob beneath the voltmeter, the amount of correction being indicated on the scale by the lower pointer.

Stereoscopic range-finders were extensively used by the Central Powers for anti-aircraft work. (A. C. W.)

SOUND-RANGING

The method of locating hostile guns by the sound, or sounds, consequent on their discharge was introduced on the British front in France during 1916. It had at that time already been in use in the French army for many months. It speedily proved its usefulness, especially in circumstances which rendered other methods of location very difficult or impossible. The system of concealment known as "camouflage" added considerably to the difficulty of finding the position of gun-pits on photographs taken from the air, and, further, these photographs offered no certain method of deciding whether a gun position, once identified, were occupied or no. The locations given by sound-ranging frequently enabled well-concealed positions, which had previously been missed on air photographs, to be detected, and offered a sure index as to whether known positions were active at a given time. Although air photographs always offered valuable confirmation of the sound-ranging locations, and were, when available, consulted with this object in view, the method is, of course, quite independent of such support. It works as well at night, or when, owing to fog, mist, or smoke, the visibility is poor, as on clear days; it can detect batteries so well hidden as to be invisible from the air or on air photographs; it is always ready when once the apparatus has been installed; and a location can be obtained, under favourable conditions, within a minute or two of the arrival of the report of the piece. On the other hand the instalment of the apparatus necessitates the laying of several miles of wire, and involves considerable preliminary labour in other ways; the method will not work during a heavy bombardment; and certain weather conditions, to be discussed later, render locations almost impossible. The difficulty first mentioned will quite possibly be surmounted or diminished; the other two seem, at present, insuperable.

The method has been elaborated to permit the directing of fire on a hostile piece by comparing the record of the sound of discharge of the piece with that of the burst of the shell directed against it. With 12-in. and 9·2-in. howitzers destructive shots have been directed very successfully by sound-ranging.

Principles.—The method generally adopted in the British, French, and American armies is to record the instant of the arrival of the sound made by the hostile piece at certain fixed and carefully surveyed posts, spaced at intervals varying from 1,000 to 2,000 yards. If it be assumed that the sound spreads out from the source with a known velocity, the same in all directions, then a known interval between the arrival of the sound at two fixed posts will determine a curve on which the source must lie. This curve is a hyperbola with the two posts P_1 and P_2 as foci, for the determining condition is that the difference of the radii vectores SP_1, SP_2 be constant. If, in addition, the time of arrival at a third post be known, then the interval between this and the time of arrival at either P_1 or P_2 will fix a second hyperbola on which the source must lie, and so determine the position of the source. In practice three posts are not sufficient, since any uncertainty caused by the recording of a spurious sound at a post would falsify the location. In general six posts are used, which, taken consecutively in pairs, give five lines which should all intersect. Any accidental selection of the record of a spurious sound at one or more of the posts is then at once detected by the non-intersection of the curves. Records of the sound at five, or indeed four, of the posts are generally sufficient for the experienced sound-ranger, even when several guns are being recorded at short intervals, so that the use of six posts allows for the sound not being successfully recorded at one or two of the posts.

Nature of Sounds from High-Velocity Guns.—In the preceding argument it has been assumed that the sound spreads out with uniform velocity in all directions from the source. There is little doubt that this is true, in a still atmosphere of uniform temperature, of the sound of the discharge of the piece. With the modern high-velocity gun, however, a second sound, originating in the motion of the shell through the air, always accompanies the sound of discharge. This second sound is due to a pulse of compression set up by the shell, known as the "shell-wave," or "*onde de choc.*" It is perceived by an observer in front of the gun as a sharp crack, which is followed after an interval depending on the type of gun, the elevation of the gun, and other factors, by the duller, heavier sound of the discharge, or gun-wave. To examine the formation of the shell-wave by the passage of the projectile, consider the resultant disturbance produced by the pulses of compression travelling out with the velocity of sound from every point of the path of the shell. For simplicity take in the first case a projectile travelling horizontally with a uniform velocity greater than that of sound; let G be the position of the gun, S_1, S_2, . . . S_{10} be the positions of the projectile at the end of the 1st, 2nd, . . . 10th second (fig. 5). When the shell is at S_{10} the compression originating at G has travelled out as a spherical shell with G as centre for 10 seconds, that originating at S_1 has travelled out as a spherical shell with S_1 as centre for 9 seconds, and so on. The envelope of all these spheres is a cone with its apex at S_{10}; if the shell be travelling close to the surface of the earth the trace of this cone on the surface is $AS_{10}C$, which represents the pulse of compression under discussion. If the velocity of the shell be considered to decrease with time, as in any actual case, the interval of space between centres of successive generating spheres will decrease as the shell travels, and the enveloping cone will be modified (fig. 6). The form of the shell-wave will resemble roughly a paraboloid of revolution, the vertex being at the shell as long as the latter has a velocity exceeding that of sound, and consequently travelling with a velocity greater than that of sound. After the velocity of the shell has dropped below that of sound the shell-wave travels out in all directions with the velocity of sound normal to the surface.

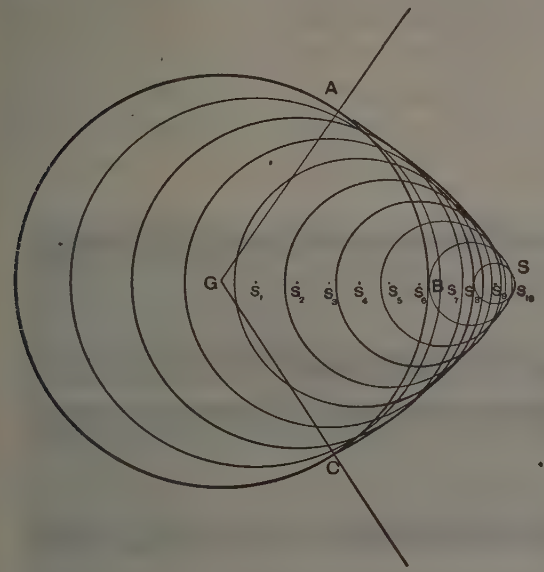

Fig. 5.

The exact form of the shell-wave will depend upon the range table of the gun and the interval since the shell left the gun, and cannot be specified as being any familiar surface. The trace of the wave on the plane of the earth's surface, with which the observer is in general concerned, depends further upon the elevation at which the gun is firing. Since the sphere representing the position of the gun-wave is one of the generating spheres the shell-wave will touch this sphere. In fig. 6 where G is the gun, ABC the trace of the gun-wave on the horizontal plane, ASC the trace of the shell-wave, within the cone represented by AGC both sounds will be heard, outside the cone only the sound of discharge. The interval between the two sounds is clearly greatest on the line of fire, decreasing as the observer moves to a flank. As the gun is elevated the interval detected by a listener in a fixed position decreases, the trace of the shell-wave approaching that of the gun-wave. This is illustrated in fig. 7. If the gun be sufficiently elevated no shell-wave is heard by a listener at any position on the ground, though it may be heard in an observation balloon. Thus the double sound has been heard by an observer so situated in the case of a 9·2-in. howitzer, firing with full charge (M.V. 1,500 f.s.), while observers on the ground heard only the single sound.

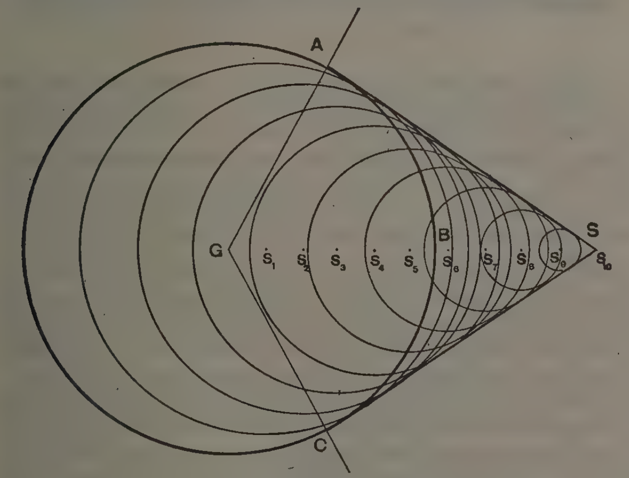

Fig. 6.

Owing firstly to the selective sensitiveness of the human ear, and secondly to the fact that the shell-wave is generated well above the surface of the earth, and travels down to the ear without meeting obstacles and without being hindered by refraction effects, the shell-wave alone is usually heard when the hostile piece is distant, and is spoken of as the sound of the piece by the casual listener. Any attempt to take rough bearings on a gun by estimating the direction from which the sound appears to be coming then leads to a very erroneous result, since it is the normal to the shell-wave that is selected. Unless the listener is on the line of fire such a bearing will pass considerably in front of the piece. To calculate the position of a gun from the intervals between the arrival of the shell-wave at different posts requires a knowledge of the exact form of the wave in question at various times of flight, and this presupposes a knowledge of the range table of the gun, and the elevation at which it is firing (given by the approximate range). It is clear that to apply the sound-ranging method to records made by the shell-wave is a matter involving information not always available, and considerable preliminary work on the construction of curves representing shell-waves for different hostile guns firing at various elevations when it is available.

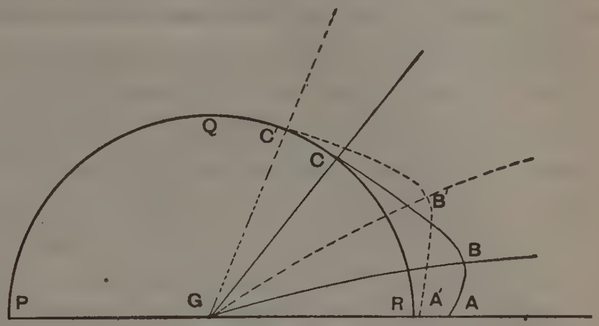

Fig. 7.

In the case of howitzers the horizontal component of the muzzle velocity is less than the velocity of sound in all ordinary cases, so that only one sound, the gun-wave, is heard on the ground.

Instruments.—The instruments comprise: (*a*) detectors, placed at each of the six surveyed posts, which give an electrical response to the arrival of the sound, and (*b*) a recording instrument, placed at a central station and connected by a separate circuit to each detector, which registers the exact time at which each detector responds.

When the method was first tried by the French the detector used was a soldier, who pressed a key when he heard the sound of a hostile piece, the key closing a circuit which actuated a pen on a smoked paper chronograph at a central station. This method involves inevitable errors due to the personal equation of the observer, and is further invalidated by the fact that, in the case of guns, the observer frequently hears only the shell-wave. The difficulties of working from records of this kind have already been discussed. Later, carbon microphones with large wooden diaphragms were introduced, small cells being included in circuit with the microphone and a primary coil, all at the post; the circuit leading back to the recording instrument included a secondary coil wound on the primary. These microphones suffered from the fact that they had a range of sensitiveness similar to that of the human ear; they responded readily to chance sounds, such as the clatter of equipment, or to shaking, and they registered the shell-wave in preference to the gun-wave. They were superseded (first in the British army, and ultimately in all the Allied armies) by the hot-wire microphone invented by Maj. W. S. Tucker (British patent No. 13123 of 1916,

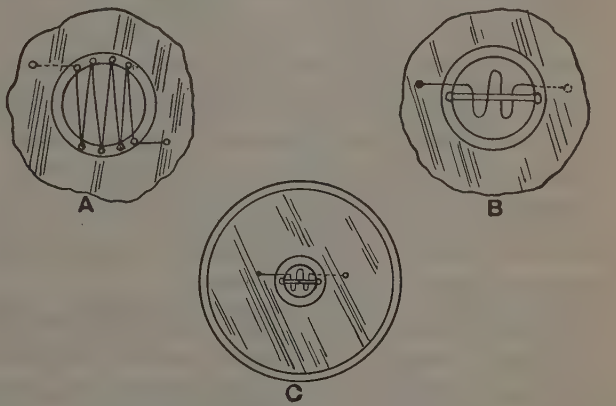

Fig. 8.—Hot-Wire Microphone.

and No. 8948 of 1918: see also *Phil. Trans. Roy. Soc.*, A, vol. 221, p. 389). This depends on the principle utilized in the hot-wire anemometer, *i.e.* the change of electrical resistance consequent on the change of temperature of a heated wire which ensues when the air round it is set in motion. A very fine wire of platinum, whose resistance at atmospheric temperature approaches 100 ohms, is mounted in the form of a grid over a circular hole some 7 mm. in diameter (fig. 8). It is provided with terminals. It is included in one arm of a Wheatstone bridge, and sufficient current passed through the network to heat the wire to a dull red. The bridge is balanced so that when the air round the wire is undisturbed no current passes through the galvanometer. Motion of the air causes the resistance of the wire to decrease, upsets the balance, and so causes a current to pass through the galvanometer.

The microphone wire is mounted in front of an air container of some 16 litres capacity. Resonance effects in this container may be partly eliminated by small openings made in the wall. The instrument so completed is insensitive to all sounds of speech, musical sounds, traffic, or even rifle fire. It responds readily, however, to gun sounds (which are low frequency disturbances), even when they are inaudible, and records also the shell-wave. Its reaction is very rapid, and the small lag which does occur appears to be the same for all similarly constructed instruments.

An essential part of the recording instrument is a galvanometer for each circuit which shall respond very rapidly to the current caused by a sound reaching the microphone. For rapid response it is necessary that the moving part of the galvanometer shall be very light indeed—the moving coil or moving magnet type is out of the question. The condition is satisfied by the Einthoven galvanometer, in which the moving part is a very fine wire (through which flows the current to be detected) mounted in a magnetic field. The wire moves in a direction normal to its length and to the direction of the field. Six wires, insulated from one another, and provided with separate terminals, can be mounted side by side in the field produced by a single small electromagnet. This provides in a small space what is essentially six independent galvanometers, one of which is included in the bridge belonging to each microphone. As the sound reaches successively different microphone posts the corresponding galvanometer wires move in rapid response.

The instant at which each wire begins to move is registered on a moving photographic film. The camera in which the film runs vertically is furnished with a horizontal slit, a cylindrical lens in front of the slit reducing its effective breadth. Shadows of the perpendicular galvanometer wires, cast by means of an electric lamp and an optical system mounted in the pierced poles of the galvanometer magnet, fall on the slit, and are focussed on the film, appearing there as six points of shadow on a horizontal line of light. As long as the wires are still each point leaves on the running film a straight line; the movement of a wire registers itself as a break in this trace.

If the film ran at a uniform speed measurement on the developed film of the distance between the breaks would give the required time intervals. As this is not the case the following device is adopted: a wheel provided with ten flat spokes, one of which is somewhat wider than the others, is mounted in the case containing the lamp, so that, when it is rotated, the spokes successively interrupt the light which illuminates the galvanometer wires. The wheel is actuated by a synchronous motor controlled by a tuning fork, and rotates ten times a second. As a result of this arrangement there appear on the film lines perpendicular to the direction of the motion, the intervals between which correspond to hundredths of a second, every tenth of a second being marked by a wider line. This recording apparatus was devised by Dr. Lucien Bull, of the Institut Marey, near Paris.

Originally the film was cut off after the required record had been taken, and developed in a small dark room adjacent to the instrument. Later a method of automatic development was devised, by which the film passed successively through developer and fixer while running, and emerged ready for interpretation.

Fig. 9 shows some typical records. (*a*) and (*b*) are records of two differently situated 5·9-in. howitzers taken by six posts in each case. The burst of the shell was also registered on these films, but as it occurs several seconds later space does not permit the inclusion of the part of the record in question. (*c*) is a record of a field gun, showing both shell-wave and gun-wave. Only five posts were used for this record. The varying interval between the two sounds at the different microphones is well shown: at the flank microphone, corresponding to the lowest trace, only one sound is heard. (*d*) is a record of the burst of a British shell on a German position.

Influence of Weather Conditions.—The method in use demands that to every time interval shall correspond an exact distance, a standard velocity of sound being assumed, which corresponds to some standard temperature, and still air. (The velocity of sound does not, of course, vary with the pressure, and the effect of humidity is in general negligible.) Hence the time interval read off from the film has to be corrected for temperature and wind before it is used on the board prepared for location. For the temperature variations which occur in ordinary circumstances the increase of velocity of sound may be taken as proportional to the increase in temperature, so that the temperature correction is easily applied. Simple geometrical considerations show that the correction for wind depends only on the velocity and direction of the wind and the position of the microphone, and not at all on the position of the gun. With given microphone positions a diagram can be prepared which allows the rapid graphical determination of the correction for a known wind.

It has been found by experiment that the temperature and wind which are concerned in these corrections are not those prevailing at ground level, but at a height of between 250 and 500 ft. up.

Owing to the refraction of sound by wind the record of a given sound at ground level is greatly influenced by the variations of wind velocity at different heights above the ground. This wind gradient determines largely whether the conditions are favourable or unfavourable for the detection of sounds. In the case of a wind increasing in velocity with height, a following wind, besides increasing the velocity of the sound, tilts the wave front so that the sound converges on the listener or instrument on the ground, and is well heard. An opposing wind causes the sound to tend to pass upwards and leave the ground. Hence a wind blowing from the instruments towards the hostile piece often renders sound-ranging almost impossible if it be of any strength. The temperature gradient also plays a part in the refraction of sound.

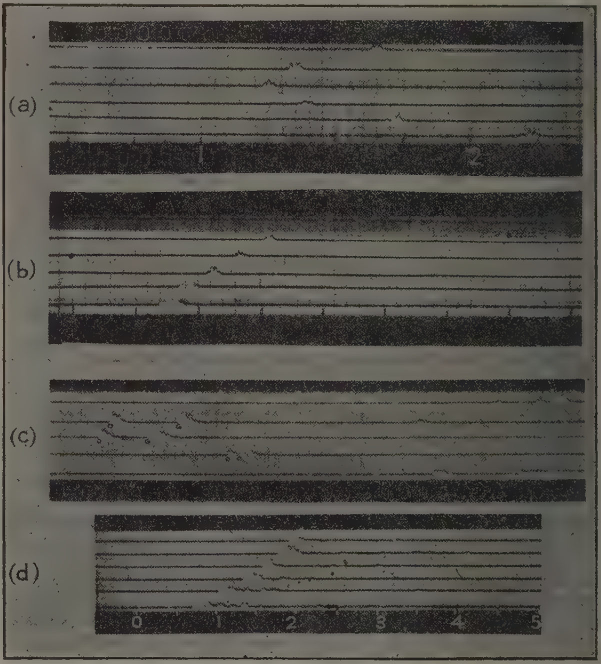

FIG. 9.—Typical records of Bull apparatus.

Location from Record.—Having seen how the intervals between the arrival of the sound at different posts can be accurately obtained and corrected to standard conditions it remains to discuss how these intervals can be made to supply the position of the gun with as little delay as possible. A map board is prepared with an accurate "grid" (coördinate system of squares) covering the region in which locations are expected. On this the microphone positions are accurately marked. The posts are usually taken consecutively in pairs; with each pair as foci a family of hyperbolae may be drawn giving the loci corresponding to various time intervals (at standard velocity of sound). In practice, however, to avoid the labour of preparing the hyperbolae it is usually preferred to use the asymptotes instead of the curves themselves: for these it is only necessary to have a thread attached to each mid-point between pairs of consecutive posts, and a scale plotted round the edge of the board for each base, graduated in time intervals, so that when the thread is placed to pass through a given graduation it is the asymptote to the hyperbola corresponding to the interval. To allow for the divergence of the asymptote from the hyperbola, which becomes serious as the base is approached, tables are prepared giving the corrections (always additive), in terms of the length of the base and the distance from the mid-point of the base, to be applied to the time intervals obtained from the record. The asymptote corrections having been applied to the various intervals, already corrected for temperature and wind, the asymptote corresponding is laid out for each base. The various lines should all intersect at a point: in general they do not, but form a small polygon from which the position of the gun can be estimated.

Estimation of Calibre.—The position of the hostile burst may be obtained from the record of its sound in the same way as the position of the piece, and the interval between the departure and burst of the shell, *i.e.* the time of flight, can be computed from the record on one microphone. Thus the record gives the time of flight corresponding to a given range, which affords an indication of the calibre of the piece. In the case of guns, as distinct from howitzers, a further indication can be obtained from the interval between shell-wave and gun-wave at the different posts.

Work in the Field.—It is not feasible to have the film running continuously during any period when records are expected. It should be started a second or two before the sound reaches the first microphone. In the field this is effected by having two forward observers in front of the line of microphones, so placed, one to each flank, that either the one or the other of them must hear the sound of the hostile piece a few seconds before it reaches any of the microphones. These observers are provided with keys, the depression of which starts the film running. They also report by telephone informations judged useful as to the estimated calibre, the approximate location of the burst, if seen, and so on.

The line of microphones in general covers a front of some 8,000 yd. and is some 2,000 yd. or more from the front line. It is usually preferred to place the instruments at approximately equal intervals on a smooth curve, which may be a straight line, or the arc of a circle either convex or concave towards the enemy, according as guns well to a flank have to be located, or attention is concentrated on a more central group of guns. Such arrangements lead to greater ease of identification of a record than is possible if the microphones are very irregularly placed.

The microphones may be placed anywhere where the hearing is good: the only obstacles which seem to cast sufficient sound shadow to affect them are high hills just in front of them. They may be put in shallow depressions dug for them, and should be protected from splinters, and also from wind and draughts. Canvas and hurdles may be used for this latter purpose without appreciably affecting the sensitiveness of the instruments.

Ranging on Hostile Pieces.—A heavy burst near a hostile gun position will furnish a sound record of its position just as does the gun itself. Fire may be directed on a piece which is in action by comparing the records which it supplies with those of the bursts of one's own answering shell. Since both gun and burst are located by the same method all uncertainties introduced in an ordinary location by ignorance of the precise atmospheric conditions are eliminated.

A differential method is adopted, the difference of times of arrival of the sound of the hostile gun and of the friendly burst at each microphone being plotted as ordinates against a certain simple function of the relative positions of the microphones and the hostile gun as abscissae. A horizontal line then corresponds to a direct hit; a straight line sloping to left or to right to an error of line to one side or the other; a curve (approximately an elliptical arc) convex or concave downwards to an error of range. The magnitude of the corrections necessary is easily estimated from curves previously prepared. (E. N. DA C. A.)

RANGER, HENRY WARD (1858–1916), American painter (*see* 22.891), died in New York City Nov. 7 1916.

RASPUTIN, GREGORY EFIMOVITCH (1871–1916), Russian monk and court favourite, was born in 1871 in the village of Pokrovskoe, near Tyumen, in the province of Tobolsk, Siberia. He was the son of a poor peasant whose disorderly behaviour resulted in his being given the name of Rasputin, meaning "debauchee." He received no education, and till the end of his life was unable to write properly. He spent the first part of his life till the age of 33 in his native village; he married in 1895 a well-to-do girl, Olga Chanigoff, and they had two daughters and a son. In 1904 Rasputin resolved to change his mode of living. He left his family and devoted himself to religious exercises, declaring to his people that he was inspired by God. His passionate nature, his great physical strength, and the superstitious atmosphere in which he had been brought up, gave an unexpected direction to his religious exaltation. He adopted the views of the sect known under the name of "Khlysty," the leading idea of whose teaching was that salvation could be achieved only by repentance.

"Sin in order that you may obtain forgiveness"—was the practical rule which he drew from this doctrine. "A particle of the Supreme Being is incarnated in me"—he told his hearers. "Only through me you can hope to be saved; and the manner of your salvation is this: you must be united with me in soul and body. The virtue that goes out from me is the source of light, the destruction of sin" (E. J. Dillon, *The Eclipse of Russia*). This extravagant and dangerous teaching, which resulted in practice in the most wild orgies, not only created for Rasputin immense popularity and the reputation of a holy man among his fellow-peasants, but opened before him the doors of some of the most fashionable Russian houses and even those of the Imperial Palace. Looking for new experiences Rasputin left his native village, and made long pilgrimages to various holy places, and even went to Mount Athos and Jerusalem. He spent some time in different monasteries and applied himself to the study of holy books, but his lack of elementary education reduced the results of his labours almost to nothing. He only retained by heart some incomprehensible passages, and often used them in his prophecies. He had, however, a strong magnetic power, the influence of which was recognized by his bitterest opponents.

In 1907, during a stay in St. Petersburg, Rasputin was introduced to the Archimandrite Feofan, rector of the Theological Academy and confessor to the Empress, who took an interest in the story of his conversion. The Archimandrite, with the assistance of the Grand Duchesses Militza and Anastasia, presented Rasputin at court, and he produced a deep impression on the Empress and Emperor. The mystic atmosphere which always prevailed at the Russian court, and which was especially strengthened by the disasters of the Japanese War, the internal troubles in 1905, and the constant fear for the health of the Tsarevich, created a convenient background for the appearance of such a man. His disdain for all rules of good behaviour, his dark prophecies, and, above all, the eventual improvement in the health of the Grand Duke Alexis, which more than once seemed to result from his influence when medicine was ineffectual, created an exceptional position for him with the Empress. Disgusted with the Russian intellectual classes and the bureaucracy, she saw in Rasputin the representative of the mass of peasantry, the only sure support of orthodoxy and autocracy, specially sent by God to save the heir to the throne and preserve the dynasty. Rasputin took advantage of this belief, and did his best to persuade the Empress that his fate was closely tied with that of the imperial family. The example of the court was followed by a large section of the upper class, and many doors were opened for the "Saviour," as the Empress used to call him. For some time Rasputin was satisfied by this side of his social success, and at first he did not interfere in politics. But his activity was felt in church questions. His friendship with the famous monk, Heliodor, and the Bishop of Saratov, Hermogen, which resulted in a complete rupture between them and in a series of scandals, had a painful echo in the country. The appointment of Varnava, an illiterate peasant and a friend of Rasputin, to be Bishop of Tobolsk in 1911, and the extraordinary servility with which the Holy Synod followed the wishes of the favourite, provoked a strong opposition among all classes of society. The most prominent upholders of orthodoxy demanded a complete reorganization of the Russian church, and denounced the servile attitude of the Holy Synod. Guchkov, the Octobrist leader, in a famous speech delivered at the State Duma, made direct allusions to the nefarious influence exercised by Rasputin. But the influence of the "Saviour" was too strong to be checked by any expression of feeling in the country, and Rasputin triumphed over all his enemies.

An unsuccessful attempt to kill him, made by a certain Guseva in 1914, incited by the monk Heliodor, only strengthened his influence, which became especially powerful during the two last years of the imperial regime. No important nomination was made without his approval, and the most unexpected people rose to the highest offices as result of his interference. Rasputin was too ignorant to have any opinion on political questions: he was in most cases an instrument of the reactionaries. Numberless stories of the debauchery practised at the court, in which the name of Rasputin was coupled not only with some of the court ladies but even with that of the Empress herself, became a common topic of conversation in all classes of Russian society. At length a supreme effort to free the Empire and the dynasty from his influence was made by a small group of men of the highest social position, which included the Grand Duke Dimitri Pavlovich, Prince Yussupoff and M. Purichkevich. Rasputin was invited to a supper at the Yussupoff Palace on Dec. 15 1916, and shot dead, after an attempt at poisoning him with a strong dose of cyanide potassium mixed with wine had not produced the desired effect. His body was thrown under the ice of a canal. The death of Rasputin was a terrible shock to the Empress; she transferred his body to the park of Tsarskoye Selo, where a special chapel was erected, and came every night to pray on his grave. The Grand Duke Dimitri Pavlovich was sent to Persia to join a fighting column. Yussupoff was ordered to leave Petrograd, and interned in his estate. Purichkevich, protected by his immense popularity in the army and by his title of member of the Duma, returned to his work on the front. (P. Vi.)

RATHENAU, WALTER (1867–), German industrialist and political economist, president of the Allgemeine Elektricitäts-Gesellschaft, was born Sept. 29 1867 in Berlin. He came into prominence in Aug. 1914 as the founder and director of organizations for providing raw materials, during the World War, for Prussia and the German Empire. On the formation of the Wirth ministry in May 1921 he was appointed Minister of Reconstruction, and in that capacity negotiated with the French minister, Loucheur, a convention for supplying German materials for the restoration of the devastated area in France, and thus paying in kind part of the reparation which the German Reich had undertaken to pay in gold. Rathenau published various books, pamphlets and articles, on social and economic questions, some of which attracted world-wide attention, especially his *Von kommenden Dingen* (1920). In Jan. 1922 he became Foreign Minister in the Wirth Ministry.

RATHMORE, DAVID ROBERT PLUNKET, 1st Baron (1838–1919), Irish lawyer and politician, was born Dec. 3 1838, the third son of John, 3rd Baron Plunket (1793–1871). He was educated at Trinity College, Dublin, taking his degree in 1859, and was called to the Irish bar in 1862. He was made Q.C. in 1868, and the same year became legal adviser to the Irish government. In 1870 he stood successfully as Conservative member for Dublin University, holding the seat for twenty-five years. From 1874 to 1877 Plunket was solicitor-general for Ireland, and in 1880 was for a short time paymaster-general. In 1885 he was first commissioner of works in Lord Salisbury's ministry, and resumed this post in 1886, when the Conservative party returned to power, holding it till 1892. In 1895 he was raised to the peerage. He died at Greenore Aug. 22 1919.

RATIONING.—In the articles Food Supply and Savings Movement the general question of food control during the World War is dealt with. During 1914–8 most of the European states, belligerent and neutral, were driven, by shortage of supplies, to ration the consumption of the more important foods, and in some cases of other articles, by the civilian population. "Rationing," of course, is a term of military origin; it denotes the supplying to each member of a fighting force or a beleaguered population of a definite "ration," based upon calculation of his needs, of the supplies available, and of the period for which they must serve. The process of rationing, therefore, has two sides—negative and positive: the negative side of preventing any individual from obtaining, by purchase or otherwise, more than the authorized quantity of the rationed article, and the positive side of making it possible for each individual in fact to obtain that quantity. It is thus a problem both of restriction and of distribution, and the success of any rationing system may be judged even more by the degree to which the positive side is carried out, than by the completeness with which the prohibition upon excessive consumption is enforced.

In this respect the British system of food rationing had for the reasons mentioned below a relatively high measure of success and is therefore described here in some detail. The modified system adopted in the United States is dealt with in a final section. Besides food and feeding stuffs for animals, fuel and light were rationed in the United Kingdom, and both these and many other things, such as clothing, tobacco, matches and housing accommodation, were rationed in various enemy and neutral countries in Europe.

British Food Rationing

Historical Sketch.—The earliest steps to the introduction of compulsory rationing in Great Britain were taken in relation to sugar. Since the first month of the war sugar had been subject to Government control, under a Royal Commission on the Sugar Supplies, constituted in Aug. 1914. By the end of 1916 the quantity of sugar that could be obtained for the United Kingdom as a whole began to fall far short of the public demand, and in the first part of 1917 this reduced quantity was being distributed on the basis of giving so far as possible to each trader, whether wholesale or retail, 50% of the quantity which he had received in 1915, it then being left to the retailer to divide his supplies as best he could among his customers, subject to a limit of price. This simple system was necessarily very imperfect in action, and grew steadily less satisfactory owing to changes in the distribution of the population. With the development of the munitions campaign new towns sprang up as at Gretna or Birtley; old towns like Coventry or Sheffield or Woolwich doubled or trebled their population or acquired new suburbs; from many country districts and provincial or university towns in the south of England the population ebbed away. Distribution of sugar or any other article of food on the 1915 basis became manifestly inequitable.

During the first half of 1917, while the acute difficulties of the new munition areas were being relieved by temporary palliatives, such as the dispatch of additional supplies after enquiry by inspectors in each case, schemes for recasting the whole system of distribution on the basis of a complete fresh registration of the population were worked out and several alternative schemes were submitted to the War Cabinet in June 1917. The Cabinet adopted one of the alternatives, under which each household was to be invited to register for sugar with a particular retailer, to whom supplies of sugar would be sent in accordance with the numbers and size of the households registered with him, at a specified ration per head, but under which there would be nothing to prevent a retailer from using any surplus sugar in his hands to supply others, or to prevent persons from getting sugar, if they could, in excess of the ration, or from any retailer other than the one with whom their household was registered.

The scheme, while applied in the first instance only to sugar, involved the setting up of extensive administrative machinery, which could thereafter be used both for rationing other foods and for any other local work of the Ministry. This machinery consisted in essence of some 1,800 Food Control Committees appointed by the local authorities, but with their expenditure met from national funds, together with Divisional Food Commissioners appointed directly by the Ministry of Food for the 15 main divisions into which the country was divided, and having the special function of supervising, assisting, and coördinating the work of the committees. Immediately after the presentation of these proposals to the Cabinet (June 1917) the first food controller, Lord Devonport, resigned his office, and the proposals were approved by the Cabinet, subject to their receiving the subsequent assent of his successor, Lord Rhondda. The latter did in fact assent, and proceeded at once with the schemes both for redistribution of sugar and for divisional and local organization. The 1,800 local sanitary authorities in Great Britain were invited by circular (issued Aug. 2 1917) to appoint Food Control Committees, and did so during Aug. and the first part of September. Each committee set up a local "Food Office," usually in one of the municipal buildings, appointed an "Executive Officer," and during Sept. and Oct. issued to each houshold in the district a sugar card showing the number of persons in the household, and having a counterfoil to be detached and deposited with the retailer from whom the householder proposed to get his sugar. There was thus carried out a complete registration of the population by households in each district. The intention was to bring the distribution of sugar to each district on to the new (population) basis, as opposed to the old (1915 trade) basis as from Jan. 1 1918.

The sugar scheme, however, was never brought into force in the form approved by the Cabinet. In that form it was a distribution not a rationing scheme, was based on households not individuals, and deliberately made no formal provision for transfer of individuals from one household to another, or for persons too migratory to form part of any household. An alternative scheme for rationing by means of individual cards, entitling the holder to a fixed quantity and no more, had been submitted to the Cabinet in June 1917 but was rejected, because at that time the Cabinet was not prepared for rationing as such. It seemed doubtful whether the public would submit to compulsory restriction of their food consumption; there was further an objection to giving the enemy the encouragement of seeing Britain apparently driven to extremities by the success of the submarine campaign.

By the end of Sept. it became clear that the public were prepared and anxious for definite rationing, that is to say for a system under which nobody could get more than a certain quantity and everybody could be certain of getting that. In Oct. and the following months accordingly the scheme was entirely revised and provision made for the household sugar cards to be exchanged for individual cards, and for any person who belonged to no household to obtain a document which should be the sole title to sugar supplies.

Another and more drastic change was also contemplated, namely, the substitution of a single centralized register of sugar consumers, that is to say of the whole population, for the 1,800 separate local registers which had resulted from the registration of households under the original scheme. The first steps to the formation of this central register—in the Imperial Institute buildings at South Kensington—were taken in Nov. 1917, and a good deal of preliminary work was done. The change over from local to central registration, however, was only to be made gradually, and was in fact never completed. After the success of the schemes described below—for rationing fats and meat on the basis of local registration (Feb.–April 1918), the idea of making a central register of the population was abandoned. The public, though at times mildly puzzled by the changes of the cards with which they had to deal, remained for the most part unconscious of the successive revolutionary changes in the ideas which dominated the administration of rationing.

The scheme, which had been started as one for the distribution of sugar to households in July 1917, came into force as a scheme of rationing by individuals on Jan. 1 1918 without a hitch. The reserve stocks at the disposal of the Sugar Commission were at that time considerable, and, since sugar is not highly perishable, the Commission had been able to distribute those stocks widely and to provide each retailer with an ample margin to meet contingencies. With insignificant exceptions, every person in every part of the country was able from the outset to get week by week the ration of half a pound of sugar to which his ration document entitled him.

Meanwhile, in the last quarter of 1917, the public became aware of serious shortages of other commodities, in particular tea, margarine, bacon and cheese. These shortages led to the appearance of queues at the shops and threatened to arouse grave industrial unrest. The centralized rationing scheme which was then the accepted policy in London could not come into force for many months. On the other hand the Food Control committees were established and at work; it was natural for Lord Rhondda to ask the committees to deal with the difficulty of the queues in the interim as best they could. One or two of the committees, among whom the Birmingham committee was conspicuous, started their own schemes for registering consumers with retailers and controlling the distribution of supplies to the retailers by the exercise of powers of requisition granted by the Ministry. General provision for such schemes was made by an Order of the Food Controller of Dec. 22 1917, which was called a Food Control Committees (Local Distribution) Order, but was in fact an order authorizing committees to introduce complete local rationing of any or every article, subject to approval of the scheme by the Ministry of Food. An important memorandum issued to the committees on Dec. 29 1917 outlined model schemes and gave advice and suggestions. The formulation of local schemes in congested industrial areas at once showed the impracticability of purely local action. It was clearly impossible for several Food Control committees in neighbouring districts forming part of a single industrial town to have different rationing systems, or for some to ration while the others did not. It was equally impossible for local committees to control the distribution of foods, such as frozen meat or margarine, which are stored or manufactured at a few main centres for distribution throughout the country. These difficulties came to the fore at once in London and its suburbs.

At a general meeting of executive officers of the London committees held on Jan. 4 1918, it was resolved to have a single rationing scheme for the whole Metropolitan area and to ask the Ministry of Food to prepare such a scheme for approval by the committees as a whole. It became clear almost immediately that no convenient break could be made between London and the districts immediately surrounding it, and the home counties were included. The scheme was originally asked for to deal with fats (margarine and butter) alone, but the meat shortage became acute at a moment's notice in Jan., and estimates of the quantities available in the first quarter of 1918 made it imperative to include meat as well.

A scheme covering both fats and meat was worked out accordingly by the Ministry, approved at another meeting of executive officers, embodied in a "London and Home Counties (Rationing Scheme) Order," and brought into force on Feb. 25 1918 for an area containing something like 10,000,000 people. It involved the issue of two ration cards to each individual, one with detachable coupons for meat, and one for butter and margarine, without coupons, but with numbered spaces in which the retailer marked off the customer's purchases as they were made; each card had a counterfoil to be deposited with a retailer, and the supplies were distributed to retailers on the basis of the counterfoils deposited with them. The scheme had an almost melodramatic success. The London queues, which, according to the observations made by the Metropolitan Police, had included, in each of the weeks just before rationing, over 1,300,000 people, fell to 191,000 in the first week and to 15,000 in the fourth. Before rationing about 550,000 persons stood in food queues every Saturday in London; on the first Saturday after rationing the number was 110,000, on the next 24,000, and on the fourth Saturday under 7,000. In effect the queues for meat and fats disappeared altogether; there remained only queues for cheese, jam and other unrationed articles. The success of rationing was one of organization; the total amount of meat and fats available for consumption and actually consumed in London was not greater after rationing than before. It was simply better distributed and made obtainable without the labour of standing in a queue.

Meanwhile local schemes under the Order of Dec. 22 1917 had made considerable headway in the diminution or abolition of queues for butter and margarine outside London and the home counties. The local rationing of meat, however, presented insoluble difficulties, and even before the introduction and success of the London scheme the decision had been taken to introduce a national scheme for meat rationing as soon as possible. This was done on April 7.

The extension of meat rationing to the whole country was as successful as its introduction in London. The queues disappeared and everyone everywhere got his ration. This result decided incidentally the fate of the sugar scheme. The attempt to form in London a central ration register of the population was abandoned; the staff, till they could be dispersed, were used on other work in the checking of coupons, and arrangements were made to include sugar in the uniform scheme of national rationing through local committees which was introduced on July 14 1918, when each member of the public received a single book with different coloured leaves of uniform coupons for meat and bacon, fats, sugar, and lard. These, with jam included for the first time in Nov. 1918, were the only articles of food which were rationed nationally, *i.e.* throughout Great Britain. In addition tea was rationed in most of the great industrial centres under local schemes, and came within an ace of being included under the national scheme of July 1918. Cheese was rationed by a number of committees, but the varying consumption in different parts of the country and by different classes of consumers made any uniform system difficult; it continued to the end to be distributed on a "trade basis," that is to say by giving to each trader a fixed percentage of his supplies in a datum year. Tea, on the other hand, though never rationed nationally, came to be distributed on a registration basis, *i.e.* in accordance with the actual population in 1918. In addition to articles for human consumption, feeding stuffs for animals were also controlled by the Ministry of Food, and in the latter part of 1918 were brought under a formal rationing system; this system hardly had time to come into full operation when the war ended.

The first national ration book had a currency of 16 weeks, and was succeeded by a fresh issue with no material change except an extension of currency to six months on Nov. 4 1918. After May 3 1919 coupons were abolished, but a limited system of rationing without coupons, by means first of the old ration books and later of identification cards, was continued for many months. Bacon and ham were freed from rationing in July 1918, lard in the following Dec., margarine in Feb. 1919, jam in April 1919, and meat in Dec. 1919. With the freeing of butter in May 1920 and sugar in Nov. 1920 rationing came to an end.

The foregoing sketch applies only to Great Britain. No rationing of meat or fats was attempted in Ireland, but a sugar distribution scheme, on the lines of the first British scheme, was put into force in Ireland by the Irish Food Control committee under powers conferred by the Food Controller.

National Rationing Scheme.—The Rationing Scheme, as finally established in July 1918, was a uniform national system administered by autonomous local committees, and having as its main features the use of individual ration books, the tie of each customer to a particular retailer, and the systematic supply to each retailer of the quantities required to meet the needs of his registered customers. A single application form had to be filled in by each household and forwarded to the Food Office, which thereupon issued a separate ration book for each member of the household. The ration book was a book containing different coloured leaves for various foods. Each leaf consisted of (*a*) a counterfoil to be signed, detached and given to the retailer with whom the holder of the book wished to register, and (*b*) coupons for each week's supply to be detached by the retailer when actual purchases were made. On registration of the customer the retailer besides detaching the counterfoil was required to enter his name and address on the appropriate part of the ration book. In addition to the leaves for foods rationed, such as sugar or meat, there were spare leaves which could be used for rationing other foods at short notice, and one of these was in fact adapted to deal with bread should the occasion ever arise. The book contained also a reference leaf, which served as an application form for subsequent issues. There were special books for children under six years of age (who got half rations of meat), books authorizing supplementary rations of bacon for manual workers and growing boys, and special books or leaves of coupons for invalids, travellers, vegetarians, Jews, soldiers and sailors on leave, and other particular classes.

The tie of each customer to a particular retailer was the essence of the scheme, the main safeguard against fraud, and the basis of distribution. Behind rationing as the public saw it—a paper affair of application forms, counterfoils and coupons—was a not less extensive and intricate machinery for distribution of the appropriate supplies through all the complex channels of trade week by week to every retailer in the country. The precise form of this machinery was naturally different for different articles of food; the common feature in all cases was that the retailer had to make an indent on a wholesaler in accordance with the number of persons registered with him, and each wholesaler in turn made application to a primary supplier (manufacturer, importer or other) based upon and accompanied by copies of the retailer's indents. The supplies flowed downwards through the various channels of trade in accordance with the applications and indents. The retailer's indents had in some cases to be approved in advance by the Food Control committees; in all cases their correctness was liable to be checked by examination of their registers of customers and of the counterfoils detached from the ration books.

In the case of meat, where the civilian supplies were mainly homegrown, there was needed in addition an elaborate organization, under Livestock Commissioners appointed by the Ministry of Food, for controlling the bringing of beasts to market, and their slaughtering and distribution, and for supplementing home supplies from the reserves of imported meat. In the case not only of meat, but of butter and margarine, there was a further difficulty—that the food was highly perishable and the retailers could not carry reserve stocks.

The importance of the tie to the retailer became apparent when it came to be realized that it would be perfectly possible to have a rationing scheme without coupons at all, if every individual consumer had to register at a particular shop and the supplies to that shop were adjusted strictly to the registration. The value of the detachable coupon was, first, in enabling the retailer to know whether he had already given a particular customer his supply for that week, and second, in affording a check upon the retailer, who could be required to make returns of supplies received, sold or retained, and to account for the supplies sold by producing an equivalent number of coupons. The staff collected for central rationing was used from April 1918 onwards to check the retailers' accounts by counting the coupons they had collected.

Apart from the points mentioned the technical details of most importance in the rationing scheme were the following:—

(1) The fixing of the ration for uncooked butcher's meat by value rather than by weight. Under the London scheme and the general meat scheme of April 1918 each card had for each week three coupons entitling the holder to buy 5d. worth per coupon, *i.e.* 1s. 3d. worth altogether of uncooked butcher's meat. As the price per lb. for each cut of meat was regulated by an elaborate schedule having regard to quality, to proportion of bone and to other matters, the fixing of the ration by value afforded an automatic means of adjusting the ration according to the cut selected. This device proved quite satisfactory and was continued in all subsequent schemes.

(2) The classification of "establishments," ranging from prisons and asylums to schools, hotels, living-in establishments, tea-shops and seaside boarding houses. With the single exception of the problem of the "self-supplier" this is technically the most difficult part of rationing, and the relatively efficient treatment of establishments in the British system was a considerable element in its general success. It is probably true to say that Britain was the only European country which made serious inroads on the comfort of living in first-class hotels or lunching at first-class clubs during the war.

(3) The provision for transfers of registration from one retailer to another, or from one district to another. This part of the scheme was framed with considerable care; the widespread organization of the Food Control committees bringing a food office within easy reach of every considerable number of inhabitants, and the reasonable latitude allowed to their officers in dealing with local and personal emergencies, prevented registration formalities from becoming intolerable.

The problems of "self-supply" and "direct supply," *i.e.* of persons producing food for themselves or obtaining food direct from the producer and not through a trader, arose in Great Britain only to a limited extent, and cannot be said to have been fully solved. Restrictions were imposed but were not pressed to the utmost.

The articles rationed and the amounts allowed at various dates are set out in the appended table.

Comparison with Other Countries.—The problem of rationing was simpler in Britain than in most European countries, and far simpler than in Germany and Austria, for the following main reasons: first, the deficiency of supplies below normal was less; second, the bulk of the British supplies were imported, not home-grown; third, the supplies of cereals could be and were kept at a point high enough to allow rationing of bread stuffs to be avoided altogether.

The difference in supplies is clearly illustrated by a table given in the article FOOD SUPPLY and published by the Ministry of Food at the end of 1918, comparing the estimated consumption per head of certain essential foods in the United Kingdom, Germany and Holland before and during the war. Another striking contrast emerges in the report of a committee appointed at the Ministry of Food at the end of 1917 to prepare a comprehensive scale of rations covering meat, cereals, fats and sugar. The committee based their scale on estimates of the minimum numbers of calories per day required by various classes of persons, according to age and occupation, and of the proportion that, having regard to other foods available, should be provided by these essential foods. Comparing their scale with the actual rations in force during 1917 in Hamburg (taken as typical of German industrial conditions), the committee found that the latter scale represented in respect of these essential foods and potatoes not more than $\frac{2}{3}$ of the minimum requirements, while the shortage of less essential foods was probably even greater. The German ration of fat was reduced still further as from Jan. 1 1918, making the Hamburg rations per week for ordinary adults as follows:—Bread $4\frac{3}{8}$ lbs.; Meat 9 oz.; Fats $2\frac{1}{2}$ oz.; Sugar $\frac{1}{3}$ lb.; Potatoes $7\frac{1}{8}$ lbs. Men engaged in physical labour received a supplementary ration of $1\frac{3}{4}$ lbs. of bread (per week), and those engaged in exceptionally hard physical labour received altogether $7\frac{3}{8}$ lbs. of bread, $\frac{3}{4}$ lb. of meat, $4\frac{1}{2}$ oz. of fats, $\frac{1}{3}$ lb. of sugar and $9\frac{3}{8}$ lbs. of potatoes. These men would be few in number.

Rationing in Great Britain 1917–20.

Article.	Period of Rationing (whether local or national).	Amount of Weekly Ration per Head.
Sugar . . .	Nationally—from Dec. 31 1917 to Nov. 29 1920	8 oz. Dec. 31 1917 to Jan. 27 1919; thereafter sometimes 12 oz. and sometimes 8 oz. with a drop to 6 oz. for a few weeks in Sept.–Oct. 1919, and again Jan.–March 1920.
Butter and Margarine	Locally from Dec. 14 1917 to July 1918 (38,000,000); thereafter nationally to Feb. 16 1919 for both fats, and to May 30 1920 for butter alone.	5 or 6 oz. for both fats under national scheme. The London scheme started with a ration of 4 oz. The separate butter ration after Feb. 1919 varied from 1 to 2 oz.
Lard . . .	Locally from Jan. 1918 (1,500,000); nationally from July 14 1918 to Dec. 16 1918.	2 oz. nationally and in most local schemes.
Meat (Uncooked Butcher's Meat)	London and home counties from Feb. 25 1918 (10,000,000) with a few other local schemes; nationally from April 7 1918 to Dec. 15 1919.	Under the London Scheme 3 coupons entitling to 4d. worth each, or 1s. altogether (about 1 lb. with average bone), subsequently changed to 1s. 3d. Under the national scheme varying values as follows: 1s. 3d., 1s., 1s. 4d., 1s. 8d., 1s. 4d., 1s. 8d., 2s.
Bacon and Ham.	London and home counties from Feb. 25 1918 (10,000,000) with a few other local schemes; nationally from April 7 1918 to July 29 1918.	Under the London scheme 4 oz. with bone per coupon. Under the national scheme 5 oz. and 8 oz.
Other Meats .	All meat (including preserved meat, poultry, game, offal, venison and horse-meat) was included in original London scheme, but control was gradually relaxed.	Varying rations.
Jam . . .	Locally from early part of 1918 (500,000); Nationally from Nov. 4 1918 to April 15 1919.	4 oz. under national scheme.
Cheese . . .	Locally from early part of 1918 (2,000,000).	$1\frac{1}{2}$ oz. to 2 oz.
Tea . . .	Locally from Dec. 1917 (17,500,000).	$1\frac{1}{2}$ oz. to 2 oz.

Notes.—The numbers in parentheses give the maximum numbers covered by local schemes of rationing. The number covered by national rationing, *i.e.* the civilian population of Great Britain, in 1918 was 39,000,000.

In the London scheme and the first national meat scheme (April 7 1918) four coupons were provided to cover all meat of every kind. Three of these coupons only might be used for uncooked butcher's meat; any of them could be used for bacon, poultry, preserved meat, etc. The normal ration at the outset was thus 1s. worth (= $\frac{3}{4}$ lb. with average bone) of uncooked butcher's meat, together with 4 oz. of bacon with average bone, or in place of the bacon, varying quantities of offal, poultry, game, etc. Later the rations were raised.

The weekly rations in Vienna by the end of 1918 were even lower:—Bread $2\frac{1}{2}$ lbs. (with an additional 2 lbs. for heavy workers); Meat $4\frac{1}{2}$ oz.; Fat $1\frac{1}{2}$ oz.; Sugar nil, and Potatoes $1\frac{1}{8}$ lbs.

The Austrian figures represent a breakdown of supplies and society. The German rations are those on which the civilian population of Germany sustained the war and made munitions during 1917 and 1918. They show a power in the human body to endure over months and years, at whatever cost in permanent loss of health and vigour, a scale of nutrition far below the minimum prescribed by scientific authority. They indicate at the same time the intensity of the strain to which the rationing regulations of the enemy countries were subjected.

The advantage to the British food controller in obtaining so large a part of his supplies from overseas was equally decisive. Imports were all brought automatically and completely under public control; nothing remained save distribution and the fixing of prices. The German and Austrian food controllers had to rely almost exclusively on home-grown supplies; they were faced by and failed to solve the problem of obtaining from the home producers a fair proportion of their produce for distribution under the rationing system. To a small extent this fact must be taken as a correction of the previous statement of rations as showing the actual consumption; an appreciable part of the total supplies escaping public control altogether was sold as contraband (*Schleichhandel*) to the urban consumers. The actual consumption in each family was the ration plus a varying proportion of contraband. The contraband trade, however, in Germany at least cannot have benefited more than a small proportion of the industrial population and was mainly an advantage to the well-to-do and to the hotels. It had a disastrous reaction on the general respect paid to the rationing regulations, and deprived them of that support of public opinion which was so marked in Great Britain.

The third great advantage of the British food controllers was that, by securing adequate tonnage for cereals, they were able to avoid the rationing of bread stuffs, and the elaborate and contentious system of graduated rations for different classes of workers which would otherwise have been inevitable. So long as rationing is confined to articles other than bread, a flat scale of rations for all adults, whether engaged in sedentary or in severe physical work, is possible; the larger amount of calories which the latter classes must have, in order to perform their work, can be obtained by increasing their consumption of bread. If bread as well as meat, fats and sugar are rationed this individual adjustment of consumption, according to the physical energy required, becomes impossible. The rationing system itself must provide differentiated rations for men doing varying kinds of physical labour or doing little or no physical work at all.

All the continental countries which rationed bread-stuffs had accordingly to introduce "supplementary" rations for heavy workers of different grades; the classification of the population for this purpose was one of the most difficult and contentious parts of the whole system; it appears to cut at the root of the principle of equality upon which rationing is based. In Great Britain a scheme of supplementary rations of bacon, for growing boys and for men engaged in physical labour, was introduced in April 1918, not so much for its own sake as in order to get the recipients classified, and so to prepare the ground, in case bread rationing became necessary, as at that time appeared possible. Fortunately the danger to the British bread supplies passed over; the supplementary rations of bacon, though they received the general support of the Food Control committees and were clearly right in principle, were strongly criticized by labour representatives, and were abolished when bacon was freed from rationing in July 1918.

While for the three reasons stated it must be recognized that the British rationing problem was immeasurably simpler than the German or the Austrian one, it may still be claimed that even allowing for this the British system was definitely superior in itself. First, the proper balance between centralization and decentralization of responsibility was attained. The British system was national and therefore uniform and fair in principle, but was carried out by local authorities with ample power to adjust it to local conditions. German rationing was local in origin; the central authorities had the impossible task of securing coördination subsequently; the traveller from one part of the country to another found himself under different regulations in every town. Second, the British food controllers never issued a ration book without a distribution system to back it. Third, the British system was probably superior in the ingenuity of many technical details. In respect of one of the main articles of food, namely meat, the British like the German controllers had practically to rely upon home-grown produce for the civilian population and had the same problem of collecting supplies from the producer. Fourth, and finally, the British system was more successful in giving equal treatment to rich and poor. This was its corner stone. Lord Rhondda had many doubts as to the practicability of rationing. He feared that the public would never submit to being limited in their purchases, tied to one retailer and subjected to transfer formalities every time they moved from one district to another. He found that the British people in war were prepared to submit to any and every restriction on their freedom of action so long as it applied fairly to all alike. (W. H. B.)

UNITED STATES

Food rationing, properly speaking, was resorted to in the United States during the World War only in a modified form, and as to two commodities, wheat flour and sugar. That is to say, the rationing system under which a strict limit was set by law and regulation to the amount of food any person might purchase, as was the case in European countries where the rationed foods were issued only on presentation of official food cards, was practically unknown in the United States. The food saving there was accomplished in general as explained in the articles FOOD SUPPLY: *United States* and SAVINGS MOVEMENT: *United States*, through the voluntary self-denial of citizens in response to Government appeals and recommendations.

Sugar.—In the last three months of 1917 a serious shortage of sugar developed, and American householders, particularly in the eastern states, had difficulty in obtaining even small quantities for table use. This shortage emphasized the necessity for special attention to its conservation. As a first step, manufacturers of "soft" drinks, candy and related commodities, were directed to reduce their consumption to 80% of the amount used by them during the first six months of 1917. This attempt at conservation was not wholly successful in its operation as some of the less patriotic manufacturers ignored the direction. On May 15 1918, when the urgent need for shipping had resulted in a diversion of tonnage from traffic with Cuba to longer voyages, regulations were issued requiring that sales of sugar to manufacturers of the less essential foods and drinks should be made only upon presentation, by these manufacturers, of certificates which they were required to obtain from the federal food administrator of the state. These certificates were issued only upon proof that the applicant had not used since Jan. 1 1918, 80% of the amount of sugar used by him in the first half-year of 1917, and the certificate enabled the manufacturer to obtain only enough sugar to bring his total to this 80 per cent. The sugar shortage became still more serious, and with the prospect of a repetition of the experience of the fall of 1917, a rationing plan modelled upon certain European systems was put in force beginning July 1 1918. The refiner or manufacturer of sugar was forbidden to ship sugar to a purchaser except upon the receipt of a certificate issued by the federal food administrators. These certificates were issued to retailers on the basis of the number of their customers. Customers were allowed to purchase only on the basis of 1 lb. per person per month. This was increased to 2 lb. on Oct. 15 1918, and the restriction was removed in Nov. 1918. The local administrators were also authorized at all times during the home canning season to issue certificates permitting housewives to buy sugar in 25 lb. lots for canning purposes after the giving of satisfactory proof that it was desired for such purposes. A further regulation for manufacturers using sugar divided them into classes, with respect to the necessity for their products, and they were permitted to buy only on the presentation of certificates issued to them on the basis of their classification. Comparing the figures for war-time consumption of sugar in the United States with pre-war and post-war consumption, a saving of from 400,000 to 600,000 tons is shown to have been accomplished through conservation measures. Assuming it to have been 500,000 tons, it would have supplied people in France for a year, at their ration of 35 lb. per head.

Wheat Flour.—In addition to the appeals for voluntary conservation, which were particularly stressed with reference to wheat flour, compulsory regulations were put in force as to certain dealers and distributors of this commodity in Jan. 1918. This step was determined upon as a result of a particularly serious appeal addressed in that month to Mr. Hoover by Lord Rhondda, British Food Controller. Lord Rhondda cabled that unless the United States could furnish 75,000,000 bus. of wheat by July to the Allies, he could not be responsible for their remaining steadfast in the war. Accordingly flour mills were required to raise their percentage of extraction to 74% and to eliminate altogether the sale of patent flours. On Feb. 3 1918, the bakers were required to use 5% of substitute flour in all bread, and this amount was raised to 20% on Feb. 24 and on May 3 to 25 per cent. Rules were also promulgated early in 1918 requiring manufacturers of cake, breakfast cereals, macaroni and the like to limit their consumption of wheat flour to 70% of the amount they had used in 1917 for the same purposes. Since more than 50% of the flour consumed in the United States is used in home baking, it was necessary to require housewives as well as bakers to use substitutes for wheat flour. Regulations were accordingly issued, about Feb. 1 1918, requiring that no dealer or miller should sell wheat flour to an individual consumer without an equal amount of substitutes. The substitutes specified included all substitute flours, corn meal, corn grits, oatmeal and rice. Although this was not, strictly speaking, a rationing measure, it is estimated that it accomplished a saving of approximately 25% in the household consumption of wheat flour. Notwithstanding a shortage instead of a surplus at the beginning of the year 1918, the American people saved out of their own consumption sufficient wheat to send to the Allies, between Jan. 1 and the harvest, not merely the 75,000,000 bus. for which Lord Rhondda pleaded, but a total of 85,000,000 bushels.

The rationing measures described were withdrawn in Nov. 1918, and after that date there was no governmental limit upon the purchase for consumption of any food commodity in the United States. Although a sugar shortage developed there in 1919 as a result of the continuing world shortage, no revival of control over consumers' purchases was attempted in the United States. The Sugar Equalization Board, which had been continued in existence for distribution of the 1919 crop, revived, for a short time and to a limited extent, its control over distribution by directing to what sections of the country refiners should ship their product. The fact remains, however, that such rationing measures as the U.S. Government employed were in force only for a few months in 1918. (W. C. M.)

RAVEL, MAURICE (1875–), French musical composer, was born at Ciboure, France, March 7 1875, and received his musical education at the Paris conservatoire, under Fauré, Pessard and Bériot. His compositions include, besides songs, pianoforte music, and chamber music, the *Schéhérazade* overture (1911), *Rhapsodie Espagnole* (1907), and the one-act opera *L'Heure Espagnole* (1907), first produced at Covent Garden in 1919.

RAVENSTEIN, ERNST GEORG (1834–1913), British geographer, of German origin, was born at Frankfort-on-Main on Dec. 30 1834, and was educated there. In 1852 he became a pupil of August Petermann, and came to England, where he served in the topographical department of the War Office from 1855 to 1872. As a geographer he was less of a traveller than a research student, and his studies led mainly in the direction of the practice and history of cartography. He compiled many original maps and atlases, bringing a fine critical faculty to bear upon the data where these were not of the first order of scientific accuracy, as in his series of eastern equatorial Africa, scale 1:1,000,000 (1881–3), and of British East Africa, 1:500,000 (1889). One of his earliest writings was *The Russians on the Amur* (1861), but he was concerned mainly with the history of geography, as exemplified in his *Vasco da Gama's First Voyage* (1898) and *Martin Behaim, his Life and his Globe* (1908), as also in his history of cartography in the *E.B.* (*see* 17.633). He was an active member of the Royal Geographical Society and of the British Association, over the geographical section of which he presided in 1890, and in which he served as chairman of a committee which made a valuable enquiry into the climatology of Africa. He had also a particular interest in gymnastics, and published a handbook on them in 1867. He died at Hofheim in the Taunus, Germany, March 13 1913.

RAWLINSON, HENRY SEYMOUR RAWLINSON, Baron (1864–), British general, was born Feb. 20 1864, son of Maj.-Gen. Sir H. Rawlinson, Bart. He joined the army in 1884 and a year later became A.D.C. to Sir F. Roberts in India on whose staff he served intermittently for some years. He took part in the Burma operations in 1886–7, and he was on the staff on the Nile in 1897–8, for which he was promoted brevet lieutenant-colonel; he had succeeded to the baronetcy in 1891. He went out to S. Africa on the staff in 1899, served through the defence of Ladysmith, and afterwards joined Lord Roberts and accompanied him to Pretoria and into the eastern Transvaal. Throughout the later stages of the war he commanded a column, and he was rewarded with a brevet colonelcy and the C.B. for his services. Then, after some months at the War Office, he became Commandant of the Staff College, passing on from there in 1906 to the charge of a brigade. He was promoted major-general in 1909 and commanded the 3rd Division from 1910 to May 1914.

He was at first employed at the War Office on the outbreak of the World War, but was in Oct. 1914 selected to command the IV. Army Corps that was being organized. He was in charge of the forces sent to assist Antwerp, and took part in the first battle of Ypres and in the Neuve Chapelle and the Loos offensives, being given the K.C.B. in 1915. He commanded the I. Army temporarily at the end of that year, was promoted lieutenant-general, and on the formation of a IV. Army was placed at its head. He commanded this during the battle of the Somme, achieving important successes, and was promoted general in recognition of his services. At the end of 1917 he was transferred temporarily to the command of the II. Army during Gen. Plumer's absence in Italy, and in Feb. and March 1918 he acted for some weeks as British representative on the Supreme War Council. But he was recalled from this to the field in April to resume command of the IV. Army before Amiens at a critical juncture. On Aug. 8 his troops in conjunction with the French attacked the enemy in this region and they gained a signal victory, which heralded the general advance of the Allies. His army played a prominent part a few weeks later in the storming of the Hindenburg line and in the subsequent victorious advance eastwards. On the final distribution of honours for the war he was raised to the peerage as Baron Rawlinson of Trent, received a grant of £30,000, and was given the G.C.B. In the latter part of 1919 he was sent to N. Russia to conduct the withdrawal of the Allies from Archangel and Murmansk, and on his return he commanded at Aldershot for a year. At the end of 1920 he went out to India as commander-in-chief.

RAYLEIGH, JOHN WILLIAM STRUTT, 3rd Baron (1842–1919), English physicist (*see* 22.933), died at Witham, Essex, June 30 1919. He was succeeded as 4th baron by his eldest son, Robert John Strutt (b. 1875), already so well-known as a physicist and F.R.S. that he is commonly cited as Strutt when references are made to his scientific papers.

REA, SAMUEL (1855–), American railway official, was born at Hollidaysburg, Pa., Sept. 21 1855. In 1871 he joined the engineering corps of the Pennsylvania railway as chain and rod man, working on several branch lines. From 1875 to 1877 he was engaged, as assistant engineer, in the construction of the chain suspension bridge over the Monongahela river at Pittsburgh. He was next appointed assistant engineer for the Pittsburgh and Lake Erie, then under construction. He returned to the Pennsylvania lines in 1879, but ten years later joined the Baltimore and Ohio. For the latter road he was chief engineer for construction of the belt-line tunnel under Baltimore. In 1892 he was appointed an assistant to the president of the Pennsylvania railway and five years later first assistant. In 1899 he was elected fourth vice-president of the Pennsylvania, rising through the various grades to first vice-president in 1911, and when the numerical grades were discarded in 1912 was made vice-president. In 1913 he was elected president. He was also president at times of several other lines, including the Philadelphia, Baltimore and Washington; the West Jersey and Seashore; the Long Island; the Northern Central; and the Pittsburgh, Cincinnati, Chicago and St. Louis. He was in charge of the construction of the Pennsylvania station in New York City (completed in 1911) and the connecting tunnel under the Hudson river, as well as the New York connecting railway and Hell Gate bridge over the East river (opened in 1917). In 1917, after the United States entered the World War, he was appointed by the American Railway Association a member of the special commission on national defense of the Railroads War Board. He was also appointed director of the department of railroads, electric railways, highways, and waterways, of the division of transportation of the Committee of Public Safety of Pennsylvania. In 1917 he presented his private yacht to the U.S. Government for patrol duty in the Atlantic. In 1918, when the railways were taken over by the Government as a war measure, he was replaced as operating head of his road, but remained in charge of its corporate affairs. He was a member of the New York Chamber of Commerce, the American Society of Civil Engineers, the Institution of Civil Engineers of London, and the Society of Naval Architects and Marine Engineers. He was the author of *The Railways Terminating in London* (1888).

READING, RUFUS DANIEL ISAACS, 1st Earl of (1860–), British lawyer and statesman, was born in London Oct. 10 1860, of a Jewish family. He was educated at University College school, and later at Brussels and Hanover, and after a brief experience of the London Stock Exchange he was called to the bar in 1887. He speedily earned the reputation of a brilliant lawyer, and in 1898 became a Q.C. In 1904 he entered the House of Commons as Liberal member for Reading, and in 1910 was made solicitor-general and knighted. The same year he became attorney-general, and in June 1912 was given a seat in the Cabinet—the first attorney-general to be so distinguished. In Oct. 1912, Sir Rufus Isaacs's name came under unfavourable discussion during the course of the enquiry into the Marconi contracts, but on the retirement of Lord Alverstone in 1913 he was appointed Lord Chief Justice of England. On the outbreak of the World War his advice on financial questions was of great value to the Government, and he was responsible for some of the most important measures immediately taken by the Treasury in connexion with the situation in the "City." Both at this time and later, his services in the sphere of national finance were, indeed, invaluable. In 1915 he went to the U.S.A. as head of the Anglo-French loan mission, earning golden opinions. He was raised to the peerage as Viscount Reading in 1916, and in 1917 again went as special envoy to America. On his return he was created Earl of Reading, and in 1917, on the retirement of Sir Cecil Spring-Rice, owing to ill-health, went to Washington for a brief period as high commissioner and special ambassador. At the beginning of 1921 he was appointed Viceroy of India in succession to Lord Chelmsford, and resigned the lord chief justiceship. Lord Reading married, in 1887, Alice, daughter of Albert Cohen. His only child, Gerald Rufus Isaacs, Viscount Erleigh (b. 1889), married in 1914 the daughter of Sir Alfred Mond.

RED CROSS WORK.—(1) British.—The British Red Cross organizations existing before 1905 were, in that year, amalgamated and formed into a new body called the British Red Cross Society. The immediate object of the society was preparation in time of peace for the ultimate work of rendering voluntary aid to the sick and wounded in war. The War Office, which in the past had been somewhat embarrassed by casual offers of similar help from private individuals, undertook that, in the future, all such offers, other than the supply of certain personnel, should reach them only through the channel of the B.R.C.S., which accordingly began its task under powerful auspices. But it was not at first easy to interest the necessary numbers of people in proceedings depending for fruition on a contingency which most of them believed to be remote. The advance of science, also, together with modern ideas of humanity, had naturally resulted in the creation of an efficient army medical service, possessed of its own military hospitals and nurses, as well as complete equipment for the transport and treatment of wounded men. It was uncertain, therefore, what scope there would be for only partially trained helpers, even if there should be another great war in the future. The formation of the Territorial Force in 1908 provided a solution of the difficulty. Being a volunteer body called into existence for the purpose of home defence, its medical department was not such as would be self-sufficing in a campaign. The War Office accordingly invited the British Red Cross to apply itself to the formation of what are now known as Voluntary Aid Detachments, both of men and women, for service in connexion with the Territorial Force. The members of these detachments were to be prepared by instruction in first aid, sanitation, nursing, ambulance, cooking and other work, and to make provisional arrangements in respect of transport and temporary hospitals for the assistance of regular medical units during military operations in Great Britain. When war broke out in 1914, the B.R.C.S. and the Order of St. John, which was also engaged in organizing V.A.D.'s, had between them 2,374 detachments with a personnel of 70,352. Before the Armistice they numbered 4,083 with a personnel of 125,993. The original idea of the V.A.D. providing supplementary aid to the Territorial medical service was, owing to the exigencies of a European war, thrown into temporary abeyance. Their usefulness, however, was quickly adjusted to the necessities of the hour. They turned to excellent account the arrangements already made in accordance with the War Office scheme, and took a leading part in the transport and reception into auxiliary hospitals of the wounded.

But although the British Red Cross owed to the V.A.D. the advantage of having been able to enroll and educate voluntary workers in time of peace, its main object extended much farther afield. The root idea of the Red Cross is that whatever it can do to save the life or limb of a wounded soldier, or to alleviate his suffering, it is willing to do, without question, whenever and wherever its assistance can be usefully employed; and whatever can be provided to cheer or comfort him, in addition to what the taxpayer supplies, it will provide so long as its funds permit. On the other hand, the medical service of the army exists in order to do all that is reasonably necessary for its patients. That service may fail under stress, as may the army itself; but in principle it does not admit that voluntary aid is indispensable, except in so far as some of it may avoid the necessity for compulsory measures. No doubt, however, arises in connexion with additional comforts. Common sense draws the line between what a Government can be expected to give its wounded men, and what luxury, which must be left to spontaneous generosity on the part of the public acting through the Red Cross. The ostensible appeal of the British Red Cross was therefore for funds to enable the sick and wounded to be given comforts which they would not otherwise receive. But in practice a large part of Red Cross expenditure never strictly meets this description, and much but not all of it relies for defence on the ground that it has been the means of saving life. Thus, the Red Cross war library, which during the war provided over 5,000,000 books for hospitals, etc., and the 2,800 Red Cross work parties and depots, in so far as the articles they produced were not among those in army schedules, may be described as pure Red Cross efforts. But the ambulance launches sent to Mesopotamia for the transport of wounded, though they saved innumerable lives and their cost probably yielded better results, pound for pound, than any other department of Red Cross work, were nearer the dividing line which separates the field of Red Cross activities from what should be army work. These launches alone carried 414,000 passengers and travelled 683,000 m., while at the various seats of war and in the British Isles Red Cross motor ambulance cars moved 10,000,000 sick and wounded cases. Yet, in fact, the transport of wounded, on which considerably more than £2,000,000 were expended by the Red Cross, was not strictly Red Cross work. It is the business of the army to clear up its own battle-fields at its own cost and take the wounded to hospital. Nevertheless, the enormous number of cases which the Red Cross was allowed to carry remains the best justification for the expenditure incurred until we know what would have happened had voluntary aid not been at hand. It is less easy to account for grants such as those made to the King George Hospital, a military establishment of 1,655 beds set up in the buildings of the Stationery Office, which was equipped by the Red Cross, and towards the expenses of which £154,000 were contributed, two-thirds of that sum being for payment of salaries, wages and ordinary expenses.

On the outbreak of war the B.R.C.S. appealed for funds, as did also the Order of St. John, which had rendered much service in the S. African War. The emergency was altogether exceptional, and the War Office soon broke away from its own regulation as to the sole agency of the B.R.C.S. in respect of voluntary assistance. In the result a joint war committee of the two organizations was formed, subscriptions were pooled, and this committee carried out all Red Cross war work undertaken in Great Britain with some exceptions. Scotland, which elected to proceed separately, raised over £2,000,000, thus providing for a fine independent effort. In addition the principal Dominions Red Cross societies sent commissions to the areas of war where their own contingents were serving, and made generous contributions to the work. Canada, Australia, S. Africa and Egypt were conspicuous examples. India was closely associated with the joint committee in connexion with Mesopotamia and E. Africa, and the American Red Cross gave valuable support. No voluntary collection in Great Britain had ever before reached the amount raised by the Red Cross during the war. Its success was very largely due to the generosity of *The Times*, which opened its columns freely to the advocacy of British Red Cross claims and the acknowledgment of subscriptions. *The Times* fund reached over £16,500,000 and covered many special efforts, such as the annual collections throughout the Empire, known as "Our Day." These produced for the four years in which they were held, over £8,500,000, of which more than five-eighths came from overseas. The farmers sent £1,000,000; the coal-owners and miners nearly £500,000; sales of pictures, jewels, etc., at Christie's amounted to £322,000; church collections to £283,000; and pearls given by ladies from their necklaces were sold for £94,000. Every class of society contributed either in money, work, or kind, and the sums received from individuals varied from 3d. to £25,000.

In addition to the cash which passed through *The Times* fund, gifts of stores to the value of £1,000,000 were made, and a very large unascertained sum was given locally through the auxiliary home hospitals above referred to. These latter, each of which was connected with one of the military centres, were set up in most of the principal towns throughout the country. Private houses, schools and suitable buildings of various kinds were converted into temporary wards, to which, in most instances, the minor cases were sent. They were, as a rule, served by V.A.D. members under a trained nursing staff and local medical men. In some a high degree of efficiency was reached, and to a few wounded were sent direct from the hospital ships. Rent and equipment were provided by subscriptions in the neighbourhood or private munificence, with, when necessary, grants from Red Cross headquarters; and the Government paid a capitation fee in respect of each patient, also affording through the country directors special facilities for rationed food supplies. It is estimated that over 3,200 auxiliary home hospitals were opened during the four years of the war. Their work received warm approval from the Army Council, who issued an inscribed scroll to each building as a permanent memorial of the patriotic purpose to which it had been devoted. That these institutions may claim to have afforded special comfort to wounded soldiers is indicated by the fact that the disciplinary measure most severely felt by refractory patients was their return to the military quarters from whence they came. Apart from the auxiliary home hospitals, a large sum was expended in equipping and maintaining hospitals abroad, special hospitals at home, and convalescent homes. Responsibility for the British Red Cross Society's hospital at Netley and the St. John Ambulance Brigade hospital at Etaples was undertaken by their respective associations. Mention should also be made of the British Red Cross Society's Star and Garter home at Richmond for totally disabled men, an institution intended to provide a harbour for those suffering from incurable spinal paralysis. In all, a sum exceeding

£5,000,000 was spent by the joint committee on hospitals and stores, excluding local expenditure on the auxiliary home hospitals. The stores department covered a great variety of items under general headings, such as textiles, provisions, tobacco, furniture, medical requirements, etc., and involved extensive business arrangements, with warehouses, buyers, and all the machinery of a large commercial establishment. Speed in delivery was a distinguishing feature, and the services of this department were on many occasions invited by the War Office. It was claimed with justice that no reasonable request which it was possible to comply with was ever refused.

A kindred department to the stores was the Central Prisoners of War Committee. The necessity for sending food to prisoners of war had resulted in various efforts which required coördination. The Government, as such, being prevented by Germany from supplying food to British prisoners of war, approved the formation of a committee under the Red Cross, which, by resolution of one of its international conferences, was entitled, and was consequently allowed by the enemy, to regard prisoners as coming within its duties. The committee administered a sum of over £4,000,000 and regularly dispatched parcels of bread, other food and clothing to the prison camps. Enquiries for wounded and missing, undertaken by the Red Cross from early in 1915 onwards, were also a much appreciated effort, resulting in over 384,000 reports being obtained at a total cost of less than 3s. 6d. each. Work for interned prisoners in Switzerland and Holland was another undertaking of high character, one of its chief objects being educational and industrial training. Much attention was bestowed by the Red Cross on the after-care of disabled men, both in connexion with accommodation for convalescents, and institutional treatment for patients suffering from neurasthenia, epilepsy, tuberculosis, paralysis and the results of wounds. It is obvious that medical or surgical treatment in such cases may be prolonged and yet not be inconsistent with some form of employment. The Government, realizing this, was prepared to maintain the patients, but difficulties arose on the question of capital outlay: "In any case," says the report of the joint committee, "as far as the Government was concerned, we were faced by delay in circumstances where promptitude was of vital importance to the success of the work. Being ourselves unhampered by restrictions other than the broad objects for which the public had subscribed to the Red Cross, and our funds being immediately available, we were able to obtain the sanction of the Joint Finance Committee for grants which met the necessities of the case. Thus, once again, was demonstrated one of the most valuable uses of such a fund as that administered by the Joint War Committee."

The report from which the foregoing extract is taken deals in detail with Red Cross activities in the various theatres of war, at all of which the joint committee was represented by a commissioner and staff suited to the circumstances. The most extensive work, of course, was that carried out in France and Belgium. There the first commission was sent in Aug. 1914, while the last of many proceeded to Vladivostok a fortnight before the Armistice in 1918. Some idea of the number of people employed by the joint committee will be gained from the fact that the total staff at home and abroad on Oct. 20 1918, was 9,234. Of these 1,353 worked at headquarters in London, 850 of whom were paid and 503 were honorary workers. It is only possible in this article to mention some of the efforts which were specially associated with the Red Cross during the war and have not already been alluded to. The supply of provisional limbs was a useful measure; invalid diet kitchens at Malta, Salonika and Egypt were a new and very successful experiment; and in Italy the ambulance units, among which may be mentioned one devoted to X-ray work, attained some remarkable results. Wherever it was possible to set up recreation rooms or to entertain the wounded, especially at Christmas time, the Red Cross undertook to do so; and at the conclusion of the war, after assisting in repatriation at Berlin and elsewhere, it continued, as it will continue for some years, to look after and help wounded men, particularly while they are waiting for final decisions as to pensions. Although the general direction of Red Cross business was in the hands of men, it is not too much to say that its outstanding feature was women's work. By hospital nursing and organization at home and abroad, motor-driving, rest-station attendance, and general service—including the humblest domestic occupations, to which ladies turned their hands for long periods—British women established a lasting claim to national gratitude; and it may be said that the example they set did more to gain for them their present place in the constitution than several decades of propaganda.

At the end of the war the joint committee was left with a considerable surplus, which approximated roughly to the amount received from the "Our Day" collection taken a few weeks before the Armistice. An Act of Parliament enabled such part of this balance as might not be required for the sick and wounded to be applied to kindred objects. A sum of £1,339,700 was given to civil hospitals and other institutions in England and Wales, and £544,300 to similar purposes in the dominions and colonies.

A heavy distribution of, for the most part, well-earned honours was made to Red Cross workers during and after the war, the chief criticism in connexion with which was that the higher grades allotted to the honorary and paid staff at headquarters in London were out of proportion to those recommended for commissioners and others who had served for long periods abroad, often under trying conditions and sometimes in no small personal danger. On the whole it may safely be said that the Red Cross war fund was managed on sound business lines which gave general satisfaction to the subscribers, the Government, and the participators in its benefits, and reflected great credit on those who carried out the work.

AUTHORITIES.—Charters of Incorporation of the British Red Cross Society, 1908 and 1919; *Field Service Regulations*, Part II.; *Organization and Administration* (1905); *Royal Army Medical Corps Training* (1911). Schemes for the Organization of Voluntary Aid in England and Wales, 1909 and 1910. Reports of the Joint War Committee and the Joint War Finance Committee of the British Red Cross Society and the Order of St. John of Jerusalem in England on voluntary aid rendered to sick and wounded at home and abroad and to British prisoners of war, with appendices (1914–9, H.M. Stationery Office). (J. D. P.)

(2) UNITED STATES.—The "American Association of the Red Cross" was organized in 1881, by the special efforts of Clara Barton (*see* 3.452) and with the approval of President Garfield and Secretary of State Blaine. Miss Barton was its first president. In 1905 the name was changed to National Red Cross, and the organization was incorporated and nationalized; the President of the United States became its president, and the War Department its auditor. By 1912, state relief boards operating under the National Relief Board of the Red Cross had been organized in practically all of the states in the Union as well as in the Philippine Is. and Porto Rico. In 1913 there were 60 chapters with about 12,000 members. In that year the association provided "disaster relief" in response to 13 calls in the United States and five from abroad. $3,000,000 were used in relief operations, of which sum one and a third were contributed directly through the Red Cross. In the same year steps were taken to erect a national memorial building in Washington as a tribute to the heroic services, in connexion with the Sanitary Commission and other activities for the benefit of soldiers, rendered by women of the North and South in the Civil War. To an appropriation by Congress of $400,000, as much more was added by private gifts, and the corner-stone of the building was laid on March 27 1915. The building was occupied as national headquarters early in 1917.

World War Work.—Early in the World War, before America's entry, the Red Cross, with the consent of the Government and in conformity with the treaty of Geneva, offered through the State Department the aid of its trained personnel and contributions of hospital supplies to every country involved in the war. The offer was accepted by all the belligerents with the exception of Belgium, which at first desired only supplies and did not ask for personnel until the spring of 1915. Japan, at first accepting, later declined assistance, as its own Red Cross was able to meet all demands, while Italy, when it entered the conflict, asked only for certain supplies. The Red Cross called the attention of the American people to the contributions made by European Red Cross societies during the Spanish-American War, and the President made a public appeal for funds. As a result, sufficient money was soon at the disposal of the Red Cross to undertake active aid to the various belligerents. Large quantities of hospital supplies and about 200 nurses were sent to Europe and distributed in England, Belgium, France, Germany, Austria, Serbia and Russia. Seventy-one physicians and surgeons were also sent, and a special sanitary commission of 43 doctors and nurses went to Siberia to fight the typhus plague there. The value of the relief supplies sent to Europe by the Red Cross before the United States entered the war exceeded $1,500,000, of which about $350,000 worth went to Germany and Austria. In the latter part of 1915, when the sanitary and general medical services of the belligerents had become sufficiently developed to make outside personnel aid unnecessary, the American surgeons and nurses were withdrawn from Europe.

In May 1917, a few weeks after the United States entered the war, President Wilson, as titular head of the American Red Cross, appointed a special Red Cross War Council of seven nationally known men, headed by Henry P. Davison of New York, to direct all the activities of the organization during the war. The first task of this War Council, besides effecting an expansion and elaborate reorganization, was that of obtaining funds on a large scale to support the extensive work planned. It was decided to appeal at once to the people for a special war fund of $100,000,000, and President Wilson designated the week of June 18–25 as " Red Cross Week " for the collection of money. Quotas were assigned to each state and city and a vigorous nation-wide campaign was begun. The result was a popular subscription of over $114,000,000. The second great campaign undertaken by the War Council was a Christmas membership drive during the week of Dec. 17–24 1917. When the United States entered the war the Red Cross membership was about 500,000, comprised in about 500 chapters. By Nov. 1 1917 the membership had increased to 5,000,000, distributed among 3,287 chapters. The first aim of the special membership drive was for 5,000,000 further memberships, but when the campaign was actually launched the goal was set at 10,000,000. At the end of the drive week over 16,000,000 new members had been added to the organization. By the spring of 1918 it was found necessary to launch a new drive for funds, so extensive had been the war undertakings of the Red Cross. Again a nation-wide appeal was made, and during the week May 20–27, approximately $170,000,000 was subscribed. These two great collections of 1917 and 1918, together with membership dues of about $37,500,000 and special funds and supplies from various other sources, made up a grand total of a little more than $400,000,000, of which about two-thirds was available for the needs of the national headquarters and one-third for the special needs of the 3,500 chapters. These special needs were such as purchase of materials to be made into relief articles, local canteen and home service, general operating expenses, etc. The undertakings of the American Red Cross during the war-time and armistice period can be classified under two heads: first, the relations of the Red Cross to the armed forces of the Government both at home and abroad, and, second, civilian relief abroad. With regard to the first category a paragraph in a report of the American Red Cross, prepared for the tenth International Red Cross Conference at Geneva on March 30 1921, sets out so admirably the manifold activities carried on that it may well be quoted. It is as follows: " The primary function of the Red Cross in war, of course, is to provide volunteer relief to the sick and wounded, and to serve as a medium of communication between the soldiers, sailors and marines and their families and the American people, but in the late war the American Red Cross activities for the fighting men covered a much wider field. From the time the American soldier entered the service until he had been demobilized, the Red Cross, at the request of the War Department, assisted him in many ways possible only to a large volunteer organization officially recognized. The American Red Cross recruited, organized and equipped hospitals and ambulance units, assisted in the care of the sick and wounded in emergencies, and mobilized nurses for the army and navy. The labour of volunteer Red Cross women provided the men in the service with knitted garments not a part of the army equipment, as well as an unlimited quantity of surgical dressings and supplemental medical supplies. Canteens established at many points in the home country and in the war zone provided the soldier *en route* with food, tobacco and other creature comforts. Home Service helped to maintain *moral* by rendering assistance in many forms to soldiers' and sailors' families. American fighters held prisoners in enemy camps, after being located through the International Red Cross, were supplied by the American Red Cross with food and other comforts. The sick and wounded behind our own lines were cheered and aided in their convalescence, the home-coming and demobilized troops were helped in readjusting themselves to civil life, and, finally, the graves of the fallen were photographed at the request of the War Department for the comfort of the home folks."

The details of the manner and extent of these various activities cannot be described here in detail. Place can be given to only a few special facts. Fifty Red Cross Base Hospital units, each consisting of 22 surgeons and physicians, 65 Red Cross nurses, and 152 Enlisted Reserve Corps men, were sent to England and France and one to Italy for duty with the American Expeditionary Forces. Forty ambulance companies of 124 trained men each were likewise sent abroad. Over 23,000 trained nurses were mobilized, of whom nearly 20,000 saw active service, one-half of these in Europe. Sanitary service in America was carried on by 29 units of trained personnel assigned to districts in 16 states. A Woman's Volunteer Motor Corps of 11,000 members organized in 300 communities covered over 3,500,000 m. in their activities. Seven hundred canteens staffed by 55,000 women workers were operated in railway stations and camps. Ninety-two convalescent homes were built in the training and embarkation camps. One hundred and thirty canteens were established in France. Also, in France, the Red Cross maintained 24 military hospitals and 12 convalescent hospitals. Thirty-three canteens were established in Italy. Twenty-eight military hospitals and 82 canteens were established just behind the lines in that small part of Belgium never overrun by the Germans. A Home Service with 50,000 workers helped soldiers' families in many ways in America. Finally, 8,000,000 Red Cross women were engaged all through the war in producing comforts and hospital supplies for the American soldiers and sailors. Under the general category of " civilian relief abroad " is included the work done by the American Red Cross, from the time the United States entered the war up to 1921 when this work was still going on, in relieving the civilian populations of the war-ravaged regions of Europe. The distress during the war of the people of the Allied nations, especially in the devastated regions of Belgium, France, Italy, the Balkan States, Poland and Russia, seriously menaced the *moral* of those countries, so that this " civilian relief abroad " by the American Red Cross during the war period was of actual military assistance to the Allies. After the war this assistance, no less necessary, took on a more purely benevolent aspect and was extended in some measure to former enemy countries as well as to the Allies. The largest need and the largest response by the Red Cross was in France. A million and a half refugees from the 10 invaded French departments were scattered throughout other parts of the country. Besides, many Belgian refugees came into France. Disease, especially tuberculosis, threatened to become epidemic. The Red Cross undertook the task, for a time at an expense of $1,000,000 a month, of housing, clothing, feeding and extending hospital and general medical aid to these civilians. This work was constantly done in association with national and local French organizations. Over 150 such organizations were aided. Sixty-seven hospitals and dispensaries, primarily for refugees, were operated by the Red Cross. Over 30,000 tuberculosis patients were directly reached and helped. A child-welfare campaign was also undertaken, partly of educational character. Special doctors and visiting nurses not only directly helped the children but organized instructional meetings and held special child clinics where modern methods were explained to nearly 300,000 French attendants. Perhaps the second largest item in civilian relief during the war was that of aid to Russia. A special commission was sent to Petrograd by way of Vladivostok, arriving in 1917, while Kerensky was in power, and provided 500,000 cans of condensed milk for children. An ambulance train of 125 cars was also sent to Russia, and $1,500,000 was devoted to the assistance of Russian soldiers who were returning from the prison camps.

During the war the Red Cross lent assistance to 75 Belgian refugee colonies in free Belgium, France, Switzerland, Holland and England. In Italy 50 kitchens were maintained for needy civilians and direct financial assistance was given to the families of 326,000 Italian soldiers. In Rumania two hospitals and an orphanage were taken over and maintained, and in three districts 40,000 persons were fed daily. Special commissions went to Serbia and Greece and aided materially in caring for refugees and poor families in those countries. In 1918, at the height of the war activities, the American Red Cross had over 20,000,000 adult and 11,000,000 child (junior Red Cross) members comprised in over 3,500 chapters. Eight million of these members were listed as " war workers." The total revenues of the national headquarters and chapters together for the 20 months ending Feb. 28 1919 were $400,178,000, of which $272,676,000 was actually expended in war relief work in America and 25 foreign countries during the 20 months' period named, which covered all the time during which the United States was in the war plus the first three and a half months of the Armistice. Of this sum $169,096,000 was expended by the national headquarters and $103,580,000 by the various chapters. The former included $28,978,000 for relief in America; $57,207,000 in France; $63,841,000 elsewhere overseas; $4,660,000 for collections, enrolments, and publications; $2,727,000 for operation of relief bureaus; $5,530,000 for operation of bureaus handling relief supplies and transportation in America of these supplies; and $4,360,000 for operation of administrative bureaus at national headquarters and divisional headquarters. The expenditures of the chapters included $60,660,000 for materials purchased; $8,790,000 for home service; $3,070,000 for military hospitals and ambulances; $2,320,000 for canteen service; $1,680,000 for influenza relief; and $7,490,000 for general operating expenses. The total resources (cash and supplies) of the national headquarters Feb. 28 1919 amounted to $110,756,000, including unexpended appropriations of $16,714,000; in addition the chapters had in hand a balance of $33,460,000. A total of 101,000 tons of relief supplies had been sent overseas; 3,780 French and more than 1,500 Italian hospitals had been aided. The relief articles (surgical dressings, hospital garments and supplies, refugee garments, and various articles for soldiers and sailors) produced by Red Cross volunteer workers during this time numbered over 370,000,000 of an estimated value of nearly $100,000,000. Eleven million of these items were knitted articles given to soldiers and sailors in the United States.

Post-war Work.—On March 1 1919, the War Council dissolved and all authority and responsibilities were taken over by the Executive Committee with Dr. Livingston Farrand as chairman. The foreign commissions were gradually closed and withdrawn, although late in 1919 over 1,000 Red Cross workers still remained in Europe. The total membership after the roll-call of Nov. 1919 was about 10,000,000. After the Dec. 1920 roll-call it was about 7,000,000. Relief work was carried on after the war in Albania, Belgium, Bosnia and Herzegovina, Czechoslovakia, France, Great Britain, Greece, Germany, Italy, Montenegro, N. Russia, Palestine, Poland (where more than 100 workers were engaged), Serbia (where 30 doctors, 50 nurses and five dentists worked at various points), S. Russia, Switzerland (caring for American soldier prisoners coming from German prison camps), Siberia (where 600 workers fought against typhus, cholera and other epidemics), and western Russia and the Baltic states. During a part of 1920 operations still continued in most of these countries, but by the end of the year the list had been reduced to Poland, S. Russia, Czechoslovakia, Montenegro, Serbia, the Baltic states, Austria (Vienna), Hungary (Budapest) and Turkey (Constantinople). In Poland 258 hospitals with 26,123 beds were established in 1920. Thirty dispensaries and 207 orphanages were aided, clothing was distributed to over 80,000 children and 2,316 towns with a total population of more than 700,000 were given general relief. In Rumania six hospitals were operated, 322 soup kitchens maintained, and relief supplies provided for 219 schools and 232 orphanages. In western Russia and the Baltic states 300,000 civilian poor, 21,000 refugees and 2,500 war prisoners were helped. In Vienna 98 hospitals were aided. Similar work was done in Budapest. In Siberia the cargoes of 30 American relief ships, and part cargoes of 92 ships from other countries were distributed. Eighteen hospitals were operated and numerous sanitary trains organized and an average of seven articles of clothing was given to each of 387,500 women and 775,000 children. Late in 1920 it was decided to restrict further operations in Europe so far as possible strictly to medical care, and $5,000,000 was appropriated for this work. Twenty child medical units were put into the field. In America the peace programme of the Red Cross in 1920 contained as its most notable features the further development of its nursing service. Enrolment in this service increased in 1920 from 35,426 to 36,705. The number of Red Cross public health nurses grew from 162 to 908 and the number of women and girls completing the Red Cross course in home hygiene and care of the sick increased during the year from 34,033 to 93,093. There were 57 major disasters in the United States in 1920 which required Red Cross relief. Altogether $780,000 was expended in this relief. (V. L. K.)

REDESDALE, ALGERNON BERTRAM FREEMAN-MITFORD, BARON (1837–1916), British politician and writer (*see* 22.968), in 1906 accompanied Prince Arthur of Connaught on his mission to Japan to invest the Mikado with the Order of the Garter. In 1915 he published his memoirs. He died at Batsford Park, Glos., Aug. 17 1916. His eldest son was killed in action in May 1915, and he was succeeded as second baron by his second son, David Bertram Ogilvy Freeman-Mitford (b. 1877).

REDMOND, JOHN EDWARD (1851–1918), Irish politician (*see* 22.968*), obtained for the first time a position of real power in Parliament after the first general election of 1910. After he had amalgamated the two Irish Nationalist parties under his own lead in 1900, he had never hitherto been able, owing to the large Unionist majority of 1900, and the independent Liberal majority of 1906, to hold that balance of power in the House of Commons which had proved such a formidable weapon in the hands first of O'Connell and afterwards of Parnell. But the great reduction of the Liberal forces in Jan. 1910 made it impossible that Mr. Asquith's Government should long continue unless it found favour in Mr. Redmond's eyes. The first use which he made of this new authority was to insist that Mr. Lloyd George's famous budget of 1909, on which the dissolution had turned, but which was in itself not very congenial to the Irish party, should be postponed till after the constitutional resolutions directed against the House of Lords—his one object being to remove the veto of the Upper House, which was the main barrier against Home Rule. This order of procedure was also demanded by the Labour party and by the Radicals; and the Government complied. But Redmond did not trust them completely, and pressed for an assurance that the Royal prerogative would be at the Prime Minister's disposal to overbear any rejection by the Lords of the veto resolutions. He regretted King Edward's death as being a momentary "check to the onward march of the constitutional struggle," and he was impatient at the constitutional conference which was called early in the new reign in order to endeavour—vainly, as the result proved—to discover a solution by consent. He himself occupied the months of its session by a successful expedition to America to secure sympathy and funds. In spite of a harassing movement on his flank by a small party of Independent Nationalists who had Mr. O'Brien and Mr. Healy as their spokesmen, and who accused him of having sold the Irish vote to the Government, he subsequently conducted a strenuous campaign on behalf of the ministerial programme for the second general election of the year. He denounced the House of Lords as the special enemy of Ireland, and said that this was not only a Home Rule election, but the great Home Rule election. When the result of the polling had confirmed him in his tenure of the balance of Parliamentary power, he forwarded the progress of the Parliament bill in 1911 by the steady vote of his party rather than by speech. In the autumn he was regularly consulted on the details of the forthcoming Home Rule bill, and delivered speeches assuring the English that the Home Rule Parliament would be duly subordinate to the Imperial Parliament, and that the Protestants had nothing to fear from Roman Catholic domination, and assuring the Irish that they would find the provisions of the bill satisfactory. When the bill was introduced in April 1912, he welcomed it in the House on behalf of the Nationalists as a great and adequate measure. He disclaimed Separatism, and said that Irish Separatists, once numerous, were now very few, and would disappear when Home Rule was granted. He went over to Ireland and succeeded in almost silencing adverse Nationalist criticism of details, and procured an enthusiastic acceptance of the bill from a Nationalist convention. His speeches during the passage of the bill through Parliament were of a moderate character and accepted the measure as a final settlement; but, while professing goodwill towards Ulster, he resisted any attempt to take her out of the bill as a mutilation of Ireland. In token of the union of feeling between Nationalists and Liberals, he attended the autumn meeting of the National Liberal Federation at Nottingham in Nov. 1912, and spoke for the first time on the same platform as Mr. Asquith, saying that, on every great item of the Liberal programme, the Nationalists were sincerely with them. When, in the next year, these began to talk, in view of the determined attitude of Ulster, of a settlement by consent between parties, he was very slow to agree and was criticised by the Independent Nationalists for his unconciliatory attitude. He professed himself ready to discuss further safeguards; but he would not go into a conference at which Home Rule would be "put into the melting pot"; Ireland, he said, was a unit, and the two-nations theory an abomination. In a speech at Newcastle-upon-Tyne on Nov. 14, he denounced the passionate opposition of the Unionists and Ulster as "a gigantic game of bluff and blackmail." He would pay a large price for settlement by consent; but it must be consistent with national self-government for Ireland. He constantly insisted that the bill would, under the Parliament Act, automatically become law in 1914. But, in deference to the general feeling, he said in the debate on the Address in that year that he would consider in the broadest and friendliest spirit any proposals for an agreed settlement that the Government might make, though he protested against the idea of an Amending bill. When Mr. Asquith proposed the scheme of provisional exclusion, by county option, for six years, he treated this as the extreme limit of concession, and consequently this was the proposal which the Government embodied in their Amending bill. He absolutely refused to consider the total exclusion of Ulster. He had difficulties with the extremists in Ireland that spring and summer. The enrolment of the Ulster Volunteers had suggested the idea of similar formations in the other three provinces to defend the Nationalist idea; and under the fostering of leaders like Casement and of the rising Sinn Fein organization, these forces had reached large numbers—over 100,000 by the spring of 1914. Their growth had been discouraged by Mr. Redmond and his colleagues;

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* *These figures indicate the volume and page number of the previous article.*

but he felt it necessary now to obtain control, and, after a somewhat sharp struggle with the extremists, succeeded in doing so in June. At the end of July he took part, in spite of Nationalist criticism, in the abortive Buckingham Palace Conference.

Then came the World War, and in the debate succeeding Sir E. Grey's famous declaration on bank holiday, Aug. 3, Redmond created a profound sensation by a speech in which he declared that the events of recent years had completely altered the Nationalist feeling towards Great Britain. The Government, he said, might withdraw its troops from Ireland, whose coasts would be defended by her own sons, Nationalist Volunteers joining with Ulster Volunteers in the task. This generous attitude was met by the decision of the Government to pass the Home Rule bill into law, suspending its operation till after the war. Redmond took an active part in promoting recruiting in Ireland. He stood on the platform in Dublin Mansion House on Sept. 25 by the side of the Prime Minister and the Lord Lieutenant, and said that Ireland would feel bound in honour to take her place beside the other autonomous portions of the King's dominions. "You have kept faith with Ireland," he said; "Ireland will keep faith with you." Unfortunately, owing partly to the anti-recruiting agitation promoted by Sinn Fein and other extremists, and partly to red tape at the War Office, his efforts were only moderately successful. But he constantly opposed the application of conscription in any shape to Ireland, and in consequence neither of the military service bills of the spring of 1916 applied to that country. He had refused Mr. Asquith's request for his help in office in the Coalition Government of June 1915; and the fact that he stood out, while Sir E. Carson was included, no doubt intensified the smouldering dissatisfaction in southern Ireland, which broke into a blaze in the Dublin Rebellion of Easter 1916. This was a stunning blow to Redmond, who had not realized the growing strength and virulence of the Sinn Fein movement. He expressed in the House of Commons his detestation of the crime, and lent his assistance to the attempt that was made by the Government in the summer through Mr. Lloyd George to arrange an agreed settlement of the whole Irish question. At first it looked as if the negotiations would be successful, on the basis of bringing the Home Rule Act into immediate operation, while excluding the six Ulster counties by an Amending bill which should cover all the period of the war, and a short interval after it. The consent was obtained of all Irish parties, except the southern Unionists; but certain modifications which the Unionists in the Cabinet demanded were treated by the Nationalists as amounting to a breach of faith; and Redmond announced his intention of criticising ministers for their procrastination not only with regard to Ireland but also with regard to the whole conduct of the war. The negotiations having failed, and the Government having restored the ordinary civil administration of Ireland, with Mr. Duke, K.C., a Unionist, as Chief Secretary, Redmond treated this as a fresh outrage on Ireland; and on Oct. 18 he moved a resolution charging ministers with maintaining a system of government in Ireland inconsistent with the principles for which the Allies were fighting in Europe. The result, he said, was that Irish regiments could not be kept up to their full strength, and that his efforts to aid recruiting had been nullified. The motion was, of course, rejected by a large majority. He criticised Mr. Lloyd George's administration in March 1917 on similar lines, and threatened a return by his party to the old obstructionist opposition. In May, however, the Prime Minister suggested among other alternatives that an Irish convention should be assembled for the purpose of producing a scheme of Irish self-government. To this Redmond agreed; and in the convention he played a prominent and conciliatory part, making in particular a favourable impression on the southern Unionists. During its sittings, however, his health failed. He died of heart failure in London on March 6 1918.

In private life, John Redmond was much liked among his friends, but he never went much into society. He was happily married to an Australian lady, Miss Dalton, by whom he had a son and two daughters.

His younger brother, William Hoey Kearney Redmond (1861–1917), intended, as a young man, to adopt the army as his profession, and in 1881 he was a lieutenant in the co. Wexford militia battalion of the Royal Irish Regiment. But he resigned his commission to take part in the Land League movement, was imprisoned as a "suspect" in Kilmainham, and went to Australia with his brother to raise funds for the Nationalist agitation. He was returned for Wexford borough in 1883, and sat in Parliament, though for different constituencies, from that time till his death. He was of an ardent and ebullient temper, which resulted in his spending three months in Wexford gaol in 1888 for inciting to resistance to the sheriff, on the occasion of an eviction, and in many agitated scenes at different times in the House of Commons, where, however, he was personally very popular. Like his brother, in the Nationalist split he adhered to Parnell, and also like his brother, on the outbreak of the World War he instantly recognized the duty of Ireland to fling herself into it on the side of the Allies. Though 53 years old, he joined at once the Irish Division, receiving a commission in the Royal Irish Regiment. He was promoted major for services at the front and mentioned in despatches. In his intervals of service he made two thrilling speeches in the House of Commons—one in Dec. 1916, in which he advocated a new Ireland built up out of the war, and declared that Nationalists and Ulstermen came together in the trenches and were friends, and that if they were brought together on the floor of an assembly in Ireland they would be friends too; the other in March 1917, when he besought the House to let the dead past bury its dead, and to make a new start between England and Ireland. He died of wounds in France on June 7 1917.

REDWOOD, SIR BOVERTON, Bart. (1846–1919), British chemist, was born in London April 26 1846. He was educated at University College school, London, and by the Pharmaceutical Society, specialized in the study of petroleum and became in 1869 secretary to the Petroleum Association. In this connexion he gave evidence before a select committee of the House of Lords, and his investigations throughout Europe and America qualified him to be the adviser of the Government as to the best use of petrol and oil fuel both before and during the World War. He founded the Institution of Petroleum Technologists and became its first president. He was knighted in 1905 and created a baronet in 1911. He died in London June 4 1919.

REHAN, ADA (1860–1916), American actress (*see* 23.48), died in New York City Jan. 8 1916.

REID, SIR GEORGE (1841–1913), British painter (*see* 23.50), died at Oakhill, Som., Feb. 9 1913.

REID, SIR GEORGE HOUSTOUN (1845–1918), Australian statesman, was born at Johnstone, Renfrewshire, Feb. 25 1845. His father, a Presbyterian minister, emigrated to Australia seven years later, and the boy was therefore Australian by education though not by birth. At the age of 13 he became a junior clerk in a business house in Sydney, but later entered the N.S.W. civil service and began to read for the bar, being finally called in 1879. Politics attracted him more than law, and in 1880 he was elected member for E. Sydney, together with Sir Henry Parkes but above him in the poll. He stood as a free trader, a policy to which he adhered throughout his political career, and with one short break (1884–5) he represented E. Sydney in the N.S.W. Legislature until 1901 when he was elected its representative in the Federal Parliament. He first held office in N.S.W. for a brief period in 1883–4 as Minister of Public Instruction. In 1894 he became its Premier and during his term of office (1894–9) introduced reforms into the civil service and represented the Colony at Queen Victoria's Diamond Jubilee. He did much to promote Federation and from 1901–9 led the free-trade party in the Federal Parliament, becoming Premier for a short period (1904–5) but being for the most part leader of the Opposition. When the Act to constitute an Australian High Commissionership was passed in 1909 Sir George Reid became the first High Commissioner and was created K.C.M.G. He represented his country in London in genial fashion until 1916, and at the end of his term of office stood for the British House of Commons and was elected for the St. George's Hanover Square division of London Jan. 1916. He was created G.C.M.G. in 1911 and G.C.B. in 1916. He published *My Reminiscences* (1917), as well as *Five Free Trade Essays* (1875), and other economic papers. He died suddenly in London, Sept. 12 1918.

REID, WHITELAW (1837–1912), American journalist and diplomatist (*see* 23.52), died in London Dec. 15 1912. His last public address was delivered before the students of the University College of Wales, Aberystwyth, on "Thomas Jefferson." In 1912 appeared *The Scot in America and the Ulster Scot* and posthumously, in 1913, *American and English Studies*.

See Royal Cortissoz, *The Life of Whitelaw Reid* (1921).

REINACH, JOSEPH (1856–1921), French author and politician (*see* 23.55), was not reëlected to the Chamber of Deputies in 1914. During the World War his series of articles, "Les Commentaires de Polybe," in the *Figaro*, were remarkable for their clear vision. He died April 18 1921.

RÉJANE, GABRIELLE [CHARLOTTE RÉJU] (1857–1920), French actress (*see* 23.58), died in Paris June 14 1920. During the World War she visited England and appeared at the Court theatre, London, in a patriotic play, *Alsace*, and at the Coliseum in *The Bet*, when she played the part of a Frenchwoman visiting the English battle-zone. She was made Chevalier of the Legion of Honour for her war services.

RELATIVITY.—The progress of physical science during the decade 1910–20 was specially remarkable for the definite emergence into general public discussion of the principle of Relativity, as expounded by Prof. Albert Einstein, professor of Physics in the Kaiser Wilhelm Institut, Berlin. Its meaning and its history as part of present-day physical theory are discussed below.

Introduction.—The primary aim of the investigator in pure science is the discovery of natural laws. As a secondary and hardly less important aim, he tries to invent a mechanism which shall account for the laws already known. The secondary aim is forced upon him partly by the constitution of the human mind; our intellects, unsatisfied with a mere accumulation of facts, impel us ever to search for the causes underlying the facts: *Vere scire est per causas scire.* But to the working scientist the discovery of a mechanism has an additional and more practical value. When he has found a mechanism which will account for certain laws, he can proceed to examine the complete set of laws which the mechanism demands. If his mechanism corresponds with sufficient closeness to reality he may in this way be led to the discovery of new natural laws. On the other hand, the new laws deduced from the supposed mechanism may be false. If the falsity of the new laws is not at once revealed science may for a time be led into wrong paths. When more accurate experimenting or observation discloses that the laws are not true, a recasting of ideas becomes necessary, and the branch of science concerned may experience a time of revolution followed by a period of rapid growth.

An obvious illustration of these general statements is provided by the history of astronomy. The laws of the motions of the planets, as observed from the earth, were tolerably well known to the Greeks. They had also evolved an explanatory mechanism, starting from the metaphysical premise that the paths of the planets must necessarily be circles. The earth was the centre of the universe and round this revolved spheres to which the planets were attached. To explain the retrograde motion of the outer planets, these were supposed attached to secondary spheres revolving about points on the primary spheres which in turn revolved about the earth. This mechanism of cycles and epicycles held the field as an explanation of planetary motion for eighteen centuries. Finally the observations of Tycho Brahe provided a test which revealed the falsity of the whole structure. The position of Mars was found to differ from that required by the mechanism of epicycles by an amount as great as eight minutes of arc. "Out of these eight minutes," said Kepler, "we will construct a new theory that will explain the motions of all the planets."

The history of the succeeding century of astronomy need not be recapitulated here (*see* 2.811). The earth yielded its place as the centre of the universe, and the structure of cycles and epicycles crumbled away. The laws of planetary motion were determined with a precision which for the time appeared to be final. The mechanism underlying these laws was supposed to be a "force" of gravitation. This force was supposed to act between every pair of particles in the universe, its intensity varying directly as the product of the masses of the particles and inversely as the square of the distance separating them—the famous law of Newton.

In science, history repeats itself. Recent years have provided a further instance of the general processes we have been considering. Under the Newtonian mechanism every planet would describe a perfect ellipse about the sun as focus, and these elliptic orbits would repeat themselves indefinitely except in so far as they were disturbed by the gravitational forces arising from the other planets. But, after allowing for these disturbing influences, Leverrier found that the orbit of the planet Mercury was rotating in its own plane at the rate of 43 seconds a century. Various attempts have been made to reconcile this observed motion with the Newtonian mechanism. The gravitational forces arising from the known planets were demonstrably unable to produce the motion in question, but it was possible that Mercury's orbit was being disturbed by matter so far unknown to us. Investigations were made as to the disturbance to be expected from various hypothetical gravitating masses—a planet, or a ring of planets, between Mercury and the sun, a ring of planets outside the orbit of Mercury, a belt of matter extended in a flattened disc in a plane through the sun's centre, an oblateness, greater than that suggested by the shape of the sun's surface, in the arrangement of the internal layers of the sun's mass. In every case the mass required to produce the observed disturbance in the motion of Mercury would have also produced disturbances not observed in the motions of the other planets. The solution of the problem came only with the theory of relativity. Just as Tycho's eight minutes of arc, in the hands of Kepler and Newton, revolutionized mediaeval conceptions of the mechanism of the universe, so Leverrier's 43 seconds of arc, in the hands of Einstein, has revolutionized our 19th-century conceptions, not only of purely astronomical mechanism, but also of the nature of time and space and of the fundamental ideas of science. The history of this revolution is in effect the history of the theory of relativity. It falls naturally into two chapters, the first narrating the building of an earlier physical theory of relativity, and the second dealing with its extension to gravitation.

The Physical Theory of Relativity.—The earliest successful attempt to formulate the laws governing the general motion of matter is found in Newton's laws. The first law states that—

> "*Every body perseveres in its state of rest or of uniform motion in a right line unless it is compelled to change that state by forces impressed thereon.*"

In this law no distinction is made between rest and uniform motion in a straight line, and the same is true of the remaining laws. Hence follows the remarkable property to which Newton draws explicit attention in his fifth corollary to the laws of motion:—

> "*The motions of bodies included in a given space are the same among themselves, whether that space is at rest, or moves uniformly forwards in a right line without any circular motion.*"

As a concrete application of this principle, Newton instances "the experiment of a ship, where all motions happen after the same manner whether the ship is at rest or is carried uniformly forward in a right line." Just as a passenger on a ship in a still sea could not determine, from the behaviour of bodies inside the ship, whether the ship was at rest or moving uniformly forward, so we cannot determine from the behaviour of bodies on our earth whether the earth is at rest or not. We believe the earth to be moving round the sun with a speed of about 30 km. a second, so that there can be no question of the earth being permanently at rest, but we are unable to determine whether it is at rest at any specified point of its orbit, or, in the probable event of its not being at rest, what its absolute velocity may be. There is no more reason for thinking the sun, than the earth, to be at rest. Newton wrote as follows:—

> "It is possible that in the remote regions of the fixed stars, or perhaps far beyond them, there may be some body absolutely at rest, but impossible to know, from the positions of bodies to one another in our regions, whether any of these do keep the same position to that remote body. It follows that absolute rest cannot be determined from the position of bodies in our regions."

The above quotations are all from the first book of the *Principia Mathematica.* Previous to them all Newton writes: "I have no regard in this place to a medium, if any such there is, that freely pervades the interstices between the parts of bodies." The two centuries which elapsed after the publication of the *Principia* witnessed a steady growth of the belief in the reality of such an all-pervading medium. It was called the aether, and by the end of these two centuries (1887) it was almost universally believed that light and all electromagnetic phenomena were evidence of actions taking place in this aether. Light from the most distant stars was supposed to be transmitted to us in the form of wave motions in the aether, and we could see the stars only because the sea of aether between us and these stars was unbroken. It had been proved that if this sea of aether existed it must be at rest, for the alternative hypothesis that the aether was dragged about by ponderable bodies in their motions had been shown to be incompatible with the observed phenomenon of astronomical aberration and other facts of nature (*see* 1.292). On this view it was no longer necessary to go to Newton's "remote regions of the fixed stars, or perhaps far beyond them," to find absolute rest. A standard of absolute rest was provided by the aether which filled our laboratories and pervaded all bodies. Owing to our motion it would appear to be rushing past us, although without encountering any hindrance—"like the wind through a grove of trees," to borrow the simile of Thomas Young. The determination of the absolute velocity of the earth was reduced to the problem of measuring the velocity of an aether current flowing past us and through us.

In this same year (1887) the first experimental determination of this velocity was attempted by the Chicago physicist A. A. Michelson. The velocity of light was known to be, in round numbers, 300,000 km. a second, a velocity which was believed to represent the rate of progress of wave motion through the aether. If the earth were moving through the aether with a velocity of 1,000 km. a second, the velocity of light relative to a terrestrial observer ought to be only 299,000 km. a second when the light was sent in exactly the direction of the earth's motion through the aether, but would be 301,000 km. a second if the light was sent in the opposite direction. In more general terms, if the earth were moving through the aether, the velocity of light, as measured by a terrestrial observer, would depend on the direction of the light, and the extent of this dependence would give a measure of the earth's velocity. The velocity of light along a single straight course does not permit of direct experimental determination, but the same property of dependence on direction ought to be true, although to a less extent, of the average to-and-fro velocity of a beam of light sent along any path and then reflected back along the same path.

It was through this property that Michelson attempted to measure the earth's velocity through the aether.

The apparatus was simple in principle. A circular table ABCD was arranged so as to be capable of slow rotation about its centre O. Light sent along CO was divided up at O into two beams which were made to travel along perpendicular radii OA, OB. The arms OA, OB were made as equal as possible and mirrors were placed at A and B to reflect the beams of light back to O. An extremely sensitive optical method made it possible to detect even a very slight difference in the times of the total paths of the two beams from O back to O. There would in any case be a difference owing to the necessarily imperfect equalization of the lengths of the arms OA, OB, but if the earth is moving through the aether in some direction OP, and if the table is made to rotate slowly about O, then this difference ought itself to vary on account of the earth's motion through the aether. Michelson, and afterwards Michelson and Morley in collaboration, attempted to estimate the amount of this variation. No variation whatsoever could be detected, although their final apparatus was so sensitive that the variation produced by a velocity through the aether of even 1 km. a second ought to have shown itself quite clearly.

Thus to the question "What is our velocity through the aether?" Nature appeared to give the answer "None." It was never suggested that this answer should be accepted as final; it would have brought us back to a geocentric universe. Clearly either the question had been wrongly framed or the answer wrongly interpreted. It was pointed out in 1893 by Fitzgerald, and again, independently, in 1895, by Lorentz, that the *null* result of the Michelson-Morley experiment could be explained if it could be supposed that motion through the aether altered the linear dimensions of bodies.

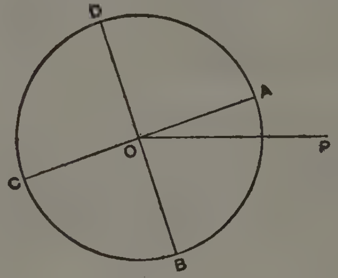

FIG. 1.

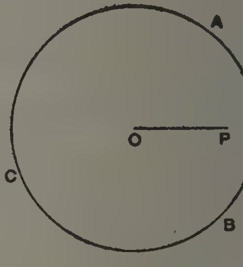

FIG. 2.

To be explicit, it was found that the experiment would invariably and of necessity give a *null* result if it was supposed that every body moving through the aether with a velocity u was contracted in the direction of its motion in the ratio $\sqrt{1-\frac{u^2}{c^2}}$, c being the velocity of light. The supposition that such a contraction occurred was not only permissible—it was almost demanded by electrical theory. For Lorentz had already shown that if matter were a purely electrical structure, the constituent parts would of necessity readjust their relative positions when set in motion through the aether and the final position of equilibrium would be one showing precisely the contraction just mentioned.

On this view, there was no *prima-facie* necessity to abandon the attempt to measure the earth's velocity through the aether. The answer to the problem had merely been pushed one stage farther back, and it now became necessary only to measure the shrinkage of matter produced by motion. It was obvious from the first that no direct material measurement could disclose the amount of this shrinkage, since any measuring rod would shrink in exactly the same ratio as the length to be measured; but optical and electrical methods appeared to be available. Experiments to this end were devised and performed by Rayleigh, Brace, Trouton and Noble, Trouton and Rankine and others. In every case a *null* result was obtained. It appeared then that if the earth moved through the aether this motion was concealed by a universal shrinkage of matter, and this shrinkage was in turn concealed by some other agency or agencies whose wit, so far, appeared to be greater than that of man.

At this time the word "conspiracy" found its way into the technical language of science. There was supposed to be a conspiracy on the part of the various agencies of nature to prevent man from measuring his velocity of motion in space. If this motion produced a direct effect x on any phenomenon, the other agencies of nature seemed to be in league to produce a countervailing effect $-x$. A long train of experiments had not revealed, as was intended, our velocity through the aether; they had merely created a conviction that it was beyond the power of man to measure this velocity. The conspiracy, if such there was, appeared to have been perfectly organized.

A perfectly organized conspiracy of this kind differs only in name from a law of nature. To the inventor who tries to devise a perpetual-motion machine it may well appear that the forces of nature have joined in a conspiracy to prevent his machine from working, but wider knowledge shows that he is in conflict not with a conspiracy, but with a law of nature—the conservation of energy. In 1905 Einstein, crystallizing an idea which must have been vaguely present in many minds, propounded the hypothesis that the apparent conspiracy might be in effect a law of nature. He suggested, tentatively, that there might be a true law to the effect that "it is of necessity impossible to determine absolute motion by any experiment whatever." This hypothetical law may again be put in the equivalent form: "The phenomena of nature will be the same to two observers who move with any uniform velocity whatever relative to one another." This may be called the hypothesis of relativity.

The hypothesis in itself was not of a sensational character. Indeed, from the quotations which have already been given from Newton's works, it appears probable that Newton himself would have accepted the hypothesis without hesitation: he might even have regarded it as superfluous. The true significance of the hypothesis can only be understood by a reference to the scientific history of the two centuries which had elapsed since Newton. The Newtonian view that absolute rest was to be found only "in the remote regions of the fixed stars, or perhaps far beyond them," had given place to a belief that absolute rest was to be found all around us in an aether which permeated all bodies. What was striking about the hypothesis was its implication—either that we could not measure the velocity relative to ourselves of a medium which surrounded us on all sides, or else that no such medium existed.

The hypothesis demanded detailed and exhaustive examination. It was for the mathematician to test whether the hypothesis was in opposition to known and established laws of physics, and to this task Einstein, Lorentz and others set themselves. If a single firmly established law proved to be in opposition to the hypothesis, then of course the hypothesis would require to be abandoned. It was unlikely that such an event would occur among the well-established laws, for if it did, the phenomena governed by that law would enable direct measurement to be made of the earth's velocity through the aether, a measurement which had so far eluded all attempts of experimenters. It was among the more obscure and less well-established laws, if anywhere, that discrepancies were to be looked for.

It is impossible here to give a complete account of the many tests to which the relativity hypothesis has been subjected. The result of all can be summed up in one concise and quite general statement:—Wherever the hypothesis of relativity has appeared to be in conflict with known or suspected natural laws, further experiment, where possible, has, without a single exception, shown the laws to be erroneous, and has moreover shown the alternative laws suggested by the hypothesis of relativity to be accurate. It is only in somewhat exceptional cases that the hypothesis of relativity of itself suffices to determine fully the form of a natural law; these cases constitute the most striking triumphs of the theory. As instances may be mentioned the determination of the law connecting the mass of an electron with its velocity; of the law expressing the velocity of light through a transparent medium in motion (Fizeau's water-tube experiment); and of the formulae for the magnetic forces on moving dielectric media (experiments of Eichenwald and H. A. Wilson).[1]

Before passing on from the general statement which has been made, particular mention must be made of one special case. A natural law which was at an early stage seen to be in conflict with the hypothesis of relativity was Newton's famous law of gravitation—namely, that every particle of matter attracts every other particle with a force proportional to the product of the two masses, and to the inverse square of their distance apart. Either, then, Newton's great law had to be abandoned, or else the hypothesis of relativity had to be discarded, in which case it would immediately become possible, in theory at least, to determine the earth's velocity through space by gravitational means. It is the choice between these two alternatives that has led to the most surprising developments of the theory of relativity; and to these we shall return later.

Space and Time.—The hypothesis of relativity, as has already been explained, postulates that the phenomena of nature will be the same to any two observers who move relative to one another with any uniform velocity whatever. The hypothesis has been so amply tested as regards all optical and electromagnetic phenomena that no doubt is felt, or can rationally be felt, as to its truth with respect to these phenomena. The hypothesis can be examined and developed in two opposite directions. We may, on the one hand, proceed from the general hypothesis to the detailed laws implied in it; this has already been done, with completely satisfactory results as regards confirmation of the hypothesis. Or we may regard the hypothesis of relativity as being itself a detailed law and attempt to generalize upward to something still wider. It is this possibility which must for the moment claim our attention.

In 1905 Einstein examined in full the consequences of the hypothesis that one simple optical phenomenon—namely, the transmission of a ray of light in free space—was, in accordance with the hypothesis of relativity, independent of the velocity of the observer. If an aether existed, and provided a fixed framework of reference, then light set free at any instant would obviously travel with a velocity which would appear to an observer at rest in this aether to be the same in all directions, and the wave front at any instant would be a sphere having the observer as centre. On the hypothesis of relativity the phenomenon of light transmission must remain unaffected by the motion of the observer, so that the light must appear to a moving observer also, to travel with a uniform velocity in all directions, and thus to the moving observer also the wave front must appear to be a sphere of which he will be the centre. It is, however, quite obvious that the same spherical wave front cannot appear to each of two observers who have moved some distance apart to be centred round himself, unless the use either of the common conceptions of science or of the ordinary words of language is greatly changed. In fig. 2 it is not possible in ordinary language that both O and P should at the same instant be at the centre of the sphere A B C. The change to which Einstein was forced is one which has an intimate bearing upon our fundamental conceptions of the nature of space and time; this change it will be necessary to explain in some detail.

Suppose that two observatories, say Greenwich and Paris, wish to synchronize their clocks, with a view to, let us say, an exact determination of their longitude difference. Paris will send out a wireless signal at exact midnight as shown by the Paris clock, and Greenwich will note the time shown by the Greenwich clock at the instant of receipt of the signal. Greenwich will not, however, adjust their clock so as to show exact midnight when the signal is received; a correction of about ·001 second must be made to allow for the time occupied by the signal in traversing the distance from Paris to Greenwich. To turn to mathematical symbols, if t_0 is the time at which a signal is sent out from one station, the time of receipt at a second station is taken to be $t_0+\frac{x}{c}$, where x is their distance apart, and c is the velocity of light. This represents the ordinary practice of astronomers, but it is clear that if the earth is travelling through a fixed aether with a velocity u in the direction of the line joining the two observatories, the velocity of transmission of the signal relative to the two observatories will not be c but $c+u$, and the time of receipt at the second station will be $t_0+\frac{x}{c+u}$. Thus it appears that it is impossible to synchronize two clocks unless we know the value of u, and that the ordinary practice of astronomers will not, as they expect, synchronize their clocks, but set them at an interval apart equal to

$$x\left(\frac{1}{c}-\frac{1}{c+u}\right)$$

which may, to an approximation, be put equal to $\frac{ux}{c^2}$.

According to the hypothesis of relativity, it is impossible ever to determine the value of u, and so is impossible ever truly to synchronize two clocks. Moreover, according to this hypothesis, the phenomena of nature go on just the same whatever the value of u, so that the want of synchrony cannot in any way show itself—in fact, if it did, it would immediately become possible to measure the effect and so arrange for true synchrony.

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[1] For references to the original papers dealing with these and other tests of the hypothesis of relativity see Cunningham, *The Principle of Relativity*, or J. H. Jeans, *Mathematical Theory of Electricity and Magnetism* (4th ed.).

As the earth moves in its orbit, the value of u changes, so that its value in the spring, for instance, will be different from its value in the autumn. One pair of astronomers may attempt to synchronize a pair of clocks in the spring, but their synchronization will appear faulty to a second pair who repeat the determination in the autumn. There will, so to speak, be one synchrony for the spring and another for the autumn, and neither pair of astronomers will be able to claim that their results are more accurate than those of their colleagues. More generally we may say that different conceptions of synchrony will correspond to different velocities of translation.

These elementary considerations bring us to the heart of the problem which we illustrated diagrammatically in fig. 2. The observer at O in the diagram will have one conception of simultaneity, while the second observer who moves from O to P will, on account of his different velocity, have a different conception of simultaneity. The instants at which the wave front of the light signal from O reaches the points A, B, C in the diagram will be deemed to be simultaneous by the observer who remains at O, but the observer who moves fron O to P will quite unconsciously have different ideas as to simultaneity. At instants which he regards as simultaneous the wave front will have some form other than that of the sphere A B C surrounding O. If the hypothesis of relativity is to be true in its application to the transmission of light signals, this wave front must be a sphere having P as its centre.

Einstein examined mathematically the conditions that this should be possible. Unfortunately a precise statement of his conclusions can only be given in mathematical language.

The observer who is supposed to remain at O in fig. 2 may be supposed to make exact observations and to record these observations in mathematical terms. To fix the positions of points in space he will map out a "frame of reference" consisting of three orthogonal axes, and use Cartesian coördinates x, y, z, to specify the projections along these axes of the radius from the origin to any given point. He will also use a time coördinate t which may be supposed to specify the time which has lapsed since a given instant, as measured by a clock in his possession. Any observations he may make on the transmission of light signals can be recorded in the form of equations between the four coördinates x, y, z, t. For instance, the circumstance that light travels from the origin with the same velocity c in all directions will be expressed by the equation (of the wave front):—

$$x^2+y^2+z^2-c^2t^2=0. \qquad (1)$$

The second observer who moves from O to P will also construct a frame of reference, and we can simplify the problem by supposing that his axes are parallel to those already selected by the first observer. His coördinates, to distinguish them from those used by the first observer, may be denoted by the accented letters x', y', z', t'. If his observations also are to show light always to travel with the same velocity c in all directions, the equation of the wave front, as observed by him, must be:—

$$x'^2+y'^2+z'^2-c^2t'^2=0.^2 \qquad (2)$$

A 19th-century mathematician would have insisted that x, y, z, t must be connected with x', y', z', t' by the simple relations:—

$$\left.\begin{aligned} x'&=x-ut\\ y'&=y\\ z'&=z\\ t'&=t \end{aligned}\right\} \quad \text{(A)}$$

but it is obvious that if these relations hold, then equation (1) cannot transform into equation (2). Einstein finds that equation (1) will transform into equation (2) provided the coördinates x, y, z, t of the first observer are connected with the coördinates x', y', z', t' of the second observer by the equations:—

$$\left.\begin{aligned} x'&=\beta\,(x-ut)\\ y'&=y\\ z'&=z\\ t'&=\beta\left(t-\frac{ux}{c^2}\right) \end{aligned}\right\} \quad . \quad . \quad . \quad \text{(B)}$$

where β stands for $\left(1-\frac{u^2}{c^2}\right)^{-\frac{1}{2}}$.

To form some idea of the physical meaning of these equations, it will be advantageous to consider the simple case in which the first observer is at rest in the aether while the second moves through the aether with velocity u. The points of difference between equations (B) and (A) then admit of simple explanation. The factor β in the first of equations (B) is simply, according to the suggestion of Fitzgerald and Lorentz already mentioned, the factor according to which all lengths parallel to the axis of x must be adjusted on account of motion through the aether with velocity u. The moving observer must correct his lengths by this factor, and he must correct his times by the same factor in order that the velocity of propagation of light along the axis of x may still have the same velocity c; this explains this presence of the multiplier β in the last of equations (B). The one remaining difference between the two sets of equations, namely the replacement of t in (A) by $t-\frac{ux}{c^2}$ in (B), represents exactly the want of synchrony which, as we have already seen, is to be expected in the observations of two observers whose velocity differs by a velocity u.

Although the equations admit of simple illustration by considering the case in which one observer is at rest in a supposed aether, it will be understood that the equations are more general than the illustration. They are in no way concerned with the possibility of an observer being at rest in an aether, or indeed with the existence of an aether at all. Their general interpretation is this: If one observer O, having any motion whatever, finds, as a matter of observation, that light for him travels uniformly in all directions with a constant velocity c, then a second observer P, moving relative to O with a constant velocity u along the axis of x, will find, as a matter of observation, that light, for him also, travels uniformly in all directions with the same constant velocity c, provided he uses, for his observations, coördinates which are connected with the coördinates of O by equations (B).

This is the meaning that was attached to the equations by Einstein in 1905, but the equations had been familiar to mathematicians before this date. They had in fact been discovered by Lorentz in 1895 as expressing the condition that all electromagnetic phenomena, including of course the propagation of light, should be the same for an observer moving through the aether with velocity u as for an observer at rest in the aether. For this reason the transformation of coördinates specified by these equations is universally spoken of as a "Lorentz transformation." What Einstein introduced in 1905 was not a new system of equations but a new interpretation of old equations. The two observers who used the coördinates x, y, z, t and x', y', z', t' had been regarded by Lorentz as being one at rest in an aether and one in motion with a velocity u; for Einstein they were observers moving with any velocities whatever subject to their relative velocity being u. Lorentz had regarded t as the true time and t' as an artificial time. If the observer could be persuaded to measure time in this artificial way, setting his clocks wrong to begin with and then making them gain or lose permanently, the effect of his supposed artificiality would just counterbalance the effects of his motion through the aether. With Einstein came the conception that both times, t and t', had precisely equal rights to be regarded as the true time. The measure t' is precisely that which would be adopted naturally by any set of observers, or race of men, who disregarded their steady motion through space; their adoption of it would be above criticism if, as Einstein suggested, their motion through space had no influence on material phenomena, and it represents, as we have seen, the usual practice of astronomers in comparing time at different places. From this point of view, neither measure of time is more accurate or more logical than the other. There are as many ways of measuring time as there are observers, and all are right.

The investigator who is trying to discover laws of nature will, in general, require to measure either directly or indirectly both time and space. If, to take a simple case, he is studying the motion of a single particle, he will measure out the position of the particle at definite instants as determined by his clock. He may specify the position of the particle at any instant by three measurements in space—for instance, he may say that two seconds after his particle started it was 6 ft. to the E. of the point from which it started, 9 ft. to the N. and 12 ft. vertically upward. The mathematician would express this by taking axes x, y, z to the E., to the N. and vertically upwards, and saying that at time $t=2$ the particle had coördinates $x=6$, $y=9$, $z=12$. Or he might, putting his time coördinate t on the same footing as the space coördinates x, y, z, simply say that $x=6$, $y=9$, $z=12$, $t=2$ represented one position of the particle. A complete set of readings of this type, each consisting of values of four coördinates, would give the complete history of the motion of the particle.

Such sets of simultaneous measurements form the common material of investigations in both pure and applied science. For instance, the engineer may measure the extension of a sample of steel corresponding to different loads; the electrician may measure the amount of light given by an electric filament corresponding to different amounts of current passed through it. In each of these cases there are only two quantities to be measured simultaneously, and an investigator can conveniently represent the result of the whole series of his measurements in graphical form; a single reading is represented by a point whose distances from two fixed perpendicular lines represent the quantities measured, and the curve obtained by joining these single points will give all the information contained in the whole set of readings.

We have seen that, in studying the motion of a particle in space, four sets of quantities must be measured, so that the results obtained cannot be plotted graphically on a piece of paper. Their proper representation demands a four-dimensional space, in which x, y, z and t are taken as coördinates. The practical importance of such graphical representation is *nil*, since it is impossible to construct a four-dimensional graph, but its theoretical importance to the theory of relativity is immense. For if the hypothesis of relativity is true, then the four-dimensional graphs of any natural event constructed by all observers, no matter what their relative motions, will be identical. The influence of their motion will be shown only in that the axes of x, y, z and t will be different for different observers, and the relations between these sets of axes will be those given by the foregoing equations (B).

The importance of this conception can hardly be overestimated, and it may be well to consider it further with the help of an illustrative example. Imagine a number of aeroplanes flying over England, and, in order to eliminate one of the three directions in space—the vertical—let us limit them to fly always at the same height, say 1,000 ft. above sea-level. Imagine a number of similar plates of glass prepared, each marked faintly with an outline map of England and with lines of latitude and longitude. Suppose that at 12 h. 0 m. G.M.T. a plate is taken and the position of each aeroplane marked by a thick black dot. At 12 h. 1 m. let a second plate be taken and similarly marked, and let this be done every minute for an hour. The 60 plates so marked will constitute a record of the motion of each aeroplane within this hour. If, now, we place the plates in order, one above the other, on a horizontal table, the mass of glass so formed will present a graphical representation, in three dimensions, of the motions of all the aeroplanes. In this graph the two horizontal coördinates represent motions in any two rectangular directions over England, say E. and N., while the third coördinate—the vertical—represents time. The individual black dots which represent the positions of any one aeroplane will form a dotted curve, and this curve gives a graphical representation of the motion of the particular aeroplane. Our rectangle of glass contains the history, for one hour, of all the aeroplanes in graphical form.

To represent the motion of particles in the whole world of space a four-dimensional graph is required. The four-dimensional space in which it is constructed may, following the usual terminology, be spoken of as a four-dimensional continuum. The history of any particle in the universe—just as that of any aeroplane flying over England—will be represented by a continuous line in the continuum, and this is called the "world line" of the particle. If the hypothesis of relativity is true the same continuum and the same world lines will represent the history of the particles of the universe equally well for all observers, the influence of their motions being shown only through their choosing different axes in the continuum for their axes of space and time. Thus the continuum must be thought of as something real and objective, but the choice of axes is subjective and will vary with the observer, the relation between different choices being expressed mathematically by our equations (B), the equations of the Lorentz transformation. An inspection of these equations shows that the sets of axes chosen by different observers have different orientations in the continuum, so that what one observer describes as a pure space interval will appear to another to be a mixture of time and space.

The instant of time and point in space at which any event occurs can be fixed by a single point in the continuum, so that the interval between two events will be represented by a finite line. The events and the interval between them are absolute, but the interval will be split up into time and space in different ways by different observers. The interval between any two events, such as the great fire of London and the outburst on the star Nova Persei, may be measured by one set of observers as so many years and so many millions of miles, but another set of observers may divide the interval quite differently. For instance a terrestrial astronomer may reckon that the outburst on Nova Persei occurred a century before the great fire of London, but an astronomer on the Nova may reckon with equal accuracy that the great fire occurred a century before the outburst on the Nova. A third astronomer may insist that the events were simultaneous. All will be equally right, although none will be right in an absolute sense. At this stage we may notice one respect in which our pile of glass plates failed to represent the true continuum. The mass of glass was stratified into different plates which represent different times for one particular observer. To obtain a section which would represent what an observer in motion relative to this first observer could regard as simultaneous positions of the aeroplanes, we should have to cut the mass of glass on the slant. The continuum is more closely represented by our plates of glass if they are annealed into a solid mass from which all trace of the original stratification is made to disappear. All observers, no matter what their motion, are then equally free to cut a section to represent their individual ideas of simultaneity.

Thus space and time fade into subjective conceptions, just as subjective as right hand or left hand, front and behind, are in ordinary life. The continuum alone is objective and may be thought of as containing an objective record of the motion of every particle of the universe. The curve in which this record is embodied is spoken of as the world line of the particle in question. To use the words of Minkowski: "Space in itself and time in itself sink to mere shadows, and only a kind of union of the two retains an independent existence."

Gravitation and Relativity.—Since all the phenomena of light and of electromagnetism are believed, on almost incontrovertible evidence, to be in accordance with the hypothesis of relativity, it is necessarily impossible to determine absolute velocity by optical or gravitational means. On the other hand, as we have already mentioned, the Newtonian law of gravitation is readily seen to be inconsistent with the hypothesis of relativity. Three alternatives are open:—

(i.) The Newtonian law may be true, in which case it must be possible to determine absolute velocity by gravitational means.

(ii.) The Newtonian law may be untrue in its original form, but may become true when amended so as to conform to the relativity hypothesis.

(iii.) Neither of the foregoing possibilities may be true.

Alternative (i.) was explored by Sir Oliver Lodge, who, assuming the exact truth of the Newtonian law of gravitation, deduced that the observed motion of the perihelion of Mercury could be accounted for if the sun were moving through space with a velocity of about 70 km. a second in a certain direction. This investigation had to be abandoned when it was shown by Eddington that a similar discussion of the motions of the other planets would lead to vastly different values for the sun's velocity. Alternative (ii.) was explored by Einstein and others, but was found to lead to a motion of the perihelion of Mercury equal only to one-sixth part of that actually observed.

Alternative (iii.) remained with its innumerable possibilities. Einstein commenced his attack on the problem by eliminating all possibilities which did not conform to two general principles. The first of these was the principle of relativity. Inasmuch as all physical phenomena except gravitation were believed to conform to this principle, it was natural to try, as a working hypothesis, the effect of assuming gravitation also to conform. The second principle was the so-called principle of equivalence, and this demands a word of explanation.

To our children we explain that an apple falls to the ground because a force of gravitation inherent in the earth's mass impels the apple towards the centre of the earth. Most schoolboys know that this is not quite the whole story; the path of the apple is more accurately determined by supposing the apple to be acted on simultaneously by two forces—a gravitational force of attraction towards the earth's centre and the centrifugal force arising from the earth's rotation. It is only because the earth's rotation is comparatively slow that the conception of an attraction towards the earth's centre gives a tolerably plausible account of the fall of the apple. If the earth rotated at 17 times its present rate objects would not fall, even approximately, towards the earth's centre; they would fall always parallel to the earth's axis, and the inhabitants of the northern hemisphere might explain this as arising from a force of repulsion inherent in the pole star. If the earth rotated many times faster even than this, bodies would fall always perpendicularly away from the earth's axis, and this might be interpreted as arising from a gravitational repulsion residing in the earth's axis.

These illustrations will show that it is easy to confuse acceleration arising from the earth's rotation with gravitational attraction. We may go further and say that it is impossible to distinguish between the effects of gravitational attraction and the effects of acceleration of any kind whatever. Every aeroplanist knows this to his sorrow; it is inherently impossible to devise any instrument which shall show the direction of the vertical in an aeroplane, since an acceleration of the aeroplane produces on any instrument whatever, effects which are indistinguishable from those of gravity. From such considerations Einstein was led to his principle of equivalence, which may be enunciated as follows:—

> "A gravitational field of force at any point of space is in every way equivalent to an artificial field of force resulting from acceleration, so that no experiment can possibly distinguish between them."

Guided by these two principles—relativity and equivalence—Einstein was led to the view that all gravitational "fields of force" must be illusions. The apparent "force" arises solely from acceleration and there is no other kind of gravitational force at all. In this statement, as in the statement of the principle of equivalence above, the word acceleration is used in its widest sense. Acceleration results not only from change in the amount of a velocity, but from a change in its direction also. For instance a motor-cyclist riding in a circle at a uniform speed of 60 miles an hour will be the subject of an acceleration towards the centre of the circle. He knows that the apparent force so produced is just as real in its effects as gravitation, and to save himself from falling as a result of its influence he must incline the direction of his machine to the vertical.

It is clear that the acceleration or curvature of path which figures as gravitation cannot be an acceleration or curvature in ordinary three-dimensional space. Before the apple starts to fall from the tree there is neither acceleration nor curvature, and yet the apple is undoubtedly acted on by gravitation. Moreover, this three-dimensional space is, as we have seen, different for different observers—it is a subjective and not an objective conception, and the gravitation resulting from such a curvature could not conform to the relativity condition. Einstein was accordingly led to suppose that gravitation arose from curvature in the four-dimensional space, or continuum, in which time formed the fourth dimension. This continuum, as has been seen, is objective and if the path of the particle can also be made objective, the resulting gravitation will conform to the relativity principle. The path of the particle in the continuum is, however, simply its "world line," which we have already had under discussion. This world line is determined by natural laws, and if these are to be objective the specification of the world line must also be objective. There is, however, only one specification of world lines in the continuum which is objective in the sense that the same specification will give the same world lines to observers moving with different velocities. It is that every world line must be so drawn as to represent the shortest path between any two points on it. Mathematically, lines which satisfy this condition are known as *geodesics*. Thus Einstein was led to suppose that world lines must be geodesics in the four-dimensional continuum.

Consider for a moment a page of this volume as presenting a two dimensional analogy of the continuum. The shortest distance between any two points is of course the straight line joining them, so that the geodesics are simply straight lines. These possess no curvature of path and if they formed a true analogy to the geodesics in the continuum there could clearly be no explanation of gravitation of the type we have been contemplating. There is, however, another type of two-dimensional surface. It is represented by the surface of a solid body such as a sphere—say the earth. On the earth's surface the geodesics are the great circles; every mariner or aeronaut who desires to sail the shortest course between two points sails along a great circle. To take a definite instance, the shortest course from Panama to Ceylon is not along the parallel of lat. (about 9° N.) which joins them—the aeronaut wishing to fly the shortest course between the two countries will fly N.E. from Panama, he will pass over England and finally reach Ceylon from the north-west. The reader may rapidly verify this by stretching a thread tightly over the surface of an ordinary geographical globe. Let him now trace out the course on an ordinary Mercator chart, and it will be found to appear very curved indeed—the course of the aeronaut will look surprisingly like that of a comet describing an orbit under the attraction of a sun situated somewhere near the middle of the Sahara.

The reader who performs these simple experiments will understand how Einstein was led to suppose that gravitation could be explained by a curvature inherent in the continuum. The world lines of particles are geodesics but the space itself, so to speak, provides the curvature. The curvature of path is thrust upon the particle by the nature of the continuum, but we, who until recently have been unaware even of the existence of the continuum, have been tempted to ascribe it to the action of a special agency which we have invented *ad hoc* and called "gravitation." According to Einstein, it is no more accurate to say that the earth attracts the moon than to say that the pockets of an uneven billiard table repel the balls.

This train of thought may seem artificial. If so, the reason is that we have not been able to explore the other possibilities which have branched off our main line of thought. In point of fact, Einstein found himself practically limited to the conclusion we have stated. Not only so, but the actual type and degree of curvature in the continuum prove to be uniquely fixed in terms of the masses of the gravitating bodies. Thus Einstein, knowing the mass of the sun, found himself in a position to predict absolutely what the motion of the perihelion of Mercury ought to be. It was found to be 42·9″ a century, a figure which agreed with observation to well within the limits of error of these observations. The motions of the other planets, as predicted by the theory of relativity, have also been found to agree with those observed to within the errors of observation. This latter test, however, is not a very stringent one, since the departures from the motion predicted by the Newtonian law are too small to admit of very precise measurement.

Einstein's theory requires us to suppose that the world line of a ray of light also shall be a geodesic in the continuum. In a gravitational field the curvature of the continuum will impose a twist on the path of a ray of light. Einstein found in particular that a ray of light which comes from a distant star and passes near the edge of the sun on its journey ought to be bent, in its passage past the sun, by an angle which should be 1·75″ if the ray just grazes the sun, and would be less in proportion to the inverse distance from the centre of the sun for other rays. The observatories of Greenwich and Cambridge dispatched expeditions to test this prediction at the eclipse of 1919. It was found that the stars which appeared near to the sun at the instant of eclipse showed an appreciable displacement, as compared with their normal positions, of the type required by Einstein's theory. Exact measurement confirmed that the displacement varied approximately as the inverse distance from the sun, and that the displacement at the limb was sensibly equal to Einstein's predicted value of 1·75″. The Cambridge observers, hampered by cloudy weather, obtained for this quantity the value 1·61″ ± 0·30″. The Greenwich observers obtained a value of 1·98″ ± 0·12″, but it has since been pointed out by Prof. H. N. Russell that their photographs indicate a horizontal and vertical scale difference of the order of 1 part in 12,000, almost certainly due to a distortion of the coelostat mirror under the sun's rays, and if the measures are corrected for this the result is brought much closer to the theoretical prediction.

The theory makes one further prediction which admits of experimental test. The atoms of any element, say calcium, may be supposed to be formed according to a definite specification, the terms of which depend neither on the velocity of a particular observer nor on his position relative to the gravitational fields of the universe. It can be deduced that the light received from a calcium atom situated in the intense gravitational field near the sun's surface ought to be of slower period, and therefore of redder colour, than the similar light emitted by terrestrial atoms. To be more precise, the Fraunhofer lines in the solar spectrum ought to show a displacement to the red; this displacement ought to be homologous, and should be of amount 0·008 A units at the cyanogen band λ 3883 at which observations have been chiefly made. Attempts to test this prediction led to strangely discordant results. All observers agreed in finding some effect of the kind predicted, but its amount was always less than the predicted amount, varying from almost *nil* (St. John, 1917) to nearly the full amount to be expected (Evershed, 1918; Grebe and Bachem, 1919). In 1921 the position with regard to this test still remained one of great uncertainty and confusion.

It will have been seen that the restricted physical theory of relativity introduced a revolution into the foundations of scientific thought by destroying the objectivity of time and space. The gravitational theory has effected a hardly less important revolution by destroying our belief in the reality of gravitation as a "force." The physicist has, however, to deal with other "forces" besides those of gravitation, and the question inevitably arises as to whether these too must be regarded as illusions, arising only from our faulty interpretation of the special metrical properties of the continuum. Prof. H. Weyl has pointed out that the continuum imagined by Einstein, and found to be adequate to explain gravitational phenomena, is not, in respect of its metrical properties, the most general type of continuum imaginable. A further generalization is possible and the new curvatures introduced must of necessity introduce new apparent forces other than gravitational. Weyl's investigation shows that these new forces would have exactly the properties of the electric and magnetic forces with which we are familiar. Indeed, the predicted forces coincide so completely with known electromagnetic forces that no experimental test of Weyl's theory is possible. Had there been the slightest divergence between the forces predicted by Weyl and those predicted by ordinary electromagnetic theory, experiment could have been asked to decide between the two, but no such divergence exists. It may, however, be said that Weyl's theory makes it highly probable that all forces reduce to nothing more than our subjective interpretations of special properties of the continuum in which we live our lives.

Finally a thought may be given to the position, under the new conceptions introduced by the theory of relativity, of the electromagnetic aether. At one stage in the history of science there was a tendency to fill space with aethers, to the extent almost of one aether for every set of phenomena requiring explanation. That stage passed, and by the end of the 19th century only one aether received serious consideration, the so-called electromagnetic aether of Faraday and Maxwell. This aether gave a plausible mechanical explanation of electrostatic phenomena, although it was more than doubtful whether it could account for the electromagnetic phenomena from which it took its name, and it was comparatively certain that it could not account for gravitation. It gave, however, a satisfactory explanation of the propagation of waves of light—they were simply waves in the aether and travelled with an absolute velocity c determined once and for all by the structure of the aether. On this view it was quite certain that an observer moving through the aether with a velocity u would measure the velocity of light travelling in the same direction as himself as $c–u$. Relativity teaches that this velocity is always precisely c, and this in itself disposes of the aether of Faraday and Maxwell. Whether any new aether will be devised to replace it remains to be seen, but none appears to be necessary. Any aether which can be imagined would appear to depend upon an objective separation of time and space. Relativity does not deny that such an objective separation may, in the last resort, really exist, but it shows that no material phenomena are concerned with such a separation. By a very slight turn of thought, the primary postulate of relativity may be expressed in the form that the material world goes on as though no aether existed.

To the relativist the essential background to the picture of the universe is not the varying agitation of a sea of aether in a three-dimensional space but a tangle of world lines in a four-dimensional space. Moreover, it is only the intersection of the world lines that are important. An intersection at a point in the continuum represents an event, while the part of a world line which is free from intersections represents the mere uneventful existence of a particle or a pulse of light. And so, since our whole knowledge of the universe is made up of events, it comes about that the tangle of world lines may be distorted and bent to any degree we please; so long as the order of the intersections is not altered, it will still represent the same universe. And so the last function of the aether, that of providing a scale of absolute measurements in space, becomes a superfluity. To the physicist who urges that space measurements without an underlying aether become meaningless, the relativist can reply that time-measurements without an underlying "time-aether" are equally meaningless. A "time-aether" has never been regarded as a necessity, and the relativist feels that the "space-aether" has no greater claim to retention. (J. H. Je.)

RENEVIER, EUGÈNE (1831–1906), Swiss geologist (*see* 23.98), died at Lausanne May 4 1906.

RENNENKAMPF, PAUL (1854–1918), Russian general, was born in 1854 and entered the army in 1873. On passing out of the Academy of the General Staff in 1882, he was appointed to the General Staff. From 1895 to 1899 he commanded a regiment and in 1900 he was promoted to the rank of general. In the war with China in 1900 he distinguished himself by his resolute action when commanding a column in Manchuria. In the war with Japan 1904–5 he commanded first a Cossack division, and later large forces of all arms, and again won distinction by his energy. From 1905 to 1913 he was a corps commander and in 1913 he was appointed to command the troops of the Vilna Military District. At the beginning of military operations in Aug. 1914 he commanded the I. Army which invaded Eastern Prussia. His inaction during the battle of Tannenberg, where the neighbouring army of Samsonov was destroyed Aug. 26–29, was a bitter disappointment, and, by the masses of the people, he was even accused of treachery. Personally brave, daring in small actions, Rennenkampf, as an army commander, showed himself in the strategic sphere alternately rash and timid, owing to his inability to grasp the situation as a whole. At the beginning of 1915 he was recalled from his duties of army commander, and later, under the pressure of public indignation, he was dismissed from the service. In 1918 he was killed by the Bolsheviks.

RENNER, KARL (1870–), Austrian politician, was born on Dec. 14 1870, the son of a peasant, at Unter-Tannowitz, Moravia. He studied law at the university of Vienna, occupying himself especially with questions of administration, and early attached himself to the Social Democratic party. He became an official in the library of the *Reichsrat*, and under the pseudonyms of "Synopticus" and "Rudolf Springer" showed a fertile literary activity, especially in connexion with the problems of the Austrian State, whose existence he justified on geographical, economic and political grounds. On the nationality question he upheld the so-called "personal autonomy," on the basis of which the super-national state should develop, and thereby influenced the programme and tactics of the Social Democratic party in dealing with it. As a theorist he was reckoned as one of the leaders of Neo-Marxism. He had been a deputy since 1907 and after the revolution of Oct. 1918 he became state chancellor of the republic of Austria, headed the Austrian peace delegation at St. Germain, and took over, after Otto Bauer's retirement, the Ministry of Foreign Affairs, which he conducted from the time of the retirement of the Coalition Cabinet in the summer of 1920 until the new elections in Oct. 1920. His principal works are:—*Grundlagen und Entwicklungsziele der oesterreichischen-ungarischen Monarchie* (1906); *Der Kampf der oesterreichischen Nationen um den Staat; Marxismus, Krieg und Internationale.*

RENOIR, AUGUSTE (1841–1919), French painter (*see* 23.101), died on the Riviera Dec. 3 1919.

REPARATION COMMISSION: *see* PEACE CONFERENCE; also 31.123 and 246.

REPIN, ILJA JEFIMOVICH (1844–1918), Russian painter (*see* 23.105), died at Knokkala, on the Finnish frontier, July 17 1918.

REPPLIER, AGNES (1858–), American writer, was born in Philadelphia April 1 1858. She was of French extraction and was educated at the Sacred Heart Convent at Torresdale, near Philadelphia. She was one of America's chief representatives of the discursive essay, displaying wide reading and apt quotation. Her writings contain much sound literary criticism as well as caustic comments on contemporary life. These characteristics were already apparent in the first essay which she contributed to the *Atlantic Monthly* (April 1886), entitled "Children, Past and Present." In 1902 the university of Pennsylvania conferred upon her the degree of Litt.D. She was the author of *Books and Men* (1888); *Essays in Miniature* (1892); *Essays in Idleness* (1893); *Philadelphia—the Place and the People* (1898); *Compromises* (1904); *In our Convent Days* (1905); *Americans and Others* (1912); *Counter-Currents* (1915).

RESZKE, EDOUARD DE (1855–1917), operatic singer (*see* 23.201), died at Garnek, Poland, May 29 1917.

RÉVILLE, ALBERT (1826–1906), French Protestant theologian (*see* 23.224), died in Paris Oct. 25 1906. His son, JEAN RÉVILLE (b. 1854), died in 1908.

REYER, ERNEST (1823–1909), French musical composer (*see* 23.225), died at Lavandou-sur-Huyères Jan. 15 1909.

REYNOLDS, OSBORNE (1842–1912), British engineer, was born at Belfast in 1842. He was educated at Dedham grammar school and at Cambridge, and in 1868 became professor of engineering at Owens College, Manchester, holding that post for nearly 40 years. He was elected F.R.S. in 1877. He was the author of over 70 papers on mechanics and physics published in the transactions of learned societies, notably *Sub-Mechanics of the Universe*, issued by the Royal Society, whose gold medal he won in 1888. (For his work *see* 3.581; 5.64; 8.783; 14.61; 22.806; 25.444; 28.428.) He died at Watchet, Som., Feb. 21 1912.

REYNOLDS, STEPHEN (1881–1919), English author, was born at Devizes May 16 1881. Educated at Manchester University and the École des Mines at Paris, he became sub-editor of an Anglo-French review in 1902 and the following year began an association with the Woolley brothers, fishermen of Sidmouth, which lasted for some years. He thus familiarized himself with fishing and the fisherman's point of view so far as to become a recognised authority on the subject and a medium of communication between fishermen and the Government. He was a member of the committee of inquiry into Devon and Cornwall Fisheries (1912), and of the departmental committee on Inshore Fisheries (1913), and in that year he was appointed adviser on Inshore Fisheries to the Development Commission. In 1914 he became also resident inspector of fisheries for the S.W. area. His publications included *A Poor Man's House* (1908); *Alongshore* (1910); *The Lower Deck, the Navy and the Nation* (1912); as well as a novel, *The Holy Mountain*, (1909) and a volume of tales. He died at Sidmouth Feb. 14 1919.

RHODE ISLAND (*see* 23.248).—The pop. of the state in 1920 was 604,397; in 1910, 542,610; an increase for the decade of 61,787, or 11·4 per cent. Rhode Island was still in 1920 the most densely populated state, having 566·4 inhabitants to the sq. m. (1910, 508·5). Every Federal census since 1790 has shown an increase in density, and at a rate faster than that of the United States as a whole.

The percentages of urban and rural pop. were in 1920: urban, 97·5 %; rural, 2·5 %; in 1910: urban, 96·7 %; rural, 3·3 %. The following are the cities of Rhode Island having a pop. of over 20,000 in 1920 and their percentage of increase in the decade 1910–20:—

	1920	1910	Increase per cent
Providence	237,595	224,326	5·9
Pawtucket	64,248	51,622	24·5
Woonsocket	43,496	38,125	14·1
Newport	30,255	27,149	11·4
Cranston	29,407	21,107	39·3
Central Falls	24,174	22,754	6·2
East Providence	21,793	15,808	37·9

The proportion of native-born in 1915 (state enumeration) was 68·8 %; of foreign-born, 31·2 %. The foreign-born whites numbered in 1920, 173,366, a decrease of 2·6 % from 178,025 in 1910. During the 10 years there has been a steady change in the proportions of the various foreign elements in the population. Up to 1910 the largest foreign-born element was Irish. In 1920 the Irish were numerically inferior to the British and English-Canadian, the Italian, and the French-Canadian. There has been a remarkable increase in the number of Italian, Portuguese and Polish immigrants, and a noticeable influx of Armenians and Syrians. "Foreign stock," *i.e.* foreign-born and native-born of foreign parents, constituted, in 1915, 63·3 % of the whole population.

Agriculture.—There has been a decline in farm acreage of 29·3 % in 30 years to 331,600 ac. in 1920, and an even greater decline, 51·2 %, in improved acreage to 132,855 ac. in 1920. The number of farms has fallen from 5,292 in 1910 to 4,083 in 1920. On the other hand there has been a rise in both the aggregate and the average value of farms, and in the value of crops (value of land and improvements, 1900, $26,989,189; 1920, $33,636,766; value of crops, 1909, $2,986,816; 1919, $5,340,378).

Fisheries.—Fishing has, on the whole, declined in relative importance. The shell-fish industry suffered severe loss, owing to the pollution of the Providence river and the upper waters of Narragansett Bay. From 1907 to 1920 the leased oyster grounds declined from 21,000 to 7,000 ac.; the state rentals, from $136,000 to $40,000; and the output during the oyster season from 10,000 gal. daily to 2,000 gallons. In 1920 the Commissioners of Shell Fisheries reported: "The Providence river has been practically destroyed as a suitable place for the production or growth of shell-fish as food," the result of contamination.

Manufactures.—Rhode Island is preëminently a manufacturing state. In 1914 it ranked 19th among the states in the value of its manufactures. The number of persons engaged in manufacturing and mechanical pursuits nearly doubled in 20 years (1900, 101,162; 1910, 156,898; 1920, 196,205). The number of factories increased from 1,678 in 1900 to 2,829 in 1919; the capital invested in manufacturing from $183,784 587 in 1900 to $304,595,000 in 1914; and the value of all manufactured products from $184,074,378 in 1900 to $346,962,500 in 1916. Wages paid to factory employees in 1914 totalled $58,784,000; value added to products by manufacture, $116,030,000. Children under 16 years employed in factories numbered, in 1920, 7,243, of whom nearly 5,000 were in textile mills. The effect of the World War upon child labour in Rhode Island may be seen from the following statistics: in 1915 children under 16 years constituted 3·16% of all the factory operatives; in 1918, 4·44%; in 1919, 3·96%; in 1920, 3·69%. Textiles still held in 1920 the first place among the manufactures of the state, employing 83,204 persons. From 1910 to 1920, woollen and worsted mills increased in number from 88 to 103 (with 463,342 spindles and 9,304 looms); in employees, from 24,924 to 29,500; in value of products, from $74,600,000 to $90,000,000. Cotton mills increased in number from 106 to 130 (with 2,595,395 spindles); in employees, from 28,786 to 37,382; and in value of products, from $50,313,000 to $67,500,000. Over 7,000 were persons employed in bleaching and finishing, 6,000 in the manufacture of silk and silk goods, and nearly 3,000 in the manufacture of hosiery and knit goods. The combined value of the products of these factories exceeded $20,000,000. Webbing and braid were also produced in large quantities; and in recent years tire fabrics have become an increasingly important article of manufacture. Third among the industries of Rhode Island in 1920 were the machinery and metal trades, with 25,197 employees, and products valued at $45,000,000. In the manufacture of jewelry and silverware Rhode Island ranked first among the states. In 1914 the value of the jewelry produced was more than one-fourth of the total for the whole United States. The number of persons employed in making jewelry, silversmithing, reducing and refining gold and silver in 1920 was 14,052, in 322 establishments; and the value of the product was estimated at $37,500,000.

Transportation.—The railway mileage within the state in 1920 was 209·49 m., electric and street railways, 351·5 miles. The construction of a branch of the Grand Trunk Railway system from Palmer, Mass., to Providence was projected in 1910; but work was suspended in Nov. 1912, and has not been resumed. Considerable sums have been spent by the Federal Government for the deepening of the channel of Narragansett Bay, for harbour improvement at Providence, Newport, Westerly and Pawtucket, and for the construction of harbours of refuge at Block I. and Pt. Judith. The foreign imports of the customs district of Rhode Island amounted in 1920 to $8,252,046. Foreign and domestic commerce passing through Narragansett Bay in 1914 amounted to $320,195,277.

Finance.—The position of the state, Dec. 31 1920, was: assessed valuation, $988,061,741; rateable wealth, $1,745,715,365 (about $2,890 *per capita*); receipts, $6,909,172; expenditures, $6,187,173; bonded debt, $10,832,000; sinking fund, $1,631,917. June 30 1920 there were in Rhode Island three state banks, 17 national banks, 13 trust companies, 15 savings banks, and 10 other institutions for savings and loans; with total resources of $416,339,951. From June 30 1918 to June 30 1920 the assets of the state banks increased 47%; of the trust companies, 21%; of the savings banks, 20%; and of the national banks, 11%. Deposits in the savings banks, June 30 1920, were $113,200,366, an average of $630 per account. The average savings deposit in 1918 ($582.95) was the largest in any state.

Charitable and Penal Institutions.—In 1917 the Board of Control and Supply and the Board of Charities and Corrections were superseded by a State Penal and Charitable Commission. The number of the inmates in the institutions under the supervision of the Commission was, in 1919, 3,241 (468 less than in 1918); and the amount expended was $1,189,956. The budget for 1921 called for $1,562,394, to which should be added about $21,000 in aid of various private charitable organizations.

Education.—The total school population (age 5 to 15) in 1920 was 123,705, of whom 106,142, or 85·5%, were in school. There were 83,525 in public schools; 20,690 in parochial schools; and 1,927 in private schools. The total expenditure for education in 1920 was $4,493,772, of which $999,850 was contributed by the state, the remainder by the towns. In addition to its expenditure for primary and secondary instruction and for normal training, the state annually votes modest subsidies for the R.I. State College; the R.I. School of Design; the R.I. College of Pharmacy; the R.I. Historical Society; the Newport Historical Society; and about 70 public libraries, with over 700,000 volumes. In April 1920 the name of the State Normal school was changed to the R.I. College of Education. The enrolment of the institution in 1920–1 was 774 students and 57 instructors; state appropriation, $86,000. The state also maintains observation and training courses in various schools, and likewise makes an annual grant of $5,000 to Brown University in support of graduate courses in education. The R.I. State College at Kingston had, in 1920–1, 345 students and 55 instructors, an income of $168,000, and buildings valued at $500,000. The R.I. School of Design, Providence, has doubled in size since 1910; the number of students has increased from 923 to 1,856; instructors from 50 to 108; funds from $186,310 to $2,849,322; buildings from $220,000 to $650,000. Its museum is considered the most valuable in New England, outside of Boston. Providence College (Roman Catholic) was chartered in 1917, and opened for instruction in 1919, under the direction of the Dominican Order. In 1920, $200,000 was raised for buildings. The enrolment in 1920–1 (two classes) was 163 students; faculty, fourteen. Brown University, the oldest (founded 1764) and largest academic institution in the state, from 1911 to 1921 increased its faculty from 85 to 107; its students from 944 to 1,367 (plus 881 in extension courses); funds from $3,758,926 to $6,600,000, with about $1,750,000 of endowment subscriptions still to be paid in; volumes in the library from 180,000 to 270,000. The Arnold Biological Laboratory and Metcalf Hall have been added to the buildings; and a new Chemical Laboratory and a Hall of Modern Languages were in 1921 about to be erected. Providence is unusually rich in libraries. Among the most important collections are those of the Providence Public Library, 230,000 vol.; the Providence Athenaeum, 95,000; the R.I. Historical Society, 50,000; the Annmary Brown Memorial (founded by Gen. Rush C. Hawkins), containing a rare collection of incunabula; and the Shepley collection on R.I. history, 25,000 volumes.

History.—The political history of the state from 1910 to 1920 was comparatively uneventful. In 1911 an amendment to the constitution provided for biennial election of the state officers and Legislature. In 1909 the number of representatives in the Lower House was fixed at 100; but repeated attempts to reform the Senate and institute representation according to population have uniformly been defeated. The city of Providence, with 40% of the population of the state, has but one member in a Senate of thirty-nine. The property qualification for the full municipal franchise is still in force. In 1912 the number of Congressional districts was increased from two to three. But under a new apportionment on the basis of the census of 1920 the state would stand to lose a seat, unless the National House of Representatives is enlarged. The presidential vote of the state was cast in 1912 for Wilson, Democrat; in 1916 for Hughes, Republican (though at the same time a Democratic U.S. Senator was elected); in 1920 for Harding, Republican. Rhode Island ratified the Nineteenth (Woman Suffrage) Amendment to the Federal Constitution; but, with Connecticut and New Jersey, failed to ratify the Eighteenth (Prohibition) Amendment. In 1920 the state brought suit in the U.S. Supreme Court to test the validity of the Amendment and of the Volstead Act. The suit was dismissed. For the service in the World War Rhode Island furnished 28,817 men. The National Guard in 1918 numbered 4,625 officers and men. Subscriptions to Liberty and Victory loans amounted to $209,444,110.

The governors since 1910, all Republicans, were: Aram J. Pothier, 1909–14; R. Livingston Beeckman, 1915–20; Emery J. San Souci, 1921– .

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RHODES, JAMES FORD (1848–), American historian (*see* 23.257), was awarded in 1910 the gold medal of the National Institute of Arts and Letters. He published in 1913 *Lectures on the American Civil War* (delivered at Oxford in 1912); in 1917 *History of the Civil War;* and in 1919 *History of the United States from Hayes to McKinley*, being the eighth volume of his *History of the United States*, of which the first appeared in 1893 and the seventh in 1906.

RHODESIA (*see* 23.259).—The three divisions of which this territory had consisted were reduced in 1911 to two by the amalgamation of North-Eastern and North-Western Rhodesia, thenceforward known as Northern Rhodesia simply. The Zambezi is the line of division between Southern and Northern Rhodesia, and whereas geographically and in its political developments Southern Rhodesia is part of South Africa, Northern Rhodesia belongs geographically to Central Africa, it is not "a white man's country" and its political future is not necessarily the same as that of Southern Rhodesia. The administration of the two regions was kept distinct, and in the present article this distinction is preserved wherever necessary. In 1921 Rhodesia was still governed by the British South Africa (Chartered) Co., but measures were in progress to terminate its rule.

Inhabitants.—At the census of May 3 1921 the white inhabitants of Southern Rhodesia numbered 33,621,[1] compared with 23,606 in 1911 and 12,596 in 1904. In 1921 males numbered 18,987 and females 14,634. The increase per cent. in the male pop. in the 10 years was 21·87, that of the female pop. 82·23. The natives in 1921 numbered 845,593, compared with 744,559 in 1911 and 591,493 in 1904. Asiatics in 1921 numbered 1,250 and the coloured pop. 1,997. Salisbury and Bulawayo, the chief towns, had in 1921 a white pop. of 5,654 and 6,830 respectively. Gwelo (white pop. 1,148) and Umtali (white pop. 1,874) were made municipalities in 1914, and Gatooma was made a municipality in 1917. All these places have most of the amenities of European towns.

In Northern Rhodesia the white in 1911 numbered about 1,500; and in May 1921 3,585, of whom 2,223 were males and 1,326 females. A considerable proportion of the white residents are officials and missionaries and their families. The native pop. in 1920 was estimated at 928,000.

Communication.—Little was done during 1910–21 to extend communication in Rhodesia itself, but from Sakania on the Rhodesian-Belgian Congo frontier the railway was continued through Katanga with the result that the valuable mineral output of that region was carried over the Rhodesian lines. The completion of the line from Zeerust (Transvaal) to Mafeking (Cape province) shortened the distance between Rhodesian stations and Johannesburg by 250 miles and enabled Durban to compete for the Rhodesian trade. On the completion in 1913 of the line through the northern Transvaal to the Limpopo at Messina, proposals were made to bridge the gap left—some 130 m.—between the Union railways and the West Nicholson branch of the Rhodesian system. As the bridging of the gap would place Lourenço Marques as closely in touch with Bulawayo as is Beira (its existing port), there was much opposition from interested parties to the building of the line and construction had not begun in 1921. Among other projects the most important was the so-called Sinoia-Kafue cut-off, to give Salisbury and Beira a much shorter line to Northern Rhodesia and Katanga. The line in 1921 had been built as far as Sinoia only. In south-eastern Rhodesia the branch line from Gwelo had been extended to Victoria.

There was a good deal of road-making, the largest piece of work being the cutting of a road—400 m. long—through the bush from Broken Hill to Lake Tanganyika. This was done for military reasons during the campaign in German East Africa. In 1919 aerodromes were made at Bulawayo and other stations on the Cairo-Cape route.

For the year ended Sept. 30 1919 the report of the Rhodesian Railways Ltd. showed that the gross revenue was £1,058,000; expenditure £568,000 and net earnings £490,000. For the year ended Sept. 30 1910 the corresponding figures were £789,990, £362,000 and £427,000 respectively. The gross revenue of the Beira-Salisbury and Kalomo-Broken Hill sections of the Mashonaland Railway Co. for 1918–9 was £647,000; expenditure £367,000 and net earnings £280,000, compared with £502,000, £184,000 and £317,000 respectively in the year ended Sept. 30 1910.

Agriculture.—At the end of 1919 the area under crops, excluding vegetable gardens and land cultivated by the natives for their own benefit, in Southern Rhodesia was 215,276 ac., of which 177,470 ac. were under maize. In 1911 the area under crops was 132,105 acres. The production of wheat increased in Mashonaland, the quantity produced in 1919 (13,432 bags) being double the amount of the output five years previously. Tobacco became one of the principal crops, the production of leaf in 1919–20 being about 2,500,000 pounds. Cotton-growing had not got beyond the experimental stage in 1921. The citrus industry made headway and considerable quantities of oranges, etc., are now exported. Over 6,000 boxes were shipped to the United Kingdom in 1920.

The Mazoe dam, which has an effective storage capacity in a normal season, after allowing for evaporation, of 4,000,000,000 gal., was completed in March 1920. This dam enables sufficient water to be stored for the irrigation of 6,000 ac. with 2½ ft. per annum.

Cattle-breeding in the decade 1911–21 became one of the leading industries of Rhodesia. By the importation of pedigree bulls the native breed was steadily improved. In 1919 29,510 head of cattle was exported by rail or on the hoof to the cold-storage works in the Union or to Portuguese East Africa and the Belgian Congo. By the end of 1919 the number of cattle owned by Europeans (673,431) exceeded the number belonging to the natives. In 1910 the total (European and native owned) was 371,000. The Liebig Co. acquired extensive ranching areas.

In Northern Rhodesia maize and tobacco are the principal crops; wheat was grown under irrigation. Experimental work in the cultivation of wheat and other cereals, fodder plants, fruit and forest trees, fibres and in the investigation of plant diseases was carried on at the Chilanga estate of the B. S. A. Company. Orange-growing was started and a small quantity of cotton grown in the Fort Jameson district adjoining Nyasaland. Large areas of wild rubber exist. Cattle ranching became popular, a good market being found in Katanga for slaughter beasts. Except for the settlement at Fort Jameson, the white residents are mostly concentrated along the railway line from the Victoria Falls to Katanga.

Mining.—Gold is now found in a large variety of formations, including quartz, schists, granite, sandstones, banded ironstones conglomerates and dolorite.[2] The value of the output steadily increased from £2,566,000 in 1910 to £3,895,000 in 1916, when the yield in ounces was 930,356. The effects of the World War, increased working costs and labour difficulties then brought about a decline and the value of the output had fallen in 1919 to £2,499,000. In 1920 the value of the output went up to £3,056,000, though the yield measured by weight (552,497 oz.) was 40,725 oz. less than in 1919, the rise in value being due to the premiums obtained on sales of gold in 1920. The silver output reached its highest level (211,989 oz.) in 1917 and this was also the case with coal (584,954 tons) and copper (3,911 tons). The largest output of chrome iron ore (88,871 tons) was in 1916. After the end of the World War production was considerably reduced. Asbestos is becoming an important industry, the chief mines being in the Bulawayo and Victoria districts. The output rose from 55 tons in 1908 to 18,823 tons in 1920. Valuable mica deposits are being worked in the Sinoia district, the output in 1920 being 97 tons. Small shipments realized up to £600 per ton. Arsenic (1920, 437 tons) and tungsten (1920, 17 tons) are worked. The output and value of the principal minerals of Southern Rhodesia in 1920 were as follows:—Gold 552,497 oz. (£3,056,549); silver 158,982 oz. (£58,178); copper 3,109 tons (£333,111); chrome iron 60,269 tons (£245,378); coal 578,492 tons (£252,000); asbestos 18,823 tons (£459,572). The total value of mineral production in Southern Rhodesia up to the end of 1920 was £56,164,325.

Northern Rhodesia.—The chief mining centres in Northern Rhodesia are Broken Hill (lead and zinc) and Bwana Mkubwa, near the Congo border (copper). The mineral production in 1920 was as follows, the figures for 1916 being given in parentheses for purposes of comparison:—Gold 569 oz. (719 oz.), value £2,998 (£2,980); silver 5,583 oz. (8,777 oz.), value £706 (£877); copper 145 tons (1,298 tons), value £7,601 (£39,362); lead 16,345 tons (1,392 tons), value £335,000 (£25,121). Up to Dec. 31 1913 13,156 tons of zinc ore, valued at £84,577, had been produced. Mining for this ore then ceased. The total value of the mineral production of the northern territory to Dec. 31 1920 was £1,534,000.

Commerce.—Bacon-making, oil-crushing and soap-making, cheese-making and meat-canning, in addition to creameries and tobacco factories and flour-mills, are established. The following table shows the value of the imports and exports of Southern Rhodesia (exclusive of specie and goods reëxported) in 1910, 1915 and 1919.

	Imports	Exports
1910 . . .	£2,786,000	£2,812,000
1915 . . .	2,949,000	4,536,000
1919 . . .	4,500,000	4,432,000

In Northern Rhodesia the value of imports increased from £168,000 in 1911 to £424,000 in 1919. Exports in 1911 were valued at £107,000 and in 1919 at £452,000.

Revenue.—For the year ended March 31 1911 the revenue of Southern Rhodesia was £773,000 and expenditure £752,000. In 1918–9 the revenue amounted to £961,000 and the expenditure was £858,000. The chief items on the revenue side of the account were: customs duty £298,000; native tax £238,000; posts and telegraphs £100,000; stamps and licences £59,000; income-tax and excess-profits tax £60,000. For the year ending March 31 1920 the revenue was £1,031,000, the expenditure £1,061,000.

The revenue of Northern Rhodesia for the year ended March 31 1912 was £116,000, expenditure being £190,000. In 1919–20 the revenue was £169,000 and expenditure £260,000. Native tax produced (1918–9) £83,000 and customs duty £36,000.

Education.—In Southern Rhodesia in 1919 public expenditure on education was £125,000, the sum of £39,000 being received from fees. At the end of that year there were 77 public schools open, with 4,775 pupils. There are schools of domestic science at Bulawayo and Salisbury. There were 670 native schools, with 38,284 pupils, conducted by missionary bodies, receiving grants in aid.

In Northern Rhodesia in March 1920 European children attending Government schools numbered 222. The Administration established boarding-houses at three centres.

Native Affairs.—No radical change was made in the system of native administration in Southern Rhodesia during 1910–21. The office of Secretary of Native Affairs was filled by the administrator and in each district a commissioner was appointed to direct and protect the natives. The conduct of the white settlers and of the Chartered Co. towards the natives was the subject of strict scrutiny.

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[1] The figures for 1921 are the unaudited return.

[2] The Geological Survey of Southern Rhodesia showed that the majority of the productive gold-mines do not lie in the "schist belt," as previously supposed, but occur in a peculiar granite mass, known as the Mont d'Or granite. Important chrome iron-ore deposits occur in a mass of serpentine and talc-schist, which is related to the Mont d'Or granite in structure and probably in origin. The two masses together, according to the Director of the Geological Survey, Mr. H. B. Maufe (formerly of the Geological Survey of the United Kingdom), constitute an important plutonic complex, which had remained unrecognized until then. The result of the mapping by the Survey was to give a view of the nature of the mineral field totally different from that generally held.

Cases of grave injustice had occurred in the earlier history of the territory and in the period under review further charges were brought against the Company in connexion with the rearrangement of the reserves. Settlers complained that certain lands in native reserves were not being beneficially used by them; the natives made similar complaints. In 1914 a commission under the chairmanship of Mr. (afterward Sir) R. T. Coryndon, then resident commissioner of Swaziland, was appointed by the Colonial Office to inspect and report upon the reserves. The commission concluded its sittings at the end of 1915. It recommended that 5,610,595 ac. should be assigned as additional reserves or extensions to existing reserves, but that 6,673,055 ac. then included within the reserves were not required for that purpose. The total, reserve area recommended was 19,428,691 ac., a net reduction of 1,062,460 acres. The Imperial Government decided to accept these recommendations in their entirety in 1917. There was, however, owing to war conditions, delay in adopting the commission's recommendations and attacks were made on the Company's native administration during the greater part of 1919. A Parliamentary White Paper issued in Feb. 1920 contained correspondence between the Aborigines' Protection Society and the Colonial Office on the subject. The charges against the Company were replied to by Lord Buxton (then high commissioner) at Salisbury in Aug. 1919, and by Col. Amery (Under Secretary for the Colonies) in the House of Commons in March 1920. Col. Amery said:—"I believe this House can with confidence endorse the very high testimony of Lord Buxton to the native administration of Rhodesia and the attitude of the civil population generally towards the natives. It is a model, not only in Africa, but for any part of the world where you have the very difficult problem of the white settler living side by side with the native." An Order in Council was passed giving sanction to the Coryndon commission's recommendations. The changes it recommended were gradually carried out and gave rise to little friction. Lord Milner (then Colonial Secretary) set forth in an official despatch that the settlement reached was regarded as final, not only as to the present, but also the future requirements of the natives. To ensure them security of tenure the reserves were vested in the high commissioner for South Africa and would be inalienable save for certain limited purposes and only in exchange for other land.

In Aug. 1921 Prince Arthur of Connaught (the new high commissioner) visited Rhodesia and received a deputation of Matabele. He told them that the decision as to the reserves must stand and that their desire to have a son of Lobenguela recognized as paramount chief could not be granted. "You cannot go back," said the Prince; "you must go forward."

The general condition of the natives of Southern Rhodesia had distinctly improved between 1910 and 1920, and their value as an asset of the country became generally recognized. They were not only producers on their own account, but considerable purchasers of European goods. They paid an annual poll-tax of £1—the only levy made upon them by the administration. In 1911 several ordinances designed to secure better housing, feeding and medical supervision of native labourers outside the reserves came into effect. Steps were also taken to provide agricultural and industrial training, and to cope with cattle disease in the native reserves.

Vaccination and medical examination of natives applying for domestic service was made compulsory and the Bulawayo municipality introduced by-laws providing for a standard of housing accommodation for native servants.

Sleeping sickness along the Congo border of Northern Rhodesia necessitated precautions being taken to prevent its southward extension. Some cases of the disease occurred in the Loangwa valley, but they appeared to be sporadic.

History.—The outstanding feature of the history of the territory in the period 1910–21 was the steady growth of political consciousness on the part of the white residents of Southern Rhodesia. The framers of the constitution of the Union of South Africa left open the door for the adhesion to it of Rhodesia. The ultimate joining of Rhodesia to the Union was taken for granted by most South Africans, but the actual formation of the Union in 1910 seemed to have a contrary effect. It appeared to give a distinct stimulus to the already nascent desire of the Southern Rhodesians for independent self-government. A distinct advance in that direction was made in May 1911, when, by Order in Council, the elected members were given a majority of the seats in the Legislative Council, provision being made for safeguarding the interests of the British South Africa Company.

The legal position at that time was that the British South Africa Co. exercised under its charter sovereign rights subject only to such control as was exercised by the Colonial Office through the high commissioner for South Africa and a Resident in Rhodesia. While the Company's administrative expenditure was by this time slightly exceeded by the revenue, there was no means of making good the heavy losses incurred in opening up the country save by the sale of unalienated lands. Of their ownership of the land and of their rights of disposal the Company entertained no doubt and this fact had much influence upon the attitude of the directors. Sir Starr Jameson, on resigning towards the close of 1912 his leadership of the Unionist party in the South African Parliament, became president of the Chartered Co. and retained that position until his death in Nov. 1917.[1] The administrator in Southern Rhodesia was Sir William H. Milton, a man of great experience and tact in his dealings both with the white residents and the natives. After over 16 years' service in the territory Sir W. H. Milton resigned in Oct. 1914 and was succeeded by Mr. (afterwards Sir) Drummond Chaplin. But while the administrator and his executive could do much to make the machinery of government work smoothly, there was no power, locally, to shape policy. Disputes arose between the Company and the settlers, who desired a still larger share in the administration. The controversy became acute in view of the fact that in Oct. 1914, under the terms upon which the charter was originally granted, the Crown would have the right to revise its terms with regard to administration. Sir Starr Jameson, Mr. Rochfort Maguire and other representatives of the Chartered Co. visited Rhodesia in 1913, when a further increase was announced in the numbers of elected members of the Legislative Council. As to the financial position the directors said that, as "the land and minerals belonged to the Company," no debt in respect to past deficits would be placed on the country when the Company relinquished its administration. Mr. Maguire described the Company's proposals as a means for bridging the period antecedent to self-government, the ideal towards which, he claimed, the Company was working. In accordance with the promise given, a redistribution ordinance was passed, the elected members being increased to 12, while the number nominated by the Company was fixed at six. At the general election in March 1914 11 of the 12 elected members returned were pledged to support the maintenance—for the time being—of the Company's administration, but, the Council declared, its continuance should not affect the right "at any time" thereafter to the institution of self-government.

The Council in April 1914 definitely challenged the right of the Chartered Co. to the ownership of unalienated lands. The question had been raised in 1908, but was then allowed to drop. It was now recognized as essential that the matter should be settled before the political status of Rhodesia was altered. On behalf of the Rhodesians (*i.e.* the white settlers) it was claimed that the Chartered Co.'s power to deal with the land was only a delegated right granted by the Crown, and secondly, that if the Company had acquired ownership rights such rights were vested in it "as an administrative and public asset only"; that as a trading body the Company had no title to the land or its revenues. Consequently it was contended that, on the Company ceasing to exercise administrative rights, all unalienated lands should go as public domain to the Government which succeeded it. In July 1914 the claim of the Legislative Council was referred to the judicial committee of the Privy Council for adjudication.

In the meantime it was decided that the Crown should not exercise its right to vary the terms of the charter, which therefore, in virtue of the original provisions, would legally continue unaltered for ten years from Oct. 29 1914. The directors of the Company intimated, however, that they would offer no objection to the earlier establishment of responsible (*i.e.* self) government should it be deemed necessary and had the concurrence of the British Government. A supplemental charter giving effect to this agreement was issued on March 13 1915.

Meanwhile the outbreak of the World War for a time forced the constitutional question into the background. But the war itself had an important bearing on the political question. The party which desired the indefinite continuance of Chartered Co. rule had nearly disappeared, but an influential party had advocated, as the alternative to self-government, joining the Union of South Africa. This party lost ground as Rhodesians saw what was happening in the Union. The growth of separatist and republican sentiment among the Dutch population, evidenced by the increasing support gained by Gen. Hertzog and particularly the rebellion of 1914, inevitably influenced the political orientation of the almost solid British population of Rhodesia. Disinclination to be swallowed up in the Union and dislike of the introduction of bi-lingualism—a necessary result of Rhodesia becoming a province of the Union—were strongly reinforced by real if perhaps exaggerated fears as to the strength of the Dutch nationalist movement. It was possibly due in part to these developments that a proposal put forward by the Company in 1915 for the amalgamation of Northern and Southern Rhodesia secured (in 1917) a majority in the Legislative Council, though it was not proceeded with.

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[1] After Sir Starr Jameson's death Mr. Philip Lyttelton Gell acted as chairman of the board of directors and in Oct. 1920 was appointed president of the Company.

After an exhaustive inquiry the judicial committee of the Privy Council gave its decision as to the ownership of unalienated lands on July 29 1918. It had had before it not only the claims of the Crown and of the Chartered Co. but those of the natives, whose case was put forward without much evidence that it was being pressed by the natives themselves. The judicial committee reported in favour of the Crown. While, however, it decided that the Company could not claim ownership of unalienated land in Southern Rhodesia, it held that it was entitled to be reimbursed for expenses and outlays of administration in current or past years, and that while it continued to administer Southern Rhodesia it was entitled to apply the proceeds of any sale of land towards the reduction of such expenditure. The Company's exclusive rights to all minerals in the country were confirmed and grants or sales of land made by it were finally legalized.

The next step was to ascertain the amount which would be due to the Company in accordance with the judicial committee's report should the administration of Southern Rhodesia by the Company cease. At the request of the Chartered Co. a royal commission, of which Lord Cave was chairman, was appointed in July 1919 to ascertain the amount which would have been due to it for its administrative expenses if its governing powers had ceased on March 31 1918. The claim filed by the Company was in round figures for £8,000,000 plus interest on the accumulated deficits. The Cave commission took evidence in Rhodesia and its award was issued in Jan. 1920. The commission rejected the Company's claim for interest and fixed the amount due to the Company at £4,435,000, subject to deductions (1) in respect of the value of lands appropriated by the Company for commercial purposes, and (2) the proceeds or value of lands and rights alienated by the Company for considerations other than cash, but plus the value of the public works which might be taken over by its administrative successor, estimated at £830,000.

In the interval the campaign for the grant of self-government had been renewed vigorously in Southern Rhodesia. In view of a coming general election the Legislative Council in May 1919 passed a resolution asking the Colonial office publicly to state what proof of fitness "financially and in other respects" would be considered sufficient to justify the grant of responsible government. Lord Milner (then Colonial Secretary) replied in Aug. that he could not regard the territory in its then stage of development as equal to the financial burden of responsible government, and as there appeared to be no great desire for the inclusion of the territory in the Union he advised that matters should be left as they were until the situation became clearer. This reply caused a good deal of dissatisfaction amongst the advocates of responsible government in Rhodesia. The strength of the movement was shown at the general election in May 1920, when the responsible government party secured 12 of the 13 elective seats in the Legislative Council. The 13th member advocated representative government, a half-measure which Lord Milner had considered impracticable.[1] Owing to the successes gained by the Dutch Nationalists at the general election in the Union a few months earlier, opinion in Rhodesia, which, in view of the discouraging attitude of the Colonial Office towards responsible government, had tended to consider more favourably entry into the Union, swung round completely.

The new Legislative Council, at its first meeting in May 1920, passed a resolution praying the Imperial Government to establish responsible government and affirming that—

> "The record of the people of Southern Rhodesia establishes that they are capable of fulfilling in the interests of all the inhabitants thereof, irrespective of race, the duties of self-government, and are equally as able to bear the responsibility thereof as other peoples of the Empire to whom the rights of self-government have been granted in the past."

Lord Milner, in a despatch dated Dec. 22 1920, again urged delay. "In principle" he favoured the Rhodesian demand and the Chartered Co. was willing, he said, to be relieved of its responsibilities, but, chiefly on the ground of finance, he proposed that the Company's rule should continue till after the next general election, which in the ordinary course would be held early in 1923. If Rhodesia was then still in the same mind, responsible government could be brought into force not later than Oct. 1924. The elected members of the Legislative Council strongly traversed Lord Milner's arguments and in the end the Colonial Office sought the advice of still another committee.

This committee, of which Lord Buxton, lately governor-general of the Union and high commissioner, was chairman, was appointed on March 7 1921. It acted with promptitude and reported on April 12 following. The electors having so recently expressed their views in favour of the abstract principle of self-government, no advantage would be gained (the committee stated) by another vote on the principle. It recommended therefore that a scheme for responsible government should be drawn up in detail and that by means of a referendum the opinion of the electors on such a definite scheme should be ascertained. If the electors accepted the scheme a proclamation or Order in Council should issue annexing Southern Rhodesia to the dominions of the British Crown and that annexation should be followed by letters patent setting up responsible government. The draft of the constitution, it was suggested, should be drawn up by the Colonial Office in consultation with the elected members of the Legislative Council. Two special provisions were proposed:—

> (1) That with regard to the natives the existing authority and control by the high commissioner should be retained; and (2) that control of unalienated land should be exercised through the high commissioner on the advice of a specially created land board. This unalienated land would be charged with the payment of the sums to which the Chartered Co. was entitled under the Cave award.

Many objections might be and were raised to the proposed manner of dealing with the land question, but the elected members of the Legislative Council, under the leadership of Sir Charles Coghlan, accepted the recommendations of the Buxton committee, and Rhodesian delegates were appointed to confer with the Colonial Office.

Meanwhile the general election in the Union in Feb. 1921 had resulted in the defeat of the Dutch Nationalists (though not in any diminution of their voting strength), and it was arranged that, before any irrevocable step was taken, the Rhodesian delegates should consult with Gen. Smuts, the Prime Minister of the Union, as to the alternative plan of Rhodesia becoming a province of the Union. The conference with Gen. Smuts was held at Cape Town in Sept. 1921, before the delegation left for England. It was made clear that if the Rhodesians had changed their minds and desired admission to the Union they would be welcomed, but that the Union would require the ownership of the unalienated lands.

The influenza epidemic of 1918 took a heavy toll of the natives of Rhodesia; the death-roll was estimated at fully 30,000.

A national tribute was paid to Sir Starr Jameson on May 22 1920, when his body, brought from England, where it had been temporarily interred, was given a last resting-place close to the grave of Cecil Rhodes at the World's View in the Matoppo Hills.

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[1] The following is an analysis of the returns, one member being elected unopposed. Votes for responsible government 4,663; for representative government 420; for joining the Union of South Africa 814; for continuance of Chartered Co.'s rule 868; total poll (out of 11,098 electors) 6,765.

Survivors of the pioneers Jameson had led into Mashonaland in 1890 were present, and Matabele and Mashona indunas.

Rhodesia's Part in the World War.—The Rhodesian frontiers in 1914 touched German protectorates both on the west and east. The Caprivi "Finger" of German S.W. Africa came up to the Zambezi, west of the Victoria Falls. It was occupied by the Rhodesian forces with little difficulty. On the east a more serious situation was presented, as the Germans, in comparatively strong force, entered Rhodesian territory between Lakes Tanganyika and Nyasa. Aided by and giving aid to the troops of the Belgian Congo, Rhodesian volunteers and the British South Africa police rendered excellent service and held their own against the Germans. Subsequently Rhodesians played a notable part in Gen. Northey's offensive. A small Matabele contingent took part in the fighting, and a combatant battalion was raised from the natives of Northern Rhodesia.

From the first the Rhodesians were not content with the defence of their own territory. A regiment (1st Rhodesian) was raised for service in the 1914 rebellion and in the campaign in S.W. Africa, and early in 1915 another regiment (2nd Rhodesian) was sent to British East Africa, where it gained a deservedly great reputation. Many Rhodesians also enlisted in the British army. Altogether 6,859 Rhodesians (Europeans) were on active service during the war, a number much more than half the adult male population. Rhodesian natives engaged as combatants in E. Africa numbered 2,721, and in addition there were 40,732 "first-line" carriers. Some 152,000 other carriers were engaged on war service in Northern Rhodesia alone.

In the last days of the war (Nov. 2 1918) Gen. von Lettow Vorbeck, with all that was left of the German forces, turning westwards from his pursuers, entered Northern Rhodesia and had reached the Chambezi near Kasama on the day the Armistice was signed in Europe. It was in Rhodesia, therefore, that the last act in the war was played, von Lettow surrendering to the magistrate at Kasama on Nov. 14.

Northern Rhodesia.—The amalgamation of North-Eastern and North-Western Rhodesia was carried into effect on Aug. 17 1911, when Mr. (afterwards Sir) Lawrence Wallace was appointed administrator, a post he held for nearly ten years.[1] The defence of the territory, which had been shared with Nyasaland, had been taken over entirely by the Rhodesian authorities a short time before the amalgamation was carried through. The number of British settlers gradually increased and missionaries did valuable work in training the natives and introducing higher standards among them. The proposal of the Chartered Co. to amalgamate Northern and Southern Rhodesia has already been referred to; the project was dropped. The war, which deeply affected Northern Rhodesia, at first caused marked depression, which was removed by the military expenditure in 1916–7, while the building of the Katanga railway and the mining activity in Katanga brought about a revival. An elective, but purely advisory, council was established in July 1913.

The Chartered Co. was faced with much the same difficulties in Northern as in Southern Rhodesia, nor in the north did revenue meet administrative expenditure. Up to March 31 1919 the deficit was placed at over £1,250,000. As in Southern Rhodesia, the Company claimed the land and minerals and the repayment of administrative deficits, and, equally, the white settlers claimed a greater share in the government, notably control of finance. The consideration of these questions was remitted to the Buxton committee, which in its second report, dated April 29 1921, advised that the legality or otherwise of the Company's claims should be settled by the Privy Council before the future status of Northern Rhodesia was decided. Meanwhile the immediate creation of a legislative council was recommended.

Barotseland (*see* 3.424).—Barotseland, the S.W. part of Northern Rhodesia, continued to be a native reserve in which Europeans, other than the officials of the Chartered Co. and missionaries and traders approved by the paramount chief, were not allowed to settle. The paramount chief in the exercise of his authority is aided by a *ngambella* (prime minister) and a *kotla* (council); he has no jurisdiction over Europeans. Relations between the Barotse and the Company were satisfactory and missionary enterprise prospered. Distinct interest in education was shown; in 1912 there were 413 scholars at the Barotse national school, 251 being boarders. Lewanika (*see* 16.519), who had placed his country under British protection and who won and retained the reputation of an enlightened ruler, died in 1916. He was succeeded by his eldest son Yeta III. (formerly known as Litia). Lealui, the native capital, and Mongu, the residence of the chief British officials, are both on the Zambezi and seven miles distant from one another.

A list of parliamentary papers relating to Rhodesia is given in the *Colonial Office List*, published annually in London, and annual reports are issued by the British South Africa Company. See also C. Gouldsbury and H. Sheane, *The Great Plateau of Northern Rhodesia* (1911); A. Darter, *The Pioneers of Mashonaland* (1914); the *Report of the Rhodesia Resources Committee* (1921); H. Rolin, *Les lois et l'administration de la Rhodésie* (1913); J. H. Harris, *The Chartered Millions* (1920); and A. S. and G. G. Brown, *The South and East African Year Book and Guide* (annually).

In the preparation of this article the writer is indebted to G. H. Lepper, of the *Trade Supplement* to *The Times*. (F. R. C.)

RHONDDA, DAVID ALFRED THOMAS, Viscount (1856–1918), British colliery owner and Food Controller in the World War, was a Welshman, born March 26 1856 in Aberdare, grandson of a Monmouthshire yeoman farmer, and son of a Merthyr grocer. His father had prospered in his trade, and in later life enriched himself by speculations in coal. Young Thomas was sent to Clifton College, and afterwards to Caius College, Cambridge, where he graduated as a *senior optime* in the mathematical tripos in 1880, and immediately joined his father in the coal business. He threw himself with great energy and ability both into that and into local Liberal politics; and was so successful in both spheres that he was returned to Parliament for Merthyr in 1888. His extraordinary commercial gifts, his insight, his foresight, and the sympathy which he brought to bear on the conditions of life in the mining industry, soon made him a prominent, and eventually the leading, figure in the industrial world of S. Wales. "D.A.," as he was always called, by his initials, in his own part of the country, endeared himself to the miners by becoming their champion in the 'nineties against the undercutting of prices by middlemen, and by the generous wages which he paid in the collieries under his control; and though in subsequent years he sometimes had differences with the men, he always retained their respect. His business combinations brought him great wealth and culminated in the Cambrian super-combine, which produced some six million tons of steam coal a year. Other important undertakings in which he took a leading share were the Ebbw Vale Steel, Iron and Coal Co., the Rhymney Iron Co., and the Taff Vale Railway Company. So extensive were the ramifications of his interests that, when he accepted office in 1916, the number of directorships from which he retired was no fewer than forty. He had much longer to wait for success in the political than in the commercial field. Though he sat in the House of Commons for Merthyr for 22 years and afterwards for some months for Cardiff, no use was made by the political chiefs of his party of his great capacities for public service, and he therefore retired from Parliament in 1910.

The outbreak of the World War gave him his opportunity. He rendered substantial help to Mr. Lloyd George both at the Exchequer and in the office of munitions, by organizing British industrial resources for war. He took a lead in "capturing German trade," carrying through, for instance, the acquisition of the Sanatogen business. He went to America to complete important war contracts for the Government, and on his return was saved, with his daughter, Lady Mackworth, from the sinking of the "Lusitania." He went back to America almost immediately, and spent seven months there at his own expense, expediting the output of munitions, and regulating and systematizing the prices charged. He was created a baron, as Lord Rhondda, for his services in Jan. 1916; and it was natural that, when Mr. Lloyd George, in forming his ministry in the following Dec., made up his mind to introduce captains of industry into office, he should turn at once to his old ally, who became president of the Local Government Board. His principal business in this post was to prepare for the establishment of the Ministry of Health. Before this was effected he accepted, in June 1917, at the Prime Minister's pressing request, the onerous burden of the Food Controllership, vacated by Lord Devonport. He was no respecter of persons, and immediately took strong steps to put an end to the speculation in the necessities of life which was becoming a public scandal. Then he gradually fixed prices and brought supplies under control, in regard to almost all articles of food except vegetables. Thus he eliminated profiteering in food-stuffs. He also carried through a great decentralization in the administration of his office. But he will be mainly remembered as the author of the system of compulsory food rationing, which was carried out with absolute fairness and impartiality, putting an end to the queues waiting at butchers' and bakers' shops that had rendered the housekeeper's life a burden. As Food Controller, Lord Rhondda ran the biggest trading organization that the world had ever seen. The turnover of his Ministry, apart from the work of the wheat and sugar commissions, amounted to 1,200 millions sterling; with them 2,733 millions sterling. Supplies never failed, and in spite of the German submarine menace there was no hunger in the United Kingdom. His strenuous labours affected his health, and in April 1918 he tendered his resignation; but his work was so invaluable that pressure was put upon him to remain, and he was created a viscount. But the strain was too great. He was attacked by pneumonia and died on July 3. Tributes to his work and to the public loss sustained by his death were paid in both Houses of Parliament.

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[1] On the retirement of Sir L. Wallace (1920), Sir D. Chaplin, the administrator of S. Rhodesia, took charge of N. Rhodesia also.

He married Sybil Margaret Haig, a cousin of Lord Haig, who survived him. They had one child, a daughter, who married Sir Humphrey Mackworth, and who succeeded to the viscounty of Rhondda under a special remainder. (G. E. B.)

RHYS, SIR JOHN (1840–1915), British archaeologist and Celtic scholar, was born in Cardiganshire, the son of a yeoman farmer, and educated at the Bangor Normal College and Jesus College, Oxford. In 1877 he was elected professor of Celtic at Oxford, the first occupant of the newly created chair, and he held that post till his death. In 1895 he became principal of Jesus College. He was Hibbert lecturer in 1886, Rhind lecturer in archaeology at Edinburgh in 1899 and president of the anthropological section of the British Association in 1900. He also served on several royal commissions and was knighted in 1907. He died at Oxford Dec. 16 1915. His published works include *Lectures on Welsh Philology* (1877); *Celtic Britain* (1882, last ed. 1904); *Celtic Heathendom* (1886); *Studies in the Arthurian Legend* (1891); *Celtic Folk-lore* (1901); as well as editions of Welsh texts (with J. G. Evans); *The Welsh People* (with D. B. Jones, 1900), and numerous other papers and studies of Celtic inscriptions and literature. For his work on the Arthurian legend *see* 12.300, 321, 669.

RIAZ PASHA (*c.*1835–1911), Egyptian statesman (*see* 23.281), died June 18 1911.

RIBOT, ALEXANDRE FÉLIX JOSEPH (1842–), French statesman (*see* 23.285). On Jan. 3 1909 M. Ribot was elected a member of the French Senate, and in Feb. of the following year was offered, but refused, the Ministry for Foreign Affairs in the Monis Cabinet. After the formation of M. Poincaré's Government on Jan. 14 1912 he took the place of M. Léon Bourgeois as president of the committee appointed to deal with the Franco-German treaty, the necessity for the ratification of which he demonstrated. In 1913 he was an unsuccessful candidate for the presidency of the Republic, and on the fall of M. Barthou's Government was invited by President Poincaré to form a Cabinet, but refused. In 1914 he became, with M. Jean Dupuy, leader of the Left Republican group which refused to accept the decisions of the Radical Socialist congress at Pau in Oct. 1913. On June 9 1914 he became prime minister and Minister of Justice, but his Government was bitterly assailed by the Radical Socialists as well as other groups, and only lasted one day.

With the outbreak of the World War M. Ribot's great reputation as an expert in finance and foreign affairs brought him effectively into office. On Aug. 27 1914 he became Minister of Finance in M. Viviani's Ministry of National Defence, an office which he retained when, on Oct. 28 1915, M. Briand succeeded M. Viviani as prime minister. On Feb. 7 1916 he visited London and held a conference with the Chancellor of the Exchequer at the Treasury. When Briand reconstituted his Cabinet, in Dec. 1916, Ribot retained the portfolio of Finance. On the fall of the Briand Ministry (March 17 1917) President Poincaré again called upon M. Ribot to form a Government, and this time he consented, himself taking the portfolio of Foreign Affairs in addition to the premiership (March 19). In the statement of his policy made to the Chamber on March 21 he declared this to be "to recover the provinces torn from us in the past, to obtain the reparations and guarantees due to France, and to prepare a durable peace based on respect for the rights and liberty of peoples." On July 31, in a reply to the German Chancellor Michaelis, he admitted that in 1917 an agreement had been made with the Tsar to erect the German territories on the left bank of the Rhine into an autonomous state, but denied that there had been any question of their annexation to France. His Government resigned office on Sept. 7; but he accepted the Ministry of Foreign Affairs in the Painlevé Cabinet constituted six days later. He resigned office finally on Oct. 16, owing to the violent criticism of his refusal to fall into the "trap" of the German peace offers.

RIBOT, THÉODULE ARMAND (1839–1916), French psychologist (*see* 23.286), died in 1916.

RICHARDS, THEODORE WILLIAM (1868–), American chemist, son of the artist William Trost Richards (*see* 23.299), was born at Germantown, Pa., Jan. 31 1868. He was educated at home, at Haverford College (S.B. 1885), Harvard (A.B. 1886; Ph.D. 1888), Göttingen, Leipzig and the Dresden Technical School. After passing through the various grades of promotion he was appointed professor of chemistry at Harvard in 1901 and was made director of the Wolcott Gibbs Memorial Laboratory in 1912. He was best known for his researches on atomic weights, of which he revised over a score, including that of radioactive lead. The results were generally accepted and for his contributions he received the Nobel Prize in Chemistry in 1914. He also gave much time to physicochemical investigation, especially concerning electrochemistry and chemical thermodynamics, piezochemistry and surface tension. Of these his contributions to atomic compressibility, to the relation between the change of heat capacity and the change of free and total energy, and to the thermodynamics of amalgams have perhaps been the most noteworthy. In 1907 he was Harvard exchange professor at Berlin, and in 1908 Lowell lecturer. He was president of the American Chemical Society (1914), the American Association for the Advancement of Science (1917) and the American Academy of Arts and Sciences (1919). He was a member of the National Academy of Sciences and of most of the European academies. He received hon. degrees from Yale, Harvard, Haverford, Pittsburgh, Clark, Pennsylvania, Oxford, Manchester, Christiania, Prague and Berlin. He was awarded the Davy (1910), Faraday (1911), Willard Gibbs (1912), and Franklin (1916) medals. He was made a member of the National Research Council in 1916.

RICHBOROUGH, a port on the left bank of the mouth of the Stour river, Kent, England, 1¼ m. N. of Sandwich, created by the Government during the World War as a base for the expedition of *matériel* to the armies in France and Flanders. The port was planned in June 1916, primarily to relieve Dover of this class of transport. The site chosen consisted of an expanse of marshland through which the Stour flowed as an insignificant stream. The work of construction was under the control of the Inland Waterways and Docks Section of the Royal Engineers, and involved the reclamation of a large tract of swampy foreshore, the widening and deepening of the waterway, the construction of a wharf and jetty nearly a mile in length equipped with powerful cranes and of docks for the building and repair of certain kinds of craft, the erection of acres of hutments and store-sheds, and the laying of some 50 m. of railway sidings. The work was rapidly pushed forward, the workers at one time numbering 20,000; and eventually a self-contained cantonment arose, having its own postal, police, lighting and other services.

The base was operated in a comparatively small way at first but developed into an undertaking of gigantic proportions. At the outset, steamers and barges were used to convey the war material across, until the French ports became congested; then special barges were introduced to take goods direct into the

French canals and thence as close to the firing line as possible. In 1917, speed of transport of material becoming extremely urgent, it was decided to establish a train-ferry service; it came into operation at the end of that year, and the hoisting of cargoes by cranes into barges was largely superseded. Three ferries plied incessantly between Richborough and Calais and Dunkirk, connecting railhead in England with railhead in France. In all, 4,000 barge loads of ammunition, 17,818 guns and limbers, and over 1¼ million tons of other stores were sent across.

The ferries, specially designed and built at the works of Sir W. G. Armstrong, Whitworth & Co. of Elswick, were of 363 ft. overall length, 61 ft. beam and 3,654 tons displacement. Four lines of rails on deck gave accommodation for 54 ten-ton wagons carrying an average load of 900 tons. A lifting bridge at the wharf-end, which the ferry approached stern on, enabled accurate connection of rails at all states of the tide, the process of embarking a train requiring ordinarily not more than 15 minutes.

For the protection of the base, a monitor was stationed in Pegwell Bay, and searchlights and heavy and anti-aircraft guns were mounted at many points. Repeated air-raids took place in the vicinity and there were several bombardments from the sea, but Richborough itself was never seriously damaged, the low-lying, featureless character of the marshland probably affording its best protection, more especially at night.

For a year after the Armistice, Richborough continued to deal with vast quantities of material returned from the western front. After the sale and disposal of the surplus military stores and equipment, the port, with the remaining equipment and the fleet of ferries and barges, was sold by the Disposal Board for £1,407,000 (plus the cost up to £40,000 of acquiring the land by the Government) to the Queenborough Development Co., who thus acquired 1,500 ac. of land including 250 ac. that were reclaimed from the swampy foreshore. In 1921, the company proposed to work Richborough as a barge and train-ferry port, ancillary to Queenborough, both centres to serve the requirements of a comprehensive scheme of industrial development in the surrounding districts including the Kent coal-fields.

RICHMOND, SIR WILLIAM BLAKE (1842–1921), English painter (*see* 23.307), died at Hammersmith Feb. 11 1921.

RICHTER, HANS (1834–1916), Hungarian musical conductor (*see* 23.312), died at Bayreuth Dec. 5 1916.

RICKETTS, CHARLES (1866–), English artist, was born at Geneva Oct. 2 1866, and was educated in France. In 1889 he became joint editor with Charles Shannon of the *Dial*. In 1896 he founded the Vale press, the output of which was a series of beautifully designed and printed books. Of his pictures, "The Plague" (1911) is in the Luxembourg at Paris, and "Don Juan" (1916) in the National Gallery of British Art. He published *The Prado and its Masterpieces* (1903), *Titian* (1906) and *Pages on Art* (1913).

RICOTTI-MAGNANI, CESARE (1822–1917), Italian general (*see* 23.316), died at Novara Aug. 4 1917.

RIDDELL, GEORGE ALLARDICE RIDDELL, 1ST BARON (1865–), British newspaper proprietor, was born in London May 25 1865 and educated privately. He became a solicitor in 1888 and began his practice in London. He then acquired an interest in the *Western Mail*, and he eventually turned his energies in chief measure to the management and control of newspapers. He obtained control over the Sunday paper, the *News of the World*, which he developed on popular lines, so that it obtained a huge circulation during the first decade of the 20th century and made its proprietor a very wealthy man. He gradually extended his newspaper connexions, becoming a director also of George Newnes Ltd., Country Life Ltd., and C. Arthur Pearson Ltd., etc. By the year 1909, when he received a knighthood, he had become one of the most influential personalities in the London press, and he took an active part in giving a more efficient organization to various forms of press work, by way of collective action between proprietors themselves and their organs. He was a prominent member of the Newspaper Proprietors' Association at the outbreak of the World War, and on nomination of the Newspaper Conference he gradually became the principal *liaison* between the Press and the Government so far as all matters of publicity were concerned. In this capacity he represented the British Press at the Peace Conference in 1919 and at all the important Allied conferences subsequently. He was created a baronet in 1918, and raised to the peerage as Baron Riddell of Walton Heath in 1920.

RIDGEWAY, SIR WILLIAM (1853–), British archaeologist, was born in Ireland Aug. 6 1853 and educated at Portarlington, Trinity College, Dublin, and at Caius College, Cambridge, where he was fifth in the classical tripos. In 1880 he was elected fellow of Caius College, Cambridge, and in 1883 became professor of Greek at Queen's College, Cork. In 1892 he returned to Cambridge as professor of archaeology and in 1907 became also Brereton reader in classics. He was made a fellow of the British Academy, and president of the Royal Anthropological Institute (1908–9). He was knighted in 1919. Amongst his publications are *The Origin of Metallic Currency and Weight Standards* (1892); *The Early Age of Greece* (1901); *The Origin and Influence of the Thoroughbred Horse* (1907); *Who were the Romans?* (1907); *The Oldest Irish Epic* (1907), etc. His views on early Greek civilization are described in 12.442; those on the origin of the Romans in 23.616, and those on the horse in 13.717.

RIFLES AND LIGHT MACHINE-GUNS (*see* 23.325 and 17.237).—Since 1910 there have been few important changes in the design of the military bolt-action rifle. The adoption by many countries of the pointed bullet in lieu of the round-nosed (*see* 23.328) has led to some strengthening of parts so as to withstand increased chamber pressures. Modifications in the patterns of sights used have also been made here and there.[1] The military rifle had practically reached its zenith before 1914, and the opening of the World War found all armies equipped with rifles of practically equal merit. With the exception that the French continued to use the tube-magazine Lebel rifle and the British and Americans had adopted a shorter barrel than the rest, it might be said that the military rifles of the world were not only equal in merit but similar in design.

This initial equivalence of the opposed rifles continued throughout the war period. Further changes of detail were made. Special rifles were sometimes brought into use for snipers, and fittings were added to the standard service rifle to adapt it as a grenade-thrower and as a sniper's weapon to be used from a deep trench. A heavy single-loader was designed in Germany as an anti-tank weapon, and many changes were made in the ammunition. But the rifle itself, the rifle of the average infantryman, was practically the same at the end of the war as it had been for the past 15 years, or, setting aside the change of bullet type, for twenty-five. The German army of 1918 carried the 1898 rifle, the French the Lebel model 1886–93, the Italians the Mannlicher-Carcano of 1891. The Russian three-line (·3-in.) rifle of 1900 was only a modification of the earlier Moussin and Nagant models. The most modern patterns were the British and the American, and these were characterized by having a relatively short barrel, experience in the S. African War having brought "snap shooting" and the consequent need of handiness into relief. Otherwise the elements and their functions were the same, and the dimensions of the same order, in all rifles except the French.

This standstill of progress, in a time when the design of every other kind of weapon was developing at an unprecedented rate, is very remarkable and indicates clearly enough that the military rifle of the conventional type had reached its zenith. As a type, it was not capable of much further development. Designers had already by 1914 produced the first practical models of automatic and semi-automatic arms. Governments were unwilling to re-arm their troops and re-stock their armouries with new models of an obsolescent class. Even the French, whose rifle was not only the oldest but also possessed a type of magazine long discarded by others, made no attempt to replace it by a weapon of the class of the British and American rifles. When war came, all Powers were waiting on events.

In the war itself the machine-gun proper very soon and decisively asserted itself, driving the simple rifle into the background. Further, trench warfare took unforeseen shapes. Grenades, trench mortars, bombs and man-to-man weapons, even clubs and daggers, became normal infantry arms in minor and subordinate combats, while in the battle proper it was the artillery and the machine-gun rather than the firing-line of rifle-armed infantry that governed the issue both in attack and in defence. Thus when, from the latter part of 1916 onwards, the "break-through," with its sequel of free infantry fighting in the background of the broken-through trench systems, became the ideal of tactics, the main infantry weapon was inevitably the machine-gun in some form. And thereupon the machine-gun of the pre-war and early war period began to develop on two distinct lines—the *heavy* machine-gun with its own rôle and characteristics (*see* MACHINE-GUN), and the light machine-gun or infantry machine-gun. When this evolution set in, the machine-rifle or automatic rifle (some forms of which were already in use as machine-guns, especially with aircraft) was more or less ready to take up the place allotted to it by tactics.

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[1] For further information *see* AMMUNITION and SIGHTS.

The light machine-gun or machine-rifle—"infantry machine-gun" is a better designation than either for the class as a whole—is differentiated from the heavy machine-gun, technically and tactically, by being: (*a*) portable by one man; (*b*) unprovided with a mounting in the proper sense; (*c*) as inconspicuous in action or movement as an ordinary rifle; and (*d*) limited for various reasons to short bursts of fire. On the other side, as against the rifle, it possesses: (*a*) fire power with which no hand-operated weapon can compete, which indeed is equivalent for some moments at a time to that of the machine-gun proper; (*b*) an accuracy that, while less than that of the heavy type, is greater than that of the rifle, owing to the absence of trigger jerk and disturbance of the firer by recoil and to the fact that a muzzle support is (usually) provided; (*c*) ease and certainty in the matter of fire control, a mechanical organ in the hands of one man being far more manageable in the confusion of battle than a squad of extended riflemen. These advantages it gains, of course, at the expense of being more cumbrous, more delicate in mechanism and more expensive than the rifle, and it requires a fuller ammunition supply, or may do so. Further, it lacks one of the characteristics of the old infantry firearm—it cannot serve as the haft of a bayonet, and thus the infantryman ceases, at least for the time being, to be self-sufficing, and infantry organization at its lowest level returns to the 17th-century form, in which a fire element and a shock element are combined in the tactical group rather than in the individual soldier.

The characteristics of automatic rifle and light machine-gun fire, which thus become the most important element of infantry tactics, are briefly as follows. (For convenience, the term "automatic rifle" will be applied to the lighter and that of "light machine-gun" to the heavier members of the class under consideration. The definition by weight adopted in the following article fixes the frontier between the automatic rifle and the light machine-gun at about 20 lb.)

The trajectory of an individual round, whether fired from a rifle, an automatic rifle, a light machine-gun or a heavy machine-gun, is the same for the same ammunition and barrel characteristics, though its relation to the object aimed at will vary to some extent according to steadiness of man or mounting, smoothness or shock of recoil and other factors. On the other hand, the cone or sheaf of fire formed by a group of rounds will be denser with the automatic rifle and denser still with the light machine-gun than it is with a number of rifles representing the same volume of fire per unit time. The grouping of shots is densest of all in the case of the heavy machine-gun fired from a steady mounting.

In proportion, therefore, as the steadiness in position, due to man, ground or mounting, enables an automatic rifle or light machine-gun to group its shots more and more closely, these weapons tend to acquire more and more of the peculiar tactical powers of the heavy machine-gun—the ability: (*a*) to support close-fighting infantry groups by overhead or acute flanking fire; (*b*) to pour a direct and intense fire into small but dangerous posts of the enemy, such as machine-gun nests; (*c*) to enfilade enemy trenches and harass bridge approaches, cross-roads, and other points of very small area by day or night. It may be admitted at once that no existing light machine-gun and, *a fortiori*, no automatic rifle, is fully capable of (*a*) and (*c*), and in particular of overhead fire or fire through intervals between moving or fighting bodies of friendly troops without endangering them. However, in (*b*) the light machine-gun is ballistically scarcely inferior to the heavy machine-gun. This is its true function, which it performs as a rule better than the heavy, because its mobility allows of a closer approach, easier observation and freer choice of position. The automatic rifle also possesses this power in some measure, but the light weapon of the future to be evolved from the two types must, before unity of type is acceptable, be made quite as capable of performing this tactical service as is the light machine-gun of to-day. At present the automatic rifle seems to be looked upon in some quarters as a weapon to be used normally as a semi-automatic, firing perhaps 50 or 60 rounds where the bolt-action rifle would deliver 10 and to that extent economizing men, reducing confusion, and minimizing casualties in the firing line, but in the last analysis always a rifle in the tactical sense. Its automatic power is reserved for special emergencies, just as, at the beginning of the evolution of the magazine rifle, the magazine was regarded as a reserve of fire power added to a single-loader.

Considering, next, volume of fire, we can safely say that for practical purposes all automatic rifles and light machine-guns have or can be made to have the same rapidity of fire as the heavy machine-gun. The rapidity is purely a function of the design. Whether recoil-operated or gas-operated, the cycle of operations is gone through as fast as the mechanism can take up the motive impulse. On the other hand, the possibility of maintaining the automatic rate for long without damaging the mechanism depends on (*a*) the solidity of the working parts; and (*b*) the capacity of the barrel to resist overheating. In both respects the light machine-gun and the automatic rifle are definitely inferior to the heavy. Solidity of working parts and the incorporation in the design of cooling devices both involve deadweight, and it is the designer's first object to eliminate deadweight. In the automatic rifle not only are weights of parts limited but cooling devices are omitted altogether.[1] The possibility of automatic continuous fire is therefore definitely sacrificed. In light machine-guns, on the other hand, the working parts are not greatly different in solidity from those of heavy machine-guns, and some form of cooling device—radiator, circulator or both—is invariably fitted. The extra weight translates itself into greater power of sustained fire. With a positive cooling system, such as the water-jacket of the German L.M.G.08/15, the volume of fire from a light machine-gun is practically equal to that of a heavy, if tactical conditions allow of equal ammunition supply to each. Even the air-cooled guns are capable of delivering many hundred rounds without a pause other than those for changing magazines or belts. It is true that the development of full fire power for several minutes continuously is exceptional and even very exceptional, and it is a matter of opinion how much importance should be attached to this factor relatively to others in the arm of the future. But it seems clear, in any event, that the infantry machine-gun which constitutes the backbone of the attack or the defence ought to possess, at least at the shorter ranges, that power of focussing a storm of bullets on the enemy's machine-gun group, nest, or other centre of effort as soon as it is located. Otherwise the attack or counter-attack must wait for the heavy machine-guns to come well up, or at least to wait till exact information as to the target and the situation has been communicated to them.

This line of reasoning would exclude the automatic rifle altogether but for certain other considerations. The blotting-out by destruction or neutralization of well or strongly posted enemy groups in key positions is not the only function of the infantry machine-gun. It prepares by its fire every local advance of the groups of its own side, whether against or past important hostile nuclei or against simple parties of infantry using fortuitous cover, which constitute the rest of the hostile "line." It is the latter which is the average, though not the decisive, incident in mobile warfare, especially when, as in 1918, the principle is to "drive a nail where it will go." In these average incidents sustained fire is the rare exception—German light machine-gun squads in the spring offensive of 1918, for instance, seem to have found that 2,000 rounds daily per L.M.G. sufficed—and mobility is of supreme importance as the machine-guns must push along as fast as the rest of the infantry, and, indeed, get ahead of it in many cases. This is a strong, and indeed the principal, argument in favour of the automatic rifle of less than 20 lb. weight, as against the light machine-gun of 20–40.

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[1] Except in the Chauchat, which is on the border line as to weight.

In sum, therefore, the light machine-gun, by reason of its greater weight and steadiness, can deliver a fire of greater accuracy and more sustained intensity than the automatic rifle, and so can perform functions for which the heavy machine-gun would otherwise have to be called in. The automatic rifle, on the other hand, possesses a greater mobility than does the light machine-gun and can for a few moments at a time develop a fire power practically as heavy. In four-fifths of a day's work in battle, then, it is as useful as, or more useful than, the light machine-gun. But the last fifth, often more important than the rest put together, it cannot undertake with much hope of success. Both have the disadvantage that they must be fed with ammunition in very difficult conditions. They must, therefore, be squad weapons and not personal weapons, and there is a tendency for the squad to group itself about the gun and so to reveal itself for what it is. Both, on the other hand, have the advantage that very few of these squads are needed, as compared with rifle-armed infantry, to attack or defend a given front.

On the whole, it seems probable that a type of the future, evolved from both, will take the form, not of the lightened machine-gun, but of the automatic rifle provided with increased magazine capacity, a cooling device, and a mount sufficiently steady, with the weight of the gun, to give a bullet grouping at short ranges as close as that of the heavy machine-gun at longer.

The rise of the light machine-gun to importance as the main weapon of the infantry battle has been followed by another development of some interest, viz. a change of principle in what may be called the personal armament of the infantry soldier. Hitherto self-sufficing, but now become a member of a gun detachment, he has felt the need of possessing some handy weapon of his own which would give him intense fire power in emergencies. The same is the case with the artilleryman and, in the present day, with many specialists such as range-takers, observers and others, who have to work in the front line but are not armed with the normal battle weapon. For these, first an increase in the capacity of the pistol magazine was tried, and later an altogether new class of weapon was designed—the machine-pistol, which is a fully automatic arm of the carbine or long pistol kind, capable of firing pistol ammunition as fast as a heavy machine-gun fires rifle calibre ammunition. Such weapons may also usefully replace the light machine-gun itself in certain conditions, *e.g.* bush or mountain warfare. Some examples of this new class of arm are described below.

As to whether the semi-automatic rifle—that is, the military rifle fitted with self-loading mechanism but fired by the trigger shot for shot—will become a universal infantry weapon, opinions differ. On the whole, it seems unlikely that it will do so. On the one hand, for group action the light machine-gun or perfected automatic rifle is definitely superior in accuracy, volume, and control of fire to an equivalent number of semi-automatic rifles in individual hands, whatever the discipline and team work of the individuals. On the other hand, as a personal armament for fighting at close quarters the new machine-pistol is superior in intensity of fire and at least equal in handiness. The semi-automatic rifle may develop as a weapon for sniping and skirmishing, and as the soldier's personal armament in theatres of war where the country is very open and troops are required to do a good deal of individual patrolling and stalking. Of these services, however, all except sniping can be performed by the machine-pistol; and, in sum, the semi-automatic rifle seems likely as a military arm to become a sniper's rifle pure and simple—the military analogue of the sporting rifle, for which the semi-automatic principle is already well established.

Speculation as to the nature of the cavalry firearm of the future is now difficult, depending as it does on the tactical question of how far dispersion will be carried in the dismounted fire fight. (C. F. A.)

PRACTICAL DEVELOPMENTS

The improvement of the rifle has been confined mainly to the development of auto-loading, or semi-automatic, rifles for both military and sporting purposes, and the development of the automatic or machine-rifle for military purposes.

The semi-automatic shoulder-rifle has become an efficient and reliable weapon for sporting purposes, but no military weapon of this type has been adopted by any of the leading powers to replace the bolt-action shoulder-rifle, although some fairly successful weapons have been produced. The principal difficulty in the way of perfection of an arm of this type is the weight limitation. The present bolt-action rifles are considered by many designers to be as light as is consistent with the pressures obtained with modern powders, and the automatic action can only be obtained through additional parts, and consequently additional weight. Successful automatic rifles of 12–20 lb. weight have indeed been produced. Such rifles are somewhat less heavy than the light machine-gun, the latter being defined as an automatic, rifle-calibre weapon, with a tripod as muzzle support weighing from 20 to 30 lb. complete, and it is possible that further developments in the type may lead to its superseding the light machine-gun as above defined.

Bolt-Action Military Rifles.—It has already been noted that no important progress was made in the design of the bolt-action rifle during the World War. Quite apart from the manufacturing difficulties attending upon an alteration of model in the midst of a great crisis, and setting aside also the changes in the tactical relations of rifle, gun and machine-gun in the war, the rifles used by the various belligerents were so nearly equivalent that no one possessed any advantage over the rest which could not be compensated for by slightly better training or slightly higher *moral* on the other side. And not only was the invention of necessity wanting, but also the conventional type of rifle had reached a point of development beyond which it was difficult to see possibilities of radical improvement.

Substantially, then, the rifles in use at the end of the war were the same as those in use at its beginning, and this is the less surprising as many peace-time criticisms levelled at one or another model proved to be useless, or practically unimportant, in war. Thus, rifles looked upon as obsolete revealed unsuspected good qualities in the severe test of war service, and modern rifles failed to show the superiority expected. The German Mauser had been popularly credited with being the best military shoulder arm; while the British short Lee-Enfield had been severely criticized on the score of its weak body and poorly designed bolt. Yet, under service conditions, the performance of the latter was excellent; the simple action, good balance, and rapidity with which it could be worked compensating for the superior ballistic qualities of the German arm. Similarly, the French Lebel, one of the oldest service rifles (1886–93), has been looked upon as being outclassed by modern arms, it being the only military rifle with a tubular magazine; yet this rifle with the "Balle D" cartridge has greater velocity and greater striking power at ranges in excess of 800 yd. than the American Springfield, which has 360 f.s. greater initial velocity. In only one instance, apparently, did a rifle prove so unsuitable that it was withdrawn from use. The Ross rifle, the original arm of the Canadian forces, while a good sporting and target rifle, proved unsatisfactory in the mud and dirt of trench fighting.

Another factor which tended to stabilize the rifle in its existing form was the interchangeability of rifle and machine-gun ammunition. Before the war there was a distinct tendency towards reducing the calibre of the rifle and employing a lighter bullet, in order to obtain flatness of trajectory at ranges within about 800 yards. But the modern light-weight high-velocity bullet loses its velocity very rapidly, which renders it less suitable than a heavier bullet for employment in machine-gun work, where effectiveness at long range is required. So long, therefore, as the ammunition of rifles and machine-guns remains interchangeable it is probable that no further reductions of calibre and bullet weight will take place. At the same time, the development of the heavy machine-gun itself may quite possibly call for not merely the retention of the present common calibre but an actual increase of calibre beyond what is admissible for the rifle. The principle of interchangeable ammunition has recently been questioned by some experts who would prefer that each class of weapon should be free to develop along its own lines; and already experiments have been carried out in the United States, not indeed with two calibre, but with two bullet weights, a bullet of 180 grains being designed for the machine-gun (and for occasional use for special purposes in the rifle) while the old bullet of 150 grains is retained for the shoulder weapon.

The only new model service bolt-action rifle produced by belligerents during the war on a large scale was the British rifle, ·303, pattern 1914, which was later adapted to ·30 U.S. ammunition and manufactured for the United States; about 2,500,000 rifles of this type being produced in that country during the eighteen months preceding the Armistice.

British Rifles of the War Period.—Before the war, the British service rifle, the short Lee-Enfield of ·303-in. calibre, had been subjected to a good deal of criticism, and the War Office, after much experimenting with various types of cartridges, found that it was not possible to obtain as high a velocity with this rifle as was desired. An improvement was effected, however, in the adoption of the Mark VII. ammunition, the pointed bullet of which weighs 174 grains instead of 215 grains as in the Mark VI., the muzzle velocity being 2,440 f.s., with a chamber pressure of 45,000 lb. This ammunition, however, did not give the ballistic qualities desired and the design of a new rifle was taken up. A rifle was finally evolved with a bore ·276 in. in diameter, and chambered for a rimless cartridge, giving a muzzle velocity of about 2,800 f.s., and a chamber pressure of 51,000 lb., and it is probable that this model would have been further perfected and adopted but for the beginning of the war. Military considerations then prevented its adoption in its original form, and it was modified to take the existing Mark VII. ·303 ammunition, and manufactured in the United States as the "British Rifle, Pattern 1914." The short magazine Lee-Enfield with Mark VII. ammunition, however, remained the standard British arm throughout the war; though the new rifle was also used.

Upon the entrance of the United States into the conflict, as a number of American factories were equipped to manufacture this rifle, it was again modified to accommodate the U.S. service ammunition and used as a substitute for the calibre ·30, model of 1903 (Springfield), under the name of the "U.S. Rifle Model of 1917." As chambered and bored for the U.S. ammunition, the rifle had approximately the same ballistic qualities as the Springfield. The British and American models of this rifle are the same in their essential features, except that the latter has not the long-range (dial and aperture) sights of British rifles. A remarkable feature common to both rifles is the position of the rear sight between two protecting lugs on the bridge of the receiver. This position of the rear sight gives a distance from back sight and fore sight of 31·76 in., that is, almost exactly over the trigger instead of in the customary position, a hand's breadth or more in front of the magazine. Further details will be found in the article SIGHTS. The length of the rifle overall is 46·3 inches. The weight without bayonet is 9 lb., 3 oz.; the sword bayonet is about 22 in. long (blade 17 in.) and weighs 15 oz. The magazine holds five cartridges which are loaded from a clip. The bore has five grooves, left-hand uniform twist, one turn in 10 inches.

The action of this rifle is as follows (figs. 1 and 2). The cycle of operations is assumed to start with the extraction of a fired cartridge case. The bolt handle is raised and the cocking piece forced to the rear in the bolt by the half-cocking cam. This also withdraws the striker into the bolt. When the locking lugs on the bolt are clear the extracting cams on the bolt and receiver engage and the continued rotation of the bolt retracts the latter and loosens and partly withdraws the cartridge case (primary extraction), the extractor and sleeve being prevented from turning by the receiver. When the limit of the turning movement in the bolt is reached, it is drawn to the rear, withdrawing the empty cartridge case; during this movement the cocking piece rides over the sear nose and depresses it; the safety stud rises in the clearance cut in the bolt. When the cocking piece clears the sear nose, the sear spring returns the sear to normal position. The slotted locking lug (left hand) of the bolt now reaches the ejector, the latter protruding in the slot sufficiently to strike the rear of the empty case and eject it to the right. After a further slight backward movement the bolt lug comes in contact with the bolt stop, preventing further movement. If the magazine is now empty the follower rises and its rib prevents the closing of the bolt. If not, the magazine spring has pushed another cartridge up and into the path of the bolt, the forward movement of which forces it forward and up over the cartridge ramp.

During the early part of the closing movement of the bolt, the ejector is pushed outward by the bolt. Later, the sear notch in the cocking piece engages the sear nose, and is arrested. The bolt then slides forward over the striker, further compressing the main spring.

When the rotation of the bolt by the handle begins, the locking lugs engage the locking cams, and force the bolt home, seating the cartridge, and further compressing the main spring. The rotation of the bolt restores the half cocking cam, so that it is out of the path of fall of the cocking-piece lug.

The bolt is now locked, the mainspring is fully compressed, and the cocking piece is held by the sear nose.

When the trigger is squeezed, the bearing of the trigger first acts on the bearing of the receiver, slowly depressing the sear nose. Then the heel of the trigger engages the receiver, and completes the depression of the sear nose, which ends in the release of the cocking piece by the sear nose. The striker is then acted upon by the mainspring, and, striking the primer of the cartridge, detonates the same.

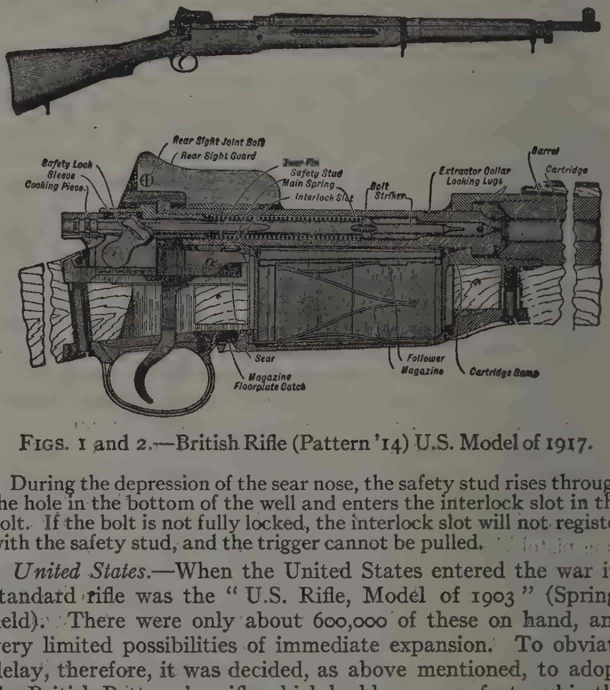

FIGS. 1 and 2.—British Rifle (Pattern '14) U.S. Model of 1917.

During the depression of the sear nose, the safety stud rises through the hole in the bottom of the well and enters the interlock slot in the bolt. If the bolt is not fully locked, the interlock slot will not register with the safety stud, and the trigger cannot be pulled.

United States.—When the United States entered the war its standard rifle was the "U.S. Rifle, Model of 1903" (Springfield). There were only about 600,000 of these on hand, and very limited possibilities of immediate expansion. To obviate delay, therefore, it was decided, as above mentioned, to adopt the British Pattern '14 rifle which had been manufactured in the United States in large quantities. This rifle, modified as previously noted, was used very successfully by a large portion of the U.S. troops; only the regular army and part of the National Guard continuing to use the Springfield. The Springfield, however, is still (1921) the official arm, the 1917 rifles having been withdrawn after the Armistice.

Other Nations.—The Lebel magazine rifle, calibre 8 mm., model of 1886–93, is still the standard arm of the *French* infantry. The magazine is tubular, lies under the barrel, and holds eight cartridges which are loaded singly. The carbine, model of 1890, and the rifle, model of 1907–15, were also used to a considerable extent. These are magazine rifles, having a one-piece stock and a bolt with a turning head. They are loaded with a charger containing three cartridges. A box magazine was later designed for these rifles, increasing the capacity to five cartridges. Several other types were used by the French, many of the old single-loading "Gras" rifles of the 1874 model being adapted.[1]

Mauser rifles in different calibres were used by *Germany, Turkey, China, Portugal, Serbia* and *Brazil*.[2] The *Japanese* "Arisaka," or "38th Year," also has a Mauser action. Many of these rifles were purchased from Japan by Russia early in the World War and also by Great Britain for training purposes. It was reported that since the Armistice Japan has increased the calibre both in new rifles and in the existing stock from 6·5 mm. (256) to 7 mm., the reason given for the change being that the 6·5-mm. bullet is too small to develop sufficient wounding power. This calibre is used by several other nations and is the smallest used in military rifles. The change is interesting, since the tendency had been towards reduction of calibre.

The standard arm of the Russian infantry is the "Three line" magazine rifle, 7·62-mm. (·3-in.) calibre. A new type of ammunition has been adopted for this rifle, having a pointed bullet weighing 148 grains and giving 2,820 f.s. velocity with 50,000 lb. pressure. The Russian Government also bought large quantities of Winchester, model of 1895, magazine rifles of the same calibre, the only lever-action magazine-rifle used in the war.

Austria-Hungary used the 8-mm. Mannlicher, "Straight Pull" rifle, model 1895, and carbine. Mannlicher type rifles were also used by *Italy, Bulgaria, Rumania* and *Greece*. The *Belgians* used the magazine rifle, calibre 7·65 mm., model of 1889, which has a Mauser action. The latest ammunition for this rifle has a pointed bullet weighing 154 grains with a velocity of about 2,740 f.s. The *Swiss* Schmidt-Rubin rifle has been redesigned to chamber a new rimless cartridge having a 170-grain streamline bullet with a velocity of 2,660 f.s.

SPECIAL BOLT-ACTION RIFLES

Snipers' Rifles.—Several types of rifles have been developed by the various Powers for the use of "snipers," whose function it is to pick off with single shots individual scouts, officers, men of working parties, enemy snipers, etc. Snipers work as a rule in pairs wherever feasible, one acting as an observer, the other as a rifleman. The rifle used for this purpose is usually a very carefully selected specimen of the standard service rifle, fitted with telescopic sights of low power, or some other variety of optical sights, though plain sights are sometimes used. The British snipers used the short Lee-Enfield rifle with various forms of telescopic and other optical sights, and also the 1914 rifle with a special back sight. The U. S. rifle is fitted with a Warner and Swasey telescopic sight, 6-power, 4½° field, which is attached to the standard rifle by side brackets, but this combination is not entirely satisfactory and a new telescope and method of mounting are being developed. The German sniper's rifle was the standard Mauser with brackets fastened by screws to the top of the magazine to take a Goerz, Luxor, or Zeiss telescope, generally of 2¾ or 3 power. The mounting of the telescope over the bolt and magazine makes it necessary to use the rifle as a single-loader and prevents the use of the regular sights while the telescope is attached. This method is, however, preferred by riflemen as aim may be taken with the cheek against the stock in the usual manner; the superior accuracy obtained offsetting these disadvantages. In the German sniper's rifle the telescope can be very quickly removed from its brackets and the rifle used the ordinary way.

Periscopic Rifle Holders or "Sniperscopes" have been designed and used with some success, although it cannot be said that these devices were ever popular or capable of very accurate or rapid fire. The tendency when using them is to shoot high and they are only reasonably accurate at ranges up to 200 yards. In the instrument developed by the Munition Invention Department of the British Government (fig. 3) the periscope (*aa*) and shoulder piece (*c*) are rigidly combined with each other and with a shoe (*d*) which takes the butt of the rifle. A trigger on the shoulder piece is connected to the rifle trigger by a cord (*eee*). Pivoted to the right side of the shoe is a system of levers (*bbb*) which enables the firer to open and close the bolt by means of a handle close to his right hand. The periscope itself is a simple mirror-periscope.

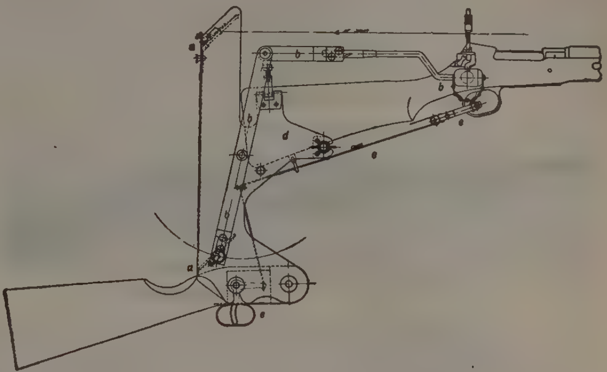

FIG. 3.—Periscopic Rifle Holder (British Type).

Anti-tank Rifle.—The German anti-tank rifle (fig. 4) is a single-shot calibre 13-mm. Mauser action rifle brought out as an emergency weapon[3] and intended to serve as a stop-gap pending the construction of a 13-mm. machine-gun. The weapon is intended for short-range work only, as the sights are graduated to only 500 metres. It is very heavy (37 lb.) and has a total length of nearly 66 in., the barrel being 39 in. long. It is provided with a bipod. The bullet, which weighs 801 grains, is pointed and armour-piercing, has an initial velocity of about 2,450 f.s., and a penetration of 20 millimetres in the best steel is claimed at a range of 500 yards. It is, however, very heavy for a portable arm, and, being a single-shot weapon, it has a very slow rate of fire. On account of the heating of the barrel and the heavy recoil, the fire cannot be sustained for more than 20 shots at a time. Each rifle was served by two men, carrying 124 cartridges as well as the rifle and accessories and their personal armament. The rifles were used in squads of three rifles, or singly, or in coöperation with heavy machine-guns using armour-piercing bullets, according to circumstances. The Germans had a high regard for this weapon.

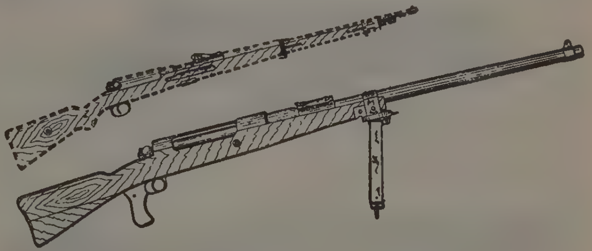

FIG. 4.—German Anti-Tank Rifle.

High-power Rifles.—Sporting rifles with an initial velocity of 3,000 f.s., or slightly more, are now in use. These rifles have no particular feature except the additional strength necessary to withstand high pressures. The so-called "explosive" effect of high-velocity bullets upon striking make them extremely effective for sporting purposes.

SEMI-AUTOMATIC RIFLES

As already mentioned, efforts are being made to produce a semi-automatic shoulder-rifle to replace the bolt-action rifle. The successful sporting weapons of this type which have been devised are not considered suitable for military use, as the powder pressures and velocities obtained from their cartridges are much below those obtained with military ammunition. Sporting rifles are not subjected to the severe conditions that are usually encountered by the military arm; the sportsman seldom fires more than three or four shots in quick succession and is usually in a position to give the self-loading rifle the care which its more complicated mechanism requires.

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[1] The German infantry throughout the war carried the 1898 pattern Mauser (7·9 mm.). The cavalry carbine of the same pattern and calibre was also occasionally used by infantry as well as by cavalry serving dismounted in the trenches, and by the personnel of light machine-gun squads. During the trench-warfare period of the war, spare magazines holding 25 cartridges were designed for attachment to the underside of the ordinary magazine, in order to obtain an increased volume of fire for emergencies; these were, however, clumsy and unpopular with the troops, and were not generally used. The only important modification of the standard arm was the introduction in summer 1915 of a short rifle (43·5 in.) known as the Erfurt rifle. This has the same trench action, calibre, and magazine as the 1888 rifle, and, apart from the reduced length, differs from it only in having the sliding parts of the breech covered by a dustproof metal casing, the barrel cased in wood (as in the British and other short rifles) and the muzzle filled with a flash-reducing attachment. The bolt-handle is curved down close to the stock. This weapon was only issued for service in the last months of the war, but seems to have been retained as a standard weapon in the post-war army and police. Troops of older categories employed in garrison and line of communication duties had the old magazine rifle of 1888 (7·9-mm. calibre).

[2] The new Brazilian 7-mm. ammunition has the highest muzzle-velocity of any military small-arms ammunition, although several of the new cartridges closely approach it.

[3] The order for a design was given in Dec. 1917 and in spite of the manufacturing difficulties which naturally presented themselves with an arm of such unusual proportions, the Mauser works were able to begin quantity supply in April 1918 (Schwarte, *Technik im Weltkriege*, p. 21). (C. F. A.)

The principal requirements in a semi-automatic rifle are that the rifle shall not weigh more than nine or ten pounds, and shall have a simple mechanism which will stand the shock of service ammunition and the wear and tear of campaigning. The weapon must be capable of being used either automatically or by hand as an ordinary rifle, and for the rest must possess all the qualities now demanded of a good bolt-action rifle. The automatic action, therefore, is not considered a substitute for any of the qualities of the present shoulder-rifle. No semi-automatic weapon so far designed has fulfilled these conditions to such a degree that it has been adopted in place of the bolt-action rifle. The Mondragon, a Mexican invention, has, however, been used by the Mexican Government to some extent, and in a modified form. A modification of this weapon was also used by Germany in the war, notably for the armament of aeroplanes. Two French models, the St. Étienne and the "Carabine Meunier," were brought out toward the close of the war, but not extensively used.

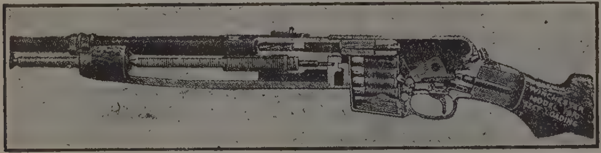

FIG. 5.—Winchester Auto-Loading Rifle.

The U.S. Ordnance Department recently (1920) held competitive tests, and further developments and tests have been made.

The principal advantages expected from the semi-automatic rifles are: increased rapidity of fire, less physical labour on the part of the soldier, and better *moral*, due to the knowledge that he can devote all his attention to the enemy and shoot without exertion or haste when necessary. On the other hand, the desirability of the semi-automatic rifle is not universally conceded. Some authorities consider the rate of fire of the present rifle to be quite as high as is consistent with accurate shooting and lay stress on the difficulties of ammunition supply.[1]

Semi-automatic Sporting Rifles.—The Winchester auto-loading system for rifles (fig. 5) utilizes the inertia of a heavily weighted bolt working against the compression of a coiled spring in the fore end to delay the rearward motion of the bolt at the moment of firing until the bullet has left the barrel. After this inertia is overcome, there still remains enough force to the recoil to move the bolt to the rear, eject the empty cartridge case, cock the hammer against the compression of the hammer spring, and finish the compression of the bolt spring. When this has been accomplished, the bolt moves forward actuated by the bolt spring and feeds another cartridge into the chamber. A pull of the trigger now fires another shot. This rifle is made in various calibres, the most powerful being ·401 in. The 200-grain bullet in this size gives a muzzle-velocity of 2,132 f.s. and has a muzzle-energy of 2,020 foot pounds. The French Air Service used this type of rifle to a limited extent in the armament of aeroplanes.

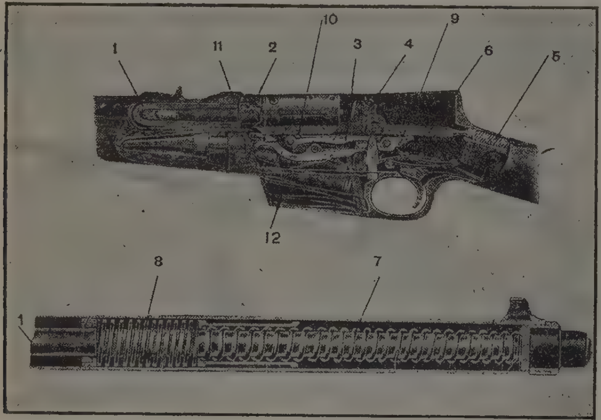

FIG. 6.—Browning Auto-Loading Rifle.

The Browning auto-loading system (fig. 6), used by Remington (U.S.A.) and the Fabrique Nationale (Belgium), differs from the Winchester in that the barrel (1), breech bolt (2), and bolt carrier (3) are locked together at the moment of firing, these parts recoiling together against a powerful spring (7) in a casing surrounding the barrel and in which the barrel slides. The rearward motion pushes the hammer (4) backward, cocking the action and compressing the action spring (5) through the link (6) and the recoil spring (7). A buffer spring (8) also serves to retard the recoiling parts. At the completion of the backward motion the bolt-carrier latch (9) springs into a notch (10), locking the bolt in its rearmost position. The barrel and bolt carrier now start forward actuated by the recoil spring around the barrel; the bolt carrier after moving a short distance is held by the bolt-carrier latch; the barrel continues its forward movement, turning the bolt by means of a helical cam slot in its side and unlocking it. The empty cartridge case is held until the forward motion of the barrel withdraws it from the chamber, after which it is ejected. When the barrel has reached its forward position, the barrel extension (11) has forced the barrel lock down. This reacts against the bolt-carrier latch and allows the bolt carrier to be pushed forward by the action spring (5), carrying a fresh cartridge from the magazine (12) into the chamber and rotating the bolt so that the locking lugs are forced into their seats in the barrel extension, thus locking the bolt to the barrel.

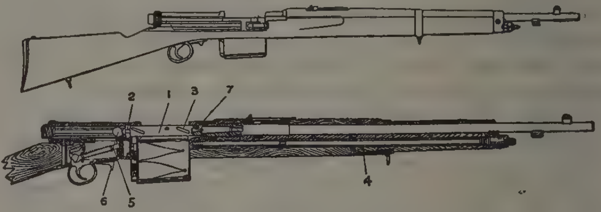

FIG. 7.—Mondragon Semi-Auto Rifle.

This rifle is made in ·25-in., ·30-in., ·32-in., and ·35-in. calibres. In the last-named the 200-grain bullet has a muzzle-velocity of 2,020 f.s. and an energy of 1,776 lb. The magazine is loaded with a clip of five cartridges similar to military rifles. Owing to the locked bolt and recoiling barrel, high pressures can be used in this arm. The cartridge is reduced in diameter or necked down for the bullet. The mechanism is, however, much more complicated than in a rifle where the breech only is blown back.

Semi-automatic Military Rifles.—The Mondragon semi-automatic military rifle (fig. 7) is the invention of Gen. Mondragon of the Mexican army. It was invented about 1891 and developed to its present state by Germany about 1915. The rifle is gas-operated, the gas being taken from a port in the barrel. It weighs about nine pounds, has the general appearance of the ordinary service rifle, is fitted for a bayonet, and is made in 7-mm. calibre. The characteristic feature of this rifle is the bolt mechanism, which permits the rifle to be used either as an auto-loading weapon or as a hand-operated shoulder rifle. The bolt (1) has three locking lugs on the forward end of the bolt and four on the rear end of the bolt, which are locked into locking recesses of the receiver (2). The bolt is made to rotate by two helical cam slots (3) in the side; two cam lugs, which are carried by the bolt handle, work these slots. The bolt handle is connected with the gas piston so that when the powder gases enter the gas chamber and drive the piston to the rear, the bolt handle is carried with it and causes the bolt to rotate and unlock, and move to the rear, extracts the empty case and compresses the recoil spring (4) which is coiled round the gas cylinder, and drives the mechanism forward after it has been arrested in the rear by the buffer spring. A gas adjustment is provided to regulate the amount of gas delivered to the gas cylinder, so that the rate of working can be to some extent regulated. The magazine has a capacity of 10 rounds. Another form of magazine, for aircraft purposes, is of the Luger "snail," or barrel type (*see* PISTOL), and holds 30 rounds. The rifle is provided with a separate hammer (5) which is linked up with the trigger mechanism as shown in the section. The change to hand-loading is done by means of a releasing catch on the bolt handle which disconnects this from the gas piston. The gas port in the barrel may also be closed by means of a valve. A safety device (6) is provided which disconnects the trigger if carried in a safe position.

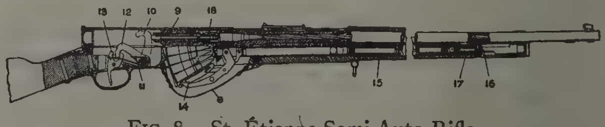

FIG. 8.—St. Étienne Semi-Auto Rifle.

The German pattern was officially known as the Aviator's Automatic Carbine (*Flieger-Selbstlader Karabiner*), model 1915, and was chiefly and successfully used for the purpose indicated by its name. It was also for a time tried as an artillery carbine, but for this purpose it proved unsuitable, in that it failed to stand the rough usage and careless handling of field warfare.

The *St. Étienne Semi-automatic Rifle* (a French "semi-automatic rifle, model 1918") is a gas-operated semi-automatic rifle which weighs about 11½ lb., is about 52 in. long, and has an ordinary rifle sight and bayonet fitting (fig. 8). It takes the French Lebel 8-mm. cartridge. The magazine which has a capacity of five cartridges is charged through the bottom of the magazine housing (8), which is hinged.

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[1] The incorporation of the light machine-gun in the small fighting unit of infantry bears on this question. (C. F. A.)

When the bolt handle, which is attached to the bolt (9), is pulled to the rear, the hammer (10) is forced to the rear against the action of the hammer and sear spring (11) until the sear (12) is engaged in the sear notch in the trigger (13). The rearward motion of the bolt compresses the recoil spring (15) which, when the bolt handle is released at the rear position goes forward and drives the next cartridge into the chamber, while the hammer is held in the rear position by the sear and trigger ready for firing. The trigger is pulled and released for each shot, but extraction and ejection of the fired cartridge case and the feeding of the new cartridge are automatic. When the trigger is pulled, the sear is released and allows the hammer to go forward and strike the firing pin which ignites the cartridge. When the cartridge is ignited a portion of the powder gases pass through the gas port (16) into the gas cylinder (17) which drives the gas piston to the rear. The gas piston is linked with the bolt mechanism through a slide which transmits the force of the gases to the bolt. This serves to unlock the bolt and drive it to the rear to extract and eject the empty case and to compress the action spring and cock the hammer for the next shot. The bolt body is forced to the rear by the slide which is attached to the gas piston, and also linked with the bolt head (18) through rotating cams which rotate the bolt head sufficiently to clear the bolt head locking lugs of the locking recesses in the receiver.

AUTOMATIC RIFLES AND LIGHT MACHINE-GUNS

As has been stated in an earlier part of this article the development of new tactical methods and conditions in the World War soon produced a demand for a light machine-gun or automatic rifle which could keep up with, and participate in, an infantry attack at every stage of its progress. Various types of weapons were adopted for this purpose and classified as light machine-guns or automatic rifles. There is no distinct separation of these types, the term " light machine-gun " being usually applied to machine-guns weighing 20 to 30 lb. fired from a bipod and used for fairly sustained direct fire. Practically all types are air-cooled by means of a heavy barrel with annular rings or a radiator. The automatic rifle, while it is sometimes supplied with a bipod, may be fired from the hip or shoulder and is capable of delivering limited sustained fire. Its weight varies from 14 to 20 pounds. The German " 08/15 " and " 08/18 " and the Bergmann, Lewis and Benet-Mercie are generally spoken of as light machine-guns. The Browning, Chauchat, light Hotchkiss and Madsen are examples of automatic rifles.

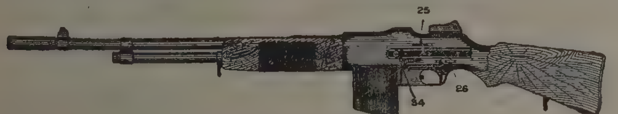

FIG. 9.—Browning Automatic Rifle.

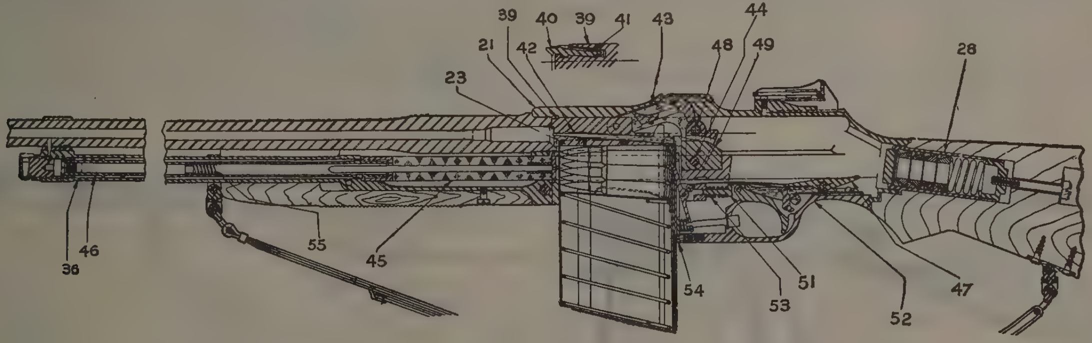

FIG. 10.—Browning Automatic Rifle.

The *Browning Automatic Rifle* (figs. 9 and 10) is the standard automatic rifle of the United States army.[1]

The rifle is light and portable, weighing only 15½ lb. and being only an inch or two longer than the short military rifle. It can be handled by one man as a shoulder rifle. As it is heavier than the ordinary military rifle, the recoil is very slight, and a man can fire the gun continuously without distress.

By means of a change lever, the action of the gun is made either semi-automatic (the trigger being pulled for each shot), or automatic (being continuous as long as the trigger is kept pressed and cartridges are supplied).

As a semi-automatic rifle it is very effective. As the trigger pull is as light as that of an ordinary military rifle, it is possible with practice, to fire 100 shots a minute without unduly tiring the finger. Used in this manner every shot can be well directed, which makes the gun in some conditions as effective as the heavy machine-gun, with a considerable saving in the amount of ammunition expended.

The gun, firing automatically, has a rate of between 450 and 500 shots per minute. The speed can be regulated to a certain extent by adjustment of the gas regulator. The weapon can be used as freely when firing automatically as when firing single shots, the firer lying down, standing, or advancing at will.

When a magazine has been emptied it can be dropped out of the gun by pressing the magazine release in the trigger guard and a full magazine quickly pushed into place with one hand, so that very little time is lost in changing magazines.[2]

The mechanism is very simple and also extremely durable. Tests have been made where over 50,000 rounds have been fired out of the same rifle without any of the parts showing distress.

The rifle is gas-operated. A portion of the powder gases, while under pressure, are trapped near the muzzle of the gun and are caused to act upon a gas piston. The pressure of the gases forces the piston and slide to the rear against the action of the recoil spring, until stopped by the buffer, when the recoil spring returns the mechanism to its forward position.

The receiver (21) in which the barrel is firmly screwed contains the principal mechanism of the gun. The bolt-supports (23), upon which the bolt slides, are riveted in position. The bolt guide (25) fits in a slot cut in the receiver wall and is held in position by the bolt guide spring. The change lever stop (26) projects from a hole in the receiver wall in the path of the change lever and must be depressed before the change lever can be moved to the safe position. The buffer tube (28) behind the receiver contains an arrangement of friction cones, cups and springs. On the left-hand side of the receiver are grooves in which the operating handle (34) slides. The forward end of the gas cylinder tube (36) is rigidly connected with the barrel.

The bolt (39) carries the extractor (40) which is held by the extractor spring (41). The firing pin (42) fits in the bolt, and has a cam lug which engages with a corresponding cam surface on the bolt lock (43). The downward motion of the bolt lock forces the firing pin back and prevents it from touching the cap of the cartridge until the arm is ready to fire. The bolt lock and link (44) are pivoted to the rear end of the bolt. The link connects the bolt lock and the slide (45), which moves horizontally in grooves in the receiver, the gas piston (46) being permanently attached to it. The slide is slotted to permit the magazine to pass through it, and has a notch on its lower rear end to engage with the sear (47). The link pin (48) passes through the link, hammer (49), and slide, pinning the three parts together in such a manner that the link may swing on the pin as a pivot. The link pin also protrudes through a slot in the receiver to engage the operating handle. The recoil spring (55) is encased in the gas piston, its front end pushing forward on the piston while its rear end rests against the head of the recoil spring guide.

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[1] Brought out in 1917, just after America entered the war, and available in small numbers by Feb. 1918, it was not employed in battle till Sept., Gen. Pershing having become so convinced of its superiority over all other types in use that he preferred not to expose it to capture and copying by the enemy till the American army had been supplied with it on a large scale and had reaped the fruits of its superiority in a great battle. In effect, none was used before his offensive battles of Sept. but 4,608 were in action between that date and the Armistice. (C. F. A.)

[2] Magazines holding 20 cartridges are the standard size; they are also made to hold 30 and 40 cartridges. They are themselves filled by a device which presses in the cartridges, five at a time, from the usual clips.

The sear (47) is pivoted in the sear carrier (51) by the sear pin which also holds the sear carrier to the trigger guard (52). The holes through which the sear pin passes in the trigger guard are slotted, allowing a slight horizontal movement of the sear carrier. When the sear engages in the notch of the moving slide, the counter recoil spring (53) acts as a buffer, allowing the sear carrier and sear to move instead of suddenly stopping the movement of the slide.

The ejector (54) is a flat spring which yields slightly when struck by the empty cartridge case so that the latter is gradually ejected.

Action of the Mechanism.—With the gun in the ready-to-feed position and the change lever set for semi-automatic fire the cycle of operation when the trigger is pulled is as follows:—The connector which is pivoted in the trigger moves the sear (47) out of engagement with the notch in the slide and is cammed forward allowing the sear to spring into position to engage the slide on its return. The recoil spring (55) which has been compressed during the recoil of the mechanism, drives the piston (46) and slide (45), carrying the bolt (39), bolt lock (43), link (44) and hammer (49) forward. As they move forward the lower edge of the bolt strikes the upper edge of the top cartridge in the magazine and drives it forward into the chamber.

As the parts are nearing their forward position, the rear of the bolt lock (43) which curves downward, comes in contact with the rounded end of the bolt-supports (23) and the rear end of the bolt lock is started moving upward. As the slide moves further forward, the top end of the link, which is pivoted to the bolt lock, tends to move upwards as the lower end is swung forward with the slide, and the link forces the rear end of the bolt lock in front of the recoil shoulder in the receiver, thus positively locking the breech, as shown in the illustration. The motion of the bolt as the bolt lock swings upward, is gradually stopped so that the bolt is not stopped suddenly, but very gently as its forward horizontal motion is transformed into the vertical motion of the rear of the bolt lock.

The hammer strikes the firing pin and the cartridge is ignited. The forward shoulders of the slide then strike the heavy buttment of the gas-cylinder tube, and the motion is arrested.

After the bullet passes the gas port in the barrel near its muzzle, the expanding gases enter the gas cylinder and drive the piston and slide rearward. The rear of the bolt lock is brought down away from the recoil shoulder of the receiver, and is started back, gradually starting the bolt rearward with it, but by the time the bolt starts to move, the pressure of the gases has subsided, so that the empty cartridge is no longer expanded against the walls of the chamber, but comes out freely. Extraction troubles are thus avoided. The bolt is both stopped and started gradually and is not damaged with hammer-like blows. The empty case is drawn from the chamber by the extractor until its under edge strikes the ejector, when it is ejected to the right and forward; this avoids interference with a man immediately to the gunner's right.

The recoiling parts are arrested when the slide strikes the buffer, and the sear once more engages in the sear notch, which holds the slide and bolt mechanism to the rear with the breech open.

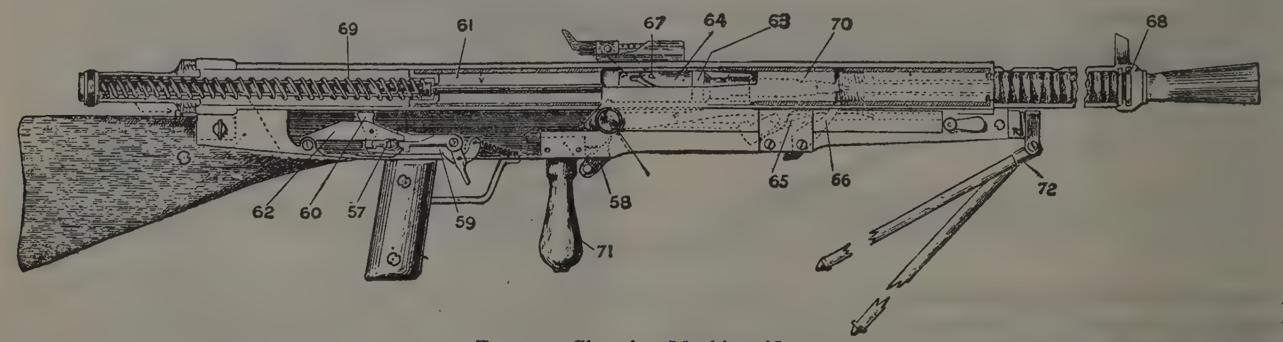

Fig. 11.—Chauchat Machine-rifle.

Chauchat Machine-rifle.—The Chauchat machine-rifle, model of 1915 (fig. 11), also known as Rifle C.S.R.G., was designed by a commission presided over by Col. Chauchat. It weighs about 19 lb. and is about 45 in. long. It takes the 8-mm. Lebel cartridge or, in the case of the guns taken over by the U.S. army,[1] the U.S. model of 1906 ammunition.

This rifle is recoil-operated; the recoil being assisted by deflecting part of the gases as they escape. The cooling of the barrel is assisted by an aluminum radiator with annular corrugations surrounding the barrel. The backward and forward motion of the barrel causes air to be driven into the holes in the radiator casing (*cf.* the Lewis gun, fig. 14) which also assists in the cooling. The locking of the bolt mechanism is positive and is done by two locking lugs on the bolt head which are rotated into locking recesses of the breech casing. Lugs are provided to guide the bolt head and bring it in contact with the cam cuts in the bolt body. The cartridges are fed from a semi-circular magazine holding 20 cartridges, when rim cartridges are used, and from a straight magazine when rimless cartridges are used. A regulator is provided, which adjusts the gun for safety, for automatic fire, or for semi-automatic fire.

The action of the mechanism is divided into two phases: the forward motion and the backward motion. The rifle is loaded by pulling the operating handle to the rear until the mechanism is arrested by the sear (57). A charged magazine is inserted into the magazine opening in the gun, the magazine being held in place by the magazine catch (58). When the trigger is pulled it causes the trigger bar (59) to rotate the hand sear (60) against the under side of the breech casing (61). This forces the sear lever (62) downward, depressing the sear and releasing it from the notch of the feed piece.

The bolt head (63), bolt body (64), firing pin, and feed piece move forward under the action of the mainspring, which is encased in the spring tube. The feed piece strikes the upper part of the head of the cartridge in the magazine and forces it forward out of the magazine. At this time the cartridge guide (65) is being held up by the roller working in the cartridge guide cam slot. The bullet is directed into the chamber, the magazine spring forcing the rear end of the cartridge up into the path of the bolt head just as the cartridge is freed from the lips of the magazine.

The cartridge guide cam causes the cartridge guide to drop, thus letting the feed piece pass forward and release the barrel catch (66).

The bolt-head stop (67) keeps the bolt head and bolt body at their extended positions so that the locking lugs in the bolt head are vertical, thereby permitting their entrance into the locking recesses. The bolt-head stop then comes out of the breech casing, the bolt head is released and rotates so that the locking lugs engage in the locking recesses in the breech casing to lock the mechanism. The bolt body and firing pin continue to move forward, and the extractor grips the rim of the cartridge as the bolt head turns. The firing pin primes the cartridge just as the feed piece releases the barrel catch.

Backward motion: The recoil from the explosion combined with the action of the gases on the barrel nut (68) carry the breech mechanism and casing in a locked position to the rear against the action of the recoil spring (69) and mainspring. The breech casing and barrel (70) being free to move, immediately start forward. The breech mechanism is held back, due to the sear engaging in the sear notch on the tail of the feed piece. As the barrel moves forward the empty cartridge case is drawn from the chamber by the extractor. As the barrel continues its forward motion the front end of the empty case clears the opening in the breech housing and it is thrown out through the ejection-opening by the pressure of the ejector upon its base. If the regulator is set for single fire the hand sear is immediately released by the trigger bar. This allows the sear to hold back the breech mechanism until the trigger is again pulled. If the regulator is set for automatic fire the hand sear is not released, but is held up by the trigger mechanism. The rear cam surface on the bottom of the breech casing strikes and depresses the hand sear just as the barrel reaches its forward position. The hand sear forces the sear lever down, which in turn depresses the sear, releasing it from the sear notch of the feed piece. This allows the breech mechanism to go forward and repeat the cycle.

This rifle is provided with a forward grip (71) for use in marching fire. A bipod (72) is provided for prone or fixed position firing.

Hotchkiss Light Machine-Rifle (fig. 12) weighs 18½ lb., is air-cooled and gas-operated, magazine-fed, and provided with a bipod (73), a hand grip (74) and a shoulder stock. The general mechanism is the same as in the Hotchkiss machine-gun. The speed regulator and buffer mechanism is especially interesting.

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[1] As already mentioned, the Browning gun was reserved until a large supply could be put into line at one time. Pending this, the American forces in France were equipped with the Chauchat of which some 34,000 were adapted to U.S. ammunition.

The regulation of the speed of the gun is controlled by an escapement mechanism, located in the tube (75), which arrests the recoil mechanism and releases it after the catch has been set free of escapement.

This weapon, like the German light machine-guns described later, and unlike those hitherto dealt with, is derived directly from the heavy machine-gun. It is the outcome, therefore, of an effort to increase the mobility of the machine-gun rather than an attempt to improve the fire power of the shoulder rifle. As a true automatic rifle was available in the form of the Chauchat, and as all facilities for the manufacture of typical machine-gun elements were absorbed by the demand for heavy machine-guns, this type was not manufactured on a service scale during the war. It is however interesting as an instance of the machine-gun approximating to the machine-rifle.

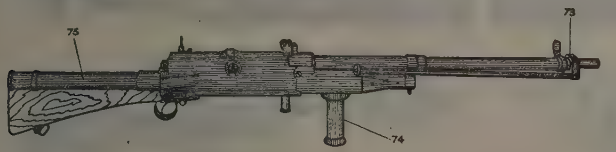

FIG. 12.—Hotchkiss Machine-Rifle (French).

Madsen Machine-Rifle (fig. 13) is a recoil-operated, air-cooled rifle weighing about 16 pounds. It may be fired either semi-automatically or automatically. The rate of fire when used as an automatic is about 500 shots per minute. The barrel is about 23 in. long, somewhat larger in diameter than the barrel of the ordinary shoulder rifle, and is provided with annular rings and a perforated barrel casing to facilitate cooling. A bipod and a rest attached to the butt steady the rifle when used by a firer lying down. The cartridges are fed from a detachable quadrant-shaped, 40-round magazine projecting above the gun. A detachable barrel is provided for the purpose of gaining a more sustained fire, the system being to replace the barrel, when it has been excessively heated, by another barrel, and continue the fire while the first barrel is being cooled. It is claimed that the barrel may be changed in from 12 to 20 seconds.

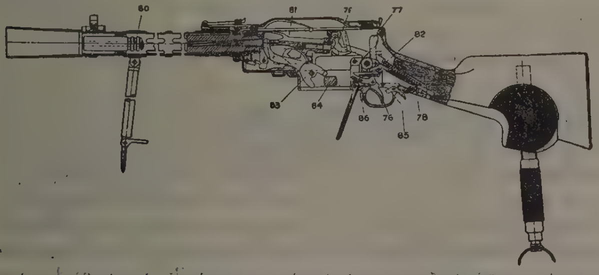

FIG. 13.—Madsen Machine-Rifle (Russian).

The action of the mechanism is as follows:—

When the gun is loaded, as shown in the figure, and the trigger (76) is pulled, the hammer (77) under the force of the hammer spring (78) strikes the link (79), which transmits the blow to the firing pin and so to the cap. On firing, the barrel (80) and bolt mechanism (81), locked as a unit, recoils, compressing the recoil spring (82) until the link disconnects the bolt from the barrel lock and allows the bolt to recoil sufficiently to cock the hammer, extract and eject the fired cartridge case. The accelerator (83) assists in driving the bolt to the rear as it engages on the accelerator lug (84) during the recoil and transmits the momentum of the barrel and mechanism to the bolt. The accelerator also drives the barrel home during the forward stroke of the bolt.

A safety device (85) controls the trigger. A change lever (86) enables the gun to be fired semi-automatically or automatically.

The Madsen light machine-rifle was designed some years before the war, and for a time all Russian cavalry divisions had automatic rifle sections armed with it. These were abolished before the outbreak of the World War and replaced by ordinary machine-gun sections as the lighter weapon was found to be too delicate for the field. The Madsen was, however, again taken into use by the Russians during the war, and under the name of the "Musket" it formed the armament of the German "Musket battalions" which were created in 1915. Some of these units with their guns were engaged in the battle of the Somme 1916 but apparently the result, in the trying conditions of the trench-warfare battle, was not very successful.[1] Tests have been made of the Madsen gun at different times in the British and United States armies.

The Lewis Machine-Gun (fig. 14) is a magazine-fed, gas-operated, and air-cooled machine-gun. The ground type, which is used as a light machine-gun, weighs 26½ lb., and is capable of firing at the rate of about 600 shots per minute. The ammunition is fed from a drum-type magazine placed over the receiver, and which holds 47 rounds for ground use, or 97 rounds for aircraft use. It was invented by Col. I. N. Lewis of the U.S. army shortly before the outbreak of the World War, and large numbers were purchased by the British Government to supplement the available Vickers (heavy) machine-guns. When the differentiation of light and heavy types began, therefore, the British army found itself already provided with a gun of what was judged to be sufficient mobility, handiness and firepower, and the Lewis gun became and remained the standard type of the light machine-gun for the fighting unit of infantry. In the United States, on the other hand, the military authorities determined to adopt the still lighter Browning, and pending the supply of this, the Chauchat as above mentioned. The Lewis gun, thus classed among the heavy machine-guns, was, however, used in large numbers for aircraft, and a few were employed for training purposes as well, some 39,000 of U.S. rifle calibre being ordered and produced. For aircraft, the gun was used by the French also, while in 1918 the Germans, who had a high opinion of it, armed some newly formed motor-cyclist units with captured weapons.

The principal feature is the cooling system, which consists of an aluminum radiator having deep longitudinal fins surrounded by a thin tubular casing which projects several inches beyond the barrel and is reduced in diameter at the front end. These parts with the barrel mouthpiece constitute the cooling system. The mouthpiece deflects the powder gases against the interior wall of the forward portion of the radiator casing in such a manner as to draw a current of cool air through the open rear end of the casing and along the thin fins from which it absorbs the heat. The heat conductivity and low specific gravity of aluminum combined with the construction described produce a light-weight cooling mechanism. The Lewis machine-gun is provided with a bipod mount. The over-all length is approximately 51 inches. The muzzle velocity and chamber pressure are approximately the same with a given ammunition as that of the shoulder rifles in which the ammunition is used.

Action: To operate the Lewis machine-gun, a loaded magazine (10–11) is placed in position on top of the gun, and the charging handle (8–4) is pulled to the rear until the sear nose (5–8) engages in the sear notch in the rack (8–1). The gun is then ready to be fired. When the trigger is pulled and held, the rack and piston (8–6) move forward under the action of the mainspring (9–9), which in unwinding rotates its gearwheel (9–7) and rack to carry the bolt (4–4) forward. As the operating rod moves forward, the front top edge of the bolt strikes the lower edge of the cartridge which is held in the magazine and feed-way, and drives the cartridge forward into the chamber. The locking lugs on the rear of the bolt move clear of the guide slots in the receiver so that the bolt is free to rotate. The locking of the bolt is then accomplished by the striker post coming in contact with the left side of a cam slot in the bolt, which forces the bolt and its lugs to turn one-eighth of a turn to the right. The extractor springs over the rim of the cartridge case (or the cannelure if rimless) as the bolt forces the cartridge in the chamber. The magazine is held by the rebound pawl (6–8) during the forward move of the bolt and piston. The feed operating arm (7–5) acted upon by the feed operating stud (4–1) on the rear of the bolt, returns to its normal position during the forward motion of the bolt ready to feed the next cartridge. When the bolt has been completely locked, the striker is free to drive forward and fire the cartridge. When the cartridge is fired the mechanism remains locked until immediately after the bullet has passed the gas port in the barrel (3–1). Thereupon a portion of the powder gases enters the gas regulator cup (3–8) and thence through a small aperture[2] reaches the front of the piston (8–6). The force of the expanding gases drives the piston to the rear and through the action of the rack, rewinds the mainspring (9–9). During the backward motion, the striker post, which is also carried on the rack, moves about one inch to the rear in a straight slot in the bolt, which, therefore, it does not affect while the bullet is traversing the final space between the gas port and the muzzle; but after the striker post has passed through the straightway of the bolt, it comes in contact with the right side in the cam slot in the bolt and unlocks the bolt and drives it to the rear. In unlocking the bolt is rotated and the locking lugs come into line with the guide slots in the receiver. Lastly the extractor (4–3) withdraws the empty cartridge case which is thrown out by the ejector (2–3), a flat lever pivoted in the centre and actuated by the feed operating stud (4–1) striking its rear end. This stud, which is carried by the bolt, also acts on the underside of the feed operating arm (7–5) and moves the arm to the left. By means of this arm and the feed pawl (7–2) that it carries, a cartridge from the magazine is brought under the cartridge guide (6–24) and into the feeding position in the feed-way in the top of the receiver and is partially turned so as to bring the next cartridge into position, being held in its new position by the stop pawl (6-7), and by the rebound pawl (6–8). The rearward motion of the mechanism is arrested when the bolt comes against the butt tang of the stock, and the bolt, rack, etc., then again move forward under the action of the mainspring, and the cycle of operation is repeated for each shot until the magazine is empty or the trigger is released. When the last cartridge is fired from the magazine, the bolt goes forward and locks with no cartridge in the barrel.

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[1] In 1918 the *Musketenbataillone* were reformed as ordinary heavy machine-gun units.

[2] The function of the gas regulator cup is to act as a well for any solid matter carried in the gas and to prevent fouling of the gas chamber. The size of the aperture can be adjusted as required.

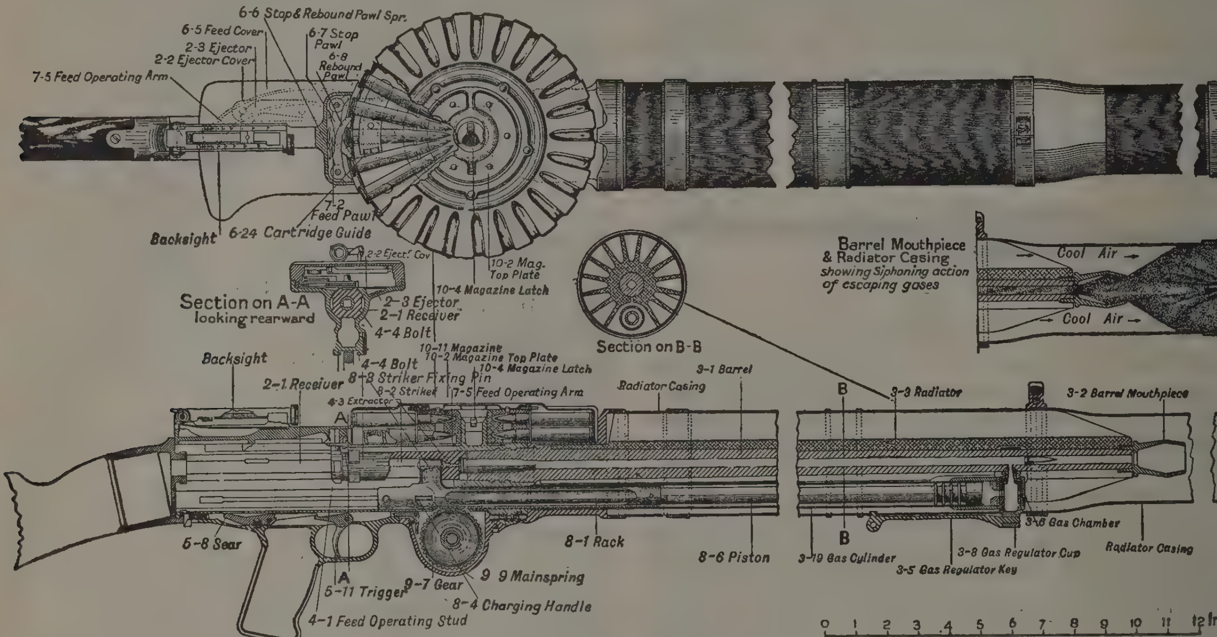
6-6 Stop & Rebound Pawl Spr.
6-5 Feed Cover
6-7 Stop Pawl
2-3 Ejector
6-8 Rebound Pawl
2-2 Ejector Cover
7-5 Feed Operating Arm
7-2 Feed Pawl
Backsight
6-24 Cartridge Guide
2-2 Eject. Cov
10-2 Mag. Top Plate
10-4 Magazine Latch
Section on A-A looking rearward
2-3 Ejector
2-1 Receiver
4-4 Bolt
Barrel Mouthpiece & Radiator Casing showing Siphoning action of escaping gases
Cool Air
Cool Air
Section on B-B
Backsight
10-11 Magazine
10-2 Magazine Top Plate
10-4 Magazine Latch
4-4 Bolt
2-1 Receiver
8-8 Striker Fixing Pin
8-2 Striker
7-5 Feed Operating Arm
4-3 Extractor
3-1 Barrel
Radiator Casing
B
3-3 Radiator
3-2 Barrel Mouthpiece
A
5-8 Sear
8-1 Rack
8-6 Piston
B
3-6 Gas Chamber
3-19 Gas Cylinder
3-8 Gas Regulator Cup
Radiator Casing
3-5 Gas Regulator Key
A
5-11 Trigger
9-7 Gear
9 9 Mainspring
8-4 Charging Handle
4-1 Feed Operating Stud
0 1 2 3 4 5 6 7 8 9 10 11 12 Inches

FIG. 14.—Lewis Machine-Gun.

The magazine is a round corrugated pan about 8 in. in diameter carrying 25 upright separator pins. This pan is mounted with an aluminum centre having annular grooves with a spiral step connecting each groove, into which the front end of the cartridge fits. The cartridge, being held from rotating by the separator pins, is fed along these grooves up the steps into the gun when the pan is revolved around the magazine centre. The pan is loaded by means of a special loading tool. The feeding of the cartridges being positive instead of depending on springs or gravity, the gun can be used when turned at any angle or upside down.

The Lewis machine-gun operates automatically, single shots being fired by quickly releasing the trigger after each shot.

In aircraft the Lewis gun is used as a "flexible gun," *i.e.*, a gun mounted (usually in the observer's pit) so as to fire in any direction in elevation or azimuth. The main differences between the ground type and the aircraft type gun are that the latter has no radiator or radiator casing, has a spade or stirrup-shaped hand-grip in lieu of the shoulder stock, and uses a 97-round magazine. A more efficient type of recoil check is also provided. This consists of a muzzle attachment which is arranged to deflect the powder gases so that they pass out practically at right angles to the axis of the bore. In this way a pressure against the muzzle piece tends to counteract recoil.

No cooling device is provided with the aircraft gun, inasmuch as the fire is in short bursts only and the speed of the aeroplane and the temperature at high elevations provide ample cooling. The aircraft gun fires at a rate of about 750 shots per minute, this higher speed being gained by increasing the gas pressure acting on the piston and the strength of the mainspring which returns the mechanism.

German Light Machine-Guns 08/15 and 08/18.—The German light machine-gun 08/15 is simply a modification of the standard heavy machine-gun (M.G. 08), which is of the Maxim type, without any change in the essentials of the system (for which *see* MACHINE-GUN, 17.237). A serviceable light machine-gun was made in large quantities and with the least possible delay, and the German authorities determined to lighten the existing material, for which manufacturing facilities were already available, rather than embark on the experiments and tool and gauge making that would have been necessary if a new type had been sought for. In consequence, the differences between the 08 and the 08/15 are very few. The diameter and contents of the water-jacket are considerably smaller in the light gun than in the 08. Instead of the tripod or sleigh mount, there is a shoulder stock and bipod, and a trigger release and handgrips replace the twin handles and firing gear. Ammunition is belt-fed as in the heavy gun, but the belt (100 rounds) is wound on a reel inside a drum attached to the right of the gun. The weight of the gun with water-jacket filled and bipod, is 40½ lb., or in action with drum and filled belt 51½. The Dreyse water-cooled light machine-gun was also used. Its weight was slightly less than that of the 08/15.

Guns of this weight, however, though they might be sufficiently mobile for trench warfare battles, were evidently too heavy for the more open warfare of 1917 and especially 1918, and a new and lighter model called the 08/18 was brought out. In this instead of the water-jacket there is a barrel casing with numerous holes to facilitate air circulation round the barrel. This abolition of positive cooling by water reduced the possibility of sustained fire almost to that of an automatic rifle, but independence of water supply greatly reduced freedom of manœuvre and the actual reduction in the weight of the gun was considerable (32 lb. as against 40½ in the 08/15).

This gun had been introduced only for cavalry and cyclists when the Armistice was signed. Had the war continued, it would no doubt have replaced the water-cooled weapons entirely.

The Bergmann Light Machine-Gun (fig. 15) in the German army, variously called L.M.G. and L.M.G. 15 n A, is a recoil-operated air-cooled, belt-fed machine-gun, weighing 30 lb. with bipod mount and sling, and fires about 600 shots a minute.

A barrel casing (91) is provided which carries the barrel and also serves as a housing in which the barrel recoils. The cooling of the barrel is assisted by rings which are formed on the barrel to increase the radiating surface. A handle (92) is provided to facilitate carrying the weapon short distances. The belt is fed through the feed-box opening (93) as in the Maxim and other heavy machine-guns.

The principal features of the Bergmann machine-gun are a small cylindrical service-rifle type of bolt and extractor, which may be operated by hand by means of a bolt handle (95); and an accelerator which is in the form of a cam lever, which acts against the bolt and barrel extension during the forward movement of the bolt, helping to push the barrel extension and barrel forward as the bolt advances under the action of the heavy recoil spring.

The gun is provided with a trigger and handgrip, a shoulder butt and a bipod, which is attached to the trunnion (96).

The front sight (97) is very high, owing to the low position of the barrel in the receiver and to the feed mechanism in cover. A tubular sight with a hole about one-fourth of an inch in diameter is attached by a bracket to the side of the gun for close-range shooting and for tank work. It will be noted that several features of this gun were adopted in the L.M.G. 08/18.

In the German army Bergmann guns formed the armament of the so-called "Light Machine Gun Detachments," mounted units created in 1916 for the Rumanian campaign. The use of this gun, however, seems to have been discontinued towards the end of the war, the weapons remaining serviceable being handed over to Turkey.

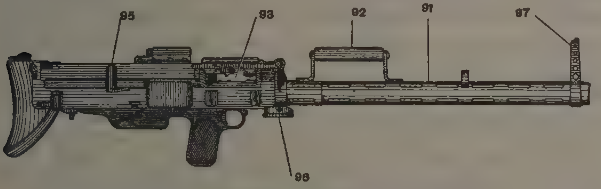

FIG. 15.—Bergmann Light Machine-Gun.

Machine Carbine-Pistols.—The idea of securing more accurate shooting from a pistol by fitting it with a shoulder stock and lengthening the barrel is an old one, and one well-known modern example is the Mauser pistol (for description *see* 21.657–8). But while in the pistol proper, from the nature of the arm and its uses, all modern development has been in the direction of perfecting the semi-automatic action (*see* PISTOL), there arose in the World War a need for some weapon lighter and handier than the rifle yet capable of developing an intensely rapid fire at short ranges. The outcome of this need was a class of firearm which at present has few representatives and no recognized generic title, but is very interesting. In the absence of an accepted designation, these may be called machine carbine-pistols.

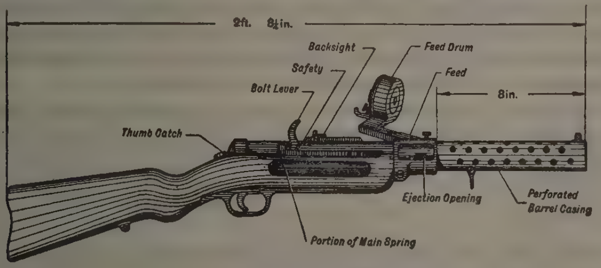

FIG. 16.—Bergmann Pistol-Gun.

In this field the precursors appear to have been the Italians. The *pistola migliatrice Fiat* (Fiat mitrailleuse pistol) was largely used by them as a substitute for the light machine-gun, no doubt because extreme lightness both in the gun and its ammunition was essential in an automatic arm for mountain warfare. The "machine pistol" is fitted with a small shield which also serves as a mounting, though the weapon can be used in the hands, if necessary. It is double-barrelled, each barrel having a separate box magazine of 25 rounds above the receiver. It is gas-operated and air-cooled. The bolt and its dependent parts are supported but not positively locked on firing. It weighs 14 lb. without shield, takes 9 mm. pistol ammunition, and is sighted to 500 metres. An outstanding feature is the very high rate of fire. Both magazines (50 rounds) are fired in two seconds, and with highly trained loaders and a full supply of magazines it is said that 1,000 rounds can be delivered in a minute. This extreme rate, in spite of certain advantages, militates against steadiness and accuracy, especially with so slight a mounting. Nevertheless, according to the Germans the weapon proved trustworthy and effective.

The Bergmann Pistol-Gun (fig. 16), on the other hand, was intended not to replace the light machine-gun but to provide artillerymen and machine-gunners with a handy personal weapon capable of intense fire power in emergencies. It originated in the pistol proper. The German service pistol 08 (Borchardt-Luger) used by specialists, who were not armed with the rifle, was fitted with a snail magazine (*see* PISTOL) allowing of 32 shots, the wooden holster being attached to the handgrip as a shoulder piece as in the Mauser pistol above alluded to, if accurate fire was required. The success of this arrangement led to the introduction of the Bergmann pistol-gun (officially, Machine-Pistol 18 I.), which in spite of its name is rather a carbine than a pistol, as an infantry weapon pure and simple.

This arm shoots 9 mm. pistol ammunition at the rate of about 540 shots per minute. The gun weighs 9 lb. 6 oz. without the magazine drum, which itself weighs 1 lb. 8 oz. empty. It is recoil-operated and air-cooled, and has an 8-in. barrel, protected by a casing perforated to allow circulation of air. The magazine (32 shots) is of the snail type (*see* PISTOL). The breech mechanism is of the "blow-back" class in which on firing the inertia of the bolt, the compressing of the mainspring, and friction of the cartridge in the chamber momentarily hold the action firm. The gun fires when the bolt reaches its forward position as the striker projects through the face of the bolt, and is cocked when the mainspring is compressed and the bolt drawn to the rear. This has the advantage that the chamber is always left empty, but the forward movement of the heavy bolt after pulling the trigger is liable to disturb the aim. The gun is sighted to 200 metres only.

This gun was only brought into use just before the Armistice.

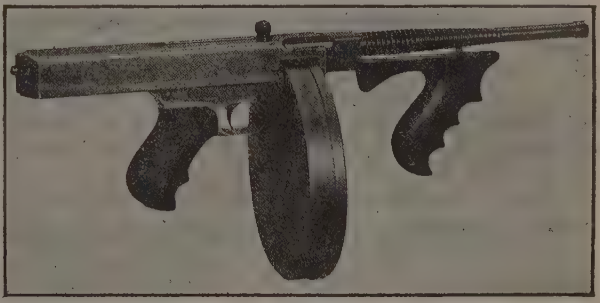

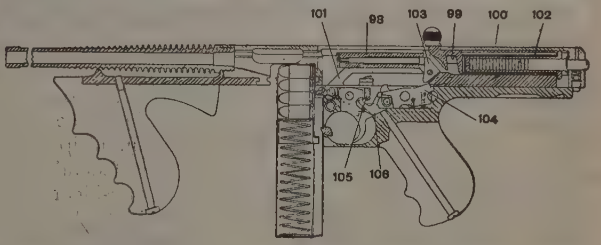

FIG. 17.
FIG. 18. } Thompson Sub-Machine-Gun.

The Thompson Sub-Machine-Gun (figs. 17 and 18) is an interesting type of a very light portable automatic weapon which shoots a ·45-calibre pistol cartridge. The action is semi-automatic or automatic at will. The rate of fire when used as an automatic is 800 to 1,500 shots per minute. The weapon is about 23 in. in length, weighs 7·5 lb., and uses a straight magazine (fig. 18) holding 20 cartridges in staggered rows, or drum magazines holding 50 or 100 cartridges (fig. 17).

The novel feature of this weapon is the angular wedge breech closure which utilizes the force of adhesion developed by the heavy breech pressure to lock the breech. The principle, developed by Comm. Blish of the U.S. navy, has been briefly stated as follows:—

"In any breech closure consisting of a breech plug in a suitable housing and having two pressure-resisting surfaces, the forward surface disposed normally to the axis of the bore, and the rear surface inclined thereto and bearing upon a suitable surface of the housing, the force of adhesion will under heavy pressure immovably fix the breech block, but at a comparatively small pressure (whose value depends upon the inclination of the two surfaces) the force of adhesion ceases to act and the breech block is rendered free to move under the influence of the forces then existing."

The principle permits the use of a very simple breech-locking mechanism, the essential element being a bolt (98) having an angular slot cut in the under side, into which the lock (99) is free to slide, and a housing or receiver (100) having a slot (101) into which a projecting lug on the lock engages when the bolt is in its firing position. Under high pressure the lock firmly adheres to the receiver shoulder and prevents the bolt from being blown to the rear. When the pressure is reduced, the adhesion ceases, and the lock, actuated by the remaining pressure, automatically slides upward and clear of its retaining shoulder while the bolt moves rearward against the recoil spring (102) and cocks the firing pin.

When the weapon is cocked the entire bolt group is held by the sear (104) in a retracted position, as shown in fig. 17. On the trigger being pulled the bolt, driven forward by the recoil spring, pushes a cartridge into the chamber. During the forward motion of the bolt the hammer (103) strikes a shoulder of the receiver and rotates on the hammer pin, its top end strikes the firing pin and the cartridge is fired. Firing is discontinued by releasing the trigger; the sear (104) then engages the bolt in its retracted position, leaving the chamber empty. By means of the disconnector (105) the weapon can be made semi-automatic at will. When the magazine is emptied, the trip (106) allows the sear to engage the bolt in a rear position ready to feed and fire again when the trigger is pulled. Sights graduated to 600 yd. are provided.

The sub-machine-gun is intended as an auxiliary weapon for trench use and for close fighting generally. It has been adopted also by the police of several American cities for use as a riot weapon, both for shot and ball cartridges. (H. O'L.)

RIGHI, AUGUSTO (1850–1920), Italian physicist, was born at Bologna Aug. 27 1850. Details of his experimental work in magnetism and the problems of electricity and light are given in 17.389, 391 and 346, 6.859, 9.206, 21.936. He was specially noted for his discovery of the electrical conductivity of bismuth and other metals, and for his pioneer work in wireless telegraphy. G. Marconi was his pupil. He died at Bologna, June 8 1920.

RILEY, JAMES WHITCOMB (1853–1916), American poet (*see* 23.343), died at Indianapolis, Ind., July 22 1916. In 1915, by proclamation of the governor of Indiana, his birthday, Oct. 7, was observed throughout the state, in honour of "Indiana's most beloved citizen." In 1913 he issued in six volumes a biographical edition of his works.

See Clara E. Laughlin, *Reminiscences of J. W. Riley* (1916).

RIO DE JANEIRO (*see* 23.353).—According to the census of 1920, the pop. of the independent municipal commune, or federal district, which contains the city and is detached from the province of the same name, was 1,157,873 inhabitants. As the census of 1906 showed 811,443 inhabitants, the pop. has increased 43% in 14 years, an annual increment of 3·05 per cent. In 1920 there were 1,265 factories, large and small, with 46,953 operatives, representing a capital of nearly 270,000,000 paper milreis, and an annual production valued at about 500,000,000 milreis. In 1920 the number of buildings in the municipality was about 113,000, as against 84,375 in 1906. The federal district is governed by a prefect appointed by the president of the republic, and elects three senators and ten deputies to the national congress. The legislative power of the municipality is vested in a council consisting of 24 *intendentes* elected for three years.

The consolidated debt of the municipality in 1920 was computed at 227,089,200 paper milreis, of which 129,225,450 milreis was an external debt, and 97,863,750 milreis internal. The revenue had grown from 29,070,883 paper milreis in 1910 to 51,182,357 paper milreis in 1919.

Education.—Primary instruction is provided by the municipality, which in 1920 maintained 320 day-schools and 68 night-schools, with a matriculation of 74,111 pupils in the former and 8,662 in the latter. There are in addition 236 elementary private schools, with 19,825 pupils; over 80 receive a subvention from the Government on condition that they adopt the official curriculum and admit a certain number of children free. Secondary instruction is cared for in public lycées and in many private establishments. There is no university, but the capital possesses higher faculties of law, medicine and engineering, besides schools providing instruction in pharmacy, dentistry, commerce, music, dramatics and the fine arts. The national Government also maintains a naval academy, a military college and a preparatory school of tactics. The most important libraries are:—the National library, the best appointed in S. America; the Municipal; the Gabinete Portuguez da Leitura; that of the Lycée of Arts and Crafts; and the collections existing in the various ministries and departments.

Streets and Buildings.—During the decade 1910–20 the ambitious programme of municipal improvements inaugurated in 1903 was in large measure completed. The port works, including a sea-wall over 2 m. long, 8 ft. above mean high-tide, and lying almost entirely in deep-water, enclosing a broad reach of reclaimed land between it and the former shore-line, provide the city with the most modern facilities for loading and unloading ships. The Avenida Rio Branco (formerly Avenida Central), built through the heart of the city in 1904, is now one of the handsomest thoroughfares in the western hemisphere. Over a mile long from N. to S., it is lined with fine private and public buildings. The military, naval and jockey clubs are situated there, and also the offices of some of the principal newspapers, such as the *Jornal do Comercio* and *O Paiz*, besides many fashionable shops, cafés and business places. At the southern end is a group of elegant State edifices, the Municipal theatre, the Monroe palace, and the National library and Academy of Fine Arts. It is adorned with three rows of trees, and with broad sidewalks of white and black stone set to form figures in mosaic, as in Lisbon. For this both material and workmen were imported from Portugal. The Municipal theatre, designed in 1904, cost over £2,000,000, although it seats but 1,700 people. The building which houses the National library, opened in 1910 in commemoration of the centenary of its founding (1808), is also a notable addition to the city. It is a fireproof structure of granite, marble and steel, equipped with every modern library appliance.

One of the important developments of Rio de Janeiro has been in suburban road-building. As the hills come practically to the bay and sea, construction is difficult, but great progress has been made and a 40-m. motor drive over perfect roads is now joining all the famous beaches with Tijuca and the city. The magnificent bayside drive, the Avenida Beira-Mar, with its double motor track and intervening lawns and gardens, is particularly remarkable.

Sanitation.—The city, formerly a hotbed of yellow fever and smallpox, has become one of the healthiest tropical cities in the world. The death-rate has fallen to about 20 per 1,000. This is the result of a campaign of scrupulous cleanliness, rigid enforcement of sanitary measures and scientific eradication of mosquitos and other germ-bearing insects, inaugurated under the direction of the celebrated Brazilian scientist, Dr. Oswaldo Cruz, in the first administration of President Rodrigues Alves (1903). In 1920 a law was passed by Congress creating a national department of public health, consisting of three divisions, one in charge of the federal capital. (C. H. H.)

RIO DE ORO (*see* 23.357).—The area of the Spanish Sahara defined and extended by the Franco-Spanish Conventions of 1904 and 1912 is about 110,000 sq. miles. The frontiers have not been delimited. The colony proper (area, about 65,500 sq. m.) extends from lat. 21°20′ N. to 26° N. The 1904 Agreement recognized a Spanish Protectorate over an area on the N. of about 34,700 sq. m., extending to lat. 27°40′ N. and bounded E. by the meridian 8°40′ W.; and the 1912 Agreement acknowledged the sovereign rights of Spain over this region. Still farther N. is an "occupied territory" of about 9,800 sq. m., extending to Wad Draa (lat. 28°45′ N.), and forming an intermediate zone between the Spanish possessions and Morocco.

The interior has been little explored. A central volcanic tableland, the Tiris, about 1,000 ft. above sea-level, falls by terraces broken by ravines to the coastal plain and to the Segiet el Hamra on the north. To the S., the vast dunes of Azefal separate the Spanish Sahara from Mauretania (*see* 17.908). Wad Shebika enters the sea about 36 m. S.W. of Wad Draa and runs parallel to its lower course. The only permanent water is in brackish wells which frequently become choked. The only district likely to repay colonization appears to be the wide basin of the Segiet el Hamra and its tributaries, whose flood-waters suffice to fertilize pasture and arable land or date-groves, as at the oasis of Smara.

There are few main tracks and a network of smaller tracks, but no roads and but few villages. Smara, 160 km. inland from C. Juby, is the most important settlement and is the headquarters of the notorious religious agitators Ma el 'Ainin and his son El Hiba. Vil Cisneros, on the Dakhla peninsula, the residence of the governor (deputy for the governor-general of the Canaries), has a garrison and fish-curing industry; pop. (1918) 529 foreigners and 495 natives, with an adjoining village of 800 negroid half-castes (Imragen). The desert population, roughly estimated at 80,000, is nomadic, fluctuating between French and Spanish territory, and is split up into pro-French and pro-Spanish partisans. In 1912, there was a general rising under El Hiba. In 1916, a small Spanish expedition occupied C. Juby, but the fishermen, of whom the chief are the Aulad Delim Arabs and their allies the Regeibat (Arabized Berbers), remained practically uncontrolled. Camels and ostriches are reared.

In 1916 the total value of imports by sea was £4,820; of exports £4,910, chiefly fish and fish products. The fishing industry would be considerable if better methods were employed. There are open roadsteads at El Msit, at the mouth of the Segiet el Hamra, and Tarfaya, about 180 km. farther north. The climate is fairly equable on the coast, but intense heat and drought prevail inland, with diurnal variations of temperature in the shade of as much as 74°. At Villa Cisneros the mean maximum summer temperature is 86° F., and the mean minimum winter 48° F. (E. G. S.)

RISLEY, SIR HERBERT HOPE (1851–1911), English anthropologist, was born at Akeley, Bucks., Jan. 4 1851. Educated at

Winchester and New College, Oxford, he entered the Indian civil service in 1873 and he had a distinguished career; but his principal work was done in connexion with Indian ethnography, the discussion of the caste system, etc., and he published under Government auspices some important volumes of anthropometric data. He had charge of the Indian census operations of 1901. In 1910 he was appointed secretary of the judicial department of the India Office. He was made K.C.I.E. in 1907, and he died at Wimbledon Sept. 30 1911.

RITCHIE, ANNE ISABELLA, LADY (1837–1919), English writer (*see* 26.716), eldest daughter of W. M. Thackeray, died at Freshwater, I. of Wight, Feb. 26 1919. She is best remembered perhaps as the author of *Old Kensington* (1873). Amongst her other novels were *The Story of Elizabeth* (1863) and *The Village on the Cliff* (1865). She also published various volumes of biographical essays (*Madame de Sévigné*, 1881, and *A Book of Sibyls*, 1883, etc.), and contributed a most interesting series of prefaces to the Library edition of her father's works, thus supplying a substitute for the regular biography of him that he had always deprecated. Her husband, SIR RICHMOND THACKERAY RITCHIE (b. 1854), became permanent Under-Secretary of State for India in 1910, and died Oct. 12 1912.

RIVIÈRE, BRITON (1840–1920), English painter (*see* 23.387), died in London April 20 1920. His later works include "Aphrodite" (1902) and "Hark! Hark! the Lark" (1909), also a portrait of Lord Tennyson (1909). His eldest son, HUGH GOLDWIN (b. 1869), became a well-known painter; and the second son, CLIVE (b. 1872), a prominent physician.

RIVINGTON, FRANCIS HANSARD (1834–1913), British publisher (*see* 23.387), died July 2 1913.

RIVOIRA, GIOVANNI TERESIO (1849–1919), Italian archaeologist, was born at La Manta di Saluzzo in Piedmont Sept. 22 1849. He came of an old Piedmontese family and on his mother's side was descended from the Riccati (*see* 23.288), a family of mathematicians and architects. He took his training as an architect and engineer at the university of Turin, entered Rome with the Italian army in 1870 and thenceforth resided there, devoting his life to travel and to the study of the architecture of the later Roman Empire. In 1884 he married Edith E. Johnson of Cheltenham. He published two monumental works, *Le Origini dell' Architettura Lombarda* (1901–7, Eng. trans. 1910) and *Architettura Musulmana* (1914, Eng. trans. 1919). At the time of his death in Rome March 3 1919 he was engaged upon a third, *Architettura Romana*, which was posthumously published in Rome (1920) by his widow.

ROBERT-FLEURY, TONY (1837–1911), French painter (*see* 23.403), died in 1911.

ROBERTS, FREDERICK SLEIGH ROBERTS, EARL (1832–1914), British field-marshal (*see* 23.403). Subsequently to 1905 Lord Roberts took an active and leading part, as head of the National Service League, in the movement in favour of compulsory military service for home defence. On the outbreak of the World War he was a frequent and welcome visitor at the War Office, and shortly after the arrival of the two Indian divisions in France he crossed the Channel to visit them when the weather was cold and inclement. He was attacked by pneumonia while at the front, and he died at St. Omer on Nov. 14 1914, the title going by special remainder to his elder daughter, Aileen Mary. He was buried in St. Paul's.

Lord Roberts was a tried and brilliant commander in the field. His self-reliance and willingness to accept risks when planning operations were demonstrated by the daring advance to Kabul after the massacre of the Cavagnari Mission, and by his swoop across the Orange Free State from the Modder to Bloemfontein in Feb. 1900, abandoning his communications. That instinctive grasp of a tactical situation which stamps the great captain was displayed by him on many occasions, notably when he attacked the Afghans on the Peiwar Kotal and at Kandahar, and on the occasion of his riding on to the field of Paardeberg. His attractive personality and his natural kindliness made him a most popular chief, and, even if he hardly ranked as a military administrator of the very foremost class, his stewardship in the high offices that he filled in India and at home was advantageous to the army and to the State. An eminently knightly figure, Lord Roberts was a fine horseman, a great gentleman, an ardent patriot and a devout Christian.

ROBERTS, GEORGE HENRY (1869–), English Labour politician, was born at Chedgrave, Norfolk, July 27 1869. His parents removed to Norwich where he attended an elementary school and evening classes. In 1883 he was apprenticed to the trade of printer and compositor. At the expiration of apprenticeship he went to London and joined the London Society of Compositors. After a year he returned to Norwich and identified himself with the movement to organize local printers in a branch of the Typographical Association, of which he became president and ultimately secretary. He also became president of the Norwich and District Trades and Labour Council. He was elected to the Norwich School Board in 1899, being the first candidate run by the local Labour party to win a seat on a public body. In 1904 he was elected to the post of national organizer of the Typographical Association and was chosen as its parliamentary representative. He was returned as one of the members for Norwich at the general election of 1906, and has held the seat since. He was whip of the parliamentary Labour party for about eight years and a member of the executive council of the party. When the Labour party joined the Coalition movement in 1915 he became a Lord Commissioner of the Treasury; he was parliamentary secretary to the Board of Trade 1916–7; Minister of Labour, 1917–8; Food Controller, Jan. 1919. He resigned from the Government Feb. 1920.

ROBERTS, JOHN (1847–1919), English billiard-player, was born at Ardwick, Manchester, Aug. 15 1847, the son of John Roberts, also a great player of billiards. Details of the exploits both of father and son are given in 3.937. John Roberts, jun., died at Worthing Dec. 23 1919.

ROBERTSON, SIR GEORGE SCOTT (1852–1916), British soldier and administrator, was born in London Oct. 22 1852. He was educated at Westminster hospital medical school, and in 1878 entered the Indian medical service. He served through the Afghan War of 1879–80, and in 1888 was attached to the Indian Foreign Office, being employed as agency surgeon in Gilgit, on the frontier of Kashmir. In 1890–1 he travelled in Kafiristan (*see* 15.630). In 1893 he went as political agent to Chitral, and in 1895 was besieged there by hostile tribesmen (*see* 6.252). For his services he was created K.C.S.I., and appointed British agent in Gilgit. He retired from the Indian service in 1899 and returned to England. He unsuccessfully contested Stirlingshire in the Liberal interest in 1900, but was elected for Central Bradford in 1906. He died Jan. 1 1916.

ROBERTSON, SIR WILLIAM ROBERT, BART. (1859–), British field-marshal, was born, of poor parentage, in Lincs. Sept. 14 1859. He enlisted as a private in the 16th Lancers in 1877 and served in the ranks of that regiment until 1888, when he won a commission in the 3rd Dragoon Guards, then in India. On joining he eagerly studied his profession in all its branches and he was very successful in learning the native languages. He was selected to be railway staff officer in the Miranzai and Black Mountain operations of 1891, and in the following year he joined the intelligence department at Simla; while on its staff he carried out a reconnaissance to the Pamirs, and in 1895 served with the Chitral Relief Force, being wounded and receiving the D.S.O. He passed through the Staff College in 1897–8—the first officer risen from the ranks to do so—and then, after a few months at the War Office, went out to S. Africa on the intelligence staff; he accompanied Lord Roberts on his advance from Cape Colony into the Transvaal and was promoted brevet lieutenant-colonel for his services. He spent the period from 1901 to 1907 at the War Office, being promoted colonel in 1903, and he then went to the staff at Aldershot, where he spent three years. In 1910 he was appointed commandant of the Staff College, was shortly afterwards promoted major-general, and in 1913 became director of military training at the War Office.

On mobilization of the army for the World War, Sir W. Robertson—he had been given the K.C.V.O. in 1913—was nominated quartermaster-general of the Expeditionary Force; he filled that appointment most successfully for five months and then, in Jan. 1915, he became chief of the general staff to Sir J. French. In the autumn of that year he was promoted lieutenant-general for distinguished service and in the following Dec. was brought back to the War Office to take up the post of chief of the imperial general staff. There he immediately introduced great improvements in the office organization, and during the first year and a half of his holding the appointment he was successful in keeping the general control of operations on sound lines. While convinced that the western front represented the decisive theatre of war, and fully aware how mischievous was dispersion of force in principle, he saw to it that, where circumstances unfortunately rendered operations in distant regions unavoidable, the commanders on the spot were furnished with what was deemed essential to achieve success—with the result that the position of affairs in Mesopotamia, on the Suez frontier and in E. Africa was completely transformed within a very few months of his taking up his task. His services were recognized by his being promoted general in 1916 and by his being given the G.C.B. in 1917. He had, however, always experienced some trouble in sufficiently impressing upon the Government that the war could only be won in the west, and in the later months of 1917 he found it more and more difficult, in view of the somewhat disappointing results obtained by Allied offensives in France and Flanders, to persuade the War Cabinet that diversion of fighting resources to Alexandretta, or to Palestine, or to Macedonia, or to the Austro-Italian frontier, endangered prospects of victory at the decisive point and might lead to disaster near home. His anxieties were increased by the manner in which the problem of man-power was treated. He moreover foresaw that the plan of having a supreme war council composed of military representatives of the Allies, such as was introduced towards the end of the year, was an unworkable one. Finally in Feb. 1918 he resigned—just one month before the success that attended the great German offensive of March proved how correct had been his appreciation of the situation. He was given charge of the eastern command, and three months later he succeeded Lord French as commander-in-chief in Great Britain. On the final distribution of honours for the war he was rewarded with a baronetcy and grant of £10,000, and he was nominated G.C.M.G. From April 1919 to March 1920 he commanded the British troops on the Rhine, and, after relinquishing that appointment on the force being reduced, he was promoted field-marshal.

See his autobiographical volume *From Private to Field-marshal* (1921).

ROBINS, ELIZABETH (1865–), Anglo-American novelist and actress, was born at Louisville, Ky., Aug. 6 1865, and educated at Zanesville, O. She had had her early training as an actress in America with the Boston Museum stock company, and afterwards with Edwin Booth. Coming to London she first appeared in *The Real Little Lord Fauntleroy* in 1889, and between 1890 and 1896 she played in most of Ibsen's plays, in which she established her position on the stage. In 1902 she was Lucrezia in Stephen Phillips's *Paolo and Francesca* at the St. James's theatre, London. Her first novels, *George Mandeville's Husband* (1894), *The New Moon* (1895) and *Below the Salt* (1896), appeared over the pseudonym of C. E. Raimond, but in 1898 the success of *The Open Question* led to her publishing in her own name, her reputation as a writer being maintained in *The Magnetic North* (1904); *A Dark Lantern* (1905); *Come and Find Me* (1908); *Camilla* (1918) and *The Messenger* (1920). She took an active part in the agitation for woman suffrage. Her play *Votes for Women* was acted at the Court theatre, London, in 1907.

ROBINSON, EDWIN ARLINGTON (1869–), American poet, was born at Head Tide, Me., Dec. 22 1869. From the public schools of Gardiner, Me., he proceeded in 1891 to Harvard, but withdrew after two years to take a business position in New York City. From 1905 to 1910 he was connected with the N.Y. Customs House, and then returned to Gardiner to devote his time to literature, and especially to poetry. He became a member of the National Institute of Arts and Letters. His works include *The Torrent and the Night After* (1896); *The Children of the Night* (1897); *Captain Craig* (1902); *The Town down the River* (1910); *Van Zorn* (1914, a play); *The Porcupine* (1915, a play); *The Man against the Sky* (1916); *Merlin* (1917); *Lancelot* (1920); *The Three Taverns* (1920); *Avon's Harvest* (1921); *Collected Poems* (1921).

ROBSON, WILLIAM SNOWDON ROBSON, Baron (1852–1918), English lawyer and lord of appeal, was born at Newcastle-upon-Tyne Sept. 10 1852. He was educated at Caius College, Cambridge, where he took his degree in 1877. In 1880 he was called to the bar and entered politics, sitting as Liberal member for Bow and Bromley from 1885 to 1886, and for South Shields from 1895 to 1910. He earned a reputation as a distinguished and energetic advocate, and became a Q.C. in 1892. In 1905 he was knighted, and became solicitor-general in Sir Henry Campbell-Bannerman's Government, being made Attorney-General in 1908. In 1910 he was made a privy councillor, and became a lord of appeal and life peer. He resigned his office in 1912, and died at Battle, Sussex, Sept. 11 1918.

ROBY, HENRY JOHN (1830–1915), English scholar (*see* 23.424), died at Grasmere Jan. 2 1915. He contributed a chapter on Roman law to the second volume of the *Cambridge Mediaeval History* in 1913.

ROCHEFORT, HENRI (1830–1913), French politician (*see* 23.426), died at Aix-les-Bains June 30 1913.

ROCKEFELLER, JOHN DAVISON (1839–), American capitalist (*see* 23.433), continued after 1910 to live a retired life, and to give great sums for charitable and educational purposes. In 1913 the Rockefeller Foundation was chartered under the laws of the state of New York (Congress having refused to enact the legislation necessary for a national charter) "to promote the well-being of mankind throughout the world." To this, the most extensive of his benefactions, Rockefeller had given in all $180,000,000 by 1921. The income and $10,000,000 of the original gifts were expended from time to time by its trustees. With increasing definiteness the Rockefeller Foundation focussed its efforts in the fields of medical education and public health. After 1913 it supported by appropriations the International Health Board, an independent organization engaged, in coöperation with governmental agencies, in demonstrations for the control of hookworm disease in 14 southern states of the United States and 22 foreign states or countries; of yellow fever in five South and Central American countries and of malaria in 10 southern states of the United States. In addition, the International Health Board, with funds provided by the Rockefeller Foundation, organized in 1917, partly as a war measure, the Commission for Prevention of Tuberculosis in France; this commission conducted in limited areas, as demonstrations, vigorous campaigns of popular education in hygiene, and provided for the training of French women as health visitors. By the end of 1920 arrangements were under way for the continuation of the work of the Commission by French authorities. In 1914 the Rockefeller Foundation established the China Medical Board to promote the development of scientific medicine and hygiene in China through medical schools, hospitals, and training schools for nurses. In 1919 the Peking Union Medical College, founded by it, was opened together with pre-medical and nurse-training schools. Gifts have been made also to other institutions in China offering pre-medical courses, and to hospitals. In 1920 the Foundation established a Division of Medical Education, through whose advice large pledges of money were made for the development of medical centres in London, and in various cities of Canada. As a part of its public health work, the Rockefeller Foundation also made grants for the support of schools of hygiene at Johns Hopkins University, Baltimore, and at the university of São Paulo, Brazil. A special feature of the work was provision for fellowships to persons from many different countries engaged in study in medical education and public health. During the year 1920, 71 fellows from 13 countries (including the United States) were supported. During the World War the Foundation contributed to war work agencies; and before crystallization of its general policy of limiting its work to medical education and public health, it made appropriations to a number of objects in other fields.

To the General Education Board, the next largest of his charities, Rockefeller had given up to Dec. 1920 over $115,000,000. By the close of the fiscal year 1920, this Board had contributed more than $32,000,000 towards the endowments of different colleges, excluding professional departments, the general practice being to make gifts contingent upon the raising of additional sums. Among medical schools which received help were Washington University, $2,345,000; Johns Hopkins, over $2,200,000; University of Chicago, $2,000,000 (joint fund with the Rockefeller Foundation, 1916); Vanderbilt, $4,000,000 (1919); Rochester, $5,000,000 (1920); Yale Medical School, $1,582,000; and the Meharry Medical College (for negroes), Nashville, Tenn., $150,000 (1920). The Board's facilities for aiding medical education were greatly increased in 1919 by a further gift from Rockefeller of $20,000,000, both principal and interest to be expended in the United States during the next 50 years. In 1919 it gave $500,000 towards the endowment of the Graduate School of Education at Harvard, opened the following year; and in 1920 appropriated $1,000,000 to the proposed building fund of Teachers' College, Columbia University, the largest gift yet made to any institution for training teachers. To the Rockefeller Institute for Medical Research, New York, Rockefeller gave in all upwards of $25,000,000. In Nov. 1920 announcement was made that he had given more than $63,000,000 to the Laura Spelman Rockefeller Memorial, New York, largely for the continuing of charities in which Mrs. Rockefeller, who died in 1915, had been interested. By that time more than $8,000,000 had already been appropriated, chiefly for the benefit of women and children.

It was estimated at the beginning of 1921 that the total amount given by Mr. Rockefeller for philanthropic and charitable purposes exceeded $500,000,000. Nearly four-fifths of this had gone to the four great charitable corporations which he created: The Rockefeller Foundation, General Education Board, The Laura Spelman Rockefeller Memorial and the Rockefeller Institute for Medical Research. Quite as significant as the magnitude of these gifts was the fact that they were free from all restrictions, having been given for the general purposes of the respective corporations, the trustees of which have power to dispose of the principal as well as the income. As the corporate purposes of these organizations are extremely broad, and the gifts are free from restrictions, they will always be adaptable to the changing needs of the future generations. While it was probably true that Mr. Rockefeller was the richest man in the world, it would appear, in view of the statements made by competent authorities, that his wealth in 1921 was less than $500,000,000, and that in making his gifts he had drawn very heavily upon capital as well as income.

RODIN, FRANÇOIS AUGUSTE (1840–1917), French sculptor (*see* 23.447), presented in Nov. 1914 20 examples of his work in bronze, including "L'Enfant prodigue," "La Muse," "France," "Cybèle," "L'ange déchu," "Balzac," and a bust of Mr. George Wyndham, to the Victoria and Albert museum, London, as a token of his admiration for the deeds of the British army. In 1916 Rodin presented all the works remaining in his possession to France, and in 1917 a replica of "The Burghers of Calais" was placed in the garden adjoining the House of Lords. He died at Meudon, near Paris, Nov. 17 1917.

RODZIANKO, MICHAEL VASSILIEVICH (1859–), Russian politician, was born in 1859 and belonged to a family of great landowners. At the age of 19 he joined the Horse Guards, but he soon resigned and retired to his large estates in the government of Novgorod. He took an active part in local life and was also a member of the conferences of Zemstova and Towns. In 1905 he was elected member of the First Duma and was reëlected at all subsequent elections. He joined the right wing of the Octobrist (Moderate Liberal) party, and with the support of the Conservatives was elected president of the Third Duma after the resignation of A. Guchkov in March 1911. Later he was reëlected president of the Fourth Duma, and took an important part in the struggle for constitutional changes in the Government of Russia. He strongly opposed the reactionary policy of the Imperial Government, and always defended the rights and privileges of the Duma. By the force of events Rodzianko was placed at the head of the national movement at the moment of the revolution, and, as president of the Provisional Committee of the State Duma, he sent a telegram to the Tsar pointing out the necessity of his abdication. But he had no real influence on the course of the revolution. He played for some time a purely decorative rôle, receiving telegrams of congratulation and delivering speeches, but he soon disappeared from the stage. After the Bolshevist revolution, he made his way to the south of Russia, where he took part in different anti-Bolshevist organizations and bodies. Later he emigrated to Germany.

ROGERS, BENJAMIN BICKLEY (1828–1919), English classical scholar, was born at Shepton Montagu, Som., Dec. 11 1828. Educated at Wadham College, Oxford, he was elected a fellow of the college in 1852 and was called to the bar in 1856. There he was on the high road to success, when increasing deafness obliged him to retire and devote himself exclusively to literature. He translated all the plays of Aristophanes, reproducing the Greek metres in the English version. He died at Twickenham Sept. 22 1919.

ROGERS, JAMES GUINNESS (1822–1911), British Nonconformist divine, was born at Enniskillen, Ireland, Dec. 29 1822. He was educated at Silcoates school, Wakefield, and Trinity College, Dublin. From 1865 to 1900 he was a minister of the Clapham Congregational church. He is best remembered for his close association with Dr. Dail in the Liberal-Nonconformist education and disestablishment campaigns of 1865–75, and for his friendship with Mr. Gladstone and Lord Rosebery, who consulted him as the foremost representative of Nonconformist statesmanship. He died at Clapham Aug. 20 1911.

ROLLAND, ROMAIN (1866–), French man of letters, was born at Clamecy, Nièvre, Jan. 29 1866. He was educated at Clamecy, and later in Paris, where he had a distinguished academic career. From 1889–91 he was a member of the French School in Rome, in 1892 went with an archaeological expedition to Italy, and in 1895 was appointed professor of the history of art at the École Normale Supérieure, later occupying the same position at the Sorbonne, where he introduced the study of the history of music. He produced many critical and historical works, among them *Histoire de l'Opéra en Europe avant Lulli et Scarlatti* (1895); *Des Causes de la Décadence de la Peinture italienne* (1895); and *Le Théâtre du Peuple* (1903); besides studies on *Millet* (1902); *Beethoven* (1903) and *Michel-Ange* (1906). His most famous work, however, is the romance of *Jean Christophe*, the biography of a German musician, one of the most remarkable productions of the present day. The work is in three series, *Jean Christophe*, *Jean Christophe à Paris* and *La Fin du Voyage.* It appeared in 10 volumes, the first, *L'Aube*, in 1904, and the last, *La Nouvelle Journée*, in 1912. A series of articles published by Romain Rolland in the *Journal de Genève* during Sept. and Oct. 1914 created an extremely bad impression in France owing to the "defeatist" attitude of the author. His later works include *Au-dessus de la Mêlée*, of which the ninth edition appeared in 1915; *Colas Brangnon*, a novel (1918); *Les Précurseurs* (1919) and *Voyage musical aux pays du passé* (1919).

See Jan Romein, *Romain Rolland* (1918); I. Debran, *M. R. Rolland, initiateur du défaitisme* (1918); W. Kuechler, *Romain Rolland* (1919).

ROMER, SIR ROBERT (1840–1918), English judge, was born in London Dec. 23 1840. He was educated privately and at Trinity Hall, Cambridge, where he was senior wrangler and Smith's prizeman in 1863. From 1865 to 1866 he was professor of mathematics at Queen's College, Cork, but in 1867 was called to the bar, becoming in 1881 a Q.C. and in 1884 a bencher of Lincoln's Inn. In 1890 he was raised to the bench of the Chancery division and knighted, and in 1899 became a lord justice of appeal. He presided over one of the inquiries made after the South African War, and was also a member of the royal commission on university education. He received the G.C.B. in 1901 and retired in 1906. Romer, who married in 1864 the daughter of Mark Lemon, editor of *Punch*, died at Bath March 19 1918.

RONALD, SIR LANDON (1873–), English conductor and musical composer, born in London June 7 1873, was educated at St. Marylebone and All Souls grammar school, and the high school at Margate. His first appearance as a musician was in 1890, as solo pianist in the wordless musical play *L'Enfant Prodigue*, and in 1891 he was engaged by Sir Augustus Harris as conductor for a Covent Garden season. During the following years his reputation as a conductor steadily increased, and in 1908–9 he had a successful European tour. In 1908 he became conductor of the New Symphony Orchestra (now the Royal Albert Hall Orchestra), and in 1910 was appointed principal of the Guildhall school of music. His compositions include various orchestral works, and a large number of songs, many of which have attained wide popularity. He was knighted Jan. 1 1922.

ROOSEVELT, FRANKLIN DELANO (1882–), American politician, was born in Hyde Park, N.Y., Jan. 30 1882. He was a distant cousin of Theodore Roosevelt. He was educated at Groton, Harvard (A.B. 1904), and the Columbia Law School (LL.B. 1907). He was admitted to the bar in 1907 and began practice in New York City. He began his public career in 1910 when he was elected to the New York State Senate, being the first Democrat in 28 years to represent his district. He was an anti-Tammany man and was associated with the group that successfully opposed the Tammany candidate for the U.S. Senate in the session of 1911–2. In 1912 he was reëlected to the New York State Senate. The same year he strongly supported Woodrow Wilson for president and on the latter's election was appointed Assistant Secretary of the Navy in 1913. He then resigned from the New York Senate. In 1915 he was a member of the National Committee of the Panama-Pacific Exposition. After America's entrance into the World War he went to Europe in 1918 to attend conferences and to inspect the U.S. naval forces, and early in 1919 was in charge of their demobilization. He was a supporter of the League of Nations; he indorsed woman suffrage and was a strong advocate of civil-service reform for the post-office and consular appointments. At the Democratic National Convention in 1920 he was unanimously nominated for vice-president on the ticket with James M. Cox, but was defeated in the ensuing election.

ROOSEVELT, THEODORE (1858–1919), twenty-sixth President of the United States (*see* 23.707), completed his second term, March 4 1909, the most famous man in his country, with a wealth of personal friends, and a reputation as a master of men. Yet from the presidency, like most of his predecessors, he stepped down into a retirement which seemed to forbid a reentry into public life or a recovery of the headship of his party. In the 10 remaining years of his life he displayed the same qualities of intense thought and action that had characterized him before; within a year after his withdrawal he again became a great force in American society and public life. A sense of fair play to his successor, President Taft, for whose choice he was indeed responsible, and that drawing-force of the unknown to which his nature was susceptible, led him to make plans for a hunting and exploring trip in Africa, some months before the end of his presidential term. He was also influenced by invitations to make addresses in England and France.

Accordingly he sailed from New York on March 23 1909 for Africa, where, in conjunction with his son Kermit and the well-known hunter Selous, he travelled a long distance, shot big game, and safely emerged at Khartum in March 1910. Here he plunged at once into politics by addresses at Khartum and Cairo, in which he stood for orderly and vigorous government for Egypt. In both instances the addresses were requested and approved by the local military authorities. From Egypt he proceeded to Europe, and, apparently to his own surprise, found himself an international celebrity. He was received in all the courts of central Europe except the Vatican, where an official interposed between him and the Pope by stipulating guarantees of his conduct in Rome. He left a most interesting account of the impressions made upon him by this journey, in a long and intimate letter written at the time to the English historian Sir George Trevelyan, and published in Bishop's *Theodore Roosevelt and His Time*. It was in vain for him to claim that he was only a "private citizen with no claim to precedence"; for everywhere he was received with the honours ordinarily paid only to sovereigns. He was warmly received in France where he made a public address at the Sorbonne. In England his Romanes lecture at Oxford, and particularly his Guildhall speech on the management of a great empire, were noteworthy; and he was designated by President Taft to represent the United States at the State funeral of Edward VII. His most striking experience was in Germany, where he was received with cordiality by the Emperor, but, as he said afterwards, it was the only country in Europe where he felt that "every man, woman and child was my natural enemy—that is, the enemy of my country."

Returning to the United States, June 18 1910, Roosevelt found that both his African and European experiences had been followed closely by the American people. President Taft had now had a year and a half of experience with the country, with Congress, and with reforms and policies which Roosevelt had initiated and expected would be carried out. There was a rift in the Republican party. Some of Roosevelt's friends were in opposition to the Taft administration. In the Ballinger controversy over western public lands, Roosevelt sided against the administration. A group of dissatisfied Republicans, the "insurgents," had arisen in Congress, and prepared to dispute the supremacy of the Conservatives in the party, on whom Taft seemed to be relying. To Roosevelt's mind, the "mossbacks" were in control; and a few hours after landing he agreed to throw his personal influence on behalf of Governor Hughes of New York, who was engaged in a struggle with the Republican Legislature over the direct primary. He made an address at Ossawatomie, Kan., Aug. 31, in which he laid down a radical programme of political and social reform to which he gave the name of the "New Nationalism." Plainly he was dissatisfied with Taft's administration. As early as Nov. 21 he discussed with an intimate friend the possibility of his accepting the nomination in 1912, to succeed Taft in the presidency. Through 1911 this quarrel grew. Soon after returning, Roosevelt became an editorial writer, bearing a free lance, in *The Outlook*, and alike in his editorials and in public addresses he took the side of the insurgent element. He regarded Taft as the representative of "the interests." Early in 1912, a group of seven Republican governors united in an appeal to Roosevelt to declare his willingness to be nominated. On Feb. 12, Taft made a bitter speech, in which, without mentioning Roosevelt, he spoke contemptuously of the extremists. This seems to have been the incident that decided Roosevelt's course; for on Feb. 26 he came out openly as a candidate for the nomination by the party convention in June.

Meanwhile the usual campaign for the choice of delegates to the Convention was going on, following the same lines as in 1908. In the southern states, where the Republicans were hopelessly in the minority, delegates were elected by the usual rump and machine-led state conventions. Roosevelt's friends made a campaign in the northern and western states, especially in those which had provided for a choice of delegates through a popular vote in party primaries. A majority of the Republican voters in those states favoured Roosevelt. When the Republican Convention met in Chicago, June 22, Taft was strong in the delegations chosen by state and local conventions; and Roosevelt in those representing a predominance of Republican voters. The organization of the Convention, however, was in the hands of the Taft men, because they had a large majority in the National Committee. Out of the numerous contested seats, only six were finally assigned by the Committee of Credentials to the Roosevelt column. On a test vote for the choice of temporary chairman, the Taft men showed a narrow margin. The turn of 15 votes—which might have been secured had Roosevelt come out a few weeks earlier—would probably have brought on a "landslide" for him. A speech by Roosevelt a few weeks earlier before the Ohio Constitutional Convention, advocating the "Recall" of judicial decisions, also gave alarm to some men who might otherwise have supported him. Once organized, the Taft forces were able to carry through the report of the Committee on Credentials, which assigned them a safe majority.

Roosevelt himself had come to Chicago a few days before the Convention, and was the centre of the hardest battle of his life. He rallied his supporters, and addressed an enormous public meeting, ending his speech with "We stand at Armageddon, and we battle for the Lord." Most of his followers stood by him; but they could not break down the walls of precedent and conservatism. The Roosevelt delegates, on their leader's request, remained in the Convention until the end, but refused to vote on the nomination; and Taft was duly nominated for a second term by the vote of about two-thirds of the Convention.

Roosevelt was a party man, who had stood by the party in 1884 when many of his friends bolted. His standpoint in 1912 was that he was trying to save the Republican party from a ruinous yielding to the forces of organized wealth and reaction. He was also a fighter, and felt himself deprived, by technicalities and personal hatreds, of an honour which the majority of his party was eager to bestow upon him. He unhesitatingly decided to "bolt," and on the evening of the adjournment of the Convention, at a meeting in Orchestra Hall, he advised the formation of a Progressive party. A later Convention of the Roosevelt men throughout the country, including a considerable number of Democrats, nominated Roosevelt, with Gov. Hiram W. Johnson of California for vice-president. Meanwhile the Democrats had nominated Woodrow Wilson, governor of New Jersey. The result was a three-cornered political contest, in which it was clear at the beginning that Taft could not be elected, but that Roosevelt probably could not win enough Democratic votes to prevent the choice of Wilson. Nevertheless, Roosevelt fought vigorously through the campaign, violently attacking Taft as a reactionary and tool of reactionaries. While on a speaking tour at Milwaukee he was shot by a fanatic, but was not seriously injured.

The result of the election was the choice of Wilson, who had 6,000,000 popular votes and 435 electoral votes; Roosevelt, 4,000,000 popular votes, and 88 electoral; Taft, 3,500,000 popular votes, and 8 electoral. On this showing the Progressives had more votes than their Republican adversaries, and therefore hoped to compel a reconstruction of the party. Their Republican opponents, however, kept tight hold of the name, organization and prestige. They had deliberately accepted defeat in advance in order to put Roosevelt out of the running.

This, the first serious defeat that Roosevelt had ever encountered, was to him a bitter humiliation. He felt that his public career was ended. His first movement was characteristic. He had cordial invitations to visit S. America and make addresses in the principal cities. As in his experiences of 1910, this dovetailed in with a plan of exploration. Accordingly, early in 1913, after visiting several S. American countries, including Brazil and Argentina, he returned to Brazil, made his way overland, and came down a river, whose uncharted course he followed for 600 miles. The hardships were severe, and he received an injury, serious for a time, and drew into his system the seeds of tropical malaria. The Brazilian Government named the stream Rio Teodoro.

On his return to the United States, out of office, a defeated candidate, an insurgent, the personal enemy of the Republican leaders, he seemed justified in his belief that his career was over. But as usual his enemies played into his hands. An obscure journalist ventured publicly to accuse him of drunkenness. In May 1913 he instituted a suit for defamation of character, with the result that the defendant broke down and acknowledged his error. A large section of the American people resented the affront, and rejoiced in the vindication. During this period Roosevelt was indefatigable as journalist and writer, first in *The Outlook*, then in the *Metropolitan* magazine, and finally through the columns of the *Kansas City Star*.

The outbreak of the World War gave him a new opportunity for his pen and voice. His instinct was against Germany as an oppressor of weak nations; but he stayed his desire for positive action for a time, from the feeling that he ought not to embarrass the President. It was at this time that a personal enemy gave Roosevelt the opportunity of again showing his character to his countrymen, through a publicity which both Roosevelt and the public enjoyed. William Barnes, one of the acknowledged leaders of the Republican party, brought a suit in April 1915 against Roosevelt because of an accusation of unfair and corrupt politics as a "boss" which Roosevelt had made against him. Roosevelt vigorously defended himself and won the suit. For 10 days he was on the witness-stand, and his testimony, which was spread broadcast throughout the land, revealed his undiminished force and appealed to the popular imagination.

The sinking of the "Lusitania" by a German submarine in May 1915 brought his bitterest denunciation, and from that time he foresaw first the possibility and then the likelihood of war between Germany and the United States. He made himself the leading spokesman for "preparedness," and presently drew down the wrath of President Wilson's administration for a speech at Plattsburg. From that time he did not spare sharp criticisms of President Wilson's policy as showing unwillingness to face the dangers of war. His utterances against Germany and in favour of the Allies had great influence.

As the election of 1916 drew near, the remaining Progressives, aided by some who had stayed in the Republican party, made an effort to force the Republican Convention to nominate Roosevelt. They called a Progressive Convention to meet at Chicago at the same time as the Republican, hoping to make a joint nomination with the Republicans. Roosevelt did his best to secure the prize, but again the party leaders would have none of him. Hughes was nominated, and this time Roosevelt accepted the situation as a loyal member of the Republican party, and supported the nominee.

As the World War went on, Roosevelt became the severest critic of the administration and the strongest advocate of preparedness. He formed a plan for raising a special division, in which he hoped to have a command, and which he would offer to the Government. Early in 1917, when the American breach with Germany came, he offered the services of himself and his sons, all four of whom subsequently enlisted. He requested that he might have a personal command, which was denied by the administration, although both Houses of Congress united in a bill making his plan possible. During the year he made some of the most notable addresses of his life, especially that before the "Order of Moose" Convention in Pittsburgh. By this time the Republican politicians were looking forward to the election of 1920 and began to group themselves about Roosevelt. His most persistent enemies, even William Barnes, accepted his nomination as a foregone conclusion. The year 1918, however, was a sad one for Roosevelt. His son Quentin was killed in the war. Ever since returning from Brazil, Roosevelt's constitution had shown weakness. He was several times in hospitals, and underwent a serious operation for abscess due to infection received during his Brazilian explorations. The hearing of his left ear was wholly destroyed. Still he continued his writing and speaking, and his direct personal influence upon his thousands of friends. Even in the first days of 1919, when he suffered from renewed disease, he looked forward to public service. On Jan. 6 1919 he died in his sleep.

A man who could do so much could not do everything perfectly, though few have ever done so many things so well. It was more true of him than of most men that his defects were inherent in his virtues. There were few half-tones in Roosevelt's moral perceptions and fewer in his vocabulary; he saw things as either black or white, and he forgot sometimes that he had not previously seen them as he saw them at the moment. He had enemies, and even former friends, who charged him with breaking promises, betraying political associates and setting his own wishes and interests above all others. The very intensity of his convictions sometimes blinded him to the sincerity and even to the justice of other points of view. Nevertheless this intensity, this moral fervour, gave his ideas a momentum and a success which they could never have acquired had they proceeded from a more judicial mind. He scorned "weasel words," and on occasion he did not hesitate to describe his enemies as thieves and liars. His remarkable energy reminded observers of some great elemental force which, like any natural phenomenon, is controlled by its own necessary laws. When Lord Morley was leaving the United States in 1904 he was asked by reporters what in America had impressed him most. "Two things," he replied, "Theodore Roosevelt and Niagara Rapids."

His fearlessness was as conspicuous as his energy. With a courage very rare in political life he attacked the iniquities that had crept into the conduct of American business. He asserted the importance of personal rights when these were being openly denied in the name of property rights. He rallied the patriotic elements of the country against the menace of a private "money power" which not only had frequently dictated the course of legislation but threatened to usurp the authority of the Government itself. He felt strongly that any position involving the exercise of power had its obligations as well as its privileges, and this feeling lent force to his denunciation of "predatory interests" and "malefactors of great wealth." On the other hand he had little patience with demagogic attacks on men or corporations merely because they were rich or successful, as was shown in his famous utterance in which he compared the authors of these journalistic attacks with the "muckrakers" in *Pilgrim's Progress.* It was said of him satirically that he had invented the Ten Commandments; but Roosevelt's earnestness in behalf of old truths was of the essence of his service to his countrymen, and more important at the juncture than the discovery of new ones.

His great personal power was used in the furtherance of honesty, fair dealing and patriotic service, when more than lip service to these virtues was vitally needed. He threw all his energy into the effort to bring about a reapplication of fundamental moral principles to American business and political life. While he was unquestionably an astute politician, the secret of his success lay in his imaginative understanding of the views and feelings of his countrymen: his enthusiasm was contagious because he vividly expressed what they already felt and believed to be the truest American ideals. When he spoke for the "square deal," the American people as a people always responded.

Born of a wealthy family, in an aristocratic society, enjoying all his days a literary and artistic atmosphere, he was still a natural democrat. He had a personal interest in every man or woman that he met, and a genuine affection literally for thousands of individual persons. He was a scientific man whose observations and deductions were valued by naturalists and investigators. He was a literary man, very widely read. He was an intellectual man, interested from youth to age in literature and philosophy. He was a politician without a rival in his time for boldness, foresight, and an innate knowledge of what his fellow countrymen were thinking about. He was a statesman of the most brilliant ability, who after a crushing defeat returned to power over the minds of the people and was on his way again to the presidency of the United States. His bitterest political enemies accepted his coming back to national leadership. To few men in history has it been given to wield such far-spreading and wholesome personal influence.

BIBLIOGRAPHY.—Between 1909 and 1919 Roosevelt published about 15 books, several of them consisting of articles and addresses. The more important are *African Game Trails* (1910); *Conservation of Womankind and Children* (1912); *Theodore Roosevelt, an Autobiography* (1913, contains little beyond 1909); *Life-Histories of African Game Animals* (2 vols. 1914); *A Hunter-Naturalist in the Brazilian Wilderness* (1914); *Through the Brazilian Wilderness* (1914); *A Book-lover's Holiday in the Open* (1916). His principal later books on public affairs and on the World War are *Realizable Ideals* (1912); *America and the World War* (1915 and 1919); *Fear God and Take Your Own Part* (1916); *National Strength and International Duty* (1917); *The Great Adventure* (1918). Numerous collections of extracts and speeches have been published, especially those of W. F. Johnson (1909); L. F. Abbott (African and European, 1910); W. Griffith (1919); J. B. Bishop, *Letters to his Children* (1919).

The most important biographies are those by J. B. Bishop (1920); H. Hagedorn, *Boy's Life of Theodore Roosevelt* (1919); W. D. Lewis (1919); W. R. Thayer (1919); Bradley Gilman (1921) and H. Hagedorn's *Roosevelt in the Bad Lands* (1921). A useful list of books by and about Roosevelt is J. H. Wheelock's, *Bibliography of Theodore Roosevelt* (1920). (A. B. H.)

ROOT, ELIHU (1845–), American lawyer and political leader (*see* 23.711), was elected president of the N.Y. State Bar Association in 1910, and chairman of the board of trustees of the Carnegie Institution of Washington in 1913. He was chairman of the N.Y. State Republican Convention in 1912, 1913, 1914, 1916, and permanent chairman of the Republican National Convention in 1912. In 1913 he favoured the repeal of the bill exempting American shipping from Panama Canal tolls. He also approved President Wilson's policy of non-interference in Mexico. He assailed as class legislation the exemption of labour unions and agricultural associations from the Sherman Anti-Trust Act. On Dec. 10 1910 he was awarded the Nobel peace prize because of his work in the pacification of the Philippines and Cuba as well as his part in the negotiations between the United States and Japan. The same day he became a member of the Court of Arbitration for settling the claims of British, French and Spanish subjects in connexion with property seized by the Portuguese Government when a republic had been proclaimed. In 1915 he opposed Secretary Bryan's treaty with Colombia, disapproving any apology for incidents attending the acquisition of the Canal Zone and regarding the proposed payment of $25,000,000 as too large. He attacked the Ship Purchase bill, pointing out dangers of international difficulties in case interned vessels were taken over. He also argued that for the Government to acquire shipping would discourage private enterprise and was socialistic in tendency. He was president of the State Constitutional Convention in 1915 and worked for many reforms, including the short ballot, means for remedying the law's delays and the excessive cost of securing justice, and the making of impeachments easier. When submitted to the voters, however, the new constitution was defeated. He was unanimously elected president of the American Bar Association in 1915. The same year he retired from the U.S. Senate, having refused to stand for a reëlection.

He had long advocated preparedness on the part of the United States and early in 1917 spoke in favour of war against Germany. After the United States entered the World War he urged full support of the President. In May 1917 he was appointed chairman of the special American mission sent to Russia and was given the rank of ambassador. Arriving at Petrograd in June he addressed the Russian Council of Ministers and in Moscow spoke at a special session of the Duma and at a meeting of the local Council of Workmen's and Soldiers' Delegates. Later he visited General Brussilov at staff headquarters. On his return to America he was elected honorary president of the National Security League, succeeding Joseph H. Choate. On Sept. 25 1917 he presided at the meeting of the National Association Opposed to Woman Suffrage and denounced suffrage agitation during the critical period of the war. He had never supported the movement and in 1914 had been blacklisted by the National American Suffrage Association. He approved in general the Covenant of the League of Nations but in 1919 suggested six amendments to protect American interests, including reservations concerning the Monroe Doctrine and immigration. He favoured separate consideration of the Peace Treaty and the League. He was strongly opposed to the Prohibition amendment to the Federal Constitution; was retained as counsel by several brewing interests and in 1920 argued before the U.S. Supreme Court against its constitutionality, but unsuccessfully. In 1920 the President reappointed him U.S. delegate to the Hague Tribunal and he went to Holland to assist in organizing the Permanent Court. In July 1920 he spoke at the unveiling of St. Gaudens' statue of Lincoln in London. In 1921 he was one of the four U.S. delegates at the Washington Conference on the Limitation of Armament.

He was the author of several volumes of lectures and addresses, including *Experiments in Government and the Essentials of the Con-*

stitution (1913, lectures delivered at Princeton); *Addresses on International Subjects* (1916); *Addresses on Government and Citizenship* (1916); *The Military and Colonial Policy of the United States* (1916); *Latin America and the United States* (1917); *Miscellaneous Addresses* (1917); *North Atlantic Coast Fisheries at The Hague* (1917) and *The United States and the War* (1918).

ROSCOE, SIR HENRY ENFIELD (1833–1915), English chemist (*see* 23.725), died at Leatherhead, Surrey, Dec. 18 1915.

ROSEBERY, ARCHIBALD PHILIP PRIMROSE, 5TH EARL OF (1847–), British statesman (*see* 23.731), took an active part in the constitutional crisis in 1910 and 1911. He treated the Parliament bill as a revolutionary measure which in effect constituted single-chamber Government, and did his utmost to arouse the nation to a sense of its danger. But he disapproved of the bill which Lord Lansdowne introduced in May 1911 for the reconstitution of the House of Lords, holding that the Opposition ought to have contented themselves with reaffirming his own resolutions of the previous year. If the Parliament bill became law, Lord Lansdowne's bill mattered little; who would then be the acolytes and sycophants who would accept the degrading position of members of a second chamber? While, however, he bitterly condemned the conduct of ministers in going to "a young and inexperienced King" for contingent guarantees, he declined to follow the extreme course of rejecting the bill recommended by the "Die-hards." He shrank from the scandal of a great creation of peers. If the bill were allowed to pass, the House would be left with some vitality; if the creation of peers was forced, they would have none at all. He showed his own estimate of the impotence of the House after the passage of the bill by ceasing to attend its debates; and indeed he took no further part in public life till the outbreak of war in 1914 fired his patriotism. As lord-lieutenant of Midlothian and Linlithgowshire he promoted recruiting and other warlike activities in his own country; and helped to hearten the nation and to avert a premature peace by occasional speeches. His feeling was shown by a preface which he wrote in Oct. 1914 for the first volume of Col. John Buchan's *History of the War*. He spoke of "the incalculable blessing which the damnable invasion of Belgium has conferred incidentally upon ourselves. . . . It has revealed to the world the enthusiastic and weather-proof unity of the Empire. . . . Blood shed in common is the cement of nations, and we and our sons may look to see a beneficence of empire, not such as the Prussians dreamed of, not a war-lordship over other nations, not a nightmare of oppression, but a world-wide British influence which shall be a guarantee of liberty and peace, and which, hand-in-hand with our Allies in Europe and with our kindred in the United States, should go far to make such another war as this impossible."

The war cost Lord Rosebery his younger son, the Right Hon. NEIL PRIMROSE (1882–1917), whose political advance had been watched by his father with eager sympathy. He was under-secretary for the Foreign Office in 1915, parliamentary secretary for Munitions in 1916, and at the close of that year became Coalition Liberal Whip under Mr. Lloyd George. But these appointments were only held for short periods in the intervals of fighting as a captain in the Buckinghamshire Hussars, and he died of wounds received in action in Palestine in Nov. 1917. He had married Lord Derby's daughter in 1915. Lord Rosebery had a further domestic sorrow in the dissolution, in 1919, of the marriage (celebrated in 1909) of his elder son Lord Dalmeny with Dorothy A. M. A. Grosvenor. Lord Rosebery was created Earl of Midlothian in the peerage of the United Kingdom—the earldom of Rosebery being a Scottish earldom—at the coronation of King George in 1911, at which ceremony, as at the coronation of King Edward, he was one of the lords who bore the canopy. He became chancellor of Glasgow University in 1908 as he had long been chancellor of London University; and was chosen lord rector of St. Andrews University for the year of its quincentenary celebration in 1911.

ROSEGGER, PETER (1843–1918), Austrian poet and novelist (*see* 23.734), died in 1918. (*See* AUSTRIAN EMPIRE: *Literature.*)

ROSENTHAL, TOBY EDWARD (1848–1917), American painter (*see* 23.735), died in Berlin, Germany, Dec. 28 1917.

ROSENWALD, JULIUS (1862–), American merchant and philanthropist, was born at Springfield, Ill., Aug. 12 1862, and was educated in the public schools. From 1885 to 1906 he was president of Rosenwald & Weil, clothing manufacturers, Chicago. In 1895 he became vice-president and treasurer of the mail-order house of Sears, Roebuck & Co., Chicago, and in 1910 president. The gross sales of the company, which were $1,750,000 in 1896, increased under his management to $258,000,000 in 1919. He served during the World War under appointment by President Wilson as a member of the Advisory Commission of the Council of National Defense. In 1918 he was sent on a special mission of cheer by Secretary Baker, of the War Department, to the American troops in France. In 1919–20 he served in Washington as a member of the President's Industrial Conference. He devoted much time to work for philanthropic, educational and civic organizations. He gave $150,000 to Tuskegee (Ala.) Normal and Industrial Institute; $250,000 for a building to house Jewish philanthropic organizations of Chicago; and (with Mrs. Rosenwald) $750,000 for new buildings for the university of Chicago. Of the latter sum $250,000 was used to erect a building, Julius Rosenwald Hall, for the departments of geology and geography, and $500,000 for buildings for the medical department. He founded dental infirmaries in the Chicago public schools. During the World War he gave large sums to relief organizations, in 1917 alone $1,000,000 to aid sufferers in eastern Europe. He contributed generously to, and took a leading part in securing contributions for, the Hoover Children's Relief Fund in 1920–1. Beginning in 1914, he stimulated a programme for building rural schools for negroes in the southern states by agreeing to contribute toward their cost and toward the lengthening of the school terms, provided both the whites and the negroes of the neighbourhood contributed also and that public funds were appropriated. Up to 1920, 800 schools were thus constructed at a total cost of $1,500,000, of which Mr. Rosenwald gave $400,000. In 1920, 500 additional buildings were authorized for immediate construction at an approximate cost of $2,000,000, of which Mr. Rosenwald agreed to pay $500,000. At the close of 1920, 14 cities had Y.M.C.A. buildings for negroes, costing altogether $2,000,000, because of Mr. Rosenwald's offer to contribute $25,000 to each city under certain conditions. His share in the cost was $350,000. He was an official of several leading philanthropic, civic and educational organizations of Chicago, including the university of Chicago; also of the Rockefeller Foundation, Tuskegee Normal and Industrial Institute, the Baron de Hirsch Fund and the American Jewish Committee, and was identified with many other movements for public benefit throughout the country.

On Dec. 29 1921 it was announced that Mr. Rosenwald had pledged about $20,000,000 to safeguard the interests of Sears, Roebuck & Co. during the critical period of business re-adjustment after the World War. He increased the company's fluid assets by purchasing for $16,000,000 part of the real estate owned by the company in Chicago, and gave the company from his own holdings 50,000 shares of its common stock (par value $100). In 1920 and 1921 the company had paid no dividends on its common stock and it was apparent that its accounts at the end of 1921 must show a deficit. But Mr. Rosenwald by this action enabled the company to readjust its finances without impairing its capital stock, and protected its stockholders, many of them employees. It was recognized generally that he established a precedent which raised the standards of business when he thus faced heavy loss in order to protect those who had bought shares because of their confidence in his leadership, and also in order to foster the practice of employees' participative investment.

ROSS, SIR GEORGE WILLIAM (1841–1914), Canadian politician (*see* 23.739), was knighted in 1910. He published, amongst other works, *The Life and Times of the Hon. Alex. Mackenzie* and *Getting into Parliament and After.* He died March 8 1914.

ROSS, ROBERT BALDWIN (1869–1918), British art critic and writer, was born at Tours May 25 1869, the son of the

Hon. John Ross, Q.C., attorney-general for Upper Canada, his mother being a daughter of the Hon. Robert Baldwin, premier of Upper Canada. He was educated privately, and later at King's College, Cambridge. After leaving the university he took to journalism. As a judge of pictures he was in very high repute, and from 1912 to 1914 he acted as adviser to the Board of Inland Revenue on picture valuations for estate duty. The most noteworthy feature of many years of his life, however, was his friendship with Oscar Wilde, whose literary executor he ultimately became. He was responsible for the publication of Wilde's *De Profundis* (1905), and subsequently for a complete edition of Wilde's works. Not long before his death Ross received from his admirers a presentation of plate, and also a sum of money which, at his request, was applied to the foundation of a scholarship at the Slade school of art. He died in London Oct. 5 1918.

ROSS, SIR RONALD (1857–), British physician and bacteriologist, was born at Almora, India, May 13 1857. He studied medicine at St. Bartholomew's hospital, and in 1881 entered the Indian medical service. About 1893 he commenced a series of special investigations on the subject of malaria, and by 1895 had arrived at his theory that the micro-organisms of this disease are spread by mosquitos (*see* 17.463, 20.786). In 1899 he retired from the Indian medical service, and devoted himself to research and teaching, joining the Liverpool school of tropical medicine as lecturer, and subsequently becoming professor of tropical medicine at Liverpool University. In 1913 he became physician for tropical diseases to King's College, London. During the World War Ross was appointed to the R.A.M.C. and became War Office consultant in malaria. In 1902 he received the Nobel prize for medicine, in 1911 a K.C.B., and in 1918 a K.C.M.G. He has also been the recipient of honours from many British and foreign universities. He published in 1910 *The Prevention of Malaria*, and also produced *Psychologies*, a volume of poems (1919), and a romance, *The Revels of Orsera* (1920).

ROSTAND, EDMOND (1869–1920), French dramatist (*see* 23.754), devoted himself during the World War chiefly to the writing of patriotic verse. Various comic versions of *Cyrano de Bergerac* were performed by the soldiers at the front, one of which, *Cyrano de Bergerac aux Tranchées* (1916), was prefaced by Rostand with some of his own verses. He died in Paris Dec. 2 1920. His two sons, Maurice and Jean, have produced various works, the former having published a volume of poems, *Le Page de la Vie* and *Le Cercueil de Cristal*, and the latter an important pamphlet on wealth.

ROSYTH (*see* 14.718).—The development of the German navy in the first years of the 20th century rendered it necessary to create a British naval base suitable for a fleet concentrated in the North Sea, and in 1903 it was decided to establish a first-class naval base at Rosyth on the Firth of Forth. Land was acquired and works were planned, but the development of possibilities of torpedo attack soon made it evident that the outer anchorage, as originally designed, would be insecure, and naval opinion became doubtful as to whether the base would be adequate. The plans of construction were, therefore, modified in 1908, but, up to the outbreak of war, Rosyth was regarded as the principal base and headquarters for the Grand Fleet, though it was decided that initial stations must be established at Cromarty (*see* CROMARTY) and Scapa Flow (*see* SCAPA FLOW). When the war began, Admiral Jellicoe preferred to establish his headquarters at Scapa Flow, but Rosyth was used as a secondary base, particularly for the battle cruisers.

The Firth of Forth had been selected, before the war, as the eastern terminus of a mid-Scotland canal which was to connect with the existing canal and follow its line for part of the way, and then crossing the low ground in the neighbourhood of Stirling, to enter Loch Lomond, and ultimately to reach the sea by a short canal from Balloch to a point near Dumbarton. The canal was projected not only for commercial purposes but also to enable warships to pass safely and rapidly from W. to E. and to make the great Clyde shipyards easily accessible from the naval base at Rosyth, and thus to avoid the necessity of constructing docks and repairing yards there. The project was again under consideration during the war, but it was obvious that it could not be accomplished in time, and Rosyth was developed as a great dock-yard.

The original scheme included a high-level main basin covering an area of 55 ac., with an entrance lock from the fairway, a dry or graving dock 750 ft. long and 110 ft. wide, a submarine tidal basin, the construction of an entrance channel, and the erection of workshops and offices, and work was begun in 1909. The whole site of the works has been reclaimed from the sea, and a great sea-wall was built to form the southern boundary of the docks, the number of which was increased from one to three. Great progress had been made by the outbreak of war, and it was anticipated that the works would be completed by the summer of 1916. Operations were pushed on vigorously during the war, and a special Act of Parliament was passed in 1915 to facilitate the provision of dwelling-houses for Admiralty employees. By the original Act for the construction of the base, the whole area between the town of Dunfermline and the land purchased by the Government was brought within the municipal area, which was thus extended from 2,016 to 7,730 acres. The erection of houses has involved the construction of new roads, and new water and sewerage schemes.

ROTHENSTEIN, WILLIAM (1872–), English artist, was born at Bradford, Yorks, Jan. 29 1872, and was educated at the Bradford grammar school. In 1888 he entered the Slade school, studying under Legros, and afterwards worked in Paris. In 1893 he began exhibiting at the New English Art Club. His paintings include "The Browning Readers" (1900), "The Doll's House" (1900), "Aliens at Prayer" (1904), "Jews Mourning" (1905), "Carrying the Law" (1910), "Morning at Benares" (1911), "Bourlon Church" (1919), and "The Last Phase: on the Rhine" (1919). Among his portraits may be mentioned those of Augustus John, Sir Francis Darwin (1905), Mr. Charles Booth (1908), Prof. Alfred Marshall (1908), Mr. Bernhard Berenson (1910), and Sir Rabindranath Tagore (1912); besides a portrait of himself (1900), now in the Metropolitan Museum, New York. His work is represented in many galleries, including the Dublin Gallery of Modern Art, the National Gallery, Melbourne, the National Portrait Gallery, Edinburgh, and the galleries of Bradford, Manchester and Johannesburg. He was in 1917 elected professor of civic art at the university of Sheffield. His published works include *Oxford Characters* (1896); *English Portraits* (1898); *The French Set, and Portraits of Verlaine* (1898); *Manchester Portraits* (1899); *Liber Juniorum* (1899); a *Life of Goya* (1900); *Plea for a Wider Use of Artists and Craftsmen* (1918); *Twenty-four Portraits* (1920).

His brother, ALBERT DANIEL RUTHERSTON (b. 1881), who took the name of Rutherston in place of that of Rothenstein in 1916, was born at Bradford Dec. 5 1881. He studied at the Slade school in 1898, and after 1901 exhibited regularly at the New English Art Club. He became well known as a theatrical designer of great taste and originality, his work including designs for *The Winter's Tale* (1912); G. B. Shaw's *Androcles and the Lion* (1913) and *Le Mariage Forcé* (1913). He also illustrated *The Children's Blue Bird* by Madame Maeterlinck (1913).

ROTHERMERE, HAROLD SIDNEY HARMSWORTH, 1ST VISCT. (1868–), British newspaper proprietor and financier, was the second son of Alfred Harmsworth, and brother of Visct. Northcliffe (*see* NORTHCLIFFE). He was born April 26 1868 at Hampstead, London, was created a baronet in 1910, Baron Rothermere in 1914, and Visct. Rothermere of Hemsted after his services as Air Minister, in 1918. He married in 1893 Mary Lilian, daughter of George Wade Share. At the age of 21 he entered the publishing firm in which his brother Alfred (afterwards Lord Northcliffe) was then the principal, soon after the date when *Answers* was launched. He assisted in developing the business on sound and economic lines, and for the next 20 years he was the close associate of his brother in all his great undertakings and shared in his triumphs. His administrative and financial skill admirably seconded Lord Northcliffe in working out his original schemes. He took an important part in the reorganization of the London *Evening News*, when his business talent helped to make that once insolvent newspaper a large profit-yielder. He was one of the three principals in the establishment of the *Daily Mail* (1896), for many years controlled the finance of that newspaper, and was largely responsible for developing its methods of distribution. He was equally active at the Amalgamated Press, the gigantic periodical publishing business which his brother had founded after the success of *Answers.* He founded the Glasgow *Daily Record*, bought the *Leeds Mercury*, and shared in the purchase of *The Times* (1908). He became known also as a most generous benefactor of charities. By the gift of a large sum he enabled the Union Jack Club to provide worthy accommodation for sailors and soldiers in London; and he gave £10,000 to the Territorial Force County of London Association. In 1910 he founded the King Edward chair of English literature at Cambridge, and in the same year he ceased his connexion with *The Times*, *Daily Mail*, and *Evening News.* In 1914 he acquired the *Daily Mirror* from Lord Northcliffe, and this henceforth became his special organ. In 1915 he founded the *Sunday Pictorial*, the first fully illustrated Sunday newspaper in London.

In the World War, Mr. Lloyd George, while Secretary for War, appointed Lord Rothermere in 1916 Director-General of the Royal Army Clothing Department. In the following year he accepted the office of Air Minister, under Mr. Lloyd George as Premier. He at once declared himself "whole-heartedly in favour of reprisals," which were the best means of carrying the war into Germany and protecting British towns against air attacks. Suffering from precarious health and his bereavements in the war, he resigned on April 25 1918, after he had carried out the fusion of the Royal Naval Air Force and Royal Flying Corps. "My second tragic loss in the war, ten weeks since," he wrote to the Prime Minister, "caused me great distress of mind and body . . . . I was suffering from ill-health and insomnia." Immediately after the war he began a most energetic campaign against extravagance in national and local finance, himself contributing numerous articles to his newspapers.

The tragic losses to which he referred were those of his two sons, Capt. Harold Alfred Vyvyan St. George Harmsworth, M.C. (b. Aug. 2 1894) and Lieut. Vere Sidney Tudor Harmsworth (b. Sept. 25 1895), both of whom, after showing exceptional promise in civil fields, served with extreme gallantry in battle and fell in the national cause. Harold, in the Irish Guards, was twice severely wounded in 1915, and was then given a staff appointment in England. This he insisted on resigning and returned to his battalion at the front. There in Bourlon Wood, on Nov. 27 1917, he received mortal wounds of which he died on Feb. 12 1918. In recording the grant of the M.C. for his conduct on that occasion the *London Gazette* stated: "He led his company forward under heavy fire and himself put out of action two enemy machine-guns. It was entirely due to his splendid example that his company reached their objective." In his memory Lord Rothermere founded and endowed the Harold Vyvyan chair of American history at Oxford University in June 1920. Vere, educated for the navy which he had to leave owing to gun-deafness, joined the Royal Naval Division immediately after the outbreak of war, took part in the expedition to Antwerp, and, when his battalion was driven across the frontier into Holland, made his escape from Dutch internment. He was in the terrific fighting at Gallipoli and in the battle of the Somme, having refused a staff appointment, like his brother, because he was determined to share the fortunes of his men. Twice wounded in the storming of Beaucourt on Nov. 13 1916, but still advancing and setting an example which, as his commander wrote, "thrilled with pride the men of his battalion," he was struck a third time by a shell and killed. In memory of him Lord Rothermere in 1919 established and endowed the chair of naval history at Cambridge which bears his name.

Lord Rothermere's third and only surviving son, Esmond Cecil (b. May 26 1898), who had served during the last part of the war in the Royal Marine Artillery, was in 1919 elected "anti-waste" M.P. for Thanet, and was then the youngest member of the House of Commons and the fifth of his family in Parliament. (H. W. W.)

ROTHSCHILD, NATHANIEL MAYER, 1ST BARON (1840–1915), Jewish financier, was born in London Nov. 8 1840, the son of Lionel Nathan de Rothschild, Austrian baron, head of the English branch of the famous financial family (*see* 23.758). He was educated at Trinity College, Cambridge, and in 1879 succeeded his father as Austrian baron. He sat in the House of Commons from 1865 to 1885 when he was created a peer by Mr. Gladstone, the first of his race and religion to be raised to the House of Lords. He was well known as an agriculturist as well as a financier, and he was renowned for his charities. He died in London March 31 1915.

His brother, LEOPOLD DE ROTHSCHILD (1845–1917), who had been throughout associated with him in the management of the financial house, succeeded him as its head and also took over most of his public offices, besides interesting himself especially in the Jewish community and becoming president of the United Synagogue. He was an art collector and owner of race-horses. He died at Ascott, Leighton Buzzard, May 29 1917.

ROUND, JOHN HORACE (1854–), English historian, only son of John Round, lord of the manor of West Bergholt in Essex, and through his mother grandson of Horace Smith, author of *Rejected Addresses*, was born at Brighton on Feb. 22 1854. He was educated privately, afterwards going to Balliol College, Oxford, where he took a first-class in modern history. The teaching of Dr. Stubbs, then Regius Professor of History, greatly stimulated the young student, whose independent and critical genius had already begun to revolt against the superficial methods of historical study traditional in the English schools, and after a few years he devoted himself to historical research. His own aim as a historian, as stated by himself, was "to add to or correct our knowledge of facts" (preface to *Feudal England*), and from the first he insisted that students of mediaeval history must go to the records in order to find evidence to supplement and check the chroniclers on whom historians of the type of Freeman had too exclusively relied. In 1883 he published in the *Antiquary* a criticism of Brewer's introduction to the *Book of Howth* (Rolls Series), in which he proved that the author was "strangely at fault" in his views on its authorship, its origin and its contents; and three years later, in his *Early Life of Anne Boleyn*, he again pointed out errors "on the simplest matters of fact" made by the same eminent scholar. In 1884–5 he published in a magazine articles on "The Origins of the House of Lords" (reprinted in *Peerage and Pedigree*, 1910), in which he argued for "that feudal origin of the House which, in view of the teaching of Freeman and Stubbs, it was, at that time, heresy to assert." In 1888 appeared his edition of *Ancient Charters, Royal and Private, prior to 1200* (Pipe Roll Soc. vol. x.), in the preface to which he pointed out their use for genealogy, topography, legal and ecclesiastical antiquities, etc. In 1891 appeared his *Introduction of Knight-service into England* (privately printed, reprinted in *Feudal England*, 1895), in which he proved the entirely Norman and feudal origin of this institution (*see* the article by Round in the *E.B.* 15.867).

In 1892 he published in the *Quarterly Review* (vol. 175, No. 349) his famous attack on Freeman's historical method. He accused him of working as a historian "not from manuscripts, but from printed books," and pointed out "the danger to our national school of history in the wide-spread and almost superstitious belief in his unimpeachable authority." This authority he proceeded to assail, centring his attack on that "palisade" of solid timber which, in his *Norman Conquest*, Freeman had imaginatively built round the English host at "Senlac," and proving that this palisade had as little existence as "Senlac" itself (*see E.B.* 13.59 note). Round had begun openly to attack Freeman as early as 1882, but the fact that the *Quarterly* article, though written before Freeman's death, did not appear till afterwards excited unjust comment, and blinded the dead historian's friends to the convincing force of the criticism itself. The long and bitter controversy that followed was summed up by Round in "Mr. Freeman and the Battle of Hastings" in *Feudal England*. In 1892 also appeared *Geoffrey de Mandeville*, a study of the anarchy under Stephen, which established the author's reputation as a constructive historian. In *Feudal England*, which appeared in 1895, Round published in collected form some of the results of his researches into the history of the 11th and 12th centuries, the first part of the book setting forth views as revolutionary on the Domesday side and the whole system of land assessment as on the actual introduction of the feudal system into England. In 1899 was published his *Calendar of Documents preserved in France illustrative of the history of Great Britain and Ireland*, vol. i., pp. 918–1206, and also another collected series of studies under the title of *The Commune of London*. In the following year he published his *Studies in Peerage and Family History*, and at the Congress of Archaeological Studies he read a paper (subsequently published) on "the systematic study of our English place-names," in which he again pointed out the impossibility of accomplishing any scientific work in the department of research until the place-names of England had been classified and traced to their origins.

Round's vast and detailed knowledge of the periods which he had made his own led to his opinion being sought by successive law officers of the Crown charged with the conduct of peerage cases brought before the House of Lords. His attention was thus drawn to peerage law, and he soon discovered that there "was room for its treatment on fresh and historical lines." In 1910 he published *Peerage and Pedigree*, containing studies on peerage law and its problems, in which incidentally he attacked "the muddle of the law," pointing out that the lawyer, whose vision is bounded by his "books," is still in the Middle Ages, while the historian is a man of science. Although the labour involved in these peerage cases was immense, Round refused to accept any remuneration; in 1912, however, his services were publicly recognized by the creation in his favour of the new office of Honorary Adviser to the Crown in Peerage Cases. His passion for historic truth led him to wage ruthless war on the "pedigree-mongers," whom he attacked with mordant wit (see, *e.g.* in *Peerage and Pedigree*, "Some 'Saxon' Houses," "The Great Carington Imposture"), and on those who were attempting to give a false value to the possession of coats-of-arms (*ibid.* "Heraldry and the Gent"). Occasionally he extended the range of his attacks, falling, for instance, upon those who, consciously or unconsciously, falsified history in the interests of particular political or religious opinions (*e.g.* "The Elizabethan Religion, in correction of Mr. George Russell," *Nineteenth Century*, vol. xli., p. 191).

History on a large scale Round never attempted. His books are all collections of particular studies, and they represent but a tithe of his published work. He edited, with prefaces, a whole series of the Pipe Rolls; he was a frequent contributor to the *English Historical Review;* he helped to edit the *Ancestor*, for which he also wrote; and innumerable papers by him are scattered in various historical and archaeological journals and reviews. In 1913 he had begun to prepare a catalogue of these scattered works, but in 1921 this had not yet been published. Round's historical method—reaching conclusions by induction from isolated facts whose connexion he had in turn to prove—prevented his becoming a popular writer; but his style is always luminously clear, and the articles contributed by him to this Encyclopaedia (Domesday, Knight Service, Baron, Baronet, Earl, Bayeux Tapestry, Scutage, the families of Fitzgerald and Neville, etc.) are excellent examples of his capacity for concise statement. (W. A. P.)

ROUVIER, MAURICE (1842–1911), French statesman (*see* 23.781), died at Reuilly-sur-Seine June 7 1911.

ROVNO, BATTLE OF.—The Rovno operations played an important part in the Russian campaign of 1915 on the eastern front (*see* Eastern European Front Campaigns).

In consideration of Austro-Hungarian troops having been set free by the rally of Mackensen's group of armies in their victorious march on Brest Litovsk, and of the connexion between the Russian N.W. and S.W. fronts having been broken by the withdrawal of the former N. of the Polyesie, the Austro-Hungarian army Higher Command decided, on Aug. 27 1915, to take the offensive with the army front which had been inactive on the Zlota Lipa and the Bug. The objects in view were Rovno (Rowne) and the liberation of the east portion of East Galicia.

The S. wing of the II. Army under Böhm-Ermolli, and the N. wing of the Southern Army under Bothmer, made a successful attempt to break through Shtcherbachev's XI. Army in the battle at Gologory and on the Zlota Lipa. Bothmer's S. wing and the N. wing of the VII. Army engaged Lechitski's IX. Army; Puhallo advanced with the main body of the I. Army towards the bent back N. wing of Brussilov's VIII. Army to throw it back on Dubno; and Field-Marshal Roth-Limanowa pushed forward on the Kovel (Kowel)–Luck road in order to capture from the Russians the command of the northern flank. Puhallo's advance decided Ivanov to break off the battles and to withdraw Brussilov during the night, and Shtcherbachev and Lechitski's N. wing on the 28th and 29th to a position behind the Sierna, on the watershed between the Bug and the Styr, on the Zloczów heights and behind the Strypa. The S. wing and centre of the Austro-Hungarian front followed immediately in pursuit, and in consequence two battles developed, after the occupation of the Russian position: one, on the 30th on the Strypa, from whose bridgeheads Shtcherbachev and Lechitski delivered mighty blows against Bothmer's S. wing and Pflanzer-Baltin's N. wing; the other, on the 29th at Zloczów, where Böhm-Ermolli attempted to break through.

Puhallo only arrived before Brussilov's front on the 29th and had to put off attacking until the 31st. Roth, having encountered opposition at Rozyszcze on the 29th, had advanced with the main body across the Styr at Sokul, and that day began a forced march towards Luck. The XXXIX. Corps, brought up by train, flung itself upon him but was defeated on the 30th.

Ivanov made Brussilov withdraw in the night behind the Putilowka and go into position at Olyka, Mlynow, Kozin and the source of the Ikwa. Luck was surrendered. Shtcherbachev held the Zloczów heights until the morning of Sept. 1, although he was surrounded on the N. and his front was broken through in places. He then retired to the position Radziwillow–Podkamien–Zalozce.

Lechitski was still holding out on the 1st, in spite of the failure of his counter-assaults, and Pflanzer-Baltin therefore delivered an assault with his group, established N. of the Dniester close to the mouth of the Sereth. During the night the Russians fell back on to the strongly fortified Sereth position, which was provided with several bridgeheads.

Ivanov hoped that his N. wing, which had been bent back a long way and was difficult to envelop owing to the adjacent marsh area, and had, further, been reinforced by fortress artillery from Rovno, would be able with the aid of flank attacks from the region of dense forests and impassable swamps known as Polyesie ("the Woods") to hold out until the S. wing, opposed by far weaker forces, should have lifted the whole front off its hinges by a victorious assault.

The Austro-Hungarian army Higher Command arranged for the N. wing, now divided into two armies under Archduke Joseph Ferdinand, to deliver a decisive blow by means of assaults on Rovno and Dubno; for Böhm-Ermolli to break through in the centre of the Russian front; and for Bothmer and Pflanzer-Baltin to contain the Russian forces by an attack on the Sereth position. Lechitski wanted to employ the time until his N. and Shtcherbachev's S. wing should be ready, by removing the threat to his flank offered by Pflanzer-Baltin's troops, who had advanced on both sides of the Lower Sereth. These battles on the 4th and 5th, combined with a simultaneous attack on the Bukovina, failed in their object.

While Bothmer was grouping his army for a break-through S. of Tarnopol, and Pflanzer-Baltin's N. wing was waiting to attack simultaneously with him on the 7th, the Russians, on the afternoon of the 6th, opened the battle of the Sereth (the battle of Tarnopol) with a great mass assault from the Trembowla area. On the same day Böhm-Ermolli finished the battle at Podkamien, begun on the 2nd, with a victory that resulted in Shtcherbachev's N. wing retiring as far as Butyn on the Goryn, while Brussilov's S. wing, abandoning Dubno, fell back behind the Middle Ikwa.

Archduke Joseph Ferdinand's I. and IV. Armies, which had come up in front of the Russian positions on the 2nd, defended themselves against numerous counter-assaults, by which Brussilov was trying to prevent the diversion of troops to the N.

wing. The pressure on the flank from Polyesie grew, and it became imperative to bring up all cavalry divisions within reach. These became entangled in difficult minor combats in the midst of forest and marsh. On Sept. 8 Archduke Joseph Ferdinand delivered at Cuman the blow which decided the battle of Olyka. Brussilov escaped by retreating behind the Stubla.

These successes barred the advance of the Sereth front, which by 7 P.M. had forced back Bothmer's and Pflanzer-Baltin's inner wings as far as the Strypa. Böhm-Ermolli's S. wing executed a relief attack E. of the Sereth towards Zbaraz. Ivanov, in his anxiety for his N. wing, ordered the S. wing reserve to be diverted and sent to its relief. This wing was for the moment endeavouring to cover the flanks of the attack-group which had advanced a great distance, but could overpower neither Bothmer's N. wing in the direction of Tarnopol nor the troops in the foreground of the Zaleszczyki bridgehead. On the 10th the Archduke Joseph Ferdinand began the battle of the Stubla, which he hoped to bring to a decision by sending the N. wing to cross the Goryn below the mouth of the Stubla, and then make an advance on Rovno simultaneously with that of Puhallo's army coming from Dubno. By the 12th the road to the Goryn had been made clear, one division brought across the river, and the groups which threatened the N. wing driven back a considerable distance.

The arrival of Russian reinforcements opposite to Böhm-Ermolli's sparsely occupied front, as well as the arming for a continuation of the Sereth front's advance, showed that Ivanov was planning a great offensive on both sides of the Tarnopol–Lemberg line. The Austro-Hungarian army Higher Command stopped Puhallo's advance, drew back Bothmer's N. wing to the level of the Strypa front and dispatched thither the VI. Corps which had been intended for use against Serbia.

On the 13th the counter-offensive set in with the battle of Krzemieniec-Gontowa, and won some initial successes. The N. wing's attack was now also stopped. On the 14th the Russians broke through the Strypa front and reached the W. bank. The VI. Corp's attack, together with an advance by Bothmer's N. wing and a group of Böhm-Ermolli's posted W. of the Sereth on the N. flank, caused the Russians to retire again in the night of the 16th-17th to their Sereth position. During this time Böhm-Ermolli had repulsed the assault, and used the reënforcements sent by the Archduke for an attack. But a calamity had overtaken the N. wing. Keeping the attention of the weakened group of armies on the Stubla cleverly riveted, Brussilov with the XXX. Corps on the 15th threw back the N. wing behind the Putilowka and forced the Archduke, by continuous envelopment, to retreat behind the Styr and the Ikwa on the evening of the 17th. The bridgehead at Luck could not hold out, and on the 23rd the Russians stood on the E. bank of the river. On the same day Shtcherbachev and Brussilov's S. wing advanced to the attack on the II. Army and Puhallo's I. Army, now under command of Böhm-Ermolli, from the Upper Sereth to the mouth of the Ikwa. This second battle of Krzemieniec ended on the 25th with the failure of the Russians. At the same time Brussilov received the news that German troops had taken part in the storming of the bridgehead at Kolki on the Styr. Recognizing the intentions of the allies, he at once ordered a retreat to the Putilowka position, while concentrating a powerful group to the N. of the Kormin brook to fall on the enemy's flank.

Linsingen, the new commander of the IV. Army and of the troops in Polyesie, was in fact planning a blow on the Russian flank and rear by way of Kolki-Sokul, using for this purpose the German XXIV. Reserve Corps (brought up from the German front through Polyesie after Gyllenschmidt's forced retreat behind the Wiesiolucha and the Styr) and the Austro-Hungarian XVII. Corps which was to have been sent against Serbia. Gerok's group, the XXIV. Reserve and the XVII. Corps, had now to do with nothing but rearguards, who by the 27th had been overthrown. On the 28th, when Shtcherbachev at the battle of Nowo Aleksiniec again attacked Böhm-Ermolli in order to keep his forces engaged, the main body of the N. wing arrived at the Putilowka. Linsingen guessed Brussilov's scheme, made Gerok wheel to the N.E., and intercepted the Russian blow. The allies' decision to grant the much-exhausted troops some rest in a permanent position brought the battle of the Putilowka to an end on the evening of the 30th.

The Russian command refused to be satisfied with this close to a campaign which had not brought them much gratification. On Oct. 3 Gyllenschmidt delivered a flank blow from Rafalowka, W. of the Styr, but was driven completely back by the 6th. The attack against Serbia was a spur to renewed exertions. On the 6th a fresh battle set in on the Putilowka, which on the 7th spread over the whole front up to the Rumanian frontier, lasting until the 10th—until the 13th on the Strypa—without a change in the situation. On the 15th Ivanov once more delivered a blow on the N. flank in the bend of the Styr at Czartorysk, which at first made great progress. But Linsingen's clever concentric placing of the hurriedly brought-up reinforcements drove the Russians back with heavy fighting behind the Styr by Nov. 14. During the crisis Shtcherbachev had attacked the II. Army in vain from Oct. 21 to 23 in the second battle of Nowo Aleksiniec. More dangerous still were the Russian attempts to break through on the Strypa from Oct. 30 to Nov. 8, which culminated in the struggle for the village of Siemikowce. Finally in the middle of Nov. a prolonged lull fell upon this theatre of war. (M. H.)

ROWELL, NEWTON WESLEY (1867–), Canadian politician, was born Nov. 1 1867 in Middlesex county, Ontario. He was called to the bar in 1891, and became head of the law firm of Rowell, Reid, Wood & Wright, Toronto; ultimately being made bencher of the Law Society of Upper Canada in 1911. He stood unsuccessfully as a Liberal for the Dominion Parliament at the general election of 1900, but in 1911 was elected to the Ontario Legislative Assembly for N. Oxford. From 1911–7 he was leader of the Liberal Opposition in the Ontario Legislature. On Oct. 1917 he entered the Federal Unionist Government as president of the council and vice-chairman of the War Committee of the Cabinet, and was elected to the Dominion House of Commons for Durham county, Ontario, Dec. 1917. He was a member of the Imperial War Cabinet and Imperial War Conference, 1918; Canadian Government representative at the International Labour Conference at Washington, 1919; and a Canadian delegate to the first assembly of the League of Nations at Geneva, 1920. He resigned his seat in Parliament in May 1921.

ROWING: *see* SPORTS AND GAMES.

ROYCE, JOSIAH (1855–1916), American philosopher, was born at Grass Valley, Cal., Nov. 20 1855. He graduated from the university of California in 1875 and the following year went to the newly established Johns Hopkins University, being one of the extraordinary first group of fellows elected there. After receiving his Ph.D. in 1878 he was instructor in English literature and logic for four years at the university of California. In 1881 he prepared *A Primer of Logical Analysis* for students of English composition. In 1882 he was called to Harvard where he taught as instructor in philosophy, assistant professor (1885–92), professor of the history of philosophy (1892–1914) and Alford professor of religion, moral philosophy, and civil polity (after 1914). He was the leading American exponent of idealism (*see* 14.284) and his works were distinguished for their literary qualities. He was made a member of the National Institute of Arts and Letters, and received hon. degrees from Harvard, Yale, Johns Hopkins, Aberdeen, St. Andrews and Oxford. After the outbreak of the World War he was a staunch supporter of the Allies, and on Jan. 30 1916, in a notable address delivered in Tremont Temple, Boston, advocated a breach with Germany. He died in Cambridge, Mass., Sept. 14 1916.

He was the author of *The Religious Aspects of Philosophy* (1885); *California* (1886, in the American Commonwealth Series); *The Feud of Oakfield Creek* (1887, a novel); *The Spirit of Modern Philosophy* (1892); *The Conception of God* (1895); *Studies of Good and Evil* (1898); *The World and the Individual* (2 vols., 1900–1, Gifford Lectures at the university of Aberdeen); *The Conception of Immortality* (1900); *Outlines of Psychology* (1903); *Herbert Spencer: An Estimate and Review* (1904); *The Philosophy of Loyalty* (1908); *Race Questions, Provincialism and Other American Problems* (1908);

William James and Other Essays on the Philosophy of Life (1911); *Bross Lectures on the Sources of Religious Insight* (1912); *The Problem of Christianity* (2 vols., 1913, lectures before Manchester College, Oxford); *War and Insurance* (1914); *The Hope of the Great Community* (1916, war addresses) and the posthumously published *Lectures on Modern Idealism* (1919).

ROYDEN, AGNES MAUDE (1876–), English social worker and preacher, was born at Mossley Hill, Liverpool, Nov. 23 1876, the daughter of Sir Thomas Royden, 1st Bart., of Frankby Hall, Birkenhead. She was educated at Cheltenham Ladies' College and Lady Margaret Hall, Oxford, and afterwards for some years did settlement work in Liverpool. She also lectured on English literature for the university extension movement, and in 1909 was elected to the executive committee of the N.U.W.S.S. From 1912 to 1914 she edited the *Common Cause*, the organ of the union. Miss Royden became well known as a speaker on social and religious subjects, and in 1917 became assistant preacher at the City Temple, being thus the first woman to occupy this office.

RUBBER (*see* 23.795*).—Since 1910 the rubber industry has developed very largely and taken increased importance in the commercial world. The word rubber is applied to three different substances: (*a*) an elastic solid, the chief constituent of the coagulated latex or milk of a great variety of trees, shrubs, vines and plants, as Pará rubber; (*b*) an elastic solid found in solution in the tissues of a few shrubs and vines, as Guayule rubber; (*c*) a chemical product from isoprene or homologous hydrocarbons, as synthetic rubber. In all commercial rubber caoutchouc exists in two forms, one fibrous or hard, the other viscous and soft. In the best trades the fibrous form preponderates. The soft form can be dissolved by benzol and many other substances of that class; the fibrous form swells but does not dissolve. Vulcanization (the chemical union of caoutchouc and sulphur) hardens the viscous portion. As the result of this process the rubber becomes less sensitive to heat and cold and to the effect of acids and alkalies and becomes more durable. A small amount of sulphur in rubber produces soft rubber. By using more sulphur and greater heat a very hard black substance called hard rubber is obtained. Moulding India rubber consists of softening by heat the stiff rubber dough until it is plastic, pressing it into a mould and vulcanizing it at a heat much less than that required to melt it; not in melting, pouring and casting according to popular misconception. Rubber once melted remains a sticky, worthless semi-fluid.

Wild Rubber.—At first there were but three types of rubber to be found in the world's markets: India rubber, the product of the *Ficus elastica* from Assam, Burma and Java; gum elastic, the product of the *Hevea brasiliensis* from S. America, and "virgin gum" from the *Castilloa elastica* of Central America. In 1921 all grades from whatever source were termed India rubber, and there were some 200 sorts. They were divided generally as follows: (1) S. American rubber, from the *Hevea brasiliensis* and kindred species which comprised Pará rubber in 3 general grades and 20 sub-grades; Caerá rubber (Maniçoba) from the *Manihot glaziovii* and kindred species, 6 grades; Mangabeira from the *Hancornia speciosa*, 2 grades; and Caucho rubber from the *Castilloa ulei*, 3 grades. (2) Central American rubber, known as "centrals," the product of *Castilloa elastica* and kindred species, some 25 grades; virgin rubber, the product of the *Sapium tolimense* and kindred species, 3 grades; Guayule rubber, from the *Parthenium argentatum*, 12 grades. (3) African rubber, a lower grade of wild rubber, produced by a great variety of vines of the *Landolphia* genus and to a degree from trees, as the *Ficus vogelii* and the *Funtumia elastica*. The number of grades was 120. (4) E. Indian rubber, the product chiefly of the *Ficus elastica* from Rangoon, Penang and Java, 9 grades; together with Borneo rubber from the *Willoughbia firma*, 3 grades; Pontianak (Jelutong), from the *Dyera costulata*, 4 grades. (5) Plantation rubber. From 1860 attempts to cultivate rubber-bearing trees and vines have been undertaken in various parts of the tropical world. The most persistent and finally the most successful were carried on in the British experiment stations and Royal botanic gardens, especially in Ceylon and the Straits Settlements. A measure of success was attained in cultivating the *Manihot glaziovii*, the *Castilloa elastica*, the *Ficus elastica* and the *Funtumia elastica*. All of them proved to be good rubber-producers but could be tapped only at intervals of several months. The product found ready sale, and considerable plantations of *Manihot* in Ceylon, and *Ficus* and *Castilloa* in the Federated Malay States were installed. American interests also planted thousands of acres of *Castilloa* in Mexico, Nicaragua and Guatemala. Experiments with another tree, however, the *Hevea brasiliensis*, developed the fact that through what was termed "wound response" it could be tapped daily without injury. This process in brief was the opening of the tapping cut by the removal daily of a thin shaving of the bark. The amount from each tapping was small, but the year's product far exceeded that of the planted trees of any other sort. The result was that most of the others were abandoned or destroyed and the *Hevea brasiliensis* put in wherever it could possibly thrive. Thus the *Hevea* plantation product, which in 1900 was four tons, increased to 8,400 tons in 1910, and from then on the increase was very large, as shown in the table below.

Hevea Plantation Acreage and Production.

	Plantation Acreage	Plantation Production (tons)	Total Wild Rubber Production (tons)	Total World's Production (tons)
1910	1,122,550	8,200	62,300	70,500
1911	1,505,350	14,419	60,730	75,149
1912	1,817,350	28,518	70,410	98,928
1913	2,021,750	47,618	60,822	108,440
1914	2,181,050	71,000	49,000	120,380
1915	2,293,750	107,867	50,835	158,702
1916	2,458,950	152,650	48,948	201,598
1917	2,611,350	213,070	52,628	265,698
1918	2,759,950	255,950	40,629	296,579
1919	2,900,000	285,225	41,775	327,000
1920[1]	3,200,000	320,000	40,000	360,000

[1] Estimated.

Distribution of the World's Rubber Production (Gross Tons).

Country	1912	1913	1914	1915	1916	1917	1918	1919	1920
United States	45,928	46,400	61,240	96,792	116,495	177,088	142,772	236,977	235,000
Great Britain	14,500	18,640	18,000	15,072	26,760	25,983	30,104	42,520	56,572
France	10,000	6,500	5,000	10,770	14,000	17,000	18,000	22,000	14,500
Italy	1,000	2,000	4,000	6,500	9,000	9,000	9,800	14,000	7,000
Russia	9,000	9,000	11,610	10,000	7,500	7,500	2,000	1,500	300
Canada	1,500	1,600	1,700	4,500	4,000	6,281	8,300	9,500	11,000
Scandinavia	—	1,500	2,400	6,568	4,525	5,323	5,000	7,000	7,700
Japan and Australia	1,000	1,300	2,400	2,500	4,500	4,500	7,490	12,000	6,000
Germany and Austria	16,000	18,500	13,400	6,000	3,000	3,000	1,000	4,000	9,300
Belgium	—	3,000	630	—	—	—	—	5,000	3,500
Total	98,928	108,440	120,380	158,702	189,780	255,675	224,376	354,497	350,872

Approximate World Consumption of Rubber, 1920.

United States	260,000 tons
Great Britain and Colonies	50,000 "
France	20,000 "
Italy	10,000 "
Japan	8,000 "
Other Countries	16,000 "
Total	364,000 tons

Synthetic Rubber.—From the time when India rubber began to be important in the arts, its synthetic production was the dream of the inventor. Analysis of rubber with a view to ultimate synthesis was made between 1835 and 1840 by Dalton, Liebig, Himly, A. Bouchardat and Gregory. A more systematic attempt to isolate and examine the products in crude caoutchouc distillate was made in 1860 by Greville Williams, the English chemist. He obtained isoprene, C_5H_8, a hemiterpene, a fluid boiling at 37° C., and a hydrocarbon now known as dipentine, boiling at 170 to 173° C., which he named "heveene." An important step towards the production of artificial rubber was that taken by Gustave Bouchardat of the Paris School of Pharmacy in 1879, when, in studying the action of hydrochloric acid on isoprene, he noted the formation of a substance having the same percentage composition as isoprene, lacking chlorine, possessing elasticity, insoluble in alcohol but soluble in ether and carbon bisulphide like natural rubber, and yielding on distillation the same hydrocarbon as caoutchouc. Sir William Tilden, the English chemist, in 1882 observed the polymerization of isoprene and that it could be converted into true caoutchouc with certain chemical reagents. In 1884 he obtained isoprene by passing the vapours of turpentine through a hot tube. In 1887 Prof. Otto Wallach of the university of Göttingen noted that isoprene undergoes polymerization on exposure to light with the production of a rubber-like mass, and Tilden in 1892 showed that such material could be vulcanized with sulphur. The synthesis of isoprene and, as a consequence, that of caoutchouc, was accomplished in 1897 by Prof. Euler-Chelpin of the university of Stockholm. In 1909, due to the rapidly mounting cost of natural rubber, greater efforts were made to produce the artificial kind on a commercial scale, the problem being attacked in England by W. H. Perkin, his assistant Weizmann, and Francis Matthews; by August Fernbach in France; and in Germany by the Bayer and Badische companies. In 1884 Tilden suggested that not only isoprene but its homologues should be capable of similar polymerization. Now these bodies, chief among them butadiene, form the basis of methods for obtaining synthetic caoutchoucs. Dr. Fritz Hofmann and Dr. Carl Coutelle, chemists in Germany, in 1909 devised a process for making absolutely pure isoprene, converted it into rubber by heating it in a closed tube or in the presence of other substances, and sent the sample to Prof. C. D. Harries, of Kiel University, who pronounced it true rubber. In 1910 Prof. Harries showed that isoprene could be converted into rubber by heating it in a closed tube with glacial acetic acid. He had in 1905 determined the chemical constitution of natural rubber. The German scientists did not confine themselves to isoprene but experimented successfully with the homologous hydrocarbons suggested by Tilden. Harries and the English investigators, Matthews and E. Halford Strange, noted independently that polymerization proceeds at great velocity in the presence of metallic sodium and the resulting rubber differs much in its properties from that produced by mere heating. German chemists observed different results when polymerization by sodium was carried on in an atmosphere of carbonic acid. A later process in Germany was based on the use of ozonizers on sodium hydrogen peroxide as catalysers. Some of the synthetic rubbers are soluble, elastic, and may be readily vulcanized; others possess only some of these qualities. They are obtained from butanes, dimethylbutanes, and from isoprene, and in each of the three classes are to be found standard ozonide, carbonic acid and sodium rubbers.

Despite this wide range of materials with their possible use in the arts, the making of synthetic rubber is still a minor industry as compared with the production of natural rubber and the manufacture of goods therefrom. In the manufacture of the hydrocarbons of the isoprene series for synthetic rubber there are such large quantities of by-products that their removal or utilization presents a problem more difficult than the production of the artificial rubber; hence competition with natural rubber is very unlikely. Synthetic rubbers lack the durability of natural rubber, possibly because they lack the resins, albumen, etc., which act as protective colloids to lessen the vulnerability of the natural article. Then, too, for a wide range of needs, synthetic rubbers cannot be substituted for natural rubber because the latter product is a uniform vegetable substance, not a mixture like the artificial product. While synthetic rubber must be greeted as a chemical triumph, it is not an industrial success, and must still be classed commercially with the more or less haphazard production of alleged rubber substitutes prepared, often by honest inventors and manufacturers, from oils, gums, cellulose, or in fact anything that will produce a waterproof plastic.

Reclaimed Rubber.—In few other industries is conservation such an important factor as in rubber manufacture. Nearly all kinds of worn-out vulcanized goods are collected and the basic material recovered to be compounded, manufactured and vulcanized again into new articles that compare favourably with those made from new gum. To so many uses is devulcanized or reclaimed rubber now put, that its annual consumption fully equals that of new crude gum. Experiments early demonstrated the value of "reclaim," and while the more conservative long looked askance at the utilization of "refuse rubber," buyers of goods made wholly or in part from the regenerated material found that for most purposes the goods were practically as serviceable as those made directly from fresh gum. The element of cost, too, played an important part in popularizing reclaimed rubber, as articles made of it could be produced and sold for much less than those made with new gum only, and to a considerable degree the price of the crude gum has been kept from rising too high by the ample supply of the reclaimed. As the advantages of reclaimed rubber became better appreciated, and as through the activities of rubber chemists and manufacturers the quality of the product was improved, it became an important factor in the industry. To meet more satisfactorily the fast-growing demand, large companies with world-wide connexions and specialized equipment soon supplanted the small reclaimers. Such concerns employ not only the most modern machinery but also maintain research and analytic laboratories for control of the processes, for standardizing the products, and for the study of reclaiming and compounding problems.

The first attempt to reclaim rubber commercially was that made in the early 'fifties when Hiram L. Hall, the pioneer manufacturer in Massachusetts, boiled powdered vulcanized rubber in water and then sheeted it. Francis Baschnagel, an early American experimenter, next patented a method for devulcanizing rubber, finely ground, by exposing it to live steam. An important later development was the destruction of fibre in the ground material by means of acids, chiefly sulphuric, for which processes over 50 patents were granted, which incidentally became the subject of much litigation. The acid process was of use chiefly in the reclaiming of worn-out footwear or "dry heat" goods, but was not of great value in recovering other waste. The alkali process, patented by Arthur Hudson Marks, an American manufacturer, solved the latter problem. In this, caustic soda was used to destroy the fabric and incidentally it proved to be the most effective agent in desulphurizing the mass. The entire removal of not only the free sulphur from vulcanized rubber (which modern reclaiming accomplishes) but also of the sulphur which during curing unites chemically with the crude rubber, is the goal towards which experimenters were striving in 1921. Notable progress in this direction had been made in England by Dr. David Spence, who used an accelerator, aniline-potassium, but in solution in excess of aniline. He claimed not only the dissolution of the waste rubber but the liberation in soft rubber of from 78% to 90% of the combined sulphur, and the changing of the latter into an insoluble alkaline sulphide. In hard rubber 73% of the combined sulphur was said to be similarly reduced.

Vulcanization, or curing, is effected generally by either the heat cure or the cold cure. In the first-named method either steam or heated air is employed. A wide range of rubber goods, either in moulds wrapped with strips of cloth, or imbedded in pans of French talc to preserve their shape, is very efficiently cured with live steam in various types of vulcanizers. For many other needs the dry-heat cure, in which the goods are placed in a hot compartment without either wrapping or mould protection, has been found serviceable. Still another heat cure, now but little used, is that of solarization, whereby the fabrics, coated with a thin skin of rubber, are exposed to the sun's rays for vulcanization. In very exacting work, such as the vulcanizing of hard-rubber sheets, curing is effected by immersion of the material in hot water. In the cold cure either the acid or the vapour process is employed. In the former, goods are dipped in solution of chloride of sulphur dissolved in bisulphide of carbon, after which they are given an alkali wash. For the vapour cure, rubber goods are suspended in a heated compartment in which the fumes of chloride of sulphur pass freely over the surfaces to be vulcanized. Over-curing is checked by the admission of ammonia fumes.

Since Charles Goodyear (*see* 12.240) in 1839 discovered, and in 1844 patented, his process for vulcanizing rubber with sulphur by means of heat, numerous attempts have been made radically to improve on his method and material; but the bulk of the rubber goods produced is still cured by the sulphur and heat method. In the long train of experiments, many of which have led to important results, the curing of rubber has been effected by the use of sulphates, sulphides, chlorides, nitrates, fluorides, bromides, iodides and phosphorets of nearly all the common earths and metals, as well as chlorine, sulphurous acid and various gases. The Russian chemist Ivan Ostromislensky, in later experiments, succeeded in vulcanizing rubber with trinitrobenzene and other nitro-compounds so as to impart all the qualities given it by sulphur, effecting the curing more rapidly than with sulphur, and with but one-twelfth of the material, while a lower temperature was maintained during the cure. Victor Henry, a French chemist, also reported in 1909–10 that he had effected the vulcanization of thin layers of rubber solutions by means of the ultra-violet rays, and others have made similar researches along the same line that have much scientific if not practical interest. The period of vulcanizing ranges from a few minutes to many hours, depending on the degree of heat employed, the nature of the compound, the thickness of the goods, etc. Factors which affect the rate of cure, as shown in England by Dr. Philip Schidrowitz, are the amount of protein or nitrogen in the crude gum, its stay in storage, its density, the amount of smoke, formalin or other preservatives used, quantity of acid used in coagulating the latex, time in drying, age of latex-yielding tree, etc. An important vulcanization development is the chemical process of vulcanization described by S. J. Peachey, the English chemist, in 1918, after an investigation of the behaviour of rubber towards the various allotropic forms of sulphur. Unlike the Parkes process, which yields an addition-product of both sulphur and chlorine, this leads to the formation without the aid of heat of a sulphur addition equal to that produced by the hot-curing process. By it rubber, alone or compounded with fillers and pigments, is exposed successively to the action of two gases, sulphur dioxide and hydrogen sulphide. Diffusing through the rubber and interacting, the gases produce an especially active form of sulphur capable of combining with and vulcanizing the rubber at the ordinary temperature, and more thoroughly than by either the hot process or the sulphur-chloride cure. A density is acquired, it is said, unattainable by the older methods. The dual gas treatment can be used either for rubber in its original solid form or liquefied with a solvent. In the latter case the gases effect a complete pectization of the solution, forming a jelly which, on evaporating the solvent, is found to be fully vulcanized rubber. One of the advantages claimed is that fabrics, as well as organic fillers such as leather waste, sawdust, woodmeal, etc., that would be more or less decomposed by the hot cure or the sulphur-chloride cure, could be used with rubber for a wide variety of new and useful purposes, as in the making of fine or heavy reformed leathers, linoleums, etc. It may also effect a considerable improvement in the waterproofing of cloth. Rubber footwear, it is said, may be produced by the new process without either the heat or pressure hitherto deemed essential, and without special machines for stitching and riveting, thus greatly cheapening the product. An additional advantage pointed out is that this process makes it possible to use both natural and coal-tar colouring-matter in rubber, so as to obtain both deep shades and delicate tints impossible with the old methods of vulcanizing.

Organic Accelerators in Vulcanization.—The recent discoveries of Dr. Spence and others that certain organic substances, termed accelerators or catalysers, mixed with rubber, notably hastened the process of vulcanization, have caused a revolution in compounding and vulcanizing. Mineral or inorganic catalysers, such as litharge and magnesia, had been in use since the discovery of vulcanization. The organic type was, however, unknown until in attempts to vulcanize synthetic rubber it was found necessary to add organic accelerators to effect the union of sulphur and the rubber-like substance. It was but a short step to their use in connexion with natural rubber, and the results were surprising. In fact, the time required in vulcanization was reduced by one-half, thus doubling the vulcanizing output without extra heat or pressure. The theory of catalytic action, according to M. André Dubosc, an eminent French chemist, is explained as follows. He found that when a typical organic accelerator derived from an amine, such as hexamethylene tetramine, was mixed with sulphur, placed in a sealed tube, and heated to 135°–145° C., not only carbon sulphide or hydrosulphuric acid but also sulphocyanic acid was evolved. At the vulcanization temperature, sulphocyanic acid separated, yielding hexavalent sulphur and cyanhydric acid. While the same temperature was maintained, this acid combined in the presence of ordinary divalent sulphur, producing unstable sulphocyanic acid which by dissociation again furnished hexavalent sulphur. M. Dubosc holds that cyanhydric acid is the true active agent in such catalysis, the practical effect of which is the transformation of ordinary divalent sulphur into hexavalent sulphur. Assuming that vulcanization is the saturation by sulphur of a double bond in the rubber molecule, then by saturation of two such bonds the speed of the reaction between sulphur and rubber should be doubled, and by saturation of three bonds the speed would be tripled. Saturation is accomplished with hexavalent sulphur generated during vulcanization through catalysing action of cyanhydric acid, evidently the true accelerator, and corresponding to Dr. Spence's "active principle." While a single molecule of rubber reacting with ordinary divalent sulphur will saturate only one double bond, hexavalent sulphur in vulcanizing may saturate three double bonds belonging to rubber with which it is in contact and during its polymerization, which M. Dubosc explains thus: (1) In the case of an aggregate of rubber molecules, the end molecules, which have a double bond, will be broken and give a molecule of rubber of which the four valences will be saturated. The aggregate will have its polymerization increased by one molecule and its resistance to break will be modified in a slight degree only. (2) In the case of vulcanization with hexavalent sulphur, saturation of the terminal free valences of three physical aggregates of rubber will take place. Polymerization will therefore be three times as great as that produced with ordinary vulcanizations, because it acts on three aggregates instead of one. Resistance to break, dependent on polymerization, will therefore be much increased and its theoretical tripling has been demonstrated experimentally. This theory would appear to apply not only to the amino (NH_2) or imino (NH) groups, but also to the nitroso compounds discovered by Peachey. Nitroso bodies decompose during vulcanization and generate cyanic acid. The latter, influenced by sulphur, yields sulphurous anhydride and sulphocyanic acid. The acid dissociates and leaves hexavalent sulphur, and the liberated cyanhydric acid again functions as a catalyser.

The most important organic catalysers are: (1) Aniline, extensively employed to quicken the combining of rubber and sulphur in vulcanization, particularly in the manufacture of tires and tubes, and obtained through a series of chemical transformations from coal-tar. It is an oily liquid boiling at 184·8° C. Special precautions are taken to carry off its noxious fumes and prevent contact of the oil with the skin of the workers. (2) Carbon bisulphide with aniline, diphenylthiourea or thiocarbanilide, melting at 154° C., used for quick-curing stocks. (3) Carbon bisulphide with dimethylamine; effects vulcanization within 15 minutes at 135° C. (4) Carbon bisulphide with either dimethylaniline, tetrahydropyrrole or dimethyl X methyl trimethylene amine. (5) Ammonium borate; effective but not practicable. (6) Aldehyde ammonia; melts between 70 and 80° C.; a very useful catalyser. (7) Quarternary ammonium bases; patented, rapid accelerators with aldehyde ammonia, para-phenylene-diamine, sodium amide, bencylamine and naphthylenediamine. (8) Accelerene; widely used and powerful English catalyser. Used in one-third to one-half of 1% reduces vulcanizing period to one-third of normal, and with quick repair compounds to one-eighth. It owes its activity to the presence of the nitroso group and adds notably to tensile strength of goods. (9) Para-phenylene-diamine; a very poisonous catalyser melting at 140° C., and subliming at 267° C., used with synthetic rubber. (10) Tetramethylenediamine; a substance formed from decomposing animal matter such as fish; called also putrescin. (11) Hexamethylene-tetramine; known also as hexamethylenemine and formin; an accelerator largely used; caution is required in its use as it is not only very soluble in water but vaporizes freely, irritating the exposed skin of the workmen. (12) Piperidine or aminopentane; a liquid easily miscible in water, boiling at 105·7° C. and smelling like pepper and ammonia. A prototype of the more recently discovered organic catalysers, it was brought out in 1912 for use in making synthetic rubber, but was soon found to be of remarkable value for vulcanizing hard and soft natural rubber, cutting down the curing time three-fourths. (13) Methyl piperidine; an active catalyser boiling at 107° C. (14) Quinoline; a good accelerator, boiling at 240° C. and with a strong, disagreeable odour; little used. (15) Quinoline sulphate; a catalyser yielding good-looking, well-vulcanized rubber. (16) Hydroxy-quinoline; regarded as a valuable accelerator. It melts at 76° C., boils at 266·6° C., and is soluble in alcohol and volatile with steam. (17) Quinosol; a catalyser of special value to users of litharge, such as rubber-footwear manufacturers. It cuts the vulcanizing period one-half. (18) Oxiquinoline and oxiquinoline sulphonic acid; the latter gives good acceleration but porous rubber. (19) Oxiquinoline sulphide; a catalyser that can be used in practically every kind of vulcanizing; regarded by some as too rapid. (20) Anthraquinone; a catalyser used in batches containing rubber substitutes and cutting curing-time three-fourths. (21) Antipyrine and (22) naphthylamine; act like anthraquinone. (23) Urea formanilide, (24) thioformanilide and (25) guanidine are useful catalysers.

The Manufacture of Rubber Goods.—The manufacture of rubber goods begins with the tearing of the rubber into shreds, passing it between corrugated rolls and washing out the impurities. A stream of water flowing over the rolls carries off a large part of the dirt, while the rolls flatten the rubber into a thin sheet. The sheets require drying, after which they are ready for mixing with sulphur and other substances into what are called compounds. Compounding is done either on a machine called a masticator or in a mixing mill which kneads the mass until it is homogeneous. The rubber is next run into sheets, cut into various shapes, built up over forms and lastly baked or vulcanized. Hard rubber is handled in much the same manner except that after vulcanization it may be turned, shaped, buffed and polished. A list of the uses to which rubber is put would, if complete to-day, be only partial to-morrow. The main lines of its use may be briefly indicated as follows:—mechanical rubber goods; pneumatic and solid tires (*see* TIRES); moulded work; druggists' and stationers' sundries; dental and stamp rubbers; surface clothing; carriage cloth; mackintoshes and proofing; boots and shoes; insulated wire; hard rubber; cements; notions; plasters. Such a list, not of articles manufactured but of special lines, some of which include hundreds and even thousands of different articles, is sufficient to indicate the great variety of uses to which rubber is put.

In the period 1910–20 not only was progress shown in such chemical discoveries as catalysers but the mechanics of rubber manufacture was revolutionized. For example, for many years rubber, after being cleaned by washing, was dried in airy lofts, often hanging for a year to "age." With the growth of the business came hot dryers, bringing the drying-period down to weeks and sometimes days. Eventually the vacuum dryer came into use and a few hours sufficed to extract the moisture. More than 250 fillers and compounding materials are used in rubber manufacture. Their purpose is chiefly to enhance or supplement certain qualities in which rubber may be lacking. For example, powdered asbestos in quantity makes a compound that is heat-resisting, as in packings and brake linings. Most of the above materials have been known for years. The successful use of organic plastics such as glue is of recent accomplishment, as is the preparation of elaterite in plastic form, known as mineral rubber and largely used.

The Pressure Cure.—From the time of Goodyear, rubber footwear was vulcanized by the dry heat cure, that is, in closed rooms filled with hot air. This was very slow, entailing some seven hours of heating. Furthermore, only rubber containing a considerable amount of litharge could be used for this type of cure. The colour was always black, and variety in compounding and stocks was impossible. The discovery of the pressure cure by Augustus O. Bourn, of Providence, R.I., in 1901, however, practically revolutionized the business. In this process the goods were confined in large boiler-shaped shells. These were filled with hot air under pressure and the air from the inner surfaces removed by a vacuum process, the result being that vulcanization was hastened and a great variety of tough compounds, as for example those used in tire treads, were at once available. Rubber and fibre soles are coming in again, with a far better product. This is a compound of rubber and finely shredded cotton fibre. It is superior to leather in waterproof qualities and in wear. It finds a large market in medium-grade footwear but has not been accepted by makers of the best grades of leather shoes. To a large degree the rubber heel has also displaced leather in medium-grade footwear.

Balloon Compounds.—With the interest in pilot and dirigible balloons stimulated by the World War, came marked progress in rubber compounds used in their manufacture. Of these the most notable were cements of vastly increased tenacity; ingredients and surface coatings that remained unaffected by the sun's rays, and compounds practically impermeable to gases and inflation. As a successful application of the last-named may be cited the gas-proof masks evolved by rubber chemists, that effectually protect the wearer from poison gas and have a wide field of use in many of the perilous industries of peace. Bathing suits and bathing caps of rubber, beautiful in texture, colours and ornamentation, are recent accomplishments. This is due to the production by chemists of colours unaffected by heat and sulphur. Rubber fills a large place in sports, but most of the goods supplied have been familiar for decades. An exceptional and novel use is rubber thread in golf-ball manufacture. The standard ball was for years made of solid gutta. In 1898 Coburn Haskell of Cleveland, O., invented a golf ball with a small ball of rubber as a core around which was wound rubber thread under tension. Outside of this was moulded a thin cover of gutta percha. The ball because of its long flight soon took the place of the "gutty" and helped enormously to popularize golf.

Hard Rubber.—Electric batteries employed in motor cars for lighting and starting and for a host of commercial uses resulted in a great demand for hard-rubber battery jars. Formerly made by a slow hand process, the invention of building and moulding machines greatly added to the quality of the product and the ability to meet the trade demands. The production of hard-rubber bowling balls, better than the lignum vitae, and of aeroplane propellers, better than laminated wood, points the way to the use of hard-rubber lumber, as nearly all the fine hardwoods are successfully imitated.

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RÜCKER, SIR ARTHUR (1848–1915), English physicist, was born at Clapham Oct. 23 1848. Educated at Clapham grammar school and Brasenose College, Oxford, he became professor of mathematics and physics at the Yorkshire College, Leeds, in 1874 and professor of physics at the Royal College of Science in 1886. This post he held until 1901, when he became principal of the university of London. He received the Royal medal of the Royal Society in 1891, was one of its secretaries from 1896 to 1901, and was knighted in 1902. He died at Newbury, Berks, Nov. 1 1915.

RUFFEY, PIERRE XAVIER EMMANUEL (1851–), French general, was born at Dijon (Côte d'Or) on March 19 1851. He entered the École Polytechnique in 1871 and two years later was appointed *sous-lieutenant* in the artillery. He became a lieutenant in 1875 and a captain in 1878. In 1879 he went through the staff course at the École de Guerre, to which he later returned as professor of artillery. He was promoted major in 1891, lieutenant-colonel in 1897 and colonel in 1901. He served with the expedition to Madagascar, and in 1905 was made a general of brigade. In 1910 he was promoted general of division and in 1913 he was made a commander in the Legion of Honour. On the outbreak of war in Aug. 1914 he commanded the III. Army, but a month later, after the Longwy battles, he was removed from the command of his army, being succeeded by Sarrail. Thereafter he was not employed in an active command at the front, and in Jan. 1917, having already attained the age of retirement, he ceased to hold any appointment. General Ruffey, during the last years before the World War, had persistently advocated the increased employment of heavy artillery with the field army, and it was perhaps due to him more than to any other leading personality that the French Army was able to adapt itself so readily to the use of the new arm.

RUMANIA (*see* 23.825).—Before 1913 Rumania had an area of about 50,702 sq. m.; and by the treaty of Bucharest (Aug. 7 1913) it received from Bulgaria an addition of 2,969 sq. m. in the Dobrudja, which formed the departments of Durostor and Caliacra. By the treaties following the World War, this area was more than doubled, the additions consisting of the Banat (11,009 sq. m.), Bessarabia (17,146 sq. m.), Bukovina (4,030 sq. m.), Crisana (8,038 sq. m.), Maramuresh (6,258 sq. m.) and Transylvania (22,312 sq. m.), making the total area of the kingdom 122,282 sq. miles. Thus during the period 1910–21 Rumania, from being slightly smaller than England, became somewhat larger than the whole British Isles. In shape Rumania is nearly circular, with a perimeter of about 1,850 miles. The Carpathians and Transylvanian Alps, which formerly separated Rumania from Austria-Hungary, run in a sickle-shaped curve from near Mt. Pietros to the Iron Gates, and almost down the centre of the country, which takes in the Transylvanian plateau and extends westwards into the Hungarian plain. Bessarabia forms a continuation of the plain of old Rumania. The territory corresponds roughly to the ancient Dacia, and the new Rumania constitutes a satisfactory ethnological unit, while its physical boundaries are, except in some parts, more defined by natural features than would appear from small-scale maps.

Population.—The Rumanian people form the great majority of the population, which was estimated in 1920 at 17½ millions, males being about 100,000 in excess. Apart from the alien elements of mediaeval or earlier origin many foreign stocks are represented in the territories which form new Rumania, and throughout the 19th century Jews driven from Poland penetrated far into the country, particularly into Moldavian towns. But no one of these heterogeneous elements numbers one-tenth of the population, and the very high rate of natural increase among the Rumanians, the common use of the Rumanian language and the wide toleration which prevails in matters of religion, all tend to unification.

The National Orthodox Church had in 1918 a membership of over 9½ millions, and the Greek Catholic, Roman Catholic and Protestant churches each nearly 1½ million. Jews numbered about 830,000, Mahommedans 44,000 and Armenians 17,000.

The chief towns are Bucharest, the capital (estimated pop. in 1919 400,000), Jassy (80,000), Galatz (60,000), Braila (60,000), Kolozsvar (60,000), Ploesci (50,000), Craiova (46,000). Kishinev, the capital of Bessarabia, has a pop. estimated at 125,000.

Government and Administration.—The Senate consisted in 1920 of 170 members, of whom 82 represented the old kingdom, 45 Transylvania, 24 Bessarabia and 19 Bukovina. The Chamber of Deputies had 347 members; old kingdom 168, Transylvania 112, Bessarabia 51 and Bukovina 16. The Constituent Assembly elected in May 1920 was charged with the adjustment of the constitutions of the old kingdom, Transylvania, Bessarabia and Bukovina. In the elections of June 1920 the returns of parties were:—People's party 215, Federal Democrats 34, Bessarabian Peasants 25, Transylvanian Nationalists 21, Socialists 19, Independent Democrats 6, others 12.

For administrative purposes Rumania is divided into 735 districts and 129 urban and 5,735 rural communes.

Education.—Education continued to make progress although a large proportion of the population was still illiterate and compulsory school attendance was difficult to enforce. There were in 1920 19,374 schools with 1,612,763 pupils. Universities were founded at Cluj (Kolozsvar) in 1919 and at Cernaŭti (Czernowitz) in 1920.

Finance.—The national debt of Rumania at the outbreak of the World War amounted to 2,086,008,329 lei. This increased during the war by 2,910,012,500 lei and subsequent increases brought the total to 11,148,408,330 lei as on April 1 1920, of which 3,986,008,330 was funded and 7,162,400,000 lei unfunded debt. To this was to be added about 10,000 million lei as Rumania's share in the national debts of the states added to her territory by the various treaties of peace, and at least 5,000 million lei required for the withdrawal of Austrian kronen and Russian rubles. The deficits of the war years were largely covered by a "National" loan (1916), a "Unirea" loan (1919) and Banque Nationale loans, and a loan against Treasury Bonds. The revenue and expenditure for the financial year 1919–20 were respectively 1,140 million lei and 4,127 million lei. About one-third of the revenue is obtained from indirect taxes and one-third from State monopolies and public services.

There were in 1919 notes of the National Bank of Rumania amounting to about 4,431 million lei, notes of the General Bank of Rumania (issued by the Germans) 2,172 million lei, more than 8,000 million Austrian kronen and about 1,000 million Russian rubles. When the krone and ruble are replaced by Rumanian notes the equivalent paper circulation may be taken at 11,500 million lei. The National Bank had in gold 315 million lei in Moscow, 80 million in Berlin and 98 million in the Bank of England: adding to this drafts and other interest-bearing resources abroad, the guarantee of the notes was nearly 34%, a high percentage compared with the notes of most banks of issue in other countries.

Agriculture.—Four-fifths of the population of Rumania are engaged in agriculture. About 40% of the land under cultivation consists of holdings under 25 ac. and 50% of farms of 250 ac. or more. Far-reaching measures of agrarian reform were begun in 1917, and large areas had in 1921 been expropriated and transferred to the peasants. Of the 34 million acres which made up Rumania after the Peace of Bucharest in 1913 (2 millions of which consisted of rivers or lakes) about 12½ million acres were under cereals; 500,000 under pulse, vegetables and various industrial plants; 400,000 were vineyards and orchards; pastures covered nearly 3 million acres and nearly 1½ million acres were meadowland. Wheat and maize are the principal crops, the former being produced chiefly for export and the latter for home consumption. Maize is the characteristic crop of the small holder in the hill regions, while most of the wheat is produced in the larger farms in the plains. The methods of agriculture are in many parts still very backward; by the development of irrigation in the plains and the abandonment of the fallow system, production could be largely increased. Table 1 shows the area under cultivation and the production (in tons) of the principal crops in the years 1914, 1915, 1919 and 1920.

TABLE 1.

Area and Production of the Principal Crops.

	1914		1915		1919		1920	
	Acres (thousand).	Tons (thousand).	Acres (thousand).	Tons (thousand).	Acres (thousand).	Tons (thousand).	Acres (thousand).	Tons (thousand).
Wheat	5,216	1,248	4,703	2,408	2,949	1,320	2,096	630
Maize	5,092	2,701	5,205	2,743	4,838	2,597	4,051	1,773
Oats	1,056	367	1,064	373	594	207	971	425
Barley	1,404	644	1,371	758	584	257	1,054	460
Rye	208	49	188	75	218	87	184	52

The cultivation of industrial plants is little developed. The vineyards produce in good years as much as 66 million gallons of wine. Plum trees take the place of the fig tree in Mediterranean countries. The tobacco and beetroot produced barely suffice for local needs.

The number of domestic animals was greatly reduced during the war: in 1920 it was estimated that in the new Rumania there were less than 5 million cattle and 11 million sheep. The breeding of horses was again becoming important, particularly in the Banat and the Nistru (Dniester) valley.

Forests.—Rumania has nearly 19 million acres of forest, of which 6¾ millions are in old Rumania, 5½ millions in Transylvania, 1½ millions in Maramuresh and 1½ millions in the Banat. A great deal of timber is required locally for building and there is a considerable export from Piatra and Galatz, but the development of the immense timber reserves had only made a beginning before the war.

Minerals.—The useful minerals occur chiefly in the hill districts; petroleum is by far the most important. The production of petroleum amounted in 1914 to over 1¾ million tons, placing Rumania fourth in the list of the world's oil-fields. Oil has been chiefly obtained in the region between the Ialomitza and the Bistritza, the main wells being in the districts of Prahova, Dambovitsa, Buzeu and Bacau and especially in Prahova; but there are strong indications that the fields are much more extensive. A line of three pipes from the oil-fields to Constantza, carried over the Danube by the Cernavoda bridge, was completed shortly before the war. The wells and oil refineries were wrecked by a British mission in Oct. and Nov. 1916 to prevent their falling into enemy hands, but during the occupation they were largely restored and a new pipe-line was laid through Bucharest to Giurgevo on the Danube. The production was 517,500 tons in 1917, 1,214,000 tons in 1918, and 920,000 tons in 1919. Considerable importance is attached to discoveries of natural gas, of which it was estimated in 1920 that the annual available supply is 2,500 million cubic feet.

Salt, which is a Government monopoly, is mined at Targu Ocna, Ocnele Mari and Slanic.

About 4 million tons of lignite are produced annually, chiefly in the region between the Danbovitsa and the Ialomitsa. Small quantities of coal (less than 400,000 tons in all annually) are mined near Oravitza in the Banat. The exploitation of iron (400,000 tons annually); copper, lead and manganese has been begun. The gold mines in the Aranyos valley are the most productive in Europe.

Manufactures.—The development of manufactures in Rumania scarcely began before the 20th century. The chief industries are petroleum refining, sugar manufacture, flour milling and saw milling. Bucharest, Braila and Galatz are the most important centres. In 1915 there were 1,149 industrial establishments employing 58,871 workmen and having invested capital of 805,472,618 lei. It has been estimated that water-power amounting to 150,000 H.P. is available, but in 1912 less than 9,000 H.P. had been brought into use.

Imports and Exports.—The total imports and exports for the years 1911–5 and 1919 are given in Table 2.

TABLE 2.

	Imports and Exports (000's omitted).					
	1911	1912	1913	1914	1915	1919
	£	£	£	£	£	£
Imports	22,790	25,516	23,601	19,970	13,186	143,318
Exports	27,669	25,684	26,828	17,897	22,581	4,116

Before the war exports were chiefly to Belgium and Holland, and cereals formed the most important articles. In 1919 more than half the value of exports was made up by petroleum. Of imports in 1911 29 % in quantity and 15 % in value came from the United Kingdom, 25 % and 24 % respectively from Austria and 19 % and 32 % from Germany. The chief imports in 1919 were cereals and cereal by-products (220,149 tons; value 362 million lei) and manufactured articles. Exports to the United Kingdom were valued at £2,742,000 in 1919 and £3,227,000 in 1920, imports from the United Kingdom £5,585,085 in 1919 and £7,121,555 in 1920.

Communications.—Rumania had in 1913 2,586 m. of national roads, 3,066 m. of departmental roads, 22,000 m. of communal and village roads and about 7,000 m. of unmetalled tracks. The main roads are well constructed and maintained, but the communal and village roads are not well adapted for traffic and are often impassable at certain seasons.

By the Treaty of Versailles the Commission of the Danube is composed of representatives of France, Great Britain, Italy and Rumania alone. The Pruth, the only important waterway in Rumania besides the Danube, is navigable for ships of about 600 tons as far as Jassy. In 1919 Rumania had 158 merchant vessels aggregating 71,158 tons, including 17 steamers of 29,441 tons. The number of vessels entered at Rumanian ports in 1919 was 10,546, total tonnage 2,991,095 tons.

The railway system is inadequate. Four main lines of standard gauge radiate from Bucharest and a number of transverse lines cross the plains. The Carpathians are crossed at three points. There were 2,200 m. of line open in 1914 and 7,240 m. in 1920. The gauge of the Bessarabian railways differs from the others. Many new lines were in course of construction or were projected in 1921.

HISTORY, 1910–21

The Balkan War.—The war which broke out in the Balkan peninsula in 1911 as a consequence of the Italo-Turkish conflict and the Albanian risings demanded the anxious attention of the Rumanian government, now headed by J. Brătianu in place of Sturdza, whom ill-health had compelled to withdraw finally from political life. Rumania's official attitude towards the conflict of 1911 was strictly neutral, public sympathy being manifestly on the side of attacked Turkey. Towards the end of the year the Liberal ministry was obliged to resign. Rather surreptitious methods had been employed to pass a measure providing the church with a new constitution, which established a Supreme Consistory of the Protestant type, representatives of the priesthood sitting side by side with the bishops—this being the result of recent episcopal scandals of a private nature. The new convention with Austria-Hungary had sacrificed the vital interests of the Rumanian herdsmen of Transylvania, accustomed to feed their flocks and herds on the Rumanian slopes of the Carpathians and on the Wallachian plain. An endeavour had been made to regulate the internal distribution of petrol; and at the last moment the Minister of Finance, Costinescu, introduced a scheme for a progressive income tax, which was not adopted by the succeeding Liberal administration.

There were two candidates for the succession: on the one hand M. Take Jonescu, who, having left the Conservative party in consequence of a long-standing feud with the leader of its younger members, the rich landowner Nicolas Filipescu, had then formed a Conservative-Democratic party, which the longing of all classes for a new era had rendered remarkably successful at by-elections; on the other P. P. Carp, whom the death of G. Cantacuzène had placed at the head of the Conservative party. Promising a long programme of reforms, including an administrative transformation (the districts to be merged in "regions" of greater size administered by captains), it was the latter who obtained the King's call to office. Among his colleagues were T. Maiorescu, N. Filipescu, and one of the country's foremost writers and orators, the lawyer B. St. Delavorancea.

The new Government far from satisfied the hopes of the public. The Minister of the Interior, Alexander Marghiloman, long regarded by Carp as his future successor, was chiefly preoccupied with assuring his party, despite its unpopularity, of a majority at the polls. To this end no pains were spared. Directly Parliament met, a virulent campaign was opened against the Liberals, beginning with an attack on their new economic policy (inspired chiefly by Vintilă Brătianu, brother of the leader of the party), which aimed at combining the interests of private capital with those of communal and state capital in such great transport concerns as the electric tramways of Bucharest. The Liberal opposition, numerically small, left the Chamber, and combined with Take Jonescu in a furious campaign for the overthrow of the Government. At the same time J. J. Brătianu, influenced by the Socialists, and by a Bessarabian "Poporanist" (peasant party) who had gained a high position in the party, raised the long-abandoned question of universal suffrage, and definitely pledged himself to the considerably milder policy of a single electoral college, with, moreover, only literate electors—the intention seeming rather to be that of weakening the spirit of independence of the first and second electoral colleges, whose sympathies were tending towards new formations like the National Democrats. Efforts were made at the same time to retain the votes of the rural school-teachers.

The Carp Government did something to ameliorate conditions of life for the peasantry; and N. Filipescu strove to improve the army, which had received scant attention of late years. In the matter of the Rumanian ecclesiastical schism—a quarrel between the Bishop of Roman and the Metropolitan Primate Athanasius—both protagonists were persuaded to resign and quit the field.

It was at this moment that the Balkan Confederation went to war with Turkey, whose European possessions they intended to share among themselves. Not only had no support been sought from Rumania, but certain clauses provided for the event of war with both that country and Austria-Hungary. At the outset, in Nov. the Rumanian Government professed complete unconcern with what was happening beyond the Danube. The rapid successes of the allies, however, and above all the Bulgarian victories of Kirk Kilissé and Lule Burgas, opened the eyes of neutral spectators to the danger of a new imperialism in the Balkans. From Austria-Hungary came formal proposals of military collaboration, in order to prevent the victors from realizing the expected profits of their astounding success, and General Conrad von Hoetzendorff arrived at Bucharest, charged with this express mission.

But already the minds of a new generation, educated in the consciousness of a Rumanian moral unity which should necessarily produce practical results at the first great European upheaval, were totally opposed to the continuance of the policy inaugurated in 1884. After a visit from Francis Joseph himself to Bucharest in 1909, the Crown Prince Francis Ferdinand made his appearance at Sinaia, hoping to strengthen ties that were daily growing looser. The Hungarian Government, of which the Crown Prince pretended to disapprove, none the less pursued its denationalizing policy, imposing, with the full rigour of the Apponyi law, which monopolized nearly the whole of primary education with the study of Magyar, an examination in that official state language even on pupils belonging to Oriental religions or to the Greek church. The Emperor-King rejected the representations of the church of Sibiu on this subject. Political prosecutions, even of women, roused public feeling among the Rumanians of Transylvania. Efforts were made, under cover of seemingly democratic intentions, to turn against the Rumanians a project of Hungarian electoral reform then in preparation; and the electoral contests of June 1910 were of unusual brutality (*cf.* the present writer's pamphlets: *Les Hongrois et la nationalité roumaine en 1909* and *Les dernières elections en Hongrie et les Roumains*, Vălenii-de-Munte, 1909–10). The idea of Rumanians marching shoulder to shoulder with the soldiers of

Hungary was received with almost general indignation (*cf.* the writer's pamphlet: *Les Roumains et le nouvel état de choses en Orient*, Vălenii-de-Munte, 1912). The necessity for a policy based on the existence of 13 million Rumanians, even though they inhabited three different countries, impressed public opinion more and more; and whatever may have been the Government's first intention, it began to realize its difficulties.

In the autumn the Bulgarian minister Danev, all-powerful at that moment, visited Rumania and offered to procure Bulgarian renunciation for ever of all claims to the Dobrudja—where, indeed, Bulgarians formed but a minority of the population—and also the modification of the frontier by flattening salient angles to the advantage of Rumania. His proposals were not accepted. "Compensation" was demanded for the huge territorial gains realized by the neighbouring state; and a formidable agitation for this broke out all over the country. M. Take Jonescu, with whom after the Court of Cassation's verdict in favour of the Tramway Co. an alliance had been made in a new ministerial grouping, with Maiorescu as president of Council, went to London to promote an arrangement, but was unsuccessful. The case was submitted to the Conference of St. Petersburg, which assigned Silistra to Rumania (April).

The mere delimitation of this territory raised many difficulties; and soon after the discussions between the Bulgarians and their allies, the question presented itself anew in different conditions. At that moment Carp, supported by Filipescu, was conducting a violent campaign against the Government, which had "lowered the dignity of Rumania," of which Silistra would even be "the tomb." The Government was called upon either to resign or to declare war on Bulgaria. Maiorescu obtained a parliamentary victory in the debate on the convention of St. Petersburg. But when the Serbians were treacherously attacked by the Bulgarians, and Bulgarian schemes for a Balkan hegemony became obvious, the idea of military intervention beyond the Danube had to be accepted. Russia, whose representative at Bucharest, Chehekov, manifested Rumanian sympathies, advised in that sense, Serbia just then enjoying the support of the Russian Cabinet. In June the Rumanian army, 500,000 strong, crossed the frontier, occupying on one side the Southern Dobrudja as far as Kavarna; and on the other side advancing in an irresistible rush upon Sofia by Vrasta and Orhanie. The exhausted Bulgarian soldiers deserted *en masse* and the Rumanians sent them back to their homes.

As the Rumanian troops, commanded by the Crown Prince, drew near the Bulgarian capital, the Tsar Ferdinand despatched a telegram to King Charles asking for peace. Negotiations were immediately begun at Bucharest between Rumanians, Serbians, Greeks and Bulgarians. Peace was concluded in August: as regards Rumania, she obtained the territory which she had already occupied in the Dobrudja; and, furthermore, her rights of protection over the Rumanians in Macedonia were recognized.

Question of Rumanians in Macedonia.—In that region, isolated from the national soil, all through the Middle Ages sturdy local Rumanian communities had persisted, with forms of autonomy respected by the Turkish Government. Besides the shepherds, whose flocks covered the plateaux of the Pindus (see Wace and Thomson, *The Nomads of the Balkans*, London, 1913), there was an industrious urban population of artizans and traders, who spread, moreover, into towns in other parts of the Balkan peninsula. Later the activity of these "Koutzovlaks" turned towards Austria, and their colonies advanced from Budapest, Vienna, and Trieste to London and even to Philadelphia. Meeting with the Rumanian intellectuals of Hungary they initiated a new national programme, and in 1830 revived the ancient relations with Bucharest. The Rumania of Charles I. not only welcomed them as brothers, but created, chiefly through the wise agency of their leader, the Apostal Mărgărit, a complete system of Rumanian education in Macedonia, including a *lycée* at Monastir, and a commercial school at Salonika. The Porte was persuaded to differentiate the Rumanian communities of that region from the Greeks of the patriarchal organization, and from the Bulgarians of the Exarchy residing at Constantinople. There lacked but one element, absolutely essential (granted the local conditions), namely the national bishop. He had been promised to the Rumanian faithful by the Treaty of Bucharest; but the clause had never been applied, as much through the Rumanian Government's own negligence as through the ill-will of the new Serbian and Greek masters of the situation.

Germany hailed Rumania's success as a means of retrieving through her ally that influence which the defeat of her *protégés* the Turks had caused her to lose in the East. As to Austria-Hungary, the imperial and royal minister at Bucharest, Prince Fürstenberg, presented a note from Count Berchtold in which the recently concluded treaty was referred to as a simple "preliminary arrangement." This conception was energetically rejected, and the scheme for a European congress to arrange Oriental affairs "definitely" was wrecked. But it did not prevent the Tsar Ferdinand from issuing to his army an order of the day in which, speaking of "spoliation," he indicated "better days of glory" as yet to come.

Rumania during the World War.—The World War was now brewing. In the month of June 1914, under the form of a pilgrimage to universities, Turkish intellectuals came to Rumania to make soundings with a view to reconcilation with Bulgaria. One month later Austria-Hungary declared war with Serbia, on the pretext of avenging the murder of the Crown Prince and his wife at Serajevo by a Serbian. The treaty with the Triple Alliance had only just been confirmed by the minister Maiorescu. His successor, the head of the Liberal party, who had come to power with a long programme of reforms—foremost among them an agrarian law based on the expropriation of the large landowners, and an electoral law establishing universal suffrage with the exclusion of illiterates—had never shown any intention of abandoning the foreign policy identified with King Charles' views and sympathies. Vienna felt assured that the Rumanian army, long prepared to that end, would march at her orders. The King's interview with the Tsar of Russia at Constantza, though it had caused a profound sensation in the country, raising hopes of a change of orientation, had produced no diplomatic results.

Public opinion was violently hostile to the Austrian adventure. During the Bulgarian campaign the soldiers had clamoured to be led to Transylvania; the King himself had witnessed their manifestations. In face of Italy's disclaimer of her obligations under the treaty, and England's declaration of war against the Central Powers, Charles I. and his advisers were forced to adopt the compromise of an armed neutrality, which the king hoped to break on the first opportunity.

When the German march on Paris failed, Rumanian politicians had to reconsider their position. M. Take Jonescu passed from the first idea of "loyal neutrality" to that of intervention on the side of the Allies, and in this he was supported especially by the combative energy of Filipescu. The latter did not shrink from dividing his own party, opposing Marghiloman, whose traditional Junimism favoured the Central Powers; and joining hands with his former rival, he effected a fusion with Take Jonescu. Meanwhile, popular demonstrations continued against Austria-Hungary and Germany, who by means of conventions were exploiting Rumania to feed the population of the German Empire, and whose subventioned Rumanian press was generally despised, despite the assistance given it by Carp and a few of his personal friends. At the "Lemberg moment" (the invasion of Galicia by the Russians), Filipescu had vehemently demanded rupture with Austria-Hungary.

In Sept. J. J. Brătianu succeeded in obtaining a declaration from the Allies (including the much-feared Russia) that in exchange for a benevolent neutrality Rumania should have the right to occupy those Austro-Hungarian territories which belonged to her by virtue of nationality. The sudden death on Oct. 10 of King Charles, to the last irreconcilable to a change of policy, facilitated the task of those who desired it. The sufferings of the Rumanians of Transylvania, induced to serve in the army of the Emperor-King by the lie that Rumania herself had embraced the same cause, and that her soldiers were fighting in

Galicia, together with the humiliations imposed on their religious and political leaders, increased the indignation provoked from the first by the conduct of the Germans in Belgium and invaded France. Soon after the Russian retreat from the Bukovina, moreover, rumours began to spread about the man-hunts organized by Austrian gendarmes against Rumanian "traitors."

The head of the Government, knowing the inadequacy of the military preparation and the difficulty of completing it, thought best to delay yet longer. Meanwhile Count Czernin, Austro-Hungarian representative at Bucharest, spoke to the Crown Prince Ferdinand (married to Princess Marie of Edinburgh, whose sympathies were well known, and whose political attitude and charitable activities were equally admirable) about the "miserable treachery" of Rumania if she abandoned her allies (*Diplomatische Aktenstücke betreffend die Beziehungen Oesterreich-Ungarns zu Rumänien in der Zeit von 22 Juli 1914 bis 27 August 1916*, Vienna, 1916). The irresistible trend of public opinion was pointed out to him in reply. In Parliament discussion was forbidden on the burning question of relations with the belligerent powers. Troops concentrated in view of possible events were now partially demobilized. And on the side of Austria all that was done was to offer the Rumanians of Transylvania, through the Orthodox Archbishop, "a certain consideration for the wishes of our non-Magyar fellow-citizens relative to the church-schools," and "the admission of the maternal language in direct communication with the authorities," and "modifications of certain dispositions of the electoral law."

As Rumania refused to allow the passage of munitions for Turkey, whose capital was now menaced by the attack in the Bosporus, war on Serbia began anew in 1915. The Brătianu Government, which continued negotiations about the frontiers of the Bukovina, claiming to receive back the province precisely as Austria had taken it in 1775, and also about the frontiers of the Banat, where owing to Serbian colonization in the western districts there was no decisive preponderance of Germans and Rumanians, once more managed to hold public impatience in check. Henceforward, all the Central Powers could exact from Rumania was the passing of measures necessary for provisioning their populations. Italy's declaration of war in May 1915 served to raise still higher the popular excitement, which was now clamouring for a prompt decision in the only possible sense.

But when the offensive of General Brussilov once more reached Galicia and the Bukovina, further delay was impossible, especially as now, in the month of July, the treaty assuring Rumania of the desired territorial limits had just been signed. Russia became urgent: the Rumanian Cabinet was warned that delay would cause the cancelling of the territorial engagements. Certain illusions had been cherished with regard to Bulgaria, whose Prime Minister Radoslavov had formerly declared in Nov. 1894 that his country was "ready to give all the guarantees which should eventually be desired that she would not attack Rumania if the latter should take part in the general war." Now, however, Russia, who undertook to unite with the Rumanian forces when they entered Transylvania, and to march in concert upon Budapest, was asked to send into the Dobrudja troops sufficient to supervise the somewhat mistrusted neighbour who had participated with such zest in the annihilation of Serbia. Without having ever made one serious proposal, the German and Austrian ministers prepared to depart the moment Rumania's declaration of war arrived at Vienna (Aug. 28 1916).

As regards the internal political situation, the Liberal Government, which had achieved the entry into war unassociated with any of the opposition parties (for Maiorescu, summoned to the palace on the eve of the declaration, had fancied he was going to be called to power in order to prevent the rupture), did not even call the Chambers together to obtain their approval of the step. The armies were swiftly crossing the mountains by all the passes, to unite and form one single front upon a diagonal line in the middle of Transylvania. The enemy's feeble forces were everywhere retreating; but Germany had soon moved in her ally's interests, and had declared war. Bulgarians armed and led by German officers now surprised at Turtucaia a badly organized Rumanian army, forced it to capitulate, and advanced through unresisting Silistra into the Dobrudja, which despite General Averescu's sturdy defensive was soon the prey of Marshal Mackensen; while in Transylvania itself General Falkenhayn was striking a decisive blow near Sibiu-Hermannstadt.

For the Rumanians nothing was left but the tragic duty of defending, with utterly inadequate technical preparation, their Carpathian frontier. This defensive they succeeded in prolonging until the end of Nov., when, served by the spies of the Austro-Hungarian companies for the exploitation of the forests, and favoured by exceptionally mild weather, they penetrated the valley of the Jiu, and occupying Craiova proceeded towards Bucharest, whose fortifications, constructed against the Russians in 1880 by the Belgian General Brialmont, had no longer any military value. After brilliant initial success a stand was made on the Argesh by advice of the French General Berthelot, but ended in defeat. The army retreated in disorder towards Moldavia to reorganize there, sheltered behind Russian troops who had at last arrived on this new theatre of war; king, ministers, and parliament were already in the ancient Moldavian capital of Jassy, where they had to remain until the end of 1918.

A counter-offensive, carefully prepared during 1917, had already begun, and in July had opened the path through Wallachia, when the Russian defection in Galicia and the subsequent push by Mackensen, who threw all the forces at his disposal upon the Sereth for an advance upon Odessa, brought upon the new Rumanian army the great disaster of Marasesti—a battle lasting ten days and ending in complete inability for further resistance. As the disintegration of the Russian army proceeded, yesterday's allies turning into pillaging bands dangerous to the whole life of the country, hostilities were perforce suspended; and eventually it became necessary to submit to the armistice imposed by the Germans on General Shtcherbachev, who had assumed the chief command on the Rumanian front, passing over King Ferdinand's right to the supreme command. Rumania, nevertheless, parleyed yet another two months before entering into negotiations that could only mean the abandonment of her rights, the diminution of her pre-war territorial possessions, and the loss of her economic independence.

Agrarian and Electoral Reforms.—Ever since in Dec. 1916 the Parliament had met at Jassy and enthusiastically approved the prosecution of the war to a finish, Brătianu had shared the burden of power with Take Jonescu and his section of the Conservative party. (Filipescu had died at Bucharest before the *débâcle.*) The activities of the Coalition Ministry had naturally been limited to ordinary current affairs. But in April the agrarian question once more became urgent, owing in part to the reactions on the public mind of the triumph of the social revolution in Russia. (The chief of the Rumanian socialists, a Bulgarian named Rakovski, after having been kept for some time under arrest at Jassy, had managed to escape, and was now agitating with his followers against the king and the *bourgeoisie.*) Influenced by the Crown, the Conservatives at last accepted the radical policy of expropriation, to be applied to an area fixed at 2,000,000 hectares.

Parliament debated the project for two months, the result being a law promulgated in July 1917, which left the original proprietors 500 hectares at most for each separate estate (absentees being completely expropriated), and assigned them a compensation in State bonds, the amount not to exceed twenty times the annual value of the property. A scheme for the communal holding by village associations of the land thus obtained was rejected in favour of the traditional individual tenure. Details of the distribution were to be fixed by law; but now, under the menace of a German occupation even in Moldavia, members of parliament were dispersing. When the triumph of the Central Powers seemed certain, and the armistice foreshadowed an early peace, the leaders of the war-party were practically forced to flee the country. A number of them took refuge in Paris, where they formed a national Committee of Claims.

Reunion of Bessarabia; Peace of Bucharest; Expulsion of Occupying Forces.—Already, however, the depredation of the

Russian Bolskeviks had obliged the Rumanians of Bessarabia to form a Moldavian Republic; the ancient Rumanian spirit had quickly awakened, thanks in part to a group of young writers who had never ceased to cultivate spiritual relations with free Rumania. An attempt to form a local army having failed, appeal was made to the Rumanian troops, who had moreover an interest in defending the stores of food in Bessarabia. The union of the Principalities was celebrated in Feb. 1919 at Chishinau, capital of the province, as well as at Jassy; and on April 9 the *Sfatul Tării* (Council of the country), formed on the model of all the other revolutionary assemblies of the former empire of the Tsars, was to proclaim the union of Bessarabia with the kingdom of Rumania. J. J. Brătianu had already resigned (Jan. 1918) in face of the equal impossibility of either organizing resistance or signing a treaty of abdication. General Averescu, charged with the negotiations because of his military prestige, went for this purpose to Buftea near Bucharest, and found in the capital a party of violent opponents of the war led by the Germanophils Carp and Stere. Count Czernin, irreconcilable in his attitude towards the Rumanians, rejected Germany's advice, brought him by von Kuhlmann, to concentrate solely on placing Rumania in a state of economic servitude, and proceeded to carve up in fantastic fashion the mountainous frontier of the kingdom; cutting off, moreover, the Dobrudja, whose future was to be settled between the Germans and the Bulgarians, Rumania being only left access to the sea under terms to be subsequently fixed. The Danube would become an artery for Austrian and German commerce, Vienna taking foothold at Severin, and Berlin at Giurgevo by means of "purchases" of wharves and sites on long leases. The entire export of the chief products of the country was assured to the Central Powers. Their army of occupation would have to remain for years to enforce the fulfillment of provisions, unexampled in severity, imposed on the country as expiation for its "crime."

This treaty was signed by the new Marghiloman Ministry, installed in office just after the arrival of a secret mission from the Emperor Charles acquiescing in the maintenance of the Rumanian dynasty. The king had been subjected to the extreme humiliation of having to go to a Moldavian railway station to meet Count Czernin, who had come there expressly to afford himself the satisfaction of that revenge.

The Marghiloman Ministry, whose chief certainly possessed statesmanlike qualities, struggled against insurmountable difficulties through months of unexampled suffering for the exploited and humiliated country. In the occupied territory everyone was snatching greedily at the remnants of national prosperity now in process of dispersal; the unlimited issue of paper money imposed on the country by the Austro-Germans through the Banque Générale presaged financial ruin; while economic ruin was ensured by the exportation of sheep and cattle, by the cutting down of forests, and by the dismantling of factories. The population, meanwhile, was starving, reduced to famine rations, and the morals of its working-class were being perverted by revolutionary propaganda. A Parliament elected under the pressure of enemy armies—a Parliament, moreover, composed of the worst elements of political life—often succeeded in disgusting even those who had desired to have it.

This state of things lasted until the battle-front of the Central Powers had been penetrated both on the Rhine and in the Balkans. The king then called to power General Coandă, an old soldier who had already had experience in diplomacy, together with General Grigorescu, to whom was due the chief credit for the victory of Marashti, as Minister of War. This Cabinet, without reference to Parliament, decreed a law for the expropriation of landowners, in accord with liberal ideas, and on the basis of the new constitutional text (the acts had been passed by the dissolved Marghiloman Parliament, the decisions of which had been declared null and void). But no sooner had the French troops commanded by General Berthelot arrived on the Danube, than the head of the Liberal party claimed, as initiator of a war due chiefly to pressure of public opinion, a change of Government in his favour. In a few days he entered Bucharest at the side of the king, to inaugurate an administration which only lasted one year.

Reunion of the Bukovina and of Transylvania.—The new Liberal Government had the extraordinarily difficult task of reuniting, in one political whole, provinces which had been under the domination of different alien states. Bessarabia was already incorporated in the ancient kingdom, having completely abandoned the idea of autonomy, which had at first been supported by her leaders, Inculetz, Pelivan, and Halipa. Before the King's departure from Jassy he had received a deputation which came to offer him the Bukovina with the delimitation of 1775. Menaced by a Bolshevist agitation begun at Czernowitz by demobilized soldiers, this province had in Nov. proclaimed its reunion with the mother-country, under the inspiration of the historian, Prof. Jean Nistor, and of Jean Flandon, formerly head of the National party and of the Rumanian Political Union (his rival, Aurèle, chief of the Democrats, had compromised himself by projects for a great Austria, to include Rumania). The German immigrants, the few Poles, and the Jews had given their assent; only the Ruthenians held aloof, planted out as they had been by Austria and sedulously represented by statistical artifices as being the principal nationality in the Bukovina.

In Transylvania during the war the Magyar administration had spared no pains to reduce the number and importance of the Rumanians, over 3,000,000 in numbers, and predominant especially in the rural districts. The prisons were filled with suspects; judicial murders were the order of the day; a measure was framed to expropriate in favour of alien immigrants the widows and children of soldiers killed in action. At Bucharest the Bessarabian C. Stere performed the deplorable rôle of editing a journal which advocated the candidature of the new Emperor-King Charles to the throne of Rumania (Prince Joachim of Prussia had also been suggested). Directly Vienna and Budapest repudiated the Habsburgs and their followers, as being responsible for the defeat, a great Rumanian assembly at Alba Iulia declared (Dec. 1918) that Transylvania henceforth formed part of the kingdom of the united Rumanians, but that they promised absolute national liberty to their Saxon and Magyar fellow-citizens. The Saxons gave their adhesion immediately; but the Magyar bishops, Catholic, Calvinist, and Unitarian, did not take the oath of allegiance to King Ferdinand till 1921. A Council of Direction, presided over by Jules Maniu, took the reins, established order, and gave new national forms to Transylvanian life. The greater number of non-Rumanian officials were retained; communes kept their accustomed privileges; Magyar and Saxon schools worked unmolested side by side with Rumanian institutions both old and new.

Latest Events: The Agrarian Question.—During the few months of Liberal Government the reunited country awaited in vain its definitive constitution. The reconstruction of the devastated districts had to be attended to, and difficult diplomatic negotiations had to be conducted that should result in the recognition by the Allies of the new frontiers. Those fixed by the treaty of 1916 were drawn back in places to give the Hungarians a part of the hinterland of Oradea-Mare (Nagy-Várad, Gross-Wardein), and the Serbians a good half of the Banat—they had pressed to be given also the town of Temesvar (Temişoara).

After the end of 1918 a Bolshevist Government had been in power at Budapest, Count Karolyi having resigned rather than acquiesce in the military convention which deprived Hungary of the provinces which she had conquered and held since the Middle Ages. This Government showed from the first its intention of serving the party of revenge, and of trying to restore the mediaeval kingdom. An armed attack on Rumanian territory by the greater part of the Red army led, in Aug. 1919, to a Rumanian counter-offensive, which—despite the interdiction of the Allies—arrived at Budapest in a few days, and there the Rumanians remained until the appointment of Admiral Horthy as regent. This was expected to promote the same policy of revenge by preparing the return of Charles of Habsburg.

The treaties of Versailles and of St. Germain recognized as Rumanian the territories which had belonged to the Dual Monarchy. Austria quickly signed what regarded her; but Hungary resisted till 1921, and then expressed her ratification in terms which left no doubt as to the sentiments animating a large part of the nation. Nevertheless, Rumania now considered it right and safe to demobilize (April 1921).

The Brătianu Government had resigned in order to avoid signing a treaty which imposed on the kingdom a system of minority rights that they would have preferred to establish by their own legislation. As a matter of fact, by two successive measures full political rights had already been granted to the Jewish population, without distinction between old inhabitants and recent immigrants; so that this "question" had finally ceased to exist.

For the first time the elections were free, under supervision of the "Ministry of Generals" presided over by Arthur Vaitoianu. They resulted in a large majority for the Peasant party (whose chief was the rural school-teacher Jean Mihalachi) and the National Democrats; the Liberals now formed but a fifth part of the total number of deputies; the National party of Transylvania, the Peasant party of Bessarabia, and the National party of the Union of Bukovinians were united in their representation; a certain number of Socialists made their appearance in this first Parliament of united Rumania. The majority parties coalesced as a "*bloc parlementaire*," and in Nov. 1919 formed a democratic Government of advanced tendencies under presidency of the Transylvanian Alexander Vaida Voévod, who at once visited Paris and London and obtained the formal recognition of a Rumanian Bessarabia (this was confirmed by his successor at the Ministry of Foreign Affairs, Take Jonescu). Measures were elaborated for a definitive solution of the agrarian question (the Mihalachi scheme, leaving landowners only 100 hectares for each estate, but granting concessions to those who had farms and agricultural installations); for the reorganization of education and administration; and for remedying the shortage of housing accommodation (scheme of Dr. Lupu, Minister of the Interior). General Averescu, who in April 1917 had founded a "League of the People," demanding penalties against the abuses of the Liberals during the war, and who had developed this organization—which contained many Conservatives and some "new men"—into a party under his leadership, now came into power, thanks to the alarm aroused at Court and in society by the Bolshevist agitations. The Socialists had promised their support to the man of the moment; and soon after his advent to power (March 1920) General Averescu concluded a pact with Take Jonescu, though without admitting that statesman's "Democratic" party (entirely Conservative but for Marghiloman's "Progressists") to a share in the administration of the country.

There ensued a régime of relentless repression. The threat of a general strike provided an opportunity to try and to condemn by court-martial the leaders of the Communists, from whom the Social-Democrats had detached themselves under the leadership of the Bukovinian Grigorovici. During the elections opponents were roughly treated. Few attempts were made to check the growing corruption of the towns. Important projects of law were hung up: that concerning the distribution of land was modified until it resembled the Mihalachi scheme in regard to the quota to be expropriated (and for the remainder, simple decrees at once put in force had, as in other cases, anticipated parliamentary decision). In March 1921 the Finance Minister, Nicolas Titulescu, having reduced to order the chaos of the Treasury Bonds, introduced a bill heavily taxing new fortunes and capital in general, while relieving the peasants and the small urban proprietors. It was hoped by this means to stabilize the national finances, and to restore the Rumanian exchange, which had fallen as low as 18 centimes in Paris. (N. J.)

LITERATURE.—The revival of Rumanian literature dates back to about the middle of the 19th century, when, owing chiefly to the awakened interest in Percy's *Reliques*, the poet Alexandri published his collection of *Folk Poems*. This, together with the *Old Chronicles*, edited by Kogalniceanu, constituted a living monument of the vernacular. Their importance as an inspiring and stimulating power to the new writers was fully appreciated by Titu Maiorescu, who became the leading critical spirit in Rumanian letters. Under Maiorescu's influence a group of national writers gathered round the newly founded periodical *Convorbiri Literare*. Among them were J. Creangă, who in the *Recollections of Childhood* and other tales embodied the spirit of the Moldavian peasantry; Caragiale, who, besides a realistic drama and two volumes of short stories and sketches of unsurpassed craftsmanship, showed in his comedies *The Lost Letter* and *Stormy Night* the grotesque effect resulting from a hasty introduction of Western manners into a society still stamped with an Oriental character; and above all the poet Eminescu. The last-named, who has been compared with Leopardi, was dominated by a note of profound, penetrating, overwhelming sadness, which affected all his successors, not excepting Al. Vlahutza, a poet with a strong individuality of his own. But there is another side to Eminescu, his broad conception of the Rumanian race. It was this that impressed writers of the later generation such as Prof. Jorga, who, in his *History of Rumanian Literature*, arrived at a clearer understanding of what a national literature may be. In his own weekly, *Sămănătorul*, as well as in such other periodicals as *Convorbiri Literare* under the editorship of Prof. Mehedintzi, *Luceăfarul* and *Viata Românească*, was first published almost all the modern writing which reflects artistically the deeper characteristics of the Rumanian people. A corner of the humble life of Banat is described in Popovici-Banatzeanu's short story, *Out in the World;* the romantic Vlach population scattered throughout the mountainous parts of Macedonia, Epirus and Thessaly is represented in Marcu Beza's volume of short stories *On the Roads* and his novel *A Life;* Transylvania has produced the poets G. Cosbuc, Octavian Goga, and Stephen Josif. To the last-named, a Transylvanian of Vlach paternity, are due the best renderings into Rumanian of Shakespeare's *Midsummer Night's Dream* and Shelley's *To a Skylark.* Barbu Delavrancea has given to the theatre an historical trilogy. Victor Eftimiu's poetic excursion into fairyland, *String ye pearls!* is founded on a popular Rumanian folk tale. And among story-writers must be mentioned Bratescu-Voineshti, Duiliu Zamfirescu, and Michael Sadoveanu. A great loss to Rumanian literature was the untimely death of the poet Cerna, who in profundity ranked next to Eminescu. (M. B.*)

RUNCIMAN, WALTER (1870–), British politician, was born at South Shields Nov. 19 1870, the son of Sir Walter Runciman, 1st Bart., a Newcastle ship-owner. He was educated at Trinity College, Cambridge, and afterwards joined his father in his shipping business, being from 1896 to 1905 managing director of the Moor line of cargo steamers. In 1898 he unsuccessfully contested Gravesend in the Liberal interest, but was elected for Oldham in 1899, although he only held the seat for a year. In 1902 he stood successfully for Dewsbury, and retained this seat until 1916. In 1905 he entered Sir Henry Campbell-Bannerman's Government as parliamentary secretary to the Local Government Board. He became financial secretary to the Treasury in 1907, president of the Board of Education in 1908, and was president of the Board of Agriculture from 1911 to 1914. From 1912 to 1914 he was also Commissioner of Woods and Forests, and from 1914 to 1916 president of the Board of Trade. On the formation of Mr. Lloyd George's Ministry in 1916 he retired from the Government.

RUPPRECHT, Crown Prince of Bavaria (1869–), eldest son of King Louis III., was born May 18 1869 at Munich. In 1899 he visited India and in 1902–3 undertook a journey round the world, of which he gave some account in his *Reiseerinnerungen aus Ostasien* (1905). In 1906 he was appointed to the command of the I. Bavarian Army Corps. At the outbreak of the World War he was commander of the Bavarian troops (the VI. German Army) and led them to victory in the great battles fought in Lorraine (Aug. 20–22 1914). In the following Oct. he was placed in command on the German front in Artois and southern Flanders, and, after having been advanced to the rank of field-marshal, was entrusted in the spring of 1917 with the chief command of the Northern Group of Armies on the western front. Prince Rupprecht's first wife, a daughter of Duke Karl Theodor of Bavaria and sister of the Queen of the Belgians, died in 1912. In 1918 he was betrothed to Princess Charlotte, afterwards Grand Duchess of Luxemburg, but at the end of the war the betrothal was annulled. Prince Rupprecht renounced his claims to the Bavarian throne at the time of his father's abdication (Nov. 1918), and in 1919 he offered to stand his trial before a Court of Justice for State Affairs, if such a court, as had been contemplated, were instituted. In a letter written in 1917, but published only in 1921 in the press, Prince Rupprecht declared his disapproval of the foreign and military policy of Germany during the World War, and expressed the well-founded opinion that it was doubtful whether the Hohenzollern dynasty would survive the war.

It may be noted that through his mother, the Archduchess Maria-Thérèse of Austria-Este, Prince Rupprecht is the descendant of the Stuarts and might, therefore, pose as the "legitimist" claimant of the British Throne.

RUSSELL, BERTRAND ARTHUR WILLIAM (1872–), English mathematician and philosopher, second son of Viscount Amberley and grandson of the 1st Earl Russell, was born at Chepstow May 18 1872. Educated at Trinity College, Cambridge, where he took a first-class both in the mathematical tripos and in the 2nd part of the moral sciences tripos, he remained at Cambridge as a lecturer, and became well known as a student of mathematical philosophy and a leading exponent of the views of the newer school of Realists. In June 1916, Mr. Russell, who had taken a strong line against the Government, and was a "conscientious objector," throughout the World War, was fined £100 and £10 costs for making statements calculated to prejudice recruiting, and, in consequence, Trinity College, Cambridge, deprived him of his lectureship. His chief published works, on which his philosophical reputation was based up to the outbreak of the World War, were *German Social Democracy* (1896); *Essay on the Foundations of Geometry* (1897); *Principles of Mathematics* (1903); *Principia Mathematica* (with A. N. Whitehead, 1910) and *Our Knowledge of the External World* (1914). Later he published *Principles of Social Reconstruction* (1917); *Mysticism and Logic* (1918); *The Analysis of Mind* (1920) and (after a visit to Russia) *The Theory and Practice of Bolshevism* (1920).

RUSSELL, GEORGE WILLIAM (1867–), Irish writer and painter (best known under his sobriquet of "Æ"), was born in Lurgan, co. Armagh, Ireland, April 10 1867, the second son of Thomas Elias Russell. He went to Dublin with his parents in 1874, and was educated at Rathmines school. After some years spent in an accountant's office in Dublin he joined the Irish Agricultural Organization Society in 1897 and became an organizer of agricultural societies. In 1904 he became editor of the *Irish Homestead*, the organ of the agricultural coöperative movement in Ireland, a position he still held in 1921. He published his first book of verse, *Homeward: Songs by the Way*, in 1894. His second, *The Earth Breath*, was published in 1897. *Literary Ideals in Ireland*, some essays in collaboration with W. B. Yeats, W. Larminie and John Eglinton, appeared in 1899; and *Ideals in Ireland*, essays in collaboration with W. B. Yeats, Douglas Hyde, Standish O'Grady, D. P. Moran and Lady Gregory, appeared in 1901. *The Nuts of Knowledge*, a book of selections of his lyrics, was hand-printed in 1903. *The Divine Vision*, his third book of verse, appeared in 1904; *The Mask of Apollo*, a book of mystical tales, appeared in the same year; *New Poems* (edited, 1904); a hand-printed selection of his verse *By Still Waters* (1906); some *Irish Essays* (1906). *Deirdre*, a play in three acts, was published in 1907. *The Hero in Man*, an imaginative musing on the character of the soul, appeared in 1909; *The Renewal of Youth*, a similar meditation, in 1911. *Coöperation and Nationality* and *The Rural Community*, two pamphlets embodying coöperative ideals, were published respectively in 1912 and 1913. *Collected Poems* appeared in 1913, and *Gods of War* and other poems, privately printed, in 1915. *Imaginations and Reveries*, a book of prose essays, was published in 1915; *The National Being: Some Thoughts on an Irish Polity* in 1917; *The Candle of Vision*, prose, in 1919. He was a member of the Irish Convention called in 1917, and his *Thoughts for a Convention*, now embodied in the 1921 edition of *Imaginations and Reveries*, appeared that year. As well as those mentioned, he published from time to time pamphlets on various social and political subjects.

As a poet he ranks among the mystics, in the sense that his verse is dominated by a spiritual conception of the universe. Of the two great poets brought to light by the Irish literary revival, W. B. Yeats and "Æ," it might be said of Yeats that he coined for the world the treasure recovered by the renewed access to Gaelic sources into what was virtually a new language in poetry, and of "Æ" that he brought into Irish literature the ancient spiritual thought of the world. His gifts as a poet are reinforced by the vision of an artist, and though in verse he attained his highest expression, his paintings convey a vision of nature as intimate and delicate as in his verse.

He embodied his ideals for the coöperative movement and his thoughts for an Irish polity in *The National Being*. In this book coöperative ideals are used, in a fashion entirely novel, for the creation of a society which would be easily malleable to human impulse and yet stable. The foundations of his state do not begin in a legislature but in the parishes of the country, the social order taking precedence of the political order. He exhibits a general dread of the highly organized state, a dread which may be to some extent an Irish characteristic, and would make the pillars of his nation innumerable coöperative societies, each with the largest freedom for economic and social development, but federated together for enterprises which are too extensive for operation by a small community alone. He would like these communities to do many things which in other countries State departments are asked by socialists to undertake. His ideas on these matters had considerable effect upon the younger generation of Irishmen as well as upon the coöperative agricultural movement in Ireland, founded by Sir Horace Plunkett, and in which "Æ" had worked so many years. His *Candle of Vision* is a record of a personal psychological experience expressed in a luminous and distinguished prose. His economic writings in *The Irish Homestead* and elsewhere, his imaginative prose writings, his verse and his painting, exhibit a unity and harmony rare in one whose modes of expression are so diverse. This probably arises because all are inspired by a conception of God and man and Nature as one single yet multitudinous being, and out of this philosophical root comes the harmony of character maintained throughout in work in such varied spheres as painting, poetry, psychology, economics and politics. (S. L. M.)

RUSSELL, ISRAEL COOK (1852–1906), American geologist (*see* 23.862), died at Ann Arbor, Mich., May 1 1906.

RUSSELL, SIR THOMAS WALLACE, 1ST BART. (1841–1920), Irish politician, was born at Cupar, Fife, Feb. 28 1841. At the age of eighteen he went to Ireland and settled at Donaghmore, co. Tyrone, working as an assistant in a drapery shop. In 1864 he became secretary and parliamentary agent of the Irish temperance movement, and became well known as a speaker for that cause; it was largely due to his energy that the Irish Sunday Closing Act was passed in 1878. In 1885 he unsuccessfully contested Preston as a Liberal, but in the following year was elected to Parliament for S. Tyrone. The Home Rule controversy was then at its height, and Russell was one of the most determined opponents of Gladstone's measure. His valuable work for the Unionist cause led in 1895 to his appointment as parliamentary secretary to the Local Government Board, a post he held until the general election of 1900. About 1899, however, Russell's views underwent a change, and from this time he not only gave up his advocacy of the Unionist policy in Ireland, but became its unceasing and rather bitter critic. His book *Ireland and the Empire* (1901) was largely an attack on the Irish agrarian system, and he also expressed in it his distaste for the Ulster point of view in no measured terms. He became in 1902–3 a member of the Dublin Land Conference, presided over by Lord Dunraven, which ultimately led to the passing of Mr. George Wyndham's Land Purchase Act (1903). In 1907

Russell succeeded Sir Horace Plunkett as vice-president of the Irish Department of Agriculture and Technical Instruction. In 1910 he withdrew from the representation of S. Tyrone, but in the following year was elected for N. Tyrone as a Liberal and Home Ruler. He received a baronetcy in 1917 and retired from public life in 1918. He died at Terenure, co. Dublin, May 3 1920.

RUSSELL, WILLIAM CLARK (1844–1911), English author (*see* 23.865), died at Bath Nov. 8 1911.

RUSSIA (*see* 23.869).—The history of Russia in the years 1910–21 was dominated by the revolution. The connexion between the World War of 1914–8 and that crisis is evident, but even the years preceding the outbreak of the war, both at home and abroad, must be considered chiefly as leading up to the catastrophe. The decay of the bureaucratic system of government, the entanglements of the foreign policy of the empire, the spread of extreme theories among the educated classes, the misery and discontent of the common people, were manifested by striking symptoms both on great occasions and in everyday life.

The Last Years of Tsardom.—The transition from an autocratic to a constitutional régime is a difficult problem to solve under any circumstances, and it was rendered especially difficult in Russia by the lack of political education among the people, the doctrinaire fanaticism of the intellectual leaders and the short-sighted egotism of the Government. Instead of realizing the necessity of working together and supporting one another in order to avoid a revolutionary catastrophe, the traditional rulers and the reformers were intent on destroying each other. The First Duma had ended its days in a vain attempt to appeal to the country against the Imperial Government. In the face of terroristic attacks bureaucratic circles invited the support of enlightened public opinion, but they did it in a characteristic fashion. General Trepov conducted negotiations with a view to forming a Cadet Ministry, but competent observers were convinced that his ultimate object in applying to the advanced doctrinaires was to effect an unworkable coalition which would have to be given up after a short interval in favour of a military dictatorship (Isvolsky, *Memoirs*, 201F).

The Stolypin Ministry, which was actually formed in 1906, started also with a programme of coöperation between the Government and "leaders of public opinion," and it sought an agreement with the more moderate sections of Liberals, especially with the Octobrists, the supporters of a policy aiming at putting into practice the Manifesto of Oct. 30. The failure of this attempt is a fact of historical importance in so far as it showed conclusively how irreconcilable the tendencies of the Imperial bureaucracy were with the programme of Moderate Liberalism. Our survey of the period must start with a brief account of Stolypin's policy, as its failure led directly to the events of the revolution which put an end to the monarchy of the Romanovs.

Stolypin's Policy.—The protagonist of the drama in 1906–10, P. A. Stolypin, was as fine a representative of Old Russia as the governing class of the time could muster—not a great statesman nor an original thinker, but a high-minded, patriotic country gentleman endowed with the traditional courage of his class, with practical experience in Zemstvo work and provincial administration, accessible to ideas of reform, but constitutionally adverse to radical theories. When Minister of the Interior in Goremykin's Ministry he had taken part in negotiations with the "leaders of public opinion," even with Cadets like Muromtsev and Milyukov; on assuming the premiership he tried to introduce into his Cabinet Liberals like Count Heyden, A. Guchkov, N. Lvov, but he did not insist on this combination and eventually formed his Ministry on bureaucratic lines, while relying on the support of the Moderates in the Duma.

The sanguinary repression of revolutionary attempts and of agrarian revolts was taken in hand with ruthless energy, and it succeeded in driving discontent underground and in reëstablishing external order, but it cast its shadow on the constructive work of Stolypin's statesmanship. After the clash with the intractable Second Duma the electoral system was altered by the Manifesto of June 3 1907.

This *coup d'état* secured to the Government a numerical majority in the Third and in the Fourth Dumas, while at the same time it weakened the moral authority of these Assemblies and made the Moderates more susceptible to the appeals of the Lefts.

Some of the points of the complicated electoral system introduced by the Manifesto of June 3 1907 may be mentioned. The deputies were chosen by provincial electoral colleges, only the principal landowners and capitalists had the right to vote personally in these colleges, while other citizens had to exercise their right through representatives chosen at preliminary meetings. The direct franchise was conceded to persons holding land in varying quantities in the different provinces, roughly from 150 dessiatines (about 400 ac.) to 600 dess. (about 1,600 ac.), or town property of the value of 15,000 rubles (about £1,500). The preliminary assemblies were constituted separately for smaller landowners, smaller householders in the towns, the clergy, factory and workshop workmen and peasants. Electors belonging to different nationalities could be divided into separate electoral groups by ministerial decree. The elections in Petrograd, Moscow, Kiev and Odessa were to be carried out by direct suffrage.

Stolypin's counter-offensive against the revolutionary movement could not be restricted to measures of police and emergency legislation: it made itself felt in the intellectual domain.

In spite of the outward pacification of the country there was no real settlement, and the flames of political passion burst out occasionally with ominous violence. The close of 1910 was marked by an increased agitation among the students—the most sensitive and audacious element of Russian society. Harrowing tales of flogging and tortures practised on political convicts in the prisons of the North and of Siberia had reached the educational centres, and a series of strikes and indignation meetings began in all the various high schools of the empire. The professors and academic authorities did all they could to put an end to these disturbances and to ensure the continuation of teaching, and the majority of the undergraduates supported them in this respect. The reactionary bureaucrats, however, with M. Kasso, the Minister of Public Instruction, at their head, decided to use these sad occurrences in order to overthrow the self-government of the universities, conceded to these institutions by the Imperial *ukaz* of Aug. 27 1905, and to curb the rebellious spirit of the students by stern centralization. Towards the end of the Christmas vacation M. Kasso and the Council of Ministers issued decrees ordering the establishment of a strict régime of official inspection, the closing of students' unions and societies with the exception of the scientific ones, and, eventually, the direct interference of the police for the maintenance of order within the universities and high schools. As a protest against these measures, strikes and obstructions broke out again in all the establishments for higher education; lectures had to be delivered in the presence of police officers, armed constables occupied the halls and corridors of academic buildings, and wholesale arrests and deportations of undergraduates took place. In Moscow the Rector (Prof. Maniulov) and his assistants declared that they could not assume responsibility for the carrying into effect of the ministerial measures, and resigned their offices, when thereupon they were deprived of their chairs; 63 professors and lecturers tendered their resignations as a mark of sympathy with their dismissed comrades. This did not disturb the minister in the least, and he promptly accepted most of the resignations, although this involved the intellectual ruin of the oldest and most famous university of Russia. The "Pride's Purge" in Moscow was followed by a number of dismissals in other educational establishments; it was obvious that some of these repressive measures had been prompted by feelings of jealousy and revenge on the part of the minister.

The unsparing scourging of the academic corporations produced the desired effect of outward submission, but it brought the feelings of hatred and humiliation among the intellectuals to the highest pitch, and the outcasts and convicts of the university "Stories" afterwards formed the principal contingent among the embittered intellectual leaders of the revolution.

Another sign of the times may be discerned in Stolypin's legislation in respect of the Zemstvos of the western provinces (Kiev, Volhynia, Podolia, Mogilev, Minsk and Vitebsk). The introduction of a measure of local self-government would have been in itself a boon to the population of these provinces, but Stolypin made it an occasion for a renewed humiliation of the non-Russian nationalities, strongly represented in these districts. The project of the Government disfranchised the numerous Jewish population, and drove the Poles into a position of inferiority by dividing the electorate according to national colleges and establishing beforehand the preponderance of the Russian colleges by means of an artificial scheme of repartition. The unfairness and political short-sightedness of these restrictions provoked a strong opposition even in the docile Third Duma.

In the Council of the Empire a coalition between the Rights and the Lefts led to the rejection of the bill. Stolypin did not submit in the face of such an assertion of independence. He prorogued the Duma for three days (May 14–17), and in the interval obtained an Imperial decree promulgating the law as an emergency measure on the strength of Art. 87 of the Organic Laws. In consequence of this snub administered to the Legislative Assemblies, the Octobrist Centre could no longer support the Government; the leader of the Octobrists, A. Guchkov, resigned the presidentship of the Duma, and votes of censure on the Government were passed in both Houses on the resumption of their sittings. Stolypin's position was made untenable by these events. His victories meant in truth the breakdown of his programme. The Premier had again to rely exclusively on the goodwill of the autocratic Tsar as against independent public opinion, and he had to strive for that goodwill in the enervating and treacherous surroundings of Court intrigue, in which obsequious chamberlains were more expert than himself. The consciousness of failure was clearly expressed in Stolypin's behaviour after the smashing of the universities and the snubbing of the Legislative Assemblies. He looked worn in July 1911, and alluded repeatedly to his approaching resignation (Prof. Pares, in the *Russian Review*, 1912).

The *coup de grâce* came from the midst of the secret police, that had become the mainstay of the Imperial system in its struggle against rebellion. One of the agents of this organization, Bogrov, inflicted a mortal wound on Stolypin at a gala performance in the Kiev Opera House on Sept. 14 1911. The hatred of oppressed nationalities and of the humiliated intellectual class had armed the hand of the assassin, a well-educated Jew.

One part of Stolypin's activity calls for special examination, his land reform, which may be considered as the immediate introduction to the social revolution of 1917.

Defects of the Emancipation.—The agrarian revolts of 1905 attracted the attention of the Government and of society to the deplorable condition of the most numerous and important social class, the peasantry. The causes of the growing impoverishment of the peasantry are to be sought primarily in the manner in which the emancipation of 1861 had been carried out. The Emancipation Act of Feb. 19 1861, liberating the peasants from personal serfdom and giving them part of the land on certain conditions, was meant at the same time to achieve two other purposes: it tried to secure the necessary number of workmen for the landowners, who had lost the gratuitous labour of their serfs, and to ensure the collection of taxes and redemption payments. Each peasant received at the emancipation a certain quantity of land from the landowner; he had to pay for it a redemption price, the amount of which was fixed by the Government: the payments had to be completed in 45 years. The plot of land which the peasants got as their share on the transaction was called the holding (*nadêl*): its size varied greatly in different provinces. "Large" holdings ranged between $2\frac{3}{4}$ (about 8 ac.) and 12 dess. (33 ac.), while minimum holdings corresponded to one-half of the maximum ones. The landowner's share comprised, besides his domain land, from one-third to one-half of the land formerly occupied by the peasants, on the condition that the latter should receive no less than the minimum holding. Besides these two principal types of holdings the Emancipation Act of 1861 established also the "beggarly" or "gratuitous" holding, which was to be no less than one-quarter of the maximum one. The gratuitous holding was established by free agreement between the peasants and the landowner; in this case the peasants had to pay no redemption, while the landowner kept all the rest of his land. On the whole the quantity of land held by the peasants had been much reduced.

The following figures for the province of Saratoff may serve as an illustration:—

Peasants who held	before 1861	after the emancipation
More than the "large" holding	48·1	5·8 per cent
From $\frac{3}{4}$ to 1 of " "	35·8	4·8 " "
Less than $\frac{3}{4}$ of " "	16·1	52·2 " "

In 1861 688,826 peasants received beggarly holdings; they held 502,383 dessiatines. In 35 provinces 921,826 souls[1] were assigned one-half of the large holding each and held 1,530,000, or less than 2 dessiatines per soul.

The peasants' landholdings, which were already whittled down at the time of the Emancipation, were further reduced after it by the increase of the population. A Commission for the investigation of the conditions and needs of the peasantry described the diminution of the peasants' holdings in the following manner: in 1860, 4·8% decrease on the average; in 1880, 3·5 decrease and in 1900 2·6 decrease. Besides a portion of the arable land, the peasant lost at the Emancipation the right of using the landowner's pasturage, of cutting wood in his forest, and some other subsidiary rights important in peasant farming.

The redemption payments were a heavy charge on the peasant's budget. The Agricultural Commission of 1872 found that squires had to spend on taxes less than 14·5 kopeks per dess., while the peasants paid more than 95·5 k. per dess. In addition the peasants had to pay the poll-tax, the amount of which was about 4r. 45k. per soul. The same Commission states that in 37 provinces the taxes and redemption payments of the former state and appanage peasants comprised 92·75% of their net income from land, the payments of former unfree peasants 198·25 per cent. Professor Yanson calculated that in the province of Novgorod the taxation of peasants who got small holdings was, in relation to the net income of their land, 275% in the case of the peasants who owned their land, and 565% in the case of those who had to pay the land redemption. This means that the peasants had to find other sources of revenue in order to satisfy the collectors of the land tax. The Government made some attempts to relieve the peasants' tax load. The salt tax was abolished in 1880, the poll-tax in 1882. But these measures could certainly not solve the financial difficulties of the peasantry. Arrears grew rapidly to enormous proportions.

The following figures show the growth of arrears from redemption payments in the province of Tambov:—

1871– 5	3%
1876–80	5%
1881– 5	16%
1886–90	35%
1891– 5	124%
1896	151%
1897	205%
1898	244%

Driven by land hunger, the peasants farmed on lease a large part of the State's appanages and of squires' land, but this expedient cannot be considered as an effective help in the solution of the land problem. The rent paid by the peasants to the landowners was usually very high. It is important to notice that certain plots of land, the use and possession of which was an essential necessity for the whole community, for example strips bordering on watercourses, remained usually after the Emancipation in the hand of the landowner. This gave him the power to require exorbitant rent for such land and keep the peasants in permanent fear of losing these grounds, without which village life was practically impossible. This led to continual collisions. Under such conditions the backward and extensive methods of peasant cultivation proved very difficult to reform.

One of the most important defects of the peasant's landholding before the land settlement of Stolypin was the intermixture of strips in the open fields. The land of a community lay only seldom in a compact block. It was usually divided into a number of smaller "shots" sometimes mixed up with lands of other villages and landowners. The blocks of land belonging to the same community were again subdivided into strips, which were sometimes 2 to 3 yd. broad and some hundred yards long. Each household held a certain number of strips 20–30–50, sometimes even 100–150. The strips were scattered at a great distance from the farmyard, and the driving to them entailed a considerable waste of time and work: this hampered greatly the farming arrangements of the villagers. A peasant of the province of Novgorod calculated that he and his horse had to make about 1,548 versts (a verst is about ¾ mile) every summer merely to go to and from his field situated at a distance of 3 versts from his farmyard. But some strips lay at a distance of 15–20 v. and even more. The intermixture of strips separated from each other only by narrow balks obliged the whole community to follow the same system of cultivation, which was usually the three-fields one. The very large extent of fallow land, the poor manure produced by weak, badly fed cattle, the carelessness of the holders who were not sure of keeping their land permanently—all this had the most ruinous effect on the peasants' farming. Under such conditions, hampering individual energy and initiative, the production on the peasants' holdings was very low indeed. The average value of the gross produce in 27 provinces[1] of one dessiatine of peasants' land was 8r. 99k., while the average cost of production per dess. was 5r. 22k.; so that the net produce per dess. amounted only to 3r. 77k. The productiveness of the squires' estate was 12–18% higher than that of the peasants, but if we take into consideration that a large area of landowners' land was taken on lease by the peasants, the difference in the results of cultivation would be much greater. Mr. Yermolov puts it at about 50%.

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[1] Persons doing the normal work of a villager.

Decay of the Peasantry.—The growing impoverishment of the peasantry during the whole period which followed the Emancipation of 1861 is reflected in the following description of peasants' life under normal conditions, taken from a memoir of the Zemstvo of Tula:—

> The peasant's life is hard and unsightly even in periods of comparative welfare. Generally he lives in a cottage of 8–9 yd. width and no more than 3 yd. in height. Cottages without chimneys are still very common, the smoke being let out through a hole in the roof. The roof is almost always thatched. In many provinces the walls are covered with dung for the sake of warmth. A peasant's family, sometimes a numerous one, is huddled together in a space of 20–30 sq. yards. The floor of the cottage is almost always bare soil, because lambs, calves, pigs and even cows are put in during the cold weather. Skin diseases are very common among the population. Meat, bacon, oil, butter appear on the peasant's table only on exceptional occasions, perhaps two or three times a year; his usual fare is composed of bread, porridge, kvass, cabbage and onions.

A very characteristic sympton of the decay of the peasants' farming is the reduction of the number of horses and the increase in the numbers of horseless households. A comparison of the figures of the horse statistics in 1888 and 1893–4 proves that in 31 provinces the number of horses had fallen by 10·88 per cent. The number of horseless households had increased during the same period in 23 provinces of central Russia from 21·56% to 26·85 per cent. More than 25% of the households have no horses at all; another 25% have only one horse each.

Let us now examine a peasant's normal budget as it is presented in the remarkable work of Mr. F. A. Shcherbina (edited by Prof. A. J. Chuprov). A medium budget of a peasant was balanced at 54r. 92k. The budget of a medium peasant householder consisted of the following items:—

Income from:—

Corn on his land	16 r. 20 k.
Corn on household land	1 r. 92 k.
Straw and hay	8 r. 16 k.
Gardening	2 r. 63 k.
Cattle-breeding	9 r. 99 k.
Trade or craft	8 r. 47 k.
Sundries	7 r. 26 k.
Total	55 r. 63 k.

Expenses:—

Corn	18 r. 10 k.
Food for cattle	8 r. 45 k.
Vegetables and fruit	1 r. 30 k.
Meat	3 r. 90 k.
Rent	1 r. 2 k.
Taxes	2 r. 65 k.
Sundries	20 r. 10 k.
Total	55 r. 54 k.

Assuming that 19 puds of corn per head are the minimum necessary during one year and that 7·5 puds are sufficient for fodder, Mr. Maress calculated that 70·7% of the peasant population had less than 19 puds per head, 20·4% had between 19 and 26·5 puds per head, and only 8·9% had more than 26·5 puds per head. This means that 70·7% of the farming population could not live on the income from their land and would be reduced to semi-starvation if they could not find any supplementary means of existence. No wonder the standard of living of the great mass of the people stood exceedingly low. The following figures[2] enable us to form a judgment as to the comparative consumption of corn in various countries; in studying them one must remember that corn was the staple food in Russia and that meat played a negligible part in the bill of fare of the people.

Average Corn Consumption and Production, per head (in kilograms) : 1909–14.

	Production	Consumption
Canada	1,696	1,326
United States	1,151	1,108
Hungary	651	552
Argentine	1,322	509
Germany	417	497
France	421	480
Rumania	875	420
Russia	445	381

The state of mind produced by this situation among the peasantry may be gathered from the opinions expressed by peasant deputies in the Second Duma in the course of the debates on agrarian reform. One of the members of the Right, Prince Sviatopolk Mirski, had said that the ignorant and inexperienced mass of the Russian people had to be guided by the landlords as a flock is guided by shepherds. Kisselev, a peasant belonging to the group of toil, replied:—

> "I should like the whole of peasant Russia, the whole of the Russian land, to remember well these words of the noble descendant of Rurik. . . . We have had enough of that kind of thing! What we want are not shepherds, but leaders, and we know how to find them without your help. With them we shall find our way to light, to truth, to the promised land!"

Afanassiev, a non-party deputy, an ex-soldier, said, among other things:—

> "In the Japanese war, I led a number of mobilized soldiers through estates (of the squires). It took us forty-eight hours to reach the meeting place. The soldiers asked me: 'Where do you lead us?'—'To Japan.' 'What for?'—'To defend our country.' They replied: 'What is that country? We have been through the estates of the Lissetskys, the Besulovs, the Padkopailovs. . . . Where is our land? Nothing here belongs to us.'"

The same deputy said on another occasion:—

> "Work, sweat and use the land! But if you do not wish to live on the land, to till it, to work on it, you have no right to own it!"

The great majority distrusted projects of expropriation based on the idea of compensating the former landowners, as likely to lead to unfair adjudications to the advantage of the squires. Some of the leaders were calculating how much should be taken outright, without any compensation; a few demanded the whole. Pianych, a socialist, exclaimed: "Throw them all off!"

Government Policy.—In order to meet this disastrous situation the Government made attempts in three directions—the increase of the size of peasants' holdings, emigration and the improvement of agricultural methods. It would be erroneous to think that the deficiency in land could be entirely removed by new distributions from the estates of the squires and the domains of the Crown. In 1906 the distribution of land among different classes of landowners was as follows (*La Réforme agraire en Russie*, Ministère de l'agriculture, 1912):—

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[1] Statistics of the Taxation Department 1903.

[2] Nordman, *Peace Problems: Russian Economics*, p. 36.

Crown land	133,038,883 dess.
Peasants' holdings	119,067,754 dess.
Land bought by communities and associations of peasants	11,142,560 dess.
Land bought by individual peasants	12,944,154 dess.
Land of the gentry	49,287,886 dess.
Land owned by other classes	22,664,493 dess.
Land owned by various institutions	6,985,893 dess.

The enormous area of the Crown lands was mainly covered by forests or situated in the northern and eastern provinces, so that it could not be used for agricultural purposes; the surface of convenient land in the hands of the Crown was only about 3,700,000 dess. The arable land owned by the Church and different ecclesiastical institutions amounted to 1,672,000 dess. (Statistics of the Holy Synod, 1890); the appanages comprised arable land of 2,000,000 dess. If we take into consideration that a large part of the landowners' land was covered also by forests, we come to estimate the surface of the arable land owned by squires at about 35,000,000 dess. (Yermolov). The sum total that could be disposed of would thus amount to 45,000,000 dess., or about 30% of the area of the peasants' holdings; divided among the villagers it would make less than one additional dessiatine per soul. The insufficiency of the land reserve becomes even more evident if we keep in mind that about 85% of the Crown's arable land, 90% of the appanage arable land, and a considerable part of the squires' land were already leased by the peasantry. Of the 7,449,228 dess. which were sold by a newly instituted Peasant Bank to the peasants from 1882 to Jan. 1 1906, village communities acquired 25·6%; peasants' associations 72%; individual householders only 2·4 per cent.

The peasants' revolt of 1905 and the new schemes of Stolypin gave an entirely new direction to the agrarian policy of the State. The Manifesto of Nov. 3 1905 suspended all redeeming payments after Jan. 1 1906. Of the surface of 2,846,620 dess., which the bank sold directly from Jan. 1 1906 to June 1 1913, peasants' communities got 5·5%, peasants' associations 14·8%, individual owners 79·7 per cent. The peasants also acquired from the landowners, with some assistance of the bank, 4,375,163 dess. It is estimated by Oganovsky that the result of the bank activity until July 1 1910 was the creation of 45 to 50 thousand separate farms and of 130–140 thousand small compact plots, the owners of which live in hamlets.

Let us turn now to the policy of the Government concerning emigration. The law of 1889 had subjected emigration to official supervision. Those were allowed to emigrate who were able to pay the expenses of the journey and of the installation of a new household, provided their departure did not harm the remaining members of the community. No Government assistance was given to the emigrants. Permission to emigrate was refused if the local authorities considered that the emigrants could find work in the old district. Those who emigrated without an official permission had to be sent back. These regulations resulted in a great reduction of the emigration movement, which was practically closed to the poorest peasants.

The events of 1905 and the new orientation of the Government brought a great change in the emigration policy. Greater facilities were granted, and Government assistance was promised by the Provisional Rules of June 6 1906. But the growth of emigration which followed the new regulations was obstructed by a complete lack of organization. The following figures give us some insight into the working of the new laws:—

	Emigrants to Asia (in thousands)	Emigrants returning from Asia (in thousands)
1906	139·1	13·7
1907	427·3	27·2
1908	664·8	45·1
1909	619·3	82·3
1910	316·2	114·9
1911	166·5	84·4

These figures prove that the emigration policy of the Government was far from successful.

We have now to consider the third branch of the Government activity, directed towards the solution of the agrarian question. The scheme for improving agricultural methods was based on a reform of the distribution of the land. In 1861 a legal confirmation of the peasants' customary commune was considered the best means to secure the return of the money advanced by the State for redemption. The statistics of landownership in 1905 showed that 23·2% of the households and 17% of the land owned by the peasants were held by private tenure; 76·8% of the farms and 82·7% of the peasants' land were in communal tenure. The right of property was attributed not to separate householders but to the whole village community, as a juridical person. In the case of communal land tenure only the farmyard belonged to households in permanent tenure; other land belonged to the whole community, and was subject to occasional redivisions. Unfree domestic servants were assigned to peasants' communities, but did not obtain holdings: they formed in this way a village proletariat.

In the reign of the Emperor Alexander III. the communal tenure, which was regulated by the Liberation Act of 1861, came to be regarded as a political safeguard, and its decay was considered to be a national danger. The law of Dec. 14 1893 made practically impossible the transition from communal to household tenure. But the growing impoverishment of the peasantry gave evidence that the existing land system ceased to be beneficial. The special conference established by an Imperial Order on Jan. 22 1902 recognized for the first time the necessity of a fundamental change in the existing land settlement of the peasants. The majority of the Conference were of the opinion that the communal tenure and the intermixture of strips were the chief causes of the alarming condition of the peasantry.

Stolypin's Land Settlement.—The agrarian disorders of 1906 gave increased importance to the problem, and proved that the settlement of it could not be postponed any longer. In the years 1906–7 the problem of land reform excited the strongest interest in governmental circles, and played a most prominent part in the programmes of different parties and in the debates of the First and the Second Dumas. Stolypin took the initiative on the part of the Government and eventually obtained the support of the Third Duma. His scheme was directed towards a political purpose, the creation of a conservative class of small peasant owners who could be counted upon to defend the existing régime. This class had to be strong and progressive from the economic point of view, as it was clear that the improvement of the peasants' condition could be attained only by more intensive farming. As was said above, some measures had been taken to enlarge the area of the peasants' holdings without violating the interests of the squires. But the greatest part of the Government activity was directed to a complete reconstruction of relations inside the village, to the creation of separate farms and to the spread of individual ownership. The Imperial *ukaz* of Nov. 9 1906, the Land law of June 14 1910, and the Agricultural law of May 29 1911 were enacted for this purpose. The leading features of Stolypin's scheme were as follow. Each householder possessed of land in a village community can demand that his land shall be constituted a plot in individual property. A simple majority of the village assembly may convert the holdings into the land owned privately. The land has to be assigned to the claimant, if possible, in a single block. The conversion of the land of the entire community can be decreed by a resolution of the village meeting passed by a simple majority of the members. All the communities where there had not been any redivision of land since 1861 were declared to have passed from communal tenure to individual or household ownership. The formation of compact plots could not be refused if it was asked for by not less than one-fifth of the householders. The Land Commissions created by the *ukaz* of March 4 1906 were entrusted with the redistribution of land under the new land settlement.

In the Duma the Right clung to the opinion which had been predominant in the time of Alexander III.; the Left entertained the hope that the communal land tenure was to form the cradle of future collectivism. The Cadets mostly agreed with the principles of the Government scheme, but they objected to the coercive character of its methods. The majority of the House supported the Government and carried its bill through the Duma. The motives that influenced the deputies of the Duma were well expressed by the chairman of the Land Committee, S. Shidlovsky, in his speech on Oct. 23 1908:—

> "Our attitude as regards the decree of Nov. 9 is in substance a favourable one, because this decree aims at the development of individual land tenure and individual land tenure is certainly the necessary condition of improved cultivation, and the latter means the solution of the agrarian problem. . . . The foundation of a State ruled by law consists in a free, independent and energetic personality. Such a personality cannot exist unless you allow the common right of ownership, and no one who wishes the State to be ruled by law should oppose the spread of private property in land. Land is, after all, only a basis for the application of labour and capital, and labour is most productive when the labourer is placed in favourable conditions. In the forefront in this respect we have to place an open door for personal enterprise, free play for creative energy, security against outside interference, personal interest. . . . The avenue towards a permanent improvement in the existence of our peasants is to be found in an immediate increase of production and income from land, and this cannot be achieved without the help of outside capital. . . . A law which opens the way to personal property enables the agricultural worker to display his creative force."

It seemed as if the reform had achieved an immediate and striking success. Before Jan. 1 1913 the Commission had arranged farms on an area of 7,413,064 dess., held by 738,980 households; strips had been concentrated into blocks on an area of 4,359,537 dess., held by 585,571 households.

The following figures illustrate the first part of the Commission's work from 1907 to 1911.

Up to April 1 1911 the number of peasants who wanted to leave the commune amounted to 2,116,600, or 23% of the whole number (9·2 millions). The movement towards enclosures was not equally popular in all the parts of the Empire. To make the process clearer we may divide the country into 5 areas: (1) South-East, (2) Agricultural Centre, (3) two Industrial Centres, round Petrograd and round Moscow, (4) South-West and West, (5) North and North-East (Oganovsky).

The following figures show the proportions of demand for compact plots in each of these provinces in proportion to 1,000 households:—

	S.E.	Agr. Cent.	Ind. Cent.	S.W and W.	N. and N.E.	The whole country
Till Nov. 1907	2·8	0·9	0·5	5·2	0·4	1·4
Nov. 1907—Nov. 1919	7·9	7·2	3·7	14·6	2·7	6·7
Nov. 1908—May 1909	15·8	9·1	6·6	15·6	1·7	8·9
May 1909—Jan. 1910	6·1	5·0	4·8	7·3	2·1	4·9
Jan. 1910—July 1910	5·2	4·6	4·8	8·6	1·4	4·7
Aug. 1910—April 1911	2·5	3·1	1·8	6·1	1·0	2·8

The number of demands for separate farms before April 1911 for each 1,000 households who held their land in communal tenure were:—S.E. 320·6; Agr. Cent. 236·9; Ind. Cent. 172·5; S.W. 427·3; N. and N.E. 77·9; whole country 234·9.

These figures show that the greatest number of demands for separate farms were made in the South and South-East provinces, where the most extensive agricultural methods prevailed. It appears also that after May 1909 the number of householders applying for farms diminished in a marked proportion. The area of the compact plots was generally very small: and the percentage of poor peasants who asked for enclosure was growing. Their intention in getting rid of communal ties was to sell their land.

To judge by these data, the Government scheme of creating a class of small independent farmers was not in a fair way to success. As was shown above, most of those who asked for separation held only a small plot, and belonged to the poorer peasantry. Even with Government assistance they were unable to start separate farms, as this undertaking involves in the beginning a considerable outlay of capital. Besides, the natural conditions in some parts of Russia were not favourable to separate farms or homesteads. One of the chief difficulties was the lack of water, which cannot be found at all, except in connexion with considerable rivers, in very large tracts of the "black soil" area. This fact, together with the traditional leaning of the peasantry to village life, obliged the Land Commission to keep up on many occasions the village system even after the concentration of the fields.

A memoir drawn up by the conference of Old Ritualists held at Moscow on Feb. 22–25 1906 discloses the view taken by the peasantry on the question of communal land tenure. The opponents of the commune suggested that it made impossible any improvements in agricultural methods and diminished the productive power of the soil; its supporters stated that communal tenure was the only system based on justice; this consideration is characteristic of the traditional feeling among the Russian people. The Government scheme sacrificed justice for the sake of expected increased production. Stolypin himself described the new land settlement as "a stake on the strong."

The small area of the holdings of the new farmers and their economic helplessness had, however, a very unfavourable influence on the expected increase of production. A farmer who held only 8–10 dess. of land could not introduce any extensive improvements in his household in the absence of cheap credit. Stolypin recognized that "primitive methods were used by the peasantry as before." On the other hand, the rapid growth of emigration was one of the results of the new settlement.

The land settlement of 1906–10 was carried out with uncommon energy, but the social needs of the population were not satisfied. The Government was accused of having destroyed by a stroke of the pen an institution formed by centuries. The sudden change affected not only the economic conditions of the peasants' life, but the juridical relations between the members of the family were also shaken. Before the new settlement the life of the peasants was based on the participation in the common holding of all the members of the household. The new law substituted for this family tenure the individual ownership of the chief householder. All the other members of the family suddenly lost their rights in the land.

Other important inconveniences were also pointed out: the compulsory introduction of the reform, the danger of the increased competition, the buying up of the peasants' land for speculative purposes, the increased difficulties of existence in the case of the small households. The great end of the settlement—the creation of a strong, wealthy and conservative class of small landowners, was not attained. The necessity of extensive Government assistance and credit for the improvement of agriculture was felt more and more, but the financial estimates under this heading for 1911 amounted only to 4,000,000 rubles.

Altogether it may be said that Stolypin's agrarian measures could take effect only if they were accompanied by a steady policy making for agricultural education and backed by extensive credit. Even in such a case a long time would have been necessary to enable them to strike root. Their immediate consequence was rather to increase the fermentation in the villages and to excite and embitter the feelings of the villagers, who were losing faith in the village community without acquiring any other standard of economic organization. Thus the legislation of 1906–11 helped the agrarian upheaval instead of preventing it.

The Third and Fourth Dumas.—The death of Stolypin left a wide gap in the ranks of the Government, and the appointment of M. Kokovtsov, the Minister of Finance, to the premiership did not result in a rejuvenation of the bureaucratic system. The new Premier was in favour of continuity in policy; this meant that he would keep on the lines traced by Stolypin's initiative and avoid new departures as far as possible. He was a trained administrator, placed by chance at the head of the country in a time when caution and routine were certainly insufficient to meet the requirements of a critical situation. The principal achievement of the three years of Kokovtsov's rule was apparent success in the management of financial operations. The budget grew every year and reached in 1914 the enormous sum of 3 milliard rubles, and yet not only was a deficit avoided, but some 1,500 millions in gold were accumulated as a reserve fund to sustain the currency and meet possible emergency calls.

The instability of the vast structure buttressed on the chronic alcoholism of the people was duly perceived by public opinion, and a campaign was started in the Duma to put an end to this shameful and perilous situation. One of the Duma members, Chelyshiv, was the soul of this active agitation in the Legislative Assemblies and in Government circles. He succeeded in obtaining the formation of a commission to examine and report on the subject, but his abolitionist plans were obstructed by the opposition of the Finance Ministry, which did not see its way to balance the budget without the resources supplied by the monopoly of the sale of spirits.

Yet signs were not wanting that the welfare of the country was seriously threatened, in spite of the deceptive appearances of an enormous and duly balanced budget. The harvest of 1911 was so poor that in 1912 Russia was visited by a severe famine. Yet the Government refused to let voluntary organizations assist in fighting the disaster; only associations affiliated to the Red Cross or to the Zemstvos were allowed to send agents into the provinces, to collect and to distribute funds. The public works organized by bureaucratic boards were conducted in a very unsatisfactory manner: the peasants got hardly any help from them, as support was systematically directed to assist householders who owned horses and were altogether better off. Public opinion was incensed but powerless. As regards workmen in factories and workshops some progress was made in connexion with insurance against ill-health, but in other respects the employers were left very much to their own way, with the result that strikes, which had decreased considerably in number and intensity after the collapse of the revolutionary movement in 1907, began to multiply again. In 1912 2,032 cases of strikes were registered, in 1913 4,098. On many occasions the unrest was quelled by the intervention of Cossacks and soldiers. The most terrible case of the kind occurred in the gold-fields of a company largely supported by British and other foreign capital—the Lena Company: a dispute as to wages and maintenance was terminated by a fusillade in which 162 workmen were killed.

It is difficult to estimate the exact effect of this kind of administration on the peasants and workmen subjected to it, although there can be no doubt that bitter resentment was increased by the fact that it was driven underground. But indirectly the disappointment and disaffection of society left its mark in the growth of political opposition in spite of all the efforts of the Government to suppress it and to obtain outward compliance by means of artificial restrictions of the franchise and downright pressure on the electors.

The dissolution of the Third Duma on the completion of its period of five years presented an opportunity for an attempt of this kind on a large scale. The Third Duma had been led by the Octobrist party in conjunction with the moderate Right. This policy had suffered shipwreck through the absolutist bent of Stolypin's administration and the colourless leadership of Kokovtsov. In the last sessions before its dissolution the Duma assumed a frankly hostile attitude towards the Ministry and the leader of the Octobrists, A. Guchkov, pronounced thundering indictments against the "irresponsible influences" which shaped the course of politics from behind the scenes: the egregious mismanagement of the Artillery Department, presided over by the Grand Duke Serge Mikhailovich, and the scandalous influence of the Empress's protégé Rasputin, gave good grounds for these attacks. The decree of June 3 1907, which had introduced an intricate and restricted franchise, provided convenient handles for the gerrymandering of elections, and Kokovtsov's Government made full use of them in order to secure a Government majority in the Fourth Duma. Especially conspicuous was the mobilization of the parish priests by command of the Procurator of the Holy Synod, Sabler: the clergy were enjoined to exert all their influence on the peasants in order to ensure the election of deputies of the Right. The bureaucracy was so far successful in this campaign that, thanks to its pressure and to the evident breakdown of the plan of a coalition with the Government, the Octobrists were defeated in a number of districts and their leader, Guchkov, succumbed at the polls.

The party grouping may be tabulated as follows:—(1) The Right, 67; (2) Moderate Right, 38; (3) Nationalists, 55; (4) Centre (Krupensky's group), 28; (5) Octobrists, 87; (6) Progressists, 37; (7) Constitutional Democrats, 60; (8) Social Democrats, 14; (9) Polish circle, 13; (10) Mahommedans, 6; (11) No party, 20; (12) Group of Toil, 7; (13) Of unknown party allegiance, 17.

The new Duma was thus apparently more reactionary than the one which had preceded it. But public discontent and the inability of the Government to frame any effective policy of reform produced the unexpected result that a combination was brought about between the groups of the Left, the Octobrists, and even, in some cases, the Right Centre. In a general way the Duma assumed an attitude of opposition as regards the Government and the reactionary Council of the Empire. This line of policy was especially conspicuous in a long series of interpellations and resolutions of want of confidence carried against arbitrary acts of the authorities. The following interpellations may be mentioned among many: on the illegal acts of the police during a search in the house of the deputy Petrovsky; on the acquisition of the Kiev–Voronezh railway line by the State; on naphtha trusts; on the secret dealings of the Government with Baron Günsburg, the principal director of the Lena gold-field; on an illegal ordinance of the Petrograd prefect concerning the suppression of hooliganism; on a reform of the Medico-Surgical Academy of Petrograd by an illegal order of its principal; on the spending of money without warrant from the Legislature and failures in carrying out the conditions as to grants and credits, etc. And yet when a bill was passed by the Duma to establish rules as to the responsibility of civil servants, the Council of the Empire refused to sanction the most modest requirements in this respect, although even the Minister of Justice had expressed his agreement. On the other hand, the Government did not scruple to prosecute a deputy (Kusnetsov) for a speech he had made in the Duma, and the administrative department of the Council of the Empire laid down the principle that members of the Legislature were liable to prosecution in such cases.

All measures of home policy, even the most urgent ones, were regarded from the point of view of political strife. The Education Committee of the Duma, in conjunction with the Zemstvos, had worked out a plan for the provision and equipment of a sufficient number of elementary schools in order to secure universal instruction throughout the country. It was calculated that some ten million children had to be accommodated in the schools, in addition to about five million who were already enrolled for a course of three years in the schools of the towns and the Zemstvos (provinces). In order to achieve the result by 1924, the Duma proposed to develop gradually a network of schools by means of appropriations successively increased by 10,000,000 rubles a year in the course of 10 to 12 years. This scheme could not be carried out in its entirety and in a systematic form on account of obstruction from the Board of Education and from the Council of the Empire. Besides the distrust of these reactionary bodies as regards all kinds of enlightenment, they were opposed to any policy which gave precedence to secular schools over Church schools, although it could not be contested that the former were much more advanced and perfect in teaching and organization. The comprehensive law of consolidation which would have ensured a steady progress towards systematic instruction in the country was wrecked by the Council of the Empire; the "enlightened bureaucrat" Count Witte did not scruple to oppose the bill in alliance with the stalwarts of reaction, because, as he expressed it himself, it was an attempt to obtain paradise by means of child-murder, the murdered child being the Clerical school organization. Thwarted in its comprehensive policy, the Duma nevertheless proceeded on its course by occasional increase of credits for elementary education.

These constant conflicts produced a perceptible sliding towards the Left in the ranks of the Duma legislators. One of the symptoms of this process consisted in the disruption of the Octobrist party. It broke up into three small groups—the Left, hardly distinguishable from the Cadets; the Centre, which professed to devote its activity mainly to the strengthening of the Zemstvos; and the Right, which still clung to the idea of a possible alliance with a reformed Government. The dismemberment of the Duma into a number of small party groups gave additional influence to the Cadet nucleus, which, though it counted few members in the Duma, acted under strong discipline and had a powerful press.

In one direction only the majority of the Duma was fairly in agreement with the Government, namely as regards foreign affairs and in questions concerning the interests of the dominant nationality of the Empire. In spite of certain minor disagreements between the parties of the Left and the Centre and Right, the Duma as a whole was decidedly Nationalistic. The Third Duma had bequeathed to the Fourth a definite line of policy concerning the Finland conflict: the Legislature backed the Government in its endeavours to subordinate the autonomy of the Finnish State to the superior claims of the Empire. The view that the union between the Grand Duchy and Russia was a *real* and not a *personal* one led to the assertion of the supreme jurisdiction of the Imperial Senate and of the St. Petersburg Court of Appeal over Finnish tribunals; to the passing of laws commuting the obligation of personal military service for money payments; and to the recognition of Russians dwelling in Finland as citizens of the Grand Duchy on equal terms with native Finns. Even the Cadets did not contest the general principle from which such demands were derived, although they disapproved of the raising of issues which embittered the intercourse between nationalities and led to unpleasant consequences in the shape of passive resistance and the incarceration of Finnish officials who refused to recognize the legality of the interference of Russian institutions in Finnish affairs, apart from the traditional channel of the governor-general and Senate as representing the authority of the Grand Duke.

The creation of the new province of Chelm (Kholm), separated from the provinces of Lublin and Sedlitz, envenomed another national conflict of long standing—that between Russians and Poles. The new Government was formed out of districts in which the dominant ethnographic element of the population was Little Russian and not Polish, although this population had been included for centuries within the boundaries of the Polish State and had been recognized as part of Congress Poland annexed to Russia by the Treaty of Vienna (1815). The Duma passed the law of separation without taking heed of the violent protests of Polish public opinion.

The Conflict with the Central Empires.—The Nationalistic orientation of the Third and Fourth Dumas was put to the test by the growing entanglements of foreign policy in the course of the years 1911–4. Russia had definitely joined the combination of Western Powers against the predominance of Germany, and opinion in the country fully supported this momentous change of front. The annexation of Bosnia and Herzegovina by Austria under the protection of Germany "in shining armour" was strongly resented, not only by Stolypin and Isvolsky as the official exponents of Imperial policy, but by the nation at large, the more bitterly as it was felt that Russia was not in a position to give free vent to her dissatisfaction. No wonder that in 1911, during the Agadir affair, Russia was found on the side of Kaiser William's opponents. But matters became especially serious when the Macedonian hostilities, which had been smouldering for decades, burst out into flames in 1912. The coalition between Bulgarians, Serbians and Greeks against Turkey had been rendered possible and effective by the support on which they reckoned from Russia; and O. Hartwig, the Minister Resident at Belgrade, was one of the principal agents in bringing it about. M. Sazonov, the successor of M. Isvolsky at the Foreign Office, cautious, but devoted to the great tradition of Russia's protectorate over the Balkan Christians, was intent on using to the full the favourable situation created by the union between the three Balkan States, the sympathy of Western Liberals and the temporary indecision of the Central Powers. In this he was supported by the Tsar Nicholas, who, however, made it clear to his agents that Russia would not risk an actual war.

The crushing defeat inflicted on the Turks by the Balkan allies seemed to justify completely the combination engineered by Hartwig. But the harvesting of the fruits of victory proved a more difficult task than the actual fighting. The Central Powers had realized the menace of a permanent Balkan League to their ascendancy in the Near East. Austria vetoed any extension of Serbia towards the Adriatic. With the support of Germany she succeeded in depriving the Serbs and Montenegrins of the position they had won in Albania. Russia did not dare to back the latter's claims to the finish at the London Conference, and the Western Powers were disinclined to proceed without Russia. The eviction of the Serbs from the west proved fatal to the peace of Europe. They tried to recoup themselves in the east by demanding districts of western Macedonia which had been previously conceded to the Bulgarians. M. Sazonov tried to stop the growing animosity between the Balkan allies by offering the mediation of Russia, and Nicholas II. attempted rather late in the day to exert his personal influence on the wily Ferdinand of Bulgaria as well as on the Serbians. These attempts at conciliation proved unavailing: the Bulgarians broke away first, but were soon checkmated by a coalition between Serbia, Greece and Rumania. The Peace of Bucharest, which gave the Dobrudja to Rumania, western Macedonia to Serbia and important districts of Thrace and Macedonia to Greece, shattered all hopes of an effective Balkan League, and laid Bulgaria open to the insidious intrigues of Austria and Germany. M. Sazonov manifested clearly the ill-humour of Russia; but this powerless discontent made her diplomatic defeat still more humiliating.

All these events were watched by Russian public opinion with keen interest and warm sympathy for the cause of the Slavs. It was realized more and more clearly that the struggle did not concern merely the small States of the Balkans, but also their big neighbours; in the Duma and in the press the attitude of the Government was applauded or criticized from the point of view of national self-consciousness and imperialistic aspirations. M. Sazonov found unexpected support from M. Milyukov, the leader of the Cadets. B. Maklakov and V. Bobrinsky came forward as the spokesmen of Slavonic solidarity. No one knew exactly how much was involved in the risk of a breach with Germany, but the public at large sought a kind of compensation for the disappointments of home politics in a bold attitude in foreign affairs. In this way, when the climax in the antagonism between Austria and Serbia was reached in the assassination of the Archduke Franz Ferdinand, the Russian public was prepared to back the Government against any hostile acts of the Central Powers. The outrageous treatment of Serbia by Austria-Hungary was rightly interpreted as a provocation to the Entente, and especially to Russia. It is well known that everything was done to preserve peace, short of surrendering Serbia to an Austrian inquisition and waiting patiently till Germany should complete the mobilization which was proceeding under the guise of "precautionary measures." The only person of any weight who advised submission at any price was Count Witte. Everybody else, from the Emperor to the most humble citizen, understood that no choice was left but to fight for existence. The dynasty was granted a unique opportunity to retrieve its misdeeds and blunders by placing itself wholeheartedly at the head of a great popular movement. The Duma, usually so critical, expressed by the voice of its various leaders the unanimous resolve of the nation to withstand the common enemy with patriotic unanimity.

Russia in the World War.—In the light of subsequent events the declarations made on the outbreak of the World War assume a particular significance. The representatives of alien nationalities expressed emphatically their resolve to stand by Russia in the struggle. Goldman, a Lett, said: "Neither our nationality nor our speech nor our creed prevent the Letts and the Esthonians from harbouring warm patriotic feelings towards Russia and from standing shoulder to shoulder with the great Russian people for the defence of the fatherland." Friedman, a Jew, spoke in the same strain: "We have lived and we live in particularly oppressive conditions. Nevertheless, we have always felt ourselves citizens of Russia and faithful sons of the fatherland. No power will ever be able to tear us from our mother-country Russia, from a land to which we have been tied for centuries. We come forward to the defence of this country not only to perform a duty, but because we are attached to it." Even the Poles chimed in. Iaronsky pointed on their behalf to the tragic situation of Poland:—

> "The Polish nation torn into three parts sees its sons in mutually hostile camps. In spite of that our feelings of sympathy for the Slavs weld us into one whole. This is suggested to us not only by the justice of the cause taken up by Russia, but also by political reflection. God help the Slavs led by Russia to repulse the Teutons in the same way as they were repulsed five-hundred years ago by Poland and Lithuania in the battle of Grünwald. Let us hope that the blood shed by us and the terrors of a fratricidal war may lead to the reunion of the three fragments of the Polish people."

If the alien nationalities spoke in this way no wonder the Russian groups expressed their resolve to spare no effort in the struggle, and to support the Government to the utmost in the task of defending the country. Even the Group of Toil declared by Kerensky's voice that they were persuaded of the righteousness of Russia's cause and ready to sacrifice everything for the country's defence. Only from the little group of Social Democrats came threatening notes. Their spokesman dwelt on the solidarity of the proletariat all the world round, on the common guilt of all the Governments in provoking the war, on the resolve of the proletariat to bring about a speedy peace, on the hope that the present terrible catastrophe would result in the abolition of all wars. These discordant notes were lost, however, in the general display of enthusiasm.

The Tsar's Government was on the crest of a mighty popular wave; it might have steered a course towards victory and national regeneration if it had possessed the moral strength to rise to the occasion, to throw away the tawdry equipment of despotism and to concentrate the forces of the people for the momentous struggle. Events soon proved that it was not only incapable of such an effort, but that its leadership was in itself a hindrance to success at home and in the war.

At the start, however, two steps in the right direction were taken by the Government: the abrogation of the State monopoly of the sale of spirits, and the promise of autonomy to the Poles. The Gordian knot of the temperance problem was cut by Imperial decree in spite of the difficulties raised by finance experts. The beneficial influence of the measure on the morals and health of the people and of the army cannot be doubted.

The results for the Imperial Treasury were not so appalling as was predicted by timorous specialists. They can be gathered from a comparison between the budgets of two consecutive years—1914 and 1915.

	1915 Estimates	1914 Estimates and Assignments	Increase or Decrease
	Rubles	Rubles	Rubles
Ordinary revenue . .	3,080,108,314	3,572,169,473	−492,061,159
Ordinary expenditure .	3,078,814,461	3,309,523,517	−230,709,056
Surplus of ordinary revenue .	1,293,853	262,645,956	−261,352,103
Extraordinary revenue . .	9,500,000	13,400,000	−3,900,000
Extraordinary expenditure .	155,493,953	304,045,881	−148,551,928
From free balance of Treasury .	—	27,999,925	−27,999,925
Deficit to be met by loan	144,700,000	—	144,700,000

The proposed budget for 1915 included 502,642,000 rubles of ordinary revenue from new taxes and increases of existing taxation. The necessity for this increase of taxation arose from the reduction in the Government spirit monopoly operations and the influence of war upon revenue. In the 1914 budget the revenue from the spirit monopoly totalled 936,217,500 r. or 26·2 % of the total ordinary revenue. For 1915 the estimated revenue from this source was only 144,360,000 r. or 4·7 % of the total ordinary revenue, a decrease equal to 22·1 % of the ordinary revenue of 1914. On the other hand account must be taken of the saving that would be effected in expenditure on the spirit monopoly. This expenditure totalled 246,787,567 r. in the 1914 estimates, but was reduced by 140,374,401 r. in the 1915 estimates. So the expected decrease in the net revenue from the spirit monopoly was about 651,000,000 rubles.

The appeal to the Poles was made in a proclamation of the commander-in-chief, Grand Duke Nicholas. The grant of autonomy was held out as a reward of coöperation against the common enemy, the Germans. It would have been better if the promise had come directly from the Tsar, and if instead of vague words something tangible had been conceded at once. As a matter of fact the high bureaucracy began at once to put obstacles in the way of any reform, and the matter never reached a further stage than that of discussions in a Government committee. The damage done by these vacillations was incalculable. Instead of enlisting the wholehearted support of Polish patriots Imperial bureaucracy drove them into a position of distrust and hostility, which became especially keen in view of the tactless and offensive behaviour of Russian authorities in Galicia, and could not be placated by occasional concession in details. This episode may serve as an example of the stupid policy followed by the Government in regard to all minor nationalities of the Empire: their enthusiastic rally was discouraged in every way, and old enmities were revived and increased at the most critical time. The case of the Jews was especially flagrant: numbers of them continued to perform their military duties faithfully and zealously, but many others took advantage of opportunities to spy and to betray their persecutors, and the round of executions and pogroms set in again with increasing force.

The Effects of Misgovernment.—In the field the old cancers of corruption and favouritism were again producing disappointment and disaster. The army did not lack excellent leaders—the chief-of-staff of the Southern command, Alexeiev, the corps commanders Ruzsky, Brusilov, Radko Dmitriev, were generals of the first rank. The officers and the common soldiers fought with the traditional tenacity and valour; no sacrifices were spared and brilliant victories were won. And yet on decisive occasions incredible things had happened. Samsonov's army was destroyed, thanks to a slackness in coöperation on the side of Samsonov's colleague, Rennenkampf, who was believed to play for his own hand. The suspicion was confirmed by a similar lapse on the part of the same commander later on at the battle of Lodz, when he failed to close the noose in which two corps of Mackensen's army had been caught. In Jan. 1915 an intelligence officer, Miassoyedov, actually sold the plans of the northern concentration to the Germans, and brought about a crushing defeat of Sivers' army. Worst of all it became clear towards the spring of 1915 that the army was insufficiently provided with munitions, aircraft, artillery and other appliances of war. The onslaught of Mackensen's and Hindenburg's Germans had to be met by soldiers many of whom had to man the trenches with sticks, in expectation that the death of comrades might give the chance of picking up rifles; batteries were forbidden to fire more than a couple of times an hour; the armies were surrounded by multitudes of "Kids"—marauders and deserters. Even in these terrible circumstances the Russians fought stubbornly, retreated step by step, and eventually, with the help of Alexeiev's strategy, succeeded in arresting the stream of the invasion on the lines of the Dvina and the Dniester. But the psychological effect of this desperate campaign was a lasting one. The common men had learned that their blood was shed without stint by a Government which had been criminally careless and inefficient. The way was opened to the insidious propaganda of revolutionary defeatists and traitors. The revolution of 1917 was prepared on the battlefields of Gorlice and Krasnostav.

The progressive elements of Russian society attempted to save the situation by a great effort. The Zemstvo and Town Unions, which had been doing wonders in hospital work and equipment, offered their services for the preparation of munitions:—

> Towards the end of May 1915, at a congress of representatives of trade and industry, the discussion of technical questions was interrupted by an impassioned speech delivered by one of the leading Moscow millionaires, V. Riabushinsky, just back from the front and full of the impressions of the life and death struggle against the invaders. "The whole of Russia forms the rear of the army," he said. "We cannot busy ourselves with our everyday affairs at the present moment: every workshop, every factory must be used to break the enemy's force." It was not a question of forming this or that committee, but of sinking all differences and appealing to the

assistance of every able man, without distinction of parties, as people had done in the West in France and in England. Prince Lvov spoke in the same strain on June 5 at a meeting of delegates of the Zemstvo Union. "At this great historical juncture," he said, "what is needed is not criticism, but energetic work. We do not want to produce irritation, but a bold spirit and combined efforts. We must strive to concentrate all the forces of the land and to inspire Government and society with mutual confidence." (Vinogradoff, *Self-Government in Russia*, 116, 117).

Technical committees were created with the participation of leaders of industry, Zemstvo workers, representatives of the working class: they displayed fervid energy and achieved good results. But the main condition demanded by Riabushinsky and Lvov—mutual confidence between the people and the Government—was conspicuously absent. Subordinate officials joined in the efforts of the unions, but the central Government continued to flounder in the morass of Court intrigues and supine reaction. The worthless Minister of War, Sukhomlinov, was indeed dismissed and put on his trial; the ancient bureaucrat Goremykin had to resign the premiership; but the appointment of his successor, Stürmer, provoked a general outburst of indignation. He was known for his reactionary opinions, and had shown his mettle in helping to coerce the progressive Zemstvo of Tver. His great merit was his subserviency and affected devotion to the Imperial family, especially to the Empress Alexandra Feodorovna. This obstinate and hysterical lady meddled more and more with affairs of State, particularly after the assumption of the supreme command by the Emperor. And behind her stood various favourites, chief among whom was the astute peasant Gregory Rasputin, whose exploits had made the Petrograd Court a place of scandal for the whole world. No wonder that the opening of the Duma in Feb. 1916 gave rise to manifestations very different from those which had occurred in that assembly in July 1914. The ally of Stolypin, Shidlovsky, speaking on behalf of the bloc of progressive parties, said: "The general longing of the entire country towards a situation in which the country could entertain confidence in its Government, and feel in union with it, has been traduced as an incitement to seize power. . . . The forces of the nation, bereft of unity, aim and guidance, have been spent in vain, and the great national effort has weakened under the dissolving influence of discontent and indifference." The leader of the Progressives, Efremov, addressed the ministers in the following words: "You must understand that your duty as patriots is to go, and to clear the place for a national Ministry."

The discord between the Government and the Duma found expression on many occasions in connexion with important questions of internal policy. The Duma rejected a bill as to the organization of coöperative societies because it placed them at the mercy of the administration. A strike at the Putilov works, suppressed by military force, gave rise to a heated discussion in which the Duma, while condemning the strike as "a stab in the back," expressed the desire that the legal activity of trade unions should be given free scope and that chambers of arbitration should be founded for the settlement of trade disputes. Perhaps the most significant pronouncement was made in the course of the debates on the budget of the Holy Synod. The Duma voted a resolution to the effect that it considered necessary a reform of the Church administration on the principle of the supremacy of Councils and of a wide application of local self-government. For this purpose a national Council should be convoked without delay. The reform should extend to central and to local administration, to ecclesiastical courts, especially in the matter of divorce procedure, and to the ecclesiastical schools; the parish should be developed as much as possible; bishops should not be transferred from one See to another, more particularly if the consent of the Church had not been obtained. The State should cease to look upon the clergy as a political instrument, and all circulars and orders in this sense should be revoked.

The Government seemed to take delight in ignoring and thwarting all these resolutions. Stürmer was called to one ministerial post after the other. In Feb. he was appointed Home Secretary in succession to N. Khvostov, in July Foreign Secretary in succession to S. Sazonov, who was dismissed because he had urged the necessity of settling the Polish question in the sense of definite and real autonomy. Altogether ministerial portfolios were shuffled like cards at the bidding of the Empress. According to the winged word of Eugene Trubetskoy, ministers were following each other like "fleeting shadows." It may be sufficient to notice the advent of M. Protopopov, a convert from the ranks of the Liberal bloc to the Ministry of the Interior (Sept. 16). The dismay and indignation of the country found expression in a series of resolutions demanding the appointment of a Cabinet supported by the confidence of the people. Even conservative institutions like the Council of the Empire and the Association of the United Gentry joined in the chorus.

The Popular Leaders.—Before proceeding with the narrative of events which led up to the actual revolution, let us consider the various currents of thought and party organization of the intellectuals who were preparing for the coming conflict.

It is not necessary to dwell at any length on the Octobrists and the Cadets. The former drew their main strength from the provincial gentry and the Zemstvo institutions, the latter from the urban middle class and the liberal professions. The Octobrists pleaded for gradual development from local self-government, while the Cadets placed their hopes on the introduction of a constitutional democracy in which actual leadership would fall to the representatives of Western culture. The importance of far-reaching social and economic reforms was fully realized by the Cadets, and they were prepared to place them in the forefront of their political activity, but in spite of a recognition of the "four-tails" formula (*i.e.* universal, equal, direct and secret suffrage), the Cadets had no hold on the mass of the people, and relied on the selection of the educated by the uneducated.

Socially and psychologically, the leading groups of the years of upheaval were bound to come from the midst of the extreme revolutionary intellectuals, and it is to them that we have to turn our attention. Three leading currents may be distinguished in the history of revolutionary thought in Russia: militant idealism born of bitter resentment at the backward state of Russia in comparison with the West; the tendency to seek regeneration in a closer contact with the folklore of the common people; the economic materialism proclaimed by Marx and transplanted by various Russian thinkers. In theory, the views of the first group were most vividly expressed by writers like P. Lavrov and N. Mikhaïlovsky. The stress was laid by them on the propaganda of progressive ideas of European civilization among the intellectuals, especially among the youth, in order to form the minds of irreconcilable fighters for emancipation in all fields of human activity. Lavrov had initiated a philosophical theory (anthropologism) somewhat akin to the humanism of the modern pragmatic school; Mikhaïlovsky had preached "subjective" ideals with great effect as a journalist and literary critic. His violent radicalism was directed not only against the "powers that be," but also against agitation among the masses without corresponding enlightenment. He repudiated "class struggle" as a "school of bestiality," from which men issued as "live corpses with faces distorted by rage." In contrast to these "Westerners" appeared a group of writers who clung to the conception of a special aptitude of the Russian people for social brotherhood and communal economics (Zlatovratsky, Korolenko, Oganovsky, Kacharovsky): their antecedents must be sought in the romantic teaching of the Slavophils as well as in emotional motives in sympathy with the toil and struggle of the peasantry.

In the case of active revolutionaries like Chernov, the radicalism of the Westerners was allied with the romanticism of the Populists, and in various combinations both tendencies helped to shape the views and the policy of the Social Revolutionary party. In the beginning of the 20th century one could distinguish some five groups representative of this party. The struggle with the Government in the first revolution (1905–6) welded these sets into a more compact body, the principal organ of which (the *Messenger of Revolutionary Russia*) proclaimed the necessity of a close alliance between revolutionary intellectuals, conspiring proletarians and the struggling peasantry. As the programme of the Social Revolutionaries aimed at union between the classes in common opposition to the Government, it laid chief stress on political rights, democratic organization and the raising of the status and consciousness of the individual. Their methods of terrorism and insurrection were themselves the outcome of the heightened sense of personality and of the importance attached to energetic action and self-sacrifice.

The ways of the Social Democrats were different; they adopted Marx's teaching as a gospel and tried to develop and to apply it in every direction. Their chief exponent was for a time G. Plekhanov, a philosopher and economist who had taken up his residence abroad, in Switzerland and in Italy. He held strictly to the evolutionary construction laid down by Marx, according to which Capitalism appears as a necessary stage in the development of production and gives way to Collectivism only when the majority of the workers have been turned into wage-earning proletarians. Marx's principal disciple, Engels, had added that it would be the greatest misfortune for the working-class if it seized power before it had fully reached the stage of complete consciousness and Western organization. As a consequence of this, Plekhanov and his followers did not consider the Russian people ready for class war against the bourgeoisie, and insisted, on the contrary, on combined action with the social groups possessed of better education and greater political experience. Some Marxians went even further in the direction of compromise with the middle class and with the Government. For a time an "economic" orientation was very much the fashion; it discarded political action as untimely and hopeless, and insisted on "business" efforts for the improvement of the standard of living, increase in wages, industrial organization, better protection for the working-class, etc. The "Revisionist" movement, initiated in Germany by Brentano and Bernstein, found a wide field for application (Struve, Bulgakov, Prokopovich). Struve declared the formula of a class war to be a "myth," although he conceded it a certain value inasmuch as it helped to rouse the self-consciousness of the proletarians. Bulgakov analyzed the situation in regard to the distribution and cultivation of land, and came to the conclusion that the process of economic evolution consisted substantially in the gradual disappearance of brutal exploitation of human beings by fellow men; in industry this was effected by the concentration of production and increasing control, in agriculture by the breaking up of large estates and the strengthening of a class of prosperous husbandmen. Both movements converge in swelling the current of rising democracy.

The realities of Russian life did not prove favourable to a growth of these tendencies towards social peace. The burden of increasing taxation, the disastrous conduct of the Japanese war, the reactionary stupidity of the Government,—all contributed to revive the revolutionary spirit in the ranks of the Social Democratic party. The history of this revival may be traced from the appearance in Dec. 1900 of the *Iskra* (*The Spark*), a newspaper conducted by Lenin and Martov, supplemented by a monthly review *Zaria* (*The Dawn*) for more detailed exposition and argument. Lenin's pamphlets, *What is to be done?* (1902) and *Letter to a Comrade* (1903), express one of the leading ideas of his later activity. He pleads in them for centralized direction and decentralized responsibility, that is, for an oligarchy of leaders and strict discipline as regards the execution of their decisions by subordinate units. Democratic watchwords are set aside and efficiency of organization is demanded at all costs. This led to the disruption of the party. At the London Congress of 1903 the fateful division between "Bolsheviks" and "Mensheviks" was inaugurated, as a consequence of disagreement concerning the problem of leadership and discipline. The Bolshevik (meaning "Majority") group carried its proposals by a very narrow majority, and captured the Central Council of the party, from which they excluded entirely their opponents. The latter, who had a majority on the staff of the *Iskra*, proclaimed a boycott against Lenin and his adherents. The insignificance of the immediate cause of the split was only apparent: in truth the division arose from fundamental opposition between the democratic orientation of Plekhanov and the oligarchical spirit represented by Lenin. The struggle was not suggested by a deep cleavage of principle among the rank and file of the party, but by disputes among its intellectual leaders.

Questions of principle arose, however, in the course of the Japanese war and the first revolution. While Plekhanov and the Mensheviks were for coöperation with the Liberals in the fight for political freedom and for a gradual introduction of social reforms, Lenin set his hopes on the hatred of the peasantry for the landlords, and preached a ruthless *Jacquerie*. In his pamphlet, *The Agrarian Programmes of Social Democracy*, he contended that orthodox Marxians had failed to grasp the peculiarities of the Russian situation inasmuch as they were still talking about a coalition of the bourgeoisie of the towns, while in Russia the moving power was to be sought in the rising of the peasant bourgeoisie against the squires. He contrasted the abstract views of the town proletariat with the intense revolutionary temper of the peasants who were "ready to fly at the throat of the landlords and to strangle them." In his view the proletariat had to supply leaders and instructors when the revolution had been set going, but he looked to the exasperated peasantry for bringing down the existing order.

It is hardly needful to point out the close connection between these literary disputes and the Zimmerwald agitation[1] of 1915–16, as well as with the eventual overthrow of the old regime in 1917. Let us note that the Congress of the Social Democratic party in 1917 sided definitely with Lenin and the Bolsheviks.

The Revolution.—The situation in the beginning of 1917 was extremely tense and abnormal. The Emperor had left the capital and taken up his residence at the army headquarters in order to see as little as possible of the ministries, the Duma, or the Court, and to lead a "simple life" among the selected retainers of the Stavka; the Empress continued to look for hypnotizing inspiration to monks and priests and interfered constantly in affairs of State in favour of reaction. Even the staunchest conservatives, like Trepov, found it impossible to remain in office under such conditions, and the field was left clear for half-insane subjects like Protopopov and bigoted courtiers like Prince N. Galitsin. The army at the front held on sullenly to its positions, but was war-weary and distrustful of its leaders;

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[1] The Zimmerwald Manifesto of 1915 is full of momentous declarations. The following are some of them:—

"The war that has produced this chaos is the outcome of Imperialism, of the endeavours of capitalist classes of every nation to satisfy their greed for profit by the exploitation of human labour and the treasures of Nature. . . .

"To raise welfare to a high level was the aim announced at the beginning of the war: misery and privation, unemployment and death, underfeeding and disease are the real outcome. For decades and decades to come the cost of the war will devour the strength of the peoples, imperil the achievements of social reform, and hamper every step on the path of progress. Intellectual and moral desolation, economic disaster, political reaction—such are the blessings of this horrible struggle of nations. . . .

"In this intolerable situation we have met together, we representatives of Socialist parties, of trade unions, or of minorities of them, we Germans, French, Italians, Russians, Poles, Letts, Rumanians, Bulgarians, Swedes, Norwegians, Dutch and Swiss, we who are standing on the ground, not of national solidarity, with the exploiting class, but of the international solidarity of the workers and the class struggle. . . .

"The struggle is also the struggle for liberty, for brotherhood of nations, for Socialism. The task is to take up this fight for peace—for peace without annexations or war indemnities. Such peace is only possible when every thought of violating the rights and liberties of the nations is condemned. There must be no violent incorporation, either of wholly or partly occupied countries. No annexations, either open or masked, likewise no forced economic union, that is made still more intolerable by the suppression of political rights. The right of nations to dispose of themselves must be the immovable fundamental principle of international relations.

"Since the outbreak of the war you have put your energies, your courage, your steadfastness at the service of the ruling classes. Now, the task is to enter the lists for your own cause, for the sacred aims of Socialism, for the salvation of the oppressed nations and the enslaved classes, by means of the irreconcilable class struggle."

the enormous levies in the rear provided crowds of conscripts, who resented the separation from their households and their land, chafed under the drudgery of stupefying training and swallowed eagerly the germs of insidious propaganda. The factory workmen in the towns were deeply affected by internationalistic and socialistic ideas, while the peasants were groaning under the heavy toll of conscription and the economic demands arising from a war which they had ceased to understand. Among the intellectuals there was a widespread feeling of uneasiness as regards the coming catastrophe: some were afraid of "cutting off the branch on which they were sitting," and many realized the madness of plunging into revolution in the midst of a war for existence. But the prevailing sentiment was despair as to any improvement under the reactionary Government. Even in Court circles the notion of a revolutionary movement was spreading rapidly, although, of course, officers of the Guards did not look further than to the elimination of Nicholas II. and of his spouse by a conspiracy similar to those which had put an end to the vagaries of Peter III. and of Paul. Such facts as Milyukov's scathing denunciation of the Empress Alexandra's protégé Stürmer (Nov. 1–14 1916), and the assassination of Rasputin by some aristocrats among whom there was a Grand Duke, Dmitri Pavlovich, showed that the indignation of upper circles of society had reached a revolutionary pitch. The Allied mission, in which Lord Milner represented Great Britain, left Petrograd just in time not to witness the explosion which everybody was expecting. But the decision came from below, and not from the stormy currents on the surface.

The principal centres of political agitation were the factories of Petrograd and the queues of householders and servants lined up for hours in sleet and snow at the doors of the bakers. It seems almost ludicrous now to consider the quest of food as one of the principal causes of unrest, but people did not realize then what might result in this respect from a disruption of orderly intercourse, and ascribed the scarcity of bread and the high prices to the inefficiency of the hated Government. Already in Nov. 1916 there had been talk in Petrograd of the imminence of a general protest strike. On March 8 1917, bread riots actually broke out, and on the next day (Friday) the streets were full of a surging mob which protested against everything. On the Saturday the police fired on the mob, and on Sunday troops used their weapons. Already on that day it was clear that part of the garrison could not be depended on. The Pavlovsky regiment of Grenadier Guards, after an encounter with rioters, in which it fired on the crowd, came back to barracks in a very ugly mood; the men declared to their officers that they would not help to murder their brothers in the streets. On Monday (March 12) the military revolt broke loose. The Volhynsky and Litovsky Guards marched against the Arsenal in the Liteynaya. They were opposed by some other troops, but before long one regiment after the other joined in the revolt, and by March 14 the principal positions in the town had been occupied by the rebels. The premier regiment of the army, the Preobrazhensky Guards, marched to the Taurida Palace where the Duma was sitting and placed itself at the disposition of its president, M. Rodzianko. An Executive Committee of the Duma was formed and subsequently a Provisional Government of members of all parties except the extreme Right (Prince Lvov, Milyukov, Guchkov, Shingarev, Tereshtchenko, Nekrasov, Godnev, V. Lvov, Manuilov, and Kerensky). At the same time another centre of authority was set up at the Smolry Institute, where a Council of Workmen's delegates appeared. It represented the factory workmen, artisans and various nondescript elements which had taken part in the Revolution and claimed a share in the reorganization of the country, and it was joined by representatives of the soldiers.

On March 15 Nicholas II. abdicated in favour of his brother Michael, who, however, declined to ascend the throne unless invited to do so by the will of the nation. In less than a week the mighty Imperial power of the Romanovs had been overthrown almost without bloodshed. All the commanders of the armies in the field and the governors of provinces, including the Grand Duke Nicholas, Viceroy of the Caucasus, hastened to promise loyal support to the new Government.

Discordant Tendencies.—People were elated in those days. Even statesmen and historians were carried away by the general rejoicings over the newly acquired freedom of Russia. Nothing seemed impossible to the great nation which had come to its own after centuries of bondage. And yet it was evident that a task of superhuman magnitude had to be faced. The story of the "Zauberlehrling" was repeating itself: the pupil of the magician had succeeded in calling up the waters of the deep, but did not possess the word capable of arresting them, and they rose and flooded the place, and drowned the unfortunate amateur in witchcraft. The party leaders thought that the Revolution could be directed by programmes and compromises. In reality the Revolution meant the overthrow of all accepted creeds, morals and habits of the people, a confusion of their entire nature in which, for a time, nothing could be relied upon —neither duty, nor humanity, nor affection. A people renowned for its Christian spirit and stubborn patience gave vent to outbursts of bestial lust and cruelty, to hysterical moods of blind selfishness. Even those of the leaders, who had apprehensions as to the effect, consoled themselves by comparisons with the French Revolution, as if the French Revolution had to deal with cultural problems of such complexity as the Russian one, or had challenged the existence of the educated class.

The history of the Russian Revolution starts with the gradual dissolution of all fundamental institutions and notions. The first to go was the army, as it was the most tangible and irksome form of State organization. The first act of the Soviet of Workmen was to issue an order to all army units enjoining the formation of Soldiers' Committees to watch over the behaviour of officers, to take over arms, etc. It is to be imagined what effect this order exercised on the discipline of the army. The patriotic Minister of War in the Provisional Government, A. Guchkov, strove might and main to stop the disintegration of discipline, the fraternization with the enemy, and the cowardly desertions. He called up a legendary hero of the war, Kornilov, and placed him at the head of the Petrograd garrison. But all these efforts were of no avail in the face of the disorganization of the soldiery; the adulation of the demagogues, the propaganda of German and native Defeatists, and the regime of Soldiers' Committees was substituted for hierarchical command. In April Kornilov left for the front in disgust, and in May Guchkov resigned in despair.

Next came the turn of foreign policy. The mob, led by the Council of Workmen and Soldiers, was repeating the magic formula of "peace without annexation and indemnities." How could fidelity to the Alliance concluded in the fateful months of August 1914, how could the aspirations towards a command of the Straits or any other aims of Russian national policy be made to square with this abstract, colourless formula, devised at Zimmerwald by the enemies of European civilization?

The extremists in Russia took a perverse delight in ignoring completely the menace of German domination, and dreamed, or pretended to dream, of a rising of the German Socialists that would substitute class war for the struggle of empires. The Minister of Foreign Affairs, Milyukov, was not willing to dissociate himself from the Allies and to disregard the German danger, nor was he prepared to tear up as a scrap of paper the agreement concluded with much difficulty by Sazonov, in which the Western Powers had acknowledged the justice of Russia's claim to Constantinople and the Straits. He had to retire, because the mob did not want to go on with the war and cared nothing about the Allies or about Imperial interests of Russia, while those who pulled the strings behind the scenes kept in touch with the Germans and were bent on the destruction of historical empires in accordance with Zimmerwald policy. After stormy demonstrations Milyukov resigned.

Even worse than these ministerial changes was the displacement of the centre of gravity in the political world. The Duma was set aside by the appointment of the Provisional Government. As the Duma had been elected on a narrow and artificial franchise, it carried no weight with the people. Its Executive Council could not find its right place by the side of the Provisional Government, and looked helplessly on the latter's efforts to assume authority. An attempt was made to summon the members of all the four Dumas to a kind of political conference, but this only led to a good many speeches without any practical results. The four Dumas in conjunction looked even more like ghosts than the fourth one by itself. This meant that a number of influential public men—Rodzianko, Shidlovsky, Shulgin, Maklakov, N. Lvov, Karaulov—vanished into oblivion, some for ever, others at the most critical moments of the incipient Revolution. The Provisional Government was left in isolation in the face of a seething mass of half-educated people, who had lost all sense of duty and all respect for authority. This would have been bad enough in itself, but the Provisional Government had to reckon not only with these heaving throngs but with a rival and energetic organization—the Soviet Workmen and Soldiers.

The resignations of Guchkov and Milyukov rendered necessary a reconstruction of the Provisional Government, and it was effected in the direction of the Left. The outstanding facts in this reconstruction were the appointments of Kerensky as Minister of War and Marine, the Social Revolutionary Chernov as Minister of Agriculture, the Social Revolutionary Skobelev as Minister of Labour. Prince Lvov was kept president of the Council, but he was not much more than a figure-head: the principal personage in the new combination was A. F. Kerensky, while the appearance of Chernov and Skobelev as members of the Government showed that the country was to be subjected to socialistic experiments of the most extreme kind. The dykes had burst and torrents of disorderly agitation were let loose on the land. The composition of the new Ministry was intended to bring some harmony in the action of the two rival centres, the Ministry and the Council of Workmen and Soldiers, to which a third element, delegated from the peasants, had been added. In practice the Government was made amenable to the direct influence of the council, whose aggressive Socialism was not tempered by any sense of responsibility. At its head stood a characteristic figure Cheidze, a Georgian Social Democrat, who hated everything that savoured of Russian national tradition. He had nothing to recommend him as a political leader except his stubborn opposition under the old regime. His election to be chairman of the Soviet, showed that the men, who were ready to discard all bonds of national honour and self-preservation for the sake of peace at any price, had the masses behind them.

The most terrible symptoms of the advancing disease was the arrival from abroad of Bolshevik leaders—Lenin coming through Germany, under the benevolent protection of the Kaiser, and Trotsky arriving from America. These men were resolved to preach the doctrine of Zimmerwald and Kienthal. Their zeal did not cool down in Russian surroundings. Riazanov demanded that deserters should be free from punishment for the sake of individual freedom. Steklov incited soldiers and citizens to kill generals suspected of counter-revolutionary designs without further inquiry. The weak spot in the armour of Russia had been discovered. A hysterical stampede began which spread rapidly from the rear to the front, and it is not a paradox to say that the Government was powerless against this organized disorganization: the Soldiers' Committees at the front acted systematically against the officers, fraternization with the enemy was encouraged by many of them, and when it came to a fight, they debated for hours whether they should obey orders or leave the line. In case of serious onslaughts on the part of the Germans and the Austrians, whole regiments gave way. The state of the army was depicted in the most mournful colours by no less a man than that great citizen-soldier of Russia General Alexeiev:—

> "Let us be frank; the fighting spirit of the Russian army is exhausted. But yesterday stern and powerful, it now faces the enemy in a trance of fatal inaction. A longing for peace and quiet has replaced the old traditional loyalty to the country. Base instincts of self-preservation are reawakened. Where is the powerful authority at home for which the whole State is yearning? We are told it will come soon. But we do not see it yet. What has become of our love for the Mother country? Where is our patriotism? The sublime word of brotherhood is inscribed upon our banners, but it is not written in our hearts. Class antagonism is raging in our midst; whole classes who had honourably fulfilled their duty to their country are placed under suspicion. As a result a deep abyss has yawned between soldiers and officers."

In front of this disruption of moral ties the reproaches and warnings of progressive leaders who had not lost the sense of their allegiance to the Motherland did not avail, and yet among these patriots there were many who had passed their lives in prison and exile for the sake of their opinions—Plekhanov, Krapotkine, Breshkovskaya, Herman Lopotin.

Kerensky's Rule.—The most conspicuous, although by far not the most worthy representative of the "Defencists," was the favourite of the Revolution, the new Minister of War and Marine, A. F. Kerensky. None had thundered with more effect against the oppressive measures of the old regime, none could speak with such enthusiasm, of freedom, the sanctity of revolution, popular inspiration, the right of the masses, and the dawn of a new era. Unfortunately, impassioned feelings and eloquent words do not serve as substitutes for statesmanlike foresight, clearness of purpose, and strength of will. After attaining to a unique position at the head of revolutionary Russia Kerensky entangled himself in a net of contradictory measures, of ill-judged assertions of authority, and of weak-minded compromises and renunciations. With incredible levity and conceit he assumed that he could, by his personal magnetism, repair the harm which was being done to the army by the propaganda of Defeatists. He rushed from corps to corps, harangued soldiers' meetings, revelled in their applause, and believed that he had achieved wonders by his appearance at the front. Witnesses of these meetings did not fail to notice that the soldiers, after listening with some interest to the new kind of theatrical performances, did not conceal their incredulity as to results. These results were disclosed in a manner which did not admit of any doubts when the time came for testing the effects of this oratorical campaign in a struggle with the enemy.

Towards the beginning of July 1917 a general offensive movement was attempted, in the hope that the gallantry of specially formed shock battalions would kindle the fighting spirit of other troops, and that the whole line would advance and break at least the thoroughly shaken Austrian army. The first onslaught in the south-west was successful; Kornilov's shock troops pushed as far as Stanislau (Stanisławów) in Galicia. But it was the last flickering flame in the case of an army disintegrated by defeatist propaganda. In the north the ordinary troops refused to support their comrades and looked on with irony at their desperate efforts against heavy odds. In the midst of the fighting a general *débâcle* began: the Russian regiments rolled back in disorderly retreat, and the only fact which prevented an immediate collapse was the extreme weakness of the enemy on the Austrian front.

The Russian nation, as represented by its army, had definitely succumbed in the great struggle. Even more terrible perhaps than the defeats at the front was the corresponding chaos in the country. A Separatist disaffection in the Ukraine seized the opportunity presented by the great catastrophe to assert claims as to an independent Government, based on the fact that the provinces on both shores of the Dnieper had for some centuries formed part of a Cossack republic and of the Polish-Lithuanian State. The fundamental unity of the Russian people, as well as the immense benefits brought by the reunion in the 17th century and the common progress in the 18th and 19th centuries, were set at nought by these people. The bulk of the Ukrainian population would not have followed them, in spite of many grievances against Petrograd rule, if it had not been for the hysterical stampede of the Revolution. As it was, people dreamt of a new heaven and a new earth in Kiev and in Poltava, as well as in Petrograd and in Moscow, only with the difference that their visions were reminiscences of Cossack prowess and licence. The representatives of the Provisional Government—the romantic socialist Tseretelli, the wealthy amateur Tereshtchenko, the shifty intriguer Nekrasov—were not able to make any stand against such treasonable pretensions, and conceded an autonomy bordering on complete separation. Some of the Cadet members of the Provisional Government—Prince Lvov, and Shingarev—protested and resigned, but their withdrawal was hardly noticed. Kerensky was placed definitely at the head of the Government and continued his campaign of eloquent appeals.

In the general confusion the group of relentless realists, the Bolsheviks—thought the moment opportune to show their hand. On July 14 a military revolt broke out in Petrograd: regiments converted by the extremists—the first machine-gun regiment at their head—seized strategic points in the capital; cruisers and destroyers flying the black and red flag of terroristic Revolution came into the Neva from Kronstadt. For three days it seemed doubtful whether the Provisional Government would be able to hold its own. The attempt was, however, somewhat premature. Part of the Petrograd garrison remained passive, and this made it possible for some loyal troops to suppress the rebellion. The Government was afraid, however, to strike hard: Trotsky, Lunacharsky and Kamenev were let out after a brief arrest; Lenin had disappeared as soon as it became evident that the outbreak had miscarried. Apart from the usual irresolution of ministers who had not learnt to govern during their long apprenticeship in the ranks of a critical Opposition, the hands of the Executive power were tied by the pressure from the Soviet of Workmen, Peasants and Soldiers. The Social Revolutionaries and Social Democrats, although disagreeing with the Bolsheviks and afraid of them, worshipped the word "Revolution," and were loth to adopt coercive measures against their comrades of the extreme Left. Stern measures against the extremists might have seemed a return to the oppression of the Tsarist regime, and the Socialists preferred risking their own safety to the danger of being accused of the crime of "*lèse-Révolution*."

So the see-saw of contradictory decrees and measures continued for some time. While the military chiefs addressed passionate appeals to the Government for a restoration of discipline, for stern punishment of deserters, for abolition of the political authority of the Army Committee, Socialists, even moderate ones, defended the "new discipline" of the noble revolutionary army, minimized its defeats and demoralization, and consoled themselves with the prospect of a rebirth of the nation under the mighty influence of the revolutionary spirit. In the meantime, the peasants were grabbing the estates and the live stock of the squires, burning houses, and killing some of the unpopular owners. The Minister of Agriculture, Chernov, looked upon this lawlessness of self-help as a perfectly natural outbreak of the policy of expropriation. The factory workers and workshop artisans in the towns were not less insistent in the assertion of their rights; wages went up by leaps and bounds, while the work done became more and more careless and casual. Owners and engineers were sometimes thrown out of their establishments, seized by the proletarians. It happened, indeed, that after trying their hand at management for some time the workmen requested or compelled their former employers to return as managers, but such isolated cases did not counterbalance the general effect of disorder and slackness. The decay of Russian industries was proceeding fast. The efforts of military chiefs and responsible leaders to arrest the spread of treason, disorganization, and demoralization were denounced by the Socialists of the Soviet and their representatives in the Provisional Government as counter-revolutionary attempts.

The Second Revolution.—Prince Lvov recognized that it was no longer possible for Liberals to work with Chernov and his companions. He resigned from the premiership, and the Cadets in the Ministry followed him. Kerensky became prime minister. Although he retained the portfolio of War and Marine, he set himself the task of constructing a "strong revolutionary" Government. In order to find a basis for a national coalition he called a conference in Moscow, in which all classes, groups and principal institutions of the Russian State were to be represented. The Bolsheviks refused to take part and ridiculed the idea of a congregation of that kind. On Aug. 26 about 2,000 delegates met in the Grand Theatre, representatives of the various parties, of Zemstvos and municipalities, of universities, of army, of factory workmen, of peasant communities, etc. The meeting might have been a first step towards the regeneration of Russia, if the leaders had clearly realized that the danger did not lie in counter-revolution but in disorganization. But Kerensky opened the discussion by a speech in which warnings as to the danger to the country were intermixed with the usual revolutionary catchwords, and no lead was given in the direction of any practical reform. Kornilov, as commander-in-chief, delegates of the officers, and many of the former political leaders, spoke strongly of the necessity of reëstablishing discipline, of a strong executive, of national work to be carried on by all parties and classes. But the delegates of the Left, who were in the majority, not only turned a deaf ear to all such exhortations, but manifested openly their contempt and dislike for the old ideals of patriotism. Among the worst were the soldiers delegated by various army committees. The whole attempt was a failure; instead of bracing up the political consciousness of the nation it revealed a state of complete paralysis on the part of the so-called rulers of the country.

At the beginning of September Riga fell, after a half-hearted and disconnected defence by the XI. Army. In the Soviet, Tseretelli tried to bring through the reintroduction of capital punishment for treason and desertion, and although he succeeded in collecting a narrow majority, this measure, insisted upon by the officers, was nullified by motions in the opposite direction—for example, by a demand that the arrested Bolsheviks should be liberated. It was evident that no serious effort to arrest anarchistic effervescence could be expected either from the Provisional Government or from the Soviet: they felt spellbound as soon as the sacred word "Revolution" was pronounced by the enemies of the State. The commander-in-chief, Kornilov, was not the man to submit meekly and without a struggle to the fatal policy of drift. He threw his authority into the scales against social disorder, and tried to force the Provisional Government to side with him. With this object in view he ordered some cavalry divisions on which he could rely to march toward Petrograd. He began negotiations with Kerensky through the medium of Boris Savinkov, a Social Revolutionary and active terrorist, who was acting as Assistant Minister of War at the time. This is how Savinkov related the main occurrences of this momentous crisis:—

> "When, on the 5th–6th of September, at Headquarters I again told him that in the near future the Provisional Government would examine the bill which was being prepared by the order of the Prime Minister, for the measures to be taken at the base, he believed that the Government was no longer hesitating, and when bidding me farewell on the 6th of September at Headquarters he declared that he would give full support to the Prime Minister, for the good of the country. On my return to Petrograd I reported my conversations with General Kornilov to the Prime Minister, and on the evening of the 8th of Sept. the bill for legalizing measures at the base (*i.e.* severe penalties for breaches of discipline) was to have been examined by the Provisional Government. But on the 8th of Sept. I was summoned to the Winter Palace, and the Prime Minister told me something that was a complete surprise to me. He told me that V. N. Lvov had come to him with an ultimatum from Gen. Kornilov, who demanded that the supreme authority should be given over to the Commander-in-Chief, with all military and civil power over the country, and that he, the Commander-in-Chief, was to form a Cabinet in which I was to be Minister of War and the Prime Minister was to be Minister of Justice. The ultimatum was in writing, but was signed, not by Gen. Kornilov, but by V. N. Lvov himself. Then the Premier called Kornilov up on the Hughes apparatus, and asked him without reading out to him the text of the declaration signed by V. N. Lvov—whether he was ready to sign the ultimatum presented by V. N. Lvov. Gen. Kornilov replied, 'Yes, I am ready to sign.' On the same day (8th of Sept.), the Prime Minister sent a telegram to Gen. Kornilov at Headquarters, demanding that Kornilov should immediately give up his post and leave the army." (Tyzkova–Williams, 214, 215.)

Kornilov's attempt to assume power was obviously conducted in a very clumsy manner: he was not a statesman, but a soldier, and the people around him were in no way able to make up for his deficiencies in political training. It is almost inconceivable how he could have chosen as his messenger the half-witted

V. Lvov. But, apart from that blunder, the chief advisers of Kornilov, were Zavoiko, a minor bureaucrat of the old regime, crafty and plausible, but devoid of insight and authority, and Aladine, a noisy half-educated demagogue, a member of the First Duma, who had turned Nationalist and had nothing to recommend him but his posing as the mouthpiece of the secret diplomacy of the Entente. However this may be, the intended *coup d'état* miscarried completely and made the situation only worse. Kerensky assumed the part of a heroic defender of the Revolution against a military conspiracy, all the various Socialistic groups joined him in the outcry against the would-be dictator, the army did not rise to support the general, who wanted to reëstablish discipline and unity of command, the leader of the cavalry corps, which had advanced to the outskirts of Petrograd, shot himself, and Kornilov and his principal supporters —Danikine and Lukomsky—were arrested and charged with treason. The outcome of the whole affair was a recrudescence of revolutionary zeal, and a violent rush to the Left. In the country the panic produced by Kornilov's attempt expressed itself in wholesale massacres.

The victorious Kerensky did not realize that he had thrown away the last chance of salvation from the rising tide of anarchy and terrorism. He appointed himself commander-in-chief and imagined that he was strong enough to defeat the onslaught from the Left as well as from the Right. Yet he received warning after warning of the crumbling away of political organization. The central executive of the Soviet had been effected by the landslide towards the Left. They called a Democratic Conference in Petrograd from which all bourgeois elements were excluded: the membership was restricted to delegations from Soviets, trade unions, coöperative societies and peasants' communes. This Assembly, in which the various Socialist groups had entirely their own way, could not even agree on a resolution calling for a Coalition Government capable of defending Russia in the hour of supreme danger. A motion in the sense was first passed and then rejected in consequence of the reluctance to admit Cadets and adherents of Kornilov to any share in the Government.

In contrast with this confusion of ideas and lack of resolution the extremists were quite clear in their minds, and the snake of Bolshevism was lifting its head again. Trotsky, who had been let out of prison, was more popular than ever, when he discoursed on the necessity of forming a Government of the Soviets and appealing for peace to the proletarian masses of the world. At the new elections to the Executive of the Soviets of Workmen, Peasants and Soldiers, he was elected President against Cheidze. This meant that the dualistic system was recognized to be obsolete, and the Provisional Government with Kerensky at its head was to be discarded in favour of a concentration of power in the hands of the Extremists. A motion condemning Kerensky and his Government was passed by the Soviet Executive.

Kerensky tried to parry the blows by supplementing a tottering Coalition Ministry with a Council of the Republic composed of representatives of all the political parties, principal associations and institutions. This body met at Petrograd on Oct. 20. It gave a measure of its capacity for political action by starting a long discussion on the question of the active or passive defence of Russia against the ever-increasing German menace. Although the Bolsheviks ostentatiously left the Council as a protest against the presence of " bourgeois " elements and the " counter-revolutionary " policy of the Council, the remaining parties were unable to agree on any definite and patriotic motion. The Internationalist delusions of many Socialists were strong enough to prevent any firm declaration directed against the Germans. Five motions were made, and all five were rejected one after the other. Defencists like Plekhanov were powerless against the Internationalists led by Martov.

The Bolshevist Usurpation.—The time of the Bolshevists had come. In the first days of Nov. 1917 the Soviet under Trotsky's leadership formed a military Revolutionary Committee, and on the 3rd, the authority of that Committee was recognized by the Petrograd garrison. Then steps were openly taken to form an armed force dependent on the Soviet and independent of the Provisional Government. By the side of this force, which was considered not to be entirely trustworthy, the sailors of the Baltic fleet could be counted upon implicity: they had long ago thrown in their lot with the advocates of civil war and terrorism. Kerensky assured his ministers, and proclaimed loudly to the population that he had taken the necessary measures to suppress any attempt at a revolt. In reality he had no troops at his disposal except a couple of battalions of military cadets and one company of women. The commander-in-chief of the Russian army relied on speeches against machine-guns, as the Chinese generals of 1860 had relied on painted dragons against the rifles of the English and French expeditionary force. The result was a similar one. On Nov. 7, Bolshevik sailors surrounded the Winter Palace, and after a brief scrap with the women arrested the ministers, the premier and commander-in-chief having disappeared in good time. A lieutenant with some soldiers drove out the Council of the Republic. The Cadet battalions were overpowered, and their remnants massacred by the soldiery and the mob. A small force of Cossacks under Gen. Krasnov skirmished for a few days against the sailors and armed workmen on the outskirts of Petrograd, but eventually concluded an armistice and withdrew. In Moscow the struggle was fierce, and Cadets held out for some time in the Kremlin together with a few loyal battalions. But there, too, defenders of the Government submitted to superior gun-power, lack of supplies and the discouraging influence of discussions and treachery. All along the front the demoralized soldiery rose against their officers and massacred them in the name of the Revolution. The commander-in-chief at headquarters, Dukhonin, was dragged out by a mob of soldiers and murdered.

The first act of the Bolshevik dictators was to satisfy the craving of the masses corrupted by them: private property was abolished, with the reservation that the land of the peasants and Cossacks was not to be confiscated. At the same time the new Soviet Government addressed to all the belligerent States the proposal to conclude peace. The Entente Powers were invited to join in direct negotiations with the Central Empires; failing this, Soviet Russia would conclude a separate peace. The advanced Socialists had no scruples as to the " letting down " of Allies who had been struggling for three years against the German Junkers: what they were chiefly afraid of was an Allied victory.

The same contempt for truth, duty and justice, was displayed in the domain of home politics. The *coup d'état* had left one institution still standing—the Constituent Assembly in process of formation. The Bolsheviks had clamoured for its immediate convocation, and accused all the parties with the criminal design of delaying or preventing its meeting. They were now at the head and could not forthwith stop the elections. These had been prepared laboriously by idealistic doctrinaires—by staunch believers in universal, equal, direct, and secret suffrage. All citizens of both sexes who had attained the age of 20 were to take part in it. To make the arrangements absolutely perfect, the principle of proportionate representation had also been introduced in a somewhat peculiar form. The various parties were to present lists containing as many names as there were seats allotted to the electoral district. The attribution of these seats to the parties was to be made in proportion to the number of votes cast in support of each list, the candidates taking places in the order of their seniority in the parties nomination. The absurdity of these mechanical devices had been already demonstrated by the municipal and rural elections, but the defects of the latter were greatly intensified in the case of the Constituent Assembly. Ignorant peasants were led off to record their votes for long lists of men whom they did not know and in support of platforms they did not understand. The extreme parties did not shrink from any kind of violence and fraud to bring in their nominees. Nevertheless, some sort of elections were actually held, right in the midst of revolutionary chaos, in the months of Nov. and Dec. The result was that the Social Revolutionaries got a large majority, thanks to the votes of the peasantry, while next came the Bolsheviks, who drew their chief support from the workmen in the towns and from the soldiers. The Mensheviks and the Cadets came in with negligible numbers, the latter with 15 out of a total of 600.

The Bolsheviks were not satisfied with such results. As soon as it became clear that they had not won in the gamble for votes, they began to revile the "parliamentarism" of the Constituent Assembly and of all national organizations as opposed to class groups. When the members of the Constituent Assembly came to Petrograd, and tried to get into the Taurida Palace, they were met by armed guards and ejected from the building. Leading members of the Cadet party, Countess S. Panina, Shingarev and Kokostsev, were arrested as "enemies of the people" and thrown into the dungeons of the Fortress of St. Peter and St. Paul. An order for the arrest of Chernov and Avksentiev was also issued, but they could not be found. At last, on Jan. 18 1918 the opening sitting of the Constituent Assembly was held. Trusty heroes from the Kronstadt fleet, with loaded rifles, surrounded the deputies from all sides; the galleries were packed with a howling mob. In spite of this, the election of the President resulted in a defeat for the Bolsheviks and the Social Revolutionaries of the Left allied with them. Their candidate, Marie Spiridonova, received 158 votes against V. Chernov, who got 244. Nor did the Assembly consent to register all the decrees handed in by the Bolsheviks and to abdicate its legislative power in favour of the Soviets. The armed rulers were not disposed to bow before the recalcitrant Assembly. After sitting one day, it was dissolved and ejected from the Taurida Palace.

By way of justification for this act of treacherous violence, it was maintained that the Constituent Assembly did not reflect the "will of the Revolution," that the "masses" had moved away from the standpoints represented by the party lists, and that, altogether, "formal democracy" has no right to decide in times of Revolution: the leadership ought to belong to the advanced organizations conscious of their aim and intent on achieving it. It was not difficult even for "nebulous" Social Revolutionaries of the Centre and Right to refute these sophisms. They urged with perfect truth that the will of the Revolution in this case meant simply the arbitrary sway of a gang of reckless adventurers, that the Assembly, in spite of all its defects, was the one authorized institution entitled to speak for Russia, an institution which had been recognized and made use of by the Bolsheviks as long as it suited the purposes of their propaganda. But what force had arguments in the face of rifles? The soldiers had run away from the front in order to rob and kill in the name of the Revolution: no one was ready to satisfy and to glorify them to the same extent as the Bolsheviks. Hence there was ample "pragmatic" justification for the Bolsheviks' *coup d'état.* Naturally the first acts of the new era were decrees of the Executive Council proclaiming the abolition of private property and the resolve to conclude a democratic peace.

Peace of Brest Litovsk.—Two parties were necessary in order to conclude that honourable peace "without annexations and indemnities" which the Bolsheviks announced before having informed themselves of the views of the other party as to the conditions of such a peace. Lenin, Trotsky, Zinoviev and their colleagues had, however, made up their minds about certain points, so that the ordinary negotiations were for them only a formal act, attractive in so far as they enabled their *sans culotte* delegation to exchange salutations and to sit at the same table with the diplomatists and soldiers of powerful empires. The Bolsheviks had long ago made their choice between the belligerents; they expected and preferred the victory of the Germans, who had served them and provided them with funds in the hour of need. Hypocritical invitations to the Allies to follow in their wake at Brest Litovsk could deceive no one as to their choice. And as they had done more than anyone to corrupt and disband the Russian army, they knew perfectly well that they had nothing to oppose General Hoffmann, when the latter chose to "bang his boot on the table" (Trotsky). Some show was made in their newspapers of strikes in Austria and in Berlin, but it was clearly a case of discussing terms with an opponent who had disarmed you and may dispatch you at his pleasure. No wonder that Baron Kühlmann, after accepting the formula of an honourable peace "without indemnities and annexations" on the basis of the self-determination of peoples, required the representatives of the Soviet Republic to cede Poland and Courland to the Central Empires, to recognize Finland, Esthonia and Latvia as independent States, to give up the Ukraine on both shores of the Dnieper, and to pay a contribution of 300 million rubles. Trotsky tried to get away with a theatrical gesture; he and his colleagues declared that they could not sign such a humiliating peace, and they departed in noble style. Even this little pretence was not vouchsafed to them. General Hoffmann ordered some German divisions to advance, and the revolutionary army was at once on the run. The delegation of Soviets had to come back crestfallen and to sign a second more dishonourable edition of the Treaty of Brest Litovsk. Lenin was in no way disturbed: he explained to the Third Congress of the Soviets that the Germans had their knees on Russia's chest and that it was no use struggling. Breathing space must be had at any price, in the hope of a further fulfilment of Zimmerwald predictions. The Congress ratified the Brest Litovsk document by a large majority, and a German envoy, Count Mirbach, was sent to Moscow to watch over the exact fulfilment of conditions by the vanquished. Trotsky, who is particularly fond of repeating, at every turn of his account of these affairs, such phrases as "we know" or "we expected," may well claim that this degradation had been foreseen and to a great extent brought about by his party. But the breathing space required by Lenin was provided, not by the Brest Litovsk peace, which was the opening move for the complete enslavement of Russia by the Germans, but by the unexpected fact that the Allies did not succumb, in spite of the treacherous conduct of the Bolsheviks. The Marxist prognostics of the victory of Germany as the nation best organized in a technical and economic sense was shown to be fallacious. The staying power of the Austrian, Bulgarian and German armies proved to be less than that of the soldiers of France, Great Britain and the United States. The victory of the Allies saved Russia from the consequences of Brest Litovsk.

The Rule of the Communists.—In spite of the fact that the elections to the Constituent Assembly had resulted in an overwhelming majority for the Social Revolutionists, the drastic way in which Lenin and his companions had satisfied the popular demands for peace at any price, for land and for proletarian privileges, ensured to them the more or less fervid support of the masses. The lower classes enjoyed the defeat and humiliations of their betters even apart from direct advantages and even at the cost of some discomfort for themselves. The pent-up resentment and envy of generations found vent in acts of brutal violence and disorder. It was pleasant to see maids of honour sweeping the streets, and generals insulted and sometimes murdered by their soldiers. We are told of cases when the descendants of serfs dug out the skeletons of their former squires from their graves and threw them into sewers. It was an act of frenzy on the part of revolted slaves when the commander-in-chief, Dukhonin, was torn to pieces at his headquarters and Ensign Krylenko installed in his place, or when, later, the heroes of the great war—Ruzsky and Radko Dmitriev—were massacred in Piatigorsk because they did not truckle under the threats of the disbanded soldiery. The officers slaughtered in Helsingfors, in Kronstadt, in Kiev, in Sevastopol, paid with their blood for the disaster of Tsushima, the Sukhomlinov misrule, the cruel discipline of the Old Army. As a result, Bolshevik domination spread over the land like a forest fire, and all attempts at resistance proved unavailing against its elemental progress. The cadets of the military schools of Moscow held the Kremlin for a few days with great gallantry, but they were betrayed by the head of the Moscow garrison; he surrendered them to the Communists "for the sake of peace." Occasional resistance in other towns was put down with even greater ease. The personnel of many administrative institutions went on strike, and attempted to stalemate the usurpers by refusing to serve under them: the strikers were reduced to obedience after a couple of months by the necessity of earning their bread somehow. Countess Panina, one of the most enlightened and public-spirited Russian women, had acted as Assistant Minister in Kerensky's last Ministry: she was thrown into prison for having supported this strike movement, which the Bolsheviks treated as a "sabotage" of Government services. She was eventually released, but two among the most idealistic, most self-sacrificing of the Liberals who had taken part in the Provisional Government, Shingarev and Kokoshkin, fell victims to a dastardly gang of murderers in a hospital where they had been lodged on account of illness.

The only serious attempt to oppose armed resistance to the bandits was offered by Gen. Alexeiev and the indefatigable Kornilov. They collected a few thousands of devoted men, most of them officers, formed them into improvised units, and took the field against the Bolsheviks in a far-off corner of the empire in Northern Caucasus. Kornilov fell in the unequal struggle, but his comrades succeeded in building up gradually a "Volunteer Army" which held its own in the Kuban territory. It was too weak to advance because the Cossacks, instead of joining it with all their forces, wavered and negotiated. Hetman Kaledin, a brilliant general who had won conspicuous distinction in Brusilov's campaign of 1916, was so grievously affected by this lack of patriotism that he committed suicide; and his successor, Krasnov, preferred to enter into an agreement with the Germans, who were spreading their tentacles from the Ukraine to the Donets and to the Volga.

The rise of the revolutionary tide was, however, not a constant and unbroken process. The shattered forces of the past did not give way without repeated attempts to reassert their vitality. The Orthodox Church that had grown up with the Russian people in its hard struggle for existence could not be reconciled with the rule of aggressive materialists. Everywhere the clergy exerted its influence publicly and secretly against the anti-Christian rulers. Tikhon, the newly appointed Patriarch of Moscow, whose chair had been set up again by a national Council of the Orthodox Church after an interval of 200 years of Babylonian bondage to lay bureaucracy, denounced and anathematized the Communists. Everywhere processions and ceremonies recalled to the popular mind the ancient traditions of creed and ritual, and even the most hardened among the rioters and deserters responded at times to these emotional appeals. The Bolsheviks turned sanctuaries into public halls, desecrated revered shrines, tortured priests and shot bishops, but these persecutions strengthened the moral hold of the Church on the flock, purified the sunken priesthood by a new baptism of blood. Among the Intellectuals themselves, religion regained many adherents, and men like Eugène Trubetskoy or Bulgakov, who had stood up for Christian ideals in the days when it was considered ridiculous for an educated man to do so, found themselves at the head of a powerful movement.

The Liberals also did not give up the struggle. A number of more or less secret associations sprang up. The Press was being gradually gagged by the Bolsheviks, but these associations continued their underground existence in spite of the espionage and arrests. The most influential were the Radical League of Reconstruction (*Soyuz Vozrojdenia*) led by Avksentiev and Argunov, the "Centre," composed of Cadets and Left Octobrists with N. Astrov and N. Shtchpkin at their head, and a union of the Rights whose principal leaders were Krivoshein and Gourko. The question of yielding to the Germans and crushing the Communists with their help was eagerly discussed in connexion with the plan of a monarchical restoration. The idea found favour among the Rights and was supported among the Cadets by P. Milyukov, who had fled to Kiev, and considered that the game was definitely lost by the western Allies and that it was wiser to accept defeat from the Germans than from the Bolsheviks. This view was, however, decisively rejected by the Liberals and the Radicals, who remained staunch in their allegiance to the Entente and could not bear to think of German domination. The chastisement for this independence of mind followed closely upon the offence: the Cadets had held a conference in Moscow on the political situation on May 13, 14 and 15, and had endorsed the policy of their leaders to remain faithful to the Entente: on May 17 their various centres were raided and many representatives arrested. Others fled south and east, but Moscow was still the nucleus of a "National Centre."

Policy of the Allies.—How did the Entente Powers react against the disruption of their alliance with Russia? Their ambassadors, having watched with anxiety the decay of the monarchy, offered ineffectual advice, and informed their Governments of the precariousness of the situation without being able to suggest any effective course of policy. When the blow fell, the Entente Powers accepted the verdict of the Revolution as a necessary consequence of Tsarist misrule, and the President of the United States actually felt more free to join the western coalition, since the danger of a victorious advance of Tsarism had been removed. The device of a double diplomacy was adopted: while Sir George Buchanan and M. Noulens continued officially to represent Great Britain and France, special envoys were dispatched to Petrograd as emissaries of various groups of Socialists faithful to national traditions. Arthur Henderson for Great Britain and M. Albert Thomas for France were even entrusted with official missions. The main object was to steer the Russian Revolution into a warlike course, to keep up the eastern front, and to provoke a resumption of the Russian offensive. The results of this unusual diplomacy were very heterogeneous. While Albert Thomas eagerly supported Kerensky in his patriotic appeals to the army, as well as in his attempts to arrange a coalition with the Soviets, Arthur Henderson became convinced of the urgent need of peace and favoured a meeting of Labour delegates in Stockholm.

The evolution of Russia was not much affected by these contradictory views of the Entente emissaries. The offensive was tried with disastrous results. The Russian army dissolved under the influence of the "peace at any price" movement. Disappointment with the conduct of revolutionary Russia was reflected in the sympathy on the part of certain circles in England for Kornilov's attempt, a sympathy which did not help but rather hampered him. The advent of the Bolsheviks drove the western Powers into an attitude of absolute helplessness. They could do nothing to counteract the Brest Litovsk negotiations, and, at the same time, they were not in a position to break off all relations with the Communist Government for fear of its taking sides with the Germans. Even the shooting of the British naval attaché by Bolsheviks did not rouse them from their torpor. The Brest Litovsk peace, the occupation of southern Russia by German troops, the intervention of the Germans in Finland, obliged them, however, to adopt a decision. The embassies were gradually withdrawn, the semi-commercial and semi-diplomatic mission of Mr. Lockhart did not lead to any favourable results, and in the summer of 1918 all official relations with the Government of the Soviets were broken off. A state of more or less active hostility set in when the anti-Bolshevik troops were being reorganized on an extensive scale in various parts of Russia. The White forces received support from the Allies in the shape of military supplies, occasional expeditions, and a blockade of the ports controlled by the Soviets. Concurrently with this intermittent support of Russian national armies, the Allies encouraged and protected all the nationalities of the Empire which were striving for a separation from Russia: Poland and Rumania came to be looked upon by the French as the bulwarks of Western civilization against Russian barbarism and German militarism. The Baltic States (Latvia, Esthonia, Lithuania) and the Caucasian formations (Georgia, Armenia, Azerbäijän) were backed in their separatist aspirations by Great Britain. This tendency to dismemberment of the Russian Empire could not be harmonized with the ideals and efforts of Russian patriots, but the Entente Powers did not pause to reflect on the inadvisability of destroying with one hand what they were helping to build up with the other. Psychologically, their centrifugal policy was connected with old antagonism to the Russian Empire, with dreams of national self-determination, restricted somehow by the vital interests of the "Big Four," and—after the victory over the Central Powers—with the

Versailles delusions of overwhelming power over the world. The incoherence and vacillations of Entente policy might not have been so pernicious if Russian patriots had been able to muster an overwhelming array of anti-Bolshevik forces in Russia itself. Unfortunately this was not the case.

Anti-Bolshevik Governments.—During the first months of the Soviet regime, while the power of the proletarian dictators was still shaky and unorganized, several concentrations opposing them were formed in the East. First, Colonel Semenov, a leader of Transbaikalian Cossacks, had started a guerrilla warfare on the borders of Mongolia and Manchuria, advancing in the direction of Chita when luck favoured him and retreating across the Chinese frontier when he met superior forces of the Bolsheviks, together with the Magyar, Austrian and German prisoners of war mobilized by the latter. In May 1918, he succeeded in forming a provisional government in Chita. Soon afterwards, Admiral Kolchak, a brilliant naval officer, who had distinguished himself in the Japanese War, organized another Provisional Government in Novo Nikolayevsk at the junction of the Siberian railway with the Maritime province line. The Japanese, who had landed a detachment in Vladivostok, supported him in a general way.

About the same time, in the spring and early summer of 1918, there occurred another startling event. Czech detachments which had been formed to fight for Russia from among prisoners of war, and who had fought gallantly against the Central Coalition in the last campaign, demanded to withdraw after the *débâcle* of the Russian army and the advent of the Bolsheviks. They were allowed to do so by the Soviet authorities, but they were to be disarmed, and in the course of their movement east towards Vladivostok they were subjected to offensive and treacherous treatment. Some of them refused to give up their arms; others, after having been disarmed, broke away, recovered arms and munitions, and turned on the undisciplined rabble of the Red troops. As a result of encounters of this kind, the Czechs, and some Slovak detachments which had joined them, seized great tracts of the Siberian railway line near the Volga, near Irkutsk, and by Vladivostok. Eventually, after many vicissitudes, these corps made their junction along the whole line. The total number of troops who effected this *coup de théâtre* averaged some 80,000 men. It would be useless to follow in detail the swaying fortunes of these detachments. Their daring exploits would hardly have achieved success if a considerable portion of the population of eastern Russia had not sympathized with them. As it happened, these disciplined troops succeeded in creating the backbone of resistance against the Moscow dictators: in Siberia, Provisional Governments were formed in Vladivostok, in Harbin (General Horvath), and in Tomsk, besides the centres of military administration started by Col. Semenov and Admiral Kolchak.

Unfortunately the various governments comprised different and mutually hostile groups, which could not be prevailed upon to act loyally together. The Vladivostok concentration reflected the Socialist ferment in the country, and worked for an independent Siberia. The Government formed in Tomsk was an Executive of a Siberian Duma, composed of delegates from various organizations—zemstvos, municipalities, political parties, social groups (workmen, students, coöperative associations). The majority of these constituencies followed a socialistic orientation, but their Executive adopted a more conservative policy and admitted several Cadets into its ranks. From Samara came yet another political tendency: some thirty fugitive members of the Constituent Assembly, dismissed by the Bolsheviks, had assembled there, and their political creed was expressed in the demand for a restoration of that Assembly, which they considered as the only body constitutionally entitled to wield power in Russia. Their aim was to reconstitute an All-Russian State, which would include Siberia as an autonomous part of its organization. On the other hand the administrations of General Horvath and Admiral Kolchak, while reserving the ultimate decision as to the system of Government to a new Constituent Assembly, discarded the authority of the one elected in December 1917 as not representative of Russian opinion. These administrations favoured the propertied classes and built up their personnel from the remnants of the military and civil bureaucracy of the monarchical period. Even in the face of the enemy all these groups found the greatest difficulty in establishing coöperation. The Vladivostok Government submitted to the authority of the West Siberian one, but the negotiations with Horvath were protracted and fruitless. A *coup d'état* on a small scale was attempted in Vladivostok by Horvath's lieutenant, Gen. Pleshkov, but the Allies intervened to reëstablish the Socialist administration because it was approved of by the Vladivostok zemstvo.

In the west a conference held in Ufa laid down the foundations of an All-Russian scheme in connexion with the Constituent Assembly of 1917, and succeeded in persuading the Siberian Government in Omsk to recognize its authority. The moving element in this case came from the Moderate Socialists, chiefly Social Revolutionaries, but Social Democrats of the Plekhanov persuasion and some Cadets were in agreement with them. A directorate of five consisting of Avksentiev, Zenzinov, Vologodsky, V. Vinogradov and Gen. Boldyrov was established. Admiral Kolchak accepted the portfolio of War in the Ministry which was to conduct the actual administration. This amalgamation of Governments was arranged in the beginning of Oct., and a mobilization of certain classes of the Siberian population which had been started somewhat earlier was carried out on a more extensive scale: it yielded some 150,000 men, whose military instruction had to be taken in hand under very difficult conditions. Many delays and mistakes occurred, and the different sets of people who had been brought together with such difficulty quarrelled over the task, suspected and accused one another. The officers who had served under the old régime were displeased with the policy of the Directors, whom they accused of indecision and vain talk; the Socialists chafed at the high-handed way in which they were treated by the military chiefs and the employees of the Ministries. In the night of November 18 these dissensions came to a head. A party of soldiers led by officers of the Omsk garrison arrested the Socialist members of the Directorate, Avksentiev and Zenzinov, and two of their assistants, while a third Director, Vologodsky, joined a meeting of Ministers which elected Admiral Kolchak as Supreme Ruler. In the communiqué issued on the occasion by the newly constituted Government, it was explained that "wide social circles had been discontented with the wavering behaviour of the Provisional All-Russian Government in regard to certain tendencies of the Left leading to the renewal of a destructive policy. While condemning the *coup d'état* as an illegal act the new Government endorsed it by taking advantage of the accomplished fact: Avksentiev and Zenzinov were allowed to escape and the two remaining Directors, Boldyrov and Vinogradov, retired.

Such a start did not augur well for the future of the reconstruction movement: it showed that the enemies of the Bolsheviks were still irreconcilably divided by the old feud between Conservative Nationalists and Socialistic idealists. These conflicts helped to keep alive in the mass of the people a spirit of lawlessness and distrust. And yet nothing was more needed in those days than steadiness and forbearance as regards details; those who had assumed the task of restoring order were least able to lay claim to efficient administration—the lack of experience and even honesty was felt everywhere. The mobilization, for example, was carried out in the most haphazard fashion, crowds of conscripts being left even without accommodation.

The fact that the Bolsheviks in Siberia were drawing largely for support on the Austrian, Magyar, and German prisoners, of whom about half a million were dispersed in various localities of the wide country, and the difficult situation of the Czechs astride the Siberian railway, had provoked an intervention of the Allies. Japanese, American, British and French detachments were landed in Vladivostok with instructions of varying intensity: all the intervening Powers gave assurances of their disinterestedness, of their friendship for the Russian people, of their resolve to leave it entirely free to decide as to its destiny; but while the Japanese were committed by their past and their future to safeguard and promote their own interests, the Americans were enjoined to restrict themselves to guarding railway communications and stores, and the French colonial troops held aloof. The British followed a middle course in the sense that part of their contingent, Col. J. Ward's Hampshire Regiment, was pushed forward right through Siberia, but there was no clear military aim in that operation and steps were retraced when the real difficulties set in. Material support was given by the British more than by anybody else, but these measures were in the nature of a risky speculation dependent on the trend of home politics and on the ability of the “White Guards” to win the game.

A somewhat different situation arose in the north of Russia, where the rule of the Soviet Commissars was overthrown both in Archangel and in the Murman, and a patriotic Government was set up under the leadership of N. Tchaïkovsky, a “Popular Socialist,” who had lived in England for many years as an exile. The opposition between progressive and conservative circles, and the difficulty of conducting business with the available demoralized elements, were also felt there, but Great Britain's stake in the game was much more conspicuous, and the British detachments under Generals Maynard and Ironside formed a very important part of the forces operating against the Bolsheviks. There was, however, no real cohesion between the Russians and their British allies, although cases of acute hostility were exceptional. Apart from such dissensions the ground was felt to be shaky on account of the war-weariness and the fickle temper of the common people. The massacre of the British officers by the men of Dyer's battalion showed that Bolshevik propaganda and Bolshevik habits were by no means a thing of the past.

The southern front, organized by General Denikin after Alexeiev's death, was suffering from similar weakness. The Voluntary Army constituting its backbone had become an efficient and powerful instrument of war; the officers' division, which had formed its bulk in the beginning, had expanded gradually into several corps by drawing into its ranks veteran soldiers who had learnt their trade in the terrible battles against Germans and Austrians. But the trusty regiments named after Kornilov, Alexeiev, Markov and Drozdovsky, had to act together with the levies of the Don and the Kuban Cossacks, who, though unrivalled as irregular horsemen, had their own axe to grind in the conflict. The Don province had been subjected to repeated attacks and devastation, and many of the Cossacks were anxious to keep to their frontiers and to manage their own affairs. As for the Kuban people, they were divided among two sets: the men of the “line” in the north were patriotic enough and fought brilliantly, but the Black Sea Cossacks, mostly descendants of the Zaporog Cossacks transferred to the Kuban from the Dnieper by Catherine II., were animated by a spirit of separatism and ready to follow leaders who worked for a Cossack Republic. A great deal depended on the skill and the political insight of Denikin's administration, and in this respect, as on the eastern front, grievous blunders and abuses occurred. The main direction was necessarily in the hands of military commanders inclined to insist above all on discipline, and contemptuous as to political theories and subtle distinctions. Denikin himself, though perfectly honest and straightforward, held systematically aloof from constitutional disputes, and declared his task to be primarily one of liberation and restoration. His principal assistants, Generals Dragomirov and Lukomsky, had even less taste for political “metaphysics,” and one of the civil advisers, Prof. K. Sokolov, openly expressed the view that the only régime suited to the circumstances of the time was a “democratic dictatorship” satisfying the needs of the common people. Although nothing was prejudged as to the ultimate form of Government, the organization of the southern territories occupied by Denikin was cast in the mould of the supreme authority of the commander-in-chief. By his side stood a Special Council composed of the heads of departments and of a few representatives of public opinion. All the members—some twenty—were nominated by the commander-in-chief. The elements of military and civil bureaucracy were decidedly predominant, and the “Left” was confined to three Cadets, all moderate Liberals. The Socialist parties were excluded from the Government and kept under strict supervision as regards their Press. One of their influential leaders, Schreider, was deported by order of the Government; many others left of their own accord for the Crimea. The greatest difficulty was experienced in holding the balance between the aims of the Volunteer Army engaged in the reëstablishment of a National State and the aspirations of the Cossack communities tending towards federalism. The problem of reconciling these contradictory tendencies was a most difficult one. The Kuban Rada (Assembly) manifested openly separatist leanings: its leaders, Bytch and Makarenko, were dissatisfied with a dualistic arrangement contrived after many efforts between the Higher Command and the Rada. They wanted the political independence of the Kuban to be recognized, and sought an alliance with other Cossack territories in order to strengthen their demands. This political strife reacted in a most unfavourable manner on the conduct of operations in the field.

Reds v. Whites.—Disgust with the hypocritical tyranny of the Bolsheviks and the humiliation of Russia found a vent in conspiracies and risings among the intellectuals. The German ascendency was challenged by the murder of the ambassador, Count Mirbach, in July 1918. Almost simultaneously the commissar in charge of the police in Petrograd, Uritsky, was killed, and Lenin himself dangerously wounded by a Socialist. The Social Revolutionaries made an attempt to overthrow the Bolsheviks in Moscow, but were suppressed with great slaughter. Later on, the most experienced of Terrorists, Boris Savinkov, engineered a rising in Yaroslavl and neighbouring districts; it was quelled after bitter fighting. These isolated attempts in the heart of Russia were not so dangerous as the simultaneous advance from the east and the south. Kolchak's armies reached at one time Kazan and Simbirsk, Denikin pushed as far as Orel, and in the north there was some hope that Gen. Ironside's British column might have joined hands with Kolchak's force near Kotlas. The Communists made desperate efforts to meet the onslaught. The Red hosts were reorganized by former officers of the Imperial army, with Polivanov, Theremissov, Klembovsky, Parsky, Dalmetov at their head. Even Brussilov lent the prestige of his name to the cause of the Moscow Soviet. These men were inspired not only by the pressure of want and despair, but in many cases by a fatalistic belief that they were serving the interests of Russia under the Red flag as against reactionaries and foreigners. An iron discipline was reintroduced, disobedience, treachery and cowardice were promptly punished with death, desertion was repressed as far as possible, there was no more indulgence for committee discussions or for the “self-determination” of military units which had wrought havoc in the last stage of the war against the Central Empires. In every battalion, squadron and battery nuclei of devoted Communists were inserted in order to watch and to lead the apathetic rank and file. Altogether the proletarian dictators reverted without any scruple or confusion to the practices they had fiercely denounced in the time of defeatist propaganda. The cadres of the army were gradually filled by wholesale mobilizations, and although crowds of conscripts were swept away by desertion, there remained enough in the ranks to outnumber the White forces: the fact that the Bolsheviks had got hold of the solid centre of Great Russia against the weaker outlying portions of the Empire was bound to assert its overwhelming influence in the end. Of course, if there had been an elemental popular rising against the proletarian leaders, they could not have withstood the attack. But the Great Russian peasantry, although by no means sympathetic to Communist doctrines and hostile to many of the commissars, were yet under the spell of the opinion that they were defending their newly conquered land against the squires who wanted to get it back. While this broad basis of popular support remained unshaken the dictators could exert their cruelty and lusts with impunity.

Terror against the bourgeoisie had been proclaimed by them from the very beginning: it formed one of the main planks of their platform. It was expanded into a system of wholesale slaughter and ruthless inquisitorial measures as a means of self-defence. The Extraordinary Commission (the famous *Tchresvichayka*) thrust the Tsar's *Okhrana* into the shade; as a matter of fact, it was served to a large extent by hangmen, torture-masters and spies borrowed from the Tsarist police, but acting with much greater independence and thoroughness. By the side of this cold-blooded and systematic machinery for crushing human beings acted innumerable gangs of ruffians and criminals, who robbed and killed in the sacred name of the Red Revolution with complete impunity and with the approval of the ruling powers. It is quite impossible to estimate the number of victims who fell a prey to this campaign of hatred.

Here is an extract from Bolshevik sources which may illustrate this butchery, although it does not in any way give an idea of its real dimensions:—

> "In 1918 the persons arrested on the charges of counter-revolution, crime in office, speculation, use of forged and other people's documents, etc., numbered 47,348. In 1919 the activities of the Tchresvichayka developed, and the number of persons arrested reached 80,662. Out of the total number of persons arrested in 1919, 21,032 were classed as counter-revolutionaries, while 19,673 were arrested for crimes of office. Out of the 128,010 arrested in 1918–9 54,250, or 42½ %, were liberated without subsequent consequences. Eight per cent of the total number of persons consisted of hostages. Nearly 11 % were sentenced to compulsory labour, 29 % retained in prison, and nearly 8 % sent into concentration camps. In 1918 6,185 persons were executed and 3,456 in 1919, the total number during the two years being 9,641." (Lazies, *The Fight on the Home Front.*)

In such cases it is not only the number of victims that counts, but also their quality: as in the times of Ivan the Terrible, only "God knows the names of the murdered," but let us notice by way of example that some of the most respected among Moscow's citizens, whose whole lives had been devoted to the service of the people—the Astrovs, the Alferovs, N. Shtechepkin—were shot as "spies" in the summer of 1919.

What did the Whites oppose to the Red fury? In fighting prowess the Whites were more than a match for the Reds, especially on the southern front: the exploits of Wrangel's Caucasian corps in the attack and defence of Tsaritsin, the advance of the Volunteer army's infantry against heavy odds on Kharkov and Kursk, the rally at Rostov in the last months of 1920, are proofs of the excellent quality of Denikin's troops. Kolchak's Siberians were not seasoned to the same extent, but they were good material and improved rapidly, and the Orenburg and Ural Cossacks operating between the two groups did everything humanly possible to oppose the Reds. But neither the eastern nor the southern armies were supported by a tolerably organized rear. Kolchak and Denikin moved rapidly forward in the hope of cutting off the economically important district of the Ural, the Donets, the corn-growing provinces along the Volga and in the Ukraine, but their rapid advance involved a hasty and superficial occupation of wide tracts. They flooded their regiments with unwilling conscripts and had to rely for supplies on requisitions: the corn and the horses of the peasants were seized without any regard for the needs of the farmers, while the raids of Cossack cavalry into regions held by the Reds resulted in indiscriminate looting of friend and foe. What constantly happened in such circumstances was that the advancing Whites were received with "bread and salt" and attacked in the rear when they had been in the country for some time.

If the White leaders had succeeded in persuading the people that their aim was genuinely patriotic and that private interests had to be sacrificed for the sake of the great cause, all the miseries of civil war might have been endured, if not willingly, at least with resignation. But neither on the eastern nor on the southern front did the Whites establish confidence, that condition precedent of success. There cannot be the slightest doubt that not only Denikin and Kolchak, but also their principal followers were fighting for the ideal of a reunited and free Russia, but there was too much of the hated past intermixed with their efforts; corrupt officials, greedy squires had flocked to the White banners and were clamouring and pressing for revenge and compensation. The frequent cases of lynching of commissars and Communists were an inevitable consequence of the civil war and of the hatred inspired by the wreckers of Russia: it was impossible to draw the line between justified retribution and wanton cruelty in many of these explosions of wrath. Sometimes, as in the case of Jewish pogroms in the Ukraine, subordinate officers acted against the direct orders of the High Command. But there were other signs of the time in the policy of the White leaders which created the suspicion that they were out for a counter-revolution, for the reëstablishment of the old monarchy and the old gentry. The Socialists, who formed a great part of the intellectual class as far as the latter still existed, were driven back without any regard for the fact that they were natural allies in the struggle against Communism. One of the leading members of the Constituent Assembly was shot by Kolchak's Government in Ekaterinburg. The same fate befell leaders of the Kuban separatists in Ekaterinodar. The Liberal members of the Denikin "Special Council," like N. Astrov, protested in vain against a policy directed against all Socialists indiscriminately. If Denikin had not personally prevented further persecutions and open reaction, the dictatorial schemes of the generals would have been embodied in some drastic Act of the State for which Prof. K. Sokolov would have supplied a juridical formula. As it was, for the mass of the people the repeated protestations of acceptance of the social results of the Revolution seemed belied by the way in which agrarian reform[1] was to be regulated. The subtle distinctions concerning compensation and redemption tax reminded the peasants forcibly of the procedure followed by the Emancipation Act of 1861, and the Reds were not slow to take advantage of this unfortunate association of ideas. The Whites started also a propaganda office (*Osvag*), but although some 200 million rubles are said to have been spent on it, its activity was subjected to bitter criticism by various groups in the camp of the Whites. The state of affairs brought about two fatal results—confusion in the rear of the White armies, and discord between the patriotic forces in Russia and the Allies.

The conditions in the rear of Denikin's army were described by Soviet propagandists with ironical satisfaction. There can be no doubt that the activity of "green" bands of marauders, and the rise of such potentates as Makhno, a brigand whose followers are said to have mustered at times some thirty thousand, made orderly life in the rear impossible and drew off considerable forces at the most critical moments for the maintenance of some sort of communications. What proved even worse was the defection of dissatisfied Cossacks. When the Volunteer army was straining its forces to hold the line against the Reds north of Rostov, Kuban troops left their positions and went home, leaving Denikin's right flank unprotected.

A similar state of affairs prevailed on the eastern front: the population in the rear, excited by Communist propaganda and fraternizing with the lawless elements so numerous in Siberia—convicts and prisoners of war—conducted a constant guerrilla warfare against the Russian and foreign troops protecting the Trans-Siberian railway line. Kolchak tried to counteract this shocking demoralization by reorganizing his government under the leadership of an energetic and enlightened man, Pepelayev. It was too late and the administrative personnel too insufficient to avert the catastrophe. The eastern front gave way even before the southern one. Thousands of soldiers and refugees perished in the retreat through the icefields of Siberia in the winter of 1919–20; Kolchak and Pepelayev, who had sought the protection of the Czechoslovaks, were handed over to the Bolsheviks in pursuit with the consent of Gen. Janin, the commander of the Allied contingents, and shot; while the Czechs succeeded in extricating themselves and carrying off part of the gold reserve seized during the occupation of Kazan.

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[1] The following were the conditions of land reform proclaimed by Denikin on July 19 1919:—

(1) Safeguarding of the interests of the toiling population;

(2) The creation and the placing on a sound basis of small and medium homesteads out of the land belonging to the State and private owners;

(3) The preservation of the right of the landowners to their land, coupled, however, with the apportionment in each district of the amount of land that is to be retained by the former owner and the order of the transfer of the remainder into the ownership of those who are land-poor;

(4) These transfers may be achieved by *voluntary agreement*, or by *obligatory alienation for compensation*. The new owners are to acquire inalienable rights to their allotments.

(5) *Intensive aid to be given to tillers* of the soil, through technical improvement of the lands, expert agricultural assistance, the supply of implements, seeds, dead and live inventory, etc.

Allied Intervention.—The action of the Allies in these deplorable times was contradictory and ineffective. Large quantities of munitions and supplies were furnished to the patriotic armies; sometimes the consignments arrived late or were in damaged condition, while a good deal of pilfering and embezzling occurred, but, on the whole, it is certain that the White armies could not have held the field for a month without this material assistance. Huge sums of money were provided to help the Russian commanders to tide over their financial difficulties, and it is estimated that the British spent about £100,000,000 in these transactions. But while so much was done in this direction, the diplomatic and strategic steps taken by the Allies were not only inadequate, but often mischievous. The policy of support for the patriotic movement in Russia lived, as it were, under a cloud: it was disturbed and hampered right through by the opposition of strong currents of opinion in western Europe and in the United States. There was, to begin with, the fear of infection of Allied troops by Bolshevik propaganda—a fear justified to some extent by such facts as the conduct of French sailors and soldiers in Sevastopol and in Odessa, where the red flag was actually hoisted by French men-of-war, and certain battalions of the army of occupation showed a marked disinclination to fight the Reds. This fear that war-weary soldiers of the Entente might not be proof against Communist propaganda led to the undignified scampering out of the Crimea and from the south-west. Even more important was the sympathy shown to the cause of the Bolsheviks by Socialists in France and the Labour party in England, a sympathy in which they were supported by influential organs of the Radical press. This feeling manifested itself in a variety of shapes and degrees: some regarded the violence and destruction of the Communist upheaval as the beginning of a new era in social history characterized by the overthrow of capitalism; others condoned terroristic methods as a necessary means of revolutionary action; others again were prepared to admit that these methods were justified by the misrule of the Tsars that had provoked the vengeance of the people; all were inclined to balance the misdeeds of the Reds by the excesses of the Whites and all objected to intervention in favour of the latter. The reorganization of Russia on Imperial lines was distasteful to many English Conservatives who were still under the influence of the ideals of Disraeli. Last, but not least, there was a growing number of "realists" who contended that the Bolsheviks had proved their right to rule because they had defeated their opponents in the field and that in these circumstances it would be best to recognize facts and to draw from them such advantages as could accrue to business men from the needs of a great country.

The weaknesses and failings of the White organizations in Russia presented most convenient materials for the action of all these elements opposed to Allied intervention. The result was a series of inconsistent steps which contributed to the decline of the cause of reconstruction. In Jan. 1919 came the proposal of the "Big Four" that the belligerents of the civil war should meet in Prinkipo and discuss conditions of pacification—a proposal that reflected in a striking manner the peculiar combination of unpractical idealism, superficial knowledge and the yielding to "happy thoughts," which formed one of the characteristics of the Versailles Conference. As the Arcadian perspectives of Prinkipo did not meet with the expected response on the part of the belligerents, schemes acknowledging the standing of the proletarian dictators began to crop up, in connexion with favourable reports by enterprising American journalists (Mr. Bullitt's mission). At the same time the British War Office countenanced the plan of a raid on Petrograd to be carried out by the victor of Sarikamish, Gen. Yudenich. This enterprise was attempted with insufficient forces (some 15,000 men); it was in the nature of a gamble, but even gamblers do not usually put stakes on opposite sides. In this case, however, the Allied High Commissioner, Gen. Sir Hubert Gough, paid more attention to the aspirations of Esthonians, who were anything but keen to promote Yudenich's success, than to the requirements of the Russians. The climax of that form of intervention was reached when Gen. Gough's chief-of-Staff, Col. Marsh, gave the Russians three-quarters of an hour to form a North-Western Government and to recognize the independence of Esthonia. No wonder the expedition did not prosper.

By Nov. 1919 Mr. Lloyd George had come to the conclusion that it was advisable to renounce intervention and to leave Russia to her fate. Though doing lip service to the unforgettable services of Russia in the war, he submitted that it was not in the interest of Great Britain to assist in strengthening that country. This point of view prevailed definitely in 1920. When Denikin was forced to abandon the North Caucasian territory, British policy steered towards a liquidation of the Russian imbroglio. Wrangel made a last and gallant stand in the Crimea, but he was recognized and supported by the French only, while Great Britain took up an attitude of neutrality favourable to the Moscow dictators.

In the war which Poland waged rather imprudently when the danger of restoration of Imperial Russia had vanished, Great Britain was prepared to surrender Poland to Bolshevik hegemony, and when the tables were turned before Warsaw, thanks to the assistance of the French, British diplomacy employed itself in arranging an armistice between Poles and Bolsheviks which enabled the latter to concentrate their forces against Wrangel and to crush him. This cleared the way to a "complete control" of Russia by the Communists, and enabled the British Premier to give effect to the plans of a resumption of commercial relations with "Sovdepia." There were, indeed, two aspects of Bolshevik policy to be considered—the alluring prospect of exploitation of latent and immense natural sources offered by Mr. Krassin, and the uncompromising attitude of the Third International, founded in Moscow for the express purpose of revolutionizing the world by fair means or foul. While France and the United States refused to have anything to do with a "Government of assassins," realistic considerations prevailed with Great Britain and Italy. Communist propaganda was treated as a bogey, and disarmed by certain stipulations as regards India and by vague promises of a general nature. On the other hand the door was open to trade, not indeed on account of "bulging corn bins" in Russia (as Mr. Lloyd George had once suggested), but on account of her need of everything in the way of raw materials and manufactures. The dictatorship of the proletariat was recognized as the *de facto* Government of Russia, and its leaders encouraged to adopt a policy of renunciation of their doctrines in return for retention of power.

The Soviet Constitution

It remains for us to consider the internal evolution of this newly recognized member of European society, and the results achieved by its rule.

Apart from general declarations of principles, the constructive policy of the Communists may be said to have been initiated at the fifth Congress of Soviets which met at Moscow in July 1918. It consisted originally of 1,132 members with power to vote, of whom 745 were Bolsheviks, 352 belonged to the Social Revolutionary Left, 14 were Maximalists, 4 Anarchists, 4 Social Democrats of the Internationalist group, 10 were outside any party, 3 belonged to "miscellaneous groups." At a later stage the Social Revolutionaries disappeared in consequence of disagreement and risings, and the Congress was supposed to comprise about 1,000 members. From a formal point of view the most important business transacted by this Congress was the acceptance of the Constitution, but this was carried in a hurried manner at the close of the session and without any debates to speak of, when the opposition had been ejected from the Assembly. Nevertheless it is advisable to begin with a summary of its most important provisions. It proclaims itself to be the Constitution of the Federal Socialistic Republic of Soviets. As a matter of fact there was no federalism about it, as no means had been provided for any genuine expression of the will of the component parts. The Ukraine, for instance, was never allowed any self-determination, but was simply conquered by the Bolshevik armies and subjected to the rule of Moscow authorities, although the pretence of separate existence and organization was kept up. The social basis of the republic was formed by the workmen and the peasants, while all those who used the labour of others for their benefit were disfranchised.[1] One of the fundamental assumptions of the system was that the normal kind of work that counts is manual work and all forms of activity which do not take the shape of manual work have, as it were, to justify their existence in relation to manual work. At best a rough equation was established between various forms of employment, at the worst people who could not claim the designation of workmen were declared to be bourgeois under suspicion. In principle no distinction was made between various kinds of performance in point of quality, and in introducing the project of the Constitution the reporter, Stekloff, appealed in as many words to the famous maxim of Fourier: " To everyone according to his needs." It may be noticed, however, that the other side of the saying—" From everyone according to his faculties "—was also acknowledged in a somewhat peculiar form (by Trotsky): those who refuse to work need not eat. The threat was directed primarily against the civil servants who had thrown up their office work, but the principle admitted of wider application and came to be applied to workmen in general.

There was no attempt at democratic equality, in any sense. As regards electoral representation, for instance, an industrial worker was treated right through as worth five peasants: 25,000 of the former were reckoned for each delegate of a Soviet Congress and 125,000 of the latter; the same ratio obtained in local and provincial organization.[2] Instead of the *direct* elections on which so much insistence was laid in the democratic stages of the revolutionary movement, all elections were managed on the principle of an ascending scale from lower to higher units. The result was that undesirable elements were weeded out in the process by means of wire-pulling or by downright violence. The clubs of Communists in the various local centres acted as committees of supervision, and terrorized the country so effectually that the Communist party, which on its own showing did not number more than 600,000 members, invariably captured three-fourths or more of the seats in the Assemblies.

The masses of the peasantry, to whom reference was so often made in the speeches of official Bolshevik orators, had much less chance of being heard than in the gerrymandered Dumas of the Tsarist regime: the so-called delegates of workmen, soldiers and peasants were generally intellectuals with a more or less incomplete educational record, but expert in journalistic propaganda and free from all received notions as to morality, humanity or justice. The Congress of Soviets should have met at least once in six months; but this rule fell into abeyance, and the years 1919 and 1920 saw only two congresses (the seventh and the eighth). The intermediate institution of the Central Executive Committee of 200 (later 300) had to act as a kind of Parliament in the absence of the Congress, and was entrusted with supreme authority all the while; but the Board of Commissars of the People, corresponding to a Council of Ministers under the Parliamentary regime, wielded the real authority. It took its lead again from its *presidium*, on which the Government of Russia entirely depended. In this way the appearance of democracy was reconciled with the reality of a very narrow oligarchy, according to the pattern worked out by the French Jacobins in the days of the Committee of Public Safety. A curious device of the sophistical combination consisted in making members of the Central Executive Council at the same time supervisors and subordinates of the commissars, as if genuine control could be expected from persons employed in working the machinery under control.

Local units were subjected to similar limitations: the bourgeois of all descriptions were condemned in every respect to the position of outcasts. Elections were to be conducted under constant pressure from the Communist clubs, and inconvenient persons were to be removed from participation in local as well as central government. A characteristic application of this all-pervading suppression of the bourgeois is the handing over of all technical means of publicity, in other words of the Press, to the workmen and peasants. This meant that there is no possibility for expressing any opinions except those approved by the Bolshevik clubs. The Press was not gagged—it ceased to exist as a free agent. It became a means of reproducing in thousands of copies the standard views decreed by the Bolsheviks. The Tsarist regime never aspired to this complete suppression of public opinion. The right of assembly was vindicated in the same way in the Constitution. The preamble of it started with a sounding declaration of freedom; but it was sufficient for commissars to declare a meeting to be counter-revolutionary in order to be entitled to put an end to it by force.

The Bolshevik legislators prided themselves on having got rid of the division of the functions of legislation and administration, and treating both as alternative manifestations of the will of the living communities of workmen and peasants. One of the effects of this unification of power in the collective unit was the right to recall representatives which belongs to the rural communities, the trade unions and the military units. In actual practice the recall was used to allow free play to the Communist wire-pullers, who were careful to watch over the orthodoxy of the various soviets. The alternation of functions opened the door to log-rolling and capricious changes of policy. Perhaps the most striking expression of the inanity of these constitutional functions was to be found in the position of the delegates of the Red army, who had to represent simultaneously controlling power in the Executive Council and the " iron discipline " of the Bolshevik regime in the ranks.

Altogether the " Constitution " of the Federal Republic of Soviets was clearly intended to be an instrument for the oppression of the formerly privileged classes and a means of propaganda for the edification of people who want to believe in the benefits of Communist rule. When reproached with the duplicity and the contradictions of this paper arrangement the Bolshevist answers: all derogations from principle are justified by the necessity to fight the counter-revolutionaries and to destroy the bourgeoisie. Pure Communism can be introduced only when the people have been ground into uniform pulp: then Law and the State will disappear of themselves. As long as there is any opposition anywhere dictatorship of the proletariat has to be kept up, and as the mass of the people is not permeated with Communist consciousness the dictatorship can only be constituted by the enlightened minority. Hence the necessity of the rule of the few for the sake of the proletariat. It is interesting to read the justification of the Soviet system on the ground that it makes popular government a reality while parliamentary institutions provide mere fictions:—

> " In democracies the only way in which a workman or a peasant participates in government is that he puts a voting paper once in four years in a ballot box. The Soviets are direct organizations of the masses; they are not impermeable, there is the right of recall. . . And this is not only the case with the Soviets which form, as it were, the top of power . . . the organization does not only belong to workmen, it is indeed a working one. In democratic commonwealths the supreme power belongs to parliaments, that is, to talking-

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[1] Chap. IV., 7. The Fifth All-Russia Congress of Soviets of Workers', Soldiers' and Peasants' Delegates considers that now, at the decisive moment in the struggle between the workers and their exploiters, there can be no place for the latter on any governing body.

Chap. XIII., 65. The following persons have neither the right to vote nor to be elected:—

(*a*) Those who employ others for the sake of profit.

(*b*) Those who live on income not arising from their own work.

[2] Chap. X., 53.

shops. Power is divided into a legislative and an executive one. The sending of deputies from the workmen to parliament once in four years gives rise to the fiction that workmen share in political work. In truth even the deputies do not share in it, because they *talk*. The real rulers are the members of a caste,—of a social bureaucracy."[1]

One might think that the rule of Soviets was free from all fictions and substitution of power.

Organization of Supplies and of the Army.—The greater part of the meetings of the Fifth Congress was taken up by the discussion of two topics of primary practical importance—the organization of supplies and the organization of the army. The first of these questions gave rise to a violent conflict between the Bolsheviks and the Social Revolutionaries of the Left. For the latter the socialization of the land was a measure of paramount importance for the future of Russia, and they wanted it carried out with corresponding regularity and deliberation, in conformity with the wishes and the interests of the peasant class as a whole. Spiridonova, the leader of this faction in the Congress, objected strongly to the anarchistic way in which land was grabbed by the peasants, and reproached Lenin with his cynical declaration that as the peasants had seized the land they might divide it as best they could. As a result of this cynical indifference the country-side had been a cockpit in which villagers and householders were arming and fighting for the possession of coveted plots. These rural feuds were not distasteful to the Bolsheviks, who were intent on crushing all well-to-do and thrifty elements of the population as representing the hated bourgeoisie. In practice they wanted corn supplies, knew that some were in the hands of the wealthier peasants and did not find any other means of getting at them but the raising of the poor peasants against the richer ones. The result was the creation of "Committees of the Indigent," whose special purpose was to ascertain who had put by any supplies and to expropriate these "tight-fists." Part of the loot would go to replenish the bins of the Red Government. This was called the "Dictatorship of the Indigent," and Lenin boasted that the Bolsheviks had succeeded in driving a wedge into the compact mass of the peasantry.

The Social Revolutionaries opposed the Bolsheviks in terrorist measures as well as in the case of supplies. In the interval between the Fourth and the Fifth Congresses the Central Executive Committee had founded and organized the "Supreme Revolutionary Tribunal" from its own ranks. The Social Revolutionaries had consented in the beginning to take part in the constitution of this Tribunal, but they seceded from it in connexion with the first trial, when Adml. Shtchasķny had been condemned to death. They protested altogether against the reintroduction of capital punishment, although they did not scruple to participate in bloody repressions of risings and conspiracies. The same difference of opinion reappeared in connexion with the reorganization of the army. Trotsky came to the Congress with a complete programme for the reconstruction of the Red army which amounted to a return to the iron discipline of the ancient regime with a change of provost marshals. "*Ote-toi de là, que je m'y mette*" was the approved maxim of the time, and, after having preached and agitated for years against the death penalty and other cruel punishments inflicted "by order of the Tsar," Trotsky found it simple and convenient to adopt all these Draconian measures and to employ former officers of the Old Army to enforce them as long as there was not a sufficient number of Red commanders and officers to provide the necessary personnel. The Social Revolutionaries were again true to theory, and denounced this change of front with bitter indignation. Their opponents retorted that it was absurd to reject the death penalty when inflicted by the courts while practising terrorism and shooting people at sight. The Bolsheviks wanted a disciplined army, and were not disposed to be fettered by sentimental considerations or the reproach of inconsistency. These conflicts coincided with the assassination of Count Mirbach and the suppression of a Social Revolutionary rising on Moscow: they ended in a disastrous way for the Social Revolutionaries, whose leaders were either shot or imprisoned.

In the interval between the Fifth and the Sixth Congresses the Central Executive Committee had to settle the foundations of two most important sides of social life—the organization of justice and the establishment of school education. Of course legislation in these respects was by no means restricted to the action of the Central Executive Committee in 1918: measures were taken both before and after, but our account must for the sake of convenience be concentrated around the laws and decrees of that year.

Administration of Justice.—Taking first the province of justice, we may notice to begin with the main principle of the Judicature: it is the substitution for the various courts of professional justice of *popular courts* consisting of three judges—a chairman and two assessors. The first of these was supposed to have some knowledge of legal subjects, though he need not be a trained lawyer; the assessors represent the lay community, and the framers of the new rules give emphatic expression to the wish that the common sense and the practical spirit of the lay members should prevail over technical considerations and a superstitious regard for laws enacted by overthrown governments. They refer with disapprobation to the bad influence of former lawyers who had found their way into the new courts and complicate their decisions by a casuistic treatment of the subject in the old style. The publications of the *Narkomjust* (People's Commissariat of Justice) gave unstinted praise to decisions free from the trammels of juridical dialectic and book-learning. The hope is expressed that the popular courts will open up new avenues of legal thought by the motives and arguments of their decisions and thus create a new and beneficial source of law.

One of the leading representatives of Soviet jurisprudence, Hochberg, compares the position of public and private law in the new system, and comes to the conclusion that the latter is the creation of the bourgeois social order, as it supposes an abstention of judicial authority from interference with the contents of claims and assumes an appearance of impartial indifference. This reminds one of the attitude of Pilate washing his hands, as regards the truth or justice of the verdict. Civil law is decentralizing, anarchistic, derived from a fiction of freedom, while public law aims at concentration and coöperation, and that is the law suitable to a socialistic commonwealth.

Another article on Soviet jurisprudence dwells on the total transformation of criminal law, and the author is not less nihilistic in his appreciation of this branch of legal organization than his colleague Hochberg was as regards private law; indeed, one branch is not more necessary than the other:—

> "There can be no idea of retribution, because the modern scientific view does not recognize any free or responsible will. Determinists cannot build their law on the idea of punishment. It is certain that crime is the product of social conditions, and therefore cannot be imputed to any single individual. This being so, there is no reason to despair of the disappearance of crime and of the coercive law directed against it. Menger halted half way: he thought that infringements of rights are to some extent the result of human nature, of inherent self-will. But serious infringements of rights proceed from class distinctions and class antagonisms. There will be no burglary or theft when there is no private property protected by law: all serious motives for homicide and other crimes of violence will disappear when men are all comrades and there is no wealth or privilege to excite hatred. Whatever occasions there may remain for inordinate self-will will be rare anomalies and can be treated as negligible quantities."

In spite of all these enchanting perspectives it is recognized that the stage of a lawless Elysium has not yet been reached, and in concession to human frailty certain prohibitions and rules have to be maintained in the epoch of transition. This epoch may last for a long time, because the new order can be secured only by psychological transformation, and psychological processes take many years to mature.

Meanwhile speculators, traders, hooligans and counter-revolutionary agitators have to be coerced, and this is the chief business of popular courts, reinforced in dangerous cases by the ruthless action of the Extraordinary Commission. Trade was made a punishable offence and threatened with most severe penalties. According to Clause 1 of the decree on speculation, "a person guilty of selling, storing or keeping with a view to sell, articles of food monopolized by the Commonwealth, if he is doing this as a trade, will be punished by imprisonment for a term not less than ten years with the hardest forced labour, and by confiscation of all his goods." Clause 2 says: "A person guilty of selling, storing or keeping with a view to sell, articles of food at prices higher than the established ones, if he does this as a trade, will be punished by imprisonment for a term of not less than five years, and by the confiscation of all or part of his goods." Clause 3 says: "A person guilty of selling, storing or keeping with a view to sell, other articles the price of which has been fixed and is subject to control, if he does it as a trade, will be punished by imprisonment for a term of not less than three years, etc." Clause 4 says: "If he does not drive a trade (but does so occasionally), he will be punished by imprisonment for a term of not less than six months." Similar penalties are imposed on those who collect provision cards with a view to trade with them.

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[1] Bukharin, "The Theory of Proletarian Dictatorship," *The October Upheaval and Proletarian Dictatorship*, pp. 19, 20.

These Draconian measures were mitigated in practice by the necessity of having recourse to lawyers, who had received their education under the old regime. The majority of the personnel of the higher courts had to be drawn from that class, and did what they could to soften the asperities of Soviet legislation.

In the same way Soviet legislators had to steer a middle course as regards private law; in 1918 law as to marriage, family relations and succession was cast in a new shape. As regards marriage the chief change was the abolition of the contrast between legitimate and illegitimate unions. The only difference was one of registration: some people might think it worth while to register their convention as to sexual relations, others did not attach importance to such routine; the consequences as to family status were about the same. Consorts kept their separate goods and had equally the right of protection and duty of maintenance as to the children. In case of disagreement in the conduct of their children's affairs, they have to apply to the local court. The latter may deprive either of them of the right of supervision in case of misuse. The wife, or woman living as such, may claim maintenance from the man with whom she has been living, if she is unable to maintain herself. As to the bringing up of children, she is allowed to claim assistance from the putative father, and if she has had such relations with several men so that fatherhood is uncertain, she enjoys the additional advantage of being able to claim contributions from each one of them. Succession is abolished. No one can dispose of his fortune by will, nor do the children inherit to the exclusion of other relations; after the death of a person his or her fortune is distributed among relations within certain degrees according to the measure of their needs. Their claims are preferred to the claims of the creditors of the deceased.

It is needless to add that Soviet legislation uprooted the rules as to contract of service. All forms of service are considered as forms of servility, as varieties of exploitation. Everyone must depend on the work of his hands and combination is entirely a matter of public law. It appears in the shape of professional unions—industrial and rural alike, or in the shape of Soviet rule substituted for the old conception of the State. Members of the Soviet Republic are comrades in work, though not in service, and it is for the Soviet Commonwealth to assign them their shares in work and produce.

Here are some characteristic passages from an article in the official organ of the Commissariat of Justice[1]:—

> "The project of the Provisional Government accepted as a basis of the legal order of industrial undertakings the fiction of a free bilateral contract." Under the rule of the Soviets "the industrial undertaking ceases to be governed by formal conventions or contracts and by one-sided declarations of the will of employers. The collective contract . . . loses the character of a bilateral convention and becomes an objective rule of conduct." This principle was first proclaimed as an exception in the case of the establishment of a tariff of remuneration in the metal workers' trade. It was subsequently recognized to be the normal arrangement of the status of workmen. There can be no more talk of "hire" and "service"; the conception of "coöperation" taking their place. "The sense of duty and of responsibility arising from it has dictated the following clauses to the Petrograd metal workers, when they constituted their tariff without the employers. Clause 16: 'When the working man receives a definite guarantee as to his earnings, he is bound to guarantee a corresponding amount of work in the shape of a definite form of production. Clause 23: In case of evident loafing or of premeditated slowness the workman is to be moved into a lower class and can even be dismissed.' 'The juridical life of the working men is being unified by movements in two directions—towards combining local undertakings into one common State economy and by uniting the interests of separate professional groups on the lines of a common class consciousness.'"

Education and Religion.—Another subject of primary importance considered by the Central Executive Committee in its fifth session in conjunction with trade unions was that of the proletarian school system. There was no discussion, and the conclusions of a committee for which Comrade M. Pokrovsky acted as reporter were approved *en bloc.* The report laid stress on the necessity of getting rid of all varieties in the curriculum of schools, produced by the sinister interests of the dominant class of the old regime. The old schools had been diversified not only by horizontal partitions as lower-middle and high-schools, but also by vertical sub-divisions as special types of humanistic, modern side (*cf. Realschule*), technical, ecclesiastical schools. This tendency towards specialization served the purpose of splitting up the compact and powerful mass of working men into a number of groups on which the dominant class could practice the *divide et impera* principle. The true educational ideal was to train all the youth of the country on the same lines, leading them through the various forms and stages of application of human energy to productive work. A course of nine years, beginning at the age of eight, would be necessary to achieve this object. Of course the old methods by which "gentlefolks'" children were taught to scrawl on paper would have to be discarded. The orientation of the school should be directed towards preparing for a life in which manual work was honoured and not despised. The aim should be to educate men able on leaving school to take up intelligently and successfully any kind of task. The curriculum would be a reproduction on a small scale of the cultural history of mankind. Astronomy would be shown to have guided the men of old in their observations of the seasons on which agriculture depends; zoölogy would be taught in connexion with the tending of domestic animals, botany on the live specimens of plants. The management of the school should be an introduction to civil life, the principle of collective labour permeating all details, methods of old-fashioned subjection and discipline being entirely discarded, and the school should be constituted as a "*commune*" and the senior pupils should take part in its administration together with the teachers and the representatives of the working population of the district. Punishments would not be necessary in these educational communes; order would be kept up by the sense of responsibility on the part of the pupils.

A quantity of literature was produced in Soviet Russia to spread the notions of the *Proletcult* (proletarian culture). In order to give an idea of this stuff, one or two extracts may be given from a paper by Comrade Bobrinsky[2]:—

> "We have to proceed towards freedom through the iron yoke of proletarian dictatorship, towards equality through rationing according to class, towards fraternity through civil war. Proletarian science becomes in practice a weapon in the struggle for power and economic existence. Science becomes politics. The bourgeois contrast between knowledge and politics, between science and action, gives way a synthesis for the first time: science is turned into the political force of the proletariat, and proletarian politics is turned into science. . . . Natural science is combined into a unity with social science. . . . The old disputes about humanistic (classical) and realistic education, the old criticism directed against the estrangement from life, against the academic character of education find a simple and radical solution in the school of labour. . . . Technology has acquired a place of equality with other sciences and it serves as a transition from natural science to sociology. . . . Technology becomes the principal science in the system of historical materialism. According to historical materialism all changes in

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[1] A. Yablonsky, The Labour Constitution in the "*Proletarian*" Revolution and Law, 5–6 issue, Oct. 15 1918.

[2] "The October Upheaval and the Dictatorship of the Proletariat," pp. 163 ff.

social life are derived from the relations of Society to production. Everyone knows that, but it is not sufficiently recognized, that, according to Marx, the evolution of history is entirely dependent on the development of means of production and that changes in the latter are conditioned by changes in technique."

It is appropriate to mention here the policy of the Soviets as regards religion, and, more especially, as regards the Orthodox Church, as its foundations are to be found in a profound contrast of cultural conceptions. The matter is well illustrated in a paper contributed to *The Octobrist Upheaval* by Comrade N. Lukin (Antonov). He begins by ridiculing the notion that the separation of the Church from the State meant emancipation for the Church from secular control coupled with the right to accumulate property and to influence public opinion on similar lines to those which obtain in Belgium. The revolution put religious associations on the same level as other common law associations, but deprived them of the right of holding property and of other privileges of juridical persons. As a natural consequence the Orthodox Church became one of the main instruments of counter-revolutionary agitation. The Council called together in Moscow did not attract any considerable attention on the part of workmen and peasants, but it was crowded with representatives of the old aristocracy, bureaucracy and counter-revolutionary "intelligentsia." The newly elected Patriarch Tikhon excommunicated the authors of the decree of disestablishment and the Council denounced it as an attack on the national faith and the religious institutions of Russia, not omitting to mention that the clergy was being deprived of the means of subsistence. In view of such an irreconcilable attitude the Soviet power is bound to wage a ruthless war against the Orthodox Church. It is armed against it by Clause 5 of the decree of Separation forbidding all ecclesiastical ceremonies and acts directed against the Commonwealth. But it must not be forgotten that even apart from the conspiracies and direct risings, religion in general is antagonistic to the social conceptions of the new order. Even in its present state the Church is able to support ignorance among the mass of the people and to divert the proletariat from the struggle for an "earthly paradise" by making them dream about a "paradise in heaven." The example of France and of America shows that the clergy is preaching war against social democracy with no less fervour because it is deprived of those powerful means of influencing men's brains which are at its disposal in countries still maintaining State religions. In creating a new world the proletariat stands in need of a complete and harmonious scientific outlook.

Foreign and Home Policy.—The Sixth Congress of Soviets met on Nov. 6 1918. Nineteen hundred and fourteen delegates assembled in Moscow, of whom 829 were Communists; 71 had been registered as sympathizing with Communism, and 2 as Revolutionary Communists, while 6 were declared to belong to the Social Revolutionary party, 1 to the Maximalists, 3 to no party. The president Sverdlov expressed his firm conviction that distribution of seats corresponded fully and correctly to the interests of "wide masses of the working population of Russia." The debates were overshadowed by two main facts—by the victory of the Western Allies and by the appalling food crisis.

Lenin, while admitting that the situation was extremely dangerous, because Communist Russia had to reckon henceforth not with two belligerents engaged in a struggle for existence but with the united front of the victorious Entente, thought it augured well for the progress of the world revolution:—

> "A complete victory of a Socialist revolution," he said, "is unthinkable in any one country. It requires at least the coöperation of several advanced countries, and Russia is not one of them. This is why the question as to the expansion of the revolution into other lands and of our success in repulsing imperialism becomes one of the principal problems of the Revolution. . . . We must raise the proletariat of all countries."

He dwelt on the benefits conferred by the Brest Litovsk peace, which gave Russia breathing-space and the possibility of reconstructing her army. Now the aim was to carry the contagion of the revolution into Central and Western Europe:—

> "We can see already how the fire has broken out in most countries—in America, in Germany, in England. . . . The peace which the rapacious imperialists of England and France are going to inflict on conquered Europe will be a more humiliating and crushing one than the treaty of Brest Litovsk, but this very peace will be their undoing, because it will rouse the revolutionary feelings of the world proletariat. We are not living in Central Africa but in civilized countries in the twentieth century. They are raising a Chinese wall against Bolshevism, but Bolshevism will pass the wall and spread its infection among the working men of all countries."

In unison with Lenin, the president, Sverdlov, declared that before six months had passed they would see Soviet rule triumphant not only in Hungary, in Germany, in Austria, but in France and Great Britain.

The problem of supplies was to be solved by expropriation in the villages. Zinoviev explained that the plan of raising the poor peasants against the well-to-do ones was being carried out with energy and success. A Congress of the "poor folk" in Petrograd had been attended by 16,000 delegates; they had resolved to organize a special "poor folk" army consisting of two men from each village. In the Novgorod Government alone 2,000 "poor folk" committees had been formed:—

> "Their chief aim is to drive a wedge into village life . . . to kindle class struggle, to kindle the sacred hatred of the poor folk against the rich. . . . We say . . . the 'tight-fists' must be strangled as we said before: strangle the bourgeois in the towns. . . . We know perfectly well that we cannot carry out a proletarian revolution unless we crush the 'tight-fists' in the villages—crush them in the economic and, if necessary, in the physical sense."

The Congress adopted a resolution in conformity with Zinoviev's proposal, the gist of which was that in order to get rid of strife and confusion produced by dualism in the villages it was necessary to assign to the "poor folk committees" instituted by the decree of July 11 1918, the superior authority and to carry out a reorganization of rural Soviets on the pattern of town Soviets, turning them into true organs of Soviet power.

The seventh Congress met on Dec. 5 1919. Of the 1,109 delegates with power to vote, 890 were registered as Communists and 34 as belonging to no party. In the course of the Congress some representatives of the Social Revolutionaries and Mensheviks (Dan, Martov and others) took part in the debates, declaring their adherence to the cause of the Socialist Republic under Soviet rule, but criticizing certain methods of Soviet administration. The atmosphere of the Congress was dominated by the elated feelings produced by the victories over Kolchak and Denikin. They were extolled as triumphs over the Entente. Lenin admitted in his speech that the progress of the World Revolution had been slower and more complicated than had been expected, but he maintained that on the whole the previsions of the Bolsheviks had been justified by the course of events. The miracle of the victory of helpless and backward Russia over the all-powerful Entente was traced by him to the instinctive sympathy of the working-classes of Great Britain, France and Italy towards their brothers in Russia. As a result of this feeling it was impossible for the Allies to expose their troops to a decisive conflict with the Red army; symptoms of fraternization had begun to appear in the ranks of the western soldiers and the Entente was obliged to withdraw them. The hope to combine the minor border states against Red Russia had also miscarried, and disillusionment had been brought by the collapse of the White Guards equipped by the "imperialistic wild beasts" of England whose greed and craving for world supremacy was worse than that of the Germans. Resolutions of the Soviet greeted the toiling masses in all countries, invited them to struggle against bourgeois Imperialism and declared the Peace of Versailles a shameless attempt to establish the domination of the Allies, to divide the world into conquerors and conquered, into great and small powers, without taking heed of self-determination.

Trotsky gave a glowing account of the victorious Red army. He described it as an exact reflection of the Soviet Republic. It was built up on the principle of class domination, the ruling class being that of town workmen:—

> "They form about 15–18 % of the army, but they lead it on account of their greater consciousness, their stronger solidarity, the higher quality of their revolutionary mettle. The responsible posts of commissars are occupied almost exclusively by workers of the

Communist party. In every regiment, every battalion, every company is to be found a communistic cell. In this way a new communistic order of 'Samurai' has been formed. And the army is not merely a fighting organization, it is a political school the like of which has not been known to the world."

Trotsky prided himself particularly on the incessant political propaganda. "In the beginning we had not a single elementary school in the army—now we have 3,800; before the 1st of Jan. we had 32 clubs: now we have 1,315. Before the 1st of Jan. we had not a single mobile library: now we have 3,392."

As regards officers and other specialists drafted into the Red army from the cadres of the old Tsarist army, Trotsky maintained that thousands of them had reconciled themselves with their new position and were faithfully serving the new order. He was contemplating the institution of one man's rule instead of the system of commanders watched over by two commissars.

Economic Problems.—The most serious discussions took place in connexion with the problems of food and fuel-supplies. Tsurupa, the People's Commissar at the head of the *Narkhoskom* (the Commissariat of People's economics) gave an account of the working of bread monopoly. All corn supplies had been nationalized and the system was enforced by charging each province with a fixed contribution which was subsequently distributed among the districts of each province, while the districts assessed the villages with *quotas* according to estimation. The whole assessment of the country was reckoned at 324 million poods of corn of every kind: of the 30% which were charged to the first quarter some 60 millions were expected to come in by Dec. 1. This did not quite correspond to the demand, but as some provinces were not under the control of the Soviet power, the assessment might be said to have been carried out satisfactorily in the greater part of the country as regards corn. This did not mean, however, that the supply of corn was secured for those who needed it. Many thousands of poods lay stored and rotting at the stations, because there was no transport to convey them to their places of destination. As regards meat the situation was much worse. Only 600,000 poods were available instead of the five million delivered in 1918; the cause was the great falling off of the numbers of cattle held by the peasants. Butter and fats were also at a discount: the commissariat could not dispose of more than 300,000 poods for the whole of Russia, and that meant famine in respect of fats. Of fish roughly 75% of the normal supply had been caught but the transport conditions were badly hampering its distribution. The proposal of the Commissariat was to extend the State monopoly and the coercive assessment to all food products and it was adopted by the Congress.

As far as fuel was concerned, the situation had grown to be catastrophic. The loss of Baku and of the Donets coal-mines had largely reduced the quantity available. Instead of 500,000,000 poods of naphtha, *e.g.* Soviet Russia disposed of 80 million. It continued to exist only because all private stores and supplies had been confiscated. Things got better when the roads to the Donets and to Ural were cleared, but the disorganization of the transport told heavily on the distribution of fuel. As a matter of necessity Russia had to fall back once more on wood fuel, although the adaptation to a new system of heating involved immense losses. The first requirement was to provide material for the railways and that was being gradually achieved by means of labour conscription. As for domestic heating, its needs were so great that the only way of solving the problem was to cut down timber in the neighbourhood of cities, and Moscow, for example, was being served by means of the clearing of timber in an area of 18–30 square versts. The Commissariat was obliged to engage the services of private contractors and agents in order to get the required supplies. When, in discussion, fanatical Communists reproached Commissar Rykov with this deviation from the recognized principles of communism, he answered that there was no other way of collecting the timber and that, after all, the Extraordinary Commission was able to proceed against speculators and profiteers. In other words, the Soviet administrators might enable men to enrich themselves by private enterprise and then prosecute them on account of their gains.

Comrade Sofronov reported on the constructive work of the Soviet; this work had proceeded from the top to the bottom and the administration of the country had assumed the shape of parallel columns subordinated to "heads" and "centres," each managing its own concerns, but with little connexion between them and often with opposed views on kindred subjects. The *Narkomjus* (People's Commissariat of Justice), for example, was not in agreement with the arbitrary terrorism of the Extraordinary Commission, but was powerless to influence or to restrict it, because it was acting within the column of the Home Commissariat, and no solution could be found for the difference between judicial and administrative tribunals.

The discussion gave rise to attacks on the bureaucratic centralization and the suppression of freedom by the communistic dictatorship. The reporter Sofronov admitted that there was a tendency towards one man's rule in all branches of the organization, but such a tendency, explicable in the course of civil war, could not be conceded as a principle. It did not check the complete anarchy of economic and legal relations produced by the lack of harmony in administration. It ought to be corrected by a reform of elections, which would regenerate the local Soviets and thus create a basis for political reorganization at the top. An essential condition for such a reform was the removal of counter-revolutionary elements. Therefore the electoral law ought to be supplemented by stringent enactments not only disfranchising the "tight-fists," but making it a punishable offence for them to take part in any electoral or other meeting in the village.

Lenin came forward to defend the policy of Soviet rule against the reproach of anti-democratic tendency:—

"We do not promise," he said, "that our constitution guarantees freedom and equality in general. Freedom—but it must be pointed out for what class and for what ends. Equality—but who shall be equal and with whom?—for those who work and who have been exploited in the course of centuries by the bourgeoisie, who are fighting the bourgeoisie even now. This has been stated in the constitution: the dictatorship of the workmen and of the poorest peasants in order to suppress the bourgeoisie."

These ideas were more fully developed in Lenin's speech to the Congress of School Extension workers (May 6 1919):—

"It cannot be gainsaid that *freedom* is a powerful catchword for any revolution, democratic or socialistic. But our programme declares: freedom, if it obstructs the emancipation of labour from the oppression of capital, is a fraud. Any one of you who has read Marx, or even popular accounts of Marx, knows that he devoted the greater part of his life to ridiculing freedom and equality, the will of the majority and all the Benthams who commented on these things in glowing terms. He proved that at the back of all these phrases lay the interests of free trade, the freedom of free capital, which are used to oppress the workers. . . . We maintain that to grant freedom of meetings to the capitalists would be the greatest crime—it means freedom of meetings for counter-revolutionaries. We say to the bourgeois intellectuals, to the adherents of democracy: 'You lie when you reproach us with the infringement of freedom. When your great bourgeois revolutionists of 1649 in England and of 1792–3 in France carried through their revolutions they did not concede to the monarchists the freedom of meetings. The French Revolution was called the Great one because it was not like the weakly phrase-making revolution of 1848: after overthrowing the monarchists it crushed them out of existence. . . . The peasant is a hybrid being: half a workman and half a speculator. This is a fact from which you cannot escape, unless you destroy money, destroy exchange. And to do that you want long years of firm domination of the proletariat, because it is only the proletariat that can conquer the bourgeoisie.' When we are told 'you have broken equality not only as against exploiters (a social revolutionary or a Menshevik might admit that), but you have broken equality as between workmen and peasants, you have broken the equality of toiling democracy, you are criminals,' we answer: 'Yes, we have broken the equality between workmen and peasants and we maintain that you, who defend this equality, are followers of Kolchak.' . . . We ask you: 'the ruined workmen of a ruined country, in which factories are at a standstill, would they be right to submit to a majority of peasants, who do not yield to them the surplus of their corn? Have they the right to take this surplus by violence if it is impossible to do so in any other way?' The peasants are a special class: as toilers they are the enemies of capital, but at the same time they are proprietors. The peasant has been taught during centuries to consider the corn as his own, and that he is free to sell it. It is my right, thinks the peasant, because it is my labour, my sweat and my blood. It is not easy to change his psychology: it will take a difficult and long process to do so. He who imagines that the transition to socialism will be effected by one man convincing another, and this other a third, etc., is at best a child, or a political hypocrite. You can, if you have luck, smash an institution at one blow: it is

> impossible to smash a habit, whatever your luck. We have given the land to the peasant, freed him from the squire, thrown off all his fetters, and yet he goes on thinking that liberty is free trade in corn, and serfdom the duty to surrender the surplus at a fixed price."

The Eighth Congress of the Soviets.—The Eighth Congress of All-Russian Soviets was convened at Moscow on Dec. 23 1920. Approximately 80% of the delegates were members of the Communist party, the remaining 20% were not affiliated to any party. It was known that with reference to certain questions of policy there was an important divergence of views among leading Communists. These differences of opinion were especially marked in connexion with (1) economic reconstruction, including the question of concessions to foreigners, and (2) the demobilization of the army. Lenin was at the head of the so-called Right Wing, while the Left was under the leadership of Bukharin. The disillusionment of many Communists concerning Soviet administration was expressed in strong terms at the Congress. These criticisms were summarized and by one of the leaders, Ossinsky, in an article which contains the following passage:—

> "For three years, the Soviet Government has seriously turned aside from the principles of proletarian democracy, and from the spirit of the Soviet Constitution. On the one hand, there have been created two legislative bodies, not provided by our constitution—the Council of Defence and the Military Revolutionary Council; on the other all constitutional organs (legislative as well as executive) have virtually disappeared. The eclipse of the Central Executive Committee is generally known. But even the Council of People's Commissars and the Council of Defence, which have ostensibly replaced the Central Executive Committee, have been, in their turn, eclipsed by still another body. In reality, the centre of political leadership has been shifted to the Central Committee of the Communist party, and even here to a smaller body, the 'Political Bureau' of this committee. Legislative measures, diplomatic acts, and military plans decided by this 'Politik-Bureau' are formally sanctioned and issued in the name either of the People's Commissars or the Council of Defence." (*The New Statesman*, 1921, p. 635.)

The Congress decided to establish Provincial Economic Conferences which should be charged with the unification of all purely local economic institutions. Meetings were to be held no less than twice a month, and the persons who were to participate in the proposed Conferences were to be designated by the Supreme Economic Council, the Commissariats of Supplies, Labour, Finance, etc. All local branches or institutions of the Supreme Economic Council in the various provinces were to be subordinated to these Provincial Councils, with the exception of so-called "principal" industries, such as important metal factories, mines, etc., which still remained directly subordinate to the Supreme Economic Council.

The number of members of the Central Executive Committee was increased to 300 and sessions were to be held at least twice a month. The managing board of the Central Executive Council was given power to cancel any decisions of the Soviet of People's Commissars. All conflicts or disagreements between the People's Commissars and Central Institutions on one side, and the local Executive Committees on the other, were to be referred to and decided by the managing board of the Central Executive Committee. All decrees and regulations of general importance, including laws, military decisions and questions of foreign policy, were to be examined by and were subject to confirmation by the Soviet of People's Commissars. The Congress considered that the Soviet of Labour and Defence which had been created at the height of struggle between the republic and an Imperialistic world (Nov. 30 1918), should be reformed so as to form a committee of the Soviet of People's Commissars. An appeal was addressed to the peasants asking them to support the republic by contributing all their surplus agricultural produce to assist the Commonwealth. Trotsky favoured a partial demobilization of the regular army and the organization of a militia.

These were the principal decisions of the Congress. The general attitude of the Communist party was best expressed in speeches delivered by Lenin and by Zinoviev. Lenin welcomed the establishment of Soviet Republics in Bukhara, Azerbaijän and Armenia, as showing that the Soviet system was acceptable, not only in industrial countries, but also in agricultural lands. It was hoped that a treaty would shortly be signed with Persia. Relations were being cemented between the Soviet Government and Afghanistan and Turkey. Lenin defended the policy of granting concessions to foreign capitalists. It would be ridiculous to talk of Russia's economic independence while the Soviet Republic remained a backward country. Guarantees would be demanded from those who received concessions and it was essential that everything should be done to promote trade relations without delay. He reminded his audience that a long series of wars had hitherto decided the fate of the revolution. They must prepare for the next chapter in this history:—

> Without economic restoration they would be unable to hold their own. To achieve this economic aim it would be necessary to unite compulsion with moral suasion as successfully as they had been united in the Red army. Russia was a State of small farmers and the transition to communism was hampered by difficulties greater than those which would have arisen in other conditions. For the attainment of their economic objects the assistance of the peasants was ten times more necessary than it had been during the war. The peasants were not Socialists. The Communist workers "must tell the peasants that it was impossible to continue freezing and dying of starvation indefinitely." If such conditions continued they would be defeated in the next chapter of the war. There must be a larger area of land under cultivation next spring, and there was no hope of salvation unless this economic victory was obtained. They recognized their obligation to the peasants. They had taken their bread in exchange for paper-money. They would compensate them as soon as industry was restored. The menace of Russia to the capitalist world could not be maintained without an improvement of economic life. As long as she remained a small farmers' country capitalism would find more favourable acceptance than Communism. The foundation and basis of their home enemy (capitalism) has not been removed. Electrification would help them to remove it.

Zinoviev admitted that the Soviet regime was degenerating through the influence of an immense and inefficient bureaucracy. He laid the blame on the traditions of the old administration:—

> The utilization of bourgeois specialists in the work of economic and administrative reconstruction was absolutely essential and inevitable. The worst feature of this recourse to specialists was that they exhibit a red-tape attitude towards their work, not entering into the spirit of it: they have brought the worst habits of Government lethargy and bourgeois bureaucracy into our administrative organs. Those workers and peasants, whom the Soviet Government drew into direct participation in the Government, although they saw the weak side of these specialists, were themselves powerless to raise affairs to a higher level. Thus a wrong attitude was taken up toward those who worked by brain and not by hand. Workers who stand at the lathe are regarded as useful members of society, but what about the man who counts the lathes, who works out plans of production, who carries out essential statistical work? Such men are sometimes contemptuously described as bureaucrats. . . .
>
> The workers' and peasants' control must be transformed from an organ of supervision over the activity of Government institutions into an organization for attracting broad masses of the workers and the peasants to administrative tasks, for inculcating the methods of administration in accordance with the decree of the All-Russian Executive Committee dated Feb. 7 1920.

RUSSIA IN 1920–1

Soviet Russia had shrunk considerably by 1921 in comparison with the former Russian Empire. Instead of a population of some 180 millions it comprised in 1921 about 130 millions, of whom 100 millions were peasants and the rest were divided among the townsfolk and the nomadic and hunting tribes of the eastern steppes and of Siberia. It is estimated that the country lost 1,700,000 killed in the course of the World War, but it is impossible to form even an approximate conception of the number of those who perished from the indirect effects of the war through wounds, ill-health and privations, and of those who were destroyed by the massacres of the civil war, the misery of retreats and migrations, the epidemics of typhus, cholera, diphtheria which claimed a heavy toll in the unsanitary conditions of life. It would hardly be an exaggeration to put the number of victims of these disorders at some 10 millions. The abnormal increase of the death-rate has been definitely registered in certain cases, and there is good reason to suppose that in all centres where people congregated for political or economic reasons exceptional mortality prevailed and the health of the population was enfeebled through starvation and sickness. Petrograd, with 2,250,000 inhabitants in 1914, had been reduced to some 700,000, and Moscow to 1,000,000 instead of 1,800,000.

But, undoubtedly, the greatest inroads had been made by the separation of large territories that had acquired political independence. Finland accounts for a diminution of 3,000,000; Poland for 11,000,000; Esthonia and Latvia for 3,000,000; Lithuania for 5,000,000; Georgia, Armenia and Azerbäijän for 8,000,000; Bessarabia for 3,000,000, the districts of White Russia and Volhynia, ceded to Poland, for 3,000,000.

Economic Disruption.—The great combination for economic intercourse guaranteed by the empire had been broken up to the detriment of most of its component parts. Of course, from the point of view of national separatism, the political independence of Esthonia or Latvia was a great conquest, a glorious assertion of self-determination, and a source of profit in the helpless condition of Russia. These Baltic States serve as a kind of neutral fringe in which Bolsheviks can be met in safety by representatives of western Powers and western commerce. Gold from the Russian State reserves was being stored there, Reval and Riga serving as outlets for whatever trade was conducted with the west by the bankrupt Government of Moscow. Undoubtedly such a position, recognized by Europe and at the same time highly useful to the Soviet, might be a lucrative one. But these newborn States hardly realized sufficiently that sooner or later an account would have to be rendered to a Russia restored to its national traditions and strength. Such a historical Russia would hardly consent to leave the gates of the Baltic in the hands of alien Governments, who had done their level best to thwart its efforts at restoration in 1919, who manifested on every occasion their hostility to the Russian people and were in more dangerous proximity to Petrograd than Ireland was to London. The Bolsheviks had no objection to using Lettish mercenaries for repressing popular risings in Russia, and Lettish stockbrokers for commercial dealings with the west, but the Russian Government could not be expected to remain anti-national for ever. In the case of Poland the necessities of the industrial situation are quite as obvious as those of the commercial one. Polish industry thrived on the economic connexion with Russia. Without the Russian market Poland is economically a lifeless strip of territory: Germany does not want Polish manufactures; the only commodity it did want from Poland was cheap labour, but recent occurrences in Silesia and elsewhere show to what an extent national animosities have obstructed intercourse, even in this respect. It will be a long time before Poland will be able to use the outlet to the sea for the purpose of considerable trade and it is not likely to become ever a sea-power of some standing. In the meantime Poland in 1921 was practically bankrupt, with its currency enormously depreciated. It would certainly not seek reunion with Russia, but it might regret the opportunity it had in 1919 for helping in the restoration of a national government in Russia. Lithuania, with its unhappy situation in the intersection of the lines of action of three powerful neighbours—Germany, Poland and Russia—had to keep up a front primarily against the Poles as its most dangerous neighbours. As German protection was excluded by the policy of the Entente and especially of France, it seemed certain that the Lithuanians would sooner or later have to lean on Russia. But it would have to be a Russia with a civilized Government and a solid national basis. As for Rumania, the seizure of Bessarabia, though confirmed by decree of the Entente Powers, and the wholesale dispossession of Russian landowners, had not pacified the province, of which half the population belonged to the Russian stock and in which even many Moldavians were reputed Russophiles. The alliance between Rumania and Poland, concluded in the spring of 1921, might serve the purpose against a possible Bolshevist offensive, but would hardly help against a reconstituted National State. In the Caucasus again, the various alien nationalities are so intermixed and so hostile to each other that it was impossible to expect the rise of any local federation or even of durable peace: the Armenians, the Georgians, the Caucasian Tartars, as soon as they were free of their movements, were inclined to jump at each other's throats, and the necessity of a strong empire holding their appetites for self-determination in check was recognized even in 1921: it formed the background of the Soviet Governments artificially created in Azerbäijän, in Georgia and in Armenia. The factor of economic interdependence was also clearly to the fore: Georgians normally hate Armenians, though the rural population of Georgian stock wants the coöperation of the Armenians in the towns. The Tartars would fain swoop down on the people in the plains, and have repeatedly tried to do so, but after a time the necessity of drawing supplies from peaceful agriculturists and traders asserts itself among them. The oil treasures of Baku are of paramount importance to any Russian State and on the other hand these oil wells cannot be exploited without drawing supplies from a "Hinterland" furnishing food and manufactured articles. Above all, these regions can reckon on peaceful development only if there is a strong police force to keep the heterogeneous elements in order. Such a force could only be provided under existing conditions by Russia. Even the Bolsheviks had found access to this disturbed region as negotiators and pacifiers although their methods of pacification were of a peculiar kind—mainly the extermination or driving out of elements opposed to the Soviets.

On the whole there could be no doubt in 1921 that anti-Russian tendencies and political arrangements found their chief support in the absurdity of Bolshevik rule as well as from a recollection of the oppressive policy of the Tsarist period. A change for the better in the direction of freedom and democracy in Russia would render it possible to restore to some degree the economic and political ties which rendered fruitful the coöperation between these interdependent elements. As things stood, Soviet Russia was in 1921 deprived of important commercial outlets and industrial auxiliaries, and had to pay a proportionate price for such help as she could get from them.

Commercial Intercourse.—The curtailment of these resources was, however, of small importance when compared with the misrule of the Communist authorities in Russia proper. As a result of the civil war, of the proscription of trade, of the destruction of the middle classes, of the ruin of currency and credit, the processes of circulation had been impeded and blocked to such an extent that one had to look back to the Mongol invasions in order to find anything similar in magnitude to the misery of the situation up to the middle of 1921. The struggles in the Ukraine, with the repeated changes of rulers (democratic Ukrainians, the German protectorate, Petlura's bands, Bolsheviks, Denikin's White Guards, the Bolsheviks again, a Polish invasion, the Bolsheviks again), and the accompanying sequence of risings and punitive expeditions had made the south-western granary of the black soil almost unavailable for years to come. In the same way the Donets basin, the Cossack territories, the Volga provinces had been the scene of bitter conflicts and disturbances which had affected their productivity in a most unfavourable way.[1]

In 1921 one could hardly talk of a Russian railway system. It was already worn out to a great extent by the war and rendered useless for the bulk of the population by the strain put on it by military exigencies. The Soviet administration had been trying hard to effect the most urgent repairs as to rails, engines and trucks, and had utilized a considerable part of the gold reserve to buy locomotives and rolling-stock abroad. But the needs were so great and the engineering resources of Russia had fallen so low, that there was no marked improvement in this respect.

The restrictions as to trade had been relaxed lately, by the decrees of March 29 and May 17 1921, and a lame attempt had been made to revive trade, but all these concessions were too much in contradiction with other standing features of Communist policy to produce an extensive change in the situation. The fact

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[1] Production of coal in the Donets basin for the first four months of 1913, 1919 and 1920 (in thousands of poods).

Months	1913	1919	1920
January	143,000	36,600	14,000
February	117,000	34,800	19,300
March	156,000	33,300	24,300
April	84,000	12,500	13,800
Total	500,000	117,200	71,400

(Report of Lord Emmott's Committee.)

remained that the dictatorship of the Soviets had employed itself systematically on cutting the connecting nerves of the economic organism and had thereby produced a state of paralysis which it was out of question to heal by a few decrees.

One of the hateful consequences of this self-inflicted disorder was the severance between town and country. The rise and the growth of towns depend directly on ways of communication and the circulation of men and goods. They are primarily centres of distribution and exchange, and if the roads to them are obstructed they are unable to perform their economic functions of distribution and exchange. There was, of course, a secondary cause to their decay in "Sovdepia," namely the fact that they were centres of industry and affected by the ruin. But their decay as centres of commerce was bound in itself to produce a back flow of the population towards the villages. Such a back flow was especially indicated in Russia, where the distinction between rural and urban life was never a very marked one, and where large numbers of the inhabitants, such as cabmen, carriers, porters, small tradesmen, were recruited from the villages for a time and accustomed to return to their rural homes at certain periods of the year. In "Sovdepia" this mixed population tried to escape from the deadening grip of the Bolsheviks in the towns to the rural districts. It could live a freer life there, and, besides, it was nearer to the direct source of food-stuffs—the tilled soil. In this way the economic evolution of "Sovdepia" might be described as a regress from commercial to natural husbandry.

Another side of this process of "naturalization" was connected with the disappearance of the mainspring of flourishing commerce—credit. The causes of this phenomenon are partly of an economic and partly of a political nature. As the whole system of Communism is based on war against capital, no accumulation of wealth or resources should be allowed in private hands. This being so, no transactions can be carried out in the strength of confidence in a person's ability to meet engagements in the future. Cash payments and (in view of the worthless currency) barter are the only legitimate forms of exchange. To this must be added the effect produced by arbitrary expropriations by the renunciation of State liabilities, at home and abroad, by the absence of any legal security against dispossession. In such conditions there can be no talk of prosperous economic intercourse. Not the market but the barrack is the social center.

The will of a people to live cannot be entirely extinguished even by a Communist regime. Practice reacts by all conceivable means against the theory. Clandestine trade had been going on in Russia all through the years 1918–21. The Sukharevka market in Moscow teemed with people bidding all kinds of goods for sale. Those who succeeded in getting a passage by rail or by river-craft carried little stores of merchandise in sacks, ostensibly for their own use, in reality for trade purposes. What prices such contraband goods fetched was another matter: people had to pay fantastic sums for the risks incurred by the traders, besides making up for the depreciation of the currency. Anyhow the flow of speculation had never ceased in spite of all the decrees of the Soviet, and the rulers had recently made up their mind to recognize the existence and to admit in half-hearted way the legality of local trade (March 1921). This was proclaimed in the west as a great victory of common sense over extremist doctrine: it was in truth an inevitable admission which did not do away with the main causes of the disorder—insecurity, disruption of communications, distrust, corrupt and arbitrary interference by the commissars. As long as these causes continued to operate, the economic life of Russia would be suffering from their cumulative effects, and the social intercourse of the country was bound to be disturbed by the fever of fraudulent and rapacious profiteering in an atmosphere of misery and disease.

Agriculture.—State of Peasantry.—One of the first decrees of the Bolsheviks proclaimed the abolition of private property and the nationalization of the land. In practice this decree sanctioned the disorderly grabbing of estates by the adjoining peasantry, and the new rulers connived at this form of appropriation for the sake of its psychological effect as a revolutionary act. This meant that they renounced "nationalization" at the same time as they professed to carry it out, and although they tried to save their face by distinguishing between the ownership attributed to the republic and the possession of land snatched by the peasants, the fact remained that the October Revolution as translated into agrarian terms meant the passage of some 50 million dessiatins (135 million ac.) from former landowners into the hands of "petty bourgeois" of the peasant class. The fact that some of the new proprietors held in village groups while others held in individual homesteads did not alter the fundamental opposition between the two social conceptions. The history of the years of Soviet domination up to July 1921 showed that the Communists did not realize at once the consequences of the agrarian revolution registered by their decree. They strove to carry out their programme of nationalization in two directions: they kept in the hands of the Commonwealth a considerable number of estates which had belonged to the State, the Imperial family and certain private landowners—they based their policy of food supply on the principle that the peasants were tenants at will of the republic liable to unlimited exactions for the benefit of the whole.

Under the first head a series of measures were adopted for the exploitation of estates on communistic principles. In the peculiar terminology of the Soviet a number of "Sovkhoses" and "Kolkhoses" were carved out of the land fund and put under the economic control of the administration. The "Sovkhoses" were economic organizations carried on under the immediate direction of the Government while the "Kolkhoses" were communes and associations of peasants enjoying economic support from the Government. Sovkhoses either carried on agriculture in general or cultivated special kinds of technical plants such as beetroot or tobacco. In the first case the Sovkhoses were mainly organized as colonies of industrial workers fitted out with agricultural implements of all kinds, cattle, seeds, etc. The object was to make town workers more independent of the "yoke" of the villages by giving them the opportunity of growing their own corn and vegetables, managing their own dairy farms, etc. These annexes of the factories, designed to rear privileged proletarians in a healthy atmosphere of occasional rural occupation and to provide the surrounding villages with examples of model farming, proved a dismal failure. According to a report presented to a congress of agricultural workers in July 1920 the delays and red tape of administrative patronage rendered the condition of the proletarian husbandmen exceedingly precarious.[1] And as for the workers it could not be expected that they would be able to give satisfaction in their amphibious pursuits. The progress of the Kolkhoses was not more successful. Some were started as actual "communes" with individual coöperation and individual "profits," and those were doomed to be a failure; other Kolkhoses merely drew assistance from the Government, and had to encounter the hostility of neighbouring, less-privileged villages. The negative results of this experiment may be gauged from the fact that the number of Kolkhoses in action decreased in one year from 1,900 to 1,500.

The immense area covered by peasant tenures on the old lines was little affected in its constitution by the Bolshevik usurpation. The attempt of the Soviet to bait the well-to-do peasants by the needy folk proved that the Communist intellectuals did not know the material with which they had to deal. There was no "village proletariat" to speak of, which could serve as a basis for the intended subversion of social relations in the villages; and such tramps and drunkards as the Bolsheviks were able to bring together in their crusade against welfare and order did not succeed in effecting much more than occasional disturbances, which ended mostly in the suppression of the "needy folk" by the peasantry.

[1] According to the decree of June 8 1919, the control of the Sovkhoses farms was given to the Glavsemkhose (the Central Board of Agriculture), which (1) united all agricultural farms organized by the industrial proletariat; and (2) united all the central boards controlling those branches of industry which were in need of agricultural plants for their production, such as "Glavsakhar," "Glavtabak," "Glavkrachmal," "Centrochai," and "Pharmacentre" (*Economic Life* Oct. 2 1919). The original area allotted to different industrial boards amounted to 200,000 dess. (540,000 ac.), but the area actually distributed amongst them was much smaller, amounting only to 80,000 dess. (*Russian Economist*, Jan. 1921).

Much more irksome were the requisitions and expropriations exercised in virtue of the eminent ownership of the Commonwealth. The Soviet was constrained to fall back on this means of extracting some supplies for feeding the army and the towns, but the decrees enjoining the confiscation of the entire produce with the exception of the quantity necessary for the subsistence of the husbandmen, could not fail to provoke a stubborn resistance. The answer of the peasantry was that the farmers restricted the area under seed to the extent necessary to feed them and their families. Why should they toil to increase cultivation if the fruits of their labour were to be taken from them? According to a Soviet authority (Larin) the quantity used for cultivation had shrunk from 5 milliard poods in 1917 to 2½ milliard poods in 1920. The Soviet Government brought all the weight of its terroristic coercion to bear against this passive resistance. It sent punitive expeditions, it encouraged its privileged proletarians to raid the countryside for supplies, it issued a decree ordering the maximum of available soil to be taken over in cultivation and threatening recalcitrant farmers with confiscation and imprisonment: all in vain as far as the general results were concerned. The hardships and disorder were increased hundredfold, but it proved impossible to drive a mass of 100,000,000 peasants by the whip to perform work which was distasteful to them.

The Soviet dictators had to acknowledge their defeat, and in the spring of 1921 (on March 23), in view of a threatening famine, a decree was issued by the Executive Council of the Soviet recognizing and guaranteeing the private tenure of householders who would conform to the payment of a tax in kind. Instead of charging the provinces with certain lump sums to be partitioned among the *uyezds* (districts) and, lower down among the *volosts*, and to be collected from the harvest according to the requirements of the Government, a land tax was imposed which had to be assessed according to the outfit and means of each separate household. It was calculated that this substitution of a land tax for the system of repartition amounted to the reduction from 470,000,000 poods of corn to 240,000,000. It remained to be seen whether the business of assessing and collecting the tax could be carried out with sufficient skill and fairness. The one positive asset of the revolutionary period from the point of view of the peasants consisted in the passage of land from the squires to the tillers, and this was certainly a conquest which the villagers were not going to give up. All attempts at political reconstruction would have to reckon with this basic fact.

Industry.—The history of industrial economy presents the same features, and describes the same curve, from partial disorganization through blockade and war to general ruin in consequence of absurd Utopianism, and, ultimately, to desperate attempts to reconstitute production by reverting to methods condemned and destroyed by the Communists. There is, however, a notable difference: while the enormous block of the rural population was able to oppose unconquerable passive resistance to the dictators in spite of terrorism and heavy losses, the scanty stratum of the industrial workers was almost worn out in the struggle.

We have again to start in our survey in the case from the years immediately preceding the Revolution. Bolshevik experiments were the culminating phase of a process of destruction which had started long before the Oct. 1917 upheaval; the guilt of the Communists consisted in the fact that instead of fighting the evil, they did everything in their power to aggravate it. The initial stage of industrial decay dates from the time when Russia was isolated from western resources by the Central Powers in alliance with Turkey and Bulgaria. The country had to attempt the impossible task of providing by its own primitive resources for the tremendous technical requirements of the war. The criminal levity of Tsarist administration under men like Sukhomlinov had left it with exhausted equipment and munitions by the end of some nine months of military operations, and an unsoluble problem was set to its patriotic leaders in 1915; they had to make up the deficiencies and to prepare further efforts. This meant technically that all the coal and all the railway machinery had to be diverted for the use of the army while the economic needs of the population were entirely disregarded. As a result, though, with the help of Zemstvo and Municipal Committees acting for purposes of national defence, the fabrication of shells and machine-guns was to some extent reëstablished and maintained, the economic work in the rear necessary for production and repairs was rapidly deteriorating. Train service, for example, was officially suspended for weeks between Petrograd and Moscow in order to make room for military transport and the most urgent needs of food supply. Repairs of locomotives had to be carried out in a more and more imperfect and insufficient manner, and the statistics as to the state of rolling-stock presented drastic symptoms of a lamentable deterioration. The March 1917 Revolution accentuated all these evils because another cause of decay came to the fore with ever-increasing force: the discontent and the demoralization of the workers broke out like a stream of all-consuming lava. The responsibility for the sufferings of the time was laid entirely at the door of greedy capitalists, and the workers were convinced that they were justified in demanding increased wages and decreased labour. A Minister of Labour of the Provisional Government, Skobelev, upheld emphatically their contention.

The following tables give illustrations of the change in the condition of the rolling stock:—

Engines.

Year	Length of the Lines, in Versts	Number of sound Locomotives	Per cent. of Locomotives out of order	Number of sound Locomotives per 100 Versts of Line
			%	
1914	64,000	17,000	15–16	27–28
1916	65,000	16,000–16,800	16–17	26–27
1917, Jan.	64,526	17,012	16·5	26
June	62,952	15,930	24·2	25
Dec.	50,131	15,810	29·4	32
1918, June	25,422	5,676	39·5	22
Dec.	23,665	4,679	47·8	21
1919, June	24,688	4,739	49·0	19
Dec.	36,551	4,141	55·4	11
1920, Jan.	48,410	3,969	58·1	8
June	59,196	6,254	58·9	10·5

Repair of Engines.

	1915	1916	1917	1918	1919	
					Jan.	Feb.
Number of Engines repaired . . .	797	1,177	640	405	25	21

Construction of New Engines.

Year	Number of new Engines constructed in Russia
1914	816
1915	903
1916	599
1917	396
1918	191
1919	85

In the cotton industry of the Moscow district the earnings of skilled and unskilled workmen per day was as follows:—

Date	Unskilled workers		Carpenters of the first category	
	In kopeks	Per cent. 1919 = 100	In kopeks	Per cent. 1919 = 100
Easter 1914 .	46	2	155	3·9
Easter 1915 .	57	2·5	160	4·0
Dec. 1915 .	59	2·6	175	4·4
Easter 1916 .	68	3·0	200	5·0
Jan. 1917 .	68	3·0	250	6·2
Aug. 1917 .	145	6·3	575	14·4
Dec. 1917 .	800	34·8	1,950	48·7
June 1918 .	1,000	43·5	2,050	51·2
Sept. 1918 .	1,000	65·2	2,650	66·2
Feb. 1919 .	2,300	100	4,000	100

All partial attempts to put a stop to constant rioting, absenteeism, and slackness availed nothing against the general intoxication of the "glorious revolutionary days."

Working Year of the Industrial Workmen in Days.

	Pre-revolutionary	Post-revolutionary	Increase since the Revolution	Per cent of Increase
Stoppages		53	53	
Sickness	7·4	19	11·6	157
Absence for other causes	16·6	52	35·4	214
Total of days absent	24	124	100	416
Days of rest	93	55	38	41
Days of work	248	180		
Total	365	365		

The table shows that, notwithstanding the large decrease in the number of holidays after the Revolution, the working year of the workman, owing to the increase of sickness, absence from work and stoppages, has decreased by 68 days, or 25 %; and if, further, the length of the working day be taken in account, in 1916, including overtime 10·1 hours, and at the beginning of 1920, 8·6 hours, then the decrease of the working year amounts to 900 hours or 30 per cent.

The Bolshevik victory in Oct. 1917 added yet another ingredient to the industrial ferment. The Marxist dictators, the industrial workers, were the chosen class, the leaders of the proletariat, and entitled therefore to carve out benefits and indulgences for themselves according to their own notions of right and expediency. More especially they were keen to ransom the employers' class, not only by appropriating the lion's share in actual profits but by exacting compensation for advantages which had accrued to employers in the past, as well as vengeance for ill-treatment of the workers in the course of centuries. The inference from this conception of economic relations between working men and their former employers was the system of *workers' control*[1] which the Soviets started in their industrial policy. It meant that each factory and workshop had to be conducted in the future under the supervision and according to the directions of a board of workmen, while the employers were degraded to the position of technical experts and banking managers.

The object of the peculiar combination between Capitalism and Socialism designated as "workers' control" was avowedly to enable the workmen to draw on the resources of the capitalist to the last drop, and in this complete success was achieved thanks to the servitude imposed on the "employer" who could neither withdraw nor oppose any decree of the workman's board. But the system had yet another effect, namely a complete industrial anarchy and consequent ruin.

The next stage was reached when the Soviets attempted to put an end to this anarchy by a regime of nationalization.[2] Nationalization could be introduced into practice only by deriving economic direction and control, not from the accidental and separate groups of workmen in factories and workshops, but from the national centre. This centre was embodied in the Economic Council of the people, supported locally by subordinate councils in the provinces and districts, and relying for the execution of its decrees on a vast bureaucracy of head offices (Glaski) and "centres."

It is difficult to form an adequate opinion as to the ramifications and numbers of this all-embracing bureaucracy. We have the evidence of its own members as to the actual working of the system. In theory it had to organize the repartition of raw materials, to assign means and draw supplies and to collect products in accordance with requirements. In reality the Soviet bureaucrats struggled with each other, stifled local opinion and individual enterprise, and had generally to record lamentable discrepancies between plans and achievements.[3]

Bureaucratic nationalization proved as ineffectual as workmen's control in solving the problems of increased production and organization of labour. Theoretically, the workmen in the nationalized industries had to be considered not as privileged beneficiaries but as disciplined citizens serving the Commonwealth. Attempts to translate this view into practice were made. Workmen were mobilized for industrial purposes, sent to the Ural or to the Donets fronts, subjected to military control and martial law, armies that had been fighting the Poles or Denikin were switched off to execute economic tasks. Trotsky developed the idea of the militarization of industry as the only means of saving the country from collapse. But the results were not encouraging. Workmen deserted from the towns and hid in the villages, while those unfortunates who were unable to leave Petrograd, or other industrial towns, went on strike, made demonstrations and riots in the face of ruthless repressions; even when they performed their hard labour, it proved miserably inadequate for lack of physical health and moral energy.

Altogether, industrial nationalization proved as much of a failure as agricultural nationalization. And so the Soviets had to retreat, here as there, to a position characterized by the abandonment of all their economic doctrines and previsions. In 1921 Comrade Krassin was recommending in the West a programme that Lenin had announced to the 10th Congress of Communists and to the Central Executive Council: capital and competent leadership were acknowledged as necessary forces in the process of industrial production: the national capitalists had been robbed and driven from Russia; therefore foreign capitalists had to be called in to take their place. They were promised guarantees against arbitrary expropriation "*à la Russe*" and they might think that they were less liable to succumb to it because they were not "comrades" but citizens of civilized states, and might count on the strong arm of their Governments. But the great inducement consisted obviously in the prospect of rapid profiteering on a scale commensurate with the risk incurred by those who ventured into the wolves' den.

In comparison with these gigantic schemes of exploitation other retrograde measures were modest and mild. Small capitalists, even when Russians, were allowed to start shops, and individual enterprise was to be encouraged somehow, although Communism was not renounced as an ideal, and big undertakings were to be kept in the hands of the State. The introduction of

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[1] The Workers' Control was established by the decree of Nov. 14 1917. It directed the production, sale and storage of products and of raw materials and the administration of the financial side of the business. It belonged to all workers by the intermediary of their elected institutions with the participation of representatives of the employees and of the technical staff.

The situation in the factories became chaotic, and the disorganization of the undertakings assumed the most extraordinary dimensions. The interference of the Workers' Committees made it quite impossible to realize any scheme planned in advance. All programmes of economical policy were annulled by the "judgment," of the Workers' Committees.

[2] In the course of a report delivered to the Moscow Congress by the Supreme Council of People's Economy in Jan. 1920, A. I. Rykov, the president of the Council, made the following statement:

"The nationalization of industry has been carried out pretty fully. In 1918, 1,125 factories and works were nationalized, and by the end of 1919 the number was about 4,000. This means that nearly all industry has passed into the hands of the state (Soviet) organs, while private industry has been destroyed, as former statistics show that there were up to 10,000 industrial undertakings, including cottage industries. These latter are not subject to nationalization, and the 4,000 nationalized factories and works include not only the larger concerns, but likewise the bulk of the average industrial concerns of Soviet Russia. Of these 4,000 undertakings about 2,000 are working at present. All the rest have been closed. The number of operatives is estimated approximately at 1,000,000, which is between one-third and one-fifth of the numbers of the proletariat in 1914. Both as regards the number of hands and the number of undertakings in operation the Russian manufacturing industry is likewise undergoing a crisis."

[3] From Jan. to June 1918, the Soviet regime at the Putiloff factory gave the following results:—

	Delivered	*Prevision*
Engines, new	2	4
Engines, new type	1	3
Engines, important repairs	2	10
Engines, medial repairs	0	12
Carriages, 3rd class, new	2	4
Carriages, 4th class, new	3	13
Carriages, for goods, new	169	309
Tramways	3	9

The real productivity of the factory is from 3 to 10 times inferior to those of the scheme of production established by the superior Council of National Economy. (Report of Mr. Molitof to the Petrograd Soviet, Aug. 15 1918, Labry, 187.)

specialists was recommended as a necessary measure. Under the regime of the workmen's control, technical experts were treated as second-rate persons to be ordered about by the ignorant "*demos*" of proletarian boards, but experts were now invited to proceed to Sovdepia in order to help to restart productive industrial activity. In the factories piece-work was given a prominent place as against the "ca'canny" devices of time work, although previously workmen used to protest most violently against this form of remuneration. Altogether payment by results was being more and more recognized as an antidote against slovenly labour. As for working hours no account was taken of the 8-hour day, and forced labour was exacted for 10 or 12 hours when deemed necessary by the commissars.

Standard of Living.—Thus the Soviet dictators were trying in 1921 to back out of the impassé into which they had run the industry of the country. There was among the working class one group which had profited by the Oct. revolution—it was the communistic nucleus used by the Soviet administration to spy on their comrades and to coerce them. They enjoyed all the privileges of an official class and could afford not only necessaries of life but such luxuries as were to be had in the market. Apart from these privileged Communists the working class was reduced to a condition of utter destitution. Even judging by the standard of the prices fixed from time to time by the ruling powers they could not make the two ends meet, because the prices had risen during Soviet domination from 16 to 25 times. In 1921 bread cost 19 times as much as in the second quarter of 1917, manufactured goods 22 times as much, footwear and soap 25 times. Wages indeed had increased also, but their nominal increase did not keep up with the cost of living. About the middle of 1918 an *enquête* had been made in Moscow as to the budgets of 2,173 workmen, and it resulted from it that on the average a bachelor working-man's wages did not exceed 462 rubles per month, though by occasional extra work they might be brought up to 624. The head of a family earned on the average 703 rubles, and might increase his earning by supplementary labour to 1,077 rubles per month. The ordinary budget was made up in the case of a bachelor by 22·2 rubles for lodging, 46·9 for food, 47·7 for clothing, 1·1 for house implements, 19·6 for health (baths, drugs, etc.), 13·4 cultural expenses (newspapers, books, etc.), 13 (parcels sent to village home), 32 miscellaneous expenses; in all, including other items, being 609 r. For heads of families the average monthly expenses rose to 952·7, of which 672·8 r. fell on food (Zagorsky, *La République des Soviets*, 214, 215). These figures show a considerable deficit in normal and well-regulated households: any disturbance in personal conduct, conditions of labour or health, was bound to result in downright starvation and ruin. Let us also notice that distress was much more marked in 1920 and 1921 than in 1918.

The only consolation for workmen was derived from the fact that the hated bourgeois were subjected to even greater hardships. In the early stages of Bolshevik domination this kind of consolation was a potent one: the feeling of triumph of the lower class over its former superiors made up for many privations, but in course of time the bourgeois were trodden down to that extent that there was not much satisfaction to be obtained from kicking them, while new contrasts arose between the mode of life of half-starved workers and of the Soviet bureaucrats shepherding them. The food situation became catastrophic in 1921. As a result of the restriction of cultivation, transport difficulties and civil disorder, a great part of the country was visited by downright famine, with terrible prospects ahead.

Credit and Finance.—In such conditions nothing could be expected but growing decay in public credit and finance. The Soviet Government had been living on the reserves accumulated under monarchical rule. The gold fund of the Imperial Treasury had been its chief asset in conducting political and commercial negotiations. Its remnant represented something like £50,000,000 in the first quarter of 1921. The needs of the home circulation were satisfied by constant emissions of paper notes. There was no system and no limit in this process of inflation. Paper notes had even come to be measured by weight instead of being reckoned at their indicated value. The Chief of the Soviet State often spoke with contempt of money currency as a worthless product of capitalistic exploitation. But the Communist Commonwealth had not yet discovered the means of replacing this system by a more adequate instrument of exchange. Figures in rubles were still being handled as if they represented realities. The only hope left for the Bolsheviks was that when they had spent the reserves captured from the Imperial Government and from the defeated armies, the national capital represented by the natural wealth of Russia in forests, minerals, fisheries, etc., should be put into the market. The handing over of this wealth to foreigners would mean, of course, economic subjection, a state similar to that of Asiatic and African dependencies of western Powers. But the Bolsheviks were not deterred by a prospect of that kind, provided it enabled them to continue in power. They mapped out a programme of concessions on the widest scale.

The Council of the Commissars of the people laid down a set of rules as to concessions, and the Councils of Economy and of Agriculture outlined a vast scheme of natural resources which should be offered to foreigners for exploitation. The rules were as follows:—

(1) Concessions should be granted by agreement on the principle of a division of profits.

(2) In case of the introduction of special machinery and appliances the concessionnaires would be granted privileges, *e.g.* large orders.

(3) The concessionnaires would be allowed to remain in possession for long periods in order that they should draw sufficient benefits from their concessions.

(4) The Government of the Soviets guaranteed immunity to the concessionnaires from nationalization, confiscation and requisitions.

(5) The concessionnaires would have the right to hire labourers on conditions specified in the Laws of the Commonwealth or on special conditions safeguarding the life and the health of the workmen.

(6) The Government pledged itself not to make any change in the conditions of the agreement by a one-sided exercise of its authority.

It would be impossible to enumerate all the resources of the country offered to enterprising capitalists for exploitation. Two or three examples must suffice to give an idea of the booty offered to foreign capitalists by Russian Communists. In Western Siberia, along the rivers Ob, Irtysh and Taz, an area of 70 million dess. (about 180 million ac.) was reserved for them. It is covered by immense forests of pines, firs, cedars and larches. If it were found necessary at the start to restrict exploitation to a strip along the rivers some 15 versts wide along each bank, there would still be available for immediate and easy use some 16 million dess. (about 42 million acres). The timber should be sawed and worked into pulp and cellulose in mills to be erected by the estuary of the Ob. Such mills ought to make up a settlement of the size of another Archangel. The natural route westwards lies down the Ob and by the Kara sea: it had already been utilized to some extent and its future importance could not be exaggerated. The whole region should be opened up by a number of railway lines. Mineral wealth of various kinds—platinum, coal, lead—is to be found in these districts. One of the most stupendous advertisements as to mineral wealth concerned the Kuzsnetsk coal mines along the Tom river. They were estimated to contain about 250 million tons of excellent coal. In European Russia 14 uyezds (districts) were advertised for agricultural exploitation and the construction of ways of communications of all kinds. All these districts are situated in the black soil region of south-eastern Russia. The application of powerful traction engines and steam ploughs would soon convert them into one of the principal granaries of Europe.

Such were the prospects held out in 1921 to enterprising capitalists. Not a word was wasted on the social and legal conditions of the human material connected with these tracts. It remained for the concessionnaires to fashion it with the assistance of the enlightened commissars: it was evident that the 5th clause of the Soviet rules ought not to be applied in such a way as to hamper the great process of economic restoration. The principal object was to get capitalists to speculate on the material basis described with such graphic details.

It remained to be seen how they would organize and keep in order the labouring population required for the carrying out of the concessions—whether the foreign capitalists would obtain feudal franchises with police powers of their own, or the Soviet power would keep watch on their behalf and use coercive measures to keep the Russian workmen up to the mark.

Another side of the repressive policy of the Soviets in the stress of dire need was presented by the appeal to the help of coöperatives. These organizations had gone through a chequered existence under the rule of the Soviets. In the early days of 1917 and 1918, the proletarian dictators used them as convenient tools at home and abroad in order to counteract the impression that Russia was ruled by an uncompromising despotism. The leaders of the coöperatives were encouraged to preach a non-party attitude, and to concentrate their efforts on purely economic work without any admixture of political opposition. In the campaign for the reopening of trade with Soviet Russia it was usual to assert that such trade would be carried on exclusively with coöperators and not with the ill-famed Moscow Government. In 1919, however, a sharp turn was given to the wheel, and the coöperatives were "nationalized"—declared to be subordinate committees of the Central Economic Council. In Sovdepia this measure was explained not only as a consequence of the general policy of Communism, but also as a necessary precaution against Social revolutionaries and Mensheviks, accused of having barricaded themselves within the coöperatives for purposes of political agitation.

In the beginning of the year 1921 a new current set in; coöperatives were to some extent reëstablished as autonomous organizations. The object was to revive them as agents of repartition. The Soviet decree of April 7 1921 was drawn up, however, in such a narrow and ambiguous form, that the institution remained doomed to mechanical subjection. The Act concerned primarily coöperatives of consumers. It allows combinations for protection and traffic only in an exceptional case and in obscure terms. As far as allowed, coöperatives are included in administrative units of state origin and local delimitation. All freedom of action is curtailed and subjected to strict supervision. Lastly, the members are not voluntary associates intending to help each other according to free agreement, but people brought together by the fact of dwelling in the same locality or belonging to the same professional group.

All this shows to what extent the principle of autonomous association was felt to be antagonistic to Soviet despotism. It might be assumed that the coöperatives would either remain inactive and fictitious, or else that they would contrive to escape the jealous supervision and the step-motherly pressure exercised by the "Glavki" and "centres."

The hard facts of economic decay admitted of no controversy and could be illustrated by tabulated results. It was still impossible in 1921 to apply the same tests to the moral aspect of the condition of Russia, although there could be no doubt that the deterioration of national life in this respect was more harmful than economic decay. The aggressive tone of Communist propaganda could not deceive any one who considered the efforts of the "Proletcult" with common sense. It was not the number of schools that mattered, but their efficiency and educational influence. The prophecy of Dostoievsky in *The Possessed* had come true: the Bolsheviks had not only squandered the reserves accumulated by orderly government, and scattered some 2,000,000 of the best educated Russians across the world—they had poisoned the mainsprings of national morals for generations to come. One or two of the conclusions of Lord Emmott's Committee may be appropriately cited in this connexion; their studied moderation makes them particularly effective:—

> "Child education in Soviet Russia is based upon an attempt to dissolve the ties hitherto existing between parent and child, and children are removed from the care of their parents soon after birth; we have received no information on the moral and physical effects of this policy. Education, both child and adult, is not merely secular, but directly anti-religious in bias."

As a specimen of the educational practice of Soviet Russia we will quote from the experience of a leading professor of the medical faculty of the university of Moscow, published under the pseudonym of "Donskry" in the *Archives of the Russian Revolution, I* (Berlin, 1921):—

> "By order of the commissars 5,000 applicants had been admitted as freshmen in the medical faculty, although the lecture-rooms were constructed for 250. Representations had been made that it was impossible to admit persons who had received no appropriate instruction, but they were disregarded. The only thing required was that applicants should have attained the age of 16 years—the rules as to admission did not mention even the necessity of knowing how to read and write. The crowd of students dwindled to small numbers very soon, however, on account of the absence of heating during the winter and of the almost insuperable difficulty in getting materials for experimental teaching."

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RUSSKY, NIKOLAI (1854–1918), Russian general, was born in 1854. On leaving the infantry military school in St. Petersburg in 1874 he was given a commission in the Guard. Graduating from the Academy of the General Staff in 1881, he served as an officer of the general staff in the Kiev military district, and by 1896, after commanding an infantry regiment, had reached general's rank. During the war with Japan in 1904–5 he was the head of the staff of the II. Army, and planned the offensive carried out by Gen. Grippenberg which led to the prematurely abandoned offensive of Sandepu. In 1909 he was assistant commander of the Kiev military district. He enjoyed the special friendship of the War Minister, Sukhomlinov. At the beginning of the campaign of 1914 he commanded the III. Army, which attacked in Galicia, and after the vicissitudes of the bloody heavy battles about Krasnik and Rava Ruska advanced to Lvov (Lemberg), through which it passed in the further advance to the San-Dniester line. The dramatic entry of the III. Army into Lvov created for Gen. Russky a popularity and prestige out of proportion to the real importance of his success. In Oct. 1914 he was appointed commander-in-chief of the north-western and afterwards of the northern "front" (*i.e.* group of armies), but, suffering from very bad health, he had on more than one occasion to leave the front for a time. He continued, however, to hold the command, and it was at his headquarters that the final scenes of Nicholas II.'s reign and his abdication took place in March 1917. Soon after the Revolution Russky retired and in 1918 he was reported killed by the Bolsheviks.

RUTHERFORD, SIR ERNEST (1871–), British physicist, was born at Nelson, New Zealand, on Aug. 30 1871. He was educated at Nelson College and Canterbury College, Christchurch. After graduating at the New Zealand University (M.A. 1893 and B.Sc. 1894), he proceeded with an 1851 science exhibition to Cambridge, where he entered Trinity College and prosecuted researches in the Cavendish laboratory, Sir J. J. Thomson being then the Cavendish professor. He published numerous researches upon the conduction of electricity through gases, for which he obtained the B.A. Research degree and the Coutts-Trotter studentship in 1897. In the following year he was appointed Macdonald professor of physics in McGill University, Montreal. There he carried out a series of brilliant investigations, in conjunction with Soddy, which established upon a firm basis the existence and nature of radioactive transformations. In 1903 he was elected F.R.S. In 1907 he succeeded Sir Arthur Schuster as Langworthy professor of physics in the university of Manchester, and he attracted there a large school of radioactive research workers. In collaboration with several of these the science of radioactivity was rapidly developed: among other work the production of helium as a product of disintegration of radium was shown spectroscopically, the spectrum of the emanation measured, the number of α particles (charged helium atoms) during a disintegration process counted, the properties of numerous radioactive products and the radiations accompanying their formation examined. Among the most important of the researches emanating from his laboratory was that of the experimental demonstration of the nuclear nature of the atom. It was also in his laboratory that Moseley determined the X-ray spectra of a number of elements. Rutherford was knighted in 1914 and in 1919 succeeded Sir J. J. Thomson as Cavendish professor of experimental physics in the university of Cambridge. Many British and foreign honours and degrees were bestowed upon him: the Rumford Medal of the Royal Society (1905), the Barnard Medal (1910), Bressa Prize (1908), and Nobel Prize for chemistry (1908). In 1920 he was appointed professor of physics at the Royal Institution, London. His works include *Radioactivity* (1904), *Radioactive Transformations* (1906), *Radioactive Substances and their Radiations* (1912).

RUTHERFORD, MARK [William Hale White] (*c.* 1830–1913), English author (*see* 23.940), died at Groombridge March 14 1913. His eldest son, Sir William Hale White (b. 1857), who was created K.B.E. in 1919, became a well-known physician, and during the World War was a colonel in the R.A.M.C.

RYAN, JOHN DENIS (1864–), American capitalist, was born at Hancock, Mich., Oct. 10 1864. He was educated in the public schools, for eight years was clerk in an uncle's store, and at the age of 25 went to Denver, where he was employed as a salesman of lubricating oils. In 1901 he secured an interest in a bank at Butte. In 1904 he was made manager of the Amalgamated Copper Co. in Montana, and after the death of Henry H. Rogers, in 1908, he succeeded him as president. He had been elected president of the Anaconda Copper Mining Co. in 1905, and after the merging of the Amalgamated interests in the Anaconda in 1910 he continued as president of the latter until 1918. He developed large water powers in Montana, and in 1913 electrified the railway between Butte and Anaconda (100 m.), the success of which led to a wide introduction of electrification. By 1920 hydroelectric power from the Montana Power Co. organized by Ryan was used in most of the mines of Montana and for lighting in all parts of the state. During 1917–8 Ryan was a member of the war council of the American Red Cross and after 1918 of its central committee. After the failure of America's aircraft programme had led to a reorganization, he was appointed in April 1918 head of the Aircraft Board of the Committee of National Defence, and in Aug. was appointed second assistant-secretary of war and director of air service of the U.S. army. After the signing of the Armistice in Nov. he resigned. Official investigation was made later, and Ryan was both attacked and defended. It was generally felt that the newly organized board fell heir to popular criticism of past failures for which it was not responsible, and the short time before the Armistice scarcely afforded opportunity to develop efficient production. In 1919 Ryan was elected chairman of the board of directors of the Anaconda Copper Mining Company, and he took a prominent part in connexion with other commercial and financial concerns.

RYDER, ALBERT PINKHAM (1847–1917), American painter (*see* 23.949), died at Elmhurst, Long Island, March 28 1917.

SAAR VALLEY.—The Armistice of Nov. 1918, in restoring Alsace-Lorraine to France, again brought the French frontier close to Saarbruck and the Valley of the Saar. This region, thanks to its large coal output, had ever since 1871 been in close relations with the coal-mines of Metz and Thionville. The big metallurgical establishments of Lorraine were largely dependent upon coal from the Valley of the Saar, from which the new French frontier would have cut them off, to the detriment of the economic development of both countries. On the other hand, France had been deprived of a large portion of her output by the destruction of her northern coal-fields, a situation which had as far as possible to be remedied by Germany. The geographical situation of the coal-mines in the neighbourhood of Saarbruck clearly pointed to their utilization for this purpose. Nevertheless, and although Saarbruck had belonged to France from 1794 to 1815, the French annexation of this country was difficult without running a risk of violating the inhabitants' right of self-determination. These were the elements of the problem which the authors of the Treaty of Versailles had to consider.

Treaty Stipulations.—Section IV. of Part III. of the Treaty deals with the Saar Valley. Articles 45 to 50 lay down the frontiers of the Saar territory, and state the general principles adopted. The regime agreed upon is laid out in an annexe which follows Article 50. It is clear from the text that the authors of the Treaty intended to cede to France complete ownership of all coal deposits in the valley. This could not have been effected had the district remained under the authority of the German Government. Disturbances were to be feared between the French State, sole proprietor of the mines, and the German Government, which would have remained the only public authority. In order to get over this difficulty, and to ensure to France the free disposal of Saar coal, the territory of the Saar was completely detached from the German State, both from a political as well as from an administrative point of view.

Frontiers.—The territory (*see* EUROPE, inset on map) as created by the Treaty stretches W., N. and E. of the town of Saarbruck (60 km. E.N.E. of Metz, and 90 km. N.W. of Strassburg). On the S. and the W. there is the French frontier, from Hornbach, S. of Deuxponts, to Ritzing, W. of Merzich (Merzig). Leaving Ritzing, the frontier includes Mettlach and its suburbs, passes near Neuenkirchen, and, going E. reaches the southern frontier of the Birkenfeld district, which it follows. From Namborn the line goes S.E., taking in Homburg, and, after bending so as to exclude Deuxponts, rejoins the French frontier near Hornbach. The territory thus formed is considerably larger than the district where coal-mines are actually being worked. The peace negotiators intended, in fact, to include in it the whole coal deposit, and not only the fields being exploited. France has become sole owner of all the fields and of all mining concessions. Indemnification of the former owners was made the concern of Germany. Transfer to France of the mines being worked was made comparatively easy by the fact that nearly all the concessions belonged to the State of Prussia or to Bavaria. The rights of France in the district were still further guaranteed by the inclusion of the district in the French Customs system. This provision had extremely important economic and political effects. However, in order to avoid a brutal cessation of the close economic relations which existed between the Saar and the rest of Germany, trade with Germany was to remain free of any Customs dues until Jan. 10 1925. France was empowered to build any railways or canals which she might deem necessary in order to link up the fields with France. All the rights and duties of the former proprietors towards their employees and workmen were assumed by France, who was also free to use French currency in all its transactions within the zone. The value of the mines thus ceded was to be credited to Germany in the Reparations Accounts.

Political Régime.—Steps had to be taken to provide the district with administration and government, France, apart from the mines, being concerned only with Customs. The Peace Treaty entrusted the League of Nations with this task, as from Jan. 10 1920. The country is governed by a commission of five, which sits at Saarbruck, and consists of one French member, one member chosen among the local population, and three who may be neither French nor German. This commission is appointed yearly by the League of Nations, which may renew expiring mandates. It is presided over by one of its number, appointed by the League of Nations. This president acts as executive agent. All powers previously enjoyed by the German Empire, Prussia and Bavaria have been transferred to the commission. The commission maintains in force the laws and regulations passed previous to the Armistice, with the exception of special war measures. It has the power to modify them if necessary; collects taxes; administers justice; directs the administration of the country, and can create new administrative organs. It is responsible for public order; the safety of the inhabitants of the district, and their representation abroad; it manages the railways and looks after all public property. These powers, for the use of which the commission is responsible to the League of Nations, are subject to several restrictions. First of all, they cannot affect the rights of the French State in its capacity as owner of the mines, and no restriction can be placed upon the circulation of French money. On the other hand, the country maintains its local assemblies, its religious freedom and its tongue. No fresh taxation (Customs excepted) can be levied without consultation with elected representatives of the inhabitants. Men and women over 20 years of age have the right to vote for the local assemblies.

The Treaty in no way affects the existing nationality of the inhabitants. It stipulates that the governing commission shall be the last judge of any dispute arising from the interpretation of the Treaty itself. The régime thus formed does not establish a state of the Saar, similar to that of Luxemburg, since no new nationality is formed, and since the League of Nations is only acting as trustee. It is none the less true that the Saar territory constitutes a political and economic entity entirely independent and entirely separated from Germany and France. The Peace Treaty did not intend to prolong this state of affairs indefinitely without giving the inhabitants of the Saar an opportunity of expressing and obtaining the fulfilment of their wishes in the matter. Therefore, 15 years after the coming into force of the Treaty, that is to say, in the course of the year 1935, the future régime of the Saar was to be settled by a plebiscite.

The Plebiscite.—The details of this plebiscite were to be settled by the League of Nations. All persons over 20 years of age who were resident in the territory on June 28 1919 were to have the right to vote. Three alternatives were to be submitted to the population. First, the permanent maintenance of the system of government provided for in the Treaty—that is to say, autonomous government under the ægis of the League of Nations; second, reunion with France; third, reunion with Germany. Voting was to be taken by commune or by district, and it would therefore be possible to take into account the various votes of different portions of the territory. The League of Nations was to fix the new frontiers, if any, in accordance with the results of the plebiscite. The fate of the mines ceded to France would be decided by the plebiscite also. If the Peace Treaty régime were continued, or if the voting went for reunion with France, there would be no further difficulty; but if all or part of the coal-fields returned to Germany, Germany would have to buy out the interests of the French State in the fields which Germany would then reoccupy. The price was to be fixed by experts and to be payable in gold.

Physical Features.—The river Saar comes into contact with the territory at Sarrequemines, and forms the French frontier to a point just above Saarbruck. It then flows through the territory to a point just downstream from Mettlach. The valley, which, between Saarbruck and Merzich, is fairly wide, runs through picturesque hills covered for the larger part with forests, the working of which is a valuable industry. Agriculture plays but a very secondary part, and it is upon industry that the population is mainly dependent. The pop. amounts to 703,000, which, on an area of 1,900 sq. km., shows a density of 370 persons per sq. km. The population is very unevenly distributed. It is very dense in the industrial regions, in the valley around mineheads, and wherever factories have been built. It is sparse in the farm and forest lands. The chief towns are Saarbruck (110,000), Voeltlingen (19,000), Sarrelouis (16,000), Dillingen (8,000), Merzich (9,000), which are all in the valley itself. Then there are the mining towns elsewhere: Dudweiler (21,000), Sulzbach (23,000), Friedrichsthal (14,000), and the industrial town of Neuenkirchen (35,000). The chief towns in the Bavarian portion of the territory are St. Ingbert (19,000), Homburg and Blieskastel. The chief industry, and the only one mentioned in the Peace Treaty, is the extraction of coal. The mines being worked in 1921 are situated in a district bounded on the one side by the Saar Valley from Burbach to Fraulautern, and by two lines drawn from Waldmohr (N.E. of Neuenkirchen) to Burbach and Fraulautern. Mines are most closely clustered in the little valleys between Saarbruck and Neuenkirchen, and before the war all of them, with the exception of those at Hostenbach and Frankenholz, belonged to Prussia or Bavaria. The total production of the basin averaged 12,000,000 tons a year. It exceeded 13,000,000 tons in 1913, and, in the opinion of experts, a very considerable increase in output ought to be obtained without much difficulty. All the mines are worked for France, with the exception of that of Frankenholz, which was left in the hands of the company which previously owned it. Output fell off during the war, as the result of fewer working hours and less productive labour. In 1920 about 9,500,000 tons were produced, and in 1921 the output would have been bigger had it not been for the general economic crisis. The mines employ over 70,000 persons, and, taking into account their dependents, it may be safely said that about a third of the total population of the country relies upon the mines for its living. The output is consumed, to the extent of about 50%, locally. The rest is exported to Alsace-Lorraine, France and Southern Germany. The export market varies in accordance with the general economic situation. The coal is not very satisfactory for the purposes of steel manufacture, and has to be mixed with coal from the Ruhr before it produces good coke. On the other hand, it is very suitable for heating and the manufacture of lighting gas, and therefore finds a ready sale to railways and municipal authorities. Metallurgical industry is highly developed, and there are no less than 31 blast-furnaces and many steel plants. The factories, which are run by powerful companies, are situated at Burbach, Brebach, Voeltlingen, Dillingen, Neuenkirchen and St. Ingbert. The steel output in 1912 was over 2,000,000 tons. Since the Armistice French capital has been largely invested in the metal industries of the Saar and metal workers and miners receive their wages in francs. There are a number of works producing machines and machine tools, so that after coal the iron and steel trades rank as second in importance. Glass and ceramic industries, the former at Sulzbach and St. Ingbert, and the latter at Mettlach and Merzich, are the next important employers of labour. There are over 120,000 persons, counting 70,000 miners, industrially employed. The majority of the workmen are natives of the country, and labour therefore has a stability not often to be found.

Communications.—A good system of communications provides an outlet for these industrial products. Saarbruck is at the junction of the Metz–Mayence and Strassburg–Trèves–Cologne line, and is also on a direct line towards Ludwigshafen and the Rhine, as well as in connexion with a number of minor or local railways. There is also a canal through the Saar, which has been canalized upstream from Sarrelouis in order to meet the mine canal and the Marne–Rhine canal in Lorraine. There is no waterway towards the Moselle.

General Considerations.—It will be seen that the population is almost entirely industrial. In the towns there are wholesale and retail dealers, and the works and factories are owned by big limited companies. There is therefore but a small middle class and a backward intellectual and artistic development. From a religious point of view Catholics are in a considerable majority, although there is a fairly strong group of Protestants at Saarbruck. Since the German revolution the Socialists and Catholic Centre have been practically numerically equal; and trades unions are either Christian or Red. It is economic questions, output and wages which chiefly concern people. In 1921 there were a number of problems to which no definite solution had been found. There were the change of the Customs frontier, the coexistence in the Saar of the French franc (with its higher and more stable rate of exchange) and the German mark, and the natural increase of economic relations with France. The great resources of the country, however, enabled one to hope that the Saar would be able to adapt itself to these new conditions. The stipulations of the Treaty of Peace, in placing the territory under the authority of a government independent both of France and of Germany, were peculiarly calculated to assist the economic development of the region. They gave to the Saar the means of protecting its own interests, and at the same time spared it the burdens and worries which are the common fate of all great states. (P. DE T.)

SABINE, WALLACE CLEMENT WARE (1868–1919), American educator, was born at Richwood, O., June 13 1868. He graduated from Ohio State University in 1886 at the age of 18 and after two years' further study at Harvard received the degree of A.M. In 1889 he was made assistant in physics at Harvard and the following year instructor. After passing through the usual stages of promotion he was appointed professor of mathematics and natural philosophy in 1905 and the following year assumed the deanship of the newly organized Graduate School of Applied Science. He was an inspiring teacher but his publications were confined to papers contributed to scientific journals. In 1916 he went to France as exchange professor at the Sorbonne but devoted most of his time to removing French tuberculous patients to Switzerland under the auspices of the Rockefeller Foundation. In 1917, however, he lectured on architectural acoustics, a subject of which he had made a special study. He himself fell a victim to tuberculosis and died in Cambridge, Mass., Jan. 10 1919.

SAGE, MRS. RUSSELL [MARGARET OLIVIA SLOCUM] (1828–1918), American philanthropist, was born at Syracuse, N.Y., Sept. 8 1828, being descended on her father's side from Capt. Miles Standish. After graduating in 1847 from the Troy (N.Y.) Female Seminary, afterwards known as the Emma Willard School, she taught, first in Philadelphia, and later in Syracuse and Troy until 1869 when she became the second wife of Russell Sage (*see* 23.1002). She proved herself a shrewd business woman and for several years before his death had full control of his affairs. She had long been interested in charities, and in estimating the services of Sage himself it should be remembered that he left to her without restriction his entire fortune, over $64,000,000, doubtless foreseeing its probable final distribution to charity. In 1907 the Russell Sage Foundation was incorporated under the laws of the state of New York, for the "improvement of social and living conditions of the United States of America," and to it she gave $10,000,000. The Foundation made many surveys of social and educational conditions in various states and issued many publications dealing especially with housing improvement and reform. In 1912 Mrs. Sage bought Marsh I., off the Louisiana coast, containing about 79,000 ac., later turned over to the state as a permanent refuge for birds. She died in New York City Nov. 4 1918. Her will provided that after enumerated bequests to relatives and friends amounting to about $12,000,000, the residue, some $36,000,000, should be divided into 52 parts and variously distributed to many colleges, museums, hospitals, charitable institutions, Bible societies and missions. To most of these she had made gifts during her lifetime. The largest portion, seven parts, was left to the Russell Sage Foundation. It was estimated that during her life she had made public gifts of some $40,000,000.

SAID, HALIM, PRINCE (1859–1921), Turkish statesman, was born at Cairo in 1859, a nephew of the Khedive Ismail. He was a keen politician, and became the official head of the Young Turk party, which carried out the revolution of 1908. He was called upon by Sultan Mahommed V. to form a Cabinet in 1911, and remained at the head of affairs until July 1912. After the murder of Shefket Pasha in June 1913 he became grand vizier and Minister for Foreign Affairs, and during his tenure of power was a strong supporter of German influence in Turkey. He resigned in Feb. 1917. He was murdered in Rome Dec. 6 1921.

SAID PASHA (*c.*1830–1914), Turkish statesman (*see* 23.1008*), again became chief minister in the autumn of 1911, and in Dec. proposed to restore to the Sultan the power of dissolving the Chamber without the assent of the Senate. This proceeding gave rise to many storms, and Said Pasha reconstructed his Cabinet Jan. 22 1912. On Jan. 21 he published in the London *Daily Telegraph* the proposed reform programme of his Ministry. He was forced to resign July 17 1912 owing to the strength of the revolutionary movement in the army. He died in 1914.

ST. ALDWYN, MICHAEL EDWARD HICKS BEACH, 1ST EARL (1837–1916), English statesman (*see* 23.1013), was created an earl in 1915. He died in London April 30 1916.

ST. JOHN, FLORENCE (1854–1912), English actress, whose maiden name was Greig, was born at Tavistock, Devon, March 8 1854. She was three times married, first to Mr. St. John, R.N., secondly to Lithgow James, and lastly to C. D. Marius, both on the stage. Her first appearance was in 1868, and she subsequently

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** These figures indicate the volume and page number of the previous article.*

played in a very large number of light operas, winning special success as Germaine in *Les Cloches de Corneville* and in *Madame Favart*. In 1902 she abandoned opera for drama, playing Nell Gwynne in *English Nell* and other comedy parts. She retired in 1910 and died in London Jan. 30 1912.

ST. LOUIS (*see* 24.24).—The pop. of St. Louis in 1920 was 772,897, an increase of 85,868 since 1910, or 12·5%. In the preceding decade the increase was 111,791 or 19·4%. The area remained as fixed in 1876, but the increasing pop. and industries have spread beyond these limits. The city, the counties of St. Louis and St. Charles in Missouri and the counties of St. Clair and Madison in Illinois are grouped as the St. Louis district and treated as a whole in the U.S. industrial census. In 1920 the district contained 1,145,443 inhabitants.

Municipal Government and Activities.—A new charter adopted in 1914 reduced the elective officers to mayor, comptroller, president and board of aldermen, collector, treasurer, recorder of deeds, sheriff and coroner, with terms of four years. The legislative branch is unicameral. Each of the 28 wards has a resident alderman elected by the entire city vote, one-half of the board retiring biennially. Mayor, comptroller and president of the board of aldermen form a board of estimate and apportionment. An appointive board of public service consists of a president and four directors of divisions, public welfare, public safety, public utilities, and streets and sewers. Municipal departments and bureaus are grouped in the four divisions. The president of the board has charge of public work and improvements. In 1919 the city's outstanding bonds amounted to $19,884,000, to which in 1920 was added $5,500,000 for removal of railway grade crossings, for a municipal farm to afford better treatment of the tubercular and insane, for new engine houses and reconstruction of streets and for municipal lighting equipment. The tax rate for 1920–1 was $2.55 per $100 assessed valuation, divided as follows: state purposes, $0.18; public schools, $0.78; municipal government, $1.51; public library, $0.04; art museum, $0.02; zoölogical park, $0.02. The assessed valuation of realty and personalty for 1920–1 was $777,500,000. City planning was undertaken in 1912 with a commission of nine citizens and five *ex-officio* members. The work done includes a concrete dock, mechanically equipped to convey freight between river and railways. A zoning law determines definitely the residential, industrial and commercial districts; 29 street widenings, openings and cut-offs were under construction in 1921. Neighbourhood parks, playgrounds and squares were increased to 80, embracing 2,908 acres. A pageant and masque given by 2,000 participants before audiences of 100,000 led to the construction in 1917 of a municipal theatre in Forest Park, with accommodation for 9,270. At a cost of $7,200,000, the city completed in 1917 a municipal bridge of massive steel construction, double track and double deck, across the Mississippi. About five years earlier the McKinley bridge was erected by the Illinois Traction Co., primarily to admit interurban electric trains. Kingshighway viaduct, 855 ft. long, completed in 1912 at a cost of $500,000, crosses the railway tracks and unites western sections of the city. A municipal court building, a city jail and a children's detention house, all of stone, were erected, the first in 1912, the others in succeeding years, at a cost of $1,855,000.

Charities and Education.—At a cost of $5,000,000 a new medical school, hospital and children's hospital, occupying several city blocks fronting on Forest Park, have been completed since 1911. The hospital, opened in 1914, represents an investment of $2,000,000, the sum left 50 years ago by Robert A. Barnes, a banker whose name the institution bears. The medical school, a department of Washington University, includes laboratory, anatomical, clinical and other buildings. In 1914 James Campbell left an estate, valued at $10,000,000, in trust to St. Louis University (subject to the life income of certain surviving relatives) for the erection and support of a hospital and for the advancement of medicine and surgery. From the surplus of the Louisiana Purchase Exposition was constructed in 1914 the Jefferson Memorial costing $485,000 and devoted to the collections of the Missouri Historical Society. On new public school buildings, and expansions of old, St. Louis expended during 1910–20, $3,177,000.

Finance.—In 1920 the assets of the banks and trust companies of St. Louis were $637,615,811.45, and bank clearings were $8,294,027,135; in 1910 the latter were $3,727,949,379. The First National Bank, with total resources of $155,953,137, was formed in 1919 by a consolidation of three existing banks.

Commerce and Industry.—According to the records of the Merchants' Exchange and the Chamber of Commerce, 35 lines of industry in the St. Louis district did a business in 1920 of $1,582,957,145. Some of the largest items of wholesale trade in 1920 were dry goods, $240,000,000; carpets, rugs and linoleums, also $240,000,000; boots and shoes, $175,000,000; groceries, $175,000,000; railway supplies, $210,000,000; hardware, $115,000,000; foundry products, $125,000,000. St. Louis receives 70,000 H.P. by a 110,000-volt transmission line from the Keokuk dam in the Mississippi at Keokuk, Ia. Motor licenses issued in 1914–5 numbered 9,867, and 45,949 in 1919–20. The position of St. Louis as the largest horse and mule market in the world was maintained, the volume of business in 1919 being $50,000,000. The city continued to be the largest primary fur market of the world, with sales of $27,200,000 in 1920. Sales of meat products in 1919 were $128,000,000; hog receipts, 3,650,534; head cattle receipts, 1,500,000. The foreign trade of St. Louis was $100,000,000 in 1920, an increase of $25,000,000 over 1919. The total tonnage shipped out of St. Louis in 1920, domestic and export, was 29,036,405 (by rail) and 166,140 (by water); tonnage received in the same year was 43,104,519 (by rail) and 177,925 (by water).

The more important new buildings of the period 1910–20 with the amounts they cost were: the Statler hotel, $3,000,000; the Warwick hotel, $400,000; the cathedral of St. Louis, $2,000,000; the Missouri athletic club, $500,000; the Railway Exchange, $3,000,000; 18 storeys, covering an entire city block; the University club, $600,000; the Young Women's Christian Association, $500,000; the Boatmen's bank, $750,000; the Arcade, $1,250,000; the Post-Despatch building, $500,000; the Bevo Manufacturing Company, $1,000,000. The cost of new buildings in 1919 was $20,538,450.

The *St. Louis Republic*, a morning newspaper founded in 1808, was purchased in 1919 by the St. Louis *Globe-Democrat* (a Republican paper), and discontinued. This left two morning newspapers, the *Globe-Democrat*, and the *Westliche Post* (German). There was a marked increase in the circulation of the evening papers.

When the Armistice was signed Nov. 11 1918 one in 13 of the city's pop.—56,944—was in the army, navy or marine corps. The total casualties were 2,511, of which 1,384 were killed in battle. Of the three Liberty Loans, St. Louis took the equivalent of 25% of the assessed value of the city's realty and personalty. On the third, fourth and fifth calls for loans the St. Louis Federal Reserve district was the first to subscribe its quota. On the third loan the city subscribed $65 for every man, woman and child, nearly three times the quota. (W. B. St.)

ST. MIHIEL, BATTLE OF: *see* WOEVRE, BATTLES IN THE, section 2.

ST. PIERRE and **MIQUELON** (*see* 24.41).—During the early years of the decade 1910–20 this little French colony suffered severely as a result of unprofitable fisheries, and large numbers of its people emigrated to Nova Scotia and Quebec. After the World War began in 1914 the French draft law called all the male inhabitants of conscript age to France where they took part in various services. As their withdrawal crippled the fisheries, which could not be prosecuted by the older people and the women and children, the survivors were returned as speedily as possible and ordinary operations were resumed. But during the decade, also, the use of the steam trawlers in the fisheries was on the increase, displacing the wooden sailing vessels previously employed, and this also lessened the number of those finding steady employment. However, during the later years of the war, with fish increasing in value, the colony became very prosperous, and after the Armistice the French Government decided to build a large refrigerating plant, costing about £1,000,000 at St. Pierre for the treatment of cod and other fishes. The financial success of this project was doubted by many, but this deep-sea fishery was being supported by France as a training school of men for its navy, and for the same reason generous bounties are given on all the fish caught. The pop. was in 1920 about 4,500, but the prosperity of the little community was impaired by the difficulties of exchange.

SAINT-SAËNS, CHARLES CAMILLE (1835–1921), French musical composer (*see* 24.44), died at Algiers Dec. 16 1921.

SAINTSBURY, GEORGE EDWARD BATEMAN (1845–), English man of letters (*see* 24.45), published subsequently to 1910 a *History of English Prose Rhythm* (1912); *The English Novel* (1913); *A First Book of English Literature* (1914); *The Peace of the Augustans* (1916); *A History of the French Novel* (2 vols., 1917–9) and *Notes on a Cellarbook* (1920).

SAIONJI, KIMMOCHI, PRINCE (1839–), Japanese statesman, was born in Kyoto, in 1839. When less than 20 years of age, he took part in the councils which led to the Restoration and at 19 was commander-in-chief of an imperial army. He studied in France from 1869 to 1880, and returned home imbued with democratic ideas. In 1881 he commenced his official career and in the following year accompanied Mr. (afterwards Prince) Ito to Europe and the United States to investigate the parliamentary system. In 1885 he was appointed minister to Austria; in 1888 he occupied a similar post in Berlin and in 1891 was appointed president of the Board of Decoration. In 1893, he became vice-president of the House of Peers and was raised to the Privy Council in 1894. In the same year he received the portfolio of education in the second Ito Cabinet, temporarily acting as Minister of Foreign Affairs during the illness of the late Count Mutsu. He was again Minister for Education in the third Ito Cabinet from Jan. to June 1898, and was nominated president of the Privy Council on the death of Count Kuroda, three times acting as prime minister during the interval between the resignation of one Cabinet and the formation of the succeeding one. In July 1903, he became the leader of the Seiyu-Kai and in 1905 formed his first Cabinet as prime minister; he was again premier in 1911 to 1912. In 1919 he represented Japan as chief envoy at the Peace Conference and was invested with the Grand Order of Merit. He was made a prince in 1920 in recognition of his services in connexion with the World War and the Peace Conference.

SAKHALIN (*see* 24.54).—The Japanese portion of the island of Sakhalin, to the S. of the parallel of 50° N. lat., known officially as Karafuto, was ceded to Japan under the treaty of peace with Russia in Oct. 1905. The area is about 13,148 sq. m. and the pop. in 1920 was 105,765. The taxes and other sources of revenue from the island, with the addition of a grant of about 700,000 yen from the national treasury, are sufficient to cover the administration, the budget balancing at about 10,000,000 yen.

The chief industry of the island, and one of the oldest, is that of the fisheries, and these are being successfully developed. The most important is the herring fishery, followed by trout and salmon, these all being relegated to specially controlled areas; cod and crab are also plentiful, the latter being canned and exported chiefly to America.

About 17,000 ac. of land were under cultivation in 1918, the chief crops raised being oats, barley, potatoes, peas and buckwheat. More than 900,000 ac., suitable for cultivation and pasturage, are still available and many settlers are engaged in agriculture, the climate and soil rendering this a profitable undertaking. There are over 8,000,000 ac. of practically untouched forest, chiefly conifer, on the island, providing in the future an almost inexhaustible supply for the manufacture of pulp for paper-making. In consequence, five pulp manufactories have already been established, each producing over 10,000 tons per annum, and five more are projected.

There are three important coal-fields in the island, producing about 136,000 tons annually. Alluvial gold is found in the river beds, iron pyrites exist in large quantities in the Notoro peninsula, and in 1907 and 1913 oil-bearing strata were discovered on the W. coast in large areas at Anshi and Notasamu. (H. SA.)

SALANDRA, ANTONIO (1853–), Italian statesman, was born at Troia in 1853. He first entered parliament as member for Lucera and from the beginning of his political career he sympathized with the views of Baron Sonnino. When the latter became Treasury Minister in the Crispi Cabinet of 1893, Salandra was chosen under-secretary in that department. He was Minister of Finance in the first Sonnino Cabinet of 1906 and Treasury Minister in the second (1909–10). When in March 1914 Sig. Giolitti resigned, Sig. Salandra was called upon to form the new Cabinet, and he was Premier when the World War broke out in Aug. following. On the death of the Marquis di San Giuliano in Oct. he offered the Foreign Office to his former chief, Baron Sonnino, who accepted it. It was the Salandra Cabinet which took the momentous decision of bringing Italy into the World War on the side of the Allies, and it conducted the Government of the country during the first months of the campaign more successfully than any of the succeeding war Cabinets. On resigning office in June 1916, he continued to support both the Boselli and the Orlando Cabinets. As professor of Constitutional Law in the university of Naples he published several important works on legal subjects, and translated Spencer's *Principles of Sociology*.

SALISBURY, JAMES EDWARD HUBERT GASCOYNE-CECIL, 4TH MARQUESS OF (1861–), English politician, eldest son of the 3rd marquess (*see* 24.76), was educated at Eton and University College, Oxford, where he took a second-class in History in 1884. The next year he entered Parliament as member for Darwen. He was defeated in 1892, but he returned as member for Rochester in 1893 and remained in the House of Commons till he succeeded his father in 1903. He fought in the S. African War with the 4th battalion of the Bedfordshire regiment, and was mentioned in despatches. On his return in 1900 he became Under-Secretary for Foreign Affairs, a post which on succeeding to the peerage he quitted for that of Privy Seal in the Cabinet of his cousin, Mr. Arthur Balfour; and he held, for some months in 1905, the office of President of the Board of Trade. Lord Salisbury never loomed large in the House of Commons, though he was for some years chairman of the Church Parliamentary Committee, and discharged competently his duties as Foreign Under-Secretary. But he gradually came to occupy a position of increased authority in the Upper House. He threw in his lot in 1911 with the "Die-hards," and spoke in favour of defeating the Parliament bill and daring the Government to create sufficient peers to carry it. During the early years of the war he was energetic in the discharge of his military duties as lieutenant-colonel of his yeomanry regiment. He did not join either Coalition Government, but was critical of both, taking an independent line. As the war drew to a close he gradually came to assume the informal leadership of a Conservative and Unionist Opposition in his House, showing himself particularly sensitive to departures from the old policy of his party on Irish and ecclesiastical questions. He married in 1887 Lady Cicely Alice Gore, daughter of the 5th Earl of Arran, and had two sons and two daughters. He was created K.G. in 1917.

SALONIKA CAMPAIGNS, 1915–1918.—Under the heading of SERBIAN CAMPAIGNS the conquest of Serbia in 1915 by Austro-Hungarian forces is narrated. The idea of reinforcing the Serbian front with Allied forces had been contemplated both in England and in France some time before it was carried out. British and French guns, in charge of naval missions, had taken some part in the campaign of 1914, and stores had been sent up from Salonika at intervals. In the winter of 1914–5 Lord Kitchener several times considered the advisability of sending a number of the British Army Divisions into Serbia *via* Salonika. On the part of the French, M. Briand, it is said, proposed later in 1914 to make a serious military effort in the Balkans. But the Dardanelles campaign diverted attention from this project, and it was not till in August 1915, when the failure of the Dardanelles offensive was evident, that the creation of an Anglo-French army on the Balkan front was seriously undertaken. General Sarrail, whose military reputation stood very high in France, had been suddenly deprived of his command of the III. Army by Joffre, ostensibly owing to an unsuccessful combat at Boureuilles in Argonne, but really as the result of long-continued friction between the two. Sarrail, however, stood in close relations with the political leaders of the Left, and the autocratic methods of Joffre's G.Q.G. had already raised considerable opposition in the Government and the Chamber; it suited the Government, therefore, to satisfy the Left, to snub the G.Q.G., and to remove to a distance a forceful and ambitious personality, by sending Sarrail to the Mediterranean as commander of an army yet to be created.

Appointed on Aug. 5, Sarrail was ordered to study the military situation and submit proposals. In his written projects he came to the conclusion that it was impossible to abandon ground in the Gallipoli peninsula, and had asked for both his own and the British contingents to be made up entirely from forces in France or in England. An inter-Allied conference, held at Calais early in September, had agreed to this, but with the reservation that no forces were to go till after the forthcoming Champagne and Artois offensives had taken place. But the news of the Bulgarian mobilization drove home at last the urgency of the crisis. Orders went to the Dardanelles on Sept. 26 for two British Divisions—in the sequel one—to go thence to Salonika; the French "Expeditionary Corps" was likewise to send a Division, and the Greek authorities had agreed to permit the landing. Sarrail himself was to bring a mixed brigade from France, as an earnest of the forces promised later.

On Oct. 3 advanced parties of the French landed at Salonika without difficulty, only a formal protest being made by the authorities on the spot. Next day M. Venizelos in a speech at Athens declared that Greece would come to the aid of her ally Serbia against any attack by Bulgaria, and at once a crisis arose at Athens. On the 5th King Constantine informed Venizelos that the policy indicated had not his support, and the Government fell, to give place to the neutralist Zaimis cabinet.

During the first few days instructions from Paris to Bailloud (commanding on the spot pending Sarrail's arrival) varied several times, apparently in accordance with political nuances. At first (Oct. 3) the word was to concentrate at Nish, in the heart of Serbia; next, the Greek frontier was not to be crossed (Oct. 10); and then again (Oct. 12) authority was given to take over protection of the railway between Demir Kapu defile and the Greek frontier against possible attack from Strumitsa in Bulgaria, thereby releasing a small Serbian force to rejoin its own army. Meantime the Serbians demanded more direct assistance, but Sarrail (who arrived on the 12th), taking into account the size of his force—only $1\frac{1}{2}$ divisions plus the British 10th Div. which was not under his orders—and the fact that it could only disembark and push on by driblets, determined to limit his advance to the near side of Demir Kapu. On Oct. 14 the leading French troops arrived at Strumitsa station (in Serbia) in time to aid the Serbian railway guards in repelling an inroad from Strumitsa.

In Sarrail's opinion the only service he could render was to concentrate on the routes to Strumitsa; and, by an offensive into Bulgarian territory, to draw off as many Bulgarian forces as possible from the main attack further north. General Mahon, commanding the British 10th Div., took the same view,[1] and formed a mixed force which began to move up to Doiran, on the right rear of the French group in the Rabrovo region. On the 17th, however, in answer to a request from the Serbian commander at Uskub, Sarrail began to push a brigade beyond the Demir Kapu defile to Krivolak, but he refused to advance it to Veles, though again pressed to do so by the Serbs, and in fact a sharp attack developed from Strumitsa on Rabrovo on the 21st and 22nd, which, till it was repulsed, threatened to isolate all French detachments N. of Strumitsa station. Meanwhile, Paris sent further instructions to the effect that all possible help should be afforded to the Serbs, subject to the limitation that the French communications with Salonika were in no case to be compromised. In reality, the French and British Governments were very uneasy about the attitude of the Greek Army, a considerable force of which lay in the region N.E. of Salonika. The fall of Venizelos had put an end to the prospect of Greek coöperation, and under the new régime the local military and civil authorities began to oppose every move of the Allies, which was not entirely covered by Serbia's treaty rights, to the use of Salonika and the railway. Thus, when Mahon's force moved forward the use of the Salonika–Kilkish (Kukush)–Doiran line was refused, and it had to use the main line, detrain in the midst of the French, and work thence outwards towards its post at Doiran.

On Nov. 1 the 122nd French Div. began to arrive from France, and Sarrail had already prepared to attack from Rabrovo towards Strumitsa with Bailloud's 156th Div., with Mahon in echelon behind his right, while his forces about Krivolak and Kavadar (51st Div.) made ready to attack in flank any Bulgarian force which should advance up the Cerna (Tserna) in pursuit of the Serbians. On Nov. 3 an attack was accordingly delivered northward from a front E. of Rabrovo; weather and the difficulty of the country brought it, however, to a standstill on the 6th, though local advances were made later. At this moment (Nov. 4) Galliéni, having become War Minister in the new French cabinet, telegraphed orders for the French Army to operate towards Veles, adding that four more British divisions were to be sent, which on arrival would take over the front leftwards from Doiran. The British 22nd Div. was in fact already close to Salonika, with another under orders to follow. But Sarrail judged that it was impossible to wait for these reinforcements. Todorov's Bulgarian Army had already thrust itself between the Serbian Main Army and Krivolak, and the urgent thing was to relieve pressure on that part of the Serbian forces which was retiring by the Babuna pass on Prilep, while reserving the possibility of action towards Veles if the Serbian Main Army should after all seek to break through towards its Allies. Orders were therefore given to the Krivolak-Kavadar force (57th Div. to be reinforced by the 122nd Div.) to take the offensive westward over the Cerna, so as to strike the pursuers in flank or rear. On the 6th–9th accordingly the 57th Div. crossed the Cerna and pushed an advance into the mountains towards the Babuna, still held by the Serbs. But the Bulgarians were in force, and the French retired to their Cerna bridgeheads, which the Bulgarians attacked without success on the 12th, 13th, 14th and 15th.

During these and the following days instructions came repeatedly from Paris to modify the French commander's views and dispositions, now laying emphasis upon coöperation with the Serbs, now upon dangers from the Greek Army in rear. Finally on Nov. 21 Sarrail was given a free hand to decide what aid he could give to the Serbians and at what moment he should retire on Salonika. He adopted at first a middle course. He wished neither to attack at the risk of involving two-thirds of his forces in the Serbian *débâcle* (the Babuna had been turned by the N. on Nov. 14), nor to fall back to Salonika, where prestige counted for so much, but to hold on in the entrenched camp of Kavadar in the hope of "something turning up." On the 21st–22nd, however, the retirement of the 122nd Div. over the Cerna under some pressure, together with the general military situation and a definitive refusal of reinforcements from France,[2] decided him in favour of falling back to Salonika, a decision approved by Galliéni. Four days later Sarrail was officially informed that the Serbians were retreating in the Adriatic direction. The preparations for the Vardar retirement had already begun on the 24th with the seizure of a position on the E. bank, to prevent interference with the retreat of the Krivolak-Kavadar force on Demir Kapu. On Dec. 1 only rear-guards remained at Krivolak. By the night of the 3rd–4th all troops were inside Demir Kapu, and on the 6th this position also was given up. On the 8th the Bulgarians, who had from time to time attacked the rear-guards on the Vardar and the positions near Kosturino on the Strumitsa route, delivered a more concerted attack on the front Ormanli (now held by the British)–Kosturino–Gradets on the E. and Mirovcha Petrovo on the W. of the Vardar. Their evident intention was envelopment, and on the 9th, judging the centre of his line to be too pronounced a salient, Sarrail took up a position along the Petrovska stream, W. of the Vardar and the heights of Dedeli E. of it, the village of Dedeli being held by Mahon's forces, which from that point were echeloned back to Lake Doiran. From this position also the Allies retired under threat of envelopment during the night 11–12, after holding their ground against attacks on the 11th. Lastly, the French 122nd and 57th Divs., at Gyevgyeli (Gevgeli) and near Doiran, covered the evacuation of part of Mahon's force on to the Salonika railway and the reconstitution of the 156th French Div., which had been considerably split up.

Thus the drive into Serbia came to an end, with little material loss, but a sad diminution of prestige, and the forces fell back to the following positions about Salonika: advanced guards of 120th French Div. Karasuli with a detachment at Gumenye, and of 57th French Div. with cavalry, Kilkish, with a detachment at Kilindir; main body (122nd, 156th, 57th) in position on the line Doganyi–Daudli. British 10th and 22nd Divs. Salonika, with other British forces arriving. Important points on the railway had been destroyed during the retreat. Meanwhile, on Dec. 4, the Serbs had evacuated Monastir in their now frankly westward retirement.

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[1] According to Sarrail, the British Government instructed Mahon that his troops were to remain at Salonika, and it was on his own initiative that the British general formed a mobile force. Further instructions authorized Mahon to move forward but forbade him to cross the Greek frontier, until on Oct. 27 a final telegram removed this restriction.

[2] At that moment, according to Falkenhayn, the combatant strength of the Allies in France was to that of the Germans in the ratio of rather more than 3 to 2. Sarrail says that in his interview with Lord Kitchener on Nov. 17, the latter informed him that Joffre had declared that he would not give him (Sarrail) another man, and that the British would furnish five divisions instead. In accordance with this promise, besides the 10th and 22nd Divs., the 27th and 28th Divs. from France landed at Salonika in the last days of Nov. and first days of Dec., and the 26th Div. also from France, early in Jan. 1916.

The reassembly of the Allied Salonika forces around their port of origin naturally raised the question—were they to remain there? Their *locus standi* had been the fact that they were Allies of Serbia using a line of communications to which Serbia was by treaty entitled. This part of the case no longer existed, Serbia being wholly in the hands of the enemy, and could only be revived if and when the Serbian Army were transferred from the Adriatic ports on which it had retreated to Salonika. Another part of the justification for the Allies' presence was the admitted fact that they had come at the request of Venizelos, and for the purposes of common action with the Greeks, but since Venizelos's fall even the Zaimis cabinet, representing "benevolent" neutrality, had given way to a cabinet representing at least strict neutrality,[1] which gave the Germanophil element at Salonika all the official justification it needed to pursue the policy of obstruction that it had already initiated in the Zaimis period. On the other hand the factor of prestige was one of great weight, especially in view of the pending abandonment of the Dardanelles campaign, and although Sarrail suggested that evacuation followed by a dramatic offensive at some other point would more than restore the lost prestige, it was decided that Salonika should be held. Beyond that decision, however, no clear military or political intention was at that time formed. The policies of the British, French and Russian Governments were in unison as to the problem of Greece, and it seems to have been thought that, by remaining, the Salonika force would confront the enemy with as difficult a diplomatic problem as its own. This was, indeed, the case. The policy to be followed by the Central Powers, both towards Greece and in occupied Serbia and Albania, was wholly unsettled. "While the troops of the two Imperial Armies were hastening from victory to victory," says General von Cramon, the German military commissioner at Austrian headquarters, "behind the scenes, at the two general headquarters, the clouds were gathering of that conflict which in the end brought about the reverses of 1916." Although on Nov. 6 it had been agreed that operations were to be pushed with all energy towards Salonika, Falkenhayn almost immediately began to check the further south-westward advance of German troops, and though Conrad succeeded in bringing the German command to renewed coöperation, this was obviously to be limited to a minimum, both on account of supply difficulties in the Balkans and of the pressing requirements of the two main theatres—in particular those of the forthcoming attack on Verdun, of which only a few men in the German headquarters and none in the Austrian had the secret. Falkenhayn's view was that the Bulgarians alone should undertake the campaign in southern Serbia. But, whatever the attitude of Greece towards Germany, it was so hostile towards Bulgaria that to cross the frontier in pursuit of Sarrail without a large proportion of German troops being included in the advance was politically impossible. Austria herself was absorbed in Montenegrin-Albanian enterprises, and could give no direct assistance in the advance to Salonika that her general staff advocated. Moreover, Conrad had his secret as well as Falkenhayn—he was planning to carry out his offensive of Asiago, with or without the aid of Germany.

At the end of 1915 therefore, though the Central Powers had succeeded in their purpose—Serbia being conquered and the railway to Constantinople reopened—whereas the Entente had failed, the outlook was no clearer for the former than for the latter. The pursuit was accordingly suspended at the frontier, partly perhaps in the hope that the Entente would itself take the initiative in closing down the operations. If they did not do so Falkenhayn was determined that eventually the Bulgarians alone should remain on this front. They were, by the terms of the military agreement, unavailable for any other, and if they succeeded in containing even a smaller force of Entente troops that was not so limited, something was gained for nothing. On the other hand this idea implied a defensive position short of the Greek frontier, as a purely Bulgarian advance into Greece was impossible. Thus, at the beginning of 1915, the opposing forces stood roughly 20 m. apart, each limited against its own will to a strict defensive by political conditions and each regarded by its own superior authorities as a "commitment."

At the end of the year two incidents occurred to illustrate the complexities of the Salonika front. On Dec. 30, though Bulgarian and German forces were forbidden to cross the frontier, German aircraft, by order, bombed the city of Salonika itself, where nine out of ten of their possible victims were neutrals and the tenth an agent of their own side. Sarrail promptly retaliated by arresting the German, Austrian and Bulgarian consuls, hitherto left unmolested. Another air raid took place on Feb. 1 1916, to which the Allies replied by bombing the village of Petrich, just within the Bulgarian frontier, but as the village contained Greek and Serbian as well as Bulgarian inhabitants, a complaint was made, and Sarrail received orders not to repeat such raids. A few days before this another incident showed that the personal estrangements of Joffre and Sarrail were still operative. The army of the Orient had been brought under Joffre's command[2] early in December, and Joffre had taken the opportunity to send out Castelnau to report on Sarrail's management of the situation. Castelnau, however, pronounced himself satisfied with what he saw, and only issued a few instructions as to details. Nevertheless, in various ways the friends and the enemies of Sarrail alike busied themselves with accusations and counter-accusations, out of which a regular *affaire* was growing up to complicate an already confused situation. Relations between Sarrail and Mahon on the other hand were excellent, and although each was independent of the other, and the British general was himself under the command of General Sir C. Monro, commander-in-chief in the Mediterranean, no important divergencies of policy developed during the phase of passive defence in the precincts of Salonika.

With the Greeks, naturally, all possible causes of friction existed. Army commanders operating under war conditions are not prone to sacrifice realities to appearances, and what seemed to them plain military common sense was, from the point of view of the Greeks, high-handed conduct to be resisted by all safe means of obstruction. Amongst the major questions at issue were the disarmament of the coast defences of Salonika, the use of the Salonika-Doiran railway for the British contingent, the feeding of the Greek forces E. of Salonika who were dependent for supply upon railways seized by the Allies, and the continuance or non-continuance of the Greek garrison in Salonika city. Minor questions of an administrative character were naturally innumerable. Most of the energy of the staffs in Salonika and the legations at Athens was devoted to finding solutions for conflicts which the equivocal position of the Allies made inevitable.[3] During these conflicts the Salonika lines, with the aid of civil labour, were made defensible by the first weeks of the new year. The line selected ran from the Vardar mouth, round by Doganzi and Daudli to the neighbourhood of Langaza, whence it passed along the barrier of lakes to the head of the gulf of Orfano—80 m. of frontage for a force of nine divisions.[1] Of this frontage, however, nearly 45 m. was guarded by lake and swamp; and, taking into account the presence of large bodies of Greek troops in the Seres–Rupel region to the right front and in the Vodena–Florina region to the left front, Sarrail considered that danger was practically confined to the central sector between Lake Langaza and the Vardar, in the event the position was ever attacked.

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[1] The first act of the Skouloudis ministry had been to announce that any of the Allied forces in Serbia which retreated into Greece would be disarmed and interned. A prompt note from the British and French Governments closed this incident, but the indication of policy was unmistakable. About the same time Skouloudis notified the Bulgarian Government that it would not permit the latter's troops to cross the frontier.

[2] Joffre was *Commandant en Chef* of the "North-Eastern group of Armies," no other formations having been contemplated before the war. On being sent to the E. Sarrail was appointed *Commandant en Chef* also. But, in Dec., Briand placed Sarrail's forces under Joffre's supreme command.

[3] On Jan. 12 1916 the bridge of Demir Hissar on the Struma was blown up by a special force sent out by Sarrail in the presence of the Greek forces stationed there—a high-handed act which could only be excused or justified by the necessity of preventing the Bulgarians and Germans from deploying heavy artillery against the N.E. part of Salonika in case of siege. On Jan. 28 1916 another problem received an enforced solution, after negotiations had failed to find an "elegant" one. Anglo-French forces by a *coup de main* occupied the Greek coast-defence batteries on the Gulf of Salonika. These incidents naturally intensified the hostility of the Greek officers and officials to the Allied occupation, or at least gave them tangible grievances. In particular, the feeding of the Greek forces isolated by the cutting of the Struma railways caused difficulties, and from it, in part at any rate, arose the critical question of demobilizing the Greek Army in the Spring of 1916.

During this period (Jan.–Feb. 1916), the Bulgarians were reinforced by the German XI. Army (von Gallwitz) consisting of the IV. Res. Corps (101st and 103rd Divs.) and the Alpine Corps, and by their own 1st Army, all these forces aligning themselves along the Greek border from Lake Ohrida to the point at which the Struma enters Bulgarian territory. The 1st Bulgarian Army, with flank guards at Dibra and Elbasan in Albania, had two divisions[2] on the front S. of Monastir–Duditsa; the XI. German Army, with 1½ Bulgarian Divisions attached, held the Vardar valley between Duditsa and the Belashitsa Planina, and Todorov's II. Bulgarian Army of three divisions that ranged from Strumitsa to Petrich, with detachments further E. at Nevrekop (Mesta valley). But in March Falkenhayn began to withdraw all the German formations save the 101st Div., which continued in the Balkans and was gradually reduced to a cadre. On his side Sarrail made some slight demonstrations towards Doiran and towards Vodena, but otherwise no move occurred. Early in March 1916, however, in the crisis produced by the attack on Verdun, Joffre telegraphed orders to Sarrail to advance in order to fix the enemy's forces on his front. On the other hand General Mahon, on asking for instructions, was forbidden to move until authorized by the British Government.[3] The relief offensive, therefore, was limited to a skirmishing advance by the French, which began on March 13, and gradually brought the French 51st Div. to the N. of Kilkish, and the 122nd to the N. of Lake Amatovo, the 156th between them (March 31).

During April 1916, while French cavalry moved out W. of the Vardar towards Vodena and the 17th Colonial Div. came up behind the centre, the British in their turn began to move up to Kilkish, authority to participate "in an operation of a demonstrative character" having been given by the War Office about April 10 (Joffre to Sarrail, April 20). Lastly, the Serbian Army, reconstituted and partially reëquipped at Corfu, was beginning to land at Salonika, and by June 1 118,000 combatants and non-combatants were present, completing their equipment and organization in the Chalcidic peninsula. These methodical proceedings, however, did not satisfy Joffre, whose instructions to Sarrail from March onwards were to prepare for an offensive in earnest. To Sarrail's demand for reinforcements for such an offensive, the French commander-in-chief replied that the French Army of the E. must prepare to attack at the moment fixed by himself, even without the British. In explanation, he hinted that when that moment came, not only would British objections be removed, and all five British divisions be equipped for mountain warfare (making Sarrail's total force, with the Serbians, 300,000 strong to the enemy's 260,000), but Rumania and Greece would be in the field as his Allies. Thus for the first time since the Serbian retreat the Salonika force was assigned to a positive purpose. It will appear in the sequel how much of reality and how much of illusion was contained in the scheme, which, in sum, was to attack at a date chosen in relation to other theatres and especially Rumania, with Sofia as the objective.

Meantime, an important incident had taken place on the Struma frontier. In accordance with their declared policy of standing aside and leaving a "lists" for the combatants, the Greeks had disarmed and evacuated their fort of Dova Tepe, situated on the watershed between the Vardar and Struma basins and commanding a knot of communications. In the course of his gradual advance to the frontier, Sarrail put a detachment into this fort on May 10. But further to the right, outside his reach, lay a still more important fort, that of Rupel defile. This fort was not merely disarmed but actually handed over to the Bulgarians by the local Greek general, with or without authority from Athens (May 26).

Events had moved. Though the German forces (except the cadre of the 101st Div.) had by this time been withdrawn from the Balkan front, the Greeks had apparently overcome their repugnance to a purely Bulgarian inroad, to the extent of actually facilitating it. The Allies' right was, potentially, turned, and if the occurrence were any indication of probabilities of the future, their rear also was endangered. Action was taken promptly by Sarrail. A mobile group of all arms was moved into the Struma region, and with the agreement of Gen. Milne (who in May succeeded Mahon in command of the British) and of the Entente Governments, the Greek authorities at Salonika were deprived of power by the proclamation of a state of siege (June 3). A day or two later London and Paris also acted. An economic blockade of the Greek coast was declared, and on the 18th Sarrail was ordered to send a brigade by sea to Athens. King Constantine accepted the ultimatum of the Allies (June 21), and Zaimis returned to power on the basis of friendly neutrality. A little later the Rupel incident had its last and most important sequel in the Venezelist *coup d'état* of Aug. 30.

Militarily the seizure of Rupel, carried out at the suggestion of Falkenhayn, seems to have had no truly offensive intention. The Central Powers had abandoned the idea of invading Greece once for all about the end of March, and the Bulgarians acted with the idea of guarding their left, and securing connexion with any Turkish forces which might be sent to their aid by the Constantinople–Seres railway, though in view of the situation in Armenia such a reinforcement was unlikely. As for Sarrail, so also for his opponents, the Balkan front was already involved in a larger game.

As has been noted above, the idea of an Allied offensive from Salonika in coöperation with a Rumanian intervention came under discussion as early as mid-April; at that time Joffre seems to have thought that this intervention might come in a few weeks, for he overruled Sarrail's objections to commencing operations in the hot weather, and fixed the month of June for the beginning of the offensive. Under these instructions Sarrail formed his first plan (May 2) which was, in brief, to employ the Serbs on the left wing for the attack of Monastir (frontally and by envelopment), and for pressure on the Cerna bend and the passes further E. towards the Vardar; to place a French division on the Vardar and the railway; to have three British divisions, with a fourth on their right rear, so placed as to execute a demonstrative attack on the strongest part of the enemy's front, viz. Vardar–Doiran; and to attack with three French divisions from Popovo Surlovo–Dova Tepe and Poroy northwards through the Belashitsa Planina, while the French Struma mobile group demonstrated towards the Demir Hisar angle of the Struma, and the fifth British division with cavalry watched the lower Struma front. In case the semi-offensive, semi-demonstrative, operations should develop into a real advance, the Serbs were to take Veles and Shtip, the British Radovishta–Strumitsa, and the French Jumaya as their objectives. The armies would thus condense their front as they advanced, the route Monastir–Veles marking the extreme left of the Serbian movement, and that of the upper Struma, famous in the war of 1913, taking the French into positions on the Bulgarian line of retreat. But the negotiations of the Allies with Rumania, and their internal discussions relative to their Salonika operations and their policy in Greece, dragged on. On June 6 Gen. Milne was informed by the British Government that he was not to engage in offensive operations, and was only to consider himself under Sarrail's orders in respect of the defence of the entrenched camp. He informed Sarrail accordingly, and suggested that the British should take over the Struma front, to which Sarrail agreed. The Serbs were now preparing to take up the front from Vodena to Lyumnitsa, with their centre of gravity on the right, the French held from Lyumnitsa to the Poroy road, and the British to the right of that road from Loznitsa to Orlyak. On the 12th Sarrail was ordered not to take any action that would involve the British in operations unconcerned with the defence of Salonika itself, and to limit himself to threatening the Bulgarians by a deployment close up to the frontier; and on the 14th he was notified that the French Government had agreed to the British proposal to postpone the offensive.

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[1] The withdrawal from Helles freed further French troops, from whom a serviceable brigade was made up and combined with a brigade from France to form the 17th Colonial Division.

[2] The Bulgarian division had twice the infantry strength of a French or German division.

[3] Sarrail's orders were issued by G.Q.G. without consultation with the British government or Lord Kitchener. (Sarrail, p. 83.)

A few days later, on the 25th, he was informed that though the instructions of the 14th held good in general, events might rapidly make it necessary for him to attack, though with a limited objective, and using the French and the Serbians only; and on July 15 he was told that the British Government had agreed that if Rumania intervened all British troops equipped for mountain warfare should participate in Sarrail's offensive, and instructed to prepare to "pin the Bulgarians on the Greek frontier and put them out of action so far as serious operations against Rumania were concerned." Three days later, on July 17, G.Q.G. informed the French commander that the Entente-Rumanian military convention would probably be signed on the basis of (*a*) an offensive from Salonika on Aug. 1, to cover the final preparations of the Rumanians and their initial operations against Transylvania; (*b*) a Russo-Rumanian offensive beginning on Aug. 8, and directed against Bulgaria; and finally (*c*) a combined advance of the Russo-Rumanian Army and the Salonika forces with a view to uniting and crushing the Bulgarian Army in the field. A few days later a formula agreed upon between the various Allies constituted Sarrail commander-in-chief of the French, British, and Serbian Armies, as also of the Italian and Russian contingents,[1] Gen. Cordonnier being appointed to command the *Armée française d'Orient* as a constituent part of the Allied Army.

Sarrail's new plan was to dispose Milne's available forces on the front Dova Tepe (exclusive)–Lake Ardzan (exclusive) or to the Vardar if possible, to reduce Cordonnier's troops E. of Dova Tepe and Milne's on the Struma front[2] to a minimum, and with Cordonnier's Army to attack on the front Vardar–Doiran, while the Serbs from above Vodena made their main attack on Huma and subsidiary advances towards the Cerna bend and possibly Monastir. This plan was approved by Joffre, who added that the British Army would receive instructions from the War Office not to limit itself to defensive or demonstrative action. But these instructions, from Gen. Robertson to Gen. Milne, introduced an important limitation in their general approval. Milne was "not to try to take the enemy's positions until an adequate equipment of heavy artillery and other conditions gave a reasonable expectation of success," and the offensive was "not to be taken till Rumania definitely came into the field," an event of which Sir W. Robertson, like Sarrail, had his doubts. Presently came the first hitch in the military convention negotiations. Rumania was not to move till Aug. 14, and Sarrail was to act ten days before that date. But on Aug. 3, the eve of the offensive, the convention was still unsigned, Rumania having expressed the intention of not declaring war on Bulgaria unless large Russian forces were added to her Danube Army; in these circumstances Sarrail's mission was reduced to "harassing" the Bulgarian Armies on his front, without ulterior purpose, from a date to be determined later (telegrams from Joffre to Sarrail Aug. 3 and 6). Finally, the convention was signed on Aug. 17, without any engagements on Rumania's part to declare war on Bulgaria. On that very day the Bulgarians began to push forward. Proposals for shortening and improving their line by pushing it forward on the one hand from the Monastir frontier towards Ostrovo, and on the other from Rupel to the angle of the Struma, had, in the spring, been put before Falkenhayn by Mackensen (who still commanded, under somewhat indeterminate conditions, the forces of the Central Powers in Bulgaria and Macedonia). Falkenhayn had declined at the time owing to the risk of bringing Greece into the ranks of the enemy. Now, however, it seemed safe to ignore this danger, and desirable to forestall the relief offensive that would doubtless accompany Rumania's intervention,[3] and on Aug. 17 a series of encounter-combats began between Sarrail's various groups, advancing for their deployment on the frontier, and the wing elements of the enemy. In the centre, the 17th Colonial Division, the British assisting to some extent,[4] took, lost and retook Dodzelli (Aug. 17–8). But on the left the French cavalry group, already mentioned, which was operating E. of the Struma bend, was driven in by a serious Bulgarian movement from Rupel and through the mountains from the Nevrekop region, and, had it not been that the Bulgarians used part of their forces in taking possession of the coveted coastal strip of Kavalla, the Struma line itself might have been forced. As it was both the French cavalry group and the British force further down the river were able to establish a sufficiently strong defence of the river. On the other flank the Bulgarian attack encountered the Serbians in the process of concentrating forward.

The new Serbian Army, commanded by the Prince Regent Alexander, with Boyovich as his assistant, was organized in three weak "Armies," the I. Army under Mishich, the II. under Stepanovich, and the III. under Yurichich-Stürm, who was shortly afterwards succeeded by Col. Vasich; of these the I. was in touch with the left of the French 122nd Div. about Lyumnitsa, the II. on its left, and the III. formed the left wing, advancing methodically and by short stages towards Banitsa. On the 17th advanced elements of the Danube Div. (III. Army) were driven out of Florina, and on the 18th a hasty counter-attack on that point failed. The Bulgarian Army developed considerable strength (6th and 8th Divs. I. Army) and on the 19th, the Danube Div., attacking again, was flung back a considerable distance to beyond Banitsa. Meantime the II. Army, working up in the Moglena district, repulsed such attacks as were made on it, and continued its deployment in front of the Moglena mountains, the left directed on Kaimakchalan, and the I. Army, between the II. and the French left at Lyumnitsa, remained undisturbed.

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[1] In the case of the Italian Division the powers of the commander-in-chief were specially limited. The Russians were, however, unreservedly at the disposal of the French. In general the formula from which Sarrail derived his authority was somewhat similar to that which was agreed upon later in the case of Nivelle. It was far from being a real international command such as that of Foch in 1918.

[2] The prevalence in that region of malaria, discovered by experience, had caused Sarrail to abandon the earlier project of delivering a principal attack with three French Divisions on the Belashitsa front in the summer months.

[3] A new military convention between the four Central Powers had provided that, in case Rumania declared war on Austria, Bulgaria and Turkey would do so against her.

[4] On the 18th the French divisional commander asked for British aid to secure his flanks and enable him to hold what he had won. But, Rumania having refused to declare war against Bulgaria, Milne, having regard to War Office reservations, declined and appealed to Sarrail to refrain from putting him, as a soldier, in the impossible position of being an inactive witness of enterprises that had no chance of success without his assistance. Sarrail, however, says that Milne had promised, before the movement on Doiran began on Aug. 10, that although he was not authorized to take the offensive, he would not leave the French with their flanks in the air. Taking these two pieces of evidence together, the only conclusion possible is that the formula defining Sarrail's authority as commander-in-chief was too limited to be of much practical value in ensuring military unity, yet too extended if the Governments desired to preserve their control of policy. Too much was left to interpretation, and the commander-in-chief was obviously exposed to the temptation of planning his operations so as to create the case for the promised assistance. Indeed Joffre's directions of July 15 contained a personal instruction to Sarrail in this sense (see Sarrail, p. 361, telegram 4977/M., 4979/M, and especially 4980/M *pour le Général seul*). The story of the Salonika campaign can only be understood by bearing in mind the political and personal undercurrents affecting it.

Impressed by the attacks on his flanks and in particular that on his left, and limited by the outcome of the Rumanian negotiations to fighting without ulterior purpose—instructed, further, by Joffre (apparently on the 16th) to attack three days after the signature of the Rumanian convention, viz. on the 20th—Sarrail changed his plan. Everything E. of the Vardar was to be defensive, everything W. of it offensive. On the extreme left irregular bands (which Sarrail had formed or subsidized) were to cut communications between Florina and the S., and to work their way into southern Albania, where coöperation had been promised by the Italian troops at Valona. An improvised French brigade was to move over to support the left of the Serbians by an attack round the S. and W. sides of Lake Ostrovo. The Serbian left was to hold up the Bulgarian advance, and the four remaining divisions to attack Kaimakchalan and the range to the E. of that point, supported by part of the French 122nd Div. in front of Lyumnitsa. East of the river, the remainder of the 122nd Div. was to stand fast, the 17th Colonial to attack W. of Lake Doiran and the 57th to demonstrate E. of it, all available British artillery participating in the effort of the 17th Colonial. The British divisions in this region (22nd and 26th) were to follow, and the Italian Div. of Gen. Pettiti, in process of disembarkation, was to relieve the 57th French Div., which was then to be transferred to the left wing. East of Dova Tepe the defensive front was to be under the command of Gen. Briggs and held by the British 28th Div., the French cavalry group (which was to explore on the further bank as before) and part of the British 27th Div., the remainder of Milne's Army being in reserve.

At this date, according to a French parliamentary paper, Sarrail's total force, combatant and non-combatant, inclusive of all details, had a ration strength of about 350,000 (four French, five British, six Serbian, and one Italian division, and a Russian brigade), and a combatant strength of 145,000 rifles, 3,000 sabres, 1,300 machine-guns and 1,032 guns, of which, however, 36,000 British infantry were not available for general service, and the 11,000 Italians only began to disembark in the last days of August.

During the regrouping process the Serbian left was driven back slowly, but in order, and on the 23rd the Vardar and the Danube divisions were about the N.W. corner of Lake Ostrovo with part of Timok, and the French Provisional divisions and the French 122nd Div. were engaged in various partial combats on the line Kaimakchalan–Lyumnitsa. On the Doiran and Struma fronts small engagements were frequent, and the French cavalry group, which again attempted to operate E. of the Struma, was driven in by superior forces with somewhat heavy losses. The Bulgarian attacks, however, as has been said before, had no more serious purpose than shortening the line and sketching out a sort of preventive attack, and they died down about Sept. 1, at which date the position of the Serbian left was practically the same as it had been on the 23rd, while the Struma front was unmolested.

Meanwhile the Rumanians had come into the field, and Bulgaria had declared war upon them. In a directive of the 24th, therefore, Joffre ordered Sarrail to continue to check the Bulgarian advance, thereby fulfilling his mission of protecting the Rumanian deployment, and to prepare for a counter-offensive, the date and objective of which was practically left to Sarrail's discretion. For this offensive Sarrail relieved the 57th Div. from the Dova Tepe front and the 122nd from the Vardar valley front, the Italians replacing the 57th, and the British divisions already on the spot taking over the whole front from Doiran to the Vardar. This enabled a group to be formed under Cordonnier consisting of the French 57th and 156th Divs. and provisional brigade, the Serbian Morava Div.[1] (released from the Lyumnitsa region by the 122nd), the Russians, and the various irregular bands above mentioned. As soon as this group should be ready the offensive was to be launched against the right flank of the enemy's new line. This was carried out on the whole front on Sept. 10. On the Struma front (Briggs) six British detachments, and another French cavalry group also, were sent over the river at different points to engage and hold the enemy in that quarter. No permanent foothold was gained or sought, and the troops were withdrawn on the 11th. On the Doiran–Vardar front, after heavy bombardments on the 11th, 12th and 13th, a salient in the position of the German 101st Div. was stormed on the night of the 13–14, but given up under counter-attacks on the following day. The French 17th Colonial Div. and the Italians made similar local attacks, and from time to time other *coups de main* took place as well as patrol activity and aerial bombing, with the object of detaining as many troops of the German XI. and Bulgarian II. Armies as possible, while the main attack was being developed W. of the Vardar. This began on the 11th, both for the Serbians and for the Cordonnier group. The former pushed up towards Kaimakchalan and Vetrenik mountains with three divisions (aided by the French 122nd Div. which carried Mayadag) and grouped the Vardar, Danube and Morava divisions for the attack of the mountain pass of Gornichevo W. of Lake Ostrovo. The Cordonnier group, much hampered in its concentration by road difficulties, and by the piecemeal arrival of the formations composing it, advanced to Rakita and Hill 633 on the Kayalar–Banitsa road on the 11th, with the Russians, as flank guard at the mountain pass of Vlachoklisura. On the 12th Cordonnier's main body reached Rudnik, the Russians the mountains 1414 and 1348 N. of Vlachoklisura, and a Serbian liaison group occupied Sotir. On the 13th there was fighting along the whole front from Kaimakchalan to the Russian positions, Cordonnier gaining a line at the foot of the Malareka ridge, and on the 14th the Serbs broke through the hostile line at Gornichevo, capturing 32 guns.

Unhappily, in these operations an acute difference arose between Cordonnier and Sarrail. The former, the man on the spot, conducting his offensive on the methodical lines of the battles of France, from which he had recently come and in which he had played a brilliant rôle, moved too slowly to satisfy Sarrail, who, released at last from all restrictions of higher policy, was determined to signalize his name and silence his opponents with a first-class victory. As to which was in the right it will be for history to say; probably it will be found that this is no more than one of the incidents between a higher command in a central command post and a subordinate command in the field that are so common and indeed inevitable in moments of crisis. But the peculiar factors of this case, personal and international, gave the incident a lasting importance. In the event, the Bulgarians, broken by the Serbians at Gornichevo, were able to retreat across the front of Cordonnier's force and reëstablish themselves on the line of the Brod, blowing up in their retreat the important viaduct of Ekshisu.

The battle now entered upon a second phase, which lasted from Sept. 15 to Oct. 30. In this period small actions on the Struma and Doiran front were continued; thus the British sent several detachments over the Struma on the 15th and 23rd, and a more serious move was made on the 30th, when Gen. Briggs initiated a methodical advance which brought him by Oct. 8 to the line Agomali–Elishan–Ormanli with advanced elements along the Belika stream facing Seres. On the Doiran front several local enterprises were carried out by the British and Italians. Meantime, on the Adriatic coast, the Italians were moving onwards from Valona along the Voyusa valley, Premeti being occupied on Oct. 9.

The practical effect of these holding attacks and demonstrative moves on the main battle-front between Vardar and Brod seems, however, to have been much smaller than it had been in the first stage. According to Sarrail twenty Bulgarian battalions were shifted over from the British front to that of the French and Serbians in the last days of September. This was only to be expected. When the real front of battle became definite, merely potential battles ceased to possess effective binding power. But the Struma front, though militarily eccentric, had possibilities in the political sense; an advance on that side threatened the Bulgarian occupation of the Kavalla region almost before it was established—for the Greek garrisons were still in being. General Milne therefore chose this front on which to exercise such holding action as was possible in the conditions.

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[1] In the sequel this division was taken to support the Gornichevo attack, and did not join Cordonnier.

On the main battle-front Cordonnier's advance on the left of the new Bulgarian position continued on the 15th and 16th, the Russians in the mountains, combined with a newly constituted French force[1] working round, and the main body moving directly on Florina and the line of the Brod. On the 17th Florina was taken by parts of the 57th and 156th Divs.; on the 18th Sarrail intervened again to press the advance towards the rear of the Bulgarians opposing the Serbians on the Brod and Kaimakchalan front. But, probably from supply difficulties due to the blowing up of the railway viaducts, but also because Cordonnier thought it necessary to clear the mountains on his left before swinging in, the advance came to a standstill again on the 19th. On the 20th the Serbians made an important advance in the region of Kaimakchalan, and held their gains against counter-attack. The Franco-Russian Div. on the extreme left also maintained its positions, and on the 23rd Cordonnier was ready to attack in concert with the Serbians along and W. of the Brod line.[2] But, meantime, reinforcements were arriving on the Brod from the British front, where the policy of demonstrations had at last been detected by the enemy. On the 24th and following days, while the artillery of Cordonnier's force was being got into position for the attack of the Brod line, and the mountain country W. of Florina was being cleared, the Bulgarians made fierce counter-attacks on the Serbian positions about Kaimakchalan. That point itself had been stormed by the Serbians on the 20th, and their hold was not shaken, but it was the 29th before the whole area was in their possession. On Oct. 3 a concerted attack of Cordonnier and the Serbs was delivered on the whole front from Kaimakchalan westward, while the British on the Struma front developed the holding-offensive already mentioned. This general attack was initiated by a vigorous Serbian push in the mountains W. of Kaimakchalan, and, finding their line turned on its left, the Bulgarians fell back, with only rear-guard resistance, to a position defined by four geographical points: German on Lake Prespa, point 1906 in the Baba ranges, Kenali in the plain, the extremity of the Cerna bend and the ridge N. of Kaimakchalan.

This closed the second phase of the battle. The Bulgarians were being effectively held, at the least. As a relief offensive, coincident in date with a new Russian offensive on Brussilov's front, with the seventh Isonzo battle on the Italian, with renewed efforts on the Somme front, and with the battles of Hermannstadt and Dobrich on the two Rumanian fronts, the Balkan battle in its first two phases accomplished all that could be expected of it. But from the point of view of the Salonika forces it was disappointing, especially to the ardent Serbians who at Kaimakchalan had reëntered their own country.

The next phase was the general advance against the Kenali–Cerna bend line. It occupied the period Oct. 4–19, and was marked by even more internal friction than the previous phase. The operations themselves consisted in artillery bombardments and local attacks, in which the Serbs advanced to the Cerna bend (7–8 Oct.) and over the river and on to the plateau N. of Velyeselo (Oct 18–19). Otherwise no important progress was made, and, indeed, a set-back occurred on the 6th, when a French and Russian attack W. of Kenali failed with somewhat heavy loss. General Cordonnier thereupon reverted to the idea of a wider turning movement, but Sarrail, who believed, from the reports of his agents and from incidents on the Serbian front, that the whole Bulgarian Army was ripe for a moral collapse, insisted vehemently on direct action. The frontal attack was carried out on the 14th, for the first time with the aid of gas shell, but it failed, with heavy losses to the French and particularly to the Russian contingent. A violent interview on the battlefield between Sarrail and Cordonnier, in the presence of many Allied officers, completed the disorganization of the command. Cordonnier, who was suffering from almost mortal disease, was sent home a few days later, being replaced for the time being by Gen. Leblois, but for some days the Serbian attack on the Cerna bend went on unsupported, until Sarrail took the step of placing the available French forces under the superior command of the Serbian Gen. Mishich with the idea of restoring moral as well as tactical unity to his dislocated offensive. The necessity of continuing it, and the chances of a striking success if it were persevered in, were equally evident. The Bulgarian *moral* had suffered from stagnation and from the rude shock of meeting an enemy risen from the grave. The German elements of the XI. Army had mostly been withdrawn,[3] its commander von Winckler (who succeeded Gallwitz in July) was in early October no longer under Mackensen's orders but under those of the Bulgarian higher command; and Gen. Otto von Bülow, summoned with the staff of the VIII. Army from Lithuania to take general charge of operations in Macedonia, only arrived in the middle of the battle. No higher purpose than gaining time and avoiding defeat was or could be contemplated on the part of the Germans and Bulgarians, and self-sacrifice in such a rôle requires either the constant *moral* of a professional army, such as that of the old regular divisions of Milne's command, or the crisis-*moral* of the citizen soldier. In these conditions, although the lateness of the season and the sharp enemy offensive in the Dobruja made a junction with the Rumanians impossible, Sarrail had reason to hope for an important victory. In any event, the turn of events in Rumania (Hermannstadt, Fogaras, Kronstadt), and on the Italian front (eighth and ninth Isonzo battles), dictated a continued offensive towards Monastir.

For some days after the Serbian success at Velyeselo weather and counter-attack prevented their further progress, and this time was utilized by Sarrail in strengthening them with French troops drawn both from the Vardar (where the British took over their line), from the western mountains (where the Italians[4] relieved them), and from the centre about Kenali, where the weather flooded the country. At the same time the artillery was established in position, the maintenance service organized to supply the battle, and touch gained on the extreme left with the Italian force advancing in Albania,[5] while Milne's Struma troops made a strong diversion by attacking and carrying Barakli Dzuma (Juma) on Oct. 31. Finally, on Nov. 10, the Serbians with French support opened a new strong attack in the Cerna bend. Between the 10th and the 13th Polog, the ridge to the E., and Iven were taken, while the artillery on the Kenali front kept up interdiction fire to prevent enemy reinforcements from crossing the Cerna; and on the 14th a general attack brought the Serbians to the ridge on which Jaratok Monastery stood, with lesser advances to right and left. The Kenali lines being now completely turned, the enemy on the night of 14–15 fell back, covered by rain and snow, to a position but little in front of the line Peristeri–Monastir–height 1378–Grunishta. But this time the advance did not halt. On the 15th, in terrible weather, the French left pushed forward to the Viro brook; in the mountains, though mud was absent, rain and snow were still more violent, but the Serbians continued to progress. On the 17th Mishich's troops, with the French aiding and conforming on their left, captured height 1212, and the 18th they stormed 1378, pursuing to Makovo in the night following, while the French centre and left forded the Viro, the Russians S. of Monastir took Kanina, Zabiani and Holeven, and the Italians, French and Russians in the western mountains developed an outflanking movement right and left of Lake Prespa.

On the morning of the 19th the town of Monastir was found evacuated, and the third phase of the Allied offensive, definitely victorious, closed with the occupation of a line from Krani on Lake Prespa[1]–Saddle 2227–Orizar N. of Monastir–Makovo–heights S. of Staravina–N. slopes of Kaimakchalan.

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[1] Henceforward called the Franco-Russian Division.

[2] There was some overlapping of the Serbians and French about Boresnitsa, due to a Bulgarian counter-attack on the 19th.

[3] Apart from staffs, there only remained 17½ battalions and corresponding artillery and army troops.

[4] A newly-disembarked Italian force relieved these in their position in the Dova Tepe region.

[5] Apart from the movement of the Valona force up the Voyusa, a fresh Italian contingent had landed at Santi Quaranta and advanced by the Turkish military road to Koritsa, and thence to the region of Okhrida and Prespa Lakes. This line became a regular line of communication.

In view of the weather victory had come in the nick of time. The force of the attack rapidly died out, even the Serbian Army with its positive and eager *moral* being too weary, and all formations being too far ahead of their administrative services[2] to be able to push on. Fighting went on in the Cerna bend till Dec. 12; the French operating in this quarter captured Dobromir on the 21st and height 1050 on Nov. 27, and the Serbs Staravina on Dec. 4; but the troublesome height 1248, overlooking Monastir and the plain, remained in the hands of the Bulgarians, and the town was under shellfire throughout the winter.

By this time the evident defeat of the Rumanians and the consequences of the Venizelist *coup d'état* at Salonika called for a reconsideration of policy. The offensive, considered as a relief offensive on Rumania's behalf, had completed its usefulness, and on Dec. 11, Sarrail was instructed to establish his forces on a defensive line, holding as much of the regained territory as possible and keeping in mind the resumption of the offensive at a date that was to be fixed according to the general plan of campaign for 1917, and particularly according to the date at which the Rumanian Army, reorganized by Gen. Berthelot, should be ready for the field. Meantime, the contingency of rapid action against Greece was to be provided for.

Henceforward, for some months, it is this last element in the problem which governs the action or inaction of the Salonika Armies. In answer to the Venizelist *coup* of Aug. 30, King Constantine began a threatening concentration of troops in Thessaly, on Sarrail's left rear. To this the Venizelist forces, hardly yet in being, were no counterpoise, and Venizelos's policy, which was also that of Sarrail, and as a rule that of the British and French Governments, was to prevent contact between the two Greek parties.[3] Sarrail therefore drew a neutral zone of some kilometres width from the Koritsa basin to the sea. Nevertheless, throughout the period of his offensive, anxieties for the flank and rear limited the play of such reserves as the Allied commander-in-chief possessed. On Dec. 1 the attempt to enforce the delivery of certain war material to the Entente representatives at Athens produced an *émeute*, in which the Allied landing parties suffered severe losses and the Legations were for a time practically besieged. This affair brought the confusion of the Greek problem to a climax. Though on Dec. 2 Sarrail's demand for authority to advance into Thessaly was refused, and some disjointed efforts at naval and military action led to nothing, sufficient unity of policy was achieved to enable the Allies to deliver an ultimatum on Dec. 14, demanding withdrawal of the Greek forces in Thessaly.[4]

The policy of the Salonika forces for 1917 was fixed at the Inter-Allied conference held in Rome in Jan., to which Sarrail was summoned. The first conclusion was that Greece was not to be attacked, both for other reasons and especially owing to the effect that any high-handed action would have on American sentiment, which was at that moment in the crisis of deciding for peace or war. The second was that operations on the front should be governed by a waiting policy—a compromise between Sarrail's demand for forces sufficient for a grand offensive, and Robertson's and Cadorna's demand for a withdrawal[5]—and that the divisions sent or to be sent to Salonika should be liable to recall, in the event either of a crisis on the Italian front, or of one in Palestine. On the other hand the full subordination of the British contingent to the Allied commander-in-chief was agreed to,[6] and (according to M. Mermeix) Sarrail's personality made so favourable an impression on Mr. Lloyd George that the agitation for his recall came to an end for the time being.

In the first weeks after the end of the battle and these decisions, the Salonika front was for the first time formed as a regular and continuous system. On the right, as far as the Vardar, were the British under Milne, consisting now of the 10th, 22nd, 26th, 28th, 29th, and 60th Divs. (the last newly arrived) with some organized units of the Venizelist forces in support. On the left of the Vardar the national contingents were more intermingled, the Lyumnitsa region being held by the French, the Kaimakchalan–Vetrenik–Duditsa front by the Serbs (6 Divisions),[7] the Cerna bend by the Italians (1½ Divisions), and the remainder of the front by the French main body, to the command of which Gen. Grossetti was shortly appointed in succession to Cordonnier. The French Army were now being reinforced, and included besides the old 57th, 17th Colonial, 122nd and 156th, the 16th Colonial (arrived early Dec.), 76th (arrived end Dec.), 30th (arrived Jan.) and 11th Colonial (newly formed from odd units on the spot). In all, therefore, there were no less than 21½ Divisions in this theatre at the outset of the 1917 campaign, besides two Russian brigades, and the Greek National Defence Army in embryo. The Italians in Albania are not counted, as they were not under Sarrail's command, and operated entirely as a separate force in their own theatre, interesting the Salonika force only in so far that their positions protected the opening up of the line of communication Santi Quaranta–Koritsa–Lake Prespa. This force was strong enough to hold all its line and yet to have larger reserves than in 1916, for either an offensive northward or a march into Thessaly.

The Bulgarians on their side established themselves solidly on the final battle line of 1916, and improved it on Feb. 15 1917 by the recapture of height 1050 in the Cerna bend from the Italians, who had only shortly before taken up this sector. An attempt to retake it failed on the 28th. The end of active operations against Rumania about the middle of Jan. released additional Bulgarians for the Salonika front. As a beginning Sarrail sent his newly arrived 76th Div. inland to Koritsa[8] just in time to prevent the seizure of that point by an Austrian force coming down from Pogradets (early Feb. 1917); the division then moved on to clear the Santi Quaranta road—the new alternative line of communications—of bands and make the junction with the Italians in Albania, which at present only existed by wireless and aeroplane. This mission was completed by the meeting of the French and Italian troops at Ersek, Feb. 17, after which the limit between Sarrail's International Army and the purely Italian force of Gen. Ferrero in Albania was fixed at a little N. of that point. The 76th Div. was then reassembled N. of Koritsa, in readiness to participate in the general offensive when this should be ordered.

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[1] The French on the W. side of Lake Prespa occupied Liskovats, a village on the same latitude as Krani, and then Horesovo.

[2] The viaduct at Ekshisu was not repaired till Nov. 27.

[3] The first battalions organized by the Venizelists were sent to the British front on the Struma. At one time the idea seems to have been entertained of reconquering Eastern Macedonia (Drama–Kavalla region) by means of an advance of these troops, presumably in concert with a British expedition. Nothing, however, was done in this direction. The regular Greek forces on this side, cut off by the Bulgarian invasion, had accepted an offer of internment as "guests of the German Government" (Sept. 14) and been transported to Germany, except a small force which from Seres had made its way to join the Allies.

[4] In the midst of these events came mutterings of trouble in the Serbian Army. Little is known as to the details, but as early as the beginning of Jan. 1917 a division commander and several brigade commanders and senior staff officers were deprived of their posts; by mid-March over twenty such officers were in prison at Bizerta charged with plotting against the Prince Regent. Finally, a number of these were brought to trial, some being condemned to death and (July 29) shot, others sentenced to 15 years' imprisonment.

[5] The idea of a Salonika front had never had any real support in the British War Office, and the Italian point of view seems to have been that the abolition of an Inter-Allied force in the Balkans would give Italy greater freedom of action in Albania.

[6] Sarrail had already been released from control of the French G.Q.G. when Joffre left it and was replaced by Nivelle (Dec. 1916).

[7] Owing to losses the Serbian Divisions were now reduced from the old high establishment and were equivalent in rifle strength to French Divisions, viz. 9 three-company battalions.

[8] Here, in the previous summer and autumn, French cavalry had operated to disperse irregular bands that were practically bandits, and to intercept communications between Athens and the enemy. For a time Venizelist sympathizers reigned at Koritsa, and the idea of annexing the district to Greece was not far in the background; but in the face of protests from Italy and from Essad's Albanian party at Salonika, Sarrail replaced them by an autonomous government of inhabitants under French protection, a course which he considered would commit nobody and yet give no excuse for the formation of Royalist bands.

Meantime the British advance beyond the Struma, originally developed out of the demonstrations made during the first stages of the Monastir offensive, had been consolidated on the line Jenimah–Osman Kamila–Hrostian Kamila–Nevolyen–Kukuluk–Elishan–Barakli Dzuma–Alipsa (Ali Pasha). This position formed a useful bridgehead in case Sarrail should be able to resume the old scheme of an offensive by way of Demir Hisar and Rupel against the Bulgarian communications, and meantime it immobilized a Bulgarian force of approximately equal strength. But the supply of the lines beyond the Struma was difficult and laborious during the winter months, and it was to be expected that the valley would be a hotbed of disease in the summer. On the Doiran front several small local attacks were made on the enemy's positions on and about Dub mountain—the Achi Baba or Hermada of this front.

The scheme which Sarrail intended to carry out was the old scheme of a principal blow from the mountain front in the direction of Demir Kapu, cutting off the defenders of the Doiran and Lyumnitsa fronts. Combined with this, local and subsidiary advances were to be made on the Cerna bend and Monastir fronts, with, to the left of all, an enveloping movement by the 76th Div. from Koritsa by Resna upon the rear of the Bulgarians N. of Monastir. Meanwhile, the British, after exercising a holding action which was to increase in intensity from left to right and culminate in a real attack on Seres, would quickly shift their centre of gravity to Demir Hisar, and thence, by Rupel and the Struma, force their way to a position on the rear of the Bulgarian line of retreat. If, as in 1915, Sofia was to be the ultimate objective—if, in short, the campaign was intended to be a decisive one—the sweep of the extreme left would pass through Uskub and Kumanovo, that of the left centre through Veles and Shtip, while the Italians bore down on Demir Kapu and the British marched on Simitli—a romantically complete success. In many ways, indeed, the scheme is identical with that eventually carried out by Franchet d'Espérey in Sept. 1918. But in both cases there were four postulates:—(*a*) Greece friendly or under entire control; (*b*) synchronization of the offensive with those in the main theatres, so that the enemy could not transfer German reinforcements in time to the Balkans; (*c*) enough men; and (*d*) enough material. Of these postulates Franchet d'Espérey was in the sequel to possess all four. Sarrail, on the other hand, though (*b*), the most important strategically, was within his power, had little real security as to (*a*) and a definite lack of means in respect of (*d*), and this last ranked as one of the most important factors for the tactical break-through on which all the rest depended. Several of these requisites being absent, Sarrail was under no illusions as to the chances of pushing success to the gates of Sofia. But he considered that there was a possibility, becoming a probability if he were given more heavy guns, of forcing the offensive of his left centre in the mountains so far north-eastward as to compel the evacuation of the Lyumnitsa–Doiran–Belashitsa front. In the absence of these additional heavy guns, however, the tactical break-through in the Moglena–Cerna region would be a matter of great difficulty, and Sarrail accepted a proposal of Milne that the British holding attack should be delivered on the Doiran front—where its effect on Sarrail's battle would be immediate and tactical—instead of towards Seres. This change of plan, made between Feb. 9 and 19 was due in the first instance to the difficulties of movement in the Struma valley, where exceptionally bad weather had made motor transport almost impossible. But the decision was one of grave importance since the height of Dub, now chosen for the British attack, was one of the strongest points on the whole front, and it was an attack, and not a demonstration, that was intended.

In this form the scheme was accepted by the Inter-Allied conference that met at Calais on Feb. 27—in circumstances of great tension—and Sarrail was ordered to hold the enemy to his ground, and authorized to seize any opportunity which offered itself to inflict real damage. So far this represented merely the waiting policy of the Rome conference. But an important modification of that policy was implied in the actual instructions to Sarrail, for not only was he told that the plan of operations had been agreed to by the British War Council, but he was instructed to be ready to launch his offensive about April 15—a few days after the date selected for Nivelle's battle on the Aisne—in spite of the fact that no Russo-Rumanian offensive could be expected so soon. That authority should be given for an attack of any kind in the conditions of the time was of doubtful wisdom. But that the conference sanctioned an attack on the strongest parts of the enemy front in order to obtain the very limited results at which it aimed is a fact that is more than difficult to explain. The strategic results that would or might accrue from a break-through in the Moglena region were indeed so great (as 1918 showed) that special tactical risks might fairly be taken to achieve this break-through. But the conference of Calais not only had no great strategic results in mind, but had expressly agreed that the circumstances of the time excluded them. And when, in addition, we find that Sarrail was, at one and the same time, told that the decisive defeat of the Bulgarians was excluded, and instructed to "take"—according to the Calais *procès-verbal*—or "seek out"—according to the French Ministry of War telegram—"every favourable opportunity for inflicting a serious check," we can only conclude that the Calais conference was so preoccupied with troubles nearer home that it could think of nothing better, as regards Salonika, than to shift the responsibility and trust to luck.

But before the offensive period arrived events had already blurred the scheme. The British were to attack the Dub, and demonstrate at other points; the French, Russians and Italians in and W. of the Cerna bend were then to move, and lastly the Serbians were to deliver the principal blow between the Cerna and the Duditsa mountain, E. of which were the French 122nd Div. and part of the Greek "Archipelago" Div. (the first of the Venizelist National Defence formations), ready to drive forward on the Huma–Vardar front so soon as the flank attack had begun to make itself felt. But the Serbians, still angered by the breakdown of joint action in the Monastir battle, and also seriously affected by their internal troubles, refused to move till after the Allied general offensive had opened in France. The Russians were deeply shaken by the revolution in their own country. Weather conditions were terrible, and the zero day of battle was several times postponed, both owing to these conditions and to the slowness with which the preliminary offensives at and W. of Monastir were developing.

As early as March 12 the French 76th Div. had begun its advance from Koritsa on Resna. But owing to snow and to the harrying tactics of enemy irregulars—who were supported by small Austrian forces from Pogradets—it made but little progress, and on March 19 Sarrail suspended the movement. Meanwhile, on the 18th, Grossetti, after several days of local attacks, delivered a larger attack on the front N. of Monastir, which by the 27th had advanced the line in this sector to height 1248, Snegovo and Rastáni, with corresponding gains to the left on the spur of Peristeri called Crvena Stena, and to the right about Dobromir and height 1050. Over 2,000 prisoners were taken, and these gains eased the uncomfortable position of Monastir, but they were not pressed, as Sarrail not only held his reserves for the April offensive but sought to disengage part of the troops engaged at Monastir for the same purpose.

On the Doiran front the British attacks began about the middle of March with enterprises intended to secure advantageous positions for the general engagement. On April 22, after several postponements, the artillery preparation began, in terrible weather, and on the evening of the 24th the infantry assault was delivered on a two-division front against Dub and its under-features. The positions of the defence were strong in themselves and strongly entrenched, and, as in the trench-warfare battles of the French front in 1916–17, the attack preparations and especially the prolonged bombardment had given full warning. Along the whole front the infantry reached the hostile front trenches, but only on the left were they able to maintain the ground won, and nowhere was progress made beyond the first enemy system. Heavy fighting, which only died down on the 28th, was necessary to consolidate the new line, and meanwhile for "climatic and other reasons"—to use the words of Milne's despatch—the rest of the front remained inactive. It was only on May 5 that the other secondary elements of the battle (W. of the Cerna, Cerna bend, Lyumnitsa-Mayadag front) began their artillery preparations. At last, on the 9th—in the case of the British the evening of the 8th—the infantry went forward on all fronts. The British, attacking between the Petit Couronné and Lake Doiran, were repulsed, but they made good an advance further W., where 500 yards in depth were gained over a frontage of two miles; these gains were held and consolidated. On the Lyumnitsa front the French 122nd Div., aided for the first time by Greek forces, carried out methodical advances by fractions at a time, and even for a moment held the Srka di Legen. Elsewhere all holding attacks were repulsed after the usual momentary successes. But the serious feature of the situation was the fact that the Serbians, who were to have been the shock element of the attack and to have begun their advance on the 9th, like the rest, came to a standstill on the 11th after engaging only one of the three divisions between Kaimakchalan and the Cerna. More, they asked to be taken out of the line, and with this the offensive scheme practically collapsed. Sarrail did, indeed, induce them to engage again with two divisions, and on the 15th attacks in aid were delivered or threatened at other points.[1] This time, after some loss, they demanded that the offensive should be abandoned altogether. Already Sarrail had received authority from Paris to suspend operations and establish his defensive line (May 15), and on the 23rd, after the second Serbian disappointment, he issued orders accordingly. It could be claimed, with justice, that these operations had pinned the Bulgarian Armies to their ground, and indeed only one Bulgarian division remained in the Danube theatre, all the rest having been drawn into the Balkans by the developing threat of the offensive. But Sarrail had hoped for much more. His object had been Veles and Demir Kapu at the least, instead of which only slight advances on the Struma, Doiran, Lyumnitsa and Monastir fronts—without exception secondary elements in his scheme—had resulted. The offensive was, in short, a failure, and one, moreover, in which it was palpable that disunity had played the major part.

The reasons are to be sought partly in the Serbian breakdown and partly in the general war situation. Allusion has already been made to the fact that the Serbian Army had for some time been passing through an internal crisis, and to the demands made by the Serbian Government and higher command for tangible evidence that all the Allies would frankly engage their forces in the battle. The engagement of the French and Greeks on the Lyumnitsa front, and above all that of the British on the Doiran front, where attacks were made in earnest, local gains secured, and heavy losses incurred[2] in aid of the projected main attack, might have been supposed to be an effective answer to this last demand, even though the Italians and French in the Cerna bend showed no great vigour.[3] But in fact it is premature to enquire how far a sense of having been left in the lurch in the autumn battle and how far internal troubles respectively contributed to the Serbian refusal. In any case a strong motive at the back of all others was that expressed in the phrase, "What is the use of delivering Serbia if no Serbs are left to inhabit it?" But there were other elements of discouragement. Exalted hopes of a great general advance to victory on all fronts had been dashed to the ground by the Aisne battle and its tragic consequences, and they were followed by a revulsion in which the war-weariness, soldiers' grievances, and the tremors of revolution produced alarming mutinies. The Russian contingent was affected not only by the revolution,[4] but by rumours of what had happened to their comrades in France, and they in turn affected the Serbs. When, on the main front and in the presence of the main enemy, the *moral* of a homogeneous army was shaken to its foundations, it was not to be expected that on this secondary front a patchwork of contingents, every one of which was exiled from its homeland, would fare any better.

In the midst of these conditions of exasperation the Greek question at last came to a head. M. Jonnart was sent out as Allied High Commissioner, and Sarrail was authorized to invade Thessaly (June 10). He had already begun to prepare a force for this purpose immediately the offensive was abandoned, and, to make certain, other troops went to Athens, to Corinth, and to Itea in the Gulf of Amphissa, whence a line of supply for the Thessaly force was opened via Bralo. Except for a skirmish at Larisa on June 12 no fighting took place. The dethronement of Constantine and the succession of King Alexander, with Venizelos as his first Minister, were successfully accomplished and most of the troops withdrawn again during July.

But the settlement of the Greek problem came too late to have any influence on operating against Bulgaria. The events of the Spring had affected governmental policies as well as common men's passions. Thus, the British War Office began to withdraw troops for the forthcoming Syrian campaign; the Italian Government began similarly to press for the withdrawal of their 35th Div. for operations in Albania; and the French Government, reconstituted after the Aisne crisis, had made it a definite policy to economize the reduced man-power of France by avoiding battle. Meantime, the Italian advance into Epirus, made concurrently with the French operation in Thessaly, antagonized Greek opinion, the relations of Greeks and Serbians were little better, and those of the French and Italians at the margin of the respective spheres of occupation in Albania none too good. The personalities of the Venizelist, and those of the regular Greek Armies, now to be amalgamated, were inevitably opposed. Finally, Essad Pasha reappeared, with a national Albanian policy and the nucleus of an Albanian contingent.

Sarrail, nevertheless, attempted to maintain a certain military activity; in particular, an enterprise on the extreme left was carried out by a French force under Gen. Jacquemot,[5] which captured Pogradets (Sept. 11) and thence advanced N. almost to Lin. In Oct. a further advance was made into the upper Skumbi valley, but this was suspended, owing to representations by the Italian Government, and the French then withdrew to Pogradets, leaving Essad's bands to operate in the Skumbi region independently. Finally, the whole front relapsed into practical stagnation.

On Dec. 10 Sarrail was relieved of his command by the new Clemenceau ministry on the renewed demand of the British and Italian Governments, and of General Foch in his capacity as chief of the staff of the French Army. This put an end to a situation which had become impossible. The proximate cause of his dismissal, so far as the French Government was concerned, had nothing to do with Salonika, but was Sarrail's relation to the parties of the Left, who, in the troubled summer of 1917, had become pacifist in character, and were suspected, rightly or wrongly, of dealings with similar elements on the enemy's side.[6] So far as the Allies were concerned, it was due partly to the personality of Sarrail, and partly to the insistent and thrusting policy of France in dealing with Greece. In effect, the overthrow of the Constantine régime was the only logical outcome of maintaining a Salonika front at all. But between that logical extreme and the other logical extreme of evacuation, which was always the desire of the British War Office, diplomacy built up a series of compromises which satisfied nobody. It was to the indefinite and equivocal position created by these compromises, even more than to any military factors or personal disagreements, that the positive ineffectiveness of the Macedonian forces was due. It remains to the credit of Sarrail that he was sanguine in the most confused and difficult conditions and resolute in carrying the occupation to a common-sense issue. In spite of proposals to retreat again into the entrenched camp, he maintained the army on the front from which, nine months later, it was to deliver the great offensive blow for which he had always hoped. On the other hand he left the Allied Army in a state of badly shaken *moral*. The consciousness of ineffectiveness, the blight of malaria, the infrequency of leave, the sense of being a forgotten "side-show," the international causes of friction—all these factors told on the *moral* of the Salonika forces at the most critical period of war-psychology.[1] A period of *remise en main* was necessary before the troops could be employed either in this theatre or in another, and Sarrail had taken the line of defending his army against all criticism, fair or unfair. It was essential, therefore, if the army was to be pulled together, that new men should be put in power.

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[1] The British on the Struma took Kupri and Ernekeui on this day.

[2] According to Sarrail the British losses in the two offensives were 8,000.

[3] The Russian brigade in the Cerna bend on the contrary *s'est fort bien conduit*, according to Sarrail (p. 257).

[4] It is only just to record, however, that to the end of the year they continued to take their share in duties in the line. The evidence of Sarrail, especially p. 289, is emphatic as to this.

[5] The superintendence of this operation was the last service of Gen. Grossetti, who left Salonika on Sept. 24 suffering from poisoning, like his predecessor Cordonnier. He died a few months later.

[6] M. Clemenceau in his explanation before the army commission late in Dec. 1917 seems to have laid stress principally on the fact that unless satisfaction was given to the Allies in respect of their complaints against Sarrail, they would not accept a French Commander-in-Chief on the western front. (Mermeix.)

General Guillaumat, the new commander-in-chief, set himself to this task under favourable conditions. No important military operations were in prospect. The Greek danger had been liquidated. The atmosphere of exasperation was largely dispersed by his appointment alone. With Russia and Rumania in collapse, and the final military trial of strength obviously imminent in one or both the western theatres, not one of the three great Powers concerned was inclined to press its Balkan interests very closely. His military position, too, soon came to be much stronger than that of his predecessor. Although the British had withdrawn two of their six divisions (the 60th in June and the 10th in Sept. 1917, both proceeding to Syria), and one battalion per brigade in the four remaining (spring 1918), the French and Italian contingents remained practically unaltered (save for the withdrawal of the Russians), while the Serbians acquired a whole new division created from Yugoslav prisoners of war, and the Greeks were taking their place as a regular Allied contingent, the "national defence" divisions at Salonika (Archipelago, Crete, Seres) being augmented by those of the regular army, reorganized by a French military mission.

The question of the use of these forces had been put on one side by the central councils of the Entente. German pressure on the Western Front, beginning with March 21 and culminating on July 15, threw all other questions into the background, and when the tide began to recede it proved as difficult as ever to convince the directors of the War that good could come from a Salonika offensive, while, at the same time, it was impossible to offer the Central Powers the opportunity of repeating at Greece's expense their customary autumn triumph. No decision imposed itself and none was taken. The only event of the early summer was a brilliant *coup de main* with limited objective, which on May 30 carried the Srka di Legen on the left of the Vardar. In July Guillaumat, after practically completing the work of reorganization, was recalled to Paris, where an energetic governor was needed in case of a German breakthrough. He was succeeded by Gen. Franchet d'Espérey. At Paris he continued to act as advocate of, and so to speak agent for, the principles of a Salonika offensive. After much persuading he obtained for his successor authority to prepare one, but authority to begin was not given till a few days before the battle.

Meantime, operations in Albania, which for two years had been in the nature of post and police warfare, rose for a moment in the summer of 1918 to the level of major operations.

In the winter of 1917–18 the posts of the Italian XVI. Corps (Gen. Ferrero) in Albania ran along the Voyusa from the sea to Memaliadz, where it turned abruptly N. and then N.E., facing Glava and Cafa Glava, Parasboar, Barguzyasi, and Cerevoda. Here it joined the French posts, which ran in a N. to S. line along the mountains to Golik in the Skumbi valley and thence nearly E. to Point 1704 S. of Lin on the shore of Lake Okhrida. Early in July 1918 a frontal advance of Ferrero's Italians from the Voyusa and combined by flank pressure by the French 57th Div. in the mountains of the Devoli regions, forced the two Austrian Divs. (47th and 81st) of Gen. Können-Hozak's XIX. Corps to evacuate the whole Berst region in haste, with a loss of nearly 3,000 prisoners. By July 20 the Italians lay along the Semeni and the lower Devoli from the coast to Petrohaudi (with a bridgehead in front of Fieri), and thence in an E. to W. line to the foot of the Mati Siloves range which was held by the French. The positions of the latter formed a marked salient, the apex of which lay at the confluence of the Holts and Devoli rivers, and the right flank of which passed by Kumichan to Golik on the old front. The importance of this salient lay in the fact that it kept the right wing of the general line echeloned well forward, threatening the rear of the enemy's lines near Berat and ultimately the connexion between Elbasan and Lake Okhrida.

In August the Austrians, now commanded by Generaloberst von Pflanzer-Baltin and reinforced by the 45th Div., as well as by the fresh 12th Bulgarian Div. in the Okhrida–Skumbi sector, began a counter-offensive all along the line. Between August 20 and 24 they recaptured the line of the Semeni and the Devoli and drove back the Italians to positions only slightly in front of Fieri and Berat. On August 24 those towns fell again into their hands, and the Italians then withdrew to a line from just S. of Fieri, along the Janitsa, S. of Berst, and along the Osum to Mt. Tomor. Meantime, the French, the left rear of their Devoli salient being thus threatened, had had to fall back in the Devoli and Tomorica valleys to regain touch with the Italians at Mt. Tomor, while still holding on to their posts between the Devoli and the Skumbi. These operations are of interest as being the last military success won by forces of the Central Powers in the War. Three weeks after their conclusion the Bulgarian front was in ruins.

At the close of these operations and the eve of the final act on the Salonika front, the numbers and positions of the forces of the Central Powers were approximately as follows: In Albania, XIX. Austro-Hungarian Corps (45th, 47th, 81st Divs.) under Generaloberst von Pflanzer-Baltin; between Skumbi Valley and Lake Okhrida the 12th Bulgarian Div.; from Lake Okhrida (exclusive) to Koziak Mountain (inclusive), the XI. German Army (Gen. von Steuben), consisting of, from right to left, the LXII. German Corps staff, with under it the Bulgarian 1st, 6th and Composite Divs., and some few German and Austrian units, the LXI. German Corps staff, with the 302nd German Div. (staff German, troops Bulgarian), the 4th Bulgarian and the 2nd Bulgarian Div., and the 3rd Bulgarian Div.; from E. of Koziak to Lake Doiran (inclusive) astride the Vardar, the I. Bulgarian Army (Gen. Nerezov), three Bulgarian Divs.; from Lake Doiran (exclusive) to Lake Tahinos (inclusive), the II. Bulgarian Army (Gen. Lukov), three Bulgarian Divs.; from Lake Tahinos to the mouth of the Struma, thence eastward in coast defence positions, the IV. Bulgarian Army (Gen. Petrov), two Bulgarian divisions. The whole of these forces were under the control of the German headquarters, which had formerly been Mackensen's and Bülow's but was now the *Armeegruppe Scholtz;* Gen. Scholtz was, however, for certain purposes under the control of the Bulgarian higher command, at Sofia, over which Todorov presided. An exact account of the forces of Bulgaria at the crisis can hardly be given,[2] but, save for one division in Rumania and some coast defence units in Thrace and E. Macedonia, the whole of Bulgaria's mobilizable force was present between the Devoli in Albania and the mouth of the Struma. In the depots were practically only the 1919 class recruits, just called up; 55,600 men had fallen in battle since 1915, some thousands were prisoners, many thousands had died or been invalided. Thus the ration strength of the Bulgarian Armies on the Macedonian front can hardly have exceeded 420,000, with some 8,000 Germans (principally Jäger battalions, heavy artillery and mountain machine-gun detachments). The combatant strength may be taken roughly as 310,000 Germans and Bulgarians. The Italians of Ferrero and the Austrians of Pflanzer-Baltin, whose operations in Albania were entirely unconnected with the battle on the main front, are ignored in this calculation.

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[1] Nevertheless it is clear that the phase of the mutinies passed off more easily than the corresponding phase in France.

[2] Some of the newer divisions had an irregular constitution whereas the older ones still retained the six-regiment organization of 1915, and some of these even the old four-battalion regiments. Moreover, at that moment movements were in progress for replacing 15 German battalions by 45 Bulgarians; the Germans had departed, all but three battalions, but few of the Bulgarians arrived in the XI. Army in time.

On taking up their battle grouping the larger formations of the Entente Armies were arranged thus: Devoli valley to Staravina (E. of the Cerna bend), the French Army of the East, in seven French, Italian and Greek Divs.; Staravina to Nonte (exclusive), the Serbian I. and II. Armies under Boyovich (3 Divs.) and Stepanovich (5 Divs.) respectively, the latter consisting of the Strumaja, Timok, and Yugoslav Divs., and the French 122nd and 17th Colonial Divs.; Nonte to Lyumnitsa, Gen. Anselme's group, Greek and French Divs.; Lyumnitsa to Dub (exclusive), astride Vardar, 26th and 27th British Divs.; Dub to Dova Tepe, 22nd and 28th British and two Greek Divs.; Dova Tepe to mouth of Struma, 3 Greek Divs.; Salonika, 1 Greek Div.; in all, 28 divisions. In addition there were a small Serbian cavalry Div., a French cavalry brigade, and other lesser formations and details. The ration strength of these forces, after making allowances for men invalided during the hot months, was about 550,000, and the combatant strength perhaps 350,000.

In sum, then, there was no great numerical disparity between the opposed forces. The equipment of the Entente Army in heavy artillery was, however, considerable. Sarrail's repeated requests for an adequate equipment in this respect had been in the end met, just before his recall. As to the number of heavy batteries on the other side accounts differ, but in any case the regrouping of guns to meet an attack, in the movement conditions of Macedonia, would be difficult if not impossible for the defence, and the mere possession of a reserve of such artillery was, in the conditions, a big element in favour of an attack, provided the duration of the artillery phase of it was reduced to a minimum. On the other hand, to oppose to the powerful material of attack, the Bulgarians had all the advantages of natural and artificial strength of position. But the success or failure of an offensive would turn more on *moral* than on material factors. Presuming that the tactical break-through was possible, would the Bulgarians knit up again on a new line further back? Or would it be found that the third winter had completed the war-weariness on which Sarrail had twice vainly counted, so that one heavy blow would finish the matter? In the light of events the answer is easy. The new government in Bulgaria was pacifist in character. Ludendorff regarded a breakdown as almost certain and detailed several divisions from the eastern front early in Sept. to proceed to Bulgaria and Serbia, the nearest indeed being ordered to Sofia to keep order. On the front itself, according to German accounts, conditions were "indescribably pitiful," and for food the greater part of the troops were dependent on ox-transport from a base 60 m. distant, and upon what they had themselves grown behind the lines, this last fact indeed making it almost impossible to induce a unit to quit its sector for a concentration. But 1917 had for the Entente been a tragedy of disappointments founded on optimistic estimates of the enemy's broken *moral* and vanished man-power, and in 1918 a not unhealthy scepticism prevailed in their intelligence staffs, although it was agreed that Bulgarian *moral* was low. Then, too, there was the question of Serbian *moral*. Since the deadlock of May 1917 the Serbians had consistently followed the principle that it was useless to rescue Serbia if no Serbs were left to inhabit it, yet they alone possessed the fire and passion which would convert tactical victory into strategic triumph, who would disregard food and rest sufficiently to exploit success by leaps and bounds, who would not stop short of the Danube. And nothing less than victory without remainder would be of any value to the Entente.

When the plans were under consideration this latter question was unexpectedly answered by the Serbs themselves. They proposed an offensive with limited objective in the Moglena sector, *i.e.* that lying between Kaimakchalan and the Srka di Legen. At once the situation was cleared up. If they were ready to carry out an attack on the mountain front for no more than a limited objective, it was unlikely that an offensive from that group with the objective of Belgrade would not fall to pieces as in 1917. On June 29 the plan was definitely fixed, and about July 7 the Serbian headquarters (now directed by Mishich) agreed to engage all its forces in the operation. The date of the offensive (which needed a good deal of material preparation as the Moglena sector had never been equipped for battle) was fixed for Sept. 15, though, owing to objections and preoccupations in Paris, the higher command did not give leave to carry it out till little more than a week before that date (Sept. 4).

On Sept. 14 a bombardment opened which, less overpowering than those of the western front, was far heavier than anything previously witnessed in the Balkans. Next day—the original date—the offensive was launched. From the Lechnitsa river to the Sokol mountain the I. Serbian Army (Boyovich), consisting of the Danube, Drina and Morava Divs., had a frontage of 5 kilometres per division. From Sokol to the Suchitsa brook the II. Serbian Army (Stepanovich) formed the break-through force. In front of the Dobropolye were the two French assault Divs. with the Shumaja Div. on their right, and the Exploitation Divs., Timok and Yugoslav behind them. The I. Army and the Exploitation Divs. were not to move till the French had carried Sokol, Kravitsa and Vetrenik heights. Then, passing through, the Yugoslav Divs. were to master the Koziak, and the II. Army front was to advance at the utmost speed on Gradsko, flankguarded by the I. Army on the left and the Timok Div. on the right.

The attack succeeded according to programme. It continues to be a matter of controversy whether the Bulgarians offered an earnest and fierce resistance. The impression left on the Allied infantry was that they did so; the Germans in their midst assert the contrary. In any case, it is probable that the backbone of resistance was the German mountain machine-gun detachments which were dispersed in the battle zone. Be this as it may, the French Assault Divs. carried their objectives by the evening of the 15th, the Yugoslav Div. passed through them in the night of the 15–16, carried Koziak on the 16th, and on the 17th drove a deep wedge, of which the point was armed midway between Gradsko and Demir Kapu, and the lengthening left flank along the Cerna was taken up by the I. Army. On the other side there was little or no tactical handling in the ensemble. Machine-gun groups and specially resolute parties of riflemen in broken ground constituted the whole resistance. This, indeed, was the typical form of defence in all theatres of war by 1918, but here it lacked the essential element of organized counter-attack. Here and there a unit turned upon its pursuers, but in the main the rear of the enemy's position was void of reserves, although it is said that only 12,000 Bulgarian and German infantry were in line on the front attacked. Later, all attempts at reinforcement always failed, as the troops concerned had to traverse instead of following the valleys and ridge-systems. In sum, by the 19th, the wedge had developed two horns, of which one, following the Cerna, was at the outskirts of Kavadar, and the other was engaged in rolling up the front opposed to Anselme's group.

Meanwhile, on the 18th, the British and Greeks of the Doiran front, under orders from Gen. Franchet d'Espérey, assaulted the whole enemy line from the Vardar to beyond Lake Doiran, with the general idea of cutting the communications between the Bulgarians opposed to Anselme, and the apex of their own country at Strumnitsa. Here, at any rate, the Bulgarians fought vigorously. Their positions were as strong by art as the Moglena positions were by nature, or stronger, and the attack lacked depth owing to the detachment of a division to work with Anselme's force, and to the low effective strength of units.[1] Thus it met with the same fate as those of 1917—small gains of ground consolidated and held after far larger gains had been for a moment achieved. A second attack next day was no more successful. But for these critical days a large force of the enemy had been completely held.

On the 20th and 21st the exploitation of the break-through was completed. The Serbian I. Army, no longer simply guarding the flank of the II., crossed the Cerna and began a drive along the mountains of the Cerna bend to which the Italians and the French of the "A.F.O." conformed little by little. The Serbian II. Army reached the Vardar between Krivolak and Demir Kapu, and its right horn continued to push due eastward along the mountain positions in front of Anselme's force, which progressively came into action from left to right. By the afternoon of the 21st the Doiran–Vardar front was in collapse, and the British aeroplanes were bombing the intermingled troops and transport of the enemy which was seeking to make their way through Kosturino to Lyumnitsa.

From that day, though progress was sometimes slow, sometimes fast, the Allied offensive became a strategic pursuit in the full sense of the word, marked by a consistent policy of outflanking, as rapidly as possible, any solid line of resistance which the enemy managed to create. Thus, on the 24th, the resolute front offered by a hastily assembled German force on the line of the Vardar near Gradsko (the administrative centre and organized base of the enemy's centre) was turned on the N. by the steady advance of the Serbian I. Army on Veles (24th–25th), and once released thereby the Serbian II. Army marched at high speed on Shtip (25th), Nochaua (26th), and Tsarevo Selo (27th), behind the rear of the forces that were giving ground before the British, who in turn worked down the Strumnitsa basin and (in concert with the Greeks further to the right) ascended the upper Struma region, with their aeroplanes sent ahead to bomb the Kresna defile.

Thus, too, when infantry fighting threatened to become stable between Veles and Shtip, the French cavalry brigade under Gen. Jouinot-Gambetta, instead of becoming involved in the Veles fighting, made an independent dash upon Uskub, and to the astonishment of both sides seized that vital centre on the morning of the 29th. This event, which secured the communication between the (so-called) XI. Army and the remainder of the Bulgarians, forced the latter into the region of Egri Palanka, and the former into that of Kosovo. Thenceforward the I. Serbian Army, with the upper Morava as the axis of movement, moved steadily northwards with its right on the Bulgarian border, and its left following approximately the line Gilau–Kinshumlia–Kralyevo, reached Racha–Krushevats–Pirot on Oct. 15, Kralyevo–Parachin–Zayechar on Oct. 23, Pozharevats–Arangyelovats–Uzhitseon Oct. 28, Belgrade–Lyuboviya on Nov. 1, and the old barriers of the Drina, Sava, and Danube on Nov. 4. Meantime, the II. Army had reconquered Kosovo and the Sanjak of Novipazar, reaching Priboy and Plevlye on Nov. 1. By that time the strategic pursuit further E. had become a series of movements authorized by the terms of an armistice, and to the W. Pflanzer-Baltin was evacuating in turn Albania and Montenegro, with, as his only purpose, the maintenance of his divisions as formed military units. The Balkan Campaigns were at an end.

For the Salonika campaigns 1915–17, the principal authority is Sarrail's *Mon Commandement en Orient*, which is profusely documented; with this should be taken Gen. Milne's despatches. The German part in the Cerna bend battles of 1916 is described in K. Lubmann's monograph *Herbstschlacht in Mazedonien*, written from official archives. The crowning offensive of 1918 is dealt with fairly fully in C. Photiades *La Victoire des Alliés en Orient*. (X.)

SALTING, GEORGE (1835–1909), British art collector, was born at Sydney, N.S.W., Aug. 15 1835. His father, a Dane, had made a large fortune by sheep-farming and sugar-growing, and on inheriting this Salting devoted himself to collecting, with great taste and discrimination, Chinese porcelain and English and French furniture and pictures. He led a very simple life and was of retiring and somewhat eccentric habits. On his death, which took place in London Dec. 12 1909, it was found that his priceless treasures had been left to the nation. They are now housed in the Victoria and Albert Museum, the British Museum and the National Gallery.

SALVADOR (*see* 24.96).—The estimated pop. in 1912 was 1,161,425; in 1917 1,700,000, indicating a pop. denser than that of any American republic except Haiti. In 1918 births numbered 49,783, deaths 33,884 and marriages 3,653. Of the births 21,528 were legitimate and 28,255 illegitimate. Most of the upper class are of European descent and reflect European influences; the lower class has a higher standard of living than has that of Nicaragua or Guatemala. The agriculturists are prosperous and alert; few of them are foreigners. Coffee is the principal crop; some 70,000,000 lb. a year are normally exported to the United States, France, Germany, etc. It constitutes 80% of the total exportation. In 1916 there were 153,517 ac. under cultivation, containing 95,000,000 coffee-trees. The 1917 crop was damaged by the great earthquake of June 7, which partly destroyed five towns. Other products are cacao, tobacco, rubber and sugar. Cultivation of cotton and wheat is being encouraged. Corn is extensively raised, because of the domestic demand. Live stock was estimated in 1919 at 284,013 head of cattle, 74,336 horses, 21,457 sheep, and 422,980 hogs. Mine products include gold, silver, iron, copper and mercury. There are native mining companies as well as English and American. The gold output runs about $1,500,000 per annum.

Foreign trade is in the hands of English, Dutch and German exporters and wholesalers. Its annual value 1912–8 was:—

	Imports	Exports
1912	$6,744,859	$ 9,942,184
1913	6,173,545	9,938,724
1914	4,958,624	10,796,495
1915	4,022,167	10,563,871
1916	5,668,000	9,970,000
1917	2,719,095	10,588,900
1918	5,979,000	12,069,000

In 1919 the exports to the United States were $4,146,113, the imports from the United States $5,821,920. National revenues and expenditures, in pounds sterling, were reported as follows:—

	1915–6	1916–7	1917–8	1918–9	1919–20
	£	£	£	£	£
Revenues	850,114	908,325	1,998,810	1,382,644	1,670,056
Exp'd't's	1,058,219	916,704	1,013,842	1,874,079	1,692,692

The estimated revenue for 1920–1 was stated at 14,726,170 colones, and expenditures 16,227,580 colones, leaving a deficit of 1,501,410 colones. The colon was fixed at $0.50 by law of Sept. 11 1919. Prior to that time it was normally worth $0.3978, but in 1917 it was worth $0.60 and by Dec. 31 1918 $0.72. The national debt at the end of 1918 was $11,098,000.

Education has long been nominally free and compulsory, but until recently received little attention from the Government. In 1911 there were 173,495 children of school age and only 21,569 in primary schools, which numbered 486; in 1916 only about one-fourth of the 245,251 children of school age were in the 989 primary schools. In the principal towns the schools have done excellent work, though with poor accommodation. In rural districts there were in 1916 only three grades, with a fourth year of industrial instruction added. The lower classes were thus purposely left without educational facilities in order to exclude them from the professions. The secondary schools, of which there are 27, lacked trained teachers and funds, as did the National University. In the latter, graduates of the secondary schools are offered courses in jurisprudence, medicine, pharmacy, dentistry, and engineering. In 1919 a law for eradicating illiteracy was enacted, and a campaign begun to reduce the proportion, then 70%, ignorant of the alphabet. The budget estimate for 1920–1 contained an appropriation of 1,831,374 colones for education. Other social measures were a campaign against alcoholism inaugurated by the Superior Council of Health, and the inception of a federation of working-men's societies.

History.—After 1909 Salvador remained substantially at peace within her borders and with her neighbours. President Fernando Figueroa was succeeded by Manuel Enrique Araujo in 1911, but the latter was murdered in 1913 and succeeded by the vice-president, Carlos Meléndez. He resigned in Aug. 1914. Alfonso Quiñónez Molina temporarily held the presidential power and when Carlos Meléndez was elected president in 1915, Molina became vice-president. On March 1 1919 Jorge Meléndez was inaugurated for the term ending 1923. The tranquil condition of Salvador was due to the decrease of hostility between Conservatives and Liberals, and to the frequent insistence by the United States upon the preservation of peace.

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[1] At that time influenza was raging in the British force.

During the World War Salvador was the only one of the five isthmian republics which did not declare war against Germany, although, by note of Aug. 24 1917, she permitted U.S. vessels, regardless of armaments, to use her ports. When the Monroe Doctrine was adopted without definition in the Covenant of the League of Nations, she interrogated the U.S. Government as to the interpretation of the doctrine; later, in 1920, a movement was made to initiate an international bureau or court excluding the United States from membership, but this movement gave way to another looking toward Central American union, which Salvador had long advocated.

On June 24 1920 the Salvador Department of Foreign Relations sent a circular telegram to the other four isthmian republics inviting their participation in an isthmian congress to review, and, if needful, change the Washington Conventions of 1907, which were intended to safeguard the interests of all Central American countries and to promote the settlement of difficulties through arbitration. The congress was also to plan for unification of the national constitutions and law codes, provision for uniform secondary and professional education, equalization of customs duties with free trade in Central American products, adoption of uniform extradition laws, moneys, weights and measures, and a single coat of arms and flag. From such unification political consolidation was expected to ensue. Conferences began Sept. 15 1920. Nicaragua seemed for a time to prevent complete accord, but a preliminary agreement as to union was reported as having been effected Jan. 21 1921. To this pact of union Salvador, Honduras and Guatemala became signatories; Nicaragua and Costa Rica rejected its terms, which became effective Feb. 10 1922. Salvador has an arbitration treaty with the United States, ratified in 1913, and a treaty encouraging commercial relations, ratified in 1919. (H. I. P.)

SALVINI, TOMMASO (1829–1915), Italian actor (*see* 24.103), died at Florence Dec. 31 1915.

SALZBURG (*see* 24.104), a Territory of Austria, borders for a considerable distance on the Italian Tirol. In 1910 it had 214,737 inhabitants; in 1920 only 213,877 (77 to the sq. mile). In 1900 16·0% of the soil was unproductive. The productive areas included 39·2% forest; 39·8% grazing lands, mostly high-lying; 9·8% meadow; 0·3% gardens; and only 10·8% arable. The most important towns are Salzburg (pop. in 1920, 36,450); Hallein (pop. 6,746); St. Johann, in Pongau (pop. 1,709). The opening of the Tauernbahn has greatly increased the importance of Bad Gastein and Hof Gastein, and the latter has developed into a modern health resort. The Gastein springs are rich in radium.

SAMSONOV, ALEXANDER (1859–1914), Russian general, was born in 1859. After being at the Cavalry school in St. Petersburg he served in the war with Turkey in 1877–8. On passing out of the Academy of the General Staff in 1884 he was appointed on the general staff. From 1896 to 1904 he was commandant of the Cavalry school at Elisavetgrad, and in 1902 he was promoted to the rank of general. In the war with Japan in 1904–5 he commanded the Ussuri mounted brigade and the Siberian Cossack division. He distinguished himself greatly as a leader of cavalry, and was awarded the St. George Cross of the fourth class. In 1909 he was made Ataman of the Don Cossacks, and in the same year he became governor-general and commander of troops in Turkestan. In Aug. 1914 he was appointed commander of the II. Army, which was concentrated on the Narev. Sentiments of loyalty to an ally and the desire to take pressure off France at the earliest possible moment led the Russian supreme command to give a premature order for an advance into eastern Prussia. Notwithstanding his report that his army was not ready for an advance the order was repeated, and as a result of the absence of support from Rennenkampf's I. Army Samsonov's army was destroyed in the battle of Tannenberg on Aug. 26–29. Convinced that the battle was hopelessly lost, he gave orders to his staff to extricate themselves from the German ring, while he went into a wood and shot himself. He was buried, with other Russian soldiers, not far from Villenberg. His wife, coming later to Germany with the Red Cross, recognized his body by a medal that he wore.

SAMUEL, SIR HERBERT LOUIS (1870–), British politician, was born at Liverpool Nov. 6 1870, the son of the banker Edwin Louis Samuel. He was educated at University College school and Balliol College, Oxford, where he took his degree in 1893. In 1895 and 1900 he unsuccessfully contested South Oxfordshire as a Liberal, but in 1902 was elected for the Cleveland division of Yorks. He entered Sir Henry Campbell-Bannerman's Government in 1905 as Parliamentary Under-Secretary to the Home Office. From 1909 to 1910 he was Chancellor of the Duchy of Lancaster, with a seat in the Cabinet, and in 1910 became postmaster-general. He held this office until 1914, and then became for a year president of the Local Government Board. From 1915 to 1916 he was again postmaster-general and Chancellor of the Duchy of Lancaster, and in 1916 became Home Secretary. He acted as chairman of the select committee on national expenditure (1917–8), and in 1919 was a British special commissioner to Belgium. In 1920 he was appointed high commissioner to Palestine and was created G.B.E.

SANDAY, WILLIAM (1843–1920), English theological scholar, was born at Holme Pierrepont, Notts., Aug. 1 1843, the son of William Sanday, a well-known breeder of sheep and cattle. He was educated at Repton and Balliol College, Oxford, afterwards becoming a scholar of Corpus Christi. He took a first-class in classical moderations in 1863, a first in the final classical schools in 1865, and was ordained in 1867. He became a fellow and lecturer at Trinity in 1869, and in 1876 was chosen principal of Hatfield Hall, Durham. In 1883 he was appointed Ireland professor of Exegesis at Oxford, and in 1891 Lady Margaret professor of Divinity, a post which he held till 1919. He died at Oxford Sept. 16 1920.

As a theological and biblical critic of the apologetic school Sanday took a very high place. His chief works are *The Authorship and Historical Character of the Fourth Gospel* (1872); *The Gospels in the Second Century* (1876); *The Oracles of God* (1891); *The Early History and Origin of the Doctrine of Biblical Inspiration* (1893); *Commentary on the Epistle to the Romans* (with Dr. Headlam, 1895); *Outlines of the Life of Christ* (1905; a republication of an article in Hastings' *Dictionary of the Bible*); *Christologies, Ancient and Modern* (1910) and *Personality in Christ and in Ourselves* (1911).

SAN FRANCISCO (*see* 24.144) increased in pop. during 1910–20 from 416,912 to 506,676 or 21·05%, making it the eleventh city in the United States. The metropolitan district, as designated by the U.S. Census Bureau in 1920, included all the communities in the extensive area surrounding San Francisco bay. This area had in 1910 a pop. of 750,000 and in 1920 1,121,631, being the fifth population centre of the United States.

Transportation and Commerce.—The railway service of San Francisco was greatly improved in the decade 1910–20. In 1917 the Southern Pacific spent approximately $1,500,000 on yards and carshops in the city. The other railways correspondingly improved their terminal yards on the bay. Steamer service grew remarkably, in part because of the opening of the Panama Canal. In 1911 the ship tonnage of the port was 5,519,556 entered and 5,545,530 cleared. In 1919 4,617 vessels entered the port and 4,696 cleared, carrying a gross tonnage of 12,261,669. In 1920 the 48 steamship lines operating out of the port had over 250 steamers; 29 lines were in foreign and 19 in coastwise trade. The U.S. Shipping Board in allotting ships gave the port 250,000 tons, including seven ships of 21,000 tons each. The urban railway mileage increased from 289·6 m. of single track in 1910 to 352·88 m. in 1920. The opening of a municipal line in Dec. 1912 caused the retention of a five-cent fare. The number of passengers carried during the fiscal year 1919 was 307,000,000 as against 157,722,720 in 1911. The south-western quarter of the city was brought within 25 minutes of the business district by building a tunnel under Twin Peaks (1917). In 1921 the port of San Francisco had 41 modern piers with a total area of 4,500,000 sq. ft., providing for more than 1,200,000 tons of cargo per month, an increase of 100 % over the accommodation available in 1910. The Belt railway, which serves all but three of the piers, had in

1920 54 m. of track. A tunnel under Fort Mason, connecting the Government docks and the Presidio with the Belt line, was completed in 1914. The harbour was self-supporting, paying all maintenance, interest and redemption of bonds. In 1911 the people of the state voted $9,000,000 and in 1914 $10,000,000 in bonds for port development. In 1920 the harbour board approved plans for an extensive combination dock and warehouse, accessible by ship and rail. The freight discharged and landed over the wharves of the port of San Francisco, exclusive of federal and private wharves, increased from 6,866,148 tons in the year 1910–1 to 10,257,612 tons in 1918–9. The foreign trade of the port in the period 1909–19 increased 274%; while the increase for the United States during the same period was 107%. The value of the foreign trade for 1920 was: exports $220,257,771, imports $212,021,768, a total of $432,279,539. The tonnage movement for the same period was: outgoing 7,033,480, incoming 7,183,042, total 14,216,522.

Industries and Finance.—Since 1916 shipbuilding has been the most important industry of San Francisco. In the three-year period 1916–9 there were constructed in the metropolitan district 97 cargo ships of a total of 945,783 tons and 110 naval craft, including three super-dreadnoughts. In 1920 there were completed 68 cargo ships of 607,650 deadweight tons.

In Jan. 1921 the estimated number of factories in the city was 2,500, employing more than 55,000 wage-earners. The principal industries, with the estimated value of their product in 1920, were printing and bookbinding, $20,000,000; fruit and vegetable canning, $15,000,000; slaughtering and meat-packing, $20,000,000; foundry and machine-shop products, $17,500,000; lumber and timber products, $7,500,000.

Bank clearings increased from $2,427,075,543 in 1911 to $8,122,064,916 in 1920, placing San Francisco eighth in the United States in bank clearings. The assessed valuation of property in 1920 on approximately a 50% basis was $819,820,078.

Public Works.—The plans of the city in 1910 to own its own water supply culminated in the Hetch-Hetchy water and power project. The city owns a watershed of 420,000 ac. in the Sierras on the headwaters of the Tuolumne river, 160 m. distant, from which 400,000,000 gal. of water can be secured daily and 250,000 H.P. produced. The work of development was well under way in Jan. 1921. A railway 68 m. long to Hetch-Hetchy valley and the Lake Eleanor dam were already built, over 18 m. of tunnel were under construction and a hydro-electric plant of 4,000 H.P. was in operation. The contract for the Hetch-Hetchy dam was let for $5,400,000. Bonds for $45,000,000 were issued and $8,000,000 spent by March 1921.

Buildings and Parks.—The value of private building operations was $22,873,942 for 1910, $18,626,199 for 1915, $18,644,343 for 1919, and $32,869,009 for 1920. Among the notable public buildings are those of the Civic Center, located in the heart of the city and surrounded by a plaza. They consist of three main buildings: the city hall, costing $4,000,000; the auditorium, with a seating capacity of 12,000, given by the Panama-Pacific International Exposition and costing $1,275,000; and the public library, costing $1,000,000. A state building costing $1,000,000 was in Jan. 1921 in process of construction near the Civic Center. Among recent buildings were the First National Bank, American National Bank, Robert Dollar building, Balfour building, Bank of Italy and the Southern Pacific building. The Exchange building, the building of the California Title Insurance Co., the Crocker building and the Furniture Exchange building were under construction in March 1921. In Jan. 1921 there were 34 parks in San Francisco with an area of approximately 2,500 acres. The Golden Gate Park Memorial Museum had been completed. Nine playgrounds were in use and several more under construction. The public library, as part of the Civic Center, was in 1921 housed in a magnificent building; there were also nine branches and 13 deposit stations with a total of 240,000 volumes, with a home circulation of 1,368,685. The Palace of Fine Arts of the Panama-Pacific International Exposition was given after the fair to the San Francisco Art Association; many of the art treasures shown in 1915 remained there. In Feb. 1921 ground was broken in Lincoln Park for a California Palace of the Legion of Honor as a memorial to the Californians who gave their lives in the World War and as a museum of art.

Education.—In 1920 there were 107 public schools, including high schools, with 1,928 teachers and an enrolment of approximately 80,000 pupils. The university of California, at Berkeley, and the Leland Stanford Jr. University, at Palo Alto, each had important teaching departments in San Francisco.

History.—The opening of the Panama Canal was celebrated, Feb.–Dec. 1915, by the Panama-Pacific International Exposition at San Francisco, representing an investment of $50,000,000. The exhibits, numbering about 80,000, were valued at $300,000,000. Thirty-nine foreign nations and 37 states and three territories of the United States were represented at the exposition. The attendance began with 245,000 on opening day, Feb. 6, rose as high as 348,500 on Nov. 2, San Francisco Day, and reached a total of 18,500,000. The architecture was of a highly varied and monumental character. One of the artistic merits of the exposition was its effective colour scheme, while the night illumination was extremely ingenious and impressive. In spite of the World War the foreign exhibits were remarkably complete. Financially as well as artistically the exposition was a success. After presenting to the city of San Francisco the auditorium already noted, the exposition authorities had on hand a final net profit of a little more than $1,000,000. The whole enterprise had been undertaken without Government subsidy; the city and state, however, appropriated $5,000,000, while private contributors added $7,500,000 more. Receipts from concessions were $7,809,565 and from admission fees $4,715,523. The beginning of a new era in world trade, which the exposition celebrated in connection with the opening of the Panama Canal, was delayed by the World War, but with the resumption of normal conditions trade increased. Following the prosecutions begun in 1907, corruption in the city government was largely eliminated, but it reappeared, though on a smaller scale, after 1909. The election under a new primary system in 1911 of a mayor and city government opposed to "graft" brought in an era of reform. In Dec. 1911, by an extension of the city charter, members of the police and fire departments were placed under civil service. A number of other charter amendments were made during the decade 1910–20, but there was no material enlargement in the power of the city.

(R. A. V.)

SAN GIULIANO, ANTONINO PATERNO-CASTELLI, Marquis di (1852–1914), Italian statesman, was born at Catania in 1852, a member of a very ancient and noble Sicilian family. After graduating in law at the university of Catania, he began his public career in the field of local politics and in 1879 was chosen mayor of his native city. In 1882 he was elected to parliament and proved an active worker on committees, speaking frequently and well on foreign and colonial affairs, railway, agricultural, social and fiscal problems. In 1891, as member of the committee of inquiry on Eritrea, he opposed the African policy of both the Crispi and the Rudini Cabinets. When in the following year Sig. Giolitti became premier, the Marquis di San Giuliano was selected as under-secretary for agriculture, while in the Pelloux ministry (1899–1900) he held the portfolio of posts and telegraphs. During the next few years he devoted himself to travel in the near East and in North Africa and to the study of the problems concerning those regions. Having been defeated at the elections of 1904, he was nominated senator; in parliament he had long been a staunch follower of Sig. Sonnino; but when, in Dec. 1905, Sig. Fortis became prime minister, he accepted the post of minister for foreign affairs, and on the fall of the Cabinet early in 1906 he was appointed ambassador in London, where he remained until 1910, gaining much popularity and contributing to render Anglo-Italian relations ever more cordial. He enjoyed the special regard of the late King Edward VII., who afterwards visited him at Catania. From London he was transferred to Paris; but he soon returned to the Consulta as member of the Luzzatti Cabinet (1910–11), and continued at the same post in Sig. Giolitti's administration. In the autumn of 1911 the crisis with Turkey broke out, and it is believed that it was he who convinced the premier of the national necessity for the Italian occupation of Libya. During the whole tenure of office the Marquis di San Giuliano was an ardent believer in the Triple Alliance, on which he thought that Italy's foreign policy should be based, and attached the greatest importance to a good understanding with Austria, an attitude not calculated to win him popularity in many circles; under his guidance consequently Italy opposed Serbia's desire for a port on the Adriatic and Greece's aspirations in Epirus, and supported the policy of creating an independent Albanian State. On Giolitti's resignation in March 1914, San Giuliano retained office under Sig. Salandra, at the latter's urgent request, and was soon faced by the responsibilities arising out of the outbreak of the World War. Public opinion was inclined to attribute the declaration of Italian neutrality to the premier rather than to the minister for foreign affairs. But it is certain that, once the decision had been taken, the Marquis di San Giuliano carried out the policy it involved with the most complete loyalty.

The strain and overwork, however, of the three years of office together with grief at the death of his only son in 1912, had told on his constitution; and after an acute attack of gout, he died in harness at the Consulta on Oct. 16 1914. He was a man of wide literary, historical and artistic culture, a Dante student, and the author of several books and articles on social questions, the conditions of Sicily, foreign affairs, etc.; his *Lettere dall' Albania* are deservedly appreciated, and his geographical studies led to his being elected president of the Italian geographical society.

SAN MARINO (*see* 24.153), area 38 sq.m., had in 1920 a pop. of 12,069. The estimated revenue for the year ending March 31 1921 amounted to 34 million lire, derived mainly from customs; tobacco, matches and salt monopolies; and taxes on patrimonial estates and on urban and rural lands and buildings. There is no public debt. The regents (*Capitani Reggenti*) exercise executive power through four principal committees nominated from the supreme "Council of Twelve," viz.: a *Congresso Economico di Stato, dei Legali, degli Studi* and *Militare*. A "treaty of good relations and friendship" with the kingdom of Italy, concluded in 1897, was revised and renewed in 1908, 1914 and 1920. The republic has extradition treaties with England, Holland, Belgium and the United States and is represented by Consuls-General at Rome, London and Barcelona and by a *chargé d'affaires* at Paris. England also has an accredited representative resident in Florence. During the World War, though nominally neutral, the republic took a share in providing hospital equipment for the Italian front and put no obstacle in the way of her nationals volunteering for service in the Italian army. San Marino was represented on the International Radio-telegraphic Congress of Basle (1913) and had a wireless station (receiving only) on Monte Titano but, on the entry of Italy into the war, complications arising with Germany, it was dismantled and in 1920 had not been reinstalled.

SANTAYANA, GEORGE (1863-), American philosopher and writer, was born in Madrid, Spain, Dec. 16 1863. At the age of nine he came to America and was educated at Harvard (A.B. 1886; Ph.D. 1889), where he taught from 1889 to 1912 as instructor, assistant professor, and, after 1907, as professor of philosophy. He then retired to devote his time to literary work. In 1905 he was Hyde Lecturer at the Sorbonne. He was a member of the National Institute of Arts and Letters. His chief work is *The Life of Reason: or the Phases of Human Progress* (1905–6), 5 vols., entitled respectively *Reason in Common Sense; Reason in Society; Reason in Religion; Reason in Art* and *Reason in Science*. His other writings include: *Sonnets and Other Verses* (1894); *Lucifer, a Theological Tragedy* (1899); *Three Philosophical Poets* (1910); *Winds of Doctrine; Studies in Contemporary Opinion* (1913); *Egotism in German Philosophy* (1916) and *Character and Opinion in the United States; with Reminiscences of William James and Josiah Royce, and Academic Life in America* (1920).

SANTO DOMINGO (*see* 24.194).—The decade 1910–20 witnessed a succession of abrupt changes in the political status of Santo Domingo, accompanied by corresponding economic and social developments. The civil security and material well-being ushered in by the Dominican-American Convention of 1907 came to an end with the assassination of President Ramon Caceres on Nov. 19 1911. Gen. Alfredo M. Victoria, the dominant military figure, secured the selection of his uncle Eladio Victoria as president. Revolutionary outbreaks of the traditional type followed, culminating in the appointment of a special commission by the President of the United States, to aid in the reëstablishment of peace and order. Conferences resulted in the resignation of Victoria and the election of Archbishop Adolfo A. Nouel as provisional President. Friction developed, and on March 31 1913, Monsignor Nouel resigned and embarked for Europe. The Dominican Congress selected as provisional successor, Gen. José Bordas Baldez. Revolutionary disturbances again broke out and the United States once more lent its good offices by sending a commission, with whose advisory aid Dr. Ramon Baez was selected as provisional president Aug. 27 1914. Some months later Juan Isidro Jiménez was chosen as constitutional president. A brief period of peace and progress ensued, terminated in April 1916 by an outbreak led by Gen. Desiderio Arias (a chronic revolutionist from Monte Christi), which President Jiménez, aged and infirm, failed to check. Arias seized the military control of the capital, practically deposed Jiménez and assumed the executive power. With another civil war thus imminent, with its patience strained by the events of the preceding years, and with the international situation developed by the World War threatening foreign intervention, the United States now took definite action. Naval forces were landed. President Jiménez resigned the presidency and retired to Porto Rico, and in May–June 1916 the pacification of the country was effected with nothing more serious than minor encounters with revolutionary forces. On July 25 1916, the Dominican Congress selected Dr. Francisco Henriquez Carvajal as temporary president. The United States, refusing recognition until assured of the non-recurrence of civil disorder, proposed a new treaty based upon the convention just adopted between the United States and Haiti (*see* HAITI), which should repair the shortcomings of the 1907 convention in providing for the collection of customs under American auspices, the appointment of an American financial adviser and the establishment of a constabulary force officered by Americans. President Henriquez refused to enter into this arrangement, with a resultant deadlock intensified by the withholding by the American authorities of the revenues collected by its officers. Matters came to a head with Henriquez's intention not to retire from the presidency upon the expiration of his provisional term but to present himself as a probable successful candidate for popular election. On Nov. 29 1916 by proclamation of the American commander of the forces of occupation, Santo Domingo was placed under the military administration of the United States. Executive departments were taken over by American naval officers, ex-president Henriquez left the country, order was quickly established, and Santo Domingo entered upon four years of civil quiet and economic improvement. The termination of this status was foreshadowed Dec. 24 1920 by a proclamation of the military government that "the time has arrived when it may, with a due sense of its responsibility to the people of the Dominican Republic, inaugurate the simple processes of its rapid withdrawal from the responsibilities assumed in connexion with Dominican affairs." Announcement was made that a commission of representative Dominicans with a technical adviser was to be appointed, entrusted with the formulation of constitutional amendments and the revision of the laws of the republic, such proposals upon approval of the military governor to be submitted to a constitutional convention and to the national congress.

The economic experience of the country in the decade reflected closely the successive political changes outlined above. Agriculture continued the mainstay of the country's life; and cacao, sugar and tobacco leaf remained its staple crops. Increased production in the years following the convention of 1907 showed arrest in 1912–4 changing to abrupt increase in 1915. With the war-induced rise in prices and the conditions born of military occupation, the upward movement in export values continued through 1920, assuming sensational proportions in the last-named year. The combined volume of imports and exports was less in 1914 than in 1911; but the increase in 1915 over 1914 was greater than the total exports in 1905, and the increase in 1916 over 1915 was almost as much as the combined exports and imports of 1905. The combined value of imports and exports was $105,257,117 in 1920, as compared with $61,621,019 in 1919 and $17,945,208, in 1911. An increasing proportion of this trade has been with the United States, 77·17 % of imports and 87·03 % of exports in 1919, as compared with 59·29 and 52·31 % respectively, in 1911. In the first half of the decade political disturbances delayed the course of financial extrication ensured by the convention of 1907; but after 1916 rapid progress was made. On Dec. 31 1920, the sinking fund established for the $20,000,000 U.S. customs administration loan amounted to $11,457,373, ensuring amortization long before maturity. A loan of $1,500,000 authorized by the United States to discharge internal debts contracted in 1911–2 was finally liquidated in 1917. A further issue of $4,000,000 authorized in 1918 to liquidate and fund all outstanding internal indebtedness, as adjusted by a claims commission appointed by the military government, will be paid off by Dec. 31 1922. Economic and social conditions, although suffering from the political agitation prior to 1916, remained throughout far above the preconvention state. Since the military administration progress was notable. Roads and bridges were built, schools established, public sanitation extended, steps taken to clear up the complicated land title situation, internal taxation made effective and competence and regularity introduced in administrative service. Whether this was achieved at the expense of weakened capacity for self-government may be doubted. The policy of the United States was to make evident to the best elements in Santo Domingo what honesty and efficiency in administration could accomplish, as well as the futility and cost of "government by revolution."

The military government of Santo Domingo completed in 1921 the first census ever taken of the republic, and reported the number of inhabitants as 897,405. The population is scattered chiefly in a fringe along the shore and in the Cibao Valley especially in the region thereof known as the Royal Plain. In the mountainous interiors are vast uninhabited stretches and valleys which have not been visited since the days of the Conquest.

See Otto Schoenrich, *Santo Domingo: A Country with a Future* (1918); Report of Military Governor on Conditions in Santo Domingo, in *Annual Report of Secretary of the Navy* (1920). (J. H. Ho.)

SARGENT, JOHN SINGER (1856–), Anglo-American artist (*see* 24.219), exhibited in 1910 the open-air paintings "Albanian Olive Gatherers," "Glacier Streams," "A Garden at Corfu" and "Vespers." In 1911 appeared "A Waterfall" and "The Loggia." His portrait of Henry James was exhibited in 1914, and was one of the pictures damaged in that year by suffragette attacks. He contributed in 1915 a blank canvas to a Red Cross sale at Christie's, which was secured by Sir Hugh Lane just before his death for £10,000. In Dec. 1916 the third series of his mural decorations in the Boston Public Library was unveiled. This concluding series is entitled "The Theme of the Madonna." The first series (1895) depicts "The Judaic Development"; the second (1903), "The Dogma of the Redemption." The theme of the whole is "Judaism and Christianity." In 1917 he was elected a trustee of the Tate Gallery. During the World War he made a number of paintings of scenes on the western front; and his large picture "Gassed" in the Royal Academy in 1919 attracted great attention. In Nov. 1921 his decorations in the rotunda of the Boston Museum of Fine Arts were unveiled.

SARRAIL, MAURICE PAUL EMMANUEL (1856–), French General, was born at Carcassonne (Aude) April 6 1856. He qualified for both St. Cyr, and the École Polytechnique but chose to enter the former. He passed out Oct. 1 1877 with the distinction of third place and was posted as a sub-lieutenant to the infantry. His regimental service and promotion followed the normal course; he became lieutenant Oct. 1882, captain in 1887, and *chef-de-bataillon* in 1897. In 1901 he was appointed Commandant of the École Militaire d'Infanterie (St. Maixent), and the following year was promoted lieutenant-colonel. From 1904 to 1906 he held the appointment of Military Commandant of the Palais Bourbon, being made colonel in 1905. In 1907 he became Director of Infantry at the War Office—an appointment which he held 4 years. He was made general-of-brigade in 1908. Three years later he was promoted general-of-division and on Nov. 1 1913 was given command of the VIII. Army Corps, being later (April 24 1914) transferred to the VI. Corps, which he commanded on the outbreak of the World War. But though General Sarrail's military capacity was recognized prior to 1914 it was principally by his semi-political activities that he was best known; and as a member of General André's military cabinet he played a conspicuous part during a very troubled period of French army history. On Sept. 2 1914, after commanding the VI. Corps with credit in the Battle of the Frontiers, he was appointed to succeed Ruffey as commander of the III. Army. This army formed the pivot of the wheel-back of the Allied forces during the retreat to the Marne, and Sarrail maintained it as such on the N.W. front of Verdun, although authorized and indeed ordered to fall back. This left him in an exposed position, but one in which the swinging-in enemy himself might present a flank to Sarrail's attack. His part in bringing about the situation which enabled Joffre to counter-attack was thus as important and as brilliant as Gallieni's on the other flank. During the trench-warfare operations of 1914–15, however, he was less successful, as he was essentially a leader of temperament, and growing friction with Joffre led to his dismissal from this command after the action of Bourdeilles. Almost immediately thereafter, under circumstances described in the article SALONIKA CAMPAIGNS, Sarrail was appointed Commander of the French Army of the East, and at a later date he became commander-in-chief of the Allied forces on that front. The troubled history of this command, which lasted till his recall in Dec. 1917, is told in the article referred to. After his return to France he saw no further active service. In April 1918 he was placed on the reserve on reaching the age limit. He became a Grand Officer of the Legion of Honour in Nov. 1914 and was awarded a Grand Cross of the same Order in Jan. 1916. He was given the Médaille Militaire in Sept. 1917. Soon after the end of the war he published his account of the Salonika operations under the title *Mon Commandement en Orient.*

SASKATCHEWAN (*see* 24.225).—This Canadian province includes 243,382 sq.m. of land area and 8,318 sq. m. of water; 251,700 sq. m. in all. Its southern boundary is the 49th parallel and its northern the 60th: it is 390 m. from E. to W. and 760 m. from N. to S. The province comprises portions of the old districts of Assiniboia, Saskatchewan and Athabasca, which formed part of the old North-West Territories, with the town of Regina as the capital and the residence of the lieutenant-governor.

The province may be divided into four more or less well-defined zones. (1) The prairie zone forms the most southerly portion, extending from the U.S. boundary as far N. as the town of Saskatoon, and marked by open rolling prairie country of the richest possible agricultural character. (2) The prairie and woodland zone extends from Saskatoon to the southern edge of the great northern forest, consisting of mixed prairie country and woodland adapted for farming and stock-raising. (3) A dense forest zone is bounded on the S. by a line passing from the Swan river in a N.W. direction near the town of Prince Albert, and on the N. by a line drawn from the northern part of Reindeer lake to the southern part of Lake Athabasca. This zone is well watered and well timbered, being covered with a forest growth of spruce, tamarack, jack pine, poplar and birch. (4) The sparsely wooded forest zone includes the remainder of the country northward.

The geology of Saskatchewan is simple. Formations of very ancient, highly crystalline, contorted and foliated or schistose rocks, together with metamorphic rocks and eruptives, form a floor or basement complex referable to the Laurentian and Huronian systems, and upon this floor of primitive rocks there rests unconformably an uninterrupted succession of evenly bedded and for the most part stratified sedimentary formations ranging from the Keweenawan of supposed Cambrian age, through the palæozoic and mesozoic, to the Tertiary and Quaternary ages inclusive.

The province has an elevation of from 1,500 to 3,000 ft. above sea-level, which accounts for the dryness and clearness of the atmosphere. As in southern Alberta, portions of the country need irrigation, and the requirements of water and the sources of supply are problems being dealt with by the several governments interested.

The following table shows the growth of pop. since 1901:—

	Male	Female	Total
1901	49,431	41,848	91,279
1906	152,791	104,972	257,763
1911	291,730	202,702	494,432
1916	363,787	284,048	647,835

In 1916 the urban and rural pops. were 176,297 and 471,538 respectively. The census showed 150,292 families with an average of 4·31 persons per family housed in 140,359 dwellings. The origins were: Canadian-born 352,920; English 90,435; Irish 62,551; Scotch 64,735; Welsh 1,451; French 24,011; German 34,091; Austro-Hungarian 24,195; Scandinavian 13,064; Dutch 5,448; Indian 10,736; Polish 2,559; Russian 11,623; Ukrainian 2,175; others 8,806. The U.S. immigrants of various nationalities born in the United States were 87,907; of these 46% were British descendants. There is a largish community of Russian Doukhobors. The Indians of Saskatchewan are chiefly plain or wood Crees, with a mixture among them of Saulteaux. Towards the S. small bands of Assiniboines are found, and here and there small companies of refugee Sioux from the United States. They number 10,736 and are all on Government reserves. Steady progress had been made in enabling the Indians to become self-supporting, and to live in comfortable houses, growing crops of grain, making hay and possessing herds of cattle. At the various industrial schools young Indians, both male and female, receive a practical education.

Regina, on the main line of the C.P.R., is the capital, and had in 1920 a pop. estimated at 27,000. It was formerly the headquarters of the Royal Northwest Mounted Police. It contains the provincial legislature buildings, one of the provincial normal schools and the Regina College.

Moose Jaw (estimated pop. in 1920, 17,000) is situated on the main line of the C.P.R. It has extensive stock-yards and flour-mills, also a storage elevator with a capacity of about 3,500,000 bushels.

Prince Albert, on the banks of the North Saskatchewan (pop. in 1920 about 7,000), bids fair to become a manufacturing centre. It contains large sawmills and flour-mills, and is the centre for the fur-trading industry.

Saskatoon (pop. 1920, 22,000) has been one of the rapid urban growths of the Middle West. It is an important railway and distributing centre, through which the C.P.R. and two Canadian National railways pass. Tributary to the town is a large area of arable and prairie land.

North Battleford, Swift Current, Weyburn, Battleford, Maple Creek, Melville, Estevan, Yorkton, Humboldt, Indian Head, Moosomin, Qu'Appelle, Kamsack, Rosthern and Wolseley are local centres, deriving their importance chiefly from their situation in the midst of rich agricultural districts.

The executive Council of Saskatchewan consists of 7 members and the Legislative Assembly of 62 members. The province is represented in the Federal Parliament by 16 members of the House of Commons and 6 senators.

Education, both primary and secondary, receives earnest attention from the Government. The schools are free and supported by the Government and local taxation. Collegiate institutes and high schools are found in every important centre. Normal schools for the training of teachers are maintained at Regina and Saskatoon. The university of Saskatchewan at Saskatoon is supported and controlled by the province. In connexion with it is the agricultural college, which is well equipped for its special purpose and conducts very practical work among the farmers of the province. Saskatchewan schools in 1918 numbered 3,941 and maintained 6,062 teachers. The total enrolment in that year was 147,232, and the entire cost of administration $9,110,925 (in 1906 it was $1,465,361).

The province is essentially agricultural. The soil, made up of the detritus or debris of a great variety of rock materials and rich in natural phosphates, is characterized by its ability to produce a high average yield of wheat, oats, barley and potatoes for many years in succession without the application of artificial fertilizers. From experiments carried on at Indian Head—the headquarters of the experimental farm subsidized by the Dominion Government—it has been ascertained that the high average yields of wheat, oats, barley and potatoes on that farm are not only maintained from year to year, but are actually larger than at any of the other Dominion experimental farms scattered throughout Canada.

Saskatchewan has probably the greatest possibilities of production of all the provinces in the Dominion. Of the land area of 243,382 sq. m. a little over 25,000 were under crop in 1918, and it is estimated that, apart from forest land requiring clearing, 112,000 sq. m. are suitable for agriculture. In its southern parts the returns equal those of Manitoba, which have been regarded as exceptional. On the average of 1915–7 the yield was 163,264,100 bus. of wheat at a total value of $207,590,833. The limited area under cultivation yields a grain crop exceeding 350,000,000 bus. in a single year. The following are yields and values for the year 1920: wheat 113,387,300 bus., value $175,700,000; oats 141,590,000 bus., value $58,035,000; barley 10,501,000 bus., value $6,931,000; rye 2,535,000 bus., value $3,194,000; mixed grains 615,000 bus., value $769,000; flax-seed 5,705,000 bus., value $10,383,000; potatoes 6,861,000 bus., value $8,576,000; turnips, etc., 3,145,000 bus., value $2,956,000; hay and clover 328,300 tons, value $3,283,000.

With the exception of wheat and oats, the field crops are mainly grown for home consumption in stock-raising. The erection of silos in connexion with well-appointed farm buildings indicates the improvement of methods and the growing prosperity of farmers. The cattle industry of Saskatchewan has reached a very important place. There are many large herds scattered throughout the province, subsisting for a large portion of the year on native grasses and for the remainder of the year—the winter months—on outdoor feeding. So rapidly has the cattle industry advanced in the past few years that it has been found necessary to establish large stock-yards at Prince Albert and Moose Jaw. Dairying, naturally associated with the cattle industry, is making rapid progress, and at important points in the province are established up-to-date creameries. The output of dairy and creamery butter for one year amounted to 19,368,668 lbs., valued at $6,192,213, to which is to be added milk and cream to the value of $7,450,000, or a total of $13,642,213. In 1907 there were only four creameries in operation with 213 patrons, and in 1920 there were 20 creameries with 7,500 patrons and in addition four cold-storage plants. The raising of sheep has become general throughout the province, particularly in the northern part, where the conditions are most favourable.

The lumbering district of Saskatchewan lies N. of Prince Albert. Trees consist mainly of spruce, larch, jack pine, white and black poplar and white birch. Much of the timber is used for railway ties, and the recent annual cut amounted in value to about $2,000,000 a year. In the northern section of the province the Dominion Government set aside a number of large areas as forest reserves. The forests of the north still abound in fur-bearing animals, the principal being bear, otter, beaver, marten, wolf and mink. Prince Albert and Battleford are local centres of the fur trade, the annual value of which is about $1,450,000.

Manufacturing industries are not yet important in Saskatchewan. There are a number of flour-mills throughout the province, and the making of cement and bricks is coming more and more into prominence. Coal-mining, however, promises to be the principal industry of the province. Mining has been carried on for several years in the vicinity of Estevan. The lignite deposits of Saskatchewan, which underlie an area of 7,500 sq. m. and are estimated to contain 200,000,000 tons of lignite coal, were in 1920 being experimented with by processes of carbonization and briquetting. Gold, silver, copper, cobalt, iron, mica, peat, pigments, ochres and natural gas are among the mineral resources of the province. The value of minerals raised in 1919 was $1,118,055. The fisheries of Saskatchewan are still in their infancy. The lakes and rivers of northern and central Saskatchewan abound in fish sufficient to supply millions of people. The value of the fisheries in 1919 was $475,797.

For more than 30 years up to 1921 the main line of the C.P.R. had crossed the province of Saskatchewan from E. to W., about 100 m. N. of the border of the United States. One of its most important branches is the "Soo" line from Moose Jaw to St. Paul, Minn. Its lines to Edmonton and Lacombe, Alberta, have daily increasing traffic and passenger service. The main lines of the Canadian National railways also cross the province, with many branches tapping its rich agricultural districts. Saskatchewan has now over 6,000 m. of railway. The province is so well served by the C.P.R. and the Canadian National railways, with their numerous branches, that few of the established settlements are more than 10 to 20 m. from a means of transport. The Hudson Bay railway when completed will afford a short haul to ocean shipping from the Saskatchewan grain-fields. The building of roads and bridges within the province has been taken up energetically by the Government, and large sums have been expended. (W. L. G.*)

SAVAGE, MINOT JUDSON (1841–1918), American divine and author (*see* 24.239), died in Boston, Mass., May 22 1918.

SAVINGS MOVEMENT.—The origin and development of what became known in England as the "War Savings Movement" provides the subject-matter of one of the most interesting chapters in the economic history of the World War. In the United States, to which reference is made in a subsequent section, the Savings and Economy movement was no less remarkable.

United Kingdom

Institutions for the normal encouragement of thrift on the part of the people of the United Kingdom were making steady progress up to the date of the outbreak of the war in 1914. From that date onwards the pace of their advance was materially accelerated. The amount due to depositors in the Post Office Savings Bank increased 28% in the decade 1903–13, while during the five years 1913–8 they increased by 42%. The amount due to depositors in the Trustee Savings Banks increased 3·2% in the decade 1903–13, while during the years 1913–20 it increased by 12·5%. These figures give a general indication of the growth of the savings of the people during the war period, but they do not tell the whole story. In the atmosphere created by the War Savings movement, and in the circumstances which for a time materially improved the financial position of the wage-earning classes, not only did existing savings institutions develop rapidly, but a new national thrift machinery was brought into being and its operations met with remarkable success.

Cost of the World War.—Within six months of the outbreak of hostilities in Aug. 1914, it became evident to those who were more closely in touch with realities that the World War would be a prolonged struggle, in which it would be necessary for the combatant nations to marshal their entire resources of production. Modern warfare was seen to demand not only that there should be a high percentage of the population in the fighting forces, but also large numbers of civilians producing on a huge scale military equipment of the most varied character. The enormous volume of goods and services which had to be requisitioned is best expressed in terms of the national expenditure. The largest amount spent by Great Britain in war in a single year before 1914 was £71,000,000. The Revolutionary and Napoleonic wars cost in the aggregate £831,000,000 spread over 20 years, an average annual expenditure of £42,000,000; the Crimean War cost £675,000,000 in three financial years, or an average annual expenditure of £225,000,000; while the S. African War of 1899–1902 cost £211,000,000 spread over four years. In the face of the expenditure during the World War of 1914–9, these figures are insignificant. The money spent by the Government of Great Britain during the five financial years cannot be placed at less than from £8,000,000,000 to £9,000,000,000. At one period the average daily expenditure rose to the enormous figure of nearly £7,000,000 sterling.

It was not, however, till the year 1915 was well advanced that the full meaning of the cost of the World War in terms of goods and services began to be appreciated, even by those in high places. During the first few months of the war the inevitable dislocation of industry caused by the calling-up of men of military age and the interference with the normal markets led to a considerable amount of unemployment, and steps were taken by the Government and by the public for the relief of distress. This period of unemployment lasted but a short time and far less distress was caused than had been anticipated. The increased demand for men for the fighting forces and the rapid organization of special war work in many directions quickly absorbed the unemployed. Women were drafted into industry in ever-increasing numbers. In the meantime, the normal production of goods was reduced and stocks diminished. Prices rose rapidly owing to the excess of demand over supply and wages were raised sympathetically. Gradually a large amount of overtime became general, and, in many instances, owing to several members of the same family being in receipt of good wages and on account of overtime, the incomes of working-class families reached very substantial figures. By the summer of 1915 the purchasing power of the people of the country had been very considerably increased.

With the increased demand for goods which followed this rise of the purchasing power of the masses, prices mounted still higher; and with the growth of credit, which was required to cover the increased payments of wages, a dangerous situation was created. By the middle of 1915 it was obvious that it was of paramount importance that the personal expenditure of the people of the country should be checked, and that, in fact, the stopping of individual expenditure was quite as important as the raising of money for the war. It was seen that while from the financial point of view it was desirable that the expenditure on the war should be covered as far as possible by monies raised by taxation, and next by loans from money saved by the people of the country, it was equally important that the mass of the people should reduce their personal expenditure in order to release the resources of the country in capital and labour for the production of the essentials of war. The military advisers of the nation were calling for still larger numbers of men for the fighting forces. Recruiting became more and more urgent. The war factories were crying out for tens of thousands of hands for the production of the vast stores needed on all the fighting fronts. At the same time, the demand of the people through their daily expenditure, stimulated by high wages and big incomes, was automatically retaining labour in the production of things which were not only not necessary for their subsistence, but were often mere luxuries. Again, the expenditure of individuals tended to increase the purchase of imported goods, necessitating either increased exports demanding labour for their production, or adversely affecting the Exchanges and necessitating the export of gold or the sale of foreign securities. The real difficulty of the situation was seen to be the scarcity of human labour to produce the necessaries of war rather than the finding of money to pay for them. Thus the exigencies of the recruiting agencies and national factories led directly to the "goods and services" point of view and to an imperative demand for personal saving.

The dangers of the situation were emphasized by Mr. Lloyd George in May 1915, and it soon became evident that drastic steps would have to be taken to enforce economy throughout all ranks of the community and particularly among the wage-earners, whose aggregate purchasing power had reached dimensions which made their personal expenditure the largest factor in the situation.

Early Efforts for Saving.—During the autumn of 1915, a vigorous mission was undertaken by a voluntary body known as the United Workers, who by the holding of lectures and meetings throughout the country did much to explain the facts to the people and prepared the ground for more concentrated effort later. About the same date a Parliamentary War Savings Committee was established, and through its efforts local war thrift committees were set up in a number of the larger towns of the country. All these efforts were, however, to a large extent ineffective, owing to the absence of any form of investment security specially adapted for persons of small means. The machinery of the Post Office Savings Bank and the Trustee Savings Banks, allowing for deposits at low interest, was inadequate to cope with the situation.

The history of the Post Office Savings Bank during the first year of the war fairly accurately indicates the trend of events. The outbreak of the war saw a sharp run on the Post Office Savings Bank deposits, a run accentuated by the actual shortage of coinage which persisted even up to the end of August. The net withdrawals from the Post Office Savings Bank Department from the declaration of war to the end of Aug. were £2,500,000 in excess of deposits. After Aug. 1914 confidence was quickly restored and deposits began to come in freely. Before the end of Sept. they had exceeded the withdrawals, and so completely did the tide turn that the deposits for the three months ended April 30 1915 exceeded the withdrawals by £4,400,000, or were £3,000,000 in excess of deposits in the corresponding quarter of 1914. For the five months from Jan. 1 1915 to May 31 1915, the balance due to depositors increased by over £6,500,000 as compared with an increase of £1,700,000 during the corresponding period of 1914.

Good as these results were in themselves, it became, however, increasingly clear that the Post Office Savings Bank alone, with the rate of interest on deposits at 2½%, was not sufficient to stimulate saving in the country to the extent that was necessary. Several times pressure was brought to bear on the Government with a view to getting the interest on the savings bank deposits increased, but this pressure was resisted. Other small attempts were made to attract saving. During the issue of the 4½% War Loan in June 1915, scrip vouchers of 5s. and 10s. and scrip certificates of £1 and £5 were issued by the Post Office. The scrip vouchers, when they amounted to £5 or a multiple of £5, and the scrip certificates could be exchanged at any money order post-office during the first fortnight of Dec. 1915, the owner being duly registered as a holder of a corresponding amount of War Loan and being given a stock certificate. Interest was allowed on the scrip vouchers according to the month of purchase and provision was made for repurchase by the Post Office at face value of any vouchers in excess of the £5 multiple. The aggregate result was that, between Nov. 1915 and Dec. 1920, scrip certificates amounting to £3,967,965 and scrip vouchers amounting to £1,049,838 were exchanged for 4½% or 5% War Loan or Exchequer bonds. The £5 scrip certificates were only exchangeable for 4½% War Loan, but the scrip vouchers could be held for subsequent loans. These were the chief official steps taken to facilitate saving by the people up to the end of 1915. In Nov. of that year the Government was pressed to increase the maximum sum which depositors might pay into the Post Office Savings Bank in any one year, but it was pointed out that this would require fresh legislation, the existing limits having been fixed by the Savings Bank Acts of 1891 and 1893.

Expression had been given to the need for action in a letter to *The Times* in the summer of 1915 from "A Banker."[1] The force of his contentions was widely recognized, and this letter may be regarded as the germ from which the War Savings movement was started. This was followed by an important manifesto signed by some of the foremost men in the world of business published in *The Times* in November. It was a straightforward statement calling the nation to thrift and urging concentration on the production of essentials only, eschewing non-essentials by universal personal economy.

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[1] The author was Mr. R. H. Brand, a partner in the London firm of Lazards, and a well-known writer on finance. (H. Ch.)

Montagu Report.—Finally, in Dec. 1915, the Chancellor of the Exchequer (Mr. R. M'Kenna) set up a Committee under the chairmanship of the financial secretary to the Treasury (Mr. E. S. Montagu) to consider the question of getting contributions to War Loans from the working-classes. The final report of this Committee (Cd. 8179), dated Jan. 26 1916, marked the birth of the War Savings movement as a national organization.

An interim report had been issued on Dec. 28 1915, recommending the removal for the period of the war and six months after of the restrictions which limited the amount deposited by any one depositor in the Post Office and Trustee Savings Banks to £50 in any one year and £200 in all. The Committee also recommended that Exchequer bonds of the denominations of £5, £20 and £50 should be placed on sale at all post-offices, provision being made for the deposit of the bonds at the post-office and the issue of books in which the deposit of the bonds would be recorded. The Chancellor of the Exchequer recommended the adoption of these proposals and they were concurred in by a Treasury minute of the same date. Two series of bonds, with interest at the rate of 5% per annum and 6% per annum respectively, were on sale in 1916 and brought into the Exchequer nearly £44,000,000.

The final report of the Committee pointed out that there were two separate objects to be attained by the successful solution of the problem of the small investor: (*a*) the reduction of general consumption, which would tend to check the rise in prices; and (*b*) the raising of a certain amount of money for the prosecution of the war. The needs of the small investor were described as being: (*a*) a simple method of investing savings; (*b*) a guarantee that the capital value of the investment will not depreciate; (*c*) the ability to withdraw savings at short notice; and (*d*) the knowledge that as high a rate of interest is paid on the money of the small investor as on that of the large. It was further pointed out that both propaganda and organization were essential to success in making any appeal for savings. The report recommended the appointment of two committees—one to carry on propaganda and to establish on a large scale voluntary War Savings associations for coöperative saving, and the second to devise and approve various schemes of saving and to safeguard their financial soundness. In order to meet the needs of the small investor the Committee recommended the issue of a new form of Government security in the shape of "War Savings Deposits" of 15s. 6d. each, each deposit entitling the subscriber to receive £1 on the fifth anniversary of the date of the deposit.

National War Savings Committees.—The Chancellor of the Exchequer adopted the recommendations, and on Feb. 8 1916 the two committees were appointed. (These two committees were amalgamated in the following April under the title of the "National War Savings Committee," separate committees being established for Scotland and Ireland.)

War Savings Certificates.—On Feb. 19 1916, the projected savings deposits were issued under the revised title of "War Savings Certificates." The War Savings certificate must rank as one of the most ingenious and successful financial instruments ever conceived. For the first time in history a security was offered to the people which by its nature tended to concentrate the mind on the growth of capital value through the accumulation of interest, rather than on the annual return in the form of dividends. This feature of the "small investor's Treasury bill," as it has been called, has had, undoubtedly, a far-reaching psychological effect. It may be said to have projected the mind of the investor towards an ultimate personal use of the accumulated proceeds of his investment after a considerable term of years, and to have reduced the motive of investment merely as a means of providing an annual sum to be spent on its arrival. To the intrinsic merits of the certificate the success of the War Savings movement is, to a great extent, attributable. The certificates were purchasable for 15s. 6d. and could be cashed at any time. At the end of 12 months a certificate could be cashed for 15s. 9d. After this period its cash value increased by a penny a *month*, and at the end of five years it could be cashed for £1; that is to say, an additional 3d. was added to the value at the end of the fifth year beyond the increase of a penny a month. Subsequently, by Section 4 of the War Loans Act, 1919, the life of the certificates issued, or to be issued, was automatically increased to ten years, the value of the certificates rising after the end of the fifth year by a penny a month until the end of the tenth year, when a further 1s. would be added, making the final encashment value 26s. By the Finance Act, 1918, Section 41, and the War Loans Act, 1919, Section 4, it was provided that the encashment of certificates held by any individual owner could be postponed beyond the period of maturity until the maturity of the last-dated certificate in his possession, such certificates held over increasing in value at a flat rate of a penny a month. Section 42 of the Finance Act, 1916, provided that the accumulated interest payable in respect to any War Savings certificate issued by the Treasury through the Post Office, under which the purchaser by virtue of an immediate payment of 15s. 6d. became entitled after five years to receive the sum of £1, should not be liable to income tax so long as the amount of the certificates held by the purchaser did not exceed the amount for the time being authorized to be held under regulations made by the Treasury. To avoid the serious consequences which would result to the revenue if income taxpayers generally were to use this form of investment, it was originally arranged to confine the issue of War Savings certificates to persons whose total income from all sources did not exceed £300 a year. Experience, however, showed this limitation to be undesirable. The necessity for a declaration as to income at the time of the purchase of the certificates caused administrative difficulties, and by reason of the income limit many wage-earners who were temporarily drawing large wages were unable to buy certificates. In view of these facts, the Committee recommended the Treasury to abolish the income limit, and the restriction was removed on June 10 1916. All formalities in regard to deduction and recovery, proof of exemption or title to abatement from income tax were dispensed with, and a limit of 500 certificates was put on the number allowed to be held by any one person.

By the Finance Act of 1918, it was provided that if a person's holding was brought by inheritance above 500 £1 certificates or their equivalent, the excess might be held without liability to any penalty or to income tax, so long as the person did not purchase for his own benefit, or have purchased for him, any further certificates while holding more than 500 certificates in all.

The War Savings certificate was ingenious not only from the financial standpoint, but also in its form. The certificates were issued in books, upon the cover of which the name of the holder and his address had to be inscribed. The book was of no value except to the person whose name was written upon it. The certificate contained a small panel on its right-hand side, to which the receipt for the purchase price had to be affixed, and the certificate was not valid until this had been done. The receipt was printed on green paper, and each receipt had a number which became the official number of the certificate. The certificate was registered at the money order department of the Post Office as belonging to the particular individual in whose name it was issued. It was necessary to have the signature of the owner to prevent the certificate being cashed by any unauthorized person. In order to provide for this, the receipt which was affixed to the certificate was only the left-hand portion of an original form of receipt, while the right-hand portion, having upon it the corresponding number, had to be filled in by the applicant and handed back to the postmaster. This portion contained the full name and address and signature of the purchaser and formed the basis of the registration system. When the certificate was cashed at a later date, the number on the certificate and the signature of the applicant on the request for repayment could be compared with that portion of the receipt which had been filed. Certificates might be bought by one person on behalf, and in the name of, another person, the signature of the beneficial owner being, if possible, supplied. A cut-out signature from a letter or other document was accepted, but if a signature was not available, it was obtained later by the Post Office. In the case of children under seven years of age the signature was not required. After the receipt had been stuck in the certificate book and a certificate had thus been completed, it could only be transferred to another person in exceptional circumstances and by permission of the Postmaster-

General. A fee of 1s. was charged in respect to each transferee. Certificates were not negotiable, and their value would not be paid to anyone but the holder whose signature was registered by the Post Office. Holders over 16 years of age could make nominations of their holdings in case of death. Every nomination had to be on a proper form, which could be obtained from the Controller of the money order department, and required to be received by the Controller during the lifetime of the holder. In addition to the receipts for the payment for single certificates costing 15s. 6d., each of which was stuck into a certificate book, single documents representing 12 or 25 certificates could be obtained from any money order post-office and most banks. These consisted of two parts divided by a perforation, the left-hand portion for registration, and the right-hand portion to be retained by the purchaser. Books were not supplied for these certificates. Documents were also issued for any number of certificates from 26 to 500, both inclusive. These were not kept at local post-offices, but were issued by the Controller and Accountant General of the Post Office, to whom application with remittance was made direct or through a bank. They were applied for on a special form and issued a day or two after receipt of the application. If a certificate, or book of certificates, were lost, a new certificate, or book of certificates, would be issued at a charge of 1s., provided the serial numbers could be furnished to the Controller of the money order department.

On Dec. 4 1920, the old print of War Savings certificates was withdrawn from sale at post-offices and banks, and on Dec. 6 "National Savings" certificates were substituted. The change was legalized by the Savings Bank Act of 1920, and was one of title only. The conditions attaching to the old certificates still applied.

The savings certificate formed the basis of the operations of the War Savings associations, which were established under the auspices of local War Savings committees and affiliated to the National War Savings Committee.

War Savings Associations.—Not less important than the War Savings certificate was the system of association, or club, proposed by the Montagu Committee. In their final report the Committee pointed out that the would-be investor should not, if it could be avoided, be left to himself to seek for an investment. Facilities for investment should be provided by agencies in close touch with him; and these agencies, having succeeded in inducing him to save, should endeavour by careful propaganda and by thorough organization to persuade him to make the continuance of saving a matter of habit. The Committee emphasized the advantages of placing an agency between the small investor and the State which could collect and manage the savings of the small investor. It was pointed out that the Government could enter into no contractual relationship with the individual investor, unless it assumed complete control over the schemes adopted and also supervised in detail the actual administration of the societies themselves. They added that the organization of such control and supervision would require the creation of a new Government department, which, apart from the question of the expense involved, it would have been impossible to staff during the war. Also, the rigidity of procedure which a State system would inevitably involve would be fatal to the free local initiative on which the success of such a scheme would depend. At the same time, if societies, many of which have at their command no expert financial knowledge, were left free to develop schemes without supervision or control, some of them would not unlikely become insolvent. The problem was to obtain the best safeguards which could be secured for the financial soundness and efficient administration of the different schemes, while leaving the responsibility for both administration and results with the societies themselves, and they recommended that the committee which should be appointed by the Government, and to which the various investment societies might be affiliated, should be regarded, not as representing the Government, but as an independent body of experts acting on behalf of the societies themselves. Its duties would be primarily of an advisory character, but it could properly refuse to recognize any society the constitution and rules of which it did not approve and withdraw recognition from any society which might fail to satisfy the committee that it was being properly administered. The committee could, if it saw fit, organize a system of inspection and audit of the operations and accounts of the affiliated societies and by these means secure a very substantial measure of control over their operations.

Local War Savings Committees.—In accordance with these views, the War Savings Committee embarked upon a widespread scheme for the promotion of savings associations, delegating the propagandist work in a large measure to local committees which were set up throughout the country. Before the war was over there were in existence in England and Wales 60 county committees and 1,840 local war savings committees acting as propagandist agencies under the general control of the central body, while the War Savings associations set up under their auspices numbered over 40,000 with a membership of approximately 4,000,000 people. (At the end of 1920 there were still 1,701 local committees and over 28,000 associations.) A savings association could be formed by any number of people who were willing to work together to secure the attainment of its objects. In practice it was found that an association could readily be formed by those who were already corporate in some way; for example, by those who were members of a trade union, a friendly society or a coöperative society, by fellow workers in a shop or factory, or by the members of a church, chapel or social club. Each association had its governing committee, secretary and treasurer.

Scotland and Ireland, with their separate organizations, developed the movement on similar lines. The total number of voluntary workers in the movement was estimated to be between 200,000 and 250,000.

Official Agents.—By the end of 1917, when nearly 30,000 War Savings associations had been affiliated, there had been established on an average one association for every 1,200 inhabitants in England and Wales. Most of the social and industrial groups were covered, but it was realized that a large section of the wage-earning population and, possibly, the most highly paid, did not readily join War Savings associations. Many employees objected to joining associations to whose books their employers might have access. They were of opinion that knowledge of the fact that they were saving money might tend to diminish the force of any claim they might make for enhanced wages on account of the increased cost of living. With a view to reaching the prospective small investors of this class, it was decided to add to the number of places where War Savings certificates and National War Bonds could be bought. Certificates were on sale at all money order offices and at most banks, but the majority of the class of persons under consideration had no banking account and had no reason to enter a bank. The Post Office staff was obviously unable to make any special effort to push the sale of Government securities, having regard to the heavy mortgage on their time caused by the manifold additional duties which the exigencies of the war period cast upon them. It was therefore arranged to license certain tradesmen and firms as official agents for the sale of certificates and bonds. These agents purchased the securities outright with their own funds and received the certificates and bonds dated, but unregistered. They then resold the certificates and bonds to their customers and others. By the end of the war, these securities were on sale at more than 14,000 shops and other establishments throughout the country. Very large numbers of certificates in the aggregate were sold in this way. The success of the system is noteworthy in that it involved the sacrifice by the official agents of the interest upon the capital used for the purchase of stocks of certificates between the dates of purchase and sale.

Savings Schemes.—The National Committee, following the guidance of the Montagu Committee, had also set itself the task of preparing various model schemes of coöperative saving to meet the requirements of the people. The following schemes were evolved at various times:—

Scheme 1.—Money subscribed through a savings association was invested in Post Office Exchequer bonds. For each £5 Exchequer Bond a subscriber paid 2s. a week for 50 weeks, or 10s. a month for 10 months. All sums subscribed were remitted to the Treasury each week, the Treasury paying interest on the amounts received at the rate of 5% per annum. The bonds and cash payments due to members were distributed half-yearly, *e.g.* in the case of subscriptions beginning May 1916 bonds and cash were distributed June 1 1917, weekly subscribers receiving a cash payment of 2s., and monthly subscribers 1s. 9d. The cash distributed was free of income tax, but had to be included in the income-tax return of members. It could be paid at the Post Office or could be credited to an account in a savings bank. This scheme was not adopted on a wide scale and was abandoned at a later date. Schemes involving subscriptions for certificates were found in practice to be more popular and more easily worked.

Scheme 2A.—Monies subscribed through an association are invested in War Savings certificates. Subscriptions of 6d. or any number of sixpences are accepted. War Savings certificates are purchased from the Post Office with the cash received by the secretary from the members, and they are dated at the time of purchase, but they are not registered. Each member when he pays his first subscription is given a book. His subscriptions are entered in the book as and when they are paid. When the subscription of any member amounts to 15s. 6d., he is given a certificate and the registration portion of the certificate is then filled in and lodged at the Post Office. The method of distributing certificates of different dates and consequently of different encashment values is settled by the committee of each association. Members can withdraw before reaching the full 15s. 6d. and the amount deposited is repaid, but without interest. The advantage of the scheme lies in this, that if 31 people individually save 6d. a week for 31 weeks, they will each have a certificate at the end of 31 weeks, but if they join an association to which they pay 6d. a week, the association is able to buy one certificate each week, and at the end of 31 weeks it will have 31 certificates. The first of these certificates is dated 30 weeks earlier than a certificate bought by any member acting alone. On the average, they will be dated 15 weeks earlier and consequently will mature 15 weeks earlier. The books are provided free of cost by the National Committee. The book-keeping is necessarily somewhat detailed, but it is essential for the protection of members.

This scheme was probably the most widely adopted.

Scheme 2B is similar to Scheme 2A, but the certificates are not distributed until one year after the subscriptions of any member amount to 15s. 6d. The scheme was not widely adopted, people preferring to get their certificates immediately they had made up their 15s. 6d.

Scheme 3 is in essence a savings bank—all the money received being invested in War Savings certificates. The minimum subscription is one penny. Any number of pennies are accepted. Subscriptions are withdrawable at 14 days' notice, or without notice in urgent cases. Each member has a book in which subscriptions are entered. On the completion of the payment of 15s. 6d. the member is registered as being entitled to the payment of £1 at the end of five years. The certificates are not distributed but are held by the association until they mature. A few associations in schools adopted this scheme, but after a time the majority ended by distributing the certificates to their members and adopting Scheme 2A.

Scheme 4 was a scheme for investment by instalments in Exchequer bonds and War Savings certificates, the Treasury paying interest on the amounts received at 5% per annum. During the war no part of the amounts paid into the Treasury were withdrawable in cash. When an Exchequer bond or certificate was fully paid for the Treasury issued the security to the association for delivery to the member entitled to it, the cost of the securities being charged to the amount standing to the credit of the association with the Treasury. Cash was to be returned to the association three months after the end of the war. This scheme was not found satisfactory and was little adopted.

Scheme 5 is a scheme similar in principle to Scheme 2A, but subscriptions are paid by buying from the association sixpenny coupons. The coupons are of a special "Swastika" design and can only be used for subscribing to associations by whom they are issued. The association is supplied on credit with coupons issued by the Central Committee and these have to be accounted for. The association overprints its coupons with its own serial number. Members get a coupon for each 6d. and place the coupon on a card. When the card is full it is exchanged for one of the certificates already purchased by the combined subscriptions of the members. As full cards of coupons come in they are sent to the Central Office in reduction of the association's liability for those supplied on credit. (At a later date the coupons were issued to the associations in the standing imprest system.) This scheme involved little or no ordinary book-keeping. A register of the issue of certificates was kept. The only clerical work involved of necessity was the keeping of a careful stock of the coupons. The scheme was adopted on a large scale and by some of the largest associations. As a general rule, local committees handled the distribution of the coupons in their districts. This threw a heavy burden on the local secretaries. Considerable difficulty was experienced in many instances in clearing coupon stock accounts, and the distribution of coupons on an enormous scale threw a large amount of work on the head office. The scheme is gradually being replaced by a more simple system of cards and savings stamps procurable from any post-office.

Scheme 6 is a special scheme under which employers purchase certificates in advance for employees with their own funds. The certificates are purchased in blank, that is to say, unregistered, and sold to the employees by any form of instalment system preferred. The employer in effect makes a free grant to his employees of the interest accruing on the money between the date of purchase and the date of sale.

Scheme 7 is a development of an earlier system under which the Post Office issued cards upon which 31 ordinary sixpenny postage stamps could be affixed by anyone. A card when filled with stamps was exchangeable at any money order office for a War Savings certificate. There was no advantage from coöperation. It was merely a simple device to enable people to save the money for a certificate by instalments of 6d. each.

When the Armistice was signed the National Committee gave careful consideration to devise some alternative scheme to avoid the heavy clerical labour entailed in the working of Schemes 2A, 2B, 3 and 5. This labour had been obtainable during the war on a voluntary basis and it is possible that the very labour itself indirectly assisted the movement in its early days in that it gave the officials of associations the knowledge that they were doing something definite for the benefit of the country in wartime. In 1918, the Post Office agreed to the issue of a distinctive adhesive war savings stamp with the Britannia head design. This stamp was placed on sale at all post-offices. Special savings cards containing 31 spaces were issued to savings associations. Treasurers and secretaries of associations provided themselves with stocks of the stamps, which they were authorized to procure as credit stocks, and they issued these to their members for cash. With the cash they purchased more stamps. The cards when filled were exchangeable for certificates at any money order office, and savings stamps purchased at any post-office or through any agency could be used. The scheme possessed considerable elasticity, as it enabled members of one association on transferring their residence to join another association and complete their subscriptions, or they could fill their cards with stamps purchased anywhere and exchange them for certificates anywhere. The disadvantage lay in the absence of the benefit of the early dating of certificates which was given by the other schemes—an advantage which, it was found in practice, was so generally appreciated that the new scheme, in spite of the saving of labour to the officials of associations, was not widely adopted. After considerable thought the scheme was revised and early in 1921 a system was introduced which, while maintaining the simplicity of Scheme 7, also gave the benefit of the early dating of certificates. The predating of certificates is secured by the use of date labels. The date labels (printed in pairs) are supplied by the National Savings Committee to the association officials. Whenever the official purchases Britannia head savings stamps, he can present at the post-office one pair of these date labels for every 31 sixpenny stamps purchased. The post-office official stamps the labels with a date stamp of that day. When a member of the association presents a card filled up with savings stamps all of which have been purchased from the association, the secretary affixes to the certificate which is issued in exchange for the card one of the officially dated date labels—one date label is affixed to the signature portion of the certificate and its fellow or counterpart is fixed on the counterpart of the certificate in the certificate book. This scheme therefore preserves the full benefit of early dating due to coöperative purchase and yet reduces the clerical work of the association official to the smallest compass. The only book which it is thought advisable for the official to keep is a control receipt book for acknowledging receipt of members' completed cards given in exchange for certificates, this serving also as a register of certificates, in case the member loses his certificate book.

The value of savings stamps sold to Nov. 30 1920 was £1,739,000, of which approximately £1,464,000 had been exchanged for savings certificates.

Municipal Savings Banks.—The Municipal Savings Bank (War Loan Investment) Act, 1916, authorized the establishment, subject to certain restrictions, of municipal savings banks in municipal boroughs with populations exceeding 250,000. The only municipality to adopt this Act was Birmingham, where a bank was started at the end of Sept. 1916. The "Birmingham Corporation Act, 1919" extended the powers of the Corporation and authorized it to establish a savings and housing bank.

Navy, Army and Air Services.—Although military savings banks and facilities for saving in the army had existed since 1859, with the recruiting of large numbers of civilians for the new armies it was found that the normal methods of saving were insufficient to attract very large sums of money.

On the issue of the 4½% War Loan in June 1915 it was felt right that due facilities should be afforded the men in the army for making their investments through the Post Office issue of the Loan. Arrangements were accordingly made for any soldier whose pay account was sufficiently in credit to invest by instalments of 5s., 10s., £1 or £5, the amount being debited to his account and transferred to the Post Office through the regimental paymaster. Similar arrangements were made for the navy and the scheme was found to work so smoothly that it was eventually extended to Exchequer bonds and War Savings certificates as they became available, and ultimately for deposits in the Post Office Savings Bank. The Post Office undertook the safe custody of the War Savings certificates and bonds for the investors. Later in 1916, by arrangement with the War Office, a special officer was entrusted with the work of establishing war savings associations in the army, with very satisfactory results. In 1917, £186,682 was saved through the army associations; in 1918, £3,162,975; in 1919, £1,804,580; and in 1920, over £1,000,000, making a grand total of £6,000,000. In June 1920 the Army Council, finding the savings associations had such a beneficial effect, made an order that all units both at home and abroad should form savings associations, and arrangements were made for command paymasters stationed abroad to hold stocks of certificates. The Air Ministry at the same time issued an order on similar lines. The War Savings movement was also carried into the navy and merchant service, suitable arrangements being made for remittance of monies through the paymasters and pay offices.

Schools.—It would be impossible to give even the briefest summary of the War Savings movement without reference to the work done by the savings associations in the schools of the country. Thanks to the influence of the Board of Education, and, particularly, to the efforts of a number of inspectors of the Board who were lent for service with the National Committee and who acted as the secretaries of the county committees and as local representatives of the Committee in the provinces, but, above all, thanks to the whole-hearted efforts of thousands of schoolmasters and mistresses throughout the country, there was scarcely an elementary school in the United Kingdom without an efficient and vigorous association. Before the war a very large number of schools had their penny banks. No attempt was made to supplant these. With the coöperation of the savings banks in connexion with which these penny banks were operated, arrangements were made to continue the penny bank system with the savings association methods, and often the two systems were carried on in the same school side by side. The old penny bank system as a "short term" saving machinery had a value which it would have been undesirable to destroy, while it naturally led by stages to the "long term" saving by means of the certificate. Most of the schools continued their banks and associations after the Armistice, and in no section of the community is the movement more alive and progressive to-day. It is impossible to say what proportion of the savings of the country stand in the names of the children, but it must amount to many millions sterling and this alone must have an incalculable effect on the future.

Propaganda.—The human machine created by the National Savings Committee was stimulated, from time to time, by every kind of publicity method. Thousands of public meetings were held and lectures given; educational pamphlets and leaflets dealing with the elements of economics were distributed; special campaigns with such stimulating machinery as "tank banks" were inaugurated; a system of commissioners and organizers in touch with headquarters kept closely in touch with the local committees; special organizations dealt with the army and the navy, munition works and other factories. The local authorities rendered invaluable assistance to the local committees by the loan of staff, the provision of office accommodation and in many other ways. The London and provincial press were consistently sympathetic to the movement and gave freely of their space to record its activities and assist its campaigns. During the war the organization was, from time to time, utilized by the Chancellor of the Exchequer to assist in the public issues of War Bonds and War Loans. During these periods invaluable help was given by leading press experts, who, in coöperation with the National War Savings Committee, undertook the control of special publicity campaigns (*see* WAR LOAN PUBLICITY CAMPAIGNS). These campaigns for the special issues greatly stimulated the small investor. On each occasion of the issue of a great public loan numbers of new associations came into being and the weekly purchases of certificates were very much increased. One of the most significant results of the adoption of these methods of publicity and propaganda was the great extension of the numbers of individual citizens holding Government securities. Whereas before the war it was estimated that there were some 345,000 holders of Government securities, it is calculated that no less than 17 million people have to-day a holding in some form of State loan; while the aggregate amount subscribed by small investors through the Post Office for War Loans and other Government securities, including savings certificates, was nearly £500,000,000 at the end of 1920.

Withdrawals.—The Montagu Committee laid emphasis on the fact that the small investor wishes to be able to withdraw his savings at short notice without loss of capital. "The financial emergencies of life come upon the working man with startling suddenness. He may be thrown out of employment, or an illness or death in the family may result in an immediate call. He has not the facilities for credit which the wealthy or even the middle classes enjoy and money only obtainable at six or twelve months' notice is of little use to him." There is no doubt that the losses sustained by the working-classes from their investments through the Post Office in Consols and other similar long-dated securities through the automatic fall in capital value due to the rise in the general rate of interest has had in the past an adverse influence on thrift. Hence the arrangements that War Savings certificates should be repayable at a definite value which is never less than the amount invested, and within two or three days of demand, that is to say, allowing time for identification of the registered holder to avoid payment to a wrongful possessor.

An analysis of the withdrawals of savings certificates is interesting. The total number of certificates sold in the United Kingdom from Feb. 16 1916 to the end of Dec. 1920, was 440,076,000 in £1 units, of a total value at 15s. 6d. each of £343,259,000. The total repayments due to withdrawals, including interest, amounted to £61,404,089, of which £3,521,948 8s. 7d. represented interest. The percentage of the value of certificates repaid (excluding interest) to total value of certificates issued was 18·01 per cent. This percentage may be considered satisfactory when one considers the calls upon the small investor and the fact that the current rate of interest on the shares of well-established commercial and industrial concerns since the Armistice has been very attractive. Much money has been withdrawn for housing, as is evidenced by the case of Higham Ferrers in Northants, a town of 2,500 people, where no less than 50 men have bought their houses through investments in savings certificates.

Post-Armistice Period.—In 1917 a committee was appointed by the National Committee to consider what facilities for saving should be provided for the small investor after the war. The committee in their report stated that the habit of saving had, as a result of the War Savings movement, been formed by many people of all classes who had not previously acquired it, and that this habit ought not to be allowed to lapse and that the State should continue to encourage saving after the war by continuing to offer special facilities to the small investor. They saw no reason to suppose that the State would at any time be unable to use profitably the money of the small investor. They pointed out that the ordinary borrowing capacity of the State would be severely taxed by the necessity for renewing and, when possible, consolidating the floating debt, and they considered it worthy of serious consideration whether a plan might not be adopted for applying the proceeds of post-war borrowing from the small investor in order to secure funds for public utility services, such as the housing of the working-classes and other projects of social urgency, the funds for which it might be difficult, if not impossible, to raise otherwise for a considerable period. The committee strongly advised the preservation of the savings machinery established during the war and recommended the permanent continuance, subject to modifications, of the War Savings certificate. The continuance of the savings organization was also recommended by the "Committee on Financial Facilities" appointed in 1917. In their report, dated Nov. 21 1918, they said:—

> "We are impressed by the enormous potential increase in the number of the small investors. The continuance on the part of the people of this country of the habit of investing their savings constitutes a most important factor in the provision of the capital necessary for the rapid reconversion of trade and industry. It is impossible to over-estimate the value of the work done by the war savings associations throughout the country, in encouraging habits of thrift

British Savings Associations Affiliated at Dec. 31 1919

County	Population	Business Firms	Churches	Schools	Friendly Societies	Clubs and Institutes	Miscellaneous	Totals
England:—								
Beds	194,588	73	27	92	3	6	59	260
Berks	271,009	76	21	116	4	..	130	347
Bucks	219,551	50	16	68	..	2	124	260
Cambs	198,074	22	21	97	1	2	91	234
Ches.	954,779	248	82	364	8	38	179	919
Corn.	328,098	31	16	243	3	10	111	414
Cumb.	265,746	33	27	194	7	23	91	375
Derby	683,423	182	37	345	6	23	106	699
Devon	699,703	127	26	250	8	40	253	704
Dorset	223,266	21	23	85		14	109	252
Dur.	1,369,860	324	74	236	2	75	174	885
Ess.	1,350,881	178	52	265	..	37	255	787
Glos.	736,097	243	70	126	6	26	219	690
Hants.	950,579	274	72	404	19	52	225	1,046
Hereford	114,269	3	11	89	5	7	57	172
Herts.	311,284	56	22	52	3	21	116	270
Hunts.	55,577	12	15	37	..	6	46	116
Kent	1,045,591	223	77	293	11	57	303	964
Lancs.	4,767,832	1,147	330	1,167	30	176	343	3,193
Leics.	476,553	335	29	218	1	17	100	700
Lincs.	563,960	152	37	250	9	36	217	701
Lond.	4,521,685	1,607	163	254	79	85	526	2,714
Middlesex	1,126,465	190	60	240	9	40	100	639
Norf.	499,116	58	18	79	3	8	225	391
Northants	348,515	166	18	163	10	18	106	481
Northumb.	696,893	198	41	101	15	36	164	555
Notts	604,098	184	30	334	3	28	108	687
Oxon	199,269	24	15	39	1	7	103	189
Rutl.	20,346	..	...	16	..	2	23	41
Salop	246,307	46	20	116	5	7	122	316
Som.	458,025	109	39	168	2	14	260	592
Staffs	1,348,259	508	63	478	9	27	154	1,239
Suff.	394,060	85	18	209	3	19	236	570
Sur.	845,578	156	55	233	11	47	200	702
Sus.	663,378	68	63	134	18	34	226	543
Warwick	1,040,409	311	55	264	8	40	166	844
Westm.	63,575	12	8	43	3	5	58	129
Wilts	286,822	82	19	64	1	13	153	332
Worcs.	526,087	138	23	265	5	19	97	547
Yorks, E. R.	432,759	112	30	85	10	22	87	346
Yorks, N. R.	419,546	42	13	103	..	7	130	295
Yorks, W. R.	3,045,377	1,160	294	1,235	52	166	313	3,220
Wales:—								
Anglesey	50,928	6	10	22		4	19	61
Brecknock	59,287	4	11	32		..	11	58
Cardigan	59,879	3	14	101	1	..	17	136
Carmarthen	160,406	21	28	158	2	2	24	235
Carnarvon	125,043	12	7	19		7	45	90
Denbigh	144,783	14	35	55	1	2	53	160
Flint	92,705	4	9	18	2	2	16	51
Glamorgan	1,120,910	285	146	386	7	42	101	967
Merioneth	45,565	1	..	34	1		19	55
Monmouth	395,719	111	41	261	3	4	58	478
Montgomery	53,146	9	3	37	1	1	23	74
Pembroke	89,960	4	10	99		2	14	129
Radnor	22,590	..	4	30	1	1	21	57
Overseas	..	..	...		..	..	20	20
Army Associations		..		..	..	...	936	936
Totals	..	9,540	2,452	10,866	392	1,379	8,242	32,967

In addition the undermentioned Savings Associations were affiliated under special schemes:—

Employers	1,721
School Post Office	587
Government Offices	121

Sales and Repayments of National War Savings Certificates (*Feb. 1916–Dec. 1920*)

Period	Certificates £1 units	Purchase Price	Repayments including exchange for War Loan, etc.	Interest paid
		£	£	£
1916 Feb.–Dec.	54,430,604	42,183,718	287,448	
1917 6 months ended June	56,381,849	43,695,933	1,294,750	492
“ “ “ “ Dec.	30,083,722	23,314,884	1,840,983	10,972
1918 “ “ “ June	74,210,407	57,513,066	2,372,099	36,524
“ “ “ “ Dec.	65,594,472	50,835,716	3,914,892	85,216
1919 “ “ “ June	53,173,874	41,209,752	7,926,293	272,769
“ “ “ “ Dec.	48,778,963	37,803,697	11,938,325	597,968
1920 “ “ “ June	32,741,850	25,374,933	17,096,541	1,202,495
“ “ “ “ Dec.	25,045,649	19,410,378	14,733,338	1,316,381
Totals Feb. 1916–Dec. 1920	440,441,390	£341,342,077	£61,404,660	£3,522,817

Contributions of the British Small Investor, 1914–9
(Decreases are printed in italics)

Date	Post Office and Trustee Savings Bank Deposits (Net Receipts)	Post Office Issues			War Savings Certificates Purchase Price	Certificate Repayments including Exchanges for War Loans, etc.	Net Cash Total
		$4\frac{1}{2}$* and 5 %† War Loans	5 and 6 % Exchequer Bonds	5 % National War Bonds§ 4 % Victory Bonds ‡ 4 % Funding Loan **			
	£	£	£	£	£	£	£
Total for five months 1914	1,152,000			..	..	..	1,152,000
Total for year 1915	*6,456,000*	39,961,000*	..	..	..	..	33,505,000
Total for year 1916	11,938,000	*138,000*	43,900,000	..	42,371,000	*290,000*	97,781,000
Total for year 1917	5,683,000	36,606,000†	4,092,000	10,856,000§	66,824,000	*3,133,000*	120,928,000
Total for year 1918	38,813,000			38,700,000§	108,349,000	*6,287,000*	179,575,000
Total for year 1919	43,541,000¶			13,700,000§ 9,900,000‡ 7,400,000**	79,013,000	*19,864,000*	133,690,000
Aug. 1914 to Dec. 1919	94,671,000	76,420,000	47,992,000	80,556,000	296,557,000	*29,574,000*	566,631,000

¶ The deposits included £55,109,506 on account of war gratuities to soldiers and sailors.

N.B.—During the year ending Dec. 31 1920, 57,787,499 certificates of a cash value of £44,785,311 were sold, and repayments, including exchange for War Loans, etc. (excluding interest), amounted to £31,829,879.

and economy. Government securities furnish by far the best and safest medium for the investment of small sums of money, and we are glad to notice that steps are to be taken, by means of savings associations, to continue the policy which had proved so successful during the war."

Immediately after the Armistice steps were taken to consolidate the position of the organization and to render permanent the machinery which had been set up during the previous three years. The county committees were disbanded, their work having been delegated to local committees which they had formed in practically every local area in the country. Steps were taken to devise a complete representative system throughout the organization. Adopting the association, or savings club, as the fundamental unit of the movement, steps were taken to ensure representation of the associations on the local committees. The local committees in their turn elected representatives on a new body called "The National Savings Assembly," which was to meet twice a year to discuss questions relative to the movement and at one of these meetings to elect representatives on the National Savings Committee, which, by the authority of the Government, dropped the word "war" out of its title. At the same time the personnel of the National Committee was considerably strengthened. In 1921 it formed a powerful body composed of representatives of Government departments and corporations and interests connected with thrift, together with representatives of the savings organizations in London and the provinces elected on a wide franchise, so that its continued influence could not fail to be beneficial to the community.

Savings and Local Government Finance.—In the summer of 1920 a step was taken which might well have far-reaching effects on the relations between local and Imperial finance.

The Finance Act 1920, Section 59, provided that 50% of the proceeds of the sales of savings certificates could be invested through the National Debt commissioners in local loans stock or bonds on the security of the local loans fund. Half the proceeds of the gross sales after Oct. 1 1920, in the area of each local authority, would be available, if required, for loans to meet authorized expenditure in connexion with the assisted housing scheme of that authority. These loans were to be made, irrespective of the ratable value of the local authority, by the Public Works Loan commissioners, on the terms in force for the time being for ordinary loans to local authorities from the local loans fund for subsidized housing schemes. In the first instance, such loans would be restricted to housing purposes, but it was hoped that, when the existing difficulties with regard to housing finance had been overcome, the scheme would be given a more general application and that the system would become a permanent feature of local finance, bringing to the aid of local authorities a new source of capital which many of them had long been seeking. The authorities derive the greater part of the benefit under the scheme, since, although they receive only half the proceeds of the certificates sold, they are not responsible for finding any of the money required to meet withdrawals.

A critic of the ordinary savings bank in the last century said: "The savings bank is after all only a slot in the wall, with a sure grasp, but no tongue to advise it. Having no fructifying use for the money that comes to it from productive employment it closes over it like a grave and effectually sterilizes it"; and Sir E. Brabrook, Chief Registrar of Friendly Societies in 1897, said he "could look upon ordinary savings banks merely as infantile efforts in thrift." He regarded "a person who deposited his money in a savings bank so that it should be kept safe for him by someone else as very much less worthy of encouragement than a person who used his savings in some way in coöperation with other people for his own benefit or the benefit of others." He "did not look upon the progress of the savings bank with unalloyed satisfaction, but only as one step to self-help."

The system of linking up National Savings certificates with local finance becomes, in effect, a national credit bank spread over the whole country. The credits of the small investor, even the half-pennies and pennies saved by the school-children, are rendered, through the machinery of the savings certificates, the Post Office, the National Debt commissioners, the Treasury, the local loans fund and the local authorities, available for investment in social and beneficial enterprise for the good of the people themselves. Owing to the widespread area from which the money is raised, short-term borrowing can be used for long-term loans with the minimum of risk, while saving is stimulated amongst the very class to whom in the past it has been most difficult to teach economy and saving. The linking-up of "saving" with the definite use of the money saved continues effectually the teaching of the war and inculcates the lessons of economy, and goes far to meet Sir E. Brabrook's criticism of the savings bank. The system is certain to stimulate the interest of the small investors in local finance generally. Not only will this be a source of financial strength to the local authorities, but educationally it will be a great advantage, and the active coöperation of the local authorities and the savings committee should do much to stimulate habits of thrift and saving.

Other Countries

The American savings movement is dealt with later. As regards other countries in the war it may be noted that the British National Committee had its organization in the East for the sale of War Savings certificates, the China and Japan War Savings Association having nine centres in China and three in Japan. The Japanese Government itself during the war sent its representatives to inquire into the methods of the National Savings Committee, and established its own system of National Savings certificates with terms of three, five and ten years.

In Canada, war savings and thrift stamps were issued by the Canadian Government.

The Government of S. Africa after the Armistice placed "Union Loan Certificates" on sale at every post-office where savings bank or money order business is transacted. The S. African scheme closely resembled the British savings scheme. Cards were issued with spaces for 15 one-shilling stamps. The cards were issued at an initial price of sixpence. When the card was completed, it could be exchanged for a 15s. 6d. certificate which is worth £1 in five years. The maximum purchasing limit is £387. 10s. 0d. for 500 certificates. The S. African Government also adopted the scheme of associations in savings clubs on the British model.

STATISTICS.—In the preceding tables statistics are given of the results of the work done under the National Savings Committee. (T. G. CH.)

UNITED STATES

Upon the declaration of war by the United States in April 1917 it became evident that the nation must practise strict economy if the huge war-time expenditures were to be successfully financed and material aid given to the Allies. Not merely in money, but in consumption (which means money), the resulting movement for economy among the American people was vigorously taken up. As a first step toward conservation, President Wilson on May 19 1917 outlined a food control programme and appointed Herbert Hoover Food Administrator, and Congress passed the law commonly known as the Lever Act, effective Aug. 10 1917—"an Act to provide further for the national security and defence, by encouraging the production and conservation of supply and controlling the distribution of food products and fuel." The administration of the Act was under the direction of a U.S. Food Administrator and a U.S. Fuel Administrator. The Food Administration summed up its purpose in the motto: "Food will win the war." The following specific ends were sought: (1) to save food and eliminate waste; (2) to distribute food equitably and cheaply; (3) to stimulate production; (4) to prevent hoarding; (5) to save transportation; (6) to provide for the needs of the U.S. army and navy; (7) to secure the largest possible amount of food for the Allies.

The most vital early need both for America and for the Allies was the conservation of sugar and wheat. The shipping shortage was so acute that it was impossible to procure the large surplus of raw sugar in Java, amounting to nearly 1,000,000 tons. Exports of sugar from the United States for the year 1917 were more than 17 times the average for the three years preceding the war. In Aug. 1917 the cost of spot sugar reached $9.15 per cwt. seaboard basis, and the demand was still unfilled. During this month an International Sugar Committee was appointed. Under the operation of this committee the price of Cuban raw sugar declined to $6.90 by Sept. 14, which was the fixed maximum for the season's crop. The prices to the consumer were maintained at from 8½ cents to 10 cents per lb., varying with the location. As the difference of one cent per lb. added to the price of sugar meant an added burden on American homes of $72,000,000, the importance of the sugar regulations is evident. As the needs of the United States and of the Allies became more acute, the Licence System governing dealers in food supplies was put into effect and various regulations adopted which governed the producer and consumer alike. In order to control the sugar situation it was announced on May 2 1918 that on and after May 15 sugar should not be sold for manufacturing purposes either by refiners, wholesalers or retailers, except upon the presentation and cancellation of certificates issued by a State Federal Food Administrator, showing the quantity of sugar sold. Retailers were restricted from selling sugar to consumers in quantities greater than 2 lb. for city residents and 5 lb. for those residing in the country, except for home canning, in which cases the dealer was required to secure certificates for the amount sold. By the operation of this system and the voluntary restriction of household consumption, a saving of between 400,000 and 600,000 tons was effected in 1918.

The most serious crisis faced by the Food Administration during its operations was the wheat shortage of the season 1917–8. In the United States the crop, following the exceedingly short harvest of the previous year, was only sufficient to meet normal demands for home consumption. France and England, which together normally produce about one-half the wheat they consume, both suffered very great crop losses, and their total production was considerably less than one-third their normal consumption. In Jan. 1918 an official communication was received from Great Britain stating that, unless America could send the Allies at least 75,000,000 bus. of wheat over and above what they had exported up to Jan. 1, there was grave fear that the war would be lost because of the lack of food. The United States Food Administration replied to this advice: "We will export every grain that the American people save from their normal consumption. We believe our people will not fail to meet the emergency." All manufacturers in the United States using wheat flour in the production of various foods were placed under licence, and either strictly limited in their use of wheat to a definite percentage of their normal requirements or were denied the use of wheat entirely. Wheatless days and other measures for wheat conservation were established. Mills were permitted to grind only a certain percentage of the amount of wheat milled during a corresponding period the previous year. Wholesale dealers were prohibited from purchasing wheat flour in excess of 70% of the amount they had purchased during a corresponding period of the previous year. In sales to consumers the retailers were required to sell an equal quantity of substitutes to the purchaser at the time wheat flour was sold. The pledge-card campaign was started in Oct. 1917, and between 13,000,000 and 14,000,000 women registered in support of food conservation by substitution. Between Oct. 1 1917 and Aug. 1 1918 hotels, restaurants, dining cars and clubs of the country effected a saving of more than 50,000,000 lb. of flour and wheat products. Flour-mills were required to raise their percentage of extraction to 74% and to eliminate altogether the sale of patent flours. This resulted in a saving of 13,504,300 bus. of wheat. Bakers were required to use a certain percentage of substitute flour in all breads, and this resulted in the saving of 16,830,000 bus. of wheat. These various measures made it possible for the United States to send abroad in 1918 approximately 140,000,000 bus. of wheat.

The importance of fats and oils in the diet of a people caused the Food Administration to lay stress on the conservation of meat products. Export of fats to neutrals was greatly restricted and the amount of fats used in bakery products limited. In 1918 1,125,397 short tons of hog products were exported as against 839,000 in the fiscal year ending June 30 1899, the largest in any previous year. In March 1918 exports averaged 10,000,000 lb. a day. Normally the United States exports yearly a little over 10% of its total pork production. In 1918, under the pressure of war needs, nearly 20% of a much larger production was exported. In 1918 773,000,000 lb. of beef were exported, or over three and a half times the exports on the average of the three war years. These supplies were made available by the conservation of meats formerly wasted, by volunteer rationing and by the adoption in many localities of meatless days and meatless meals.

As the demand on transportation facilities became increasingly heavy, it was vital to keep the routes by which food passed from the producer to the consumer as active as possible. The tremendous increase in the exportation of food and munitions, coupled with the shortage of ocean tonnage, congested eastern terminals. To remedy this condition, a regulation was promulgated providing an average increase in the minimum car-loads of about 50% over those of the published tariffs of the carriers. Thus the number of cars required for the distribution of the commodities on the list of non-perishable groceries was reduced fully 25%. Much material formerly wasted was salvaged by the Waste Reclamation Service, organized originally under the War Industries Board and later transferred to the Department of Commerce. One million five hundred thousand tons of book and writing material were made in 1918 from old paper. The total value of all waste material reclaimed during 1918 was approximately $1,500,000,000. In monthly reports as to garbage utilization during 1918 it was shown that the redemption plants reclaimed more than 50,000,000 lb. of garbage grease and 160,000 tons of fertilizer tankage from garbage.

Several conservation projects were developed in conjunction with food conservation. The National Emergency Food Garden Corporation put 1,500,000 ac. of city and town land under cultivation in 3,000,000 gardens, resulting in an increase of the food supply to the value of over $350,000,000 in one year. The School Garden Army, 6,000,000 strong, raised and preserved fruits and vegetables and also aided in the utilization of waste products. Community canning kitchens were widely conducted. The Women's Land Army had during the summer of 1918 units in 20 different states, showing an enrolment of 10,000 in camps and 5,000 in emergency units. They were engaged in fruit packing, dairy work, truck gardening and general farming. Cash-and-carry plans were encouraged and the limitation of deliveries to one a day to any family or on any one route was recommended.

The U.S. Fuel Administration began its work in Aug. 1917, with Dr. Harry A. Garfield as director. The Administration set out to accomplish: (1) increased production; (2) better distribution; (3) fair sale prices; (4) the elimination of waste. Small production was largely due to strikes. The Fuel Administration succeeded in getting employers and employees into agreement and eliminated much of this difficulty. In April 1918 a nation-wide plan designed to insure equitable distribution of coal was put into effect. An essential feature was the zoning system, by which more than 5,000,000 tons formerly shipped from eastern mines to western territory adjacent to western mines was saved for the eastern states where the demand of war industries was greatest. All the price-fixing was done by territory. Inspectors visited each one of the 250,000 industrial plants in the United States using large amounts of coal and worked out with the management systems of conservation. In one week 50,000 tons of coal were thus saved in Pittsburgh alone. Rationing was put into effect, the supply of coal to non-essential industries being greatly reduced. It was estimated that this saved over 1,000,000 tons. All industries were held to their minimum needs. Stores and office buildings were encouraged to take their electric current from central plants. The "skip-stop" system on electric street railways by which no stops were made at unimportant crossings resulted in a great saving. Economy was also effected by lightless nights, which affected window lighting, electric display and street illumination. Home instruction was given in the operation of heating systems and in the use of electricity. For several weeks heatless Mondays were observed in stores, office buildings and places of amusement. A saving of 12,700,000 tons of coal for the first half of the coal year was thus effected.

On March 19 1918 the President approved the legislation entitled "An Act to save daylight, and to provide standard time for the United States." The purpose of this legislation was to conserve daylight and the Act is commonly known as the "Daylight-Saving Law." It provided for setting the clocks of the nation ahead one hour at two o'clock on the morning of the last Sunday in March of each year and for retarding them by one hour at the same time on the last Sunday in Oct. of each year. By the same piece of legislation the United States was divided into five standard zones. After the repeal of this Act in Aug. 1919, several of the states enacted daylight-saving laws. The operation of the daylight-saving plan caused the saving in seven months of approximately 1,250,000 tons of coal.

Gasoline-less Sundays were inaugurated in Aug. 1918. A cessation of Sunday motoring from 75% to 99% was effected. This resulted in an estimated saving of 1,000,000 bar. of gasoline, from which it is known that 500,000, or 10 shiploads, were sent overseas. The order governing the use of gasoline was withdrawn on Oct. 20 1918.

Under the provisions of "An Act to authorize the President to increase the military establishment of the United States," approved May 18 1917, and later amended, the President was authorized to raise and maintain military forces by selective draft "under such regulations as the President may prescribe not inconsistent with the terms of this Act." Under this law certain exemptions were made removing the liability to military service from those whose industrial occupations were deemed essential to the proper prosecution of the war. Along similar lines several of the states passed like enactments, commonly termed "Work or Fight laws," by which those who had been exempted from military service were forced to accept employment in essential industries or else join the military or naval service and thus conserve the man-power of the nation. Non-essential occupations were listed and because of the simultaneous enactment of a drastic law against loafing in the state of New York the New York City Federal Employment Service was overrun with applications. Over 6,000 were registered July 1, and the next day after the order had been given publicity one bureau registered over 10,000. The majority were from the non-essential occupations, together with a small percentage of the idle or vagrant classes.

The Conservation Division of the War Industries Board was established May 9 1918. Its purpose was to eliminate wasteful or unessential uses of labour, material, equipment and capital. Its specific aim was: (1) to secure the maximum reduction in the number of styles, varieties, sizes, colours or finish of products of the various industries; (2) to eliminate accessories which used material for adornment or convenience, but which were not essential; (3) to substitute materials which were plentiful for those which were scarce; (4) standardization; (5) reduction of waste; (6) economy in samples; (7) economy in containers and packing. The length and swing of men's sack coats and overcoats and the width of facing were limited, the size of samples reduced and each manufacturer restricted to not more than 10 models of sack suits for the season. This resulted in a saving of from 12 to 15% of material. A saving of 33% of wool used in the knitting of sweaters was effected by the reduction in styles and colours. For example, only one shade of green was used where formerly there were many. Manufacturers of shoes were restricted to white, black and tan; wasteful features were eliminated and height limited. As a result one tanner reduced his line from 81 colours and shades to 3, and manufacturers in general reduced their line by about two-thirds. A schedule issued Sept. 13 1918 to manufacturers of rubber footwear provided for the elimination of 5,500 styles, with an estimated annual saving of 29,012,600 cartons, 5,245,300 sq. ft. of shipping and storage space, 2,250,272 lb. of material to be dyed, 74,750 lb. of starch, 30,380 gal. of varnish, 125,300 lb. of tissue paper and 49,617 days of labour.

In addition to the efforts of the War Industries Board there were numerous appeals by Government officials and patriotic organizations to conserve clothing and shoes. As a result a very great proportion of the people wore garments which in normal times would have been discarded. Patching and remaking of clothing became popular practices. Although it is impossible to estimate the saving effected, it is undoubtedly true that many millions of dollars, which would ordinarily have gone for the purchase of wearing apparel, were used to purchase Liberty Bonds and to aid various war philanthropies.

The Pulp and Paper Section of the War Industries Board was organized June 6 1918 to restrict the use of paper and its products and thus to save fuel, transportation and labour. On July 5 1918 the following preliminary economies were requested of all newspapers publishing daily and weekly editions: that they (1) discontinue acceptance of the return of unsold copies; (2) discontinue the use of all samples and complimentary copies; (3) discontinue giving copies to anybody except for office working copies or where required by statute law in the case of office advertising; (4) discontinue giving free copies to advertisers except not more than one copy each for checking purposes; (5) discontinue arbitrary forcing of copies on news-dealers; (6) discontinue the buying back of papers at either wholesale or retail; (7) discontinue payment of salaries or commissions to agents, dealers or newsboys for the purpose of securing equivalent of return privileges; (8) discontinue all free exchanges. On Sept. 20 the following additional regulations went out: no publisher shall sell his paper at retail less than his published prices; no publisher shall use premium contests or similar means to stimulate his circulation; no publisher shall issue holiday, industrial or Sunday special numbers. These regulations brought about a saving in paper during Sept. of 10·4% of the average monthly tonnage during the six months preceding and in Oct. of 5%. There was produced in Sept. 1918 104,209 tons and in Oct. 110,498 tons. All regulations relative to paper were withdrawn on Dec. 15 1918.

The universal response by the people of the United States to the request that they lend money to the Government to provide necessary funds for the prosecution of the war was one of the most significant things of the war period. Millions of people purchased Liberty Bonds and Victory Notes in various denominations from $50 to $10,000 (*see* LIBERTY LOAN PUBLICITY CAMPAIGNS), and other millions invested in the smaller War Savings securities. Early in the war President Wilson made the statement: "I doubt that many good by-products can come out of a war, but if our people learn from this war to save, then the war is worth all it has cost us in money and material." This statement, together with the desirability of having the entire nation participate in financing the war, suggested the underlying purpose behind the war savings movement, which was put into operation in Dec. 1917. Section 6 of the Second Liberty Bond Act, approved Sept. 24 1917, authorized the Secretary of the Treasury "to borrow from time to time on the credit of the United States for the purpose of this Act and to meet public expenditures authorized by law, such sums as in his judgment may be necessary and to issue therefor at such price or prices and upon such terms and conditions as he may determine War Savings Certificates of the United States on which interest to maturity may be discounted in advance at such rate or rates and computed in such manner as he may prescribe." The Act further provided that "each War Savings Certificate so issued shall be payable at such time, not exceeding five years from the date of its issue, and may be redeemable before maturity, upon such terms and conditions as the Secretary of the Treasury may prescribe." A limitation of $2,000,000,000 was placed by the Act upon the amount of War Savings Certificates which might be outstanding at any one time; it also provided that no person should be sold at any one time certificates amounting to more than $100, and it also placed a $1,000 limitation upon the amount of certificates which might be held by any one person. The original Act was amended by the Act approved Sept. 24 1918, which increased the amount of certificates which might be issued from $2,000,000,000 to $4,000,000,000, removed the $100 limitation on the amount of certificates which might be sold to any one person at any one time, and also altered the previous Act by allowing persons to hold an amount not to exceed $1,000 worth of any series of certificates.

Pursuant to the authorization contained in the original Act, the Secretary of the Treasury appointed a committee of five, with Frank A. Vanderlip as chairman, to confer with him as to the form of security and the terms on which it should be issued. Following the recommendation of this committee, the Secretary of the Treasury offered for sale on Dec. 3 1917 an issue of War Savings Certificate Stamps, Series of 1918. Each certificate stamp when affixed to a War Savings Certificate (a folder with spaces for 20 stamps) would have a fixed maturity value of $5, with the date of maturity not to exceed five years, the purchase price to vary one cent each month throughout the year of issue, beginning in Jan. at $4.12, increasing to $4.23 in December. The stamps might be redeemed before maturity, their redemption value increasing one cent each month. There were also provided 25-cent Thrift Stamps, bearing no interest and not redeemable for cash, but to be accumulated on a Thrift Card until there were 16, when they could be exchanged for a War Savings Certificate Stamp by paying the additional odd cents necessary to cover the current price of the War Savings Certificate Stamp. Succeeding issues of War Savings Certificate Stamps were on Jan. 1 1919, Jan. 1 1920 and Jan. 1 1921.

In addition to the original securities there were offered in July 1919 Treasury Savings Certificates, one of $100 and the other $1,000 maturity value. Treasury Savings Certificates were registered at the Treasury Department at the time of purchase and increased in redemption value monthly on the same interest basis as War Savings Certificate Stamps. In Jan. 1921 there were offered for sale $1 non-interest-bearing Treasury Savings Stamps and $25 Treasury Savings Certificates, in addition to the other Treasury Savings Securities.

Following the working out of the types of securities in 1917, an organization for their sale was effected. In addition to the National War Savings Committee, consisting of the chairman and four members, the Secretary of the Treasury appointed six Federal directors, each having general supervision over approximately two Federal Reserve Districts; and 52 state directors, each of whom had complete charge of War Savings activities in his state or part thereof. The National War Savings Committee and the six Federal directors functioned at the National War Savings Committee headquarters in Washington. It was the duty of this sales organization to obtain coöperation from the heads of all enterprises operating nationally and then to decentralize the work through the Federal directors to the respective state directors coming under their jurisdiction, the ultimate goal being to offer every man, woman and child in the United States the privilege of aiding the Government by investing in Government securities, and at the same time to develop habits of thrift. The War Savings securities were put on sale at every post-office, at banks and in thousands of voluntary agencies. House-to-house canvass for their sale was made by postmen, boy scouts, representatives of insurance companies and members of women's organizations. In the autumn of 1918 the Treasury Department created a Savings Division of the War Loan Organization, which took over the work previously carried on by the National War Savings Committee, so that the people of the country might be taught for their peace-time value the lessons of thrift and saving learned during the war. The specific ends sought were: (1) to develop and protect all war issues of Government securities; (2) to sell Treasury Savings securities; (3) to make permanent the habits of regular saving and investment in U.S. Government securities. The Savings Division was placed in charge of a Director of Savings, with an organization in Washington, and one in each of the 12 Federal Reserve Districts.

School Government Savings systems were established. Instruction in thrift, saving and the principles of sound finance was introduced in schools throughout the nation. At the annual convention of the National Education Association in July 1920 a committee of state superintendents was appointed to work out with the Savings Division the best plans for placing the savings movement permanently in the American school system. The American Federation of Labor and various labour bodies passed resolutions commending the work of the Savings Division and calling on the Government to make permanent the policy of issuing small securities. Many local labour organizations invested their reserve funds in Government securities. In industrial plants throughout the country Government Savings Associations were established and the employees put aside small amounts regularly each week in Government Savings securities. Women's organizations of the country during the years 1919 and 1920 created the office of thrift chairman in their boards of officials. They took up the study of finance at club meetings, promoted the use of the household budget and with the savings thus effected purchased Government securities.

The total sale of War Savings securities from Dec. 3 1917 to Jan. 1 1921 amounted in round figures to $1,176,111,000. The total redemption of War Savings securities for the same period amounted to $415,174,000. (W. M. Le.)

SAXONY (*see* 24.265).—The pop. of the Territory and Free State of Saxony, according to the census of 1919, was 4,663,298; in 1910 it was 4,806,661.

During the last few years before the World War political life in the German kingdom of Saxony was dominated by a conflict about the constitution. The parties of the Left had for years demanded a reform of the First Chamber, the Upper House, by which the predominance of the Agrarians in that House should be broken, and commerce, industry, and handicrafts should obtain greater influence. In Jan. 1910 the National Liberals, the Liberals (*Freisinnige*) and the Social Democrats once more introduced resolutions with this object in the Second Chamber, the Lower House, but these proposals met with the keenest opposition from Government, which shared the opinions of the Right. Notwithstanding the majority in the Lower House for the Reform, it was defeated by the refusal of the Upper House to accept it. It was only in Dec. 1917, that the Government introduced a bill for the reform of the Upper House, which again led to fierce conflicts between the Right and Left parties in Parliament, but the advent of the Revolution put an end to these conflicts. Simultaneously controversy concerning a new Electoral Law for the Lower House had constantly been going on since 1910. In Nov. 1911 a Social Democrat was for the first time elected Vice-President of the Diet. With the outbreak of war these questions fell into the background. In the educational sphere the reform of the National Schools System, which was especially advocated by the teaching profession in Saxony, aroused sharp conflicts of opinion among almost all classes of the people. The teachers were fighting for a development of the school system on lines of greater liberty and particularly desired that religious instruction should be regarded in a more liberal light. In 1912 the Government introduced a bill, which did not fully meet the wishes of the school teachers. After some elaborate debates in the Lower House, which produced great excitement throughout Saxony, the bill was rejected in Dec. 1912.

On Nov. 30 1910, Dr. von Rüger, who had been Minister of Finance for many years and at the same time had presided over the Ministry, retired, his successor as Finance Minister being von Seydewitz, while the minister of Justice, von Otto, took over the presidency of the Ministry and was in turn succeeded by the Minister of War, Freiherr von Hausen, in Sept. 1912, who on May 21 1914 gave place to von Carlowitz. The latter resigned his office to Lt.-Gen. von Wilsdorf on Oct. 27 1915 on taking a command in the field.

The year 1913 saw the opening in June of an airship base at Leipzig, the largest in Germany at that date.

On Oct. 18 1913 the unveiling of the monument commemorating the *Völkerschlacht* (the great victory of the continental Allies over Napoleon Oct. 16–18 1813) took place in Leipzig, a celebration at which the Emperor William II. and all the German sovereigns were present. After the ceremony the foundation stone of the German Library was laid, an institution which has since been completed and put in working order. All German publishers have undertaken to place a free copy of every work published by them at the disposal of this library, so that it already possesses more than a hundred thousand volumes. On July 29 1916 the Technical School of Mining at Freiberg, the oldest institution of its kind in Germany, celebrated the hundred and fiftieth anniversary of its foundation.

Saxony, which is chiefly an industrial country and cannot boast of much agriculture, suffered more under war conditions than most other German states. As a country which had been hitherto provisioned from outside, it found the problem of supplying food to its population extremely difficult. There was in many places a real dearth in the most important foodstuffs, such as corn and potatoes, so that the population was frequently obliged to have recourse to substitutes (*Ersatzmittel*).

Shortly before the outbreak of war, during the week July 17–24 1914, King Friedrich August of Saxony was on a visit to the Russian court at Petrograd; then on Aug. 2 the King's warlike appeal to the civilian and military population was published. At the beginning of the war the Saxon troops suffered heavy losses during their advance into the north of France. Already in 1917 the extreme Left in the Saxon Diet had begun an agitation, which never abated, for the early conclusion of peace; this demand led to violent debates between the Left and the Government, the latter being supported by the parties of the Right. On Oct. 26 1918 the Cabinet was forced to resign and to give place to a new Government of a more Liberal colour under Dr. Heinze. On Nov. 9 1918 the revolution broke out, and King Friedrich August abdicated on Nov. 13. A Cabinet of Commissaries of the People (*Volksbeauftragte*) was formed and was entirely composed of members of the extremist section of the Social Democrats, the Independent Socialists. The revolutionary conflicts of Jan. 1919, which entailed sanguinary street fighting in Leipzig, Dresden and other Saxon cities, led to the resignation of the Cabinet, which was succeeded by a Government of the right wing of the Social Democratic party. The extreme Left instituted demonstrations against this Government throughout the country, and there were serious excesses, especially in Plauen and Leipzig. In April 1919 a Councils (Soviet) Republic was proclaimed at Leipzig. It was only on May 12 that the *Reichswehr* (the regular army of the *Reich*) under Gen. Maerker entered the city and put an end to the Soviet Republic. Serious disturbances followed in the Vogtland and in Chemnitz in June and August. On Oct. 2 1919 the (non-Socialist) Democratic party joined the Ministry, which was now composed of Social Democrats and Democrats. The Ministry kept in power till April 25 1920. It was replaced by a Coalition of Social Democrats and Independent Socialists; which, when the Diet reassembled, received a vote of confidence. This Cabinet was vigorously combated by the non-Socialist parties, all of which voted against the salaries of ministers in April 1921.

The insurrectionary movement of the spring of 1920 had been very formidable, especially in W. Saxony. In Leipzig sanguinary fighting continued for several days, and there were heavy casualties. In the Vogtland the Communist Hölz formed a band of several hundred men, with which he conducted a reign of terror in the towns and villages. The Government long hesitated to take action against him; finally, however, Hölz's force was surrounded and dispersed by *Reichswehr* troops. Hölz himself fled across the frontier into Czechoslovakia, where he remained until the Communist rising of March 1921 in central Germany, when he returned and took command of the insurgents. After the collapse of the insurrection he was for a time in hiding in Berlin, where he was ultimately arrested, and after a trial which lasted a fortnight was condemned to penal servitude for life with the loss of civil rights (June 1921).

In July and Aug. 1920 there were widespread food riots in Saxony, but they did not assume the dimensions of the fighting in Leipzig and in the Vogtland. In the first half of 1921 there had been no further disturbances. (C. K.*)

SAZONOV, SERGIUS DMITRIEVICH (1866–), Russian statesman, came of a family of great Russian landowners. He was educated at the Alexandrovsky Lycée. In politics he was connected with a group which formed the Right Centre in the Council of the Empire and supported the general policy of Stolypin. Enlightened and convinced of the necessity of reforms, he remained, however, a staunch supporter of the monarchical and orthodox tradition of Imperial Russia. He entered the diplomatic service, and his first important post was that of Councillor of Embassy in London, where he assisted Count Benckendorff in the task of improving the relations between Great Britain and Russia. He subsequently acquitted himself successfully as Russian Minister at the Vatican. He was appointed Minister of Foreign Affairs in St. Petersburg at a critical juncture when Isvolsky left that office for the Paris Embassy. Russian policy had just disengaged itself from the coils of the traditional friendship with Germany, and the Kaiser, though still corresponding with "Dear Nicky" and keeping a personal representative in attendance on the Tsar, had given up the scheme of cementing an alliance with Russia against England and forcing France into the combination. Germany was demonstrating "in shining armour" by the side of Austria-Hungary, and was drawing Turkey away from her former protectors, the Western Powers. The idea of the penetration of the Near East was developing the more effectually as the scheme of directing Russia towards the Far East had proved unsuccessful. The backing of Austria and Turkey by Germany meant necessarily the crushing of the Slavonic Balkan States and a conflict with Russia. Sazonov was the most appropriate person to oppose this aggressive tendency with firmness and dexterity, but without chauvinism. He managed to strengthen the ties of mutual confidence between Russia and Great Britain by avoiding all kind of provocation in Central Asia or in Persia; as to France, the solidity of the alliance was beyond question. The treatment of the Balkan nationalities was a much more complicated problem. And when, after the disastrous squabble between the Balkan allies in 1913, the peace of Bucharest left Bulgaria bleeding, humiliated and weakened, the result was not only the destruction of the Balkan League, but a lasting alienation of Bulgaria from Russia and from the Western Entente. Russian diplomacy did not shine in those days: ineffectual attempts at arbitration between Serbia and Bulgaria, ineffectual discontent with the progress of the negotiations at Bucharest, and eventual recognition of defeat in the end, did not enhance the prestige of Russian foreign policy.

When the great crisis broke out in 1914, after the assassination of the Archduke Franz Ferdinand, the Tsar and Sazonov found themselves heavily handicapped by events. Both had tried to avoid the outbreak of war: but it was impossible for Russia to look on while Serbia was being delivered to the tender mercies of an Austrian inquisition, or to allow Germany to mobilize under the protection of specious formulas without herself taking any steps as regards the slow mobilization of the Russian army. Sazonov saw clearly that war had been decided upon in Berlin, and he helped to make it clear to the Tsar that the German talk about the ancient tie between the two Empires and the services rendered to Russia during the Japanese war was mere manœuvring for position. The precise sequence of events is narrated elsewhere. Suffice it to say that the early course of the war itself showed how the Balkan situation had been irremediably jeopardized by preceding diplomatic mistakes and mishaps. Turkey, Bulgaria and Greece fell away one after the other. Possibly none of these events could have been averted, but it is sufficiently clear that neither the Entente Powers nor Russia in particular were prepared for them, and that they did not take in time measures which would have made them less injurious: the Straits could have been forced when the "Goeben" and "Breslau" passed them; Bulgaria might possibly have been won over by concessions, or attacked with advantage before she was ready to strike. In any case the actual results were disastrous; they determined the isolation of Russia at a time when she stood greatly in need of technical help from her allies. As an indirect consequence of the Balkan events there was a gradual change in the Russian demands as regard Constantinople. It is interesting to compare the reports of two conversations between the Tsar and the French Ambassador, M. Paleologue. In Nov. 1914, Nicholas II. restricted his claims to the opening and neutralization of the Straits, the expulsion of the Turks from Europe and international administration for Constantinople. In March 1915 he declared that the Russian people were more and more intent on the annexation of Constantinople as the ancient site of orthodox Christianity. Sazonov succeeded in getting from the Western Powers a promise to grant these demands in the hour of victory.

It is superfluous to say that Sazonov was staunch in his fidelity to the Entente and in his opposition to the projects for a separate peace or armistice, which at times cropped up in court circles; he had however, like all other moderate Liberals, the greatest difficulty in resisting the discreditable influences which swayed the Government in its reactionary policy. He opposed as far as he could the assumption of the Army command by the Tsar, as this measure could not effect any improvement in military matters, weakened the home Government and made it more accessible to intrigues. He strongly urged the necessity of winning over the Poles by a real measure of Home Rule, and he seemed to have convinced the Tsar of the necessity of such a measure, but this apparent success was really the occasion of his fall. The Empress Alexandra brought pressure on the Tsar; the measure was countermanded, and Sazonov was dismissed.

He was preparing to start for London as ambassador to succeed Count Benckendorff, when the revolution of March 1917 broke out. He deplored its advent, which brought an end to Russia's participation in the war and plunged the country into an abyss of uncertainty and misfortune. He consented, however, to proceed to London as an envoy of the Provisional Government when the fall of Milyukov and the subsequent degradation of the Government made it necessary for him to step aside. He was again put in charge of the Ministry of Foreign Affairs by Adml. Kolchak, and proceeded to London and Paris in the hope of contributing by his personal authority to win a recognition of the claims of historical Russia from her former allies. Such hopes proved to be in vain. The Peace Treaty of Versailles made only general allusions to the possibility of her reappearance in the future. Nor was Sazonov the man to curry favour with Esthonia, Latvia and Georgia, in order to obtain help, at the cost of a renunciation of the imperial interests of his country. (P. Vi.)

SCAPA FLOW, an expanse of sea, in the S. of the Orkneys, bounded by Pomona on the N., Burray and South Ronaldshay on the E. and S.E., and Hoy on the W. and S.W. The area contains seven small islands and is about 15 m. in extreme length (N. to S.), and about 8 m. in mean breadth. There are two chief exits—one, 7 m. in length and 2 m. in mean breadth, into the Atlantic Ocean by Hoy Sound, and the other, 3½ m. in length by 2 m. in mean breadth, into the North Sea by Holm Sound. Scapa Flow contains several good anchorages, the best being Longhope in the island of Hoy. When the danger of a war with Germany came first to be apprehended, it was proposed to establish the chief British naval base, in the event of war, at Rosyth in the Firth of Forth, but it was afterwards decided that a larger base in a natural harbour farther N. would be required, and in 1912 it was proposed to construct defences both at Cromarty and at Scapa Flow. Permanent defences at Scapa were, however, abandoned in 1913, owing to the developments of submarine warfare, which rendered it very costly to protect the various entrances. Immediately on the outbreak of war, batteries were erected at Scapa and the Territorial Garrison Artillery of the Orkneys were mobilized to man them. Scapa Flow was preferred to the Cromarty Firth as his chief naval base by Admiral Jellicoe, but no preparations had been made and everything had to be improvised, guns being landed from the ships to strengthen the defences. The absence of preparations came to be felt more strongly with the rapid growth of the submarine menace, for the depth and number of the entrances made it a serious problem to establish adequate defences. By the middle of Oct. 1914, "U" boats were active in the neighbourhood of Scapa Flow, and on Oct. 16, an enemy submarine was reported to be in the Flow. The few capital ships which happened to be there put to sea, and it was recognized that the base would be unsafe until anti-submarine defences were installed. While the necessary operations were in progress, the fleet occupied temporary bases in Skye and Mull and in the defended harbour of Lough Swilly in Ireland, and the absence of the fleet was successfully concealed. By the end of 1914, the entrances of Scapa Flow had been adequately protected, facilities for carrying out all but the most serious repairs were installed, and Scapa Flow gradually assumed the aspect of a great naval station, which it retained to the end of the war. As a precaution against espionage, navigation in the adjacent waters was very severely regulated, and an ever-widening region of the mainland (ultimately extending as far S. as the Caledonian Canal) was proclaimed as a prohibited area. The German ships which were surrendered in Nov. 1918 were interned in Scapa Flow, where on June 21 1919, all the battleships and battle cruisers, with the exception of the battleship "Baden" and five light cruisers, were scuttled. Three light cruisers and some smaller vessels were beached.

SCARBOROUGH, England (*see* 24.301).—The pop. decreased from 38,161 in 1901 to 37,224 in 1911. In 1913 the municipal area was increased from 2,562 to 2,902 acres. The town was bombarded by a squadron of German cruisers on Dec. 16 1914; 18 persons were killed, 84 injured, and damage done to 231 buildings. On April 27 1917, it was ineffectually shelled by submarines, but in a second attack, on Sept. 4 of the same year, 3 persons were killed. The repair of the castle walls and keep, considerably damaged in the bombardment of Dec. 1914, was in progress in 1921.

Excavations of archæological interest were carried out on the foundations of the old Northstead Manor House at Peasholme, and the remains of the Roman camp on Castle Hill have been bared and opened up. To the amenities of Scarborough were added during 1911–21: a bathing pool measuring 350 by 190 ft. at the foot of the cliff in South Cliff Gardens; a new Floral Hall of Glass in Alexandra Gardens, with accommodation for 1,500 people; Peasholme Park as a public garden, with a boating lake; and the Spa Promenade was extended and a bandstand and large café added. A town-planning scheme was prepared in 1921. Some industrial works were established during the decade, including a piano factory at the Mere, clothing factories, a motor-body works and a colour-printing works.

SCARFOGLIO, EDOARDO (1860–1917), Italian journalist, was born at Paganico (Aguila) in 1860, and died at Naples Oct. 6 1917. He was one of the most vigorous and ablest journalists of his time and an excellent newspaper manager as well as editor. He founded the *Corriere di Roma*, the *Corriere di Napoli*, the *Ora* of Palermo and the *Mattino* of Naples. It is with the latter paper, which he owned and edited for many years, that his name is chiefly associated. He was the husband of the novelist Matilde Serao (*see* 24.661), from whom, however, he had been separated for many years.

SCHARLIEB, MARY DACOMB (1845–), British surgeon, was born in London June 18 1845, the daughter of William Candler Bird. She was educated privately, and married a barrister who was then practising in India. She wished to study medicine, at that time an extremely difficult profession for a woman to adopt, and entered the medical college at Madras, receiving its diploma in 1878. She afterwards went to England and studied at the London School of Medicine for Women, taking her degree as Bachelor of Medicine and Surgery in 1882 with very high honours. In 1883 she returned to India, and became lecturer in midwifery and gynæcology at the Madras Medical College and examiner in the same subjects to the university of Madras. In 1888 she took her London degree of M.D., and from 1887 to 1902 was surgeon at the New Hospital for Women, being senior surgeon from 1889. In 1887 she was appointed lecturer on forensic medicine to the Royal Free Hospital, in 1889 lecturer on midwifery, and in 1902 chief gynæcologist. She retired from these posts in 1909. In 1917 Mrs. Scharlieb was made C.B.E. She was a member of the royal commission on Venereal Diseases (1913–16), and published *A Woman's Words to Women* (1905); *The Mother's Guide* (1905); *The Seven Ages of Woman* (1915); *The Hope of the Future* (1916); *The Welfare of the Expectant Mother* (1919).

SCHEER, REINHARD (1863–), German admiral and ultimately commander-in-chief of the German battle fleet in the World War, was born Sept. 30 1863 at Obernkirchen in Hesse-Nassau. He served in the German colonial wars in Cameroon and E. Africa and was appointed in 1903 to the command of the 1st Torpedo Division. Subsequently he was for a time at the head of the Central Section in the Imperial Navy Office. In 1913 he was promoted to the rank of vice-admiral and was made commander of the 2nd squadron. In 1916 he was appointed to the command of the German battle fleet (Hochseeflotte). He was in command of the Fleet at the battle of Jutland, and in his book *Deutschland's Hochseeflotte im Weltkrieg* claimed to have won a victory there. In July 1918 he was made chief of the Admiralty staff and again in Aug. of the same year chief in command of the Fleet. In Dec. 1918 he was retired.

SCHEIDEMANN, PHILIPP (1865–), German Social-Democratic leader, was born July 26 1865 at Kassel. He was by trade a printer, but in 1895 took to editing Socialist newspapers, first at Giessen and afterwards successively at Nürnberg, Offenbach and Kassel. In 1903 he was elected member of the Reichstag for the great industrial constituency of Solingen, and in the course of the World War he became the leader of the Social-Democratic party. In his reminiscences of the war period, which he published in 1920 under the title of *Der Zusammenbruch* (The Collapse), he gives an account of the attitude of the Socialist party as a whole at the beginning of the war, and of the change of policy which, to the disappointment of international socialism in other countries, led the German Socialists to give an all but unanimous vote in the Reichstag for the first war credits. He refers to the hurried visit of his Socialist colleague Hermann Müller to Paris on Aug. 1 1914 to discuss the situation with the French Socialists, and the effect of Müller's report, when with great difficulty he had managed to make his way back to Berlin. Scheidemann represented the attitude of the great majority of the Socialists in the Reichstag, if not in the country, by persistently supporting the Government in the main lines of its war policy, up to the months immediately before the so-called "Peace Resolution" of July 19 1917 at any rate. In conjunction with Erzberger he was one of the leading authors of this Resolution, which demanded "peace without annexation or indemnities." Before this date the improvement in the position of the Socialist party in German political life had been shown by the way in which its leaders, particularly Scheidemann, were frequently called into conference with the imperial chancellor, Bethmann-Hollweg. Scheidemann, in his book, gives a vivid account of some of these conferences, and also of the celebrated interviews which the leaders of parties in turn had with Hindenburg and Ludendorff in Berlin when the army authorities endeavoured to obtain the modification of the so-called "Peace Resolution" before it was produced in public. It was largely owing to the firm attitude taken up by Scheidemann and the Majority Socialists that the chancellorship of the incompetent Michaelis (July to Oct. 1917) was brought to a close. In June 1918 Scheidemann was elected vice-president of the Reichstag, and on Oct. 3, on the formation of the last imperial Ministry by Prince Max of Baden, he received a secretaryship of State without portfolio. The part which he and his associates in the leadership of the Governmental or Majority Socialists played on the eve and on the outbreak of the Revolution was somewhat ambiguous. There is said to be evidence that, while insisting upon the abdication of William II. and the renunciation of the Crown Prince's rights of succession they were prepared to tolerate the continuance of the monarchical form of government in the shape of a regency, with, perhaps, the Crown Prince's eldest son, a young boy, as the prospective monarch. If this be so their plans were speedily brought to naught by the greater vigour of the Minority or Independent Socialists, led by Haase. The Independents had been active in sowing the seeds of revolution among the troops at the front, the sailors at Kiel and Wilhelmshafen, and the workmen in the munitions and other great factories. It was the Independents who forced the hand of Scheidemann and his associates by the arrangements which they had made in Berlin in the first week of Nov. 1918 for a general strike, a demonstration of the masses, and an appeal to the soldiers of the garrison to follow the example which had just been set in Kiel and other northern towns. And it was for this reason that the leaders of the Minority Socialists had to be admitted on equal terms and in equal numbers into the Provisional Government of the "Commissioners of the People," formed on Nov. 10 by Ebert, Scheidemann, Haase and three others. How little Scheidemann's party had been prepared for the course events took was shown by the fact that a proclamation appeared in the Socialist *Vorwärts* on Nov. 10, announcing that Prince Max of Baden in resigning the chancellorship had handed over the conduct of affairs to Ebert, who accordingly signed this proclamation as "Imperial Chancellor" (*Reichskanzler*). On Nov. 9, when the revolution in Berlin was slowly and, at first, peacefully spreading throughout the city, it was only after the announcement of the Kaiser's abdication had been published by Prince Max of Baden on his own initiative, at noon, and after the troops which were in occupation of the Reichstag building had thrown their rifles into the Spree and gone home, that Scheidemann appeared in front of that building at two o'clock and dramatically proclaimed the republic.

Scheidemann was closely associated with the policy, alleged to have been inevitable, which led the provisional and, afterwards, the first properly constituted republican Government to retain the services of reactionary officers and troops for the suppression of communist disorders. He was, therefore, together with Ebert and Noske made the subject of violent denunciations, not only by the Communists but also by the Minority Socialists after they had seceded from the Provisional Government at the beginning of Jan. 1919. When the National Constituent Assembly met at Weimar on Feb. 6 1919 Scheidemann was selected as president of the first regularly constituted republican Ministry of the Reich. He guided the affairs of Germany through the stormy period of the first half of 1919, when it repeatedly looked as if the communist insurrections, which broke out in various parts of the country, might result in the overthrow of the democratic republic and in an experiment in some kind of Bolshevism. On July 20 1919, being unable to agree to the signature of the Treaty of Versailles, he resigned with the rest of his Ministry. He then resumed the leadership of the Majority Socialists in the National Assembly and subsequently in the first republican Reichstag. In Jan. 1920 he was elected chief burgomaster of his native town, Kassel.

SCHIFF, JACOB HENRY (1847–1920), American banker and philanthropist, was born at Frankfort-on-Main, Germany, Jan. 10 1847. He was educated in the schools of Frankfort and for a time worked in a banking house. In 1865 he went to New York City and two years later organized there the brokerage firm of Budge, Schiff & Co., which was dissolved in 1873. In 1875 he married a daughter of Solomon Loeb, head of the banking firm of Kuhn, Loeb & Co., was taken into the firm and, on Loeb's retirement in 1885, succeeded to the leadership. Meanwhile, largely due to Schiff's energy, the firm had greatly expanded its business and had become known throughout the financial world. In 1897 his house took an active part in reorganizing the Union Pacific railway, which later secured control of the Southern Pacific, assisting E. H. Harriman in these transactions. In 1901 a struggle took place between Schiff and the Harriman interests on the one side and James J. Hill and J. P. Morgan on the other for possession of the Northern Pacific railway. The resulting compromise was the formation of the Northern Securities Co. as a holding company for their joint interests (*see* 27.733). After the outbreak of the Russo-Japanese War in 1904 Schiff introduced Japanese war loans in America and subsequently was decorated by the Mikado. In his later years he gave much personal attention to charities, especially for the Jewish people, and on his seventieth birthday distributed $700,000 among various charitable organizations and public institutions. He was a founder and president of the Montefiore Home for Chronic Invalids, New York City, and vice-president and trustee of the Baron de Hirsch Fund. In 1903 he presented a Semitic Museum to Harvard. He was vice-president of the N.Y. Chamber of Commerce and a director in many large corporations. He died in New York City Sept. 25 1920. His estate was estimated at about $50,000,000. He bequeathed $1,350,000 to various institutions, most of which had received benefactions during his life. The largest bequests were $500,000 to the Federation for the support of Jewish Philanthropic Societies of New York City and $300,000 to the Montefiore Home.

SCHIMMEL, HENDRIK JAN (1825–1906), Dutch poet and novelist (*see* 24.326), spent his last years in work on spiritualistic research. He died at Bussum in 1906.

SCHLESWIG.—The older "Schleswig-Holstein Question" (*see* 24.335) had an important sequel as the result of the World War, in the severing from Germany of part of Northern Schleswig.

The Peace of Vienna of 1864 had set up a joint administration of Schleswig-Holstein by Austria and Prussia. In the Peace of Prague (1866) Austria surrendered to Prussia her claims to both duchies. As regards the administration of Northern Schleswig (Nord Schleswig), an eventual cession to Denmark was reserved if the population should decide in this sense by a free vote. In 1878, however, Austria gave up this reservation, and Denmark in the Treaty of 1907 with Germany recognized that by the agreement between Austria and Prussia the frontier between Prussia and Denmark had finally been determined. The Danish population of Northern Schleswig had, it is true, never acquiesced in this settlement. Propaganda for union with Denmark never ceased, although it had greatly diminished in the years which preceded the World War. At the first elections for the Reichstag the Danes of Northern Schleswig won two seats, but after about 20 years they retained only one of them.

During the World War the movement in Northern Schleswig for separation from Prussia seemed to be in abeyance. It was only the Armistice of 1918, which gave prominence to certain points in President Wilson's programme, that once more inspired among the Danish population a vigorous demand for a plebiscite to decide the nationality of the North-Schleswigers. The Danish Government had at first adopted an attitude of reserve. But from the spring of 1919 onwards a propaganda was conducted in Copenhagen for "South Jutland," the chief leader in the movement being Hansen-Nörremölle, who till then had been the representative of the Danish population in the German Reichstag. The German Government declared its readiness to apply President Wilson's programme for the "self-determination" of nationalities to the Danish portions of Northern Schleswig. The Treaty of Versailles provided for a plebiscite in that region. The original intention was to take the plebiscite throughout the whole of the Duchy of Schleswig, which for this purpose was to be divided into three zones. Finally, the idea of taking a plebiscite in the most southerly zone was abandoned, as the population of that district was purely German.

Article 109 of the Treaty established two zones for the plebiscite. The northern, or first, zone was bounded on the S. by a line passing through the islands of Röm and Sylt, keeping S. of Tondern, and then running to the N. of Flensburg, through the middle of the Flensburger Fjord, and leaving the island of Alsen to the N. of the line. The second zone included the islands of Sylt and Föhr and ran on, after bulging somewhat to the S. to the Flensburger Fjord on the east. Within this second zone lay Flensburg. The whole of the plebiscitary area had to be evacuated by the German troops and civil authorities within 10 days after the Treaty of Peace came into force. Powers of administration were transferred to an Inter-Allied Commission. In the first zone the plebiscite was to take place, at latest, three weeks after the German evacuation; in the second zone, at latest, five weeks after the plebiscite in the first zone. The decision regarding the assignment of territory to Denmark or to Germany on result of the plebiscite was to be taken on the proposal of the Inter-Allied Commission with due consideration for the special economic and geographical conditions of the region. The Danish Government appointed the former Reichstag deputy Hansen to the post of Danish minister for Schleswig, with the task of maintaining Danish interests in the plebiscitary area. All persons, without distinction of sex, who had completed their twentieth year and either had been born in the plebiscitary area or had lived there before Jan. 1 1900, were entitled to vote. On the German side, a German committee for Schleswig was formed, and was entrusted with German propaganda and preparations for the plebiscite.

On Jan. 15 1920 the Inter-Allied Commission, which had previously assembled at Copenhagen, took over the administration of the plebiscitary area. The German officials had to leave this territory, and their place was taken by native *Landräte* and administrative officials appointed by the Commission. The German troops evacuated the region by Jan. 20. A battalion of British troops was stationed at Flensburg, a French battalion at Hadersleben and another at Sonderburg. The Inter-Allied Commission was composed of Marling (Great Britain), Claudel (France), Heyste (Norway), and von Sydow (Sweden). It promptly issued regulations for the plebiscite, dealing with the voting qualification and the registration of votes. A control over persons entering the plebiscitary area was also established. A vigorous propaganda was initiated both on the Danish and on the German side and led to a number of incidents especially at Flensburg. The plebiscite in the first zone took place on Feb. 10. On the whole it passed off quietly. It resulted in a great Danish majority; 75,151 votes were cast for Denmark and 25,231 for Germany. The larger towns, Tondern, Hoyer, etc., had in all cases a German majority, while the rural population, with the exception of a few German *enclaves*, voted almost in its entirety Danish. The campaign was much keener in the second zone, where the polling day had been fixed for March 14. There were sharp conflicts, particularly at Flensburg, where the burgomaster, Todsen, was expelled by the Inter-Allied Commission. When a prohibition against the display of flags on the day of the plebiscite was issued on March 6, the German assessors of the Inter-Allied Commission resigned their posts. Repeated collisions with the French troops of occupation took place at Flensburg, and were not unattended by bloodshed. The plebiscite resulted in a great German success; about 51,000 votes were recorded for Germany and only 13,000 for Denmark. There were only two communes which had a Danish majority.

The determination of the frontier took a long time. Germany advocated the so-called Tiedje line, while on the Danish side propaganda was made for the so-called Clausen line. The Council of Ambassadors of the Allies gave its decision at the beginning of June. On June 15 the president of the Paris Peace Conference handed the German delegation a note in which the German-Danish frontier was fixed as follows. It begins at the entrance to the Flensburger Fjord, passes through the middle of that fjord, reaches the mainland immediately to the N. of Flensburg, leaves Flensburg to the S. and then follows a line which reaches the North Sea at Sieltoft. The island of Sylt falls to Germany, the island of Röm to Denmark. On the whole this meant the adoption of the Clausen line. The territory assigned to Denmark was at once handed over to her on June 15, while the territory that remained German was forthwith placed once more under German administration. German troops reëntered Flensburg on June 16 after the members of the Inter-Allied Commission had left the town.

The detailed settlement of the territory to be ceded to Denmark was effected by a treaty concluded between Germany and Denmark and signed in the middle of July. At the beginning of July Denmark gradually took over the administration of the ceded districts, the administration of justice being the last department to become Danish. It is worth noting that the day of the plebiscite in the second zone coincided with the Kapp *Putsch* in Berlin. (C. K.*)

SCHLICH, SIR WILLIAM (1840–), British forestry expert, was born at Darmstadt Feb. 28 1840, and educated there and at the university of Giessen. In 1866 he entered the Indian Forests Department, became conservator of Forests in 1871, and ten years later inspector-general of Forests to the Government of India. He was one of the pioneers of the study of forestry in England, organizing the first school at Cooper's Hill, which was afterwards transferred to Oxford in 1905. He was appointed professor of Forestry at Oxford the same year. Among his books on the subject are *A Manual of Forestry* (1889–95; 3 vols.), and *Forestry in the United Kingdom* (1904). In 1901 he was elected a fellow of the Royal Society, and in 1909 he was created K.C.I.E.

SCHMOLLER, GUSTAV (1838–1917), German political economist (*see* 24.344), died in 1917.

SCHOLL, AURÉLIEN (1833–1902), French author (*see* 24.356), died in Paris April 16 1902.

SCHÖNAICH, FRANZ, FREIHERR VON (1843–1916), Austro-Hungarian general of infantry and Minister of War, was born at Vienna in 1843, and entered the army as a lieutenant in 1861. He spent the greater part of his service on the general staff and on special employments, especially as a chief of sections in the War Ministry. For a short time in command of the IX. Corps he became head of the Austrian Imperial Ministry of Defence, after which he took over the charge of the Imperial War Ministry. Schönaich had an attractive personality, was a practised orator, and well-informed in political matters. Therefore he knew how to maintain good relations with the parliamentary parties, to whom his capacity as an organizer, in the crisis of the winter of 1908–9 (the annexation of Bosnia and Herzegovina), was of great advantage. He was less successful in connexion with the Defence Act of 1911, the financial basis of which he was only able to arrange with important restrictions and serious limitations. In this matter he came into conflict with other influential personages, a circumstance which led to his retirement in the autumn of 1911. During the World War he was in supreme command of the War Provisioning Department, and died at that post in the spring of 1916.

SCHOULER, JAMES (1839–), American lawyer and historian (*see* 24.377), published in 1913 a seventh volume of his *History of the United States of America Under the Constitution*, covering the period of reconstruction (1865–71). The original plan of his work had been enlarged by the publication in 1899 of a sixth volume, covering the period 1861–5.

SCHREINER, OLIVE (*c.*1862–1920), pen-name of Mrs. Cronwright Schreiner, was born in Basutoland, the daughter of a German missionary sent out by the London missionary society. She was a sister of W. P. Schreiner, afterwards Prime Minister of Cape Colony, and married in 1894 Mr. S. C. Cronwright, also a S. African politician. Early in 1882, when she was 20 years old, she brought to England the MS. of her first novel, *The Story of an African Farm*, and submitted it first to George Meredith, then reader for Chapman & Hall. He praised the book and suggested certain alterations, most of which she accepted. Eventually it was published by the firm in 1883, over the pseudonym "Ralph Iron." Its success was immediate, but nothing else that she wrote had quite the same literary quality. Her later work includes *Dreams* (1891); *Trooper Peter Halkett of Mashonaland* (1897), a much-criticized attack on the first settlers in Rhodesia; *An English South African's View of the Situation* (1899); and *Woman and Labour* (1911), a fragment of an earlier MS. which had been burnt with other papers during the S. African War. She died at Cape Town in Dec. 1920.

SCHREINER, WILLIAM PHILIP (1857–1919), South African lawyer and statesman, the youngest son of a German missionary, was born in the district of Herschel, Cape Colony. He studied law at Cape Town and at Cambridge and London universities. He was called to the bar (Inner Temple) in 1882 and the same year returned to the Cape where he was admitted an advocate of the Supreme Court. He soon attained success and was for many years leader of the Cape bar. In 1893 Schreiner, who had been legal adviser to the High Commissioner since 1887, began his political career as attorney-general in the second Ministry of Cecil Rhodes. He resigned the same year, took the same portfolio again in Sept. 1894 and remained in office until the Jameson Raid brought about the downfall of the Rhodes Ministry. In 1898, having helped to bring about the fall of the Sprigg Ministry, Schreiner became Prime Minister of Cape Colony and held that position when the Anglo-Boer War of 1899-1902 began. During the crisis which preceded the outbreak of hostilities he allowed the passage of armaments to the Dutch republics, and when the war broke out he wished to keep Cape Colony neutral (*see* 5. 244). Acute differences in the Cabinet caused Schreiner to resign office in June 1900. Later he advocated, unsuccessfully, the federation instead of the unification of the South African colonies. In 1914 he accepted the office of High Commissioner of the Union in London and held that post until his death. He died at Llandrindod Wells on June 28 1919. Schreiner married, in 1884, Frances, sister of F. W. Reitz, President of the Orange Free State. He was a brother of Olive Schreiner, the novelist. Schreiner was a man of high attainments, great industry and impressive speech. His qualities showed at their best at the bar, and the proper crown of his career would have been a seat on the bench. But as a politician he suffered from a lack of suppleness which disqualified him from becoming a popular leader. He had also too much of the cross-bench mind. He was a sincere friend of the natives, and, in 1908–9 successfully defended Dinizulu against the charges of treason and murder brought against him. He also went to London as a delegate of the Coloured Races Political Association to oppose restrictions in the Act of Union.

SCHULTZ, HERMANN (1836–1903), German theologian (*see* 24.382), died in 1903.

SCHURMAN, JACOB GOULD (1854–), American educationist (*see* 24.386), was appointed in 1912 U.S. minister to Greece and Montenegro, serving one year. During the World War, when Germany began unrestricted submarine warfare, he urged that American rights be firmly insisted upon; he pointed out that the destruction of the "Lusitania" in 1915 threatened to efface the distinction between combatants and non-combatants long recognized by civilized peoples. In 1915 he was first vice-president of the N.Y. State Constitutional Convention. In Oct. 1917 he was appointed a member of the N.Y. State Food Commission, resigning in June 1918 to go to France as lecturer to American soldiers under the auspices of the Y.M.C.A. He was opposed to many of President Wilson's policies, especially in connexion with Mexico, and also to Article X. of the Covenant of the League of Nations, believing that it would involve the United States in war. As early as 1913 he urged the independence of the Philippines in the near future; in 1914 he declared in favour of woman suffrage. He resigned the presidency of Cornell University in 1920. He was appointed minister to China in 1921. He was the author of *The Balkan Wars 1912–1913* (1914, lectures at Princeton).

SCHUSTER, SIR ARTHUR (1851–), British physicist, was born in Frankfort-on-Main Sept. 12 1851, the son of Francis Joseph Schuster, of Frankfort, who in early life made his home in London, where he carried on a successful business as merchant-banker in Cannon St., his three sons, Ernest Joseph (b. 1850), subsequently a well-known lawyer, Arthur, and Felix (see below), being brought up, like himself, as British subjects. Arthur Schuster was educated at Owens College, Manchester, and at Heidelberg University, and devoted himself to a scientific career as an astronomer and mathematical physicist. He was chief of the "Eclipse" expedition to Siam in 1875, and from 1888 to 1907 was professor of physics in Manchester University, his main work for many years being connected with advanced research in spectroscopy, on which subject he contributed the article in the 9th ed. of the *E.B.* in 1887 (as also to the 11th ed. in 1910). He was awarded the royal medal of the Royal Society in 1893, and was one of the secretaries of the Royal Society from 1912 till 1920. He was president of the British Association in 1915, having in 1892 acted as sectional president for astronomy, and he became well known throughout the scientific world, receiving hon. degrees from both Oxford and Cambridge. He was also secretary of the International Research Council, and during the World War, both in that capacity and as a representative of the Royal Society, he did invaluable work as a scientific adviser in connexion with the organization of research in various departments. He was knighted in 1920, and was appointed a member of the royal commission on the universities of Oxford and Cambridge. His numerous publications include works on *Theory of Optics* (2nd ed. 1909), *The Progress of Physics* (1911) and *Britain's Heritage of Science* (1917).

His brother, SIR FELIX SCHUSTER, Bart. (1854–), was also educated at Owens College, Manchester, and studied further abroad, afterwards making his career in London banking. From 1895 he was identified, as governor, with the Union Bank of London, afterwards the Union of London & Smiths Bank, and in 1918 amalgamated with the National Provincial Bank as the National Provincial & Union Bank of England. He was a member of the Council of India from 1906 to 1916, and became chairman both of the Central Association of Bankers and of the Committee of London Clearing Banks. In these years he established for himself a leading position in financial and economic circles, and was made a member of several important Government committees and royal commissions, his annual addresses to the shareholders of his bank being recognized, with those of Sir Edward Holden (of the London, City & Midland Bank), as among the most important contributions of the day to sound thinking on current monetary problems. He was created a baronet in 1906.

SCHWAB, CHARLES MICHAEL (1862–), American capitalist, was born at Williamsburg, Pa., April 18 1862. He was educated in the public schools and at St. Francis College, Loretto, Pa., where he gained an elementary knowledge of engineering. From 1878 to 1880 he was a clerk in a store at Braddock, Pa., and then became a stake driver in the engineering corps of the Edgar Thomson Steel Works of Carnegie Bros. & Co. His ability brought him rapid promotion and in 1881 he was made chief engineer and assistant manager. Six years later he was appointed superintendent of the Homestead Steel Works. In 1889, on the recommendation of Henry Frick, he was made general superintendent of the Edgar Thomson Steel Works, and in 1892, after the formation of the Carnegie Steel Co., he was made also general superintendent of the Homestead Works. In 1897 he was elected president of the Carnegie Steel Co., and when this was merged in 1901 in the U.S. Steel Corp. he was made president of the latter. He resigned in 1903. He then turned his attention to shipbuilding and a few years later with other capitalists secured control of the Bethlehem Steel Corp., which owned the Bethlehem Steel Co., and several other corporations engaged in the iron, steel and shipbuilding business. He was made chairman of the board of directors. After the outbreak of the World War in 1914 and before the United States entered it, these companies filled orders for the Allies aggregating between 400 and 500 million dollars. The manufacture of submarines for England raised the question of neutrality, but this was solved by shipping parts to Canada, where they were assembled. It was generally understood that German interests made attempts to secure control of the Bethlehem works in order to shut off munitions from the Allies, and a report that Mr. Schwab was offered $100,000,000 for his interest was not only widely published but was given prominence in a reception given to him by the New York Chamber of Commerce, and neither then nor at any other time denied by Mr. Schwab. After America's entrance into the war special attention was given to the speeding up of shipbuilding, and in April 1918, at the urgent request of President Wilson, Mr. Schwab became director-general of the shipbuilding board of the Emergency Fleet Corp. His power of rousing enthusiasm among workers by personal contact began immediately to produce results. The resulting output for 1918 was 410 steel vessels (2,570,077 deadweight tonnage), 106 wooden ships (376,480 deadweight tonnage), and 10 composite ships (37,500 deadweight tonnage), a total of 526 vessels. After the signing of the Armistice in Nov. 1918, feeling that his services were no longer required, he resigned from the Emergency Fleet Corp. in Dec. and returned to his position as chairman of the board of directors of the Bethlehem Steel Corp. Later, charges were brought that he had wrongfully used Government money for expenses unrelated to public duties during his tenure of office, but official investigation completely exonerated him. His benefactions include a Catholic church at Loretto, as well as buildings and endowment for St. Francis College; a church at Braddock, Pa., a school at Weatherly, Pa., and a country home on Staten Island, N.Y., for children of the New York Foundling Hospital.

SCIENTIFIC MANAGEMENT.—This is one of the names adopted for a certain body of principles and methods of management which have been propounded as applicable to industrial undertakings, other names being Efficiency Engineering and Industrial Management. Developed in the United States, mainly since about 1905, and particularly in connexion with engineering work, the methods of Scientific Management have exercised a profound influence on methods of factory management in England and on the continent of Europe, as well as in America. Though applicable to most of the problems of industrial administration, they have in fact been worked out mainly in connexion with the control of workshop processes.

The theory underlying Scientific Management is briefly that there is "one best way" of doing every act that has to be performed in a workshop, and that it is the duty of the management to discover that "one best way" and to make such arrangements as will ensure that it is always carried out. The method of procedure may be indicated by propounding the following three questions:—

1. What are the factors which limit the speed of a particular workshop process or machine?
2. Why is it that the volume of output from a particular process is always less at the end of the week than the product of the speed of the process or of the machine, multiplied by the working hours in the week, would lead one to expect?
3. Why do some workers produce so much more than others working under the same conditions?

An attempt to discover full answers to these questions leads to very far-reaching inquiries, and radical changes in organization and administrative methods may become necessary if the results of such inquiries are to be put to effective use.

Thus, the investigations prompted by the first question may be expected to lead to modifications of the mechanism and construction of a machine to enable it to run faster; to modifications of tools or appliances used; to changes of the material used for machine parts, for tools or for accessory purposes. Changes in the design of the work to be done might also follow, which, while leaving the product just as suitable for its purpose as before, would enable the process to be carried out faster. A different method of handling the work, the machine or the tools might be developed, involving a new series of motions on the part of the workman which would result in a saving of time. Not only would specific improvements be made of the kind suggested above, but the effect of each of the many elements which influenced and limited the speed of a process would be reduced to a law, the knowledge of which would save a great deal of experimentation in applying the process to changed conditions.

Investigation of the second question might lead to equally valuable discoveries. For instance, it might be found that the process was stopped altogether for portions of the working week for such reasons as lack of continuous supply of material to be worked on; changes of the "set-up" of a machine due to change in the nature of the work to be done; breakdowns of the machine; adjusting or sharpening of tools; waiting for instructions and many other possible causes. The attempt to remedy these would lead to the development of methods of work-control and planning. These would aim at ensuring that material was always ready to hand to be worked on; that all work of a like nature was carried through at the one time, to avoid needless resetting of machines; that tools and appliances were ready to hand; that instructions as to the next job were prepared and ready in advance; that the nature of each new piece of work was clearly described and so on. Schemes of periodic inspection or adjustment of machines or tools might be indicated in order to reduce time lost through breakdowns.

The third question would lead to the discovery that different workmen had slightly different ways of doing the same thing, and that the ways of the faster workers could be explained to and adopted by the others; that some workers were temperamentally more suited to a particular kind of work than others; that some were not trying; that others were trying too hard and were worrying themselves by their failure; that in some cases the relations between the workmen and the foreman were happy and in other cases not.

The remedying of these troubles would lead to careful methods of choosing workmen for particular jobs, to ensure that men of suitable temperament as well as capacity and skill were employed; to schemes of instruction for showing the worker exactly what was required of him, and for teaching him the methods which had been found to be the best for carrying out the work in question. A scheme of payment by result might be developed, to give the workman the necessary incentive to ensure that he would profit by the instruction given him and would follow the methods laid down. The methods of control, the relationship of the various grades of personnel and the demarcation of the spheres of authority of the various officers of the workshop might also require rearranging, to allow of the foregoing changes and to ensure satisfactory relations between the workmen and those directing them. Built up on the result of such investigations as have been indicated, a variety of systems of management have grown up, one emphasizing one factor and another specializing in another direction, and all known by the general description of Scientific Management.

The origin of the movement is traceable to the work of F. W. Taylor, an American engineer, for many years a manager in the works of the Bethlehem Steel Co., Midvale, Pa. His investigations, leading later to the development of his methods and principles of management, sprang from the attempt on his part to lay down a standard fair day's work and to see that he got it from the men under his control. This led him into a deep analysis of the elements affecting the amount of work that could be done in a given time, and in turn by the kind of steps already indicated to the formulation of his system. One of the largest single pieces of investigation carried through by him was concerned with establishing the laws governing the rate of removal of metal by cutting-tools in a machine. This was carried on at intervals during 26 years. One result of it was the discovery in 1899 of modifications in the composition of tool steel from which the modern high-speed steel was developed. The whole results were published in 1906 in the *Transactions of the American Society of Mechanical Engineers* under the title "The Art of Cutting Metals." In this Taylor distinguished 12 different factors as influencing the possible speed, and he established formulæ expressing the effect which each had on the rate at which metal could be removed during a machining operation. He found that the maximum speed of working could only be attained by a correct adjustment of each variable in relation to all the others. To enable this calculation to be made quickly, one of Taylor's assistants, C. G. Barth, devised a type of compound slide rule, by which the best adjustment of the 12 variables referred to could quickly be found, so establishing the combination of conditions under which the work could be done in the shortest time. An account of these slide rules was published in the *Transactions of the American Society of Mechanical Engineers* (1904). A special slide rule was needed for every variation of every type of machine, and in order to reduce this complication it was necessary to group together all machines capable of doing similar work and to modify them so as to make their movements identical. One calculation and one slide rule would then serve for all the machines of a group. In other words, machines were, where possible, standardized.

To enable maximum cutting speeds to be attained Taylor established, as a result of the foregoing investigation, a set of standard cutting tools for the commonest kinds of machine operations, such as lathe work. These standard tools were specified as to contour of cutting edge, all angles of cutting edge, size of shank and hardening treatment, etc.

Another piece of standardization work resulting from Taylor's investigations was in connexion with the design and use of belt drives. Obviously, if a machine was to be called on to give its maximum performance the means of driving it must be suitable to ensure adequate power. This necessitated an investigation into the laws of power transmission by belting and the drawing up of rules for the standardization both of the material of the belts themselves and of the conditions under which they should be used. One of the most important of these conditions is the tightness of the belt before starting up the drive. Besides laying down suitable rules for this, apparatus was designed for measuring and checking it. Accounts of this work were published by Taylor in 1894 and elaborated by Barth in 1908, both in the *Transactions of the American Society of Mechanical Engineers.*

Concurrently with all this investigation another line of thought had been receiving attention, both from Taylor and others, again mostly in connexion with the engineering trade. This was the problem of obtaining from the workman a higher level of effort than he gave under ordinary methods of workshop management. Although "piece work"—payment by the piece as against payment by the hour or day—was in very general use in many industries, the practice of "cutting the rate" had reduced its efficiency as a stimulus to maximum effort. One of the earliest attempts was the development during the 'eighties by H. R. Towne of the Yale & Towne Mfg. Co., United States, of a scheme called by him "gain sharing," according to which improvements in the efficiency of a works department resulted in the payment to workers in it of a bonus on a prearranged scale. Other plans were the Rowan scheme, which consisted in the fixing of a variable rate per piece, the rate falling according to a fixed scale as the workmen's output rose. By this plan, although the workman benefitted by extra effort, the rate of increase of benefit constantly diminished. The aim was to avoid the temptation to "cut the rate" while still making an attempt to fix a standard of expected output from the workman. This plan was published in 1891.

In 1895 Taylor published his *Differential Piece Rate*, which may be considered to be the basis on which all the multitudinous systems of payment by result of the Scientific Management movement are founded. Taylor's system contained two revolutionary ideas. The first was the careful specification in great detail of the work to be done, with standard times allowed for each element of the work as against the "overall" time hitherto specified for the complete job. The second was the offering of an increased rate of return to the worker for increases in his efficiency—exactly the opposite to the Rowan plan. This was achieved by offering two alternative piece rates, the lower to apply if the work was done at less than the standard speed and the higher if it were done at the standard speed or faster. The feasibility of this scheme depended entirely on the accuracy with which the "standard time" could be determined. So important did this become that the idea of "time study," with its later development of "motion study," is probably the best-known feature of Scientific Management, and indeed is often taken to be synonymous with it.

Many modifications of Taylor's scheme of payment by result were developed by other workers in the movement. All retained as their basis the setting of a standard time by careful time study, the time being built up of the times for the elements of the work, and the nature of the work to be done and the methods to be followed being specified in great detail. All provided that the rate of incentive should increase at or about the efficiency needed to accomplish the task. The best known of these other schemes are the "Gantt bonus plan" by H. L. Gantt, published in 1901, and that of Harrington Emerson, published in 1909.

It will be realized that the characteristic features of Scientific Management so far touched on—the standardization of appliances and methods, the detailed specification of the work to be done, time and motion study, setting the workmen's task, regulating his payment by his performance of it—all lead to increased complication of management functions.

The material equipment of a works requires special attention to keep it in conformity with the standard. The quality of raw material must be more carefully regulated to enable it to be worked at the standard speeds and on the standard methods. The elimination of waiting between jobs requires elaborate planning of work; the making of time studies is the work of experts; the studies themselves require constant revision to suit changes in design, working methods or material; the incentive to output necessitates systematic inspection of work to ensure the standards of accuracy or finish being maintained. In these and numberless other directions work of a much higher order than hitherto is demanded from the management staff if the system is to function at all.

In order to enable the works management to cope with the new demands made upon it, Taylor devised a new method of administrative organization known as functional control, and applied it particularly to the sphere of the shop foreman.

Under the usual methods of organization a foreman has complete charge of the men under him. All instructions from the higher management pass through him and reach the workman as though they were the foreman's own orders. Taylor's idea was that the instructions which had to be given to the workmen under his system were so much more detailed and elaborate, and dealt with so many more aspects of his work than hitherto, that it became impossible to pass them through a single foreman. It was impossible, he claimed, to find a foreman sufficiently expert in all the sides of the control work or having a sufficiently rich endowment of qualities to carry out the multiplicity of functions now embodied in management. Thus, he would have to be sufficiently skilled at the particular process to teach the men under him how to carry it out; he should have the impartial judgment of an inspector; he must have the assertiveness and force of character needed to get a good day's work out of his men; knowledge of character, sympathy and sense of justice to deal with matters of discipline; he must be methodical and sufficiently versed in clerical and statistical methods to plan out his work and avoid loss of time between one job and another. He must understand costing, methods of handling material, time study and the setting and adjusting of piece or bonus rates, and so on. Because of the obvious impossibility of creating a staff of foremen who should be experts in all these lines, Taylor replaced the single foreman having complete charge of a group of men by a number of "functional foremen," each specializing on one aspect of management control. Each individual workman would now receive his orders from perhaps half a dozen experts. One told him which job to do next, or in what order to do a series of jobs. Another supplied him with the instructions as to the nature of the work to be done or the article to be worked on. Another told him at what speed to run his machine. Another saw to the upkeep of the machine; another set the piece rate; another judged the quality of the product, and so on. Behind each of these functional foremen was a special department looking after a particular aspect of management, of which he was the mouthpiece, as far as the workman was concerned.

This rigid and literal working-out of Taylor's idea of "management by experts" had usually to be modified in practice on account of the friction and confusion it almost inevitably led to, due to the difficulty of defining sufficiently clearly the sphere of each functional foreman, or to the clash of personalities.

Harrington Emerson embodied the necessary modification of Taylor's scheme in his plan of "Staff and Line" organization, published in 1909. In this the usual chain of executive authority, the "line," was maintained, by which a group of men was wholly answerable to a single foreman, a group of foremen to a departmental manager, several of these to a works manager, and so on. The experts, on the other hand, were collected into special "staff" departments, and their functions were to advise or instruct the "line" officials as to what instructions should be given, or how their work could best be done. This plan gives scope in the line organization for that personal leadership which was fatally destroyed by Taylor's functional foremanship, but still enables the methods of work and the technical policy to be laid down by experts in the various functions.

The last of the three questions propounded at the beginning of this article did not receive the same amount of attention as the other two at the hands of any of the leaders of the Scientific Management school of thought. Taylor in his paper on Shop Management (1903) does, it is true, make a feature of selection of the worker to suit the job, but his ideas in this direction were very different from those of the later school of applied psychology. Taylor's aim was the discovery, by records of individual performance, which men were as a matter of fact most successful in carrying out the task set them. The less successful were to be shown the correct methods of working, but if they still failed to reach the predetermined level of achievement, which was that of a good man, not an average worker, they were to be discharged to make room for others. A follower of Taylor, Dr. Katherine Blackford, made an attempt at selection of the workers beforehand, in distinction to Taylor's selection by trial and error on the job. In her book, *The Job, the Man and the Boss* (1914), she attempted to devise tests which should indicate the capacity of men for various kinds of work, *i.e.* their chance of making good if taken on and given trial. In view of the recent progress of applied psychology in this field, her work is not, however, worthy of serious consideration.

It may be useful to summarize the features embodied in Scientific Management systems as actually applied to an industrial undertaking.

Standardization of all machines doing similar work; of all factory equipment, *e.g.* driving and power transmission gear, factory furniture, etc.; of all tools and appliances; of materials to be worked on; of routines; of quality of work, etc. The maintenance of the standards usually necessitates several special departments, *e.g.* for inspection of quality, for upkeep of machines and tools, for dissemination of information, etc.

Time and Motion Study.—Time studies are made of the elements of all jobs, as distinct from overall times. Motion study is a development of time study, being an analysis by special methods (including photographic and even cinematographic) of the motions involved in an element of work. From this study motions or parts of motions which are useless are eliminated and the new method taught to the worker. The results of time and motion studies are embodied in written instructions for the use of the worker. These are in considerable detail, covering not only a full description of the work to be done but also of the exact methods of doing it, the tools to be used, the "setting" of the machine, etc., with times for each element both of the machine's work and the work of handling.

Payment by Result.—Some schemes of extra payment for the successful performance of the task as laid down in the instruction based on the time study.

Functional Management.—This may vary from complete functional foremanship to functional study of methods, technique and procedure, the results being conveyed to the workman via a departmental foreman.

Planning.—A special functional department is charged with laying down the order of preference of all work, the sequence of operations or moves through which each job has to pass, the arranging beforehand that all material, tools, appliances, etc., shall be on hand for each job when needed, the conveying of all instructions either to the foreman or to the workman according to the degree of functional management in operation. The planning department is also the central statistical bureau of the factory where all records of the state of advancement of all jobs, of costs, of machines available, often of stores, of men available, etc., are kept.

These features do not exhaust all the functions of management, but may be taken as those which distinguish Scientific Management schemes of organization from earlier types. Of course, certain of these features have been selected and applied in many instances where the full and complete scheme has not been adopted. A scheme which could claim to be ranked among the instances of Scientific Management would, however, include all the above features.

This account would not be complete without some mention of the attitude of labour to Scientific Management. Taylor himself, and later some of his followers, made extravagant claims to the effect that the new methods, by enabling standards of work to be laid down and the worker's achievement to be measured and his exertion rewarded on a prearranged scale, solved the labour problem. Not only has this happy result failed to materialize, but the attitude of labour, suspicious at the outset, has tended to harden into declared antagonism. The extension of the system in America was opposed more and more vigorously as time went on, leading to a serious strike against it in the Watertown Arsenal in 1911.

As a result of growing antagonism the United States Commission on Industrial Relations in 1914 directed that an investigation into the working of Scientific Management should be made, and appointed for this purpose Prof. R. F. Hoxie, of the university of Chicago, with the assistance of a Scientific Management expert and a labour leader. This Commission visited many of the chief establishments in the United States at which Scientific Management was in operation, and its findings are given in Prof. Hoxie's book *Scientific Management and Labor*. Everywhere the investigators found labour antagonistic; the objections which, with minor ones, appear to be fundamental were as follows:—

The system leads to "driving" the worker and to sweating, due to its attempt to speed up all to the speed of the fastest.

The minute splitting up of jobs leads to very much increased specialization of the worker, to the narrowing of his range of skill, and consequently to the destruction of craftsmanship. The work became more monotonous and less satisfying to the worker.

It was claimed that the individual task and reward, and the constant selecting of the fastest workers, destroyed the solidarity of the workers in a factory. The knowledge of a "trade" was no longer necessary to the workmen; all the specialized knowledge having been acquired by the management, the workman had less to sell than previously.

For these and other reasons it was claimed by the workers that the system was anti-social; that it was undemocratic; that it treated the worker as a tool, denied him scope for his personality, and condemned him to endless routine meticulously laid down and arbitrarily enforced.

There can be no doubt that much of the resentment of labour has been aroused by the personality and mental attitude of the Scientific Management experts and the staffs they created in the works which they reorganized, rather than by the fundamental ideas of their system. Their conception of industry was entirely mechanical. Their organizations were ingenious structures of men, machines and routines. Each of these had its place in their buildings, but like steel, brick and cement, though differing in their qualities, all alike were simply building materials, inanimate and obedient to the hand of the builder.

This cast of mind inevitably bred bitter antagonism in labour, and by the year 1921 there was already distinct evidence of a change on the part of the most advanced organizers, both in America and in England. It was significant of this change that Taylor's scheme of functional foremanship had come to be regarded as mistaken even by many of his closest followers, who were inclining to believe that in forfeiting the vital factor of personal leadership the loss was greater than could be compensated for by any amount of intensification of expert knowledge. There was a growing tendency too to concentrate study and standardization on the inanimate side of industry, on machines, tools and equipment, on materials and their treatment, on handling methods and appliances, on labour-saving devices, rather than on speeding up and regulating the motions of the worker. The same distinction was seen in the attitude of British labour leaders to Scientific Management. Among the more intellectual leaders the accumulation of more and more of the technical knowledge of an industry in the hands of the management and the more detailed regulation and instruction of the manual worker which results were recognized as inevitable. They were seen to be merely a continuation of the process of replacing hand labour and hand skill by machinery. Such men accepted the need for the application of science to industry as far as the inanimate factors were concerned, and concentrated their antagonism against the treatment of the worker as mere impersonal mechanism.

By the end of the World War some 100–200 American undertakings, largely engineering concerns, had adopted Scientific Management in one or another of its forms, as a complete system. In Great Britain the number of such firms was perhaps one-tenth of those in America, and the positions in France and Germany were perhaps less advanced still. The influence of the movement, however, cannot be estimated by any such figures. For every concern that had adopted the system in its entirety there were 10 or 20 that had adopted portions of it, or had modified their previous methods of management under the influence of ideas first given prominence by the Scientific Management school. The conception of "the one best way," the belief that every act, every relation and every implement of industry is worthy of close and systematic study, has provided an inspiration and a stimulus to management methods in all industries and in every country, the effect of which can hardly be less than that of the introduction into industry of machinery a hundred years ago. (C. G. R.)

SCOTLAND (*see* 24.412*).—The history of Scotland from 1910 to 1921 resolves itself largely into the effect of the World War (1914–9) and of the conclusion of peace upon industry and commerce. In the history of actual military operations, Scotland played, naturally, a small part, although for the first time in the history of Great Britain as a sea-power, the main activities of the fleet took place in Scottish waters. Zeppelins attacked Edinburgh and the E. coast on April 2 1916. On May 2, in the course of a raid which was upon an unusually large scale, but had very slight results, a Zeppelin (L20) missed Edinburgh and sailed as far N. as Aberdeenshire, where it dropped bombs which fell harmlessly on fields. Another fruitless expedition to the S.E. of Scotland took place on Aug. 9 1916; the raiders got into thick weather and their bombs were dropped in rural areas. On May 15 1918, St. Kilda was bombarded by a German submarine and damage was done to the church and some other buildings. The surrender of the German fleet is the only other operation definitely associated with Scotland. German naval emissaries arrived in the Firth of Forth on Nov. 15 1918, and the surrender began on Nov. 21. It was in Scapa Flow that the crews of 70 German warships scuttled their ships on June 21 1919.

The part played by Scotland in supplying man-power and in providing munitions of war was worthy of the national tradition. The Scottish recruiting record in the period preceding the introduction of compulsory service will compare with that of any other portion of the United Kingdom, and Scottish industries, like those of England and Wales, were directed to the production of war material. The Clyde, naturally, took a large part in naval construction and repairs, and all over Scotland, munition factories came into existence. In the naval warfare, the E. coast of Scotland was of great strategic importance.

Apart from the war and its effects, the ten years witnessed few important internal events or movements. Trade and commerce were frequently interrupted by strikes, but the only serious riots took place in Glasgow on Jan. 31 1919, when considerable damage was done to buildings. Political interests, before the war, pursued their traditional course, and in the general election of Dec. 1910, Scotland returned 58 Liberal, 11 Unionist, and 3 Labour or Socialist members. By the date of the Armistice, party politics had undergone a complete transformation, and, at the general election of Dec. 1918, Scotland, which by the Reform Act of 1918 received two additional members, returned 58 supporters of the Coalition, 7 Independent Liberals, 7 Labour representatives and 2 Independents. A feature of the period has been the large number of state visits paid by King George and Queen Mary. An Accession Court was held at Holyrood in June 1910, and, a year later, the King dedicated the new chapel of the Thistle in St. Giles's cathedral, Edinburgh. Royal visits to Edinburgh, Glasgow, Dundee, Perth and Stirling took place in July 1914. During the war, the King paid some private visits to centres of munition industries, and the programme of state visits was resumed in July 1920, when the King and Queen held a Court at Holyrood, and in their yachts visited the Clyde during the regatta known as the "Clyde Fortnight."

In church affairs, the most important events have been the issue in 1910 of the final Report of the Royal Commission appointed under the Churches (Scotland) Act of 1905, allocating the property of the old Free Church between the United Free Church and the Free Church, and the series of negotiations for union between the Church of Scotland and the United Free Church, which became a matter of practical politics after the discussions in the Assemblies of 1912 and had advanced so far by 1919 that, on Dec. 17, the commission of the Assembly of the Church of Scotland agreed to approach the Government with a view to carrying a bill through Parliament.

The recent growth of a keener appreciation of the value of historical records and monuments is illustrated by the enactment in 1913 of the Ancient Monuments Consolidation and Amendment Act, by the work done by the Royal Commission on Ancient Monuments, originally appointed in 1908, and by the gift of four great historical buildings to the nation. In 1918, Lord Glenconner presented Dryburgh Abbey to the nation, and in the same year the Duke of Buccleuch followed his example by the gift of Melrose Abbey. In 1919, the Duke of Roxburghe made an arrangement with the Commissioners of Public Works and Buildings by which Kelso Abbey became a national monument and is maintained by the State, and in 1920 Col. Hall Dempster placed Restenneth Priory (Forfarshire) in the charge of the Commissioners of Works for national guardianship and for the benefit of the nation. On the other hand, by an outrage attributed to suffragettes, Scotland lost on Feb. 26 1914 the church of Whitekirk (Haddingtonshire), one of the few beautiful pre-Reformation churches surviving.

Two important centenary celebrations took place in the period—the quin-centenary of the foundation of the university of St. Andrews, held in 1911, when Lord Rosebery was installed as Lord Rector and made a famous oration, and the sex-centenary of the victory of Bannockburn (June 24 1314), which was celebrated by a procession and a banquet at Stirling on June 27 1914, when Sir George Douglas delivered the address. The town council of Aberdeen commemorated the quin-centenary of the battle of Harlaw, fought in 1411, and the town council of Arbroath, in Sept. 1920, held a patriotic and religious service to celebrate the sex-centenary of a famous assertion of the independence of Scotland in a letter addressed to the Pope by a Parliament which met in the abbey at Arbroath in 1320.

More practical evidence of renewed interest in Scottish history was given by the success of the Scottish Historical Exhibition at Glasgow, opened by the Duke of Connaught in May 1911, the proceeds of which formed the main endowment of a Chair of Scottish History and Literature founded in the university of Glasgow in 1913.

The demand for some form of Scottish Home Rule has been insistently pressed by its advocates since 1910 but there has been no evidence of any wide-spread feeling on the topic, apart

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from the more general question of the adoption of a system of Devolution for the United Kingdom, a suggestion which received much parliamentary support in the years 1918–20.

Apart from the extensions of Edinburgh and Glasgow, the most important municipal event is the amalgamation, in 1920, of Motherwell (about 42,860 inhabitants) with Wishaw (about 27,484 inhabitants) to form a single municipality known as Motherwell and Wishaw.

Legislation.—In addition to the emergency war legislation which affected Scotland equally with England the decade 1911–20 was marked by a series of important legislative enactments, intimately affecting the political and social life of the country. A vast change was made in the parliamentary electorate by the Representation of the People Act of 1918, which increased the number of voters (counties, burghs and universities) from 800,448 at the general election of Dec. 1910, to 2,211,178 at the general election held in Dec. 1918. The Fourth Reform Act (1918) not only made a wide extension of the franchise; it also, by its redistribution of the constituencies, severed the last link with the old tradition of Scottish parliamentary representation as it existed before the union. The shire ceased to be the unit of county representation, and the old Scottish system of separate burghal representation was abandoned. The burgesses had sat in the Scottish Parliament, as a separate estate, from a much earlier period than the commissioners of shires, and the royal burghs, which they represented, had special trading privileges which distinguished their interests from those of the counties in which they were situated. The principle, adopted in 1707, of grouping together small burghs, sometimes geographically distant, as separate constituencies, was retained in 1832, 1868 and 1885; *e.g.* the inland burgh of Elgin voted with the distant seaport of Peterhead, instead of forming part of the constituency of Morayshire. In 1918 the burgh of Perth, which had enjoyed separate representation, and eight groups or districts of burghs were merged in county constituencies; six districts of burghs still exist, but the constituent members of each group are in close geographical proximity. The last vestiges of the privileges of royal burghs, in which the distinctively Scottish system of distribution originated, had been removed as long ago as 1846.

The other important Acts of the period may be described as social legislation, dealing with housing and provision for medical attendance, land questions, temperance and education. An Act of 1909 had extended to Scotland the Housing of Working Classes Acts, 1900–3, with certain modifications, and had given powers to local authorities, with the consent of the Scottish Local Government Board, for the compulsory acquirement of land; for the borrowing of money from the Public Works Loan Commissioners to provide working-class dwelling-houses; and for the execution of town-planning schemes. The shortage of houses which became a serious social danger after the war, not only led to various emergency Acts limiting rents and mortgage interest and severely restricting the powers of landlords to terminate existing tenancies, but was also one of the causes of the creation of a Scottish Board of Health by an Act of 1919. The powers and duties of the Local Government Board for Scotland, and the Scottish Insurance Commissioners and also some powers of the Privy Council conferred by a large variety of recent Acts, were transferred to the Board of Health, which was entrusted with the execution of all measures conducive to the health of the people. A Housing (Scotland) Act of the same year (9 & 10 Geo. V., C. 60) gave to the new Board of Health the supervision of the schemes of local authorities for the provision of working-class dwellings, and empowered it, in the event of the failure of local authorities to prepare schemes, to make a public inquiry in any such locality and to arrange for the preparation of a scheme. The Act made provision for financial assistance (under the supervision of the Board of Health) to local authorities, public utility societies, and housing trusts, for the building of houses, largely increased the powers of local authorities as regards compulsory purchase, and made it compulsory for them to prepare town-planning schemes. Other measures affecting public health which were passed during the decade were the Highlands and Islands (Medical Service) Grant Act of 1913, which created an annual grant of £42,000 for the improvement of medical services and nursing in the Highlands and Islands; and the Midwives (Scotland) Act of 1915, which provided for the training and certification of midwives. The powers granted to the Privy Council under these two Acts are among those transferred to the Board of Health. The first Annual Report of the Board of Health (for the year 1919) showed that 212 housing schemes had been submitted by local authorities, providing for the erection of 112,573 houses, the total pop. represented by the authorities being 4,169,501. The report brought out the interesting point that, even in localities which are near stone quarries, the cost of building in stone exceeded, by a considerable sum, the cost of building in brick.

A very important measure dealing with land was passed in 1911. By the Small Landholders (Scotland) Act, the Scottish Land Court and the Board of Agriculture for Scotland were constituted, and the provisions of the earlier Crofters Acts were extended to other small landholders, and were amended in various respects. A dignified status was given to the Land Court by a provision that its chairman should enjoy the same rank and tenure of office as a judge of the Court of Session. The powers of the Board of Agriculture and Fisheries, under previous statutes, were distributed between the Board of Agriculture and the Board of Fisheries, and an Agricultural (Scotland) Fund was created for the establishment, enlargement and improvement of small holdings. Disputes between landlords and the Board of Agriculture are settled in the Land Court, which also determines the amount payable to landowners as compensation for permanent improvements, fixes rents in certain cases and prescribes regulations for pasture, grazing and common rights. The decisions of the Land Court are not subject to review by other courts, though the Court of Session may be consulted by the Land Court on questions of law. The first Report of the Land Court, for the nine months ending Dec. 31 1912, showed that 2,434 applications for small holdings had been received, and that 256 had been decided, the total rents, in these cases, being reduced from £2,226 16s. to £1,568 2s. and arrears of rent amounting to £1,721 14s. being reduced to £771 19s. In 1919, "fair rents" were fixed for 170 holdings, the average reduction of rent being 10%, and 275 holdings were re-valued, at the expiry of seven years from the fixing of a "fair rent"; the original rents of these holdings amounted to £2,823, the first "fair rents" to £1,927, and the rents fixed in 1919 to £2,058, representing an increase of over 6½% on the previous decisions—an indication of the improvement in the value of land. Further provision for the acquisition of land for the purposes of small holdings was made by the Land Settlement (Scotland) Act of 1919 (9 & 10 Geo. V., C. 97), which also amended the Small Landowners Act of 1911. Fresh powers were given to the Board of Agriculture by the removal of restrictions as to total area to be acquired and as to methods of purchasing or taking land on lease or feu, and by widening the range of its activities. A large series of statutes for crofts and small holdings is now in operation, and the Land Court in its 1919 Report drew attention to the urgent necessity for their codification in order to remove ambiguities, inconsistencies, and difficulties of interpretation. Less important measures dealing with land were the Feudal Casualties Act of 1914, for providing for the redemption of duplicands and grassums (entry fees) and other sums payable by feuholders to their superiors at intervals of more than a year; the Entail (Scotland) Act of 1914 restricting the possibilities of future entails of land or property; and the Duplicands of Feuduties (Scotland) Act of 1920, passed to reverse the effect of a decision of the House of Lords in 1919 that a "duplicand" payment of a feuduty means, unless otherwise defined in a deed, the payment of double the regular feuduty in addition to the ordinary annual payment. The Act defines a duplicand, in accordance with what has been the traditional usage, as "one year's feuduty only over and above the feuduty for the year." The prevalence of the system of feus in Scotland rendered the legal decision a matter of considerable importance.

Liquor Licensing.—The Temperance Act (Scotland) 1913 provided that, on the Act's coming into force in June 1920, local authorities should, on the receipt of signed requisitions from electors in their areas, take a poll on three alternative resolutions dealing with the number of licenses in an area. The resolutions were (1) that there should be no change in the system of licensing, (2) that the licensing court should grant not more than 75% of the licenses previously in force and (3) that no license should be granted within the area, except, in special circumstances, to *bona fide* hotel and restaurant keepers, who might be allowed to sell drink in retail to residents in hotels or to persons taking meals at restaurants. The areas were defined as burghs of a pop. not exceeding 25,000; separate wards in larger burghs; and parishes in the counties. The voters were defined as electors to town councils in burghs and electors to parish councils in the counties. Each voter could vote for only one resolution, but, where a no-license resolution was not carried, the votes given for no-license were to be added to the votes given for limitation of licenses. A no-license resolution was to require 55% of the recorded votes in a poll of not less than 35% of the electors, in order to be carried; a limitation resolution required a bare majority vote in a poll of the same size. Polls were held in Nov. and Dec. 1920, in 580 out of 1,221 polling areas; of the remainder, about 300 were areas in which no license existed, and in the rest no requisitions were submitted for a poll. The polls took place in all the towns and in the more thickly populated rural districts. Five hundred and nine areas voted for no change, 35 for limitation of licenses, and 40 for no license. The total numbers of votes were:—708,727 (60%) for no change; 19,400 (1·6%) for limitation; and 453,728 (38·4%) for no license. In Glasgow, four wards (Camphill, Cathcart, Pollokshields and Whiteinch) voted for no license, and nine wards for limitation; in Edinburgh, Dundee and Aberdeen no change was carried in every ward. There were in Nov. 1920, 9,371 licensed premises in Scotland, of which 1,471 were hotels or inns, 4,847 were public-houses and 3,053 were grocers' shops. The reduction made in May 1921, in accordance with the result of the polls, involved the extinction of about 450 licenses, a majority being in urban areas, where middle-class residential districts voted for the abolition or reduction of licenses. Glasgow contributed 99 to the total number of withdrawals of licenses, but these were chiefly in the residential districts already named or in other residential districts like Govanhill, Kelvinside, Park and Pollokshaws, in which there was an unusually large proportion of grocers' licenses. Among the smaller towns which "went dry" were Buckie, Cullen, Kirkintilloch, Sanquhar, Lerwick, Stornoway, Stromness and Wick. The contest was fought by the Temperance party on a prohibition programme, and its influence was thrown against the limitation resolution; the result was, therefore, rather a repudiation of prohibition than an indication of satisfaction with existing licensing conditions. The Act of 1913 provided for further polls, on a requisition by electors, in Nov. and Dec. 1923, but the experience of the poll of 1920 made it clear that modifications were required in the Act, especially in the definition of an "area" as a single ward in the larger burghs, which must be treated as a whole in order to secure that any reduction of licenses shall be more equally distributed than was possible in 1920.

Education.—A large amount of attention has been devoted to education, with a corresponding increase in public expenditure, both national and local. The English Education Act of 1918, which marks an era in State provision for education, was accompanied by the Education (Scotland) Act of the same year. The Act swept away the system of school-boards, created in 1872, in favour of the principle of a larger area for educational administration than a parish. The new administrative body created by the Act is known by the awkward name of an Educational Authority. Five large burghs, Edinburgh, Glasgow, Aberdeen, Dundee and Leith, were made separate educational areas; the number has since been reduced to four by the amalgamation of Leith with Edinburgh. Elsewhere, the area is the county, including the burghs within its bounds, and the Secretary for Scotland was empowered to make, by order, electoral divisions within the areas, to define the number of members of each educational authority, and to apportion the representatives among the divisions of the area. Electors to educational authorities are the persons registered as local government electors under the Representation of the People Act (1918). Voting is conducted on the principle of proportional representation; each elector has one transferable vote. School management committees, acting under an education authority and including representatives of parents and of teachers, exercise general powers of supervision and management, but have no control over finance, or over the appointment or dismissal of teachers. Education authorities are empowered to expend public money not only on the maintenance of schools but also on the provision of food and of books for the children (including books for general reading), and they may make grants to pay travelling expenses of young persons resident at a distance from the nearest intermediary or secondary school, and may give assistance to a qualified person attending a university or training college. They are bound to provide free primary, intermediary and secondary education in all districts, but may maintain a limited number of fee-paying schools and may also make contributions to certain schools not under their jurisdiction. Religious instruction may be given in the schools, but no child whose parents object to such instruction is thereby to lose any other advantage of the school. Voluntary or denominational schools may be (and nearly all have been) transferred to educational authorities and managed as public schools, their teachers being appointed by the local authority and approved as to character and religious belief by representatives of the church or body by whom the school was conducted. In such transferred schools, the time devoted to religious instruction is not less than it was under the former management. Voluntary schools, not thus transferred, are not eligible for grants from the Education Fund; new voluntary schools may be established by educational authorities under conditions similar to those affecting transferred schools. An educational authority administers the Education Fund of the area, arising from Government grants or loans, supplemented by its own education rate, which is fixed by the authority and levied by the parish councils of the area. The Act also extended the school age to 15 years and severely limited the employment of children of school age, prohibiting the employment of children under 15 in factories, workshops, mines or quarries, and forbidding street trading by persons under seventeen. A system of continuation schools was also provided for. An attendance of 320 hours annually in a continuation school may be required from all young persons up to the age of 18, unless their education is otherwise provided for, and instruction in such schools is to include English and general education, instruction for special forms of employment, and physical culture; when the scheme comes into operation, employers will be bound to afford facilities for an attendance of 320 hours, exclusive of hours between 7 P.M. and 8 A.M., unless hours within these limits are sanctioned by the Scottish Education Department, the approval of which is also required for the exercise of a large number of the powers conferred by the Act.

The operation of the Act of 1918, contemporaneously with a large increase in the salaries of teachers, has resulted in a vast increase of expenditure. The estimate for ordinary public education in Scotland for the year ending March 31 1911, was £2,253,725, and for the year ending March 31 1921, £6,877,220, and to this increase have to be added the large sums raised by local rates, which have risen proportionally. The system of assessment, based on house rent, and divided, in almost equal proportions, between proprietor and tenant, is generally regarded as being no longer suitable to the circumstances, the value of the house occupied by a ratepayer not affording a satisfactory test of his ability to pay, and a demand has been made for the substitution of a local income tax; some reform of the system of local rates has been promised by the Secretary for Scotland. In addition to State grants for elementary and secondary education, financial assistance to the Scottish universities has been increased from an estimate of £93,000 in the year ending March 31 1911 to an estimate of £195,000 for the year ending March 31 1921, besides a share of a non-recurring grant to universities and other institutions adversely affected by the war. Private benefactions, including grants from the Carnegie Trustees, have provided funds for the institution of new chairs and lectureships in all the universities, including chairs of Scottish History and Literature, French, German, Bacteriology, Organic Chemistry, Physiological Chemistry, Mercantile Law and Engineering at Glasgow; chairs of Agriculture and Political Economy at Aberdeen; and chairs of French, German, Accounting and Business Method, Chemistry in relation to Medicine, Zoölogy, Forestry, Clinical Medicine, Bacteriology, Tuberculosis, Therapeutics and Psychiatry at Edinburgh.

Evidence as to social conditions is available in reports of Government departments. The Mental Deficiency and Lunacy (Scotland) Act of 1913 reconstituted the existing Commissioners of Lunacy as a General Board of Control and amended the Lunacy Laws. The Board's first Annual Report (for 1914) showed that there were 19,557 insane persons in Scotland, of whom 16,870 were paupers. In 1919 the total was 17,580, of whom 14,562 were paupers. The latest Report of the Board draws attention to the decrease, pointing out that the average total for the five years from 1911 to 1915 was 18,537, and for the five years 1916–20, 18,132, and remarks that "it may be assumed that but for the influence of the war the numbers in the last quinquennium would have been at least 19,883 instead of 18,132." The Prison Commissioners, in their Report for 1919, state that the influence of war conditions was ceasing to operate at the end of that year. The total number of persons committed to prison in 1918 was 9,773 as compared with 14,505 in 1917 and 43,535 in 1914. The figures for 1918 are the lowest on record; there was a continued decrease in the first four months of 1919, but the total number of commitments for that year was 11,725: similarly, the judicial statistics for 1919 show an increase of 26·9% in the number of persons dealt with in criminal courts, as compared with the previous year; the numbers being 80,152 in 1918 and 101,687 in 1919. The total for 1911 was 155,537. The most satisfactory feature of the year 1919 was a decrease (from 10,772 to 9,176) in the number of persons dealt with in juvenile courts, as compared with 1918; the numbers of such persons had risen during the war from 10,761 in 1911 to 11,851 in 1915 and 12,180 in 1917, a result attributed to the absence of paternal control during the war years.

Shipbuilding.—The figures of production in Scottish shipbuilding for 1911 represented a considerable increase over 1909 and 1910, the number of vessels being 557 in 1911 against 450 in 1910, and the tonnage 671,624 against 420,250. These numbers exceeded the previous record of production—757 vessels with a tonnage of 675,173 in 1907—because the I.H.P. (indicated horse power) figures were 742,299 in 1907 and 837,668 in 1911. The output for 1911 consisted chiefly of vessels of moderate size, and the types of vessels were very varied. The main increase was, naturally, in the Clyde area; the E. coast shipbuilding areas (the Forth, the Tay, the Dee and the Moray Firth) produced 144 vessels with a tonnage of 41,041 and I.H.P. 47,739—an increase of 13,183 tons and 17,311 I.H.P. upon 1910. In 1912, a fresh record was created, the total Scottish tonnage being 688,188, with I.H.P. 914,741, and in 1913 the figures rose to a tonnage of 809,711 and I.H.P. 1,148,225. The Clyde output for 1913 was more than double that of any other British shipbuilding area, except the Tyne, and it exceeded the output of the Tyne by 317,000 tons; the advance since 1910 was the most remarkable in the whole history of Clyde shipbuilding, for the tonnage of 1910 had been nearly doubled in 1913; but the increasing cost of production caused some anxiety about the future. Among the larger vessels built before the outbreak of war were H.M.S. "Conqueror," the largest battleship yet built on the Clyde, which was launched in 1911, and the liner "Aquitania," the largest vessel then built for the merchant service (tonnage 45,600, speed 23 knots), which was launched in 1913. In the seven months of 1914 which preceded the outbreak of war, the output showed a continuous decrease, and a period of depression was believed to be at hand, and from Aug. three of the largest yards had to devote practically their whole attention to naval construction. The total tonnage as published for 1914 was 460,258 with I.H.P. 496,126, but these figures are exclusive of the construction of warships and must be compared with the 1913 figures for mercantile construction, *viz.*: 692,601 tons with I.H.P. 649,240—a decrease of 232,343 tons and 153,120 I.H.P. The naval figures, now available, show that the outbreak of war had not merely checked the depression but had produced a fresh "boom" in Scottish shipbuilding. In 1915 mercantile construction amounted to a tonnage of 233,501, with I.H.P. 205,288—figures not far below the U.S.A. construction for the year—although the yards were almost entirely controlled by Government, and merchant work was neglected. No separate Scottish figures for 1916 were published until after the close of the war, and, in 1917, the mercantile tonnage for the United Kingdom was a state secret. Mercantile construction had been, to a large extent, in abeyance until the end of 1916, but great activity was shown in this department in 1917 and 1918. The totals (including naval construction) for the five war years were:—

	Vessels	Tonnage	I.H.P.
1914	481	591,396	1,192,347
1915	386	331,410	1,231,043
1916	477	541,527	1,898,044
1917	517	502,875	1,628,950
1918	585	613,709	1,958,944

In no one of the war years did the tonnage approach that of 1913, but this is explained by the circumstance that the proportion of tonnage to I.H.P. is much smaller in naval than in mercantile construction, and the 1913 I.H.P. figures were exceeded in every year of the war. In the war years, the volume of naval repairs was also very great.

In 1919 the tonnage figures of Scottish yards rose to 729,490 with I.H.P. 1,590,894, and in 1920 to 778,914, with I.H.P. 673,040; the figures relate entirely to mercantile shipping, as naval construction was stopped. The increase of tonnage over 1918 was in the building of many cargo steamers, the average size of which was greater than before the war, and the decrease in new machinery indicated in the I.H.P. figures is explained by the circumstances that such steamers are of comparatively low power. Judged by the test of tonnage, the output for 1920 was not far below that of 1913, although the machinery installed was not much more than half; compared with the purely mercantile output of 1913, both the tonnage and the I.H.P. figures were larger in 1920, and the year ranked as second only to 1913, but the prospects for the future were very poor.

Shipping.—The year 1911 was marked by a rise in freights which continued throughout 1912 and the first half of 1913, but in the end of that year there was something like a collapse, and the "slump" continued until the outbreak of war, when a temporary suspension of chartering was followed by a very sharp rise in freights which continued, progressively until Government control began, in 1917. A further rise took place at the beginning of 1918 in order to cover Government liability for losses in tonnage through sinkings. The reorganization of Scottish shipping, after the interruption of the war, did not make much progress until the latter half of 1919, owing to the necessities of demobilization; and the process of reorganization was hampered in 1920 by labour troubles and especially by the uncertainty of the export coal trade. Freights continued to be high in the early part of the year, but even high rates proved to be unprofitable in view of the cost of coal and of labour and rises in harbour tolls, stevedoring, and insurance premiums; and in the end of the year there was a "slump" in freights. The effect of the war may be traced in the decrease in the total number of vessels registered in Scottish ports. In 1914 there were 494 sailing vessels, with net tonnage 153,323 and 3,441 steam vessels with net tonnage 2,675,720—a total of 3,935 vessels with net tonnage 2,829,043. In 1918 there were 354 sailing vessels with net tonnage 82,181 and 2,759 steam vessels with net tonnage 1,797,907—a total of 3,113 vessels with net tonnage 1,880,088, the decrease in tonnage being constant and progressive until 1918, in which year there was a check to the rate of the downward movement. The decrease in net tonnage registered in Scottish ports was 172,134 in 1915, 232,994 in 1916, 389,183 in 1917 and 154,644 in 1918, the figures in each case representing the decrease on those of the previous year. Statistics showing the recovery in 1919 and 1920 were not available in Feb. 1921. The following table shows the effects of the war and of the first year of peace upon the imports and exports of merchandise at Scottish ports:—

	1911	1915	1917	1918	1919
Imports in £	46,937,758	58,442,334	76,970,468	109,343,866	112,631,887
British and Irish Exports	46,683,953	38,242,899	44,048,744	32,333,700	69,661,877
Foreign and Colonial Exports	677,301	1,442,711	1,025,380	526,349	6,146,906
Total in £	94,299,012	98,127,944	122,044,592	142,203,915	188,440,670

Coal.—The table at the foot of the page shows the output of Scottish coal in the decade.

The export trade before the war amounted in round numbers to 16,000,000 tons per annum, of which 6,500,000 represented bunker coal and coal shipped to home ports. The outbreak of war at once closed markets in Germany, Austria, Russia, and Turkey, and interrupted trade with other countries. The effect was specially felt in the E. of Scotland, which is largely dependent on overseas trade. Exports further decreased from 1915 to 1917. In 1918 they amounted to 7,460,000 tons, or about 45% of the pre-war average, but, in the end of that year, shipments to foreign countries were almost entirely suspended, owing to the demand for bunker coal and for coal for Admiralty and home use. Exports were specially low in the Forth area because the ports of Bo'ness, Grangemouth, Granton, and Burntisland were largely or entirely requisitioned by the Admiralty. In 1920 the coal controller, to safeguard an expanding home demand, placed very severe restrictions upon exports; and Scottish exports, in the first ten months of that year, amounted to 1,156,475 tons as compared with 2,129,059 tons in the first ten months of 1919; these figures are exclusive of bunker coal. Total output was reduced by strikes in 1912 and in 1920, and, during the war, by shortage of labour. Prices were low at the beginning of 1911 and fell in the first half of the year, but, by the beginning of 1912, they showed an advance of from 1s. to 2s. per ton in all classes of fuel. Prices remained high in 1912 and rose in 1913; they varied at different periods in 1914, and the advance of recent years began in 1915, although there were remarkable fluctuations in 1916. Maximum retail prices were fixed for home consumption in 1917. After the Armistice, prices advanced rapidly in the second half of 1919, and the supply was unequal to the demand. Export prices reached an unprecedented level in 1920, but the beginning of 1921 witnessed a "slump" in exports. Before the war, the Scottish coal trade had to face German competition. At one time, Germany was an important market for Scottish coal, but exports to Germany had fallen to under 3,000,000 tons, and German coal was competing with Scottish coal in foreign markets. New markets were, however, being opened up, and from 1911–4 Fife coal was developing large exports to S. America. A new dock at Methil, built principally for this trade by the North British Railway Co. (at a cost of nearly £1,000,000), was opened in 1913.

Iron and Steel.—In spite of a temporary decline in the price of hematite pig-iron and steel scrap in 1911, the decade opened well for the steel and iron trades. There was an increase in steel exports in 1911 and it was maintained, in spite of the coal strike, in 1912, and in the first half of 1913; but German competition was severely felt both in home and in Japanese, Canadian and Indian markets. In 1914 both the pig-iron trade and the steel trade were inactive, but a rapid improvement followed the outbreak of war, and steel and malleable iron continued to be in great demand throughout the war. The pig-iron market, on the other hand, suffered in 1915 from an unprecedented advance in the price of ore and from freight difficulties. Early in 1916 all the works in which pig-iron was produced were placed under the Ministry of Munitions, and there was a steady demand in spite of reduced exports. The pressure of work in the steel and iron trades continued after the decontrol of steel in Jan. 1919 and of iron in the following April, and prices were high. In the end of the year steel ship-plates were £19 15s., boiler ship-plates £24 10s., and angles £19 5s., net per ton delivered on the Clyde, as compared with £7 2s. 6d., £7 17s. 6d., and £6 15s., respectively, the highest prices in 1911. Hematite iron rose to 210s. per ton as compared with 72s., the highest price in 1911. Prices reached still higher levels in 1920, demand far exceeding supply in the earlier part of the year, but prices proved to be too high for remunerative trade, and reductions were made in November. Imports of pig-iron from France and Belgium were begun, but in quantities so small that competition with Scottish production had not yet become serious.

Mineral Oil.—The Scottish mineral oil trade, the centre of which is W. Lothian, was suffering severely from foreign competition in the years immediately preceding the war. Low prices and decreased dividends marked the year 1911; there was a revival in 1912, due partly to the general "boom" in trade and partly to the opening up of wider markets, and 1913 was also prosperous in spite of the growing competition of the Mexican oilfields. Production remained about the average of over 3,000,000 tons of shale in 1914, but prices fluctuated, and exports decreased from 324,704 tons of oil in 1913 to

	No. of mines at work under Coal Mines Act	No. of persons employed	No. of tons of coal produced
1911	518	138,377	41,718,163
1912	520	143,302	39,518,629
1913	542	147,549	42,456,516
1914	547	146,168	38,847,362
1915	535	121,854	35,596,856
1916	537	127,104	36,193,000
1917	522	130,027	38,569,964
1918	522	124,475	31,890,218
1919	512	144,286	32,457,864

The estimated output for 1920 was 31,000,000 tons

311,000 tons. Prices were maintained at a high level throughout the war, and the demand was steady, but, at the beginning of 1919, the largely increased cost of production rendered it very doubtful if the industry (which was estimated to employ directly about 10,000 workpeople and indirectly probably about 50,000) could be continued on a remunerative basis. The problem was solved by an offer from the Anglo-Persian Oil Co. to form a new consolidated company known as Scottish Oils Ltd.; its acceptance by the shareholders of the Scottish companies allied the Scottish oil trade with a strong group of oil interests under one central management, and the result has been satisfactory, although demand decreased in the end of 1920 owing to the general uncertainty of trade conditions.

Textiles.—The woollen trade in the Borders had a year of great prosperity in 1911, the output and the export trade (especially with Germany) being very great. Thread and yarn makers had also a prosperous year, and the linen trade of Dunfermline was steady, though not brisk, but the jute trade of Dundee passed through one of its worst years, with unprecedented curtailment of production, due chiefly to over-production in Calcutta. The following year saw a remarkable revival in the jute industry, which enjoyed a period of unparalleled success, the woollen trade continued to be prosperous and conditions in the linen trade were normal. Prosperity in textile industries continued through 1913 and was not checked until the outbreak of war, when the export of tweeds and linen came suddenly to an end, and the textile industries as a whole suffered from a decrease in the purchase of luxuries and from the cessation of imports of raw material. Jute, which had been prosperous in the early part of the year, became unremunerative towards its close. New outlets were found in the manufacture of khaki cloths, flannel shirtings, and military blankets, but reorganization took time and was delayed by lack of dyes and by the circumstance that Scottish flannel was largely made from Belgian raw materials. Throughout the war, the Dunfermline linen trade suffered more severely than other textiles, the looms being unsuitable for the goods which were required. The jute trade recovered in 1915, largely owing to Government orders. These conditions continued to the end of the war; prices, in spite of Government control, were very high, and rose after the Armistice. The year 1919 was very prosperous for the jute trade, and linen made a considerable recovery, in spite of difficulties about raw material, but the woollen trade suffered from a poor clip after a severe winter and a late spring. The general prosperity in textile trades continued into the first quarter of 1920, but was followed by an almost complete cessation of demand for woollen and linen goods, and similar conditions prevailed in the jute trade. All over, prices, as determined by cost of production, were too high for the consumer.

Agriculture.—Agricultural conditions have undergone a large number of changes. In 1910, agriculture was an unprofitable occupation for the tenant, and rents were low—on the average, about half what they were in the 'eighties. Agricultural wages were also comparatively low, although they had recently advanced, and the average weekly earnings for all classes of agricultural labourers were higher in Scotland than in England. Farmers were feeling the burden of foreign competition and of the expense of the machinery necessary for scientific farming. The food problem during the war gave a new impetus to agriculture, the effect of which may be seen from the following table:—

	Area under:—			
	Crops and grass acres	Arable land acres	Permanent grass acres	Corn crops acres
1911	4,845,835	3,348,568	1,497,267	1,218,055
1914	4,786,179	3,295,040	1,491,139	1,186,432
1915	4,781,416	3,290,543	1,490,873	1,220,307
1916	4,775,525	3,303,180	1,472,345	1,234,748
1917	4,776,200	3,360,342	1,415,858	1,273,549
1918	4,761,101	3,453,494	1,307,607	1,493,169
1919	4,751,475	3,408,479	1,342,996	1,378,318

The largest increase in production was in the years 1917 and 1918. In 1917, the total produce of wheat was 304,169 quarters (an increase of 21,000 quarters over 1916) and in 1918 it rose to 402,000 quarters. The figures for barley and bere are 704,788 quarters in 1917 (an increase of 57,600 quarters over 1916) and 677,000 in 1918; and for oats 5,446,931 quarters in 1917 and 6,457,000 in 1918. The total produce of the potato crop was 1,110,085 tons in 1917 (an increase of 579,000 tons on 1916) and 1,151,000 tons in 1918. Live stock showed similar variations; the number of horses rose from 206,474 in 1911 and 198,704 in 1915 to 207,113 in 1916 and 210,048 in 1917, falling slightly in 1918. Numbers of sheep and pigs declined slightly in the war years—sheep from 7,164,342 in 1911 to 6,878,198 in 1918, and pigs from 171,115 in 1911 to 128,007 in 1918, but cattle rose from 1,200,017 in 1911 to 1,225,330 in 1916 (1,209,842 in 1918).

The increases in corn crops and potatoes were the result not only of economic conditions, such as rising prices, but also of administrative and legislative measures. In the summer of 1915 the Secretary for Scotland appointed a departmental committee to report on the measures necessary to increase the production of food during the war; in 1916, the attention of military tribunals was directed to agricultural necessities, and the army lent military labour at certain seasons of the year. The Corn Production Act of 1917 led to the division of Scotland into districts with District Wages Committees to fix wages. The general prosperity of agriculture is shown by the rise in Fiars Prices—average prices ascertained annually by an inquiry held by the sheriff of a county in order to fix the amounts payable to parish ministers for each kind of grain. The prices vary considerably in different counties, but the value of all sorts of grain and of oatmeal was doubled or trebled between 1911 and 1918, and remained at its high level through 1919 with a slight decline in 1920. The wages of agricultural labourers increased proportionally, and their standard of living rose, giving impetus to a tendency notable before the war, to abandon the traditional brose and porridge in favor of more expensive foods and especially butcher's meat. A result of agricultural prosperity was a very large number of sales of land in 1919 and 1920. Scotland, to a large extent, ceased to be a country of huge estates, and the number of farmers who farm their own lands greatly increased.

Forestry.—Before the war, there was a revival of interest in forestry, due to the exertions of several Scottish landlords, and to the action of the Board of Agriculture and the Development Commission. In 1912, a departmental committee, appointed to select a suitable locality for a demonstration forest area, issued an elaborate report on steps for the promotion of sylviculture, some of their suggestions being adopted by the Development Commission in 1913. These developments were interrupted by the war, for scarcity of labour put an end to afforestation, and the extensive demand for timber brought about a depletion of woodland areas from 1915 onwards. It was estimated in 1916 that more than half of a home production of 40,000,000 cubic ft. of timber had come from Scottish forests. The depletion of woodlands was continued owing to the demand for timber for purposes of reconstruction in 1919 and 1920, and in June of the latter year there was a series of destructive forest fires in Ross-shire, Inverness-shire and Aberdeenshire. In 1919, a Forestry Act, passed for the United Kingdom, transferred to the Forestry Commission the powers in this respect of the Board of Agriculture for Scotland. The Commission had acquired, by the end of 1920, about 60,000 ac., of which about half was plantable.

Fisheries.—The character of the Scottish fishing industry was already undergoing an important development by the year 1910. It was ceasing to be conducted by small fishing boats, owned by the fishermen who used them, and was passing into the hands of large companies whose capital provided the necessary fleets of steam drifters. The capitalization of the industry was extending to salmon fisheries, which were being bought up by wealthy companies. These conditions have persisted even in the Highlands and Islands, where the combination of fishing with the cultivation of crofts became much less common. In 1910, the Scottish fishing fleet consisted of 9,724 vessels, valued at £4,409,027, of which 1,073 (valued at £2,457,586) were propelled by steam; in 1919, there were 6,534 fishing vessels, valued at £7,198,431, of which 3,722 were sailing or rowing boats; the remainder consisted of 294 steam trawlers (valued at £3,342,255), 767 steam drifters, and 1,751 auxiliary motors. The number of boats which possessed auxiliary motors in 1910 was 156. Between 1910 and 1919, the number of sailing and rowing boats decreased from 8,175 to 3,722, and the estimated value from £642,902 to £122,823. The sailing and rowing boats were manned by 25,985 men and boys in 1910, and by 9,830 in 1919; the total number of men and boys employed as crews decreased from 38,941 in 1910 to 27,408 in 1919. The increase of motor vessels in the western area was a notable feature of the period. In 1910, 40 motor vessels belonged to Campbeltown and 11 to Ballantrae, and 23 to other W. coast fishing ports; in 1919, the numbers at Campbeltown and Ballantrae had increased to 78 and 88 respectively and there were 209 belonging to other ports, of which Loch Carron and Skye possessed 80 (as compared with 4 in 1910) and Inverary 70 (as compared with 8 in 1910). Stornoway, where there were no mechanically propelled vessels in 1910, had 18 steam liners and drifters and 13 motor-boats in 1919. The steam trawlers were still, in 1919, confined to Leith, Montrose, Aberdeen (which possessed 193 out of 294), and Peterhead, except for 8 belonging to Greenock. The large use of motor-boats was partly a result of the diversion of steam drifters to other purposes during the war, and the demand for them decreased in 1919, when steam drifters again became available. In the course of the war, 302 trawlers, 829 drifters, and 133 motor-boats (a total of 1,264 fishing vessels) were requisitioned by the Admiralty, chiefly as naval auxiliaries. Of these, about 100 were lost while on war service; of the remainder, all except 131 were released in 1919 and most of them had been reconditioned and were again engaged in the fishing industry by the end of that year. The number of Scottish fishing vessels sunk while engaged in fishing in the course of the war was 96, of which 51 were trawlers. In June 1915, no fewer than 34 vessels were lost, and the experience of that month led to the enforcement of very severe restrictions upon the fishing industry. The effect of war restrictions is evident from the total quantities of fish (exclusive of shell-fish) landed in Scotland in successive years by Scottish vessels:—1913, 7,267,328 cwts.; 1914, 6,926,241 cwts.; 1915, 2,319,390 cwts.; 1916, 3,412,030 cwts.; 1917, 3,079,768 cwts.; and 1918, 3,313,228 cwts. In 1919, the quantity rose to 5,968,866 cwts. The value of the catch naturally rose in proportion to scarcity; the value of over 7½ million cwts. in 1913 was £3,733,379; of about $2\frac{1}{3}$ million cwts. in 1915, £2,051,171; and of over 3 million cwts. in 1917, £3,645,015. The most remarkable rise occurred in 1918, when about $3\frac{1}{3}$ million cwts. were valued at £5,991,693. In a week of Jan. of that year, the average price of all white fish sold in Aberdeen was £7 9s. 2d. per cwt. Maximum prices were fixed, but they had necessarily to be fixed at a high level in view of scarcity of labour and the special dangers attaching to fishing industry. In 1919, the increase in quantity over 1918 was 80 %, but the value was £6,063,739—an increase of only a little above 1 %, as compared with 1918; but the average price in 1919 was about double that of 1910, and prices remained high through 1920. The stress of the outbreak of war was felt specially heavily by the herring industry, for the chief markets for cured herrings were in continental Europe and communication was cut off. There was a large existing stock of unsold herrings, and great quantities had been sent to German ports. As the war progressed, decreased production and increased home demand led to a great improvement, and exports were resumed—in 1916, 366,682 barrels of herring were exported (as compared with 1,385,323 barrels in 1913), and 113,284 barrels in 1917—so that 1914 was the only disastrous war year. Increased production in 1919 brought about a difficult situation, for political and economic conditions in Russia and in Central Europe prevented the resumption of trade, and the industry was saved from disaster by a Government guarantee, which was renewed for 1920, but was refused for 1921, which opened with very gloomy prospects for the herring fishing industry. A committee of the Fishery Board recommended in 1919 that whaling operations should be prohibited in any part of Shetland, on the ground that the decline of the herring fishing in Shetland is directly connected with the introduction and development of whaling, an industry carried on almost entirely by foreigners.

Railways and Transport.—No new railways have been constructed since 1911, and the whole railway conditions have been abnormal since 1914. Serious railway accidents during the decade include a collision at Burntisland on April 14 1914, in which two railway employees were killed; collapse of a culvert near Carrbridge on June 18 1914, involving a disaster to a train and the deaths of five passengers by drowning; and an accident at Ratho on Jan. 3 1917 resulting in 12 deaths. The gravest railway disaster occurred to a troop train at Quintin's Hill, near Gretna, on May 22 1915, when 227 of the 7th Royal Scots were killed and 246 were injured. The accident occurred through the carelessness of two signalmen, both of whom received sentences of imprisonment. There has been a large increase in motor transport, but agriculture, fishing, mining and commerce are still handicapped by the lack of transport facilities. The proportion of mileage of railway to pop. is much smaller in Scotland than in such a small maritime country as Sweden, the number of miles of railway per 10,000 pop. being 16·2 in Sweden and 8·2 in Scotland. Transport conditions compare even more unfavourably with Belgium, which has a great system of canals, in addition to an elaborate system of railways, light railways and steam tramways. A committee on Rural Transport, appointed by the Secretary for Scotland, reported in 1919 that the construction of a considerable number of railways and light railways is essential for the development of the country, especially of inland straths and glens in various regions and of the W. coast and the islands. They gave illustrations of the results of lack of transport—the impossibility of growing early potatoes on soil specially suitable, the continued use of land for sheep farming which could be turned into good meadow land, the closing of a lead mine and the impracticability of working iron stone. In many districts, land could carry more stock and would be capable of closer settlement if better transport were available. The system of water transport could also be extended with advantage. Scottish canals fell largely into disuse after the introduction of railways, and some of them were acquired for the construction of their permanent way by railway companies. The total mileage of canals in Scotland is 183. There has been much discussion of the project of a reconstruction of the Forth and Clyde Canal, but without any result. The question of transport is closely associated with the utilization of water-power, several schemes for which are under consideration, the most important being schemes for the utilization of water-power in the districts of Lochaber and Fort William. In the large towns, there has been a great development of systems of electric tramways and motor omnibuses, and motor vehicles running in rural districts have proved formidable competitors to the railways.

Highlands and Islands.—The Board of Agriculture issued in 1913 a report on home industries in the Highlands and Islands by Prof. R. W. Scott, who pointed out that most of the existing home industries depend upon raw materials derived from the land—the hosiery and tweed industry using wool, and the basket industry, osiers, and that the encouragenemt of these industries must be closely connected with general agricultural policy. Shetland industries depend upon an improvement of the wool of Shetland sheep; in the Hebrides a deterioration in the quality of home-grown wool has led to large imports for Harris tweeds, while in Skye little has been done to encourage the cultivation of osiers. The report recommended the creation of local committees, under the authority of the Board, to supervise cottage industries, but the outbreak of war prevented the carrying out of the suggestions made. The home industries in existence in the Highlands and Islands in 1911 were hosiery, wool and worsted manufacture, basket-making, lace-making, silk-spinning, shirt-making, umbrella manufacture, straw hats and bonnets manufacture, small ware and fancy goods, but only one person was reported as engaged in lace-making. The total number of workers in home industries was 5,649, about 500 of whom were males. An attempt by Lord Leverhulme to establish in Stornoway a large fish-curing and packing industry and to develop the whole resources of the island has been hampered by the seizure of land by returned soldiers, and the future of the project was in 1921 still uncertain. Lord Leverhulme's proposals included the construction at Stornoway of a fishing harbour superior to any existing harbour on the W. coast or in the western islands and the completion of a canning factory and of carding and spinning mills, the building of which was begun before the interruption of the execution of the scheme by the "raiding" of farms in the spring of 1920. The organization not only of the fishing industry but also of the Lewis and Harris hand-woven tweed industry was thus contemplated, along with the opening up of the common grazing lands in Lewis and Harris and the provision of some 3,000 allotments of a quarter of an acre in size, selected so as not to interfere with existing dairy or other farms.

The effects of the World War can readily be traced in Scotland of the present day. The efforts made, alike for the recruiting of the fighting armies, for the production of ships and munitions, and for the maintenance of food supplies, and generally, of the social and national organization, rendered those years the most strenuous period in the whole history of the country, and constitute a record of courage and endurance which cannot but leave its mark upon the national character. Like other portions of the Empire, Scotland has, since the end of 1918, suffered from the weariness produced by stupendous effort and from a consequent restlessness and impatience which has found vent in industrial disputes and in an eager adoption, by some of the youth, of new social ideals, in which the influence of Russian Bolshevik experiments and propaganda has been conspicuous. Such manifestations can be paralleled from other periods following the end of a great military struggle, and there is already evidence that the disturbances in organization and habit produced by the experiences of the war have reached their climax, and, with the restoration of commercial and industrial prosperity, will cease to operate adversely upon the peace of the country.

(R. S. R.)

SCOTT, CYRIL (1879–), English musical composer, pianist and author, born at Oxton, Birkenhead, Sept. 27 1879, was musically educated at the Hoch conservatorium, Frankfurt A/M, chiefly under Ivan Knorr. While still in the pupil stage Scott heard his first symphony performed at Darmstadt in 1899. On Scott's return to England Hans Richter produced an orchestra suite by him at Liverpool. Subsequently Scott produced a vast amount of music, more especially of songs, most of which are on the same high level as that of the *Schumacherlieder* of his student days. Violin and pianoforte music also poured from his pen. A series of early overtures written for plays by Maeterlinck seem to have been suppressed, but there remain a Christmas overture, the two fine Passacaglias, the *Ballad of Fair Helen*, *La Belle Dame sans Merci*, and a pianoforte concerto and also two quintets, a piano quartet and a violin sonata. Scott also published several volumes of poems, including *The Voice of the Ancient* (1910); *The Vales of Unity* (1912); *The Celestial Aftermath* (1915) and the prose book *The Philosophy of Modernism* (1917). In 1920 his *Nativity Hymn* was accepted for publication by the Carnegie Trust, and in 1921 he paid a visit to the United States.

SCOTT, SIR JOHN EDWARD ARTHUR MURRAY, BART. (1847–1912), English art collector, was born at Boulogne Feb. 23 1847. The son of an English doctor at Boulogne, he became secretary to Sir Richard Wallace, heir of the 4th Marquess of Hertford. He helped Sir Richard to organize relief for the sufferers of the siege of Paris in 1870, and after the siege, to transport the treasures of the Hertford art collection from Paris to Bethnal Green museum. It was largely through his influence that Sir Richard Wallace's widow left the collection *en bloc* to the British nation, together with Hertford house, and he acted as chairman of the trustees' committee until his death. He became a trustee of the National Gallery in 1897, was created a baronet in 1899, and a K.C.B. in 1908. He died in London Jan. 17 1912.

SCOTT, ROBERT FALCON (1868–1912), English sailor and explorer, was born at Devonport June 6 1868, the son of John Edward Scott of Outlands, Devonport, and entered the navy in 1882. He was promoted lieutenant and appointed to the "Amphion" in 1889, and torpedo-lieutenant to the "Majestic," flagship of the Channel Squadron, 1898, becoming commander 1900. He commanded the National Antarctic expedition of 1901–4 (*see* 21.966) and in 1905 published his account of it in *The Voyage of the "Discovery."*

On his return he was promoted captain and commanded first the "Victorious," flagship of the Channel Squadron, and subsequently the "Essex" and the "Bulwark." He was awarded the gold medals of the Royal Geographical Society and of the Royal Scottish Geographical Society, and received medals from the geographical societies of many foreign countries, and an hon. degree from Cambridge. During part of 1909 he was naval assistant to the Second Sea Lord of the Admiralty, and in June 1910 he again set out for the Antarctic in the "Terra Nova" in command of a new expedition, financed partly by private individuals but aided by a Government grant. He arrived at Lyttelton, N.Z., in Oct. and reached McMurdo Sound at the end of the year. On Nov. 2 1911 he started on his journey of 850 m. to the Pole, accompanied all the way by Dr. E. A. Wilson, Capt. L. E. G. Oates, Lt. H. R. Bowers, and Petty-Officer Edgar Evans. He reached the Beardmore glacier on Dec. 10 and on Jan. 4 1912 left behind him his last supporting party in lat. 87° 32′ S. When last heard of he was about 150 m. from the Pole, which his record shows that he reached Jan. 17 only to find Amundsen's tent and records left there one month earlier. On the return journey Evans fell (Feb. 17) in descending the Beardmore glacier and died shortly after. Blizzards were encountered and progress was slow. Food ran short, and on March 17 Oates went out alone to die. Three days later a fresh blizzard checked the survivors, whose supply of oil-fuel was exhausted and their food-supply very low. Scott's last entry in his diary was made on March 24. He was then only 11 m. from One Ton depot and a supply of food; but he was unable to reach it and died, with Wilson and Bowers, on or about March 27 1912.

A search party, sent out from the base in March 1912, had been driven back from One Ton depot by the weather, and it was recognized that there was no chance of Scott's party surviving the winter. Nothing further could be attempted until Oct., when search parties went out, and on Nov. 12 Dr. Atkinson and Mr. Wright found Scott's tent with the bodies of Scott, Bowers and Wilson and the valuable scientific records. Capt. Scott had a warm sympathy for scientific research and a good knowledge of many branches of science qualifying him for the leadership of an expedition, the main results of which were obtained by the labours of his scientific colleagues. The news of the disaster did not reach England until the survivors landed in N.Z. Feb. 10 1913. A memorial service, held in St. Paul's cathedral, London, Feb. 14, was attended by King George, and by royal warrant the rank and precedence of the wife of a K.C.B. were conferred on Capt. Scott's widow. A fund was raised as a memorial of Capt. Scott, from which ample provision was made for the surviving relatives of the lost explorers, and the balance was devoted to the promotion of polar research, a substantial amount being granted in 1921 towards the endowment of the Polar Research Institute of the Geographical department of the university of Cambridge.

On Sept. 2 1908, Scott had married Miss E. A. Kathleen Bruce, daughter of Canon Lloyd Bruce. Lady Scott had attained some reputation as a sculptor, and, later, executed statues of her husband, which have been erected in Waterloo Place, London, and at Portsmouth. Her other works include a statue of his companion, Dr. Wilson, at Cheltenham, one of Capt. Smith of the "Titanic" at Litchfield, and portrait busts of Mr. Asquith, Lord Knutsford, John Galsworthy, Granville Barker, and other well-known contemporaries. She was one of the first women to undertake munition making, and in 1916 she became private secretary to the secretary of the Ministry of Pensions. In Jan. 1922 her engagement to Lt.-Comm. Edward Hilton Young, D.S.O., M.P. (b. 1879), financial secretary to the Treasury, was announced.

SCOTT-GATTY, SIR ALFRED SCOTT (1847–1918), British herald and genealogist, was born at Ecclesfield, Yorks, April 26 1847, the son of the Rev. Alfred Gatty, vicar of Ecclesfield and sub-dean of York, by his wife Margaret Scott (*see* 11.530), a popular writer. One of his sisters was Juliana Horatia Orr-Ewing (*see* 10.40), the writer of children's books. The additional name of Scott was assumed by him by royal licence in 1892. He was educated at Marlborough and Christ's College, Cambridge. In 1880 he entered the Heralds' College and became Rouge Dragon pursuivant, and in 1886 was appointed York herald. In 1899 he became registrar of the college, and in 1904 was made Garter principal king-at-arms and knighted. Sir Alfred Scott-Gatty was an authority on heraldry and genealogy, and presented many copies of records to the Heralds' College. He was also an accomplished musician, many of whose songs became popular. In 1911 he was created K.C.V.O. He died in London Dec. 18 1918.

SCRIABIN, ALEXANDER NICHOLAEVICH (1871–1915), Russian composer, was born at Moscow on Christmas day 1871 (O.S.). His father was a lawyer; his mother, a good pianist and pupil of Leschetitsky, died when he was one year of age. His schooling was received in the Moscow Cadet Corps, but he never showed any liking for the military career for which he was intended, and at 18 entered the Moscow Conservatory of Music where he was a pupil of Safanov and Tanier. On leaving the conservatory Scriabin was greatly helped by the patriotic music publisher Belayef, who brought out his earlier works and arranged a European piano recital tour for him. At 20 he returned to Moscow and joined the conservatory staff. Later he again travelled, this time for six years, visiting the United States amongst other countries. He then settled in Brussels for some time, and in 1910 returned to Moscow. In 1914 Scriabin visited England, giving two piano recitals, playing his own Concerto and appearing as pianist in his *Prometheus*. He was then suffering from a tumour of the lip, from which, soon after his return, he died, April 14, 1915.

As a composer Scriabin represents what may be called the classical school carried forward to its most advanced point. The form of his sonata and symphony movements he derives from Mozart, through Beethoven; however bewildering these may at first sound, they will be found, on a second or third hearing, to be laid out on essentially the Mozart-Beethoven lines. In his pianistic idiom and general pianistic qualities of style, Scriabin derives largely from Chopin, of whose work he was a great admirer. All this then indicates a conservative side to his composition, but he was more radical in his harmonies, and it was, probably, largely the novelty of these that retarded appreciation of his later works. Gradually he evolved what may be called a new scale or, from another point of view, a new chord. It consists of the upper partials of the fourth octave from the fundamental note, less two (taking C as the fundamental note—C, D, E, F♯, A, B♭ or, arranged as a superposition of fourths, as Scriabin most frequently uses them, C, F♯, B♭, E, A, D). The hint of this new harmonic scheme may be seen in the earliest compositions, and its development was fairly regular and consistent, until it came to dominate his later output. In his later works he discards entirely the old key signatures. In his orchestration Scriabin calls for a large force, and uses it very freely: his scores are excessively contrapuntal in texture, the various instruments moving very independently and weaving together their respective themes: muted brass plays a large part in his orchestral colour scheme. In the First Symphony a chorus is used in the finale; the "Poem of Fire" also uses a chorus, but in an orchestral way, no words being supplied. For the last-named work the composer also wrote an optional part for a "Tastiera per luce," or keyboard of light, the intention being that varying colours should play upon a screen as the work was being performed. The composer was greatly interested in theories as to a correspondence between the musical scale and the scale of colours. In his great *Mystery* (left unfinished at his death) music, dance, speech, perfume and colour were to be combined; this work was to be rather a work of ritual than of art, and was to express its author's idealistic mysticism through the medium of 2,000 participants.

It is usual to look upon Scriabin's musical work as largely the expression of theosophical views, and undoubtedly much of his inspiration was drawn from the works of Blavatsky and others. He was not, however, a close reader, or a careful thinker. Seizing the main idea of a book or a creed, he would neglect the details, and his imagination would quickly develop a huge scheme of thought having little relation to what he had read. The titles of many of his works and of their separate parts, and the marks of expression affixed to particular passages, indicate plainly the existence of a spiritual "programme." The emancipation of the human soul through ceaseless striving, and its achievement of self-expression, may be said, very roughly, to represent the general sense of the spiritual basis of Scriabin's musical works.

The works of Scriabin have been variously classed into periods. A logical classification is into four periods as follows: 1st period, with a strong Chopin influence; the dividing line between this and the 2nd period runs through the First Symphony, and the 2nd period shows some Wagner and Liszt influences; the dividing line between this and the 3rd period runs through the Fifth Sonata, and a 4th period begins with the "Poem of Fire."

Works.—Orchestral: Revery (*op.* 24); Symph. I. (26); Symph. II. (29); Symph. III., or Divine Poem (43); Symph. IV. (54): *Prometheus*, or "Poem of Fire" (60). Piano: Sonatas I. (*op.* 6);

II. (19); III. (23); IV. (30); V. (53); VI. (62); VII. (64); VIII. (66); IX. (68); X. (70). A very large number of preludes, études, impromptus, mazurkas, poems, etc., including the great "Vers la Flamme" poem and the much-discussed last work, the Five Preludes (*op.* 74). Piano and Orchestra: Concerto (*op.* 20). No songs or chamber music are included in Scriabin's output. (P. A. S.)

SCULPTURE (*see* 24.488).—The state of coma which, so far as public interest is concerned, had afflicted European, and particularly British, sculpture up to the neighbourhood of 1910, yielded at about that date to a long-sustained treatment of shocks administered by the exhibitors of what has been regarded as "freak" sculpture. These shocks, sporadic but startling and lingering in their effect, had persisted throughout the preceding decade, and the so-called "rebels," authors of these frequently unintelligible sculptural efforts, found their ranks considerably swelled by converts to a system that seemed both easy of adoption and financially profitable. Hitherto, indeed, British sculpture had been well-nigh moribund, and only on occasion had the public evinced an interest in the case by crowding the bedside of the invalid to witness in some London gallery the delirium of the dying art as represented by the works of some new "rebel."

The attention of the public was caught and their mind entertained to an unusual degree in the closing years of the last century when Rodin, the great French master, startled the world by his originality of thought and won admiration by the freshness and vigour of his work. The interest thus awakened was, however, ill sustained in England, until the breach with academicism which Rodin inaugurated by his originality and independence was reflected and rendered wider in the work of the artistic "rebels" in Great Britain. The wave of revulsion from academicism and realism reached perhaps its high-water mark in 1910, and in 1921 had shown no sign of ebbing.

It would be difficult to classify these revolutionaries or to apply to their work any generic term, yet this movement has something in common with the post-impressionism of the painters. It had reached England from the Continent, where it was far more widely spread and had rooted more deeply. In France it received smaller encouragement than in Germany and Austria, where its influence is revealed in much of the recent monumental sculpture. The gospel of the movement forbids in chief any show of anatomical detail, and allows but little of true construction or of natural forms.

There can be little doubt that to this movement, in part at least, was due the awakening of public interest in sculpture about the year 1910. It was during the following year that considerable efforts were made to collect for public exhibition the works of that foremost of British sculptors, Alfred Stevens. That these efforts were successful was plain from the space devoted to the exhibition in the Tate Gallery during Nov. and Dec. 1911 and Jan. following. This exhibition constituted in the case of the majority of visitors a first introduction to the finest sculptor Great Britain had produced. The interest it provoked encouraged a scheme for a further and more permanent collection and preservation of the scattered works of this great master. Public interest in Stevens was promoted to a very large extent by the labours of the Stevens Memorial Committee, and by the enthusiasm and solicitude of Prof. Legros, and it was on behalf of this Committee that in 1911 the late Sir William Richmond presented to the trustees of the gallery an interesting bust of Stevens by Edouard Lantéri. Since then the collection at the Tate Gallery has been enriched by a cast of Stevens's remarkably fine chimney piece at Dorchester House.

Foremost of European sculptural works raised in 1911 were, in Rome, the large memorial to King Victor Emmanuel, and, in London, the great memorial to Queen Victoria at Buckingham Palace. The Victor Emmanuel monument reveals no individualism or inspiration in its design or modelling. The Victoria Memorial, largest of sculptural monuments in London, is imposing in its effect and is magnificently situated at the head of the Mall and before the Palace. In 1912 the great bronze quadriga by Adrian Jones was placed upon Decimus Burton's arch at the top of Constitution Hill, London.

The revival of sculpture which marked this period was not evident alone in parochial and civic patronage; it was found—not for the first time—a suitable and convenient, and certainly an effective, channel, through which might be expressed international courtesies adaptable to various occasions. Three such works, which might be regarded as political, were erected in London during the year 1920-1, to which reference will be made later. During 1912 two such monuments were unveiled in France, both of which were in the form of courtesies between that country and Great Britain. On April 12 M. Poincaré unveiled at Nice the Queen Victoria Memorial, and on April 13 a memorial to King Edward was presented to the public at Cannes.

In the meantime one of the most important events of 1912 in England was the completion of Alfred Stevens's monument to the Duke of Wellington in St. Paul's Cathedral by the addition of the bronze equestrian statue of the duke which was designed to surmount the monument. Alfred Stevens, the designer of this splendid work, had died leaving the memorial incomplete, and it must for ever remain a matter for regret that many important architectural features in Stevens's original design were modified with results destructive to the purity of the style and the elasticity of the structure. It was not until 45 years after Stevens's untimely death that the screens were removed and the completed monument revealed to the public gaze. Fortunately the great sculptor had left behind him a small model which he had designed for the equestrian group, and John Tweed, who was finally commissioned to carry out this portion of the work, followed and developed with no mean intelligence the ideas conveyed in the small original model. The result is not, however, as happy as could have been desired. The horse is in the Renaissance style as intended by Stevens, and is in keeping with the rest of the design; the light is quite inadequate to illuminate the upper parts of the monument, which is far too high for its position, the bronze group barely clearing the overhead structure of the building and consequently suffering some obscurity.

The Tate Gallery, in London, latterly more fittingly known as the National Gallery of British Art, was enriched by the addition of Havard Thomas's bronze statue "Lycidas," the gift of Mr. and Mrs. E. Sadler, while perhaps the most interesting work in the Royal Academy exhibition of 1912 was the same sculptor's statue "Thyrsis," which was acquired by the Felton Bequest Committee for the National Gallery of Melbourne.

The outbreak of the World War had no immediately noticeable effect on British sculpture. The work shown at the Royal Academy exhibition just then concluded had been of an unusually high standard, Sir Thomas Brock's statue of Capt. Cook had been set up in the Mall, London, and a very large number of works of some importance were well on the way to completion in the autumn of 1914. These did much to cover any paucity which might have been apparent in the exhibition of the following year. Nevertheless, upon the outbreak of hostilities a vast number of contracts for important architectural sculpture were at once cancelled or their execution postponed. This, it is hardly necessary to say, resulted in a period of distress and stagnation which terminated only with the demand for war memorials after the signing of the Armistice.

While general attention was focussed upon the war, British sculpture suffered a severe blow by the death of Prof. Edouard Lantéri, of the Royal College of Art. As a sculptor his output amounted to little, but, as he himself would have had it, the fruits of his teaching will long survive him, and those sound constructive principles of sculpture which he taught will remain an influence in that distinctively British school of sculpture which he endeavoured to promote.

Two works of outstanding beauty and remarkable workmanship in the Academy exhibition of 1914 should be mentioned: Havard Thomas's bronze cast of his "Thyrsis," which had appeared in wax two years previously, and Derwent Wood's bronze bust of Mr. Henry James.

No sculpture of importance was made public during 1915 beyond Rodin's "Burghers of Calais," Lady Scott's statue of Capt. Scott, and such works as were exhibited at the Royal

Academy. Mr. Toft's figure, "The Bather," was a notable exhibit, and it was bought by the Trustees of the Chantrey Bequest for the national collection. A large work in marble which attracted much attention was the statue "Premier Matin" by the Belgian sculptor Egide Rombeaux. Political interest in Serbia, arising out of the war, was in part responsible for the exhibition this year in London of the work of Mestrovic, the Serbian sculptor; his work, though showing an extreme revolt against academicism, is undoubtedly powerful and full of individualism. Rodin's already well-known bronze group, "The Burghers of Calais," purchased in 1912 by the National Arts Collection fund, was erected in Victoria Tower Gardens, London, and the memorial statue of Capt. Scott was set up in Waterloo Place, London.

Derwent Wood won further honour with his child's head (a portrait of Master Charles Haviland Hillman) in the Academy in 1917. This year was specially marked, however, by the death of that greatest of modern sculptors, Auguste Rodin, a master who has exercised probably a greater influence upon the sculpture of his day than has any before him. His works had long since found their way into every important public and private collection of modern art in Europe and America; a triumph of extraordinary significance, because it was not until comparatively late in his career that he won official recognition.

In Aug. 1919 a picturesque figure was removed from sculpture circles by the death of Walter Winans. Never a sculptor of more than technical ability, Winans worked to please himself and for the entertainment of his friends. Horses and shooting were perhaps as great a passion with him, and, though in sculpture he was a gifted dilettante and no more, he had some successes and was widely known.

Save for the few exceptions of those men who were physically unable to render war-service, almost every British sculptor had now been for some time with the fighting forces or engaged in the hospitals or munition works at home. Metals—particularly those of which bronze is constituted—were controlled by Government in order to safeguard the supply necessary to the manufacture of war munitions. This supply, though sufficient for those needs, did not very far exceed them; it is worthy of note, therefore, that the Government, in the interests of sculpture, ascertained the average amount of bronze used by those sculptors who were still at work, and assigned to each such quantity of metal as was in fair proportion to his previous needs. Beyond this, however, the British Government did little or nothing to encourage or to make use of sculpture, though Germany, in the meantime, found a valuable weapon in the production of war medals, which were designed as propaganda to serve the double purpose of heartening the German people by commemorating real or supposed victories and of disseminating in neutral countries evidence of Albion's perfidy and of the success of German arms. These medals, of which some hundred or more were designed, are in very many cases works of a high artistic order, and several museums in Great Britain have secured fairly representative collections of them.

During 1920–1 no fewer than three public statues which may well fall under the category of "International Courtesies" were erected in London: the monument of "Gratitude" (a bronze group by Victor Rousseau)—the gift of Belgium—erected on the Thames Embankment in Canning Enclosure, Westminster; the statue of Abraham Lincoln by Saint-Gaudens—a gift of the United States; and the bronze replica of Houdon's George Washington, presented by the state of Virginia and set up in Trafalgar Square.

The London memorial to Nurse Cavell by Sir George Frampton, erected near St. Martin's church, Trafalgar Square, caused something like a sensation in 1920 by the evidence it gave of this well-known academic sculptor's conversion to simple and severe forms of archaicism. This was particularly noticeable in the treatment of the architectural forms. Some remarkable sculpture was exhibited in June 1921 by Paul Manship, a sculptor of great individuality and strength of modelling. In July 1921 Bertram MacKennal's equestrian statue of King Edward VII. was unveiled in Waterloo Place by King George. The sculptor was knighted after the ceremony. In Scotland Mr. Pettendrigh MacGillivry was made "King's Sculptor," a title that has no counterpart in England. (C. Po.)

UNITED STATES.—Although the period 1910–20 brought to light no new master in American sculpture, it showed an increase in the number of sculptors, and much good work was done. D. C. French, who in 1920 had reached the age of 70, was still indefatigable; conspicuous among his later works were the "Melvin Memorial" and the statue of Emerson, both at Concord, Mass.; "Lincoln," at Lincoln, Neb.; the Longfellow and Lafayette reliefs; the exquisite Spencer Trask Memorial at Saratoga Springs, N.Y.; and the imposing "Lincoln" for Washington, D.C., besides a score of architectural groups of high value. F. W. MacMonnies erected a "Pioneer Fountain" at Denver and a Washington group at Princeton, N.J. G. G. Barnard was as always original; his gigantic processionals in Harrisburg, like his rugged "Lincoln" in Cincinnati, compelled attention and discussion. Paul Bartlett devoted years to his equestrian "Lafayette" for Paris, following this with the pedimental group for the capitol, Washington, D.C. Henry Shrady's monument to General Grant (Washington, D.C.) was a work of sincerity. H. A. MacNeil embellished Ohio's capitol with his "McKinley Memorial" and Albany with a soldiers' monument. St. Paul and Springfield, Ill., and Worcester, Mass., gained new works by Andrew O'Connor. A. A. Weinman's Baltimore group, C. Keck's "Republic" in Pittsburgh, and H. A. Lukeman's various monuments were important contributions. Karl Bitter's untimely death in 1915 was a great loss; among his last works were the admirable East pediment of the Wisconsin state capitol, the austere "Carl Schurz" (New York), and the "Lowry Memorial" in Minneapolis. Another good pediment was that of the Kentucky capitol by Charles Niehaus. Miss Anna Hyatt's "Joan of Arc" (New York) was completely successful. Cyrus E. Dallin continued his mounted Indians; "The Appeal to the Great Spirit" was perhaps the finest. J. E. Fraser's "End of the Trail" was a notable achievement. Among portrait statues were Weinman's seated "Lincoln" (Hodgensville, Ky.); Edmund T. Quinn's "Edwin Booth" (New York); R. Tait McKenzie's "Whitefield" (Philadelphia); and Leonard Crunelle's "Governor Oglesby" (Chicago). Herbert Adams produced his "Bryant" (New York), as also his graceful MacMillan Fountain in Washington, D.C. In portrait busts Charles Grafly continued to lead, with his former pupil, Albin Polasek, a close second. Atillio Piccirilli's "Outcast" and "A Soul" were sculpture "by first intention." McCartan's graceful fauns and Rudolf Evans' beautiful "Golden Hour" were of this period. Chester Beach and Paul Manship continued their successful work. Sherry Fry's fountain for St. George, Staten Island, revealed skill of a high order. Evelyn Longman was well represented by her Allison Memorial (Des Moines, Ia.), and the Illinois Centennial Monument, Logan Square, Chicago. Nellie V. Walker had important works in many western cities—for example, her heroic "Keokuk." Lorado Taft's "Black Hawk" and several fountains were also of this period. Doubtless the most stimulating event of the decade was the Panama-Pacific Exposition of 1915 in San Francisco. Among the many sculptors who made valuable contribution to its display of decorative art were Calder, Aitken, Roth, MacNeil, Jaegers, and Konti.
(L. T.)

SEAMAN, SIR OWEN (1861–), English poet and editor of *Punch* (*see* 24.543), was knighted in 1914. His later volumes include *War Time* (1915); *Made in England* (1916) and *From the Home Front* (1918), mainly reprints of verses contributed to *Punch*. At the beginning of the World War he joined the "Veterans" corps of the former Inns of Court Volunteers, later known as the Inns of Court Reserve Corps (2nd batt. of the County of London Volunteer Regt.). He was gazetted lieutenant in 1916.

SEDGWICK, ADAM (1856–1913), English biologist, was born at Norwich Sept. 28 1856. Educated at Marlborough, King's College, London, and Trinity College, Cambridge, he became fellow and tutor of his college and assisted F. M. Balfour, the first professor of animal morphology at Cambridge. From 1890 to 1907 he held a readership in that subject himself, and in 1907 became professor of zoölogy in Cambridge University. Two years later he was transferred to the Imperial College of Science and Technology in the same capacity. Details of his work in cytology and embryology are to be found in 7.720, 9.320 and 328. He died in London Feb. 27 1913.

SEEBOHM, FREDERIC (1833–1912), English historian, was a native of Bradford and came of a Quaker family. His interest in problems of modern life, social and religious, led him to study the conditions of English rural life in the past and the religious movements of the Reformation. In his *English Village Community* (1853) he dwelt on the survival of Roman influences in agricultural life; and in his *Tribal Systems in Wales* (1895) he reconstituted a Celtic society from 14th century evidence. He died at Hitchin Feb. 6 1912.

SEELY, SIR CHARLES, 1st Bart. (1833–1915), British politician was born at Lincoln Aug. 11 1833. He came of a family which held large property, including coal-mines, in the Midlands, and also in the Isle of Wight. In 1869 he entered the House of Commons as Liberal member for Nottingham, but lost his seat at the general election of 1874. He was reëlected in 1880, but seceded from the Liberal party on Irish Home Rule, and in 1885 lost his seat. He was once more elected in 1892, and held the seat until 1895. In 1896 he was created a baronet. Sir Charles Seely was a warm supporter of the Volunteer movement. He died suddenly at Brooke House, Isle of Wight, April 16 1915.

His youngest son, John Edward Bernard Seely (1868–), British politician, was born at Brooke Hill Hall, Derbyshire, May 31 1868. Educated at Harrow and Trinity College, Cambridge, he was called to the bar in 1897, and from 1900 to 1901 served with the yeomanry during the South African War. In 1900 he entered the House of Commons as Liberal member for the Isle of Wight, but was defeated at the 1906 election. He was, however, elected the same year for the Abercromby division of Liverpool. In 1908 he entered the Asquith Government as Under-Secretary for the Colonies, but in 1910 lost his seat, although in the second general election of that year he stood successfully for the Ilkeston division of Derbyshire. In 1911 he was made Under-Secretary for War, and in 1912 became War Minister. Owing, however, to the events attending the Curragh incident of 1914, he resigned in the summer. He served in the army with distinction in the World War, rising to the rank of general in 1918, and on his return to official life became parliamentary under-secretary to the Ministry of Munitions and deputy-Minister of Munitions (1918). In Jan. 1919 he became Under-Secretary for Air, and president of the Air Council, but resigned in Nov. of the same year.

SÉGUR, PIERRE M. M. H., MARQUIS DE (1853–1916), French author (*see* 24.584), died at Poissy Aug. 13 1916.

SEISMOLOGY (*see* 8.817 and 24.589).—Strictly speaking, seismology is that department of knowledge which is concerned with the study of earthquakes, and such was its meaning up to the end of the 19th century, the older seismology being exclusively concerned with the earthquake which could be felt. In the early nineties it was discovered that suitably designed and sufficiently sensitive seismometers recorded disturbances which were evidently connected with great earthquakes, and, as it was known that the intensity of disturbance decreased with an increase of distance from the central region of greatest violence, it was natural to conclude that the very small disturbances, registered at great distances, were due to the same cause that gave rise to the destructive earthquake. With the accumulation of observations difficulties began to arise; it was found that neither the magnitude of the disturbance, nor the distance at which record could be obtained, bore any constant relation to the magnitude of the earthquake. Some shocks of great violence gave small records, not very extensively distributed, while others of much less severity at the place of origin gave much larger records and were registered all over the earth. The distant records, however, continued to be regarded as records of the earthquake itself, and are still generally described as such. In 1909 R. D. Oldham, when examining the circumstances of the Californian earthquake of 1906, arrived at the conclusion that the fractures and dislocations of the surface rocks, which gave rise to the destructive earthquakes, were but a secondary consequence of a deep-seated disturbance, to which he gave the name of *bathyseism*, and suggested that this, and not the earthquake, was the origin of the disturbance which, propagated through the interior of the earth, gave rise to the long-distance records, commonly known as seismograms. Subsequent consideration of other earthquakes confirmed his belief in the correctness of the conclusion, and from this it results that the word "seismology" is at present being used to cover two distinct and independent departments of study, which may be distinguished as *teleseismology* (τῆλε, distant) or the study of the long-distance records, and *engysseismology* (ἐγγύς, near) or the study of the earthquake proper, each being distinct and independent offshoots of the bathyseism, or deep-seated disturbance. It is the first of these which, at the present day, is more especially meant by seismology, and it is an instance of the way in which words gradually depart from their original meaning, that the term should have come to imply something which has no direct connexion with earthquakes.

Nothing is known at present of the origin of the bathyseism, and very little of the depth at which it originates. The latter probably varies considerably, those disturbances which give rise to well-marked teleseisms and moderate surface earthquakes taking place at greater depths than others which are accompanied by violent and destructive earthquakes. The only suggestion which has yet appeared of the depth of origin is by Dr. G. W. Walker, who has followed up certain investigations, started by Prince Boris Galitzin, of the angle of emergencies of the wave-paths, and finds that in many cases they indicate an origin at a considerable depth (it may be as much as 1,200 km.) below the surface. These investigations require following up before they can be accepted as conclusive, but the suggestion is of interest; there is no inherent impossibility, and it seems to offer a possible explanation of some difficulties which have arisen in the interpretation of the long-distance seismograms.

Since 1910 many improvements in detail have been made in the instruments used for obtaining the long-distance records of the newer, or tele-, seismology, and an entirely new principle was introduced by the late Prince Boris Galitzin for a direct measurement of the acceleration of the true motion of the ground. This instrument is based on the fact that, if a plate of quartz is subjected to pressure between two sheets of metal, a free electric charge appears in those sheets, the amount of which is proportioned to the pressure. An instrument was actually constructed on this principle and subjected to experimental tests, but has not been applied to the recording of natural disturbances, owing to the death of the inventor and the effects of the political revolution in Russia.

The rate of propagation of wave-motion through the earth, as registered by long-distance seismographs, has been investigated by Dr. C. G. Knott, who has succeeded in solving the mathematical difficulties of the problem. He finds that the rate of transmission of both the first phase, condensational, and of the second phase, distortional, waves increases continuously till the wave-path attains a depth of about three-tenths of the earth's radius, the wave-paths reaching lesser depths than this having a continuously curved form, convex towards the centre of the earth. Beyond this the rate of propagation is nearly constant, even decreasing at certain depths so that some of the wave paths are concave towards the centre in part of their course. Below six-tenths of the radius the distortional wave is killed out, and is not registered at distances greater than 120° from the epicentre. The rate of propagation of the two forms of wave-motion is about 7·2 and 4·0 km. per second respectively, near the surface of the earth, and about 12·8 and 6·8 at depths of over 1,500 kilometres.

For the older seismology or study of earthquakes proper, *see* Geology (section *Dynamical Geology*).

Authorities.—The best general introduction to the newer seismology is Dr. G. W. Walker, *Modern Seismology* (1913). The most complete is by Prince B. Galitzin, original in Russian; a German translation, *Vorlesungen in Seismometrie*, appeared in 1912. G. W.

Walker, "Focal depth and the Time Curve," *Brit. Assn. Rep.* (1917, p. 13). C. G. Knott, "The Propagation of Earthquake Waves Through the Earth, and Connected Problems," *Proc. Roy. Soc. Edinburgh* (1919, p. 157). (R. D. O.)

SEITZ, KARL (1869–), Austrian politician, was born at Vienna on Sept. 4 1869, the son of a wood merchant. Left without parents at an early age, he grew up in an orphanage, and, after completing his course in the public elementary school, began to learn the tailoring trade, until through the medium of patrons he was provided with a place in the teachers' seminary at St. Pölten. In this way he became an elementary school teacher. Originally inclined to the German National party, he joined in 1888 the Social Democratic party. He organized the Social Democratic teachers of Vienna, and in the Diet of Lower Austria waged a fierce fight against Burgomaster Lueger and the dominant Christian Socialist party. Elected to the Austrian *Reichsrat* in 1901, he became, after the death of Pernerstorfer, its vice-president down to its dissolution. After the revolution of 1918 he was president of the German-Austrian National Assembly, and subsequently of the national parliament (*Nationalrat*) until the new elections in Oct. 1920, and federal president until Nov. 1920. He was in 1921 chairman of the committee of the Social Democratic party and of the parliamentary party, and vice-president of the *Nationalrat*.

SELBORNE, WILLIAM WALDEGRAVE PALMER, 2ND EARL OF (1859–), English politician (*see* 24.599), on his return from the governorship of South Africa resumed his prominent position in the House of Lords. He took an active share in defending the House against Liberal attack, and was one of the leading "Die-hards" who maintained an uncompromising resistance to the Parliament bill. In regard to Irish Home Rule, he constantly pressed for a referendum to the people. As a former First Lord of the Admiralty, he contributed decisively to the condemnation passed by the House on the Declaration of London. When the World War came he was largely occupied with his military duties with the 3rd Battalion of the Hampshire Regiment; but he joined the first Coalition Ministry as Minister of Agriculture and Fisheries. As minister he appointed a committee of technical experts and practical agriculturists, under the chairmanship of Lord Milner, to report on the means of maintaining and increasing food production in England and Wales; but, fortified by the opinion of a Scottish committee appointed for the same purpose, he and the Government rejected the English committee's recommendation to guarantee farmers a minimum price of 45s. a quarter for the four years following the harvest of 1916. He preferred a plan for organization and coöperation through the county councils and the Board of Agriculture. In June of the following year he resigned his office because he disapproved of the Irish policy accepted by Mr. Asquith's Government as a result of Mr. Lloyd George's negotiations with Irish leaders. He did not join Mr. Lloyd George's Ministry, and after the war he was mainly conspicuous in ecclesiastical matters; he was forward in promoting the movement for self-government in the Church which culminated in the Church Enabling Act of 1919. His elder son, ROUNDELL, CECIL, VISCT. WOLMER (b. 1887), entered Parliament in 1910, and proved an active member of the Unionist party. A younger son was killed in the war.

SELF-DETERMINATION.—This phrase, defined in the Oxford *New English Dictionary* as "the determination of one's mind or will by itself towards an object," was used exclusively, from the 17th century to within quite recent years, as a synonym for "free will" in the individual person, as opposed to the determination of this will by God's predestination—the doctrine of Determinism. Thus John Scott, in his *Christian Life* (1683–6), speaks of "necessary agents, that have no Free-will or Principle of Self-determination," and Bishop Stillingfleet, in his *Origines Sacrae* (1662), of giving man "the freedom of his actions, and a self-determining power." The *New English Dictionary* fails to show any use of the phrase in earlier days in the sense in which it became widespread and familiar at the close of the World War, and it has been commonly assumed that it was a new word coined, or rather adapted from the Russian *Samo-obrazhenie*, to give convenient expression to the political principle for which the nations of the Entente were then supposed to be fighting, that is to say, the right of nations to determine their own allegiance and form of government. It had, however, been used in this sense even before the war. Thus in his article on ROME in the earlier volumes (11th edition) of this Encyclopaedia (a recension of the 9th edition article by Prof. H. F. Pelham) Prof. H. Stuart Jones, writing of the Roman provincial government, says that "nothing could compensate for the lack of self-determination" (*see* 23.653).

It was after the Revolution of March 1917 in Russia that "self-determination" as a political catch-word came into sudden prominence. On April 10 the Russian Government, then dominated by the Radical element under Kerensky, issued a statement which said, among other things, that "Free Russia does not aim at dominating other nations; . . . its object is to establish a durable peace on the basis of the rights of nations to decide their own destiny." The substance of this proclamation was at once condensed into the formula "self-determination, no annexations, no indemnities," which was to produce so profound, and in some ways so disastrous, an influence on the world-settlement which followed the war. The principle of self-determination had, indeed, already been laid down by President Wilson in his address to Congress of Jan. 22 1917. "No peace can last," he said, "or ought to last, which does not recognize and accept the principle that Governments derive all their just powers from the consent of the governed." The principle, and the words in which it is defined, are those of the American Declaration of Independence; it was not till a year later that President Wilson himself crystallized this principle in the word "self-determination" in the address to Congress of Feb. 11 1918, in which he defined the Fourteen Points; and on this occasion the phrase is still marked as a neologism by being printed between inverted commas. "'Self-determination' is not a mere phrase," he said; "it is an imperative principle of action which statesmen will henceforth ignore at their peril." Two months later, in his speech of April 6, the phrase had become, as it were, naturalized; he speaks of "the free self-determination of nations upon which all the modern world insists." The inverted commas no longer appear.

President Wilson has been blamed in certain quarters for his failure at the Peace Conference in 1919 to make the principle of self-determination the only basis of the ultimate settlement, for allowing the old diplomatic Adam too much say in the adjustment of national boundaries. In this respect the blame is not deserved; for he had early pointed out that the application of the principle must be conditional; the fourth of the "Four Principles" laid down in his speech of Feb. 11 1918 was "that all well-defined national aspirations shall be accorded the utmost satisfaction that can be accorded them without introducing new or perpetuating old elements of discord and antagonism that would be likely to break the peace of Europe and consequently the world." This is, of course, a serious limitation of the principle of self-determination in its practical application, since it involves a check upon this determination by an outside authority, which authority President Wilson defined as "the organized force of mankind"—embodied in the League of Nations—but which in effect has been, and always must be, those nations that are in a position to make their will prevail, whether inside or outside the League. In practice, then, self-determination has proved largely illusory. The Treaty of Versailles made advances towards the application of the principle, but these advances were tentative and timid. No transferences of territory of the first importance—such as those of Alsace-Lorraine to France or of Posen and West Prussia to Poland—were made subject to plebiscites. In the treaty with Germany plebiscites were prescribed in the cases of the districts of Allenstein and Marienwerder, of Upper Silesia and of North Schleswig, and negative plebiscites in the case of Eupen and Malmédy. In the Austrian treaty plebiscites were prescribed in the cases of Klagenfurt and Teschen, but it was only in the former case that a popular vote was actually taken. A plebiscite was refused in the case of Western Hungary, transferred to the Republic of Austria under the name of Burgenland. The case of East Galicia was left open, and so remained in 1921. Experience in the case of Upper Silesia abundantly proved the wisdom of thus limiting the right of self-determination. Plebiscites had worked smoothly enough in the case of fairly homogeneous areas defined by ancient boundaries, as in Avignon in 1791 and Savoy and Nice in 1860; they are altogether another matter in districts inhabited by mixed populations divided by bitter national jealousies. The method proved in any case to be costly and dilatory. In large areas it involved an extensive military control which the victorious Allies were unable to provide, while it was impossible to set up provisional governments to supervise the partition of areas over which they exercised control.

The experience of the diplomatists at Versailles has then, if properly studied, great value as a corrective to the dreams of idealists who persist in building theories for an imaginary world. But, apart from this experience, it is certain that the principle of self-determination could not be universally applied without overthrowing all that remains of the world's order. Yet the principle remains, in spite of disillusionment, a powerful solvent of established bodies politic, and it is therefore still important to understand its implications. The phrase "the self-determination of nations" is widely accepted as the expression of a principle as clear as it is just. So far as the meaning of self-determination is concerned, it is indeed clear enough. What is not so clear is what is meant by a "nation." This is a subject round which interminable discussions have centred, and which must be examined if the full implications of the principle of self-determination are to be realized.

Definition of Nation and Nationality.—Legally defined, a nation is the aggregate of the subjects or citizens of a particular sovereign state, and nationality is the quality of such subjection or citizenship. But the word "nation" has also a wider meaning, which the *New English Dictionary* embodies in the following inclusive definition:—"A nation is an extensive aggregate of persons closely associated with each other by common descent, language, or history, so as to form a distinct race or people, usually organized as a separate political State and occupying a definite territory." This definition is open to criticism, as involving some confusion of thought: and this confusion is not made less confounded by the definition of "nationality" as primarily synonymous with "nation" but "frequently a people potentially but not actually a nation," while a "people" is defined as "a body of persons composing a community, tribe, race, or nation."

The truth is that the vagueness of our terms reflects the vagueness of our ideas about a problem the intricacies of which we have only recently been called upon to unravel. No satisfactory definition of the word "nation" is possible because, save in its legal sense, it conveys no definite idea; and the same is true of the word "nationality." Yet a clear definition is the essential preliminary to any fruitful discussion. It is proposed then, for the purposes of the present argument, to use the word "nation" in the sense of "the sum of people constituting a sovereign and independent body politic," the Latin *populus* as distinguished from *natio*. The word "nationality" it is proposed to deprive of its legal connotation, and to define a nationality as "an extensive aggregate of persons conscious of a community of sentiments, experiences, or qualities which make them feel themselves a distinct people." The various elements that produce this consciousness will be discussed later. They have an important bearing on the practical problem which was only very imperfectly solved by the Treaty of Versailles, namely, the problem raised by the claim of nationalities, thus defined, to become nations. The complexity and perils of the issues involved in this claim may be illuminated by the fact that, even now, in the actual polities of the world, nationalities and nations nowhere coincide. It remains, therefore, of great importance to determine what are the essential qualities of nationality and what are its necessary relations to the conception of the state.

Theories of Nationality.—On few subjects has there been so great a difference of opinion as on the question of what constitutes nationality. Fichte explained it, in terms of his transcendental philosophy, as a thing divine and spiritual, a manifestation of the mind of God revealing itself in the national soul. So, too, for Mazzini, the prophet of the Italian *risorgimento*, nationality was a thing sacred, not to be profaned by a cold analysis of its elements, but believed in and suffered for as a prime article of faith—the "faith in liberty"; for him the map of Europe would have to be redrawn on national lines as the necessary first step towards "the universal association of the human race."[1] No student of the history of the rise of nationalities during the last hundred years will underrate the part played by such prophets as these. Yet their enthusiasm by itself explains nothing and would have achieved nothing; it is like fire, itself a subtle and mysterious element, which yet needs very material fuel to feed its destructive and creative force. The explanation of the phenomena of nationality, as other thinkers have realized, must be sought, not in the region of metaphysics, but in that of observed facts.

If we analyze the composition of the several nationalities, we find these elements: race, language, religion, common habitat, common conditions, mode of life and manners, political association. These elements are, however, never all present at the same time, and none of them is essential. Community of race, even where this is put in the forefront of the claim of nationality, is mainly a politic fiction, at least in countries of European civilization, in which the races are inextricably mixed up. Language, again, is as little as race the criterion of nationality, It may be, as Bluntschli says, the expression of a common spirit and of intellectual intercourse, and as such it may be brought powerfully to the aid of nationality, as in the case of the Czech language in Bohemia, or, still more strikingly, of the English language in the United States. But nationality and inherited community of speech are not identical. The Swiss are a distinct nationality, though they speak four different languages. Community of language, on the other hand, has not prevented the British and the Americans from developing different nationalities. Religion, too, has clearly no necessary connexion with nationality, though it has played a great part in creating and stereotyping nationalities, notably in countries of backward civilization, as in the Balkan peninsula or in Ireland. A common habitat and common conditions are doubtless powerful influences at times in determining nationality; but people have thus lived together for centuries without developing a national consciousness, and in many cases—notably in the east of Europe—they have evolved separate national consciousnesses in spite of a common habitat and common conditions. As for manners and mode of life, these are apt to raise stronger barriers between classes than between nationalities. Lastly, political association, though—as in the case of the Swiss—it sometimes encourages the spirit of nationality, is more often its result than its cause.

All these elements, then, may or may not contribute towards the formation of a nationality, but when we have summed them up we are no nearer to a solution of the problem of its formation. Some theorists seek this solution in a psychological process. "A nationality," says Bluntschli, "only comes into being slowly, by a psychological process which gradually produces in a mass of men a distinctive form of existence and community of life, and stereotypes these as the inheritance of the race."[2] For him time, and a tradition of many generations, are the essential conditions. This may be true of the evolution of new nationalities; it is not true of the creation of a new sentiment of nationality in even large masses of persons. It is, for instance, the boast of the United States that they have been able to absorb annually some million of alien immigrants, and that one generation has usually sufficed to give them not only the name but the full sense of American nationality. The "psychological" element, indeed, may be admitted, but it does not explain the whole of the phenomena nor the ultimate driving force, so to speak, of nationality.

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[1] *Scritti* (18 vols., Milan-Rome, 1861–91), viii., 205; xi., 181, 243; xii., 245. Mazzini avoided the practical problem involved in the reconstruction of Europe on national lines by saying that it was sufficient to indicate the "large lines," and "to leave details to the future and to the votes of the peoples" (x., 137). His own plan of reconstruction included the restoration to Poland of the frontiers of 1772, and the setting up of a Bohemian-Moravian-Hungarian federation. As Signor Salvemini (*Mazzini*, 1920) points out, "the 'design of God' was not quite so clear as Mazzini believed."

[2] *Lehre vom modernen Staat* (5th ed. of *Allgemeines Staatsrecht*, 1875), i., p. 92.

The German historian Karl Lamprecht came nearer the truth when he added another element, the economic, as the creative force in the evolution of nationality. Like Bluntschli, he found a general law for this evolution in the development of the *Volksgeist*, but he explains this development by changes in economic conditions. Nationality, that is to say, is but a manifestation of the instinct of men to group themselves for the defence of their common interests, and it follows that the groups thus formed tend to shift and change with the ebb and flow of the economic struggle for existence. This view, which—if it be sound—obviously conflicts with the belief that the triumph of the principle of self-determination would bring permanent peace to the world, was elaborated by the Austrian Socialist Otto Bauer, in his *Nationalitätenfrage*, with special reference to the nationality question in the former Habsburg Monarchy. "It is," he said, "the battles of the economic classes, everywhere active, the changes in the means and the conditions of work which determine the strength and weakness, the death and rebirth of nationalities." The determining factors of nationality in Austria-Hungary—which for the purpose of this study might be considered the laboratory of Europe—he declared to be not cultural but economic. The mass of men, the peasants and the labourers, are incapable of that consciousness of a widespread, common, inherited culture which is supposed to be the hallmark of nationality; but they are dissatisfied with their lot, resentful of the dominant powers whom they hold responsible, and ready therefore to group themselves against them.

This revolutionary tendency, which among the lower classes of the dominant races is anti-national and cosmopolitan, is apt among subject races to express itself in *nationalism*. The process was strikingly exemplified in Bohemia, where the flood of Czech nationality followed the channels opened up by industrial change, and German nationality succumbed not so much to cultural as to economic pressure. Before the World War the same process was taking place in all the eastern marches of Germany—in Silesia, in Posen, and in East and West Prussia, in which for years past the German element had been succumbing to the irresistible flood of Polish nationality, of which the unifying force was the economic opposition of the Slav proletariat and peasantry to the German capitalist and governing classes. The same phenomenon is apparent in the case of Ireland. The idealists of Sinn Fein never succeeded in inspiring the shrewd peasantry with their own enthusiasm for their "Milesian past"; the use of the renovated Gaelic language remained a conceit of the "intellectuals" of the cities; and the labourers and peasants were won to the Republican cause by a frank appeal to their economic interests—the promise of small holdings and of freedom from war taxation and the burden of the national debt.

It is then clear that there is an economic basis for nationality, and that, whatever other elements may enter into it, a sense of community of material interests is always present. It may be added that this sense is the strongest and most essential factor, and that without it nothing else will serve to maintain the common sentiment. Common origin, common language and a common tradition of culture and laws will not preserve the unity of a nationality when the material interests of its parts come into violent conflict. This truth received its most momentous illustration in the secession of the southern states of the American Union in 1860–1 and the bitter struggle that followed. The principle of state sovereignty and independence on the one side, and that of American national union on the other, did but disguise the true causes of the struggle, which were less political than economic; the agricultural south was determined to preserve its economic system, based on negro slavery; the industrial north was primarily inspired, not by any abstract love of coloured humanity, but by the economic objection of the labouring masses to the slave system.

Relation of Nationality to the Nation or State.—In considering the relation between the idea of nationality and that of the state we are apt to be confused by the romantic and idealistic tinge given to the idea of nationality by the poets and philosophers of the struggles for freedom. A nationality, conceived as something divinely inspired, is believed to have not only the capacity but the right to become a nation, and its legitimate growth to be necessarily stunted if it be prevented from doing so. Bluntschli, for instance, described a nationality as an incomplete organism which could only become completed as an effective "personality" by political organization as a nation or state, and some such idea underlay the Liberal enthusiasm for that "principle of nationalities" which during the last hundred years has so profoundly changed the map of the world. But when we come to examine this principle, as stated by its most conspicuous champions, we find no clear conception of what it ultimately involves, while the main question—of what constitutes a nationality—is consistently begged. The late M. Émile Ollivier, for instance, defines the principle of nationality (and incidentally of self-determination) as follows:—

> This principle is that every association of men called a people is an independent individuality; free, sovereign, enjoying the imprescriptible right of self-determination (*de disposer d'elle-même*) both in internal and external affairs.[1]

If the word "people" be taken in its usual non-political sense, this statement was, and remains, obviously untrue, or represents at most an aspiration; if it means a *nation*, then the principle as here defined is merely that of the sovereign independence of nations, *i.e.* states, which has always been a fundamental doctrine of international law; it is, that is to say, a conservative, not a revolutionary principle. But this is not what M. Ollivier meant by it. For him, as the apologist of the Liberal Empire, the principle of nationality was dynamic, not static; it involved a regrouping of the nations, not—as Alexander I. of Russia had once proposed—by the formation from above of homogeneous populations fenced off by their natural boundaries, but by the free vote of the people concerned—the Napoleonic plebiscite. This principle of nationalities, he says in his *L'Empire libéral*, is to be carefully distinguished from the theory of great agglomerations, the natural limits of the race, for race has nothing to do with it:—

> In the politics of nationality there are no natural frontiers. The true frontiers are those fixed by the will of the populations. The idea of race is barbarous, exclusive, retrograde, having nothing in common with the large, holy, civilizing idea of country (*patrie*).

Renan, in his *Qu'est-ce qu'une nation?* comes to much the same conclusion. A *Zollverein*, he says, is not a *patrie;* a nation is a grand aggregation of men with a moral conscience which causes them to sacrifice their individual interests to those of the community; wherever the existence of such a moral conscience is proved a nation exists as of right. "If there is any doubt as to its frontiers, consult the populations in dispute."

This solution of a difficult problem would be admirably easy were the rivalries of nationalities confined to the frontiers of states, which we have the best reason to know they are not, and were these frontiers themselves a mere question of marks on the map. But in any case, as Herr Bauer points out, this "psychological-voluntarist" theory begs the whole question of nationality, for it does not explain the factors that determine the will of populations to form a nation or to attach themselves to a nation already formed—supposing they are conscious of possessing a choice. It does not, that is to say, give us the real connecting link between nationality and the state, nor does it explain why in the 19th century, for the first time, nationality was erected into a *Staatsprinzip*.

Historically it seems clear that the explanation is at least largely economic. It may be true that a *Zollverein* does not constitute a *patrie*, but the experience of Germany proved that it may be a powerful element in the constitution of one. It was not enthusiasm for the abstract rights of man which bound together the old provinces of France in a sense of common nationality; it was the economic gains of the Revolution, the creation of a prosperous nation of *bourgeois* and of peasant proprietors, that made the *patrie*. It needed the passion of Mazzini and Garibaldi for an ideal Italy to rouse the Italians to throw off the yoke of an oppressive and alien system, but it was the long prosaic labours of Cavour that laid firmly the economic basis of Italian unity. Instances, indeed, might be multiplied to show that, whatever may be the constituent elements of nationality, it is only a strong sense of common material interests that can create and maintain a nation. It is certainly no mere coincidence that the development of the principle of nationality during the 19th century kept pace with the vast economic changes produced by the industrial revolution.

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[1] *L'Empire libéral*, i., p. 164.

The factor of sentiment is not, of course, excluded; but the sentiment of nationality is not a thing apart, or especially holy. It is, as Mr. A. J. Balfour has pointed out, but one of a group of such sentiments for which there is no common name. Man is a gregarious animal; he has the group instinct; and this implies also the instinct of self-sacrifice for the sake of the group—*esprit de corps*, the civic sense, local or national patriotism. All human associations are directed to some common good, and from the point of view of the group sentiment it matters little how this good is conceived—whether as material or spiritual. A trade union is an association for a purely economic purpose; but it demands self-sacrifice on the part of its members, and it certainly develops a strong sense of *esprit de corps*. To say, then, that the strongest and most permanent bond of a nation is the sense of common interests is not to belittle the value of loyalty to a national cause.

The modern world has become so accustomed to hearing of nationality as the basis, or the only sound basis, of the state that it is apt to forget how very recent is this conception, which for many people is rooted in the very nature and justice of things. The sentiment of nationality is of course very ancient; it is indeed (as the Latin word *natio*, from *nasci*, "to be born," implies) a natural development of the sentiment of the family and the tribe. But this sentiment was, until comparatively recently, not consciously associated with any conception of the state as we understand the term. The ancient Greeks were strongly conscious of their common Hellenism, but their political unit was the city state; there was a Greek people, but no Greek nation. The Roman Empire, which, as it were, flattened out national differences throughout the civilized world, was in essence the expansion of the city state; it was in no sense "national," even from the point of view of the Romans. The Middle Ages, which inherited the Roman tradition, recognized nationality, but not as the constituent principle of bodies politic. The voting in general councils of the Church was by "nations," but these had so little to do with the conception of states that it was not until the Council of Constance, in 1414, that a fourth nation was added to the Italians, the French and the Germans—the English, who had hitherto been included among the Germans. Yet so early as the 11th century the poet of the *Chanson de Roland* celebrates "French" valour and puts into the mouths of his warriors praises of "sweet France," and in the next century the German minnesingers are denouncing "welsh" arrogance and exalting German nationality. Yet there was no such thing as a national state, the root reason being that the material basis of society was feudal, that is to say, determined by the ownership of land—the only stable form of wealth then existing—and by an elaborate system of reciprocal services and obligations which took no account whatever of the frontiers of nationality. With the growth of the fenced cities, and of the commerce of which they were the centres, the feudal system gradually decayed. But the monarchies which rose upon its ruins had still for the most part a purely territorial basis, and so continued as long as landownership gave the strongest title to wealth and power, that is to say, until the beginning of the 19th century. The industrial revolution, with the vast impetus it gave to international commerce and the new self-conscious classes it created, sapped their foundations. Artificial boundaries became a nuisance, and the German *Zollverein* was the beginning on a large scale of a process of economic concentration, segregation and exclusion which has continued ever since, and is likely still to continue. To say that it is economic pressure which has largely determined the formation of nations is not to pretend that the economic vision of peoples is always clear. The group instinct sometimes defeats its own ends. The disappearance in 1918, for instance, of the last of the great purely territorial monarchies, Austria-Hungary, destroyed an economic unit of the greatest importance to all its constituent countries. It used to be said that if Austria did not exist, Austria would have to be created. This was from the political point of view. From the economic it was true still.

National Expansion.—"If men had any strong sense of the community of nations," says Bertrand Russell, "nationalism would serve to define the boundaries of the various nations. But because men only feel community within their own nation, nothing but force is able to make them respect the rights of other nations, even when they are asserting similar rights on their own behalf" (*Principles of Social Reconstruction*, p. 33). The truth of this is revealed in the whole history of the last hundred years. The Magyars, after securing their own liberty by a gallant struggle, proceeded to force their own national ideals on the races subject to them. The Germans, welded into a great nation by "blood and iron," embarked on a policy of conquest beyond their own borders. The Italians, when they had liberated themselves from the Germans, aimed at recapturing the "national frontiers" of Italy, though this involved the attempt to absorb alien populations, and even began to dream of reëstablishing the Mediterranean empire of Rome. The Poles, reunited after a century and a half of agony, scarcely waited for the ink on the Treaty of Versailles to dry before starting on the great adventure of reconquering their frontiers of 1772. Even Bolshevist Russia, wicked fairy godmother of the bantling "self-determination," showed little disposition to allow her outlying provinces to determine themselves. The Sinn Feiners in Ireland passionately claimed self-determination for themselves, but equally passionately resented its application to the solid minority in Ireland concentrated in north-east Ulster when they too demanded it.

All this, though lamentable from the point of view of self-determination considered as an instrument of peace, is merely the natural outcome of this principle considered as the expression of group selfishness. If the national group is bound together by a vivid sense of common and exclusive interests, sooner or later it will seek to expand, if it is a healthy organism and thus subject to the ordinary laws of growth. German political theory before the World War conceived of the national group as such an organism, and as subject to the universal law of the struggle for existence and the survival of the fittest. "A cessation of growth," said Paul Rohrbach in his *Der Deutsche Gedanke*, "would be for us a catastrophe both internal and external, for under our present conditions it could not possibly be natural or voluntary, but would only happen when another people or combination of peoples should hurl us to the ground in such a way as to make us infirm for a long while to come." "In every great nation," he says again, "the instinct of self-preservation reveals itself in the form of a natural pressure to expand, which only finds its frontiers where it meets other national-political counteracting forces strong enough to resist it." From the ideal point of view this "doctrine of conquest" is, of course, wholly evil and misguided. From the strictly scientific point of view, judged that is to say by the experience of the past and even of the last few years, it must at least be treated with respect. To this world-old doctrine of conquest, reinforced by the new spirit of national exclusiveness, the new doctrine of democratic self-determination, combined with a new organized spirit of international good-will, is prescribed as an antidote. How far is it likely to prove effective?

Self-determination and Peace.—The advantage of the old unnational conception of the state was that it offered no rigid barriers to the economic expansion of the nationalities, in so far as these existed outside the political sphere, the overflow of a nationality in one state percolating, or occasionally flooding, into another without any sense of inconvenience to the state invaded, which merely received a very often welcome addition to the number of its subjects. In the days before the industrial revolution these transferences of population were, indeed, more often determined by other than economic causes. Thus in the 17th century some 30,000 Slav and Albanian families migrated into the Habsburg dominions, Slavonia and southern Hungary, in order to escape the fury of the Turks; Flemish and French Protestants fled in thousands to the British Islands; and the Electors of Brandenburg peopled their waste spaces with Huguenot refugees from France and Protestant refugees from southern Germany. In the industrial age the migrations took another form. German industrial expansion demanded a vast supply of cheap labour, and this was provided by a mass immigration of Slavs, which created misgiving even when the German Empire was supremely powerful.[1] Little misgiving was created, on the other hand, by the still vaster immigration of all the less developed nationalities of Europe into the United States and, later, into the British Dominions. The process, indeed, was in itself unobjectionable so long as the migrating masses carried with them no conscious sentiment of nationality in a political sense, and no claim to assert themselves as separate entities, *i.e.* so long as allegiance was conceived as due not to the nationality but to the state. It is quite another thing when, under the principle of self-determination, the balance of nationalities in any given state becomes a matter of vital importance to the state itself. The Emperor Leopold I. would hardly have given special privileges to the Slavs who sought refuge in his dominions had he foreseen that this migration would lead, some 200 years later, to the downfall of the Habsburg Empire and dynasty. The danger of similar consequences is increased when the constitution of the state itself is made dependent upon a popular vote, and all the signs point to the fact that self-contained nations will no longer permit promiscuous immigration—the United States has set the example by "tightening up" its immigration laws—and will be increasingly intolerant of national divergencies within their own borders. The effect of the principle of self-determination, logically applied, would therefore be to establish the nationalities as jealously segregated nations, probably surrounded by tariff walls, certainly defended against dangerous infiltration of alien elements from without by rigid rules as to naturalization, and earnestly bent on reducing all within their borders to the same national model. The danger to peace of attempting to confine the expansive forces of nationalism within such artificial limits is obvious, and the danger will not be avoided by the creation of an international force, such as the League of Nations, charged with the duty of preserving the *status quo* or of readjusting it according to the ebb and flow of the national life of the several communities; for the pressure of the forces of expansion of vigorous nationalities, artificially restrained, would blow the League to pieces.

It may be that the economic development of the world, by increasingly demonstrating the interdependence of nations, will reduce the sentiment of nationality to the position it occupied during the long ages when it was not the basis of the state, still less an intolerant crusading power. But the World War at least proved that the international movement associated with labour, disfigured as it was by its insistence on the necessity of a new form of war—that of class against class—was powerless against the passion of nationality. The true hope of peace for the future lies in the recovery by the world of the idea of the state, whatever form it may take, as a thing apart from and above the idea of nationality and infinitely tolerant of national divergencies. It is the ideal towards which the British Empire has been consistently tending. The ideal League of Nations will be some such loose confederation, embracing all the world, of which each constituent state, while guarding its own interests, will realize that these interests are bound up with those of the totality of states. For such a universal union, however, the world is not ripe; for there are peoples who are not yet capable of self-government, and will only become so, if ever, by a long process of education. To talk of self-determination for such peoples is a mockery. It is also a wrong; for, as Senator Elihu Root wisely said with reference to the Philippines, "the right to government is prior to the right to self-government."

See W. Alison Phillips, "Europe and the Problem of Nationality," *Edinburgh Rev.* for Jan. 1915, of which parts are incorporated in the above article; J. W. Headlam-Morley, "Plebiscites," *Quarterly Rev.* for July 1921 (No. 468); Sarah Wambaugh, *A Monograph on Plebiscites, with a collection of Official Documents* (1921); *Plebiscites*, vol. xxv. of the Peace Handbooks issued by the Historical Section of the Foreign Office (1920); *A History of the Peace Conference of Paris*, edited by H. W. V. Temperley (3 vols., 1920). Among more modern foreign works on the subject are Schallmeyer, *Vererbung und Auslese im Lebenslaufe der Völker* (1903); Kirchhoff, *Zur Verständigung über die Begriffe "Nation" und "Nationalität"* (1905); Otto Bauer, *Nationalitätenfrage und die Sozialdemokratie* (1907). (W. A. P.)

SELOUS, FREDERICK COURTNEY (1851–1917), English explorer (*see* 24.614), in 1909 organized Mr. Roosevelt's hunting expedition in East Africa, and in 1910 represented Britain at the Congress of Field Sports held at Vienna. In Aug. 1914 he offered his services to the War Office, but they were declined on account of his age (he was over 62). Persistence, however, gained him a subaltern's commission (Feb. 1915) in the Legion of Frontiersmen (25th Fusiliers) and he reached Mombasa in May following. Selous took part in many engagements in the East African campaign, was promoted captain and (Sept. 1916) given the D.S.O. He was killed in action at Beho Beho on Jan. 4 1917 (a year after his eldest son had been killed on the western front). His private collection of trophies was given by his widow (Mary Maddy, whom he married in 1894) to the Natural History Museum, London, where in June 1920 a national memorial to him was unveiled—a bronze half-figure by W. R. Colton—a Selous scholarship being also founded at his old school, Rugby.

See J. G. Millar's Life of *Frederick Courtney Selous* (London 1918), and *Geog. Jnl.*, vol. xlix. (1917).

SENUSSI AND SENUSSITES (*see* 24.649).—The military activity of the Senussi from 1900 to 1910 had been directed against the advance of the French in the regions bordering the Sahara between Lake Chad and the Nile basin. There was evidence of an increase of adherents to the sect in Egypt and in Arabia; in N.W. Africa and in the Anglo-Egyptian Sudan Senussiism made practically no headway.

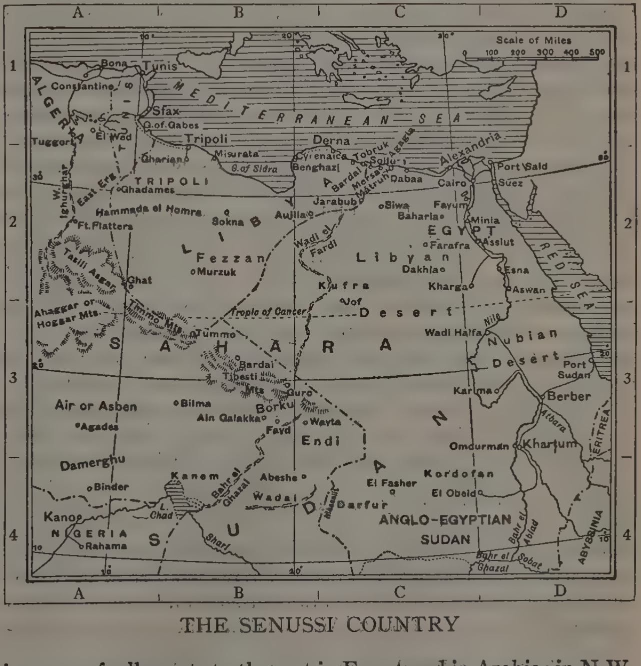
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Port Said
Cairo
Suez
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Sokna
Aujila
Jarabub
Siwa
Baharia
Fayum
Minia
EGYPT
Assiut
Farafra
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RED SEA
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Tropic of Cancer
Tummo Mts.
Tummo
SAHARA
Nile
Wadi Halfa
Nubian Desert
Port Sudan
Bardai
Tibesti Mts
Guro
Borku
Karima
Berber
Air or Asben
Bilma
Ain Galakka
Fayd
Wayta
Agades
Endi
Atbara
Omdurman
Khartum
ERITREA
Damerghu
Kanem
Bahr el Ghazal
Abeshe
Wadai
Kordofan
El Fasher
El Obeid
Binder
Darfur
ANGLO-EGYPTIAN SUDAN
Kano
L. Chad
NIGERIA
Rahama
SUDAN
Shari
Bahr el Abiad
Bahr el Ghazal
Sobat
ABYSSINIA

THE SENUSSI COUNTRY

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[1] See a remarkable series in the *Frankfurter Zeitung* in 1911.

Activity in Cyrenaica.—While continuing hostilities against the French, the Senussi sheikh Sayed (Sidi) Ahmad esh Sherif in 1911 aided the Turks in Cyrenaica, then commanded by Enver Bey (later Pasha) in the campaign against Italy. The traditional policy of the Senussites was one of suspicion in regard to the Turks but they had been won over by Pan-Islamic propaganda. By the Treaty of Lausanne, Oct. 1912, the Turks agreed to evacuate Tripoli and Cyrenaica. At that time the Italians held only the chief seaports of Cyrenaica, the rest of the country being in the military occupation of the Senussites and their allies. Sidi Ahmad continued the war with Italy, aided by a body of Turkish troops, which, contrary to treaty engagements, remained in Cyrenaica. The Italians devoted their attention to the occupation of the hinterland of Tripoli (including Fezzan), a process completed in Aug. 1914. In Cyrenaica they remained mainly on the defensive. General Ameglio, appointed governor of Cyrenaica towards the end of 1913, had however begun a vigorous campaign against the Senussites, when in Feb. 1914, in consequence of the threatening situation in the Balkans, orders were issued from Rome to suspend operations.

When the World War began, and while Italy still remained neutral, Turkish agents, with German support, sought to make Cyrenaica and Tripoli bases of action against the French and British. To the tribes which rose in revolt in Tripoli and its hinterland the Senussites gave some support, but Sidi Ahmad, through the intermediary of chiefs friendly to Italy, was conducting unofficial negotiations, and had the Italians been willing to acknowledge his independence an accommodation with them might have been reached. He refused however to accept the position of "a protected Bey." By the spring of 1915 he was again attacking Italian posts. Strong efforts had been made for some time by the Turks and their German advisers to induce the Senussites to invade western Egypt; a special Turkish mission now visited Sidi Ahmad and endeavoured to get him to proclaim a *jihad*. The Senussi sheikh was disinclined to take the advice offered him. The Senussites had always maintained good relations with Egypt—for much of their trade they were dependent upon the good-will of the Egyptian authorities. It was the demonstration that the Turco-Germans could give him substantial military and financial aid which finally changed Sidi Ahmad's views. A large number of Turkish officers and some Arabic-speaking German officers from the German garrison at Constantinople were smuggled into Cyrenaica, a matter of little difficulty. Among the arrivals was Nuri Bey, a half brother of Enver Pasha who exercised much influence. Nuri was joined in April 1915 by Gaʽfar Pasha, an Europeanized Arab of considerable ability, and with and after Gaʽfar came arms, ammunition and other stores, including wireless and telephonic apparatus.[1] By Aug. 1915 the Germans were using the landing places between Sollum and Tobruk as submarine bases. The time for putting the Turco-German plans into operation was approaching. These plans were, mainly through Senussite instrumentality, to threaten at once French north and central Africa, Nigeria, Egypt and the Anglo-Egyptian Sudan. It was also designed to penetrate to Cameroon and establish land communication between the Mediterranean and the Gulf of Guinea. The German Emperor, as "Islam's Protector," exhorted Sidi Ahmad to "expel infidels from territory which belonged to true believers." But besides the Senussi sheikh the only important chief won over to the cause was ʽAli Dinar, Sultan of Darfur, a tributary state of the Anglo-Egyptian Sudan, and the plan failed.

French determination to secure their position in the central Sudan contributed largely to the localization of the conflict. In 1909–10 the French had conquered Wadai (*see* 28.225), which adjoins Darfur, thereby withdrawing from the Senussite sphere a country in which they had been all powerful. In 1913, pushing N. from Kanem into the Saharan borderland, Colonel Largeau conquered Borku, capturing ʽAin Galakka, the Senussite southern base, in November, of that year. In the middle of 1914 Bardai, the chief settlement in the Tibesti highlands, was occupied.[2] These newly conquered regions on the southern fringe of the Libyan Desert were placed under the control of Lt.-Col. J. Tilho. Though risings against their authority by chiefs acting on Senussite instructions, and raids by nomads continued up to the early months of 1917, the French posts formed an effective barrier against any Senussite advance into central Africa.

Campaign in Western Egypt.—Since May 1915 the danger of a Senussite invasion of western Egypt had existed. It was due to the great tact with which Lt.-Col. C. L. Snow,[3] who commanded the small force stationed in western Egypt, handled a very delicate situation that the rupture with the Senussites was delayed till Nov. 1915. At the last moment, early in November, a final effort was made to avoid a break, Sidi Mohammed el Idris, Senussite envoy in Egypt, being sent to Cyrenaica to arrange for the Senussi sheikh "to get rid of his Turkish advisers in return for a sum of money." It was too late; Sidi Ahmad was already well supplied with German gold as well as arms.

The enemy plan of campaign was to advance in parallel lines with two forces, one across the Libyan plateau,—a great limestone tableland—the other farther S. along the string of oases leading from Siwa to the Nile. Simultaneously the Sultan of Darfur was to rise in revolt, invade Kordofan and advance on Khartum. The plan was boldly conceived, but the danger to Egypt and the Sudan was not chiefly in the military force at the command of the Senussi sheikh and his allies. That danger lay in the spiritual authority exercised by Sidi Ahmad and the high prestige he enjoyed in Egypt. Many if not most of the 200,000 Bedouins of western Egypt were adherents of the Senussi sect and should the Senussi forces gain any striking success it "might lead to serious religious and internal disorders." So wrote Gen. Sir John Maxwell, then commanding the forces in Egypt, who added that the Senussi peril was his principal source of anxiety—not the Turkish attack on the Suez Canal.

The opening of the campaign was accompanied by great activity by German submarines off the Cyrenaican coast and in the Gulf of Sollum; among the boats sunk were the British auxiliary cruiser "Tara" and the horse transport "Moorina." Survivors of the crews were handed over to the Senussi and suffered great privations (Cyrenaica is a very desolate country and the Senussites themselves were often short of food). Land hostilities began on Nov. 15 but in view of the isolation and smallness of the Egyptian garrisons at Sollum and other advanced posts they were withdrawn, and a stretch of country 200 m. or more in length was at once overrun by the Senussites. They advanced as far as Dabya (90 m. W. of Alexandria and the terminus of the railway along the coast), sweeping past, but not attacking Mersa Matruh, the chief port of western Egypt and reached by boat from Alexandria in 12 hours. This port was made the base for the British operations.

General Maxwell's endeavour, in view of the internal situation, was to avoid anything in the nature of a reverse, to keep the enemy as far as possible from the Nile valley, and, as soon as possible, to strike a decisive blow at the Senussi and by his defeat to diminish his influence as a spiritual potentate. These aims were achieved, but at the outset the difficulty was to get together a force strong enough to undertake operation. In Aug. 1915, when the situation on the western Egyptian frontier became critical, the Gallipoli campaign was being vigorously prosecuted, while the Turks had again advanced towards the Suez Canal. When the Senussi invasion occurred the decision to evacuate Gallipoli had not yet been taken, while the British Government had just committed itself to the Salonika campaign. In these circumstances Sir John Maxwell had to content himself with collecting a "scratch" force to oppose the Senussi. The strength of the Senussi is conjectural. The Turkish troops with them may have numbered 1,000; the *Muhafizia* or Senussite regulars were perhaps 5,000 strong. In addition there was an irregular body of tribesmen, Arabs and Arabized Berbers, probably numbering 20,000, all well armed and accustomed to desert warfare, but undisciplined and untrustworthy. The Senussites were well supplied with rifles and small-arms munitions; they had field guns and machine-guns; they had an ample camel transport and many of their troops were well mounted. With them were about 100 Europeans; Ga'far Pasha was commander-in-chief, and was accompanied by Sidi Ahmad and Nuri Bey.

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[1] The German political agent was a certain Mannismann, who after the defeat of Sidi Ahmad endeavoured to persuade the Senussites to continue the war. He was attacked and killed in the desert by tribesmen hostile to Ahmad.

[2] Turkish troops had occupied Tibesti in 1910 and Borku in 1911. They were recalled at the outbreak of the war with Italy.

[3] Col. Snow was killed in the first action (Dec. 11 1915) by an Arab whom he was endeavouring to persuade to surrender. He had served over 20 years in the Egyptian coastguard and was intimately acquainted with the desert tribes.

Through bad leadership, or from other causes not explained, the Senussi offensive was not carried out as planned. When the advance across the Libyan plateau was made, Siwa oasis was also occupied; but no further progress towards the Nile by that route was then attempted. Moreover, 'Ali Dinar of Darfur, who had formally renounced his allegiance to the Sudan Government in April 1915, while preaching a *jihad* and indulging in abusive letter writing,[1] did not carry out his threat of invasion. Thus at the outset the British had to deal only with the enemy advance along the Mediterranean coast.

Orders for the formation of a Western Frontier Force were issued on Nov. 20. Maj.-Gen. A. Wallace, who was given the command, took up his headquarters at Matruh on Dec. 7. His troops consisted of Yeomanry, Territorials, Australians, New Zealanders, Indians and Egyptians, with a squadron of armoured cars and a squadron of aeroplanes. The striking force was a composite mounted brigade under Brig.-Gen. J. D. T. Tyndale Biscoe and a composite infantry brigade under Brig.-Gen. the Earl of Lucan. "Regiments and staff had been collected," wrote Sir John Maxwell, "somewhat hastily. . . . The composite yeomanry brigade contained men from 20 or more different regiments. . . . It was not until the middle of Feb. (1916) that the condition of the Western Frontier Force could be considered really satisfactory."

The Senussites were engaged on Dec. 11 and 13 in the neighbourhood of Matruh with indecisive result. Having received reinforcements, General Wallace again engaged the enemy, on Christmas Day, at Gebel Medwa, a few miles from the coast. The Senussites, severely handled, retreated to Halazin (officially misspelt Hazalin), 25 m. S.W. of Matruh. Torrential rains now interrupted operations; in any case General Wallace was too weak to resume the offensive until further reinforced. The first of these new reinforcements consisted of the 2nd Regt. of the 1st South African Infantry Brigade, which disembarked at Matruh on Jan. 20 and 21, 1916. They were the first S. Africans from the Union to take part in the war outside the limits of S. Africa.[2] On Jan. 23 the Senussites were attacked at Halazin and after an eight-hours' stubborn engagement were defeated and fled. The country had been turned by the rains into a quagmire and mud played an important and unfortunate part throughout. General Wallace's successes now induced many of the Egyptian Bedouin (mostly the Walad 'Ali tribesmen) to desert the Senussi cause. Wallace had been tied to his base at Matruh by lack of sufficient camel transport, but by February this difficulty was overcome and the force had been further strengthened, partly by more South African infantry. The time for a real offensive had come. At this period General Wallace resigned and was succeeded by Maj.-Gen. W. E. Peyton (Feb. 9 1916).

On Feb. 20 General Peyton sent forward a force under Brig.-Gen. H. T. Lukin (commander of the 1st S. African Inf. Brig.) with orders to take Barrini, 50 m. E. of Sollum. On the 26th an engagement was fought at Agagia, in which Ga'far Pasha attempted to carry out his favourite manœuvre—an enveloping movement. This movement was checked, the infantry pressed forward and after a two-hours' struggle the Senussites were compelled to evacuate their position. The yeomanry were then sent in pursuit, and the Dorset Regiment (under Col. H. M. Souter) in a fine charge broke into the enemy lines and captured Ga'far Pasha.[3] Nuri Bey took over the command of the Senussi forces, which offered little further resistance. Two British columns advanced on Sollum, which was reoccupied on March 14. Sollum is close to the Cyrenaican frontier and into Cyrenaica, that is into Italian territory, Nuri Bey and his forces retreated after blowing up their main ammunition dump. General Peyton did not further pursue Nuri, but on March 17 a squadron of armoured cars, under Major the Duke of Westminster, raced 120 m. across the desert and rescued the survivors—some 90 in number—of the "Tara" and "Moorina." Shortly afterwards General Peyton's force was reduced, the S. Africans leaving in April for France.

Sidi Ahmad had been with Ga'far Pasha until the end of Jan. 1916. He then went to Siwa and began the advance along the oases that lead to the Nile. The advance came too late to be effective, but on Feb. 11 Senussites occupied Baharia oasis, some 100 m. from the fertile and densely peopled districts of Fayum and Minia. Before the end of February the Senussites had also occupied the more southerly oases of Farafra and Dakhla. Thereupon the Egyptian officials were withdrawn from Kharga (the Great Oasis), which is connected by railway with the Nile valley, and the Senussites proceeded to occupy it. The strategical importance of the oases is great, but having no troops available for an offensive in S.W. Egypt, General Maxwell took defensive measures only. A command under Maj.-Gen. J. Adye patrolled the region from the Fayum to Assiut and Esna. The oases were kept under constant observation by aeroplanes, and the Senussites did not emerge from them. After the complete defeat of their northern force they abandoned Kharga, which was reoccupied by the British on April 15 1916. Gen. Sir Archibald Murray had meanwhile (March 19) succeeded General Maxwell in the Egyptian command.

Darfur Campaign.—At this period, in the Sudan, the Sirdar, Gen. Sir Reginald Wingate, was dealing with 'Ali Dinar of Darfur. For over a year the Sultan had been openly defiant and since Dec. 1915 had been making arrangements to invade Kordofan. As the Sudan Government had not in 1915 any force available for action in Darfur, negotiations were entered into with him, but without result, and the belief grew in the Sudan that the Government was too weak to deal with so powerful a sultan ('Ali Dinar had a regular "slave" army some 10,000 in number, for the most part well armed). Early in 1916 it had become imperative to clear up the situation if the general peace of the Sudan was to be preserved. Though it was the worst season of the year for military operations the Sirdar determined to anticipate 'Ali Dinar's offensive. An expeditionary force, 3,000 strong, was organized under command of Maj. (temporary Lt.-Col.) P. V. Kelly. Except for a detachment of the R.F.C. the troops consisted entirely of units of the Egyptian army—this being the first time since the *Mahdia* that Egyptian troops had fought Sudanese Arabs. The expedition was highly successful. It was remarkable for the manner in which transport difficulties were overcome. Khartum, the base, is 500 m. by rail from the nearest seaport: El Obeid, railhead, is 428 m. from Khartum; and from El Obeid the force had to advance nearly 400 m. across a desolate roadless country. It then had to engage a numerically superior enemy of indomitable valour. Battle was given by the Darfurians on May 22 (1916) at Beringa, near El Fasher, 'Ali Dinar's capital. A body of 2,000 riflemen, supported by a large mounted force, attacked the Egyptians with all the accustomed bravery of the Dervish warrior. They were beaten back, counter-charged and completely defeated, losing over 50% of their number in killed alone. 'Ali Dinar and a considerable following of horsemen fled from the field. The party was chased and bombed by airmen, but the Sultan made good his escape. He retired to the confines of French central Africa. In Oct. 1916 a column was sent against him; he again fled, was pursued and killed in action on Nov. 6.

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[1] He addressed one letter to "The Governor of Hell in Kordofan and the Inspector of Flames in Nahud."

[2] A volunteer force raised in Rhodesia (the 2nd Rhodesian Regt.) had gone to E. Africa in 1915.

[3] Like many other Arab officers and men in the Turkish army who fell into the hands of the British, Ga'far Pasha joined the Arab forces under the Emir Faisal and took part in the Syrian campaign against the Turks. After his capture at Agagia he had been confined in the citadel at Cairo. He tried to escape by means of a rope. Ga'far being a very heavy man, the rope broke; he fell, injured himself, and was removed to hospital. While there, he learned of the Sherif of Mecca's revolt and resolved to join his forces. In 1920 he became Minister of Defence in the Provisional Arab Government of Mesopotamia. He was a delegate at the Near East Conference held in Cairo in March 1921.

The Siwa Defeat.—In the oases west of the Nile (where Maj.-Gen. W. A. Watson had taken over the command) there was little change between April and Oct. 1916. The patrolling of the desert front, over 800 m. in length, was done by light motor-cars, the Imperial Camel Corps and aeroplanes. In October, the British, with slight opposition, reoccupied Dakhla oasis, where Sidi Ahmad had a farm and where he had been living for some months. From Dakhla a daring attempt was made by a party of British, in motor-cars, to reconnoitre Kufra, but it was found impossible to cross the belt of sand dunes west of the oasis.

Sidi Ahmad now retired by way of Farfara and Baharia oases to Siwa. As long as he remained there he was not utterly discredited in the eyes of the Egyptians. It was therefore decided to attack Siwa with a force sent in motor-cars from Matruh. The distance to be covered was 150 m., but the ground was for the most part hard. Leaving Matruh on Feb. 1 1917, the armoured-car force, under Brig.-Gen. H. W. Hodgson, reached the escarpment, below which lies Siwa oasis, the next afternoon, and was in action the whole of Feb. 3. The Senussites were about 1,000 strong, including 800 riflemen, and had mountain and machine-guns. An attempt to rush the cars was frustrated, but the action appeared to be indecisive. However, at daybreak the next morning the Senussites, having blown up their ammunition, retreated west. The head of their column was ambushed, but the main body got away. Sidi Ahmad, with Mohammed Salih (ex-commander of the Egyptian coastguard, who had deserted at the beginning of the campaign), had already fled to Jarabub (the oasis in which is the mosque-tomb of the founder of the Senussite fraternity). Thither he was not pursued, and in the Kufra oases he had a practically inaccessible place of refuge.

Nevertheless, with the defeat of Siwa the danger to Egypt from the Senussi movement disappeared and though raids were made on the Darfur border they did not seriously affect the Sudan. In Cyrenaica, too, the situation was altered. An Anglo-Italian agreement had been concluded in July 1916 for common action against the Senussi and it was in contemplation to transfer from the Egyptian to the Italian sphere Jarabub and that part of the Libyan Desert containing Kufra.

An Understanding with Italy.—During 1917 and 1918 Turkish and German influence among the Senussites steadily declined while strong efforts were made by the Italians to come to an understanding with the sect. They secured the release of 700 Italian soldiers, prisoners of war. Sidi Mohammed el Idris, the former envoy to Egypt, and the eldest son of Senussi el Mahdi, had disapproved his cousin's action and had taken no part in the invasion of Egypt. He had an influential following and was desirous of peace with both Italy and Great Britain. After the fight at Siwa he entered into an agreement with both Powers. Sidi Ahmad himself was deeply committed to his Turkish and German counsellors. Many of these, including Nuri Bey, had left Cyrenaica. In the summer of 1918 the Idrisi party gained the mastery in the Senussite ranks. Sidi Ahmad's position was undermined and he found it convenient to quit Cyrenaica. In August of that year he was conveyed by a German submarine from Misurata to Polo, whence he went to Turkey, still claiming to be the head of the brotherhood. In 1919 he "girded the Sultan with the sword of 'Othman" but in 1920 had turned Nationalist and aided Mustafa Kemal.

The Senussi chiefs in Libya had chosen Sidi Mohammed el Idris as Grand Senussi, and the new head of the order in Jan. 1919 sent a mission to Rome, when Italian sovereignty was implicitly recognized. Neither Italy, France or Great Britain had challenged the right of the Senussi sheikh to exercise spiritual authority over the members of the brotherhood; Italy in 1917 had gone further and had acknowledged Sidi Mohammed's temporal authority in what may be called his hereditary dominions. By the accord of Regima concluded Nov. 1920 the 1917 agreement was ratified and Sidi Mohammed, to whom the Italians gave the title of emir (prince), himself visited Rome to pay homage to the King of Italy. An indication of Sidi Mohammed's attitude was the permission he granted at this time to an English woman to visit Kufra, though in the guise of a Moslem. The lady in question, Mrs. Rosita Forbes, testified to the desire of the Senussi chiefs to resume trade with Egypt.

AUTHORITIES.—See the despatches of Sir John Maxwell, Sir Archibald Murray and Sir Reginald Wingate (*London Gazette* supplements June 21, Sept. 25, Oct. 25 and Dec. 1 1916 and May 27 1919); *The Times History of the War*, vol. ix., chap. cxlv.; Lt.-Col. J. Tilho, "The Exploration of Tibeste . . . in 1912–7," *Geog. Jnl.*, vol. lvi. (1920); Capt. Gwatkin Williams, R.N., *In the Hands of the Senussi* (1916); Rosita Forbes, *The Secret of the Sahara: Kufra* (1921); W. T. Massey, *The Desert Campaigns* (1918).

(F. R. C.)

SERBIA (*see* 24.686) had in 1910 an area of 48,303 sq. km., which after the Balkan wars was increased to 87,358 sq. kilometres. The pop., according to the census taken on Dec. 31 1910, was 2,911,701, showing an increase of 417,931 over that of 1900. The country was divided into 18 districts, as follows, (the pop. is shown in brackets):—Belgrade[1] (155,815), Belgrade City (89,876), Valjevo (157,648), Vranja (252,937), Kragujevac (189,025), Krajina (112,142), Kruševac (167,371), Morava (203,638), Niš (198,768), Pirot (112,314), Podrina (238,275), Požarevac (259,906), Rudnik (85,340), Smederevo (143,216), Timok (149,538), Toplica (110,216), Užice (146,763), Čačak (138,911). Of this total pop. 2,528,819 lived in the country, and only 382,882 in towns. Of these the most populous were Belgrade (89,876), Niš (24,949), Kragujevac (18,452), Leskovac (14,236), Požarevac (13,411), Šabac (12,100), Vranja (11,439), Pirot (10,737). In 1900 the density of population was 51.6 per sq. kilometre.

The territory acquired by Serbia in the wars of 1912–3 contained (according to not very reliable statistics) a pop. of 1,481,614, divided among the following 12 districts:—Prijepolje (49,315), Raša (81,214), Zvečane (81,643), Kosovo (193,337), Prizren (124,101), Tetovo (146,803), Skoplje (Uskub, 157,078), Kumanovo (144,983), Bregalnisa (101,442), Tikveš (84,657), Bitolj (Monastir, 252,646), Okhrida (84,395).

Thus Serbia on the eve of the World War had a pop. of roughly 4,500,000. The births, deaths, and marriages in Serbia amounted in 1911 and 1912 to 107,219 and 114,257, to 64,369 and 63,358, and to 30,420 and 13,289 respectively.

Agriculture.—Serbia is a land of small holdings, the former Turkish proprietors having been expropriated in 1833 and 1880: in 1900, out of a total of 401,093 families, no less than 91·5% were owners of land. Of these only 86 persons owned over 100 hectares of land, and only three persons over 300, while there were 98,253 properties (33·4%) of under three hectares. There has been a very rapid development of coöperative societies since 1895 (900 in 1909, with 35,000 members; 1,200 in 1913, with 40,000 members).

Of a total area of 2,045,176 hectares there was in 1905 (*a*) cultivated land 1,223,671 (arable land 1,027,815, gardens 25,815, vineyards 33,101, orchards 136,939); (*b*) grazing land 418,391; (*c*) commons and uncultivated land 110,101. In 1908 the chief products of the harvest were (in tons) maize 533,691, cereals 457,734, hay and clover 226,858, straw 777,728, plums 530,061, potatoes 54,946. In 1905 (latest statistics available) the live stock was distributed as follows: horses 174,363, cattle 969,953, pigs 908,580, sheep 3,160,166, goats 510,063.

Forests.—Over one-third of Serbia's total area (3,750,000 ac.) is forest land, all but 750,000 ac. of this belonging to the State or the various communes. The chief varieties of tree are beech (750,000 ac.), oak and conifers.

Mines.—The mining industry of Serbia has a great future, but has hitherto been but little developed, owing to lack of capital and means of transport. Table 1 gives the export of ores (in metric tons) according to the last statistics available. That these are merely the first primitive beginnings is best shown by the fact that in the year

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[1] The phonetic spellings of the names of the districts and towns, following the system adopted by the Committee of the Royal Geographical Society, are: Belgrade, Valyevo, Vranya, Kraguyevats, Krajina, Krushevats, Morava, Nish, Pirot, Podrina, Pozharevats, Rudnik, Smederevo, Timok, Toplitsa, Uzhitse, Chachak, Leskovats, Shabats, Priyepolye, Rasha, Zvechane, Kosovo, Prizram, Tetovo, Skoplye, Kumanovo, Bregalnitsa, Tikvesh, Okhrida. The spellings given above follow the Croatian form or its equivalent.

TABLE 1.—Exports of Ores.

	1904	1906	1908
Coal and Lignite	2,631,810	2,375,067	296,125
Gold (in kilogrammes)	89	139	191
Silver " "	48	3	823
Black copper	1,641	7,613	2,198
Lead	245	213	1,552
Antimony	4,725	3,200	261
Pyrites			32,726
Cement	52,500	92,357	11,074

1910 a single copper mine (Bor) exported ore to the value of over 8,000,000 francs, thus exceeding the total result of all the mines given above.

Foreign Trade.—The progress of Serbian trade may best be gathered from the following Tables 2 and 3. In 1910 maize to the value of over 21,400,000 francs was exported. The famous plum industry (known to the west only through German intermediaries) accounted in 1908 for the export of 49,042 tons of prunes (value 10,350,721 francs) and of 14,398 tons of plum jam (value 3,251,093 francs). The pig trade, upon which Serbia's prosperity very largely depended, having been injured by Austria-Hungary's tariff policy, a new system of slaughter-houses was established in Belgrade, and in 1911 the chief of these exported 9,751 tons of pork (68,047 head). By 1913 the amount exported had risen to 12,913 tons (100,776 head).

TABLE 2.—Imports and Exports.

	1905–7 (triennial)	1908–10 (triennial)	1909	1910	1911
Imports	6,821,000	9,196,000	2,941,403	3,387,826	(?)
Exports	9,004,000	10,626,000	3,719,270	3,935,521	4,676,640

TABLE 3.—Distribution of Trade.

	Imports from		Exports to	
	1909.	1910.	1909.	1910.
Germany	£1,154,068	£1,399,033	£ 623,791	£876,594
Austria-Hungary	711,894	645,930	1,163,866	712,875
U.K. and British Colonies	303,409	456,997	5,696	66,892
Turkey	194,224	237,382	878,967	938,837
France	141,460	144,144	97,172	47,644
Italy	93,800	145,798	121,864	42,786
Russia	77,294	72,925	815	541

Finance.—On Jan. 1 1913 the public debt amounted to £26,362,240. Table 4 shows how the budget balanced in the years before the war. In 1915 the budget was fixed at the same figure. From 1915 to 1918, owing to the conquest of the country, no proper budget was possible, the Government and army subsisting upon the subsidies of the Allied Powers.

TABLE 4.—Finance.

	Revenue	Expenditure	Surplus
1909	£4,145,764	£4,132,945	£12,818
1910	4,611,109	4,602,913	8,198
1911	4,805,458	4,803,272	2,186
1912	4,972,758		
1913	5,230,588		
1914	8,572,826		

Education.—In 1909 there were only 1,296 elementary schools in Serbia with 2,584 teachers and 138,434 pupils, and 20 secondary schools with 393 teachers and 7,317 pupils. In 1910–11 the university of Belgrade had 1,025 students. Only 27% of the pop. could read and write.

Army.—After 1908 great efforts were made to increase the efficiency of the army. Organized under a system of obligatory service, the war strength in 1914 was estimated at 350,000 men, which, with the addition of the Landsturm, could be raised to about 400,000. (*See* ARMY: *Balkan Armies.*)

POLITICAL HISTORY, 1909–18

The annexation of Bosnia by Austria-Hungary in 1908 marked a turning point in the history of Serbia. Henceforth public opinion, supported by prominent statesmen in every party, was practically unanimous in regarding a conflict with Austria-Hungary as sooner or later inevitable. This belief had at once a national and an economic basis: for Count Aehrenthal not merely supported the Hungarian policy of repressing Yugoslav national aspirations inside the Dual Monarchy, but obstructed Serbia's commercial development by tariff and frontier restrictions, by a veto upon either direct access to the sea or a common frontier with Montenegro, and by opposition to all idea of Balkan coöperation. Those Serbs who feared so unequal a conflict and would have preferred a more conciliatory attitude towards Austria-Hungary, were reduced to silence by Aehrenthal's refusal to admit the international aspect of the problem or to consider the Serbian proposals for arbitration before the Hague Tribunal. Isolated in Europe and jealously shut off from her natural outlets on the Adriatic, Serbia was driven to seek new political and economic ties in the east and south. The policy of Aehrenthal inevitably strengthened the tendencies towards the creation of a Balkan League, and these were accelerated by the political unrest evoked throughout the Balkan Peninsula by the Young Turk Revolution.

The Balkan League.—The idea of a Balkan League was by no means new. It had been advocated as early as 1844 by the Serbian statesman Garašanin, and formed the subject of serious negotiations between Prince Michael Obrenović and the Bulgarian exiles of his day, and also between Kossuth, Prince Michael, and Prince Cuza of Rumania. The last serious overtures had been made in 1891 by the Greek premier Tricoupis, and after their betrayal to the Porte by Stambulov the idea remained dormant for nearly 20 years. The speech of the Russian Foreign Minister Isvolski on Christmas Day 1908, advocating a league between Turkey and the three Balkan Slav States, inaugurated a new era of Russian activity in the Balkans, under the active direction of Tcharikov, the ambassador at Constantinople, and Hartwig, who rapidly acquired great influence as minister at Belgrade. In the spring of 1910 the kings of Bulgaria and Serbia paid successive visits to St. Petersburg and Constantinople, and Dr. Milovanović, the Serbian Foreign Minister, was especially active in his endeavours to secure the adhesion of Turkey to a general Balkan League. His views were also shared by Venizelos, who came into power in Greece in October of the same year, and even to a lesser degree by Gešov, a Russophil, who became Bulgarian premier in March 1911. In view, however, of the increasingly chauvinistic attitude of the Young Turk regime in Macedonia and Albania, Venizelos considered it advisable to make overtures to Bulgaria, with a view to common defensive action against a possible Turkish attack. His initiative led to important secret negotiations, in which Mr. J. D. Bourchier, *The Times* correspondent, acted as intermediary. These preceded by at least five months the first conversations between Serbia and Bulgaria, which appear to have originated from an overture made by Rizov in Belgrade at the instance of King Ferdinand.[1] On Oct. 11 1911 Gešov, on his return from the west, had a long discussion with Milovanović in the train between Belgrade and Nish, and secret negotiations continued throughout the winter. The coming of age of Prince Boris of Bulgaria in Feb. 1912 was attended by the crown princes of Serbia, Montenegro, Greece and Rumania, and this demonstration was widely regarded as a symbol of increasing coöperation between the Christian States of the peninsula. On March 13 1912 a secret treaty of alliance was concluded between Serbia and Bulgaria, and was supplemented on May 12 by a military convention. On May 29 a similar treaty was concluded between Bulgaria and Greece. There was no actual treaty binding Serbia and Greece, while the Serbo-Montenegrin treaty, concluded as late as Sept. 1912, was less political than military and provided for separate though parallel action.

The Treaties.—By the terms of the Serbo-Bulgarian agreement each State was bound to assist the other with all its forces, in the event of an attack by one or more States unspecified, and in particular in the event of any Great Power trying to annex any portion of Turkey's Balkan possessions. If internal troubles should arise in Turkey, either ally might initiate proposals for military action, and any point upon which agreement was not reached, should then be referred to Russia for decision. Special provision was made for possible conquests, Serbia recognizing Bulgaria's rights over the territory lying east of the Rhodope Mountains and the Struma river, and Bulgaria similarly recognizing Serbia's rights north and west of the Šar (Shar) Mountains. The districts lying between these limits, the Aegean and the Lake of Okhrida, were to form "a distinct autonomous province"; but should their partition prove inevitable, then Serbia undertook to make no claim beyond a line drawn from the Lake of Okhrida to near Kriva Palanka on the old Turco-Bulgarian frontier and including Skoplje, but not Monastir, Prilep or Veles. In the event of a dispute, the Tsar was to act as arbitrator, and Bulgaria undertook to accept the more southerly line as its new frontier with Serbia, if the Tsar should decide in favour of the latter. In the event of war, Bulgaria undertook to place at least 200,000, Serbia at least 150,000, men in the field against Turkey. If either Turkey or Rumania attacked Bulgaria, Serbia was to send 100,000 men to her aid; while Bulgaria on her part must provide 200,000 men in support of Serbia, in the event of an attack by Austria-Hungary.[1] The treaty between Bulgaria and Greece was much more indefinite, though it provided for mutual aid against Turkey, not merely in case of direct military aggression, but also of the infringement of treaty rights and of the principles of international law—a phrase which was of course intended to cover the championship of co-nationals in Macedonia or Thrace against Ottoman misrule.

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[1] See *Samouprava*, Oct. 28 1913.

No attempt was made to define the territorial claims of the two countries in the event of a successful war, and the division of the spoils was thus left to the chance of a future agreement. The military convention was not concluded till Sept. 22, when events were already moving rapidly. By it Greece undertook to provide at least 120,000 men against Turkey, while Bulgaria increased the contingent already promised in her agreement with Serbia to 300,000 men. Special clauses provided for a blockade of the Aegean by the Greek fleet, and forbade the conclusion of peace or even of an armistice without the consent of all the allies.

The League, Turkey and the Powers.—Internal disorder had spread rapidly throughout Turkey in Europe in the year following Italy's invasion of Tripoli: and the ferocious policy of suppression adopted by the Committee of Union and Progress towards all the non-Turkish nationalities culminated in a reign of terror at the parliamentary elections of 1912, in a recrudescence of Komitaji activities, and in an Albanian rising even more widespread and more determined than in the two previous summers. The premature death of Milovanović on July 1 not merely deprived Serbia of her ablest modern statesman, but removed one of the few restraining influences in any Balkan capital. He was succeeded as premier by Trifković, and in the conduct of foreign affairs by the Old Radical leader Pašić, who placed almost unreserved reliance on Russian support and worked in the closest accord with Hartwig. On Sept. 12 Pašić became premier at the head of a purely Old Radical Cabinet.

By this time not even the most pacific statesmanship could have arrested the growing anarchy in Turkey. Public opinion in Belgrade and Sofia was roused by a massacre of Bulgarians at Kočana (Kochana) on Aug. 1, and by the report of similar outrages in the Sanjak. By the middle of the month, Uskub, and the entire district recognized by the secret treaty as Serbian, were in the hands of the insurgent Albanians; and the concessions granted by the Porte, while failing to arrest the movement, only served as an incentive to swift action on the part of the neighbouring States.

The somewhat vague proposals for decentralization and administrative reform put forward by Count Berchtold on Aug. 20 prompted the Balkan allies to hasten their preparations. While the slow-moving concert of Europe was discussing alternative proposals for Turkish reform, the Porte suddenly held up Serbian war material at Salonika and began to mass troops round Adrianople. Before any collective step had been taken by the Powers, the situation was gravely compromised by the almost simultaneous mobilization of the Bulgarian, Serbian, Greek and Turkish armies (Oct. 1). At the last moment the Porte announced its intention to enforce the Vilayet Law of 1880, which had been allowed to remain on paper for a whole generation. But this was very naturally regarded by the Balkan allies merely as a fresh attempt at evasion, and the Powers still further alarmed them by a note which, in its endeavours to soothe Turkish susceptibilities, laid far more stress upon Turkish territorial integrity and sovereign rights than upon the cause of reform. Simultaneously the Powers warned the four Balkan States against warlike action and assured them that even in the event of victory no change in the territorial *status quo* would be tolerated. The further announcement of their intention—after a lapse of 34 years—to enforce the Treaty of Berlin, decided the four allies to precipitate events, and before the impending note could be formally communicated, the King of Montenegro, by an act of undoubted collusion, declared war upon Turkey. On Oct. 13 the other three Balkan Governments presented to the Porte a series of far-reaching demands, culminating in racial autonomy for all the nationalities of the Ottoman Empire, and four days later the Turks, without deigning to answer, declared war on Serbia and Bulgaria. (For the military events, *see* BALKAN WARS.) All the Great Powers, though for quite divergent reasons, genuinely attempted to prevent war. This is equally true of Russia, who, though privy to most of the designs of the Balkan allies, disapproved because she could not wholly control the time and method of action, and of Austria-Hungary, to whom the existence of an anti-Austrian clause in the treaty had been betrayed, but who already reckoned confidently upon setting the allies at variance before it could come into operation. That the Powers, having failed to prevent war, adopted a passive attitude during its early stages, was due to the almost universal assumption in official circles that the Turks would be victorious, and that the refractory Balkan States would soon be only too glad to accept a settlement dictated from without.

The First Balkan War.—The rapid and overwhelming success of the allies radically transformed the situation. By the end of November Turkish rule in Europe was restricted to the Chatalja lines, the Gallipoli Peninsula, and the three fortresses of Adrianople, Janina (Yannina) and Scutari. The Serbs in particular, after the victories of Kumanovo and Monastir, were in actual occupation of all Macedonia west of the Vardar, and had reached the Adriatic at Durazzo and Medua. They were thus able to go far beyond their obligations under the military convention, by help to the Bulgarians investing Adrianople.

Kumanovo was much more than an ordinary victory. It restored to Serbia that self-confidence which had been so gravely shaken by the rebuffs and scandals of the previous 30 years; and throughout the Yugoslav provinces of Austria-Hungary it was hailed as an atonement for Serbia's downfall on the field of Kosovo, and as a pledge of her new mission as the Southern Slav Piedmont. In Croatia especially, where the Hungarian Government had suspended the constitution and established Cuvaj as dictator, there were continual demonstrations in favour of the Balkan allies, even on the part of sections of the population hitherto regarded as Serbophobe. Austria-Hungary at first adopted a waiting attitude, but as the Serbs approached the Adriatic, she suddenly ordered a general mobilization, and suppressed all public expressions of feeling, while the official press of Vienna and Budapest adopted a menacing tone towards Serbia. Great prominence was given to the alleged insults offered to Herr Prochaska, Austro-Hungarian consul at Prizren, and for some days public opinion was allowed to believe that he had been shamefully mutilated by Serbian officers. It only transpired at a much later date that Prochaska, known to be in touch with the open enemies of Serbia in the Sanjak, had been entirely unmolested by the invaders, but that on the other hand he had received definite instructions from Vienna to create an "incident" such as might provide a pretext for action. The Austro-Hungarian chief-of-staff and War Minister, Gens. Conrad and Auffenberg, are known to have favoured a radical solution of the Southern Slav question by immediate war with Serbia (*see* under Austrian Empire: *Foreign Policy*): and Count Forgacs, who as minister in Belgrade, had supervised the anti-Serbian forgeries exposed at the Friedjung trial, was now permanent under-secretary at the Ballplatz and using all his influence with Count Berchtold in favour of war. There is practical certainty, however, that the Archduke Francis Ferdinand on this occasion supported Francis Joseph's aversion to war, and that the decisive factor was Italy's opposition to any "forward" policy from Vienna. As negotiations were already proceeding between Berlin, Vienna and Rome for a fifth renewal of the Triple Alliance (actually signed on Dec. 5 1912 for six years), Italy was able to use as a lever the special Austro-Italian agreement of 1909, by which Austria-Hungary had pledged herself to make no change in the Balkan *status quo*, "without a previous agreement with Italy, based on the principle of compensation." Moreover, Berlin, concerned for the Alliance, insisted strongly in Vienna upon the need for reassuring Rome by a more moderate attitude towards Serbia. The march of events had taken Vienna altogether by surprise, and in complying with its ally's wishes, it was influenced by the altered outlook of the Great Powers. On Oct. 8, in a last effort to avert war, they had warned the Balkan States that no territorial changes would be tolerated. But the success of the campaign and the general relief with which public opinion hailed the downfall of Turkish rule in Europe, soon led to a change in their attitude. On Oct. 30 M. Poincaré proposed a general declaration of *désintéressement* in territorial questions: and though this was rejected by Vienna, its moral effect was only increased when Mr. Asquith spoke in favour of recognizing the accomplished fact and remaking the map of eastern Europe. On Nov. 2 this view was strongly endorsed by M. Sazonov. For the moment all that Count Berchtold could do was to encourage Bulgarian designs on Constantinople and attempt to sow dissensions among the allies. The Turks, seeing themselves isolated in Europe, made overtures of peace as early as the 11th to King Ferdinand, who was not willing to consider them until his troops had been checked before Chatalja. On the 25th, however, negotiations were opened and resulted, not in peace, but in an armistice (Dec. 3) pending a general peace conference in London. When this opened at St. James's Palace on Dec. 16, Serbia was represented by the ex-premier and historian Novaković, the president of the Skupština Nikolić, and the minister in Paris, Vesnić. The wisdom of the allies in excluding Greece from the armistice soon became apparent: for her command of the sea limited the Turks to the Anatolian railway as the sole channel of reinforcement. In London Turkey pursued a policy of dilatory diplomatic intrigue and only receded inch by inch before the very drastic demands of the allies. After a month had been wasted, the Powers, with unexpected unanimity, presented a joint note to the Porte, advising the cession of Adrianople to Bulgaria and hinting at the loss of Constantinople as a possible consequence of renewed hostilities (Jan. 18 1913). Kiamil Pasha laid the proposals of the Powers before a specially convoked council of notables, and was on the point of yielding when the extremists of the Committee of Union and Progress overthrew his Cabinet and murdered the commander-in-chief, Nazim Pasha (Jan. 23). In view of the united front presented by the Powers, there can be little doubt that the new Cabinet would soon have been driven to the necessary concessions. But the Balkan delegates, rightly or wrongly, took the protestations of the Young Turks at their face value, and broke off the negotiations on Jan. 28. The council of ambassadors initiated by Sir Edward Grey continued to sit in London, and devoted especial attention to the Albanian problem and to the friction produced between Albanians and Serbs by the latter's presence on the Adriatic. Since the commandant of Scutari, Hasan Riza, declined to recognize the armistice, hostilities before the town had continued throughout Dec. and Jan., and Serbia sent repeated reinforcements to the aid of the Montenegrins.

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[1] Gešov in his *Memoirs* asserts that King Ferdinand in signing this was decided by his knowledge of the text of a secret Austro-Rumanian military convention, permitting Rumania in the event of war with Russia, to annex not only Bessarabia, but also Silistra, and even Ruščuk (Ruschuk), Šumla (Shumla) and Varna.

Resumed Hostilities.—When war was resumed on Feb. 3 the brunt fell upon Bulgaria, and the Serbs, being complete masters of Macedonia, were free to contribute 47,000 men and a siege train of 38 guns to the operations against Adrianople, which held out until March 26. The dispute which arose as to whether Shukri Pasha had surrendered to the Bulgarians or to the Serbs, was in itself quite unprofitable, but was a symptom of the friction which was daily increasing between the two allies. Gen. Stepanović, who commanded the Serbian contingent, was allowed to pass through Sofia with his staff, without a single greeting, and on April 16 Bulgaria renewed the armistice with Turkey, without waiting for her allies. The final phase of the war concentrated round Scutari, which Montenegro and Serbia made desperate efforts to reduce. Even the announcement that the council of ambassadors, in fixing the frontiers of the new Albanian State, had definitely included Scutari (while leaving Dibra, Prizren, Peć [Ipek] and Djakovo to the two Serb kingdoms) only served as an incentive to create if possible a fresh *fait accompli*. But Austria-Hungary upheld her veto, and on March 20 addressed a severe note to Montenegro, reproaching her for the murder of a Bosnian Franciscan and other incidents, and at the same time dispatched a strong naval squadron to the southern Adriatic. Her next step was to urge upon the Powers a collective demand for the cessation of hostilities and the withdrawal of the Montenegrin and Serbian forces from the territory assigned to Albania, and to threaten the use of force unless at least the civil population of Scutari were allowed to leave the town (March 23). This demand was supported by Britain, partly in order to avert a conflict, and was conceded: but the close support of Cetinje by Belgrade rendered the danger of Austro-Hungarian intervention increasingly acute. On March 31 the Powers ordered Montenegro to cease hostilities, and on her refusal established a naval blockade of her strip of coast. This seemingly illusory measure at least had the effect of restraining Austria-Hungary, who could not act separately so long as the Powers held together. It was, however, simply defied by King Nicholas, who gained time by consenting to the withdrawal of the Serbian troops and meanwhile closed the frontier and conducted secret negotiations with Essad Pasha, commandant of the town since the assassination of Hasan Riza on March 30. On April 23 Scutari surrendered to the Montenegrins, and the Powers had difficulty in restraining Austria-Hungary from immediate action. What finally decided her appears to have been the knowledge that her seizure of Mount Lovčen (Lovchen), the key to Cetinje, would be followed by Italy's occupation of Valona, with its control of the entrance to the Adriatic.

Amid the countless rival intrigues the Powers presented in public a unanimous front, and on May 14 the Montenegrins found themselves obliged to surrender Scutari to Adml. Burney, as commander of the international fleet. Negotiations could now be resumed in London for a general peace (May 20), and the Powers found it easier to take a strong line. Before the delegates could be brought to business, it was necessary for Sir E. Grey to inform them, with quite undiplomatic bluntness, that unless they were prepared to conclude peace without further delay they had better leave London altogether. By the Treaty of London, which was signed on May 30 1913, and only contained seven brief articles, Turkey ceded to the four allies conjointly the island of Crete and all territory lying to the west of the Enos–Midia line, and all the contracting parties agreed to refer the settlement of Albania and the Aegean Islands to the five European Great Powers, and all financial questions to the International Commission convoked in Paris.

The Dispute between the Allies.—The Balkan allies were now faced by the thorny problem of dividing the spoils. Macedonian autonomy, which the treaty had laid down as the ideal solution, was from the first abandoned by all parties. Their success, as it had far exceeded their expectations, also increased their appetites and encouraged them to extend their claims. Thus while Serbia found herself in effective possession of most of Macedonia, and remembered the imperial traditions of Stephen Dušan, Bulgaria saw the possibility of acquiring Adrianople and Thrace, and not content with the "Big Bulgaria" of the

Treaty of San Stefano, dreamed of "the four seas" (the Adriatic as well as the Black, Aegean and Marmora). The four Governments seemed each bent upon annexing a maximum of territory, and thus too often became the tools of Powers whose ambitious plans of political and military equilibrium they had unconsciously upset. Above all, the long delays in restoring peace stabilized the various regimes of occupation and proved fatal to mutual understanding. Between Bulgaria and Greece there was no territorial bargain, and no obvious means of reaching one, while Serbia as early as Jan. 23 formally raised the question of a revision of the Serbo-Bulgarian treaty. This rested on the argument that Serbia was entitled to compensation for four reasons—(1) that she had furnished her ally with military support far in excess of her bargain, (2) that she had absolved Bulgaria from her military obligations in Macedonia, (3) that she had loyally continued the war three months after her own work was done, and (4) that the acquisition of Adrianople by Bulgaria radically modified the basis upon which the bargain rested. But if Serbia's attitude is to be justified, it must be on the broader ground that events had transformed the situation still further to her disadvantage in another direction. Her two parallel aims in the war had been the political liberation of her kinsmen under Turkish rule, and her own economic emancipation by means of free access to the sea; and from the practical rather than the sentimental standpoint the second was much the more vital. Her whole calculation centred upon securing the Sanjak, Kosovo and a link with Montenegro, and a port in northern Albania (as the best substitute for access through Herzegovina); and when Austria-Hungary imposed her veto upon the latter, the Vardar valley became Serbia's only possible alternative outlet, and this involved her retention of Veles, Prilep, Monastir and Okhrida as well as the "disputed zone." That Vienna deliberately aimed at thus embroiling Serbia and Bulgaria is shown by the fact that during the earlier Albanian negotiations Count Berchtold had offered to Serbia the whole of the Vardar valley with Salonika itself, if she would renounce her Adriatic claims. Bulgaria, on her side, insisted on the literal interpretation of the treaty and showed herself indifferent to Serbia's difficulties on the west.

Meanwhile Russia had made every effort to avert a conflict, Sazonov going so far as to express regret at the Serbo-Greek negotiations (April 17), while warning Bulgaria of possible danger from Rumania, in the event of aggression against Serbia (April 28). On April 30 the Russian ministers in Sofia and Belgrade simultaneously reminded the two allies of their obligation to submit disputes to Russian arbitration. But Sazonov's success in settling a Bulgaro-Rumanian frontier dispute had only served to render Sofia more unyielding, and on May 19 the Bulgarian commander-in-chief wrote to the premier, assuming war with Serbia and Greece to be inevitable, and urging concentration against the former. The pressure very rightly brought to bear by Sir E. Grey upon the peace delegates in favour of the Treaty of London was misinterpreted by the Bulgarians (who alone had any motive for haste) as a guarantee of that Treaty against Turkey, and as dispensing them from the need of guarding their eastern frontier. They were still further encouraged by the openly Serbophobe tone of the official press in Vienna and Budapest: and King Ferdinand had already ordered Gen. Savov to hasten the transference of the army from the Thracian to the Macedonian front, when on May 27 Pašić, under pressure from the Serbian opposition, publicly committed his Government to the demand for treaty revision. This hastened the resignation of the pacific Gešov, behind whose back King Ferdinand was already concerting aggressive action. Before he went, Gešov, under strong Russian pressure, met Pašić at Tsaribrod (June 1) and agreed to Russia's proposal for a meeting of Balkan premiers at St. Petersburg; but a further proposal for the immediate reduction of the allied armies to a third, though accepted by Serbia and Greece, failed owing to the impossible conditions put forward by Gen. Savov. Gešov's successor, Dr. Danev, opposed the meeting of the premiers, contended that Russia had already prejudged the case by even considering revision, and relied increasingly upon Austria-Hungary. That his confidence was not ungrounded is shown by Count Berchtold's assurance to Rumania in May that the Dual Monarchy was ready to defend Bulgaria "even by force of arms."[1] Serbia and Greece on their part were fully alive to the danger; there had been informal talks between Venizelos and Novaković in London, and between Prince Alexander of Serbia and Prince Nicholas of Greece in January and March at Salonika. After the accession of King Constantine, a less conciliatory mood prevailed in Athens and Belgrade, each of whom in turn made secret overtures to Rumania for a defensive alliance, but without success (April 19, June 8). Their own agreement was hastened by the common danger, and the Serbo-Greek military convention of May 14 was revised on June 1 and supplemented by a definite treaty of alliance for 10 years. While the first of these provided for mutual military support in case of a Bulgarian attack upon either ally, the second extended the *casus foederis* to an attack by a third Power, "in circumstances envisaged by the Treaty of Alliance between Greece and Serbia." Both the wording and the events of the moment make it clear that the intention was to guard against an Austro-Hungarian attack upon Serbia; in 1913 King Constantine took this risk, but in 1915 he was to deny its application.

On June 8 the Russian Government made its supreme effort for peace, by inducing the Tsar to address a personal appeal to the kings of Serbia and Bulgaria, which closed with the warning that "the first to make war would be responsible before the Slav cause." King Peter's courteous though somewhat ambiguous answer was never published; but that of King Ferdinand, which threw the entire blame upon Serbia and argued that the Bulgarian claim had long been admitted by Russia, was a fresh blow to the cause of peace. On June 13 the Powers made a joint *démarche* at Sofia and Belgrade in favour of demobilization, but Bulgaria imposed the impossible condition of a preliminary joint occupation of the disputed territory. Her attitude stiffened still further after the speech of the new Hungarian premier, Count Tisza, who emphasized the right of the Balkan States to settle differences in their own way—*even by war*—and declared that Austria-Hungary could not allow any other Power to acquire special prerogatives in the peninsula (June 19). As a natural result, Russia's fresh proposals for a conference of Balkan premiers in St. Petersburg, while promptly accepted by Belgrade and Athens, were met by Dr. Danev with a reiterated demand for joint occupation, and a virtual ultimatum giving Russia a week in which to pronounce as arbiter and 48 hours to announce compliance with the request. With Sazonov's sharp reply bidding Bulgaria to expect nothing more from Russia, St. Petersburg's influence over Sofia may be said to have ended. Count Tarnowski, the Austro-Hungarian minister in Sofia, was supreme in the counsels of King Ferdinand during the critical fortnight that followed. The deadlock was complete, when on June 22 the Serbian Cabinet was driven to resign, owing to the resentment of the military party at its alleged moderation. The most it could do was to place itself unreservedly in Russia's hands, and when this was endorsed by the Skupština after a stormy secret session Pašić resumed office (June 26). But Russia was by this time powerless to avert the catastrophe.

The Second Balkan War.—On the night of June 29, without previous declaration of war, the Bulgarian armies made an almost simultaneous attack upon the Serbs and Greeks. Their extended order and lack of proper reserves showed how greatly they had underestimated their enemy, and Gen. Savov is credibly reported to have declared that he could cut through the Serbs like "a knife through rotten cheese." But the Serbian generalissimo, Gen. Putnik, was fully alive to the Bulgarian preparations, and in confidential orders to his commanding officers had warned them that the Bulgars would "use their amicable relations with us" for a surprise attack. In point of fact, on certain sectors those who carried out this "stab in the back" had been dining only a few hours earlier with their Serbian comrades across the lines. It is probable that Savov did not aim at regular war, but hoped by a sudden shock to drive a wedge between Serbs and Greeks, seize the coveted districts of Macedonia and then hold them until the foreign intervention which he believed to be imminent should settle the dispute on a basis of "*beati possidentes*." This is borne out, not merely by captured despatches, but by the amazing fact that when Putnik's forces everywhere held their own, Savov on July 1 telegraphed the order to stop hostilities. But the war so lightly begun could no longer be stopped. That afternoon the Serbian counter-offensive opened, and a proclamation of King Peter, prepared some weeks previously in Belgrade, with a blank space for insertion of the date, was issued to the troops. The desperate struggle which continued almost uninterruptedly from July 1 to 9 is known as the battle of the Bregalnica (Bregalnitsa), though it actually extended over a much wider front. At its close the Bulgarians found themselves cut into two by the inaccessible Plaskovica Mts., and were obliged not merely to relax their hold upon the Vardar valley at Krivolak, but to abandon the whole Ovčepolje (Ovche Polye) district, the strategic key to central Macedonia.

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[1] Prince Fürstenberg to Take Jonescu, who published the facts in *La Roumanie*, Dec. 15 1914.

It appears certain that the original attack took place without the knowledge of the Danev Cabinet and contrary to its unanimous decision.[1] But that the premier was contemplating war at an early date is shown by his request that Vienna should ascertain whether the Turtucaia–Balčik (Balchik) line would buy Rumania's neutrality (June 28) and by his warning to the Rumanian minister that Serbian resistance would be over before Rumania could complete her mobilization (July 1). That there were two parallel policies in Sofia is further shown by the fact that on the very day of the request to Vienna the Rumanian Government officially informed Bulgaria that it would not remain neutral in the event of war. During the mutual recriminations that followed defeat, Dr. Danev publicly asserted (1) that Count Tarnowsky had already given assurances to King Ferdinand that Austro-Hungarian troops would re-occupy the Sanjak in the event of a Serbo-Bulgarian war, and (2) that on June 26 a treaty was signed between Austria-Hungary and Bulgaria, by which the latter bound herself, in the event of an Austro-Serbian or an Austro-Russian war, to mobilize enough troops to paralyse Serbia's action, while Austria-Hungary in her turn undertook to prevent, either by diplomatic or military action, any attack of Rumania upon Bulgaria in the event of the latter becoming involved in war with the allies, and even to intervene herself, should the war take a turn unfavourable to Bulgaria. These assertions have never been contradicted: the first coincides with the known facts, but for the second documentary evidence is as yet lacking. The memorandum addressed by Radoslavov and Genadiev to King Ferdinand on July 6—advocating a close accord with Austria-Hungary as the sole hope of averting disaster—neither proves nor disproves the existence of an alliance, for they may well have written in ignorance of a secret compact; but it should have served as an index to the attitude of those statesmen in 1915.

The Treaty of Bucharest.—By July 17 the Serbs had forced back the Bulgarians at all points to the frontier of 1912, and could henceforth adopt a mainly defensive attitude; but on July 16 Rumania declared war and began to throw troops across the Danube, while on July 15 the Porte repudiated the provisions of the Treaty of London and ordered Enver Pasha to advance upon Adrianople.

The frantic appeals of Sofia to the Powers to enforce upon Turkey respect for a treaty concluded under their auspices were disregarded, and Western public opinion was not inclined to save Bulgaria from the consequences of her own act. At the same time the entry of two new combatants greatly complicated Austria-Hungary's designs of intervention. She was held back by both her allies—Italy, who viewed with alarm the Balkan activities of any outside power and was determined to insist upon compensation, and Germany, who feared the loss of Rumania for the Triple Alliance, and the consequent derangement of the military balance in Europe. William II. was further influenced by a triple personal motive—the appeal of his brother-in-law King Constantine, old friendship for King Charles, and active dislike for King Ferdinand. This momentary divergence of view between Vienna and Berlin sealed Bulgaria's fate: though Vienna and St. Petersburg united to hold back Rumania from occupying Sofia or claiming the Ruščuk (Ruschuk)–Varna line. Bulgaria had no course left but to sign an armistice on July 31 and to open peace negotiations at Bucharest with her four Christian neighbours. This apparent emancipation of the smaller Powers from the European concert's control decided Austria-Hungary in favour of belated action against Serbia. But on Aug. 9 the Italian Government made it clear to Vienna that it would not recognize the *casus foederis* of the Triple Alliance as applicable to such a case;[2] and the combined pressure of Rome and Berlin, coupled with the certainty of Russian aid to Serbia, again averted war at the last moment.

The Treaty of Bucharest, signed on Aug. 10, gave to Rumania the Turtucaia–Balčik line, deprived Bulgaria of almost all her conquests in Macedonia and left her to settle the fate of Thrace as best she could with Turkey. Serbia acquired all Macedonia to the W. of the Vardar, and to the E. the districts of Štip (Istib or Shtip) and Kočana; but at the last moment Bulgaria was left in possession of a dangerous salient at Strumnica (Strumitsa), which enabled her to threaten Serbia's only railway connexion with the Aegean. The new Serbo-Greek frontier had already been fixed by mutual agreement, and ran from Gjevgjeli (Gyevgyeli or Gevgeli) (30 m. N. of Salonika) to the S.E. corner of the Lake of Okhrida, leaving Florina and most of the Monastir–Salonika railway to the Greeks. The Treaty of Constantinople, which was concluded between Bulgaria and Turkey on Sept. 29 and deprived the former of the greater part of Thrace, did not directly concern Serbia; but the indifference shown by her and her new allies, and still more by Britain and Russia, to Turkey's violation of a treaty which was their joint work and indeed was morally binding upon them, was to be dearly paid for by Bulgaria's attitude in the World War.

The treaties marked a new orientation in the Near East. Slav cooperation was replaced by mutual hatred, which promptly threw defeated Bulgaria into the arms of Turkey and predisposed both for an alliance with Berlin; Rumania's ties with the Triple Alliance were sensibly loosened, while Greece was drawn in two directions by dynastic attractions and party rancours. The military balance had undoubtedly been altered to the disadvantage of the Triple Alliance, yet it was to William II. that King Charles addressed a cordial telegram on the conclusion of peace, "which thanks to you remains definitive," and it was to the joint efforts of France and Germany that Greece owed Kavalla.

The Albanian Conflict.—Austria-Hungary now concentrated her attention upon Albania, and thereby rendered still more acute the relations between Serbs and Albanians. In the past three decades the latter had been rapidly ousting the former from the historic territories of Kosovo, Prizren and Dečani (Dechani), and now tried to justify present possession by a claim as autochthonous owners of the soil. The mountainous and inaccessible character of these borderlands and the extreme backwardness of their population made a guerrilla warfare almost inevitable; and the summons addressed to Belgrade by the Great Powers for the withdrawal of the Serbian troops (Aug. 19) was a signal for further trouble. Late in Sept. there was a formidable Albanian rising, and the insurgents, aided by numerous bands from beyond the frontier and armed with foreign rifles, seized Dibra and even Okhrida, and forced Serbia to remobilize the Morava division and many of her reserves. In order to prevent fresh raids, the Serbs occupied certain strategic points in Albania, and this gave Austria-Hungary excuse for a sharp warning. Thus for the first fortnight of October there was once more acute friction between Vienna and Belgrade. At last Serbia accepted the inevitable and withdrew her troops, but covered her retreat by a note to the Great Powers, begging them to enjoin upon their Albanian protégés a respect for the frontiers created for their benefit (1804). Even after this crisis was over, Count Berchtold made further trouble for Serbia by steadily opposing her Government's very natural desire to take over, so far as Serbian territory was concerned, the shares of the Orient railway hitherto owned by Austrian subjects. Vienna's permanent ill-will was further revealed by attempts to block the conclusion of a concordat between Serbia and the Vatican.[1]

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[1] Gesov, *The Balkan League*, p. 92.

[2] The essential facts were first revealed by Signor Giolitti in the Italian Parliament in Dec. 1914.

By Christmas 1913 the situation in Old Serbia[2] was rapidly becoming normal, but the administration in the new territory left much to be desired, and the closing of Bulgarian schools, the expulsion of Exarchist clergy and occasional excesses against the Moslem population caused serious unrest and discontent. The Pašić administration became absorbed in defending itself against the increasingly violent onslaughts of the Opposition. In Dec. 1913 and again on June 2 1914 it resigned, but eventually remained in office. On March 4 the Opposition had withdrawn from the Chamber as a protest against alleged unconstitutional action of the Government in budget matters. But though the tension was increased by the activities of a powerful military clique known as "The Black Hand" and by the sudden and arbitrary seizure of its club premises by the masterful Minister of the Interior, Protic, the Government was still in office in the summer. The visit of Crown Prince Alexander and Pašić to St. Petersburg early in February had given rise to rumours of a new Balkan League under Russian auspices; but the advent of Radoslavov to power in Sofia had really made any such plan impracticable, and King Charles of Rumania, though bent upon coöperation with Serbia and receiving the Tsar with special honours at Constanta (Constantsa), had no idea of breaking his connexion with the Triple Alliance.

The Assassination of the Archduke.—On June 24 King Peter, incapacitated by ill-health, appointed Prince Alexander as Regent, and simultaneously dissolved Parliament, Pašić having in April pledged himself to the election as for a "Great Skupština" for constitutional changes. Only four days later the assassination of the Archduke Francis Ferdinand and his wife at Sarajevo revived the latent Austro-Serbian conflict in a more acute form than ever. The authors of the crime, Princip and Čabrinović, belonged to a group of Bosnian Serb students, mostly under the age of 20, who gave terrorist expression to the universal discontent aroused by Austro-Hungarian repression throughout her Yugoslav provinces. The victories of Serbia during the Balkan Wars and the openly hostile policy pursued towards her by Vienna and Budapest had assured to her in the eyes of public opinion the position of the Yugoslav Piedmont. Thus no external incentive to the crime was needed: and the young hotheads were further swayed by sentimental considerations. The motive of the Archduke's visit was to conduct manœuvres which had no meaning save as a rehearsal for a future campaign against Serbia: while the selection of "Vidovdan" (St. Vitus's Day—the anniversary of Kosovo) for his public reception in Sarajevo was regarded as a deliberate challenge to the Serb idea. It was, however, proved that the assassins had been in Belgrade and had been secretly smuggled across the Drina into Bosnia, after receiving hand grenades and revolvers from the Serbian Komitajis Major Tankosić and Ciganović. On these facts the Ballplatz sought to establish the complicity of the Serbian Government, but for this no evidence has ever been produced. Indeed presumption overwhelmingly favours the opposite theory. The country was exhausted by two wars; the Albanian campaign in the previous autumn had shown the reluctance of the peasant soldiers to return to the colours, and it was now the eve of harvest. Military stocks were alarmingly low, as the next winter was to show. The young Prince had only just assumed the reins of Government; the position of the Cabinet was shaky, and a fierce electoral campaign was opening. The Concordat with the Vatican had only just been signed, and delicate negotiations with Montenegro for a customs and military union and perhaps even a dynastic arrangement, were still pending. Serbia had every conceivable motive for avoiding aggressive action. After the tragedy, it is difficult to see what other course her Government could have pursued; its one omission was to offer a thorough inquiry, without waiting for any suggestion from Vienna. The situation was from the first envenomed by the press of Belgrade, Vienna and Budapest; but it is to be noted that while the former had always had an irresponsible and highly scurrilous section, which the Government was unable to restrain owing to the lack of any proper press or libel laws, the two latter had always been extremely sensitive to the directive of the Ballplatz, and the worst offences were committed by journals with the strongest official ties.

Austria-Hungary and Serbia.—The ominous silence preserved by Austria-Hungary for nearly three weeks after the murder has been very largely explained by the documents published since the war by the Austrian and German republican Governments. From memoranda on Balkan policy prepared for Count Berchtold during May 1914, and re-drafted by him personally both before and after the murder, it is evident that Austria-Hungary was pressing upon Germany the need for clearing up the situation with Rumania, and for attaching Bulgaria to the Triple Alliance, and that Germany wished to use Bucharest as a bridge between Vienna and Belgrade, but dropped this idea after the tragedy. On July 2 Francis Joseph wrote to William II. that the main basis of Austro-Hungarian policy must be the isolation of Serbia, and "her elimination as a political factor in the Balkans," again advocated alliance with Bulgaria and proposed that Rumania should be warned that the friends of Serbia cannot be the friends of Austria-Hungary and Germany.[3] On reading the letter the Emperor William said that he must be prepared for European complications and must therefore talk with his Chancellor; but he at once authorized Count Szögyény to inform Francis Joseph that he might reckon upon Germany's full support "even in this case," and he urged that if there was to be an advance into Serbia, it should be at once, especially as Russia was certain to be hostile, though unprepared for war (July 5).[4] Next day Herr von Bethmann Hollweg instructed the German minister in Sofia to coöperate with his Austro-Hungarian colleague in favour of the Bulgarian alliance, and the German minister in Bucharest to announce Germany's abandonment of all idea of agreement with Serbia. That Germany gave *carte blanche* to Austria-Hungary has been vehemently denied by Bethmann Hollweg in his *Memoirs*, but is admitted in so many words in the preface to the official German White Book,[5] and is proved by Herr von Tschirschky's assurances to Francis Joseph on July 2, by the instructions which he received from William II. and Bethmann Hollweg, and by William's letter of July 14 to Francis Joseph.[6] As early as July 8, Tschirschky reported to Berlin Berchtold's intention of drafting an ultimatum in such a form that "its acceptance seems out of the question,"[7] and not merely is there no trace of Berlin rebuking this tendency, but there are repeated signs of impatience in Berlin at Vienna's delays. Not merely was the full initiative left to Vienna,[8] but on July 12 there was a joint decision between Vienna and Berlin not to inform Italy of their intentions, but to place her before "an irretrievable situation."[9] In Vienna the only counsels of moderation came from the Hungarian premier, Count Tisza, who at the Crown

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[1] This statesmanlike measure was negotiated by Vesnic, the Serbian minister in Paris, and Gavrilovic (afterwards Yugoslav minister in London), aided by Bakutic, a Croat expert in canon law, from Sebenico.

[2] Since 1912 this name was transferred to the original kingdom and the "Old Serbia" of Turkish times became "New Serbia."

[3] Goos, *Das Wiener Kabinett und die Entstehung des Weltkrieges*, p. 29.

[4] *Ibid.*, p. 31.

[5] P. 5 (Authorized English Edition).

[6] *Die Deutschen Dokumente*, Nos. 11, 15, 26.

[7] *Ibid.*, No. 19.

[8] Goos, op. cit., p. 44.

[9] *Diplomatische Aktenstücke* (Republik Oesterreich) i., p. 51 (No. 16).

Council of July 7 opposed Count Berchtold and declined to admit war to be inevitable. He deprecated a surprise attack, without previous diplomatic action, as likely to place Austria-Hungary in a bad light before Europe and rally the Balkan States against her; he favoured harsh, but not impossible (*unerfüllbar*) demands upon Serbia, and even if their refusal should lead to war, he would not favour Serbia's complete annihilation, partly because Russia would then be forced to intervene, and partly because as Hungarian premier he could not sanction annexations at Serbia's expense. (Here he was following the traditional Hungarian view that the inclusion of further Slavs in the Dual Monarchy was a menace to Magyar supremacy in Hungary.) All the other ministers present—viz. the three joint ministers, Berchtold, Bilinski, and Krobatin, the Austrian premier Count Stürgkh and the chief-of-staff Baron Conrad—were agreed that a mere diplomatic success, even if it led to the public humiliation of Serbia, would be worthless, and that demands must be addressed to her such as would render rejection, and consequent military action, probable. By threatening to resign, Count Tisza carried his point that there should be no mobilization until the ultimatum had been rejected.[1] His attitude is clearly revealed by two memoranda which he addressed to Francis Joseph on July 1 and 8. In the first he condemns Berchtold's idea of using Sarajevo as an excuse for the final reckoning with Serbia as "a fatal blunder," but begs Francis Joseph to make every effort to overcome William's "prejudice in favour of Serbia." From the second it transpires that it was "the satisfactory assurances" of Berlin which had decided all Tisza's colleagues in favour of war with Serbia. He himself dissents, and insists that Serbia must be given a chance of escape, though only through severe diplomatic defeat. This is necessary in order to avoid complications with Italy, to ensure Britain's sympathy and to enable Russia to remain inactive.[2] On July 14, however, after full discussion with Berchtold, Tisza called upon Tschirschky and announced that "he had abandoned his original doubts and is quite in accord with energetic action,"[3] and that "the note will be so drafted that its acceptance may be virtually ruled out."[4] Berchtold on his side informed Tschirschky that Tisza had not merely come round to his view, but had "in certain points introduced a stiffening." On July 15, in answering an interpellation, Tisza denied that war was inevitable, but significantly added that a State which does not regard war as *ultima ratio* cannot maintain itself as a State. Thus while Tisza must be credited with statesmanship such as was signally lacking in his colleagues, his final decision and his subsequent zeal in the conduct of war make it impossible to claim him or his Government as unwilling actors in the great struggle, just as it is beyond dispute that the Magyar policy towards Croatia and the nationalities was a foremost factor in provoking the Austro-Serbian conflict which actually fired that train.

The Ultimatum to Serbia.—A further proof of Germany's failure to exercise a restraining influence on her ally is afforded by the detailed note presented on July 20 by the Serbian chargé d'affaires in Berlin to Herr von Jagow, expressing the strongest detestation of the murder, the desire for friendly relations with Austria-Hungary and a readiness to meet all such demands as might be compatible with State independence.[5] Jagow, however, deliberately refrained from taking up the note's concluding appeal for friendly intervention in Vienna, and there is no evidence to show that he even reported to Count Berchtold the Serbian appeal, while on the contrary he ignored King Charles's offer of mediation on July 10. The secret of the ultimatum was jealously guarded, and the long delay, created, as was intended, a false sense of security in some quarters. Its delivery at Belgrade, which took place at 6 P.M. on July 23, was carefully timed for the moment after President Poincaré's departure from St. Petersburg after his State visit, the object being to eliminate the chances of French mediation. The ultimatum, after reminding the Serbian Government of its formal undertakings of March 31 1909, charged it with "culpable tolerance" of terrorist propaganda directed against Austria-Hungary and blamed Serbian officers and functionaries with planning the Sarajevo murders. It therefore demanded that the "Narodna Odbrana" (League of National Defence) and any similar society guilty of anti-Austrian propaganda should be dissolved, that objectionable passages should be expunged from Serbian educational works, that all officers or officials whom Austria-Hungary might name as guilty of propaganda should be dismissed, and that the Belgrade Government should not merely arrest certain specified persons charged with complicity, but should order the trial of others, allow Austro-Hungarian delegates to take part in the inquiry and accept the collaboration of Austro-Hungarian officials "in the suppression of the subversive movement."

The general impression produced by this document upon European opinion is best summarized in the words of Sir E. Grey, who telegraphed the next day to Sir M. de Bunsen, that he "had never before seen one State address to another independent State a document of so formidable a character."[6] The fifth demand in particular (that of collaboration), he pointed out, "would be hardly consistent with the maintenance of Serbia's independent sovereignty."[6] None the less, Serbia in her reply actually consented to "such collaboration as agrees with the principle of international law, with criminal procedure and with good neighbourly relations." Only on one point did she reply in the negative; the share of Austro-Hungarian officials in the actual inquiry would, it was argued, be a violation of the constitution and the criminal code, but even this could be met by "communications in concrete cases." On all other points there was unqualified submission, and in certain respects, such as the offer to introduce legislation for fuller control of the press and to stiffen frontier regulations regarding weapons, the answer went much further than had been demanded. As a final proof of sincerity, Serbia offered to submit any outstanding points to the decision of the Hague Tribunal or even to the Great Powers which had imposed upon her the declaration of March 31 1909.[7] Thus Serbia is found for the third time in six years offering to submit herself to the verdict of the Hague—the two previous occasions being the Bosnian crisis and the Friedjung trial—and each time it is Austria-Hungary who rejects the proposal. Three days later, as a last resort, the Serbian Government informed the Italian Foreign Minister that it was even prepared to swallow the whole note, "if only some explanation were given regarding the mode in which Austrian agents would require to intervene," and went so far as to offer to accept these explanations from a third party, if Austria-Hungary was not disposed to give them to Serbia direct.[8]

Austria-Hungary had demanded an answer to her note by 6 P.M. on July 25, thus leaving a period of 48 hours for either reply or mediation. The official documents published in Berlin and Vienna since the war make it abundantly clear that the Ballplatz deliberately couched the note in such terms as to be unacceptable; but even in 1914 this was obvious from its tenor and from the significant fact that Baron Giesl, who received the Serbian answer from Pašić a quarter of an hour before the expiry of the time limit, instantly handed him a fresh note announcing the rupture of diplomatic relations and the immediate departure of himself and his staff. Moreover the text of the answer was kept secret in Vienna for several days, until a sarcastic commentary could be added; and Belgrade, presumably owing to the confusion which prevailed there, appears to have taken no steps to bring it promptly to the notice of the other Powers.[9] This is the more regrettable, since even William II. (to judge from his marginal notes on diplomatic documents, as published since the Revolution) was impressed by the moderation of the Serbs, regarded Vienna's essential wishes as fulfilled and expressed the view that Giesl ought to have remained in Belgrade. His ministers, however, had failed to support Sir E. Grey's proposal for a prolongation of the time limit, and were thus responsible for bringing Russia into action. On July 27 the Tsar replied to a despairing appeal of the Prince Regent for assistance to Serbia, by a telegram strongly urging him to "neglect no step which might lead to a settlement," but conveying the assurance that "Russia will in no case disinterest herself in the fate of Serbia."[1] On July 28 Austria-Hungary formally declared war upon Serbia, and on the same day rejected the Russian proposal for a friendly exchange of views between Vienna and St. Petersburg.[2]

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[1] Goos, op. cit., pp. 53–62.

[2] Goos, pp. 62–70.

[3] *Diplomatische Aktenstücke* I, No. 23.

[4] *Die Deutschen Dokumente*, No. 49.

[5] *Die Deutschen Dokumente*, No. 86.

[6] *British Diplomatic Correspondence, No. 5.*

[7] *British Diplomatic Correspondence, No. 39.*

[8] *British Diplomatic Correspondence, No. 64.*

[9] *e.g.* it was communicated to Sir E. Grey by the Serbian minister on the same day on which it reached London through the Austrian embassy with Count Berchtold's comments.

Henceforward the Austro-Serbian quarrel is merged in the larger diplomatic conflict between Alliance and Entente. Due stress ought, however, to be laid upon one of Sir Edward Grey's many efforts to avert war even at the last moment. On July 29 he received Count Mensdorff's assurance that Austria-Hungary "had no idea of territorial aggrandisement," and when he hinted that there were other means of turning Serbia "into a sort of vassal state," received the rejoinder "that before the Balkan War Serbia had always been regarded as being in the Austrian sphere of influence."[3] Undeterred by this ominous attitude, Sir Edward on July 30 put forward the proposal that Austria-Hungary, after occupying Belgrade, should cease her advance and consent to discussions with Russia, who otherwise could not be expected to "suspend military preparations."[4] In other words, Belgrade would become a kind of pledge in Vienna's hands for the attainment of a satisfactory settlement. The elaborate dispute regarding the Russian and German mobilizations has hitherto obscured the essential fact that on July 31 Francis Joseph definitely, almost petulantly, refused the British proposal as transmitted through Berlin,[5] thereby rendering the military action of St. Petersburg inevitable.

The Outbreak of War.—When Baron Giesl presented the ultimatum, Pašić had been absent electioneering in the provinces; but he at once returned to Belgrade, and on July 25 mobilization was ordered, and the seat of Government and the archives were hastily transferred to Nish. In view of so grave a crisis elections became impossible, and as parliamentary sanction was more than ever necessary, the Government had no other course than to ignore the fact of dissolution and to call the previous Skupština once more into existence. At its first meeting in Nish on Aug. 1, the entire Opposition endorsed the Government's action, and for the moment party life was in abeyance. Parliament also ratified the Concordat with the Vatican and a law ensuring to Catholicism full freedom of worship in Serbia. There was an unexpected delay in the invasion of Serbia, and it was not till Aug. 12 that the first Austro-Hungarian troops crossed the Drina and the Save. After 12 days of desperate fighting (known as the battle of the Jader) the invaders were thrown back across the frontier, this being the first definite Allied victory. Unduly elated by this success and by the news of Russia's rapid advance in Galicia, the Serbs were now led to underestimate Austria-Hungary's resources, and encouraged by the Allies, passed to the offensive early in September. Their rash invasion of Syrmia—a necessary preliminary to any successful penetration of Bosnia from the east—soon proved beyond their strength and had to be abandoned by Sept. 13; and the joyous welcome everywhere accorded to them by the population merely brought down a cruel vengeance on its head when the Austro-Hungarian army returned. A further mistake was made in attempting to hold the rich but strategically indefensible Mačva (Machva) district, doubtless owing to the horrid excesses committed there by the enemy during their first inroad. None the less the Serbs were able to check a second Austrian advance across the Drina in mid-September. But on Nov. 6 General Potiorek began a third invasion in great force, and during the next month steadily pressed back the Serbian forces into the heart of their country. The danger was aggravated by shortage of ammunition, and when at last the necessary supplies began to arrive, a large force of Bulgarians armed with machine-guns and acting with the connivance of Sofia, raided the Vardar railway from the Strumnica salient and destroyed an important bridge on the only line by which the new guns could be moved up to the front. The enforced evacuation of Belgrade on Nov. 29 revealed the extremity of the danger, and brought the latent political crisis to a head. On Dec. 5 the purely Radical Cabinet resigned and was succeeded on Dec. 13 by a Coalition Government, in which Pašić remained premier, but the leaders of all parties save the Liberals received portfolios. It was however in this blackest week that the Skupština unanimously endorsed the Government's declaration that its foremost war aim was "the liberation and union of all our Serb, Croat and Slovene brethren not yet set free." This was the first public step of Serbia in favour of Yugoslav unity.

Serbia after the Austrian Rout.—With the arrival of munitions from the West the army's flagging spirits revived, and the brilliant offensive initiated on Dec. 2 by Gen. Mišić and the 1st Army resulted, after a twelve days' battle along the whole front, in the complete rout of Potiorek. By Dec. 14 Serbian soil was for the third time entirely free from invaders, and an enormous booty was captured. But the enemy left deadly infection behind him, and by the early spring of 1915 exhausted Serbia was immobilized by a typhus epidemic which is estimated to have caused about 300,000 deaths among the civil population. A notable part in checking its ravages was played by Lady Paget as head of the Serbian Relief Fund units in Skoplje, and by Col. Hunter and a R.A.M.C. detachment, who organized a scheme of disinfection on the whole Serbian railway system. The latter step appears to have been taken in view of the possibility of Allied troops being employed upon the Danube, an idea which receded from the general design, in proportion as the Austro-German recovery in Galicia became more marked. Serbia's negative rôle during 1915 was due not only to exhaustion but to considerations of high policy. The attitude of Bulgaria was from the first extremely equivocal, and Serbia, had she listened to certain ill-considered pleas for a fresh offensive into Hungary, would have been at any moment liable to an attack from the rear, unless she could rely upon Greece or the Allies to hold Bulgaria in check. Meanwhile the Entente was eagerly working for the intervention of Italy and of Bulgaria, neither of whom could receive adequate satisfaction save at the expense of Serbian aspirations. During the winter pressure was repeatedly brought to bear upon Nish to make territorial concessions to Bulgaria in Macedonia; but the one and only condition upon which Serbia could safely have considered this—namely, that the Allies should guarantee Yugoslav unity in the event of victory—was precluded by their parallel negotiations with Italy, whose official policy it was to prevent, not to further, Yugoslav unity, and to whom by the Treaty of London, concluded on April 26 1915, no less than 700,000 Yugoslavs were assigned. The fact that this treaty's concealment from Serbia was made an absolute condition by Rome, did not tend to diminish the reserve of the Nish Government, who almost immediately learned the essential facts through Mr. Supilo's discoveries in official circles at Petrograd. The Serbs, who were not formally recognized as Allies by the Western Powers, were more conscious than ever of the value to them of the Vardar valley, which would form part of any serious concessions to Bulgaria; and they were from the first sceptical as to the possibility of winning over Bulgaria, whom they believed to be tied to Vienna and Berlin by a secret compact. They were further handicapped by the attitude of Greece, who in the autumn of 1914 exercised her right of veto, under the Serbo-Greek Treaty, upon any cession of territory to Bulgaria and was prepared to demand Monastir as compensation. This attitude could not be ignored at a period when Greece was still ready to intervene on the side of the Allies; and when even King Constantine had firmly rejected William II.'s suggestion that he should fall upon Serbia and tear up the Treaty of Bucharest. What changed the views of both Athens and Sofia was simply the unfavourable turn in the military fortunes of the Allies. As long as the Bulgarians thought that the Dardanelles would be forced, their help could probably have been secured in return for the promise of Macedonia and the guarantee of an Allied occupation: what was lacking was the corresponding pledge to Serbia. The conclusion of a Bulgarian loan in Berlin in Feb. was the first sign of a change, and after March neutrality was the best that the Allies could hope for from Bulgaria, though she showed great skill in furthering Bulgarophil illusions in the West. Thus the concrete proposals addressed to Sofia by the Entente on May 29, over Serbia's head, came two months too late. The Radoslavov Cabinet now played for time, and while asking on June 15 for further details, concluded parallel negotiations with Turkey regarding the Thracian railway. On July 18 the official *Narodni Prava* spoke of the impossibility of Bulgaria keeping out of the war, and public opinion freely discussed the rival alternatives. The final reply of the Entente (Aug. 3) offered Bulgaria the "whole uncontested zone" of the treaty of 1913, with immediate occupation as far as the Vardar; discussion even of Skoplje and of the "contested zone" after peace; Seres at once and Kavalla in the future; and the Enos-Midia line in Thrace. The price was to be war upon Turkey. Greece at once protested, and the Emperor William urged his brother-in-law on no account to cede Kavalla. But the decisive factor was the fall of Warsaw on Aug. 8; not only public opinion, but the general staff now regarded Germany's triumph as inevitable. The Turco-Bulgarian agreement was initialed on the very day after the Allied note, and completed at the end of the month, and on Aug. 20 its negotiator, the Germanophil Žekov, replaced Fičeo as War Minister. Meanwhile the position of the Pašić Cabinet was extremely delicate. It loyally declined to discuss the indirect overtures made to it from Vienna, and stood officially for the programme of unity: but during the summer, yielding to pressure from the reactionaries in Petrograd, it showed a readiness to limit its claims to the territory generally regarded as purely Orthodox—viz. Banat, Syrmia, Bosnia-Herzegovina and South Dalmatia—and to leave the Catholic Croats and Slovenes to their fate. This scheme would have fitted in with Italian designs and with the Treaty of London, which envisaged three separate Slav States, an enlarged Serbia, an enlarged Montenegro and a reduced Croatia. Its weakness lay in the ignorance of its promoters; for even such a division would have left well over a million Catholics in "Orthodox" Serbia. Its failure, however, was above all due to the vigilance of Mr. Supilo and his colleagues of the Yugoslav committee.

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[1] *Serbian Blue Book, Nos. 37 and 43.*

[2] *Russian Orange Book, No. 25,* and *British Diplomatic Correspondence, No. 93.*

[3] *British Diplomatic Correspondence, No. 91.*

[4] *Ibid., Nos. 103 and 110.*

[5] *Die Deutschen Dokumente, No. 482.*

The Conquest of Serbia.—In the late summer the Serbian Government was unduly optimistic as to Greek and Rumanian intervention, and its disbelief in a German invasion was encouraged by Allied military opinion. Only three weeks before Mackensen crossed the Danube, Lord Kitchener, in conversation with a Serbian representative, gave his opinion that any action from the north was mere bluff. Hence though the Skupština on Sept. 5 authorized the Government to make territorial concessions, Pašić adopted a waiting attitude. Bulgaria's mobilization, two days after the opening of the Austro-German bombardment along the river front, proved his calculations to have been correct. Yet even at this moment Allied opinion hoped that Bulgaria might enter on the Entente side, and therefore a veto was imposed upon the Serbian general staff's plan for an immediate attack upon Sofia before the Bulgarian army was ready (Sept. 27). Next day Sir Edward Grey in the House of Commons announced that in the event of Bulgaria's aggression "we are prepared to give to our friends in the Balkans all the support in our power, in the manner that would be most welcome to them, in concert with our Allies, without reserve and without qualification." Relying on the fulfilment of this pledge, the Serbs devoted their main effort to checking the Austro-German advance and remained on the defensive towards Bulgaria. The danger was increased by King Constantine's repudiation of Greece's treaty obligations towards Serbia and the overthrow of Venizelos. That statesman, however, had enquired of the Allies as early as Sept. 23, whether, if Bulgaria declared war on Serbia, and if Greece asked Serbia to supply the 150,000 men stipulated by the Serbo-Greek Treaty for such a contingency, France and Britain would assume Serbia's obligation for her; and an affirmative answer was received within 48 hours. On Oct. 6, the rupture with Bulgaria was complete. The fatal delays in sending the promised troops, coupled with Allied insistence that the Serbs should hold back Mackensen to the last moment, belong to military history; but their results were eminently political. At the critical moment of the Bulgarian menace to the Nish-Salonika railway there were at Salonika not 150,000 Allied troops ready for action, but 35,000 French, and 13,000 British, the latter under strict injunctions from London not to cross the frontier into Serbia.[1] Nish was decorated to welcome Allies who never came. The whole Serbian plan of campaign collapsed, and the armies, losing control of the railway southwards, retired precipitately through the passes leading to the plain of Kosovo. General Sarrail, informed that he must not expect reinforcements, was forced to arrest his belated offensive northwards (Nov. 12) and soon to withdraw to the west of the Vardar. The Serbs were thus cut off from Allied help, lost Skoplje and only just escaped envelopment by the converging Austro-German and Bulgarian armies. The final retreat of the Serbian army and Government took place in the dead of winter across the inhospitable snow mountains of Albania and Montenegro to Scutari, Medua and Durazzo, a smaller section escaping southwards from Prizren and augmenting the Serbian forces south of Monastir. Fortunately, the general exodus of the civilian population was checked before it had gone too far; but the retreat stands out as one of the great tragedies of the war, and the loss of life which it involved must have far exceeded 100,000 and is estimated at twice that number by very sober authorities.[2] After dreadful sufferings the fugitives were conveyed by Allied transports to Corfu, which for the remainder of the war became the seat of the Serbian Government and a base for the convalescence and reorganization of the army. Notable assistance was rendered by British voluntary units, and some idea of the generous response of the British public to Serbia's need may be gathered from the fact that the Serbian Relief Fund from first to last collected over £1,000,000 in money and material, and employed over 700 workers in Serbia, Albania, Corfu, Salonika, Corsica, Biserta and France, while the Scottish Women's Hospitals under Dr. Elsie Inglis performed notable services for the Serbs both on the Balkan and the Russian fronts. The deaths of Mrs. Dearmer, Mrs. Harley (Lord French's sister), Mrs. Haverfield, Dr. Inglis herself and many others set a seal on the new-found friendship of the two nations.

Conquered Serbia was divided for administrative purposes between Austria-Hungary and Bulgaria, the latter holding the Timok, Nish, Skoplje and Macedonia: all that remained to the Serbs was a fragment of territory south of Monastir. Bulgaria now threw off the mask and officially declared the Serbian State to have ceased to exist. It therefore enrolled all men of military age throughout the occupied territory and in Feb. 1917 extended this to include the whole male population. It refused to recognize the Serbian Red Cross and took possession of the Serbian Legation in Sofia. All "ownerless" land was confiscated, all Serbian schools, law courts, and inscriptions were Bulgarized, libraries and collections were either destroyed or removed to Bulgaria, the Serbian clergy were evicted, and there were wholesale deportations. A formidable rising in the mountains behind Kuršumlje (Kurshumlye) was brutally repressed, with over 2,000 executions (March 1917). The war aims now repeatedly avowed by Sofia were the annexation not only of Macedonia, but of Kosovo and Prizren, and the whole upper Morava and Timok valleys: a common frontier with Hungary: the prevention of Yugoslav unity and of Russia's acquisition of Constantinople: and (after Rumania's entry) the retention of the whole Dobruja. Dr. Radoslavov more than once proclaimed Bulgaria's resolve to keep all her conquests,[1] and his official organs declared that Serbia's reconstitution, "no matter under what form, would be a perpetual menace to Balkan peace" and will never be permitted.[2] Austria-Hungary showed much greater reserve, airing from time to time various alternative schemes for a vassal Southern Slav State under the Habsburgs, keeping Prince Mirko of Montenegro as a possible candidate for its throne and employing agents in Switzerland to sow dissension among the exiles.

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[1] See Gen. Sarrail, *Mon commandement en Orient*, p. 27.

[2] G. Djurić, in *Royal Statistical Journal*, May 1919.

The Serbs in Exile.—Soon after the establishment of the Serbian Government at Corfu party rivalries began to revive. The deputies were scattered, living mostly on the Riviera, an independent press was impossible, and regular Allied subsidies made the Government virtually immune from serious democratic control. The supersession of the Voivode Putnik and almost all his staff caused great indignation, and though the whole Serbian Coalition must bear the responsibility, it was known to be the work of Pašić, and his masterful colleague in the Radical party, Protić, then still out of office. In Aug. 1916 an attempt is alleged to have been made upon the life of the Prince Regent at the front, and the Government, after vainly urging the Skupština to institute a new form of courts-martial, proceeded in the winter—while the joint advance under Sarrail was crowned by the capture of Monastir from the Bulgarians—to order numerous arrests on a charge of conspiracy and murder. Among those implicated were the late governor of Macedonia, Gen. Popović, the ex-War Minister Gen. Bojanović, and several distinguished staff officers: many line officers known for their gallantry were placed on the retired list or confined to the island at Corfu.

The Conspiracy Trial which opened in Salonika in Jan. 1917 and was conducted behind the shelter of a strict military censorship, resulted in a death sentence upon nine Serbian officers, and notably of Col. Dimitrijević, the head of a secret society known as "Union or Death," or more colloquially the Black Hand, whose chief aim had been to fan nationalist sentiments in the army. There is no doubt that "Apis," as Dimitrijević was called throughout the Slavonic South, interfered unwarrantably in politics, and it is probable that he had his hand in the Sarajevo murder; but the lack of convincing evidence for the alleged conspiracy makes it probable that he was the victim of rival military and political cliques. Strong pressure of the Old Radical leaders forced the Prince Regent to sign three death warrants and to disregard appeals for mercy from the Western capitals. This trial revived all the old party dissensions: the reactionaries had triumphed on the very eve of the collapse of their chief support, the Tsarist Government. Pašić found himself between two fires—the need for a more democratic restatement of foreign policy, and the demand of the young Radical and Progressive parties for a revision of the Salonika trial. Refusal led to their withdrawal from the Cabinet, and its reconstruction on a purely Old Radical basis under Pašić and Protić. The last occasion when all parties coöperated was on July 20 1917, when the Declaration of Corfu, drawn up between Dr. Trumbić for the Yugoslav committee and Pašić for the Serbian Government, met with unanimous approval. Pašić, having strengthened his position abroad by a visit to Paris and London, declined to convoke Parliament for four months after the legal period had expired. At last, as the result of a direct appeal of its President to the Crown, it met in Corfu on Feb. 12 1918; and the Government resigned, but after weeks of fruitless negotiation for a coalition ministry, was allowed to resume office. The Opposition, which numbered 60 as against 64 Old Radicals, still insisted on the revision of the trial and the transference of foreign affairs from Pašić to their own candidate Drašković; and in April, when the budget was introduced, they withdrew in a body from the Chamber, thus leaving the Government without the quorum of 84 required by the Serbian Constitution. Serbian public opinion was too scattered and disorganized to be effective, and the Corfu Government tried to discredit its opponents' action before the uninformed West, as defeatist or even Austrophil. Thus throughout the spring and summer of 1918 there was acute and growing tension among the rival Serbian groups, and the real initiative in the Yugoslav question and in the political campaign against Austria-Hungary, had passed to Trumbić, Beneš, Lansing and the Allies and to the leaders of the movement inside the Dual Monarchy. Pašić had reverted to his Pan-Serb attitude, opposed inclusion of Dr. Trumbić in a Yugoslav and no longer purely Serb Cabinet, and steadily obstructed the Yugoslav committee's work. There was, moreover, a certain section in the army which aimed at Serbia's military occupation and annexation of Habsburg territory, rather than a free union on equal terms. Fortunately all such ideas were absent from the mind of Voivode Mišić, whose comprehension of the issues at stake was illustrated by his special encouragement of the Yugoslav volunteers and by his signal tact in dealing with the newly constituted Government in Zagreb. Events, moreover, favoured union on terms of full equality; for Austria-Hungary had ceased to exist and her authority had been shaken off by all her Yugoslav subjects long before the Serbian army in its northward advance had even reached Belgrade. Any slight possibilities of initial friction were averted by Italy's action in advancing beyond the Armistice line; the whole Croat and Slovene population thus clamoured for the arrival of the Serbian army and received it everywhere as their liberator from Habsburg rule and their champion in the complications which then seemed imminent. (For the completion of national unity, *see* YUGOSLAVIA.)

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SERBIAN CAMPAIGNS.—Although the Balkan area developed into one of the side-shows of the World War, it was there that it started in 1914 with the ultimatum of Austria-Hungary to Serbia. The 1914 operations and the conquest of Serbia in 1915 are narrated in separate sections below. Under SALONIKA CAMPAIGNS an account is given separately of the Allied operations on the southern Serbian front, 1915–8.

I. OPERATIONS IN 1914

The Austro-Hungarian military problem in starting a campaign against Serbia was complicated by the prospect of a Russian intervention in Galicia. The alternatives were: to defeat Serbia completely before the Russian threat became deadly, or to stand on the defensive against Serbia till after a great battle had decided the issue in Galicia.

The strategic geography of Serbia was, in its broad lines, simple. On the N. side there is the formidable obstacle of the

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[1] *e.g.* in *Vossische Zeitung*, Oct. 10 1916.

[2] *e.g. Narodni Prava*, May 19, *Kambana*, Oct. 9 1916.

Danube and Sava, on the W. the line of the Drina, a river not very broad, but rapid and difficult to bridge, these rivers forming the actual frontier.[1] Initially then the assailant must begin by forcing a river barrier, whatever the direction of his advance, and his power to do so depended: (*a*) on the communications on his own side of the river, which would enable him to collect the troops and material for forcing the passage; (*b*) on the barrier itself; and (*c*) on the defensive positions available for the Serbs inside the barrier. Taking all these factors together, an attack on the northern barrier offered the best chances of success. It was the course chosen by Prince Eugene in 1717 and by Mackensen in 1916, and it was that which the Serbs themselves regarded as most likely to be taken in August 1914. The reasons which led the Austrian commander to choose differently will be considered presently. More important than the choice of a point at which the barriers could most easily be forced was the choice of a direction for the subsequent advance. The objectives were plain enough, the defeat of the Serbian field army and the occupation of the most important part of the country. Without the attainment of these objectives, Austria could not pretend to have conquered, or even to have defeated, Serbia. Both, however, were attainable by an invasion of the Belgrade–Pozharevats–Kraguyevats–Krushevats region, conventionally called the Morava valley. This was the richest part of the country, and the centre of all its communications. Here and here only could the Serbian army be definitely brought to action under conditions in which the Austrian superiority of numbers would be effective.

This region could be approached from the N. (Belgrade or Danube–Pozharevats front), from the N.W. (Sava and Lower Drina front), from the W. (Middle Drina front) or from the S.W. (Upper Drina front).[2] The first named was the most direct route. For the forcing of the Danube[3] five railheads on the Hungarian side were available, for the prosecution of the advance the Orient railway (Belgrade–Constantinople) and various branches of it. The country was rich in local supplies, populous, and relatively well provided with roads, and the general trend of the natural features, governing that of the lines of communication, was from N. to S. On the other hand, the defender would of course be best prepared for attack on this front, and the Danube obstacle was here most difficult to overcome, in spite of the command of the water ensured by the Austrian monitors.[4] Next in importance were the lines of advance from the Sava and Lower Drina, and especially those from the Sava, since the Drina valley was totally destitute of railway approaches on the Hungarian side. In the angle of the Sava and Drina lies the fertile plain of the Machva; many favourable points exist on the Sava for the forcing of a crossing, and the town of Shabats in particular offers a choice of tolerable roads leading S. to the slopes of the Tser (Cer) range S.W. to Valyevo, and W. to Arangyelovats, the last-named route conducting an invader to either Palanka or Kraguyevats in the Morava region. In conjunction with such an advance, an operation on the left, over the Lower Kolubara, supplied from the Sava, would lead to the rear of Belgrade, while on the other flank a successful operation by troops organized for mountain warfare by Valyevo over the Kolubara and Rudnik ranges to Gorni Milanovats and Chachak would threaten the rear of the whole Morava region. As a way of turning the great obstacle of the Danube front, the lines of advance grouped on the axis Shabats–Arangyelovats possessed tempting advantages. But, considered from the point of view of supply, the disadvantages were very serious. Not only was this the longest route between the railheads of deployment and the final objective, but it was destitute of railways[5] E. of the Kolubara. West of that river, indeed, the line Valyevo–Arangyelovats–Palanka lay in the very axis of the march, and a branch-line connected this with Obrenovats on the Sava, where water-borne supplies could be unloaded. But the barrier of the Kolubara and the ridge behind it had to be mastered before this branch could be used, and it was certain that the Serbs could assemble in time to fight on the Kolubara line if not W. of it. That is, from deployment to the first great battle the campaign would have to be carried out with road transport, and in the case of the rightmost routes (axis Valyevo–Chachak) pack transport only.

From the Middle Drina (Lyeshnitsa–Lyuboviya front) all routes converge on Valyevo, at the head of the Kolubara. Thence operations towards Arangyelovats, Gorni Milanovats and Chachak would take the course already discussed. But up to Valyevo operations would lie wholly in mountainous country[6] and would depend for supply almost entirely on pack transport from distant railheads—for in Bosnia the railways come to an end 25–27 m. W. of the Drina, and from that river to Valyevo is a further 32 miles. All arguments against the choice of the Shabats route therefore applied with far greater force to the Valyevo route. Farther S., in the region of Vishegrad, operations into Old Serbia by way of Uzhitse might gain a footing, or help a Valyevo force to gain a footing, at Chachak. But such operations would be mountain warfare pure and simple. Although in this part the railway runs right up to the frontier, no body of troops large enough to deal with the Serbian army could be collected and fed in the upper valley of the western Morava, either by way of Uzhitse or by way of Valyevo. As a threat to the flank and rear of a beaten Serbian army retreating up the Morava valley, such manœuvres might be effective; but to the beating of that army they could contribute practically nothing. Operations from Vishegrad into New Serbia would be too eccentric to have the slightest influence upon the conflict of armies in the Morava valley, and the same would apply to operations from Focha or from the Herzegovina against Montenegro, supposing that state to join Serbia in resisting the Austrian advance. Operations in this quarter would be scarcely more than guerrilla.

On a review of the conditions, then, the most logical plan of campaign from the Austrian point of view would be a frontal operation S. from the Danube front, coupled with an enveloping movement from the Sava (or Sava–Lower Drina) front directed on Arangyelovats, the latter either preceding the other by some days and seeking to surprise possession of the Kolubara ridge, or following it and directed to the flank and rear of an ascertained position of the enemy. Loosely connected with these main operations an advance from the Middle Drina or Vishegrad or both on Chachak and the western Morava had advantages for the exploitation of victory, but not for the winning of it. Such a plan was proposed before the war in the Austrian staff, and practically the same plan was assumed by the Serbians as the basis of their defensive deployment. Whether any or all of these operations could be carried through before the Russians intervened, or before their intervention became dangerous, would depend on available time. If no time at all were available, a pure defensive was the only course. If time for a thorough conquest, all the operations above mentioned with proper proportioning of strength would contribute something to a decisive success. In any intermediate conditions, one or more of the subsidiary operations would be omitted from the plan, and, especially, if a minimum time were available only the direct S. attack from the Danube front would be admissible, with or without a collateral attempt by light forces from Shabats or Obrenovats to seize the Kolubara ridge.

The calculation of this available time depended principally upon the arrangements made between the Austrian and the German staffs for initial operations in Poland, Galicia and E. Prussia. For this a plan had been drawn up by Conrad von Hötzendorf and Moltke in consultation; and, on the basis of this plan, the scheme of operations adopted against Serbia was apparently the full scheme outlined above; concentric advance from all the fronts in varying strengths and at various dates. Nearly half the army was placed in position for this advance, and the Austrian supreme headquarters intended to conduct the campaign itself. But at the last moment, it is asserted, the Germans, rightly or wrongly, changed their minds, the allies' scheme for Poland and Galicia fell to pieces, and, in trying to adapt their plans to the new conditions, the Austrians threw their S.E. forces into confusion before they had even deployed. The responsibility for a grave initial blunder, then, lies ultimately with Moltke, if he failed to keep his promise, or with Conrad, if he interpreted a mere interchange of views as a binding engagement. In any case the effect was to withdraw the forces on the San–Danube front to another theatre amid the battle for the river crossings.

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[1] In its upper course the Drina passes inside the Austrian frontier, and direct advance into Serbia is therefore possible from the region of Vishegrad. But this roadless, mountainous region is quite unfitted for the movements of large forces.

[2] Attack from the stretch of the Danube front lying in the mountains between Weisskirchen and the Iron Gates was regarded by both sides as outside the limits of probability.

[3] The lowest reaches of the Sava are usually considered as belonging to this front.

[4] Six in number, armed with 4·7-in. guns, and armoured.

[5] The small line connecting Shabats with Loznitsa was of no importance, except in the case of stabilized trench warfare in the Machva.

[6] Even the Yadar valley road was in many places unsuitable for wheeled transport.

The Yadar Campaign.—The deployment, carried out according to the original scheme,[1] in spite of the fact that, at some date not yet known, it had been decided to make a radical alteration, was as follows:—

II. Army.—General of Cavalry Böhm-Ermolli on the Danube–Sava front from Weisskirchen to Mitrowitz (Mitrovicza). Left to right—VII. Corps (34th and 17th Divs.); 7th Div.; IV. Corps (32nd and 31st Divs.); IX. Corps (29th Div. only); 10th Cavalry Division. In reserve 23rd Honved Division. Total: 131 battalions, 42 squadrons, 56 batteries.

V. Army.—General of Infantry Liborius von Frank. On the Lower Drina from mouth to Lyuboviya, and left to right—VIII. Corps (9th Div., 21st Landwehr Div. and combined brigade); XIII. Corps (36th Div., 42nd Honved Div., one brigade, one mountain brigade). Total: 79 battalions, 15 squadrons, 39 batteries.

VI. Army.—Feldzeugmeister Potiorek. Vishegrad-Focha region, left to right—XV. Corps (1st and 48th Div. staffs with 4 mountain brigades); XIV. Corps (18th Div. staff and 6 mountain brigades); in reserve 40th Honved Division. Detached, facing Montenegro, 47th Div. and 3rd Mountain Brigade. Total: 74 battalions, 5 squadrons, 40 batteries.

Each army had in addition one Landsturm brigade and the V. and II. one to three "march" (*i.e.*, reinforcement) brigades.

Of these forces the II. Army was withdrawn on Aug. 14,[2] leaving the others in full battle on the Drina. That this battle was in being, however, was due not to Conrad, who—naturally, under the changed conditions—ordered the "Balkan Forces" to stand on the defensive, but to "*Feldzeugmeister*" Potiorek, commander-in-chief as well as commander of the VI. Army. This officer, high in favour at Court, had been for some years viceroy in Bosnia-Herzegovina, and regarded the problem from the standpoint of the Sarajevo residency rather than from that of a military headquarters faced with a military problem. He saw above everything else the possibility of the Serbians advancing over the Drina to excite insurrection among their brothers and cousins, although there was nothing in the layout of the Serbian deployment to suggest this, and he not only kept the centre of gravity of the forces on the Drina, but, on his own responsibility, launched a "preventive" offensive on this unfavourable front.

On the Serbian side, general mobilization had been ordered on July 25, months since the demobilization that marked the end of the Balkan Wars. Of a population of about 3,100,000 in Old Serbia and about 1,800,000 in New Serbia (where there had been no time to set up the administrative machinery of conscription), 489,500 men were mobilized at the outset and some 43,000 more between August and September.

On Aug. 5 1914 Montenegro declared war on Austria-Hungary. Her forces amounted to about 50,000 militia with very little artillery, and were of no direct assistance to Serbia. But they occupied the attention of three mountain brigades of the enemy's army and, what was perhaps more important, they added considerably to Potiorek's politico-military anxieties.

Strategically, there were three possible courses open to the Serbs: the defensive in their own country, the offensive W. into Bosnia, Herzegovina and Croatia, and the offensive N. into Hungary; but the first course was the only one practicable. An offensive into Bosnia, even with Montenegrin aid, could only have succeeded if the populations there had been ready to rise at the first signal, which they were not. Politically, it would have played into the hands of the enemy by showing the world that Austria's fear of Serbian ambitions had been justifiable. Militarily, an offensive over the Drina presented the same supply difficulties in either direction. An offensive into Hungary, whether to the right or left of the Danube, must begin with the forcing of the Danube or the Sava, and in view of the disproportion between the opposed forces had no chance of success unless the bulk of the Austro-Hungarian army were at the same time closely engaged in Galicia and Poland. In the initial stages of the operations at any rate, therefore, such a movement was out of the question.

The strategy adopted was, therefore, purely defensive, in spite of the offensive victories of 1912–3 and the mania for the offensive at all costs and in all conditions which then pervaded almost every army in Europe.

The order of battle was as follows, the Crown Prince Alexander being commander-in-chief, and Voivode R. Putnik chief-of-staff, with headquarters at Kraguyevats:—

I. Army.—General Boyovich. Divisions Timok I., Timok II., Morava II., Danube II., 52 battalions, 7 squadrons, 26 batteries: approximate strength 55,000, grouped about Palanka and Racha and Topola.

II. Army.—General Stepanovich. Divisions Shumaja I., Morava I., Danube I., and "Combined Division." 64 battalions, 10 squadrons, 33 batteries, about 71,000 men. Grouped about Arangyelovats, Lazarevats, Belgrade.

III. Army.—General Yurichich-Stürm. Divisions Drina I., Drina II., 28 battalions, 5 squadrons, 16 batteries, about 32,000. Grouped around Valyevo.

Uzhitse Army.—General Boyanovich. Division Shumaja II., Uzhitse Brigade, 24 battalions, 2 squadrons, 11 batteries, about 26,000. Grouped at Uzhitse and Bainabashta.

Independent Cavalry Division.—Sixteen squadrons, one battery, about 3,000 concentrated at Ub.

Belgrade Group.—About 9 battalions, 2 squadrons, 10 batteries.

Obrenovats Group.—About 11 battalions, 5½ batteries.

Other frontier troops, in all about 25 battalions, 13 batteries.

In infantry, therefore, the Serbians had about 213 battalions to pit against the 272 of the enemy's II., V. and VI. Armies. On the other hand, nine out of ten of the men in these 213 battalions had fought in the wars of 1912–3. In artillery the opposed forces were nearly equal, about 110 Serbian to about 130 Austro-Hungarian; three-quarters of the Serbian guns were of a better model than the Austrian, and some heavy artillery was available. On the other hand, the equipment of the Austrians and their resources in ammunition and stores were much superior, for Serbia was nearly isolated, the one available arsenal was small, and stocks depleted in the Balkan Wars had not been made good.

In sum, then, it would appear that the Austrian expeditionary force—even counting the II. Army which appeared only to be withdrawn, and the III. Corps which did not appear at all—was none too strong for the defeat of the Serbian field army, let alone its destruction. And as soon as it had been decided to withdraw the II. Army, replacing it by a mere screen along the Danube, it was or should have been obvious that the 141 battalions, 17 squadrons and 70 batteries of the V. and VI. Armies were far too weak a force to attempt an offensive into difficult country held by superior numbers of well-trained and war-experienced troops. Potiorek, however, decided otherwise.

From July 26 to August 11 only minor incidents took place—bombardments of Belgrade and other places by the monitors, raids over the river for reconnaissance purposes. Then, on the night of August 11–12, the Austrian main bodies began to cross on a wide front at Drenovats (near Shabats) on the Sava, several points between Lyeshnitsa and Loznitsa on the Lower Drina, and Zvornik and Lyuboviya on the Middle Drina. On the 12th the frontier troops of the Drina defence were pushed back concentrically in the general direction of Valyevo, those of the Sava defence driven out of Shabats. E. of that point the II. Army, under orders for Galicia, remained inactive except for the seizure of Gipsy Island (Ostrovo Tsiganlya) close above Belgrade, while in and S. of the Vishegrad region the XV. and XVI. Austrian corps were preoccupied by the activity of the Uzhitse army,[1] and the Montenegrins.[2]

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[1] The III. Corps (6th and 28th Divs., 22nd Landwehr Div.), however, which mobilized with the other seven corps, did not proceed to the Serbian front, but was dispatched to the Dniester at once.

[2] It arrived in Galicia too late for the crisis there.

During the 12th and following days the Serbian headquarters became convinced that nothing was likely to come from the Danube front, and shifted the centre of gravity of their forces towards the Upper Kolubara. The calvary division at Ub was ordered to reconnoitre towards Shabats and to separate the Shabats column of the enemy from the Drina columns. The II. Army was to push the right wing (Shumaja I.) against Shabats, and its centre and left along the Tser and Iverak ridges and the Yadar valley in conjunction with the III. Army, which concentrated forward from Valyevo to Zavlaka and Krupany to support its retiring outposts. The I. Army was to take over the whole northern front as far as Obrenovats. The Danube 1st Div. was transferred to it, the II. Army receiving Timok I. in exchange.[3] These movements, in spite of forced marching, took time, and but for the difficulties which at once arose in the Austrian army—the V. Army had only wheeled transport—so forward a concentration would have been impossible. As it was, the dispositions were practically realized by the night of Aug. 15–16, when the battle proper opened with the Austrians on the front Shabats–Slepcevish (elements of IV. Corps, and 29th Div., X. Corps, both of II. Army); Bela Reka–Tser plateau and Lyeshnitsa valley (VIII. Corps); Iverak ridge and Yadar valley W. of Yarebitse (36th Div., XIII. Corps); W. of Krupany and N.E. of Lyuboviya (remainder of XIII. Corps).

During the night and the day following there was heavy fighting on this line. The Serbian cavalry division, supported by Shumaja I. of the II. Army, pushed up to and towards the left of the positions of the Austrians about Shabats. The II. Army arrived in sufficient strength to hold a line on Tser, in the Lyeshnitsa valley, and on Iverak, in touch with the right of the III. Army W. of Yarebitse. But the centre and especially the left of that army retired under severe pressure from the Austrians (right of XIII. Corps) who, in this case equipped for mountain warfare, were able to capture Krupany and enforce the swinging-back of the whole Serbian left wing. Yarebitse was given up and, pivoting on the right of the II. Army, the remainder of that army and the III. took up new positions in an arc about Zavlaka (night of 16–17th).

On the 17th the Serbian cavalry spread over the Machva, intercepting communications between the Austrian Shabats force and the columns working along Tser plateau.[4] But Shumaja I., advancing from the S. on Shabats, was arrested by entrenched infantry some 3 m. short of its objective. The II. Army on Tser and Iverak and the right of the III. Army in the Yadar valley maintained an unbroken front, and on Tser in particular carried out counter-attacks, but the continued pressure from the S.W. on the centre and left of the III. Army compelled a further retreat. Here the situation was becoming critical, the Austrian 42nd Div. threatening to seize the Valyevo road to Osechina behind the Serbian positions, while farther to the S.E. only third-ban troops stood between the Austrian mountain brigades and the Petska–Valyevo road.[5]

On the 18th the fighting continued in front of Shabats, and Shumaja I. drew back to Slatina, while the cavalry division, meeting the Austrian 21st Landwehr Div. about Lipolist, fell back to concentrate in line between Shumaja I. and the Tser ridge. On Tser and Iverak the day was a repetition of the 17th, with more pronounced counter-attacks on the front of the defence. On the right of the II. Army the strong position of Kozaningrad on Tser was stormed and held, in spite of the fact that reserves had been given up to strengthen the III. Army. On the critical wing of that army also the day was rather more favourable,—thanks to the arrival of the II. Army reserves alluded to above, which by counter-attacks prevented an imminent breach in the centre of the III. Army, now E. of Zavlaka, in the Yadar valley. Farther to the S.W., little ground was gained by the Austrian mountain troops, the Serbians still holding Rozan and Proslop at night.

The 19th was destined to be the critical day. On the Serbian right, the Austrian Shabats force, now superior in numbers to Shumaja I., took the offensive and drove back the Serbs to the river Dobrava, while the 21st Landwehr Div. from Lipolist pressed back the cavalry division a short distance. On the left of the general front, the III. Army and the left of the II. lost ground, both in the Yadar valley and on the extreme left where Rozan and Proslop and even Petska fell into the enemy's hands.

But in the centre, on Tser and Iverak, a definite change in the situation set in. Freed by the capture of Kozaningrad on the previous day, the Serbian "Combined" division on Tser pushed ahead rapidly along the ridge, although with every advance it was more and more ahead of the troops on either flank. This success not only imposed caution on the assailants of the cavalry division on the Machva plain, but, what was of decisive importance, brought them into positions overlooking the Lyeshnitsa valley. Threatened in rear, and with their wheeled transport exposed to capture, the Austrians began to fall back not only in that valley but also on Iverak before Morava I., and General Stepanovich decided to ignore the grave position of affairs on his left and force victory in the Yadar valley. The "Combined" division and Morava I., therefore, always echeloned from right to left, drove along Tser and Iverak, Timok I. in the Yadar valley conforming. The battle of the Yadar was decided.

On the 20th the drive along the ridges was accentuated more and more, and the Austrians fought no longer for victory, but for escape. So vigorous was the pursuit on Tser that a part of the "Combined" division outran all support and barely escaped destruction in the rear of the enemy's lines. Both along Tser and along Iverak, artillery was, with great efforts, pushed up behind the advancing infantry to shell the valleys below. In the Yadar valley Yarebitse was captured by 10 A.M. and the general pursuit ended near the Drina the same evening. The right wing of the Austrians, less hard pressed and better organized for movement in rough country, retired in good order. Morava II., from Valyevo, only reached Krupany on the 21st. No attempt was made, however, by the Austrians either on the Lower or the

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[1] On Aug. 2–4, Serbian forces captured Uvats, Rudo and Ustiyar, and raided the Drina immediately below Vishegrad. Other raids were pushed, with Montenegrin coöperation, over the Metalka Saddle on Chaynicha (Čajniče), and towards Focha. On the 7th an Austrian advance from Vishegrad on Gradishte was checked by the Serbians. On the 16th a Serbian attempt to capture Vishegrad by forces from Uvats, Gradishte and the hills to the N.E. was repulsed. The Austrian XV. and XVI. Corps at the same time took the offensive on the front Vishegrad–Chaynicha. While the left flank was being cleared by sharp mountain fighting (19th) about Chelebish (S.E. of Focha), the Chaynicha force crossed the Metalka Saddle and moved on Plevlye, Priyepolye, while the Rudo troops on the left forced the Serbian positions on the Lim at Uvats and Priboy (20th–22nd) and the Vishegrad troops repulsed a second attack on their stronghold (20th–21st). But at this moment the collapse of the main offensive on the Drina compelled the Austrians to retreat to Vishegrad and Focha, whither they were followed by the Uzhitse army and the Montenegrin Plevlye group.

[2] On Aug. 7–11 Montenegrin forces raided Artovatz on the Gatsko road and Klobuchi on the Trbinye road. Cattaro was intermittently bombarded, and Budua raided, from Mount Lovchen. These raids were repelled by the Austrian 3rd Mountain Brigade and 47th Division. But on Aug. 15 the main body of the Montenegrins appeared before Bilek (Bileva) which they blockaded for some time. On the 25th–26th, however, a northward sortie of the garrison, coupled with a southward advance of the 3rd Mountain Brigade from Gatsko, caused the Montenegrins to give up the blockade, and on Aug. 30–Sept. 2, forces from Trbinye coöperating, the 3rd Mountain Brigade and the Bilek force drove back the invaders into their own territory. A threat to the Montenegrin rear by part of the 3rd Mountain Brigade which advanced from Gatsko S.E. to Visznitsa Do largely contributed to the result.

[3] This distant division seems to have reached the front on the 18th.

[4] The Austro-Hungarian force at Shabats was limited to pure self-defence by orders of the army command which was preparing for the move to Galicia. After crossing on the 12th, it was actually withdrawn again on the 14th, leaving only outposts on the hostile bank. At Potiorek's request, however, the 29th Div. was again sent over the river on or about the 17th.

[5] So serious was the situation that already on the 16th G.H.Q. had ordered Morava II. of the I. Army, hitherto posted about Lazarevats to meet a possible attack by Obrenovats, to move by forced marches to a position astride the Petska–Valyevo road. The division reached this position on the 18th.

Middle Drina to keep a foothold on the right hand, and on the 22nd the whole river front was again occupied by the Serbians.

Meanwhile the troops of the Austrian II. Army had ceased to press Shumaja I. on the line of the Dobrava, and begun to fall back on Shabats, and the 21st Landwehr Div. in the plain likewise retreated on the Drina, followed by the Serbian cavalry division which gleaned prisoners, guns and vehicles. On Aug. 21–22, Shumaja I., reinforced by troops from Tser on its left, and also by Timok II. from the I. Army, advanced from the S.E., S., and S.W. on Shabats, held by elements of the IV. Corps and by the 29th Div., under the command of General Tersztyanski. On the 23rd sharp counter-strokes were made by the Austrians to hold off pressure on their river flank. Only rear-guards remained in Shabats when the Serbs attacked on the 24th.

So ended the first invasion of Serbia. The principal reason for its failure was the Austrian commander-in-chief's undervaluation of the military, and overvaluation of the political, factors with which he had to deal. Neither on the part of the Higher Command nor on the part of the Court was pressure brought to bear on him. Nor, after the event, did he attempt to find scapegoats among his subordinates. What he did, he did in the exercise of unfettered judgment. But history will not regard this judgment as of a high order. To hurry[1] on an offensive in mountainous country, from a starting-point at a maximum distance from the strategically decisive point, with three armies equipped in the main for warfare in the plains, of which one was under orders for another theatre, is so astonishing a proceeding that it can only be assumed that the campaign was never intended to be more than a demonstration of activity, analogous to a punitive march up some valley of the Indian frontier region. And indeed, Potiorek's position as civil and military commander of a rough frontier region has been very aptly compared to that of an Indian viceroy. Regarded from this standpoint, the advance over the Drina is an operation differing in degree only from the advance of the XV. and XVI. Corps on the Lim or that of the 3rd Mountain Brigade into the fastnesses S.E. of Gatsko. And in such an operation the assistance of the II. Army might no doubt be dispensed with. But if the ground of justification be thus shifted, the basis of criticism is shifted also, and in that case what is to be said of a modern European commander-in-chief who thought that an organized army of 11 strong divisions, recently victorious in two campaigns over other organized armies, could be treated as though it were on the military-technical level of a frontier tribe? Actually, it appears that the astonishment and dismay of the commanders, from army down to and below division commanders, at the incomprehensible sequence of events was no small factor in the issue.

Of the conduct of operations on the Serbian side it need only be said that Putnik's management of his forces in space and time, and the choice of the moment and place of counter-attack, were masterly. To gain great results, the risks of a forward concentration were accepted, but always under such conditions that the chances and profits of success were greater than the chances and losses of defeat. The object was limited, but its attainment complete without remainder.

At the same time, in this as in many other instances, the idea of a limitation of objective has been criticised *per se.* Only a detailed reconstruction of the conditions at the moment of the counter-offensive would make a final judgment to be formed on the question in the present case; and for that the materials not only have not been published but are probably not even in existence, since the bulk of the Serbian archives were destroyed in the autumn of 1915. But this much may be said, that the Serbians were, in point of ammunition and transport, ill-equipped for a great strategic pursuit either into Bosnia or into Hungary, that the great battle in Galicia was only just opening, and its consequences could scarcely be foreseen, and that the strain of the forced marches imposed by the forward concentration, followed by that of hill fighting, had told heavily on the victors.

The Syrmian Operation and the Massed Austro-Hungarian Attack.—The Yadar and Shabats operations closed, then, on the river line, but meanwhile no events had taken place on the front E. of Obrenovats, and the Austro-Hungarians were palpably withdrawing forces by all railheads between Weisskirchen and Mitrovitsa, and after a short rest the Serbian command decided to push an offensive over the Sava into Syrmia (Srem), the subdistrict of Hungary lying in the angle between the Sava and Danube. In this region were three of the six railheads at the enemy's disposal and an important lateral line. Its occupation would therefore thrust back the line of deployment of any future attack from the N., and the new front to be held defensively at the further limit of the occupied area would lie in and across the Fruska mountain range (the Mitrovitsa–Peterwardein), and thence along a part of the Danube which was exceptionally strong as an obstacle—owing to the marshes and channels at the confluence of the Theiss—to Semlin and the old Danube front. This gained, it would be possible to embark upon an invasion of Bosnia without fear of a sudden attack in flank and rear.

As early as the 26th, two days after the reconquest of Shabats, Putnik issued general instructions regrouping the army for the new project. The II. Army (now to consist of Morava I., Timok I., Timok II., and "Combined" divisions) was to occupy and defend the Lower Drina to Lyeshnitsa exclusive. The III. Army (Drina I., Drina II., Morava II.) was to hold from Lyeshnitsa inclusive to Zvornik. A special detachment, reporting directly to G.H.Q., was to hold the crossings below and at Lyuboviya. The I. Army (Shumaja I., Danube I., cavalry division) was to assemble towards Shabats and prepare to force a passage into Syrmia. The Belgrade and Pozharevats groups were to continue in their defensive missions, the former to be prepared to coöperate with the I. Army in the capture of Semlin, the latter to dispatch its principal formation, Danube II., to Obrenovats for Sept. 9. The Uzhitse Army was to continue its mountain offensive towards Vishegrad, in concert with the Montenegrin Plevlye group. The date of the Sava crossing was to be ordered by G.H.Q., and meanwhile the II. and IV. Armies were instructed to reconnoitre crossing places on the Drina line, and to obtain all possible intelligence as to the condition of the enemy in their front.

A pause followed, while the preliminary work was being carried out and the I. Army being marched over from the Morava valley. The enemy was occupied with reorganization, and with the reliefs and takings-over consequent on the withdrawal of the II. Army. On the whole northern front there remained one post-line division only, the 29th; along the rivers themselves were Landsturm formations. Yet Potiorek was in fact contemplating a new thrust on the Drina; and the 29th Div. was ordered to be ready to coöperate by forcing a passage of the Sava at Yarak. Thus it befell that the division was grouped between Huma, Yarak and Nikinci when the Serbian offensive was launched. Apart from it, there were no formations in Syrmia other than the regiments holding the thin surveillance line.

On Sept. 3 General Krauss, commanding the 29th A.H. Div., received word that the Serbs intended to force the passage of the Sava below Mitrovitsa. This report he more than half-disbelieved, and in any case, regarding Mitrovitsa–Yarak as the centre of gravity of the Serbian offensive into Syrmia, he was content to leave his forces grouped as they were for Potiorek's intended advance. This was to take place on the 7th, and for it the 7th Inf. Div. was added to Krauss's command, henceforward known as the "Combined Corps Krauss."

On the night of Sept. 5–6, the Serbian preparations being complete, the passage was forced in two places, between Mitrovitsa and Yarak by Timok I. of the II. Army, and at the Kupinovo loop by the I. Army. The former, intended more as a demonstration than an operative crossing, was successfully achieved, but the eager troops pressed on without making a bridgehead, fell into the midst of Krauss's troops and, driven back on the river, were overwhelmed in the attempt to recross, five battalions being completely destroyed.

The Kupinovo division, on the other hand, secured their position with a bridgehead line before pushing on. Fortune favoured them, too, for the defence here consisted of Landsturm forces directed by a headquarters at Peterwardein, and Krauss, bound to Yarak by his orders to coöperate in Potiorek's Drina offensive which had not been cancelled, only sent his newly arriving 7th Div., piecemeal, to assist the Landsturm in holding the Syrmian plain. This was, of course, unknown to the Serbian I. Army, which developed its advance cautiously across the plain and by the night of the 8th occupied a front from Platicheno near Klenak by Brestac round to Progar. In the next days, the left stood almost fast while the right pushed out, cleared a passage for the troops at Obrenovats, and by a threat to the rear of Semlin forced the enemy to give up that place to the Belgrade forces. Lastly, the right of the line swung up with its flank on the Danube and its centre on Gorubintsi; the intention was to bring this right wing by a wheel into the W. part of the Fruska range and so to make good the line across that range from river to river which was the objective, without losing men in a frontal battle against the enemy's strong forces about Huma and Mitrovitsa. For three more days it was persisted in, then on the evening of Sept. 11, owing to the situation of affairs on the Drina front, it was given up. On the 12th, 13th and 14th a methodical retreat, with which Krauss's 29th Div., though released at last from Mitrovitsa–Yarak, was unable to interfere seriously, brought the Serbian I. Army and Belgrade and Obrenovats forces back to their original positions whence the field divisions were hurried with all speed to take part in the new battle of the Drina.

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[1] The Commander of the V. Army, von Frank, protested against this hurry, and only submitted to a formal order.

Potiorek's second offensive had opened on the night of Sept. 7–8. The VIII. Corps (with which originally the 29th Div. was to have coöperated) bordered the Lower Drina as far up as Biyelyina, the XIII. from that point to Kozluk, the XV. thence to Zvornik, and finally the major part of the XVI. corps opposite Lyuboviya, the remainder, as in the previous phase, facing the Uzhitse Army and the Montenegrins. The Serbs were, as the result of the Yadar operations and the proposed offensive into Bosnia, deployed in strength, and this, on the one hand, increased the probability of repulsing any given attempt, but on the other made it more difficult to deal with any break-through that might actually occur, as the defence system lacked depth.

The attack began with the VIII. Corps. Here it only succeeded in establishing a bridgehead in the N.W. corner of the Machva, covering temporary bridges at Parashnitsa; and the expected coöperative attempt of the 29th Div. at Yarak was not made, as, by the date fixed for this coöperation (the 9th), Krauss had concluded that the failure of the VIII. Corps was too clear, and the situation in Syrmia too critical to allow it.

But farther S., on the front of the XV. Austrian Corps and the right of the XIII., the Serbians' III. Army had more difficult conditions for defence, and on the night of Sept. 8–9 the passage was forced first at Brasinski Han and then at Zvornik. Crossings followed at other points farther up as far as Lyuboviya. The Serbs were forced back to the Guchevo–Boranya–Yagodnya ridge. By the 11th the situation on this wing was serious enough for the Serbian command to order the cessation of the Syrmian offensive and the transfer of the I. Army with all possible speed to the region of Valyevo–Petska.

Meanwhile, local reserves gathered from behind the centre had been dispatched to establish a front Yagodnya–Brankovac–Rozani–Proslop. Behind this line, the reassembly of the I. Army about Valyevo was to take place. Its headquarters were ordered to Valyevo, its forces to the same point as a preliminary to concentrating about Petska, whence the enemy was to be attacked in flank and rear towards Krupany, Zavlaka or Osechitsa, according to the amplitude of his presumed sweep. The definite line of resistance on which battle was to be accepted if the Austrian pressure was maintained, was from the Dobrava S. of Shabats to Brestovats and Tser ridge (II. Army), thence in the hills about Zavlaka or about Osechitsa (III. Army), according to circumstances, to whatever point on the Petska–Valyevo road the concentrating I. Army[1] was able to reach in time.

Two days later the situation was suddenly modified again. On the night of 12–13th parts of the Austro-Hungarian XIII. Corps began to cross the Drina at Kuriachista, midway between Lyeshnitsa and Loznitsa, opposite the left of the II. Serbian Army, which was by now weakened through giving up local reserves and taking over an extended front for the benefit of the III. Army. This new move threatened not only to cut the Serbian line in two, but to roll up the whole Guchevo–Yagodnya position by a drive along the Yadar valley behind it.

With this, the battle becomes too tangled for brief description. Though the particular threat from Kuriachista was soon ended, the left of the Austro-Hungarian XV. Corps developed strong attacks on Loznitsa. The struggle for the W. end of Guchevo ridge and the lower part of the Yadar valley was fed from day to day by successive reinforcements arriving on each side. Here, minor contests for the possession of minor ground features, attempts to hold a hill long enough for it to be crossed with guns, or to storm it before it could be crowned, went on for days collaterally with the pressure exercised by the Austrian mountain troops of the XVI. Corps on the left of the Serbian III. Army, until the forces of the Serbian I. Army began to appear on Sept. 15. Next day, with a considerable force in hand, the I. Army staff mounted a counter-attack which bore back the Austrians from the line W. of Kostaynik–Sanats (pt. 835)–Sokoloka Planina–Petska, to one which on the evening of the 18th ran from W. of Kostaynik–Sanats–Veles–Karashitsa–Lyuboviya. Then, with further Serbian gains to the right of Sanats, fighting died away all along the line and trench warfare set in on the front from Karashista to Lyuboviya, the Austrians and Serbs facing one another on the line Guchevo–Boranya–Yagodnya–spur S. of Yagodnya.

On the Machva front, meanwhile, the offensive of the VIII. Corps, which had at first obtained only a bridgehead at Parashnitsa, was resumed in combination with a crossing at Yarak by Krauss's corps, when Syrmia had been evacuated by the Serbs. Here also, after violent but narrow-fronted attacks, trench warfare set in on the line of the two bridgeheads (N. of Shabats–Glushtsi, and Ravnye–Serbian Racha) which on Oct. 31 were united in one by a successful advance of the VIII. Corps from Ravnye to Glushtsi.

The second phase had been very different from the first. The Austrian staff had taken their opponent seriously, and laid their plans carefully, and it was only after the greatest exertions and very heavy losses that the Serbs had succeeded in pushing back the invaders. Even so, the latter had mastered the greatest part of the river obstacles, and in the absence of aircraft on the side of the defence, could carry on all preparations for a fresh offensive, unseen behind their firmly held trench-line.

Meanwhile, the Uzhitse Army and the Montenegrins, who at the close of the first phase were following up the retreating Austrians towards Vishegrad, had developed a series of operations which, like the expedition into Syrmia, were designed to prepare the way for a serious offensive of the II. and III. Armies over the Drina. This being forestalled by the Austrian offensive, the operations of the Uzhitse Army and its allies were without practical effect. They were, however, vigorously conducted.[2]

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[1] To aid in this concentration, only the Danube I. Div. was to be disengaged at once in Syrmia, and the army was to be reconstituted by this division's picking up *en route* Danube II. from Obrenovats and a division of the II. Army from Tekerish. This latter did not join, becoming absorbed in the lower Yadar fighting.

[2] On Sept. 4 Goles Height, S.E. of Vishegrad, was stormed by Shumaja II., while farther up the Dwina, other Serbian and Montenegrin forces attacked at Ustipratsa, Gorazda and Focha. At the latter place the Montenegrins broke through on Sept. 11, and a raid was pushed deep into the enemy's country, while a number of simultaneous attacks at Gorazda, Ustipratsa, Vishegrad and Bainabashta caused the Austrian 8th Mountain Brigade to draw back to Han Pesak and Srebenitsa, when it crossed the rear of its Corps (XVI.) fighting N. of Lyuboviya. This and the other Austrian mountain brigades, however, maintained an active war of raids and expeditions in the mountains. The Montenegrin main body, from Focha, moved E. to Kalinovik, which it captured and then evacuated. Other Montenegrins from Focha and Serbs from the Vishegrad and Rogatitsa region threatened Sarajevo for some time, though periodically cleared away by expeditions of the mountain brigade from Sarajevo and the 8th Mountain Brigade from Srebenitsa and Han Pesak. Meanwhile, the bulk of the Serbian Uzhitse forces (Shumaja II.) advanced by Han Pesak on Vlasenitsa, and also to Srebenitsa. Indecisive fighting took place at the former during the last of September and the first of October, but at Srebenitsa the threat to the rear of the Austrian XVI. Corps was dissi-

The Kolubara Campaign.—The course of the war during September and October had not been favourable to Austria-Hungary. Galicia had been lost, and the line of battle had receded W. until it lay in the region of Lodz–Cracow–the Dunajec and the Carpathians. In November, the campaign in the western theatres had ended in deadlock. Falkenhayn had succeeded to the control of German operations, and his doctrine of wearing-down strategy was taking shape. Winter was at hand.

Nevertheless, Potiorek meant to resume active operations. No binding order prevented him from doing so. Conrad's instructions were that he was to prevent an irruption of the Serbs into Austro-Hungarian territory, but it was left to him to decide whether that defence should be passive or conducted offensively by partial attacks. The Emperor expressed the wish that Potiorek would succeed in defending the monarchy, to which the *Feldzeugmeister* replied that he "hoped to do a good deal better than that." Falkenhayn, with his wider outlook, suggested a sudden seizure of the N.E. corner of Serbia with the view of opening up a line of munitions transport to Turkey, but this project aroused no interest at the headquarters of the "viceroy" of Bosnia, who was resolved to drive another offensive into Serbia with all his might, at the first favourable opportunity.

The Serbians meanwhile had suffered severely from the unfamiliar conditions of trench warfare, notably in the Machva, and at the end of October Putnik had decided to evacuate the line in that quarter. The Austrian attack of Oct. 31, therefore, met with only outpost resistance, and Shabats was occupied two days later, while monitor activity continued on the rivers.[1]

The advance of Krauss and the VIII. Corps in the Machva was the first stage of the new general offensive. On the night of the 4–5th it was developed by a frontal attack from Shabats combined with a fresh crossing at Mishar, the Serbians continuing their retreat to the line N. Dobrava–Dobrits–Tser ridge. On the next night (Nov. 5–6) a heavy bombardment opened along the whole Austrian front, especially on that of the Guchevo range. On the 6th, infantry pressure began along the mountains from the W. end of Guchevo as far as Yagodnya. Once more, evidently, Potiorek intended the centre of gravity of his attack to be on the right and right centre, the front of his own army composed of mountain troops long familiar to him, and well equipped for the work. On the 6th, from the slopes of Guchevo itself he issued a proclamation, stirring his troops to the highest efforts by promising them this time the "annihilation" of the "exhausted" enemy. Nor were these empty words, for the condition of the Serbian *moral* at this time and their shortage of ammunition were evident.

At this opening moment, the dispositions and order of battle on both sides were as follows:—

Serbian II. Army (Vidoyevitsa–Dobrava): Morava I., Timok II., Shumaja I., Timok II., Cav. div. and details; 63 battalions, 27 squadrons, 34 batteries.

III. Army (Yadar–Kostaynik): Drina I., Drina II., Combined Division; 40 battalions, 6 squadrons, 18 batteries.

I. Army, under Boyovish (Kostaynik–Uzovnitsa stream and Drina): Morava III., Danube I., Danube II. (temporarily detached to II. Army); Lyuboviya detachment; 44 battalions, 9 squadrons, 24½ batteries.

Uzhitse Army, under Aratich (along Upper Drina from Tiryeshnitsa stream to the Lim, front continued thence by Montenegrins): Shumaja II., Lim detachments, Uzhitse Brigade; 34 battalions, 2 squadrons, 12 batteries.

Belgrade Detachment, under Zhivkovich (Brestovik–Pechani): 17 battalions, one squadron, 9 field and some medium batteries.

Obrenovats Detachment (Pechani–Vukodrazh R.): 6 battalions, 3 batteries.

Branicevo Group and Kraina Group (Brestovik–Kladovo): 12 battalions, 4 batteries.

(The three last-mentioned forces were on the river front.)

Serbian total: 226 battalions of all categories, 41 squadrons, 113 batteries, modern and B.L.

The Austro-Hungarian forces and dispositions, as established by the Serbians, were as follows:—

River front from Shabats E.: 55 battalions, almost entirely Landsturm.

Shabats–Machva–Loznitsa front (V. Army, in order from left to right Krauss, VIII., XIII.): 87 battalions.

Loznitsa–Lyuboviya (VI. Army, XV., XVI. Corps, 40 Honved Divs., and other troops): 110 battalions.

South-west of Lyuboviya: mountain troops (1–2 brigades).

On the 7th, the VI. Army attacked and pushed the Serbian III. Army off the entire Guchevo ridge, and bore back the I. Army[2] and the right of the Uzhitse Army till the latter, marking the extreme left of the battlefronts, stood on Trsvena Stena.

On the 8th the retrograde movement of the III. and I. Armies continued to the line Kozaningrad (pt. 706) on Tser–Strasha (1424)–Zavlaka–Petrina Stena–Proslop. Meanwhile, the Serbs on the Machva retiring to the line Kozaningrad–the Dobrava were under strong pressure. Next day, in the midst of general activity on the water, an Austrian regiment forced the passage of the Danube at Semendria, threatening an inroad in the Morava valley itself, and part of the Belgrade force was hurried E. to deal with this threat, which it did successfully.

The reports from the front had already decided Putnik to withdraw to a line covering Valyevo, viz. Obrenovats group, Kolubara mouth to Skela; II. Army, Ub–Blizonzhski heights; III. Army, Yantina–Kamenitsa; I. Army, Yolina Breza–Sovachki Kik; Uzhitse Army, right Trsvena Stena–centre and left Vishegrad to river Lim. But it soon became apparent that a stand could not be made on this line. *Moral* was low, with mixture of units considerable. In the two Drina divisions of the II. Army in particular men feared for their families and considerable numbers left the ranks and made their way home, while accompanying the retreat were hundreds of refugee families with their carts and beasts, fugitive or requisitioned. From the interior, new drafts came up in thousands and congested Valyevo.

Though the army was by no means in dissolution, it was undisguisedly in full retreat. By order of G.H.Q. communications were destroyed in the retirement.

The line now to be taken up was the so-called "Kolubara line," which from the rear followed that river to the confluence of the tributary Lig, then, by the Lig to Gukosi and thence by height 700 to the Malyen ridge at Malyen (point 997). The Kolubara part of the line (with a defensive flank along the Sava) was to be held by the Obrenovats group; from just below Lazarevats to Malyen inclusive was allotted to the II., III. and I. Armies west. The Uzhitse Army was to leave one brigade at Kadinyacha on the ridge between Rogatitsa and Uzhitse, the remainder astride the Vishegrad–Uzhitse road at Shargan.

By the evening of Nov. 14, the Obrenovats detachment had taken up its positions behind the Kolubara, the II. Army had fallen back from Kotsielevo towards Lazarevats and the Middle Kolubara, the III. Army, always manœuvring so as to extricate its right before its left could be turned, was astride the Yadar–Valyevo road at the water parting about Kamenitsa, and the I. Army continued the line S. to Velovitsa, with its Rogatitsa detachment (somewhat out of touch) pushing the left in the

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pated by a counter-attack of the 8th Mountain Brigade when that formation returned from an expedition in relief of Sarajevo. The Serbian column retreated whence it had come, to Bainabashta. Finally, when on the main front much warfare set in, the Serbians and Montenegrins began slowly to retire to their respective frontiers, while on the other side a systematic drive was carried out by large forces of the XV. and XVI. Corps. One Austrian group advanced from Sarajevo E. on Rogatitsa, and won a severe engagement on Romanja Planina on Oct. 21–22. While another following up the retirement of the Serbs from Vlasenitsa advanced on Rogatitsa from the N. The Montenegrins between Focha and Katinovik did not give way without inflicting severe losses on the group opposed to them. But by the end of October all the allied forces had withdrawn behind the Drina. Farther S., the region of Artovats was again the scene of some irregular fighting in October.

[1] During October, there had been many local engagements on the Danube–Sava front. Belgrade was frequently bombarded. The defence was very active and minefields were placed at several points, to one of which, near Shabats, the monitor "Temes" fell victim on Oct. 23. In the main, however, the Austrians kept the upper hand.

[2] The I. Army was short of Danube II., which had been taken to strengthen the II. Army N. of Tser. Habitual disregard of the order of battle, *i.e.* an unnecessary regrouping, has been criticised as a peculiar failing in the Serbian method of conducting operations. Often, of course, there was no alternative. But there seems some justification for the criticism, nevertheless.

higher mountains. By the evening of the 16th, the positions were:—Obrenovats group, Obrenovats–Konatitsa; Cavalry division, Konatitsa–S.W. of Stepoyevats; II. Army, Voluyak–Lazarevats–Chavka; III. Army, Chibutkovitsa–Ivanovatsa; I. Army, Gukoshi–Mednik–Bachinovats–Ruda–Malyen; Uzhitse Army, right S.E. of Yasenovats–Yelova Gai, and left Shargan and Leshka Gora.

The weather was terrible, but Potiorek, sure of success, drove on his troops to new efforts, although communications became worse and longer day by day. On the 17th the cavalry at Konatitsa was threatened, and had to be reinforced, while the mountain troops of the XVI. Corps, pushing along the ridge of Malyen, reached Strazara (pt. 1000). On the 18th the position of Choka on the front of the II. Army was attacked. But the main bodies of the invaders' columns were not yet up to the front. The Serbs thus enjoyed a relative respite, and their left, at Malyen, was able to reëstablish patrol communication with the Uzhitse Army.

On the 19th the Austro-Hungarian main bodies began to exercise general pressure, their efforts being specially directed on the angle of the Kolubara and the Lig, and on the point where the line crossed the Yadar river (Gukoshi and Mednik heights). On the 20th the battle followed the same course, and Putnik ordered an offensive to be resumed on both flanks. But the time was not ripe, and the army and divisional generals reported themselves unable to carry it out.

On the 21st the Austrian XVI. Corps broke the Gukoshi–Malyen line in its centre and the defence was brought back to Gukoshi–552–Rayats–Suvobor–Malyen, and on the 23rd the Malyen position was evacuated and touch with the Uzhitse Army again lost. Nothing now intervened between the XVI. Corps and the head of the western Morava valley, but the weather and the distance of its supply sources, and the liability of the convoys to be cut off by descents of the Uzhitse Army, imposed caution, and for some days only minor fighting occurred here.

In reality, it was not here that Potiorek intended to win his victory, but farther north. The initial phase of the operations was complete when Valyevo was in his hands, and secured against attack from the S. by a sufficient foreground. The next was to be the driving back of the Serbs from the Lower Kolubara, the cutting off of Belgrade, the opening of the Obrenovats–Valyevo railway for supply, and finally the advance in the dry and not too hilly country N. of Lazarevats into the Morava valley, accompanied in its last stages by a descent upon Chachak and Gorni Milanovats in the enemy's rear.

The weather had, however, converted the poor roads of the Ub country into deep mud, and the regulation military transport foundered in this mud, so that the intended rapid advance by Krauss and the VIII. Corps to the Kolubara had been impossible. The mountain troops had outpaced the scheme, and it was not till the 22nd that the Austrian V. Army was able to open a real attack on the Kolubara. By the 25th it had made good the passage, but progress was slow, and at that date only Chopka and Konatitsa had fallen. Obrenovats still held.

Putnik had now resolved to give up Belgrade. Ammunition was expected, but had not arrived. *Moral* was becoming lower and lower, and only ruthless concentration on essentials would enable the army to last till the day when, with pouches and wagons refilled, counter-offensives could be launched. Meanwhile, his policy was to fight for time, so as to evacuate Belgrade as thoroughly as possible.[1] Then the Belgrade and Obrenovats forces were combined and posted on the line Varovnitsa–Kosmai–Sibnitsa (night of 29–30th), in touch on the right with the Pozharevats (or Branicevo) force, which held the Danube front astride the Morava. The Austrians entered Belgrade on Dec. 1.

On Dec. 2 the Serbian positions were as follows:—

Belgrade-Obrenovats force, Varovnitsa–520–313–Rogacko Brdo–281.

II. Army (4 divisions and cavalry division), Sibnitsa–Olbrezak–Ravani (318)–Medvyednik (365)–Vayan (490).

III. Army (3 divisions), Mramor (398)–Kalanyevitse–489–520–Motika (603).

I. Army (4 divisions), (now commanded by Mishich), Nakuchani–Vrnchani–Sinoshevtsi–Galich (703)–Vuskova Glavitsa.

Uzhitse Army (equivalent of 2 divisions) Kita–Kablar–Ovchar–Markovitsa.

On the Austro-Hungarian side they were:—

V. Army: Combined Corps and VIII. Corps, area E. of Lower Kolubara and S. of Belgrade; XIII. Corps, Arapovats–Trbushnitsa–Parlog–Liplye.

VI. Army: XV. Corps, Vrlaya–Golubats; XVI. Corps, Vranovitsa–Leusitsi–Ruyevitsa (583), detachments Godun, Pozhega, Arilye.

Both opponents were by now almost worn out. Suffering from their exertions, their losses, and the absence of food, shelter and ammunition, they were held together only by the inertia of the system. In this condition victory would fall to that side which first found a stimulus. This came to the defenders in two forms, the example of the old King, who took a rifle and fought in the ranks, and the arrival of the long-expected ammunition.

On the night of the 2nd, while Potiorek was slowly regrouping his forces to develop the attack on his left, Putnik issued orders for a general offensive S. of Sibnitsa "in order to profit by the enemy's present weakness and raise the *moral* of our troops."

The II. Army was to drive the enemy over the Kolubara; the III. (Drina II. and "Combined" division) to push towards the old line on the Lig; the I. to make good the line Krivareka–Lozany–Teochin (in order from right to left, Timok II., Morava II., Danube I., Danube II.); of the Uzhitse Army the available portion of Shumaja II. to attack N. and N.W. along Pranyani and Goina Gora; the Lim detachment to attack between the Lushnitsa and Venchaska streams by Breziak N.; the remainder of this undispersed army standing fast or forming a defensive flank for the advancing centre.

The counter-offensive was delivered or launched on the morning of Dec. 3, and was quite unexpected by the Austrians. The Uzhitse Army's offensive wing reached a line astride its assigned ridges marked by Ruyevitsa and Godun. The I. Army drove the XVI. Corps back to the line Byezna–Ozrem–Kriva Reka. The III. Army reached the line Vrlaya–Lipet, the I. Okressak–Barosevats–295–347, while on its right the cavalry maintained contact, at Slatina, with the defensive right flank, the Belgrade-Obrenovats force.

Next day the Uzhitse Army's advance was sharply arrested, and it only maintained its ground on the line 370–Ruyevitsa–Godun–Oruyewitsa–Krstats. But the I. Army drove a deep wedge, and by nightfall occupied Golubats–Prostruga–Rayets–Suvobor–Babina Glava. The III. and II. Armies met with stiff resistance. The III. made no progress, and the southern wing of the II. was hung up by the unshaken resistance of Kremenitsa; the N. wing reached Arapovats and Sakulya. No serious fighting occurred on the part of the cavalry or on that of the Belgrade-Obrenovats force, and the commander of the latter, fearing that an envelopment was in progress, extended his right to the heights E. of Grotska. Next day Putnik, conscious also of the danger of allowing the regrouped Austrians to break through into the Morava region and envelop his right, caused the II. Army to extend its right (Timok II.) past Vitnitsa to Kosmay heights, behind the cavalry. The attack of the centre was in fact at a standstill, and it was evident that it was impossible to defeat the enemy's leftward regrouping of flank attack.

On this day (Dec. 5) the Uzhitse Army's attack, numerically weak and divided amongst several directions, came to a standstill. But the success of the I. Army on the ridge of Prostruga was made definitive, the Austrian XVI. Corps brigades retiring N. towards the Kolubara with heavy losses.

On the 6th the I. Army pursued its opponents N. and downhill towards Valyevo, while on the left of its flank the Uzhitse Army made advances N., N.W. and W. against weakening opposition, and on the right the III. Army reached the line of the Lig. But simultaneously, the storm broke on the extreme right, where the slowly prepared attack of Krauss and the VIII. Corps was launched at last. The line of defence held, but Timok I. from the II. Army was set in motion for the extreme right.

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[1] Some French naval guns had to be blown up, as they could not be removed. Before destruction they fired all their ammunition into Bezania.

On the 7th, while the I. and Uzhitse Armies continued their advance to Valyevo and Uzhitse respectively—their opponents withdrawing divergently on the Loznitsa and Shabats routes—the III. turned the flank of the defenders of Kremenika and thus enabled the II. Army, weak as it now was, to make progress towards Lazarevats and Voluyak height. But on the right the Austrian attack made real progress and approached the advanced line of the Kosmay position. On the 8th and again on the 9th the Kosmay line itself was taken and retaken. On the evening of the 9th the alignment of the Serbian defensive flank was from the Danube E. of Grotska, by Umchari, Varovnitsa, and Kosmay to the Kolubara valley near Sakallia. Lazarevats was reoccupied by troops of the II. Army on the 9th, and the III. Army, coming up into line with the I., bordered the Kolubara as far as Valyevo, these two armies beginning the pursuit of those Austrian forces which had taken the Shabats direction in their retreat.

The 9th was in fact the turning-point of the battle, as the 3rd had been that of the campaign. On the evening of that day Potiorek, ill informed of the state of affairs in the N., and deeply impressed with the defeat of the mountain troops (VI. Army) which he had himself accompanied and directed, gave orders for a general retreat on Belgrade, Shabats and Loznitsa. On that day also Putnik issued general directions for the continuance of an offensive which was evidently yielding much greater results than those aimed at in the instructions of Dec. 2.

The position of affairs on which the new scheme was based was: heavy and apparently increasing pressure on the Kosmay front (VIII. and Krauss), indicating an attempt to break through into the Morava region; stiff resistance of the enemy (XIII. Corps of II. Army) between that front and the Kolubara, and on that river astride the Ub routes; and full retreat of the Austro-Hungarian XV. and XVI. Corps in the divergent directions of Shabats, Loznitsa and Vishegrad.

Putnik's objects were two: to follow up the retreating XV. and XVI. Corps quickly so as to regain possession of the national territory and rescue the inhabitants, and to attack the enemy northern forces frontally and in flank before they could prepare a winter position on the Belgrade loop. Attacked all along the front and threatened on their right, he hoped that the Austrians would evacuate the capital without ruinous street-fighting. Some hopes were no doubt cherished of cutting off the retreat of the two corps (VIII. and Krauss) but they were slight. The physical conditions were adverse. "Our national mud," hitherto Putnik's ally, became now a hindrance.

On the 10th, therefore, the Uzhitse Army continued to pursue in the direction of Bainabashta and Rogatitsa, part of the I. Army pushed along the Loznitsa road, part towards Shabats, while the III. Army, with its left already over the Kolubara S. of Ub, began to wheel to the N., pivoting on Lazarevats, with the outer flank following the direction of Ub–Obrenovats.

But already on that day, the battle at Kosmay diminished instead of increasing in intensity. The Austrians began to draw back. Hopes of completing the wheel of the III. Army vanished. The Austro-Hungarian XIII. Corps gave ground only slowly. The renewed *moral* of the Serbs had sufficed to give them victory, but it could not force them through the phase of exploitation, when it was evident that the enemy was evacuating the country of his own accord and also that he would not be hustled. Had the Ub–Obrenovats direction been assigned to troops of the I. Army, which alone of the five larger formations had really experienced the sensation of clear victory, it is possible, though by no means certain, that the envelopment might have succeeded. As it was, the last phase of the battle was practically a frontal drive E. of the Kolubara, with heavy local fighting and the gleaning of prisoners and spoil, but no *débâcle*. When on the 13th the left division of the III. Army seized Obrenovats, the Austrians had already withdrawn clear of the flanking threat. They had, owing to the state of the VIII. Corps, decided not to make a stand on the Belgrade loop, and after one day's further fighting, they evacuated Belgrade which the Serbian patrols reoccupied at 10 A.M. on the 15th. Meanwhile, Shabats, Loznitsa and Bainabashta had been reached and reoccupied by the pursuing columns of the I. and Uzhitse Armies.[1]

The recovery of the country and the capital intact, and the capture of 41,000 prisoners and 133 guns, with large quantities of stores, even though no Sedan had been achieved, constituted a victory that was both decisive and—after a crisis of *moral* such as that of the end of November—wonderful. It gave Serbia peace in the midst of World War for a few months to come. But her losses had been very heavy. In the three battle periods of 1914, 69,000 Serbian soldiers had been killed or had died of sickness, perhaps 15,000 had been taken prisoners, and probably 180,000 had been wounded, out of a mobilized force which at the outset numbered 490,00.

II. The Conquest of Serbia, 1915

When the third punitive expedition ended in failure, Potiorek was relieved of the command, and the V. and VI. Armies were fused in one called the "Balkan Forces," to which the Archduke Eugene was appointed as commander, with Krauss as his chief-of-staff. Under cover of outposts along the rivers, the corps were reorganized and disposed for the defence of Hungary. Soon the VIII. and XIII. Corps were withdrawn for service in other theatres, and on Italy's entry into the war the Archduke and Krauss were transferred to Laibach to command the new front, General Tersztyanski being left with a much weakened force opposite the Serbs. The latter indeed were not fitted for the offensive. Not only were their numbers greatly reduced by the battles of 1914, but an epidemic of typhus devastated their ranks still further.

Meanwhile, Falkenhayn, reasoning not in the spirit of a Bosnian viceroy who wished to teach a lesson, but in that of a modern war-manager, had become convinced of the necessity of opening a road to Turkey for the transit of munitions and expert personnel. The desire to reserve or to recoup forces for this purpose went so far, indeed, that he constantly imposed a brake on Hindenburg's and Conrad's proposals for decisive operations in the Russian theatre. At one time in the spring, the beginnings of a German army were assembled in Hungary, though the scheme—at that period only one of clipping off the N.E. corner of Serbia—was abandoned before effect had been given to it. Later, when the first fear of the Italians had died away, and the Russian campaign was nearing its end, it was taken up again.

Throughout the spring and summer negotiations had been in progress for winning, or buying, Bulgaria's active support. Falkenhayn exercised all his influence to keep these alive, even under difficult circumstances, for though Bulgaria's price was high, without Bulgarian aid no forces that could be spared from other fronts would suffice for the clearance of the Orient railway, while the nature of Bulgaria's reward imposed the conquest of Macedonia in addition to the military occupation of N. Serbia. There were, further, internal difficulties between the two allies on the question of command. Bulgaria insisted on a German commander as chief, and found in this matter, naturally, Falkenhayn's entire support, but Conrad, ever jealous of the prestige of the Austro-Hungarian army and hostile to German control, long refused his consent. It was not, indeed, until the verge of the offensive that a formula acceptable to all these states was discovered.

The plan of operations adopted was the reverse of Potiorek's, and was substantially that proposed by Krauss and by Tersztyanski successively, viz., direct attack over the Sava and Danube, coupled with a coöperative attack from the Machva, for the securing of the Kolubara line and its railway. But it had the further element of Bulgarian intervention on the right rear of the defence which, if energetic and controlled as to timing and direction by the same commander-in-chief as the frontal offensive, would be decisive. The appointed commander-in-chief of the group of armies was Mackensen. He was to have under him the reconstituted XI. German Army (Gallwitz), the reconstituted

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[1] During the period of the Kolubara campaign, there was a certain amount of minor fighting between the Montenegrins and the Austrian forces of Bosnia and Herzegovina, on the Drina, about Artovats, and about Trbinye. No results of importance were achieved on either side.

Austro-Hungarian III. Army (Kövess), and one Bulgarian army, the I. Another, smaller, Bulgarian army (the II., Todorov), not under Mackensen's command, was assembled for the seizure of Macedonia. The political treaty of alliance was ratified on Sept. 4, at Sofia, the military arrangements embodied in a convention at Pless on the 6th. According to the latter, within a period of 30–35 days, Germany and Austro-Hungary were to engage 6 divisions each and Bulgaria 4 (each equivalent in infantry strength to 2 normal divisions).[1] Another Bulgarian division was to operate, as above mentioned, into New Serbia (Macedonia).

Accordingly, Kövess's army, consisting of the Austro-Hungarian VIII. and XIX., and the German XXII. Res. Corps (seven divisions), was assembled in Syrmia, and Gallwitz's III., IV. Res. and X. Res. Corps (also seven divisions) in the Banat.

The Bulgarian I. Army (Boyadiev) (1st, 5th, 6th and 8th Divs.) was disposed in the region of Vidin, Kula, Belogradchik and Tsaribrod. The small Austrian forces still available in Bosnia after meeting the demand of the Italian front, were to operate in the Upper Drina region, to hold the Montenegrins in check.

On the Serbian side, there was a definite and perhaps a decisive inferiority in numbers. Battle in 1914 and typhus in 1915 had cost the little country 125,864 dead by Oct. 1 1915, without counting permanently disabled men and prisoners. Gaps had been made good by calling up two new conscript classes, and the ration strength had increased to 572,171 in August. But this figure was far in excess of that available for fighting service—indeed, the German intelligence staff estimated the latter at not more than 200,000.

The Serbian dispositions were generally as follows:—Drina front from the Lim to Bainabashta, Montenegrin forces; Middle and Lower Drina, Machva to Kolubara (exclusive), III. Army (Yurichich-Stürm), 3 divisions; Kolubara to Grotska, Belgrade force (Zhivkovich); the Lower Morava, II. Army (Mishich), 3 divisions; general reserve, Palanka, 2 divisions and cavalry division; in the N.E. angle were the Branicevo and Kraína groups. On the Zayechar–Knzajchevats front, the Timok army (Goykovich), on the Nish–Pirot route and to the S. as far as Vranya, the II. Army (Stepanovich), and on the routes into Bulgaria, E. of Uskub, Boyovich's group, comprised 4 divisions and 3 Ban formations.

These dispositions, which at first sight seem to dispose in cordon, weak everywhere, at least five-sixths of the available force, indicate not only a sense of the danger impending on the E. side, which the Western Powers had forbidden Serbia to meet by a preventive offensive, but also the hope of assistance from Salonika. The help of Greece was invoked under the terms of the treaty of alliance of 1913, that of the Western Powers had been promised, if tardily and with reservations. To deploy, facing N., with three-fifths of her forces, and to guard the route to Salonika with the remainder, was, in sum, Putnik's plan.

As against an attack supported by artillery on the 1914 scale, there would have been no reason to suppose that this type of defence would be less successful than it had been in the Kolubara campaign. One line after another could be defended, and when the dead point of the offensive was reached, the reinforced defenders would deliver the counter-stroke of reconquest.

But tactics, unhappily for Serbia, had advanced since 1914, notably German tactics. Discreet reconnaissances, under the direction of the German Lt.-Col. Hentsch, chief-of-staff of Mackensen's group of armies—the same who had borne so grave a responsibility at the Marne—had been carried out for weeks past, for the purpose of fixing of battery positions and working out technical details of the Sava and Danube passages. Searchlights were assembled, large troop barges constructed, and for the protection of the main crossings heavy artillery was massed.[2]

Oct. 6 was fixed as the initial day for Kövess[3] and Gallwitz, the 11th for the Bulgarians.

The bombardment opened on the 5th, laying towns and villages in ruin all along the line; but on the Serbian side only outposts held the river lines, local reserves being kept under cover.

Kövess's main crossing place was to be Belgrade, opposite which place technical preparations had been multiplied and two corps out of three assembled. The third (XIX. Austro-Hungarian) was to pass the Drina at Byelyina, and the Sava at Shabats, Kupinovo, Progar and Zabrezh, in order to create bridgeheads and to prevent the defenders from concentrating to the eastward

Gallwitz's crossings were to take place at Ram and at Semendria, on each side of the Morava mouth, opposite which points lay the railheads, and at the island of Temes Sziget between them; the attack was to be accompanied by a demonstration from Orsova and a Bulgarian threat towards Negotin.

On Kövess's front the secondary crossings, especially in the Machva, secured footholds on the S. side of the water, but all attempts to advance out of the waterlogged river valleys themselves were checked (Oct. 7). Opposite Belgrade, in the early morning hours of the 7th, the first boatloads of troops of the VIII. Corps pushed off into the stream under cover of innumerable searchlights, heavy artillery fire, and monitor activity, while a little way up the Sava the XXII. Res. Corps put over its advanced troops into Ostrovo Tsiganliya (Gipsy Island). Zhivkovich had 16 battalions and nearly all the Serbian heavy artillery, including French and British 6-in. guns, to oppose to them. The landing—the only operation in the World War analogous in form and spirit to that of the Gallipoli Peninsula—succeeded, but only after the fiercest fighting was the foothold really made good and room secured on the front of both attacking corps for the passage and deployment of large forces. On the night of 9–10th, Zhivkovich abandoned the attempt to hold the town, and fell back a little way S., on the line Zarkovo–(249)–Visznitsa.

Simultaneously, Gallwitz's 3 corps had been launched, on both sides of the Morava. Preceded by a demonstration at Orsova on the 6th, the left corps (X. Res.) forced the passage at Ram on the night of 6–7th, and drove inland, over the Anatema heights to Kuryatse, threatening Pozharevats from the north-east. The IV. Res. Corps (3 divisions) seized Temes Sziget Island with little difficulty and reached Brezhani (Brežani). But the front from Semendria to Gatsko defied the III. Corps, and not only protected the right rear of Zhivkovich, but gave time to Putnik to bring troops from the Machva.[4]

Nevertheless, it was clear by the 11th that the river barrier was lost and Putnik began a steady policy of fighting successive delaying actions on the N. front, while at all costs keeping back the Bulgarians on the right and rear, in order to gain time for the arrival of French and British aid, the first elements of which had already reached Salonika.

On the 12th Mackensen opened the general advance, in the midst of a gale which, known as the *Kossova*, descends seasonally upon the country from the south-east. Kövess made slow progress till the 16th, when the Serbians evacuated under pressure the Petrov Grob–Avala–Velika Kamen line, and fell back to Melyak–Ripany–line of R. Ralya.

Gallwitz by that date had enforced the evacuation of Pozharevats, cleared the way for his III. Corps to advance on the Semendria front, and brought his left flank to Bozevats. To the E. of Kövess, the Austrian offensive was a simple follow-up of the retiring Serbs, who now attempted no real defence W. of the Kolubara, though small forces with local riflemen delayed the Austrians long enough for the families and the live stock to be evacuated on Valyevo. The Montenegrins, and with them some Serbs, were maintaining a particularly independent struggle between the Yadar and the Lim.

By this time the Bulgarian advance on the right flank had begun, though some days later than had been intended. In the south, Todorov's II. Army (7th Div. with improvised formations) prepared to threaten the flank of the Salonika railway from Strumitsa, the Ovchepolye from Kyustendil, and Vranya from Trn. The I. Army advanced on the various routes to attack Zayechar, Knyazhevats and Pirot; on these the Serbs had advanced to meet them, always with the idea of gaining time, and by the 16th very little progress had been made by the invaders, except by one regiment which by a daring mountain march seized Vranya and cut the railway there. This success weakened the position of the Serbian forces on the Egri Palanka road at Stratsin, and when, farther S., Todorov turned their right by Kochana and pushed cavalry to Veles, they evacuated the Ovchepolye (Oct. 18-19). On the 21st Uskub itself fell into the hands of the Bulgarians and the Salonika line was lost, though a counter-attack recovered Veles from the Bulgarian cavalry two days later.

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[1] An interesting sidelight is thrown on the relations of the allies by the fact that Germany thought it necessary to require from Bulgaria a written guarantee of unimpeded transport freedom through Bulgarian territory.

[2] In the case of the Belgrade crossing, no fewer than 20 batteries of heavy and superheavy artillery were collected, nearly half of which consisted in 30·5 and 42-cm. howitzers, and 18-cm. long guns. In addition, about 90 field guns and howitzers were engaged.

[3] The Drina portion of Kövess's army was, however, behind time.

[4] All Austrian forces in Bosnia were late in their preparations and took no effective part in the offensive.

At that moment for the first time, the French from Salonika came into action, threatening Strumitsa and Todorov's left. It was too late.

On the northern wing of the Bulgarian army, Boyadiev's central columns cut the road between Zayechar and Knyazhevats on the 21st, and farther to the Bulgarian right, Negotin was occupied by the invaders, who there made contact with the Orsova detachment of the XI. Army. The Serbs in this quarter offered little resistance, their rear being already threatened by Gallwitz's progress in the Morava valley.

In that region the fighting had been heavy, the weather severe, and it was not till the 19th that Mackensen's two armies mastered the Ralya line. On the 21st, the date on which the Bulgarians seized Uskub and the French came on the scene at Strumitsa station, Mackensen's N. front was marked by the line Shapina-Selevats-S. of Kosmay. On the 23rd it lay on the line Lazarevats-N. of Arangyelovats-N. of Palanka-Petrovats, and the Serbian eastern fronts began to be in difficulties, though some days were still to elapse before Goykovich's force finally disappeared and junction was effected between Boyadiev's right and Gallwitz's left. In W. Serbia the Austrians from Bosnia were beginning to be active, and the country-side was being evacuated by men, women and children, with their animals and belongings. From Uzhitse as well as from Valyevo, the emigration had set in towards Novipazar.

Putnik's left armies were now falling back concentrically towards Kralyevo-Krushevats, in proportion as his E. front caved in. On Oct. 30, after no light efforts, the XIX. Austro-Hungarian and XXII. Res. Corps of Kövess's army were S. of Gorni Milanovats, the VIII. Austro-Hungarian Corps S. of Raibrovats, Gallwitz's army to the S. of Lapovo-Petrovats. The Serbs had evacuated Zayechar on the 25th, Knyazhevats on the 27th, and after a fierce resistance and repeated counter-strokes from Pirot, Stepanovich had retired on Bela Palanka on the 29th. Farther to the S., Todorov's attention had been thoroughly attracted to the Strumitsa side, and the position at Uskub and on the Upper Vardar had scarcely changed.

From Nov. 1 onwards, the final desperate effort was made by the Serbians to gain time for the arrival of the French and British by holding the arc Chachak-Kraguyevats-Yagodnya-Nish-Leskovats. Still the Bulgarians were held back in this phase, but the Germans and Austrians steadily advanced. Kraguyevats fell, with its arsenal, on Nov. 1; Yagodnya on the 3rd, Kralyevo on the same day, Paratyin on the 5th. For some days longer the defence continued stubborn on the S. side of the W. Morava and about Varvarin in the Morava valley, where a salient was held to enable the last elements of the Serbian IV. Army (Goykovich) to extricate itself from the closing vice. But by the 9th the defence on this line was at an end, and Mackensen was preparing the dispatch of the XXII. Res. Corps to another theatre, having received the Alpine Corps (division) in lieu.

On the E. front meantime, Stepanovich's counter-attacks had completely held up the Bulgarians at Bela Palanka, while a great part of the population flowed away through Nish into Kossovo. It was not until Nov. 4, when Boyadiev had received a fresh division (the 9th) and Paratyin had fallen, that orders were given to evacuate Nish, and that centre was held by rear-guards till the 5th. Leskovats resisted till the 7th.

The Orient railway, the objective for which Falkenhayn had planned the campaign, was now clear from Germany to Constantinople, and with his usual economy he was already thinking of withdrawing the German forces to other theatres.[1] The Serbian army, plainly in dissolution, had ceased to be a menace to the Danube monarchy. But new problems were arising—the Albanian question, the problem of Greece and the Allied Salonika army, the question of a submarine base on the Aegean. In all these, each of the three victors had a different standpoint, and fresh difficulties set in between the three Governments. Belonging as they do to the Salonika phase of the Balkan campaigns, these problems will not be dealt with here, and it only remains to describe, briefly, the last stages of the Serbian tragedy.

Substantially, the results of the Bulgarian coöperation had fallen considerably short of what was expected. The tough resistance of Stepanovich, and even of the small IV. Army in the N.E. corner, had kept back the eastern danger until it was too late for an envelopment. Indeed, considerable portions of Boyadiev's army—those oriented on Negotin and Zayechar, if not also that on the Knyazhevats route—were already crowded out of the closing front. For effective envelopment of the Serbian right, there only remained the N. portion of Todorov's II. Army, and, with the increasing arrival of French and British in the region of Rahovo and Doiran, this Bulgarian general was obliged to be cautious, while encircling attack upon the Serbian left was practically excluded by the fact that the Bosnian forces had made a late start and were traversing very difficult country. Supply and weather conditions, moreover, were becoming serious for the invaders. Practically, nothing could now prevent the remnant of the Serbian army from escaping into Albania, should it choose to do so.

But for this desperate measure, which would involve the loss of all war material and of many thousands of lives in the roadless, snow-bound interior of Albania, the Serbian command was not yet prepared. It seemed preferable to attempt to break through towards the S., where the long-expected Allied army was now advancing and Todorov was in difficulties.

The II. Bulgarian Army had, after seizing Uskub and taking, losing and retaking Veles, moved out fan-wise against the mountains N.W. and W. of Vranya, Kachanik, Kalkandelen, and the Babuna pass, while its extreme left was on the defensive against Sarrail's Rahovo group, and its left centre column was moving down from Shtip on Krivolak and Kavadar, where also Sarrail was collecting a considerable force. In the existing conditions it was evidently more important, from Todorov's point of view, to bar the Vardar valley against Sarrail than to attempt to force the mountain barrier of the Kara Dagh and the Shar Dagh. He therefore placed his centre of gravity well to the S., leaving his N. flank covered by a mixed force drawn partly from the I., partly from the II. Army.

Against this force, Putnik assembled the remnants of 5 divisions E. of Prishtina, and with them assumed the offensive with all the violence of which his troops were still capable, on Nov. 9.

This began on the 9th, driving the Bulgarian group of General Ribarov back to Vranya in the one direction and towards Kumanovo in the other. By the 15th Ribarov's right was in extreme difficulties. But the arrival of part of the I. Bulgarian Army from Leskovats on the left rear of the attacking wedge rescued it. By now the general front of the Austrian and German pursuit had reached Uvats, the line of the Ibar, Yaver (Javor), Kurshumlye. Pressure on the rear was too close to allow of persistence in the southward break-through. The moral rally which had permitted that attempt was dying away on all the defended avenues, and Putnik made up his mind to escape through Albania with what could be saved of the army and the people. Between Nov. 20-25, the historic Kossovopolye witnessed another last effort of the Serbian people, then everything flowed away towards Ipek (Pech), Dyakovo and Prizren.

At these points the pursuit ceased in the first week of December. It had practically become Bulgarian alone. Such German troops as remained in the theatre when Falkenhayn's orders had been carried out were sent down the Vardar, into the midst of the Bulgarian II. Army. The Austrians diverged into Montenegro, which was completely occupied, with some severe local fighting and much secret negotiation, by the third week in Jan. 1916. But the end of pursuit did not mean rest and reorganization for the poor remnant of the Serbian army. It was impossible to live at the halt; and a midwinter march through the Albanian mountains, brought those whom its rigours left alive to the coast of the Adriatic. Thence, after some delay, they were transferred to Corfu, where the Western Powers provided food, equipment, clothing and stores, so mitigating a disaster that they might have prevented. (C. F. A.)

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[1] As above mentioned, Mackensen was given orders almost on the battlefield to send away the XXII. Res. Corps.

SERVIA: *see* SERBIA.

SETON-KARR, SIR HENRY (1853–1914), British big-game hunter, was born in India Feb. 5 1853. Educated at Harrow and Corpus Christi College, Oxford, he was called to the bar in 1879, but developed a taste for travel and big-game hunting which carried him all over the world. He also interested himself in state colonization and was a member of the Royal Commission on Food Supplies in Time of War. He published *The Call to Arms* (1900–1) and *My Sporting Holidays* (1904). He represented S.W. Lancs. (St. Helens) in the House of Commons from 1885 to 1906 and was knighted in 1902. He lost his life when the "Empress of Ireland" sank in the river St. Lawrence May 29 1914.

SEX (*see* 24.745*).—The problem of the determination of sex has in recent years been greatly elucidated. Knowledge has come from several sources. Both breeding experiments and cytological observation have severally led, as will be seen, to concordant conclusions, proving that the sex of the offspring is generally decided by one or other of the germ-cells which unite in fertilization. But though in ordinary circumstances the mode of determination is now known, there are nevertheless indications that in special cases the normal course may be altered or at least disturbed by various influences, the operation of which is not understood. The reconciliation of this latter class of evidence with the former has not yet been satisfactorily effected.

Sex Determined by Spermatozoa.—Knowledge of sex-determination began with the observation of Henking (1891) that in certain insects the spermatozoa were of two kinds, (1) those which contained a supernumerary, unpaired, or accessory chromosome (*see* CYTOLOGY), now generally called the X-chromosome, and (2) those without this body. McClung (1902) first suggested that this chromosome might be a determiner of sex, and took it to be the peculiarity of the male, but Miss Stevens (1905) and E. B. Wilson (1905), to whom the development of this part of the subject is chiefly due, proved that the spermatozoa bearing the X-chromosome are in these animals destined to form females. The eggs are alike in each possessing an X, and thus the somatic or diploid cells of the daughters come to have 2 X, one received from their mother and one from their father, whereas the diploid cells of the sons have one only, received from their mother. Since the gametes of the male are of two kinds, that sex is said to be *hetero-gametic*, the female being *homo-gametic*. Further observation, however, showed that the organization of even nearly allied genera of insects is by no means uniform in respect of the sex-chromosomes. Though unpaired in the males of some genera, the X may in others have a pair or "mate" of smaller size, known as the Y-chromosome. Between these and other genera in which the male has a pair of sex-chromosomes not visibly different from each other there are several transitional conditions. In a considerable number of forms also, the X is represented by a group of separate chromosomes, regarded as collectively the mates of the Y.

The X-chromosome has been seen in several orders of insects, especially Hemiptera, Orthoptera and Coleoptera, in spiders, myriapods and some nematodes. In man it is said (Guyer) to be represented by a pair corresponding to a single Y-chromosome.

Sex Determined by Ova.—Naturally this discovery that the male is hetero-gametic was at first supposed to be of universal application, but the next advance, which resulted from experimental breeding, showed that this simple view could not be entertained. The Currant Moth (*Abraxas grossulariata*) has a variety *lacticolor*, characterized by a deficiency of black pigment, till then known only in the female. Doncaster, instituting experiments with this variety, found that by breeding such females with normal males the F_1 family consisted of males and females, all normal.[1] Interbred, these gave F_2 composed of two normal males: one normal female: one *lacticolor* female. But *lacticolor* ♀ × F_1♂ produced families containing normal ♂, normal ♀, *lacticolor* ♂ and *lacticolor* ♀, all in equal numbers. On breeding any normal *grossulariata* ♀ with the *lacticolor* ♂ now produced, the sons were all *grossulariata* and the daughters all *lacticolor*.

Other interpretations have been proposed, but it is evident that the eggs of the *grossulariata* ♀ are of two kinds, (1) those which are destined to be females, and do not carry the *grossulariata* factor, (2) those which do carry this factor, and are destined to be males (Bateson and Punnett). Taking the factors G, grossulariata: *g*, its absence; F, femaleness: *f*, its absence, the results may be represented symbolically thus:—

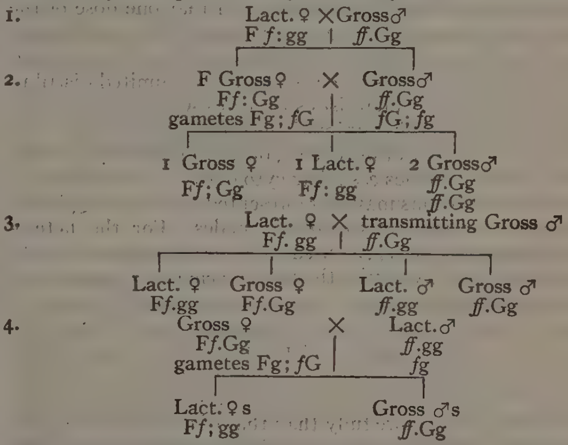

Sex-Limitation and Sex-Linkage.—Such a system of heredity is sometimes called "sex-limited," and the descent of the character so limited serves as an indication of the mode by which the factor determining sex is transmitted from parent to offspring. The proof that in these moths sex is determined by the eggs, or in other words that the female is the hetero-gametic sex, is thus complete. The same has been shown to be true of birds. In fowls, several conditions have been shown to be sex-limited to females; *e.g. black* as against the *cuckoo-markings* of the Plymouth Rock; *golden* (as in Sebrights or Hamburgs) as against *silver*; the *black pigment* of Silky fowls is suppressed by a sex-limited *factor which inhibits* this development, etc. In canaries the peculiar form of albinism known as *Cinnamon*, and in doves the pale albinotic variety shows a similar behaviour. We have thus to recognize that, paradoxical as it may appear, sex is in some animals determined by the sperm, and in others by the eggs. Man belongs to the former class. Apart from the cytological evidence, as yet unconfirmed, the descent of sex-limited conditions, notably colour-blindness, demonstrates this. Substituting male for female, colour-blindness, is transmitted in man exactly as the *lacticolor* character is in the moths. A colour-blind man mated with a normal woman has sons and daughters with normal colour-vision. The sons cannot transmit the colour-blindness, but the daughters transmit it to *half* their sons who are therefore colour-blind. Moreover, when the transmitting female is mated with the colour-blind man, the *colour-blind female* is produced, just as in the corresponding mating (3) in the *grossulariata* experiment, the *lacticolor* male was formed. Finally when the colour-blind woman mates with a normal man the sons are all colour-blind and the daughters are all transmitters. Following Doncaster's notation in the *grossulariata* scheme, if M, maleness, be substituted for F, and N, normal colour-vision, for G, the same analysis represents the observed facts: the transmitting female (Nnmm) in man, for example, corresponds with the male Ggff, etc.—in *grossulariata.*

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[1] In genetics the following symbols are frequently used: ♀ = female; ♂ = male; × = mated with; F_1, F_2, etc. = the first filial family, the second, etc.

** These figures indicate the volume and page number of the previous article.*

There is thus no doubt that just as in the bird and the moth the female produces two kinds of eggs destined respectively to form females and males, so in man the male produces two kinds of sperms destined to form respectively males and females.

Cytological Interpretation.—The notation given above provides the simplest representation of the empirically observed facts without any attempt to refer them to cytological phenomena. This attractive branch of Genetics has been actively developed by T. H. Morgan and his colleagues with remarkable success; and though serious difficulties remain, the incidence of the sex-limited characteristics can so readily be interpreted as depending on the distribution of sex-chromosomes, observed or hypothetical, that a causative influence has with great plausibility been attributed to them. Starting from the now familiar fact that in certain animals the XY male has visibly one X-chromosome and the XX female two, it is argued that the "double dose" of X is the cause of the female characteristics and that one dose of the same element produces the male attributes. If, then, in such animals the dominant factors, which show linkage, be supposed to be also carried in the X-chromosome, the sex-limited distribution of the negative characteristics to males will result. At first sight the fact that in other animals the female is hetero-gametic seems irreconcilable with this scheme, but, by making the assumption that in these females a similar cytological apparatus exists, the genetic observations may be represented on the same plan as that adopted for the hetero-gametic males. For the hetero-gametic female may be represented as XY and the male as XX, and here again if the X carries the positive element, say the G of *grossulariata*, then the gamete of the composition XG is always destined to the sons, and Yg to the daughters, as the facts require. Perhaps the strongest evidence in favour of the chromosome hypothesis has been found in the phenomenon of "non-disjunction" in *Drosophila*, the fruit-fly, whose genetical composition has been studied more fully than that of any other organism (see GENETICS). In this creature sex-limitation is to males, and the male is hetero-gametic; but, exceptionally, unexpected forms appear, as, for instance, red-eyed males in the mating where white-eyed alone should normally be produced. Bridges found that in such individuals and among the families containing these abnormal members, irregularities in the occurrence of the chromosomes could be demonstrated. Apparently in some maturation division two X-chromosomes had passed to the same egg, others receiving none. From this a series of exceptionally constituted gametes are derived which could have brought about the observed exceptions. Another line of argument pointing to the same conclusion has been derived by Morgan and his associates from a study of gynandromorphs—the curious individuals composed of more or less irregular patchwork of male and female tissues, which are formed with some frequency especially among the various orders of insects. A number of these have occurred in the pedigreed families of *Drosophila*, and on analysis it was found possible in almost every case to refer the characters shown in the several parts to their parental origin.

A primary objection to these modes of interpretation is that the cytological conclusions rest on a still slender basis of observation. As regards the forms with hetero-gametic females an unpaired chromosome has been reported to exist in the females of two moths (*Phragmatobia* and a *Psychid*), but on the other hand, Guyer states that in certain birds the *male* has an unpaired chromosome. Commonly, moreover, no consistent cytological distinction between the two sexes can be observed. But a still more fundamental difficulty besets the conception of the characteristics of either sex as dependent on a merely quantitative distinction. From arguments which cannot be here developed the Y-chromosome is regarded as demonstrably empty, and containing no determining elements, and XY is therefore to be understood as in potentiality merely the half of XX. Chemical phenomena, vaguely analogous, have been appealed to as making this system of interpretation less inadmissible than it at first appears, but that it is beset by grave objections cannot be denied.

Cytology has been of great assistance in codifying the apparently contradictory records as to the intricate series of parthenogenetic or agamic and sexual forms of the Hymenoptera and Hemiptera. We have learnt for example that in Hemiptera (Morgan; von Baehr) when fertilization produces females only, the fact is due to the death of all the sperms, which do not bear the X-chromosome. But in these groups it not rarely happens (*Neuroterus*, Doncaster) that the fertilized females give rise parthenogenetically to other females of which, without fertilization, some produce females only and others males only, but no cytological distinction between these two types of females has been seen. Whatever be the true cytological account of sex-determination, we have nevertheless to recognize that femaleness and maleness respectively, though similar throughout the Metazoa both in outward manifestations and in deeper physiological features, are constructed upon at least two distinct genetic plans. To reconcile the infrequency of visible cytological distinctions between the sexes with the chromosome hypothesis it has been suggested that the critical bodies are in such cases attached to other chromosomes, but this, though undeniable as a possibility, is as an argument dangerously tinged with obscurantism, a comment which applies to many of the subordinate hypotheses supporting the chromosome theory of genetic causation.

The situation is one through which many scientific problems have passed before final solution has been obtained. By independent lines of evidence conclusions largely identical have been reached. The facts are not in dispute, but a consistent interpretation of the whole series has not at present been obtained.

Disturbance of Normal Sex-Ratios: the Production of Inter-Sexes.—Hybridization is not rarely followed by a disturbance of the normal sex-ratio. From canary females crossed with other finches and from domestic hens crossed with cock-pheasants *male* mules (sterile) are easily bred but female mules seldom if ever. Among Bovidae some crosses give fertile females but sterile males (S. v. Nathusius) and the same occurs in a cross between species of cavies (Detlefsen). Among Lepidoptera a series of such examples are known, the first having been observed by Standfuss, who called attention to the absence or scarcity of females in many species-crosses. Recently Goldschmidt, working with races or species of *Lymantria dispar* brought together from many countries, carried out a remarkable series of experiments. He found that a Japanese race used as ♀ × European ♂ gave normal males and females, but that in the reciprocal cross though the males came normal, the females were intersexes, exhibiting many transitional stages, approaching males in various degrees both in form, colour and instincts. When Japanese males of certain races were used, the whole of the female offspring are said to have been thus transformed into males. Goldschmidt states that the various races can be arranged in an ascending scale according to the completeness with which these effects are produced; but the phenomena showed many complications not as yet adequately represented, notably the appearance of partially transformed *male* intersexes in the F_2 generation raised by inter-breeding the normal offspring raised in the first experiment. It has been pointed out by J. B. S. Haldane (1920, unpublished) that, apart from certain exceptions, a general principle can be perceived in this group of phenomena. If in hybrid offspring either sex is consistently missing or defective, this will be the hetero-gametic sex, *e.g.* in birds and Lepidoptera the female, in mammals, the male.

Sex of Twins.—The facts hitherto dealt with all go to prove that sex is determined by the gametic contribution made by one or other of the parents and that this is the normal course is not open to question. In harmony with that conception of sex-determination, it is found that when, as in twinning of embryos and generally when the fertilized egg multiplies by division, the products are commonly all of the same sex. In the armadillo (*Tatusia novem-cincta*), studied in detail by Newman, four embryos, demonstrably arising by division of one blastodermic vesicle (developing ovum), are usually produced at a birth and are always of the same sex, the four being all males or all females. Patterson found an exception in the case of the parasitic

Hymenopteron *Paracopidosomopsis*, which by polyembryonic division sometimes produces both males, females and intermediates. That something analogous to non-disjunction here occurs is an acceptable interpretation of this anomalous instance. But there is a remarkable group of incontrovertible facts which show that sometimes the normal course of sex-development may be disturbed. F. Lillie discovered a remarkable example. When in horned cattle twins of opposite sexes occur, the female is sometimes sterile, being called a free-martin. It might be thought that these twins arose by division of one fertilized ovum, but Lillie by study of material from the Chicago stock-yards proved that an ovum had dehisced from each ovary and that therefore the twins were originally distinct. He further showed that sometimes the twins had an actual anastomosis between their foetal circulations. The presence of a male embryo must therefore be regarded as having the power of inhibiting the development of the female embryo, poisoning it in so far as the formation of the reproductive organs is concerned.

Effects of External Conditions.—Disturbance of the normal sex-ratios as a consequence of various interferences, such as starvation, high or low temperature, etc., has several times been alleged to occur, especially in Amphibia, and the evidence of R. Hertwig that delay in fertilizing the eggs of the frogs causes the production of a preponderance of males has been fully confirmed. Circumstantial details preclude the obvious suggestion that this is a result of differential mortality. Hertwig thought that inasmuch as the polar bodies are excluded very late, after the eggs are laid, his result might perhaps be reconciled with the conception of cytological pre-determination if the conditions of the experiment could in some way have decided which elements should be retained in the egg and which ejected in the polar body. Recently Seiler has made an observation of this kind in regard to a Psychid moth, *Talaeporia*. He states that if the females are kept in a high temperature while the eggs are undergoing maturation, it can be seen on cytological examination that the accessory chromosome more frequently remains in the egg, and that as a matter of observation more males are produced, the converse occurring under cold conditions. Until we know definitely which sex in Amphibia is hetero-gametic the discussion can scarcely be carried further, but the frequency with which transitional forms are found in the Ichthyopsida raises a probability that the facts are of a higher order of complexity. As to the genetical composition of the Amphibian intersexes, an important observation has lately been made by Crew. From the eggs of a female fertilized by a male showing intersexual characters 774 tadpoles were reared, all females. According to Baltzer, sex in *Bonellia* is directly determined by the conditions of larval life. The female is of course an animal of considerable size, whereas the male is a minute creature parasitic on her. Larvae which find the proboscis of the female and attach themselves to it are said to develop into males, those which remain free-swimming becoming females. Larvae artificially detached from the proboscis become intersexes. Adequate controls, by which the hypothesis of predisposition may be excluded, would in such an instance be most difficult to institute.

Effects of Castration.—Collateral evidence bearing on the nature of the distinction between the sexes has been drawn from many sources, especially from the results of castration, but though the facts thus empirically observed are of much physiological interest, they have no very direct bearing on the primary problem. The reproductive glands, acting chiefly, if not entirely, by virtue of the secretions (hormones) of their interstitial components, have often a great influence on the development and maintenance of secondary sexual characters, but the part played by the hormones must obviously be of a secondary nature. Removal of the genital glands has divers effects in various animals. In good agreement with the discovery that in the bird the female is the hetero-gametic sex, it is found that both in the fowl and the duck (Goodale) the removal of the ovary induces the plumage and some other characteristics of the male. The female is thus an organism in which the male attributes are concealed or recessive, whereas a capon does not develop hen-feathering. Moreover, Morgan found that in the Sebright bantam, the males of which are "henny" in plumage (not in combs or wattles), after castration the cocks acquire ordinary male plumage, which may naturally be interpreted to mean that the hen-feathering of these cocks is due to their possession of part of the female complex which has been transferred to them. Morgan and Punnett also have shown that the henny character behaves as dominant in breeding, a fact which proves that the dominance proper to the whole female complex of the bird pertains also to that part of the complex which controls the plumage.

Castration performed on moths during the larval stage has not produced modification of secondary sexual characters (Oudemans). In crabs, however, the destruction of the testes by certain parasites produces very striking "feminization" of the abdomen and appendages (Geoffrey Smith), but we do not know which sex in Crustacea is hetero-gametic. We are without a satisfactory interpretation of this group of observations, some of which superficially considered seem to run counter to the facts of gametic determination already established, but the disturbances of the normal course may commonly, though perhaps not always, be conceived of as due to interruption of the chain of events by which the full effects of gametic predetermination are developed.

Hermaphrodites.—Attention should be called to a remarkable lacuna in our knowledge of sex-determination. Up to the present nothing has been yet discovered either by cytological or analytical methods as to the genetical relation of the hermaphrodite types among animals to those in which the sexes are distinct. In plants a little progress has, as will appear, been made, pointing to the conclusion that the hermaphrodite is dominant, containing something which the females at least do not, but as to hermaphrodite animals nothing can be said with confidence. This is much to be regretted, as the whole subject might be greatly advanced by such knowledge.

General considerations.—From the observation that the two sexes are formed by modification of a common structural plan, and from the fact that by interferences, of which some have been mentioned, individuals cytologically, or at least gametically, destined to be of one sex may be made to assume more or less of the characteristics of the other, the conclusion has often been announced that each sex contains the other latent in it. To this expression, in the light of modern knowledge, no precise meaning can be attached, and it probably conveys nothing of essential truth. The primary sexual distinctions evidently depend on factorial elements which follow more or less closely the familiar principles of Mendelian segregation. The determining factor for sex should probably be regarded as a complex, usually transmitted in its entirety, but capable by accidental errors of cell-division of being disintegrated, so that the elements responsible for special characteristics may become detached from the rest and may even be passed over to the sex which normally does not receive them. For example, the races of fowls which do not incubate have presumably thus lost a portion of the dominant sex-complex; the hen-like cocks of the Sebright bantam may be represented as having acquired that ingredient of the female sex-factor which in the normal female inhibits the formation of the sickle-feathers and hackles of the cock, and so on. A similar representation may be applied to those cases (*e.g.* Phalaropes) in which the cocks are hen-like and normally incubate the eggs. It is not unreasonable to suppose that the transference of an actual fragment of critical material, presumably a portion of a chromosome, is responsible for the physiological abnormality. The literature of obstetrics and of stock-breeding abounds with nostrums for the arbitrary regulation of sex in man and the domestic animals, but from what is accurately known of the mechanism of sex-determination, nothing favourable to these claims can yet be adduced. Nor can any explanation be offered of the fairly constant departures from equality which normally occur in man and various domesticated animals. In the pig, ox and rabbit the male births are said sensibly to exceed the female, but in the horse and sheep there is a small excess of female births. The races of man show definite differences in the proportions of the sexes at birth. Of living births, taking females at 1,000, the males for England and Wales were for some time slightly below 1,040, which, though about the same as the proportion in Japan, is somewhat low in comparison with Germany, several European countries, and the white population of the United States, in which the males are about 1,060. On the other hand for the coloured population of the United States the male births are still less in proportion (in the year 1890, 1,024) and occasionally fall actually below the female number (998 in 1900). In all countries for which data can be obtained the proportion of males among *still-births* is very largely in excess of the females. Such divergences usually point to differential mortality or to the action of lethal factors, but in view of the large excess of males among still-births this account is not readily applicable here. The excess of males (surviving infancy) is exceptionally large in certain, though not all, of the families affected with the tendency to bleed profusely from trifling injuries, known as haemophilia. This is one of the sex-linked abnormalities appearing in males which follow much the same system of descent as colour-blindness. Illegitimate births in most countries show a distinct diminution in the excess of males.

Since the publication of Düsing, the proposition which he (following earlier writers) developed, that war produces an increase in the proportion of male births, has been widely disseminated. S. Newcomb investigated data as to births in the United States during the Civil War but found no positive result, and other parts of the evidence have been declared to be fallacious. Nevertheless, statistics for Great Britain and also those for Germany during the World War show a progressive rise which can scarcely be deemed insignificant. It should be remarked, however, that this rise had begun in Prussia some years before the war. On the other hand, no similar change has taken place in the neutral countries. For an adequate consideration of the facts many concomitant phenomena must be taken into account; for example, the fact that the total birth-rate of Prussia fell in the war period to less than half. Whatever be the immediate cause of the rise in male births, it is likely that it should be referred to the incidence of a differential pre-natal mortality rather than to any more fundamental genetic process.

Sex in Plants.—The attempt to make a factorial analysis of sex in the higher plants has not led to clear conclusions. Dioecious plants suitable for experiment are few. Correns, from results obtained in reciprocal crosses made between *Bryonia dioica* and the monoecious *B. alba*, inferred that the male of *dioica* was heterogametic, but the argument did not amount to proof. Shull's experiments with *Lychnis dioica* and a variation having the elements of both sexes present together were also beset with many complications and obscurities. In dioecious mosses the Marchals proved that segregation, in respect of sex, normally occurs at spore-formation, but both their experiments and those of Collins gave indications of further complexities. *Sphaerocarpos*, a liverwort, produces spores in tetrads, and of the four, two became males and two females. C. E. Allen states that the female spores each receive an accessory chromosome larger than that which passes to the male spores. Blakeslee showed that Mucors consist of several strains which may be called + and −, and that conjugation only takes place when a + culture comes into contact with a − culture. These strains may with great probability be regarded as two sexes, but the results were complicated by the discovery of other strains which are indifferent. We meet here the same difficulty noted in the case of animals, that the factorial relations between hermaphrodite plants and the dioecious forms have not yet been successfully represented. Varieties having the stamens to a greater or less degree aborted are not uncommon among the species of flowering plants which are normally hermaphrodite. If the deficiency is extreme, the variety is not merely in function female, but it is in a condition morphologically not distinguishable from the females of plants dioecious in the strict sense such as *Lychnis dioica* or *vespertina*. When such female varieties are fertilized with pollen from the hermaphrodite type the resulting family may be a mixture of hermaphrodites and females, but not rarely females only are produced. As the hermaphrodite is a dominant this evidence demonstrates that the hermaphrodite factor must thus be relegated to the female side, the male side taking the recessive in which the anthers are aborted. Such "unilateral" distribution of the factors may exist in regard to colour, double flowers and probably many other factorial distinctions, and the conception of sex-linkage is in a special and limited sense applicable to them (C. Pellew). Otherwise nothing comparable with the sex-linkage of animals has yet been discovered in plants. It must always be remembered that, on account of the complications created by the existence of a syncopated alternation of generations in the higher plants, no direct parallel between sex, as manifested in them, and that of animals can be instituted.

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SGAMBATI, GIOVANNI (1843–1914), Italian composer (*see* 24.757), died at Rome Dec. 15 1914.

SHACKLETON, SIR ERNEST HENRY (1874–1922), British polar explorer, was born at Kilkee Feb. 15 1874. He was educated at Dulwich College, and afterwards entered the merchant service, subsequently becoming a lieutenant in the R.N.R. In 1901 he joined the Antarctic expedition of Capt. Scott in the "Discovery," but had to return home on account of ill health. In 1908 he organized his first Antarctic expedition, largely fitted out by himself, which started from New Zealand in the "Nimrod," and achieved important results, reaching a point on the Antarctic continent about 97 m. from the South Pole (*see* 21.968). For this he was knighted in 1909, also receiving the C.V.O., while the Government contributed £20,000 towards the expenses of the expedition. He equipped a second expedition which left England in the "Endurance," Aug. 1 1914, with the idea of approaching the Antarctic continent from Weddell Sea and ultimately joining hands with another party whose ship, the "Aurora," was to start from Australia and approach by way of Ross Sea. Owing largely to bad ice conditions, the expedition was almost uniformly unfortunate (*see* Antarctic Regions). The story of this expedition was related by Sir Ernest Shackleton in *South* (1919). He received the King's

Polar medal and many honours from learned societies. In addition to the work mentioned above, he published *The Heart of the Antarctic* (1909). In 1921, in the "Quest," he organized a third expedition, which set sail in September; but while it was still on its way he died from an attack of *angina pectoris*, on board, off Georgia I., Jan. 5 1922.

SHANGHAI, China (*see* 24.799).—During 1911–21 the population and trade of Shanghai expanded steadily, as the result of the development of the port's railway communications with the interior and of the increasing development of cotton-spinning, shipbuilding and other industrial enterprises. At the same time the wealth and importance of the foreign settlements rapidly increased, chiefly because of the large number of Chinese officials, capitalists and political refugees who sought there security from the civil strife and disorders prevalent throughout the interior after the revolution.

The city's rate of expansion is reflected in the maritime customs returns, which show that the gross value of the trade of the port in 1919 amounted to 768 million taels, which, at an average exchange of 5s. 8d., represents £217,000,000. In 1908 the sterling value of the trade was £40,400,000. The changed conditions of international commerce brought about by the World War were manifested in the fact that in 1919, for the first time, the United States took the first place in the list of Shanghai's foreign trade, with a margin of 28 million taels over that of Japan, thus reversing the position occupied by the two countries in 1918. The trade of Great Britain, which before the war headed the list, showed signs of recovering some of its lost ground, especially in the matter of Manchester cotton goods.

The total pop. of Shanghai, as estimated by the Imperial Maritime Customs, was 1,000,000 in 1916, an estimate which included the inhabitants of the native city as well as those of the international and French settlements; but the actual total to-day must be considerably higher, for the Chinese pop. of the international settlement alone was 620,401 in 1915, and was estimated at 673,000 in June 1919. No reliable statistics are forthcoming in regard to the population of the native city (which displays but little evidence of the reformers' activities) nor of that of the Chinese-controlled suburbs of the foreign settlements, but it may be assumed to be increasing, while that of the French municipality has grown very rapidly since its boundaries were enlarged and its area developed by a progressive scheme of road construction. The foreign pop. of the international settlement in 1919 was calculated to be 22,000; at the last census (Oct. 1913) the total was 18,519, of which number 7,169 were Japanese, 4,822 British, 1,323 Portuguese, 1,307 Americans and 1,155 Germans. After the conclusion of the Russo-Japanese War, the number of Japanese residents increased much more rapidly than that of any other nation, but as the franchise for the election of the Land-renters' Executive Council is limited by property-owning or tax-paying qualifications, the British community still retains its predominant influence in municipal affairs. The Land-renters' list at the beginning of 1920 showed 1,100 British voters, as against 300 Japanese, 230 Americans and 150 Germans. The steady expansion of the revenues collected by the self-governing Council of the International Settlement (in which the Chinese Government has no jurisdiction) affords evidence of the growth and prosperity of the city during the past decade. In 1911 the rates and taxes collected were 2,589,628 taels; in 1919 the total was 4,419,961. The street traffic returns are significant not only of rapid growth but of changing conditions. In 1911 the council licensed 11,111 jinrikishas, 1,277 carriages, 217 motor-cars, 5,310 wheelbarrows, 199 sedan-chairs and 958 carts; the corresponding figures for 1919 were 14,726 jinrikishas, 831 carriages, 1,378 motor-cars, 8,667 wheelbarrows, 18 sedan-chairs and 2,141 carts. Industrial enterprise during this period was greatly stimulated by the improved facilities for the transport of raw materials provided by railway construction in the interior; cotton-mills, in particular, increased rapidly, the number of these at Shanghai at the close of 1920 being 26, with a total of 901,898 spindles. Factories were also established for the making of flour, cigarettes, matches, etc., and, as in Japan, a new development of the retail trade was manifested by the establishment of large department stores, conducted on European and American lines.

The political importance of Shanghai, as the headquarters of Young China and a sanctuary for political refugees of all descriptions, naturally increased during and after the upheaval of the Chinese Revolution. Many wealthy and conservative officials of the old régime sought and found security for themselves and their property within the limits of the extra-territorialized Foreign Settlements; later, in 1913, the expulsion of the Kuo-Min-tang politicians from Peking by President Yuan led many of these southern Parliamentarians to make Shanghai their headquarters, and each succeeding year of civil strife added to the numbers of those who sought shelter from its widespread disorders under the shelter of the municipality. Nor were the political refugees all Chinese, for, after the revolt of the Koreans against the Japanese Government in 1919, "the Provisional Government of the Korean Republic" established itself at Shanghai. Thus the little spot originally set apart as a place of residence for foreign traders came by force of circumstances to be the birthplace and centre of political activities in China, the vernacular press at Shanghai (including several of the most influential newspapers in the country) being generally in opposition to the policy of Peking and in sympathy with the views of the student class. By common consent of the contending factions, the Peace Conference convened in 1919 to discuss the differences between the Peking Government and the southern "Constitutionalists" was held in the neutral territory of the international settlement. An interesting feature of Young China's political activities in 1919–20 of particular importance to the future of Shanghai lay in its increasing insistence, on the one hand, on the abolition of the foreigners' extra-territorial rights and, on the other, on the recognition of the Chinese taxpayers' claim to a share in the direct executive government of the settlement, a claim which (while morally undeniable) would, if successful, effectively put an end to the conditions by virtue of which the Foreign settlements have afforded security for life and property during periods of widespread disorder in China.

See George Lanning and Samuel Couling, *The History of Shanghai* (1920). (J. O. P. B.)

SHANNON, CHARLES HAZELWOOD (1865–), English painter (*see* 24.801), was elected A.R.A. in 1911, and in 1918 became vice-president of the International Society of Sculptors, Painters and Gravers. His more recent works include "The Amethyst Necklace" (1907), "The Morning Toilet" (1912), "The Embroidered Shawl" (1914), and "The Incoming Tide" (1918); while in 1918 he produced various portraits, including those of Princess Patricia of Connaught, Miss Lillah McCarthy, and Miss Hilda Moore ("The Lady in Black"). Among his lithographs may be mentioned "Playmates" (1908), "Ebb Tide" (1917), "The Tidal River," and "A Sharp Corner" (1919). In 1920 he was elected R.A.

SHAUGHNESSY, THOMAS GEORGE SHAUGHNESSY, 1ST BARON (1853–), Canadian railway president, was born at Milwaukee Oct. 6 1853, his parents being Irish. He was educated at St. Gall's academy, Wisconsin, and began his railway service at the age of sixteen. In 1882 he joined the staff of the Canadian Pacific as general purchasing agent, and by 1891 had risen to be its vice-president. From 1899 to 1918 he was president and chairman of the board of directors, as well as a director of all the allied lines. He was knighted in 1901, created K.C.V.O. in 1907, and raised to the peerage of the United Kingdom as Baron Shaughnessy of Montreal and of Ashford, co. Limerick, in 1916. His two sons, William James Shaughnessy (b. 1883) and Alfred Thomas Shaughnessy (b. 1887) served in the Canadian Expeditionary Force during the World War, and the younger was killed in action in 1916.

SHAW, ANNA HOWARD (1847–1919), American reformer, was born at Newcastle-upon-Tyne, England, Feb. 14 1847. When she was a small child her parents moved to Massachusetts, and soon afterwards to Michigan, where her father cleared a farm, 40 m. from the nearest post-office and 100 m. from the railway. From 1872 to 1875 she studied at Albion College, Mich., and in 1878 graduated from the Theological School of Boston University. The district conference of the Methodist Episcopal Church granted her a local preacher's licence, and she held pastorates at Hingham and East Dennis, Mass., remaining in the latter place seven years, until 1885. Meanwhile the New England Conference of the M.E. Church refused to ordain her because of her sex, and the refusal was upheld by the General Conference at Cincinnati in 1880. But the same year she was ordained in the Methodist Protestant Church. While preaching she had studied medicine and received the degree of M.D. from Boston University in 1885. She was then chosen lecturer for the Massachusetts Woman's Suffrage Association. The following year she was made national superintendent of franchise of the Women's

Christian Temperance Union, serving for six years. She was also associated after 1886 with the National American Woman's Suffrage Association as lecturer, vice-president-at-large, and from 1904–15 as president, when she declined reëlection. She had spoken in every state, before many state Legislatures, and before Congressional committees. She was a member of the International Council of Women; the International Suffrage Alliance; the National Society for Broader Education and the League to Enforce Peace. In 1917 she was appointed chairman of the woman's committee of the Council of National Defense, and in 1918 edited for this committee a department in the *Ladies' Home Journal.* She died at Moylan, Pa., July 2 1919, shortly after the passage of the suffrage amendment to the Federal Constitution by Congress. Her last message was an appeal to women to use their influence for the ratification of the League of Nations. She was the author of *The Story of a Pioneer* (1915, with Elizabeth Jordan) and joint editor of *The Yellow Ribbon Speaker* (1891, with Alice Stone Blackwell and Lucy Elmira Anthony).

SHAW, GEORGE BERNARD (1856–), British dramatist (*see* 24.812), produced on the London stage subsequently to 1910 *Fanny's First Play* (1911), *Overruled* (1912), *Androcles and the Lion* and *Great Catherine* (1913) and *Pygmalion* and *The Music Cure* (1914). He also produced in Dublin, or at special performances in London, the one-act plays *O'Flaherty, V.C.* and *Augustus does his Bit* (both satires on problems of the World War), *The Inca of Jerusalem* and *Annajanska*, and published a three-act play *Heartbreak House* (1919), produced in New York, and also in a German version in Vienna in Nov. 1920. A few months after the outbreak of war he published, as a special supplement to *The New Statesman*, an outspoken deliverance on "Common Sense and the War," which occasioned much comment and earned him some unpopularity. In 1921 he published *Back to Methuselah.* (*See* ENGLISH LITERATURE.)

SHAW, JOHN BYAM (1872–1919), English painter, was born at Madras Nov. 13 1872, the son of John Shaw, registrar of the high court of Madras. He came to England in 1878, and his first art teaching was obtained at the St. John's Wood school of art. He entered the Royal Academy schools in 1889, and his picture "Rose Mary" was hung in 1893. One of his best-known works was "Love the Conqueror" (1899). He illustrated a great number of books, among them being Browning's *Poems* (1898); *Tales from Boccaccio* (1899); *Pilgrim's Progress* (1904); Edgar Allan Poe's *Tales* (1909), etc. In 1911 he established, with Rex Vicat Cole (b. 1870), a school of art at Kensington. He died in London Jan. 26 1919.

SHAW, RICHARD NORMAN (1831–1912), English architect (*see* 24.813), died at Hampstead Nov. 17 1912.

SHAW, SIR WILLIAM NAPIER (1854–), British meteorologist, was born at Birmingham, March 4 1854. He was educated at King Edward's school, Birmingham, Emmanuel College, Cambridge, of which he became a fellow in 1877, and the university of Berlin. From 1887–99 he was university lecturer in experimental physics at Cambridge, from 1898–9 assistant director of the Cavendish laboratory, and from 1890–9 senior tutor of Emmanuel College. In 1891 he was elected a fellow of the Royal Society. In 1897 he became a member of the Meteorological Council, and was from 1900 to 1905 its secretary, in the latter year being appointed director of the Meteorological Office. In 1907 he became reader in meteorology in the university of London. He was president of the mathematical and physical section of the British Association in 1908 and of the educational section in 1919, and in 1919 was president of the International Conference of Meteorologists held in Paris. He was knighted in 1915, and in 1920 retired from his position at the Meteorological Office. Sir Napier Shaw's works include *Life History of Surface Air Currents* (with R. G. K. Lempfert, 1906); *Air Currents and the Laws of Ventilation* (1907); *Forecasting Weather* (1911); *Manual of Meteorology* (1919); besides many papers in scientific journals and valuable reports of meteorological and other subjects. He received many honours and distinctions, including the Symons medal of the Royal Meteorological Society.

SHELL-SHOCK, the popular name given during the World War to an obscure form of nervous disease which became rife among the armies. The term "shell-shock" appears to have been officially adopted in Great Britain in 1916, although cases to which this term might have been equally applicable had occurred in the English and French armies from the beginning of the war and onwards. It is probable, although it is not recorded, that similar cases occurred in previous bloody wars; but never before have such vast numbers of men been subjected to such terrific strain, dangers and horrors from forces generated by explosives. In consequence thereof the term "shell-shock," applied to all forms of war psycho-neurosis, found ready acceptance by the press and public, but by neurologists it was generally regarded as a misnomer—unless it were strictly limited to cases of concussion or commotion of the brain directly caused by the violence of the forces generated by the explosion.

Early in the war, and subsequently, cases of sudden death of groups of men without visible external signs of injury were recorded. They were particularly noted when the explosive forces were generated in confined spaces, where percussion and repercussion would be intensified in their effects upon the cerebro-spinal fluid, which acts as a water-jacket to the central nervous system and especially protects the vital centres in the medulla from concussion. Carbon-monoxide poisoning was also considered a possible cause of such a death, and especially was this likely in the case of explosion of mines or the imperfect detonation of shells in closed spaces, such as dugouts, saps or ravines.

The great majority of cases diagnosed as "shell-shock" were not *commotional* in origin, but *emotional*, and due in most instances to the existence in the sufferer of an inborn timorous, neuropathic or psychopathic disposition; but in a certain number of cases an emotional instability was acquired by the prolonged strain and stress of war. Thus fatigue, insomnia, anxiety and infective disease frequently combined to cause a neuro-potentially sound individual, with an excellent record of service, to become emotive and to develop "shell-shock," the final breakdown having been precipitated by a shell bursting near to him. The present writer had the opportunity of examining post-mortem the brain in such a case, and it showed rupture of minute vessels and haemorrhages into the substance of the brain and cerebro-spinal fluid.

In the absence of objective signs during life, such as ruptured tympanum, and changes in the cerebro-spinal fluid—for example, the existence of blood—it would be impossible for the medical officers to decide whether such a case was primarily commotional or emotional. This is an important matter, for the former was classed as a battle casualty and entitled the sufferer to a gratuity. The large number of British cases claiming a gratuity for "shell-shock" led to the promulgation of Army Form W. 3436, which required circumstantial evidence by an eye-witness of the proximity of the soldier to the bursting shell. Even then great difficulties were experienced in coming to a just decision, for a purely commotional case, if not severe, usually recovered more rapidly than an emotional one; consequently a record of service and the severity, character and persistence of symptons had to be taken into account.

The diagnosis of "shell-shock" was made at the Casualty Clearing and Field Ambulance stations, and when a barrage was opened prior to the attack of the enemy, or other intense shell-fire, medical officers at the front-line stations had little time to investigate the numbers of casualties coming in, and until the later period of the war cases of "shell-shock" were sent to the base hospitals. The wish in a great number of these cases was not to go back to an intolerable situation; and fear, associated with the instinct of self-preservation, arose as an unconscious defence mechanism, and persisted in maintaining such hysterical manifestations as amnesia, tremors, paralyses, contractures, convulsive tics, aphonia, mutism, blindness, deafness and other functional sensori-motor disabilities. Whereas hysterical manifestations were extremely common in the ranks, they were relatively rare among the officers, who suffered from neurasthenia and anxiety neurosis instead. These two forms of psycho-neurosis in no essential manner differed from those affecting civilians of either sex (*see* 14.211 and 19.432).

Among the causes which led to the prevalence of cases diagnosed "shell-shock" was the neurological and psychological inexperience of medical officers in the diagnosis and treatment of psycho-neurosis. Another was the degree of discipline, *moral* and *esprit de corps* in a regiment; this largely depended upon the personality of the commanding officer, the medical officer and the quartermaster, their efficiency in performing their duties and their endeavours to supervise the welfare of their men so far as the emergencies of war permitted. Thus confidence and will-power were inspired in the men to face with them any situation, and "shell-shock" cases were relatively few in such regiments as compared with the number of cases in a regiment with poor *moral* and discipline, where suggestion played an important part.

It is generally accepted by medical authorities in England and abroad that the stress and strain of war, including exposure to shell-fire, does not produce psychoses such as epilepsy, manic depressive insanity, dementia-praecox, obsessional psychasthenia, or an organic disease like general paralysis, but it may excite or reveal them. It is, however, admitted that exhaustion or toxic psychoses with mental confusion of a temporary character are often due solely to the stress and strain of war.

Relation of "Shell-shock" to Court-Martial Procedure.—As a result of questions in Parliament and a debate opened on April 28 1920 by Lord Southborough, a War Office committee, with Lord Southborough as president, was constituted July 1920 with the following terms of reference:—

> "To consider the different types of hysteria and traumatic neurosis called 'shell-shock'; to collate the expert knowledge of the service medical authorities and the medical profession from the experience of the war, with a view of recording for future use the ascertained facts as to its crisis, nature and remedial treatment and to advise whether, by military training or education, some scientific method of guarding against its occurrence can be devised."

In the House of Lords debate, in which Lord Horne, Viscount Peel and Lord Haldane took part, a good deal of attention was devoted to court-martial procedure, and especially in relation to "shell-shock" and to death sentences in connexion with cowardice and desertion. From what was said it seems probable that in the early days of the war, before "shell-shock" was fully understood, a few men were shot who, in the light of further knowledge and experience, could not have been held responsible for their actions. The question arises, When is a man who has pleaded "shell-shock" (taken in its widest acceptance) to be held responsible for and conscious of the quality of his acts? The psychology of the emotion of fear in relation to the instinct of self-preservation and the will-power to control supplies a basis upon which to answer this question. The emotion of fear is associated with three instinctive reactions, as we see in animals: (1) flight; (2) immobility; (3) concealment. In war practically every man, even the bravest, before a battle may experience fear; but a soldier should, by suitable training and confidence in his superior officers, overcome this by will-power, and thus convert the primary reaction of fear into that of anger. How can a medical officer differentiate between cowardice and fear causing an irresponsible lack of will-power in a man to control his actions in the face of difficulties and dangers? The doctor should know the man's personality, his previous record and what his comrades thought of him. It is not so much what he says as what he did, or what he has done, which will help towards a decision. There are, however, certain signs in a man who refuses to go forward in action or who runs away, that show he cannot be held altogether responsible for his action. He may be dazed in consequence of "shell-shock" and be the subject of mental confusion; there may be physical signs of fear over which he has no voluntary control, namely rapid action of the heart, dilatation of the pupils, sweating, blueness and coldness of the hands, often protrusion of the eyeballs, and an expression on the face which is hard to simulate. These conditions, associated with trembling, are sufficient indications of true fear inhibiting the will.

Out of the psychology of fear arises the question whether *in recruiting* there is any test by which the unfitness for active service on account of a nervous disposition can be ascertained. And, if so, whether it would be desirable to eliminate from the army such a man without probation. It is a fact that many highly intelligent men with nervous instability may, if suitably trained, develop into most efficient officers and non-commissioned officers. Much depends upon the method of training and on those who undertake the training. A sensitive nature with self-esteem must not be broken by harshness or injustice, which produces a mental conflict ending in an anxiety-neurosis or neurasthenia. It is generally admitted that under no circumstances should an imbecile, an epileptic or an individual who has suffered with a previous attack of insanity be recruited.

For further information the reader is referred to *Parliamentary Debates, House of Lords*, Wed. April 28 1920, vol. xxxix., No. 29. See also Sir F. W. Mott, *Shell Shock and War Neurosis* (1919).

(F. W. Mo.)

SHERMAN, JAMES SCHOOLCRAFT (1855–1912), American politician, was born near Utica, N.Y., Oct. 24 1855. He graduated from Hamilton College in 1878, was admitted to the bar in 1880, and practised in Utica until 1907. In early manhood he left the Democratic party, became a Republican, and as such was elected mayor of Utica in 1884. In 1886 he was elected to the National House of Representatives and was returned continuously until 1908, excepting the term 1891–3. He was a delegate to the National Republican Convention in 1892; chairman of the Republican State Convention in 1895, 1900, and 1908; and chairman of the Republican National Committee in 1906. For 12 years he was chairman of the House Committee on Indian Affairs—a subject naturally of great interest to him, as he was a relative of Henry R. Schoolcraft (*see* 24.359)—and the Sherman Institute in California, an Indian school, bears his name. At the Republican National Convention of 1908 he was nominated vice-president on the first ballot and was elected on the ticket with William Howard Taft. Four years later he was renominated, but he died at Utica, Oct. 30 1912, shortly before the elections.

SHEVKET, MAHMUD (1858–1913), Turkish pasha, was born at Bagdad in 1858, and from early youth showed marked qualities of intellect and personality. He received his military training at the military college in Constantinople, 1875–80, and after a very brief period of service with the troops was given an appointment on the general staff. Von der Goltz, who at that time was reorganizing the Turkish army, thought very highly of the young Shevket, and it was through his agency that the latter was sent to Germany to manage the reëquipment of the Turkish army. As a result he remained from 1884 to 1894 in the small arms factory of Mauser Bros., at Oberndorf on the Neckar. He also studied armament problems in France for a short time, and in 1894, as the reward of his labours, was made inspector of military arsenals in Constantinople. From 1901 to 1903 he was military governor of the Hejaz, in Arabia, then in what amounted to a state of war. He next went in a like capacity to Kossovo (Uskub), and there came in contact with the Young Turk movement, which had its headquarters in Salonika. In 1908 Abdul Hamid averted the break-up of the old régime by summoning a National Assembly. This state of things, however, did not last long. In the spring of 1909 the Old and Young Turks were struggling for supremacy. A powerful Old Turk counter-revolution was prepared, but, in mid-April, the III. Army Corps, under Hussein Husni Pasha, marched from Salonika against Constantinople. At San Stefano Mahmud Shevket took over the command, and, after heavy fighting, forced his way on April 4 into Constantinople. Impressed by his victory the National Assembly no longer dared to oppose the will of the Young Turks, and on April 26 voted the deposition of Abdul Hamid. Mahmud Shevket was the hero of the day. But he did not care for politics, which he considered had been the ruin of the Turkish corps of officers, and preferred to confine his activities to purely military matters. The next few years afforded him plenty of opportunities. In 1910 and 1911 he put down a revolt of the Malissors with great energy, and in 1912 fought against the rebels in Albania. In the summer of 1912 he became Minister of War, and in Jan. 1913 succeeded Kiamil as Grand Vizier. He took a very active part in army reforms, but he came into conflict with the Union Libérale, which took its orders from Sherif Pasha in Paris, and he was murdered by one of its members on June 11 1913.

SHIP AND SHIPBUILDING (*see* 24.867).—The period from 1910–21 was marked by great progress in shipbuilding; that progress was in some ways interrupted, in others stimulated, by the World War, which overshadowed every phase of development both in commercial and naval enterprise. The naval strengths during ten years after 1921 of the chief nations were restricted as a result of the decisions summarized in the article WASHINGTON CONFERENCE.

The great object of the Allied belligerents during the war being to obtain the maximum output both of war material and of merchant ships on which their supplies depended, those responsible for the building of all types of ships naturally turned their attention to standardization. This had the effect of retarding the adoption of new inventions on the one hand; but on the other the novel circumstances and continued development of material by Germany during the war, and the ruthless use made of that war material, continually called for novel devices and new types of ships to meet and defeat the continually changing and ever-increasing intensity of the campaign. This, whilst it produced many new types of warships and countless devices for their improvement in offence and defence, in the case of many classes of warships, but more particularly in the design of merchant ships, had the effect of developing standardized types, both in Great Britain and later in America, in order to increase the numbers of ships for transport purposes of all kinds and so counter the enormous losses due to the German submarine campaign. After the Armistice, although at first there was an enormous demand for ships of all classes, the slump in trade in 1920–1 and the very high prices of ships had the effect of reducing the demand. In Great Britain many of the warships building after the Armistice were broken up and no new ships had in 1921 been started. The output of merchant ships was in 1921 steadily declining, so that it could not be said that shipbuilding had yet resumed that steady advance which was being made before the war.

The outstanding features which have affected the design of all classes of ships specially are the gradual adoption of oil in lieu of coal as a fuel, the further development of the steam turbine, and, for certain classes of vessels, the progress made with internal-combustion engines (*see* INTERNAL COMBUSTION ENGINES).

In the British navy, and to a great extent in other navies, during this period, oil most completely superseded coal for steam-raising. At first destroyers were the only type of vessel, apart from submarines, in which coal was altogether abolished as a fuel in the British navy. Then in 1912 light cruisers of the "Arethusa" class had oil only. A little later in that year, in the "Queen Elizabeth" class of battleships oil was decided upon as the only fuel for the first time in a capital ship. Subsequently to that, no British warship proper, with the exception of the "Raleigh" class of 10,000-ton light cruisers, which were destined for world-wide work, had anything but oil as a fuel, and in the "Raleighs" seven-eighths of the power was derived from oil. This change was a very momentous one to make, especially when it is considered that in Welsh coal Great Britain possessed the finest and then the cheapest steam coal in the world. In spite of this, however, the advantages of oil were so great that, when in use it had been found satisfactory, coal was relegated to be the fuel of none but special or auxiliary ships in the navy.

The advantages of oil may be summarized shortly as follows: For the same weight it has 50% more thermal value than coal. It occupies less space and can be stowed in spaces inconvenient for coal and other stores. Boilers with oil remain much cleaner for a long period, so that full power can be kept up indefinitely as long as the fuel lasts. Oil can be easily taken on board at any time, thus not calling upon the crew for the great exertion involved in coaling ship hurriedly, perhaps just before their energies are required for fighting an action. The exertion of stoking is entirely done away with and far fewer men are required in the stokehold, which is always clean and comfortable. With oil also much larger boilers can be used, which saves space in the boiler-rooms. Though there are other contingent advantages, those named are enough to show that the British Admiralty took a wise course in adopting oil for all fighting ships, and this was amply proved during the war.

Subsequently, owing to the very high price of coal and of wages for firemen, many of the advantages enumerated above induced merchant shipowners to adopt oil in place of coal for high-powered passenger vessels. In low-speed cargo-boats the great economy of internal-combustion engines as compared with steam-engines, makes the advantage of the adoption of oil still more paramount, and the number of these vessels has been largely increased. The comparatively low powers, however, which can be got with internal-combustion engines prevented their being adopted up to 1921 for fast merchant ships or for any warships, except submarines, which generally have comparatively low power and moderate speed. In submarines a much lighter internal-combustion engine than that used for cargo vessels has been developed, with a high number of revolutions.

Another very important advance in marine engines has been gained by the used of toothed gearing. This gear enabling the high number of revolutions in turbines to be reduced, so that large slow-running propellers can be used in conjunction with very quick-running efficient turbines, a much higher efficiency has been secured and increased speed of ship and economy of working has resulted. In its present form this gearing was first introduced in 1910 by Sir Charles Parsons in connexion with the turbine engines of a merchant vessel named the "Vespasian." The success of the trials of this ship led to the further adoption of gearing, and for the British navy it was first tried in destroyers, then in some light cruisers, and was in 1921 gradually coming into use for most war ships and many mercantile ships. The largest ship in which it had been adopted was H.M.S. "Hood."

I. BRITISH WARSHIPS

Taking the first most important type of British warship, namely capital ships, the naval actions in the Russo-Japanese war of 1904–5 had demonstrated the capital importance of the heavy long-range gun, while the turbine system of propulsion had been sufficiently tested in high-speed passenger vessels and small warships to justify its adoption, at any rate experimentally, in warships of a larger size. These changes were, no doubt, bold ones, both as regards guns and machinery; but the wisdom of their selection for the design of the first "Dreadnought," in 1905, was sufficiently vindicated by subsequent experience, and by the general acceptance of these two features by other naval Powers.

Laid down in Oct. 1905, the original "Dreadnought" proved so successful that from 1907 onwards the designs of British capital ships moved on progressive lines without departing from the essential principle of the "Dreadnought" type, viz. a ship carrying an all-big-gun armament, adequately protected for taking her place in the line of battle, and of a speed at least equal to that of any foreign ship of similar rank.

The next 10 years therefore saw a succession of post-"Dreadnought" battleships in which the primary armament passed from the ten 12-in. guns of the "Dreadnought" through the ten 13·5-in. guns of the "Orion" (all on the centre line of the ship) to the eight 15-in. guns of the "Queen Elizabeth," an increase, within that brief period, of over 126% in the heavy projectile weight of discharge. There was no secondary battery, properly speaking. The "Dreadnought" carried 24 12-pdrs. for repelling T.B.D. attack, but this armament was soon recognized as being too light for the ever-increasing size and power of destroyers, and in subsequent ships up to the "King George V." class (inclusive) batteries of 12 to 16 4-in. guns were mounted as high up as possible to repel the attack of destroyers. In the "Iron Duke" and "Queen Elizabeth" classes 6-in. Q.F. guns were substituted for the 4-in., as the latter weapon was then thought to be insufficient against destroyers and light cruisers.

The speed of these battleships was kept at the uniform level of 21 knots up to and including the "Iron Duke" class. The type of turbine machinery on four shafts, which had proved so satisfactory in the original "Dreadnought," became the standard, but the growth in displacement necessitated a corresponding increase in power to attain the requisite speed. The use of oil fuel in association with coal was maintained until the "Queen Elizabeth" class was reached, when the greater advantages of oil fuel and the improved methods of its combustion finally caused the abandonment of coal as fuel. A noteworthy feature of these remarkable vessels was the advance in speed to 25 knots, necessitating, on a slightly larger displacement than that of their predecessors, an increase of about 150% in the power.

Concurrently with the development of the battleship proper, that of the British battle cruiser may be followed with advantage. Up to the inception of the "Dreadnought" design nothing more ambitious than an armament consisting of 9·2-in. guns associated with 7·5-in. guns ("Warrior" and "Minotaur," 1903–4) had been attempted in armoured cruisers. But the same reasons which caused the evolution of the all-big-gun battleships from the mixed armament of the "King Edward VII." and "Lord Nelson" classes now called for a similar simplification in the armoured cruiser designs. The outcome of this policy was the production of the "Invincible" class of "cruiser battleships," now generally known as "battle cruisers."

In these vessels the additional power necessary for their 4 to 5 knots superiority of speed over the "Dreadnought" was obtained at the sacrifice of two 12-in. guns and some loss of armour protection. The value of speed, which in battleships had always been a debatable point, was, of course, incontestable for the battle cruisers, and the development of the type has, both before and since the outbreak of the war, kept pace with the insistent demands of the strategist for the highest speed obtainable. Within the 10-year period referred to above, the increase in speed and power from the "Invincible" (25 knots for 41,000 H.P.) to the "Renown" (32 knots for 120,000 H.P.) required an increase in displacement from 17,250 tons to 26,500 tons, the relative increase in power being over 190 per cent. Finally in the "Hood" a speed of 32 knots with 144,000 H.P. on a displacement of 41,200 tons, an increase of 235% in power was involved.

The wisdom of the policy which initiated this new era in naval construction, relegating temporarily into the background the former British supremacy in capital ships, was naturally the subject of much criticism. But evolution in warship construction is not the property of any one navy, and there is little doubt that, at the conclusion of the Japanese war, the world stood on the threshold of a new era in naval architecture. If British naval supremacy was to be maintained it had to be done by leading the world along the new path of warship design, without waiting for others to utilize the advantages that had been rendered possible by progress in armour, guns and machinery. How great an advance the "Dreadnought" represented on previous ships may be gauged from the particulars given in Table I.

TABLE I.—*Comparison between "Dreadnought" and the Best Previous Ships.*

	"Dreadnought" (as designed)	Best Previous Ship
Number of 12-in. guns carried	10	4
Length of line of battle for equal number of 12-in. guns on the broadside	Ratio	1 to 2
Total muzzle energy per broadside of 12-in. guns	383,000 ft.-tons	145,000 ft.-tons
Length of line of battle for equal 12-in. broadside gun power	Ratio	1 to 2·6
Tons displacement per 12-in. gun	1,785	3,750
First cost per 12-in. gun in line of battle	£175,000	£280,000
Annual upkeep of ship per 12-in. gun carried.[1]	£ 34,800	£ 62,300
Speed (knots)	21	19
Endurance:		
At economical speed (nautical m.)	5,800	5,790
At 16 knots (nautical m.)	4,000	3,000

Other navies were not slow to follow the lead given by Great Britain. The veil of secrecy in which the new types were closely shrouded whetted the emulation as well as the curiosity of other nations. Germany, ever ready to reap where others have sown, set about preparing for the change, and two years later produced the "Nassau" class, with 12 11-in. guns as main armament and 12 6-in. guns as anti-destroyer armament. At the rate of three a year she continued to lay down ships of this type—improved in armament as time progressed—each batch being accompanied by a battle cruiser of corresponding power and speed. Other nations fell into step, and, during the five or six years preceding the outbreak of war, produced, with variants appropriate to their several necessities, all-big-gun ships carrying a main armament of 10 or 12 primary weapons grouped in turrets shielding two, three, or even four guns each.

While the German output of capital ships had, once it got under way, continued with methodical regularity, British naval construction had suffered from the vagaries inseparable from divergent political views and aspirations.

Under the "Cawdor Memorandum" of Nov. 30 1905 it had been laid down that the minimum British requirements would be four large armoured ships a year, and the "Dreadnought" with the three "Invincibles" fulfilled this condition, but in each of the two following years only three battleships (and no battle cruisers) were laid down, while the 1908–9 programme only provided for one battleship ("Neptune") and one armoured cruiser ("Indefatigable"). Efforts had been made to induce Germany to curtail her naval expansion—"a year's holiday in naval construction" being suggested—but such hopes as were based on this contingency gradually faded before the inexorable German determination to challenge British sea supremacy. In the 1909–10 estimates provision was therefore made for laying down four capital ships, two in July 1909 ("Colossus" and "Hercules") and two in Nov. ("Orion" and "Lion"), while four "contingent" ships ("Monarch," "Thunderer," "Conqueror" and "Princess Royal") were to be laid down in April 1910, if the German menace showed no signs of abating. So far from this latter being the case, there was an acceleration in the dates of laying down the German ships, and the programme outlined above was therefore punctually carried out. The 1909–10 programme, it will be seen, was a memorable one in the history of British naval construction, and its adoption enabled Great Britain to maintain her naval supremacy, which otherwise would have been jeopardized.

Notwithstanding the atmosphere of uncertainty created by the delays due to hopes of a reduction of armaments, the rate of progress on warships under construction was well maintained, and, with a few exceptions, Great Britain was able to complete the largest battleships within 24 to 30 months of laying down, a performance which compared favourably with the best achievements abroad, and which not even Germany with her methodical preparations was able to equal.

The disposition of the heavy guns in both battleships and battle cruisers had, during the first five years of this period, undergone several important modifications. In the "Dreadnought," "Bellerophon" and "St. Vincent" classes the five two-gun turrets were placed as in the diagram:—A being on the forecastle deck, the remaining turrets on the upper deck, giving eight guns on each broadside, six ahead and six astern.

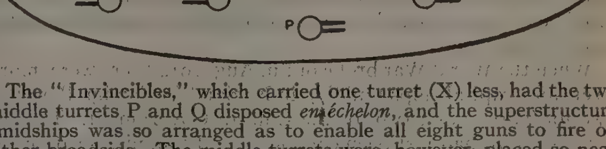

The "Invincibles," which carried one turret (X) less, had the two middle turrets P and Q disposed *en échelon*, and the superstructure amidships was so arranged as to enable all eight guns to fire on either broadside. The middle turrets were, however, placed so near to one another that serious trouble was experienced from gun blast when firing across the deck. In the battle cruisers of the "Indefatigable" class, and the battleships of the "Neptune" and "Colossus" classes, therefore, where a similar arrangement was adopted, the centre pair of turrets were spaced wider apart. A further change in the arrangement of turrets was adopted for the first time in these battleships, where the after-pair were disposed at different deck levels to enable X turret to fire over Y. This arrangement, which now became the standard practice, while it introduced some difficulty in providing for stability, was economical of space, and simplified many of the gunnery problems connected with the ship; it gave, moreover, a higher gun platform for some of the armament.

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[1] This includes pay, victualling, repairs, coal, stores, etc., together with an addition of 15% per annum of first cost, for interest and depreciation, etc.

While the offensive qualities of the battleships had continued to increase in successive types, the need for improved defence, particularly against mine and torpedo attack, had not been overlooked.

The adoption of protective bulkheads against under-water attack as carried out in the "Dreadnought" and subsequent capital ships was the outcome of the naval engagements of the Russo-Japanese war. The Russian battleship "Tsarevitch," in particular, had been fitted with a protective deck which, instead of being continued to the side of the ship, was turned down in wake of the magazines, forming a heavy longitudinal bulkhead situated some distance from the ship's side. This protection had enabled her to resist successfully the explosion of several torpedoes. It was decided to incorporate in the "Dreadnought" design some under-water protection to the vitals. Within the limits of displacement available it was not possible to do more than protect the magazines and shell-rooms. These were given 2-in. protective bulkhead plating at the three centre-line turrets, and 4-in. protective bulkhead plating outside the two beam turrets, as the latter, being situated nearer the sides of the vessel, were consequently much more vulnerable.

In the subsequent "Bellerophon" and "St. Vincent" classes this side protection was developed in the form of a continuous longitudinal protective bulkhead terminated by protective transverse bulkheads completely boxing in the magazines and shell-rooms of the five turrets and the main machinery spaces enclosed between them. The thickness varies from 1½ in. to 3 in. according to the distance of the bulkhead from the outer shell of the ship. In a vertical direction the bulkhead ran from the outer bottom to just above the lower edge of the side armour. In the "Hercules" and "Orion" classes there was a reversion to the original "Dreadnought" system of isolated protection to the various compartments immediately below each of the three groups of turrets, the remainder of the ship's hull below water-line being unprotected. In the "King George V." and "Iron Duke" classes the under-water protection was extended by joining up the portions between the two foremost turrets to those below the centre turret, so that only the ends of the ship and something less than the middle third remained unprotected. Concurrently with the battleships this form of protection was also fitted in the battle cruisers, but limited to the magazines and shell-rooms.

Finally, in the "Queen Elizabeth" (the torpedo menace having increased) the continuous longitudinal protective bulkheads were once more incorporated, and with the transverse protective bulkheads at each end, girdling the ship throughout nearly her entire length, so that not only shell-rooms and magazines, but engine- and boiler-rooms had the protection of a bulkhead 2 in. thick some 10 ft. from the ship's side, with the addition of another longitudinal bulkhead of 17 lbs. plating placed (at a distance of 7 ft. amidships and at varying distances at the ends) on the inner side of the protective bulkhead, further minimizing the risk of damage to the vitals of the ship from the effects of an explosion.

The arrangement of the protective bulkheads in the "Royal Sovereign" class generally followed that of "Queen Elizabeth," but their thickness was 1½ inches.

The efficiency of this system of protection, which a series of experiments had established, was demonstrated at Jutland, and it was further improved upon by the later forms of bulge protection.

The construction of British battle cruisers had proceeded concurrently with that of the battleships, although in smaller numbers. The demands made upon the engineering staff to provide for the large increases of power already referred to involved many difficult problems, but the "Indefatigable" was nevertheless completed (in 1911) within two years of laying down, and the later ships, "Lion," "Princess Royal," "Queen Mary," and "Tiger," followed on in succeeding years, each marking some advance in power and speed. Two other battle cruisers of the "Indefatigable" type, viz. "New Zealand" and "Australia," built for the Dominions from whence they took their names, had also been completed and were available for reinforcing the battle cruiser squadrons.

When the World War broke out in Aug. 1914 there were, moreover, four capital ships building in England for foreign Powers—two for Turkey and two for the Chilean Government. The two Turkish ships had just been completed and commissioned, one at Armstrong's and the other at Vickers', and were on the eve of sailing when war was declared. As both vessels were subject to preëmption in the event of war, the Government promptly took them over and added them to the British fleet under the names of "Agincourt" and "Erin" respectively.

Of the two Chilean ships building in England at Armstrong's, the "Almirante Latorre" (10 14-in. guns and 16 6-in. guns) was the further advanced, and she was taken over and renamed "Canada." She was completed in Sept. 1915. The "Almirante Cochrane" was taken over in 1918 for conversion into an aircraft carrier, being renamed "Eagle."

There were thus at the outbreak of war the following completed capital ships on the offensive British list:—

"Erin" and "Agincourt" (purchased)	2
"Iron Duke" class	2[1]
"King George V." class	4
"Orion" class	4
"Colossus" class	2
"Neptune"	1
"St. Vincent" class	3
"Bellerophon" class	3
"Dreadnought"	1
Battleships	22
"Queen Mary"	1[2]
"Lion" and "Princess Royal"	2
"Indefatigable," "Australia," and "New Zealand"	3
"Invincible," "Inflexible," "Indomitable"	3
Battle cruisers	9

The total armament comprised in the above completed ships was as follows: 134 13·5-in. guns; 162 12-in.; 60 6-in.; 360 4-in., of which 18 were anti-aircraft[3]; 62 3-in. and 12-pdr., of which 38 were anti-aircraft; 46 6-pdr. and 3-pounder.

Of the older battleships, from the "Majestic" class (1895) onwards, the British navy possessed:—

"Lord Nelson" class	2
"King Edward VII." class	8
"Swiftsure" class	2
"Duncan" class	5
"Formidable" class	2
"Canopus" class	6
"Majestic" class	9

These older ships, whose speeds ranged from 17 knots to 19½ knots, comprised a total armament of 152 12-in.; 8 10-in.; 52 9·2-in.; 28 7·5-in.; 416 6-in.; 28 14-pdr., and 530 12-pounder. They were, of course, not in a position to meet modern "Dreadnoughts" on equal terms, but they compared favourably in offensive and defensive qualities with contemporary German warships, while being numerically in considerable superiority. They all rendered useful service during the war.

The old "Revenge," completed in 1894 (renamed "Redoubtable" in 1914), the last available vessel of the old "Royal Sovereign" class, was commissioned and rendered useful service in the Belgian coast bombardments of 1914 and 1915.

In addition to the "Tiger" and the two remaining ships of the "Iron Duke" class which were approaching completion, there were five "Queen Elizabeths" in a more or less advanced state of construction, and five "Royal Sovereigns" laid down eight to ten months previously. The "Queen Elizabeth," being the farthest advanced, was pushed on with all possible speed, and by Jan. 1915 she was sufficiently completed to be commissioned and sent out to the Mediterranean, where she took part in the bombardment of the Dardanelles forts.

With regard to the design of British capital ships in the past, a most serious limitation had been the restricted width of the graving-docks in Great Britain. This involved keeping the extreme beam of the ships within about 90 feet. Had wider docks been available, thus making it possible to have had a greater beam, the designs on the same length and draught could have embodied more fighting qualities, such as armour, armament, greater stability in case of damage, and improved under-water protection. This condition subsisted until the completion of the two big floating docks for Portsmouth[4] and the Medway, the two locks at Portsmouth, and the large graving-docks at Rosyth; but the shortage of wide docks was a serious handicap during the war, and it was necessary to make use of the Gladstone Dock at Liverpool and the dock at Avonmouth.

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[1] Two more nearly complete.

[2] One more ("Tiger") nearly complete.

[3] The anti-aircraft armament was not provided until after the outbreak of war, when such provision became necessary.

[4] Portsmouth floating dock was transferred to Invergordon in 1914, and the Medway Lock to the Tyne in 1915.

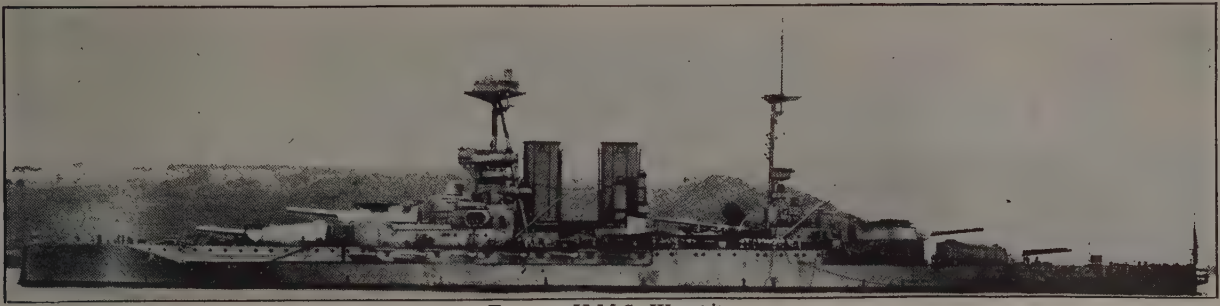

Fig. 3.—H.M.S. *Warspite.*

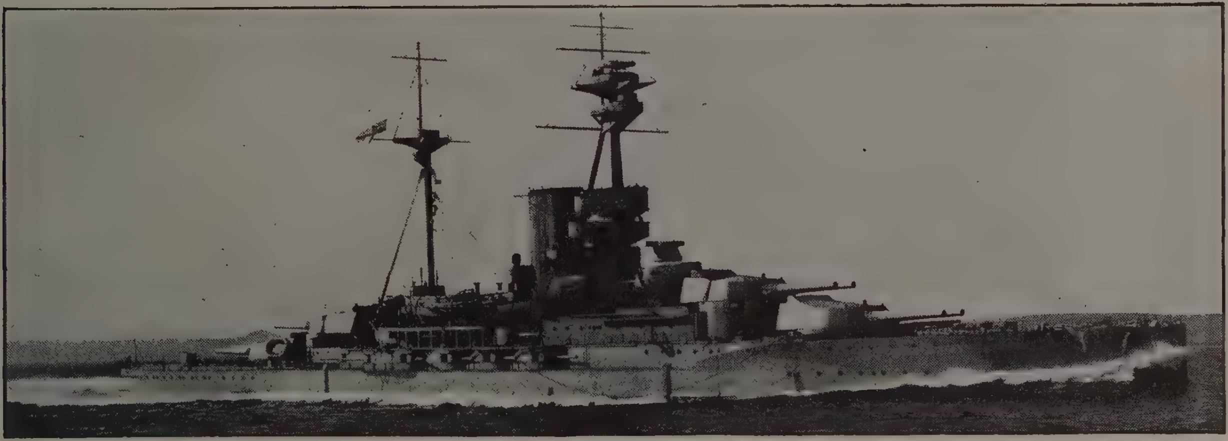

Fig. 5.—H.M.S. *Revenge.*

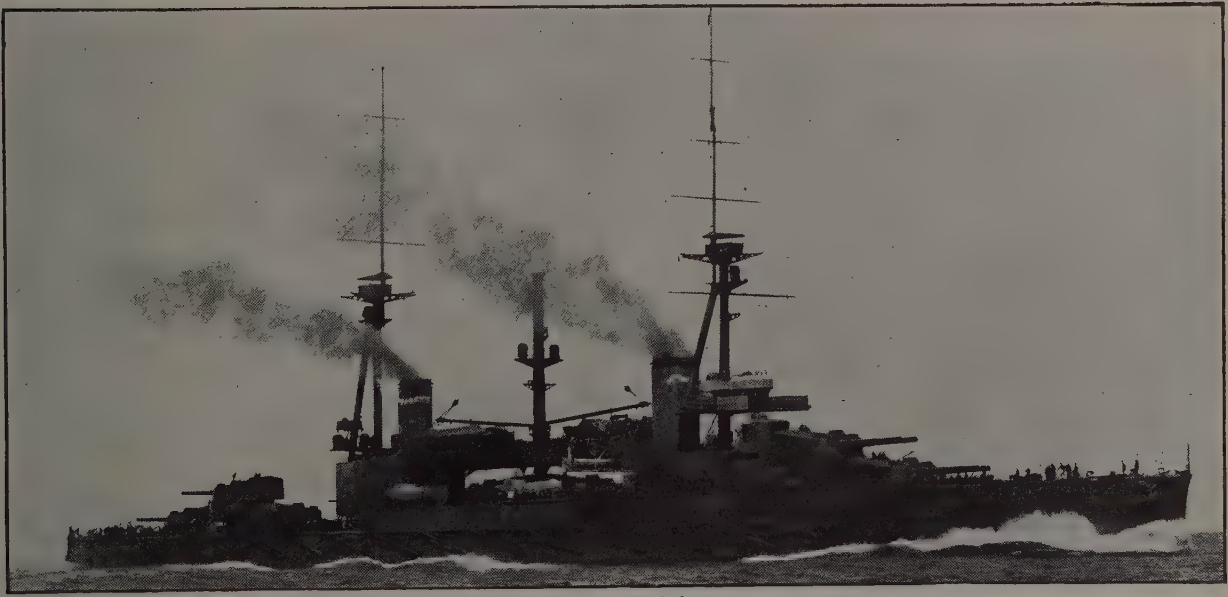

Fig. 6.—H.M.S. *Agincourt.*

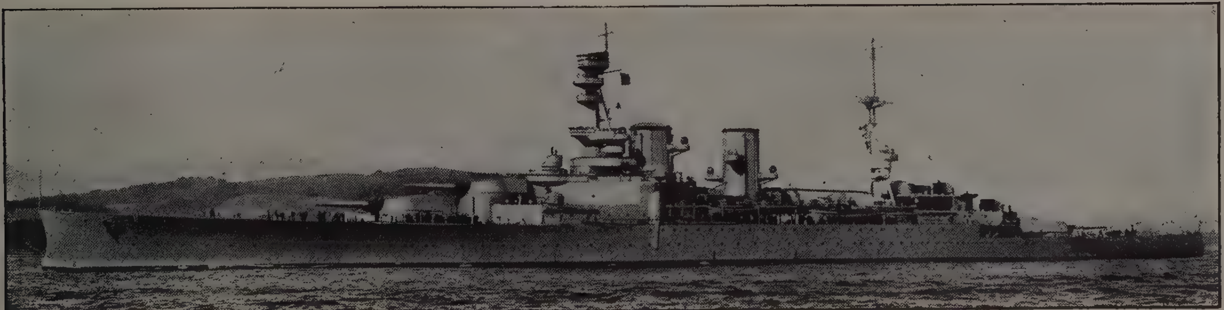

Fig. 8.—H.M.S. *Repulse.*

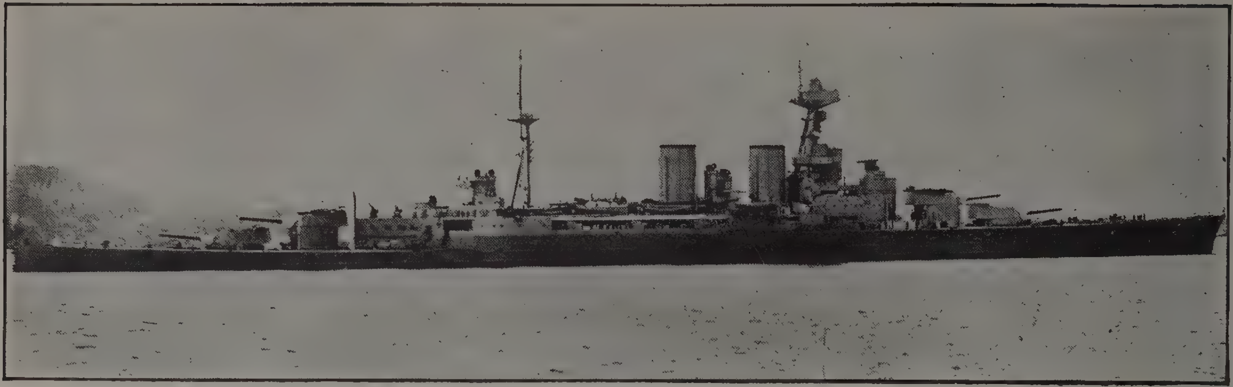

FIG. 10.—H.M.S. *Hood.*

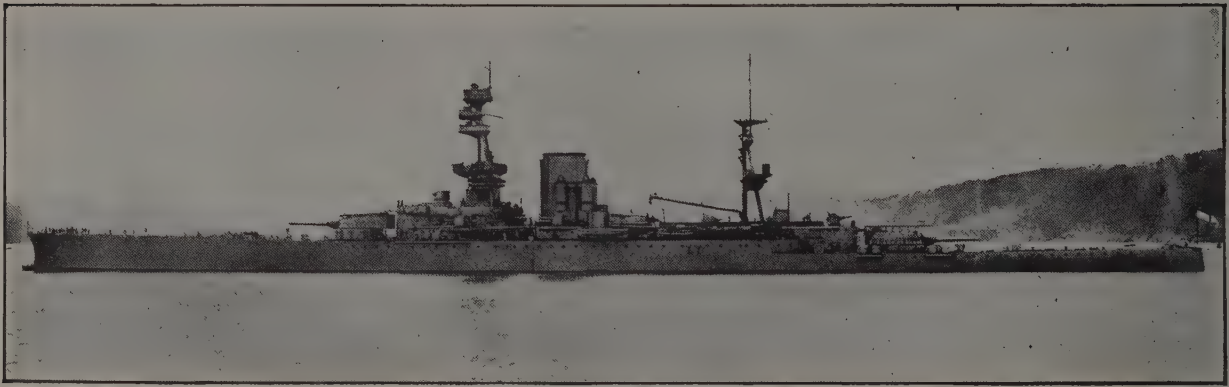

FIG. 12.—H.M.S. *Glorious.*

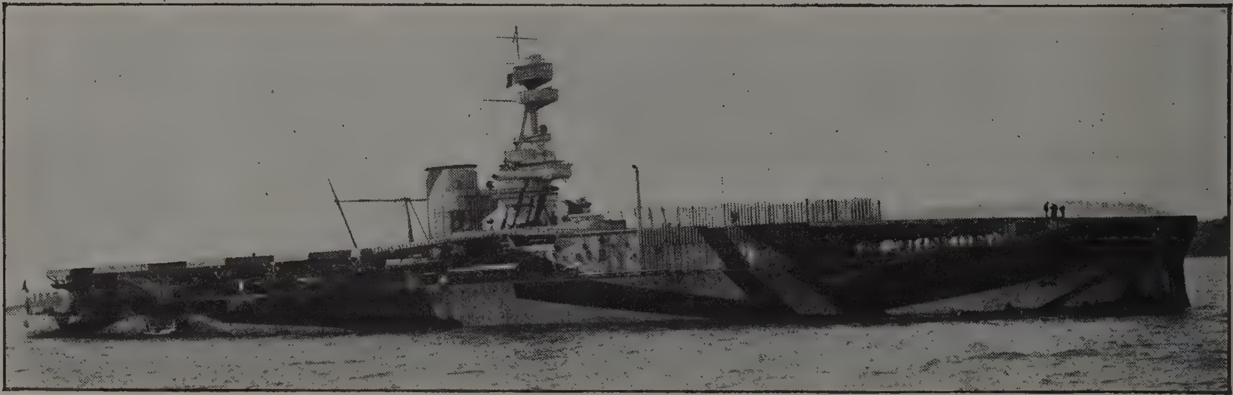

FIG. 13.—H.M.S. *Furious.*

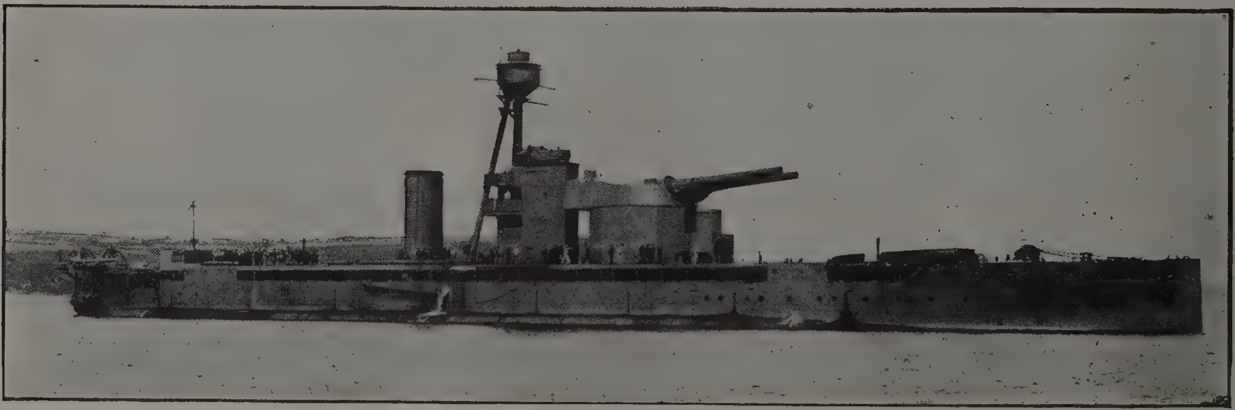

FIG. 20.—H.M.S. *Terror.*

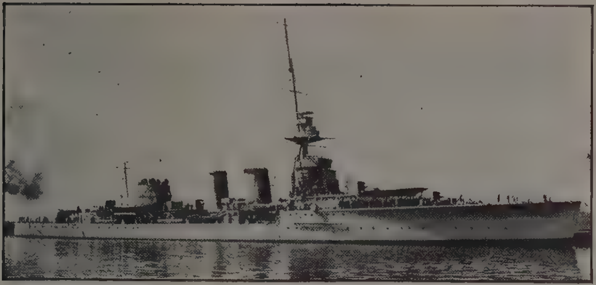

FIG. 14.—H.M.S. *Ceres.*

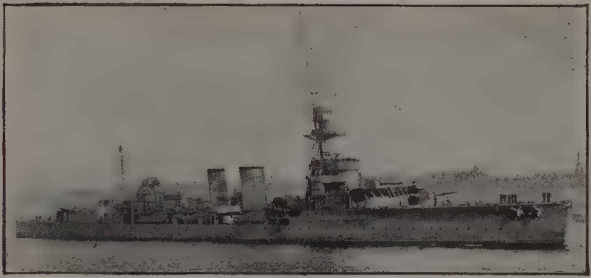

FIG. 16.—H.M.S. *Danae.*

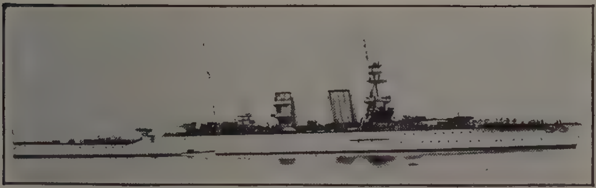

FIG. 18.—H.M.S. *Hawkins.*

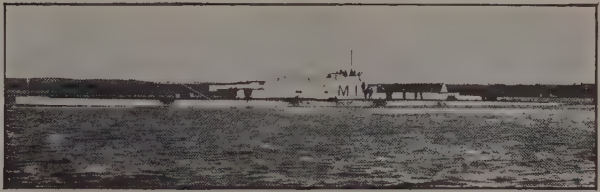

FIG. 29.—H.M. Submarine *M1.*

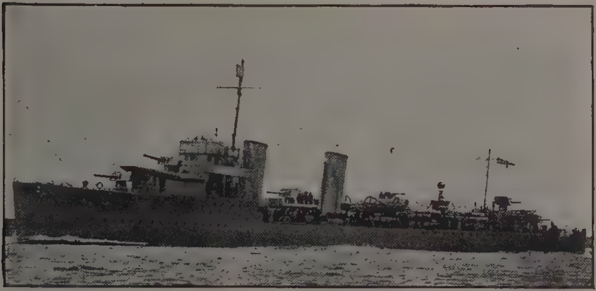

FIG. 22.—H.M.S. *Shakespeare.*

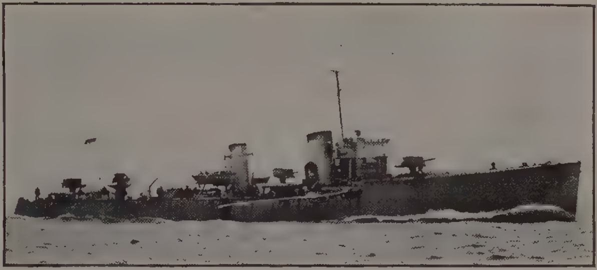

FIG. 23.—H.M.S. *Torch.*

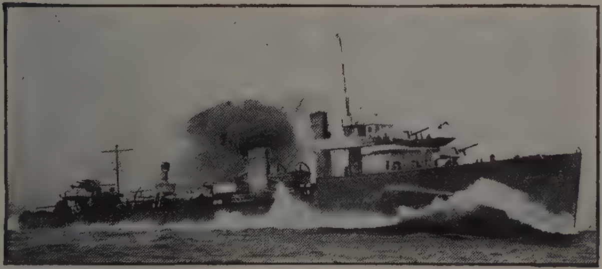

FIG. 24.—H.M.S. *Vimiera.*

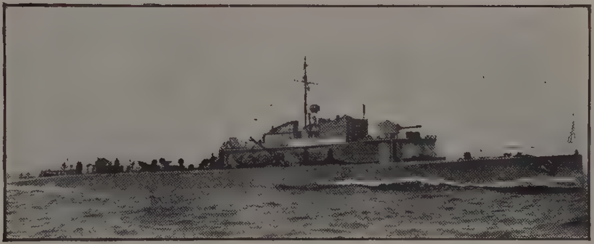

FIG. 25.—H.M.S. *P32.*

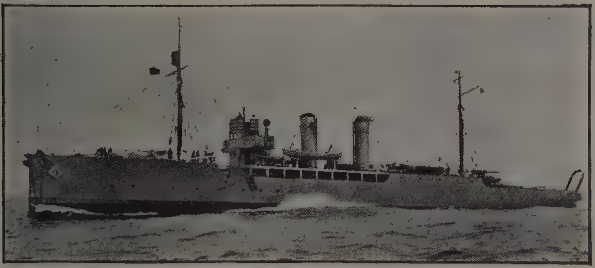

FIG. 26.—H.M.S. *Primula.*

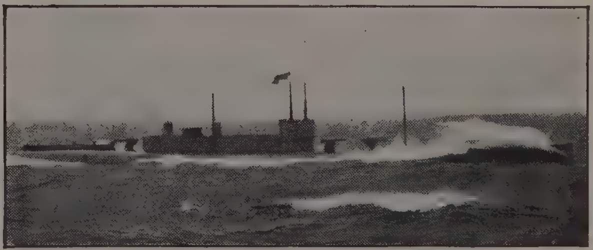

FIG. 27.—H.M. Submarine *K3.*

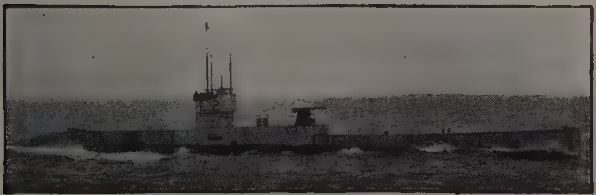

FIG. 28.—H.M. Submarine *L2.*

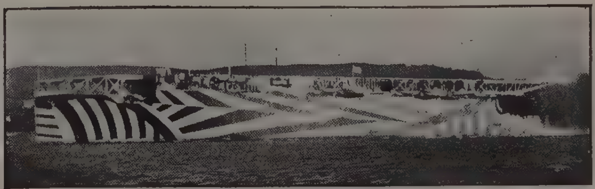

FIG. 30.—H.M.S. *Argus.*

Even in 1921 there was a great need for more British floating docks of the largest description. This was more especially apparent on the Clyde, where there was no dock, either floating or graving, which could take capital ships.

The German ships were not handicapped in this way, and most of their later capital ships had widths of between 90 and 100 ft., which enabled them to carry more armour, and as far as it is possible to judge, they stood a good deal of battering without showing any lack of stability, while they proved to be good gun platforms, at any rate for work in the North Sea.

Immediately after war was declared great pressure was exercised to complete the ships then building for the British navy, and to order such other vessels as could be designed and finished in the shortest possible time. The view held in the early days that the war would only last a year necessarily coloured all that was done in the way of naval design and construction. Generally speaking, therefore, the construction of new battleships was ruled out. With the acquisition of the "Agincourt," "Erin" and "Canada," which were building in England for foreign Governments in private yards, and in view of the certain early completion of the remaining two vessels of the "Iron Duke" class, shortly to be followed by the vessels of the "Queen Elizabeth" class, Great Britain had a great preponderance of heavier capital ships, or Dreadnoughts, over the enemy; and as this class of ship takes longer to design and construct than any other, it was obviously a prudent course to concentrate on such types as were specially needed and could be built more quickly.

It should also be remembered that the menace of the submarine, which was from the first beginning to loom as a vital factor in the war, pointed in the direction of large numbers of patrol boats, torpedo-boat destroyers, and smaller types of vessels to deal with this menace. No time, therefore, was lost in placing orders for additional British destroyers, submarines, light cruisers, sloops, mine-sweepers, patrol boats, etc.; and it very soon became clear that the Royal dockyards and the regular warship-building contractors would not be able to cope with the mass of new construction that was required. Accordingly, orders for many of the last-named classes were placed with builders who had hitherto only been accustomed to mercantile work. With the arrangements that were made, however, for superintending and overseeing the work by the Admiralty, with the assistance of the registration societies—Lloyd's and the British Corporation—very little difficulty was experienced in getting the work satisfactorily carried out by the firms new to this class of shipbuilding, and success attended the arrangements made.

Table II. gives the number and tonnage of vessels added to the British navy during the war. The total number (including other classes besides those in the table) was 1,513, of approximately 2,356,000 tons displacement.

TABLE II.—*British Warships Completed and Lost Between Aug. 4 1914 and Nov. 11 1918.*

	Completions		Losses	
	No.	Approx. Displacement	No.	Approx. Displacement
Battleships	15	395,000	13	201,000
Battle cruisers	3	81,500	3	63,000
Cruisers	3	56,500	13	158,500
Light cruisers	36	143,000	12	46,000
Monitors	40	126,000	6	14,000
Aircraft-carriers	8	67,500	3	27,500
Flotilla leaders	28	45,500	3	5,000
Torpedo-boat destroyers	255	273,000	64	52,000
Submarines	146	151,500	54	43,500
P. and P. C. boats	63	40,000	2	1,000
Sloops	124	155,500	18	22,500
Paddle mine-sweepers	34	27,500		
Twin screw mine-sweepers	55	43,000		
Patrol gunboats	30	27,000		
Oilers and petrol carriers	67	436,000		
Whalers, trawlers and drifters	382	173,500		

Battleships.—To take ships added to the British navy during the war in the proper order, it is necessary to begin with battleships of the "Iron Duke" class. The particulars of Dreadnoughts built after the "Hercules" are given in Table III.

The "Iron Duke" class (see fig. 1), of which there were four, followed the "King George V." class, both in sequence of time and in general characteristics. The same main armament, similarly arranged, with the five turrets all on the centre line of the ship, was adhered to, the chief difference in the "Iron Dukes" being that instead of the 4-in. guns forming the secondary armament, a battery of 12 6-in. guns protected by 6-in. armour was finally decided upon. The protection also was somewhat increased over that of the "King George V.," involving an increase in dimensions over any previous British battleships. Two of the class were laid down in Jan. 1912 and two in May, the four vessels being completed in March, June, Oct. and Nov. 1914, so that two were ready just

TABLE III.—*Particulars of British Battleships.*

Vessel	Date of Launch	Length between perpendiculars; (length over all)	Breadth	Mean Draught	Load Displacement: Tons	Speed: Knots	Horse Power	Armament	Thickest side of Armour
"Orion"	1910	545 ft. (581 ft.)	88 ft. 6 in.	27 ft. 6 in.	22,500	21	27,000	10—13·5-in. 16— 4-in. 3—21-in. T. T.	12 in.
"Thunderer"	1911								
"Conqueror"	1911								
"Monarch"	1911								
"King George V."	1911	555 ft. (597 ft. 6 in.)	89 ft.	27 ft. 6 in.	23,000	21	27,000	10—13·5-in. 16— 4-in. 3—21-in. T. T.	12 in.
"Centurion"	1911								
"Ajax"	1912								
"Audacious"	1912								
"Iron Duke"	1912	580 ft. (622 ft. 9 in.)	90 ft.	28 ft.	25,000	21	29,000	10—13·5-in. 12— 6-in. 4—21-in. T. T.	12 in.
"Marlborough"	1912								
"Emperor of India"	1913								
"Benbow"	1913								
"Queen Elizabeth"	1913	600 ft. (643 ft. 9 in.)	90 ft. 6 in.	28 ft. 9 in.	27,500	25	75,000	8—15-in. 12— 6-in. 4—21-in. T. T.	13 in.
"Warspite"	1913								
"Barham"	1914								
"Valiant"	1914								
"Malaya"	1915								
"Royal Sovereign"	1915	580 ft. (624 ft. 3 in.)	88 ft. 6 in. 102 ft. with bulge.	28 ft. 6 in.	25,750	23	40,000	8—15-in. 14— 6-in. 4—21-in. T. T.	13 in.
"Royal Oak"	1914								
"Revenge"	1915								
"Resolution"	1915								
"Ramillies"	1916								
"Agincourt"	1913	632 ft. (671 ft. 6 in.)	89 ft.	27 ft.	27,500	22	34,000	14—12-in. 20—6-in 3—21-in. T. T.	9 in.
"Erin"	1913	525 ft. (559 ft. 6 in.)	91 ft. 7 in.	28 ft. 6 in.	23,000	21	26,000	10—13·5-in. 16—6-in 4—21-in. T. T.	12 in.
"Canada"	1913	625 ft. (661 ft.)	92 ft.	28 ft. 6 in.	28,000	22¾	37,000	10—14-in. 16—6-in 4—21-in. T. T.	9 in.

before, and two shortly after, the declaration of war. Four torpedo-tubes were carried in lieu of three in the previous ships, and after the battle of Jutland a considerable amount of additional protection was added over the magazines—a course which was practically adopted in all British ships at that time as a precautionary measure. Only in one case was any portion of a shell found to have penetrated below the protective deck; but with the ever-increasing range at which actions were fought, and the increasing penetration of improved shell, the danger of the decks being inadequate had to be considered. Special interest is attached to this class, as the "Iron Duke" was the fleet flagship during the whole time of Adml. Jellicoe's appointment as commander-in-chief, and she was in action at Jutland with her sister ships.

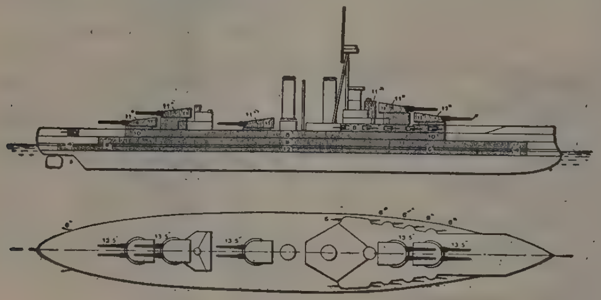

FIG. 1.

The "Marlborough," it should be specially noted, was the only British battleship of the post-"Dreadnought" type struck by a torpedo during the whole war, and the value of the longitudinal protective bulkhead and of the subdivision and arrangements adopted was clearly shown, as the ship was able to remain in the line, no vital damage being done. She was afterwards safely docked in the Tyne and repaired. This is specially interesting, as many of the older ships, some with centre-line bulkheads and with other arrangements not so good for dealing with under-water damage, were sunk in the Dardanelles and elsewhere by enemy torpedoes.

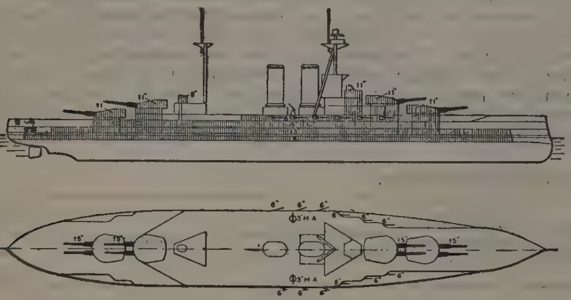

FIG. 2.

The next type to note is the "Queen Elizabeth" class of the 1912–3 programme (see figs. 2 and 3). Three of these vessels, after taking a little more than two years to build, were completed in Jan., March and Oct. 1915. The other two were completed in Feb. 1916. A very considerable departure was made in the "Queen Elizabeth" from any previous "Dreadnoughts," the 15-in. gun taking the place of the 13·5-in., and the designed speed being increased by 4 knots over previous "Dreadnoughts," whilst the secondary armament was similar to that of the "Iron Dukes," consisting of 6-in. guns. Their very great increase of speed involved more than doubling the H.P. of the "Iron Duke" to give the 25 knots desired, and the great increase in the weight of the 15-in. guns and mountings over the 13.5-in. meant accepting only four turrets with eight 15-in. guns, as against five turrets with 10 13·5-in. guns in the previous ships, and even so the armament was considerably heavier. The further great departure from previous practice in battleships was the adoption of oil only as the fuel. This necessitated special arrangements of the oil bunkers, many of which were 30 ft. in height, and required special construction to withstand the head of oil. The armour and protection were fully maintained as compared with previous ships, but all these additions involved increasing the displacement to 27,500 tons.

In the battle of Jutland the Fifth Battle Squadron, consisting of four vessels of this class, were heavily engaged for several hours, and although they inflicted and sustained heavy punishment, especially in the case of "Warspite," all the vessels gave a splendid account of themselves and were not seriously damaged or put out of action. After the battle of Jutland additional protection was added to the magazines. The oil fuel proved a complete success in the stress of war conditions, it being found easier to keep up a high sustained speed, with the smaller complement carried.

It should be noted that Sir Philip Watts was responsible as Director of Naval Construction for the design of the "Iron Duke" and "Queen Elizabeth" classes, thus completing a series of 27 battleships of the "Dreadnought" type designed and built during his tenure of office at the Admiralty—in addition to the large number of battle cruisers, light cruisers, destroyers and other vessels built during that period—truly a great record.

Following the "Queen Elizabeths" came the "Royal Sovereign" class of the 1913–4 programme (see figs. 4 and 5). These were the first capital ships built by the Admiralty to Sir Eustace d'Eyncourt's designs, he having succeeded Sir P. Watts in Aug. 1912. These vessels were to have the same armament as the "Queen Elizabeth," but as there was some question about the supply of oil fuel when the design was discussed, it was decided to revert to coal, and also to accept the slower speed of 21 knots, which would make them more homogeneous with other "Dreadnoughts." Subsequently, when the vessels were in process of construction and the great advantages of the use of oil fuel with other types of warships became apparent, it was decided to change from coal to oil, so enabling increased power, giving a speed of about 23 knots, to be obtained. When fully laden with about 4,000 tons of oil, the "Revenge" attained 22 knots, which was equal to about 23 knots in the designed load condition. A somewhat different disposition of deck and side armour was also adopted by which the thick protective deck at the centre of the ship was brought up to the level of the main deck; this portion of the protective deck being thus well above the level of the deep load line, and giving more protected freeboard in the damaged condition than on any of our earlier battleships. This was an important feature, as a somewhat reduced metacentric height was decided upon for these ships with a view to making them steadier gun-platforms than some of the ships with more initial stability. The vessels were provided with good under-water protection, which was later reinforced by adding outside bulge protection. This was done to "Ramillies" before her launch and to the other vessels of the class after they had been in commission some time. The addition of "bulges" was suggested first by Sir E. d'Eyncourt originally for the "Edgar" class, for which this form of protection was added in 1914 after experiments had been made. The results proved the efficiency of the bulges.

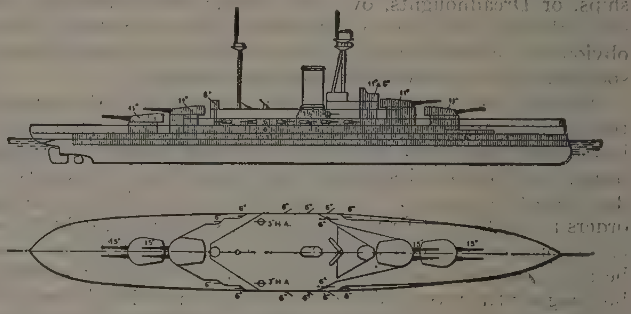

FIG. 4.

The three battleships taken over by Great Britain from foreign Governments were of different types. H.M.S. "Agincourt" (see fig. 6) was commenced in Sept. 1911 for the Brazilian Government, from designs got out under Mr. Perrett at Elswick, but modified by Sir E. d'Eyncourt in Rio Janeiro, where he was then representing the Armstrong firm, before his appointment at the Admiralty. The Brazilian authorities, after much discussion, decided upon 14 12-in. guns, twin-mounted in seven turrets. This involved a ship with a length of 632 ft. between perpendiculars and 670 ft. over all. The main armour was somewhat lighter than that of British "Dreadnoughts" and in other respects, such as fuelling facilities, the ship hardly came up to the British standard. However, she was well reported on, and the 14 big guns were liked by the gunnery officers, who preferred a large number of guns for their salvoes. Certain alterations had to be made to fit her for the British service, but in the main she was left as designed.

It should be mentioned that in 1914 the "Agincourt" was transferred by Brazil to Turkey and she was on the point of leaving the Tyne for Constantinople when, on the declaration of war, she was taken over by the British Government.

The design of the "Erin" was settled by three firms, Armstrong's, Vickers and John Brown, in consultation with the Turkish authorities, for whom the vessel was built, being commenced in 1911. In general characteristics she more nearly followed the "King George V." class than any other British ship, except that the secondary armament consisted of 6-in. guns, as in the "Iron Duke" class. This vessel also was taken over by the British Government in Aug. 1914, and certain modifications made to fit her for the British service. In respect of quantity of fuel carried, the "Erin" was below the standard adopted for vessels designed for the British navy.

The third ship taken over from a foreign Government was ordered and commenced in 1911 at Elswick from designs prepared at Elswick by Mr. Perrett for the Chilean Government. There were two ships of the class, the "Almirante Latorre" (which became H.M.S. "Canada"), and the sister ship the "Almirante Cochrane" (now H.M.S. "Eagle"). The "Canada" had 10 14-in. guns, twin-mounted, in the centre line, and was originally designed to have 22 4·7-in. as the secondary battery, but this was subsequently altered to 16 6-in. guns. The protection again was somewhat lighter than that of the British "Dreadnoughts," but the speed was rather higher, viz. 22¾ knots, and as a matter of fact this speed was considerably exceeded on trial. The ship was taken over by the British Admiralty in Sept. 1914, and completed, after certain necessary modifications, a year later. Her fuel consisted of coal, with the addition of a certain amount of oil, as in most British battleships. In 1920 the "Canada" was returned to the Chilean Government under her original name.

The sister ship, "Almirante Cochrane," remained in an uncompleted condition on the stocks at Elswick till early in 1918, when she was taken over by the British Government and rearranged as an aircraft-carrying ship. She was renamed H.M.S. "Eagle," and as a compliment to the U.S. navy, she was, at the request of the Admiralty, launched by Mrs. Page, the wife of the then American Ambassador to Great Britain.

Battle Cruisers.—As regards the British battle cruisers later than the "Princess Royal," particulars are given in Table IV.

The "Tiger" was included in the 1911–2 programme and followed on the "Queen Mary," the general features of the two ships being much alike, the chief differences being that the secondary armament of "Tiger" is 12 6-in. guns in lieu of 16 4-in. in "Queen Mary," and "Tiger" has two submerged torpedo-rooms, whereas "Queen Mary" had only one.

The "Tiger" was laid down at Clydebank on June 12 1912, and completed in Oct. 1914. In common with so many ships completed during the war, the early commissioning and joining of the fleet was so imperative that no exhaustive trials in deep water were carried out, but the runs made on the Polperro course showed that the designed power of 108,000 S.H.P. could be obtained with little difficulty, corresponding to a speed of 30 knots. In the early stages of the design the oil-fuel capacity was very largely increased from 1,000 tons originally intended to a maximum oil stowage of 3,480 tons, in addition to the 3,320 tons of coal.

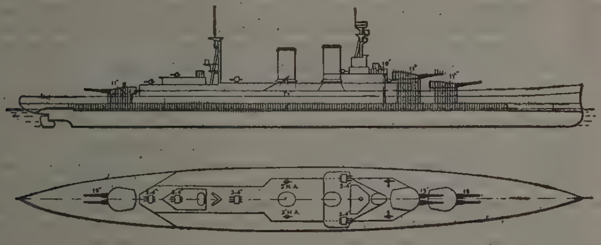

FIG. 7.

At the commencement of the war two additional battleships of slightly modified "Royal Sovereign" type, viz. the "Renown" and "Repulse" (see figs. 7 and 8), had been laid down, but in view of the long time it would take to complete these ships, the construction was not pressed forward. Immediately after the battle of the Falkland Is., in which the British battle cruisers "Invincible" and "Inflexible," in company with other smaller cruisers, annihilated Von Spee's fleet, the value of the battle cruiser type became very apparent, and on the initiative of Lord Fisher, then First Sea Lord, it was decided to stop the construction of "Renown" and "Repulse" as battleships and to alter the design completely into that of very fast battle cruisers.

Instructions to redesign these ships were given about Christmas 1914. The new design had to give a speed of 32 knots, with the largest number of big guns possible for such a vessel, and with protection similar to that of the "Invincible" class. A modified form of bulge was adopted in these ships to give additional under-water protection against torpedo attack. After the war further additions were made to the bulge protection and to the armour.

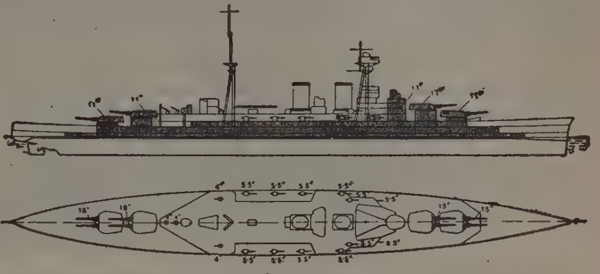

FIG. 9.

The general outline design was completed and approved in ten days, and 6 15-in. guns adopted as the main armament, the secondary armament consisting of 17 4-in. guns, of which 15 were mounted in five specially designed triple-gun mountings. It was necessary that the ships should be completed at the earliest possible date, and the "Tiger's" machinery was repeated with some additional boilers, with oil as the fuel, thus increasing the power to 120,000, which, with the extra length given to the ship, made it possible to obtain the desired speed of 32 knots.

Lord Fisher also insisted that the ships must be completed within 15 months—an abnormally short time for an entirely new design—this period of completion was not realized, although not greatly exceeded. By Jan. 21 1915 the two firms entrusted with the orders, viz. Messrs. John Brown and Fairfield, were supplied with sufficient information to enable them to proceed with the structure, and both keels were laid on Jan. 25, which was Lord Fisher's birthday. All the drawings and specifications were completed by April and the design finally approved in that month.

The arrangement of the whole ship, showing the protection, is given in fig. 7, the plating over the magazines having been considerably increased as a result of the Jutland fight.

"Repulse" was launched in Jan. 1916, less than a year from the laying down, and "Renown" was launched three months later. "Repulse" went through her commissioning trials early in Aug., and "Renown" followed one month later and was completed in September. The speed of "Repulse" on trial was over 31¼ knots in the deep condition, and the "Renown" obtained 32·6 knots mean speed in the normal condition.

The construction of these vessels in a little over one and a half years from the first order to get out the design constitutes a record in design and construction of two such important vessels, and reflected great credit, not only upon the Royal Corps of Naval Constructors, but also upon the contractors and all concerned in the construction and completion of the vessels. In fact, the Admiralty conveyed their appreciation of this to Sir E. d'Eyncourt, the Director of Naval Construction, in a letter dated Sept. 1916.

The battle cruiser H.M.S. "Hood" (see figs. 9 and 10), the latest addition up to 1921 to the capital ships of the British Fleet, was designed early in 1916, and had only just been ordered from Messrs. J. Brown & Co. when the battle of Jutland took place. This great event naturally led to a revision of the design and in view of the damage which was then done to British battle cruisers and also to

TABLE IV.—*Particulars of British Battle Cruisers.*

Vessel	Date of Launch	Length between perpendiculars; (length over all)	Breadth	Mean Draught	Load displacement: Tons	Speed: Knots	Horse Power	Armament	Thickest side Armour
"Lion" . .	1910	660 ft.	88 ft. 6 in.	28 ft.	26,350	28	70,000	8—13·5-in. 16—4-in. 2—21-in. T.T.	9 in.
"Princess Royal" . .	1911	(700 ft.)							
"Queen Mary" .	1912	660 ft. (703ft. 6in.)	89 ft.	28 ft.	27,000	28	75,000	8—13·5-in. 16—4-in. 2—21-in. S.T.	9 in.
"Tiger" . .	1913	660 ft. (704 ft.)	90 ft. 6 in.	28 ft. 6 in.	28,500	30	108,000	8—13·5-in. 12—6-in. 4—21-in. T.T.	9 in.
"Renown" .	1916	750 ft.	90 ft.	25 ft. 6 in.	26,500	32	120,000	6—15-in. 17—4-in. 2—21-in. T.T.	6 in.
"Repulse" .	1916	(794 ft.)							
"Hood" .	1918	810 ft. (860 ft.)	104 ft.	28 ft. 6 in.	41,200	32	144,000	8—15-in. 12—5·5-in. 6—21-in. T.T.	12 in.

the German ships of similar type, it was deemed advisable to increase the armour protection, if possible. As the result of very extensive investigations, it was found possible, by accepting a deeper draught and a slightly reduced speed, to add very considerably to the protection of the vessel as already designed, without otherwise seriously affecting the design of the ship as a whole. The alterations were of a very radical character, the armour belt being increased from 8 to 12 in. and the barbettes from 9 to 12 in.; and certain increases were also made in the deck protection. At the same time the eight 15-in. gun mountings had their design modified to admit of an elevation of 30 degrees, and certain other modifications were made, both in the torpedo armament and also in the arrangements for preventing the flash penetrating to the magazines—a form of protection which was elaborated for all British ships at this time. All these increases involved an additional weight of nearly 5,000 tons, the legend displacement of the "Hood" becoming finally 41,200 tons when carrying 1,200 tons of fuel; the ship then having a draught of 28½ ft., and a draught of 31½ ft. with full fuel load, viz. 4,000 tons.

The original length and beam of the ship were maintained as before. Some extra plating had to be provided on the decks for strength purposes, but the under-water protection against torpedoes was retained as in the original design. With the modifications made, the "Hood" when completed was by far the most up-to-date capital ship in existence.

The changes in the design and other circumstances militated against the quick construction of the ship, and it was about four years from the approval of the original design in April 1916 to the time of her completion, this being about double the time taken to build recent British capital ships, and nearly three times that taken to build the "Repulse" and "Renown." The modifications were, however, quite justified by the circumstances, and they made the ship a much more powerfully protected one, whilst increasing her displacement, and consequently the weight of material to be worked, to about 50% more than that of "Repulse" and "Renown."

The main machinery of the "Hood," consisting of geared turbines to develop 144,000 H.P., has the largest power which has ever been put through gearing, namely, 36,000 H.P. on each of the four shafts. The machinery is placed in three engine-rooms, of which the forward one contains two independent sets for the outer shafts; the middle and after engine-rooms contain one independent set for each of the inner shafts. This power, which was designed to give 32 knots for the earlier design of 36,300 tons displacement, was expected to give at least 31 knots in deep water with 210 revolutions of the propellers, at a displacement of 41,200 tons for the "Hood" as built. The 24 boilers represented the small-tube type with forced draught, arranged in four boiler-rooms. Such boilers were first adopted for large vessels in the "Courageous" class. Oil is the only fuel used in "Hood." On trials on the measured mile the "Hood" obtained a speed of 32·07 knots with 151,000 S.H.P. at 42,200 tons displacement, and 31·9 knots with 150,000 S.H.P. at 44,600 tons displacement.

It will be seen from the plan (fig. 9) that the main armament of eight 15-in. guns was mounted, as in recent British battleships of the "Queen Elizabeth" and "Royal Sovereign" classes, in four turrets, all on the centre line, with very large arcs of training, the forward ones training to 60° abaft the beam, and the after ones to 60° before the beam. The anti-torpedo-boat destroyer armament consists of twelve 5½-in. guns arranged on the forecastle deck and shelter deck. There are also four 4-in. anti-aircraft guns on the shelter deck aft. There are two 21-in. submerged torpedo tubes, each in a separate compartment forward, and four 21-in. above-water torpedo tubes between the upper and forecastle decks; these above-water tubes being a further addition since the original design was made. The distribution of armour is also shown. The 12-in. belt had a length of 562 ft. and a depth of 9 ft. 6 inches. Above the main belt was a strake of 7-in. armour to the height of the upper deck, and above that again there was 5-in. armour between the upper and forecastle decks. The side armour all sloped outward from below, the shell being thus unable to hit the armour normally, so that the virtual thicknesses were somewhat greater. There was thick plating behind all the armour, varying from 2 in. over the greater portion to 1½ in. and 1 in. elsewhere. The torpedo protection consisted of the bulge arrangement, with an outer compartment of air and an inner one specially strengthened with the necessary separating bulkheads, etc. This protection extended throughout the whole length of the machinery spaces and magazines, and it has been proved that it renders the ship as safe against attack from torpedoes under water as she is against gun attack above water. The oil fuel tanks are arranged along the sides, thus giving additional protection. The "Hood" was successfully launched in Aug. 1918 at Clydebank, the ceremony being performed by Lady Hood, widow of Adml. Hood, who lost his life whilst gallantly leading into action the Third Battle-Cruiser Squadron at Jutland. The launching weight was about 22,000 tons. As the other three ships of the class which were commenced had none of them reached the launching stage at the time of the Armistice, it was subsequently decided not to proceed with them, in view of the international conditions, and the "Howe," "Rodney" and "Anson" were accordingly scrapped.

As regards the general design of the ship, the "Hood" may be cited as an example of what can be achieved by going to a large size. Her design embodies the armament and armour protection of a first-class battleship, including also good under-water protection against torpedoes, and at the same time gives the speed of the fastest battle cruisers. This involved great length and displacement. The under-water bulge protection, which has entirely superseded the provision of torpedo netting, is additional to anything provided in pre-war "Dreadnoughts."

In connexion with the size of the "Hood" and general considerations of design, it is interesting to note the chief characteristics of the "Queen Elizabeth" and "Renown." The "Queen Elizabeth" is a well-armoured ship of about 28,000 tons, with eight 15-in. guns and speed of 25 knots, while "Renown," of slightly less displacement, viz. 27,000 tons, though of greater length, is a vessel with 7 knots more speed than "Queen Elizabeth," but with only six 15-in. guns against eight, and approximately about half the armour protection provided in the "Queen Elizabeth." The "Hood" has the same armament, viz. eight 15-in. guns, as the "Queen Elizabeth," armour protection fully equal to and, in fact, rather heavier in the aggregate than that of the "Queen Elizabeth," 7 knots more speed than the "Queen Elizabeth," which makes the speed about equal to that of "Renown," and in addition complete protection against torpedo attack.

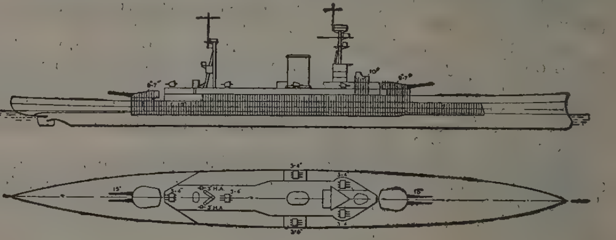

FIG. 11.

Large Light Cruisers.—Early in 1915, as sanction was not given by the British Government for building more capital ships taking two years or longer to complete, while additional light cruisers had been already approved of, it was decided to build "Courageous" and "Glorious" (figs. 11 and 12) on the lines of very large light cruisers mounting a few guns of heaviest calibre, so as to be able to annihilate any enemy light cruisers or raiders. They were to have light protection, similar to British light cruisers, and a speed of not less than 32 knots, the draught being restricted to about 22 ft., or about 5 ft. less than any existing battleships or battle cruiser carrying such heavy guns, the main armament of four 15-in. guns in two turrets, one forward and one aft, making them a match for any raider or light cruiser that might be encountered. At this time it should also be remembered that the armaments of ships, especially as regards heavy guns, had to be regulated by the guns and gun mountings which would be available or could be manufactured in a short time, and this condition applied to the 15-in. mountings which were adopted for these ships. The secondary armament consisted of eighteen 4-in. guns in six triple mountings, similar to the triple mountings of the "Renown" and "Repulse." The side armour consisted of 2-in. protective plating added to the 1-in. shell plating, and a thin protective deck was worked all fore and aft, but this was considerably thickened over the magazines after Jutland. A modified "bulge" was arranged for, as in "Renown" and "Repulse."

The machinery adopted for these ships was of the type fitted in the light cruiser "Champion." It consisted of a 4-shaft arrangement of geared turbines, the power being transmitted to the propeller shafts by double helical gearing. The eighteen boilers of Yarrow small-tube type were also similar to those of the light cruisers, and with all-oil firing a power of 90,000 S.H.P. at about 340 revolutions of propellers was aimed at. Such trials as it was possible to make showed that 32 knots could easily be obtained at the designed displacement, and on service this was actually exceeded.

It was intended that these vessels should be built in a year, or as near that as possible, but this was not realized, and the ships were both commissioned in Oct. 1916.

The "Furious" (see fig. 13), was similar to, but a modification of, the "Courageous" and "Glorious," having about the same length and the same machinery, but the form of midship section was somewhat different, having a more pronounced bulge and a simpler form of main framing and structure of the hull. The armament also was different; each turret, instead of having two 15-in. guns, was arranged to carry one big gun of 18-in. bore.

Early in the spring of 1917 the necessity for having fast aeroplane-carriers became very obvious, and it was approved to fit "Furious" for this purpose. This entailed the removal of the fore turret and making other considerable alterations. A large hangar was built on the forecastle deck, and a flying-off platform 160 ft. long was arranged on the roof of the hangar, which was designed to house about 10 machines. Later it was decided to remove the after-turret as well, and a flying-on deck 300 ft. long, extending from the funnel aft, was constructed. The secondary armament, which had consisted originally of 11 5½-in. guns, was retained, with the exception of one gun; the remaining 10 guns being rearranged. Four sets of triple 21-in. torpedo tubes were fitted on the upper deck aft, and one pair each side on the upper deck forward.

After these alterations were completed, the ship was tried and commissioned in July 1917, a speed of 31½ knots being obtained with 94,000 S.H.P. at 330 revolutions. From the speed point of view the great advantage of size and length is clearly shown in these ships compared to T.B.D.s, since with about three times the H.P. of a destroyer it is possible to drive a ship of nearly 20 times the displacement at the same speed. This in smooth water; in anything of a head sea the T.B.D.s are left behind altogether by the great ships (see Table V.).

Light Cruisers.—Following upon the previous light cruisers of the town classes, a very important departure was made in the light cruiser design in the programme 1912–3, when the "Arethusa" class (see fig. 14) was designed by Sir Philip Watts. The importance attached to speed was specially brought out in this design, and it was decided to install very powerful machinery of 40,000 S.H.P. and this could only be achieved by adopting engines and boilers closely approximating to those hitherto used only for destroyers.

In conjunction with high speed a good armament was provided, consisting of two 6-in. and six 4-in. guns, though in the original design the armament consisted entirely of 4-in. guns. The ship's sides up to the level of the upper deck were protected by a high tensile plating varying from 2-in. to 1½-in. and 1-in. in addition to the 1-in. shell plating. This arrangement of plating also greatly added to the strength and stiffness of the ship. Further particulars of the class are given in Table V.

The "Arethusa" and other light cruisers were in the action off Heligoland on Aug. 28 1914.

In the 1913–4 programme the "Calliope" class, slightly larger vessels than the "Arethusas," but with the same power, were decided upon, the designs being made by Sir E. d'Eyncourt. After considerable discussion regarding the merits of mixed or homogeneous armament, it was decided to give these vessels two 6-in. guns, both on the centre line placed aft, and eight 4-in. guns. The protection consisted, as in the previous design, of a belt with a total thickness of approximately 3 inches. Most of this class had practically the same machinery as the "Arethusa," but Parsons geared turbines were installed in two of them, the "Calliope" having four shafts and the "Champion" two shafts. This was at the time a very important experiment, the putting of 20,000 H.P. through gearing being a very bold departure from anything which had been hitherto contemplated. The final results obtained with "Champion" were, however, excellent, and she obtained a speed of 29½ knots with 337 revolutions and about 41,000 S.H.P., this speed being slightly in excess of any of the other vessels of the class at corresponding displacement.

The "C" class are the first ships, other than battleships, to have superposed guns on the middle line, a sort of spoon-shaped bulwark being fitted to protect the crew of the lower from the blast of the upper gun firing over them.

For the subsequent vessels of the "C" class reference should be made to the tables, which show a gradual growth in size and power of armament; "Ceres" class (fig. 14) finally having a length of 425 ft. and a beam of 43 ft. 6 in., and a normal displacement of about 4,200 tons. These vessels carried five 6-in. guns, all on the centre line.

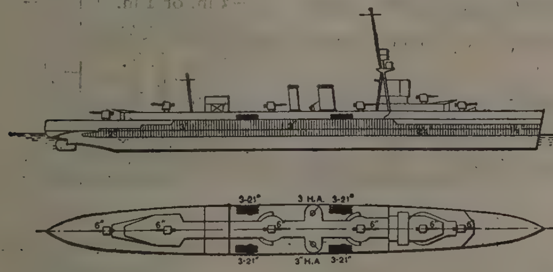

FIG. 15.

The next class were the "D's" (figs. 15 and 16), the general arrangement and protection of which followed that of the "Ceres," except that six 6-in. guns were carried on the centre line instead of five. The power was only slightly increased in these ships over the previous classes, but the revolutions were reduced to 275, all these later classes having the twin-screw geared arrangement, and although the displacement of the "D's" increased to 4,650 tons, the additional length and the reduction of revolutions enabled the speed of close upon 30 knots of the whole class of light cruisers "C's" and "D's" to be maintained.

In addition to these light cruisers, which were all to Admiralty design, two vessels—the "Birkenhead" and "Chester"—built at Messrs. Cammell, Laird's for the Greek Government, were purchased in 1915. These vessels were considerably heavier than the "C" class and more closely resembled the British "Chatham" class. They carried an armament of ten 5½-in. guns. The boilers were modified to burn only oil in the "Chester," instead of coal and oil as in the "Birkenhead," and the resulting increase in power to 31,000 gave the former a speed of 26½ knots.

Designs were prepared in 1915 of the "Raleigh" class (figs. 17 and 18), a considerably heavier type of light cruiser, more especially suited for ocean work in any part of the world. They were to have a speed of 30 knots and a large radius of action. Various armaments were considered, and it was finally decided to adopt an armament of seven 7·5-in. guns with twelve 3-in. (four being on high-angle mountings). Five of the big guns were placed on the centre line, and the other two were on the broadsides amidships. The bow and stern guns were superposed, thus giving a fire of four guns, both ahead and astern, and six guns on either broadside. These ships were originally designed to burn oil and coal, but the coal-burning boilers were subsequently altered in three ships of the class to burn a larger amount of oil, the original power of 60,000 S.H.P. on a four-shaft geared turbine arrangement being thus considerably increased up to about 70,000 shaft horse power.

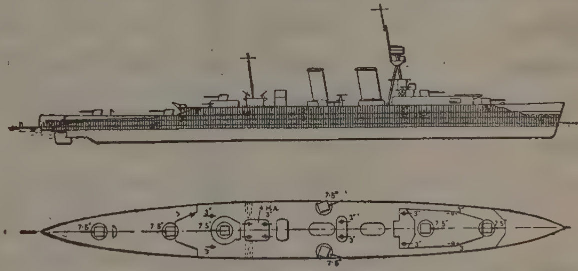

FIG. 17.

These vessels also differed from the light cruisers referred to above in having modified bulges as protection against under-water attack. The protective plating was similar to that of the other light cruisers. One of these ships, the "Cavendish," was altered into an aircraft-carrier, and renamed "Vindictive."

Monitors (see Table V.).—The first vessels of this type to be added (or reintroduced) to the British navy were the three ex-Brazilian river monitors built by Messrs. Vickers, Ltd., and taken over by the British Government in Aug. 1914, and renamed "Humber," "Mersey" and "Severn." The particulars of these vessels are given in the table, from which it will be seen that the armament consisted of medium-calibre guns, viz. 6-in. and 4·7-inches. These vessels, though designed for river service, did very good work in the war, both on the E.-African and Belgian coasts.

The need for vessels of the monitor type mounting heavy guns soon became apparent, and in Nov. 1914 it was decided to prepare designs of monitors of more substantial structure for sea-going service, but of light draught, with good protection and carrying some heavy guns, the light draught combining the advantages of being able to go close inshore and greatly reducing the risk of being struck by a torpedo.

The earliest design was that of the 14-in. gun monitors, four in number, which was commenced in 1914. Four twin-mounted 14-in. guns and mountings were available, and with the very simple form of structure adopted, these vessels were designed and built in six months. They were quickly followed by the 12-in. monitors, which were of similar design but carried pairs of 12-in. guns, taken from older battleships. These vessels were also built in about six months. They all had a complete bulge of a form which was of simple construction, with an air space outboard and a water space between that and the ship proper.

Following on the 12-in. monitors, early in Jan. 1915 two more vessels were ordered, mounting a pair of 15-in. guns. For these ships, internal-combustion engines, which were well under way, but designed for another purpose, were installed. These vessels were named the "Marshal Ney" and "Marshal Soult."

In Sept. 1915 two improved 15-in. monitors were ordered and named the "Erebus" and "Terror" (figs. 19 and 20). These were of finer form, of more horse power and a speed of 14 knots.

Following the earlier 15-in. monitors, some much smaller vessels, each carrying a 9·2-in. gun, were designed, and others again which carried 6-in. guns. A good many of both large and small monitors went out to the Dardanelles in the early part of the war, and did very good work, and for a long time they seemed to bear a charmed life, as they enjoyed complete immunity from torpedo attack. Later, however, the "Erebus" and "Terror" were both torpedoed; the latter received three torpedoes, two hitting forward of the bulge with severe damage resulting; the third, which hit the bulge itself, did very little damage. The former ship was hit full amidships by a distance-controlled boat carrying a very heavy charge, but the bulge gave her complete protection and both ships were quickly repaired. It is interesting to note in this connexion that some of the old

TABLE V.—*British Light Cruisers, Destroyers, Submarines, etc.*

LIGHT CRUISERS	Date of Launch	Length between Perps. (Length over all)	Breadth		Draught		Displacement: Tons		Speed: Knots		Horse-Power		Armament	Side Armour
		ft.	ft.	in.	ft.	in.								
" Courageous "	1916	735 (786)	81	0	21	6	17,400		32		90,000		4—15 in. 18—4 in. 14—21 in. T. T.	3 in.
" Raleigh "	1917–21	565 (605)	65	0	17	3	9,750		30–1		60,000–70,000		7—7·5 in. 12—3 in. 6—21 in. T. T.	3 in.
" Chatham " Class	1912–3	430 (457)	49	10	15	10	5,440		25½		25,000		8 or 9—6 in. 2—21 in. T. T.	3 in.
" Arethusa " "	1913–4	410 (436)	39	0	13	6	3,500		30		40,000		3—6 in. 4—4 in. 8—21 in. T. T.	3 in.
" Calliope " "	1914–5	420 (446)	41	6	13	6	3,750		30		40,000		4—6 in. 4—21 in. T. T.	3 in.
" Caledon " "	1916–7	425 (450)	42	9	14	1	4,120		29		40,000		5—6 in. 8—21 in. T. T.	3 in.
" Ceres " "	1917	425 (450)	43	6	14	1	4,190		29		40,000		ditto	3 in.
" D " "	1918	445 (471)	46	0	14	3	4,650		29		40,000		6—6 in. 12—21 in. T. T.	3 in.
" E " "	1919–20	545 (570)	54	6	16	6	7,550		33		80,000		7—6 in. 12—21 in. T. T.	3 in.
MONITORS:														
" Erebus "	1916	405	88	0	11	0	8,000		12		6,000		2—15 in.; 8—4 in.	—
9·2 in. Gun Monitors	1915	177	31	0	6	0	540		12		600		1—9·2 in.	—
6 in. Gun Monitors	1915	177	31	0	4	0	355		10		400		2—6 in.	—
DESTROYERS:														
" M " Class	1914	273	26	8	8	8	1,025		34		25,000		3—4 in. 4—21 in. T. T.	—
" R " & " S " Class	1916–8	276	26	8	9	0	1,065		36		27,000		3—4 in. 4—21 in. T. T.	—
" V " & " W " "	1917–9	312	29	6	9	0	1,300		34		27,000		4—4 in. or 4—7 in. 4 or 6—21 in. T. T.	—
DESTROYER LEADERS:														
" Kempenfelt " Class	1914	325	31	9	10	0	1,650		34		36,000		4—4 in. 4—21 in. T. T.	—
" Scott " & " Shakespeare "	1917–9	332½	31	9	10	0	1,800		36		42,000		5—4·7 in. 6—21 in. T. T.	—
PATROL BOATS:														
"P" Class	1915	224½	23	9	7	7	573		22		4,000		1—4 in. 2—14 in. T. T.	—
SLOOPS	1915	268	33	6	11	0	1,250		17		2,400		2—4 in. or 4·7 in.	—
MINE-SWEEPERS:														
Paddle	1916	246	29	0	6	9	810		15		1,400		1—3 in.	—
Twin-screw	1916	231	28	0	7	0	750		16		1,800		1—3 in.	—
SUBMARINES:							Surface	Submerged	Surface	Submerged	Surface	Submerged		
" E " Class	1912	181	22	6	12	6	660	800	15	10	1,600	840	1—3 in. 5—18 in. T. T.	—
" J " "	1915	275	23	0	14	0	1,210	1,820	19½	9½	3,600	1,350	1—3 in. or 4 in. 6—18 in. T. T.	—
" K " "	1916	338	26	6	16	0	1,880	2,560	24	9½	10,000	1,400	1—4 in. 1—3 in. 8—18 in. T. T.	—
" L " "	1917	231	23	6	13	6	890	1,070	17½	10½	2,400	1,600	1—4 in. 6—18 in. T. T.	—
" M " "	1917	296	24	6	15	9	1,600	1,950	16	9½	2,400	1,600	1—12 in. 1—3 in. 4—18 or 21 in. T. T.	—
" R " "	1918	163	15	6	11	7	420	500	9½	15	240	1,200	6—18 in. T. T.	—
" CHINA GUNBOATS:"														
Large	1915	237½	36	0	4	0	645		14		2,000		2—6 in.	—
Small	1915	126	20	0	2	0	98		10		175		1—4 in.; 1—3 in.	—

British cruisers of the " Edgar " class, which had had bulges added to them early in the war, were torpedoed in the Mediterranean, but the bulge gave them complete protection. They were taken to port and repaired. In fact, no bulged ship struck by a torpedo was sunk.

On the heavier monitors it may be remarked that of all ships carrying heavy guns these vessels were probably more often in action off the Belgian coast and elsewhere than any of our heavy-gun ships, and they no doubt gave the enemy in occupation of that coast a very anxious time.

Destroyers and Flotilla Leaders (Table V.).—With regard to the development of British destroyers and flotilla leaders during the war reference may be made to the tables and plans (figs. 21, 22, 23 and 24). These vessels gradually increased in size and power, and war requirements continually added to the weights which they had to carry, including considerably more fuel, heavier armament both of guns and torpedoes, depth charges, larger bridges, and other additions. In fact, some of the ships which before the war were 900-ton vessels, exceeded 1,000 tons towards the end. The introduction, however, of the geared turbine added enormously to the efficiency of the machinery and propellers.

During the war nearly 300 T.B.D.'s and flotilla leaders, which are simply a larger form of T.B.D. with improved accommodation, were added to the British fleet, and the whole class of these vessels was called upon to do continuous work often in heavy weather. They came through the ordeal with very few breakdowns of machinery or other parts of the ship, whilst the duties they were called upon to perform in combating the submarines, convoying, etc. were continuous and varied. Numbers of these vessels were built by firms who had never built a warship before, but the work turned out by them fully met the Admiralty requirements.

The flotilla leaders, with a deep load displacement of about 2,000 tons and an armament of five 4-in. or 4·7-in. guns, and with their very high speed, might well be described as fast scouts or third-class cruisers.

Patrol Boats (Table V. and fig. 25).—Patrol boats were specially designed to relieve the T.B.D.'s of some of their duties such as patrolling, submarine-hunting and escort work, for which high speed was not a necessity. They had to be as small as possible, consistent with keeping the sea in all weathers, with sufficient speed to run down submarines, besides having shallow draught and all top hamper kept low to prevent their being seen at a distance. Economy of fuel was also an important feature, and it was desirable to have them built of mild steel rather than high-tensile steel, in order to simplify the construction. Some were provided with a special hard steel ram, with which a considerable number of enemy submarines were sunk. The various features were combined in a vessel of something under 600 tons, with geared turbine engines of 3,800 H.P., giving a speed of over 22 knots, with 330 revolutions of the propellers. The boats had large rudder area and were cut up aft, so that they could turn very quickly upon the enemy—a most important feature for ramming purposes. They proved very valuable boats on service and did a great deal of work against the submarines in all weathers. They were armed with only one 4-in. gun, mounted in a commanding position on the forward superstructure, one 2-pdr. and two 14-in. torpedo tubes, and later it was arranged to carry depth charges. Their cost was, of course, considerably less than that of a modern destroyer.

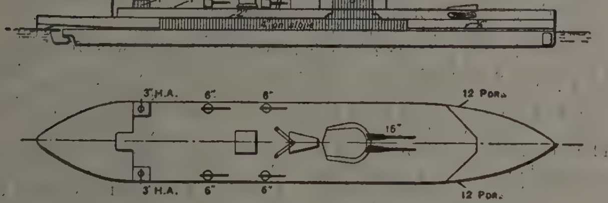

FIG. 19.

Some of these boats were afterwards disguised to look like small mercantile craft—a device which also proved quite successful.

Sloops and Mine-Sweepers.—On the outbreak of war it became clear that there would be a great demand for mine-sweeping vessels. A good many coasting and cross-channel steamers were taken up for this purpose, but more were required, and it was decided in Dec. 1914 to build twelve single screw ships (fig. 26) of simple design to this end. With the view of hastening construction, it was decided to adopt mercantile practice as far as possible in both hull and machinery. The vessels, although of very fine form, were built of simple construction and under Lloyd's survey. The boilers were of ordinary Scotch type, and single screw machinery was provided.

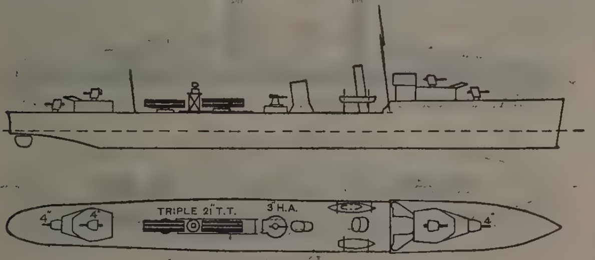

Later Vessels have 4-4·7" Guns in lieu of 4-4" Guns

FIG. 21.

In the end nearly 100 of these vessels were built, and the armament, which at first was two 12-pdrs., was subsequently increased to two 4-in. or two 4·7-in. guns. A great many of these vessels were built in about six months from the order, and the first 36 averaged 25 weeks in building. They proved excellent sea boats, and were used not only for mine-sweeping, but also for submarine work and for convoying. At later stages some of these vessels were disguised as ordinary merchant ships. They were economical steamers, and were able to attain a full speed of 17 knots, with a H.P. of about 1,800 to 2,000 in the earlier, which was increased to 2,500 in the later, vessels.

Several of the vessels were mined, but although the damage they sustained was very severe, they kept afloat and were repaired.

The Admiralty was asked to design and provide some vessels of this type for the French Government, and eight of these were designed by Sir E. d'Eyncourt and built for that purpose and armed with somewhat heavier armament than our own ships. The French Government were very satisfied with the vessels.

In addition to this, at a later stage, for sweeping in shallow water, some paddle mine-sweepers were designed at the Admiralty. These were 15-knot boats, with draught just under 6 ft. 9 inches. They did good work, but were of course not such good sea boats as the sloops. As there was some danger of mines getting under the paddles, a further design of twin-screw mine-sweepers was got out. These were vessels of about 800 tons and about 16 knots speed.

Submarines (Table V. and figs. 27, 28 and 29).—During the war the design of submarines was enormously developed. A very large number of these vessels were added to the British Fleet. There were some twelve different types, some embodying very special requirements and all being improvements on their predecessors. The Admiralty produced the fastest internal-combustion engined submarine in "J" class, which attained a speed of over 19 knots. As a still higher speed was wanted for fleet work, the "K" boats were designed with a surface speed of 24 knots. To arrive at this it was necessary to go to steam, and special arrangements had to be made for shutting down watertight the funnels, etc. However, all these difficulties were overcome.

It is an interesting point about these vessels that, besides the steam turbines for full speed on the surface and the electric drive when under water, they were provided with a Diesel engine for use just before diving or immediately after breaking surface, in order to quicken diving or getting away after coming up.

Although the Germans had the advantage of more power per cylinder in their Diesel engines, Great Britain produced submarines, faster and more heavily armed than theirs.

M. 1. submarine was a monitor submarine armed with a 12-in. gun; she was an experimental boat, and proved quite successful.

"China Gunboats."—For use in Mesopotamia or for river work two classes of so-called "China gunboats" were designed by Messrs. Yarrow. The smaller of these vessels, 120 ft. long and of about 100 tons, were constructed in Great Britain in such a way that the parts could be sent out to Abadan, where they were assembled, and the vessels reërected and completed under the supervision of Admiralty officers. Some of the larger boats 230 ft. long and of 645 tons, were completed in England and went out to Mesopotamia, where all of them were of the greatest service in that campaign. Most useful work was also done by motor launches and many other types.

Other Auxiliary Craft and Aircraft Carriers.—The Admiralty was called upon to design many other auxiliary craft—notably some fast Fleet oilers which were able to carry 5,000 tons of oil and had a speed of 15 knots. There were also designed a great number of special smaller craft for all purposes, and a number of merchant ships were taken over and modified to meet diverse requirements.

The most important modifications were those made to vessels taken over and converted into aircraft-carriers, including "Campania," "Ark," "Royal," "Engadine," "Riviera," etc.; the "Furious" was also altered, and the "Cavendish" (now named "Vindictive") was converted into an aircraft-carrier. The "Argus" (fig. 30) was originally built as a passenger mail ship of 20 knots, and was taken over and converted into an aircraft-carrier with complete flush deck, the funnels being carried aft in long horizontal ducts, discharging the smoke astern. The "Eagle" was taken for conversion into a large aircraft-carrier with a somewhat different arrangement, with the funnels and all deck erections included on an "island" on one side of the deck. Aircraft-carrying ships are in fact gradually becoming more important for the Fleet.

Altogether during the four years more than 2,000,000 tons were added to the navy, at a cost between £250,000,000 and £300,000,000 sterling, exclusive of modifications to auxiliaries. Reference to the navy estimates shows that the aggregate sum spent during the four years before the war on new construction amounted to approximately £60,000,000. In fact, during the four years 1915–8, more tonnage was built for the British navy than during the previous 25 years.

II. NAVIES OF OTHER COUNTRIES

During the period 1910–20 foreign naval construction of all types generally followed the line of British designs, with one or two important exceptions which must not be overlooked.

The most important departure from the British practice was in respect of the number of guns mounted in the barbettes. Triple-gun mountings for the main armament have been adopted by several nations, viz. France, Italy, Austria, Russia and the United States, while in 1914 the French began the construction of quadruple-gun turrets, but neither these turrets nor the ships for which they were intended have been completed.

The British example in regard to the adoption of turbine machinery for propulsion of the first "Dreadnought" battleship and battle cruisers was not followed by the other nations at once. In some cases, for example, Japan and the United States, sister vessels were built, one having turbine engines and the other reciprocating engines. Finally, however, turbine engines were almost universally adopted, while the United States made a further advance by the adoption of the electric drive. The first American battleship in which this was installed was the "New Mexico," and it was arranged for all subsequent vessels to be propelled similarly.

In the adoption of oil only as the fuel the British again took the lead, and up to Aug. 1921 this had only been followed by the United States. The German authorities had considered that their sources of supply were not sufficiently reliable to justify their depending on oil alone.

On the whole, therefore, it may be said that the designs, apart from the above features, of foreign warships did not differ essentially from the British types, as can be seen from the notes and tables which follow.

Of the minor navies, many of which depended on British or other foreign builders for the design and construction of their warships, little need be said, as with the war the development of their navies practically ceased, and some of the most important vessels, such as the battleships building for Chile and Turkey, were taken over for the British navy.

At the Armistice both the German and Austrian navies ceased to exist as factors in the general naval situation, all their principal ships being surrendered to the Allies, the great majority of the vessels being finally destroyed, either being broken up or used as targets, with the exception of a few of the less important units, such as light cruisers and destroyers, which were incorporated in the French and Italian navies.

Battleships

(1) *United States.*—The first vessels of the "Dreadnought" type constructed for the U.S. navy were the "Michigan" and "South Carolina," launched in 1908. These vessels, carrying only eight 12-in. guns, were of about 2,000 tons less displacement than the "Dreadnought," and 2 knots slower than this vessel. The main armament of the U.S. vessels was disposed, however, in an original manner, constituting a bold departure in that they were all mounted on the centre line of the vessel in two superposed twin-gun turrets forward, and two aft, with large arcs of training on each beam. This arrangement of turrets gave an ahead and astern fire of four guns and a broadside fire of all the eight guns. The water-line armour belt was 11 in. thick with 8 in. above. Cage masts constructed of a large number of steel tubes were fitted in these vessels and such masts have been fitted in all later U.S. capital ships and also in some of the earlier vessels in substitution of their original masts. The "Michigan" and "South Carolina" were propelled by twin screws driven by reciprocating engines, thus differing from the "Dreadnought."

The next battleships built were the "North Dakota" and "Delaware," launched respectively in 1908 and 1909. These vessels were a considerable advance in size over their predecessors, being more than 60 ft. longer, 4,000 tons heavier, and two knots faster, while they carried two additional 12-in. guns. The 10 guns were mounted all on the centre line, the two turrets forward being superposed as in the previous class, while the three turrets aft were arranged so that one could fire over the other two, which were both on the same deck so that one could only fire on either broadside. The arrangement of guns thus increased the broadside fire but left the ahead and astern fire as before. The armour belt consisted of a tier of 11 in. at the water-line, with a tier of 8 in. above. The advance in speed involved an increase of 50% in the H.P. of the engines, viz. from 16,500 to 25,000. Turbines of the Curtis type were installed in the "North Dakota" for the first time in a U.S. capital ship, but the "Delaware" was fitted with reciprocating engines. An important departure in these vessels was the fitting of 14 5-in. guns as secondary armament in a battery amidships, protected by 5-in. armour.

The next pair of battleships, named the "Utah," launched in 1909 and the "Florida," launched in 1910, were enlarged "North Dakotas," but both had Parsons turbine engines of 28,000 shaft horse-power. The tonnage was increased to 21,800 tons on the same draught, and the speed remained practically the same. The length was increased slightly to 521 ft. and the beam to 88 ft. The main armament was the same in number of guns and arrangement of turrets as in the "North Dakota," but the secondary armament was increased to 16 5-in. guns, protected by 5-in. armour. The armour was practically the same as in the previous vessels.

The succeeding pair of battleships, "Arkansas" and "Wyoming," launched in 1911, were characterized by another large increase in dimensions, the length being increased to 562 ft. and the beam to 93 ft., while on the same draught as previous vessels the displacement was 26,000 tons. The engines were Parsons turbines of about 28,000 S.H.P., the speed being about ½ knot less than the "Utah," of the same power but 4,000 tons less displacement. The greatly increased displacement enabled 12 12-in. guns to be mounted in six twin-gun turrets arranged all on the centre line in three superposed groups, one group forward, another just abaft of amidships and the remaining group aft. The ahead and astern fire thus remained as in previous vessels at four guns, but all 12 guns could be fired on either broadside. The secondary armament was 16 5-in. guns in a 6-in. armoured battery. The protection was generally similar to the previous vessels, the water-line belt and barbette armour being 11 in. thick. The turrets and conning tower were of 12-in. armour.

These vessels were the last U.S. battleships mounting 12-in. guns. The example of the British in fitting 13·5-in. guns in the "Orion" class was followed by the adoption of 14-in. guns in the next vessels laid down by the United States. These were the "Texas" and "New York," launched in 1912, the dimensions of which were slightly greater than those of the "Arkansas" and the displacement 1,000 tons greater. Ten 14-in. guns constituted the main armament and was mounted in five twin turrets, arranged generally in a similar manner to the British "Orion," four guns firing ahead and astern and all 10 on either broadside. The secondary armament remained as before, 16 5-in. guns being mounted in an amidships battery protected by 6-in. armour. The water-line belt was 12 in. thick with a 9-in. belt above it, and the protection generally was somewhat greater than that of the previous vessels. An important feature in these vessels was the return to reciprocating engines, which on a power of 27,000 gave the vessels a speed of 21 knots. The reintroduction of this type of engine was made chiefly to obtain greater economy at cruising speeds.

The next pair of battleships, "Nevada" and "Oklahoma," launched in 1914, were of slightly increased length and tonnage. The main armament was the same numerically as the "New York's," but was arranged in four turrets, two containing two guns each and the other two three guns each. The twin-gun turrets were superposed above the triple-gun turrets at each end of the vessels. The secondary armament of the "Nevada" and "Oklahoma" consisted of 12 5-in. guns arranged in an unprotected battery farther forward than in previous vessels. Turbines were again adopted for the propulsion of the "Nevada," but reciprocating engines were fitted in the "Oklahoma." The reduced power of the machinery, viz. 24,800 H.P. of both vessels, resulted in a reduced speed of 20½ knots.

The British example of adoption of oil only as the fuel for the "Queen Elizabeth" class was followed by the United States in the "Nevada" and "Oklahoma," the total quantity of fuel arranged for, however, being 2,000 tons, compared with 3,400 tons in "Queen Elizabeth."

The saving in weight resulting from the adoption of triple-gun turrets and oil fuel enabled considerable additions to be made to the armour protection of the "Nevada" and "Oklahoma." The belt amidships was 13½ in. thick and extended from 8½ ft. below to 9 ft. above the water-line. The conning tower was protected by 16-in. armour, this being also the thickness of the front plates of the twin-gun turrets, those of the triple-gun turrets being of 18-in. armour. The vessels are further distinguished from their predecessors in that only one funnel, instead of two, is fitted. The uptakes are protected by 13½-in. armour.

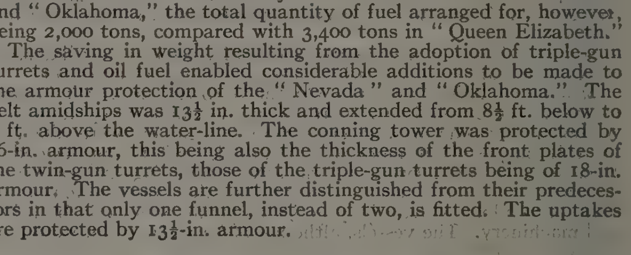

FIG. 31.

The "Nevada" and "Oklahoma" were succeeded by the "Pennsylvania" and "Arizona" (fig. 31), launched in 1915, in which the dimensions were further increased and the displacement became 31,400 tons. The main armament was increased to 12 14-in. guns arranged in four triple turrets in two superposed groups forward and aft. The secondary armament originally consisted of 22 5-in. guns, but has been reduced to fourteen. The protection of the vessels was generally similar to that of the "Nevada" and "Oklahoma," but the side armour was increased to 14 in. maximum. Turbine engines were fitted in both vessels of the class, the "Pennsylvania" having geared cruising turbines in order to secure economy.

The "New Mexico," "Idaho" and "Mississippi," launched in 1917, were similar in general design, protection, and main armament to the "Pennsylvania." The displacement was slightly increased to 32,000 tons. The main armament of 12 14-in. guns was again arranged in four triple turrets, with front plates of 18-in. armour, side plates 9 in. to 10 in. and roof plates 5 inches. The secondary battery of 14 5-in. guns was fitted a deck higher than in "Pennsylvania" and was unprotected.

The "New Mexico" was distinguished from her sister vessels by the adoption of electric motors for her propulsion, the other two vessels having turbines arranged as previously; she had two turbo-electric generating sets of 11,400 kw. capacity installed, and this electric power was transmitted electrically to four motors of, nominally, 6,600 H.P., one on each of the four propelling shafts. These motors were reversible, thus avoiding, as in the ordinary turbine method of propulsion, the necessity for astern as well as ahead prime movers. The electric drive appears to have been successful, especially as the "New Mexico" was not originally designed for this method of propulsion; the accommodation for the machinery being obtained by modifications in the arrangement of the spaces provided in the original design for turbines, without affecting the other features of the design. The vessel was put through exhaustive trials with satisfactory results, a maximum speed of just over 21 knots being obtained at 31,200 H.P. on a displacement of 32,800 tons, with economical steam and fuel consumption. An advantage conferred by the electric drive at cruising ship speeds arises from the ability to obtain the necessary power from only one of the electric generating sets, which can thus be worked at nearly full power and therefore give very good efficiency. The "New Mexico" escorted President Wilson across the Atlantic, and on both eastward and westward voyages only one turbine generating set was used. The weight of the machinery was greater per H.P. than that of turbine machinery of about the same power in British warships, but it was considered that this was capable of improvement in the future, especially in the case of vessels intended from the outset to have the electric drive. The electric drive has been adopted for all succeeding U.S. capital ships.

The "Tennessee" and "California," launched in 1919, were practically repeats of the "New Mexico," the displacement being 32,300 tons. These vessels, however, have two funnels. Also a new system of under-water protection (which has since been adopted for all U.S. battleships) was introduced. This consists of five vertical longitudinal bulkheads extending parallel to the ship's side from the forward to the after magazines, thus protecting the whole of the vitals of the ship. The innermost bulkhead is about 17 ft. inboard, the other bulkheads being approximately equidistant from one another; the bulkheads next to the skin bulkhead and innermost bulkhead are all thin plating, the other three being of thicker plating; the middle three of the five spaces formed by this arrangement are utilized as oil-fuel bunkers.

In Aug. 1915 Congress approved the first building programme ever drawn up for the U.S. navy, according to which 10 battleships, 6 battle cruisers, 10 scouts (or light cruisers), 50 destroyers, 9 fleet and 58 coast submarines were to be added in three years to the U.S. navy, in addition to a number of auxiliary vessels.

The first battleships to be built under this programme were the "Colorado" (launched 1921), "Maryland" (launched 1920 and completed 1921), "Washington" and "West Virginia." The dimensions of these vessels are not greatly different from the "Tennessee," except that the displacement is slightly greater, being 32,600 tons, the H.P. of the electric propelling machinery being increased to 28,900 to maintain the speed of 21 knots. The chief departure in the new vessels was the adoption of 8 16-in. guns as the primary armament, arranged in four twin-gun turrets superposed in pairs forward and aft. The secondary armament consists of 14 5-in. guns. The armour protection is generally as in the "New Mexico" class.

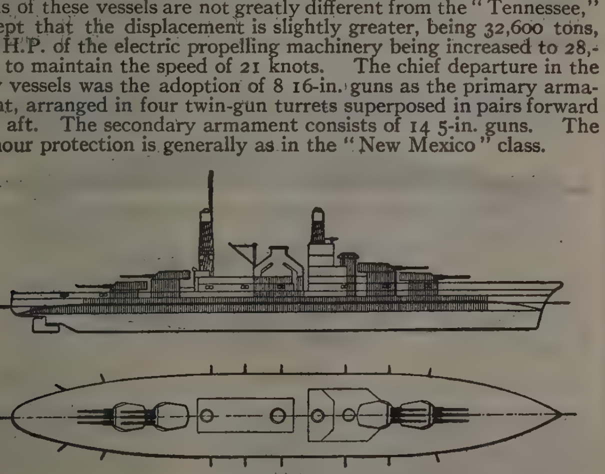

FIG. 32.

The remaining six battleships of the 1916 programme had not yet been launched in 1921. Their names are "South Dakota," "Indiana," "Montana," "North Carolina," "Iowa," and "Massachusetts" (fig. 32). They are a very great advance on their predecessors, being 684 ft. long, 106 ft. wide and displacing 43,200 tons on a draught of 31 feet. An increased speed, 23 knots, is aimed at, the electric drive being of 60,000 horse-power. The main armament is increased by 50%, consisting of 12 16-in. guns mounted in four triple-gun turrets, and the secondary armament comprises 16 6-in. guns. The torpedo armament was two submerged 21-in. torpedo tubes throughout all the battleships described in the foregoing. In 1919 a second three-year programme was considered, to consist of 156 vessels in all, including a further batch of 10 battleships and six battle-cruisers.

(2) *France.*—The French navy did not immediately adopt the single-calibre main armament, their first vessels, designed after the "Dreadnought" era had begun, being the "Danton" class, which resembled the "Lord Nelson" in armament, 12 9·4-in. guns being carried in addition to the usual 4 12-in. guns. They were about 2,000 tons heavier than the "Lord Nelson" and were fitted with turbines of 22,500 H.P., giving a speed of 20 knots.

The first French battleships of the "Dreadnought" type were the "Jean Bart" class, launched in 1911 and 1912. These vessels, "Jean Bart," "Paris," "France" and "Courbet," were a considerable advance on the "Danton" class, being 546 ft. long, as against 481 ft., with increased beam and draught, and displacement of 23,100 tons. Turbine machinery of 28,000 H.P. was fitted, giving a speed of 20 knots. The main armament comprised 12 12-in. guns mounted in six twin-gun turrets arranged in two superposed groups forward and aft, with the remaining two turrets on the broadsides amidships. The ahead and astern fire was thus 6 guns and broadside 10 guns. The secondary armament was very numerous, consisting of 22 5·5-in. guns protected by 7-in. armour. The side armour was 10¾ in. thick, tapering to 7 in. at the bow and stern, the turret armour being also 10¾ in. thick.

The "Jean Bart" successfully withstood torpedo attack by an Austrian submarine in 1915, being struck well forward. Compartments were flooded, but the vessel proceeded under her own power to Malta, where she was repaired in H.M. Dockyard.

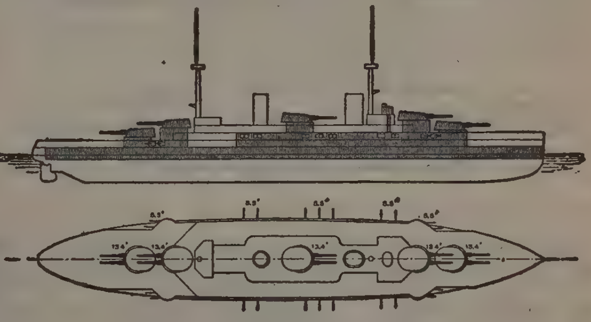

FIG. 33.

The next battleships built by the French were the "Bretagne" (name ship of the class) (fig. 33), "Lorraine" and "Provence," all launched in 1913, practically repeats of the "Jean Barts," except that the main armament consisted of 10 13·4-in. guns mounted in five twin-gun turrets, all on the centre line of the vessels, the usual superposed groups of two turrets forward and aft, the fifth turret being amidships. The secondary armament again consisted of 22 5·5-in. guns, arranged slightly differently from the "Jean Bart," but this number was decreased after the war to 18, during a partial reconstruction when director-firing was installed on a new tripod foremast.

These vessels were the last battleships completed for the French navy, the completion of the five vessels of the "Normandie" class, launched in 1914 and 1915, having been abandoned, with the exception of the "Bearn," which has been converted into an aircraft-carrier. The "Normandie" class were designed to carry 12 13·4-in. in three quadruple-gun turrets, a unique arrangement. The four guns in each turret were arranged on two mountings, so that virtually they comprised two twin guns. The secondary armament was to have consisted of 18 5·5-in. guns. The machinery intended for these vessels was of an interesting type, consisting of a combination of turbine and reciprocating engines, the two inner shafts being driven by turbines and the two outer shafts by reciprocating engines, which alone were powerful enough to have given the vessels a speed of 16 knots, the full power of 35,000 H.P. being designed to give a maximum speed of 21 knots.

It was intended to have laid down in Oct. 1914 four battleships of the "Duquesne" type, but the outbreak of the war caused this intention to be abandoned. The vessels were designed to carry 16 13·4-in. guns in four quadruple-gun turrets, arranged in two superposed groups forward and aft. The displacement was to have been 29,500 tons, and, with combination turbine and reciprocating engine, a speed of 23 knots was anticipated.

It should be noted that during the whole war period the French Government dockyards, and many private yards also, devoted their whole capacity to the production of munitions of all kinds for the army; naval work being almost entirely relegated to the background.

No provision was made in the French naval budget for 1921 for the construction of any capital ships.

(3) *Japan.*—The "Satsuma" and "Aki" were the first battleships built in Japan after the "Dreadnought" era had begun. They were a development of the "Kashima" class, and therefore

resembled in type the "Lord Nelson." Launched in 1906 and 1907, they mounted 4 12-in. and 12 10-in. guns on a displacement of about 19,500 tons. Turbine machinery of 24,000 H.P. was fitted in the "Aki," giving a speed of 20½ knots. The "Satsuma," with reciprocating engines of 18,500 H.P., was 2 knots slower.

The first Japanese battleships of the "Dreadnought" type were the "Settsu," launched in 1911, and the "Kawachi," launched in 1912. The latter vessel was blown up in 1918 in a Japanese harbour by the explosion of her magazines. These vessels were of 20,800 tons and mounted 12 12-in. guns, arranged in six twin-gun turrets, one forward and aft on the centre line and the other four on the broadsides. The ahead and astern fire was thus 6 guns and broadside fire 8 guns. The secondary armament was 10 6-in. guns, mounted in an amidship battery protected by 6-in. armour. Eight 4·7-in. guns were also mounted. The armour belt was 12 in. thick amidships at the water-line and 9 in. above, with 5-in. armour forward and aft, the 12-in. guns were protected by 11-in. armour, and the conning tower by 12-in. armour. Turbine machinery of 25,000 H.P. was fitted, giving a speed of 20½ knots.

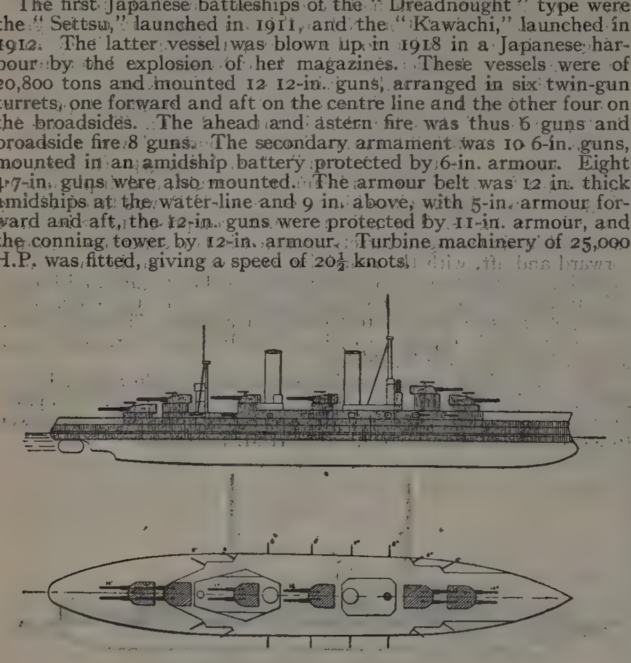

FIG. 34.

Large increases in dimensions and power characterized the next class (fig. 34) of Japanese battleships, 14-in. guns being adopted. These vessels were the "Fuso" and "Yamashiro," of 30,600 tons and 40,000 H.P., launched in 1914 and 1915 respectively, and the "Ise" and "Hyuga," of 31,260 tons and 45,000 H.P., launched in 1916 and 1917. The main armament consisted of 12 14-in. guns mounted in twin-gun turrets all arranged on the centre line of the vessel. Two turrets are superposed forward, with a similar arrangement aft, the remaining two turrets being abaft the forward and after funnels respectively. The first pair of vessels named mount 16 6-in. guns, and the second pair 20 5·5-in. guns, as the secondary armament in an amidships battery protected by 6-in. armour. The belt and turret armour is 12 in. thick. The speed of the vessels is about 22½ knots.

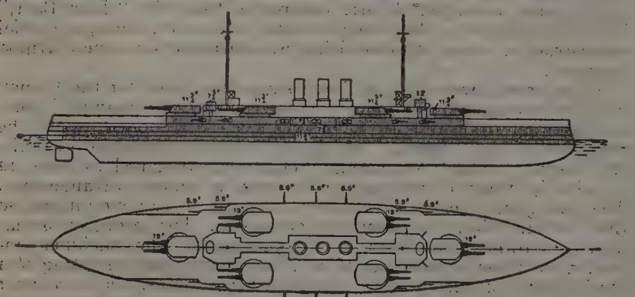

FIG. 35.

The next class of Japanese battleships are characterized by the fitting of 16-in. guns. These vessels were "Nagato" (launched 1919 and completed 1920) and "Mutsu" (launched 1920), of 33,800 tons displacement, and "Tosa" and "Kaga" (building 1921) of 40,600 tons displacement. The former pair of vessels mount 8 16-in. guns in four twin-gun turrets arranged in the now usual manner, with 20 5·5-in. guns as secondary armament. The latter pair of vessels were probably to mount 10 16-in. guns. The torpedo armament, which in previous vessels consisted of five or six submerged tubes, was increased to eight tubes, four of which are mounted above the water-line. The vessels were slightly faster than previous vessels, a speed of 23½ knots being intended, geared turbines providing the requisite power, which was about 46,000 in the "Nagato" and "Mutsu" and 60,000 in the "Tosa" and "Kaga."

Under the 1920–8 Navy Law four battleships were projected.

(4) *Germany.*—The "Dreadnought" type of battleship was adopted at once by Germany, the advance from the "Deutschland" class (of the "Formidable" type) being made without trial as was done in some other navies, of vessels of the "King Edward VII." or "Lord Nelson" types. The first German "Dreadnoughts" were the four vessels of the "Nassau" class, launched in 1908. Shorter but wider and somewhat heavier than the "Dreadnought," the "Nassau," on a displacement of 18,600 tons, carried 12 11-in. guns in six twin-gun turrets, mounted one at each end on the centre line, and two on each broadside, thus giving an ahead and astern fire of six guns and broadside fire of eight. The secondary armament consisted of 12 5·9-in. guns, mounted in a battery protected by 7-in. armour. A large torpedo armament of six 17·7-in. submerged tubes was fitted. The water-line armour belt was 11½ in. thick, with an 8-in. belt above, and tapering to 5 in. forward and 4 in. aft. The speed was 19 knots, the requisite H.P. of 20,000 being developed by reciprocating engines.

The "Nassau" class was followed by the four ships of the "Helgoland" class (fig. 35), launched in 1909 and 1910. These vessels marked a considerable increase in dimensions and displacement. The 12-in. gun was adopted for the first time in these vessels, the Germans claiming that this weapon was the equivalent of the 13·5-in. gun then being adopted by the British in the "Orion" class. The "Helgoland" carried 12 12-in. guns arranged similarly to the 11-in. guns in the "Nassau." The secondary armament was increased to 14 5·9-in. guns and the six submerged tubes were of 19·7-in. diameter. The protection was generally the same as that of the "Nassau" class. The speed was increased to 20·5 knots. The various increases involved a displacement of 22,440 tons and engines of 25,000 H.P., but the reciprocating type was still adhered to.

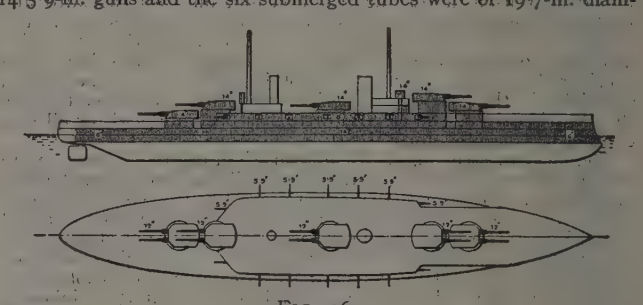

FIG. 36.

The "Kaiser" class (five vessels), launched in 1911 and 1912, were slightly larger and faster than the "Helgoland" class, being of 24,300 tons and 21 knots, but the main armament was reduced to 10 12-in. guns without loss of broadside fire, as they were arranged similarly to the British "Neptune" (designed two years previously), with one turret forward, two superposed aft and two broadside turrets *en échelon*, all guns thus being able to fire on either broadside. The secondary armament was unaltered and the bow torpedo tube was omitted. The armour protection was considerably increased, the water-line belt being of 13¾ in. maximum thickness tapering to 9 in., with an upper belt of 7¾ in., the secondary battery above and both ends of the ship being protected by a like thickness. Turbine engines were installed for the first time in German battleships, the power being 28,000 for a speed of 21 knots, which was somewhat exceeded on trials.

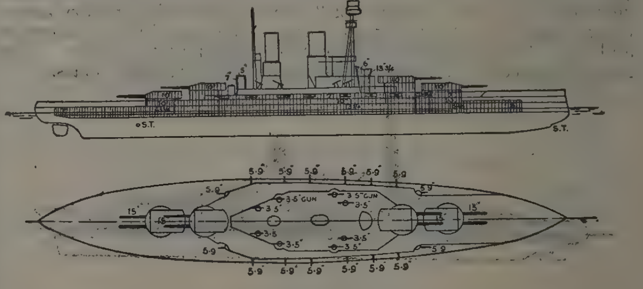

FIG. 37.

The four ships of the "König" class (see fig. 36), launched in 1913 and 1914, were, with the exception of slightly greater dimensions and displacement, generally repeats of the "Kaiser" class in respect of number and calibre of guns and torpedo tubes and of protection. The main armament was arranged all on the centre line, as in the British "Orion" class, the amidship turret being, however, between the two funnels. An important advance lay in the increased oil-fuel (700 tons) capacity, previous vessels having only 200 tons.

The last battleships built by the Germans were the "Baden" and "Bayern" (see fig. 37), launched in 1915, two others of the class not being completed at the time of the Armistice. A very complete description of the "Baden" was given in a paper read by Mr. S. V

Goodall before the Institution of Naval Architects in March 1921. The "Baden" and "Bayern" were about 3,000 tons heavier than the "König" class, the dimensions being increased proportionately. The chief difference, however, was in the main armament, 8 15-in. guns being mounted in four turrets on the centre line in two superposed groups forward and aft, as in the British "Queen Elizabeth." The secondary armament was increased to 16 5·9-in. guns, and the torpedo armament consisted originally of 5 23·6-in. submerged tubes, one forward in the stem and the other on the broadside forward and aft. The forward torpedo room was damaged by an under-water explosion and when repairs were made the torpedo tubes were not replaced. Turbine machinery of about 50,000 H.P. total was fitted, driving three propellers, and a speed of about 22 knots was obtained on trials. The main armour belt was 13¾ in. thick, tapering to 6¾ in. at the lower edge. Above was a belt of 10-in. armour extending to the upper deck. The secondary battery was protected by 6¾-in. armour. Forward the side armour was 6 in. thick and aft 7 inches. The latter and a deck of 4¾ in. thickness provided protection to the steering gear. The maximum thickness of armour for the barbettes, turrets, and conning tower was 13¾ inches. Protection against under-water attack was provided by a longitudinal bulkhead 2 in. thick, set in about 13 ft. from the side.

(5) *Italy.*—The first Italian "Dreadnought" was the "Dante Alighieri," of 19,200 tons, launched in 1910. This vessel was then remarkable for the high designed speed of 23 knots and the adoption of triple-gun mountings for the main armament of 12-in. guns, of which 12 were carried in turrets all fitted on the centre line of the vessel. The turrets, funnels and masts were so disposed that the vessel could practically be described as "double-ended." The vessel was protected by a water-line belt of 10-in. (maximum) armour amidships and 4-in. at the ends, with an upper belt of 6-in., by which 12 of the secondary battery of 20 4·7-guns were protected. The remaining 8 4·7-in. guns were mounted in four twin-gun turrets on the upper deck. The 12-in.-gun turrets had a maximum thickness of 10-in. armour. Turbine engines of 26,000 H.P. were fitted; these developed 35,000 H.P. on trial, when 24 knots were attained. Three torpedo tubes were fitted.

The "Dante Alighieri" was followed by the "Conte di Cavour," "Leonardo da Vinci" and "Giulio Cesare," launched in 1911. These vessels were 3,000 tons heavier than their predecessor and mounted an extra 12-in. gun, making 13 in all, four of which were in two twin-gun turrets superposed above triple-gun turrets forward and aft, a further triple-gun turret being fitted amidships. This arrangement enabled an increased all-round fire to be obtained over the previous vessel. The secondary armament of 18 4·7-in. guns was carried in an amidships battery protected by 5-in. armour, which was above the upper belt of 9-in. armour, the water-line belt being 10-in. amidships and 4-in. at the ends. Turret armour was 10-in. and conning tower 12-inches. Turbine engines of 24,000 H.P. were fitted to give a speed of 22 knots.

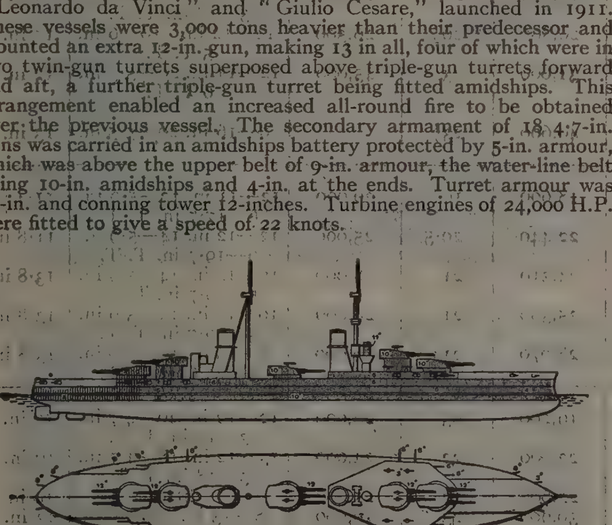

FIG. 38.

The "Andrea Doria" and "Caio Duilio" (see fig. 38), launched in 1913, were slightly longer and heavier than the "Conte di Cavour," but except for an improved secondary armament of 16 6-in. guns fitted abreast the forward and after turrets, the changes were of a minor nature.

The "Leonardo da Vinci," blown up at Taranto in 1916 by the explosion of her magazine, was refloated and dry-docked upside down in 1919. After repairs she was floated out of dock still upside down and then righted. This operation reflects the greatest credit upon the Royal Italian Corps of Naval Constructors, who conducted the operations throughout. The vessel, will, however, not be restored as a warship, but utilized for a subsidiary service.

The last four battleships laid down in 1914 and 1915 for the Italian Navy, the "Caracciolo" class, have not been completed. They were to have been generally similar in size, armament, speed and protection to the "Queen Elizabeth."

(6) *Russia.*—The Russian navy has ceased to exist as an important factor, but technically the various classes of battleships built are of interest.

Following the construction of two vessels of the intermediate "Lord Nelson" type, four battleships of the "Petropavlovsk" class were launched in 1911 and three of the "Imperator Alexander III." class (for the Black Sea Fleet) in 1914. The first four were slightly heavier, longer and faster than the others, but their general characteristics are similar. They all mount 12 12-in. in four triple-gun turrets on the centre line of the vessel, arranged similarly to the Italian "Dante Alighieri," the speed of which, 23 knots, was the same as that of the "Sevastopol," the Black Sea vessels being 2 knots slower, all the vessels having turbine engines.

The "Imperatritza Marie" was blown up by an internal explosion at Sevastopol in 1916, and refloated and docked upside down in 1919, similarly to the "Leonardo da Vinci."

(7) *Austria.*—Three battleships of intermediate ("Lord Nelson") type were completed in 1910 and 1911. Following these vessels four "Dreadnoughts" of the "Viribus Unitis" class were completed in 1912–5. On a displacement of 20,000 tons, 12 12-in. guns in four triple-gun turrets (of 11-in. armour maximum) were carried in two superposed groups forward and aft with 12 5·9-in. guns as secondary armament in an amidships battery protected by 6-in. armour. The water-line belt was 11 in. amidships and 5 in. at the ends. An upper belt of 8 in. was fitted amidships. Turbine engines of 25,000 H.P. gave a speed of about 20 knots.

Two vessels, the "Szant Istvan" of this class and the old battleship "Wien," were sunk during the war as the result of daring attacks by Italian fast motor-boats. The "Viribus Unitis" sank in 1918, due to the explosion of a mine placed in contact with the vessel by two Italian officers in a small torpedo-like motor-boat.

A contemplated programme of four battleships of 25,000 tons, carrying eight 15-in. guns, did not materialize owing to the war.

(8) *Argentina.*—The only "Dreadnought" battleships are the "Moreno" and "Rivadavia," launched in the United States in 1911 and completed in 1914; 12 12-in. guns, in six twin-gun turrets, and 12 6-in. guns are carried on a displacement of 27,600 tons, turbine engines of 39,500 H.P. giving a speed of 22½ knots.

(9) *Brazil.*—The "Rio de Janeiro," laid down at Armstrong's, Newcastle, in 1911, was sold later to Turkey, from whom the vessel was requisitioned by the British on the outbreak of the World War, and renamed "Agincourt." The "Minas Geraes" and "São Paulo" are thus the only two "Dreadnought" battleships possessed by Brazil.

(10) *Chile.*—The "Almirante Latorre" and "Almirante Cochrane" were building at Armstrong's in 1914 for the Chilean navy. The former vessel, after service during the war as H.M.S. "Canada," was sold back to Chile, but the latter vessel remains as H.M.S. "Eagle." Chile thus possesses only one "Dreadnought."

(11) *Greece.*—The "Salamis," of 19,500 tons and 23 knots speed, building in Germany at the outbreak of war in 1914, had not been completed. The four twin-gun turrets constructed in the United States for this vessel were purchased by the British and fitted in the first four large monitors.

(12) *Norway.*—The "Nidaros" and "Bjorgvin" (coast-defence battleships), launched by Armstrong's in 1914, were taken over by the British during the war and completed, with the addition of bulges, as H.M.S. "Glatton" and "Gorgon."

(13) *Spain.*—The smallest "Dreadnought" battleships ever designed have been completed for the Spanish navy. On a displacement of 15,500 tons, the "Alfonso XIII.," "España," and "Jaime I." carry 8 12-in. guns in four turrets (the amidships turrets being *en échelon*) and 20 4-in. guns. Turbine engines of 15,000 H.P. give a speed of 19½ knots. Armour protection consists of a 9-in. water-line belt, with 10-in. armour for the turrets and conning tower. The vessels were built in Spain from designs and under the supervision of British firms.

(14) *Sweden.*—Three small battleships, the "Sverige" (completed in 1917), and the "Drottning-Victoria" and the "Gustav V." (which in 1921 were nearing completion), are of 7,600 tons displacement. They mount four 11-in. and eight 6-in. guns, and with turbine engines of 22,000 H.P. a speed of 22 knots is expected.

(15) *Turkey.*—Two battleships completing in England for the Turkish navy were taken over by the British Government on the outbreak of war and renamed "Agincourt" and "Erin."

Battle Cruisers

Up to 1921 battle cruisers had been built only for Japan, Germany and Russia, besides Great Britain (see Table VII.). The United States had six vessels building.

United States.—The "Lexington" class (fig. 39) were designed in 1916, but no progress was made in their construction during the war. After the Armistice their design was reconsidered. The displacement was increased from 35,300 tons to 43,500 tons, the main armament being changed from 10 14-in. guns to 8 16-in. guns. The S.H.P. was 180,000 total, driving four propellers, and this was estimated to give 35 knots as the original design displacement and 33¼ knots for the final design. This enormous H.P. (the maximum so far contemplated for any ship) is developed by the electric drive, on generally similar but improved lines to that of the "New Mexico." Oil fuel only is burnt in the boilers. The changes made included considerably increased protection against gunfire and under-water attack. The result of all the changes made is that the vessels will be powerful battle cruisers, with good offensive and defensive qualities as compared with the initial design. The torpedo

TABLE VI.—*Non-British Battleships, 1921.*

Country and Class	No. in Class	Date of Launch	Length		Breadth		Draught		Displacement: Tons	Speed: Knots	Horse-Power	Armament	Side Armour
			Ft.	In.	Ft.	In.	Ft.	In.					
UNITED STATES:													
"South Carolina"	2	1908	453	0	80¼		27		16,000	18½	16,500	8—12 in. 12—3 in. 2—21 in. T. T.	11 in.
"Delaware"	2	1908–9	519	0	85¼		29		20,000	21	25,000	10—12 in. 14—5 in. 2—21 in. T. T.	11 in.
"Florida"	2	1909–10	521	6	88¼		29½		21,825	20¾	28,000	10—12 in. 16—5 in. 2—21 in. T. T.	11 in.
"Arkansas"	2	1911	562	0	93¼		29½		26,000	20½	28,000	12—12 in. 16—5 in. 2—21 in. T. T.	11 in.
"New York"	2	1912	573	0	95¼		29½		27,000	21	28,000	10—14 in. 16—5 in. 4—21 in. T. T.	12 in.
"Nevada"	2	1914	583	0	95¼		29½		27,500	20½	24,800	10—14 in. 12—5 in. 2—21 in. T. T.	13½ in.
"Pennsylvania"	2	1915	608	0	97		30		31,400	21	34,000	12—14 in. 14—5 in. 2—21 in. T. T.	14 in.
"New Mexico"	3	1917	624	0	97½		30		32,000	21	27,500 32,000 32,000	12—14 in. 14—5 in. 4—21 in. T. T.	14 in.
"Tennessee"	2	1919	624	0	97½		30		32,300	21	28,500	12—14 in. 14—5 in. 2—21 in. T. T.	14 in.
"Maryland"	4	1920 & bldg.	624	0	97½		30½		32,600	21	28,900	8—16 in. 14—5 in. 2—21 in. T. T.	14 in.
"South Dakota"	6	Bldg.	684	0	106		31		43,200	23	60,000	12—16 in. 16—6 in. 2—21 in. T. T.	14 in.
FRANCE:													
"Jean Bart"	4	1911–2	544	6	88½		29⅔		23,100	20	28,000	12—12 in. 22—5·5in. 4—18 in. T. T.	10¾ in.
"Bretagne"	3	1913	544	6	88½		29¾		23,200	20	29,000	12—13·4 in. 22—5·5in. 4—18 in. T. T.	10¾ in.
"Normandie"	5	1914–5 not completed.	574	0	89		29		24,800	21	35,000	12—13·4 in. 24—5·5in. 6—21 in. T. T.	12 in.
JAPAN:													
"Aki"	2	1907	460	0	83½		27½		19,800	20½	24,000	4—12 in. 12—10 in. 5—18 in. T. T.	9 in.
"Settsu"	2	1911	500	0	84		27		20,800	20½	26,500	12—12 in. 10—6 in. 5 T. T.	12 in.
"Fuso"	4	1914–7	640	0	94		28½		31,000	23	45,000	12—14 in. 20—5·5 in. 6 T. T.	12 in.
"Kaga"	4	1919 and bldg.	700	0					40,600	23½		8—16 in. 20—5·5 in.	13 in.
GERMANY:													
"Nassau"	4	1908	478	0	88	4	26	7	18,600	19	20,000	12—11 in. 12—5·9 in. 6—17·7 in. T. T.	11·4 in.
"Ostfriesland"	4	1909–10	546	3	93	6	26	11	22,440	20·5	25,000	12—12 in. 14—5·9 in. 6—19·7 in. T. T.	11·8 in.
"Kaiser"	5	1911–2	564	4	95	2	27	3	24,310	21	28,000	10—12 in. 14—5·9 in. 5—19·7 in. T. T.	13·8 in.
"König"	4	1913–4	573	2	96	9	27	4	25,390	21	28,000	10—12 in. 14—5·9 in. 5—19·7 in. T. T.	13·8 in.
"Baden"	4	1915	588	7	98	5	27	8	28,070	21	50,000	8—15 in. 16—5·9 in. 3—23·6 in. T. T.	13·8 in.
ITALY:													
"Dante Alighieri"	1	1910	549	6	87	6	28	6	19,200	23	26,000	12—12 in. 20—4·7 in. 3—18 in. T. T.	10 in.
"Giulio Cesare"	3	1911	576	0	92	0	29	0	22,000	22	24,000	13—12 in. 18—4·7 in. 3—18 in. T. T.	10 in.
"Caio Duilio"	2	1913	576	0	92	0	29	0	22,600	22	25,000	ditto	10 in.
"Caracciolo"	4	laid down. 1914–5 not completed.	691	0	97	0	29	0	30,900	25	70,000	8—15 in. 16—6 in.	13 in.
RUSSIA:													
"Petropavlosk"	4	1911	590	0	87	0	27	3	23,000	23	42,000	12—12 in. 16—4·7 in. 4—18 in. T. T.	9 in.
"Imperator Alexander III."	3	1913–4	550	0	89	6	29	0	22,600	21	23,000	12—12 in. 20—5·1 in. 4—18 in. T. T.	12 in.
AUSTRIA:													
"Viribus Unitis"	4	1911–4	530	0	89	3	27	0	20,000	20	25,000	12—12 in. 12—5·9 in. 4—21 in. T. T.	11 in.
ARGENTINA:													
"Moreno"	2	1911	585	0	95	0	28	0	27,600	22½	39,500	12—12 in. 12—6 in. 2—21 in. T. T.	12 in.
BRAZIL:													
"Minas Geraes"	2	1908–9	543	0	83	0	25	0	19,200	21	23,500	12—12 in. 22—4·7 in.	9 in.
CHILE:													
"Almirante Latorre"	1	1913	661	0	92	0	28	6	28,000	22¾	37,000	10—14 in. 16—6 in. 4—21 in. T. T.	9 in.
SPAIN:													
"Alfonso XIII."	3	1912–4	459	0	78	9	25	6	15,500	19½	15,000	8—12 in. 20—4 in.	9 in.
SWEDEN:													
"Sverige"	3	1914	397	0	61	0	21	6	7,000	22	22,000	4—11 in. 8—6 in. 2—18 in. T. T.	8 in.

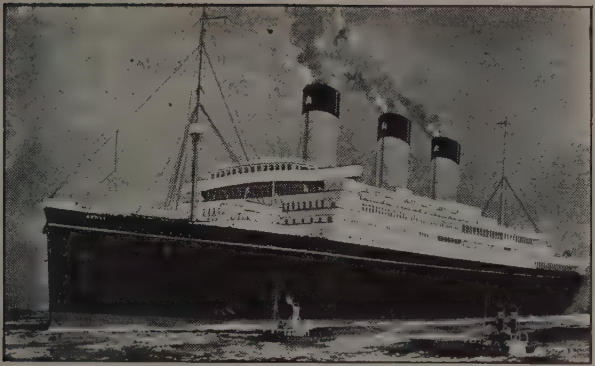

FIG. 45.—White Star (ex-German) Liner *Majestic*.

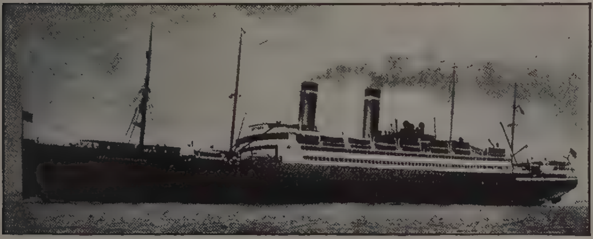

FIG. 48.—U.S. (ex-German) Liner *George Washington*.

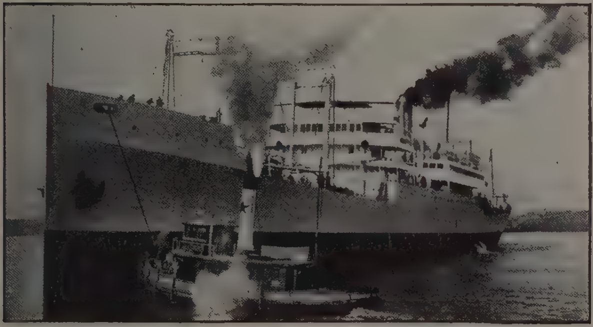

FIG. 49.—American Liner *Centennial State*.

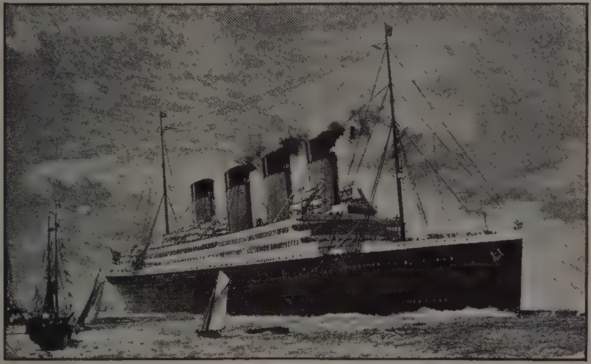

FIG. 46.—White Star Liner *Britannic*.

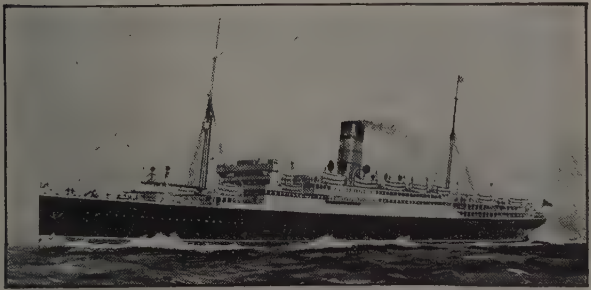

FIG. 47.—Cunard Liner *Samaria*.

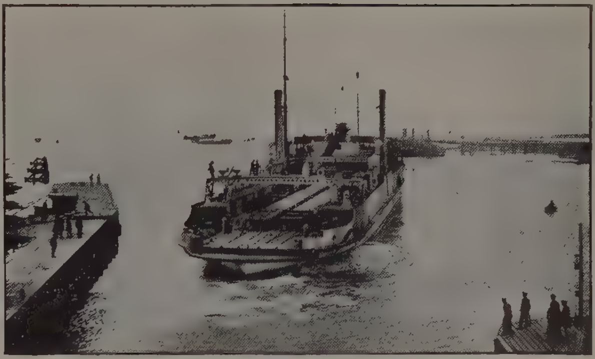

FIG. 51.—Richborough Train Ferry (Kent, England).

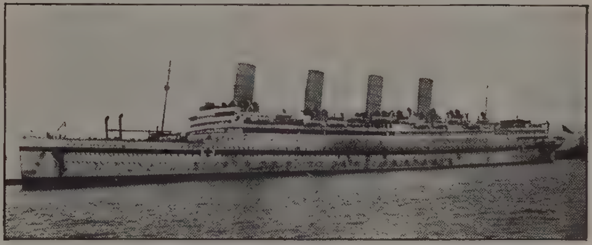

FIG. 52.—Cunard Liner *Aquitania* (as Hospital Ship).

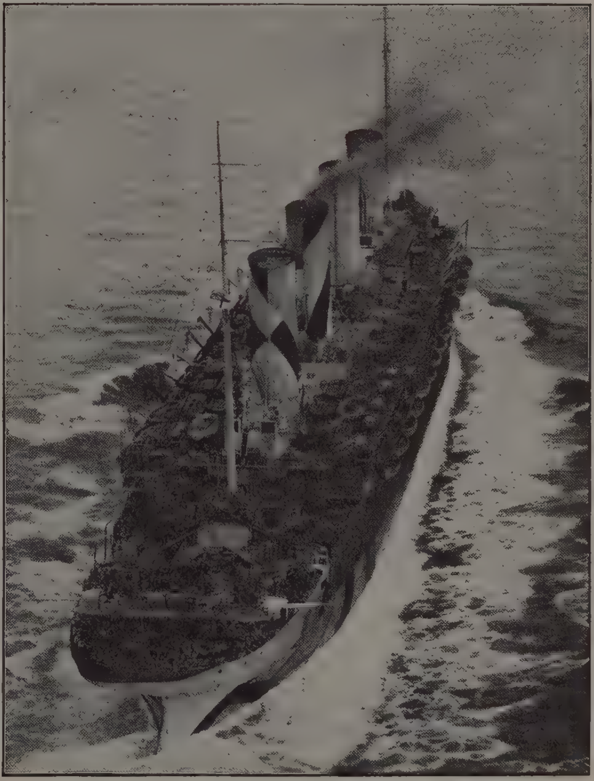

FIG. 53.—White Star Liner *Olympic* (as Troopship).

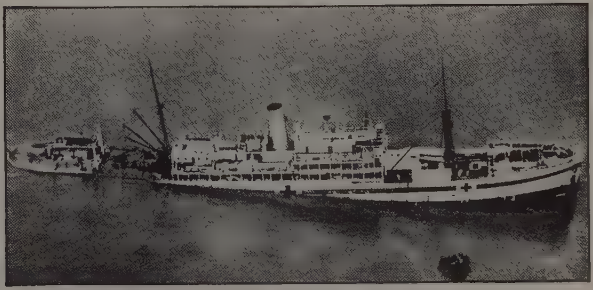

FIG. 54.—Castle Liner *Llandovery Castle* (sinking).

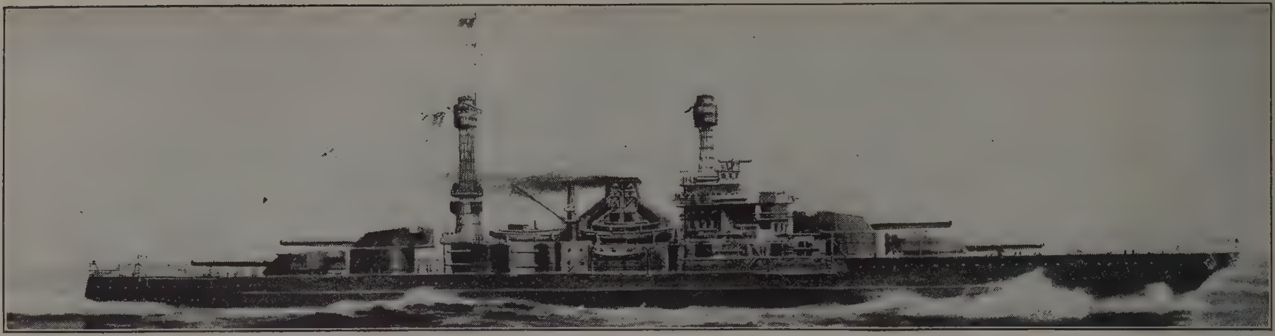

FIG. 32a.—U.S. Battleship *North Carolina* Class.

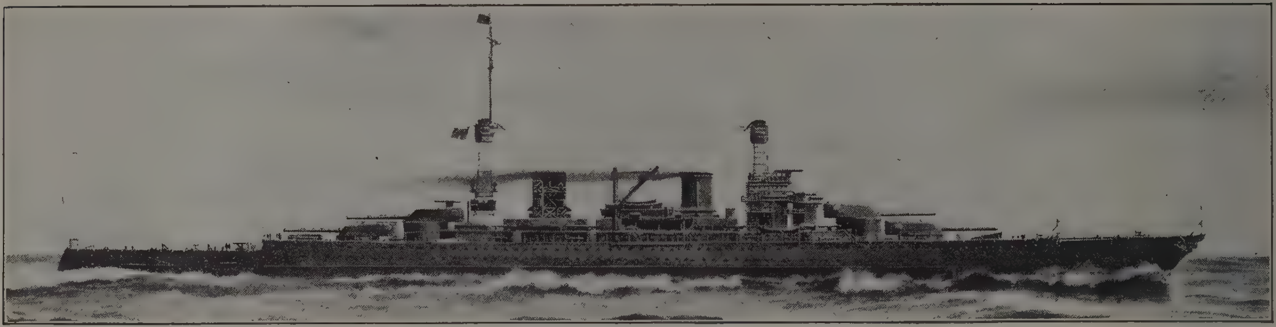

FIG. 39a.—U.S. Battle-Cruiser *Lexington* and Class.

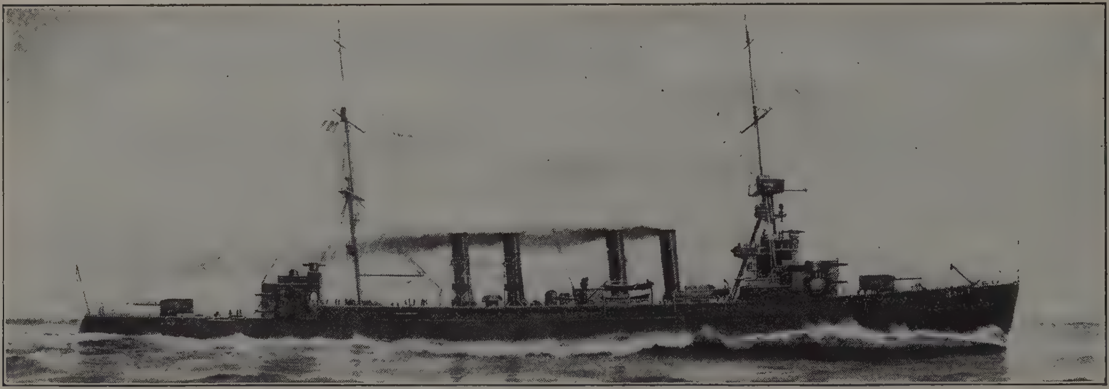

FIG. 42a.—U.S. Scout Cruisers *Nos. 4–13*.

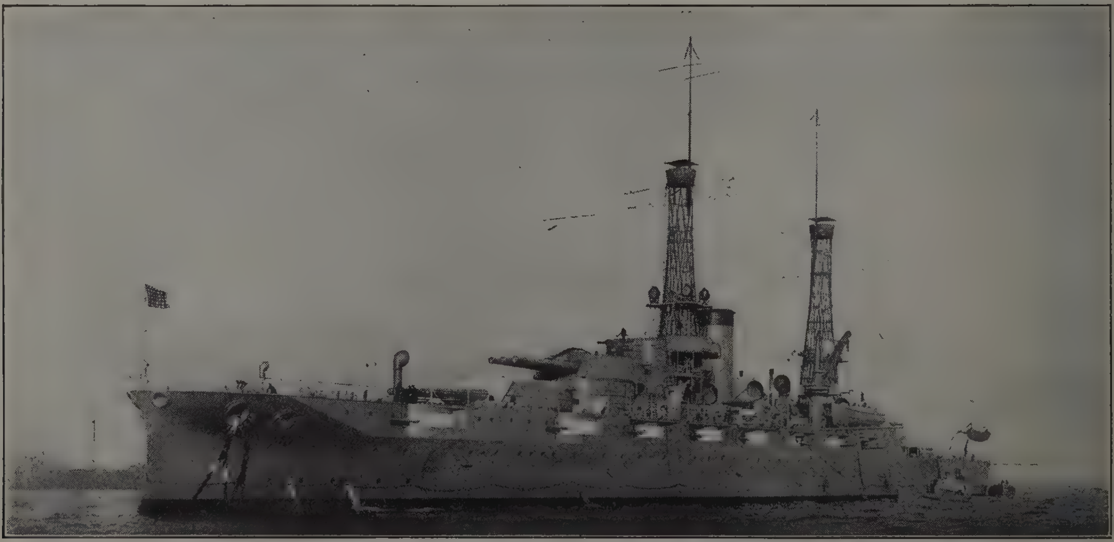

FIG. 31a.—U.S. Battleship *Pennsylvania*.

armament is very large for a U.S. vessel, consisting as it does of four submerged and four above-water 21-in. torpedo tubes. None of the vessels had yet been launched in 1921.

Russia.—Four battle cruisers were launched in 1915, but they had not been completed up to 1921. On a displacement of 32,200 tons, with a length of 750 ft., 12 14-in. and 24 5-in. guns and 6 torpedo tubes were to have been carried, turbine engines of 66,000 H.P. being estimated to give a speed of 27 knots. The side armour had a maximum thickness of 12 inches.

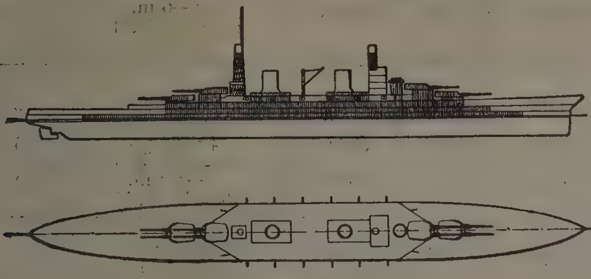
FIG. 39.

Japan.—The "Tsukuba" and "Ikoma" were laid down in 1905 and the "Kurama" and "Ibuki" in 1907. These vessels are classed as battle cruisers, but they lacked the high speed considered an essential feature of the battle-cruiser type. The "Tsukuba" was blown up in a Japanese harbour in 1917. The next battle cruisers built by Japan were the four vessels of the "Kongo" class, launched in 1912–3, the name ship being constructed by Vickers at Barrow, and her sisters in Japan. These vessels resemble the "Lion" class, having an armament of 8 14-in. and 16 6-in. guns on a displacement of 27,500 tons, a speed of 27 knots being obtained with turbines developing 64,000 horse-power. The vessels are well protected by 10-in. (maximum) armour, and they carry a powerful torpedo armament of 8 submerged 21-in. torpedo tubes. Four battle cruisers of the "Amagi" class were in 1921 under construction. They were reported to be vessels of 40,000 tons displacement and 30 knots speed, with a main armament of 8 16-in. guns.

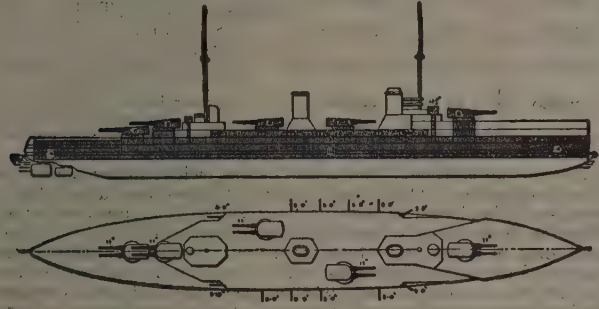
FIG. 40.

Germany.—As with the "Dreadnought" type of battleship, the Germans followed the British in their battle cruisers. The first vessel of the type, "Von der Tann," was launched in 1909. On a displacement of 19,100 tons she carried 8 11-in. and 12 5·9-in. guns. The armour belt was of 10-in. (maximum) thickness and her designed speed was 24 knots, the turbine engines developing about 45,000 horse-power. This speed and H.P. were exceeded on trials. The "Moltke" (1910), "Goeben" (1911), of 22,600 tons and 25 knots, and "Seydlitz" (1912), of 24,600 tons and 26½ knots (fig. 40) were generally improvements on the "Von der Tann." The main armament consisted of 10 11-in. guns arranged as in the British "Neptune" (of two years earlier design), as compared with 8 13·5-in. guns in contemporary British battle cruisers. The "Goeben" was transferred to Turkey early in the war, having been in the Mediterranean when the war broke out. Return to Germany being impossible, she escaped to Constantinople. The "Seydlitz" was badly damaged at the battles of Dogger Bank (1915) and Jutland (1916). Her return to harbour after the latter was only effected with great difficulty, and probably only the close proximity of the German coast enabled her to reach port in time. The "Derfflinger" (1913) and "Lützow" (1913) were the first German battle cruisers to mount 12-in. guns, of which they carried eight on a displacement of 26,200 tons. The speed was 26½ knots and maximum armour 12 in. thick. The "Lützow" was sunk at the battle of Jutland. The "Hindenburg" (fig. 41), launched in 1915 and completed in 1917, and "Mackensen," launched in 1917 but not completed, were virtually repeats of the "Lützow," with the same armament, but improved speed of 28 knots. The "Graf von Spee," also launched in 1917 but not completed, was of 27,000 tons, with six 15-in. guns as the main armament. A sister vessel, "Prinz Eitel Friedrich," had not been launched at the Armistice. The last three vessels were dismantled, as well as other battle cruisers whose construction had not been far advanced.

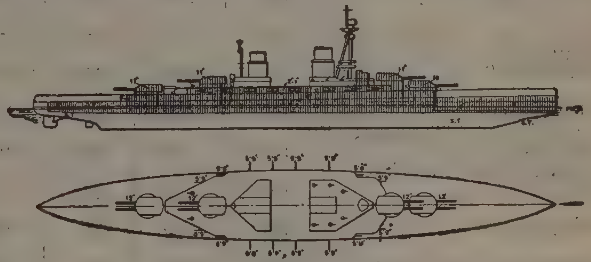
FIG. 41.

Light Cruisers

The light cruiser type of warship has in recent years been constructed by very few nations (see Table VIII.). The *United States*

TABLE VII.—*Battle Cruisers of Non-British Navies.*

Country and Class	No. in Class	Date of Launch	Length	Breadth	Draught	Displacement: Tons	Speed Knots	Horse-Power	Armament	Side Armour
UNITED STATES:			ft. in.	ft. in.	ft. in.					in.
"Lexington"	6	Bldg.	874 0	105 6	31	43,500	33¼	180,000	8—16 in. 16—6 in. 4—21 in. T. T.	8
RUSSIA:										
"Navarin"	4	1915 Not completed.	750 0	100 0	30	32,200	27	66,000	12—14 in. 24—5 in. 6—18 in. T. T	12
JAPAN:										
"Kongo"	4	1913	653 6	92 0	27½	27,500	27½	64,000	8—14 in. 16—6 in. 8—21 in. T. T.	8
"Amagi"	4	Bldg.	850 0	100 0		40,000	30		8—16 in.	
GERMANY:										
"Blücher"	1	1908	528 6	80 5	26¼	15,500	24	32,000	12—8·2 in. 8—5·9 in. 4—17·7 in. T. T.	7
"Von der Tann"	1	1909	562 8	87 3	26 7	19,100	24	43,600	8—11 in. 10—5·9 in. 4—17·7 in. T. T.	9·8
"Moltke"	2	1910–1	610 3	96 10	26 11	22,640	25	52,000	10—11 in. 12—5·9 in. 4—19·7 in. T. T.	11
"Seydlitz"	1	1912	656 2	93 6	27	24,610	26½	63,000	ditto.	11·8
"Derfflinger"	2	1913	689 0	95 2	27¼	26,180	26½	63,000	8—12 in. 12—5·9 in. 4—19·7 in. T. T.	12
"Hindenburg"	2	1915–7	697 0	96 3	27½	26,640	28	85,000	8—12 in. 12—5·9 in. 6—19·7 in. T. T.	12

TABLE VIII.—*Light Cruisers of Non-British Navies.*

Country	Date of Launch	Length Ft.	Breadth Ft.	Draught Ft.	Displacement Tons	Speed Knots	Horse-Power	Armament	Side Armour In.
UNITED STATES:									
"Omaha" 10	1920 and bldg.	555½	55	14¼	7,500	33¾	90,000	12—6 in. 4—21 in. T. T.	
JAPAN:									
"Yahagi" 3	1911	475	46½	16½	4,950	26	22,500	8—6 in. 3—18 in. T .T.	3
"Tatsuta" 2	1918	440	41	13	3,500	31	51,000	4—5·5 in. 6—21 in. T. T.	3
"Tama" 20	1919	500	46¾	15¾	5,500	33	90,000	7—5·5 in. 8·21 in. T. T.	3
ITALY:									
"Basilicata" 2	1914	272	42	16½	2,450	16½	5,000	6—6 in. 2— T. T.	
GERMANY:									
"Stralsund"	1912	446	43½	16	4,480	27	24,000	7—5·9 in. 2—17·7 in. T. T.	
"Regensburg" . . . . (now French "Strasbourg")	1914	456	45	17	4,850	27½	26,000	7—5·9 in. 2—19·7 in. T. T.	
"Königsberg" . . . (now French "Metz")	1915	450	43½	16	4,200	28½	45,000	7—5·9 in. 4—19·7 in. T. T.	
"Frankfurt"	1915	465	45½	17	5,120	28	45,000	8—5·9 in. 2—19·7 in. T. T.	
"Brummer"	1915	430	41	15½	4,000	30	46,000	4—5·9 in. 300 mines 4—19·7 T. T.	
"Cöln"	1918	489	47	16½	5,600	27½	29,000	8—5·9 in. 4—23·6 in. T. T.	
RUSSIA:									
Admiral class	1915	535	51	18	7,600	30	55,000	15—5 in. 2—18 in. T. T.	

did not construct any after the completion of the "Salem" class in 1908 until after the World War, when the construction of 16 light cruisers of the "Omaha" class (fig. 42) was commenced. These vessels were designed in 1916 and their construction authorized by the Act of Congress of 1917. The chief characteristics of these vessels, which are classed as "Scouts" by the U.S. navy, are an over-all length of 555½ ft., a displacement of 7,100 tons, S.H.P. of turbine engines 90,000, giving an estimated speed of 35 knots. The armament at first consisted of eight 6-in. guns arranged in double-storied batteries of four guns each, forward and aft, but recently this armament has been augmented by the addition of a twin 6-in. gun turret on the centre line forward and aft. The torpedo armament is to consist of two 21-in. above-water torpedo tubes. Protection, consisting of 3-in. total, is provided amidships to the machinery compartments. With the exception of some protection to the steering gear, the side protection does not appear to be so extensive as that provided for British light cruisers. Oil fuel only is burnt in the boilers of these vessels, the machinery arrangement of which is of considerable interest. The turbine engines drive four propellers, the engines for the outer shafts being accommodated in an engine-room situated between two groups of boiler-rooms, the engines for the inner shafts being in another engine-room abaft the second group of boilers. The turbines are geared, the reduction gears being of the Westinghouse floating-frame type. Cruising turbines are fitted to obtain economy at cruising speeds.

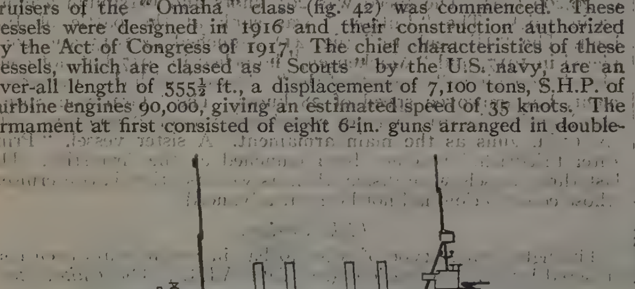

FIG. 42.

Japan.—Three light cruisers were completed for Japan in 1912. These vessels, of about 5,000 tons displacement, 26 knots and carrying eight 6-in. guns, are very similar to their British contemporaries of the "Newcastle" class. No other light cruisers were built by Japan until the "Tatsuta" and "Tenryu" were laid down in 1917 and completed in 1919. These vessels are in general characteristics similar to the British "Arethusa" class, with higher speed and reduced armament. On a displacement of 3,500 tons, a speed of 31 knots is obtained with 51,000 H.P. and four 5·5-in. guns are carried. Following these vessels were eight light cruisers of the "Tama" class, some of which have been launched. Twelve additional light cruisers of the 1920 programme will follow. It is understood that these 20 vessels are generally of the same class and are a considerable improvement upon the "Tatsuta." On a displacement of 5,500 tons, seven 5·5-in. guns will be carried and engines of 90,000 H.P. will be fitted to give a designed speed of 36 knots.

Germany.—The German naval programme provided for a small number of light cruisers to be built each year. The four vessels of the "Cöln" class, completed in 1910 and 1911, were of 4,280 tons, 25½ knots and carried 12 4·1-in. guns. They were an advance in size and speed on their predecessors. In 1912 and 1913 six vessels of slightly greater displacement and speed than the "Cöln," but with the same armament, were completed. The next 14 vessels, completed 1914–5, were of 5,000 tons, 27 knots, 30,000 H.P., and had an improved armament of 2 5·9-in. and 10 4·1-in. guns. During the World War a number of light cruisers were built, the chief characteristics of which were their improved armaments, 6, 7, and 8 5·9-in. guns being carried. Some of the earlier cruisers were rearmed with 5·9-in. guns in lieu of 4·1-in. guns originally fitted. The "Brummer" and "Bremse," two of the surrendered vessels, were interesting ships. They were mine-laying cruisers of 4,000 tons, and, with turbine engines of 46,000 H.P., were generally credited with a speed of 34 knots, but this was at least 4 knots higher than the actual speed. They were arranged to carry about 300 mines. One of the chief differences between British and German light cruisers lay in the

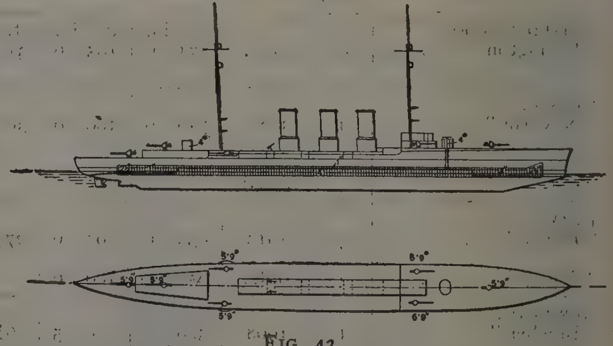

FIG. 43.

protection. British vessels, after the "Weymouth" class, were protected by side plating of 3-in. total thickness, the German vessels having less or no side protection, but with decks of 1-in, or 2-in. thickness. A number of light cruisers were under construction at the Armistice. The "Cöln" is typical of them. On a waterline length of 489 ft. and displacement of 5,600 tons, she was to have carried 8 5·9-in. guns (five of which could be fired on the broadside), 3 3½-in. H.A. guns and 4 revolving 23·6-in. torpedo tubes. Turbine engines of 29,000 S.H.P. were to have been provided for a speed of 27½ knots. The protection consisted of about 2¼-in. side and ¾-in. deck.

Four of the German light cruisers were incorporated, with new names, in the French navy, and three in the Italian navy.

Austria.—In 1910 the light cruiser "Admiral Spaun" was completed and in 1914 three similar but slightly improved vessels. These were of 3,500 tons, 27 knots, and mounted 9 3·9-in. guns. Two of these vessels were taken into the Italian navy, and one into the French navy, all with new names.

Italy.—Six small light cruisers were completed between 1912 and 1916. The most interesting were the "Quarto" class (three vessels), of 3,400 tons and 28 knots, carrying 6 4·7-in. and 6 3-in. guns (see fig. 43).

Russia.—At the outbreak of the World War two small light cruisers, which were taken over by Germany, were under construction in German yards. One is now in the French navy, and the other was lost at Jutland. Eight light cruisers of a larger and more powerful type were under construction in Russia, but were not completed. They were designed to be 520 ft. long, of 7,600 tons displacement, armed with 15 5-in. guns, and, with turbines of 55,000 H.P. a speed of 30 knots was expected.

Holland.—Two light cruisers of 7,000 tons and 30 knots, with 10 5·9-in. guns, were under construction for a long time, but had not yet been completed in 1921.

Spain.—A light cruiser of 5,600 tons, generally similar to the British "Birmingham," was being completed in 1921, and others of this class were projected.

France.—Six light cruisers of 5,000 tons, 30 knots speed and 8 5·5-in. guns, were projected in the 1920 programme.

Torpedo-Boats and Submarines

Specifications of the torpedo-boats and flotilla leaders and submarines of foreign navies are given in Tables IX. and X., and the reader is referred to the *Transactions of the Institute of Naval Architects*, 1920, for further information.

(3) MERCHANT SHIPS

The ordinary course of mercantile shipbuilding development, which continued from 1910 until the autumn of 1914, was abruptly checked by the World War. As the result, merchant shipbuilding was practically stopped in France, Germany, Italy and Austria, and it was very much reduced in the United Kingdom owing to men joining the colours. At the same time a great fillip was given to shipbuilding in the United States and neutral countries. In England many of the best ships building were requisitioned and fitted out for war services, or for auxiliary services with the fleet. Large numbers of vessels were also withdrawn from the mercantile fleet for similar purposes, and this, together with the great losses due to submarines, very quickly created great demands for new ships. Shipbuilding resources were developed with great rapidity all over the world, leading up to: (1) a vastly increased output; (2) new types of vessels which could be constructed quickly; (3) development of new methods of construction. At the same time a vast increase took place in the plant of all kinds for the manufacture of armament, etc. The services rendered by the mercantile marine during the war were invaluable (*see* SHIPPING), while, broadly speaking, the ships themselves stood the brunt of war with very remarkable success. In some cases, however, large passenger ships were quickly sunk because of the existence of passages, or doors in bulkheads, which permitted the sea to find access to compartments other than those directly damaged, thus leading to the foundering of the vessels. This caused renewed attention to be given in all maritime countries to matters of life-saving and subdivision.

Many very notable vessels were lost. Some of the best known are shown in Table XI. Among these losses, the "Britannic" and "Justicia" (formerly "Statendam") were the largest vessels building in the United Kingdom in 1914.

After the war the German ships which had been seized or interned were distributed among the Allies. Germany also had to surrender all ships above 1,600 tons afloat or on the stocks, many smaller ones, floating docks, cranes, and other craft, amounting to about 3,000,000 tons. These were divided chiefly between Britain and the United States, with smaller shares to France and Japan. She also had to undertake to build 1,000,000 tons for the Allies if required, but this was not enforced. Table 12 gives the names of some of the most noteworthy vessels thus distributed.

TABLE IX.—*Torpedo-Boats and Flotilla Leaders.*

Navy	Date of Launch	Length Ft.	Displacement Tons	Horse-Power	Speed Knots	Armament
Chile	1912	320	1,800	30,000	31	2—4·7 in. 2—4 in. 4—21 in. T. T.
France	1914	269	880	17,000	30	2—3·9 in. 4—18 in. T. T.
	1917	272	675	10,000	29	1—4·7 in. 4—3 in. 4—18 in. T. T.
Italy	1913	238	770	18,000	33	4—4 in. 4—18 in. T. T.
Japan	1916	336	1,300	28,000	34	3—4·7 in. 6—21 in. T. T.
United States	1917	314	1,200	27,000	35	4—4 in. 12 T. T.
Germany	1914	322	1,350	40,000	37	4—4·1 in. 24 mines 6—19·7 in. T. T.
	1917	280	1,000	24,000	33	3—4·1 in. 6—19·7 in. T. T.
	1917	200	350	6,000	26	2—3·4 in. 1—17·7 in. T. T.
	1918	360	2,400	54,000	35	4—5·9 in. 4—23·6 in. T. T.
Russia	1917	315	1,260	30,000	35	4—4 in. 9—18 in. T. T.
Austria	1912	266	787	17,000	33	2—4 in. 4—3 in. 2 T. T.
Italy	1916	310	1,460	40,000	35	5—4·7 4—21 in. T. T.

Table XII. includes a number of very fine vessels which Germany was building in 1914 to compete with the "Aquitania," "Olympic," and such types of British ships, in order to gain a still larger proportion of the Atlantic trade. Amongst them were the largest vessels afloat in 1921. In certain cases German companies were afterwards enabled to repurchase from the Allies some of the surrendered ships, which then reverted to German ownership. Austria had to surrender all her shipping, about 1¼ million tons. This was handed over to Italy, with the exception of about 70,000 tons for France.

Statistics.—The world's output had reached a maximum of 3,330,000 tons in 1913, and was falling again in 1914. The tonnage launched in the United Kingdom reached the record total of approximately 2,000,000 tons in 1913, and in 1914 it had decreased by over 10 per cent. Great efforts had been made in France, Germany, Holland, Japan and Norway, and the totals in these countries showed distinctly upward tendencies. In the United States very great fluctuations occurred; the output on the coast had fallen to 95,000 tons, and on the Great Lakes to 75,000 tons in 1911, while in 1913 228,000 tons were launched on the coast and only 48,000 tons on the Lakes.

Table XIII. shows the tonnage of ships launched in various countries from 1910–20. The diagram Fig. 44 has been prepared on the basis of these figures. The striking results obtained in the British colonies and Japan will be noted, and the overwhelming influence of U.S. shipbuilding. Many of the American yards which were specially constructed for war purposes were in 1921 being closed,

TABLE X.—*Submarines of Non-British Navies.*

Navy	Date of Launch	Length Ft.	Displacement: Tons		Horse-Power		Speed; Knots		Armament
			Surface	Submerged	Surface	Submerged	Surface	Sub-merged	
BRAZIL	1913	150	250	370	800		14	8½	2—18 in. T. T.
CHILE	1915	150	350	470	480	640	13	11	4—18 in. T. T.
FRANCE	1916	173	410	560	1,300	900	13½	8	1—3 in. 8—18 in. T. T.
	1917	243	850	1,180	2,900	1,650	17	10½	2—3 in. 8—18 in. T. T.
ITALY	1915	207	700	1,000	2,600	1,300	18	10	2—14 V'dr. 6—18 in. T. T.
JAPAN	1917	215	700	1,070	2,600	1,300	18	10	1—3 in. 6—18 in. T. T.
UNITED STATES	1918	186	570	680	880	900	13½	10½	1—3 in. 4—21 in. T. T.
	1918	264	1,100	1,500	4,000	1,500	20	11½	2—3 in. 8—21 in. T. T.
GERMANY Class:—	1914–8								
U86	"	230	800	940	2,400	1,180	16½	8	1—4·1 in. 1—3·5 in. or 2—4·1 in. 4 T. T.
U142	"	320	2,160	2,760	6,000	2,600	18	8	2—5·9 in. 6 T. T.
UB1	"	92	128	143	60	120	6½	5½	1 machine gun. 2 T. T.
UB48	"	181	521	657	1,100	760	13½	7½	1—4·1 in. 5 T. T.
UC1	"	111	170	185	90	138	6½	5	1 machine gun. 12 mines.
UC90	"	184	496	575	650	600	12	6½	1—4·1 in. 14 mines. 3 T. T.
UE71	"	186	762	846	900	800	10½	8	1—3·5 in. 36 mines. 2 T. T.
UE117	"	267	1,170	1,515	2,400	1,150	15	7½	1—5·9 in. or 2—4·1 in. 42 mines. 4 T. T.
Deutschland (U152) .	"	214	1,525	1,885	800	800	10	5½	2—5·9 in. 2 T. T.

TABLE XI.—*Merchant-ships lost in the War.*

Name	Tonnage (Gross)	Country	Name	Tonnage (Gross)	Country
"Alcantara"	15,831	U.K.	"Koningen Emma" . . .	9,181	Dutch
"Andania"	13,405	"	"Laconia"	18,099	U.K.
"Arabic"	15,801	"	"La Provence"	13,753	French
"Aurania"	13,936	"	"Laurentic"	14,892	U.K.
"Avenger" (ex. "Aotearoa")	13,441	"	"Llandovery Castle" . .	11,493	"
"Ballarat"	11,120	"	"Lusitania"	30,096	"
"Britannic"	48,158	"	"Medina"	12,350	"
"Bonheur"	7,132	Norway	"Minnehaha"	13,714	"
"Calgarian"	17,515	U.K.	"O. B. Jennings" . . .	10,290	U.S.A.
"Cameronia"	10,963	"	"Oceanic"	17,274	U.K.
"Campania"	12,884	"	"Otaki"	9,575	"
"Cap Trafalgar" . . .	18,710	German	"President Lincoln" . . .	18,168	U.S.A.
"City of Adelaide" . . .	8,389	U.K.	"Principe Umberto" . . .	7,929	Italian
"City of Paris" . . .	9,239	"	"Rotorua"	11,140	U.K.
"Covington"	16,339	U.S.A.	"Royal Edward" . . .	11,117	"
"Franconia"	18,150	U.K.	"San Hilario"	10,157	"
"Gallia"	14,966	French	"Transylvania"	14,315	"
"Glenart Castle" . . .	6,824	U.K.	"Troilus"	7,562	"
"Hirano Maru" . . .	7,936	Japan	"Tubantia"	13,911	Dutch
"Ivernia"	14,278	U.K.	"Tuscania"	14,348	U.K.
"Justicia"	32,234	"	"Volturno"	11,496	Italian
"Kaiser Wilhelm der Grosse"	13,952	German	"Yasaka Maru" . . .	10,932	Japan

while others were falling back rapidly to pre-war conditions (*see* SHIPPING: *United States*).

In the United Kingdom, from the middle of 1915, a committee of the Board of Trade, in conjunction with the Transport Department of the Admiralty, assumed control of the British mercantile marine, including shipbuilding. A Merchant Shipbuilding Advisory Committee was formed, with Sir George Carter as chairman. In Dec. 1916 the Ministry of Shipping was set up, under Sir Joseph Maclay. The Shipbuilding Advisory Committee was enlarged, and on its advice steps were taken to standardize the types of merchant ships to be built, and to simplify the details of construction both of hull and machinery to secure the greatest and quickest output possible. Five types of "standard ships" were designed, varying from 3,000 to 8,000 tons deadweight, and between Dec. 1916 and April 1917 considerable numbers of these vessels were ordered. In order to harmonize the work of shipbuilding for the Admiralty and the mercantile marine, the whole was placed under one authority, Sir Eric Geddes, in June 1917, when he assumed office as controller of the Navy. Arrangements were made for setting up new shipyards with a view to producing "fabricated" ships, which could be put together with very much reduced amounts of skilled labour; but the results were disappointing, and at the end of 1918 the output in the United Kingdom was still only at the rate of 1,500,000 tons per annum. In March 1918 Lord Pirrie was appointed controller-general of

TABLE XII.—*Ownership of Some Notable ex-German Ships.*

Old Name	Gross Tons	New Name	New Owners
"Amerika"	22,622	"America"	U.S. Government.
"Barbarossa"	10,984	"Mercury"	U.S. Government.
"Batavia"	11,464	"Batavia"	French Government.
"Berlin"	17,324	"Arabic"	White Star Line.
"Bismarck"	56,000	"Majestic"	White Star Line.
"Blücher"	12,350	"Leopoldina"	Brazilian Government.
"Bremen"	11,540	"Bremen"	Shipping Controller (P. & O. S. Nav. Co.)
"Bulgaria"	11,440	"Philippines"	U.S. Shipping Board.
"Cap Arcona"	9,832	"Cap Arcona"	U.S. Shipping Board.
"Cap Finisterre"	14,503	"Cap Finisterre"	Japanese Government.
"Cap Ortegal"	7,818	"Cap Ortegal"	French Government.
"Cap Polonio"	20,597	"Cap Polonio"	P. & O. Steam Nav. Co.
"Cleveland"	15,746	"King Alexander" (ex "Mobile")	Byron S. S. Co. Ltd.
"Columbus"	35,000	"Homeric"	White Star Line.
"Friedrich der Grosse"	10,688	"Huron"	U.S. Shipping Board.
"Fritz"	3,083	"Assyrian"	Ellerman Line.
"George Washington"	25,570	"George Washington"	U.S. Shipping Board.
"Graf Waldersee"	13,193	"Graf Waldersee"	Shipping Controller (P. & O. S. Nav. Co.)
"Grosser Kurfürst"	12,642	"Aeolus"	U.S. Shipping Board.
"Imperator"	52,022	"Berengaria"	Cunard S. S. Co.
"Johann Heinrich Burchard"	19,980	"Limburgia"	(Koninklyke Hollandsche Lloyd).
"Kaiserin Auguste Victoria"	24,581	"Empress of Scotland"	Canadian Pacific.
"Kaiser Wilhelm II."	19,361	"Agamemnon"	U.S. (Navy Dept.).
"Kigoma"	8,156	"Algeria"	Anchor Line.
"Cöln"	7,409	"Amphion"	U.S. Shipping Board.
"König Albert"	10,643	"Ferdinando Palasciano"	Italian Government.
"Königin Luise"	11,103	"Omar"	Orient S. N. Co.
"König Wilhelm II."	9,410	"Madawaska"	U.S. Government.
"Kronprinzessin Cecilie"	18,372	"Mount Vernon"	U.S. Shipping Board.
"Kronprinz Wilhelm"	14,901	"Von Steuben"	U.S. Government.
"Main"	10,186	"Main"	French Government.
"Moltke"	12,335	"Pesaro"	Italian Government.
"Neckar"	9,709	"Potomac" (ex "Antigone")	U.S. Shipping Board.
"Patricia"	14,466	"Patricia"	Shipping Controller (Ellerman Line).
"Pennsylvania"	13,333	"Nansemond"	U.S. Shipping Board.
"President Grant"	18,072	"President Grant"	U.S. (War Dept.).
"Pretoria"	13,234	"Pretoria"	Shipping Controller (Ellerman Line).
"Princess Alice"	10,421	"Princess Matoika"	U.S. (War Dept.).
"Prinz Eitel Friedrich"	8,170	"Mount Clay" (ex "De Kalb")	American S. & C. Nav. Corp.
"Prinz Friedrich Wilhelm"	17,099	"Empress of China"	Canadian Pacific Ocean Services, Ltd.
"Prinzess Irene"	10,352	"Pocahontas"	U.S. Shipping Board.
"Rhein"	9,959	"Susquehanna"	U.S. Shipping Board.
"Tirpitz"	19,300	"Empress of India"	C.P.O. Services Ltd.
"Vaterland"	54,282	"Leviathan"	U.S. Government.
"Wm. Oswald"	20,200	"Brabantia"	Kon. Holl. Lloyd.
"Wittekind"	5,640	"Freedom" (ex "Iroquois")	U.S. Shipping Board.
"Ypiranga"	8,103	"Assyria"	Anchor Line.
"Zeppelin"	14,167	"Ormuz"	Orient S. Nav. Co.

TABLE XIII.—*Tonnage Launched in 1910–20* (in thousands of tons).

Year	U.K.	Brit. Dom.	U.S.	Japan	France	Germany	Holland	Other Countries	Total
1910	1,143	26	331	30	81	159	71	116	1,957
1911	1,804	20	172	44	125	256	93	137	2,651
1912	1,737	35	284	58	111	375	99	201	2.900
1913	1,932	48	276	65	176	465	104	266	3,332
1914	1,684	47	201	86	114	387	118	216	*2,853
1915	651	22	177	49	25	(No returns)	113	163	*1,200
1916	608	32	504	146	43	do.	180	175	*1,688
1917	1,163	94	998	350	19	do.	149	165	*2,938
1918	1,348	280	3,033	490	14	do.	74	209	*5,448
1919	1,620	359	4,075	612	33	do.	137	308	*7,144
1920	2,056	204	2,476	457	93	do.	183	393	*5,862

*Returns not complete.

merchant shipbuilding and given extraordinary powers. The new shipyards were pushed on during 1918, but had scarcely come into active production when the Armistice was signed.

TABLE XIV.—*Gross Tonnage of Shipping owned in 1910–21* (in millions of tons).

Country	1910	1914	1919	1920	1921
United Kingdom and Colonies	19·0	21·0	18·6	20·6	22·1
United States	5·1	5·4	13·1	16·0	17·0
Germany	4·3	5·5	3·5	0·7	0·7
France	1·9	2·3	2·2	3·2	3·7
Japan	1·1	1·7	2·3	3·0	3·4
Norway	2·0	2·5	1·9	2·2	2·6
Denmark	0·7	0·8	0·7	0·8	1·0
Sweden	·9	1·1	1·0	1·1	1·2
Italy	1·3	1·7	1·4	2·2	2·6
Holland	1·0	1·5	1·6	1·8	2·2
All other Countries	4·5	5·6	4·6	5·6	5·5
Total, World's Shipping	41·8	49·1	50·9	57·2	62·0

Largely as a result of the efforts of the United States, by the end of 1918 ships were being built at the rate of 7,000,000 tons per annum, against the pre-war record of 3,330,000 tons per annum. In June 1920 the steam tonnage of the world amounted to about 54,000,000 tons, notwithstanding the losses of the war. The total losses had amounted to about 9,000,000 tons of British ships and 6,000,000 tons others, making a total of 15,000,000 tons. Of the total, 2,000,000 tons were due to ordinary marine risks.

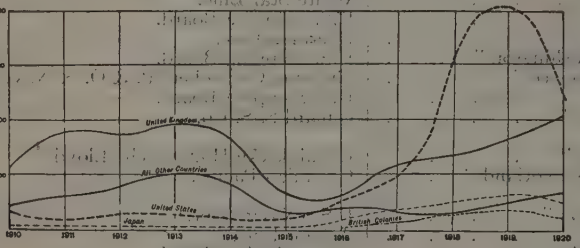

FIG. 44.

Motor-Ships.—The period 1910–21 saw immense changes in the means of propulsion. In 1911 the "Selandia" and "Jutlandia" were launched, and a number of other vessels were being built, in which internal-combustion engines of a more or less experimental character were being fitted. *Lloyd's Register* reports that by 1914 there were 290 motor-ships of 234,000 tons gross, while in 1921 there were no fewer than 1,447 ships of 1,263,000 tons gross, so that in 1921 there were nearly five times as many motor-ships in existence as there were in 1914, and the tonnage of these ships was nearly six times as great. In these seven years motor-vessels increased from ·47 to 2·1 per cent of the world's tonnage.

Dr. Diesel's master patents expired in 1909 and 1910, and since then many successful types of internal-combustion engines have been established in Europe and in America (*see* INTERNAL-COMBUSTION ENGINES), and the proportion of motor to steam vessels building rapidly increased. In June 1921 183 motor-vessels of 502,944 tons were under construction, and out of this number 57 of 241,003 tons were being built in the United Kingdom.

Oil Burners.—Another very great improvement is in the use of oil instead of coal under steam boilers. *Lloyd's Register* reports that in 1914 364 vessels of 1,310,000 tons were fitted to burn oil, but in 1921 these had increased to 2,563 ships of 12,797,000 tons, or from 2·62 to 20·65% of the world's tonnage. In the United States four vessels burn oil to every three vessels burning coal. This use of oil fuel has demanded a large increase in the number of oil-tank steamers. In 1914 there were 385 tankers of 1,479,000 tons, while in 1921 there were 861 tankers of 4,419,000 tons, an increase from 2·94 to 7·16 per cent of the world's tonnage.

Electric Drive.—It has been the almost universal practice for submarines to be propelled by electric motors when submerged. In a few cases of small surface vessels electric drive had also been used prior to 1910. The earliest recorded appears to be Nobel's tank vessel "Sarmat," fitted with the system in 1904. About 1910 a small vessel named the "Electric Arc" was built on the Clyde to test the method of electric transmission devised by Mavor, using Squirrel cage motors. The experiment was not altogether a success, but it gave a good deal of experience. Mavor proceeded to America and discussed his ideas with Emmet, and no doubt assisted Emmet in the great undertaking carried out for the American navy in the collier "Jupiter" (now aircraft-carrier "Langley"). The American navy built three colliers at this time of identical dimensions, about 20,000 tons displacement, 7,500 H.P., 15 knots full speed, and cargo 12,000 tons. The "Cyclops" has two reciprocating engines, the "Neptune" has Parsons turbines and a Westinghouse floating frame mechanical gearing, while the "Jupiter" was fitted with a Curtis turbo-electric generator, running at 2,000 revolutions, giving alternating current at 2,200 volts, and motors driving two propeller shafts at 110 revolutions. The reported engine room weight of the "Jupiter" is 223 tons, compared with 343 tons in "Cyclops" and 189 tons in "Neptune."

Mavor's next step was to fit up an installation of 1,500 S.H.P. in the "Tynemount," built by Messrs. Swan, Hunter & Co. in 1913. This vessel was 250 ft. long, 1,644 tons gross, and of about 8 knots speed. This system, however, did not admit of development on a large scale.

The next important progress was made in Sweden, where two sister vessels were built, 225 ft. x 36 ft. x 15½ ft., 2,250 displacement, 975 tons gross. Each was provided with 900 H.P. for 11½ knots. In the "Mimer" triple expansion reciprocating engines were fitted. In the "Mjolner" Ljungström turbo-generators running at 800 r.p.m. were fitted, with two motors of 450 H.P. each, and geared to a single propeller shaft running at 85 r.p.m. It was reported that fuel consumption was reduced by over 40%, to ·89 lb. per I.H.P. per hour, and that a saving of 74 tons in weight was effected. A large number of other vessels have since been fitted on the "Ljungström" system. These include the "Turbinia," of 2,259 tons and 1,020 H.P., built in 1916 in Sweden, and the "Wulsty Castle," of 3,566 tons and 1,500 S.H.P., built in 1918 by Blumer of Sunderland. It was reported that in 1921 there were 40 vessels building in different countries on this system with the aggregate of 70,000 horse power.

The success of the "Jupiter" was so great that electric transmission was adopted by the U.S. navy for a great many of their later ships, even of the highest power. The next great experiment in electrical propulsion was put in hand by the U.S. Shipping Board, who decided to remove the mechanical gearing in 12 vessels and fit an electric drive instead. The first vessel taken was named "Eclipse," the next three vessels "Archer," "Independence" and "Victorious." The "Eclipse" is 440 x 56 x 35·2, of 7,589 tons gross and 11,900 dead-weight. The boilers are fitted with Dahl oil burners, steam 215 lb. and 200° super heated. One turbine of the Curtis Impulse type is fitted to run at 2,000 r.p.m. A three-phased generator supplies current at 2,300 volts. An induction motor is fitted directly on the propeller shaft working at 2,300 volts and running at 100 r.p.m. for 3,000 H.P. The speed may range from 20 to 110% of the normal. The result of the trials was very gratifying. The reports as to the first voyage were not quite so good. The other three vessels named had not yet gone on service in 1921.

Another very interesting case is that of the "Cuba," a vessel 310 x 40 x 26·9 of 2,963 tons gross. This vessel has also been fitted with a turbine electric drive by the General Electric Co., Schenectady, but in this case a synchronous motor is fitted. Steam of 190 lb. with 200° super heat is supplied to an 8-stage Curtis turbine, as in "Eclipse." This runs at 3,000 r.p.m. and 1,150 volts. The motor gives 3,000 H.P. at 100 r.p.m. and 1,150 volts, and is fitted directly on the shaft. The trials of this vessel were well reported on. Both vessels are of 11 knots speed.

The question of the efficiency and economy of the electric drive was being very much discussed in 1921. On the one hand it was said that the transmission loss of the electrical system was 8% instead of 3% with the mechanical current, but the other ships with electrical current reported very good economy of fuel.

Wood Vessels.—In 1914 wood vessels amounted to 1% of the total steam tonnage, but owing to the special building during the war it had risen to nearly 4% in 1921. Of this large increase the United States owns one million tons.

The Emergency Fleet programme provided for ordering 1,067 wooden and composite ships, of 3,227,200 tons; but only 607 of 1,948,250 tons, were actually produced. In June 1921 288 cargo carriers remained in the possession of the U.S. Shipping Board, 15 being on active service and 273 tied up. The board also had 14 tugs, of which 9 were on active service. Up to this date 211 had been sold, 12 of which had been built for service as cargo carriers and 61 as tugs. One had been fitted for carrying oil in bulk. Seventy-four were incomplete when sold. In Aug. 1921 the remaining wooden vessels were reported to be sold to the Ship Construction and Trading Company.

Concrete Ships.—Prior to the war a number of small vessels for harbour or river service had been built of ferro-concrete in Italy, Norway and France. During the war a few experimental vessels of small size were built in various places, and the system was adopted to an increasing extent, practically all over the world. As larger vessels were built, the methods received careful consideration, and by proper development vessels up to 7,500 tons dead-weight were successfully produced. The complication of rods and ties in the larger vessels became very great, and sectional or panel systems were introduced, as contrasted with the usual monolith system. The reports as to results varied. The weight of hull was reported to be from 50 to 100% more than for steel, or about equal to wood; while the saving of steel for carrying a given dead-weight amounted to 55 to 66% of the steel ship. This was an enormous advantage during the steel shortage, and a further advantage was the power to build by a new class of labour, giving a greater aggregate of labour for shipbuilding. The most notable vessel was perhaps the S.S. "Faith," built by the San Francisco Shipping Co. in 1918.

This vessel, 320 ft. long, 3,427 tons gross, and fitted to burn oil fuel, was a great success. On arrival in England with a cargo the holds were found to be absolutely dry. Table XV. gives the total tonnage recorded of vessels of this type.

TABLE XV.—*Ferro-Concrete Vessels Included in "Lloyd's Register," 1921–2.*

Country	Steam and Motor Vessels		Sailing Vessels		Total	
	No.	Tons	No.	Tons	No.	Tons
United Kingdom	13	4,222	46	31,625	59	35,847
Canada (coast) .	1	320		..	1	320
United States (sea) . . .	15	73,894	..	..	15	73,894
Denmark . . .	3	2,413	..	..	3	2,413
France . . .	3	2,383	1	816	4	3,199
Italy	..	..	3	602	3	602
Norway . . .	14	6,093	..	..	14	6,093
Spain . . .	1	273	..	..	1	273
Total . .	50	89,598	50	33,043	100	122,641

Large Liners.—Particulars of notable Atlantic liners of recent construction are given in Table XVI. When the "Lusitania" was sunk during the war, the "Mauretania" (30,704 tons) was the only pre-war 25-knot Atlantic liner left. She was followed, however by the "Aquitania" (45,647 tons), of 24 knots, launched by John Brown & Co., for the Cunard Co., in 1914, and the "France," of 23,666 tons gross, launched at St. Nazaire for the Cie. Générale Transatlantique in 1912. The "France" had turbines of 45,000 H.P. on four shafts for her 24 knots, and carried 1,926 passengers besides her crew of six hundred. The "Aquitania" was completed during the war as a hospital ship, but saw very little service as such. After the war she was overhauled and fitted to burn oil fuel, so as to carry 3,250 passengers.

In 1917 another great French liner was launched, the "Paris," of 33,700 tons; it was not completed until June 1921. She could carry 98 passengers in *cabins de luxe*, 468 first-, 464 second-, 1,100 third-class (in cabins), also 1,100 steerage in open berths—the total, including crew, amounting to 3,900 persons. She was fitted with four screws driven by Parsons' turbines, manufactured at Havre. During completion she was modified to burn oil fuel on the Wallsend-Howden system. On her first trip, with 12 boilers out of 15 in service, she averaged 21 knots.

Of the great White Star liners, the "Adriatic," of 24,541 tons gross, capable of carrying a total dead-weight of cargo and fuel of 19,710 tons, at a speed of 18½ knots, may be taken as typical. A later ship, the "Belgic," of 24,547 tons gross, which was put prematurely into service during the war (1917), could carry 22,025 tons at the same speed. The "Adriatic," "Baltic," "Cedric" and "Celtic," averaging 22,600 tons gross, with a total dead-weight capacity of over 55,000 tons, became well known to Atlantic passengers as the "Big Four."

The White Star policy of combining comfort for passengers with a large cargo-carrying capacity found its highest expression, however, in the "Olympic," of 46,359 tons, launched by Harland & Wolff in 1911. She could carry a total of 12,770 tons dead-weight on a draught of 34 ft. 7 in., with a displacement of 52,300 tons, and could take 2,400 passengers, besides her crew of 900, across the Atlantic at 21 knots. Having been altered to burn oil fuel, she could take sufficient at New York (7,500 tons) to provide for the double journey. Her maximum speed is 22½ knots at 55,000 horse power. The "Olympic" was in 1921 the biggest British-built vessel, but her dimensions had been exceeded by the "Britannic," of 48,158 tons, which was launched by Harland & Wolff in 1914, and was sunk in Greek waters while serving as a hospital ship in 1916.

Still larger, however, were the three great liners built in Germany during 1912–4. The largest of these (and in 1921 the largest in the world), the "Majestic," (fig. 45) launched by Blohm & Voss in 1914, and acquired by the White Star for entering service in 1922, is of 56,000 tons gross. Turbines of about 100,000 H.P. on four shafts, the greatest installation yet fitted in any merchant vessel, give her an ocean speed-capacity of 23 knots. She is 956 ft. in length, 100 ft. in width, and 102 ft. in height from keel to boat deck. Parsons' turbines, arranged for triple expansion, are fitted on four shafts, and steam is supplied by Yarrow water-tube boilers at 260-lb. pressure. The machinery weighs 8,500 tons, and 5,700 tons of fuel are consumed on one trip. The funnels come up at the side of the ship, joining together above, and thus leave the central part clear for dining-halls, etc. The ventilation involves 18 m. of piping, while there are 15,000 electric lamps, and 225 electric motors for various purposes, requiring a total of 1,565 horse-power. She can carry 4,000 passengers, while the food for one voyage includes 12 tons of fresh meat, 12 tons of vegetables, 14 tons of milk and about 5 tons of eggs.

Amongst the latest additions to the White Star line up to 1921 was the "Homeric," of 35,000 tons, carrying 2,700 passengers at 21 knots; she was launched at Danzig in 1913 as S.S. "Columbus." The "Homeric" is notable as being the last large ship propelled by reciprocating engines only, of which she has two sets, triple expansion, cyls. 50½ in., 86½ in. (2), 96 in. and 70 in. stroke; but these were exceeded in size by those of "Britannic," (fig. 46) which were 54 in., 84 in. (2), 97 in. and 75 in. stroke, to give 32,000 I.H.P. on two wing shafts, and in addition "Brittannic" had l.p. turbines to give 18,000 S.H.P. on two central shafts. The engines of "Britannic" were probably the most powerful single sets made for an ocean liner, while the "Kronprinzessin Cecilie" (now "Mount Vernon") had the greatest total I.H.P., as she had two sets of 4-cyl. engines on each shaft; they were 37½ in., 49 in., 75 in., and 112 in. (quadruple expn.) and 71 in. stroke. Other new vessels being added by the White Star line are:—"Regina" (16,314 tons), and "Rimouski" (9,281 tons) for Canadian service; "Laurentic" (18,000 tons), "Doric" (16,600 tons) and "Pittsburgh" (16,600) for U.S. services.

The Cunard Co. acquired the "Berengaria" (formerly "Imperator") of 52,022 tons, launched by Vulcan Works, Hamburg, in 1912. This vessel has Parsons' turbines of 60,000 H.P. on four shafts and can attain a speed of over 22 knots with 185 revolutions. She carries 4,000 passengers and a crew of 1,200.

The Cunard Co. decided immediately after the war to build a large number of intermediate vessels somewhat of the "Olympic" type, but smaller and of less speed. The first four were 600 ft. ships of about 21,000 tons gross and 27,000 tons displacement, at 30-ft. draught, and were named "Scythia," "Samaria," "Franconia," "Laconia." The "Samaria," (fig. 47) which may be taken as typical, was built by Cammell Laird & Co. in 1921. Her engines (turbines) are fitted with double helical speed reduction gear, to drive the propellers at an economical speed. The boilers are of the cylindrical type, fitted to burn oil fuel with forced draught on the Wallsend-Howden combined system. They will give steam at 220 lb. with 200° F., superheated by means of Schmidt's smoke-tube type of superheater. Her twin screws are operated by Brown-Curtis turbines, which run at 2,750 revolutions. Triple expansion is arranged for as follows: On each side of the ship a H.P. and I.H.P. turbine are fitted in tandem on the shaft of the first driving pinion, and the l.p. turbine is fitted on the shaft of the second driving pinion of the first reduction gear, both then operate through the second reduction gear and give the propeller shafts a speed of 90 revs. per minute. The total S.H.P. of 13,500 gives a sea speed of 16 knots. The astern turbines are compound, and are incorporated in the exhaust casings of the intermediate and low-pressure ahead turbines, and give a total power equal to about 70% of the ahead power. This may be taken as typical of the best turbine arrangements of 1921. The "Samaria" can carry about 350 first-, 350 second- and 1,600 third-class passengers. Her deck machinery is driven by electric power through hydraulic variable-speed gear at each of the machines. Two large sets of turbo-driven generators are provided for this purpose, and an oil-driven emergency dynamo is also fitted. A gyro-compass installation is fitted, the master compass being on one of the lower decks, with three separate controlled compasses at suitable positions for navigation. Her subdivision is on the most approved principle, with increased numbers of watertight bulkheads, the water-tight bulkhead doors being operated on the Stone-Lloyd hydraulic system. She is further subdivided by fireproof bulkheads, and the "Grönwald" system of fire extinguishing is installed. Electric passenger hoists are provided.

Among great pre-war German liners which came into the service of U.S. shipping companies were the "America," of 17½ knots and 22,622 tons, launched by Harland & Wolff, Belfast, in 1905, and the "George Washington," (fig. 48) of 18 knots and 25,570 tons, launched by the Vulcan Works, Stettin, in 1908. In addition, the "Leviathan," of 54,282 tons, and 21 knots, launched by Blohm & Voss, Hamburg, in 1914, was still in 1921 awaiting renovation and allocation to service. During the war these great vessels were utilized to transport immense numbers of American troops across the Atlantic. For this service they were specially prepared and ballasted, and, on sailing, the "Leviathan" had what may perhaps be a record draught for a vessel leaving port, viz. 40 ft. 11 in. "Leviathan" carried as many as 11,000 troops on a single trip.

Among American liners the place of the old "St. Paul" has been taken by ships of the "State" class, which were started as 522-ft. troopships (fig. 49). The first on the Atlantic service were the "Panhandle State," and the "Old North State," vessels of 10,500 tons, completed in 1920. There were five other vessels also of the same type, 522 ft. overall, with 502 ft. between perpendiculars. Supplemented by the great ex-German ships named above, they enabled the Shipping Board to send their faster (535 ft.) State type of vessel to the Pacific.

Germany in 1921 retained the old "Deutschland," which had now only machinery for 15½ knots, and was named "Hansa." Just prior to the war Germany was building a series of splendid vessels, most luxuriously fitted out, and supplied with every modern device for the attraction and comfort of passengers in order to capture the S. American trade. They were fitted with a combination of reciprocating engines and turbines. The best-known vessel, "Cap Trafalgar," 18,710 tons, 17½ knots (1913), was, as an armed merchant cruiser, met and sunk after a stiff fight by the Cunarder "Carmania," also fitted out as an armed merchant cruiser. Other vessels of the type were the "Cap Finisterre," 14,503 tons, 17 knots, (1911) (now the "Taiyo Maru"), and the "Cap Polonio," 19,500 tons, 18 knots (1914). The last had specially luxurious apartments to fit her for the use of the ex-Kaiser, but after the war British owners could not run her at a profit, and she was sold back to Germany, and was, in 1921, far the best and fastest German steamer.

France replied with the "Lutetia," 14,654 tons (1913), and the "Massilia," 15,147 tons (1914), both having a combination of reciprocating engines and turbines for 20 knots.

The "Esperia," of 11,393 tons, the finest passenger vessel built as such in Italy, was launched at Genoa in 1921. She is fitted with Parsons' turbines, of 19,600 H.P., on two shafts, with mechanical reduction gearing, for 21 knots, and carrying 480 passengers in addition to a crew of three hundred. Italy also ordered two fine vessels in Great Britain. One, the "Conte Rosso," built by Beardmore, Dalmuir, was requisitioned by the Admiralty, razeed to give an uninterrupted flat deck, with no funnels, and fitted out as the aircraft-carrier "Argus." She was finished just before the Armistice. To take her place another vessel of the same name was launched in 1921 by Beardmore, 15,500 tons, 18½ knots speed, dimensions 570 ft. x 74·2 ft. x 36·1 feet. The second vessel, "Giulio Cesare," laid down by Swan, Hunter & Co. at Wallsend, stood half plated during the war, and was finally completed in 1920, 21,500 tons, 18½ knots sea speed. In her the fitting-out of the German "Cap" vessels was rivalled by a combination of British and Italian art, and this vessel was in 1921 the largest and finest Italian liner, and the finest vessel trading to S. American ports. She has four sets of turbines of 21,900 H.P. with single reduction gearing driving four propellers, giving a speed of 19½ knots speed on trial, and carries 243 passengers in *de luxe* state-rooms, 306 second-class, 800 steerage and a crew of 520, giving a total of 1,869.

Spain had two fine vessels built just before the war, the "Infanta Isabel de Borbon," of 10,348 tons, 17½ knots, launched by Denny at Dumbarton (1913), and the "Reina Victoria Eugene," 10,137 tons, launched by Swan, Hunter & Co. (1913), 17½ knots, and of about the same general dimensions. Both are fine well-fitted vessels, and both have a combination of reciprocating engines and turbines of 10,000 H.P. for propulsion at 17½ knots speed. Spain also built herself vessels of a steadily improving class. The "Alfonso XIII." (of 10,137 tons gross), built in 1921 at Bilbao, was the finest vessel yet constructed in Spain. Her dimensions are 480 ft. x 61 ft. x 41 feet. She is fitted with two sets of geared steam turbines of 10,300 S.H.P., giving 14 r.p.m. at the propellers, and a speed of about 17½ knots.

Particulars of notable recent Pacific liners are given in Table 17. The wonderful development of what might be spoken of as secondary liners is illustrated by the new vessels built for the Canadian Pacific railway (now Canadian Pacific Ocean services). The "Empress of Canada," of 22,000 tons and 22 knots, built in 1920 by Fairfield will be the finest vessel on the Pacific Ocean.

TABLE XVI.—*Particulars of Notable Atlantic Liners.*

Name	Tons gross	Speed Knots	Owners	Date of build.	Dimensions Builders L B D	Dead-weight Tons	Horse-power	No. of screws	Types of Machinery and Makers	Steam pressure lbs.
"Mauretania"	30,704	26.6	Cunard Co.	1907	762.2 x 88 x 57.1 Swan Hunter, Newcastle.	12,280	70,000	4	Parsons' turbines Wallsend Slipway Co.	195
"Aquitania"	45,647	24	Cunard Co.	1914	868.7 x 97 x 49.7 J. Brown, Clydebank, Glasgow.	12,913	60,000	4	Steam turbines J. Brown, Clydebank.	195
"Berengaria" (*ex* "Imperator")	52,022	22½	Cunard Co.	1912	882.9 x 98.3 x 57.1 Vulcan Werke, Hamburg.	12,000	60,000	4	Steam turbines Vulcan Werke, Hamburg.	...
"Scythia"	19,503	16	Cunard Co.	1921	600.7 x 73.8 x 40,7 Vickers, Barrow	12,400	....	2	Steam turbines Vickers, Barrow.	....
"Samaria"	20,937	16	Cunard Co.	1921	601.5 x 73.7 x 40.7 Cammell Laird, Birkenhead.	12,400	13,500	2	Brown Curtis turbines with double reduction gear. Cammell Laird.	220
"Britannic" (lost in World War).	48,158	....	White Star Co.	1914	852.5 x 94 x 59.5 Harland & Wolff, Belfast.	....	50,000	3	Reciprocating & l.p. turbine Harland & Wolff.	....
"Olympic"	46,439	22	White Star Co.	1911	852.5 x 92.5 x 59.5 Harland & Wolff, Belfast.	12,770	50,000	3	Reciprocating & l.p. turbine Harland & Wolff.	215
"Majestic" (*ex* "Bismarck").	56,000	23	White Star Co.	1914	912 x 100 x 57.1 Blohm & Voss, Hamburg.	....	100,000	4	Steam turbines Blohm & Voss, Hamburg.	....
"Belgic"	24,547	18½	....	1917	670.4 x 78.4 x 44.7 Harland & Wolff, Belfast.	22,025	....	3	Reciprocating & l.p. turbine Harland & Wolff.	....
"Homeric" (*ex* "Columbus").	35,000	19	White Star Co.	1913	750 x 83 x 48.9 F. Schichau, Dantzig.	....	....	2	Reciprocating F. Schichau, Elbing.	....
"America" (*ex* "Amerika").	22,622	16.7	U.S. Government (War Department)	1905	668.8 x 74.3 x 47.8 Harland & Wolff, Belfast.	20,765	17,500	2	Reciprocating Harland & Wolff.	210
"Leviathan" (*ex* "Vaterland").	54,282	22½	U.S. Government (Navy Department)	1914	907.6 x 100.3 x 58.2 Blohm & Voss, Hamburg.	15,000	65,000	4	Steam turbines Blohm & Voss.	240
"George Washington")	25,570	17	U.S. Shipping Board	1908	699.1 x 78.2 x 50.1 A. G. Vulcan, Stettin.	13,465	18,000	2	Reciprocating A. G. Vulcan, Stettin.	215
"Agamemnon" (*ex* "Kaiser Wilhelm II.")	19,361	21½	U.S. Shipping Board	1902	684.3 x 72.3 x 40.2 A. G. Vulcan, Stettin.	8,700	43,000	2	Reciprocating A. G. Vulcan, Stettin.	213
"Panhandle State"	10,533	14	U.S. Shipping Board	1920	502.1 x 62.2 x 28.3 New York S. B. Corp.	13,000	7,000	2	Reciprocating New York S. B. Corp.	220
"France"	23,666	24	Cie. Gen. Transatlantique	1912	689.0 x 75.6 x 53.4 Ch. & Atel. de St. Nazaire, St. Nazaire.	6,384	45,000	4	Steam turbines Ch. & Atel. de St. Nazaire.	....
"Paris"	32,000	22	Cie. Gen. Transatlantique	1917	734.9 x 85.2 x 59.1 Ch. & Atel. de St. Nazaire, St. Nazaire.	....	....	4	Steam turbines Chant. de Penhret. St. N.	....
"Massilia"	15,147	20	Cie. de Nav. Sud-Atlantique.	1916	574.0 x 64.0 x 40.2 Forg. & Ch. de la Médit., La Seyne.	....	....	4	Reciprocating & 2 l.p. turbines Forg. & Ch. de la Médit.,M.S.L.	....
"Rotterdam"	24,149	17	Holland-Amerika Line	1908	650.5 x 77.4 x 43.5 Harland & Wolff, Belfast.	....	2,451 N.H.P.	2	Reciprocating Harland & Wolff, Belfast.	215
"Limburgia"	19,980	17	Koninkl.-Hollandoche Lloyd	1914	592.0 x 72.3 x 39.7 J. C. Tecklenborg, A. G., Geestemünde.	....	....	3	Reciprocating & l.p. turbine J. C. Techlenborg, A. G., Geest.	....
"Giulio Cesare"	21,560	18½	Nav. Gen. Italiana	1920	601.4 x 76.0 x 51.0 Swan Hunter, Newcastle.	....	....	4	Steam turbines Wallsend Slipway Co. Ltd., Newcastle.	....
"Conte Rosso"	15,550	....	Lloyd Sabaudo Socy.	1921	570.0 x 74.2 x 36.1 Beardmore, Glasgow.	....	....	2	Steam turbines W. Beardmore, Glasgow.	....
"Esperia"	11,393	20	Soc. Italiana di Servizi Marittimi	1918	492.1 x 61.7 x 34.1 Soc. Esercizio Bacini Riva Trigoso.	....	19,600 H.P.	2	Geared steam turbines N. O. dero fie A Seotui. P.	....
"Infanta Isabel de Borbon"	10,348	....	Cía. Transatlantica	1913	481.9 x 61.3 x 32.7 W. Denny Bros., Dumbarton.	6,229	22,186	3	Reciprocating & 1 l.p. turbine Denny & Co., Dumbarton.	200
"Stavengerfjord"	12,977	15½	Den Norske Amerika Linje	1918	532.5 x 64.2 x 29.3 Cammell Laird & Co., Birkenhead.	7,200	1,567 N.H.P.	2	Reciprocating Cammell Laird & Co.	220
"Bergensfjord"	10,709	....	Den Norske Amerika Linje	1913	512.4 x 61.2 x 29.4 Cammell Laird & Co., Birkenhead.	7,300	1,469 N.H.P.	2	Reciprocating Cammell Laird & Co.	220
"Campania" (lost in World War).	12,884	22	Cunard Co.	1893	601.0 x 65.2 x 37.8 Fairfield Co. Ltd., Glasgow.	....	3,191 N.H.P.	2	Reciprocating Fairfield Co. Ltd., Glasgow.	165
"Great Eastern"	18,915	13	Great Eastern S.S. Co.	1858	680.0 x 82.8 x 48.2 Millwall.	....	11,000 I.H.P	....	S. screw & paddles.	30

The U.S. Shipping Board has allotted many of its best vessels to various companies for service on the Pacific. The "Wenatchee" and "Creole State" are typical of the 535-ft. vessels so appropriated. These vessels are 535 ft. overall, 516 ft. between perpendiculars, with a beam of 72 ft., and moulded depth 27·8 ft., and to "A" deck 50 ft.; about 14,000 tons gross. When loaded to a draught of 30·6 ft. their total dead-weight is 10,000 tons, and total displacement 21,250 tons. They have accommodation for 257 first-class and 300 second-class passengers, besides 200 of ship's company. They can also carry 6,700 tons of cargo, and can maintain 17½ knots for long distances, having obtained over 19 knots in some cases on trial. They are fitted with water-tube boilers 265 lb., and 75° superheat. Westinghouse double-flow type turbines are fitted, run at 3,650 revolutions, with double reduction gearing, to drive two propellers at 110 revolutions. The smaller vessels of the same type are 522 ft. overall, 502 ft. between perpendiculars; breadth 62 ft. and depth to "A" deck 42 ft. They only carry 78 passengers, but they can take another 1,000 tons of cargo. They are fitted with cylindrical boilers 220 lb., and two sets of four-cylinder triple expansion engines giving 6,000 H.P. for 14 knots at 105 revolutions.

For service between Europe and Australia, via The Cape, the "Ceramic," of 18,481 tons and 17 knots, triple screw, of the White Star line, was the finest and largest vessel running in 1921. She was built by Harland & Wolff in 1913, and can carry 19,590 tons cargo, and bunkers, at a sea speed of 17 knots, with a maximum of 18½ knots. For the India and Australia service of the P. & O., a new series of "N" class of steamers was being built. The first of these "Naldera," 15,825 tons, was built by Caird, and used by the Government during the war. "Narkunda," 16,118 tons, was the first liner to be completed by Harland & Wolff at Belfast after the war. These are vessels of 18½ knots speed. For the India service direct a new series—"M" class—was being built. Typical of these is the "Mongolia," built by Armstrong, 550 ft. x 72 ft. x 42·3 ft. When loaded to a draught of 30 ft. they will have a displacement of 24,500 tons, and 15,550 tons gross, and carry a dead-weight of about 13,000 tons. They can carry over 400 first- and second-class passengers, and of seven cargo-holds two are insulated. Two later vessels—"Maloja" and "Mooltan"—are 20,700 tons gross.

The Cunard Co. has also built a number of vessels of the "Ausonia" type for the Cape and Australia services. These vessels are 519 ft. x 65·3 ft. x 43 ft., and 13,000 tons gross at a draught of 29·6 feet. Their displacement is 20,420 tons with a dead-weight of 10,120. Geared turbines of 8,500 H.P. are fitted for a speed of 15 knots. They can carry over 500 cabin passengers and about 1,200 third-class. The "Ausonia" is remarkable, as making a record of 1,000 ships built by Messrs. Armstrong, of a total of 3,000,000 tons. Of these, 800 were merchant ships and 200 were warships.

The Australian Government was in 1921 providing itself with seven liners of 12,500 tons, 15 knots full speed, built on the Isherwood longitudinal system. The "Largs Bay," built by Messrs. Beardmore, may be taken as typical of all five. She is 530 ft. long, breadth 68·3 ft., depth 39·8 ft., 12,500 tons gross tonnage, and can carry 12,000 tons dead-weight at a draught of 29 ft. 9 in. and displacement 23,120 tons. She can carry 730 third-class and about a dozen first-class passengers. Machinery, of 9,000 S.H.P. on two shafts, is provided for a speed of 15 knots; Parsons' geared turbines are fitted in two complete sets. The h.p. turbines run at 3,200 revolutions, and l.p. turbines at 2,100. They are independently connected to the shafts by double reduction gearing 35·5 to 1, and 23·4 to 1 respectively, giving a speed of propellers of 90 revolutions per minute, and on each ship astern turbines are provided equal to 60 to 65 % of the full power ahead.

South Africa.—For the direct service to the Cape the Union Castle line added the "Balmoral Castle," of 13,361 tons, of 18 knots maximum speed, in 1911. Two very fine vessels had in 1921 been recently added: the "Arundel Castle," and "Windsor Castle," 650 ft. x 72 ft., and of 19,000 tons gross. They were the first four-funnelled ships on the Cape line, and were fitted with 15,000 H.P., and single reduction gear, to two shafts, for a sea speed of 17 knots. They could carry 273 first-, 224 second- and 566 third-class passengers, besides the crew of 400, and a large cargo, the total dead-weight being 14,000 tons.

Coast and Channel Steamers, etc.—The finest recent vessels of these types have been built in America. Two remarkable vessels, the "Great Northern" and "Northern Pacific," built by Cramp in 1915 for service between San Francisco and Astoria, are 8,255 tons gross and 24 knots speed. They are 500 ft. x 63 ft. x 50·5 ft., moulded, to promenade deck. When loaded to 21-ft. draught they have dead-weight of 2,185 tons and displacement of 9,700. They carry 550 first-class passengers and 316 second and third-class passengers. They are fitted with 12 water tube boilers of the Mosher type, and Parsons turbines driving three screws, and giving 22,000 S.H.P. These were, perhaps, the finest vessels that had yet been built in the United States, though not the largest.

New Channel steamers have continued to be built in England, France and Belgium. The fastest steamer on the English Channel service in 1921 was the "Versailles," built in France and completed in 1921, 305 ft. long and 36 ft. in breadth; she had obtained 25 knots on speed.

An important type of cross-channel steamer is the train ferry. During the war such vessels were used by England for the first time. These vessels are 363·5 ft. long, 61·5 ft. broad, draught 9 ft. forward and 10 ft. aft. They displace 3,654 tons, and have 12 knots speed. Two were built by Messrs. Armstrong and one by Messrs. Fair-

TABLE XVII.—*Particulars of Pacific, etc., Liners.*

Name	Tons gross	Speed knots	Owners	Date of build	Dimensions Builders L. B. D.	Dead-weight Tons	Horse-power	No. of screws	Type of machinery and makers	Steam pressure, lb.
"Wenatchee"	14,127	15	United States Shipping Board.	1921	516·5 x 72·2 x 27·8 New York S. B. Corp., N. J.	..		2	Steam turbines, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.	..
"Aeolus" (ex "Grosser Kurfürst")	12,642	14½	United States Shipping Board.	1899	560·6 x 62·3 x 35·9 F. Schichau, Danzig.		1,016 N.H.P.	2	Reciprocating, F. Schichau, Elbing.	..
"Arundel Castle"	19,600	18	Union Castle S.S. Co.	1921	630·0 x 72·5 x 41·5 Harland & Wolff, Belfast.	..	..	2	Steam turbines, Harland & Wolff.	..
"Balmoral Castle"	13,361	17½	Union Castle S.S. Co.	1910	570·0 x 64·5 x 38·9 Fairfield, Glasgow.	...	2,234 N.H.P.	2	Reciprocating, Fairfield & Co.	220
"Ceramic"	18,481	17	White Star Line (Australian Service).	1913	655·1 x 69·4 x 43·8 Harland & Wolff, Belfast.	19,590	..	3	Reciprocating and 1 L.P. turbine, Harland & Wolff.	..
"Empress of Canada"	22,000	22	Canadian Pacific Ocean Services, Ltd.	1920	627·0 x 77·7 x 42·0 Fairfield, Glasgow.	..	..	2	Steam turbines, Fairfield, Glasgow.	
"Empress of Asia"	16,909	21	Canadian Pacific Ocean Services, Ltd.	1913	570·1 x 68·2 x 42·0 Fairfield, Glasgow.	9,135	3,720 N.H.P.	4	Steam turbines, Fairfield, Glasgow.	190
"Niagara"	13,415	18	Union S. Shipping Co. of New Zealand, Ltd.	1913	524·7 x 66·3 x 34·5 J. Brown, Clydebank, Glasgow.	...	12,000	3	Reciprocating, J. Brown, Clydebank, Glasgow.	220
"Narkunda"	16,118	18½	P. & O. Line.	1920	581·4 x 69·4 x 27·7 Harland & Wolff, Belfast.	...	1,428 N.H.P.	2	Reciprocating, Harland & Wolff.	..
"Ausonia"	13,050	15	Cunard S.S. Co.	1921	519·0 x 65·0 x 43·0 Armstrong, Whitworth & Co., Newcastle	10,120	8,500	2	Parsons geared turbines, Armstrong, Whitworth.	220
"Mongolia"	15,550	17	P. & O. Line.	1921	550·0 x 71·7 x 42·2 Armstrong, Whitworth & Co., Newcastle	13,000	13,000	2	Steam turbines, Armstrong, Whitworth.	..

field. On the deck, well protected by deckhouses, are four lines of rails, which will take 54 10-ton wagons. Heavy guns and heavy machinery of all description were transported by these vessels.

Some of the most remarkable vessels in the world are the Sound and Lake steamers of the United States. Recent vessels on the Lakes are the largest paddle steamers ever built, such as the "City of Cleveland III." (1907), 4,568 tons and 19 knots speed; "City of Detroit III." (1912), 6,061 tons and 20 knots speed; and "Seandbee" (1912), 6,381 tons, 19½ knots. This last remarkable vessel is 484·5 ft. x 58·1 ft. x 24·0 ft. To drive her paddle wheels she is fitted with compound, three cylinder engines; cylinders being, one 66 in. in diameter, and two 96 in. in diameter, with a stroke of 9 feet.

Developments in Shipbuilding.—The greatest innovations during 1910–20 were in connexion with rapid shipbuilding during the war. The production of "standard ships" in Great Britain has been already referred to. Six types were "standardized" (*see* Carter I.N.A., 1918; and, for detailed summary with dimensions, *Shipbuilder*, May 1918).

Others were approved at a later date, and permission to build large numbers of such ships was given to various shipbuilders. In these ships special methods were adopted to reduce risk of submarine attack, such as improved sub-division, making both ends alike, with bridge, poop and forecastle ends rounded; funnels and masts symmetrical in profile elevation with regard to a vertical line amidships, but not on the fore and aft centre line so as to increase difficulty of detecting speed and course of vessel. Very greatly improved accommodation for ship's company was also provided.

The best method of expediting the building of merchant ships occupied many minds, and proposals were made by Sir Eustace d'Eyncourt in 1917 to simplify the construction of war-time vessels by making all frame-lines straight, and the plating so far as practicable of developable surfaces. A successful design was proposed on this basis, and adopted by the Controller of Merchant Shipbuilding for use in the fabricated ships about to be built at the National Shipyards on the Severn. The first fabricated "straight line ship," the S.S. "War Climax," was completed at Wallsend by Swan, Hunter & Co., on Sept. 28 1918, 31 weeks from laying keel.

In Great Britain large numbers of vessels of standard designs were built by various shipbuilders according to their usual routine. The "fabricated" ship followed later. In the United States, however, the standard ships were mostly fabricated ships also. The first series were produced by the Submarine Boat Corporation in new premises at Newark Bay. The most wonderful of all the American shipyards was, however, at Hog's I., Philadelphia, which in less than 12 months passed from open 50 ft. ground to the greatest shipyard in the world, with full equipment and deep water jetties. The contract was signed on Sept. 13 1917, and work started Sept. 20. The first keel (S.S. "Quistconck") was laid Feb. 12 1918, launched Aug. 5 1918, and by Jan. 8 1919, 16 vessels had been launched and 7 completed, 50 slips had been built and 7 jetties, 1,000 ft. long and 100 ft. wide for fitting out afloat. By April 17 1920, 102 ships of 800,000 tons d.w. had been launched and 84 of 657,000 tons completed. The fabricated parts were prepared in 90 engineering works from 10 to 1,500 m. away.

Ferro-Concrete Ships.—For many years small vessels had been built of reinforced concrete in localities where steel and the special labour required for steel shipbuilding was not available. Such vessels had been built in Italy, Norway and France. Between 1887 and 1917 some 200 craft had been built, but in the latter year the subject was more seriously considered, and craft of increasing size were built, and greater numbers of them fitted with propelling machinery. In England 1,000 ton barges, tugs of 750 h.p., and cargo steamers of 1,150 tons d.w. were built. The first steamship, "Armistice," was built at Barrow, and was reported to run well and cost very much less than a steel ship for upkeep. In Great Britain most of the concrete vessels were tow barges, but in a number of cases steam or oil engines were fitted. Cargo boats 1,150 tons d.w. 205 ft. x 32 ft. with engines of 350 I.H.P. for 7½ knots, and tugs 125 ft. x 27 ft. 6 in. with engines of 750 I.H.P. were built. In the United States very much larger vessels were built as experience was gained. The S.S. "Faith" was 320 ft. x 44·5 ft. x 30 ft. d.w. 3,950 tons on 22 ft. 6 in. draught, triple expansion engine of 1,600 I.H.P. were fitted giving 10½ knots speed. Others were built of 3,000, 3,500 and 7,500 tons d.w. as well as eight oil tankers of 7,500 d.w. The Emergency Fleet Corporation ordered 56 ships of an aggregate d.w. of 300,000 tons, besides 34 barges and lighters.

Welded Ships.—The Oxy-Acetylene process, for cutting out damaged portions of ships and machinery, and for welding in portions in the course of repair, has been of great service, particularly for the repairs of large forgings, castings and boilers. To a less extent the "Thermit" process has been used for welding purposes, but its application has been of a comparatively limited character. During recent years very considerable progress has been made in developing systems of electric welding, which were used to carry out repair work of considerable magnitude during the war. It has also been proposed that the complete ship should be welded, thus avoiding a great portion of the labour and expense of riveting. Several systems have been developed which can be operated in the ordinary shipyard, and considerable progress has been made in Sweden, England, the United States and France. In 1915 a small vessel was built by Geary at Ashtabula Harbour, Ohio. This vessel was 42 ft. long, 11 ft. beam and 6 ft. 6 in. draught, and the welding was carried out with bare metallic electrodes. Two vessels of 52 to 62 ft. in length have also been built, one in France in 1919 and one in 1920 in Sweden "Esab IV." In each case the welding was carried out by the Kjellberg process, and each of these craft is propelled by semi-Diesel crude oil engines, which can also be used to provide electric power for welding, and compressed air for use in carrying out the repairs of ships by this process as they float in harbour. In this process the arc is also used, but a fireproof sleeve of non-conducting material projects over the arc so as to shield the molten metal from oxidization. A boiler 15 ft. 6 in. in diameter, known as the Hawthorn-Wyber boiler, has been successfully constructed by means of this process. The process of the General Electric Co. is quite different; in this case metallic contact takes place, the welding material is raised to the necessary temperature by resistance to the passage of the current, and it is at the same time pressed into place by hydraulic pressure. A 46-ft. section of a 9,600 ton vessel being built in New Jersey has been used to test the practicability of this, and other methods, and it is reported that these experiments show a saving of 60% on labour and 15% on material, as compared with riveted work.

During the war a steel barge, 120 ft. by 16 ft. and 275 tons displacement, was built at Richborough, Kent, in order to test to what extent labour could be saved. Here the Quasi-Arc process was used and the vessel was satisfactorily completed. On this system the steel electrode has a sheath of blue asbestos, which melts and flows down over the molten metal, thereby extinguishing the arc. This asbestos also forms a floating covering over the molten metal and protects it from oxidization. In order to give further protection, an aluminium wire is carried down by the side of the steel electrode, so that the molten aluminium may take up any oxygen which gets beneath the flux. Messrs. Laird built a small sea-going vessel, the S.S. "Fullagar," in 1920, using the Quasi-Arc process. If welding can be adopted as the general practice, a very large saving should arise in the cost of labour, and an appreciable saving in the case of weight and material.

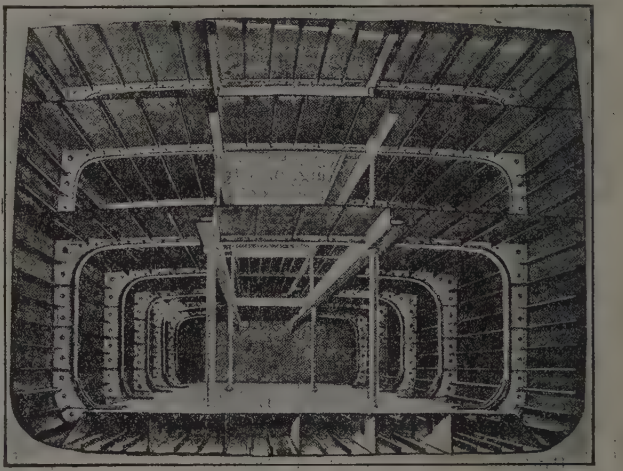

FIG. 50.

Isherwood System.—For many years warships have been built on the longitudinal system of framing, *i.e.* the principal structural members of the framing run fore and aft in continuous girders, the transverse framing being of a secondary character (apart from bulkheads), and fitted between the longitudinal girders as necessary for local support. This system of framing has not found general acceptance for merchant ships, because of the theory long held by shipowners that a merchant ship must have such strong transverse frames that she may ground in an ordinary berth with a cargo on board and without damage. With the improved wharf accommodation now available for important vessels this idea is being gradually relinquished. The most important movement in this connexion was inaugurated by Mr. (later Sir) Joseph Isherwood, who devised a plan for utilizing the whole of the framing of the bottom of the ship and of the decks so that it might be incorporated as part of the structural girder strength of the ship. In 1908, six ships were built of 31,000 tons; for the next six years, 40 or 50 ships were built per annum; but in 1915, under war conditions, the number very greatly increased, and in 1918, 250 ships of nearly 2,500,000 tons deadweight capacity were built. Clearer holds, greater strength and a saving of about 10% of weight of structure are obtained, as well as decreased cost of building. By June 1921 1,400 ships, aggregating 12,000,000 dead-weight, had been built on this system.

The combination of a longitudinal system in the double bottom, and a transverse system above the bottom, has been adopted by Mr. W. Millar of Greenock, and several vessels have been built on the Millar system. Other systems in which a longitudinal construction is adopted are associated with various names—Mr. Foster King, Dr. Montgomery, and Sir Westcott Abell.

The "Unsinkable" Ship.—A so-called "unsinkable" ship has been designed by M. La Parmentier. It consists of two cylinders, 22 ft. in diameter and about 300 ft. in length, each divided into 7 holds, connected so as to form a vessel 320 ft. in length and about 48 ft. extreme breadth, estimated to carry 4,250 tons d.w. on a draught of 16 ft. fitted with twin screws, and engines of 700 H.P. for eight knots. In 1921 several such vessels were being built in the United States.

Cruiser Sterns.—Several of the new liners have a rounded stern, with the profile sloping forward in a curved line as it rises from the water upwards. This is called a "cruiser stern," and is being very generally adopted. It gives somewhat increased capacity, and with the same total length of ship provides a longer water-line, thus facilitating propulsion. In the case of a 550-ft. ship, for 18 knots this meant a decrease of 2,000 H.P., which resulted in a saving of 225 tons of machinery, as well as 220 tons of fuel per trip, giving a saving of over 400 tons available for extra cargo. In 1921 over 160 vessels were built with sterns formed in this way.

On this system the flat plate rudder is replaced by two curved plate rudders ("Kitchen rudders"), forming an almost cylindrical casing round the propeller. By revolving these curved rudders as desired the stream of water is directed as necessary by reaction to steer the ship. For going astern the rudders are brought together abaft the propeller.

Safety at Sea.—During the war many other points were developed for increase of safety in navigation, such as use of range-finders, directional wireless, gyro-compasses, reflex sound apparatus, "clear view" weather screens, submarine sound signalling, and "Leader" cables laid along the bed of the channel.

Following the loss of the "Titanic" on April 16 1912, rigorous enquiries were conducted, in New York under Senator W. A. Smith of Michigan, and in London under Lord Mersey. In both cases recommendations were made that liners should have boats for all, regular boat drill, more efficient W.T. arrangements, and improved sub-division in construction. The British Board of Trade appointed two committees. Sir Archibald Denny presided over the first committee (Bulkheads and Sub-Division) and Sir John Biles over the second committee (Boats and Davits). As a result the Board of Trade laid draft rules before Parliament (Paper Cd. 6402 1912) and took immediate action to improve the supply of boats, while shipowners proceeded to improve the sub-division of their ships. An International Convention was called with a view to similar treatment of these questions by all maritime powers. This Convention was signed on Jan. 20 1914 and rules embodying the agreement as to life-saving appliances were immediately put into force in Great Britain (Parliamentary Paper 219 Merchant Shipping Life-Saving Appliances dated May 8 1914). The whole Convention was discussed in Parliament, and an Act was passed (Aug. 10 1914) authorizing its adoption, but the Board of Trade was left with the power to decide the date on which the Act was to be put into operation. On account of the war, action was postponed, but discussions were proceeding in 1921 between the principal maritime powers with a view to the holding of another Convention.

During the war a great demand arose for improved life-saving appliances. The most successful of all these was the Carley Life Raft, made in the United States. It is made in various sizes. A large copper pipe is bent into the form of an O, brazed up to be airtight, surrounded by cork and canvas, provided with a strong rope netting to form a floor within the O, and fitted with hand ropes, etc. This type was the means of saving very many lives; for instance, a float 9 ft. by 14 ft. will support more than 60 people.

Research and Experiment.—Increasing attention is being given to the study of naval architecture and marine engineering, and of research, in America as well as in Europe. Chiefly owing to the advocacy of Sir W. H. White, and the generosity of Sir A. F. Yarrow, a national experimental tank has, in England, been provided at the National Physical Laboratory at Teddington. The experiment tank is intended for the service of any shipbuilding or shipowning firm. Primarily intended for the experimental investigation of any problems connected with ship resistance and propulsion, it has successfully dealt with such different problems as the manœuvring of ships, torques on rudder heads, skin friction, resistance due to rough seas, rolling and pitching of ships, stability of ships and hydroplanes in motion on the water, and the form of flying-boat hulls for efficient and stable action in getting on and off the water. During the war it dealt with many problems, including the detection of submarines, mine-sweeping, torpedo firing, design of anchored mines, protection against torpedoes, and the design of standard ships. (E. T. d'E.)

SHIPPING (*see* 24.983).—In the decade following 1910, the influence of the World War had a profound effect on the shipping industry. Nor can it be limited to the period between the beginning of Aug. 1914 and Nov. 1918, when the Armistice was signed. For many months after the cessation of hostilities, a great strain was imposed on the British mercantile marine in the repatriation of millions of men. Goods which could not be transported during the war were waiting in vast accumulations to be carried, and in 1921 the effects on shipping were still being shown. In fact, so far-reaching were the effects that they were certain to be felt for many years.

(1) UNITED KINGDOM

The year 1910 was, judged by the ideas then ruling, a comparatively satisfactory one for British shipping, although the industry did not entirely escape the consequences of a strike of coalminers caused by difficulties traceable to the operation of the Eight Hours Act. In 1911 there were a number of industrial disturbances, notably in the collieries, on the railways, at the docks, among seamen and in the cotton-mills. Yet rates of freight were on a higher basis than for some years previously. The time charter rate, *i.e.* the monthly rate of hire per ton dead-weight for ordinary cargo steamers, may be taken as a good barometer of the condition of freight rates generally. As compared with a rate of about 3s. a ton, or rather more, ruling in 1910, the time charter rate rose to about 5s. in 1911. There was a further upward movement in 1912, which was regarded as a very satisfactory year for the shipping industry. Time-charter rates ranged from about 4s. 6d. a ton to 7s. 6d. Employment for shipping was good, although, as some set-off to the increased rates, there was a general rise in working costs. In 1913 rates declined, partly owing to the increase in shipbuilding which had been carried out during the good years. The year 1914, destined to be one of the most important for shipping as for all other industries, opened with freights on a downward grade, and in midsummer the industry was in a very depressed condition. All freight rates for cargo steamers were low, and the liner companies were feeling the severe competition of the German ownerships. The two great German companies in the N. Atlantic trade—the Hamburg-Amerika and the Norddeutscher Lloyd—had been for years claiming a larger share of the passenger traffic. In the summer of 1914 the Deutsche-Australische Gesellschaft announced its intention of inaugurating a direct service from Hamburg to New Zealand. Discussions were in progress with the British shipping managers when war broke out.

Beginning of the World War.—Immediately a number of liners were requisitioned by the British Government for service as merchant cruisers, transports, and hospital ships. Freight markets were almost staggered by the unexpected blow which had fallen, and, at first, chartering of all sorts came to a standstill. Happily, the Government at once put into operation a scheme of war insurance on the lines of the recommendations of a committee which had been previously appointed and was presided over by Mr. Huth Jackson. These recommendations provided for the granting of war insurance on shipping by the Government up to 80% of the values. This insurance was worked through the mutual associations of shipowners which were in existence for the purpose of covering such liabilities as shipowners could not obtain under ordinary marine insurance policies. In the preparation of this scheme Sir Norman Hill, the secretary of the Liverpool Steamship Owners' Assn., had taken an active part. The shipping entered in the Liverpool Steamship Owners' Assn. represented 3,948,623 tons, and that in the Liverpool and London War Risks Assn., which included the great bulk of the liner tonnage of the United Kingdom, 6,371,329 tons.

There were also important associations of the same kind with headquarters in London and on the N.E. coast. The main result of putting this scheme at once into operation was that all ships could proceed on their voyages and others could leave without involving disaster to their owners if the vessels were captured or destroyed by the enemy. Had no such scheme been available, a great many vessels, if not all, must have been detained in port. Commerce would immediately have come to a stop. In those days it was the possibility of capture by the enemy's surface cruisers that was in men's minds: that was considered serious enough. The risk of destruction by the enemy's submarines had hardly been taken into account.

As a complement to this scheme for the insurance of hulls, there was also established a Government office for the insurance of cargo. The marine insurance market continued actively in business, but underwriters had themselves realized that bad news or heavy losses could easily have the result of forcing up rates to levels that might be prohibitive for commerce. The Government office was intended to exercise a steadying influence. It was vital that essential goods should continue to be shipped, and, if the risks were greater than insurance companies or private underwriters could bear, it was for the nation to assume them. The first rate quoted by the Government was £5 5s. %. On Aug. 8 the rate was reduced to £4 4s., on Aug. 18 to £3 3s., and on Sept. 2 to £2 2s.

All the time underwriters in the market continued to write war risks. Their rates of premium were frequently below those of the Government, and there were many risks which the Government office would not accept. For instance, the Government office would not accept lines after a ship had left port. Merchants sometimes found that larger quantities of goods had been shipped than they had anticipated, or that the values were greater. Then insurances were effected in the open market. As Germany was no respecter of the rights of neutrals, insurances were also placed in the market on behalf of steamship owners abroad. Some underwriters of insurance companies and at Lloyd's wrote war risks freely from the outset. They took big risks and made large sums of money. The premium incomes of the insurance companies writing war risks were, in some cases, as much as five times the pre-war standard. This was due not only to the demand for insurance against war perils, but also to the great increase in values of commodities which set in as they became scarce.

The Government office was inaugurated under the auspices of the Board of Trade. The services of a number of leading underwriters were enlisted. On Aug. 5 1914, the office was opened at the Cannon Street hotel and the knowledge that there was a market for the risks undoubtedly had a very reassuring effect. While credit was due to several underwriters who gave their services in the working of this scheme, much of the organization fell upon Mr. W. E. Hargreaves, a leading member of Lloyd's, who worked in close coöperation with the Board of Trade.

There were thus in existence from the very beginning of the war facilities for the insurance of ships and cargoes against all the perils that then had to be faced. There was not the same mobilization of the shipping industry.

Immediately after the declaration of war, freights remained listless. A very few shipowners were able to see what was coming, and chartered neutral steamers for "time" at the low rates then ruling, and, in the event, found the transactions very profitable. Most shipowners, however, did not foresee the extremely heavy demands which would be made by the Government upon the industry for ships for direct war purposes. Cargo steamers were requisitioned to act as colliers to the fleet and were needed to carry supplies to the armies abroad. It was not until the end of 1914 that freight rates began to move upwards. Just before the outbreak of war the grain rate from Argentina which may be regarded as a representative rate, was 12s. 6d. per ton. By the end of the year this freight had advanced to 50s. per ton. It rose again sharply in the autumn of 1915, and its movements indicated the influence of the introduction of the Excess Profits duty. On Sept. 20 of that year, when Mr. McKenna, the then Chancellor of the Exchequer, introduced the tax, the Argentine grain freight stood at 57s. 6d. per ton. Within a month it had risen to 70s., by Nov. 20 it had advanced to 85s., and by Dec. 20 to 120s. In 1916 the rate advanced further. By Jan. 20 of that year it stood at 140s. and by Feb. 20 at 157s. 6d. The rate further advanced in 1916 to 183s. 6d. Similar increases took place in other shipping trades. These increases were clearly due, in the first place, to the diminution in the supply of shipping available for commerce, which, in turn, was caused by the ever-increasing requirements of the Government, and by the destruction of shipping by the enemy, and also to the incidence of the Excess Profits duty. This tax provided the argument that the nation got the benefit of the increases. The Treasury did, but not the country which had to pay for them in the increased cost of imported commodities. It represented a form of taxation, at the best, imposed without the authority of Parliament, and the surplus remaining to the owners meant higher profits than, in pre-war years, could ever have been thought possible by them.

For nearly two and a half years the real responsibility for the shipping not requisitioned by the Admiralty rested with the Board of Trade, of which Mr. Walter Runciman was then President. The President of the Board of Trade, with his multitudinous duties of endeavouring to watch over the welfare of all industries, was obviously incapable of giving the close attention to shipping which all the circumstances demanded. The public gradually became keenly interested in the rise that was proceeding in freights and was irritated by it. As its interest developed, it grew into indignation. The matter was raised in Parliament, but the Government of the day showed complacency, regarding the movement apparently as inevitable. It is true that on Christmas Eve, 1915, when freights were still climbing, Mr. Arthur Balfour referred in the House of Commons to the "terrible level" of freights which, he admitted, increased the price, both of the necessities of life to the poor, and of many things which were essential to the Government in the proper conduct of the war. Yet the Government, when it was spurred into action, contented itself with adopting further piecemeal measures.

Government Measures.—One successful measure taken at the outset might have formed a model for a broader policy, and, two and a half years later, did so. This was the requisitioning by the Government of the whole of the refrigerated space in the meat-steamers trading between the United Kingdom and Australasia. This transaction was followed, a few weeks afterwards, by the requisitioning of similar space in the steamers trading with S. America. Arrangements were, at the same time, concluded by the Government with the meat companies for a proportion of their weekly production at fixed prices. Thus, not only were there ample supplies secured for the navy and army at reasonable cost, but supplies were available to maintain the civil population.

In the autumn of 1914 owners were asked to keep the Admiralty informed of the movements of their ships. It was a peculiar fact that very little, if any, information was then in the hands of any Government department of the services of the British shipping companies. Such information had to be sought from the companies themselves.

In the summer of 1916 a scheme was instituted, on behalf of the Indian Government, for buying in India, transporting to the United Kingdom and selling there the exportable surplus of the Indian wheat crop and, through the formation of a committee of brokers, the freight rates were kept on a comparatively moderate basis. In the autumn of that year the Imperial Government was forced into further action. A committee was appointed to consider the desirability of particular voyages and a system of licences was introduced. Another committee was formed for the requisitioning of vessels for the transport of foodstuffs, and a third, known as the Port and Transit Executive Committee, was formed to deal with the congestion at the ports of the United Kingdom, which, by then, had become a very serious matter. As from March 1 1916, licenses were required for all ships of over 500 tons gross trading to and from the United Kingdom.

Licences were granted for whole services or particular voyages. The system also enabled discrimination to be exercised between the different ports of the United Kingdom and so it was important in the relief of congestion.

The committee appointed to deal with the requisitioning of ships for foodstuffs followed the policy of directing owners to load their vessels where the need was most urgent and then to leave the owners to accept the full market rates of freight.

The first chairman of the Port and Transit Executive Committee was Lord Inchcape, and the Committee included representatives of the Admiralty, the War Office, shipping, railways and dock authorities. It was subsequently strengthened by the addition of Labour leaders. It owed responsibility, directly, to the Prime Minister and adopted such measures as would tend to relieve congestion at the ports. Its task was a formidable one and, while the Committee was able to bring about certain reforms, it could not entirely remove the troubles. These actually seemed to be at their worst after the Armistice. Immense supplies of commodities which could not be moved during the war were poured into the country, and the facilities for removing these proved quite inadequate, with the result that ships were detained for long periods, owing to inability to discharge their cargoes. Much public attention was focussed on the waste of shipping thereby involved. Strenuous efforts were made by all concerned to improve the situation. As an indication of what was being done, the Port of London Authority issued a weekly bulletin showing the number of vessels detained, and continued to issue this until the situation was completely changed and, early in 1921, the weekly return showed that large numbers of steamers were laid up idle owing to the lack of employment. Lord Inchcape was succeeded as Chairman of the Committee by Sir Norman Hill, who, on a breakdown of health caused by overwork was, in turn, succeeded at the end of 1919 by Sir John Barran. The Committee was formally dissolved by the Prime Minister early in 1921. During the period of its activity it had wide powers, and, at the outset, had, among other measures, effected a change in the Customs Regulations which, as was proved, were then having the effect of accentuating the difficulties.

The chairman of the Ship Licensing Committee was Mr. (afterwards Sir) Maurice Hill, and it included Mr. (afterwards Sir) F. W. Lewis, then deputy chairman of Messrs. Furness, Withy & Co., as vice-chairman, Mr. H. A. Sanderson (president of the International Mercantile Marine Co. and chairman of the Oceanic Steam Navigation Co.), Mr. Scholefield, of Newcastle, Mr. Purdie, of Glasgow, and Mr. Burton Chadwick, of Liverpool.

The Committee for the requisitioning of ships was presided over by Mr. J. H. Whitley, who in April 1921 became Speaker of the House of Commons. It included three shipowners, namely, Mr. (afterwards Sir) T. Royden, deputy chairman of the Cunard Co., Mr. (afterwards Sir) E. W. Glover, of the shipowning firm of Glover Bros., and Mr. R. D. Holt, the chief of the important shipowning firm of Liverpool. All these members had previously been advising the Transport Department of the Admiralty.

In spite of the measures that were being adopted, freights remained on a very high level, and the shipping situation was very unsatisfactory. The need for complete control was urged persistently in *The Times* newspaper, and in Feb. 1916 the Government was again forced to act. In that month an Allocation Committee, or Shipping Control Committee, was formed in order to apportion the tonnage according to the various and urgent demands that were made upon it. Lord Curzon was appointed chairman of this Committee. Other members were Lord Faringdon, then better known as Sir Alexander Henderson, Mr. Thomas Royden, and Mr. F. W. Lewis.

Supply of Tonnage.—It became plainer every day that the ever-reducing supply of tonnage was becoming less adequate to meet all the demands made upon it. Consequently, the Government decided to place restrictions on the importation of various commodities. The first of these to be effected were paper, paper-making materials, tobacco, dried fruits, furniture woods, stones and slates. In March 1916, a prohibition was placed on the importation of many articles under the general heading of "luxuries." Among such articles were motor-cars for private use, musical instruments, cutlery, hardware, cotton and woollen manufactures, chinaware, fancy goods and soap. A restriction was also placed on the importation of certain brewing materials.

The inadequacy of the tonnage to meet the supplies was at that time due more to the requirements of the Government for ships for direct war purposes than to the depredations of the enemy. The highest quarterly loss of British shipping due to the enemy was 356,000 tons in the third quarter of 1915. In 1916 the ratio of loss fell; in the second quarter, the total amounted to 271,000 tons and in the third quarter to 284,000 tons. This drop was, however, only temporary, and in the fourth quarter of 1916 the total sprang up sharply to 617,000 tons and then continued at a high rate until the conclusion of the Armistice.

Throughout 1916 what became known as the "shipping problem" continued to attract great public attention. Articles were published in *The Times* urging the need of centralized control, in order that the utmost use might be made of the continually declining supply of tonnage and so that ships might be employed in the most effective way, irrespective of the individual trades of the ownerships to which they belonged. It was realized that this could only be brought about when all ships were hired to the Government, so that it would become for the owners a matter of more or less inconsequence into which routes the vessels were put. The principle of standardization was also persistently urged in order that large numbers of vessels might be constructed on identical plans and of parts fabricated from the same models. It was not, however, until the formation of Mr. Lloyd George's Government in Dec. 1916 that the shipping situation was completely taken in hand.

Ministry of Shipping.—A feature of the new Government was the creation of a Ministry of Shipping. As Shipping Controller, Sir Joseph Maclay was appointed. Sir Joseph Maclay had been known in shipping circles as a successful manager of cargo steamers and, while he was little known to the general public, the appointment was regarded in the shipping industry as a good one. By his own wish Sir Joseph Maclay was not a member of the House of Commons, but was represented there by Sir Leo Chiozza Money, as parliamentary secretary.

Various measures were soon taken to secure a better grip of the shipping problem. One of the most important of these was a general requisitioning of liners by the Government. These vessels were hired to the Government on the basis of what were known as Blue-book terms—those agreed early in the war with the Admiralty by a committee of owners presided over by Lord Inchcape. The management of such vessels as could be retained in ordinary commerce was left with the owners, who were required to give a financial account of their stewardship to the Government, and to pay over all profits above the Government rates of hire. Under this system it was less important to the individual ownerships into which routes their vessels were put. It was well that control was centralized, for, early in 1917, the enemy submarine war intensified and the losses greatly increased. As compared with a loss of 617,000 tons in the last quarter of 1916, the British tonnage sunk in the first quarter of 1917 amounted to 912,000 tons. The pinnacle was reached in April of that year and for the second quarter of 1917 the losses totalled 1,362,000 tons. Sinkings of foreign vessels were proceeding apace all the time, and in the second quarter of 1917 the total losses for the world amounted to 2,237,000 tons. The losses for each quarter throughout the war period are shown in the following table extracted from a White Paper (C.9221) issued at the end of 1918:—

Period	British	Foreign	Total of World
	Gross tons	Gross tons	Gross tons
1914			
Aug. and Sept.	341,824	85,947	427,771[1]
4th Quarter	154,728	126,688	281,416
1915			
1st Quarter	215,905	104,542	320,447
2nd "	223,676	156,743	380,419
3rd "	356,659	172,822	529,481
4th "	307,139	187,234	494,373
1916			
1st Quarter	325,237	198,958	524,195
2nd "	270,690	251,599	522,289
3rd "	284,358	307,681	592,039
4th "	617,563	541,780	1,159,343
1917			
1st Quarter	911,840	707,533	1,619,373
2nd "	1,361,870	875,064	2,236,934
3rd "	952,938	541,535	1,494,473
4th "	782,889	489,954	1,272,843
1918			
1st Quarter	697,668	445,668	1,143,336
2nd "	630,862	331,145	962,007
3rd "	512,030	403,483	915,513
4th "	83,952	93,582	177,534
Totals	9,031,828	6,021,958	15,053,786

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[1] This figure includes 210,653 gross tonnage interned in enemy ports. After Oct. 31 the tonnage lost by enemy action was: British 11,916, Foreign 2,159.

New Construction.—Attention was at once given by the Shipping Controller to the need of construction, and a programme for standardized ships was laid down. The principle of standardization had already received practical recognition in June 1916, when the Standard Shipbuilding Co., to operate at Chepstow on the river Wye, was formed. This company received very powerful support, the capital being subscribed by, among other companies, the P. & O. and British India, New Zealand Shipping, Orient Steam Navigation, Federal Steam Navigation, Messrs. Furness, Withy & Co., the Shire Line, Messrs. A. Weir & Co., Messrs. Harris & Dixon, Messrs. Trinder, Anderson & Co., Messrs. Bethell, Gwyn & Co., and Messrs Birt, Potter & Hughes. Mr. James Caird, the head of Messrs. Turnbull, Martin & Co., was appointed chairman, and Mr. John Silley, managing director of R. & H. Green and Silley Weir, an old and famous shipbuilding firm, was appointed vice-chairman. In Aug. of that year this company acquired the engineering firm of Edward Finch & Co., Ltd., which had originally been formed to build Brunel's Bridge over the river Wye. In this yard three building slips were prepared, and at the beginning of 1916 two cargo steamers of 3,300 tons were being built there, in addition to a large number of smaller vessels. The first four slips for building steamers of up to 10,000 tons in the Standard Co.'s new yard were also being prepared. Difficulties had to be overcome in the way of securing sufficient labour and part of the scheme provided for the construction of a garden city. Early in 1917 much progress had been made with the provision of housing accommodation under licences from the Ministry of Munitions.

These yards were subsequently taken over by the Government. A great deal of money was spent upon them. Various difficulties arose, and the results of the work there were very disappointing. After the Armistice the great bulk of the property was sold to private interests.

On assuming office, Sir Joseph Maclay at once tackled the problem of shipbuilding, and appointed a committee to advise him on all matters connected with the acceleration of merchant ships under construction and nearing completion, and the general administration of a new merchant shipbuilding programme. This committee included Mr. (afterwards Sir) George J. Carter (of Messrs. Cammell, Laird & Co., Ltd.), president of the Shipbuilding Employers' Federation, as chairman; Mr. (afterwards Sir) W. S. Abell, (chief surveyor to Lloyd's Register of Shipping); Mr. (afterwards Sir) F. N. Henderson (of D. & W. Henderson & Co., Ltd.); Mr. James Marr (of J. L. Thompson & Sons, Ltd.); Mr. Summers Hunter (of the North-Eastern Marine Engineering Co., Ltd.); Mr. (afterwards Sir) C. J. O. Sanders (of the Marine Department, Board of Trade); and Mr. (afterwards Sir) W. Rowan Thomson (of Messrs. D. Rowan & Co., Ltd., president of the North-West (Clyde) Engineering Trades' Employers' Association); Mr. A. R. Duncan, secretary to the Shipbuilding Employers' Federation, who, as Sir Andrew Duncan was later appointed Coal Controller, was secretary to the new committee.

The last word in merchant shipbuilding then rested with the Admiralty, on the ground that it was necessary for the naval authorities to determine what proportion of labour and material should be allotted to naval and merchant construction respectively. These proportions were dependent on the view held as to whether it was better to concentrate on the building of destroyers and other craft for the destruction of enemy submarines and for the protection of merchant vessels, or to build merchant ships. There was a great deal to be said for the theory that it was better to prevent ships being sunk than to build vessels to replace those destroyed. In May 1917 Sir Eric Geddes was appointed to the post of Navy Controller, and shortly afterwards, Maj.-Gen. A. S. Collard, director of inland waterways and docks, in the department of the director-general of movements and railways, was appointed deputy controller for auxiliary shipbuilding. The latter term was used to cover all merchant vessels. In July 1917, Sir Edward Carson was succeeded as First Lord of the Admiralty by Sir Eric Geddes, and Mr. (afterwards Sir) Alan Anderson became Navy Controller. The problem of merchant shipbuilding was at this time acute. The British shipping destroyed by the enemy in 1916 represented 1,498,000 tons, or nearly three times the production in British yards. This had fallen from the very poor total of 650,000 tons in 1915 to 541,000 tons in 1916. The peak in British shipbuilding had been reached in 1913, when 2,280,000 tons gross had been built, consisting of 1,920,000 tons of merchant vessels and 320,000 of warship tonnage calculated on a converted basis. It was to repeat such a production that the authorities at last aimed, the difficulties being enormously increased by the fact that large numbers of skilled men had been withdrawn from the shipbuilding industry for the fighting forces. The military authorities agreed to release such skilled men as could be spared, but as these were scattered over the various theatres of war, their return was very slow.

When responsibility for mercantile shipbuilding was transferred from the Ministry of Shipping to the Admiralty, some little friction arose between the new authorities responsible and the old Advisory Committee to the Shipping Controller, and in the autumn of 1918 a Shipbuilding Council to the Navy Controller was created, consisting of the members of the old Committee and advisers from the Admiralty. The position continued in some respects unsatisfactory, and in the spring of 1918, after an agitation for a more energetic merchant shipbuilding programme, Lord Pirrie was appointed Director-General of Merchant Shipbuilding, the official appointment being announced in the House of Commons on March 20 1918. He was regarded as the outstanding figure in British shipbuilding, and he was able to infuse energy into the shipbuilding programme. One of his first efforts was very greatly to improve the organization for the repair of damaged ships. Many vessels, after being torpedoed, managed to limp into ports, some of which, notably Falmouth, became seriously congested. A system of close and centralized control of the repairing facilities was organized, and much was done to make the damaged ships soon available again for service. The assistance of the United States in merchant construction had been earnestly invited. That country threw itself into the effort with immense fervour, and the height of the shipbuilding campaign was reached there in the summer of 1918. In June 1918, as responsibility for merchant shipbuilding now rested with the Department of the Controller-General, Sir. Alan Anderson resigned from the position of Navy Controller. After the Armistice the responsibility for the completion of the merchant shipbuilding programme was transferred again to Sir Joseph Maclay, the Shipping Controller.

Financial results of the shipbuilding programme were described in the House of Commons on March 12 1921, by Col. Leslie Wilson, parliamentary secretary to the Ministry of Shipping. Colonel Wilson stated that the total cost of 228 ships built in the United Kingdom for the Government was £36,481,000, and that the ships were subsequently sold for £47,591,000, showing a total profit of £11,110,000. An agreement was entered into with the Government by Lord Inchcape, who undertook to distribute the ships to those British owners who desired them, in proportion to their losses. The agreement was made on the basis that no profit should accrue to him through the transaction. Outside the United Kingdom there were built for the British Government 122 ships, the vessels being built at much higher prices than those paid for the vessels constructed in the United Kingdom. The total cost of these vessels was £26,884,000, and the selling price was £18,289,000, showing a loss on the ships built abroad of £8,595,000. The net profit on 378 ships built and sold, excluding any allowance for depreciation, was £2,515,000. Colonel Wilson maintained that the Government would have been fully justified in taking depreciation into account, and, allowing 5% depreciation on 311 ships which were being worked, there would have been a net profit not of £2,515,000, but of £5,122,000. Again, but for the new ships it would have been necessary for the Government to try to charter neutral vessels, for which high rates of freight would have had to be paid. This would, it was estimated, have involved an additional expenditure of £27,000,000. There was no question that the Government acted wisely, at any rate from the financial point of view, in disposing of the ships when it did. They were offered to the shipping industry at a time when freights were still high, and so substantial prices were bid. A very different situation existed when the ex-German ships allotted to this country were offered to British shipowners, again through the medium of Lord Inchcape. Severe depression had, by then, fallen on the shipping industry, and the absorption of the ships, many of which were not of attractive type to British owners, was a very slow matter.

Replying to a question in the House of Commons on May 24 1921, Sir Robert Horne, the Chancellor of the Exchequer, stated that 202 ex-enemy ships allotted to the British Empire for final ownership had been sold, and that 85 merchant ships and 22 trawlers remained unsold. The gross amount realized was £14,523,074. From this gross total there fell to be deducted expenses of repair, delivery, etc., and a considerable part of the purchase money was payable in instalments over a period of years. The net cash then passing was £6,500,000.

War Services of the Mercantile Marine.—All the classes of British ships which form a great mercantile marine rendered services of immense value to the Allies during the war. Merchant vessels, in comparison with warships, were once described as being mere cockleshells, yet their crews faced the hidden dangers of mine and torpedo without flinching. The persistent reduction of the British mercantile marine which proceeded was a matter of extreme gravity to the Allies. Experience showed that the losses of the large and fast liners were, in every way, more formidable than those of the ordinary cargo vessels. When at last the United Kingdom, enthusiastically supported by the United States, bent energies on the construction of merchant vessels, it was the simple cargo steamers that were built. In both countries the plan of building simple vessels of standard type was adopted. Everything that was complicated was ruled out. Straight lines were substituted for curves, and parts were produced in great numbers, so that identical ships could be built rapidly. In the United States the principle of standard construction was carried further than in England. There, steel works, which had never undertaken shipbuilding work before, produced shapes and angles for ships, and the assembling of the parts was carried out by bridge builders and other steel workers who had had no previous experience of shipbuilding. In England fabrication on somewhat similar lines was planned in connexion with the new shipyards on the river Wye, of which control was assumed by the Government, but these plans did not begin to show their full effect until the conclusion of the war made such methods no longer necessary. While, in a case of emergency, a good case could be established for building cargo vessels in mass production, like Ford motor-cars, there was no similar way of building the large liners. In the height of the crisis and, indeed, throughout the war, the building of such vessels yielded place to the need for carriers of food and munitions. Yet the duties devolving on the liners steadily increased. At first a comparatively small number were requisitioned to serve as merchant cruisers, patrol vessels, hospital ships, and transports. The Dardanelles campaign made heavy demands on this type of vessel, and, later, the Salonika expedition. The climax was reached when, in the spring, summer and autumn of 1918 every possible ship that could be provided was needed to transport American troops. Liners were withdrawn from every British service and vessels never intended for such work were put into the N. Atlantic route. It was indeed fortunate for the nation that a large mercantile marine was in existence at the outbreak of war, and the magnificent services of some of the greatest ships will be always remembered.

Of all the crimes committed by Germany at sea, the destruction of the "Lusitania" on May 7 1915 remains the outstanding example. The liner was torpedoed near the Old Head of Kinsale, when 1,195 persons were drowned, including 291 women and 9 children. Represented in tonnage alone this loss was exceeded by the "Britannic," sunk in the Aegean Sea on Nov. 21 1916, by submarine or mine, while employed as a hospital ship. The "Britannic," uncompleted on the outbreak of war, was of 48,158 tons and was the largest White Star liner. The "Lusitania," built in 1907, was of 31,550 tons.

Splendid service was performed by the sister ship "Mauretania." At first she was employed in the ordinary trans-Atlantic service, where her speed was of great importance in view of possible attacks by German cruisers. In June 1915 she flew the White Ensign, conveying troops to Mudros for the Gallipoli campaign. Four months later she became a hospital ship. In Dec. 1916 she again became a troopship and brought Canadian troops to this country. Early in 1918 she became an armed cruiser, but was soon engaged in bringing American troops to Europe. She also carried many distinguished passengers whose urgent duties made it necessary for them to cross the Atlantic. Fine service was also rendered by the Cunard liner "Aquitania," of 45,600 tons. Only three round voyages between Liverpool and New York had been made by this great ship before the war. At once she was requisitioned by the Admiralty and was commissioned as a merchant cruiser, leaving Liverpool in this capacity four days after the outbreak of war. She became a transport later and carried 30,000 troops to the Dardanelles; then she became a hospital ship and as such carried 25,000 men. Early in 1918 she was refitted as a transport, and in nine voyages carried 60,000 American troops. The liner was extremely useful in repatriating troops after the Armistice, and in the spring of 1921, in the middle of the shipping depression, had the reputation of being the only ship afloat that was earning any money. Besides carrying large numbers of saloon passengers, she was eminently fitted for the transport of emigrants, of whom she carried enormous numbers from the Continent.

The "Carmania," well known as a Cunard liner before the war, distinguished herself by sinking the German merchant cruiser "Cap Trafalgar" in a duel. The "Laconia," another Cunard liner, shared in the operations in the Rufiji river, East Africa, when the German cruiser "Königsberg" was sunk. Besides the "Lusitania," the Cunard Co. lost the following vessels:—the "Caria," "Veria" (1915), "Franconia," "Alaunia" (1916), "Ivernia," "Lycia," "Folia," "Trachia," "Feltria," "Ultonia," "Volodia," "Vinovia" (1917), "Andania," "Valeria," "Aurania," "Ansonia," "Vandalia," "Carpathia," "Flavia" and "Ascania" (1918). These represented extremely serious losses, and after the Armistice the company put in hand an extensive programme of construction. Unfortunately the cost of building was then on a very high level.

Losses of the White Star Line were also serious and included, besides the "Britannic," the "Oceanic," "Arabic," "Laurentic," "Cymric," "Afric," "Georgic," and the "Delphic." Shortly after the outbreak of the war, the "Oceanic," "Teutonic," "Cedric," "Celtic" and "Laurentic" were commissioned as armed cruisers. The "Laurentic" was sunk by submarine off the coast of Ireland in Jan. 1917, while carrying gold, of which a substantial proportion was recovered in salvage operations after the Armistice. The "Teutonic," built in 1889, and one of the most famous of the White Star liners, was subsequently acquired by the Government and was later publicly offered for sale. Services of immense value were rendered by the "Olympic" of 46,439 tons. She was employed in carrying troops to Gallipoli and in bringing, first, Canadian troops, then Chinese labour battalions, and, finally, American troops to Europe. Her war record included that of transporting more than 200,000 persons during the period, including the wives and families of Canadian soldiers returning to Canada after the war. Among her special services were the rescue of the company of the super-dreadnought battleship "Audacious," sunk by a mine off the N. coast of Ireland, and the ramming of a large German submarine in the English Channel in May 1918.

Several of the ships of the allied company, the Atlantic Transport Co., were employed in the transport of troops. These included the liners "Minneapolis," "Minnesota," "Minnewaska," "Minnetonka," "Marquette," "Manitou," "Menominee," "Missouri" and "Maryland." Besides carrying troops, the vessels of the Atlantic Transport Co. carried large numbers of horses and mules, for which service the vessels were especially suitable. The losses of the line, representing 24,100 tons, or 43% of the fleet, included all the regular passenger liners which were most favourably known in the trade between London and New York.

Liners of the Canadian Pacific Ocean Services were employed as merchant cruisers and transports. At once the "Alsatian," "Victorian" and "Virginian" were requisitioned and placed in the 10th Cruiser Squadron which was responsible for a share of the blockade of Germany. The "Calgarian" was sunk on March 1 1918 when proceeding in charge of a convoy of 30 ships.

The total number of vessels lost by the P. & O. Co. and its allied lines was 81, representing 491,600 tons, while 14 vessels of 76,600 tons were lost through marine causes. One of the most heroic actions of war at sea was fought between the "Otaki" of the associated New Zealand Shipping Co. (whose commander, Lt. Archibald Bisset Smith, received a posthumous award of the V.C.) and the disguised heavily armed German cruiser "Moewe." After the "Otaki" had suffered several casualties and much damage had been done to the hull which was heavily on fire, Lt. Smith ordered the boats to be launched in order that the crew might be rescued. He remained on the ship and went down with her when the vessel sank with colours flying.

The Orient Co.'s liners "Otranto," "Orama" and "Otway" were early commissioned as armed cruisers and, at the beginning of 1915, the "Orvieto" and "Ophir" were likewise commissioned. Subsequently the "Ophir" was bought by the Government. Other vessels of the line were employed as transports. The "Otranto" was lost by collision on Oct. 6 1918.

Heavy losses were suffered by the various companies controlled by Sir John Ellerman. In all, 103 ocean vessels, with a total cargo capacity of 600,000 to 750,000 tons, were destroyed. These included the liner "City of Athens" mined off Cape Town in Aug. 1917. The "City of Winchester" was the first merchant vessel to be destroyed during the war, being captured by the German cruiser "Königsberg," while homeward bound from India with a very valuable cargo of produce. Another liner belonging to the Ellerman fleets was mined far from Europe. The "City of Exeter," a fine passenger ship, struck a mine in the Indian Ocean, about 400 m. from Bombay. Number 1 hold filled at once, and the master gave orders for the passengers and crew to leave the ship. Then the master and chief engineer returned and, at grave risk, made a thorough examination of the ship. They decided that, with the exercise of the greatest care, the crippled vessel could reach Bombay under her own steam. The passengers reëmbarked and the vessel safely arrived in port. This was only one example of fine seamanship, of which there were many hundreds of magnificent cases during the war. When the enemy's submarine campaign became intensified not a voyage through infested waters could have been completed without the exercise of courage of the highest order, and repeatedly the seamanship and endurance of the officers and crews were put to the severest test. There were lurking dangers for the ancient little collier which had to feel her way up and down the North Sea, her one protection being a little gun—slight armament against a powerfully armed submarine; for the great liners which proceeded without escort and relied on their speed, their own guns, their "dazzle painting," and their zig-zag courses to baffle the efforts of the enemy to sink them with, perhaps, several thousand troops on board; and for the slower cargo vessels which, in convoy formation, when thick weather obscured the other ships, ran the very serious risk of collision.

Vessels of the Royal Mail Steam Packet Co. had the distinction of being the first among British liners to be fitted before the war for carrying a gun for defensive purposes. This was in accordance with the policy initiated, before the war, by Mr. Winston Churchill when First Lord of the Admiralty. Royal Mail vessels were largely employed as armed cruisers, transports and hospital ships. As armed cruisers there were commissioned the "Andes," "Arlanza," "Almanzora," "Avon," ("Avoca"), "Ebro" and "Alcantara." The last named, only lightly armed, fought the disguised German raider "Greif" for 20 minutes in the North Sea, and sank with colours flying just before her enemy went to the bottom. The "Asturias" was torpedoed while bearing all the marks of a hospital ship. Other ships of the line which bore the Red Cross were the "Araguaya," "Drina," "Essequibo," "Tagus," "Agadir," "Berbice" and "Balantia" (renamed "St. Margaret of Scotland"). Many vessels of the fleets were sunk, including the large liners "Amazon," "Drina," and "Merionethshire."

No fewer than six of the Union-Castle liners were torpedoed or mined while serving as hospital ships, namely, the "Galeka," "Braemar Castle," "Dover Castle," "Glenart Castle" (twice), "Gloucester Castle," and "Llandovery Castle." While based on Southampton the hospital ships of the company carried 331,000 British wounded officers and men to port and also landed 8,200 enemy wounded. The liners "Armadale Castle," "Edinburgh Castle," "Kinfauns Castle," and "Kildonan Castle" were commissioned as armed merchant cruisers. The company's vessels also carried very large numbers of troops. It was not surprising that, after the Armistice, many months elapsed before a sufficient number of vessels could be again placed in the ordinary S. African passenger service to provide weekly sailings.

Recognition of the services of British shipping during the war was made by the King and his ministers in various speeches. Speaking at the Guildhall on July 29 1919, the King declared that the splendid services of the officers and men of the British mercantile marine had been vital to the successful issue of the war. From day to day these men had been facing death no less than the soldiers in the fighting line, and, even when the submarine menace was at its height, no single British crew ever refused to sail. He urged the re-creation of the merchant navy and the development of the ports as essential if the United Kingdom was to regain its old supremacy.

Men of the mercantile marine marched in the procession of the Allied and Associated Forces through the streets of London on July 19, 1919. There was also a special pageant of the Sea Services on Aug. Bank Holiday 1919. This took the form of a procession of lifeboats, bearing the House flags of all the shipping companies, from the Pool of London to Chelsea. The procession was headed by a launch flying the flag of the Port of London Authority, followed by a steam vessel of Trinity House, with the Duke of Connaught, as Master, on board. Then came a picket boat with a naval officer in charge as escort to the Royal barge. In this were the King and Queen, Queen Alexandra, the Prince of Wales, Prince Albert (afterwards Duke of York) and other members of the Royal Family. Following this was a specially prepared barge bearing the Lords of the Admiralty and then the Lord Mayor, as admiral of the Port of London, in the barge of the commander-in-chief at the Nore. These were followed by launches of the Ministry of Shipping, the Customs and Excise, Lloyd's and the Thames Conservancy. A dozen twelve-oared naval cutters, four picket boats and an armed motor-launch of the navy, models of naval guns, motor and steam lifeboats, a motor-launch carrying Trinity House pilots, steam-boats of the Mercantile Marine Association and boats from the training ships, fishermen's motor drifters, and vessels representing the Missions to Seamen. The rear was brought up by 70 lifeboats towed by tugs bearing the flags of the various shipping ownerships. Bands were placed along the line of route and famous old sea songs were sung. Such a commemoration was unprecedented, but then the services of the mercantile marine during the war were likewise unique.

The Commonwealth Government Line.—In the summer of 1916 a development occurred of great importance to shipping. For some time Australia had been seriously disturbed about the difficulties encountered in arranging for her exportable surplus of wheat, a matter of vital importance to the Commonwealth. With the ever-diminishing supply of tonnage, British vessels had naturally been directed more and more into the N. Atlantic, since it was obviously much quicker to bring wheat to the United Kingdom—less than 3,000 m. across the ocean—than more than 12,000 miles. Mr. W. M. Hughes, the Prime Minister of Australia, arrived in the United Kingdom in March 1916, but he got little satisfaction from the Imperial authorities on the shipping question. He sailed for home in June and, when he was on the water, the announcement was made that he had bought, on account of the Commonwealth Government, 15 second-hand cargo vessels. The steamers had an average dead-weight carrying capacity of between 7,000 and 8,000 tons, and 10 of them were taken from Messrs. Burrell's Strath line. For the larger vessels the price worked out at about £19 a ton. This was, perhaps, from four to five times greater than the pre-war price, but as events occurred, the purchase proved a profitable one, financially, for Australia. One effect was that the vessels were removed from the United Kingdom Register and were no longer subject to excess profit taxation. This action of Mr. Hughes hardly commended itself to any of the shipping authorities in the United Kingdom, but he had shown unmistakably that full recognition had to be given to the Australian viewpoint. In the autumn of that year the President of the Board of Trade announced that a large purchase had been made of Australian wheat on behalf of the Imperial Government, and that a number of steamers had been requisitioned to proceed to load the wheat in Australia. As the supply of available shipping became steadily less, it proved impracticable to transport all the wheat bought, and immense quantities were stored in Australia until after the conclusion of the war.

The purchase of the 15 cargo vessels represented the foundation of a Commonwealth Government line. Being free from taxation and with freights ruling high, large profits were earned, which made the venture temporarily, at any rate, profitable to the Australian people. A number of German steamers seized in Australia were added to the fleet and, later, ships were built both in Australia and the United Kingdom. In 1919 Mr. W. M. Hughes, on a visit to the United Kingdom, placed contracts for five large steamers with leading builders. These were designed for carrying a large amount of refrigerated cargo, and some hundreds of third-class passengers. Limited accommodation was to be provided for a few passengers in the saloon. The first of these steamers, the "Moreton Bay," of 14,500 tons gross, was launched from Messrs. Vickers's shipyard at Barrow on April 23 1921. It was then asserted that the four other vessels would be in the water during the ensuing few months, and that all the vessels would be in service before the end of 1921. Between the time of the placing of the contracts in 1919 and the time of launching, the cost of ship construction had risen very seriously. All work was done on the "time and lime" principle, by which the owners paid for the cost of materials, the cost of labour, an allowance for overhead charges, and a sum, either as a fixed amount or as a percentage on the outlay, as profit to the builders. The ships were thus understood to have cost considerably more than had been expected, and with freights falling, the problem of making the vessels pay their way was enhanced. A wooden ship programme carried out for Australia in the United States was hardly successful financially. The building of wooden vessels, of which large numbers were constructed for the American mercantile marine, could only be regarded as an emergency measure. The inauguration of the Commonwealth line aroused much criticism from shipping managers, who cordially disliked the idea of a State enterprise. They maintained, and could do so justifiably, that a State enterprise could be carried on without the same consideration for profit and loss as a public company, if, for instance, a Government chose to carry merchandise at below cost price.

The Canadian Merchant Marine.—Canada instituted a line of Government steamers. It found itself after the Armistice with a great fleet of vessels which had been built in the period of emergency. Instead of offering them to the shipping industry, it decided to operate them on account of the nation. A corporation was formed, entitled the Canadian Government Merchant Marine, Ltd., in close conjunction with the Canadian National railways. The policy of the management was to institute new services and to coöperation with the existing lines, rather than to compete with them. New services were established to and from the United Kingdom and many parts of the world. In 1920 an agreement was entered into with Messrs. Alfred Holt & Co. for a joint trans-Pacific service to and from Vancouver, and with the British India Co. for a service between Montreal and Indian ports, via the Suez Canal. In the United Kingdom the Cunard Co. acted as managers for the line. The usual practice in making these arrangements with the shipping companies was for the Canadian National railways to represent the steamship companies in Canada, and for the agents of the shipping companies abroad to act similarly for the railways. This policy of working in conjunction with the shipping companies disarmed criticism, which was very strong in the case of the Australian scheme.

Amalgamation and Fusion Schemes.—Numerous amalgamations and fusion schemes took place between 1910 and 1921. Sir Owen Philipps, who at the beginning of 1910 was chairman of the Royal Mail Steam Packet Co., was particularly active in the policy of fusion. In that year the capital was acquired of the Pacific Steam Navigation Co., which was mainly interested in the trade with the E. and W. coasts of S. America. In the same year a fusion agreement was entered into with Elder, Dempster & Co., Ltd., which owed its development largely to the genius of the late Sir Alfred Jones. In 1911, the capital was acquired of Lamport & Holt, Ltd., largely concerned in the trade between the United Kingdom and also the United States and S. America, and in the same year an agreement was entered into with the Glen Line, Ltd., which is concerned in Far Eastern trade. Incidentally, the Glen Line is notable among British ownerships for its policy of building motor-ships, which is known to have been very successful. In 1912 the capital of the Union-Castle Co. was acquired by the Royal Mail Co. and the Elder Dempster Co. This, perhaps, was the most important of the fusion agreements which Sir Owen Philipps effected. The Union-Castle Co., a consolidation of the old Union and Castle companies in the S. African trade, had been feeling the loss of a great chief in the death of Sir Donald Currie, to whose extraordinary powers the line owed very much. In 1913 control was secured of the Nelson Lines, Ltd., which was and is engaged in the carriage of meat to the United Kingdom from Argentina, together with participation in the passenger trade. In 1917 an interest was acquired in MacAndrews & Co., Ltd., concerned in trade with the Peninsula; in the Coast Lines, Ltd., a consolidation of coasting companies trading round the United Kingdom; and in the Moss Line, Ltd. In 1919 an interest was secured in the old-established ownership of David MacIver & Co., Ltd., in Messrs. Bullard, King & Co., Ltd., and in Messrs. J. & P. Hutchinson, Ltd. While Sir Owen Philipps thus had enormous interests in British shipping, Lord Inchcape was also to the forefront in effecting fusion schemes.

At the end of 1914, Sir Thomas Sutherland retired from the positions of chairman and managing director of the P. & O. Company. For 42 years he had occupied the office of managing director and for 34 years that of chairman. The expansion of the P. & O. Co. will always be associated with his name. His last important act was to effect an amalgamation with the British India Co., of which Lord Inchcape was managing director. On the retirement of Sir Thomas Sutherland, Lord Inchcape became chairman and managing director of the P. & O. Company.

In June 1916, the P. & O. Co. acquired an interest in the New Zealand Shipping Co., which, in turn, controlled the Federal Line trading with Australia. Exactly a year later, in June 1917, a representative interest was secured in the Union Steamship Co. of New Zealand, which not only provided various coasting services in New Zealand, but also maintained services with Australia, British Columbia, and India. In the autumn of 1917 shares were secured in the Hain & Mercantile Steamship Co., and also in the Nourse Line, each of which possessed a considerable amount of cargo tonnage. The fleets of these three companies, together, included 107 steamers of 370,000 tons gross.

Other notable fusions of the war period included the acquisition of a controlling interest in the Prince Line, Ltd., which had been associated with the name of its founder Mr. James Knott. This acquisition, which was effected in Aug. 1916, involved the addition of 37 steamers, mainly cargo vessels, to those controlled by Messrs. Furness, Withy.

In Oct. 1916, Sir John Ellerman, chief of the Ellerman Lines, acquired all the shares of Messrs. Thomas Wilson, Sons & Co., Ltd., the Wilson fleet including nearly 80 vessels of about 200,000 tons. Its services were based on Hull. At almost the same time an agreement was concluded between the Anchor Line (Henderson Bros., Ltd.) and the Donaldson Line, Ltd., for a fusion, under the title of the Anchor-Donaldson Line, with Sir Alfred Booth, chairman of the Cunard Co., as chief of the new formation. The agreement meant that the Cunard Co. secured control of the Donaldson Line, for it already had a controlling interest in the Anchor Line.

Shipowners' Associations.—Important work was done by the Liverpool Steamship Owners' Association, especially through the war period. It acted on the principles upon which it was founded in 1848. These were, broadly, that the growth and prosperity of the British mercantile marine is dependent on the enterprise, skill and ability of the individuals directly concerned, and that neither State control nor State aid can prove an effective substitute for these qualities. The Association has not sought to interfere with the individual freedom of its members. It has, however, consistently opposed all measures calculated either to transfer the control of the country's shipping to official hands, or to hamper its development by rigid rules and standards. It has recognized that the first duty of the shipowner is to secure the safety of the lives and property entrusted to his care, but it has maintained that the individual shipowner, as long as he is discharging that duty, is entitled to carry on his business in the manner which will attain the best results.

The Association had much to do, particularly through the work of its secretary, Sir Norman Hill, with the establishment of the War Risks Insurance Scheme. Throughout the war period it consistently worked with the object of getting the maximum number of voyages made and the maximum number of cargoes carried. It coöperated with the Government authorities when control of shipping was obviously necessary, and when the great emergency had passed, it pressed for freedom for the shipping industry.

A marked development has taken place in recent years in the organization of London shipowners through an extension of the activities of the Chamber of Shipping of the United Kingdom. Rather curiously, the formation of the Chamber in Feb. 1878, was distinguished by the appointment of a Hull shipowner as president. This member was Mr. Henry John Atkinson. The Chamber was composed of local shipowning associations in various ports and of most of the Protection and Indemnity Clubs, with a central office in London. Its primary objects were to discuss questions affecting shipping; to disseminate information, from time to time, on matters concerning the industry, and to secure the advantages of united action, especially in communications with the Government and various bodies. The Chamber did useful work for many years under its original constitution, but the events of the war showed the need for a more effective organization that would include all classes of shipping. Largely due to the enterprise of Sir Kenneth Anderson, the president of the Chamber in 1915, the reconstruction of the Chamber was carried out. Sir Kenneth Anderson was succeeded as chairman in 1916 by Sir William Raeburn, who held the office for three years assisted by Mr. J. Herbert Scrutton as vice-president. During the years 1916–7 new life was put into the Chamber, and much was done to keep the public informed on matters affecting the shipping industry. Until the reconstruction, the Chamber was fairly representative of the ordinary cargo steamship owners, but the great passenger and cargo steamship companies had not actively been identified with its work. In 1917 a number of highly important steamship companies joined the Chamber, including the Peninsular and Oriental Steam Navigation Co., the Royal Mail Steam Packet Co., and the Union-Castle Mail Steamship Company. The finances were put on a sound basis, enabling the necessary cost of maintaining the work to be secured on the plan of a levy on the tonnage. New offices were taken, and Mr. H. M. Cleminson, a leading shipping lawyer and member of the firm of Messrs. Botterell & Roche, was appointed general manager. Sir William Raeburn, who was elected president in 1916, held office for two years and was succeeded as president by Lord Inchcape in 1918, who also held the position for two years. In 1920 Mr. W. J. Noble was elected president. He was succeeded by Sir Owen Philipps in 1921, with Sir Frederick Lewis as vice-president.

The constituents of the Chamber at the beginning of 1921 consisted of 19 local and special associations, such as those at Belfast, Swansea, on the N.E. coast and Glasgow; 11 Protection and Indemnity Clubs; 7 Freight, Demurrage and Defence Clubs and shipowners entering their tonnage direct, of which early in 1921 there was 5,430,800 tons. The aggregate amount of tonnage entered under the heading of Protection and Indemnity Clubs represented 6,364,300 tons. Membership of these clubs is open to any shipowner possessing a seaworthy vessel who wishes to cover himself against third-party risks. Only British owners are eligible for membership of the Chamber. Until 1919 the Chamber was not incorporated, but in that year it obtained the grant of a Royal Charter. The business of the Chamber is conducted by a council of shipowners who are nominated by the various constituents. Incorporated in the Chamber is the Documentary Committee, which examines and approves forms of charter between shipowners and merchants.

Statistics.—In the 1919–20 edition of Lloyd's Register of Shipping, the figures for the mercantile marines of the principal maritime countries before and after the war were set out. These figures were so important and authoritative that they are given in the table following. Outstanding facts were the decrease of 2,547,000 tons in the shipping owned by the United Kingdom, the gain of 7,746,000 tons to the seagoing merchant marine of the United States, the loss of 1,888,000 tons by Germany, and the gain of 617,000 tons to Japan.

Steam Tonnage of Principal Countries, 1914, 1919.

Country	June 1914 Thousand tons gross	June 1919 Thousand tons gross	Difference	
			Thous'd tons	Per cent
United Kingdom	18,892	16,345	−2,547	− 13·5
British Dominions	1,632	1,863	+ 231	+ 14·1
America (United States):				
Seagoing . .	2,027	9,773	+7,746	+382·1
Great Lakes	2,260	2,160	− 100	− 4·4
Austria-Hungary .	1,052	713	− 339	− 32·2
Denmark	779	631	− 139	− 18·1
France . . .	1,922	1,962	+ 40	+ 2·1
Germany . .	5,135	3,247	−1,888	− 36·8
Greece	821	291	− 530	− 64·6
Holland . . .	1,472	1,574	+ 102	+ 6·9
Italy . . .	1,430	1,238	− 192	− 13·4
Japan . . .	1,708	2,325	+ 617	+ 36·1
Norway . . .	1,957	1,597	− 360	− 18·4
Spain . . .	884	709	− 175	− 19·8
Sweden . . .	1,015	917	− 98	− 9·7
Other Countries .	2,427	2,552	+ 125	+ 5·2
Grand total .	45,404	47,897	+2,493	+ 5·5
Total abroad .	26,512	31,552	+5,040	+ 19·0

In this edition the Register went further than setting out the actual figures of gains and losses. It attempted to estimate the position of the world's tonnage as it would have been if there had been no war. There were obvious difficulties in the way of arriving at a definite conclusion in the case of various countries, for many factors had to be taken into account, but a careful estimate was prepared on the following assumptions. These were: (1) it was reasonable to expect that the percentage of addition to the world's tonnage would have continued at the ratio (a decreasing one) recorded during the previous 15 pre-war years, and that the percentage of the United Kingdom tonnage to the world's tonnage would show, approximately, the same ratio of decrease recorded during the most recent of these years; (2) countries in which there had been a large addition of tonnage during the previous quinquennial period might be expected to show a reduction in the ratio of increase, and, as a rule, the larger the previous increase the larger would such reduction be; (3) allowances were made in the special cases of countries where pre-war conditions pointed to the acquisition of tonnage, in the near future, at a higher ratio than that recorded during the previous period.

The net result of the calculations made was to show that the British mercantile marine had suffered a loss of 5,202,000 tons, and foreign mercantile marines, with the exception of the United States of America, a loss of 9,000,000 tons, making a total loss to the world of 14,202,000 tons. As a partial set-off to these losses, the United States gained 6,729,000 tons, so that the net world's loss expressed in gross tonnage, was 7,473,000 tons. Germany's loss was set out as 3,582,000 tons, but it was explained that her losses were actually greater, since vessels which at the date of the Armistice had not been captured or requisitioned by other countries were included in her mercantile marine. Excluding enemy countries, the greatest sufferers after the United Kingdom were Norway, whose losses were estimated at 1,025,000 tons; Italy, which suffered a diminution of 677,000 tons; and France with an estimated loss of 536,000 tons.

In these calculations the question of the comparative efficiencies of the pre-war and post-war merchant fleets was not taken into account. The Register pointed out that, apart from additions to the merchant fleets of the world before the war, replacements of steam tonnage lost, broken up, etc., amounted each year to about 1½% of the total tonnage owned, while during the war it required new tonnage equivalent to 33% of the steam tonnage owned in 1914 to replace the losses. There is no doubt that a large amount of the tonnage afloat at the end of the war represented shipping which, in ordinary conditions, would have been broken up and replaced by modern and more economical vessels. How this factor affected the statistical position is indicated by the statement that in the three pre-war years 1911–3, nearly 2,000,000 tons of steamers were sold to foreign owners and replaced by better vessels, while during the three years 1916–8 probably less than 100,000 tons of steamers were sold in this way. Further, a large proportion of the shipping built during the war was, undoubtedly, not the equal in general efficiency of that built in the few years immediately preceding. Taking all these considerations into account, the Register estimated that, through the war, the world had lost 8,500,000 tons gross of shipping, representing a dead-weight carrying capacity of 12,500,000 tons.

Within 12 months the position was very much changed. The total tonnage of the world increased from 47,897,000 tons in June 1919 to 53,905,000 tons in June 1920, an increase of 6,008,000 tons. The loss suffered by the United Kingdom as at June 1919 of 2,547,000 tons had been reduced to a decrease of only 781,000 tons. The United States gain of 7,746,000 tons had been increased to one of 10,379,000 tons. Germany's loss had been increased by the surrender of tonnage, from 1,888,000 tons to 4,716,000 tons. Japan further increased her gain of 617,000 tons to 1,288,000 tons. Once more the Register endeavoured to estimate what would have been the position of the world's mercantile marines in 1920 if there had been no war. It found that the loss suffered by the United Kingdom was 2,920,000 tons; that of Germany 6,103,000 tons; and that of other countries a loss of 3,330,000 tons, making a total loss of 12,353,000 tons. As against this loss, the United States gained 8,837,000 tons, thus reducing the world's net loss to 3,516,000 tons. This estimate again did not take into account the question of the comparative efficiencies of the mercantile marines before and after the war. While such calculations are of great interest, the fact remains that, as the result of the great shipbuilding effort during the war, the world's shipping was greater in June 1920 by 9,282,000 tons. This figure was increased further during the year. The president of the Chamber of Shipping of the United Kingdom stated at the annual meeting held on Feb. 25

1921, that the world's merchant shipping since 1914 had been actually increased by more than 10,000,000 tons. Unfortunately for the shipping industry, the world's trade had not developed in proportion. Owing to the complete breakdown of credit in some countries trade was practically at a standstill.

An unprecedented step was taken by the Register in April 1921, when issuing its shipbuilding returns for the first quarter of the year. It issued with these returns a statement to the effect that, as the times were not normal, the figures of tonnage reported to be under construction did not provide a true index of the relative position of the shipbuilding industry as compared with, say, 12 months previously.

The total tonnage under construction in the United Kingdom at the end of March 1921 was given as 3,798,500 tons represented by 884 vessels. In ordinary times such an amount of work in hand would have indicated great activity and prosperity in the shipbuilding industry. It compared, for example, with 1,890,800 tons under construction at the end of March 1914, showing an increase of 1,907,700 tons, and with 1,722,100 tons under construction at the end of June 1914, the last quarter completed before the outbreak of the war. But the amount of tonnage stated to be in course of construction at the end of March 1921 included a considerable amount on which work had been suspended, owing to the heavy fall in shipping values consequent on the severe decline in freights and the corresponding decline in the demand for tonnage. The tonnage on which work had been suspended in this way amounted to 497,000 tons. There were also included in the total figures some 350,000 tons, the completion of which had been delayed owing to the cessation of work by ship joiners. To arrive at comparative figures, it was therefore necessary to deduct these two figures, amounting together to 847,000 tons, from the amount of tonnage described as being under construction. The total figures of tonnage on which work was actually proceeding at the end of March 1921 was thereby reduced to 2,951,500 tons, showing an increase of 847,000 tons over March 1914.

There would have been grounds for satisfaction in such an increase if the world's commerce had been active. Unfortunately, enormous numbers of the world's inhabitants were taking no part in international commerce, and, further, there were immense numbers who were not producing goods or working at the same rate as before the war. Consequently the construction of so much tonnage, although the work was proceeding at a slow pace, could not be regarded with unmixed satisfaction. Cancellations of shipbuilding contracts by owners were common, and large sums were paid in order that owners might be relieved of their commitments. The surplus of ordinary cargo steamships was especially large. The losses of mail and passenger liners during the war had not been made good, but the high cost of building tended to prevent replacements.

As compared with the figures for the quarter ended Dec. 1920, there was a reduction in the shipping launched during the first quarter of 1921 of 146,000 tons. The tonnage started during the quarter declined by 113,000 tons, while in the tonnage in preparation, but not actually commenced, there was a fall of 75 %, as compared with the figures of the first quarter of 1920. Attention was called by Lloyd's Register both at the end of 1920 and in the beginning of 1921 to the lower rate of construction as compared with pre-war times. In 1913 the average amount of tonnage completed during each quarter was over 23 % of the total work in hand at the beginning of the quarter, whereas the figures for 1920 fell below 13 %. During the first quarter of 1921 the output fell as low as 8 % of that under construction at the beginning of the year.

The total amount of tonnage being built abroad was 3,288,100 tons—not quite so large an amount as the tonnage described as being under construction in the United Kingdom, but actually larger than that on which work was actively proceeding there. The Register pointed out that the returns for foreign countries, unlike those for the United Kingdom, were not subject to any material reduction on account of suspended or delayed work, of which there appeared to be comparatively little in other countries. The shipping being built abroad was less by 183,000 tons than that under construction at the end of 1920. The decline was due to the continued decrease in the United States of America, where the tonnage under construction was less by 27 % than that building at the beginning of 1919. Apart from the United States, the countries in which the largest amount of shipbuilding was taking place were France, with 427,100 tons, an increase for the quarter of about 30,000 tons; Holland with 417,600 tons; Italy with 351,600 tons; and Japan with 294,300 tons, an increase of 46,000 tons.

The returns showed that there were then 187 steamers and motorships, each of over 1,000 tons, with a total of 1,320,100 tons, under construction for the carriage of oil in bulk. Of the total number, 84, of 557,000 tons, were under construction in the United Kingdom, and 82, of 632,000 tons, in the United States. In the former the oil-tank tonnage represented 57 % of the total amount of construction. The tonnage of vessels under construction to be fitted with internal combustion engines amounted to 503,800 tons.

A highly unsatisfactory feature was the diversion of a large amount of British shipping from British to foreign shipyards for reconditioning. This was due to a refusal on the part of the ship joiners to accept the lower wages proposed by the employers and the consequent cessation of work by the ship joiners in the United Kingdom for many months. Large liners were diverted to Dutch and French ship repairing works. The work of reconditioning was essential, and the stoppage by the ship joiners meant the loss of a large amount of work to the United Kingdom, which, it was to be feared, might have a far-reaching effect on the British industry.

Condition and Prospects.—What might be described as a bird's-eye view of the state of the shipping industry during 1910–21 is afforded by the course of prices of a "new, ready, 7,500-ton cargo steamer" as recorded in the chart published by the weekly shipping journal *Fairplay* and described as "Fairplay's Curve." This type of vessel may be considered representative of ordinary cargo steamers. In 1910 the price of such a vessel was £37,000. Prices then rose sharply and by the end of 1911 a price of £47,000 was reached. A further rise took place in 1912 to £58,000. That year, as has been shown, was a prosperous one for shipping, and from the high point reached, values fell to £48,000 at the end of 1913. A further drop occurred in 1914 to £43,000. The great rise then began. By the end of 1914 the price had advanced to £60,000. In 1915 prices more than doubled and £125,000 was reached. In 1916 there was a further advance to £188,000. The effect of the Excess Profits duty was seen in 1917 and values fell to £165,000. In 1918 there was a recovery to £181,000 and then a fall to £169,000. An extraordinary rise took place in 1919, the high price of £232,000 being reached. Early in 1920 there was a further upward movement. Then a great and steady fall began and by the end of the year the value of £105,000 had been reached. In the first six months of 1920, values again receded. On May 24 two new, ready steamers of 9,250 tons dead-weight built by the Furness Shipbuilding Co. to Lloyd's highest class were sold for £85,000 each, representing rather more than £9 a ton. These ships were of the shelter-deck type, with the tonnage openings closed. Vessels of similar size with tonnage openings would carry only 8,300 tons dead-weight, and on that basis the prices bid for the two ships appear somewhat better. Another ship which was of 5,500 tons dead-weight and was built by Charles Hill & Sons, Ltd., of Bristol, was sold for £40,000, representing only rather more than £7 a ton. This particular ship had not been launched, and was not expected to be ready for sea for at least two months.

The Chamber of Shipping estimated that at the beginning of 1921 there were laid up in the United Kingdom, the United States and Scandinavian ports, 5,000,000 tons dead-weight of shipping, or, approximately 3,000,000 gross. This amount of tonnage was made up of 2,250,000 tons in the United Kingdom, represented by 600 vessels, of 2,000,000 tons in the United States represented by 250 vessels, and of 750,000 tons represented by 428 vessels in Scandinavian ports. In addition, many vessels were laid up in Spain, Italy, Japan and other countries, and in the early months of 1921, the amount of tonnage laid up throughout the world steadily increased.

In 1920 there took place the greatest fall in freights that has ever been recorded. The extent of the drop is shown by the movement of the time charter rate, *i.e.* the monthly rate of hire for ordinary cargo steamers. When vessels are chartered in this way the owners provide and pay the crews and pay for the stores. The charterers pay for the coal, since the amount consumed and the cost depend upon the trade into which the vessel is put. At the beginning of 1920 the usual time charter rate for cargo steamers was 30s. a ton dead-weight. By midsummer the rate had dropped to 20s. a ton or rather less. By the end of the year the rate had fallen to 10s. a ton, and with very little inquiry it fell further. By the end of the first quarter of 1921 steamers were chartered at a rate of 6s. a ton. There were also heavy falls in the voyage rates.

As compared with maximum rates during the war for free British steamers bringing grain from Argentina of about 183s. a ton, the freight early in 1921 had fallen to about 35s. Then, when the coal stoppage occurred at the end of April, rates advanced, owing to the necessity of steamers proceeding from this country in ballast, and to the difficulty of securing bunkers. By the end of May, rates of about 57s. 6d. a ton were being quoted for vessels that were available for immediate loading. It was generally accepted in shipping circles that a freight of about 50s. was necessary to cover the cost of sending a vessel to S. America in ballast and bringing her home with a cargo of grain. The fact that, before the war, cargoes of coal had always been available from the United Kingdom meant competition for the homeward voyage and enabled freights to be restricted. The new conditions were distinctly serious for the shipping industry.

Coal also represented a serious problem for the liner companies. Sir Owen Philipps, chairman of the Royal Mail Steam Packet Co., gave some figures respecting comparative costs at the annual meeting of the company in June 1921. He stated that in 1902 the average cost of all coal consumed by the company's steamers in all ports served, including rail carriage and freight, was exactly 22s. a ton. In 1903, the average price had increased to 22s. 3d., while 10 years later, in 1913, the average cost, including railage and freight, had increased to 22s. 11d., which was then considered a very high average price. In 1920, the average cost per ton of all coal consumed by the company's steamers, including railage and freight, was 120s. 1d. Early in 1921 the price fell very considerably, largely owing to the supply of coal by Germany to France and Belgium, with a consequent falling off in the demand for British coal. Then when the stoppage at the British collieries had been proceeding for some little time, and stocks were being exhausted, British shipping had to look to the Continent for supplies.

The Cunard and White Star companies were in a favourable position as regards the great trans-Atlantic liners, "Aquitania," of 45,600 tons, and "Olympic," of 46,300 tons, since these vessels had been adapted to the use of oil fuel in 1920. Oil fuel, after the war, increased in popularity, although some owners hesitated to commit themselves too much to it, owing to fears that supplies would not be sufficiently abundant, and planned their vessels with a view to the use of either oil or coal. Scandinavian owners, especially, pinned their faith to motor-engines, and it was notable that while coal-burning steamers were laid up idle, motor vessels belonging to the same ownerships were being profitably employed. There was good reason to believe that an extensive development of the use of motor-engines was to be expected. It was quite certain in 1921 that a strenuous competitive period lay ahead for shipping, and owners had to take into account all possible measures conducive to cheap transport at sea. (C. MA.)

(2) United States

From the founding of the Federal Government in 1789 onward the United States has possessed a considerable merchant marine. For a hundred years it was the second power in amount of merchant tonnage in the world, surpassed only by the United Kingdom. From the end of the Civil War in 1865 to the outbreak of the World War in 1914, though the American flag was infrequently seen in foreign waters, a great and valuable merchant shipping was in existence, with well-equipped shipyards and a large force of officers and seamen, chiefly employed in home trade on the Great Lakes or on the Atlantic, Gulf and Pacific seaboards with their insular dependencies. The American people at no time in their history have been out of intimate touch with shipbuilding and navigation.

Unlike other nations the United States has steadily maintained an important and increasing waterborne domestic commerce capable of holding its own with formidable railway competition. This coastwise commerce, including the trade with Alaska, Porto Rico and Hawaii, by an unshaken national policy, has been reserved entirely to American vessels, and has had a significant bearing on the development of the American merchant marine. It is interesting to recall that in 1860, the year before the opening of the Civil War, the commercial fleet of the United States was divided almost equally between 2,379,396 gross tons registered for foreign commerce and 2,644,867 tons enrolled or licensed for coastwise carrying. In 1866, the year after the close of the Civil War, the registered foreign trade fleet, as a result of the war, had fallen off to 1,387,756 gross tons—a decrease of almost a million tons—while the coastwise fleet had increased to 3,381,522 tons. This tendency of the foreign trade shipping to decrease, and of the domestic trade fleet to grow, was even more manifest by the year 1910, when the former had fallen to 782,517 gross tons, or actually less than the 981,019 tons which the United States had possessed a century earlier in 1810, while the coastal fleet had increased to 6,668,966 tons, or more than twice as much as the entire American commercial shipping of 1860.

This sharp contrast between the steady decline of the overseas tonnage and the unbroken advance of the domestic tonnage is attributable to the intensity of foreign competition in the one trade and to the absence of it in the other. Through those years the wages of American crews and their subsistence and general style of living imposed a higher cost upon the operation of American ships, and American-built ships in addition bore a substantially higher cost of construction. Moreover, American laws and regulations governing ships have contributed somewhat to this higher expense by their more exacting character. Against this higher expense the coastwise vessels from 1860 onward were absolutely protected by the exclusion of foreign vessels from domestic trade, while the overseas vessels were protected in no way whatever, except for casual postal subsidies to a few regular lines. In view of the fact that from 1860 high protection has been almost continuous in the United States, this exception of the most intensely competitive of industries, ocean shipping, is difficult to understand. The generally accepted explanation is that it has not been possible at any time to present a definite form of national encouragement to the overseas shipping industry which was acceptable to all of the various sections of the country. Subsidies have almost been voted by Congress several times. Discriminating customs duties and tonnage dues, an expedient first adopted in 1789 and maintained in whole or in part for 60 years thereafter, have had a powerful advocacy but, as a matter of fact, have never been made effective because of general commercial treaties which have forbidden them. "Free ships"—that is, the free admission and registry of foreign-built vessels instead of the general prohibition of American registry for foreign-built vessels obtaining since 1789—were adopted for vessels of less than five years of age in the Panama Canal Act of 1912, but had remained wholly futile up to the war of 1914, which suddenly gave exceptional value to the flag of the greatest neutral.

Pre-war Position.—American overseas shipping as distinguished from coastwise shipping reached almost the lowest ebb in 1910, when only 782,517 gross tons were recorded by the Commissioner of Navigation as registered for foreign commerce and sufficed to convey only 8·7% of the total imports and exports of the United States. Though relatively little effort had been bestowed upon the promotion of foreign commerce in these years of wonderful domestic development, the total foreign trade of the United States had increased markedly from a value of $762,288,550 in 1860 to $2,982,799,622 in 1910. Whatever the cause of the decline of the overseas American merchant marine, it had certainly not been from any lack of cargoes.

No change or event of consequence marked the years from 1910 to 1914 in the annals of American shipbuilding or navigation. Official records show the amount of shipbuilding, the total registered overseas and the total coastwise tonnage, the total merchant marine and the proportion of American overseas commerce conveyed in American ships, for the five fiscal years ending June 30 1914, to have been as follows:—

Year	Ships Built	Registered for Foreign Trade	Enrolled or Licensed for Coastwise Trade	Total Merchant Marine	Proportion of Value of Imports & Exports Carried in American Ships
	Gross tons	Gross tons	Gross tons	Gross tons	Per cent
1910	342,068	782,517	6,668,966	7,508,082	8·7
1911	291,162	863,495	6,720,313	7,638,790	8·7
1912	232,669	923,225	6,737,046	7,714,183	9·4
1913	346,155	1,019,165	6,816,980	7,886,518	8·9
1914	316,250	1,066,288	5,818,363	7,928,688	8·6

These records indicate a condition of virtual stagnation in the American merchant marine during the period immediately before the World War. New construction was only slightly in excess year after year of tonnage lost or worn out and abandoned. It was a time of disheartenment among those who desired to see an adequate ocean service under the American flag, and a valuable naval reserve for an emergency.

In the Panama Canal Act of Aug. 24 1912 Section 5 provided that "No tolls shall be levied upon vessels engaged in the coastwise trade of the United States." It was contended before and after the passage of this Act that it contravened the provision of the Hay-Pauncefote treaty, that "The canal shall be free and open . . . to the vessels of commerce and war of all nations . . . on terms of entire equality, so that there shall be no discrimination against any nation or its citizens or subjects in respect to the conditions or charges of traffic or otherwise." President Wilson, who had originally favoured this exemption of American coastwise ships, and had been elected on a platform approving it, unexpectedly early in 1914 advocated the repeal of the exemption provision on the ground that it was in conflict with the treaty, and also that "repeal be granted by Congress in support of the foreign policy of the Administration." After an animated debate in the course of which the President was opposed by several senators of his own party, and at the same time upheld by some eminent Republicans, including Senator Root of New York, repeal was finally accomplished. No actual advantage had accrued to American coastwise vessels from the toll exemption, for the canal had not then been opened to commerce. It was opened Aug. 15 1914, and was utilized in its first year by 1,317 vessels, including merchant carriers, men-of-war and yachts, of an aggregate net Panama Canal tonnage of 4,596,644. Tolls paid amounted to $5,216,149. In the coast-to-coast fleet of the United States there was soon a notable expansion, and new and important steamers of 10,000 or 12,000 tons dead-weight capacity were plying on the route shortened from 13,000 m. via the Straits of Magellan to 6,000 m. via the Canal. These large coastwise steamers were destined to prove of abundant value to American overseas commerce in the emergency presented by the war.

War Period.—When the World War began in Europe Aug. 1 1914 all but 8·6% of the imports and exports of the United States were being conveyed in foreign vessels, chiefly of British and German nationality. The first result was the voluntary "interning" in American harbours of a considerable fleet of

German and Austrian steamers, including the "Vaterland," the largest ship afloat, and other passenger craft of the Hamburg-American and North German Lloyd lines. Another and a much more serious effect upon the carrying of American passengers, mails and cargoes was produced when the British Government, under the increasing stress of the conflict, withdrew month after month from overseas service to and from American ports its own passenger ships and freighters, for the transport service of the gathering British armies and for the auxiliary service of the war fleets. Then the lack of an adequate merchant shipping of its own began to be severely felt throughout the United States.

In the autumn and winter of 1914 agriculture, both North and South, was gravely depressed by the inability to export grain, provisions and cotton, because of the scarcity of ocean ships. Freight rates soon became exorbitant. In Dec. 1914 the freight on cotton from New Orleans to Rotterdam had risen to three or four times its pre-war figure, or to $2 per hundredweight. Grain in July 1914 had been carried from New York to England for four or five cents a bushel. In Dec. 1914 the cost was 16 to 17 cents, and it still went on advancing. The Democratic party, in power at that time, had as a whole opposed shipping subsidies, but in this crisis the Wilson administration early in 1915 brought forward in Congress a proposal to create a great merchant marine under government ownership and operation. This proposition for what was stigmatized as a dangerous adventure into state socialism was sharply opposed in Congress by conservative Democrats and the great body of Republicans. Meanwhile, the crisis continuing, Great Britain, France and Norway in their acute need of ships to make up for losses by German submarines, began to place contracts for new tonnage in the established and not over-busy shipyards of the Atlantic and Pacific coasts of the United States. In the report for the fiscal year ending June 30 1916 the Commissioner of Navigation noted that of ships building or ordered at that date in American yards "fully 125,000 tons were for foreign shipowners," and that "since July 1 1916 the tonnage ordered in American yards for foreign shipowners exceeded that ordered for American owners." Many of these vessels, it transpired, were being built by funds furnished or guaranteed by the British Government.

So much antagonism had been created by the proposal for a government-owned and operated merchant marine that it was not until Sept. 7 1916 that the Shipping Act desired by President Wilson was passed, and then in a much-amended form with government ownership and operation reduced to a temporary character. Section 3 of this important law provided:—

> "That a Board is hereby created, to be known as the United States Shipping Board, and hereinafter referred to as the Board. The Board shall be composed of five Commissioners, to be appointed by the President, by and with the advice and consent of the Senate; said Board shall annually elect one of its members as chairman and one as vice-chairman.
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> "The first Commissioners appointed shall continue in office for terms of two, three, four, five and six years respectively from the date of their appointment, the term of each to be designated by the President, but their successors shall be appointed for terms of six years, except that any person chosen to fill a vacancy shall be appointed only for the unexpired term of the Commissioner whom he succeeds."

Under the authority of this act the President appointed on Dec. 22 1916 the first Federal Shipping Board, headed by Mr. William Denman, an admiralty lawyer of San Francisco. Not one of the members of the Board had ever operated American-flag ships in ocean commerce. Under the Act the Board was authorized to form a shipping corporation with a capital stock not exceeding $50,000,000, of which a majority was to be held by the United States for the purchase, construction, equipment, lease, charter and operation of merchant vessels in the commerce of the United States. This became known as the Emergency Fleet Corporation. Its power to operate vessels would cease, under the original Act, five years after the close of the war.

Less than four months after the appointment of the first Shipping Board the United States itself entered the World War, and the powers and resources of the Board were immensely increased by war legislation. Vast sums of money were placed at the disposal of the Board for the rapid construction of merchant ships on a scale before undreamed-of. Chairman Denman resigned on July 24 1917, and the President nominated in his place Edward N. Hurley, who had been the President of the Illinois Manufacturers' Association, an organization long committed to the development of the merchant marine. A subsequent change made Charles M. Schwab, the steel manufacturer and head of the Bethlehem Shipbuilding Corp., the Director of the Emergency Fleet Corporation. Under the stimulus of Messrs. Hurley and Schwab, the war programme of merchant shipbuilding, which had at first lagged badly, began to take on a new life and vigour. These men had not only directed their vast organization, but aroused the country to respond with all its wealth and power to Mr. Lloyd George's appeal for "Ships, and more ships and yet more ships," to compensate for the havoc wrought by the German submarines. When the United States entered the war in the spring of 1917 there were in the country 37 steel shipyards with 162 ways, and 24 wooden shipyards with 72 ways, capable of launching vessels of 3,500 dead-weight tons. At the signing of the Armistice there were in all 223 shipyards, steel and wood, with a total of 1,099 ways.

There is no parallel in history for this swiftness with which additional shipyards were created. In April 1917, when the United States declared war, every one of the 234 shipways in this country was occupied by a vessel under construction—in part for American owners, in part for foreign owners, the remainder for the navy or other branches of the Government. It was absolutely necessary to create at once the additional facilities required for the building of the 3,115 vessels of a total of 17,276,318 dead-weight tons provided for in the maximum building programme of the Shipping Board. Scores of new shipyards, for steel and wood vessels alike, had to be built. Proper sites were rapidly selected on the Atlantic, the Gulf and the Pacific seaboard, the yards hurriedly laid out, and the requisite tools and machinery installed. This work was pushed with the utmost vigour. Long before the new yards were ready a nation-wide movement had started to recruit an army of shipyard volunteers. It was represented to the workers that they were as truly serving the Allied cause as if they had enlisted in the navy or army. This new crusade was advanced by the State Councils of Defense and by the Department of Labor. Within the first two weeks no fewer than 280,000 workers were enrolled. At the signing of the Armistice 381,000 men were employed in the old and new American shipyards, as against 44,000 when the war began.

American shipyards before 1917 were adequate only for the fairly steady demand of the coast and lake trades and for the requirements of the navy, which, however, were partly filled from Government yards. Only now and then was an overseas steamer constructed. But the coast and lake trades of the United States employ many relatively large and heavy vessels of from 6,000 to 10,000 tons, fit for the 2,000-m. voyages from Portland, Boston, New York and Philadelphia to the Gulf of Mexico, or the 6,000-m. voyages through the Panama Canal between the Atlantic and Pacific seaports. Six or seven yards on the Atlantic and two on the Pacific before the war were capable of building the most powerful dreadnoughts and armoured cruisers. Ocean shipyards, large and small, possessed well-trained and experienced managers and workmen, and there were also many excellent shipyards on the Great Lakes. These efficient staffs were drawn on for the more responsible positions in the new war-born shipyards. The great body of 381,000 workers enlisted were, of course, unfamiliar with ship construction. Most of them had never laboured in a shipyard of any kind. There were thousands from the general building, electrical and other engineering trades, and other thousands from inland farms. It was a composite array, and there was undoubtedly at first much inefficiency and shirking. But the men already trained were set to show the others. Proficiency was rewarded by high wages. The incompetent were gradually weeded out. Appeals to patriotism were effective. Riveting and other work was "speeded up" by offers of prizes, and more and more all hands were made to realize that they were taking an essential part in the winning of the war.

As a result, unheard-of achievements in the way of production speed were soon recorded. The "Tuckahoe," a 5,500 dead-weight ton collier, was completed by the N.Y. Shipbuilding Co. at Camden, N. J., in 37 calendar days; the "Crawl Keys," a 3,500-ton freighter, at the Great Lakes Engineering Works, Ecorse, Mich., in 34 days. Heavy 8,800-ton freighters were built in Pacific shipyards in from 78 to 88 days, where before the war from six to ten months would have been required. The Bethlehem Shipbuilding Corp. yard at Alameda, Cal., launched the 12,000-ton cargo liner "Invincible" 31 days after the laying of her keel. It was thoroughly realized that such haste would often mar the quality of the work—that ships built in such brief time might well prove less efficient and enduring. But the Government and the builders realized also that it was a race with the German submarines, and that enough ships must be provided by whatever methods at whatever cost to feed and supply the Allies, and to carry and sustain the troops that would soon be crowding over.

One expedient which greatly helped toward quick production was the fabricated ship. One factor in the choice of this plan of construction, never adopted on a large scale before, was the success of the Submarine Boat Corp. in building in 1916 a fleet of 550 submarine-chasers for the British Government. These little vessels were of wood. It was obvious that steel would lend itself more readily to fabrication, and Mr. Henry R. Sutphen, Vice-President of the Submarine Boat Corp., submitted to the Emergency Fleet Corp. a proposal for manufacturing standard steel ships from the same kind of commercial structural steel that is employed for buildings and bridges. This plan was successfully carried out. Structural plates, shapes and other material were prepared at plants all over the country where they could be produced to the best advantage, and shipped to the assembling yards for final riveting together, a certain number of rivets indeed having already been driven before the material arrived. One hundred and fifty fabricated steamers of about 5,000 tons dead-weight were contracted for with the Submarine Boat Corp.'s. yard on Newark Bay, N.J. One hundred and eighty fabricated ships of about 7,500 tons were ordered from the great Hog I. Shipyard near Philadelphia. This shipyard, the largest in the world, with 50 ways, was created in less than six months under the direction of the engineers of the American International Corp., out of what had been a waste marsh on the shores of the Delaware River. With its ways, storehouses and workshops it covered 900 acres. Its cost was $66,000,000. On the completion of its building programme, and when its ships were no longer needed, it afforded an admirable site for a great rail and ship terminal.

Several hundred wooden steamers of a dead-weight capacity of from 3,500 to 5,000 tons were ordered by the Emergency Fleet Corp. in the war emergency. There was much criticism of this project, for the building of wooden steamers for overseas service had long been abandoned in America. Among practical men there never was any delusion that wooden steamers would be of lasting value in peace time service. As Chairman Hurley of the Shipping Board stated: "It was not contended by any responsible authority that wood ships would prove commercially advantageous, that they would be formidable competitors with the ships of the maritime powers in time of peace; but they were regarded, at least as far as the subsequent development of the wood ship programme was concerned, as mere war emergency ships." It should be borne in mind also that when these wooden steamers were contracted for a war lasting for years was contemplated as possible, and elaborate general preparations were being made to that end. As a matter of fact few wooden steamers were completed in time to carry supplies before the signing of the Armistice, and most of the wooden craft that did get to sea were laid up as soon as possible. Many of them seemed structurally fit, but their cargo capacity was too small to permit of profitable employment. The Emergency Fleet Corp. built more of the relatively small steel ships than could be absorbed by the requirements of normal commerce. Justification for this is to be found in the inexorable needs of war. These small steel steamers of from 3,500 to 5,000 dead-weight tons are of a type very useful in limited numbers in a near-by trade, like that with the West Indies, for example. Some of them, particularly the oil-burners, are capable of engaging advantageously in transoceanic trades. Moreover, no steamers more than 260 feet in length and of about 4,000 tons dead-weight capacity could be brought out into the St. Lawrence River and the Atlantic through the Canadian canals, and it was important in the war months that the Great Lakes shipyards should be utilized.

American commerce, coastwise and overseas, is relatively a trade of rather large cargoes. It is the larger ship, with the lowest crew wage cost per ton, which American shipowners can operate to the best advantage. Nevertheless, these prudential considerations were frankly cast aside by the American Government in the crisis of the war. The authorities deliberately planned and built the kind of a merchant fleet that could be most quickly constructed in the greatest numbers and employed to the best advantage of their Allies.

After the War.—On the signing of the Armistice immediate steps were taken by the Shipping Board to reduce its programme of construction. In most cases where a contract could be cancelled at a cost to the Government less than the difference between the cost to complete and the probable market value of the ship at time of completion, cancellation was ordered. By June 30 1920 the building programme of the Shipping Board, which in Oct. 1918 had totalled 3,115 vessels of 17,276,318 dead-weight tons, was reduced to 2,315 vessels of 13,675,711 tons, of which 1,696 vessels of 11,656,961 tons were of steel construction. An important element of the new fleet not cancelled consisted of 23 passenger and cargo steamers of about 13,000 tons each, which were designed as army transports but have been adapted to commercial use. This class of ships, of which the American merchant marine still had too few, is adapted to service across the Atlantic and Pacific and to South America.

Appropriations for the Emergency Fleet Corp. up to the end of the fiscal year 1920 amounted to the immense sum of $3,255,413,024, of which nearly all was expended for shipbuilding in the war emergency and afterward. Government-built steamers cost on the average $200 to $225 per dead-weight ton. Ships of the same type were built in the United States before the war for from $60 to $70 per ton, as compared with $40 to $60 in the United Kingdom. The record of America's war effort is clearly written in the returns of the Commissioner of Navigation of the total gross tonnage of shipbuilding in the United States in the fiscal years from 1915 to 1920 inclusive:—

Year	Gross Tonnage Built
1915	225,122
1916	325,413
1917	664,479
1918	1,300,868
1919	3,326,621
1920	3,880,639

In 1920 a marked decline in shipbuilding set in as the Government war programme approached completion. On March 1 1921 only 330 steel vessels of a total gross tonnage of 1,434,000 tons were on the ways. More than one-half of this tonnage was of tank oil carriers. Fifty-four of the 330 vessels, representing 435,000 tons, were building on Government account, and 276, of 999,000 tons, for private ownership. This sharp decrease in shipbuilding was then manifest all over the world, and was intensified by the shrinkage of trade and the unprecedented fall of ocean freight rates, which characterized the winter of 1920–1.

Manning and Operation.—Far less formidable than the task of creating new shipyards and building 13,000,000 dead-weight tons of ships for the war emergency was the work of officering, manning and operating these vessels. In the existing merchant marine of the United States, in Aug. 1914, there was a trained personnel of about 86,000, only a small part of whom could be spared for the new overseas services which the war demanded. Moreover, many of the trained American officers were required at once in the navy and the naval reserve. Two steps were promptly taken to meet the crisis; the President, by executive order July 3 1917, suspended the provision that watch-officers of vessels of the United States registered for the foreign trade must be American citizens, and the Shipping Board established an extensive sea recruiting and training bureau for the instruction of both officers and men. Many who had followed the sea in their youth and had left it now returned, and new recruits appeared in great numbers. From June 30 1917 to June 30 1920 this service produced 9,642 licensed officers and 32,335 men, all American citizens. Many others who did not pass through the training service also joined the new ships, and wherever there was need officers and men were ordered from the navy personnel, which had reached a total strength of 500,000. Few ships were anywhere seriously delayed for lack of crews.

For the control of the new Shipping Board tonnage a division of operation was developed. Relatively few of the new vessels were directly operated by the Board itself. Most of them were placed in the hands of the established private companies or new concerns which the war had brought into existence. The vessels were placed on routes indicated by the Shipping Board. Their freight rates were controlled by the Board during and for some months after the war. Division of expenses and profits was difficult to arrange, and was long the cause of much friction between private operators and the Government. Not until 1920 was a fairly satisfactory plan finally devised by which the Shipping Board assumed the risk of the voyage, and a fixed percentage of the gross receipts was allowed to the manager for his services. Government ownership and operation of shipping, especially in the stress of war, proved a difficult undertaking in the United States, as elsewhere. Particularly important was the work of the Ship Control Committee, which directed the movements of shipping to the best advantage. This committee was composed of President P. A. S. Franklin of the International Mercantile Marine Co., President H. H. Raymond of the American Steamship Owners' Association, and Sir Connop Guthrie, representing the British Government.

At the signing of the Armistice, Nov. 11 1918, the Shipping Board controlled a total fleet of 1,196 vessels of 6,540,205 deadweight tons, composed of American, requisitioned, chartered, neutral and seized German tonnage. On Aug. 3 1917 the President, under authority bestowed by an Act of June 15, requisitioned for the national service all steel hulls and materials in American shipyards of vessels of over 2,500 deadweight tons, building either for American or foreign owners, a total of 431 vessels, of 3,056,000 deadweight tons. On Oct. 12 1917, as a further step in Federal control of the shipping situation, another executive order requisitioned all American steel-built power-driven cargo vessels of 2,500 deadweight tons and over, and all American passenger vessels of 2,500 gross tons and over fit for overseas service. This established control over an American fleet of 444 vessels of 2,938,758 deadweight tons. Many of these ships were transferred to their owners for operation. Others were chartered to the war and navy departments. About 600,000 tons of German vessels, seized in American ports when the United States entered the war, were divided among the Shipping Board and the army and navy. In addition the Shipping Board secured the use of a considerable fleet of enemy vessels seized in waters of other countries. To obtain an adequate amount of tonnage the Board also chartered many Allied and neutral ships, a resource which on Sept. 1 1918 amounted to 331 ships of a deadweight tonnage of 1,084,986. By order of March 20 1918, an act which though necessary was deeply regretted at the time, the President caused the navy to seize for the use of the United States 87 Dutch vessels of 533,746 deadweight tons, at that time in or bound to American waters.

A little more than one-half of the two and one-quarter million American soldiers sent to Europe were conveyed in the passenger steamers of Great Britain, France and Italy, chiefly in large vessels of the British lines. Most of the soldiers sent over under the American flag were borne in the former German liners that had had their damaged machinery repaired. After the Armistice, however, most of the American troops were repatriated under the colours of their own country.

The La Follette Law.—In the years from 1915 to 1920 inclusive there were several important Federal enactments relative to the merchant marine. One of these was the La Follette Seamen's Law, approved March 4 1915, after a long and bitter controversy in the House and Senate. This law to a large extent governs working conditions on American ships at sea and in harbour. It requires a certain fixed proportion of able seamen and certificated lifeboatmen, a complement of boats and rafts sufficient for all passengers and crew, and improved living spaces and sanitary conditions. Most of the Act in fact deals with life-saving methods and appliances, in accordance with the recommendations of the London Conference on safety of life at sea, following the "Titanic" disaster. Several sections require a more humane discipline than had been frequent in the old days. One section, which has been the cause of much displeasure among the foreign shipping companies, brought about the amendment of treaties requiring the U.S. Government to seize and return to their ships seamen deserting from foreign vessels in American waters. This, and a complementary section permitting seamen of American or foreign vessels to demand at every port the payment of one-half of the wages due to them, once every five days, is charged with promoting the desertion of foreign crews in American waters and of burdening foreign companies with the cost of hiring substitutes at the American wage rate and with the expense of returning these substitutes to their country. It is insisted by the seamen's unions, however, that these provisions of the law tend to bring foreign ship wages up to American standards.

Other Legislation.—By Act of Congress of Aug. 18 1914 the free ship clause of the Panama Canal Act of Aug. 24 1912, which had proved wholly ineffective, was amended by admitting ships more than five years old, and exempting all foreign-built vessels admitted to American registry from compliance with American survey, inspection and measurement laws and regulations. Under this amended law 140 foreign-built vessels of 583,000 gross tons, owned by American citizens or corporations, were admitted to American registry for foreign trade in the fiscal year 1915, when the security afforded by the American flag was valuable. The number of vessels thus admitted fell off, however, to only 26, of 69,697 tons, in the fiscal year 1916, as the higher wages and operating costs of the American flag came to be realized by the owners of foreign-built tonnage. Many of these owners, indeed, sought to change their naturalized ships back to foreign registry, and 160 American vessels, of 102,479 tons, were transferred to foreign flags in 1916. On Feb. 5 1917 the President by executive order forbade the sale, lease or charter of American vessels to foreign flags without the approval of the Shipping Board.

In the spring of 1920 a most important measure known as the Merchant Marine Act of 1920, or the Jones law (from Senator Wesley L. Jones, Chairman of the Committee on Commerce), was finally passed by large majorities in Congress and signed June 5 by President Wilson. This Act solemnly declared it to be the purpose of the American people to possess a merchant marine capable of carrying "the greater portion" of their commerce and to serve as a naval or military auxiliary in time of war, this merchant marine "ultimately to be owned and operated privately by citizens of the United States." A new Shipping Board of seven members, fairly representative of political parties and of all sections of the country, was authorized in the Act and given large authority over the merchant marine. This Board was directed to sell the Government-owned tonnage to private owners "as soon as practicable." Postal subsidies and encouragement to new and necessary shipping routes were provided for. Deferred rebates and discrimination against shippers were forbidden. The coastwise law barring foreign ships was extended after Feb. 1 1922 to the trade between the Philippines and the United States. Benefit of preferentially low railway rates on imports and exports was reserved to American vessels wherever their capacity is sufficient. Encouragement was given to American marine insurance, and to the American Bureau of Shipping, the "American Lloyd's." A new and favourable system of ship mortgages was provided. American vessels in foreign trade were exempted from excess profits taxes on condition that the amount of the exemption and twice as much more of the capital of the owners were applied to the building of other ships in the United States. The President was directed to secure the amendment of provisions in commercial treaties that prevented the United States from imposing discriminating customs taxes and tonnage dues on goods imported in ships of foreign registry. President Wilson refused to carry out this last-named requirement on the ground that the action indicated would provoke the resentment of foreign ship-owners and their Governments. The Treasury Department failed to prepare regulations for the application of the clause exempting American foreign-trade ships from excess profits taxes. Preferential treatment for American ships in the dispatch of imports and exports hauled at low rates on American railways was not made effective by the Shipping Board and the Interstate Commerce Commission, whose coöperation was necessary for the actual enforcement of the law.

Statistics.—The amount of shipbuilding, the total registered overseas and coastwise tonnage, the total merchant marine, and the proportion of American imports and exports conveyed in American ships for the six fiscal years ending June 30 1920 are as follows:—

Year	Ship-building	Registered for Foreign Trade	Enrolled or Licensed for Coastwise Trade	Total Merchant Marine	Proportion of Value of Imports and Exports Carried in American Ships
	Gross tons	Gross tons	Gross tons	Gross tons	Per cent
1915	225,122	1,862,714	6,486,384	8,389,429	14·3
1916	325,413	2,185,008	6,244,550	8,469,649	16·3
1917	664,479	2,440,776	6,392,583	8,871,037	18·6
1918	1,300,868	3,599,213	6,282,474	9,924,518	21·9
1919	3,326,621	6,665,376	6,201,426	12,907,300	27·8
1920	3,880,639	9,924,694	6,357,706	16,324,024	42·7

A new Shipping Board, appointed in June 1921, by President Harding, headed by Albert D. Lasker of Chicago and including Admiral William S. Benson in its membership, quickly effected an important reorganization of the executives of the Board, installing a group of practical shipping men as officials of the Emergency Fleet Corporation, and committing to these men the active management of the government-owned merchant fleet. Following this reorganization, the new Shipping Board addressed itself to the working out of a comprehensive subsidy system for postal liners and cargo ships, intended to facilitate the sale of the government-owned fleet to private owners, as directed by the Merchant Marine Act of 1920.

(W. L. M.)

SHOCK, in surgery (*see* 24.991*).—Experience during the World War has thrown new light on the nature of "shock" in pathology. The first effect of an injury is usually to produce a state resembling that of fainting. This is clearly produced through the nervous system and is recovered from more or less rapidly, supposing that the injury is not in itself sufficiently severe to be fatal. This "primary shock," as it may be called, does not show itself to any important degree in the case of operations done under an anaesthetic. But it has long been familiar to surgeons that another kind of shock may appear during or after an operation. This "secondary shock" was of frequent occurrence during the war of 1914–8 and the cause of many deaths. To define it, Cowell suggested the name "wound-shock." The symptoms are very difficult to distinguish from those of mere loss of blood, but it became obvious that it might be present although actual haemorrhage had been very slight. This fact is of significance in the interpretation of the actual pathology of the condition, as will be seen later. As indicated above, it does not show itself at once; it may, however, develop in less than an hour if the injury has been great, and primary shock may sometimes pass into it gradually without a period of recovery. It shows itself by a state of general collapse, with pallor, coldness, thirst, low blood pressure and the various consequences of this, such as vomiting, sweating and sometimes rapid shallow breathing. No evidence of heart failure or of paralysis of vasomotor centres has been obtained. The higher nerve-centres do not suffer until the late stages. Pain is not a prominent factor. If the state has not been of long duration nor of severe intensity, it may pass off on warming and rest, but if left alone death nearly always ensues.

Observations made by Sir Cuthbert Wallace in operations before the war suggested to him that the actual injury to the tissues, and especially to muscle, played an important part. This surgeon noticed that operations involving much section or removal of tissues were more liable to produce shock. The fact might, of course, be also interpreted as the result of the irritation of nerves, acting subconsciously on the centres; but Quénu, a French surgeon, at an early date in the war, propounded the view that the serious effects of wounds are due to an absorption into the blood of toxic products arising in the injured cells. This view was confirmed by the recognition of the importance of early removal of the injured parts; operative procedure was pushed nearer and nearer to the fighting line as the war progressed. It was also noticed that, even after shock had developed, a marked improvement was frequently brought about by excision of the damaged structures. Experimental work by Bayliss and Cannon showed that it was possible to produce in anaesthetized cats a condition similar to that of wound-shock. This could be done by extensive injury to the muscles and skin of the legs. It was found that the results were identical whether the nerve channels from the injured tissues were severed or not, but that they were absent if the blood returning from the tissue was prevented from passing into the general circulation. Thus the name "traumatic toxaemia," proposed by Quénu, is an appropriate descriptive title for the state under consideration.

But what is the nature of the poison and how does it act? These are important questions in dealing with appropriate methods of treatment. The possibility of bacterial toxins has been definitely excluded, and although it cannot be stated that we have yet found the actual substance produced in wounded tissues, the work of Dale and his colleagues on the properties of a base called "histamine," which is formed by removal of carbon dioxide from one of the component amino-acids found in the proteins of tissues, namely histidine, shows that we have to deal either with this compound or with a very closely related one.

Dale and Laidlaw found, in fact, that a small amount of histamine injected into the veins of cats or dogs produced a large fall of blood pressure, accompanied by the other signs of shock, which increased progressively until death. The heart was unaffected and continued to beat powerfully, although nearly empty of blood. Now, until the work of Dale and Richards, it was believed that to produce a fall of blood pressure without removal of blood or depressing the heart it was necessary that the muscular coat of the arterioles should be relaxed and thereby the peripheral resistance decreased. But the previous work had shown that histamine has the effect of causing *contraction* of all smooth muscle, including that of the arterioles. The fall of pressure produced by a very small dose of histamine remained a paradox until the work mentioned, which was published in 1918. In this research it was shown that the effect was due to a wide-spread dilatation of the capillary blood vessels. In order to appreciate the significance of this discovery, a few words are necessary on the reactions of the capillaries and on the importance of the volume of blood in circulation. Although various observations had been made indicating that the capillaries are not merely inert channels, but that their walls are capable of contraction and dilatation in response to chemical stimulation or nervous influence, there seemed to be difficulty in realizing how protoplasmic cells such as those of the capillary wall succeed in doing this. The changes of shape in amoeba and in pigment cells, nevertheless, show the possibility. Dale and Richards, by an ingenious series of experiments, demonstrated that histamine does actually cause a marked widening and opening-up of the capillaries of the body generally. It may also be pointed out that Krogh has recently shown the existence of a nervous regulation of these vessels, which appears to be of an antidromic nature, like that of the dorsal roots described by Bayliss. Now, when we observe how enormous a share of the total vascular system the capillaries make up, we realize what a large volume of the total circulating blood may be penned up or pooled in these vessels when they are dilated, leaving very little to be sent round by the heart to supply the organs with oxygen obtained by its flow through the lungs. The whole of the body is therefore suffering from want of fresh blood containing the oxygen necessary for its existence.

These facts have caused renewed attention to be paid to the question of the volume of blood in circulation. By the injection into a vein of an innocuous dye, which does not quickly diffuse out of the blood vessels, such as "vital-red" or better "congo-red" (Harris), the degree of dilution of the amount injected indicates the volume of the fluid part of the blood. When observations of this kind were made by N. M. Keith on men suffering from shock, it was found that, even when they had lost little or no blood, the volume actually in circulation was greatly reduced. Hence we are justified in postulating the presence of a toxic action dilating capillaries, an action similar to that of histamine.

It was early recognized that shock might be greatly exaggerated or even brought on by various conditions incidental to the state of the wounded man, or to the treatment necessary afterwards. Some of these throw additional light on the subject.

Anaesthetics.—Dale observed that a dose of histamine highly toxic to a cat under ether was innocuous to a normal animal. Thus there are processes in the healthy organism which either destroy the poison rapidly but are inactive under ether, or the anaesthetic itself makes the capillaries more sensitive. In any case, it was often noticed in the war that a state of shock came on during an operation under ether and that there was less risk with nitrous-oxide and oxygen.

Haemorrhage.—Since the serious nature of shock is due to the deficiency of circulating blood, it is obvious that when blood has actually been lost a lesser degree of capillary stasis will suffice to induce shock. This was also found to be the case, experimentally, by Dale and by Bayliss and Cannon. A practical conclusion as regards operations seems to be that loss of blood should be avoided as far as possible and that means for replacing it by intravenous injection should be at hand in case shock makes its appearance.

Thirst.—There was always a notable demand for water by the wounded soldier. If he was already suffering from thirst when wounded, his blood volume was diminished. Water is a valuable remedy and, as absorbed from the alimentary canal, it is very effective in restoring the blood volume. As we shall see, it is the actual volume of the blood, rather than its dilution, that is of consequence. Unfortunately, the vomiting frequently present in shock prevents this treatment in many cases. Water or saline solution may, however, be given by the rectum.

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* *These figures indicate the volume and page number of the previous article.*

Cold.—Exposure to cold has a very potent exaggerating effect in shock. It may happen that spontaneous recovery takes place in the comparative comfort of the casualty clearing station, but, for the reason to be given below, it is not well to wait long if no sign of improvement is seen in a short time. It is difficult to give precise reasons why cold is so markedly deleterious. It may be the result of the generally depressing effect on all bodily functions, which would naturally be greater in states of inadequate circulation of blood.

Anxiety and Fear are recognized also as predisposing factors of shock. Perhaps the depressing effect is the cause, as with cold.

Treatment.—Since the cause of the trouble is the deficiency of blood in circulation, it is obvious that the chief remedy is to increase this. Much attention was given during the war to improving the methods of transfusing blood and there seems no doubt that many lives were saved by this means. But donors are not always available and it is clearly a matter of importance to possess, if possible, an artificial solution which can be used in unlimited amount. Simple saline or glucose solutions were soon found to be useless. They disappear from the blood in less than an hour. To prevent this disappearance, it is necessary to add to the solution some colloid which has an osmotic pressure equal to that of the colloids in normal blood. This is done in the "gum-saline" introduced by Bayliss. The solution contains 6% or 7% of pure gum arabic in addition to 0·9% sodium chloride. The reason for the addition of the colloid may be stated thus: the blood-vessels are impermeable to colloids, hence the osmotic pressure of these substances can manifest its effects. The important point is that it causes an attraction of water and thus prevents any rapid filtration by the blood pressure on the arterial side and brings about a reabsorption in the capillary and venous regions, where the blood pressure is lower than the osmotic pressure of the colloid. Thus a solution containing a sufficient amount of gum arabic is not lost from the circulation.

Of course, the blood actually in circulation is diluted by such injections, but the work of Gesell shows that the greater flow more than compensates for the lesser oxygen-carrying capacity per unit volume. Moreover, as the circulation improves, the capillaries begin to give up their stationary corpuscles to the general mass of blood.

When the state of shock is complicated by haemorrhage it might seem that the addition of blood itself is imperative. It is remarkable, however, that in actual experience the benefit of gum-saline was more obvious after haemorrhage than in severe cases of wound-shock without haemorrhage. It seems probable that these latter cases were such as to have arrived at that stage in which a second action of histamine shows itself. To this we may now turn. After large doses or prolonged action of smaller ones, the capillary blood-vessels become permeable to the colloids of blood as well as to the salts. The addition of solutions of colloids or even blood itself is useless in this stage. They are quickly lost. It was found by observations on wounded men that the plasma of the blood transfused was lost rapidly. Whether the effect on the capillaries is a direct one or whether it is due to the asphyxial state brought about by the low blood pressure is not clear at present. Krogh brings evidence that, when the capillaries are rapidly and widely dilated, there may be formed minute pores between the cells of their walls, which allow colloids to pass through. The fact warns us, in any case, not to allow the state of low blood pressure to last for any length of time.

Cases of shock in this stage were generally regarded as hopeless. It was not found possible to restore them either by blood or by gum-saline. Some experiments made later by Bayliss suggest, however, the possibility that further repeated injections might in some cases have been effective. Although the greater part of the fluid of the first injection was lost, it seemed that some improvement in the state of the capillaries resulted, since a second injection produced a slight permanent rise in the blood pressure and a third injection recovery.

Owing to the fact that gum-saline is quite innocuous and can now be obtained in sterilized form from the dealers, it should always be at hand in operations for use if shock threatens, as also for accidents or serious haemorrhage from any cause.

See *Special Reports, Nos. 25, 26, 27, Medical Research Council* (London H.M. Stationery Office, 1919); E. Quénu, *La Toxémie traumatique* (Paris, Alcan, 1919); Bayliss, *Intravenous Injections in Wound-Shock* (London, 1918). (W. M. B.)

SHORT, SIR FRANCIS JOB (1857–), English engraver (*see* 24.1007), was elected R.A. in 1911, and in the same year was knighted. In 1910 he became president of the Royal Society of Painters, Etchers and Engravers. His later work exemplifies every type of his activity. Among etchings, "On the Banks of the Bure" and "The White Mill, Canterbury" show his adherence to the use of line in that medium, and a version of Turner's "Ehrenbreitstein to Coblentz" continues his series of translations of paintings. He also added "Moonlight on the Medway at Chatham" and "Dumbarton Rock" to the plates in etching and mezzotint completing Turner's "Liber Studiorum." Two aquatints, "The New Moon" (1918) and "'Twixt Dawn and Day," show broad handling and remarkably rich quality in the darks; and two mezzotints, "Orion over the Thames" (1913–4) and "The Night Picket Boat at Hammersmith" (1914–5), are among his finest plates in a medium peculiarly his own.

SHORTER, DORA (Sigerson) (1866–1918), Irish poet, was born in Dublin, Aug. 16 1866. She was the daughter of Dr. George Sigerson, the Celtic scholar, and married in 1896 Clement K. Shorter (b. 1857), editor of the *Sphere* and other London illustrated papers (*see* 19.563). Her first volume of verse appeared in 1894, and she established a considerable reputation as a writer of lyrics and ballads; the subjects often religious, or drawn from the treasures of Irish legend, or in praise of the Irish country. Her *Collected Poems* were published in 1909, and she wrote one novel, *Through Wintry Terrors* (1907). She died in London, Jan. 6 1918. Two posthumous volumes of poems appeared in 1918 and 1919, as well as *A Dull Day in London and other sketches*, with a preface by Thomas Hardy, in 1920.

SHORTT, EDWARD (1862–), British lawyer and politician, was born at St. Anthony's Hall, Newcastle-on-Tyne, March 10 1862. He was educated at Durham school and University, and in 1890 was called to the bar. In 1907 he became recorder of Sunderland and in 1910 a K.C. In 1910 he entered the House of Commons as Liberal member for Newcastle. In May 1918 he became Chief Secretary for Ireland, but in 1919 resigned and was appointed Home Secretary.

SIAM (*see* 25.2).—For the purposes of administration the kingdom of Siam is divided into 17 provinces (Monthons), the area of which is given officially at 484,128 sq. kilometres. The revised census figures for 1910–1 gave a pop. of 8,149,847, and the official estimate of the pop. for the year 1920 was 9,022,000.

On the death in 1910 of King Chulalongkorn he was succeeded by his son, the Crown Prince Maha Vajiravudh, who in 1917 assumed the title of King Rama VI. Under this monarch the work of consolidation and development progressed steadily. To foster the idea of the duty of national service among the elder generation the "Wild Tiger" Corps was established. The Siamese boy scout organization, of which the King became president, educates the younger generation on the same lines. The number of boy scouts was in 1920 over 15,000.

Among various changes may be noted the royal decree that all privy purse property should be subjected to ordinary taxation, the abolition of lottery farms and public gambling-houses, the strict regulation of the opium traffic, and the great development of football and other athletic sports. Under the patronage of the King, a Navy League was established, and the Red Cross Society was reorganized. The Red Cross Society has under its direction the Chulalongkorn hospital, the Pasteur institute and laboratories for the preparation of vaccines and serums.

The calendar has been revised. The Siamese year formerly dated from the foundation of Bangkok. It now corresponds with the Buddhist era. The new year begins on April 1 and terminates on March 31. Hence April 1921 to March 1922 is, in the Siamese calendar, B.E. 2464. The day is divided into two periods of 12 hours each as in Europe, except in the railways and the post and telegraph department, where the 24-hour day is used.

On July 22 1917 Siam declared war on Germany and Austria-Hungary. Enemy aliens were interned, and later sent to internment camps in India. A military mission was sent to Europe early in 1918, and a Siamese military contingent landed at Marseilles in Aug. of the same year. This contingent comprised motor ambulance transport, which rendered efficient service on the western front, and an aviation corps. The aviators were trained by French officers, and although many had gained pilot's certificates, hostilities ceased before the corps was prepared to commence operations. The contingent returned to Siam in 1919. Siam was represented at the Versailles Peace Conference by three delegates, who signed the general Peace Treaty on behalf of their country.

The main clauses affecting Siam are Articles 135, 136 and 137. In *Article 135* Germany recognizes that all treaties, conventions and agreements between her and Siam, and all rights, titles and privileges derived therefrom, including all rights of extra-territorial jurisdiction, terminated as from July 22 1917. In *Article 136* all goods and property in Siam belonging to the German Empire or to any German State, with the exception of premises used as diplomatic or consular residences or offices, pass *ipso facto* and without compensation to the Siamese Government, while the goods, property and private rights of German nationals in Siam shall be dealt with in accordance with the provisions of Part X (Economic Clauses) of the Treaty. By *Article 137* Germany waives all claims against the Siamese Government on behalf of herself or her nationals arising out of the seizure or condemnation of German ships, the liquidation of German property, or the internment of German nationals in Siam, this provision not to affect the rights of the parties interested in the proceeds of any such liquidation, as governed by the provisions of Part X (Economic Clauses) of the Treaty. Under the Treaty Siam became a member of the League of Nations, and took part in the first Assembly of the League at Geneva in 1920.

Agriculture.—Owing to deficient rainfall in 1919, rice, the main agricultural crop of Siam, was barely sufficient to supply the needs of the population, and the price rose to five times pre-war rates. To meet the deficiency the export was prohibited, but was resumed in 1921. The question of extensive irrigation works, which had been considered in the previous reign, was again investigated in 1915, and important works were started. The difficulty of obtaining steel work from abroad during the war delayed their progress but work on the Prasak scheme, estimated to cost some 13,000,000 ticals, was afterwards vigorously pushed forward, and was expected to be completed in 1922.

Army and Navy.—The law of 1903 making military service compulsory was revised in 1917. Every able-bodied man of 21 to 22 years of age is liable to be called to military service for a period of two years with the colours, passing afterwards into the reserve, of which there are three classes according to age. There are various military schools for the training of officers, non-commissioned officers, aviators, military engineers, etc., as well as a General Staff school. The arms and equipment are modern, and in 1914 a national cartridge factory was established. The navy is recruited from the maritime population under the military service law. There are some 5,000 men available for service afloat, with a reserve of 20,000. In 1920 a 35-knot destroyer was purchased from the British Admiralty and rechristened the "Phra Ruang."

Communications.—On the declaration of war the northern and southern State railways were amalgamated under a Commissioner-General, H.R.H. Prince Purachatra of Kambaeng Bejra. The personnel, which had included German engineers, became chiefly Siamese, with a few engineers of Allied nationality. A standard metre gauge was adopted for all lines. The southern line through the Malay Peninsula was originally constructed of metre gauge to permit of through connexion with the Federated Malay States railways. The work of converting the northern line, first built to the normal gauge of 4 ft. 8½ in., was begun. A through service of trains from Penang to Bangkok was opened on the southern line in 1918, and in March 1920 railhead reached the Siam-Kelantan boundary. The northern line reached Chiengmai in 1920, and the Bandara-Swankalok branch was then under construction. The length of State lines in 1920 was: opened 2,215 km., under construction 211 km., and under survey 460 km. The average capital cost per km. of open line was tcs. 54,584.

Education.—There were in 1920 over 380,000 pupils receiving primary education, of whom 250,000 were being educated by priests in the Buddhist monasteries, 100,000 in local and private schools, and 30,000 in schools directly under the Ministry of Education. Secondary education, reaching a standard approximating to that of the London University Matriculation, is provided for by the Ministry of Education, with 120 schools attended by 8,500 pupils, by the two Royal Pages' schools and King's College, under the direct patronage of the King, and by certain missionary schools. In 1917 the Chulalongkorn University was opened at Bangkok with four Faculties—Medicine, Arts and Science, Engineering and Political Science. It includes hostels for 100 resident undergraduates.

Finance.—Annual revenue rose from tcs. 17,334,469 in B.E. 2437 (1894–5) to tcs. 86,494,066 in B.E. 2460 (1917–8). During this period the expenditure increased from tcs. 12,847,165 to tcs. 74,149,289. The national debt consisted in 1921 of two sterling loans both of 4½%, one for £1,000,000 floated in 1905, and one for £3,000,000 floated in 1907, both free of taxes present or future, levied by the Siamese Government and repayable by yearly drawings. The 1905 loan will be entirely paid off in 1945, and the 1907 loan in 1947. In 1909 a loan of £4,000,000, increased in 1913 to £4,750,000, was negotiated with the Federated Malay States Government. This loan is exclusively for constructing railways in the Malay Peninsula, the amount advanced is limited to £750,000 in any one year, and interest is at the rate of 4 % on the money actually received. The amount actually advanced on this account to March 31 1921 was £3,880,000, when the total debt of the kingdom stood at £7,312,560.

The mint was closed to the free coinage of silver in 1902, and, supported by the Treasury, exchange had steadied to around tcs. 13 to the pound sterling by 1909. In 1917 and 1918 the rate was maintained at tcs. 13·02 to the pound sterling, but by 1918 the Treasury had sold to the banks tcs. 77,000,000, representing nearly £6,000,000 sterling. As a result of these sales a large proportion of Treasury funds was transmitted abroad. The rise in the price of silver nearly denuded the country of silver coinage, and in 1920 the exchange rose to tcs. 10 to the pound sterling and over. The gold standard reserve fund, established for the maintenance of the gold value of the tical, remained untouched on March 31 1918 at £1,222,146.

Trade.—For 1917–8 the value of imports exceeded tcs. 97 million, including tcs. 3½ million of gold leaf and treasure. This shows an increase of some 10 millions over the previous year and 22 millions over 1915–6. The exports amounted to tcs. 123½ million, showing an increase over the previous year of tcs. 2 million and over 1915–6 of nearly tcs. 18 million. The value of rice exported was over tcs. 97½ million and of teak tcs. 5½ million.

Justice.—The Penal Code became law in 1908, and the preparation of other codes continues. All courts are under the Ministry of Justice. The judiciary is composed of native or European-trained Siamese judges, assisted in cases where foreigners are concerned by European legal advisers. In commercial cases where there is no Siamese statute or precedent customary law is administered. Where precedents are wanting the Siamese courts are guided generally by English statutes and cases as circumstances admit. On the outbreak of war with Germany and Austria a prize court was established to deal with enemy ships seized "*jure belli.*" Twenty-five enemy vessels were taken, and condemned as lawful prize by this court.

Public Health.—Modern sanitation began in Siam in 1897 with the creation of a Public Health Department under a director-general, assisted by a medical officer of health and a city engineer. The principal developments have been the inspection of cattle and meat and the regulation of the public abattoirs under veterinary inspection, the establishment of infectious diseases hospitals, medical treatment of the insane, quarantine, registration of births and deaths, compulsory notification of plague and cerebro-spinal diseases, and compulsory vaccination and revaccination against smallpox. An efficient public-health laboratory has been organized under the department. Bangkok is now efficiently drained and lighted. Pure filtered water is supplied from the Government water works. New roads have been cut through congested districts, and numerous bridges have been built over the canals which intersect the city. On the outskirts new residential quarters have been laid out, with broad roads lined with trees. (A. C. CA.)

SIBELIUS, JEAN JULIUS CHRISTIAN (1865–), Finnish musical composer, was born at Tavastehus, Finland, Dec. 1865. He was educated at Helsingfors, and later studied music at Berlin and Vienna. In 1916 he became a professor of literature at Helsingfors. His orchestral works include "Romance in C" (1890); *Karelia* (1893); *Frühlingslied* (1893); *Finlandia* (1905) and five symphonies (1897, 1901, 1905, 1910, 1915). He also composed many songs and pianoforte pieces. His music to the tragedy *Kuolema* (1904) contains the "Valse triste," which has gained wide popularity. In 1921 he visited England and produced his 5th symphony.

SIBERIA (*see* 25.10).—The name Siberia now generally excludes the Steppe provinces but includes Kamchatka and Russian Sakhalin.

Little progress has been made in the mapping of the wide tracts between the great rivers or the mountainous regions in the south. Even in the existing maps of southern Siberia little reliance can be placed on the detail except near the railway. There are no large scale maps of northern Siberia. The whole course of the Yenisei river has been mapped on a large scale, the shores of Lake Baikal have been surveyed and geological exploration in the Amur basin and some parts of the upper Lena basin has resulted in accurate maps.

Kamchatka contains a notable range of volcanoes which forms part of the Pacific ring. Forty have been located of which 14 are active. The loftiest active volcano, the loftiest mountain in Siberia, is Klyuchevskaya, 16,130 feet. Koryatskaya is 11,522 feet.

Investigations in Lake Baikal have shown that there are three basins of unequal extent and depth. The southerly basin has an extreme depth of 791 fathoms, and is separated by a shoal ridge of less than 300 fathoms from the middle and most extensive basin which reaches 832 fathoms in depth. The northern basin does not exceed 540 fathoms. On the W. of the lake the deep water goes inshore but on the E. the coastal waters are shoal. The area of the lake is 13,200 sq. m.; its surface is 1,561 ft. above sea level.

New surveys of the Arctic coast by Tolmachev, Vilkitski and others have resulted in considerable modifications in the chart. Shitkov explored the Yamal peninsula and cleared up some doubtful points in its hydrography. The small islands between the Gulf of Yenisei and Taimir peninsula have proved to be more numerous than was supposed and Taimir Gulf has been found to be relatively narrow. Cape Chelyuskin lies in lat. 77° 42′ N. Nikolas Land and other islands have been discovered to the N.W. of this cape, and new discoveries have been made in the New Siberia and Wrangel Is. (*see* ARCTIC REGIONS). There is still some doubt about the configuration of the coast-line between Cape Chelyuskin and the Lena delta. Hydrographical surveys have resulted in the discovery of some harbours on the Arctic coast including several in Taimir Land; Tiski Bay, E. of the Lena delta; and Chaun Bay in long. 170° E. Surveys in the Sea of Okhotsk have shown that the best harbours are Yamskaya Bay; Ola Bay, off Taui Bay; and Port Ayan. Okhotsk is falling into decay owing to its poor site. In Kamchatka Baron Korfa Gulf has been found to contain several good harbours. In the Maritime province the best harbours, in addition to Peter the Great Bay, are de Castries Bay, Imperial Bay and Olga Bay. De Castries Bay, a little S. of the Amur mouth, affords a far better and more accessible harbour than the Amur estuary. The Tartar harbours are closed by ice from Nov. to April or May and the Okhotsk harbours for a month or two longer.

Population.—There has been no census since 1897 but in 1915 the pop. was estimated at 10,377,900 on the basis of the last census and the yearly rate of increase. It was distributed as follows:—

Governments and Provinces [1]	*Area in sq. m.*	*Population* [2]	*Density per sq. m.*
Tobolsk (Govt.)	535,739	2,085,700	3·9
Tomsk (Govt.)	327,173	4,053,700	12·0
Irkutsk (Govt.)	280,429	821,800	2·5
Yeniseisk (Govt.)	981,607	1,143,900	1·1
Yakutsk (prov.)	1,530,253	332,600	0·2
Transbaikalia (prov.)	238,308	971,700	4·0
Amur (prov.)	154,795	261,500	1·6
Maritime or Primorsk (prov.)	266,486	631,600	3·0
Kamchatka (prov.)	502,424	41,600	0·1
Sakhalin (prov.)	14,668	34,000	0·5
Total	4,831,882	10,378,100	2·0

[1] These indicate the administrative divisions in force under the empire. The present (1921) divisions are uncertain and unstable.

[2] The pop. estimates are probably somewhat too high.

The two Steppe provinces, Akmolinsk and Semipalatinsk, which are geographically part of Siberia, though they were administratively distinct under the late imperial regime, have a combined area of 403,394 sq. m. and an estimated pop. (1915) of 2,421,400. The figures given above include native tribes (see below).

Colonization.—The Russians number over 85% of the total pop. of Siberia as a whole and about 93% of the total pop. of western Siberia (Tobolsk and Tomsk). The number of settlers entering Asiatic Russia (including the Steppe provinces) from Russia in Europe rose from 141,000 in 1906 to 619,000 in 1909. For some years after there was a decline, due, it is said, to a succession of good harvests in southern Russia: in 1912 and 1913 the annual immigration was little over 200,000. In 1914 it was 242,000. From 1906 to 1914 nearly 3,000,000 Russians entered Asiatic Russia, about 2,000,000 of whom went to Siberia. The Siberian railway zone continued to attract most settlers in western and central Siberia but many went to the Baraba steppe, the Altai region and the district round Minusinsk and the upper Yenisei. The Uryankhai region around the head streams of the Yenisei in the Sayansk mountains, which is nominally part of outer Mongolia under the suzerainty of China, contains many Russian settlers and for some years has been more or less under Russian control. In Transbaikalia much land is occupied by Cossacks and their descendants, and natives (largely Buryats), but in the upper Amur and the Ussuri valleys there are considerable areas of Russian settlement. The efforts, however, that were made by the State before 1917 to attract colonists to the Amur and Maritime provinces met with somewhat meagre response. Attempts to colonize Kamchatka have been practically abandoned and for many years Russian Sakhalin has failed to attract settlers. North of lat. 58° N. in western Siberia, and lat. 54° N. in eastern Siberia, there are very few Russians permanently settled. Total exemption from military service and other privileges which the State offered colonists in the lower valleys of the Yenisei and Lena did not succeed in attracting many settlers. The migration of Chinese and Koreans to the Amur and Ussuri valleys and the Transbaikal region was marked for many years. The Chinese came as temporary labourers but the Koreans were more inclined to become permanent settlers. Japanese artizans are found throughout eastern Siberia. In 1914 the Russian Government was making attempts to exclude Asiatics at the same time that it offered inducement to Russians to settle in the Far East.

Native Races.—While no strictly ethnological classification of Siberian natives is yet possible, it is recognized that the tribes of the extreme N. and E., even if they differ from one another, have certain characteristics in common which distinguish them from later arrivals in Siberia. For these earlier tribes, who may possibly have migrated to Siberia from America at a very early period, the name Palaesiasts is used by Schrenk and Palaeo-Siberian by Czaplicka. For later tribes the term Neo-Siberian has supplanted Ural-Altaians to which there are linguistic and ethnological objections. Czaplicka classifies the native tribes of Siberia as follows, taking numerical statistics from Patkanov, who based his estimates on the census of 1897 which gives the latest trustworthy data: I. Palaeo-Siberians. i. Chukchee; in north-eastern Siberia, 11,771. ii. Koryak; S. of the Chukchee, 7,335. iii. Kamchadal; southern part of Kamchatka, 2,805. iv. Ainu; in southern Sakhalin and Yezo, 1,457. v. Gilyak; near Amur mouth and in northern Sakhalin, 4,649. vi. Eskimo; shores of Bering Strait, 1,307 (in Asia). vii. Aleut; in Aleutian Is., 574. viii. Yukaghir; between the lower Yana and lower Kolima, 754. ix. Chuvanzy; S. of Chaun Bay, 453. x. Ostyak of Yenisei; on the lower Yenisei, 988. II. Neo-Siberians. i. Finnic tribes (*a*) Ugrian Ostyak; lower and middle Ob, 17,221. (*b*) Vogul or Maniza; middle Ob, 7,476. ii. Samoyedic tribes; in far N. from Europe to Khatanga mouth, 12,502. iii. Turkic tribes (mainly outside Siberia) (*a*) Yakut; from the Lena to the Amur and Sakhalin, 226,739. (*b*) Turco-Tartars of Tobolsk and Tomsk, 176,124. iv. Mongolic tribes (*a*) Kalmuk or Eleut; practically all outside Siberia (*b*) Mongols proper or Kalkha, 402. (*c*) Buryat; around Lake Baikal, 288,599. v. Tunguskic tribes (*a*) Tungus; far eastern Siberia, 62,068. (*b*) other Tunguskic tribes, totalling 14,439, viz. Chapogir: on the lower Tunguska; Goldi: on the lower Amur; Lamut: on the shores of Sea of Okhotsk; Monagir: on the middle Amur; Oroche: E. of the lower Amur; Orochon: on the Olekma; Oroke: in Sakhalin; and Solon: S. of the middle Amur. Tribes who live in the more fertile parts seem to be increasing in numbers but those who occupy the more barren regions of the N. are dwindling. The natives probably do not exceed one million.

There is much disease, particularly among the native tribes, although the climate itself is not unhealthy. In addition to goitre, leprosy occurs in the Lena and Amur valleys and elsewhere. Smallpox is endemic in many parts and tuberculosis is prevalent. Cholera is never absent in the Far East and occasionally assumes the proportions of an epidemic. Plague sometimes enters from Manchuria. Venereal diseases are rampant throughout Siberia. A curious nervous affection known as Arctic hysteria is common among the natives of the far north. It is not infrequently associated with melancholia and suicide. The hysterical manifestation of Shamanism may not impossibly be associated with this nervous affliction.

Education.—The last statistics date from 1912 when there were 6,245 schools in Siberia with a total of 341,271 pupils. The number of pupils per 1,000 of the pop. was thirty-six. Out of every 100 persons under nine years of age only 16 could read and write.

Towns.—Towns situated on or near the railway have grown rapidly but others have made little or no progress. In 1914 towns with a pop. of 10,000 or over numbered at least 21 compared with 17 in 1900; but estimates of the pop. of Siberian towns vary considerably and must be accepted with reserve. The largest towns are Tomsk (112,000) and Irkutsk (113,000), the capitals of western and eastern Siberia respectively. Omsk (128,000) is really a Siberian town but actually within the Steppes. Other large towns in western Siberia are: Novo-Nikolaevsk (63,000), a centre of rapid growth situated where the Siberian railway crosses the Ob; Barnaul (52,000) and Biisk (28,000), both centres in the rich Altai region. Kurgan (35,000) on the Tobol, a great agricultural market; Tyumen (30,000) now on the railway and a focus for trade between Russia and Siberia; Tobolsk (21,000), a declining fur and fish market on the Irtish; Kolivan (13,000) on the Ob, with agricultural interests; Mariinsk (13,000), a mining centre on the railway and Achinsk (10,000) a little farther east. In eastern Siberia other important towns are: the great port of Vladivostok (95,000); the two Amur ports and agricultural centres, Blagovyeshchensk (76,000) and Khabarovsk (53,500); Chita (73,000) with growing agricultural and commercial interests; Krasnoyavsk (73,000), the chief river and railway port of the Yenisei; Nikolsk-Ussuriski (34,700), a rising industrial and railway centre 70 m. from Vladivostok; Nikolaevsk (12,500), the port at the Amur mouth; the two mining centres on the Yenisei, Minusinsk (14,000) with agricultural interests, and Yeniseisk (10,000); Kansk (10,000) on the upper Yenisei and Siberian railway; Stryetensk (10,000), at the head of the Amur-Shilka navigation; and Verkhne-Udinsk (9,500), a railway and industrial centre in Transbaikalia. The towns of the far N. are small and primitive. Yakutsk, a fur-trading centre on the Lena, has a pop. of 8,200 and Verkhoyansk, on the Yana, only 450. The pop. of Sredne-Kolimsk, on the Kolima, which is the largest centre in the N.E. of Siberia, is 650. Petropavlovsk, the capital of Kamchatka, has fallen to some 500; Alexandrovsk, the capital of Russian Sakhalin, about 6,000, a figure, however, which includes more natives than Russians; and Okhotsk to less than three hundred.

Agriculture.—In western Siberia about 17,000 sq. m. are under crops (1913) but there are still great areas of natural grassland waiting for cultivation. In eastern Siberia agriculture has not made great progress except in the southern Ussuri plain: natural grasslands are scarce but there are many forest areas on the Amur which, if cleared, would afford good agricultural land. The area under crops in eastern Siberia is 2,800 sq. m. (1913). Agricultural methods in the W. have undergone some improvement, through the use of fertilizers and the importation of American agricultural machinery. Many flour-mills have been erected. Western Siberia sends its surplus wheat to Russia and eastern Siberia. The latter region also imports corn from Manchuria. In 1913 the total cereal production of Siberia was 68,200 cwt. and the average annual production (1908–13) was 50,200 cwt.

Land Tenure.—After the revolution of 1917 the State became the owner of all land in Siberia except some 5,000,000 ac. granted to Cossacks or other private persons. All other holders of land are tenants of the State, enjoying in some cases hereditary leases. The State ownership would seem to apply also to minerals, timber, fisheries and water power but some concessions have been recognized in favour of foreigners.

Live Stock.—The rearing of live stock has made more progress than agriculture. In 1913 the Steppe towns of Petropavlovsk and Omsk had become great centres for the export of meat to European Russia, drawing a large part of their supply from the Tomsk province. In the Transbaikal, Amur, and Maritime provinces cattle-breeding promises to attain greater importance than agriculture, but the meat supply of eastern Siberia is partly dependent on imports from Manchuria. The successful acclimatization of the merino sheep in central Siberia holds promise of much wool production in the Yeniseisk and Irkutsk provinces. Pig-breeding is a growing industry in western and central Siberia and by 1914 bacon exports had become important. Reindeer-breeding is the chief occupation of most of the far northern tribes. Maral deer and other species of wapiti are bred in the Altai, the Maritime province and elsewhere for their horns, which to the Chinese have a reputed medicinal value. The official figures (in round numbers) for the number of live stock in Siberia in 1911 and 1914 are as follows:—

	Horses	*Horned cattle*	*Sheep and goats*	*Pigs*
1911	4,598,000	5,719,000	5,250,000	1,126,000
1914	4,840,000	6,541,000	5,745,000	1,428,000

The dairy industry has developed quickly, fostered by State encouragement and the export facilities afforded by the railway. In 1912 there were 1,060 coöperative dairies in the Tobolsk province, and 2,042 in the Tomsk province. The export of butter from western Siberia reached 35,000 tons in 1903 and 76,000 tons in 1913: in the latter year the home consumption accounted for an additional 75,000 tons. The industry is of less importance in eastern Siberia.

Hunting.—The fur industry retains great importance and was much stimulated during the early years of the World War by the high price of skins. But decrease of game is causing hunting in many parts of the N. to take a secondary place to fishing and reindeer-breeding. The sable became so scarce that from 1913 to 1916 its slaughter was forbidden. The white fox is becoming rare. The principal fur fairs are at Irbit (Feb.) and Yakutsk (July), but Ishim, Blagovyeshchensk, Nikolaevsk and Anyui are also frequented by traders in search of furs. Yakutsk has also a trade in fossil ivory from the New Siberia Is.: in 1913 nearly 20 tons were sold. In order to prevent their extermination the few seals of the Commander Is. were protected for five years from 1912.

Fishing.—In western Siberia the most important fisheries are on the Ob. Tobolsk is the headquarters of the industry: Obdorsk, Beresov, Surgut and Narim are also important centres. At least 10,000 men take part in the fishery and the annual catch is about 15,000 tons. On the upper Irtish Pavlodar and Lake Zaisan are centres of fishing. The fisheries of the lower Yenisei send S. about 3,000 tons every year. In Lake Baikal there are valuable fisheries both in summer and, through the ice, in winter. In the Lena and Kolima regions the natives live chiefly on fish but lack of transport facilities prevents export. Fisheries in the Amur, Okhotsk and Kamchatka regions steadily increase in importance. The fish are mainly species of salmon but not the same as those in western Siberia. The fisheries are largely in Japanese hands but legislation in 1899 restricted to Russians all fisheries in the Amur and its estuary. In 1913 the mouths of certain rivers on the Okhotsk and Kamchatka coasts were closed to all fishing in order to conserve the fisheries. In 1913 the Okhotsk and Kamchatka fisheries resulted in a total catch of 46,000,000 salmon, most of which went to Japan. Salmon caviar to the extent of 2,477 tons was exported from the same districts. Salmon-canning is a new industry: in 1913 the output from Kamchatka was over 500,000 tins, and from the lower Amur 100,000 tins. Attempts to send frozen fish from the Amur to Europe met with some success when begun in 1913. The fisheries of Russian Sakhalin are losing their importance. In the Sea of Japan the herring-fishing from Imperial and Peter the Great bays is growing in value.

Timber.—Siberian forests of commercial timber are estimated to cover about 470,000 sq. m. or about one-tenth of the total area of the country, but owing to absence of transport facilities only 150,000 sq. m. are considered to be exploitable. In western Siberia there is little trade in timber and the demands for home use and the havoc of forest fires are decreasing the available supply. The principal saw-mills are at Tobolsk, Tyumen, Omsk, Novo-Nikolaevsk and Tomsk. In eastern Siberia the timber industry is confined to the Amur and Maritime provinces except in respect of the demand for fuel for railway, industrial and domestic purposes. The principal saw-mills are at Irkutsk, Blagovyeshchensk, Nikolaevsk, Imperial Bay, Vladivostok and Alexandrovsk (Sakhalin). Export is from Vladivostok, Imperial, Olgi and Posiet bays to Australia, the British Isles and Japan. Before the war great efforts were being made to encourage this trade.

Minerals.—Gold is the most important mineral in Siberia. The Lena drainage area, especially the valleys of the Olekma and Vitim, is considered to be the richest gold-producing area in the world. All the gold worked is alluvial and the annual yield (1916) was some 400,000 oz. Bodaibo, connected by rail to the Vitim, is the centre of the industry. The gold-fields of the Amur valley when fully explored will probably prove to be even greater in extent. The new town of Zeya Pristan on the Zeya is the principal mining centre on the middle Amur. The Bureya valley is also rich in gold. On the lower Amur there are rich gold-fields near Lake Chyla. The Amur gold is alluvial and most of it is very fine. British interests control the principal gold-fields of both the Lena and Amur basins. Gold is reported from several places on the Sea of Okhotsk, in the Chukchee peninsula and in the Anadir region. The output in Transbaikalia is falling off. In the Yeniseisk region there are valuable deposits in the Abakan valley. In western Siberia the gold output is declining but, as placer mining gives way to quartz crushing, shows prospect of reviving. Quartz veins are rich in the neighbourhood of Ust-Kamenogorsk and Lake Zaisan. The gold-bearing rocks in Siberia as a whole, including the Urals, are estimated to cover over 800,000 sq. miles. The total output of gold in 1913 was estimated at 1,500,000 oz., of which over 90% was from eastern Siberia; but there is reason to doubt the accuracy of official figures. In the same year the number of men employed in the gold industry in Siberia was 56,400. Climate, labour and transport, apart from political difficulties, afford obstacles in the development of the industry. The output of silver has shown a decline for many years, but numerous rich deposits are known to exist in the Altai region and around Nerchinsk. The production of zinc has increased, largely due to the rich Tyutikha mines in the Priamur. Lead is obtained from these mines and also from the Altai mountains and Ust Orlinskaya on the Lena. Zinc and lead mines at Riderski in the Altai are linked to the Irtish by a 70-m. narrow-gauge railway. Tin occurs in the Onon valley in Transbaikalia, but it is little worked. New deposits of graphite have been reported from Cape Dezhneva on Bering Strait. Copper occurs mainly in the Urals and in the Karkaralinsk district of the Kirghiz steppes, both of which regions are outside Siberia proper. There has been little if any progress in the production of iron except in the Urals, but valuable deposits of iron ore are reported in the Amgun valley near the Amur mouth, in the vicinity of Vladimir and Olgi Bays in the Priamur, in many parts of the Altai and near Karkaralinsk in the Steppes. Considerable coal deposits of varying quality have been located, but comparatively few are mined. Want of markets and transport facilities are drawbacks even where the coal is of good quality. The most promising deposits are the Kuznetsk beds in the Altai region which contain coking coal; beds around Cheremkhovskoe, 70 m. W. of Irkutsk, where some 5,000,000 tons of lignitic coal are mined annually, principally for use on the railway; the Suchan mines, 60 m. from America Bay, on the Sea of Japan, and the Mongugai beds near Amur Bay on the Tartary coast. The Mongugai beds and those at Due in Sakhalin both consist of good anthracitic coal but neither is seriously worked. Coal in the Amur and Lena valleys and Transbaikalia is chiefly lignitic. There are large deposits of lignite at Baron Korfa Gulf in Kamchatka. In the Kirghiz steppe coking coal is worked at Ekibas-tuse. The mines, which are controlled by a British company, are connected with the Irtish at Yermak by a railway 70 m. in length. Petroleum-bearing strata exist on the eastern shores of Lake Baikal and near Nabilski Bay in Sakhalin, but the oil is not exploited.

Manufactures.—Manufactures on a large scale have made little progress except in engineering works and repair shops for the railways. The competition of the Ural iron foundries, which have better transport facilities, has adversely affected the Siberian foundries, but a few persist, notably at Petrovsk in Transbaikalia, Blagovyeshchensk and Tyumen. At Ekibas-tuse in the Steppes the zinc and lead ores from the Riderski mine are smelted. Some river ports, as Khabarovsk, Blagovyeshchensk, build and repair vessels.

Tanneries, tallow factories, brickworks and breweries are widely scattered. Only 7·6% of the pop. is estimated to be engaged in manufacturing industry (1914).

Communications.—Efforts to open up communication with Siberia by its northward flowing rivers and the Arctic Ocean have met with some success, but access by this route is possible only in the height of summer. Experience has shown that during Aug. and Sept. ice seldom presents any real difficulty in the Kara Sea and a steamer can rely on making the estuary of the Ob or Yenisei. One or two vessels take this route annually. Along the eastern part of the Arctic coast the only regular navigation is by occasional vessels between the mouth of the Kolima and Vladivostok.

The Ob affords 17,000 m. of navigable waterways, but the delta impedes communication with the Arctic Ocean. Seagoing vessels can reach Obdorsk, but large vessels have to lie at Nakhodka Bay in the Gulf of Ob. River steamers ascend the Ob to Biisk, 2,059 m. from the sea, and the Irtish to Lake Zaisan, 3,100 m. from the sea. The Ob-Yenisei canal between the Ket and the Kas is accessible only to small barges. In 1915 there were 350 steamers and several hundred barges on the Ob and its tributaries. The Yenisei is navigated to Minusinsk, 2,045 m. from the mouth. Small seagoing vessels can reach Yeniseisk, but larger vessels discharge and load at Golchikha (Ghilghila) in the delta. The Yenisei is the only Siberian river for which sailing directions and large-scale charts are published. Beacons and buoys assist navigation. In 1915 there were 60 steamers on the Yenisei. The tributaries are of little value for navigation. The Lena has a navigable length of 2,760 m. to Kachugskoe, 230 m. from Irkutsk, the nearest point on the railway. In 1914 there were some 30 steamers on the river, mainly between Yakutsk and Vitimsk. The Vilyui, Aldan and Vitim are tributaries on which a few steamers ply. The Amur with the Shilka is navigable for 2,000 m. to Stryetensk on the Siberian railway. There are many sandbanks, but vessels drawing 3 ft. can make the whole journey. The river is buoyed and marked and supplied with a few dredgers. Seagoing vessels stop at Nikolaevsk in the delta, but if the stream was dredged in a few places they could reach Khabarovsk. In 1916 there were about 400 steamers and several thousand barges on the Amur and its navigable tributaries. Practically all the vessels were Russian, although Chinese vessels have equal rights down to Khabarovsk. On the Sungari, the Manchurian tributary of the Amur, there is Chinese and Japanese shipping. The Ussuri is navigable throughout its length. Steamers ascend the Ussuri and Sungacha to Kamen-Ribolov, on Lake Khanka, 500 m. from Khabarovsk. Navigation on Lake Baikal has become less important since the construction of the railway round the southern end. In addition to two powerful ice-breakers there are about 12 steamers on the lake, some of which ascend the Selenga. The shores of Lake Baikal are well provided with lighthouses. The best harbors are Baranchuk on the west and Misovski on the east. Both are provided with breakwaters and wharves and are on the Siberian railway.

In 1916 the railway mileage in Siberia was approximately 6,800 m., not counting the Chinese Eastern (trans-Manchurian) railway. The Amur railway was built between 1908 and 1916. It marks a reversion to the course originally projected for a railway to the Pacific and provides a through route independent of Chinese territory. The Amur railway is a single track linking Kuenga via the Amur valley with Khabarovsk, 1,295 m.; the embankments and bridge piers are built for a double track. There are branches to the Shilka river at Chasovaya, and to the Amur at Reinova, Chernyaeva, Blagovyeshchensk, Innokentievskaya, and Pashkova. The bridge across the Amur at Khabarovsk is 7,038 ft. in length and has 22 spans. In western Siberia the line from Petrograd to Tyumen has been extended via Ishim to Omsk on the original Siberian line. A line from Ekaterinberg destined to reach Tobolsk goes via Irbit and ends at Saitkovo on the Tavda river. The Altai railway from Novo-Nikolaevsk to Barnaul (with a branch to Biisk) and Semipalatinsk, 408 m., was opened in 1915. It serves mining and agricultural interests in one of the most promising parts of western Siberia. The new line from Achinsk to Minusinsk, 300 m., opens a rich agricultural district in the valley of the upper Yenisei and tributaries. From Tatarskaya, 105 m. E. of Omsk, a line goes S. to Slavgorod, 196 m., in a region which in 1913 was attracting settlers. From Yurga, 385 m. W. of Krasnoyarsk, a line to Kolchugino, 200 m., taps rich coal-fields. These two lines were built by private enterprise. The Siberian railway is now double-tracked from Omsk to Karimskaya where the Stryetensk and Amur line begins. Some of the bridges still require to be widened. There is a double track from Nikolsk-Ussuriski, the junction of the Ussuri and Chinese Eastern railways, to Vladivostok. A line 93 m. long connects the Suchan coal-mines with Vladivostok. During the years 1915–6 the Siberian rolling-stock was much increased from the United States, and new railway shops were erected at Pervaya Ryeka near Vladivostok.

The telegraph system has been extended into Arctic Siberia: lines follow the Ob to Beresov, the Yenisei to Turukhansk and the Lena to Yakutsk and Vilyuisk. There are lines from Yakutsk to Okhotsk and from Khabarovsk to Nikolaevsk with connexion to Sakhalin. The Siberian telegraph system is linked via Semipalatinsk with that of Turkestan, and via Chuguchak with that of Mongolia. A second line to Mongolia between Kosh Agach, on the frontier, and Kobdo was incomplete in 1921. The Siberian and Chinese systems join at Kyakhta. Wireless telegraph stations exist in many places in the far N., and in 1916 were working at Cape Mare Sale in the Yamal peninsula; Dickson I. at the Yenisei mouth; Novo-Mariinsk and Markovo on the Anadir; Gizhiga Bay; Okhotsk; Khabarovsk; Nikolaevsk; Petropavlovsk in Kamchatka; Iman on the Ussuri and Vladivostok.

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SICKERT, WALTER RICHARD (1860–), British painter, was born at Munich, May 31 1860, the son of the painter, Oswald Adalbert Sickert, a well-known contributor to *Fliegende Blätter*, and grandson of Johannes Sickert of Altona, painter and lithographer. Walter Sickert studied painting and etching under Whistler in Tite Street, Chelsea, but in 1885, following the advice of Degas, began to paint from drawings instead of from nature. His first work on these lines, "Mammoth Comique," was published in the *Yellow Book*. The dramatic quality of his work owes much to his study of the technique of wood engraving and to his interest in the work of John Leech and Charles Keene, while he was also much influenced by Wilhelm Busch (*see* 4.869) and Adolf Oberländer (*see* 19.946). His subject pictures include "Mamma mia po' areta" (1903), "Noctes Ambrosianae" (1906), "The Camden Town Murder" (1906), "Army and Navy" (1913), "Ennui" (1914), "Sinn Fein" (1915), "Pierrots on Brighton Beach at Night" (1915), "Baccarat at Dieppe" (1920) and "Supper at the Casino" (1920). He also produced some architectural paintings, including "Hôtel Royal, Dieppe" (1900), "Miracoli" (1903), "Lansdowne Crescent" (1917) and "Pulteney Bridge" (1918), while his best known landscapes are "The Happy Valley" (1919) and "The Priory of Auberville" (1919). Examples of his work are in the British Museum, Tate Gallery, Bibliothèque Nationale, the Luxemburg and the art galleries of Manchester and Johannesburg. He became a member of the Société du Salon d'Automne, the Society of Twelve and the International Society, and was a fellow of the Royal Society of Painters, Etchers and Engravers. As a teacher he exercised a strong influence over the younger school of British painters.

SICKLES, DANIEL EDGAR (1825–1914), American soldier and diplomatist (*see* 25.36), died in New York City, May 3 1914. In 1912 after having served for more than a quarter of a century as chairman of the New York Monuments Commission he was removed following the discovery of a shortage of $27,000. His last years were disturbed by financial difficulties.

SIDGWICK, ARTHUR (1840–1920), English scholar (*see* 25.39), was in his later years an ardent advocate of the abolition of compulsory Greek at Oxford, both in the interest of the classics and with the view of extending the field whence the university should draw its students. He was also a warm supporter of the admission of women to the university degrees, as he had previously been both of woman suffrage and indeed of all aspects of the higher education of women. He died at Oxford, Sept. 25 1920.

His elder brother, William Carr Sidgwick (1834–1919), also a classical scholar and fellow of Merton College, Oxford, died at Rugby, Oct. 18 1919.

SIDGWICK, ELEANOR MILDRED (1845–), British educationalist, was born in Scotland, March 11 1845, the daughter of James Balfour of Whittingehame and his wife Lady Blanche Cecil. She was thus the sister of Mr. Arthur James Balfour. She was educated at home, and in 1876 married the philosopher Henry Sidgwick (*see* 25.39). Mr. and Mrs. Sidgwick were both much interested in the advancement of the higher education of women, and were actively concerned in the founding (1880) of Newnham College, Cambridge, of which Miss Clough was the first principal. On the death of Miss Clough in 1892, Mrs. Sidgwick succeeded her as principal, and retained the position until 1910. In that year she retired, and until 1919 was bursar of the college. Mrs. Sidgwick shared her husband's interest in psychical phenomena, and in 1910 became secretary of the Society for Psychical Research.

SIEGECRAFT AND SIEGE WARFARE.—The earlier article on Fortification (10.679) reviews the prevailing ideas of defence against siege-warfare just before the World War. Opinion was then still unsettled on fundamental points, as well as on those differences in arrangement of the available elements of defence which have always divided the military engineering world into two or more schools. In the earlier days, Vauban and his competitors might disagree as to design, but they were in agreement as to purpose; and even at a later date, when the "bastion" school carried on its controversies with the "polygonal" or *caponnière* school, there was complete unity as to the necessity of permanent fortifications and substantial unity as to their functions. But the economic history of the 19th century, and the military history of its latter half, had brought the principles as well as the practice of fortification into the melting-pot.

Amongst many reasons for this, the following were the more important:—

(*a*) The increased size of armies, made possible by the credit system of finance, the universal service system of recruiting, the industrial system which could arm them, and the road and rail system which enabled them to disperse without risk in order to feed on the countryside, or to remain massed without starving through a breakdown of convoys, or both.

This increased size soon reached a point at which the old-fashioned fortress ceased to be an adequate base for the army's depots, or an adequate shelter in which to refit after defeat. There were signs of this even in 1870, although by that date the fortress had expanded into an entrenched camp of large perimeter, and between 1870 and 1914 the scale of field artillery, field transport and field ammunition for a given force, was practically doubled.

(*b*) The character of war, as between "armed nations," in which, in principle, a speedy decision by battle was sought at all costs, whereas warfare between the old professional armies had been prolonged from campaign to campaign. The objects sought by each side were now rather spiritual than material, or at any rate more general than local; and the fortress, which used to be judged according to the degree of protection it gave to the material objects of enemy desire—a city, a province, a port—came to be judged according to the degree in which it aided or impeded the manœuvres of a field army seeking to win the war in battle. The task of fortification thus became much less positive and definite, and a programme of works took on a somewhat speculative character.

(*c*) Development of communications, which, besides the effects referred to under (*a*), had that of making civilized countries everywhere or nearly everywhere penetrable. The fortress as conceived of in the 18th and early 19th century, therefore, no longer exercised any power of control beyond the range of its guns or the striking radius of its semi-mobile garrison. And it could easily be "turned," and then either enveloped or—by means of a masking force—eliminated as a factor in the campaign. Cases indeed remained, and still remain, of "obligatory points of passage," where local control of the route by means of fortification implies strategic control of the adjacent regions which are limited for their intercommunication to that route. Especially is this true still of rail communication. But in the main, armies and their transport can, in present-day west and central Europe, move where they will, except through areas directly under the tactical control of fortifications.

Further, the rapidity of communication as well as the wealth of routes enables a modern state to concentrate its defensive forces in the threatened region far more rapidly than of old, and the necessity for fixed defences, to gain time for the assembly of mobile forces, steadily declined.

(*d*) The development of the technique and manufacture of weapons of war, from about 1860, became so rapid that permanent fortifications of any given design were liable, like modern warships, to fall into obsolescence after a brief life of usefulness which contrasted sadly with the long career of a place like the old citadel of Antwerp, built in 1567 and besieged with all the forms and means of siegecraft in 1832.

Three out of four of these operating causes, it will be noted, are extrinsic, and one only intrinsic. In the case of the latter, operating alone, it is easy to conceive of a sort of duel between the gun constructor and the military engineer, analogous to the continued contest of gun *versus* armour plate. Few fortresses have ever had the good fortune to be fully up to date in design and equipment at the moment of siege. The reply of the French engineer who was asked what he would do if the Germans made the length of their scaling ladders greater than the depth of his ditches, expresses an inevitable condition of permanent fortification design. "It will always be easier," he said, "for the Germans to make scaling ladders than for me to dig ditches." Similarly, it will always be easier to make a new gun that will cut through a given thickness of concrete or armour than to increase the latter. For—questions of expense apart—the fort is a permanent sentry guarding against surprise, and the reconstruction of its works is a heavy piece of engineering which not only takes time but frequently renders them useless for the period of the repairs. Thus, in 1914, war surprised the fortress of Belfort when four of its principal works were under reconstruction. And if, as is generally the case, the programme of reconstruction is so drawn up as to minimize these risks, some part of the fortification system is sure to be obsolescent at any given moment. At any such moment, then, the question is not whether the means of attack have the upper hand—practically this is almost always the case—but whether the superiority is of such an order that the fortress or fort is useless. The new long-ranging powers of siege artillery in 1870, subjecting the area *intra muros* to concentric bombardment by an indefinitely numerous attacking artillery, and the demolishing powers of the superheavy siege howitzers evolved in Germany and Austria between 1900 and 1914—at least as against average concrete—were superiorities of that order.[1] But such cases are not frequent in military history, and it is more usual—in modern times, especially—to find a sort of thrust and parry, in which the artillery of the attack maintains a lead, but not a decisive lead.

The extrinsic causes in operation, meantime, were tending to bring about radical changes in the very meaning of fortification.

Outwardly, the controversies of the period 1885–1914 turned on technical questions, and chiefly on whether improvised fortifications could be shown to possess a resisting value practically equivalent to that of permanent fortifications. But in reality it was the feeling that the purposes and principles of fortification, as they had been understood in the past, no longer responded to the needs of warfare, that produced the multiplicity of designs and proposals for artillery works and infantry works, armoured and unarmoured works, self-contained and mutually interdependent works, and so on, characteristic of the period of unsettlement. If most of this ingenuity remained, as it did, unconvincing, this was due to the fact that there were great general causes at work, of which, in default of war experience, only the existence and not the effects could be seen.

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[1] Even in this instance, it must be admitted, the event was due in part to faulty designs which were not up to date even when laid down. Thus the new Antwerp forts (*see* Antwerp) were only built to resist the 21-cm. mortar, although the Japanese had already, under very unfavourable conditions as to communications, managed to employ 28-cm. pieces at Port Arthur. On the other hand Fort Douaumont at Verdun, where the concrete was excellent (1892) and of adequate thickness, resisted a far heavier bombardment even by 42-cm. howitzers.

The size of armies steadily increased, all the European continental Powers being drawn into a competition based on the numbers of citizen soldiers who could be conscripted and financially maintained. The power of armament increased also, and with it the possibility of holding a wider front per unit of armed force. The special results of this, from the point of view of fortification and siegecraft, were the extension of perimeters and the thinness with which a circle or arc of investment could now be maintained. But the more general results were the more important. An army developed along a front of some hundreds of miles could no longer be worked by radial lines of communication centring upon one or two ring fortresses. In Napoleonic practice, a stronghold of some sort was always the centre of operations on which the army's movements pivoted; and only that portion of the theoretical base-line, which was in relation with the stronghold in use at the moment, formed what has been called the "effective" base. With the modern extended fronts, on the contrary, the effective base has widened more and more, until it practically coincides with the theoretical base. In other words, each part of a great army has its own lines of communication and its own sources, the connexion between the army line and the base line, or front edge of the home supply area, being a sheaf of more or less parallel routes. Whatever local variations may appear when portions of the system are isolated and examined by themselves, in the *ensemble* the strategic structure of warfare in civilized countries had become linear.

But the more the front extended, the more difficult it became to collect any considerable force at one part of it for offensive effort. The "parallel battle in all its horror"—unit facing unit all along the line—was admitted to be the negation of generalship. But whether the dispositions were made *a priori* or by manœuvre within the battle, whether envelopment or break-through were the method chosen, the parallel battle could only be avoided by reducing the living forces on certain passive or semi-passive parts of the line to a minimum. The small economies that could be effected on these parts by judicious tactical arrangements in the open—though certainly not to be despised—would no longer suffice to give the really considerable superiority of force necessary for decisive victory on the active front. The expedient of economizing force by sacrificing territory had become, under modern conditions of social and economic life, more dangerous than it had ever been before. Recourse was had, therefore, to fortification. It became one of the rôles, if not indeed the principal rôle, of permanent fortification to economize active living forces on the passive fronts—a principle already applied to field fortification within the tactical sphere. As soon as the competition in numbers had set in all over military Europe, we find permanent fortification developing a new tendency to be *linear* instead of *circular* in type. The ring fortress becomes a sort of end-redoubt to a long line of forts, usually drawn along some natural barrier. This tendency is shown in the creation of the Meuse line (Verdun–Toul), and the Moselle line (Épinal–Belfort) in France, the line Namur–Huy–Liége in Belgium, the Sereth line in Rumania, the Bobr–Narew–Bug line in northern Poland, and lastly the Diedenhofen–Metz and Molsheim–Strassburg–Istein lines in Germany. In the same way, most of the new ring fortresses that were not so connected by permanent works were so placed as to be keystones of a linear battle-system; conspicuous instances are the systems Lille–La Fère–Laon–Reims–Verdun and Dijon–Langres–Epinal. Of the rest—setting aside the fortresses of eastern Europe where poverty of communications enabled permanent works, as of old, to dominate great areas by dominating a few nerve-centres—we find Antwerp, Copenhagen, Bucharest, Paris, designed as self-sufficing ring-fortresses, but not so much for playing a part in a battle-system as for serving as refuge for an army and a government that for the time being could not maintain its line of battle in the open field. Three of these four were called upon in the World War to play the assigned rôle and it is significant that not one of them did so successfully. Bucharest was evacuated as the result of an unsuccessful linear battle in the foreground; Antwerp was given up by the Belgian field army and Government as soon as the choice had to be made between standing a siege and continuing the war in the open; while in the crisis before the Marne the evacuation even of Paris was seriously considered.[1] Two ring-fortresses, Maubeuge and Besançon, were constructed in France in advance of the battle-system, in order apparently to draw upon themselves a part of the invader's effort condensed on the wings, and to control certain nuclei of communications which might otherwise be useful to him as he pressed forward. But the latter task is really that of a barrier-fort, and indeed Maubeuge was in process of being converted into a pure barrier position when war broke out, the old intention of an isolated defence *à outrance* having been abandoned. The linear systems with end-redoubts, on the other hand, performed in the war all the services for which they had been designed, with the exception of Liége–Namur; and even in this case failure—so far as there was failure—was due not to any vice of principle but to other factors.

The tendency to force a speedy decision in battle at all costs, specially characteristic of citizen armies, could not but reinforce the effects that the size of armies in itself produced upon fortification. With such a tendency on both sides, the initial deployment on each side would inevitably be carried out, wholly or largely, in accordance with an *a priori* plan of battle. Strategic considerations for the side which had chosen the pure offensive and moral and political considerations for the side which had chosen the defensive-offensive, imposed concentration close up to the frontier, in the first case so as to seize the initiative, and in the second so as to surrender as little of the national territory and resources as possible. Frontier fortification therefore had as its first duty protection of a line or zone of railheads close behind it; and since railway communication is in principle highly sensitive, a system of ring-fortresses at intervals could not give the same protection against sudden raids as linear defences of equal trench-length. But there was a further consideration. An *a priori* scheme of battle, with frontage and not depth as its main characteristic, is liable to require considerable modification when contact has been made and the first serious combats have produced their varied results, and thus a regrouping process begins in the course of the operation itself. In this regrouping, fortification is called on not only to protect the lateral shifting of masses by rail (as for instance the moves of the French IX. and XVIII. Corps from eastern Lorraine to the Ardennes in the middle of Aug. 1914), but also to send away its own local reserves to the area of decision (as in the case of the three French divisions transferred from the Meuse-line front to the Somme at the end of Aug. 1914).

The more penetrable the country, the more pronounced the linear character of the fortifications that must cover it. Not knowing the direction of attack, the defender must either prepare for it at all points of his allotted frontage of influence, or else resign himself to giving up country that *ex hypothesi* is economically valuable, and manœuvre in retreat to gain time. The old policy of devastating a deep zone to cover manœuvre, occasionally practicable when the organization of the state was simple and predominantly agricultural, is almost or wholly inapplicable in an industrial country. In Oct.–Nov. 1914 Hindenburg devastated part of W. Poland as cover for a lateral regrouping. But when it came to including Upper Silesia in the devastation programme, industrial influences promptly intervened to mitigate it. The expedient of making even a narrow zone truly impenetrable by means of radical destructions, adopted by the Germans in France in the spring of 1917, requires both time and an elaborate labour programme, neither of which is available in a battle crisis. In some cases, inundations serve the purpose, but even inundations take time to spread. On the Yser front in Oct. 1914, five days elapsed between the order to open the sluices and the creation of an effective barrier thereby. Moreover, in a generally penetrable country the area of decision might turn out to lie in an unexpected direction, and, if so, a system of fortifications designed to protect regrouping by likely lateral routes might prove to be useless for covering those which actually were required to be used. Thus, a speculative element began to come into schemes of fortification. It was no longer possible to justify heavy capital expenditure on works by reference to plain and definite needs. Already it was admitted that if the unexpected happened, it would be necessary to make shift with improvised works; already a considerable body of opinion held that permanent works, if admitted at all, should be similar in general design to field works; and the tendency in these circumstances was inevitably to trust to the latter, which were cheaper, could be built just where they were wanted, and according to many experts were just as good in principle as permanent works, and indeed better than most of the expensive fortifications already in existence.

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[1] In the event Paris played the part, originally assigned to Laon-La Fère, of end-redoubt in the battle-system. Antwerp, after capture, was organized by the Germans for the same purpose, viz. to serve as end-redoubt to the Antwerp–Meuse line.

This underground growth of the linear principle was fostered by another cause. The time-honoured relation of the town and its defences was altered. Under the influence of tradition theory continued to conceive of the fortress as a circular defence round a town. But the town had ceased to interest the military engineer, who now called it the "nucleus." He disposed his ring of defences at such a distance as to protect the nucleus from bombardment, a convention which was imposing a larger and larger perimeter with every improvement in the range of guns, but his works were now meant primarily to take a share in the operations in the field. That being so, except in such cases as that of Port Arthur, where the nucleus contained establishments regarded as essential to the conduct of the war, it was almost a matter of indifference whether a particular town should be protected or not. The old relation of the town and its walls had been based on the fact that the walls preserved the town from pillage and murder. In the course of time this had changed to a great extent, and in the era of "cabinet wars" it had almost vanished. But the old mediaeval spirit of the towns came to life again in such instances as Zaragoza, Colberg, Venice, and even if the towns-people were indifferent or sullen, the governor could usually resist pressure from them, because he was strong in the conception of his plain duty as a soldier to defend the post entrusted to him. But when the defence perimeter had advanced out of sight of the town, and the *enceinte* had either been turned into a public garden or retained, demilitarized, as a historical monument only; when, further, in peace-time no military barrier whatever differentiated the defended area from the open country; when, lastly, two generations of railway traffic had destroyed the self-centred economic life of the town and blurred its particularism—then from the point of view of the town it was in much the same position as any undefended town or village in the theatre of war. It might come within the ambit of military operations or it might not; if it did, it might either resist the invader heroically in the manner of Belfort in 1870–1, or agitate for demilitarization as Lille did in 1914, but the fact that a ring of forts lay out in the country around it had very little influence either way on its conduct as a town. Open towns in modern times have behaved like fortresses of old, and fortresses like open towns of old.

Correspondingly, the position and outlook of the governor has changed. Formerly the town was his charge, and almost his viceroyalty. His troops were his own; organized for sedentary warfare and not for campaigning, they were not at the disposal of a field army which happened to be operating in the neighbourhood, and the town was in practice defended—sometimes with spirit, sometimes feebly—whatever course operations took outside. Up to the very eve of the World War a French fortress governor was responsible to the Government only, and took no orders from the commander-in-chief of the field armies. The era of "cabinet wars" made little difference to this state of things; the population might be indifferent to the war in the towns as in the country, but to the governor and his troops the fortress was still a charge to be defended. Moreover, it was a real base for the armies in the field, in that the stores and supplies for those armies were accumulated in the fortress, and a real strategic aid in that it commanded routes that were obligatory for both sides. But when, in our own times, the governor had become simply the commander of a certain group of forces destined like other forces to take their part in a general scheme of battle; when the area within his defences had to a great extent ceased to be the source of stores and supplies for the field army, and when railways, needing protection at all points and not merely at a focus, became the principal lines of communication, the choice between evacuation and defence came to be governed by larger considerations of strategy. The governor's decisions therefore were assimilated in principle to those of any tactical executant of the strategist's instructions. He might defend or evacuate as a field commander might hold his ground or retire. But the peculiar character of his responsibility was gone. Even in France, the country which has been most tenacious of the fortress tradition, the old regulation, already quoted, was modified in the 1913 "Regulations for the conduct of Higher Formations," which empowered the commander-in-chief to assume control of any fortress and its forces if he thought fit.[1]

On the German side, units made up from fortress garrisons formed quite one-third of the Eastern armies during the first campaigns of 1914 operating sometimes a hundred miles away from their fortress of origin and in the sequel, never returning to it.

In sum, therefore, causes of a general character operating before 1914 produced these tendencies: (*a*) to divorce fortifications from their nucleus or central town, (*b*) to make them rather linear than circular in trace, (*c*) to bring them into conformity with the battle-scheme of the field armies (with *déclassement* as the alternative), and (*d*) to construct them as far as possible according to the principles of field fortification.

The theory of fortification, on the other hand, was still bound by the notion of a nucleus, and unable, therefore, for the moment to employ its stock of ideas and methods to the best advantage. The practical technique of fortification and siegecraft was, meantime, progressing in details; reinforced concrete had come into normal use, armour was improving in quality, the defence had it in its power no less than the attack to profit by developments in the design of quick-firing guns and howitzers of medium calibres. Observation balloons and kites were available, superior to the old spherical types; wireless telegraphy removed some of the dangers of investment and made it possible to coördinate the activity of a besieged garrison with that of a relieving army. The technique of bored mines developed, and trench-mortars and grenades reappeared. The lessons of Port Arthur in matters of detail-tactics and design were assimilated in the various armies. The enormous defensive power of the machine-gun was realized and to some extent exploited. It remained to synthesize the application of these elements, old and new, in an art of fortification that responded to the new demands and conditions of warfare.

This art began to take shape with the introduction of the "group" principle. Advocated by several theoretical writers in the period of controversy, it was applied practically, and on a large scale, by the Germans in the celebrated *Feste* constructed on the Moselle and the Rhine in the last ten years before the

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[1] It was in virtue of this new regulation that Galliéni's Paris forces were brought under Joffre's command in the battle of the Marne; and in accordance with the spirit of it that Sarrail acted in the same crisis, when, although only an army commander, he sent imperative orders to the governor of Verdun to despatch his mobile reserves to the battle-field of Revigny. The fact that the governor, General Coutanceau, though himself under attack, complied with this requisition instead of standing on his undoubted legal rights, is itself evidence of the changed outlook of the fortress governor in modern warfare. In a somewhat different way, the confused story of the *déclassement* of Lille in Aug. 1914 points the same moral.

World War. They may be considered from two points of view: locally, as examples of a type of fortification, and collectively as a defensive *ensemble*.

The *Feste*, as its name indicates, is rather a self-contained fortress on a smaller scale than a fort in the old sense. Although it forms with other such works, and with forts or batteries, part of a defensive system which as a whole may be either linear or circular, it contains within its own wire entanglements each of the elements of defence—artillery for counter-battery, artillery for flanking the intervals, and infantry works for the protection of this artillery against a close attack. But it combines them in a way which differentiates it in principle from the types of fortification characteristic of the 1873–1903 epoch.

In that period there were, broadly, two opposed schools of thought, and a school of compromise. One school, fairly perhaps designated as the French, favoured an arrangement in which the "forts" form the close-defence element and intermediate battery-positions the distant-defence element. The opposite, or Brialmont school, exemplified in the Liége and Namur works (*see* 10.698–9 for plans), relied on a simple ring of powerful self-contained forts, each including both these elements. Variations within the respective schools turned chiefly on the use or non-use of armour, some relying upon it for the protection of all defensive weapons, others confining it to the close-defence weapons and yet others excluding it altogether. The compromise school, favoured by Austrian opinion, sought to modify the characters of each type so as to combine them. In all cases, it should be added, the intervals were intended to be garnished in war with an improvised trench system, with its wire, its dugouts, and its machine-gun emplacements.

The *Feste*, on the contrary, attempts to combine the two elements of defence without modifying either. Full security for the long-range elements is given in principle by dispersing them, equally full security for the close-defence armament by concentration within an obstacle. To add positive or negative protection, armour is introduced wherever necessary, and loose and "provisional" as the forms may seem to the student of earlier fortification, it must not be forgotten that, structurally, every detail of the *Feste* is a piece of permanent work.

This very warning, however, suggests that it is necessary—more necessary than ever—for the student of fortification, whether practical or theoretical, to find a satisfactory answer to the question: What is it exactly that we require of "permanent" fortification in the tactical sphere?

The rôle of permanent fortification, it is suggested, is to give to the garrison or defence force a greater degree of security, and to its armament better conditions of employment, than "provisional," *i.e.* heavy field, fortification can give.

To prevent the enemy's guns from obliterating the defences of the front attacked, and thus enabling his infantry to make its way into the defended area, these guns must be counter-battered and (if possible) destroyed, but in any case neutralized as far as practicable. This implies a counter-battery armament on the side of the defence. According as the guns of this armament are exposed to enemy observation or not, they require, or they can dispense with, fighting protection. But in both cases, and especially in the second, they require to be screened against hostile raids or brusque infantry assaults that may develop during this counter-battery phase, emerging perhaps from dead ground close in front.

This protection can be given in the form of an obstacle to the enemy's passage, so serious that a great and organized effort is necessary to reduce it. Such an obstacle may be a deep ditch, or a system of wire entanglements or grilles, or both. Normally, the former is the better obstacle, but except in country already intersected with canals, wet ditches, river-channels, the use of a ditch requires that the armament to be protected shall be grouped very closely. Unless, therefore, the engineer and his Government are prepared to face the expense and provide cover of the solidest kind[1] the ditch as obstacle is usually excluded, so far as concerns the protection of what may be called the main armament. The wire or grille, as compared with the ditch, is greatly inferior as an obstacle, but much more readily created, more easily destroyed, but more easily repaired also. Obstacles can be traversed, either after being broken down by bombardment in advance of the assault or by means of scaling ladders and bridges accompanying it. As against destruction by bombardment in advance, the only remedy of the defence is the counter-battery which entirely or partially stops the bombarding guns. But even without such destruction, the obstacle may be overcome by ladders and bridges, wire cutters, petards and other appropriate means, in the course of the assault itself, unless the work of placing these devices is made impossible by the defenders' fire. Hence the obstacle, whether it be ditch or wire, must be protected by a close-defence armament, and nowadays it is generally admitted that this armament must be a specialized organ. But how is this in its turn to be protected against destruction or neutralization at the critical moment? Practically by its own defensive arrangements alone. And thus, in the element designed to guard the obstacle, we reach the alternate unit of fortification upon which the whole system depends, that which in the last analysis ensures for the main armament the power of undisturbed counter-battery (in the case of a *fort d'arrêt* of keeping the forbidden area under steady fire).

The close-defence organ, then, has two functions—to protect other elements and to protect itself. The former presents no particular difficulty, and is merely a question of providing the necessary fire-power. But the latter is the critical problem of modern fortification.

If the counter-battery guns are concentrated, as in a fort, and the obstacle is a ditch, then—quite apart from the material cover required for these guns to enable them to fight—material cover is also needed for the close-defence organ, since its position is practically obligatory. But the cover is obtained relatively easily since the weapons covered are sunk to the level of the ditch-floor, and any necessary thickness of protection can be provided over it both on first construction and later.

But such a concentration of counter-battery methods creates large intervals between work and work, and access to the defended area (which with a dispersed main armament is automatically barred by the obstacles defending this and the fire of the organ which protects them) must be prevented by organs in the works so placed as to control the open zone. In some systems reliance has been placed on the counter-battery guns themselves to do this, but modern engineer opinion generally may be said to be opposed to this, since guns which have been engaged in the artillery duel may have been put out of action by the time that they are wanted for close-defence, and even if intact should be wholly absorbed in their proper task. The organ providing ditch defence, by reason of its situation is not as a rule able to undertake control of the open intervals; and in short the only alternatives are small cupolas or *traditore* batteries. The former are open to many objections. If built into the same work as the main armament they are almost as much exposed to premature destruction as the latter is[2] and must be provided with fighting protection on the same scale. If mobile, they are exceedingly costly in proportion to the fire-power they develop. For these reasons modern practice generally favours the *traditore* battery, which is a casemated emplacement (sometimes a cupola) at or near ground level, giving fire only to the flanks and rear of the work, situated in the rear portion of it and protected against bombardment to a great extent by the mass of the work itself.

But, from the nature of its duty, the site of the *traditore* battery is frequently obligatory, and when it is combined inside the same obstacle with a concentrated counter-battery armament, the needs of the latter as to site may conflict with those of the *traditore*. In the avoidance of this, perhaps more than in any other single factor, lies the central idea of group-fortification of the *Feste* type. Two dissimilar elements have to be both protected by the same obstacle and yet spaced some distance apart. But the obstacle (in such conditions mainly wire or grille) itself requires local close-defence. This “ ultimate unit ” has thus not yet been arrived at. Nevertheless, this ultimate unit, in group-fortification, has only to give short-range protection to the obstacle, and in practice it is an infantry-manned stronghold, designed to give fighting protection to its garrison,[1] sometimes provided for, its own local safety with a deep ditch and sunken flanking defences, sometimes organized with a fighting parapet frontally commanding an artificial foreground which is wired, but always having as its real function the protection of an obstacle external to itself.

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[1] As Col. J. C. Matheson has pointed out, the closer the grouping the denser the material required to protect it.

[2] The cupolas of this class in the Antwerp forts suffered nearly as severely as those of the main armament, although they were hardly called upon to exercise their special functions, since the infantry attack of the Germans was not pressed into the intervals before the fire of the forts had been beaten down.

In the case of concentrated main armament, therefore, it would seem that fighting protection for the counter-battery guns, for the *traditore* batteries, and for sunk ditch defences is required to be designed on such a scale as will enable these elements to defy, actively or passively, the attack guns of the day and the morrow. The same applies to the shelters in which—in the case of group fortification—the garrison of the infantry work is placed in readiness to man the parapets, but not necessarily to these parapets themselves. Further, in proportion as wire replaces the deep ditch, as an obstacle, heavy and expensive work in peace-time is dispensed with.

In the system of deployed main armament, on the other hand, the proportion of permanent work, it would seem, can safely be much less. With modern artillery means, the sites for counter-battery armament are rarely obligatory; observation must be provided for; but the actual position of the guns, and therefore the line of liaison between observation post and guns, are—to a great extent at least—free from limitations of ground. This being so, the close-defence element of the fortifications may be disposed to the best advantage for carrying out its task—that of protecting a system of obstacles suitably placed between the battery zone and the enemy.

In point of permanent work, then, although parts of the battery positions themselves may occasionally require concrete or even armour, concealment of virgin earth, and alternative positions in the great majority of cases afford all necessary protection. For the close-defence guns, on the other hand—the element which must be able to endure at all costs—the chosen positions are often (if not in most cases) obligatory, and full-scale fighting protection must be given. Even so, there being by hypothesis no necessity to develop frontal fire, and the volume of the required lateral protective fire being relatively little, a permanent work which is essentially a *traditore* battery and nothing else can be both small and well-covered against frontal fire at an expense much less than that of a great self-contained fort. Its own local protection may be either a ditch with sunk defences or an infantry system surrounded by wire, but these auxiliaries, too, would be withdrawn from the crest facing the enemy to positions on the reverse slope. The only case in which it would be necessary for any part of the system to go forward to the crest and front slope would be that in which the artillery observation and command post is combined with the *traditore* in one work or one enclosed group. In such a case the post in question would undoubtedly require special treatment as regards its own close-defence. But all that in principle is necessary is that the post and its liaisons should be immune.

On the other hand, the security of the main armament against a rush of hostile infantry was far greater when an obstacle defended by fire completely surrounded it, and military engineers were very loth to impair this security. No doubt, when the obstacle covering the front of the batteries in the deployed order was fully organized, the latter might be considered safe enough for practical purposes so long as the interval-defence remained effectively in action to protect it. But a danger period was foreseen in which the obstacle was not yet fit to perform its function with certainty. The “ brusque ” or (more accurately) the “ abbreviated attack,” proposed by the Bavarian General von Sauer, had many supporters; and as the tendency already mentioned, of modern warfare between “ armed nations ” is to push the line of resistance as nearly up to the frontier as possible, the fortifications of that line were in fact exposed to instant attack.[2] Those of Verdun and Toul were little more than 20 m., the easternmost fort of Liége only 13 m., from the German frontier, while the western Metz forts could be bombarded from French soil. In former days, this would have mattered less, but the growing mobility of heavy artillery—from about 1890—for the first time made it possible to employ true siege artillery within a few hours of the opening of hostilities. The attacker, on the other hand, naturally had to forego some of the power of his attacking means in attempting a *coup*. His truly mobile siege artillery was limited, or supposed to be limited, to the calibre of 21 cm. Heavier pieces though they no longer took weeks or months to arrive in their emplacements, at any rate took days to do so, and by a sort of general agreement (to which however there were exceptions) the situation was met by placing a part of the main armament of the defence—called the safety armament—inside a closed obstacle. Usually it was an existing fort that was adapted to house the safety armament, but sometimes it was included in the design of a new work. The fort thus in practice reverted partially to its old duty of serving as a battery position, while in theory its function had become entirely that of locally protecting a *traditore* or other interval defence. The distinction between property and accident was no doubt clear to specialists, but the result was that the generality of armies and peoples continued to look upon a fort as their fathers had looked upon it, till the astonishing events of Aug., Sept. and Oct. 1914 so thoroughly undeceived them—too thoroughly, indeed, for in the revulsion, not merely safety-armament guns but even interval-flanking guns were removed from closed works.

In the system of group-fortification, it was naturally much easier to house a safety armament. No element within the ring of wire need cramp any other, or be drawn into the fighting activity of another, or suffer from the shells intended for another.[3] Full fighting protection will be necessary, as is always the case with safety armaments, but, as has been noted above, with more room the same safety can be given with less expense.

In sum, therefore, the necessity of compromise on this question of safety armament has caused the dispersed-elements and the concentrated-elements schools to agree upon: (*a*) the group or *Feste* principle for interval-flanking elements, obstacles and defence of the same, and safety portion of main armament; (*b*) the order principle of deployed artillery, with an obstacle covered by flanking fire, for the remainder of the main armament. This, it will be noted, leaves a real liberty for the treatment of particular cases. The proportion of total armament installed as “ safety ” is whatever the designer chooses to make it in each instance, the *Feste* being adaptable to any proportioning within reasonable limits fixed by the contour of the ground. A practical check on enclosing an unnecessarily high proportion will always be the expense of giving full fighting protection.

Examples of Group-Fortification.—Types of forts, both main armament forts and others, being described and illustrated in 10.696, it is only necessary here to consider examples of the newer group-fortification. Three forms may be taken, one of which, the Metz form, has been applied on a large scale, while the others, though academic examples, are fully representative of principle.

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[1] The term “ storm-proof,” frequently applied to such infantry works, hardly seems to connote their real function.

[2] To wire a perimeter or frontage of 30 km. to a depth of eight yd. only requires three eight-hour shifts of (in round numbers) 6,000 workers each, as well as mechanical, animal or human transport for about 4,000,000 yd. of barbed wire, weighing 300 tons or so, and 100,000–130,000 stout posts. Other work to be done includes the clearance of the field of fire, the digging of trenches, the construction of shelters (if not in existence already), opening of communications and liaisons, etc. Land which is occupied by a fortress garrison in war rarely belongs to the Government in peace.

[3] This can be demonstrated by the “theory of probabilities.” Assume a main-armament cupola 16 ft. in diameter, under accurate attack by a gun having a probable error of 60 ft. in range and 3 ft. in line. Calculation shows that this will probably be hit by 7% of the shots fired. Now assume a *traditore* element having a vulnerable surface on top of 20 ft. from front to rear and 25 ft. laterally. Placed with its front edge 120 ft. behind the centre of the cupola, this will receive 3·62% of the shots aimed at the latter. Placed with the front edge 240 ft. behind, it will be hit by 0·2% of the shots. In other words, at twice the distance it is eighteen times as safe.

Common to all, it will be seen, are: (*a*) a wire obstacle round the whole group, and behind it an infantry trench-position; (*b*) very large area, equalling that of town and fortifications together in some of the old Vauban fortresses, and six to eight times that of the typical 1873–1903 fort; (*c*) batteries, closed and under armour, for the guns of the main armament (or safety armament) irregularly disposed within the wired area.

So far, all are in agreement. But beyond, there are some important differences. Thus, the Metz group, and those proposed by de Mondesir, both possess powerful infantry works with ditches, whereas the Austrian type lacks this element. Again, de Mondesir and the Austrian text-books agree in attaching the greatest importance to the *traditore* element, remarkably neglected in the Metz works—at least as originally built. Lastly, the Austrian and German engineers tend to place the centre of gravity of the artillery, and even that of the infantry, defence well forward, while the French author puts them as far back as possible, with only observatories and frontal trenches in the forepart of the area.

The Austrian design (fig. 1) as the simplest, is taken first. On the height 130 is an armoured battery P B, containing four 6-in. howitzers in cupolas, with an observation post in a small cupola in the centre.[1] Between the cupolas are magazines for the storage of 800 rounds per gun. A passage runs along the backs of the cupolas and ammunition rooms, and two barrack rooms are provided at the ends, with other small rooms as offices, etc., in the centre. In the actual design the thickness of the concrete is, in places, less than 2 metres, which is considerably below present-day standards.

On the forward slopes at S, S, S, are small works, combining in each 2 cupolas for quick-firing guns (intended for frontal close-defence, not main-armament work), with an armoured observation post between them and a shelter for infantry and machine-guns in waiting, to man the trench-line against assault. These are built with a roof of about the same thickness as that of the main-armament battery. On the rear slopes are two powerful *traditore* batteries, T T with quick-firing guns (4 to 6 in each, in order to have sufficient for a distributed fire over the interval, in case fog or darkness makes accurate aim impossible). The inner parts of the concrete masses are organized as barracks (U) and magazines. The *traditore* is in two tiers, the upper commanding the country outside and the lower sweeping the (wired) bottom of the ditch. Armour is used for the faces of the gun casemates and nearly 3 metres of concrete form the roof. Those parts of the wired ditch not swept by the *traditores* are flanked by counterscarp casemates (F F) containing machine-guns or pompoms and protected by 2·8 metres of concrete. Tunnels connect the various elements of the group. In this design, which is simple and, owing to the absence of refinements that would not stand bombardment, strong, there are nevertheless some points of weakness, which may be discussed here, not by way of criticism but because they afford convenient illustrations of certain practical points which the engineer cannot ignore.

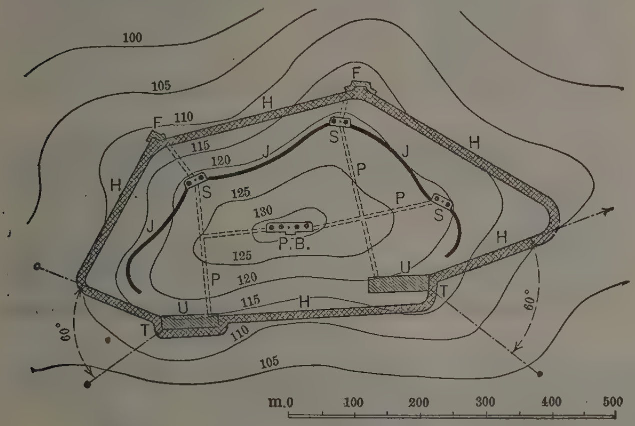

Fig 1.—Austrian Type

The whole of the front wire depends for its intimate flanking upon the counterscarp casemates, F F. In such cases it is necessary to protect the backs of the casemates and their communicating galleries from mine attack, by providing the roots of a counter-mine system at the outset. This was a form of attack which played a considerable rôle at Port Arthur. It is perhaps the only way of dealing with counterscarp casemates, but it is an effective one. At Fort Vaux (Verdun) the Germans made their way through a counterscarp casemate into the tunnel system of the fort, and the terrible gallery fighting of Port Arthur repeated itself. But, unlike the Japanese, the Germans had no difficulty in gaining access to the galleries in the first instance, as the French had themselves blown away the backs of the casemates in order to get convenient access to some external trenches. It is noteworthy that in the final stages of refortifying Metz on the group principle, the Germans were careful to provide the foundations of counter-mine systems. In the Austrian design here considered, nothing prevents the development of mine attack on these casemates except the fire of the central battery P B and the batteries, S, S, S, all of which are exposed and liable to neutralization or destruction by counter-battery. The depth of the ditch containing the main wire varies, and no walls exist to make it an important obstacle in itself. The integrity of the obstacle therefore depends purely on the fire of the counterscarp casemates, and—quite apart from the question of mining attack on these—later war experience has shown that there is great risk of the flanking fire being impeded or intercepted by the debris produced by intensive bombardment. This weakness is common to all ditches, and the problem of keeping the field of fire open had not yet been solved in 1921. But it is evident that the longer the ditch, the more chance there is of a heap of debris collecting at some point in it. In any case, it would seem that to attempt ditch protection for the whole perimeter of a group work involves the expenditure of money that might more profitably be devoted to other elements of defence. Another defect seems to be the small number of the infantry shelters, having regard to the time required for the defending infantry to come out and man the parapet. This is the more important, as this design altogether lacks the strong self-contained infantry work which is the kernel of those now to be described. The evolution of Metz as a ring-fortress is dealt with at 10·696. Allusion is there made to new works in progress outside the existing perimeter. These were the famous *Feste*. They were built in succession from 1899 to the outbreak of the World War, and were continued and practically completed in 1915. Their characteristics were only approximately known at that time, but when Metz was retroceded to France by the Treaty of Versailles, not only their present condition, but their history and cost accounts became available. (See the French official *Revue du Génie* of Jan.–Feb. 1921.)

The *Feste* in fig. 2 (from the *Revue du Génie*) shows an actual example. It should be understood that the Germans designed the earlier works of this class with a minimum of defensive precautions, notably in respect of external interval flanking, but that, in the later works constructed in the two or three years prior to the World War, there was a marked tendency to develop the hitherto inadequate external flanking, even at the expense of the main armament, which on this line of evolution would, in due course, have become a "safety" armament only. The group-work illustrated is rather of the earlier than of the later kind, as it is lacking in the *traditore* element. But it is one of the greatest advantages of the group-work over the cramped fort that additions and alterations can be made as required, and in fact many such works at Metz were provided later with 57-mm. and 77-mm. *traditore* batteries.

The *Feste* forms an irregular quadrilateral, measuring, from outer edge to outer edge of wire, 1,200 yd. from front to rear and the same from flank to flank, with an area within the outermost wire of about 120 acres. At the front and rear angles there are strong and minutely organized infantry works, which form the basic units of the system: their rôle is to flank the wired perimeter and to look after their own close-defence as well. At the right and left angles, the perimeter trench takes the form of redoubts, which contain, in their forward sides, infantry observation posts, and, in their rear sides, both observation posts and organs for flanking the rearward wire. In the interior of the *Feste*, four armoured batteries for main armament are disposed irregularly and each has a war barracks attached, communicating with it by underground passages. The perimeter trench is provided at intervals with armoured sentry posts. The artillery observatories are aligned on the front slope, and have tunnel connexions with their batteries. The fifth battery is a dummy—a device freely used in these Metz works, in which there is plenty of room. The perimeter wire is sunk to a depth of 2 metres, and the ground in which it is bedded is sloped up to the infantry line, which has the lowest command compatible with its functions. This perimeter wire is carried round the main works (01, 02) also (though partly unflanked), but the strength of these lies in their inner system. Behind the perimeter wire and the advanced parapet or covered way lies a deep ditch (20 ft.), wired at the bottom and provided with a concrete counterscarp. The floor of this ditch is flanked (in the case of the forward work 01) by a double counterscarp casemate at the apex and a small *caponnière* in the gorge.

About the same time as these Metz works were being evolved in Germany, Lt.-Col. (afterwards General) Piarron de Mondesir, in France, advocated another type of group-fortification, which, though generally of the same class as the *Feste*, shows some characteristic differences.

De Mondesir's group is in general outline oval, or rather lens-shaped, with the curved front towards the enemy and the flattened front towards the defended region. Like the *Feste* it bestrides the natural crest. Immediately beside the main wire is a continuous infantry parapet, which has at frequent intervals concrete shelters for machine-guns as well as infantry. On the natural crest, a central structure of concrete and armour contains the commanding officer's observation post and two machine-guns in cupolas for the direct sweeping of the foreground, and towards the flanks two somewhat similar structures house each a 75-mm. Q.F. gun, its observation post, and the observation post of one of the main armament batteries mentioned below. Just behind the crest are two large battle-shelters in concrete for counter-attack infantry. Then, well back, comes an inner system forming a still flatter "lens." This contains the main armament batteries, the *traditore* element, and the infantry keep. Its front wire traverses the whole interior of the group, leaving the crest elements and counter-attack shelters outside it, and resting its flanks on the infantry parapet, the junction being sealed by blockhouses. Within this wire, which is protected frontally by several "infantry batteries," *i.e.* loopholed steel screens or penthouses for riflemen, lie, towards the flanks, two batteries of main armament artillery in cupolas and one or two "Bourges casemates"—genuine *traditore* batteries which can only fire to the flank and rear and are heavily protected and masked towards the front. Centrally placed between the artillery positions is the infantry keep, in this case as in the German the basis unit. It is four-sided and has a deep wired ditch which is flanked not by counterscarp casemates, but by two low *caponnières* springing from the base of the escarp at the diagonal angles. In the concrete of this keep are the war barracks of the whole garrison, observation cupolas, and at least two machine-gun cupolas which are in fact the essential defence of the keep. Embryonic counter-mine systems are provided at the salients of the keep. Behind the keep is a battery for small short-range mortars—a novelty which, unlike the present writer's "infantry batteries," was destined to survive and multiply in the World War. The rear defence of the inner system is provided by the rear portion of the perimeter trench, with its concrete machine-gun shelters and its wire.

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[1] This is a miniature of the gun cupola, with a telescope placed in the port. The development of the periscope now makes the provision of protected command ports much easier than it was at the time of this design.

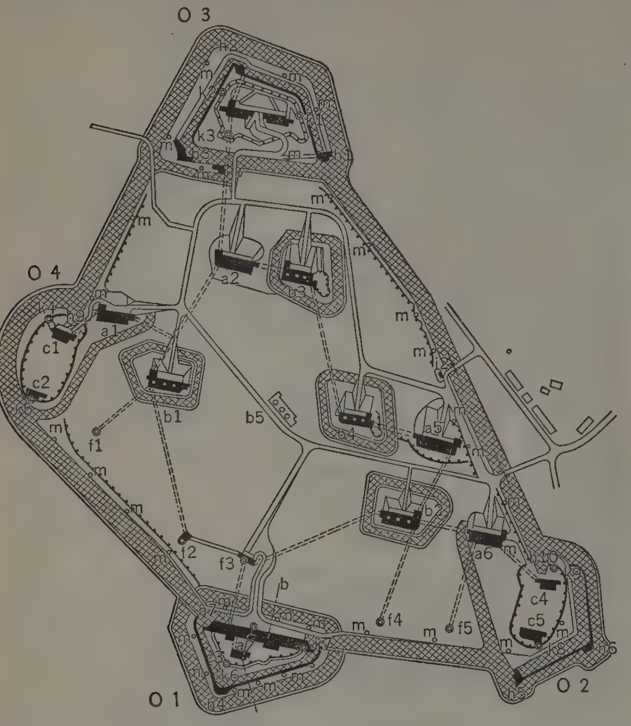

FIG. 2.—Plan of a Metz *Feste*. *References*. 01, 02, main infantry works; 03, 04, flank portions of infantry positions organized as "redoubts"; b1, b2, etc., armoured batteries (b5, dummy); a1, a2, etc. war barracks, f1, f2 etc. artillery observatories; h1, h2 etc. counterscarp casemates, *caponnières* and the like for flanking perimeter wire or ditch wire; k1, k2, etc., infantry observatories (armoured); m, m, parapet sentry posts; cf, c2 etc. concrete shelters for infantry on duty; i, entrance blockhouse.

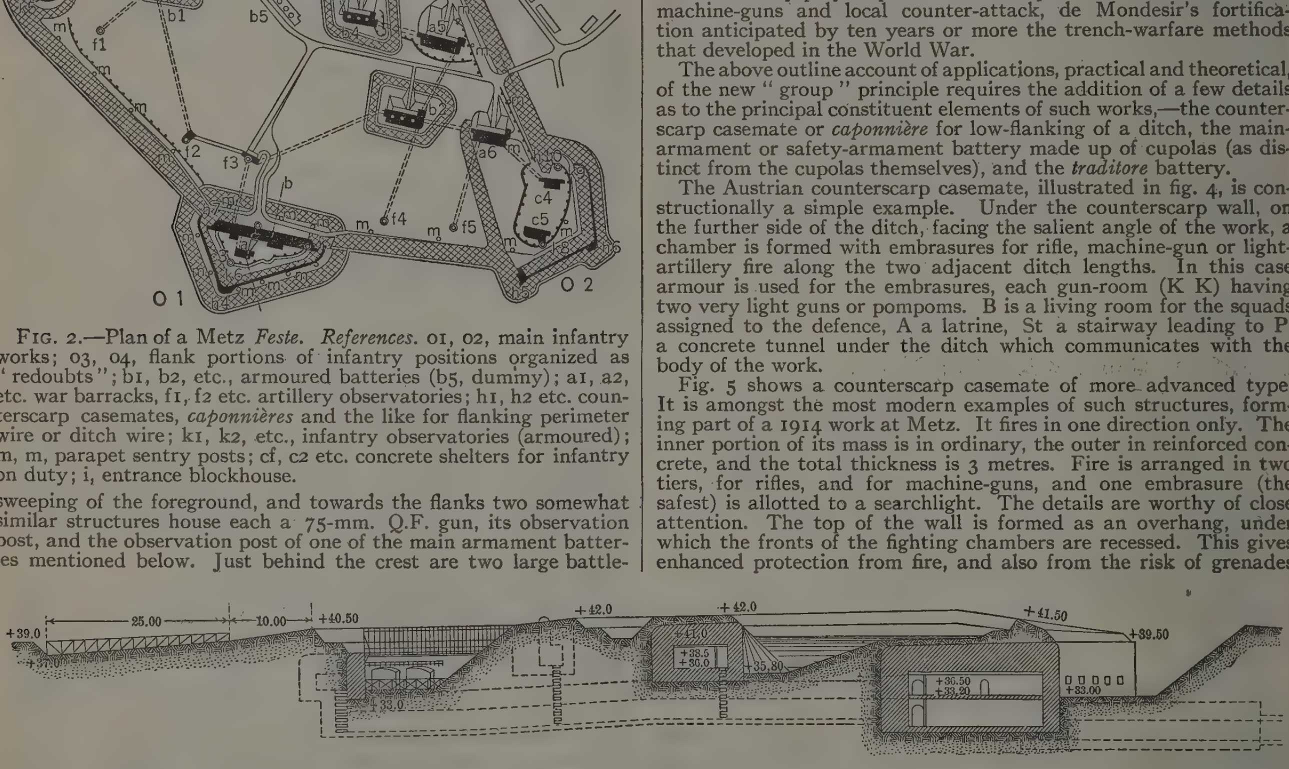

FIG. 3.—Section of infantry work 01 of fig. 2, on line a–b.

The most marked characteristic of this design is the fact that the interior space of the "group" is organized principally for step-by-step close-defence, whereas it is utilized in a *Feste* for battery sites. The middle foreground is under the fire of two quick-firing guns in cupolas, but the author of the system evidently does not trust to these organs overmuch, for he arranges that they shall be fired into and destroyed by the main-armament guns if captured. The essential element of the first stage of close-defence is the machine-gun detachments in the front trench, which are housed under concrete till the moment of action. The second stage, which begins when the assault has broken into the front trench, is a combination of counter-attack from the great shelters behind the crest with machine-gun fire from the central crest cupolas; to facilitate this counter-attack, the back of the front trench is smoothed to glacis-form. When all this is lost, the inner system with its "infantry batteries" sited well down the reverse slope, has still to be carried before the main-armament or *traditore* batteries can be reached, and the machine-gun cupolas of the keep not only coöperate in this third stage, but (with the blockhouses attended to earlier) make it difficult for the enemy to make a lodgment even in the fourth and last stage. In all stages after the first, the curved fire of the trench-mortar battery plays a part. In this respect, and in the free use of machine-guns and local counter-attack, de Mondesir's fortification anticipated by ten years or more the trench-warfare methods that developed in the World War.

The above outline account of applications, practical and theoretical, of the new "group" principle requires the addition of a few details as to the principal constituent elements of such works,—the counterscarp casemate or *caponnière* for low-flanking of a ditch, the main-armament or safety-armament battery made up of cupolas (as distinct from the cupolas themselves), and the *traditore* battery.

The Austrian counterscarp casemate, illustrated in fig. 4, is constructionally a simple example. Under the counterscarp wall, on the further side of the ditch, facing the salient angle of the work, a chamber is formed with embrasures for rifle, machine-gun or light-artillery fire along the two adjacent ditch lengths. In this case armour is used for the embrasures, each gun-room (K K) having two very light guns or pompoms. B is a living room for the squads assigned to the defence, A a latrine, St a stairway leading to P, a concrete tunnel under the ditch which communicates with the body of the work.

Fig. 5 shows a counterscarp casemate of more advanced type. It is amongst the most modern examples of such structures, forming part of a 1914 work at Metz. It fires in one direction only. The inner portion of its mass is in ordinary, the outer in reinforced concrete, and the total thickness is 3 metres. Fire is arranged in two tiers, for rifles, and for machine-guns, and one embrasure (the safest) is allotted to a searchlight. The details are worthy of close attention. The top of the wall is formed as an overhang, under which the fronts of the fighting chambers are recessed. This gives enhanced protection from fire, and also from the risk of grenades being thrown in by an assailant overhead. At the foot of the wall is a pit which lowers the floor of the ditch so far that the assailant in the ditch cannot reach the embrasure. This pit also serves to take debris that might otherwise mask the fire of the lower tier. A gallery formed in the mass of the counterscarp connects the casemates of the different angles.

An example of the modern counterscarp is shown in fig. 6 from another Metz work. Here it will be noticed that, for defence and also for ventilation, the gallery possesses a loophole. Over this is a grille to prevent the placing of scaling-ladders and the upper part of the counterscarp wall is formed to a peculiar section which gives a minimum foothold to an assailant scrambling down, and presents an unfavourable striking angle to all projectiles.

The Mass—for it is a mass rather than a wall—is 7 metres thick for 7 metres of height. The communication tunnel between such a gallery and the body of the work (fig. 7) gives 2 metres of (ordinary and reinforced) concrete protection besides that afforded by the earth of the ditch floor.

Some designers, owing to the risk of the backs of counterscarp chambers and galleries being breached by mining, or the communicating tunnel destroyed from above or below, prefer to keep the ditch between the enemy and the flanking organ. In this case a low *caponnière* is built out into the ditch from the escarp or from the mass of the work; in the work 01 of fig. 2 the ends of the two-story concrete barrack are arranged to act as *caponnières.*

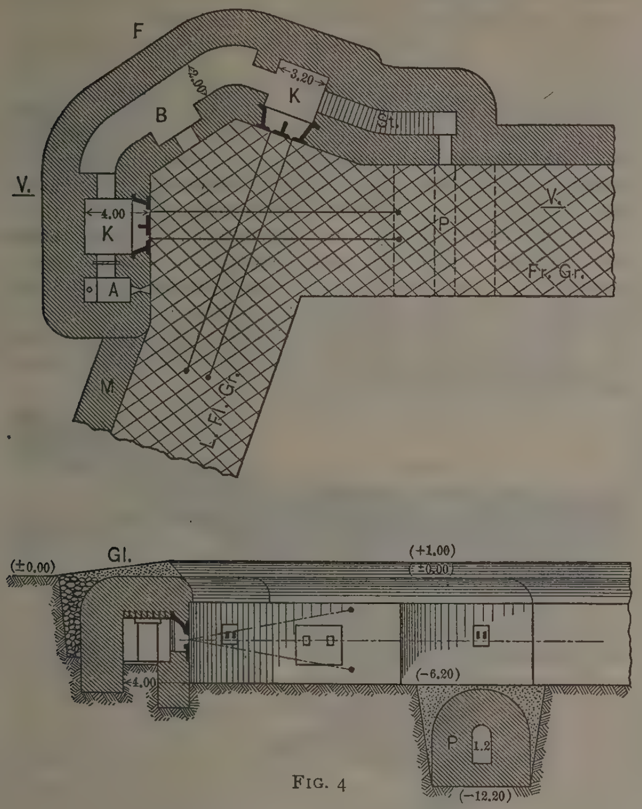

FIG. 4

An unusual flanking organ designed for Metz is shown in fig. 8. Here the difficulty of giving sufficiently thick protection for an organ flanking wire at or near ground level (*e.g.* the outer wire of a *Feste*) is met by providing a sort of detached *caponnière* in the form of a low, fixed, armour-structure bedded in concrete, the guard-room, etc., being formed in the mass of the latter. It is intended for rifle and pistol fire through loopholes, and like all modern German flanking organs it has a small searchlight.

A battery for main armament is substantially an assemblage of two to four individual gun or howitzer cupolas in line within one mass of concrete, with the space available between and behind cupolas formed into expense-magazines, shell-rooms, duty men's rooms, offices, etc. Being as a rule dispersed over the open ground comprised in the "group" they require subterranean communications with each other and with their observation posts. The latter are sometimes included in the same concrete mass with the gun cupolas, but it is more usual to withdraw the battery mass behind the crest and to push the observatory forward. Batteries are often wired in, and sometimes given means of local protection against surprise attack. They contain not only a large stock of ammunition, but also, nowadays, laboratories and workshops.

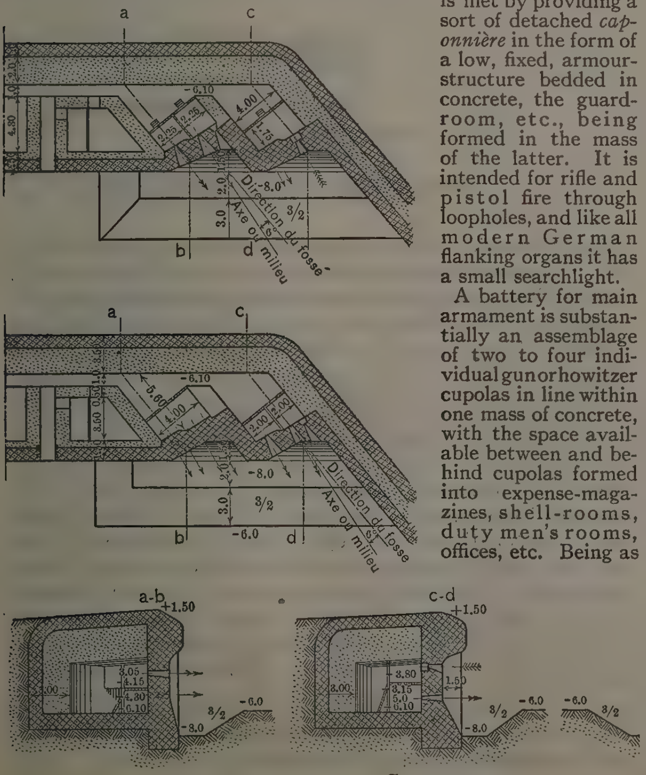

FIG. 5.—Counterscarp Casemates.

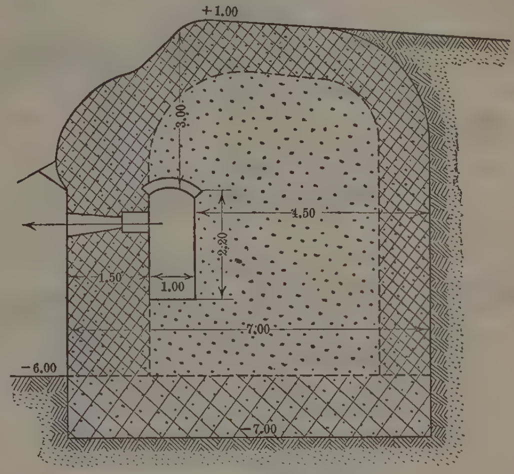

FIG. 6.—Counterscarp from Metz.

Traditore batteries, by hypothesis, fire only to the flank and rear. They are thus always placed, so to say, behind a corner; that is, protection is accumulated in front of the gun casemates, and this protection is continued laterally for such a distance that a projectile from any likely direction will either meet the covering mass or pass clear of the gun muzzles. The original form is that designed in France and known as the "Bourges casemate" (fig. 9) from de Mondesir's *Fortification Cuirassée.*

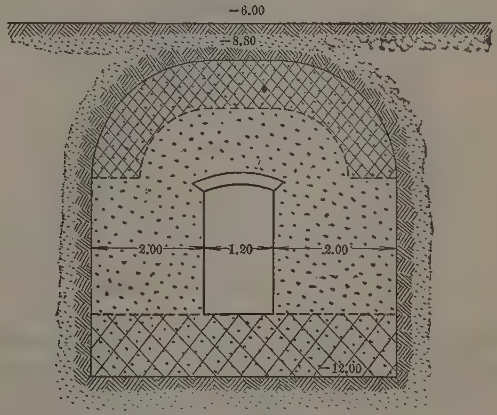

FIG. 7.—Communication Tunnel to Counterscarp.

A larger *traditore* of Austrian design is shown in fig. 10. This is formed in the end of a concrete mass of which the remainder contains the war barracks, storehouses, etc. The lower embrasures flank the floor of the fort ditch, the upper—the real *traditore* battery—sweep the flanks and rear of the external intervals. (T T are the gun casemates; B St is the post of the officer controlling the fire; M M the ammunition room; G S a small flanking element to control the ditch just under the *traditore.*) Armour is used to reduce the thickness of concrete, both vertically and horizontally.

The gun usually employed in *traditore* batteries is a field gun of about 75-mm., or a gun of the small naval or tank class, 57-mm., being the commonest calibre. Pompoms (1-pdr. Maxims) and even machine-guns are also found, but as a rule it is the field artillery type of effect that is required and provided for. Cupolas are sometimes, but rarely, employed, as their characteristic virtue of all-round fire is not wanted.

Administrative Arrangements.—Any work that has to act in isolation, or semi-isolation, is provided with all the necessary "services." Store-rooms, hospitals, barrack-rooms, etc., with all furniture and equipment, must be formed in the interior of the available concrete masses; water must be laid on, lighting and heating provided for. Though hitherto it has not been thought desirable to provide power for working cupolas, etc., it has already become necessary to include a power-room (dynamos and Diesel engines) in the equipment of the *Feste*.

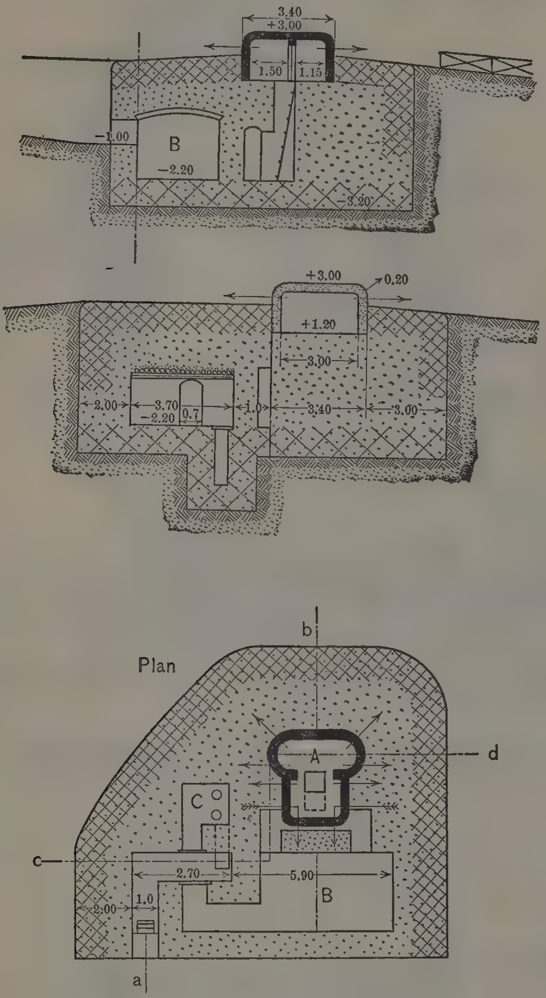

FIG. 8.—Flanking Organ (Metz).

Amongst these auxiliary arrangements, there is one, however, which during the World War proved to be of predominant importance—ventilation. The fall of the forts of Liége and Antwerp was largely due to the ventilation arrangements proving inadequate. Poisonous fumes from the burst shell penetrated the concrete fissured by its explosion, and filled the underground galleries of the fort, asphyxiating or disabling a large proportion of the already overstrained garrison. In the latter part of the war, the development of gas warfare added a further complication, as it became unsafe to draw in air from outside. The solution adopted by the French for the Verdun forts (which, it should be noted, no longer contained either main-armament or *traditore* artillery, but had become pure close-defence infantry works) was to deliver filtered air from a considerable distance, under slight pressure, to certain rooms in the fort, which were sealed against local air by air-tight doors or otherwise. All men working elsewhere than in these rooms wore gas-masks. Although the group principle of fortification, by dispersing the elements of defence, *ipso facto* dispenses with the subterranean labyrinths of the Belgian forts, and so reduces the effects of explosion fumes, the fact remains that the men in the armoured batteries and the *traditore* and flanking organs, must be protected from gas entering either by embrasures, cupolas, seatings or fissures, while pure air must be supplied and foul air evacuated somehow. It may be, indeed, that the question of aëration, hitherto subsidiary, will become one directly affecting the fighting design.

Materials.—Earth was always the common property of permanent and of field fortification. Before 1914 concrete and armour were reserved for permanent work, but during the World War both came into use for heavy field works as well. Further, as both in permanent and field work care is taken nowadays to disturb the natural earth as little as possible, and tunnelling freely employed, relief being kept down to a minimum, there remain only, as specially characteristic of permanent work, (*a*) the heavily armoured, deeply-sunk, mechanically highly finished gun-mounting, and (*b*) the great concrete mass. It is not unreasonable to consider the necessity, or otherwise, of these elements in a fortification scheme as a criterion of the necessity of "permanent fortification," using the words here in the technical sense for fortification of a kind that can only be carried out at leisure in peace conditions.

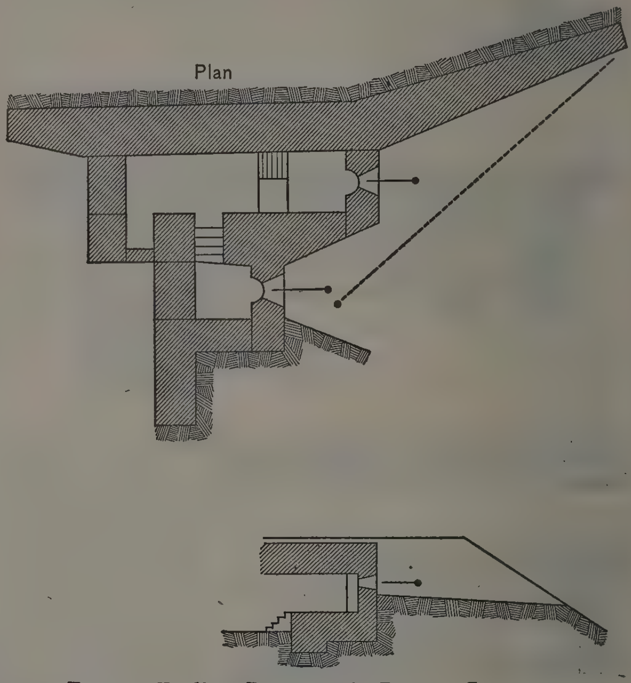

FIG. 9.—*Traditore* Battery—the Bourges Casemate.

The justification of the elaborate gun-mounting under armour (the cupola, according to present practice) lies in its power to resist, for an indefinite time, counter-battery by the most powerful guns available. That power was tested, during the World War, above all in the case of the Belgian fortresses and at Verdun. The gross results of these two trials were diametrically opposite—the Belgian cupolas failed, usually through the failure of their surroundings but sometimes by their own defect, while the Verdun cupolas held out magnificently. Influenced by the general distrust of permanent work which the Belgian failures had produced, the French had ceased to rely upon their forts for the flanking of the intervals, and the *traditores* had been actually disarmed before the attack of Feb. 21 1916. As this was the principal rôle allotted to the forts, the action of the few distant-defence guns in cupolas (safety-armament) could, *ex hypothesi*, be only a small part of the total artillery defence. But their powers of passive resistance were presumably tested as thoroughly as if they had been the protagonists of the main-armament, and practically none, save some minor cupolas for observation and machine-guns, were disabled at the close of the great siege. Yet they had endured an unexampled bombardment. Fort Vacherauville, for instance, was hit by no less than 2,250 shells, of 28-cm. and above—two such shell for every three square metres of surface. Monlamville received 330 hits by 42-cm. shell. The more exposed forts, such as Douaumont and Souville, deluged with medium and field as well as heavy shell, received over 30,000 hits apiece. Thus, cupolas of the thickness and quality of those of Verdun are capable of all necessary resistance.

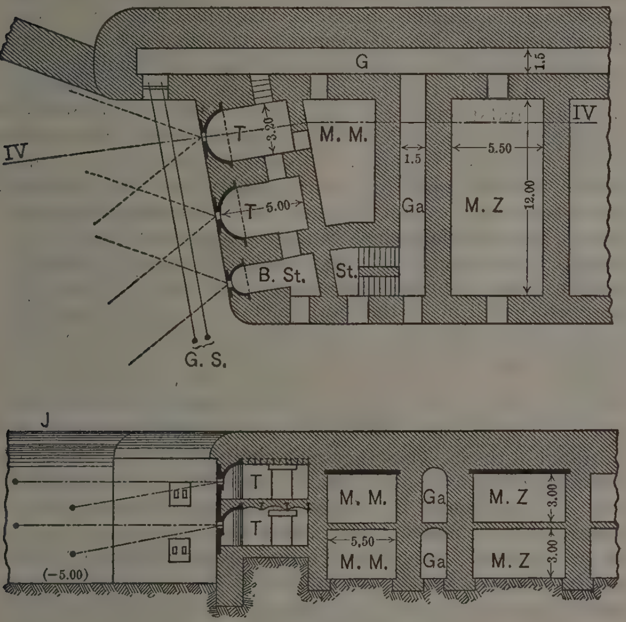

Fig. 10.—Austrian Traditore.

Even more marked is the discrepancy between the behaviour of concrete at Liége and Antwerp and its behaviour at Verdun; as in the case of armoured gun mountings, the Belgian sieges brought concrete into discredit. Here, however, it is a question of quality of material and of conscientious painstaking work. The best concrete has a resistance such that a test bar will break across the stones rather than the cement; the worst is feebler than virgin earth, especially rooty earth. The Verdun concrete had not only been well made, but had also been given an adequate safety margin of thickness; and it was found that, in spite of the volcanic bombardment, 3 metres of special concrete or 2 metres of reinforced concrete, or 2½ metres of special concrete (or 1·75 metres reinforced) disposed as an apron overlying an old masonry vault, with a sand cushion interposed, would steadily resist calibres up to 42-cm. inclusive. Although the effects of these monster mine-shell were felt in the ground to a depth of 14 metres (nearly 47 feet), the fissuring which had ruined the Belgian forts does not seem to have occurred at Verdun.

In the Metz *Feste* the characteristic disposition is a mass of ordinary concrete with a thick outer casing of ferro-concrete. An arrangement which is favoured by some engineers is to dispose reinforced concrete in layers separated by air-spaces; this had not in 1921 been subjected to the test of siege. The lesson of Verdun, however, is held to be not so much that it proved 3 metres to be a sufficient thickness, but that it demonstrated the importance of *mass* as a material element of resistance and *depth* as a *moral* element. The smaller concrete masses suffered under bombardment much more severely in proportion than the larger, and it is considered therefore that organs small in themselves such as *caponnières* should form part of a larger body of concrete, as in fig. 2, 01, or in fig. 10. As regards depth, it was found that in tunnelled habitations well below the level of the forts—the foundations of which at Verdun are in rock—*moral* remained unimpaired by the heaviest bombardment. At Antwerp, from the nature of its site, no such burrowing was practicable, and the *moral* of the defenders was subjected to a fresh strain at the explosion of every monster shell.

In sum, armour and concrete in masses calculated according to the lower standards of a previous epoch, but given a safety margin in application, proved capable of meeting the heaviest strain of bombardment which history records. The problem of the engineer to-day is to determine what safety margin is required for new work or reconstruction calculated according to the standards of Verdun.

A fixed resistance, *in situ*, of several months, then, is practicable with the materials and means of permanent fortification. That it is not so with those of field fortification is shown by the various trench-warfare offensives of 1916–7. At Verdun the German attack progressed rapidly till it confronted a close-defence system which had permanent works as its backbone. At the Somme, though the Allies' progress was slow, it was sure, and the defense finally evolved a system of "elastic" or "coilspring" resistance, which by its very nature implied the giving-up of ground until an organized counter-attack could be mounted for its recapture. The success of this type of defence, so long as the *moral* of the defending troops, and their skill in group, platoon and company tactics, remain high, is a matter of history. But it is equally a matter of history that there are positions which, strategically or morally, must be defended to the end without yielding ground, on which the defender must say, with Pétain at Verdun, "*On ne passera pas*." And it is for these cases, so far as they can be foreseen in peace, that permanent fortification exists.

The very words of Pétain's defiance, however, carry the implication of a linear system. Fournier at Maubeuge, Kusmanek of Przemysl—governors of ring-fortresses—could not say that the enemy "shall not pass," for the enemy could go round. It was not Verdun the ring-fortress, but Verdun the end-redoubt of the fortified line Verdun–Toul, that compelled the Germans to traverse Belgium in August 1914. In 1916 Falkenhayn hesitated between Belfort and Verdun as the objectives for his attack. Both had been ring-fortresses, but both were now key-points in a long line of battle, and derived their whole strategic importance from that fact. At Liége, we find the ring-fortress splitting itself into two halves which acted to the best of their ability as successive barrier positions. At Antwerp the attacks on the defence were purely frontal; and indeed, save Przemysl, not one ring-fortress attacked in the World War was vigorously invested and attacked by convergent radial efforts. But it is perhaps Metz which affords the clearest illustration of the modern tendency to convert the stronghold into the barrier. From 1899 onward the old ring becomes of less and less importance, and the *Feste* were not only disposed on a wider perimeter, but collectively took the form of a sort of a parabola instead of that of a circle or ellipse. Facing westward, the system began with a group of *Feste*, forming an end-redoubt; and at the same time the pivot of the field armies that were to swing through Belgium, at Diedenhofen (Thionville), then ran southward along the Moselle to the neighbourhood of Metz, where it curved westward, passed round the S. of the old ring, and E. of the Moselle, took a new direction north-eastward, till finally it was completed by the "Nied position" (created on mobilization) which connected it to the stable line of battle that would be formed by the middle Saar. The southern bend of the system is about 14 m., the westward-facing limb 36 m. and the south-eastward-facing limb about 38 m. in frontage, the whole differing in scale rather than in principle from the familiar "Western Front" of the trench-warfare years which constituted between the Oise and the Moselle a great salient with the apex at Verdun. Outside this blunted redan, Diedenhofen–Metz–Rehlingen, the Germans were prepared to yield ground, but on it the defence was meant to be absolutely stable. The growth of the linear tendency is discernible even in the creation of the successive parts of the system. Beginning with the endeavours to increase the perimeter of Metz itself, the Germans presently bore away at a tangent on each side of the southern sector. The individual *Feste* became longer in proportion to depth, and finally, in the case of the Amanvillers-Horimont works, of 1912, attained a frontage of nearly 2 m. and consisted substantially of a great ditch with its flanking-organs.

Correspondingly, a change follows in ideas as to interval organization. It is evident that, in a ring-fortress of the 1873–1903 type, the individual "forts" occupy only a small proportion of the perimeter as compared with group-works. The latter, therefore, allow of an extended perimeter for the same admissible intervals. Presently, as we have seen in the case of Metz, the perimeter attains an enormous length, and the ring opens out on the home side, becoming a gigantic redan or salient which comprises a whole region. The standard interval between work and work continues to be honoured at and near the exposed apex, but the gap increases towards the rear till near the root of the salient permanent work may give place to field work and simple utilization of natural obstacles, as in the "Nied position."

In the early 19th century, the ring-fortress was practically an enlarged enceinte-fortress with the curtains omitted. Later, though perimeters increased (in order to prevent bombardment of the "nucleus"), the forts still contain the whole of the main armament and retain responsibility for the defence of the interval against methodical attack. The interval is organized according to the needs of minor tactics, so as to prevent the enemy penetrating to the nucleus by any method but regular, large-scale attack. At the next stage (which is the most important in the evolution of ideas) the main artillery (except the safety-armament) is taken out of the forts and deployed in the intervals, the forts becoming "strong points" on a line of battle which has to protect this artillery. It is this stage which is represented in fig. 11, taken indirectly from a semi-official Russian work of 1913, by Colonels Golyenkin and Yakovliev (which, incidentally, marks the acceptance in Russia, after long opposition, of the principle of armour protection).

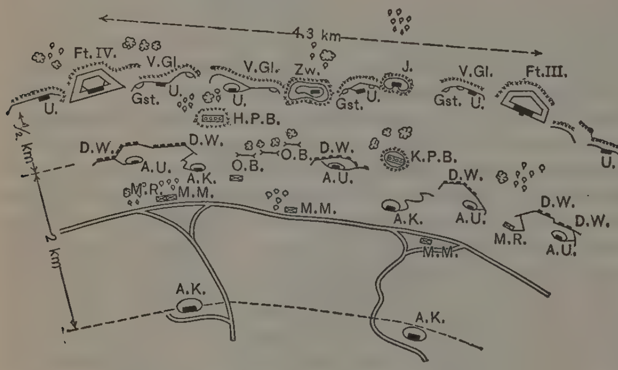

FIG. 11.—Russian Fort, close-defence.

The "fort" is a large and elaborate close-defence work designed specially for the sweeping of the intervals by *traditore* batteries, immunity of these being secured by a full equipment of flanked ditches, quick-firing guns under armour and fighting shelters. The arc of fire of the *traditores* is sometimes carried unusually far forward, as it is laid down in principle that special flanking guns, in or out of the fort, must cover the ground from 1,200 yards in front to 700 yards behind the next fort. No part of the main-armament is included in the fort.

From fort to fort, the interval, it is laid down, should not exceed about 4,500 yards. Otherwise, the responsibility placed on the *traditores* is too heavy (the average interval of Verdun, it may be remarked, is only about half this), and closed infantry work (Zw. in the plan) may sometimes be required to command some part of the interval that is not well covered by the forts. Frontally, the interval is held by a number of separate trench-positions formed with glacis foregrounds (V. Gl.) and provided with concrete fighting shelters (U.) and sometimes barracks (J.). Some of these positions have their own light quick-firing guns (Gst.) for flank protection. Four to five hundred yards in rear of this guarded obstacle are armoured batteries (H.P.B., K.P.B.), wired in, which contain the "safety" part of the main-armament with its ammunition. For the rest of the main-armament, battery positions (D.W.) with (M.R.) shelters for detachments on duty (A.U.) and protected barracks for those in waiting (A.K.) are prepared 600–800 yd. behind the front line and connected up as required by trenches. For other batteries, told off as a mobile reserve, positions are marked out (O.B.). The main magazines of the sector are shown at M.M. and barracks for the third relief of artillery at A.K. in rear.

Apart from the batteries of the safety-armament and occasional foreground-flanking guns not comprised in the forts, peace-time work on the intervals is limited in this example to the construction of fighting shelters, barracks, magazines and the walls of battery positions. But, as soon as permanent work of any sort appears in the intervals, these begin to lose their blankness, and it is a short step to the modern conception of position-warfare—the attack and defence of a long, shallow zone which contains in its forepart the close-defence and in its rear portion the distant-defence elements. In this zone, permanent work will, we may predict, be called upon to perform the services which field and heavy field work cannot perform. It will provide, generally, those of the essentials which cannot be improvised (such as the concreted or armoured infantry, machine-gun and flanking-gun positions, required in the more exposed sites), and in key sections, those which will make the local defence as nearly as possible inexpugnable. And since, as explained earlier, these key sections can be in many or most cases predetermined, whereas the exact position of the rest may vary according to the opponent's plan of campaign, the greater part, if not the whole, of the material protection obtainable with a given expense will tend to be concentrated in them. Thus they may continue to be labelled with the names of towns or other localities as of old. But, essentially, they will be planned in relation to things outside and not to things inside, themselves. They will secure, or deny to the enemy, the use of certain ground or certain communications, definitely and completely. Locally, in order that the close-defence component may fully secure the operation of the distant-defence component, the permanently fortified key section may form a ring, or possess turned-back flanks of considerable length. But in the *ensemble*, and in many cases even locally, the tendency will be to reduce the depth and increase the frontage of permanent fortifications, so that the works of standard strength which can be built with the available funds may offer the widest direct and positive barrier to an enemy.

New Weapons in Siegecraft.—The evolution, during the World War, of weapons essentially unlike those for which the permanent fortification above-outlined was designed to use and to meet, raises the question—what modifications, if any, do these new weapons impose?

If the conclusion reached above be correct—that permanent fortification has now become, from general causes, the backbone of position-warfare, instead of being a thing apart—it follows that the new weapons will affect it in any case through their influence on position-warfare generally. Were it the case, for instance, that aerial warfare totally superseded land warfare, the ring-fortress might return in a new form as the means of protection of flying bases. But such speculations would serve no useful purpose here, and it is preferable to confine ourselves to the modifications of detail to be expected in permanent fortification as such.

Chemical Warfare is a term covering several very different weapons. Smoke which "blankets" the defence organization, gas which disables the defenders, vapour-producers which infect areas, are all tactically dissimilar. The strength of chemical warfare as against fixed defences lies in their fixity, its weakness in the fact that anti-gas protection is not limited, as it is in field warfare, to apparatus and devices that can stand rough usage and be carried without inconvenience by the already burdened soldier. One form of anti-gas defence has been mentioned above—the supply of pure air under slight pressure to rooms sealed from contact with local air. Improvements on this line of progress would include more and more of the interior chambers of a work in the protected space, while other devices made the gun embrasures as gas-tight as possible. The most important defence against gas is the impermeability of the structure of the work itself, which practically means its solidity under bombardment. The direct influence of aircraft on permanent fortification is not easy to estimate. There is no limit to the power and flexibility of anti-aircraft guns sited in fixed defences. All fighting elements in the works are fully protected against the attack of super-heavy artillery, and *a fortiori* against that of air-bombs. The attack of *traditore* or *caponnière* embrasures by machine-gun fire from low-flying planes, if practicable, could be easily countered. Direct attack from the air, therefore, is not likely to affect design seriously. But observation from the air is another matter. Local superiority in the air may pass, in the course of the operations, back and forth several times, and design has to provide against the unfavourable case. It may be assumed with certainty that, in prolonged operations (such as by hypothesis the reduction of a permanently fortified front would entail) every battery position of the defence would be photographed, whether inside a group or fort or placed in the "interval." The defence is thereby compelled either to change position very frequently, or to build in. In the latter case, either the guns must have full fighting protection, or must be so buried and camouflaged as to be practically invisible to eye and to camera at a height of, say 15,000 ft., even when in action, while at the same time provision must be made for confusing the enemy's sound-ranging records. Here, then, the engineer is in the hands of the artillery researcher. Should the latter not succeed in producing gun-mountings, ammunition, and sound-camouflage (so to call it), which can defy the air-observer and the sound-ranging instrument, the engineer will be compelled to put his main armament again under concrete and armour, and perhaps to concentrate it somewhat. The alternative of frequent changes of position has many disadvantages, chief of which perhaps is the probability of having to traverse areas systematically infected by mustard gas.

Armoured Vehicles in the World War were of two classes, the slow-moving cross-country tank and the armoured car. It seems probable that these will fuse into one class, the fast tank. The tank was originally designed for traversing and crushing wire entanglements, and it is in this capacity that permanent fortification is chiefly concerned with it, for the defenders of solid permanent works are practically immune from its actual attack. The question for the engineer is—will the present types of obstacle-flanking organ succeed in dealing with the tank, and if not, how must they be modified? One type of obstacle, the deep ditch with vertical counterscarp, is impossible for the unprepared tank, but such ditches are liable to be bridged at ground level by suitable girders carried by a "bridging" tank; and the best safeguard of permanent works against invasion by tanks is the fact that the latter must traverse a belt of ground which is swept at close range by an organ specialized for that duty alone, and invulnerable to the tank's guns. Although the dimensions of tanks will doubtless be taken into account in planning ditches, the first care of the designer will be to provide flanking pieces sufficiently powerful to destroy the tank as it crosses the line of fire, and to provide flanking fire in such a form that a disabled tank will not mask it. More generally, permanent works which form a section of a long battle zone will be organized to participate in the anti-tank defence of the system, and for this duty the *traditore* batteries are naturally the most appropriate organ.

The armoured car, or fast light tank, owing to its ability to make an inroad from a great distance at the shortest notice, may prove very dangerous to a fortified area which is in the crisis of mobilization and war armament. Special measures to deal with this risk could never be omitted; so far as fortification is concerned it would seem necessary to maintain at all times a clear field of fire for, and a state of readiness in, the *traditore* batteries, as well as in such gun positions of the safety armament as command obligatory or probable points of passage in the foreground.

Field and Heavy Field Fortification.—The methods of field fortification in vogue at the outbreak of the World War (*see* 10.719) were concerned essentially with light fortification, that is, incidental fortification on the battlefield. Starting from the conception of an advance brought to a standstill or a retreating army turning to fight, the engineer gave the infantry man types of works which were defensible after an hour's labour and which could be improved gradually during a more prolonged stay in the position. Lateral and overhead cover were provided, but only against rifle, machine-gun and the lightest artillery fire. Great stress was laid upon concealment, obtained by moulding the work as closely as possible to the ground, turfing exposed soil, keeping relief as low as conditions of effect allowed, and also upon communications; a system of short trench lengths was preferred to long continuous lines, which entailed unnecessary labour and assisted the enemy to locate the defences. A good field of fire up to 400 yd. from the rifles was considered essential. Pivotal positions, whether localities, woods or hills, were organized for all-round defence. These principles, so long as the general course of the operations retained the foreseen open-warfare character, substantially justified themselves; perhaps, indeed, they justified themselves only too well, since it was the great strength of even lightly fortified fronts which compelled each side, in France, to extend ever further and further to a flank in the hope of turning the opponent's frontal defence, and so in the end produced a trench-line that was continuous from the Swiss frontier to the English Channel. The deadlock which ensued marked the beginning of a position-warfare which was locally indistinguishable from siege warfare as that term was understood in 1914. Nor was it only from the point of view of local, minor tactics that the analogy of siege operations held good. The succeeding campaigns were indeed a siege of the east front of Germany, whose western offensives of 1916–8 have sometimes been described by the Germans themselves as sorties from the *Festung Frankreich.* For the Allies, as against these offensives, the nature of the defence, especially after the middle of 1916, resembled that of an investing cordon attacked by a desperate sortie, and fighting to gain time for the arrival of forces from other parts to drive in the prisoners and bolt the door again,—though it is true that the siege was mutual and the "sortie" was at the same time a penetrating assault.

Regarded from this point of view, the principal factors which, directly or indirectly, governed revolution were: (*a*) a theatre of war richly provided with communications; (*b*) highly developed industrial resources at the back of both sides; (*c*) enormous numbers of men and therefore labour power; (*d*) an initial situation of tactical deadlock in positions not deliberately selected but representing only the line on which offensive effort in open warfare had expired; (*e*) the haunting idea of a break-through, followed by exploitation in open-warfare in the old style.

Taking the technical effects of (*d*) and (*e*) together, it was inevitable that positions naturally unsound should be maintained by an equilibrium of forces acting in opposite directions. The attacker of the moment was necessarily attracted by these weak sectors, while the side which intended to attack in the future had a strong motive for holding as forward a position as possible. Fortification was called upon to make these intrinsically unsound positions safe, and all its resources in design and labour were taxed to the utmost to meet the call.

Taking (*a*), (*b*) and (*c*) together, we find these factors enabling each side to produce, to bring up and to apply *in situ*, technical stores on a scale hitherto undreamed of in siege warfare.

Taking the factors singly (*a*), by enabling artillery to be collected in enormous strength for an attack, compelled field fortification to develop unimagined powers of passive resistance, and by facilitating the concentration of great attack masses, induced commanders to strip non-offensive sectors of every human defender who could be spared, thereby forcing fortification to adopt forms which required a minimum garrison. By (*b*) there were brought into current field use not only materials hitherto reserved for permanent work, *e.g.* concrete, but also novel scientific devices and weapons of war, such as the air camera, gas, tanks, and, above all, improved methods of production, which increased the quantities of guns, ammunition and machine-guns available per unit of living force. By (*c*) trenches and obstacle-lines were multiplied to such an extent that there were eventually 20 to 25 miles of trench-work for every linear mile of frontage. Through (*d*), in the first year of trench-warfare, numerous bitter fights were engaged in on all parts of the battle-front for minor rectifications of position; in these fights there were developed new forms of detail tactics, with corresponding demands upon rear resources for a varied armament for the front-line combatant, whose equipment finally comprised, besides rifle and bayonet, grenades (hand and rifle), the light and medium trench mortars, flame throwers, periscopic sniper-rifles, knives, clubs, helmets and body-armour, not to mention gas masks. It led, further, to the retention of waterlogged trenches, and so to the introduction of pumping apparatus, trench-flooring, and other bulky non-combatant stores, into the front line. Through (*c*) it was demanded of fortification that it should protect both the masses of men assembled for attack and exposed to enemy "counter-preparation," and also the minimized garrisons of other parts of the front. These factors, operating, singly or together, with different relative intensity at different times, caused position-warfare to evolve, between 1914 and 1918, through three distinct phases, which may be distinguished by the titles field-fortification, position-fortification, and zone-fortification. The first of these characterized the western front from the end of the battle of the Marne to about the end of 1915, and the eastern front from the beginning of stabilization (which occurred at different periods on different parts of the front) to July 1915, and then again from Oct. 15 1915 to the end of the war on that front. On the eastern, Salonika, and extra-European fronts, evolution did not pass beyond this stage, because in these theatres the more important of the factors above enumerated were more or less inoperative. The second stage, position-fortification, is that of the Battles of Verdun, the Somme and the Aisne and the Artois battles of 1917; also of Asiago and the last six of the Isonzo battles on the Italian front. The third stage, zone-fortification, is characteristic of the Flanders battles of the latter half of 1917 and of all the 1918 battles. These indications of date do not of course imply that the changes specified came into force, formally and simultaneously, at any specific time. They are landmarks in the evolutionary process, which in this, as in other things, does not tolerate leaps.

In the first period fortification devotes itself, substantially, to the improvement and multiplication of the trenches bequeathed by the expiring offensives of 1914. The trenches are deepened, kept narrow, provided with more numerous traverses and shelters, though the protection afforded by the last-named only with difficulty manages to keep up with the increasing volume of fire from the enemy's medium howitzers. The close ranges at which the 1914 offensives died out have left the opposed front lines separated by a very narrow "no man's land," which is heavily wired by both parties. Concealment, as understood before the war, has thus lost its significance, more especially as all trench systems are regularly photographed from the air. Detail fighting produces the need of circulation and supervision trenches and other parallels behind "the trenchy," and calls for more numerous communication-trenches, to which there is no further objection on the score either of concealment or economy of labour. In plan, the general result is an irregular skein of trenches, from 50 to 150 yards across, following the contour of the front line, which itself undulates considerably and at certain points forms sharp cusps or salients of local importance. The closing-in of key positions for all-round defence, which figures in pre-war fortification, has become more thorough, and internal subdivision has converted these wired-in areas into the "Labyrinth" of Neuville-St. Vaast, the "Hohenzollern Redoubt" of Hulluch and the "*Trapèze*" of the Champagne battlefield. At the same time the interpretation of what constitutes a "key" position is different; it is chosen in relation to the trench system rather than in relation to the ground. Mining plays no small part in the fight for the possession of particular hillocks, or trench lengths, with a view to improved observation or better defence. But from the standpoint of evolution, the most important difference between 1915 and 1914 work is the deliberate withdrawal of the infantry firing-line behind the military crest of the position. This was far from being universal in practice, but it had become the recognized ideal. As in permanent fortification, so also in field, the preservation of the close-defence element from bombardment was the motive of abandoning the command of the foreground. Stress begins to be laid, especially, on the local flanking of wire by machine-guns in covered emplacements. But—again as in permanent fortification—the needs of the artillery observer frequently conflict with those of the close-defence; and each local problem, solved according to the value attached to these conflicting requirements at one time, has to be re-solved by fighting when the conditions change.

In this phase there are no marked innovations in the materials employed. The works are cut deeply in the earth and revetted by the conventional sandbags, hurdling, etc. of the text-books; details typical of trench-warfare fighting, such as trench blocks, sap-heads, island traverses, have been added. The "shelter" has become the "dugout," roofed in by layers of logs, house material, or in exceptional cases railway iron, and as a rule, though not always, withdrawn from the front line into one of the parallels behind. Guns are casemated, and dugouts provided for their ammunition and personnel as well as for a variety of command posts, aid posts, signal offices and the like.

In the second phase, which grew by degrees out of the first, the technique of fortification is modified owing to new conceptions of general tactics and to the bringing in of different materials. This is the phase that will remain forever typical of the western front campaigns. Its chief tactical characteristic is intense preparation and concentration of means of all sorts on the attack front, with a corresponding absence of the surprise element. The first consequences for fortification were: (*a*) the deepening of forward dugouts, and their construction by mining methods which leave the natural earth undisturbed; (*b*) the quasi-certainty of losing the first trench system, at least temporarily, with the certainty of its being reduced to a tormented ruin in any case; (*c*) reliance for close-defence upon the concealed machine-gun almost to the exclusion of other weapons; (*d*) multiplication of systems instead of multiplication of trenches in a system; (*e*) more elaborate provision for the maintenance of supply for forward troops, represented in practice by the accumulation of stores in forward dumps of all sorts. It was in positions organized on these lines that the Germans fought out the battle of the Somme. But their Higher Command did not at first accept the implications of (*b*), and paid a heavy penalty for attempting the impossible task of holding the devastated front line in strength. Especially heavy was their loss in prisoners, due to the "deep" dugout, which was so deep that the men could not get out of it in time to man the trenches. Yet without adequate protection it was impossible to hold the front line, or any other line, under bombardment, even after converting it into a line of machine-gun posts; and the first modification due to the Somme experience was the introduction of the only alternative to the deep dugout, viz. concrete. This was a step of great importance, both tactically and technically. Concrete had already been used, here and there, to reinforce parts of an earth-system, and was constantly employed in various back-area installations. But it was not till the latter part of 1916 that it became the principal material of "field" fortification. Instructions for mixing quick-setting concrete, and even for making ferro-concrete, on the spot begin to figure in training manuals, and in the chief belligerent countries a new industry springs up for the manufacture of standard concrete elements, which are transported to the scene of operations and built up as required. The timber, mine-gallery framing hitherto used in dugouts gives place largely to standard semi-cylinders of corrugated iron, also made at home and transported to the front in great numbers. Thus the ideal dugout for troops becomes a concrete structure lined with corrugated iron, proof against all field and medium calibres without being buried to any great depth; and the machine-gun emplacement and its dugout are fused in one concrete or ferro-concrete structure of the casemate type, famous in 1917 under the name of "pillbox" or "Mebu" (in full *Maschinengewehr-Eisenbeton Unterstand*). With this, the trench itself becomes of secondary importance. Though tradition and its undoubted usefulness in all circumstances except those of great-battle days made the command in all countries exceedingly unwilling to give up the trench altogether, it is the chain of dugouts and machine-gun casemates, which, with the wire, defines the "position" of position-warfare at its highest development in the spring of 1917.

In the broadest sense, a "position" consists of several distinct, and more or less parallel, systems, each of which is at such a distance from the one in front that the enemy's artillery must change position—with all the attendant difficulties and delays of repairing communications through the battle-devastated area—and mount a new attack. At intervals, a switch-line, designed on the same general principles as the parallel lines, is drawn so as to bolt off the area which may be lost in one battle phase. Between the first and second systems lies a zone in which a very active infantry resistance is carried on by means of "strong points," which are no longer labyrinths of the 1915 type but well protected and wired-in machine-gun strongholds, resembling in principle the *traditore* batteries of permanent fortification. With these as a basis, light trench-work will be run out in the directions required by the battle-situation from time to time, *e.g.* so as to fence off a lost sector; and for this purpose conveniently situated shell-holes are made defensible so as to constitute the framework of such lines. Tunnelling is largely used for short communications, especially where forward slopes have to be held so as to include artillery observation positions. The trench system bequeathed by the older methods is now broad (12 ft.) as well as deep, and is utilized as a covered-way, defensible in emergencies, rather than as a battle element. From 3-ft. to 5-ft. thickness of concrete (or ferro-concrete) over corrugated iron covers the casemated guns and machine-guns. With dugouts of similar design (the old deep dugouts are now sealed up or filled up by order of the command) these constitute the new defence system, whether disposed in lines or belts along the frontal systems or switch-lines, or scattered in the intermediate areas. Wire is now disposed in very wide belts, and does not conform to the direction of the trenches but lies in irregular salients and reëntrants, each part under the eye of some machine-gun or trench-gun casemate. In short, the site of the "position" is governed by the needs of artillery *observation*, and by those of *supply*, while the organization of the site is based on the time, labour and material available for the construction of *casemates and dugouts of concrete.*

But "trench" warfare has thereby divorced itself from the element which has been its characteristic for ages, the trench, and from June 1917 to the close of the World War is the period of zone-fortification. The elements of defence are now dispersed in innumerable "nests," containing machine-guns, anti-tank guns, or counter-attack groups. The "position" attains hitherto unheard-of depth, and its forepart is held only by outposts, whose function is to police the ground in quiet times and give warning of assault in battle. Behind the "outpost zone" lies the "battle zone," in which machine-gun and anti-tank-gun defence break up the attack, which a counter-stroke then sweeps back to its starting points. As a precaution, a "rear zone" is organized behind the battle-zone. But field-fortification has at this stage been completely merged in field tactics, which it assists, no longer by ingenious tracing of lines of defence, clearances of foreground, economical disposition of working parties and materials, but simply by placing, at points indicated by the tactician, standard casemates and personal shelters, borrowed from the practice and made with the materials of permanent fortification.

Thus, while permanent fortification is concentrating its stock of ideas and devices upon the task of holding a long front of diminished depth, without any yielding of ground whatever, against the heaviest bombardments, field tactics have become fluid and mobile, ground being lost and won almost as readily as in the days of "manœuvre" warfare, though by different methods. It is at the points of junction between permanent fronts and field fronts, where particular features of ground are neither quite indispensable nor yet of negligible importance, that a field-fortification of the future will presumably find its proper scope. Like the zone-fortification of 1917–8, but to a further extent, it will have at its disposal many of the forms and methods of permanent fortification. (The illustrations to this article are reproduced by permission of MM. The Librairie Berger-Levrault, of Paris, from *La Revue du Génie Militaire.*) (C. F. A.)

SIENKIEWICZ, HENRYK (1846–1916), Polish novelist (*see* 25.54), died at Vevey, Switzerland, Nov. 14 1916.

SIERRA LEONE (*see* 25.54).—There was a modification of the S.E. frontier in 1911, when Sierre Leone acquired the Kanre-Lahun district from Liberia in exchange for a district on the Morro river. The new boundary was delimited in 1913–4, Col. Cowie being the chief British commissioner. The total area of the colony and protectorate is estimated at 31,000 sq. miles. The census of 1911, partly based on estimates, gave a population of 1,402,878, Freetown, capital and chief port, having 34,090 inhabitants. The European population numbered about 1,000, that of the colony (as distinct from the protectorate) being 702, including 62 women; the Sierra Leonians some 70,000. There were also some hundred Syrians, almost all traders.

The commerce of Sierra Leone is bound up with the products of the oil palm, which constitute some 75 % of the exports. Next in importance is the kola nut, in universal demand among the natives of West Africa; scarcely any of the nuts reach Europe. Minor exports are ginger, piassava fibre, gum copal, rice and hides. Rubber and ivory have virtually ceased to be exported; cotton-growing experiments were abandoned. Native cocoa plantations have been made since 1910 in the Northern Shebro district, but up to 1920 cocoa did not figure in the exports. From 1909 to 1913 (inclusive) there was a steady expansion of trade, the total value rising from £1,960,000 to £3,481,000, imports and exports being almost equally balanced. Revenue showed a corresponding expansion, from £361,000 in 1909 to £618,000 in 1913. Expenditure in the years named was £336,000 and £622,010 respectively. During this period, in 1912, an extension of the railway going north from Boia junction on the Freetown-Liberian border was begun. In 1916 this northern line reached Kamabai, 118 m. from Boia and 182 from Freetown. A loan of £1,000,000 raised in 1913–4 was expended as to £308,000 on railway extension and as to £110,000 on improvements to Freetown harbour. As to shipping, British tonnage in 1913 was 2,050,000 out of a total of 2,931,000 tons, and during and after the World War the proportion of British tonnage increased.

At the beginning of 1914 a fall in the prices paid in Europe for palm kernels, rubber and other products of the country led to a decline of trade, and the outbreak of war in August aggravated conditions, as the German market was closed. Some 87 % of the palm kernels had been exported to Hamburg, and the British kernel-crushing machines could not cope with the great quantity of kernels diverted to the Liverpool market. The erection of new oil mills in England—the oil enters largely into the composition of margarine—met this difficulty, but in 1915 a decrease in the market value of the kernels led to a smaller return from a larger output than in 1914. By 1917 however the quantity of kernels shipped exceeded that ever previously exported and also realized a higher price. Of 58,000 tons exported France took 1,380; the rest went to the United Kingdom. Thus the readjustment of trade was safely accomplished. As to palm oil, next to kernels the most important export, the greater part was always taken by Britain. (Of 828,750 gal. exported in 1919—the largest quantity exported for 10 years—Great Britain took 819,375 gallons.)

By 1918 the total value of trade was £3,197,000, the United Kingdom taking over 50 % of the exports and furnishing over 80 % of the imports, the United States providing the bulk of the other imports. Trade in 1918 surpassed in value that of any year since 1913, and there was a further marked rise in 1919, when exports were valued at £2,101,000 and imports at £2,034,000. Excluding Government imports, exports showed an excess over imports of £12,000, as compared with an excess of imports in 1918 to the value of £163,000. The high figures both for 1918 and 1919 were, however, due largely to inflated prices, though there was also an increase in the quantity of exports. Revenue in 1919 was the highest recorded—£748,000, expenditure being £740,000. The estimate for 1921 put both revenue and expenditure at over £1,000,000.

The colony and protectorate made progress in spite of the World War. There was an increased demand for education among the natives, chiefly met by the missionary societies, but the Government maintained schools for Moslems, and an agricultural training college for vernacular teachers was established at Njala, in the protectorate. In 1919 there were 163 elementary and intermediate schools in the colony and protectorate, with an average attendance of 6,285. Including secondary and technical schools there were in all 192 centres of education with over 12,000 pupils on the rolls. Sir L. Probyn, appointed Governor in 1910, was succeeded (1914) by Sir E. M. Merewether, and (1916) by Mr. R. J. Wilkinson. The natives showed much loyalty to Great Britain during the World War, and the Sierra Leone forces played a prominent part in the Cameroon campaign.

Notwithstanding the increase in trade, 1919 witnessed much distress in the colony and protectorate. Owing to adverse weather conditions in 1918 and an epidemic of influenza at harvest time, there was a great shortage of rice and other food crops, and famine resulted. This led in July 1919 to serious rioting, the Syrian traders, who were accused of hoarding food-stuffs, being attacked and driven from their houses and stores. As the bulk of the kola nut trade was in the hands of the Syrians that industry suffered severely. The high price of imported goods also caused much distress. The year was further notable for the prohibition of the import of "trade spirits," but it was not until 1920 that total prohibition was enforced.

See H. O. Newland, *Sierra Leone* (1916); N. W. Thomas, *Anthropological Report on Sierra Leone* (1916); H. Michell, *An Introduction to the Geography of Sierra Leone* (1919), and the annual reports issued by the Colonial Office, London. (F. R. C.)

SIFTON, SIR CLIFFORD (1861–), Canadian politician, of Irish descent, was born in Middlesex, Ont., May 10 1861. His father, John W. Sifton, was Speaker of the Manitoba Assembly, and the son, after graduating at Victoria University, Cobourg, was called to the Manitoba bar in 1882, and six years later entered the Manitoba Legislature as member for North Brandon. He was Attorney-General and Minister of Education from 1891 to 1896, became Q.C. in 1895, and from 1896 to 1905 was Minister of Interior in Laurier's Dominion Cabinet. In 1911 he opposed Laurier on reciprocity. He was agent of the British Government in the Alaska Boundary Tribunal (1903); represented Canada at the International Conference on Conservation (Washington, 1909) and was chairman of the Canadian Commission for Conserving National Resources (1909–18).

His brother, ARTHUR LEWIS SIFTON (1858–1921) was elected to the N.W. Assembly in 1898 and was Chief Justice of the N.W. Territories (1903–05) and of Alberta (1905–10). Premier of Alberta from 1910 to 1917, he then became a member of the Dominion Cabinet. As Secretary of State for Canada he signed the Treaty of Versailles.

SIGHTS (*see* 25.60).—Although in the years before and during the World War, the instruments employed in artillery work were considerably improved and developed, research was in the main directed rather to auxiliary instruments such as range-finders than to gun and rifle and machine-gun sights as such. It may be said, therefore, that the modern artillery sight, as designed before 1914, stood the test of war; and the task of the present article is only to review developments. In one respect, however, those developments were wholly new. The anti-aircraft sight which was virtually non-existent in 1910, has already become an elaborate instrument and its evolution is still in progress. Considerable importance—practical rather than technical—attaches also to the new machine-gun panorama sight and to the application of aperture sights to the military rifle and light machine-gun.

Gun Sights.—The purpose of a sight is to ensure the accurate laying of the gun both in direction and elevation. The sight must provide for movement in a vertical plane to register the "angle of sight," the "tangent angle," and hence the "quadrant angle," and thus the range for which the gun is laid; also for movement in a horizontal plane, to allow the direction of the gun to be corrected for deviation due to "drift," wind, want of level and any movement of the target. In order that the operation of laying shall be unaffected by firing, the sights are in modern equipments fixed to a non-recoiling part of the carriage; this may be the cradle, the trunnions, or the intermediate carriage, and, in the last-named case, it must be so connected to the trunnion that the same angular movement is given to it as is given to the gun.

Laying for elevation may be accomplished in the following ways:—(*a*) By setting the required tangent angle in the sight and directing the sight-line upon the target. (*b*) With fixed mountings on level platforms, the quadrant angle may be registered on an elevation or range indicator incorporated in the elevating system; or, with both field carriage and fixed mountings, the gun may be laid at the required quadrant angle by means of a clinometer. (*c*) With fixed mountings at a definite height above sea-level, by connecting the sight through a cam with the intermediate carriage in such a manner that for a given quadrant angle the sight is automatically depressed to the correct angle of sight.

Laying for direction may be either direct or indirect; direct when the sight-line is aligned on the target, indirect when a convenient object or auxiliary aiming-mark is used. It may be accomplished as follows:— (*a*) By aligning the sight-line upon the target, the inevitable deviation of the shell from the vertical plane containing the gun being allowed for automatically, or set on the sight as deflection. (*b*) By using a panoramic sight and any convenient aiming-point; the horizontal angle between aiming-point and target is determined and set on the sight and the latter aligned on the aiming-point. (*c*) With fixed mountings, by obtaining the direction from an independent source and setting it on the oriented training-arc on the pedestal.

For laying both in elevation and direction it is essential that the sight should be truly vertical. This is attainable easily with a fixed mounting; but with field carriages the wheels or the platform may be out of level; in such a case, the elevation registered on the sight will not be correct, and the gun will shoot towards the lower side. If, however, the verticality of the pivot be maintained, it is immaterial whether the carriage basic structure be level or not. Adjustment for verticality is permitted by the reciprocating principle, in which the sight can always be made to move in a vertical plane parallel to that containing the axis of the gun. Thus the sight-line and gun, when laid, lie in parallel vertical planes, so that neglecting drift, etc., correct direction is obtained.

Means to compensate automatically for drift of the projectile by giving appropriate deflection to the gun are usually introduced into the sight. As drift increases with the range, so also does the necessary deflection; but in some instances, a fixed deflection (representing an average correction) is put on to the sight system. The correction is effected by arranging the sight, when setting for elevation, to move in a plane inclined slightly to the vertical and intersecting the vertical plane in a line parallel to the axis of the gun; thus the greater the elevation on the sight, the greater the automatic deflection imparted. This method of compensation allows of a convenient combination with the reciprocating sight, by mounting a transverse bubble in such a manner as to ensure that, when central, the body of the sight is tilted to the left at the required angle; but the open, telescopic or panoramic sights are mounted on the rocking portion so as to have true verticality when the bubble is cross-levelled. Thus the cross-levelling gear neutralizes any want of level, and permits drift to be corrected for by movement of the sight in a tilted plane when setting for elevation; but the range-scale must be graduated to register elevation in a vertical plane.

In the system of independent line of sight in use with certain light field carriages the two parts of which the quadrant angle is composed—the angle of sight and the tangent angle—are applied to the gun independently and by different men. This system necessitates an intermediate component carrying the sight, and two elevating systems, the lower of which elevates the intermediate component, sight, cradle and gun for angle of sight, and the upper elevates the cradle and gun for tangent angle. Thus, conjointly, the two elevating gears give the quadrant angle. A sight clinometer is fitted to the sight to register the angle of sight for indirect laying, whilst a range-indicator, operated by the upper elevating gear, registers the tangent angle. Once the sight has been aligned on the target, the tangent angle may be altered to correct the range without disturbing the layer for direction. Such a system is useful when firing at moving targets, the direction and elevation having to be altered simultaneously, but it has a disadvantage in that it is difficult to apply the reciprocating principle when the gun has to be moved independently of the sight. Drift is usually corrected for by inclining the trunnion axis. The latest method of securing this principle, though not truly "independent," combines the reciprocating sight with an automatic drift correction.

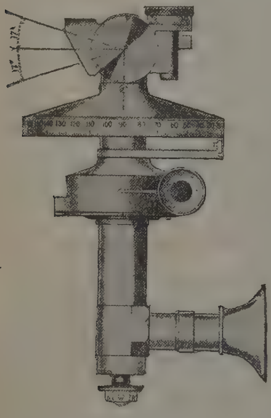

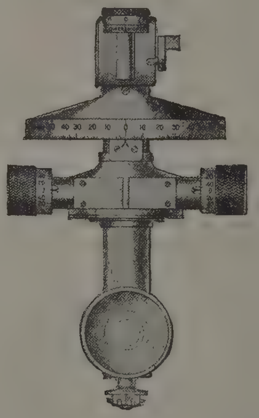

The rocking-bar sight is mounted on a pivot which is always parallel to the gun axis, and thus can be rocked laterally under the control of cross-levelling gear to maintain verticality, which is indicated by a transverse bubble. An acorn-pillar, or front sight, and notched leaf, or rear sight, are fixed at the extremities of a sight-bar which is mounted on a vertical pivot on top of a rocking-bar; the rocking-bar is pivoted transversely at the front of a sight-carrier attached to a support on the cradle. The sight is set for elevation by means of a worm and arc-pinion drive in mesh with an arc on the rocking-bar, the range or tangent-angle being registered on a drum fixed to the pinion-spindle. The pivot of the rocking-bar is inclined so as to give an approximate drift correction at all ranges. To give deflection, the rear of the sight-bar is fixed to a nut mounted on an endless screw carried at the extremity of the rocking-bar; the nut traverses across a degree scale fixed to the rocking-bar. Bearings for a telescope are fixed to the sight-bar.

A sight clinometer is usually fitted to the rocking-bar so that, if necessary, the sight can be set first for angle of sight and subsequently for tangent angle. In effect, the clinometer is an adjustable spirit-level. A bubble is mounted in a sliding segment having worm-teeth cut on a curved base; the segment is moved relatively to a carrier by a screw mounted in the latter and in mesh with the teeth. Degrees of elevation or depression are registered on the face, while the screw is fitted with micrometer head to read minutes.

The employment of muzzle-velocity correctors for use in conjunction with the range drum is becoming general. The corrector (not to be confused with the "corrector" employed for varying the height of burst of time fuzes) also provides means for determining the muzzle velocity from firing at a known range, allowances being made for standard conditions; sights so fitted are known as calibrating sights. The corrector, which may be attached to the oscillating bracket or to some part of the range-gear in independent-line sights, fits over the face of the range-drum and is graduated in ranging muzzle velocities; a knife-edge reader, hinged at one end, has the other end attached to a nut mounted on a screw in the corrector and engraved with an arrow for reading the muzzle-velocity scale. The knife-edge reads the yard-scale graduations while fine adjustment along the muzzle-velocity scale is ensured by the nut-and-screw arrangement. The yard-scale is engraved upon a spiral designed in conjunction with the muzzle-velocity scale to give the correct tangent angle for the muzzle velocity used.

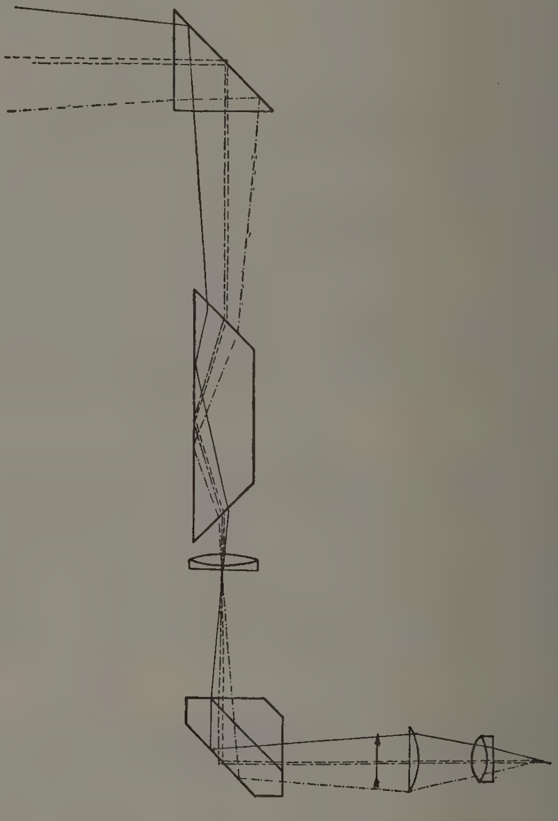

FIG. 2

With certain carriages it is inconvenient to mount the sight on either the trunnion or the cradle. In such cases the sight is mounted upon a pivot on the intermediate carriage, the sight-carrier being constrained, by means of parallel link-motion gear, to make the same angular movement as the gun. For the sight to be effective, the parallelogram must be correct, and adjustments may be required for the lengths of the link and the arm. In certain designs the independent line of sight is obtained without the use of an intermediate component, and combined independent-line and reciprocating sights are also in use.

The automatic sight is discussed and an example illustrated at 25.64; here, therefore, it is sufficient to recall its basic principle, which is, that for a gun mounted on a level platform at a fixed height above mean sea-level, there is only one angle of depression of sight and one quadrant angle for any given range. Thus, if the sight be pivoted transversely to the cradle and made with an arm projecting downwards from its front end, there is, for a given quadrant angle, one position only for the lower extremity of this arm; if the arm be caused to engage with a suitably cut cam fixed to the intermediate carriage, any quadrant angle on the gun will impart the correct sight-depression to the sight.

A distinctive feature in connexion with all anti-aircraft sights is the necessity for an automatic reduction in the tangent angle for a given range as the angle of sight and quadrant angle increase. Consequent on the varying range, height and speed of aerial targets, large corrections have to be applied to compensate for the vertical and lateral angular movements of the target; these corrections inter-act to complicate further the design of an efficient sighting system. No description of such a sight, therefore, is possible within the limits of this article. For reasonable accuracy of fire, the mounting must be level. Anti-aircraft mountings are generally fitted with training arcs; in some cases a second set of indicators is fitted to enable horizontal ranges and quadrant angles to be used. A sighting system which also embodies the principle of the independent line of sight has been tried in the British service.

The panoramic sight is used with field ordnance for indirect laying for direction, from a position out of view of the target. The layer is enabled to take advantage of any auxiliary aiming-mark and to lay without exposing himself. The sight may be used also for direct laying.

A typical panoramic sight is shown in fig. 1. It is a prismatic telescope mounted in a vertical tube having a rotating hood at the upper, and a horizontal tube at the lower end; the hood is mounted on a horizontal graduated dial-plate with which it may be revolved through a complete circle, by worm-gearing; the worm-spindle is mounted in an eccentric to enable the worm to be thrown out of gear for quick setting; on the periphery of the dial-plate are graduations read by a pointer fixed to the vertical tube; while the ends of the worm-spindle are fitted with micrometer-heads to read smaller divisions. A prism mounted within the hood can be rotated about a horizontal axis by means of a worm-spindle in mesh with a toothed arc on the prism holder; this permits of a wide selection of aiming-points in the vertical plane. The optical arrangements are shown in fig. 2. They consist in a reflecting prism mounted within a holder in the hood; in the vertical tube, an erecting prism controlled by differential gear to move at half the rate of the dial-plate and hood; a fixed object-glass below the erecting prism; and a reflecting prism below the object-glass to reflect light along the horizontal tube; in the horizontal tube, a glass diaphragm engraved with horizontal and vertical lines, and in rear of this, eye-lenses to give a magnified image. The rays of light from the object enter through a plain glass window and are reflected downwards by the prism in the hood; they pass through the erecting prism, the purpose of which is to give an erect image, whatever the rotation of the hood, and are focused by the object-glass; they then pass to the lower prism and are reflected along the horizontal tube; the eye-piece magnifies the image which is seen on the cross-lines of the diaphragm, the latter being illuminated by a plain window let into the horizontal tube.

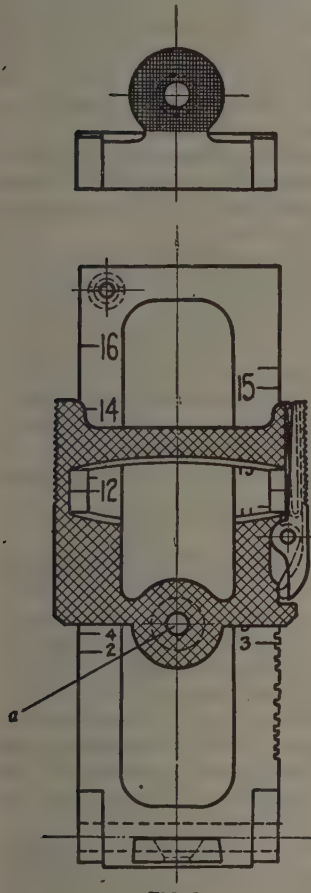

FIG. 3

Other forms of dial sight are, the simple graduated and flexible dial fitted with an open sighting-bar; and the *collimator*, which exists in several forms. In principle an eye-lens and ground-glass window are mounted at the ends of a tube, an arrow or cross on the window being at the principal focus of the lens. With one eye applied near the lens, the cross will be seen, but there is no vision beyond the cross due to the ground-glass; the other eye sees the aiming-point. The gun is traversed until the cross appears superimposed on the aiming-point. Both eyes are used, and are viewing approximately parallel rays. Unlike ordinary open sights, there are not three points at varying distances to be brought simultaneously into alignment, but the eyes view two points under practically the same conditions.

Sights for Rifles and Machine-Guns.—The improved ballistics of rifles generally, on the one hand, and the shortening of the sight radius due to shortening of the barrel, on the other, have made the question of better sights a very urgent one. Attempts to retain the old sight radius by bringing the rear sight closer to the eye resulted in the discovery that it was impossible effectively to use an open sight nearer than twelve to fourteen inches from the eye (owing to the inability to focus on rear sight, front sight, and target at the same time) and led to the reintroduction of the aperture or peep sight, in itself an old invention. In this the rear sight is placed close to the eye, and no attempt is made to focus on the aperture. The eye looks through the aperture and instinctively centres the front sight. Any blur around the aperture will not impair the accuracy as it is equal on all sides of the opening. If the eye is now focused on the target, the front sight is at sufficient distance to afford very good definition. Another advantage is that the accuracy of the sight is not affected by slight changes of light.

Aperture sights are of two general types: the disc aperture consisting of a large disc, which shuts off all view of the target except that seen through a peep hole of from ·03 to ·06 in. in diameter; and the Lyman type which has a thin rim with peep hole about ·010 in. in diameter. Disc sights, which are used principally for target shooting, are unsuitable on account of their limited field for moving-targets, or where quick aiming is required.

In the Lyman type the entire target and its surroundings may be seen while aiming; it may be used in poor lights where open sights cannot be used, and moving objects may be quickly aimed at. The sights on the British 1914 rifle (U.S. Rifle Model of 1917), and the Browning automatic rifle are of this type (fig. 3). The aperture (*a*) is 0·1 in. in diameter, and is made through a disc of about twice the diameter of the aperture. The battle-sight[1] is vertical and in use when the leaf sight is flat and vice versa; the sizes of aperture and ring are the same in both. This sight was found very satisfactory during the World War. It has no lateral adjustment, service experience having shown that the sights were satisfactory without this refinement. An aperture 0·1 in. in diameter is thought by many to be too large, ·070 in. to ·080 in. being the size most favoured. The U.S. 1903 Rifle (Springfield), and the now abandoned Ross rifle are the only other military rifles with an aperture sight. In the case of the Springfield, which has also sight notches of the usual type on the slide, it is found that, although the aperture is very small (0·05 in.), and too far from the eye, it is always preferred to the V. for fine shooting. The superiority of the aperture sight over the open sight is in fact now generally admitted. It is almost universally used by rifle experts, and the delay in its general adoption for military use is due to the impracticability of effectively and cheaply applying it to rifles now in existence.

Optical rifle fore sights designed for use with aperture rear sights have recently been placed on the market. These sights consist of a dioptric convex lens of magnification of about 2½ diameters, with a spot or ring in the centre for use as a bead. The lens when viewed 3 or 4 ft. from the eye gives an upright magnified image of distant objects. An aperture rear sight, preferably of the disc type, with an aperture of 0·03 to 0·04 in. diameter, or a lens rear sight should be used. Better definition as well as magnifying power is claimed for these sights.

Luminous sights for night use have been experimented with and used to a limited extent on machine-guns and rifles for military purposes. These sights, as a rule, consist simply of metal sheaths which slip over the front sight and rear sight and have suitable containers for the luminous material used. For periscope sights see RIFLES AND LIGHT MACHINE-GUNS.

Telescope sights are often applied to sporting rifles and military rifles used for special purposes. These sights consist of a telescope with a reticule for aiming which takes the place of a front sight. The magnification is usually from 2·5 to 6 diameters; those from 2·5 to 3 power are considered the best for general purposes as they give a larger field and can be used in poor light. Adjustments for range are made either by moving the crosshairs only, as in most German rifle telescopes, or by means of holding brackets with adjusting screws which give both vertical and lateral adjustment; the latter type being more accurate. The advantages claimed for telescopic rifle sights are that they permit more accurate aim by magnifying the errors of holding the rifle, also that they allow objects to be seen more distinctly, particularly in a poor light. The latter is probably their greatest advantage; their superiority to a good aperture sight not being as great as is popularly supposed.

The Vickers and Browning machine-gun sight embodies the principal small-arms-sight developments of recent years. The slide, which is made to travel obliquely in the leaf to compensate for drift, has a revolving disc with apertures of various sizes which may be used for different ranges and light conditions. A fine adjustment for elevation and a windage adjustment are provided, also an open battle-sight. The fore sight is a blade, open or hooded.

The Lewis gun has a simple tangent aperture sight without drift or windage adjustments, but with a vertical adjusting screw for fine adjustments in elevation. The sights used for direct fire on Continental European machine-guns are all of the open type and are usually without correction for either drift or windage.

Tubular sights, which consist simply of a straight piece of tubing, are used to some extent on tank machine-guns, as these sights only require a very small opening in the armour plates for their effective use. The latest tendency, however, is to provide tank machine-guns with a telescopic sight of special construction.

Anti-aircraft machine-gun sights, which compensate for the drift and trajectory of the bullet and offset the speed and direction in which an aeroplane is travelling, were brought into use during the World War. One of these is illustrated in fig. 4, showing a design used by the British and U.S. armies. This consists of a slide having an aperture 0·25 to 0·5 in. in diameter and fitting on the regular back sight leaf. The aperture (*b*) is set at a given height for a standard range. The front sight has two concentric elliptical ovals which are mounted as a leaf sight to the barrel or casing of the gun. The shapes of the ellipses are proportional to the actual horizontal sections of a cone of fire from the gun at a given height and elevation. The design of the outer oval (*a*) is based on an assumed angle of gun elevation of 50°, height of target about 1,000 ft., and a speed of plane of 100 m. per hour; that of the inner oval, on an assumed angle of gun elevation of 15°, a height of 250 ft., and a speed of 120 m. per hour. The middle figure shows the correct firing position with the hostile plane central as viewed through the rear and front sights; that on the right shows a plane at close range flying at an angle with the gun position and perpendicular to the axis of the bore; and that on the left shows the target at a greater range and at an angle with the gun. (H. O.'L.)

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[1] A battle-sight is one which requires no adjustment for distance, or rather is permanently set to a certain range, inside which the bullet in its flight never rises more than a man's height above the line of sight.

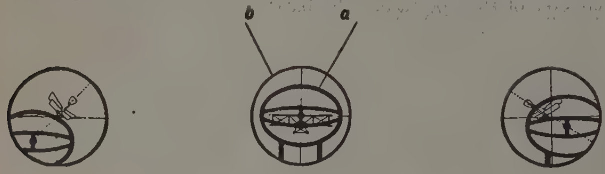

FIG 4

The Panoramic Machine-Gun Sight.—The use of machine-guns for indirect fire during the World War was followed by the demand for instruments for obtaining data and laying the guns. This demand led to the production of many devices, some of which were well fitted for their purpose, and some of which were make-shifts. But, as the war progressed, it became apparent that indirect fire was becoming increasingly important, and an attempt was made to produce one high-grade device that would replace as many instruments as possible. This effort, in the case of the United States, resulted in the production by the Ordnance Department of the panoramic machine-gun sight, described below. At the same time, all Browning machine-guns were fitted with a bracket on the left side which was designed to carry the panoramic sight and also to furnish on its upper surface a flat space for applying the clinometer.

FIG. 5

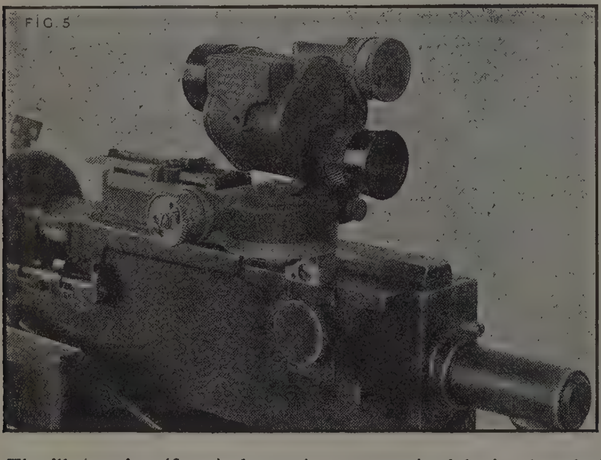

The illustration (fig. 5) shows the panoramic sight in place in its bracket on the Browning machine-gun. The sight consists of a X6 prism telescope capable of movement in elevation and azimuth (360°). The movements of the sight are controlled by means of graduated knobs. The lower knob is for movement in azimuth (deflection), and a quick release is furnished to enable large changes to be made quickly. The upper knob controls the vertical movement of the sight. This knob has two sets of graduations. One of these is for ranges, and the second, which is on a ring-sliding friction tight on the knob, is for vertical angles, above or below the horizontal (angle of site). The telescope is provided with a spirit-level which is parallel with the axis of collimation. This instrument is used on the same principles as the panoramic sight of artillery, to measure angle of site and to lay the gun on a visible or invisible target. The telescope has, besides the usual cross-lines, graduations showing both vertical and horizontal angles, and also a vertical scale resembling an inverted sight leaf, which is employed for the correction of fire when the strike of the shots can be observed. The sight can also be used separately from the gun (in combination with a compass and a tripod of non-magnetic metal) for the same operations as those performed by our artillery director. (J. S. Ha.)

SIGNAL SERVICE, ARMY (*see* 25.71).—In the ten years that elapsed between the Russo-Japanese War of 1904–5 and the outbreak of the World War in 1914, evolution in military signalling was rapid, both as regards organization and as regards instruments employed. The old principle of deliberate crudity of means, based on the idea that no refined instruments could be relied upon to survive the rough conditions of war employment, was giving way to a sense of the great possibilities opened up by modern science as applied to army signalling, while, in tactics, the ever-increasing tendency towards articulation of forces and distribution in depth was forcing the problems of liaison more and more into the foreground. But such evolution as there was in the period 1904–14 was naturally slight indeed compared with that which took place during the World War, in which stabilized conditions of warfare and the concentration of the scientific talents of all belligerent countries upon war needs produced results, both upon the army signal system and its instruments, that amounted to a revolution in the practice of war and, moreover, must affect profoundly the methods of intercourse between civilized nations in peace.

In the following article an account is given of the organization, working principles, and instruments of the signal service of the British army in the World War, and of some of the more notable features of signal practice in other armies.

(1) *Definition and Duties.*—The signal (intercommunication) service of a modern army is responsible for the maintenance of efficient intercommunication between all branches, departments, formations, and units of the army. Intercommunication within units, other than signal units, is usually provided by means of regimental signallers, but the officers of the signal service exercise supervisory control here also. The signal service bears the same relation to the army of which it forms a part as does the nervous system to the human body. Its principal duties are:—

(*a*) The transmission of information from the front to unit commanders and to the headquarters of formations.

(*b*) The transmission of orders from commanders to their subordinates.

(*c*) The maintenance of efficient liaison between infantry and other arms (such as artillery, air force, tanks, etc.) and between neighbouring formations.

For the efficient working of an army, means of intercommunication must be swift, certain, and, under the circumstances of modern war, varied. The system must be essentially simple and standardized to the greatest possible extent, yet capable of considerable expansion at short notice, and of modification to meet the most diverse conditions of warfare. Organization and working schemes must be elastic, and types of signal instruments must be devised to cope with all special sets of conditions that have been experienced or can be foreseen.

(2) *British Army System.*—Until the application of electricity to the long-distance transmission of messages, the intercommunication of armies was carried out mainly by means of visual appliances or by the use of message carriers. Liaison officers and orderlies have been used from the very earliest times; the arrow was frequently employed in mediaeval times for the transmission of information into and out of besieged towns; the pigeon was used with success, notably in the wars of the Netherlands against Spain; permanent lines of semaphore communication (masts with movable arms) were employed both by the French and the British during the Napoleonic Wars. Later, the invention of the Morse code and the adaptation of the semaphore principle to field signals led to the general employment of flags, lamps and, later, of the heliograph. The field telegraph made its appearance in the middle of the 19th century, and in the last years of the century the field telephone came into use. Lastly, in the Russo-Japanese War of 1904–5 wireless telegraphy came on the scene.

In 1911 the British "Signal Service" was constituted as a distinct branch of the Royal Engineers. At about the same time, the adoption of the buzzer telephone as a standard army instrument and the employment of the motor cyclist as a message carrier placed two new methods of intercommunication at the disposal of the signal officer. The outbreak of the World War in

Aug. 1914 found the Expeditionary Force equipped with a signal service controlled by a director of signals on the general staff at G.H.Q. This service included a signal unit at G.H.Q., a lines-of-communication signal company, and a signal company with each corps and each division. Artillery intercommunication was, however, entirely a separate matter for which that arm itself was solely responsible. So also, was intercommunication inside the infantry unit; and the absence of a chain of command within the signal service itself (each unit commander being responsible only to his own general staff) caused a looseness of organization which soon showed itself to be a grave defect. The means of intercommunication employed were those already mentioned, viz., telegraph, telephone, flag, lamp and heliograph, with the addition of wireless telegraphy, which was, however, at this time adopted only for the special requirements of the far-ranging cavalry division, and consisted only of one lorry and a few wagon and pack stations, all of rotary spark type. (The power of the stations was 3, 1·5, and 0·5 K.W. respectively; the range, when working to stations of similar type, 100, 80 and 30 miles.)

The signal organization summarized above proved adequate to deal with the mobile conditions of the first few months of the war. These early days were specially notable for the triumph of the motor cyclist. Telegraph and telephone, visual and orderlies, and mounted liaison officers also played useful parts, and it was not until position warfare set in in the winter of 1914–5 that further changes were found to be required. Then, however, the desire for, and the possibility of collecting, a greater quantity of more exact information (especially for artillery observation) led to a considerable increase in the complexity of the army signal organization. To the exigencies of position warfare may be attributed almost all the evolution in signal implements and signal organization which marked the course of the war. The chief alteration in signal policy, on the other hand, was brought about not so much by position warfare as by the resumption of semi-mobile and mobile warfare which took place to a slight degree in 1916, to a slightly greater extent in 1917, and completely in 1918.

The principal result of "stabilization" was naturally an immense increase in the number and weight of the guns employed. Both for offensive and defensive purposes massed artillery became the weapon of paramount importance, and this had two principal effects on the forward signal service. The fire of the large number of guns employed could not be effectively directed without a greater measure of intercommunication; while at the same time, intercommunication in the region subject to heavy gunfire became more and more precarious.

The extra intercommunication required was supplied by a rapid increase in the number of telephones in use at observation posts and at artillery headquarters. The need for intimate liaison between infantry and guns led to a similar increase at infantry headquarters.

The magneto telephone came into use for the first time forward of corps headquarters, and, once the superior convenience and efficiency of the instrument were recognized, the demands for its installation increased so rapidly as to tax the signal service to its uttermost capacity. A new danger at once arose and threatened to wreck the whole intercommunication service. The tendency was to concentrate all available energies on the installation of telephones and the laying and maintenance of telephone lines. All other means of signalling lost their proper proportion, and an inefficient telephone service was soon in a fair way to become the only means of intercommunication throughout the whole army. Such an undesirable result was only prevented by the incidental troubles arising from the indiscriminate laying of lines. In effect, it was the "overhearing" menace, which will be referred to later, that, together with the prevalence of induction trouble and the difficulty of making "safe" the forward lines, proved to the signal service and to the commanders it served that it was unwise to stake everything upon one method of intercommunication.

The difficulty of maintenance of forward intercommunication was overcome partly by the adoption first of shallow and subsequently of deep buried cable; partly by the evolution of various new alternative methods of signalling; partly by the perfection and adaptation of methods which had temporarily fallen into disrepute under the new conditions.

In 1915, cables were buried 2 or 3 ft. deep and by this means temporary immunity from shellfire was gained; in 1916, the general adoption of the 6-ft. bury (while it saddled the signal service with endless labour problems) successfully solved the difficulty of the maintenance of an efficient forward telephone and telegraph system. One inevitable consequence of the adoption of the "bury" was the concentration of the forward lines into a few main routes, thus paving the way for the great reform in policy which was later brought about under the pressure of rather different circumstances.

The induction which resulted from the collection of 20 to 100 circuits in these main corps and divisional routes was reduced to a slight extent by the general substitution of the sounder for the vibrator in forward units[1] and by the elimination of the buzzer as a general means of intercommunication. It was later almost entirely overcome by the adoption of metallic circuits of twisted cable[2] for all forward lines.

Mention should be made of the alternative methods of signalling which underwent their first main period of evolution in 1915. In 1914, the weight and accuracy of modern artillery fire had caused visual signalling to fall into disrepute as being too dangerous. It was soon found, however, that the lines which were at that time the only general alternative to forward visual signalling, were also untrustworthy, and that salvation lay in employing as many alternative means as possible and therefore in improving all available methods as well as evolving new ones. Visual was rehabilitated by the invention of the inconspicuous signalling disc and shutter, by the general adoption of "D.D. D.D." working (signalling from front to rear without reply) and by the adoption of the efficient electric signalling lamp in place of the more conspicuous and noisy Begbie oil lamp which was the standard equipment at the outbreak of war. At the same time the use of pigeons as message-carrying agencies was revived, and wireless telegraphy began to be adapted to forward work. The former were first used by the Intelligence Corps towards the end of 1914, when the British were operating in a district noted for its pigeon fanciers. From this small beginning grew a service which at the Armistice numbered over 20,000 pigeons, while no less than 90,000 men of all arms had been trained to handle the birds. Lofts were kept usually on a line passing about through divisional headquarters and pigeons were forwarded by motor cyclist and taken into the trenches by selected pigeoneers. Here they remained until required for use or until 48 hours had elapsed, when they were released with or without messages.

Wireless telegraphy for the forward area was first attempted in the summer of 1915, when experiments were carried out which resulted in the standardization of two types of set, the 120-watt (Wilson) and the 50-watt (British field) set. The former was intended for work at divisional and corps headquarters and consisted of separate transmitting and receiving apparatus. The spark transmitter received its energy from a 26-volt accumulator through a small motor-driven interrupter fitted in the set itself; its original complement was a crystal receiver specially designed for the short waves (350, 450, and 550 metres) on which the forward sets were obliged to work. The 50-watt set, on the other hand, was a combined transmitter and receiver, the transmitting portion of which was energized by the current from a 10-volt accumulator. It was intended for work in posts close to the front line and at brigade and battalion headquarters and the complete station with its two 15-foot masts could be carried by a party of three men. Both types of set fulfilled their original purpose admirably. They remained the standard wireless sets for forward infantry command intercommunication purposes throughout the war, and have only gradually been superseded by the continuous-wave wireless sets which are now the standard sets for practically all purposes.

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[1] The two telegraph instruments, the sounder and the vibrator, are worked on entirely different principles. In the former case the currents used rise to their full value very rapidly and then remain steady a comparatively long time. On the vibrator system, on the other hand, the currents used are constantly altering in value and even changing in direction, the vibrations being at an audible rate of frequency (several hundred per second). It is these latter rapidly alternating currents which set up rapidly alternating EMF in the earth surrounding the conductor and provide the ideal conditions for overhearing at a considerable distance. A buzzer is a particular type of instrument using "vibrating" or "alternating" current.

[2] In a telegraph circuit consisting of two wires laid side by side, the electromotive force set up around one conductor will be neutralized by that set up around the other in which the current is travelling in the opposite direction. The most efficient disposition of such neutralizing cables is naturally that where the two halves are most intimately interturned, as in twisted cable.

Other wireless sets which were evolved during the war, which owed their invention to the same necessity for indestructible and invisible alternative means of forward intercommunication, were the loop wireless sets. These were sets of short fixed wave-length (66 and 80 metres respectively) which were arranged in two complementary installations—a " forward " and a " rear " station to each set. The forward station was distinguished by the possession of a rectangular aerial of folding tubing which could be erected wholly below the surface of the ground in a deep trench or in a dugout, thus rendering the station invisible and often invulnerable. The rear station had a short wire aerial, much of the type used with the standard "British field" (50-watt) set. It was intended, as its name suggests, for work at places not in the direct observation of the enemy. These sets with slight modifications, remain in use at the present day for intercommunication within the infantry battalion.

At least as important as this evolution of alternative methods was the consolidation and reorganization of the signal service which took place during the years of position warfare.

For the understanding of the present organization of an army signal service some account of the effect of the interaction between the requirements of the general staff and the unfamiliar war conditions experienced in the years 1914–7 is essential. Whereas in the pre-war organization of the signal service the ruling consideration was mobility, a military situation arose within six months of the declaration of war, and continued for three years, in which extended movement was the exception and not the rule. The effect on the signal service was a multiplication of the calls for intercommunication made upon it and at the same time an increase in the unreliability of all means of forward signalling. Work in the danger zone had usually to be done not once but many times; duplication of routes forward, first of brigade, and then of divisional headquarters, became essential. At the same time, the demands of the staffs, of the unit commanders, and especially of the artillery, increased manifold.

An establishment adequate to the demands of mobile warfare could not possibly cope with those of position warfare. The small degree of supervision and absence of coördination, due to the practical autonomy of the signal service within each formation, which had been recognized as drawbacks in the manœuvre warfare of 1914, became impossible obstacles to efficiency in 1915.

The first reforms which enabled order to be wrought out of the chaos into which forward signals were in danger of falling were—(1) the vesting of the control of all forward signals in the hands of the divisional signal company commander and (2) the assumption by the signal service of responsibility for, and a measure of control over, artillery signals. By this means it proved possible towards the end of 1915 to eliminate unnecessary lines and to insist on the reeling-up of derelict cables. At the same time steps were taken to supplement the obviously inadequate personnel.

The original signal service units of the British Expeditionary Force of 1914 had consisted essentially of (*a*) the personnel to man one or at most two headquarters offices; (*b*) sufficient cable or airline detachments to lay one main route to all subordinate formations or units then considered to be entitled to telephone or telegraph; and (*c*) a few despatch riders, orderlies, and visual signallers. This establishment only just sufficed for the skeleton intercommunication system required in a mobile army, and neither office staff, line-building detachments, nor orderlies, were sufficient to man the greatly swollen system of position warfare. Reinforcements were essential, and not only reinforcements but radical reorganization as well. Much of the personnel required was for the maintenance of heavily shelled, long divisional and corps lines through the danger area. If these routes were to be efficiently maintained and circuits allotted with due regard to the relative urgency of individual requirements, the men manning them must remain at their posts irrespective of divisional moves. This meant the formation of pools of area-maintenance personnel and units at corps or army headquarters and the creation of these pools was one of the main features of signal reorganization during the position-warfare period. Individual increases to the mobile portions of units also took place, corresponding to changes in signal methods (all in the direction of increased complexity) or alterations in procedure (*e.g.* the assumption of responsibility for artillery and machine-gun signals) which applied equally in position and in mobile warfare.

The increases in the strength of signal units during the war are indicated by the figures in the annexed table, which gives the strength of the signal personnel in an army of two corps, each of three divisions, in 1914 (when the only equivalent of an army signal company was the G.H.Q. signal company) and in 1918, respectively.

Strength, 1914, at Mobilization.

Unit	Each		Total	
	Off	Other Ranks	Off	Other Ranks
G.H.Q. signal company	5	75[1]	5	75
Two army corps H.Q. companies	4	63	8	126
5 airline sections	1	57	5	285
8 cable sections	1	35	8	280
6 divisional signal companies	5	157	30	942
Total personnel			56	1708

Strength at Armistice, 1918.

Unit	Each		Total	
	Off	Other Ranks	Off	Other Ranks
One army signal company	15	340	15	340
2 cable sections	1	34	2	68
3 airline sections	1	43	3	129
8 area signal detachments	1	13	8	104
One signal construction company	3	113	3	113
One light railway signal company	1	61	1	61
9 army, field artillery brigade sig. sub-sections	1	19	9	171
17 heavy artillery group sig. sub-sections	1	28	17	476
Two corps signal companies	6	105	12	210
4 airline sections	1	43	4	172
4 cable sections	1	34	4	136
Six divisional signal companies	15	400	90	2400
Total personnel			168	4380

While the above description applies principally to the evolution of organization in the general signal service, some special mention of the alterations which took place in wireless units is necessary, particularly since wireless telegraphy will in all probability play a more dominant part in the intercommunication service of the army of the future. The few wireless sets which were in use in the British Expeditionary Force at the outbreak of war were manned by personnel who were all incorporated in a single " wireless section " which shortly became a " wireless company." The first great increase in the value of army wireless came with its application to intelligence purposes, originally for the simple interception of enemy wireless messages, and then also for the location of enemy wireless sets whether in the field, at sea, or in the air. For this latter use of wireless alone,—" position finding "—many special sets were devised and a numerous personnel collected in special intelligence wireless units.

Next, the invention and perfection of the portable " trench " wireless sets in 1915 and 1916 created a further demand for wireless personnel and increased the already swollen establishment of the central " wireless company." The result was a measure of devolution and the formation of an army wireless company in each army. The commanding officer of this unit acted as staff officer for wireless to the chief signal officer of the army, and was responsible for the organization and practice of wireless within the limits of the army.

Yet another direction in which wireless personnel found employment was in the detection and prevention of the indiscretions which, in 1916 particularly, enabled the enemy to glean important information by listening to the traffic over the British telephone system. It was in 1915 that this menace first became important and in the following year "overhearing" became so serious that the forward telephone service was stultified. Many important results followed, directly, or incidentally. Of these may be mentioned:—

(1) The general adoption of closed metallic circuits everywhere within 3,000 yd. of the front line.

(2) Alterations in the system of identification calls.

(3) The replacement of the buzzer telephone by the fullerphone in the forward area.

(4) The invention of the screening buzzer, a powerful vibrator used for drowning all sounds carried forward by induction from the front line.

(5) The invention and perfection of the 3-valve listening sets and the formation of detachments of the army wireless companies to work them.[1]

(6) The growth of an organization for the interception of speech on enemy lines and the policing of our own telephone system.

(7) The application of earth induction telegraphy to signalling which resulted in the invention and evolution of the power buzzer.

(8) The increased employment of alternative methods of signalling (visual, wireless, etc.) so obviously liable to overhearing or overseeing that they were used with caution.

It is difficult to decide which of the many results was the most important, but perhaps the most interesting from the present point of view was the evolution of the power buzzer. This was a powerful vibrator worked by the current from a 10-volt accumulator, and connected to inconspicuous earths of insulated wire which could, if necessary, be buried 6 ft. deep with little labour. It occupied a place in position-warfare signals for which no other instrument, except perhaps the loop sets which lately more or less superseded it, was suitable. Detachments of troops isolated by the enemy could send out code signals which could be picked up by listening sets, themselves inconspicuous, at ranges up to 3,000 yd. On several occasions of importance these sets remained the only means of communication with and from units that had advanced rapidly in attack, or become isolated in defence.

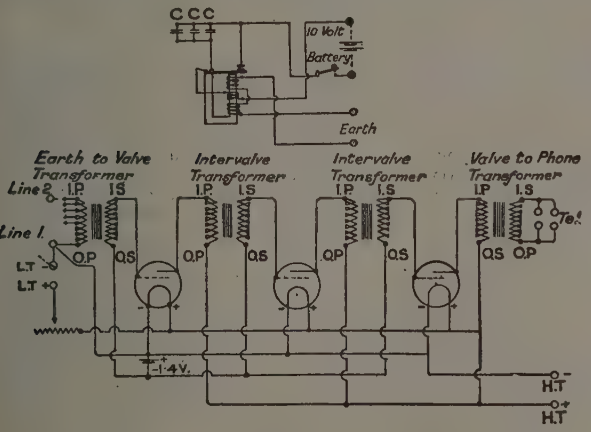

FIG. 1.

The diagrams in fig. 1 show the principles of the power buzzer amplifier system. The transmitter (*a*) is a powerful buzzer taking its current from a 10-volt accumulator. When the Morse key is pressed, a current from the 10-volt battery flows through the key to the upper contact, across to the lower contact, along the armature, thence along the primary coil, and back to the battery. The current magnetizes the coil which attracts the armature, thus breaking the contact, and allowing the armature to fly back and remake contact, etc. Each time the primary current is thus completed and broken, currents in the opposite direction are induced in the secondary coil and are passed to earth through shut lengths of cable and earthpins. Condensers, as shown, are connected across the break to reduce the sparking to a minimum.

To obtain the best results in two-way working a three-valve amplifier (*b*) is employed. The currents, received on similar earths, pass through the primary circuit, are induced into the secondary of the earth-to-valve transformer which is connected to the grid and, through a single dry cell, to the filament of the first valve. The amplified signal from the first valve passes through the second and third valves and, finally, the three-amplified signal passes through a valve to telephone transformer with ordinary wireless receivers in series with the primary winding.

With all these developments, and especially with the rapid increase in the number of listening sets, the wireless service, as a separate entity, was becoming unwieldy, and its absorption into the general signal service organization was essential to its most efficient administration. In 1917 and 1918, therefore, the army wireless companies were broken up, the section which had composed them being allotted to the divisional, corps, and army signal companies, according as they were equipped with portable trench sets, Wilson and listening sets, or the larger and more powerful Crossley motor sets used for supervisory and tactical work at army headquarters. In this form wireless organization survived the war.

The only change of moment in army wireless after this time was the application of the continuous wave system to army use. The early experimental sets made their appearance in 1917, but for some months they proved to be too delicate and untrustworthy for the work under the hard conditions of active service. Gradually, however, technical difficulties were overcome and more robust types of instrument devised. Before the end of position warfare, portable 30-watt continuous wave sets of about the size and portability of the 50-watt spark sets, but with forward aerials only 4 ft. high and a normal range of 12 m. were doing good work with heavy artillery observation stations. The Armistice in Nov. 1918 found continuous wave wireless still chiefly confined to the artillery, but new and more powerful sets had already been devised and tested. Since that date, spark wireless has been entirely ousted from its former position except for the short-range loop sets—the successors of the power buzzer—which are retained for work within the battalion and similar small units working in the immediate vicinity of the front line. There seems little doubt that in the future development of army signalling, continuous wave wireless is likely to play an all-important part.

While the chief characteristic of the earlier position-warfare period was the evolution of signal implements and the adaptation of signal organization to stationary tactics, it was in the great battles of 1916 and 1917 that signal policy began to crystallize in very definite shape. The first result of the stabilization of the situation was the running forward of lines in all directions to serve the multifarious units which now for the first time made good their claims to telephone communication. Magneto and buzzer telephones and magneto, buzzer, and combined exchanges made their appearance in all formations from brigade rearwards, and buzzer telephones and exchanges were issued to battalions and batteries. The lines to serve these telephones and exchanges had in many cases to be duplicated and even triplicated, and a festoon of lines, converging from front to rear, or stretched transversely and at all angles across the front, hampered movement and defied the utmost efforts of the signal personnel whose business it was to maintain them. The necessity for economizing signal personnel and for the protection of lines alike tended to bring about two reforms. On the one hand, control was vested in the signal officers of superior formations; on the other hand, by their orders, all circuits were concentrated into a certain limited number of well-defined main routes.

The first of these reforms in point both of importance and of time was the rearward movement of the centre of gravity of the command of forward signals from the uncontrolled battalion, through brigade, division, and corps, to army. Concurrently with this, the commanders of signal units became staff officers—*i.e.*, representatives of the command itself—instead of simple executants.[1]

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[1] The early overhearing experiments were made with ordinary telephone receivers and results, while they pointed out the danger, were not very satisfactory. In the German, French and British armies, it was the discovery of the possibility of using the new 3-electrode valves for magnifying extremely small changes in electric potential which at the same time raised the "overhearing" menace to its greatest pitch and caused the development of large branches of "Intelligence" and Signals to deal with this new branch of scientific warfare. The valves were used in receiving circuits both as detectors and amplifiers and revolutionized both telephony and wireless telegraphy.

In the meantime, the idea of the central signal route in each formation having been launched, it was natural that other means of signalling should at once tend to concentrate along these routes, with their protected test-points and signal offices. Economy and greater trustworthiness at once followed, and in the battle of the Somme, 1916, when the British army first carried out a great offensive from prepared positions, the central signal route, running from front to rear of each divisional sector and reinforced with all possible means of intercommunication, was attempted as a definite policy. The line system was carried forward in 6-ft. buries to a cablehead in, or even in advance of, the front line. Cable detachments were organized and held in readiness to extend the lines. Runners and despatch riders were organized in relay posts along the cable route. Wireless and power buzzer sets were also erected in convenient dugouts close to cablehead and the forward communication centres. By this concentration of means along one line, and by an all-round training which made the personnel to some extent interchangeable, economy of personnel, elasticity of procedure, and a minimum of casualties were ensured.

In the more extended offensives of 1917, this principle was carried still further and reinforced by instructions issued by G.H.Q., which required the headquarters of formations to give the signal officers concerned early and detailed information as to projected operations, forbade movements of headquarters without good cause, and laid down other important points of principle.

The culmination of position warfare thus arrived in the spring of 1918 to find the signal service quite equal to the calls made upon it. At G.H.Q. and on the lines of communication were adequate office staffs and a sufficient number of permanent line and airline construction companies and sections. The bases, camps, depots, and stores concerned with the administration and supply of a great army were served by army telegraph and telephone routes. Maintenance parties at all offices dealt with ordinary day-to-day repairs; breakdown gangs at central positions were in readiness to cope with the catastrophic breaks due to bombing and long range shelling. At G.H.Q. itself powerful wireless stations formed the initial link of a chain line which reached right forward to the front line; other stations were engaged in intercepting the German wireless; and a headquarters wireless staff coördinated the activities of the Intelligence stations scattered throughout the rear army zone. Here, also, was the nerve centre of the whole signal service in France—the directorate of signals—the staff which formulated the policy of the service, supervised its organization and working, and allocated the incoming reinforcements of men and material.

The basis of the signal system of the army was again a telegraph and telephone network which was built up on a "chessboard" or "grid" system, that is with front-to-rear routes and routes transverse to the front, spaced at regular intervals and with the main signal offices and test-points at the junction of the two. Until late in 1917 the approved theory was to make the line system approximate as nearly as possible to the perfect "grid" with as few and as heavy routes as possible. With the increase in the amount of long-range shelling and bombing which was a marked feature of early 1918, this principle required considerable modification. Two or three parallel routes usually took the place of the single heavy route of each corps or army area, and all routes were diverted to a much greater extent in order to avoid centres likely to be bombed or shelled.

The constitution and working of the army signal company perhaps more nearly reflected the conditions of position warfare than did that of any other. A telegraph construction company, a light railway signal company, and airline sections were the chief elements of the construction personnel, though there were also cable sections for connecting up isolated units at any time, and dealing with emergency connexions in battle. Here, also, were wireless light motor sections, mainly employed on supervisory duties, but like the G.H.Q. wireless, available to take their place in the chain of intercommunication in the event of the failure of the lines. Most of the traffic was dealt with by wheatstone, duplex, and simplex telegraphy, and the magneto telephone, wireless telegraphy being chiefly utilized to assist and police the more forward stations. The chief signal officer of the army had also to coördinate the signal schemes of the formations in his army, and under his command were the area detachments whose permanent duty was the maintenance of the buried cable in the army area.

In the area of a corps—the forward position of which was liable to frequent shelling—the main routes were still permanent line and airline and the construction personnel consisted in the main of airline detachments. In addition, corps cable sections were available for emergency cable-laying, for loan to overworked divisions (a frequent case), for artillery signal work, or for running spurs to isolated offices off the main airline routes. The personnel of the corps cable sections was also often employed to supervise labour parties in the construction of the buried cable system, though, as above mentioned, maintenance personnel was provided through the army area detachments. The corps wireless section, while principally concerned with store distribution and supervisory and police duties, was more intimately connected with the tactical employment of wireless than was that of the army. Particularly in battle periods, the corps-directing station was frequently obliged to step in and assist its less powerful subordinates to attract the attention of other stations or to rebuke stations using undue power or contravening priority regulations, besides policing procedure and listening for occasional windfalls from forward German stations.

Lastly, the chief signal officer of the corps had to supervise and control the signal communications of the heavy artillery. For this purpose a special section had been added to his company, but this was altogether inadequate and in practice the whole energy of one corps cable section was usually devoted to the construction and maintenance of artillery lines. These corps units were differentiated in principle from the area detachments by the fact that they possessed sufficient transport to enable them to move forward while continuing their work. In all adaptations of the signal units of formations below army the essential characteristic of mobility was respected. Those elements of the service which required to be specialized to areas were embodied almost entirely in the army company, others being organized so as to be able to move as integers.

This principle of mobility naturally applied with still more force to divisional signal companies. Even when position warfare seemed to be most definitely established the retention of its horse transport by the divisional company was insisted upon, in spite of the extra work entailed by the care of horses upon a personnel fully occupied with its technical work. This insistence had its reward in the long run, for mobility regained all its old importance on March 21 1918 and retained it to the end of the war.

The original divisional signal company in 1914 consisted of the following elements—three "brigade sections" (in principle serving the infantry brigades), each of a telephone detachment and a squad of signallers, a "headquarters section" consisting of a small office staff and a few signallers and despatch riders, and a "No. 1 section" of three cable detachments, each of which was capable of laying 10 m. of cable and carrying three offices. By the spring of 1918 the "headquarters section" had been enlarged in every branch, and "No. 1 section" had been increased to four detachments to cater for the field artillery headquarters; but the "brigade sections," though much overworked, had remained practically unchanged. To these three original elements, however, others had been added. A small section, similar to a "brigade section," was serving with every field artillery brigade in the division. The reorganization of the machine-gun service in Feb. 1918 added another small section to serve the divisional machine-gun unit. The extension of wireless telegraphy to the division had involved the addition of sufficient personnel to man a "Wilson" and three "50-watt" sets and a charging set for accumulators. In addition, men were attached from brigades to man six power buzzers and their corresponding receivers, and to eke out the still undermanned visual detachments.

Forward of battalion headquarters, the direct responsibility of the divisional personnel ceased and, in battalions and batteries, signal communications were built and maintained by regimental signallers. Occasions occurred when the requirements of these units could be accommodated on the central system, but these were exceptional. Usually their signallers were fully occupied with the lines and with visual communication between the front line and their headquarters. The means at their disposal were light cable lines and enamelled wire with D3 buzzer telephones; heliograph, lamp, flag,[2] disc, or shutter; pigeon, messenger dog, message-carrying rocket and runner. In the case of power buzzer, pigeon, and messenger dog, communication was usually roundabout, via brigade, division and even corps headquarters; in the case of other appliances, direct touch from front line to company headquarters and from company to battalion headquarters was the rule.

The most interesting portion of the evolutionary history of signal communication in the war finishes with this period, and the story of the remaining months of mobile warfare is that of the reversion to simple skeleton systems, based on the principle of the central route studded at suitable intervals with forward communication centres. No further radical reorganization took effect, the principal change being the gradual switching over from spark to continuous wave wireless for command intercommunication purposes.

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[1] Strictly, this applies only to corps and army headquarters, though before the war ended, it was the unofficial practice in most divisions also.

[2] The artillery still used both Morse and semaphore; infantry signallers at this stage of the war were trained in Morse only.

(3) *Signals in Theatres of War other than France.*—While the greatest measure of evolution and adaptation naturally took place in the most important field and that nearest to the home sources of supply, almost every one of the outlying British theatres of war presented its special problems and emphasized the need of forethought and careful preparations, in respect of methods, personnel and stores alike, to suit local conditions, for instance in arranging for intimate coöperation with the intercommunication service of the navy in such operations as those of the Dardanelles, and the coastal operations of Sinai and Syria,[1] and in assigning an unusually large part to visual and wireless communications when a considerable water gap has to be spanned, as in the Dardanelles campaign. But perhaps the most significant lesson of experience in these campaigns was the greatly enhanced importance of wireless telegraphy relatively to other means of communication. Wireless plays a predominant part in such operations as those in E., W. and S.W. Africa, or those of the desert mounted corps in Palestine, which are conducted in vast, ill-developed theatres of war by comparatively small forces; for these frequently involve far-flung troop movements in the offensive, and tactical isolation of detachments in the defensive.

The sets in use in the British Expeditionary Forces engaged in outlying theatres were the 3-K.W. lorry set; the $1\frac{1}{2}$-K.W. set mounted on a limbered wagon and drawn by teams of horses, bullocks, mules, or even men; and the Marconi pack set, a 0·5-K.W. set either carried in a limbered wagon, on pack horses or mules, or by bearers. The latter proved particularly valuable for work with flying columns of swiftly moving troops. All three types of set were spark sets deriving their energy from internal-combustion engines. In the future, these will doubtless be replaced by the more efficient continuous wave system of wireless, but they played their part well in the 1914–8 campaigns over ranges respectively of 120–100, 80, and 30–50 miles. The extreme case of isolation in the defensive is of course that of a garrison under prolonged siege, and as an example both of the utility of wireless telegraphy in this case and of the actual working output of even a small set, the case of Kut may be quoted. The only means of signalling possessed by the defenders of Kut for some weeks was a small wireless set. By means of this, touch was kept with the relieving forces until the surrender, 6,313 messages consisting of 434,861 words in 144 days being the final record of the set.

One other lesson learnt in the outlying campaigns may be mentioned—the special necessity, in the theatres far from home supply services, for standardization of implements and stores. This had only been partially carried out when the war ended, but since then a considerable reduction has been effected in the number of types of instruments in use.

(4) *Relation to other Arms.*—A subject of considerable importance is the relation between signals and other arms. Before the World War, the signal service was regarded by the general staff as an executive servant and by other elements of the army its existence and potentialities were too often slighted or ignored altogether. As the war went on, the importance of rapid, trustworthy, and copious intercommunication was emphasized more and more. The effect of this, in the gradual change in the status of the formation signal officer from the executive to the staff officer, has already been emphasized as one of the main features of the evolution of the service during the war period. Similarly, the relation of "signals" to intelligence, artillery, and even to infantry, has undergone a distinct change.

The intelligence service of all armies owes no small measure of its present effectiveness to the means provided by signals for tapping sources of enemy information. The listening sets; the position-finding wireless set; the interception wireless set; the aeroplane wireless compass, are all efficient means of making out enemy plans and dispositions. So-called "wireless camouflage"[2] and the dissemination of false information by all means of signalling are well-recognized strategems.

The relation between artillery and the signal service is still more obvious. Efficient artillery fire was never more dependent on good observation than it was in the position-warfare battles of 1915–7; and observation is useless without intercommunication. As has been noted earlier in this article, artillery signal communication has become one of the definite functions of the signal service.

With the infantry, the signal service, through the regimental signal personnel which it supervises, has an equally close connexion, though the personal comradeship which is the basis of true liaison was made difficult, in the war, by the inevitable demands made on infantry labour for the burying of cables.

Signal personnel have frequently proved their ability to give a good account of themselves in infantry fighting, but it cannot be too strongly emphasized that the employment of signallers as infantrymen whether in the battalion, brigade, division, corps, or army, is a mistake except as a very last resource. The signaller is a valuable technical tradesman and he cannot be trained in a few days or even a few months. More casualties have probably been caused by lack of signallers, and therefore of the efficient signal communications essential to the guidance of the battle, than can ever have been saved by their employment in the fighting line.

No small amount of the attention of signal units, especially in position warfare, is now devoted to serving the needs of other technical branches of the army. Tank corps, royal air force, and survey battalions all made special demands upon the intercommunication service.

(5) *Means of Intercommunication.*—Details of the means of intercommunication employed by the British army signal service will be found in the official Manual of the Corps of Signals, Parts I., III., IV., and V. Some of the details of more general interest are given in the following few paragraphs.

Telephone and Telegraph.—The standard instruments in use are the telephone No. 110 (magneto ringing), the fullerphone (buzzer call) and the telephone D Mk. III. (buzzer call). (In addition, a lineman's telephone is provided for the use of the intercommunication maintenance personnel which has both magneto ring and buzzer call.) Of the telephones, no special description is needed, their only peculiar characteristic being a robustness of structure and parts calculated to stand the rough usage of army life.

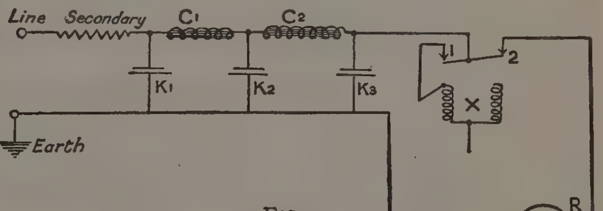

FIG. 2.

The fullerphone is an instrument of peculiar interest. The chief cause of the leakage from telegraph and telephone circuits was the electrical stresses set up within the earth by the rapidly alternating current used. The fullerphone is a telegraph instrument, the essential point of which is the changing at the receiving end of a steady current into an intermittent current of audible frequency, while at the same time the current in the line remains steady. A typical fullerphone receiving circuit is shown in fig. 2. The interrupter (X) may be driven by any means, either electrical or mechanical. In army patterns it is driven electrically, being operated by means of a local cell.

If a steady E.M.F. is applied between line and earth and the circuit is closed at the interrupter, a steady current will pass through the choke coils (C1, C2), contact 2 and receiver. If the circuit is broken at X the current cannot pass through the receiver but will flow into the condensers (K1, K2, K3). When the circuit is again closed at X the condensers partially discharge through the receiver.

When the interrupter is working we therefore get an intermittent current in the receiver which can be made audible by adjusting the interrupter to run at a suitable speed, while the line current alternately runs into the condensers or through the receivers and remains practically constant and continuous in the line. The dots and dashes sent by the single current Morse key at the end of the line are therefore reproduced in the receiver as short or long notes. Readable signals can be obtained with about half a microampère, a main battery of one dry cell being sufficient. The employment of such an extremely small continuous line current eliminates danger of overhearing, induction being reduced to a minimum.

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[1] It was doubtless owing largely to the experience of these campaigns that steps were taken towards the end of the war to harmonize the signal procedure of the navy, the army and the post-office, that is, the form and manner of sending messages, the checks in accuracy, the ensuring of priority, and suchlike matters of technical detail that, in fact, are as important to efficiency as the design of instruments and the principles observed in their employment.

[2] Manipulating the technicalities and the volume of traffic of one's own wireless so as to mislead the enemy's interception service.

In the rear areas, simplex, duplex, and wheatstone telegraphy are all used in the offices of the higher formations, which in the case of the armies may contain several hundred telegraph instruments and telephone subscribers. Magneto exchanges are the rule as far forward as brigade headquarters. At brigade headquarters buzzer exchanges are also installed and at battery and battalion headquarters buzzer exchanges are the rule. Circuits are of galvanized iron or copper wire beyond the limits of frequent shelling. Forward of this, main routes are of buried armoured cable (2-, 4-, or 7-pair brass-sheathed or iron-armoured usually) or light field cables which are standardized in several sizes in both single and twisted twin circuits. Enamelled wire, that is, wire roughly insulated by a coating of enamel, was used by forward troops during the war, but is now obsolescent.

Wireless Telegraphy and Telephony.—In all formations down to infantry battalions continuous wave wireless is now practically the only means used. There are three standard sets. For use at, or in rear of, army headquarters, or for long distances in mobile campaigns, a set is provided with a maximum range of 400 miles. The set has two 70-foot masts and is fitted to be carried either in a box car or a limbered wagon. (This is the equivalent of the former "heavy motor set.")

For distances up to 200 m. a smaller set is provided which has two 40-ft. masts and can be carried as above or on pack animals. For divisional work, the old "Wilson" and "British Field spark" sets have been replaced by a portable set with a range of 12 miles. This has two 15-ft. masts, is worked from accumulators or by a hand generator, and carried on pack animals or by bearers.

Finally, the loop sets already mentioned earlier are retained for work within the battalion and battery if required, though they are likely to be replaced soon by short range and short wave C.W. sets of much greater efficiency. The power buzzer and 3-valve amplifier sets are also available for issue in case of position warfare.

Small portable wireless telephone sets for forward work have been devised, and similar sets were indeed used in the Air Force during the last months of the war. The sets are not yet standardized, but those in use have a range of some 2,000 to 3,000 yards.

Visual Telegraphy.—The visual instruments include the heliograph as used in pre-war days (*see* 13.223); the Lucas lamp; the shutter, and the flag. Of these, the heliograph has a range up to 100 m. or more, but is only of really extended use in a country with a large proportion of sunlight.

The very efficient and portable Lucas lamp is a powerful electric lamp with an 8-candle-power bulb set in the back of a cylindrical lampholder with a powerful reflector at its back. An 8-cell battery of ever-ready cells provides a current at an E.M.F. of 12 volts. The lamp has a range in daylight of 2 m. with the naked eye and 3 to 4 m. with the telescope, and at night of 6 m. with the naked eye and twice that distance with the telescope.

The signalling shutter is also a development of the position-warfare phase of the war. It consists of three flaps of American cloth which are black on one side and white on the other. At the back of the shutter are metal clips by which the device can be attached to an ordinary bayonet. The flaps are normally closed with the black side outermost, but by pulling on the operating cord they are pulled down and the white exposed. On releasing the cord the flaps spring back to their original position. When not in use the instrument can be rolled up and stowed in a canvas case.

Message-carrying Agencies.—Of these the most important are (*a*) despatch riders, mounted orderlies, or runners; (*b*) carrier pigeons; (*c*) message-carrying rockets; (*d*) dogs; (*e*) air craft.

(*a*) For use in rear of brigade headquarters the motor cyclist despatch rider is invaluable. A feature of the modern signal service is the organized D.R.L.S. which deals with all official correspondence too urgent for post and not sufficiently urgent for the telegraph. Within brigades, divisions, and in cavalry units and formations, mounted orderlies are often used for conveying messages and this is true of all formations in country impassable to motor cyclists. In the forward battle zone the runner is the last resource of the forward commander. His use should, however, be restricted to occasions when all other means of signalling have failed or are unreliable, for casualties amongst runners are many and men suitable for this duty are not too common.

(*b*) The pigeon has proved its value for position-warfare conditions during the war. The pigeon service is controlled from corps headquarters and messages from the trenches will usually reach the battalion via brigade or divisional headquarters. The employment of pigeons with tanks and artillery is an important branch of the pigeon service. New developments are their delivery to isolated or front-line posts by aeroplane and parachute, and the teaching of pigeons to fly by night. In the latter case the birds are kept in red light and are flown to a loft where the trap is illuminated by a powerful arc or acetylene light.

(*c*) Message-carrying rockets with a range of 2,300 yd. have been adopted as a standard means of signalling. Their course through the air is outlined by a trail of smoke and their position at the end of their flight by a coloured flare automatically lighted at the moment of impact with the ground.

(*d*) The use of the messenger dog is likely to be confined to position warfare. These dogs have done good service on occasion, but are likely to find their vocation only in stationary warfare or during a very methodical deployment for battle.

(*e*) In certain phases of a battle the aeroplane is the only trustworthy or even possible intermediary between troops and command. Apart from wireless telegraphy, messages can be communicated to the aeroplane by visual signalling, or if of a simple conventional character, by means of the ground panels used for the notification of positions, while, from the aeroplane to the ground, the most secure method yet discovered is to drop a written message, provided with long streamers, on to selected "dropping grounds" contiguous to the headquarters concerned.

Notification Signals.—Light and smoke signals are made use of as occasion directs and a plentiful supply will be held in store. These are used, under prearranged schemes, for such purposes as calling for barrage or protective fire; notifying positions of forward troops; answering one-way messages, etc. The manufacture of distinctive flares, and light signals generally, has been carried to a very high degree of perfection.

Acoustic signals have not been generally successful with the exception of the Klaxon horn in aircraft. Special sirens and horns for calling attention to gas attacks and other general alarms have been much used, but an attempt made by the French to signal by means of tuned acoustic horns was not very successful. The noises of a modern battle are such as to handicap this method of conveying information very greatly.

(6) *The French Signal Service.*—The French intercommunication service at the outbreak of war differed from the British in being in two separate compartments—a telephone system controlled by the engineers, and a runner and despatch rider service under entirely separate direction. In addition there existed a motor service with the maintenance of liaison between units as its chief duty. The absence of the telegraph in forward formations threw much extra work on the remaining personnel, and caused a consequent increase in the proportion of despatch riders, runners, and orderlies. Construction personnel was in the main kept in the rear and sent forward only when actually required, according to exigencies.

The greatest reliance was placed upon the ringing telephone even in the forward area, and this statement is true even for 1918, although time and again the forward telephone system had been swept away in hopeless ruin by the bombardments which preceded the great position battles. In the rear, the very complete telephone network with an excellent system of locality exchanges served all purposes very well, whether in the normal stationary warfare, in the pressure of traffic before or during an attack from a trench system, or in the hurry of an advance or retreat on a considerable scale. In the last-named case as the attacking armies very soon outran the major portion of their heavy artillery, these well-built lines stood well, and the French system of locality exchanges served the retreating divisions as well as it had served the corps and armies for which it had been originally built.

In the forward area the French signal service was faced with a somewhat different problem from that which confronted the British. Serving a professional staff and a conscript army, far more accustomed to mass manœuvres than the British armies, a relatively far greater proportion of attention could be paid to getting back information from the front than orders forward to the front. The absence of the telegraph had also taught the forward staffs to rely more upon the spoken word and to dispense to a great extent with those written explanations and confirmations of orders which were considered essential to the British staff procedure.

The British subordinate commander was often *able* to act upon his own initiative; his French equivalent was not only able but *expected* to do so to a much greater degree. The result was a far greater use of one-way working, and to this was perhaps due the fact that the power buzzer—essentially a one-way instrument—was first developed in the French army.

A further feature as regards signal policy and practice was a tendency to confine forward routes to front-to-rear routes only. All lateral liaison was by liaison officers, despatch riders, or runners. When a British division was working next the French, the position always involved responsibility for two lateral routes instead of one.[1] Not only did the French not employ lateral lines, but it was only under suasion that they would make use of them when provided.

The front-to-rear forward routes were mainly of buried cable, though shallow splinter-proof and traffic-proof trenches and narrow open trenches were also employed. "Comic" airline, that is airline built with improvised poles and other stores, which was an invention of the British army, was also adopted by the French, but the latter placed more reliance on fairly heavy routes of poled cable, especially of 7 or 8 cables slung together on pickets 3 to 4 ft. high, a method seldom employed in British divisions except when working in French areas, but which proved very satisfactory when used by a British corps in the advance from the Marne in July 1918.

A further divergence of practice was the concentration upon continuous wave wireless to the exclusion of spark wireless for forward command purposes which was the outstanding characteristic of the forward French wireless service. In 1918, continuous wave wireless was used for command purposes in armies, corps, and divisions and the wireless system achieved a considerable measure of success in the final advances of the autumn. This was the logical outcome of the fact that, on the Allied side, the French were throughout the pioneers of the development of the 3-electrode valve and its application to practical war problems. In no army were the research departments of the signal service keener or better directed. The chief triumph achieved was the designing of such a valve of a much more robust type than any previously produced. This valve, known as the "French" valve, became the standard equipment for the majority of the forward wireless and listening sets both in the French and British armies. (R. E. P.)

(7) *The German Signal Service.*—In the German army before 1914 the signal service formed part of the "Communication Troops" (*Verkehrstruppen*) which had been separated from the engineers for some years. Six Prussian, one Saxon and two Bavarian telegraph battalions existed, and these units, as well as the regimental signal personnel, were trained principally in the buzzer telephone. Wireless telegraphy was provided for by separate detachments, in principle destined for G.H.Q., army headquarters, cavalry formations, and important fortresses. The only other means in use by the signal service of the field army of 1914 was the visual apparatus (*Blinkgerät*), but this was not regarded as having any value in battle, for which the intention was to depend on good tactical and technical handling of the telephones. The strength of the signal service in peace was about 8,500, increased on mobilization to 26,000, and at its maximum in the winter of 1917–8 the establishment reached 192,000. This was nearly an eightfold increase in numbers, but as the number of formations provided with signal units had itself increased, it is more instructive to compare the signal personnel of an army of given strength in 1914 and 1917–8. In the former year, a German army of 12 divisions had about 1,900 signal personnel, and in the latter (nominally) some 9,300. Comparison of these figures with those given above for a British army of 6 divisions in 1914 and in 1918 shows that the German army was at the outset less well-provided than the British, as was indeed to be expected from the long tradition of colonial wars of the latter. At the end of the World War, however, the German signals were, nominally, slightly superior in numbers to the British, though in practice, as the German system assigned to signals certain duties that were not so assigned in the British organization, the strengths—or rather establishments—were about equal for a given force.[2]

In the first German operations in the western theatre in 1914, intercommunication was in principle by the telephones of the signal service from supreme command to brigade headquarters and by the telephones of the regimental signalling sections (at first, eight men per battalion) farther forward. The flag was also in use, but, as in the British service, it soon disappeared when tested by war. Between the supreme command and armies and cavalry formations, wireless telegraphy—especially in the later stages of the advance to the Marne, when the army telephone detachments failed to keep up with the march—was the principal means of communication and was supplemented by missions of staff officers carried in motor cars. It is admitted by all German critics that this liaison proved far too loose, and its defects are considered to have contributed very largely (some say, principally) to the defeat of the Marne. The forward telephones, on the other hand, in corps signal and in regimental charge, met the demands made on them, to the surprise, it appears, of the army generally, which at the outset had little faith in the utility of technical aids on the battlefield and believed the runner or despatch rider to be the only really trustworthy means of intercommunication. The reconnoitring cavalry was particularly well equipped with telephones, and used a light wire, enamelled to give some degree of insulation to the line in wet weather.

Common to all branches of the intercommunication service was the principle of building from front to rear. Army detachments were responsible for making connexion with the supreme command, corps detachments with army headquarters, and so on. The western campaign of Aug. and Sept. 1914 demonstrated almost at once that this principle was unsound, but only after the penalty for imperfect liaison had been paid.

In the eastern campaigns of 1914–5, and to some extent also in the Rumanian campaign of 1916, conditions imposed upon the Germans radical departures from pre-war regulations. Firstly, the signal units of Hindenburg's armies of 1914 were largely improvised, like many other services and even combatant troops in the East. Secondly, the sparseness of communications and the difficulty of movement compelled the German command from the first to manipulate its signal resources in accordance with the operations in hand or in prospect instead of attempting a schematic layout of lines to all formations alike. Thirdly, the initial mobile warfare conditions continued in the East for more than a year of constant campaigning, and at a later stage, the Rumanian campaign came to prevent the lessons of open warfare from being forgotten. Lastly, the operations began on friendly territory and the policy of the signal service was to build forward from the home telegraph system. These conditions led to (*a*) enhanced importance of wireless telegraphy, (*b*) economy of cable, and the use of airline close up to the front, (*c*) the return to telegraphy for work in rear of corps and even division headquarters, and consequently the development of quick-writing telegraph instruments,[3] and (*d*) the principle of concentrating both wire and wireless communication on a central route connecting a headquarters with a forward report centre (*Meldekopf*, report-head) in the region of the advanced guard, a principle which, for quite different reasons, came into honour later on the western front. The importance of wireless was again emphasized in the Balkan campaign of 1915 and the Rumanian campaign of the following year, in which also the visual apparatus rendered good service.

In the position-warfare campaigns of the West, evolution—speaking very generally—followed the same course on the German side as on the British, similar difficulties and problems naturally suggesting similar remedies. It has already been noted that the numerical growth of the signal service in relation to other arms was approximately the same in the two armies. As regards organization, an important difference was that on the German side the basis of classification was, to the end, the instrument used and not the formation served. Although the signal service branches were combined in one corps of *Nachrichtentruppen* in May 1917, this was subdivided at all échelons into telephone units, wireless units, and visual units. The first-named were responsible for telephones and telegraphs (the latter being largely employed from division headquarters rearward), the wireless detachments for wireless of all kinds and power buzzers, and the visual detachments for the *Blinkgerät*. Moreover, the listening sets, the pigeons and the dogs, were all organized administratively as separate sections of the corps. But in each headquarters, from supreme command to divisions inclusive, the *Nachrichtenkommandeur* was a member of the formation staff and was responsible not only for the command of his own units but also for communication arrangements and procedure generally within the formation, including regimental signallers of infantry, cavalry and artillery, in his capacity as a staff officer. The control and manning of aircraft wireless stations was also in the hands of the signal service, as well as wireless police and wireless intelligence, and (again in his capacity as a staff officer) the divisional signal commander performed many functions that in a British division were assigned to the intelligence officer.

The possibility of applying the recently discovered "audion," or 3-electrode valve, to the purpose of overhearing the opponent's telephone conversations was first realized by the Germans, and the success of this innovation may be said to have revolutionized signal practice on both sides during the war. It made closed metallic circuits in the forward lines and strict telephone discipline essential, and, further, from the listening set there came the "earth telegraph" (power buzzer) which played so important a part in the signalling of all armies in the last two years of the war. But, quite as important as these applications of the 3-electrode valve was its effect on wireless telegraphy through the air. It made possible the change from the spark to the continuous wave system, by providing (*a*) an intensifier for small, weak receivers such as those of trench and aeroplane sets, and (*b*) the means of very sharp tuning which allowed of many sets being employed together in a restricted area without mutual interference. Satisfactory trench wireless apparatus on the continuous wave system was designed in 1915 and used in the battle of Verdun in April 1916.[1] A further development, made necessary by the adoption of elastic defence tactics in lieu of holding defined trench lines, was the so-called "shellhole" set, which comprised aerial, receiver, transmitter and source of power in a unit weighing only 40 pounds. In elastic defence the visual apparatus also played a useful part.

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[1] With British formations amongst themselves the convention was for each to open and to maintain communication with its left-hand neighbour.

[2] Throughout this comparison, regimental signalling personnel is ignored.

[3] The Siemens *Schnellfernschreiber* is said to be capable of dealing with 1,000 letters a minute.

In trench warfare proper, the Germans did not employ buried cable to the same extent as the British. Their remedy for constant cutting of lines was to put the cables in open trenches sufficiently deep to save them from traffic, and to devote the greater part of the available labour to providing thorough protection for offices, and especially for repair squads. Cable-throwing mortars and messenger dogs carrying reels of self-unwinding cable were occasionally employed to lay lines in conditions of special difficulty. An apparatus known as the "Utel," analogous to the British fullerphone, was evolved to meet the overhearing danger. The visual *Blinkgerät*, message-carrying projectiles and rockets, and especially pigeons, were used to supplement the telephone and the wireless communications, as in the armies of the Entente. Unexpectedly good results were obtained with messenger dogs, powerful and intelligent wolflike animals, specially trained and carefully bred.

For the great offensive battle of March 21 1918, the experiences both of the eastern and the western fronts were drawn upon. Between army and corps headquarters, and also between corps and division, the principle of the central route with a *Meldekopf*, to which all forward units made their connexion, was adopted. For the forward units special arrangements were made for transport and routes over the shellhole area. The wireless units were reorganized to permit of great subdivision, and the divisional wireless troop was equipped with its own transport. Visual apparatus was similarly made mobile and self-supporting, and a system of light, smoke, and other recognition signals completed the preparation for battle. In spite of losses and friction telephonic communication was successfully kept up as far forward as regimental headquarters during the first days of the offensive. Thereafter, however, the telephone system broke down owing to the inability of the sections to maintain their lines against the enemy's shell fire and even more the ceaseless movement of transport in the ever-deepening battle zone. Pigeons, even, could finally only be got to the front units by means of aeroplanes. Earth telegraphy failed for want of range; message-carrying projectiles and dogs for the same reason were only occasionally useful, and in the later rapid stages of the advance intercommunication from front to rear depended almost entirely upon wireless telegraphy and upon simple notification signals (such as panels shown to aircraft, light and smoke signals of agreed meaning) in the hands of the troops themselves. The wireless system was based on the divisional central route, which was maintained by two powerful units, each alternately keeping up communication between *Meldekopf* and headquarters and moving forward to a new, more advanced *Meldekopf*. The small wireless sets distributed in the front zone, the other reporting agencies, and the staffs, made their connexion with the head of this extending route wherever it happened to be at any moment, while the telephone units, largely reinforced by fresh units hitherto reserved at the disposal of the supreme command and aided by captured material, followed on with airline. This system served its purpose, and the efforts of the signal service were rewarded by special mention in the *communiqué* of March 26, but normal signal traffic did not become possible again till the advance had slowed down sufficiently to enable the telephone units to catch it up.

In their rearward signal communications, the Germans made much use of Pupin coils to bring their iron wire (adopted from motives of economy) up to the technical efficiency of copper wire, and also to increase the efficiency of the latter for long distance telephony. Direct telephonic communication between the German and the Turkish supreme commands was opened in 1917. The use of quick-writing telegraph instruments has already been alluded to.

(C. F. A.)

(8) *United States Army*.—In the United States army, the signal corps has been a separate organization for many years. The units into which it was organized in 1917–8, apart from those serving in the "S.O.S." or lines of communication in France, were of two main classes, field signal battalions and telegraph battalions. To an army were assigned two telegraph battalions and one field signal battalion; to each corps were assigned one telegraph battalion and one field signal battalion; and to each division, one field signal battalion. The telegraph battalions consisted of two companies each, while the field signal battalions each consisted of three companies, a wire company, a radio company, and an outpost company, the latter battalions including 470 men. The outpost company was responsible for communication at and in advance of infantry brigade headquarters working in four regimental sections in position warfare and in two brigade sections in mobile warfare. The radio company was equipped for all types of radio communication within the divisional area. The wire company constructed and operated the normal system of communications between the division headquarters and the artillery headquarters between the former and infantry regimental headquarters. The corps and army signal units were responsible for maintaining and operating lines forward to the next subordinate headquarters and to certain troops of their own respective headquarters.[2]

A distinct feature of the work of the United States army signal corps was the tendency for the preponderate use of the telephone over the telegraph and the very full and wide provision of telephone facilities. This characteristic is due to the fact that in the United States, the telephone organization is highly developed and the "telephone habit" wide-spread amongst all classes. Hence there would be a wider demand for such facilities, a greater familiarity in operating under circumstances of heavy traffic, and a greater manufacturing capacity for producing telephone equipment, than in the case of other countries.

The signal corps also included the meteorological, the pigeon and the radio direction-finding service and, until late in the war, the aviation service of the United States army.

SILESIA, UPPER.—It was provided in 1919 by the Peace of Versailles (Art. 88) that the inhabitants of Upper Silesia (pop. in 1919, 2,280,902) should be called upon to decide by a plebiscite whether they would belong to Germany or Poland (*see* PEACE CONFERENCE). It should be noted that for the purpose of the plebiscite the purely German districts of Falkenberg (pop. 37,526), Grotthau (pop. 40,610), Neisse (pop. 7,781), part of Neustadt (pop. 25,000) and Hultschin (pop. 45,552), situated in the northern and western parts of Upper Silesia and representing a total population of about 156,469, were excluded. Up to the day of the plebiscite the supreme authority in the plebiscitary area was to be vested in an Inter-Allied Commission, consisting of one representative of France, Great Britain and Italy respectively. In this commission France was represented by Gen. Lerond, England by Col. Percival, and Italy by Gen. de Marini. On Feb. 1 1920 Allied troops occupied the plebiscitary district. The local German officials were then subordinated to the Inter-Allied authorities. The German police (*Sicherheitspolizei*) was replaced by a special polling police (*Abstimmungspolizei*), which was composed half of German-speaking, half of Polish-speaking, Upper Silesians.

On the whole the collaboration of the Inter-Allied control and the German officials proved satisfactory; but various differences arose, such as that which led to a strike of judges in May 1920. Both the Poles (under Korfanty) and the Germans opened an active canvassing campaign; and under Polish pressure the Germans in the southern and eastern districts were subjected to oppressive treatment. On Aug. 19 1920 the Poles felt strong enough, indeed, to make an attempt to seize the country by force. On all sides bands of Poles, chiefly recruited from Congress Poland, usurped authority. A number of Germans were forcibly carried across the frontier into Poland, and many were killed. Several weeks elapsed before it was possible to quell this rising and restore order. In the autumn of 1920 there was an exchange of notes between Germany and the Entente relating to the manner in which the plebiscite should be taken. It had been suggested by the Entente that the non-resident Upper Silesians of the German Reich should vote outside Upper Silesia, at Cologne. Germany protested against this, and her protest was recognized as valid by the Entente. In Jan. 1921 the date of the plebiscite was fixed for March 20 1921. An immediate revival took place in the use of terrorism by the Poles, especially in the districts of Rybnik, Pless, Kattowitz and Beuthen. It reached its climax in the days preceding the plebiscite. Voters from other parts of the German Reich were frequently refused admission to the polls; sometimes they were maltreated and even in some instances murdered; and houses where outvoters were staying were set on fire. The day of the plebiscite passed, however, without disturbance except at a few places, such as Rybnik and Pless.

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[1] The experiment was very successful, but the higher authorities for some time refused to allow the general adoption of trench wireless on the ground that it involved a reduction of infantry strength. But a stronger motive was no doubt the fear of interception.

[2] In comparing the strength of these organizations with those of other armies, it must be remembered that the United States army division was much stronger than the corresponding unit of other armies. It comprised two infantry brigades each of two 3-battalion regiments and one artillery brigade of two field and one medium artillery regiments besides other divisional troops.

The day after the plebiscite the Polish excesses recommenced, and from that date onwards continued without interruption; nor was the Inter-Allied Commission able as a rule to prevent them. The poll showed 717,122 votes for Germany and 483,514 for Poland. In 664 districts there was a German, in 597 a Polish majority. Practically all the towns voted for Germany. There was a Polish majority in the following administrative districts—Rybnik, Pless, Beuthen, Tarnowitz and Gross-Strehlitz. The decision of the Inter-Allied Commission as to the allocation of the disputed regions to Germany or to Poland was delayed on account of differences which arose within the commission itself; the French representative, Lerond, who had from the first been accused of tacitly supporting the Poles, wished to allot the whole of southern and eastern Upper Silesia to them, while the English and Italian representatives wished to apportion the industrial region to Germany. Protracted diplomatic negotiations between Paris, London and Rome did not lead to any result. At the end of April a report became current that the Council of Ambassadors at Paris had determined to give only the districts of Rybnik and Pless to Poland. In consequence of this rumour the first days of May witnessed a new Polish insurrection which assumed far greater proportions than the former one. Korfanty had secretly raised a well-organized Polish force which was provided with arms and munition from across the frontier, and was reinforced by large bodies of men from Poland. With these troops he occupied the whole south-eastern part of Upper Silesia, on a line extending from the S. of the district of Kreuzburg through Gross-Strehlitz to the Oder in the south. He nominated himself dictator of the districts under Polish occupation, took over the administration, and treated even the Allied officials with such scant consideration that they were obliged to withdraw to Oppeln and the regions that were not occupied by the Poles. It was only in the larger towns, where there was a German majority, that the Allied troops, supported by the German population were able to maintain themselves. A further advance on the part of the Poles was prevented by the German Defence Force (*Selbstschutz*) under Gen. Höfer, which was composed of Upper Silesians and Germans who poured in from other parts of the Reich. There was severe fighting between the German Defence Force and the Poles, especially in the districts of Ratibor and Gross-Strehlitz. Colonel Percival, the British representative, was obliged to resign owing to ill-health, and was succeeded by Sir Harold Stuart. Attempts on the part of the Inter-Allied Commission to put an end to the insurrection by negotiations with Korfanty were unsuccessful, and the Allies were compelled to despatch reinforcements of French and British troops, under the command of Gen. Heneker, to Upper Silesia. After lengthy negotiations with the German Defence Force, which refused to withdraw unless guarantees were secured that the Poles would first quit the field, an agreement was ultimately effected with regard to the evacuation. By June 20 the British troops had again occupied the larger towns, while the Poles had the upper hand in the rural districts. As a result of the difficulties in paying his men and providing them with food Korfanty now lost control over his followers. Independent bands were formed which plundered the villages, ill-treated the Germans, and murdered many of them. In the industrial districts work in many of the mines and iron works came to a standstill, because imports of raw material and exports of coal had become impossible. By the end of June the loss suffered by the industrial region was estimated at 3 milliard marks; and there seemed to be no prospect of the restoration of tranquillity.

The French adhered to their contention that the greater part of the industrial region should be assigned to Poland. Great Britain, on the other hand, firmly maintained the view that such a partition would, as Mr. Lloyd George publicly expressed it, be "unfair" to Germany on the basis of the Treaty of Versailles and the result of the plebiscite. There were at one time three rival proposals for partition: (*a*) the Korfanty line, the extreme Polish demand; (*b*) the Sforza line, a proposal put forward by the then Italian Foreign Minister; (*c*) and the British proposal giving Poland only the south-eastern corner with the towns and districts of Pless and Rybnik. France was ultimately left in a minority of one on the Supreme Council, Italy and Japan having adhered to the British view. After prolonged debates and open differences among the principal Allied Powers on the subject of the partition, it was at last arranged, at a Paris conference in Aug. 1921, that the solution should be entrusted to a Commission of the Council of the League of Nations. This commission was ultimately constituted by the representatives of Japan, Brazil, China, Spain and Belgium, with the Japanese representative, Baron Iishi, as chairman. (C. K.*)

On Oct. 20 1921, the text was published of the documents containing the award of the League of Nations on the partition of Upper Silesia. The proposed new frontier line between Germany and Poland was as shown by the appended Map. The division here made in the industrial area, previously German, was such that the Council of the League of Nations declared it to be desirable, however, that measures should be taken to guarantee the continuity of the economic life of the region during a provisional period of readjustment, and to provide for the protection of minorities. It was recommended, therefore, that a general convention for this purpose should be concluded between Germany and Poland, so as to place Upper Silesia under a special regime during the transitional period, and that an "Upper Silesian Mixed Commission" should be set up as an advisory body, composed of an equal number of Germans and Poles, with a president of some other nationality to be designated by the Council of the League, together with an arbitral tribunal for settling private disputes occasioned by the temporary measures.

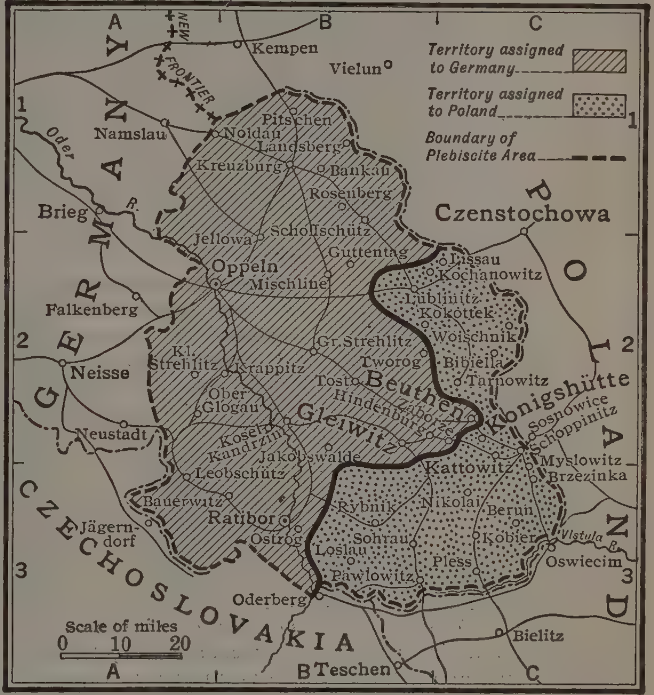

Upper Silesia Frontier, 1921

The provisional or transitional period was to be 15 years, and certain stipulations were laid down by the League of Nations for the economic arrangements during that period in the "plebiscite area." (1) Railway and tramway systems, privately owned or municipal, were to continue under the terms of their concessions, and the German State railways were to be put under a joint system of operation. Railway rates were to be uniform. The State insurance of employees in the Silesian railway system was to be undertaken by that system. A single Accounts Office was to be set up for the whole system. Expenses of new construction to be charged to a separate account, and borne by the State in whose territory it was carried out; the working capital for operation to be lent by the German State, and interest charged to the account of this system; profits or deficits to be divided between the two countries in proportion to the length of line and amount of traffic belonging to each. (2) The German mark was to be the only legal unit of currency, and Poland was to recognize the rights of the Reichsbank, for a period not exceeding 15 years, but by agreement the two Governments might modify this arrangement earlier. (3) While the German monetary system was maintained in the Polish zone, the postal telegraph and telephone charges should be in German currency. (4) The customs frontier would coincide with the political frontier, and the German and Polish customs law would apply, with certain exceptions. For 6 months, incoming goods from other countries, on which German or Polish duties had been paid previously to the partition, should cross the frontier without duty. For 15 years, natural products originating or coming from one of the two zones of the plebiscite area and destined for consumption in the other should cross the frontier free of duty. For six months, raw, half-manufactured and unfinished products of industrial establishments in one zone, destined for industrial establishments in the other, should cross free of duty; and this should continue for 15 years when the products, as finished, were intended for free importation into the country of origin. Natural or manufactured products originating in the Polish zone should, on importation into the German customs territory, be exempt from duty for three years from the date of the frontier-delineation. As regards export, the two countries should facilitate for 15 years the export of such products as were indispensable for industry in either zone. (5) Poland was to permit, for 15 years, the exportation to Germany of the products of the coal mines in the Polish zone, and Germany similarly to Poland in respect of the mines in the German zone. (6) For the 15 years, any inhabitant regularly domiciled or occupied in the plebiscite area should receive a "circulation permit" free of payment, enabling him to cross the frontier without other formalities. (7) Generally, the two countries should respect private rights.

SILVER (*see* 25.112).—Few subjects of economic importance present such a phase of the mysterious as silver, and the reason for this is perhaps not difficult to understand. In the case of the world's crops, not only are up-to-date and approximately reliable statistics daily available from the countries of production, but the countries of consumption see to it that they equally are in the foreground as to the daily progress of world's crops; and the manner in which statistics relating to these all-important subjects are now presented to consuming markets has become quite an art. For some reason the same attention unfortunately has not hitherto been—and is not even now—paid to the production of silver. Most excellent statistics are presented annually by the U.S. Director of the Mint, by the Government of India, and in pre-war days by the German *Metallgesellschaft*, but these unfortunately are what we may term "post date" figures, and, whilst of great value in informing the student as to what has been, they do not tell us what is going on at any given period.

This state of affairs is no doubt due to the great difficulty which has always been experienced in obtaining definite and conclusive data as to the production of silver, owing to the fact that the metal is now chiefly obtained as a by-product and not from mines worked solely for silver itself. Generally speaking the most important metals with which silver is associated are—gold, copper, lead and zinc. Gold and silver invariably occur together. Lead and zinc usually accompany one another, and the ores carrying these two metals—particularly where lead predominates—are frequently fairly rich in silver. Lead and silver usually form an especially marked combination, whilst copper is frequently associated with both gold and silver. These ores are generally described as silver lead, silver lead zinc, silver zinc and gold silver ores, and the mines producing these ores are not uncommonly spoken of as silver mines, overlooking the fact that the ores of the base metal have to be treated by smelting methods before the silver can be extracted. The quantity obtained in these ores ranges from about 2 to 50 oz. to the ton.

The production of silver, therefore, may now be said to be dependent upon that of gold, copper, lead and zinc; and consequently any causes which affect the production of these metals largely affects the production of silver as a by-product, and the world's demands for these metals will in a great measure control the future supplies of silver. Estimates from what are considered good sources give the percentage of the world's production of silver as ranging from 70% from base metal ores and 30% from precious metal ores.

Table 1.—World's Production, 1860–1919.

Year	Fine oz.	Year	Fine oz.
1860	29,095,428	1890	126,095,062
1861	35,401,972	1891	137,170,000
1862	35,401,972	1892	153,151,762
1863	35,401,972	1893	165,472,621
1864	35,401,972	1894	164,610,394
1865	35,401,972	1895	167,500,960
1866	43,051,583	1896	157,061,370
1867	43,051,583	1897	160,421,082
1868	43,051,583	1898	169,055,253
1869	43,051,583	1899	168,337,452
1870	43,051,583	1900	173,591,364
1871	63,317,014	1901	173,011,283
1872	63,317,014	1902	162,763,483
1873	63,267,187	1903	167,689,322
1874	55,300,781	1904	164,195,266
1875	62,261,719	1905	172,317,688
1876	67,753,125	1906	165,054,497
1877	62,679,916	1907	184,206,984
1878	73,385,451	1908	203,131,404
1879	74,383,495	1909	212,149,023
1880	74,795,273	1910	221,715,763
1881	79,020,872	1911	226,192,923
1882	86,472,091	1912	224,310,654
1883	89,175,023	1913	223,907,845
1884	81,567,801	1914	168,452,942
1885	91,609,959	1915	184,204,745
1886	93,297,290	1916	168,843,000
1887	96,123,586	1917	174,187,800
1888	108,827,606	1918	198,168,408
1889	120,213,611	1919	174,517,414

In order that an idea may readily be obtained of the centres from which production is now derived, the figures in Table 2, from the annual report of the U.S. Director of the Mint (1920), supplement those given in Table 1 for production itself.

Table 2.—Production of silver (10,000 oz.) by countries.

	1914	1915	1916	1917	1918	1919
United States	7,246	7,500	7,441	7,174	6,781	5,668
Canada	2,840	2,660	2,546	2,222	2,128	1,568
Mexico	2,754	3,950	2,284	3,500	6,252	6,268
Central and South America	1,320	1,660	1,818	1,781	1,846	1,751
Europe	924	1,010	847	651	687	490
Australasia	1,100	925	1,070	1,000	1,000	743
Asia	554	589	756	970	936	836
Africa	105	118	120	118	108	127
	16,843	18,412	16,882	17,416	19,738	17,451

United States.—The production of silver in the United States, the bulk of which comes from the western states, has always constituted a high proportion of the world's supply. Generally speaking the major portion of U.S. silver is obtained from gold, copper, lead and zinc ores mined in the States and metallurgically treated in that country. In addition large quantities of similar ores are imported from other countries—Mexico, Central America, Peru, Bolivia, Chile and Canada—for treatment, and the silver thus resulting goes to swell the U.S. figures of production of refined silver. The United States first came into prominence as a large producer in 1859 when operations on the famous Comstock lode in Nevada began. In 1860 the production was 116,019 oz., and in 1915 the output reached the high figures of 74,961,075 ounces. The preliminary official estimate of the production in 1920 was 56,564,504 oz., a reduction of 117,941 oz., as compared with that of the preceding year.

On April 23 1918 the Pittman Act became law in America, under which it is provided that: "The Secretary of the Treasury is hereby authorized from time to time to melt or break up and sell as bullion not in excess of $350,000,000, standard silver dollars now or hereafter held in the Treasury of the United States." This $350,000,000 represented about 270 mill. fine oz., of which the share of India was reported to have been 200 mill. fine oz., all of which was received in India between July 1 1918 and July 17 1919. The Act also provided that these sales were to be replaced by purchases of silver actually mined in the United States at the rate of $1. per oz. pure. The total purchases by the U.S. Treasury under this Act up to May 17 1921 totalled 54,120,197 oz., thus leaving 145,879,803 oz., still to be repurchased.

Mexico.—This country can safely be described as first among silver-producing countries of the world, in spite of the decreased output of recent years following upon the outbreak of civil war in 1913. The silver-bearing ores are widely distributed throughout the country; the mines and mining districts are exceedingly numerous, and many of the mines have been in continuous operation for hundreds of years. In 1911 the mine production of silver was reported as 79,032,440 oz.; in 1914, owing to the civil war, it dropped to 27,546,752 oz., but subsequently the output steadily increased up to 1920. As to what the future Mexican production would be time alone could prove, but in 1921 good authorities did not hesitate to predict that, given a recognized and stable Government and a reasonable price, it would later exceed that of Mexico's palmiest days.

Canada.—The Canadian production of silver hitherto has occupied the third position in the world's list of supplies. The metal is found chiefly in Ontario, British Columbia, Quebec and Yukon. The Ontario silver has been almost entirely derived from the silver ores of Cobalt, which field, however—judged from a continually reduced output—would appear to be working out. The British Columbia, Quebec and Yukon supplies are derived mainly from silver, lead and copper ores. In 1920 reports were coming to hand of discoveries of further silver-bearing ores which promise important results. In 1900 the total Canadian production was given as 4,468,225 fine oz., of which 3,958,175 came from British Columbia; in 1910 the Canadian output had increased to 32,869,264 fine oz., of which Ontario accounted for 30,366,366, whilst in 1919 the output was reduced to 15,675,134 fine oz., and the 1921 production seemed likely to show a further reduction.

Central American States.—The silver produced in these States—mainly Honduras, Costa Rica and Panama—is chiefly derived from gold-silver ores; the production in 1914 amounted to 2,754,868 fine oz., and in 1919, according to figures supplied by the director of the Washington mint, to 2,800,000 fine ounces.

South American States.—The countries included under this category rank as fourth producers of the metal. In early days the true silver mines in Peru, Chile and Bolivia ranked amongst the most important in the world, but as in the case of the older mines of Mexico they appear to be no longer in operation, and the production is being chiefly derived from base metal ores—copper and tin. In 1917 the production of Peru was reported as 10,865,061 oz., and in 1919 as 9,781,734 ounces. Bolivia in 1902, according to the U.S. mint reports, gave 12,992,641 fine oz., whilst in 1919 the production had dropped to 2,435,000 fine ounces. Chile was reported to have reached 2,349,379 fine oz. in 1900 and 1,900,000 fine oz. in 1919.

Europe.—Prior to the World War Germany was looked upon as the largest producer in Europe, and according to the *Metallgesellschaft* reports, the silver which is chiefly derived from base metal ores reached a production in 1904 of 5,822,727 fine ounces. The major portion of the concentrates from which the silver was extracted came from the Broken Hill mines in Australia.

Spain.—Next in Europe to Germany as a producer comes Spain, whose output of silver is mainly obtained from her important lead and copper ores. In 1915 her output was given as 4,565,396 fine oz., whilst in 1919, according to U.S. mint reports, it was stated to be 2,900,000 fine oz.—probably an approximate estimate.

United Kingdom.—It is impossible to say what the refinery output of silver in Great Britain is. It may, however, be stated that it is practically all obtained from imported ores treated in the country. The proportion of domestic mined ores is far too small for consideration. The number of refiners engaged in this business is considerable, but as they never publish returns, the difficulties experienced in arriving at anything approaching a reliable figure will be appreciated. According to the "Census of Production" the total outturn in the United Kingdom in 1907 was given as about 43,979,000 oz., troy.

Australia.—New South Wales stands preëminent as the chief Australian producer, the silver being mainly obtained from the wealthy silver lead ores treated at the Broken Hill Works at Port Pirie. Their output for 1919 has been given as 6,304,818 fine ounces.

Africa.—The Transvaal, Cape Colony, and Natal provide the main output, and the 1919 production has been stated to be 891,304 fine oz., at the same time a not inconsiderable proportion of their gold-silver ores are shipped to and refined in England.

Asia.—The chief countries producing silver are Japan and India. The production of copper has made great strides in Japan of late years, and it is chiefly from these ores that her silver is obtained; the metal is also obtained from the gold ores mined in Formosa and Korea. Japan's output of silver in 1917 was reported at 6,844,500 fine ounces.

The Indian output is chiefly derived from the mines in Upper Burma belonging to the Burma Corp. Ltd., and the production from Jan. to Oct. 1920 amounted to as much as 2,014,261 oz., and it was said that 1,000,000 oz., per month would in the future be a very possible outturn. What India ultimately would be able to produce must remain problematical, but there is no question whatever about India's potential mineral wealth, which only requires time to develop.

Consumption of Silver.—Although great difficulties are experienced in obtaining definite data as to production, that problem is relatively simple in comparison with the consumption side of the subject. Briefly stated, consumption may be discussed from four standpoints—the respective world nations' coinages, their arts, and the requirements of India and China, and it is here that the absence of readily obtainable and reliable information is felt. In the case of America the admirable figures annually presented by the U.S. director of the mint, in so far as America is concerned, supply the following information:—

American silver coinage.

1918	35,004,450 fine oz.
1919	14,682,079 " "
1920	19,763,600 " "

Industrial arts.

	Silver consumed	Of which new material
1917	27,039,845 fine oz.	15,998,807 fine oz.
1918	36,252,596 " "	26,722,333 " "
1919	32,700,521 " "	26,237,519 " "

As regards the coinage requirements of other nations, a most remarkable reversal of conditions has arisen. Prior to the World War the annual requirements for such purposes probably amounted to 70,000,000 oz. at least. In 1921 that was all changed, and the spectacle was presented of a great number of countries demonetizing silver as quickly as possible, and / or reducing the fineness of their silver coinages. England had reduced hers from 925 to 500, and the Straits Settlements from 900 to 500. The quantity of silver which had already been placed on the market, though somewhat problematical, was probably 50,000,000 oz., with a fairly safe estimate of as much more to follow.

As regards the world's requirements for arts, it may be safe to say that the majority of European countries were in 1921 in far too impecunious a position owing to the war to become real factors under this heading for many years to come—in fact, the majority had been and still were sellers of silver ware.

Table 3.—Silver coin and bullion imported into and exported from British India, 1887–1919. (British standard ounces.)

Fiscal yr. ended March 31.	Imported	Exported	Net Imports
1887–8	37,877,141	5,994,542	32,782,599
1888–9	37,844,665	5,408,636	32,436,029
1889–90	43,940,659	5,296,885	38,643,774
1890–1	56,190,870	4,661,785	51,529,085
1891–2	38,177,580	5,829,142	32,348,438
1892–3	54,180,144	8,656,632	45,523,512
1893–4	60,328,296	5,999,323	54,328,973
1894–5	32,638,069	5,598,047	27,040,022
1895–6	34,082,810	7,064,731	27,018,079
1896–7	37,520,322	11,591,234	25,929,088
1897–8	68,535,612	24,250,995	44,284,617
1898–9	49,226,780	26,061,355	23,165,425
1899–1900	50,663,542	32,017,260	18,646,282
1900–1	64,746,549	15,311,385	49,435,164
1901–2	66,726,972	27,721,780	39,005,192
1902–3	75,569,185	32,294,876	42,274,309
1903–4	104,324,765	25,142,629	79,182,136
1904–5	98,118,908	23,769,313	74,349,595
1905–6	88,853,079	4,535,314	84,317,765
1906–7	125,878,008	7,679,151	118,198,857
1907–8	106,358,274	8,442,915	97,915,359
1908–9	85,048,761	11,308,630	73,740,131
1909–10	75,501,745	14,486,993	61,014,752
1910–1	69,272,319	14,396,030	54,876,289
1911–2	70,378,747	38,149,647	32,229,100
1912–3	107,190,427	16,112,785	91,077,642
1913–4	79,834,999	8,727,648	71,107,351
1914–5	64,160,128	8,394,005	55,766,123
1915–6	39,833,279	6,900,906	32,932,373
1916–7	116,959,115	24,765,309	92,193,806
1917–8	88,814,458	14,282,960	74,531,498
1918–9	241,747,806	4,719,187	

In studying the figures for British India (Table 3) very great care is necessary to discriminate between what represents Government and what private imports, as the Government figures are for coinage purposes entirely. The need for this will be apparent when it is realized that out of the figures given in Table 3 for the years 1912 to 1919 Government coinage requirements were:—

	Standard oz.
1912–3	56,057,978
1913–4	35,425,057
1914–5	169,342
1915–6	302,259
1916–7	109,522,499
1917–8	79,404,555
1918–9	237,189,080

As the stock of silver held by the Government of India in their currency reserve, according to the return dated May 22 1921, amounted to Rs. 66,41,00,000—against an average for the five pre-war years, 1910–4, of Rs. 21,99,00,000—it may safely be assumed that they were not likely to be purchasers of the metal for some years to come.

As regards China's consumption, it is an almost hopeless task to supply anything approaching reliable data. The figures in Table 4, however, taken from the Chinese Maritime Customs reports may be taken as approximately correct—they are, however, given in Haikwan taels.

Table 4.—China.

	Imports	Exports
1914 . . .	861,167 taels	13,861,917 taels
1915 . . .	818,827 "	18,211,040 "
1916 . . .	19,903,117 "	8,102,268 "
1917 . . .	13,871,778 "	5,024,575 "
1918 . . .	1,228,342 "	2,281,659 "
1919 . . .	51,078,643 "	9,896,429 "
1920 . . .	50,966,880 "	68,469,360 "

Imports into Hong Kong for the year 1920 were reported to be the equivalent of £7,049,700—the greater portion of which was probably dealt with by the mint in Canton. The stocks of silver held in Shanghai on Dec. 31 of the following years are shown in Table 5. The increase in stocks in 1920 over 1919—viz, taels 15,460,000, and dollars 18,420,000—represents the equivalent of an increase of about 31,030,820 ounces.

Table 5.—Stock at Shanghai.

	Taels	Dollars	Bar Silver
1917	21,760,000	14,640,000	357
1918	18,860,000	13,470,000	4
1919	19,140,000	11,260,000	242
1920	34,600,000	29,680,000	nil

Prices.—Table 6 gives the highest, lowest and average price of bar silver in London per oz., British standard—925 fine—since 1833, from which it will be seen that the highest quotation recorded since 1833 was $89\frac{1}{2}$d. in 1920, the next highest being $79\frac{1}{8}$d. in 1919, $62\frac{3}{4}$d. in 1859 and $62\frac{1}{2}$d. in 1864. Though the highest point reached was in 1920, the average quotation for that year was only $61\frac{19}{32}$d. against averages in 1859 of $62\frac{1}{16}$d. and $61\frac{3}{8}$d. in 1864, which would point to more stable conditions existing in the silver market in the years 1859 and 1864 than in 1920. To the years 1902 and 1903 belong the honour of recording the lowest prices, viz. $21\frac{11}{16}$d., whilst the lowest average goes to 1915 with $23\frac{5}{8}$d. followed by 1909 with $23\frac{23}{32}$d. When the Pittman Act became law in the United States, good authorities, not only in America but in England, made bold to assert that the result of this Act would be to stabilize the world's price of silver at not less than \$1 per oz., for many years to come, whilst Senator Pittman went further and predicted that the world's price would range between \$1—and \$1.29—the parity of the American silver dollar—for the next 20 years. The spot price in London on June 1 1921, was $33\frac{1}{2}$d., and the price in America on the same date for foreign mined silver was 60 cents nominal.

Table 6.—Highest, lowest, and average price of bar silver in London, per oz. (British standard 0.925) from 1833 to 1920.

Year	Highest pence	Lowest pence	Average pence
1833	$59\frac{7}{8}$	$58\frac{3}{4}$	$59\frac{3}{16}$
1834	$60\frac{3}{4}$	$59\frac{3}{4}$	$59\frac{15}{16}$
1835	60	$59\frac{1}{4}$	$59\frac{11}{16}$
1836	$60\frac{3}{4}$	$59\frac{5}{8}$	60
1837	$60\frac{3}{8}$	59	$59\frac{9}{16}$
1838	$60\frac{1}{8}$	$59\frac{1}{2}$	$59\frac{1}{2}$
1839	$60\frac{5}{8}$	60	$60\frac{3}{8}$
1840	$60\frac{3}{4}$	$60\frac{1}{8}$	$60\frac{3}{8}$
1841	$60\frac{3}{8}$	$59\frac{3}{4}$	$60\frac{1}{16}$
1842	60	$59\frac{1}{4}$	$59\frac{7}{16}$
1843	$59\frac{5}{8}$	59	$59\frac{3}{16}$
1844	$59\frac{3}{4}$	$59\frac{1}{4}$	$59\frac{1}{2}$
1845	$59\frac{7}{8}$	$58\frac{7}{8}$	$59\frac{1}{4}$
1846	$60\frac{1}{8}$	59	$59\frac{5}{16}$
1847	$60\frac{3}{8}$	$58\frac{7}{8}$	$59\frac{11}{16}$
1848	60	$58\frac{1}{2}$	$59\frac{1}{2}$
1849	60	$59\frac{1}{2}$	$59\frac{3}{4}$
1850	$61\frac{1}{2}$	$59\frac{1}{2}$	$60\frac{1}{16}$

Table 6.—*Continued.*

Year	Highest pence	Lowest pence	Average pence
1851	$61\frac{5}{8}$	60	61
1852	$61\frac{7}{8}$	$59\frac{7}{8}$	$60\frac{1}{2}$
1853	$61\frac{7}{8}$	$60\frac{5}{8}$	$61\frac{1}{2}$
1854	$61\frac{7}{8}$	$60\frac{7}{8}$	$61\frac{1}{2}$
1855	$61\frac{5}{8}$	60	$61\frac{5}{16}$
1856	$62\frac{1}{4}$	$60\frac{1}{2}$	$61\frac{5}{16}$
1857	$62\frac{3}{8}$	61	$61\frac{3}{4}$
1858	$61\frac{7}{8}$	$60\frac{3}{4}$	$61\frac{5}{16}$
1859	$62\frac{3}{4}$	$61\frac{3}{4}$	$62\frac{1}{16}$
1860	$62\frac{3}{8}$	$61\frac{1}{4}$	$61\frac{11}{16}$
1861	$61\frac{3}{8}$	$60\frac{1}{8}$	$60\frac{13}{16}$
1862	$62\frac{1}{8}$	61	$61\frac{7}{16}$
1863	$61\frac{3}{4}$	61	$61\frac{3}{8}$
1864	$62\frac{1}{2}$	$60\frac{5}{8}$	$61\frac{3}{8}$
1865	$61\frac{5}{8}$	$60\frac{1}{2}$	$61\frac{1}{16}$
1866	$62\frac{1}{4}$	$60\frac{3}{8}$	$61\frac{1}{8}$
1867	$61\frac{1}{4}$	$60\frac{3}{8}$	$60\frac{9}{16}$
1868	$61\frac{1}{8}$	$60\frac{1}{8}$	$60\frac{1}{2}$
1869	61	60	$60\frac{7}{16}$
1870	$60\frac{3}{4}$	$60\frac{1}{4}$	$60\frac{9}{16}$
1871	61	$60\frac{3}{16}$	$60\frac{1}{2}$
1872	$61\frac{1}{8}$	$59\frac{1}{4}$	$60\frac{5}{16}$
1873	$59\frac{15}{16}$	$57\frac{7}{8}$	$59\frac{3}{16}$
1874	$59\frac{1}{2}$	$57\frac{1}{4}$	$58\frac{5}{16}$
1875	$57\frac{5}{8}$	$55\frac{1}{2}$	$56\frac{11}{16}$
1876	$58\frac{1}{2}$	$46\frac{3}{4}$	$52\frac{3}{4}$
1877	$58\frac{1}{4}$	$53\frac{1}{4}$	$54\frac{13}{16}$
1878	$55\frac{1}{4}$	$49\frac{1}{2}$	$52\frac{9}{16}$
1879	$53\frac{3}{4}$	$58\frac{7}{8}$	$51\frac{1}{4}$
1880	$52\frac{13}{16}$	$51\frac{1}{2}$	$52\frac{1}{4}$
1881	$52\frac{7}{8}$	$50\frac{7}{8}$	$51\frac{11}{16}$
1882	$52\frac{3}{8}$	50	$51\frac{5}{8}$
1883	$51\frac{3}{16}$	$50\frac{1}{16}$	$50\frac{9}{16}$
1884	$51\frac{3}{8}$	$49\frac{1}{2}$	$50\frac{11}{16}$
1885	50	$46\frac{7}{8}$	$48\frac{9}{16}$
1886	47	42	$45\frac{3}{8}$
1887	$47\frac{1}{8}$	$43\frac{1}{4}$	$44\frac{11}{16}$
1888	$44\frac{9}{16}$	$41\frac{5}{8}$	$42\frac{7}{8}$
1889	$44\frac{3}{8}$	$41\frac{15}{16}$	$42\frac{11}{16}$
1890	$54\frac{5}{8}$	$43\frac{5}{8}$	$47\frac{3}{4}$
1891	$48\frac{3}{4}$	$43\frac{1}{2}$	$45\frac{1}{16}$
1892	$43\frac{3}{4}$	$37\frac{7}{8}$	$39\frac{3}{4}$
1893	$38\frac{3}{4}$	$30\frac{1}{2}$	$35\frac{9}{16}$
1894	$31\frac{3}{4}$	27	$28\frac{15}{16}$
1895	$31\frac{3}{8}$	$27\frac{3}{16}$	$29\frac{13}{16}$
1896	$31\frac{15}{16}$	$29\frac{3}{4}$	$30\frac{13}{16}$
1897	$29\frac{13}{16}$	$23\frac{5}{8}$	$27\frac{9}{16}$
1898	$28\frac{3}{8}$	25	$26\frac{15}{16}$
1899	29	$26\frac{5}{8}$	$27\frac{7}{16}$
1900	$30\frac{1}{4}$	27	$28\frac{5}{16}$
1901	$29\frac{9}{16}$	$24\frac{15}{16}$	$27\frac{3}{16}$
1902	$26\frac{1}{16}$	$21\frac{11}{16}$	$24\frac{1}{16}$
1903	$28\frac{1}{2}$	$21\frac{11}{16}$	$24\frac{3}{4}$
1904	$28\frac{9}{16}$	$24\frac{7}{16}$	$26\frac{13}{32}$
1905	$30\frac{5}{16}$	$25\frac{7}{16}$	$27\frac{13}{16}$
1906	$33\frac{1}{8}$	29	$30\frac{7}{8}$
1907	$32\frac{7}{16}$	$24\frac{1}{4}$	$30\frac{3}{16}$
1908	27	22	$24\frac{13}{32}$
1909	$24\frac{7}{8}$	$23\frac{1}{16}$	$23\frac{23}{32}$
1910	$26\frac{1}{4}$	$23\frac{3}{16}$	$24\frac{21}{32}$
1911	$26\frac{1}{8}$	$23\frac{11}{16}$	$24\frac{19}{32}$
1912	$29\frac{11}{16}$	$25\frac{1}{8}$	$28\frac{1}{16}$
1913	$29\frac{3}{8}$	$26\frac{1}{16}$	$27\frac{9}{16}$
1914	$27\frac{1}{4}$	$22\frac{1}{8}$	$25\frac{1}{4}$
1915	$27\frac{1}{4}$	$22\frac{5}{16}$	$23\frac{5}{8}$
1916	$37\frac{1}{8}$	$26\frac{11}{16}$	$31\frac{3}{8}$
1917	55	$35\frac{11}{16}$	$40\frac{13}{16}$
1918	$49\frac{1}{2}$	$42\frac{1}{2}$	$47\frac{17}{32}$
1919	$79\frac{1}{8}$	$47\frac{3}{4}$	$57\frac{1}{32}$
1920	$89\frac{1}{2}$	$38\frac{7}{8}$	$61\frac{19}{32}$

(W. E. P.)

SIMON, SIR JOHN ALLSEBROOK (1873–), British politician and lawyer, the son of a Congregational minister, was educated at Fettes, and at Wadham College, Oxford, where he was a scholar and was eventually elected an hon. fellow. He became pres. of the Union in 1896, and took a first-class in *Lit. Hum.* in the same year, being subsequently elected fellow of All Souls. He went to the bar, became Barstow Law scholar in 1898, and was called in 1899. His manifest abilities and the persuasiveness of his advocacy soon brought him into notice; he was chosen one of the counsel for the British Government in the arbitration on the Alaska Boundary in 1903; and he rapidly attained so considerable a practice that he was able to take silk in 1908. Meanwhile he had gone into politics, and was elected as an advanced Liberal for Walthamstow at the general election of 1906. At first, probably owing to his absorption in his legal work, he did not command nearly so much attention in Parliament as his Wadham contemporary and fellow-lawyer, Mr. F. E. Smith (afterwards Lord Birkenhead). But he gradually made his way, and was appointed by Mr. Asquith solicitor-general in 1910, and Attorney-General with a seat in the Cabinet in 1913. On the outbreak of war in 1914, his resignation, along with those of Lord Morley and Mr. Burns, was confidently expected; but he finally decided to remain with his chief and the bulk of his colleagues. When the first war Coalition Government was formed in May 1915, he was offered the lord chancellorship, but he declined the greatest prize of his profession as he preferred a political career in the Commons. Accordingly he accepted the home secretaryship, and gave up his legal practice, by means of which he had acquired a comfortable fortune. Early, however, in the following year, owing to his inability to accept the Government bill for compulsory military service, he resigned his office and led a fruitless opposition to the measure in the House; and then went out to the front in France as a major in the R.A.F. He subsequently resumed practice as a barrister, and immediately regained his position in the front rank of his profession. On the break between Mr. Asquith and Mr. Lloyd George, Sir John Simon adhered to the former. He lost his seat in Parliament at the general election in Dec. 1918, subsequently taking an active part in political work outside the House in the interests of the Independent Liberals. He was twice married—in 1899 to Ethel M. Venables, who died in 1902, leaving a son and two daughters, and in 1917 to Kathleen Manning.

SIMS, WILLIAM SOWDEN (1858–   ), American naval officer, was born at Port Hope, Ont., Canada, Oct. 15 1858. In childhood he removed to Pennsylvania and was graduated from the U.S. Naval Academy in 1880. Then for eight years he served on board various ships in the N. Atlantic. During 1889–93 he was with the nautical school ship "Saratoga," and then was transferred to the Pacific Station, and later to the China Station. From 1897 to 1900 he was naval attaché to the American embassy, first at Paris and afterwards at St. Petersburg. In 1900 he returned to the Pacific Station. Convinced of the inadequacy of American methods of target practice Lieutenant Sims wrote numerous letters to the Washington officials urging changes. Meeting with no response he finally addressed a personal letter to President Roosevelt, which led to his recall to Washington. In the end he was enabled to arrange for a gunnery test and proved his claims. In 1902 he was assigned to the Bureau of Navigation, serving for the next seven years as inspector of target practice, which was remarkably improved under his guidance. Meanwhile in 1907 he was made commander and appointed naval *aide* to President Roosevelt. With this rank he was placed in charge of the battleship "Minnesota" in 1909. The following year, during a visit of the Atlantic Fleet to England, Commander Sims caused a stir by certain indiscreet remarks made at a dinner at the Guildhall, London, where he said: "Speaking for myself, I believe that if the time ever comes when the British Empire is menaced by an external enemy, you may count upon every man, every drop of blood, every ship, and every dollar of your kindred across the sea." A semi-official protest against this utterance was made at Washington by the German Government, which took offence at it, and there was some talk of Sims being dismissed from the service, but the incident ended in a severe reprimand from the Secretary of the Navy. In 1911 he was promoted captain and for two years was a member of the staff of the Naval War College, Newport, R.I. During 1913–5 he was in command of the Atlantic Torpedo Flotilla and then returned to Newport as president of the Naval War College. When America entered the World War in April 1917 he was chosen to command American naval operations in Europe. In Jan. he had been promoted rear-admiral, and early in April, when war was imminent but before its formal declaration, he sailed in disguise to England in a merchant vessel. In May he was made vice-admiral. In 1916 he had urged construction of battle cruisers, arguing their supremacy over submarines as shown in the battle of Jutland. In his book *The Victory at Sea* (1920, in conjunction with Burton J. Hendrick) he shows how the convoy system, used in transporting 2,000,000 American troops, frustrated the submarines. In 1919 he criticised the manner in which naval honours had been awarded; in particular, he held that "the commanding officer of a vessel that is sunk by a submarine should not receive the same reward as the commanding officer of a vessel which sinks a submarine." This criticism was obviously directed against the Secretary of the Navy for having decorated his own son-in-law, whose boat was sunk. He himself refused the D.S.M. In 1920 he made a formal report to the U.S. Senate, and charged the U.S. Naval Board with serious errors in the conduct of naval operations during the war. His English sympathies and his admiration for the British navy were openly expressed—too openly for the liking of some of his critics.

SINCLAIR, MAY (–   ), English author, was born at Rock Ferry, Cheshire, and educated at the Ladies' College, Cheltenham. She began her career by writing verse and philosophical criticism. In 1895 she published her first short story, followed in 1896 by her first novel *Audrey Craven*. *Mr. and Mrs. Neville Tyson* appeared in 1898 and *Two Sides of a Question* in 1900. But it was not until she published *The Divine Fire* in 1904 that she became widely known. It was followed by *The Helpmate* (1907); *Kitty Tailleur* (1908); *The Creators* (1910); *The Combined Maze* (1913); *The Three Sisters* (1914); *Tasker Jevons* (1916); *The Tree of Heaven* (1917); *Mary Olivier* (1919) and *The Romantic* (1920), as well as one or two volumes of short stories. In *A Defence of Idealism* (1917) Miss Sinclair published acute criticisms of modern philosophic theories, and in a *Journal of Impressions in Belgium* (1915) she gave her experiences in the autumn of 1914 as a member of an advance field ambulance.

SINHA, SATYENDRA PRASSANO, 1st Baron (1864–   ), Indian statesman, was born of an ancient Kayastha family in the village of Raipur, Birbhum district, Bengal, in June 1864. Matriculating at 14 he held a scholarship at the Presidency College, Calcutta, and in 1881 came to London to join Lincoln's Inn, where he won many prizes and scholarships, and was called to the bar in June 1886. In practice at Calcutta he rapidly rose to a leading position, and was appointed standing counsel to the Government of India in 1903. He was the first Indian to be appointed advocate-general of Bengal (1908), and the first to become a member of the Government of India. He held the law portfolio from April 1909 to Nov. 1910, up to the retirement from the viceroyalty of Lord Minto, who testified to the success of what some English critics regarded as a dangerous experiment. Sinha resumed his lucrative practice at the bar, presided at the Indian National Congress session at Bombay in 1915, and was again appointed advocate-general of Bengal (1916). He and the Maharaja of Bikaner were the first Indians to participate in Empire deliberations in London, for in 1917 they jointly assisted the Secretary of State at the meetings of the Imperial War Cabinet, and were members of the Imperial War Conference. Sinha joined the Bengal Executive Council in the same year, but returned to England in 1918 as a member of the Imperial War Cabinet and Imperial War Conference. Immediately on getting back to India he was called to London and Paris as an Indian member of the Peace Conference. Knighted in 1915, in 1918 he was made K.C., a distinction not previously conferred upon a barrister of Indian birth or practice. When the Coalition Government was recast at the beginning of 1919 he established further records for an Indian by being appointed to the Ministry as Under-Secretary for India, and being raised to the peerage as Baron Sinha of Raipur. He was the second Indian to be sworn of the Privy Council. He skilfully conducted the Government of India Act, 1919, through the House of Lords, and when dyarchy was initiated at the close of 1920 was appointed governor of Bihar and Orissa, being the first Indian to preside over a British province.

SINN FEIN: *see* IRELAND: *Political History.*

SKEAT, WALTER WILLIAM (1835–1912), English author (*see* 25.168), died at Cambridge Oct. 6 1912.

SLATIN, SIR RUDOLF CARL VON (1857–), Anglo-Austrian soldier and administrator in the Sudan (*see* 25.212). For his capable and gallant services in the Sudan Slatin Pasha had been created K.C.M.G. and had received the thanks of both Houses of Parliament in 1899. In 1906 he was created a baron of the Austrian Empire and was made an Austrian privy councillor in 1904. The same year he married Baroness Alice von Ramberg of Vienna (d. 1921). In 1912 he received the G.C.V.O. from H.M. King George. On the outbreak of the World War, Slatin, who was on leave in Vienna, was prevented, by the Austrian mobilization, from returning to his appointment in the Sudan, and in this difficult position he voluntarily took up work as head of the Austrian Red Cross, and in charge of prisoners-of-war, and would accept no remuneration for his services. In this capacity he did much to ameliorate the conditions of imprisonment, and was largely responsible for the humane treatment of the Allied soldiers in Austrian hands. The German Government (through Bethmann Hollweg) offered him a high post which he refused. Subsequent to the signing of the Armistice, he was selected as a member of the Austrian delegation to discuss the terms of peace in Paris.

SMILLIE, ROBERT (1859–), British labour politician, was born in Belfast in 1859 of Scottish parents. He was sent to a primary school but left at the age of 14 years to work in a shipyard at Govan. Two years later he went into the mining industry of Lanarkshire and worked underground for 16 years. From 1878 onwards he was an active trade unionist, although in the earlier years of this period he was earning only 18s. 6d. a week. In 1890 he was elected paid organizer for the Larkhall district and owing to his activity the Lanarkshire Miners' Union soon reached a membership of 30,000. He took a prominent part in the formation of the Scottish Coal Trade Conciliation Board and its satisfactory results were largely attributable to his efforts. His abilities as a leader caused him to rise steadily from the chairmanship of the Scottish Trade Union Congress to the first presidency of the parliamentary committee of the Scottish Trade Union Congress and in 1894 he became permanent president of the Scottish Miners' Federation. In 1912 he was elected to the presidency of the Miners' Federation of Great Britain and the building up of this body has been the great work of his life. Politically his success has not been so great as on the industrial field and although he stood as a candidate for Parliament seven times he was never elected. His greatest poll was 3,847 in a three-cornered fight at Mid-Lanark in 1910. In 1885 he was elected a member of the district school board for Larkhall, a position which he filled for 20 years. His work on the Coal Industry Commission from March till June 1919 brought him into greater prominence, but he became very ill in Nov. 1919. In March 1920, as his health was no better, he tendered his resignation from the presidency of the Miners' Federation, but the Federation refused to accept it and gave him leave of absence instead. In March 1921 ill-health compelled him to resign from the Federation and retire from public life.

SMITH, ALFRED EMANUEL (1873–), American politician, was born in New York City, Dec. 30 1873. The son of humble parents, his father being a truck driver, he was educated in the St. James parochial school and for several years was employed in the Fulton Fish Market. He was very popular with his associates and at the age of 29 was offered the Democratic nomination for the N.Y. State Assembly by the Tammany leader of the district in which he lived. He was elected for 1903 and by reëlection served for 12 years. In 1911 he became Democratic leader in the Assembly and was appointed vice-chairman of the Factory Investigating Committee which made a searching inquiry into industrial conditions in the state, resulting in remedial legislation. In 1913 he was speaker of the Assembly. In 1915 he was chosen a delegate to the State Constitutional Convention, taking an active part in its proceedings. He opposed the constitution as finally revised, one reason being that it contained a provision designed to prevent New York City from having a majority of legislators. He "stumped" the state against its adoption and it was overwhelmingly rejected. The same year he was elected sheriff of New York county, then a lucrative post because of the system of fees (later abolished), and in 1917 president of the Board of Aldermen of New York City. In 1918 he was elected governor of New York, defeating Charles S. Whitman. As a member of the Assembly he had been a strong supporter of woman suffrage, and in June 1919, as governor, called a special session which ratified the woman suffrage amendment to the Federal Constitution. In 1920 he was again the Democratic nominee for governor, but was beaten in the overwhelming Republican landslide of that year; he lost, however, by only 73,000 votes, whereas the Democratic candidate for president was at the same time defeated by a million votes in New York state—a remarkable testimony to his own personal popularity.

SMITH, ALFRED HOLLAND (1863–), American railway official, was born in Cleveland, O., April 26 1863. He began work on the New York Central railway system as a messenger-boy in 1879. After serving as a foreman of construction and in various capacities in the engineering department, he was in 1890 appointed superintendent of the Kalamazoo division of the Lake Shore & Michigan Southern railway. He was successively division superintendent, assistant general superintendent and general superintendent of the Lake Shore road. In 1902 he became general superintendent of the New York Central railroad; in 1906 vice-president of the New York Central system; and in 1914 president. When the American railways were taken over by the U.S. Government Dec. 27 1917, he was appointed assistant director-general and it was he who worked out the form of central and regional administration under which the railways of the country were managed during the 26 months of Government operation. His aim, in which he succeeded, was to keep the management of the roads with their 2,000,000 employees, nearly all voters, in the hands of practical railway-men and, above all, out of politics. He divided the country into two regions and later into seven, each region being in charge of a railway officer of experience and reputation, he himself taking charge of the most important region, the Eastern. These regional directors had complete authority and only broad matters of policy and inter-regional questions were handled by the central (political) administration at Washington. In this way the railways were conducted throughout the war without great blunders or disorganization. On the completion of this important national service he was reëlected president of the New York Central Lines in June 1919. It was largely due to him that the New York Central Lines were greatly strengthened in operating efficiency and financial credit.

SMITH, FRANCIS HOPKINSON (1838–1915), American author, artist and engineer (*see* 25.260), died in New York City April 7 1915. His later writings included *Kennedy Square* (1911); *The Arm-Chair at the Inn* (1912); *Charcoals of New and Old New York* (1912); *In Thackeray's London* (1913) and *In Dickens' London* (1914).

SMITH, SIR GEORGE ADAM (1856–), British divine (*see* 25.261), was knighted in 1916, and from 1916 to 1917 was moderator of the general assembly of the United Free Church of Scotland. His later works include *The Early Poetry of Israel* (1912); *Atlas of the Historical Geography of the Holy Land* (with J. G. Bartholomew, 1914) and *Syria and the Holy Land* (1918).

SMITH, THEOBALD (1859–), American pathologist, was born at Albany, N.Y., July 31 1859. He was educated at Cornell (Ph.B. 1881) and at the Albany Medical College (M.D. 1883). In 1884 he was appointed director of the pathological laboratory of the Bureau of Animal Industry, in Washington, where for 11 years he investigated infectious animal diseases. At the same time he was professor of bacteriology at Columbian, later known as George Washington, University. From 1895 to 1915 he was director of the pathological laboratory of the Massachusetts State Board of Health, and after 1896 was professor of comparative pathology at Harvard. In 1915 he was appointed director of the department of animal pathology of the Rockefeller Institute for Medical Research, New York. He made important contributions to the relation between human and bovine tuberculosis.

His numerous scientific papers include *Investigations into the Nature, Causation, and Prevention of Texas or Southern Cattle Fever* (1893); *Investigations Concerning Bovine Tuberculosis with Special Reference to Diagnosis and Prevention* (1894); *Investigations of Diseases of Domesticated Animals* (1897); *The Agglutinative Affinities of Related Bacteria Parasitic in Different Hosts* (1903) and *Certain Aspects of Natural and Acquired Resistance to Tuberculosis and Their Bearing on Preventive Measures* (1916).

SMITH COLLEGE (*see* 25.273).—Between 1910 and 1921 Smith College added to its equipment Burton Hall for biology, and the number of dwelling houses for students increased from 16 to 33. The library in 1920 contained 82,000 volumes and the Hillyer Art Gallery had increased its endowment to $100,000 and added largely to its collections. The college abandoned the system of admission by certificate and all students enter by examination. In 1919–20 there were 181 teachers and 2,001 students, of whom 31 were graduate students, and the endowment was $3,157,000, the total assets being over $6,000,000. A campaign for increased endowment was carried on in 1920, with the result that, when the promises were realized, the assets of the college would be over $9,000,000. The college publishes, besides its permanent bulletin, the *Smith College Studies* in history, modern languages and classics, and contributions of the department of biology. President Seelye was succeeded in 1910 by Marion LeRoy Burton (b. 1874), a graduate of Carleton College, Northfield, Minn., and Yale Divinity School, who resigned in 1917 and was succeeded by William Allan Neilson (b. 1869), a graduate of Edinburgh and Harvard Universities. In the World War the Smith College Relief Unit, the pioneer among American college women's units overseas, worked in 16 villages in the Somme, France, affiliated with the American Fund for French Wounded, and later with the Red Cross, from July 1917 until April 1920, with the exception of the period after the retreat of March 1918 until the following Jan., when the unit operated clubs and canteens and assisted in the hospitals at Beauvais and later behind the American front at Château-Thierry, at Nancy, and in the Argonne. A small group of the Relief Unit worked with the refugees at Orléans in the autumn of 1918. Three Smith Canteen Units were organized and operated under the Y.M.C.A. in France. Another small group worked as a Smith Unit with the Near East Relief in Armenia.

(W. A. N.)

SMITH-DORRIEN, SIR HORACE LOCKWOOD (1858–), British general, was born May 26 1858. He joined the army in 1876, took part in the Zulu war and in the Egyptian campaign of 1882 and, attached to the Egyptian army, served at Suakin in 1884 and afterwards on the Nile in 1885–6, for which he was given the D.S.O. He took part in the Tirah campaign of 1897–8 and, showing conspicuous skill in handling troops, was rewarded with a brevet lieutenant-colonelcy. Immediately afterwards he was summoned to the Sudan to take part in the final advance to Khartum; for this he was promoted brevet colonel. He went out to the Cape in command of his regiment in 1899 and was shortly afterwards given a brigade and promoted major-general; he remained in the field in S. Africa, taking part in numerous operations, until the end of 1901, when he was appointed adjutant-general in India. From 1903 to 1907 he acted, first as a district, and afterwards as a divisional commander, being promoted lieutenant-general in 1906. He was then brought home to take up the command at Aldershot, an appointment which he filled with marked success until 1912, when he was transferred to the Southern Command; he was promoted general that year.

On the death of Gen. Grierson in Aug. 1914 while the Expeditionary Force was still assembling in France, Sir H. Smith-Dorrien (who had been given the G.C.B. in 1913) was appointed commander of the II. Army Corps. At Mons, and during the subsequent retreat, the brunt of the enemy's onsets fell upon his troops, and when hard pressed near Le Cateau he found himself obliged to halt and to give battle; by his resolute action he effectually checked pursuit, although his losses were somewhat heavy. He subsequently commanded his corps at the battle of the Marne, on the Aisne, and during the severe fighting in Flanders in Oct. and Nov. On the splitting up of the Expeditionary Force into two armies he was appointed to the command of the II., receiving the G.C.M.G. for his services. This position he occupied until April 1915, when he returned to England and was placed in charge of one of the Home Defence armies. In the following Nov. he was chosen to take charge of the operations against German East Africa, but he fell ill on the voyage out, was unable to take up the command, and had to return home. He was appointed lieutenant of the Tower in 1917 and in 1918 became governor and commander-in-chief at Gibraltar.

SMOOT, REED (1862–), American politician, was born at Salt Lake City, Utah, Jan. 10 1862. He was educated in his native town and at the Brigham Young Academy, Provo, Utah. He amassed considerable wealth as a banker and woollen manufacturer. In 1895 he was appointed one of the presidency of the Utah Stake of the Church of Jesus Christ of Latter Day Saints (Mormon), and in 1900 was made an apostle. He was elected to the U.S. Senate from Utah in 1902 and reëlected in 1908, 1914, and 1920. In 1903 attempts were made to prevent his entering the Senate because of his connexion with the Mormon church, and on the charge that he personally favoured polygamy and even that he himself was a polygamist. He was allowed to take his seat; but the matter was placed in the hands of the Senate Committee on Privileges and Elections for further investigation. In June 1906 the Committee by a vote of 7 to 5 recommended that he be unseated; but as the personal charges against him had not been proved the Senate in Feb. 1907 by a vote of 42 to 23 refused to remove him. In 1919 he was chairman of the Republican Senatorial Campaign Committee. In 1921 he was a leading advocate of the adoption of a sales-tax, but failed to obtain its acceptance by the Senate, though the movement was widely favoured in business circles.

SMUTS, JAN CHRISTIAN (1870–), S. African statesman, of Dutch descent, was born at Cape Town in 1870, the son of J. A. Smuts, member of the Legislative Assembly for Malmesbury, Cape Colony. He was educated at the Victoria College, Stellenbosch, at the Cape University, and then went to Christ's College, Cambridge, where he took a "double first" in the Law Tripos in 1894. In 1895 he returned to Cape Town and practised as an advocate of the Supreme Court of the Cape till the end of 1896, when he went to Johannesburg to practise as an advocate there. The rapidity of his success is shown by his appointment as State Attorney to the Transvaal Republic in 1898. Thus before he was 30 his remarkable ability was acknowledged and, though he was opposed to the policy of President Kruger, his hand is to be recognized in the State documents of the Transvaal during the critical period which ended in the sending of the ultimatum to Great Britain and the outbreak of the S. African War of 1899–1902. During that war Smuts served throughout with Boer forces, rising during its latter period to the rank of general, and to the authority among his own people of one who had shown the possession of gifts as a leader in the field as brilliant as those which he was known to possess in the realm of the law. Thus when the negotiations for peace began Smuts stood out as one of the recognized Boer leaders.

With Gen. Botha, he threw his influence during the negotiations into the scale for peace, and when, in 1907, responsible government was granted to the Transvaal, Smuts became the right-hand of Gen. Botha, the first Prime Minister of the Transvaal, in the Ministry which he then formed. As colonial secretary the bulk of the administrative work of the new Ministry fell to him, and his success as an administrator was then proved beyond subsequent doubt. He brought to his task an intellect of the first calibre—keen, quick, penetrating. His industry was untiring. Already a man of the world, he commanded the admiring devotion of his subordinates. These gifts would have secured for Smuts a position of great influence in any Ministry. They were no more than one of Smuts' many claims to such a position in the Botha Cabinet. He showed at once that he had high parliamentary ability. His rapid brain made him a master in debate. The complexities of legislation had no difficulties for him. His mind had a natural bent towards compromise on unimportant points, and he showed again and again an almost uncanny gift for producing at a moment's notice the form of words that would give body to such compromises. His loyalty to, and affection for, Gen. Botha strengthened an influence thus already very strong, and when in 1909 the S. African National Convention met to draft an instrument for the union of the four S. African colonies, Smuts went to it as a delegate from the Transvaal with a reputation for ability and capacity second to that of no other delegate. High as it was, this reputation was enhanced by his work at the Convention. He had gathered round him a staff of experts, had thought out a scheme of union, had worked out its details, was prepared to put this framework before the first meeting. Such foresight had its reward, the more because it was buttressed during the debates of the Convention by the same readiness in debate, the same clear recognition of essentials, the same natural disposition towards compromise on details, and the same quickness in producing verbal formulae, as Smuts had already shown in the Transvaal Parliament.

When union was accomplished Smuts became for S. Africa what he had been for the Transvaal—the right-hand of Gen. Botha, the first Prime Minister of the Union. His success, both administrative and parliamentary, in the Transvaal was repeated as a minister of the Union. As Minister of the Interior, of Mines, and of Defence, he bore the lion's share of the early administrative work of the Union. His Defence Act, passed in 1912, was a model of organization, and the speech in which he moved its second reading in the Union House of Assembly established his reputation throughout S. Africa.

Thus on the outbreak of the World War in 1914, when Gen. Botha declared for the most loyal support of the British Government, the bulk of the burden of organizing the military forces of the Union fell upon Smuts. It was sustained with complete success. The expedition against German S.W. Africa, and the crushing of the rebellion in the Union in 1914, both bore testimony to his capacity as an organizer of victory. He took command of the Union columns invading German S.W. Africa from the S. and carried through that part of the campaign with great boldness of strategy and complete success. Then Botha and Smuts turned to other fields of war. Expeditionary forces were organized against German E. Africa and to take part with the Allies in the fighting on the western front in Europe. In Feb. 1916 Smuts was appointed by the British Government commander-in-chief of the Imperial forces operating in German E. Africa. He had been offered the appointment in Nov. 1915, but had then declined. When he took command, the operations against German E. Africa had reached a state of stalemate. He conducted his campaign with great vigour, exacting from his troops heavy sacrifices of long marching in that trying climate, and before the end of 1916 he had reduced the German forces to the position of fugitive bands. Then another duty called him away from E. Africa. At the end of 1916 Mr. Lloyd George became Prime Minister of Great Britain and at once summoned the Imperial War Cabinet. General Smuts went to it as the representative of S. Africa. So useful did he prove himself to be in that position that he became the only permanent Dominion member of the Imperial War Cabinet. With Botha he represented S. Africa at the Peace Conference in Paris, and returned to S. Africa after peace was signed, only to lose Botha almost immediately and to find himself, by the sudden death of his leader and close friend, Prime Minister of the Union in Sept. 1919.

The political position in S. Africa was menacing. The Nationalist agitation, led by Gen. Hertzog, had grown among the Dutch-speaking people during the war. Resentment at being involved in the quarrels of Europe had fed it. The old passion of the Dutch of S. Africa for peaceful isolation had revived in full strength. Smuts speedily made up his mind that the sense of the country must be tested by a general election. It took place in the spring of 1920 and left Smuts and his party without the semblance of a clear majority in Parliament. Smuts held office by the grace of the Unionists. He had no doubt as to the needs of his position. S. Africa required an established Government; it must be formed by combination between his followers and one of the other parties. His natural impulse was for reconciliation with the Nationalists, and he sought reconciliation with them, but on one clear condition. They must repudiate their Republican aims; and S. Africa must remain willingly a state of the British group of nations. This condition the Nationalists refused. Then Smuts turned to the Unionists, who throughout the war had supported the Botha Ministry as the one safeguard of membership for the S. African state of the British Commonwealth of Nations. With ready self-sacrifice the Unionists accepted his invitation. The two parties were joined into one, the Unionists becoming members of the S. African party, which had been Botha's party and was now led by Smuts. The general election of March 1921 followed, and gave the new party a decisive victory at the polls and a clear and substantial majority in the Parliament of the Union. (B. K. L.)

SMYTH, ETHEL (1858–), English musical composer, was born in London on April 23 1858, the daughter of Gen. J. H. Smyth. She began her musical studies at Leipzig in 1877, becoming a pupil of Heinrich von Herzogenberg, then conductor of the Bach Verein, whose wife was an intimate friend of Johannes Brahms. She was thus thrown from the first into a highly intellectual musical society. Her earliest works, principally chamber music, were performed at Leipzig; her first orchestral works being produced by (Sir) August Manns at the Crystal Palace concerts and the symphony concerts started in 1886 by (Sir) George Henschel. She also produced a Mass, performed in 1893 at the Albert Hall. Subsequently she turned her attention to opera, her first work in this direction being *Fantasio*, based upon a book by De Musset (produced at Weimar 1898 and revived at Karlsruhe 1901). This was followed by *Der Wald*, produced at Dresden in 1901 and at Covent Garden, London, in 1902, and New York 1903; and *The Wreckers*, produced under the title "Strandrecht" at Leipzig and Prague in 1906, at His Majesty's theatre, London, in 1909, and at Covent Garden in 1910. Her opera, *The Boatswain's Mate*, written for a German theatre, but, owing to the war, not produced there, was produced in London in 1915, and was revived in 1918 and met with considerable success. She also published in 1907 a series of songs with instrumental accompaniment, and in 1913 four orchestral songs. Miss Smyth, who received the degree of Mus. Doc. from Durham University in 1910, became known as a leading militant suffragette, and, besides other music written for the cause, produced *The March of the Women* (1911). In 1919 she published two volumes of brightly written autobiography and reminiscences under the title *Impressions that Remained*, and in 1921 another book, *Streaks of Life*. On Jan. 1 1922 she was created D.B.E.

SMYTH, HERBERT WEIR (1857–), American classical scholar, was born at Wilmington, Del., Aug. 8 1857. He was educated at Swarthmore (A.B. 1876), Harvard (A.B. 1878), Leipzig, and Göttingen (Ph.D. 1884). During 1883–5 he was instructor in Greek and Sanskrit at Williams College, and then for two years was reader in Greek at Johns Hopkins. From 1887 to 1901 he was professor of Greek at Bryn Mawr. In the latter year he was called to Harvard as professor of Greek and in 1902 was appointed Eliot professor of Greek literature, succeeding William Watson Goodwin. During 1899–1900 he was professor of the Greek language and literature at the American Classical School at Athens. From 1889 to 1904 he was secretary of the American Philological Association and editor of its *Transactions* and in 1904 was elected president. He became a fellow of the American Academy of Arts and Sciences, a member of the American Philosophical Society and vice-president of the Egypt Exploration Society.

His works include *The Sacred Literature of the Jains* (1894, a translation); *The Ionic Dialect* (1894); *Greek Melic Poets* (1900); *Greek Grammar for Schools and Colleges* (1915); *Greek Grammar for Colleges* (1920). He was also author of *The Greek Language in its Relation to the Psychology of the Ancient Greeks* (read before the Congress of Arts and Sciences at the St. Louis Exposition in 1904); "Aspects of Greek Conservatism" (in *Harvard Studies in Classical Philology*, 1906); "Greek Conceptions of Immortality from Homer to Plato" (in *Harvard Essays on Classical Subjects*, 1912) and various contributions to philological journals. He was editor of the *Greek Series for Colleges and Schools* (20 vols.).

SNOWDEN, PHILLIP (1864–), British Labour politician, was born at Cowling, Yorks, July 18 1864. He was educated partly privately and partly at a board school, and in 1886 entered the Civil Service. In 1893 he retired, and devoted himself to journalism and lecturing, becoming well known for his ardent advocacy of extreme socialistic views. He unsuccessfully contested Blackburn in 1900 and Wakefield in 1902, and in 1903 he became chairman of the Independent Labour party. He held this position until 1906, and in that year was returned as Socialist member for Blackburn. He sat on various royal commissions, including those on the Civil Service and Venereal Diseases, and from 1917 to 1919 was again chairman of the Independent Labour party. Mr. Snowden made himself extremely unpopular during the World War owing to his pacifist opinions, and was one of the Socialist members of Parliament who lost their seats at the general election of 1918. He had married in 1905 Miss Ethel Annikin, who became well known as a speaker and writer on social subjects. In 1920 she went to Russia as a member of one of the various Labour delegations invited to inspect Soviet conditions of government. She published on her return an account of her experiences, under the title of *Through Bolshevik Russia* (1920).

SOCIALISM (*see* 25.301*).—Socialism is at once a theory, or rather a whole body of theories, and a movement, or rather a number of movements more or less closely connected. The name has been used during the past century to describe many different social theories, in all of which a common character has been perceived. In recent times it has come to be used less with reference to any definite theory than for the purpose of describing the movements in various countries which have adopted the name or have declared their adhesion to Socialism. It is thus possible, in setting out to give a summary account of Socialism, to describe it either by its connotation, that is to say, in terms of the ideas for which it stands, or by its denotation, that is, in terms of the groups and parties which profess allegiance to it. But neither of these methods of description is by itself satisfactory, nor is it possible by either, or even by a combination of both, to arrive at a satisfactory or adequate definition of Socialism. The word is used, and has been used increasingly in recent years, in a number of different and frequently overlapping senses. It has changed its meaning with time: but the changes have not served to clarify it, but rather to increase the number of different senses in which the term is used.

It would be well to begin by ruling altogether out from the scope of this article certain popular uses of the term which have been current especially during the past generation. The well-known phrase, "We are all Socialists now," and the constant references to "socialistic legislation," only serve to obscure the real meanings which attach to the word. When it is said that, "We are all Socialists now," all that is meant is that everybody nowadays is prepared to agree that a greater measure of governmental intervention both in industry and in the affairs of society generally is necessary than was currently regarded as necessary or even possible 100 years ago.

The phrase "socialistic legislation" again is frequently used to cover almost any extension of governmental activity in the sphere either of industry or of provision under the State or under local government auspices for the needs of the people. The phrase "socialistic taxation" is used, with a greater approximation to accuracy, in reference to those forms of taxation which aim not merely at producing revenue for the public authorities, but at bringing about an actual readjustment in the distribution of income in the community, arrived at by the unregulated operation of capitalist economic forces. Again, almost any extension in the sphere of local government action, such as the taking over of a tramway system or the establishment of banking or insurance facilities by a local authority, is frequently referred to as "municipal socialism," even if the public body which inaugurates this policy does not consist of members who profess any allegiance to, or have any sympathy with, the doctrines of any Socialist party or group. All these and similar uses of the word "Socialism" are here ruled out of consideration.

The word "Socialism" first came into use in the third or fourth decade of the 19th century in England and France. The first-known literary reference to it occurs in the "Poor Man's Guardian" in 1833; but it is believed that the word was occasionally used at an earlier date in both France and England. In Great Britain it was most frequently used during the first half of the 19th century in reference to the doctrines associated with the name of Robert Owen and his disciples, and to the theories of the anti-capitalist economists, such as W. Thompson, who were largely affected by Owenite teaching. In France the name similarly attached itself to the doctrines of thinkers of whom the most important were followers of St. Simon and Fourier. Its use then spread much more rapidly on the continent of Europe than in Great Britain, and it was mainly in connexion with the growth of continental Socialist movements (Louis Blanc in 1848; the First International Working Men's Association in the 'sixties and the Paris Commune of 1871) that it was used by English writers, until it was reimported into Great Britain as the name applied to a constructive body of doctrines in the early 'eighties, especially under the auspices of H. M. Hyndman and the Democratic Federation (subsequently the Social Democrat Federation).

It is important to realize that in all its modern meanings the word "Socialism" refers definitely to doctrines and movements which owe their rise to the growth of large-scale production and the capitalist system in industry. It is, indeed, sometimes applied to theories and Utopian speculations, such as those of Sir Thomas More, which have no direct reference to any particular stage of social evolution and are merely attempts to outline the structure of an ideal commonwealth. But, although such Utopias as those of Plato and More may present features of resemblance to the doctrines of modern Socialism, there is no real connexion between these and the theories or attitudes towards property which are sometimes comprehended under the terms "mediaeval Socialism" and "mediaeval Communism." Socialism, as a body of doctrine and as a movement applicable to modern conditions—and these are the senses of the term which matter to the student—made its appearance when the changes in methods of production and transport, which are usually described as the "Industrial Revolution," had created the modern working class or "proletariat," and had caused this class to make the attempt to organize for common protection against the the evil effects of new industrial conditions.

Modern Socialism, although it has claimed many adherents belonging to other classes, is thus essentially a working-class or "proletarian" movement, in that it is based upon and directly due to the rise of the "proletariat" as a distinct social class capable of independent class organization and suffering under a sense of injustice and inhibition. The Socialism of the Owenite period serves in certain respects very clearly to reveal this essential character of the movement. Owen himself has indeed been described by subsequent social thinkers—by Marx, for example—as a "Utopian" Socialist; but the rise of the Owenite movement is very clearly and directly traceable to the actual economic conditions of the early 19th century. It was out of his experience as a factory manager and owner at New Lanark and elsewhere that Owen developed his Socialist doctrines; and, in the minds of most of his followers even more than Owen himself, these doctrines possessed always a close and definite relation to the rise of the working class to social consciousness and to the possibility of social power. Thus, while Owen was expounding his doctrine of ideal Coöperative or Socialist communities, and endeavouring to demonstrate by practical experiment possibilities of achieving Socialism by the foundation of such communities in the midst of a rapidly developing capitalist environment, many of those who were most affected by his doctrines were engaged either, as economists, in developing their critique of the current economic theories based on capitalism, or, as leaders in the new-born working-class movement, in endeavouring to organize the "proletariat" for the winning of control over industry and over the machinery of Society. The Grand National Consolidated Trades Union, in which Owenite ideas played so large a part, was organized by men who were aiming not merely at the protection of the working class in face of the adverse conditions created by the new factory system, but at a definite transformation of the industrial order and the winning of control over industry for the "productive classes." This aim was even more clearly defined in the other great "Owenite" union of the period, the Builder's Union, and its abortive plan of 1833 for the formation of a Grand National Gild of Builders. The Chartist movement, which was largely influenced by Owenite and Socialist ideas, was definitely aiming at the conquest of political power by the organized working class with a view to social transformation.

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* *These figures indicate the volume and page number of the previous article.*

Socialism in Great Britain thus came into existence as: (1) a challenge to the orthodox economic theories of Ricardo and other writers; and (2) an attempt to win power in Society for the organized working class. It was, however, left for later thinkers, and above all for Karl Marx (1818–83), to take up where they had been dropped by the original English pioneers both the anti-capitalist economic teachings and the endeavour to build up the working-class movement into a constructive force aiming at the transformation of the social order. The Socialism of Karl Marx is frequently contrasted with the Socialism of previous thinkers as being "scientific," whereas their Socialism was "Utopian." But, in fact, Marx's Socialism was very largely based upon that of the earlier thinkers and working-class leaders, although he for the first time formulated into a definite system the views and the policy which they had only suggested and sought after.

All modern Socialism, even that of the schools which repudiate or at least profess no allegiance to Marx, has been profoundly influenced by him. This applies even to those schools of Anarchist Communists and French and Italian Syndicalists who seem to have least in common with Marxian teaching; for, even in their case, many Marxian ideas have blended with the ideas which they have derived from other Socialist and *quasi*–Socialist thinkers, such as P. J. Proudhon; and, although they have interpreted the Marxian teaching differently, a great deal of it has found its way into their systems and policies.

Marx's first important contribution to Socialist thinking, *The Communist Manifesto* (1847), which was drafted jointly by him and Friedrich Engels, is generally recognized as the starting point of the modern Socialist movement. His *Das Kapital*, of which the first volume was published in 1867, is the working-out into a system of the most vital ideas originally presented in *The Communist Manifesto*. These works have, of course, been translated into practically all European languages, and their ideas have generally passed into the common stock of European Socialist thought. This has hitherto been true of Great Britain in a less degree than of any other important industrial country; but even English Socialism began in the 'eighties on an essentially Marxian foundation, and, although Marx fell into disfavour with British Socialists in the 'nineties and in the earlier years of the present century, there has recently been an important revival of the study of his works among the more radical section of the British working-class movement. In other countries the organized Socialist movement is in practically all cases definitely Marxian, and bases its thinking and its propaganda throughout on Marxian terminology and Marxian ideas. Thus we find that, as divergent currents have again and again appeared in European Socialism, the name of Marx and his fundamental conceptions have been invoked, for the purpose of justifying widely divergent policies and conceptions. During the past few years, for example, a great pamphleteering controversy has been proceeding between Nikolai Lenin on the one side and Karl Kautsky on the other, representing two very different tendencies in European Socialism. Each of these writers bases his contentions on an almost theological reverence for the words of Marx, and seeks to justify his position by copious quotations from Marx's books and manifestos.

In the criticism which has been directed against Marx by orthodox economists in many countries, attention has been paid mainly to his theory of value, and only in a considerably less degree to his theory of history. This is unfortunate; for there is no doubt that the theory of value has played a quite secondary part to the so-called "materialist conception of history" in the influence which Marx's teaching has exercised on the modern working-class movement. The theory of value, as it was presented by Marx, and his attempt to build a theoretical economic system on the idea of labour as the source of value and exploitation as consisting in the appropriation by a privileged class, the owners of the means of production, of the surplus value created by labour, was mainly a criticism and inversion, to suit Socialist ends, of the current economics of Marx's own day. Like Thompson and the earlier English economists to whom he owed so much, Marx took the Ricardian theory of value and drew from it conclusions by no means acceptable to orthodox economic theorists. Undoubtedly his ideas of "surplus value," and exploitation resulting from the individual appropriation of "surplus value," played an important part in creating the sense of injustice and oppression among the workers; but by themselves they would never have sufficed to give Marx his dominant position as the theorist of modern Socialism.

This position depends far more on his theory of history, the effect of which was to give to those members of the working class who encountered his teaching the sense of possessing a mission and of having on their side the great world forces of social transformation. Interpreting historical changes as the result of the operation of economic forces, Marx insisted that to each stage in the evolution of the means of production there corresponds an evolution in the forms of political society and in the class structure of society. The industrial system of the 19th century, he claimed, had called into existence a new social class, the propertyless, wage-earning "proletariat"; for, although there had been capitalists and wage-earners in earlier stages of social evolution, the economic structure of Society had not before been based upon the dominance of the capitalists as a class. Nor had the "proletariat" been called into existence as a class, confronting the possessing capitalists throughout the industrial system in all the countries of the world which had reached the capitalist phase. The next stage in social evolution, according to Marx, would be the rise to power of the "proletariat," and, just as the capitalists had risen to power and displaced or absorbed the privileged classes with which social authority had previously rested, so the "proletariat" under the system of large-scale industry would improve its organization and increase its strength until it was able to do battle with, and to overthrow, the capitalist class. In expounding this theory of "economic determinism" or the "materialist conception of history," Marx made a number of prophecies concerning the actual future of capitalist industrialism which have not thus far been at all completely verified. The progressive elimination of the small capitalist, the aggregation of the control of capital into fewer and fewer hands, the progressive "misery" of the "proletariat," which Marx prophesied, are forecasts in which truth and falsehood are intertwined. But these prophecies concerning the actual course of events are in no sense vital to his central idea, which is that of the gradual rise to power of the "proletariat" or working class, and the conquest by it of economic authority, resulting necessarily in the transformation of the political structure of Society and in the abolition of social classes.

It is easy to see that this doctrine was bound to exercise a strong fascination over the minds of those men and women of the working classes who were brought into contact with it. Whereas, without some such theory they were conscious only of the enormous strength of the forces to which they were subject, and of their manifest weakness as almost property-less wage-earners, living in constant insecurity, at the mercy of trade fluctuations which resulted periodically in widespread unemployment, Marx gave them the sense of fulfilling an historic mission, and of having on their side a world-force far more powerful than the huge economic and political strength which seemed to be in the possession of the ruling classes of the day. It is this one thing, and one thing only, that explains the veneration in which Marx is held throughout practically the whole Socialist movement. It was he, who, more than anyone else, gave the working class a sense of power, and imported into their efforts towards organization and concerted resistance to the evils to which they found themselves subject a conscious purpose not merely of combating capitalism, but also of replacing it.

In the earlier article some account was given of the rise of Socialist parties in various European countries. This rise continued at an increasing pace in later years, a great impetus having been given to the Socialist forces in almost all parts of Europe by the circumstances of the World War.

There was in 1921 in every industrialized country at least one Socialist party, possessing in the majority of cases a considerable representation in its national Parliament. Indeed, in many countries there had come into being more than one Socialist party; for the process of unification of Socialist political forces which had been proceeding steadily up to the outbreak of the war gave place to a separatist tendency, which resulted in a regrouping of forces in most of the countries in which the movement was strong. The first cause of these divisions was the attitude of Socialists towards the outbreak of the World War. In almost all belligerent countries the Socialist parties became divided over the issues of the war. In some cases these divisions of opinion resulted in actual cleavages within the various parties; in others the parties held together, but acute divisions of opinion continued inside them. These differences were greatly accentuated by the Russian revolutions of 1917, which inevitably exercised a very powerful influence on Socialist opinion throughout the world. Just as, in its earlier days as an organized political movement, Socialism always tended to look back to the Paris Commune of 1871, it now even more definitely looks back to the Russian revolutions of 1917, upon which the most acute divisions of opinion in the world of Socialism to-day are based. Any attempt, therefore, to analyze the forces at work in the Socialist movement of the various countries in 1921 must begin by taking into account the new alignment of opinion caused by the Russian revolutions.

The first Russian revolution of 1917 was universally acclaimed by Socialists throughout the world. It meant for them the overthrow of Tsardom and the destruction of the most powerful and complete absolutist monarchy left in the world. Moreover, refugees from Russia had played an important part in the Socialist movement in almost all countries in which it had become organized. It was not the first of the Russian revolutions but the *coup* of Nov. 1917 that divided acutely the Socialists of the various countries. Everywhere the left wing of the Socialists acclaimed the Bolshevik Revolution, while the right wing was hostile to what it regarded as the overthrow of the "democratic" institutions which had been introduced under the Kerensky regime.

During the following years, from 1918–21, the differences within the Socialist ranks resulting from the Bolshevik Revolution were steadily accentuated. Under the auspices of the Russian Bolsheviks, or Communists as they now call themselves, with a definite reference back to *The Communist Manifesto* of 1847, a new international organization of Socialism, the Third or Moscow International, was inaugurated, and an appeal was made to the "proletariat" in all countries to rally to this new body, of which the fundamental ideas were the overthrow of the capitalist regime by the intensive prosecution of the class war, involving the use of force, and the assumption by the "proletariat" of dictatorship over Society during the "transitional period," which would be necessary both for the combating of the attempts of the "counter-revolution" to regain power, and for the laying of the foundations of a Socialist or Communist society free from class distinctions. During the years after the Bolshevik Revolution these Communist doctrines gradually spread over Europe, and resulted in the formation in most countries of Communist groups and parties of varying degrees of importance. Sometimes these began by working as groups within the existing Socialist parties, and sometimes they succeeded in winning over to their side a majority of the older Socialist parties, which thus became Communist. In other cases, however, the Communists, unable to command a majority in the Socialist parties in other countries, founded new and rival parties of their own.

Thus in 1921 the position of European Socialism was extraordinarily complicated, as a reference to the state of affairs in a few of the principal countries will readily indicate. In France the Communists had succeeded in securing a majority in the ranks of the French Socialist party, and it had thereupon changed its name to the French Communist party. The minority, which refused to accept the change in name and policy, thereupon reformed the Socialist party as a coalition of right wing and central elements. In Italy the Socialist party, which was throughout opposed to Italian participation in the war, at first affiliated to the Moscow International; but subsequently differences arose as to the strategy to be adopted, and these led to a split in the ranks of the party, the extreme Communists, who were in a minority, seceding and forming a Communist party of their own, while the right and centre, including many Communists, held together as the Italian Socialist party. In Germany the Social Democratic party split during the war. A majority section of the party supported the German Government in the prosecution of the war and voted war credits. Gradually a minority party formed, and finally the anti-war elements left the Social Democratic party and formed the Independent Socialist party. After the Bolshevik Revolution in Russia two small Communist parties were also formed in Germany. In 1920 the majority of the Independent Socialist party resolved upon adhesion to the Moscow International and united with the Communist factions to form the German Communist party. The right wing of the Independent Socialist party continued in existence under the old name; and there were thus in Germany, in 1921, three distinct parties, Social Democrats or Majority Socialists, Independent Socialists, and Communists. In Great Britain the position was somewhat different; for political action was taken through the Labour party, a federation of trade unions, Socialist societies and kindred bodies. Of the Socialist societies, the British Socialist party, the direct descendant of the Social Democratic Federation, the earliest Socialist body in Great Britain, affiliated to the Moscow International and became the nucleus of a Communist party which applied for affiliation to the Labour party, but was refused. The Independent Labour party, which, unlike the Labour party as a whole, was hostile to participation in the war, nevertheless remained affiliated to the Labour party. There were thus only two groups undertaking political action in Great Britain—the Labour party, including the Independent Labour party, on the one hand, and the small, but militant, Communist party on the other.

These instances, drawn from a very much larger number, serve to illustrate the general character of the divisions which had arisen in the world Socialist movement since the Russian Revolutions of 1917. As the movement has been divided nationally, so a division has taken place in the international organization of Socialism. Before the war most of the Socialist parties of the world were loosely held together by the Congresses of the "Second International," of which the first was held in 1889. Out of the Congresses developed the International Socialist Bureau, which was formed in 1900. The Bureau was unable to function effectively during the war, both because communications were to a large extent interrupted, and because of the differences of opinion between and among the various national sections. Various attempts were made to secure united action by all the national Socialist parties; but, in face of the opposition of the Governments and of internal differences, these produced little result, the attempt to call an International Socialist conference at Stockholm in 1918 breaking down. The Socialist parties of the Allied countries, however, held a number of conferences, and drew up a declaration of war aims, which exercised a certain influence. Immediately on the conclusion of hostilities steps were taken to convene a full International Socialist conference, and an attempt was made to reform the pre-war Socialist International. The reformed body, however, known as the "Second International," never became, in face of acute differences of opinion, at all fully representative, and during 1919 and 1920 there were numerous secessions from it, until it came to consist principally of the British Labour party, the German Social Democratic party (Majority Socialists), and the Socialist parties of a number of small countries such as Sweden, Poland, Belgium and Holland. A number of Socialist parties held aloof both from the Second and from the Third International, and these bodies in 1920 formed a provisional International "Working Union," of which the aim was the reconstitution at a later stage of a fully representative and inclusive Socialist International. This provisional body, sometimes known as the "Vienna International," includes the British Independent Labour party, the German Independent Socialist party, the French and Swiss Socialist parties, and a number of others. The Italian Socialists were in 1921 unconnected with any of the three Internationals.

There can be no doubt that the division of opinion in the Socialist ranks which is reflected in these divisions in national and international organization is very profound. With the growth of parliamentary representation, the political Socialist parties of the various countries have been becoming steadily more moderate and constitutional in their outlook. But the Moscow revolution, accomplished by insurrectionary methods and by "proletarian" direct action, represented a challenge to the constitutional political attitude of the more orthodox Socialist parties. Those which have rallied to the call of Moscow profess to be the only true inheritors of the Marxian tradition and the legitimate successors of the International Working Men's Association, or "First International," of 1864. It is still impossible in 1921 to forecast the result of the conflicts between this section and the older Socialist parties; but it seems likely that the divisions which have come into existence will be to a considerable extent permanent, even if the ultimate point of cleavage has not yet been discovered.

James Bonar on p. 301 of vol. 25 defines Socialism as "that policy or theory which aims at securing by the action of the central democratic authority a better distribution and, in due subordination thereunto, a better production of wealth than now prevails." It will be clear from what has been said above that this definition is certainly no longer adequate or correct in 1921, even if it could be regarded as adequate at the time at which it was made. It is as true now as then that all schools of Socialism are united in seeking a better distribution and also a better production of wealth; but it cannot be assumed that this is sought solely or even mainly "through the action of the central democratic authority," or that many Socialists would agree that any such body as a "central democratic body" exists in the community as it is organized to-day. Any present-day definition of Socialism would certainly have to emphasize the fact that it seeks not merely a better distribution and production of wealth, but a fundamental reorganization in the whole system of organized Society, political as well as economic. At the time when Bonar wrote, Socialists, especially in Great Britain, were largely engaged in combating the still prevalent doctrines of *laissez-faire* politicians and economists, and in seeking to emphasize the necessity for a greater measure of collective regulation of the social and economic life of the community. In Great Britain, more than elsewhere, many Socialists came to regard the political State, or machinery of government, as the principal instrument of this regulation, and to look forward to the transition to Socialism mainly through the nationalization, or transference to State ownership, of all vital industries and services, together with an extension of municipal ownership in the sphere of local public-utility services. This idea of the form of the transition to Socialism fitted in well with the stress which was laid, during the 'nineties and the earlier years of the 20th century, upon political action. This period witnessed the formation, first of the Independent Labour party, and then in 1900 of the Labour Representation Committee, which subsequently became the Labour party. It was also the period during which the Fabian Society, with its propaganda of political permeation, largely influenced British Socialism, and diverted it from the Marxism of its earlier development in the 'eighties.

But from 1910 onwards new currents of opinion were increasingly affecting these accepted dogmas of Socialism, both in Great Britain and elsewhere. Important, in this connexion, is the rise of the Syndicalist movement in France, which was at its zenith in the earlier years of the 20th century, and of the Socialist Labour party and the Industrial Workers of the World in the United States of America. There were important differences between the standpoints of French Syndicalism, which was derived largely from the semi-Anarchist doctrines of Proudhon and his school, and American Industrial Unionism, based by Daniel De Leon and his followers upon the large-scale and "trustified" American capitalist system. But they were alike in stressing rather the economic than the political character of the transition to a Socialist system, and in demanding more aggressive action by the workers in the industrial field. In Great Britain and in other European countries these doctrines, although they were not accepted in their completeness, exercised a powerful influence, seen especially in Great Britain in the rise of the Guild Socialist movement after 1912 (*see* GUILD SOCIALISM).

Whereas Syndicalism and, in some of its forms, Industrial Unionism directly challenged the utility of Socialist political action and demanded an exclusive concentration upon the industrial field, the Guild Socialists never took up this attitude, but sought, without disparaging political action, to secure an intensification of industrial activity, and in particular a change in the attitude of Socialists towards the problem of industrial control. Their influence in this direction has extended far beyond their own ranks, and it is not too much to say that the effect of the various movements possessing largely an industrial character—Syndicalism, Industrial Unionism, Guild Socialism, etc.—has been to bring about a revolution in Socialist thinking on this question. It is no longer assumed by Socialists that nationalization is necessarily desirable, or that the transference of industry to the State, even if it be accomplished by a political victory of Socialists, furnishes an adequate solution of the industrial problem. Most Socialists are agreed in desiring, in a greater or less degree, as an integral part of any Socialist system, the control of the administration of industry by the organized workers by hand and brain who are engaged in it.

Nor has this change in the attitude of Socialists towards the problem of industry been without its effect in other spheres of policy. As Socialism passed from its earlier revolutionary into its middle purely constitutional and political phase, it came gradually to be assumed that the realization of Socialism would involve only the capture of political power by the Socialist parties and the use of the existing machinery of Society—modified perhaps in certain particulars, but remaining essentially the same—for socialist instead of for individualist ends. There is now acute division of opinion on this question; but most Socialists are far more ready than in 1910 to agree that the realization of Socialism would involve not a mere conquest of political power and the assumption of control over the machinery of government by the workers, but also a profound transformation in the machinery of government itself. By Lenin and the Communists (see Lenin's *The State and Revolution* for the best statement of this point of view) the State is regarded as purely a "capitalist organ," the tool of a dominant class in Society. In the words of *The Communist Manifesto*, they regard the State as "an Executive Committee for administering the affairs of the whole governing class." Such an instrument, essentially coercive in its character, will in their view become unnecessary with the realization of Socialism. During the transitional period of "dictatorship" the "proletariat" will indeed require an instrument fully as coercive as the capitalist State. But the Communist view of the existing machinery of the State cannot be adapted for this purpose, but must be destroyed and replaced by a "quasi-State" based definitely and exclusively upon the power of the workers themselves. Gradually, as the realization of Socialism comes nearer, they hold that this "quasi-State" will "wither away" and give place to a free organization of Society in which "government," which they understand to imply a system based on coercion, will be replaced by "administration." Even among those Socialists who do not accept this Communist view, keen criticism has been directed in recent times upon the structure of the present-day State and upon the conception of political democracy which was almost universally accepted in the 19th century. Universal political suffrage is no longer held to furnish any adequate basis, or even necessarily any basis at all, for truly democratic institutions; for it is pointed out that, as long as great inequalities of wealth and power exist in the community, and as long as the industrial system is based on an acute division of classes, this "political democracy" is in fact inoperative, since the power and wealth of the few can be used in order to prevent the will of the people from finding expression, and, indeed, to prevent the people from developing any conscious or clearly formulated will of its own. By the Guild Socialists and by many others of the newer schools of Socialist thought, stress is laid upon the importance of securing a system of democratic self-government in the industrial sphere as the necessary condition of democracy in politics or in Society as a whole.

These changes in the conception of Socialist aim and method have resulted in a much closer relationship between Socialist ideas and the definitely economic forms of working-class organization, such as Trade Unionism and Coöperation. No longer basing their hopes of Socialism entirely upon action in the political sphere, Socialists are driven more and more to rely on the development of the organizations created by the working classes themselves for the protection of their interests and standard of life under capitalism. Whereas the earlier Socialists appealed to Trade Unionists and Coöperators to realize the necessity for Socialism and to embark upon political action, the newer schools of Socialism are endeavouring also to influence the policy of the Trade Unions and of the Coöperative movement in the direction of Socialism applied to industry—that is, of the development and expansion of working-class industrial control (*see* TRADE UNIONISM and GUILD SOCIALISM).

The organization of the Socialist movement in Great Britain is often exceedingly bewildering to those who approach it for the first time. There are a large number of bodies of varying degrees of importance, and often with names which bear a close resemblance one to another. The Labour party, which is by far the largest political body, may be regarded as definitely Socialist in the sense in which the majority of continental European Socialist parties are Socialist. Its annual conference has repeatedly pronounced, in general terms, in favour of Socialism, and its policy on the whole coincides with that of the "right wing" Socialist parties of Europe. At the same time, its main strength is drawn from the trade unions. In 1920 it consisted of 126 affiliated trade unions with a total affiliated membership of 3,511,000. In addition it included the Independent Labour party and the Fabian Society and one or two smaller Socialist bodies. Locally it was organized in several hundred Local Labour parties, which in their turn consisted mainly of affiliated branches of trade unions, Socialist societies and kindred bodies. These Local Labour parties, under the new constitution of 1918, also admit individual members who accept the aims of the party. There is a very considerable individual membership enrolled in this way; but no figures are available. In 1920 the Labour party had 66 members in the House of Commons.

Apart from the Labour party, although in some cases affiliated to it, are the various Socialist societies, of which the largest is still the Independent Labour party, which has been mentioned above. This party had in 1920 35,000 members organized in local branches throughout the country. It had returned five members as Independent Labour party members to the House of Commons; and these sat as members of the Labour party. In addition a considerable number of members who were returned under the auspices of the trade unions, affiliated to the Labour party, belonged to the Independent Labour party.

Next in point of size stands the Communist party of Great Britain, formed in 1920 by a fusion of the British Socialist party with a number of local Communist organizations. This party is affiliated to the Third or Moscow International. It was gaining adherents in 1921. Its total membership, however, certainly did not at that date exceed 10,000. Of minor Socialist parties the following deserve mention. The Social Democratic Federation, formerly the National Socialist party, is the result of a split which took place during the war in the British Socialist party. A section of the British Socialist party, including H. M. Hyndman, the veteran Socialist leader, and many of the older members of the earlier Social Democratic Federation, resigned from the British Socialist party as a protest against its anti-war attitude and formed a separate body of their own. The Social Democratic Federation (the name was again assumed at the end of 1920) is affiliated to the Labour party. It is very small, its membership in 1920 being returned as 2,000.

The Fabian Society, founded in 1883–4, has been principally associated with certain intellectual leaders of the right wing of British Socialism, especially Mr. and Mrs. Sidney Webb and Mr. Bernard Shaw. It had about 2,000 members in 1920 and was affiliated to the Labour party. Its pamphlets and other propagandist work exercised a powerful influence on the formation of Socialist opinion during the period from 1889 to 1910, but it has since ceased to count as an effective influence; for, although Mr. and Mrs. Webb and other leaders remained active, they had transferred their main activities to other bodies, such as the Labour party itself.

The Socialist Labour party is an offshoot of the American "De Leonite" Socialist Labour party. It gained considerably in membership and influence during the war, when its leading members took a prominent part in the shop-stewards' movement, and in other rank-and-file trade-union and anti-war movements. Most of its more active members, however, passed over to the Communist party in 1920; and it then ceased to exercise any considerable influence. The Socialist party of Great Britain is a very small and unimportant body of rigid Marxians of the extreme left wing. The National Guilds League, the propagandist organization of the Guild Socialists, is described in the article GUILD SOCIALISM.

It will be seen from the foregoing account that the Socialist movements of the world were in 1921 in a state of unrest and transition, due largely to the events of the war and to the revolutions in Russia. It is impossible to forecast what will be the ultimate result of this ferment of forces and ideas, or in what manner the Socialist parties and societies of the world will eventually regroup themselves. Two clearly defined tendencies can be seen in the movement. The first is a constitutionalist and parliamentary tendency, expressing itself in the activities of the Majority Socialist parties of many countries. Its adherents repudiate for the most part recourse to revolutionary methods save under quite exceptional circumstances. At the other extreme is the tendency represented by Communism and the Communist parties which have arisen in most countries in recent years. Its adherents favour the use of political as well as industrial action, but regard the transition to Socialism essentially in terms of force to be generated by the uprising of the "proletariat." They envisage the transformation of Society by a catastrophic overthrow of the existing political and economic system, and the substitution for it of a new system based on the "dictatorship of the proletariat." Between these two extremes there is no equally definite central body of opinion extending to a number of countries; but in almost every country there are "centrist" groups and tendencies, bearing in some cases a closer resemblance to the constitutionalist right wing (*e.g.* the Independent Labour party in Great Britain), and in others to the revolutionary left wing (*e.g.* the Socialist party in Italy).

The Guild Socialists and, in a less degree, the French *Syndicalistes* stand to a considerable extent in a different position, since in their case the main stress is laid neither on revolution nor on constitutional political action, but on the extension of the industrial power of the workers towards control over industry.

A marked feature of the more recent developments of the Socialist movement has been the growing closeness of the relationship between it and the economic organizations created by the workers for the defence of their interests and aspirations as producers and consumers. It has become far more manifest in the later years of the 19th and the early years of the 20th century that Socialism is not solely, or even mainly, a political movement, but at least equally an industrial movement, aiming at a fundamental transformation not simply in the ownership, but also in the control and administration of industry, and in the motives upon which the industrial system depends. This is, indeed, to some extent a harking back to earlier conceptions of Socialism, such as those of Robert Owen in Great Britain and of Louis Blanc in France. It has resulted in a far closer affiliation between the Socialists of all schools, "right wing," "left wing" and "centre" alike, and the trade-union movement; and the struggles between the rival schools of Socialism now largely reproduce themselves in the industrial sphere, as the various Socialist sections seek to influence the policy and to secure the allegiance of the trade-union organizations. This is true to a less extent of the coöperative movement; but it is becoming increasingly true in this case also.

Based, as it is, mainly upon the organized working-class movement, Socialism has necessarily, to a large extent, an economic basis; but it is important to realize that a great deal of its driving force comes from the fact that it is not only an economic movement, but also a movement based on certain clear and definite ideas which are largely shared by Socialists of all schools.

The differences between Socialists are far more differences as to method than differences as to ideal. Thus all Socialists are agreed that the carrying-on of industry on a basis of private profit produces anti-social results, and that the idea that the interests of the whole are best served by the enlightened pursuit by each private citizen of his own interests is fundamentally wrong. Although they differ widely as to the structure which a Socialist society should assume, and as to the forms of industrial administration which would best express the new community spirit, Socialists are agreed in demanding that all important industries and services should pass over from private hands into some form of social ownership and control, whether into the hands of the State or of local authorities, or of self-governing guilds, or of the coöperative movement, or of other forms of organization designed to express the communal spirit. They are agreed in believing the individual ownership of the means of production, distribution and exchange to be undesirable, and in holding that both the extent and the character of production should be determined, not by any anticipation of individual profit, but by considerations of social need. Moreover, all Socialists insist that with the change from the system of private ownership and control in industry to social ownership and control must go a change in the motives which operate in the industrial system. They hold that, if industries and services are conducted under forms of organization designed in the interests of the whole community, the motive of public service, which is at present thwarted and inhibited by the existence of capitalism, will be brought into play, with the result that the members of the community will be more ready to render willing and efficient service. They are also increasingly of the opinion, first strongly urged by the Guild Socialists, that in order to bring this motive of social service into play it will be essential to democratize the industrial as well as the political system, by providing for a large measure of self-government in industry by the "workers by hand and brain."

The charge used to be brought against the Socialist parties and groups of dwelling almost exclusively upon the economic concerns of Society, and of caring little or nothing for other questions of social and political policy. This charge can hardly be made nowadays; for the Socialist and Labour parties of the world have in almost all cases been led to formulate inclusive programmes and policies, and to take an active part in furthering social reorganization in all spheres of both national and international policy. Perhaps the best exposition of the national and international policy of Socialism of the constitutional type is contained in the pamphlet *Labour and the New Social Order*, issued by the British Labour party in 1918. This pamphlet has had an important international influence. The Communist wing, more fully preoccupied with questions of revolution than with plans for reform under the existing system, has not issued any quite comparable declaration of its aims; but the new *Communist Manifesto* of the Third (Moscow) International furnishes the clearest indication of its aims and policy as an international movement.

BOOKS ON SOCIALISM.—*A., General.*—There is no really good account of Socialism as a whole. The handiest text-books in English are: T. Kirkup, *History of Socialism* (new ed. revised by Edward R. Pease, 1913); and Werner Sombart, *Socialism and the Social Movement* (translated by M. Epstein (1909); R. C. K. Ensor, *Modern Socialism* (1907), is a useful collection of extracts from writings of Socialists of all countries. Max Beer's *History of British Socialism* (2 vols., 1919 and 1920) is indispensable. For the growth of the movement in various countries see Robert Hunter, *Socialists at Work* (1908), and the *Labour International Handbook*, prepared by the Labour Research Department (1921). Of books hostile to Socialism the best known are O. D. Skelton, *Socialism: a Critical Analysis* (1911), and W. H. Mallock, *A Critical Examination of Socialism* (1907); Hartley Withers, *The Case for Capitalism* (1920), may also be consulted. Other useful general books include: E. Bernstein, *Evolutionary Socialism* (1909); Robert Blatchford, *Merrie England* (1895); Fabian Society, *Fabian Essays* (1889); J. Bruce Glasier, *The Meaning of Socialism* (1920); Laurence Gronlund, *The Coöperative Commonwealth*, edited by Bernard Shaw (1891); J. Ramsay MacDonald, *Socialism, Critical and Constructive* (1921); William Morris and E. Belfort Bax, *Socialism: its Growth and Outcome* (1893); Bertrand Russell, *Roads to Freedom* (1918); Emile Vandervelde, *Collectivism and Industrial Evolution* (1907); *Le Socialisme contre l'État* (1919); W. E. Walling, *Socialism as it is* (1912); H. G. Wells, *New Worlds for Old* (1908, rev. 1914). See also the innumerable pamphlets published by the various Socialist bodies.

B., Marxism.—Karl Marx's *Capital* (English translation, 3 vols. 1887–1909) is, of course, the foundation of most modern Socialist thinking. Of Marx's other works the most important for Socialist theory are: *The Communist Manifesto*, written in collaboration with Friedrich Engels (1847); *The Critique of Political Economy* (English translation, vol. ii. 1907); *The Civil War in France* (1871, reissued 1921); *Revolution and Counter-Revolution* or *Germany in 1848* (Eng. 1896); *The Poverty of Philosophy* (Eng. 1900). Of the works of Engels the most important are: *Socialism, Utopian and Scientific* (Eng. 1892), and *Landmarks of Scientific Socialism* (Eng. 1907). Karl Kautsky, the leading exponent of political Marxism in Germany, can be best studied in *The Erfurt Program* (Eng. 1910); *The Social Revolution* (Eng. 1902); and in his attack on Bolshevism, *Terrorism and Communism* (Eng. 1920). For the Communist exposition of Marxism see N. Lenin, *The State and Revolution* (Eng. 1919), and other works. Of books on Marx and Marxism the most important are: Max Beer, *The Life and Teaching of Karl Marx* (Eng. 1921); Achille Loria, *Karl Marx* (Eng. 1920), and for a hostile criticism: E. von Böhm-Bawerk, *Karl Marx and the Close of his System* (Eng. 1898). Georges Sorel's *La Décomposition du Marxisme* (1908) and Benedetto Croce's *Historic Materialism and the Economics of Karl Marx* (Eng. 1914) are important detached studies. A much fuller bibliography will be found in *What to Read on Social and Economic Subjects* (Fabian Society, new ed. 1920); and reference should be made to the bibliographies at the end of the articles on COMMUNISM, GUILD SOCIALISM, SYNDICALISM. There is, of course, a very large literature of the subject in almost every European language.

(G. D. H. C.)

SODEN, HERMANN, FREIHERR VON (1852–1914), German biblical scholar (*see* 25.339), died Jan. 15 1914.

SOLDENE, EMILY (1840–1912), English singer and actress, was born at Islington, London, in 1840. She had made her debut in 1864 on the concert stage, and in 1871 appeared in *Geneviève de Brabant*, her favourite rôle, and in *La Fille de Madame Angot* in 1872. Her successes were mainly in opera-bouffe, and she retired young from the stage. She published one novel, *Young Mrs. Staples* (1896), and *My Theatrical and Musical Recollections* (1897). She died in London April 8 1912.

SOLF, WILHELM (1862–), German colonial politician, and, at the time of the revolution, Secretary of State for Foreign Affairs, was born Oct. 5 1862 in Berlin. He made a special study of Sanskrit and Oriental languages, and, after a long sojourn at Calcutta, returned to Germany in order to study political science. He then entered the German Colonial Service and, after having been employed in a judicial post in German East Africa, was sent to Samoa, first as president of the municipal council (1899) at Apia under the old "condominium" of Great Britain, Germany and America and afterwards as governor of German Samoa (1900). In 1911 he was appointed German colonial secretary and achieved considerable success in the reform of the German colonial administration. When Prince Max of Baden's Ministry of desperation was formed towards the end of the World War, Solf was appointed Secretary of State for Foreign Affairs on Oct. 3 1918. In this capacity it fell to his lot to conduct the negotiations for the Armistice, first with President Wilson and then with the Allied and Associated Powers. He continued to hold this office as an "expert" under the revolutionary Socialist Government of the Commissioners of the People, and did not resign till Dec. 17 1918. In 1920 he was appointed German chargé d'affaires and afterwards ambassador to Tokio. He was the author of *Weltpolitik und Kolonialpolitik* (1918) and of *Kolonialpolitik, Mein politisches Vermächtniss* (1919).

SOMALILAND (*see* 25.378).—The territorial division of Somaliland between Abyssinia, Great Britain, France and Italy, except for a comparatively slight readjustment of the Italo-Abyssinian frontier, remained unchanged during the period 1910–21. However, Italy obtained from Great Britain the promise of the addition to Italian Somaliland of part of the Jubaland province of British East Africa (Kenya Colony). Italy also desired to acquire the port of Jibuti (French Somaliland), but failed to do so (*see* AFRICA: *History*).

BRITISH SOMALILAND.—From 1910 to 1920 the mullah Mahommed bin Abdullah, popularly known in Britain as the "Mad Mullah," continued to dominate the interior of the protectorate. In March 1910 the British troops were withdrawn to the seaports and a policy of "strict coastal concentration" adopted. Officially arrangements had been made to enable the friendly tribes to defend themselves from attack by the Mullah; in fact the "friendlies" were not only systematically raided by the dervishes, but also quarrelled among themselves. At the end of 1912 a camel constabulary, 150 strong, was raised and under R. C. Corfield checked inter-tribal fighting. In Aug. 1913 Corfield, acting against instructions, engaged a raiding party of some 200 dervishes at a place called Dolmadoba, 110 m. S.E. of Berbera. In the action Corfield was killed, his little force of 109 men had over 50% casualties and was compelled to fall back. G. F. Archer, the acting commissioner, rode out from Burao (40 m. distant) with an escort of 20 Indian troops and covered the retreat. The dervishes proceeded to occupy some of the chief grazing ground of the "friendlies" and the Mullah built strong forts at Jidballi and Shimber Berris—places in the S.E. part of the British protectorate, Jidballi being 220 m. S.E. of Berbera. In March 1914 dervish raiders reached the coast and fired into the town of Berbera. Archer, who in May 1914 became commissioner of the protectorate[1] in succession to H. A. Byatt, urged that duty should compel Britain to safeguard the tribes in the protectorate and further operations were authorized. Sheikh and Burao were reoccupied and on Nov. 23 Maj. (local Lt.-Col.) T. A. Cubitt defeated the dervishes at Shimber Berris. Cubitt having returned to Burao, the dervishes reoccupied Shimber Berris. Here they were again attacked by Cubitt on Feb. 3–4 1915, and after severe fighting, partly in caves, were driven out and all their forts destroyed. There was no means of following up the Mullah, nor any belief that his power had been crushed, though for over a year after the destruction of Shimber Berris he remained quiescent. His headquarters were at Tale, towards the Italian frontier, where, under the direction of Arab masons from the Yemen, his followers built elaborate stone fortifications of great strength.

Subsequently the Mullah again overran the centre and east of the protectorate, building more forts and making many raids on the "friendlies." This state of affairs lasted until 1920, when carefully planned and ably executed operations resulted in the complete destruction of the Mullah's forces. The Mullah had, in Sept. 1919, suddenly moved northward from Tale to Jidballi with most of his fighting men, establishing his own camp in the hills at Medishe, 12 m. N.W. of Jidballi. This move, occasioned by the hostility of the Mijertin Somalis, proved advantageous to the British plans. The main attack was made from the air, the force employed being one flight of DH9 aeroplanes under Group-Capt. R. Gordon. The ground troops were a King's African Rifles contingent (700 rifles), the Somaliland Camel Corps (700 rifles) and the 1st 101st Grenadiers, Indian Army (400 rifles). Lt.-Col. G. H. Summers was in command, the whole operations being, apart from the initial attacks by the air force, under the personal direction of Archer. Hostilities began on Jan. 21 with an aerial attack on the Mullah's camp at Medishe and ended on Feb. 12 with the flight of the Mullah, his eldest son, a brother and four or five followers. The rest of his followers were killed or captured, together with all his stock and property of every kind. The killed included 7 of the Mullah's sons; the captured, his 5 wives, 6 of his sons, 4 daughters and 2 sisters. The British casualties were very slight—3 natives killed and 8 wounded. The cost of these operations was about £84,000. Their success was primarily and mainly due to the Royal Air Force. The dervishes, good fighting men, were demoralized from the start by the attacks from the air and offered no serious opposition. They appeared not to know the character of aeroplanes; when the first attack was made on Medishe the Mullah is reported to have regarded the appearance of the machines in the air as a divine manifestation. It is known that on their approach he collected his people around him and awaited their coming under the white canopy used on state occasions. The first bomb killed an uncle of the Mullah's, who was standing by his side, and singed the Mullah's clothing.

When the British captured Tale (Feb. 9) the Mullah was already in flight, and he succeeded in eluding pursuit with the small following named. He crossed the Haudh to Galadi. News was received in the summer of 1921 that the Mullah had died at Imi in the heart of the Ogaden country the previous Feb., deserted and destitute. The Mullah's defeat was regarded in Somaliland as marking the deliverance of the country from 21 years of dervish oppression. Archer, to whose persistent advocacy this result was due, was created a K.C.M.G.

The World War and the high prices prevailing in 1918–20 had a marked influence on trade, the Somalis exporting large numbers of sheep and goats for the Aden Field Force and many thousands of camels for the Egyptian Expeditionary Force. Apart from this the most valuable export was skins and hides, the Somali skins being of very high quality. The great majority of the skins, especially the sheepskins, went eventually to the American market. The chief imports—American grey sheeting, dates, rice, sugar and tea—showed a heavy decline in quantity during the war, but an increase in value. Trade with Abyssinia continued, but the Zeila route could not compete beyond Harrar with the railway-borne traffic through Jibuti. In 1910–1 the total value of imports was £267,000 and of exports £247,000. In 1919–20 the figures were: imports £754,000, exports £346,000 (of which £134,000 was the value of hides). External trade was mainly in the hands of Indians and Arabs.

Revenue was mainly derived from customs and was inadequate to meet the cost of administration. The figures for 1910–1 were: revenue £30,000, expenditure £99,000; for 1919–20 revenue £81,000, expenditure £322,000. Deficits, incurred mainly for military purposes, were met by Imperial grants in aid. There was evidence to show that, with internal peace and a reasonable development of the resources of the country, the protectorate would become self-supporting. It was known to contain oil-fields, favourably reported upon by experts as long ago as 1914. A step towards opening the interior was taken in 1920 when a motor road was made from Berbera (the capital and chief port) to Lower Sheikh and from Upper Sheikh to Burao.

See R. E. Drake Brockman, *British Somaliland* (1917); H. F. Prevost Battersby, *Richard Corfield of Somaliland* (1914); A. H. E. Mosse, *My Somali Book* (1913); A. Hamilton, *Somaliland* (1911); and the annual Colonial Office reports on the protectorate. The account of the final overthrow of the Mullah is given in a supplement to the *London Gazette* of Nov. 1 1920.

FRENCH SOMALILAND.—Situated on the western shores of the Bab-el-Mandeb, French Somaliland is important as possessing the only French port on the Suez Canal route and as being the main artery of trade with Abyssinia. The pop. in 1917 was estimated at 206,000. Jibuti, the port and capital, had 13,608 inhabitants, of whom 294 were Europeans (107 French).

The resources of the country, which is largely arid, are limited. Date palms have been planted in the desert round Jibuti. Cotton-growing was tried in the same neighbourhood but was abandoned. On the higher ground there is rich grassland, on which the natives —Somali and Danakil—have herds of camels, goats and black-faced sheep. The Bahr 'Asal has been exploited since 1912 for its immense deposits of salt; in 1918 the export was 11,500 metric tons. There is also a considerable fishing industry, and mother-of-pearl figures among the exports.

Jibuti is regularly visited by French, British and Italian steamers and has a local service to Aden. In 1917 the steamers entered at

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[1] In Oct. 1919 the title was changed to that of governor.

Jibuti numbered 272, with a tonnage of 643,000. About 90% of its trade is the transit of goods to and from Abyssinia, the railway from Jibuti to Addis Abbaba being owned by a French company. In 1913, before the railway had reached Addis Abbaba, the value of the transit trade was £1,636,000. In 1918, with the railway completed, the imports destined for Abyssinia were valued at £1,433,000 and the exports from Abyssinia at £2,622,000. There is also a trade in supplying passing ships with coal, previously imported. Textiles, food-stuffs and coal are the chief imports; the exports are the characteristic produce of Abyssinia—coffee, live stock, hides and skins, ivory, rubber, beeswax, etc.

The colony is administered by a governor assisted by a council composed equally of official and non-official members. The budget for 1919 was balanced at 2,370,000 francs. Relations between the Somali and Danakil and the French proved satisfactory, the tribes being very lightly administered. A small military force was maintained for the security of Jibuti and the railway. The colony was on good relations with its Italian, British and Abyssinian neighbours, save for differences with the Abyssinian customs officials, whose valuation of dutiable goods passing inwards was often arbitrary. Some anxiety was caused in 1917–8 by the presence of Lij Yasu, the deposed Emperor of Abyssinia, in the Danakil country, and by his threats to the railway. His effort to raise the tribes against the French failed.

See the *Côte Française des Somalis* (annual reports by the French Colonial Ministry), and *L'Afrique Française* (monthly).

ITALIAN SOMALILAND.—The efforts of Italy in Somaliland during 1910–21 were concentrated upon the southern part of their protectorate. By a royal decree of July 1910 this southern region, Benadir and its hinterland, was constituted a Crown colony, administered by a civil governor resident at Mukdishu (*Ital.* Mogadiscio), and divided into four "commissariats." This region included the fertile valleys of the lower Juba and Webi Shebeli and the good grazing land on the plateau between those rivers. Dura was the main crop, but cotton and rice plantations were formed along the Juba and aid given to Italian colonization companies. The result was not great; the Somalis preferred a nomadic life, while the agricultural classes, negroes or semi-negroes, were few in number. This paucity of labour was the most serious problem confronting the administration.

By the occupation of strategic posts and the building of roads the Italians secured the safety of Benadir, and with this security a considerable trade developed with Abyssinia, chiefly via Lugh, on the Juba. But the absence of any harbours—all the ports are open roadsteads—proved a great drawback, and to remedy this difficulty Italy had obtained facilities at the harbour of Kismayu, in British East Africa (Kenya), some little distance south of the mouth of the Juba. That river formed the Anglo-Italian frontier. On Dec. 24 1915 an agreement was reached for the appointment of a permanent mixed commission to deal with customs, transit, conservancy, navigation, irrigation and other purposes in the Juba region. Italian desires in respect to the Juba were, however, of a wider character. It was believed that with complete control of the lower Juba—spoken of as a second Nile—the economic future of the colony would be assured, and in the treaty with the Allies which preceded her entry into the World War Italy secured *inter alia* a promise of the rectification of her Somaliland frontier. Formal negotiations to that end were entered upon in 1919, when Great Britain agreed to the cession of Kismayu and of a strip of land which would give Italy both banks of the Juba.

The northern part of Italian Somaliland remained under the rule of Somali chiefs, of whom the most important was the Sultan of the Mijertins, whose territory included the coast facing the Gulf of Aden. The Mijertins, who number approximately 100,000, possess large numbers of camels, sheep and cattle, and their country, as also Obbia and the Nogal territory, abounds in plants which furnish gum-arabic, myrrh, frankincense, etc. The Mijertins were near neighbours of Mahommed bin Abdullah, the "Mad Mullah," who between 1905 and 1909 was settled in the lower Nogal region. The hostility of the Mijertins finally drove out the Mullah, who established himself at Tale, in the southeast corner of British Somaliland. The continued and unwelcome attentions of the Mijertins induced the Mullah in 1919 to remove farther into the British protectorate, while in 1920 the Mijertin Sultan, Osman Mahmoud, assembled his warriors to prevent the Mullah's reëntry into Italian territory.

Italian relations with Abyssinia were satisfactory. Following the Italo-Abyssinian convention of 1908 the frontier was delimitated in 1911, tribal boundaries rather than physical features determining the line chosen. In the north, where the frontier reaches the southern limits of British Somaliland, the Italo-Abyssinian frontier was fixed at 48° E., instead of 47° E., as provided in the 1908 agreement. This gave to Abyssinia the small portion of Ogaden tribal lands which had been in the Italian protectorate, including Galadi.

The external trade, valued at £174,000 in 1908–9, had risen to £326,000 in 1912–3, and was £800,000 in 1918. Throughout this period imports greatly exceeded exports, the exports in 1918 for example being valued at £243,000 only. Imports are chiefly cotton goods from Italy and food-stuffs. Skins form, in value, 75% of the exports. The expenses of administration exceed revenue; the Italian grant in aid (£119,000 in 1910–1) was £186,000 in 1920–1, when the budget was balanced at £440,000. Of the expenditure one-fifth was for the military force, some 3,000 strong, sent from Eritrea, the men being Abyssinians.

A 1920 estimate put the total pop. as high as 650,000. Mukdishu had 14,000 inhabitants. Besides a few hundred Europeans there are at the coast towns settlements of Arab and Indian traders. Mukdishu was, in 1915, connected with Massawa by a high-power wireless station. Surveys for railways had been made, but no construction had begun up to 1921. There were in that year some 1,500 m. of road in southern Somaliland.

See G. de Martino (sometime governor of the colony), *La Somalia Nostra* (1913), and *Italian Somaliland*, a British Foreign Office handbook, with bibliography (1920). (F. R. C.)

SOMERSET, ISABELLA CAROLINE [LADY HENRY SOMERSET] (1851–1921), English philanthropist, was born in London Aug. 3 1851, the eldest daughter and co-heiress of the 3rd and last Earl Somers. She married in 1873 Lord Henry Somerset, son of the 8th Duke of Beaufort, at one time comptroller of Queen Victoria's household, from whom she later separated. She became well known as a temperance reformer and interested herself deeply in the reclamation of inebriate women, with this end in view founding the Duxhurst Farm Colony, near Reigate, the first settlement of the kind in England. In connexion with it she established a home for destitute children and a "children's village" for saving infant life. Lady Henry Somerset was for many years president of the National British Women's Temperance Association, and made a reputation as an able speaker. In 1894 she founded the *Woman's Signal* in the interests of women's work, becoming its editor, and she was also the author of various children's books and many pamphlets and articles on social work. She died in London March 12 1921.

SOMME, BATTLES OF THE.—Under this heading it is proposed to deal with the principal battles which took place in Picardy and southern Artois during the World War. The geographical limits in which these battles took place may be roughly defined as the Scarpe on the N., the Oise on the S., the line Cambrai–La Fère on the E., and the line Amiens–Creil on the W.

The strategic geography of this region is governed by the course of the Somme between St. Quentin and Amiens; in the upper part of this course it runs S.–N., in the lower E.–W., and in that general course it continues to the sea. Thus from Péronne, the point at which the river bends through the right angle, to Abbeville, a water barrier divides opposed armies that face N.–S., and separates each into well-defined tactical theatres if they are operating towards the E. and the W. The upper (or strictly the middle) Somme (Péronne–Ham) prolonged to the Oise by the Crozat Canal, on the other hand separates the E.–W. adversaries and either protects or hampers those operating in N.–S. direction. Thus the operations which took place in the region, profoundly influenced by the alignment of the Somme and its tributaries, are in spite of their dissimilarity, properly designated "battles of the Somme."

In the first phase of the war, this region was traversed by the German I. Army, and a number of local combats took place between it and the forces that Joffre gathered, little by little, to form his VI. Army and outflank the Germans in their wheel.

More severe and continuous fighting took place between the Oise and the Scarpe during the development of the opposed northern wings in the "Race to the Sea."

Of this the battles of Lassigny, Roye, and Albert, which led up to and even into, the battle of Arras (*see* ARTOIS, BATTLES IN) formed the first phase.

In each locality or area the effort of each side to hold the other frontally, while outflanking him to the N., produced an ever-extending frontal battle that, after see-sawing to and fro, produced the line of stabilization characteristic of the trench warfare period.

In 1915 the line of stabilization between the Oise and the Scarpe was relatively quiet. And apart from a combat in Jan. 1916, in which the French lost possession of Frise, the line, as it was left at the close of the "Race to the Sea" in 1914, was the starting line of the great offensive of July 1 1916.

I. BATTLES OF JULY–NOVEMBER 1916

The four months and a half of almost continuous fighting which began with the great attack of July 1 1916 mark a turning-point in the World War in more than one respect. With July 1 1916 began that period of sustained and systematic Allied pressure upon the enemy which, though interrupted in the spring and early summer of 1918 by the desperate German counter-offensive, in the end wore his resistance down. Before July 1916 the Allied offensives had been relatively brief interludes in a long period of stalemate; from that date onwards it was the periods when active operations were in abeyance which formed the interludes. Further it is clear even from the grudging admissions of the German commanders that this great struggle materially affected the strategical situation as no earlier Allied offensive had, that the strain which the maintenance of their defence imposed on the resources and the *moral* of the German armies exercised an important influence on the course of the struggle. The actual gains of ground made by the Allies between July 1–Nov. 19 1916 were not large, but in making them they established a moral ascendancy over their enemy and brought home to the Germans the probability of defeat. And in this struggle the British army had for the first time to bear the major part: the French who fought on Sir Douglas Haig's right with so much gallantry and efficiency played a part of the greatest importance in the battle, but one as distinctly subordinate to the efforts of the British as the British attacks in May and Sept. 1915 had been to those of the French.

To speak, as is the common habit, of "the battle of the Somme" in 1916 is to fall into a natural but serious error. The operations were a series of great battles, each surpassing all those of previous wars in magnitude and intensity, parts of a common whole but still definite and separate operations for distinct purposes. It is possible to distinguish four main phases in the operations: first the winning of a position on the southern edge of the main plateau between the Somme and the Ancre, a matter of three weeks' hard fighting, embracing two attacks on a large scale and many lesser intermediate operations; in the second phase, which lasted till the middle of Sept., nearly two months, the operation took the shape of a contest for this main ridge and for the extension of the footing which the Allies had gained upon it so as to enable them to develop their offensive on both flanks as well as straight to their front; in the third phase the Allies pushed forward across the ridge and down its farther side, only to have their progress arrested by the persistent bad weather which set in about the beginning of Oct. and prevented anything like a general attack upon the rearward system of defences which covered Bapaume and Péronne; the fourth phase of the operations, extending from the beginning of Oct. till Nov. 18, saw a series of smaller efforts against particular points and strongholds, culminating in a bigger attack on Nov. 13 astride the Ancre which completed the reduction of the main ridge and captured ground of vital importance on the right bank of the Ancre. But the main rearward system was not penetrated, thanks largely to the mud which hampered every movement of the attackers and made the performance of the normal administrative services for the troops in the advanced position a task of the greatest difficulty. The devastating effects of the repeated bombardments made themselves felt over the whole area: houses and whole villages were reduced to ruins; woods were represented by a few shattered stumps and a tangle of broken trunks and branches; roads were rendered impassable till the battlefield became a dreary wilderness of mud and water-logged shell craters. To maintain trenches in defensible condition was all but impossible, to consolidate a captured position, difficult even in dry weather, became practically out of the question. The middle of Nov., therefore, saw active operations broken off and two months elapsed before anything more than quite minor operations became possible. The operations during the two months which preceded the German withdrawal to the Hindenburg line, including as they did a systematic advance up both banks of the Ancre on Bapaume, were essentially the continuation and completion of those of the last phase of the operations of the autumn, and it would be not unreasonable to treat them as yet another stage of "the Somme." They had brought the British practically within striking distance of the last line which covered Bapaume and Péronne when in the middle of March the German retreat anticipated its enforced evacuation.

First Phase.—The German positions astride the Somme and Ancre attacked on July 1 1916 were strong by nature and had been made doubly formidable by every device known to the military engineer. Their line represented the positions taken up in Oct. 1914 by the German VI. Army in the course of that "Race to the Sea" which culminated in the desperate fighting of Oct. and Nov. 1914 for Ypres and the Yser. The line then established had remained substantially unchanged, for neither side had since then attempted any operations of importance in this quarter where the British III. Army had relieved the French in front of Albert in July 1915. Hence the Germans had had ample time to develop their defences to the highest degree: villages and woods had become fortresses; two elaborate trench systems, each comprising several lines, had been dug, the second from two to three miles in rear of the first, "switches"—communication trenches—connected them up and greatly complicated the task of the attacker who should happen to penetrate any part of the front. Deep dug-outs, to the construction of which the chalk country lent itself admirably, gave shelter to the trench garrisons during bombardments; deep belts of barbed wire protected the different trenches, and most careful and skillful arrangements had been made for enfilade and supporting fire from numerous machine-guns; positions of special tactical value had been secured by formidable redoubts, while a well-placed and ample artillery was ready to support the defenders. Moreover, the advantage of the ground lay with the Germans, whose facilities for observation were excellent.

The frontage selected for the attack extended from just N. of Lihons on the extreme right to the Somme at Curlu, a distance of about nine miles, crossed the Somme and ran as before from N. and S. to Maricourt, another 3,000 yards. Here the French front ended, and the line turned sharply and ran W. for 7,000 yards. Here it turned N. again, making a sharp salient at the village of Fricourt. Thence to the Ancre, approximately 10,000 yards, the line ran over several spurs which jut S.W. from the ridge which formed the backbone of the German position. This ridge runs roughly N.W. from Péronne, dividing the valley of the Somme from the basins of the Scarpe and Scheldt. After crossing the Ancre the German line continued in a generally N. direction in front of Beaumont-Hamel and Serre, this last village forming the N. end of the front to be attacked, though a couple of miles farther N. a subsidiary attack was to be made against the pronounced salient at Gommecourt. The total frontage was over 25 miles, exclusive of the Gommecourt operations.

Against this frontage the British had available the five army corps of Sir Henry Rawlinson's IV. Army, which put into the front line eleven divisions keeping another nine in reserve, while two divisions of the III. Army (Sir E. Allenby) were to be employed against Gommecourt. On the German side some six divisions were holding the line to be attacked by the British.

Opposite the French, where they do not appear to have been expecting an attack, they were proportionately weaker, having three divisions in the line on a front of eleven miles.

Relatively to the numbers engaged in the Loos offensive, the British army was not employing in its first attack any greatly increased force of infantry. Where its preparations had altogether outstripped those of Sept. 1915 was in artillery, and it was on this arm that its chief hopes rested. For the six days' preliminary bombardment the heavy guns available were so numerous that it was difficult to find good positions for them all. Indeed the artillery personnel engaged in the first attack came to nearly half that of the infantry, and in weight as well as in number of guns the Allied artillery were able to establish a predominance over the enemy. This was largely due to the success with which the Royal Flying Corps was at the time contending against the enemy's aircraft; the mastery of the air which it had established ensured to the Allies—when weather conditions permitted—observation of artillery fire and denied to the enemy this important advantage and the opportunity of gaining information of movements behind the lines. Ammunition, too, if not as unlimited as it was to be in 1918, was plentiful. The careful economy which had been a painful necessity during the winter and spring had allowed the accumulation of large reserves, and although the great development of munition-making in England, undertaken in the summer of 1915, was only just beginning to produce its effects, its influence was already apparent in the effective bombardment to which the German positions were subjected for the week preceding the attack.

In one way the bombardment was almost too effective. The destruction was in some places so complete that it proved far more difficult to consolidate captured positions and to hold them against counter-attacks than to carry them. But to a large extent the German defences proved capable of withstanding even the tremendous shelling to which they had been subjected. Many nests of machine-guns had escaped intact, in places there were still stretches of uncut wire and the German artillery were able to make a most effective reply. North of the Ancre in particular German counter-battery work had much to do with the failure of the 31st Div. (VIII. Corps), the left of the main attack, to capture Serre. On its right the 4th Div. penetrated some way into the German position N. of Beaumont-Hamel, but found its flanks exposed by the check to the 31st Div. and by the failure of the 29th Div. against Beaumont-Hamel itself, one of the very strongest parts of the German line. It was counter-attacked and driven out after a stubborn resistance.

Immediately S. of the Ancre the X. Corps fared little better than the VIII. Its left division, the 36th (Ulster) began well and pressed forward N. of Thiépval. But Thiépval itself, another formidable fortress, defied the attacks of the 49th and 32nd Divs., with the result that the very success of the 36th contributed to its undoing. Its advanced detachments were cut off and overwhelmed, and in the end it was forced to evacuate its captures. South of Thiépval, however, at the angle known as the Leipzig Salient a slender foothold was gained and maintained despite the vigour of the German counter-attacks. On the right of the X. Corps, the 8th and 34th Divs. of the III. Corps had two very difficult places to attack in the strongly fortified villages of Ovillers and La Boisselle. Neither of these was captured, but the III. Corps managed to penetrate the German lines on either side of them, very slightly N. of Ovillers, rather more deeply between that and La Boisselle, and very much deeper S. of La Boisselle. Here also the 21st Div. of the XV. Corps, flanked on its right by a brigade of the 17th Div., made substantial progress N. of Fricourt, which village was in danger of being cut off, as E. of it the 7th Div., also of the XV. Corps, was most successful, storming the German front lines and penetrating as far as the village of Mametz. To the right again the XIII. Corps (18th and 30th Divs.) made great progress, reaching all its objectives from Montauban, W. to Mametz and E. to the Briqueterie. Thus, despite the failure of the British left and the limited success of the centre, the right had made a promising opening.

The reverse on the left may be in part explained by the exceptional strength of the German defences N. of the Ancre, and by the concentration of the German artillery in that quarter where they both expected and especially feared an attack. Had Beaumont-Hamel and Thiépval gone the German position on the main ridge would have been more seriously endangered than it was by the British success between Fricourt and Montauban. But if the Germans were less well prepared for an attack on this frontage, opposite the French they were certainly neither expecting one nor ready for it; and this, together with the ample artillery support available and the superior experience of the French gunners, contributed to the complete success of General Foch's attack. On both banks of the Somme his infantry mastered the German front system and made their way deep into their positions, reaching the outskirts of Hardecourt and Curlu N. of the river, while S. of it they progressed even farther, taking Dompierre and Foy. Exploiting their victory, the French pressed on, and by July 4 not only penetrated into the second system of German defences, but captured it over a length of six miles from Estrées N. to the Somme at Buscourt. Some 6,000 prisoners fell into their hands, with many guns, and as S. of the river they were well forward of the line reached on the right bank they were able to enfilade the German positions from across the river.

While General Foch's troops were exploiting and increasing their gains the British IV. Army was similarly employed, though on a frontage shorter than that originally attacked. Recognizing the futility of renewing the attempt on the formidable positions astride the Ancre, Sir Douglas Haig decided to concentrate his efforts on pushing home the success of his right. Divisions which had lost particularly heavily, like the 8th and 36th, were withdrawn and replaced by others from the reserves. Four days of hard and continuous fighting substantially extended the lodgment gained on July 1. The 7th and 17th Divs. joined hands behind Fricourt, cutting off that village; then, supported by the 23rd, they pressed forward against Contalmaison while the 19th Div. on their left reduced La Boisselle and made headway towards Ovillers. Advancing from Montauban after repulsing several strong counter-attacks the XIII. Corps captured Caterpillar and Bernafay Woods. With this the hostile front system over a front of six miles was secured and consolidated, but before a footing could be gained on the main ridge it was necessary to cross the valley which runs N.E. from Fricourt, to gain more ground towards Contalmaison, and to reduce Ovillers.

On July 7 therefore a second stage of the first battle started, the 12th and 25th Divs. assailing Ovillers while the troops who had cleared Fricourt and La Boisselle pushed on against Contalmaison and the 38th (Welsh) Div. attacked Mametz Wood. This last proved difficult to reduce but was finally cleared by the 21st Division. By July 13 Contalmaison also had been taken, and after some desperate fighting by the 9th, 18th, and 30th Divs. important gains had been made on the British right, Trones Wood (which changed hands repeatedly) being the scene of the fiercest contests. Meanwhile the French had cleared Hardecourt and advanced their line S. of the Somme to Biaches.

During all this fighting the German resistance had been stiffening. The stubborn fights which had been put up for Ovillers and Contalmaison and Trones Wood had given time for the arrival of strong reinforcements and the reorganization of the defence. The divisions on whom had fallen the brunt of the bombardment and of the first attack had been relieved by fresher troops; artillery had been shifted to meet the requirements of the new situation. Moreover, as the Allies advanced over the area devastated by the bombardment their administrative difficulties increased at each step; the advance of the guns to new positions meant new arrangements for ammunition supply, roads had to be repaired or improvised, and the feeding and watering of the advanced troops were laborious and troublesome. All these circumstances added to the difficulties of the next step, the assault upon the enemy's second system of defences on the S. crest of the main ridge. This system, though hardly as strong as that stormed on July 1, was formidable enough, and, like it, was supported by the fortified villages Longueval, Bazentin le Grand, and Bazentin le Petit and by several woods. To get within assaulting distance the troops had to advance under cover of darkness for about 1,000 to 1,400 yards in order to line up below the crest. This operation was a severe test for the troops; most of them had no experience of anything but trench warfare, but they acquitted themselves most creditably and the attack, launched just before dawn on July 14, met with great success. The 18th Div. finally cleared Trones Wood. Longueval and the two Bazentins were carried, the former by the 9th Div., the others by the 3rd and 7th Divs., while farther W. the 21st Div. cleared Bazentin le Petit Wood, and more ground was gained on that flank by the 1st and 34th Divs., though here the success was less complete.

For a time indeed even more substantial, almost decisive, results seemed within reach, for, after some counter-attacks on the British centre had been repulsed, it proved possible to push the 7th Div. forward to the top of the ridge to occupy High Wood. But the divisions on the flanks could not get up level with this, and though all the next day the detachment in High Wood held its ground, the position was untenable and had to be evacuated on the evening of July 15. The Germans, indeed, realizing the critical nature of the situation, spared no efforts to stop the further progress of the British and developed a series of counter-attacks against which the captured positions were only maintained with the greatest difficulty. Thus, though the attack had given the British the Bazentin Ridge on a front of 6,000 yards, and had incidentally led to the complete isolation and surrender (July 17) of Ovillers, which allowed a substantial advance to be made toward Pozières, it was followed by a phase of the battle in which the Allied progress was disappointingly small and seemingly out of all proportion to the efforts made and to the casualties incurred.

Second Phase.—The battles of July 1–12 and July 14–17 had left the Allies in a tactical situation not altogether advantageous. The check to the British left centre had left the Germans in possession of Thiépval which with Pozières about two miles S.E. of it presented serious obstacles to any progress towards the Ancre and threatened to enfilade any further advance straight to the front. Pozières must be mastered before the British centre could get forward. Even more important was it to improve the position round Longueval, where the advance of July 14 had created a sharp salient with its apex at Delville Wood, N.E. of the village. From this point the British line ran almost due S. to join the French at Maltzhorn Farm S.E. of Trones Wood, being continued thence S.W. of Maurepas to the Somme at Ham. It was imperative that the British right and the French troops N. of the Somme should make a substantial advance in order to reduce the sharpness of the salient at Delville Wood, a point which was extremely difficult to maintain, being subjected to a concentric artillery fire from the N. and E. as well as repeatedly counter-attacked. The wood had been captured on July 15 by the S. African Brigade of the 9th Div., but had been promptly counter-attacked by the 10th Bavarian Div. and then by the 7th and 8th Divs., picked troops all of them, and its possession continued in dispute for weeks. Longueval in like manner changed hands several times, the 2nd, 3rd, 5th and 18th Divs. in addition to the 9th being at one time and another engaged in the struggle for these key positions, the scenes of fighting as desperate as any in the long struggle of " the Somme."

And when at last Delville Wood had been cleared the task of debouching from its ruins presented great difficulties. In Ginchy and Guillemont, E. and S.E. of it, the enemy had positions of great strength, the fortifications of which formed a formidable support to their second system of trenches which ran S.E. by Maurepas towards the Somme. Maurepas proved a similar stumbling-block to the French; they reached it on July 30, but not till Aug. 24 was it completely in their hands, and they had to pay heavily for it. And behind Maurepas lay Le Forest with Rancourt and Frégicourt yet farther back.

The last week of July and all Aug. passed without any advance like that of July 14. The Germans fought stubbornly and counter-attacked persistently and resolutely, while, as over-addiction to the use of the bomb had sadly reduced the standard of musketry of the British infantry, their counter-attacks escaped the punishment they would have received in 1914. It was a time of constant and desperate fighting, of small advances, of many repulses and disappointments. Guillemont in particular was attacked on July 23 and July 30, on August 8 and August 16, but without more success than the capture and retention of the railway station on the outskirts of the village. But despite all these checks the line crept forward: to a considerable extent on the French front where, during Aug., it got within assaulting distance of Combles, Le Forest and Clery, and nearly 3,000 prisoners were taken; to a smaller extent on the British right; to a rather larger extent in the British centre, where the 33rd Div. won a foothold in High Wood and the 5th and 7th gained ground between that point and Longueval, while W. of High Wood a series of minor operations gradually advanced the British line up the crest. Farther to the left again, there was hard fighting by the troops of the Reserve or V. Army. This had been formed after July 1 by putting Sir Hubert Gough in command of the left wing of the IV. Army, in order to allow Sir Henry Rawlinson to concentrate his attention on the attack to the E. of the Albert–Bapaume road. The capture of Pozières was urgent as an indispensable preliminary to any advance over the watershed, and when this was accomplished (July 25) by the 1st Australian Div., flanked by the 48th, an important gain had been secured. But the German resistance in this quarter was very determined, and though some progress was made towards Thiépval from the Leipzig salient on the S. and from Pozières, Mouquet Farm E. of Thiépval proved a stumbling-block. Bad weather, too, with much rain and frequent cloud which impeded aerial observation of artillery fire, hampered the attackers, and the Germans, now thoroughly alive to the importance of holding up this advance, brought up fresh divisions with great rapidity. By the end of August five times as many German divisions as had been in the line on July 1 had been located on the British front. However, by Ludendorff's own admission, the strain on the Germans was tremendous; the need for constantly relieving exhausted divisions taxed their resources in men, artillery was so short that batteries were constantly kept in the line when their relief was due, the ammunition supply was beginning to cause anxiety, and worst of all, the resistance of the German infantry was weakening under the pressure of the Allied infantry attacks and of the Allied superiority in artillery and aircraft. The supersession of General von Falkenhayn as chief of the general staff by Field-Marshall von Hindenburg, with Ludendorff as his chief assistant (" First Quartermaster-General "), which took place on Aug. 27, may be in part attributed to the effects of the Somme, and was promptly followed by " the momentous order for the cessation of the offensive at Verdun." Pressed as they were on the Somme the Germans could no longer continue attacking elsewhere. If the immediate Allied gains on the Somme seemed small their offensive there had already relieved Verdun.

With September the second phase of the struggle was reaching its final stage. This took the shape of a general attack, extending almost as far as that on July 1, even N. of the Ancre, where the V. Army once again assaulted Beaumont-Hamel. Most success fell to the French, who not only attacked and took Le Forest and Clery but attempted more S. of the Somme than on any occasion since the middle of July. Besides pressing on against the Berny–Vermandovillers line which they had then reached they extended their attack as far S. as Chaulnes, storming the old German front line on a front of three miles. Their success here, which brought over 7,000 prisoners with many guns, did not as immediately affect the fortunes of the main struggle as did the capture of Le Forest and Clery, which was a considerable help to the British right as well as threatening Combles and the Péronne–Bapaume line, where the Germans were already busy on a rearward system of defences; still, it increased the area on which the Germans had to keep on the alert, and it was a great encouragement to the French, so lately strained to the utmost to retain Verdun, to be recovering more territory from the German grip.

To the British, Sept. 3 was a day of more qualified success. Once again the Beaumont-Hamel position proved impregnable, the efforts of the 49th Div. against Thiépval met with no success, and though in the British centre between High Wood and Delville Wood ground was gained, German counter-attacks recovered most of it. But the right fared better. The 20th (Light) Div., assisted by a brigade of the 16th (Irish) Div., at last mastered Guillemont, the obstacle which had held up so many attacks and cost so many casualties. The 7th Div. reached Ginchy, but after desperate fighting was thrust out of it again, while on the extreme right three days of hard fighting gave the 5th Div. Falfemont Farm and brought it to Leuze Wood. Here, therefore, the original German second system, which had so long held back the British right, was at last pierced and when on Sept. 9 this success was followed up by the capture and retention of Ginchy by the 16th Div. and the advance of the 56th (London) Div. up to Bouleaux Wood, the great stumbling-block to the advance of the British centre was at last so far removed that it could now push forward without putting itself at a grave disadvantage from enfilade and reverse fire. Thus the battles for Guillemont and Ginchy (Sept. 3 and 9) mark a very definite stage in the Allied progress. The forward crest of the main ridge was in their hands over a front of five miles and more. It was now possible to plan a general advance against the villages on the northern slopes of the watershed. Such an attack, if successful, would bring the British up against the rearmost of the enemy's original systems of defence, and would make the position of the Germans on their old front line S. of the Ancre and immediately N. of it a pronounced salient.

Third Phase.—The next attack, therefore, opened a new phase in the offensive. Special preparations were made for it, and a week's pause after the taking of Ginchy allowed of many reliefs. Thus the ten divisions of the IV. Army employed in the attack of Sept. 15 included several which had not yet taken part in the operations, among them the Guards, the 6th, one of the original units of the 1914 "B.E.F." and the New Zealand. Similarly in the V. Army the Canadian Corps had replaced the Australians, who had since their capture of Pozières made considerable gains N. of the Albert-Bapaume road. In addition to these fresh troops it had been decided to employ in this attack a new weapon from which much was expected. Despite the great increase in the available artillery and ammunition and the great improvements in the methods for directing, controlling and observing artillery fire, barbed wire and machine-guns were still the chief assets of the defence and had held up attack after attack. The evolution of the "tank" had been a long process. The idea of an armoured motor-car capable of defying both machine-guns and barbed wire had occurred to many people from the earliest days of the deadlock set up by the extension of the trench line from Switzerland to the North Sea. To translate this idea into practical shape, to produce a machine capable of accomplishing what was wanted, had been the work of months of ingenuity, experiment, devotion and skill. Not the least remarkable feature had been the success with which secrecy had been maintained. The tanks at their first venture hardly fulfilled their designers' hopes and expectations—it would have been extraordinary if they had—but they did quite well enough to encourage the Allies and to shake the *moral* of the German infantry, to whom they came as an effective surprise.

The frontage included in the British attack stretched from just S. of Courcelette to just W. of Combles. That strongly fortified position itself was not to be attacked, as the capture of the high ground on either side of the valley would determine its fate, and S.E. of the valley the French, who had already on Sept. 12–13 attacked and taken Bouchavesnes with 2,000 prisoners, were ready to coöperate.

The attack proved a great if not a complete success. On the left the Canadians not only captured their objectives S. of Courcelette but exploited their success so well that the village itself, not part of the original objective, was carried and consolidated. To their right the 15th (Scottish) Div. captured Martinpuich, High Wood was at last completely cleared by the 47th Div. and farther to the right again the New Zealand and 41st Div., with some assistance from tanks, captured Flers and pushed some way beyond it. On the right the success was less pronounced. A strong work between Ginchy and Morval known as the Quadrilateral held up the 6th Division. The tanks detailed to attack this point broke down and the gallant efforts of the infantry were unavailing. This check prevented the Guards Div. reaching their final objective, Lesboeufs, though they stormed their first and second objectives on the ridge S.W. of that village and maintained their position against counter-attacks. But with Lesboeufs and Morval, the objective of the 6th Div., still in German hands, the centre of the attack could not push forward without creating the same sort of situation as had prevailed on the right after the attack of July 14, and any further exploitation of the success was out of the question. Still, a big success had been achieved, a strong position had been broken into on a six-mile front, 4,000 prisoners had been taken, and the troops had the encouragement of having crossed the ridge and being able to see what lay on the farther side of the crest it had cost so much to gain.

The days that followed had to be occupied in reducing the Quadrilateral and in straightening out the line between Martinpuich and Flers. The 6th Div., not to be denied, pressed hard upon the Quadrilateral and after another unsuccessful attempt captured it on Sept. 18. But it is significant of the intensity and costliness of this fighting that the Quadrilateral had cost the 6th Division over 3,500 casualties. Its capture, however, allowed the line to be pushed forward within 1,000 yards of Morval and Lesboeufs, against which a new attack was in preparation.

Bad weather, however, delayed the delivery of this attack until Sept. 25. On this day the frontage attacked started at the Albert–Bapaume road but reached as far as the Somme. The French had, since capturing Bouchavesnes, improved their position S. of the Somme considerably by completing the reduction of Vermandovillers, Berny and Deniécourt, and they had on Sept. 20 successfully repulsed a strongly pressed counter-attack, N. of the Somme. Their objectives on this occasion included Rancourt and Frégicourt, Combles being dealt with indirectly by the capture of the heights on either side of it.

The "battle of Morval"—the official title for the attack of Sept. 25—was one of the most successful of the separate incidents of the Somme offensive. Except in the British centre at Guedecourt all the objectives were reached and carried before nightfall. On the left the 50th, 1st, New Zealand and 55th Divs. carried the line forward down the slopes N. of Flers and Martinpuich clearing two lines of trenches; on the right the Guards and 6th Divs. carried Lesboeufs and the 5th Div. took Morval, while Guedecourt also was captured next day (Sept. 26) by the 21st Div. assisted by a tank. The French were equally successful, and early on Sept. 26 British and French met in Combles, which was found full of stores and of German dead and wounded, the garrison having withdrawn just in time. Over 1,500 prisoners were captured by the British and nearly as many by the French, while signs were not wanting that the Germans were no longer putting up the stout resistance they had offered in the long struggles round Delville Wood and Guillemont. At several points large numbers of Germans surrendered or evacuated their positions almost without fighting. The strain of the continual bombardments and of the steady advance of the Allies was beginning to make itself felt.

The substantial success of Sept. 25 on the Allied right and centre was promptly followed up by victory in another quarter. Since July 1 there had been only one serious effort to renew the direct attack on the British left and the attempt of Sept. 3 had been a failure. Thiépval and all N. of it remained untaken. What progress had been made in this quarter had been from the S. and E. and it had not been rapid. The first real gain had not been made till the last half of Aug. when the scanty foothold already secured in the Leipzig salient directly S. of Thiépval had been enlarged by the 48th Div. This had been followed up by the capture (Aug. 24) by the 25th Div. of a trench known as the "Hindenburg trench." A violent counter-attack by a Prussian Guard Div. was successfully beaten off and minor gains had followed. Finally, on Sept. 14, a formidable redoubt known as the "Wonderwork," and situated just S. of Thiépval, was stormed by the 11th Division. Meanwhile the progress of the Australians beyond and W. of Pozières had greatly increased the prospects of success in attacking Thiépval.

From Thiépval a trench ran E. towards Courcelette known as the Zollern trench, halfway along which and N. of Mouquet Farm was the Zollern redoubt. North of Thiépval was the strongly fortified Schwaben redoubt from which the Stuff trench ran E. to the Stuff redoubt S. of Grandcourt, being continued beyond the Stuff redoubt as Regina trench. The capture of this second line would allow the British to overlook the Ancre valley and would make the position of the Germans N. of the Ancre most precarious. It was natural, therefore, that the Germans should cling with great pertinacity to the Thiépval position, but despite a stubborn resistance the V. Army's attack (Sept. 26) achieved a conspicuous success. The Canadian Corps on the right carried their objectives and brought their line within striking distance of Regina trench. The 11th Div. stormed the Zollern redoubt, the 18th on the left had the satisfaction of capturing Thiépval itself with over 1,000 prisoners from a Württemberg regiment, which had held that stronghold for nearly two years and believed it impregnable. These successes were promptly exploited and the capture of the Stuff redoubt by the 11th Div. and of part of the Schwaben redoubt by the 18th (Sept. 27–28) left the Germans with only a scanty foothold on the main ridge.

Simultaneously with the success at Thiépval, lesser but useful gains had been made by the IV. Army, including the capture of Destremont Farm, S. of Le Sars (Sept. 29). This was followed up by the taking after a stubborn fight of Eaucourt l'Abbaye (Oct. 3), though a gallant effort by the Canadians against Regina trench (Oct. 1) proved unsuccessful.

Fourth Phase.—It was at this moment, when the enemy's fourth system of defences had been reached and the Allies seemed about to accomplish a break-through (for the new lines on which he was at work still farther to the rear were not to be compared in strength or completeness with those already overcome), that a long spell of bad weather set in. Nothing could have been more unlucky for the Allies. As has been said, the German infantry were no longer fighting with their old resolution, their counter-attacks were not pressed with the old devotion and determination. But the constant rain and the cloudy days, which formed almost the only intervals in the rain, prevented adequate observation of artillery fire and turned the already damaged battle area into an impassable quagmire. The troops already engaged in the Somme offensive had had ample experience of hardships and difficulties; those encountered in Oct. and Nov. altogether surpassed what had gone before. The state of the ground was appalling: it had become a sea of mud, through which even lightly equipped runners found movement almost impossible, much more men laden with rifle, equipment and ammunition. In these conditions an ordinary trench relief was an achievement, to attack across such ground a hopeless undertaking. It is easy now to argue that the attempt to continue the attack in such adverse circumstances was a mistake, and could achieve nothing commensurate with the casualties and sufferings which it entailed. But it must not be forgotten that to suspend the offensive meant relaxing the pressure on the Germans, on whom the strain of fighting under these conditions was scarcely less severe and meant also giving them time to convert their incomplete new lines into defences scarcely less formidable than those the Allies had so painfully slowly pierced. At the beginning of Oct. the Germans had been pressed back to their last really strong positions, and behind the line that ran from Sailly–Saillisel past Le Transloy and in front of Bapaume they had not had time to develop anything elaborate or formidable. The anxiety of the higher command to pierce the Le Transloy line without delay was natural enough.

The situation after the capture of Thiépval was that on the British left the Germans retained a precarious footing on the heights above St. Pierre Divion and Grandcourt, but that any substantial advance by the British centre, now almost down into the Ancre valley N. of Martinpuich and Guedecourt, would turn the German positions lower down the Ancre. As before, however, the centre could not push on far with safety unless the right came forward level with it, and it was in front of the right that the German positions were most formidable. Their Sailly–Saillisel–Le Transloy line, itself strong, was covered by a long spur running in a N.W. direction and separating Lesboeufs and Guedecourt from Le Transloy and Beaulencourt. To capture this spur was indispensable before the Le Transloy line could be attacked. But a successful attack on the Le Transloy line was needed to open to the Allies the opportunity for an advance on a wide front in a N. and N.E. direction. Such a stroke would not merely outflank the Beaumont–Hamel position but the whole German position from Arras to the Ancre would be taken in rear. A dry Oct. might well have seen this hope realized and in Oct. 1916 there was no "Hindenburg Line" to bring an Allied advance to a standstill.

But with the weather as it was Oct. was a month of disappointment and scanty progress. The fighting was constant and costly. Trenches were difficult to take but much more difficult to consolidate or defend. The operations may be divided into three groups; on the right the French attacked and took Sailly-Saillisel but could make little progress N. and E. of it. In this quarter the repeated British efforts against the spur in front of Le Transloy resulted in the establishment of their line on its crest of the spur. In the centre, after the capture of Eaucourt L'Abbaye (Oct. 3) the chief gain was that the 23rd Div. secured Le Sars on Oct. 7. But to the N.E. of Le Sars the Allied progress was arrested by the gentle rise on which stands the mound known as the Butte de Warlencourt. This position was not particularly formidable in itself and in dry weather would not have held up the advance for long, but between the difficulty of accurately observing the fire of the supporting artillery and that of moving up the muddy slope on which the Butte stood attack after attack failed. The 47th Div. on Oct. 7, the 9th and 13th on Oct. 12, the 50th on Oct. 25 all found the Butte impregnable, though between Oct. 18 and 20 the 9th Div. did secure an advanced position in Snag trench, halfway up the slope, after a savage struggle.

The failure to take the Butte de Warlencourt or to make any substantial progress farther to the E. was to some degree compensated for on the left. Despite more than one repulse the line of Regina trench from the Courcelette–Pys road W. was stormed on Oct. 21 by the 15th, 18th, 39th and 4th Canadian Divs., and on Nov. 10 the Canadians extended their success by capturing the E. part of the trench on a front of half a mile.

By this time a sufficient improvement had taken place in the weather to allow of an operation on a larger scale than anything attempted since the battles of Morval and Thiépval. The more ambitious schemes for an advance across the Upper Ancre could not be put into force, but the German hold on the Beaumont-Hamel position had been weakened by the capture of Thiépval and it was decided to renew the attack in this quarter, the only portion of the frontage originally attacked which was still in German hands.

After a bombardment covering two days, the attack was delivered about an hour before daybreak on Nov. 13. South of the Ancre the 19th Div. cleared the German trenches N. of the Schwaben and Stuff redoubts and the 39th Div. took its farthest objective at St. Pierre Divion with remarkable ease and rapidity. North of the river the 63rd (Royal Naval) Div. fought its way forward to Beaucourt sur Ancre and held on tenaciously though in advance of the troops on its left. These, the 51st (Highland) Div., had been stoutly opposed at Beaumont-Hamel but had finally mastered the village, N. of which the 2nd Div. had carried the right portion of its objective. On the left, however, where the ground was specially heavy, the 3rd and 31st Divs. had been less successful; Serre had once again proved impregnable. But on the following day the success was exploited, Beaucourt was captured and the 51st and 2nd Divs. pushing forward along the spur N. and E. of Beaumont-Hamel established themselves on a line which secured Beaucourt on the N. and W. With this important gain of ground over 7,000 prisoners were taken, and to the Germans the quite unexpected loss of the long impregnable Beaumont-Hamel "was a particularly heavy blow" (Ludendorff). Advantage was taken of this victory to deliver a successful attack on a front of three miles against the German trenches on the slopes above Pys and Grandcourt (Nov. 18), but then the return of bad weather finally stopped the prosecution of active operations.

General Aspects.—The Allied offensive on the Somme had not yielded all the results that had been hoped for or that had at times seemed within reach. It was only natural that in some quarters the heavy cost at which the watershed between the Somme and Ancre had been mastered should be looked upon as altogether disproportionate to the gains, and that those who had not studied war sufficiently to realize that decisive victory is not to be had without a heavy price, and that it is not in achieving but in exploiting victory that the more tangible and spectacular gains are reaped, should be so disappointed as to overlook the substantial results which had been achieved. The Allies had begun the offensive with three main objects: to relieve the pressure on Verdun, to pin the enemy's main forces down to the western front, and, lastly, to wear down his powers of resistance. All these had been achieved, and of the three, the last, if the least tangible, was far from the least important. The 40,000 prisoners taken by the British and the 30,000 taken by the French might seem trifling in comparison with the vast captures made by both sides on the eastern front, but in quality the Germans taken on the Somme were very different from the half-armed Russians and the unenthusiastic mixture of nationalities who formed the Austro-Hungarian armies; and the decline of the German *moral*, admitted as it is by Ludendorff, outweighed in importance their losses in prisoners or material, considerable as these latter were. An eye-witness of the battle of Malplaquet wrote of that action, "the enemy was so advantageously posted that when the battle was over we wondered how we had surmounted the difficulties." Those who had been through the Somme might well have echoed his words, and despite the punishment they had received and the hardships they had endured the British and French had ample reason to be encouraged by their achievements. If the flower of the "new armies" of Great Britain and her Dominions overseas had been expended on the Somme, the Allies ended the year 1916 with a moral ascendancy over their enemies and with well justified hopes. It is only necessary to compare the strategical situation of Dec. 1916 with that of July 1 to see what a change had come over the war. On July 1 the Germans were certainly not contemplating attempting to negotiate a peace through the good offices of a neutral. And where had the change been brought about? Not on the eastern front, where Rumania had collapsed and the Russian offensive come to a standstill; not in Macedonia, where the capture of Monastir had been powerless to assist Rumania; not in the more distant theatres of war, where Kut was still in Turkish hands and the British had not yet reached the eastern frontier of Egypt; not in Italy, where the Austro-Hungarians were still holding up the Italian offensive across the Isonzo. Bad weather had prevented the immediate exploitation of the success earned in the struggles of July, Aug. and Sept.; changes of command and of plan were to throw away much of what the Allies had in their grasp early in 1917, but the change in the situation was the work of the Allied forces on the Somme. (C. T. A.)

II. GERMAN OFFENSIVE OF MARCH–APRIL 1918

As soon as the general military situation towards the end of 1917 seemed to offer the Germans a possibility of conducting the war in the western theatre by means of attack, preparations for this were set on foot by the Supreme Command. The first German move was to fetch up all the troops from elsewhere that could be spared and establish—at least temporarily, until the strong American reinforcements were added to the Allies—a balance of forces in the western theatre of war, or, if possible, a preponderance on the German side. This would obtain the necessary time for rest and training. To this end German division after division, and battery after battery, had been rolling up since the end of 1917 from Italy and the East into France. A number of heavy Austro-Hungarian batteries were also brought up. Finally 62 divisions and 1,706 batteries were made available for the main attack. For a second simultaneous attack in a different place these forces were not enough.

Systematic training for the attack was begun simultaneously behind the whole German front. Side by side with following out the instructions issued by the Supreme Command, the whole body of men had to be brought to exchange the defensive idea with which they had been living for the idea of the attack. The troops had to be taught the full use of machine-gun fire, guns and *minenwerfer*, and the support which airmen could give to infantry. They had to be trained to the utmost mobility and uplifted morally. The idea of surprise, which offered the only chance of the successful execution of a break-through operation, had also to be worked out in tactics.

Hand in hand with the equipping of the division chosen for the attack with horses and utensils of every kind went the collecting of munitions, supplies, building and sanitary materials, as well as the erection of railways, roads and battery positions.

Only a limited number of divisions could be equipped for the attack owing to the shortage of draft and horses. The building preparations were extended along the whole of the W. front so as to veil tactical purposes as long as possible.

At the end of Dec. 1917 the German Supreme Command had arranged for the mounting of quite a number of attacks. Although it was admitted that, for want of forces, the whole Allied front could not be attacked at once in order to find the suitable point for a break-through according to the Schlieffen idea, it was intended to keep the enemy as long as possible in ignorance of the German Supreme Command's actual intentions.

The decision as to which attack should actually be carried out was arrived at from a tactical point of view, strategical considerations being put aside. "Tactics had to be considered before purely strategical objects," writes Ludendorff, "which it is futile to pursue unless tactical success is possible. A strategical plan which ignores the tactical factor is fore-doomed to failure." Starting from this point of view Ludendorff decided to carry out the so-called "Michael" attack against the projecting southern sector of the British front. The attack was aimed at the British only, because they were still exhausted from the fighting of 1917 and it was desirable on general grounds to beat them first. It was to be executed at an early date independently of weather conditions. The sector to be attacked was thinly held and insufficiently fortified. It therefore seemed probable that the attack would succeed and that strategical use could be made of the break-through. It was unavoidable that the attack should take its course over the ground destroyed in the "Siegfried" retreat and the battle of the Somme.

The plans for the great attack were issued by the Supreme Command on Jan. 24 1918. The following individual attacks were to be prepared:—"Mars" (left wing) and "Michael I.," towards the N.E. past Bapaume, by the XVII. Army; "Michael II.," to the N. of the Omignon brook, by the II. Army; "Michael III.," on both sides of St. Quentin, by the XVIII. Army; "Archangel," south of the Oise, by the VII. Army. The "Michael" attack was proposed for March 20. The "Mars" and "Archangel" attacks were to follow a few days later, after the regrouping of the "Michael" artillery. The main attack was to break through the enemy front, and then, in conjunction with "Mars" left wing, to push on through Péronne–Arras. The XVIII. Army was to reach the line La Fère–Péronne. The "Archangel" attack was conceived merely as a diversion. The preparation of the attacks on Ypres–La Bassée (George I. and II.) was to be continued, the Hector-Achilles operations in the Argonne and Champagne were to be kept simmering. In case the Michael attack stopped short there was to be an attack by the III. Army. Instructions for demonstration actions were kept in reserve.

Rupprecht's group of armies, which, according to this plan, were to carry out the main assault with the XVII. and II.

Armies, were instructed to aim first and foremost at cutting off the British in the Cambrai bend. The armies were to advance with strong inner wings, the XVII. on Ypres and the II. on Equancourt. Subsequently the XVII. army was to deliver an assault in the direction of Arras–Albert and gradually roll up the adjacent British front, the II. Army to push forward in a westerly direction with the left wing on the Somme.

In the German Crown Prince's group of armies the XVIII. Army had to conquer the Somme and the Crozat Canal and eventually to extend to Péronne. If the II. Army should encounter any considerable resistance the XVIII. Army was to advance strong forces through Beauvois–Tertry to cut off the opponent in front of the II. Army. The Mars attack S. of the Scarpe was to follow the Michael attack as soon as possible and amplify the Michael operation. Farther N. preparations were also made to profit by it (Mars, N. Walkürenritt).

The forces provided for the break-through were 15 attack divisions and 2 position divisions for the XVII. Army, 15 attack divisions and 3 of position for the II. Army, and 19 attack divisions and 5 of position for the XVIII. Army. Besides these, 3 divisions were retained by the Supreme Command for disposal, first at Bouchain, then at Denain. As regards artillery, 950 field batteries, 701 heavy and 55 heaviest batteries were called up. Added to these were a few Austro-Hungarian heavy batteries, inadequately supplied with munitions.

In the prolonged preparations now carefully made, the attack front was kept as lifeless as possible, with the troops unchanged and the day-traffic kept down. Detrainments went on a long way to the rear on a wide front, and all movements of importance were held over until night time.

In March, each of the four groups of armies executed a first attack. In the Crown Prince Rupprecht's group the preparations were so elaborate in the region of Ypres and Armentières that even the troops themselves and their leaders were convinced that a great attack was really imminent. The German Crown Prince's group made a show of preparing an attack in the neighbourhood of Reims. From the 14th onwards reconnaissance attacks, bombardment of the enemy headquarters, bombing by airmen and the bringing up of reinforcements, set in. The increased artillery activity continued until March 24. Gallwitz's group of armies carried out a great attack on Verdun systematically up to the stage when the infantry should have come in, with several days of artillery preparation, a gas attack, and the bombardment of railway stations behind the lines. Duke Albrecht's group feigned an attack on the Lorraine front, and carried out a heavy artillery battle from March 20 to 24.

The result of these German operations was to intensify the opponents' suspense to the utmost. The British put themselves in a position of defence against a great attack between Armentières and La Bassée and between Arras and St. Quentin, and shifted forces from Flanders to the south. The French evidently expected an attack at Reims. New defensive works arose everywhere in the chief opponents' lines. They reinforced their batteries and sought by increased activity on the part of the airmen and patrols, to penetrate the obscurity which enveloped the German mode of procedure.

In the front of the actual attack the Germans counted upon having, in front of the XVII. Army, 15 strong British divisions of the III. Army (General Byng), and in front of both armies 23 divisions of the V. Army (General Gough). The Germans assumed, further, that the leader of the combined operations of the Entente, General Foch, would have in readiness strong reserves, mainly French, somewhere in the region of Meaux behind the centre of the enemy front. The majority of the British reserves were supposed to be behind the centre of the British front. No signs of withdrawing were seen on the enemy's part. A restricted foreground was counted upon.

The actual forming up for deployment of the attacking armies began on March 10 with the munitioning. The artillery deployment followed, and the attack divisions next moved into their positions at the front. Everything passed off smoothly and without any great counter-measures being taken by the defence. All the difficulties due to compressing within a narrow space great masses of human beings and piles of utensils and contrivances were easily overcome. The divisions were organized in groups, usually three lines deep, the first line being made the strongest in order to ensure rapid results at the beginning. The first line advanced close up to the front trenches on March 20, the second standing at a distance of 3–5 km. and the third 7–10 km. behind. The hindermost lines were looked upon as reserves for the higher command. They were not simply to follow up the others but to be fetched up according to the needs of the tactical situation.

The Supreme Command held in readiness, besides the above mentioned three divisions at Denain, other reserves behind the remaining army fronts, and reserved to itself the right of withdrawing forces from the front line when necessary.

On March 20 the attack divisions, protected by aircraft, were drawn up behind the position from which the assault was to be made. The deployment of the artillery and *minenwerfer* was complete and the munitions in readiness. Only the order to advance had still to come. But here the weather threatened to upset all plans, for the direction of the wind was such as would spoil the effect of the artillery's gas, and the fog would make the attack movement difficult for the infantry. By 12 at midday the weather conditions had so far improved, however, that it was decided to carry out the attack on March 21. On that day, accordingly, at 3:30 A.M., the gassing of the Allied batteries began. This was followed by a 3-hours' preliminary bombardment of the British positions by the German artillery and minenwerfer. At 9:40 A.M. the German infantry dashed forward to the attack. The mass of artillery then made a barrage, which, creeping gradually forward, was to pave a way for the infantry into the depths of the opposing trench system.

The attack itself turned out very differently at different points. In the XVII. Army, commanded by Otto von Below, the coöperation of infantry and artillery was not without its hitches. The barrage "ran away from the storming infantry," who only reached the opponent's first position and found itself in the evening before the strongly occupied second position. At Vaulx Vrancourt and to the N. of it, as also at Doignies, the British put up strong counter-attacks, to repel which several 2nd line German divisions had to be put in. The British defended themselves here with great stubbornness against the obvious danger of being shut off on the Cambrai bend.

The II. Army, commanded by von der Marwitz, pushed through to the line Gonzeaucourt–E. of Epéhy–Templeux le Guérard–Le Verguier. Their main battle raged around the high-perched village of Epéhy, which the XXIII. Reserve Corps failed to take in spite of heroic efforts. With this army only a small portion of the second line divisions needed to be brought up. There were no serious counter-attacks.

The greatest success was achieved by the XVIII. Army, commanded by von Hutier. Its right wing pushed through the second British position and took the Holnon Wood. The centre got through beyond Savy, Dallon, Fontaine les Clercs, and the left wing took Urvillers, Essigny le Grand and Beney, and forced the Oise crossing. The XVIII. Army also took the most booty.

On the whole a great initial success had been achieved. Everything depended upon whether it could be successfully developed.

The German Supreme Command was determined to order the continuation of the attack according to the results of the first day's fighting. It allotted the first reinforcements brought up to the XVIII. Army and the left wing of the II. Army, directing the XVIII. to ease the advance of the II. by pushing forward on Tertry. The II. Army was likewise to put its weight upon the left wing. On the second day the fighting was heavy, the chief burden falling on the infantry. A systematic preliminary bombardment was impracticable on account of the progress made on the first day, and it was a difficult matter to pull the batteries through the obstacles and shelled areas. The heaviest and most thankless task was once more allotted to the XVII. Army. Its infantry penetrated the second British positions time after time, only to be forced back just as often by strong counter-attacks assisted by tanks. Not until the afternoon did they succeed, with considerable losses, in taking Croiselles, Vaulx Vrancourt and Morchies, and entering Hermies. To do this they had to be assisted by large portions of the third line. In the evening the army found itself once more up against another strongly held British position on the line Béhagnies, Beugnâtre–Beugny.

The II. Army had also had more hard battles to win. It took Epéhy and pushed forward as far as Fins–Longavesnes-Marquaix–Coulaincourt, capturing considerable booty. It was not able to interfere with the British evacuation of the Cambrai bend, owing to the slow progress made by the XVII. Army.

The XVIII. Army made a good advance encountering only slight resistance. It stormed Feuquières and forced a crossing over the Crozat Canal between Jussy and Tergnier. For March 23 General Ludendorff ordered an attack by the XVII. Army in the direction of Bapaume, to supplement the success of the II. Army, and an advance on both sides of the Somme by the II. and XVIII. Armies.

This day at last brought the reward of their heavy labour. The XVII. Army met with sharp opposition even now from newly put in divisions, but was able to take Monchy, Driencourt, St. Leger, Beaumetz, Lebucquière and Havrincourt.

The II. Army encountered heavy resistance on the right wing only, and was able to reach the line Neuville–Etricourt–E. of Bouchavesnes–E. of Péronne–the Somme at Brie, with only slight opposition. The XVIII. Army took the Somme crossing at Béthencourt by fighting, stormed Ham and crossed the Crozat Canal. Its left wing corps (the IV. Reserve) repelled the counter-attacks of 3 French divisions that were being hurried up as reinforcements in a bloody battle.

For the next two days the scene remained unchanged. The XVII. and II. Armies advanced towards the Ancre, fighting violently, the II. being more and more hindered by the shelled area of the Somme battle. But gradually a new front arose on the Ancre in front of these armies, stretching southward to the Somme. In the region of Albert the British executed one counter-attack after another, though with heavy losses.

The centre and right wing of the II. Army had, by March 26, reached Thiépval, Beaumont-Hamel, Mametz, Cornoy, Albert and Braye sur Somme. Certain portions veering in from the N. opened a way of advance for the lagging left wing, which was thus able to come up with the rest of the army on March 27 on arriving at Ville sur Ancre–Sailly. Meanwhile the resistance was visibly growing, and it was possible to calculate the point at which it would be equal to the decreasing pressure of the attacking forces.

The XVII. Army had been steadily fighting its way forwards through village after village. In proportion as the opponent's fighting power waned new forces were put in. He seemed determined that there should be no question of rolling up or breaking through his front at Arras under any circumstances. In spite of this the army managed to take Bapaume on March 24, Béhzgnies, Sapignies, Grévillers and Irles on the 25th, and to reach Boiry, Becquerelle, Hamelincourt, Achiet le Grand and Achiet le Petit on the 26th. The attacking power of the army was now exhausted. On the 27th it did no more than capture the village of Ablainzeville and repel the counter-attacks of new British forces with powerful artillery.

The II. Army progressed in much the same way. The XVIII. Army maintained its almost unbroken advance throughout the days from March 23 to 27. By the evening of the 25th it had reached Nyencourt, Curchy, Nesle, Hattencourt–Beaulieu-Bussy, and on the 27th was in possession of Pierrepont, Montdidier, Boulogne la Grosse and Lassigny.

At this point the great battle came temporarily to a close. General Ludendorff had, on the evening of March 26, shaped his plans with the view of dividing the British and French by a gradual left-wheel advance of the II. and XVIII. Armies against the French. To this end the Somme at Amiens, and the Avre had to be reached, and the operation continued towards the S.W. The original plans had thus undergone a complete change in the course of its execution. It would now very soon be shown whether the tactical break-through could still be brought off in spite of the waning of the Germans' strength and the increase of the Allied resistance.

The course of events on March 27 did not come up to Ludendorff's arrogant expectations. It was impossible for the attacking force to know that in the direction of Amiens—the decisive point—the Allies had only very weak forces at their disposal on that day. In this case, as in every break-through, the difficulty of accurately estimating the exact effect presented itself. The difficulties of provisioning, too, made themselves increasingly felt in the shelled area of the Somme battlefield. The supply of munitions ceased, and the establishment of rearward communications had not kept pace with the advance of the attack. From certain signs it was evident that the German troops were not everywhere at their highest level of achievement and endurance. The losses, particularly those of the XVII. Army, exceeded what under the circumstances was the legitimate number.

Ludendorff therefore changed his intention once more on March 27. The XVII. Army was ordered to close down the attack. The XVIII. and the left wing of the II. were to renew their attack on the now isolated French on March 30 between the Somme and the Oise. This attack resulted in the filling out of the German line where it curved in S. of the Somme, and the taking of the localities Aubercourt, Démuin, Moreuil, Sauvillers, Hargicourt, Contigny, Anainvillers, and Rollot—the so-called bridgehead of the Avre. But while the break-through at Amiens failed, the Germans were able to repulse the violent, though disconnected, French counter-attacks in every case. By April 4 the right wing of the XVIII. Army had still been able to take the heights W. of Moreuil. The II. Army reached the western border of Hamel and pushed forward almost to Villers Bretonneux and Hangard. The battle then ceased.

Later repetitions of the attack in the direction of Amiens had no better results. An assault on April 24 by the II. Army in the neighbourhood of Villers Bretonneux, in which tanks were used, made good progress at first but could not hold the ground gained. The battle ended therefore without any clear decision. Certainly the Germans had achieved an initial success such as had been denied to the Entente during the preceding 3½ years of hard struggle in spite of the masses of men and material put in; they had more than made good the ground lost in 1916, and had captured—apart from enormous booty—90,000 prisoners and 1,200 guns. The British army was heavily shaken; 20 French divisions had been drawn into the battle; but the war had not been won, and neither the transition to a war of movement, nor the separation of the French and British had been achieved. In the course of the battle 90 German divisions—almost half of the western army—had suffered more or less heavy losses. New and great efforts would be required for the fulfilment of Ludendorff's great aim.

Battles of Arras and the Oise.—An attempt was next made to extend the front of the attack on both sides. To this end Rupprecht's group of armies had been preparing since March 22 to carry out the Mars N. attack at an early date, and had allotted to the XVII. Army three divisions standing behind the VI. Army in view of this. To replace them four divisions of the IV. Army were sent to the VI. The group of armies hoped at last to break the British lines by delivering two attacks on their front—this one and the Walkürenritt by the VI. Army—while the II. and XVIII. Armies profited by their early success on the British right wing. But this plan had for the moment to be pushed aside as the Supreme Command placed all the pressure on the left wing of the Michael operation. Not until March 25 did Ludendorff revert to the extension of the attack on the British. He settled that the Mars attack should take place between the Loretto height and the Scarpe on March 28, together with a secondary attack south of that stream. The Walkürenritt attack on the Loretto height was to follow closely.

For this attack 7 German divisions were placed N. of the Scarpe, under the general command of the I. Bavarian Reserve Corps, and 4 S. of it under the general command of the III.

Bavarian and IX. Reserve Corps. But no success was obtained, although the divisions were mainly fresh ones. The work of attacking was hampered by the indistinct nature of the country and the endless maze of trenches. The British opposed the attack with fresh forces, and, particularly by the skillful use of their machine-guns, impeded the advance of the attacking force. North of the Scarpe the 1st line divisions, after some insignificant successes at the start, met with strong British counter-attacks, which threw back the attackers for the most part to their starting positions. Only the two localities, Gravelle and Roeux, remained in German hands. The Command did not put in any reserves.

South of the stream the localities of Neuville and Ayette yielded to the bold assaults of the German divisions fighting in that quarter, but no decisive success was attained. The taking of several thousand prisoners, and heavy losses on the Allied side, were the only positive results of the Mars attack, which had failed for two reasons—it was obviously on too narrow a front and had not been launched as a surprise.

The Supreme Command now gave up the VI. Army attack on the Loretto height, and ordered the XVII. Army, including its right wing, to stand on the defensive.

The extension of the attack S. of the Oise had no such wide operative aims. It was designed in the first place to protect the projecting left flank of the XVIII. Army and the road running behind it through La Fère–Chauny–Nayn, which was indispensable for bringing up drafts. To ensure this the Ailette line, which cut off the reëntering angle between the XVIII. and VII. Armies, had to be won. The task was entrusted to the general commands of the VIII. Army Corps and the VIII. Reserve Corps under the leading of the 7th Higher Army Command. The attack was led from the N.E. in view of the difficult Oise crossing. The attacking force, on April 6, took the French—who were apparently in no great strength—obviously by surprise, and pushed through South Chauny and Amigny to Marizelle and Barisis railway station. On April 7, after a short preliminary bombardment, the attack was continued, and Pierremande and the Coucy Wood were reached with only slight opposition. On the 8th the VIII. Army Corps advanced to the Ailette, S. of Le Bac d'Arblincourt, and stormed Champs. The VIII. Reserve Corps captured Coucy le Château, and reached the road Coucy–Landricourt–Arizy at nightfall. Finally on the 9th the two corps won the Oise–Aisne Canal along the whole front.

In a 4-days' struggle the problem had been smoothly solved. The victors held 2,300 prisoners. The front had been considerably shortened, and the possibility of successful attacks even against French defenders had been established. (W. M.-Lo.)

III. The Battle of Amiens, Aug. 8–22 1918

At the beginning of the fourth week in July, the German offensive on the Marne and in Champagne, which had been intended by their Higher Command as decisive, had been brilliantly repulsed by an Allied counter-blow, which had not only thrown back the enemy over the Marne but was forcing him back to the Vesle. Gen. Foch was resolved to follow up the advantage thus gained and assume the offensive on all his front as soon as possible; but it was essential before so doing to clear the main railway lines running laterally behind his front, several of which were menaced or blocked by the enemy. The most important of these was the Paris–Amiens line, and it was therefore decided that the first measure should be the freeing of this railway by a joint Franco-British attack on a wide front E. of Amiens. This operation was discussed first at a council of the four Allied commanders-in-chief, held at Bombon, near Melun, on July 24 1918 and further in a conference between Gen. Foch and Sir D. Haig on the 26th, and was finally embodied in a directive issued by the Allied Generalissimo on the 28th. It was therein laid down that the offensive should be conducted by the IV. British and I. French Armies, under the command of Field-Marshal Haig; that covered by the Somme, it should be pushed as far as possible in the direction of Roye, and that the road from Amiens to that place should be the dividing line between the two armies. The date fixed, at first Aug. 10, was later advanced to Aug. 8.

Preparation for the British Attack.—An operation similar to that ordered had for some time been contemplated by the IV. Army, and preparations for it were therefore pressed on from July 26 onwards. At this date the army, under Gen. Rawlinson's command consisted of the Australian (Monash) and III. Corps (Butler), (8 infantry divisions and one cavalry division), on the front Albert–Villers-Bretonneux. By the date of the attack it had been reinforced by the Canadian Corps (Currie) (4 infantry divs., another Australian infantry div., and 2 cavalry divs.), while the artillery was brought up to a total of over 2,000 guns, the aircraft to 28 squadrons and the tanks to 456 machines, 96 being whippets. The difficulties of effecting the concentration of these masses of troops and material, while keeping it secret from the enemy, were successfully overcome by means of elaborate precautions surpassing even those taken by the Germans before their spring and summer offensives. The cavalry, whippet tanks and part of the artillery were moved into the IV. Army area by road, the remainder (far the larger proportion) of the troops and material, being brought up in the period Aug. 1–8 in some 300 special trains. It was regarded as of the utmost importance to keep secret the arrival of the Canadians; in order to deceive the enemy, the troops themselves were deceived; Canadian units were sent from Arras into the trenches in Flanders, and the corps was actually brought into line, only a few hours before the attack, relieving the right of the Australian Corps, which had by Aug. 1 taken over the front from the French as far as the Amiens–Roye road. The precautionary measures taken were entirely successful in their object of ensuring that no warning of the attack should reach the enemy.

The front of the IV. Army attack extended from the Ancre S. of Albert to the Amiens–Roye road, a frontage of some 13 m.; three successive objectives were assigned, at distances, respectively of about 2-2½, 3-5, and 6-8 m. from the original starting line, which would bring the army eventually on the line of the "Amiens outer defences," on the front Le Quesnel–Harbonnières–Morcourt. The country, open rolling downland, was favourable for the operations of all arms; the enemy's defences were not formidable. The hostile forces believed to be available to oppose the British, consisted of the LI., XI. and XIV. German Corps (seven divisions in first line and eight in support and reserve) belonging to Gen. v. der Marwitz's II. German Army.

By the morning of Aug. 8 all preparations for the battle had been successfully completed and the British forces were, all unsuspected by the enemy, about to enter on the first stage of their march to the Rhine.

The British Offensive on Aug. 8.—Punctually at 4:20 A.M. on the morning of Aug. 8 the British infantry and tanks, under cover of a powerful barrage, debouched to the assault. Thick ground-mist veiled their advance from the eyes of the Germans, who were completely surprised and in an instant overwhelmed with little resistance. The Canadian Corps sector extended from the Amiens–Roye road to the Amiens–Chaulnes railway; 156 tanks coöperated in the attack of this corps. Opposed to them was the 119th German Div., which was in process of being relieved by the 117th Division. The 3rd Canadian Div. on the right of the line, making light of the difficult task of debouching from a narrow bridgehead on the S. bank of the Luce river, set foot on the plateau between that stream and the Avre, captured Hangard and Démuin, and by noon had carried its front forward to the second objective, between Cayeux and Mezières. Thenceforward the 3rd Cavalry Div. took up the advance, followed by the 4th Canadian Div.; the cavalry, after taking Beaucourt, were held up by machine-gun fire, and though the infantry when they arrived succeeded in pushing forward, it was not found possible to reach Le Quesnel, the final objective, which at fall of night was still strongly held by the enemy. The centre and left Canadian Div., and the 1st and 2nd, attacked each on a front of one brigade, employing a separate brigade for each successive objective; the 1st Div. met with little serious opposition as far as the first objective, which it reached at 6:20 A.M. but the 2nd Div. only attained it an hour and a half later, having had heavy fighting at Marcelcave. At 8:20 A.M. the advance was resumed, and again the 1st Div. had the easier task, the German machine gunners putting up considerable resistance against the 2nd Division. Two brigades of the 1st Cavalry Div. now passed through to the front, and drove far into the hostile territory, capturing Caix, and attaining the final objective, in conjunction with the Canadian infantry, which moved behind them clearing up the ground already passed over by the cavalry. By 5:35 P.M. the Canadian Corps had, with the exception already noted on its extreme right, carried out its appointed task; it had penetrated the enemy's defences to a depth of over 8 m., capturing 12 villages, over 6,000 prisoners and 160 guns.

The Australian Corps advanced between the Amiens–Chaulnes railway and the Somme against the 41st, 13th and parts of the 108th and 43rd German Divs. The Australians had their 2nd and 3rd Divs. in first line and their 5th and 4th in support, the 1st Div. being in reserve N. of the Somme; 168 tanks were attached to the corps. The corps was drawn up by its commander in such a manner as to necessitate a double "leap frogging" of its divisions, while equalizing the exertions demanded of them and the distances to be traversed by them; and this complicated manœuvre was carried out with entire success. The 2nd and 3rd Divs., assisted effectively by the tanks, carried Warfusée and Cérisy, and then relinquished the attack to the 5th and 4th Divs. which pushed forward beyond Baronvillers and Morcourt, despite heavy flanking fire from the German artillery on the N. bank of the Somme. On the second objective being reached at 10:30 A.M. a brigade of the 1st Cavalry Div., with 16 whippet tanks, passed forward to Harbonnières, and an armoured car battalion raced forward down the Amiens–Brie road, scattering death and destruction far to the E. in the enemy's back areas. Behind them the Australians, throwing back their left to face the enemy on the N. bank of the Somme, pushed forward their centre and right to the final objective, just W. of the line Vauvillers–Proyart, where they found the cavalry held up. In the space of under six hours, between this opening of their attack at 6:20 A.M. and the attainment of the above line about midday, the Australian Corps had occupied seven villages, and taken over 8,000 prisoners, 173 guns and much other booty too numerous to mention.

On the N. of the Somme the operations of the III. Corps had not, however, met with the expected measure of success. It had been intended to advance with the 58th, 18th and 12th Divs. to a river from the line W. of Etinehem to W. of Morlancourt, thus securing the left flank of the main attack S. of the Somme; 34 tanks were detailed off to assist this attack. The programme of attack was disarranged by a partial advance of the enemy on Aug. 6 which forced back the 18th Div., and from the first moment difficulties were met with. Sailly Laurette was carried after stiff fighting by the 58th Div. and eventually the first objective was reached along the whole corps front. The further advance of the 58th Div. broke down against the resistance of the enemy holding the Chipilly spur and the 18th Div., which succeeded for a time in gaining ground farther to the N., were counter-attacked and forced to fall back. The enemy on the III. Corps front was not surprised, and fought well, and the attacking infantry were unable to find much support from the tanks, for which the ground was unsuitable in many places; 2,400 prisoners were taken by the III. Corps, together with 40 guns.

The results of what had undoubtedly been the most successful day's battle waged hitherto by the British army in the World War, and one of the finest British victories of all time, were the complete defeat of 11 German by 11 British divs., a gain of ground to an average depth of 6 to 7 m. on a front of 8, and the capture of close on 17,000 prisoners, 373 guns, several thousand machine-guns, and quantities of ammunition and stores. Most important of all, the battle revealed to the enemy Higher Command weaknesses hitherto unsuspected in their army, and destroyed the last hope of German victory. "It was," says Ludendorff, "the black day of the German army in the war. It was the worst experience I had to go through. It marked the decline of our fighting strength and destroyed our hopes of a strategic improvement. To continue would be a gamble. The war would have to be ended."

Operations of I. French Army around Montdidier (Aug. 8–11). The plan of Gen. Fayolle, commanding the French reserve group of armies, involved not only the participation of Gen. Debeney's I. French Army in the British operations N. of Montdidier but a subsequent extension of the attack to the S. of that town by the right wing of that army and eventually as far as the Oise by the French III. Army (Gen. Humbert). Gen. Foch sanctioned this scheme on Aug. 3, and it was decided that the attack S. of Montdidier should take place on the 9th and that of Humbert's army on the 10th.

The French I. Army at this time held a line from the British right flank near Domart to Castel on the Avre and thence along the W. bank of that stream to Courcelles, S.E. of Montdidier, whence the French III. Army continued the line to the Oise. Debeney had under his command the XXXV., X., IX. and XXXI. Corps (in line in that order from right to left) and the II. Cavalry Corps in reserve, in all 12 infantry and 3 cavalry divisions. In face of him stood the 2 left divisions of the German LI. Corps, of von der Marwitz's II. Army, as far as Moreuil, and 7 divisions in line with 2 in reserve, belonging to Von Hutier's XVIII. Army, from Moreuil southwards. The enemy on this front had recently withdrawn his line behind the Avre as a result of several small French operations on the W. bank and was therefore well on the alert.

Debeney's plan for the forthcoming operations consisted first of an advance by his two left corps in the angle between the Luce and the Avre in conjunction with the British right, followed by the passage of the Avre and the Trois Doms and a rapid advance to the plateau around Hangest on both sides of Montdidier by his centre and right, and the capture of that place. The whole army was then to push forward astride the Avre in the direction of Roye.

This programme was carried out without a hitch. The French bombardment commenced at 4:20 A.M. on the 8th, the hour of the British attack, and the infantry and tanks of the XXXI. Corps debouched between the Luce and Moreuil at 5:5 A.M. The German LI. Corps on this part of the front, was, contrary to expectation, taken unawares and put up little resistance; many prisoners were captured while engaged in cutting corn in the fields. Moreuil was taken and the way cleared for the IX. Corps farther S., which about 9 A.M. began to cross the Avre on foot-bridges thrown under cover of darkness early that morning. Here there was stiff fighting, and it was not till late in the day that the tanks were got across the river and cleared the way for the infantry, which at nightfall had reached the line Fresnoy–Plessier. Behind the IX. Corps, the X. was passing the Avre, and preparing for its S.E. advance on the morrow to encircle Montdidier from the N., while the XXXV. Corps was about to execute a similar manœuvre from the south.

The second stage of the operations commenced early next morning, the 9th. In order to secure the left of the X. Corps in its advance on Montdidier the XXXI. Corps attacked Hangest and occupied it about 11 A.M. The X. Corps, passing the Avre and the Trois Doms in its turn, took over the IX. Corps, and, assisted by the latter's artillery as well as its own, pushed forward to the E., meeting with considerable resistance, while the XXXV. Corps, debouching against Assainvillers at 4 P.M., took the enemy by surprise and advancing some 3 m., reached and cut the Montdidier–Roye road near Faverolles. The garrison of Montdidier, their retreat threatened from two sides, fell back hastily under cover of darkness by the road to Guerbigny, leaving behind a rearguard which fell into the hands of the French X. Corps on their entry into the town on the morning of the 10th.

Debeney, urged by Foch in a personal letter "to push forward towards Roye and there join hands with the French III. Army" (which was due to open its attack between Courcelles and the Oise on the 10th), decided, now his army was successfully reunited astride the Avre, to press his advantage in conjunction with the British on his left. The disaster to the German II. Army in the N. had rendered the position of the XVIII. Army, which was facing Debeney, so difficult that it had to throw back its right flank to W. of Roye—a movement which was carried out on the night of the 9th. By the evening of the 10th the I. Army following up the retiring enemy had reached the line Andechy–Bus, and on the next day a further slight advance was made on either wing of the enemy, Lechelle and Tilloloy being taken by the XXXI. and XXXV. Corps.

By now the German XVIII. Army, although its attention was distracted by the advance of the French III. Army against its centre and left, was reconstituting a solid line in the old French zone of 1916. Von Hutier, whose forces had been increased from 15 to 18 divisions by the 11th, established them in depth on two successive lines of trenches, with a strong belt of wire in front, all lines of approach being swept by direct and indirect machine-gun fire. A continuation of the rapid advance of the French I. Army was under these circumstances out of the question, and it was necessary to resort to slower and more thorough measures for overcoming the German resistance which was day by day hardening in proportion as further fresh reinforcements arrived.

Continuation of British Advance (Aug. 9–11).—It was decided by Gen. Rawlinson that the IV. Army should on the 9th continue its advance to the line Roye–Chaulnes–Bray–Dernancourt. The main attack was entrusted to the Canadian Corps which was to push S.E. to the line Roye–Hallu, while the Australian Corps was to secure its left between the latter place and Méricourt, and the III. Corps to advance to Etinehem and form a strong defensive flank on the N. bank of the Somme.

The Canadian attack, on the 9th, failed to attain all its objectives. Assisted by the 2nd Cavalry Div., it none the less effected a deep advance of some 4 to 6 m., secured eight more villages, and halted for the night on the line Arvillers–Rosières. To its left the Australians advanced their front between the Chaulnes railway and the Amiens–Brie road as far as Lihons hill, W. of Lihons village, and Framerville, after stubborn fighting. The III. Corps, reinforced by an American detachment, carried all its objectives for the day, clearing the Chipilly spur and taking Morlancourt. The German II. Army, still much disorganized, had been reinforced by six additional divisions from the XVIII. and IX. Armies, sent up by train and lorry and thrown straight into battle, often without their artillery, and its resistance had noticeably stiffened.

The British advance was continued on the 10th. The Canadians, now opposed by fresh troops from the XVIII. German Army, succeeded in attaining with its left the front assigned to it at Hallu and Fouquescourt but failed to get its right forward to Roye, the western suburbs of which were stoutly held. The Australian Corps which had now extended its left astride the Somme, in order to secure effective coördination of the operations on both its banks, had severe fighting on Lihons hill and was held up by determined German counter-attacks. Operations were undertaken on both banks N. of the Somme under cover of darkness, the plan being to encircle the hostile positions in the Etinehem and Méricourt bends by drawing a cordon across the bases of these bends. Etinehem and all its garrisons were easily taken, but the attack on Méricourt was broken up by hostile bombing planes and had to be completed on the 11th.

The IV. Army orders for this day's operations were that the Canadians and Australians should continue their advance to the line of the Somme and secure the crossings from Offoy (E. of Ham) to Bray. During the 10th and 11th, however, 8 more German divisions had come into line and delivered a series of vigorous counter-attacks which had the effect of putting a stop to any real British advance. The Canadian attacks were cancelled and the Corps had hard work to hold its ground. The Australians captured and held Lihons but could get no farther.

In fact, it was now clear that to push the offensive further would lead to disproportionate loss with little corresponding gain. The German II. Army had reformed its front, shattered on the 8th, with fresh troops drawn from the XVIII. and IX. Armies and from Prince Rupprecht's group in Flanders, and settled itself on the edge of the area devastated in the Somme battles of 1916, where a maze of old trenches, wire, and shell holes rendered defence easy and rapid advance impracticable. The British IV. Army had engaged all its 13 divisions, and its units were tired and in need of a breathing space. Gen. Rawlinson therefore decided on the 11th to allow his troops a few days' rest, while preparing for a renewal of the attack on the 15th. The units in the line were relieved and the tired infantry together with the cavalry were withdrawn into reserve.

French I. Army's Operations (Aug. 12–22).—On Debeney's front also during this period, minor activity took place, resulting in merely local advantages to the French. On the left of the I. Army, the line was drawn closer to Roye on the N.W. and W., while on the right the XXXV. Corps took Reuvraignes on the 20th. In this area, however, the German XVIII. Army had put into line no less than 10 divisions, while on the whole front between Roye and Lassigny a total of over 20 divisions were engaged between Aug. 9 and 22 against the French I. Army. Thanks to the employment of these strong forces, and to the increasing facilities for defence afforded by the shattered and intersected country into which the battle line had now been carried, the German XVIII. Army was enabled to maintain its ground to the W. and S. of Roye until the pressure of events elsewhere compelled its withdrawal in conformity with the armies on either flank at the end of August.

The operations of the French I. Army since Aug. 9 had resulted in the reconquest of an area of ground to a depth of 10–15 m. and the capture of some 12,000 prisoners and over 100 guns, besides much other material and stores.

British Operations (Aug. 12–22).—The IV. Army offensive planned for the 15th did not take place and only partial actions were carried out on its front during the period from the 12th to the 22nd. British attacks alternated with German counter-attacks with no great change resulting in the situation. Thus on the 12th the Australians took Proyart, while on the 15th the Canadians secured Damery and Parvillers. On the 17th Sir D. Haig decided that the next large-scale attack by the British should take place on the I. and III. Army fronts; the Canadian Corps left the IV. Army, the French taking over its sector as far as S. of Lihons and the remainder of the IV. Army line, which on Aug. 22 ran from Damery by Lihons and Proyart to Dernancourt, was left to the 12 divisions of the Australian and III. Corps. Facing them the German II. Army had available 26 divisions, of which, however, only 16 were in good fighting trim.

During the period from Aug. 8 to Aug. 22 the IV. Army had forced back the Germans to a depth of 12 m., had defeated or engaged with its own 13 divisions no less than 27 of the enemy's, had taken from him 23,000 prisoners and 400 guns and had killed and wounded more than an equivalent number of his men at a cost to itself of some 27,000 total casualties.

Offensive of French III. Army (Aug. 10–22).—In accordance with the scheme of Gen. Fayolle, already mentioned, the attack of the French III. Army was launched on the early morning of the 10th. The XXXIV. and XV. Corps (7 divs.), on a front of 14 m., from Courcelles to the Oise, were opposed by 7 German divisions in line and one in reserve, forming the centre and left of the German XVIII. Army. The objective of the French offensive was assigned as the line Lassigny–Noyon. The nature of the ground in front of Humbert's right, a tangled and broken mass of wooded hills, known as the "Petite Suisse," forbade any rapid advance in that quarter, and recourse was had therefore to an enveloping movement by the left (XXXIV.) Corps of the III. Army, which was directed to turn the highland by the north. At 4:20 A.M. on the 10th the attack commenced without artillery preparation; little resistance was met with at first, and before noon a penetration of some 3 to 4 m. had been effected, the infantry reaching the front Onvillers–Macqueglise. The advance was continued during the afternoon against the high ridge of Boulogne, while French aeroplanes carried out a bombing raid on Lassigny, and by nightfall the XXXIV. Corps was on the line Onvillers–Boulogne–La Neuville.

On the 11th the XV. Corps on the right of the army was put into the attack directly against the front of the "Petite Suisse," while the XXXIV. continued to progress to the N. of it. The resistance of the XVIII. German Army, reinforced by an extra division, stiffened appreciably during the day, and all along the line there was hard fighting. Hostile machine gunners ensconced in the broken country made the advance slow and painful; every foot of ground had to be fought for and the French could only advance step by step. After a week's fighting, the "Petite Suisse" still remained partly in German hands, while the French left wing was not yet in possession of Lassigny. The German XVIII. Army which, as already mentioned, had brought back its right flank to Roye on the evening of the 9th and was now also withdrawing its left along the Oise, fought stubbornly to secure time for the evacuation of its artillery and material Nevertheless the French III. Army made daily headway.

It was not, however, till the offensive by the French X. Army on the E. of the Oise threatened by its rapid progress to imperil the retreat of the Germans in the "Petite Suisse" that Humbert's troops could finally force them from their stronghold. On the morning of the 21st the German XVIII. Army fell back all along the line; the French infantry occupied Lassigny and cleared the wooded highland and by the 22nd had reached the line of the Divette, where they were halted to regroup and prepare for a renewed advance.

In the thirteen days' fighting Humbert's 7 divisions had driven from their strong vantage ground 8 enemy divisions and had taken from them 5,000 prisoners and 100 guns.

General Results of the Battle of Amiens.—The course and results of the fortnight's fighting between Aug. 8 and 22 may be summed up as follows:—The three Allied armies engaged (IV. British, I. and III. French), with 32 divisions, had attacked and defeated the II. and XVIII. German Armies, in all 42 divisions. Of these 42 divisions 30 were originally in line or reserve at the moment of the attacks, and 12 were put in from other parts of the front, being drawn from seven different German armies, belonging to three different army groups. The Allies advanced to a depth of between 6 and 14 m. on a front of 47, taking a total of 40,000 prisoners, 600 guns, thousands of machine-guns, quantities of ammunition, *matériel* and stores of all kinds. A wide breach had been made in the German front, susceptible, as events showed, of being rapidly widened to either flank by further Allied attacks. A shattering blow had been dealt to the *moral* of the German army and the German Higher Command, from the effects of which neither was destined to recover. The Battle of Amiens was the first page in the story of the Allied victory of 1918. (X.)

IV. Battle of Bapaume–Péronne, Aug. 21–Sept. 2

The first conception of the battle of Bapaume–Péronne was laid down in a directive from Marshal Foch to Field-Marshal Haig, written on Aug. 10—that is at the moment when the battle of Amiens had just been crowned with a brilliant success, and the enemy was retiring E. along the whole front from the Ancre to the Oise under the pressure of the British IV. and French I. and III. Armies. In this directive it was enjoined that "enterprises of the British III. Army in the general direction of Bapaume and Péronne should be prepared as soon as possible," while "the action of the British IV. Army should be pushed in the direction of Ham." Further instructions for the enlargement of the battle towards the N. to take place simultaneously with its extension to the S. by the advance of the X. French Army between the Oise and the Aisne (timed for Aug. 20), were sent to Haig on the 12 and it was finally decided that the advance of the III. Army should commence on the 21st and be followed by a general offensive on the front of that Army and the IV. Army two days later.

The general scheme of the operations between the Somme and the Scarpe was based, according to Lord Haig, on the following considerations:—

> "The enemy did not seem prepared to meet an attack in this direction and owing to the sucess of the IV. Army, he occupied a salient, the left flank of which was already threatened from the south. A further reason for my decision was that the ground N. of the Ancre river was not greatly damaged by shell fire and was suitable for the use of tanks. A successful attack between Albert and Arras in a S.E. direction would turn the line of the Somme S. of Péronne and gave every promise of producing far-reaching results. It would be a step forward towards the strategic objective St. Quentin–Cambrai. This attack moreover would be rendered easier by the fact that we now held the commanding plateau S. of Arras about Bucquoy and Ablainzeville, which in the days of the old Somme fighting had lain well behind the enemy's lines. In consequence we were here either astride of or to the E. of the intricate systems of trench lines which in 1916, we had no choice but to attack frontally, and enjoyed advantages of observation which at that date had been denied us. It was arranged that on the morning of Aug. 21 a limited attack should be launched N. of the Ancre to gain the general line of the Arras–Albert railway, on which it was correctly assumed that the enemy's main line of resistance was sited. The day of Aug. 22 would then be used to get troops and guns into position on this front and to bring forward the left of the IV. Army between the Somme and the Ancre. The principal attack would then be delivered on Aug. 23 by the III. Army and the divisions of the IV. Army N. of the Somme, the remainder of the IV. Army assisting by pushing forward S. of the river to cover the flank of the main operation. Thereafter if success attended our efforts, the whole of both armies were to press forward with the greatest vigour and exploit to the full any advantage we might have gained."

The line of the British IV. Army at the date of the opening of the new battle on Aug. 21 ran from Fransart by Chilly, Proyart and Dernancourt to Albert. The right of this line as far as the Bray–Corbie road was held by the Australian Corps (Monash) with five divisions (from the right, 4th Canadian, 4th Australian, 32nd, 5th Australian and 3rd Australian) in line and three (1st Canadian, 1st Australian and 2nd Australian) in reserve. To the left of this the III. Corps (47th, 12th and 18th Divs. in line and 58th in reserve) continued the line to the army boundary northward of Albert on a front running along the W. bank of the Ancre as far as Beaucourt and thence W. of Puisieux, Bucquoy and Moyenneville to the Cojeul. The III. Army held the line in order from the S. with the V. Corps (Shute) with the 38th and 21st Divs. in line and the 17th in reserve, from N. of Albert to Beaucourt; the IV. Corps (Harper) with the 42nd, New Zealand and 37th Div. in line and the 5th and 63rd in support, extending as far as opposite Ablainzeville; and the VI. Corps (Haldane) (2nd Guards, 56th and 52nd Divs. in front line, with the 3rd in rear), as far as the army boundary.

Facing these troops the German II. Army (v. Marwitz) held the front opposite the IV. British Army, from N. of Roye to N. of Albert. This army, after its battering on Aug. 8 and succeeding days, held its front with 16 divisions, retaining 7, mostly exhausted and reduced in numbers, in reserve. The XVII. Army (Otto v. Below) was on the right of the II. extending as far as Avion, S. of Lens. On the eve of the attack this army had 11 divisions in first line and 2 in reserve. Both of these armies, together with the IX., to the left of the II., belonged to the newly-formed Army Group of von Boehm, whose area of command thus extended from N. of the Scarpe to the Aisne.

First Stage of III. Army's Advance (Aug. 21–26).—The main attack on the front of the British III. and IV. Armies was timed for Aug. 23 and the two previous days were to be in some sense only a prelude. The operation to be undertaken on Aug. 21 consisted of an advance by the IV. and VI. Corps on a front of 9 m. from opposite Miraumont to Moyenneville, while the left division of the V. Corps secured the right flank of the attack along the Ancre. The general objective was to be the line of the Arras–Albert railway, the attainment of which involved a penetration of the hostile front to a depth of 2 to 3 miles.

The attacking infantry, supported by tanks and covered by a strong barrage, moved forward at 4:55 A.M. The enemy was fully aware of the probability of an offensive on his XVII. Army sector and had adopted his well-tried system of defence in depth, the positions forward of the railway being lightly held by weak forces. These were rapidly driven in along the whole front of attack, their task being rendered difficult both by thick mist and smoke thrown out to cover the advance of the assaulting infantry.

While the 21st Div. of the V. Corps pushed forward along the right bank of the Ancre as far as Beaucourt and set to work to prepare a passage over the flooded and marshy stream at St. Pierre Divion, the 42nd, New Zealand, and 37th Divs. of the IV. Corps carried their first objective, the high ground E. of Bucquoy and Ablainzeville, and then gave place to the 5th and 63rd Divs., which carried the line up to the final objective W. of the railway. Further to the N. the 2nd and Guards Divs. of the VII. Corps, assisted by the 3rd Div., which was leap-frogged over the 2nd for the last stage of the advance, also carried out their allotted task, and though the fog, which had at first favoured the attacking troops caused some little confusion and loss of direction, succeeded not only in reaching but in crossing the railway E. of Courcelles and Moyenneville. Over 2,000 prisoners were captured along the front of attack, of which 1,400 fell to the lot of the IV. Corps.

The German XVII. Army, in view of the loss of its forward positions, requested permission to retake them by a counter-offensive, which was delivered in force on the 22nd, and drove in parts of the new line both in the IV. and VI. Corps sector. It failed however to gain any decided advantage, as the Germans themselves admit, and meanwhile the preparations for the general advance on the whole of the IV. and III. Army fronts on the 23rd were being rapidly completed. At the point of junction of the armies the 38th Div. of the V. Corps, in coöperation with the III. Corps, carried out a series of operations which had as their result the occupation of Albert, and the seizure of points of passage which rendered it possible to throw strong forces to the E. bank of the Ancre in preparation for the morrow.

The main phase of the III. Army's operations began in the morning of Aug. 23, the various formations attacking at different hours along the whole front of 16 m. from Albert to the Cojeul. The enemy resisted with determination, but considerable progress was made all along the line. On the right the V. Corps, still acting in close conjunction with the III. Corps to the S. of it, pushed out its right, the 38th Div., E. and N.E. from Albert and completed its occupation of the hills overlooking the town. By the end of the day this division held a line from just W. of La Boisselle to Aveluy, while its left brigade had thrown parties across the marshes E. of Hamel, where they held on all night in face of repeated German attacks. On the front of the 21st Div., on the left of the V. Corps, only small attacks took place, but the IV. Corps to the N. of the Ancre, commencing its advance at 11 A.M., with the 42nd, New Zealand, 5th and 37th Divs., carried the railway, the enemy's main position, from N. of Miraumont to Achiet le Grand, and pushing forward further on the left, reached a line from Bihucourt to Loupart Wood, whence the front at the end of the day ran sharply westwards N. of Irles and N. and W. of Miraumont. On the VI. Corps the attacking divisions, from right to left were the 2nd, 3rd, Guards, 56th and 52nd. The 3rd Div. opened the advance at 4 A.M. with a successful attack on Gomiécourt, after which at 11 A.M. the 2nd Div. passed through on either side of the village to continue the advance, its objective being the line of the Arras–Bapaume road between Sapignies and Ervillers. The right of the attack made little progress, but on the left Ervillers was taken early in the afternoon. Farther N. the Guards, after seizing Hamelincourt, had also established themselves across the main road, and Boyelles and Boiry Becquerelle also fell into the hands of the VI. Corps before the end of the day, which resulted in the capture of 5,000 prisoners and a number of guns.

In view of the success gained during the day, it was decided to renew the advance at 1 A.M. on the morning of the 24th, the moon being then at the full. This decision was fully justified by the excellent results achieved all along the line. On the V. Corps front, it was projected to carry the strong position on the Thiépval plateau by means of a converging attack from S. and W. by the two wings of the 38th Div. While the right brigade stormed the high ground of La Boisselle and Ovillers, the left brigade, wading across the Ancre at Hamel under cover of its detachments thrown over the previous day, pushed forward as far as Pozières, thus turning the defences of Thiépval from the north. In the afternoon and evening the V. Corps, of which the central and left Divs., the 17th and 21st, had pushed forward through Grandcourt, by dint of heavy fighting, attained the general line W. of Contalmaison–Martinpuich–Courcelette. The IV. Corps had also been highly successful; the 42nd Div. pushed its front by way of Miraumont, where the enemy resisted with unusual stubbornness, to Pys, while the 5th, New Zealand, and 37th Divs., farther N., advanced to the line Grevillers–Avesnes–W. of Behagnies-Mory. The VI. Corps on the left of the army occupied St. Leger and Henin-sur-Cojeul but were held up by a determined defence in front of Croisilles and in St. Martin-sur-Cojeul.

The attack was vigorously pushed on the 25th despite the fact that the troops were becoming weary and the enemy's line heavily reinforced, showed signs of stiffening. The main advance was in the centre; the V. Corps on the right advancing over the old battlefields of 1916 where the ground afforded good facilities for the defence could get on but slowly, and the enemy's prepared fortifications gave him every advantage in the VI. Corps area, where little progress could be achieved. In the centre however, N. of Bapaume, the IV. Corps cleared up the hostile resistance at Sapignies and Behagnies and pushed on in the evening to the line Favreuil–Mory, thus seriously menacing the line of retreat of the defenders of Bapaume.

In fact, at this moment the situation on the front of the XVII. German Army was regarded as "extremely critical." It was believed that the offensive against it was bound to continue and the difficulty of getting up reserves and supplies was enhanced by the lack of communications across the desolated area of the old Somme battlefields. The Army Group of von Boehm was accordingly instructed to retire the line of the XVII. Army to a position already reconnoitred and partly prepared running from Quéant E. of Bapaume and Combles. The withdrawal took place at once in accordance with orders, and was completed by the morning of the 27th under cover of strong rearguards which fiercely contested the advance of the British III. Army.

Conclusion of III. Army's Advance (Aug. 26–Sept. 1).—During the 26th the V. Corps gained the fruit of its hard struggles of the previous days in a deep advance over the Somme battleground, which carried it forward to the western outskirts of what had once been the villages of Longueval, Flers, and Le Sars. The IV. Corps continued to swing round to the N.E. of Bapaume, occupying Beugnâtre, but the garrison of the town still held out. The next few days were taken up with bitter and strenuous fighting along all the front of the army, which grew stiffer as the advancing British drew nearer to the new prepared positions of the enemy. A new British Corps, the XVII. (Ferguson), took over the three left divisions (56th, 52nd and 57th) of the VI. Corps on the evening of Aug. 25, and undertook the hard task of overcoming the German resistance around Croisilles and in the Hindenburg line to the E. Croisilles was not finally secured until the 28th when the enemy garrison, finding its retreat menaced from both flanks, abandoned it early in the morning and from that date for four successive days the XVII. Corps was engaged in to-and-fro fighting in the maze of trenches and dugouts around Bullecourt and Hendecourt which were finally secured by the 52nd and 57th Divs., respectively, on the morning of Sept. 1. The line was established E. of Riencourt by the evening. The part of the XVII. Corps in the brilliant operations of the I. Army against the Drocourt–Quéant line on Sept. 2 does not come within the scope of this narrative.

Further to the S. by the evening of Aug. 29 the Germans, though still holding their ground stubbornly before the VI. Corps, had left Bapaume to the New Zealand Div. of the IV. Corps, and retired before the V. Corps to the eastern edge of the devastated area on the general line Morval–Beaulencourt. Following up their advantage the IV. Corps pressed their advance on Aug. 30 and 31 to beyond Riencourt, Bancourt and Frémicourt, thus rendering it possible for their neighbours on the right and left to resume their progress which had for the moment ceased. While the V. Corps on Sept. 1 drove the enemy from Beaulencourt, Morval and Sailly-Saillisel and on the 2nd from Le Transloy, Rocquigny and Barastre, the VI. Corps finally made itself master of the bitterly contested villages of Ecoust and Vaux Vrancourt and pushed forward to Noreuil. The IV. Corps in the centre, keeping pace with its comrades reached the front Villers au Flos–Beugny on the evening of Sept. 2.

During the 13 days' fighting the 14 divisions of the III. Army had engaged 23 hostile divisions, taken from them 11,000 prisoners, many guns and much material of war, and had driven them back to a depth of from 8 to 13 m. on a front of 20, besides inflicting on them heavy losses in killed and wounded.

IV. Army's Advance to Upper Somme (*Aug. 22–30*).—It has already been stated that the left of the IV. Army N. of the Somme had successfully coöperated in the main advance being carried out by the III. Army on its left during all the period under review from Aug. 22 onward. At the same time, other offensive operations were also carried out by the centre and right of Gen. Rawlinson's line astride and S. of the river, which had the effect towards the end of Aug. of forcing the Germans to retire to the line of the Somme above Péronne.

The attack of the III. Corps, delivered on the morning of Aug. 22, had for its objective the capture of Albert and the crests E. and S.E. of it in order to afford a crossing-place for the V. Corps (the right corps of the III. Army) over the Ancre valley. The 18th, 47th and 12th Divs., as also the 3rd Australian Div., were entrusted with the operation, which involved an advance of some 2,000 to 3,000 yd.; the 58th Div. was held in reserve. Despite the fact that all the precautions taken failed to ensure secrecy and that hostile counter preparations began at 4 A.M., 45 minutes before the attack was timed to commence, considerable progress was made on the whole front. The 18th Div. cleared Albert and joined hands E. of Méaulte with the left of the 12th Div., which together with the 47th on its right, had reached practically all its objectives before noon. The 3rd Australian Div. on the extreme right of the attack had also fulfilled their allotted task as early as 8:30 A.M. But in the afternoon a heavy German counter-attack, put in against the centre of the new British line, recovered much of the lost ground in that quarter, and inflicted such severe losses on the 47th Div. that it had to be relieved during the course of the next day by the 58th Div. from reserve.

This untoward incident somewhat disarranged the army plan for the 23rd, which had originally involved an advance on the whole front from Albert to Chaulnes. It was now decided that only the 18th Div. on the extreme left of the III. Corps should attack in conjunction with the Australians S. of the Somme. Accordingly, on the morning of the 23rd, the 18th Div., acting together with the V. Corps of the III. Army on its left, completed its operations of the previous day by the capture of the ridge immediately E. of Albert. The Australian attack to the S. was more ambitious and equally successful. It was carried out on a front of 4 m. by the 32nd Div. on the right and the 1st Australian on the left and involved an advance of some 2,000 yd. in depth, right up to the edge of the area laid waste in 1916, on the approximate line Herleville–Chuignes–Cappy. The divisions debouched at 4:45 A.M., assisted by 45 tanks and covered by an excellent barrage. The 32nd Div. early seized Herleville and the 1st Australian Div. also successfully carried out the first two stages of its advance, but met with unexpected difficulties in the last phase, which were only overcome after severe and gallant fighting. As a result of the day, 3,000 prisoners and 23 guns remained in the Australian Corps' hands.

Gen. Rawlinson decided, as a result of the day's operations, to go on with the attack N. of the river, and by way of variation to the usual methods an advance was carried out just after midnight of the 23rd by the whole of the III. Corps (47th, 12th and 18th Divs.) and the 3rd Australian Division. With the aid of the brilliant moonlight, good progress was made by all these formations, and despite violent hostile reaction, the ground lost on the 22nd was entirely recovered and La Boiselle, Bécordel and Bray all taken and held. The same good success attended the continuance of the advance next day, Fricourt and Mametz being both seized.

It had by now become evident, in fact, that the German resistance on the IV. Army front, partly owing to the vigorous pressure exercised throughout the last four days, partly owing to the successes of the III. Army farther N., was beginning to weaken, and that only strong rearguards were being encountered fighting to gain time for the retirement of the main body behind the line of the Somme above Péronne. The German Higher Command, as already mentioned, on the 25th, ordered von Boehm (who had about the middle of Aug. been appointed to the command of a new Army Group consisting of the II., XVIII. and XI. Armies, between the Ancre and the Aisne) to fall back to the line of the river Somme–Ham–N.E. of Noyon, and the movement was carried out on the 26th and 27th. During these days the progress of the IV. Army was rapid, being opposed mainly by long range artillery fire and strong machine-gun detachments. By the evening of the 27th the Australian Corps, which had handed over part of its line, as far N. as beyond Lihons, to the French I. Army on the night of the 24th, had reached the front Vermandovillers–Fontaine–Vaux, while the III. Corps which had been severely tested by the resistance of three fresh enemy divisions newly put into line on its front had cleared Trones Wood and Longueval. The German II. Army had now reached its chosen positions of defence between Morval and Pargny but had apparently, at the desire of the Army Group which considered it important to retain the possibility of flanking movement from in front of Péronne against any eventual British advance in the open country to the N., decided to retain its hold on the W. bank of the river in that quarter. Accordingly, the resistance in that area, where the left of the Australian Corps was operating, grew stiffer during the 28th and 29th; while the 32nd Div. on the right of the corps reached the W. bank of the Somme astride the Amiens–Brie road without severe fighting early on the 29th, the 5th and 2nd Australian Divs. only established themselves on the river line after heavy fighting and thanks largely to the coöperation of the 3rd Australian Div. on the N. of the Somme. By the evening of the 30th the Australian line ran along the W. bank from Cizancourt in the S. to Biaches and thence over the river to Clery and was continued by the III. Corps along the western edge of Marrières Wood to Priez Farm and E. of Combles. The Germans in this latter area had also fought stubbornly during the past two days and it became evident that they were here standing on a chosen line of defence. In view, however, of the small prospect of success afforded by any attempt to force the strongly held Somme line above Péronne, the IV. Army Command decided that the next operation must be a strong advance by the centre and left in order to turn that line to the N. and orders to this effect were issued on the evening of the 30th.

Forcing of the Somme Line by IV. Army (*Aug. 30–Sept. 2*).—The plan for the IV. Army's further operations involved the turning of the Somme line, to which the German II. Army had retired, by means of an advance N. of Péronne to the high ground around Nurlu. The III. Corps was to carry out the frontal attack from the W. against the German line northwards from Péronne, while the Australian Corps covered the southern flank of the attack and coöperated in the main operation by pushing forward against Nurlu from the S.W. Before this could be done, however, it was necessary to occupy Péronne and the key to it, the commanding height of Mont St. Quentin. This in itself was a most formidable task, for the position, strong both by nature and by art, dominated all the country to N. and W., and all the river passages by which it could be approached. The German High Command fully realized its importance, and had committed its defence to the picked troops of the 2nd Guard Div. with orders to hold it at all costs.

Sir John Monash, the Australian Corps commander, had already on the 29th formulated his plans for the attack of this stronghold. On this date the line of the corps was held from S. to N. by the 32nd, 5th, 2nd and 3rd Divs., the last-named being N. of the Somme. The idea was to bring over the 5th and 2nd Divs. to the N. bank, for the attack of Péronne and Mont St. Quentin respectively. The seizure of a bridgehead on the N. bank S.E. of Clery, an essential preliminary, was carried out by the 2nd Australian Div. during the course of the 30th, and the bridge at Ommiécourt was ready for use by before dawn on the morrow. On this same night the 32nd Div. on the corps, right extended its front to the N., relieving part of the 5th Div. which in turn took over part of the front of the 2nd Div., thus liberating the necessary forces for the assault.

This was opened at 5 A.M. on the 31st by the 5th Bde., of the 2nd Div. which moved off under cover of a strong barrage and making good progress had attained by 7 A.M. both Feuillaucourt and Mont St. Quentin villages; the right of the brigade however was held up in front of Anvil Wood. To the left of the brigade also the attack of the 3rd Australian Div. had failed to keep pace and a heavy German counter-attack, flung in against the front and left of the troops holding Mont St. Quentin village, compelled them to relinquish it. They rallied again, however, on the western edge and there held their ground till nightfall. Feuillaucourt had also to be abandoned later in the day. Meanwhile the 6th Bde. (also of the 2nd Div.) crossed the river behind the 5th and part of it pushing forward on the right of its comrades, seized Halle and established itself on a line beyond. The remainder halted S.E. of Clery. The 14th Bde. of the 5th Div., also effected a crossing at that place and collected E. of that village, pending the moment when the further advance of the 2nd Div. should allow it to advance against its assigned objective Péronne. By nightfall the 1,200 fighting men of the 5th Bde. had already broken the back of their task. Despite the difficulties which faced them, they had penetrated the formidable hostile positions to a depth of some 2,000 yd., and though reduced in numbers to some 600 rifles had held out on a wide front of 4,000 yd. against reiterated and desperate counter-blows by a foe in every way worthy of their steel. Their single feat of arms was rightly judged one of the finest in the war, and was to receive full fruition on the morrow.

The 6th Bde. of the 2nd Div., assembled S.E. of Clery, was assigned to complete the capture of Mont St. Quentin, passing through the sorely tried 5th Bde., its units already in the front line S.E. of Halle being relieved by the 14th Bde. of the 5th Div., which now undertook the attack on Péronne. While this last-named brigade swept forward through Anvil Wood and Ste. Radegonde, forced its way into Péronne and got possession before noon of practically all the town with the exception of the north-eastern suburbs, the 6th Bde., despite strong opposition from parties of the enemy still at large behind the 5th Bde. front on the Péronne–Bapaume high road, reached the line of that road and after a short preparation by artillery stormed Mont St. Quentin village and wood and established itself on a line from there N. to near Allaines and S. to the E. edge of Péronne. The night of Sept. 1 thus saw the Australian Corps, the 3rd Div. of which on the extreme left had taken possession of the ridges S. of Bouchavesnes, in possession of all its objectives, after completely defeating the enemy opposed to it.

Further to the N. the III. Corps also had done most creditable, if less spectacular work, during these two days of battle. The 58th Div. on the right had cleared Marrières Wood on the 31st, while the 47th Div. made progress towards Rancourt, repulsing a hostile counter-attack. On the morrow these successes were continued and completed by the capture of Rancourt and Bouchavesnes, while the 18th Div. on the left of the corps in a brilliant series of attacks seized in turn Priez farm, Frégicourt and Saillisel, inflicting serious losses on the enemy, who afforded a stubborn resistance.

Sept. 2 saw the completion of the successful operations of the IV. Army in the battle of Péronne, the Australian Corps occupying Allaines and the III. Corps St. Pierre Vaast and Vaux woods. The results of the battle were imposing enough even in mere figures. In the period between Aug. 22 and Sept. 2 the IV. Army's 9 divs. had engaged and defeated 23 hostile divs. and taken from them over 23,000 prisoners, many guns and vast quantities of material. The strong line of the Somme had been turned and rendered untenable by sheer hard fighting in which the attacking troops had shown themselves capable of meeting and defeating the best of the German divisions which, thrown in piecemeal and in the utmost haste and confusion as they arrived on the field, had been unable to hold for long even the strongest natural and artificial defences.

General Results of the Battle of Bapaume–Péronne.—In the battle described above the British III. and IV. Armies, consisting of five corps (23 divs.) in all, had fought and defeated the German XVII. and II. Armies, consisting of five corps (46 divs.), had forced them to fall back to a depth of from 6 to 13 m. on a front of 28, and had captured from them a total of 34,250 prisoners and 270 guns, without reckoning other material of war too various to recapitulate. The whole area of the Somme battlefields, which had cost the British five months' bitter fighting in 1916, had been conquered in less than a fortnight; more than half the area gained by the great German advance of the spring had been recovered; the only good natural line of defence available for the enemy to the W. of the Hindenburg system had been broken asunder; and the moral and material superiority of the British over the German fighting machine had become patent to the world. (X.)

SONNINO, SIDNEY, Baron (1847–), Italian statesman (*see* 25.416). During the debates on Giolitti's Steamship Subsidies bill in the spring of 1909 it was Baron Sonnino who conducted the most vigorous attacks against the Government, exposing the radical defects of the measure, and when Giolitti resigned on Dec. 2 it was Sonnino who was called upon to form a ministry, for the second time. But he did not enjoy the favour of the still Giolittian Chamber, and his Cabinet was defeated over the new shipping bill. On March 21 1910 he resigned, again after 100 days of office. He continued to take an active part in the debates in the Chamber, and was a stern but just critic of Giolittian political methods, although during the Libyan war he generally abstained from opposition for patriotic motives. In the autumn of 1914, after the death of the Marquis di San Giuliano, the Premier Salandra assumed the Foreign Office for a short time, but when he reconstituted his Cabinet on Nov. 5 he offered that portfolio to Sonnino, who accepted it. His conduct of the Foreign Office was characterized by sincerity of purpose, high principles, unswerving patriotism and a wide knowledge of international politics. He had not, moreover, a free hand. He was still Foreign Minister, under Orlando's premiership, during the Peace Conference, which he attended as second Italian delegate from Jan. 18 to June 19 1919. On the fall, however, of the Orlando Cabinet (June 19 1919) Sonnino retired into private life. The irritation of the whole of Italy against the policy of the Allies towards Italy at the Peace Conference reacted to some extent against the nation's representatives at Paris, and Sonnino himself came in for a large share of unpopularity, although the more intelligent and better informed part of public opinion realized the great difficulty of his task and the insufficient support afforded him by Orlando, as well as the value of his actual achievements. He did not stand for Parliament at the elections in Nov. 1919, but was subsequently made a senator. In spite of what was regarded as his failure to overcome the obstacles of the Peace Conference, he enjoyed the reputation of being the greatest Minister for Foreign Affairs that Italy had had since Cavour, with the possible exception of Crispi, while as a financier he ranked very high. He was also a man of wide reading and culture, and a distinguished Dante scholar and bibliophile.

SOROLLA Y BASTIDA, JOAQUIN (1863–), Spanish painter (*see* 25.434), was engaged for practically the whole of the decade 1910–20 on work for the Hispanic Society of America. It includes a series of portraits of Spanish writers, and a "Panorama of the Forty-nine Provinces of Spain" consisting of forty-nine immense compositions, each representing views, costumes and customs of a different province. This great undertaking was completed before paralysis brought the artist's painting to an end. Important exhibitions of his work were held at the Grafton Galleries, London, 1908; in New York, 1909; in Chicago, 1913; and he was represented by two typical works in the 1920–1 Exhibition of Spanish Paintings at Burlington House.

See Hispanic Society of America, *Eight Essays on Joaquin Sorolla y Bastida*, 1909; A. de Beruete y Moret, *Sorolla y Bastida*, 1920.

SOUND (*see* 25.437).—The increase in our knowledge of the subject of acoustics (the science of Sound) during recent years has been largely associated with the war conditions which prevailed from 1914 to 1918. As a consequence of the war the development of this science has been abnormal,[1] and research has been directed towards the rapid realization of practical acoustic devices and methods for immediate use in warfare, both on land and sea. A general survey of the work done shows that the advances consist of applications of well-established principles, rather than the discovery of new phenomena. Generally, the observations made have proved to be in accordance with previous theoretical investigations, mainly due to the late Lord Rayleigh.[2] This war work falls naturally under two headings, viz. (1) the detection and perception of direction of sounds in air, and (2) the detection and perception of direction of sounds in water. Theoretically, these two problems have much in common, but, practically, there are important differences which make it desirable to treat them in separate sections. A special section (3) is devoted to the important advances recently made in auditorium acoustics, and the remaining section (4) deals briefly with miscellaneous outstanding features of modern work on sound, not essentially military in character.

1. DETECTION AND PERCEPTION OF DIRECTION OF SOUNDS IN AIR[3]

Detection.—The human ear itself is a remarkably sensitive detector of the air vibrations which constitute sound. It is still much superior in this respect to any mechanical device which has yet been produced for recording the vibrations visually. Thus the perception of feeble sounds of necessity depends upon the limitations of audibility, either indirect listening, or with the ear aided by the intervention of an electrical device such as a microphone. The audibility of a feeble sound can be very largely augmented by making use of the principle of resonance, provided that the sound itself approximates to a pure tone. This can be secured, for example, by the use of a Helmholtz resonator applied to the ear in the case of direct listening, and in addition, by tuning the diaphragm receiver when microphonic listening is adopted. It has happened fortuitously that one of the chief sounds in air which it is important to be able to detect, viz. those emitted by aircraft, do contain predominant notes which enable the application of resonance, as above indicated, to increase largely the range of audibility. Typical predominant frequencies (apparently due to engine exhaust) are given in the following table, which relates to the engine running at the usual speed:—

Aeroplane engine	Frequency (vibrations per second)
S. E. 5	130
R. E. 8	90
F. E. 2B	70
Avro	90
Gotha	80

The following frequencies have been detected in the sounds from the Maybach engines of a Zeppelin airship:—

Slow speed—27, 54, 108, 135, 243.
High speed—57, 114, 171, 228.

The operation of the *Doppler effect*, arising from the relative motion between the aircraft and the observer, prevents the possibility of the identification of the machine by means of the observed frequency, this being liable to change by as much as 20%, according to the speed and direction of flight. An interesting observation which has been constantly made is that the notes of low pitch continue to be heard at ranges where those of high pitch have ceased to be audible. This is in accordance with the theoretical expectation that damping increases with frequency.

The determination of the direction whence a sound arrives is theoretically possible by a variety of methods dealt with below, several of which have been tried in aircraft localization.

(*a*) *Binaural Listening.*[4]—Lord Rayleigh's experiments (*Collected Papers*, vol. 5, p. 347) have shown that low-pitched sounds are determined in direction by the observation of the phase difference between the vibrations arriving at the two ears. This principle has been applied in direction-finding, and the effect has been exaggerated by increasing the distance between the two points of reception. The sound is received by two equal trumpets or horns rigidly connected together and capable of rotation about an axis perpendicular to the line joining them. Separate and exactly equal tubes lead from the trumpets to the two ears, respectively, and the apparatus is rotated until the sound under observation appears to come from directly in front. The line joining the sound receivers is then perpendicular to the incident sound stream. An alternative method which dispenses with the necessity of rotating the apparatus is to use a *compensator* or *phase-measurer*, which consists of tubes, adjustable in length, inserted between the sound receivers and the appropriate ears, so as to provide a path difference equal to that between the distant source of sound and the two receivers. Adjustment of the tube lengths is made until the impression received is that the sound is neither to the right nor to the left, and the determination of direction is then a matter of simple geometry. In practice the compensator is graduated to give direct angular readings.

The practice of binaural listening has verified theoretical conclusions in several important respects. It has been found that it is easier to perceive the direction of a mixed sound, or noise, than a pure note. Apparently it is necessary that the wave train should contain more or less isolated special characteristics whereby the phase difference can be readily appreciated. In the regular sine wave corresponding to a pure tone each vibration is exactly like those which immediately precede and follow it, and the ears are unable to identify corresponding displacements. It is apparently also necessary for successful binaural listening that the two portions of the incident wave which enter the two receivers should be free from subsequent distortion; in particular, that the sound receivers should be as nearly as possible non-resonant for the vibrations in question. Any amplification of the sound which depends upon resonance, therefore, such as the use of Helmholtz resonators already referred to, is incompatible with efficient direction-finding by observations of phase difference.

The construction and arrangement of the receivers used has varied very much in practice. As a typical system, that commonly used in the British army may be quoted, namely, circular cones, 2 to 4 ft. long and of semi-angle 20°, as receivers, placed about 7 ft. apart—a distance which proved to be sufficient for attaining nearly the maximum practical accuracy of setting.

The method is subject to many errors, chiefly those arising from the motion of the sound source, refraction due to temperature inequalities in the air, and the effect of winds. The necessary corrections are tabulated for use in practice.

(*b*) *Sound Mirrors.*—Some success has been attained in direction-finding by means of concave sound reflectors. The chief limitations have arisen from the question of size, and, consequently, of portability. In optics the size of mirrors commonly in use is very great in comparison with the wave-lengths of the light; in the corresponding problem in acoustics it is almost impossible to make them so; and yet this is a necessary condition for the geometrical laws of reflection to apply with accuracy. In the largest sound mirrors—perhaps 20 ft. in diameter—the size is at most only a few wave-lengths for the aircraft sounds under investigation, with the result that the image of a distant sound obtained at the focus proves to be an area much larger than that corresponding to optical calculations. There is therefore no advantage secured by making the mirror paraboloidal instead of spherical, and considerable roughness of the surface is not detrimental. The mirrors were usually made of concrete, and listening was effected either by means of a small horn receiver placed in the focal plane and connected by a tube to the ears, or by means of a microphone placed in a similar position. If, as was more usual, the mirror was fixed, the direction of the sound source could be found by determining the position of maximum intensity in the focal plane. It may be noted that in this method of direction-finding amplification is obtained on account of the area of the mirror, and that further augmentation is attainable by using resonators, to which the same objections do not apply as in binaural listening. The accuracy of the determinations vary very much with frequency, being much greater for notes of high pitch than for low, as would be anticipated from considerations of wave-length.

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[1] Owing to the abnormality of the conditions, it is impossible to follow the usual practices in writing the present article. Experiments on sound, with military ends in view, have been carried out in nearly all the belligerent countries. Comparatively few of the results have found their way into the recognized scientific journals, largely by reason of the secrecy which is still frequently enforced by the various Governments, under whose control most of the work was done. In the circumstances it is not safe to attempt to assign credit to particular investigators, nor is it possible to give adequate references. The present article has been drawn up, therefore, upon broad general lines which, since they fulfil censorship conditions, form necessarily a by no means complete survey; and names have been avoided as far as possible.

[2] Lord Rayleigh's work is contained in his *Collected Papers* (No. 6, 1920). His contributions were numerous between 1911 and 1919, when he died.

[3] The information contained in this section is largely drawn from a manual entitled *Development of Sounds*, kindly placed at the writer's disposal by the British Munitions Inventions Dept.

[4] This method of perception of direction has been largely used also in a connexion which scarcely justifies treatment in a separate section. The *geophone* is an instrument for direction-finding of sounds proceeding through the earth, and its particular use during the war was for localizing the sounds of picks, etc. used in tunnelling and land mining. It consists of two hollow boxes connected by equal tubes to a stethoscope arranged so that the sounds proceed from the two boxes to separate ears. The boxes are laid upon the ground a few feet apart, and moved about until the sounds of the pick appear to come from straight ahead. It is then known that the sound source is on a line perpendicular to that joining the two geophone receivers, since the sounds arrive through the earth in synchronism. By combining several pairs of geophones separated by considerable distances, the actual position of the pick can be estimated, for it lies at the intersection of the several perpendiculars above specified.

(c) *Interference and Diffraction Methods.*—There have been many attempts to apply the principle of interference as a substitute for binaural listening, *i.e.*, by ultimately mixing the sounds entering the two receivers, instead of leading them to different ears, and adjusting the compensator until the total sound heard is as loud as possible. Theoretically this will occur when there has been provided in the compensator a difference of path equal to the path difference outside the receivers. The method has not proved very successful, for a variety of reasons, some of which are obscure. We shall not elaborate them here.

On the other hand, remarkable results have been obtained by the application to sound waves of a phenomenon well known in the *diffraction* of light. A small distant source of light gives in the middle of the shadow of a small circular obstacle a luminous region, called the "white spot," arising from the diffraction of light round the edges of the obstacle. The same phenomenon is observable in sound under suitable conditions. Thus a large horizontal disc, at least 20 ft. in diameter, and made of material which either reflects or absorbs sound, will give below itself a sound shadow of a sound source, such as an aeroplane, above it. Near the centre of the shadow, in a position depending on that of the source, there is a region where the sound heard is comparatively loud—in many cases much louder than it would be if the disc were absent. The relation between the direction of incidence of the sound and the position of maximum intensity has been calculated, and the method provides, perhaps, the most reliable means of perceiving the direction of air-borne sounds.

(d) *Sound Ranging.*—This special military aspect of the localization of sound sources, viz. those arising from gun-fire and shell bursts, is dealt with in the article RANGE-FINDERS.

2. DETECTION AND PERCEPTION OF DIRECTION OF SOUNDS IN WATER[1]

Of all the methods practised for the detection of submarines that depending on the sounds which they emit has been of the widest application. The question of detection has been, of course, of nearly equal importance in the opposite sense, viz. the hearing of surface ships by the crew of a submerged submarine. The sounds created in the sea by a screw-propelled ship are of a very complicated character, arising partly from the interaction between the propeller and the water, and partly from the vibrations of the machinery which are transmitted through the walls of the ship into the sea. They vary greatly from ship to ship, even of the same class; and, in the later stages of the war, submarines had been constructed which, when cruising submerged at certain slow speeds, emitted practically no noise at all. In many ways the detection of submarines in the sea is more difficult than that of aircraft in air. Normally, listening in air takes place at stations which are fixed; in submarine listening the stations were most frequently ships, which for tactical reasons connected with their safety, had to be constantly on the move. Their own machinery noise and the acoustic disturbances arising from their motion through the water were very apt to drown the noises proceeding from more distant sources. The noise of the sea, too, even in weather not at all stormy, interfered greatly, and the range at which a submarine could be heard varied much from day to day. A serious additional limitation was that recourse could not normally be had to the reflection of ordinary sounds (as is possible in air) chiefly by reason of the great size of the necessary reflectors. For the speed of sound in sea water is more than four times that in air, so that the wave-lengths are larger in the same ratio. This necessitates a corresponding increase in the linear dimensions of the sound mirror, if equal efficiency is to be obtained.

Hydrophones.—Hydrophones, or under-water sound detectors, were already in use before the war for signalling purposes, being carried by ships for listening to submarine bells operated by Trinity House as warnings in foggy weather. They consisted of small, metal, water-tight cases of which one face was a metallic diaphragm operating an enclosed microphone. The electrical disturbances of the microphone caused by any vibration of the diaphragm arising from sound pressure waves in the sea, were conveyed to telephone receivers on the ship, where listening took place. It was usual to suspend the hydrophones in water-filled tanks attached inboard to the outer shell of the ship, which, owing to the fact that steel in water transmits sound almost completely, does not diminish appreciably the intensity. Normally the hydrophone diaphragm was tuned so that its natural frequency in water[2] approximated to that of the signalling bell, and so that increased range could be secured by depending on resonance.

The earlier hydrophones used for naval purposes were of much the same type, although the resonant diaphragm proved to be by no means an unmixed advantage. All sounds containing a component corresponding to the diaphragm frequency were distorted in reproduction, and what was gained in sensitivity was liable to be lost in the difficulty of recognition, or, in other words, failure in discrimination between genuine noises due to a submarine and other noises inevitably present in the sea. Appeal to resonance is only really advantageous when the sound under observation has a predominant note, as in the case of an aeroplane; and submarines do not display this characteristic. Ultimately hydrophones of a non-resonant character came to be preferred, and were frequently used in practice. These consisted most usually of enclosures made of rubber, sufficiently thick to withstand the pressure of the sea at the usual depth (about 15 ft.), and having natural frequencies *below* the limit of audition.

An alternative type of hydrophone consisted merely of a hollow enclosure without a microphone, sometimes with a metallic diaphragm, and sometimes simply a rubber tube, filled with air and connected by long tubes to stethoscopes applied to the ears. These are operated by the transference of the pressure vibrations from the sea to the air cavity and thence to the ears. Electrical hydrophones have the advantage over non-electrical ones that their sensitivity can be readily augmented by various means, *e.g.*, bv the use of thermionic amplifiers (*see* WIRELESS TELEGRAPHY).

In cases where the hydrophones had to be used by ships in motion, they were sometimes fitted into the hull of the ship; or themselves consisted of fish-shaped bodies towed at a considerable distance behind the ship. The former precaution, *i.e.* making the shape stream-like, aimed at diminishing the vibrations created by the passage of the hydrophone through the water; the latter had in view the partial elimination of the disturbances arising from noises in the towing ship. Even so, it frequently became necessary to stop the engines temporarily, and listen with the towed hydrophones while the momentum of the ship continued to carry it forward. This proved to be only feasible at comparatively slow speeds.

Directional Hydrophones.—All the hydrophones so far described are of a non-directional character, *i.e.* the intensity of the sound heard in them is practically independent of the orientation of the sensitive receiving diaphragm with respect to the position of the source of sound. The limitations of dimensions necessitated by considerations of portability, etc., are such as to render the instruments much too small to give an effective "sound shadow." The reason for this has already been mentioned, viz. the great wave-lengths corresponding to audible sounds. At a frequency of 500 per second, for example, the wave-length in water is nearly ten feet.

Differential Hydrophones.—Curiously enough, however, one type of directional hydrophone, called here for distinguishing purposes a *differential* hydrophone, did, in fact, depend upon the small differences of pressure operating upon its two sides; and it met with considerable success. It was made in various forms, the simplest of which consisted of a circular metal diaphragm, bearing at its centre a water-tight box containing a microphone, and clamped round its rim to a heavy metal ring. When placed in the sea so that the plane of the diaphragm passed through the position of the sound source, the pressure variations on the two sides are the same both in amplitude and phase, with the result that the diaphragm and therefore the microphone, has no motion imparted to it, and the sound heard is a minimum. If, however, the diaphragm faces the sound source, there are, apparently, differences in the pressures on the two sides (probably in both amplitude and phase), and a small differential vibration takes place, with consequent sound in the receiving telephones. Actually, as the hydrophone is rotated through 360° about a vertical axis, two maxima and two minima of sound intensity are observed. In this form, therefore, the instrument is what is called *bi-directional*, *i.e.* it is unable to distinguish between sources in *front* and *behind*. The desirability of obtaining a *uni-directional* instrument led to the introduction of the so-called *baffle-plate*, the behaviour of which has not yet been explained satisfactorily in terms of orthodox theory. The essential characteristics of a baffle appear to be that it should be made of non-resonant material and have air cavities within it. Such a plate, fixed at a small distance (which has to be determined by trial) from one face of a bi-directional hydrophone, transforms it into a uni-directional instrument. A single sound maximum is now obtained upon rotation, occurring when the sound source and the baffle plate are on opposite sides of the diaphragm; and a single minimum,—this when the baffle lies between the sound source and the diaphragm. The "edge-on" minima, observed when the baffle is absent, now disappear.

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[1] The following publications should be consulted, although, for reasons already given, they form by no means adequate references:—H. C. Hayes, *Engineer* (1920), p. 491; C. V. Drysdale (Kelvin Lecture), *Journ. I.E.E.* (1920); W. H. Bragg, "Submarine Acoustics," *Nature*, July 1919; F. L. Hopwood, "Submarine Acoustics," *Nature*, Aug. 1919.

[2] This is considerably lower than the natural frequency in air, on account of the additional loading by the water.

Binaural Listening.—The principles underlying this method of direction-finding have been described already. In the present case the main difference is that the sound receivers have to be submerged hydrophones. It has been found to be equally necessary for success that these should be as completely as possible non-resonant. The simplest arrangement used in practice was two rubber cavities placed several feet apart horizontally, and joined by separate equal tubes to the two ears. The device could be rotated about a vertical axis, usually passing through the hull of the operating ship. As in the case of air listening, compensators were often used in order to avoid the necessity of rotating heavy apparatus. An arrangement much preferred was to tow two or more fish-shaped hydrophones in known positions (about 12 ft. apart) behind the ship. Here electrical transference of the acoustic disturbances had to be adopted, and this necessitated great care in the choice of the microphones and telephone receivers so as to avoid selective resonance. (The behaviour of microphones in this respect was often unsatisfactory, and telephone earpieces, or magnetophones, were frequently substituted for them. This results in diminished sensitivity, but the binaural effects are much improved.) The telephone receivers delivered the sound into the compensator, and the phase difference was measured in the usual way; allowing, of course, for the difference of speed of sound in the sea and in the air channels of the compensator. In using a compensator with two sound-receiving units only, there remains an ambiguity of estimated direction, *i.e.* one cannot distinguish between the angles θ and $\pi+\theta$. The introduction of a third unit, so that the three form a triangle of known dimensions,—the units being capable of use in pairs with the compensator—ensures the correct choice between the alternative angles.

Other Methods of Direction-finding.—Several other methods of perception of direction, not easy to classify, have found application in practice. One of these consisted in fitting in the shell of a ship, on opposite sides, two diaphragms with microphones attached, arranged so that the hydrophones thus formed were of as nearly as possible equal sensitivity. These were listened to alternately by means of a reversing switch. The ship, on account of its considerable size, was capable of giving a marked sound shadow. Thus the starboard hydrophone would give greater response than that on the port side if the sound source were to starboard, and vice versa. By steering the ship so that the responses were equal, it could be inferred that the course was directed towards the cause of the sound. The limitations of the method were mainly those arising from local noises; and the speed had to be small while listening took place.

In other cases large numbers of sound receivers, usually simple diaphragms whose function was to transfer the vibrations from the sea to the air inside, were inserted in the ship's hull. Good results were obtained by an arrangement of this kind, called the Walser gear, in which the sound receivers were disposed at regular intervals on a large bulge, in the shape of a spherical segment, incorporated in the hull on either side towards the bows. The system acted as a sound lens, a sound focus occurring at a point where the "sound paths" by alternative routes were equal. Application of the laws of geometrical optics enabled the relation between the position of the focus and the direction of incidence of the sound wave on the ship's side to be determined.

Sea Sound-Ranging.—The methods hitherto mentioned for perceiving sound direction would all fail when the sounds are abrupt in character, because they all require an appreciable time for carrying out the necessary tests. To determine the position of an exploding submarine mine or torpedo we require, therefore, a different device. A suitable method is one identical in principle with that practised on land. The main variations in applying the device to the sea are that the microphones must be in submerged hydrophones, and that a correct knowledge of the velocity of sound in sea water must form the basis of the calculations. Ordinary non-directional hydrophones of the type first mentioned have proved to be quite sufficiently sensitive. Indeed, the greatness of the distances at which explosions in the sea have given unmistakable impressions on the recording film has been surprising. Small detonators serve at distances of several miles, while the explosion of 40 lb. of gun-cotton is operative more than 100 m. from the receiving hydrophones. Many experiments have been carried out by the British Admiralty with hydrophones disposed in suitable positions on the East coast of Britain, and the installations promise to be useful, not only for locating mine and torpedo explosions in circumstances of war, but also for navigational and surveying purposes. A ship in fog, for example, could ascertain its position by exploding (with due notification by wireless to the sound-ranging station) a small charge near itself in the sea; the station could within a few minutes inform the ship—again by wireless—of its position.

Sea sound-ranging has necessitated the accurate redetermination of the velocity of sound in sea water. This has been accomplished by the inverse of the process just mentioned, viz. by exploding charges in the sea, and measuring by the recording string galvanometer the time intervals between the reception of the first shock by hydrophones submerged in accurately known positions. The observed velocity depends on several factors, including tidal flow, temperature, and salinity, which vary from place to place. The following table gives some of the results obtained, corrected to a standard salinity corresponding to a specific gravity of 1·026 and a temperature of 10° C.:—

Date	Place	Corrected Velocity in ft. per sec.
16· 5· 18· .	Dover	4,882
6· 11· 18· .	"	4,921
18· 7· 18· .	"	4,924
26· 7· 17· .	Culver (I. of W.)	4,962

The effect of tide, apparently, has not been allowed for. It would amount, at most, to a few feet per second.

3. AUDITORIUM ACOUSTICS

The acoustics of public buildings have recently been put on what approximates to an exact scientific basis, largely as a result of the work of W. C. Sabine (*Frank. Inst. J.*, 179, p. 1, 1915). For good hearing three conditions are necessary and sufficient. The sound heard must be *loud enough;* the simultaneous constituents of a mixed sound must preserve their *relative intensities;* and the successive sounds must *remain distinct and in the correct order*, and be free from extraneous noises. The extent to which these conditions are fulfilled depends on the construction of the auditorium, its shape, its dimensions, and the materials of which it is composed. In already finished buildings radical alterations of the first two are not often feasible, but great improvements can be secured solely by suitable changes in the internal features.

The main difficulty arises from what has been called *reverberation*, due to the multiple reflection of sound at different parts of the room. If the reverberation is prolonged, it means that the rate of absorption of the sound is slow. Thus, in a lecture room at Harvard, where these experiments were commenced, the rate of absorption was so small that a single spoken word continued to be audible for 5½ seconds. Successive syllables thus had to be heard and appreciated through a loud mixed sound due to the reverberation of many previous syllables, and the conditions of hearing were intolerable. Great reduction of the multiple echoes constituting reverberation can be made by increasing the rate of absorption of sound. It is apparent that, in the space of several seconds, the sounds travelling at 1,100 ft. per sec. will have suffered many successive reflections, and will, therefore, have penetrated to practically all parts of the room. The sound will have become diffuse radiation, and absorbing material introduced almost anywhere will be equally effective in reducing reverberation. An open window proves to be a complete absorber, in the sense that it permits the egress of the maximum possible quantity of sound radiation (*cf.* the properties of a small aperture in an isothermal enclosure in heat radiation). The introduction of cushions, carpets, wall hangings and people also largely diminishes reverberation, because of their considerable absorbing powers. Sabine has made a systematic study of the coefficients of sound absorption of various materials by the inverse method of measuring their effect in reducing the duration of reverberation. Typical results are given in the following table. These apply to the frequency an octave above middle C.

Material	Coefficient of Absorption
Open window	1·000
Linoleum, loose on floor	0·12
Oriental rugs	0·29
Plaster on wood lath	0·034
Glass, single thickness	0·027
Plain ash chairs	0·008
Upholstered chairs	0·30
Hair felt, 2·5 cm. thick, 8 cm. from wall	0·78

Other measurements indicated that an audience gave an absorption equal to 44% of that due to an equal area of complete absorber, thus accounting for the improved hearing conditions known to exist in well-filled buildings.

The absorption of sound can thus be adjusted with precision, but it must not be carried too far, otherwise the *sound intensity* is too much diminished. The ear is able to disregard, or even to take advantage of, reverberation which is not too prolonged, and the extent of absorption has to be adjusted to the appropriate amount. Too many apertures such as open windows or doors must be avoided.

Sabine has also made examination of the exact manner in which sound is reflected in an auditorium by constructing scale models of the latter, and photographing the sound waves at various instants after creation, using the beautiful method due to Toepler (*Annalen der Physik*, 127, p. 556) and elaborated by R. W. Wood (*Physical Optics*, 2 ed., 1911, p. 94). By this means the positions of the sound waves, both incident and reflected, are capable of observation at all instants and at all points in the model room, and they provide data upon which can be based correct architectural construction from the acoustic point of view.

4. Miscellaneous Advances

Absolute Measurement of Sound.—A. G. Webster (*Nat. Acad. Sci. Proc.*, 5, p. 173, 1919) has advanced to a considerable extent the methods of absolute measurement. For this purpose it is impossible to rely upon audition, handicapped as it is by the vagaries of the ear. What is required is a reliable mechanical device, the performance of which is constant, to record the sound vibrations with sufficient magnification. Webster has made an exhaustive study of the properties of various materials, and has constructed from those most suitable for the purpose two instruments which he has called the *phone* and *phonometer* respectively. The phone provides a means of creating a simple tone of intensity and frequency which are under control and capable of exact measurement. The phonometer is an instrument for measuring absolutely the vibrations received by it. It consists of the combination of a diaphragm and a resonator, both of which are adjustable in frequency. The motion of the diaphragm is observed by making it a reflector and part of a Michelson interferometer, so that the amplitude is measured in terms of the wave-length of suitable monochromatic light. In practice the interference fringes are photographed on a moving film upon which they appear as wavy lines. Against this instrument, which is regarded as a standard, other portable phonometers can be calibrated, these depending on the simpler process of the deflection of a beam of light set into angular oscillation by the receiving diaphragm. With such instruments, and also with D. C. Miller's *phonodeik* (referred to later) L. V. King has carried out an elaborate investigation on the propagation of sound in air and fog-signal efficiency (*Phil. Trans.*, 218, p. 211, 1919) in the region near Father Point, Quebec. King, in this paper, also describes a modification of the siren called the *diaphone*, used as a standard source of sound in his research.

Analysis of Sound.—Webster's phonometer described above is a resonant instrument, and, therefore, unsuitable for the analysis of mixed sounds. Much progress has been made, however, in the analysis of such sounds, using non-resonant recorders, for example, D. C. Miller's *phonodeik*. This instrument, which depends on the motion imparted to a tiny mirror by the operation of a vibrating diaphragm, is described in Miller's *Science of Musical Sounds* (1916), where also will be found the results of the analysis of various sounds. Similar work has been carried out by C. V. Raman, in relation to the vibrations of bowed strings and instruments of the violin family (*Indian Assoc. for Cultivation of Science*, Bull. No. 15, 1918). In these cases the sound record is of the ordinary type and consists of the trace on a moving photographic film of a spot of light vibrating at right angles to the motion of the film, thus forming a transverse wave. Records of a different type have recently been obtained (A. O. Rankine, *Proc. Phys. Soc. Lond.*, 32, p. 78, 1919) in which the sounds are caused to vary the *intensity* of a narrow beam of light, which gives on a moving film a line image perpendicular to the motion. The record thus consists of a negative film of varying transparency along its length. It is not so suitable as transverse records for direct analysis of the component frequencies, but it has the advantage that it admits of *reproduction* of the sound by means of a selenium cell, such as is used in photo-telephony. This arrangement constitutes a novel type of phonograph operated by light, first invented by Ernst Ruhmer in 1900, but hitherto little known. (A. O. R.)

SOUTH AFRICA (*see* 25.463).—On the conquest of German S.W. Africa by the Union forces in 1915 the whole of S. Africa, except for the Portuguese possessions S. of the Zambezi came under British administration. Excluding the Portuguese territory (for which *see* Delagoa Bay and Portuguese East Africa), S. Africa was in 1921 divided politically as follows:—

1. The Union of S. Africa, a self-governing dominion of the British Empire formed in 1910 and consisting of the former colonies of the Cape, Natal, Orange River (Free State) and Transvaal.
2. The S.W. Protectorate (ex-German S.W. Africa), administered under mandate as an integral part of the Union.
3. The native protectorates of Basutoland, Bechuanaland and Swaziland, administered by the British Colonial Office.
4. Rhodesia, consisting of two separate administrations, S. Rhodesia and N. Rhodesia; both under the rule of the British S.A. Company.

Area and Population.—Including both Rhodesias the area of S. Africa is approximately 1,650,000 sq.m., of which some 125,000 sq.m. are Portuguese. The total pop. in 1921 was little over 11,000,000, of whom some 700,000 lived in Portuguese territory.

The following table shows the white population in the Union and in Rhodesia at the censuses of 1911, 1918 and 1921:—

	1911	1918	1921
Union of S. Africa	1,276,242	1,421,781	1,521,635
S. Rhodesia	23,606	..	33,621
N. Rhodesia	1,497	..	3,585
Total	1,301,345	1,421,781	1,558,841

The increase per cent. in the Union in the period 1911–21 was 19·23, masculinity (the number of males to 100 females) decreased from 115·92 to 106·14.

The next table gives particulars of area and pop. of British South Africa at the 1911 census:—

	Area Sq. m.	Pop. 1911 White	Native and Coloured	Total
Union of S. Africa:				
Cape Province	276,995	582,377	1,982,588	2,564,965
Transvaal Province	111,196	420,562	1,265,650	1,686,212
Natal Province (includes Zululand)	35,371	98,114	1,095,929	1,194,043
Orange Free State Province	50,392	175,189	352,985	528,174
Total Union	473,954	1,276,242	4,697,152	5,973,394
Territories:				
S. Rhodesia	148,575	23,606	747,471	771,077
N. Rhodesia	290,000	1,497	821,102	822,599
Total Rhodesia	438,575	25,103	1,568,573	1,593,676
Protectorates:				
Bechuanaland	275,000	1,692	123,658	125,350
Basutoland	10,293	1,411	402,434	403,845
Swaziland	6,536	1,083	98,876	99,959
Total Protectorates	291,829	4,186	624,968	629,154
Total British S. A.	1,204,358	1,305,531	6,890,693	8,196,224

Compared with the census of 1904 the increase in the white pop. was 172,390. Of this increase 123,285 was in the Transvaal. In Rhodesia the white pop. had nearly doubled in the seven years. The increase in the native and coloured pop. was 885,660. With respect to the coloured pop. two important factors must be remembered. (1) The Cape province total of native and coloured includes 391,000 persons with a marked strain of white blood, officially classed as "mixed"; the total "mixed" pop. being 435,000. (2) The Natal province total of native and coloured includes 133,000 Indians. There were also 10,048 Indians in the Transvaal, the total Asiatic pop. being 152,000.

The following table gives particulars of the white pop. of the Union by provinces at the censuses of 1911, 1918 and 1921:—

	1911		1918		1921	
	Males	Females	Males	Females	Males	Females
Cape Province	301,268	281,109	311,312	307,513	329,934	321,620
Natal	52,495	45,619	62,745	59,186	70,624	66,834
Transvaal	236,913	183,649	260,840	238,507	284,952	258,529
O. F. S.	94,488	80,701	93,969	87,709	97,971	91,171
Total, Union	685,164	591,078	728,866	692,915	783,481	738,154

The coloured pop. of the Union in 1921 was in round figures 6,000,000, that of S. Rhodesia 744,000 and of N. Rhodesia about 1,000,000, that of the native protectorates 750,000, that of S.W. Africa 240,000, or a total of about 8,750,000.

There were in 1918 five towns with a white pop. of over 20,000 and eight towns with a white pop. between 10,000 and 20,000. The following list of the five chief towns gives the total pop. at the 1911 census with the white pop. in 1918 in brackets:—Johannesburg 237,104 (137,166), Cape Town 161,759 (99,683), Durban 89,998 (48,413), Pretoria 57,674 (41,690), Port Elizabeth 37,063 (23,339). Outside the Union the only considerable towns in S. Africa were Bulawayo and Salisbury in Rhodesia, Swakopmund and Windhuk in the S.W. Protectorate and Lourenço Marques (Delagoa Bay) and Beira in Portuguese territory.

THE UNION OF SOUTH AFRICA

The Union of S. Africa came into being on May 31 1910. Minor amendments were made in the constitution during the next 10 years, but its main features (*see* 25.467) remained unaltered. In accordance with the electoral provisions—the basis of representation being the number of European male adults as ascertained by census taken every fifth year—the Transvaal province obtained nine additional seats in 1915, and four more seats were added in 1920. The seats allotted in 1920 were Cape 51, Transvaal 49, Natal and Orange Free State 17 each.

No alteration was made in the franchise laws. In the Cape province in 1919 out of a total of 186,000 voters, 33,000 were "other than European." In Natal the voters numbered 32,000, of whom 348 were "other than European." In the Transvaal (140,000 voters) and Orange Free State (47,000 voters), "Europeans" only, possess the franchise.

Agriculture.—The progress made in agriculture (including pastoral occupations) was in many respects the most encouraging feature in the economic development of S. Africa between 1910–21. The establishment in the Transvaal during the period of Crown Colony Government, of an agricultural department on scientific lines had given an impetus to the adoption of modern methods by the farmers, and the fusion, at the Union, of the agricultural departments of the four former colonies led to greater improvements. By withdrawing the control of agriculture from the provinces the Union Government was able to coördinate the work and to disregard artificial boundaries. Much of the progress was due to Gen. Botha "who with his instinct for things that really mattered" had held the portfolio of agriculture together with the premiership of the Transvaal, and in the Union was also for a considerable period minister of Agriculture as well as prime minister. General Botha gave full encouragement to the technical and scientific staff. Schools of agriculture—there were five in 1921—and experimental stations were established on large farms situated on main railway lines. A two years' course of instruction was provided as well as shorter courses and up to 1920 some 5,000 students had passed through the schools. Of the 300 experts in the department in 1921, over one-third were ex-students. Up to that year £1,000,000 had been spent on buildings and equipment.

The veterinary service did invaluable work in investigating the diseases of stock, discovering the causes of East Coast fever, and other diseases, some of which were eradicated. Its work rendered possible the keeping of animals in many districts where it had not previously been possible, and made profitable the importation of high-class live stock. In 1920 it was estimated that the value of the live stock in the country, chiefly cattle and sheep, was over £100,000,000. The entomological and botanical divisions were also active, one notable achievement being the ridding—at least temporarily—the country from locust plagues. This was done by tracking the locusts to their breeding places and as soon as the young were hatched (when they crawl, but do not fly) sprinkling them, and the surrounding veld, with a mixture of arsenic and molasses, a plan devised by a Natal farmer. This method proved so effective that in 1918–20 no swarms of locusts were reported in the Union.

New crops and plants were introduced, among them *teff* grass from Abyssinia, very valuable for hay, which in 1920 was grown on 234,000 acres. The general result of the Agricultural Department's work, backed by the rise in prices during the World War, was to make S. Africa almost self-supporting as regards food-stuffs, while in 1919 agricultural and pastoral exports were valued at £33,000,000, and in 1920, a year of depression—especially in the ostrich feathers trade—at £27,000,000. In the back-veld farming had been "transformed from what was little more than nomadic grazing to an organized industry and throughout had been placed on a higher plane."[1]

Of pastoral industries the breeding of woolled sheep is the oldest and most important. The number of woolled sheep in the Union was 21,842,000 in 1911, 26,490,000 in 1916 and 23,548,000 in 1919. The number of other sheep, 8,814,000 in 1911 had, however, declined to 4,943,000 in 1919. These figures did not include sheep in native locations, which in 1919 numbered about 2,250,000. The wool exported from the Union reached 176,971,000 lb. in 1913 and was 115,634,000 lb. in 1918. The World War sent up prices, the average price per lb. in 1913–4 being 7·95d. and in 1917–8 20·78d. In 1918–9 when the average price was 20·08d. the value of the wool exported was £14,648,000. Wool worth £5,678,000 went to the United Kingdom, £5,209,000 to the United States and £2,786,000 to Japan. France and Canada were the next largest customers. There is also a considerable trade in sheepskins; the value of the skins exported was £594,000 in 1911 and £1,329,000 in 1918.

South Africa produces more than half the world's supply of mohair. The Angora goats in the Union in 1918 numbered 5,278,000, mohair exported that year was 19,645,000 lb., valued at £1,641,000. The trade in mohair is subject to wide variations, and the limit of production in S. Africa is that of successful competition with Turkey for the supply of the Bradford market. In 1920 the value of mohair exported fell below £500,000, chiefly owing to lessened demand for yarn from Bradford by Poland and Germany.

The number of cattle in the Union rose from 5,796,000 in 1911 to 7,255,000 in 1919. The steady progress of the cattle industry is seen in the figures of imports and exports of meat.[2] Up to and including 1913 imports greatly exceeded exports. Thus in 1913 the quantity of meat imported was over 11,000,000 lb., and that exported but 1,387,000 lb. In 1917 the imports had fallen to 23,000 lb., while the exports had leapt to 47,250,000 lb. (valued at £1,043,000). This was an exceptional war-time condition, but in 1919 while there were no imports the exports reached 44,408,000 lb. In 1916, for the first time, sufficient butter and cheese were made in the Union for all local requirements and something left over for export. The total export of butter in 1918 was 1,316,000 lb., of cheese 424,000 lb. In 1919 butter exports fell to 452,000 lb., but that of cheese increased to 1,546,000 pounds.

Large areas of S. Africa are well adapted to horse-breeding; in general, horses do well wherever conditions are best suited for sheep. The numbers of horses in the Union in 1919 was 695,000, of mules 81,000, of asses 498,000. These figures do not include horses, etc., in native locations.

Ostrich-farming suffered severely through the World War. In 1913 the industry had attained unprecedented success, when feathers weighing 1,023,000 lb. valued at £2,953,000 (an average value of £2 17s. 9d. per lb.) were exported. In that year there were 776,000 ostriches in the Union (757,000 of them in the Cape province). Over-production and the effects of the war in five years brought about an almost total collapse of the feather trade; the export fell by three-fourths and prices to 15s. a lb. Many breeders took up other branches of farming and by 1920 few persons were wholly dependent on ostriches for their living. The stock of birds was greatly reduced (it was 314,000 in 1918), only those of finest plumage being retained.

The pig and bacon industry is a development wholly post-Union. Pedigree animals were imported but the industry had barely got beyond infancy in 1920. The total production of bacon in the Union in 1917–8 was slightly over 7,000,000 pounds.

Among cereals the most important crop is maize. The maize belt covers a large area in the eastern portion of the Union, chiefly in the Transvaal and Orange Free State. There is an expanding home market for maize and an assured overseas market. The quantity of maize exported was 356,000,000 lb. in 1910 valued at £693,000 and 509,000,000 lb. in 1918, valued at £1,600,000. Kaffir corn, grown chiefly by natives, specially valuable for fodder in regions too dry for maize, was also an increasingly valuable crop. The area under wheat is mainly in the western part of Cape province; the production, 362,000,000 lb. in 1911, rose to 608,000,000 in 1917–8, but fell the next year to 478,000,000 lb. Of oats 48,454,000 lb. were exported in 1919.

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[1] Consult a paper on S.A. Agriculture by F. B. Smith, sometime secretary of the S.A. Agricultural Department, read at a meeting of the Colonial Institute, May 31 1921.

[2] The figures relate to beef and mutton but the quantity of mutton exported is small, 62,000 lb. in 1910 and 46,000 lb. in 1919.

Sugar plantations are confined to Natal and Zululand. The area under sugar in 1916–7 was 163,000 ac., the production that year being 114,000 tons and the value £3,134,000. In 1919–20 the output was approximately 180,000 tons, of which over 30,000 tons were exported. The cultivation of tea declined, sugar yielding greater profits; the yield for 1916–7 was 1,747,000 lb., compared with 2,681,000 in 1903, the year of highest production. Tobacco production did not show great variation in quantity during 1910–20, the yield being 15,000,000 to 17,000,000 lb. yearly, but there was considerable alteration in the class of tobacco grown, due to the increased demand for light and medium varieties. Cigarettes from locally grown Turkish tobacco became very popular.

Fruits of many varieties are produced for which there is a very large home demand, especially in the mining areas. The export trade, in fresh, bottled, canned and dried fruit and in jams showed a fair amount of extension and in 1919 was valued at £125,000.

Plantations of black wattle for the production of tan-bark cover about 250,000 ac., of which 160,000 are in Natal. Before the World War the bark was taken by Germany; factories for the production of the extract were erected in Natal in 1919 and the extract sent to Great Britain. The value of the exports increased from £269,000 in 1916 to £412,000 in 1918.

Irrigation.—Considerable progress was made in local irrigation schemes, but no great project had been undertaken by the Union Government up to 1922. The opposition of vested interests stood in the way of an adequate water law for the whole country, but in 1912 an Irrigation and Conservation of Waters Act was passed and an Irrigation Department created. Provision was made for irrigation loans to private persons and to irrigation boards, and for hydrographic surveys, etc. The government expenditure on irrigation increased from £276,000 in 1912–3 to £573,000 in 1917–8. By 1920 schemes involving an expenditure of £2,500,000 had been approved. The Sunday river, Cape province, irrigation works were the largest then under construction and were designed to bring 42,000 ac. under cultivation.

Mining.—Despite appearances the most valuable mineral in S. Africa is coal. The position was put succinctly in 1920 by Mr. U. P. Swinburne, Chief Inspector of Mines, when he wrote in the *Official Year Book of the Union* "S. Africa has made its name through the production of gold and diamonds, but it is mainly due to the existence of cheap coal that the large output of gold and diamonds has been made possible. On the Witwatersrand proper only a few mines would be working at the present time if a plentiful supply of cheap steam coal was not available." Opinions of experts on the life of the gold mines on the Rand differ; the report of the Union Economic Commission, presented early in 1914, estimated that 550,000,000 tons of payable ore remained in the mines then working. This figure was very much less than had been expected. Since that year new mines on the Far Eastern Rand have been developed. Mr. P. A. Wagner, in his presidential address in 1918 to the S.A. Association for the Advancement of Science, hazarded the conjecture that £1,200,000,000 worth of gold remained to be extracted and that 50 years ahead some of the mines might still be profitably worked. But gold production on the Rand is so costly that a slight rise in costs has on many mines a disastrous effect.

With regard to diamonds their abundance is unquestioned, and a policy of limiting supplies to keep up prices is adopted. Even so most of the diamond mines were shut down in 1920–1, a striking example of the economic depression prevailing, S.A. being the only considerable source of the supply of diamonds in the world. Depression in prices led also in 1918 to the closing of the copper mines in Namaqualand, Cape province.

Since 1912 the gold industry has become increasingly dependent on the development of the Far East Rand. Thus in 1918 the dividends paid from the Far East Rand mines amounted to £3,344,000, compared with £1,929,000 from all other Rand mines. The value in sterling of the gold output from the Transvaal mines rose from £31,973,000 in 1910 to £39,489,000 in 1916. This was considered the high water mark.[1] The value in 1917 was £38,306,000, in 1918 £35,758,000, in 1919 £35,389,000 and in 1920 £34,652,000 (for the first half of 1921 the output was £16,671,000).

The statistics of the output of diamonds reflect the purchasing power of the public. The market is strictly controlled by the producers and the only diamond field of importance which was outside the Union—that of ex-German S.W. Africa—as a result of the World War came into line with the other S.A. mines. In 1914, shortly before the war began, a conference of representatives of the diamond industry was held in London with the object of regulating the output from each mine. Though no binding agreement was then made such an arrangement is virtually in force. The value of the diamonds extracted in 1910 was £8,746,000, in 1913, the last full year before the war, £11,389,000. In 1915 diamond mining almost ceased, the total output that year being valued at £399,000. The mines restarted in 1916, when the value of the output was £5,728,000. In 1918 the figure was £7,114,000 and in 1919 had risen to £11,734,000, thus exceeding the record of 1913. The year 1920 began well and ended badly; the market was overstocked and purchasers few. The overstocking of the market was attributed by the De Beers Co. to the sale of diamonds by the Russians—by the Soviet Government to obtain goods and by private individuals who had lost other means of subsistence. The Rhodesian output of diamonds is very small; the De Beers Co. has the right to dispose of all diamonds found in the territory. In the Premier mine, Transvaal, the system of open working still prevailed in 1921. In Sept. 1917 a fine stone of 442 carats was found in the Dutoitspan mine, Kimberley.

A very marked development of coal mining took place between 1910 and 1921. The mines of the Cape province, which yield only poor quality coal, were nearly all abandoned as the richer deposits in Natal and the Transvaal were opened up. The output from the Cape exceeded 100,000 tons for the last time in 1909, in which year the Natal fields first yielded over 200,000 tons. The total output from the Union rose from 7,112,000 tons valued at £1,869,000 in 1910 to 10,382,000 tons valued at £3,275,000 in 1917 and was 10,266,000 tons in 1919. Besides supplying cheap fuel for the gold and diamond mines and other purposes, the coal is in great demand for bunkering ships and for export to India, E. Africa and S.A. ports. In 1919 Union coal bunkered was 1,427,000 tons; coal exported 1,092,000 tons (half of these exports going via Delagoa Bay).

The output of tin, mined almost entirely in the Waterberg and Olifants river districts, Transvaal (3,672 tons in 1913 valued at £436,000), had dropped in 1918 to 1,900 tons valued at £277,000.

Copper output increased with the opening of the railway in 1913 to the Messina mines on the Limpopo. These with the Namaqualand mines represented the copper output of the Union, which in 1916 with 22,800 tons reached a value of £1,137,000. In 1919 the output sunk to 4,900 tons valued at £208,000.

Trade and Shipping.—The following table gives the total of imports and exports to and from the Union for 1911, the first complete year after the Union had been established, for 1915, the year of the greatest restrictions of trade owing to war conditions, and for 1919. The exports include diamonds and gold, the imports government stores and specie:—

Year	Imports	Exports	Total Trade
1911	£38,035,000	£57,308,000	£95,343,000
1915	£33,833,000	£35,012,000	£68,845,000
1919	£50,791,000	£104,561,000	£155,352,000

Trade in 1920 was conditioned by the world depression, which did not become marked till the second half of the year. Imports in the first six months showed a large increase, being £48,000,000 against £28,000,000 in the corresponding period of 1919, and for the whole year exceeded £90,000,000. Exports for the first six months of 1920 showed a comparatively small decline, being £51,000,000 as against £58,000,000 for Jan.–June 1919, but for the whole of 1920 the total was only £72,000,000.

The distribution of trade by countries was as follows in 1910 and 1919:—Imports (1910) United Kingdom 59%, (1919) 46%; other British lands (1910) 11%, (1919) 17%; United States (1910) 8%, (1919) 24%; other countries (1910) 22%, (1919) 13%. Exports (excluding gold) United Kingdom (1910) 80%, (1919) 61%; other British lands (1910) 1%, (1919) 8%; United States (1910) 17%, (1919) 24%; other countries (1910) 17%, (1919) 15%.

Nearly all the external trade of the Union passed through Durban, Cape Town, Port Elizabeth and East London. The only non-British port which had a share in the trade of the Union was Delagoa Bay. In 1913 Delagoa Bay had 12% of the trade, in 1918 only 8% (*see* DELAGOA BAY). Of neighbouring countries the chief trade was with Rhodesia, Portuguese E. Africa and the Belgian Congo. The exports to British E. Africa (Kenya Colony) increased from £19,000 in 1913 to £396,000 in 1918; in the same period the imports from British E. Africa rose from £16,000 to £139,000. Of foreign countries outside Africa and excluding the British Empire and the United States, France and the Argentine were the chief traders with the Union. As to overseas carrying trade the British proportion of cargo shipped in 1918 was 79·85% and the Japanese 7·51. Of cargo landed the British proportion was 69·17% the Japanese 10·12% and the American 9·43%.

The value of the preferential treatment accorded certain articles of merchandise imported into the Union from the United Kingdom, Canada, Australia and New Zealand is shown by the following figures:—In 1913 on imports valued at £22,498,000 the amount rebated was £628,000; in 1918 on merchandise worth £25,158,000 the rebate was £698,000.

The number and tonnage of vessels entered at Union ports (including the coastwise trade) was as follows in the years named. The figures represent the gross number of vessels using the Union ports, *i.e.* the same vessel, if it called and cleared at Cape Town, Port Elizabeth and Durban, would be entered three times. The tonnage of vessels cleared is not given, it corresponds closely to the figures of tonnage entered.

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[1] The total value of gold mined in British S. Africa in 1916 was £43,416,047: of this total £3,859,111 came from Rhodesian mines, £31,726 from the Tati goldfields, £1,336 from Natal and £132 from Cape province. The Natal mines in 1915 had yielded over £10,000.

Year	No. of vessels entered	Net tonnage British	Net tonnage Total
1913 .	4,349	10,586,000	12,939,000
1915 .	3,322	7,298,000	7,937,000
1917 .	3,888	7,682,000	9,252,000
1919 .	3,060	6,642,000	7,608,000

The number of German ships entering Union ports in 1913 was 230, of 723,000 net tonnage.

Communications.—Nearly all the railways in the Union are state owned. Railways and harbours are under the control of a Board, whose finances are independent of the other revenue departments. The mileage of railways open in 1910 was 7,586, of which privately owned lines had a mileage of 545. In 1919 the mileage open was 10,049, of which government lines had 9,542 mileage. It will be seen that development was rather slow, an average of 246 m. a year in a period of 10 years. The total expenditure on new lines in these 10 years was £9,113,000. The principal new line, that from Prieska to Kalkfontein connecting the Cape and S.W. Protectorate systems, was built for military purposes. The extension in 1913 of the railway from Krugersdorp via Zeerust to Mafeking brought Johannesburg and Bulawayo within 680 m. of one another (instead of 975 m. via Fourteen Streams) and made Mafeking the business centre for the western Transvaal. The opening, also in 1903, of the Messina railway, afforded the opportunity, by the building of a connecting line to W. Nicholson in S. Rhodesia of putting Bulawayo in direct communication with Delagoa Bay. But, up to 1921, the needed link had not been built (*see* RHODESIA). In the Cape province the completion of the Mossel–Bay–George–Oudtshoorn line gave a much more direct connexion between Cape Town and Port Elizabeth reducing the distance from 910 m. (via de Aar) to 684 m. (the distance by sea between the two ports is 436 nautical miles). The adoption of electricity on a number of lines, including the main line from Durban to Glencoe was recommended in 1920 by the government's consulting engineer. The scheme was adopted by the ministry for the Cape Town–Simon's Bay line and for the Natal main line from Durban as far as Maritzburg. With the electrification of the Durban–Maritzburg line a new alignment was undertaken as part of a scheme for rebuilding the whole line from Durban to the Rand.

The Railways and Harbour Board after the World War took over control of the railways in the S.W. Protectorate. The total railway mileage in the Union and Protectorate at the beginning of 1920 was 11,334. Up to March 31 1920 the capital expenditure on Government railways was £96,408,000. The gross earnings in 1919–20 were £19,169,000 and working expenses 78·9% of the gross earnings.

The use of motor vehicles greatly increased from 1913 onwards (when over 4,000 cars were imported), farmers having by then learned their value. In 1919 over 16,000 vehicles were licensed. Nearly all the cars came from America (United States and Canada), but heavy motor lorries were imported from England. Notwithstanding this development of motor traction the trek ox was still employed though in decreased numbers.

The extension of the telegraph system kept fair pace with the needs of the community, and wireless stations were erected at Durban, Cape Town and (in 1921) at Port Elizabeth. These were not of high power, the guaranteed range (at night only) not exceeding 1,500 miles. Wireless telephonic stations were added in 1921.

With respect to the mail service to England no improvement in speed was made. A contract to run for 10 years from Oct. 1 1912 was entered into with the Union Castle Co. for a weekly service to and from Southampton, the duration of the voyage to be 16 days 15 hours. The subsidy paid was £171,000 yearly, of which £21,000 was in consideration of the mail steamers beginning and ending their voyages at Durban instead of Cape Town. The contracting parties were on the one hand the steamship company and on the other hand Great Britain, the Union, Southern Rhodesia and the Bechuanaland Protectorate. Postal communication with Australia, India and the Far East was maintained by private ships as opportunity offered. A steamship service between Holland and S. Africa, subsidized by the Netherlands Government, was established in 1920, and in 1921 a direct service between S. Africa and Vancouver was started by the Canadian Government. While some £10,000,000 or more a year was spent on harbour works except at Durban (*see* DURBAN) the facilities for shipping were not greatly extended, and Cape Town suffered from lack of adequate dock accommodation.

Air travel developed slowly. The first aeroplane flight was made in 1910 in a Voisin biplane. Little progress was made in civil aviation until after the World War, when, in 1919, aerodromes were laid out at Wynberg, Bloemfontein, Johannesburg and other places as stages on the cross-Africa route. The first flight from Cairo to Cape Town was made in 1920 by two S.A. military pilots. In the same year an Aero Club for S.A. was formed at Cape Town.

Education.—"Education, other than higher education," which definition in practice was held to include all education other than university, is controlled by the provincial councils. The standards and methods differ in each of the four provinces but in general provision is made for a sound training of white and coloured (as distinct from native) children. A matter which aroused acute dissensions before and in the two years immediately following the establishment of the Union was the question of the medium of instruction. By law the English and Dutch languages were in a position of equality. An attempt to favour Dutch was made in the Transvaal schools, while in the Free State the education authorities tried to enforce bi-lingualism, insisting that English-speaking children should be taught in the medium of Dutch. Eventually all four provinces adopted the principle recommended by the Union Parliament in 1911, namely that the medium of instruction up to standard IV. should be in the "home" language of the scholar, and that above that standard freedom of choice should be left to the parents. The compromise worked and in June 1912 the private schools which had been opened by the English speaking residents in the Free State in 1910 as a protest against compulsory bi-lingualism were handed over to the provincial administration. The subject of religious instruction presented little difficulty. The practice in each province in all public schools is for school to be opened with prayer and a reading from the Bible. Scripture teaching, subject to a conscience clause, is generally provided; sectarian teaching under certain conditions is allowed in the Cape province by an ordinance passed in 1913. The number of schools in the Union for white children increased from 3,873 in 1910 to 4,846 in 1918; in the same period the schools for coloured children increased from 1,999 to 2,877. The number of white scholars in 1910 was 163,200, in 1918 the number was 283,100. The coloured scholars had increased in the same period from 136,000 to 220,100. The teachers had increased from 10,912 to 18,301, and the expenditure from government funds had grown from £1,597,000 to £3,631,000. Private schools were not numerous; there were 270 in the Union in 1918, of which 96, the oldest dating from 1880, were in the Cape province. There were then in the Union 135 private schools founded since 1910.

State and state-aided schools for natives are provided in all the provinces, and in Natal and the Transvaal there are special schools for Indians. The expenditure on native schools rose from £81,000 in 1911 to £137,000 in 1918. In Natal in 1918 the government established an institution for training the sons of chiefs and *indunas* in the special duties they are called upon to perform. The education of the natives remained, however, very largely in the hands of missionary societies, though there was a growing inclination, among the natives, particularly in the Transkeian territories, to secularize education and to obtain a larger direct share in its management. Of the 23 principal institutions which in 1919 provided higher education for natives—literary, commercial, industrial, agricultural and training for the ministry—12 were in Cape province, the largest and most comprehensive being the famous Lovedale College. The most important step in regard to higher education of natives was the establishment in 1914 of the S.A. Native College on a site at Fort Hare, Cape province, given by the United Free Church of Scotland. To this college the natives and the missionary societies, Presbyterian, Anglican and Wesleyan, contributed; the Union Government gives an annual grant. The college aims at providing education of university standard and is open to coloured and Indian students.

The system of higher education was reorganized in 1918, after much heated controversy (*see* below § *History*). Under the new scheme the university of S. Africa, with headquarters at Pretoria, which replaced the university of the Cape of Good Hope, is an examining body, having the following constituent colleges:—Grey University College, Bloemfontein, Huguenot College (for women), Wellington, Natal University College, Pietermaritzburg, Rhodes University College, Grahamstown, South African School of Mines, Johannesburg, and Transvaal University College, Pretoria. The new university of Cape Town provides for the residence as well as the teaching of students (men and women). A special feature of the new Stellenbosch University is its agricultural faculty (the Transvaal University College has also an agricultural faculty). The number of university students in the Union increased from 1,171 in 1910 to 2,069 in 1918. In the last-named year the expenditure on higher education in the Union was £240,000.

Finance.—The unitary system of government adopted in 1910 was strongly marked in the financial provisions made. All public revenues were payable to the Union Government, and the funds needed to carry on the administration of the provinces were provided by grants from the Union Exchequer. By the Financial Relations Act which came into force in April 1913 the Union Parliament assigned the revenue derived from transfer duties, liquor licenses and native pass fees in Transvaal labour districts to the provinces, but gave the provinces no power of legislation in regard to such revenue. Other sources of revenue, such as education fees, trading and professional licenses were assigned to the provinces with power of legislation in regard thereto. A subsidy from Union funds of one half the ordinary expenditure of the provinces was also made, plus additional subsidies to Natal and the Orange Free State whose funds were shown to be inadequate to meet the necessary expenditure. The provinces are not allowed to borrow from any other source than the Union Treasury.

All trust moneys, (*e.g.* post office savings bank moneys) are handed over for investment to the Public Debt Commissioners. Any yearly surplus of revenue over ordinary expenditure is paid to the Commissioners and by them applied to the redemption of debt.

Revenue and expenditure of the Union is divided into two distinct funds, the ordinary or general, and the railway and harbours.

The following table shows the ordinary revenue and expenditure, for three typical financial years:—

	1913–4	1916–7	1920–1
Revenue	£15,980,000	£18,617,000	£28,381,000
Expenditure .	£14,289,000	£15,490,000	£28,890,000

The chief sources of revenue for the year 1919–20, were as follows: customs, £5,010,000; interest, £4,277,000; income, super, and dividend taxes, £4,050,000; posts, telegraphs and telephones, £2,031,000; excise, £1,228,000, and mining revenue, £1,023,000. The native poll and hut taxes produced altogether, £830,000. Among the main items of expenditure for the same period were: public debt, £6,940,000; provincial administrations, £3,520,000; justice, £3,209,000; postal, etc., services, £2,144,000; defence, £1,575,000; pensions, £1,200,000; interior, £1,019,000; agriculture, £861,000, and public works, £614,000.

Railway and harbour finance is controlled by a board presided over by a cabinet minister. The management of harbours and railways is required to be upon business principles. The following table shows receipts and expenditure for these services in the years named:—

	1913	1916	1918–9
Harbours (receipts) .	£1,039,000	£1,031,000	£939,000
" (expenditure)	£900,000	£656,000	£479,866
Railways (receipts) .	£12,388,000	£13,257,000	£11,680,000
" (expenditure)	£8,964,000	£8,891,000	£15,282,000

The war expenditure of the Union was met out of loan funds, the total charge on such funds amounting on March 31 1920 to £29,736,000. At the same date the public debt of the Union was £173,905,000.

The South-West Protectorate

After the surrender, in July 1915, of the German forces in S.W. Africa Gen. P. S. Beves was appointed military governor of the protectorate.[1] None of the German inhabitants was then repatriated and while the regular troops were placed in internment camps the civilians were allowed to return to their homes and continue their ordinary business. Mr. (afterwards Sir) E. H. L. Gorges, Secretary of the Interior in the Union, who had at Gen. Botha's request already drawn up a scheme for the future administration of the protectorate was made chief civil secretary. On Oct. 30 1915, on Gen. Beves's departure the two offices named were abolished and the functions of both taken over by Mr. Gorges with the title of Administrator. This post he retained until nearly the close of the military occupation period, which lasted till the end of 1920. Martial law remained in force but in a mild form and the administration was on civilian lines. At the beginning of 1917 it was found necessary to send an expedition to Ovamboland, the northern and most populous part of the protectorate, where German authority had been very slight. A chief named Mandume proved recalcitrant and two battalions, the first and the fourth of the S.A. Mounted Riflemen, together with a composite regiment of military constabulary were sent against him, Col. de Jager being in command. The expedition, despite fever, flood and dense forest, as well as the opposition of the natives, was successful. Excellent relations were afterwards established with the Ovambo.

In the rest of the protectorate S.A. rule was from the first welcomed by the natives, and the Germans gave no serious trouble. Until nearly the close of the World War they believed that the British occupation was temporary, being confident in the ultimate victory of Germany. This was evidenced by the fact that the German banks and traders maintained a rate of exchange of 24 marks to the £ sterling until Nov. 1918—the month of the Armistice. Instances were known of farmers selling their stock for sterling and converting it into paper marks. Where the artificial rate of exchange broke down serious losses followed. The Germans, however, continued to entertain false hopes, and after the Armistice they wrote to President Wilson asking his help on "self-determination" lines. They desired, they said, to become an autonomous republic leagued to the German republic, and this solution, they gratuitously added, would, they believed, meet the wishes of the natives. In 1919 the German soldiers—about 5,800 in all—together with some 600 "undesirables" were repatriated. This still left, according to official figures, over 9,000 Germans in the protectorate. These German settlers continued hostile to Union rule, and obnoxious to authority. Lord Buxton, then governor-general of the Union, who visited Windhuk, the capital, in Oct. 1919, took occasion to inform them that the severance from Germany was irrevocable, and that the protectorate would in future form an integral part of the Union. Gen. Smuts when on an official visit to the territory in Sept. 1920 used similar language. The Germans had informed him that the country should be administered as "an independent province," and that the German civil code should continue, arguing that the introduction of the Roman-Dutch law would be "a retrogression of centuries." They also asked for the recognition of German as an official language, and the maintenance by the State of the German schools, but were refused.

By the treaty of Versailles Germany had renounced sovereignty over the protectorate, and in accordance with its provisions the Supreme Council in May 1919 assigned the mandate for the territory to the Union of S. Africa. An Act was passed by the Union Parliament in Sept. 1919 to give effect to the mandatory powers; finally the mandate was confirmed by the Council of the League of Nations on Dec. 17 1920. On Jan. 3 1921, martial law was withdrawn and Mr. Gysbert Hofmeyer, who had succeeded Sir Howard Gorges as Administrator in Oct. 1920, was given a nominated advisory council of six members. This council met for the first time on Feb. 2 1921.

Settlers and Industries.—In general the laws in force in, and the economic policy of, the Union was applied to the protectorate from the early days of Sir Howard Gorges's rule. Walfish Bay, the only good harbour on the S.W. coast, had languished. It had formed a small British enclave in what was German territory, and without hinterland, served only the purpose from which it got its name—a whaling station. Swakopmund was an artificial and poor port. The Union authorities built a line (22 m. long) from Walfish Bay to Swakopmund, and thus gave the protectorate its natural sea outlet. The whole length of the line from Walfish Bay to Windhuk was relaid on the standard S.A. gauge of 3 ft. 6 inches. In 1921 the Railways and Harbour Board undertook the construction of a line (132 m. long) eastward from Windhuk to Gobabis.

While no crown lands were alienated up to 1921 temporary licenses were granted and many members of the army of occupation on demobilization settled in the country with their families. A fairly large British-Dutch population soon grew up, evidenced sufficiently by the fact that in 1920 there were 975 children attending Government schools.[2] The new settlers were chiefly engaged in stock raising and farming; the copper, tin, and diamond mines were already in beneficial occupation, largely with British capital. The Otavi mines in the years 1916–8 produced 100,000 tons of copper ore, valued at £600,000. The expectation that the Lüderitzbucht (Luderitz Bay) diamond fields would be thrown open to all comers was not realized. At the end of 1915 some of the companies on the diamond field were allowed to resume work; between Oct. 1915 and Jan. 1919 diamonds valued at £1,900,000 were obtained. Later the whole diamond field came under the control of one company, which entered into a working arrangement with De Beers and other diamond mining companies in the Union. The depression in trade led, in 1921, to the temporary closing of the mines. Depending upon diamonds for prosperity, was, declared Mr. Hofmeyer, like building on sand.

Trade and Revenue.—During the war external trade was all overland with the Union, trade being facilitated by the line built in 1915 from Prieska to Kalkfontein to connect the two railway systems. Customs duties were those in force in the Union, with free trade between the Union and the protectorate. During 1918 the value of imports was £1,031,000, about one half being S.A. produce. Of the total imports £409,000 represented the value of food and drink, and £181,000 cotton goods. The value of exports in 1918 was £817,000. The chief items were, diamonds £652,000, copper ore £55,000, cattle and small stock £57,000, horns, hides and skins £35,000.

The revenue of the protectorate in the financial year 1917–8 was £295,000; and in 1918–9 £377,000, of which £275,000 was from the tax on diamonds. The expenditure for the two years named was £650,000 and £744,000; as to more than three-fourths the expenditure was on the upkeep of the garrison.

Native Affairs.—Nowhere else had German methods of dealing with the natives been more ruthless than in S.W. Africa. The result of an examination of German judicial and administrative methods and documents was made public in 1918. It showed that not only during the Herero and Hottentot wars but in peace time the natives were systematically subjected to brutalities and robberies, by the Government as well as by the settler. One consequence was that, apart from Ovamboland, where the Germans had little authority, the native population had decreased from some 130,000 in 1904 to 37,000 in 1911. In 1920 it was estimated at 80,000. To reconstruct, as far as practicable, tribal organization, Sir Howard Gorges established native reserves (over 4,000,000 ac. in all) controlled by hereditary chiefs, when such survived, or by an elected or nominated headman. To these men small salaries were given. Rules to protect natives in the railway and other public departments and in European private service were enforced.

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[1] For earlier events *see* GERMAN SOUTH-WEST AFRICA.

[2] The German settlers had separate schools. Efforts were made in 1921 to induce them to abandon these schools. They were offered "mother-tongue" instruction up to standard VI., coupled with the compulsory learning of either English or Dutch.

THE NATIVE PROTECTORATES

No change was made in the political status of the native protectorates—Basutoland, the Bechuanaland protectorate and Swaziland—in the period 1910–21. They remained under the control of the Colonial Office, represented by the High Commissioner for S.A. and were administered by resident commissioners. They form in whole, or in greater part, native reserves, and the Basuto and Bechuana showed marked disinclination to incorporation in the Union of S. Africa. All three protectorates prospered.

Basutoland.—At the 1921 census the people numbered 500,544 (of whom 1,615 were whites and 155 Asiatics) compared with 403,845 in 1911 and 348,848 in 1904; of the total pop. in 1921 males numbered 224,435 and females 276,109. Maseru, the capital and largest town had (1920) approximately 900 native and 500 white inhabitants. Outside Maseru, the white residents are nearly all officials or missionaries. Ownership of land by whites is forbidden. Some 20,000 male Basutos are normally employed outside the country—mostly on the Rand gold mines. Agriculture and stock raising are the chief occupation of the people.

Education is in the hands of the missionary societies, except for four small Government schools. In 1919 there were in all 344 schools with 28,500 scholars, most of the schools being maintained by the French Protestant Mission (the Paris Evangelical Society). Grants in aid are made by the administration (£25,000 in 1920–1). Serious crime is rare and the drinking habits of the people, which once threatened their destruction, have been very largely abandoned under missionary influence. About one-fourth of the Basutos prefers Christianity. Trade is almost exclusively with the Cape and Free State provinces; the Basuto export grain, cattle, wool and mohair, and horses; and import mainly clothing, ploughs, saddlery, iron and tin ware, and groceries. The value of imports increased from £239,000 in 1908 to £1,137,000 in 1919. In the same period the value of exports rose from £193,000 to £1,380,000—in part due to inflated prices obtained for wool and mohair.

Financially Basutoland is self-supporting. Revenue is obtained from customs, licenses and, principally, from the poll tax on natives. This tax was substituted in 1911 for the hut tax previously enforced. A tax of £1 per annum on adult males was then put in force, but if a Basuto had more than one wife, he paid £1 per annum for each wife, up to a maximum of £3 for himself and his wives. This tax yielded £92,000 in 1913 and £106,000 in 1918–9. Total revenue increased from £145,000 in 1910–1 to £199,000 in 1919–20; the corresponding figures for expenditure were £134,000 and £202,000.

The system of government which under a resident commissioner allows a measure of home rule to the Basutos continued to work well. The *pitso* or national council meets yearly, 95 out of its 100 members being nominated by the chiefs and the other five by the administration. It has advisory powers only, but its advice is often taken. Sir H. C. Sloley who had been resident commissioner since 1901, and who earned the full confidence of the people, was in Dec. 1917 succeeded by Lt.-Col. E. C. F. Garraway. Letsie II., who had been paramount chief since 1905, died in Jan. 1913. He was a great grandson of Moshesh, the founder of the Basuto nation and dynasty, and was succeeded by his brother Griffith. When the World War began Griffith and his people offered to raise regiments for combatant service. The offer was declined, to the grief of the Basutos, to whom service with the labour contingent did not appeal. However, 1,400 Basutos served with the S.A. Native Labour Contingent in France, and many were employed in S.W. and E. Africa. The Basuto also contributed £50,000 to war funds. In 1921 the new High Commissioner, Prince Arthur of Connaught, visited Maseru, and the presence of a member of the royal house was made the occasion for a national tribute by the "Sons of Moshesh"—as the Basutos call themselves—to their loyalty to the British throne and their wish to remain directly under imperial control.

Bechuanaland.—The Bechuanaland protectorate is a much poorer country than Basutoland and the Bechuana are a less virile race than the Basuto. Bathoen, paramount chief of the Bangwaketse, died in July 1910 and Sebele, paramount chief of the Bakwena, died in Jan. 1911. Montsioa, chief of the Baralong, died in April 1911. All these chiefs were noted men in the early struggles between the Boers and British for the possession of Bechuanaland, Sebele being a son of the chief Sechele, the friend of David Livingstone. Khama, the chief of the Bamangwato, and a Christian from his youth, still survived in 1921 and had then ruled over his people with undisputed authority for some 50 years.

The Bamangwato are the largest tribe, numbering about 40,000. The people grow maize, kaffir corn and other crops but their chief wealth is in cattle, and cattle hides and skins are the chief exports. Firewood and timber for mining props are also exported. In 1917–8 exports to the Union included 23,600 horned cattle and 36,000 sheep and goats. The chief markets are Kimberley, Mafeking and Johannesburg. For customs purposes the protectorate is dealt with as part of the Union and no statistics as to value of imports and exports are kept. Revenue, £52,000 in 1910–1, first exceeded expenditure in 1915–6, when the figures were revenue £70,000, expenditure £68,000. In 1919–20 revenue was £81,500, expenditure £91,600. Deficits were made good by grants from the Imperial Exchequer. The seat of the administration is Mafeking, in the Cape province. Mr. J. C. Macgregor became resident commissioner in 1917. Khama's headquarters are at Serowe (pop., 1920, about 25,000).

Swaziland.—At the 1921 census the inhabitants numbered 113,772, of whom 2,203 were whites. Of the total pop. 54,702 were males and 59,070 females. The state of chaos into which Swaziland had fallen owing to the indiscriminate grant of concessions (*see* 26.181) was ended by 1914. The partition of rights between the European concessionnaires and the Swazis was completed in 1911, and those natives who were required to move from properties held by whites by July 1914, did so voluntarily—such as did move, for many natives made terms with the concessionnaires and remained on their farms. Out of a total area of 4,274,000 ac. 1,635,000 ac. were set aside as Swazi reserves; in addition the Swazis bought 77,000 acres. The Swazis raise maize and other crops and own large stocks of cattle while 7,000 to 10,000 Swazis are usually at work on the Rand mines. The whites engage in agriculture, including fruit farming and cotton and tobacco growing and in mining. The gold mines, which produced 6,497 oz. in 1915–6, were closed down as unprofitable in 1917. Tin of a total value of £346,000 was produced in the years 1915–20. The large coal deposits in the protectorate had not been exploited up to 1921. No separate statistics of Swaziland trade are kept. Revenue which in 1910–1 was £58,000 had risen to £91,800 in 1919–20. Expenditure in the same period rose from £62,000 to £87,000. The settlement of the concessions' questions cost £182,000.

The administration is under the charge of a resident commissioner, with headquarters at Mbabane, a small, picturesquely situated hill village (altitude 4,000 ft.) overlooking the middle veld. The paramount chief and other chiefs exercise jurisdiction in all civil cases in which natives only are concerned. Naba Tsibeni, the "queen regent," a well-known figure in Swazi history acted for many years as paramount chief, until the coming of age of her grandson Sobhuza (born about 1900). Education is mainly in the hands of missionaries; Sobhuza was educated at a Government school established at Naba Tsibenis Kraal. Mr. De S. M. G. Honey who had served in Swaziland since 1904 became in 1917 resident commissioner.

HISTORY

The 12 years (1910–21) following the establishment of the Union of S.A. were marked by political, racial and industrial crises which profoundly affected the future of the country. The most urgent issue was raised by a powerful section of the Dutch community, which revived a narrow Nationalism and developed a demand for the separation of the Union from the British Empire. Coupled with this conception went strong opposition to action against Germany, or any share in the World War. But this Nationalist section, whose greatest figure was ex-President Steyn and whose mouthpiece was Gen. Hertzog, was unable to control events. The policy of Gens. Botha and Smuts of "building up a new State on non-racial lines" and as an equal member of the British Commonwealth prevailed.

Besides this main issue the growth of an organized Labour party, which found its chief stronghold on the Rand and put forward an advanced socialistic programme, presented perplexing problems to a community new to such manifestations. The position of Indians in the Union, and the resolve of the white races to prevent further immigration of Asiatics was another problem which caused acute controversy, only partially silenced by the ultimate assent of the Government of India to the policy of exclusion. And behind all these questions was the ever-present problem of the relation between the white and native races. Signs multiplied that the Bantu peoples, gaining in knowledge and an increasing factor in industry, had acquired a sense of race solidarity and would not rest satisfied with their existing economic, social and political status.

While these racial and political questions held the field they were accompanied by a steady development of the material resources of the country and of trade. The progress in agriculture and in mining was marked; a beginning was made in manufactures. The benefit of unification in this respect was apparent. That benefit was even more apparent in the relations of S.A. with the outside world; she spoke with one voice and as a powerful unit. The new position which S.A. had acquired, in common with the other British Dominions, was seen when as a separate entity she was represented at the Peace Conference in Paris and her delegates signed the Treaty of Versailles.

Outside the Union the period under review was chiefly noticeable for two things: the disappearance of German sovereignty accompanied by the transfer of the administration of ex-German S.W. Africa to the Union, and the decision to terminate the government of Rhodesia by the Chartered Company, in response to the demand of Rhodesians for self-government.

Botha's First Ministry.

The Union had been brought about by the recognition by the leaders of the Dutch and British communities that S.A. was one country, not several, and that in every part of it the interests of the two races were so intermixed that they could not be separated without harm to both. Lord Gladstone, the first governor-general of the Union, had called upon Gen. Botha, the Prime Minister of the Transvaal, to form the first Ministry under the Union.[1] This Gen. Botha had done and this Ministry came into existence on May 31 1910, the day on which the Union was proclaimed (being the eighth anniversary of the close of the Anglo-Boer War). General Botha's Ministry was formed from members of the expiring Cabinets of the various colonies, but while it included Natal ministers and strong Boer partisans it was not a coalition ministry. The first general election, held on Sept. 15 1910, was fought on party lines and was hotly contested. It resulted in a majority for the "South African" party, that led by Gen. Botha, of 13 over all other parties, though Gen. Botha himself was defeated at Pretoria East by Sir Percy Fitzpatrick and a seat had to be found for him by means of a by-election. In the first session of the Union Parliament (opened by the Duke of Connaught on Nov. 4) Gen. Botha had the support not only of his own party, but of that of the four Labour members elected by Rand constituencies and of several of the Natal members of whom 13 out of 17 had been returned as Independents. The opposition, known as the Unionist party (and mainly British) was led by Dr. Jameson, who was created a baronet in Jan. 1911. Owing to ill health Jameson resigned the leadership in April 1912, and was succeeded by Sir Thomas Smartt, an ex-Cape minister and, like Jameson, a medical man. In Oct. 1912 Jameson resigned his seat for Albany (Graham's Town) and retired from Parliament.

General Botha's Cabinet was of a rather heterogeneous character. Among its members were Gen. Smuts, Mr. H. C. Hull, Mr. Jacobus Wilhelmus Sauer, Mr. Henry Burton, Mr. Abraham Fischer and Gen. Hertzog. They were divided on personal and provincial as well as progressive and retrogressive lines. General Smuts, Minister of the Interior, did not at first figure very prominently, but was the Prime Minister's right-hand man. Mr. Hull (b. 1860), after being in the Cape civil service, had practised at the bar, served in the war of 1899–1902 and was afterwards Treasurer of the Transvaal, and he entered the Union Cabinet as Minister of Finance. Mr. Sauer had been 30 years a member of the Cape House of Assembly and had frequently held office. In Gen. Botha's Cabinet he was Minister of Railways and Harbours and chairman of the Railways and Harbours Board, and thus head of the largest revenue producing department of State. Mr. Fischer and Gen. Hertzog represented the extreme element among the Boers. They were both from the Orange Free State, of which (as the Orange River Colony) Mr. Fischer had been Prime Minister. In the Union Cabinet he became Minister of Lands and Gen. Hertzog Minister of Justice.

Education Controversies.

The first session of Parliament was devoted mainly to putting the Union machinery into working order. It was not until towards the close of 1912 that Gen. Hertzog publicly abandoned the principles on which the Union had been established, though there was no doubt of his belief that the Dutch community had a prescriptive right to dominance in S. Africa. The most controversial issue considered in the 1911–2 session arose out of the Education Acts of the former Orange River Colony (*see* 20.160), where, during its brief period of self-government, Gen. Hertzog as Minister of Education had enforced bi-lingualism in the state schools. By the Act establishing the Union education "other than higher education" had been left in the control of the provincial councils for a period of five years, after which Parliament was free to take what action it pleased. In the meantime it could only advise. A select committee on which the S.A. and Unionist parties were equally represented considered the subject and on April 17 presented a majority report recommending that instruction up to Standard IV. should be given in and through the "home language," with the optional use, on the demand of parents, of the other language, and that above Standard IV. freedom of choice in the medium of instruction should be left to the parents; also that teachers should be free to qualify in either language (English or Dutch). This was a reversal of Gen. Hertzog's policy, but though he disliked this compromise it was accepted by the Union Parliament (April 24). During 1911–2 the provincial councils of the Transvaal, Free State and the Cape passed ordinances adopting the compromise, though with some modifications in favour of Dutch. This virtually ended the language controversy as far as schools were concerned, and the provincial councils taking a liberal view of their duties, their control over elementary and secondary education was continued even after the lapse of the five years provided in the Union Act. But Gen. Hertzog's position was much shaken during the controversy over the medium of instruction. The success of an action for slander (Aug. 1911) brought against him by Mr. Wm. Fraser—Free State inspector of schools whom Hertzog had dismissed in 1909—caused much scandal, which was intensified by the success (Nov. 1911) of another slander action brought against him, the second plaintiff being Dr. Ward, president of the O.F.S. medical council. The situation was rendered piquant by the fact that Hertzog was Minister of Justice. He tendered his resignation, but Gen. Botha, not wishing to alienate the Boer extremists, refused to accept it.

Having brought about a settlement of the language question in elementary schools the Union Parliament was called upon to deal with higher education. The only university in S.A. at the time of the Union was that of the Cape of Good Hope, founded in 1873, with its seat at Cape Town. It was an examining body, with affiliated colleges. Demands for teaching universities had grown up and the Union Government had to deal with an offer of £500,000, half of this sum being a bequest by Sir Julius Wernher, the other half being given by Messrs. Alfred and Otto Beit. This money it was desired should go to establish a national university on the Groote Schuur estate, near Cape Town. A bill to give effect to this proposal was introduced into Parliament in the session of 1913. It met with much criticism and was withdrawn, a strong University Commission being appointed in Nov. 1913 to enquire into the subject. Its report, issued in 1914, is a valuable document, dealing fully with the lines of possible development, though the Commission was fain to acknowledge that the many vested interests constituted an "almost insolvable" problem. It recommended two universities—one at Cape Town and one at Pretoria, to one or other of which the existing university colleges would be attached. This recommendation provoked almost as much criticism as had the bill of 1913.

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[1] Mr. J. X. Merriman, as Prime Minister of the Cape, the oldest colony in S.A., had some claim to be called upon to form the first Union Ministry, but his claims were passed over. He declined to serve under Gen. Botha. It appears, however, from the biographies of Jan Hofmeyr and of ex-President Steyn that both Botha and Merriman were prepared to serve under Steyn. Steyn was an invalid, and his doctors forbade him to entertain the idea of taking office. The ex-President was against a coalition Ministry, among other reasons because he feared that had Dr. Jameson been in the Cabinet he would have pressed for the inclusion of Rhodesia in the Union. While Steyn had favoured the Union movement he was not prepared even in 1910 to accept its full consequences. *See* J. H. Hofmeyr's *Onze Jan.* (1913) and Van der Merwe's "Life" of Steyn (in Dutch 1921).

The Dutch community strongly opposed the proposal that Victoria College, Stellenbosch, founded in 1866 as the Stellenbosch Gymnasium and mainly attended by Dutch students, should be incorporated in the Cape university. A solution of the difficulty was reached in 1916 when Parliament passed Acts establishing three universities: the university of South Africa, the university of Cape Town, and the university of Stellenbosch. The two last were to be teaching universities and the seat of the Cape Town University was to be at Groote Schuur. It was formed by incorporating the South African College (founded at Cape Town in 1829) and to it the £500,000 of the Wernher-Beit bequests accrued.

The university of South Africa took the place of and was the legal successor of the university of the Cape of Good Hope, headquarters being removed from Cape Town to Pretoria. The new university, like its predecessor, was a federal organization with examining functions. Its first chancellor was the Duke of Connaught. The changes became effective on April 2 1918.

Defence.

In the 1911–2 session of Parliament an attempt was made to grapple with the relations of the white and Kaffir races, the position of Asiatics in the Union and with national and imperial defence. General Botha with two of his colleagues (Sir David de Villiers Graaff and Mr. F. S. Malan) had attended the Imperial Conference held in London in May and June 1911, when the Asiatic question and defence had been considered. The Union Government decided that S. A. should provide for its own internal defence, and a Defence Act was passed in June 1912, creating a citizen force at a cost of about £500,000 a year; this is in addition to a permanent force of five regiments.[1] The Act provided for the military training of 50% of the young men between 18 and 21; the other 50% being compelled to join rifle clubs and similar associations. The 50% for training are obtained in the first place by voluntary enlistment, but if sufficient numbers are not forthcoming by this method, then by ballot. (Recourse to the ballot had not been necessary up to 1922.) Members of the Citizen Force with the colours are paid. Provision was made for artillery, cavalry, infantry, engineer and transport units, uniformity with the units of the other overseas' dominions being aimed at. General C. F. Beyers, one of the Transvaal commandants in the Anglo-Boer War, was appointed commandant-general, while the Council of Defence created by the Act consisted of Gen. Schalk Burger (Transvaal), Col. (afterwards Sir) Charles Crewe (Cape), Gen. de Wet (Orange Free State), and Col. Sir Duncan Mackenzie (Natal).

Objections to the Act came chiefly from the "back-veld" Boers who entertained strong dislike to compulsory service. The force being established, the reduction of the strength of the British imperial forces in S.A. from 11,500 to about 7,000 was announced in Nov. 1912. With regard to naval policy practically no progress was made. General Botha was fully alive to its importance and sought to educate his followers on the subject in several speeches. But in 1920 the situation remained as it was in 1910. The British Admiralty continued to use Simon's Town as headquarters of the Cape and East Coast Squadron. In 1921, however, the Government adopted the principle of the formation of a S.A. navy for home defence.

The Indian Question.

The policy to be adopted with respect to Asiatics had two aspects: (1) the treatment of Asiatics already in the Union and (2) whether or not to permit further immigration. On the second question there was a determination on the part of the great majority of white S. Africans to prohibit the further entry of Asiatics alike on racial and economic grounds. They had the black man ever with them and they were determined as far as in them lay not to add another racial and disturbing factor. But there were already 150,000 Asiatics in the Union, and except for some 2,000 Chinese they were all British Indians. Of these fully four-fifths lived in Natal. They had gone thither at the invitation of that colony, where the sugar and tea plantations depended upon coolie labour. Indeed almost the only dissidents in the Union from the exclusion policy were the Natal planters. On the question of immigration the Government of India, however, took a step which eased the situation. It was a vigilant champion of the rights of Indians settled in other parts of the Empire and it had been for years dissatisfied with the treatment of the coolies in Natal. In 1908 it had decided to prohibit the further importation of indentured Indians into Natal and it was at the request of the Natal authorities that it permitted the system to continue until July 1911, when it finaly ceased. This left untouched the question of voluntary immigration, which among the coolie class was never great. The position in the various provinces of the Union differed. In the Orange Free State as a result of a rigid exclusion policy constantly enforced there was no Indian question; in the Cape province Indians enjoyed equal rights with whites—political and municipal, not only in theory but in practice. But comparatively few Indians were attracted to the Cape and in that province the question was not acute. The Cape Immigration Acts of 1902 and 1906 sufficiently guarded the province from the influx of undesirable elements. In Natal the matter was much more pressing. There the Indians considerably outnumbered the whites and besides the coolie class included many Bombay Mohammedans (often misnamed "Arabs" in S.A.), keen and enterprising traders. Measures restrictive of Indian enterprise had been passed by Natal and in that province they had no political rights. They however possessed the municipal franchise and, as in the Cape province, had unrestricted rights to own and occupy land. In the Transvaal the Indians had neither political nor municipal rights nor were they allowed to own land, save in specially assigned locations. The Indians in that province were mainly Moslem traders, who had found a favourable field for their activities in the development of the country which followed the discovery of the Rand gold mines. For years the Indians in the Transvaal had been subjected to many restrictions; it was in this province that feeling against them was most bitter and the agitation against them most strong. The position held by white S. Africans was plainly stated by Gen. Smuts at the Imperial Conference of 1917. What he then said was strictly applicable to the situation in 1911 when the Union Parliament first took up the subject.

> In S.A. there has been this fundamental trouble [he said], that the white community has been afraid of opening the door too wide to Indian immigration. We are not a homogeneous population. We are a white minority on a black continent, and the settlers in S.A. have for many years been actuated by the fear that to open the door to another non-white race would make the position of the few whites in S.A. very dangerous indeed. It is because of that fear . . . that they have adopted an attitude which sometimes has assumed the outward form, although not the reality, of intolerance.

Save that among many of the whites in the Transvaal the outward form of intolerance was also its reality, this was a fair statement of the position of white S. Africans. They feared, or a considerable proportion of them feared, being swamped by Asiatics, and, especially in the Transvaal, they greatly feared Indian competition in trade. On its part the Government of India, when the Union began legislating on the subject was ready to acquiesce in an exclusion policy, but sought in return to secure fair treatment for the Indians already in the Union. And by "fair treatment" the Government of India meant in the long run political and municipal rights—weapons by which the Indians would have effective means of self-protection. In 1911 and again in 1912 Immigration Restriction bills were introduced into the Union Parliament, but the bills were dropped, a wider measure being announced for 1913. In Oct. 1912 Mr. G. K. Gokhale, one of the most influential of Indian politicians, visited S.A. on "a mission of peace" and in Nov. went to Pretoria as the guest of the Union Government to confer with them on the forthcoming legislation. Mr. Gokhale's object was primarily to secure concessions for the Indians already in S. Africa. This was also the main object of Mr. M. K. Gandhi, who had first gone to S.A. in 1893 to conduct a law suit, but had stayed there and become the leader of the Indians in Natal and the Transvaal.

In June 1913 the Union Parliament passed an Immigrants Regulation Act, the chief purpose of which was to prevent the further entry of Asiatics into the Union. This was done not *eo nomine* but by ministerial certificate. Wives and young children of domiciled residents were allowed to enter, and also registered Indians who might be temporarily absent from S. Africa. The Act further restricted Asiatics to the province in which they were resident. This restriction of movement, and the poll tax of £3 levied on all ex-indentured Indians in Natal—a tax unequal and uncertain in its incidence—caused great dissatisfaction among the Indian community. Under Mr. Gandhi's leadership (Mr. Gokhale had returned to India) they adopted an attitude of passive resistance, but this was succeeded by strikes at Durban and at the collieries and plantations. Then, to assert the right of Indians to move from one province to another, Mr. Gandhi put himself at the head of some 2,700 Indians who started to march past Majuba to Johannesburg. About 500 were stopped at the Natal border, the rest got some distance into the Transvaal before they were turned back. Mr. Gandhi was arrested and convicted on several charges, *e.g.* he was sentenced to nine months' imprisonment for abetting a strike of coal miners. But the situation could not be met simply by repressive measures. An Indian Inquiry Commission was appointed and, on its recommendation, the Natal poll tax was abandoned and certain concessions made as affecting the recognition of Indian marriages. These changes were made operative by the Indian Relief Act, 1914. More important was the so-called Smuts-Gandhi agreement of the same year. General Smuts as Minister of the Interior was in charge of the legislation affecting Indians, and, seeking a statesmanlike solution of the difficulty, he approached Mr. Gandhi. The negotiations succeeded and the arrangement reached was set forth in letters exchanged between Mr. Gorges (then secretary to the Ministry of the Interior) on behalf of Gen. Smuts, and Mr. Gandhi and dated June 30 1914. The essence of the agreement was the assurance by Gen. Smuts that existing laws would be administered "in a just manner and with due regard to vested rights." This was at the time interpreted by the Indians, by the Government of India and by many of the whites in S.A. to mean that the rights which Indians were entitled to exercise under the laws as existing in 1914 could not be restricted by fresh legislation. Mr. Gandhi, conceiving his mission in Africa ended, returned shortly afterwards to India.

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[1] Only persons of European descent were allowed to become members of the Defence Force.

It is convenient here to summarize later developments of the Indian question before turning to the main stream of S.A. history. Mr. Gandhi in a farewell letter, published in the *Rand Daily Mail* of July 20 1914, had assured the Indians that the settlement then reached did not preclude them from fresh agitation for the removal of other disabilities: for their part a large section of the whites agitated for further restrictions upon Indian activity. Friction inevitably arose, but during the World War untoward incidents were avoided. A definite settlement of the immigration question was reached at the Imperial Conference of 1918 when a reciprocity resolution was accepted which declared it to be "an inherent function of the governments of the several communities of the British Commonwealth, including India, that each should enjoy complete control of the composition of its own population by means of restriction on immigration from any of the other communities." In accepting this resolution on behalf of the Union Mr. Burton declared, justly, that S. Africans had found the Indians "good, law-abiding, quiet citizens" and that it was the duty of the Government to see that they were treated "as human beings, with feelings like our own, and in a proper manner."

What was the "proper manner" was still a point of contention. After the Smuts-Gandhi agreement Indians applied for and obtained new licences to trade, and in the Transvaal formed private companies with limited liability for the purpose of acquiring land and fixed property—the Transvaal law of 1885 which prohibited individual Indians from acquiring land not applying to corporate bodies. This action by the Indians was denounced by the white community in the Transvaal as a flagrant violation of the Smuts-Gandhi compact, to which the Indians replied that it was one of their vested rights and that such companies had been formed before the agreement was made. There were in fact three such companies in 1913; by March 1919 the number registered had grown to 370, with a total capital of £479,000. Early in 1919 the Krugersdorp municipal council brought the matter to an issue, nominally on the trading question, by obtaining an interdict from the Supreme Court at Pretoria, prohibiting Indians from occupying a certain trading "stand" in the town. This led to the appointment of a parliamentary select committee. As the result of its investigations an Act (No. 37 of 1919) was passed by the Union Parliament which, while confirming the right of Indians to the occupation of land for trading purposes which they then held, prevented the further acquisition of land by Indians through private companies.

The Act of 1919 pleased neither party. It was noteworthy that in the Transvaal, where numerically the Indians were few, feeling against them was much stronger than in Natal, with its large Indian population. The explanation was to be found in the fact that whereas in the Transvaal nearly all the Indians were traders—many of them merchants owning large businesses and formidable competitors with white traders—in Natal the great bulk of the Indians were Madrassi of the agricultural and labouring classes, and save in fruit and vegetables did not enter largely into trade. Moreover, large numbers of the Indians in Natal were S.A. born and could hardly speak any Indian language. The agitation in the Transvaal against the "Asiatic menace" led in Feb. 1920 to the appointment of the Asiatic Inquiry Commission specifically charged to consider the question of trading rights and land ownership by Indians. The sittings of the Commission were held in public, the Government of India being represented throughout by Sir Benjamin Robertson, a man with unrivalled knowledge of the history and facts relating to Indians in S. Africa. The Commission issued an interim report in May 1920 recommending that steps be taken to aid the repatriation of as many Indians as desired to leave the country, and some few thousands did return to India. The final report of the Commission was issued in March 1921. The chairman was Sir J. H. Lange, a judge of the Supreme Court, and all the commissioners were men of experience, animated with the wish to do justice. Their inquiry had the merit of bringing out the facts and dispelling the belief that the Transvaal was menaced, numerically, by an Asiatic invasion. They also made clear the fatuity of the proposals put before them for the compulsory expropriation of the whole Indian population, or of "squeezing them out" by multiplying restrictions on their activities. Their recommendations were however significant of the strength of white feeling on the subject. They proposed alterations in the law which would secure Indians from being refused trading licences arbitrarily or on the ground of race; they opposed compulsory segregation, but advocated a system of voluntary separation by "attraction" to desirable residential and trading areas. They opposed the repeal of the Act of 1919 and went further by proposing that in Natal the right of Asiatics "to own land for farming or agricultural purposes should be confined to the coast belt, say 20 to 30 m. inland." On this last point Mr. Duncan Baxter, one of the four commissioners, dissented, describing it as retrograde and a breach of the conditions of recruitment. The Government of India also at once lodged a protest against this recommendation, holding that it was not only a breach of the conditions under which Indians were recruited but also a breach of the Smuts-Gandhi agreement. The Union Government took no action on the Commission's report in the 1921 session of Parliament, but Mr. Patrick Duncan, who had become Minister of the Interior, indicated his sympathy with a proposal to allocate separate and distinct areas for occupation by the Indians of Natal.

The Government of India, while still seeking the removal of particular grievances, adhered to its wider view that only by the grant of equal rights could Indians in the Dominions be fully protected. At the Imperial Conference held in June–Aug. 1921 the Indian delegates pressed for the recognition of this principle and it was accepted by the representatives of Canada, Australia and New Zealand. But the S.A. delegates, of whom the chief were Gen. Smuts and Sir Thos. Smartt, declined to subscribe to the resolution which declared that it was desirable that "the rights to citizenship" of Indians lawfully domiciled in other parts of the Empire "should be recognized." They regretted "their inability to accept this resolution in view of the exceptional circumstances of the greater part of the Union." Direct negotiations between the Governments of India and of S.A. to reach a more satisfactory position were not precluded. That the Union delegates rightly interpreted the feeling of most white South Africans was shown by an ordinance passed at this time by the Natal provincial council to prevent any Indians in the province acquiring in future the municipal franchise. This ordinance was disallowed by the Union Government. At the Cape at the same time an Indian, Dr. Abdurrahman, a well-known member of the Cape Town municipality, was also a member of the provincial council.

The Natives and the White Races.

The first step taken by the Union Government in regard to the relations between the white and native races was the decision that the control of all regulations made by local authorities affecting natives should be exercised not by the provincial councils but by the Government through the Native Affairs Department, a decision tending towards a much-needed uniformity of policy. While the Government were considering what principles should guide their action public attention in 1911–2 was chiefly focussed on one aspect of the question, assaults by Kaffirs on white women. On the Rand in the first half of 1911 three Kaffirs were shot by white women whom they had attempted to assault. This shooting followed the commutation, in Jan. 1911, by the High Commissioner (Lord Gladstone) of a death sentence on a Rhodesian native convicted of an attempt to assault a white woman. This action roused much indignation against the High Commissioner who, however, met his critics fairly and won their respect. But feeling was intensified by the acquittal in Aug. 1911, by a Rhodesian jury, of a white man who had shot dead a Kaffir. (This led to the making of a special jury list for the trial of such cases, the ordinary jury not being trusted to administer impartial justice.) In all during the year ending March 31 1912, there was in the Union alone (*i.e.* Rhodesia excluded) 85 cases of outrages upon Europeans by natives, as compared with 69 during 1910. On the Rand the evil was attributed in part to illicit liquor selling and in part to the fact that the mine labourers were without their women-folk, and a petition signed by 52,000 Rand residents (presented to Parliament May 1912) asked *inter alia* for the provision of compounds in which natives should be permitted to keep their wives, as well as for facilities for training native female servants and for the importation of European domestics.

A commission, appointed in June 1912 on the motion of Sir Thomas Smartt, enquired into the prevalence of sexual assaults, and the extent to which they were attributable to economic and social factors. This commission was presided over by Mr. Melius de Villiers, ex-chief justice of the Free State and included four ladies, one from each province. On its report remedial measures were taken, such as provision for wives in the compounds. It was shown that one cause of the evil was the undue familiarity with which many white women treated male natives employed by them as domestic servants. The measures taken had a good effect, and assaults of the character stated became fewer.

On the larger question as to the place which the Bantu should hold in the community there was much heart searching. There was on the part of the whites agreement on one point only—the dependence of agriculture and industry on the manual labour of the native. The situation was complicated by the fact that the whites had not only the native to deal with but a very large number of coloured persons with a greater or less proportion of white blood—the well-known "Cape Boys." These people not only competed with the whites in skilled labour, but a good many of them had entered the professions as lawyers, doctors, journalists, land surveyors, etc. The pure African was following their example, and both the coloured and native peoples were learning the power of coöperation. They had their own newspapers, their own political and trade organizations, and were quick to learn from the methods of the whites. Especially powerful was the influence of education and Christian missions. Many natives made great sacrifices to obtain education. For educational facilities they had to rely chiefly upon the missionary societies. The provincial councils were not generous in their expenditure in this respect though the total expended on native education rose from £81,000 in 1913 to £137,000 in 1918. More than half the total sum was spent by the Cape province. In regard to higher education the Union Government took a somewhat more liberal attitude and gave its support to the South African Native College at Fort Hare.

The desire of the natives, or the more vocal section of the natives, to escape from European tutelage was seen in a growing inclination, particularly in the Transkeian territories, to secularize education and to obtain a larger share in its management. This desire for "self-determination" was also seen in the setting up of many churches independent of European control, a movement fostered by intercourse with the negro churches of the United States. Of these native separatist churches perhaps the most influential was the "Ethiopian Church of South Africa." Their leaders joined in the demands of the "Native National Congress," an organization claiming to represent the Bantu peoples of S.A., in demanding redress of grievances and in especial the removal of the colour bar which existed in all the provinces except the Cape. A deputation from this body came to England in 1919 "not to demand independence, but admission into British citizenship."

Such were the aspirations of educated men among the coloured and native races; the more extreme, among whom communist doctrines had gained a hold, raised the cry of "Africa for the Africans." The loyalty of the natives and the valuable services they rendered during the World War went to show that the extremists were not an immediate danger. But the natives also during the war got a new idea of their power. Bantus in Rhodesia, the "Cape Boys" from the Union served as combatants in the E.A. campaign—and they saw that the heaviest fighting there fell to black troops. A new situation had arisen, one of the most noteworthy being the development of a race, as distinct from tribal, consciousness.

The problem as it presented itself to the Union Government was how best to secure the future for the white race in S.A., surrounded as it was by a black population five or six times its numbers. The Government would have had to face the bitterest hostility of the Dutch community, and of a considerable section of the British in Natal and the Transvaal had they attempted to remove the colour-bar in those provinces or in the Free State; had the Boers had their way the colour-bar would have been set up in the Cape province. Gen. Botha did not subscribe to the principle of Cecil Rhodes—"equal rights for all civilized men." Yet he and his colleagues acknowledged that it was the duty of the State to help forward the native on the path of efficiency and civilization, in opposition to the standpoint of the extreme Dutch Nationalists that there was no room for the advancement of the native save at the expense of the white man. The point of view of the Government was that the natives should be aided in such a manner that they should not come into competition with the whites. The proposal which attracted most support was to keep blacks and whites in separate areas, while still employing natives for labour on white enterprises. The plan was feasible; it was for example being worked in Basutoland under the Colonial Office. In that territory white settlement was forbidden, but thousands of Basutos went on contract to the gold-mines or to farms in the Free State. And there were already native areas in the Cape, such as the Transkei, where, under white officials, the natives possessed some share in the administration. It was in this direction Gen. Botha looked for a solution of the problem. In a speech in Parliament (May 9 1912) he stated that "the time was coming when the native question would have to be considered most seriously in the direction of keeping whites and natives apart and preventing their intermingling. They would have to fix attention closely on the question of segregation, while treating everyone with absolute justice." The segregation plan received the support, among many others, of Sir Matthew Nathan, an ex-governor of Natal, and Gen. Hertzog. But it was opposed by those who, like Mr. P. W. Schreiner and Mr. Patrick Duncan (a leading member of the Unionist party), regarded it as both wrong and impolitic to put hindrances in the way of the advancement of the natives in civilization and industrial efficiency. Mr. Duncan in a striking pamphlet published in Oct. 1912 ("Suggestions for a Native Policy") admitted the dangers foreseen by the segregationists, but believed the remedy to be in European immigration on a large scale. "Nothing else," he declared, "will save S.A. for the European race." But to immigration on a large scale the Dutch community was definitely opposed, and it was not till 1920 that the Government made any strenuous effort to attract white settlers to the country.

A motion brought forward at the Unionist Congress in Johannesburg (Nov. 21 1912) to commit the party to the policy of segregation was defeated, the previous question being carried by 91 votes to 7. Opinion being so divided the Union Government found great difficulty in shaping its native policy. As a temporary measure a Native Land Act was passed in 1913 which prohibited the further acquisition of land by natives or from natives—an Act which led to vehement protests from native associations and leaders of native thought, while a legal decision was obtained that the provision of the Act did not apply to the Cape province. The Act had set up a commission, under the chairmanship of Sir William Beaumont, which had for its object the ascertainment of what land areas should be allocated to natives and those from which they should be excluded. The commission reported in 1916 and a Native Affairs Administration bill was introduced in 1917, chiefly as a means of ascertaining public opinion, native as well as white. It embodied the principle of separate areas in rural districts. After exhaustive consideration Parliament in 1920 passed a Native Affairs Act which was in effect a half-way segregation measure. The Act, for which Gen. Smuts was largely responsible, was based on the principle that the white man is the permanent and predominant factor in the civilization and government of S. Africa. But it was not repressive to the black man. It set aside areas for the exclusive occupation of the natives in which they would have greater opportunities than before for obtaining local self-government, it opened the way to a system of representative native congresses which would express authoritatively native opinion on intended legislation, and it held out the prospect of the development of native institutions parallel to but separate from those of the whites. In short Gen. Smuts, the great advocate for the union of the two European races in S.A., was equally earnest in his efforts to keep the streams of white and (nascent) black civilization apart. A feature of the Act of 1920 was the establishment of a permanent Native Affairs Commission to deal with the position of natives in urban areas, education and the Pass Law system, in all of which matters it was admitted that the natives had not received fair treatment. The Act was regarded by the white community—Dutch extremists apart—as a piece of constructive statesmanship, and its policy received the approval of the most responsible leaders of the natives. But danger lay in the inflammable language and actions of less responsible, and less educated agitators, working on the mass of their fellows, scarcely emerged from barbarism, and in the equally pernicious utterances of the white extremists. Events in 1920–1 showed the peril attendant on any mishandling of the native question.

Trade and Tariffs.

The promotion of trade and agriculture occupied much of the energies of the people and Government. A prolonged drought—lasting from Oct. 1911 to Nov. 1912—the most severe experienced in S.A. since 1862, affected chiefly Natal, the Transvaal and the Transkei. The severe losses sustained forced attention to the need of more scientific farming and to irrigation works, upon which the Government expended £500,000 in 1912. In 1919 there was another very serious drought involving the country in an expenditure of £16,000,000. This led to the appointment of a commission in 1920 to enquire into drought, soil erosion and other allied problems. One result was to emphasize the need of water storage in connexion with irrigation. In Oct. 1912 a State Land and Agricultural Bank began operations in the Union, and a similar institution was established in Rhodesia.

Much diversity of view existed as to the tariff policy of the Union. Early in 1912 a commission, of which Sir T. M. Cullinan was chairman, appointed to enquire into the conditions of trade and industries reported in favour of increased duties on wheat, flour, sugar, tea, clothing and furniture, declaring that it was "not only necessary that a policy of protection should be adopted, but that there should be continuity of policy." Two influential members presented minority reports in favour of the "open-door." Rhodesian feeling was in favour of a lower tariff, and it was suggested that Rhodesia might withdraw from the Customs Union rather than bear greater fiscal burdens. At Johannesburg on Nov. 19 1912 Sir Thomas Smartt declared that a plank in the Unionist party's platform was a tariff primarily for revenue purposes, combined with a policy for the encouragement of industries for the general benefit and the extension of the existing imperial preference. This was, in the main, the solution adopted. Tariffs and rebates were fixed by various Acts of Parliament passed between 1914 and 1919, designed to afford relief to home manufactures, the majority newly established. An Industries Advisory Board was set up in Oct. 1916, consisting for the most part of business men, and early in 1917 a Scientific and Technical Committee was instituted. There followed in 1921 the creation of a Board of Trade and Industries, and a definite policy of industrial development was undertaken by the Government. But Mr. F. S. Malan, Minister of Mines (and then acting Prime Minister) addressing the convention of the Federated Chamber of Industries at Port Elizabeth (July 25 1921) declared that the Government had no intention of "going in for an out-and-out protective policy." And Col. Reitz (Minister of Lands) told the sugar planters of Zululand that "the consumer must be protected. Higher tariffs would mean dearer prices."

One great department of state, the Railways and Harbour Board, was required by the Act of Union to be run with due regard to agricultural and industrial development and not as a producer of revenue for extraneous purposes. The Board built needed railway lines and undertook harbour works, though nothing material was done to enlarge the docks at Table Bay, a matter which provoked strong protests from the citizens of Cape Town. Mr. Sauer, the minister in charge of the department—whose budget was separate from that of the general budget of the Union—took an independent view of his duties and as early as July 1911 differences arose between him and his colleagues, especially with Mr. Hull, the Finance Minister. Mr. Hull had also to meet the attacks of Mr. Merriman, the most accomplished parliamentarian and ablest financier in the House of Assembly and a very candid friend of the Ministry. Mr. Merriman denounced the Government's financial proposals as predatory and extravagant, while Mr. Hull alleged that railway expenditure was incurred without Treasury sanction—that there had been a tendency to regard the railway and harbour administration as something for which the Government had no collective responsibility. General Botha admitted that the Cabinet had not been sufficiently consulted in railway matters and on May 18 1912 Mr. Hull resigned. A reconstruction of the Ministry was postponed until after the close of the parliamentary session (June 24), when the chief changes made were the appointment of Mr. Henry Burton (an ex-Cape minister), to the Ministry of Railway and Harbours, while Mr. Sauer became Minister of Agriculture, an office which Gen. Botha had combined with the premiership.

The Two Streams Policy.

The differences between Mr. Hull and Mr. Sauer were shortly afterwards forgotten in consequence of the attitude taken up by Gen. Hertzog, who now began publicly to assail the principles upon which the Union had been established. To what extent Hertzog was supported or restrained by ex-President Steyn is uncertain; but Steyn, whose opinion would have been decisive with a large section of the Dutch community, did nothing publicly to counteract the rekindling of the fires of racial bitterness. The by-election campaign at Albany, caused by the resignation of Sir Starr Jameson, brought about a crisis. General Botha, and with him Gen. Smuts and the majority of the Dutch members of the Cabinet, had definitely accepted the British connexion, and the position of S.A. as a self-governing member of an Imperial Commonwealth, with corresponding responsibilities, and, knowing that peace between the two white races was essential to the prosperity of the country, he was an ardent advocate of the closest coöperation between them. On both these points Hertzog was violently opposed to his colleagues. His motto "South Africa first" meant in fact Dutch supremacy. In a speech at Nylstroom (Oct. 1912) he characterized Sir Thomas Smartt (who had succeeded Jameson as leader of the Unionist party) and other prominent members of the Opposition as "undesirable political foreign adventurers," and at Rustenburg, on Dec. 8, he declared that imperialism appealed to him only when it was useful to S. Africa. He had a short time previously pronounced in favour of the Dutch and British in S.A. remaining "two nationalities flowing each in a separate channel." General Botha though he publicly dissented from Gen. Hertzog's views was desirous if possible to avoid an open breach, but after the Rustenburg speech action was unavoidable. On Dec. 12 Col. Leuchers, Minister of Public Works and a Natal member of Parliament, resigned as a protest against Hertzog's "anti-British and anti-imperial sentiments." Botha then intimated to Hertzog that his resignation would be acceptable, but Hertzog refused to move. Botha met this difficulty by tendering his own resignation, Dec. 15, and was at once asked by the governor-general (Lord Gladstone) to form a new Ministry. This he had accomplished by Dec. 20, the new Cabinet being composed of the same members as the old except for the omission of Gen. Hertzog and Col. Leuchers (the latter replaced by Sir Thos. Watt, another Natal member). The death of two ministers—Mr. Sauer and Mr. Fischer—during 1913 necessitated a further remodelling of the Cabinet. Mr. N. J. de Wet became Minister of Justice and Mr. H. C. Van Heerden Minister of Agriculture.[1]

The cleavage in the ranks of the ministerialists (the S.A. party) became complete in 1913. It was soon apparent that the appeal to Dutch racialism had considerable support, notably in the O.F.S., and some 10 or 12 members of the House of Assembly elected as supporters of Gen. Botha turned to Hertzog as their leader. At the party conference opened at Cape Town on Nov. 30 Gen. de Wet nominated ex-President Steyn as "leader of the party outside Parliament, with power to nominate the Prime Minister." On this proposal being defeated the malcontents left the conference in a body and in Jan. 1914 a new party under Hertzog's leadership was formed. It took the title of the Nationalist party.

Rand Labor Riots.

The year 1913 and the opening months of 1914 were, however, as notable for labour unrest as for political differences. The disturbances in Natal due to the opposition of the Indians to the Asiatic legislation of the Union have already been recorded. They caused no such trouble as attended disturbances on the Rand, which began with a strike of the white miners at the New Kleinfontein mine in May 1913. The strike was nominally on the question of hours, but it was symptomatic of a determination of Labour to gain greater control over industrial conditions. There was, too, a revolutionary wing to the movement, and the extremists seemed likely to carry with them the mass of the men.[2] The two antagonistic views were afterwards sharply put by Gen. Smuts and Mr. Creswell, the latter the leader of the parliamentary Labour party. Smuts declared the movement to have been "a conspiracy against constituted order." Mr. Creswell declared that there was "a conspiracy (of the Govt.) with capitalists to run the country in their own interests." Neither view gave a satisfactory explanation of the facts. The strike extended, negotiations for a settlement failed, feeling ran high and by the end of June the Government had drafted 2,000 troops into the Benoni district, the centre of unrest, and some 20 m. E. of Johannesburg. The leaders of the strike had chosen a time when the Union was without a regular armed force of its own. The citizen army provided by the Act of 1912 was not yet formed, while the militia and volunteers had been disbanded as from July 1, and the permanent force—the S.A. Mounted Riflemen—provided for in the Act of 1912, had only begun training in April (1913). British regulars were therefore drafted into Johannesburg, where serious rioting followed a demonstration by the men in Market Sq. (July 4). The strikers seized the electric power station, and during a night of terror burned down the Park railway station and the offices of the *Star* newspaper. Several persons were killed and many injured in conflicts with the police and military. The next morning Gens. Botha and Smuts intervened and opened negotiations with the strikers. While these were going on dynamite explosions occurred and the mob attacked the Rand club. The negotiators succeeded in reaching agreement and at night the strike was declared "off", one condition being the reinstatement of the men at the New Kleinfontein mine. But it was difficult to appease the mob and there was further rioting on July 6. In all some 20 persons were killed and 250 injured. A grave element of danger was the excited condition of the native labourers on the Rand mines and it was in part consideration of what they might do if the riots continued that drew the authorities and the strike leaders together. The situation continued anxious, as extremists were calling for a new and general strike. But on July 31 the executive of the Federation of Trades decided by 65 votes against 18 not to call a general strike. An official inquiry into labour conditions was then instituted, but in Jan. 1914 new trouble arose. A policy of retrenchment on the railways was resented by the men and a general strike proclaimed for Jan. 14. It was, according to the official view, an attempt by the Trades' Federation to control the railway administration. The Government acted promptly (Gen. Smuts was at the time both Minister of Defence and Minister of the Interior). Martial law was proclaimed and 20,000 troops mobilized and concentrated on the Rand. Ten prominent Labour leaders—not including Mr. Creswell—were arrested and secretly deported, illegal action for which the Government subsequently obtained an Act of indemnity. In Parliament Gen. Smuts justified his action on the ground stated, namely that the leaders of the men were engaged in a revolutionary conspiracy. The action of the Government had, in any case, prevented a renewal of the rioting of 1913 though a large number of outrages occurred. Ameliorative measures were then tried and during 1914 an Industrial Disputes Act was passed. It set up machinery intended to render easier the settlement of disputes and this Act was followed in subsequent years by other measures—such as the Factory Act of 1918—designed to improve labour conditions.

In 1914 Lord Gladstone's term of office as Governor-General and High Commissioner expired and he returned to England shortly before the outbreak of the World War. His successor was Mr. Sydney Buxton, who on his appointment was created a viscount. Lord Buxton assumed office in Sept. 1914.

Effect of World War.

The outbreak of the World War tested S.A. in a manner in which no other British Dominion was tested. Twelve years only had passed since the Boers had been in arms against Great Britain, they had long and bitter memories and all the ties of kinship, affection, a common tongue and a common heritage which powerfully influenced the British in S.A. were in them lacking. The spirit of racialism had revived, and a large number of the Dutch were led to believe that the war was no concern of theirs and that S.A. should remain neutral. A smaller section actively sympathized with Germany and a few prominent Boers had entered into relations with the Germans in S.W. Africa. The German Government counted with some confidence that S.A. would stand aloof from the contest. It was misled. The attitude of Gen. Botha and of his colleagues was never in doubt. Botha, Smuts and the other Dutch members of the Government represented all those Boers who were not only faithful to the new allegiance they had solemnly recognized in 1902, but who were sincerely convinced that by the subsequent grant of responsible government to the ex-Dutch republics and the establishment of the Union, S. Africa's interest, as a self-governing dominion, was to stand side by side with the other members of the British Commonwealth.

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[1] The year 1913 witnessed the death of other prominent S. Africans:—Sir Gordon Sprigg, four times Prime Minister of Cape Colony, Sir Richard Solomon, High Commissioner in London of the Union, and Dinizulu, the son of Cetywayo. Sir Walter Hely-Hutchinson, formerly Governor of Natal and of Cape Colony, also died in 1913. Sir R. Solomon was succeeded as High Commissioner by Mr. W. P. Schreiner, who died in 1919. Sir Edgar Walton was appointed High Commissioner in 1921.

[2] The white employees in the mines were almost equally divided between those born in S.A. and those born in the United Kingdom. The foreign born were scarcely 5%.

Rebellion of 1914.

The test as to the part S.A. would play in the World War soon came. On Aug. 7 1914, the Imperial Government telegraphed to the Union Government that "if they desired and felt themselves able" to do so, the seizure of such parts of German S.W. Africa as would give them the command of Lüderitzbucht, Swakopmund and the wireless stations there, would be "a great and urgent imperial service." And two days later the British Cabinet suggested that another expedition might be sent later to Windhuk, where there was a long-distance wireless station. On Aug. 10 Gen. Botha replied that he and his colleagues cordially agreed to coöperate with the Imperial Government and that the military operations indicated would be undertaken by the Union Government. General Botha had already intimated—on the day that war was declared—that the country would undertake its own defence, thus setting free for duty elsewhere the imperial garrison in S. Africa. It was not however until Sept. that Gen. Botha publicly announced the intention of the Government to send an expedition against German S.W. Africa, though this intention was communicated to Gen. Beyers on Aug. 13 and discussed at a meeting of the principal officers of the defence force held on Aug. 21. On that occasion Beyers expressed approval of the measures proposed. While their intentions in regard to S.W. Africa were meanwhile regarded as confidential, the fact that the Government had ranged itself on the side of Britain had been known from the first day of the war and had greatly excited the Dutch Nationalists. Some of them saw in it the opportunity they had eagerly awaited of regaining the independence of the Boer republics; some were already aiding the Germans in S.W. Africa. The decision of the Government to take the offensive against the Germans precipitated, but was not the originating cause of, the rebellion. German secret agents, too, had been busy, but their intrigues at most only served to fan smouldering fires of revolt. Botha submitted the resolution authorizing an expedition to German S.W. Africa at a session of Parliament on Sept. 9. It was bitterly denounced by Hertzog and his followers, who declared that the Union should remain neutral, but it passed the House of Assembly by a large majority on Sept. 10 and by the 14th had received the approval of the Senate. On Sept. 15 Gen. Beyers made clear his true attitude. He resigned his post of commandant-general of the Union Forces, affirming that "by far the great majority of the Dutch-speaking people of the Union" disapproved the expedition against German S.W. Africa. Botha's reply was that he himself would take command of the Union forces and personally command the operations against the Germans. On Oct. 9 Lt.-Col. Solomon G. Maritz, the commander of the Union forces—about 1,600 men—on the German frontier, was in open rebellion; on Oct. 23 de Wet was in rebellion in the Free State, the next day Beyers and Maj. J. Kemp were in rebellion in the Transvaal. The movement was concerted, though the plans for concerted action failed. Of the four rebel leaders named, Maritz was the least important and the only one proved to have been in treasonable relations with the Germans before the World War began. The evidence against Beyers of collusion with the Germans through Maritz after the war had started was conclusive, but there is no evidence that he rose in revolt out of sympathy with them. As one of their ablest leaders in the Anglo-Boer War he enjoyed a great reputation with the Transvaal Boers. Kemp also was known to them as an efficient soldier who had been one of De La Rey's chief lieutenants in the Anglo-Boer War. Kemp was now an officer of the Defence Force. De Wet was the most famous fighting general of the Free State Boers. All the men named desired to translate into action the policy which Hertzog advocated, and which they believed Steyn approved. In the opinion of a judicial commission[1] which later enquired into the rebellion (whose report was issued in Dec. 1916) Gen. De La Rey plotted a rising as soon as the war broke out. The chief aim was to restore the Dutch republics—if not to establish a completely independent S.A. Republic. At the time it looked as if De La Rey was being dragged into rebellion by Beyers and Kemp. It is certain that they depended upon De La Rey to give the word to the Transvaal burghers to rise. Whether or not through infirmity of purpose when De La Rey was brought to Treurfontein (Aug. 15) to address a meeting of burghers which had been called, in his name, with the intention of immediately starting a revolt instead of the expected words he advised his hearers to remain calm and wait events. De La Rey two days previously had been called to Pretoria by Botha and there had had a prolonged interview with Botha and Smuts who had exhorted him to use his unrivalled influence in the western Transvaal in the interest of peace.[2] And without question the burghers, though mystified, obeyed De La Rey and dispersed quietly to their homes. Then came the public announcement of the expedition against German S.W. Africa and De La Rey went to Cape Town to attend the session of Parliament, of which he was a senator. Meanwhile the Citizen Force of the western Transvaal was gathered at Potchefstroom and Beyers and Kemp arranged with De La Rey that he should return N. and address the burghers in camp on Sept. 15. On the evening of that day, at Pretoria, Beyers announced his resignation. In the morning of the same day he had received a messenger from Maritz who brought word that "all was ready" on the border. De La Rey had reached Johannesburg from the Cape; Maritz's messenger was sent by Beyers to bring him to Pretoria and late in the evening the three set out to go by motor to Potchefstroom. The revolt was to be started the next morning. The way led through Johannesburg and the car was ordered to stop by armed police, who were looking out for a gang of criminals who had escaped in a motor. Beyer's driver disregarded the summons to stop and drove on. The police patrol fired and De La Rey was shot dead. The dramatic death of De La Rey disorganized the conspirators' plans. It deprived them of the one man who could have raised the whole of the western Transvaal against Botha and the one man whose military talents might have matched those of Botha and Smuts. It accounted for the delay in the rebellion, for the interim protestations of loyalty made by Beyers and de Wet's declaration that he wanted to act constitutionally. In de Wet's case there was no evidence that he had been mixed up with Maritz's intrigues with the Germans until after the World War had begun; his was pure discontent with the existing regime.

An illuminating light on the mentality of the rebels was the profound belief that many of them entertained for the "visions" of a certain Nicholas Van Rensburg, a farmer of Lichtenburg, who had served in the Anglo-Boer War under De La Rey, at which time his reputation as a seer was established. Van Rensburg's sincerity was doubted by few—and he seldom professed to understand his own visions, which were of a true Delphic character. One of them was held to foretell the struggle in Europe and to indicate the victory of Germany "the grey bull" which defeated a red bull (England) in bloody combat. Another concerned Gen. De La Rey and with this vision was associated the number 15, which Van Rensburg beheld on a dark cloud from which issued blood. This man's visions and the faith they inspired among the burghers—and in none more strongly than in De La Rey himself—were cleverly worked upon by the conspirators—it was because of the visions that the Aug. and Sept. meetings were called for the 15th of the month. But the rebellion rested on more solid foundations than visions. As has been stated the moving cause was the desire of the Boers to regain independence, while support for the rebellion was largely gained by the assertions of Beyers and others that there would be no fighting and that Botha was secretly on their side.

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[1] Composed of three judges of the Supreme Court, namely J. H. Lange (chairman), M. W. Searle, and F. A. Hutton.

[2] From Gen. Botha's account of the conversation De La Rey appears to have been in a distracted frame of mind. That he wished S. A. to break away from the British Empire and proclaim its independence is beyond question, and he saw in the World War an opportunity to achieve this object. He was very much under the influence of the "prophet" Van Rensburg (see later). By several observers of his conduct at this time De La Rey was believed to be mentally deranged.

The Appeal to Mr. Steyn.

News of Maritz's open revolt reached Beyers and Kemp on Oct. 12; two days later de Wet was in conference with Beyers at Pretoria and final plans prepared. But Maritz was crushed before the others could take effective action. General Smuts, as Minister of Defence, had taken over the full direction of affairs from headquarters. Colonel Coen Brits was sent to deal with the traitor and did so effectively; in an engagement at Kakamas on Oct. 24 Maritz's force was broken into small and fugitive bands and he himself compelled to take refuge over the German border. Meanwhile both Botha and Smuts were urgent in their efforts to prevent bloodshed in the Free State and the Transvaal. They turned to ex-President Steyn as the one man whose word could deter the rebels from executing their purpose. On Oct. 11 Botha telegraphed to Steyn—who, in poor health, was living at his farm Onze Rust, near Bloemfontein—informing him of the treason of Maritz, and saying "A word from you will go far." Steyn refused to speak the word. Not that he approved the action of Maritz, but because "I shall have to tell the people that I most strongly disapprove of the policy of the Government respecting an attack upon German W. Africa . . . that as far back as three years ago I warned you against such a policy and that on the outbreak of the European war I had again repeated that warning to Gen. Smuts. . . . As a result of that policy a number of officers and men, who as far as I know were loyal, have become rebels." To this Botha replied that the Government's policy was "not only supported but demanded by the vast majority of the population of the Union," and that, moreover, he possessed proofs that Maritz's plot was formed long before the Government's decision was made. He ended with a moving appeal to Steyn to speak a word "to warn our people against treason, against the everlasting stain that anything of the kind would be upon our national honour, and against the incalculably fatal consequences." No sign in reply came from Onze Rust. On Oct. 22 Botha again wrote to Steyn, informing him of the imminent revolt of de Wet, Beyers and Kemp. In this letter Botha referred feelingly to the outcome of an insurrection "headed by men who in the past have been our honoured leaders" and once more appealed to Steyn to turn those men "from the path of destruction where they now stand." Botha suggested that Steyn should summon de Wet, Beyers and Kemp to a conference at Onze Rust, and now at length Steyn acted. From Oct. 23 onward, and after hostilities had begun he used his efforts to bring the rebel leaders to reason. But only after he had been beaten did Beyers go to Onze Rust, nor was it until he, too, had been defeated that de Wet showed any desire to visit Steyn. The ex-President himself publicly uttered no word. It may here be added that two years later Steyn died and the restraining hand which he had laid upon the extreme manifestations of Dutch racialism was removed. Hertzog, who had not joined the rebels, and had indeed given Steyn some help in trying to induce de Wet and Beyers not to proceed to hostilities, was then free to develop his demand for separation from the Empire.

De Wet captured.

General Botha delayed operations against Beyers and de Wet as long as there was any possibility of avoiding bloodshed, indeed the Government was sharply criticized for allowing de Wet undisturbed to overrun the northern part of the Free State on pretext of carrying on private negotiations. Rebel activity in the Transvaal at length compelled action and Gen. Botha himself took the field against his old colleagues. If that action finally destroyed his influence with part of the Boers, it won the support of many others and it was one of the disappointments of the rebels that so many men of their own blood sided with the Government. On Oct. 27 Botha dispersed a rebel commando led by Beyers at Commissie Drift, S. of Rustenburg. Even after this encounter—in which the casualties were two or three men wounded—efforts were made to avoid further fighting, but unavailingly. Beyers crossed into the Free State and on Nov. 7 a fight took place at Gruis Drift, on the Vet river, in which some 400 rebels were taken prisoners. It was after this defeat that Beyers, under a safe conduct, sought a belated conference with Steyn, a conference which led to no result. Meanwhile de Wet had been active in the Free State, his burghers freely pillaging all whom they pleased. At Vrede on Oct. 29 he denounced "the ungodly policy of General Botha," the "miserable pestilent English" and described the S.W. expedition as "a dastardly act of robbery." On Nov. 9 he seized Winburg; he had refused to go to Onze Rust to see Steyn. Smuts rightly gauged the mentality of de Wet in stating that unless he were "convinced by force" he would not listen to reason. On Nov. 12 Botha defeated de Wet's main commando, some 2,000 strong, at Mushroom Valley, 18 m. S.E. of Winburg. After this de Wet was willing to go and see Steyn, but the Government was convinced that the time had gone by for the rebels to "extort peace terms" and on Nov. 17 Smuts informed Steyn that now unconditional surrender was required, on the basis of very lenient terms already announced. Pressed by the Government troops de Wet doubled and redoubled and finally, with some 50 followers, turned due W. hoping to make German territory. But he was overtaken about 100 m. W. of Mafeking—his tired horses being no match for the fleet armoured cars chasing him—and surrendered, Dec. 1 (1914) to Col. Brits. A few days later the end came for Beyers. After his visit to Steyn he had rejoined his commando, and after an engagement at Bultfontein on Nov. 16 made N. intending to re-enter the Transvaal. On Dec. 8, in the Hoopstad district, he was once again defeated. With some 25 burghers Beyers reached the Vaal river near Zand Spruit closely pressed by a party under Field-Cornet P. H. de Necker. While the rebels put up a delaying fight, Beyers and one companion tried to cross the river on horseback. When fired upon they dismounted. Their horses managed to gain the further bank, but Beyers and his comrade, though they escaped the bullets, were carried away by the current and drowned. A week later (Dec. 16) the last of the rebel commanders, Fourie, was defeated and he surrendered. The rebellion was over.[1]

Altogether about 10,000 men had been in armed rebellion, while the number of their sympathizers was very considerable. In their ranks were three members of Parliament. The casualties on the Government side were 132 killed and 277 wounded. Of the rebels over 5,700 were either captured or surrendered—their casualties are not known, and many returned home during hostilities under assurances that by so doing they would not be prosecuted. Only one man, Fourie, an officer of the Citizen Force who appears to have deserted while on active service, suffered the last penalty. He was tried by court-martial and shot on Dec. 20. The rest of the rebels were leniently treated. De Wet, in June 1915, was sentenced to six years' imprisonment and a fine of £2,000; Kemp was sentenced to seven years' imprisonment and a fine of £1,000. Others received lesser sentences and few, if any, served their full term; de Wet, for instance, and 118 others were released in Dec. 1915 in time to spend their Christmas at home.

During the insurrection Hertzog's name had been freely coupled with that of the rebels, and in the parliamentary session of 1915 he made himself their advocate. He was no rebel, neither, he maintained, were de Wet, Beyers and their following. Their action was only "an armed protest" against the invasion of German S. West Africa.[1] Nor did Hertzog and his parliamentary supporters modify their attitude; they sought to gain at the polls what the rebels had tried to gain arms in hand. But Gen. Botha had no difficulty in enrolling thousands of Boer volunteers for the campaign in German S. West Africa; the force raised for that purpose was composed almost equally of Dutch and British S. Africans. The campaign ended in the surrender of the Germans on July 9 1915, and on his return home Botha received a triumphal welcome from Boer and Briton alike. Popular feeling against Germany had become intense with the sinking of the "Lusitania," which led to serious riots; in Johannesburg alone damage to German property estimated at £500,000 was done.

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[1] Major Kemp had been sent, on Nov. 2, by Beyers on a mission to get arms and ammunition from Maritz. Kemp, who had with him some 800 men, appeared at Kuruman on Nov. 8 where he obtained supplies from the townsfolk. Followed up by loyal forces he made his way to German territory and joined Maritz at the end of November. In Jan. 1915, in company with Maritz, he reappeared, attacked Upington and was defeated. At the same place on Feb. 3, with over 500 men he surrendered to Col. (later Maj.-Gen. Sir) J. L. Van Deventer, while 100 of Maritz's men surrendered at Kakamas. Maritz and his immediate following withdrew to German S.-West Africa. Not wanted there Maritz went to Angola and to Lisbon.

Forces raised for War Service.

After the conquest of German S.W. Africa Nationalist hostility was aroused by the beginning of recruitment for service in Europe. The response to the appeal for volunteers, considering the hostility of the Nationalists, was excellent. First to last the Union (apart from forces used in suppressing the rebellion) raised 146,515 men for service in the World War, and of these over 30,000 served in Europe and 43,000 in E. Africa. These figures refer only to whites. Including the native labour contingents and the coloured combatant corps from the Cape provinces the total personnel of the S.A. forces on war service was 231,591. The casualties numbered 18,642, including 6,606 dead.

General Election, 1915.

None knew better than Gens. Botha and Smuts how deeply they were distrusted by a large section of the Dutch community. The general election held on Oct. 20 1915, fought on the issues raised by the rebellion, gave a very fair indication of the strength of the Dutch irreconcilables. Botha had appealed to the electors to sink their differences and "see the war through." Out of a total of 130 seats in the House of Assembly the S.A. (Botha's) party gained 54, the Nationalists (Hertzogites) 27 and the Unionist (mainly British) party 40. Labour, out of favour after the industrial upheaval, gained only three seats and there were six Independents (all anti-Hertzogites). Most of the Nationalist members were returned for constituencies situated in the districts where the rebellion had been. The luck of the ballot was with Botha and the Unionists for the figures of the poll showed the Nationalist strength to be greater than the number of seats secured. The figures were: South African party 93,374 votes, Nationalists 78,301, Unionists 48,484, Labour 25,305, Independents 12,029. Some 75% of the electors voted.

As a result of the election Botha was dependent for continuance in office on the support of the Unionists, and this was ungrudgingly given. There was some talk of Sir Thomas Smartt and other leaders of the Unionists joining the Ministry, but this was not done. The cordial support given by the Unionists to Gen. Botha was the more valuable as the Nationalists continued their agitation and increased their demands. Hertzog's efforts were powerless to affect the policy of the Cabinet but they led to increased bitterness in S. Africa. The Government had, nevertheless, no difficulty in securing volunteers for service in German E. Africa. The appointment of Gen. Smuts as commander of the British forces there entailed his absence from the Cape, an absence prolonged by his selection early in 1917 as a member of the Imperial War Cabinet in London. This was a serious loss to Botha in the conduct of home policy.

Republican Propaganda.

After Steyn's death (in Nov. 1916) Hertzog became more openly hostile than ever to the imperial connexion. At Stellenbosch in May 1917 he declared that S. Africa's autonomy (*zelfstandigheid*) entitled her to remain neutral in the war and that no real self-government could exist without independence of all other countries, including Great Britain. "The only bond that binds us together," he said, "is our common King but under him we each stand separately and independent of each other." But even "the common bond" was irksome, and the logical outcome of Hertzog's policy was seen in the adoption by the Nationalist party of republicanism as a plank in their programme, to be achieved "by steady constitutional pressure." The opposite policy was seen that year in operation in London. General Smuts was sitting in the Cabinet with equality of status with that of the ministers of the United Kingdom, and the Imperial War Conference of that year (1917) declared the Dominions to be "autonomous nations of an Imperial Commonwealth with an adequate voice in foreign policy." The adoption of republicanism in the Nationalist platform was strongly resented in the Union and on the motion of Mr. Merriman—who voiced very accurately the feelings of most of the Cape province Dutchmen—a motion condemning republican propaganda was carried (June 18 1917) by 72 votes to 21. The propaganda, however, grew in virulence. There was, said Gen. Botha in 1918, an agitation on foot to establish a republic by violent means.

It will be seen that throughout the World War S.A. had been divided by bitter racial strife. It was not, however, the traditional clash between Briton and Boer, but a combination of Boer and Briton against a section of the Boer community, and this marked an advance on old conditions. Nor were all those who gave Hertzog their votes really prepared to follow him to all lengths. But the defeat of Germany brought no respite in the Nationalist agitation—it rather increased, nor did it require much astuteness for Hertzog to fix upon President Wilson's declarations in favour of self-determination as a weapon. The last half of 1918 was, however, noteworthy in S.A. for other than political happenings. In the influenza epidemic which swept over the world S.A. suffered very severely. Influenza attacked both the white and coloured population and was most severe in the Cape peninsula. A total of 54,899 deaths were registered in Aug.–Dec. 1918. Of these, 11,510 were among whites and of these 6,094 occurred in the Cape province. (There was a recurrence of the epidemic in 1919, but in a milder form.)

Nationalists and Self-determination.

As soon as the World War ended Gen. Botha was summoned to London[2] where he joined Gen. Smuts. They represented S.A. throughout the peace negotiations and both were signatories of the Treaty of Versailles, under which S. A. and the other British Dominions became original members of the League of Nations. The counter-measures of the Nationalists failed. No sooner had hostilities ceased than the central committee of their organization sent a note to President Wilson expressing their desire to lay before him their aspiration that the principle of self-determination should be applied as much to the S.A. people as to "other small nations." Mr. Wilson declined to interfere. General Hertzog was at heart most concerned to regain independence for the ex-Dutch republics. Thus in a debate initiated by Sir Thomas Smartt on the republican propaganda in the House of Assembly in Feb. 1919 he maintained the right of the Free State to break away from the Union. At the opening of the session in Jan. one of his henchmen, Mr. Tielman Roos, in the debate on the resolution congratulating King George on the victory of the Allies, had moved an amendment declaring that peace could only be maintained by the "complete application" of the principle of self-determination enunciated by the Allied and Associated Powers. This amendment had been defeated by 73 votes to 20.

Hoping to get some advantage out of the struggle going on around the Peace Conference table in Paris Gen. Hertzog and certain of his colleagues determined to visit Europe. Hertzog held that the question of the Union as a whole becoming a republic was a matter in which Great Britain had no voice, but meanwhile Great Britain might "redress the wrong done to the ex-Dutch republics by restoring to them their freedom." He and his colleagues would lay their case before the Prime Minister, Mr. Lloyd George. When it was announced that a Nationalist deputation would leave for England, trouble arose. The crews of the mail steamers intimated that they would not put to sea if Gen. Hertzog and his colleagues were passengers. This difficulty was met by the offer to bring them over to England in a British man-of-war. Hertzog, however, realized that that would render him ridiculous; eventually he and his friends sailed in a Dutch vessel to New York, whence they took passage to Europe. They saw Mr. Lloyd George, they visited Paris, and they returned to S.A. unsatisfied. Mr. Lloyd George pointed out to them, among other things, that the restoration of the Dutch republics was not a matter to bring before the Imperial Government; the Union of S.A. was a self-governing state and could speak only through its own constitutionally chosen Ministry.

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[1] In a proclamation issued by Beyers and de Wet on Oct. 29 1914, they signed themselves "generals of the protesting burghers."

[2] In Botha's absence Mr. F. S. Malan was acting Prime Minister.

Botha's Death: Smuts Prime Minister.

The Treaty of Versailles having been signed (June 28 1919) Gens. Botha and Smuts returned to S. Africa. A few weeks later Gen. Botha, whose health had been indifferent for some time, died (Aug. 27) after a very brief illness. In him S.A. lost one of her greatest sons, and the Empire a man who, whether as friend or foe, had been large minded, sincere and whole-hearted. With regard to Botha's successor Lord Buxton, the governor-general, had no hesitation. Gen. Smuts was the inevitable choice. In Sept. at a special session of Parliament, the peace treaty with Germany was debated, and a resolution passed asking King George to ratify it on behalf of the Union. In this debate and on many other occasions Gen. Smuts dwelt on the enhanced position S.A. had acquired as a result of the World War; she had not only become an equal member of the British Commonwealth, with a voice in the direction of its foreign affairs, but a separate entity in the comity of nations. Greater freedom it could not possess; it was mistress of its own destinies, but, so he argued, it was not open to the Union to break away from the British connexion.

The war had ended, economically S.A. had suffered from it less than might have been anticipated, and a period of trade expansion had set in. Smuts, both in generalship and in diplomacy, had been the greatest figure which the British Dominions had thrown up during the conflict. He was presently called upon to get the verdict of his own people on his policy and actions, for by the constitution, another general election was due. It was held in March 1920 in circumstances somewhat unfavourable for the Ministry. Though on imperial questions the Unionist party and the S.A. party held the same views, there were many points on purely domestic issues on which they did not agree and they opposed one another at the polls, often too when a Nationalist was contesting the same seat. There were several triangular and even some quadrilateral contests—caused by Labour candidatures. And the election showed that the Nationalists, determinedly narrow in their outlook—for many back-veld Boers the world outside S.A. counted as nothing—had gained strength. There were 134 seats to be filled as against 130 in 1915. The Nationalists came out the strongest single party with 45 seats; the S.A. party held 40, the Unionists 25, while Labour gained the remarkable number of 21 seats. Three Independents completed the list. The Nationalists were jubilant and with the help of the Labour members hoped for great things. Gen. Smuts was in a difficult position but he resolved to meet Parliament and carry on the Government. This could only be done with the help of the Unionists—and that help was given to Smuts as freely as it had been given to Botha. Even so, the margin of votes was exceedingly small and would have disappeared had not several of the Labour members on the main issues also supported the Ministry. As it was Smuts went through the session with remarkable skill and succeeded in passing more than one important measure—among others the Native Administration Act (*see* above).

Hereeniging Efforts.

The evidence that the election had afforded of the strength of the Nationalists could not however be ignored, nor was it possible that in the existing state of parties Parliament could continue to do its work efficiently or the country be at peace. Some way out must be found. Considering his race, it is not a matter for wonder that Smuts tried first to see if an accommodation could be reached with the Nationalists. A reunited party which would have the support of the whole Dutch community was a tempting prospect. Negotiations went on for some time; finally in Sept. 1920 a *hereeniging* (reunion) conference was held at Bloemfontein. It failed, and its failure might have been foreseen. On various points the Nationalists or the S.A. party were prepared for compromise, but when the test came it was seen that there was no bridging the gulf which separated them on essentials. Gen. Smuts and his party held firm to the principles of the unity of the Union and the preservation of the ties which linked the Union to the Empire. The Nationalists, on their side, refused to abandon the republican plank in their platform.

The 1921 Election.

Gen. Smuts consequently turned for support elsewhere. In a manifesto issued on Sept. 29 and addressed to "all right minded S. Africans, irrespective of race or party," he asked them "to join a new party which shall be strong enough to safeguard the permanent interests of the Union against the disruptive and destructive policy of the Nationalists." This was an open bid to the Unionists, nor were they indisposed to respond. Their fundamental principles were those of Gen. Smuts and his followers. But when at the conference of the S.A. party, held on Oct. 27, a resolution was adopted directing the head committee of the organization to take the necessary steps not for the creation of a new party, but for "an expansion of the S.A. party," some difficulty was created. The Unionists, who represented the bulk of the British section of the community, had, though with natural regret, been prepared to make a new combination, but they disliked the idea of simple absorption into a predominantly Dutch organization. These feelings were expressed at the Unionist party conference at Bloemfontein early in November. Counsels of patriotism prevailed and at a meeting between the Unionist executive and Gen. Smuts at Johannesburg on Nov. 27, a complete agreement was reached. The Unionists joined the S.A. party, which retained its name. Nor was it an unfitting title, though it would become meaningless if the fusion of the two races came about, and the old distinction between Boer and Briton obliterated. This possibility was precisely what the Nationalists (and also a few British extremists) most dreaded while it was the goal to which Smuts looked forward. Speaking in London on May 22 1917, he had declared "we want to create a blend out of various nationalities. We want to create a new nation and that is the South African nation. . . . I am hopeful that . . . we shall in the end succeed and create under our South African sun a new type in the world."

Having drawn together the supporters of "national unity of the European races and the economic development of S.A. along peaceful lines" Gen. Smuts made a new appeal to the country, backed by the whole strength of what had been the Unionist party. Smuts fought the election on the republican issue. With the alternative thus nakedly put the Nationalists took alarm. They knew that success for them on such an issue was impossible and therefore they tried to confuse the people, and snatch a victory on other grounds. Severance from the British Empire, the turning of the Union into a republic, was not, they declared, their immediate object, rather was it an ideal which they hoped to attain in a remote future. This manœuvre deceived no one. Even if the Nationalists did not ardently desire a complete rupture with Great Britain they did want to secure at once complete ascendency in the ex-Boer Republics. During the election campaign Hertzog was induced to put the case baldly. Heckled at a meeting at Roodebank in the Standerton district he said that "even today (1921) he would accept a republic in the Transvaal and Free State and those Englishmen who objected might retain their British citizenship. If they had any grievances they would be represented by a British diplomatic agent." He admitted that if his wish were granted and difficulties arose the country would be in exactly the same position as before the Boer War.

The election was held in Feb. 1921 and resulted in a notable triumph for Gen. Smuts and the enlarged S.A. party. But it was significant that the Nationalist vote increased and that on balance of losses and gains they held two more seats in the new than they had held in the old Parliament. The distribution of parties was as follows:—South African 76, Nationalist 47, Labour 10, Independent 1.[1] The 76 seats held by the S.A. party compared with 40 in the old S.A. party and 25 in the old Unionist party. The gains of the enlarged party had been at the expense of the Labour candidates. But an analysis of the poll showed that Smuts had rallied to his side many doubtful voters besides those transferred from Labour. Nor could the Nationalists claim that those who voted for Labour candidates favoured their propaganda; there were in the Transvaal bitter contests between Nationalist and Labour candidates. In considering the figures of the votes cast it should be remembered that nine S.A. party candidates were returned unopposed, whereas only one Nationalist (Gen. Hertzog himself) was not opposed. It is also noteworthy that the Nationalists' successes were almost entirely in rural and remote constituencies, decisive evidence that their strength lay in the back-veld Boers. The figures were: S.A. party 138,942 (an increase of 19,455 compared with 1920), Nationalists 104,692 (an increase of over 8,000), Labour 28,983 (a decrease of over 12,000).

Following upon the election there was a reorganization of the Cabinet in which Sir Thos. Smartt became Minister for Agriculture, Mr. Patrick Duncan Minister for the Interior, and Mr. J. W. Jagger Minister for Railways and Harbours. Another leader of the late Unionist party, Sir Edgar Walton, was appointed High Commissioner in London. In June 1921 Gen. Smuts, Sir T. Smartt and Col. H. Mentz (Minister of Defence) came to London to attend the Imperial Conference. In regard to matters affecting the internal affairs of S.A. the most delicate question discussed by the conference was the status of British Indians (see above). While the ministers were still in London the question of the future of Rhodesia advanced a stage. A deputation had been invited to discuss with the Colonial Office a plan for ascertaining whether Rhodesia was prepared to take a referendum upon a definite scheme of self-government (*see* RHODESIA). Largely however as the result of the general election in the Union in Feb. 1921 the party in Rhodesia which preferred to join the Union had again grown in strength. The Rhodesian deputation saw Gen. Smuts early in Sept., immediately after his return to Cape Town, when it was made clear that though the admission of Rhodesia as a province of the Union would be welcomed, it was a matter for the Rhodesians to decide.

Native Unrest.

In the 1921 election campaign the Nationalists sought to evade the main issue partly by assailing the policy of the Government on native affairs. That policy has already been outlined; by Nationalist orators addressing the back-veld Boer the conciliatory measures adopted were denounced as "coöperating with niggers"; by Nationalist orators addressing audiences in the Cape province—where the native had the vote—the segregation clauses of the Act of 1920 were denounced as evidence of the bias of the Government against the Kaffirs. This method of electioneering had elements of danger, for discontent among considerable sections of the natives was pronounced. The chief ground of complaint was in regard to their economic position. The natives had been quick to learn the lesson of the strikes of white labour on the Rand and in 1917 and subsequent years there had been strikes and native disturbances at Johannesburg and other cities. There were also many evidences of political and religious ferment. Serious disturbances at the Lovedale missionary institute in April 1920,[2] were followed on Oct. 23 of the same year by a disastrous collision at Port Elizabeth. In the last-named case the native labourers had struck for higher wages and their leader, Masabalala, president of the Native Workers Union, had been arrested and refused bail. An angry crowd gathered before the court house and fire was opened upon it by the Europeans who feared an attack. Rioting and incendiarism ensued and for a time it looked as if Port Elizabeth would be at the mercy of the natives. In all over 20 persons (including one European) were killed and 40 injured. The action of the natives was condemned by many of their leaders, such as Dr. Rubusana, an ex-member of the Cape provincial council and by Mr. Jabavu,[3] a graduate of London University, who, while calling for the remedy of grievances, denounced the "Bolshevist propaganda" permeating the native mind. An investigation made by a commission appointed by the Government tended to show that the authorities at Port Elizabeth had mishandled the affair, and that bloodshed might have been avoided had Masabalala been granted bail. It was a cause for angry recriminations later when Nationalist candidates for Parliament appeared on the same platform as Masabalala.

A greater tragedy followed at Bulhoek, near Queenstown on May 24 1921. For months several hundreds of natives known as Israelites, proselytes of one Enoch Ngijima, who gave himself out as the prophet Enoch, had been allowed to remain at Bulhoek and they had become a menace to the community. Whether or not earlier action might have averted the calamity is not certain; in this case the Government acted with great forbearance. But at length it became imperative that the Israelites should be compelled to return to their homes, and forces were moved to Bulhoek to be in readiness for eventualities. Enoch proved intractable and his followers proved themselves possessed of all the fanaticism of dervishes. On May 24, when preparations were being made for their removal, large numbers of them, though destitute of firearms, charged the troops, and some 400 were killed or wounded before their ranks wavered and broke. On this occasion the soldiers had no option but to fire; the Israelites, though their reckless charge exhibited only fanaticism, had also shown military skill and had dug trenches and prepared ambushes for the troops. Their dispersal was a necessity. Neither did responsible native leaders approve Enoch's teachings.

The Bulhoek tragedy was, however, regarded by the leaders of the natives as the outcome of unjust economic laws. The case against the Government was put by Mr. Selby Maimang, the president of the Industrial Commercial Workers Union—a union which embraced nearly all the native and coloured trade organizations in South Africa—at its meeting at Cape Town in July 1921. Mr. Maimang said that the land laws of the country were to blame for the catastrophe. Enoch's following had fallen victims to bad influences brought about by bad administration. Coloured workers were smarting under irritating disabilities in every walk of life. Mr. Maimang, a representative of moderate opinion among the natives, reprobated the useless stirring up of passions, declaring it to be the duty of the Union to educate all non-European workers to guard their own interests. Organization was essential; they could only ward themselves against exploitation by a distinct band of comradeship. As to that many European employers were already convinced that combination among the natives engaged in industries was a factor which they could not ignore.

The decline in trade which became noticeable in the middle of 1920, and was acute in the first half of 1921, added to the difficulties of the industrial problem. It affected both white and coloured labour severely and caused renewed agitation on the Rand, while diamond mining came almost to a standstill.

Lord Buxton's tenure of the office of governor-general and high commissioner came to an end in 1920. In very difficult circumstances he had carried out his duties with firmness and in a manner which won the esteem of all classes, including the Nationalists. He identified himself with the interests of S. Africa. On giving up office he was granted an earldom (Oct. 21 1920), and on his return home served as chairman of the committee appointed to inquire into the future government of Rhodesia. Prince Arthur of Connaught was chosen as the new governor-general and high commissioner. He reached the Cape on Nov. 17—ten years after his father, the Duke of Connaught, had opened the first session of the Union Parliament.

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[1] These figures include the results of recounts and of two by-elections in the Transvaal, necessitated by ties in the voting at the general election. At two by-elections for Cape Town constituencies in Sept. 1921 Labour candidates won, bringing the Labour members of Parliament to 12 and reducing the S.A. Party to 74.

[2] The students attempted to burn down the college buildings and murder the professors. The rioting began with complaints as to the quality of the bread served, which was the same for whites and blacks.

[3] Son of Tengo Jabavu (d. 1921), editor of *Imvo (zi Bantu)*, an influential native newspaper, which he had founded in 1884.

AUTHORITIES: (*a*) *Official. The Official Year Book of the Union*, prepared by the Union census and statistics department is a valuable record and contains sections relating to state archives and official publications and a classified bibliography. The Colonial Office, London, publishes annual reports on the native protectorates, and the *Colonial Office List* (yearly) gives lists of all parliamentary papers. The Government of India issues reports concerning Indians in S.A. (see especially *Statement made by Sir B. Robertson before the Asiatic Enquiry Commission* (1921), a survey of the whole question).

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DEFENCE AND MILITARY INSTITUTIONS

The establishment of union in S. Africa in the year 1910 involved a fusion of the different military systems then obtaining in the four colonies which became original Constituent Provinces in the new amalgamation. These systems were as follows. The Cape Colony maintained a permanent force (the Cape Mounted Riflemen) together with a volunteer force and a cadet organization. The forces of Natal consisted of a military force, of much the same strength (3,000–4,000 men) and character as the volunteer force of the Cape and a reserve organized in rifle clubs, and included cadets again on much the same lines as those of the kindred organization in the Cape Colony. The two forces contained regiments of long standing and high reputation gained in many local campaigns and embraced all arms. These regiments retained their identity in the new forces. A volunteer force on modern lines, confined to the towns, except for two mounted regiments recruited from country districts, was the form of military organization which had been adopted by the Transvaal. This force, however, had only been in existence for seven or eight years at the date of union. In the same period an efficient cadet system had been instituted. In each of these three colonies a small permanent staff was maintained. The Orange Free State relied upon the burgher system based on universal male liability for service in time of war, a principle accepted indeed by all the four colonies, and reaffirmed in the present S. Africa Defence Act.

It was not until June 14 1912 that it was found possible to pass a law embodying the recommendations which had been made and the conclusions which had been arrived at after investigation, but upon this date the S. Africa Defence Act, 1912, was placed on the statute book. Field-Marshal Lord Methuen, then commander-in-chief of the British forces in S. Africa, evinced great interest in the matter of South African defence and assisted the local military authorities in the conferences and deliberations which preceded the passing of the Act. By this Act every citizen between 17 and 60 (both included) is liable to render personal service in time of war in defence of the Union "in any part of South Africa." A permanent force is provided for, but in May 1921 an amending bill was before the House of Assembly, which if accepted would materially alter the composition and functions of this force.

Every citizen is liable to undergo, beginning in his twenty-first year, four years "peace training" in the Active Citizen Force, which constitutes the first line of defence. It is however permissible for any citizen to enter voluntarily for his "peace training" in any year between his 17th and 21st years (both included). The number of citizens to be trained in the Active Citizen Force is placed in the Act at 50% of the total number liable, but Parliament has power to increase this number. If the number required for training in any district is greater than that of its voluntary entries, a ballot may be taken to make good the shortage. After four years' "peace training" in the Active Citizen Force the citizen goes to Class A of the Citizen Force Reserve where he remains until his 45th year. A Coast Garrison Force is established, and service may be undertaken in that force as equivalent to Active Citizen Force "peace training." A similar concession is allowed to citizens who may elect to serve in the Royal Naval Volunteer Reserve which is part of the Royal Naval Reserve constituted under the Naval Forces Act 1903 (Great Britain and Ireland) and may be placed at the disposal of the Royal Naval authorities. Any citizen who at 21 has not been entered for service in the Active Citizen Force (or one of its equivalents) is compelled to serve for four years in a Rifle Association where he is taught to be "familiar with the use of military weapons of precision," after which he is included in Class B. of the Citizen Force Reserve until his 45th year. Cadet service is compulsory, but a request from a parent or guardian that a boy "be exempt from cadet training" secures a certificate of exemption. Several special reserves are provided for in the Act, and one of these, the Veteran Reserve, was largely used in establishments within the Union during the period 1914–8. The National Reserve consists of all citizens who, liable to render personal service in time of war, do not belong to any other portion of the forces. The full establishments of the Active Citizen Force in 1914 represented a force of approximately 30,000 men. The periods of "peace training" are not more than 30 days in the first year and 21 days in each subsequent year with a maximum of continuous training (in camp) of 22 and 15 days respectively.

The response to the first year's (1913) call for entries was striking, and 44,193 citizens entered voluntarily for training, producing a strength of 14,000 in excess of requirements. The following year saw the outbreak of the World War, and the annual registration in Jan. of all citizens who reach the age of 17 in the year has been in abeyance since Jan. 1914.

Immediately after the passage of the Defence Act in 1912 steps were taken to establish the military system for which it provided. The permanent force at its inception consisted of two portions. The staff was employed partly at defence headquarters and partly distributed in the 15 military districts of the Union. The South African Mounted Riflemen (five regiments and three batteries of field artillery) was, with the exception of the artillery, employed solely on police work, and divided into very small detachments on posts. The whole of the police force had in May 1921 been placed under the command of the commissioner of police, and the new military arrangements proposed in 1921 contemplated a reduced permanent force employed on military duties alone.[1]

The complications introduced by the rebellion made it impossible to call out the whole of the citizen forces in the formations in which they strictly belonged, and, though a considerable number of units of the Active Citizen Force were called out by proclamation in the regular way, most of the Dutch members of the forces—many of whom were beyond the age of those in the Active Citizen Force—were specially embodied under the old commando system to which they had been formerly accustomed. Thus the whole of the Dutch-speaking units serving under Gen. Botha in the rebellion and German S. W. Africa were organized on a commando basis, the English speaking units being those of the Active Citizen Force. In the rebellion 30,000 troops (of whom 20,000 were of Dutch descent) were employed at a cost of £5,100,000 to the Union Government, and casualties to the extent of 132 killed and 242 wounded were sustained by the loyal troops. In German S.W. Africa 67,237 Union troops were engaged at an approximate cost of £15,000,000 and 127 lives were lost, the wounded amounting to 272.

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[1] The S. African Mounted Riflemen, as a brigade, served in the rebellion of 1914, and at the close of the campaign in German S.W. Africa, but thereafter were retained in the Union, though many individual members of the force served with credit and distinction on many battle fronts.

At the conclusion of the campaign in German S.W. Africa the Union Government turned its attention to other fields in which assistance was needed. These were oversea, and the liability of S. African citizens to military service did not extend to such distant spheres of activity. It was thus necessary to devise special measures to furnish troops composed of S. Africans who were prepared of their free will to serve beyond the limits of S. Africa.

In July 1915 the Imperial Government accepted the offer of the Union Government to furnish personnel for units for service beyond S. Africa. A director of war recruiting was appointed and recruiting was maintained until the Armistice in 1918. The following are the numbers of all the forces which were raised in the Union for the different campaigns in which South African troops took part:—

The rebellion	30,000
German S.W. Africa	67,237
Overseas (France)	30,880
German E. & Central Africa	47,521
For service in the Union	5,180

The achievements of the S. Africans in France and their fortitude under hardship in the East African campaign are matters of history.

The coloured community in the Cape province had early expressed a strong desire to furnish a representative body of troops, and an infantry battalion of the Cape Corps was formed, and later a second battalion was recruited. The regiment after gaining valuable experience in E. and Central Africa was sent as one battalion to Egypt and Palestine, where it served with credit. The natives of the Union, who throughout the war maintained an attitude of complete self-control and loyalty, furnished for non-combatant duties 35,000 men for German S.W. Africa, 10,600 for France and 18,000 for E. and Central Africa. Some hundreds of natives lost their lives in the transport "Mendi" which was sunk in the English Channel.

While, as a consequence of the large number of men who, especially at the outset of the war, joined the British forces as individuals, a full statement of the casualties sustained by S. Africa in the World War is not available, the following figures give some idea of the incidence of losses. In the S. African Infantry Brigade in France nearly 15,000 casualties were sustained, of which some 5,000 were killed. In the Cape Corps which served in E. Africa, Egypt and Palestine, the casualties in dead and wounded totalled 701. Disease and privation took heavy toll in East Africa and hundreds of men returned to the Union from the campaign in that country shattered in health. The Royal Naval Volunteer Reserve supplied and maintained a strong detachment for service in the Grand Fleet and naval establishments. Hospitals, camps, supply and ordnance depots, and veterinary hospitals were formed in S. Africa under Union control, and heavy purchases were made and vast amounts of supplies were forwarded to E. Africa under Union military supervision on behalf of the Imperial Government.

As regards the future military arrangements of the Union the main provisions of the Act of 1912 have been accepted as sound, though methods will doubtless be reformed to a considerable extent. An amending defence bill in May 1921, in addition to important changes in the constitution and functions of the permanent force, provided for a resumption of registration, with retrospective effect as regards citizens who should have been registered in and since 1918; also for the working of the normal training system in 1922, and for a substantial increase in the period of continuous "peace training," as well as for increasing cadet efficiency, by additional expenditure of public funds and by extending the age for cadet service. The bill was, however, dropped in June 1921. (J. J. C.)

SOUTH CAROLINA (*see* 25.499*).—The pop. of the state in 1920 was 1,683,724, an increase of 11·1% over the previous decade, as compared with 13·1% and 16·4% during the two preceding decades. During the decade 1910–20 the whites increased from 679,161 to 818,538, or from 44·8% of the total pop. to 48·6%. The density was 55·2 per sq. mile. The urban pop. was 17·5% of the whole, as compared with 14·8% in 1910. The pop. of Charleston was 67,957 and the decennial increase 15·5%, the white increase being 28·3% and the negro 4%. The white pop., increased by war industries, was 52·4% of the whole, constituting a majority for the first time in about 200 years. The pop. and decennial increase for the other leading cities were as follows:—

	1920	1910	Increase per cent
Columbia	37,524	26,319	42·6
Greenville	23,127	15,741	46·9
Spartanburg	22,638	17,517	29·2
Florence	10,968	7,057	55·7
Anderson	10,579	9,654	9·5
Sumter	9,508	8,109	17·3

Manufactures.—Textile mills paid very large dividends during 1917–20, and in addition doubled or trebled their capital. Wages rose greatly, but were cut 30 to 50% in the depression of 1920–1. The number of spindles in 1918 was 4,914,524; of operatives in 1919, 50,898, a decrease of about 4,000 since 1916; the bales of cotton consumed diminished from 972,000 in 1916 to 779,000 in 1918–9; capitalization that year was $201,237,320. Almost half the motive power in 1920 was hydro-electric. Unionization has not proceeded far among textile workers, though skilled trades in larger places are generally organized. The State Board of Conciliation, created in 1916, arbitrates labour disputes on invitation or investigates them on its own motion or the order of the governor. Women are forbidden to work in stores after 10 P.M. or over 12 hours in one day.

Agriculture.—The coincidence of the World War and a large cotton crop in 1914 demoralized farming. A law was passed forbidding the planting of more than a third of a farm's acreage in cotton, but was repealed before the next planting season. An enormous inflation of values soon followed and in turn was succeeded by a decline of prices from about $0.40 to $0.10 or $0.11 in six months (1920–1), entailing great hardship. Legislation (1912) sought to stabilize agricultural prices by a system of state warehouses for holding products for a favourable market. Private capital has been extensively invested to the same end. The boll weevil became a serious menace in 1920 in the south-western counties. A packing plant with a daily capacity of 400 hogs was established in Orangeburg. Butter-making in coöperative creameries has made some progress. Under the law of 1920 extensive drainage projects were undertaken. Agricultural methods have improved; farm-houses are better; banks, which have increased in number and capital, finance the farmer directly at greatly lower cost than formerly charged by "lien merchants." South Carolina led all the states in 1917 in crop value per acre with an average of $63. The value in 1918 was $75. According to state Government estimate cotton covered in 1920 45% of the cultivated acreage and represented 50% of the value of the 13 leading crops. One million five hundred and thirty thousand bales were raised, the state's acreage being fourth and its production second in the Union. Corn, second in value, amounted to 42,370,000 bushels. Other crops were: tobacco 66,950,000 lb.; rice 120,000 bus.; sorghum 1,500,000 gal.; peanuts 1,620,000 bushels. The average value of ploughed lands was $61 per acre as against $91 for the United States. Average monthly wages for adult male farm labour without board were $41.80, next to the lowest for any state. During 1910–20 the number of farms increased from 176,434 to 192,693; improved land from 6,097,999 ac. to 6,184,159 ac.; average value per farm from $2,223 to $4,946; average value per acre from $29.02 to $76.70.

Education.—School legislation since 1910 included an Act for compulsory school attendance in 1919 throughout the state, increased state additions to local funds, calculated to ensure after 1920 a seven-months' term in the poorest districts; night schools for adults; consolidation and grading of rural schools, with transportation for children; an increased number of high schools; special teachers and inspectors in rural and textile districts; greatly improved school buildings; enlarged facilities for agricultural, vocational and home economics training; state standard certification of teachers and enforcement of payment for tuition at state colleges by those able to pay. The most significant principle underlying the forward movement in education has been the recognition of the necessity of greater assistance from state funds and greater power in the state authorities as distinguished from the local divisions. Difficulties have been the lack of competent teachers to carry out the enlarged programme and maintain the higher standards, the shortness of the rural school term, and excessive local authority to do or neglect to do what it pleases. The expenditure on common schools in 1918–9 exceeded $8,000,000. Attendance in common schools in 1919–20 for whites was 226,065; for negroes, 251,980; total 478,045. There were in that year enrolled in the 36 colleges in the state 12,000 students, of whom a third were negroes.

The three most numerous religious denominations, the Baptist, Methodist and Presbyterian, have added materially during 1910–20 to their extensive work in higher education. All but 11 of the 36 institutions for higher education in the state were in 1920 under church control, and these institutions contained a thousand more students than all state and other non-sectarian institutions combined.

Social Legislation.—Every attempt of forces of reaction to abandon a step in the large number of forward moves in social legislation since 1910 has been defeated, usually overwhelmingly.

****These figures indicate the volume and page number of the previous article.***

In 1912 race gambling was forbidden. In 1913 the penitentiary hosiery mill was abolished as harmful to the health of the prisoners. The State Board of Charities and Corrections, created in 1915, was reorganized in 1920 as the State Board of Public Welfare. The state hospital for the insane was entirely remade, materially and administratively, during 1915–9. A school for the feeble-minded was established in 1918. The placing of orphans and homeless children was taken over by the state in 1920. In 1918 the Industrial School for Girls, a reformatory institution for white girls, was established and the reformatory for negro boys was reorganized. The probate judge in each county is constituted a juvenile court, and several cities have undertaken remedial work for juvenile delinquents and dependents. Penal and charitable institutions (including church and private charitable institutions) have been since 1915 under state inspection. Since 1918 diseased women prisoners of all classes are held until cured. The age of consent was raised in 1921 to 16 years. No city has acted upon the permission in 1915 to segregate whites and negroes by city blocks. Marriage licences were required by law in 1911 and registration of births and deaths in 1914. Medical inspection of school children was made state-wide in 1920.

Finance.—The budget system, concentrating responsibility on the governor and the chairmen of the two legislative finance committees, adopted in 1919, has tended to economy and system, though the Legislature may disregard without any limitation the recommendations. The State Tax Commission, created in 1915, has improved the administration of the tax laws. The assessed taxable value of all property in 1920 was $448,222,786, being from a fourth to a third of the market value. For the state government there was raised a revenue of approximately $6,000,000; for county governments $12,000,000; for common schools (local tax) $8,000,000; and for municipal government between $5,000,000 and $6,000,000.

Political History.—The class feeling that has always been strong in South Carolina politics found violent manifestation during the governorship of Coleman L. Blease, who served two terms from 1911 to 1915. Blease's political tactics were calculated to appeal to the lower and less literate elements of the state; he quarrelled with the state Supreme Court, with the General Assembly, with other state officers and with the U.S. authorities. The Legislature was at all times controlled by his opponents, and probably more measures were passed over his veto than had been so passed in the case of all former governors combined. He startled a congress of governors at Richmond, Va., in 1912 by an open advocacy of lynching, and while governor he pardoned or paroled more than 1,500 criminals. At the time of his resignation (a few days before his term expired in 1915) he had freed all but 150 convicts, the number then said to be remaining in the institutions of the state. Almost his last official act was an order disbanding the state militia; this was promptly countermanded by his successor. Resigning without giving any explanation, he was succeeded for five days by Lt.-Gov. C. A. Smith. In 1918 Mr. Blease made a campaign for election to the U.S. Senate, taking extreme ground against the country's entering the war. He was overwhelmingly defeated. A progressive period began with the election of Gov. Richard I. Manning in 1914. A significant feature of the campaign was the support given to Prof. John G. Clinkscales in his advocacy of compulsory education. Gov. Manning's two administrations were marked by constructive legislation and effective coöperation with the national Government. Gov. Robert A. Cooper was elected in 1918 on a platform that made education its chief plank and frankly announced that as the result of progressive legislation taxes would be higher. He was reëlected without opposition in 1920. His chief measures were the strengthening of the public schools, the creation of a budget system and the consolidation of management of charitable and correctional institutions. The Australian ballot was put in force (1921) in primaries, though not in the general election, the latter being merely a formal ratification of the former as the Democratic nomination is equivalent to election.

The World War.—Of the total of 78 Congressional Medals of Honour awarded, South Carolina received six. The total number of men sent by South Carolina into the war was 54,254, not including those who had enlisted before the Unites States declared war. The amount of Liberty and Victory loans and other Government securities bought was $94,211,244, and $3,027,740 was contributed to Red Cross and similar appeals.

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SOUTH DAKOTA (*see* 25.506).—The pop. of the state in 1920 was 636,547, as compared with 583,888 in 1910, an increase of 52,659, or a little more than 9%. The average density in 1920 was 8·3 per sq. mile. The rural pop. was 84% of the whole in 1920, against 86·8% in 1910, an increase of 27,460, or 5·4%. The urban pop. (cities with 2,500 inhabitants and over) was 101,872 in 1920 against 76,673 in 1910, an increase of 25,199, or nearly 33%. The pop. of Sioux Falls increased 79·7% to 25,176 in 1920. Its rapid growth is due largely to the opening of extensive packing plants, stock yards and factories. Aberdeen in 1920 had 14,537 inhabitants; Watertown, 9,400; Mitchell, 8,478; Huron, 8,302; Rapid City, 5,777; Yankton, 5,024; Lead, 5,013; and Pierre, the state capital, 3,209. The foreign-born white pop. in 1920 was 82,372, of which 16,807 were Norwegians, 8,569 Swedes, 5,983 Danes, 15,670 Germans, 11,191 Russians, 4,453 Canadians, 2,943 British.

Communications.—A panoramic picture of the surface of the state in 1921 would present many changes from one in 1910, but both pictures would have the appearance of a chess-board, of which the country roads, running a mile apart from E. to W. and from S. to N., would mark the squares. In the hills, near river beds, in the bad lands, and in uncultivated and thinly populated portions, the roads are not uniformly maintained. The law provides that they be 66 ft. in width. Each square mile of land is called a section and contains, including one-half of the roads on the four sides, 640 ac. of land. The roads are still for the most part dirt roads. During the decade 1910–20 they were considerably improved by grading and elevating the centre. All of the 64 counties either have been actually engaged in the building of hard-surfaced roads or have started preparations for doing so. Advantage is taken of the Federal appropriations for highway purpose of which South Dakota's share was $4,458,545. State and county have made heavy assessments. Over $6,000,000 has been spent in building hard-surfaced roads. The state Legislature appropriated $2,000,000 for the construction, in 1921, at Rapid City, of a cement plant with a daily capacity of 2,000 barrels. A system of state trunk highways is supposed to connect all county seats and all towns having a pop. of 750 and more. A law provides that every county must employ a county engineer whose occupation is the planning of better highways. The automobile, the truck and the tractor have become more common than horsed vehicles, and have awakened the farmers to the advantage of good roads; 117,320 automobiles, enough to carry comfortably all the inhabitants of the state at one time were licensed in 1920. In connexion with the improvement of the roads, mention should be made of the bridge which was being built in 1921, at a cost of $1,500,000, across the Missouri river at Yankton, and which supplies the last connecting link of the Meridian Highway which crosses the state and extends from Winnipeg, Canada, to the Gulf of Mexico. Only about 300 m. of railway were built during the 10 years, 1910–20.

Agriculture.—There were 74,637 farmers in 1920, of whom 47,815 were owners, 26,041 renters and 781 managers. Many owners of the rented farms either lived on their farms or in the neighbouring towns, having rented to their prospective heirs. Though there were 74,637 farmers to 76,868 sq. m. of land, it is not the case that the great majority of the farmers occupied on an average a sq. m. of land each. All of the land area was not under cultivation; and among those who occupy the 34,636,491 ac. of agricultural lands outside of the corporate limits, the great majority of the farmers have each much less than the average, which is 454 acres. A minority, mostly west of the Missouri river, operate the large farms.

The farmers prospered during the 10 years, 1910–20. Their prosperity was evident in many other respects than the improvement of the highways and the large number of automobiles, trucks and tractors. Farm life underwent a rapid change. Electricity, telephones, rural mail delivery and consolidated school-houses added to the comforts and education of the people. Farm machinery was improved and bodily labour decreased. Many of the counties employ county agents, who are supposed to be highly trained agricultural experts. Because of the introduction of scientific methods, farm crops have become more varied and rotation of crops has become possible. The corn acreage in 1920 surpassed the wheat acreage, and the production of other grains and grasses increased. The introduction of alfalfa was especially noteworthy. Alfalfa was harvested three and four times a year. As a result, and also because of the large use of the silo, much more stock has been raised and more dairy products and eggs sent to market. The breeds of cattle, horses, hogs and poultry have been improved and many farmers raise only pure-blooded stock. A much greater number of farmers, as well as of city people, were in 1921 raising their own vegetables and fruits. Orchards and groves have increased in number and area. Because of many clusters of trees the unbroken prairie-like appearance of the farms has been modified. Farm values have more than doubled and the use of improved farm equipment has become much more extensive. There were not only many more farmers in 1921 than in 1910, but the investment per acre was much greater. The homes, barns, stables and granaries more recently erected are usually well built, are much larger than those of the past and have modern conveniences. Practically all of the towns with a population of 2,500 have their own electric light plants. The Homestake Mining Co. has a power plant costing about $2,000,000. The 1919 Legislature provided for an hydro-electric commission and appropriated $50,000 for the purpose of surveying the Missouri river to find water power. The engineers found three sites—Mobridge, Mulehead, and Medicine Butte—to be advantageous, in the order named. The commission presented a report to the 1921 Legislature and recommended that the Mobridge site be developed. It estimated that the dam and plant would cost $9,400,000 and the transmission system $7,833,000. Under the economic conditions existing in 1921 the Legislature hesitated to act favourably and the question was to be submitted to the people in the election of Nov. 1922. The following table shows the increase of farm products:—

		Acreage	Production	Value
Corn	1919	2,756,234	69,060,782 bus.	$89,779,016
“	1909	2,037,658	55,558,737 “	26,395,985
Wheat	1919	3,891,468	31,086,995 “	69,323,996
“	1909	3,217,255	47,054,590 “	42,878,223
Oats	1919	1,839,089	51,091,904 “	38,318,937
“	1909	1,558,643	43,565,676 “	16,044,785
Barley	1919	754,929	12,815,768 “	15,378,922
“	1909	1,114,531	22,396,130 “	10,873,522
Rye	1919	463,132	4,111,543 “	5,961,741
“	1909	13,778	194,672 “	115,126
Flaxseed	1919	159,234	1,109,303 “	4,880,931
“	1909	518,566	4,759,794 “	7,001,717
Potatoes	1919	58,180	2,863,186 “	7,157,983
“	1909	50,052	3,441,692 “	1,967,550
Hay and forage	1919	5,071,747	4,996,846 tons	71,988,845
“ “ “	1909	3,435,907	3,651,706 “	15,247,570

In 1919 receipts for the sale of dairy products were $12,222,562; of chickens, $1,477,500. The total value of domestic animals on farms was $232,364,625.

Minerals.—The value of the minerals produced in the state in 1919 was $5,500,000. Prof. Freeman Ward, state geologist, has computed the mineral products in yearly averages for the five-year periods, 1905–9 and 1915–9, as follows:—

	1905–9	1915–9
Bentonite	..	$5,480
Coal	$4,000	23,500
Copper	2,200	3,000
Gold	6,000,000	6,600,000
Gypsum	10,000	45,000
Lythia	1,000	38,680
Mica	50,000	10,400
Natural gas	18,120	19,000
Silver	97,900	126,000
Stone		
Crushed	23,480	80,000
Limestone	15,000	31,140
Sandstone	140,000	100,000
Structural materials	371,800	310,400

Manufactures.—The following table indicates the growth of manufactures:—

	1919	1909
Number of establishments	1,414	1,020
Proprietors and firm members	1,410	942
Salaried employees	1,242	682
Wage earners (average)	6,382	3,602
Capital	$30,933,030	$13,017,932
Salaries	2,076,199	615,621
Wages	7,905,426	2,297,512
Cost of materials	42,985,870	11,476,350
Value of products	62,170,782	17,870,135
Value added by manufacture	19,184,912	6,393,785

The principal industries in 1919 were flour-mill and grist-mill products, bread and other bakery products, printing and publishing, automobile repairing, cars and general shop construction and repairs by steam railway companies, lumber and timber products.

Doane Robinson, secretary of the state History Department, estimates the value of the total production of all commodities as $581,119,000 in 1918; $481,624,000 in 1919; and $316,305,000 in 1920. He gives the produce sold outside of the state as $270,536,000 in 1918; $376,720,000 in 1919; and $324,667,000 in 1920.

Finances.—The bank deposits were $206,496,073 in 1918; $235,617,276 in 1919; and $251,804,649 in 1920. They were protected by a depositors' guarantee fund amounting to $1,247,397 in 1920. The total assessed valuation of all taxable property was $1,598,544,562 in 1918, $2,095,154,178 in 1919, and $2,257,853,656 in 1920. The assessed valuation was usually not above half the real value, but even so amounted to $3,547 *per capita* in 1920. The tax levied was $17,781,439 in 1918, $21,470,598 in 1919, and $27,550,312 in 1920. The expenditure for the state Government, education, charitable and penal institutions was $1,255,593 in 1910, $9,711,964 in 1920. The state's debt in 1910 was $1,073,575 which was reduced until in 1919 the funds in excess of the debt amounted to $35,785. In addition there were in 1920 outstanding bonds, covering rural credit, highway and land settlements, amounting to $33,800,000.

Since 1917 South Dakota has had a noteworthy state rural credit system. Up to 1921, 13,575 applications had been made for loans amounting to $61,243,000. The rural credit board conservatively allowed only 7,915 loans, amounting to $31,083,450. This is more than four times the business done in the state by the Federal Farm Loan Board. The state can borrow money several per cent below the rate paid by individuals, and gives the farmers this advantage. The rural credit system having proved a success, the voters at the election of 1920 empowered the Government to make similar provisions for people in the towns. A law was consequently passed by the Legislature to create a municipal credit board and to make state loans to individuals for the purchase of homes. The state insures crops against hail at a low rate per acre. The Government administrative departments have been enlarged and a number of new commissions or departments have been created, including the following: insurance, railways, free circulating library, marketing, highway, rural credit, industrial, immigration, pure food and drug, state engineer, budget, tax, agriculture, charities and corrections, bank, depositors' guarantee fund, securities, health, pharmacy, live stock (sanitary), game and fish, coal mines, land settlement.

History.—South Dakota remained strongly Republican throughout the decade 1910–20. Of the political questions before the people the primary election law received the greatest attention. Successive Legislatures failing to deal with the matter by statute, an appeal to the initiative was successfully made at the election of Nov. 1912. Several months later, the Legislature of 1913 passed an Act of its own, and submitted it to the people at the 1914 election. It failed and the 1912 law remained in force. Thereupon the 1915 Legislature repealed the 1912 law and enacted one of its own, only to have the 1912 law in a somewhat revised form carried in the 1918 election. There has been much progressive legislation. The Non-Partisan League is a strong and active organization, but since a number of its policies have been adopted and carried out in legislation by the older parties it has not gained control of the Government. The code was revised and published in 1919. The number of men supplied by the state in the World War was 35,000, 10,000 being volunteers. There was purchased, in the state, of the Liberty and Victory bond issues $109,627,200. A bonus was voted for those who served in the World War and the sum of $6,000,000 appropriated for this purpose. Ex-service men engaged in farming are also given a state loan for "purchase of land, improvements and live stock to be placed on the land." The loan may be as high as 70 and even 90% of the value, and is payable on the instalment plan over a period of 30 years.

The governors since 1910, all Republicans, were Robert S. Vessey, 1909–13; Frank M. Byrne, 1913–7; Peter Norbeck, 1917–21; William M. McMaster, 1921– . (C. C.*)

SPA (*see* 25.525).—Pop. (1909) 8,293. The Germans occupied the town, which was undefended, on Aug. 4 1914, and it became first a hospital base and, later, a place of convalescence for their sick and wounded. The German Great G.H.Q. was transferred here from Kreuznach in March 1918 and the Kaiser fled from the Château du Neubois, 2½ m. E. of the town, into Holland on Nov. 8 1918. His concrete dugout at the château is preserved intact and shown to visitors. A conference of the Supreme Council of the Allies was held at Spa in July 1920.

SPAIN (*see* 25.527).—At the census of 1910, the total pop. (including the Balearic and Canary Is., as well as the territories of Northern Africa, but not those of the Guinea Colony) was 20,364,392, giving a density of 34·49 per sq. kilometre. The maximum density corresponds to the province of Biscay (161·59 per sq. km.) the minimum to that of Lerida (23·45). Figures above 100 per sq. km. are given by the province of Barcelona (148·46); Guipuzcoa (120·28); Pontevedra (112·80), and Madrid (109·80). There are only eight towns of more than 100,000 inhabitants, namely, Madrid (599,807), Barcelona (587,411), Valencia (233,384), Seville (158,287), Malaga (136,365), Murcia (125,057), Saragossa (111,704), Cartagena (102,542). The birth-rate varied between 2·83 and 3·08 per 100 inhabitants for the period 1914–9, 0·16 per 100 inhabitants being illegitimate. The marriage-rate fluctuated between 0·65 and 0·67 per 100 inhabitants during the war years, and made a sharp rise to 0·81 in 1919. In the same period the death-rate varied between 2·13 and 2·31 per 100 inhabitants, with an exceptional rise to 3·31 in 1918. Infant mortality is very high, being 20·20% of the total of deaths for infants of less than one year, and 16·73 between one and four.

Education.—There were in 1910 59·35% people who could not read (figure including and referring to all ages). In 1919, 51,815 youths (of which 3,730 were females) were studying in secondary schools. In the same year 23,660 students were inscribed in the 11 universities of the country. This figure does not include numerous special and technical colleges, catering for certain professions such as architecture, engineering, veterinary science, etc., or the numerous agricultural, and arts and crafts, schools financed by the Government, municipalities and provincial councils.

Agriculture.—Some progress is shown in area and production. Wheat crops oscillate near an average of 3,265,000 tons and reached their maximum at 4,145,751 in 1916. The wheat area averages 3,809,464 hectares. Barley shows greater fluctuations with an average of 1·5 million tons. Maize keeps close to its average of 0·6 million tons, while oats remain at 0·4 million tons. Vineyards suffer from parasitic trouble, and the area planted diminished gradually from 1905 (1·4 million hectares) to 1914 (1·2) then began to grow again, but without reaching its previous value. Yet the maximum crop corresponds to 1917 with over 4 million tons, of which 3·8 million were transformed into wine and produced 23·7 million hectolitres. The olive area grows steadily, and reached 1·6 million hectares in 1918. The maximum crop corresponds to 1911 with 2·2 million tons of olives, of which 2·1 were transformed into oil (0·4 million tons). The average figures are about half. Sugar, both cane and beetroot, is cultivated, but while cane decreases, beetroot shows an irregular increase in area (36,741 hect. in 1911, 66,000 in 1918). This increase does not, however, correspond to a similar increase in production. The best year was 1913, with 1·3 million tons, and the worst 1918, with 0·672 million tons. While the average value of the annual agricultural production of the country in 1903–7 was estimated at 3,824,394,425 pesetas (£152,975,777), it was valued at 7,975,623,025 pesetas (£319,024,921) in 1916. A growing tendency is manifest towards the use of mechanical implements, of which there are several manufacturers in the country. More important machinery is imported, mostly from America.

Mining.—Mining was much stimulated by the war, the high price of coal having allowed the working of deposits which would not have been economically workable in normal conditions. Some Spanish products played an important rôle in the war; thus, pyrites were in high demand. The total value of the production of Spanish mines passed from 453 million pesetas in 1910 to 1,323 millions in 1917.

Railways.—There are 14,902 km. of railway lines, of which 11,378 are normal and 3,524 narrow gauge. In 1918, the number of persons conveyed rose to 75,480,648, or an average of 206,796 daily. In the same period the transport of goods rose to 35,244,659 tons. Gross receipts amounted to 557,931,445 pesetas, or 37,060 per kilometre.

Pre-war and after-war traffic figures are as follows:—

	Persons	Goods (tons)
Pre-war average	50,350,000	29,090,223
1920	84,300,000	35,351,920
Increase	33,950,000	6,261,697

When war broke out, the Spanish railways were going through a crisis of growth, the traffic of the country having developed in excess of the railway plant, while the companies found themselves too near the date when they had by statute to revert their lines to the State, to be able to borrow money on good terms. The war aggravated this situation by all but stopping coast-shipping. Since then, a great increase in salaries and wages, as well as the rise in the price of coal and materials, has completely upset railway finance. An increase of 15% in rates was allowed after much opposition, and another is proposed which public opinion refuses to countenance. Several schemes are afoot to cope with the difficulty, all of them including a greater or lesser measure of State interference.

An electric railway line is proposed to link Dax with Madrid and Algeciras, by means of a French-gauge line, to be linked up in the future with Moroccan lines. This scheme is subordinate to a general scheme for the harnessing of water-power in the whole peninsula, through the construction of hydro-electric stations and a polygonal distribution line. A further advantage of the scheme would be that the numerous deposits of second-rate fuel existing in the peninsula would then be economically exploited in the production of electricity.

Merchant Marine.—Despite heavy war losses, the merchant fleet was in 1920 slightly larger than in 1914. The figures for 1920 were:—

		Ships	Tons
Sail	more than 500 tons	38	53,906
	less than 500 tons	516	60,639
Steam	more than 500 tons	379	840,007
	less than 500 tons	259	52,640
Total		1192	1,007,192

This represents an excess of 318 sailing vessels with 81,575 tons and 10 steam vessels with 48,325 tons over 1914.

Industry and Commerce.—The war gave great stimulus to Spanish industries. Though many enterprises born out of the artificial conditions created by an exceptional Allied demand died out with the peace, progress is to be observed, particularly in Catalonia, Biscay and Asturias. Thus, while in 1905 there were in Spain 775 business corporations with an aggregate capital of 5,633 million pesetas, there were in 1916 no less than 2,435 of such corporations with a capital of 9,456 million pesetas. The average value of foreign trade for the pre-war period was about 2,250 million pesetas, or 112.90 pesetas per head. The war radically altered the *régime*. The commercial balance was against Spain in 1911. An excess of imports over exports, which had reached 150·5 million pesetas in 1900, fell to 3·6 in 1904, exceeded 100 millions in 1905 and 1906, fell to 2 millions in 1907, and varied between 16 and 75 millions in the following years, while in 1912 there was a 10·6 million excess of exports. 1913 and 1914 saw high excess of imports again (229 and 170 millions), but after the war *régime* began in 1915 Spain registered in 1918 her maximum favourable balance, amounting to 338 million pesetas. Considerable imports of gold and silver tended to neutralize this figure in the total commercial statistics. The value of the peseta rose accordingly (see Exchange, Foreign).

Banking.—The Bank of Spain increased its gold reserves considerably. From 576 million pesetas in 1914, they grew to 2,415 million pesetas in 1919. Banks developed in all parts of the country, and, with the end of the war, a general invasion of foreign banks was also to be observed. English banking, which till then had not seemed to be interested in the peninsula, appeared in Spain, and now forms an important feature in Spanish business, not only in Madrid, but in Barcelona, Valencia, Seville, etc.

Finance.—The Budget shows an increasing deficit due mostly to two causes: on the expense side, an increase in numbers and salaries of the bureaucracy; on the receipt side, a failure to reorganize taxation on a sound basis of direct taxes. If 1909 be taken as a unit (100), expenditure grew steadily up to 168 in 1918, while receipts grew to 134, including Treasury bills. The actual figures in pesetas for 1920–21 were:—Expenditure, 2,403,730,313.69; receipts, 1,842,720,570.32; the deficit being 561,009,743.37. The Public Debt, which had diminished by 2,000 million pesetas in 1910, had reached its previous amount again in 1918, and in 1920 was 11,926,295,232 pesetas.

Canalejas Ministry.

History.—The closing months of 1910 were occupied by important legislation carried on by the Canalejas Government. The "padlock" bill, forbidding the settlement of further religious communities in Spain until the negotiations with the Vatican were completed was carried in the Senate (Nov. 4) and a compulsory service bill introduced while the Chamber discussed a Municipal Taxation Reform Bill with a view to the suppression of the unpopular *octroi*. Meanwhile, Señor García Prieto, after laborious negotiations, brought to a head the Spanish-Moroccan Agreement, which was signed in Nov. (*see* Morocco). The Agreement was well received by all political parties except the extreme Left. A bill was introduced and passed, regulating work in the mines; a moderate measure but a step in the right direction. An important political event, the breaking up of the Republican-Socialist block which had been created under the Maura-Cierva reactionary administration, was brought about unexpectedly by a debate on the Barcelona water supply. Señores Azcárate, for the Republicans, and Iglesias, for the Socialists, having expressed their disapproval of the action taken in the matter by Señor Lerroux and his radical followers, who controlled the municipality of Barcelona, a rupture ensued. Thus began the gradual weakening of the anti-dynastic Left, which continued in later years. The "padlock" bill was passed by the Chamber of Deputies on Dec. 22.

Señor Canalejas' Cabinet ended the year greatly strengthened by its vigorous legislative policy. Yet, on the last day of the year, the prime minister being desirous of reconstituting his ministry handed in his resignation, and the King having renewed him his confidence, the new Cabinet was sworn in slightly reconstituted. The crisis thus settled, the King visited Melilla (Jan. 7–13) amidst scenes of great enthusiasm, France being represented by Gen. Toutée and by the warship "Du Chayla." Rumours of a Spanish intervention in Portugal began to circulate then but were promptly met by a strong denial from Señor Canalejas himself. This second Ministry lasted till April 3. Its main efforts were spent in securing unanimity for the negotiations with the Vatican, the most important point of which was the drafting of a new Associations Bill to apply to religious as well as to ordinary communities or societies, the Vatican refusing to renew negotiations unless the Spanish Government agreed to submit its bill to the approval of the Holy See. Señor Canalejas naturally resisted such a condition.

Associations Bill.

The Ferrer Case.

The Government was somewhat weakened by the attacks of Señor Urzáiz and Señor Azcárate on its financial policy particularly on their bills for the reform of the Public Debt and for certain alterations in the working of the Bank of Spain. But the end came from another quarter. A debate on the Ferrer case (*see* 25.568) gave rise to an extremely grave crisis. An outspoken speech by Don Melquiades Alvarez was answered by Señor Canalejas in a half-hearted way, which did not sufficiently conceal the fact that the prime minister was not far from agreeing with the opponents of the military court which had sentenced Ferrer. A deep discontent was soon manifest in the ranks of the officers of Madrid, and the War Secretary, Gen. Aznar, intimated that in his opinion the debate should be closed at once. Señor Canalejas submitted the resignation of the Cabinet to the King, who renewed his confidence to his prime minister. The new Cabinet appeared before the Cortes, and the debate on Ferrer's case was proceeded with in a somewhat cooler atmosphere. The incident was, however, typical as a forerunner of much that was to come in future years.

Morocco Crisis.

The attention of Parliament was soon diverted towards Moroccan affairs. The French were preparing their advance on Fez, a fact which forced Spain to an active policy in order to maintain her much diminished rights in Morocco. The first signs of this policy were received with ill humour by the French press, and a press duel began then between the two nations which was to last to the very eve of the World War. Meanwhile the Government had introduced its long expected Associations Bill (May 8), which provoked a protest from all the archbishops and bishops headed by the primate. The Government were successful in passing the bill for the suppression of the *octroi* (May 22). This success initiated a campaign of active opposition from the Conservatives, the aim of which was to defeat the bill in the Senate, but the plan failed, for the bill was passed by the Senate by 178 to 63 (June 3). The fact was significant of the amount of determination exercised by the Crown, for if it had not used its influence over the non-elective part of the Senate the Government would have been defeated by the Conservative vote.

The Government, meanwhile, in the teeth of popular opposition, rendered more dangerous by several strikes, was sending troops to Morocco and preparing for events. On June 9, Spanish troops landed at Laraish, thus putting France before a *fait accompli* which was not much to the taste of the Quai d'Orsay. France, however, was prevented from taking any strong action by the sudden arrival of the "Panther" at Agadir, but a certain tension prevailed between France and Spain all through the summer. At the same time, popular opposition to the war, not only to that which was going on in Morocco but to that which it was feared was going to break out in Europe as well, was spreading, and tended to encourage the extreme parties. Meetings took place in Barcelona and Madrid, this last one being stimulated by the presence of two French "comrades"; and a Republican rising plotted by the lower deck of the cruiser "Numancia," though unsuccessful, startled public opinion. The movement seems to have been connected with political efforts to overturn the monarchy, which were being prepared on land.

Labour Troubles.

The greatest danger, however, was to come from a campaign of strikes which began early in the year. In Sept., nearly all these strikes still dragged on, and their effect was further aggravated by the feeling that the Government was attempting a big operation in Morocco behind the backs of the people. Grave disorders occurred in the Bilbao district, where 20,000 steel smelters went on strike, and the situation developed soon into a general strike, which spread to the coalfields of Asturias. The Government, which at first seemed inclined to favour the workers for the sake of national conciliation in view of the international situation, gradually veered round. They began by suspending the constitutional guarantees in Biscay (Sept. 12); then, on receipt of grave news from Asturias, in the whole of Spain (Sept. 19). By this time, the movement had spread to nearly the whole peninsula, and grave disorders had occurred in Catalonia and Valencia, notably in Cullera, where a magistrate was mobbed to death. The Government met the situation with coolness and resolution, and by Sept. 22 the strike fever had abated upon the settlement of the Bilbao strike.

Morocco: Tension with France.

General Luque himself, though then a War Secretary, was sent to Morocco to preside over the operation, which began successfully on Dec. 6, but collapsed a few days later after a gallant attempt to force the passage of the River Kert. The Spanish press voiced a belief, then current in the Spanish army, that the Moorish tribes were provided with French arms and ammunition, and the imprisonment by the French Gen. Toutée of several French officials in Ujda gave some colour to this view, much resented though it was by the French press. General Luque, though in a veiled manner, suggested in an interview to the press that his failure had been due to lack of French coöperation. Under such unfavourable conditions began the negotiations for a Franco-Spanish agreement following upon the Franco-German Treaty on Morocco. The Spanish troops were soon attacked on the River Kert, and rumour attributed the move to French initiative. The matter had to be smoothed over by the Foreign Secretary, Señor García Prieto (Dec. 28).

Cullera Rioters Reprieved.

During the first days of the new year the case of the Cullera riots came before the military supreme court. The court pronounced seven death sentences, and a press campaign started at once for the reprieve of the seven condemned men. Señor Canalejas seized the opportunity to make the King benefit by the popularity which always follows acts of clemency. He brought his Cabinet unanimously to agree that six out of the seven men should be reprieved, but that the seventh, the head of the riot, known as *El Chato de Cuqueta*, could on no account be recommended for mercy. He then allowed King Alphonso to be besieged by petitioners, including the old mother of the doomed man, who was granted a special audience, so that the King might be provided with an excuse for reopening the affair. Thereupon, Señor Canalejas agreed to reprieve *El Chato*, but resigned. Though the resignation was purely formal, the King took for himself all the merit of the act of clemency, and a wave of popular gratitude was his reward. Thus by a mixture of mercy and ability, Señor Canalejas reversed in 1912 the position which Señor Maura had created by his uncompromising policy of 1909, and this incident did much to harden Señor Maura in his attitude of "*implacable hostilidad*" to the Liberal party.

Canalejas Cabinet Reconstructed.

Much of the parliamentary session was spent in the usual recriminations wherewith the Conservative party endeavoured to weaken Senor Canalejas' position, and on March 11 Señor Canalejas had to sacrifice several of his colleagues, notably his Minister of Public Works, Señor Gasset. The King renewed his confidence to Señor Canalejas, and the new Cabinet was reshuffled. The inclusion (as Minister of Education) of Señor Alba, known to be a personal follower of Señor Moret, was considered as a token of reconciliation between Señor Canalejas and his former chief. Señor Canalejas seized the opportunity afforded him by this crisis to adjourn Parliament until May 1.

Reformist Party.

Local Government Bill.

The salient feature of this interval was the launching of the Reformist party by Don Melquiades Alvarez, a moderate Republican working in close touch with Señor Azcárate and Señor Perez Galdós. In a first speech delivered on April 7, Señor Alvarez announced the formation of a Reformist party which would reconcile the moderate elements of the middle classes with Republican ideas. This was but the beginning of an evolution which was destined to bring a certain important portion of Republican opinion into the fold of the monarchy. On May 1 the Cortes was reopened and an agitated parliamentary session began, in which the main question in debate was the bill called "De Mancomunidades." This bill was a sop given by Señor Canalejas to Catalan opinion, for it allowed *Diputaciones* (elected provincial councils) to unite into groups for purposes of common administration, a measure which, though in appearance of a general character, was meant to enable the four Catalonian provincial councils to unite into a kind of local parliament. The bill caused a deep cleavage in the ranks of the Liberal party. General Weyler, Señor Montero Rios (president of the Senate), Señor Moret, and Count Romanones (president of the Chamber) were all emphatically against it. Senor Canalejas' difficulties were increased by the fact that, though the measure formed a part of a more ambitious Local Government Bill devised by Señor Maura during his last term of office, Señor Maura opposed it on the ground of its having been as it were taken from its context. Yet Señor Canalejas piloted his bill successfully through a hostile Chamber, and when, on July 5, he had the Cortes adjourned, the bill had been virtually passed. He, however, avoided a final vote, knowing that, on the bill appearing before the Senate, Señor Montero Rios would resign. His triumph was therefore more apparent than real.

Period of Great Strikes.

Murder of Canalejas.

Treaty with France.

With the summer a period of strikes set in. Saragossa, Málaga and the mining and steel-smelting district of La Felguera (Asturias), became restive with social strife (August). Reus, Madrid and Murcia also suffered from partial strikes. But all these conflicts were soon overshadowed by a grave railway strike which affected nearly the whole country. Señor Canalejas met it by applying Art. 221 of the Recruiting Law, which in cases of danger or abnormal circumstances allows the drafting into military service of all men of military age working in industries of public importance; and this measure, combined with a really conciliatory policy, caused the collapse of the strike on Oct. 5. On Oct. 14 the autumn session of the Cortes began, and three days later the bill "De Mancomunidades" was passed in the Chamber, but the work of the session was suddenly brought to a close by the murder of Señor Canalejas on Nov. 12. The prime minister was shot dead in the Puerta del Sol (Madrid) in broad daylight, while he was inspecting the books at a book-shop window. The emotion aroused by the crime was enormous. The King, with his usual impulsiveness, hurried to the Home Office, where the body had been laid, in the first carriage which he found at his disposal; then, on the day of the funeral, he walked in person at the head of the mourners, through the streets of Madrid. This brought him great popularity. Meanwhile, Count Romanones had replaced Señor Canalejas at the head of the Government, with the definite task of passing the budget and of completing the treaty with France. On Dec. 27 this treaty was signed, after laborious negotiations which had begun on Dec. 6 1911. The discussion of the treaty occupied the remainder of the session, which Count Romanones closed at Christmas.

Romanones Government.

Having thus fulfilled the programme for which he had been entrusted with the seals of office, Count Romanones gave the King an opportunity to alter his policy by tendering the resignation of the Cabinet. The King, without consulting any of his statesmen, gave Count Romanones a new lease of power. This decision finally settled the question of Señor Canalejas' successorship to the direction of the Liberal party in favour of Count Romanones. Yet, his rival, Señor García Prieto, though bowing for the moment to the royal pleasure, signified his intention to stand for the leadership in the future by abstaining from a seat in the Cabinet, though coöperating with Count Romanones from outside. The Liberal solution of the crisis contributed further to increase the popularity of the King. The sensational withdrawal from public life which Señor Maura announced on Jan. 1 1913 worked in the same direction. In a lengthy note addressed to his followers he animadverted on the action of the King in having lent himself to a policy of coöperation between the Liberal opposition and the antidynastic Left. Señor Maura resigned his seat in the Chamber, followed by Señor La Cierva, and as these two names had symbolized reaction to the Spanish people since 1909, their withdrawal, in direct conflict with the King, enhanced the prestige of the Crown. Señor Maura's retirement was of short duration. On the 4th he saw the King; on the 10th he answered a message from his followers by accepting once more the leadership of the party.

Señor Alvarez, who meditated a *rapprochement* with the monarchy, made on this occasion a sensational speech, in which he had the courage to bestow great praise on the King at a public Republican meeting. Encouraged by the success of this first attempt, he spoke in the same strain in Murcia (Jan. 12) and obtained from his Republican audience an enthusiastic ovation for the King's policy. Nor did King Alphonso sleep on his laurels. On Jan. 14 he summoned to the palace for consultation the three most eminent men of Republican Spain, Señor Azcárate, head of the Republican-Socialist Coalition, and a respected specialist in labour questions, Prof. Cossio, a well-known pedagogist and art critic, and Señor Ramón y Cajal, the famous biologist. The significance of these interviews escaped no one, and least of all the Conservative Reactionaries. On Feb. 11, these interviews were the main subject of speeches delivered by Señor Azcárate and Señor Alvarez at a Reformist banquet in Madrid, the net result of which was the public recognition by these gentlemen of the fact that, whatever obstacles there were to the democratization of Spain, they did not come from the Crown. The meeting, a further step towards the monarchy taken by the middle-class and intellectual section of the Republican party, served to outline a scheme of conditions and constitutional guarantees which the Reformist party would require in order to coöperate with the Crown.

Count Romanones took a good share of whatever merit there was in this policy. The death of Señor Moret (Jan. 28) removed his most serious rival in the Liberal party. Count Romanones then endeavoured to persuade Señor Azcárate to accept the presidency of the Chamber, a clever move likely to reflect favourably on the prime minister, while avoiding the elevation of any would-be rival to the post considered in Spanish politics as the stepping stone to the premiership. Señor Azcárate refused, and Señor Villanueva was at last selected. The King's official visit to Paris, on completion of the Franco-Spanish treaty, had proved a success (May 6–9), and Count Romanones, having replaced Señor Villanueva by Señor Gasset as Minister of Public Works, felt strong enough to face the Cortes. But no sooner had he appeared before Parliament (May 26) than a speech by Señor Maura (28th) forced him to hand in his resignation. Señor Maura had merely re-stated his position of "*implacable hostilidad*" to a policy of coöperation with the parties of the antidynastic Left, and Count Romanones thought that no Liberal party could govern without a properly constituted Opposition, willing to take office on the fall of the Government. The crisis was again solved by the Crown in favour of the Liberal party. The King ratified the policy which Señor Maura had refused to countenance, and Count Romanones came back at the head of the same Government. But the discussion of the bill "De Mancomunidades," which at last had to come before the Senate, produced a still graver crisis, for it precipitated the division of the Liberal party, latent since the death of Canalejas. The group headed by Señor Montero Rios (president of the Senate), and his son-in-law, Señor García Prieto, dissented from that of Count Romanones on the principle of this bill, Count Romanones having accepted it as part of Canalejas' political testament. This difference of opinion brought about the resignation of the Cabinet (June 11). Despite insistent efforts from the King, no solution could be found to bridge over the difficulty; and on June 13, Count Romanones having failed to conciliate the non-conformists of his party, formed a Cabinet of personal followers, which aggravated the division. Parliament was indefinitely adjourned. The division in the party materialized in the formation of a García Prieto faction, and it was generally realized that the solution given to the crisis was a mere stop-gap, necessitated by the coming visit of M. Poincaré to Madrid.

Franco-Spanish Rapprochement.

The Government weathered several strike difficulties and had to face a troubled period of unrest in Morocco, where Gen. Marina succeeded Gen. Alfau as High Commissioner. A Franco-Spanish *rapprochement* was then initiated, with a visit of Gen. Lyautey to Madrid and of M. Barthou, the French prime minister, to San Sebastian, where he saw the King. All these movements prepared the ground for the official visit of M. Poincaré, then President of the French Republic, who arrived in Madrid Oct. 7. The President left Spain by way of Cartagena, where he embarked on the battleship "Diderot," Spain being represented by the battleship "España" and England by H.M.S. "Inflexible." Both the King and the President emphasized the fact that it was in Cartagena that six years earlier Spain, France and England had agreed on a common policy in the Mediterranean.

Señor Dato Prime Minister.

As soon as the summer holidays were over and M. Poincaré had left Spanish soil, the latent crisis which divided the Liberal party broke out again. The prime minister had to provoke it himself in the Senate. He was beaten (Oct. 25) and he resigned. The King then considered that the Liberal policy which he had consistently followed since Señor Maura's fall in 1909 was at an end. But he was not ready to follow Señor Maura in his uncompromising attitude, and he selected Señor Dato as a solution more acceptable to the democratic wing of the country. Señor Dato was unable to consult his chief on the King's offer, for Señor Maura had left Madrid for an unknown destination. He therefore accepted office (Oct. 27), being averse to leaving the Crown without the services of one of the two great historical parties. From this date, the Conservative party began to show open signs of division, and thus the second of the two great rotating parties, which Cánovas and Sagasta had created, began also to disintegrate. The first act of the new Government was to grant a decree giving validity of law to the bill "De Mancomunidades," a move directed to enlisting the sympathies of Conservative opinion of Catalonia. On the last day of the year, Señor Dato obtained from the King a decree dissolving the Cortes.

Opposition to the King's Personal Power.

The first half of 1914 saw the consolidation of the Dato faction of the Conservative party. The general election, which took place in the spring, yielded a sufficient majority, both in the Senate and in the Chamber. Moroccan affairs were the main subject of discussion in Parliament and press, and the King lost a good deal of the popularity which he had won under the Liberals on account of several incidents which, rightly or wrongly, were interpreted as acts of personal power and interference with the discretion of the Government in military matters. This opinion was strengthened by an uncalled-for decree, countersigned by Gen. Echagüe as War Minister, establishing the King's right to correspond directly with his army officers of all ranks. Yet the Reformist movement, which had gathered great momentum at a demonstration on Oct. 23 1913, when Don Melquiades Alvarez had defined its aims and limits, gained ground, ably helped by an intellectual group headed by Prof. Ortega y Gasset.

The international situation of Spain at the outbreak of war was defined by two sets of circumstances: official, and national or popular. The official situation was ruled by the Cartagena Agreement of 1907, confirmed by the conversations held in the same place in 1913 between M. Poincaré and Count Romanones. These agreements and conversations stipulated that "should new circumstances arise tending to alter the territorial *status quo*" in the Mediterranean or in the European and African coasts of the Atlantic, the three powers concerned (Spain, France and England) would "enter into communication" in order to take any measures that might be necessary. The war was obviously a "circumstance" falling within the limits of the above definition. Yet Spain did not "enter into communication" with France and England. But, contrary to what was generally believed at the time, her abstention was due to the fact that the two powers most interested in the matter, France and England, made no sign to set in motion the Cartagena Agreements. Faced with this situation, Señor Dato promptly declared for an absolute neutrality. This decision was based on a sound reading of the situation from its national and popular point of view. The violation of Belgium had given to the war an almost sacred character which the Allies emphasized to the full. Yet the fact did not escape Spanish public opinion that, though the defence of Belgium and the interest of the Allies were two coincident aims, they were not essentially one and the same "cause." Thus, while the generosity of England in rushing to the rescue of Belgium (and for that matter of France) was not denied, it was also realized that England had a strong national interest at stake which powerfully helped her to make up her mind. Now, such a strong national interest was entirely lacking in the case of Spain. Spain was in fact the only European nation which had no stake in the war. Add to this that the nation was divided as to its feelings. The working classes, the more numerous part of the intellectuals and most of the trading communities, were pro-Ally. The clergy, most of the army and of the bureaucracy and the "idle rich," were pro-German. The Moroccan negotiations had by no means improved the feelings of the Spanish people towards France. For the well-informed politician and publicist, France was the nation which treated with Germany and with England as if Spain did not exist, and turned round afterwards to make Spain pay what she had had to pay in Berlin or in London. For the clergy, France was the atheistic republic, the scarlet woman of the West. For the army, France was the ever-watchful rival in Morocco. For all of them, England was a nation whose dominating principle in foreign affairs was the increase of British power. Thus, the country was split into a reactionary and conservative pro-German wing and a democratic or "advanced" pro-Ally wing, and, as this division was real, and not fictitious as were the party groups, it cut across the parties. So-called Conservatives such as Señor Sánchez de Toca, so-called Liberals such as Count Romanones, sided with Reformists and Republicans on the pro-Ally side, while Liberals such as Señor Villanueva and Conservatives like Señor Besada led the pro-Germans.

Policy of Neutrality.

On one definite point everybody agreed. Spain was to keep out of the war. There were only two exceptions, more apparent than real. Señor Lerroux, the leader of the Catalan Radicals, advocated participation in the war on the side of the Allies. But he spoke without responsibility, as a man who knows that he can make capital out of an opinion which he is perfectly sure he will never be in a position to carry into practice from office. The other case was more serious. On Aug. 10 *El Diario Universal*, a paper known to reflect the opinions of Count Romanones, published an article under the title of "Deadly Neutralities," which in a veiled manner advocated participation in the war on the side of the Allies. It created a great sensation, for it was attributed to Count Romanones himself, and it is certain that, if not written by him, the article was concocted under his direct inspiration. As events were to show, it was only meant as a *ballon d'essai*, and, after a short period of press agitation, was forgotten.

War Legislation.

The Government concentrated their activity on the organization of the country for the new situation created by the war. A "Committee of Initiative" was created for the study and coördination of national and private efforts to deal with war problems, and this Committee was put under the chairmanship of Señor La Cierva—a move to attract this important political figure to the Datist side of the

Conservative party. Parliament resumed its sittings on Oct. 30 and unanimously endorsed the foreign policy of the Government. The country was meanwhile recovering from the first shock of the war, getting used to abnormal conditions, and even beginning to realize that there might be some material profit to be made out of it. The pro-German press raised frequent protests against the enormous increase in exports to France which the Customs reported. Metals, raw and manufactured, clothes and boots, all kinds of foodstuffs, horses and mules, poured into France, under the "neutral" eye of the Government. Before adjourning the Cortes, however, the Government introduced and passed a bill which gave them special powers to deal with such matters as customs tariffs, railway rates, State purchases of food, shipping and expropriation of foodstuffs. A navy bill was also passed, authorizing the building or purchase of 4 fast cruisers, 6 destroyers, 28 submarines, 3 gun-boats, 18 mine-laying and auxiliary ships, mines and submarine defences, aircraft, and several important naval land works in Ferrol, Cadiz and Cartagena. The Foodstuffs Act did not prevent a period of serious unrest in the spring, due to the scarcity artificially created, partly by excessive exports, partly by speculative holding up of stocks. Special Juntas, composed of the civil governor, the financial delegate and the mayor of the provincial capital, were set up in each province to administer all available stocks of food, and a policy of prohibition of exports was even initiated in March (1915). Yet the great increase in exports had contributed perhaps more than any other cause to the rise in the value of the peseta, a rise which gave the Government an opportunity to repatriate the Public Debt, *i.e.* enacting that all Spanish Government stock held by foreigners which was payable in francs or sterling should become payable in pesetas in the Spanish market.

German Propaganda.

Though the Cortes was closed, great political activity was displayed, by all parties, with a view to a consolidation of the loose political forces of the day into that symmetric form of two rotating parties the need of which seemed to be felt as a habit by all concerned. This activity, which the Government had driven towards the press and public meetings by closing Parliament, was stimulated by an active German propaganda, soon to be imitated by similar endeavours on the part of the Allies. The mouthpiece of extreme pro-German views was Señor Vazquez de Mella, an eloquent and versatile Carlist professor and M.P., who on May 31 pronounced a strong pro-German speech in the Zarzuela theatre (Madrid), before a house full of Germans, Carlists and Maurists, and adorned by the presence of a cluster of aristocratic ladies, many of whom belonged to the Queen's household. But though the excitement produced by this and similar outbursts of partisan feeling did not go very deep, and though the mass of the people were not swayed out of the attitude which they had spontaneously assumed, the Government thought there might be some danger in liberty, and they decided to deny all permits for meetings on neutrality and the war. Despite many complaints, for the measure was obviously illegal, the Government held fast to their decision.

Financial Crisis.

It is worth noting that while this protest from all political groups, including the two sections of the Liberal party headed by Count Romanones and Señor García Prieto, failed to shake the power of the Government, a crisis was precipitated on the refusal of the business community to coöperate with the Government in the launching of a loan. The Finance Minister, Señor Bugallal, prepared an issue which was expected to yield 750 million pesetas (£30,000,000); 283 of which were already covered by exchange for an equivalent sum in short-term bonds. The new money to be found did not therefore exceed 467 million pesetas, or a little over 19 millions sterling. Now, of this sum, no more than 52 million pesetas (just above 2 millions sterling) was subscribed, and it was noticed that small subscriptions far exceeded the sums subscribed by big owners of capital. Several explanations were put forward, but the main cause of the failure seems to have been a reluctance of business circles to subscribe under conditions which were not considered generous enough for the subscriber. The resignation of the Government (June 22) as a result of this failure was quickly followed by a reinstatement of the same Cabinet, despite the insistent desire for retirement manifested by the Minister responsible, Count Bugallal. The situation of the Treasury was by no means flourishing. The estimates for 1915 had been set at 1,465 million pesetas against 1,281 million pesetas revenue. But as months went by, both sides of the account showed signs of moving in the wrong sense. The liquidation at the end of the year was to show that revenue would remain at 1,202 million while expenses, not including Government purchases of foodstuffs, were to rise up to 1,556 million. The Government had to fall back on Treasury Bonds negotiated through the Bank of Spain.

Industrial Prosperity.

The difficulties were of course of a purely administrative order, for the work of the country was in full swing under the stimulus of war orders. As one sign of this growing industrial coöperation between Spain and the Allies, the shipowners announced to the Government (Aug. 1915) that the premiums granted them by the Shipping Acts as a measure of protection were no longer necessary and would not be cashed. This was, of course, but a euphemistic way of hinting that such premiums were no longer worth the sacrifice which they entailed of the shipowner's liberty to trade as he pleased between foreign ports. Great shipping profits ensued, and torpedoings followed. On Aug. 17 the s.s. "Isidoro" of Bilbao was sunk by a German submarine. On Aug. 20 the s.s. "Peña Castillo" of Santander sank in obscure circumstances. Public opinion was divided as to the right attitude to take in these circumstances, and while it was generally recognized that some sort of protest should be made, the free hand claimed and obtained by shipowners for the carrying on of their highly profitable industry was a serious handicap to their case.

Fall of the Dato Government.

Though the war absorbed most of the political interest of the day, several efforts were made to reunite the Liberal groups into one party again, and these efforts having failed, owing mainly to the unwillingness of either leader to surrender his claims to the leadership of the whole, Count Romanones, the more active of the two, prepared a plan of campaign against Señor Dato's Government on the Military Reform Bills then being prepared by the War Secretary, Gen. Echagüe. General Echagüe introduced his bills, and Señor Dato declared that the Chamber would have to pass them before discussing the budget. Count Romanones was adamant against this condition imposed by a Government which had kept Parliament closed for the best part of the year, and the Government fell on Dec. 6.

Romanones Cabinet of Reunited Liberals.

This crisis is worth recalling for it marked a further step in the approximation of Don Melquiades Alvarez to the monarchy. King Alphonso having expressed a wish to hear Señor Alvarez' opinion along with that of the leaders, the chief of the Reformist party called at the royal palace for the first time. The crisis ended in the formation of a united Liberal ministry (the two groups having melted into one as they came nearer the warmth of office). Count Romanones took the premiership, and, in order to counterbalance the effect of his well-known pro-Ally views, assigned the Foreign Office to Señor Villanueva, a notorious pro-German. Señor Barroso (Justice) and Señor Burell (Education) represented the García Prieto faction. Señor Urzáiz, an independent and outspoken Liberal, went to the Exchequer, probably at the suggestion of the King, who also caused Admiral Miranda, though a Conservative, to remain at the Navy Office. General Luque came back to the War Office, and Senator Salvador was appointed Minister of Public Works.

The programme of the Government was very much the same as that of its predecessor: neutrality, military bills, financial and economic reforms, and the budget. In a sense, the inclusion of Señor Urzáiz, who, though a Liberal, was a party unto himself, and of Adml. Miranda, a Conservative, initiated the period of mixed ministries, which was about to open as a logical consequence of the gradual weakening of the old parties, and in its turn would accelerate the process of their disintegration. The experiment, so far as Señor Urzáiz was concerned, proved a failure. A man with a strong will and little adaptability, he came into conflict with his chief and was dismissed before he had time to resign (Feb. 25). The union of the two branches of the party which this Cabinet consecrated was apparent. Apart from the underlying cleavage between the García Prieto and the Romanones groups, the party showed further signs of division owing to the rising ambitions of Señor Alba, who by a clever use of the opportunities of his new office, made for himself an enviable reputation of a bold democratic tax-legislator. His bill on war profits aroused the opposition of all the minorities except the socialist. Yet Count Romanones, with a fine political *flair*, backed his Finance Minister. The matter, however, was purely political, for the bill had not been passed when the Cortes was closed, a general railway strike having suddenly upset all Government plans on July 13. Count Romanones faced the conflict with an unusual luxury of precautions, constitutional guarantees were suspended in the whole peninsula, and martial law declared in Madrid. But the strike was over one week later, and the autumn session was too deeply occupied in the discussion of Señor Alba's ambitious budget schemes to think of the War Profits Bill. The discussion of these schemes dragged on till Dec. 19, when it was resolved to validate the old budget for the coming year, while the new one was further discussed. The Government reappeared before the House on Jan. 19, but in the meantime Count Romanones had resigned and accepted office again with the same ministry. This curious crisis (Jan. 9) was probably devised by the prime minister as a means to recover from the King the moral authority which some thought he had lost at the hands of the pro-German press, which accused him of drawing great profits as a business man from his foreign policy as a prime minister.

Resignation of Romanones.

Count Romanones wore his neutrality with a difference, and, though the inheritor of Señor Dato's policy, he did little to conceal his pro-Ally views. The natural development of the war made every day more urgent the need of defining a policy which would be something more than a mere passive attitude. By Sept. 1916, Spain had lost more than 30,000 tons of shipping by torpedoing, and more than 50,000 in circumstances which were, to say the least, obscure. The shipping interests asked for Government help. A period of Government activity set in, during which Count Romanones was loyally seconded by Señor Gimeno, a pro-Ally Foreign Secretary, but the pro-German press countered by a fierce personal campaign against the weakest flank of the Government, the prime minister's industrial interests. On Jan. 31 Germany sent in a note establishing an "absolute blockade" of the Allied coasts. Count Romanones was committed to a policy which implied a firm answer to such a note. He gave it, for, though somewhat watered down by his pro-German colleagues, the Spanish note of Feb. 6 signed by Señor Gimeno was a well-worded protest against German methods with neutral rights. But the prime minister was too shrewd a politician not to realize that this firmness meant nothing unless backed with the will to fight if necessary, and that public opinion would not follow him so far. He therefore resolved to leave the Government there and then, at the top of the wave of his own policy.

Social-Political Upheaval.

Other considerations of home policy were perhaps not altogether without effect on his decision. A dangerous social-political upheaval was taking place under his eyes. In March and April, a serious strike situation developed in Madrid and Valladolid, which necessitated this second town being declared in a state of siege. In Barcelona, a military conflict, which was fundamentally to alter Spanish politics for years to come, was beginning to make itself felt. When on April 20 Count Romanones resigned, he took the easiest path. His fall, however, cost him the leadership of his party, the majority of which, somewhat frightened at his bold foreign policy, turned towards Señor García Prieto, while Señor Alba consolidated a separate group. The new Ministry, under the premiership of Señor García Prieto, was frankly neutralist, and Germany rightly interpreting the position felt freer to intensify its submarine campaign. But the Government had to concentrate on a far graver problem, the situation created by the so-called Committees of Defence. The artillery and engineer officers had been organized for years past into a Committee of Defence, the main object of which had been the maintenance of certain standards of professional honour and of certain rules of comradeship as to promotions, etc. The infantry officers had no such organization, their *esprit de corps* being less developed. But towards the middle of 1916, a system of infantry Committees of Defence had appeared, which soon evinced a tendency to claim authority over the army, and to interfere with the Government in such a manner that towards the end of the year, Count Romanones, then in office, insisted on their dissolution. Despite the reassuring reports of Gen. Alfau, Capt.-General of Barcelona, the headquarters of the organization, the system continued, a situation which was not altogether unconnected with Count Romanones' eagerness to resign in April 1917. General Aguilera, the War Secretary in Señor García Prieto's administration which then took office, was frankly averse to the Committees, and ordered the leaders to be arrested. A reserve Junta had been prepared, which stepped into the shoes of the arrested officers, and the conflict was only aggravated. General Alfau was dismissed and General Marina sent in his stead. But meanwhile, probably owing to royal hints, a less disciplinarian line of action was taken, and the arrested men were released. It was known later that an ultimatum had been placed in the hands of Gen. Marina, with a time-limit of 12 hours (June 1). Not unnaturally, the Government resigned. Count Romanones having refused to support any Liberal situation which would recognize the Committees, Señor Dato was called to office, and on June 9 the Liberal party ended a short spell of office during which its disintegration had rapidly advanced. Señor Dato's Government capitulated before the Juntas and accepted their regulations in full.

Dato Again Prime Minister.

This victory of a movement which, in its essence, was revolutionary, had an immense effect on immediate events as well as on the political evolution of the country. The revolutionary ferment was stimulated. A state of excitement and hope—due to the plausible, high-spirited language of the Juntas—spread over the revolutionary Left. The more responsible elements of advanced politics thought it necessary to give a lead to this popular spirit. Political manifestos asking for a renovation in Government and Constitution followed each other (Socialists June 12, Catalanists June 16, Left-Coalition June 16). All but three of the deputies and senators for Catalonia met on July 5 at Barcelona, and passed a resolution asking for an immediate meeting of the Cortes, and declaring that, should the Government refuse to comply with this request, a meeting of all the deputies and senators composing the Cortes would be called at Barcelona on July 19. The Government refused to recognize the right of the Catalan representatives to dictate its policy, and made it known that should the Assembly meet on the 19th it would be considered as rebellious and treated as such. The Assembly met, 13 senators and 55 deputies attending, including all the Socialist Republican and Reformist members of the Cortes, and, before the Civil Governor dissolved it by (formally) arresting one by one all its members, it voted conclusions asking for a reform of the Constitution, and set up three commissions to prepare reports on reforms to be submitted to a second meeting to take place later. At one moment, it looked as if these 68 men would take the lead of the revolutionary spirit which the bold action of the army officers had stirred in the country. But the mass of the Assembly was too dull, and no real leader manifested himself in it. Thus two attempts, one military, one middle-class, both directed against the evils of the old *régime*, failed through lack of coördination and mutual understanding. A third attempt, and a third failure, was still to come. On Aug. 2 the railwaymen of the Northern railway announced a strike. Though at first the men appeared desirous of a settlement, neither the Government nor the company succeeded in

The General Strike.

avoiding the strike, which began on the 10th. On the 12th, a general strike was suddenly launched in the whole country. It was clearly revolutionary, and aimed at the overthrow of the monarchical system and its replacement by a more or less socialistic republic. The country was declared in a state of war. Riots of a grave character took place in nearly every important town and industrial district of the country, and the military, which had been entrusted with the situation, crushed the rebellion with a ruthless hand. This revolutionary onslaught was somewhat aimless and impulsive, yet the period of street fighting lasted a whole week. By Aug. 9 the situation was well in hand. The net result was to prove that the only real force in the country was the Army Committee system.

Power of the Committees.

García Prieto Coalition Government.

On Aug. 10, the Council of Ministers passed a special credit for military expenses, implying an extension and renovation of several important services. The Juntas, conscious of their strength, encroached further and further upon the administration of the War Office, and even asserted themselves in the field of civil politics. Their first victim was Marshal Primo de Rivera, whom they practically forced to leave the War Office. Then the scandal became public, on the Government having lifted the censorship. The Committees attempted to deliver a message into the hands of the King, and a period of intense political excitement ended in the fall of Señor Dato, who had to resign on a "perfectly constitutional" hint by the King. In point of fact Señor Dato was expelled by the Army Committees. The crisis was long and laborious, and in the midst of it, the Parliamentary Assembly met in Madrid (Oct. 30) in order to hear the reports prepared by the three commissions appointed in its first sitting. Speeches were pronounced by Señor Cambó and Señor Alvarez, which were addressed rather to the King, then in consultation with political leaders, than to the Assembly. Both leaders declared that they would not accept office in a Government which would not be ready to adopt the conclusions of the Assembly, involving some democratic changes in the Constitution. But while Señor Alvarez held fast by this declaration, Señor Cambó allowed two of his followers to enter the Cabinet which was at last formed by Señor García Prieto. This Cabinet was a Coalition ministry in which, in order to give satisfaction to the new demand for an impartial general election, a non-political judge was given the post of Home Secretary. It was composed of Maurists, Liberals and Catalanists. Señor La Cierva, who took the War Office, was the real head of the Cabinet. His policy consisted in ingratiating himself with the Committees of Defence, so as to become their leader and representative.

An incident which occurred early in the year (Jan. 3) showed the extent to which the revolutionary action of the Juntas had affected the army. The N.C.O.'s, it was suddenly found out, had formed a Committee of Defence and were threatening to take action unless their claims were satisfied. Señor La Cierva had no difficulty in applying to them, with the blessing of the Officers' Committees, those drastic measures which the Officers' Committees had themselves deserved. Nor was the system of Committees of Defence limited to the army. Juntas were soon formed by the civil servants of nearly all Government departments, and on Jan. 12 1918, on the occasion of a difference between the Postmaster-General and his subordinates, an agitation began which was ultimately to cause the downfall of the Government. On Feb. 21 the telegraph officers went on strike—by meticulously carrying out official regulations.

Señor La Cierva and the Committees.

Ministry of "All the Talents."

On Feb. 24 the general election took place in these abnormal conditions. For the first time a Coalition Government presided over an election, and great hopes were entertained as to the result. The new Chamber, however, was but an average of the preceding ones, different only in that no party in it had a clear majority. Señor La Cierva began then to act as the self-appointed leader of the Committees. He first provoked a crisis (Feb. 27) so as to get rid of his Catalanist colleagues, Señores Ventosa and Rodés, who would have been obstacles to his plans, and having accepted their replacement by two second-rank men he faced the Government with a demand that a programme of extensive military reform be enacted by Royal Decree, without submitting it to Parliament. This provoked a second crisis, Señor Gimeno, Count Romanones' representative in the Cabinet, having stood firm against such an insult to Parliament. The crisis, however, was settled on the secret understanding that the decree would be granted while Señor La Cierva would negotiate the self-dissolution of the Juntas. Then the conflict was suddenly aggravated on its civil side, the Government having decided to be as firm with the civil Juntas as it had been weak with the military ones. At the instigation of Señor La Cierva, the telegraphs were put under War Office authority and all civil Juntas were declared officially dissolved (March 14), while Señor La Cierva obtained from the military officers an apparent submission under the form of a reduction of their own Juntas to the status of "Committees of Technical Studies." On Feb. 17 the postal services declared a strike. Señor La Cierva's efforts to cope with this by means of military improvisations ended in utter failure, and at the very first sitting of the Cortes (March 18) the Government fell. All possible combinations were tried and failed, until on March 21 at midnight, at a meeting of ex-prime ministers called by the King in his study, after, it is said, having threatened his abdication, King Alphonso succeeded in forming a "ministry of all the talents," composed as follows: Maura (Premier), Dato (Foreign Office), Besada (Finances), Cambó (Public Works), Alba (Education), Marina (War), Pidal (Navy). The solution given to the crisis produced an outburst of popular enthusiasm due mostly to the downfall of Señor La Cierva. This Government had agreed on a concrete programme: reform of the standing rules of the Cortes, amnesty, military reforms, budget. The Government carried them all but the fourth, Señor Alba having left the Cabinet on their refusal to pass his education plans (Oct. 8), which ultimately brought the Cabinet to its end on Nov. 6.

Liberal Government of García Prieto.

Romanones Ministry.

The new Government had to be formed amid the sensation caused by the arrival in Madrid of the news of the Kaiser's flight, and great changes were expected as the result of this. The Reformists having refused to coöperate on the conditions offered them, the changes were limited to the appointment of a Liberal Ministry, on Nov. 9, with Señor García Prieto as prime minister. The world being full of the idea that the triumph of the Allies meant that of democracy, the Government published an "advanced" manifesto. Other signs of the *Zeitgeist* were a bold Land Bill, introduced by Señor Alba, a series of telegrams of congratulations sent by King Alphonso to all the Allied chiefs of state, a meeting of the Conservative party, where a reform of the Constitution was seriously mooted, the waiving by the Government of their right to appoint the Mayor of Madrid, and a revival of the Catalanist question as manifested in a message to the Government addressed by the *Mancomunidad*. This last message produced a split in the Cabinet, Count Romanones, its Foreign Secretary, being in favour of Home Rule. The ministry thus fell on Dec. 3 1918, and it was decided that Count Romanones would form a stop-gap cabinet so as to pass the budget and leave the King free for a change of policy. The first important act of Count Romanones was his visit to President Wilson, then in Paris.

It is clear that from the middle of 1917 on, home problems occupied the Spanish mind more than the war. The incidents of the submarine campaign had to be handled by Governments which knew the country to be resolved not to fight, divided as to its sympathies, and rent by revolutionary and constitutional crises. It is to the credit of the successive Governments which ruled Spain during this period that they succeeded in steering clear of all obstacles, home and foreign, overburdened as they were with home problems and foreign advice not always disinterested. On June 29 1917 a German submarine, "UC52," arrived in Cadiz for repairs. Señor Dato allowed its arrival and departure within 24 hours, and thereupon had a Royal Decree signed forbidding submarine navigation in Spanish waters. The next incident of the kind was the escape of "U53," which had been interned in Cadiz under the above Royal Decree. The escape appears to have been due to an excessive amount of trust in the German commander on the part of the Spanish naval authorities, whom the Government promptly deprived of their commands. On the initiative of the Romanones administration a treaty had been negotiated in London between the Marqués de Cortina and the English Government. This agreement was signed on Dec. 6. Its importance consisted in that it legalized, in the eyes of the pro-Germans, all trade with England, which received food and ore in exchange for coal. Torpedoings continued all the same, and the Spanish Government sent strongly worded notes on the sinking of the s.s. "Giralda" and the s.s. "Duque de Génova" (1918). The s.s. "Larrinaga" was torpedoed while conveying petrol from New York to Santander, on a Government charter (July 25 1918), and thereupon the Spanish Government, alarmed at the heavy losses sustained by the merchant marine, decided to apply to Germany the claim of ton for ton. This was the high-water mark of anti-submarine methods adopted by the Spanish Government. Germany had agreed to the ton-for-ton indemnity when the end of the war came. The Spanish merchant marine had lost 65 ships representing 140,000 tons.

Industrial Effects of the War.

From the material point of view, the neutral attitude adopted by Spain contributed to accelerate the progress which was observable in her economics in the pre-war years. This period of exceptional activity comprises two coincident movements. One is a somewhat artificial "inflation" of Spanish industries, due to the demand of the Allies. The other one is the mere continuation of a development already noticeable before the war. Thus certain industries, really national, such as that of olive oil, succeeded at last in establishing themselves in foreign markets. The effect of the war on the country was therefore neither altogether bad nor altogether good. While it served to stimulate a progress which had already set in, it also created artificial conditions which contributed much to social unrest by flooding the country with money too easily earned.

Troubles in Barcelona.

Fall of Romanones Government.

Count Romanones did not precisely find in Paris in 1919 the diplomatic triumph which he had expected, but neither did he return wholly disappointed. He brought back a seat in the Council of the League of Nations for Spain. He found the country astir with a mixture of two political currents, one a democratic, constitutional agitation, born of the Allied victory, another one a revolutionary agitation which could be traced to the unwholesome effect of the Juntas' *pronunciamientos*. The main effect of these two movements was felt in Barcelona, and was represented by Catalanist propaganda, a military undercurrent of opposition to it, and lastly a syndicalist agitation which made the two former forget their mutual enmity and unite against it. Two sets of events suddenly revealed the power of the syndicalist agitation: a general strike which paralysed the whole life of the town, and a series of murders of employers. The Government played with two policies. It militarized the strikers, then tried to conciliate them by sending to Barcelona three liberal-minded civil authorities—Señor Morote, Señor Montañes (Civil Governor) and Señor Doval (Chief of Police). A violent conflict arose between the military and the civil authorities, and when the strike had been settled by the latter, the Government suddenly resigned. It was known afterwards that this resignation was due to the military having expelled the civil authorities from the town. Señor Maura took office on April 15, asked for a decree dissolving the Cortes, and to the consternation of all parties, obtained it. This amounted almost to a *coup d'état* on the part of the King. After a general election held under a strict censorship, under the protest of all the Left parties (including the Monarchical Liberals), and with the use of electioneering methods which had fortunately been long forgotten in Spain, Señor Maura failed to bring to the new Cortes more than about one-eighth of its total membership under his banner. His Government fell scandalously under a discussion of his electioneering methods (July 15), and Señor Sánchez de Toca (Señor Dato being ill), formed a Conservative Cabinet, which had to deal with a grave situation in Barcelona, where syndicalist trouble was again brewing. But a new outburst of the Juntas forced the Government to resign, and Señor Allendesalazar (a follower of Señor Maura) took office with a Coalition Cabinet. The change of policy which the change of Cabinet implied determined an aggravation of the conflict. Murders continued. A mutiny organized by syndicalist soldiers took place in a barracks in Saragossa. Disorders broke out in Valencia and Santander. Another militaristic outburst, the publication of secret letters by Gen. Milans del Bosch (Capt.-General of Catalonia) and the subsequent dismissal of that officer by the Government, which in its turn caused the resignation of Señor Gimeno, imposed by the military, ended the life of the Cabinet, which, having passed the Budget, left office on March 4 1920. Two schools of thought manifested themselves then: one favourable to occasional coalitions, taking office in order to carry out definite programmes, another one favouring the reconstruction of the old system of two rotating parties. The King favoured this second school, represented by Señor Dato and Señor García Prieto, and the former was called to power. But the general election which he called forth at the end of 1920 showed that the mainspring of that old system—*i.e.* the docility of the electorate to any kind of government—could no longer be counted upon. Señor Dato failed to obtain a working majority, his supporters numbering 177 members out of 405. All his efforts were accordingly bent towards the reconciliation of the several factions within the Conservative party. While engaged in this task he was assassinated by anarchists on March 8 1921.

Conservative Cabinet under Sanchez de Toca.

Dato Prime Minister.

Spanish Literature

The dominant feature of Spanish contemporary literature in 1910–21 may be found in an effort to achieve the fusion of the critical with the creative element in the race (see S. de Madariaga, "Introduction to Spanish Contemporary Literature," *London Mercury*, Sept. 1920). With the death of Galdós, the sceptre of Spanish literature falls on Miguel de Unamuno (b. Bilboa, 1864), a professor of Greek in the university of Salamanca, a voracious reader, familiar with all European, American and classical literature, and an indefatigable writer. Unamuno represents the modern version of the Spanish mystic writer. His main concern is the relation of man to creation. It is the subject of his masterpiece *El Sentimiento Trágico de la Vida*, a book of passionate meditation, and, at any rate as an attitude of mind, it dominates his criticism (*En torno al Casticismo*, *Ensayos*), his novels (*Abel Sánchez*, *Tres Novelas y un Prólogo*) and his plays (*Fedra*). In these works Unamuno appears as the apostle of an ideal of life more closely connected with spiritual Easternism than with the intellectual and social tenets of the West. He thus fulfils in Spain much the same function which Dostoievsky held in Russia, for Spain, like Russia, stands as a transition between East and West. His ideal is in intensity rather than in extension, in individual achievement, the saving of one's soul, rather than in social work and collective material progress. His style corresponds to his beliefs. It reminds one of Carlyle's in that it is written with the whole man's being, body and soul, but it is never eloquent and rhetorical; rather does it tend to conversational familiarity and evinces now and then a proclivity towards being led to new thoughts by the mere shuffling of words.

Should we care to complete the parallel with Russia by finding a Spanish westerner to oppose to Unamuno, as Turgueniev stands to Dostoievsky, a younger man than the Basque master, José Ortega y Gasset (b. 1883), would have to be mentioned. A professor of Philosophy at the university of Madrid, Señor Ortega y Gasset is a refined humanist, strongly influenced by German contemporary neo-Kantian schools of thought. His style is naturally polished and his mind penetrating and acute.

His main work is in the field of criticism and psychology (*Meditaciones del Quijote, El Espectador*). To this same school may be ascribed José Martinez Ruiz (b. 1876), better known under his literary name as "Azorin." His art has all the finish and exquisiteness, all the smallness also, of miniature-painting. He has had the rare merit of applying it to the interpretation of national scenes and places (*Castilla, Los Pueblos*), and has thus contributed in no small measure to the movement for national self-knowledge which is noticeable in contemporary Spain.

In fiction, though belonging to an older generation, Vicente Blasco Ibáñez (b. 1866) must be mentioned, since he continued to wield a never-idle pen. His creative vigour was unabated. His war novel, *Los Cuatro Jinetes del Apocalipsis*, made him famous with the English-speaking public. Older novels have been translated, such as *Sangre y Arena* (as *The Matador*) and *La Barraca* (as *The Cabin*). Blasco Ibáñez represents a kind of art which is Spanish only in its subject, but not in its spirit, manner or style. He is more closely related to the French *naturaliste* school than to any Spanish literary tradition. Of a younger generation, Pio Baroja (b. 1872) is perhaps the most widely read. A Basque, with all the acuity of mind of his race and not a little of its rustic independence and antagonism to civilization, Baroja writes abundantly and carelessly, with more spirit than art. He is more capable of rendering with remarkable accuracy separate aspects of truth than of weaving them into an organic unity endowed with life. His best work is perhaps *Idilios Vascos*, where he has rendered the quaint charm of his own country. Ramón Pérez de Ayala (b. 1881), a critic of great talent, has written several novels, the best of which are *Novelas Poemáticas* and *Belarmino y Apolonio*.

Jacinto Benavente (b. 1866) is still the dominating figure of the Spanish theatre. His most famous play, *Los Intereses Creados* (1907), is not representative, for it illustrates but one phase of the talent of this many-sided author. A more powerful tragedy, *La Noche del Sábado*, is of the same period. In more recent times he has given an intense drama of love in *La Malquerida*. There is, however, a type of play in which Benavente must yield the prize to the brothers Alvarez Quintero (Serafin, b. 1871; Joaquín, b. 1873). As authors of *Comedias de Costumbres* these two writers, who always work together, are unsurpassed. The list of their comedies is long (*Las de Cain, Puebla de las Mujeres*). Other playwrights of note are Linares Rivas (b. 1866), remarkable for his skill in the handling of dialogue; Martinez Sierra (b. 1881), a delicate psychologist; and Pinillos ("Parmeno," b. 1875), a vigorous painter of social conflicts. But drama and comedy are but one, and not the more important, aspect of the Spanish theatre. Still more typical of the nation is what is modestly known in Spain as *gênero chico* (small genre), a full growth of theatrical production, generally short and accompanied with music, and ranging from variety pieces akin to operettas to little masterpieces of musical drama. Its best-known exponents are the brothers Quintero and Carlos Arniches (b. Alicante, 1866).

The two main currents which influenced Spanish poetry towards the close of the 19th century, *i.e.* the national tradition and the symbolist school of France, more or less interpreted by South American poets, such as Ruben Dario (b. 1867), remained still observable up to 1920, though the first was more vigorous and conscious, the second widened so as to include all influences, from those of d'Annunzio to those of Maeterlinck and even Rabindranath Tagore. As more typically national, we shall mention Miguel de Unamuno (*Rosario de Sonetos Líricos, El Cristo de Velázquez*), strong and somewhat unharmonious, but true and austere; Antonio Machado (b. 1875) (*Soledades, Campos de Castilla*), whose pessimistic serenity is in keeping with the landscape of central Spain which inspires his poems; and Salvador de Madariaga (b. 1886), whose *Romances de Ciego* restate, in a new spirit, the old Spanish theme of Jorge Manrique. Other poets appear under more complex influences. Thus Manuel Machado (b. 1874), whose main inspiration is popular and southern, has, however, written excellent verse in which the influence of French elegant sensibility is discernible. Juan Ramón Jiménez (b. 1881), more remarkable for his exquisite sensibility than for his power (*Arias Tristes, Elegías*), is led by his melancholy moods towards fluid rhythms which, though more subtle, remind one of Maeterlinck and, through him, of Rossetti. Ramón del Valle Inclán (b. 1870), perhaps the most skilful musician amongst modern Spanish poets, has given in *La Marquesa Rosalinda* an admirable example of the adaptability of the Spanish language to the most refined rhythms. Ramón Pérez de Ayala (b. 1881), in *El Sendero Innumerable*, succeeds in effecting a happy wedding of thought with harmonious poetry, in a work not wholly uninfluenced by Francis Jammes, d'Annunzio and Walt Whitman.

Among historians of literature the work of Marcelino Menéndez y Pelayo is continued by D. Ramón Menéndez Pidal (b. 1869), whose works on the Poem of Myo Çid and on the Spanish chronicles have thrown great light on the origins of Spanish epic poetry. Francisco Rodríguez Marín (b. 1855), the editor of *Don Quixote*, a specialist in Spanish folklore, has succeeded the master as head of the National Library. In the younger generation, Federico de Onis (b. 1885) has edited Fr. Luis de Leon, and Américo Castro (b. 1885) has worked on Lope de Vega.

Journalism, always a great art in Spain, where the paper is infinitely more read than the book, is cultivated by all writers, and every one of the names quoted above might be quoted here again as a journalist. Mention must be made, however, of two eminent contemporary writers whose work is almost exclusively journalistic—Ramiro de Maeztu (b. 1874), a versatile mind whose educating influence on the Spanish reading public has been incalculable; and Luis Araquistain, a powerful dialectician and a master of the polemic style. (S. de M.)

SPECTROSCOPY (*see* 25.619).—As developed in more recent years (1910–21) the science of spectroscopy has for one of its chief purposes the analysis of spectra, and the deduction therefrom of the nature of the atoms and molecules which generate the spectra. The progress which has been made in this connexion has depended upon improved determinations of the wave-lengths of spectral lines, the further investigation of the varying spectrum of the same substance when excited to luminosity in different ways, the more complete analysis of certain spectra into regular series systems, and, finally, on theoretical investigations. In another direction, important advances have been made in the interpretation of the spectra of the various classes of celestial bodies, which may be regarded physically as experiments on large masses of matter at various high temperatures.

Standards of Wave-Length.—Extensive interferometer determinations of wave-lengths in the arc spectrum of iron, based upon 6438·4696 "international" angstroms for the red cadmium line, have been made by K. Burns[1] and others, which provide valuable standards for the general determination of wave-lengths by interpolation. It has been found, however, that the wave-lengths of many lines differ considerably in different parts of the arc, so that special precautions are necessary in order to obtain comparison spectra in agreement with the tabulated standards. Probably the most accurate set of standards are those given by St. John and Babcock,[2] who used a small central zone of a "Pfund" iron arc operated between 110 and 250 volts, with five amperes or less, at a length of 12 mm. This list contains 1026 lines, from λ3370 to λ6750, and for most of them the wave-lengths are believed to be accurate to 0·001 angstrom.

Flame, Arc and Spark Spectra.—The range of spectroscopic research has been almost indefinitely extended by the discovery that in nearly all cases the same substance yields different spectra when stimulated in different ways. Such differences are of little importance from the point of view of *chemical* analysis, but they have become of great significance to the physicist, and have also greatly aided in the interpretation of the spectra of celestial bodies.

The three typical methods of producing luminosity for the observation of the spectra of metallic elements or their salts are the flame, the electric arc and the electric spark. As a general rule, the three sources exhibit important differences. In the flame the lines are comparatively few in number; in the arc the flame lines remain prominent, but many more lines, including some which are as strong as the flame lines, make their appearance. In the spark, there is a tendency for many of the typical arc lines to disappear, whilst other lines may be much intensified, and entirely new lines may also be present. The important class of lines which are intensified, or which only appear, under the violent action of the condensed spark were designated *enhanced lines* by Sir Norman Lockyer, and this name has been generally adopted. The different classes of lines are thus commonly known as flame, arc, and spark (or enhanced) lines, according to their relative prominence in these three sources. This classification, however, is in some respects imperfect, and more definite designations will doubtless eventually be based upon the theoretical considerations to which reference will be made later.

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[1] *Lick Obs. Bull.*, No. 247 (1913); *Zeit. f. Wiss. Phot.* xii., 209.

[2] *Astrophys. Jour.* liii., 260 (1920).

There are many possible variations of these experimental methods of producing spectra, but it would seem that the equivalent of one or other of the three typical sources, or of some intermediate stage, is almost invariably obtained. A more detailed temperature classification of the lines has been based upon experiments with the electric furnace by King,[1] but the terms flame, arc and spark lines suffice for most purposes of description.

Similar variations have also been observed in the spectra of gases when submitted to the action of discharges of varying intensity, and the different classes of lines are sometimes distinguished by analogy as arc and spark lines, although with few exceptions the arc is not actually employed. Independent justification for these names, however, is found in the fact that the arc spectra of some gases can be directly observed. The primary and secondary spectra of hydrogen, for example, have both been observed in the arc,[2] and some of the principal series lines of oxygen have also been observed in the spectra of metallic arcs in ordinary air.[3] The actual spectrum given by a gas depends upon its pressure as well as upon the intensity of the discharge by which it is made luminous. Generally speaking, the greater the pressure of the gas, the greater will be the strength of the discharge required to produce the "spark" lines.

One important aim of modern spectroscopic research has been to search for an explanation of these phenomena, for it cannot be doubted that the causes of the variations in the spectra are intimately connected with atomic structure. In this connexion it will be instructive to refer first to the spectra of known compounds. There are many compounds which can be excited to luminosity without total decomposition,[4] and it has been found that each compound gives a characteristic spectrum by which it can be identified as such. These spectra invariably consist of bands, and different sets of bands characterize, for example, the oxides, chlorides and fluorides of the alkaline earth elements.

It is sufficiently obvious that if a compound be stimulated so strongly that it becomes dissociated, the spectrum will change from one consisting of bands representative of the compound to one containing the lines of the constituent elements. It is not only compounds, however, that show changes of this character. Experiments on nitrogen, for instance, show a range of spectra from one consisting wholly of bands to one in which lines occur alone. Even hydrogen has two spectra: (1) the highly complex, so-called secondary spectrum, which doubtless represents a banded spectrum of rather coarse structure[5]; and (2) the familiar line spectrum, constituting the Balmer series. Similar results have been obtained for many other elements, and from analogy with the spectra of compounds the natural conclusion is that the band spectra of the elements arise from molecules, while the line spectra are produced by the atoms which are set free when the molecules are dissociated.

If this be a true view, the change in the structure of the atom, or in its mode of vibration, which accompanies the successive modifications of the line spectrum becomes a question of paramount interest. Lockyer[6] did not hesitate to believe that while the arc lines of an element were to be attributed to ordinary atoms, the enhanced lines could only be produced by the splitting-up of the atoms themselves, and he called these simpler forms of matter the proto-elements. Proto-calcium, for instance, denoted calcium which had been broken up into sub-atoms by the application of a sufficient stimulus. A somewhat similar, but more probable, explanation has been based upon an application of the quantum theory by Bohr to Rutherford's nucleus theory of the atom. This theory is founded largely on the analysis of spectra into regular series.

Range of Observations.—For the complete determination of the laws of spectra it is necessary to extend the observations far beyond the limits of the visible spectrum. Conspicuous success in the direct photography of the near infra-red spectrum has been achieved by Meggers and others, by the use of ordinary plates stained with dicyanin.[7] By this method excellent photographs of the arc spectra of a large number of elements, extending to λ10,000, have been obtained with a concave grating, and the positions of the lines have been measured with a high degree of accuracy. For the present, the extreme infra-red can only be investigated by thermal effects, involving the use of the thermopile, bolometer, or radio-micrometer, as in the researches of Paschen, Lehmann, and Randall.

Spectroscopic observations in the direction of the ultra-violet, beyond the limit about λ1850 set by the absorption of quartz, and beyond about λ1700 set by the absorption of air, which were first made by Victor Schumann, have been greatly extended by the use of concave gratings, and wave-lengths of considerable accuracy have been determined. Lyman has recorded lines as far as λ500 angstroms, and in similar work at Toronto, McLennan has observed a line attributed to carbon at λ584. A still greater extension has been made at Chicago by Millikan[8] and his colleagues, who have observed lines of nickel as far as λ202. Several improvements in technique were necessary to this success. It was achieved, in the first place, by using gratings specially adapted for the purpose; secondly, by working in an essentially perfect vacuum, through the use of powerful pumps; and finally, since no ordinary spark could pass in a vacuum, by the use of a specially strong sparking apparatus which was capable of forcing a discharge across a very small space between the electrodes. Such a spark was found to produce the extremely short X-rays in the case of carbon, so that the gap which had previously existed between ordinary light waves and X-rays was for the first time bridged.

Spectroscopic data thus cover a very wide range, and offer many interesting problems to the investigator. Their solution depends on his ability to make a true analysis of spectra, and to deduce therefrom the corresponding atomic or molecular conditions.

Analysis of Spectra.—Considerable progress has been made in the analysis of spectra into series. One of the most important advances in this direction is the increased knowledge of the primary spectrum of hydrogen, which is now known to contain, not only the Balmer series, but also two similar series, one in the infra-red and the other in the far ultra-violet. The former was discovered by Paschen, and the latter, previously predicted by theory, was found by Lyman with his vacuum spectrograph. Each of these series is well represented by a mathematical formula, which is simplified if the lines are expressed by their "wave-numbers" (ν) instead of their wave-lengths. The wave-number is the number of waves per centimetre *in vacuo*, and is proportional to the frequency of the vibration. In practice, it is obtained by dividing the wave-length (in angstrom units), connected to a vacuum, into 10^8. In these terms, the formulæ for the hydrogen series are as follows:—

$$\text{Lyman series:}\quad \nu=\frac{N}{1^2}-\frac{N}{m^2}\quad (m=2,\ 3,\ \ldots).$$

$$\text{Balmer series:}\quad \nu=\frac{N}{2^2}-\frac{N}{m^2}\quad (m=3,\ 4,\ \ldots).$$

$$\text{Paschen series:}\quad \nu=\frac{N}{3^2}-\frac{N}{m^2}\quad (m=4,\ 5,\ \ldots).$$

Thus, a general formula for the primary hydrogen spectrum, which might include other undiscovered series, would be $\nu=\frac{N}{m_1^2}-\frac{N}{m_2^2}$.

N is a constant, whose value[9] is 109678·3. m is a constant integer for any one series; and m_2 has a different integral value for each line of a series. R. W. Wood[10] has recently extended the Balmer series to $m=22$, *i.e.* to 20 lines, by experiments with long vacuum tubes. In the spectrum of the sun's chromosphere, 34 lines of the series have been recorded.

There is only one other known spectrum which has the same simplicity as that of hydrogen—namely, the enhanced spectrum of helium. This includes the series first found by Pickering in the star ζ Puppis, and the line λ4686 and others calculated by Rydberg, by whom both series were attributed to hydrogen. These lines were produced in the laboratory by Fowler,[11] and additional lines of the Pickering series, first indicated by Bohr's theory, were afterwards observed by Evans[12] and by Paschen.[13] It was, in fact, the theoretical work of Bohr which first suggested that the lines in question originated in helium and not in hydrogen.

The enhanced series of helium can be represented by a formula similar to that for hydrogen, with the difference that the series constant has rather more than four times the value for hydrogen. Thus, the series which includes λ4686 is given by $\nu=4N'\left(\frac{1}{3^2}-\frac{1}{m^2}\right)$ when N′ is 109723. The complete Pickering series is given by substituting $1/4^2$ for $1/3^2$ in this formula, and a further series calculated by the use of $1/2^2$ has been partially observed by Lyman. It should be noted that alternate lines of the Pickering series are nearly coincident with the Balmer series of hydrogen.

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[1] Several papers in the *Astrophys. Jour.*

[2] Fowler and Shaw, *Proc. Roy. Soc.* A lxxxvi., 128 (1912).

[3] Meggers and Kiess, *Sc. Pub. Washington Bur. of Standards*, No. 324, p. 644 (1918).

[4] Stimulation by "active nitrogen," according to the methods of R. J. Strutt (now Lord Rayleigh), is particularly effective for the spectra of many compounds.—*Proc. Roy. Soc.* lxxxvi., 105 (1912).

[5] An excellent photographic map of this spectrum has been given by T. R. Merton, *Proc. Roy. Soc.* A xcvi., 382 (1920).

[6] Lockyer, *Inorganic Evolution* (1900).

[7] *Scientific Papers, Bureau of Standards*, No. 312 (1918), and subsequent papers.

[8] *Astrophys. Jour.* lii., 1 (1920).

[9] W. E. Curtis, *Proc. Roy. Soc.* A xcvi., 147 (1919).

[10] *Proc. Roy. Soc.* A xcvii., 455 (1920).

[11] *Monthly Notices R. A. S.* lxxiii., 62 (1912); *Phil. Trans.* A ccxiv., 254 (1914).

[12] *Phil. Mag.* xxix., 284 (1915).

[13] *Ann. d. Phys.* l., (1916).

Other spectra exhibit several series superposed. The three types of series early recognized as occurring in the same spectrum were denoted by Schuster as the "Trunk," "Main Branch," and "Side Branch" series, but these names are now entirely superseded by the titles: "Principal," "Sharp," and "Diffuse," originally assigned by Rydberg. A fourth type of series, called the "Fundamental" or "Bergmann" series, has since been recognized. The four chief types are closely interrelated, but apparently have a certain measure of independence. Each series may consist of singlets, doublets, or triplets.

In each series the lines converge to a definite limit, and their wave-numbers are obtained by subtracting a sequence of "terms" from the wave-number of the limit. The formulæ for series in general, however, are not known with the same accuracy as for hydrogen and enhanced helium. In some spectra, notably the arc spectra of the alkali metals, a close approximation to a series is given by such a formula as that of Hicks,[1] namely, $\nu = A - N/(m+\mu+\alpha/m)^2$ where N has nearly the same value as for hydrogen, while μ and α are constants and A is the limit of the series; as before m takes successive integral values. In some series, however, such a formula by no means gives an accurate representation of the observed lines. All that the theoretical investigator can accept with confidence at present is that the general term formula is $N/[f(m)]^2$, where $f(m)$ is a function of m whose form is known only for hydrogen and enhanced helium.

The four main sequences of terms are denoted, for brevity, by the symbols mP, mS, mD, mF, where different integral values of m correspond to the different terms in each sequence. The limit of each of the four series is the first term of one of the others, so that in the abbreviated notation, we have:—

Principal series	$=1S-mP$
Sharp series	$=1P-mS$
Diffuse series	$=1P-mD$
Fundamental series	$=2D-mF$

The term 1P has one, two, or three values, according as the series consists of singlets, doublets, or triplets; and, similarly, the term 2D has two or three values, in doublet and triplet series respectively, when satellites are present in the diffuse series.

It was first shown by Ritz, and expressed in his "combination principle," that lines often occur in positions corresponding to other differences of terms besides those giving the four main series. Thus, there may be a series $2S-mP$, $1P-mP$, and so on. Many lines not previously included have in this way been proved to form part of general series systems.

The recognition of the importance of "terms" is a definite step towards the simplification of spectra, since the number of terms is less than the number of lines included in the series and combinations. Moreover, theoretical investigations indicate that the terms have a more immediate physical significance than the lines themselves. On this account, it is of great interest to construct a "term-spectrum," in which the terms, instead of the lines, are plotted along a horizontal scale. Such a term-spectrum—for the element lithium—is shown in the appended diagram. For economy of space, the terms are represented horizontally by their logarithms instead of their actual values.

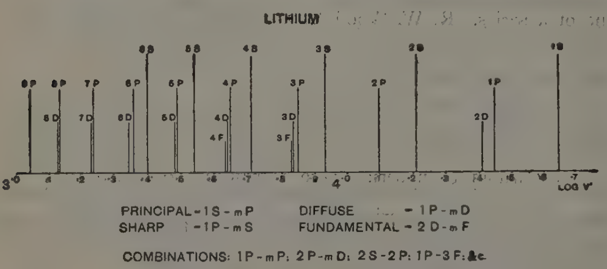

In the term-spectrum diagram, the four main sequences are distinguished by the varying heights of the strokes by which their terms are represented. The highest principal term (1P) minus the sets of sharp and diffuse terms, gives the sharp and diffuse series of lines respectively, while the highest sharp term (1S) minus the set of principal terms, and the highest diffuse term (2D) minus the set of fundamental terms, give the principal and fundamental series. These four series are generally well developed, but, as already remarked, other combinations often arise. It appears, however, that all the combinations which are mathematically possible do not occur with the same frequency.

Origin of Spectra.—The theory of Bohr,[2] which has already been mentioned, offers a remarkably accurate explanation of the spectra of hydrogen and enhanced helium, and gives a physical meaning to the terms which has proved very fruitful in suggesting new directions of research. According to this theory, the atom of an element consists of a positively charged nucleus surrounded by an appropriate system of electrons, such that the total negative charge of the electrons is equal to the positive charge of the nucleus. Nearly the whole of the mass of the atom is concentrated in the nucleus, which is very small in comparison with the distances separating it from the electrons. When an electron is removed from its normal position by the application of an external stimulus, it may traverse temporarily one or another of certain orbits determined by quantum considerations. In each of these orbits it has a certain amount of energy, which is assumed to remain constant while the electron revolves in the orbit. The terms of the spectrum are then taken to be proportional to the respective amounts of energy. When the electron returns to its normal position, it comes to an orbit in which, for equilibrium, it must possess less energy than it had in the temporary orbit. The difference of energy, which is proportional to the difference of the corresponding terms, is emitted as a homogeneous radiation, and gives rise to a definite spectral line, while, if the electron occupies successively different orbits on its return, several lines will be produced in succession. The actual spectrum at any moment is the summation of the different lines yielded by atoms in different states. The term spectrum can thus be regarded as a diagram of the atom, in which the nucleus is at the zero of the scale (to the right in the diagram), and the strokes are parts of the possible orbits. A spectrum line appears when an electron passes from one orbit to another on its return towards its normal position in the innermost orbit.

The differences between the arc and enhanced spectra receive a simple explanation on the Bohr theory. The lines of an arc spectrum are supposed to be generated by the disturbance of a single electron and its subsequent interaction with the nucleus and remaining electrons. When two electrons are removed from their normal positions, and one remains at a great distance, the return of the second electron generates an entirely different spectrum consisting of the enhanced lines. An atom which has lost one or more electrons is said to be "ionized."

Assuming the hydrogen atom to consist of a nucleus and a single electron, the energies of the possible orbits can be calculated, and are found to be proportional to the observed terms N/m^2. Helium, the next lightest element to hydrogen, is believed to have two electrons, and the mathematical problem of determining their motion has not yet been solved. If one of the electrons is removed, however, the atom is similar to that of hydrogen, except that the nucleus has a double positive charge and a greater mass. The resulting enhanced terms are therefore calculable. They again have the form N/m^2, but N has now a much larger value than it has for hydrogen. It is represented in both cases by the expression $\frac{2\pi e^2E^2}{ch^3}\cdot\frac{mM}{m+M}$, where e, m, and E, M, are respectively the charge and mass of the electron and nucleus, h Planck's constant and c is the velocity of light. In the case of hydrogen $E=e$, and when the experimental values of the various quantities are substituted in the formula, the series constant is reproduced with remarkable accuracy. The second factor increases with M, so that it will be slightly greater for helium than for hydrogen. Also, the double nuclear charge makes the first factor in the expression for N four times as great for enhanced helium as it is for hydrogen. These theoretical requirements have been completely verified by experiment. Fowler, calculating N for hydrogen and helium from the observed lines, used the theoretical expressions to calculate the value of M/m,—*i.e.* the ratio of the masses of the hydrogen atom and the electron—and obtained a result in very close agreement with that arrived at by direct measurement. Moreover, he has shown[3] that in the more complicated spectra of the alkaline earths, the enhanced line terms are also represented by formulæ in which N has four times its value for arc spectra.

It has not yet been possible to calculate the theoretical terms of other spectra, on account of the mathematical difficulties connected with the interaction of more than two bodies. The same principles, however, are believed to apply to atoms containing many electrons, and the physical conceptions of the theory have led to valuable information regarding the order of excitation of the lines under gradually increasing stimulus.

Further developments of the theory, taking into account the variation of the mass of the electron with velocity required by the theory of relativity, have indicated that the lines of the hydrogen and enhanced helium series are complex, and under high resolution should appear to consist of several components. This has been verified by Paschen,[4] who found results for helium in remarkable agreement with the predictions of Sommerfeld. The intensities of the several components also are in the ratio calculated by Sommerfeld by a special hypothesis.

Resonance and Ionizing Potentials.—Strong support for the Bohr theory is given by experiments in which atoms are bombarded by electrons, with a view to temporary disintegration. If an electron, of charge e falls through a potential difference, V, it acquires a

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[1] *Phil. Trans.* A vols. ccx., ccxii., ccxiii., ccxvii., ccxx.

[2] *Phil. Mag.*, vol. xxvi., pp. 1–25; 476–502; 857–875 (1913); vol. xxvii., pp. 506–524 (1913); vol. xxix., pp. 332–335 (1915).

[3] *Phil. Trans.* A ccxiv., 254 (1914).

[4] *Ann. d. Phys.*, vol. l., pp. 901–940 (1916).

Spectrum	GROUP							
	VIII. or O	I.	II.	III.	IV.	V.	VI.	VII.
Arc	Not completely analyzed	Doublets	Triplets and singlets	Doublets	Triplets?	Doublets?	Triplets	(?)
Enhanced	(?)	Not completely analyzed	Doublets	Triplets and singlets	Doublets?	Triplets?	Doublets?	Triplets?

quantity of energy, eV, expressed in appropriate units. If such an electron bombards a neutral atom, it is found that no change takes place until V reaches a certain value, when there is a sudden radiation of energy corresponding to a particular line—usually a strong flame line—in the spectrum of the bombarded atom. According to Bohr's theory, the energy in this particular radiation is equal to $h\nu$, where ν is the wave-number of the line, and h is Planck's constant. Experiments with several elements show that this critical value of V is determined by the relation $eV = h\nu$. This means that the energy of bombardment has been just sufficient to remove the electron in the atom from its normal position to the next orbit, and, on its return, the electron restores the energy in the form of monochromatic radiation of the appropriate frequency. If V is expressed in volts, the wave-number of the emitted line is numerically equal to $V \times 8102$. The value of V when emission first takes place is known as the "resonance" or "radiation" potential. Further, by increasing V, it is possible to remove an electron from the atom altogether. If the energy, eV, in this case is equated to $h\nu$, the resulting value of ν is found to be equal to the largest term in the spectrum—usually the term 1S, the limit of the principal series. This term would correspond to the innermost orbit of the electron, and the result suggests that the energy which must be applied to remove an electron from the atom is just equal to the energy possessed by the electron when revolving in its normal position. The potential required to remove an electron from the atom is known as the "ionizing potential." It has been determined experimentally for a number of elements and has been found to be in complete agreement with the orbital energy as calculated from the largest term in the spectrum. The Bohr theory thus presents a simple picture of the processes taking place in experiments of this type.

The Stark Effect.—The resolution of spectral lines under the influence of intense magnetic fields—usually known as the Zeeman effect—has been extensively studied for a large number of elements. Somewhat similar effects, but much greater in magnitude, produced by an electric field, have been brought to light by Stark,[1] and examined in considerable detail by a number of workers. Nicholson and Merton [2] have shown that the Stark effect may operate to an appreciable extent in an ordinary vacuum-tube discharge, causing a broadening of the lines. Both the Zeeman and Stark effects have been treated on the basis of the Bohr theory,[3] with some success.

Spectra and the Periodic Table.—Attention is being drawn more and more to the relation of the spectrum to the periodic table of the elements. While it cannot be said that the relation is known with any approach to completeness, a number of important facts have been noted which may ultimately prove of great service in the interpretation of the table. It has long been known that, when doublets or triplets occur in the spectra, the wave-number separations of their components (which are constant in the sharp and diffuse series) are approximately proportional to the squares of the atomic weights of the elements producing the spectra—so long as those elements belong to the same family group. The Zeeman effect also is generally the same for lines of corresponding series in the spectra of elements belonging to the same group. But perhaps the most comprehensive connexion of spectra with the periodic table is established by the "displacement law" of Kossel and Sommerfeld.[4] It has been observed that the "complexity" of the lines of a series—*i.e.* their character as singlets, doublets or triplets—is constant throughout a group, but varies from one group to another. The displacement law states that, when an element is ionized, the enhanced series take on the same type of complexity as the arc series produced by the element to the left (*i.e.* in the preceding group) in the periodic table. It is assumed that electrons arrange themselves round the nucleus in rings, and that spectrum phenomena are produced by electrons in the outer ring. If the outer ring contains an odd number of electrons, the spectrum will consist of doublets, while, if the number is even, the spectrum will show triplets and singlets. In the periodic table each element contains one outer electron more than its neighbour in the preceding group, while a group consists of elements having the same number of electrons in the outer ring. It follows that the removal of an electron from an element will make the outer ring similar to that of the immediate forerunner of the element in the table, and so make the enhanced lines of the first element of the same type of complexity as the arc lines of the second. Removal of a second electron would restore the arc type of complexity, for the number of outer electrons would again become odd or even, as the case might be. A second ionization is difficult to bring about in most cases, but with silicon it is probable that one, two, and even three electrons have been removed, step by step, thus making possible four distinct spectra. These appear to show the alternation of complexity required by the displacement law. The table above gives the types of series produced by the neutral and ionized elements of the various groups, so far as they are known at present.

The spectra of the higher groups are much more complex than those of the lower ones. Their series, if they possess any, are possibly of a different type from those with which we are familiar. The displacement law, however, suggests that, by repeated ionizations, series—and therefore terms—might be detected in such spectra, of the same kind as those of the groups of elements on the left. But since, with each successive ionization, the term constant, N, is multiplied in the ratio 1:4:9:16—etc., the chief series lines might tend rapidly to approach the far ultra-violet and become difficult to observe.

Band Spectra.—Several band spectra have been studied in further detail, but it does not appear that any very fundamental advance in our knowledge of the structure of these spectra has been made. The discovery of a band spectrum of helium,[5] however, is probably of considerable importance. It has been shown by Fowler[6] that, while the individual bands follow the ordinary laws of band spectra, the heads of some of them are arranged in accordance with the laws of line series. In this respect the helium bands appear to be quite unique. Unlike the *lines* of helium, the bands have not yet been traced in any celestial source.

The Solar Spectrum.—A striking feature of continued work on the solar spectrum is the identification of a large number of faint lines with lines composing the bands of certain compounds, in addition to the band lines of carbon and cyanogen previously recognized by Rowland and Lockyer. The peculiarities of the region about the G group of Fraunhofer have been shown by Newall[7] to be due to the absorption of the well-known hydro-carbon band $\lambda 4315$, and the group P has been found by Fowler and Gregory[8] to include the strong ultra-violet band of ammonia having its maximum near $\lambda 3360$. In addition, the band of luminous water vapour beginning at $\lambda 3064$ has been found by Fowler[9] to be present in the solar spectrum. A large number of previously unknown solar lines have thus been accounted for, and it is not improbable that the thousands of faint lines which remain unidentified may eventually be traced to other band spectra.

An interesting application of modern theories of spectra to solar problems has been made by M. N. Saha.[10] On the reasonable assumption that the composition of the sun is essentially the same as that of the earth, it remains to account for the absence of spectral indications of many of the elements. Dr. Saha urges that the varying representation of different elements arises from the varying response of these elements to the solar stimulus, depending upon the structure of their atoms, and the consequent difference in their ionizing potentials. Cæsium, for example, has a low ionizing potential and is considered to be completely ionized in the sun, so that the familiar lines do not appear, while the chief lines of the ionized element are out of range. In contrast, sodium has a higher ionizing potential and is only partially ionized in the sun, so that the lines of the neutral atoms appear strongly. Other elements, such as neon and argon, have very high ionization potentials, and are not excited at all. Dr. Saha finds support for his views in calculations of the percentage ionizations of various elements at different temperatures and pressures, and it is possible that the peculiarities of the solar spectrum may be satisfactorily explained by these considerations.

Stellar Spectroscopy.—Our detailed knowledge of the spectra of the stars has been greatly advanced by the use of the large telescopes which have been erected, and considerable progress has also been made in the interpretation of the stellar lines through experiments in the laboratory. In particular, the use of stronger discharges than had previously been employed has led to the discovery of new lines of several elements, which have been identified with the lines occurring in the hotter stars. Certain lines of the Wolf-Rayet stars, for example, have thus been traced to carbon by Merton,[1] and others to oxygen by Fowler and Brooksbank.[2] The general outcome of the experimental reproduction of stellar lines is to support the view that the order in which the different classes of stars had been arranged is a true temperature sequence. This order, previously indicated by Secchi and Vogel, is now generally expressed by the classification introduced at Harvard by E. C. Pickering, in which the most important classes, passing from the white to the redder stars, are designated by the letters B, A, F, G, K, M.[3] On passing from the relatively cool M stars to the hot B stars, it is necessary, in accordance with the work of Lockyer, to employ a gradually increasing stimulus in order to excite the spectra which appear at successive stages of the stellar sequence.

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[1] *Ann. d. Phys.*, vol. xliii., p. 965 (1914), etc.

[2] *Phil. Trans.* A. vol. ccxvi., p. 459 (1916).

[3] Bohr, *Danish Acad. Sc.* iv., 1, part ii., pp. 1–100 (1918); H. A. Kramers, *Mémoires Acad. Sc., Copenhagen*, 8th ser., iii., No. 3, pp. 287–384 (1919); Epstein, *Ann. d. Phys.*, vol. l, pp., 489–520, 815–840 (1916).

[4] *Verh. Deut. Phys. Gesell.* (1919).

[5] W. E. Curtis, *Proc. Roy. Soc.*, lxxxix., 146 (1913); E. Goldstein, *Verh. Deut. Phys. Ges.*, xv., 10 (1913).

[6] *Proc. Roy. Soc.*, xci., 209 (1915).

[7] *Monthly Notices R. A. S.*, lxxvi., 640 (1916).

[8] *Phil. Trans.* A ccxviii., 351 (1918).

[9] *Proc. Roy. Soc.* A. xciv., 472 (1918).

[10] *Phil. Mag.* xl., 809 (1920).

There are certain peculiarities of the successive stellar spectra which call for explanation, if it be assumed that all stars are of essentially the same composition. Thus, at every stage of the stellar sequence there are many elements which are not represented at all, and different selections of the elements appear at the various stages. The earlier attempts to deal with such questions are incompatible with modern views as to the origin of spectra. The new theory of spectra, however, supplemented by a theory of the temperature radiation of gases, has been shown by Dr. M. N. Saha[4] to provide a very probable explanation of most of the phenomena. According to this theory, a gas or vapour may emit radiations, or become ionized, by subjecting it to appropriate thermal stimulus, depending in part upon the density, and the emissions produced mechanically by the spark may thus also be generated by the action of a sufficiently high temperature. Dr. Saha concludes that, under the temperature stimulus prevailing in the atmosphere of any particular star, certain elements are excited to radiation of their characteristic lines, in accordance with their resonance and ionization potentials, while other elements are either ionized, or the stimulus is too weak to excite the lines by which their presence could be recognized. When an element is completely ionized in this way, it will often happen that the most characteristic lines of the modified atoms will lie far in the ultra-violet, outside the range of possible observation, so that the element will escape detection. Again, under the action of the highest temperatures, a second step in ionization may set in, producing still more refrangible chief lines as a rule, so that even the elements which yield enhanced lines in the ordinary range of spectrum at some stages will eventually cease to be represented. The simplification of the spectra of the hotter stars thus receives an acceptable explanation; the surviving elements represented in the spectra are those for which the maximum amount of energy is required to produce the successive ionizations, or those for which these conditions yield lines of sufficient intensity within the range of spectrum which is open to observation. Preliminary calculations of the probable temperatures at which such changes of spectrum would occur are in substantial agreement with the temperatures of the various classes of stars deduced from spectro-photometric observations by Wilsing and Scheiner. It therefore seems probable that temperature is the controlling factor in determining the character of the spectrum given by a star, and, as Dr. Saha remarks: "The stellar spectra may be regarded as unfolding to us, in an unbroken sequence, the physical processes succeeding each other as the temperature is continually varied from 3000° to 40,000°."

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SPEE, COUNT MAXIMILIAN VON (1861–1914), German admiral, was born June 23 1861 at Copenhagen. He was first officer of the battleship "Brandenburg" when it was sent to East Asia in 1899 during the Chinese boxer disturbances. In 1908 he was chief of the staff of the North Sea command, and in 1913 he was appointed chief in command of the Cruiser Squadron. When the World War broke out he was on a voyage with this squadron from Tsing-tau to the South Sea Islands. He was hard pressed by British and Japanese naval forces, but was at an advantage when he was engaged on Nov. 1 1914 off Coronel on the Chilean coast by Adml. Cradock with a British squadron which was inferior to his own in numbers and speed, as well as in range and weight of fire. Adml. Cradock went down with his ship, the "Cape of Good Hope," and the "Monmouth" was also sunk. On the following Dec. 8 Count Spee's squadron was drawn into action off the Falkland Is. by the powerful cruiser squadron of Adml. Sturdee which had been sent out to look for him. Count Spee's own ship, the "Scharnhorst," was sunk, he himself and his two sons going down with all hands. The "Gneisenau" was also sunk, as were the "Leipzig" and the "Nürnberg." The light cruiser "Dresden" escaped, but was afterwards sunk off Juan Fernandez in the Pacific.

SPIELHAGEN, FRIEDRICH VON (1829–1911), German novelist (*see* 25.667), published during his later years *Freigeboren* (1900); *Die schönen Amerikanerinnen* (1902); *Ultimo* (1903); and *Am Wege* (1903). He died at Charlottenburg, Berlin, Feb. 25 1911.

SPIERS, RICHARD PHENÉ (1838–1916), English architect and author. Phené Spiers occupied a unique position amongst the English architects of the latter half of the 19th century, his long mastership of the architectural school at the Royal Academy having given him the opportunity of moulding and shaping the minds of more than a generation of students. He was educated in the engineering department of King's College, London, and proceeded thence to the atelier Questel of the École des Beaux-Arts, Paris, for upwards of three years, a method of study rare for an architectural student in those days. On his return he won the gold medal and travelling scholarship of the Royal Academy, and in 1865 the Soane medal of the R.I.B.A. In 1871, after he had worked in the offices of Sir Digby Wyatt and William Burges, he gained second premium with a spirited design (showing a good deal of the Neo-Grec feeling consequent on his French training) for the new Criterion building, London. His work of about this period included Lord Monkswell's house, Chelsea. Phené Spiers travelled in France, Spain, Egypt, Syria and the East, and besides his record of more purely architectural data, he made many water-colour sketches showing much talent and facility. He was a frequent exhibitor at various galleries, and a good specimen of his art—the loggia at Hampton Court—is in the Victoria and Albert museum. His works and publications were many, and covered a wide ground. Amongst them are his new edition of James Fergusson's *History of Architecture* and the further volumes on Indian and Eastern art; *Architectural Drawing; The Architecture of Greece and Rome* (conjointly with the late W. J. Anderson); *The Mosque at Damascus;* and the articles on Persian and Roman Architecture in Dr. Russell Sturgis's *Dictionary of Architecture*, besides an edition of Pugin's *Normandy.* For the *E.B.* Spiers wrote most of the articles dealing with architecture. The position to which his erudition and ability entitled him was fully recognized in other countries as well as his own, as is shown by his election to membership of many foreign societies in France, Spain and America. He died in London Oct. 3 1916.

SPIRITUALISM: *see* PSYCHICAL RESEARCH.

SPITSBERGEN (*see* 25.708).—The highest peaks in Spitsbergen are believed to be Mount Newton, 5,676 ft., and Mount Poincaré, 5,446 ft., both in the eastern part known as New Friesland. Mount Eidsvoll in King James Land is 4,770 ft, and Mount Monaco on Prince Charles Foreland is 3,543 ft.

Geology.—Considerable exploration has not greatly modified the main conception of the geological structure. The old rocks of the W., generally described as the Hekla Hook series, seem to be of Silurian age to which may also be ascribed the so-called Archaean rocks of the N.W. There are no Permo-Carboniferous rocks in King James Land and the strips of rocks on the N.E. side of Prince Charles Foreland and the opposite shores of the mainland, formerly attributed to that age, are now known to be Tertiary. Certain of the coal measures in Advent Bay prove to be of Cretaceous and not Tertiary age and these Cretaceous beds probably appear also below the Tertiary beds in Lowe Sound.

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[1] *Proc. Roy. Soc.*, A, xci., 498 (1915).

[2] *Monthly Notices*, *R.A.S.*, lxxvii., 511 (1917).

[3] The work of H. N. Russell, in general agreement with that of Lockyer, renders it probable that the true sequence is from M to B with increasing temperature, and thence from B to M with decreasing temperature, the density increasing throughout. Stars of rising temperature, on account of their great volume, have been called "giants," those of falling temperature "dwarfs." Differences between the spectra of giants and dwarfs of the same spectral class have been found by Adams (see *Monthly Notices*, *R.A.S.*, lxxxi., 334).

[4] *Proc. Roy. Soc.*, A, xcix., 135 (1921).

An extinct volcano and several hot springs with a temperature of 75° to 82° F. were discovered in Bock Bay, off Wood Bay, in 1910. The volcano seems to date from a later period than any other volcanic manifestation found in Spitsbergen. Research has proved that dislocation has played a great part in determining the main features of the fjord system, especially in Ice Fjord where the course of the fjord has been decided by great faults.

Climate.—From the meteorological data now available, including eight years' records from Green Harbour, the following means may be given: Cape Thordsen, Jan. 0·3° F., July 39·9° F.; Green Harbour, Jan. 6·7°, July 39·7°; Axel I. (Lowe Sound), Jan. 1·6°, July 40·3°; S.E. of Edge I., Jan. 1·5°, Aug. 37·4°; Bear I., Feb. 10·4°, Aug. 40·1°. The mean annual precipitation at Green Harbour is 11·6 in.; Prince Charles Foreland has more and the interior of Spitsbergen less.

Exploration.—There is little doubt that the land called Svalbard ("cool coast") in the Icelandic annals, discovered by Norsemen in 1194, was really Spitsbergen. If Spitsbergen was forgotten by the Norsemen it was possibly rediscovered by Russian hunters from the White Sea in the 15th or 16th centuries or at least previous to Barents' rediscovery in 1596.

Recent exploration in Spitsbergen has been devoted mainly to geological work, largely with economic ends in view, and detailed cartographical survey. A German expedition under Lt. Schroeder-Stranz in 1912 came to grief on the N. coast, after the loss of the leader. Half the staff were lost and the survivors were rescued by Norwegians under A. Staxrud.

The principal survey work has been done by Norwegians working in small parties every summer since 1906, assisted by grants from the Norwegian State. These parties have been successively commanded by G. Isachsen, A. Staxrud and A. Hoel, and have mapped in detail the western side of the mainland from the N. coast to the South Cape. The work is expedited by the use of photogrammetric methods to assist triangulation. The detailed survey of Prince Charles Foreland has been completed by Dr. W. S. Bruce and assistants who have also mapped the area between Klaas Billen and Sassen bays. Swedish surveyors have mapped the land round Lowe Sound and Braganza Bay. The Prince of Monaco has shown continued interest in Spitsbergen exploration by giving assistance to several explorers, including the Swiss H. Stoll who in 1913 crossed the unknown country between Lowe Sound and Agardh Bay on Stor Fjord. Lt. W. Filchner in 1910 surveyed the glaciated region between Temple Bay and Mohn Bay. In 1920 J. M. Wordie scaled several of the highest peaks on the W. coast, including Mounts Monaco, Rudmose and Barents. Hydrographic surveys have been carried out by G. Isachsen and others on the W. coast and in Green Harbour, by W. S. Bruce in Foreland Sound, Klaas Billen and Sassen bays and Stor Fjord. Swedish Government surveyors have been at work in Lowe Sound. Oceanographical work has been done in Spitsbergen waters by Dr. F. Nansen. The Norwegian Government has maintained a wireless telegraph station and meteorological observatory in Green Harbour since 1911. A German meteorological station was founded in Eleltoft Haven, Cross Bay, in 1910 as the outcome of a visit by Prince Henry of Prussia and Count Zeppelin when experiments with dirigible balloons were conducted. This station was abandoned in Sept. 1914. In 1920 Norway opened a new meteorological and geophysical station for aerological and geomagnetic research. Besides the Norwegian state wireless station at Green Harbour, there were in 1921 seven others (4 Norwegian, 2 English and one Swedish). In Aug. 1921 a Norwegian Church was consecrated at Longyear City.

Mining.—The development of the coal-fields has proceeded rapidly, greatly stimulated during the war by the scarcity and high price of coal in Scandinavia. The coal-mine in Longyear Valley, Advent Bay, which had been under American ownership since 1905, was sold in 1916 to Norwegians who have been assiduous in their export. Several other Norwegian mines have started, notably in Kings Bay, Green Harbour and Hjorth Haven in Advent Bay. Swedish mines were opened in Lowe Sound (Braganza Bay) in 1917. There are Russian mines in Green Harbour and Dutch mines at Cape Boheman. British enterprise, hampered by war conditions, revived in 1919 in the coal-bearing areas in Klaas Billen Bay and Lowe Sound. By 1920 practically all the coal-bearing areas were annexed by one or other company and at least five mines had reached the export stage. The total amount of coal exported in 1919 was 90,000 tons, all of which went to Norwegian ports, including some to Narvik for the Swedish railways. The coal exported so far is of Tertiary and Cretaceous age and proves to be good steam coal. Bituminous coal of Carboniferous age will soon be available for export. Jurassic coal occurs but is of poor quality and no longer worked. Mining continues throughout the year but the export season at present is from June to Sept. The largest mining camp is Longyear City in Advent Bay, housing some 400 men in summer and 300 in winter. No other minerals besides coal are as yet exploited commercially, but large deposits of iron ore (36% iron) and gypsum are known, as well as smaller deposits of zinc and asbestos. Signs of oil have been reported. A Norwegian company is exporting coal from Bear Island. The approximate area (in sq. m.) of estates owned by various nationals in Spitsbergen is as follows: British 6,500, Norwegian 900, Swedish 400, Russian 60 and Dutch 10. Whaling was revived in Spitsbergen waters in 1905, abandoned in 1912 and restarted during the World War. The only station is now in Green Harbour. Winter fur-hunting is pursued by a few Norwegians.

Political History.—The question of political control had been discussed since about 1870, mainly by Norway, Sweden and Russia, without any solution being found. Spitsbergen therefore occupied the curious position of being *terra nullius*. In 1907, however, Norway again opened negotiations for an international conference to decide the question of sovereignty, and one was held at Christiania in July-Aug. 1910, followed by another in 1912, without definite result. In July 1914 a conference which included also representatives of Britain, France, Belgium, the United States, Holland and Germany tried to devise a form of administration consistent with the country remaining a *terra nullius*, but the outbreak of the World War put an end to the discussions. In 1919 the Supreme Council conferred the sovereignty of Spitsbergen, including Bear I., on Norway. The signatories of the treaty were Great Britain and the British Dominions, France, Italy, the United States, Japan, Holland, Denmark, Norway and Sweden. The rights and territories of nationals other than those of Norway are safeguarded, and Norway is not allowed to show preferential treatment to Norwegian mining companies or to levy taxes except for expenditure on the administration. Disputed claims to estates were to be decided by a neutral commission presided over by a Dane.

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(R. N. R. B.)

SPORTS AND GAMES.—The tendency towards "internationalism" in competitive sports and games had been rapidly growing in intensity, partly as a result of the establishment of the Olympic Games, from 1896 onwards; but it was rudely interrupted by the World War, and conditions were still unfavourable up to 1921 for more than a limited renewal. The decade from 1911 to 1921 offers no proper material, therefore, for a consistent history in this field, by way of supplement to the separate articles in the earlier volumes of this Encyclopædia; nor, indeed, in the case of most sports and games, as carried on in 1910–21, had there been more than minor changes, either in equipment, methods or rules. So far as British and American interests, however, are concerned, the chief statistics, as regards the main events in the more important sports and games, are recorded in the following sections.

Athletics, Track and Field.—The Olympic Games were held at Stockholm in July 1912, the highest number of points being scored by the United States, and again at Antwerp in 1920, the 7th Olympiad being projected for Paris in 1924.

While the United States won the track and field events of the 1920 Olympic games in Antwerp by a considerable margin in the point score, and set new records in the pole vault, the high jump, and the 400-metre hurdles, the Americans totalled only 9 first places, the same as the team of 24 men from Finland. The "stars" of the American team were C. W. Paddock in the 100 metres, Allan Woodring in the 200 metres, Frank Loomis in the 400-metre hurdles, Richard Landon in the high jump, Frank Foss in the pole vault, Pat Ryan in the hammer, Pat McDonald in the 56-lb. weight, and H. H. Brown, the individual winner in the 3000-metre team race, the only American to win a distance event. In swimming the Americans were supreme, with Duke Kahanamoku and Kealoha, both of Hawaii, Norman Ross, Ethelda Bleibtrey, Aileen Riggin and Charlotte Boyle. The winners at the American eastern college meetings were: 1911, Cornell; 1912, Pennsylvania; 1913, Pennsylvania; 1914, Cornell; 1915, Cornell; 1916, Cornell; 1918, Cornell; 1919, Cornell; 1920, Pennsylvania; 1921, California. Princeton won against Oxford (July 8 1920) at Queen's Club, London, by 6 events to 4. At the Pennsylvania Relay Games (April 30–May 1 1920) the Oxford-Cambridge 2-m. team, Tatham, Stallard, Milligan and Rudd, set a new world's record of 7 min. 50⅖ sec.

Cricket.—Before the war English cricket was in a flourishing condition. The visit of a South African team to Australia in 1910–1, in which the South Africans did hardly as well as had been expected, served as a prelude to the so-called Triangular Tournament of 1912; and in the meantime an English team under the management of the Marylebone Cricket Club carried through a successful tour in 1911–2. Of 18 eleven-a-side matches the M.C.C. team lost only the first test match; four were drawn, and 18, including four test matches, were won by the Englishmen. At the end of 1910 a team sent to South Africa by the M.C.C. won two and lost three test matches. In 1912 the interest in county cricket was largely eclipsed by the Triangular Tournament between England, Australia and South Africa, in which nine test matches were played. England proved victorious, winning four matches (three against South Africa and one against Australia) and drawing twice with Australia, owing to bad weather. The Australians beat the South Africans twice. Of the 102 matches played up to 1920 between England and Australia, England won 46 and Australia 35. Of those played in England the home team won 17 and Australia 8, and 17 were drawn. In those played in Australia England won 30 and Australia 27, three being drawn. In 1921, however, in their visit to England, the Australians won an easy victory.

A new method of deciding the English county championship was inaugurated in 1911. With the idea of discouraging the players from aiming at drawn matches, five points were given for a win, and three points (with one point to the losing side) for a first-innings victory. The championship was won by Warwickshire in 1911, by Yorkshire in 1912 and by Kent in 1913. In 1914 the championship was not decided owing to the outbreak of war, but the M.C.C. Committee adjudged Surrey the winners. It was resumed in 1919, when a new system was adopted, by which only wins counted, the winners being the county with the highest proportion of wins to matches played. Yorkshire was at the head of the list in 1919, and Middlesex in 1920 and 1921.

The Oxford and Cambridge match was not played between 1915 and 1918. In 1911, 1914 and 1919 Oxford won, and in 1912, 1913 and 1921 Cambridge were the winners, the match in 1920 being drawn. From 1911 to 1921, with the exception of the years 1915 to 1918, when the match was not played, Eton won against Harrow.

English Football.—(1) Rugby.—In 1911 a French team for the first time was victorious in an international match, beating Scotland in Paris. In the same season Wales beat England, Ireland, Scotland and France; Ireland beat England, Scotland and France; England at Twickenham beat Scotland and France. In 1912 all the international matches that took place in the United Kingdom were won by the fifteen playing in its own country. England defeated Wales and Ireland, but narrowly lost to Scotland. Ireland beat Scotland and Wales, and Wales beat Scotland. In no match was France victorious. A strong South African team began a tour in Great Britain in the autumn of 1912. After gaining several decisive victories over counties, the South Africans lost to Newport, were with great difficulty victorious over Llanelly, the United Services and London, beat Oxford and Cambridge Universities, were narrowly beaten at Twickenham by another London fifteen, and easily beat Scotland at Edinburgh. They next gained their most decisive victory at Dublin, securing 36 points against Ireland, and beat Wales by a try at Cardiff, but lost to Swansea by the same margin. In the international matches in 1913 England defeated Scotland, Wales, Ireland and France; Wales beat Scotland, Ireland and France; Scotland beat Ireland and France; and Ireland beat France. In 1914 England beat Scotland, Wales, Ireland and France; Wales beat Scotland, Ireland and France; and Ireland beat Scotland and France. From 1915 to 1919 the matches were not played. In 1920 England beat Scotland, Ireland and France; Wales beat England, Ireland and France; Scotland beat Wales, Ireland and France; and France beat Ireland. The University match went in favour of Oxford in 1910, 1911, and 1913. Cambridge won in 1912, 1914, 1915 and 1920. (2) *Association.*—In 1910 a tour was undertaken in Brazil by the Corinthian Football Club, and another in North America in 1911–2. From 1907 to 1914 amateur international football was affected by a dissension among English clubs. In consequence of the Football Association insisting upon the admission of professional clubs (so-called) to the district associations, a large number of amateur clubs, including the University, College and Public Schools Club, seceded to form the Amateur Football Association. The officers of the army, while sympathizing with the seceders, considered it advisable for the sake of regimental football to retain their connexion with the Football Association. But in 1911–2 they used their influence to promote a reconciliation. A conference was held at which the delegates of the two associations only failed to arrive at an agreement because the older body would not accept an arrangement by which the younger could receive the adherence of newly formed amateur clubs. In 1914, however, the Football Association and the Amateur Football Association sank their differences. The Amateur elevens of the Football Association won matches with Wales, Belgium, France and Holland in 1910–1, but lost to Ireland. In 1911–2, besides victories at the Olympic Games, they defeated Ireland, Wales, Denmark, Holland and Belgium. The Amateur Football Association teams beat Wales and France in both seasons. The full representative eleven of the Football Association defeated Ireland and Wales in 1911 and drew with Scotland. Ireland lost to Wales and Scotland, and Scotland drew with Wales. In 1912 England and Scotland again played an indecisive match, but both beat Wales and Ireland; Wales lost three matches. In 1913 England beat Scotland and Wales; Wales beat Ireland and drew with Scotland; Scotland beat Ireland; and Ireland beat England. In 1914 England beat Wales; Scotland beat England; Ireland beat England and Wales and drew with Scotland; and Wales drew with Scotland. In 1920 England beat Scotland and Ireland; Wales beat England and drew with Ireland and Scotland; and Scotland beat Ireland. The Football Association Cup was won in 1911 by Bradford City, in 1912 by Barnsley, in 1913 by Aston Villa, in 1914 by Burnley, in 1915 by Sheffield United, and in 1920 by Aston Villa. The championship of the Football League was carried off by Manchester United in 1911, by Blackburn Rovers in 1912, by Sunderland in 1913, by Blackburn Rovers in 1914, by Everton in 1915, and by West Bromwich Albion in 1920. The principal trophy of the Amateur Football Association was won in 1911 by the Old Malvernians, in 1912 by Oxford City, in 1913 by the New Crusaders, in 1914 by Ealing, and in 1920 by Dulwich Hamlet. The Arthur Dunn cup for public school clubs fell to the Old Reptonians in 1911, to the Old Malvernians in 1912, to the Old Brightonians in 1913, to the Old Reptonians in 1914, to the Old Wykehamists in 1920, and to the Old Carthusians in 1921. Oxford won the University match in 1911 and Cambridge won in 1912, 1913, 1915; in 1914 and 1920 the match was drawn.

American Football.—Of all amateur sports in America, college football (the American Rugby game) drew the largest crowds and aroused the greatest enthusiasm. Occasional professional teams drew big gate receipts, especially in Ohio and Michigan, where the professional game was popular, but in general it was not encouraged. After 1908 a number of colleges abandoned football because of the deaths and injuries that resulted from the old-style mass playing. In the following years, especially in 1910 and 1912, radical revisions of the old rules were made; the new rules were designed to foster a more open style of play and to make the game more interesting to spectators. The periods of play, formerly two halves of 35 min. each, were altered to four periods of 15 min. each, with an intermission of one minute between the first and second, and third and fourth periods, and 15 min. between the second and third periods. The playing field, from goal line to goal line, was shortened from 110 to 100 yd. and each side was given four trials in which to make the required 10 yd. The removal of the restrictions on the forward pass was one of the most conspicuous changes; this with other new rules, had the effect of encouraging an open, running game, in which the advantage lay rather in quick thinking and skillful playing than in mere weight or strength. The full possibilities of the new rules were not realized for some time, but, as familiarity with them increased, the play became more spectacular, and there was no question that the game had been improved from the standpoint of both spectator and player. Ordinarily the schedule of football games was not designed to determine the champion team among eastern colleges; therefore in reviewing the football games of the decade 1910–20 the choice of the strongest teams is to some extent a matter of opinion. From 1910 to 1915, inclusive, Harvard University had a succession of strong teams, which in nearly every year gained what appeared to be a clear title to the championship. The succession was interrupted in 1911, however, when Princeton defeated both Harvard and Yale. In the next year the honours went to the smaller colleges—especially the university of Pittsburgh and Colgate University—and this was interpreted as due in part to the fact that the new rules had removed certain handicaps from the less powerful teams. Football probably had never been so popular as in 1916; it was estimated that in that year 35,000 games were played throughout the United States, with an attendance of 6,500,000. Owing to the entrance of the United States into the war, the major teams practically cancelled their schedules during the two following years, but in the army and navy every unit had its team. A full schedule was played by the A.E.F., the winners being the 89th Div. team, captained and coached by Captain Gerhardt of West Point. The resumption of college games in the east in 1919 showed that college football had lost none of its popularity. One of the strongest teams of 1919 was that of Pennsylvania State College, though Harvard went through the season without experiencing defeat. Despite a tie with Harvard, Princeton was generally conceded to have had the best team turned out in the east in 1920, the first really normal year of play after the war. The tendency among colleges was more and more towards open play, with much kicking and forward passing. The east, however, continued to play a far more conservative game than was popular in the west and south. Among the colleges of the middle west the strongest teams were Michigan (1910), Minnesota and Michigan (1911), Wisconsin (1912), Chicago (1913), Illinois (1914), Illinois and Minnesota (1915), Ohio State (1916–7), Illinois (1918–9), Ohio State (1920). Ohio State, champions of the middle-west group in 1920, played an intersectional match at Pasadena at the Festival of Roses in that year with the university of California, and was badly defeated. The large attendance at football matches led to the construction of immense stadiums of concrete and steel to accommodate the crowds. Two of these stadiums, those at Harvard and at Syracuse University, had been constructed before 1910; after that year there were built a number of others, among which the most noteworthy were, perhaps, those at the university of Chicago, Yale (the "Yale Bowl"), the university of Michigan, Princeton (the Palmer Memorial stadium), the university of Pennsylvania and the college of the City of New York. The greatest of these structures, the Yale Bowl, has exterior dimensions of 940 by 744 ft. and a permanent seating capacity of 61,000. This huge amphitheatre cost more than $500,000 and is considerably larger than the Roman Colosseum, which had a seating capacity of about 45,000. The Palmer stadium at Princeton provides seats for 41,000 and cost $350,000.

The *Association* game made remarkable gains in popularity not only among American colleges and the country clubs, but among the big industries as well. Each year the United States Football Assn. conducted a national cup competition, the final round of which was won in 1920 by the Ben Miller Athletic Club of St. Louis from the Fall River Club of Quincy, Mass. Previous winners include the Bethlehem Steel Co., the Fall River Rovers, and the Brooklyn Field Club.

Baseball, the universal American sport, occupied the attention of the public in the United States chiefly as a professional game in which the leading cities were represented by baseball teams comprising two major leagues—the American and the National. At the end of each year the winning teams of the two leagues played what was known as the world series for the championship. During 1910–20 these contests were by far the most popular of all annual sporting events. This is indicated by the attendance and gate receipts, which in 1920 were 174,414 and $564,800, respectively, and in 1919, 236,928 and $722,414, as against an attendance of 125,222 and receipts of $173,980 in 1910. In the following list of world-series contests since 1910, the name of the winning team is given first, that of the losing team second, and the score in games third: 1910, Philadelphia (American League) *vs.* Chicago (National League), 4—1; 1911, Philadelphia (A.L.) *vs.* New York (N.L.), 4—2; 1912, Boston (A.L.) *vs.* New York (N.L.), 4—3, one game tied; 1913, Philadelphia (A.L.) *vs.* New York (N.L.), 4—1; 1914, Boston (N.L.) *vs.* Philadelphia (A.L.), 4—0; 1915, Boston (A.L.) *vs.* Philadelphia (N.L.), 4—1; 1916, Boston (A.L.) *vs.* Brooklyn (N.L.), 4—1; 1917, Chicago (A.L.) *vs.* New York (N.L.), 4—2; 1918, Boston (A.L.) *vs.* Chicago (N.L.), 4—2; 1919 Cincinnati (N.L.) *vs.* Chicago (A.L.), 5—3; 1920, Cleveland (A.L.) *vs.* Brooklyn (N.L.), 5—2. In 1914 an attempt was made to organize a third major league, known as the Federal, but this was unsuccessful, and at the end of the following season it was amalgamated with the two older leagues. After 1919 baseball was for a time under a cloud, owing to charges that certain members of the Chicago American League team had been bribed by outside persons to lose the 1919 world series. The accused players were expelled from organized baseball, and there was a general overhauling, with the result that final authority over the game was given to Kenesaw Mountain Landis, a Federal judge known for his proficiency in the law and his knowledge of baseball. During the World War American soldiers carried the game to England and France, where it was a favorite diversion in the camps of Canadian and U.S. soldiers. The professional game enjoyed an extraordinary revival after the war, the crowds breaking all records, especially since Sunday playing was more generally permitted by law than before. Colleges generally resumed the game, though interest in college baseball was slight in comparison with interest in college football.

Lawn Tennis.—American players, during 1910–21, were in the forefront, but an increasingly high standard of play was being shown among other nationalities besides the British and American, notably the French and Japanese. The International Davis Cup was won by Australia in 1911 and 1914, by the British Isles in 1912, and by the United States in 1913 and 1920. In 1911 the United States team (Larned, McLoughlin, Little and Bundy), were beaten by Australia (Brookes, Dunlop and Heath) after beating Great Britain (Dixon, Lowe and Beamish). In 1912 Great Britain (Dixon, Parke and Beamish) defeated Australia (Brookes, Heath and Dunlop). In 1913 the United States (Hackett, McLoughlin, Little and Williams) beat Great Britain (Parke, Dixon, and Roper-Barrett). In 1914 Australia (Brookes, Wilding, Dunlop and Doust) beat the United States (McLoughlin, Williams, Behr and Bundy); McLoughlin defeated Brookes in a memorable match (14–16, 6–3, 6–3), and Wilding by 6–2, 6–3, 2–6 and 6–2, but McLoughlin and Bundy lost the doubles to Brookes and Wilding. In 1920 the United States (Hardy, Johnston, Tilden, Williams and Garland) defeated Great Britain, France and Australia.

In the English singles (world's) championships A. F. Wilding won in 1911, 1912 and 1913; N. E. Brookes in 1914; G. L. Patterson in 1919; and W. T. Tilden in 1920 and 1921. Mrs. Lambert Chambers won the English ladies' singles in 1911, 1913 and 1914; Mrs. Larcombe in 1912; and Mlle. S. Lenglen in 1919, 1920 and 1921. In the English covered court championship A. H. Gobert won the singles in 1911, 1912, 1920 and 1921; Gobert and M. J. G. Ritchie won the doubles in 1911, Wilding and S. N. Doust won the doubles in 1912 and 1913. P. M. Davson won the English singles in 1913 and 1919. In 1914 Ritchie won the English singles and in 1914 and 1921 T. M. Mavrogordato and Davson won the doubles. In 1919 the English doubles were won by R. Lycett and R. W. Heath, and in 1920 by Gobert and Lycett.

In the United States, William A. Larned won the championship for the seventh time in 1911, his experience proving too much for the challenger, Maurice F. McLoughlin; the doubles went to Raymond D. Little and Gustave Touchard, while Miss Hazel Hotchkiss won the women's title for the third time. In 1912 McLoughlin won the American championship, Larned not being in the tournament; McLoughlin and Thomas Bundy won the doubles from Little and Touchard, and Mary Browne won the women's championship. The outbreak of war in 1914 robbed the Newport tournament of interest. The German team was interned in England on the way home. Meantime Williams won the national title, and McLoughlin and Bundy the doubles. In 1915 much attention was paid to building up the junior tournaments. There was no international competition. William M. Johnston, of California won the championship. With Clarence J. Griffin, another Californian, he also won the doubles. Miss Molla Bjurstedt (later Mrs. Mallory), won the women's championship. In 1916 the United States was the world's lawn-tennis centre. The season was marked by the appearance of two Japanese players, Kumagae and Mikami, in the principal tournaments. Williams won the national singles title, Johnston and Griffin the doubles. Miss Bjurstedt took every title she contested. In 1917, with the United States in the war, tennis was transferred to the army and navy, all the ranking 10 players being in the services. The "patriotic" singles, in lieu of a national championship, was won by R. L. Murray, a Californian settled in the east. In 1918 R. L. Murray won the title in straight sets from William T. Tilden. Tilden and Vincent Richards won the doubles title. In 1919 Johnston won the singles title from Tilden, while Brookes and Gerald Patterson, from Australia, took the doubles. Brookes, Patterson, Lycett and Thomas, of Australia, invaded the United States, but were beaten at Forest Hills, 4 matches to 0, by Johnston and Williams, and in the doubles by Tilden and Johnston. In 1920 Tilden won back the singles titles from Johnston, while Johnston and Griffin won the doubles.

Polo.—The United States retained the cup against England at Meadowbrook in 1911, winning by 2 to 0, the American team consisting of the famous "big four," Lawrence Waterbury and J. M. Waterbury (forwards), Harry Payne Whitney (No. 3), and Devereux Milburn (back); in 1913 the same team won again by 2 matches to 0. In 1914 Lord Wimborne's team took the trophy to Great Britain winning 2 straight matches from an American team consisting of Milburn, who played both 3 and back, the two Waterburys, and René La Montagne. In 1921 an American invasion of Hurlingham was led by Devereux Milburn, whose team, consisting of himself at back, J. Watson Webb at No. 3, Thomas Hitchcock, Jr., at No. 2, and Louis E. Stoddard at No. 1, brought the cup back to the United States winning 2 straight matches by 11 to 4 and 10 to 6.

Yachting.—Just before the outbreak of the war Sir Thomas Lipton renewed his challenge for the America's Cup, there having been no races since 1903. "Shamrock IV.," a much-criticized boat, was sent to a drydock in Brooklyn, while "Resolute" and "Vanitie" reappeared and contested the right to sail as defender. The thirteenth series of races for this trophy was not sailed until July 15–27 1920, off Sandy Hook. The challenger was designed by C. E. Nicholson and was sailed by Capt. William P. Burton, an amateur skipper. Capt. Andrew Jackson Applegate, an American familiar with conditions on this course, acted as professional pilot. The defender was "Resolute," winner of 7 out of 13 races against "Vanitie," 4 being won by the latter and 2 called off. "Resolute" was built by a syndicate of New York yachtsmen, composed of J. P. Morgan, Cornelius Vanderbilt, Arthur Curtiss James, George F. Baker and others. The skipper was the well-known amateur, Charles Francis Adams of Boston. The sailing-master was Capt. Chris Christensen, he and the mates being of Scandinavian birth but American citizens. The defender was designed by Nat. Herreshoff, of the Herreshoff family of Bristol, R.I. The first 2 races were won by "Shamrock," the last 3 and the cup by "Resolute." Twice the yachts failed to finish within the 6-hour time limit. Once the wind was deemed too strong to permit a start. It was feared that with lee decks awash there was risk of losing a man overboard. In all but one race "Resolute" was allowed 6 min. 40 sec. handicap, due largely to the challenger's great sail area with Marconi mast and extreme hoist. In the same year was held the first race for the championship of the North Atlantic fishing fleet off Halifax. "Esperanto," United States, defeated "Delawanna," Canadian, in two straight races over a 40-m. course, for $4,000 and a cup.

Golf.—In Great Britain, H. Vardon was the champion in 1911 and 1914, E. Ray in 1912, J. H. Taylor in 1913, G. Duncan in 1920, and Jock Hutchison in 1921. In the amateur championships H. H. Hilton won in 1911 and 1913, John Ball in 1912, J. L. C. Jenkins in 1914, C. J. H. Tolley in 1920 and W. I. Hunter in 1921. The ladies' open championship fell to Miss D. Campbell in 1911, to Miss G. Ravenscroft in 1912, to Miss Muriel Dodd in 1913, and in 1914, 1919, 1920 and 1921 to Miss C. Leitch.

In the United States the amateur championship was won by H. Hilton in 1911 and by Jerome Travers in 1912. J. J. McDermott won the open tournament both in 1911 and 1912. Travers defeated Anderson for the amateur title in 1913, and Francis Ouimet won the open title, after a tie with Harry Vardon and Ted Ray of England. No amateur before had won this title, and Ouimet was only 20 years old. Miss Gladys Ravenscroft, of England, won the American ladies' championship in 1913. In 1914 Ouimet defeated W. C. Fownes for the amateur title, and Walter Hagen won the open from a field of English, French and Scotch professionals; the women's title went to Miss Georgiana Bishop. The amateur title for 1915 went to Robert M. Gardner; and Jerome Travers won the open, the second triumph of an amateur. In 1916 "Chick" Evans took the amateur title from Gardner, and the open from the professional Jock Hutchison. With the United States at war in the following year golf was abandoned save as exhibitions were given in aid of the Red Cross. The first revival came in 1918 with a match in Canada between American and Canadian amateurs, which was won by the Canadians, 23 to 19. A complete revival followed in 1919; S. Davisson Herron won the amateur title, though four former champions, Travers, Gardner, Ouimet and Evans, were entered. "Bobby" Jones was the runner-up. The open was won by Walter Hagen, while Miss Alexa Stirling easily took the women's title. Gardner went to England in 1920 for the amateur championship, and was only beaten in the final, after an extra hole, by Cyril J. Tolley, the Oxonian. Ray and Vardon made this year a remarkable invasion of the United States, Ted Ray winning the open championship. The amateur title went to Evans. The U.S. team easily won the Devonshire Cup from Canada. In 1921 an American invasion of England by the strongest of professional and amateur teams resulted in the winning of a team match by the Americans, and of the open championship by Jock Hutchison, of St. Andrews, a naturalized American.

Horse Racing.—The following is a list of the winners of the Derby in England from 1911 to 1921:—

	Winner	Owner	Trainer	Jockey
1911	Sunstar	Mr. J. B. Joel	C. Morton	G. Stern
1912	Tagalie	Mr. Raphael	D. Waugh	J. Reiff
1913	[1]Aboyeur	Mr. Cunliffe	Lewis	Piper
1914	Durbar II.	Mr. H. B. Duryea	(trained in France)	MacGee
1915	[2]Pommern	Mr. S. B. Joel	C. Peck	S. Donoghue
1916	[2]Fifinella	Mr. E. Hulton	R. C. Dawson	J. Childs
1917	[2]Gay Crusader	Mr. Fairie	A. Taylor	S. Donoghue
1918	[2]Gainsborough	Lady James Douglas	A. Taylor	J. Childs
1919	Grand Parade	Lord Glanely	Barling	F. Templeman
1920	Spion Kop	Major G. Loder	Gilpin	F. O'Neill
1921	Humorist	Mr. J. B. Joel	Morton	Donoghue

[1] Craganour, who came in first, was disqualified.

[2] "New Derby" run at Newmarket.

Other "classic" races resulted as follows:—

	Oaks	Doncaster St. Leger	2,000-guineas Newmarket	1,000-guineas Newmarket
1911	Cherimoya	Prince Palatine	Sunstar	Atmah
1912	Mirska	Tracery	Sweeper II.	Tagalie
1913	Jest	Night Hawk	Louvois	Jest
1914	Princess Dorrie	Black Jester	Kennymore	Princess Dorrie
1915	[1]Snow Marten	Not run	Pommern	Silver Tag
1916	[1]Fifinella	Not run	Clarissimus	Canyon
1917	[1]Sunny Jane	" "	Gay Crusader	Diadem
1918	[1]My Dear	" "	Gainsborough	Ferry
1919	Bayuda	Keysoe	The Panther	Roseway
1920	Charlebelle	Caligula	Tetratema	Cinna
1921	Love in Idleness		Craig an Eran	Bettina

[1] Run at Newmarket.

In 1914, before the season was half over, came the war. During most of August racing was suspended, partly because of difficulties of transit and also because some courses were occupied by the military. Owing largely to the King's desire that the interests of the many people employed in racing establishments should not be endangered, the remaining fixtures were carried out, so far as regarded the more important ones. For the first time since 1865 the Derby was won by a horse bred and trained in France, Durbar II. On May 16 1915 the Jockey Club issued a notice suspending all racing under their jurisdiction, except the Newmarket fixtures, until further notice. Substitute races for the Derby, Oaks and St. Leger were arranged at Newmarket.

In the United States, too, horse-racing was interrupted by the war, but there was a prompt revival afterwards. In 1920 Man-O'-War, a chestnut colt by Fair Play-Mahubah, from the Glen Riddle Farm, and trained by Louis Feustel, started in 21 races, winning 20 and taking one second. Its total winnings amounted to $244,465. Man-O'-War held the American running records for 1 m. (1 min. $35\frac{4}{5}$ sec.), $1\frac{1}{8}$ m., $1\frac{3}{8}$ m. and $1\frac{5}{8}$ m. The climax of the 1920 season was a match race between Man-O'-War, owned by Samuel Riddle, and Sir Barton, owned by Commodore Ross of Canada, at a mile and a quarter, at the Kenilworth track, Windsor, Ont. The race was for a purse of $75,000 and a $5,000 cup offered by A. M. Orpen. Man-O'-War won by seven lengths in 2 min., 3 sec., three seconds slower than the record made by Whisk Broom II. in 1913.

Rowing.—For the professional championship of the world, the following contests took place:—

1910—R. Arnst beat E. Barry on Zambesi.
1911—R. Arnst beat H. Pearce on Parramatta.
1912—E. Barry beat R. Arnst on Thames.
1912—E. Barry beat E. Durnan on Thames.
1913—E. Barry beat H. Pearce on Thames.
1914—E. Barry beat J. Paddon on Thames.
1919—A. D. Felton beat E. Barry on Thames.
1920—E. Barry beat A. D. Felton on Parramatta.

In England the winners in the Oxford and Cambridge boat races for 1911–21 were:—

1911	Oxford	1915–9	Not rowed
1912	Oxford	1920	Cambridge
1913	Oxford	1921	Cambridge
1914	Cambridge		

In the 1912 races, as originally rowed, both boats became waterlogged and Cambridge sank. But the race was rowed again the following Monday, Oxford winning.

American rowing, interrupted by the war, was promptly revived, and assumed an international character when in 1920 the veteran crew of the U.S. Naval Academy at Annapolis defeated a picked English eight over the canal course at Brussels for the Olympic championship. In 1921 the Annapolis crew, with two new men in the boat, was defeated by Princeton University in a race on Carnegie Lake, over a course of a mile and three-quarters. The same Annapolis crew in the same year won the revival of the Poughkeepsie Regatta over three miles, easily defeating California, Cornell, Pennsylvania, Syracuse and Columbia, the last named up to that time an unbeaten combination. Yale defeated Harvard in 1921, on the Thames river at New London, Conn., at four miles, using English rigging and boat, and being coached in the last two weeks by James Corderry, an English sculler, who had succeeded Guy Nickalls at the eleventh hour as coach at New Haven. In 1920 Harvard beat Yale, but the previous year Yale won under the coaching of Prof. Mather Abbott, an Englishman who had taught rowing for many years at St. Paul's School, Concord. Syracuse in 1916 won the Poughkeepsie Regatta under the coaching of James A. Ten Eyck. In 1920 Charles E. Courtney, Cornell's rowing coach, the foremost of American coaches, died. The winners of the American Intercollegiate regatta after 1909 were Cornell (1910, 1911 and 1912), Syracuse (1913), Columbia (1914), Cornell (1915), Syracuse (1916 and 1920), Annapolis (1921). The Yale-Harvard races were won as follows: Harvard (1910, 1911, 1912, 1913), Yale (1914 and 1915), Harvard (1916), Yale (1919), Harvard (1920), Yale (1921).

Boxing.—The official maximum boxing weights (Great Britain and the United States) are as follows:—Flyweight, 8 st. (112 lb.); Bantamweight, 8 st. 6 lb. (118 lb.); Featherweight, 9 st. (126 lb.); Lightweight, 9 st. 6 lb. (132 lb.); Welterweight, 10 st. 7 lb. (147 lb.); Middleweight, 11 st. 6 lb. (160 lb.); Light-Heavyweight, 12 st. 7 lb. (175 lb.); Heavyweight, no maximum.

In 1920 the official list of the world's champions was:—*Flyweight*, Jimmy Wilde (Gt. Britain); *Bantamweight*, Peter Hermann (U.S.A.); *Featherweight*, Johnny Kilbane (U.S.A.); *Lightweight*, Benny Leonard (U.S.A.); *Welterweight*, Jack Britton (U.S.A.); *Middle*, Mike O'Dowd (U.S.A.); *Heavy*, Jack Dempsey (U.S.A.).

The results of the Amateur Boxing Association Championships in England were as follows in 1911–4:—

	Bantamweight	Featherweight	Lightweight
1911	W. W. Allen	H. Bavers	A. Spenceley
1912	W. W. Allen	G. R. Baker	R. Marriott
1913	A. Wye	G. R. Baker	F. Grace
1914	W. W. Allen	G. R. Baker	R. Marriott

	Middleweight	Heavyweight
1911	W. Child	W. Hazell
1912	E. V. Chandler	R. Smith
1913	W. Bradley	R. Smith (walked over)
1914	H. Brown	E. V. Chandler

In professional contests the bantamweight championship of England was won by Digger Stanley against Alec Lafferty in 1912, by B. Beynon in 1913 (*vs.* Digger Stanley) and by Curly Walker in 1914 (*vs.* C. Ledoux). Fred Welsh was the lightweight champion of England in 1912 (*vs.* Matt Wells), 1913 (*vs.* H. Mehegan) and 1914 (*vs.* W. Ritchie). Johnny Summers was the welterweight champion of England in 1912 (*vs.* Arthur Evernden) and 1913 (*vs.* S. Burns). Jack Harrison was the middleweight champion of England in 1912 (*vs.* Private McEnroy). In 1913 (*vs.* Packy Mahoney) and 1914 (*vs.* Colin Bell) Bombardier Wells was the heavyweight champion of England, and in 1913 (*vs.* Alec Lambert) Kid Lewis was the featherweight champion of England. In 1912 Jim Driscoll (Cardiff) won the featherweight championship of the world against Jean Poesy (France); Jack Johnson (America) (heavyweight champion of the world) beat Jim Flynn (America); Georges Carpentier (France) beat Jim Sullivan (England); Frank Klaus (America) beat Carpentier; Billy Papke (America) beat Carpentier.

In 1913, in the middleweight championship of the world, F. Klaus beat Billy Papke; in lightweight championship of the world F. Welsh beat H. Mehegan; in featherweight championship of the world, J. Driscoll and Owen Moran drew; and in heavweight championship of Europe, Carpentier beat Bombardier Wells.

In 1914, in lightweight championship of the world, F. Welsh beat W. Ritchie; and in heavyweight championship of Europe, Carpentier beat Gunboat Smith.

In 1915, at Havana, Jess Willard defeated Jack Johnson in the 25th round for the world's championship.

In 1919, at Toledo, U.S.A., Jack Dempsey beat Jess Willard (holder) for the world's championship in the 3rd round.

On Dec. 4 1919, at the Holborn Stadium, London, Carpentier beat Joe Beckett in a fight for the heavyweight championship of Europe. Beckett was knocked out in the first round after the fight had lasted one minute fourteen seconds. In 1921 Carpentier was beaten at Jersey City, U.S.A., by Dempsey, in the 4th round, in a contest for the heavyweight championship of the world, the greatest interest having been excited by this fight.

Swimming.—American swimmers in 1920 held a majority of the world's records. A large number of these records were held by three men—Duke Kahanamoku of Hawaii, Perry McGilvray of Chicago and Norman Ross of San Francisco. Kahanamoku won the 100-metre race at the Olympic games of 1920, establishing a new world's record of 1 min. ⅖ sec. Ross was winner in two events (400 metres and 1,500 metres); Warren Kealoha of Honolulu was victorious in the 100-metre backstroke race, and the American team carried off the honours in the 800-metre relay. Two races were lost to Swedish swimmers. American women also proved themselves good swimmers, one of their triumphs was the defeat in 1919 of two Australians, Miss Fanny Durack and Miss Wylie, who visited the United States in that year. The victorious Americans were Miss Ethelda Bleibtrey and Miss Charlotte Boyle, both of Brooklyn. Miss Bleibtrey won a number of races at the Olympic games in 1920, where she established a record of 4 min. 34 sec. for 300 metres open water.

English Billiards.—Since the prohibition of consecutive spot hazards and the push stroke, English professionals have relied chiefly upon the top-of-the-table game. An innovation, however, was introduced in 1911 by the Australian, George Gray, who repeatedly made huge breaks by means of a series of losing hazards from the red ball. In all, he scored 24 breaks of four figures, of which the highest was 2,196. Gray invariably declined to play matches with ivory balls, and these breaks were not made under Billiard Association rules. H. W. Stevenson, though not at his best in 1911, beat M. Inman twice for the championship of the Billiards Control Club. In Jan. 1912 George Gray met Stevenson and defeated him in two games out of three of 18,000 up. M. Inman beat T. Reece for the Billiard Control championship in 1912, 1913 and 1914. In 1919 Inman beat Stevenson in the Billiard Association championship by 6,532 points in 16,000. In 1920 W. Smith beat C. Falkiner in the Billiard Association championship by 1,500 points in 16,000. In 1921 Newman beat Reece in the professional championship by 5,256 points in 16,000.

In 1911 H. A. O. Lonsdale did not defend his title of amateur champion, and the cup reverted to H. C. Virr. An alteration was made in the arrangements, the champions of England, Ireland, Scotland and Wales meeting in competition in the finals. Virr beat Major Fleming by only seven points in 3,000 for the amateur championship in 1912. The influence of Gray's example was plainly perceptible in this competition in the use made of the losing hazard. In 1913 Virr beat J. Nugent by 1,044 points in 3,000 and in 1914 by 1,962 in 3,000. In 1914 the Scottish championship was won by A. Croneen, and the Welsh championship by A. Paton. In 1915 the United Kingdom Amateur Championship was won by A. W. T. Good (England) by 3,000 points to 2,716. In 1918 it was won by Graham Symes by 2,000 points to 1,721. In 1919 S. H. Fry won the Amateur championship by 2,000 points to 1,729, but in the Billiard Control Club's Amateur Championship Tournament was beaten by Major Fleming by 2,000 points to 1,903. In 1920 Fry again won the Amateur Championship, by 3,000 points to 2,488.

A break of 1,016 was made by Stevenson in 1912 against W. Cook, without a series of spot strokes, anchor cannons or long successions of losing hazards. Stevenson made a break of 919 in 1913, and in the same year M. Inman made one of 894. In 1903 the amateur S. H. Fry made a break of 236.

Archery.—The opportunity may be taken here to correct the earlier article on ARCHERY in some particulars. The bow now used by men is from 6 ft. 1 in. to 6 ft. 4 in. in length; a lady's bow ranges from 5 ft. 6 in. to 5 ft. 8 in., measured between the nocks; these lengths according in the one case with an arrow of 27 in. to 28 in. and in the other with an arrow of 25 in. to 26 in. Exceptionally long arms may render necessary an arrow an inch longer and a corresponding addition of one or two inches to the bow. The "weight" of a bow is the number of pounds required, when appended to the string, to draw to the head an arrow of 28 in. for a man's bow or 25 in. for a lady's. The weight of men's bows varies from 36 lb. to 58 lb., of ladies' from 18 lb. to 30 lb., the lighter weights being sufficient for beginners. Bows are styled "self" or "backed" according as they are made of one wood or of two or more glued together. "Self bows," if of yew, are usually made of two pieces joined by a double fish splice at the handle: as it is difficult to find a piece of this wood (incomparably the best) of sufficient length while free from knots. If made of lance they are invariably of a single piece. "Backed bows" may be of yew, backed either with the same wood or with hickory; or alternatively of washaba or of ruby, lance, or other woods backed with hickory; the back being the flat side of the bow, and the "belly" the rounded side. Three woods are sometimes employed, a thin strip of fustic being interposed between a belly of yew and a back of hickory. There should be an inflexible centre of about 21 inches, whence the bow should taper gradually towards each end. It should be straight, the back true, and, when strung, the string should appear to cut the belly into two equal parts. Self yew bows are the best. They are light in the hand, the sweetest to pull, and have the best cast; but they require careful handling. They are also expensive, costing from £5 to £15, and they are liable to "crysals," or tiny cracks, which gradually spread until the bow breaks. A yew backed yew, which is next in merit, can be bought for £5 and is somewhat less liable to crysals. Between the others there is little to choose, provided that they are properly made, and not "reflexed," as they are said to be when the ends bend outward; for these jar the hand. Their price varies from 25s. to 3 guineas. The string for a man's bow should be from 6 in. to 6¾ in. from the back of the bow when strung; for a lady's from 5¼ in. to 6 in., according to the length of the bow. The nock of arrows—it is never called the "notch"—should not be "cut square" but rounded. The feathers must be wing and not body feathers, which are quite useless. They should be from the same wing, *i.e.* right or left, about 1½ in. long and tapering to the front from a depth of ½ in. at the nock. If balloon-shaped, their greatest depth should be at one-third of their length from the nock-end.

With regard to target scoring and handicapping it should be noted that a St. George's Round has never been shot at a public meeting, or, indeed, at any meeting held within the last 60 years. Handicapping by the loss of rings has been obsolete for more than 35 years, nor is there any system which can rightly be called handicapping by points. Handicapping is now carried out either by dividing the archers into classes according to their powers, or by deducting percentages from their scores for previous successes.

As regards the history of archery, some corrections may also be made. The bow was used in war at a later date than 1860, viz. by the Japanese against the English at Surni Nosake, September 5 1864. Nor did the Armada year see the last appearance of the English archer. A company of archers was raised for the expedition to the island of Rhè in 1627. There were archers among the Russian troops in the Crimea. Again, the relation of Finsbury Archers, the Hon. Artillery Company and the Royal Toxophilite Society requires restatement. In July 1676, William Wood, Marshal of the Finsbury Archers, was sent round with a paper, signed by Sir E. Hungerford and others, setting forth that the "officers and others of the Society of Archers, within the cities of London and Westminster" have determined "that the bearer shall have a silver badge and bear the same as Marshall to the Queen's Majesty's Regiment of Archers." The names of the subscribers were appended (Guildhall MSS. 193). Consequently this badge or shield had no connexion with Oxford. The Finsbury Archers became extinct about 1761, but the Royal Toxophilite Society was not founded until 1781, when Mr. P. Constable, the last captain of the Finsbury Archers, joined it and handed to it the shield and other valuables. There was, therefore, no combination of the two clubs in 1841. It is incorrect to assert that the Finsbury Archers were not connected with the Hon. Artillery Company. They were connected, and under their powers shot over the Finsbury Fields up to 1657. The Archers' Division of the Hon. Artillery Company was formed by members of the Royal Toxophilite Society in 1784. (X.)

SPRING-RICE, SIR CECIL ARTHUR (1859–1918), English diplomatist, was born in London Feb. 27 1859, the second son of the Hon. Charles Spring-Rice (1819–1870), sometime assistant under-secretary for foreign affairs, and grandson of the 1st Baron Monteagle. He was educated at Eton and Balliol College, Oxford, and entered the Foreign Office in 1882, becoming private secretary to Lord Granville in 1884 and précis writer to Lord Rosebery in 1885. He went to Washington as third secretary in 1886, and after various brief appointments went in 1895 to Berlin. In 1898 he became secretary at Teheran, and from there went in 1901 to Cairo as British commissioner on the Caisse de la Dette. In 1903 he went to St. Petersburg, first as secretary and later as councillor of embassy, remaining in Russia during the war with Japan of 1904–5 and the revolution of 1905. In 1906 he was sent to Persia as minister, having lately been created K.C.M.G., and his stay there coincided with the period of the delicate negotiations which preceded the signing of the Anglo-Russian agreement of 1907. In 1908 he was created G.C.V.O. and went to Sweden as minister, and in 1912 was appointed ambassador to the United States. Ill-health, however, prevented his undoubtedly brilliant capacity from making his work at all prominent during his tenure of this position. He died at Ottawa on his way home to England Feb. 14 1918. He married in 1904 Florence, daughter of Sir Frank Lascelles, and left two children.

SQUIRES, RICHARD ANDERSON (1880–), Newfoundland politician, was born at Harbour Grace, Newfoundland, Jan. 18 1880. He was educated at the Methodist College, St. John's, and Dalhousie University, Halifax. In 1902 he was admitted a solicitor, and in 1911 was called to the bar (K.C. 1914). In 1909 he entered the Legislature as Liberal member for the Trinity district, for which he sat until 1913. In 1914 he became Minister of Justice and Attorney-General, from 1914 to 1917 was a member of the Legislative Council, and from 1917 to 1918 Colonial Secretary. He was nominated leader of the Liberal party in Aug. 1919, and the same year became Prime Minister.

STAFF, MILITARY (*see* 25.752).—One result of the unqualified success which Prussian arms achieved in the wars of 1866 and 1870–1 was that the general staff principle, which had so largely contributed to give victory to the hosts controlled by von Moltke in those contests, was adopted by almost every military power during the last quarter of the 19th century. The exact nature of the arrangements necessarily varied in different countries, but the ideals sought after were the same. Thus in the different staff organizations as they were constituted in peace-time, work in connexion with devising plans for offensive operations and for ensuring territorial defence, duties dealing with the collection of military information, the superintendence of the education of officers, the conduct of manœuvres and the training of troops, were kept as far as possible distinct from administration—"*adjutantur*," as the Germans call it. Before the year 1900 most armies possessed a general staff which was more or less in close touch with its Government on the one hand and, thanks to its ramifications, with the troops on the other.

Only two of the more important nations—the United Kingdom and the United States—adhered for all practical purposes to previously existing systems, under which preparation for war was relegated to the background in staff duties. It is true that in either state certain improvements were effected by the military authorities, tending towards ensuring that at least some of the functions properly performed by a general staff should be allocated to special branches of the staff; but, such as they were, they did not go very far. Then came the S. African War of 1899–1902. The difficulties and disappointments encountered by British military forces in that protracted struggle, coupled with the unsatisfactory working of the staff in the field (especially in its higher grades) during the progress of the operations, made plain the need of reform, and the War Office was considering the question of far-reaching modifications of the system in force when, in 1904, the Government suddenly set up a "War Office Reconstitution Committee" charged with the duty of reorganizing the central administration of the army. The committee recommended a number of drastic alterations, but by far the most important of its proposals was that a General Staff Department, which was to constitute the foremost branch of the professional side of the War Office, should be created forthwith out of certain existing sections, with entirely new sections superposed. The committee further urged that a general staff organization, acting under the aegis of, and in close touch with, the general staff in Whitehall, should be introduced into military districts and commands. The recommendations of the committee were accepted by the Government, and so it came about that a British general staff was established ten years before the outbreak of the World War. During those ten years remarkable progress was made, and when the nation was confronted by the tremendous emergency of Aug. 1914 it had at its disposition a body of well-trained general staff officers, sufficient for the comparatively small army that was available to take the field at the opening of hostilities, although totally insufficient to meet the requirements of the vast forces which had to be improvised after war had broken out. The Government of the United States was still later than that of the United Kingdom in establishing a general staff of the kind that Scharnhorst had thought of a century before. This was only set on foot in 1911, six years before the entry of the Republic into the great conflict which was to upset so many preconceived ideas on the subject of conducting war, but which was to prove—even more conclusively than had the Franco-German War and the Japanese triumphs of 1904–5—how imperative it is under modern conditions for a state which embarks upon a serious struggle with a foreign foe to have an efficient and suitably organized military staff at its command. Owing to the very small number of trained general staff officers that were available when the country became committed to hostilities on a vast scale, the U.S. forces were even worse equipped in this respect when they took the field in Europe than were those of the United Kingdom in their greatly expanded form.

The remarkable progress that has taken place in science of recent years has tended to impose some entirely new duties upon military staffs, brought about their expansion in certain directions, and even necessitated the creation of some entirely new branches as part of their organization. There is, for instance, in the first place that development in railway communications which has occurred in most civilized countries and in many possible and actual theatres of war, as also the contriving of numberless devices by which the construction of new lines of rail is facilitated during operations in the field. Then again there is the question of electric communications, which to-day play so conspicuous a part in war. Improvements in small arms and in ordnance have brought it about that the volume of ammunition needed for the weapons in the hands of troops has come to be out of all proportion to the amount which experience had proved to be ample in campaigns of the past. Developments in mechanical traction are giving this an ever-increasing military importance, not merely from the point of view of the supplying of armies but also from that of their tactical employment. The appearance of the tank on the battlefield is another feature of very recent date which tends to increase staff work. Finally, there is the establishment of air power which has introduced a factor of incalculable importance as affecting the control of belligerent armies; whether the combatant aeronautical service of a nation form part of its military organization or be independent, its operations in time of war impose duties upon military staffs such as had not to be performed by them in any contest previous to the World War. In some cases it is mainly the general staff that finds its labours increased by these modern developments, in other cases the new work falls rather upon the administrative staff. But in all cases both subdivisions of the staff are, at least to some extent, affected.

One most important duty which devolves upon the general staff in a State compelled by its geographical position and by political and international problems to maintain fighting forces both by sea and by land is the establishing and the maintenance of intimate relations with the naval authorities. Such conditions prevail in the case of most maritime nations, and, where this is so, it is imperative that the two services shall be capable of effective coöperation in the event of war. Effective coöperation when an emergency arises can only be ensured if the military staff has been in close touch with the corresponding naval staff in time of peace. Much attention had fortunately been paid to this question in the United Kingdom during the period that intervened between the creation of the British general staff and the outbreak of the World War. Permanent contact existed between the thinking branches of the Admiralty and of the War Office. Problems which might possibly arise in the future had been examined by them in conference, principles of action had been laid down, details had been worked out, and to this is to be attributed the secrecy and the smoothness with which the British Expeditionary Force was transported across the Channel to France during the fortnight succeeding the declaration of war in 1914. Moreover, thanks to their being brought into contact at staff rides with naval officers and to the happy relations which existed between these two services, British general staff officers as a body had studied and were acquainted with naval doctrine and naval procedure, a great advantage when, as was the case at the Dardanelles, operations partook of an amphibious character. General staffs on the Continent did not, on the other hand, prove to be equally well-informed as to maritime conditions; this was made apparent during discussions such as often took place between military authorities representing the different Allies, concerning the policy which ought to be pursued in the Near East and other problems in which sea-power was necessarily involved. It is only natural, however, that a military staff which is representative of a sea-faring people should devote more attention to such subjects than will that of a non-maritime nation or of a nation possessing small maritime interests and limited maritime resources.

When a country elects to make of its air service a department of State distinct from the army, as has happened in the United Kingdom, it necessarily falls to the lot of the military general staff to maintain those intimate relations with the aerial general staff by which alone mutual coöperation can be secured in time of war. Under such circumstances the military general staff stands towards the air service as it does to the navy.

"War," said Clausewitz, "is only a continuation of State policy by other means," and elsewhere that "none of the principal plans which are required for a war can be made without an insight into the political relations." It was a recognition of this truth on the part of her Government that led to the triumphs of Prussia, first over Austria and then over France, in the days of von Moltke, the foremost professional interpreter of Clausewitz' doctrines. The executive in Berlin had during the middle decades of the 19th century been working hand in hand with the general staff. Sadowa and Sedan were the outcome. The history of the short-lived German Empire indicates that in later years a tendency made itself felt for the general staff to attempt to direct, and even partially to succeed in directing, the policy of the Government. A system of genuine militarism in its worst form began to creep in, which in due course brought untold disasters on the German people; but the passages quoted above from the great Prussian military writer do not inculcate anything of that kind. What they do inculcate is that there should be at all times an intimate understanding between what has been called the "brain of the army" and the civilian executive at the head of the State. The truth is that any Government which understands its business will always, when any question of a delicate nature arises between it and the rulers of some foreign Power, keep itself fully acquainted with the resources at command for enforcing its wishes should a quarrel supervene. If, moreover, the most is to be made of such fighting force as a country will dispose of in the event of finding itself in a state of belligerency with some neighbour, it is indispensable that the military—as also naval—authorities shall have made beforehand a study of the strategical situation that will, as far as can be foreseen, arise when hostilities break out. It is also indispensable that those authorities shall have been made aware in advance of the likelihood of the struggle's taking place. It is on the central directing branch of the general staff, *i.e.* on the General Staff Department at the War Office in the case of the United Kingdom, as it was on the "Great General Staff" of the days of von Moltke and the German Empire, that devolves the duty of maintaining relations with the Government and of advising it regarding the military aspect of problems created by the international situation. That central directing branch of the general staff is entitled to expect that the Government shall keep it fully *au courant* with the political conditions of the day.

The merits of the doctrine preached by Clausewitz seem to be self-evident, but leaders of opinion in the United Kingdom were slow to realize its importance. There existed an almost unaccountable inability to perceive the dangers to which a State unprepared for emergencies is exposed. When a Royal Commission presided over by Lord Hartington virtually recommended the setting up of a general staff in 1889, one of its members, a prominent politician who at a later date came to be Prime Minister, actually—in one of the most fatuous documents ever written by a public man—objected to the proposal on the grounds that, owing to its peculiar position, Great Britain had no need to study possibilities of conflict in advance. With such ineptitude in influential quarters, the bitter experiences of the S. African War were required to awaken British statesmen to a realization of their responsibilities. The lessons of that contest were to some extent learnt. By the setting up of the Committee of Imperial Defence, in which professional opinion was given a powerful voice, some preliminary steps had been taken in the right direction even before the creation of the general staff in 1904, and, subsequent to that date, the general staff at the War Office has been constantly consulted by the British Government and has been kept well-informed on all points of importance connected with the international situation.

How, as a matter of administration, the relations between the general staff and the executive are to be governed, and by what process communications between them are to be carried out, necessarily depends upon the political system in vogue in the state concerned. In any country possessing representative institutions the general staff can only be acting in a consultative capacity, at all events in peace-time. In the United Kingdom in the years preceding the World War the Chief of the Imperial General Staff and the Director of Military Operations were *ex-officio* members of the Committee of Imperial Defence. When strategical or administrative questions in which military force was or might be concerned were to be discussed by the committee, documents setting out the general staff view on the subject were laid before it by the general staff representatives. The decision of the committee on the points under discussion was taken and recorded, and executive action sometimes followed if it was involved by the decision. But although the more prominent members of the Government were included in it, the committee itself was merely a consultative body, and no executive action involving expenditure could follow on one of its decisions without the obtaining of at least nominal Cabinet sanction. Such recommendations were liable to be vetoed on account of the expense by the committee without reference to the Cabinet. Moreover, it did not necessarily follow that the view of the general staff would be accepted by the committee even on academical questions.

An interesting example of the working of the system is provided by the story of the Dardanelles. The expediency of an attack upon the Straits in the event of a war with Turkey was gone into by the committee as an academical question in 1906. The general staff were opposed to such a venture and the Admiralty representatives in the main agreed with them, the committee decided that the undertaking would in the event of a contest be inadvisable, and the result was that study of the subject on the part of the general staff virtually ceased. When early in the World War the project was brought up afresh by the First Lord of the Admiralty, the decision which the Committee of Imperial Defence had arrived at eight years before was ignored, and when the operations were undertaken their progress was hampered by lack of information, owing to the general staff's having acted on that decision and having to some extent abandoned research with regard to the topography, the resources and so forth of this potential theatre of war. But experience proved that the general staff had been right.

When hostilities arise some instrument a good deal more effective than a consultative committee is needed to control conduct of the war, and, from Aug. 1914 to the date of the Armistice, the operations were, in the case of the United Kingdom, for the first two and a half years of the struggle under supreme charge of various forms of war council directly representative of the Cabinet and given a free hand by that body. They were later under supreme charge of the specially established War Cabinet. The general staff was practically always represented at the meetings of the war councils and of the War Cabinet, but purely in an advisory position without voting power. They were responsible to the council or the Cabinet for the advice they gave, but the council or the Cabinet was responsible to the country for accepting or rejecting that advice. It is true that as a result of somewhat peculiar conditions that held good in the early days of the struggle, attributable partly to the unique personality of Lord Kitchener and partly to the weakening of the general staff at the War Office when its cream was skimmed off and dispatched to the Continent, the influence of the brain of the army was not for a time exerted very effectually in the councils of the Government. But that was only a passing phase. At a later stage the general staff was always at least allowed to express its views, even if its opinion was not necessarily accepted.

As a matter of fact its opinion was occasionally ignored in questions of considerable importance. This was no doubt partly due to some want of confidence in its judgment felt in Government circles owing to the slow progress made towards victory, and partly due to the personality and the temperament of certain members of the Government itself. The general staff also must have been sometimes at fault on occasions when its advice was rejected, although, should the full facts ever be made known impartially, posterity will probably pronounce it usually to have been right. Still, a general staff, however well-organized it may be and however gifted and informed its personnel, is not infallible. That this is so was demonstrated in the protraction for years of the World War, whereas the British general staff had at the outset confidently reckoned on its only lasting some months. The German general staff, again, looked with contempt upon the huge forces that Lord Kitchener was known to be improvising, until the value of the British "New Armies" was proved up to the hilt in the field; and at a later stage of the struggle it totally miscalculated and underestimated the military potentialities of the United States. Moreover, all the European general staffs alike, in their forecasts made in time of peace, underrated the wastage in personnel and the expenditure in ammunition in a modern campaign on a great scale.

It has been said that a general staff must "think politically." If this maxim is merely to be taken as meaning that a general staff should appreciate political habits of thought, watch political tendencies, and keep itself acquainted with the political aspects of every question influencing military action alike in peace and in war, its truth is indisputable. But one of the most important duties falling to the lot of a general staff, especially in times of emergency, will often be to strive to prevent mere policy from adversely influencing the conduct of operations of war or affecting Government decisions in connexion with military subjects. History provides some striking examples of political considerations gravely prejudicing the prospects of armies in the field. MacMahon's fatal march to Sedan was a case in point. The retention of Gen. Penn Symons' advanced force at Glencoe in the opening days of the Natal campaign of 1899 furnishes another instance. Had the question at issue been regarded solely from the soldier's point of view, it is more than doubtful whether Gen. Townshend would ever have been launched on his ill-omened effort to reach Bagdad in Nov. 1915. When problems of this kind present themselves, a general staff will often have a difficult and delicate rôle to play. But the golden rule to govern its conduct on such occasions would seem to be that it ought to regard and present the problem from the fighting point of view alone. The politicians can look after the political side.

It cannot be too clearly understood that neither in the United Kingdom nor in any other military state does the staff of an army in reality consist of a general staff alone. There must always be what, for lack of a more distinctive nomenclature, is called in the British service its "administrative" side—although in point of fact many of the duties of a general staff are necessarily of an administrative character. It is indeed the case that, at least in peace-time, the administrative staff of an army is in a sense the more important of the two. The army has to be recruited and fed and clothed and equipped, and its discipline has to be maintained, otherwise there will be no troops for the general staff to dispose of and there will be no *raison d'être* for the general staff. Whereas the general staff will often in peace-time be engaged on work which in the event may prove of little profit, the administrative staff is constantly busy disposing of questions which if not dealt with will cause a collapse. Calling the administrative staff "*adjutantur*" may alter its status and may lower its dignity, but does not alter the fact that it is a staff and that it performs staff duties. The organization as affecting the administrative staff that was introduced into the War Office in the United Kingdom in 1904, and in due course extended throughout the army (the details of which have been touched upon in earlier paragraphs), worked extremely well both at headquarters and with the troops during the pre-war period, and it also gave good results when subjected to trial at manœuvres between 1909 and 1914. The same staff organization was extended to India shortly after it came into force in the United Kingdom. Nor, when it came to be put to the test in warfare on a gigantic scale in many parts of the world, was it found wanting. Although the problems engaging the attention of the quartermaster-general's staffs and the inspector-general of communications' staffs were in many respects fundamentally the same in the Gallipoli Peninsula, in Mesopotamia, and in France and Flanders, the wide differences in the geographical and topographical conditions as between the three theatres of war obliged the problems to be solved on separate lines in each case. In France and Flanders several railways connected the troops at the front with the secure and well-equipped ports that acted as bases. In the Gallipoli Peninsula open beaches under fire served for bases, and the communications were to all intents and purposes maritime. For most of the time in Mesopotamia it was a case of an army dependent on one single line of river communication, hundreds of miles long, although the river was gradually to some extent supplemented by specially constructed sections of railway. And yet the organization of the administrative staff as it had been designed in peace-time met requirements under these diverse sets of circumstances. Where failures occurred, they were due to errors in execution or else to lack of essential resources. Such alterations as have recently been carried out as a result of the teachings of the World War have been in detail and not in principle.

The British plan subordinates the administrative staff to the general staff less than is the common practice. This is perhaps due to the nature of British campaigns of the 1874–1902 era, campaigns fought in regions often destitute of communications and always poor in resources. Almost everything hinged on supply and transport in these contests, and the transport generally had to be improvised on entirely new methods for each particular case. Losses in action were as a rule trifling as compared to losses from disease. For one thought that the commander or his chief advisers gave to the enemy, ten thoughts were given to communications. Instead of looking to the front they were generally looking to the rear. Duties such as are now apportioned to the administrative staff greatly outweighed in importance duties such as are now apportioned to the general staff. There was little difficulty in beating the enemy if only supplies could be got up to permit a fight. But, to whatever cause it may be attributable, the fact remains that the chief of the general staff of a British army nowadays is merely in the position of *primus inter pares* relatively to the adjutant-general and the quartermaster-general—and it is the same at the War Office. In almost all other armies, on the other hand, including that of the United States, the chief of the general staff is definitely chief of the staff. And he also is usually called chief of the staff, the heads of different branches of the administrative staff being absolutely subjected to him. The "chief of the staff" plan was moreover adopted in the case of several British campaigns of modern date, *e.g.* that of 1882 in Egypt and Lord Wolseley's and Lord Kitchener's expeditions up the Nile in 1884–5 and 1898. A chief of the staff was appointed to Sir R. Buller at the outset of the S. African War (although owing to unforeseen events he never took up the post), and at a later date Lord Kitchener went out as chief of the staff to Lord Roberts.

If the existing British staff organization comes to be compared with those where the chief of the general staff is also chief of the staff, it will be found that there is something to be said on both sides. That part of the British system under which a command or a district is in peace-time supplied with a superior officer in charge of administration, to whom wide responsibilities are allowed and who is generally in practice senior to the principal general staff officer, permits the general in command to devote nearly the whole of his attention to preparing his troops for war. But that arrangement would be unworkable in the field. There the progress of operations is so dependent on the work of the administrative staff that the commander cannot transfer his authority in connexion with the latter to somebody else—as is recognized in the British staff organization in time of war by the heads of the adjutant-general and the quartermaster-general staffs, as well as the inspector of communications, then dealing direct with the commander. Still, the fact that a peace arrangement does not fit in with the requirements of war is not a conclusive argument against that arrangement's holding good in peace-time, which after all represents the normal condition of things; and the British plan of a chief of administration is only a special feature in a larger question. Objections do undoubtedly exist in peace-time to the supremacy of the chief of the general staff. That automatically makes him responsible for the work of the administrative staff, and as all manner of administrative problems—unimportant problems, perhaps, but problems which have to be solved—are constantly arising in peace-time, most of the chief of the general staff's time may come to be occupied with matters that are not general staff matters at all, and military policy, manœuvres, training of troops, higher instruction, defence schemes, and so forth, may suffer. But, if peace represents the normal state of affairs, armies none the less exist for purposes of war, and in time of war the case for the British system is not so strong.

In face of the enemy, operations—planning them, deciding whether the plan is feasible, and taking the necessary steps for their execution—are of paramount importance, but cannot be said actually to govern administration, for unless the army's establishments are maintained and unless it has its food, its ammunition, etc., it cannot carry out the operations. The success of the plan may in the main depend on strategical and tactical factors; but in framing the plan the duties which the administrative staff will have to perform in connexion with its execution must have been considered with meticulous care. It is for the administrative staff to say whether the plan is feasible from the point of view of supply, transport, depots, hospital service, and so forth. There may be great administrative difficulties in the way, which will as a matter of course be represented. It is, however, for the general staff to weigh the administrative as against the strategical aspects of the case and then lay the whole subject before the commander for a final decision. The British *Field Service Regulations* clearly admit by implication that the chief of the general staff is the superior of the adjutant-general, the quartermaster-general and the chief of communications, without their being actually under him. That, under conditions such as develop on active service, is apt to prove a somewhat clumsy arrangement and to give rise to friction. It is neither one thing nor the other. Granted that the "chief of the staff" system means centralization, granted that it demands from the chief of the general staff a somewhat closer acquaintance with purely administrative questions than would be necessary if the heads of the chief branches of the administrative staff were virtually his equals, even granted that under it less of his time will be available for the consideration of the strategical and tactical situation than would otherwise be the case, the system does seem a more satisfactory arrangement for purposes of operations in the field than that which found favour in the British army after the setting up of the Army Council. Nor would it seem to follow as a matter of course that the "chief of the staff" system must not be adopted in war-time, simply because it does not obtain during peace. (C. E. C.)

STAMBOLIISKI, ALEXANDER (1879–), Bulgarian statesman, was born at Slavovitsa in Bulgaria Sept. 1 1879. He was of peasant origin, but obtained a good education at Sofia and then at Halle in Germany. In 1902 he became editor of the newspaper of the Agrarian League and later entered the Sobranje. He soon acquired great influence among the peasants, and from the first took up an attitude of fearless opposition to King Ferdinand's policy. In 1908 Stamboliiski headed the Agrarian protest against the Declaration of Independence, as being in the interest of the dynasty rather than of the people. In 1911 he made a violent speech in the Grand Sobranje, opposing the amendment to the constitution by which the King was given the right to make secret treaties, and in 1913 he openly accused the King of having brought about the calamitous war with Serbia. On Sept. 17 1915 Stamboliiski accompanied the other leaders of the Opposition to the palace, and, in a forcible speech and later in personal conversation, he warned the King with characteristic *brusquerie* that if he again plunged the country into war it would end in disaster and that he would lose his throne, if not his head. Stamboliiski was then condemned to imprisonment for life, and was kept in strict and painful confinement from Sept. 30 1915 for three years; he was, however, allowed access to books and spent much of his time in study and writing. On Sept. 25 1918, when imminent catastrophe compelled Bulgaria to seek an armistice, he was released, and, after a stormy interview with the King, went to the front, where a revolutionary movement among the troops was developing. He returned with the insurrectionary troops to Sofia, and order was restored only after much loss of life; Stamboliiski was obliged to go into hiding, even after the King's abdication. The Government, however, soon realized that his help was essential in the critical state of the country, and he became Minister of Public Works in Todorov's Cabinet. Although the Agrarians had not an actual majority after the election of Aug. 1919, Stamboliiski became President of the Council and Minister for Foreign Affairs; on Nov. 27 he had the courage to sign the Treaty of Neuilly on behalf of his country. In April 1920 the Cabinet was reconstructed, Stamboliiski remaining as Premier, Minister for War and of Foreign Affairs in a Cabinet composed entirely of his own followers.

STANFORD, SIR CHARLES VILLIERS (1852–), Irish musical composer (*see* 25.773), published in 1911 *Musical Compositions;* three years later appeared *Pages from an Unwritten Diary* and in 1916 *A History of Music,* written in conjunction with his former pupil, Cecil Forsyth. In later years his music included the operatic piece *The Critic* (op. 144), produced by Beecham in 1916, and *The Travelling Companion* (op. 146), which won a Carnegie award in 1917, but had not yet been produced in 1921. In 1919 his symphony *L'Allegro ed Il Penseroso* also won a Carnegie award, and in 1921 his setting of a poem by Mr. Justice Darling entitled *At the Abbey Gate*—the point being the burial of the Unknown Warrior in the Abbey—was produced by the Royal Choral Society in the Albert Hall. Stanford's *Songs of the Fleet,* originally produced in 1910, gained great popularity, and he also composed much chamber music.

STANMORE, ARTHUR HAMILTON HAMILTON-GORDON, 1ST BARON (1829–1912), British administrator, was born Nov. 26 1829, the youngest son of the 4th Earl of Aberdeen. He was educated at Cambridge and afterwards entered politics, becoming private secretary to the Prime Minister, Lord Derby, from 1852 to 1855, and sitting as member for Beverley from 1854 to 1857. He was successively governor of Trinidad (1866–70), Mauritius (1871–4), Fiji (1875–80), New Zealand (1880–2) and Ceylon (1883–90). He was raised to the peerage in 1895, and died in London Jan. 30 1912. He was succeeded by his son, George Arthur Maurice Hamilton-Gordon, born Jan. 3 1871, who in 1916 was appointed lord-in-waiting to King George V.

STEAD, WILLIAM THOMAS (1849–1912), English journalist (*see* 25.817), was drowned on the "Titanic" April 15 1912.

STEED, HENRY WICKHAM (1871–), English journalist, was born at Long Melford, Suffolk, Oct. 10 1871, the son of a local solicitor, and was educated at Sudbury grammar school and the universities of Jena, Berlin and Paris. From 1896 to 1913 he acted continuously as foreign correspondent to *The Times*, beginning in Berlin, passing on to Rome, where he remained five years (1897–1902), and thence to Vienna (1902–13). His *Hapsburg Monarchy* (1913; 4th ed. 1918) is recognized as the most illuminating work that has been written on Austria-Hungary. In 1914 he became foreign editor (in London) of *The Times*, and in Feb. 1919 was appointed to succeed Mr. Geoffrey Dawson as editor. During the World War he was a prominent supporter of the Yugoslav movement. In 1918 under Lord Northcliffe he was engaged on propagandist work in the enemy countries, and he headed a special mission to Italy in March and April of that year. His other publications include *The Socialist and Labour Movement in England, Germany & France* (1894); *L'Angleterre et la Guerre* (1915); *L'Effort Anglais* (1916); *La Democratie Britannique* (1918).

STEER, P. WILSON (1860–), English painter (*see* 25.868), exhibited after 1886 practically the whole of his work at the New English Art Club, in whose formation he took a leading part and of which he was at one time president. His earlier work, such as the "Boulogne Sands" showed the influence of impressionism in its feeling for light and its handling of colour; but after 1895 he adopted a more sober palette, at times using strong black shadows with silvery lights, and gave increased attention to design. After 1900 he returned to the use of a full range of pigment, and produced some of his finest work, such as "Richmond after Storm" (1903) and "The Isle of Purbeck" (1909). In later years he only used the impressionist colour analysis to a very limited extent, and generally worked within a chosen and limited colour scheme. His feeling for colour harmony and power of rendering subtle variations in tone relate him to Gainsborough (a likeness well exemplified in "The Beaver Hat"), and give his work its characteristic quality. Most typical perhaps are his landscapes, mainly wide stretches of country with broken skies, full of light, atmosphere and a sense of space; but he also produced many portraits and figure compositions, his paintings of the nude being marked by great appreciation of the character and quality of flesh. His later work includes "A Summer Evening" (1914), "Painswick Beacon" (1916), "The Vale of Gloucester" (1917), "Chirk Castle" (1917), and a considerable group of water-colours, very delicately and directly handled. A self portrait is in the Uffizi Gallery, Florence, and he is represented in the Tate Gallery, the Municipal Gallery, Dublin, and the Johannesburg Gallery.

STEFÁNSSON, VILHJÁLMUR (1879–), Canadian explorer, was born at Arnes, Manitoba, Nov. 3 1879, of Icelandic parentage. He was educated at the universities of North Dakota and Iowa, and afterwards at Harvard. He became a newspaper reporter, but later was appointed to an instructorship of anthropology at Harvard, and became deeply interested in the problems of the Arctic regions. He made a private expedition to Iceland in 1904, and the following year returned with a Harvard archaeological expedition. He visited the Eskimo of northern Alaska (1906–7), and in 1908 started on a four years' expedition to the Arctic shores of Canada under the auspices of the Geological Survey of Canada and the American Museum of Natural History, with interesting results. In 1913 Stefánsson was appointed commander of the Canadian Arctic expedition which sailed from Victoria, B.C., in June of that year to explore the northern shores of Canada and Alaska. In 1914, with two companions, he crossed Beaufort Sea on the moving ice from Martin Point, Alaska, to the north-western corner of Banks I.; in 1915 he visited the sea west of Prince Patrick I. and discovered more land to the north; and in 1916 discovered land west of Axel Heiberg Island. The following year he travelled, again over moving ice, as far as lat. 80° 30′ N. and long. 112° W. The expedition returned to Canada in 1918 (*see* ARCTIC REGIONS). Stefánsson published *My Life with the Eskimo* (1913), *The Friendly Arctic* (1921) and an anthropological report on the expedition of 1908–12, besides many articles in scientific journals. He received many honours from learned societies.

STEIN, SIR (MARK) AUREL (1862–), British archaeologist, was born at Budapest Nov. 26 1862. Educated in the public schools of Budapest and Dresden and afterwards at the universities of Vienna and Tübingen, where he studied Oriental languages and antiquities, he went to England for further study and then to India, where he became principal of the Oriental College, Lahore, and registrar of the Punjab University in 1888. Eleven years later he was appointed to the Indian Education Service, and for the next two years carried out archaeological explorations for the Indian Government in Chinese Turkestan. In 1906–8 he made further explorations (*see* 27.425) in central Asia and western China, receiving the gold medal of the Royal Geographical Society. From 1909 he was superintendent of the Indian Archaeological Survey, and in 1913–6 carried out explorations in Persia and central Asia, described by him in the *Geographical Journal* (1916). He was created K.C.I.E. in 1912. His other publications include *Chronicle of Kings of Kashmir* (1900); *Ancient Khotan* (1907) and *Ruins of Desert Cathay* (1912).

STEVENSON, ADLAI EWING (1835–1914), American political leader (*see* 25.907), died at Chicago June 13 1914.

STEWART, JULIUS L. (1855–1919), American painter (*see* 25.914), died in Paris Jan. 4 1919.

STEYN, MARTINUS THEUNIS (1857–1916), Dutch S. African politician (*see* 25.915). After the prominent share which he took in the work of the S. African National Convention in 1909–10 ex-President Steyn retired into private life at his farm, Onze Rust (Our Rest), near Bloemfontein. From this retirement he never emerged till his death Nov. 28 1916, except to address occasional meetings of the Dutch people of S. Africa on topics of national interest. Yet this almost complete retirement from public activities did nothing to lessen his influence with his own people. It cannot be said that this influence was exercised to promote racial peace in S. Africa. When the dissension between Gen. Botha, the first Prime Minister of the Union of S. Africa, and Gen. Hertzog began to shake the frame of the Ministry, ex-President Steyn might have had a decisive influence in composing that difference, which was ultimately to break Gen. Botha's Cabinet and to lead to long dissension among the Dutch-speaking people of S. Africa. His weight, however, was thrown without reserve on the Hertzog side. The ideas of ex-President Steyn were the ideas of Kruger. He held with tenacity the creed of the Boer who regarded himself as the holder of S. Africa by a species of divine right, who resented the intrusion of the British element, and was determined to treat that element as intruders and "foreign adventurers." Beyond doubt they were sincere, if narrow. He held, as Kruger had held, and as Gen. Hertzog held, that the intrusion of the British element involved a descent into the muddy waters of commercialism, the strife of contending ideas and embroilment in the tangles of world-politics.

STINNES, HUGO (1870–), German industrialist and financier, was born at Mülheim on Feb. 12 1870. He was the son of Hugo Stinnes, and grandson of Matthias Stinnes, who was the founder of a firm in no great way of business at Mülheim in the Ruhr district. After passing his leaving examination from a *Realschule*, young Stinnes was placed in an office at Coblentz where he speedily picked up the elements of a business training. In order to get a practical knowledge of mining he worked for a few months as a miner at the Wiethe colliery. He then, in 1889, attended a course of instruction at the Academy of Mining in Berlin. In the following year he entered the firm which his grandfather had founded. He remained there only two years and then established a firm of his own, Hugo Stinnes, Ltd. The whole original share capital was 50,000 marks (pre-war=£2,500). Gradually, from dealing in coal, he became himself the owner of several mines and extended his business to the manufacture of different kinds of fuel such as briquettes. He also began to purchase sea-going vessels as well as river steamers and barges, the latter, especially on the Rhine, on a constantly increasing scale. He next organized an extensive international business in coal, and had 13 steamers trading to and from North Sea, Baltic, Mediterranean and Black Sea ports. They carried coal, wood and grain, also iron-ore, Stinnes having begun to manufacture iron and steel. He also imported great quantities of English coal and had an agency at Newcastle as well as an interest in some English mines. This led to his establishing branches of his business at Hamburg and at Rotterdam. Before the World War he was the possessor of a fortune which was vaguely estimated at several millions of pounds. He was a director of many of the greatest industrial and mining companies of Westphalia, the Rhineland and Luxemburg. Business interests of this magnitude were constantly expanding, and he became interested in numerous subsidiary enterprises, such as tramways and the supply of electric power and light. He was always engaged in founding new concerns or amalgamating existing ones. Stinnes managed to maintain an extensive and even a detailed knowledge of the working of all the concerns in which he was engaged, and in all of them to exact zealous and conscientious work from his business subordinates. The secret of his success was essential unity of direction and coordination of aims in all branches of his enterprises.

When the World War broke out he secured an enormous share in the war profits which flowed into the coffers of the great industrialists. In enemy countries, it is true, his enterprises were sequestrated, and his firm at Rotterdam placed on the Allies' "black list." But he was richly compensated, apart from the regular indemnification paid by the German Government, when he was called in by Ludendorff as the most competent expert to give advice, to organize the coal and the industrial production of occupied Belgium and to help to set in motion the gigantic production of war material which the German G.H.Q. demanded from the homeland. His connexion with Ludendorff led to his becoming an influence behind the scenes in German politics, and, after the revolution, to his entering the Reichstag, as well as to his début as a newspaper proprietor on a grand scale. During the war he had extended his activities in Hamburg and had bought up in 1916 the Woermann and the E. African lines. In these fresh undertakings he became associated with the two greatest German shipping concerns, the Hamburg-American line and the North German Lloyd. His Hamburg interests continued from that date onwards to multiply in something like geometrical progression. Half a dozen landed estates were purchased in Saxony to supply timber for pit props. At Flensburg in Schleswig he secured control of the largest Baltic shipping concern, and proceeded to build a new fleet of ships, christening one of them the "Hindenburg." In the elections of June 1920 he secured a seat in the Reichstag as a member of the Deutsche Volkspartei, the new electioneering name of the former National Liberal party. He had about the same time begun to buy up leading German newspapers, one of his main objects being to organize a solid and powerful *bloc* of opinion in Germany in support of law and order and the promotion of the highest industrial and commercial efficiency. His newspaper purchases included the *Deutsche Allgemeine Zeitung* in Berlin, formerly the organ of Bismarck and then of all succeeding German Governments, the *Münchener Neueste Nachrichten* and the *München-Augsburger Zeitung*, the last-named being one of the oldest newspapers in Germany. Both of the South German journals were previously exponents of a very much more democratic trend of opinion than that which came to characterize them under the new proprietorship. Ancillary to these acquisitions large interests were secured by Stinnes in paper-works in order to make his newspapers independent of the paper market.

In the autumn of 1921 he was reported to be contemplating some still vaster venture in the nature of a super trust to control every industry in Germany, so that the whole might ultimately be coördinated like one gigantic concern regulating production, transport and the supply of the German markets and those of the whole world. It might thus be possible to avoid waste, sudden crises, ruinous competition and foreign commercial dictation. He was reported to have already expended the equivalent of about £250,000,000 on these aims and to be continuing to sink further millions in them. The Social Democrats were believed not to be averse from Stinnes' vaster scheme, as it corresponded in certain aspects with their own plans, when they were in power, for coördinating all German industries, pending the possibility of socializing them. An instrument for superintending this coördination in the social and economic aspects was ready to hand in the Economic Council of the German Reich, set up by the new Republican constitution of 1919.

The only public check which Stinnes was known to have received in the course of his career was at the Spa Conference in 1920, when he attempted to address that assembly in peremptory language concerning the impossibility of the coal deliveries demanded by the Allies and was summarily silenced by the president.

STOCK EXCHANGE (*see* 25.930).—Before the outbreak of the World War in Aug. 1914 the London Stock Exchange had for several years experienced two remarkable periods of activity, both being the outcome of industrial development which caused a rapid intensifying of the demand for two commodities—namely, oil and rubber. This was the sequel to the discovery of the internal-combustion engine, and its increasing adoption in mechanical road transport.

Pre-war Rubber and Oil Booms.—The rubber boom came first. It began in 1909, and lasted until about 1912. The demand for rubber applied a great stimulus to the rubber plantation industry in the Malay States, the Dutch East Indies, Ceylon and India. The price of rubber rose at one time to over 12s. per lb., and an enormous number of new companies were formed, mostly with capitals of moderate size. In order to popularize rubber as an investment the resourceful company promoter introduced shares of the denomination of 2s. each. The innovation was extraordinarily successful, and a very large number of companies were floated with capital divided into 2s. shares, while others formed prior to the boom sub-divided their shares into the smaller and more popular denomination. Prices of shares rose to extraordinary heights. Premiums of thousands per cent were common, the shares of the Patalung and Selangor companies, two of the earliest plantation companies, rising to premiums in excess of 3,000 per cent. In Stock Exchange parlance the public "got the bit between its teeth," and the boom persisted for a long time. Large fortunes were made by people who participated in the boom in the early period. A reaction in the price of rubber, which ultimately fell below 1s. per lb. in 1921, had already put an end to the boom before the war began. Although the extravagant prices paid during the boom were at no time justified, the companies paid very satisfactory dividends for years; and it was not until the post-war depression, which was unparalleled in its severity, swept over the commodity markets in the latter part of 1920 and the first part of 1921 that the industry was faced with real difficulties. The tremendous stimulus applied to planting in 1910, 1911 and 1912 led to the inevitable overproduction, and in 1919 and 1921 schemes for limiting output were put into force.

The oil boom began shortly after the activity in rubber had been well spread. It persisted for a longer period, for the reason that the price of oil rose steadily from the introduction of the motor-car. It eventually reached its maximum height in 1920, but a reaction began in 1921, and this produced a corresponding movement in the share market. There was an enormous demand for petroleum spirit in the war period, and the price rose steeply. After the cessation of hostilities the price rose further, a circumstance which was partly due to the conversion of locomotives and ships' engines from coal to oil, partly to the great extension of mechanical transport on the road and in the air, and partly to the fact that the refinement and distribution of oil was in the hands chiefly of two vast organizations. The boom was accompanied by the flotation of a number of companies, particularly in Russia, where the Maikop field for a time attracted much attention. But in comparison with rubber, oil did not provide the same opportunities for the company promoter, and the flotation of companies for the exploitation of oil-fields, known and unknown, was comparatively limited. The oil boom lasted approximately 10 years, when a reaction set in. But meanwhile huge fortunes were made. Bonus shares were issued in great numbers by the principal oil companies, and this, together with high dividends, kept public interest at a high level.

With the exception of the oil market, stock markets were in a depressed condition for some time before the outbreak of war.

The War Period.—Early in July 1914, rumours of war began to affect the Continental *bourses*. On July 13 the Vienna market was demoralized by fear of hostilities, but it was not until July 24, when the terms of the Austrian ultimatum to Serbia were made known, that the London market became seriously perturbed. From that date until Friday July 31, when the London Stock Exchange Committee for General Purposes decided to close the House for an indefinite period, markets were inundated with a vast flood of selling orders from home and abroad, and excitement was intense. The European *bourses* virtually ceased to function, and this diverted an enormous stream of foreign selling orders to London. Inter-*bourse* securities naturally suffered a very heavy decline. On Monday July 27 many London jobbers ceased to "make prices." This was "general carry over" day, and the difficulties to be met by speculators were formidable. The settlement, however, was completed on Wednesday July 29, without any very serious disaster, though 9 failures, involving 20 members, were announced. Dealing, however, had become a matter of negotiation entirely, and on Thursday July 30 1914 the House opened for the last time that year. During the first two hours no attempt was made to do business, and the next morning the committee decided not to reopen the House until further notice. On Monday July 27 four consecutive transactions in consols were officially recorded at prices showing a movement of £1 between each bargain, a circumstance without precedent in modern London Stock Exchange history. During the closed period, business, despite official discouragement, was not entirely suspended. A certain amount of dealing, on a strictly cash basis, was found to be possible. On Sept. 14 the committee fixed minimum prices for trustee stocks, based on the quotations ruling on July 30, the object being to prevent disastrous depreciation. The New York Stock Exchange similarly made minimum prices for American shares, and these values were adopted by the London committee. The maintenance of these prices was insisted upon by the banks, which had undertaken to continue their loans against securities without asking for any additional margin.

Meanwhile the question of dealing with the uncompleted mid-August account was taken in hand on the London Stock Exchange and completed on Nov. 19, a special set of rules governing its arrangement. The gist of these rules was that bulls of stock carried over on July 27 should put up a 5% margin on high-class securities, and 10% on others, and pay interest fortnightly, or alternatively pay a higher rate of interest in lieu of margin. The "taker in" was put under the obligation of continuing to "take in" stock at July 27 prices until 12 months after the war, or the expiring of the Courts (Emergency Powers) Act, 1914, whichever event was the sooner. The declaration of a moratorium, which was continued until Nov. 4 1914, made it impossible to reopen the Stock Exchange for some months. About £90,000,000 had been borrowed against securities before the war began, and it was not until the moratorium came to an end that the mid-August settlement was carried through. The affairs of a small number of members were in this operation wound up under the liquidation rule, but the amount of stock carried over under the temporary regulations was smaller than had been feared. As stocks rose to the mean price of July 27 they had to be taken up or sold. On Dec. 23 1914 the conditions governing the reopening of the London Stock Exchange were promulgated. The minimum price list was then extended to include inter-*bourse* securities. Minimum prices were gradually abolished as liquidation ceased and prices settled down to the new level of investment values. On July 3 1916 the last of the minimum prices were removed.

The London Stock Exchange was reopened for the first time after the outbreak of war on Jan. 4 1915. Severe restrictions were placed upon the transaction of business, in accordance with arrangements made in Dec. 1914, between the Committee for General Purposes and the Treasury. These arrangements were embodied in Temporary Regulations which were substituted for the old regulations governing Stock Exchange practice. All bargains had to be done on a cash basis. The suspension of virtually all speculative business was the most important innovation introduced by the Temporary Regulations. Normally, speculation forms the great bulk of business effected on the Stock Exchange, and its temporary abolition deprived many members of their occupation. The volume of business which it was possible to do was further restricted by two other features of the Regulations—namely, the "physical possession" rule, which prohibited dealings in stock that had not been in physical possession in the United Kingdom since Sept. 1914, and the fixing of minimum prices for trustee and other securities, which were in nearly every case the mean prices on July 27. Both of these rules were relaxed to some extent during 1915; the former to facilitate sales of American securities held in Allied and neutral states, and to allow sales of colonially held stock. When they were established, minimum prices undoubtedly served a very valuable purpose, but when the issue of high-yielding war loans completely altered the standard of investment, as regards the yield in interest, no useful purpose was served by them. The retention of minimum prices fixed on a pre-war basis of credit made it impossible to deal in the securities affected, and that was the reason for their removal. But the absence of speculation naturally caused a considerable reduction in membership. On the day of reopening the number of transactions was less than 1,000. On subsequent occasions the number rose to well over 3,000 per day, but in 1915 the daily average was nearer 2,000 than 3,000. A heavy loss of revenue was sustained by the company owning the Stock Exchange, and in 1915 it failed to distribute an interim dividend.

The arrangement by which all stocks carried over at the outbreak of war were continued until after the end of the war, unless the "end of July 1914" prices were reached, worked well in practice, thanks largely to the American demand for securities; and the "open" position on the London Stock Exchange, which in Aug. 1914 was about 90 millions sterling, had been reduced by the end of 1915 to about 20 millions.

With the reopening of the London Stock Exchange an important reform was introduced which was continued after the cessation of hostilities. The Temporary Regulations provided that every bargain should be recorded. This practice was much preferred by the public to the pre-war custom of marking only occasional bargains. The absence of buying and selling prices, dealers being prohibited from offering stock in the market, was one of the reasons for the compulsory marking of all bargains. This reform led to the issue of a supplementary list of bargains in securities not quoted in the daily "official" list. Thus, from Jan. 4 1915 onwards, a complete record of business done was furnished by the two lists, on the authority of the committee. Another innovation was the retention in the lists of prices of previous bargains, which added to their value to the public.

The course of prices in 1915 and subsequent war years was generally downward. In June-July 1915 the flotation of the unlimited 4½% British Government War Loan made a lowering of investment values inevitable. This for a time checked business in the stocks protected by minima, and caused a heavy fall in other fixed interest-bearing securities. In March 1915 minimum prices were reduced to a small extent. The minimum for Consols was reduced from 68½ to 66½ prior to the issue of the 4½% War Loan, and it was removed later when the great bulk of the stock had been converted into the 4½% stock. The market for American securities was very active and strong throughout 1915, and prices showed a substantial advance on the year. The war-time prosperity in the United States caused a great demand for American securities held in the United Kingdom and France. European holders were encouraged to sell by the appreciation of the dollar in terms of sterling, which enabled a profit on exchange to be made. In the second half of the year the British Government bought large quantities of American securities held in the United Kingdom and sold them in the United States in order to provide itself with means of making payment for munitions, etc. (*see* DOLLAR SECURITIES MOBILIZATION). It is estimated that in this year about 150 millions sterling of American securities were transferred to the United States. Towards the end of 1915 the Government ceased operations in the market, and invited holders either to sell or loan approved securities to it. Thus came into force what was subsequently known as the Dollar Securities Mobilization Scheme. The terms of purchase were approximately the parity of the New York price, and for loan a bonus of ½% per annum in addition to the interest or dividend on the loaned security, plus a premium of 2½% in the event of the Government exercising its right to sell the stock loaned to it. The Temporary Regulations were made more stringent as the war continued, but 1917 witnessed a check to the depreciation of fixed interest-bearing securities for the first time since the S. African War of 1899–1902, and also a sustained upward movement in industrial securities.

The following table, compiled from figures published by the *Bankers' Magazine*, shows the course at different important dates of investment values since the calculations were first made. The values relate to 387 representative securities:—

Jan. 1907	£3,843,000,000
*July 20 1914	£3,371,000,000
†Nov. 1918	£2,822,000,000
Dec. 1919	£2,634,784,000
Dec. 1920	£2,319,777,000

*Pre-war. †Month of Armistice.

The general depreciation was due not only to the exceptionally heavy demand for money to carry on the war, but also to the growing burden of direct taxation in the United Kingdom. For a time the British investor showed a marked preference for industrial securities, on which high dividends were paid together with, in many cases, bonuses either in the form of cash or scrip. Bonus shares were created and issued by a large number of concerns. The scarcity of capital caused a steady rise in the rate of interest, and first-class companies found it necessary to pay 8% and even more on new debentures and preference capital. The Treasury scheme for buying and borrowing dollar securities in 1916 was followed in 1917 by a scheme for requisitioning those which had been neither lent nor sold. This put the finishing touch to the process which had begun in 1915, of extinguishing the American market in London.

Throughout the war period the London Stock Exchange Co. had a very lean revenue. Receipts, which in 1914–5 amounted to £296,757, dwindled to £130,304 in 1917–8; and the dividend dropped to £1 per share.

A feature of the year 1918 was the advance in foreign Government securities, especially those of neutral nations. Bonds of the neutral countries were bought for exchange purposes, and they changed hands up to extraordinarily high figures in the first half of the year. Spanish 4's touched 135 at one time, owing to the rise in the sterling value of the peseta, and Swedish 3½% stock rose to 115, through appreciation in kroner.

Calculations made by the *Bankers' Magazine* show that the values of 387 representative securities fell during 1919 from £2,801,089,000 to £2,634,784,000, a decrease of £166,605,000, equal to 5·9 per cent. (As on July 20 1914, the total was £3,371,000,000, the decline in the five and a half years to Dec. 1919 was no less than £736,216,000, or nearly 22 per cent.) At one time during the war the values touched £2,572,000,000. This was on April 20 1918—at the height of the Germans' last great offensive effort. It is interesting to note that in Jan. 1907, when the valuations began, the total was £3,843,000,000. The valuation at the end of 1919 showed a net shrinkage of £1,208,000,000, or 31½%, of which £736,216,000 was due to conditions brought about by the war. The war-time depreciation in fixed interest-bearing securities was greater than this. Taking the values of 108 fixed interest-bearing securities we find that the total on July 20 1914 was £1,989,000,000, at the close of 1918 £1,575,000,000, and at the end of 1919 £1,378,906,000. On the other hand, the value of 279 speculative investments, *i.e.* the dividends on which fluctuate according to profits, was £1,382,000,000 on July 20 1914, at the close of 1918 £1,226,000,000, and at the end of 1919 £1,255,578,000. Thus there was a net depreciation in fixed interest-bearing securities of £610,094,000, or 30%, in the whole war period, of which £196,094,000 occurred in 1919; while speculative investments showed an increase of £29,578,000 in value during 1919, or 2.4%, but a net depreciation of £126,422,000 on the whole period, or 9 per cent.

After the War.—In spite of marked activity in speculative investments, the year 1919 witnessed a generally downward tendency in prices of securities, with the result that a large part of the appreciation which took place in the closing months of 1918, following the collapse of Germany's war effort, was lost. The reaction was due in a large measure to heavy Government expenditure, bringing with it the pressure of high taxation, and an adverse American exchange, the former involving a continuance of heavy borrowing, and the latter a rise in the Bank of England rate from 5 to 6% at the beginning of Nov. 1919. The failure of the British Government's Funding Loan operation in the summer had an adverse effect on the market for gilt-edged investments, and the City of London received something like a shock on learning that national expenditure in the second half of the year was scarcely distinguishable in amount from that of a large part of the war period. Markets, however, presented a generally animated appearance. This was in part due to the return of warrior members. Attention was mainly concentrated on speculative securities, notably oil, brewery, insurance, shipping, S. African gold, and commercial and industrial securities. Fixed interest-bearing securities were persistently neglected, owing to the higher value of money and the competition of numerous new issues offering yields as high as 9 per cent. In the summer of 1919, various war-time restrictions were removed from the London Stock Exchange with the approval of the Treasury. The removal of the embargo on exports of capital enabled foreign-held stocks to be realized in the London market; but arbitrage transactions continued to be prohibited. Some of the declarations which had to accompany each transaction were abolished, but the temporary regulation prohibiting any but cash transactions was retained.

Gold-mining shares made a substantial advance in the closing months of 1919 owing to the high premium received on gold under an arrangement come to in July for restoring free conditions to the market for gold newly produced. This enabled the companies to declare larger dividends in Dec., and rescued a large number of low-grade mines from imminent bankruptcy. Towards the close of 1919 Rand Mines shares were introduced on the New York market, this being the first time that S. African gold shares were listed in Wall Street. The diamond companies enjoyed a wonderful prosperity during the year, the De Beers Co.'s revenue amounting to as much as one whole day's war expenditure at the maximum level. Record dividends were paid, and share quotations reached unprecedented figures.

The year 1920 was the most remarkable of the early post-war period. At the beginning markets in London were extraordinarily active, owing to the boom in trade. The oil market was in a state of ceaseless activity, and other speculative markets felt some of the reflected glory of inflated oil profits. Nomination for membership of the London Stock Exchange rose in price to £650, but was almost unsaleable at the end of the year. There was a great congestion of work in brokers' offices in the early months, and they were kept open until late at night for several weeks. But the introduction of a British budget of 1,200 millions, with its unpleasant reminder of the burden of taxation, administered a check to the reckless buoyancy of markets. The collapse of the exchanges of all the countries except the United States

Sweden, Switzerland and Holland, caused a steady stream of liquidation in London from the Continent, which grew in volume when, later in the year, a heavy fall occurred in wholesale commodity prices. The fall in commodities forced traders to realize securities. The pressure to obtain money to finance production and distribution and pay taxes caused persistent liquidation in the gilt-edged market, and British Government securities fell to a level giving a return of well over 6% per annum. In Dec. 1920 the leading stocks, in some cases, touched the lowest points on record. The 5% War Loan fell to $81\frac{5}{16}$, Victory Bonds to $70\frac{1}{2}$, Funding Loan to $65\frac{3}{16}$, and Consols to $43\frac{5}{8}$. The *Bankers' Magazine* calculations of the prices of 381 representative securities in Dec. 1920 showed a fall in values of no less than £315,000,000, the largest loss ever recorded in one year. British and Indian funds fell in value in 1920 by 11·9%, foreign Government stocks by 18·8%, home railway stocks by 17·3%, foreign Government stocks by 23·5 per cent. The decline in commercial and industrial securities was much greater, the percentage being 40·9. The severity of this reaction was, of course, due to the sudden collapse of the six-year-old boom in trade. Iron and steel shares suffered a depreciation of 33·7%, shipping securities of 21·7%, and S. African mining shares of 39·2 per cent. The losses of the investor were so severe that he lost all interest in speculative stocks and turned his attention to gilt-edged stocks. This brought about a steady recovery in the latter in the first half of 1921. The issue of foreign Government loans in London, which was suspended on the outbreak of war, was renewed in 1921, when a loan to the São Paulo Government was issued, followed by an issue of Norwegian Government bonds.

American and Foreign Stock Exchanges.—The shock of the World War caused stock markets all over the world to shiver and collapse more or less. By custom London was a market to which every *bourse* abroad turned for help when there was any pressure, and for a period of at least a fortnight after the middle of July 1914 the London market was called upon to absorb a flood of selling orders from every mart in Europe where securities were dealt in. While the European *bourses* had to all intents and purposes suspended business by the beginning of the week ended Aug. 1, there was a fairly free market for securities in London in the great majority of international securities down to the middle of the week. The news of the coming war affected the European *bourses* early in July. On the 13th of that month the Vienna market was described as having become quite demoralized by the fear of war. The Berlin *bourse* reflected this nervousness because Germany was Austro-Hungary's chief lender, Government and municipal loans of the Habsburg Empire being held in Germany to the extent, it was estimated, of over £200,000,000. On Monday July 27, the day before the declaration of war by Austria, the panic in Vienna was such that the *bourse* was ordered to be closed for three days. Subsequent events showed it was destined to be closed for an indefinite period. The Brussels market followed the lead of Vienna, ceasing business on July 27, and the Paris *coulisse*, or outside unofficial market, also suspended operations on that day. On Tuesday July 28, before the declaration of war by Austria had become known, dealings became very difficult. On July 29 all account dealings in Berlin were suspended, transactions being confined to cash bargains. The Amsterdam and St. Petersburg *bourses* were entirely closed that day, while on Thursday all markets suspended business except London, Berlin, Paris and New York, but the settlement in Paris fixed for July 31 was postponed. Business on the Berlin *bourse* was ordered to be suspended on the following day (July 31), though the *bourse* was kept open. The Paris market remained open throughout that day, July 31, but only six quotations were available out of some sixty stocks and shares usually quoted in reports from that centre. The Paris *bourse* was the only stock-market to keep open its doors after Thursday July 30. But this *bourse* is under the direct control of the Government, and the authority of the Goverment was no doubt responsible for the *bourse* being kept open. Down to Sept. 2 a few quotations were forthcoming from Paris, but on that day the *bourse* was shut until further notice owing to the approach of the Germans to the French capital. The New York Stock Exchange was open on Tuesday July 28, when the news of the declaration of war by Austria first became known, and it was called upon to withstand the first shock of that announcement. By the end of the day's session it was found that transactions for the first time that year (1914) had exceeded one million shares. On Tuesday July 28 the Toronto Stock Exchange was closed, after being open for 10 minutes, and business on the Montreal market ceased in the afternoon. On July 30 violent breaks in prices occurred on the New York Exchange, but there was at all times a market. The next day, however, the committee decided to follow the lead of London and to close the Exchange.

New York.—In the latter part of 1912 there was a serious decline in American securities, owing to selling from Europe brought about by the Balkan War, but as soon as this unloading ceased the market was much unsettled by the decision of the Supreme Court of the United States ordering the dissolution of the Union Pacific–Southern Pacific merger. Down to the beginning of the World War New York had shown a tendency to develop more and more as a market for international securities, though very little was actually done to encourage foreign securities to seek a market there. In the short and frantic period in the last few days of July 1914 bankers saw ordinary standards of value scattered to the winds and loans aggregating $2,000,000,000 imperilled almost in a night. When the House was closed special committees were set up to undertake the stupendous task of straightening out the apparently hopeless tangle of contracts outstanding when operations were suspended.

The New York Stock Exchange tentatively opened its doors again on Nov. 28 1914, for trading in bonds only. As the experience was encouraging, the committee decided to reopen the House for regular trading on Dec. 13. Minimum prices had been fixed by the committee on Oct. 13, and trading in unlisted securities was resumed on the following day. The minimum prices were revised from time to time and abolished on March 31 1915, owing to a rise in quotations having rendered minima no longer necessary. Then began the most remarkable era in the history of the Exchange. In point of feverish activity and wild fluctuations in prices, the year 1915 was then without precedent. Million-share days, sensational advances, and equally sensational declines, were common occurrences. Price movements were very erratic. The most conspicuous feature of the enormous volume of trading was the participation by the outside public seldom if ever before witnessed on the New York Exchange. Under clique and pool manipulation, prices were whirled upward with startling rapidity. Stocks which led the advances were those of companies which, it was supposed, would benefit most largely from war orders. Throughout the year there was heavy buying of both stocks and bonds by investors and financial interests of the first rank. Many securities reacted from their highest levels before the close of the year, but others, on good business prospects, retained the greater part of their phenomenal rise. Even more remarkable was 1916. Activity was intense, and prices rose to exceptionally high figures. Every dollar security offered from Europe was eagerly snapped up.

The following year witnessed a reaction. The depreciation in the market value of American railway securities was estimated at $3,000,000,000—about one billion in bonds and two billions in shares. The principal causes of this great shrinkage in the market value of railway securities, in which about one-twelfth of the wealth of the United States was invested, were reported to be as follows:—

(1) Enormous destruction of capital in the war, with unprecedented Government loans at rising rates of interest.

(2) The liquidation by Europe of about $1,700,000,000 of American railroad securities in payment for munitions of war.

(3) A rapid advance in the cost of railroad materials and labour, with no compensating advance in railroad rates, and fear on the part of investors that the Government would not promptly raise rates to maintain railroad property and credit.

When the U.S. Government declared war, the composure and strength of the Stock Exchange was an impressively favourable omen. This composure did not continue throughout the year. Prices of outstanding bonds declined steadily; and in Sept. and Oct. an extremely violent movement of liquidation swept over the Stock Exchange, carrying prices of the best investment stocks down to a level lower than that of the panic of 1907. This extreme demoralization of the Stock Exchange did not result from money tension—lending rates were comparatively low throughout the year—nor was it primarily a consequence of decreased earnings or of a weakened economic position on the part of the investing public. It was due to war taxation legislation, and the drawing up of estimates as to how much would have to be raised by taxes and by loans. In 1918 there was a recovery, with prices generally higher on the whole.

In 1919 there was a boom in stock markets which will rank in American finance as one of its greatest historical episodes. The pegging of sterling exchange at $4.76⅞ was removed on March 20 1919, and the other Allied exchanges were released a few days later. But the depreciation of European currencies which followed did not stop European purchases. These increased in volume, and the demand acted as a powerful stimulant on the stock market. There began a speculation in stocks of an unprecedented description. Thousands of industrial corporations were endowed by the war with enormous reserves of cash which war taxation had barely skimmed. The atmosphere of Wall Street was charged with the wildest rumours of "melon splitting," increased dividends, and Liberty Bond distributions. Prices advanced by 10 and 12 points in a day, and on some days 20- and 30-point rises were not uncommon. Amidst this furious activity the million-share day ceased to be exceptional. In May the Stock Exchange was obliged to close on Saturdays in order to give the staffs an opportunity of overtaking arrears of work. When, in the latter part of June 1919, the first reaction occurred, there had been 46 consecutive million-share days. The rise in the value of money was said to be the chief factor which brought the boom to an end. By the middle of Oct. the Federal Reserve Bank of New York found its proportion of reserve to liabilities reduced below the minimum prescribed by law. Call money rose to 30% in Nov., the highest figure since 1907. A coal strike, the heavy fall in the exchanges, and the failure of the Senate to ratify the Peace Treaty, were depressing factors.

Stocks reached the peak of the rise in Nov. 1919. On that occasion the figure was only fractionally below the high-water mark of the war period, viz. 101·51, which marked the culmination of what was described in the picturesque language of Wall Street as the "war-brides" boom of 1916. Then followed the bursting of the distended balloon. In about three weeks the average price of 50 stocks dropped more than 15 points to 85. The collapse remained in the minds of members for a long time afterwards. Despite occasional rallies, prices dropped steadily, and it was manifest that the World War boom was definitely over. November 1920 was also a month of devastating declines, which produced conditions resembling a panic. The index figure of the 50 stocks fell to 68·85, against 94·07 in April.

In the first 11 months of 1920 transactions in stocks on the New York Stock Exchange showed a considerable reduction in volume from those of the corresponding period in 1919—210,220,428 shares, against 296,822,497. The par value of the shares dealt in was $17,983,885,575, or about nine billions of dollars less than the year before. Bond transactions, on the other hand, were much larger, increasing from $2,473,588,050 to $2,495,821,750 for Government bonds, from $258,442,500 to $319,567,400 for state and municipals, and from $522,315,000 to $693,527,000 for those of private corporations.

Arbitrage dealings were restored between New York and London at the beginning of Dec., but there was little business of this character. The depreciated paper pound killed the market for American securities in London. Throughout 1920 a growing interest in foreign securities was shown by American investors, and a comparatively large number of foreign Government and municipal obligations were sold in the American security markets. Competition of domestic issues, however, was fierce, and no little difficulty was experienced in inducing the American public to take up foreign bonds. This had a serious restricting influence on America's export trade, and owing to the inability of Europe to pay for her purchases by exports she had to depend largely on credit given by the United States. In 1921 the depression in trade became very marked, but later a recovery set in.

Paris.—Down to 1911 Paris had been a powerful and persistent supporter of the world's money markets, because of the saving habits of the French people, but in the three years prior to the outbreak of war a change had developed. This was particularly noticeable after the Balkan War of 1912 had disturbed the European *bourses.* France had begun early in 1914 to bring money home to meet her own needs. Excessive issues of short-term notes, the disturbances in Mexico, and the collapse of the St. Louis & San Francisco railway in 1913, caused a feeling of revulsion as regards American securities, and Paris, in the year prior to the outbreak of war, was steadily selling them. On the other hand, Germany was increasing her creditor position in the world's markets. The Paris *bourse* witnessed the end in 1911 of a bull campaign which had lasted for several years, and 1912 saw a persistent depression in gilt-edged stocks. The price of French 3% Rentes, which touched 105 in 1898, when Mr. Cochery dreamed of conversion, fell to 87½ in 1912, and with the outbreak of the Balkan War there was a panic.

The *bourse* was reopened after the events of Sept. 1914, on Dec. 7, and thereafter there was a steady rise in prices. After 15 months of war the first war loan was raised. As a necessary preliminary the settlement of the long-deferred end of July 1914 *bourse* account was begun on Sept. 30 1915, and was carried through with comparative ease. The open account had been very largely reduced by gradual sales, and the Bank of France came to the rescue of both Parquet and Coulisse, lending the former about 150 and the latter 35 million francs. The plan of settlement adopted differed considerably from the London Stock Exchange scheme—5% interest was charged from July 1914, to Sept. 1915; holders were asked to pay their differences in full, or were given the option of paying 10% of their differences at the first settlement, and 10% on each subsequent monthly settlement until the balance was wiped off; 6% was fixed as the rate on all unpaid differences; from the make-up prices of the end-Sept. account differences had to be settled at each settlement as before the war. After the first *post-bellum* settlement contangoes averaged about 4½ per cent. All new business was for cash, dealing on account being confined to clearing up accounts which existed before Aug. 1 1914.

Berlin.—Before the war the Berlin *bourse* was subject to frequent attacks of nerves. On Sept. 4 1911 the *bourse* had what was described as its worst day of the year. It was alarmed by the foreign political situation. Nevertheless business was very active in that year, and the stamp duty on *bourse* transactions produced £75,000 more than in 1910. In 1912 the *bourse* was again much disturbed by political fears, and rumours of war caused heavy selling from time to time. Excessive speculation in the earlier months of 1912 caused the Government Commissary of the *bourse* to issue a public warning. On Oct. 1 of that year came news of the Balkan mobilization, and a panic seized the market. Settlement stocks in one day lost, on an average, 20 points. The total loss in values in that year was estimated at about £150,000,000. On the outbreak of war, Germany imposed more stringent conditions upon the Stock Exchange business than any other country. The open market for stocks and shares was abolished, and the publication of prices was strictly forbidden. Towards the end of 1915, cautious efforts were made, with some success, to liquidate *bourse* transactions which had remained in suspense since the outbreak of war. In 1916 there was much speculation on the German *bourses*, and this was given as a sufficient reason for continuing the veto upon the publication of quotations. But at the end of that year, lists of prices were issued for the first time since July 1914, for the purpose of taxation assessments. The quotations showed many large gains in industrial securities, due, of course, to the enormous profits made by German companies. In 1916 the dividends of 10 explosives manufacturing concerns averaged 22¾%, a group of metal companies paid out 20%

on a capital of £9,000,000, and a group of leather companies paid 19% on an average. All the German war loans were, however, listed by special instruction at the price of issue. In 1917 there was again considerable speculation on the *bourses*, with generally rising prices, but the intervention of the United States in the war caused a set-back. At the end of 1917 the listing of prices was resumed, but publication of prices was strictly prohibited. German 3% stock rose 7 to 8 points, and there was a strong demand for industrials. Between Sept. and Dec. 1918 the quotations of German securities on the German markets fell so heavily that German financial writers estimated the decrease in capital value at about 50 per cent. Meanwhile Germany witnessed her foreign credit—such as it was—go to pieces. This was proved not only by the price of the mark, but by an almost universal desire in neutral countries to withdraw outstanding credits to Germany. The index figures prepared by the *Frankfurter Zeitung* showed the following (*a.* representing values of 24 of the principal shipping, mining and dyeing concerns; *b.* of 10 important munitions, metal, petroleum and potash concerns. The table shows the effect of speculation before the German collapse, then a heavy fall, followed by a slight recovery at the end of 1918):—

	July 28 1914	Dec. 31 1917	Aug. 31 1918	Dec. 5 1918	Dec. 31 1918
a.	185	278	272	151	164
b.	232	445	442	177	197½

Amsterdam.—The Amsterdam Stock Exchange, which was closed on the outbreak of war in 1914, was reopened on Feb. 9 1915. Business at first was not very extensive, except in shipping and home industrial shares. Foreign stocks were very weak in 1915 owing to persistent selling from Germany. The year 1916 was a record of remarkable fluctuations, and at the close all kinds of shares showed enormous gains. The largest improvement took place in the securities of home industrial concerns, which made huge profits, as the result of the elimination of German competition. The Dutch Indian plantation companies made enormous profits, especially the sugar plantations, which sold a great part of their output to the British Government at high prices. Rubber and tobacco shares also improved in value. Royal Dutch shares were introduced for the first time on the American market in 1916. In 1917 the stock markets were rather quiet. Russian stocks fell enormously in the last months in consequence of the stoppage of interest payments, and the announcement that the Bolshevist Government would cancel the national debt. This latter step could only mean a serious financial disaster for Holland, where Russian stocks had found a ready market as being thoroughly sound investments. The total Dutch ownership of Russian stocks of State as well as private railways was estimated at 1,500,000,000 to 2,000,000,000 florins. New shipping shares amounting to 27,500,000 florins in face value were added to the market in 1917. In the following year the tendency was irregular, and sometimes weak, directly owing to the German collapse, but towards the end of the year prices rose again. Large new issues were made by shipping, plantation, and trading companies.

Vienna and Budapest.—In the early years of the war there was extravagant speculation on the Vienna and Budapest *bourses*, and prices rose to extraordinary heights on the enormous profits on paper made by all the industries of the country. But a heavy collapse succeeded the military breakdown in 1918, and the subsequent break-up of the old Empire.

Switzerland.—Following the example of the chief foreign *bourses*, the Basle and Zurich Stock Exchanges suspended operations towards the end of July 1914. The Geneva and Lausanne *bourses*, however, remained open even during August. On Jan. 7 1915 the Basle Stock Exchange resumed the publication of its daily price list. A further step forward was taken on Dec. 1 1915, and on April 25 1916 the bond market was reopened in its entirety. On June 26 transactions were extended to the full pre-war list. The Zurich *bourse* restarted official business on May 15 1916. (C. J. M.)

STOKER, BRAM (1847–1912), Irish author, was born in Dublin Nov. 8 1847 and was educated at a private school there and at Trinity College. He entered the Irish civil service, to which his father also belonged, and wrote critical articles for various newspapers. He was called to the English bar, but in 1878 he joined Sir Henry Irving at the Lyceum theatre and was for many years his secretary and finally his biographer. He wrote a number of novels, of which *Dracula* (1897) was the best known, as well as *Personal Reminiscences of Sir Henry Irving* (1906). He died in London April 20 1912.

STOLYPIN, PETER ARCADEVICH (1863–1911), Russian statesman, was born in 1863, the son of Admiral Stolypin by his wife, a princess of the house of Gorchakov. He was educated at the university of St. Petersburg, and in 1884 entered the Government service. In 1902 he was appointed governor of Grodno, and in 1905 was transferred to Saratov, where he became known as a firm administrator. In 1906 he was recalled to take up the position of Minister of Internal Affairs, and in July of the same year succeeded Goremykin as Minister President. His career as Premier is described in the article RUSSIA. His firm and repressive policy toward all kinds of sedition caused him to be regarded as a deadly enemy by the revolutionary party, and many attempts upon his life were made. In Aug. 1906 a bomb was exploded at his summer residence, which seriously injured one of his daughters, but all efforts to kill him proved vain until 1911, when he was shot in a theatre at Kiev on Sept. 14, before the eyes of the Imperial family, by a Jew named Mordka Bogrov. The minister died of his wounds Sept. 18 1911.

STONE, MARCUS (1840–1921), English painter (*see* 25.957), died in London March 24 1921.

STONE, MELVILLE ELIJAH (1848–), American journalist, was born at Hudson, Ill., Aug. 22 1848. His father was a Methodist minister, of New York birth, who had moved to Illinois in early life and combined his activities as a circuit-preacher with the running of various small businesses, including book-selling and printing. He had English, Scottish and Irish blood in his veins, the Stone family having settled in New England in the 17th century. In 1860, when Melville was 12, his father was made pastor of a Methodist church in Chicago, and it was there that he got his schooling. In 1864 he began work as a newspaper reporter, but after sundry journalistic experiences he was set up in business in 1868 as proprietor of an iron-foundry and machine-shop, which incidentally made a specialty of the supply of folding theatre-chairs, etc. In the great Chicago fire of 1871 this was destroyed, and Stone was then for some time occupied in the administrative work of municipal relief and reconstruction after the fire. But in 1872 he again took up journalism, as one of the editors of the Chicago *Republican* (subsequently *Inter-Ocean*), and later of the *Post and Mail*, becoming for several years a political correspondent at Washington. At the end of 1875, having returned to Chicago, he and a colleague started a new Chicago paper, the evening *Daily News* (*see* 19.571), and, after he had obtained the help of a new partner in Victor F. Lawson as its manager, their venture soon became increasingly prosperous. In 1878 he and Lawson bought out the *Post and Mail*, and in 1881 they established the *Morning News* (later *Record* and *Record-Herald*). In 1888 Stone's interest was bought out by Lawson, and he retired, taking a prolonged holiday in Europe. Returning to Chicago in 1891, he took to banking by the foundation of the Globe National Bank, of which he became president, and he kept up this connexion for about ten years; but meanwhile pressure was put on him to take part in the reorganization of the Associated Press, then already a well-known news-agency, and in 1893 he accepted the position of general manager. In this capacity Melville Stone became even more prominent and powerful in the journalistic world than he had been as a Chicago editor and newspaper proprietor. At that time the Associated Press was still struggling (*see* 19.547) with its competitor, the United Press, but its enterprise now received a new stimulus, and by 1897, under Stone's management, and as subsequently reorganized in 1901, its service knew no rival. Stone had intimate relations with all the leading men of his time and played an important part in the publicity given to events and movements. He held this position until the close of 1918, when he retired. During that period of 25 years the budget of the Associated Press had grown from $500,000 to $6,000,000 and it had come to furnish more than half the news printed in American newspapers.

See the Autobiography: *Fifty Years a Journalist* (1921).

STOREY, GEORGE ADOLPHUS (1834–1919), English painter, was born in London Jan. 7 1834. He was partly educated in Paris, but in 1850 returned to England and commenced studying in London at J. M. Leigh's school, subsequently entering the Royal Academy schools. His first picture was hung in 1852. He was in early life a follower of the Pre-Raphaelite school, but gradually changed his style, becoming well known both as a subject painter and for his excellent portraits. He was elected A.R.A. in 1876 and R.A. in 1914. He became teacher of perspective at the Royal Academy in 1900. Among his best-known pictures are "The Old Soldier" (1869); "Christmas Visitors" (1874); "Mischief" (1897) and "The Love-Letter" (1901). Storey published several books, the most important being *Meissonier* (1886) and *Theory and Practice of Perspective* (1910). He died at Hampstead July 29 1919.

STORY-MASKELYNE, MERVYN HERBERT NEVIL (1823–1911), English mineralogist, was born near Wroughton, Wilts, Sept. 3 1823; he was descended on the mother's side from Nevil Maskelyne, the Astronomer Royal. He was educated at Bruton grammar school and Wadham College, Oxford, and studied for the bar, but in 1850 was invited to deliver lectures at Oxford on minerals, where he stipulated for a chemical laboratory, then a complete novelty in the university. He was prominent in the struggle over the proposal to erect a museum of science and in 1856 became professor of mineralogy with a laboratory in the new museum; but from 1857 he combined the work with the keepership of the minerals at the British Museum and resided in London. In 1880 he resigned this post, but retained his Oxford professorship until 1895. He had inherited a Wiltshire estate from his father, and in 1880 he entered Parliament as Liberal member for Cricklade. In 1885 he was reëlected for N. Wilts as a Liberal Unionist and sat until 1892. He studied especially crystallography, meteorites and gem-stones, and was the author of many scientific papers, and of a book *On the Morphology of Crystals*. He also possessed a valuable collection of antique gems. He died at Bass Down, near Swindon, May 20 1911.

STOUT, SIR ROBERT (1844–), New Zealand judge and statesman, was born on Sept. 28 1844 at Lerwick, Shetland Isles, where he was educated at the parish school and became a pupil teacher. He arrived in New Zealand in 1863, and became second master in the Dunedin grammar school and afterwards in the Dunedin district high school. On July 4 1871 he was admitted as a barrister and solicitor of the Supreme Court of New Zealand, and he then matriculated at Otago University which opened in that month. In 1873 he took first-class honours in mental and moral science and political economy, and from 1874 to 1876 he was Law lecturer at Otago University. Elected a member of the Otago Provincial Council in 1872, he became provincial solicitor in 1873, and he held that position until the abolition of the provinces in 1876. In 1875 he was elected to Parliament as Liberal member for Caversham and in Feb. 1878 he became Attorney-General and Minister of Lands and Minister of Immigration in Sir George Grey's Ministry. But in the following year he resigned owing to the serious illness of his partner, and he did not return to public life till 1884 when he entered Parliament again as member (M.H.R.) for Dunedin East. On the defeat of Sir Harry Atkinson's Government he joined with Sir Jules Vogel in forming a Ministry, which lasted less than a fortnight (Aug. 16–28 1884), but after another Atkinson Government had held office for a few days (Aug. 28–Sept. 3) a second Stout-Vogel Government was formed which lasted three years. In both the Stout-Vogel Governments Sir Robert Stout was Premier and Attorney-General. At the general election in 1887 the Government was defeated and he lost his seat by a narrow margin.

Refusing the offer of other seats, Sir Robert Stout remained out of politics till after the beginning of the long Liberal-Labour régime in 1891. Both by Ballance and by Seddon he was offered a portfolio but he declined both offers. In June 1893, however, he was elected at a by-election for Inangahua as an Independent Liberal, and at the general elections of 1893 and 1896 he was elected for Wellington City, to which he transferred his residence and his legal practice. In 1898 Sir Robert Stout resigned his seat, and in June 1899 he became Chief Justice.

In politics Sir Robert Stout was a strong Liberal of the individualistic school, devoting special attention to the land and labour questions and to educational and temperance reform. Among his principal measures were the Land Act of 1877, the first Land Tax Act, which he drafted in coöperation with Ballance and which became law in 1878, and the Civil Service Reform Act of 1886, which threw the doors of the service open to women and made examination and competition (the latter being added by the Legislative Council) the tests of all appointments except those of experts. As a member of a Royal Commission appointed in 1881 he helped the late Mr. Allen Holmes in forming the Code of Civil Procedure, which was enacted in the following year and made the Supreme Court Procedure of New Zealand one of the simplest in the world. A life-long abstainer, Sir Robert Stout was always a keen advocate of temperance reform. The local option bills which he introduced in 1876 and 1893 did not get further than their second reading, but the second of these measures forced the hand of the Seddon Government and led to the establishment of local option by a less liberal measure in the same session.

He became a member of the New Zealand University Senate in 1884, and also of the Victoria University College Council, Wellington. In 1903 he was elected chancellor of the university. He was made a K.C.M.G. in 1886. Besides writing many essays and lectures on social, literary and legal subjects, he was the author, jointly with his son, J. Logan Stout, of *New Zealand* in the Cambridge University Manuals of Literature and Science, and of the article on New Zealand in the Oxford University Survey of the British Empire. He married in 1876 Anna Penrhyn, daughter of Mr. J. Logan, official clerk to the Superintendent of the Province of Otago. He had four sons—of whom two served in the war as medical men and one obtained the D.S.O.—and two daughters.

STRACHAN-DAVIDSON, JAMES LEIGH (1843–1916), British classical scholar, was born at Byfleet, Surrey, Oct. 22 1843, and educated at Leamington College and Balliol College, Oxford. He graduated first class in *literae humaniores* in 1866, and was elected to a fellowship of his college the same year. This he held until 1907 when, on the resignation of Edward Caird, he was elected to the mastership of the college. His whole life was devoted to university teaching and administration, as classical tutor, examiner, delegate of non-collegiate students, pro-vice-chancellor, etc., and to the study of Roman history. Amongst his published works were *Cicero and the Fall of the Roman Republic* (1894), *Problems of the Roman Criminal Law* (1912), as well as articles on the Roman Constitution in *Smith's Dictionary of Antiquities*. He died at Oxford March 28 1916.

STRACHEY, JOHN ST. LOE (1860–), English journalist, was born at Sutton Court, Som., Feb. 9 1860, the second son of Sir Edward Strachey, 3rd Bart., and Mary Isabella, daughter of John Addington Symonds. He was educated at Balliol College, Oxford, graduating with a first-class in modern history, and was subsequently called to the bar; but he adopted journalism as his profession from the age of twenty-four. In 1886 he became assistant editor of the *Spectator*, and after the death of R. H. Hutton (1897) and the retirement of Meredith Townsend (1898) he became proprietor of the paper, which under his editorship not only maintained but increased the high reputation it had gained (*see* 19.562) for sober political criticism and well-informed appreciation of art and literature, so that he exercised great influence upon English opinion. St. Loe Strachey also edited (1896–7) the *Cornhill Magazine*. He was specially interested in problems of rural housing, pauperism and local government generally. Amongst his publications are: *The Manufacture of Paupers* (1907); *Problems and Perils of Socialism* (1908); *The Practical Wisdom of the Bible* (1908); *A New Way of Life* (1909).

STRAIGHT, SIR DOUGLAS (1844–1914), English lawyer and journalist, was born in London Oct. 22 1844 and was educated at Harrow. Up to 1865 he engaged in journalism, but was then called to the bar and soon worked up an extensive practice, especially at the Central Criminal Court, London. He sat in the House of Commons as Conservative member for Shrewsbury from 1870 to 1874, and from 1879 to 1892 he was a judge of the High Court of Judicature at Allahabad. He was knighted on retirement, and four years later he returned to journalism as editor of the *Pall Mall Gazette*. He retired in 1909, and died in London June 4 1914.

STRAITS (DARDANELLES AND BOSPORUS.)—The waterway formed by the Dardanelles, the Sea of Marmora and the Bosporus, which connects the Mediterranean and the Black Sea, has possessed marked political importance from the earliest times. This importance, however, grew with increasing rapidity during the 20th century. The increase of population, the growth of commerce, the construction of railways, and the rise of nations in the basin of the Black Sea, enormously added to the political and military significance of the Straits. And while these factors gained in weight yearly, the Ottoman Empire, which held the guardianship of the Straits, declined yearly in vigour and strength. Correspondingly, it became more and more the object of national intrigue and ambition on the part of foreign Powers, whose designs would benefit were they in a position to control the Straits themselves.

These matters received forcible illustration during the World War. Problems having their origin in the existence of the Straits became then of supreme importance, even to the extent of prolonging or shortening the period of war. At the Peace Conference, too, questions of the Straits became acute. The seaborne commerce of the 100 million inhabitants occupying the basin of the Black Sea must perforce pass through the Straits. By railway communication with central Asia this region, too, is concerned with control of the Straits. The traditional Russian ambition for a warm water port looked to Constantinople and the Straits for fulfilment; and in 1915 the Powers in alliance with Russia accepted the Russian claim to the great position. Apart from Russia and Turkey, three states—Georgia, Rumania and Bulgaria—had a coast-line confined to the Black Sea, and therefore depend upon the Straits as the one route for their maritime trade with the outer seas. To Germany, control of the Straits in war by her ally Turkey meant the isolation and strangling of her enemies, Russia and Rumania. In fact the closing of the Straits at this time had much to do with the collapse of Russia, the outbreak of the revolution, and the prolongation of the war. With such possibilities and interests hanging upon them, the Peace Conference dealt comprehensively with the Straits in the Treaty of Sèvres. Under this treaty they were thrown open to all navigation in peace and war, without distinction of flag, and blockade of these waters was prohibited. An International "Commission of the Straits" was established to control the waterway. And still further to ensure that military interruption should not take place, a demilitarized "Zone of the Straits" was created, embracing all adjoining coastal territory. Within this area all military works and fortifications were to be razed, and the construction of similar works was forbidden.

(W. J. C.*)

STRAITS SETTLEMENTS AND DEPENDENCIES (*see* 25.980*).—The resident pop. of the Straits Settlements proper, according to the census of 1911, was 705,405, divided as follows: Singapore, 303,321; Penang, 141,559; Province Wellesley, 128,978; Malacca, 124,081; the Dindings, 7,466. Males outnumbered females nearly as 2 to 1. Included also in the Government of the Straits Settlements are Labuan (pop. in 1911, 6,546), Christmas Island (1,369) and the Cocos Islands (749).

In Labuan and Cocos Islands males did not greatly outnumber females, but in Christmas Island, with an almost wholly labouring pop., males were 1,328 and females 41.

In 1919 the pop. of the whole colony was estimated at 827,719. That of Christmas I. was 514 on Jan. 1 and 617 on Dec. 31.

In the colony the birth-rate in 1919 was 30·3 per thousand. The death-rate, which was 46·45 per thousand in 1911, fell to 29·15 in 1915, rose, with an epidemic of influenza, to 43·85 in 1918, and was 33·04 in 1919. The principal causes of death in the last year were infant diseases (5,848) and malaria (4,623), and the other most serious maladies as returned were tuberculosis, beri-beri, pneumonia, and dysentery, but probably many deaths were due primarily to influenza. The epidemic of this disease resulted in the revival, after 30 years, of the native *wang-kang* ceremony at Malacca, in which a model boat is constructed in a temporary temple, and is subsequently burnt as a sacrifice to some supposedly neglected god.

Principal nationalities and religions were shown by the census as follows:—

Nationalities

	Chinese	Malay	Indian	Europ. and Amer.
Straits Setts. proper	366,765	235,762	81,928	7,276
Labuan	1,799	4,434	—	34
Christmas I.	1,252	44	—	19
Cocos Is.	—	668	—	39

Religions

	Chinese[1]	Mahommedan	Hindu	Christian
Straits Setts. proper	359,760	261,154	52,579	24,474
Labuan	—	4,430	—	116
Christmas I.	—	46	—	32
Cocos Is.	—	669	—	50

[1] Other than Mahommedan and Christian.

Chinese immigrants in 1919 numbered 70,912—21·4% more than in 1918, and 73·6% less than in the "record" year, 1911. Adult males were 62·4% and females 19·5%. 101,433 immigrants arrived at Penang from southern India, and 46,767 Indians quitted the colony. There were 2,439 labourers from Netherlands India.

The Chinese community was on the whole prosperous during the World War; the increased cost of living and the high rate of exchange with China bore hardly upon the poorer classes, but the increase of wages in great measure counterbalanced these disadvantages. The Chinese freely supported patriotic and charitable funds, and after some demur, before its purpose was fully understood, recognized without further difficulty the war-tax ordinance of 1917. The war, however, produced its problems for the community. It was necessary to establish a censorship of Chinese newspapers, and in June 1919 an anti-Japanese boycott resulted in rioting in Singapore and Penang, while a Chinese patriotic league and an anarchical body, the so-called Truth Society, gave some trouble.

Finance.—Revenue in 1911 amounted to $11,409,220, in 1919 to $34,108,465; expenditure in 1911 to $9,085,389, in 1919 to $34,901,233 ($1 = 2s. 4d.). A noteworthy financial measure was the introduction of an income tax, which, in spite of controversy, raised £400,000 sterling in 1917 without friction.

The colony had at the end of 1919 a debt of £6,913,352 sterling in respect of the loan raised by the issue of 3½% Straits Settlements inscribed stock, 1907. About four-fifths of this loan was expended on account of the Singapore Harbour Board, and the rest on account of the Penang Harbour Board, the municipal commissioners of Singapore and Penang, and on Government harbour works, and interest charges are borne by these bodies.

Among Government monopolies that of opium is by far the most productive; the sales of chandu in the colony in 1919 yielded $17,511,229, in addition to which there were sales to the Federated and Non-Federated Malay States and Brunei. But prices were raised and other measures were taken in that year with a view to the gradual reduction of the amount of opium consumed.

Economic conditions: Agriculture, etc.—In many respects the colony actually benefited from the World War: there was, for instance, an increase in the gross value of trade from £63,600,000 in 1914 to £148,200,000 sterling in 1917. The more serious economic problems were not all results of the war. For example, it was about 1909–10 that a remarkable development of agricultural activity set in, especially in Malacca and Province Wellesley. This took the direction mainly of rubber planting, which led to the neglect of fruit cultivation and other forms of native agriculture; and this tendency has persisted. It has been asserted, indeed, that the rubber industry has been overexploited here: the people ceased in great measure to cultivate their own food crops and raise their own live stock, and became dependent on imported food stuffs. In 1917 rice was imported from Rangoon, Siam, and French Indo-China; wheat flour from Australia and India; cold storage foodstuffs from Australia, and other foodstuffs from China. Difficulties connected with shortage of supplies and shipping made it necessary to set up food control in 1917. An enquiry was instituted into measures for increasing home produce of rice and other foods, and "cultivation clauses" were inserted into leases of newly alienated lands. In 1918 the United States restricted imports of rubber, with a consequent reaction upon the Straits Settlements industry. This could not, however, immediately affect food cultivations, and in that year shortage in India, floods in Siam, and the demand for imported rice in Java and

Japan caused serious conditions in the Straits Settlements. Siam prohibited export of rice in July 1919: the Straits Settlements controller took entire charge of import and wholesale dealing, and a food production department was established which fostered home planting, and in spite of many difficulties it was found possible, early in 1920, to ensure supplies for several months. The Governments of the Straits Settlements, Netherlands India, and Ceylon agreed in 1919 to purchase through a single agent to avoid competition.

The cultivation and yield of coco-nuts declined in and after 1917, and the destruction of palms to make room for rubber had advanced so far in Singapore and Province Wellesley that an enactment was directed against it. Copra prices, however, rose in 1919. The clove, nutmeg, gambier, and areça nut industries of Penang shared in the general decline of cultivations which had become subsidiary to that of rubber. The pineapple cultivation was affected by the difficulty of obtaining tin plate for the canning industry. As for live stock (of which mention has been made above) a report for 1917 showed that whereas in 1910 Malacca exported 12,000 pigs, in the later year that number was imported, and that the former large export of poultry from Penang was more than balanced by import.

Forestry.—Measures have been taken to amalgamate the forest services of the Straits Settlements and the Federated Malay States, the first step being taken in 1918, when the forests of Malacca were placed under the deputy conservator of forests for Negri Sembilan. The area of reserved forests in 1920 was 107,270 ac., about 11% of lands in the colony. The mangrove industry has been fostered by imposing a control over cutting, and by replanting, over 2,000,000 seedlings having been planted in Penang and the Dindings in 1919.

Tin.—War conditions reacted favourably upon the tin trade. In July 1918 the price reached $160 per picul, and subsequently $185 when buying was prohibited except under licence. But after the Armistice the price, already declining, was further lowered when the Imperial Government ceased to buy direct, and the Federated Malay States had to guarantee purchase at $118 per picul.

Commerce.—Imports were valued at £43,856,000 sterling in 1914, and exports at £38,032,000. Both rose annually thereafter almost without exception, until in 1919 the figures were: imports, £96,664,000; exports, £99,318,000. The *entrepôt* trade in tin and Pará rubber is illustrated by the following figures for 1919:—

Imports (piculs)			
From	Tin	Tin Ore	Rubber
Malay States	133,000	686,000	1,412,000
Netherlands India	38,000	113,000	456,000
Siam	6,000	207,000	—
Other countries	2,000	32,000	79,000

Exports				
To	Tin, piculs	Value	Rubber, piculs	Value
United Kingdom	324,000	$41,347,000	406,000	$ 44,088,000
United States	454,000	$59,928,000	2,310,000	$230,511,000
Elsewhere	219,000	$27,445,000	254,000	$ 24,227,000

Shipping.—The total tonnage of shipping entered and cleared for the year 1919 is shown as follows: Singapore 14,088,775; Penang, 4,009,126; Malacca, 564,400; Christmas I. and Labuan, 222,882. The principal flags were British (nearly five-ninths of the whole), Japanese, and Dutch, and the total increase over the year 1918 was 5,820,913, nearly four-fifths of which was in British shipping. The total of 18,885,183 tons thus compares with 13,064,270 tons for 1918 when the shortage of shipping was most acute, and with 27,124,789 tons in 1913.

Work on the Lagoon wet dock and main wharf reconstruction, Tanjong Pagar, was completed and made over to the Singapore Harbour Board in May 1917. The revenue and expenditure of the Board, which reached $6,015,648 and $4,216,015 respectively in 1912, declined to $5,432,425 and $3,421,271 in 1915, and amounted to $9,617,718 and $5,444,410 in 1918. Penang wharf and dock receipts amounted in 1919 to $996,372 (approximately), and expenditure to $815,092. The wharf tonnage returns for Singapore and Penang show the following figures:—

		No. of Vessels	Net Tonnage	Inbound and Outbound	
				Coal, tons	Cargo, tons
Singapore	1913	2,708	5,794,536	1,338,495	1,462,788
	1918	2,114	3,330,791	732,231	1,213,730
Penang	1913	732	1,532,361	282,067	399,412
	1918	513	581,132	60,029	251,183

Land Communications.—The Singapore Railway Transfer Ordinance, 1918, enabled the Government of the Federated Malay States to construct a causeway across Johor Straits and to lay a railway to connect the Singapore line with the Johor and Federated Malay States systems. The sale of the Singapore Railway and railway stores involved a sum of $4,149,750. Metalled roads in the colony at the end of 1919 had a length of 584 m. (Singapore, 96 m.; Penang and the Dindings, 86 m.; Province Wellesley, 166 m.; Malacca, 231 m.; Labuan, 5 m.); and the Public Works Department had charge, in addition, of 50 m. of gravelled roads in Malacca, and 93 m. of "natural" roads in Penang, the Dindings, and Prov. Wellesley.

Education.—The centenary of the modern foundation of Singapore by Sir Stamford Raffles was the occasion of local celebrations in Feb. 1919, and by way of commemoration it was decided to found a Raffles College for higher education. Evidence of the general enthusiasm for this scheme was given by the prompt provision of subscriptions which ensured its success and enabled plans to be laid forthwith. The Straits Settlements Government promised a donation of $1,000,000 and an annual contribution of $50,000: the Governments of the Federated Malay States and Johor, and many private individuals, contributed. There have been other signs of a demand for a more active education policy; it being especially desirable as a counter measure against undesirable propaganda.

The Government maintained in 1919 eight English schools, and aided 45 English, Anglo-Tamil, Malay, Tamil, and Chinese schools: it also supported the Malacca Training College for Malay teachers. The Central Training College in Perak, the erection of which was started in that year, is intended for Malay teachers not only in the Federated Malay States but also in the Straits Settlements.

Labuan.—Revenue collected in Labuan in 1919 amounted to $38,308, and expenditure was $81,927. The total value of trade was $3,748,930 in that year, and $2,763,561 in 1918. Merchant shipping entered and cleared amounted to 141,686 tons in 1919. The Labuan Exploration Co. of London undertook a geological survey in 1920 with the view of prospecting for minerals.

Christmas Island.—Revenue (1919), $26,155; expenditure, $12,791. The export of phosphate of lime, which reached 89,889 tons in 1917, showing a large increase, fell to 53,370 tons in 1918 and amounted to 68,621 tons in 1919. The export was taken in 1919 by Japan (71%) and Australia. Shipping entered and cleared amounted to 81,197 tons (61% Japanese). There is a small export of rubber. The phosphate company maintained its output during the war, completed an inclined haulage way, and carried the railway to new quarries at South Point in 1918–9.

Cocos Islands.—A typhoon in 1909 left standing only 3% out of over 1,000,000 coco-nut palms, but replanting was completed in 1911, and export of copra was resumed two years later and reached 800 tons in 1918. An exchange cable station of the Eastern Extension Telegraph Co. and a high-power wireless station are established on Direction Island. The German raider "Emden" landed a party to destroy these on Nov. 9 1914, and was caught and herself destroyed by the "Sydney" of the Australian navy, running ashore on North Keeling Island, while her landing-party captured and escaped in the schooner belonging to the proprietor of the islands.

The governor of the Straits Settlements is high commissioner for the Malay States, Federated and Non-Federated (*see* MALAY STATES), and also for Brunei, and British agent for Sarawak and British North Borneo. These three divisions of northern Borneo are dealt with below.

Brunei (*see* 4.681).—Pop. (1911), 21,718. Revenue (1919), $162,020; expenditure, $138,844. Imports were valued in 1916 at $254,756, and $614,061 in 1919; exports at $734,254 in 1916 and $1,134,864 in 1919, including plantation rubber ($243,596), cutch ($304,249), and coal ($296,621). The demand for sago, wild rubber (jelutong) and other forest produce, and dried fish, was great, and purchase prices ceased to be controlled by a group of traders as previously, which enabled the peasantry to profit to the extent of balancing the high prices of rice and other foodstuffs. Attempts were made to increase home production. The rice crop of 1918–9 failed, but the effort was maintained and rewarded in the following season. Plantation rubber (429,823 lb.) came mainly from the Brunei district, which has become the chief centre of the industry, in place of the Temburong basin. The cutch industry was suffering from the former indiscriminate cutting of mangroves in accessible districts where no replanting had been done, and the production was only maintained at the expense of heavier labour and transport. The Brooketon collieries yielded 29,565 tons of coal in 1918 and 26,274 tons in 1919. Attempts to develop a petroleum field at Tutong at this period were unsuccessful, though it was still expected that later there would be good results. Plantations and mines were encountering a serious shortage of labour, owing to the prosperity of the native traffic in forest produce, etc., above referred to.

Sarawak (*see* 24.207).—Pop. (estimated 1919), 600,000. Revenue (1918), $1,921,964; expenditure, $1,455,692. Imports, $9,908,732; exports, $11,540,190. Gold was exported to the value of $1,256,500 in 1915 and $923,100 in 1918. An extensive oil-field has been developed in Baram district, and 74,400 tons of oil were exported in 1918. Other principal exports include sago, pepper, and jelutong. There are four wireless stations, affording communication with Singapore. Charles Vyner Brooke (b. 1874) succeeded his father, Sir Charles Johnson Brooke, as rajah on May 17 1917.

British North Borneo (*see* 4.262).—Pop. (1911), 208,183; (estimated 1919), 227,000. The revenue of the British North Borneo Chartered Company (exclusive of land sales) has shown unbroken increase since 1910, from £170,767 in that year to £234,804 in 1914 and £373,936 in 1919; expenditure for 1919 amounted to £193,230. Imports were valued in 1919 at £925,235, and exports at £1,453,990, including rubber (£782,037), tobacco (mostly grown on estates; £230,122), coal (£78,706), copra (£39,629), cutch (£24,651), sago, and dried fish. The company's railway from Jesselton extends to Melalap in the interior, and has a branch from Beaufort to Weston, and a total length of 130 miles. There are four wireless stations. A Legislative Council was established in 1911 to aid the governor and civil staff in the local administration: the commercial, planting, Chinese, and native communities are represented on it. The company created an opium monopoly department in 1913, following the policy of the Straits Settlements Government. (O. J. R. H.)

STRANG, WILLIAM (1859–1921), British painter-etcher (*see* 25.982), was in 1918 elected president of the International Society of Sculptors, Painters and Gravers. In 1909 the degree of LL.D. was conferred upon him by Glasgow University. His later work includes the etchings "The Little Flower Girl" (1909); "Nymph and Shepherds" (1910); "On the Omnibus" (1911); "The Walls of the Alhambra" (1912) and "The Mirror" (1912); besides various portraits, including one of Thomas Hardy (1910). He had only recently been elected a full R.A. when he died suddenly at Bournemouth, on April 12 1921.

See *Catalogue of William Strang's Etched Work, 1882–1912* (1912).

STRATEGY: *see* TACTICS.

STRATHCONA AND MOUNT ROYAL, DONALD ALEXANDER SMITH, 1ST BARON (1820–1914), Canadian statesman (*see* 25.1000), died in London Jan. 21 1914. His barony passed by special remainder to his daughter Margaret Charlotte, wife of Robert Jared Bliss Howard, of Montreal (d. 1921).

STRAUSS, RICHARD (1864–), German composer (*see* 25.1003). His opera, *Ariadne auf Naxos* (1912), was produced at His Majesty's theatre by Thomas Beecham in May 1913 and the same year *Der Rosenkavalier*, first produced at Dresden in 1910, was performed at Covent Garden with great success, eight performances being given; in point of fact, this proved to be Strauss's most popular opera. His other recent works include *Festliches Praeludium*, for orchestra (1913), and *Josephs Legende* (1914). In addition to the works enumerated mention should be made of *Eine Alpensinfonie*, (1915, op. 64); and the three-act opera, *Die Frau ohne Schatten*, libretto by Hugo von Hofmannsthal (1916, op. 65). In the winter of 1920–1 Strauss visited S. America, where he officiated at Buenos Aires as opera conductor, subsequently returning to Vienna.

STRAVINSKY, IGOR (1882–), Russian musical composer, was born at Oranienbaum, near St. Petersburg, June 18 (O.S. June 5) 1882. His father was an opera singer, who early discovered his son's remarkable musical gifts. At the same time, however, he wished the boy not to devote himself entirely to music but to study law, and with this end in view Igor Stravinsky entered the University of St. Petersburg. At the age of 22, however, a meeting with Rimsky-Korsakov decided him in the direction of a musical career, and the former declared himself ready to take Stravinsky as a pupil. His first work for orchestra was a symphony (1907), followed by a suite, *Faune et Bergère*, and two short works, also for orchestra, *Feu d'artifice* and *Scherzo fantastique*. A meeting with Serge Diaghiliev turned his attention to the possibilities of the ballet, and in rapid succession appeared *L'Oiseau de feu* (1910), *Petrouchka* (1911), and *Le Sacre du Printemps* (1913). His next important work was an opera, *Le Rossignol* (1914), founded on Hans Andersen's fairy story of *The Nightingale*, of which the second and third acts were later worked up into a symphonic poem, *Le Chant du Rossignol* (1917). The opera was produced at Covent Garden in 1920, and the same year appeared a revision by Stravinsky of Pergolesi's *Pulcinella*.

STREUVELS, STIJN, the pen-name of FRANK LATEUR (1871–), Flemish author, who was born at Heule, West Flanders, Oct. 4 1871. He was a nephew of Guido Gezelle (1830–1899), a celebrated Flemish poet, and until 1905 worked as a baker at Avelghem, a village near Courtrai in West Flanders. Writing in the West Flemish dialect, he was accepted in Belgium and Holland as the most distinguished Low Dutch author of his day. He produced many short stories, including *Openlucht* (1905) and *De Vlaschaard* (1908), a collection of which, translated into English by A. Teixeira de Mattos, appeared in 1913 under the title of *The Path of Life*. In 1912 appeared *Het glorierijke Licht* ("The Glorious Light").

STRIKES AND LOCK-OUTS (*see* 25.1024).—In the following account of later developments between 1907 and 1921, strikes in the United Kingdom are first dealt with, sections following for other countries.

(A) UNITED KINGDOM

I. *Statistics.*—Table 1 shows the total number of strikes or lock-outs recorded in each year from 1907 to 1920, inclusive; the number of workpeople involved therein, and the aggregate loss of working days due to these disputes.

Table 1.

	No. of Disputes	No. of Workpeople Directly and Indirectly Involved	Aggregate Duration of Disputes in Working Days
1907 . .	601	147,000	2,162,000
1908 . .	399	296,000	10,834,000
1909 . .	436	301,000	2,774,000
1910 . .	531	515,000	9,895,000
1911 . .	903	962,000	10,320,000
1912 . .	857	1,463,000	40,915,000
1913 . .	1,497	689,000	11,631,000
1914 . .	999	449,000	10,111,000
1915 . .	707	453,000	3,040,000
1916 . .	578	281,000	2,581,000
1917 . .	803	885,000	5,809,000
1918 . .	1,300	1,142,000	6,332,000
1919 . .	1,413	2,515,000	34,903,000
1920 . .	1,715	1,932,000	27,011,000

It will be seen that the figures show a general advancing tendency, partially checked during the World War. The total for the year 1920 shows the highest figure ever recorded for number of disputes, the highest figure (with one exception) for the number of workpeople involved, and the highest figure (with three exceptions) for the aggregate duration of disputes. The exceptions in this latter case are 1893, with 30,468,000 working days; 1912, with 40,915,000 working days; and 1919, with 34,903,000 working days. In 1893, 1912 and 1920 the high figures were principally due to great coal strikes; the year 1919 was a year of great industrial unrest.

As showing the general advancing tendency of the figures, it may be instructive to compare the average of the four years 1907–10 with the average of the four years 1917–20:—

	Average of Years 1907–10	Average of Years 1917–20
No. of Disputes . . .	492	1,308
No. of Workpeople Involved	315,000	1,633,500
Aggregate Duration (in Working Days) . .	6,416,000	18,511,000

It should be stated that the increase in the number of disputes may be partly accounted for by improved facilities for obtaining information with regard to minor disputes, which may have previously escaped notice; but this will not account for more than an insignificant part of the increase in the figures for number of workpeople involved and for aggregate duration, since the greater disputes, involving large numbers of workpeople, have always been well reported in the newspapers. Table 2 (p. 583) shows the distribution of strikes between the principal groups of trades, taking the averages for the 10 years 1911–20.

Table 2 shows that the average number of workpeople involved in each dispute was a little over 1,000, and that the average duration of disputes was about 14 days. The figures, however, vary widely as between one trade and another. Thus, the average number of workpeople varies from a little more than 200, in the building trades, to over 3,000 in the mining and quarrying group; while the average duration varies from 8 days, in the transport trades, to 27 days in the building trades.

The figure for average numbers involved, and still more that for the average duration, give an exaggerated idea of what may be called the "normal" magnitude and duration of a strike. It is the great strikes, involving many thousands of workpeople, that are commonly also the hardest fought and the most prolonged. Great masses of workers are not mobilized for industrial conflict except for some object which they regard as of first-class importance; and it is exceptional for a strike or lock-out of this magnitude to occur unless all means of reaching a pacific settlement have been exhausted, and unless both employers and workpeople are organized in strong combinations, with great financial resources. All these factors tend to prolong precisely those strikes—in reality a small minority—which involve large numbers of workpeople, and thus exaggerate enormously the figure for "aggregate duration." For example, nearly 40% of the aggregate duration of disputes in the building trades was due to the great dispute in the London building trade in 1914, which lasted for more than six months and accounted for about 2,500,000 working days. In the mining and quarrying industry, two-thirds of the total aggregate duration of all the disputes was due to the two great coal strikes of 1912 and of 1920; if these were eliminated, the average number involved in disputes in this group of trades would be reduced from over 3,000 to 1,800, and the average duration from 14 to 8 days. The case is much the same with the other great groups of trades; and, speaking broadly, it may be said that the vast majority of recorded disputes involve comparatively small numbers of workpeople, and last less than a fortnight—often indeed, only a few days.

To put the same thing in another way. The number of disputes which had an aggregate duration of 25,000 days and upwards varied, in the period 1904–13, from 11 (in 1904) to 72 (in 1913), with an average of 32, or 5% of the total number of disputes. Yet this 5% of disputes accounted for 65% of the number of workpeople involved, and for no less than 86% of the aggregate duration. Or again, the number of disputes in which 2,500 workpeople or upwards were involved varied, in the years 1904–13, from a minimum of 4 (in 1905 and in 1907) to a maximum of 43 (in 1913), with an average of 18, or less than 3% of the total number of disputes; but this 3% of disputes accounted for 67% of the total number of workpeople involved, and for 74% of the aggregate duration.

Some trades are far more subject to industrial disturbance than others; in the building trades the proportion of men who strike or are locked out rarely reaches 1% of the total number employed in the industry, and in the clothing trades the proportion is not much higher; whereas in the coal-mining industry the proportion who strike or are locked out rarely falls below 5% and frequently rises above 20% in a year.

The mean percentages of workpeople involved in disputes for the years 1904–13 were as follows:—

Building trades	0·7
Coal mining	21·4
Other mining and quarrying	2·2
Metal engineering and shipbuilding	3·3
Textile trades	6·4
Clothing trades	1·3
Other trades	1·7
All Trades	4·4

The statistics of *causes* show, on the whole, remarkable regularity. Such fluctuations, as there are, are due principally to the prevalence or otherwise of wage disputes. In years of good or improving trade, strikes for advances in wages are numerous; in years of bad and declining trade such strikes become much fewer.

The statistics of *results* show somewhat less regularity. The principal features of this part of the table are the diminishing proportion of disputes settled in favour of the employers, and the increasing proportion settled by a compromise. In the first half of the period the proportion of disputes settled in favour of the workpeople was 24% on the average; settled in favour of the employers, 44%; and compromised, or partially successful, 32%. In the second half of the period the corresponding percentages were 26, 28, and 46. It should be noted that the second period includes three or four years of exceptional prosperity, a condition which tends to promote settlements in favour of the workpeople; and that this was followed by the period of the war, when prices were constantly rising and industrial conditions were altogether abnormal.

Table 2.

Group of Trades	No. of Disputes	No. of Workpeople involved (Thousands)	Aggregate Duration in Working Days (Thousands of Working Days)
Building	119	25	652
Mining and Quarrying	164	508	7,067
Metal Engineering and Shipbuilding	265	180	2,765
Textile	107	138	2,143
Clothing	58	19	258
Transport	88	150	1,230
Miscellaneous (including Employees of Public Authorities)	260	68	968
Average for all above Trades[1]	1,061	1,088	15,083

Table 3 classifies the disputes of the years 1900 to 1920, (*a*) according to their causes, and (*b*) according to their results:—

Table 3.

Year in which Disputes began	Proportion of Disputes arising on questions of					Proportion of Disputes settled				
	Wages	Hours of Labour	Employment of particular Classes or Persons.	Other Questions	Total	In favour of Workpeople	In favour of Employers	Compromised	Indefinite or Unsettled	Total
...	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1900	68	1	14	17	100	31	34	34	1	100
1901	63	4	13	20	100	26	44	30	..	100
1902	60	5	13	22	100	24	47	28	1	100
1903	60	4	14	22	100	23	48	29	..	100
1904	65	4	13	18	100	17	51	32	..	100
1905	66	4	13	17	100	20	47	33	..	100
1906	68	3	11	18	100	32	37	31	..	100
1907	64	3	14	19	100	32	41	27	..	100
1908	62	3	14	21	100	20	44	36	..	100
1909	59	6	14	21	100	18	46	36	..	100
1910	57	4	15	24	100	25	37	38	..	100
1911	64	3	16	17	100	25	32	43	..	100
1912	63	3	17	17	100	27	31	42	..	100
1913	66	3	16	15	100	29	25	46	..	100
1914	63	3	18	16	100	25	33	42	..	100
1915	73	2	12	13	100	23	37	40	..	100
1916	76	3	12	9	100	22	27	51	..	100
1917	73	1	15	11	100	31	20	48	1	100
1918	68	2	17	13	100	29	21	48	2	100
1919	64	11	15	10	100	24	22	54	..	100
1920	69	3	15	13	100	24	29	47	..	100
Averages	65	4	14	17	100	25	36	39	..	100

II. *Principal Disputes.*—The year 1908 (in contrast to 1907, which was entirely free from any disputes on a great scale) saw three great disputes: (1) a shipbuilding dispute involving 35,000 workpeople, and with an aggregate duration of 1,719,000 working days; (2) an engineering dispute on the N.E. coast, involving 11,000 workpeople, and with an aggregate duration of 1,706,000 working days; and (3) a dispute in the cotton trade, involving 120,000 workpeople, and with an aggregate duration of 4,830,000 working days.

In each of these three disputes the workpeople struck against (or were locked out to enforce) a proposal to reduce wages. This was at one time a common and important cause of disputes; the great coal strike of 1893, for example, was against a reduction in wages. During 1910-20 there were few or no disputes of any importance on this ground; in fact, these three disputes in 1908 were the last important disputes arising out of an attempt to reduce wages, until the ship-joiners' dispute, which, beginning in Dec. 1920, was the precursor of a series of strikes or lock-outs culminating in the coal strike of 1921.

In each of the three disputes referred to above, one or more of the trade unions concerned was prepared, before the strike or lock-out occurred, to accept the terms offered by the employers; but in each case one or more other trade unions resisted the reduction. Modified terms offered by the employers were accepted in all three cases.

There were no important disputes in 1909; but in 1910 several prolonged disputes, involving large numbers took place.

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[1] Exclusive of the general strike at Dublin in 1913–4, which cannot be classified under any of the separate trade headings. This strike involved about 20,000 workpeople, and had an aggregate duration of about 1,900,000 working days.

Trouble arose in Northumberland and Durham in Jan. 1910, with regard to the working of the coal mines under the Eight Hours Act (the Coal Mines Regulation Act, 1908), which came into operation, in those two counties, on Jan. 1 1910. Agreements had been reached between the two coal owners' associations and the respective miners' union in Dec. 1909, as to the working of the mines under the new arrangements; but a large number of men at the various mines repudiated the agreements, and refused to go down the pits. About 85,000 workpeople were involved in Durham, and about 30,000 in Northumberland. At most of the pits the strike was over by the end of Jan.; but a minority of men stood out, and the strike was not finally settled until April. The aggregate duration of the dispute was about 1,280,000 working days in Durham and about 1,080,000 working days in Northumberland.

Certain members of the United Society of Boilermakers and Iron and Steel Shipbuilders stopped work in Aug. 1910, in breach of an agreement with the Shipbuilding Employers' Federation, at two shipyards, one on the Tyne and the other on the Clyde; and the Employers' Federation locked out the members of the Boilermakers' Society at all the federated shipyards on Sept. 3. About 25,000 workpeople were directly or indirectly affected.

A provisional agreement made between representatives of the parties on Oct. 11 1910, was twice rejected by the workpeople on a ballot vote, and it was not until Dec. that a final agreement supplementing that of March 1909 was reached, and accepted by the workers. Work was resumed on Dec. 15. The aggregate loss of time in this dispute was about 2,850,000 working days.

A strike of *coal miners and surface workers* in the Rhondda Valley began on Sept. 1 1910 and continued for nearly a year, being settled in Aug. 1911. It arose out of a dispute at one pit concerning the price list for a particular seam, and was followed by sympathetic strikes at other pits belonging to the same employers. An agreement was finally reached on the price list, and on a guarantee of an average wage. About 12,800 men and boys were involved at the beginning of the strike.

The years 1911-2-3 were years of violent, and almost continuous industrial unrest. Among the most important disputes of these years were those described below.

A series of *seamen's and transport workers'* strikes began in June 1911. The original occasion of the first dispute was a demand put forward by the National Sailors' and Firemen's Union for the formation of a conciliation board, consisting of representatives of the Union and of the Shipping Federation, to consider a programme of reforms desired by the Union. The Federation refused to discuss the demands, and the seamen and firemen came out on strike at various dates in June 1911, many of the principal ports being affected. (London was not affected till a little later.) Strikes of dock labourers, carters, tramwaymen, and other transport workers occurred at some of these ports, partly in sympathy with the seamen, and partly in support of demands of their own for improved working conditions. Serious disorder occurred at Hull, Manchester and Salford.

Settlements were reached at various dates in July and Aug. affecting seamen and dockers at Hull and Goole; seamen and carters at Manchester; dock labourers and tramwaymen at Liverpool; and seamen and transport and other workers at Cardiff. There were also a large number of sectional settlements in the London dock, shipping, and transport trades.

The *railway* dispute of 1911 began with a strike of 1,000 railwaymen (goods porters, etc.) at Liverpool on Aug. 5, the men alleging their inability to get their grievances dealt with by the conciliation boards set up under the scheme of 1907. They were joined by railwaymen at Manchester and at many other centres. On Aug. 15 the executives of four of the railwaymen's trade unions sent to the various railway companies a resolution, stating that they were being pressed by their members to declare a strike, and giving the companies 24 hours to decide whether they would immediately meet representatives of the workers to discuss their grievances. The Government got into touch with representatives of the companies and of the trade unions on Aug. 16; and on the following day the Prime Minister announced that the Government was prepared to appoint immediately a Royal Commission, to investigate the working of the Railway Conciliation Agreement, and to report what amendments, if any, were desirable in the scheme. This announcement did not prevent a strike; but a provisional settlement was reached on Aug. 19, and work was generally resumed on Aug. 21 (except on one railway, where it was resumed on Aug. 23). The Royal Commission began its sittings on Aug. 23, and reported on Oct. 18. The trade unions, however, refused to accept the Commission's recommendations without various modifications; the railway companies, on their side, took the line that both sides were bound by the findings of the Commission. On Nov. 22 the House of Commons debated the question, and passed a resolution to the effect that the parties should be invited to meet with the view of discussing the best mode of giving effect to the report of the Royal Commission. The Board of Trade signified to the parties their readiness to call a fresh conference "on the understanding that the findings of the Royal Commission were accepted in principle and in substance." The parties accepted these conditions, and a conference was held, at which an agreement was reached, the recommendations of the Royal Commission being accepted with certain alterations and additions. The effect of the new agreement was to expedite the settlement by the conciliation boards of matters in dispute, to secure greater uniformity in the decisions of the conciliation boards, and to give such decisions greater finality than they had previously possessed.

The Cotton Weavers' Association of N. and N.E. Lancashire engaged in an active campaign in this year (1911) against the employment of non-unionists. The employers replied by a general lock-out, which began on Dec. 28, about 160,000 workpeople being involved. This is exclusive of the workpeople in the spinning section of the trade, who were put on short time, or thrown out of work, owing to the stoppage of the principal outlet for their production. The chief industrial commissioner (Sir George Askwith) invited the parties to a conference, which was duly held; and an agreement was reached on Jan. 19 1912. Work was to be resumed on Jan. 22, under the old conditions of employment, on the understanding that no action should be taken for six months in the way of tendering notices or striking mills on the non-unionist question. It was also agreed that, at the end of that period, Sir George Askwith would, if requested, submit proposals for the settlement of the question.

The great *coal* strike of 1912 involved an aggregate loss of working time of over 30,000,000 working days in the coal mines alone. There was also, of course, much consequential unemployment and under-employment in other industries. The percentage unemployed among members of trade unions rose to 11.3% at the end of March 1912; while blast furnaces, steel sheet works, and the glass bottle industry, were brought almost to a standstill, and tinplate mills working were reduced to about 14% of the normal number.

The strike arose out of a demand by the Miners' Federation for the payment of a minimum wage for every man and boy working underground in the mines. A conference between representatives of the coal-owners and of the miners had discussed the question of the earnings of miners in "abnormal" places (*i.e.* in working places where, owing to the thinness of the seams, or other causes beyond their control, the hewers were unable to earn the recognized minimum or average rate for the district), and a considerable measure of agreement had been reached; but at the annual conference of the Miners' Federation at Southport on Oct. 6 1911, it was decided "to take immediate steps to secure an individual district minimum wage for all men and boys working in mines in the area of the Federation, *without any reference to the working places being abnormal.*"

A ballot of the members of the Federation was taken on the question of handing in notices to establish the principle of an individual minimum wage, as expressed in the resolution quoted above. There was a large majority (445,801 to 115,721) in favour of giving notice; and notices were accordingly handed in, to terminate at the end of Feb.

At a subsequent meeting the Miners' Federation fixed the minimum rates they were prepared to accept in each district for piece workers "at the face" (*i.e.* hewers, etc.); and also added the following general instructions to their representatives, for their guidance in any negotiations that might ensue with the mine owners:—

> "No underground adult worker should receive a rate of wages less than 5s. per shift." (This did not apply to the Forest of Dean, or to Bristol and Somerset.) "Individual minimum wages for all piece workers other than colliers to be arranged by the districts themselves, and to be as near as possible present wages."

Day rates for underground workers, and boys' wages, were also to be left to local arrangement; the boys' wages not to be less than the then existing wages, and not in any case less than 2s. a day.

Unsuccessful negotiations took place between the coal owners and the men; and on Feb. 20 Mr. Asquith, who was at that time Prime Minister, intervened, and invited both parties to meet him and other members of the Government, separately, in conference on Feb. 22. From that date onward till March 15 the Prime Minister kept in constant touch with the parties, who finally met, in joint session, with representatives of the Government, on March 12, 13 and 14. On March 15, the Prime Minister announced that the Government had decided to ask from Parliament "a legislative declaration that a reasonable minimum wage, accompanied by adequate safeguards for the protection of the employer, should be a statutory term of the contract of employment of people who are engaged underground in coal mining."

In accordance with this announcement the Prime Minister introduced a bill in the House of Commons on March 19 1912, which received the Royal Assent on March 29, as the "Coal Mines (Minimum Wage) Act, 1912." The Act provided for the setting up of a joint district board in each of 22 districts specified in a schedule to the Act, to determine the minimum rates of wages for workmen employed underground in coal mines. On March 27 the coal owners met and adopted a resolution in favour of working the Act; and on the same day the men's Federation decided to take a ballot of the members on the question of resuming work, pending the settlement of minimum rates by the district boards. The ballot showed a majority (244,011 to 201,013) against resumption; but, at a national conference held on April 6, it was decided to terminate the strike.

A great strike of *dock and other transport workers* in the Port of London and on the Medway began on May 21 1912, and lasted over two months. The immediate occasion of the dispute was the refusal of a workman who belonged to the Amalgamated Society of Foremen Lightermen to join the Amalgamated Society of Watermen, Lightermen, and Bargemen; the latter society is affiliated to the National Transport Workers' Federation, but the former is not. The employers refused to interfere, and between 5,000 and 6,000 lightermen left work on May 21, followed later by a number of dock workers, who ceased work in sympathy.

The underlying cause of the dispute, however, was dissatisfaction with the carrying out of the various agreements that had been arrived at in settlement of the disputes in the previous year (*see* above). The Government ordered an enquiry to be held by Sir Edward Clarke, K.C.; and the alleged grievances of the workmen were found to come under seven heads, including:—

> Employment of non-union men, in alleged breach of an agreement, by two of the employers' associations.
>
> Refusal of an employers' association to meet the trade union to discuss rates of wages and conditions of labour.
>
> Refusal of certain employers to pay rates of wages fixed by various awards or agreements. Alleged interference with union workmen.

The board of trade invited representatives of the employers and of the workers to a conference, to discuss Sir E. Clarke's report. The men accepted, but the employers declined to be present, and stated that they could not accept Sir E. Clarke's report as an award on the points dealt with by him. They were unable to adopt certain suggestions made by the Board of Trade for the formation of a federation of employers; and refused, "under any circumstances, to any recognition of the Union of Transport Workers' Federation ticket, or any discussion for such recognition." Following upon debates in the House of Commons, and upon further conferences with the parties, the Government put forward various proposals on June 7; these were accepted (in substance) by the men, but refused by the employers. The Transport Workers' Federation thereupon declared a national strike of transport workers. Certain of the unions affiliated to the Federation took a ballot of their members as to the advisability of ceasing work, the result being in each case a majority against a strike; and only about 20,000 men, at Manchester and some of the minor ports, came out on strike. These all returned unconditionally after a few days' stoppage.

The places of the men on strike in London had by this time begun to be filled up by non-unionists; and the employers took a very determined attitude, refusing to agree to any conditions precedent to the men returning to work. Further negotiations were fruitless, and on July 27 the men's strike committee recommended an immediate resumption of work. By July 31 the return to work was fairly general; and by Monday, Aug. 6, practically all the men who could find work were reinstated. About 100,000 workpeople were involved in the dispute, and the aggregate duration was about 2,700,000 working days.

A strike of *tube and other metal workers* in Birmingham, Wolverhampton, Wednesbury, and other towns in the "Black Country," began on April 25 1913, and continued until the middle of July. As many as 50,000 workpeople were involved at the height of the dispute, and the aggregate duration was about 1,400,000 working days. The majority of the strikers were labourers or semi-skilled workers; but a large number of skilled men were thrown idle owing to the absence of the labourers. The men demanded an all-round advance of 2s. a week on day-rates, and 10% on piece-rates, with a standard minimum of 23s. a week for unskilled men; and various rates, on a scale rising with each year of age, for youths and for girls. The parties were brought together through the intervention of the chief industrial commissioner; and an agreement was signed on July 7, fixing the standard rate for adult able-bodied unskilled labourers at 23s. in the Birmingham district, and at 22s. in the Black Country district, to be raised to 23s. after six months. The rates for youths and for girls were also fixed, on a scale rising by ages. Piece-work rates were to be fixed by agreement between the several employers and their workmen, the day-rate, however, being guaranteed irrespective of piece-work earnings.

The Dublin dispute of 1913–4 was unique in British industrial history, in that it was the only dispute of importance, at least since regular records have been compiled, in which all the trades of a whole city and district were involved, including even agriculture. It was, in fact, the nearest approach to a "general" strike that had ever been known. Ever since the year 1908 there had been much industrial unrest in Dublin, frequently taking the form of the sympathetic strike. The "sympathetic" strike, in this developed and organized form, is a species of boycott, aiming at the complete dislocation of the trade of the firm or firms attacked; the withdrawal of their own employees is supplemented and reinforced by the refusal of the employees of other firms to handle their goods. The immediate occasion of the strike was an announcement by the Dublin Tramway Co. of the temporary closing of their parcels department, and of their intention, when that department was reopened, not to allow their employees in that department to belong to the Irish Transport and General Workers' Union, which had been active in the policy of the sympathetic strike. A number of tramwaymen struck work on Aug. 26, demanding the reinstatement of the locked-out workpeople in the parcels department; they also put in claims for increased wages, shorter hours, and other concessions. Following this came strikes (or lock-outs) of employees of flour millers, coach builders, biscuit manufacturers, coal merchants, steamship companies, master carriers, master builders, timber importers, cement and brick merchants, and farmers in the County Dublin; besides a large number of independent firms, in a wide variety of trades. At a meeting on Sept. 3, 400 employers in Dublin passed a resolution to the effect that "the position created by the Irish Transport and General Workers' Union (a union in name only) was a menace to all trade organizations, and had become intolerable"; and pledging themselves not to employ members of that Union, or any persons refusing to carry out his employer's lawful and reasonable instructions. A large number of employers endeavoured to require their workpeople to sign an undertaking in the following terms:—

> "I hereby undertake to carry out all instructions given to me by or on behalf of my employers, and, further, I agree to immediately resign my membership of the Irish Transport and General Workers' Union (if a member), and I further undertake that I will not join or in any way support this Union."

On Sept. 26 it was announced that a Court of Enquiry had been appointed, consisting of Sir George Askwith, Sir Thomas Ratcliffe Ellis, and Mr. J. R. Clynes, to inquire into the dispute, and to take such steps as might seem desirable with the view of arriving at a settlement. The Court of Enquiry heard evidence at Dublin on Sept. 29 and on Oct. 1–4, and issued their report on Oct. 6. The report (1) regretted that no steps had been taken to set up Conciliation Boards, as had been several times suggested; (2) reported that there were indications that substantial grievances existed in the various industries; (3) condemned the policy of the sympathetic strike; "no community," it declared, "could exist if resort to the sympathetic strike became the general policy of Trade Unionism"; and (4) condemned the undertaking which the employers had endeavoured to impose on the workpeople, as contrary to individual liberty, and such as no workman or body of workmen could reasonably be expected to accept. The report also made proposals for the settlement of the dispute, based on the establishment of a series of conciliation committees. These proposals were accepted by the workers but rejected by the employers, who declared that they could not recognize the Irish Transport and General Workers' Union, until it was reorganized on proper lines, with new officials approved by the British Joint Labour Board.

Various other efforts were made to settle the dispute, notably by the Joint Board (the "British Joint Labour Board," already referred to). This was a composite body representing the parliamentary committee of the Trades Union Congress, the Executive Committee of the General Federation of Trade Unions, and the Executive of the Labour party. These overtures came very near to success, the parties being brought together in joint conference; but the negotiations broke down, on Dec. 20 1913, on the question of reinstatement. All this time the employers had been gradually replacing the men on strike or locked out; and a few of the men who had struck (or been locked out) had returned to work. During Jan. and the early part of Feb., the majority of the remaining strikers whose places were still open returned to work, most of them agreeing to handle all goods and to obey orders. In some cases the men also undertook not to belong to the Transport Union.

The principal dispute of 1914 was in the London *building* trade. Numerous strikes had occurred against the employment of non-unionists, although most of the trade unions were bound by agreements which contained (*inter alia*) a stipulation that there should be no discrimination between union and non-union labour. At a conference with eight of these trade unions, held on Dec. 23 1913, the employers put forward certain proposals for enforcing these agreements by means of penalties; these proposals were rejected by the trade unions, and on Jan. 7 1914, the London Master Builders' association gave notice that they regarded the working-rule agreements as no longer in force. The employers next endeavoured to impose on the workpeople an individual undertaking to work peacefully with non-unionists, on pain of a penalty of twenty shillings. Most of the men refused to sign the undertaking, and the strike began on Jan. 26 1914. Various efforts were made to settle the dispute; but proposals which had been agreed to by the men's representatives were twice rejected by the trade unions on a ballot vote. One of the smaller unions, however, accepted the terms at the second vote, and came to a sectional agreement; and sectional agreements were afterwards made with two other trades. At this point the National Federation of Building Trade Employers resolved on a lock-out of all their employees throughout the country, if the dispute were not settled by Aug. 15. Before the threat could be carried out, however, the World War had begun; and a settlement was hastily reached, on the basis of the acceptance by the men of the terms last offered by the employers, with certain modifications. The chief points in the settlement were:—

> Employers to be at liberty to employ any man, but unions to have right of appeal against any operative who has made himself specially objectionable to his fellows. Ticket inspection granted, but not during working hours. National executives of unions to guarantee observance of rules. Six months' notice to be given for termination or modification of rules.

There was a strike of coal miners in Yorkshire, lasting from the middle of Feb. to nearly the end of April 1914, in which about 150,000 workpeople were at one time involved. The employers at certain collieries had refused to add the usual percentages to the newly established district minimum rates; and it was finally decided that a lower minimum should be fixed for certain collieries, and the percentages above standard calculated on these reduced minima.

The outbreak of the World War brought all the important current disputes to an end; and, though there were a large number of disputes in the remaining months of 1914, and indeed during the whole period of the war, most of them were quite unimportant, and were brought to a very speedy conclusion. After the passing of the first Munitions Act in 1915 many of these strikes were illegal; and, even when they were not illegal, they were sometimes unauthorized by the central executives of the respective trade unions. The fact that the dispute was illegal or unauthorized; the swift intervention of the Government, armed with emergency powers; and—perhaps more important than all these—the severe reprobation of strikes by public opinion, tended to restrict their scope and above all to shorten their duration. Hence the aggregate duration even of some of the disputes that excited most public feeling, such as the Clyde Engineering dispute of Feb. and March 1915 (about 110,000 working days) was quite trivial by comparison with the great disputes before the war.

On Feb. 4 1915, the Government appointed Sir George Askwith, Sir Francis Hopwood, and Sir George Gibb, as a "Committee on Production in Engineering and Shipbuilding Establishments," to enquire and report as to the best means of insuring that the productive power of the employees in engineering and shipbuilding establishments for Government purposes should be made fully available. The Committee recommended (*inter alia*) that industrial disputes should never be allowed to result in a stoppage of work; and that disputes which could not be settled by the ordinary means should be referred to an impartial tribunal for immediate investigation and report with a view to a settlement. The Government accepted the recommendation, and appointed the Committee on Production as the tribunal indicated.

Hence in 1915, though there were over 700 disputes, there was only one with an aggregate duration of over a million days, a coal strike in South Wales, arising out of a deadlock over a wages agreement.

There was also only one large dispute in 1916, a strike of 30,000 jute workers at Dundee, which lasted from March 24 to June 8. The workpeople claimed an advance of 15% on piece-rates of wages, but ultimately returned to work on the old terms. This year was particularly free from disputes in the coal industry, which is generally the most affected by disputes.

Several unauthorized strikes, on a fairly large scale, occurred in the *engineering* trades in 1917. These excited a great deal of public attention, both because of the vital importance of maintenance of the fullest possible engineering output during the war, and also because the strikes were openly outbreaks of revolt, not only against the restrictions imposed on industrial freedom by various statutes and regulations, but also (what was felt to be even more serious) against the authority of the trade union executives. Measured, however, by the test of aggregate duration, only one of these disputes—the engineering strike of May 1917—was of very serious importance; and, as all the disputes had many features in common, it will suffice here to give an account of the dispute in May and of another in November.

In Nov. 1916 the Government had introduced a system of "trade cards," under which certain trade unions, including the Amalgamated Society of Engineers, were permitted to issue cards to their own members, conferring (under specified conditions) protection from military service. The system was obviously open to abuse, and the Government decided to abolish it. Simultaneously they had before Parliament a new munitions bill, which, as originally drafted, proposed (*inter alia*) to make provision for "dilution" (*i.e.* the partial utilization of unskilled or semi-skilled labour on work hitherto confined exclusively to skilled men) on commercial engineering work. Previously "dilution" had been confined to Government work.

The immediate occasion of the strike was a trivial dispute at an engineering works at Rochdale, the owners of which had committed a technical offence against the Munitions Acts. They were prosecuted and fined; but the result of the prosecution was not known until after the strike had begun.

On April 29 1917 the honorary secretary of an unofficial body called "the Manchester Joint Engineering Shop Stewards' Committee" sent out a letter calling upon engineers to come out on strike at the close of work on the following day against (1) dilution on private and commercial engineering work, (2) the withdrawal of the trade cards, and (3) the new munitions bill. Most of the engineering employees in Lancashire (which is the chief centre of the textile engineering trade) came out; and also in Sheffield, Derby, Southampton, and finally London. On the other hand, Glasgow, Newcastle, Cardiff, Birmingham, and Leeds, which were mainly "munition" centres, and not likely to be affected by the new policy, remained at work.

The unofficial committee who had taken charge of the strike denounced the official executives of the trade unions in violent terms. The executives, on their side, denounced the strike, and came to an agreement with the Government for the abolition of the trade card system. The Government supported the executives, declared their determination not to recognize the rebellious shop stewards, and finally arrested eight of these. Ultimately, however, the Government was obliged to receive the shop stewards' leaders; but under the guise of "the unofficial strike committee," and accompanied by the Executive Council of the Amalgamated Society of Engineers (the principal trade union concerned). A settlement was immediately arrived at, the unofficial committee agreeing to go back to their districts and get the men back to work, and leaving the negotiations in the hands of the Executive Council of the Amalgamated Society of Engineers.

The trade card system was abolished; but later in the year the minister of Munitions announced the withdrawal of the clauses in the Munitions Bill which would have permitted dilution on private work.

The Coventry strike was also a "shop stewards" strike, Coventry being one of the centres of the Shop Stewards movement. Unrest in this town was increased by the housing conditions, which were very bad, owing to the influx of munition workers and the consequent excessive overcrowding. On Nov. 19, the toolmakers and toolsetters at one of the engineering works in Coventry adopted a "stay-in" strike, as a protest against their inadequate rates of pay (in comparison with the unskilled men whom they had to instruct), and also in support of their demand for the recognition of the shop stewards. Next day the shop stewards went in a body to interview the head of the firm; he was ready to meet them, "and not ask who they were," but this was not enough for them; they demanded to be received *as shop stewards*. The employer refused, and the shop stewards called out all the workpeople. The whole of the engineering firms at Coventry were stopped within a few days, when it was estimated that 50,000 workpeople (men and women) were out. The strike was settled on Dec. 2 1917, by four members of the Government, who interviewed representatives of the employers and of the workpeople, the latter including some shop stewards. The negotiations which followed led up to an agreement between the Engineering Employers' Federation and the trade unions which for the first time recognized shop stewards, if duly elected and officially endorsed and controlled by their trade unions.

Apart from the engineering and munition trades the most important dispute of 1917 was a strike of *colliery examiners* (overmen, firemen, and shot-firers) in South Wales for the recognition of their trade union; the other underground and surface workers, to the number of nearly 128,000, were thrown idle by the strike. After a stoppage of three days the Colliery Examiners' Trade Union was recognized, and the employers agreed to set up a joint board to decide questions relating to firemen and shot-firers.

Industrial disputes were very numerous in 1918, but the great majority involved small numbers and were of short duration. Nearly all the considerable disputes occurred in the second half of the year; the extreme seriousness of the military situation in the first half of the year exercised a restraining influence, sufficient to prevent many large movements. The only strike of any magnitude in this period was one among coal miners in the employment of a "combine" in S. Wales, who sought for recognition of a committee of their own, confined to workers in the pits of the combine.

An *engineering and munition* strike occurred at Coventry and Birmingham in July 1918, against the introduction of what was known as the "embargo." This was a prohibition by the Government of the engagement of any additional skilled men by certain firms. The prohibition applied only to a very small number of firms, but this fact was not known to the workers; indeed the existence of the embargo at all was not generally known until a notice (in misleading terms) was issued by one of the firms affected. The strike was brought to an end, after a week's stoppage, by the Government announcing that men absent from work on July 29 would have their protection certificates withdrawn.

Two strikes in the *cotton* trade occurred in this year, one in Sept. and the other in December. The first arose from a demand of the cotton spinners and piecers for unemployment pay for time lost owing to the restrictions on the working of the mills imposed by the Cotton Control Board to meet the shortage of raw material. They returned to work after a week's stoppage on the promise of an enquiry by an independent tribunal, to be appointed by the Government. The second strike was in support of a demand by the cotton spinners and piecers, and the card-room workers, for an advance of 40% on the current rates of wages (*i.e.* on the list prices, *plus* all the percentage additions already made thereto). They returned after nine days' stoppage, having obtained an advance of 50% on the standard piece-price list of wages, equivalent to about 30% on the current rates.

In this year there was also a long dispute (lasting 47 working days) between a coöperative society and the Amalgamated Union of Coöperative Employees. This union seeks to organize all classes of employees of coöperative societies, whether distributive or productive, without regard to occupation, or "craft." The coöperative society, however, demanded that its employees in printing works should belong to one or other of the "craft" unions, and not to the Amalgamated Union of Coöperative Employees. The matter was ultimately referred to arbitration, and decided in favour of the society.

The years 1919 and 1920 were years of great industrial unrest in a variety of trades. The hours of labour in the *engineering and shipbuilding trades* were reduced, as from Jan. 1 1919, from 53 or 54 to 47 per week; but many of the workers were dissatisfied, some desiring a reduction to 44 or even 40 hours, while others were aggrieved because the rates paid to piece workers and to "lieu" workers were not increased to compensate for the reduction of hours. (Time workers received the same rate of pay for the reduced hours as for the hours previously worked.) Workpeople, to the number of 150,000 in all, came out on strike in Jan. at various centres, and remained out for periods ranging from one to eight weeks. Some returned to work unconditionally; others agreed to return on the promise of a national settlement.

There was much unrest in the *coal mining* industry. One hundred and fifty thousand miners were on strike in Yorkshire in Jan. 1919, in support of a demand for a simultaneous stoppage of 20 minutes per shift for meals for surface workers; most of these were out for one or two days only. The demand was granted, for the period of Government control. The same men were on strike again in July and Aug., for an advance of 14·3% in piece-rates to compensate for the reduction in hours from eight to seven per day; after a stoppage of from 25 to 29 days they accepted the national settlement, which gave an advance of 12·2%. In March 100,000 miners in South Wales, the Midlands, and Yorkshire were on strike, and another 75,000 miners in Nottinghamshire, Derbyshire, Lancashire, and other districts were on strike in July, over the question of the miners' demands for increased wages, a reduction of hours, and the nationalization of the mines.

There was a great strike in the cotton trade, for a reduction of hours and 30% advance in wages, in June and July 1919, both the spinning and the weaving sections being affected. The advance was granted, and the hours were reduced from 55½ to 48 hours per week (instead of 46½, as asked).

The greatest *railway* strike that had ever occurred in England began at midnight on Sept. 26 1919. An agreement had been made between the Government, the Railway Executive Committee (representing the companies), and the trade unions in March 1919, providing, *inter alia*, for the determination by negotiation of new standard rates of pay for the various grades. Standard rates were agreed upon, in Aug., for drivers and motormen, firemen and assistant motormen, and engine cleaners; and in Sept. the Board of Trade forwarded to the National Union of Railwaymen their proposals for the standard rates of other grades, showing an average advance of 100% on pre-war rates, with a minimum of £2 a week. The Union rejected these proposals, claiming that the new rate should be based on the highest standard rate already existing for each grade, *plus* 33s. war wage, with a minimum of £3 a week. Failing a favourable reply by Sept. 25, they announced an immediate strike. Negotiations continued, and fresh proposals were made by the Government; but the Union did not feel justified in postponing the strike, which accordingly began, as stated, at midnight on Sept. 26. The Associated Society of Locomotive Engineers and Firemen, although not directly concerned in the dispute, supported the National Union of Railwaymen, and its members also ceased work.

On Oct. 1 a conference, arranged by the National Transport Workers' Federation (to which the railwaymen are affiliated), was attended by representatives of the Trades Union Congress Parliamentary committee, of the Labour party, and of a number of other trades besides railways. A mediating committee was appointed, and negotiations were resumed between the Government, the mediating committee, and the National Union of Railwaymen. A settlement was reached on Oct. 5, and work was resumed on the following morning.

The settlement provided for the resumption of negotiations, with the understanding that they should be completed by Dec. 31 1919; and for the stabilization of wages at their then existing level up to Sept. 30 1920 (subject to review at any time after Aug. 1 1920). It was also provided that "no adult railwayman in Great Britain shall receive less than 51s. so long as the cost of living is not less than 110% above pre-war level."

A strike of *ironmoulders, coremakers, and iron and steel dressers* began on Sept. 22 1919, and lasted until Jan. 12 1920. About 65,000 men were involved in the immediate dispute; but the shortage of castings consequent on the dispute greatly hindered the working of the engineering industry for many months.

The demands of the men were for an advance in wages of 15s. a week for journeymen and 7s. 6d. a week for apprentices. At the settlement on Jan. 12 they accepted an advance of 5s. for men over 18 years of age, the same as had been granted to men in the engineering trades in the previous November. It was also agreed that negotiations should be resumed on the questions of: (1) the general working conditions in foundries; (2) questions arising out of the introduction of the 47-hour week; (3) minimum standard rates for the various districts; and (4) the jurisdiction of the unions over apprentices, and the wages of apprentices.

A strike of all classes of workpeople in the *furnishing* trades began in the Manchester district and N. E. Lancashire on June 27 1919, in support of a demand for an advance in wages, a working week of 44 hours, and other concessions. On July 26 a lock-out was declared at High Wycombe, Birmingham, Nottingham, Bristol and other centres, to enforce the termination of the dispute. At most of the centres involved in the lock-out settlements were reached by the end of Oct., advances in wages being granted; in some cases provision was made for the discussion of proposals to introduce sectional work, piece-work, or female labour, where not formerly in operation. The original dispute was also settled at the end of Oct., various advances being granted. At High Wycombe, where the largest number of workpeople was involved, the lock-out was not brought to a close until nearly the end of Nov.; here also advances in wages, varying according to sex and standing and the class of work done, were granted.

The year 1920 was remarkable for one dispute, the national *coal strike* of Oct. and Nov., the aggregate duration of which was second only to those of the two previous great coal strikes in 1893, and in 1912; and for an unprecedented number of smaller disputes, in a great variety of trades, many of which would have ranked as "great" disputes in a normal year. There were also many minor disputes in the building and in the textile trades. The coal strike began out of a demand put forward by the Miners' Federation of Great Britain (1) for a flat-rate advance in wages of 2s. a shift for all persons of the age of 18 years or over, with corresponding advances for those under that age; and (2) for a reduction of 14s. 2d. a ton in the price of domestic coal. These demands were presented to the Controller of Coal Mines on July 15, and refused by the Government on July 26. A ballot of the Federation showed a great majority (606,782 to 238,865) in favour of a strike in support of these demands; and strike notices were handed in, in every district, to expire on Sept. 25.

Negotiations between the Government and the miners continued, in the course of which the miners dropped their demand for a reduction in the price of domestic coal. The Government, after making various alternative proposals which were not acceptable to the miners, concentrated on the policy of making any advance that might be granted bear some relation to increased output. The miners, however, still pressed for an immediate unconditional advance of 2s. The strike notices were twice postponed, at first for a week and then for another fortnight, in order to allow the negotiations to continue. At this stage the mine-owners were called into conference; and meetings between representatives of the miners and of the mine-owners took place almost daily from Sept. 25 to Oct. 2, inclusive.

During the first fortnight of Oct. a second ballot of the miners took place on certain proposals which had been formulated by the mine-owners at these conferences. These were to the effect that if, during the first fortnight of Oct. there were indications that the output of coal was at the rate of 240,000,000 tons per annum, an advance of 1s. a shift should be conceded as from Oct. 1, with an additional 6d. for each 4,000,000 tons, up to 3s. at 265,000,000 tons. The wages for the remainder of the year would be similarly regulated, and the whole scheme would come up for review at the end of December. The owners also pledged themselves to coöperate with the men in measures for increasing output. These proposals were rejected by the men, on a ballot vote, by a still larger majority (635,098 to 181,428); and work at the mines ceased on Oct. 16, except that certain men were allowed to continue at work for keeping the mines in order.

The strike was debated in the House of Commons on Oct. 19; and tentative suggestions for a settlement were made by Mr. Brace (at that time a member of the executive of the South Wales Miners' Federation), and by other members. Informal conversations, and then formal negotiations, followed between the Government and the miners' representatives, to which at a later stage the mine-owners also were called in; and an agreement was reached on Oct. 28 which the miners' representatives undertook to submit to their members, with a recommendation of acceptance "as a temporary measure." The agreement pledged the miners and the mine-owners to coöperate with the view of increasing output; also to prepare a scheme for the future regulation of wages, "having regard, among other considerations, to the profits of the industry, and to the principles upon which any surplus profits are to be dealt with." Pending the preparation of this scheme an immediate advance of 2s. a shift was to be granted to persons of 18 years of age and over, with corresponding advances to persons under that age; and from Jan. 3 1921, until the new scheme was ready, the advance would be automatically adjusted, at monthly intervals, in accordance with the surplus output in excess of 219,000,000 tons a year. The ballot upon these terms showed a small majority against acceptance (346,504 to 338,045), on a reduced total vote; but at the miners' delegate conference at which the result was announced it was decided that work should be resumed on Nov. 4, or as soon after as possible, in view of the rule of the Miners' Federation which requires a two-thirds majority for the continuance of a strike.

A strike in the *building* trade of Scotland occurred in May, June, and July 1920. During the war wages in the Scottish building trade had been regulated by awards given every four months, as in the engineering and shipbuilding trades. A claim for an advance of 6d. an hour, as from April 1 1920, came before the Industrial Court in March under this agreement, and was refused. The joiners in the west of Scotland, influenced by the high rate of wages given to joiners in the shipyards, had withdrawn from the National Agreement, and claimed the advance of 6d. independently of the other building trades operatives; and, when this award was given, they came out on strike, to the number of about ten thousand. Negotiations with the employers ensued; and at the beginning of July about a third of the operative joiners had obtained their demand for a rate of 2s. 6d. an hour. Bricklayers and masons and their labourers had also obtained an advance in the west of Scotland; but at Edinburgh and Dundee, and in Ayrshire, they were out on strike. As delay to housing schemes was feared through the strike, further conferences were held under the chairmanship of an officer of the Ministry of Labour; and an agreement was reached on July 8 giving all classes of operatives an advance for the period from July 9 to Nov. 30. The parties also agreed to meet again, to consider a scheme for levelling up rates between sections, and for the grading of districts.

Shipyards joiners and carpenters came out on strike on Dec. 1 1920, against a proposed reduction in wages of 12s. a week. (This was the first strike, on a considerable scale, against a reduction of wages since those of 1908, mentioned above.) The employers alleged that the ship-joiners had received a special additional bonus during the preceding time of pressure in the shipyards, over and above that given to other shipyard workers, because it would have been impossible otherwise to obtain the necessary labour, in view of the intense competition from the building trades; and that the exceptional circumstances which had justified the advance had now come to an end. The number involved at the end of Dec. was about ten thousand.

A strike of *piano workers* in London, to the number of about 6,500, began on April 10 and lasted for three months. The employers sought to introduce a system of payment by results, which was objected to by the workers. Work was resumed on the systems of payment existing in each factory; with a provision that a ballot vote should be taken within three months to determine the future system of payment for the entire trade.

A strike of *electricians*, which was of great importance owing to the principle involved, began on July 2 and ended on Sept. 16 1920. The members of the Electrical Trades Union came out on strike at an engineering works at Penistone (Yorks), against the employment of a foreman who was not a member of their trade union. The Engineering Employers' Federation replied by a lock-out of all members of the union employed in federated firms throughout the country. The Government appointed a Court of Enquiry, under the Industrial Courts Act, to enquire into the dispute; but the day after the Court had begun taking evidence the Electrical Trades Union notified to the Joint Industrial Council for the Electricity Supply Industry their readiness to withdraw the question of principle, *i.e.* the claim that foremen must be members of a trade union. The dispute was settled on these lines on Sept. 16, the men withdrawing their strike notices and the employers the lock-out notices. The number of men involved by the lock-out was about seven thousand.

A strike of *shirt and collar makers* in Belfast, Londonderry, Coleraine, Dublin, and other towns, began on June 12 1920, and lasted for over two months. The cutters only were directly involved, to the number of about 302; but about 17,000 other workpeople were thrown out of work. The cutters demanded higher wages, and the strike was settled by a compromise.

A strike in the spinning branch of the *cotton* trade began at Oldham on Sept. 15 1920. During the war an agreement had been made for the employment of female "creelers" (who carry away the finished yarn) to help the spinners in cases where "little piecers" (boy assistants) were not available; and it was part of the agreement that the spinners should receive extra payments, in compensation for the additional work thrown upon them when "creelers" were employed instead of "little piecers." In Sept. 1920, an agreement was signed between the master spinners and the Operative Spinners' Trade Union withdrawing, in part, these extra payments. A large number of the spinners came out on strike against this agreement, in defiance of the executive of their union. The strike began on Sept. 15, and the maximum number on strike was reached a week later, when the number was about 20,000; and about an equal number of cardroom workers and others were thrown out of work by the dispute. The men gradually went back to work on the terms of the agreement; most of them were back by Oct. 5, but the strike was not quite at an end until the end of that month.

Coal Strike of 1921. The first seven months of 1921 were notable for a rapid and continuous increase in the number of trade disputes concerning proposals for reduction of wages. The strike of shipyard joiners and carpenters against a proposed reduction of 12s. per week, which had begun on Dec. 1 1920, and came to involve directly some 10,000 workpeople, continued until Aug. 1921, when a settlement was reached on the basis of a reduction of 9s. per week, to take effect in two stages. Among other important disputes in this period was the strike in Feb. 1921 of some 5,000 nut and bolt workers in the Black Country against a proposed wage reduction, which lasted five weeks, the employers' terms being then accepted. In March 3,500 vehicle builders and 2,170 waterproof garment finishers came out on strike against proposed reductions of wages; the former dispute lasted four weeks and ended in the acceptance of a modified reduction; the latter lasted five weeks and ended in the acceptance of the reduction on condition that it should take effect in two stages. In June a national engineering strike was threatened but avoided at the last hour, while 10,000 engineering apprentices in the Manchester district struck against a proposed reduction in wages, which three weeks later was accepted. In June, also, a new wages agreement in the cotton textile industry, involving an immediate reduction of about 19% on actual wage rates, was only made after a dispute which lasted three weeks and involved some 375,000 operatives.

None of the strikes of 1921 against proposed reductions in wages compares, however, in magnitude or consequence with the great national coal strike, which began on April 1 and ended on July 1 in an agreement which was to last until Sept. 30 1922, and thereafter, until terminated by three months' notice on either side. The position at the end of the coal strike of 1920 has already been described. Briefly a temporary settlement has been made under which the wages of miners varied according to the total output of coal from the mines of Great Britain: the more the output, the higher were the wages to be received. The miners and owners were under an obligation to prepare a scheme not later than March 31 1921, for the future regulation of wages in the industry, "having regard, among other considerations, to the profits of the industry and to the principles upon which any surplus profits are to be dealt with." The industry was still under Government control, and the "control" powers of the Mines Department of the board of trade did not expire, in any event, until Aug. 31 1921.

The coal industry, however, did not escape the effects of the general industrial depression, which indeed may be dated from the coal strike of 1920. The values of exported coal fell heavily, while the demand for coal for industrial or domestic consumption at home also decreased. The output figures for each of the four months from Dec. 1920 reflect the changes in the current demand. In the five weeks ended Dec. 25 the output for Great Britain was 25,406,700 tons; while in the five weeks ended Jan. 29 1921, it was 21,803,600 tons. In the four weeks ended Jan. 29 it was 18,540,500 tons; while in the four weeks ended Feb. 26 it was 17,369,100 tons, and in the four weeks ended March 26, 16,435,200 tons. An incidental result of this decreased output was the disappearance as from Feb. 28 of the wages advances granted under the settlement of Nov. 1920. In so far as the position, as affected both by the decreased output and by the reduction in values of export coal, may be judged from the Mines Department statistics, in Feb. 1921 the average loss over the whole of the collieries of Great Britain on every ton of coal disposed of commercially was 5s. 11¾d. In two districts, namely Yorkshire, and Derby, Nottingham and Leicester, there were small credits of 3½d. and 1½d. per ton respectively; while the debit balances ranged from 4s. 0½d. per ton in Durham to 18s. 1½d. per ton in South Wales.

In these circumstances the Government decided to terminate their control of the mining industry on March 31. This was the date at which the agreed scheme for the future regulation of wages in the industry was to be ready, but it was five months earlier than the date at which decontrol had been expected. On the one hand, the fall in the price of export coal to such an extent that there was no appreciable difference between the export price and the inland price, made it no longer necessary to regulate the pit head prices and the distribution of coal, and all such regulation was withdrawn as from March 1. On the other hand, the continuance of financial control, which had been a corollary of the regulation of prices and distribution was only involving the Government in heavy financial liabilities. The Coal Mines (Decontrol) Act, 1921, "an act to curtail the duration of and amend the Coal Mines (Emergency) Act, 1920," was therefore passed. The Act received Royal Assent on March 24, and its effect was to terminate the special interest the Government had hitherto had in the Mining Industry, as regards, for example, output and prices, wages and profits. Control at that moment meant financial assistance to the industry, and the removal of that financial assistance on March 31 made the formulation of a new wages agreement a matter of imperative urgency, if the work of the mines was to be continued after decontrol.

The decision of the Government to decontrol was communicated by the president of the board of trade to the mine-owners and miners, *i.e.* the Mining Association and the Miners' Federation of Great Britain, on Feb. 23. At the time the announcement was made, the Mining Association and the Miners' Federation were in the midst of negotiations with regard to the permanent scheme for the regulation of wages, which under the agreement of Nov. 1920, they were to complete by March 31 1921. On Feb. 25 the two bodies met again, and agreement was reached upon a considerable number of important points. But on one fundamental issue it was found impossible to agree. The representatives of the Miners' Federation insisted upon the necessity of a national wages scheme, with some form of a national pool, for the industry. The representatives of the owners insisted that wages must be based upon the wage-paying capacity of the districts, national discussion being confined to the enunciation of certain general principles which might provide the districts with some uniform method of determining their wage-paying capacity.

A definite conflict of principle had thus occurred. It was clear however that no scheme designed to be permanent would be applicable without modification to the abnormal position in which the industry would find itself on decontrol on April 1. It was therefore conceivable that agreement might be reached on a temporary scheme applicable strictly to the emergency period, leaving the points of difference on the permanent scheme for further discussion. In this way the occurrence of a dispute immediately upon the cessation of control might be avoided. Following upon a joint meeting of the two sides held on March 17, the National Delegate Conference of the Miners' Federation decided to ascertain the opinion of the districts as to whether or not they were prepared to abandon temporarily the policy of a national wages board and a national pool, and to empower the national executive to proceed with the negotiations with a view to establishing a temporary agreement on a district basis. On March 24 the Conference reassembled to receive the replies of the several districts, and these indicated that a very large majority of the Federation were against the proposal to enter into any temporary agreement on a district basis. There was thus no movement towards the owners' position. Notices terminating on March 31 contracts of employment at the existing rates having already been issued by the owners, the Executive Committee of the Miners' Federation met on March 30, and sent out the following instruction to the districts:—"That all notices must take effect regardless of occupation in every mine and plant in the Miners' Federation." Practically the whole of the men ceased work in accordance with this instruction at the close of the last shift on March 31. There was, however, some divergence in the districts on the question of withdrawing the pumpmen and enginemen who were covered by the official instruction of the Federation. These men were not withdrawn in all cases.

At this stage it may be noted that there were some points of agreement between the owners and miners. The agreement of Nov. 1920, envisaged a permanent scheme for the regulation of wages which would have regard "to the profits of the industry and to the principles upon which any surplus profits are to be dealt with." Working from this basis, by the time of the joint meeting of Feb. 25, four further principles had been agreed upon as follows:—

1. Wages must conform to the capacity of the industry to pay.
2. The receipt of a standard wage should justify a corresponding minimum profit to the colliery undertakings.
3. Any surplus remaining after these, and, of course, the usual working costs, had been met, should be divided between the men and the owners in agreed proportions, the workpeople's share to be an addition to their standard wages.
4. Joint audits of the owners' books by accountants representing each side should be made to ascertain all the data necessary for the periodical determination of wages.

On all other matters arising out of the proposed permanent scheme there were differences of considerable importance between the two sides. The following account of the main differences is based upon the draft agreement approved by the Delegate Conference of the Miners' Federation of Great Britain on March 10 (*i.e.* at the first available opportunity after the joint meeting of Feb. 25), and the report of the mine owners on the situation which was submitted after approval by the Central Council of the Mining Association, to the president of the board of trade on March 25 (*i.e.* immediately after the refusal of the miners to enter upon negotiations with a view to a temporary settlement on a district basis):—

1. The miners proposed that there should be established a National Board, consisting of 16 representatives of each side, which should determine all questions of wages and profits affecting the mining industry as a whole, *i.e.* the national regulation and distribution of wages. The National Board would take over the powers and duties of the existing district conciliation boards with regard to the fixing of general rates of wages. The owners would agree to maintain in production by the means of a national profits fund all existing collieries, and all collieries developed subsequently, until such times as the National Board might decide to the contrary.

On these points, the owners' position was that the idea of a "national profits fund" was abhorrent to them, that they wished district conciliation boards to be the sole authorities for fixing wages, and that national discussions should only deal with questions of principle, so as to provide the districts with a uniform method of determining wages.

2. The miners proposed that the new standard wage should be made up by incorporating all the existing percentage additions to district basis rates with those district basis rates, special allowance being made in favour of the men who were benefitting under the flat rate minimum advance which was guaranteed with the 20% wages advances of March 1920. The owners proposed that the new standard wages should be the district basis rates, *plus* the percentage additions prevailing in July 1914, *plus* the percentage additions made consequent upon the reduction in hours from 8 to 7.

3. The miners proposed that against their standard wages should be set, as minimum profits to the owners, a sum amounting in the aggregate to 10% of the sum paid as standard wages. The owners proposed that this figure should be 17%.

4. The miners proposed that any surplus remaining after meeting standard wages, other costs and minimum profits, should be divided between miners and owners in the proportion of 100 to 10. The owners proposed that that proportion should be 80 to 20.

5. The miners proposed that their share of this surplus should be distributed by means of national uniform flat rate additions to their standard wages. The owners proposed that the miners' share of the surplus as ascertained in each district should be distributed as a percentage addition to the standard district rates.

6. Whereas the miners' proposals meant that the whole mining industry in Great Britain should be treated as one unit within which wages would be varied uniformly, the owners proposed to take as the units of uniform variation, the 25 districts among which the collieries of Great Britain are distributed by the Second Schedule of the Mining Industry Act, 1920.

With regard to the question what modifications, if any, might be introduced to meet the abnormal conditions of the period following immediately on control, the owners expressed their willingness to waive their share of the surplus in favour of the workmen, on condition that ascertainment of the proceeds of the industry in each unit should be made at monthly periods during the continuance of the concession; but they insisted that it was inevitable that wages should go down on decontrol. From the miners' point of view it was evident that the introduction of their scheme at that moment might mean the loss to the men of war wage and Sankey wage, and the miners' argument therefore was that the Government's obligation to pay war wage or Sankey award did not cease by the decision to decontrol the trade on March 31. The war wage had been given to meet the increased cost of living when the latter was only 80 per cent in excess of the pre-war figure, and (though the Government rejected this interpretation) under the terms of the award the miners claimed that the wage was liable to revision only when the cost of living fell again to that point. With regard to the Sankey wage, the argument of the miners was that the Government had accepted the Sankey Commission's recommendations for an advance in wages of 2s. per day, and if the Government now proposed that these conditions should be abandoned, it would be guilty of a breach of faith. The miners reiterated at all times from Feb. 23 to March 31 their demand that the Government should abandon its decision to decontrol the industry, or at least should continue to subsidize it during the existence of the depression from which it was suffering.

The general argument of the miners at this time was that the situation demanded a full national settlement of the wages and profits problem for the industry. The trade as a whole needed uniform peace and security, and district or local negotiations must result in strife. The workmen and their families had to live in the poor districts as well as in the rich, and for uniform expenditure of energy there should be uniform reward. This had been recognized by the Government, first by the payment of uniform war wages to meet the increased cost of living, and, secondly, by the acceptance of the decision of the Sankey Commission to raise uniformly the wages of all coal miners to meet the agreed case for a uniform advance in their standard of living. A National Wages Board, exercising the right to distribute nationally both wages and profits, need not necessarily result in a uniform profit for all undertakings, but by means of a small levy upon the total tonnage raised in every mine, money would be made available for maintaining poor collieries in production as long as their coal was in demand.

The view of the owners, on the other hand, was that the wide variations in the losses of different coalfields made anything in the nature of a national settlement of wages impossible. While there were such divergencies between district and district, each district must determine its own wages by its ability to pay, and the individual who could not pay the wages so determined must decide for himself whether to close his pits or to bear the loss. The country could not afford to keep unprofitable pits working.

From the opening of the strike on April 1, four whole months passed before an agreement between the owners and miners was reached. The first difficulty to secure a resumption of negotiations encountered was in the Government insisting that the first subject to be discussed should be the return of the safety men to the mines, while the miners held that negotiations were useless if their demands for a wages settlement along national lines, and a national profits' pool, were totally unacceptable. But the influence of the other members of the Triple Alliance secured a modification of both points of view, and joint negotiations were resumed on April 11 and 12. On April 12 the view of the Government was outlined that, while the miners' demand for a national settlement of wages might be practicable, their demand for a national pool of profits was impracticable. A pooling arrangement for the equalization of wages in the industry was declared not to be possible without the resumption of complete and permanent control by the State of the mining industry. A national settlement of wages, however, was suggested, by which the 2nd, 3rd, 4th and 5th points at issue between the owners and miners as outlined above should be determined by the joint conference, whilst subsequent differences of interpretation should be referred to a national joint committee of owners and miners. The prime minister explained the Government's proposals as regards the abnormal period following upon decontrol, as follows:—

> "If and when an arrangement had been arrived at between the coal owners and the miners as to the rate of wages to be paid in the industry, fixed upon an economic basis, the Government would be willing to give assistance, either by loan or otherwise, during a short period, in order to mitigate the rapid reduction in wages in the districts most severely affected."

These proposals were fully discussed, but the miners' officials intimated their inability to accept them or to abandon their former position, and the conference thereupon ended. This failure at once brought to a head the question whether the other two members of the Triple Alliance, namely, the National Union of Railwaymen[1] and the National Transport Workers' Federation, would take sympathetic strike action in support of the miners. A general meeting of the National Union of Railwaymen, and a full conference of the executives of unions affiliated to the National Transport Workers' Federation, were summoned, and remained in session until April 16, when the question of sympathetic action was finally settled. The mediatory efforts of the railwaymen and transport workers on April 9, which secured the resumption of negotiations between owners and miners, had been supported by a decision that a sympathetic strike should take place on the night of April 12 unless negotiations between the miners, owners and Government were reopened before that date. This strike of April 12 was avoided by the resumption of negotiations on the 11th, but on the 13th, the day after the failure of the resumed negotiations, the railwaymen and transport workers determined to strike at 10 P.M. on April 15 in support of the miners. This sympathetic strike of April 15 was avoided, however, at the last moment. In the late evening of the 14th a group of private members of the House of Commons, after hearing a statement by Mr. Evan Williams, president of the Mining Association, dealing with the effect on the miners' actual earnings of the owners' proposals, invited Mr. Frank Hodges, the secretary of the Miners' Federation, to make a similar statement on behalf of the miners. In the discussion which followed his speech, it was understood from Mr. Hodges that the miners would be prepared to discuss a temporary wages settlement, provided that a period of time were fixed for the negotiation of a permanent settlement, to contain the principles of a national pool and a national wages board. The Prime Minister was at once communicated with, and on the following morning he invited owners and miners to meet him again for a further consideration of the wages question. The executive of the Miners' Federation, to general surprise, abruptly declined this invitation, and Mr. Hodges, whose "offer" was thus ignored, tendered his resignation (though it was afterwards withdrawn). The leaders of the railwaymen and transport workers, however, in these circumstances decided not to proceed with the sympathetic strike, and a breach was created in the Triple Alliance.

The next stage in the history of the dispute was a second series of joint negotiations between owners and miners, from April 22 to 28, as a result of a further invitation from the Prime Minister. This conference produced a further set of proposals from the owners, and the first detailed proposals for a settlement made by the Government in the course of the dispute, but these were rejected on the 28th by the National Delegate Conference, on the ground that they did not concede "the fundamental principles of a National Wages Board and a National Pool." No definite progress had been made as regards the proposed establishment of a permanent scheme for the regulation of wages in the industry. The Government suggested that the period of the permanent scheme should be one year from the close of the temporary period, subject thereafter to 3 months' notice on either side. This suggestion became part of the final settlement of July 1. They declared that a national pool or levy would involve legislation and must be regarded as a political issue; but they would accept a "National Wages Board" entrusted with the tasks of drawing up a schedule of districts and determining the principles by which wages should be adjusted in the districts, as well as with the duties of interpretation. The owners also spoke at this time of "areas" rather than "districts," the "areas" being the six divisions of Great Britain, among which the 25 districts are distributed by the Second Schedule of the Mining Industry Act, 1920. On the other hand, as a result of the statements of the owners and the Government, substantial progress was made with the preparation of a detailed temporary scheme for the emergency or abnormal period. The main points of these proposals may be summarized as follows:—

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[1] The Associated Society of Locomotive Engineers and Firemen before the close of this episode joined the other railwaymen and the transport workers in the discussions and the decisions on the question of sympathetic strike action.

1. The duration of the temporary scheme was to be three months.
2. In each of the three months, a maximum sum per shift should be fixed, and the wages of no miner should be reduced by more than that maximum sum. The maximum reduction would be expressed as a national flat rate.
3. For the first month a maximum reduction of 3s. per shift was proposed and for the second month, one of 3s. 6d.
4. The Government were prepared to make a grant of £10,000,000 as their share in the cost of the scheme, and it was suggested that a portion of this grant might be carried forward into a fourth month.
5. The owners were prepared to waive all share in the surplus in any area, if the taking of that share would have the effect of reducing the rates of wages in one month as compared with the previous month. This was an elaboration of the proposal of the owners as regards the emergency period given above, and made public on March 25.
6. The owners were also prepared to agree that, during the period of the temporary scheme, deficiencies in standard profits should not be carried forward from one accounting period to another.

The miners, however, were as much opposed to this proposed temporary scheme as to the owners' permanent scheme. They could not accept a temporary settlement which was related to district settlements; they could not accept reductions which would force their wages below the cost of living level; and they maintained their demand that the Government should render financial assistance to the industry so as to prevent this occurring. On a cost of living basis they argued that the maximum reduction in the first place should be 2s. per shift: whereas the Government proposed a first reduction of 3s. per shift.

From the close of the second series of joint negotiations on April 28, a whole month elapsed before official negotiations were resumed. A third series of negotiations was then begun on May 27, an address being made by the Prime Minister to a joint assembly of the central committee of the Mining Association and the executive committee of the Miners' Federation. Proposals for a settlement were submitted by the Government separately to the two sides on May 28, and on June 3 the observations of owners and miners on these proposals were communicated to the Prime Minister. The reply of the Miners' Federation, drawn up by their executive committee, was to the effect that in every instance the districts had rejected the proposals. On June 4 the Prime Minister announced that the Government's offer of a grant of £10,000,000, intended to mitigate the reductions in wages and allow of a gradual scaling down of wages until they reached an economic level which the industry could sustain, would be withdrawn unless a settlement were reached within 14 days. This announcement was followed by joint meetings between owners and miners on June 6, 7, 8 and 9, and on June 10 the National Delegate Conference of the Miners' Federation adopted a recommendation of their executive to refer the alternative courses of action to a ballot vote of their members. The alternatives were put to the men as follows:—

"(1) Are you in favour of fighting on for the principles of the National Wages Board and National Pool, with loss of Government subsidy of £10,000,000 for wages if no settlement by June 18 1921?
"(2) Are you in favour of accepting the Government's and owners' terms as set forth on the back of this ballot paper?"

The result of the vote was known on June 17: the first question was answered in the affirmative by 435,614 members, and the second question by 180,725. The previous decisions of the representative bodies of the Federation were thus emphatically confirmed. The Government therefore announced their withdrawal of the proposed subsidy, and the basis for a temporary settlement had for the time being disappeared.

From the point of view of the final settlement, however, this third series of negotiations was important for the modifications which were made in the owners' permanent scheme. The owners definitely adopted the Government suggestions regarding the duration of the permanent scheme and the establishment of a National Wages Board; they proposed the establishment of similarly constituted district boards to determine district questions; they accepted a proposal made by the Government that if the rates of wages as fixed under the permanent scheme did not provide a subsistence wage to low-paid day wage workers, additions in the form of allowances per shift worked should be made by the decision of the district wages boards; and they were prepared to guarantee that the miners should receive during the first year of the agreement a minimum percentage addition of 20% to the standard wage as proposed by the owners.

The final period from June 17 to July 1 was remarkable for the marked changes in the attitude of the executive of the Miners' Federation. On June 18 an invitation was issued to the executive committees of all unions affected by wages disputes to meet the miners' executive at the earliest possible date, with the object of taking joint national action with the miners to secure their several demands. The meeting was arranged for June 25. Meanwhile the annual conference of the Labour party held at Brighton on June 21–4 showed plainly that no support for extended militant action would be given by other trade unions. The projected meeting of June 25 was therefore abandoned, and the Prime Minister was again approached by the miners' executive with a view to securing a satisfactory wages settlement. Joint negotiations between miners and owners were accordingly resumed on June 27, and on the evening of that day it was reported to the Government that an agreement had been reached, upon the assumption that the Government would reopen their offer of a grant of £10,000,000 to the industry. On June 28 the Government expressed their willingness to subsidize wages as required, during the temporary period, up to a maximum of £10,000,000. The miners' executive then referred the proposed terms to their districts; and their recommendation that the terms should be accepted was indorsed at the district meetings. On July 1 the final agreement between the Miners' Federation and the Mining Association was signed, the House of Commons voting, on the same day, a subsidy in aid of wages in the form offered by the Government on June 28. Work in the coal mines throughout Great Britain was resumed as rapidly as the circumstances at each colliery permitted.

The agreement largely incorporated the terms of the interim proposals. With regard to the temporary period of three months, it was agreed that the maximum national flat-rate reductions should be 2s. per shift in the first month, 2s. 6d. in the second month, and 3s. in the third month; and that, in those districts where it was not necessary to enforce the full maximum reduction, the wages payable during the temporary period should be calculated in terms of uniform district flat-rate reductions, and not in terms of basis rates *plus* percentages. On the other hand, the Government subsidy was now a maximum sum, and any balance not issued in respect of the temporary period of three months was no longer available to ease any further reductions which might be necessary in the fourth month after the settlement. With regard to the permanent scheme the settlement provided that standard profits should be 17% of standard wages, and that 83% of the surplus proceeds should be applied to the payment of wages above the standard rates. The duration of the guarantee that the miners should receive a minimum percentage addition of 20% to the standard wages, was extended from one year to the whole period of the permanent scheme. In other respects the permanent scheme was the one first outlined by the owners before the beginning of the strike, but it included the important modifications and safeguards introduced in the course of the third series of joint negotiations.

The outbreak of the strike had led to the Government passing an Emergency Powers Act into law, to enable exceptional provision to be made for the protection of the community when "any action has been taken, or is immediately threatened by any person or body of persons, of such a nature or on so extensive a scale, as to be calculated . . . to deprive the community, or a substantial portion of the community, of the essentials of life." On March 31 a proclamation was made under this Act declaring a "state of emergency" to exist, and by successive renewals at monthly intervals the "state of emergency" was continued until the settlement of July 1. Within this general period a state of more intense emergency occurred from April 8 to June 2. During this latter period the Reserves were embodied, and in addition to the enrolment of special constables, a Defence Force was enlisted with the object of supporting the police in providing protection to volunteers who were maintaining the mines in condition, or who might be required to carry on transport work in the event of the extension of the coal strike to railway and transport services. During the state of emergency, a series of emergency regulations were in force under which the Mines Department of the board of trade controlled the supply, consumption and movement of coal, and the police authorities in the various parts of the country were endowed with special powers for the suppression of sedition.

(B) Foreign Countries

A brief account is given below of the most recent statistics of the strikes and lock-outs in the principal European countries, other than the United Kingdom, available in 1921.

France.—Detailed statistics of strikes and lock-outs for the years 1890 to 1912 and summaries for the years 1913 and 1914 had been published by the French Ministry of Labour. The following are the totals for the years 1907–14:—

Year	Number of Disputes	Number of Workpeople directly affected	Aggregate Duration in Working Days
1907	1,279	198,136	3,563,237
1908	1,104	124,248	2,307,120
1909	1,036	169,509	3,581,928
1910	1,511	290,899	4,887,837
1911	1,474	230,795	4,037,475
1912	1,120	268,230	2,335,891
1913[1]	1,073	220,448	2,223,781
1914[1]	672	160,566	2,192,078

[1] The figures for the years 1913 and 1914 relate only to strikes.

The principal groups of industries affected by the disputes were in 1907 the transport group involving 43,248 workpeople; in 1908 and 1909 the building trade group involving 56,691 and 42,658 workpeople respectively; in 1910 the transport group involving 83,025 workpeople, and the building group involving 75,695 workpeople; in 1911 the building group involving 93,660 workpeople; and in 1912 the mining and quarrying group involving 137,602.

During the years 1907 to 1912, 46% of the total number of workpeople affected were involved in disputes concerning wages, 19% in disputes concerning hours of labour, 10% in disputes concerning the employment of particular classes of persons, 11% in disputes concerning working arrangements and the remaining 14% in disputes due to other causes. The results of disputes during the period under survey were as follows: disputes involving 12% of the total number of workpeople directly affected terminated in favour of the workpeople; disputes involving 44% in favour of the employers; those involving the remaining 44% in a compromise.

Germany.—From 1899 statistics of strikes and lock-outs other than in agriculture have been published annually by the German Federal Statistical Office. The figures for the period 1907 to 1918 are summarized below:

Year	Number of Disputes	Number of Workpeople directly or indirectly affected
1907	2,512	280,016
1908	1,524	119,781
1909	1,652	130,883
1910	3,228	390,706
1911	2,798	385,216
1912	2,834	493,749
1913	2,464	323,394
1914	1,223	98,339
1915	141	15,238
1916	240	128,881
1917	562	668,032
1918	772	1,325,897

The principal groups of industries affected by disputes in 1913 were the metal and engineering group involving 81,025 workpeople, the mining and smelting group involving 78,221 workpeople, and the building trades group involving 69,899 workpeople. In 1918 the principal groups were the mining and smelting group with 336,378 workpeople involved, and the metal and engineering group with 279,921 workpeople involved.

Of the total number of disputes occurring during the period 1907–18, 52% arose on questions of wages, 16% on questions of hours, and the balance on questions of the employment of particular classes of persons, working arrangements and miscellaneous matters. During the same period 15% of the total number of disputes were settled in favour of the workpeople, and 39% in favour of the employers, while 46% were compromised.

Belgium.—Statistics of strikes and lock-outs are published by the Belgian Ministry of Industry, Labour and Supplies. The table given below shows the number of strikes and lock-outs, and the number of workpeople directly affected, in the period 1908 to 1919, with the exception of 1914 to 1918.

Year	Number of Disputes	Number of Workpeople directly affected
1908	118	17,085
1909	123	23,469
1910	110	27,257
1911	162	57,203
1912	206	63,772
1913	167	23,752
1919	372	164,030

The mining and quarrying and the textile industries accounted for 6,096 and 3,114 respectively of the workpeople affected in 1908, for 6,456 and 2,846 of the workpeople affected in 1909, for 21,103 and 2,388 in 1910, for 34,417 and 9,089 in 1911, and for 38,479 and 5,856 in 1912. In 1913 the textile industry accounted for 10,158 of workpeople affected, and in 1919 the mining and quarrying industry for 99,035 of the workpeople affected. The causes of the disputes during the period 1908–13 were mainly questions of wages, 52% of the workpeople being involved on this account. Of the total number of strikes during the same period 13% ended in favour of the workpeople, 59% ended in favour of the employers, and 28% resulted in a compromise.

Holland.—Statistics of disputes in Holland are published by the Central Statistical Bureau. The figures for the years 1907–19 are given in the table below:—

Year	Number of Disputes	Number of Workpeople directly affected	Aggregate Duration in Working Days
1907	154	15,154	4,366,691
1908	135	7,165	91,860
1909	189	8,455	272,013
1910	146	13,238	334,595
1911	217	20,005	435,992
1912	283	21,672	367,751
1913	427	30,161	787,876
1914	271	25,569	361,400
1915	269	15,179	165,247
1916	377	18,127	249,442
1917	344	31,317	526,507
1918	325	39,640	607,236
1919	649	61,667	1,051,884

During the period 1911–5 the proportion of disputes due to questions of wages was 55%; it was 58% in 1916, 55% in 1917, 57% in 1918, and 58% in 1919. The results of the disputes during the period 1910–9 were as follows:—22% ended in favour of the workpeople, 28% ended in favour of the employers; 44% were compromised; and 6% were either indeterminate or the result unknown.

Sweden.—The Swedish labour department has published statistics of strikes and lock-outs since 1903. Figures for 1908 to 1919 are shown below:—

Year	Number of Disputes	Number of Work-people directly affected
1908 . . .	302	40,357
1909 . . .	138	301,749
1910 . . .	76	3,671
1911 . . .	98	20,576
1912 . . .	116	9,980
1913 . . .	119	9,591
1914 . . .	115	14,385
1915 . . .	86	5,119
1916 . . .	227	20,711
1917 . . .	475	46,701
1918 . . .	708	61,223
1919 . . .	440	81,041

Of the disputes recorded during the period 1910–9, 63 % were caused by questions of wages. In the same period 28 % of the disputes were settled in favour of the workpeople, 28 % in favour of the employers, and 42 % were compromised.

Spain.—Statistics of strikes are published annually by the Spanish Institute of Social Reforms. The figures for 1905–18 are given below:—

Year	Number of Strikes	Number of Work-people directly affected
1905 . . .	130	20,176
1906 . . .	122	24,394
1907 . . .	118	12,671
1908 . . .	127	12,748
1909 . . .	78	6,683
1910 . . .	151	35,897
1911 . . .	118	22,154
1912 . . .	169	36,306
1913 . . .	201	84,316
1914 . . .	140	49,267
1915 . . .	91	30,591
1916 . . .	178	96,882
1917 . . .	176	71,440
1918 . . .	256	109,168

Questions of wages were the main causes of 48 % of the strikes during the period 1910–8. In the same period 32 % of the strikes terminated in favour of the workpeople, 34 % in favour of the employers and 34 % were compromised. In 1918, 29 % of the workpeople directly affected were employed in agriculture and cattle breeding, 11 % in the textile industry, 10 % in the mining industry, and 9 % in both metal and engineering and clothing trades.

(C) British Dominions

Canada.—Statistics of disputes are published by the Department of Labour. The following table shows the number of disputes, the number of workpeople involved and the aggregate duration in working days during the years 1908–19:—

Year	Number of Disputes	Number of Workpeople directly or indirectly affected	Aggregate Duration in Working Days
1908	68	25,293	708,285
1909	69	17,332	871,845
1910	84	21,280	718,635
1911	99	30,094	2,046,650
1912	150	40,511	1,099,208
1913	113	39,536	1,287,678
1914	44	8,678	430,054
1915	73	9,140	106,149
1916	75	21,157	208,277
1917	148	48,392	1,134,970
1918	196	68,489	763,241
1919	298	133,988	3,942,189

Of the 449 disputes recorded during the period 1911–5, 128 occurred in the building trades, 103 in the metal trades, 51 in the clothing trades, 39 in the general transport trades and 29 in the mining industry. The majority of the disputes during the same period were due to questions of wages and hours, about 70 % of the disputes being due to this cause. With regard to the results of the disputes during this period 139 or 30 % resulted in favour of the workpeople, 164 or 36 % in favour of the employers, 79 or 17 % were compromised and in the remaining 67 cases the result was indefinite.

In 1919 the industry most affected by disputes was the metal and engineering, in which there were 45 strikes, involving 70,268 workpeople and a time loss of 1,993,704 working days. Forty strikes, involving 10,779 workpeople and resulting in a loss of 287,146 working days, occurred in the building trades. Of the 298 disputes recorded in 1919, 223 were due to wages. In the same year 157 of the disputes terminated in favour of the workpeople, 88 in favour of the employers and 23 were compromised.

Australia.—The systematic collection of statistical data regarding strikes and lock-outs in Australia was initiated by the Commonwealth Bureau of Census and Statistics at the beginning of 1913.

The following table shows the number of strikes and the number of workpeople directly and indirectly affected in the years 1913–9:—

Year	Number of Disputes	Number of Work-people affected
1913 . . .	208	50,283
1914 . . .	337	71,049
1915 . . .	358	81,292
1916 . . .	508	170,683
1917 . . .	444	173,970
1918 . . .	298	56,439
1919 . . .	460	157,591

In 1919 the total number of working days lost on account of strikes and lock-outs was 5,652,726. (J. H.)

(D) United States

In Nov. 1909, more than 25,000 shirt-waist makers struck in New York City; in July 1910 the cloak and suit makers in the same city; and in Oct. the men's clothing workers in Chicago. These strikes were remarkable for the numbers involved, and for the plans of adjusting grievances which resulted.

The joint agreement of the bituminous mine operators with the United Mine Workers expired April 1 1910. Disagreements as to district boundaries prevented its renewal without friction. On April 1 about 300,000 miners struck. In most districts the operators soon granted the wages increases demanded. Some 45,000 miners remained out. In July the union concluded an agreement with the remaining operators, only to have it rejected by referendum of the strikers. The miners returned to work in Sept.; the union had paid out $674,216 in strike benefits. The same year, in Columbus, O., the street-railway employees struck three times, in April, May and July, because of discharges of union members. The state Board of Arbitration considered the company responsible. The strikes were marked by violence; much of the company's property was destroyed and a number of lives were lost. Twice the militia were used to restore order.

In 1912 there were strikes led by the Industrial Workers of the World among the silk workers of New Jersey, the lumbermen in Louisiana, and the textile workers in Lawrence, Mass. (*See* Trade Unions.) The Lawrence strike lasted for nine weeks and affected 12 mills. On Jan. 11 about 14,000 employees walked out, and during the strike the number increased to 23,000. The cause of the strike was the announcement by mill owners, when the state law went into effect limiting the hours of women and children to 54 a week, that the reduction in hours would not be accompanied by an increase in the hourly rates of pay. At the beginning of the strike only a small number of the operatives were organized; the paid-up membership of the I.W.W. in Lawrence was not more than 300. During the strike the I.W.W. claimed 14,000 members; but the next year the membership had dwindled to one-half. Violent acts by strikers, greatly exaggerated by the press, and violent acts by deputies, police and militia, scarcely mentioned by the press, embittered the struggle. Early in the strike Haywood, Ettor and Giovannitti, I.W.W. organizers, went to Lawrence. Their coming resulted in a reduction of violence, for they preached passive resistance; however, threats to prevent strikebreakers from working probably continued. A business man of Lawrence, not connected with the strikers, was arrested and fined for placing sticks of dynamite in various parts of the town, presumably to discredit the strikers. The American Federation of Labor contributed $11,000 to the strike relief fund, the Socialists $40,000 and the I.W.W. $16,000. Two hundred children of the strikers were sent to New York to be fed by other workers in order that their parents might hold out longer. Ettor and Giovannitti were arrested in connexion with the murder of a woman, and used their trial for propaganda. The I.W.W. urged a general boycott of Lawrence. As a result of the strike 30,000 employees received wages increases of from 5 %

to 20%, and an increased rate for overtime. The largest increases were given to the unskilled workers.

The anthracite coal strike, beginning March 31 1912 lasted seven weeks. About 170,000 men and boys were out. The results were wages increases, abolition of the sliding scale and provision for a grievance committee. A strike of the coal-miners of Paint Creek and Cabin Creek in W. Virginia lasted from April 1912 to July 1913, and was marked by violence and lawlessness. Thirteen lives were lost. It has been estimated that the employers lost $2,000,000 because of the strike, the strikers $1,500,000 in wages and that the strike cost the taxpayers of the state or county $500,000. Miners in other states contributed $602,000 to the strike fund. The U.S. Senate ordered an investigation.

In 1913 business was active, the cost of living was rising, and there were many strikes. A strike of silk workers in Paterson, N.J., beginning in Feb. involved 293 establishments and over 25,000 workers. The strike was in protest against the introduction of the three- and four-loom system, and to enforce shorter hours and increased wages. After the strike began, the I.W.W. sent in their leaders. They succeeded in holding the workers together during the five months of the strike. The attempt by the American Federation of Labor to organize the workers and effect trade agreements with the employers failed. The strike was lost through exhaustion of the workers. A strike in the copper mines of upper Michigan, for recognition of the Western Federation of Miners and to compel the enforcement of certain state laws, began in the summer of 1913 and lasted until April 1914. The men were taken back with the promise of wages increases and reduction of hours, but on condition that they give up membership in the union.

In Sept. 1913 a strike broke out among the employees of the Colorado Fuel and Iron Co. for recognition of the United Mine Workers' Union, wages increases and the enforcement of state mining laws. In Dec. a Federal grand jury indicted many of the union officials for violating the anti-trust Act by trying to create a monopoly of labour. Mine operators were also indicted for violating state mining laws. In Jan. 1914 the Federal House of Representatives ordered an investigation. Early in the strike the state militia had been sent in and martial law declared. Both sides were guilty of violence. The strikers had moved from the houses owned by the company to tent colonies on land leased by the union. One of the largest of these was at Ludlow. On April 20 1914 militia fired into the tents, which were ignited, and 7 men, 2 women and 11 children perished. Each side accused the other of initiating the attack. John D. Rockefeller, Jr., on behalf of the employing company, refused to go to arbitration with the union, which he believed to be controlled by eastern agitators. President Wilson then sent 2,000 Federal troops to restore peace. They took the place of the militia, who withdrew, and disarmed the strikers and mine guards and deported the strikebreakers. In Sept. President Wilson proposed that the company should take back the strikers not guilty of violence and establish grievance committees and a committee of appeals to effect arbitration. The proposal was accepted by the miners but rejected by the operators. Early in Dec. 1914 the President appointed a commission to settle future disputes in the Colorado mines, made up of representatives of the employers, the union and the public. The union then voted to call off the strike and on Dec. 30 part of the Federal troops were withdrawn. At no time during the strike did the directors of the company visit the property, but after investigation by the U.S. Commission on Industrial Relations, John D. Rockefeller, Jr., visited Colorado. The result was the introduction of a system of employee representation. The miners voted to accept the plan, which provides for annual election, by the workers in each camp, of representatives to meet in conference with the employers' representatives. Each district conference names committees on conciliation, safety, sanitation, health and housing, education and recreation. A supervisor of welfare work was appointed. The workers were granted the basic 8-hour day and check-weighmen. A promise was given that union men would not be discriminated against, but the union was not recognized.

A lock-out of 16,000 coal-miners in Ohio which lasted more than a year was settled in May 1915, by Federal mediation. For a year after the war broke out in Europe, business was depressed in the United States, and many workers were competing for employment; but with increasing demand for labour on war contracts strikes again became numerous. In 1915 there were 102 strikes and 6 lock-outs of machinists in the four months July to Oct.; in nearly every case the basic 8-hour day was gained. In 1916 there was rioting in connexion with strikes in the oil refineries at Bayonne, N.J., of iron and steel workers in East Youngstown, O., and of 30,000 workers of the Westinghouse Electric Co. in Pittsburgh. Unorganized iron miners on the Mesaba range in Michigan were on strike from June to October. In the same year there were also strikes of longshoremen on the Pacific coast, and street railway employees in several cities. Coal strikes affected 350,000 men. Some 10% of the strikes that year were in New York City where more than 300,000 workers were out, chiefly in the garment trades.

After the United States entered the war the American Federation of Labor discouraged strikes in essential industries. Disputes were settled by negotiation. A number of strikes did occur, however, in some cases involving large numbers of workers; the great majority were settled by Government committees. Those responsible for war labour administration were of the opinion that the period of the war should be one of truce in the industrial field. Demands for closed shop or for radical social change were barred. The truce was not always respected by workers or employers, but on the whole it was adhered to. Local machinists' unions in Bridgeport and Newark came under radical socialist leadership. As many of the Allies' war orders were placed in Bridgeport there was great demand for machinists and the town became overcrowded. The men were dissatisfied because their pay was lower than that of men in the shipbuilding yards, and because employers discriminated against the unions. In the summer of 1917 the men demanded the 8-hour day, 10% increase in wages with certain minimum rates of pay for each class of workers, right of union membership and shop committees for the adjustment of grievances. The answer of the employers was to ask the U.S. attorney-general for criminal action. Various Federal agents were sent to Bridgeport but were unsuccessful in preventing the strike which occurred in May 1918. The strikers, however, were persuaded by the Federal mediator to return to work. Hearings were held in Washington before a special board of the Ordnance Department, and on June 8 the award was made public. After some protest the workers accepted it, but the employers refused, with the result that the men again went out on strike June 26. The War Labor Board took up the matter, but unsuccessfully, an umpire was appointed, who granted the 8-hour day, arrangements for collective bargaining, and wages increases for the most poorly paid workers; but not classification of workers with minimum wage rates. The men felt that the Government should have sustained its earlier award, and they refused to accept the second, which seemed to them to be a compromise with the employers. A third time they went out on strike. President Wilson then wrote to the strikers threatening that unless they returned to work immediately, they would be refused employment in any war industry in their community, they might not claim draft exemption on the grounds of employment in an essential industry, and that the U.S. Employment Service would refuse to find them work in other localities. On Sept. 17 1918 the men voted to return to work. The President also required the employers to reinstate all strikers. The collective bargaining machinery provided by the award never functioned.

In the summer of 1917 the entire lumber industry of the north-west was disorganized by strikes. The chief demand was for the 8-hour day. The President's Mediation Commission was unsuccessful in its attempt to settle the difficulties. The employers continued the 10-hour day, but they had difficulty in keeping men, and those who did accept employment practised sabotage. In the shipyards workers refused to handle "10-hour lumber." These conditions continued until Col. Brice P. Disque, sent into the field by the "spruce division" of the War Department, effected the organization of the Loyal Legion of Loggers and Lumbermen made up of both employers and employees and with the aim of improving conditions by mutual agreement. Members signed a pledge of loyalty to the U.S. Government. On March 1 1918 the employers introduced the 8-hour day without reduction of wages. A sanitary survey of the camps was instituted, and other improvements in living conditions were made. Labour turnover decreased and output increased considerably. Although at first it had aroused suspicion, the organization won support of most of the employers and men, but both A. F. of L. unions and I.W.W. continued to oppose it.

In many places the public, in sympathy with the employing interest and angered by the philosophy of the I.W.W., attempted to prevent strikes by arresting labour organizers as these came into a locality. Some were thrown into jail and sometimes kept there for long periods without trial. Among the strikes in connexion with which violence occurred were those of the miners in Arizona, in 1917, who struck near Jerome (May) and Bisbee (June) and also in two other districts. The chief demands were for higher wages and grievance committees. Mine owners charged the I.W.W. as responsible, although an A. F. of L. international union was actually in charge of the strike. About 100 miners were deported from Jerome by the employing interests, in cattle-cars. The train was turned back at the California state line, and the men were kept in jail for three months. On July 12 1917 in Bisbee, 1,200 strikers were dragged from their beds by armed citizens, compelled to march, and then confined in a ball-field and loaded on cattle-cars. The train was sent through the desert until taken over by soldiers camped at Columbus, N.M. Here they lived on army rations for three months, and then scattered. One-third of these men were members of the I.W.W. In July 1919 county officials arrested 107 men, prominent citizens of Bisbee, charged with kidnapping and assault, in connexion with the deportations of two years before. Civil suits for damages were filed against mining companies and the railways by the men who had been deported; these were settled out of court.

In the six months following America's entrance into the war 3,000 strikes were reported; in the first six months of 1918 the number was 1,771. When the Armistice was signed, the War Labor Board had on hand several hundred cases awaiting hearings. Now that the national emergency had passed, many employers and employees ceased to coöperate. Strikes began again. As in 1916 and 1917, the greatest number of strikes in 1918 and 1919 were in the metal trades, building, clothing, textile, transportation and mining. The largest number of workers in any one strike in 1916 was 60,000, in the men's clothing strike in New York; in 1917 no strike involved as many as 40,000; in 1918, 60,000 machinists were on strike in northern New Jersey. The strikes of 1919 were remarkable for the number of workers included; the total number was reported to the Bureau of Labor Statistics as 4,112,507. Not many strikebreakers were employed; the labour reserve was still depleted owing to business prosperity of the war period. Many of the larger strikes occurred in New York City and its vicinity; 176,000 struck in the clothing trades; 150,000 textile workers in New Jersey and New England; 16,000 marine workers struck in New York harbour in Jan.; 17,000 in March; and 20,000 longshoremen in March. In July 40,000 marine workers of the Atlantic coast struck; 100,000 were out sometime during the year. In 1919, also, 65,000 struck in the stockyards in Chicago; 100,000 in the shipyards of New York and vicinity; 151,000 in the New York building trades; 43,000 anthracite miners in Pennsylvania.

After the Armistice, war labour adjustment boards, one after another, were dissolved. Workers who had been prevented from striking by the promise of peaceful settlement of grievances, felt that the Government and employers had broken faith. The result was widespread unrest, and a number of spontaneous strikes by the rank and file of union membership, not authorized by the union officials. Demands both for the closed shop, and for the open shop were pushed without thought of compromise. Employers discriminated against union men, and recourse was had to force. In accordance with a resolution of the convention of the A. F. of L. in June 1918, the 24 international unions which claimed jurisdiction over the trades in the steel industry coöperated to organize all the workers in that industry. Mass meetings were held in Sept. in mill towns. The companies replied by discharging union members; the U.S. Steel Corp. ignored the request of President Gompers of the A. F. of L. for a conference. On July 20 1919 the committee of the 24 unions decided to submit a strike vote to their membership. Twelve demands were made. The real issue was recognition of the union. Wages in the industry were high, but the hours long. In 1911 the stockholders of the Steel Corp. had ordered an investigation of conditions of work. The report showed that 50% to 60% of the employees in rolling-mills, open hearth and blast furnaces worked a 12-hour day. The committee recommended a reduction in hours, but the recommendation was quashed by the finance committee. In Sept. 1918 the basic 8-hour day was granted, which resulted in increased pay, not shorter hours. The communities in which steel workers lived were ruled politically by company influence. In W. Pennsylvania organizers were denied free speech and assemblage by local authorities. The unions voted to strike. The call to strike on Sept. 22 1919 was published in seven languages, to all workers in iron and steel mills and blast furnaces not bound by trade agreements. The companies prepared for battle. At McKeesport alone 3,000 citizens were sworn in as special police subject to instant call. The mills of the Pittsburgh district were fortified and provisioned. On Sept. 21 rioting and arrests began. The next day 365,000 men stayed away from work. The state constabulary were sent in. Gradually the men went back to work. On Jan. 8 1920 the national committee for organizing the workers permitted the 100,000 men still out to return to the mills. Those who were taken back were required to give up their union cards. The national committee reported that 156,702 union members paid initiation fees between Aug. 1 1918 and June 31 1920, and estimated at 250,000 the total number organized.

February 6 to 11 1919 there was a general strike in Seattle Wash., involving 60,000 persons, in sympathy with shipyard employees who were striking for an increase in pay. The general strike was carried out by craft unions of the A. F. of L., although I.W.W. propaganda in the interest of industrial solidarity may have helped to put the workers into the spirit for such a mass demonstration. On the first day 110 unions stayed out; some workers had permits from the strike committee to work in the interests of public health and safety; garbage was collected and milk was delivered to distributing stations. A Labour guard patrolled the streets to preserve order. The business men viewed the strike as a "revolution." The mayor announced that unless the strike were called off on the morning of Feb. 8, he would declare the city under martial law. This threat was not carried out, although citizens armed themselves, and the governor sent troops and machine-guns. On Feb. 11 the strike was called off. Workers had been returning, indeed, since the second day and a month later all were back, without wages increases.

The New York harbour strike of Jan. 1919 arose spontaneously as the result of local initiative and comprised practically all the 16,000 or 17,000 men employed on harbour craft. As a result 50,000 longshoremen also were idle. The harbour had been the scene of industrial dispute since 1917. The immediate cause of the 1919 strike was the refusal of the employers to appear for arbitration before the War Labor Board to which the men had appealed for the 8-hour day and increased pay. The employers were persuaded by President Wilson to accept arbitration, and the men returned to work. The award did not provide for the 8-hour day, and the men struck again. The Railroad Administration then made concessions to the men on boats, and they returned to work. Other Government employees followed, and by April the private employers settled for the original 10-hour day but with wages increases. On Oct. 7 the railway men struck again. The longshoremen joined them, against the orders of their national officials. They wanted increased pay; the strike dwindled away and was over by November.

In Aug. 1919, although forbidden by their national officers, the railway shopmen called a strike because of the delay of the Wage Adjustment Board to reach a decision on the demands of the men for increased pay. The strike began in Chicago and spread to New York and Boston; 250,000 men went out. After six days the strike was called off and the men returned to work. At the request of President Wilson the demands for wages increases were postponed. Other strikes not authorized by national officers of the union were those of employees of the General Electric Company in four cities in 1918 and of the New York local of the International Typographical Union in 1919. For 1917, 72 "unauthorized strikes" were reported, 58 for 1918, and 125 for 1919. Those in 1919 involved 1,053,256 strikers.

In Nov. 1919 435,000 bituminous coal-miners struck for wages increases of 60%. They also demanded the 6-hour day, and the 5-day week in order to distribute the work through the year. The miners at first refused to arbitrate the dispute as they feared the delay would give advantage to the employers. An injunction was issued to prevent the use of union funds for strike benefits. An award of an impartial committee was accepted in March 1920, which granted an average of 27% increase in wages, but the 8-hour day was retained.

About 93% of the policemen of Boston struck in Sept. 1919 for the right to organize and affiliate with the American Federation of Labor. The city was subject to rioting and crime until the National Guard restored order. President Wilson declared a police strike to be a crime against civilization. The police commissioner filled the places of the strikers with other men. In Aug. 1919 there was also an actors' strike, in which the stage hands and musicians joined in sympathy. An "outlaw" strike on the railways in April 1920, due to the delay of the President in appointing the Labor Board provided by the Transportation Act, was opposed by the brotherhoods. In 1919 and 1920 there were strikes on the Brooklyn Rapid Transit road, and in 1919 also on the Interborough Rapid Transit of New York.

A strike and lock-out in the men's clothing industry in New York of six months' duration was settled June 2 1921. The settlement may be regarded as a victory for the union, and for the principle of trade agreements. Since Sept. 1920 negotiations had been carried on between the employers' association and the union. Business depression gave an advantage to the employers, for whom a lock-out would not mean such a loss as if it had come a year earlier. On Dec. 2 the employers presented an ultimatum to the union stating that unless piece work, a reduction in wages and the employer's full control of employment and discharge were accepted before Dec. 6 the manufacturers would put their own programme into effect, regardless of the decision of the impartial board. The union rejected the ultimatum. The reply of the employers was an announcement that the impartial machinery had ceased to function. Stoppages of work by employees and lay-offs and shut-downs by employers followed. By Dec. 13 the union instituted picketing. An offer of mediation by the state Industrial Commission was accepted by the union, but rejected by the manufacturers. The manufacturers' association resigned from the national federation. In Jan. 1921 one of the employers began suit for an injunction against picketing, $500,000 damages, and dissolution of the union because of its alleged revolutionary character. The suit for dissolution was dismissed on March 29. By March 27, 425 shops had reopened under agreements with the union, so that 25,000 of the 60,000 clothing workers were again at work. On April 5 the union announced that $1,000,000 had been raised toward their defense fund. Early in May certain of the employers resigned from the association, and the remainder reached an agreement with the union, by which the bargaining machinery with the impartial chairman was reinstated. The workers accepted a 15% cut in wages. The union brought suit for $1,000,000 damages against the employers on the charge of attempted boycott of union members.

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STRINDBERG, AUGUST (1849–1912), Swedish author (*see* 25.1038), died at Stockholm May 14 1912. His plays have been translated into English by E. and W. Oland (1912–3) and H. B. Samuel (1914).

See A. Henderson, *European Dramatists: August Strindberg* (1914); C. D. Marcus, *Strindbergs Dramatik* (1918); C. L. Schleich, *Erinnerungen an Strindberg* (1917).

STRYPA-CZERNOWITZ, BATTLE OF.—The fighting in the area between the River Strypa and Czernowitz (the capital of the Bukovina) in the winter of 1915–6 comprised an important series of operations on the eastern front between Russia and the Central Powers.

In the middle of Nov. 1915 the fighting activity in the Russian theatre of war had died down (*see* Eastern European Front Campaigns). Both for Austria-Hungary and for Germany the war against Russia became of secondary importance in proportion as the war of annihilation against Serbia progressed. The Central Powers had for the moment no offensive in view against Russia, who was exhausted after the heavy fighting which had gone before. Both belligerents now settled down to a war of position, which enabled them to restore their armies. This lasted until Christmas.

In the middle of Dec., Ivanov, who was in command of the Russian S.W. front, prepared for a new great offensive. This was, no doubt, with the view of raising their fallen prestige and regaining the confidence of the wavering Balkan States; above all to relieve Montenegro, whose overthrow by Austria-Hungary was imminent; and not least to serving the advantage which a Russian victory would have in influencing Rumania, which was still vacillating, to join in against the Central Powers.

Three Russian armies—the VIII. under Brussilov, the XI. under Shtcherbachev and the IX. under Lechitski, with 32 infantry and 13 cavalry divisions as well as some *Reichswehr* formations—attacked the Austro-German front S. of the Polesic in E. Galicia and in the Bukovina. From N. to S. there stood opposed to the Russians the main body of Linsingen's group of armies, Böhm's group of armies and Bothmer's and Pflanzer-Baltin's armies, counting roughly 40 infantry and 13 cavalry divisions. The approximate strength expressed in rifles was in the proportion of 450,000 Austro-Hungarian to 480,000 Russian. The Austro-Hungarian infantry divisions were on a lower establishment than the Russian.

Whereas on the N. wing and in the centre no particular actions took place, the main attack, assigned by Ivanov to Lechitski's and Shtcherbachev's armies, was delivered against Pflanzer and Bothmer on a front stretching from the Rumanian frontier to Burkanów on the Strypa. The main burden of the attack fell on Pflanzer-Baltin's army, which was fighting with 8 infantry and 5 cavalry divisions against the Russians' 10 infantry and 6 cavalry divisions.

Not without reason had the Russians selected the S. wing as the point of attack. A success which should give them back the capital of Bukovina could not have failed in its effect on Rumania. And besides, an advance into Bukovina was the shortest cut to the Carpathians, the reacquisition of which was among their most cherished ambitions. They hoped, by defeating Pflanzer's army, to roll up Bothmer's and Böhm's fronts.

The preparations for the attack on the Bessarabian front had been evident since the middle of December. Lechitski had during that month assembled 4 corps in front of Pflanzer's S. wing between the Pruth and the Dniester. A sharp watch was kept on this section by the XI. Corps under von Korda, general of infantry, with 3 infantry divisions and 1 of cavalry. Pflanzer was prudently preparing for the anticipated attacks by organizing the positions so strongly as to compensate for the deficiency in numbers. Reinforcements did not arrive until later.

On Dec. 23 an attack on Papp's brigade was repulsed with heavy Russian losses. In the following days small enemy attacks multiplied themselves at numerous points of the front. On the 26th heavy artillery fire began, and on the morning of the 27th, heralded by a heavy bombardment from at least 200 guns, the Russian mass attack was launched on the Bessarabian frontier and to the N.E. of Zaleszczyki, having as its centre of gravity the positions N. of Toporowce. In the afternoon also the Russians flung themselves six times on the Austro-Hungarian positions, 15 or 16 rows deep, but in vain. They were driven back with heavy losses either by artillery fire or in hand-to-hand fighting.

On the 28th they repeated their ruthless attacks, which, as at Toporowce and Bojan, became exceedingly violent. The S. wing of the S. army was attacked on the same day by the Russian XI. Army, now commanded by Gen. Sakharov in place of Shtcherbachev. At Burkanów an Austro-Hungarian outpost on the Mogila height had to be brought back to the main position. On the 29th the battle reached its height. Not only the XI. Corps but also the VI. Corps and the 36th Inf. Div., defending the heights on the E. bank of the Strypa, were furiously attacked.

The Russians had brought up fresh forces from Odessa and Kherson for the attack on the N. wing of Pflanzer's army. The Russian VII. Army, with 5 to 6 divisions of the Caucasian V. Corps and the II. Army Corps, pushed in between Lechitski's and Sakharov's armies, and in addition the II. Cav. Corps came over from Lechitski's S. wing. Considerably reinforced by these new forces, Ivanov continued to bring fresh masses into the attack on the Austro-Hungarian VI. Corps and the 36th Inf. Div. But as on the previous days all these attacks, courageous as they were, broke down. Sakharov's S. wing met with the same fate in attacking the Burkanów bridge-head. Here the 132nd Inf. Bde. of Hoffmann's Corps heroically repulsed one onslaught after another and brought 900 prisoners behind the lines, leaving as many Russian corpses in front of the obstacles.

On the 30th and 31st the Russians, after hours of preliminary bombardment, renewed their attempts to break through opposite the VI. Corps. But Arz, reinforced by the 38th Honved Inf. Div. which had been brought up from the S. army, repulsed all the assaults. On the 31st the Russians, having had no success, and considerably weakened by their enormous losses, withdrew in the evening. On the Dniester front and the Bessarabian frontier they confined themselves on both days to moderate artillery fire, being greatly exhausted by the preceding days. On the II., I. and IV. Army fronts also, only artillery duels took place.

On New Year's eve and the morning of Jan. 1 1916 the attacks on Pflanzer's S. wing in Bessarabia increased in intensity. But Korda repulsed all the Russian IX. Corps attacks in hand-to-hand fighting, with the help of the 9th Inf. Bde., which had come up from the Italian theatre. In the afternoon 6 Russian infantry regiments returned to the assault at Rarancze, and succeeded in forcing back the Austro-Hungarian position by about 300 paces on a breadth of 1,200 paces. A counter-attack was at once put in hand, but could not penetrate owing to renewed Russian attacks. Arz's and Bothmer's S. wing, which was attacked by the Russian XXII. Corps at Sokolov, repulsed all attacks on New Year's day.

On the 2nd the Russians repeated their efforts to break through at Rarancze, but failed in each case. But in view of the Russians' superior numbers, the Austro-Hungarian higher command renounced the idea of winning back the lost position.

On the 3rd and 4th the battle burst forth again on the Dniester front. At Toporowce and Rarancze furious fighting again took place. But the Russians' efforts remained fruitless, their attacks being frustrated by the striking bravery of the defenders in close fighting. Here the brave Croats of the 16th Inf. Reg. played a most glorious part. At Ocna, too, and at the bridge-head of Michalcze, N.W. of Uscieczko, the front and flanks of which were already surrounded by the Russians, all attacks were untiringly repulsed. On the 5th, after these assaults, a short lull set in once more in E. Galicia and on the Bessarabian frontier.

On Jan. 7, the Russian Christmas Day, which was also the opening day of the attack on Montenegro, the Russian storm-masses again attacked the VII. Army. At Dobropole a counter-attack by the 12th Inf. Div. drove the troops of the 3rd Turkestan Div. out of a captured line of trenches. At 11 A.M. the Russians opened a heavy bombardment on the Korda's XI. Corps, following it up at one o'clock with an infantry attack on the Toporoutz and Rarancze positions. But this again brought no success.

On the 8th, 9th and 10th, it seemed as if the Russians had again to pause and take breath. Austro-Hungarian airmen reported the approach of new Russian reinforcements opposite the N. wing of Pflanzer's army. On all these three days, however, the Russians continued to fire on the positions. On the 10th the firing at Toporowce and Rarancze became considerably more vigorous, and when it reached its greatest intensity on the 11th, and finally resolved itself into a bombardment, Korda again prepared for a most determined resistance. From three o'clock in the afternoon until ten in the evening, the Russian masses stormed the Austro-Hungarian positions unceasingly in the attempt to break through. But each new attack ended in a precipitate retreat, thanks to the excellent artillery defence.

Pflanzer's front had meanwhile been reinforced by the 40th Honved Inf. Div., the 2nd Cav. Div. and the 24th Inf. Division.

It was not until the 13th that the Russians girded themselves for a fresh attack. With their divisions filled by fresh troops, they launched against Korda's positions eight violent assaults before the evening of the 14th, but were obliged to retire each time with heavy losses. This was their last effort. Their strength seemed broken, and on the 15th, except for some firing on the positions, there was peace.

The failure of the Russian attacks, and the cessation of hostilities against Montenegro which followed on the 17th, indicated the close of the New Year's battle. There were still a few isolated attacks in the next few days, but the need for rest on both sides brought about a speedy return to the war of positions. The embittered attacks of the Russian S. army persisted with only a few intervals for 24 days, ending in a complete victory for Austria-Hungary along the 130-km. battle-front of the VII. Army. At Rarancze only was a small portion of the front given up, whereas the Russian masses paid heavy tribute before the strong Austrian positions.

Thus the Russians failed to achieve their great aims. Their offensive was not able to save Montenegro from her fate, the Austro-Hungarian front had not been forced back, and the failure of the attack, which cost the Russians at least 170,000 dead and wounded and 6,000 prisoners, could not definitely influence Rumania's policy. (E. J.)

STUART, JAMES (1843–1913), British educationist and politician, founder of the university extension movement, was born at Balgonie, Fife, Jan. 2 1843, the son of Joseph Gordon Stuart, a manufacturer. He was educated at St. Andrews and at Trinity College, Cambridge, where he was third wrangler in 1866. In 1867 he was elected a fellow of Trinity, and became a mathematical tutor. The same year he lectured in astronomy to women teachers at Liverpool, and such was the success of these lectures that he was invited to repeat them at other centres. From this small beginnning arose the university extension movement, which, though undertaken at first merely as an experiment, has now attained a very great success. In 1875 Stuart became first professor of mechanism and applied mechanics at Cambridge, and in this capacity was responsible for the organization of the university workshops and the teaching of engineering generally. In 1882 he unsuccessfully contested Cambridge University as a Liberal, but in 1884 was elected for Hackney. He held this seat till 1885. From 1885 to 1900 he was member for Hoxton and from 1906 to 1910 member for Sunderland. He was created a privy councillor in 1909. For many years he was a Progressive member of the London County Council, and was also interested in the management of the *Star* and the *Morning Leader*. Stuart married in 1890 Laura Elizabeth, the daughter of J. J. Colman, head of the great firm of mustard manufacturers, and became a director of the firm in 1898. He died at Norwich Oct. 13 1913.

STUART, RUTH McENERY (1856–1917), American writer, was born in Avoyelles parish, La., in 1856. She was educated in private schools in New Orleans and in 1879 married Alfred C. Stuart, a planter. Her first story, *Uncle Mingo's Speculations*, appeared in 1888 in the *Princeton Review*. She moved to New York City in 1891 and soon became known for her stories of negro life in the South. She also wrote much verse for magazines.

She often appeared as a public reader of her own works, which were characterized by humour and pathos. Tulane University, New Orleans, conferred upon her in 1915 the degree of Litt.D. She died in New York City May 6 1917.

Her numerous books include *Carlotta's Intended* (1894); *Sonny* (1896); *In Simpkinsville* (1897); *Moriah's Mourning* (1898); *Napoleon Jackson, the Gentleman of the Plush Rocker* (1902); *The Second Wooing of Salina Sue* (1905); *Sonny's Father* (1910); *The Unlived Life of Little Mary Ellen* (1910); *Daddy Do-Funny's Wisdom Jingles* (1913) and *Plantation Songs and Other Verse* (1916).

STUBBS, CHARLES WILLIAM (1843–1912), English divine, was born at Liverpool Sept. 3 1843, and educated at the Royal Institution school, Liverpool, and Sidney Sussex College, Cambridge. His father and grandfather were Yorkshire agriculturists, and throughout his life he took a strong interest in the welfare of the agricultural labourer, publishing three volumes on the subject, *Village Politics* (1878), *Christ and Democracy* (1883) and *The Land and the Labourers* (1890). He was a strong Liberal with somewhat socialistic views, and was preferred by Mr. Gladstone to the living of Stokenham and Chivelstone in Devon in 1884. In 1887 he was transferred to Liverpool, becoming rector of Wavertree. In 1893 he became dean of Ely, remaining there till 1905, when Sir Henry Campbell-Bannerman nominated him to the bishopric of Truro. He was Hulsean lecturer at Cambridge in 1904, and published his lectures under the title *The Christ in English Poetry* (1905). His other works include *A Creed for Christian Socialists* (1896); *Charles Kingsley and the Christian Social Movement* (1898) and a *Handbook to Ely Cathedral* (1898). He died at Truro May 4 1912.

STURDEE, SIR FREDERICK CHARLES DOVETON, 1ST BART. (1859–), British Admiral, was born at Charlton, Kent, June 9 1859, the son of a naval officer, and entered the navy in 1871. He was promoted lieutenant (1880), commander (1893), captain (1899), rear-admiral (1908), vice-admiral (1913), admiral (1917) and admiral of the fleet (1921). He saw service in Egypt (1882) and in Samoa (1898–9) when he was in command of the Anglo-American force. He was assistant-director of Naval Intelligence to the Admiralty (1900–2) and chief of staff, Mediterranean Fleet (1905–7) and Channel Fleet (1907). In 1910 he became rear-admiral of the first Battle Squadron, and commanded the 2nd Cruiser Squadron (1912–3). During the World War he was commander-in-chief, on the "Invincible," of the squadron which won the battle of the Falkland Is., Dec. 8 1914, and he took part in the battle of Jutland. He was created K.C.B. (1913), and K.C.M.G. (1916); and a baronetcy was conferred on him in 1916, with the title "of the Falkland Is." In 1918 he became commander-in-chief of the Nore.

STURDZA, DEMETRIUS (1833–1914), Rumanian statesman (*see* 25.1051), died in 1914.

STÜRGKH, CARL, COUNT (1859–1916), Austrian prime minister from Nov. 3 1911 to the time of his murder, was born on Oct. 30 1859, of an ancient noble Styrian family, and in 1881 he became an official of the Statthalterei at Graz, and later of the Ministry of Education. He left the State service in 1891, when he was elected as a representative of the loyal land-holding interest to the Reichsrat. He attached himself to the Left of the German party, and came forward as a keen opponent of universal suffrage. He was from Feb. 10 1909 to Nov. 3 1911 Minister of Education, and a zealous advocate of the humanistic education traditional in the gymnasia. Stürgkh was one of the committee of five ministers who decided on the dispatch of the ultimatum to Serbia and the declaration of war, which brought on the World War. He was killed on Oct. 21 1916 by a shot fired by the Social Democrat Friedrich Adler, a son of the Social Democrat leader, Viktor Adler, as a protest against Stürgkh's government without parliament. (*See* AUSTRIAN EMPIRE.)

STÜRMER, BORIS VLADIMIROVICH (1849–1917), Russian politician, was born in 1849, the son of an emigrant—his father being captain of a fire brigade at Tula. He studied at the university of Petrograd, and there made friends with Count Bobrinsky, a member of one of the leading Russian families, who introduced him into the upper circle of Petrograd society. His affable manners and his ability to win the confidence of important people are the only explanation of his brilliant success in a circle to which he did not belong by birth or fortune. He started his career in the Chamberlain's department of the Imperial Court, but he held at the same time different situations in the Senate, the Ministry of Justice and elsewhere. When in 1892 the Government rejected the candidate nominated to the presidency of the executive board of the Tver Zemstvo, Stürmer, whose name was on the list of the Tver gentry, was appointed to this office. It was the first case of a president of the Zemstvo being appointed instead of being elected. In 1894 Stürmer was appointed governor of the Novgorod, and later of the Iaroslavl province. Subsequently he was in charge of a department of the Home Office. In 1904 he was created member of the State Council, but he never took an active part in the legislative work. Meanwhile he won the confidence of the Court, and he was made prime minister in Jan. 1916, at a period when the Emperor, avoiding strong personalities, wished to secure the fulfilment of his orders by devoted servants. As prime minister Stürmer's reactionary attitude provoked a strong opposition in liberal and patriotic circles; rumours accusing him of connexions with Germany were widely spread without real proof. These accusations were finally brought to the tribune of the Duma by M. Milyukov and resulted in Stürmer's resignation in November. After Sazonov's dismissal Stürmer took the portfolio of Foreign Affairs, and his activities in this department resulted in the premature declaration of war by Rumania, so disastrous for that country and for Russia. He was arrested after the revolution, and he died in prison of disease in Sept. 1917.

STYRIA (*see* 25.1058), an Austrian territory bordered on the E. by the Southern Slav State and that part of Burgenland which belongs to Austria; on the N. by Lower and Upper Austria; on the W. by Salzburg and Carinthia; and on the S. by the Southern Slav State. The part of Styria included in the Southern Slav State has an area of some 2,366 sq. m. and had, in 1910, a pop. of 433,000. The Austrian territory extends over some 6,304 sq. m., of which the greater part is mountainous and almost the whole lies in the Eastern Alps. Styria had formerly three large divisions:—Northern or Upper Styria; Middle Styria; and Southern or Lower Styria. Lower Styria and the southern part of Middle Styria, up to the Posruck range and to the Mur have, however, been taken over by the Southern Slav State. Middle Styria is surrounded on the W. and N. by a semi-circular mountain range which joins the Cetic and a part of the Noric Alps and has recently become known as the "Steierische Randgebirge." The pass through which flows the river Mur between Bruck and Graz unites it to Upper Styria. The northern part of Upper Styria is occupied by the heights of the *Nördlichen Kalkalpen.* The eastern part of the Noric Alps, the Bachern together with the Posruck, now belongs to the Southern Slav State.

Population.—The pop. of the Styria of to-day was, in 1910, 952,590; in 1920 it had decreased to about 946,720 (151 per sq.m.). It is almost purely German. The proportion of males to females in 1910 was as 1,000 to 983; in 1920 as 1,000 to 1,053. While Styria lost some 75,000 Germans, among whom were 9,000 belonging to the exclusively German-speaking districts, she has now only about 5,000 Slovene inhabitants. In 1910 the pop. of the present-day Styria was as to 97·4 % Roman Catholic and 2·1 % Evangelical.

For administrative purposes, Styria is divided into 16 districts and the autonomous city of Graz, the capital (pop. 157,032 in 1920). Other important places are:—(pop. figures are taken from the census of 1920) in the Traun and Enns district of Upper Styria—Bad Aussee (pop. 1,370); Eisenerz (pop. 6,337); Mariazell, the famous resort of pilgrims (pop. 1,881); in the Upper Mur district—Judenburg (pop. 5,668); Fohnsdorf (pop. 7,199); Zeltweg (pop. 3,682); Knittelfeld (pop. 10,672); Leoben (pop. 11,231); Donawitz (pop. 15,087); Vordernberg (pop. 2,352); Bruck an der Mur (pop. 8,490); —in Mürz-Thal—Kappenberg (pop. 12,576); Mürzzuschlag (pop. 6,483);—in Middle Styria—Köflach (pop. 2,655); Voitsberg (pop. 3,283); Eggenberg bei Graz (pop. 15,554); Weiz (pop. 3,620); Fürstenfeld (pop. 5,649) and the Gleichenberg Spa, Kurort Gleichenberg (pop. 872).

Education.—Styria has three higher educational establishments, namely the university and the technical college of Graz and the Montanist College in Leoben.

Notwithstanding the great unevenness of the surface, only 8·0 % of the present Styria could be reckoned as unproductive in 1900. Of the productive parts, 19·1 % was arable; 0·9 % gardens; 0·5 %

vineyards; 11·8% meadows; 13·3% grazing lands; 54·4% was, however, forest. This territory is justly called "green Styria." Cattle-raising has greatly developed and farming is actively carried on on the high lands. Nevertheless, in 1918 there were only 358,108 head of cattle (of which 170,630 were milch-cows) and 344,188 swine. A good breed of horses exists in Ennsthal and considerable attention is devoted to poultry-farming in Middle Styria, where the shooting and fishing are good. The forests yield a great variety of timber.

Minerals.—Styria is so rich in iron ore that it has been called the "land of iron" (*eiserne Mark*). Lignite is also abundant. Of the total output of the mines of present-day Austria (51,000,000 kronen in 1915) 71% (36,000,000 kronen) is attributed to Styria; its output of iron (1·8 million tons in 1915) is over 94% of the Austrian total. Iron-mining is almost exclusively confined to the Erzberg between Eisenerz and Vordernberg. The manufacture of iron in Austria is now almost entirely confined to Styria (538,753 tons out of a total of 541,004 tons). The most important iron-smelting works are in or near the above-named region and at Hieflau, Trofaiach and especially Donawitz; in the lignite districts, in Zeltweg and Knittelfeld, near the lignite diggings of Fohnsdorf and in Eibiswald; also in Mürz-Thal (Kapfenberg, Mürzzuschlag). The Mürz-Thal is also the centre of the newly created scythe-making industry. The lignite produced, 1·8 million tons or over 74% of the Austrian total, is found in many places. The most important mines are at Fohnsdorf in Upper Styria; the product of those near Leoben is used by the great metal works of Donawitz and others—and there are smaller mines in Mürz-Thal; in Western Middle Styria in the districts of Höflach and Voitsberg and those of Eibiswald and Wies. Styria also produces salt; 28,000 tons, some 17% of the whole Austrian output, was obtained near Aussee in 1915. It yields also almost the entire Austrian output of graphite and some sulphur, lead and zinc ores, clay and building stone. The output of magnesite has become especially important; Styria alone almost supplies the world, chiefly from the neighbourhood of Veitsch, Trieben, Kraubath, in the Breitenau near Bruck and elsewhere.

Water-power.—The plentiful and accessible supply of water-power has caused the installation of great electrical stations of which, however, full advantage has not been taken. The electrical works of Weiz are world-famed.

Manufactures.—Notable Styrian manufacturing industries are those of the iron works at the places already named, also at Pallen-Thal (Rottenmann, Trieben) and at and near Graz. These turn out a great variety of iron goods; small articles as well as scythes, machinery, locomotives (Graz), bicycles (Graz) and wagons. Graz makes carriages and automobiles and also holds an important place in the wide-spread wood industries (including furniture). The manufactures of lignite and cellulose, pasteboard, paper (Grat-Korn, near Graz, and other places), also of beer (Graz), tiles, flour, leather, explosives (Deutsch-Landsberg and other places) are considerable. Less important are flour-milling, and the textile, glass, tobacco and chemical industries.

Communications.—The new frontier cuts through the Marburg-Unterdrauburg line so that the connexion between Middle Styria and Carinthia goes a long way round, causing considerable inconvenience. Mariazell is now connected by rail with Vienna.

SUBMARINE CABLE TELEGRAPHY (*see* 26.527).—In 1921 there were over 298,000 nautical miles of telegraph cable in operation at the sea bottom, made up of some 3,000 separate lengths, of which about 2,540 were administered by the various governments concerned, whilst the remainder were the property of private (mainly British) companies. Of the world's cables, over 130,000 n.m. are owned by British companies, 71,000 by American companies, and 24,000 by companies of other countries. How much the Allied countries—especially Britain—were indebted to submarine telegraphy in connexion with the World War will probably never be fully realized. Had British communication with the Dominions been cut off at the outset by the enemy, months would have elapsed before arrangements could have been completed for the despatch of the overseas contingents which rushed to British aid. On the other hand, within four hours of the declaration of war, Germany was entirely deprived of direct telegraphic communication with the United States. A British cruiser effected the required interruption in the English Channel by cutting both the cables running between Emden and New York via the Azores, one being taken in to Penzance (Cornwall). Then in March 1917 they were both cut at points 643 and 610 n.m. respectively from New York, one of them being diverted by a British P.O. telegraph ship into Halifax, Nova Scotia. Since July 1917 this has been at any rate temporarily turned to account as a connecting link with the All-British Pacific Cable system. The other line was handed over to France and taken in to Brest.[1] Altogether 20,000 n.m. of ex-German cables were captured during the war, covering practically every one of those passing through the English Channel.

Remarkable indeed were the achievements of submarine telegraph cable- laying and repairing authorities during the war. Despite the active German submarine warfare, a vast number stand to the credit of British ships, largely to meet immediate strategic requirements. Whilst some of these were effected by cruisers of the Royal Navy provided with the necessary apparatus and the required length of cable, they were in the most part carried out by specially designed telegraph ships, though accompanied as often as possible (where especially desirable) by a man-of-war as escort. In addition to manufacturing 20,000 m. of trench telephone cable, the Telegraph Construction and Maintenance Co. made 19,000 m. of submarine cable, and its ships were actively engaged on highly dangerous work in the way of laying, repairing and diverting cables. The "Telconia"—perhaps the most efficiently designed telegraph ship in existence—made 75 cable repairs and laid 24 new lines around the English and Irish coasts whilst in commission for H.M. Post Office.

The first entirely new cable to be laid during the war was that by the Telegraph Construction Co.'s T.S. "Colonia" between Montevideo and the Falkland Is. in 1915, under the auspices of the British Admiralty. In the same year, this company also laid, under Post Office supervision, a direct Anglo-Russian cable from Peterhead (Aberdeenshire) to Alexandrovsk (about the nearest Arctic Ocean coast point to Petrograd). In both instances this was the earliest occasion on which a cable had been brought to the farther point. The first line had purely strategic objects in view, but the second was more especially to meet the fact that communication between Britain and Russia had previously been only effected across countries that were now to a great extent enemy countries; indeed, the Indo-European Telegraph Co.'s land line system had become practically inoperative ever since the outbreak of the war. This work was a truly remarkable feat. The cable was laid in the winter and was landed on Russian territory at the time of year when the sun does not rise above the horizon in those northern latitudes. In fact, the entire undertaking had to be carried out in darkness, as well as in seas infested with enemy submarines. It was conducted with every possible secrecy, it being arranged for the "Colonia," in order to mislead the enemy, to go on a preliminary cruise in an entirely different direction. With land lines at each end and special repeaters, direct telegraphic communication was thus established between the Central Telegraph Office in London and the corresponding building in Petrograd. Moreover, many telegrams from countries S. of Russia—Greece, for instance—passed over this cable in making their circuitous journey from the Levant to various quarters of the globe. This was the first piece of ocean cable work that the British Post Office had ever had to do with. Thus, for its purpose, Post Office engineers and clerks were initiated, at short notice, in the art of deep-sea cable-laying and long distance cable-working at the hands of the contractors, as well as by a staff of the Eastern Telegraph Co. provided for working the cable.[2]

The other more especially important piece of British cable work was the putting through of one of the Emden–New York cables as the first Imperial Atlantic cable to link up with the All-British Pacific line. The path taken by what now constitutes a completed "All Red" route to Australasia is London, Penzance, Fayal Isle, Azores (mid-Atlantic), Halifax, Bamfield (Vancouver), Fanning I. (a small, mid-Pacific, coral formation), Suva (Fiji Is.), Norfolk I., from whence there are two branches, one to Southport, Queensland (Australia) and the other to Auckland (New Zealand).

The Atlantic section of this "All Red" cable system was being worked in 1921 by the Post Office. Thus it has come to pass that a Government department, that, conjointly with the great cable companies, had opposed in turn the scheme for an All-British

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[1] Owing to the enemy's submarine activities, the late German Atlantic cables could not be attended to for some 14 months.

[2] The Post Office Engineering Department's previous experience of cable work was closely confined to short Channel lines, etc.

Pacific Cable and then later that for an All-British Atlantic Cable, has been called upon itself to put into practice the latter, and now appears as an exponent of "All Red" cables generally. The department in question did much fine work during the war. At the very outset—on the eve of Aug. 4 1914, indeed—its principal telegraph ship, the "Monarch," set forth for the N., where many emergency cables were forthwith laid. It was not long, however, before she met her glorious end, and her "shattered bones" are now lying on the bed of the English Channel—the scene of most of her work. She was one of the very first vessels to be especially designed for cable-laying and repairing.

Another telegraph ship that met her end over the war was the "Dacia," owned by the Silvertown Company. This vessel had accomplished a great deal in her time, and during July 1915–Feb. 1916 she effected cable communications between Brest (France) and Casablanca (Morocco), by cutting in at suitable positions and picking up and relaying part of the Borkum–Teneriffe cable belonging to Germany. Nearly 450 n.m. of cable were picked up and relaid on this occasion, part of it in a depth of 2,000 to 2,500 fathoms. She then proceeded to establish communication between Casablanca (Morocco) and Dakar (W. Africa), by cutting in, picking up and relaying portions of the Teneriffe–Monrovia cable belonging to Germany. Eight hundred n.m. of deep-sea cable were on this occasion recovered and relaid in an average depth of over 2,000 fathoms. We have here a "record" in cable work. It was undertaken for the French Administration, and Casablanca had not up to that time been connected to Europe by submarine cable. The cable facilitated the sending of troops to France by Morocco and Senegal when greatly needed.

Messrs. Siemens Brothers' unique and highly efficient telegraph ship "Faraday"—originally designed by the late Sir William Siemens, F.R.S.—also achieved much during the course of the war on behalf of the British Post Office, which had at one time in commission practically every telegraph ship available, including the largest (T. S. "Colonia").

Even though observing constant vigilance, a telegraph ship, when effecting a repair, being deprived of manœuvring powers by attachment to the cable, is peculiarly vulnerable to anything like a torpedo attack. It is, therefore, something to be able to say that the Post Office kept Britain and the European continent in continuous electrical communication. During the early part of the war telegraph ships went about their business alone and unattended, but with the development of intense submarine warfare naval escorts had to be provided by the Admiralty. Escorts are not, however, a safeguard against submerged mines, and so it was that the old "Monarch" met her fate, going down with her flag flying. On one occasion a telegraph ship on repairing work hove up a mine with the cable, but beyond damage to machinery and breakage of crockery, no harm was done.

Apart from the disposal of four of the world's telegraph fleet,[1] there were only two instances of Germany getting the best of things in the matter of cable communication. Within the first year of the war, a German man-of-war landed a party on the deserted beach of Fanning I., and this party succeeded in cutting the All-British Pacific cable there. The other case was that of the "Eastern" cable landed at Keeling-Cocos. Here again the attacking party from the "Emden" succeeded in cutting the cables,[2] but an alarm signal which had been got through led to the "Emden's" final doom. In this case great enterprise was shown by the "Eastern" Co.'s superintendent, and in neither instance was the interruption very serious or lengthy. Though there were only these two cases of enemy disturbance of the Allies' cables, many were rendered dumb from the wear and tear of four years, during which time it was impossible to effect repairs, for lack of suitable ships and the risk of exposing slow-moving vessels to enemy attack.

During the latter part of the war, the American submarine cables on the Pacific and Atlantic Ocean coasts were taken under control of the United States Government. *Inter alia* there was a feeling that considerable advantage would attach to the coördination of all the telegraph systems throughout the country. Eventually (Nov. 2 1918) the U.S. Postmaster-General also assumed administrative control of all cable landing on U.S. territory, after the necessary negotiations with other countries concerned had been carried through. Control ended on May 2 1919.

Post-war Developments.—War wastage, the banning of private codes, considerable general increase of traffic[3] (partly owing to absence of mails) and voluminous Government messages, were all responsible for an appalling cable congestion during the war, the result being several days'—sometimes even weeks'—delay in the transit of messages on most of the more important trunk lines. Though, after the Armistice things became somewhat easier, with the withdrawal of the censorship and the renewal of private codes, the ultimate delivery of cablegrams was even in 1921 a very slow business. When the Marconi Trans-Atlantic wireless service was re-established some measure of relief was felt. Unfortunately, however, it was only capable of dealing with a small proportion of the ordinary prevailing cable traffic. The hampering of trade, during the war, by the prohibition of most private cable codes, was very considerable. To take an example, a certain firm had been in the habit of sending every week some 40 cablegrams at an average of £1 each. The cost of the same messages in plain English would have been some £320.

Most of the cables requiring repairs after the war had been attended to by 1921, but there was still considerable delay on cablegrams, even though the lines were being worked at their full capacity, day and night.

When it is remembered that in the year before the war (1913) 826,000 messages passed through the two Atlantic cables then connecting the United States with Germany,[4] it will be realized what it meant to American commerce alone to be deprived of these direct cable connexions. In 1921 it was planned to lay a new Atlantic cable between the two countries, and to extend the German cable that had been taken into Brest by the French, as a compromise, to central or northern Europe with a landing *en route* off Denmark.

Ever since all of what were formerly British Atlantic cables passed, in 1912, into the administrative hands of the Western Union Telegraph Co. of America, the British Government had been strongly urged—as, indeed, for many years previously—to establish a State Atlantic Cable as a connecting link with the All-British Pacific Cable. The war only served to accentuate this view. Whilst the capture and diversion of the German Atlantic Cable (taken into Penzance and Halifax) went some way to meet requirements, this line had not only been irregular in its performance but much congested with traffic, largely American. When therefore, in 1919, the Western Union Co. brought to an end their lease of the Direct United States Co.'s cable system—between Ballinskelligs (Ireland), Halifax (Nova Scotia) and Halifax–Rye Beach (United States)—on the ground of it being so constantly out of operation—the British Government entered into negotiations, towards the end of 1920, for the purchase of the line at a cost of £570,000, or scarcely more than half the value of a new cable. When this is given effect the line—together with the Imperial Pacific Line—will form a complete and strictly "All Red" route between the Mother Country and Australia. Though the line (originally laid in 1874) is even of more ancient order than the ex-German cables, British Imperial needs will, to a great extent, be met. The shortcomings will be further met when a Canadian land line, connecting the All-British Atlantic and Pacific Cables, is provided.

The All-British Pacific Cable, first laid in 1902, has more than justified itself. During its first year scarcely more than 200,000 words were sent. Ten years later, the volume of traffic had been increased ten-fold. The war brought this up to some 26,000 words per day, or about 9,500,000 words per annum. Notwithstanding the large capital cost of this line (£2,000,000) it produced a gross profit of £94,000 for the year 1920; whilst its reserve fund stood at nearly £1,107,000. To illustrate the high strategic value of the line, during the war, if the Allies had happened to be—even temporarily—deprived of naval control, the British Mediterranean cables would undoubtedly soon have been cut, which would have meant that British inter-imperial telegraphic communication could only have been secured by means of the All-British Pacific line. It had been felt for a long time that, since the Imperial Pacific cable was laid as far back as 1902, steps must be taken to duplicate it in order to provide against complete breakdown, as well as for dealing with over-congestion. In 1921, however, owing to the necessity for economy and to the high cost of materials, it seemed probable that this duplication would require to be limited, for the present, to the duplication of the long, slow working, section in very deep water, *i.e.* the 3,458 n.m. between Bamfield (Vancouver) and Fanning I., which runs into a depth of 3,400 fathoms (nearly 3½ n.m.), and brings down the resultant speed on the whole line to a low figure.

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[1] The total number of such vessels in 1921 was 49, of which some half dozen were owned by contractors for the original laying of ocean cables, the rest being smaller vessels, of the cable working companies, for subsequent repairing operations.

[2] The officials in charge had, however, prepared a ruse by utilizing some spare cable as a dummy, and this dummy the Germans solemnly cut.

[3] In the case of the Eastern Co.'s system this was more than doubled by the war. Thus, the annual gross receipts of the company were about £2,000,000 more than previously, and much the same applies to others in the same group.

[4] In actual fact these cables accounted for 32% of the total traffic of the Commercial Cable Company.

Perhaps nothing contributed more in the past to the leading commercial position of Britain than her enterprise in the matter of telegraph cables. Fortunately, too, she also recognized that the problem of Empire is largely a problem of communication. Arising out of the war to some extent, there has been a general demand for a great deal more inter-communication, not only between different branches of the British Empire, but also between distant foreign countries. This demand must be met in the first place by a considerable addition to the world's cable system over and above those that were in operation previous to hostilities. The part of the British Empire which in 1921 was more especially badly served in the matter of telegraphic communication was the West Indies, where, largely owing to the nature of the sea bottom, the existing inter-insular lines (originally laid in 1870) were constantly breaking down.[1] But for "atmospherics" in these tropical regions, this would be an ideal case for "wireless." As it is, it would seem that an efficient air service would do most to improve prevailing shortcomings—at any rate for mail purposes, the steamer service being also very deficient. From a world standpoint, however, probably the most acute need for additional cable facilities is in the Pacific Ocean, for, while the traffic over the N. Atlantic cables has been practically quadrupled since 1913, Pacific cable traffic has increased nearly nine-fold.

The war also aroused the United States to her disadvantage in the matter of cable communication as compared with her trade rivals. Thus, on April 26 1921, the U.S. Senate passed a bill "to prevent unauthorized cable landings in the United States or any of its possessions." The bill gives the President sweeping authority also to issue, withhold and revoke licences as to cable landings, as well as for obtaining concessions for the United States in other parts of the world. Section 2 of the bill enables the President "to withhold or revoke such licence when satisfied such action will assist in obtaining for the landing or operation of cables in foreign countries or in maintaining the rights or interests of the United States." The President may grant such licence on such terms as will assure just and reasonable rates. The licence is not to give the licencee exclusive rights of landing or of operation, in the United States. The policy appears to be based chiefly upon considerations that shall guard against consolidation or amalgamation with other cable lines, while insisting upon reciprocal accommodation for American corporations and companies in foreign territory. In 1920 the U.S. authorities refused to allow a cable laid for the Western Union Co. to be landed at a point on the coast of Florida on the ground that it was intended for connecting up, *via* Barbados, with the "Western Telegraph" system (at Maranham) of a British company.[2] The American Government considered that allowing such a cable to be laid would have lent colour to the British company having sole rights of communication between the United States and Brazil. As a matter of fact, another American company (All America Cables, Inc., of New York)[3] was also preparing to lay a cable to the Brazilian Coast, and it was thought by the U.S. Government that by acceding to the application of the Western Union Co., the claims to a monopoly being possibly established thereby might prevent the other cable being laid—a cable greatly to the interests of American trade with Brazil. The United States had evidently determined to establish its own system of cables throughout the world, partly for high national reasons, but also with a view to developing trade, especially with S. America.

France also has shown a disposition to be increasingly active and enterprising in this matter; likewise Japan.

International Cable Conference, 1920–1.—Probably no telegraphic conference has ever been the scene of such acute disagreement on essential points as that which held sittings during parts of 1920 and 1921 at Washington. This was perhaps natural, when we remember (*a*) that Germany had been relieved of practically all her cables, (*b*) that the destiny of these cables was of first-rate importance to all the principal powers.

Soon after the confiscation of the German cables an agreement was entered into between Great Britain, France, Italy and Japan, whereby these ex-German lines were to be severally distributed amongst them. The United States having come into the war some time later, it was proposed at the Conference, that these cables should, as a substituted arrangement, become the joint property of the five Allies.

The actual diversion of the German Atlantic cables was completed by Great Britain in July 1917, and by France in Nov. 1917—in both instances after the United States had joined the Allies. The American view was, therefore, that neither of these appropriations of cables between the Azores (Portuguese possessions) and the United States could be justified, seeing that both the United States and Portugal were already allied with England and France in the vigorous prosecution of the war. Then again, no single section of the ex-German cable in the Pacific touched Japanese soil, but one landed on American territory (Guam). Thus it was argued that it was something of an anomaly that the Japanese should ever have seized the German cable system, to the great detriment of American trade with China and the Philippines—and correspondingly to their own (Japanese) advantage.

There were probably few matters that could, in principle, be dealt with so suitably by the League of Nations as those associated with international telegraphic communication. But that could only apply if, and when, the United States joined the League, or, on the other hand, in instances where America was in no way concerned. With ex-German islands and cables, however, it was quite clear that the United States was very much concerned. Further, there was no nation whose interests were liable to be so much affected by the mandate as regards Yap—more especially in reference to the cable—as the United States. The control of telegraphic communication between that island and China meant much to Japan. On the other hand, such an arrangement was regarded as contrary to American interests. In these circumstances, seeing that the United States was one of the "principal Allied and Associated Powers," the question was raised why such a mandate was ever granted to Japan without the assent of the United States. However, the Yap difficulty was eventually settled, so as to preserve American rights, at the Washington Conference in Dec. 1921 (*see* JAPAN; also WASHINGTON CONFERENCE).

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[1] *Report of the Royal Commission on Trade between Canada and the West Indies* (Cd. 5369, 1910).

[2] The prospects of trade with S. America are, in fact, so attractive that telegraphic communication therewith has been made a special consideration of recent years both in Britain as well as in the United States. Thus, in order to improve the then existing facilities, a cable was laid in 1910 by the Telegraph Construction & Maintenance Co. between St. Vincent, Ascension and Buenos Aires, these sections now forming a part of the Western Telegraph Co.'s system. In 1920, the same company laid a cable between Maranham and Barbados.

[3] Formerly the Central & S. American Telegraph Co., with lines down the W. coast of the American continent.

It was perhaps in the nature of things that those countries—such as the United States—which were in a less favourable position in the matter of cable ownership should especially desire the internationalization or neutralization of cables. Certainly, the neutralization and internationalization of cable systems might have one advantage, *i.e.* bring to an end the suspicions, right or wrong, that messages concerning another country were delayed, scrutinized, tampered with, etc. Such charges were largely due to keen commercial rivalry, and principally—if not entirely—a question of news agencies rather than cable companies. Any foundation they had was probably more or less closely limited to the war, when certainly Canada was very ill-supplied with news from Europe—or indeed, with reference to Imperial matters—whilst over-abundantly informed of trouble in Ireland.

Strategic Cables.—Unless the strict neutralization of cables becomes the order of the day, under the League of Nations or otherwise, the best principle would probably be that every country should—partly for strategical reasons—establish for itself many more cables on a variety of routes well clear of foreign soil. These should be worked on a low rate basis for the general encouragement of intercommunication, but especially for developing commerce and trade. They should be supplemented by wireless, which is already in use as feeders to the cable systems. There can be no question that messages passing through cables touching foreign territory are insecure. If the cable lands on an enemy's country, the message is stopped or read off, and if on neutral soil, it runs the chance of also finding its way to the enemy, if only because a country which is neutral to-day may be unfriendly to-morrow. A clear distinction must be observed between an international submarine cable and a national cable. An international cable is one which connects the territory of different independent states; a national submarine cable is one which unites the territory or the colonial possessions of a single independent state. The character of the charter or ownership of a submarine cable determines whether it should be deemed foreign or national in respect to a particular state. Apart from their great strategic value, the Chambers of Commerce of practically every important town in the United Kingdom have, on strictly business grounds, loudly urged for a system of All-British cables worked at comparatively easy rates. The same course has also been taken at various influential congresses of the Chambers of Commerce of the British Empire, partly with a view to ensuring against enemy interruptions and eavesdropping. Promoters of private enterprise are indisposed to undertake the laying of cables of a strategic, rather than commercial, order. On the other hand, the cables on the trade routes—through the Mediterranean, etc.—are especially liable to interruption, much more so than those in the open ocean.

Cable Tariff.—The ordinary cable rates, though showing material reduction from those of the earliest days, were in 1921 still very high from the public standpoint.[1] For financial reasons, they were largely based on the length of cable involved (see accompanying table), whereas it is just in the case of especially great distances that the cablegram is at an advantage against the mail boat. Here is a striking case where public (*i.e.* national) and private interests necessarily clash, and where, of course, national interests should be made supreme. This, it is to be feared, can be done only by adequate state control.

In the final report (Cd. 8462) of the Dominions Royal Commission in 1917 expression was given to the view that "charges are very high, the scales extremely complicated and their justification difficult to recognize." The report goes on to say: "The popularization of the cable service can only come with a simplification of the charges and their radical reduction; at present outside its commercial use cable communication is a luxury."

Principal British, etc., cable route stations, with approximate cable distances from London, and tariff, ordinary rate, therefrom.

Station	Approximate cable mileage	Ordinary rate	
		s.	d.
Madeira	1,617	1	0
St. Vincent	2,744	2	2
Ascension	4,519	2	0
St. Helena	5,307	2	0
Cape Town	7,199	2	0
Gibraltar	1,501	0	3
Malta	2,618	0	4
Alexandria	3,483	1	0
Port Said	3,636	1	0
Aden	5,065	2	0
Bombay	6,910	1	8
Colombo	7,328	1	8
Penang	8,735	2	10
Singapore	9,135	2	10
Labuan	9,869	2	10
Hong-Kong	10,657	3	0
Shanghai	11,584	3	0
Zanzibar	7,024	2	0
Seychelles	8,145	2	0
Mauritius	9,210	2	6
Fremantle	14,289	3	0
Adelaide	15,834	3	0
Melbourne	16,500	3	0
Tasmania	16,700	3	0
Bathurst	3,319	2	6
Sierra Leone	3,785	2	6
Accra	4,807	3	0
Lagos	5,079	3	0
Bonny	5,400	3	0
Newfoundland	2,410	1	0
Nova Scotia	2,727	1	0
Halifax	3,150	1	0
Montreal	3,777	1	0
Vancouver	6,677	1	6
Fanning Island	10,358	2	6
Fiji (Suva)	12,401	2	8
Norfolk Island	13,383	2	8
Queensland	14,220	3	0
Auckland	14,101	2	8
Nelson	14,550	2	8
Sydney	15,352	3	0
Bermuda	4,000	2	6
Jamaica	5,264	2	6
Colon	5,894	2	8
Barbados	6,542	2	6
Trinidad	6,621	2	6
Pernambuco	4,606	1	7
Rio de Janeiro	5,973	2	7
Montevideo	7,135	2	9

In 1912 a system of half rates for plain-language cablegrams deferred in transmission for 24 hours was introduced after many years' outside pressure. This reform marks something of an epoch in the history of cable telegraphy, and has, in due course, become universal. Week-end cablegrams at a reduced rate were also introduced a little later, this being further supplemented by reduced rates for press messages between Britain and her Dominions. There is also now the "cable letter" service which offers even more favourable rates.

With practically all the great cable companies, the tariffs were maintained throughout the war at the same normal figure, whilst considerably more business was done than under peace conditions. A great increase in Government messages occurred, and the suspension of private codes added vastly to the length of most business telegrams, not to mention the continuous flow of extensive press "cables" relating to the war. Then, again, an enormous number of messages were sent such as in normal times—free from postal shortcomings—would be limited to ordinary written correspondence or to "deferred" traffic, which was abandoned by most of the cable companies throughout hostilities. The net result was that these organizations, unlike railway companies, not only maintained their reserves, but very materially added to them during the war. The best explanation here is to be found in the fact that cable repairs to be faced after the long period of warfare were altogether abnormal, though it must be remembered most of the companies concerned already had enormous reserves. The principal exception is the case of the Central and South American Telegraph Co., combined with the Mexican

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[1] Some of the more recent reductions may possibly be due in part to the competition—such as it is—of wireless telegraphy.

Telegraph Co. (the former operating what are now known as the All-America Cables), which, during the war, made large reductions in their tariff, even though, on the greater part of their route, holding a monopoly. The directors expressed their conviction that (*a*) the cable performs a very special mission during warfare, and (*b*) it plays a highly important part in the fostering of trade relations. They were, therefore, determined to aid in every way possible the efforts to maintain and extend the already large trade between the United States and the countries of Central and S. America.

It must not be forgotten that an essential accompaniment to a low telegraph tariff is many more communicating strings; otherwise, the congested condition only becomes worse congested. On the other hand, it is also only by great developments—of one sort and another—in our means of communication that an increased, as well as cheaper, telegraphic output can be secured.

Nationalization.—One result of the Dominions Royal Commission's exhaustive inquiry was the following expression of opinion.[1] "We feel bound, however, to record our opinion that at no distant date the nationalization of the private cable companies will become one of the most urgent problems for statesmanship." Their report states further:—"It appears difficult, if not impossible, to attain the desired cheapness of cable communication, as to the importance of which we hold the strongest views, without interfering with the rights of private companies." Again:—"The urgency of placing cable communication on such a footing that it would be available, not only to the rich, but to all classes, not only to the merchant, but also to the private individual, is manifest and imperative."

But it must not be forgotten that the world is indebted, in the first instance, to the enterprise of private companies for the establishment of submarine cable communication. Some of the companies have certainly been assisted in their enterprise by large Government subsidies.[2] Moreover, these companies have met with rich returns over their enterprise.

Telegraph Control Board.—Whether State ownership should ever be adopted by a country is, of course, a large question, but it seems obvious that in national and imperial interests a measure of State control is desirable in the matter of inter-imperial communications generally. A controlling organization of one sort or another appears to be called for, if only for watching and securing public interests, where clashing with private interests, in return for favours granted by the State.

In the case of Great Britain there are no less than seven Government departments (in addition to the Treasury) concerned in this matter. Hitherto one of these alone (the Post Office) has been acting for the Government, and all questions regarding other departmental interests had to be submitted to the Post Office. This was never very satisfactory in the result.

A British inter-departmental board to deal with inter-departmental telegraphs of all sorts has been advocated for many years. By this scheme, all the Government departments concerned were to be represented and to meet periodically to discuss and settle all important matters as they arose. The war made it clear to the British Government that something of the sort was necessary; and Jan. 1 1919 saw the establishment of such a committee, the whole coming under the *aegis* of the Committee of Imperial Defence. Such a control board, or committee, becomes increasingly desirable in these days of wireless development, for a nice sense of impartiality and discrimination may be required for deciding what should be effected by cable and what by wireless.

Working Developments.—The development of the art of submarine telegraphy was considerable during 1907–21—not so much in relation to the cable itself as to the electrical apparatus for working it. These include the introduction of automatic relays (associated more especially with the names of the late Dr. Alexander Muirhead, F.R.S., and Mr. S. G. Brown, F.R.S.) on the Eastern, Western Union, All-British and Commercial-Pacific cables, as well as other wide-spread cable systems.

These have almost entirely superseded manual retransmission between cable sections. Secondly, the introduction of magnifiers (or amplifiers, as they are sometimes called), by rendering the signals more legible, has enabled the carrying capacity of the cables to be enormously increased, at the same time adding to their reliability in the matter of accuracy. Such devices are based on the published experiments of Charles Curtis in the United States and Edward Raymond-Barker in England, and emanate in turn from K. C. Cox, T. B. Dixon, Walter Judd, Angus Fraser, E. S. Heurtley and Axel Orling. The Heurtley magnifier has been very widely adopted by the Pacific Cable Board, the Eastern Association Companies, etc. In vastly improving the character of the signals, this type of apparatus achieves the net result of adding to the effective working speed in the same degree. Indeed, the later results with the Orling magnifier point to a speed increase of as much as 200 per cent.

Thirdly, automatic printing apparatus has been introduced on the land lines worked in conjunction with cables. This apparatus is for the most part due to Mr. F. G. Creed.

Then again, Maj.-Gen. G. O. Squier, Chief Signal Officer of the U.S. army, has experimented with alternating current generators for cable telegraphy, and his researches point to results of a highly advanced—as well as revolutionizing—character.

The Imperial Cable section of the "All Red" route is associated with some of the latest developments in cable telegraphy. The transmission both at London and Halifax is effected by what are known as converter cable transmitters. These are entirely automatic in their working, and, by the use of a switch, will take either Morse or cable type of perforation. There are automatic repeaters at each of the intermediate stations. One of these sections, *i.e.* Bamfield–Fanning, 3,458 n.m., is the longest existing cable length, and has always been a source of great difficulty in the matter of speed as well as from a commercial point of view generally. In the circumstances, the results that have been achieved, by means of recent electrical devices, are very remarkable. It is, indeed, highly creditable that the score of a cricket match can be got through from Melbourne to London within 15 minutes, despite the six intermediate retransmitting points, over so great a total length. A few years earlier, such retransmissions were always effected manually. Now, however, automatic (machine) repeaters are gradually becoming general for all extensive systems with a number of intervening cable sections. The average duplex working speed on the entire route (controlled by that of the long section) was formerly 18 words per minute,[3] but it has been very considerably increased by means of the Heurtley amplifier or magnifier. Something like a 40% increase in the simplex working speed (or 20% duplex) is claimed on this apparatus, which converts the microscopic signals associated with a long cable worked at high speed into characters of reasonable size. On the Atlantic sections some of the very latest devices have been introduced for the purposes of efficient and high speed working, such as had previously been adopted by the Eastern Associated Telegraph Companies. In the main, the plan is that of Morse working in connexion with the Gulstad Relay, so that the speed of connecting land lines is brought up to that of cable code working.[4] The Eastern Compa-

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[1] Final Report (Cd. 8462 of 1917).

[2] These are as follows:—

Name of Company	Amount of Subsidy	Period of Subsidy	Cables for which Subsidy granted
	£		
Eastern Telegraph Co.	4,500	20 years from April 24 1901.	Sierra Leone-Ascension.
Eastern & S. African Telegraph Co.	28,000	20 years from Nov. 1893.	Zanzibar-Seychelles-Mauritius.
	13,500	20 years from Jan. 1 1900.	Three S. African cables.
Eastern Extension Co.	4,000	Indefinite.	Chefoo-Weihaiwei.
Direct West India Co.	8,000	20 years from Feb. 1 1898.	Bermuda-Jamaica.

[3] Nearly all long cables are now worked on the duplex system.

[4] On the Indian Government (Persian Gulf) system between Basra and Karachi, the speed for land line Morse was actually raised from 35 to 75 words per minute.

nies have further greatly added to the efficiency of their system by means of the Creed Printer, which is also installed on the Atlantic section of the "All Red" route, as well as in connexion with Wheatstone high-speed working on the Pacific cable land line system between Melbourne and Sydney.

A Stock Exchange Telegraph Service of a highly efficient order was established some years ago between London and New York. So efficient is this that messages are got through within ten minutes. Something like 2,500 such messages are transmitted between the two Stock Exchanges during an afternoon.

Cables and Commerce.—In pre-cable days each country was, in large measure, an independent commercial unit. The submarine cable has done much to alter that state of things. Whereas in 1870 the total value of the commerce between the United States and Great Britain was about £90,000,000, in the fiscal year ending June 30 1920 it was as much as £525,000,000. Besides the enormous increase in volume of business brought about by the extension of telegraphic service across the oceans, this quickened communication has also brought a complete change in business methods. It has, indeed, introduced an element of stability into international trade such as was seriously lacking when intercourse depended solely on the mail.

The World War has tended also to increase cable traffic because of changed business habits. During the early months of the conflict a rigorous censorship on cable messages was enforced by the Allied Governments. At first codes of all kinds were prohibited, and although this regulation was subsequently modified to allow the use of ordinary commercial codes, private codes and lighter messages were stopped. As a result, many business firms discovered that for much of their cable business the time and labour spent in coding and decoding—as well as the errors which are inevitable in the transmission of unintelligible matter—made messages in plain language only slightly more expensive than code. The result after the war has been a considerable increase in the percentage of plain-language messages. Another factor in the greater traffic has been the increased use of the cables for transactions which were formerly carried on by mail. This has been due partly to changed conditions which have made speedy communication more than ever necessary, and partly to the fact that the business houses, which were forced to increase their use of the cables during the war, have continued to do so on discovering the great convenience of cable communication in comparison with the mail.

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SUBMARINE CAMPAIGNS.—At the beginning of the World War the submarine was a comparatively new weapon of untried possibilities, whose ultimate place in naval warfare it was hard to foresee; and there ensued a period of tentative effort, confined at first to the North Sea, which lasted from Aug. 1914 to Feb. 1915. Germany started the war with 28 submarines, but the unreliable nature of the Korting engines fitted in the first 18 boats (U1–U18) had given her a low opinion of their merits. This was accentuated by the result of the first operation of the war consisting of a sortie by 10 boats up the North Sea, in which U15 was rammed by the light cruiser "Birmingham" on Aug. 9 1914 and U13 disappeared. On the British side some 56 submarines were available, the newest boats of the D and E class being attached to the 8th Flotilla (18 boats) employed under Commodore Roger Keyes in guarding the approach to Dover Straits with a couple (E6 and E8) reconnoitring in the Bight.

Early Days of the War.—Submarines did not play a decisive part in the Heligoland Bight action on Aug. 28. The six British submarines present were disconcerted by the unexpected appearance of British light cruisers, and the German submarines were retained off Heligoland guarding the approach to the rivers. The first British warship to be sunk by submarines was the "Pathfinder," a small cruiser torpedoed by U21 (Otto Hersing), off the Forth on Sept. 5, an incident which aroused little comment beyond emphasizing the danger of old ships patrolling on regular beats. The sinking of the "Cressy," "Hogue" and "Aboukir" off the Dutch coast on Sept. 22 1914 was a much heavier blow. They had been sent to patrol on the Broad Fourteens, between England and Holland, and were steaming slowly in line abreast two miles apart at 6:30 A.M. when the "Aboukir," "Hogue" and "Cressy" were torpedoed in quick succession. This was the work of Otto Weddingen in U9, and the wholesale disappearance of Cruiser Force C within an hour with a loss of over 1,400 men came as an unpleasant shock, and definitely established the power of the new weapon. By the end of Sept. submarines were pushing past Dover Straits into the Channel, and on Oct. 16 1914 the fear of the new weapon reached a climax, when on a false alarm of one in Scapa Flow the British Grand fleet hastily put to sea at night and proceeded to Lough Swilly where by a freak of misfortune the "Audacious" ran on a mine and was lost. Oct. 20 1914 had seen the sinking of the first merchant ship, the ss. "Glitra," off Norway by U17, but it was not until Nov. 23 that U18 actually attempted to enter the Flow. The Grand fleet were at sea at the time and U18 was rammed by a minesweeper, the "Dorothy Gray," close to the Hoxa entrance. She went down to 11 fathoms with her hydroplanes damaged, and coming to the surface later was rammed by the destroyer "Garry" and forced to surrender, the first and (with the exception of UB116 in 1918) the last attempt to enter Scapa Flow.

Defensive Methods.—The war found the British navy almost destitute of defensive methods against the submarine. A committee had sat on the subject but had evolved nothing but the modified sweep—a somewhat clumsy contrivance consisting of a line of explosive charges towed astern, regulated in depth by a water-kite and fired from inboard. The defence of Scapa had been mooted as early as 1912, and Adml. Jellicoe, then at the Admiralty, had taken an important part in discussions on the subject, but nothing had been done beyond allocating a small sum for the purpose in 1913, which was diverted to Dover to build a wall on the breakwater, in pursuance of the pre-war tendency to try and fit prospective wars into the existing naval ports. By the end of 1914 Cromarty had been supplied with Capt. Donald Monro's boom, but Scapa with all its entrances was not secure till Feb. 1915. Counter measures at this stage of the war were confined to an extensive development of the Auxiliary Patrol organization, the tentative supply of defensive armament to merchant shipping, and the equipment of a comparatively small number of vessels with the modified sweep. The trawlers of the Auxiliary Patrol played an important part in minesweeping and in escort work, but were too slow and too poorly armed to be really effective in offensive operations against the submarine. By the end of 1914 the submarine was generally recognized as a new and powerful weapon in naval warfare, though its tremendous potency as an instrument of the *guerre de course* had not been fully realized. Germany had lost 7 and with the addition of 11 had 30 now available, with 42 U boats and 127 UB and UC under construction and on order. Von Tirpitz, fully alive to their possibilities, was already building great hopes on them.

The early morning of New Year's Day 1915 saw the old battleship "Formidable" (Capt. A. N. Loxley) fall a victim to U24 off Start Point while patrolling up and down with the Channel fleet at 10 knots. The captain went down with the ship. Only 141 were saved out of a crew of over 800, and the incident demolished once and for all the opinion of a certain school of naval thought that the submarine could be ignored.

They were now going farther afield. Otto Hersing in U21 made his first cruise to the Irish Sea in Jan. 1915, and this month too saw the first instances of a ship being torpedoed without warning in the case of the British s.s. "Tokemaru" and s.s. "Ikaria" off Havre on Jan. 30 by U20 (Schwieger, who was to earn an unenviable reputation for ruthless warfare).

Campaigns of 1915.—Feb. 4 1915 saw the close of what may be termed the preliminary phase of submarine warfare. The German naval staff now decided to conduct a general campaign against merchant shipping, and on this date the German Government issued a declaration constituting all waters round Great Britain and Ireland a war zone (*Kriegsgebiet*), in which from

Feb. 4 all enemy merchant ships would be destroyed without it being always possible to avoid danger to passengers or crew, and where even neutral vessels would be exposed to danger of attack. This evoked on Feb. 11 a strong protest from the United States denouncing it as an indefensible violation of neutral rights. The date was postponed to Feb. 18 and the order modified to the extent that neutral ships were to be spared, though in adjudging their neutrality all circumstances and not the flag only were to be taken into account. March 18 1915 saw the end of Otto Weddingen in U29 which was on her way home round Great Britain, about half-way between Kinnaird Head and Norway, when she was rammed by the battleship "Dreadnought" after attacking the battleship "Marlborough." The inauguration of the new campaign was followed in March by the establishment of the Flanders flotilla, which at first consisted of small UB and UC boats working chiefly round the Thames and east coast. By Oct. 1915 it had grown to 16 boats, and was contributing a fair proportion of the ships sunk.

The Flanders flotilla had hardly started its career when it met with a formidable obstacle in Dover Straits. Experiments had been proceeding for some months in the use of steel wire nets to indicate and obstruct the passage of submarines, and the admiral at Dover (Rear-Adml. Hon. Horace Hood) now succeeded in closing the Straits by this means for over four months. The nets used were in lengths of 100 yds. and 60 or 30 ft. deep, shot by drifters, and by Feb. 13 1915 he had some 30 drifters riding to their nets in the Straits. Bad weather took a heavy toll of the equipment, but the results were surprisingly successful to an extent hardly appreciated at the time. U8 fouled one of these nets on March 8 1915 off the Varne and was forced to come up by the destroyer "Ghurka," which exploded a modified sweep over her. U37 went down the Channel later in the month and never returned. Early in April U32 got caught in a net, and had so much difficulty in getting clear that she went home northabout. She drew a formidable picture of the obstruction, and on the strength of her report the Bight flotillas received instructions to go northabout, and the Flanders boats following their example also eschewed the Straits for over four months. It was thought at first that in the net a permanent antidote to the submarine had been found, and net bases were established at several ports, particularly at Larne for the North Channel, but technical difficulties (clips and indicator buoys) supervened, and the Germans overcame the lighter form of net by net cutters.

The sinking of the liners "Falaba," "Lusitania" and "Arabic" constituted three beacons in the 1915 campaign. The former, an Elder Dempster liner of 4,806 tons on the way to Sierra Leone, was torpedoed with five minutes' warning on March 27 by U28 off the south of Ireland, and sank in eight minutes with the loss of over 100 lives. The indignation arising from this incident had hardly subsided when it was fanned to fever heat by one of the most momentous incidents of the war. On May 7 1915 Schwieger in U20 was off the Old Head of Kinsale (south of Ireland) when he sighted a great liner homeward bound. This was the "Lusitania" going only 18 knots, her decks crowded with women and children. At 2:15 P.M. he sent two torpedoes into her without warning and she went down in 20 minutes with the loss of 1,198 lives, while Schwieger "moved with mixed feelings" watched the terrific scene. A chorus of applause arose in Germany, but the deed can be seen now as an error of the first magnitude, which set on foot the whole train of circumstances which brought America into the war. The controversy between the German naval staff and the Chancellor immediately reached a crisis. The latter refused to be responsible for such acts, and on June 5 1915 an imperial order was issued forbidding the sinking of large passenger vessels. Von Tirpitz, the Secretary of State, was furious, and he and Bachmann, the chief of the naval staff, both sent in their resignations, but were commanded bluntly to remain at their posts.

Meanwhile Otto Hersing, the pioneer in distant fields, had sailed on April 25 in U21 for the Mediterranean. Arrangements had been made to provide him with oil on the way, probably in the vicinity of Tangiers, but they broke down, and he arrived at Cattaro on May 13 with only half a ton of oil fuel left. He reached the Dardanelles on May 25 and instantly made his presence felt. The "Vengeance" was missed by a torpedo that day; the old battleship "Triumph" supporting the Anzacs off Gaba Tepe was hit by two torpedoes at 12:30 P.M. and turned turtle in nine minutes with a loss of over 200 lives. Two days later (May 27) the "Majestic," supporting the troops inside the Straits, was hit and capsized with the loss of 49 men. The whole system of naval bombardment received a severe shock, though it was not till Aug. 13, when the "Royal Edward" was sunk near Kos by UB14, that the transports began to suffer.

By this time another counter to the submarine had been found in the decoy ship, whose early type consisted of trawlers or vessels with submarines in tow. Three submarines were sunk in this way during the summer of 1915 (U40 on June 23 by C24, U23 on July 20 by C27, and U36 on July 24 by the "Prince Charles"). Aug. 19 1915 saw the destruction in the approach to St. George's Channel by the decoy ship "Baralong" of U27, while she was attacking the "Nicosian." Several German sailors had boarded the latter vessel, and the American cattlemen in her, when they saw the submarine disappear, fell on them and threw them overboard. Germany gave vent to a roar of indignation, undisturbed by the fact that the very day U27 was sunk U24 (Schneider) met the White Star liner "Arabic" outward bound off the south of Ireland and sank her without warning with the loss of 44 lives. Indignation in America flamed up anew. Again at great headquarters von Tirpitz wrestled with the Chancellor and again the Chancellor won the day. The use of decoy ships and defensively armed merchantmen, by increasing the danger of coming to the surface, provided the German naval staff with a strong argument for unrestricted warfare, but the imperial decision went in favour of the Chancellor, and orders were issued on Aug. 30 that no liners were to be sunk without warning and due regard for the safety of passengers. This was a bitter blow to the partisans of submarine warfare, and Adml. Bachmann, the chief of the naval staff, who had not been consulted on the issue, resigned and was succeeded by Adml. von Holtzendorff. The commander-in-chief of the High Sea fleet, Adml. von Pohl, also asked to be relieved, but to no purpose. He was told he did not understand the political situation. On Sept. 20 1915 further orders were issued to suspend submarine warfare on the west coast and in the Channel. The campaign now languished in British waters. From Sept. 1915 to Feb. 1916 activity against merchant shipping practically ceased in the Bight and was transferred to the Mediterranean.

During the year Feb. 1915 to Jan. 1916 a total of 394 Allied and neutral ships had been sunk by submarines with a gross tonnage of 1,059,141 tons; of these 225 (760,440 tons) were British, 54 of which had been sunk in the Mediterranean. Some 60 merchant ships had been sunk without warning during the year and 17 submarines had been destroyed, an average of one submarine for 23·1 ships.

The Baltic.—Meanwhile British submarines had been active in the Baltic and the Dardanelles, where a great field had opened to British heroism. In the Baltic E9 (Comdr. Max Horton) and E1 (Comdr. N. F. Laurence) were the first to penetrate early in 1915, and proved a valuable addition to the Russian (Adml. Essen's) force. On July 2 1915, when the Russians sank the minelayer "Albatross," E9 sent two torpedoes into the old cruiser "Prinz Adalbert" and drove her back to port. On Aug. 4 1915 E13 ran ashore on the Danish island of Saltholm while passing the Sound. Before the 24 hours given her by the Danes to get off had elapsed two German destroyers appeared and, opening fire on her, killed half the crew, an act which did not pass unavenged. The Germans at the time were making a determined attempt to force the Gulf of Riga with a view to operating on the Russian flank, and the battle-cruisers of the 1st Scouting Group with the 1st Battle Squadron and a number of light cruisers had been lent for this purpose by the High Sea fleet. E1 now appeared on the scene, and the very day that E13 received its deadly hail of fire sent a torpedo into the battle-cruiser "Moltke" off the Gulf of Riga, driving her back to port.

Winter did not stop the activity of the British submarines. In the latter part of 1915 E8, E9 and E19 (Comdr. F. A. N. Cromie) attacked the important iron ore trade from Lulua (Sweden) to Germany, and between Oct. 11 and 23 sank 14 large German steamers engaged in it. The "Prinz Adalbert" too was sunk by E8 on Nov. 8, and on Dec. 12 the light cruiser "Bremen" and destroyer V191 were sent to the bottom. The Germans now set to work vigorously to devise counter measures. Minefields were laid in the Sound off Drogden, in the Flint-Rinne at the southern end of the passage on the Swedish side and at Falsterbo; an old battleship was stationed to defend them; torpedo flotillas were despatched to patrol the entrance to the Baltic, and convoy flotillas were organized for the Swedish trade with the result that British submarine activity suffered a severe check and the difficulty of entering the Baltic was greatly increased. The work of submarines there was also seriously hampered by the inability of the Russian dockyards to cope with their demands, an unmistakable indication of the probable failure of any attempt to conduct a big campaign in that sea.

The Mediterranean.—In the Mediterranean the ability of submarines to assist the Dardanelles campaign by interfering with Turkish transport in the Sea of Marmora was fully realized, but the passage of the Dardanelles was not an easy proposition. Twenty-seven miles long with a width of only a mile in the famous Narrows (the $3\frac{1}{2}$ m. stretch between Chanak and Nagara) lent itself easily to defence, and could be transformed into a veritable trap for submarines. It is impossible to give the details of every passage where every passage was an heroic venture. Lt.-Comdr. Norman Holbrook had made the passage on Dec. 11 1914 in B11 and torpedoed an old battleship, the "Messidiyeh." E15 (Lt.-Comdr. T. S. Brodie) was now the first to go up on April 15, but grounded in Kefez Bay (on the Asiatic side some 10 m. up) and was lost, his ship being torpedoed later by a picket boat under Lt.-Comdr. Eric Robinson, to prevent it falling into the hands of the Turks. E14 (Lt.-Comdr. E. C. Boyle) followed, passing Chanak on the surface and running submerged for forty-four hours. She sank three ships, including the transport "Gul Gemel" with 6,000 troops, bringing her commander a V.C. AE2 (Lt.-Comdr. H. H. G. Stoker) made the passage on April 25, diving under the minefields, but on the 30th broke surface suddenly, and coming under fire was forced to the surface and sunk. On May 1 the French submarine "Joule" attempted the passage and succumbed to a mine. E11 (Lt.-Comdr. M. E. Nasmith) passed safely at the end of May, sank 10 ships, penetrated into the Bosporus and torpedoed the transport "Stamboul" and an ammunition ship there. Passing Kilid Bahr on his way back, her commander found a large mine perched in the bows which he dropped neatly by dipping and going astern, and won a V.C. in its place. E12 (Lt.-Comdr. Kenneth M. Bruce), E7 (Lt.-Comdr. A. D. Cochrane), E2 (Comdr. David Stocks), E20 (Lt.-Comdr. C. H. Warren) and H1 (Lt. Wilfred Pirie) followed, doing the same heroic work in difficult and dangerous waters. E14 was up again in July and sank 22 ships, great and small, including a 5,000-ton steamer on Aug. 7, and clearing the Sea of Marmora. He was assisted in this task by E11, who sank the old battleship "Hairredin Barbarossa" the same day and the transports "Chios" and "Samsoun" with the ammunition ships "Espahan" and "Tenedos" a week or so later. By this time a powerful barrage had been laid at Nagara, greatly increasing the risk of the passage. The French submarine "Marriotte" encountered an enemy submarine and was sunk (July 26) and E2 on her way in got badly entangled in the Nagara obstruction, but managed after 10 minutes' plunging about to get clear. E7 was not so fortunate. Going up on Aug. 4 she got enmeshed in the nets, and after the explosion of three mines in her vicinity was forced to the surface and sunk. E12, who followed in Sept., remained up 40 days with E20 and H1 in her company for a time and sank 37 ships. On the way down she fouled a net in the Narrows and went down to 245 ft., with the hydroplanes jambed and the conning tower flooded; finally she struck the chain moorings at Kilid Bahr which swept away the entanglement, and though she broke surface and came under fire managed to win through. The French submarine "Turquoise" was sunk by gunfire on Oct. 30 1915, and a final toll of British boats was taken in E20 (Lt.-Comdr. C. H. Warren) which fell a victim to stratagem after passing through the Narrows. With the help of an Allied code probably taken from a captured submarine she was inveigled to a rendezvous and torpedoed by UB14 on Nov. 6. E11 remained up a record period of 48 days in Nov. and Dec., sinking 46 ships of different sizes. The last submarine to make the hazardous passage was E2, which was recalled on Jan. 2, a week before the final evacuation, and got safely through.

For the latter part of the year 1915 two submarines had usually been working in the Sea of Marmora at a time. Altogether some 32 passages had been made or attempted by submarines, and though they had incurred the loss of 7 of their number (E15, AE2, E7, E20, "Joule," "Mariotte" and "Turquoise," their efforts had met with a large degree of success. The Sea of Marmora had been made unsafe, the Turks had been forced to send their troops by a roundabout route—by rail to Rodosti and then a three days' march to Gallipoli. Their tale of losses included two old battleships, one destroyer, 12 sloops and small craft, 7 transports, and no less than 197 vessels of all sorts and sizes, steam and sail, of which 36 were over 1,000 tons. This was the end of the Dardanelles submarine campaign, whose record fills a golden page in the annals of the navy.

In the autumn of 1915, when activity in British waters diminished, five more German submarines were sent to the Mediterranean. With them went Max Valentiner in U38 and Arnauld de la Perière in U35, two of the most distinguished German submarine commanders. The result was immediately evident. Valentiner, on his way from Gibraltar to Cattaro alone sank a round dozen of ships, including the Italian liner "Ancona" with a loss of over 200 lives, and the sinkings in the Mediterranean in Nov. went up to 23 chiefly off Crete, Malta and Tunis. They were nearly all merchant ships. No more men of war fell to them, and out of 242 transports only three were lost, the "Royal Edward" (Aug. 13, loss of life 955), "Ramazan" (Sept. 19) and the "Marquette" on Oct. 23. On Dec. 30 1915 Valentiner sank the P. & O. liner "Persia" (7,974 tons) off Crete without warning with a loss of 334 lives, but Germany refused to admit that it was one of her submarines and tried to transfer the responsibility to Austria. This brought the year 1915 to an end, a year fertile in hope and speculation, begetting vast promises of further success. To all Germany the future of her navy lay beneath the waters, though few could read the riddle as far as the bottom of Scapa Flow.

Types of German Submarines.—A short digression may be inserted here on the general types and characteristics of German submarines. They comprised four main classes—converted mercantiles (Deutschland class), U boats, UB and UC. The converted mercantile numbered a bare half-dozen (U151–U155) and were used chiefly off the Azores and in 1918 off the coast of America. They were about 213 ft. long, large, slow and clumsy, going about nine knots only on the surface, but capable of remaining out for three to five months. They had a good armament of two 5·9-in. guns, six torpedo tubes (4 bow, 2 beam) and 30 torpedoes. The U boats were the principal type, and were large boats which did most of their work in the Atlantic approaches. They were 210–225 ft. long, could go $14\frac{1}{2}$–17 knots on the surface, and 8–9 knots submerged. They could only maintain this speed submerged for an hour or so, but could continue at a speed of about two knots for as much as 48 hours; then, like all submarines, they had to come to the surface and recharge their batteries with the help of their Diesel motors. They carried two guns (usually one 4·1 in. and one 22-pounder), with 4 to 6 torpedo tubes and 8 to 12 torpedoes, and remained out generally from 25–30 days. There was also a special class of U minelayers, which originally numbered 10, viz. U71–U80, carrying 36 mines and 2 torpedoes. They had only a single hull and were slow boats, rarely cruising at more than 5 knots. Though the work on the west coast of Scotland and off the Dutch coast in 1918 was done by these boats they were not as a class very successful, and by 1918 there were only 5 of them left. The UB boats were originally built for coastal work, and the first 17 were small boats capable of being sent in sections overland. The earlier boats could remain out from 7–14 days, the later boats from 14–24 days. They carried one gun forward (a 4·1 in. or 22-pounder) and the earlier boats 2 to 6 torpedoes, which were increased to 5 tubes (4 bow, 1 stern) and 10 torpedoes in the later type. The UC boats were essentially minelayers, carrying one 22-pounder forward, 3 tubes with 4 to 6 torpedoes, and 18 mines. They remained out from 10–20 days in the North Sea, but when working in the Channel from Flanders rarely more than twelve. Submarines cruised normally on the surface. When attacking they usually proceeded at periscope depth (about 45 ft. for U boats), cruising at 65–85 ft., and going to 150 ft. if attacked. The fact that a periscope was rarely visible, even with glasses, at over a mile, emphasizes the difficulty of counter-attack.

German Submarine Flotillas.—The flotillas were distributed in four principal commands—the North Sea (or High Sea fleet) flotillas working from the Bight and usually termed the North Sea flotillas; the Flanders flotillas working from Zeebrugge; the Mediterranean based on Pola, Cattaro and Constantinople, and the Baltic (or Kurland) flotilla working from Baltic ports. The Flanders flotilla consisted wholly of UB and UC boats and was allotted a definite area of operations, which extended on the east coast of Great Britain as far as Flamborough Head (Yorks), and in the Channel as far as 7° W. (about as far as Waterford) and down to the Gironde. At the beginning of the year 1916 the strength of the various flotillas was approximately North Sea 16, Baltic 6, Flanders 18, Mediterranean 12. There were 16 boats approaching completion, and 161 boats building and being delivered at the rate of 8 to 10 a month.

Campaign of 1916.—The year 1916 was marked by another long-drawn-out controversy between the German Chancellor and the naval staff. The Chancellor stood out against unrestricted naval warfare (that is sinking at sight); the naval staff fought for it. Nor were their arguments lacking in force. If a submarine came to the surface at a distance a ship could run away, if it rose close at hand it was exposed to fire from an armed merchantman or decoy ship. In Jan. 1916 the German naval staff presented a memorandum claiming that unrestricted warfare would force England to make peace in six months. It stated that from Feb. to Oct. 1915 one or two steamers, averaging 4,085 tons, had been sunk daily by each submarine. This was an exaggerated estimate, for the figures for British ships in 1915 were more nearly one-third of a ship per submarine per day, but on this basis they calculated a loss of 631,000 tons a month, at which rate it was estimated that England would be reduced to her knees in six months. A definitive audience took place at Great Headquarters on March 6 1916, when it was decided to postpone its execution till April 1 in order to bring all possible means of persuasion to bear on the United States in the attempt to reconcile them to the idea.

Von Tirpitz, in despair at the continual frustration of his plans, resigned, and his place was taken by Adml. von Capelle. Five days before the prescribed date UB18 (Steinbrinck) torpedoed the "Sussex" on March 24 1916 on her way from Folkestone to Dieppe with 25 American citizens on board; and though she remained afloat, the forepart of the vessel was blown up and some 80 passengers were killed and injured. America's patience now came to an end, and on April 18 President Wilson threatened to break off diplomatic relations. The German Government gave way, and abandoning the idea of ruthless warfare issued an order on April 25 precluding submarines from sinking any merchant ship at sight, and requiring them in their war against trade to act in strict accordance with the methods prescribed by prize law, which entailed stopping a ship, examining her papers and giving all the crew and passengers an opportunity to leave her before proceeding to any act of destruction.

Meanwhile the chief of the naval staff at Berlin had issued an order, which came into force on Feb. 29 1916, that armed merchantmen were to be regarded as warships, and the attention of German submarine commanders was called to a clause in the prize regulations under which all merchantmen which might attack a German or neutral ship were to be regarded as pirates. This found its sequel on March 28, when Capt. Fryatt in his ship the "Brussels" attacked U33 on her way to Holland, and, being captured with his ship by a German destroyer on June 23, was tried and shot (July 27 1916).

The decision against unrestricted warfare came as a bitter disappointment to Adml. Scheer, who received the order on his way to carry out the Lowestoft raid on April 25 1916. He immediately recalled all the High Sea fleet submarines and ordered them to cease operations against merchant shipping. He refused to have anything to do with what he called the blunt edge of the weapon, and had decided that if they were not to be used in unrestricted warfare he would use them only in fleet operations. The Flanders command followed suit with most of its boats, and the Mediterranean flotillas were left to continue the campaign against commerce alone. Just as Adml. Scheer's order went out an extensive barrage was being laid off the Belgian coast (April 24) by the Dover Patrol (Vice-Adml. Sir Reginald Bacon). This was an effort on a large scale to cope with the submarine by a combination of mines and mine-nets. It consisted of some 18 m. of moored nets fitted with net mines, supported by lines of mines, running parallel to and about 12 m. off the Belgian coast. It was completed by May 7 1916 and a patrol was maintained on it by day from May to October. It is difficult to estimate its precise value, for the diminished activity ascribed to it at Dover was undoubtedly due to the cessation of submarine operations on political grounds from May to Sept. 1916. No doubt it made work more difficult for Flanders submarines, but the mines were poor and notoriously ineffective. A single boat (UB3) was destroyed in its vicinity the day it was laid by a lance bomb thrown from a drifter, the "Gleaner of the Sea." Another (UB10) ran into it and took eight hours to clear with net mines exploding all round her, and though the work entailed in the barrage deserves a generous meed of praise no submarine was actually destroyed by it in 1916, and it certainly never prevented the entry and exit of the Flanders boats.

Steinbrinck, of the Flanders flotilla, was now sent to cruise in the Channel to report on the feasibility of warfare on the lines of prize law, which involved the stoppage and due warning of ships before destruction. His report was unfavourable, and during the summer the Flanders boats worked only on the E. coast. Scheer meanwhile used his Bight flotillas (reinforced with Flanders boats) in fleet operations, of which the most important were those of Jutland and Aug. 19, when the "Nottingham" and "Falmouth" were sunk by U52 and U66. It was on this latter occasion that E23 (Lt.-Comdr. Robert Turner) torpedoed the German battleship "Westfalen" on its way out of the Bight. This was at 5:30 A.M., and on rising to the surface later at 10:10 A.M. he reported the German fleet to the C.-in-C., then some 180 m. off, an incident which first brought into prominence the possibilities of the submarine in fleet reconnaissance work. During the summer the chief of the German naval staff was trying to persuade Scheer to modify his "harsh professional conception" of submarine warfare, and resume restricted war against commerce in accordance with prize law. The Mediterranean submarines had continued working on these lines with good results; the Flanders flotilla had recommenced on a small scale in Sept. 1916, and the operations in concert with the fleet had only resulted in the sinking of two light cruisers. The "Deutschland," under Capt. Paul König, tried a trading venture across the Atlantic during the summer, reaching America on July 9 1916 and returning on Aug. 23 with a cargo of rubber, nickel, and tin, but the "Bremen" which followed her in Sept. was lost. U53, under Lt.-Comdr. Hans Rose, a skilful and chivalrous commander, crossed the Atlantic (leaving on Sept. 17 and arriving on Oct. 7) and sunk five merchantmen off Newport News. The "Deutschland" made a second trip across, arriving in New London on Nov. 1 and reaching Germany safely on Dec. 10 1916. There her mercantile career ended, and she was fitted out as a submarine-of-war and went off to work in the Azores. Archangel too became a sphere of activity for a time, and seven ships were sunk there in Oct., but the initial success did not continue, and in Nov. U56 was sunk by Russian patrols. The German naval staff now decided that all flotillas were to resume the campaign against commerce in accordance with prize law, and orders to this effect were issued on Oct. 6 1916. Scheer had underestimated the power of legitimate warfare. The monthly average of all Allied and neutral merchant ships sunk by submarines had been 76 ships and 153,521 tons (gross) from Feb. to Sept. 1916. From Oct. 1916 to Jan. 1917 the average rose to 173 ships and 346,405 tons, and the campaign was extended with success to the Azores, Canaries and Madeira, where Funchal was bombarded on Dec. 3 by a converted mercantile.

"Unrestricted" Warfare, 1917.—But during the autumn Scheer and the naval staff found powerful allies for the policy

of unrestricted warfare in Hindenburg and Ludendorff. The topic was again discussed on Sept. 3 1916 at Great Headquarters at Pless in the presence of the Chancellor, Hindenburg, Ludendorff and Adml. von Holtzendorff, and it was finally decided to postpone it till an effort had been made to come to terms. Then followed the note of Dec. 12 1916 calling on the Allies to avoid further bloodshed, and on Dec. 22 the naval staff presented another memorandum in which it was hoped to reduce British shipping by 39% in five months, on a basis of 600,000 tons monthly, an estimate which turned out to be excessive, for by June 1917 British shipping had been reduced only from 18·2 to 16·6 million tons, a reduction of only 9·1%. The offer to negotiate was rejected by the Allies, and it was decided on Jan. 9 to commence unrestricted warfare on Feb. 1 1917. All Germany was waiting for the decision. The Reichstag listened to the Chancellor's announcement in breathless silence, and on Feb. 3 the American ambassador left Berlin. Germany now had 148 submarines, of which 28 were in the Mediterranean and some 20 in Flanders. She had commenced with 28 and had lost 51. The repairs incurred at Jutland, the provision of patrol vessels and the vacillations of policy had reacted on submarine building, and von Capelle had only laid down 90 boats to Tirpitz's 186, but during 1917 269 more were ordered and it was hoped to keep pace with the demand. The barred zone announced by Germany on Jan. 31 1917 in which all shipping was liable to be sunk extended roughly from Terschelling (Holland) to Udsire (Norway), thence to the Faroe Is. and passing down the meridian of long. 20° W., 350 m. from the coast of Ireland, went on to Finisterre. It also included the Mediterranean with the exception of its western portion round Majorca and a narrow track 20 m. wide as far as Greece. The area round Archangel was added to it in March 1917, and on Jan. 11 1918 it was extended to the meridian of long. 30° W., 720 m. from the coast of Ireland, and two large areas were added round the Azores and C. Verde Is.

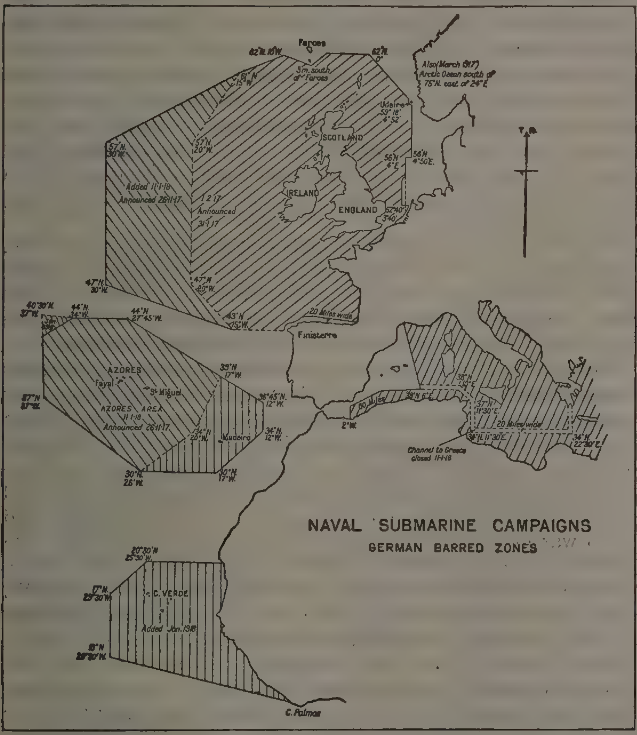

NAVAL SUBMARINE CAMPAIGNS
GERMAN BARRED ZONES

The effects of the new campaign were quickly felt. The system under which traffic approached Great Britain on routes patrolled by ships and trawlers with a sprinkling of destroyers proved incapable of meeting the emergency. Losses of Allied merchant ships rose from 171 in Jan. to 234 in Feb., 281 in March and 373 in April. This was the black month of the war. At this rate one ship in every four that left British shores did not return, and by Nov. 1917 the irreducible margin of shipping would probably have been reached. The effects were most severely felt in the Channel, Mediterranean and the routes south of Ireland (called the Fastnet and Scilly approaches), which were strewn with the hulls of sunken ships. The outlook was dark and perplexing to those who saw the Grand Fleet remaining mistress of a sea which was becoming a cemetery for British shipping, and had not realized the fact that the battle fleets were becoming subsidiary factors in a new form of the *guerre de course*. The efforts to deal with the situation took a threefold form. Firstly, a convoy system (*see* CONVOY) was introduced involving the escort of merchant shipping at sea and the control of all shipping movements; secondly, the naval staff was reorganized so as to insure a due status for the convoy system, and a planning section and anti-submarine division were added to it (*see* ADMIRALTY ADMINISTRATION); thirdly, invention and research were speeded up in the technical fields of mines, depth charges and hydrophones. These efforts were successful. Gradually the losses of ships went down and the losses of submarines crept up.

The enemy's operations can only be broadly described; his principal areas were the approaches to the Channel and Irish Sea, the North Sea (particularly off the Yorks. coast), the Channel and Mediterranean. The number of submarines operating varied. As a rule there might be two or three (converted mercantile) operating in the Azores and on the Dakar (W. Africa) coast, 8 or 9 U boats in the Atlantic approach (from longitude 7° to 12° W.) and on their way there and back, 4 or 5 (including a couple of Flanders UC) in the Channel and its approach, with 5 UB (Flanders) and 2 UC (Flanders) in the North Sea. In the Mediterranean there were usually 4 to 6 submarines at work, including 1 or 2 on the N. African coast, 1 or 2 round Italy, 1 perhaps off Salonika, 2 off Egypt, Syria and Crete. This gives a total of some 25–30 submarines at work. The tonnage sunk per submarine varied. Curiously enough the average bag was considerably more in the time of restricted warfare than it was in 1917–8. In the former period it was probably something like 16,000 tons a trip. U49 on her first trip in Nov. 1916 in the Channel and Bay of Biscay sank 40,000 tons, and Forstmann, Arnauld de la Perière and Max Valentiner in the Mediterranean thought little of 20,000 tons a trip in 1916. But in 1917 the average bag was probably not much more than 8,000 tons for a U boat and 3,000 for a UB or UC. In the North Sea in Jan. 1918 a U boat was fairly fortunate to get 4,000 tons, and in the Channel 6,000 tons had become a fair bag.

Progress of Counter Measures.—In the anti-submarine campaign great progress was made in technical devices, and larger depth charges were supplied in greater quantities. Type D charge (300 lb. T.N.T.) entirely superseded type D^x (120 lb.), and the output was increased. Destroyers carried five or six instead of one or two; some were equipped with as many as 20 or 30, and the number of submarines sunk by depth charges rose from 8 in 1917 to 15 in 1918. Decoys (generally designated Q ships) continued effective in 1917, and five submarines were sunk by them during the year. These were merchant ships manned with a trained crew and armed with guns carefully concealed by special devices. On a submarine opening fire the ship would stop and a portion of the crew called the "panic party" took to the boats, lowering them carelessly and hurriedly in the hope that the submarine would approach and board the vessel. If she did the bulwarks fell and a deadly fire was poured into her at close quarters. Capt. Gordon Campbell was the most successful exponent of this stratagem. U38 fell to his ship, the "Pargust," on Feb. 17 1917 off the southwest of Ireland, and UC29 was sunk by her on June 7 in the same area, bringing him a V.C. His last ship, the "Dunraven," sank on Aug. 10 after a heroic action with U61, in which the after gun's crew remained steady at their post with the poop blazing under them and were blown up with the gun rather than betray the nature of their ship. The "Prize," (Lt. Wm. Sanders) and the "Stonecrop" (Comdr. Morris Blackwood) were also gallant ships, the former sinking U88 out in the Atlantic on Sept. 17 and both being sunk by submarines. By Sept. 1917 the decoy had lost its efficacy, though four were still in use in the early part of 1918. From first to last it achieved the destruction of 13 submarines with the loss of some 20 decoy ships, great and small, some like the "Prize" and "Vala" with all hands. Its place was now taken by the seaplane and P boat. The latter were low boats not easily seen in mist or at dawn and were responsible for no less than four submarines in 1917. Aircraft now began to be really effective, and in 1917 six submarines succumbed to the 300-lb. bombs of large Handley-Pages in the southern portion of the North Sea. British submarines too were constantly on patrol, and were able to count six submarines to their credit by the end of the year (G13 sank UC43 off the Shetlands March 10; E54 U81 in the Atlantic May 1; D7 U45 north of Ireland Sept. 12; E45 UC79, Oct. 19; E52 UC63 Nov. 1, in the North Sea, and C15 UC65 Nov. 3, in the Channel). The hydrophone, an instrument designed to detect submarines by sound waves under water, also developed greatly, but was more useful as a detector and in controlled minefields than in actual pursuit.

The whole system of staff work was overhauled. Direction of convoys became one of the principal functions of the naval staff and the machinery of Intelligence was adjusted in this light. Intelligence of first-rate importance derived from wireless directionals had hitherto been shrouded in secrecy and locked away in drawers for the edification of the very few. The director of Naval Intelligence (Rear-Adml. Sir W. R. Hall) at last obtained control of it, and spread it abroad and circulated it to every command. The movements of all enemy submarines hitherto veiled in secrecy were displayed on a great chart in the Convoy room, and subjected to careful analysis by the new Plans Section. In Oct. 1917 this division prepared a large mine-net operation based on careful observation of submarine tracks in September. In spite of bad weather and unfavourable circumstances three large submarines (U50, U66 and U106) found their way into the minefield and were sunk, causing a scare in the Bight which sent submarines round by the Kattegat for the first time.

Plans were prepared too for mining the Bight, but it was not till Sept. 1917 that the new mines were ready in sufficient quantity. Gradually the whole strength of the High Sea fleet had to be concentrated on getting submarines in and out. An armada of minesweepers, barrier breakers, escort forces and outpost forces were constantly at work trying to keep a passage open for them along ways which extended as far as 150 m. from Heligoland. Dover still remained a thorn in the flesh. The cessation of submarine activity in April 1916 had been erroneously attributed there to the Belgian coast barrage, and a similar barrage had accordingly been laid across the Straits in the latter part of 1916. It was composed of mine-nets 60 ft. deep with a minefield in support. But the mines were of the old defective design. They dragged into the nets, sank British ships, and had to be swept up in June and July 1917. The barrage entailed enormous labour but did not close the Straits, and from Feb. to Nov. 1917 enemy submarines passed at the rate of at least 24 passages a month. This was a serious matter, for the Dover passage saved a Flanders boat eight days on the double journey to the Channel approach out of its trip of 14 days, and a Bight boat six days out of its trip of 25 days. In Oct. the whole question became acute, for Flanders boats were responsible for some 22 ships a month in the Channel. The proper antidote was a strong minefield, and the vice-admiral at Dover had suggested in July 1917 laying a deep minefield from the Varne to Gris Nez, but the new mines were not ready and could not be supplied to Dover till Nov. It was partly laid on Nov. 21, but it was not constantly and intensively patrolled so as to make the submarines dive, with the result that between Nov. 21 and Dec. 8 21 submarines made the passage in safety. This was a severe disappointment, and instructions were sent to establish a strong patrol equipped with flares and searchlights to force the submarines down. This was done to a limited extent, and on the 19th the new minefield took its first toll in UB56. But difficulties arose in the execution of the plans and the urgency was so acute that before the end of the month Rear-Adml. Sir Roger Keyes, Director of Plans, was sent to Dover to assume the command, and the next four months saw nine submarines destroyed in the Dover area. By Feb. 1918 the Bight boats had ceased to use the Straits, and by May the activity of the Flanders boats in the Channel had been enormously reduced; the blocking of Zeebrugge contributed to this result, and the losses in the Channel were reduced to six a month, the minefields laid by the Flanders boats falling from 404 in 1917 to 64 in 1918.

The year 1918 saw the commencement of a much more ambitious scheme—the Northern Barrage—which aimed at nothing less than mining with 120,000 mines the huge stretch of 240 m. between the Orkneys and Norway. (*See* MINESWEEPING AND MINELAYING.) This was really an immense task, complicated by a deep gut some 60 m. wide on the Norwegian side where the depths ran to 150 fathoms. The credit for its conception and execution lies largely with Adml. Sims and the U.S. navy. It was an American enterprise performed by American sailors in American minelayers. As it was only commenced in April and was barely completed in Oct. its value is difficult to appraise, but the loss of some half-a-dozen boats can be attributed to it in Sept. and Oct. 1918. United States destroyers too were doing invaluable work in escorting convoys, and had been doing it ever since May 1917, during the dark months of 1917 when destroyers were more valuable than battleships.

The losses in the Mediterranean had given rise to serious concern, and the First Lord (Sir Eric Geddes) and the director of Naval Intelligence proceeded there in person to arrange for an extensive reorganization of the commander-in-chief's staff. Its clear waters, too deep for mines, and its regular tracks had been an ideal hunting ground for submarines. During 1917 only two German submarines had been lost there, and in the black month of April 1917 the Mediterranean had supplied one-fifth of the tonnage sunk. The arrival of some 14 Japanese destroyers in the summer brought the losses down about 10%, but in Dec. 1917, when vigorous action had greatly reduced the losses at home, the Mediterranean was still contributing 147,000 tons a month or over one-third of the whole. The convoy system was now introduced in the Mediterranean, the Otranto barrage was established and reinforced, and in May 1918 no fewer than four submarines were destroyed there. The effect of these measures was soon felt. Our losses in that sea were reduced from 95 ships a month in the last quarter of 1917 to an average of 43 in July, Aug. and Sept. 1918.

The U-boat zone had been extended to the Azores in Nov. 1917, and one or two boats had been working regularly there with fair results and comparative immunity till May 11 1918 when U154 was torpedoed by E35 about 150 m. west of Cape St. Vincent, an exploit directly due to improved intelligence.

Adml. von Capelle had been confident that his submarines would be able to prevent the U.S.A. troops reaching Europe, but actually not a single transport was lost up to Feb. 5 1918, when the "Tuscania" was torpedoed with a loss of only 44 lives out of 2,404. To stop the ceaseless flow of troops four large submarines were sent across the Atlantic, but though they destroyed over 60 ships they did not get a single loaded transport, and U156 was lost in the Northern Barrage on her way home. On July 19 1918 the great liner "Justicia," 32,234 tons, was hit by a torpedo from UB64 at 2:30 P.M. off the Skerryvore (Scotland, W. coast), and attacked again by U54 and UB124 the next morning. A whole armoury of depth charges was dropped round UB124 by the "Marne" and other destroyers, forcing her to the surface to surrender. All this time the mining of the Heligoland Bight went steadily on with the help of the gallant 20th Destroyer Flotilla (Capt. Berwick Curtis), and its exits were occasionally entirely closed. The Flanders flotilla felt the full force of the increased activity at Dover and suffered heavily. In Jan. 1918 it numbered 29 boats; it lost no less than 24 during the year and its strength dropped to 13. By the middle of 1918 it had earned the dread name of the "Drowning Flotilla," and its boats could reckon on a life of only three or four trips.

The Kattegat still remained open. In April 1918 a deep minefield was laid there, and had it been possible to keep it patrolled the submarines would have had to face another serious danger. How far this was practicable is a moot point.

The reports of destruction in 1918 gradually began to fall into four categories. Either a mine demolished the boat wholesale, or an aeroplane swooped down on it with 300-lb. bombs, or a volley of depth charges forced it to the surface, or a torpedo from a British submarine brought its career to a sudden end. Depth charges competed with mines as the principal instrument of destruction (destroyers and patrols 39%, mines 30%); then came the submarine 8%, with aircraft a bad last.

It is impossible to narrate the long story of destruction. UB81 may be mentioned as an example of the unenviable career of a German submarine. On her way down Channel on Dec. 2 1917 she struck a mine off the Owers (near Portsmouth) and water began to enter by the stern. An attempt was made to bring her to the surface, but the after-tanks would not blow and her stern sank to the bottom in 90 feet. The gauges showed the bows to be out of water, and with the boat lying at an angle of about 60° a torpedo was lowered from the bow tube, and a man rammed up its narrow length. The sea cap was opened cautiously and it was found that the mouth of the tube was a couple of feet above water. Men were rammed carefully up and seven men had dragged themselves painfully out, only to find the cold so bitter and the strain so great that most of them elected to go back and join those who were seeking oblivion and death in the oxygen flasks. P32 patrolling in the vicinity saw the bows above water, but in the endeavour to get alongside the wind and waves bumped her against the submarine, which went to the bottom, leaving only a solitary survivor. Two little drifters contributed their quota to the tale. On April 17 1918 a little drifter, the "Pilot Me," whose jolly name was in itself an omen of success, working in the North Channel, suddenly sighted the periscope of UB82, 150 ft. off, and turning quickly dropped four depth charges on it. The submarine came up at an angle of 45°, and three other drifters, the "Young Fred," "Look Sharp" and "Light," all opened fire on her. She went down and the "Young Fred" dropped four depth charges on her, bringing her to a final end.

Statistics of Submarine Warfare.—The dreary dreadful tale of ships sunk and attacked is too long to give (for dates and names see *Admiralty Return of British Merchant and Fishing Vessels Captured or Destroyed*, Aug. 1919, H.C. 199). It includes the names of nine hospital ships, all, with one exception, large ships whose character was unmistakable ("Asturias" March 20 1917, Channel, beached, 44 lives lost; "Gloucester Castle" March 30 1917, Channel, towed in; "Donegal" April 17 1917, Channel, sunk, 41 lost; "Guildford Castle" April 10 1917, Bristol Channel, hit by dud torpedo; "Lanfranc" April 17 1917, off Havre, with 167 wounded Germans, sunk, 34 lost; "Dover Castle" May 26 1917, Mediterranean, sunk, 7 lost; "Rewa" Jan. 4 1918, Bristol Channel, sunk, 4 lost; "Glenart Castle" Feb. 26 1918, Bristol Channel, sunk, 95 lost; "Llandovery Castle" June 27 1918, Atlantic). Of these the attack on the "Llandovery Castle" by U86 (Patrig) was probably the most flagrant breach of the principles of humanity. She was homeward bound from Canada 116 m. from the Fastnets (S.W. point of Ireland). The enormous red cross of a hospital ship was lit on her side, glowing in the twilight like a lustrous jewel, when she was attacked and sunk; of the 258 persons on board, including 14 nurses, all except a boatload of 20 perished.

Allied and Neutral Merchant Ships Sunk, 1914–8.

	1914 (5 mths.)	1915	1916	1917	1918 (10 mths.)
By Surface Craft	55	23	32	64	3
" Submarines	3	396	964	2,439	1,035
" Mines	42	97	161	170	27
Total	100	516	1,157	2,673[1]	1,065[2]
Total Tonnage (in 000's)	303	1,277	2,348	6,184	2,627
German Submarines sunk	5	19	25	66	74[3]

[1] Also three by aircraft.

[2] Also one by aircraft.

[3] Not including 14 blown up on evacuating Flanders and the Adriatic.

Allied and Neutral Merchant Ships Sunk, 1917–8.

A.—Allied and neutral merchant ships sunk by submarine.
B.—Gross tonnage of merchant shipping sunk by submarines, in 000's.
C.—Submarines sunk.

	1917			1918		
	A	B	C	A	B	C
Jan.	145	291	2	121	298	9
Feb.	209	464	4	114	315	4
March	246	507	4	163	231	5
April	354	834	2	107	261	6
May	264	549	6	110	290	17
June	272	631	4	95	240	3
July	210	492	6	95	259	6
Aug.	178	489	4	102	270	6
Sept.	149	315	10	78	186	9
Oct.	150	429	8	50	106	5
Nov.	113	259	9	..	..	4
Dec.	149	353	7	..	..	..
Total.	2,439	5,613	66	1,035	2,556	74
Total*	2,673	6,184	..	1,065	2,627	..

* (Including losses by surface craft and mines.)

In Oct. 1918 Flanders was evacuated and the remains of the flotilla blown up. It was a Flanders boat UB116 (Lt. Emsmann) which made a last desperate effort to enter Scapa on Oct. 28. It was heard on the hydrophones, and seen for a moment in the search-light beam. Then came the heavy shock of an explosion and the last of the Flanders flotilla found a fitting end in the very gates of the enemy.

When the Armistice was under discussion, Scheer, who was now chief of the German naval staff, recalled all the submarines, intending to make use of them in a last desperate sortie with the fleet, but he found himself suddenly confronted with mutiny, and the fleet never sailed, though the submarines remained true. Meanwhile in the British navy the evolution of the submarine had followed a different path. Here there was a tendency to produce a type useful in reconnaissance work and able to act in tactical conjunction with the fleet. Of E class, which did yeoman service, 49 were built and 27 lost. They were vessels of 180 ft. long with three to five 18-in. tubes and a speed of 15 knots on the surface and 10 submerged. They were followed by G class (10 built in 1916, 4 lost) with better seagoing qualities and double hulls, armed with one 3-in. anti-aircraft gun and 5 tubes (four 8-in. and one 21-in. astern); their speed was 14 and 10 knots. Of J class 7 were built in 1916–7 and 1 lost. They were 270 ft. long, carried one 4-in. and six 18-in. tubes and could do 18 knots on the surface. K class were designed for fleet work, and were completed in 1917–8 (16 built, 3 lost). They were steam-driven on the surface, attaining a speed of 22 knots, 334 ft. long, and carried one 4-in., one 3-in. A.A. gun and eight 18-in. tubes. L class carried one 3-in. A.A. and six 21-in. tubes. They were 222 ft. long with a surface speed of 17 knots. Some 25 were complete in 1918 (2 lost). Of M class only 4 were ordered. They were about 200 ft. long and carried a single 12-in. 35 calibres gun which could be fired only in the direction of the bow. The design was "freakish" and displayed a lack of tactical, strategical sense. Only one was completed. R class, of which 12 were completed (none lost), was specially designed for anti-submarine work. They were short and built for quick diving and rapid manœuvring. They carried one 3-in. gun and four 18-in. tubes. Of British submarines 54 were lost during the war:—

By enemy destroyers	3
By mines	4
By enemy submarines	4
Unknown (probably by enemy)	21
Aircraft	1
Sunk in error by British craft	3
Wrecked	4
Scuttled	10
Accident (collision)	4
	54

The question arises, How nearly did the German submarine campaign attain its aim? The increase in submarine destruction and the decrease in shipping losses possess little meaning apart from the figures of output in either case. In spite of strenuous

British effort the German submarine output more than kept pace at first with their destruction. In 1917 the net gain in submarines was approximately 45, but in 1918 the two exactly balanced (74 added, 74 lost). The shipping position depended largely on the irreducible margin which would have fulfilled British needs. This may be taken as 12½ million tons, and in addition there was always some 600,000 tons of British shipping under repair (from enemy and marine damage), requiring a total of, say, 13,000,000 tons (gross). By the end of 1918 there were 3,391 British steam vessels of over 1,000 tons, with a gross tonnage of 14,049,000.

The British shipbuilding capacity remained much the same (about 1·2 million tons a year, 1·310 million tons gross for Jan. to Oct. 1918), but net losses had been reduced to about 33,000 tons gross per month, which meant that the submarine could no longer attain its object within a reasonable time. It is true that the German output of submarines would have increased 20 or so monthly in 1919, but there is every reason to believe that the Allied navies could have dealt with it. The really critical time from Aug. 1917 to Dec. 1917 had passed. The submarine campaign had failed. On three grey Nov. days they filed along Germany's *via dolorosa* towards Harwich, bringing to a grim and sordid conclusion one of the most tremendous chapters in the history, not only of naval warfare, but of the world.

Final Tale of German Submarines in Nov. 1918.

	U.	UB.	UC.	Total.
Building and fitting out	28	15	26	69
Surrendered	59	53	26	138
Inspected	12	7	7	26
Blown up	4	5	5	14
Sunk and interned	66	68	57	191
Various	—	3	—	3
	169	151	121	441

See Comdr. A. Gayer, *Die deutschen U Boote* (1920); Scheer, *Germany's High Sea Fleet in the War* (1920); Archibald Hurd, *The Merchant Navy* (vol. i., 1921); Comdr. J. G. Bower, *Story of our Submarines* (1919); Henry Newbolt, *Submarine and anti-Submarine* (1918); Comdr. Émile Vedel, *Quatre années de Guerre Sousmarine* (1919). (A. C. D.)

SUBMARINE MINES (*see* 26.1).—It was the Russo-Japanese War 1903–4 which saw the first use of what has been called deep-sea mining—that is to say, the application of the submarine mine to strategic and tactical uses quite distinct from its previous application for coast defence; and that war led to the intensification of development in all maritime countries.

In the World War 1914–8 Great Britain laid a total of 130,389 non-controlled mines, 1,192 controlled mines and 25,983 of a small special type of net mine; in addition, 899 British non-controlled mines were laid by a U.S. minelayer. As showing the growing intensity of mining as the war developed, British minelayers were engaged on an average number of days in each month of 2½ in 1915, 5¼ in 1916, 11 in 1917, and 20 in 1918. A mine barrage across the Dover Straits contained 9,373 mines. The great Northern Barrage from the Orkney Is. to the coast of Norway contained 69,766 mines; of this number 56,033 were American mines and laid by the U.S. minelayers. The British minelayers, who were chiefly employed elsewhere, laid the remainder. British submarines laid 2,469 mines. (*See* generally MINELAYING AND MINESWEEPING.)

The chief naval war losses in surface ships due to the action of mines were:—

	Battleships	Cruisers	Destroyers and Torpedo Boats
Great Britain	5	3	22
France	1	1	5
Russia	1	—	6
Italy	1	—	2
United States	—	1	—
Japan	—	—	1
Germany	—	2	20
Austria	—	—	3
Turkey	—	2	—

Mines, as distinct from depth charges, accounted for the known loss of 35 German (or Austrian) submarines.

The loss of the British mercantile marine due to mines was 673,417 gross tons, besides a loss in fishing vessels of 8,545 gross tons.

Classification of Mines.—Submarine mines can be divided into two general types, controlled and non-controlled. These may be again divided, each into two divisions, contact and non-contact, and these may be further sub-divided into three classes, moored, drifting and ground. A ground mine is one which is laid actually on the bottom; it is chiefly useful in shallow waters. Drifting mines may be submerged and oscillate between set depths, may float on the surface, or may be suspended below a float; they are especially suitable for employment in river warfare. A moored mine which is the type most frequently used, is a buoyant mine anchored to the bottom by a heavy weight or "sinker," the mine being attached to its "sinker" by chain or wire rope. The "sinker" may be automatic in its working and, following an adjustment which is capable of being readily made by the layer, it will take the mine to the desired depth below the surface. The depth adjustment will be made by the layer in accordance with the draft of the enemy's ships.

Controlled mines are those which have their firing source outside the mine and directly controllable by human agency. An electric current, provided by a dvnamo or battery, is conveyed to the mines by cables led along the sea bottom from a control station on shore where the current may be switched on or off as desired. In the case of contact controlled mines a break in the controlling circuit, inside the mine, is completed when the mine is struck. Sometimes this is arranged by the crushing of a horn or it may be arranged by mechanism which acts due to the inertia of the blow. In the case of non-contact controlled mines, the firing is accomplished either by the direct observation of the operator or the mines themselves are made their own observers. In the first case the observer follows the enemy vessel through a telescope, which works over a prepared chart having metal strips on it corresponding to the positions of the mines; when a plunger on the training arm attached to the telescope comes into contact with one of the metal strips, the circuit is completed to that particular mine or line of mines and the mines are fired. Where the mines are their own operators, each contains mechanism, such as a microphone, which will pick up the sound of a ship's propellers and will indicate to the operator the moment when he should fire. The observation current from the mine is conveyed to the operator by the same cables that are used to fire the mine.

Controlled mines are specially applicable to the defence of harbours, where, by nature of their control, passage of friendly ships can be permitted but, at any time if necessary, can be denied. Contact controlled mines are used chiefly in side channels, because, although they can be put to "safe," they nevertheless foul the ground and friendly ships passing might damage them or tear them from their moorings; used channels have, therefore, to be mined with non-contact controlled mines, moored at a depth below the draft of the deepest draft ship using the channel.

Controlled mines are very costly to install and maintain and they require a large personnel to tend and operate them. (*See* PLATE, figs. 6 and 7, for types of non-contact controlled mines.)

Non-controlled mines are those which are automatic when once laid. They carry their own firing source or obtain it from the sea and have no further dependence on any human control. Mechanism is usually fitted which renders them safe during laying and for a short time afterwards, or at any time should they break adrift from their moorings. They may also be fitted with mechanism rendering them safe or disposing of them by explosion after a determined interval, and unless so fitted they must be swept up when no longer required.

There are several methods by which contact non-controlled mines are fired:—(i.) Inertia, where the momentum of the blow displaces a weight or pendulum inside the mine, causing the release of a percussion firing mechanism. (ii.) Mechanical lever, where the contact with a vessel displaces a rod or lever on the outside of the mine which first cocks and then releases a percussion firing mechanism. (iii.) Hydrostatic, where the contact with a vessel admits water, usually by the crushing of an external horn, into a valve inside the mine, which acting under the water pressure releases percussion firing mechanism. (iv.) Electrical, which is usually of the well-known "Hertz" horn type, where contact with a vessel crushes an external horn which contains within it a bichromate solution in a glass tube. When the glass of this latter is broken, the solution flows to the plates of an electric battery, previously inert, situated within the mine at the base of the horn. The solution energizes the battery, which is electrically connected to the mine detonator, thus firing the mine. This type, though electrical in action, carries the energy in a chemical form.

In the case of non-contact non-controlled mines, firing can be accomplished by an observing mechanism, as for instance a microphone, within the mine; as a vessel approaches, the sound of her propellers is picked up by the microphone and by means of relay mechanism the mine can be made to fire when a pre-determined intensity of sound has been reached.

SUBMARINE MINES

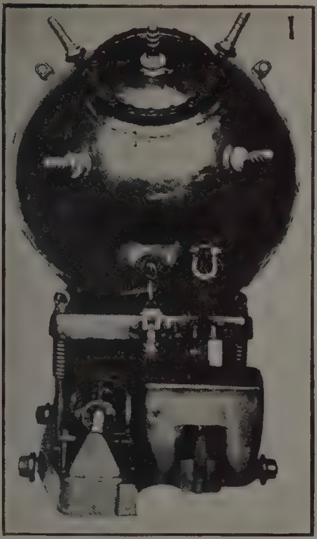
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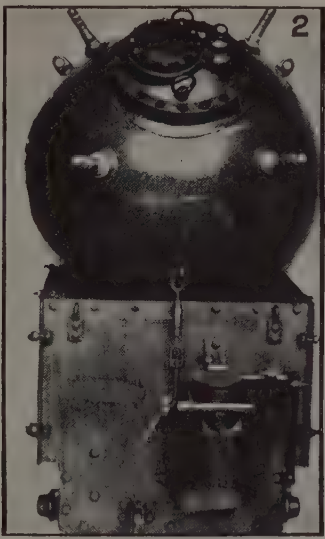
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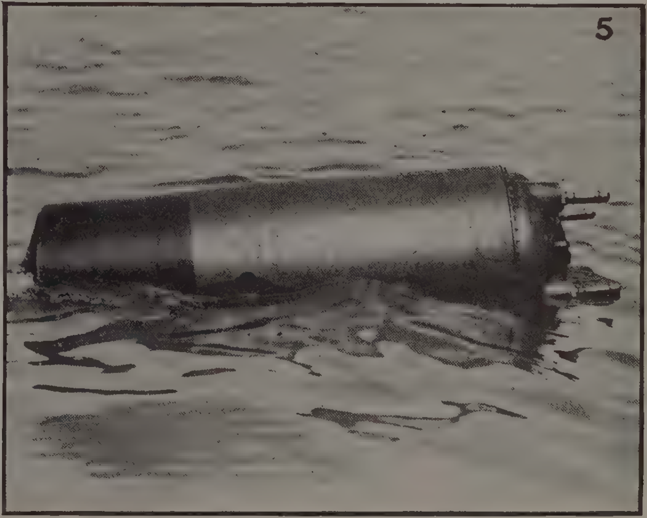
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Figs. 1 and 2 show contact non-controlled mines having the horn type of firing mechanism and attached to their automatic sinkers as they would appear on board the minelayer when ready for laying. The small wheels on each side of the sinkers at the bottom engage on the rail track laid along the minelayer's deck.

Figs. 3 and 4 show similar types of mines as they would appear when broken adrift from their moorings and floating on the surface.

Fig. 5 shows a special type of horned contact non-controlled mine adapted for discharge out of a torpedo tube of a submarine.

Figs. 6 and 7 show types of non-contact controlled mines as they would appear when broken adrift from their moorings and floating on the surface.

Fig. 8 shows the explosion of a depth charge fired at a depth of 40 feet.

The object of such an arrangement is to increase the probability of the mine, but since in this case the mine is fired out of actual contact with the ship's hull, explosive effect is sacrificed for the gain in probability, a failing common to all types of non-contact mine. (Various types of non-controlled mines are shown in the accompanying Plate, figs. 1–5.)

Minefields.—Controlled minefields, on account of the complicated nature of material, etc., are applicable only to a limited defence of friendly shores. The mines are usually laid by small special minelayers in short lines or small groups, all the mines of a line or group being fired simultaneously where these are of the non-contact type.

Non-controlled minefields on the other hand are required on an extensive scale and in all depths of water, both for offence against the enemy and defence of friendly coasts. They may consist of "barrages" to prevent the passage of enemy vessels through definite and particular areas, "independent minefields" to inflict loss on the enemy where there is a reasonable possibility of doing so, and "mined areas," which are built up of individual minefields to inflict loss on the enemy in areas which he is obliged to use when his ships put to sea for operations or exercise. Mines are laid in lines which are either continuous or broken up into groups, but variations of a single line are more often used, especially when several minelayers are taking part in the operation together, the more usual variations being two or more parallel lines, single indented or stepped line and dog's leg line.

There are also some special forms of mining, such as the laying of "connected mines" where two or more non-controlled mines are connected together, or where, as an anti-submarine measure, the mines are suspended in nets. The object of all such systems is to increase probability, but the latter is only gained, in these cases, by complication of the material and the laying of it out.

Minelayers.—Various classes of vessels are employed for laying non-controlled minefields:—(*a*) Large minelayers with large carrying capacity for laying "barrages." (*b*) Fast minelayers of moderate capacity for laying "mined areas" or "independent minefields" in enemy waters. (*c*) Very fast minelayers and submarine minelayers for laying small minefields close in to vulnerable points.

Submarine minelayers require special laying apparatus. Surface minelayers are usually provided with narrow-gauge rails running along the deck and ending in a discharge "trap" at the stern. The "sinkers" have two pairs of wheels which fit the rail gauge and each mine rests on top of its own sinker. The mines and sinkers are disposed in long tiers along the rails and as the minelaying proceeds the tiers are gradually hauled aft towards the traps, electrical power being usually employed for this purpose. On nearing the "trap" each "unit" is hauled off the face of the tier in succession and pushed into the "trap" from whence it is let go by order.

The spacing of the mines apart varies according to circumstance, but the least distance at which mines can be spaced apart is limited to the distance at which one mine, if exploded, will not damage or countermine the next adjacent. The spacing on board the minelayer is regulated by time; the interval between successive mines being let go varies according to the speed at which the vessel is steaming and the spacing being used. Where a minelayer has more than one set of rails, it is usual to drop mines alternately from each set; this is for convenience and gives more time for the loading of each "trap." (H. D. B.)

Depth Charges.—A development of submarine mines which came in during the World War is the engine known as a depth charge. This, as its name implies, is a charge of explosive which is detonated on reaching a given depth.

The explosive is carried in a mild-steel plate "charge case," to which rings are secured at the top and bottom for handling. A primer for detonating the main charge is secured in the centre of the charge case, round which primer lies the great bulk of the explosive charge and immediately above the primer is secured the "pistol." The pistol is arranged to fire the charge at varying depths.

One principle by which a depth charge may be fired consists of admitting water to a chamber containing a hydrostatic diaphragm. The pressure of the sea-water acts on the diaphragm and at the set depth causes a striker to act, thereby exploding the charge. A suitable safety arrangement is of course provided, and this consists of a safety key which cannot be withdrawn until the depth charge has been adjusted for a depth setting.

Depth charges are carried in the stern of vessels, either in chutes or on a tilting tray, and can be released either hydraulically from the forebridge, or by hand. As the depth charge sinks at a rate of 10 ft. per second, it is clear that the laying vessel must maintain a certain minimum speed to ensure herself against damage by the depth charge she has dropped. This is 10 knots.

In addition to the two methods of carrying and dropping depth charges already mentioned, an alternative is provided in some ships in the form of a depth charge thrower. This consists of a steel barrel and an "expansion chamber." Into the expansion chamber is screwed an explosion tube which on firing sets up a pressure which will throw the depth charge a distance of 40 yds. with a time of flight of four seconds.

The introduction of the depth charge was brought about in 1915 owing to the complete immunity enjoyed by a submarine immediately on submersion, notwithstanding the knowledge of a surface vessel that the submarine was in its immediate vicinity. The introduction and rapid development of the depth charge entirely removed this sense of security, and quite apart from the destruction of 34 submarines actually achieved by this means, it produced a very great moral effect upon hostile submarines, and hampered them in attacks upon surface craft, owing to their perception of the risk of allowing their periscopes to be sighted, and thus drawing down a rain of these depth charges upon them.

Though depth charges generally cannot be depended on to vitally damage a submarine outside a range of about 30 ft. (depending on the weight of the charge), the effect on the nerves of a crew of a series of heavy explosions at a greater distance than this fatal limit is very marked, and may be regarded as one of the great uses of this weapon. In many cases in which British submarines have been subjected to a depth charge attack, the force of the explosion has caused an immense concussion inside the boat. Fig. 8 in the accompanying Plate shows the explosion of a depth charge at 40 feet. (B. A.)

SUDAN (*see* 26.9).—The countries of the western and central Sudan are treated under their distinctive names; the present article deals with the Anglo-Egyptian Sudan, which, following official usage, is called the Sudan simply.

The area administered by the Sudan Government, enlarged during 1910–6 by the addition of the Lado Enclave and Darfur, was officially given in 1921 as 1,014,000 sq. miles. In the same year the pop. was estimated at over 4,000,000, which compared with an estimate of 1,853,000 in 1905. Nearly half the people are primitive negroid tribes living in the equatorial belt. Khartum, including Khartum North, had 39,056 inhabitants in 1921; Omdurman 59,429.

Economic and Social Conditions.—The years 1910–2 were years of prosperity, so much so that in April 1912 Lord Kitchener declared that "there is now hardly a poor man in the Sudan." But in that year the country experienced low floods and poor rains, while the 1913 Nile flood was one of the lowest on record. The rains, scanty at the best, failed altogether in some districts. The result was that 1913 and 1914 were years of acute agricultural and trade depression—1914 was described as perhaps the most difficult, from the point of revenue and the economic situation, experienced in the history of the Sudan. Trade suffered another shock with the outbreak of the World War. Abundant rains in the autumn and a high Nile happily resulted in providing the country with an ample supply of food-stuffs. Yet 1915 was little better than 1914. War conditions and the scarcity of shipping had caused a much lessened demand for the produce of the country. The cultivators, who form the majority of the people, "while they had enough to eat, were short of ready money" and hard pressed to pay their taxes. European conditions were indeed closely reproduced in the Sudan so far as commerce and economics were concerned. This was seen in 1916 when a period of comparative prosperity set in, though this was also due in part to abundant rains and a good flood in 1915. "The influence of the war," said the official report issued in 1920, "which had had such a depressing effect on trade in 1914 and 1915, began to operate in the reverse direction, and a great impetus was given to the export trade through an unprecedented demand for Sudan products. The presence of a large body of British troops in Egypt requiring grain and live stock, the demand created on the Arabian coast for Sudan millet, and in England and Allied and neutral countries for cotton and gum enabled all these commodities to be disposed of freely."

The experience of 1916 was repeated in 1917 and 1918 and, although there was a low Nile and poor rains in 1918, the country suffered no serious setback in 1919. Conditions in 1920 were influenced by the world depression in trade, nevertheless the year (following average rains and a medium flood in 1919) proved one of fair prosperity.

In considering the productivity and industry of the country it should be remembered that the Sudan consists of three natural zones, the desert zone in the north, where cultivation is only possible in a narrow strip on either bank of the Nile; a central zone where there are large areas of fertility, including the rainlands of Kassala and of Tokar, the Gezira plain, the pastures and gum-forests of Kordofan; and a southern belt, where the soil is richest and the rain tropical. But this southern belt up to 1921 yielded very little, for the negroid tribes which inhabit it showed scant inclination to do more than supply their own needs, while the lack of communications over enormous distances and the difficulties of administration rendered development by outside agencies extremely hazardous. Timber was, however, obtained from the forests of the Bahr el Ghazal and Lado and a (diminishing) quantity of ivory.

Apart from the tribes of this southern zone—and even among them progress in civilization was made—the people of the Sudan, negro and "Arab,"[1] showed willingness, in many cases eagerness, to benefit by Western civilization. Their standard of living became more exacting and their desire for education greater. Moreover, the possibilities and advantages of trade, through the World War, had been brought home to a larger number of the population than before. "There has been," wrote the governor-general, Sir Lee Stack, in April 1920, "an advance in energy and initiative, particularly among those who make their living by cultivation."

Products and Trade.—Gum arabic is perhaps the most characteristic product of the Sudan, which provides the bulk of the world's supply. Formerly the only Sudan product in which Germany had a direct interest, the largest share of the gum trade is now with Great Britain. In 1913 the export of gum was 336,000 kantars, it fell to 258,000 kantars in 1915 and was 344,000 kantars in 1919 (a kantar equals 99·049 pounds). The value of the gum varied in the period named from £E314,000 to £E744,000. The principal crops are durra (millet) and cotton. As the area cultivated depends upon an uncertain rainfall and an equally uncertain Nile flood, the amount produced is liable to great variations. In 1915 the total area under cultivation was 2,463,000 feddans, in 1916 it fell to 1,489,000 feddans, was over 2,000,000 in 1917 and but 1,669,000 in 1919 (a feddan equals 1·038 acre). Nor in respect to durra does the export correspond to the crop raised. Much of the grain is home-consumed and only the surplus sent abroad. The durra exported in 1913 was 2,080 tons; in 1914 only 530 tons. Exports rose to 84,000 tons in 1917 and fell to 1,650 tons in 1919. The total export of durra for the five years 1915–9 was 245,300 tons, against 53,500 tons in 1910–4.

Great expectations were held as to the development of the area under cotton by irrigation, but the financial situation created by the war rendered any large extension impossible for the time being. The variation in output was great—9,400 bales (of 400 lb.) in 1914; 23,900 bales in 1915; 12,300 bales in 1919. The total export of cotton in the 10 years 1910–9 was 161,000 bales. The yearly fluctuation was mainly due to the variation in the crop of flood-grown cotton in the Tokar district, Red Sea province. Only by irrigation works and by the building of railways to afford the cotton districts rapid and cheap means of access to the world's markets could any great increase of the crop be expected (see below: *Irrigation* and *Communications*).

Besides gum, cotton and durra the chief exports were cattle and sheep, hides and skins and sesame. The extent to which the export of live stock was stimulated during the war is shown by the following figures: Total number of cattle exported 1910–4, 64,400; in 1915–9, 129,500. In the same periods the number of sheep exported was 459,000 and 648,000 respectively. The export of hide and skins, however, decreased, being 1,928,000 in the five years 1910–4 and 1,552,000 in 1915–9. The very large number of camels exported for the use of the Egyptian Expeditionary Force is not included in the trade returns. Supplies of ivory decreased; 2,792 kantars were exported in 1913 and only 1,105 kantars in 1919. Dates, wood, charcoal, gold and senna were minor exports.

Three-fourths of the total exports go in the first place to Egypt, whence a considerable proportion is reëxported to Europe. Nearly all the rest of the exports go to Arabia, Abyssinia or Eritrea. Imports consist mainly of textiles and food-stuffs. An indication of the increased purchasing power of the people was the rise in the value of the imports of cotton fabrics, sugar, tea, coffee and spices. Those imports were valued at £E684,000 in 1914 and at £E2,062,000 in 1918. Imports come mainly from Great Britain and Egypt (each about 30%) and India and Aden (about 15%). South Africa (chiefly coal and sugar) and Abyssinia supply most of the other imports.

The following table shows the value of external trade (excluding specie) in the years named:—

Year	Imports	Exports (including Reëxports)	Total
1910	£E1,348,000	£E 977,000	£E2,325,000
1913	2,109,000	1,278,000	3,387,000
1918[2]	4,024,000	4,210,000	8,234,000
1919[2]	4,805,000	3,009,000	7,814,000

Irrigation.—The cultivator in the Sudan depended mainly on the rainfall and only to a less extent on the Nile flood and on artificial irrigation. While these conditions continued the area cultivated, in a year of good rains, could not much exceed 2,500,000 feddans, while cultivable land, given irrigation, has been estimated as high as a fourth of the total area of the Sudan. The Sudan Government elaborated schemes for irrigating a small portion of this uncultivated land, namely the Gezira plain and the Tokar area. In addition they embarked in 1909 on a scheme for irrigating an additional 100,000 feddans in the Dongola province by annual flooding on the basin system. In 1917, as an emergency measure to meet war needs, some 19,000 feddans in Berber and Dongola provinces were put under cultivation by means of pump irrigation.

The Gezira scheme was of much importance. The Gezira (=island) is the land lying between the White and Blue Niles. It was originally proposed to irrigate 100,000 feddans. Experiments undertaken in 1911 at Tayiba, near Wad Medani, on the Blue Nile, having proved conclusively that Egyptian cotton of the best quality could be grown commercially in that district, irrigation work was started early in 1914, with funds advanced by the British National Debt Commissioners. The intention then was to raise in London a loan of £3,000,000 to meet the expense of the work, but owing to the World War the scheme had to be held in abeyance. Eventually, in 1919, a loan of £6,000,000 was authorized by the British Parliament, £4,900,000 to be spent on the Gezira works. Meanwhile it had been decided to increase the area to be irrigated to 300,000 feddans. The Gezira scheme provided for the erection of a dam on the Blue Nile at Makwar, near Sennar, so as to raise the river to a level sufficient to feed a great canal excavated across the plain. Work on the canal, the levelling survey and the necessary buildings was continued at a snail's pace (owing to war exigencies) until 1917, when a fresh start was made. In the interval the Egyptian Government had intervened with irrigation projects intended for the benefit of Egypt, and in 1916 investigations were conducted in connexion with the water supply of both the Blue and White Niles. The result was a larger project, for which Sir Murdoch Macdonald, then adviser to the Egyptian Ministry of Public Works, was responsible. In addition to the Gezira scheme it was decided to build a dam across the White Nile at Gebel Aulia about 24 m. south of Khartum, which should be able to hold up nearly double the quantity of water stored by the Aswan dam—this White Nile dam being for the benefit of Egypt. Drawings of the two dams, both engineering works of the first magnitude, were completed in 1917. Cement having been found at a convenient spot near Makwar, a factory was erected there in 1919, and the preliminary work pushed forward on both dams, some of the workmen engaged being brought from the Yemen. Sir William Willcocks, the engineer of the Aswan dam, having very severely criticized the schemes, a Nile Projects Commission, composed of eminent engineers unconnected with the Egyptian or Sudan services, made a thorough investigation during 1920. The commission reported that both schemes were sound and the last obstacle to the building of the dams appeared to be overcome. In 1921, however, the Egyptian Government was compelled, owing to the serious financial situation, to order the discontinuance of work on the Gebel Aulia dam; the Gezira operations were continued but at a greatly reduced rate. Up to June 30 1921 some £E3,264,000 had been spent upon the Gezira schemes. Meanwhile a proposal to increase the Sudan loan to £9,500,000, owing to the increased cost of labour, material and transport, had been rejected. The Tokar area irrigation works, for which only £140,000 was estimated to be needed, were continued.

Communications.—As a corollary to the irrigation schemes at Tokar a railway from that town to the seaport of Suakin was sanctioned in 1919. The distance is about 60 miles. The railway south from Khartum to Sennar and thence, crossing the White Nile at Kosti, westward to El Obeid, the capital of Kordofan—a distance of 428 m.—was completed in 1911. It had the immediate effect of stimulating the trade in gum arabic for which Kordofan is famous. Both railways and steamers are State-owned; in 1918 the steamers department, which controlled the whole of the river traffic on the White and Blue Niles and their tributaries south of Khartum, was incorporated with the railways department, which had taken over the administration of the harbour of Port Sudan in 1914. The chief difficulty of the department during 1914–20 was in maintaining regular services efficiently. Great difficulty was experienced in keeping the Bahr el Ghazal free from sudd blocks, which caused much delay to steamers.

The upkeep of existing roads and the building of new roads entailed heavy labour and expense. In the northern and central zones wells had to be dug to make many of the tracks usable; in the south there was superabundance of water and dense forests to be cut through. One of the most important trade roads was that from Rejaf—the southern limit of navigability of the Nile from Khartum—westward to the Belgian Congo border. Good work was done on this road in 1916–8. Eighty streams had to be crossed in 125 m.; a single-span steel bridge 193 ft. long was erected over the river Yei. The difficulty of keeping the roads practicable in the equatorial regions in the long rainy season was great. It was largely on the opening-up of roads, and more roads, that the complete pacification of the southern provinces depended. From 1916 onward experiments were made in the use of motor tractors and cars on the roads, with at first but moderate success. In 1920 the use of aeroplanes by officials for visiting distant posts was first recorded. This followed the laying-out in 1919 of a number of aerodromes and the passage in Feb. 1920 of aeroplanes engaged in the first Cairo to Cape flight. This flight led to the discovery, from the air, by Dr. Chalmers Mitchell, of the volcanic character of a range of hills in the Bayuda desert (*see* AFRICA: *Exploration*).

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[1] Most of the "Arab" tribes in the Sudan are of Hamitic stock.

[2] Includes for 1918 Government imports £E988,000, and for 1919 Government imports £E1,804,000.

On the conquest of Darfur the telegraph system was extended to its capital El Fasher. Telephone exchanges are established in the chief towns. The first wireless telegraphic stations were erected in 1915—at Port Sudan, Malakal, Nasser and Gambeila, a chain extending from the Red Sea to S.W. Abyssinia. In 1916–8 five other wireless stations were erected, three in Darfur, the others in the far south, at Wau and Mongalla.

Finance.—The subvention in aid of civil expenditure made to the Sudan by the Egyptian Government, which began in 1899 with an allocation of £E.156,000, reached its maximum in 1902 with £E.268,000, after which it was gradually reduced. In 1912 it stood at £E.163,000. In 1913 it ceased to be paid in accordance with an arrangement by which the Egyptian Government credited the Sudan with the amount of the customs collected in Egypt on goods entering and issuing from the Sudan, estimated at £E.85,000. The Egyptian Government, however, continued to defray military expenditure on account of the Sudan, estimated at £E.172,000. The insufficient rains and low floods with other external factors exercised an adverse effect on the economic situation just when the subvention was withdrawn. Nevertheless, the Sudan budgets of 1913–4–5 closed with a slight surplus. The more prosperous conditions which followed eased the situation and allowed an increase of taxation without impairing trade. Revenue, which in 1911 stood at £E.1,664,000, rose in 1919 to £E.2,950,000, with a surplus over expenditure of £E.267,000. The budget for 1920 was balanced at £E.3,500,000. A traders' tax was imposed in 1913, the trading community as a class having up to then paid nothing in direct taxation. In 1919 £E.6% was payable on assessed annual profits exceeding £E.500. In 1917 an excise duty was imposed on sugar, in 1919 the duty on tobacco was raised; heavy increases were made in railway and steamer rates both for goods and passengers. The railway and steamer services yielded a substantial profit (£E.210,000 in 1915, £E.286,000 in 1919). The rise in the price of all commodities was the main cause of the increase in taxation. The surpluses obtained since 1916 were passed to a reserve fund, the only source available, apart from borrowing, for capital expenditure. On Jan. 1 1920 the reserve fund amounted to £E.426,000 only, the "reserve" being almost wholly expended year by year on necessary works.

Education.—The Government schools are all in the northern or Moslem half of the Sudan; the only schools among the pagans in the southern half are those of the missionary societies. In the north there was a considerable increase in the number of boys attending elementary vernacular schools, while the sending of girls to school became more popular with parents. There were in 1919 five elementary girls' schools, besides higher schools for girls managed by missionaries. There was after the war a considerable demand for boys with a technical or industrial education. In 1920 over 400 boys trained in the Gordon College workshops were in employment, as to three-fourths in Government service. (F. R. C.)

Political History.—The political status of the Anglo-Egyptian Sudan remained in 1921 as defined by the treaty between Great Britain and Egypt of Jan. 18 1899. Although the country passed through a period of depression in 1913–5, comparing 1920 with 1910 there was a distinct advance in the well-being and resources of the people. The recovery from the disastrous rule of the Mahdi and Khalifa was shown by the large increase in population. The period 1910–20 was also notable for a marked growth of confidence in the Government. The loyalty of the leading chiefs and notables was never in doubt, and throughout the World War the vast majority of the people remained peaceful and contented. The number of minor operations undertaken both before and after the war were mainly against primitive tribes in the far south and did not affect the more highly developed provinces.

By the annexation of Darfur in 1916 (see below) the area under the control of the Sudan Government was increased to over 1,000,000 sq. miles. This vast region was administered in 1921 by some 110 British officers and officials, assisted by a technical staff. The military establishment included 14,000 men of the Egyptian army, with one British infantry battalion and a detachment of garrison artillery at Khartum. A new unit, the Western Arab Corps, was raised for service in Darfur.

The Lado Enclave (*see* 16.60) was transferred in 1910 from the Belgian Congo to the Sudan and added to the province of Mongalla. In the same year an outbreak of the old fanatical spirit had to be suppressed in Sennar, and during 1910–2 minor expeditions dealt with local disturbances in Kordofan and Mongalla. Others were also undertaken in 1914–8 to deal with turbulent elements in the Nuba Mountains—traditionally obnoxious to authority—and to keep order in the equatorial regions, where the Nuer and Dinka tribes gave a good deal of trouble. The most important of these operations was in the Nuba province in 1917–8. After a number of collisions, in which Capt. R. W. Hutton was killed (April 1917), a considerable force was sent in the autumn of that year and after a somewhat arduous campaign the hill tribes were in Feb. 1918 reduced to submission. In 1918 the Sudanese troops aided in operations against the warlike Turkana, a tribe, much given to raiding, living on the Sudan-Uganda border. Unfortunately neither the Sudan nor the Uganda Government had forces to spare to station troops permanently in this remote area.

An incident at Kassala towards the end of 1918 of no political importance is yet noteworthy as illustrative of the sporadic outbursts of fanaticism to which parts of the Sudan were liable. It was thus officially recorded:—

> "Without a word of warning and in the dead of night a band of some 40 fanatics, led by a religious lunatic, suddenly rushed the guard and inlying picket furnished by the Egyptian unit on the fort and then proceeded to attack the lines of the camel company of the Eastern Arab Corps. No longer aided by the element of surprise, the band suffered heavily in killed and wounded at the hands of the latter unit. The leader was amongst the killed and the few that escaped were ultimately accounted for by the camel company and the police."

Aggressive action by the Aliab section of the Dinkas in Mongalla province led to the despatch of a small force in 1919 under Maj. R. F. White, which was accompanied by the governor, Maj. C. H. Stigand. An attack by spearmen in the long grass led to the death (Dec. 8 1919) of these two valuable officers and other casualties, entailing a punitive expedition in the following year.

The completion of the railway from Khartum to El Obeid, the capital of Kordofan, in 1911 enabled the Government better to control Darfur, where 'Ali Dinar ruled as a Sultan tributary to the Sudan; and, after the French occupation of Wadai, negotiations were in 1912 opened with France for the determination of boundaries by the inspector-general, Sir Rudolf von Slatin, on behalf of Great Britain and Egypt.

In Jan. 1912 King George and Queen Mary paid a visit to Port Sudan on their return journey from India, and a review was held at Sinkat by the King, at which representatives from almost every section of the Sudan were present. The scanty rainfall and abnormally low Nile of 1913 caused famine conditions in portions of Dongola and the Blue and White Nile provinces. Relief measures and the importation of large quantities of millet from India made a most beneficial impression on the populations affected. In April 1914 an exchange of certain districts on the Upper Nile was effected, in the interests of both administrations, with the Uganda Protectorate (*see* UGANDA).

On the outbreak of war with Turkey in Nov. 1914 the various provinces of the Sudan, notwithstanding the Moslem character of the majority, displayed perfect loyalty to the administration. In Darfur, on the other hand, the Sultan 'Ali Dinar renounced his allegiance, and, instigated by Turkish emissaries working through the Senussi sect, contemplated an invasion of the Sudan. His communications with the Senussites were cut off by posts of irregulars, and early in 1916, military operations were undertaken which led to the defeat and subsequent death of 'Ali Dinar (for the military operations, *see* SENUSSI). Darfur was thereafter administered as a province, and an Anglo-French convention, signed at Paris on Sept. 8 1919, at length settled the common frontier of Darfur and Wadai. The occupation of Darfur was followed by an expedition in coöperation with the French in the region north of Darfur against marauders of the Guraan tribe, who had given considerable trouble to both administrations. A garrison for Northern Uganda, whence troops had been withdrawn to meet the menace from German East Africa, was for a brief period provided by the Sudan Government. Except in Darfur, the war did not, externally, touch the Sudan at any point, and its administration continued on normal lines. The Prince of Wales visited the Sudan in 1916 and the Duke of Connaught in the following year.

The disturbances which broke out in Egypt in 1919 interrupted direct communications with Cairo, and the temporary cessation of Nile traffic caused a certain loss of trade. The Sudanese populations were not concerned with the aspirations of Egyptian nationalism, and the large Egyptian official community, while by no means indifferent to the development of events in their own country, did not actively display sympathy, so that this period of crisis passed without incident. Nor did the Armistice and the negotiations which followed the victory of the Allies occasion special comments. A delegation of Sudanese notables proceeded to England to offer congratulations on the successful termination of the war and returned with pleasant impressions of their visit. The only remaining centre of unrest in 1921 was the Abyssinian border, where raids and hunting parties of chiefs, nominally but not effectively under Abyssinian control, continued to give difficulty.

The outstanding event in Sudanese history during the war period was the withdrawal of Sir Reginald Wingate from the governor-generalship, on his being called to Cairo in Dec. 1916 as high commissioner for Egypt. He succeeded Lord Kitchener as Sirdar of the Egyptian army and governor-general in Dec. 1899, after an almost continuous service with the Egyptian army since 1883. Under his able and sympathetic administration the Sudan had emerged from the chaotic condition to which Mahdist misrule had reduced it, and gradually developed into a peaceful and contented country. His name will long be remembered by the people to whose regeneration he devoted the best years of his life. Another historic association with the Sudan was terminated by the outbreak of war between Great Britain and Austria-Hungary, when Sir Rudolf von Slatin, the inspector-general, whose advice in all native affairs had been most valuable, was inevitably compelled to resign. Mention may also be made of the resignation of Sir Edgar Bonham-Carter in 1917 after 18 years' service. He had been responsible for the creation and development of the whole legal and judicial system of the Sudan.

Col. (afterwards Maj.-Gen. Sir) Lee Stack, civil secretary to the Sudan Government, succeeded Sir Reginald Wingate as governor-general and sirdar; Slatin Pasha's post was not filled.

See the Annual Reports on the finances, administration, etc., of the Sudan, issued annually in London up to 1913, and the Report for 1914–9, issued 1920, which is of special value. The *Sudan Almanac* and *Handbook to the Sudan* are also official publications. Murray's *Guide to Egypt and the Sudan*, and Macmillan's, Baedeker's and Lock's guide-books may be used with profit. See also Y. P. Artin, *England in the Soudan* (1911); and *Sudan Notes and Records*, an excellent serial publication begun in 1918. The Survey Department, Khartum, issues a map of the Sudan, in many sheets, on the scale of 1:250,000. (J. R. R.)

SUDERMANN, HERMANN (1857–), German dramatist and novelist (*see* 26.20). His novels include *Das hohe Lied* (1909); and *Litauische Geschichten* (1917); while in 1911 appeared a volume of short stories, *Die indische Lilie*. His later plays include *Strandkinder* (1910); *Der Bettler von Syrakus* (1911); *Der gute Ruf* (1913); *Die Lobgesänge des Claudian* (1914), and *Das Höhere Leben* (1919).

SUESS, EDUARD (1831–1914), Austrian geologist (*see* 26.21), died at Vienna, April 25 1914.

SUEZ CANAL (*see* 26.22).—The five years 1909–13 witnessed a considerable increase in the traffic passing through the canal. The World War greatly restricted the use, particularly in 1917.

In the following table the figure for receipts is obtained by taking 25 francs as equal to £1 sterling except for 1920, when the rate is reckoned at 50 francs to the £1:—

	No. of vessels	No. of passengers	Net tonnage	Gross receipts
1909	4,239	213,122	15,407,527	£4,782,724
1913	5,085	282,235	20,033,834	£5,140,403
1917	2,353	142,313	8,368,918	£2,880,761
1920	4,009	500,147[1]	17,574,657	£5,329,213

[1] This abnormal increase was due to the movement of troops.

In Feb. 1915 the Turks, who had traversed the Sinai peninsula, attacked the Suez Canal at various points, and it was not until after the battle of Romani in Aug. 1916 that all danger to the canal was ended. Throughout this period traffic was interrupted on two occasions only, and then for very brief periods. During the World War, under Adml. Robinson as Director-General of the Egyptian Ports and Lights Administration, 1,239 transports and men-of-war, totalling over 8,000,000 tons, were passed in safety through the canal, and 965 transports, 43 hospital ships, 36 store ships and 307 colliers were dealt with at Port Said.

Striking differences in the pre-war and post-war shipping were the elimination temporarily after 1914 of German vessels (which in 1911 had 13·4% of the tonnage) and the increasing number of Japanese and United States ships using the canal. Japanese vessels represented before the war 1·7% of the tonnage; in 1920 their tonnage had increased to 9·1%. United States vessels, rarely seen in the canal before the war, in 1920 represented 4·1% of the tonnage. British ships continued to provide the bulk of the tonnage, the proportion in 1920 being 61·7% compared with 62·2% in 1911. In 1920 three passages were made by steamers of over 23,000 tons gross, a figure never before reached, and one vessel had a length of 669 ft., the longest registered in the canal. The quantity of goods passing through the canal in 1920 was 34% below the figures of 1913. There had been some change in the character of the merchandise, foodstuffs diminishing sensibly in volume, though corn from Manchuria and China made its appearance. Imports of coal from S. Africa and Australia were particularly marked in 1919 and 1920.

A scheme to extend the concession of the Suez Canal Co.—the existing concession does not expire until 1968—was rejected by the Egyptian General Assembly in 1910, not on its merits but in an effort to discredit the British administration. The Suez Canal Co. coöperated heartily with the British authorities in Egypt during the war. To meet the increased costs caused by the war the Company in 1916 and 1917 imposed higher tariff charges, which, after the war, acted in restraint of traffic and were not of permanent benefit to the Company. In 1919 the Company asked to have put into operation at Port Said the free zone regime provided for in an agreement made in 1902 between it and the Egyptian Government. It held that the transit trade would be stimulated if an area were set apart in which goods could be handled, or remain, uncontrolled by the customs. An agreement on the subject was drawn up in 1920.

It is noteworthy that in 1919, and to a much more marked extent in 1920, the Company benefited by the decreased value of the franc. This was made possible as shipping dues were collected in Egypt and were paid in money less depreciated than the franc, and profits earned in Egypt were used in the purchase of francs at current rates. In 1920 the benefit from these operations amounted to 101,772,000 francs, or over £2,000,000 at average rates of exchange.

The annual reports of the Suez Canal Co., published in Paris, give full statistical information. (F. R. C.)

SUGAR (*see* 26.32).—In the year 1910–1 the world's production of sugar amounted to 16,951,000 tons, of which 8,391,000 tons were produced from cane and 8,560,000 tons from beet, including that grown in America. For 1913–4 the world's total production reached 18,486,000 tons, of which the cane production was 9,577,000 tons—an increase of 1,186,000 tons of cane. The beet crop for the same period was 8,909,000 tons, of which 655,000 tons were grown in America—an increase of 349,000 tons. These were the highest figures reached during the decade 1910–20, for after the outbreak of the World War in 1914 the European production declined yearly, until in 1919–20 the world's beet crop reached only a little over 3,200,000 tons, of which 653,000 tons were American. The world's crop of sugar for 1920–1 was estimated at about 16,475,000 tons, of which cane was estimated to produce over 11,828,000 tons, and beet 4,647,000 tons, of which 935,000 tons were American.

Owing to the British Government recognizing at once the importance of securing to the nation a supply of sugar sufficient for the wants of the people, sugar was the first commodity to be controlled in the United Kingdom during the war (*see* Food Supply), and within a few days of its outbreak the Government had bought several thousand tons of sugar. In Aug. 1914 a Royal Commission on the Sugar Supply was formed. It took over the duties of buying and selling sugar. These operations were done through the ordinary channels of trade, and everyone was guaranteed a supply on the basis of his trade before the war, the actual quantities being fixed from time to time in proportion to the sugar held by the Government; and it is not too much to say that the sugar control was the most successful of the many Government controls.

It may be noted that in the Final Report of the Commission issued in June 1921 it was stated that: "The wisdom of the Government in at once taking over in 1914 responsibility for the sugar supply was, in our opinion, fully proved in the sequel. But while we recognize that in the special circumstances State management was a necessity, our experience does not lead us to think that State control is a desirable thing in itself in the region of trade in commodities."

The total consumption of sugar sold under control was approximately as follows:—

	Tons
1915	1,818,488
1916	1,314,910
1917	1,219,761
1918	1,109,905
1919	1,595,004
1920	952,408

The stocks held by the Commission on March 31 1921 were 390,479 tons of raw and 57,787 tons of white.

The Commission had desired to carry out their operations free of cost to the Exchequer. "This aspiration cannot now be realized," they add, "but the fault is not ours. From time to time since the middle of 1919 the Commission has on various occasions pleaded for an increase in the selling prices of its sugars, so as to build up a reserve to meet the loss which it foresaw as probable on the liquidation of its stocks on the conclusion of its operations. But on no occasion has a rise been authorized until weeks or months after it was recommended, and then not always to the extent recommended.

"From a calculation we have made we are able to say that if our recommendations (which were always kept as low as possible in view of the reluctance shown by the Cabinet to an increase in prices) had been approved at the time they were made our receipts would have been £16,000,000 more than they have been in fact. Even that sum is less than the deficit which it is probable that the Exchequer will have to meet on our operations, and which we estimate at not less than £24,500,000. Some may perhaps hold that it is not of material importance to the public whether it has to bear a burden of this kind in its capacity as a taxpayer or in that of a consumer of sugar. But to us it is a matter of regret that we shall not be able to claim that we discharged the duties imposed upon us without having recourse to the funds of the Exchequer otherwise than for the purpose of the temporary financing of our operations. The advances made to us under this latter head by the Treasury stood on March 31 at £27,281,937."

The cost of the establishment of the Commission from 1914 to 1922 is given as £103,239.

The year 1920 stands out as having the most violent fluctuations the sugar trade has probably ever experienced. The British Royal Commission on the Sugar Supply and the American Equalization Board acted conjointly in 1919, and by their actions controlled both the American and European markets. Prices were kept between 30s. and 63s. per cwt. for Java 96° F.L., but there was some hesitation in the autumn with regard to the continuation of the operations of the American Equalization Board, which did not decide on further action until December. In the meantime a good deal of the Cuban crop had been sold to Europe and the East on a basis of 6½c. per lb., and when the American Equalization Board decided to continue control it was too late to secure the Cuban crop. The planters, having sold a certain quantity of sugar, were independent, and prices were forced up to 12c. (equal to 76s. 9d. per cwt.) at the end of January. In Feb. there were, however, large offerings on the part of the Cuban planters, owing to supplies of sugar coming into the market, and quotations declined to 9c. (equal to 59s. 3d. per cwt.). In March the American refiners began to buy freely, and this increased demand was intensified by two serious reductions in the estimate of the Cuban crop. Wild speculations took place, and in May as much as 23½c. (equal to 136s. per cwt.) was paid. Large purchases were also made in Jan. and May of Manila sugar for shipment during the summer months. The effect of these inflated prices brought its own remedy; consumption decreased rapidly both in England and in America, and by the end of July Cuban prices had fallen to 16c. which was equal to a fall of 40s. per cwt. This fall continued until, at the end of the year, Cuban sugar was actually sold at 3⅝c. per lb., or equal to a total fall from the highest point of over 110s. per cwt. The result of these heavy fluctuations caused a financial crisis in the trade. Enormous losses were suffered by the American and Canadian refiners, who had bought and sold heavily for the autumn months, and these forward sale contracts were largely repudiated when the time came for delivery. The British refiners, being still under control, escaped these violent losses.

The values of refined sugar in 1910 varied from 17s. 3d. to 23s. 6d. per cwt. for Tate's cubes, and in 1911—the year of exceptional drought—prices continued to advance to 27s. 6d., but towards the end of 1912 prices declined to 19s. 3d. and with slight fluctuations prices were further reduced at the outbreak of war to 17s. 9d. There was then a steady rise, and in 1914 cubes were sold at 35s., and granulated at 30s. per cwt.; in 1915 cubes were 50s. and granulated 33s., and then by gradual stages till, for domestic consumption, cubes in 1920 reached 116s. and granulated 112s., but, under the voucher system which was in vogue during control, the prices of sugar for manufacturing purposes were from 160s. to 164s. per cwt. Refined sugar produced by the British refineries from 1910 till the outbreak of war averaged about 45% of the total consumption, but after the war the production was about 74%. The British duty from 1910 till 1914 was 1s. 10d. per cwt., in 1915 9s. 4d. per cwt., in 1916 14s. per cwt., and in 1918 it was increased to 25s. 8d. per cwt., at which it remained in 1921. This was out of all proportion to the value of the sugar, and naturally checked consumption.

In 1913 the British Government withdrew from the Brussels Convention, which had been adopted in 1903, after many years' endeavour on the part of Great Britain to counteract the effect of the system of continental bounties on beet sugar. The adoption of the Convention had undoubtedly saved the British West Indian sugar trade from extinction, and British sugar refiners were able to compete on more equal terms. At the same time there was still strong opposition in England from the Free Trade party, who were anxious to have sugar at any price, whatever injustice might be inflicted on the British colonies and the home refiners. In 1911 there was a serious falling-off in the European beet crop, and there was a large deficiency in the world's supply, so that an inevitable rise in price took place. Russia, however, had large stocks on hand, which, under the Convention, could not be imported into England owing to the fact that prohibition was in force instead of countervailing duties. Had there been countervailing duties the sugar would have been shipped to England and the difference in duty paid. Giving way to pressure from those who were anxious to get cheap sugar irrespective of the reason for the cheapness, Mr. Asquith's Liberal Government gave notice in Aug. 1912 to withdraw from the Convention. The curious feature was that, as the result of this notice, Russia was permitted to send a considerable quantity in excess of the limit laid down by the Convention, but the quantity she sent had very little effect in making up the shortage of about 1,700,000 tons of the world's production.

In 1919 Mr. Lloyd George's Government (with Mr. Chamberlain as Chancellor of the Exchequer) took a further step in accordance with the views of the British West Indian planters, and agreed to give preferential treatment to sugar produced within the British Empire, in the form of a reduction in its case of one-sixth off the import duty on sugar. The British preferential duty on raw sugar at 96° polarization is equal to a preference of about 3s. 9d. per cwt., and on white sugar of a polarization over 98° 4s. 3.33d. It was too soon in 1921 to know what permanent effect this concession would have upon the production of sugar in the British colonies, but it was hoped that it would enable their planters to compete with Cuba and other countries where costs are considerably less, and consequently secure a larger share of the sugar trade of the United Kingdom.

Since 1910 serious attempts have been made to grow beetroots in England for the manufacture of sugar. A factory was erected in 1911 in Cantley, in Norfolk, but was worked only one season, and was closed during the war. It was purchased by a private Liverpool firm in 1920. A fair quantity of beetroots was grown in the immediate neighbourhood, but the high price which was given for the roots made it impossible for the purchaser to make a profit on the sugar produced. As a matter of fact a loss of from £60,000 to £70,000 was incurred. A further and more ambitious attempt was in 1921 being made at Kelham, Notts, where a large factory was erected, considerable quantities of beets having been planted in the neighbourhood. The British Government not only subscribed £250,000 of the capital, but also guaranteed interest on the amount of public capital raised at 5% for 10 years, and took £125,000 of second debentures.

See also FOOD SUPPLY and RATIONING. (L. A. M.)

SUKHOMLINOV, VLADIMIR (1848-), Russian general and war minister, was born in 1848. He passed through the cavalry school in St. Petersburg, and in 1867 was given a commission in the Guard Ulans. He graduated from the Academy of the General Staff in 1874. He took part in the war with Turkey in 1877–8 as an officer of the general staff, and was awarded the St. George Cross of the fourth degree. From 1884 to 1886 he commanded a dragoon regiment and from 1886 to 1897 he was the head of the officers' cavalry school in St. Petersburg, having meantime in 1890 been promoted to the rank of general. His next appointment was as commander of the 10th Cavalry Division. In 1899, while commanding the troops of the Kiev military district, Gen. Dragomirov appointed him as his chief-of-staff and later as his assistant. His close connexion with Gen. Dragomirov, who enjoyed enormous prestige in the Russian army, ensured Sukhomlinov's future career. After the death of Dragomirov, he was appointed commander in Kiev.

From 1909 to 1916 he was Russian war minister, and it was under him that two Russian orders for mobilization were given at the outbreak of the World War. Self-confident and ambitious Sukhomlinov played a disastrous rôle in the administration of the Russian army. Notwithstanding the discovery, even in Oct. 1914, that there was an insufficiency of shells, rifles and cartridges, he assured the Duma that everything was all right. It was only in 1916, under strong pressure of public opinion, that the Tsar Nicholas II. dismissed him from office. Finally he was brought up for trial on a charge of treason. The court found him guilty of offences in office, and he was sentenced to penal servitude. Later Sukhomlinov was freed by an amnesty granted by the Bolsheviks and went to Finland. In 1921 he began the publication of his memoirs. (N. N. G.)

SUN YAT-SEN (1867–), Chinese leader of the revolutionary movement which ended in the abdication of the Manchu dynasty in Feb. 1912, was born in Kuangtung province, the son of a native Christian. He studied at the College of Medicine in Hong-Kong from 1887 to 1892, and there took his degree in medicine and surgery. He practised his profession first at Macao and then at Canton, but from the outset of his career displayed more interest in politics than in medicine, being by temperament an iconoclast, an organizer of secret societies and a leader of conspiracies against the established order of things. Inspired by his semi-European training, with bitter resentment against the Manchus, whom he regarded as responsible for China's humiliation at the hands of Japan, he first raised the standard of rebellion and of Cantonese independence in 1895; but the *coup* failed and Dr. Sun was compelled to seek safety in exile. Henceforward all his energies were directed towards stimulating the anti-dynastic movement, first by the collection of funds from the Chinese communities in the United States, Hawaii and the Straits Settlements, and then by organized propaganda work conducted by secret agents throughout the Empire. He received considerable assistance and encouragement in Japan, where he founded a society known as the Tung Men-hui, which played a prominent part in Chinese politics after the establishment of the Republic. Although an exile, he was generally regarded by the "Western-learning" section of Young China as its leader, especially after the Chinese Government's attempt to kidnap him in London, in 1896. In 1911, when the revolution broke out prematurely at Wuchang, Dr. Sun was in England; but he hurried back to China and arrived at Shanghai on Christmas Eve, in time to be acclaimed as the originator of the Republican programme and elected Provisional President by the delegates to the National Convention assembled at Nanking. On Jan. 5, after having taken the oath of office, he issued a Manifesto (countersigned by Wu Ting-fang as Minister for Foreign Affairs) in which the purposes and policy of the Republican Government were proclaimed. On Feb. 12 an Imperial edict announced the abdication of the Emperor; it surrendered the reins of government to the representatives of the sovereign people and declared that henceforth the constitution should be Republican; at the same time, the organization of the new form of government was entrusted, "with full powers," to Yuan Shih-k'ai. On the 14th, Sun Yat-sen resigned the Presidency and in the name of the Nanking Assembly invited Yuan to accept the position of Provisional President. His action was applauded by Young China at the time as evidence of patriotic self-abnegation, but events proved that it was chiefly inspired by recognition of the fact that he and the Cantonese group of politicians who had joined him as leaders of the Republican movement, did not yet carry sufficient weight to justify them in attempting to form a national government.

Relations between Sun Yat-sen and Yuan Shih-k'ai were never cordial, but until the ejection from Peking of the Kuo Min-tang Radicals by the President Dictator in 1913, they preserved the appearance of goodwill, and towards the end of 1912 Sun accepted a highly paid appointment as Director of National Railways at Shanghai. After the failure of the Kuo Min-tang's "war to punish Yuan," Sun wandered again in a wilderness of conspiracies. Eventually, after the death of the Dictator (1916) he became one of the Cantonese group of politicians which waged continual warfare against the party in power at Peking. Because of the futility and sordid intrigues which characterized the independent Military Government at Canton, he, whose reputation in 1912 had stood high at home and abroad, came gradually to be regarded as an irreconcilable conspirator, whose personal ambitions were largely responsible for the continuance of the senseless civil strife between the North and the South. By the vehemence of his rhetoric, by the fervour of his grandiose schemes for the remaking of China at the time of the revolution, he captured the imagination of considerable sections of the public, especially in the United States; but his subsequent career failed to justify his own belief in himself as a heaven-sent reformer. In April 1921, a special session of the Southern (Canton) Parliament elected him to be President of the Chinese Republic, his supporters declaring the Canton "Military Government" to be the only lawfully constituted government in the country; but the influence of these Cantonese "Constitutionalists" over the other southern provinces had then become almost insignificant, and the "Military Government," prohibited by the Foreign Powers from interfering with the revenues of the Maritime Customs, was confronted by financial problems of a kind which threatened not only its reforming activities but its continued existence.

SUPAN, ALEXANDER GEORG (1847–1920), Austrian geographer, was born at Innichen, South Tirol, March 3 1847. He was educated at the Laibach gymnasium, and in 1870 took his doctor's degree at Graz, afterwards becoming a teacher in the Oberrealschule at Laibach. In 1872 he left Laibach and studied geography at Vienna, Dresden and Halle, returning in 1877. In 1881 he was appointed professor of geography at the university of Czernowitz, and in 1884 became editor of *Petermanns Mitteilungen*, retaining this post until 1909, when he accepted the chair of geography at Breslau. Under Supan's editorship *Petermanns Mitteilungen* was more concerned with reports and accounts of geographical work in every sphere than with original papers and records of discovery, and a feature in which the editor was much interested was the publication of supplements to the *Mitteilungen*. An account of the economic produce of N. America, 1880–5, appeared in this manner in 1886, and *Die Bevölkerung der Erde*, founded 1872 by Hermann Wagner and Behm, was continued by Supan as a supplement from 1890 to 1910. In 1889 he became editor of the statistical calendar of the *Almanach de Gotha*. His original contributions to geographical science are chiefly concerned with climatology and oceanography, and his published works include *Lehrbuch der Geographie* (1873); *Statistik der unteren Luftströmungen* (1881); *Grundzüge der physischen Erdkunde* (1884); *Deutsche Schulgeographie* (1895; latest ed. 1915) and *Die territorialische Entwicklung der europäischen Kolonien* (1906), besides many papers in *Petermanns Mitteilungen*. He died at Breslau July 6 1920.

SUPPLY AND TRANSPORT, MILITARY (*see* 26.113).—During the World War, the administrative services—*i.e.* the management of transport, supply, welfare and salvage—became of vastly increasing importance. The struggle was between groups of nations bending to the task of war the whole of the resources of a highly complex scientific civilization, and using in its prosecution every material and moral factor at their command. Some note of the working of the administrative machinery (especially at the culminating point of the struggle) is necessary to give a true picture of the war. Attention will be given here in the main to the British organization in 1918—with illustrative references to other armies and to prior dates. For the feeding of the British army, *see* FOOD SUPPLY.

When the armies first took the field in 1914, Germany was at a clear advantage in administration. That was to have been expected. It was her war, and she had prepared for it with meticulous care. The equipment of the German soldiers comprised several novel ideas for greater comfort and efficiency. Examining some of the German dead who had fallen in the early reconnaissance affairs in front of Tirlemont on Aug. 14, the writer had the first uneasiness that Germany might win, so strong was the evidence their equipment gave of a patient and thoughtful preparation. The impressive sweep of the German host through Belgium showed, too, that the German railway organization was superb, and the way the guns kept up proved that there had been a clear thinking out in advance of the new problems of ammunition-supply which the free use of heavy artillery as field pieces had brought to the fore. German staff documents published since the war by Gen. Ludendorff indicate that these matters of administration had been studied from 1910 onwards and that the German staff were confident that their inferiority in numbers would be compensated by a superior organization in supply. The French administrative services in 1914 appeared much weaker if examination were confined to plans and *matériel*. The troops were not as well provided for, the transport organization not so well planned. But if the human factor were taken into consideration much of the handicap was made up. The French showed a genius for improvisation on the actual battle field, and an astonishing faculty for "getting there" with inferior means. Their food scales for man and beast (to give an example) spelt scarcity in German or in English eyes; but they sufficed. In the battle the French soldier was never inferior in energy and endurance; and the French transport was generally up to time. The national *élan* overcame material deficiencies; and a genius for quick improvisation showed constantly, never more dramatically than in the mobilization of Gen. Galliéni's "Taxi-cab Army" which moved out to the defence of the capital at a critical juncture. The British administrative services in 1914 were lavish both of supplies and transport. But the British force was a small one, and though its scale of transport was extravagant compared with the French, the total was only 250 motor cars, 950 motor lorries and 40,000 horses. With railway transport it then had no concern: the French managed its railway transport. Indeed the British force in France in 1914 did not completely "administer" its own affairs. Though it was a distinct army in command it was dependent on the French organization for essential services of transport.

The Trench War.—A long period of trench warfare followed the battle of the Marne, and the administrative systems of the three armies were adapted to new conditions, the chief of which were an enormous increase of ammunition expenditure, the introduction of poison-gas as a weapon, calling for entirely new supplies of offensive and defensive material, and a simplification of the problems of transport, which in a stabilized warfare could follow almost a civilian routine, disturbed only by the chances of shell fire. The trench war was, of course, punctuated by heavy attacks on both sides, but the shift of ground was never great. Administration, whilst it had to cope with the enormous progressive increase in the scale and variety of supplies per division, was thus given ample time as a rule to increase its transport facilities. It could add to its broad-gauge railway tracks, supplement them by light railways and tramways as well as by motor-roads, and develop the canal systems as useful adjuncts.

In this period of trench warfare the Germans suffered from a steady deterioration as compared with the French and the British. The war had become a contest of *matériel* in which Germany could not keep up. The French were able to develop their supply on more generous lines with the help of British and American resources. The British transformed their system completely. The nation took the view that "money was no object" in securing for the troops the best possible chance of victory and the best possible comfort in the trenches. The growth of supplies (and therefore in transport) was almost incredible. The British force in 1914–5 suffered from a shell and gun shortage as compared with its enemy, because it had been trained and equipped for a different type of warfare. It had very little H.E. shell, and what it had was not really "high explosive" owing to poor fuzes. The patient search for a "fool-proof" fuze had been so successful that what little H.E. shell they had spluttered off rather than shattered off. The production of high explosive in 1914 was almost negligible. The whole year's supply would not keep the guns of 1918 going for a day. In 1915 Britain began to produce high explosive on a large scale. In 1916 she had increased the 1915 amount sevenfold. In 1917 she had increased that 1916 amount fourfold. From March 1915 to March 1917 the increase was twenty-eight fold. With the increase in the production of high explosive went a corresponding increase in big guns and in field pieces. The expenditure of ammunition in time reached to huge figures. The following are the biggest day records in tons:—July 1 1916 (Somme) 12,776; April 9 1917 (Vimy) 24,706; June 3 1917 (Arras) 17,162; June 7 1917 (Messines) 20,638; July 31 1917 (Ypres) 22,193; Sept. 20 and 21 1917 (Polygon Wood) 42,156; Aug. 8 and 9 1918 (general attack) 15,598 and 23,706. Ordinarily the British depots in France kept a reserve of 258,000 tons of ammunition, and the issues in a normal month ran to about that figure, though it varied a good deal month by month. Thus the average daily expenditure during the last months of 1918 was:—May, 5,478 tons; June, 4,748 tons; July, 5,683 tons; Aug., 9,046 tons; Sept., 8,576 tons; Oct., 4,748 tons; Nov., 3,158 tons. (*See also* MUNITIONS.)

Gas Warfare.—The introduction of poison-gas was, after the growth of ammunition expenditure, the chief factor in the increase of supply. It was constantly presenting new problems for the administrative services. At first British and French work was solely defensive—the provision of masks, the wearing of which would give immunity, the detection of new gases so as to provide new means of defence. But in time the Allies took the gas offensive, and then their gases were more potent and more plentiful than the enemy's, and for lack of material he could not give his men perfect gas protectors. The last form of gas warfare was the introduction of mustard-gas, a powerful corrosive discharged from shells, which infected the ground on which it fell for many hours. The use of mustard-gas by the enemy raised many problems of supply. The disinfection of contaminated ground with chloride of lime, a prompt change of clothing and bath treatment for men affected, proved efficacious in dealing with mustard-gas. There was, too, safety in protective overalls of oilskin. Mustard-gas affected the veterinary service heavily, there being many casualties to horses and mules through passing over ground infected with the gas.

Big-gun ammunition and gas-warfare munitions were, however, only two items of supply. Rifle and machine-gun ammunition, food for man and beast, trench stores, engineering stores, were other items, all of which had a tendency to grow. In the total during a spell of intense fighting, the British administrative services would carry up to the battle-line 1,934 tons of supplies of all kinds per day per mile of front. The intense battle-front might stretch over 10 miles or more, calling for some 20,000 tons of munitions, food and equipment per day for that 10 miles, much of it passing through furious shell fire before reaching its objective.

The French administrative services never reached the same scale of supply as the British. They expended less ammunition, issued a ration of less weight to man and beast, and dispensed with much of the "comforts" equipment of the British force. But in facing such a German effort as the Verdun attacks of 1916 they had a tremendous problem of transport, which was met by a motor lorry mobilization, the success of which was one of the great feats of the war.

British System Reorganized.—From 1914 up to the date of the first battle of the Somme (July 1916) the British administrative services had had no very severe test (unless the battle of Loos could be so counted, and the organization then was not good).

But by the middle of 1916 the British force in France considered itself completely organized. In munitions it was better supplied than any other force in the field. It had taken over control of its own railway services, supplementing the French broad-gauge railway system, which it had taken over and increased, it had a system of light railways and a greatly increased scale of motor transport. But the Somme battle showed many serious weaknesses. Supply had been increased beyond the scale that transport could cope with. There followed in Nov. 1916 a reorganization of the system. One feature of this organization was good. The division of authority, which put the administrative services under two heads, one for the battle area and one for lines of communication, was done away with. The military railways, which had been hitherto starved, were reorganized, and were generously supplied with staff and material. But what proved in the result to be a mistake in organization was made: railways were separated from the control of the quartermaster-general (who kept control of other forms of transport), and put under an independent directorate of transportation. Thus the commander-in-chief had two separate transport authorities to deal with.

There followed after the battle of the Somme a period when the line was practically stable for a long period; and whilst the almost stationary trench warfare continued, the weakness of this division of authority, and the mistake of allowing any but the military idea to rule in an essential part of the army organization, were not apparent. When the Germans attacked in the spring of 1918 those errors showed very clearly, and the railways had to be brought again under the control of the quartermaster-general, after an interval during which they were under a committee of the staff. But the transport situation then was very critical. The German advance had brought the British front lateral line—St. Just–Amiens–St. Pol-Hazebrouck—under shell-fire at many points. The Germans, whose strategy under Gen. Ludendorff was dominated largely by transport considerations, sought to paralyze completely the whole railway system by continuous air-attack on the British rear lateral—Eu–Abbeville–Etaples,—especially at the points where it crossed the rivers Canche and Somme. Whole-hearted work in building "avoiding" lines and bridges, and the efforts of the motor transport, just kept the position in hand until a British advance in front of Amiens relieved the front lateral. It was a happy circumstance that a new quartermaster-general of the British army in France, Lt.-Gen. Sir Travers Clarke, had just brought to completion the building up of a G.H.Q. reserve of motor lorries. He thought in the winter of 1917–8 that the battle of Passchendaele had exposed a weakness in light railways—that they had to work along defined tracks which could be intensively shelled by the enemy. The British army therefore decided to trust more to the motor transport. There was effected a complete reorganization of it, with the central idea of doing away as far as possible with the "earmarking" of motor vehicles for particular units or particular tasks, and making its total strength completely mobile and liquid. Vehicles saved by this "pooling" were formed into a G.H.Q. Motor Reserve. This proved of great strategical benefit in the spring of 1918. The G.H.Q. Motor Reserve was able then to take up part of the traffic load, and was largely responsible for saving the situation. There were lorry drivers who held the wheel for 36 hours at a stretch, and were lifted from their seats fainting or asleep; a few—who carried on until no longer able to see through their bloodshot eyes—ran their cars into trees or walls or ditches. There were many casualties, but the situation was saved at a time when the railways could not meet the work of supply.

Passchendaele, terrible ordeal as it was for the British army, gave valuable hints as to the proper place of light railways in an administrative system. Light railways at one stage of the war were perhaps over-estimated. There was an inclination to regard them as all-sufficing. The British administrative services ultimately gave them their proper rôle, recognizing that they were most valuable when the line of battle was stabilized for some length of time, but tended to be less valuable as the war became one of movement. In the spring of 1918, the British army had 920 m. of light railways in operation; in the summer 100 m. less. Its great advance was planned on the principle of concentrating labour upon pushing forward the broad-gauge railways and the roads forward from them, trusting to motor transport and to horse transport to carry on the load from broad-gauge railhead. Earlier in 1918 controversy on the subject was keen, and the French were inclined to take a differing view. The Germans, of course, were tied to light railways, for they had not the means to extend their motor traction. The position on Nov. 11 1918 seemed to justify the British view.

By the summer of 1918 the British administrative services were so confident of their machine that they were supporting strongly in favour of trying for a "knock-out blow" as against the alternative plan of devoting the winter to final preparation for an overwhelming campaign in the spring of 1919. "Administration" covered at this stage a wide scope. It arranged the supply, from England, and from its own workshops and local civilian workshops, of all the varied equipment of the forces, from a tank and a 15-in. howitzer to a tin of dubbin. There came to the ports of France every month for the B.E.F. about 800,000 tons of material. The men to be fed totalled over 2,000,000 and the animals about 500,000. The transport system in addition to half-a-million horses and mules, had about 20,000 motor lorries running over 9,000,000 motor miles per month; it carried on its light railways about 544,000 tons a month, and ran every day 250 trains on its broad-gauge lines. It was constantly building new railways and new roads, and developing new harbour facilities. It ran canal and sea barge services, forestry and agricultural services, and repair shops, on a gigantic scale. It supplied the medical stores for wounded and sick, the veterinary services, the laboratories for the defence of men and animals against poison-gas and for the gas counter-offensive. In the last year of the war it produced timber from French forests for four-fifths of its total needs. It grew vegetables and other food and fodder stuffs, and helped as tiller and harvester in the French fields (in 1918 it saved the crops on 18,000 acres, harvesting at night, the soldiers having to work sometimes in gas masks). It was its tailor, bootmaker, laundryman and even ragpicker. The soldier on going out of the line had clean underwear waiting for him at his divisional baths; his soiled garments were disinfected, cleaned and repaired for reissue; his socks darned, buttons replaced, rents patched; and the garment beyond repair was shipped away as rags for the shoddy mills of Dewsbury.

This administrative army was caterer for men and horses. The civilian world throughout Europe might be suffering from scarcity of food supplies, but to the very last the British soldiers and horses enjoyed good rations. This was only made possible by an organization that eliminated every form of waste.

As banker this administration dealt with every currency and note-issue of the world. It had savings banks and an investment organization for British troops, and even special savings banks for the Chinese. It insured its civilian labourers against death and accident; it negotiated the payment of *octroi* to towns where its troops were stationed, and paid compensation of French property owners for the leases of their lands and buildings and the war damage to their property.

The Complexity of Administration.—This wide range of activities, though it had to be carried on under conditions which varied from day to day, fell with minor variations into three main categories. (1) *Maintaining a stabilized position.* This was comparatively easy. The traffic demand was known. Wastage of horses and material could be calculated with some certainty and replaced by a routine process. (2) *Preparing a big attack.* This made the greatest strain on transport and supply, and the necessary conditions of secrecy added complications. In preparing an offensive the traffic tonnage more than doubled per division. This was due to the necessity for making new railways and new roads, and the accumulation of defence material to fortify a new line. But the accumulation of ammunition was also a factor. On a quiet sector two divisions could be served by three trains daily. For the preparation of a big attack ten divisions might be concentrated on that sector, and those divisions in the preparatory stage of the attack would need about 33 supply trains a day, and during the offensive about 27 trains a day. And these trains would carry material only to broad-gauge railhead. After that most of it had to go farther forward by light railway, motor and horse traffic, and in some cases even by the "Yukon pack," *i.e.* by man porterage. (3) *Resisting a big attack.* The difficult element here was its unexpectedness. The amount of supplies per division necessary to go up from base would be 25% less than in the case of the preparation of a big offensive. There was always carried a good reserve of ammunition, food and engineering stores, close behind the line, and a further reserve of ammunition already loaded on trains at appropriate railway centres. In case of emergency, ammunition could start to move up as soon as a locomotive could be coupled to a standing train. The German offensive in 1918 showed that the British carried near the front line too great reserves, and there were unnecessary losses in food, stores and ammunition, as a consequence. Forward "dumps" were thereafter reduced.

The organization at the front in 1918 to cope with this work in the British army, had at its head the quartermaster-general (Lt.-Gen. Sir Travers Clarke) and two deputy quartermaster-generals (Maj.-Gen. Ford and Maj.-Gen. May). The headquarters staff consisted of about 40 officers, and the detailed work was divided under the following departments:—Director of Agricultural Production (Brig.-Gen. Earl of Radnor); Director of Army Postal Services (Brig.-Gen. Price); Deputy Controller of Canteens (Col. E. Benson); Director of Engineering Stores (Brig.-Gen. Sewell); Director of Forestry (Brig.-Gen. Lord Lovat); Director of Hirings and Requisitions and President of Claims Commission (Maj.-Gen. L. B. Friend); Controller of Labour (Brig.-Gen. Wace); Director of Ordnance Services (Maj.-Gen. Sir C. M. Mathew); Paymaster-in-chief (Maj.-Gen. Sir C. A. Bray); Director of Remounts (Brig.-Gen. Sir F. S. Garrett); Controller of Salvage (Brig.-Gen. Alexander Gibb); Director of Supplies (Maj.-Gen. Carter); Director of Motor Transport (Maj.-Gen. Boyce); Director-General of Transportation (Maj.-Gen. Crookshank); Director of Veterinary Services (Maj.-Gen. Moore); Vice-Chairman Imperial War Graves Commission (Maj.-Gen. Fabian Ware); Director of Works (Maj.-Gen. Sir A. M. Stuart). Subsidiary directorates under the Director-General of Transportation were:—Director of Construction (Brig.-Gen. Stewart); Director of Docks (Brig.-Gen. Wedgewood); Director of Inland Water Transport (Brig.-Gen. Luck); Director of Light Railways (Brig.-Gen. Harrison); Railway Traffic (Brig.-Gen. Murray); Roads (Brig.-Gen. Maybury).

A comparison of this organization with the French administrative services would suggest that the British was over-elaborate. But consideration must be given to these important facts: that the British army was operating in a foreign country, and moreover in the country of an Ally where there must be the least possible friction with the inhabitants; that by custom both men and animals in the British force required a particularly generous ration; that the British force expended far more ammunition than the French, and in its campaign methods kept up a permanent minor offensive even on quiet sectors, as was not the custom with the French. When in the course of the operations early in 1918, French and British troops were intermixed in the battle line, it was found by experience impracticable to supply British units through the French system, and, except as regards such items as hay and petrol, which were kept in a common pool, the supply and transport had to be duplicated, a British system being set up side by side with a French.

Salvage.—An account of the administrative system in the World War would be incomplete without some reference to the salvage activities of 1917–8. The submarine war began to have its cumulative effect just when there came the most peremptory reminders that supply was going to be the determining factor of the final struggle. Munitions, food, equipment, railways, roads, ships—these had become the most important factors, and victory would incline to the force which could best concentrate the means to maintain an overwhelming force at some particular point, and could best develop, conserve, and transport its material. From 1915 to the middle of 1917 it was only necessary for the British army to ask and it received. Later in 1917, and in 1918, there came requisitions which could not be met. Just before the German attack in 1918 (to give one example) there were desperate calls for barbed wire, to make up an actual shortage of 8,000 tons in the minimum requirements for safety; but it was not available. In food, forage, clothing, timber, metals, the world-shortage had now become acute. The administrative services of all armies sought to better their position, in Europe, by the organization of a department of salvage. As the British salvage department explained, "the shortage of almost every kind of raw material used for war supplies makes salvage an important administrative service. Without a well-organized and thorough salvage system, the full maintenance of our force in the field would be made difficult. . . . The salvage organization is not intended to take the place of, or in any way discourage, a consistent effort on the part of every supply department to recover for repair and re-issue its own articles and its own empties. It is intended to supplement that effort; to collect and put to use what would otherwise become derelict; to insure that nothing utilizable is allowed to go to waste. . . . There is nothing of the debris of the battlefield which we cannot put to some use." Some of the items of salvage values taken from a monthly return show the wide range of the department—swill for piggeries, £600; solder from old tins, £300; cotton waste, £500; tin-plate (won by unrolling old biscuit tins, etc.), £2,500; old lead, £400; various by-products £200,000. The old rags collected did a great deal to help the cloth shortage at home. The old bones collected made glycerine for explosives. In Sept. 1918 the British army saved £4,000,000, and the American army £3,000,000 by salvage.

The Animals of the Force.—The administration of the animals of the British force—the largest mobilization of animals known to history—calls for a special note. The worst difficulty in their case was mud. From early in autumn until late in spring the mud season lasted. Off the *pavé* roads all the fighting area of Flanders was semi-liquid, and the problem at horse-lines was first to secure a solid "standing," next to secure a solid road in and out to that standing, and finally to secure a solid road to and from a solid watering-place. Standings were usually made of bricks, and the army requisitioned all the brick yards in the occupied area. Shell-ruined villages were another source of brick supply. The bricks had to be set properly; rubble was lost in the soil within a week. Losses from enemy action were not very high among the animals until the last phase. There was little cavalry work except at the end of the campaign and at its very beginning. But horses and mules suffered greatly when the enemy began to use mustard-gas (1917–8). The ground where a mustard-gas shell had fallen was infected for long afterwards. If horses were picketed on it, or even passed over it, casualties were high. The irritant poison of the gas attacked their hoofs and their skins wherever the hair was thin and caused sloughing wounds. An effective curative treatment was found in a dressing, the chief ingredient of which was chloride of lime. From the spring of 1918 the animals suffered severe attacks from the air. The enemy devoted much of his air-force to bombing attacks on horse-lines, with a view to lessening British transport strength. At first these attacks had serious effects. Then horse-lines were camouflaged; the animals were separated into small groups; the lines were protected by bomb-proof traverses of earthwork, which localized the effects of explosions. In the summer of 1918 the wastage of animals by sickness had been cut down to a very low rate (7·7%), as the result of skilful horse-mastership. At this time forage difficulties were acute, but there had been close organization for grading fodder in army and line-of-communication areas, and the animals always had sufficient rations. British administration was able to take a considerable part of the burden of horsing the American units which arrived in France in 1918. Nearly 25,000 animals were made available by reductions of the horse-strength of artillery units. A further 14,000 were saved by giving 6-in. howitzer and some 60-pounder batteries mechanical transport. Another means of economy in horse flesh was the setting up of a "category B" for animals which were not quite fit for arduous work with a fighting unit, and were withdrawn to units whose demands on them were less exacting.

Some Comparisons.—As between the three administrative machines, the French, the British, and the American in the autumn of 1918, certain points of difference may be noted. Both French and American systems still kept a dividing line as regards administration between the base and the fighting line. The British system had abolished this (together with the post of Inspector-General Lines of Communication) in 1917. The French divided the zone of the armies into the zone of the advance and the zone of supplies (with sometimes an intermediate zone). In the zone of their advance administration was in charge of the *Aide major-général chargé de la direction de l'arrière* at G.H.Q. But his administration had no functions of procurement, only of distribution. In some points of administration the dividing line between the zone of advance and the zone of supplies was abolished; *e.g.* all motor transport and all light railways, wherever operating, were under a D.A. at G.H.Q. The French system of supply and distribution was fashioned for war in the home-country or near to it; when it was transplanted (for instance, to Salonika) it had to be modified somewhat on the lines of the British system. The American system put administration in the fighting line under an assistant chief-of-staff (G.4) at G.H.Q.; and on the lines of communication under a general commanding S.O.S. (corresponding to the former British I.G.C.). Under the American system the chiefs of the supply services were not at G.H.Q. but at the H.Q. of S.O.S. With both the French and the American systems evacuation and hospitalization of casualties were purely "Q" services: in the British army they were under the adjutant-general assisted by the quartermaster-general. Some other differences came from geographical reasons. France itself was really the supply-base for the Americans, whereas the British had the United Kingdom for this purpose; so the Americans held great stocks in depots—15 days of supplies in advance depots, 30 days supplies in intermediate depots, 45 days supplies in base depots. The American army naturally relied more largely on local purchases (from the Allied armies and from European civilian sources) than did the armies with their home bases nearer at hand. General Pershing founded a general purchasing agency to control these purchases. In 1918, out of 17,600,000 ship-tons used by the American army only 7,600,000 tons came from the United States and 10,000,000 tons were purchased locally, and to the end of the campaign the American army drew largely upon British and French supplies.

The British administrative machine in one particular point was inferior to the American machine in 1918. Under the British system the navy had control of all supplies by ship until they left the transport. The navy could put a supply-ship into any port it pleased, and naturally was guided chiefly by shipping considerations. Thus supplies for the southern area might go to a northern port. The American system put the supply ships under army direction when they came within the three-mile coast limit, and they could be directed to the port of supply which was most convenient from the army point of view. The French and the Americans used the railway regulating stations as depots; the British used them as sorting stations only. The British used the base-ports for sorting goods to a great extent; the Americans did not. In the autumn of 1918 the Americans found their one great depot, and sorting and regulating station, at Is-sur-Tille insufficient for the needs of their growing army, and they were proceeding with the organization of another station when the Armistice came.

The general staffs of the various combatant nations were in 1921 still working out the lessons of administration as taught by the World War. One principle seems to be generally accepted, that it is wise to centralize as far as possible all administration under one staff officer over the whole war area, trusting to him to devolve and coördinate. That was the final principle of the organization of the administrative services in the British army in 1918. In the first phase of the war the French organization did a large portion of the work of transporting the British army and its supplies. As the British force grew in strength, and the problem of its administration grew in complexity, the experiment was tried of dividing responsibility between the quartermaster-general of the force and the G.O.C. lines of communication. "Q" tasks were under different control in battle areas and at the base. This did not work satisfactorily, and the next experiment was to divide responsibility between the quartermaster-general and the director-general of transportation (the latter having control of the broad-gauge railways, the former of all other transport). This arrangement broke down in the spring of 1918, when the British army was put into serious jeopardy through the transport situation; retirement south of the Somme had to be contemplated, at one stage as probable, and the details were actually arranged for the destruction of the ports of the Pas-de-Calais so as to deny their use to the Germans. In the summer of 1918 the British administrative services from the coast line to the trench-line were put under one head, the quartermaster-general, for experience suggested that the commander-in-chief should have one man to whom he could confide the responsibility of the administrative side of his army's operations: to divide the responsibility was not to simplify but to complicate the task. (F. F.)

SURVEYING (*see* 26.142*).—The most striking feature to be recorded in connexion with surveying generally is the greatly increased importance which it acquired during 1910–20 from a military standpoint. This was chiefly due to the stationary character of the World War on the western front, but other factors contributed, notably the introduction of air-photography. The use of photographs, taken from aeroplanes, to determine the position of enemy trenches and other detail inside the enemy's lines, made a considerable difference in the technique of modern war and reacted upon the methods of peace-time surveys. But not only photographs from the air, but also photographs taken on land have been pressed into the service of surveying, and the applications of photography to surveys of mountainous regions such as the higher Himalayas have been greatly extended.

In exploratory surveying the conditions have been changed and simplified by the introduction of wireless telegraphy, for the determination of longitude; the accurate fixing of his longitude, long the explorer's bugbear, is now no more difficult than taking a latitude. In the more regular branches of the subject the principal matter demanding attention is the development (in which many countries have taken part) of accurate methods of levelling, particularly of precise or geodetic levelling.

Surveying in War

Geographical and topographical surveys are well known adjuncts to military operations. The war of 1914–8 showed that all other classes of land surveying, *i.e.* geodetic triangulation, levelling, and large scale surveying may be called upon to assist in the development of scientific and mechanical warfare. It is not possible to forecast whether future developments may demand an enhanced accuracy of survey, or whether the increasing importance of aviation, amongst other factors, may not prevent a recurrence of the stationary operations which prevailed over the western front for four years. A description of the more important duties of the Survey battalions on the western front, offers the best record of an intensive large scale military survey.

The Trigonometrical Control.—The extent of the line, liable to periods of intense activity throughout its length, and the constant changes of army and corps fronts made it necessary to provide a homogeneous and complete system of triangulation upon which to base the maps and the local surveys called for.

Five separate and distinct triangulations already covered this area before the outbreak of war, viz:—

1. The French main arcs and subsidiary triangulations of 1800–50.
2. The new French Paris meridian and Amiens parallel and their subsidiary orders of 1890–1900.
3. The French Admiralty coastal triangulation.
4. The Belgian national triangulation.
5. The German national triangulation.

All these triangulations were eventually combined into a single coherent system, but not until just before the Armistice and too late to assist in operations. The surveyors of the various armies kept in the closest touch with each other, but discrepancies arose nevertheless, and time was wasted in fresh observations and recomputation. It was realized somewhat late that the adjustment of the discrepancies of local triangulations is the best preliminary to military surveys.

Many of the stations of the triangulations enumerated had been destroyed or built over before the war and many were destroyed during its progress. Numbers of new stations had, therefore, to be established and the trigonometrical observer was employed in intersection and interpolation, rather than new triangulations.

This patched and reconstructed triangulation stood then as a basis for all the military surveys of the western front.

Provision and Issue of Maps.—The British Expeditionary Force took the field equipped with the 1/80,000 *carte de l'état major* of France and the British 1/100,000 maps of Belgium. Topographical maps of this sort were accurate enough for mobile operations in which no heavy guns were employed. Directly the operations tended to become stationary first on the Aisne, and then in Flanders, staff, gunners, and infantrymen demanded a map of such accuracy and

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**** These figures indicate the volume and page number of the previous article.***

scale that administrative arrangements, lines of fire, and trench systems could be shown upon it. Such a map did not exist except in the Belgian area, and elsewhere had to be made. The earlier war surveys were made upon the plane table on a scale of 1/20,000 and were completed up to the British trench lines. The subsequent development of air-photography, and the discovery of the manuscript sheets of the cadastral communal surveys, made it possible to compile reliable maps, not only of territory in British occupation, but of all that portion of north-eastern France occupied by the German armies.

The trench zone was mapped on a scale of 1/10,000, and forward and back areas at 1/20,000. In all 6,000 sq. m. were surveyed.

A reliable map of the physical and artificial features of the country is not sufficient in itself. The positions of defensive works of the enemy batteries, of the points of administrative importance, and of many other objects must be shown on frequently recurring editions. From 12 to 20 editions embodying such information on various scales were kept up for the actual area of operations, whilst during the progress of a battle daily editions were brought out.

To cope with this volume of printing it was found necessary to provide for the rapid reproduction of trench maps at the Ordnance Survey Office at Southampton and for small but complete lithographic establishments in each army and at G.H.Q. Zinc plates were prepared by the Vandyke process or by helio-zincography, and flatbed printing machines, preferably motor-driven, were used for printing in the field. The French and German armies had well-equipped printing trains which were used for increasing printing facilities in important areas. The French, for example, dispatched a printing train to Italy in 1917. Towards the end the Americans employed a well-designed printing plant in lorries.

A scale of issue of about two copies per officer engaged, of each important map, was maintained, but experience showed that this scale should be increased. During the whole period of operations about 34,000,000 maps were printed for issue to the British troops, of which about two-thirds were printed by the Ordnance Survey in England and a third in France.

For the use of large scale maps in trench warfare a well-thought-out system of coördinates, based on a suitable projection, was needed. It must be possible to read off at sight the coördinates of any desired point from a "grid" or network of lines printed on the map. All the armies had such systems. Experience proved that for ease and accuracy of reference the "grid" should be in squares, the sides of which can be divided decimally by eye. The artillery often desire coördinates of the same accuracy as the surveyor—*i.e.* on the scale of nature. The system adopted should therefore be based upon the coördinates used by the surveyor, with an easy form of abbreviation to be used by all arms to define map positions. Accuracy of bearing from any one position must be maintained together with as near an approach to linear accuracy as possible, whilst the system must allow of extension over the whole area of operations.

The considerations which influence the choice of a reference "grid" have already pointed to the desirability of an orthomorphic projection. For the conduct of surveys constantly in progress it is equally important. Computations must be cut down to the minimum, and this is best secured by working on a projection in which the position on the ground and the position on the map can be calculated in one process without sensible error.

From the cartographic point of view the question is not so important, and there are many projections which would provide a sensibly accurate map over large areas.

It was decided late in the war to adopt an orthomorphic projection with two standard parallels which had recently been adopted in the French armies, but the decision came too late, and the Bonne projection continued in use in the British army until the Armistice.

Surveys for Artillery Purposes.—Other things being equal, that artillery will dominate its adversary which has the quickest and most accurate knowledge of hostile battery positions and which can open most quickly an accurate and unexpected fire upon them. The construction and calibration of guns and howitzers, the homogeneity of ammunition, and the measurement of those atmospheric elements which affect ballistics are involved; but accurate survey of the relative positions of gun and target is essential.

The positions of British heavy batteries were, therefore, fixed with a theodolite, each battery was supplied with a chart or "artillery board" on which the map was pasted down, in sections, upon a zinc or three-ply wood surface, and special "bearing pickets" were inserted in numbers in the battery zone. The bearings from these pickets to surrounding objects, suitable as reference objects, were tabulated and distributed.

The positions of hostile batteries were also surveyed with as much dispatch and accuracy as possible by one or other or both of the following methods:—

(*a*) Intersection of three or more rays observed upon the flash of discharge, the reflection in the sky of this flash, or, upon the smoke puff from the muzzle. This operation, commonly known as flash spotting, was carried out by units, each of which manned four survey observation posts, or instrument stations, and one headquarter post. Each section had its own internal telephone system and was in direct communication with an artillery headquarters.

Observations were directed by an ingenious controlling exchange upon hostile guns in succession. This method, independent of the map, gave very good results but depended for success upon good visibility. Flash-spotting units could survey the positions of the bursts of our own shell and were, therefore, also used extensively for ranging and for calibration.

(*b*) *Sound-ranging.*—A sound, in still uniform air, spreads outwards from its origin with an equal velocity in all directions, and the sound waves may therefore be likened to the ripples spreading outwards on a pond from the point at which a stone has fallen into it.

If we now imagine a row of surveyed pegs, more or less tangential to a ripple, projecting from the surface of the water, if we measure the times at which the ripple strikes each peg and know the velocity of the advance of the ripple we shall have all the data necessary for fixing the position of the origin of the disturbance. All armies engaged on the western front had some system for determining the position of a gun from the sound of its discharge, embodying the above principle. It is unnecessary here to describe the British system, except in so far as the survey of the sound-receiving stations is concerned. A sound-ranging base was generally, though not invariably, laid out on the arc of a circle, the centre of which lay in the zone of the enemy's heavy artillery. There were usually six sound-receiving stations about 1,000 metres apart. The coördinates of the selected spot for each station were computed in the office, and the surveyor had to find and mark the corresponding points on the ground. Errors of more than one metre in position resulted in sensible errors in sound-ranging.

Sound-ranging is naturally unaffected by bad visibility, but is put out of action by a moderate wind blowing from base to gun and is interfered with by any high wind. As in the case of flash spotting, a good telephone connexion to the artillery headquarters is essential.

Surveying by Air-photography

Air-photography, or, to be more precise, photography of the ground from the air, has been recognized as a possible method of survey since the middle of the 19th century.

Experiments in photographing the ground from balloons had been made by Col. Laussedat, Major Elsdale and others from 1859 onwards, but air-photographs played no part in any important survey before the outbreak of war in 1914. During the course of the war the difficulty of producing maps on medium scales was enhanced by the inaccessibility of the most important areas. It was due to this fact, and to the development in 1915 of photography from aeroplanes, that large areas in many theatres of war were mapped by the aid of air-photographs. But no full examination of the possibilities was made, and for peace surveys the method still remains in the experimental stage.

Optical Principles.—Provided that the optical axis of the camera is vertical at the moment of exposure, the resulting photograph of a flat level area will be an accurate plan at a scale determined by the equation

$$\frac{f}{h}=s$$

where f is the focal length, h is the height of the camera above the ground at the moment of exposure, s is the representative fraction of the scale.

Such photographs will be called vertical photographs. As a rule, however, the photograph is not exactly vertical, but the axis is tilted at an angle to the vertical. The photograph then becomes an inclined perspective view. (*See* Fig. 1.)

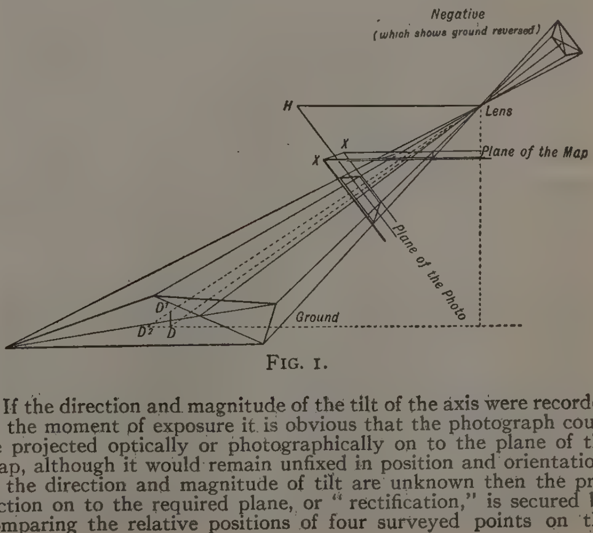

FIG. 1.

If the direction and magnitude of the tilt of the axis were recorded at the moment of exposure it is obvious that the photograph could be projected optically or photographically on to the plane of the map, although it would remain unfixed in position and orientation. If the direction and magnitude of tilt are unknown then the projection on to the required plane, or "rectification," is secured by comparing the relative positions of four surveyed points on the ground and on the photograph, which is then also fixed in position and orientation. Where the tilt is known, approximately three points common to map and photograph will furnish a solution. Two further points of importance are that (1) straight lines upon a plane remain straight lines upon any perspective view of that plane; (2) at any point on an inclined perspective view the scale is not the same in directions parallel to and perpendicular to the axis of tilt.

In plotting detail from vertical photographs certain errors, due to instrumental imperfections, may arise but are seldom of sensible magnitude. These are due to (1) a change in the relative position of plate lens and area photographed, due to the shutter moving so comparatively slowly that the movement of the aeroplane becomes noticeable on the plate; (2) distortion due to optical imperfections of the lens.

Construction of the Map.—In order to explain how a map is built up, wholly or partly, from air-photographs it is advisable to take some illustrative cases. The simplest case is where it is desired to produce a map of an area in which a sufficient trigonometrical control already exists and of which there is available a complete collection of cadastral plans, which are, however, much out of date. Ground features are low and gently undulating, extreme difference of altitudes being two or three hundred feet only.

In such a case topography can be brought up to date from air-photographs taken with the axis as nearly vertical as possible, and fitted upon the cadastral framework by one or other of the methods described below. When this is complete the map is contoured in the field, names are added and the topography examined for omissions or mistakes.

The most difficult case arises when the area to be mapped is rugged and mountainous, and the inhabitants hostile: the positions and heights of a few peaks in it, visible from accessible ground, have been fixed trigonometrically, but no reliable map exists.

As a preliminary measure oblique photographs are taken from a variety of points of view. The positions of the camera in space are calculated, and from measurements on each photograph a number of rays are drawn to noteworthy points in the valleys and on the hills. Positions and heights are thus determined for a subsidiary control. With the axis vertical a series of photographs of valleys and of watersheds are taken, pasted together, and fitted to the control. When the map has been thus built up, form-lines are added from the oblique photographs and upon the fixed heights. In the majority of surveys difficulties will be of an order intermediate between those of the foregoing two cases.

Applications of Air-photography.—In any particular survey air-photographs may be used then for any or all of the following processes, viz.:—(1) Air-photo control, (2) Air-photo-topography, (3) Air-photo contouring.

In taking vertical photographs for air-photo control, exposures are so regulated as to ensure a substantial overlap, generally amounting to 50% at least. Each successive photograph may therefore be fitted to its predecessor, and lines or traverses of photographs may be mounted and scaled between fixed points. Any two or more traverses of different and independent lines may be made to intersect over some topographical object, the position of which may be determined as the simple, or weighted, mean of the individual positions from each traverse. Traverses may also be made to converge and end upon some prearranged and hitherto unfixed object. This method has given fairly accurate results in flat country on the scale of 1/40,000, and is dependent upon the ability of the pilot to maintain an even keel and a constant height.

In broken and hilly country no method can be regarded as trustworthy which does not take into account differences of altitude. We must then be content to limit the use of each photograph to the measurement of horizontal and vertical angles and to fix the positions of new points by intersection from two or more photographs. Where this principle is decided upon there remains no advantage to be derived from the vertical photograph, and oblique photographs are used in preference as covering larger areas and allowing greater refinement in the measurement of vertical angles.

The first stage of this photo-topography from the air is to interpolate the position of exposure in space from three or more points, the positions of which on the earth's surface are known, and which appear on the photograph. If we consider the pyramids whose apices are the lens and the bases of which are the triangles formed by the three fixed points respectively on the ground and on the photographic plate (*see* fig. 2), we see that (*a*) the angles at the apex are a function of the lengths *ab*, *ac*, *bc* (which can be measured upon the plate), and of the focal length; (*b*) the inclination of the ground pyramid to its base is determined by the direction and magnitude of tilt; at the present time there are no means of measuring accurately the tilt of the plate at the moment of exposure, and calculation follows by successive approximations from a preliminary estimation; (*c*) the position of O in space can be calculated and plotted in its correct projection on the plane of A, D, C; (*d*) angles may be measured upon the plate and rays drawn to additional points from O.

From the nature of the case air-photo control must be limited to the provision of a few supplementary points.

Where the area to be mapped contains a sufficiently close control the filling in of topographical detail is more easily done from vertical than from oblique photographs, providing that the area in question is not markedly hilly. The scale on which photographs are taken may be larger or smaller than that of the map, but it must be sufficiently large to allow of clear identification of detail.

The area to be mapped is photographed from a prearranged height in strips allowing for an overlap in all directions. Much depends upon the training of the pilot in maintaining his height and his overlap. It is usual to arrange for a mechanical control of exposures regulated according to the ground speed of the aeroplane.

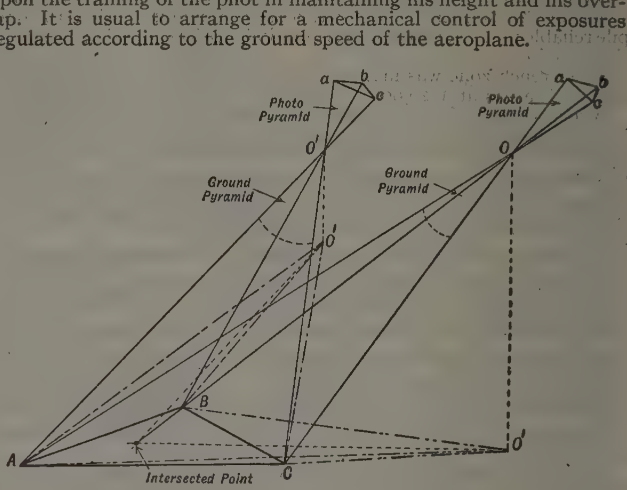

FIG. 2.

The plotting of detail from these photographs would be simple if the axis of the camera could be maintained in a vertical position. It would then be necessary only to bring the photograph to the scale of the map. No means of ensuring this verticality has, as yet, been evolved. It often becomes necessary, therefore, to fit photographs individually upon the control points. This can be done graphically, or optically by the *camera lucida*, or by the enlarging camera.

The graphic method depends upon the principle that as straight lines on one plane remain straight lines on any perspective of that plane the position of a point which lies upon the intersection of two lines common to the ground and to the photograph may be readily determined. Within narrow limits the proportional compass set to the difference of scale between map and photograph at this point may be used to fix additional points. It is more accurate, however, to maintain the straight line principle and to cover the map and photograph with a "grid" of corresponding lines, as in fig. 3.

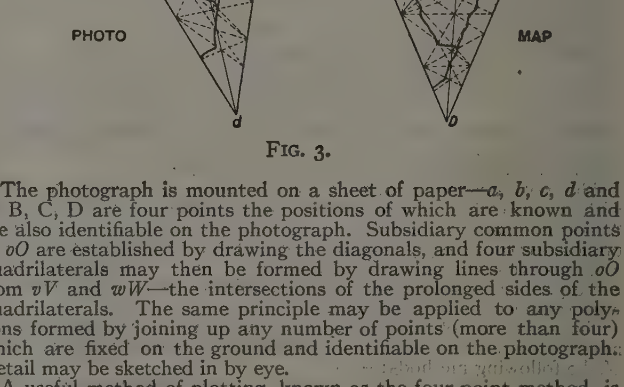

FIG. 3.

The photograph is mounted on a sheet of paper—*a*, *b*, *c*, *d* and A, B, C, D are four points the positions of which are known and are also identifiable on the photograph. Subsidiary common points at *o*O are established by drawing the diagonals, and four subsidiary quadrilaterals may then be formed by drawing lines through *o*O from *v*V and *w*W—the intersections of the prolonged sides of the quadrilaterals. The same principle may be applied to any polygons formed by joining up any number of points (more than four) which are fixed on the ground and identifiable on the photograph. Detail may be sketched in by eye.

A useful method of plotting, known as the four-point method, is as follows (fig. 4): It can be proved that the cross ratios of four points which lie upon a straight line are the same upon any perspective view of that line, hence we can readily plot the position of a fifth point (S) if we know the positions of four points A,B,C,D.

Let A, B, C, D be four known points on the photograph and *a*, *b*, *c*, *d* their positions on the map, and let S be a point on the photograph the position of which on the map is to be found.

Join A B, A C, A S, and A D, *a b*, *a c*, and *a d*.

Lay a piece of paper with a straight edge, in any position cutting the lines A B in B′, A C in C′, A S in S′ in A D in D′ and mark these cutting points on the paper.

Now lay the paper strip on the map and fit it upon the lines *a b*, *a c*, and *a d*, so that B′, C′ and D′ lie upon these lines.

Mark on the map the position of a point *s*′ opposite the mark S′ on the paper strip. Join *a s*′. Then *s*, the position of point S, upon the map, lies upon the line *a s*′.

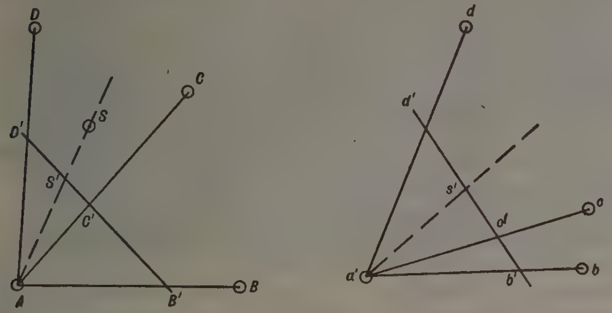

FIG. 4.

Repeat this proceeding from B, C, or D, and another line *b s*′, *c s*′, or *d s*′, will be secured, the intersection of which with *a s*′ will define the position of S.

The *camera lucida* (*see* 5.104) has been used extensively for plotting. The upright carrying the prism is mounted on a stand upon which are also mounted two boards roughly at right angles to each other called respectively the map and photograph boards. Movements are added to allow of rotating the photograph in its own plane, of tilting the map (or tracing of control points) around an axis parallel to a marked horizontal line on the photograph board, and of increasing or decreasing the distance between the prism and the photo board (fig. 5).

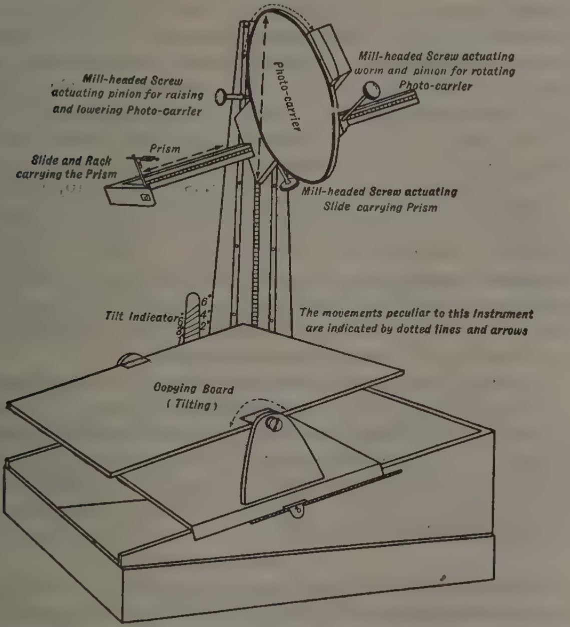
Mill-headed Screw actuating pinion for raising and lowering Photo-carrier
Photo-carrier
Mill-headed Screw actuating worm and pinion for rotating Photo-carrier
Prism
Slide and Rack carrying the Prism
Mill-headed Screw actuating Slide carrying Prism
Tilt Indicator
The movements peculiar to this instrument are indicated by dotted lines and arrows
Copying Board (Tilting)

FIG. 5.

Graphic and optical methods are tedious and lengthy compared with a photographic rectification. The ordinary enlarging camera can be made to answer the purpose with little modification. It must provide, in addition to its focussing movements, as follows:—

1. The negative must be capable of rotation in its own plane around its centre.
2. The copying board and negative carrier must be capable of rotation around parallel axes which are at right angles to the optical axis of the lens.
3. The copying board and negative carrier must be capable of movement along the line axis of the lens.
4. The negative carrier must be capable of a movement bodily at right angles to its axis of rotation.

By means of these movements a coincidence can be obtained between the four control points on the map and on the photograph, and a "rectified" print may be obtained.

Little contouring has as yet been based on air-photographs. It must be recognized at the outset that it is impossible to calculate relative heights from measurements taken from a single photograph; for the accurate determination of relative heights we must have at least two photographs taken from different places. An outline of photogrammetry from the air has already been given and mention has been made of interpolation in space, and of the survey of new points by intersecting rays. A short additional step—the measurement of vertical angles on the plate—makes it possible to calculate the height of these new points.

Stereo-photogrammetry from the air may develop in the future, but has not been made use of hitherto. On the other hand much use has been made of the stereoscopic effect visible on two photographs of the same area taken from different positions. Such information is not of an exact nature but gives a valuable indication of ground forms and brings out the system of drainage.

Until 1920 mapping from air-photographs had been confined almost entirely to war time, and to areas already covered by a trigonometrical control, hence there had been little opportunity of comparing the cost of this method with that of any other, or of laying down definitely its possibilities and limitations. Clearly its greatest value lies in the mapping of inaccessible country.

So far as can be judged, the chief fields of usefulness open to air-photo-topography are, the surveying of native towns on scales of about 1/10,000, or 6 in. to 1 m.; the surveying of deltas and intricate water channels; and the surveying of ancient sites, on which the indications of a former civilization become far more evident in the air than on the ground. Topography on ordinary small scales, and accurate large scale cadastral mapping are, so far, ruled out. But it appears that developments may very well be looked for in each of these directions.

Photographic Surveying

The idea of applying photography to surveying was originally due to Col. Laussedat (1819–1907), who made some experiments in the matter in 1859, and continued during his long life to expound and develop the method. Although the system originated in France not much was done in that country in the way of its practical application, and, if we except some minor work by MM. J. and H. Vallot in the Mont Blanc region in 1892 and some similar mapping by M. Flusin in 1905, it is to Canada that we must go for its first use on any considerable scale.

In 1895 Mr. E. Deville, surveyor-general of Dominion Lands, published his important work on photographic surveying, which remains a complete exposition of the subject if we exclude some recent departures. Between 1886 and 1892 photographic surveys were confined to the Rocky Mts. in the neighbourhood of the Canadian Pacific railway, but in 1893–4 the method was used by Mr. W. F. King in the survey of the Canada-Alaska frontier. In 1901–2 Mr. A. O. Wheeler carried out a very successful photographic survey of the Selkirk range, British Columbia, on the scale of 1/60,000; this was published, with an interesting account of the range, in 1905.

In the U.S. photo-topographic surveys had been made use of on the International Boundary Survey and reports made by Mr. M. A. Flemer of the U.S. Coast and Geodetic Survey in 1897–8. Stereo-photo surveys (*see* below) were employed in the survey of Tutuila, Samoa, by the U.S. Hydrographic Office in 1916; and an innovation in the shape of a panoramic camera was first used by Mr. C. W. Wright in Alaska in 1904 and extended by Mr. J. W. Bagley who wrote an important treatise on the subject in 1917 (Washington, Government Printing Office).

In 1907–8 Lt. M. Weiss, of the expedition commanded by Duke Adolphus of Mecklenburg, made a photo-survey of the volcanic Mfumbiro Mts. to the N. of Lake Kivu. Other fragmentary surveys in various parts of the world have been carried out by the aid of photographic methods; most of them, as well as those mentioned above, were in mountainous country.

Outline of the Method.—Assuming that a photograph is a true perspective view, that the plate was vertical when exposed, and that the horizon-line and focal length of the lens are known, it is clearly possible to determine the horizontal and vertical angles from the point where the camera was set up to all objects represented in the photograph, the horizontal angles being measured from some known, represented object. If two such photographs are taken from two points, at known distance apart, we have the means of determining the distance and height of all points shown on both photographs.

It will therefore be necessary in planning a photographic survey, to arrange for a triangulation to fix the relative positions of points at which the camera will be set up, and the first stage in the office work will consist in the plotting of the triangulation. A camera station need not, however, be a trigonometrical point, provided that its trigonometrical position can be measured from the photograph. To use the photographs for plotting the detail, from each camera station A draw, at its correct angle, the central line of view. Along this line draw A x, equal to the focal length of the lens; through x draw a line at right angles to A x and plot from x the projections of the distant points, as measured on the horizon-line of the photograph. The intersection of rays from A to the points so obtained, with rays to the same objects from other stations, will give their positions.

It is an almost universal rule of photographic surveying from the ground to maintain the photographic plate in a vertical position, because any inclination of the perspective plane of the plate adds difficulties to the plotting.

A supplementary order of triangulation is usually added contemporaneously with the field work of photogrammetry, both to fix camera positions and to add a few bearings and vertical angles from which the photographic data may be checked.

For many years cameras specially designed for surveying work have been available, a good example being the Bridges-Lee phototheodolite. The essential features of these are, that the focal length should remain constant (for which purpose the sensitized surface of the plate should be pressed firmly against the frame of the camera), that the position of the optical centre, and of the horizon and principal planes should be deducible from marks on the plate, and that the lens should be free from distortion and aberration. It is also important to provide levels by means of which to ensure the verticality of the plate. The later photogrammetric cameras are either interchangeable with transit theodolites on the same portable stands, carry eccentric telescopes, or else combine the two instruments by substituting a telescopic lens for the usual photographic lens, and by inserting an eyepiece in the back of the camera. The field work demands a high standard of topographic training, for it is not easy to select the minimum number of views sufficient to cover the country whilst leaving no gaps. Valleys and low-lying areas constitute the main difficulty. One or two stations *per diem* are all that have been occupied by the same party in the photogrammetric surveys of the Canadian N.W. frontier, whilst a supplementary triangulation was carried on concurrently.

The office work takes two or three times as long as the field work and consists in plotting positions, calculating heights, and drawing contours from data measured on the developed plates.

The picture trace will naturally assume the form of the arc of a circle if a panoramic camera is used such as that employed during 1910–6 by Mr. J. W. Bagley in Alaska.

There are several plotting devices on the market, such as the perspectograph, but they have not been largely employed. On the other hand vanishing scales and perspectometers (grids showing the perspective on a vertical plane of a series of squares on a horizontal and lower plane) can be readily constructed.

Stereo-photo Surveying.—The most recent development of photographic surveying consists in the employment of the stereoscopic principle. The stereoscope as a toy has long been known, but Dr. Pulfrich of the firm of Zeiss of Jena, and Col. von Hübl of the Austrian military geographical service, conceived the idea of applying the stereoscopic principle to the service of exact surveying. Other pioneers in 1907–8 were the late Capt. F. V. Thompson, R.E., and Mr. Conrady. In 1913 Mr. G. Muller carried out a successful stereo-photo survey for part of the proposed Hankow-Ichang railway. In order to carry out a normal photographic survey successfully it is necessary to arrange for stations far apart and for intersections of some 30 degrees or so. But in stereo-photo surveying two stations can be occupied on the same hill-top and their distance apart need only be some 50 to 300 feet.

In the simplest case let two vertical photographic plates be exposed from two points, say 100 ft. apart; let the plates be in the same plane and their centres on the same level. Then if these plates are put into a stereoscope provided with a system of lenses and prisms such that the eyepieces are brought to a convenient distance for seeing, we shall clearly get a very much magnified stereoscopic effect as compared with what is obtainable with the naked eyes. In the diaphragm of each eyepiece let there be a similar movable mark, or line on glass. On looking through the eyepieces the marks in question will appear as a single mark floating in space, and by vertical and horizontal adjustments this mark can be made to touch any given object in the picture. We have, thus, a means of measuring small parallaxes and vertical angles, and these can be read off graduated micrometer heads.

A stereo-comparator as above described gives angles from the centre of the plate, distances and vertical angles; but the reading is laborious and the map has to be constructed point by point.

In 1907 Lieut. von Orel, of the Military Geographical Institute of Vienna, attempted the construction of a machine which should quasi-automatically draw the map, and in 1909 such an instrument was made by Zeiss of Jena. A further model of 1911 permitted the automatic drawing of contours and the outline of detail. The instrument is called the stereo-autograph; several have been made and are in existence in Austria, Germany and France. A stereo-autograph is, of course, an expensive instrument and requires a skilled operator and good plates of even density. But, given these conditions, practical results have been obtained and the method is one to be reckoned with in the future. Generally with stereo-photography we are not limited to a country with marked features, as is the case with normal photo-topography. Provided that the view is clear, gently undulating or flat country can be as well surveyed and contoured as a mountainous region. The method has some obvious applications, but it is useless in forest-clad country or in towns and its value largely depends upon good view points. The old, photographic surveying has as its chief field of usefulness a well-marked mountainous region. The new is not so limited but its rôle has not yet been fully determined.

Bibliography of Photographic Surveying.—In 1895 Mr. E. Deville was able to quote the titles of 26 works on photographic surveying; in 1911 Dr. Pulfrich in his *Stereoskopisches Sehen und Messen* mentions 276 works, chiefly in German, on stereo-photography alone! The following books may be recommended: *Photographic Surveying*, E. Deville, Ottawa, 1895; *Hints to Travellers*, vol. I. R.G.S., 1906; *The Use of the Panoramic Camera in Topographic Surveying*, James W. Bagley, Washington, 1917; *Revue Générale des Sciences*, March 1914, Paris, for stereo-photo-topography.

Longitude by Wireless Telegraphy

The chief technical difficulty which explorers and surveyors in new countries have hitherto experienced has been in the determination of longitude in regions unprovided with a telegraph system. This applies to almost all the unexplored, or little explored, parts of the world. Since 1910, however, the great advance made in the transmission of signals by wireless telegraphy has completely done away with this source of difficulty and error. Wireless "receiving" sets are now made of a very portable character; so much so, that one mule or one porter can carry the whole apparatus. Frequent practical use is being made of this method of obtaining time signals, as the following instances will show. In the year 1912 Comm. Edwards fixed positions during the Bolivia–Brazil boundary commission by wireless signals from Washington and intermediate stations; in 1913–4 Cav. Dr. Filippo de Filippi in an expedition to the Karakoram used wireless signals from Lahore and from Italy; Major A. J. Woodroffe in 1913–5 determined longitudes on the Peru–Brazil boundary commission by wireless signals sent from Senna Madureira, Brazil; in 1914–7 the French explorer, Lt.-Col. J. Tilho, used wireless signals from Paris to determine longitudes in his explorations of Tibesti, Borku, Erdi, and Ennedi; in 1917 Capt. A. J. Bamford determined the longitudes of Bagdad and Kermanshah by wireless signals from Fao, which had previously been connected with Basra; in 1919–20 the American traveller, Dr. A. Hamilton Rice, made use of wireless signals from Annapolis, Washington and Darien, to determine longitudes during his Amazonas expedition. Fig. 6 illustrates the wireless receiving set used by Dr. Hamilton Rice in 1919–20; it was designed by Mr. J. W. Swanson and Mr. P. F. Godley, and was found quite satisfactory and very portable.

It is safe to say that, in future, no properly equipped exploring expedition will be without its wireless receiving set. The designs of these sets will change from time to time and, no doubt, improvements will be made; but the method has proven to be thoroughly practical, and the extra amount of transport required is already of a negligible character. One of the greatest difficulties of the explorer has thus been removed.

Levelling

Since 1910 much progress has been made in the development of a sound system of levelling, especially with regard to precise, or geodetic levelling, *i.e.* that levelling which provides the framework on which all national levels depend. The now defunct International Geodetic Assn. laid down some wise rules on the subject of the precision of work of the highest standard. The admirable treatise of M. Ch. Lallemand, *Nivellement de haute Précision*, marked a great advance on previous text-books; and the production of the modern geodetic levelling instruments of France, the U.S. and Switzerland afforded the means of greatly increasing the accuracy of observation. To this should be added the introduction, by the Ordnance Survey of the United Kingdom, of a specially devised kind of permanent bench-mark, which did away with a weak element in the old levelling, the instability of the ground marks.

Levelling Instruments.—As a type of the instruments in use for levelling of high precision the level designed by Dr. Wildt, and made

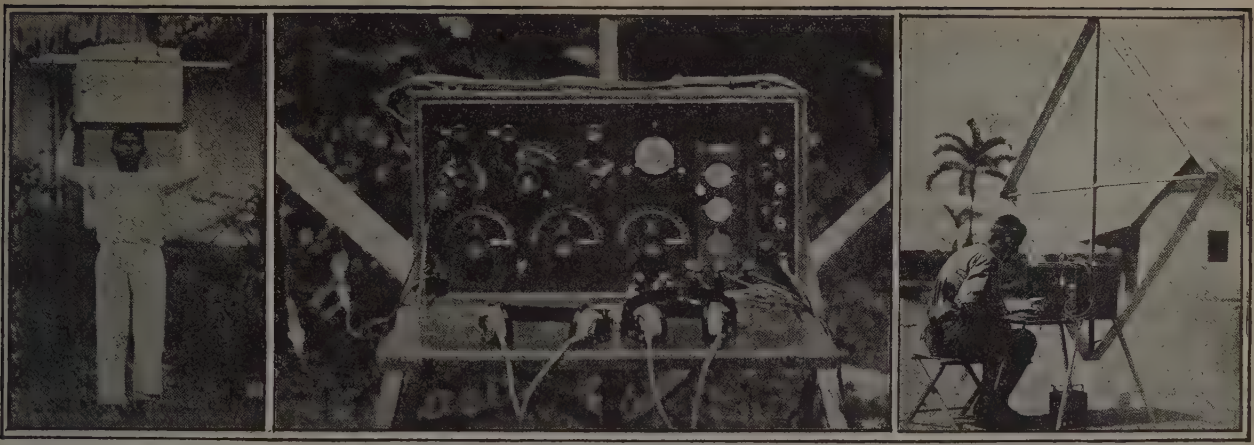

Set packed for transport. Receiver and Loop set up ready for use. Receiving Signals.

Fig. 6.—Portable Receiving Set.

by the Carl Zeiss optical works of Jena, may be taken. Levels of this kind are also manufactured by Messrs. T. Cooke & Sons of York and Messrs. E. R. Watts & Son of London. The instrument includes the following modern improvements which distinguish it from the levels used for rougher surveys or engineering work; the bubble is read from the eye end of the telescope, so that it is not necessary to disturb the instrument by walking to its side and bending over to read it; the final levelling of the instrument is effected by means of a slow-motion screw which slightly tilts the telescope; and the level is provided with a micrometer attachment in the form of a plate of glass with parallel faces in front of the object glass and this attachment can be tilted by means of a screw, the amount of the tilt being read on a graduated drum. The use of this micrometer attachment enables readings to be made by the intersection of graduations on the staff, instead of by estimation. It is essential in using this attachment that the sights should be of equal length. Various patterns of staves have been used by different survey departments. The Ordnance Survey, for the new geodetic levelling of England and Wales, used staves manufactured by the Cambridge Mathematical Instrument Company. These staves are 10 ft. long and the graduations are marked on a strip of invar (an alloy of steel and nickel which has a very low factor of expansion); fixed to each staff is a circular level, for the staff-holder to keep it vertical.

Ground Marks.—The ground marks to which the observations are taken in the field are of various kinds and are known in British surveying as bench marks. The bench marks in use on the Ordnance Survey are: first class or fundamental; second class, which consist of flush brackets made of bronze let into a wall or other vertical surface, and fixed with cement; rivets, let into horizontal surfaces, such as pavements; and, third class, bench marks cut with a chisel in brick or stone walls, of broad-arrow shape.

The fundamental bench marks are new. It is well known that bench marks of the ordinary type are in general unstable; walls or houses are pulled down, or are subject to settlement, bench marks on isolated stones have been known to be moved and set up in new positions, marks on pavements or kerbs are shifted. None of the old types of bench marks is satisfactory as constituting permanent records of height and position. Moreover, in certain localities, such as mining areas and clay hillsides, the ground itself is unstable. It was therefore decided in planning the geodetic levelling of England and Wales that fundamental bench marks would be devised which should be of a very stable nature. These are established at intervals of about 25 m. from each other; the sites are carefully chosen and no bench mark of this kind is placed on loose soil or rock liable to local disturbance. In constructing such a mark a pit is dug through the soil, sub-soil and loose rock, until sound rock, or hard chalk, is found. The bottom and sides of the pit are lined with concrete, and two reference marks are placed in the bottom concrete, one of bronze and one of polished flint; these are covered with removable caps of metal. When the observations have been finished the pit is filled with sand or other suitable dry material. The internal marks described are those which are used for departmental purposes; but, for the public, an external mark is also provided. It is hoped that these marks will last for many hundreds of years and will, in the future, afford valuable information with regard to vertical movements of the crust of the earth.

Method of Observation.—The system of carrying out the observations in the field is based on the following principles. In order to minimize the effect of systematic error the levelling of any line is carried out once in each direction; the interval of time between successive levellings should be as short as possible; to minimize the effect of inclination of the line of sight the distances from the instrument to the fore and back staves should be as nearly equal as possible; to enable the graduations on the staves to be read easily the length of a space between the two staves is not in precise work to exceed 100 yds.; to reduce the effect of refraction, no reading is allowed even with the lower stadia hairs nearer than 6 in. from the lower end of a staff; observations are not allowed in bad or windy weather; the level is to be shielded from the direct rays of the sun.

It is on the observance of these and other common sense rules that the accuracy of the work will largely depend, and great attention must be paid to details, such as keeping the staves truly vertical or not letting the staff fall heavily on the picket or bench mark.

Errors.—The errors to which levelling is subject may be divided into those due to the staff, those due to the level, those due to the staff-holder, those due to the observer, and those due to the state of the ground, atmospheric conditions and unknown causes. The system of observation above described is directed towards eliminating, as far as possible, all errors not purely personal. Ultimately, when everything is done to evolve a sound system, it is the human element which tells most in the result, and the observer should possess excellent eyesight, a good stock of patience and be scrupulously honest; for in this, as in all scientific measurement, there must not be the least bias or wish to obtain a particular result. If the errors were all accidental and subject to the ordinary law, the probable error should increase as the square root of the distance levelled. There is, however, in levelling, a factor known as the "systematic error," by which the far end of a line constantly tends to appear the lower. If this systematic error were quite uniform, then double levelling would completely eliminate it; but this is not quite the case, and in the result, we are left with errors mainly accidental, plus an unknown amount of error not strictly subject to the law of accidental errors. A careful investigation by the Ordnance Survey has shown that the safest course, and that most in accordance with the conditions of the case, is to treat the whole error as accidental and as accumulating in proportion to the square root of the length of the line levelled. This is contrary to French practice. The probable error of 1 m. of double levelling is usually calculated from the formula $e = 0{\cdot}67\ (\Sigma d^2/4M)$, where Σd^2 is the sum of the squares of the discrepancies between the forward and back levelling from mark to mark, and M the length of the line in miles. The value of the probable error so obtained will usually be less than that obtained from a consideration of the closing errors. In recent Ordnance Survey precise levelling the value of e, from the above formula, is found to be somewhat less than ·003 ft., whereas the value found from a discussion of the actual errors of closure of the level net-work is ·0077. The probable error accumulated in the net-work between Newlyn in Cornwall and Dunbar in Haddingtonshire, two places separated by about 700 m. of levelling, is 0·16 ft., or about 2 in. This figure will serve to give an idea of the accuracy of modern precise levelling.

AUTHORITIES.—See Close & Cox, *Text Book of Topographical and Geographical Surveying* (H.M. Stationery Office, London, 1913); Middleton & Chadwick, *A Treatise on Surveying* (1911), chiefly of value for engineering surveys; W. Norman Thomas, *Surveying* (1920). (C. F. CL.; H. S. L. W.)

NAUTICAL SURVEYING

Although the World War restricted hydrographic surveying work, it led to improvements in methods and in instruments.

So far as the British Naval Surveying Service was concerned, it had generally been considered before that a marine survey need not be carried out with the degree of accuracy which is rightly considered necessary in purely land surveys: it being contended that so long as a marine survey was graphically correct very little attention need be paid to topographical details. Before the war the delineation of topographical details was but a secondary consideration in a hydrographical survey, and it was limited to the accurate fixing of objects conspicuous from seaward; contouring, except in large harbour plans, was generally sketched in by form lines. The experiences in the World War showed that in localities of possible strategic value accurate topography is of great importance. Where no land surveys are in existence or contemplated, the delineation of the land features must be included in the hydrographical survey. The lack of information due to the neglect of this important subject was much felt during certain operations of the war, particularly as affecting long range naval bombardments. The necessity for this accurate work on the part of the hydrographic surveyor has resulted in the adoption of new methods and of new instruments and the more general use of the land surveyor's instruments, all of which undoubtedly tends towards the more accurate charting of the seas. The elaborate methods and rigid accuracy of a triangulation on shore have been recognized by marine surveyors, although the refinement necessary for so-called first-class triangulation work does not often present itself.

Instruments.—Theodolites in current use (1921) are 4 in., 5 in. and 6 inch. The majority of these, formerly graduated to one minute, read to 20 sec. by Vernier, and micrometer theodolites read to 10 seconds. The use of the theodolite for astronomical and tacheometer work largely increased. Sextants for observing, with stand and artificial horizon, continue in use, but improvements in the sextant such as an endless tangent screw and electric light for night work have been adopted. More portable folding stands with slow-motion screws for movement of the sextant in azimuth and altitude are also supplied, and in addition amalgamated troughs, consisting of gold-covered plates on which a thin film of mercury is floated, have superseded the old artificial horizon consisting of a mercury bath; the new pattern is far less sensitive to earth tremors caused by surf, traffic, etc.

The Astrolabe à Prisme, a very precise instrument for finding position, enables altitudes of any stars at the exact altitude of 60° to be observed (see John Ball and H. Knox Shaw, *A Handbook of the Prismatic Astrolabe*, published by the Egyptian Government, Cairo Government Press, 1919).

Measuring chains have been almost entirely superseded by 100-ft. and 500-ft. steel measuring tapes, which are supplied with standardization certificates. The "10-ft. pole" has been supplemented by a "20-ft. pole" operated by two men and consisting of two boards connected by a wire 20 ft. in length and used in conjunction with a sextant. This method of measuring distance is, however, being gradually superseded by the use of tacheometers and tacheometer staves marked according to the Admiralty pattern, with which distances up to over 2,000 ft. can be very accurately measured.

One-metre base range-finders are useful in measuring short bases for plans of harbours, etc., when time or circumstances do not permit of a more accurate method.

Of the various forms of heliostat the Galton sun signal has proved a most excellent instrument, and fitted to theodolites it allows of the sun's rays being expeditiously and accurately directed to, and kept on, the station desired, whether the latter is visible or not.

Ship sounding has been greatly improved by the introduction of the Douglas Schäfer sounding gear, which enables ship sounding to be carried out under way in any depth up to about 40 fathoms with great speed; other methods of sounding such as the "Somerville" gear have also been adopted, and, in addition, far greater attention has been paid to sweeping for rocks, shoals, etc., the method used for mine-sweeping having been adapted to this purpose.

Other entirely different methods of sounding were also due to experience gained during the war. The most popular method under trial in 1921 was "Acoustic Depth Sounding" which depends on the principle of the acoustic echo, the depth being measured by the time taken for the shock of an explosion or other impulse produced in a ship to reach the bottom and be reflected back as an echo to a receiver on board the ship. By this device it was hoped to obtain either a single indication of the exact depth at any moment or a continuous indication of the depth registered automatically at any selected position. The importance of this method of sounding from a ship under way at any speed, without the necessity of casting the lead, needs no insisting upon.

Taut wire measuring gear was in 1921 fitted or being fitted to all British surveying ships. This method of measuring distances at sea in comparatively shallow depths had proved most successful and was adopted after having been extensively used in connexion with mine-laying during the war. The ship preserves a steady course and at a constant speed over the distance to be measured and at the same time runs out a thin piano wire from a drum which carries many miles of the wire. It is laid taut by means of a special brake device, the amount of wire out being registered on a dial. A correction (always subtractive) must be made for errors. This varies from 1,000 to 3,000 ft. in a distance of 100 m., and is governed by the contours of the sea bed upon which the wire has been laid. The dial registers 1,000 rev. for a mile of 6,080 ft., consequently when plotting in sea miles a second correction, for latitude, is necessary. This method of determining distance is specially useful when surveying out of sight of land, and is used in combination with astronomical observations and moored beacons.

Fixing Positions of Ships, Buoys, etc., by Subaqueous Sound-ranging.—This new method of accurately fixing the positions of buoys, etc., is carried out by dropping an explosive charge at the position it is required to fix. The sound of the explosion travels through the water to a number of hydrophones suitably placed, and the positions of which are accurately known. The differences between the times at which the shock reaches the various hydrophones are recorded photographically by a galvanometer on shore, to which the instruments are connected by cables. From these observations it is possible to calculate a position line for each pair of hydrophones. Three or four such lines from hydrophones suitably placed will give a cut, which is the position of the explosion.

As in all surveying problems, the accurate fixing of a point from two others depends on the length of the base, that is, the distance between two known points, so does the accurate fixing by sound through the water depend on the hydrophones, or groups of hydrophones being such a distance apart, commensurate with the distance at which it is required to fix the buoy, etc.

Chronometers.—Surveying ships are now supplied with from 8 to 12 chronometers of the box type, with pocket chronometers for use outside the chronometer room. The chronometers supplied are selected instruments which have successfully passed most exhaustive tests at the Royal Observatory, Greenwich. For astronomical work on shore, the portable Lindqvist chronograph is employed. In this instrument, a chronometer fitted with special contact pieces automatically sends an electric current every two seconds through an electro-magnetic coil, and thus, by suitable mechanism records every alternate second as a perforation on a paper tape, which is kept moving at a uniform rate by means of clockwork. The closing of a switch by the observer operates a second coil, which records the instant of observation in a similar manner by making an additional perforation in the tape.

Wireless Telegraphy for accurate time and obtaining meridian distances has been adopted, and in this connexion the wireless Vernier time signals made by Eiffel Tower may be mentioned.

Amongst minor improvements introduced in surveying appliances since 1910 may be mentioned the standardization of the markings of leadlines, improved buoys for beacon work, light filters for fitting to the eyepieces of sextant and theodolite telescopes.

By 1921, platinised and stainless steel mirrors for sextants and sun signals were under trial; electrical lighting arrangements to sextants and theodolites; eye shields for use in observing to assist in perfect orientation of the head; sextant supports to facilitate observations at sea; the arcless sextant which enables angles to be taken and read off (on a drum) without the necessity of removing the eye from the telescope; wireless telegraphy outfits for use of detached parties, and the gyro compass, were all in various stages of experimental development. The Pillsbury current meter was entirely superseded by the Ekman current meter, and other meters such as the Daisy and Gurley were in use.

In calculating triangulations considerable time is saved in correcting for false station by use of the station corrector diagram, by which the correction can be obtained very quickly to any accuracy required (generally about 5 sec. of arc) and the tedious trigonometrical calculation avoided. The slide rule has come far more into prominence for small rough calculations. As the result of modern inventions, it has been found necessary in recent years to produce special charts for the use of submarines and for other purposes in addition to the ordinary navigational chart. Charts for submarines indicate graphically the nature of the sea bottom, so as to indicate where vessels can rest with safety.

The introduction of wireless direction-finding stations as an aid to navigation has necessitated the production of charts drawn on the gnomonic projection, by the use of which positions can be more accurately determined. Additional charts are also required for testing range-finders and compass adjusting. Physical charts indicate the direction of prevailing winds and ocean surface currents at different periods of the year, localities and time where ice may be fallen in with, and the direction and force of the stream and drift currents of the oceans.

Considerable gain in accuracy has been obtained by printing charts directly on backed paper, whereby the distortion incidental to the old system of subsequently mounting them is largely eliminated. (H. P. D.)

SUTTNER, BERTHA, Baroness von (1843–1914), Austrian writer (*see* 26.171), who in 1911 became a member of the advisory council of the Carnegie Peace Foundation, died at Vienna June 21 1914.

See H. v. der Mandere, *Bertha Suttner* (1909).

SUTTON, SIR HENRY (1845–1920), English judge, was born Jan. 10 1845. He was educated at Rugby and Christ's College, Cambridge, where he graduated in 1868. He was called to the bar in 1870, in 1890 was made junior counsel to the Treasury, and in 1905 was raised to the King's Bench division, being knighted in 1906. He retired in 1910, and died in London May 30 1920.

SVENDSEN, JOHANN SEVERIN (1840–1911), Norwegian composer (*see* 26.175), died at Copenhagen June 14 1911.

SWAN, SIR JOSEPH WILSON (1828–1914), English physicist (*see* 26.179), died at Warlingham, Surrey, May 28 1914.

SWAYTHLING, SAMUEL MONTAGU, 1ST BARON (1832–1911), British financier, was born at Liverpool Dec. 21 1832, and came of a Jewish family named Samuel, but afterwards took by royal licence the name of Montagu. Beginning in early life in a very humble way of business he gradually acquired great wealth by enlarging its scope, and he rose to the head of the most important arbitrage house in London. A strong Liberal in politics, he sat in Parliament for the Tower Hamlets from 1885 to 1900; he was a member of the Gold and Silver commission of 1887–90, being himself a bimetallist. He was created a baronet in 1894, and raised to the peerage in 1907. Throughout his life he was a zealous promoter of Jewish interests, founding the loan fund of the Jewish board of guardians, the Jewish working men's club and several synagogues, and for his work on emigration schemes for the persecuted Russian Jews he made many journeys in Europe and America, succeeding Sir Julian Goldsmid as chairman of the Russo-Jewish Committee. He also helped to establish a modern secular school for Jews at Jerusalem in 1875. He died in London Jan. 12 1911, being succeeded in the title by his eldest son, Louis Samuel Montagu (b. 1869). His second son, Edwin Samuel Montagu (b. 1879), entered politics, and, after having been Under-secretary for India (1910–4), Chancellor of the Duchy of Lancaster (1915), Financial Secretary to the Treasury (1914–6) and Minister of Munitions (1916), was made Secretary of State for India in 1917. His fourth daughter, Lilian Helen (b. 1873), became a well-known social worker and was appointed J.P. for the County of London in July 1920.

SWEDEN (*see* 26.188).—The Swedish census of 1910 showed an increase since 1900 of 7·5%, from 5,136,441 to 5,522,403 inhabitants. The pop. on Jan. 1 1920 was 5,847,037 (2,868,395 males and 2,978,642 females), of whom 1,701,249 were living in cities, distributed as follows: Norrland (northern division) 1,018,009, Svealand (central division) 1,879,146 and Götaland (southern division) 2,949,882. The density of pop. is rather low; in Götaland 34, Svealand 23 and Norrland only 4 inhabitants per square kilometer. The chief towns with a pop. exceeding 20,000 inhabitants (Jan. 1 1920) were Stockholm (415,201), Gothenburg (200,577), Malmö (111,931), Norrköping (57,377), Helsingborg (45,805), Gävle (36,092), Örebro (35,096), Eskilstuna (30,103), Västerås (29,530), Jönköping (28,875), Upsala (28,041), Karlskrona (27,029), Linköping (26,300), Borås (23,941) and Lund (22,827).

The excess of births over deaths is low: 10·6 per 1,000 in 1910, 6·9 in 1915 and 5·2 in 1919. The birth-rate for 1919 was 19·6 per 1,000. There were 24,704 emigrants in 1906, 27,816 in 1910, 7,512 in 1915, 10,571 in 1916, 6,440 in 1917, 4,853 in 1918, 7,337 in 1919. During the war emigration was naturally difficult. The immigration figures were: 6,357 in 1915, 6,713 in 1916, 5,811 in 1917, 4,932 in 1918, 7,809 in 1919. The United States received the largest contingent of the emigrants, but Norway, Denmark and Canada also received considerable numbers. Swedes resident abroad number between 2,120,000 and 2,245,000, of whom 1,500,000 are in America and 370,000 in Finland.

Occupations.—Agriculture, fishing and forestry provided 48·4% of the pop. with their livelihood in 1910; in 1900 the percentage had been 54·4, and in 1890 61·51, the decline having been progressive since 1840, when the percentage was 80·9.

Those dependent on employment in industry, mining, trade and communications represented 45·8% of the pop. in 1910, as against 38·8% in 1900, 31% in 1890 and 10·7% in 1840. Those following the so-called "free crafts" (*fria yrken*) or engaged in the public service (*allmän tjänst*) represented 5·8% in 1910 (6·8% in 1900, 7·5% in 1890 and 8·4% in 1840). The most significant feature in this development is the increased importance of the industrial section. The census figures for 1920 in this respect were not available in 1921, but this section now represents half the population.

Agriculture.—Cultivated soil included 3,723,000 hectares in 1915, 1,715,000 hectares being used for grain, 1,411,000 for fodder stuffs, 26,100 for root crops, 3,000 for other crops, and 333,000 being left fallow. Gardens in 1915 occupied 47,533 hectares. The total value of the harvests in 1914 was estimated at 1,112,000,000 kr. and in 1920 at 2,012,000,000 kronor. The annual consumption of wheat increased from 47·7 kgm. per person in 1891 to 87·8 in 1915. The consumption of rye diminished from 110·6 in 1891 to 98·1 in 1915. The country's own production of corn has not been sufficient, and large supplies have been imported. During the decade previous to the war about 50% of the wheat was imported, and from 10% to 15% of the rye. The ease with which corn could be imported militated against all attempts to make the country self-supporting in this respect, and efforts came to be concentrated on stock-raising. The number of horses in 1916 was 701,099, of cattle 2,913,159, and of pigs 1,065,396. It was the agricultural policy of the country before the war to import a considerable amount of the corn required and large supplies of maize, oilcakes and other fodder stuffs, and in their place to export live stock, butter and cheese. The balance was not in Sweden's favour if seen merely from an agricultural standpoint. In 1913 there was an exportation surplus for live stock of 16,500,000 kr. and for butter and cheese of 46,700,000 kr., but there was an importation surplus for other animal products of 25,400,000 kr.; for grain, potatoes and seed corn of 58,600,000 kr.; for fodder stuffs of 22,800,000 kr. and for manure of 14,800,000 kr. The balance showed an importation surplus of 58,300,000 kr. Some decades earlier the country was as good as self-supporting, but the great industrial population has come into being since then and conditions of life have been radically changed thereby.

A more intense cultivation of the soil has been carried out with great energy. The splitting up of the land for the most part into small holdings has been a disadvantage to a certain extent. The large farms lead the way, and in localities where modern methods of agriculture sufficiently prevail the small farmers join together in coöperative societies. The scientific study of plant-growing and of manures is carried on in different parts of the country under the guidance of a central institute in Stockholm. Seeds have been greatly improved under the influences of the seed society in Svalöv (in Skåne), which also exports seeds. The Swedish moss cultivation society, which has its headquarters in Jönköping, has taken the lead in the systematic cultivation of the country's wealth in bogland.

Fishing contributes considerably towards the support of the population. The value of a year's catch may be estimated at between 20,000,000 and 30,000,000 kronor. Export of fish provides a balance of gain to the country of some millions of kronor a year. During the years of the World War measures were taken to promote the consumption of fish in Sweden itself.

Forestry.—Out of Sweden's total land area, which amounts to 41,000,000 hectares, 21,400,000, or nearly 52%, constitute forest-bearing land, whereof about 4,900,000 hectares, or 23·1%, are public property. In 1913 the output of sawed or planed timber was estimated at 7,800,000 cub. metres, mechanical wood pulp 326,000 tons, chemical wood pulp 860,000 tons, charcoal 4,300,000 cub. metres, and other products 18,500,000 cub. metres. In the same year the exports of plain sawn and planed wood were valued at 186,900,000 kr., of partly worked wood at 28,600,000 kr., and of wood-pulp at 99,700,000 kr., or 315,200,000 kr. altogether. These exports amounted to 38·6% of the total exports of the country. In certain years the exports of the products of the forests have amounted in value to half the total exports of Sweden. The economic world crisis after the war naturally caused a great diminution in export.

Industry.—Sweden is also rich in iron ore, and her water-falls make her well equipped for industrial enterprises. But coal is to be found in only one province, Skåne, and she is obliged to import large supplies of both coal and coke. The great distances for transport, moreover, entail heavy freight costs. Workmen enjoy a correspondingly high standard of living.

In 1915 the products of manufactories and mines had a value of something over 3,000,000,000 kronor. The extent to which Swedish industries had developed may be seen from the fact that the amount of horse-power in machinery per 1,000 workers had increased to 3,532 in 1915, from 2,841 in 1911 and 1,980 in 1906. The most important wood-sawing industries are found on the coast of Norrland, notably around Sundsvall and Hernösand. The timber is floated down the big rivers from the forests. Paper pulp is one of Sweden's most important exports. Paper is another. The exports of mechanical wood-pulp (dry weight) in 1915 amounted to 150,103 tons, of which 80,783 went to Great Britain. In the same year Sweden exported 721,786 tons (dry weight) of chemical paper-pulp, of which 298,056 went to Great Britain. The iron industry is to be found within a broad belt of land nearly level with Stockholm and a little farther to the north. The use of charcoal has helped to make practicable the manufacture of Swedish high-quality steel. In 1915 there were 135 iron-works (with 28,868 workmen), of which 78 had in all 120 furnaces in use, producing 748,928 tons of pig-iron and 11,773 tons of castings. The exports of iron and steel in 1915 had a value of 97,600,000 kr., as compared with imports of 27,800,000 kronor. Foundries and mechanical engineering works in 1915 had an output of 339,600,000 kr.; exports were valued at 115,600,000 kr., as compared with imports of 41,400,000 kronor.

During the war some industries throve exceedingly, as, for instance, those of iron, paper-pulp and paper; others suffered appreciably at times from the lack of raw materials, as, for instance, the textile industry. During the second half of 1920 and in 1921 industry was hit hard by the economic crisis.

Commerce.—Sweden's foreign trade in 1910–20 presented a curious picture, inasmuch as the value of her exports during the war period exceeded that of her imports. In 1910 her imports amounted to 669,200,000 kr. and her exports to 592,900,000; the corresponding figures for 1914 were 726,900,000 and 772,400,000. The figures for the subsequent war years were as follow: 1915, imports 1,142,500,000 kr. and exports 1,316,400,000 kr.; 1916, imports 1,138,600,000 kr. and exports 1,556,400,000 kr.; 1917, imports 758,600,000 kr. and exports 1,349,600,000 kr.; 1918, imports 1,233,300,000 kr. and exports 1,350,400,000 kr. After the war the picture changes. In 1919 the figures were: imports 2,534,000,000 kr. and exports 1,575,700,000 kr.; in 1920 imports 3,373,500,000 kr. and exports 2,293,600,000 kr. It will be noted how goods were regularly drawn out of the country during the war, while the imports were inadequate. The circumstance that home-grown wood was to a great extent used instead of imported coal also counted. When the war came to an end the country lacked reserve stocks and needed many articles of consumption. Importation increased, in part on speculative lines, from Germany and Russia, and with results which for the most part were unfortunate.

It may be interesting to give figures illustrating Sweden's commercial relations with the leading belligerent Powers. In 1913 imports into Sweden amounted to 846,500,000 kr.; exports from Sweden to 817,300,000. Her imports from Great Britain amounted to 206,800,000 kr. and those from Germany to 289,900,000 kr.; her exports to Great Britain amounted to 237,300,000 kr. and those to Germany to 179,100,000. Her transactions with Germany were somewhat in excess of those with Great Britain, but the latter country came first as purchaser of Swedish products. During the war a great reduction came. Imports into Sweden from Great Britain amounted to 183,800,000 kr. in 1914; 213,500,000 kr. in 1915; 164,400,000 kr. in 1916; 65,100,000 kr. in 1917; 148,700,000 kr. in 1918 and 668,900,000 kr. in 1919. Imports from Germany came to 238,600,000 kr. in 1914; 251,500,000 kr. in 1915; 420,200,000 kr. in 1916; 288,200,000 kr. in 1917; 447,900,000 kr. in 1918 and 269,100,000 kr. in 1919.

Exports to Great Britain amounted to 258,300,000 kr. in 1914; 329,600,000 kr. in 1915; 320,100,000 kr. in 1916; 216,100,000 kr. in 1917; 252,600,000 kr. in 1918; 509,900,000 kr. in 1919. Exports to Germany came to 174,800,000 kr. in 1914; 486,400,000 kr. in 1915; 437,500,000 kr. in 1916; 352,100,000 kr. in 1917; 292,800,000 kr. in 1918 and 130,800,000 kr. in 1919. During the war years British coal imports into Sweden declined, and Germany largely made good the deficiency, being naturally anxious to secure imports from Sweden. The figures for the Swedish importation of coal and coke, in thousands of tons, during the years 1913–7 were: from England, 4,916; 4,683; 2,816; 1,707 and 604; and from Germany, 431; 335; 2,174; 4,281 and 1,708. It will be seen how energetically Germany came forward in Great Britain's place as exporter to Sweden.

Shipping.—The Swedish commercial fleet in 1910 included 1,214 steamers and motor-boats, of 842,460 total tonnage deadweight; in 1915 1,278 vessels, of 984,799 tonnage; in 1918 1,238 vessels, of 894,260 tonnage. The figures for sailing vessels were in 1910 1,635, of 204,624 tonnage; in 1915 1,422, of 161,650; and in 1918 1,295, of 141,396. The diminution was due partly to war-losses.

Communications.—The Swedish railway system had in 1910 a length of 13,829 km., and in 1919 of 15,154, whereof 4,418 and 5,496 respectively were State railways. Through the thinly populated inner region of Norrland there runs a State railway line which has been opened for traffic between Östersund and Vilhelmina. A single-line railway along the coast of Norrland has been planned out and begun with aid from the State. During the war the railways were sometimes quite overloaded, so that locomotives could not be repaired to the extent they needed, and lubricants and good coal ran short. The increased costs drove up passenger and goods rates.

During 1909–16 the Trollhätte canal was reconstructed and deepened to four metres. The Sodertalje canal was in 1921 in process of reconstruction and of deepening to five metres. Through the former operation navigation was made possible to the great Lake Venner and thus between Gothenburg (Göteborg) and the Western mining district, and through the latter a good waterway was being created to the harbour of Lake Mälar.

Social Conditions.—Democracy has a strong hold on the Swedish people, owing to the high degree of education reached by the masses and to their inherited respect for the sanctity of law. Familiarized from an early date with self-government, Sweden had begun already in the closing decades of the 19th century to build up a kind of network of nonconformist religious associations, Anglo-Saxon in their character, temperance unions and friendly societies. When, as the outcome of advances in industrialism, the labour movement began to take shape, it was able to utilize these habits of organization and thus secure a position of considerable power comparatively quickly. Now more than 60% of Sweden's wage-earners belong to trade unions; at the beginning of 1921 these had over 400,000 members, of whom 280,000 combined to constitute the so-called "Lands Organisationen," which may be translated as "The National Organization," while simultaneously the political side of the labour movement, Social Democracy, became a force of the first order. Swedish Social Democracy has relied more and more on parliamentary methods of reform, thereby awakening opposition on the part of the labour extremists, with the result that in 1917 a new Socialist party of the left came into existence, formed for the most part of young men, a large number of whom were strongly influenced by Russian Bolshevism. In the spring of 1921 these latter formed a Communistic party connected with the Third International in Moscow. The bulk of Swedish workmen, however, hold aloof from revolutionary tendencies, thanks to the great extension which has been attained by coöperation. While workmen constitute a typical class party, another class party formed by the association of farmers and countryfolk, under the title of the "Böndeförbund," dated its origin from 1917.

In 1913 a law was passed instituting compulsory old-age and disablement insurance for the entire population. In 1916 a similar accident insurance law was passed. The law passed in 1919 for an eight-hour day was the most advanced of any in Europe. The national administration includes a special social department, as well as a number of boards for dealing with social questions.

The communes also, especially the large towns, have instituted important social reforms; for instance, by creating public labour exchanges, which have been State-endowed since 1907 and are under State guidance and control. In common with the State, moreover, the communes contributed to the general pensions insurance. The guardianship of the poor used to rest on the primary communes, but, through a new Poor Law, passed in 1918, this burden is now in certain cases transferred to the provincial assemblies (Landsting) and the State.

The first decade of the 20th century was marked by the creation and swift growth of employers' associations (notably that known by the name "Svenska Arbetsgivare Föreningen," whose members in 1920 employed nearly 300,000 workmen) and also of associations of landowners; and in several great conflicts, as, for instance, in a five-weeks' general strike in the summer of 1909, in which 300,000 workmen took part, the victory fell to the employers. For a long time the State's only action in the matter remained the passing of a law in 1906 for the intervention of a Conciliation Court in labour disputes. By reason of the high standing, however, of the trade-union organizations, and as the result of frequent collective agreements on both sides, certain conventional methods of treaty came into vogue in the field of labour disputes. In 1920 the Riksdag passed a law instituting a central State conciliation and arbitration court, as well as local courts of the same kind, to pronounce judgment in labour disputes on the basis of their collective agreements.

The Liquor Question.—For close on a century past the alcohol question in Sweden has been a subject for the most serious consideration and for constant measures of reform. The unhappy results of the excessive consumption of gin at the beginning of the 19th century called forth an energetic temperance movement, led by a clergyman named Peter Wieselgren (1800–1877), a "domprost," or dean, of the Lutheran Church; and in 1855 a law was passed which abolished the right to manufacture gin for home consumption and which granted concessions to companies, with no financial interest in the traffic, to sell alcoholic drinks under public control. This "Gothenburg System," as it was designated, brought about considerable improvements in many respects, and the great temperance societies, with a total membership of 450,000, have worked in the same direction. It was, however, only by the new law regarding the sale of liquor which was passed in 1917, and which came into force in 1919, that the underlying principle ("disinterested management") of the Gothenburg System was consistently put into general practice. By this law the selling to individuals of drinks containing more than 3·6% of alcohol was confined exclusively to the so-called "systembolag" ("system company"), with about 150 branches, over the management of which the State authorities have decisive control and which pays over all its profits to the State Treasury except for 5% interest on the capital invested. The controlling of this "system company" is entrusted to a central institution known as "Kontrollstyrelsen." All persons who wish to purchase such liquors for home consumption are registered and receive a pass-book; the total amount of liquor allowed to them being limited to a maximum of four litres a month. The abuse of alcohol is attended by further restrictions or by the absolute withdrawal of the right to purchase. The amount of liquor which may be sold to a customer in a restaurant is also strictly limited and confined to meal-times. This system of liquor-dealing, which was set on foot in Stockholm in 1913 and organized by Dr. Ivan Bratt (coming to be known as the Bratt system), was supplemented by a special measure regarding the treatment of alcoholists. The system had remarkable results, proportionate in large degree to the activity of the leading members of the various companies. The consumption of spirits decreased in many places, for instance in Stockholm, by nearly 50%. The number of cases of drunkenness, which was formerly somewhat high, was reduced throughout the country—in Stockholm and in certain other places by 60%—and so was the number of persons suffering from alcoholism. Much opposition from the side of those who regard the restrictions introduced as altogether excessive was brought to bear against the system; on the other hand, a tendency arose among the temperance associations to believe that total prohibition was the only way towards the solution of the alcohol problem. Smuggling and illegal manufacture of spirits developed to a disquieting degree in the years 1917–8. There were signs, however, in 1921 of a return to a better state of things.

Finance.—In 1910 the state budget amounted to 265,200,000 kr., in 1915 to 415,400,000, in 1920 to 929,400,000, and in 1921 to 1,131,100,000. For 1920 and 1921 the so-called "tilläggsstater," *i.e.* supplementary military budgets, are included. The tax revenue in 1921 amounted to 579,200,000 kronor. The consolidated national debt amounted at the end of 1920 to 1,280,600,000 kr.; in 1910 it had been 543,400,000 kronor.

Apart from the national bank, the Riksbank, which alone issues bank-notes, there were in 1910 17 private and 63 joint-stock banks, which in 1920 had decreased to 11 and 30 by amalgamations. Their total paid-up capital and reserve funds amounted in 1910 to 562,600,000 kr. and in 1920 to 1,084,000,000 kronor. At the end of 1920 the Riksbank balanced its revenue and expenditure at 1,017,500,000 kr. and the other banks' balance stood at 7,662,300,000 kronor. The leading private bank is Stockholme Enskilda Bank; the largest joint-stock banks are Skandinaviska Kreditaktiebolaget, Svenska Handelsbanken (formerly Stockholms Handelsbank) and Aktisbolaget Göteborgsbanken.

The circulation of paper money increased from 206,500,000 kr. in 1910 to 759,900,000 kr. in 1920. During the war years the Riksbank was relieved from its liability to meet notes with gold, and also to receive gold in ingots (*see* EXCHANGES, FOREIGN).

The Swedish savings banks in 1919 numbered 477; their deposits amounted to 1,870,800,000 kr. and their capital to 107,100,000 kronor. The post-office savings bank, a State institution, had deposits amounting to 84,400,000 kr. at the end of 1920.

Constitution.—The Swedish Parliament, the "Riksdag," consists of two elected Chambers, the First Chamber being composed of communal representatives. A constitutional change of a radical kind took place in 1907 and was confirmed by the Riksdag of 1909. The communal suffrage was on a scale proportionate to income, the graduation was now limited so that no person could have more than 40 votes, the bulk of the middle classes thus acquiring a preponderance. Absent voters could delegate their voting rights to others. Women had the communal suffrage in proportion to the degree in which they themselves were liable to taxation. Proportional representation was introduced in the case of both Chambers. Members of the First Chamber, in common with those of the Second, were paid. The suffrage in the case of the Second Chamber became universal and remained, as before, equal for all.

By Riksdag resolutions in 1918, 1919 and 1921 the constitution was further developed in a markedly democratic direction. Under these reforms the First Chamber consists of 150 members, elected by proportional representation by the provincial assemblies, *i.e.* either by "Landstingen" or by specially formed bodies of electors, chosen also by proportional representation by those possessing the communal suffrage. The communal suffrage is universal and equal; it is no longer graduated and it is personal. When it was graduated in proportion to income, business companies possessed the communal suffrage. Anyone who fails to pay his taxes for three successive years forfeits his right to vote. Women have the same voting rights as men. The age at which the voting right is acquired is 23, but the age is 27 for the right to vote for the members of the provincial assemblies which elect the First Chamber. The right to vote by proxy is abolished, but a husband may deliver a wife's vote in a closed envelope, or a wife a husband's. Similarly, in the case of both the communal elections and the elections to the Second Chamber, soldiers on active service, absent seamen and fishermen, and employees of railways, ports, customs and pilot services may send in their votes by post.

The number of the voters in the communes has been more than doubled. After the reform the communes' lists of voters contained nearly 3,300,000 names, *i.e.* more than 56% of the pop., and of these about 1,600,000 were men and 1,700,000 women. In March and April 1919 took place the new communal assembly elections: in two 'Landsting' out of 25, and in 20 towns out of 107 (among them Stockholm), the Social Democrats and Socialists of the Left together won absolute majorities. In ten 'Landsting' and 38 towns the Social Democrats were the strongest party. The election periods are eight years for the members of the First Chamber, one-eighth of whose number are elected each year; and four years for the Second Chamber's 230 members, who are all elected at one time. Women as well as men are eligible as members of both Chambers. The age at which a person becomes eligible for the First Chamber is 35, for the second 23. To be eligible for the First Chamber a person must have a certain specified income or property. If a member can no longer perform his duties, his place is taken by a substitute elected at the same time as himself. The Riksdag is called together every year on Jan. 10 for its ordinary meeting.

In 1921 the Riksdag passed an Act to provide that a consultative referendum shall be had recourse to when the Government and the Riksdag think it desirable to take the opinion of the people direct by plebiscite on some important question before its decision by the Riksdag. The proposal decided on must be submitted once again after a new Second Chamber election before it becomes binding. Another constitutional change was involved in the creation of a foreign affairs committee, which the Riksdag shall elect every year, and with which the Government shall take counsel regarding foreign affairs. The Riksdag's right to share in decisions regarding agreements with foreign countries has been extended. Yet another constitutional novelty is the right given to women to hold office under the State where no special hindrance lies in the way.

HISTORY.—On the death of King Oscar on Dec. 8 1907 he was succeeded by his eldest son Gustav V. Rear-Adml. Arvid Lindman had been at the head of the Government since May 1906, with Erik Trolle, former Swedish minister at Berlin, as Minister of Foreign Affairs; Carl Swartz, a manufacturer, as Minister of Finance; Maj.-Gen. Lars Tingsten as chief of the Department of National Defences, and Alfred Petersson i Påboda, a landowner, as Minister of Agriculture. In 1907 this Ministry had carried a measure of constitutional reform, embodying universal suffrage in regard to the Second Chamber and proportional representation in regard to both Chambers; and this measure, in accordance with statute, was confirmed by the Riksdag of 1909 after the election of members of the Second Chamber in the autumn of 1908. Owing to a divergence of opinion within the Ministry upon an important point bearing upon the extent of the Riksdag's powers, Trolle, Petersson and one other minister resigned in 1909. The new Foreign Minister was Count Arvid Taube, who had succeeded Trolle as representative of Sweden at Berlin. Some time afterwards Maj.-Gen. Tingsten also resigned. Moderate Conservatism was the note of this Ministry. The ministerialist party in the Riksdag had a majority in the First Chamber and a minority in the Second.

The National Defence Question.—At this period the problem of national defence was in the forefront of Swedish politics, inasmuch as the foreign affairs of the country were in a condition calculated to arouse anxiety. The union with Norway had been dissolved in 1905 and Sweden now stood alone in respect to foreign politics. Finland, which in 1809 had been taken from Sweden and united to Russia, had been having its autonomy more and more reduced, and Russia's foreign policy seemed to show a forward tendency westwards. A great variety of new military measures in Finland seemed to point to something more than a desire on the part of the Russian Government to prevent a German invasion of Southern Finland in the event of a Russo-German war. Right up to the north of the Gulf of Bothnia a network of railways was being spread out for military purposes, and new strategic lines were constructed of a kind necessitated neither for purposes of defence against Germany nor for purposes of trade. Barracks sprang up at the railway junctions. In Sweden Russian spies were ubiquitous, and a Russian military attaché had to be recalled on the ground of having pushed inquisitiveness beyond all limits. A handbook was produced for the use of the Russian military service containing information about the conditions of life in Sweden, and with Swedish maps in it, as well as a short vocabulary of military terms in Russian and Swedish. Swedes had an uncomfortable feeling that the attention of Russia was being directed altogether too closely upon their inadequately defended country.

A careful enquiry into the question of national defence had been undertaken in 1907. The Liberal members of the committee of investigation which was appointed were dissatisfied with its estimate of the defence expenditure required, and signified their attitude by withdrawing from it in 1910. This militated somewhat against the efforts of the committee, and it proved to be impossible, as had been intended, to submit a new scheme of national defences to the Riksdag of 1911. Instead of this, the Government brought forward a proposal for a new naval programme, and, in the face of opposition from the Liberals and Social Democrats, carried a bill, as a first step, for the construction of a powerful new battle cruiser.

Liberals in Office.—In Sept. 1911 the general election for the Second Chamber of the Riksdag, under the reformed methods which had almost doubled the electorate, resulted in increasing the strength of the parties of the Left. The Liberals elected numbered 101, the members of the Right numbering 65 and the Social Democrats 64. Admiral Lindman's Ministry resigned, and in Oct. the King entrusted Karl Staaff, who had been prime minister in 1905–6, with the task of forming a new Government. This Ministry remained in office until Feb. 1914. Count Albert Ehrensvard, previously Swedish minister at Washington, became Minister of Foreign Affairs, and both of the departments of national defence were placed under civilians, in accordance with the Liberal view that there should be greater civil control. Alfred Petersson, who had gone over to the Liberals, became once more Minister of Agriculture. The question of national defence again came up for treatment, but upon different lines and almost exclusively at the hands of the members of the Left. It had not been possible to proceed further with the projected new ironclad than the making out of the designs. The Government proposed to the Riksdag of 1912 that the project should be abandoned and the Riksdag agreed. This cancelling of a previous decision of the Riksdag, on account of the new elections having altered the composition of the Second Chamber, evoked strong dissatisfaction. Within a brief space of time a sum of 17,000,000 kr. was raised by voluntary subscription for the building of the ship, and since the Government was unable to decline to use this fund the keel was laid down on Dec. 1. The whole country was now stirred up, and further sums were subscribed in the same way to furnish machine-guns for the Landsturm and to provide aircraft. Towards the end of 1913 things had come to such a point that the prime minister was able in the course of a speech to advance arguments in favour of a forthcoming proposal for a winter training for the army, the establishment of reserve forces, the levying of a higher war-tax on the more well-to-do, the amelioration of the laws governing war, etc. But in view of the election promises to which the Liberal leaders had committed themselves during the contest of 1911 this programme was not to be submitted all at once; its most important item alone, that of the training of the infantry, would in the first place be submitted by itself on the occasion of the Second Chamber elections of 1914 before being proposed to the Riksdag. The public discussion of the matter became very lively, and although no thoroughgoing defence programme was in fact submitted to the Riksdag of 1914, violent feelings were aroused and expressed.

At last even the small farmers and peasantry, usually anything but enthusiasts for defence measures owing to the heavy personal taxation entailed, were drawn into the movement. On Feb. 6 1914 there was a great meeting in Stockholm of more than 30,000 representatives of this class from all parts of the country, assembled for the purpose of bringing home to King Gustav their anxiety at not seeing the question handled promptly and in its entirety. They were received by the King in the great courtyard of the Royal Palace, and their spokesman declared that the Swedish people were willing to bear the burden of whatever measures of defence were necessitated by the gravity of the time. The King answered that he, too, was of opinion that the problem called for treatment in its entirety and without delay.

This demonstration had important consequences at once. The Ministry had had no previous intimation of what the King was going to say, and matters were brought to a head by the resignation of Staaff and his colleagues. On Feb. 17 a new Ministry was formed, with Hjalmar Hammarskjiöld as its head.

Policy of Reform.—In connexion with foreign affairs during this period it may be added that, by arbitration at The Hague, the sea boundary between Sweden and Norway was fixed in accordance with Sweden's claim, and Sweden became a party to the North Sea and Baltic Agreement of 1908. By dint of close coöperation between the Government and the Riksdag a large number of important reforms were instituted. Among those carried through during Adml. Lindman's administration may be mentioned (in addition to the franchise measures above noted) the creation of a supreme administrative Court of Justice (*Regerings rätten*), together with a legal council, formed of some members of the Supreme Court, as advisers to the Government in legislative matters. Civil marriages were made permissible for all members of the State church. New laws were introduced as to farmers' tenancies and the leasing and letting of houses, flats, etc., and the speculative operations of the big companies dealing in land in Norrland were restricted and placed under control. A new company law was passed by the Riksdag and also a new banking law. A progressive income and property tax, based on the taxpayer's own statements as to both, was also introduced, together with a progressive inheritance tax. Custom-house duties were remodelled and the sugar-tax modified. An arrangement was come to with the Grängesberg Co. in regard to its iron-ore business in Lapland, by which the complicated question of proprietorial rights was so settled that the State joined in as part owner, receiving preference shares to the value of 40,000,000 kr., a specified royalty on the proceeds of the mining at Gellivara and Kirunavara and the right of redemption after a specified period. Large grants were made to the electric power stations at Trollhättan and Älvkarleby in central Sweden, as well as to that at Porjus in an uninhabited region of Lapland, and a widening of the Trollhätte canal was put in hand. A new law regarding insurance against illness was passed. Night work in certain occupations was forbidden for women. Improvements were made in higher technical education. In 1909 a sharp conflict arose between employers and workmen, and the latter organized a general strike in which nearly 300,000 took part. There were, however, no disturbances, thanks both to the discipline maintained and to the wise measures adopted by the Government. Social life was not brought to a standstill, as the workmen expected, and after a lapse of two months the conflict was brought to an end.

While the reforms introduced by Adml. Lindman's Ministry lay mainly in the sphere of economics and industry, the Staaff Ministry devoted its energies more especially towards social questions. A new social department was instituted, as a centre for the State's activities in this direction. The law bearing on the protection of workmen was extended, and various forms of workmen's unions were placed under control. A law was passed regulating the methods of dealing with alcoholists. The profits of the sale of spirits by the communes were allocated to the State, compensation being allowed therefor, the object of this being to free the communes from all economic interest in the liquor trade. After long preliminary planning, an illness and old-age pensions insurance law was passed, enacting obligatory insurance, with payments in three degrees, for all, except pensioners of the State, between the ages of 16 and 66, the pensions to be given in case of illness, or on the completion of the 67th year.

The War Years, 1914–8.—In the ministry which Herr Hammarskjiöld formed in Feb. 1914 Herr K. A. Wallenberg, the banker, was Minister of Foreign Affairs; Herr Dan Broström, shipowner, Minister for Naval Defence, and Herr Oscar von Sydow was Minister of the Interior. The Second Chamber was dissolved, and after a very sharp contest the advocates of active defence measures were returned in increased numbers, but without having secured a majority, polling 86 seats out of 230, while the Liberals numbered 71 and the Social Democrats 73.

The Riksdag met again in May, and the outbreak of the war brought with it a solution of difficulties, inasmuch as all parties recognized that there must be no disputing as to details of defence at a moment when the whole surrounding world was aflame. Universal military service had already been introduced, but now the training time for infantry was increased to 340 days, of which 250 were to be spent in recruit classes beginning in the autumn and continuing throughout the winter, followed by the usual training courses during three years. In order to secure non-commissioned officers of the right kind it was judged well to impose a longer training time, extending to 485 days, on students and other young men of similar standing, while for cavalry and artillery the period was fixed at 365 days. Large sums were allotted for the provision of war materials and for the strengthening of the coast defences. A programme was drawn up for adding new vessels to the fleet. Simultaneously with these steps towards increasing the defences of the country, measures were introduced for modernizing the existing code of punishments for military offences, this being accompanied by the creation of a special official, to be appointed by the Riksdag, whose duty it would be to inquire into all allegations regarding abuse of power or other derelictions on the part of superior officers in the army or navy—an appointment designed to act as a protection for soldiers and sailors against injustice.

An official declaration of neutrality was published without delay, and all the ministries holding office during the war, with the Riksdag's expressed approval, aimed at remaining absolutely neutral. Neutrality involved the duty of preventing any of the belligerent Powers from using Swedish territory as a basis for operations against enemies. Throughout the entire war the Swedish fleet remained on guard along the coasts of the country and on several occasions it had to take active measures. During the summer of 1916 there were many violations of neutrality in Swedish waters. In order to elude the observation of foreign battleships, trading vessels, flying the flags of belligerent countries, or carrying dangerous freights, sought to get through a channel called Kogrundsrännan within Swedish waters in Öresund, and apparently frequent attempts were to be expected on the side of belligerent countries at both ends of this channel to seize enemy vessels even at the risk of this occurring within Swedish waters. This channel was closed therefore against all but certain known Swedish vessels. The Allied Powers considered this action incorrect and protested, but the channel remained closed until Dec. 1918. A number of trading vessels belonging to the Allied Powers, which, owing to the closing of the channel, were confined in the Baltic, were, however, allowed egress on the condition that the Swedish population received a certain measure of necessary supplies from the west.

The stagnation produced by the outbreak of the war as regards foreign trade and shipping did not last long. Sweden became for a time, like Holland and Italy, an intermediary in the American trade with Germany, quite in accordance with international law as it stood before the war. When, however, the Allies proceeded to employ more and more stringently their weapon of blockade against the Central Powers this business as intermediary came quickly to a stop. The intensifying of the war at sea brought with it great obstacles in the way of neutral commerce. Its most painful feature was the sinking of neutral vessels by the German submarines, with its accompanying loss of lives. The mines which were spread about by other groups of belligerents also claimed many victims. The proceedings of the submarines called forth much indignation, and protests were made, but without much effect. The measures of the Allies were of a different order, but their control over shipping presently became so oppressive that protests against this also were made, the weightiest protest coming from the three northern kingdoms acting together. Sweden's geographical position and the commercial conditions which existed before the war necessitated the maintaining of relations with both sides. Trade transactions with Germany were in 1913 somewhat in excess of those with Great Britain, but Great Britain was the larger purchaser of Swedish products. During the war one great displacement in trade resulted from the diminution of Sweden's imports of coal from Great Britain and the consequent necessity of making good this diminution by imports from Germany.

Despite all the difficulties to be encountered it proved possible to maintain importation into Sweden from the west of raw materials, grain and other necessaries down to well on in 1916, but from this time onwards there was an increasing scarcity. When the Allies intensified their blockade, and Sweden could not break off trade relations with Germany, the blockade-line was drawn not between Sweden and the Central Powers but west of Sweden and the other Scandinavian countries. All goods which had to pass the blockade-line in the North Sea on the way to or from Sweden were subjected to sharp control. As regards goods from Sweden certificates of origin and ownership had to be furnished, to make sure that they were not in reality disguised exports from Germany, while in the case of goods for Sweden guarantees were required to the effect that they would not be forwarded to Germany. Suspected goods were unloaded in British seaports. Black lists caused serious losses to conscientious tradesmen as well as to others. Both groups of belligerents set on foot elaborate systems of trade espionage in neutral countries. In order to regulate the undertakings which the belligerents demanded from merchants, manufacturers and shipowners, the so-called War Trade Law was passed in 1916 to give legal value to officially recognized undertakings to foreign Powers, while at the same time it was laid down that undertakings not thus recognized lacked all legal value. A special trades commission was created to investigate all questions connected with this matter. The international goods exchange came to be worked like an enormous system of compensation, controlled by State officials by means of agreement. Every neutral country had to offer some equivalent in return for its imports. During the first years of the war it was to the interest of the Allied Powers that goods should go through Sweden to Russia. The great consignments caused inconvenience to the Swedish railways, but they made things easier for Sweden in the matter of imports.

Negotiations were set on foot for a commercial agreement between Sweden and Great Britain and her Allies, but they led to no result during the time of Herr Hammarskjiöld's Ministry, and this fact was turned to account against him in the political conflict which went on over the internal affairs of the country. After this Ministry resigned on Mar. 1 1917, and Herr Carl Swartz formed a new Government, the Foreign Minister, Adml. Lindman, brought about a temporary agreement by which the Swedish people were allowed the right to import nearly 92,000 tons of grain and about 40,000 tons of other goods, on the condition that certain vessels belonging to the Allies then confined in the Baltic should be allowed egress through the closed channel of Kogrund.

After Herr Eden's Ministry succeeded to that of Herr Swartz in the autumn new discussions were entered upon in regard to imports. In Feb. 1918 a so-called *modus vivendi* agreement was come to, enabling Sweden to import about 75,000 tons of maize, feeding-stuffs, raw phosphate, mineral oils and coffee, and in June a more comprehensive agreement was reached, in accordance with which it was possible to import larger quantities of grain, feeding-stuffs coal, oils, india-rubber, cotton, wool, hides, etc. In this connexion Sweden placed at the disposal of the Allies a portion of her commercial fleet. In addition, Sweden guaranteed to the Allies a certain share in her iron-ore exports, and also undertook to allow a certain amount of credit for goods bought in Sweden. In this way Sweden's most essential import was made sure of until the end of the war. In consequence of the universal scarcity the three Scandinavian countries came to an agreement as to the mutual exchange of commodities.

The hard conditions which prevailed during the war brought Sweden and Norway closer together again. After the severance between Sweden and Norway in 1905, and the election of a Danish prince as King of Norway, the relations between the Scandinavian countries had been somewhat cold. King Gustav, who at one time had been the Norwegian Crown Prince, himself took the initiative, and in Dec. 1914 invited the Norwegian and Danish monarchs to a meeting at Malmö, at which the affairs of the three countries as affected by the war came under discussion. Other such consultations followed, for instance at Christiania in Nov. 1917, and the prime ministers and foreign ministers of the three kingdoms also came together, while on some occasions of importance there were meetings at which special delegates were present.

In Jan. 1918 Sweden gave her recognition to the new Finnish State. When, shortly afterwards, the Red outbreak occurred in Finland, there was a strong movement in favour of Sweden's joining in on the side of the newly formed Finnish Government, but when the Russian troops began to take part in the struggle on the side of the Reds, Russia continuing to be a belligerent Power, the Government and the Riksdag agreed that it would not be wise to intervene. Swedish volunteers fought on the side of the Whites, and a couple of Swedish ambulances were sent over. Swedish refugees were brought back from Southern Finland. While the civil war in Finland was still in progress a petition came from the inhabitants of the Åland Is. for Swedish protection against aggression on the part of Russian troops which were stationed there. Troops were sent from Sweden to maintain order on the islands, and they achieved their purpose. When Germany, however, came to the support of the Whites and landed forces on the Åland Is., the Swedish troops were withdrawn.

Economic Measures.—At the very beginning of the war period the Swedish Government carried through several special administrative measures. The exportation of a number of commodities of great importance was prohibited, partly in order that they might be kept for home consumption, partly in order that they might control the exportation by export licences. This system was gradually developed until at last the export of *all* important goods was prohibited. An Industrial Commission and an Unemployment Commission were set up to decide on the measures which should be taken to maintain industrial work and to mitigate the serious condition of unemployment which threatened. A Food Commission was appointed to study the development of the market, and a National War Insurance Commission was charged with the task of dealing with insurances against loss of life and property through the war on the seas, as the private insurance companies were unable to undertake all the risks. The Riksdag's legislative powers were also called into play. A financial Moratorium was instituted at an early date. The Riksbank's obligation to meet its own notes with gold was suspended, and new laws were introduced giving the Government new powers, which were employed when necessary, to effect the compulsory purchase of goods from individuals and to fix maximum prices on commodities. Swedish vessels could not be sold to other countries without the Government's sanction, nor could they carry freight from one foreign country to another. All this accumulation of legal measures, which presently had added to it the law against unreasonable increases in rent, the law against "profiteering" and several others, did not come about at once but grew out of the needs which were created by the conditions of the war period. New organs for war-time administration were formed in the Trade Commission (June 1915) and the Food Control Commission (autumn 1916), the former of which had to apply the War Trade Laws and to supervise exports and imports, while the latter, as the successor of an earlier Food Commission, took in hand the food rationing of the country.

Rationing.—Before the war Sweden produced about four-sevenths of the cereals which she required; the rest had to be imported. On the other hand, she exported live cattle, pork and butter, the production of which was made possible by the importation of feeding-stuffs. The fodder harvest of 1914 was so scanty that it necessitated a reduction of live stock. The importation of cereals was undertaken by the State through the agency of the Food Commission. When there began to be a scarcity in some of the animal foods, and prices suddenly rose, recourse was had to the fixing of maximum prices for the first time in Nov. 1915. In the course of the year also the exportation of animal foods was restricted and producers were obliged, in return for the granting of export licences, to allot a certain proportion of their goods ("compensation goods" so-called) to the State for sale by the communal authorities at low prices to those who were less well-to-do. In the autumn of 1916 the scarcity of animal foods became so serious that rationing had to be decided on, and, even so, anxiety was occasionally felt lest the supplies should fail. The situation was aggravated later by the bad harvest of 1917. In Oct. 1916 it was decided that nobody should obtain sugar without presenting a sugar-card. These sugar-cards gave a person the right to purchase 13 kgm. of sugar a year, with an additional amount for preserving purposes to each family. In Jan. 1917 bread-cards were introduced. Farmers were allowed to retain a certain quantity of corn but had to sell all the surplus to the State. All such stores, whether bought by the State or imported, were rationed out to the rest of the population, who were given bread-cards providing at first allowances of 250 grammes a day to each person, later only 200 grammes, but again 250 in Nov. 1918. Persons engaged in particularly arduous work were allowed extra rations. The bread-cards were used also on journeys. The carrying out of this work of rationing needed very thorough supervision, and this evoked dissatisfaction and annoyance, especially among the farmers. The system was changed in the food control year of 1918–9, each farmer being called upon to supply a certain specified quantity of corn and being allowed to do more or less as he pleased with what he had left. Rationing ceased at the end of Aug. 1919.

The supply of bread was scantier than in normal times, and it had to be supplemented with other food-stuffs, especially potatoes. The consumption of all these rose enormously and a great scarcity began to be felt, most severely in the late winter and in the spring of the year 1917 and 1918. People had to have recourse to the eating of turnips. In the spring of 1917 there were food riots in various localities. In 1918 the danger of famine became worse, but calm prevailed. In the autumn of that year potatoes also had to be rationed, but this expedient did not work well. In densely inhabited localities milk was so rationed that the needs in the first place of small children, then of pauper children and the old and the sick were supplied. The exportation of meat, including bacon and pork, ceased altogether in the first half of 1917. The scarcity of fodder became at times so intense that moss and heather and even pine-needles had to be employed as substitutes in the cow-sheds. The selling of bacon and pork was placed under strict control, but only with the result that both disappeared almost altogether from the open market. The rationing of butchers' meat was considered, but it was not thought safe to take this step. Among other things rationed was coffee. The scarcity of food generally caused the Government to do what it could to intensify production by the putting of new land into cultivation, etc.

The Fuel Question.—The fuel question was beset with difficulties although Sweden is so rich in wood. Before the war about 5,000,000 tons of coal and coke were imported, for the most part from England. When, during the war, the importation from England ceased, and Germany was unable to supply as much as England used to do, the country was faced by a very serious scarcity of fuel. This was at the beginning of 1917. The regulation of the business of the wood supply was then entrusted to the Fuel Commission, which put wood-cutting operations in hand on an enormous scale. In Nov. 1917 56,000 workmen were in employment at wood-cutting. Down to May 1918, when the work ceased for the most part, 19,400,000 cub. metres of wood had been cut. Forest owners were allowed to make provision for their own needs. Other households had certain specified quantities allotted to them, according to the number of persons in each, special wood-cards being provided and the price of the wood being fixed at figures which did not quite cover the cost. Those persons who wished to buy more could do so but at higher figures. Factories and railways had to pay higher prices. The result was that fuel was always available in sufficient quantities, but that the wood supply involved a loss to the State of over 100,000,000 kronor.

Industry during the War.—The importation difficulties reacted also upon industries. There was a great scarcity of lubricants. This was partly met by the use of substitutes. The textiles, rubber and leather industries, as well as several branches of the chemical industry, suffered from the lack of raw materials. The scarcity of copper and certain other metals and metal alloys had injurious results on the working of electrical machinery and generally throughout the whole sphere of mechanical engineering, but, on the whole, Swedish industries were kept going under favourable conditions. To deal with the importation of raw materials, which was controlled by the Allies, import associations were formed by the manufacturers who needed the raw materials in question. These associations furnished the guarantees required by the Allies and imposed corresponding guarantees on the delivery of the small quantities thus dealt out. The associations were controlled by the Trade and Industry Commissions. In cases where the supply of certain goods was exceptionally small the State laid claim to the whole, and a system of rationing was sometimes carried out by Raw Material Associations, formed by the manufacturers and craftsmen who were in need of them. In 1916 steps had to be taken in regard to regulations for the sale of lubricants, iron pyrites, German iron, and hides, skins and printing paper. The first article to be appropriated by the State was linseed oil, next came hemp and india-rubber. In 1917 hides and skins were appropriated, as well as lubricants, leather shoe-soles, several metals, rails, paraffin, etc. Tickets for the purchasing of benzine for motor-cars and motor-boats were provided through the agency of the Industry Commission. All fat from the bones of mammals and all offal, etc., were turned to scientific or technical account. The use of carbide lamps increased swiftly, as carbide is a Swedish product. The Swedish iron-works and factories were constrained to supply iron goods at reduced prices to cultivators of the soil. In April 1918 rationing of wool began, as well as of cotton yarn, woollen or cotton stockings and woollen or cotton textiles and underclothing of these materials. Purchasing cards were supplied only where the need of them was genuine and "controlled." In Nov. 1918 the rationing ceased.

There was actually no very serious unemployment during the war. A great number of men who lost their work in the building and textile industries were employed in wood-cutting, clearance work in the forests, executing orders for supplies of stone for the communes, etc.

High Cost of Living.—High prices were the combined result of scarcity and the inflation of paper money. The prices of goods rose higher than in Great Britain, for example. Official investigations show that if a family which had an income of 2,000 kr. in 1914 sought to keep up the same kind of living its expenditure would have been increased to something over 3,000 kr. a year according to the prices which prevailed in May 1917, and to over 4,850 kr. according to those which prevailed in Oct. 1918. Wages had to be raised considerably. The State granted war bonuses which amounted in all to a sum total of 100,000,000 kr. a year. The State and the communes expended large sums also in subsidies. From Dec. 1916 down to the middle of 1920 the sum of 112,500,000 kr. was used for lowering the prices of food, clothes and fuel and, in some exceptional cases, rent, for the poorer classes. Of this amount the State provided 77,000,000 kr. During the first half of 1918 389,000 families, or 1,344,000 persons, benefited by purchasing goods at these lowered prices. The building industry was at a standstill almost entirely. The State took steps to help it but without much success.

Changes of Government.—At the beginning of the war all the burning questions of internal politics were put on one side, and all efforts were concentrated on solving the problems presented by the new condition of affairs. In the autumn of 1914 the new elections for the Second Chamber took place. The party of the Right remained unchanged in numbers, 86, the Liberals numbered 57 and the Social Democrats 87. Dissatisfaction with Herr Hammarskjiöld's Ministry increased gradually, the Government—as always happens—being held to blame for the hardships of the times. The Opposition contended that the ministers showed a lack of diplomacy in their negotiations with Great Britain and that they had not paid due regard to the opinions of the Riksdag—certainly the coöperation between the Government and the Riksdag was not what it might have been. In March 1917 the Ministry resigned. In an address with 600,000 signatures Herr Hammarskjiöld and his colleagues were urged to continue in office, but they persisted in their desire to withdraw. Herr Carl Swartz, who previously had been Financial Minister, formed the new Government, which was Moderate Conservative in character.

The Swartz Ministry, in which Adml. Arvid Lindman was again Foreign Minister, lasted only into the autumn. From the start it had borne the stamp of a stop-gap Ministry, inasmuch as the new elections were to be held in September. These went against the Right because, among other reasons, the prevailing hardships and the various measures of State interference were laid to their blame. The Right polled 59, the Liberals 62, the Social Democrats 86, while two new parties, the "Bondeförbund"—a league of farmers and countryfolk—and the Socialists of the Left came in with 12 and 11 respectively. The Ministry resigned and the King tried to arrange for a Coalition Government representing all parties. This effort proving unsuccessful, the Liberal leader, Prof. Nils Eden, undertook the task of forming a Liberal-Social-Democratic Government. The prime minister himself, the Foreign Secretary, Herr J. Hellner, and five other members of the Government were Liberals; Herr Hjalmar Branting, the leader of the Social-Democratic party, was for a short time Finance Minister; Baron Erik Palmstierna, a former naval officer and a Social-Democratic member of the Riksdag, was Minister of Marine; there were two other Social-Democratic members of the Government, which adopted a Liberal-Radical programme.

After the War.—The Riksdag of 1918 passed, among their legislation, a new Poor Law and a new Education Law, reflecting the increased influence of the wage-earners. The wind of reform blew more and more strongly in the autumn. An extraordinary meeting of the Riksdag was called and very noteworthy decisions were come to, which were ratified by the Riksdags of 1919 and 1921, involving (*see* under *Constitution*, above) an immense democratizing of the administration. The consequences for the First Chamber showed themselves at once, when the Government dissolved it in the autumn of 1919 and the new election took place. The chamber had been made up of 86 Conservatives, 43 Liberals, 19 Social Democrats and two Socialists of the Left. This was now altered to 38 Conservatives, 40 Liberals, 19 members of the "Böndeförbund," 49 Social Democrats and four Socialists of the Left. The greatest novelty lay in the women's vote and in their eligibility for both chambers of the Riksdag.

After the termination of the war in Nov. 1918 the emergency measures were almost entirely abandoned. The regulation of the bacon-and-pork-selling business ceased in Jan. 1919 and the rationing of potatoes in May. In Aug. bread-cards disappeared and the rationing of sugar also stopped on Aug. 1. Most of the industrial regulations came to an end during the first quarter of 1919. The Fuel Commission administration of the rationing of fuel terminated on March 1 of the same year. With the close of May the War Insurance Commission ceased its operation. The Riksdags of 1920 and 1921 renewed in modified form some of the emergency laws, but at the end of the first half of 1920 all that remained of the various Commissions were some small committees of liquidation.

When the League of Nations was still in process of formation the Governments of Sweden, Denmark and Norway appointed committees for the purpose of considering together their attitude towards it. The Swedish Government laid its proposal to join the League before the Riksdag of 1920. Opinions were divided: the decision was given in favour of accession by 86 votes against 47 in the First Chamber and by 152 against 67 in the Second. The Riksdag incorporated in this decision an expression of approval of the basic principles of the League, but formulated also its conviction that the Government should avail itself of every opportunity for urging that the States not invited at first to join the League should be incorporated in it as soon as possible; that a more satisfactory arrangement should be come to for the representation in it of the smaller States; that more definite rules should be framed for the meetings of delegates and for their methods of work; that the standing international tribunal should be constituted as soon as possible, and that its procedure in regard to mediation and arbitration should be more clearly defined and further elaborated; and also that efforts to bring about a universal and effective reduction of armaments should be set on foot without delay and vigorously pursued.

Sweden was represented at the International Labour Conference in Washington in 1919 and at that in Genoa in 1920, as well as at the League of Nations' first meeting at Geneva in 1920, when the Swedish delegates acted on the lines indicated in the Riksdag's utterance. In May 1921 the question between Sweden and Finland as to the sovereignty over the Åland Islands was settled by the League of Nations in favour of Finland (*see* ÅLAND ISLANDS).

Sweden did not formally recognize the Soviet Government in Russia, but at first a Russian representative was allowed to reside in Sweden to maintain the *de facto* relations between the two countries. In Jan. 1919 he was obliged to leave (but not until

Swedish residents in Russia had been enabled to return home) because of oppressive conduct in Russia towards Swedes and in regard to Swedish property. All trade relations were for a time broken off, but to an enquiry from the Allied Powers as to whether Sweden would take part in a blockade of Russia a reply in the negative was given. In 1920 permission was accorded to a Russian trade delegation to visit Stockholm. From the Russian side large orders for railway engines were placed with Swedish manufacturers, and much Russian gold passed through Sweden, mostly destined for America.

The Eight-Hour Day.—Within the ranks of the Eden Ministry there was from the beginning a fundamental divergence of view between the Liberals and the Social Democrats, but for some time it was possible for them to work together. Moreover, this Ministry was the only one for a long time past which had a genuine majority, though a very heterogeneous one, in the Riksdag. The most important measure introduced in 1919 was for a legalized eight-hour day, but when first proposed it was rejected by the First Chamber. The Government dissolved the Chamber, and after the new elections an extraordinary autumn session was called at which the eight-hour day proposal was accepted. The Right had retained only 38 seats, the Böndeförbund coming back with 19, the Liberals with 41, the Social Democrats with 49, and the Socialists of the Left with three. According to this law, which was to hold good provisionally until the end of 1923, 48 hours in the week constitute work-time in industrial and other businesses in which at least four employees work at an employer's expense, agricultural work and forestry work excepted. As a general rule over-time must not be instituted to a greater degree than 150 hours in the year. A newly founded institution, the Labour Council, decides questions concerned with the carrying out of the law. A number of flaws were soon discernible in the law, and in the Riksdag of 1920 this Council applied to the Government to effect certain improvements. A proposal was laid before the Riksdag of 1921 and was in the main accepted. The modifications left the main principles of the law unchanged. Sweden subsequently declined to ratify the draft of the Washington Convention of the League of Nations on hours of labour, partly because it conflicted with the Swedish measure already passed, and partly because adhesion would be binding for 11 years, while the Swedish law held good provisionally for a shorter period.

The Social-Democratic Ministry.—It was over the communal taxation question that the Eden Ministry went to pieces. This question had for a long period been under discussion, and it was intended to submit some proposal in connexion with it to the Riksdag of 1920. The Social-Democratic members of the Government asked for a definite settlement, while the Liberals wanted only a provisional solution. The end was that the entire Ministry resigned, and that the King invited the Social-Democratic leader, Herr Branting, to form a new Government. In March 1920 he did so. Baron E. Palmstierna, formerly Minister of Marine, became Minister of Foreign Affairs. All the ministers were Social Democrats. The new Government could only count on minorities in both Chambers as a regular Ministerial party. The discussion of the communal taxation question ended in a victory for the Liberal standpoint, a provisional arrangement. In the meantime the Ministry awaited the result of the general elections to the Second Chamber in the autumn of 1920. A comprehensive programme was put forward by means of commissions of inquiry into projects of socialization, industrial democracy, and the control of trusts and other great combinations.

Change of Ministry.—Dissatisfaction with the eight-hour day and with the socialistic projects brought a good many electors over to the party of the Right. The strength of the Social-Democratic party in the Second Chamber went down from 86 to 75, and the number of the Liberals was reduced from 62 to 47, while that of the Right went up from 59 to 70 and of the Böndeförbund from 10 to 29. The Socialists of the Left were reduced from 11 to 7, a result of their sympathies with the Russian Communists. Two members of the Chamber were "independents." The more than usually complex party conditions led the King to invite Baron Louis de Geer to form a non-political Ministry. Count Herman Wrangel quitted the post of Swedish minister in London, in which he was succeeded by Baron Palmstierna, to become Minister of Foreign Affairs. The new Government began at once to occupy itself seriously with industrial, commercial and financial matters. Among other bills which it put before the Riksdag of 1921 was one for increasing the duty on coffee. On this being rejected Herr Tamm, the Finance Minister, resigned, and the prime minister, too, then resigned. He was succeeded by Herr Oscar von Sydow, former Minister of the Interior.

The Economic Crisis of 1920–1.—During the latter half of 1920 Sweden had entered on a grave economic crisis—her share of the general economic difficulties which prevailed after the war. The period from the dissolution of the union with Norway in 1905 down to 1914 has been characterized as one of great economic development. During and after the war cost of production rose swiftly, not least because the workmen, after the passing of the Eight-Hour Day Act, in most cases obtained higher rates of wages so that they could earn as much as when working longer hours. Compensation had already been allowed them for the increase in prices. As soon as importation possibilities became increased after the war, goods began to be imported to an extravagant degree, so that the country became flooded with them to the detriment of home industries. Finally the Swedish exchange, which stood somewhat higher outside than inside the country, facilitated importation but hindered exportation. When the international crisis came, with its swift fall in prices, it became necessary to lower wages again, but this brought the country up against great difficulties. In April 1921 about 60,000 industrial workmen were unemployed; in June about 90,000.

The Swedish Red Cross.—Some account of the activities of the Swedish Red Cross must have its place in an outline of Swedish history during and after the war. King Gustav's brother, Prince Carl, played a leading role in this connexion, and also the Crown Princess Margaret (daughter of the Duke of Connaught), whose death in 1920 was sincerely mourned. The work of the Swedish Red Cross was directed more particularly to relieving prisoners of war in the various countries, above all in Russia on the one side and Germany and Austria-Hungary on the other. During 1915–8 a great number of invalided prisoners, including 3,617 Germans, 22,123 Austro-Hungarians, 428 Turks and 37,295 Russians, were brought homeward through Sweden by means of the Swedish Red Cross, specially equipped trains travelling between the Swedish-Finnish frontier in the north and Trälleborg in the south. Across Sweden, moreover, there went a stream of parcels by post, in both directions, for prisoners. The Swedish postal service dealt with 12,700,000 parcels of this kind. The Crown Princess was specially interested in collecting books to despatch to the prisoners' camps. Important work was also done in the inspecting of the prisoners' camps in Russia, Germany and Austria-Hungary. Delegates distributed gifts from home among the prisoners: 1,016 railway waggons packed with such gifts passed through Petrograd *en route* eastwards, and from Russia 1,012 travelled into Germany and 304 into Austria-Hungary. The delegates drew attention to various shortcomings in the German camps and in most cases this resulted in improvements being effected. The conditions in Russia and Siberia were found to be much worse. Delegates' records of what they saw revealed a terrible condition of things in many camps. In some there were 30 deaths a day among the prisoners. Under the guidance of the Swedish delegates new hospitals were established in many places or old hospitals improved, kitchens and baking-rooms being constructed, drains put into order, and large stores of medicines and bandages, etc., being supplied. In Jekaterinburg, for instance, the authorities threw all care for the prisoners entirely on the Swedish delegates within a region of 1,200 sq. miles. Thirty-three hospital buildings were erected in this region, and at some periods a Swedish Red Cross Kitchen established there was able to distribute food to 1,200 men a day. This work was attended with risks. Two delegates were murdered and several died in hospitals for infectious cases. During the Finnish civil war two ambulances were sent to Finland in 1920, and one ambulance was sent to Poland to help in coping with the epidemic there.

The grave privations in many countries after the war due to the scarcity of food aroused deep sympathy in Sweden. Among other steps taken to afford help may be mentioned the welcoming of 20,000 children from Germany and Austria (and in some degree from the Baltic Provinces) to stay in Swedish homes with a view to their regaining health and strength. The homes of both the well-to-do and the poor were thrown open for this. The total amount of money devoted to such acts of helpfulness (including the cost of the children's visits) is estimated at more than 25,000,000 kr., of which the State was responsible for 1,500,000 and the rest was collected by private subscriptions. A detailed report was laid before the International Red Cross Conference in Geneva in 1921. (K. H.*)

SWEET, HENRY (1845–1912), English philologist, was born in London Sept. 15 1845. Educated at King's College, London, Balliol College, Oxford, and Heidelberg University, he was a recognized authority on the subject of phonetics (*see* 21.460–61; 9.597), and a readership in phonetics was specially created for him in 1901 by the university of Oxford. His published works include an *Anglo-Saxon Reader;* a *Student's Dictionary of Anglo-Saxon;* an *English Grammar; The History of Language,* and many editions of Old and Middle English Texts. He died at Oxford April 30 1912.

SWETE, HENRY BARCLAY (1835–1917), English theologian, was born at Bristol March 14 1835. He was educated at King's College, London, and Caius College, Cambridge, and in 1858 was ordained. After some years of work in various country curacies and livings he became in 1869 theological lecturer and tutor at Caius College. In 1881 he became examining chaplain to the Bishop of St. Albans, and the following year was appointed professor of pastoral theology at King's College, London. In 1890 he succeeded Westcott as regius professor of divinity at Cambridge, and retained this position until 1915, when he retired with the title of emeritus professor. He was in 1911 appointed an hon. chaplain to the King. Swete's works on Biblical texts are of the highest importance. In 1887 he published the first volume of his edition of the Greek text of the Old Testament, completing the series in 1894 (3rd ed. 1901–7), while in 1898 appeared the Greek text of the Gospel of St. Mark, with notes and introduction (2nd ed. 1902) and in 1906 that of the Apocalypse of St. John (2nd ed. 1907). He was the editor of *Cambridge Theological Essays* (1905) and *Cambridge Biblical Essays* (1909), and was a contributor to Smith and Wace's *Dictionary of Christian Biography* (1882–87) and Hastings's *Dictionary of the Bible* (1899–1900). He also produced many historical and critical works, including *The Apostles' Creed in Relation to Primitive Christianity* (1894; 3rd ed. 1899); *Church Services and Service Books before the Reformation* (1896); *Patristic Study* (1902); *The Appearances of Our Lord after the Passion* (1907; 2nd ed. 1908), and *The Last Discourse and Prayer of Our Lord* (1913). He died at Hitchin May 10 1917.

SWIMMING: *see* SPORTS AND GAMES.

SWINFEN, CHARLES SWINFEN EADY, 1ST BARON (1851–1919), English lawyer and master of the rolls, was born at Chertsey, Surrey, July 31 1851. He was educated privately, and in 1874 was admitted a solicitor, but in 1879 he was called to the bar, having been during his period as a student a pupil of Cozens-Hardy. In 1893 he became a Q.C., and in 1901 was raised to the bench of the Chancery division and knighted. In 1913 he became a lord justice of appeal, and in 1918 master of the rolls in succession to Lord Cozens-Hardy. He retired in 1919 and was raised to the peerage only a few weeks before he died in London Nov. 15 1919.

SWITZERLAND (*see* 26.238).—Before dealing with the affairs of Switzerland during 1909–21, a note may be made on a curious theory recently put forth, especially in Romance Switzerland, that the Swiss Confederation is "the oldest republic or democracy in the world." Now certainly a "king" has never ruled in Switzerland (save in the case of Neuchâtel before 1857), nor since 1648 has any emperor ever had any claim on the allegiance of the Swiss. But then we must recollect that till 1798 Switzerland never had a *single* head, whatever he might be entitled. If we take the term "republic" to mean a "democratic Government," it is quite true that there were (and are) "republics" of that kind in various regions of Switzerland (*e.g.* Schwyz), but what is true of a part is not true of the whole. Again, before 1798 there was no Central Government at all in Switzerland, while it was only in 1848 that it first possessed a "President" (with very limited powers). But there was a president already in 1787 in the United States of America, while the "free communities" or "republics" of Andorra (in the Pyrenees) and of San Marino (Italy) are far older than any such in Switzerland. Naturally the use of the word "*Republik*" by certain cantons before 1798 (*e.g.* the "*Stadt und Republik* Zürich") referred to the rural districts of each, and these by no means enjoyed "democratic government" at the hands of their respective towns. The fact that in 1848 the first "democratic Swiss Constitution" (still in force so far as regards the practical details relating to the Central Government) was avowedly based on that of the American republic is sufficient to disprove the quaint theory that Switzerland is the (in any sense) "oldest Republic in the world." The reverse is really more nearly the case. In neither of the two ordinary senses of "republic" is this theory even approximately accurate.

Population.—As regards resident population, the results of the last two Swiss censuses, Dec. 1 1910, and Dec. 1 1920 (only the provisional results, published in Feb. 1921), were as follows:—

	1910	1920
Total	3,753,293	3,861,508
Languages		
German	2,594,298	..[1]
French	793,264	..[1]
Italian	302,578	..[1]
Romansch	40,122	..[1]
Other languages	23,031	
Religions		
Protestants	2,107,814	2,218,589
Roman Catholics	1,593,538	1,586,826
Jews	18,463	20,955

[1] Figures not published up to Jan. 1 1922.

The decrease in the number of the Roman Catholics is mainly due to the fact that in 1910 the "Christian Catholics" (Old Catholics) were reckoned among them, whereas in 1920, for the first time, they were counted separately, the number given, however (56,250), being greatly exaggerated, since in Tessin (where there is none of this sect) many Roman Catholics described themselves as such under some error. It is noteworthy that the Jews were in 1850 only 3,145 in number, but in 1910 already 18,463, and in 1920 20,955.

In five cantons the population has diminished (Outer Rhodes of Appenzell, St. Gall, Tessin, Vaud and Neuchâtel). In recent years there has been much fear expressed in Switzerland that the non-Swiss were increasing too rapidly for the welfare of the land. This no doubt was due to the vast immigration of German, French, and Italian workmen, who asked lower wages than the Swiss, and, when settled down, became exempt from military service in their native land. During the World War many returned home, and so the figures are not so alarming as was feared at one time. Here is a complete list:—

1860	114,983, of which 1,202 were British subjects;	
1870	150,907	(British subjects 2,297)
1880	211,035	(British subjects 2,812)
1888	229,650	(British subjects 2,577)
1900	383,424	(British subjects 3,535)
1910	552,011	(British subjects 4,118)
1920	410,983	(British subjects, figures not available).

Thus the percentage rose from 57 per thousand in 1860 to 79 in 1888, and to 116 in 1910, the culminating point being reached in 1900 with 147, so that the 1920 figures of 106 show a distinct decrease, largely due, like the diminution of the Roman Catholics, to the greater number of French citizens who have gone from Geneva back to France. In 1920 the 12 most populous towns in Switzerland (number of residents) were: Zürich, 205,892 (190,733 in 1910); Geneva, 138,034 (123,153 in 1910); Basle, 135,134 (132,276 in 1910); Berne, 103,990 (90,937 in 1910); St. Gall, 69,651 (75,482 in 1910); Lausanne, 67,852 (64,446 in 1910); Lucerne, 43,696 (39,339 in 1910); La Chaux de Fonds, 37,591 (37,751 in 1910); Winterthur, enlarged, 49,491 (46,384 in 1910); Bienne, enlarged, 34,414 (32,401 in 1910); Neuchâtel, 22,951 (23,741 in 1910); and Fribourg, 20,468 (20,293 in 1910). No other Swiss town has a population attaining 20,000, though Schaffhausen is not far off with 19,930 (18,101 in 1910). There are also 14 Swiss towns with populations below 20,000, but over 10,000. The increase in the case of Berne is due to its absorption of the suburb Bümpliz, etc., and in the case of Bienne to increased prosperity, while the decrease in the cases of St. Gall, of La Chaux de Fonds and of Winterthur are to be accounted for by industrial depression, and the departure of many workmen.

As the "Conseil National" is elected in the ratio of one member for 20,000 of the total population or fraction surpassing 10,000, the new census will increase its members by eight, so that henceforth it will have 197 members.

Politics.—The members of the Swiss Federal Executive (*Bundesrat*) were almost all changed in the period 1910–20, so that in 1921 the seniors were G. Motta (first elected in 1911), and E. Schulthess (first elected in 1912). The five other actual members had all entered the Council since 1917—R. Haab in 1918, Karl Scheurer, E. Chuard, and J. Musy, all in 1919, and H. Häberlin in 1920. E. Chuard was the oldest in years (b. 1857), while J. Musy was born in 1876. Thus the Council had been greatly rejuvenated. Six members were Radicals, Signor Motta being the only Conservative and Roman Catholic.

The recent presidents of the Swiss Confederation (little more than the chairmen of the Federal Executive) have been A. Deucher (1909); R. Comtesse (1910); M. Ruchet (1911); L. Forrer (1912); E. Müller (1913); A. Hoffmann, (1914); G. Motta (1915); C. Decoppet (1916); E. Schulthess (1917); F. L. Calonder (1918); G. Ador (1919), and G. Motta (1920); while the president for 1921, E. Schulthess, would in 1922 be succeeded by the vice-president, R. Haab. Of late years the Political Department (*i.e.* the Ministry of Foreign Affairs) has become specially important. A resolution of the Federal Executive in 1917 decided that this important department should *ipso facto* be attributed to the president. But, as the president changes annually, this plan was soon found very inconvenient, and so in 1920 a return was made to the older system that each councillor should retain the department assigned to him. Hence G. Motta would be Foreign Minister till Jan. 1 1923, when the date of fresh election came round again.

The Swiss people adopted by a popular vote the principle of proportional representation for elections to the "Conseil National" in Oct. 1919. But though it was expected that the Socialists would win many more seats they only won much fewer. The Radical majority was reduced from 102 to 60, in the Assembly of 189 members, thus losing its absolute majority over all other parties combined, but remaining the strongest single group. Forty-one Socialists (in 1917 but 19) and as many Conservatives were elected, and the new "Citizens and Peasants" party (a split from the Radical party) obtained 28 seats.

Proportional representation was also winning its way in the cantons, Aargau and Fribourg adopting it in 1920, followed in 1921 by Berne and the Valais. Thus 18 of the 22 cantons approved it. Indeed in 1920 the canton of Fribourg, hitherto reckoned one of the most backward as to the recognition of popular institutions, made a great advance, accepting in one day the facultative referendum, the initiative, the election of the Executive by the people, and that of the Legislature by proportional representation. A number of Federal votes have been taken in recent years. The constitutional amendments related to infectious diseases (1913), the creation of an administrative court (1914), the levy of a war tax (1915), the imposal of a stamp tax on certain business papers (1917), regulations as to waterways (1918), a renewed war tax (1918), entry of Switzerland into the League of Nations (1920), and regulations as to hours of work (1920). A law (facultative referendum) as to sick insurance was also accepted in 1912. But of the "Initiatives" two were rejected (proportional representation in 1910—accepted, however, in 1918), and a Federal tax in 1918, but in 1919 the detailed regulations as to the working of proportional representation in the "Conseil National," and a law abolishing gaming houses were accepted. Of four later votes, all in 1921, those relating to popular approval of international treaties of a certain length, and new regulations as to motor-cars and to aviation were accepted, but a fourth relating to military courts of justice was rejected.

At the very beginning of the World War (Aug. 3 1914) the Federal Parliament handed over to the Federal Executive certain extraordinary (emergency) powers of acting, and these powers, excluding all obligatory popular votes were found to be very convenient by the Federal Executive.

The entry of Switzerland into the League of Nations was accepted by a popular vote on May 16 1920, the majority in favour (mainly from the French-speaking cantons) being 97,051 votes and by 11½ to 10½ cantons. But in Feb. 1921 the Federal Executive declined to allow the passage through Switzerland of troops, raised to act as police in the case of the Vilna plebiscite.

Some of the members of the former Austrian Empire have sought a nearer connexion with Switzerland. Liechtenstein was indeed admitted into the Swiss postal, telegraph, and telephone system. But the Vorarlberg (and for similar reasons the Tirol) had not up to Aug. 1921 succeeded in being admitted as Swiss cantons, there being great fear felt in Switzerland of increasing the German-speaking population, and particularly of augmenting the number of strict Roman Catholics.

Finance.—The finances of the Swiss Confederation were in 1921 (so said M. Musy, the Swiss Finance Minister) in a difficult position. Their backbone, in the matter of receipts, even in the pre-war period, was the amount of the customs' duties. But even at that period these produced less than heretofore. The last year when they showed an increase was in 1912 (£3,500,000). After that time the decline was pretty steady, and the deficits higher and higher. It has been estimated that, while in 1913 they sufficed to defray about 84% of the total expenses of the State, in 1919 the amount met only 28% of these expenses (in 1913 £3,360,000, and in 1919 only £2,520,000). And these expenses steadily increased after the outbreak of the war, though, of course, Switzerland was not one of the belligerent Powers. The deficits since 1914 are as follows:—1914, £901,000; 1915, £862,000; 1916, £665,000; 1917, £2,000,000; 1919, £2,475,000, and 1920, £3,980,000—in 1920 the receipts were £13,740,000, and the expenses £17,720,000. Despite the formal assurances of neutrality received from the principal combatants, the War Minister of Switzerland thought it essential to guard all its frontiers with a strong military force, and to erect costly new fortifications (as at Morat), so that at the end of 1920 the total "mobilization expenses" amounted to no less than £47,500,000, while the military expenses in the accounts for 1921 were £2,880,000, and that only an estimate far inferior to the demands of the military authorities. Large loans (nine in number, to the total amount of some £31,200,000) have been contracted, but on these heavy interest has to be paid. Exchequer bills for two to five years at 6% were also issued in order to assure the supply of necessaries of life. Special taxes were imposed, first a war tax (which produced £4,400,000), then a tax on war profits (which produced £11,120,000), next a "renewed" war tax (to last 16 years). The increased salaries and wages of the army of federal officials (including the railwaymen) were a further burden, and, naturally, as the cost of living increased, there came a fresh rise of salaries and wages to meet it—a vicious circle. Even the telegraph and telephone rates had to be raised, not to speak of the postal charges, so that while formerly a letter within Switzerland cost only 1d. it cost 2d. in 1921 and a post card 1d. in lieu of ½d. The charges on foreign correspondence have also been raised, so far as regards the transit from Switzerland to the outer world, for a letter from 2½d. to 4d., and for a post card from 1d. to 2½d. As Switzerland produces very little in the way of raw materials, such as coal, these had to be bought at high prices, a fact which further raised the cost of travelling, hotel prices, and of all articles of home consumption. The only persons who have not felt these raised prices are the self-sufficing (or nearly so) peasants, who, in some cases, have even made large profits by the sale of their milk, cheese, butter, etc. Naturally the towns felt this rise to an extraordinary extent, and great distress and lack of employment resulted. The only cheering symptom, from the Swiss point of view, was that the currency exchange was almost everywhere favourable to Switzerland, save as regards American money. An attempt has been made (Feb. 1921) to raise provisionally certain customs duties but at Protectionist rates, so that the interests of the consumers are being sacrificed to those of certain trades, as well as (also provisionally) to limit imports to a certain extent. In 1912 the customs duties amounted to 6% of the value of the goods imported, but in 1920 not even to 3 per cent.

Hence the deficit in the Federal budget for 1921 was put at five or six million pounds, a huge amount for a country with under four million inhabitants. If the Federal finances were in this state, the cantonal and communal finances were no better.

It must be borne in mind that the direct taxes are paid by a very small minority of Swiss. In the case of the direct taxes the total amount, from 1914 to 1920, was about £70,000,000, while the indirect taxes only brought in some £18,000,000.

Switzerland is still predominantly an agricultural country, so that the majority of voters are peasants, with very narrow views. The industrial population is very much weaker politically, and is regarded with great disfavour by the Agrarian party, which desires, for its own objects, to set up a "Chinese wall" round Switzerland. But the land must have other manufactures than chocolate, condensed milk, cheese, etc., and thus must import much which has to be paid naturally by its exports. Yet the narrow "Cantonal spirit" is still widely diffused in Switzerland.

The annual deficits on the Swiss State railways are especially great. It was officially reckoned that in 1918 the total Federal debt had attained a height of about £33 per head of the population, whereas in 1912 it had only been £17.

Army.—Formerly detailed annual accounts as to the Swiss army (a purely militia force) were published. But since the outbreak of the war these accounts have no longer been issued. But an indiscretion of the semi-official Bernese newspaper, the *Bund* of Berne (June 23 1920), tells us that in June 1920 the numbers were 337,282, of whom 71,993 formed the "second reserve," the rest falling into the "Auszug" or "Elite" and the "Landwehr." The "Elite" includes the younger men from 20 to 32, and the "Landwehr" or first reserve those between 33 and 40, while the "Landsturm" or reserve proper is composed of men between 41 and 48.

At the beginning of the war Col. Ulrich Wille was elected the "General," while Col. A. T. L. Sprecher von Bernegg became chief of the staff. It was thought necessary to guard all the Swiss frontiers, a policy which cost £47,500,000, and disorganized industry and agriculture to a very great extent. The German-speaking troops were sent, as far as possible to the Jura or the French-speaking or the Italian-speaking regions, while the French-speaking soldiers looked after the German-speaking districts. The object was to prevent any fraternization with the troops of the belligerents. Much inconvenience was caused by this mobilization. The military organization was tightened up on the lines of the German army, and this greatly bothered the free Swiss citizens.

Naturally the military budget increased greatly, amounting in 1921 to £3,000,000, though this represented a reduction of about £250,000 on the demands of the military authorities. This great increase is to be explained in part, at least, by the increased cost of material. In 1910 the annual cost amounted only to £1,680,000.

Agriculture, Commerce and Railways.—Censuses of cattle have been frequently made. In 1866 there were 553,205 cows, in 1886 663,102, in 1906 785,950, in 1911 796,909, in 1916 849,011, but in 1919 738,896 and in 1920 only 729,999. The great fall in the numbers is commonly attributed to the huge purchases of milch cows made during the war by Austrian and Hungarian cattle dealers, for export to Germany. Hence came a milk famine, and milk had to be "rationed." Potatoes and other such produce were also rationed and each householder had to plant them on his land, however unsuited for this kind of cultivation.

In 1920 foot-and-mouth disease raged furiously in all parts of Switzerland, and even intercourse between neighbouring valleys was forbidden in order to try to stop the spread of the infection.

During the war certain branches of Swiss commerce flourished much, for, against the wishes and instructions of the authorities, there was much smuggling of all kinds of goods over the frontier, especially towards Germany and France, which, naturally enough, are Switzerland's best customers. The imports were often less than the exports. But in 1915 they were nearly equal in money value, the imports being slightly more than the exports. However, in 1916, the reverse was the case, the exports being £99,000,000, and the imports £93,000,000, but in 1917 the imports had again the best of it. In 1918 the imports amounted to about £96,000,000, and the exports to about £78,000,000. (Great Britain ranked third in each case.) In 1919 the exports amounted to £136,000,000, the highest figure ever attained, and the imports to £143,000,000. But in 1920 the imports rose to the prodigious figure of £169,000,000, while the exports dropped to £131,000,000.

As coal is practically non-existent in Switzerland it must be imported, naturally at considerable cost. Hence the imported supply had to be strictly "rationed" during the war, and the price increased enormously, especially in the case of domestic consumption. Of course, the factories suffered much, and the railways even more. Hence the electrification of the latter was pushed on as quickly as possible. But it was not possible to do this all at once, and so one saw locomotives driven by means of logs of wood. The number of trains was reduced, at one time very much indeed, and the fares pushed up to a great degree, which much hindered communications, even within the country. The first electrically-driven train went through the St. Gotthard tunnel early in 1921. The Lötschberg railway was opened in 1914, just before the outbreak of the war, and thus its prosperity was greatly let and hindered, while on the Valais slope, above Brieg, the unstable nature of the ground has caused many landslips, and thus entailed many costly repairs. But the great scheme for connecting the two stations in Geneva has been indefinitely postponed, owing to its excessive cost.

Social.—In 1912 a vast scheme of insurance against sickness and accidents was accepted on a popular vote. But up to 1921 money was lacking to put it into operation, even though unsuccessful attempts had been made to "earmark" certain items of the revenue.

As everywhere else in Europe the unemployment problem was troublesome in Switzerland. The militia employed in the great mobilization came home, unused to work as before, while work was scarce owing to the lack of money, the higher cost of living, and the rise in the salaries and wages of nearly all classes. Naturally this want of employment was felt most in and near the great Swiss towns. And here came in a fresh complication—the lack of dwelling houses and flats. This was, in part, due to the rush from the country to the towns, and the crisis became very acute, so that in Berne, at least, all foreigners were ordered out of the town, so as to procure lodgings for Swiss workmen. In the rural districts neither unemployment nor lack of dwelling houses was felt to anything like the same degree, though, no doubt, they existed to a certain extent. But these rural regions are inhabited by peasants who do not easily move from their homes, and are occupied in the cultivation of their small bits of land. As in Switzerland there are few persons of means independent of a trade or a profession, the disturbance in social life was very great, while the high taxes and high wages limited the power of employing labour.

Ecclesiastical.—There were several welcome symptoms of the cessation of the "Kulturkampf," or religious strife following on the decrees of the Vatican Council. On Sept. 1 1920, a papal nuncio for Switzerland was named, for the first time since 1873, in the person of Monsignor Luigi Maglione, titular archbishop of Caesarea. He was already favourably known in Switzerland by reason of his love for that country, and his devotion in the case of prisoners of war and sick children. In Feb. 1921, the canton of Berne at last resumed its full legal responsibility for the reconstituted diocese of Basle, after holding aloof for many years, and thus recognized the bishop as spiritual head of the diocese, thus allowing him full liberty of exercising his functions within the canton for an unlimited period (and no longer for five or 10 years, as heretofore). Again, in the census of 1920 the "Christian Catholics" (the Swiss "Old Catholics," who previously had been included among the Roman Catholics) were numbered apart, though by reason of some error in the case of the canton of Tessin their number was put at 56,250; the real number is believed not to exceed 35,000 to 40,000.

On the other hand the Pope laid claim to the direct nomination of the bishop of Sion in the Valais.

The new census has put an end to the topsy-turvy fact that in the canton of Geneva the Roman Catholics outnumbered the Protestants—so many French Roman Catholics have returned to France that the balance has been reversed.

Mention may be made of the fact that, in 1910, in the canton of Basle, the separation of Church and State was carried out, while in the same year women obtained the right of voting in the disestablished Protestant church of Geneva.

In the summer of 1920 reunion conferences were held both at Beatenberg and in Geneva, but almost wholly between various Protestant denominations.

The World War Period.—During the fateful days immediately before the war broke out in 1914, the uncertainty whether there would really be war or whether commonsense would prevail kept the whole of Switzerland in a state of feverish anxiety, and when the loaded dice fell, very many persons in Switzerland were seized with panic. A wild assault was made on all provision establishments which supplied the necessaries of life, and these were bought in mad fashion and in quantities far above what was required. In many families stores of eatables were still found after the lapse of two years, and that quite apart from what had been spoilt. The banks and other establishments of a like kind had to withstand a regular siege, for everyone desired to get his property back. This haste had finally to be restrained by orders issued by the Government. As if by enchantment coins of small denominations disappeared from circulation. Not even at the post-offices was it possible to change Swiss banknotes for large sums. It was especially hard on the foreign tourists who were surprised by this sudden war. No one was any longer willing to change their foreign banknotes and cheques, formerly cashed so eagerly. Only the hotel keepers found themselves forced to receive cheques in payment for their accounts, and that despite the danger of incurring great losses by this act of friendship.

On the Swiss frontiers the blocking of all communications took strange forms. A typical case was that of Basle, close to the northern frontier. The tourists rushed in by thousands, and the railway trains were enormously delayed. With the keenest anxiety everyone sought for a carriage, a motor car, or some kind of cart so as to reach the frontier as easily and as quickly as possible. Many, whose cash had disappeared in consequence of the difficulties caused by the exchange, had to set out on foot, burdened with their luggage, to cover the great distance. These carts themselves were heavily laden with luggage, trunks and band boxes, while high up on these artificial mountains were perched travellers of every land, who to-day shared their common hard fate peaceably, but on the morrow were to oppose each other as enemies. Here was a German professor clothed in homespun, there an Englishman in tweeds, near by were some merry Belgian ladies with huge hats and elegant parasols, and, on top of all, countless schoolboys with caps of diverse colours. So was it all day long in the town. All this wild confusion was caused by the sudden interruption of international communications and the closing of the frontiers.

Thousands also were deprived at one fell stroke of their daily bread. Such were chiefly Italians, who desired to regain Italy over the St. Gotthard or the Simplon, often with only a little cash, sometimes quite penniless, and who were blockaded in Basle, and in incredible numbers, finally some 40,000 of them. All these unfortunates had to be cared for till it was possible for them to resume their journey. Quarters were found in private villas and other dwelling houses for the sick women and children. The Coöperative Society of Basle sent great carts filled with bread and milk, private benevolence made gifts of tea and other eatables. School houses and gymnasiums gave shelter to these unhappy, homeless Italians as far as quarters could be found anywhere, but a great number had to camp out in the open. Only when the great rush had somewhat abated was it possible to facilitate their return to their own country.

Side by side with these arrangements military preparations were carried out in Switzerland. On July 31 1914 the entire Swiss army was warned to be ready, and as early as Aug. 1 the order to mobilize was given. The first day for this was Aug. 3, and two days later the mobilization was quite complete. The troops were ordered to the frontiers which till now had been guarded in part by the second reserve (Landsturm), called out first of all. At the same time (Aug. 3) the Swiss Parliament gave the Swiss executive unlimited powers, even in financial matters. Col. Ulrich Wille was named as commander-in-chief, and Col. Sprecher von Bernegg as chief of the general staff. As it was hoped that the war would not last very long, the mobilized troops went off joyfully to the frontiers. The belligerent States solemnly assured Switzerland of their intention of observing its neutrality, a declaration which brought about a certain amount of relief. When finally the principal operations of war were seen to be taking place far from the Swiss frontiers, the Swiss people were able to think of recalling the troops, in order to simplify matters, from the service on the frontiers, though some were later summoned to relieve those actually serving there. But if in Switzerland a sigh of relief arose, the sad fate of Belgium was felt to be a stern warning, and greatly embarrassed the Swiss authorities, military and political, and it was felt to be quite impossible to strip the frontiers of all watching troops. The fact of this monotonous service, and the conviction that the war might possibly last a long time, brought about a certain disinclination for further service of this kind. Besides, such protection of the frontiers threatened to become costly to an appreciable degree. Therefore much criticism was exercised, chiefly by the Socialists, who especially blamed what, from their point of view, were the mainly needless fortifications around Morat, which were regarded as simply a piece of military display and lavishness, and were considered as a partial measure directed against one only of the belligerents. Thus the Swiss authorities had to order certain alleviations and simplifications in this frontier service. In order to satisfy the agricultural interest the peasant soldiers were called out at a period which caused least disturbance in the cultivation of the land, etc.

Among the military war measures must be counted the abolition, from the beginning, of telephonic communications between the different Swiss towns. This caused all the greater rush to the telegraph offices, and yet even these were under the censor, at least so far as regarded foreign countries.

The equipment of the Swiss army in new, field grey, uniforms was carried out in 1915–6. The expense of these new uniforms amounted to about £800,000.

Most unpleasant for Switzerland was the "Affair of the Two Colonels" (Jan. 15 1916), Egli and von Wattenwyl. This pair of Swiss officers were in regular communication with the German and the Austrian military attachés, ostensibly only for supplying such information as affected no Swiss military matters. All the same this "affair" caused great amazement, especially in French-speaking Switzerland, and in the breasts of the Socialists, who saw in this action of two officers of the Swiss general staff an unneutral and unfriendly act as regards the Entente. They were court-martialed, but were acquitted of the charge of infringement of their official duties, and were handed over to the Swiss executive for "disciplinary punishment" because of their conduct against Swiss neutrality. By this they were each sentenced to 20 days' strict arrest, and to suspension as leading officials in the Swiss general staff. Col. Egli demanded his dismissal at once. The Socialists and a delegation of the Government of canton Vaud required the summoning of the Swiss Parliament in order to discuss the "Affair of the Two Colonels."

About the same time the war control of the Swiss railways was abolished, while a census of Swiss who were not liable to do military service and of arms in private hands was decreed. A later appeal for well-qualified sharpshooters among Swiss citizens resulted in the volunteering of about 100,000 men, of whom, however, only a small percentage was accepted as being really fit for such military service.

Much bad blood was caused in the Socialist camp, and also among other citizens, by the Swiss Government's decision that punishments for certain purely military offences were to be purged in the penal establishments of Witzwil and of Orbe, while in the case of the officers confinement in the fortresses of St. Maurice and St. Gotthard alone was directed. Complaint was also made of the alleged rigorous treatment of ordinary soldiers, and of the far lighter treatment of officers charged with offences.

All this occasioned the promotion of an "Initiative" for the total abolition of courts of military justice. Enough signatures were obtained for this "Initiative," but it was later defeated on a popular vote.

It is easy to understand that Switzerland was the special rendezvous of foreign spies, especially the frontier towns and even the capital, Berne. In this respect all the belligerents did their very best. So even the former director of the Bernese tourist bureau, for taking part in an intelligence service in favour of a foreign Power, was condemned to five months' imprisonment and a fine of £8.

As early as Nov. 1916, the Swiss executive resolved to recruit 250 volunteers out of the army to serve as army police, and this for the entire duration of the war mobilization.

Certain troops, especially those from industrial regions, had to be pacified by the Swiss Parliament by increased pay. This scheme did not find support as late as the end of the year 1916, but was adopted in April 1918, and then it was not merely the pay which was increased, but also the amount of food rations carried in the knapsacks, and emergency support in case of need (this in the case of soldiers' families).

The fact, too, must not be overlooked that in cases of discontent with the military service many unfortunate events contributed to this dissatisfaction. One example was the accelerated mobilization of the 3rd Division (May 1917), and the following endurance marches in great heat, in consequence of which many soldiers were made ill, and fell exhausted on the roads. This brought about an exceedingly vehement movement against all military service, and was utilized to the utmost by the workmen.

In June 1917 the Swiss Government had raised the amounts of the emergency family grants in the big towns to about 2s. a head per day for grown-up persons, and to 8d. for children, while in the smaller towns the respective amounts were 1s. 6d. and 6d. In the same year the length of the relief services was fixed at 2½ months for the younger and active men (Auszug), and at six weeks for the older men of the first reserve or "Landwehr."

Considerable discontent prevailed in French-speaking Switzerland with the chiefs of the Swiss army, who seemed to it too "Germanophile." This went so far that, in course of the discussion by the Swiss Parliament of a report on Swiss neutrality (Aug. 1917), a formal vote of want of confidence was proposed, and the compulsory retirement of the general and of the chief-of-staff demanded. All such proposals, however, were rejected, but they threw a lurid light on the disagreement between French-Swiss and German-Swiss. In the Assembly, however, the assertion of the supremacy of the civil power over the military power was approved, as was also greater economy in the matter of constructing fortifications, etc.

In consequence of the prolongation of the war, and the frequent calling up as reliefs of soldiers without much means, great distress was inflicted on them and on their families, and many could not find work on being released from active service, as their situations had been filled by Swiss citizens exempt from military service and sometimes even by women. In order to alleviate this crying distress a department for the promotion of the welfare of the soldiers was founded by the Swiss executive which gave this department a first contribution of some £18,000 (Aug. 2 1917). Later on came the "National Collection" (a voluntary contribution made throughout Switzerland) which brought in millions of francs. To stimulate this collection specially large medals of copper, silver, and gold were struck, and also brooches made, all being sold to the people. The term and the institution "For the welfare of the Soldiers" must be understood to include also other benevolent institutes for the soldiers on active service, such as "Soldiers' Homes," some of which were splendid soldiers' institutes where refreshments were to be had cheaply, and which afforded opportunities for reading and for writing letters. We must not pass over the arrangements made for the washing of the soldiers' garments. Not merely was the soldiers' body-linen washed, but their clothes repaired, and in part replaced.

It would be most unjust to pass over the very prolonged occupation of the Swiss frontiers if we did not mention the exertions of the Swiss Red Cross Society. The Swiss Red Cross is managed usually by a board of directors. But at the very beginning of the mobilization (Aug. 2 1914) the Red Cross men were also called up, and a medical man placed at their head as chief. At that moment the Red Cross had at its disposal not quite £6,000. Hence it was resolved to organize a national collection, not merely for actual money, but also for gifts in kind (especially linen and woollen garments), and this idea was eagerly taken up. The money collected amounted to about £84,000, while the gifts in kind flowed in abundantly. As to the latter the Swiss women displayed great zeal. From all sides poured in shirts, socks, and other things, in huge quantities, including bed-linen and objects for use in hospitals. We must note the quaint fact that, over and above what is commonly used by soldiers on active service, many odd gifts were received, such as chemises for women, articles for female toilettes, and even children's toys.

If detailed figures were to be given for the useful objects collected from Aug. 1914 to June 1918 by the Swiss Red Cross Society, such as body-linen, shirts, sheets for beds, etc., the number would run up to several hundred thousands. The shirts, and the like, were specially welcomed by the poorer soldiers, who otherwise would have fallen victims to various diseases arising from the lack of such things, or in winter-time would have been frozen. For many, military service was thus rendered far more endurable.

One of the chief tasks which fell to the Swiss Red Cross was the creation of the so-called "Red Cross Squads." These were composed of men, exempt from military service, who placed themselves voluntarily at the disposition of the Red Cross, and were provided by it with uniforms and all things necessary for a regular "health service." The Red Cross Society itself has a great number of carriages at its disposal, and also sometimes commandeered motor-cars, and prepared them for the transport of the wounded. The troops on active service, like the Medical Corps, also used such vehicles in great numbers.

A further task of the Swiss Red Cross consisted in the training of well-qualified Red Cross women nurses (Red Cross sisters). Besides these there were other training establishments, either religious or lay (the latter are the mother houses which train nurses). At the very beginning of the war the Red Cross reckoned on the services of 960 sisters who could be employed in the care of sick soldiers. Many of these were employed in the huts for the wounded, set up at fixed distances behind the front, and in the military hospitals.

The Swiss army was severely tried by the influenza epidemic in the summer of 1918 and in the following winter, and that, too during the general strike (*see* below). If the Swiss Red Cross had had many claims upon it previously, it was now scarcely able to meet the tremendous demands made upon it, first, by the army leaders, and later on (at first the plague was contemptuously termed "the Spanish grippe") when the epidemic spread to a totally unexpected extent among the non-military population, and the unceasing cries for help from this side resounded louder and louder. As the epidemic spread more and more widely, voluntary help had to be enlisted. Here stepped in the so-called "Samaritan Associations" (St. John's Ambulance), already closely connected with the Red Cross, and encouraged their members, with a certain amount of training obtained in voluntary sick-nursing courses, to place themselves at the disposition of the afflicted families. The chief work, however, fell upon the Red Cross and its professional trained nurses, and it is amazing how much the Red Cross achieved in this department. About 10% of the professional nurses (sisters) died of their exertions.

In another respect too the Red Cross rendered excellent service. As is well known, the American Red Cross Society gave some £20,000 to the Swiss military nursing department. This sum was employed in creating convalescent homes for the Swiss soldiers who had suffered from influenza. The Swiss executive put this task also in the hands of the Swiss Red Cross, which, however, later on had to make considerable additions to this amount of money.

In consequence of the spread of the influenza epidemic it became necessary either to suspend or to delay the holding of the training courses for recruits, the subsequent drill courses, and the education of the non-commissioned officers. The percentage of invalid soldiers was unexpectedly high, and as the epidemic was so rapid as to seem like an explosion, it could be combated only with very insufficient means. Hence very caustic criticisms were expressed without reserve. These demanded publicly the dismissal of the chief of the medical department of the Swiss army, who was said to be already overweighted with the care of the "interned" foreign soldiers, and so could pay too little attention to his own Swiss soldiers, and had ordered precautionary measures at too late a period. All kinds of military hospitals, if one can credit the accounts in newspapers of all shades of opinion, presented a very sorry appearance. The care of the foreign interned soldiers was taken away from this Swiss chief medical officer, and also, after an enquiry, he was acquitted of want of attention to his own Swiss soldiers.

After the Armistice (Nov. 1918) the Swiss army could gradually be almost wholly demobilized. The defence of the frontiers was entrusted to volunteer troops whose pay was fixed at from 8 to 10 francs (6 to 8 shillings) a day. This afforded a decent income at least to many who no longer earned anything, whether because of the direct effects of the war or of the prolonged military service in their own land. It was asserted that in consequence of the prolonged mobilization the Swiss soldiers had gained immensely in military efficiency. But it was a pity that such efficiency cost the little land of Switzerland between 40 to 50 million pounds, and this expense had to be met by raising the customs duties, taxes on excess profits, two sets of special "war taxes," etc., which, it was hoped, would bring in the necessary funds, if only after a lapse of many years.

Once again considerable bodies of troops had to be called up because of the general strike (Nov. 1918), which failed in a few days. And these extra troops were required also by reason of the break-up of the German and, especially, the Austrian armies, which flowed back like a flood, and threatened a regular invasion of Switzerland.

In Nov. 1918 Gen. Wille resigned his post, as he considered that his work was at an end. In the same month the military pensions were increased 10% and the export of arms and ammunition forbidden, while the bureau of the Swiss general staff was also dissolved.

To meet the emergency support of the families of poor soldiers during the four years of the mobilization period nearly £2,000,000 were expended. Both for the mobilized soldiers and for the volunteers the daily pay was raised to about 7s. Before the war ordinary soldiers received only 8d. a day. The old arrangements were put into force again in March 1920.

The defence of the northern frontier had to be strengthened again at the time of the signature of the Peace of Versailles (June 1919), for a huge immigration from Germany was feared. Later, the frontier police had also to be strengthened because of the great amount of smuggling and the enormous number of people who crossed the frontier because of the bad conditions of life in central Europe and the lack of employment, for Switzerland, as the sole non-enemy land open, was regarded as an El Dorado. On Aug. 28 1920 the watch on the frontiers was definitely abolished. The strict watch on the frontiers had greatly impeded all facilities for travelling, and the very severe regulations as to the visa of passports and payment of other dues were subsequently greatly lightened.

Economic Effects of the War.—After the first excitement had died down, there were, in the first months of the first year of the war, no notable advances in the prices of various articles in Switzerland. This took place gradually, as the difficulties of importing articles increased. As early as Nov. 1914, Italy announced that she would place no hindrances in the way of the export of articles of food and supplies of raw materials.

In the matter of corn Switzerland was not in a very favourable position at the beginning of the war, for the supplies existing there would have barely sufficed for a couple of months. One must not forget that the Swiss agriculturists devote their attention far more to milk and cheese than to corn. This latter, therefore, could be delivered more cheaply by foreign countries, and was a far less profitable occupation for the Swiss farmer than milk and its products. Hence Switzerland fell more and more into a state of dependence on foreign countries.

The Swiss authorities naturally first of all attacked this pressing problem, and tried to find a remedy. They acted very shrewdly in that they introduced, Jan. 9 1915, a provisional monopoly of corn, and issued a special decree relating to its export. Thus the country was to a certain degree provided with the raw materials for bread and, above all, a bar was placed on all speculation in this most necessary article. Hence it was possible in the following month of May to note that the regular supply of corn was proceeding quietly, and that Switzerland was better supplied with corn than at the beginning of the war.

In the case of various articles such as bread and milk, a prohibition to export them was issued at once. It may cause surprise at first to be told that milk was included in such a prohibition. But whoever is aware of the fact that nearly all the milk, so far as it is not consumed within Switzerland, was worked up into various shapes (*e.g.* cheese, butter, condensed milk) and then was exported in great quantities, will not find fault with this prohibition, when he learns that in Switzerland itself there were periodical milk famines for the native consumers. And it came to pass that milk itself was exported from Switzerland. For example, in the frontier city of Basle, the inhabitants at the beginning of the war were forced to exchange milk for vegetables grown in Alsace, because for ages the supply of fresh vegetables for Basle had been supplied by Alsace alone.

When the war had lasted about a year, and no end to it was visible, the necessaries of life in Switzerland began to be not only more expensive, but also scarcer. In June 1915 it was therefore forbidden to export any articles of this kind. This regulation was due to the act of profiteers, who bought these necessaries of life in huge quantities, and then accumulated them for export to central Europe. Switzerland now found itself in a rather awkward position. If she forbade the export of necessaries of life, central Europe menaced the stoppage on their side of the import into Switzerland of the various articles which she most needed, such as coal, raw materials, artificial manure, etc. On the other hand, the Entente threatened Switzerland with a rationing of the consignments of necessaries of life in case the export of such to Germany and Austria were not entirely stopped, for the Entente had soon discovered that for central Europe this matter was the sorest point in its war administration.

In the course of wearisome negotiations with both parties the Swiss tried to find a satisfactory arrangement. So first they tried to found with Germany some sort of organization for imports. Industrial firms founded private import trusts, *e.g.* in Geneva, under the name of *Société auxiliaire du Commerce et de l'Industrie.* A similar trust was created in St. Gall, and in Basle a so-called "Import Trust Company." It became harder and harder to assure sufficient supplies for the whole country. The imports of necessaries of life from the "Free Zones" to Geneva were subject to strict supervision by France. On the heels of the corn monopoly of 1915 there followed in 1916 a monopoly of the importation of rice. In order to ascertain the amount of existing stocks of provisions within Switzerland the Swiss executive ordered a return of the supplies of such wares as were found in the entire country. As the supplies of necessaries of life became scarcer, so did the prices rise steadily.

The "S.S.S." (*i.e. Société suisse de Surveillance économique*), with its headquarters in Berne, had itself entered on the commercial registry. Complaints were made by important members of the general public that by this action the exports and imports were placed practically under the control of the Entente. It was, however, too easily forgotten that naturally it was not the intention of the Entente to permit an uncontrolled import to Switzerland, and then an uncontrolled export to central Europe, and so supply its enemies with the things they lacked. But the Swiss rightly argued that it was absolutely essential for them to keep up a certain exchange of commodities with central Europe. For instance, cattle in great numbers were exported to Germany and Austria-Hungary, whence coals, iron, steel, manure, sugar and other needful articles were imported into Switzerland.

It would have been far easier to supply Switzerland with all these goods, had a larger number of railway goods trucks been available. But many were away in foreign parts in order to collect the accumulated goods in foreign harbours, because neither France, Germany, nor Italy had any trucks available for the through journey to Switzerland. Often the trucks were delayed for months on the way, or were utilized by the belligerents for their own needs, so that quite often Switzerland had to make protests, and to claim the return of its trucks. Even in 1921 France was still refusing to pay the sum agreed on for Swiss trucks held up and utilized by her. In consequence of this insufficient supply of goods trucks the import of corn to Switzerland was at one time quite blocked, and this caused no little anxiety in that country. As the feeding of the Germans began to be more and more difficult, and the prisoners and evacuated persons had to suffer thereby, many good persons in the Entente lands caused bread to be baked in Switzerland, and then, with other articles, to be sent to Germany for the use of the Entente subjects interned there. Switzerland had nothing to urge against this proceeding so long as there were sufficient supplies for its own people. But later on the supply of wheat for this purpose had to be specially delivered by the Entente. In the same year (1915) a prohibition to export cotton was issued, and from Nov. 25 onwards cheese could not be sent away in quantities of more than 1½ lb., and licences to export butter were no longer granted.

It was in 1916 that the profiteers were most numerous and most active in Switzerland. In April the Swiss executive had to make new and sharper laws against the speculators who chose the necessaries of life as their field of operation. In Geneva a great organization was discovered which busied itself with such speculations. By order of the cantonal executive considerable supplies of coffee, cocoa, and chocolate were seized, and a number of foreigners expelled. Great quantities of rice and fat were also confiscated in Basle and in Buchs, on the Austrian frontier. One must assume, of course, that the greater portion of these goods had been smuggled over the frontier. Soldiers, customs officers, frontier guards had their hands full with countering the tricks of smugglers, speculators and profiteers.

Henceforward the economic relations began to get sharper and sharper. After the inquiry as to the existing stocks of sugar came the sugar monopoly. This had become necessary because the wholesale firms were no longer willing to undertake the importation of sugar. (Before the war Switzerland imported annually sugar to the value of about £1,500,000.)

As the blockade of the Central Powers by the Entente became more and more strict, this had a reflex action on the economical situation of Switzerland. That little country found itself hard pressed from all sides. In June 1916 Germany threatened the stoppage of all exchange of goods if Switzerland would not deliver those which had been stored on German account in Switzerland, and the Entente as firmly refused to let this threat be carried out. In the same month a Swiss delegation journeyed to Paris in order to remove these difficulties. But at first no settlement could be reached, for the Allies and Germany both obstinately clung to their points of view. Finally in Sept., with great trouble, an arrangement was concluded with Germany. Hardly was this in force when France, England, and Italy required that Switzerland apply to them measures similar to those which Switzerland had accepted in the Germano-Swiss arrangement. How complicated this situation often was for Switzerland is shown best by the Note, according to which the Entente required from Switzerland a prohibition for the export of all those manufactures (machines and parts of machines), the making of which required oil for greasing them which came from the Entente states. The distrust of Switzerland became greater and greater. Germany complained that Switzerland had abandoned its neutrality, and was under the protection of the Entente. On the other hand, the Allies grumbled that the goods delivered by them were handed over by Switzerland to the Central Powers. What wonder then that the saying became prevalent in Switzerland—"A neutral Power is kicked from the left, and whipped from the right."

The following fact will show how much during the war Switzerland had to depend on a reasonable amount of imports. In 1916, despite all the efforts of the Swiss farmers, only two-thirds of the supply needed for the country could be produced. Besides wheat for bread, raw materials, artificial manure, cattle for slaughter, fat, and by far the greater amount of the potatoes used, had to be imported from foreign parts (Germany, Holland and Italy). In 1916 Germany exported to Switzerland 1,600 trucks filled with potatoes, both for consumption and for sowing.

For foreigners it was not easy to understand why Switzerland placed the seizure of the harvest and the fixing of maximum prices for the most important necessaries of life in the hands of the Military Department, for in Switzerland, as in other lands, so-called official Food Departments had been set up. It was easier to understand that the military authorities were empowered to issue orders that the supplies of hay and straw of each harvest should be commandeered. Inquirers were informed that the Military Department or the Chief War Commissariat office had, in the course of years, accumulated a great stock of corn, which was renewed every three years. When, at the very beginning of the war (Aug. 27 1914) the Swiss executive sanctioned the grinding of "full flour" and then, as is well known, ordered a corn monopoly for the Confederation (Jan. 9 1915), and also commandeered the entire corn harvest, the Chief War Commissariat office was the right authority to carry these orders out. But on Aug. 1 1917 a central bureau for the provision of bread was set up, and on Aug. 10 1917 this was followed by a Swiss bread bureau. On Sept. 13 1918 a Swiss Provision Department was resolved on, and the bread matter was entrusted to it.

The entry of Italy into the war (May 23 1915) was a hard blow to Switzerland, making it more anxious than ever, but still worse was the declaration made by Germany (Feb. 1917) to the Allies of the unrestricted submarine warfare. By this step Germany won no sympathy from the neutrals, although the Swiss executive refused the suggestion of the United States to break off all diplomatic relations with Germany. The Swiss held that this refusal was in accordance with their neutrality, as Germany was the sole land which supplied coal to Switzerland, for the Entente had now to send coal to Italy and could not supply it to Switzerland. At any rate Switzerland got coal from Germany, despite increased prices, cheaper than Italy did from its Allies.

The declaration of Germany (on Feb. 1 1917) that the port of Cette lay outside the blockade zone was only a poor comfort for Switzerland. It ought to have secured previously a reasonable amount of imports. France strained its resources to satisfy the demands of Switzerland as far as it could, and sanctioned important traffic alleviations for the transport of necessaries of life. But this did not hinder the needs of Switzerland from being increased. On Feb. 12 1917 two "meatless" days per week were ordered, and on other days only a single dish of meat was allowed for each meal.

One misfortune followed another. Soon the Argentine Republic announced (April 1917) that it had forbidden the export of wheat,—even the supplies already bought by Switzerland.

However, it must not be thought that during this critical period Switzerland had simply folded its hands on its breast. It tried as far as possible to make itself independent of foreign countries by directing additional planting of potatoes, vegetables and materials for bread. Flowers disappeared from all gardens. Everywhere their place was taken by potatoes and other vegetables. The pleasure parks and drill grounds in and around the towns were commandeered for the same purposes. In the evenings, when the day's work was done, the workingmen of the towns were seen, pick and hoe in hand, busy turning up the ground which previously had served all purposes except the planting of useful things. The State ordered each parish to put gratis at the disposal of the poorer classes land for cultivation, and even swampy spots had in all haste to be prepared for cultivation. It is easy to understand that sometimes practical impossibilities were demanded. "One lives and learns." Next, after the land had been prepared for cultivation, suitable kinds of manure were no longer to be had. Those who were not owners of cattle could produce none. Artificial manure of good quality proved too dear to be purchased by poorer people. These were obstacles that must not be underestimated, but absolute need and the horrible period of the war overcame them all. Frequently the results of this compulsory planting did not even approximately reward the pains and work which had been bestowed upon it, but people were too filled with joy to despise the little that was actually the result. Thousands and thousands of families who previously did not produce necessaries of life had themselves to plant the amount of potatoes and vegetables required for their own use, and so considerably relieved the crying need. In 1917 120,000 trucks of potatoes were produced (the normal production was about 100,000 trucks). But there was no abundance of this commodity, for in many poorer families potatoes had to replace macaroni, and such like wares which had become more expensive.

These measures on the part of the Swiss authorities were indeed very drastic, but they could not have acted otherwise. The townsman, like the country farmer, was affected by them. The latter indeed had to submit to regulations which meant a revolution in his ordinary business. He was ordered, without the slightest regard to the number of his cattle, to plant a fixed quantity of his land in corn, in such and such a manner. With far less help than heretofore (for the men of military age were generally absent), the peasant women and their half-grown children had alone to do all the work. Not infrequently even their horses were taken away for service on the frontier.

When the peasants had planted, as ordered, the fixed quantity of land in corn, and so helped in the supply of bread, it turned out that now they had too little hay for their cattle. Experience taught here, as elsewhere, that an existing state of things could not be simply changed by the alteration of a screw in a machine. The aforesaid regulations reminded men of the State right of tutelage in the matter of dealings with corn, as had been usual in Switzerland as late as the 18th century. Great quantities of corn were procured and stored in granaries, in order to secure cheaper bread to the people in general.

The more profitable pasture business (*e.g.* breeding of cattle and milk industry) had developed from agriculture. Before the war there were big farmers in Switzerland, who only grew potatoes and other vegetables enough for their own use. But the rest of the land was laid down in grass. So it is easy to understand that before the war Switzerland could export yearly huge amounts of cheese, butter, and condensed milk.

Against the introduction of "bread cards" Switzerland fought with tooth and nail. The workingmen in the towns were not willing to be deprived of their unrestricted amount of bread. A middle way was therefore tried in Switzerland—the grinding of the corn less finely, and the prohibition of the sale of fresh baked bread (Feb. 12 1917). Further, in May, a decree directed that bread should only be sold 36 hours after it was baked. But already in Oct. the final solution of this problem could no longer be deferred—the daily ration of 9 oz. a head.

Bread and meal were joined on the same card. The bread card was split up into such small rations that the traveller could obtain in the hotels and restaurants per portion only 1½ ounces. This regulation was followed in Feb. 1917 by the order to make macaroni, etc., only out of eggs, and then on March 1 1917 appeared the cards for rice and sugar. In the case of sugar about 2¼ lb. extra were allowed per head for making jam.

Every month or two Switzerland had to start new negotiations with the belligerents, and to conclude new agreements. In May 1917, the negotiations about the management of the S.S.S. were brought to a conclusion, and an understanding was reached about the import of fodder and the export of live cattle. For the export of fodder from the Entente lands, Switzerland had had to export live cattle as "compensation." A new economic agreement between Germany and Switzerland was also concluded.

A special chapter in the provisioning of Switzerland was formed by the struggle about the price of milk. Here the consumers and the producers were often hotly opposed to each other. The workingmen in the towns reproached the peasants with illegal exploitation of the hard lot of the people, and that the latter often from time to time intentionally brought about a milk famine in order to drive prices still higher up. The "Town Associations" (a product of the war as against the country) took an active part, though not always with the same arguments, in this struggle against the peasants. These, on their side, refused absolutely, seeing that all kinds of fodder were always becoming dearer, and by reason of the general rise in prices, to supply their wares at the same fixed price. It was not always easy for the authorities in case of these quarrels to hit on a middle way which was good for all parties alike. One reason for the scarcity of milk was certainly that Switzerland temporarily exported many head of cattle, and this business wasted much milk. Then again, as butter and cheese rose in price, greater supplies of these articles were manufactured, as it was the more profitable business. All this took place, be it well understood, at the expense of the consumer, who had to suffer much thereby.

In order to assure nevertheless a sufficient supply of milk for the Swiss people in general, the Swiss executive empowered the Agricultural Department to fix the amount of the milk rations allowed to each parish, and sanctioned the delivery of milk at reduced prices to persons of small means. The maximum price for a litre (1¾ pt.) of milk was therefore fixed at 33 centimes (about 3½d.) in April 1917, but for people without means at 26 centimes (about 2½d.). The State and the parishes had between them to make up the deficiency. In order to create a closer organization and to render the commerce in milk somewhat the same for all 22 cantons, a central bureau for the supply of milk and its products in Switzerland was set up in Aug. 1917. It was empowered to issue decrees, and to subject the whole industry to Federal control. That was quite necessary, because it happened that the milk for the inhabitants of the towns was already rationed (so in Berne on Jan. 1 1918 the daily allowance a head was only three-fifths of a litre), while in the country free trade prevailed in this business. As the danger of a fresh rise in the price of milk became more and more imminent, the town workmen opposed it vigorously. They threatened a general strike if this most essential commodity should be again raised in price. In the Chamber of Deputies of the Swiss Parliament a compromise was made on this basis—the Swiss executive to grant one rappen (less than a farthing) per litre to the milk producers, and to pay the extra expenses of the transport—this was only to avoid a fresh rise in the price of milk (Oct. 1917). This was well meant, but it turned out later to have been a mistake, since from this time onwards rich and poor profited by this arrangement, and the Swiss authorities had to pay out a huge amount of money.

For the time certain kinds of cheese (cream cheeses, etc.) were not allowed to be sold, and the consumption of butter was restricted. Finally, it was arranged that each landowner was obliged to deliver a fixed quantity of milk from each cow for consumption. When later in 1918–9 the rationing was still more limited (Oct., half a litre, and in Nov. one-third litre per head) this evil was not so much due to any intentional over-production of milk products by the peasants, but, as pointed out above, because many peasants by reason of the compulsory planting of corn, and dearer hay, etc., and the consequent hay famine, could afford only to keep a far smaller number of cattle. This circumstance may have affected the production of milk more than was stated above. It must be added that children up to a fixed age and persons over 60 could claim an extra ration—so too sick persons, but for these a medical certificate was necessary.

At the beginning of the war people were much perturbed by the payment of 26 rappen (about ¼ of a franc) for a litre of milk, and yet in 1921 the price was 52 rappen (about ½ franc), or an increase of 100 per cent. After the conclusion of peace and on the return of more normal economic conditions it was hoped that a slight alleviation would ensue. But in 1919–20 the foot-and-mouth disease in Switzerland increased to such a degree that at the end of 1919 the daily ration of milk in the towns sank to below the average in the war-time—to one-third of a litre. The foot-and-mouth disease caused Switzerland a loss of about £5,500,000. Finally, in April 1920 this limitation was abolished. The milk famine was one of the greatest calamities that occurred in Switzerland during the entire war period.

It goes without saying that macaroni, groats and oatmeal, barley, cheese, butter, fat, and oils were all rationed, and even also, in part, potatoes and coals. The supervision took place by means of specially issued cards. The butt of the card had to be given up every month when new cards had to be procured. These bore every month differently coloured signs of authenticity. A regulation was also made that in each household even necessaries of life, which were *not* rationed, should not be kept in quantities exceeding the supply required for two weeks.

Some necessaries of life were meted out with a very sparing hand: thus only rather over 1 lb. of meal per head and per month was sanctioned, while, from Oct. 1917, white meal and groats were only allowed for hospitals and sick persons, and, even to procure these, corresponding bits of the bread and meal card had to be sacrificed. Other important necessaries of life were rationed as follows: maize about 14 oz., rice about 9 oz., and sugar about 20 oz.—in each case per head and per month. But even these rations were not fixed fast—on the contrary they were raised or lowered according to the existing supplies imported.

The restrictions that were most felt were those on butter and on fat for cooking. Foreign lard, even before the outbreak of the war, had been imported in great quantities. But afterwards the imports of this article fell off more and more—in July 1917 it had decreased by 90 per cent. Hence the supervision of all kinds of fat was placed under State control, and in Jan. 1918 a so-called "Central Bureau for Fat" was set up to ensure the provisioning of the country with fat and oil, both for eating. The fat and butter cards (fat for eating and oils) were brought in on March 1 1918. They allowed about 12 oz. of fat and about 5 oz. of butter per person each month. In June the ration of butter fell to about 3½ oz., and then rose again to about 9 oz. After the Swiss Government succeeded in buying in America (Jan. 1919) 15,000 tons of pigs' fat, it became possible to abolish the rationing of fat in July of the same year, but the butter cards remained in use for two months longer.

About the same time (July 1919) the rationing of macaroni, groats, oatmeal, and barley was abolished, and two months later (Sept.) the same was done with the bread and meal cards, and finally with the "meatless" days.

For the poorer classes so-called "Distress Relief" was organized, *i.e.* the Confederation, the cantons, and the parishes together paid over to these poorer people a portion of the price of certain necessaries of life. The principal objects of this charity were bread, milk, and potatoes. In the towns many classes of the population had to be supported in this manner—in the town of Berne alone about 27%. In the summer of 1918 the increase in the prices of necessaries of life rose to 120%, and in the autumn of the same year to 150%. Throughout the country the town workmen organized demonstrations against this increasing cost of necessaries, and these were combined with other matters of political discontent, these latter being stimulated by the events in Russia and in Germany and all leading up in Nov. to the general strike (*see* below).

Manufacturers in general accommodated themselves quickly to the state of things produced by the war. An exception was formed by the embroidery industry of eastern Switzerland, which was paralyzed through insufficient exportation and lack of foreign orders. On the other hand, the watch factories did very well, because they could manufacture parts of ammunition for the belligerents, which brought in much money, both to masters and men. The same thing happened with the great industrial magnates, who manufactured turning lathes, machines or parts of machines for the same object, and exported them. The delivery of completely manufactured ammunition was forbidden by the Swiss executive as being contrary to neutrality, but it was not difficult to get round this prohibition. Each of the belligerents sought to arrange matters to its advantage. Germany once claimed that every manufacturer of western Switzerland who delivered articles to the Entente should receive no more German coal for his factories. France, on the other hand, forbade the use of grease for machines and parts of machines which were to be exported to Germany. It was not always easy for Switzerland to steer the right course, without totally depriving its workmen of their wages.

The provisioning of Switzerland with coal proved often a very difficult and complicated matter. At the beginning of the war, and in part even up to the year 1916, it was not possible to complain in Switzerland of a coal famine, properly speaking, for the prices had risen by not quite a quarter per ton. Before the war one had to pay to the coal merchant (including his profits) about £2. 8s. per ton, and in 1916 some 7s. or 8s. more. But matters changed altogether in 1917, for not only did the price (including the profits of the coal merchant) rise to £5. 4s. but restrictive measures were taken. By a decree of the Swiss executive of March 7 1917, no one was allowed to procure a supply of provisions sufficient for over three months. In Basle the so-called "Central Bureau for Coal" was set up. Any person who required more than five tons of German coal had to take a share in the aforesaid company, or else to pay an extra £2 per ton. The object was to secure to Germany an adequate money advance, probably in order to compensate her for the loss on the exchange. Germany was required to provide solvent guarantors, so as to make sure that the money would be forthcoming. Later on, a local "Coal Supply Bureau" was set up in every town and every parish, which fixed the amount that any person could be allowed, and supervised the distribution. The prices for good coal (including merchants' profits) amounted to £10 per ton. New restrictions were often issued. The census of the amount of coal was soon followed by its rationing. It is well known that Switzerland, apart from peat and some slate coal, possesses no coal proper. That fact suffices to prove how dependent she is in this respect on foreign supplies. A "Swiss Coal Co." was formed, the object of which was to support financially efforts to find more coal in the country. Researches were carried on all over the land, and a certain amount of coal of poorish quality was found in the cantons of Berne and of the Valais. Peat too was cut, wherever there was a possibility of the smallest supply. But one cannot be surprised that, despite the high prices, the quantity of this coal fell far short of the amount required.

Soon after the scarcity of coal began, and particularly by reason of the rise in its price, the railways and the steamboats on the Swiss lakes were forced not only to raise their fares, but to take other restrictive measures. First of all the "excursion tickets" were suppressed, and then also the cheaper sorts of return tickets abolished (1917). The circulation of trains was reduced from March 1 1918 by a third. In Nov. 1918 the State railways raised their tariff for goods by about 80%, and in the same month experiments were made with supplying locomotives with wood instead of coal, and this, in consequence of the ever-increasing coal famine, even in the case of fast trains. The cantons were each bound to deliver a certain quantity of wood, according to their size and their supplies. Canton Berne, in particular, had to furnish very large quantities of beech wood. Previously, the whole supply of fuel had been seized by the State. All public bureaux and post-offices had to reduce the hours during which they were open, schools had to have holidays, etc. One restricted railway scheme appeared after another, and from Dec. 1 the circulation of travellers, on those bits of the railways which were still run by steam, was provisionally entirely suspended on Sundays and festivals. The only trains allowed on those days were those which carried milk. At the same time the distribution of letters on Sundays was discontinued.

In this time of need strenuous attempts were made by the Swiss authorities to electrify the railway lines, where this could be done most efficaciously. The private non-State railways were encouraged to do the same, and subsidies were promised to them for that purpose. Although, with certain exceptions, such as the St. Gotthard line and some smaller bits, this permission could not be utilized to the extent required, this is to be explained by the unheard-of prices asked for raw materials. The purchase of electrical machines alone absorbed such huge sums that the necessary capital could not be brought together.

In Oct. 1920 a fall in the price of coal took place, and the supply also gradually became better than heretofore, so that in the winter of 1920–1 the rationing of coal was abolished. The coal supply organization in Basle was wound up. But now another difficulty appeared. In consequence of the augmented supply the "Central Bureau for Coal" had acquired great quantities of coal at prices which were still high. Likewise the supply of peat had increased in amount. But as the coal prices sank the supply could not keep pace with the reduction in prices unless at a great loss. Business men complained that they could get coal direct from the pits at lower prices than those payable in Switzerland. The Swiss executive resolved to give financial aid for the distribution of the existing stocks in the country at cheaper prices. But it imposed on each ton of imported coal an extra customs duty, and this measure was to last until this advance was reimbursed.

Treaties.—In order to complete the picture of the economic difficulties which existed in Switzerland during the war we must here add a short account of the treaties which she was compelled to conclude with the belligerents.

The "S.S.S." (*Société suisse de Surveillance économique*), intended to regulate the circulation and employment of wares in the interest of the Entente, was founded on Oct. 11 1915. At the same time the "Treuhandstelle" for commerce with the Central Powers came into existence.

On Sept. 2 1916 the so-called Economic Agreement was concluded to facilitate the exchange of goods. Germany by this had to release per month 253,000 tons of coal, and the amount of iron and steel required by Switzerland. Switzerland, on the other hand, handed over products of milk, meat, etc. A Swiss export committee looked after the export of war supplies, produced with German raw materials (the so-called "Swiss Central Iron Bureau"). It was forbidden to use German iron or German coal for the production of war supplies destined for the Entente.

On Aug. 20 1917 a new arrangement was made. Germany was to grant permission to export 200,000 tons of coal at £3. 12s. a ton, and 19,000 tons of iron and steel, in both cases per month. On its side, Switzerland was to grant Germany a credit per month of £800,000 (foundation of the "Central Bureau for Coal").

On Sept. 29 1917 this arrangement was followed at once by a similar agreement with France. A group of Swiss banks granted to a group of French banks a credit per month of £500,000, this to last from October to December. In return Switzerland obtained from France certain economic reliefs. After two months this arrangement was renewed for 10 months, the credits allowed rising with certain improvements in the import of goods. On March 20 1918 a similar credit was granted to a group of English banks, the monthly maximum amount being fixed at £400,000.

On Aug. 30 1917 an agreement with France and Italy was concluded for the export of wood, to be worked up, from Switzerland. On Dec. 5 1917 the United States also made an agreement to supply 240,000 tons of bread-stuffs, till the next harvest. Other kinds of goods were "contingented." The lack of room on ships delayed, however, the delivery of these supplies very much. In place of the agreement with Germany (which had run out) a new treaty, much less favourable, was concluded (May 15 1918). Germany was bound to give leave for the export of 200,000 tons of coal, iron, and steel. The Swiss "Treuhandstelle" had to superintend the exchange of goods according to the S.S.S. system.

The Economic Agreement of May 5 1915 with Italy was still in existence. But on Nov. 1 1918 an economic and financial treaty was made with this country, as also with France and England. The credit to be allowed every month was fixed at a maximum of £200,000, but the amount of imports was limited.

In order to execute all these financial obligations of Switzerland the "Swiss Financial Association" was founded in Lucerne on Aug. 1 1918. To protect itself against the imminent danger of a maritime blockade, Switzerland agreed with Germany on April 24 1918 that free passage should be given for all cargoes destined for Switzerland.

In a fresh financial agreement with France (July 19 1919) Switzerland obtained a credit of about £1,250,000. The economic treaty with this country ran from March 25 1919 to the end of 1919. In Oct. and Nov. of that year the contingents of Switzerland for watches and embroideries were somewhat raised. In a fresh agreement of March 10 1920 a bargain was made with Switzerland for the delivery of 10,000 tons of coal (brown coal) from the pits on the left bank of the Rhine each month. Switzerland had to supply, among other things, electric power, but the promised amount of manure received by Switzerland was quite insufficient.

At the end of Nov. 1919 a new compensation treaty was made with Italy about the delivery of oil-cake and hay in exchange for cattle, for breeding and use.

The coal agreements came to an end in the beginning of 1919.

On Jan. 22 1919 an economic treaty was made with the United States; bigger contingents of goods were secured to Switzerland and a tonnage of 70,000 (soon raised to 100,000), England and France guaranteeing these amounts.

On March 25 1919 yet a new agreement was made with France about the supply of goods. France promised to deliver 60,000 tons of coal from Lorraine per month (at £4. 16s. a ton) and also manure and facilities for the transport of goods. On its side Switzerland engaged to deliver cattle for breeding and certain goods (chocolate, watches, embroideries, etc.) to the value of about £108,000 per month, and also a new credit not to exceed about £1,500,000 at the most.

The credit arrangement with England of March 20 1919 was not renewed. Later on, England too raised the contingents which could be imported, and sanctioned (March 1 1919) again the admittance of embroideries and silken goods. On April 28 1919 the "black lists" were abolished, and also the certificates of nationality and the contingents of imports permitted by the S.S.S.

Such were the economic agreements which Switzerland had to sign. Her economic dependence on foreign countries is thus abundantly clear, and yet it must be said that all the belligerents had taken much kindly notice of her position in this way or in another. It must be recognized that the Swiss authorities managed to get well through all their difficulties, and did not fail to take precautionary measures (sometimes very incisive) to provide the Swiss with all the necessaries of life. But, in consequence of the incredible rise in prices and the excessive prices of necessaries of life, even of those which are most indispensable, they were unable to bring it about that the distress of the people should not lead to dissatisfaction, complaints, and great discontent.

General Strike of Nov. 12 1918.—The Swiss Socialists (or Social Democratic party) were never stronger, and to a certain degree more feared, than towards the end of the fourth year of the war. The rise in prices of all commodities, and too the unforeseen and the previously unknown dearth of dwelling houses, were utilized very cleverly and ably for the purposes of propaganda, and brought great reinforcements to the Socialists. Protest meetings against too high prices were organized, and these were sometimes accompanied by political demands which caused serious restlessness. The revolution that had broken out in Russia in the preceding year and the break-up (Oct. 1918) of Germany, from the military point of view, and in part also from the political point of view, hurled their waves of revolt as far as Switzerland. Here the leaders of the workmen imagined that the moment was come for violent action. The crisis was the summoning of troops to Zürich, the Government of which on occasion of the memorial day (organized by the Socialists) of the Russian Revolution, feared serious riots. The calling of the troops to Zürich was considered by the workmen as a provocation, and the reply was a general strike for 24 hours, which very soon developed into an unrestricted general strike in the whole of Switzerland. The railways ceased to run, and in most Swiss towns the entire body of workmen took a holiday, though not in the rural districts or in western Switzerland where the strike was sometimes only a partial cessation of work, and ended in a speedy breakdown. In order to make this general strike more popular with the workmen the so-called "Olten Committtee of Action" put forth a social and political programme, which was submitted for speedy acceptance to the authorities, and included the following demands. The immediate transformation of the Government of the country so as to be in accordance with the will of the people. The new Government was to bind itself to the following programme at the very least; new election of the "Conseil National" according to the principles of proportional representation; voting rights of all kinds for women; introduction of the general obligation to work, and of the 48-hour week in all public offices and private businesses; the reorganization of the army so as to make it the army of the people; the securing of the supplies of necessaries of life, this provision to be carried out with the agreement of the rural producers; insurance for old and sick persons; State monopoly of imports and exports; and redemption of all State debts by the rich.

The Swiss executive refused to negotiate with the strikers, and the peasants made a show of cutting off the milk supplies of the towns. Another hope too of the strike leaders failed. They had expected that the soldiers, especially the members of the association of the "League of Soldiers" (thought to be imbued with revolutionary ideas and later forbidden by Gen. Wille), would naturally refuse military obedience. The military authorities, however, had taken the precaution to summon trusty troops from the rural and Alpine regions, and so the leaders of the strike saw their hopes falsified. When the news spread of the ultimatum issued by the Swiss executive to end the strike at once, otherwise the strike leaders would run the risk of being put into prison, the general strike came to a natural end. Such a strike has seldom broken down more wretchedly. The 48 signers of the "Olten Appeal" were accused of instigating the strikers to mutiny, and so were handed over to the military authorities for examination. By this accusation was meant any appeal which directly or indirectly was made to the soldiers, with the warning not to march against their own brothers, and not to turn their weapons against the workmen, but, in case such a command should be given, rather to refuse military obedience. By far the greater number of the 48 signers were acquitted. Only a few of the most prominent and the most compromised leaders were kept, and received punishments ranging up to six months' imprisonment. Here, as elsewhere, it became clear that the greater part of the Swiss workmen never would approve a united general strike with purely political aims.

Interned Prisoners.—As early as Oct. 1914, a beginning was made with the dispatch of the evacuated civilians home to France, Germany, and Austria, passing through Switzerland. And up to March 5 1916 some 60,000 persons were conveyed back to France alone by the same route.

On Feb. 21 1916 an arrangement was finally made about the exchange of the severely wounded German and French prisoners who were to pass through Switzerland. After the consent of the Swiss Red Cross had been previously obtained, this duty was confided to it by a decree of the Swiss executive. Now began the foreign action of that institute which lasted for five long years. Constance and Lyons were fixed on as the exchange centres; the trains were to pass through Switzerland at night, and the railway carriages required were to be furnished by the State railways.

Before the actual transport took place, "selection committees" visited the various prisoners' camps, in order to inspect the severely wounded men, and to settle which should be included in the exchange. The Swiss Red Cross agreed to defray all the expenses for the food, etc., of these poor men, and their nurses etc., but not the railway fares.

Besides the medical men, male Red Cross nurses accompanied the trains, sometimes also soldier nurses, while women nurses from nearly every Swiss nursing home looked after the invalids. The journeys took place at longer or shorter intervals, but often there were lengthy breaks, due to the state of the war, and to difficulties that arose between the hostile states.

The Swiss people took a great and a very sympathetic share in these transport trains. People flocked from long distances to the railway stations merely to see the trains rush past, and had the feeling that thereby they had showed their sympathy with the unfortunate victims of the war. At the places where the trains halted, the joy was enormous. At some spots the trains had to stop because the people would block them by standing on the rails, and a huge quantity of loving gifts, for which room was scarcely found, literally overflowed the Red Cross carriages.

The good example of France, Belgium, and Germany was followed in Nov. 1916 by Italy and Austria also. The exchange stations here were Como-Monza and Feldkirch-Dornbirn, and many trains came through with Austrians, Bulgarians, Turks, Serbs, English, and Italians. Later on, when Austria resolved to repatriate the numerous Italian consumptives, whose illness was still in the preliminary stages, special consumptive trains became also necessary. Imbecile soldiers were transported in great numbers. Twice trains, with many such, came through, and no one could determine their names or their homes.

A most pitiful and moving spectacle was the sight of the trains filled with evacuated civilian travellers. Old men with snow-white hair, women of all ages, and children, even unweaned infants, were seen in these trains. These unfortunate persons were warmly welcomed and well fed, in the most hospitable fashion. It is a gloomy chapter in the history of the war.

The interned soldiers were mostly housed in the Alpine regions. This took place for various reasons. First of all, the high air was looked upon as a great factor in their convalescence, and then again they were isolated from the temptations of bigger places and towns, and, finally, in the tourist centres many hotels stood empty, all ready to receive this new kind of guest, and well fitted to shelter great bodies of interned.

No Swiss industry was so hard hit by the war in its very existence as the Swiss tourist traffic, once so flourishing. According to the statisticians, milliards of francs were invested therein, and so, soon after the outbreak of the war, special measures of protection (such as exemption from bankruptcy suits) and also acts of charity had to be taken. What wonder then that the Swiss authorities, by this action in favour of the interned, hoped to kill two birds with one stone, and appropriate these small profits to the stricken *industrie des étrangers?*

The daily sum paid for accommodation, etc., per head was originally four francs, later five francs, and even in 1921 an extra amount of one franc daily per head for 1918 was the subject of negotiation. (These sums were paid by the respective states concerned.) But no state, save defeated Germany, had agreed up to June 1921 to this extra expense. The food was simple and nourishing, and in some places it was more than good.

At the beginning of the period of internment the interned were given free postage for all letters sent to their native countries. And nothing too was charged for parcels sent thence to foreign countries. This humane arrangement was afterwards first restricted, and later on quite suppressed, as the war seemed to be never ending, and the cost to the Swiss post-office ran up to £2,000,000, and even more.

A great difficulty arose as to the employment of the interned. In some places they took to an industry which promised them certain profits. Such were the beautiful, and even most artistic works of art which were produced by simple and untrained soldiers. They acted as joiners, mechanics, turners, wove baskets, made ropes, and nets, painted pictures, etc. In Thun, as early as 1916, a school of commerce was opened for the interned. The universities of Basle, Berne, Geneva, Lausanne, and Zürich allowed interned to matriculate as students. The Bernese University Committee provided in 42 prisoners' camps outside Switzerland both teachers and students with money, food of various kinds, clothing and books. The interned were permitted to hold exhibitions of their products, and special committees were founded to promote the sale of the fruits of their labour. Now and then they received visits from high-placed countrymen (such as Gen. Pau, etc.). They looked after their social amusements themselves. One English committee even got together money for the visits of English women to their husbands interned in Switzerland. The English interned enjoyed the special sympathy of the Swiss. The number of prisoners interned in Switzerland was already in Aug. 1916, 18,936—11,823 French, 4,322 Germans, 1,607 Belgians, 1,183 English, and one Austrian. These numbers later increased very much, and finally, when difficulties arose about food in Switzerland, it could not possibly receive an unrestricted number, and so after a certain time the interned were exchanged for others.

When the internment of wounded prisoners was resolved on in Switzerland this business was entrusted to the chief army medical officer, and the Swiss Red Cross. Practically, the Red Cross took charge only of the transport of the interned to and from Switzerland, everything else being supplied by the army authorities. The interned had fewer invalids than the exchanged prisoners, and so required only ordinary trains with occasional carriages in which to lie down; but many persons seriously ill were sent home, and the Swiss Red Cross looked after all such cases.

After the Armistice the principal transport of the prisoners belonging to the Entente took its start. The sick and invalids were partly sent for in special "sanitary" trains,—French, English, American, and Italian,—the nurses, etc., being supplied by the Swiss Red Cross. All these journeys passed off without any serious accidents, at least it never happened that any one was injured, though the trains went at express speed.

The Swiss Red Cross spent (apart from the railway fares) some £13,000 in carrying out this transport. No fewer than 81,377 persons were conveyed by the Swiss Red Cross, and that without counting the numerous civilians interned and civilians evacuated, who had previously passed through Switzerland, the number of these amounting to several hundred thousands. All these persons travelled through Switzerland.

In April 1919 there were still 5,000 Germans interned in Switzerland. These could only be sent home later, shortly before the home-coming of the prisoners interned in France.

The international action of the Swiss Red Cross extended also to investigations as to prisoners and missing soldiers. From all parts enquiries arrived, relating to the whereabouts of various soldiers. This was a task which properly belonged to the International Committee at Geneva, specially created for this purpose. In many cases, however, the Swiss Red Cross, thanks to its fortunate and useful communications by reason of the exchange of the interned, could answer these enquiries. With this object a special office was set up in Berne for the interned prisoners of war in Switzerland, and to this all enquiries were to be addressed, whether for interned persons or missing persons.

International Red Cross at Geneva.—The following was the share of this well-known institution. When hatred and reprisals on both sides got the upper hand, it issued a series of appeals, first of all in favour of common action in carrying out the task of the Red Cross, next to the belligerents on behalf of the wounded and sick, of the nursing staff, of their supplying necessary wants in accordance with the Convention of Geneva, and of the Hague Convention. Next came protests against the torpedoing of hospital ships and against the bombardment of hospitals on the field, the protection of Red Cross unions, the recognition of the Red Crescent, as to the treatment of prisoners, and the distribution of money collected (about £13,000) to the Red Cross associations of the belligerents, as to the reception of Red Cross sisters in Switzerland for rest and refreshment, missions to visit camps of sick prisoners in Italy, Bulgaria, etc., and prisoners' camps in general, the facilitating of communications between the Red Cross associations of the several belligerents, in favour of the sending home certain categories of war prisoners, against the propaganda bureaux, and against the employment of poisonous gas, etc. That is only an imperfect list of the tasks which the International Red Cross undertook, and which it would take a book to describe in detail. Its influence was not less blessed than that of the Swiss Red Cross, and was of extreme importance for facilitating communications between the belligerents. It is worth mentioning that the French poet, Romain Rolland, gave half the proceeds of his Nobel prize to Gustave Ador, the president of the International Red Cross in Geneva, for the war prisoners.

Help Given to Other Nations.—As early as June 28 1915, Switzerland hearkened to the cry of distress from little Luxemburg, then occupied by the Germans, and sent flour to help its suffering population. On Oct. 6 of the same year the Luxemburg Minister of State, von Eyschen, came to Berne to arrange for the supply of the necessaries of life to his country through the Swiss "Import Trust." The principality of Liechtenstein was supplied also with food-stuffs; this led to its closer association with Switzerland, and in 1921 it had Swiss postage stamps and used francs as money. On Dec. 4 1918, shortly after the Armistice, Switzerland, in order to alleviate the hunger in the German districts of Austria, sent ten trucks, laden with flour, and nine with rice, to Innsbruck. These supplies were reimbursed by the Entente, as also were the 100 trucks of necessaries of life sent on the 27th of the same month. Switzerland was selected as being able to send supplies quickly. Later, she sent them from the stocks meant for her own consumption.

But this kind of help was not the only sign of sympathy shown by Switzerland. When the need increased it extended its charity to the reception of badly nourished children belonging to the belligerent states. In Sept. 1916, 760 Belgian children from the occupied territory were long in the canton of Fribourg. In other Swiss cantons such poor children were also received. In the year 1919 alone a total of 43,000 foreign children was received in order to recover from illness. It were principally Belgian, Austrian, and German children who benefited by this act of charity.

Obituary, 1910–21.—Death was especially busy with the great Swiss historians during the decade 1910–20. J. Dierauer (1842–1920); W. Oechsli (1851–1919); Karl Dändliker (1849–1910); B. van Muyden (1852–1912) passed away, as well as Jakob Heierli (1853–1912), the principal authority on prehistoric Switzerland; Adolf Wäber (1841–1913), the bibliographer of works of travel in Switzerland; Caspar Decurtins (1855–1916), the great authority on the Romansch dialect; Jean Grellet (1852–1918), the well-known writer on Swiss heraldry; Emilio Motta (1857–1920), the founder and also the editor (for 35 years) of the *Bollettino della Svizzera Italiana*, which rendered such great service for the history of Italian-speaking Switzerland; and Henri Fazy (1842–1920).

The fine arts also mourned the loss of Ferdinand Hodler (1853–1918), the merits of whose pictures were so hotly discussed during his lifetime; Max Buri (1868–1915), the delineator of Bernese peasant life; and Eugène Burnand (1850–1921). To these losses we must add Richard Kissling (1848–1919), the famous sculptor; and J. R. Rahn (1841–1912), the historian of Swiss art.

Other Swiss, each eminent in his own way were Theodor Kocher (1841–1917), the world-famous surgeon; F. Imhoof-Blumer (1838–1920), the celebrated numismatist; F. A. Forel (1841–1912), the physicist and monographer of the Lake of Geneva; Johannes Coaz (1822–1918), the great authority on Swiss forestry, and a mountain climber whose active career ended in 1850; J. H. Graf (1852–1918), the mathematician and leading authority on old Swiss cartography; and, last but not least, J. H. Dunant (1828–1910), the founder of the International Society of the Red Cross at Geneva.

We must not omit a group of men of letters of the "Suisse Romande"—Gaspard Vallette (1865–1911) and Philippe Monnier (1864–1911); and the novelist Edouard Rod (1859–1910).

Our list may be brought to a close with the names of the linguist, Ferdinand de Saussure (1857–1913); and of the Romance scholar, Heinrich Morf (1854–1921).

Miscellaneous.—Perhaps the most important event which happened in Switzerland in 1920 was the first meeting of the League of Nations in Geneva, a spot selected, it is said, by President Wilson. In Feb. 1921 Switzerland declined to allow the passage of police troops to guard the peace in the Vilna popular vote.

Switzerland has adopted officially the day of 24 hours, running from midnight to midnight.

Naturally, the possibility of winter sports in Switzerland was excluded (save for the natives) during the war, and they had not quite reached their former vogue even by 1921.

The long war had a most disastrous effect on the Swiss hotel industry. Previously to it far too many big hotels had been built, so that the whole industry was overcapitalized and in a state of great indebtedness to the banks. After the end of the war many hotels were pulled down or diverted to other uses, even in such frequented spots as Interlaken and Grindelwald. It has been stated by H. Gurtner that the total capital invested in the Swiss hotel business was in 1912 about £45,500,000, or about one-thirtieth of the total amount of the wealth of Switzerland. The same writer puts the total value of the hotels in the Bernese Oberland at about £6,000,000 just before the outbreak of the war.

On May 15 1914 a great national exhibition was opened at Berne. But the speedy outbreak of the war nearly ruined it.

The rate of exchange on London varied much during the war. After the first shock it rose to over 26 francs (par 25), but then sank, and attained its lowest point in June 1918, with 18·83$\frac{1}{3}$. It subsequently recovered somewhat, but in Aug. 1921 it stood only at 21·64. Of course this involved great losses for English residents and travellers, while the better value, obtained both in France and Italy, drew many to those lands.

BIBLIOGRAPHY, 1909–21.—In 1910 the 6th and final volume of the *Dictionnaire Géographique de la Suisse* (the first appeared in 1902) was issued at Neuchâtel, while in 1918 the same publishers began the publication of the *Dictionnaire Historique et Biographique de la Suisse*. (Both publications are issued in French and German.) H. Barth gave to the world in 1914–5 the three vols. (going down to the end of 1913) of his marvellous *Bibliographie der Schweizer Geschichte*. In the domain of constitutional history we have a new and revised edition (1914) of W. Burckhardt's *Kommentar der schweiz. Bundesverfassung von 1874*; A. Heusler, *Schweiz. Verfassungsgeschichte*; E. His, *Geschichte des neueren Schweiz. Staatsrechts 1798–1848* (vol. i. 1920); and W. Raustein, *Die schweiz. Halbkantone* (1912). For very early Swiss history we have A. Schenk, *La Suisse Préhistorique* (1912); P.E. Martin, *Études critiques sur la Suisse à l'Époque mérovingienne, 554–715* (1910); and Marius Besson (now the Bishop of Lausanne and Geneva), *L'Art barbare dans l'ancien diocèse de Lausanne* (1909).

The very best detailed history of the Swiss Confederation is that by J. Dierauer, entitled *Geschichte der Schweiz. Eidgenossenschaft*, now complete in five vols. and published at Gotha (vols. i and ii., 2nd. ed., 1913; vol. iii., 1907; vol. iv., 1912; and vol. v., 1917) which brings the tale down to 1848;—a continuation is in preparation—there is also a French translation. E. Gagliardi, *Geschichte der Schweiz* (2 vols., 1920), is a new general Swiss history.

An important episode in Swiss history is narrated by E. Gagliardi, *Der Anteil der Schweizer an den italienischen Kriegen, 1494–1516* (vol. i., 1494–1509, 1919). Marie Louise Herkin's life of *C. V. Bonstetten, 1745–1832* (1920) is a contribution to Swiss literary history of the 18th century. W. Oechsli's *Geschichte der Schweiz im 19ten Jahrhundert*, from 1798 (vol. ii. appeared at Leipzig in 1913, the work will be continued by E. Gagliardi), and J. Winiger's life of *Josef Zemp, 1834–1908* (1908), like E. Deriaz's *Un Homme d'État vaudois, Henri Druey, 1799–1855* (1920), and T. Weiss' life of *Jacob Stämpfli, 1820–1879* (1920), relate to modern Swiss history. In 1918 W. Oechsli published at Zürich a new edition of his *Quellenbuch zur Schweizergeschichte.*

In geology we have to note A. Heim, *Geologie der Schweiz* (appearing since 1919 in parts at Leipzig). In the domain of the fine arts vol. iii. of the *Schweiz. Künstler-Lexikon* appeared in 1913, as did an extensive supplement to the work. The special works by J. Scheuber, *Die mittelalterlichen Chorstühle in der Schweiz* (1910) and by E. A. Stuckelberg, *Cicerone im Tessin* (1918) are also very useful works in this department.

In ecclesiastical history we have the fine monograph, *Angelomontana* (1914), and vol. ii. (vol. i. appeared in 1907) of J. G. Mayer's *Geschichte des Bisthums Chur* (1914), and vol. v. (1917) of E. Doumergue's *Jean Calvin.*

Another subject of great importance to Switzerland is treated of in H. A. Gurtner's *Zur Verschuldung des schweiz. Hotelgewerbes* (1918), written by a Swiss hotel-keeper's son.

The following works refer to the Swiss Alps—Julien Gallet, *Dans l'Alpe Ignorée* (1910); E. J. P. de la Harpe, *Les Alpes Valaisannes* and *Les Alpes Bernoises* (1911 and 1915 respectively); and H. Dübi, *Die ersten 50 Jahre des Schweizer Alpenclub* (1913, also in French).

Turning now to the several cantons the following works deserve mention:—

Basle: R., Wackernagel, *Geschichte der Stadt Basel* (vol. ii. 1916, vol. i. appeared in 1907); A. Heusler, *Geschichte der Stadt Basel* (vol. i., 1917).

Geneva: L. Cramer, *La Seigneurie de Genève et la Maison de Savoie, de 1559 à 1605* (2 vols. 1912); H. Heyer, *L'Église de Genève, 1535–1909* (1909); L. Blondel, *Les Faubourgs de Genève* (1919; vol. iii. 1918) of the *Recueil Généalogique Suisse*; W. Oechsli, *Les Cantons Suisses et Genève 1477–1815* (1915); and E. Doumergue, *La Genève des Genevois* (1914).

Ticino: Karl Meyer, *Leventina und Blenio von Barbarossa bis Heinrich VII.* (1911).

Valais: D. Imesch, *Die Walliser Landrats-Abschiede seit 1500* (vol. i., 1500–19, 1916); and A. Büchi, *Korrespondenzen und Akten zur Geschichte des Kardinals Matth. Schiner* (vol. i., 1489–1515, 1920).

Vaud: B. van Muyden, *Pages d'Histoire Lausannoise* (1911), and *Recueil de Généalogies Vaudoises* (4 parts, 1912–20).

Zürich: K. Dändliker, *Geschichte der Stadt und des Kantons Zürich* (3 vols., 1908–12). (W. A. B. C.)

SYDENHAM, GEORGE SYDENHAM CLARKE, 1st Baron (1848–), British soldier and administrator, was born in Lincolnshire July 4 1848. He was educated at Haileybury and Wimbledon, and afterwards at the Royal Military Academy. In 1868 he entered the Royal Engineers, and in succeeding years served in various expeditions abroad, including the Sudan operations of 1885. The same year he returned to England, and was employed at the War Office until 1892, being at the same time secretary to the Colonial Defence Committee. He was also secretary to the Royal Commission on Navy and Army Administration. From 1894 to 1901 he was superintendent of the royal carriage factory at Woolwich. During all these years Sir George Clarke, who was created K.C.M.G. in 1893, had earned a great reputation, outside as well as inside his profession, as an authority on military questions, over and above his special subject of fortification. On his retirement from Woolwich, he was made a member of the important committee on War Office reorganization. In 1901 he was appointed governor of Victoria (Australia), and on his retirement in 1904 he became secretary to the Committee of Imperial Defence. From 1907 to 1913 he was governor of Bombay. He had been created G.C.M.G. in 1905, and in 1913 was raised to the peerage. He subsequently took a vigorous interest in many public questions, becoming chairman of the Royal Commission on Contagious Diseases (1913–5), chairman of the Central Appeal Tribunal (1915–6), and president of the National Council for Combating Venereal Diseases. In addition to his classic work on *Fortification* (1890; 2nd ed. 1907), his publications include *The Navy and the Nation* (1897) and *Imperial Defence* (1898), besides handbooks on military subjects.

SYKES, SIR MARK, 6th Bart. (1879–1919), English traveller and politician, was born March 16 1879, the only child of Sir Tatton Sykes, 5th Bart., of Sledmeer, Yorks. He was educated at the Roman Catholic public school of Beaumont College and afterwards at the École des Jesuites, Monaco, and Jesus College, Cambridge. He served in the South African War (1902), in 1904 became secretary to Mr. George Wyndham in Ireland, and in 1905 went to Constantinople as honorary attaché to the British embassy, remaining there until 1907. Before this, however, he had begun a series of travels and explorations, especially in Turkey and the Near East. He published several works dealing with his various expeditions, among them being *Through Five Turkish Provinces* (1900); *Dar-el-Islam* (1903); and *Five Mansions of the House of Othman* (1909). He also prepared maps of the north-western region of Mesopotamia and of the southern districts of Palestine, for which in 1906 he was thanked by the Army Council and Foreign Office. His knowledge of these regions proved invaluable during the World War. In 1911 he was elected to Parliament for Central Hull as a Unionist, and in 1913 he succeeded his father as 6th Baronet. On the outbreak of war in 1914, Sir Mark Sykes raised a battalion of the Yorkshire Regiment, but did not proceed with it to France. He was sent on important special missions to Russia, Mesopotamia and Syria, and published in 1915 *The Caliphs' Last Heritage.* He died suddenly in Paris Feb. 16 1919.

SYMPATHETIC NERVOUS SYSTEM, in physiology (*see* 26.287). On studying the effects of stimulation of the sympathetic nervous system it appears that they are directed towards activating the body for fight or flight. The dilatation of the pupil increases the perception of light; the acceleration and augmentation of the heart-beat increases the blood supply; the constriction of the blood vessels in the visceral area raises the blood pressure, driving the blood from the digestive area, whose functions are simultaneously inhibited, into the skeletal and cardiac muscles, the lungs and the brain. The sweat glands are stimulated to cool the blood heated by increased muscular effort and the hairs are erected in many animals to render them more alarming. The "goose skin" experienced by man under emotional stress is similarly produced, though not now advantageous. Some emotional responses, like some bodily structures, are vestigial remains. The other division of the autonomic system, to which the name of parasympathetic has been given, serves the purpose of building up reserves and of fortifying the body against times of need and stress. Thus by contracting the pupil it shields the retina from excessive light; by slowing the rate of the heart it gives it longer periods for recuperation; it excites appetite and by promoting the assimilation and digestion of food it stores up energy. The sacral division of the parasympathetic is a mechanism for emptying, thus leading to greater comfort. The sympathetic is, therefore, katabolic, converting potential energy into kinetic, and facilitating outward manifestations of that energy; while the parasympathetic is anabolic, directing energy inwards, where it is stored up. When these two are distributed to the same structure their action is always antagonistic.

In pain, fear, rage and any intense excitement, the sympathetic neurons are brought rapidly into play and the action of the cranial division of the parasympathetic is inhibited. Anabolism is in abeyance and katabolism goes on unchecked. This is comprehensible, since these katabolic activities are defensive in origin and aided the primitive animal in its struggle with or flight from its enemy.

Of late it has been realized that each of these divisions of the autonomic system coöperates with its appropriate group of endocrine glands. The sympathetic group consists of the adrenals, the thyroid and the pituitary—each of which are accelerators of metabolism. The intimate relationship embryologically, structurally and functionally between the nervous and glandular elements is best illustrated by the adrenals. The medulla of the adrenals and the sympathetic ganglia originated from similar cells, preganglionic fibres end round both, and adrenalin, the secretion of the medullary portion, produces the same effect on any part as stimulation of the postganglionic fibres; an interesting example of parallelism between a nervous and chemical mechanism. Just as the preganglionic fibre stimulates the secretion of adrenalin, so adrenalin increases the postganglionic responses.

A similar reciprocity exists in the case of the thyroid; it is stimulated to secretion by the sympathetic and the secretion lowers the threshold to sympathetic stimulation. The existence of sympathetic secretory nerves to the pituitary has been shown, but there is no definite evidence of a reciprocal action of its secretion on the sympathetic.

The endocrine group which coöperates with the parasympathetic must be looked for chiefly in the glands of the alimentary tract and its annexes, since the building up of energy must ultimately be derived from the food. Gastric secretion is started by the appetite and the taste of food reflexly stimulating the organs, but it is continued by a hormone in the pyloric glands of the stomach which spur the fundus glands on to renewed effort. In its turn the acid gastric juice entering the duodenum acts on its mucosa to form secretion, which stimulates secretion of pancreatic juice. But the pancreas forms an internal secretion as well, which promotes the assimilation of sugar. Indeed, the metabolism of sugar gives a particularly good illustration of the general principle here laid down. Acting muscle requires three and a half times as much sugar as resting muscle, and the mobilization of sugar into the blood is a necessary preliminary to muscular effort. Accordingly sympathetic stimulation is found to produce this effect, through the adrenals, thyroid and pituitary, the secretion of each of which taken separately will lower carbohydrate tolerance and may excite glycosuria. On the other hand, the pancreas which is innervated by the parasympathetic has a precisely opposite effect, the antagonistic action of the glands being as definite as that of the associated nerves. Another example of this antagonism is seen in the continuous flow of pancreatic juice following removal of the adrenals, which can be temporarily inhibited by injection of suprarenal extract. Again, it is well known that adrenalin dilates the pupil of an excised eye but not of the intact eye of a normal individual. Therefore something inhibits the adrenalin effect. In depancreatised dogs adrenalin does dilate the pupil, and it has been found to do the same in patients suffering from pancreatic disease, since the normal antagonism of the pancreas to the adrenals is then lost. This pupillary response may also be present in hyperthyroidism, suggesting that the thyroid excess inhibits pancreatic activity, allowing adrenalin to show its dilator action unchecked.

The sympathetic nervous system, the endocrine glands and the gonads form a basic tripod entrusted with the duty both of the preservation of the individual and the continuity of the species. Their relationship is shown in disease as well as in health, and is reflected in many neuroses and psychoses. Disease is the resultant of some external action and of the reaction of the organism against it. It therefore draws on the defensive mechanisms and connotes a position of less stable equilibrium in which the body works with more friction. It may demand an increased supply of hormones to compensate for this, which may ultimately lead to exhaustion of the gland that provides it. In this way the balance between the endocrine glands is disturbed, either from overaction of a gland, or from its unopposed action through the loss of an antagonist.

The sympathetic-endocrine system is affected alike by toxic, nutritional or psychic factors, and is particularly likely to be injuriously influenced if more than one such factor is overtaxing it. As this system has to defend us against internal foes, such as bacterial infections, as well as external enemies, we find that it plays an important part in the regulation of the body temperature. Since it has been shown that the cerebral vessels are remarkably impermeable to drugs and toxins as long as they maintain their integrity, it has become impossible to explain febrile reaction to infection by a central mechanism. When the activity of the thyroid and anterior lobe of the pituitary is diminished, less heat is produced. When increased production is required, the thyroid and adrenals give histological evidence of increased secretion. Cramer has found this both in fevers and after exposure to cold. He has also experimentally produced such changes by the injection of a drug which causes fever. Infections such as gas gangrene which do not induce a febrile reaction do not produce these changes. He has traced the adrenalin into the blood vessels, whereby sympathetic nerve endings all over the body will be stimulated. At the same time more sugar is poured into the blood, largely through thyroid activity. The oxidation of this sugar increases heat production. It has long been known that the adrenals may show marked signs of exhaustion after a severe infection such as diphtheria, while the thyroid may suffer after typhoid fever. Such exhaustion appears to be an important factor in the psychoneuroses of convalescence.

The influence of nutritional factors on the apparatus is seen in the way in which (1) pregnancy enlarges the thyroid and pituitary; (2) vitamine defects cause enlargement of the adrenals and pituitary while causing some atrophy of other endocrine glands; (3) deficiency of assimilable protein in the food causes pellagra in which the adrenals suffer, while the sympathetic nervous system shows actual structural degeneration. While toxic and nutritional influences play chiefly on the glandular part of the apparatus, psychic factors naturally act primarily on the nervous part, though ultimately both parts will become affected, whichever is involved first. The sympathetic is the lowest level of the nervous system and retains several characteristically primitive features, such as peripheral ganglion cells, myenteric nerve nets, connector fibres lying outside the central nervous system, and urgent widespread responses, rather than accurately localized and discriminative ones. This is in accordance with the evolution of the nervous system for defense, and with the maintenance of this primitive function by the sympathetic. Pain has been shown by Trotter to be the specialization of the primitive sensation of lower animals, and fear might similarly be regarded as a specialization of a primitive emotion. It is to such sensation and emotion that the sympathetic nervous system preëminently responds. Both pain and fear are apt to become intense when the appropriate motor response is prevented, though they may not be appreciated when vigorous response is possible. Thus during the excitement of a fight neither fear nor pain may be experienced under conditions which would ordinarily induce them. In the civilized state the response appropriate to primitive man has often to be repressed. The effect of this repression may show itself either as an anxiety neurosis, at the psychic level, or at the sympathetic-endocrine level in certain affections of the associated glands, and in cardiac or digestive neuroses. Such repressions are particularly likely to be necessitated when the great instincts of self-preservation, reproduction and gregariousness, which relate respectively to the life of the individual, of the species and of the community, come into conflict with one another. The constant demand for adrenalin when sympathetic action is increased in fear and anxiety may lead to exhaustion of the gland. Addison's disease presents a clear-cut picture of adrenal deficiency in its symptoms of muscular weakness, low blood pressure, pigmentation and vomiting. Although this is due to organic changes, slighter degrees of a similar condition are now recognized and it has been suggested that this enters into many war neuroses and other functional states characterized by vasomotor instability, low blood pressure and myasthenia. Conversely, prolonged oversecretion by the adrenals must tend to raise blood pressure through the sympathetic, tending in turn to arteriosclerosis, with all its widespread effects. The well-known influence of anxiety in producing this condition can thus be explained.

There is a close association between the thyroid, the reproductive organs and the sympathetic. The thyroid tends to enlarge at puberty, marriage and in pregnancy, while myxoedema is most apt to occur after the climacteric. Amenorrhoea is common even in the minor degrees of hyperthyroidism. The effect of sympathetic irritation in producing thyroid enlargement and Graves' disease is now recognized. Cushing showed that if in cats he sutured the phrenic nerve to the cervical sympathetic so that every respiration stimulated the latter, he could produce the symptoms of Graves' disease. The influence of distressing emotions in producing hyperthyroidism was well shown during the air-raids on London during the World War. Epidemics of Graves' disease also followed the Kishinev massacres and the San Francisco earthquake. Again, if a distressing emotion has a matrimonial origin, it is particularly likely to induce Graves' disease, for here each limb of the basic tripod is involved. The disease has been compared with a state of continuous fear, a description which tallies with its general appearance.

The pituitary body also shows the two-fold association with the reproductive organs and the sympathetic nervous system. The anterior glandular part has an effect on temperature, the growth of bone and skeletal tissues and the reproductive organs. The intermediate lobe influences carbohydrate metabolism, while the secretion of the posterior lobe is mainly a stimulant to plain muscle and to the secretion of milk. The effect of the secretion of the posterior lobe on diuresis is still a matter of controversy, but it is clear that disease of the posterior lobe is often found in diabetes insipidus and that stimulation of the sympathetic nerves to the gland will cause polyuria. Probably hysterical polyuria is thus produced.

It is also clear that some cases of glycosuria are of sympathetic nervous origin; the physiological mechanism by which this can be brought about has already been explained. Diabetes is characterized, like sympathetic stimulation, by an exaggerated katabolism. This shows its effect first on the most abundant and most easily metabolised of the food-stuffs, the carbohydrates, which are also essential for muscular action, to which sympathetic stimulation should normally be a preliminary. Sympathetic stimulation induced by various disagreeable emotions will increase metabolism generally and specially lower carbohydrate tolerance. The influence of excitement and emotion in causing glycosuria is well recognized. It is commonest in Jews, a notoriously emotional race. When stocks go down in New York, says Crile, diabetes goes up. Temporary glycosuria occurred in a number of men who merely watched a football cup-tie without participating in it. Glycosuria has been, unfortunately, comparatively common in young officers entrusted with heavy responsibilities during the war. Singer and Clark have recorded two cases in which there was alternation between glycosuria and the exhibition of mental symptoms, as if the emotional discharge asserted itself either at the metabolic or the psychic level but not at both.

Finally, the inhibitory effect of the sympathetic on the digestive processes must be remembered. Fear checks the secretion of saliva, anger stops the secretion of gastric juice. Depressing emotions acting through the sympathetic check the peristalsis of the stomach while closing the pyloric sphincter, thus leading to a dilatation of the stomach. A similar inhibition of intestinal peristalsis may occur, leading to intestinal stasis. This in its turn will lead to a drag on the sympathetic nerves in the mesentery, increasing their inhibitory effect. Thus a vicious circle is established and the persistent intestinal toxaemia that results may produce organic changes in many structures, including the group of endocrine glands which coöperate with the sympathetic.

The consideration of diseases produced through the agency of the parasympathetic lies outside the present topic, except in so far as the vagus may overact from a loss of balance produced by diminished sympathetic action. Suffice it to say that laryngeal spasm, asthma, slow or irregular action of the heart, low blood pressure, hyperchlorhydria, spastic constipation and a liability to skin disturbances of the vasodilator type are among the symptoms evoked. Since febrile reaction to disease is a function of the sympathetic, which is antagonistic to the parasympathetic, we find that those subjects with an overacting vagus do not react well to infections and, indeed, show an abnormal sensitiveness to many foreign proteins. Their tendency to undue anabolism is sometimes indicated by their tendency to flabbiness of the tissues and overgrowth of lymphoid structures. A curious point is the occurrence of sweating, since the secretion of the sweat glands is under the control of the sympathetic. But a similar discrepancy is seen in the action of a vagotropic drug such as pilocarpin.

In assessing the effects of the sympathetic nervous system in disease, it must be borne in mind that we have very little knowledge of its morbid anatomy, though a beginning has been made in the study of pellagra. The evidence so far mainly relates to function and were our knowledge of its structural alterations at all comparable to what we know of organic changes in the spinal cord, we should be on firmer ground. But enough has been learned to show that the sympathetic plays a large part in the regulation of the internal viscera, and, through the endocrine glands, in general metabolism. The balance between these glands determines to a large extent both the racial and individual characteristics. Climatic influence has a profound effect through the skin on the sympathetic nerves and hence on the endocrine glands. The development of protective pigment is an important method by which the sympathetic-endocrine system can react to this, and the unadaptibility of albinos in this respect is well known. Thus physical environment can influence both temperament and structure, and the sympathetic-endocrine system must have played a large part in developing the variability of man into different races.

Evolved in a subconscious plane the sympathetic nervous system remains for ever beyond the control of the will. Timme quotes an instance which, while apparently contradicting this, proved on further inquiry to support it. This was the case of a man who could voluntarily dilate his pupils, who could cause the pilomotor muscles to raise the hairs on his arm, and who could at will produce the phenomenon of "goose-flesh" in various parts of his body. When closely questioned he admitted that the effects were produced not immediately by his will, but always by the intermediation of some association called into being by him. Thus when dilating his pupils he always imagined himself looking far into space, under which conditions the pupil does dilate. For the goose-flesh effect he would picture to himself his arm plunged into ice-cold water, and the goose-flesh appeared. Various associations produce autonomic effects without our will, and it is reasonable to infer that, if we can recall these associations through our will, the same autonomic effects will be produced.

The higher centres of the brain show their influence on the lower chiefly in the direction of inhibition. The highest organism is the most self-controlled, but the sympathetic cannot be thus controlled. The will can only help in so far as "it can make our voluntary activities harmonize with our environment." The emotional apparatus remains, as McDougall has pointed out, the most unchanging part of our nervous equipment, though the stimuli to which it responds may vary enormously in different individuals. But once the response occurs, it is extraordinarily true to type. This is comprehensible since the apparatus retains so many features of the primitive nervous system. (W. L. B.*)

SYNDICALISM.—"Syndicalism" is the name given to a form of socialist doctrine elaborated by, and born from the experience of, the members of the French *syndicats* or trade unions. On the one hand it is a body of social doctrine, or theory of social organization; on the other it is a plan of action for the realization of this ideal. Of all the social theories competing for existence it is the most purely proletarian in origin. One writer indeed has described it as "working-class Socialism" (*le socialisme ouvrier*) in contradistinction to the types of socialism originated and propagated by middle-class "intellectuals." Without unduly stressing the importance of this fact, it may be said that syndicalism is that form of socialist theory which regards the trade-union organizations, entirely proletarian in origin and direction, as at once the foundations of the new society and the instruments by which it is to be erected.

The syndicalist starts from the assumptions common to most schools of socialist thought. He affirms the inherent injustice of the wages system and the fundamental immorality of capitalist society, which is based, in his belief, on the exploitation of labour. He accepts and pushes to its logical conclusion the Marxian dogma of the class war; he therefore affirms that solidarity of interests does not, and cannot, exist as between employer and employed, between capitalist and wage-earner. From these premises he draws the usual socialist conclusion, namely, that individual ownership of the instruments of production must be abolished and communal ownership and control substituted for it. But at this point syndicalism and socialism (as usually understood) part company. Whereas the orthodox socialist demands control by the consumers acting through the State and its dependent organs the municipalities, the syndicalist demand, until very recently, was for producers' control, acting through the organizations of their own creation—the trade unions. This is the essential feature of syndicalist theory, that which differentiates it from other revolutionary schools of thought. The arguments usually employed by its advocates may be briefly set out.

State organization and control of industry are, in their view, incompatible with true working-class emancipation. The State is, and must be, an instrument of class domination; it is indeed "the executive committee of the capitalist class." It exists to defend the interests of that class, and is consequently as much the enemy of labour as capital itself. To extend its powers would be to twine the bonds of wage slavery ever more firmly about the workers' limbs. The State is, however, hopelessly wedded to an uncreative bureaucracy, incapable of initiative and ignorant of industrial technique. Its control, even if it were benevolent (which the syndicalist denies it could be), would necessarily be despotic and inefficient; the spirit of routine would combine with inexperience to crush out the possibility of economic progress. Here, as will be seen, the syndicalist endorses the ordinary individualistic criticism of State socialism. Producers' control, exercised through the *syndicats*, would, on the other hand, combine freedom with efficiency. Every worker would participate directly in the government of his industry; he would thus enjoy the substance of democracy instead of the shadow offered him by the *bourgeois* State. Moreover, the worker would be led to identify his personal interests with the successful conduct of the industry; he would have a pride in his work which would manifest itself in improved quality and greater output, thus producers' control would be justified both on human and economic grounds.

The form of social organization in which this ideal could be realized was, until recently, conceived somewhat as follows. The unit of organization would be the local *syndicat*. This would be brought into touch with the local groups by means of the *Bourse du Travail*, the present function of which is to act at once as an employment agency and a general centre for trade-union activities. When all the producers were thus linked together by the *bourse*, the administration of the latter would be able to estimate the economic capacities and necessities of the region, could coördinate production, and, being in touch through other *bourses* with the industrial system as a whole, could arrange for the necessary transfer of materials and commodities, inwards and outwards. A species of "economic federation" would thus replace the structure of capitalist industry, with which would necessarily disappear the political and administrative machinery of the State. Two features of this Utopia need to be emphasized: consumers as such were excluded from any share in industrial control, and a localized system of industry was envisaged.

This latter feature was a direct reflexion of French economic circumstances; both industry and trade-unionism were much more local in range than in other and more highly developed countries. But the movement towards large-scale organization which has so profoundly affected every aspect of economic life in recent years has produced a corresponding modification in syndicalist ideals. At the same time, it has begun to be recognized by the theorists of the movement that the consumers' point of view cannot wholly be disregarded. The experience of the World War has also had its effect. The Congress of Lyons, therefore, in 1919 was moving with the times when, in demanding the "industrialized nationalization of the great services of modern economy: land and water transport, mines, water-power, and credit organizations," it defined "nationalization" as "the confiding of national property to the interested parties, namely, the associated producers and consumers." This clearly envisages organization on a national scale and the participation of consumers' organizations in control.

Syndicalist theory starts, as has been said, from the idea of a class war which must be waged relentlessly till a complete social transformation has been accomplished. The essential weapon in this struggle is the power of the organized workers. As the cause of the conflict is economic it must necessarily be fought out in the economic sphere. Syndicalist congresses have persistently repudiated political action, and pinned their faith to a general strike as the grand instrument of social revolution. This reliance upon industrial or "direct" methods of action flows necessarily from the fundamental notions of syndicalism as to the nature of the State, and also from strictly practical considerations. Outside the mine or factory, workingmen hold divergent religious or political opinions which make effective mass action difficult, if not impossible. Inside, the nature of their employment gives them a sense of solidarity which overrides minor differences and bands them together in the *syndicat* for common defence; to persuade them to pass from the defensive to the offensive is the syndicalist's task, and in the accomplishment of this political labels and controversies would be a hindrance. Moreover, the political party is not, and cannot be, a class organization. The Socialist parties swarm with men of middle-class origin whose only bond with the workers is the slender one of opinion. In any event, the political party is an inefficient instrument for revolution; it can only operate effectively at electoral periods, and even then the mass of voters do nothing more than cast a ballot and return to their customary apathy for a term of years. Political action does nothing to rouse them from that apathy, to inspire them with revolutionary *élan*, to train them to initiative and independent thought. On the contrary, it asks for nothing better than docile followers of self-constituted leaders. The strike, therefore, is the characteristic syndicalist weapon. However limited in its scope and object, it is an educative experience; successful, it inspires the workers with a sense of power; unsuccessful, it impresses upon them the servility of their lot and the necessity for better organization and wider aims. Thus every strike is a preparation for the revolutionary "day," when the workers, or a fighting minority of them (for syndicalism repudiates as *bourgeois* the dogma of the sacredness of majority rule), shall seize the instruments of production by an "expropriatory" strike. In the meantime, they are working out from day to day, in the ordinary course of their employment, the ethics and the jurisprudence of the new social order.

The strike, of course, is not the only weapon in the syndicalist armoury. Various other means of waging the class war, known collectively as *sabotage*, are both preached and practised. These range from bad or slow work to the *grève perlée* (destruction of goods or machinery) and the *chasse aux renards* (assaults on "blacklegs" or *jaunes*). It is fair to say that many syndicalist leaders criticize these methods as destructive of the worker's moral and technical competence.

Syndicalism is essentially French in origin and reflects French working-class experience and conditions of life; nevertheless the history of Great Britain shows interesting foreshadowings of it. The idea of industrial self-government by the producers attracted for a time the mobile mind of Robert Owen; and the Grand National Consolidated Trades Union of 1834 was an attempt to realize it in practice. James Morrison, a young self-taught operative builder, seems to have originated the syndicalist conception of class antagonism on the part of the working-classes (see Max Beer, *History of British Socialism*). The Building Trades Union had developed the same notion in the previous year (S. and B. Webb, *History of Trade Unionism*). The plan of a general strike—originated by one Benbow—for a time, under the strange title of the "Sacred Month," made part of Chartist propaganda. There is no evidence, however, that these projects had any echo on the European continent. The syndicalist idea, as understood in France, may be said to have originated in the discussions of the International Working Men's Association. A French delegate to the Congress of Basle in 1869, for instance, prophesied that "the grouping of different trades in the city will form the commune of the future" when "government will be replaced by federated councils of *syndicats* and by a committee of their respective delegates regulating the relations of labour—this taking the place of politics" (Levine, *Syndicalism in France*). The collapse of trade-unionism in France after the sanguinary suppression of the Communalist insurrection in 1871 had as a necessary consequence the submergence of these ideals for a considerable period, and only a combination of favouring circumstances brought them once more to light. Among these the discontent of the organized workers with Socialist politics, and the anarchist propaganda of a general strike, may be particularly mentioned. These influences manifested themselves with increasing strength during the 'nineties in the two great labour organizations of the period—the General Confederation of Labour (or "C.G.T." under its French initials) and the Federation of *Bourses du Travail*. The secretary of this latter organization, Pelloutier, did more perhaps than any other individual to work out the characteristic doctrines of syndicalism and spread them among his fellow-workers. When these two bodies joined forces in 1902, trade-unionism in general and syndicalism in particular received an immense accession of strength, and the doctrine subsequently remained—in spite of the efforts of political socialists to capture the *syndicats* for their own purposes—the characteristic expression of French revolutionary idealism.

As such, it has inevitably received much attention from observers and writers drawn from other social classes. Of these the best known is Georges Sorel, but it is a complete error to suppose that he was the originator of syndicalism, or that he has had much influence on working-class opinion. The difficult form of his writings, with their frequent obscurity and lack of continuity, would alone have made this impossible. Sorel's adaptation of the Bergsonian doctrine of the "*élan vital*" to syndicalist purposes, and his theory of "social myths" (of which the general strike is one), have had considerable influence upon intellectual circles, but have affected no more than a fringe of working-class readers.

Syndicalist doctrine has had considerable influence outside France. In the United States, a movement of somewhat similar character arose with the organization of the Industrial Workers of the World. The Chicago Convention of the I.W.W. in 1905 drew up a declaration, the preamble of which affirmed the reality of the class struggle, embodied the theory of social organization which this involves and further made a plan for the realization of this ideal:—

> "The unit of organization industrially is the workshop or Yard Committee, wherein the workers are organized as workers, irrespective of craft, grade, or sex. These Committees are coördinated by the formation of Works or Plant Committees, composed of delegates from each Workshop or Yard Committee. The Plant or Works Committees are coördinated by delegates from each of these Committees, in a village, town, city, or district, forming a Workers' Council, in which there are also delegates from the residential committees, these latter being the units of the social aspects of the organization."

The above scheme differs very little from the general theory of syndicalism in France, and presents a simple parallel to the shop-stewards' movement in Great Britain, which indeed was based upon it. The influence of the I.W.W., it may be noted, was largely confined to the alien immigrant workers: it never penetrated the American Federation of Labor to any serious degree.

The influence of these ideas on the trade-union movement in Great Britain and Ireland has been very pronounced, though they have taken a different direction, modified by the traditional, conservative instinct of the British working-class. In Great Britain the real cause of the permeation of certain unions by syndicalist ideas was the absorption of trade-union leaders in administration or in politics, which caused them to lose touch with the rank and file. Especially is this the case with regard to the miners, the railwaymen's unions and the engineers.

Daniel De Leon was a leader of the Socialist Labour party in the United States from 1880 onwards, and his writings influenced British socialist thought, particularly in the Clyde and in the mining valleys of S. Wales. Though not a syndicalist in the strict sense, he advocated organization by industry and the general strike. It is significant that 1903 saw in England the secession of the Socialist Labour party from the Social Democratic Federation. After that date, in addition to the growing educational influence of the Independent Labour party (though this was never syndicalist), was seen the promotion of the Workers' Socialist Federation, the British Socialist party (in the post-war period) and the Communist League, all of which advocated practically the same structure of organization and policy. They all agreed in a lack of faith in political action, though not always refusing to utilize it, but their real *politik* was industrial action. After the Russian Revolution of 1917, they secured greater prominence; they became the stormy petrels of the labour world in Great Britain, and their effect on the political action of the Labour party was seen in the Council of Action in Aug. 1920.

In England, between 1900 and 1910, there was a growing dissatisfaction among the rank and file with political action, despite the fact that the influence of the Labour party in the House of Commons secured the trade-union movement freedom of industrial and political action by the Trades Disputes Act of 1906 and the Trade Union Act of 1913 to a greater degree than ever before, it was felt by the far-sighted among the rank and file that a speeding up was necessary, and State collectivism as a way out towards industrial democracy was discredited. James Connolly, the Irish Labour leader who was executed after the Easter rising in Ireland in 1916, started a similar organization to that of Daniel De Leon on the Clyde in 1905. In his pamphlet *Socialism made Easy* he enunciated the syndicalist principles "that they who rule industrially will rule politically," and that "the functions of Industrial Unionism is to build up an industrial republic inside the shell of the political state, in order that when the industrial republic is fully organized it may crack the shell of the political state and step into its place in the scheme of the universe." Tom Mann, while in France and Australia, which had imported the ideas of the I.W.W. from America, was also powerfully influenced by the same theories, while on the Rand, in S. Africa, a small but very influential group of leaders was working out the structure, forms and policy of a movement similar in character. In 1910 Tom Mann preached the new faith in all the big industrial centres and rapidly won many followers. Workmen had refused to follow their orthodox leaders from about 1908, as they felt that the trade union of the old Liberal-Labour school was behind the times. The Plebs League was founded by a group of labour students in Ruskin College, Oxford, about the same time, and in 1909 these seceded from Ruskin College and founded first a labour college in Oxford and then moved to London as the Central Labour College, financed by the S. Wales miners and the railwaymen. This educational movement organized classes in every mining area in S. Wales, led by tutors from these two colleges, and influenced largely by the new ideas. A similar movement took place on the Clyde, in the great shipbuilding centres like Barrow, Birkenhead, and Pembroke Dock, and also in inland engineering centres like Coventry and Sheffield. Then followed the railway strike of 1911 and the great coal strike of 1912. It is quite clear that the National Union of Railwaymen and the Miners' Federation of Great Britain became organized as two of the most powerful unions in consequence of the new thought, *not* because their leaders had adopted syndicalism in the form taught by De Leon and the French group of thinkers, but because they adapted it in the peculiar British way; they made it practical and definite; they shaped it in alliance with the political and trade-union structure of Britain. They disagreed with the syndicalist view of the State, but they recognized the driving power of the theories that stated "that political power is a reflex of industrial power." The transport workers soon had a similar federation, and after the strikes of 1911 and 1912, and the Irish transport workers' strike of 1913, the Triple Alliance (of railwaymen, transport workers, and miners) was formed in 1915. The failure of this last to function during the miners' strike in the spring of 1921 discredited "direct action," and the British labour movement swung back towards constitutional and parliamentary methods.

See J. A. Estey, *Revolutionary Syndicalism* (1913); L. Levine, *Syndicalism in France* (2nd ed. 1914); G. D. H. Cole, *Self-Government in Industry* (3rd ed. 1918), *The World of Labour* (1919), *Labour in the Commonwealth* (1919), *Introduction to Trade Unionism* (1918); S. and B. Webb, *History of Trade Unionism* (1920); H. Lagardelle, *Le socialisme ouvrier* (1911); J. R. Macdonald, *Syndicalism* (1912); John Spargo, *Syndicalism, Industrial Unionism and Socialism* (1920); Bertrand Russell, *Principles of Social Reconstruction* (6th ed. 1920); Arthur Gleason, *What the Workers Want* (1920); *The Industrial Council for the Building Industry 1919* (Garton Foundation); G. D. H. Cole, *Guild Socialism Re-stated* (1920); J. Graham Brooke, *American Syndicalism* (1913); P. F. Brissenden, *The I. W. W.* (1919); James Connolly, *Socialism made Easy* (1905); N. Ablett, *The Miners' next Step* (1912); *A Plan for the Democratic Control of the Mining Industry* (South Wales Socialist Society, 1919); J. T. Murphy, *The Workers' Committee* (1918). (S. H.; J. M. R.)

SYNGE, JOHN MILLINGTON (1871–1909), Irish dramatic author, came of an Anglo-Irish family, which had contributed several bishops to the Irish church. He was born near Dublin April 16 1871. A delicate child, he was left much to himself, and as a youthful member of the Dublin Naturalists' Field Club took long rambles over the Dublin and Wicklow hills. At Trinity College, where he graduated in 1892, he obtained prizes in Irish and Hebrew, and he knew something of several modern languages. At this period his chief interest was in music and he gained a scholarship in counterpoint and harmony in the Royal Irish Academy of Music. A sonnet, moreover, contributed to *Kottabos*, shows not a little of the accomplishment of verse, as well as his innate passion for primitive things. During the next few years (1893–8), Synge travelled in Germany, Austria, Italy, finally making Paris his headquarters. He managed to spend a third of the year in Paris, a third in the W. of Ireland, and a third in London or Dublin. W. B. Yeats found him in Paris (1898) preoccupied with theories of language and literature, and advised him to return to Ireland. He went to the Aran Is., where he shared the life of the islanders, and he gave an account of it in a series of sketches afterwards collected in the volume, *The Aran Islands* (1907). In these and other sketches of the same period he had not quite shaken off the obsession of "stylism," and still had a wish "to do for the W. of Ireland what Pierre Loti had done for the Bretons." Gradually, however, Ireland got hold of him, and, turning to the dramatization of incidents in the life he now knew intimately, he began to elaborate, partly from his note-books and partly from the writings of Lady Gregory and Dr. Douglas Hyde, that richly imaginative though largely artificial dialect of Anglo-Irish which he carried to its furthest capacities. The Abbey theatre was opened towards the close of 1904, with Synge as one of the directors. He had already produced two one-act plays, *In the Shadow of the Glen* and *Riders to the Sea* (1903), of which the first had acquired some notoriety for the author as an affront to Irish morals; he had also written a farcical play, *The Tinker's Wedding*, which proved a failure when acted (1909) after his death. The beautiful three-act play, *The Well of the Saints*, produced before a few dozen people in the early months of the Abbey (1905), was regarded as a new affront; and in Jan. 1907, rumour having got about of its subject matter, the performance of *The Playboy of the Western World* was interrupted by an organized disturbance which continued night after night for a week. This affair, when the merits of the play came to be known, made the fame of the Abbey theatre. Synge's health was now shattered, and with death in prospect he worked at his fine play *Deirdre of the Sorrows*, all but completing it before the end came on March 24 1909. Just before he had collected his curious *Poems* (1909).

Synge appeared at a peculiar moment in the development of Irish literature, which had begun to address a largely increased public, blended of the two main elements of the population. By descent and culture he was of the Anglo-Irish stock, and he really saw the Irish subject matter in the detached spirit of an artist. It was probably something like this that part of his audience detected in the *Playboy*, and it caused his work for a while to be rejected in his own country. Time, however, has already proved the depth of Synge's insight into the soul of peasant Ireland. The *Playboy* is by general consent his masterpiece. In this play, the fantastically rich imagery of his dialogue, which elsewhere has often a somewhat monotonous effect, has full dramatic justification; the play has even, like *Hamlet*, the supreme mark of vitality, that it conveys the suggestion of a permanent human enigma. There are good critics, however, who assign the highest place among his works to *Deirdre*.

A collected edition of Synge's works, in four volumes, was published in 1910. In *John Millington Synge and the Irish Theatre* (1913), M. Maurice Bourgeois has given, in great detail, an account of his life and writings; and there is a critical study of him by P. P. Howe (1912). (W. K. M.)

SYRIA (*see* 26.305).—The greater part of the decade 1911–21 was a period of depression and distress in Syria, which, in common with the rest of the Ottoman Empire of which it then formed part, suffered from the interruption of commerce and the war-time exactions consequent upon the Italo-Turkish, the Balkan and the World Wars in an almost unbroken succession from 1911 until 1918. Although only for a brief time an actual theatre of hostilities, Syria, which had escaped with a slight bombardment of Beirut in Feb. 1912 during which a Turkish gun-boat was sunk in the harbour by an Italian squadron, was particularly exposed to military requisitions and exactions.

Even before the entry of Turkey into the World War involved the Levant ports in a fresh blockade (Nov. 1914) the coastal population had begun to migrate inland from fear of enemy landings, and the whole country was disorganized by the pressure of refugees on the one hand and of the military preparations for an invasion of Egypt on the other, while the civil population was much excited by the shameless propaganda conducted by German agents who sought to inflame Moslem prejudice against Christians all over the country. The Minister of Marine, Ahmad Jemal Pasha, who was also in command of the IV. Army and governor-general, conducted the government of the province in such a way as to give rise during a long period to the suspicion that he aimed at imitating Mehemet Ali in founding for himself a semi-independent viceroyalty; and his autocratic exactions and high-handed measures did much to pave the way for the final revolt against Turkish authority, which caused its collapse when the battles in Palestine in Sept. 1918 had broken the front.

In the subsequent operations Syria was overrun rather than conquered. Damascus fell to the British and Arabs on Oct. 1, Tyre was taken by the British on Oct. 4, Beirut was seized by a French squadron on Oct. 5 and occupied on Oct. 7 by British troops, which took Homs on Oct. 16, Tripoli (Tarabulus) on Oct. 18, Hama on Oct. 21, while the Arabs took Aleppo on Oct. 25 and the French occupied Alexandretta on Nov. 10.

Immediately after the liberation of Syria Gen. Allenby set up an administration of Occupied Enemy Territory in accordance with "the Laws and Usages of War" laid down by international agreements embodied in the Hague Convention. In order to comply as far as possible with the divergent policies to which the British Government had committed itself he confided those areas which had been liberated chiefly by Arab troops to "O.E.T.A. East," with Arab administrators under a chief administrator at Damascus—'Ali Riza Pasha er Rikabi, while the Lebanon, the littoral N. of the Ladder of Tyre, and as far as Bab Yunis N. of Alexandretta, was under Col. P. de Piépape as chief administrator O.E.T.A. North in Beirut with French officers. Later, when Cilicia was occupied in conformity with the Armistice which came into effect on Nov. 1 O.E.T.A. in Beirut became O.E.T.A. West and Cilicia was controlled by a new O.E.T.A. North under the French Col. Brémond.

From the very first the French had considerable difficulties to face, as Arab Nationalism and the idea of Syrian independence based upon the doctrine of self-determination both greatly influenced the civil population, which was, moreover, puzzled in that French officers were engaged in administering the country on French lines and conducting a French propaganda, when it was notorious that British troops had liberated the country and were still occupying a great part of it, and that the Arab administration in Damascus was anxious to lean on the British alliance and to ignore as far as possible the existence of the Sykes-Picot Agreement which had divided the country into arbitrarily defined spheres of influence regardless of the claims of the Arabs. Colonel de Piépape was, moreover, much hampered by the limited selection of French officers from whom he had to pick his administrators. Furthermore, Syria being a comparatively rich and civilized part of the Ottoman Empire and inhabited almost entirely by non-Turks had been particularly exposed to the exactions of the Turkish army and Government, and her population had been greatly exhausted by military conscription, political deportations, voluntary flight of refugees and by the ravages of locusts, starvation and disease. Yet Syria was unable to benefit to any great degree from the presence of the British army, as had Palestine; few military roads were made—except the remarkable rock-cut carriage-way across the face of the Ladder of Tyre (Ras en Naqura) which was made by Sir Valentine Fane's 7th Indian Div.—little local labour was employed, and charitable contributions for the help of the civil population of Syria were the less readily forthcoming as it had none of the religious and sentimental glamour attaching to the Holy Land.

With the withdrawal of the British Army of Occupation from O.E.T.A. North and West which began on Nov. 4 1919 and ended on Jan. 19 1920 the difficulties of the French were greatly enhanced, as their own troops were hardly numerous enough to cope with the forces of disorder which began to raise their heads almost immediately. Attempts to enforce French authority were met with armed resistance. Certain of their agents played them false, and both in Cilicia and Syria Gen. Gouraud, who had become High Commissioner in Beirut in Oct. 1919, had to cope at once with Turkish Nationalist plots directed from Angora, panislamic agitation, anti-Armenian traditional hatred and Syrian and Arab Nationalism. Active troubles soon began, the Damascus administration, now controlled by the Emir Faisal, had little real authority over the semi-independent tribes which were plentifully supplied with rifles, either issued to them for war against the Turks, or captured weapons, and it was itself harassed by the conflicting policies of the Syrian extremists who resented the presence of the Arab "Patriarchalists" from the desert, and of the Hejaz Arabs who maintained that Syria was but a province conquered by them in war and lawfully at their disposal. The Emir had, moreover, to keep the peace with his French and British allies in the face of a growing anti-European spirit which was hostile to the French schemes for controlling Syria and indignant at the British attitude towards the Jews, while Syrian Nationalists resented the partition of the country between two foreign Powers and inclined towards anybody—even the once hated Turks—who offered hopes of driving the Europeans into the sea.

Baalbek was the scene of the first fighting between the French and Arabs—at Christmas 1919. In Jan. 1920 the French were attacked near Quneitera and in the Merj Iyun. Later in the month their troops were engaged in the Latakia (Ladigiye) district, and while they were able to recover Baalbek before the end of Jan. their garrison at Alexandretta was attacked in Feb. On March 1 the Jewish colony at Tell Hai, near Metulla, in what was then the French sector of Upper Galilee, was raided by Arabs. On March 8 the Syrian National Congress, sitting in Damascus, under the influence of impatient extremists, proclaimed the Emir Faisal as King of Syria, and placed him in an extremely difficult diplomatic position. In the face of the extremists he was unable to hold back, and he organized a Syrian Cabinet under Riza Pasha and did his best to enforce discipline throughout his dominions where compulsory military service had been reintroduced on Dec. 21 1919. The authority of Damascus was, however, unable to restrain the outbreak of Arab Nationalist enthusiasm which the formation of the kingdom of Syria aroused. Antioch was taken from its small French garrison on March 20, there was anti-European trouble from the Amanus to Jerusalem (*see* PALESTINE), and Arab officers entered into renewed relations with the Nationalist Turks of Angora. As early as Dec. 11 1919 Ramadhan ibn Shalash, the Arab governor of Raqqa, instigated by Angora, had made common cause with a Kurdish freebooter, Ibrahim Pasha Milli, and had attacked Deir ez Zor, from which, although in the French sphere of influence, the British had not yet withdrawn. The Emir Faisal immediately dismissed Ramadhan, but he became contumacious, declined any longer to recognize the authority of Damascus and openly adhered to the Nationalist Turks. His Arab successor in Raqqa, Maulud Pasha, was equally disloyal, and throughout the summer disturbances in both French and British areas were actively fomented by him and other disobedient adherents of the Damascus Government.

More vigorous steps were taken by the Nationalist Turks of Angora. Not content with conducting a campaign of extermination against the Armenians in Cilicia where the French were not strong enough militarily to occupy the whole province in the face of the formidable Turkish forces operating against them and the Armenians, the Government of Angora invaded northern Syria itself. Aintab was attacked in strength on April 1 1920. It was relieved by a French column with some difficulty on April 15–16, but, when the relieving troops were withdrawn on April 28, the siege was resumed on April 30. It was relieved a second time on May 22, and an armistice was concluded on May 29 by which the French evacuated the citadel and established themselves in a fresh position. They were again attacked by the Turks and relieved for a third time on Aug. 11. This time the French were strong enough to attack in their turn, although unable entirely to invest the Turks, who had occupied the citadel as part of their position. After long-drawn operations, during which the Turkish mines in one of the piers of the great bridge of the Bagdad railway over the Euphrates at Jerablus were exploded by lightning and two spans of the bridge wrecked, the French were successful, and Aintab was once more made safe on Feb. 10 1921. During this period its pop. is supposed to have decreased by some two-thirds to 25,000. Nor were the disturbances in the N. confined to the Aintab area, apart from the campaign in Cilicia. Nationalist Turks and Syrians at the beginning of Dec. raided as far S. as Jebele on the coast 14 m. S. of Latakia, and farther E. a force of Nationalist Turks established themselves near the newly fixed boundary between Syria and Mesopotamia and tried to stir up unrest among the desert tribes.

In the S. the existence of an independent state at Damascus with Nationalist aspirations to absorb all Syria and the Lebanon, and unwilling to admit French influence or recognize any French mandate, was likely to prove an uneasy neighbour—the more so as the Emir Faisal had declined on two occasions (March 27 and May 8) to repair to Paris at the invitation of the Allies to explain the situation. The Emir maintained that it was only by remaining at Damascus that he could hope to restrain the more extreme Nationalists from launching a wholesale attack upon French territory. As soon, therefore, as Gen. Gouraud had an adequate force at his command with which to enforce the authority given to France as Mandatory for Syria on behalf of the League of Nations, he made ready to impose it upon Damascus, when in June 1920 the Emir Faisal was beset by difficulties. Himself one of the Ashraf, a son of the King of the Hejaz, he found it increasingly difficult to restrain the Nationalist Syrians, the pro-Turk panislamists and the Patriarchalist tribesmen who were traditionally hostile to any authority which sought to stand between them and their prey in the cultivated lands. In June the Cabinet of Riza Pasha fell, largely on the question of the relations between Syria and the Europeans—particularly the French, and Hashim Bey Attassi took office. At that time in the discussions of the budget in the French Chamber it appeared that France, while proposing to allot some £3,700,000 for the expenses of the High Commissionership of Syria and some £440,000 for propaganda to be directed against the extremist doctrines of those opposed to her rule, was ready to grant a subvention of £800,000 to the Emir Faisal provided that he co-operated whole-heartedly in the execution of the Mandate. The Emir was, however, in no position to do so, owing to the intractability of the Nationalist leaders who threatened to depose or murder him if he ventured to abate in any way from the extreme of their ambitions, wholly incompatible with any foreign Mandate. At the same time the economic situation of Syria was bad, and the taxes were extremely high—for example, the camel tax in Syria was £E3 (£3 1s. 6d.) per beast as against 1 rupee (1s. 4d.) per beast in Mesopotamia, and the sheep tax was 36 P.T. (7s.) against 8 annas (8d.)—and were, moreover, farmed, owing to the absence of the necessary fiscal machinery for ensuring official collection. Thus the Emir's Government was regarded with suspicion by the Nationalists and those who were opposed to any accommodation with France, or indeed any European Power.

On July 14 1920 Gen. Gouraud informed the Emir that French authority was to be enforced and that he would assume control of the Syrian railways—hitherto run by the Arab administration, parts of which had not been working since January. This intimation was none too soon, as it was known that the Arab general, Rushdi Bey, in command of the 3rd Arab Div. and governor of Aleppo, who had formerly been in the Ottoman service, was in active communication with the Nationalist Turks of Angora for the purpose of arranging joint operations against the French. Almost at the same time Gen. Gouraud found it necessary to arrest nine members of the Administrative Council of the Lebanon, apparently for conspiring with Syrian Nationalists to make it impossible for France to exercise her Mandate.

The Emir Faisal was willing to comply with Gen. Gouraud's wishes, but the Syrian Nationalists, miscalculating their strength, opposed the advance of Gen. Goybet's column which was sent to occupy Damascus. They even attacked the Emir Faisal, delayed the final message of submission sent by the Emir and his Cabinet to Gen. Goybet, and by ill-judged hostilities compelled the French to defeat them smartly at Khan Meiselun on the road through the mountains N.W. of Damascus on July 24, and to enter that city next day as conquerors rather than as protecting allies, thus bringing about the downfall of the Emir, whom the French held responsible for the resistance of the Nationalists although it had been offered in defiance of his authority and policy. The Emir's last Cabinet fell with him, and the French, who inflicted a fine of £S500,000 (10,000,000 frs.) upon the country, caused a new administration to be formed under 'Ala ed Din er Rubi, while the Emir Faisal and his family withdrew from Damascus on July 28, going to Haifa, where he remained until Aug. 4, when he left for Europe.

The suppression of the Nationalists at Damascus did not immediately bring peace to the country, as the French were unable adequately to control the Hauran, and on Aug. 20 Bedouin raiders stopped a train at Khirbet el Ghazali on the Hejaz railway and murdered the Syrian prime minister 'Ala ed Din er Rubi, Ata el Ayyubi, the Minister of the Interior, and 'Abdurrahman Yusuf, President of the Council of State; for some time afterwards railway communication was hazardous in that area, and trains were generally protected by a guard of soldiers in armoured trucks at either end.

On Sept. 1 1920 Beirut became an autonomous district of the Greater Lebanon (*Grand Liban*), which was enlarged from its former extent under the Turks so as to embrace all Biqa' or the Coelesyria composed of the Turkish kazas of Hasbeya Rasheya, Biqa' and Baalbek (which, originally allotted to "O.E.T.A. West," were left to the administration of O.E.T.A. East by Gen. Allenby as having been largely liberated by Arab troops), and the coast territories between Palestine and the Nahr 'Akkar; and next day the former Turkish sanjak of Latakia and the northern parts of that of Tripoli were formed into a new administrative area of Alawiya (*Territoire des Alaouites*). In the N. the Turkish sanjaks of Alexandretta, Deir ez Zor and Aleppo, were united (Sept. 1 1920) to form the "Government of Aleppo," which thus extended to the Khabur, beyond which the country was under the administration of the French officer commanding in the *Confins Militaires;* and by the end of the year the caravan route over the Beilan Pass above Alexandretta was so far cleared of Turkish raiders and Arab marauders that civilian traffic began to be resumed. In the S. however the Hauran was still disturbed, and in March 1921 a party of Arab raiders blew up bridges on the Hejaz railway over the Yarmuk and to the N. of Dera, while the Syrian Nationalists were reported to be active in that sector of the British sphere beyond the Jordan which still formed part of the Emir Faisal's dominions but was not in any way subject to British authority. In April however this danger was abated, as the Emir's elder brother, the Emir ʽAbdalla, arrived in ʽAmman and restored order throughout the area of the ancient kingdom of Kerak in coöperation with the British.

Frontiers.—On Dec. 23 1920 the frontiers towards Mesopotamia and Palestine were fixed in such a way as to retain the whole of the Litani-Leontes watershed with Quneitera in French mandated territory, and providing for the joint Anglo-French use of the railway between Semakh and Nasib, although the line itself remains in French territory. On the side of Arabia the frontier runs from Nasib to Imtar and thence in a straight line to Abu Kemal on the Euphrates.

In March 1921 Gen. Gouraud, when in London for the Near Eastern Conference, took advantage of the presence of the representative of the Nationalist Turkish administration at Angora, Bekir Sami Bey, to conclude an agreement, in virtue of which the French withdrew from the whole of Cilicia, and adopted as the northern frontier of their Syrian mandated territory a line running from Payas on the coast N. of Alexandretta to Choban Beg (Bey) on the Bagdad railway, and thence along the railway to Nisibin, whence it runs to the Tigris and down that river as far as the frontier of Mesopotamia near Jeziret ibn ʽOmar, thus restoring Killiz, Aintab and Urfa (Edessa) with an area of 22,500 sq. km. and an estimated pop. of some 640,000, to the Turks.

On March 4 1921 the formation of an autonomous Druse (Druz) State, comprising the Jebel ed Druz in the Hauran, to be under French supervision but independent of Damascus, was announced.

Area and Population.—Thus the area comprised in Syria as defined by the boundary agreements of Dec. 1920 and March 1921 is divided into the Greater Lebanon (*Grand Liban*), Damascus, Jebel ed Druz, Alawiya, Aleppo and the military territory.

Although no exact census had been taken in Syria the following figures are supplied by the French administration:—

I. Greater Lebanon (*Grand Liban*):

	Sanjak	Capital	Area sq. km.	Pop.
(*a*)	South Lebanon	Sidon (Saida)	2,172	132,000
(*b*)	Biqaʽ	Zahle	3,600	110,000
(*c*)	Mount Lebanon	Baʽabda	3,000	180,000
(*d*)	North Lebanon	Shtora	2,065	164,000
(*e*)	City of Tripoli			
(*f*)	City of Beirut		18	140,000
	Total		10,855	726,000

II. Alawiya (*Territoire des Alaouites*):

(*a*) Sanjak of Latakia—composed of the kazas of Jebele, Sahyun, Baniyas (Valenia), Omranie or Masyaf and the municipal area of Latakia.

(*b*) Sanjak of Tartus—composed of the kazas of Tartus (Tortosa) Safita, Qal ʽat el Husn.

Total area 6,200 sq. km. with a pop. of perhaps 400,000.

III. Government of Aleppo:

(*a*) Sanjak of Alexandretta, area 5,000 sq. km. divided into the kazas of Alexandretta pop. 26,000, Beilan pop. 20,200, Antioch pop. 126,900, and Harim pop. 36,700, or 209,800 inhabitants for the sanjak.

(*b*) Sanjak of Deir ez Zor, area 30,000 sq. km. and a pop. of 174,000.

(*c*) Sanjak of Aleppo:

	Area sq. km.	Pop.
City of Aleppo	—	144,006
Kaza of Jebel Simaʽan	4,694	25,130
El Bab	2,437	27,752
ʽAzaz	2,200	9,957
Membij	3,867	5,030
Maʽaret en Nuʽman	3,450	21,629
Idlib	1,800	53,598
Raqqa	7,200	9,865
Jisr esh Shughr	1,125	36,018
	26,773	332,985
Total for the whole Government	61,773	716,785

IV. Government of Damascus:

		Area sq. km.	Pop.
(*a*)	Sanjak of Damascus:		
	Kaza of Damascus	600	238,504
	Wadi el ʽAjam	800	16,732
	Duma	841	37,937
	Zebdani	180	14,155
	Quneitera	2,000	43,183
	Jerude	12,000	29,431
	Nebk		22,221
		16,421	402,163
(*b*)	Sanjak of Hauran:		
	Kaza of Hauran	3,500	29,760
	ʽEzra	1,318	30,018
	Musmiye	3,972	14,718
	Bosra Shams	970	26,436
		9,760	100,932
(*c*)	Sanjak of Homs:		
	Kaza of Homs	4,000	88,214
	Qaryatein	4,000	6,945
	Job Jerra	2,000	4,159
	Palmyra (*Tadmur*)	10,000	5,340
		20,000	104,658
(*d*)	Sanjak of Hama:		
	Kaza of Hama	1,900	77,205
	Selemiye	2,500	20,864
	Hamra	815	—
		5,215	98,069
	Total for whole Government	51,396	705,822

Thus the whole of Syria contains:—

Greater Lebanon	10,855	726,000
Alawiya	6,200	400,000
Aleppo	61,773	716,785
Damascus Jebel ed Druz	51,396	705,822
Military Territories	25,700	154,500
	155,924	2,703,107

The precise boundaries of the state of the Jebel ed Druz had not yet been settled in 1921, but it was to be detached from the sanjak of the Hauran then in the Government of Damascus.

Administrative Divisions—Of these various administrative areas the Greater Lebanon is under a French Governor who appoints Lebanese officials to take charge of the seven departments of Interior, with *Gendarmerie* and Police; Finance; Justice and Pious Foundations; Public Works, Posts and Telegraphs; Education and Fine Arts; Agriculture, Trade and Industry; and Public Health. Each of these officials is assisted by a French adviser. The sanjaks are administered by Lebanese *mutesarrifs* with French advisers, assisted by local administrative commission. Pending a census of the population and a subsequent election a provisional administrative commission of 15 Lebanese members had been nominated. Its functions and powers are analogous to those of the old Administrative Council under the Organic statute of the Lebanon in 1864.

In Damascus the administration is directed by a Council of State composed of Ministers each assisted by a French adviser.

In Aleppo there is an Arab Governor who appoints native officials to take charge of the departments of Finance; Justice and Pious Foundations; Public Works, Posts and Telegraphs; Economic Services; and *Gendarmerie* and Militia. The Governor is assisted by a council and an administrative commission. The former is composed of the heads of the five departments, of heads of religious communities, of two members from each of the three sanjaks, and of the mayors of Aleppo, Antioch and Alexandretta. The administration is supervised by a French Resident appointed by the High Commissioner, and French advisers assist the heads of departments and the *mutesarrifs* of sanjaks.

In Alawiya a French Administrator with French heads of the four departments of Finance; Public Works, Posts and Telegraphs; Public Health; and Justice and Pious Foundations, controls the administration. There is an administrative commission composed of seven Alawiye (or Nuseiriye), two Christians, two Sunni Moslems and one Isma ʽiliye ("Assassin"). Each sanjak has a French Deputy Administrator with a native *mutesarrif* as his subordinate.

In virtue of the treaty of March 4 1921 between Gen. Gouraud and the religious and political chiefs of the Druses the State of the Jebel ed Druz in the Hauran is administered by a Druse governor elected by the population for four years, subject to the confirmation of the French High Commissioner. He is assisted by a council, elected for three years, which has one session every year during which the budget is voted, and by a permanent Administrative Commission. French advisers assist the higher Druse officials. The local *gendarmerie* and police are recruited by voluntary enlistment.

All these administrations, which are autonomous *inter se*, are subject to the general control of the French High Commissioner of Syria who resides at Beirut, going into summer quarters at Aley in the Lebanon.

Currency.—On May 1 1920 the standard currency of the pound Syrian (£S) was introduced to supersede the pound Egyptian (£E), which had been the official currency under the British occupation, and the now obsolete pound Turkish (£T). The £S is equivalent to the French *louis* of 20 frs., formerly well known in Syria, and is divided into 100 piastres of 20 French centimes each.

Railways.—During the decade 1910-20 the railway construction in Syria was chiefly directed towards improving and linking up the lines serving the trade routes across, and little attention was paid to the development of a purely Syrian system for the development of the country. The only line which can be classed in this category is that between Tripoli and Homs, which was opened in June 1911, and even this was chiefly useful for importing the heavier material required for the construction of the Bagdad railway which was being built across the country in the north. During the World War it was taken up and its rails used in the extension of the Bagdad railway towards Nisibin, but after the French administration had been established the line was relaid and the railway was again opened for traffic in July 1921. In the same way the French Hauran railway between Damascus and Mezeirib was taken up and used in Palestine.

Of the Bagdad railway, destined to link the Syrian system with Haidar Pasha, and perhaps with Europe and Mesopotamia, the Adana Osmanie (92 km.) and Dorak-Yenije (23 km.) sectors in Cilicia were opened on April 27 1911, the sector Bulgurlu-Ulu Kyshla (38 km.) in the Taurus was opened on July 7 1911, and that from Ulu Kyshla to Kara Punar (52 km.) in Dec. 1912. At the same time the Aleppo-Moslemiye (Muslimie) (15 km.), Moslemiye-Raju (77 km.), and Moslemiye-Jerablus (103 km.) fork was opened, and the branch from Toprak Kale (on the Osmanie branch) to Alexandretta (60 km.) at the foot of the Beilan Pass was opened in Nov. 1913. This branch was cut in several places by H. M. S. "Doris" in Dec. 1914, but was reopened for traffic in 1921. During the war every effort was made to complete the great tunnels in the sectors Kara Punar-Dorak and Osmanie-Raju, and, after being used for narrow gauge traffic for some months they were opened for standard gauge use just before the Armistice, and the first through train from Haidar Pasha reached Aleppo in Oct. 1918. Further E. the line was pushed forward to Nisibin:—Jerablus-Tell el Abyadh (95 km.), Tell el Abyadh-Ras el 'Ain (87 km.), Ras el 'Ain-Nisibin (120 km.).

In Dec. 1913 in return for a French loan the Porte gave a concession for the extension of the French standard gauge railway then working between Aleppo and Rayak down through the Biqua' and Galilee to Ludd in Palestine, but nothing came of it, and no steps were taken to start the harbour works at Jaffa, Haifa, Tripoli and Alexandretta for which permission was granted at the same time.

During the war the railways of Syria were greatly strained to meet military requirements, damaged by hostile action, and inadequately kept up, rolling stock became worn out and many engines built for coal consumption were forced to use wood. As a result when the French took over the control of the Syrian railways in July 1920 they found them in need of wholesale reconstruction.

Agriculture.—The chief Syrian industry is agriculture, and it is estimated by the French authorities that of 11,000,000 ac. available for cultivation in Aleppo, W. of the Euphrates, only about 1,500,000 were in 1921 under the plough. A still larger and even less developed area is known to be available for agriculture E. of the river. In the sanjaks of Hama and Homs and in the Biqua' the cultivable area is estimated at over 1,000,000 ac., while the Damascus oasis contains 1,500,000 ac. of good land.

The corn lands of the Hauran are reported to have produced 230,000 tons of wheat in 1919-20, of which 115,000 was exported to neighbouring districts. During the war the Haurani cultivators were generally able to sell their wheat to the Turks for gold, and it is estimated that they obtained £E2,000,000 in this way. Payments for animals and labour however were only in depreciated paper.

The tobacco district of Latakia in Alawiya used to produce some 1,000 tons of tobacco annually.

The production of silk in Syria, which fell during the war to less than one-tenth of its former volume, began to revive in 1920, and the export from Beirut nearly doubled on the 118 tons of silk and 82 tons of cocoons and allied materials exported in 1919.

Before the war it was estimated that there were some 5,000,000 sheep, 1,000,000 goats, 500,000 kine and 250,000 camels in Syria, but during the war it appears that the sheep and goats were reduced by at least 50%, the kine suffered more severely, and the camels, which were very wastefully used by the Turks for military purposes, were still further reduced in numbers, at least 40,000 having been lost in the Jordan valley alone in 1916-7.

Commerce.—The trade of the port of Beirut since 1910, the last complete year of peace, may be summarized as follows:—

	Imports Tons	Exports Tons
1910	233,297	50,934
1911	216,162	48,078
1912	145,054	53,072
1913	193,844	49,248
1914	118,917	30,588
1919	64,547	18,547

Exports of Syrian produce from Beirut in 1911, the last normal year of peace, and in 1919, the first complete year since the Armistice, were as follows:—

	1911 Tons	1919 Tons
Wool	5,500	1,521
Hides	400	122
Olive Oil	233	90
Apricots	4,468	1,436
Wine	161	7
Gums	40	34

During the first quarter of 1920 466 tons of wool were exported from Beirut and 248 tons from Alexandretta, which had just been reopened for commercial traffic. In that period 67 tons of hides were exported from Beirut. For 1919 the value of imports was declared at the Customs as follows:—

	£E
Jan.	59,597
Feb.	223,111
March	629,614
April	376,117
May	551,737
June	900,370
July	1,213,974
Aug.	534,332
Sept.	848,570
Oct.	781,366
Nov.	1,031,477
Dec.	895,248
	£E8,045,513

It must, however, be remembered that goods have to be declared at their local value, on which an 11% *ad valorem* duty is collected. During 1909 prices for imported goods were unreasonably high.

Archaeology.—Before the war extensive excavations had been started on the site of the ancient Carchemish, near Jerablus, under the direction of D. G. Hogarth, with the aid of T. E. Lawrence and C. L. Woolley. These operations, which had yielded highly satisfactory results after the interruption due to the war, during which these three archaeologists all distinguished themselves by their widely different services against the Turks, were resumed in Jan. 1920 under Mr. Woolley, and pursued in spite of the prevalent unrest and the actual hostilities which went on in the immediate neighbourhood. (H. P.-G.)

SZÉLL, KOLOMAN (1845-1915), Hungarian statesman, was born on June 8 1845. He studied at Pest and Vienna, and in 1867 became deputy for the district of St. Gotthard. He very quickly won the reputation of being remarkably well informed on economic and financial questions. Széll was one of Deák's intimates, whose ward, the daughter of the Hungarian poet Vörösmarty, he had married. In 1875 he was Finance Minister in the Cabinet of Koloman Tisza, and as such imposed on himself the task of restoring the shattered credit of Hungary. In 1878 he concluded with Austria the first economic *Ausgleich*. At that time the single Austrian bank was changed, in conformity with this arrangement, into the dualistic Austro-Hungarian bank, and Széll consolidated the Hungarian Rentes, and nearly succeeded in balancing the State finances. As he feared that this balance would again be upset by the occupation of Bosnia and Herzegovina, he resigned from the Cabinet, incurring thereby the displeasure of the Crown. He still kept his seat in Parliament, and as deputy constantly criticized the financial policy of the Tisza Cabinet. At the beginning of the eighties Széll founded the Hungarian Mortgage Credit Bank, of which he was governor until the end of his life. He opened entirely new sources of credit for Hungarian agriculture. He declined repeated offers of the portfolio of Finance. When the Banffy Ministry suffered a serious crisis at the end of 1898 and was compelled to resign in Feb. 1899, Széll was entrusted with the formation of a new Cabinet. By means of the Pact of Feb. 23 1899 he restored parliamentary peace. On the basis of the so-called Széll formula the new *Ausgleich* with Austria until the year 1907 was concluded after long negotiations. The most important result of this was that Hungary attained the status of an independent customs area, but, under the arrangement for reciprocity, still maintained intact the existing conditions of the Customs Union with Austria. In 1901, under Széll's Ministry, the new elections resulted in a Liberal victory. A year later began the struggle for the reform of the national defence, and Széll introduced in 1902 the law for increasing the number of recruits, in exchange for which the Independent party wanted concessions to the principle of nationality. The obstruction against the provision for defence lasted from the end of Jan. to April 4 1903, and resulted in the suspension of the constitution ("*Ex lex*" condition). Széll sought to wear down the opposition by delay. As part of the majority would not agree to this, he resigned on June 16 1903. When his successor, Count Stephen Tisza, on Nov. 18 1904 brought about a split in the Liberal party by forcing through Parliament new rules of procedure, Széll joined Count Andrassy in the secession from the party. Under the Coalition Cabinet of Wekerle, Széll was chosen president of the Constitutional party. He tried continually, but in vain, to bridge the opposition between Tisza and Andrassy. He died on Aug. 16 1915. (E. v. W.)

SZILAGYI, DESIDER (1840–1901), Hungarian statesman and jurist, was born at Nagyvarad (Grosswardein) on April 1 1840. He studied law at Budapest, Vienna, and in Germany, and early attracted attention by his articles on law and politics. As head of a section in the Hungarian Ministry of Justice he travelled on a commission from the Government to England to study there the conditions of the administration of justice, of which he had a knowledge then equalled by few. Brought up wholly in Liberal ideas, Szilagyi took a conspicuous part in the codification work of the Ministry of Justice. Deputy in 1871, professor of public law and politics at Budapest University in 1874, he was in 1877 one of the leaders of the Opposition, which, however, he left in 1886. In 1887 he was returned to Parliament by Pozsony (Pressburg) as an independent member. He became Minister of Justice in 1889. From this time to 1894 he directed his efforts principally towards a radical reform of the whole administration of the courts. In 1894 he took a conspicuous part in ecclesiastical legislation, with which his name is permanently connected. Article XXXI. of the Law of Civil Marriage, and articles XXXII. and XXXIII. on the religion of the children and on State registration, were the result of his active coöperation. After the appointment of Baron Banffy, the former president of the Hungarian House of Deputies, as prime minister, Szilagyi was elected president of the House on Jan. 21 1895, which office he retained until 1899. A man of extensive knowledge, spotless character and wide vision, and a brilliant orator, he was one of the most considerable of the Hungarian statesmen of his day. He died on July 3 1901.

See *Szilagyi's Speeches* (4 vols., in Hungarian, Ed. Fayer).

(E. v. W.)

TACNA-ARICA QUESTION.—Among long-standing disputes between states, the question of Tacna-Arica, between Chile and Peru, still remained unsolved in 1921. Its history can be summarized as follows.

The Treaty of Ancon, which, ratified on March 28 1884, put an end to the war of 1879 between Chile and Peru, was carried out in its entirety with the single exception of Clause 3, dealing with the fate of the provinces of Tacna and Arica. In 1881, when Peru first sued for peace, Chile, with an eye to the future safety of her frontiers, demanded the cession of three Peruvian provinces: Tarapacá, Tacna and Arica. The Peruvian Government made no difficulty about the first-named, which passed definitely into Chile's possession; but they refused to consider the cession of the relatively valueless provinces of Tacna and Arica, on the ground that public opinion in Peru would never suffer it. To smooth the way for them Chile offered to purchase the territory in question for the sum, or equivalent, of ten million Peruvian *soles*, but the offer was rejected. The war therefore continued until 1882, when Chile succeeded in occupying the Peruvian capital. Chile again made the cession of Tacna and Arica a *sine qua non* for the signing of the peace treaty. The Peruvian Government's chief concern was to find a way of acceding without grievously wounding the national sentiment. Examples were not lacking in recent European diplomacy of a means of effecting this; France, especially, had had recourse to an expedient wherewith to save appearances and mask important transfers of territory, namely, Nice and Savoy in 1860 (Treaty of Turin), and the island of St. Barthélemy in 1877 (Treaty of Paris). That expedient consisted in inserting in the treaties whereby the territory was ceded a soothing stipulation for a plebiscite, which should decide, at some future date, its definite ownership. Comparison shows that the negotiators of the Treaty of Ancon, in drafting the clause concerning Tacna and Arica, followed closely enough the formulas provided by the Treaties of Turin and Paris. The clause runs as follows:—

> Art. 3. The territory of the provinces of Tacna and Arica, bounded . . . etc., shall continue in the possession of Chile and subject to Chilean legislation and Chilean authorities for the term of ten years, reckoned from the ratification of the present Treaty of Peace. This term having expired a plebiscite shall decide by popular vote whether the territory of the said provinces is to remain definitely under the domain and sovereignty of Chile or continue to form part of Peru's territory. The country in whose favour the provinces of Tacna and Arica shall be annexed shall pay to the other ten million *pesos* in Chilean silver money or in Peruvian *soles* of equal fineness and weight.
>
> A special protocol, which shall be considered an integral part of the present treaty, shall establish the form in which the plebiscite is to take place and the terms and periods in which the ten millions are to be paid by the country which shall remain owner of the provinces of Tacna and Arica.

Chile's contention subsequently was that this clause was inserted solely in order to allay Peruvian national resentment and so to make possible the conclusion of peace; that the plebiscite to which it refers was to be carried out under such conditions as to render inevitable the definite annexation of Tacna and Arica, upon which Chile had insisted from the first; that the sole purpose of the stipulated lapse of 10 years before the plebiscite should be held was to give the Peruvian people time to accustom themselves to Chilean rule, and that the sum of 10 million *soles* which would be paid by Chile was meant as compensation for the cession. Peru, on the other hand, maintained that the plebiscite clauses introduced into such treaties as those of Turin and Paris had not the disguised intention that Chile claimed, and that, even supposing they had, the plebiscite called for in the Treaty of Ancon was of a very different nature.

The period of 10 years had not expired before Peru took steps to secure the holding of the plebiscite, proposing conditions, which, as they included the restriction of the vote to the Peruvians born in the two provinces, proved unacceptable to Chile. Several years of fruitless negotiation ensued, and in 1901 Peru severed diplomatic relations. Four years later she accepted Chile's invitation to renew their intercourse, and to seek with her neighbour an agreement based upon the interests and convenience of the two republics; but the Peruvian plenipotentiary, on his arrival at Santiago, made it clear that his Government desired no other agreement than such as would forward the carrying-out of the plebiscite under the same conditions proposed previously, and diplomatic relations were again broken off.

Notwithstanding her contentions as to the purely accommodatory nature of the clause in dispute, Chile always declared her willingness that the plebiscite should be held, provided the suffrage were not limited to Peruvians but extended to all the adult inhabitants of the provinces, including foreigners resident therein since a certain date, who could read and write; and that a representative of Chile, as the nation exercising sovereignty over the territory, should preside over the commission controlling the proceedings. For her part, Peru insisted that the 10 years stipulated for the holding of the plebiscite was a *maximum* period, and that since its expiry in 1894 Chile no longer exercised such sovereignty *de jure*, and could not therefore justly claim to preside. Chile, on the contrary, held that the term was intended as a *minimum* period.

Diplomatic intercourse having been resumed, Chile, in 1910, made definite proposals for the holding of the plebiscite in accordance with her contentions. Peru refused, and once more broke off relations.

In 1920 Peru made formal request for the revision of the Treaty of Ancon by the 1921 Assembly of the League of Nations, but later withdrew her demand, reserving the right to renew it at a future Assembly. The problem of Tacna and Arica stood in 1921 therefore in much the same position as at any time subsequent to the Treaty of Ancon, though towards the end of the year suggestions for arbitration were again under discussion. The area of the territory in dispute was only 23,306 sq. km., and only 18,000 ac. were in 1921 under cultivation. The pop. numbered no more than 37,000, and the trade and industry were almost negligible. Nor were any ethnical, linguistic or religious considerations involved, the inhabitants, whether Chilean or Peruvian, being of the same race, speaking the same language and professing the same faith.

TACTICS[1] (*see* 26.347*).—While personal reminiscences of the Great War had up to 1921 appeared in plenty, and in many languages, it is remarkable that so far no comprehensive and scientific study of its abiding tactical lessons had been published. Diarists and biographers there had been; also not a few training-manuals and text-books; but the world was still awaiting the Clausewitz or Henderson who would show it how military science developed from 1914 to 1918 in the minds of great leaders, how the world struggle differed from anything and everything that preceded it, and how it was finally lost and won. This is the task which will eventually confront the true biographer of Marshal Foch, the greatest soldier figure of the war, when it becomes possible to follow his innermost thoughts during the progress of the conflict. The future historian will have to show how principles and theories which had been developed during a lifetime of profound study were abandoned, modified or confirmed as the result of experience of modern war, contact with the military chiefs of Allied nations and bitter contest with the best military brains Germany and Austria could produce. When some skilled military writer shall have interpreted Marshal Foch as G. F. R. Henderson interpreted Lee and Stonewall Jackson, it may be possible not only to understand the Allied victory but perhaps even to penetrate into the future and to realize some of the simpler problems which war on the great scale has in store. That is the best the military historian can hope to do—so to present the picture of the past as to throw some light upon the obscurity of the future. Always we are left groping our way through what is at the best semi-darkness, but any ray of light is helpful. It is in this spirit and with full consciousness of the difficulties and dangers which lie ahead that the present writer attempts here the task of reviewing the practical developments of the decade 1910–20 and of presenting them in a form which in 1921–2 might already be out of date.

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[1] This article may be considered also as supplementing, for the World War, the article STRATEGY (25.986).

* *These figures indicate the volume and page number of the previous article.*

I.—TACTICS IN THE WORLD WAR

Tactics and Strategy.—First it may be as well to inquire exactly what is meant by tactics, and whether the division between strategy and tactics is left as clear as it was before the World War introduced the new feature of continuous lines offering no flanks for attack, and ceaseless fighting which, from day to day and month to month, varied only in intensity.

Let us ask two questions: (*a*) Can grand or combined tactics still be defined as the sphere of the higher commander on the day of battle? and (*b*) if so, can we accept the corollary that all the fighting on the western front from 1915 until 1918 was tactical and outside the sphere of strategy? All days were battle days; but does this mean that the problems which the commanders of the British, French and Italian armies in the field were called upon to solve were essentially tactical in their nature? The definition may require some modification, but to the second question the answer is distinctly "Yes." They were vast problems involving all sorts of considerations, but they were essentially *tactical*. Questions of strategy, so far as Britain was concerned, were dealt with in London, or in conference with her Allies in Paris, Rome or elsewhere. It was in these places and not in the field that great decisions were formed as to the despatch of troops to the various theatres of war, the formation of new forces, and the wisdom, or the reverse, of embarking upon fresh undertakings. Behind them all were the equally anxious problems of finance and allotment of man-power. In modern wars, Army, Navy (in which is included the Merchant Marine) and Munitions are only three departments of the nation; each puts forward its rival claims, which can only be judged by the Government in consultation with the technical advisers. And so it is that, as war absorbs into itself more and more of a nation's energies and resources, the Government with the prime minister at its head must accept responsibility for *strategy* in the highest possible sense of the word. In no sense, however, can the Government be held to be responsible for *tactics*, which are the exclusive sphere of the military commanders. The Government, in consultation with their technical advisers, allot troops; soldiers alone command them. Whether that command, in its turn, gives scope for *strategy*, as in Palestine, or only for *grand tactics*, as on the western front, depends upon the number of men available in proportion to the size of the theatre of war, upon the railway and road development of the theatre of operations, and upon many other considerations.

Strategy, now as always, is the art of bringing the enemy to battle on terms which are disadvantageous to him; *grand tactics* are the methods employed for his destruction by a force of all arms. Before the war, when aviation was still in its infancy, the term "all arms" included as a rule no more than infantry, artillery and cavalry. Even the engineers were rarely considered as having any direct influence upon the result of a battle. All this is changed, and to the four arms there must now be added, without any doubt, aeroplanes and tanks, and it is a matter for the gravest consideration whether in future wars the chemist will not occupy as important a position as he now does in peace. Machine-guns are purposely excluded here, not because their importance is underrated, but merely in the hope of avoiding unnecessary complication and because they may be included in the wide term of infantry, which also covers such accessories as bombs and rifle grenades.

The sphere of the higher commander in battle is therefore by so much enlarged in that he must know how to utilize and combine far more weapons than were at his disposal in earlier wars, and the demands made upon him are in the same degree heavier and more complex. And so through all the long chain of command, from "the Chief" at G.H.Q. to the platoon commander in the foremost trench. It has been amply proved that, more than ever, no arm of the service is complete in itself; each requires in a greater or less degree the assistance of others in order to win even a small success. The smallest raid into a German trench needed hours, almost days, of careful preparation: night patrols and aeroplane photographs for reconnaissance; artillery and trench mortars to destroy the enemy's wire; if the ground won is to be held engineers must help to make it good, and even if it is not to be held the engineers must be called upon to destroy with explosives enemy machine-gun emplacements or other defences. Then, according to the object of the raid and the intentions of the commander, arrangements must be made for the withdrawal or reinforcement of the raiding party, all of which require most thorough and careful forethought. Much of the detailed preparation for a minor operation of this kind will fall upon company and platoon commanders; and when it is remembered that in war platoons may be, and often are, commanded by junior non-commissioned officers, it is seen that, just as responsibility for the success of higher strategy must depend upon the wisdom of the prime minister and the Government, so responsibility for tactical success extends to the last link in the chain of military command.

War has become national in a sense in which it never was before, and it is a sad reflection that, after twenty centuries of Christianity, its study is more important than ever. Owing to the insular position of Great Britain, its dense population and consequent dependence upon overseas trade, it, more than any other country, is dependent upon success in war. No country in the world could so ill support defeat; yet in no country is the study of war so much neglected. There has recently been a most praiseworthy effort to train the British soldier in the arts of peace; it might be well if similar efforts could be made to fit the civil population in all classes of society for the vital responsibilities of war. The response to Lord Kitchener's appeal in 1914–5 proved beyond doubt the essential soundness of the national spirit; but the story of a hundred battles proves that spirit without professional knowledge and skill is desperately expensive in life.

Hence it is that, just as our conception of war has become national and the need of study more general and less strictly professional, so our definition must be less restricted. We prefer to regard tactics, even "combined tactics," simply as the art of commanding troops in action, without any limitation as to the number of troops employed or the status of the commander. Indeed, it is perhaps easier, in considering the fighting in France and Belgium, to exclude the rôle of the commander-in-chief than that of many of his junior subordinates. Nevertheless, for the purpose of this article, we shall be concerned entirely with the sphere of the larger formations, with organization and equipment, with the effect of inventions upon attack and defence, and with the changes and developments in tactics since Russia and Japan fought themselves to a standstill in the plains and highlands of Manchuria.

Communications.—Now, these changes have been brought about by exactly the causes which have produced the whole evolution of tactics during the last two thousand years, namely, improvement in weapons and communications—that is, in conveying ever more men to the field of battle and in furnishing them with ever more efficient means of killing when they get there. For, after all, the object of tactics is to kill; if possible without being killed, but in any case to kill. For the first time in history these developments enabled armies during the World War to be placed and maintained in positions which offered no flanks for attack and therefore afforded no scope for strategy or for manœuvre. Increase of population was a contributory cause, but primarily the "continuous lines" extending from sea to sea were rendered possible only by the development of railway and road communications, and by firearms of marvellous range, rapidity and precision. It was these features, existing so far only in Europe, and attaining their fullest influence only in western Europe, which differentiated the World War from everything which preceded it. Something of the same kind was seen during the Russo-Japanese War, when great mountain ranges made movement far from the railway extremely difficult, with the result that, broadly speaking, neither Oyama nor Kuropatkin had room for manœuvre, and tactically the war resolved itself into a series of frontal assaults on a defended defile. So it was that, from 1914 to 1918, commanders on the western European front had no opportunity for crushing strokes and striking victories like Austerlitz, Rossbach or Salamanca. Their genius had to show itself rather in the skill and ingenuity with which they made use of the resources placed at their disposal by modern science, than in rapidity of movement and dashing leadership. More than ever war has become "an art served by many sciences," but in so doing it has lost much of its romance. It was only as they moved eastward out of Europe to Palestine and Mesopotamia, where restricted railway communications and scanty populations made it necessary to operate with comparatively small forces in big countries, that the British commanders found themselves working under conditions which previous experience had made familiar to them. Before 1914 instances of the tactical use of railways could be numbered on the fingers of one hand; the arrival of the ever-famous Stonewall brigade on the battlefield of Bull Run, the dramatic appearance of Lambton's naval brigade at Ladysmith on the morning of Oct. 30 1899 at a critical moment in the action of Lombard's Kop, and one or two other examples complete the tale of occasions when railways can fairly be said to have had a direct influence upon a tactical decision.

All this is now changed. Broad-gauge and light-gauge lines are now a necessary and ever-increasing part of the mysterious machinery of battle; and it is they, together with the complementary service of road transport, that have made it possible to mobilize the entire manhood—almost the whole adult population —of a nation, and to maintain in the field armies numbering several millions of men. These armies in their turn claim the services of every industry and every factory to such an extent that in time of war the term "civilian population" is merely misleading, and undefended towns and ordinary merchant vessels become legitimate objects of attack. Thus it is that the new feature of "continuous lines" has been introduced into civilized war, and frontal attacks have become inevitable.

Obstacles: Wire.—Here, however, we must stop to consider another new factor which has resulted directly from the extended use of railway communications and the "nationalization" of war. This is the use of obstacles, more particularly of wire. For several years before 1914 it had been amply evident to every student of the great military problem of Europe that, so soon as the German armies were mobilized and received the order to march, every road between the Dutch frontier and the mountains of Switzerland would be filled to overflowing with advancing troops. There was, be it noted, no doubt whatever among competent soldiers that Germany would not hesitate to violate the neutrality of Belgium; indeed, the very size of her armies, as well as her declared principle of envelopment, made it certain that she would do so, even had the fortifications of the eastern frontier of France not barred the way from Alsace and Lorraine to Paris. To this extent, therefore, "continuous lines" had been foreseen, but it was generally considered that they would exist only during the opening phase.

The present writer can recall very clearly an interesting argument between a very distinguished senior officer and two of his subordinates which took place early in 1914. The senior officer maintained that he found it impossible to visualize a collision along a front of something like 140 miles. The two subordinates maintained that this gigantic battle must be the result of the numbers which would certainly be mobilized; clearly it could not last very long before it broke up into groups of armies operating semi-independently, but, taking Mukden as something of a guide, they expected to see the first, and perhaps the decisive, battle rage from Belfort to the neighbourhood of Namur for perhaps three weeks. "Well," was the senior officer's final remark, "I'll give you three weeks, but not a day longer," and with that the juniors departed content. Some things, it will be seen, turned out as anticipated; but many, especially the rapidity of the Allied retreat, turned out very differently. On the one hand, the German movement through Belgium was too quick and too successful to allow the Allied armies to make the expected stand; on the other hand, the continuous lines were never broken, and after three months of moving warfare the *siege of Germany* began. Once started, it lasted, not for three weeks, but for four whole years—a phenomenon which was due to field fortifications and, more than anything else, to wire.

It is a remarkable fact that in all the tactical exercises, staff rides and other instructional devices in which soldiers were accustomed to indulge before the war, the problem of field fortification was but lightly considered. This is true of all countries, and it is quite wrong to believe that Germany, as has been held in too many quarters, showed any greater prescience than her enemies. The reasons are simple: first, it was not possible to test the efficacy of trenches, dug-outs, barbed-wire entanglements or "pill-boxes" under manœuvre conditions, when time was short and compensation a grave consideration; secondly, it was generally agreed that fortified positions limited the offensive power of the defending garrison and could themselves be easily avoided or turned. This was the teaching of the South African and all previous campaigns, and even Manchuria gave but little indication of what war was to be like in the highly industrialized areas of western Europe. Thus it was that, at the end of the first battle of Ypres, in the middle of November 1914, the British, French and German armies found themselves confronted with entirely novel tactical conditions which demanded entirely new tactical treatment; and to-day new tactics involve not only the training of troops but also the application of mechanical device. In 1914 the new conditions were those of "continuous lines," for which the solution was eventually found, but only through a weary process of "trial and error," in the course of which the ultimate victors came perilously near to exhaustion.

It is not proposed here to discuss the various methods which were adopted with a view to avoiding the central problem and seeking a decision in other theatres of war, for they have nothing to do with tactics. It is, however, permissible to refer to the effect of operations in different theatres of war upon the tactical evolution in the armies of the Allies and of the Central Powers.

Interior Lines.—Put quite briefly, it would appear to be this —that, as a result of their central position and possession of *interior lines* facilitating the rapid transfer of troops from one theatre of operations to another, the German commanders were not so free to concentrate their attention upon the demands of local conditions as were the French and especially the British. The theatres of Mesopotamia, Gallipoli and later of Salonika and Palestine were so remote from France and from each other that it was less difficult to allot to each the necessary proportion of the different arms, and to give to each the distinct training and equipment essential for its efficiency, than it was for Germany, whose troops and commanders were constantly on the move from one theatre to another. Hence it was that, while Germany was inclined, or compelled, to compromise, the Allies opposed to her were able to specialize, with the result that, with one notable exception, in every theatre the initiative and the lead in tactical development were with them. That notable exception was the not very noble or praiseworthy one of the use of gas. In the true realm of tactics it may fairly be said that, from the end of 1914 until March 1918, when Ludendorff had for the first time been able to devote his undivided attention to the problems of the western front, the lead in tactical evolution was always with the Entente armies.

Changes in Organization.—To return to the deadlock in the West, it became clear towards the end of 1914 and beginning of 1915 that the problem of field fortification could not be solved by the methods of 1870, S. Africa or Manchuria. It was not that principles were changed and theories at fault. The power of modern rifle fire had been amply demonstrated, especially by the British Expeditionary Force, whose trust in their weapons had been more than justified; the French seventy-five, the British long-range field gun (for as such the 60-pounder must be regarded), and indeed the German heavy howitzers had done all that had been expected of them, but one and all failed to compete successfully with the new factor. Infantry, even with the best available artillery support, could not be expected to assault with success the hostile lines, which were daily becoming stronger; and cavalry, which had been invaluable during the retreat of Aug. and the early days of Sept. 1914, as well as in the subsequent advance, could find no scope when Nov. and Dec. came. No vulnerable flank was offered, nor was there the slightest opportunity for those daring raids against the hostile communications which have sometimes offered such dangerous attraction to the cavalry leader. The conditions were indeed the exact opposite of those in S. Africa during 1899–1902. Similarly, the German army had been able to prove that the theory of tactical envelopment was the inevitable corollary of machine-guns and quick-firing artillery, for frontal attack was far too costly, and Joffre and French and their lieutenants had once more proved to the world that counter-attack was the soul of successful defence. It was not that the principles or theories were wrong; so far as they went they were correct enough, but the trouble was that they did not carry sufficiently far. Their basis was manœuvre, and suddenly it was found that manœuvre was no longer possible, but that it had been displaced by the tedious processes of siege warfare. Infantry was still the conquering arm, but was now less dependent upon cavalry, and even more dependent upon engineers and artillery; while the Air Force was rapidly acquiring an importance which, though foreseen, had in peace always been put aside by considerations of expense. It was at this stage, too, that the bomb first made its reappearance as an infantry weapon, and its use increased to such an extent that, towards the end of the battle of the Somme, in the autumn of 1916, it threatened to supersede the rifle. Many new auxiliary services grew up, many new weapons were invented, and leading men in every branch of science devoted their great talents to the destructive art of war.

Yet amidst so much which was new the great central problem of war remained unchanged, for it was, as it always has been, the destruction of the enemy's field army. In the new conditions which had arisen this meant great innovations in army organization. The cry was for more technical troops of all kinds. A third field company (engineers) and a pioneer battalion were added to each British division; the signal service was greatly extended, and, above all, the demand for more and heavier artillery was urgent. Every month, almost every week, new needs were discovered and fresh demands from the armies in the field were reaching the British authorities at home, who were already more than fully employed in equipping Territorial divisions and in raising new armies. Put quite broadly, however, the problem of the capture of the German fortified lines, which could not be turned, was one of improved material and improved coöperation between artillery and infantry, each with the attendant services necessary to efficiency. That is the main thesis to which it will be necessary to return again and again.

Artillery and Infantry Coöperation.—At this point it will be as well to look backward and to trace very briefly the history of the evolution of artillery and infantry coöperation for the previous twenty years or so. It is the story of the contest between artillery and field fortification, which in some respects resembles that between the gun and armour at sea, or between ships and forts. It is, in fact, the old contest between attack and defence. For many years before the S. African War it was an accepted axiom of combined tactics that any attack by infantry must be preceded by an artillery bombardment, of which the principal purpose was partly to overcome the enemy's artillery and partly to shake the *moral* of his infantry. Accustomed as we have become during the last few years to think of guns at least in hundreds, it seems strange to turn to the official account of the battle of Magersfontein (1899) and to read that at 4.30 P.M., on the day preceding the attack which was to take place at dawn, the British force opened fire with one 4·7 gun, one battery of howitzers and three of field artillery, which "shelled Magersfontein Hill for two hours. . . . Though his guns had provoked no reply from the Boer, Lord Methuen felt confident that they had not only inflicted loss, but had produced considerable moral effect upon the Boer commander. This, however, was not the case. The fire had but one important result, that of warning the enemy that an attack was imminent." The fact was that in those days military science overestimated the powers of a few guns and underestimated those of hastily constructed entrenchments, which were then in their infancy and almost an unconsidered feature of war. Again and again the same thing occurred, but so difficult is it to learn from any experience but one's own that we find the Japanese army making exactly the same mistake some four years later. Then, at the action of Ta-shih-chiao, the Japanese, with a vastly stronger artillery than the British had possessed at Magersfontein, bombarded the Russian right for several hours. So heavy was the fire on this occasion that General Stakelberg declined to occupy his trenches, and reported to his senior officer that, should he be forced to do so in order to repel an infantry attack, he would certainly suffer very heavy loss. But no infantry attack developed, Stakelberg's troops remained under cover, and the losses inflicted by the bombardment were almost negligible. From these and many similar experiences the theory was deduced that, in order to get results from the fire of the guns, the artillery bombardment must be accompanied by an infantry attack. To coöperate successfully, the action of the two arms must be simultaneous instead of successive, for only in this way could the enemy be compelled to man his defences, to show himself above his parapets, and to expose himself to shrapnel fire. In the words of the French regulations of 1913: "Artillery no longer *prepares* the infantry attack, but *supports* it." The old term, "artillery preparation," belonged to a dead language.

Such, in a few words, was the generally accepted theory of infantry and artillery coöperation at the beginning of the World War, and during the earlier stages it proved to be remarkably correct. It was not until the field armies found themselves brought up short by deep trenches protected by wire entanglements, furnished with strong revetment, and strengthened by dug-outs, that the experts discovered that, curiously enough, new conditions must be met by old methods, and the discarded, not to say discredited, "artillery preparation" was revived.

Up to this point, too, it may be fairly claimed that the actual artillery material with which the various armies took the field in the autumn of 1914 had stood the test well, although naturally subjected to the restrictions on ground of expense which are inevitable in times of peace. Each artillery, English, French and German, had, however, developed on somewhat different lines, corresponding to the mentality of the different nations, their theories of battle fighting and the amount of money available for each experiment. Each of the three armies had a mobile field gun, England the 18-pounder, France her famous 75-millimetre and Germany the 77. France, thinking always of rapid movement either in retreat or advance, and always refusing to consider the possibility of standing on the defensive, had concentrated on the light, rapid-firing and very accurate field gun, with an organization on a divisional basis. England also believed in the divisional organization, but in addition to the 18-pdr. she had the 4·5-in. howitzer for high-angle fire, which had been found so necessary in S. Africa, and the 60-pdr., whose long range, commanding the roads and often forcing premature deployment of the German infantry, was invaluable during the retreat. The German army alone possessed heavy howitzers and high explosive, no doubt because the general staff always considered the possibility of being forced to engage permanent fortifications on the French and Belgian frontiers, but it was weak exactly in those points upon which the French and English had specialized. The 77-mm. was inferior as a field gun both to the 75-mm. and to the 18-pdr.; it possessed nothing corresponding to the 4·5-in. howitzer; and its heavy artillery, while possessing great shell power, was lacking in range. Thus it came about that, when expense was no longer a ruling factor, each army began to borrow ideas from the other and to adopt material suitable to the wearisome ordeal of trench warfare. Thus, too, Europe stumbled into that war of material, of ever stronger material of defence and ever stronger material of attack, which was to last until the autumn of 1918. It was under these conditions that the German army, which was to have been back in its own homes "by the fall of the leaf," found itself pinned to French and Belgian soil, and that the war, which at the outset, as was believed by most of the leading authorities in England, political, military and financial, could not last more than six months, dragged out its devastating existence for more than four long years. One man among them alone ventured at that early stage to lay his plans for a long war, Lord Kitchener.

Offensive or Defensive?—It was a depressing situation for the professional soldier of England, France or Germany to find himself in. No matter to which of the three armies he happened to belong, he had been trained from youth in a war of movement, of stroke and counter-stroke, and of rapid decision. The more he knew of the history of his profession, the more deeply he had studied the campaigns of the great captains, the firmer was his belief in the power of the offensive and the "will to conquer." There was much searching of heart, especially among those who had seen the German masses beaten back time after time by the attenuated lines of the British Expeditionary Force in the first battle of Ypres. If the rifle alone could do so much, how was it possible to overcome strong defences heavily protected with barbed wire and bristling with machine-guns? Had modern developments changed not only the methods of warfare but the very basic principles themselves? Had, in fact, the defence become stronger than the attack?

There were those who thought that a decision, since there must be one somehow, must be sought elsewhere than in France or Flanders, and there arose the controversy between "Easterners" and "Westerners," which lasted as long as the war itself. But that great question carries us into the region of strategy. Clearly no commander could be content to sit still and avoid a decision on his own front, at least without direct orders from the supreme authorities. Nevertheless, the same causes which gave birth to the desire to "find a flank" elsewhere than in France produced even on the western front two schools of thought, which were christened by the French, with their wonderful gift for discovering appropriate labels, the "usuristes" and the "trouistes." The former, as their name implies, held that nothing could be gained by hurling infantry, however well supported, against the German lines. In support of this view they were able to point to the desperate losses which were incurred in the fruitless fighting of the early part of 1915, and to the opinion of a captured German officer who, when asked when and how he thought the war would end, was said to have replied: "In about six months' time, and about fifty metres from where we now are." A war of attrition, and victory through exhaustion, or by somebody else's efforts in some other field, were the tenets of the "usuristes." These theories found no appreciable support in the British army, nor in the British troops from overseas or in the Dominions whence they came. The war of attrition was rightly regarded by them as a dangerous "will-o'-the-wisp" which was bound to lead to disaster, for it meant the abandonment of that "will to conquer" which has always been the greatest asset of victorious leaders, and depended for success upon the collapse of the enemy's *moral* rather than upon the triumph of their own. The arguments of the "usuristes" could not be disproved. They could be met by faith alone; but faith was not lacking, and the names which will always be held in the highest honour in every country are those of leaders, whether political or military, who never lost their belief in the power of the offensive and refused to be tempted into the broad and easy path of the "usuristes."

The "trouistes" had their way, and in the end they compelled victory. The principal article of their belief was a firm conviction that morally the defensive is the weaker rôle, and that the path to victory must always lie through a wisely and resolutely conducted offensive. Put shortly, and in axiomatic form, "there is no defence which cannot be broken." The formula was simple, but the proof was only found after three more years of trial and error.

Since the very earliest days of the war the cry in every army had been for more and heavier artillery, with more and heavier shells, and the fighting of the earlier part of 1915 merely emphasized the same need. By Sept. 1915 the French and British armies, no less than the German, had been provided upon a scale never before dreamt of, but yet far below that which was to be reached before the war was over. Side by side with this vast expansion went the increase of the signal corps, for without coöperation between the arms it was clearly useless to expect the full value from either. Before the war, both in France and England, this subject of coöperation had received great attention. It formed the subject of countless essays, lectures and articles in technical magazines. All that was lacking was practical application and testing under service conditions. Probably the Signal Service which took the field with the British Expeditionary Force excelled both the French and the German, but it depended largely upon despatch-riders, admirable in a war of movement but of less use on a modern battle field. In the words of a French writer: "Il eût mieux valu quelques harangues de moins sur la liaison, sur l'union des coeurs d'artilleurs et de fantassins, et quelques kilomètres de plus de fil téléphonique." But telephone wire costs money, and its absence is just one of those difficulties with which every army must expect to be faced at the beginning of a great war. By Sept. 1915, however, the Signal Service, the link between infantry and artillery, was well equipped; but, in the absence of practical experience, its possibilities and limitations were not yet realized. In this direction, as in many others, much was still to be learnt.

First Great French Attack.—Material equipment was provided lavishly and the first of the great attempts to burst through the enemy's lines was eventually fixed for Sept. 25 1915. At that date much of the British army was still new and inexperienced, so the main attack was delivered entirely by the French in the Champagne country. Farther to the north subsidiary attacks were launched both by the French and the British, but with them we are not concerned. Already the old formula: "The artillery does not prepare the attack, but supports it," had been so far abandoned that three days were devoted to the destruction of enemy's defences by guns of every calibre, and these had themselves been preceded by several days of counter-battery work; thus was seen the revival of the old discredited "artillery duel," which cannot fail to interest the eventual historian of tactical evolution.

It is clear that an attack which is thus prepared has one grave weakness. The exact time, and even the day, of the infantry assault may be concealed from the enemy unless he is sufficiently fortunate to capture a prisoner who knows and can be persuaded to part with the secret, but there is nothing of the rapid march followed by the speedy onslaught and crushing blow of a Lee or a Stonewall Jackson. On the contrary, the attack is not only faced by astonishingly strong defences but is at the same time deprived of what is perhaps its principal weapon—surprise. Some efforts were, of course, made to conceal the exact area selected for the main attack by carrying out similar bombardments on other parts of the front, but the vast amount of ammunition necessary for a real destruction of wire defences and dug-outs rendered it impossible to carry out a thorough preparation at more than one or two points. Thus it came about that the element of surprise was lacking, and the attack was to this extent weakened. Nevertheless in the initial stages it was almost completely successful. The hostile front was broken on a front of 15 miles, and some 20,000 prisoners were taken, together with about 100 guns.

Great hopes were raised momentarily, not only on the fighting front but in London and in Paris. But these hopes were sadly dashed, for it was quickly discovered that, after all, the real difficulty for the assaulting troops was not the capture of the enemy's organized first-line defences, formidable and almost impregnable though they had hitherto appeared to be, but the exploitation of success. So soon as the great attack had been launched there was no longer any doubt as to the exact point or points at which the German reserves were required, and as the attack began to lose its energy and vigour the defence grew stronger. The assaulting infantry found itself in a comparatively narrow salient, exposed to a cross fire of artillery from both flanks, and checked in front by machine-guns which could not be hastily located. It was just at this moment that the infantry found that its own artillery support was weakened, for guns were trying to move forward to new positions and were at the same time struggling against perhaps their greatest difficulty, namely, ignorance as to the exact position of their own infantry. As the days passed the defence steadily grew stronger, until at last the attack withered away and finally ceased altogether towards the end of the first week in October. When the time came to reckon up gains and losses it was found that against a gain of some 40 square kilometres of ground, 30,000 prisoners and more than 100 guns, the French army had put a loss of 120,000 killed or missing and 260,000 wounded. The German loss was probably not much less.

The stories of the various subsidiary attacks were not very different from that of the principal French effort. There had been no break-through, but much had been learnt. In the first place it had been proved that the attack was still stronger than the defence, for the leading infantry had passed through the German lines with surprising ease, and there was a general feeling that at several points, notably at Loos, the Allies might well have won greater success than that which actually came to them. There was, therefore, reasonable ground for the feeling that, notwithstanding bitter disappointment, the advocates of the "break-through" had been justified, and that, with the experience that had been gained, success would certainly be achieved "next time."

New Tactical Lessons.—The causes of failure may be summed up thus: (*a*) the attacks were made on too narrow fronts; (*b*) there was no surprise; (*c*) communication between infantry and artillery was not satisfactory. So far as the first of these causes of failure was concerned, it was evident that it could be remedied by allotting more men to the attack, and that in turn developed itself into the more or less mechanical question of the provision of more guns and ammunition. The second cause was more difficult, since, as has already been seen, surprise and prolonged bombardment cannot well be reconciled. One or the other must be sacrificed. The third cause of failure led to a very definite step in infantry and artillery tactics, and to the evolution of ideas which were put into practice for the first time in the fighting on the Somme in 1916.

As has been seen, it had already been found necessary to abandon the idea, formed in S. Africa, that "artillery does not prepare the infantry attack," and it had been realized that an adequate artillery would have had no difficulty in dealing with the Boer defences. The fault, after all, had not been in the older theories of attack, but in the British army having tried to carry them into effect with insufficient material. Had, for instance, Lord Roberts's army in Feb. 1900 been provided with heavy and light guns on the 1915 scale, Cronje's defence at Paardeberg could not have lasted six hours, and the costly infantry attacks would have been entirely superfluous. Clearly the fault had not been in the theory of an artillery preparation, which had now been proved to be so completely indispensable that it was necessary not only against the first system of defences but also against the less elaborate lines in rear. How to secure this cöoperation against the second and third lines of defence was in Sept. 1915 the latest of tactical problems. The solution then adopted was that the guns must lengthen range or attack new targets *at the request of the infantry.* Such was the training and instruction of 1915, and it was only when put to the test of actual fighting that it was discovered that no system of communication which the wit of man had yet devised was sufficiently good and sufficiently reliable to keep artillery fully informed of the requirements of the infantry; nor was the artillery always able, for various reasons, to do exactly what the infantry wanted, even when fully informed. It was out of the confusion and disappointments of Champagne and Loos that the theory of *methodical progress with limited objectives* was eventually evolved and put into practice in the Somme fighting of 1916.

The experience of the first two years, or, more accurately, twenty-two months of the war was brilliantly summarized in a memorandum on the attack, dated June 20 1916,[1] over the signature of Marshal Foch, then general commanding the northern group of the French armies. Later experience, no doubt, caused further modification of views, but this document is invaluable as showing the stage which had been reached by the best military thought of the day; for it is in every way worthy of the great reputation which the author had already won for himself as a writer and as a student of war no less than as a great commander in the field. No excuse is needed for quoting some of the more important passages.

In the first place it is assumed as a reasonable basis for consideration that the German defensive organization will consist in a series of prepared positions, of which two will be complete, while the others will be more or less skeleton, but sufficiently advanced to be quickly made tenable.

> "Against such defensive organizations and against an adversary who is perfectly protected, infantry is incapable of preparing an attack with rifles and machine guns, just as fire power prohibits all action by 'cold steel.' For these reasons infantry has lost its offensive power in the actual battle. Guns alone can destroy the enemy's defences, upset his organization, kill or annihilate the defenders and master his artillery.
>
> "In consequence, the rôle of the infantry is limited to seizing and occupying the ground over which the artillery has wrought effective and complete destruction."

In another part of the same paper the marshal says:—

> "In such conditions the attack of every position entails two phases: (1) the destruction of the defences, or the artillery preparation; (2) effective occupation by the infantry (*de vive force*). Experience has shown that when the destruction by the artillery has been effective the advance of the infantry is easy and cheap in human life. When the destruction has been but partial or not thorough, infantry is completely checked"
>
> "Artillery preparation is clearly the measure of infantry possibility. It must be resumed the moment the advance is checked. The *depth of ground shelled by the artillery decides the area which can be allotted for conquest by the infantry. It is not great—two, three or four kilometres.*"[2]

From these hypotheses it follows logically that each successive position requires fresh reconnaissance, fresh bombardment and a fresh infantry assault. Infantry, however, by virtue of its own fire-power, is more than ever able to resist counter-attack.

These new theories may be summed up in the words of another high authority: "Artillery conquers defences, infantry occupies them." What a complete change two years of war had brought about from that other phrase: "The artillery does not prepare the infantry attack, but supports it"! Yet be it noted that the latter was also the direct result of war experience.

A further example of the leading position which artillery had by this time attained is seen in the rapid elaboration of the "creeping barrage." It will be remembered that during the Champagne fighting, artillery altered range or changed its targets "at the request of the infantry." This system had proved unworkable in actual practice, and for it was gradually substituted a new plan by which infantry and artillery worked together in accordance with a carefully prepared time-table. It is only necessary here to record the fact that for the first time infantry movements conformed to artillery fire, although it is also true to say that the artillery "lifts" were based upon the speed at which it was calculated that infantry could move. It is also noteworthy that, as the idea of moving close up to the wall of bursting shell, whether shrapnel or high-explosive, became more familiar to the infantry, the artillery "lifts" were reduced and the rate of progress became slower. Such tactics required no mean degree of confidence in the infantry and a high standard of accuracy in guns and ammunition as well as of training in gun-crews. Some casualties from the barrage fire were unavoidable, but it was found far safer for infantry to run the risk of an occasional short burst than to let the barrage run away from them, leaving them exposed to enemy machine-guns.

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[1] It will be noted that this memorandum was issued only a few days before the opening of the Somme offensive.

[2] The italics are ours.

Two other points in connexion with the Somme battle are especially worth noting. First, several attempts were made to operate on a really large scale by night, and on one occasion at least considerable success was won. Secondly, tanks made their first appearance, an event of real historic importance.

Nevertheless it must be admitted that 1916 brought the Allies little if any nearer to the longed-for "break-through" than had 1915, and largely for the same reasons. Again it was evident that prolonged bombardment was the enemy of surprise. Again it had been found that the first system of defence was far less difficult to deal with than were the less well-organized and comparatively ill-defined lines in rear. In addition it was discovered that the shell-torn ground opposed a formidable obstacle to the movements of the attacking infantry, while every hole was a ready-made emplacement for a German machine gun.[1] Great things had indeed been achieved both by the British and the French armies but the enemy was not crushed, and after months of fighting on an unprecedented scale he still preserved an unbroken front from the English Channel to the Swiss mountains. This time the explanation was held to be that, after all, the system of limited objectives was wrong, for the delay necessitated by the methodic preparation for each successive attack merely permitted the enemy to recover from the previous reverse, to bring up reserves of infantry and artillery, and to organize a fresh defence. Thus at each stage of the battle the defence grew stronger, and the attack weakened until it at last died from exhaustion. From this premise it followed that if real success was to be won the artillery preparation must be heavier than ever but in greater depth, and the infantry must pass through all the successive lines of defence in one irresistible rush. Such was the teaching of the French official instructions of Dec. 1916 which prepared the ground for Gen. Nivelle's disastrous attack in April 1917.

Lessons of 1917.—Unlike its predecessors, the campaign of 1917 was singularly unfruitful in tactical ideas. Partly owing to insufficient preparation, partly to over-confidence and partly to want of secrecy—for it was commonly reported that every flower-seller in Paris knew exactly what was intended—the great French offensive by the IV., V. and VI. Armies met with a severe reverse. The subsidiary attack by the British I., III. and V. Armies was more successful, but again resistance was found more difficult to overcome as the attack progressed, and the operations were finally abandoned when it became evident that the main attack, from which so much had been hoped and expected, could not attain its object.

The principal scene of operations then became the Ypres area. First the capture of the Messines ridge, and then the prolonged attack, in appalling weather and on a narrow front, against the Passchendaele ridge. As had happened on every previous occasion, the first system of enemy defences fell easily enough,[2] but difficulties increased just when, theoretically, they should have been most easy to overcome. The artillery "preparation," on a scale far greater even than in the Arras battle of April, did its work only too well, for, coupled with the heavy rains, it converted a naturally swampy country into a pock-marked morass, intensifying in a high degree the troubles of the infantry, and greatly curtailing the usefulness of the tanks, which were by this time an important new arm of offense. During this period, too, the use of gas, especially the newly discovered "mustard" variety, became more persistent and more general than ever before. Masks were worn for hours on end, and so impregnated did the soil become that many men suffered merely from sitting or lying down to rest. Never has any army fought under greater disadvantages than did the British during the autumn of 1917, yet, even if it did not do what was hoped from it, it is only necessary to read Ludendorff's account to realize how heavy was the strain upon the German resources. Moreover, under the leadership of Hindenburg and Ludendorff, the defensive strategy and tactics of the German army had been radically overhauled during the winter of 1916–7, and the *moral* of the troops had been wonderfully improved. Indeed, the army which held the French on the Aisne, the British at Arras and the combined Allies round Ypres was altogether different in spirit from that which had been hunted back to the Hindenburg line during the previous winter. Even the air service responded to the new spirit, and the Entente troops no longer enjoyed the immunity from bomb attacks which had been theirs throughout 1916; far from it. Such was the effect of the masterful and trusted leadership which now had control of the German army.

Tactically, the principal change brought about by the new régime was a greater elasticity in defence, which aimed at affording as ill-defined a target as possible to the attacking artillery and the vaguest possible objective to the assaulting waves of infantry. In reserve were held certain battalions whose duty it was to advance to the counter-attack as soon as it was known that an attack had been launched, and thus it came about that more than once infantry which was in process of organization and consolidation after a successful attack found itself thrown upon the defensive and perhaps forced back from a position which had been dearly won. Special aeroplanes were detailed to look out for these counter-movements, and special batteries to deal with them, sometimes by putting down a defensive barrage of gas, and from these small beginnings grew up that war of movement which gradually reasserted itself and increased in intensity until at last the war was lost and won. More and more as the great attacks, whether French, British or combined, failed to win a decisive result, it was realized that in some way or another the element of surprise must be reintroduced, for without it the offensive was deprived of almost half its power. But the question was, How could the enemy defences be overcome without the preliminary bombardment which inevitably "gave away" the assailant's intended plans? The solution of the problem was at last found in the use of tanks, and at the battle of Cambrai tanks came into their own.[3] Massed secretly by night conveniently near the objective, and advancing when the time came under cover of an artillery barrage, but over ground which had not been rendered impassable by tons of heavy shell, the tanks effected a complete surprise, passed line upon line of defences, and enabled supporting infantry to occupy an important area of ground with but little loss. So severe had been the drain upon the German reserves during the Ypres fighting that for some twenty-four hours the British troops were within an ace of really effecting a break-through, and Ludendorff has himself said that if they had been able to push on a little farther they might have broken in upon his communications and so have scored a considerable strategical success. But the drain upon the British reserves had been no less heavy than upon the German, and the necessary weight to turn a tactical victory into a strategical success was just lacking. In the end Ludendorff was able to mass troops for a counter-attack, and some of the ground which had been lost was re-won; but for the Allies by far the most important result of the Cambrai fighting was that the "trouistes" had been able to justify the faith which was in them and to show that there was a way leading to decisive victory—namely the proper coöperation of infantry, tanks and guns. The seed sown at Cambrai bore rich fruit in the campaign of 1918, but before it could do so Ludendorff was to show that, even without tanks, a break-through was not impossible.

The "Break-through" in 1918.—In discussing the first great French effort to break through the German defensive lines, that of 1915 in Champagne, it was shown that there were three important causes of non-success—namely, absence of the element of surprise, unsatisfactory coöperation between infantry and artillery, and the fact that the whole enterprise was on too small a scale. In a brief review of later offensives it has been possible to show how these defects were gradually overcome, how artillery gradually dominated the tactical theories of the day, but at the same time rendered surprise an impossibility, until at Cambrai it seemed that the solution had at last been found. But Cambrai was itself something of an experiment, and on too small a scale to have a really decisive result. As is always the case in war, the armies of the Central Powers had been passing all the time through the same evolutionary stages as those of the Entente. The minds of Hindenburg and Ludendorff were busy with exactly the same tactical problems as those which daily occupied the thoughts of British, French and Italian commanders. After the great failure in front of Verdun in the early part of 1916 there was no German offensive on the Franco-British front until March 1918, but much experience had been gained in the East and in Italy; moreover, there can be no doubt that Ludendorff's penetrating mind had grasped the reasons for the failure of successive attacks by the Entente armies, as well as the real meaning and significance of Cambrai. Profiting by the experience of others—always a most difficult thing to do, but perhaps particularly so in war—he had refrained from himself taking the initiative until the Russian *débâcle* had put him in a position to do so on a really grand scale. By March 1918 he was able to mass some 80 well-trained divisions for offensive operations in the West, and this in turn enabled him to attack the British III. and V. Armies on a front of 80 kilometres.

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[1] In addition the British armies in particular had to overcome almost incredible difficulties in keeping up the requisite supplies of ammunition and food over a country which was almost devoid of roads. It was indeed found necessary to institute a regular road department of the transportation directorate.

[2] It should also be noted that the perfection (coupled with ample supply) of instantaneous fuze now made the destruction of wire defences a far simpler affair than it had been before.

[3] It should be noted that the earliest embryo of the tanks made its appearance against Bullecourt in May 1917; but the number of these new engines was then insufficient and their tactics were not well understood. The attack failed, but the date is important historically.

The mere fact of being able to stage an attack on this scale gave the German armies a great prospect of success, and eliminated the third of the causes of failure enumerated above. The other two were more difficult to deal with, but in order to secure surprise Hindenburg and Ludendorff decided to dispense with that counter-battery work and artillery preparation which on the Somme, at Arras and round Ypres, no less than in Champagne, had disclosed the Allies' intentions while at the same time rendering the ground difficult, and sometimes impossible, to the attacking infantry. Five hours only were allotted to the artillery bombardment, and in this time wire was to be cut and the enemy guns to be mastered at least sufficiently to allow the infantry to advance. Such was the solution of the second problem—the introduction of surprise—and the decision to attempt so much in so short a time was perhaps the bolder since the German army must accomplish without tanks and on a much larger scale what the British had accomplished with them at their last attempt.[1] The third difficulty—that of coöperation—was overcome by the provision of large numbers of light trench mortars,[2] which, as well as a proportion of field guns, accompanied the infantry advance, as well as by an elaborate system of light signals by which the infantry might indicate their position and wishes to the artillery.

Thus each of the difficulties of 1915 found an appropriate solution in 1918. The attack was on a sufficiently large scale to allow considerable room for manœuvre within the salient which was inevitably formed; the infantry received adequate support from the artillery, at least for several days, and until it was itself exhausted by appalling loss and by the breakdown of supplies (for which the efficiency of the British air service was largely responsible) on congested roads; lastly, a tactical surprise had been effected, with the result that the troops which bore the brunt of the first onslaught were without reinforcements for several days, and this was principally due to the fact that there was no preliminary bombardment to indicate definitely the portion of the front which had been selected for attack.

Nevertheless, notwithstanding the admitted skill and care with which the German commanders had prepared their plans and the colossal scale upon which they carried them out, they, no less than the Entente, failed to reach decisive results. What they did was to show what it was possible to achieve with the materials which science and industry had by this time placed in the hands of the commanders in the field. They had shattered many of the shibboleths of trench warfare and shown that infantry was still the conquering arm. In doing so, they not only exhausted their own man-power, but set loose a new set of tactical ideas which were seized by the genius of Marshal Foch and eventually assisted in their own destruction; for, just as Germany had learnt from the Allied successes and failures of 1915, 1916 and 1917, so the Allies in their turn learned from the German success and failure of 1918.

Foch in Command.—It is not necessary here to trace the steps which led to the appointment of Marshal Foch to the Supreme Command in March 1918. All that remains to be done is to follow the effect of that appointment upon the tactical history of the war on the western front. Even after the first great German drive had been checked in front of Amiens, the initiative remained with the Germans for more than three months while the great soldier who was now in command of the Allied armies was reorganizing his forces and making his own plans. During this period the German attack tactics were unaltered, but each successive effort was a little weaker than that which preceded it, and the only new development was the skill with which one French commander evaded the enemy's blow, surrendered his forward posts and crushed the assaulting lines as they approached his real fighting positions. Such tactics were only possible at a specially favoured portion of the front, but that they were brought into play at the right place and at the right time was another sign that trench warfare was becoming a thing of the past. Meanwhile Foch was maturing his plans, and when historians of the future, with full documentary evidence at their disposal, examine the record of these days it may be found that the marshal's greatest claim to fame is that he, the student of the past, still retained his belief in the war of movement and in the counter-stroke as the strongest weapon of defence.

Twice in the earlier stages of the war great counter-strokes had been delivered with marked success, but for two years they had not been repeated, and the side which had attacked had been met only with passive defence. In 1914 the German sweep towards Paris had been outflanked by Manoury and thrust back to the line of the Aisne, and nearly two years later the costly attempt to capture Verdun had been checkmated by the opening of the first battle of the Somme, though not until it had been in progress for several months. Since that date there had been the two great Entente attacks of April and July 1917 and the German attack of March 1918. In 1918 troops for the attack were provided by withdrawal from Russia, where they were no longer required; but in 1917 it had been necessary to denude important parts of the front in order to release the number of divisions necessary for offensive action, and to trust for defence to a highly developed trench system which could be held by comparatively few troops, so that there was a considerable risk of counter-attack. It is remarkable that, against an enemy trained in the German traditions, the assailant was always able to impose his will, and the defence became largely a question of railways and transportation. The relief of troops on a fighting front, their replacement by others, and their transport to a quiet part of the line became a regular tactical system to which the French gave the name of *roulement*. It was a new feature of war, completely contrary to the peace teaching of every country, but one which was the logical result of the elaborate preparations which were then considered necessary before it was possible to burst through a modern system of field fortification. It was not until Marshal Foch assumed command that the grand tactics of defence underwent any real change, and perhaps he was fortunate in that Cambrai and the March offensive had shown what was possible, and that, as the result of the movement which had taken place, the positions held by the opposing forces were not so formidable as they had hitherto been. Be that as it may, it is none the less the fact that Marshal Foch had the courage and resolution to make his defence active, and to base it upon the counter-attack—to return, that is, to the practice of former wars, and to the theories which he had himself so often preached in peace.

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[1] The facts that the German design had been foreseen at Versailles and that the evidence of prisoners confirmed the British forecast in no way detract from the tactical skill with which Ludendorff's plans were prepared and executed, or from the value of the lesson.

[2] It has been said that the Germans possessed 15,000 of these weapons in 1918.

In this connexion two points of particular interest should be noted. First, it was not until the middle of July in 1918 that Foch was ready to pass from the defensive to the offensive, and by that time the Germans were perilously near Paris. There must, therefore, have been a grievous temptation to stand purely on the defensive, as Ludendorff had so often done with success, and it was a bold decision which rejected what to a lesser man might have appeared the easier and the safer course. Secondly, there was the peculiar configuration of the German front, which, after running almost due south from the English Channel to Soissons and Château-Thierry, turned sharply eastward to Verdun. The German forces within this right-angled salient were lapped round and enveloped, with the result that in whatever direction they attacked they must expose a flank to an active and vigorous opponent. If Ludendorff should attack southward, Foch would counter eastward from the west face of the salient; similarly, if Ludendorff attacked westward, the counter-movement would come from the south. In either case vital German communications provided a strategical objective within possible striking distance. It was indeed a weak tactical situation, in which a series of great and costly but only half-successful assaults had landed the German army, and of which the commander of the Entente armies intended to take full advantage.

His opportunity came in the middle of July. On the morning of the 15th the Germans attacked on both sides of Reims. For three days the battle continued with varying fortunes, until at daylight on the 18th Foch launched his carefully prepared counter-stroke on a front of 35 miles against the right flank of von Boehm's army. There was no artillery preparation, but the French advance was covered, on the Cambrai principle, by a swarm of tanks. The surprise was complete, and by nightfall the German flank was crushed and von Boehm's principal line of communication was in Mangin's hands. But more than this had happened, for at one blow Foch had passed from the defensive to the offensive, and had seized the initiative, on a more comprehensive scale, but in the form made classic by the great commanders of history. The initiative, once chosen, was never relinquished, but was followed by a series of rapid and vigorous blows, beginning with the brilliant attack by the British IV. Army south of the Somme on Aug. 8. From that moment until 11 A.M. on Nov. 11 the German army knew no rest, but was pushed from one strong position to another by victorious forces of many nationalities, into all of which Foch had been able to instil something of his own personality and surprising vigour. The time as well as the direction of the counter-stroke had been truly chosen, for, after acting on the offensive through four strenuous months, the German infantry had exhausted its strength, and moral defection and despondency had spread from the homeland to the armies in the field. It is Foch's eternal glory that he had had the moral daring to wait until this moment had come. So the great counter-stroke of 1918 had in it all the elements which had gone to make the success of exactly similar, if smaller, efforts in former campaigns. It was carefully prepared as an integral part of a general plan of campaign; it was directed against an adequate strategic objective; it came as a surprise; and it was correctly timed. Perfect in conception and execution, it met with its reward, but the curious thing is that it contained nothing new. What the world really saw on that July morning of 1918 was the touch of the artist who knew how to express old ideas in modern terms of war—for Foch was bigger than the tools he handled. Perhaps Ludendorff was not—but it is easy to criticize the commander who fails.

Attack Tactics.—At this point it may be as well to leave the subject of the counter-attack and to return to the study of infantry and artillery coöperation as exemplified in the latest phase of the operations. Once more we may turn with advantage to a French memorandum on attack tactics. This time it is one dated July 12 1918, only six days before Mangin's counter-attack. In it, as in all the more recent documents, stress was laid upon surprise, and it was expressly laid down that attacks must be launched either without artillery preparation, or, if that was not possible, then the bombardment must be as short and as violent as possible. Then followed the important words:—

> "Finally, the infantry must realize that it possesses an armament which is strong enough to enable it to exploit its first success, and to continue its progress, while overcoming local resistance with its own resources and without artillery action."

The same spirit inspires the IV. Army instructions for Aug. 8 when the tactics of Cambrai were more or less closely followed. What a change from the memorandum of June 1916 when the system of methodical advance from position to position, with artillery preparation preceding each stage of the infantry movement, is insisted upon. Surely tactical opinion has again come round full circle, and at the end of four years' war we are not very far from the position at which we started: "Artillery does not prepare the infantry attack, but supports it." Yet both the tactical memoranda from which we have quoted have the same high authority, that of Marshal Foch himself, and both are wise, for the conditions of 1918 differed widely from those of two years earlier. In 1916 the initial attack was against positions upon which months of labour had been spent, and held by an infantry confident in their leaders and in themselves, and quite sure of ultimate victory. Against such defences and with the material at the disposal of the Allied commanders, prolonged bombardment offered the only possible prospect of success; but it equally increased the difficulty of subsequent movement across heavily shelled country and left the enemy in no uncertainty as to ultimate intentions. In minor operations, notably round Thiépval and Beaumont Hamel, real tactical surprise was frequently attempted with success, but only in comparatively minor operations undertaken with important but limited objectives when the defence had been already disorganized.

In 1918, on the other hand, German infantry had been wearied by incessant travelling from front to front in its efforts to burst through the network of opposing armies, with which Entente strategy had encircled it. Two years of effort, which history will certainly look upon as prodigious, had culminated in the great offensive which, begun on March 21 and ended on July 18, had exhausted the physical energy of the troops and produced a corresponding deterioration of *moral*. At the same time two years of under-nourishment and nervous strain had undermined the spirit of the civil population to an extent which was necessarily reflected in the army. The defences, again, were but improvised trench systems, hastily adapted to the requirements of the moment and in no way comparable to those of 1916. Against them the British and French armies could bring a more numerous and more powerful artillery than at any previous period of the war; a better and more numerous air service; a more formidable infantry equipment, thanks to the now universal light mortars; and, finally, an ample provision of tanks—those new engines of war which were certainly the best means of overcoming the German machine-gun defence and, by their moral as well as their physical effect, were to play so great a part in the final phase of the war. With such changed conditions it would indeed have been strange and wrong if corresponding changes had not been introduced into tactics. Changes in tactics are brought about by scientific discovery and consequent improvements in the means of killing. At no time in history have men of science devoted themselves so universally and so whole-heartedly to war requirements—that is to say, to the art of killing their fellow-creatures—as they did from 1914 to 1918. Gas, bombs, smoke screens, wireless telegraphy in the field, are but a few of the means by which scientists had a direct influence upon tactics and by which the research student in the laboratory was directly connected with the platoon commander in the field.

It was, therefore, by the united efforts of all classes in a truly national war that trench warfare came to an end in Aug.

1918; but that which followed was not the open warfare of Frederick the Great, Napoleon or Wellington. Even to the very end, in Nov., the opposing lines were continuous for 300 miles, and no open flank afforded opportunity for crushing defeat. Local flank attacks there were in plenty, and some on quite a big scale, but there was no Waterloo or Sedan. It had been a national war, and the German nation had suffered a crushing national defeat; but even when the Emperor had deserted and fled ignominiously to Holland the beaten army was still able to withdraw across the Rhine in some semblance of order.

Palestine.—Different in almost every respect, and therefore also in the tactics employed, were the campaigns conducted in parts of the world outside Europe. This was especially so in Palestine, and for that reason will it be well to devote some space to the special conditions of that theatre of war and upon the resulting conduct of operations. In the first place the theatre of war was practically a neutral country. Nominally a part of the Turkish Empire, Palestine was in actual fact extra-national, or extra-imperial, with a population by no means united or enthusiastic in support of the Turkish power. The Russo-Japanese War offers another, and even more remarkable, instance of a quarrel between two nations being settled on the territory of a third. In such conditions the war can have none of those national characteristics which formed such a dominating and distinctive feature of the war in the west of Europe. This was the fundamental difference between the main campaign and the subsidiaries, from which it came about that the defeat of Turkey was less national and far more military than was the defeat of Germany. A second important feature of difference is to be seen in the railway development of the theatre of war. It is only through a complete network of railways, supplemented by road transport, that a nation is able to concentrate the whole efforts not only of its manhood, but of its entire population upon the one purpose of winning a war, just as in peace the whole efforts of a population are concentrated upon various forms of industry. When the necessary conditions are lacking, the resultant warfare must inevitably be, if not exactly more primitive in form than in a highly developed country, at least nearer to that waged by the professional armies of the past.

The preparatory stages of this campaign, including the Turkish raids against the Suez Canal and the subsequent advance to El Arish and the neighbourhood of Gaza, need not detain us beyond noting the construction of the broad-gauge railway from Kantara across the Sinai desert. It was wise strategical and tactical foresight which had led Allenby's predecessor, Sir A. Murray, to insist upon a broad-gauge line and so be prepared for operations on a large scale instead of yielding to the temptation to content himself with a narrow-gauge line, which could have been more easily and rapidly constructed and would have sufficed for his own immediate requirements. A false, or at least a different, decision on his part in the spring of 1916 would have had a most hampering effect upon subsequent operations, of which it was at that time only possible to foresee the most shadowy possibility.

For the purely tactical study, we may pass at once to the period of Lord Allenby's command and the advance in Palestine. This period may itself be divided into two phases: first, that campaign which began with the capture of Beersheba on Aug. 31 1917 and culminated in the entry into Jerusalem on Dec. 11 of the same year; secondly, the dramatic series of operations which, between Sept. 19 and Oct. 26 1918, resulted in the destruction of the IV., VII. and VIII. Turkish Armies.

Allenby's strength in mounted men was significant of the possibilities of the theatre in which he was to operate. In discussing the development of the tactics on the western front no mention has been made of the mounted arm, simply because after the first weeks of the war it had no scope for acting in its peculiar sphere; there was no scope for mobility and the mounted man never really found his opportunity. It was exactly the reverse with the Palestine campaign. So we find that in all these operations the infantry gets from the cavalry or other mounted troops far more of the support which it always requires and from the artillery far less. There are no long preliminary bombardments, for as a rule there are neither guns nor targets, but in the very first operation undertaken, the capture of Beersheba, "a mounted attack by Australian Light Horse, who rode straight at the town from the east, proved completely successful. They galloped over two deep trenches held by the enemy just outside the town, and entered the town about 7 P.M., capturing numerous prisoners."[1] In passing, it is worth noting that the operation against Beersheba was undertaken expressly because "when it was in our hands we should have an open flank against which to operate, and I could make full use of our superiority in mounted troops"; and again, when the city had been taken, with 2,000 prisoners and thirteen guns: "This success laid open the left flank of the main Turkish position for a decisive blow." Surprise and movement had taken the place of costly infantry assaults, simply because local conditions had made them possible.

Exactly the same experience was repeated in the second stage of this campaign, which began in Sept. 1918 and ended when the armistice came into force on Oct. 31. At the commencement of these operations the Egyptian Expeditionary Force was holding a line from the river Jordan on the right to a point where the left rested on the Mediterranean coast, 10 miles north of Jaffa. The total fighting strength of the force was 12,000 mounted men, 57,000 infantry and 540 guns. Opposing them, the Turkish IV. Army watched Lord Allenby's right on the Jordan, in the centre was the VII. Army on a front of some 20 miles, while on the right was the VIII. Army holding a similar length of front. Including reserves, but excluding certain posts on the Hejaz railway which were more than fully occupied defending themselves against the Arabs, the Turkish commander-in-chief had at his disposal some 4,000 mounted men, 26,000 infantry, with 400 guns, by no means a strong force with which to stand on the defensive on a front of over 50 miles against an active and resolute enemy.

Allenby's numerical superiority, it will be noted, was especially in mounted men, and this he decided to turn to full advantage when he resolved to make Nazareth, a good 40 miles to the north, the objective of his next advance; but to set his cavalry free it was first necessary for the infantry and artillery to force an opening through the Turkish front. By using every device to deceive the enemy as to his intentions, Allenby was able to concentrate 35,000 rifles and 383 guns on his left, where they were opposed by no more than 8,000 rifles and 130 guns, while two cavalry divisions and one Australian mounted division were immediately available.[2] The infantry attack was launched at 4:45 A.M. on Sept. 19 after an artillery bombardment lasting no more than fifteen minutes, the exact object of which is not clearly evident. The attack was completely successful, and the cavalry, dashing through the opening afforded to them, seized the communications and closed all lines of retreat to the north. Nazareth was entered on the second day of the operations, and four days later "the last remnant of the Turkish VII. and VIII. Armies had been collected." The IV. Army met the same fate only a few days later, and on Oct. 1 the Arab army and Allenby's Mounted Corps entered Damascus, which lies nearly 100 miles in a straight line to the north-east of Nazareth. Still pressing northward, and completing as they went the unutterable destruction of the Turkish armies, the mounted troops, with a few armoured cars, entered Aleppo, more than 200 miles north of Damascus, on Oct. 26, and when the armistice was signed on the 31st were within striking distance of Alexandretta.

II.—TACTICS AFTER THE WORLD WAR

An effort has been made so far to give in outline some idea of the tactical conditions on the western front and in Palestine, the methods resulting from these conditions, and the results achieved. Utterly dissimilar as were these two theatres of war, the underlying principles of victory are found, as always, to be the same. A firm faith in the offensive, concentration at the right time and against a suitable objective, surprise, and coöperation. The welding of all the forces, moral and physical, by the genius of the commander into one homogeneous whole, with one common inspiration, and directed to a common objective, namely victory. So far the two campaigns selected for illustration are in agreement with one another and with all the campaigns of the past; in every other respect the contrast is complete. On the one hand, in France and Flanders we find whole nations in arms, troops numbered by hundreds of thousands, and, as a necessary corollary, continuous lines, heavily fortified and without flanks to be turned, almost (one might say) without any vital line of communications, so complete were the railway and road systems available. As the result—long periods of stagnation, infantry deriving no assistance from the mounted troops (except indeed when acting dismounted), and dependent in the first place upon artillery and latterly upon tanks as well. Movement, when at last it comes, is by slow stages, until when victory is won it is by the crushing of a nation rather than of the armies in the field alone; for this was national war. On the other hand, in Palestine we find armies operating in a neutral arena, small in numbers with open flanks to the east, and each dependent upon a single line of railway; scope and objective not only for trained and disciplined mounted troops, making full use of their mobility, but also for light rapid-moving Arab levies harrying the Turkish communications, and achieving great strategical and tactical results, with but little loss to themselves, entirely by the power of movement. Artillery here plays but a secondary or even lesser rôle, for instead of congestion there is space—space in plenty, and when that element is present light troops come into their own; activity takes the place of force, and victory is over the field armies rather than over the civil population.

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[1] From Lord Allenby's despatch, dated 16.12.1917:—"What would not the British or French cavalry on the western front have given for such an opportunity! But wire, mud, shell holes, and especially German machine guns, effectually prevented any such possibility."

[2] Lord Allenby's despatch, dated 31.10.18.

Between the two extremes of the western European front and Palestine lay such other campaigns as Mesopotamia and Macedonia; but these, though interesting enough in themselves, add nothing to our present purpose and seem only to emphasize the same theory in less convincing form—namely that each theatre of war, by its own distinctive physical features and climate, influences, if it does not actually dictate, the tactics by which battles and campaigns are won. Otherwise war might become an exact science instead of the most difficult of the arts.

This war of 1914–8, then, by its very size and variety, has solved no tactical problem, has answered none of the questions left by S. Africa in 1899–1902, or Manchuria in 1904–5, but, like all its predecessors, has raised many new ones. Strategy is still the art of bringing the enemy to battle on terms which are disadvantageous to him; tactics are still the methods employed for his destruction. In former wars this most desirable object was accomplished by a judicious combination of artillery, cavalry and infantry. To-day the object is the same, but the means have been complicated to a degree which in 1910 was altogether beyond human imagination. Railways have completed the work of Carnot and the French revolutionary generals, and made national war a complete reality; but through the perfections of the internal-combustion engine war itself has taken on a third dimension. If a great master was formerly required properly to handle and combine the comparatively primitive means at his disposal, how much greater should the artist now be who is to use, and not to waste, the much more complicated tools which science has now placed in his hands. As science advances the art becomes more complex, things tend to become greater than men, and use more difficult than invention. Always change has followed along the same line, but so rapid have been the latest steps that the armies of 1921 were further from those of 1821 than Napoleon's armies were from those of Hannibal; yet the human imagination and capacity remain as they were two thousand years ago.

All through the ages changes in tactics have been brought about by improvements in the means of killing. Latterly science has advanced with giant strides, yet the mechanism of slaughter appears to be only in its infancy. How difficult, therefore, to foresee even with what weapons later wars may be fought, and what may be the next steps in tactical evolution. It is easy, indeed, to let the imagination run riot, and to picture whole populations destroyed by infernal machines easily and efficiently controlled by wireless waves. The pebble is to be thrown in at Berlin, Stockholm, Moscow or anywhere else you will, and the influence carried to the uttermost parts of the earth. Equally easy it is to persuade oneself that there will be no change, and the next war will begin exactly where the last left off. History teaches us, unfortunately, that neither of these views is likely to be exactly fulfilled. Possibly they serve as useful correctives one to the other; but the difficulty is to strike the happy medium. When so many new questions have been raised and so few old ones have been answered, only one definite new principle seems to have been established. It is that, more than ever before, tactical methods must vary in accordance with the theatre of operations, and that methods suitable to one country are unsuitable to another. Indeed even this is hardly new, since it is clear that methods which sufficed to overthrow the Mahdi at Omdurman would have been quite unsuitable against the Boers in S. Africa. A short time ago we were satisfied with two classes—"normal warfare" and "savage warfare"; that is to say, war against highly trained, well-equipped professional armies or against primitive races, of which every able-bodied man was an ill-equipped untrained soldier. Those distinctions no longer suffice. Here there is an initial difficulty, for in trying to imagine the tactics of the future we must first imagine the conditions under which war will be fought. Will they resemble the conditions of France and Flanders, of Macedonia, Mesopotamia or Palestine?

Conditions for Future Wars.—One thing is certain, that the wit of man cannot devise a system which will be equally suitable for all. Principles there are, but nothing more. This is especially a British difficulty, for no army of the world is called upon to fight under such varying conditions as is the British; moreover, the British army of modern history has never fought in its own country. It is only necessary to reflect upon the history of the World War of 1914–8 to realize that, while Germans fought almost entirely on their own frontiers, if not in Germany, Frenchmen in France, Italians in Italy, Turks and Bulgarians in Turkey and Bulgaria, the British army and troops from the British Dominions and India fought all over the world. French troops, it is true, fought in many distant campaigns, but except at Salonika the oversea campaigns were preponderatingly British, and cannot be considered apart from the British Dominions and India. The only other countries at all in like position are America and Japan, with few extra-territorial commitments.

As a further branch of this same problem we must for a moment consider the troubles of organization and equipment which are inseparable from those of tactics. The French army exists for the defence of France, the Italian army for the defence of Italy. Defence, no doubt, includes offensive action, especially in the case of Germany, but how simple these tasks seem compared with that imposed upon Great Britain with all her world-wide interests. It is easy to see with what confidence the general staffs of continental European nations can address themselves to their well-defined problems, and how much more complex are the manifold problems of the British general staff. Others can fortify their frontiers. Not so Great Britain or her Dominions, who must always be prepared to fight oversea in some theatre of war which cannot be foreseen with any degree of confidence or certainty. That is one fundamental and special complication, as the result of which tactics, organization and even equipment must always, from a British point of view, be something of a compromise, ready and able to be adapted to special conditions on the actual outbreak of war.

Let us consider for a moment what is to be the future of trench warfare. Will future wars reproduce the conditions of 1914 which led up to it? Will it be the normal warfare of the future, or was it no more than a passing phenomenon? Is it desirable or not to organize, train and equip modern armies with a view to it?

The only possible answer to these questions is that nobody knows. Similar conditions would no doubt produce similar results, but are we likely to find them? What we know beyond the possibility of doubt is that in 1914–8 highly developed industrial countries with dense populations were fighting on or near their own borders. It was these conditions which made possible a war on a front of hundreds of miles; and we may well ask if they can be found again, and, if so, where? Probably the answer would be that only nations possessing the greatest possible resources could support a war of this kind, and that those nations are extremely limited in number, even more limited in 1921 than they were in 1914. Trench warfare in its extreme form is the direct outcome of the industrial revolution of the nineteenth century, and is not possible between such nations, for instance, as Russia and Poland.

But there is more than this. It must also be remembered that trench warfare came in 1914–5 as a surprise, and that all armies dropped into it quite unconsciously. It began with a few strands of ordinary wire laid out in front of simple old-fashioned fire trenches. It was indeed a strange phenomenon. In place of the rapid decision for which everyone had looked, the largest armies the world had ever seen were peering at one another through their screens of metal. That was late in 1914, just at the moment when all the belligerents had practically run out of gun ammunition, when there was no means of dealing with such an unexpected obstacle, and neither side could get at the other. Nothing like this had ever been seen in war. As we now know, it took four years to find the way out of the impasse, but the important point to note is that after the war every nation possessed the antidote. With masses of artillery, instantaneous fuzes and tanks, is trench warfare of this type in any circumstances conceivable? One thing at least seems to be certain, and that is that, having learnt their lesson, the armies of all nations will strain every nerve to render it impossible, and to avoid a repetition of the wearisome experience of 1914–8.

If this means anything at all it is that future wars between civilized nations will be opened with a suddenness and violence far in advance of 1914. In past wars there have always been a few days of grace between the declaration of war and the first serious collisions. In 1914 Germany issued orders for her general mobilization on Aug. 1, France declared war on the 3rd, the Belgian frontier was crossed by Germans on the 4th and by France on the 6th; Liége was entered on the 7th, and the last forts were captured on the 15th; finally the field armies came into collision on the 17th and 18th. Meanwhile on the southern front the French occupied Mülhausen on the 8th with covering troops, but failed to hold it, and it was not until the 14th that their I. and II. Armies and the Alsace group were mobilized and ready to advance into Alsace and Lorraine.

Now, in considering the strategy or the tactics of the opening phases of any future campaign, it was very difficult in 1921 to divest the mind of the picture of 1914, and to remember that there no longer existed in Europe two great military nations with armies magnificently led, fully organized and separated only by an almost imaginary line called a frontier. Something of the sort, it is true, may be found in the borders of France and Italy, but a formidable mountain range only to be traversed by troops at certain well-defined points introduces an important factor which was absent in 1914. Other open frontiers also remained in 1921, notably between Germany and Poland, between Poland and Russia, and still between France and Germany; but, for the time at all events, organized well-equipped armies no longer existed as we knew them in 1914, except in the cases of France and Italy. Nevertheless it is necessary to look forward. Germany, no doubt, had been forbidden by the Peace Treaty to maintain an army of more than 100,000 men, but it was by no means impossible that before many years had passed several of the more backward nations of Europe would become rich and prosperous, with great industries and extensive railway systems, and would be unable to deny themselves the luxury of great standing armies and all the paraphernalia of war. History, at least, is not encouraging in this respect, and it would certainly be most unwise to assume that, because the necessary conditions of a first-class war were no longer visible in Europe in 1921, they would remain so for ever, or even for a very long time; moreover, it cannot be forgotten that the opening years of the twentieth century saw a first-class war far outside the confines of the European continent.

No excuse is, therefore, necessary for the assumption, in 1921, that coming generations would know war even as the present generation has known it, and that its opening phases would not be so very unlike those of 1914, always with such difference as is brought about by the scientific development of engines of destruction. If this assumption is justified—and it is absolutely necessary to make some assumptions—the prospect is that either there will be no declarations of war, or that by various means the period of mobilization will be very much shortened and the great collisions will take place much more rapidly than before. And this with two objects, partly to avoid trench warfare and to reach a rapid decision, partly to ensure that fighting shall take place on enemy territory and not in the homeland. These objects are in their essence strategical, but will naturally find themselves reflected in the tactical sphere. In the first place, with a view to protecting themselves from a sudden inrush, nations may have to spend vast sums upon the fortification of their frontiers, as France did after 1870, and as Germany did for ten years prior to 1914. The influence of these great fortifications and their ultimate fate are not, however, very encouraging, and it is more probable that money may be spent upon the equipment of field armies, and that very special attention may be paid to the success of the first inroad into enemy territory, to seizing the initiative, upsetting the enemy's plans and insuring that at least the opening battles are fought upon his soil.

Tanks and Aeroplanes.—For these purposes great use will presumably be made of aeroplanes, and rapid-moving tanks acting in company with cavalry and horse artillery, and here we are at once upon highly speculative ground—since the tactical value of these new services is still uncertain. There is a fascination in dreaming of possibilities, but experience shows that tactical development has always proceeded by the slow processes of evolution rather than by revolution, and notwithstanding the great successes achieved by tanks towards the end of the World War, it is difficult to believe that they will be able to act alone for any great length of time. In this connexion it must always be remembered that at the end of 1918 tanks had the enormous advantage of still being something of a surprise. They were constantly improving in efficiency and numbers, and through bitter experience correct tactical methods were gradually evolved. More important than all, even up to the end of the war anti-tank defence was ineffective, an advantage which the new arm cannot expect to enjoy even at the beginning of future campaigns. Even with this great advantage in their favour tanks were vulnerable, and at Hooge and even at Cambrai it was seen that boldly handled artillery could, on occasion, inflict great damage. Increased speed and improved mechanism will render tanks less vulnerable, but against them must be set such possible defence as light easily hidden artillery and anti-tank guns. Indeed, there is just a possibility that future years may see a competition, not unlike that at sea, between gunnery in its various branches on the one hand and speed coupled with armour on the other. The tank will endeavour to combine mobility for offensive action with its own protection, while the gunner and rifleman will try to force the tank to carry armour so heavy as to destroy its mobility. Something of this kind was actually seen in the case of the German tanks, which, in the effort to afford security to their crews, had been so solidly constructed as to be almost useless. Another difficulty from which tanks may suffer is inability to carry out their own reconnaissance in moving warfare. Tanks would also appear to be almost as defenceless at night as is artillery; they are indeed entirely an offensive weapon except for the actual protection which their armour affords to the crews. For these reasons tanks would appear to be dependent upon other arms, and incapable of entirely independent action at all stages—for reconnaissance, for overcoming anti-tank defence and for security. At the same time there is no doubt whatever about the immense reinforcement of offensive power which they have brought to the other arms. In themselves they combine mobility, fire and protection, each in a certain degree; moreover, they may solve many difficulties with regard to supply of ammunition, especially to cavalry. It has been amply proved that the great enemy to cavalry, and to infantry as well, is the machine-gun, and it is exactly against this weapon that tanks have proved themselves to be most efficient. Once a machine-gun is located in the open, *i.e.* almost anywhere except behind concrete defence, the tank can deal with it quickly and effectively, while guns heavy enough to destroy the tanks themselves should in their turn be dealt with by horse artillery. In this way each of the three arms will derive support and protection from the other, and all will derive information and active assistance from the air.

Aeroplanes will carry out both strategical and tactical reconnaissance, will locate the enemy's forces, and, so long as light lasts (an important reservation), will watch and report his movements. In action they will watch the progress of their own forces, look out for counter-movements, indicate in every possible way the nature of the enemy defences, and intervene in the fight, whenever possible, with bombs and rifle-fire. If any such coöperation is to be possible, the various arms must not only understand one another thoroughly, have been trained together and have established a mutual confidence, but they must have ample and efficient means of intercommunication, which can only be by wireless telegraphy or telephony.

The same principles must apply to the employment of tanks with infantry and field (including heavy) artillery. Of all the difficulties which infantry has to overcome the two most dreaded are wire and machine-guns. In discussing the action of tanks with cavalry, rapid movement over comparatively open country has been assumed, but it is unlikely that this can be more than a preliminary phase of a few days' duration in a campaign where the belligerents are on even terms in matters of equipment. Heavy slow-moving troops will be rushed by rail to the frontier and will come into action within a few miles of railhead. Then will come the great struggle for the initiative, the result of which may well decide the whole war, and ruthless vigour will be demanded from troops and leaders. At this stage there will be great battles in which, as in August 1914, neither side will be completely on the defensive or completely on the offensive; but both, in their determination to reach rapid decision, will think chiefly of attack, and there will be comparatively few highly organized defences, other than those which may have been prepared in peace-time. Hastily prepared defences may be extremely effective against infantry, especially if well concealed. It is then that tanks, moving easily across country, crashing through hedges, crossing hollow roads, climbing embankments and making paths, easily and quickly, through hastily constructed wire entanglements, will be of the utmost assistance to their accompanying infantry. In the stage of the campaign we have tried to imagine there will hardly have been time to construct land mines, the tank's greatest enemy, but the opposing infantry will be provided with heavier anti-tank rifles and more light field guns than are possible with cavalry. Possibly the tanks themselves may be more heavily armoured than those with the cavalry, where rapid movement is the ruling factor, but they cannot be entirely proof. They, like the cavalry tanks, will be dependent upon the air for information and upon artillery for support. Hence smoke screens, concealing the moving target from the defending guns, may be invaluable, as well as the moving barrage and the fire of guns told off to deal with special obstructions, batteries of emplacements which have been reported by aeroplanes or detected from air photographs. But since both sides will possess tanks, presumably approximately equal in numbers and efficiency, and since the tank is essentially an offensive weapon, it is probable that a new feature may be introduced into tactics, namely tank counter-strokes and tank engagements, for on each side these machines will attempt to get at the enemy's infantry and protect its own. But with all their power for offensive action the tank still has grave limitations, for there are still obstacles to movement, such as the muddy banks of a sluggish stream, which they cannot overcome; mud, as the armies knew it in Flanders, is to the tank what uncut wire is to the infantry, and without power to move the tank is highly vulnerable. Valuable as they doubtless are, it is, therefore, easy to fall into the error of overestimating their possibilities, and it is important to bear in mind that they will not always have the moral effect upon infantry that they had when they were terrible and unfamiliar objects on the battlefield. They cannot turn hostile infantry out of even hastily prepared entrenchments; the most they can do is to make it comparatively easy for their own infantry to get in, and even to do so much they are themselves dependent upon the help of supporting artillery, while all arms are almost blind without the help of aeroplanes.

So far it may perhaps be possible to penetrate into the future, and to anticipate that the opening stages of the next great war between highly developed nations possessing contiguous frontiers will not be very unlike those of 1914 except that they will be fought out with more complicated machinery and with even greater vigour. He would, however, have to be very bold who would venture to prophesy whether, with all the new inventions we now possess, or indeed with others of which we as yet know nothing, wars will really be short and decisions quick or whether prolonged passive resistance is still a possibility. Have the aeroplane and the tank, heavy artillery and the instantaneous fuze so strengthened the offence that it will be able to overcome any defence which human ingenuity can devise, and that there will be a return to the Napoleonic era, or will the defence again be able to assert its superiority as it did from the winter of 1914 to the summer of 1918? Is it again possible that aeroplanes, aided conceivably by artillery firing at extreme range, may wage war against the civil population with asphyxiating gases and heavy bombs, and render war so terrible and so destructive to life and property that field armies may cease to have their purpose? The answer would appear to be that one lesson which emerges from the late war is that there is no limit either to human ingenuity or to human endurance, and for that reason, if for no other, it is only prudent to assume that the balance between offence and defence will be as finely adjusted as ever in the past, and results will depend not upon engines but upon the brains and courage of those who use them.

Minor Wars.—If we leave for a time the consideration of what may be termed first-class campaigns and turn to those of the second or third class, it would certainly seem as though science had rendered the advantage of civilized nations over uncivilized greater than ever before in both the strategical and tactical spheres. As has been shown, one great feature of differentiating first- from second-class campaigns is that of space and freedom of movement. Movement means power to concentrate with rapidity and secrecy and so to effect surprise. Now, it so happens that while campaigns of the first class have in the past been confined almost entirely to Europe, those against uncivilized or undeveloped races are conducted under the burning skies of Africa or Asia. Frequently the climate has been a more formidable foe than the enemy, and the tribesmen or local levies have had far greater mobility than highly trained European infantry. Any device, therefore, which can add to mobility is enormously in favour of the civilized man, the product of industrial conditions. The campaign in Palestine gives the best possible example of tactical success directed against a suitable strategical objective. Victory when it came was absolute and complete, but it was over an enemy whose *moral* had been shaken through acting purely, or almost purely, on the defensive through four years of war. Against that enemy the British forces had won a series of tactical successes, but it was not until cavalry had secured full liberty of movement that tactical success was crowned by strategical victory. Against an enemy ill provided with special means of defence and with inferior artillery equipment, fast-moving tanks should give to cavalry or mounted infantry an invaluable reinforcement in fire power. It is the weakness of mounted troops that whenever they are called upon to use fire one-fourth of the personnel is out of action, merely taking care of their horses; and this at the critical moment of action. No such disability handicaps the tanks, whose fire power is great in proportion to the personnel employed. They will, therefore, supply exactly the factor in which mounted troops are necessarily weak, while their own peculiar drawback, vulnerability to fire from artillery or specially constructed rifles, will be of little account. Mechanical difficulties, from heat and other causes (for the strain upon the crew in a closely confined space is always great), they will certainly have, but these should not be insuperable and may be disregarded. A mixed force of tanks and mounted troops should therefore have just that combination of mobility and fire power which is necessary to allow civilized troops to make free use of space—that is, to manœuvre freely and confidently—against an uncivilized or ill-equipped enemy before his *moral* has been shaken.

Exactly the same arguments apply to tanks acting with infantry and artillery in a formal attack against an uncivilized enemy in position. The mere fact that such an enemy does not himself possess tanks will add enormously to the moral effect of their appearance, and should go far toward rendering an artillery preparation or bombardment of any kind unnecessary. If this is so, surprise becomes much more simple; and surprise is, as always, the strongest weapon of the attack. It is evident, therefore, that at every stage the older arms will be wonderfully strengthened by new inventions, yet it cannot be claimed that even in second- or third-class warfare science has yet succeeded in producing anything entirely to take the place of the man and the horse; for the man and the horse are, after all, the only pieces of mechanism which are adaptable to varying circumstances, yet perfect in themselves and directed by an individual intelligence. Science then does not as yet supersede the most primitive factors in war, but where one side has the monopoly of its products (or even only of some of them) there should be economy of effort, and consequently of life, which should enable the civilized army to be always on the offensive and to force a favourable decision with great rapidity.

Lessons of 1914–8.—To sum up, then, the experiences of the past war and the effects of the latest discoveries, it would seem that at first the defensive proved to be a far stronger form of warfare than had been anticipated, because, owing to dense populations and good communications, armies could hold continuous lines, with no open flanks. Frontal attacks of the most pronounced kind became unavoidable, and months and even years passed before the attack regained its ascendency. In these conditions there was no scope for the mounted arm, and even the infantry returned to the most primitive form of warfare. Rifle-fire was useless, for it could not kill, and fire which does not kill is wasted. It was then that the infantry had recourse to the bayonet and the bomb, and the long-range fighting of S. Africa ceased to be. Instead, for three whole years infantry tactics were on a lower and less scientific plane than in the Manchurian War, which, in the opinion of many soldiers, was fought out on altogether a lower plane than the S. African War which preceded it. Meanwhile ever-growing demands were made upon the artillery, not only for increased weight of projectile and volume of fire, but for a degree of accuracy which had never before been considered necessary or even possible. So far did the dependence of the infantryman upon artillery support extend that there were some who advocated the abolition of the rifle altogether, since it could no longer kill. Then came two vitally important inventions—first, the instantaneous fuze, which deprived wire of much of its terror, and then tanks, with their combination of mobility and fire. With tanks and artillery, infantry recovered its power of movement, and with movement the rifle recovered its position, for trenches had lost their protective value and once more it could kill in the open. In less civilized warfare we can see that on a narrow space like the Gallipoli peninsula continuous lines were possible, but elsewhere space gave freedom for movement, fire was supreme, and the victor imposed his will by crushing the enemy's field armies. In both forms of warfare it was proved once more that in the end infantry is still the queen of battle, but requires ever more assistance from the other arms and from science.

Now, in this very question of the influence of scientific discovery upon tactics, the World War has taught us much. But need the experience have been quite so bitter? No doubt it is easy to be wise after the event, but we should learn little if we allowed ourselves to be convinced that we were perfectly wise before it. To take only one instance, the enormous expenditure of gun ammunition during the opening weeks of the war had the effect of entirely using up all reserves within a very short time after the opening of hostilities. It is now no secret that by the end of the first battle of Ypres the British artillery was practically without ammunition; guns were rare enough, but even the few there were had nothing to fire. And this was true of all armies. It was not only the weather which stopped the fighting in the middle of Nov.; it was, as well, largely the fact that infantry was almost deprived of artillery support. Moreover, it was just this period of respite which enabled the armies to dig themselves in, and to organize those systems of field fortification which for so long defied assault. Now, this deficiency was due to two causes. In the first place to a short-sighted economy, always in favour of running a risk in order to avoid unpleasant parliamentary criticism—and this tendency exists in all countries; in the second place, it was due to a tendency, which is also universal, to devote too much attention to the past and too little to the future. It is so easy to follow Napoleon's advice, to read and reread the campaigns of the great commanders; it is so easy to store the mind with facts and figures; but it is so difficult to apply the knowledge acquired to the requirements of the future and to breathe life into Dryasdust. This is, perhaps, the most difficult task of the general staffs, which all nations had by 1921 established more or less upon the Moltke model. Every great army has its inventions board, whose duty it is to sift the corn from a vast quantity of useless chaff; but the real trouble is to foresee what the tactical effect of any new discovery may be and how to turn it to advantage upon the field of battle. It is easy to learn by experience, but wonderfully difficult to prophesy. Some instances there have been, notably Wellington's confidence that, with the weapons he had, he could dare to go into battle in new formations giving him unprecedented fire power. By his penetrating insight he gained a very definite advantage over men whose experience in European warfare was infinitely greater than his own, and, by breaking away from the stereotyped lines rendered classic by Frederick the Great and even by Napoleon, British infantry gained a tactical advantage which they retained until Waterloo. It was exactly the same firm and traditional belief in the efficacy of rifle-fire which won the first battle of Ypres, for at least in this respect nothing approaching the training of the British Expeditionary Force had ever been seen in European armies. Similarly, it was Moltke's realization of the power of improved weapons and other developments of science that was the origin of his idea of envelopment, whereby he revolutionized German tactics and crushed the armies of Austria and France. Both commanders took risks which are now difficult to realize, but both were justified, not only by their own victories, but by subsequent history. Wellington and Moltke both had their critics, but there is no one who now doubts the wisdom of linear formations or enveloping tactics.

It is unfortunately impossible to produce a Wellington or a Moltke at will, but the application of the lessons of history to the requirements of the future is at least as important and needs at least as much study as the facts themselves. With each step forward and as science renders more and more services to the great art of war the future becomes more difficult to forecast. In the first place it is evident that, as war becomes more complex, peace manœuvres must become less and less realistic. It is related that Frederick the Great regularly rehearsed the movements with which he intended to beat the Austrians. We are also told that the comment of the victorious Prussian soldiers after Königgrätz was that the battle had been "exactly like the last manœuvres." Something of the same kind might conceivably have been said of Mons or Le Cateau, but certainly not of the Marne or of the first battle of Ypres; still less of the Somme, the German offensive of 1918 or of Aug. 8. For many reasons manœuvres can only last for a strictly limited time, whereas modern battles are almost unlimited in length; for the same reasons troops can be employed only in limited, instead of unlimited, numbers; while for other reasons the convenience of the civil population outweighs the demand for military instruction. To such an extent did civil requirements outweigh military that up to the outbreak of war British troops were not allowed to sleep even in barns or outhouses, although billeting is a most necessary, and by no means easy, military exercise, ignorance and inexperience of which subsequently caused the British army much suffering and fatigue. How infinitely more difficult will it now be to produce anything which shall in any way represent the conditions of a modern battle-field, with trenches, wire entanglements, smoke screens, gas attacks, barrages, aeroplanes and tanks! The thing simply cannot be done. Manœuvres will still be a valuable means of training up to a certain stage; but that stage will be far short of the reality, and must be supplemented in the general staffs by imaginative thought.

That is the first difficulty to be overcome. In the second place invention, which has received so great a stimulus since 1914, will not now stand still. The vital importance of the general staff keeping in close touch with the best and most progressive scientific thought of the day, either through the inventions board, or through any other form of "liaison," can, therefore, require no emphasis. If anything is clear as to the course of future wars between civilized countries it is that success at the outset is half way to ultimate victory. If through more rapid mobilization, a better strategical plan, or both, one side can seize the initiative and drive it home by early tactical success it will be in a winning position from the start. It cannot be denied that, owing to the foundations laid by Moltke, the superstructure built by Schlieffen, and the attention which had for years been paid to the possibilities of machine-gun fire, Germany held an advantage in 1914 which was only wrested from her by "the miracle of the Marne" and by the fact that her ammunition supplies failed her just as did those of England and France. Had German leadership, equipment and tactics in 1914 been equal to those of 1918 it is difficult to believe that Paris would not have fallen in spite of the genius of French and British commanders. And so it seems probable that the next war will open with even greater suddenness and greater violence than the last, with more efficient engines of destruction and more rapid movement. The country that would have its tactical development keep pace with science must, therefore, be prepared to spend money upon experiment; its general staff should have its research department; tactical training and scientific research should together form the latest new Model Army. Indeed, just as during the war every army commander had on his staff his meteorological expert and his chemical adviser, so surely the general staff in peace should have its chemical department, for it is not impossible that the chemist may become as important in war as in every great industrial enterprise.

But there is yet a third reason why future wars will certainly produce unpleasant surprises which may even be revolutionary in their nature. By the Treaty of Versailles the German army was reduced to 100,000 men, but it could not alter the fact that Germany's central position in Europe placed her in a situation in which she believed that she must trust to arms for her existence or go under in the struggle. She has also been trained in the belief that offence is the surest defence. Except that Poland had taken the place of Russia on Germany's eastern frontier, and that the Austrian Empire had disappeared, the military problems of Central Europe remained in 1921 much what they were before 1914. Germany was still an ambitious, industrious nation, with 60,000,000 well-educated and intelligent citizens. On the one frontier lies France, and on the other Poland, both with large armies, and neither of them particularly friendly to Germany. In these circumstances it was only reasonable to assume that her policy would be to avoid war, at least for many years to come. At the same time it was clearly evident that her military problems must give rise to very anxious thought. This spectacle of a rich, densely populated country with an army regulated by treaty is, it is true, not entirely new. The same thing happened after Jena, but with the difference that Germany was not then either rich or densely populated. Nevertheless an answer was found to the restrictions imposed by Napoleon. It need not be the same answer this time, precautions against that having been taken, but there is the alternative that Germany's effort may be to compensate for the numerical weakness imposed upon her by scientific equipment and by bringing new forces into play. The World War showed beyond doubt that, given good leaders, a mass of untrained human beings could quickly be converted into an efficient fighting force. Germany's military aim will, therefore, naturally be to train the 100,000 men she keeps in peace-time to become highly efficient leaders in war. Her war budget will be high per man, for the army must be recruited on a voluntary basis; yet the total sum will not be great compared to that of other countries, and money will be available exactly for those purposes of research and experiment which are seen to be so highly important. Many years must elapse before Europe can have recovered sufficiently from the results of the World War to reproduce the conditions of 1914; and perhaps by that time her peoples may have realized the futility of war as a solution for differences of opinion or interest; but in this respect history is far from encouraging, and all the time there will be in the centre of Europe a nation whose soldiers are thinking out war problems on lines which must inevitably be quite different from those followed by their neighbours. Hitherto all the military nations have thought along similar lines. Sometimes one and sometimes another has thrown up a great genius, the product of whose mind had placed his own country at an advantage; but here we have an entirely new set of problems, the solution of which may lead to new and startling results.

In 1921 there were thus three important factors rendering it more than ordinarily difficult to penetrate the obscurity of the future. First, the impossibility of reproducing in peace-time the conditions of the battle-field as we actually know them; secondly, the effect of scientific research upon tactical evolution; thirdly, the peculiar position of Germany and its repercussion upon military thought. Other factors doubtless exist, for the opening stages of every war bring their own peculiar surprises. All that can be done is so to arrange plans that they may not be too rigid, and may if necessary be adapted to meet the unexpected, just as Joffre in 1914, surprised by the extent and weight of the German turning movement through Belgium, switched his own reserves to his extreme left and produced the counter-stroke of the Marne and the Ourcq. This is merely an example culled rather from strategy than tactics, but it serves to illustrate the fact that, in war, the great contest between brain and brain, it is the unforeseen which happens. The real difficulty is to anticipate the problem rather than to solve it. Never in the history of the world have tactical problems received such close attention and study as during the years just prior to 1914. With one great war just finished and the shadow of another hanging heavily over Europe, discussions on strategy and tactics filled the columns of newspapers and magazines not only of the professional but also of the general press. The general staffs of all nations worked out theories and doctrines of war, and the official handbooks gave the armies the considered opinions of the best military brains in each country. The conflicting systems of envelopment and penetration were weighed and considered, with the result that military training could be classified in two clearly defined systems, sometimes called for convenience the French and the German. The real value and capabilities of quick-firing artillery and the necessary infantry formations with which to meet it were thrashed out in theory, and so far as possible by experiment, for, although the French "75" was already an old gun, its effects had never really been tested on the battle-field. Meanwhile Germany introduced her heavy field howitzer and England her long-range field gun. The probable effect of these new factors in war were weighed, discussed and fairly accurately foreseen. But surprise came elsewhere, for the factor which was neglected was the power of the railways to maintain in the field such armies as the world had never beheld, with what we can now see was only the natural corollary—field fortifications impregnable to the material which armies then possessed, and by their strength and extent rendering impossible both envelopment and penetration. The truth is that it is less difficult to find the correct answer to the questions which are asked by history, experience and such foresight as we possess, than to foretell and ask the really vital questions.

III.—The Art of Leadership

So far we have dealt almost entirely with the mechanism of war, the tactics of 1914–8, and possible future developments. There remains the all-important subject of command, and the qualities which go to make a great commander—the human element—for without true leadership arms and equipment and even training will achieve but little. "With a great general no action is executed which is the fruit of chance or fortune; everything is the result of combination and talent" (Napoleon's War Maxims, No. 82). Such was the considered opinion of the great master of war, and it can be confidently asserted that nothing has happened since he fought his last, and perhaps his most wonderful, campaign in 1815 to shake it. Surely no commander ever took greater risks than did Napoleon in the series of operations which ended at Waterloo, but they were the result of careful study and calculation and they came near to victory over almost double his numbers. Even now who can say what might have happened but for failure of his physical power and energy at the most critical moments, for surely England and Europe were never in greater danger than during the forty-eight hours after the Prussians had been beaten on the field of Ligny. How curious to reflect that a little more than a hundred years later the descendants of those who stood at Waterloo should have fought out another campaign on a vastly greater scale but on very similar lines and on ground not very far distant. The combatants were differently grouped, it is true, but the German blow in March 1918 was directed at the junction of the Allied armies, this time the British and the French, just as in 1815 the French blow was struck at the junction between Wellington and Blücher. Once again the British army was based on northern ports, while her ally was based on inland territory; once more the allies were for a time in danger of retiring along divergent lines and perhaps of defeat in detail. Numbers and weapons were different from those of 1815, but the main features of the campaign and the principles upon which it was fought out were the same. So true it is that the principles of war are simple and eternal, but the application of them varies in each particular case. Never yet has there been a great commander who has not read and thought deeply about his art in order that, by training his instinct on the right lines, he may decide correctly when the supreme hour arrives. It is not in order that we may master the principles of war that Napoleon has advised us to "read and reread the campaigns of Alexander, Hannibal, Gustavus, Turenne, Eugène and Frederick," but in order that we may "obtain the secrets of the art of war," and those secrets lie in application.

How strange, too, that of the great names which will go down to history in connexion with the campaign of 1918 two at least are those of men who had seen little or nothing of war before 1914—Foch and Ludendorff. For more than forty years Foch had no experience of anything but peace soldiering; Ludendorff heard an enemy's rifles and saw his own men drop for the first time in his life near Visé on Aug. 4 1914. Both had mastered every detail of their art, not in the open field but in the solitude of the study. Each in his own way was an artist, but of the two it was Foch who had the inspiration, "the fire in his belly," which is the sign of the true master. Yet it is not enough to follow the movements even of these two, for all wars will not be fought either with the numbers or the weapons of 1918 any more than with the weapons and over the extent of ground of 1815. Something between the two may be found to be nearer to the normal, but when due allowance is made for later invention, surely no campaign is better worth studying than this of 1815. Fought out between two great captains in the space of a few days and over a few miles of country, it forms a very epitome of war in all its branches. The doubt up to the last moment as to Napoleon's intentions; the strategical surprise; a concentrated force with one line of communication operating between two forces with divergent lines; the handling of D'Erlon's force and the attempt to effect a concentration on the battle-field at Ligny; the British and Belgian rearguard action at Quatre Bras and the retreat to Waterloo; Wellington's masterly disposition of troops as contrasted with Blücher's two days earlier; his telling use of advance posts, Hougoumont and La Haye Sainte, breaking up Napoleon's massed attacks; the concentration of forces on the field and the great counter-stroke against Napoleon's right and rear, so largely the result of Blücher's loyalty and force of character; finally the stupendous defeat, the inevitable result of this most difficult manœuvre when successfully accomplished, as it was here, at Königgrätz and on one or two other occasions in history; and the relentless pursuit. They were indeed crowded days of glory. And then Wellington's characteristic comment: "A damned serious business. Blücher and I have lost 30,000 men. It has been a damned nice thing, the nearest run thing you ever saw in your life. . . . By God! I don't think it would have done if I had not been there."[1]

Since those days Moltke has perfected the art of marching to the battle-field, of concentration by many different roads upon a single objective, and we have seen the same manœuvre developed under more difficult circumstances at Liao-yang. Arising from Moltke's tactics, so closely followed by Oyama in Manchuria, there have been many fierce disputes upon the comparative virtues of envelopment and penetration on the battle-field. Yet all these theories, these varying systems and bitter discussions, are based upon one solid foundation, the development of fire; for from the days of the long-bow to those of the modern tank it is to the development of fire that all changes in tactics are directly due. To-day, more than ever before, the power of developing fire is in the hands of the commander who seizes and retains the initiative. This he may do either through superior readiness for war and quicker mobilization, through a better strategical plan, or through superior numbers. In any case he will require superiority in the air, and better, more numerous or more skilfully handled covering troops, cavalry and rapid tanks. Decisive battle will be the object, and the experience of the World War would appear to prove that quick decision can only be obtained through envelopment. Converging lines of communication drawn from widely separated bases may then be a positive advantage, especially since the rapid means of communication now available have overcome much of their danger. Moreover, so devastating is the effect of converging or enfilade fire from modern weapons that the troops exposed to it are in deadly danger. An attacking force, it is true, may conceal an exposed flank by the skilful use of smoke, but not so the defending force, and the increased range and rapidity of modern arms are on the side of the attack rather than of the defence. Each commander will, therefore, strive with all his energy and will power to secure the initiative at the outset of a campaign; every artifice will be used and every engine will be employed. Sooner or later, however, one or other of the combatants will be forced to the defensive, but, if he is master of his art he will not resign himself to his fate any more than did Wellington and Blücher in 1815 or Joffre in 1914. He will devote all his skill and resource to recovering his freedom of action and to assuming that domination over events which will enable him, in his turn, to impose his will upon his adversary.

This change of fortune can only be brought about by a tactical counter-stroke, exactly as was done by the Entente armies in

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[1] *The Creevy Papers*, vol. i., chap. x.

1914 and again in 1918. On each occasion they aimed at the envelopment of the enemy forces, for the very successes which had brought the Germans so close to Paris afforded to a commander, sufficiently skilful to seize it, the opportunity to deliver an enveloping counter-attack—the very opening he needed. Thus it is clear that even to-day, provided the opposing armies are well led, neither can have the monopoly of enveloping movement or fire development, but that, as has always been the case in war, "everything must be the result of combination and talent." So it is that so soon as a great commander finds that, for one reason or another, the initiative has passed from him he will think only of the counter-offensive whereby he is to regain it. He cannot wait, like Wellington at Salamanca, or Napoleon at Austerlitz, and watch his enemy commit a fatal error, for modern battle-fields are too vast, and mistakes are committed too far from the field of action. His aeroplanes will no doubt bring him much useful information, but before he can turn it to advantage the whole situation may have altered.[1] He cannot, therefore, so plan his battle as to make the action of his reserve, or striking force, dependent upon some chance or fleeting opportunity. Instead he must form some new plan, some new combination of his own, and carry it through with undiminished audacity and resolution. It is, perhaps, this blindness of the commander which has brought about the greatest change of all in modern grand tactics, for he cannot now survey the whole even of his own force, and much more than formerly he is dependent upon his subordinates, who must, in Napoleon's phrase, "understand his system" if he is to be well served.

But there is another aspect of the matter. With weapons of still longer range and greater accuracy than our modern artillery, with small-bore weapons of still greater rapidity of fire than the Maxim or the Lewis gun, fronts will become more and more extended, and the establishment of continuous lines will be possible even to comparatively small armies. It will be easier to use natural obstacles for the protection of flanks, which will become more difficult to find and to turn. In this respect the defence would appear to have gained a distinct advantage over the attack, in that frontal assaults are likely to become more inevitable. The indirect result of the increased volume of fire seems, therefore, to be more important than the direct effect. Against this it is possible to put forward the suggestion that frontal attacks are actually less to be feared than they were. Formerly they had two disadvantages—first, that they were desperately costly in life; secondly, that at the best they resulted merely in the tactical retirement of the enemy, not to his destruction or to any great and decisive strategical result. Now, however, owing to the same increase of fire power which has strengthened the defence, it is possible for the assailant to make all his dispositions for attack out of sight of and unperceived by any enemy who elects to stand purely on the defensive. Little more than a hundred years ago Napoleon drew up his army in front of La Belle Alliance in full view of Wellington on the slopes of Waterloo; a few years earlier Marmont had manœuvred in front of Wellington at Salamanca and met his doom exactly as had Kutusov, for exactly the same reason, at Austerlitz. All this is now changed, and in 1918 Ludendorff showed how, even without command of or even superiority in the air, it is possible for the assailant to make his arrangements for attack without being detected; and this instance is the more remarkable since his intention had been foreseen and his troop movements were at least suspected. It is this power of massing unseen against the portion of the front selected for attack that gives the assailant his principal chance of success, even should the attack not come as a complete surprise. Moreover, the very extension of the front which, by our hypothesis, has rendered the frontal attack inevitable, makes it extremely difficult for the defender to ensure that his reserves are best placed for resistance. Even with superiority in the air and good intelligence, a commander who has lost the initiative and has been forced to stand on the defensive cannot be absolutely certain when the blow will fall. With his widely extended lines, it is more than probable that he has several delicate points to guard, failure at any one of which would give the enemy some considerable strategical advantage. Hence the disposal of the reserves intended to be used for defence becomes a matter of extreme difficulty, and unless the assailant's intention is exactly anticipated, as is not very probable, much priceless time must be lost in moving them to the point of danger, and meanwhile the assailant may have secured an initial advantage of which it will be extremely difficult to deprive him.

This brings us to the second weakness of frontal attacks—the difficulty of winning any real strategical result. That weakness was very real so long as the only result of defeat was to compel an army, as in the Russo-Japanese War, to retire along its line of communications to a fresh position somewhat nearer to its base. But with modern lines, extended even more widely than in Manchuria, a new tactical idea has been evolved. Partly owing to our enlarged ideas on the massing and use of artillery, partly owing to the improved engines of destruction which brought a great accession of strength to the attack, and partly owing to the tactical use of aeroplanes, there grew up that idea of a "break-through" which was completely realized in the World War only in Palestine, but which came near to accomplishment in France in March 1918. But perhaps the factor which contributes most to the chance of a successful "break-through" is that very difficulty in the disposal and handling of reserves to which reference has just been made. In this connexion it must be remembered that tanks have given the attacking force an altogether new power of pushing home an initial success with rapidity and vigour. In place of the slow-moving infantry which laboured painfully through the shell-torn swamps of the Somme or the Passchendaele ridges, we may well see a strong force of tanks, able to move at a steady pace for several hours on end, turning defeat into rout, disorganizing communications and spreading panic before reserves can be brought from distant parts of a widely extended battle-line. Hence it would seem that just those developments which give to the defender the power to defend his flanks and to guard against envelopment have at the same time given to the frontal attack a greater chance of success than it ever had.

In this case it may be asked, How should the commander who has lost the initiative and been compelled to stand on the defensive attempt to recover control of his campaign? The answer is, by exactly the same methods as those by which Foch recovered it in July 1918—that is to say, by counter-attack. There is no other means. And this is true whether the attack be enveloping or frontal, and it is if possible more essentially true than ever before, since, owing to the distance to be covered, reserves which are held for purely defensive action are in great danger of being too late. Not only can they not win a battle; they may well be too late to save it. Thus even the briefest consideration of defence brings us to the old conclusion *that attack must be met by counter-attack, that offence is still the soul of defence, and that the true rôle of the reserves in a defensive action is to convert it into an offensive one.* These are but the oldest principles of battle fighting, true from the days of Alexander the Great until to-day, but always put into practice by new means and new methods. This is the essence of Marshal Foch's own appreciation of Napoleon (London *Times*, May 5 1921):—

> "Often during the darkest days of the war we used to ask ourselves what Napoleon would do with the armies of to-day. . . . This is what he would have said: 'You have millions of men; I never had them. You have railways, telegraphs, wireless, aircraft, long-range artillery, poison gases; I had none of them. Yet you make nothing of them. Stand aside while I show you how to use them.' In a month, or perhaps two, he would have changed everything, reorganized everything, employed everything in some new way, and crushed the bewildered enemy."

There in a few words we have the marshal's views on his great predecessor. It is not that he would have discovered some spectacular and dramatic way of winning the war, but merely that he would have bent scientific discovery to his own ends and put each new invention to its proper tactical use. Thus he would have won battles, and when he had finished his work all would have appeared obvious and simple. That is the way of the artist; and the great tactician is a supreme artist. (N. M.*)

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[1] Moreover, so many movements will be carried out at night that even the aeroplanes will miss a great deal.

TAFT, LORADO (1860–), American sculptor (*see* 26.354), was elected to the National Academy in 1911. He was director of the American Federation of Arts from 1914 to 1917 and in the latter year was appointed a member of the board of art advisers for the state of Illinois. He received a silver medal at the Panama-Pacific Exposition, San Francisco, 1915. His recent works include: "Black Hawk" (1912, figure of an American Indian, at Oregon, Ill.); Thatcher Memorial Fountain (1918, at Denver, Colo.); and "The Fountain of Time" (1920, at Chicago). In 1921 he published *Recent Tendencies in Sculpture.*

TAFT, WILLIAM HOWARD (1857–), 27th President of the United States (*see* 26.354), antagonized a considerable branch of his own party in 1911 by his endeavour, which proved unsuccessful, to secure a reciprocity agreement with Canada. Meanwhile wide public interest had been awakened in the conservation of national resources and the President's attitude was attacked by the conservationists. In 1909 Gifford Pinchot, chief forester, charged Richard A. Ballinger, Secretary of the Interior, with being opposed to conservation. A Congressional committee, after investigation, exonerated the Secretary, but he later resigned. The attack upon Ballinger was denounced by the President, who continued to be criticized in connexion with the sale of public lands, and who dismissed Pinchot from office. The President lost ground also as a result of a breach of friendship between himself and Theodore Roosevelt, who supported Pinchot. In 1912 the President signed the Panama Tolls bill, exempting American coastwise shipping from tolls; he affirmed that it did not violate the Hay-Pauncefote Treaty, and believed also that the United States had the right to fortify the canal. At the same time he expressed a readiness to arbitrate the question with Great Britain, who had protested. Cleavage within his party was crystallized at the Republican National Convention in 1912. In the pre-convention campaign Roosevelt came forward as leader of the progressive wing against Taft as leader of the conservative or "stand-pat" wing, and the mutual recriminations were bitter. At the convention, however, the conservatives controlled the party machine, and the committee on credentials by arbitrary decisions excluded most of Roosevelt's contesting delegates. Taft was renominated on the first ballot, receiving 561 votes, 21 more than the required majority. Roosevelt denounced the action of the convention and later was nominated by the newly formed National Progressive party. In the ensuing election Woodrow Wilson, the Democratic nominee, won an overwhelming victory, securing 435 electoral votes to 88 for Roosevelt and 8 for Taft. President Taft carried only two states, Utah and Vermont, and those only by small pluralities. The general feeling throughout the country was that President Taft had shown a deplorable lack of administrative firmness, his good nature having caused him to vacillate. On retiring from the presidency in 1913 he became Kent professor of law at Yale, but devoted much time to lecture engagements. In 1913 he was elected president of the American Bar Association, and in 1914 first president of the American Institute of Jurisprudence, organized to improve law and its administration. After the outbreak of the World War in 1914 he supported President Wilson's strong stand for neutrality. In 1915 he approved the Army League's campaign for preparedness. He was an active promoter of the League to Enforce Peace, but after America's entrance into the war he argued that victory was necessary for attaining lasting peace. In 1918 he was appointed by the President a member of the National War Labor Board for arbitrating labour disputes during the war. In 1919 he endorsed the Peace Treaty of Versailles, regarding its most important part to be the Covenant of the League of Nations. He spoke throughout the country in behalf of the League. After the Senate's rejection of the Peace Treaty he urged reservations if these would secure ratification. In July 1920 he was appointed to represent the Grand Trunk railway on the board of arbitration for determining the sum to be paid by the Dominion of Canada when the road was to be made a part of the national system. He supported Warren G. Harding, the Republican candidate for president in 1920. On June 30 1921 he was appointed by President Harding Chief Justice of the Supreme Court to succeed Edward Douglas White, deceased.

He was the author of *Popular Government: its Essence, its Performance, and its Perils* (1913); *The Anti-Trust Act and the Supreme Court* (1914); *The United States and Peace* (1914); *Ethics in Service* (1915, Yale lectures); *Our Chief Magistrate and his Powers* (1916, Columbia lectures) and *The Presidency: its Duties, its Powers, its Opportunities and its Limitations* (1916, lectures at the university of Virginia).

TAGORE, RABINDRANATH (1861–), Indian poet and author, was a member of a well-known Bengali family noted for its activities in literature, art and religious reform as well as for its public benefactions. In 1921 the head of the orthodox Hindu branch was Maharaja Bahadur Sir Prodyot Coomar Tagore (b. 1873), a great-nephew of Prosunno Coomar, who was the first Indian to be nominated to the Viceroy's Legislative Council and founded the Tagore law professorship in the university of Calcutta. The grandfather of Rabindranath was Dwarkanath, "merchant, philanthropist and reformer," who was known to his contemporaries as "Prince Tagore." He visited England in 1842 and again in 1845, sat to D'Orsay for his portrait, and, dying of fever in London in 1846, was buried at Kensal Green. In conjunction with Raja Rammohan Roy he initiated the movement of religious reform which took shape as the Adi Brahmo Somaj. This work was continued by his son Maharshi Devendranath, of whose seven sons, Dwijendranath, the eldest, devoted himself to the study of philosophy; Satyendranath, the second, was the first Indian to enter the covenanted civil service and served for 35 years in the Bombay Presidency; and Jyotirendranath, the third, was an accomplished musician. Their cousins, Abanindranath (b. 1871), Gogonendranath and Narendranath, became distinguished artists. Rabindranath, the youngest son, was sent to England to study law, but soon returned. In 1901 he established the famous Shantiniketan, or abode of peace, at Bolpur, a village 93 m. from Calcutta. Originally organized as an *asram*, or retreat, by the Maharshi, it was developed by Rabindranath into a school conducted on unconventional lines, and he aimed at enlarging it into an international university which should comprehend the whole range of eastern culture. His outlook upon the west was thus summarized by him in a letter published in the Indian press at the close of 1919: "The bulk of English people can never be in a normal state of mind with regard to us, our situation being unnatural, and I am impelled to think that it is best for us to do our own work quietly in our own surroundings." Gandhi's policy of noncoöperation was, however, severely condemned by him as perverted nationalism, "which was making of India a prison," in a letter addressed to the principal of his school at Bolpur in June 1921. He paid frequent visits to Europe, Japan and the United States (where his son Rathindranath became a student in the university of California), and carried through several lecturing tours. His reputation as a writer among his own countrymen was early assured, and the 30 poetical and 28 prose works composed by him in Bengali are now regarded as classics. The English public first became interested in his works in 1912, and his fame rapidly spread. In 1913 he was awarded the Nobel Prize for literature and utilized the whole amount, £8,000, for the upkeep of the school at Bolpur. He was given the degree of Doctor of Letters in the university of Calcutta and accepted a knighthood in 1915, but addressed a letter to the Viceroy in 1919, resigning the title as a protest against the methods adopted for the repression of disturbances in the Punjab.

His more important books, of which English translations have been published, are the poems *Gitanjali* (Song Offerings) (1913), *The Crescent Moon* (1913), *The Gardener* (1913), *Songs of Kabir* (1915), *Fruit Gathering* (1916), *Stray Birds* (1917), *The Lover's Gift and the Crossing* (1918); the plays *Chitra* (1914), *The King of the Dark Chamber* (1914), *The Post Office* (1914), *The Cycle of Spring* (1917), *Sacrifice* (1917), and other plays; the novels, *The Home and the World* (1919), *The Wreck* (1921); as well as a volume of letters, *Glimpses of Bengal* (1921), and the short stories *Hungry Stones*

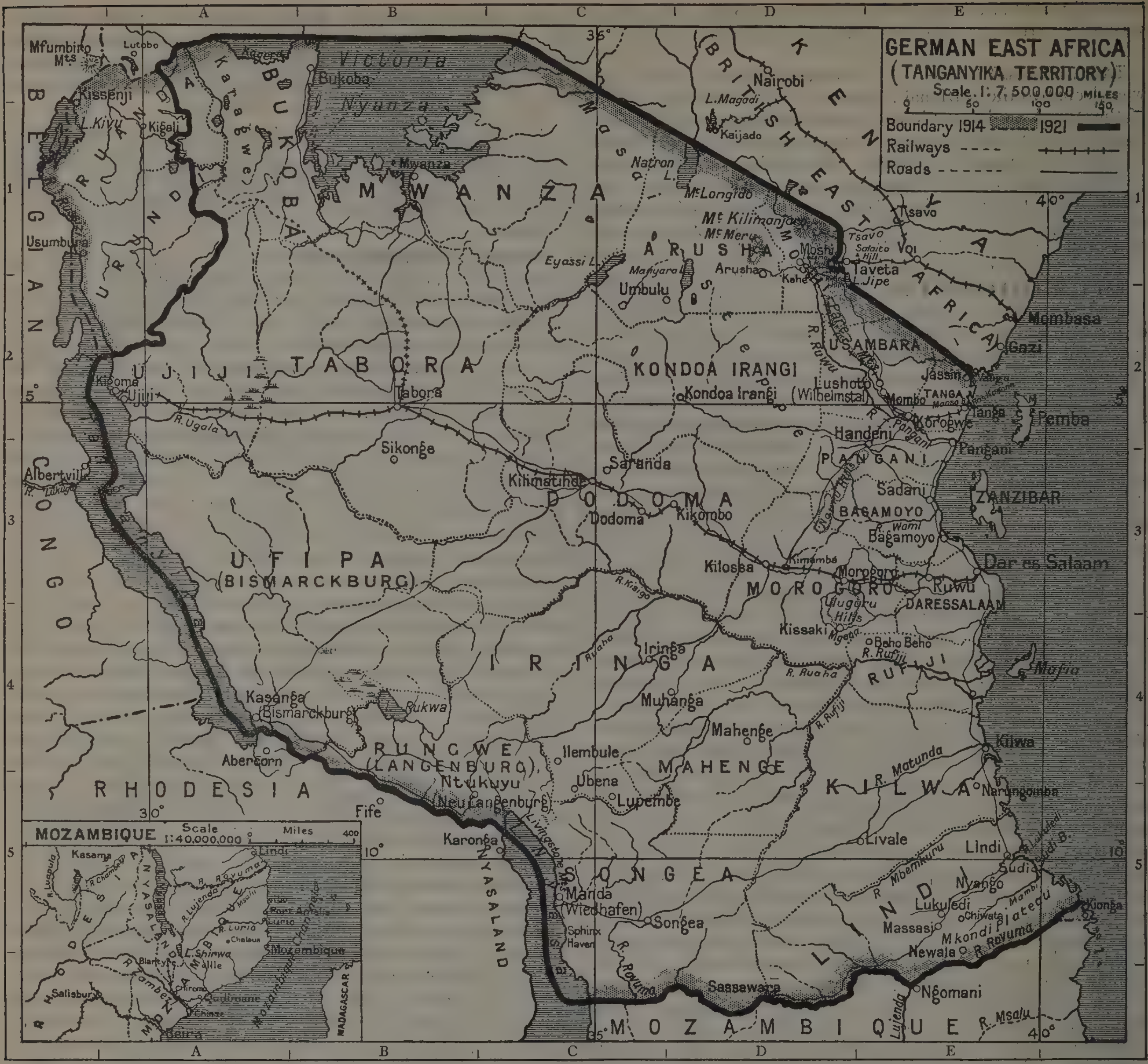
GERMAN EAST AFRICA
(TANGANYIKA TERRITORY)
Scale 1: 7,500,000 MILES
0 50 100 150
Boundary 1914 1921
Railways
Roads
MOZAMBIQUE
Scale 1:40,000,000
Miles
400
Victoria Nyanza
Bukoba
Mwanza
MWANZA
BUKOBA
Karagwe
RUANDA
URUNDI
Kissenji
L. Kivu
Kigali
Usumbura
Mfumbiro Mts
Lutobo
Kagera
BELGIAN CONGO
Kigoma
Ujiji
UJIJI
TABORA
Tabora
R. Ugala
Sikonge
Albertville
Lukuga
UFIPA
(BISMARCKBURG)
Kasanga
(Bismarckburg)
Rukwa
Abercorn
RHODESIA
RUNGWE
(LANGENBURG)
Ntukuyu
Neu Langenburg
Fife
Karonga
NYASALAND
Manda
(Wiedhafen)
Sphinx Haven
SONGEA
Songea
Sassawara
MOZAMBIQUE
R. Rovuma
Lujenda
R. Msalu
LINDI
Lindi
Sudi
Nyango
Lukuledi
Massasi
Mkondi Plateau
Newala
Ngomani
Kionga
Chiwata
Livale
R. Mbemkuru
KILWA
Kilwa
R. Matunda
Narungombe
MAHENGE
Mahenge
Ilembule
Ubena
Lupembe
IRINGA
Iringa
Muhanga
R. Ruaha
R. Rufiji
RUFIJI
Mafia
Beho Beho
Kissaki
Uluguru Hills
MOROGORO
Morogoro
Kilossa
Kimamba
DARESSALAAM
Dar es Salaam
Ruwu
R. Wami
Bagamoyo
BAGAMOYO
Sadani
ZANZIBAR
Pangani
PANGANI
Handeni
Korogwe
Tanga
TANGA
Mombo
Lushoto
(Wilhelmstal)
Jassin
Pemba
USAMBARA
KONDOA IRANGI
Kondoa Irangi
Saranda
Kilimatinde
DODOMA
Dodoma
Kikombo
R. Kisigo
ARUSHA
Arusha
Mt Meru
Mt Kilimanjaro
Moshi
Kahe
Taveta
L. Jipe
Mt Longido
Natron L.
Masai Steppe
Eyassi L.
Manyara L.
Umbulu
Nairobi
L. Magadi
Kaijado
KENYA
(BRITISH EAST AFRICA)
Tsavo
Voi
Salaita Hill
Mombasa
Gazi
R. Ruvu
35°
40°
30°
5°
10°
A B C D E
1 2 3 4 5
Kasama
Lindi
R. Rovuma
Port Amelia
Ibo
R. Lurio
Chalaua
Mozambique
L. Shirwa
Blantyre
Zomba
R. Zambesi
Tete
Salisbury
Chinde
Quelimane
Beira
Mozambique Channel
MADAGASCAR
NYASALAND
RHODESIA

(1916) and *Mashi* (1918); and republished lectures, *Sadhana, or the Realization of Life* (1913), *Nationalism* (1917), *Personality* (1917). He also published his *Reminiscences* (1917).

See W. W. Pearson, *Shantiniketan* (1917); article in *Hindusthanee Student* (March 14 1921). (H. E. A. C.)

TANGANYIKA TERRITORY, the name officially given in Jan. 1920 to that part of ex-German East Africa administered by Great Britain. It has an area of some 365,000 sq. m., compared with the 385,000 sq. m. of the former German protectorate, the rest of the region having been added to Belgian Congo except the small Kionga district at the mouth of the Rovuma, which was incorporated in Portuguese East Africa. Urundi and Ruanda, the provinces acquired by Belgium, were the most populous parts of German East Africa, and whereas the population of the German protectorate in 1916 was estimated at some 8,000,000 that of Tanganyika Territory in 1921 was under 5,000,000. Europeans in 1920 numbered about 2,200, of whom 1,400 were British and 300 Greek. The largest towns were Dar es Salaam (20,000 inhabitants) and Tanga (16,400) on the coast, and Tabora (25,000) inland.

With the conquest of the country in 1916–7 civil administrators were appointed by the British and Belgians in the areas they occupied, Mr. (afterwards Sir) H. A. Byatt being chosen by the British. His headquarters were at Dar es Salaam. Iringa, Mahenge and other regions were, until March 1918, administered by Gen. Northey's chief political officer, Mr. (afterwards Sir) H. L. Duff. At first the Belgians, with Col. Malfeyt as Royal Commissioner, administered, from Tabora, the western area from Victoria Nyanza to near the southern end of Tanganyika. In March 1918 the Tabora region was taken over by the British. By decision of the Supreme Council in May 1919 the mandate for German East Africa was assigned, without qualification, to Great Britain, but Belgium advanced claims to retain not only Urundi and Ruanda but a much larger area, including the province of Ujiji, with the lake terminus of the railway from Dar es Salaam. The matter was settled by an Anglo-Belgian agreement signed in Sept. 1919. By this agreement Ujiji province went to Great Britain, and also such parts of Urundi and Ruanda as were needed to allow the projected railway from Tabora to Western Uganda—a link in the Cape to Cairo scheme—to remain in British administered territory. By another convention signed in March 1921 Belgium obtained the right of transit of goods free of all custom duties over the railway from Kigoma (the lake terminus of the line) to Dar es Salaam, and in general by any other route adapted for transit, together with areas (on payment of nominal rent) at both ports for wharfs, bonded warehouses, etc. The districts which Belgium had temporarily administered but which fell within the British mandatory area were formally transferred to the British administration on March 22 1921.

Orders in Council for the government of Tanganyika Territory were made in July 1920. The next month the administrator, Sir Horace Byatt, was gazetted governor and Sir William M. Carter appointed Chief Justice. The terms of the mandate, as proposed by Britain, were made public in March 1921.

In accordance with the terms of the Covenant of the League of Nations the mandatory was bound to allow equality to nationals of all members of the League in matters of residence, trade and commerce. This condition had an important bearing on the position of British Indians in the territory. It prevented any discrimination being made against them, as had been done in the neighbouring colony of Kenya. A proposal had been made during the World War that the territory should become, in effect, a reserve for India. This proposal could not be adopted, but in Aug. 1919 the Colonial Office consulted the Indian Government as to the desirability of setting aside special areas for colonization by Indians. Investigations were made in the territory by Sir Benjamin Robertson, with the result that the Government of India in a despatch dated Feb. 10 1921 stated that it was improbable that Indian farmers would be attracted to Tanganyika, where only large estates seemed likely to succeed.

The Indian Government moreover drew attention to the rights Indians possessed under the mandate and urged that Indians should also be granted perfect political equality with other settlers, of whatever nationality. Indians in Tanganyika numbered in 1921 some 15,000. They had penetrated to every part of the territory, and save for the competition of Greeks in certain areas practically monopolized the retail trade.

The transition period—1918–21—proved difficult, and there was much delay in setting up the new machinery of government. This was in part inevitable, as until the Treaty of Versailles came into force, an event delayed until Jan. 20 1920, the country was still legally German territory. The whole of the German settlers were repatriated and their estates sold during 1921. Until this process was completed no new land grants were made, and agriculture was practically at a standstill. A Land and Mines Department was, however, formed towards the close of 1920, and mining regulations were promulgated early in 1921. The only mineral worked on a considerable scale was mica, the chief deposits being in the Uluguru mountains. Between 1917 and 1920 mica valued at £40,000 was exported for the British Ministry of Munitions. In March 1920 the mines were closed. The alleged indifference of the administration to the needs of the commercial and planting community evoked strong protests, and further difficulties were caused by the change from the German currency in rupees at 15 to the £ to the florin at 10 to the £, preliminary to the substitution of the shilling for the rupee, as in Kenya (*see* KENYA COLONY). The exports and imports for 1917–20, taking the rupee at 15 to the £, were:—

	Imports	Domestic Exports	Re-exports
1917–8	£1,109,000	£591,000	£36,200
1918–9	£1,007,000	£674,000	£26,200
1919–20	£1,158,000	£1,330,000	£96,300

These figures did not include sisal and cotton to the value of £284,000 exported by the custodian of enemy property nor the mica exported for the Ministry of Munitions. The principal exports were sisal, cotton, hides, skins, copra, coffee and ghee. Up to 1920 the exports were mainly accumulated stocks. The chief imports were cotton piece goods, rice and other foodstuffs. The re-exports represented transit trade with the Belgian Congo. Trade was mainly with Zanzibar, Kenya and India. For the year ending March 31 1920 the net tonnage of the ships cleared was 193,000 (154,000 British).

Sir Horace Byatt and his staff had a difficult task in building up a new administration on the ruins of the German system. In native affairs they sought to reëstablish the old tribal organization, almost destroyed under German rule, and steps were taken to abolish slavery. During 1918 and 1919 the Government had to feed large numbers of the people, who, as a result of continued drought, suffered severely from famine. The Indian penal codes were introduced, but it was not until 1921 that civil courts having jurisdiction over non-natives were established. The absence of such courts was not an unmixed evil in this period of transition, though traders, who could not sue for debts, were loud in complaints. But the tendency to wild speculation and to charge high rates of interest was checked. Customs laws—with a general *ad valorem* duty of 10% on imports—similar to those in force in Kenya were introduced before the World War ended, and, in 1921, British weights and measures. Revenue was derived chiefly from the customs dues, trade taxes and licences, and hut and poll taxes, each able-bodied male native paying not fewer than three florins a year. While revenue naturally rose as the area under civil administration increased, so likewise did expenditure. Up to March 31 1920 the total revenue received was £1,596,000, and the total expenditure £1,365,000. It then became necessary to spend much larger sums to put the country into working order, and for the year ending March 31 1921 the Imperial exchequer made a grant of £330,000. For the next financial year the Imperial exchequer made a grant of £914,000—the Colonial Office had asked for £1,500,000. Heavy expense was incurred in making good the damage done during the World War to railways, roads and harbours. The garrison maintained three battalions of the King's African Rifles; cost about £250,000 yearly.

Under British administration the German names given to certain districts and towns were replaced by native names. The following changes were made: Wilhelmstal district became Usambara district and Wilhelmstal (town) Lushoto. Bismarckburg district became Ufipa and Bismarckburg (town) Kasanga. Langenburg district became Rungwe and Neu Langenburg (town) Ntukuyu. Wiedhafen, on Lake Nyasa, became Manda. In 1917 Oldoinyo Lengai (God's mountain) at the S. end of Lake Natron was in frequent eruption; it is the only known active volcano in the territory. In May and June 1919 very severe earthquakes occurred in the S.W. part of the territory. By the fall of the side of a mountain near the N.E. end of Lake Nyasa some 5,000,000 tons of earth and rocks were displaced: the falls in the Livingstone mountains altered considerably the face of the country.

See *Report on Tanganyika Territory* (1921), a valuable official monograph covering the period to the end of 1920; the *Colonial Office List* for parliamentary papers; A. S. and G. G. Brown, *The South and East African Year Book and Guide* (London, annually); Hans Meyer, *Ostafrika* (1914); F. S. Joelson, *The Tanganyika Territory* (1921), and the authorities cited under GERMAN EAST AFRICA.

(F. R. C.)

TANKS.—The name "Tank," applied during the World War to a bullet-proof, armed, track-driven, climbing, automobile, machine-gun destroyer, was first given to an engine of war in Dec. 1915, as a blind to conceal the true nature of the experimental fighting machine then being secretly constructed in England. After the first appearance of the machine in the field in Sept. 1916, the word was universally adopted. It is here used to describe all armed and armoured automobiles of a fighting type propelled on the caterpillar system. To the British is due the credit of first conceiving and introducing this weapon, which was destined to exert a decisive influence on the course of the war on land.

The conditions responsible for the birth of the tank were not in principle new. They were the same as have always existed in war, but intensified by the application of modern methods to the situation unexpectedly created by the course of the land campaign on the western front. Neither the strategic development nor the outcome of its full tactical exploitation had been foreseen. It was owing to this that so vital a factor as the tank proved to be should have had to be improvised during the course of hostilities as the solution of an age-old problem. The problem was that of giving effective assistance, in the shape of direct protection, to infantry advancing under fire.

Apart from coöperation elsewhere, assistance can be given in two ways. It can be effected either by artillery, which with its power of long range action can support advancing infantrymen whilst in motion, and therefore unable to make full use of their rifles, by shooting over their heads, or more directly by the provision of some form of physical protection against blows or missiles. The attempt to provide protection whilst retaining the power of movement both for hand-to-hand fighting and also against missiles, as opposed to that afforded by fortification to troops when stationary, has recurred throughout the history of warfare. The best known examples of it are the shield and body armour carried or worn by the man. Though the need for these did not then cease, their practicability was terminated by the introduction of firearms, since no weight of material that the human being or the horse could carry was of avail against missiles propelled by the force of powder. There was also the idea of giving wheel-borne collective protection to several men at a time, and devices for doing this have been numerous, and have varied according to the progress of mechanical knowledge and the resources available at the moment.

The Assyrians made use of war chariots, or mobile fortresses, which were adopted from them by the Egyptians and Israelites.[1] Chariots were also employed by the Chinese in 1200 B.C. Then, for siege warfare, there were the Roman *Testudo*, or "Tortoise," and the mediæval *Beaufroi*, or "Belfry," which was usually assisted by the "Cat" or "Sow," an engine of a more mobile type. About 1400 A.D. Conrad Kyeser wrote on this subject, and some 20 years later Fontana and Archinger designed cars, the latter a large machine to carry 100 men. In the middle of the 15th century appeared the "Scottish War Carts," known also as "Tudor War Carts." In 1472 one Valturio designed a machine to be propelled by wind sails. In 1482 Leonardo da Vinci wrote to Ludivico Sforza describing a machine which, except in motive power, was in essentials the counterpart of the tank. A battle car was designed for the Emperor Maximilian I., and in 1558 Holzschuher described one for use with infantry and cavalry. Eleven years later two land battleships are stated to have been built by Simon Stevin for the Prince of Orange. Except those propelled by the wind, all the above were moved by the muscular power of men or horses. In 1634 David Ramsey took out an English patent for a self-moving car, and Caspar Schott designed one for use against the Turks. In 1769 Cugnot, a Frenchman, actually constructed a steam-driven road car which could be used in war; and later Napoleon wrote a paper on the subject of the automobile in war. In 1855 James Cowan, in England took out provisional protection for a "locomotive battery fitted with scythes to mow down infantry," and endeavoured to persuade Lord Palmerston to take up this adaptation of the chariot. Capt. Nadar put forward a similar suggestion in 1870; and in 1900 John Fowler, of Leeds, produced armoured steam traction engines for S. Africa.

The introduction of rifled breech-loading firearms did not force into use any system of man-borne or horse-borne protection, notwithstanding that the range, volume and accuracy of all kinds of fire was immensely increased and its effect rendered correspondingly more deadly. For, it was less possible than it had been to produce shields or body armour which were capable of resisting the greater penetration of the rifle bullet and yet light enough to be carried; whilst no practical method of mechanical propulsion across country of the heavy weights involved in collective protection had been discovered. And yet, as time passed, the need for some more intimate form of help for the infantry soldier than that afforded by artillery grew more insistent. It was accentuated by the invention of the machine-gun and of the magazine and the automatic rifle, and by every successive improvement in small arms or artillery. In point of fact, however, the mechanical difficulties had been overcome some years before 1914. The "caterpillar," or "track," or "endless band" system of propulsion, by which weight is distributed by the increase of the surface bearing on the earth, instead of being concentrated, as with a wheel, and a better tractive effect obtained, which had been known, and in the United States largely employed, for some years, had furnished the key to cross-country mobility; and the perfecting of the internal combustion engine had subsequently given to the world compact power with light weight.

The principle of the "footed wheel," "caterpillar," or "track" system of propulsion appears to have originated in the patent of Richard Lovell Edgeworth in 1770 for a device whereby a portable railway could be attached to a wheeled carriage.[2] This employed the basic principle of all subsequent track-driven machines. Then followed patents for tracks of different natures, by Thomas German in 1801, William Palmer in 1812, John Richard Barry in 1821. In 1846 there was the Boydell engine, with footed wheels, improved upon by Andrew Dunlop in 1861; whilst in 1882 Guillaume Fender and John Newburn designed modifications of tracks. In the following year the actual use of tank-like engines for war was predicted by M. Albert Robeida in *La Caricature*.[3] In 1886 there came the Applegarth tractor, and the Batter tractor was patented in the United States two years later. The latter anticipated the tank in many details. All the above machines were steam propelled. In America steam locomotives with caterpillar tracks, some furnished with sleds or runners, had for years before the war been applied to haulage in lumber camps. After the appearance of the petrol engine Frank Bramond patented in 1900 a special form of track for pneumatic tired wheels. In 1907 a Rochet-Schneider car fitted with a chain track was tried for military traction purposes, and in 1908 a 70 H.P. Hornsby-Ackroyd chain track tractor took part in a review at Aldershot, and Hornsby also demonstrated a 75 H.P. Mercèdes motor car fitted with tracks, a speed of 20 m. an hour being attained on sand. Another British tractor, of the footed wheel type, was the Diplock Pedrail. In America petrol-driven caterpillar tractors had before the war become quite common for agricultural purposes, amongst them being the Bullock, Killen Strait and Holt tractors.

While experiments in petrol-driven caterpillar-track tractors for military use had been carried out by the British authorities before the war, there had been no serious investigation or proposal by any nation to develop the caterpillar principle for fighting as opposed to transport purposes. In 1903 Mr. H. G. Wells had in fiction anticipated the intervention in battle of fighting machines which amounted to large-size tanks. Five years later Capt. T. G. Tulloch had suggested a scheme for a steam-driven pedrail armed and armoured trench-crossing machine, and in 1911 had put forward a proposal to use armed and armoured linked Hornsby-Ackroyd tractors with a crew of a hundred men. And in 1912 Mr. L. E. de Mole, an Australian, actually placed before the War Office a design, followed in 1916 by a model, for a climbing, fighting track-driven machine. This was the real prototype of the tank; and in some particulars, especially its pivoted ends and flexible chain tracks for steering a curved course, it seems to have been superior to the machine actually produced. Unfortunately, whatever may have been official opinions or intentions in regard to this scheme, no action was taken.[4] In Dec. 1915 a caterpillar-track wire-cutter, invented by M. J. L. Breton, the French deputy, and called the *Tracteur-porte-cisaille*, or *Tracteur Breton*, was tried, and orders were given for a few, which, however, were not constructed. The *Boirault* cross-country motor, which consisted of an articulated polygon, was also tried, but was found impracticable owing to lack of steering power.

In the years preceding 1914, military opinion generally inclined to the belief that in any future struggle open warfare, or a "war of movement," alone was probable; that in such a campaign mobility was the essential; and that there would not be many occasions when a sheer unassisted frontal attack would have to be pressed to the end against carefully prepared positions held by unshaken defenders. It was appreciated that such operations if attempted would be costly to the infantry, though how costly was not realized. And it was thought that they could usually be avoided by manœuvre, or, if they had to be carried out, would be assisted by envelopment or flank action which would relieve the task of the infantry by weakening the power or determination of the defence to fight to the end, or by operating at night or by surprise. The other, local, measures for assisting the infantry consisted of the bombardment and supporting fire of the attacking artillery up to the moment of actual assault, and the covering rifle fire from stationary infantry to cover those who could not use their rifles whilst actually moving forward, both of which were intended to keep down the defenders' fire. Great and, as it proved, undue reliance was placed on this concentration of the fire-power of the attack both from artillery and from small arms. It was hoped that by the continual cumulative reinforcement of the firing line until it had arrived at assaulting distance, and possibly dug itself in, a superiority of fire over the defenders would be gained sufficient to permit of the delivery—helped by artillery till the last moment—of the final assault with the bayonet. To enable the firing line to improvise some sort of protection when it could no longer move forward and was "frozen" to the ground, the infantry of all armies were equipped with a portable entrenching tool. The blade of this instrument, it was thought, also, might in some cases serve as a species of shield. Except by the Germans, wide extension of the attacking infantry was relied on to reduce the casualties. The Germans favoured mass tactics, trusting to break through by weight of numbers in spite of loss.

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[1] The greater part of this historical summary is taken from *Tanks in the Great War* by Brvt.-Col. J. F. C. Fuller, and *The Forerunner of the Tank* by H. M. Manchester, *The American Mechanist*, Vol. xlix. No. 15.

[2] *The Engineer*, Aug. 10 1917 and following issues.

[3] *Strand Magazine*, June 1917.

[4] Mr. de Mole's ideas had no influence on the evolution of the tank, for the originators of the latter were ignorant of his project, which only became generally known after the war, in Oct. 1919, some four years after the Mark I. tank was designed, when the subject came up before the Royal Commission on Awards to Inventors.

Up to the outbreak of the war, therefore, partly owing to a wrong estimate of possibilities; to a non-appreciation of the progress of science in its application to warfare; to fallacious reasoning based thereon; to the necessity for economy in military matters; and to the mechanical difficulties which had so long stood in the way and which were still thought to stand in the way, not only had no solution of the problem of providing mobile protection been arrived at, but no serious effort to reach a solution had for a long period been attempted. It followed that when hostilities opened in 1914, save for the development of artillery tactics and *matériel*, not one of the combatants was really in possession of better means of rendering possible the advance of infantry under fire than those which had been at the disposal of the opposing forces in the Russo-Japanese War of 1904–5. Indeed, in face of the actual growth in strength of the tactical defensive all armies were in this direction relatively weaker than in previous wars of modern days. And the weakness seems to have caused no anxiety. The prevailing complacency, however, was soon to receive a rude awakening.

It might be imagined, since the Germans first assumed the offensive on the western front, that they would have been the first to become aware of this deficiency and to feel the need for mobile protection. This was not so. Though they carried out a succession of attacks during the first month of the war they were not held up, except for a short time before the fortresses Liége, Namur, Maubeuge, and Antwerp, which they reduced by gunfire, and were able until they reached the Marne to continue their onward rush and to maintain their pressure. These attacks, with the exception of the abortive assault on Liége, were not executed against carefully prepared positions such as developed later, and were not usually of a purely frontal nature unassisted by tactical or threatened strategic flank operations or envelopment. Nevertheless, the German losses were extremely heavy, probably more severe than had been expected, but were thought to be the price of the apparent general success of their strategy at the time. They would have been truly justified had the German plan of campaign in fact succeeded. During this period such losses as they suffered were caused mostly by the quick-firing field artillery of the French on the one hand, and on the other by the musketry of the highly trained long-service British infantry hastily entrenched in improvised positions. This, it is stated, was so intense as to lead to the erroneous conclusion that the British Expeditionary Force had been secretly and lavishly equipped with machine-guns. And it was not owing to the strength of the resistance of the British or French field armies on the defensive that the progress of the Germans was finally brought to a standstill at the Marne.

It was only when the rôles of the two sides were reversed and the Allies assumed the offensive that the factors first came into play that eventually forced on them a fresh effort to solve the ancient problem. It was then, so far as the British were concerned, that it became apparent that, notwithstanding the weakness shown by permanent forts which had quickly succumbed to the power of specially designed ordnance, not only had the capacity for passive resistance of field defences been much increased, but the active power of the defensive had been very greatly enhanced by the application of modern methods and the scientific employment of modern arms.

More than a hint of this was given first by the nature of the resistance made by the German rear-guards during the battle of the Marne, notably at the crossing of that river at La Ferté-sous-Jouarre on Sept. 9, where the British 4th Div. was held up almost entirely by machine-gun fire in its endeavour to force the passage. It has since become known that the Germans had concentrated at this spot some 42 machine-guns, equivalent to the number of these weapons with 21 British battalions.[1] Later, during the fighting on the Aisne, greatly as the British were harassed by the German weight of artillery, it was mostly by machine-guns that their efforts to advance were checked, in some instances by the combined action of these guns and obstacles, such as abattis and wire entanglements, which though improvised, were found to be very effective, especially in view of the British weakness in artillery. Even at this early stage so strong were the German defences that the nature of the operations began to approximate to that of siege warfare. Later, at the beginning of Oct., in the more open action when the British endeavoured to outflank the German right to the north of Lille it was the same story. Their progress was in every direction opposed by machine-guns, sometimes in the open, sometimes in defended villages or houses, and often protected by improvised entanglements. Almost invariably the presence of German advance troops even in small bodies implied the presence of machine-guns which were handled with the greatest skill. The static warfare which then ensued on the western front during the winter of 1914–5 after the failure of the German offensive and the efforts of both sides to outflank each other on the coast, only accentuated the tendencies already noted. Its effect was to convert the struggle into a species of "field siege" warfare from which all possibility of manœuvre was excluded and in which all efforts at the offensive had perforce to be attempts to break through, entailing frontal attacks. Nevertheless, though this development had been expected by the Germans no more than by the Allies, and their immense preparations had been based on their original plan of an overwhelming and short offensive campaign on this front, they were in many ways well equipped for it. They were for a long time in possession of an immensely preponderating artillery—an advantage in attack or defence; whilst in defence the nature of the fighting gave full scope to their untiring industry backed up by their genius for field fortification. They also had a great proportion of technical troops and an armament of machine-guns far superior to that of the Allies. Though the relative conditions between the sides in these particulars changed, in the struggle which lasted for nearly four years the defensive was for a long time to prove stronger than the offensive, all attempts at which had to be carried out without finesse, by the method of brute force with its prodigal loss of life. It was during this period more especially that the machine-gun was to exert its influence and to reveal to the full its true power in the prepared defensive.

The machine-gun was no new invention, but its possibilities when cleverly used in numbers, though shown to some extent in the Russo-Japanese War of 1904–5, had not been proved. The British and German were equipped with almost identical types of the same gun differing only in detail, both being the outcome of the genius of the late Sir Hiram Maxim.[2] Previous to the Russo-Japanese War the weapon had never been held in great esteem by the British military authorities, except by a few enthusiasts; but the lessons of that campaign had led to an effort to increase the proportion of these guns in the equipment of the army beyond that which existed at the time of the S. African War. But this was not done owing to mistaken ideas of economy. It was also held that superior musketry fire discipline would make up for any deficiency in this respect, and great pains were taken to train the infantry to attain a rate of fire which in fact did exceed that of any other troops. On the other hand the machine-gun had become the weapon *par excellence* of the Germans. They perhaps of all nations had most correctly gauged its worth, the fact that it combined the maximum of killing power with the minimum of vulnerability, and the economy in a military sense of its adoption on a large scale. And after the Russo-Japanese War they had made a specialty of it. Without ostentatiously increasing the proportion of machine-guns with their infantry formations they had armed special units with them and accumulated a large stock in reserve. They had also trained a body of picked officers and men in their technical and tactical use. Their army, therefore, entered the war in this particular better equipped than any other. The first sign of this fact was given by the bold method in which they employed machine-guns in their onrush in the west. The next, as has been said, was the skilful way in which they used them in defence, at first in rear-guard operations, and then in the prepared defensive. In these tactics they excelled, and specialized in combining the intense fire power of the machine-gun with the obstacle—usually barbed wire entanglements—in a way which had never before been done. So far from the weapon being looked upon as a rare article impossible of replacement to be cherished and kept out of danger, it was not considered a disgrace for a gun to be lost once it had earned its value in killing the enemy. This apparent prodigality was a measure of the reserve of weapons available and the chief source of the great increase revealed in the strength of the defensive. The pre-war policy of the Germans was justified in the event. It was the combination of this weapon with barbed wire as initiated by them that suggested the need for the tank. And it was its intensive application and elaboration after the opposing armies had crystallized in two continuous closely opposing lines of carefully entrenched positions extending from the sea to Switzerland, that eventually brought the tank into being.

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[1] "*Die deutsche Kavallerie in Belgien und Frankreich*," Von Poseck, p. 102.

[2] The British were equipped with the Vickers, the French with the Hotchkiss, and the Germans with the Vickers-Maxim.

BRITISH TANKS

Early in Oct. 1914, it was borne in on the mind of a British officer who had special opportunities for ascertaining what was actually occurring, that the frontal assault of prepared positions, especially when adequate artillery coöperation was not available, had become impossible unless some more effective assistance could be rendered to the infantry than that previously contemplated and accepted as adequate; that this assistance in the absence of gun power and ammunition sufficient to blast a way through the whole enemy system of defences—trenches, obstacles and machine-guns—should consist of some protected power-driven machine which could force itself through barbed wire, climb across trenches and destroy by gunfire or crush by its weight the machine-guns of the defence. Knowing of the existence and cross-country capabilities of the American Holt caterpillar tractor, it occurred to him that a specially designed machine developed on similar lines would be the solution of the problem. This officer, Lt.-Col. (later Maj.-Gen.) E. D. Swinton, R.E., at that time acting as official military correspondent ("Eyewitness") with the British Expeditionary Force, was the first officially to put forward a scheme for a caterpillar machine-gun destroyer, in a communication to the Secretary of the Committee of Imperial Defence in London on Oct. 20 1914.[1] Though the machine then contemplated and finally evolved was for the purpose of giving infantry protection when advancing, it was expressly designed to do this indirectly, by its own offensive and destructive action. It was definitely intended, and designed, for the express purpose of forcing its way through wire and crossing trenches and hunting for machine-guns in order to destroy them by shell fire or to crush them by passing over them. The only "protection"—using the word in its limited, and more usually accepted sense—afforded by it was that of its bullet-proof sides to its own fighting crew. This point is accentuated because of the misconceptions which have existed as to the rôle of the tank, chiefly as to its being an armoured vehicle for transporting men, or a mobile shield to give cover to those moving up behind it. It did in fact perform this latter service, but only incidentally, in its quest for machine-guns. Machines for carrying up bodies of infantry and stores were not actually developed until three years later as an extension of the principle. As will be seen, the necessity for finding some mechanical method of carrying troops under cover across country had already occurred independently to a French officer. And in England similar suggestions were put forward, also independently, by Lt. R. F. Macfie, in Aug., and Lt. B. J. F. Bentley in Oct. 1914.

The history of the tank from Oct. 1914, until it took the field 23 months later, and even afterwards, is a record of progress made often in the face of apathy, scepticism and even opposition. This is typical of the history of the evolution of most inventions or new ideas, but is somewhat remarkable in this instance because the subject was one of vital urgency immediately concerning the lives of the British troops in the field. It is also remarkable for another reason. The idea of this land weapon not only received its first help toward realization from the minister responsible for the navy, but its realization was, indeed, only rendered possible by the financial support given by him from naval funds. The gist of the suggestion made to the Secretary of the Committee of Imperial Defence in Oct. 1914 was put forward by him in a memorandum and reached the First Lord of the Admiralty, Mr. Winston Churchill, who was predisposed towards experiments in the direction of some mechanical armoured device for carrying troops across country, to take the place of the armoured motor car which could only operate on roads. A certain number of these cars, belonging to the armoured car section of the Royal Naval Air Service, organized by the Admiralty, had been operating in France and Belgium, and their utility had become seriously curtailed by the destruction of the roads and the state of trench warfare which had arisen. In Jan. 1915, the First Lord, to whom the employment of mobile bullet-proof shields had already been suggested, took up the question of the urgent need for methods of meeting the deadlock reached on land, and his views were officially brought to the notice of the army authorities. He did not, however, only place the matter before the military. He caused researches to be made in the direction of crossing trenches by means of tractors carrying portable bridges, and in Feb. summoned a special Admiralty expert committee under the chairmanship of Mr. (later Sir) E. H. Tennyson d'Eyncourt, the Director of Naval Construction, to explore further the subject of mechanical cross-country transport generally. This committee at once started work and continued its labour for some time, experimenting chiefly in the direction of "landships" with large wheels, coupled steam rollers, pedrail and caterpillar tractors, single and articulated, for which suggestions had been put forward by different individuals. The underlying idea of all these investigations was the production of a machine for the conveyance of troops, not a machine-gun destroyer.

Previous to the receipt of the First Lord's views, the need of a specific machine-gun destroyer had been urged on the War Office directly by Col. Swinton early in Jan. 1915, followed by representations from Capt. Tulloch. The War Office took the matter up, but did not associate itself with outside technical experts to investigate possibilities, as had been recommended. After the trial and failure in Feb. of a Holt caterpillar tractor to cross obstacles which it was not designed to negotiate, and that of a wheeled tractor with the naval trench bridging device in May, it dropped the whole idea as impracticable. Meanwhile the Admiralty committee had continued its experiments, though without knowledge of the conditions of the military problems it was required to solve. In June, the War Office, then aware of the Admiralty's activities, became desirous of collaborating in them, and a joint naval and military committee was formed. The efforts of the Admiralty thus obtained the first official recognition of the service for whose benefit it was really working. At the end of the month the committee was furnished by the War Office with a detailed specification of the requirements of the destroyer as prepared by Col. Swinton and forwarded by the Commander-in-Chief in France, and the Admiralty designers were for the first time in a position to apply their inventive faculties to fulfilling certain definite conditions. The result of their efforts was the production in Jan. 1916 of an experimental machine paid for entirely from naval funds and produced almost entirely by naval agency, which was the prototype of all British machines. The chief point of its design, and on which it differed from other caterpillar machines, was its rhomboidal shape and all-round track, which were the invention of Lt. (later Lt.-Col.) W. G. Wilson, of the Admiralty landships committee, working in conjunction with Mr. (later Sir) W. Tritton. This machine, afterwards known as the Mark I. Tank, successfully underwent its official trials on Feb. 2.[2]

As has been said, at the beginning of the war the solution of the problem of enabling a frontal attack on trenches to be carried out had been thought to lie very largely in bombardment by artillery. But the futility of the limited bombardment by field guns with shrapnel shell, which was all that was possible for some months even against such comparatively weak defences as the Germans at first held, became apparent. Then, in reply to the insistent demand from the front the national energies had been turned to the making of guns and ammunition of all types, and prodigious quantities had been produced. But after the battle of Loos it began to be realized that even a great concentration of artillery and the expenditure of an immense amount of ammunition in a prolonged bombardment from guns of all calibres was not necessarily effective against such defences as the Germans had created, and could not insure that the assaulting infantry would not be held up by uncut wire and suffer terrible loss from concealed and protected machine-guns. Some other means of dealing with the numbers of these weapons which would survive a bombardment even of the heaviest nature was necessary. As a result of the performance of the experimental tank in Feb. 1915, G.H.Q. France came to the conclusion that such machines might be of some assistance, and made a demand for 40.[1] This number was increased by the British War Office to 100, and supply was undertaken by the Tank Supply Committee of the Ministry of Munitions, composed of members representing interests directly concerned, under the chairmanship of Maj. (later Sir) Albert Stern. Orders were placed on Feb. 12, and production was commenced at once with the utmost secrecy, under great difficulties of labour and material owing to the great national effort then in full swing to produce munitions of all sorts.

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[1] For the origin of the tank see the Minutes of the Proceedings before the Royal Commission on Awards to Inventors, Oct. 1919.

[2] For purposes of secrecy the name "Tank" had been applied in Dec. 1915 to the experimental machine under construction, then known as a "landship," in a report by a sub-committee of the committee of Imperial Defence. It was suggested by two officers connected with that committee. The experimental machine was afterwards known as Big Willie, and, though a male, as "Mother."

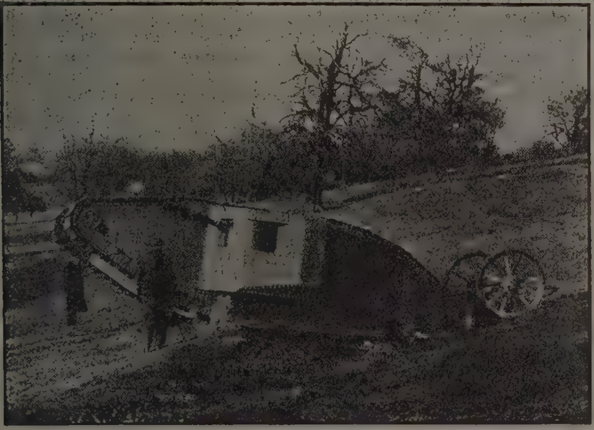

FIG. 1.—Mark I. Tank.

During this initial period of manufacture various minor improvements of the original design were incorporated. The sample machine, in accordance with the original specification for a machine-gun destroyer, was armed with two 6-pdr. guns and three Hotchkiss machine-guns. It was soon realized that, though effective for its purpose, this armament was deficient in man-killing fire-power for self-defence in the event of attack by large numbers of men, and it was decided to arm a certain proportion of tanks with four Vickers machine-guns instead of two 6-pounders. They were known as "females," the gunned machines being known as "males." The total number under construction was 150, half males and half females.

The Mark I. Tank (*see* figs. 1 and 2).—Details of this machine are given in the table on p. 697, but since all the succeeding machines were a development of it, some further description is given. Its main characteristic was the all-round track, which gave it its climbing power. This was perpetuated in all the British heavy tanks, though in the medium, or "Whippet," tanks evolved later, the same result was obtained by the projection of the tracks which were not under the machine. The essential value of both forms of construction was that whatever the fore and aft angle of the machine with the horizontal a gripping surface was presented. This was achieved by the high, curved bows, rendered possible by combining the body and the chassis of the machine and using the sides of the body to support the tracks. The length was 32 ft. 6 in., over all, and 21 ft. 5 in. without the tail. The width was 13 ft. 9 in.; the height 8 ft. ½ inch. Power was given by a six-cylinder sleeve valve Daimler engine of 105 H.P.; transmission consisted of a cone clutch, primary (two speed) gear box (controlled by the driver) differential secondary (two speed) gears, actuated by hand levers, one to each track, and chain drives to the driving sprockets at the rear of each track. There were thus four speeds ahead. This system necessitated a "gearsman" at each side, and was inconvenient and clumsy. The petrol feed was by gravity. There was no silencer. The armour plate varied from 12 mm. thickness in front to 6 mm. at the top and on the belly, the only part proof against the German "K" (armour-piercing) bullet being that 12 mm. thick. The armament of the male tank comprised two 6-pdr. guns, one on each side and four Hotchkiss machine-guns, and that of the female tank two Vickers machine-guns on each side and three Hotchkiss machine-guns. Owing to the pressure of time certain details in the design and equipment of the machine were adopted in order to employ material which was in production and quickly obtainable without waiting for special manufacture. The power unit, including the engine, with gear-box and differential was adopted because it was the standard power unit of an existing tractor and already in production. The 6-pdr. gun was adopted not because it was considered the best for dealing with machine-guns (the 2-pdr. automatic gun was originally specified), but because the Admiralty had a large number of these guns in hand and promised to supply the requisite number to the army. The 6-pdr. proved, however, to be a very good weapon for its purpose. The male tank carried 324 rounds of 6-pdr. common shell for the 6-pdr. gun and 6,272 rounds of S. A. A.; the female carried 31,232 rounds of S.A.A.[2] The crew consisted of one officer and seven other ranks. The driver sat with the officer in the conning tower in front. The total weight of the male tank when loaded was 28 tons; of the female 27 tons. The average speed across country was 2 m. per hour, and the radius of action, nominally 23 m., averaged 12 m. over rough ground. The

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[1] The first order placed by the French army headquarters, without awaiting the construction of an experimental machine was for 400 machines, and this was increased to 800.

[2] It was originally proposed to carry a certain proportion of case shot. This was not done, but it was found necessary later to do this,

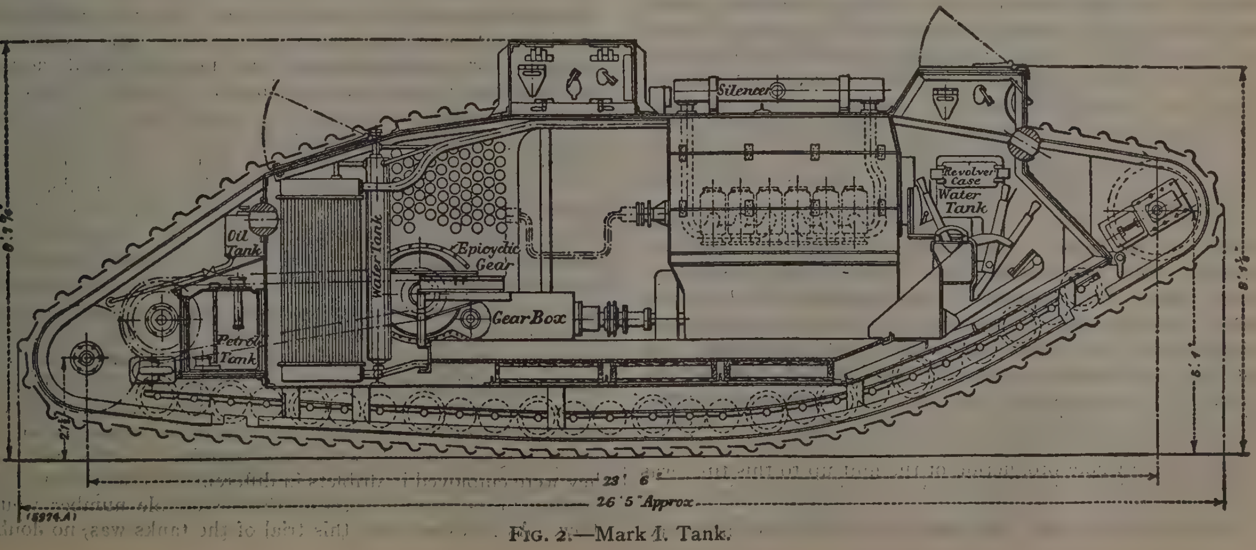

FIG. 2.—Mark I. Tank.

tank could cross trenches up to 11 ft. 6 in. in width and could climb a vertical height up to 5 feet. Six of the first establishments of tanks were equipped with a wireless set capable of sending and also to some degree of receiving.[1]

Two features of the Mark I. tank were not perpetuated in later patterns, except in the first gun-carrier machines. One was the tail. This consisted of a pair of wheels carried by a frame pivoted at the stern of the machine which for ordinary steering could be actuated by the driver by means of wire cables. For sharp turns, which were effected by driving on one track alone, they could be raised off the surface of the ground by a hydraulic ram at the back of the tank. The weight of this tail attachment also served to ease the rate of descent of the tank after crossing a summit, and the extra length it gave to the whole machine increased the width of the gap which could be crossed. It was found in actual practice that the complication and liability to damage the tail was not compensated for by its advantages, and its use was abandoned after the first actions. In both the male and female Mark I. machines the 6-pdr. and Vickers machine-guns were mounted in sponsons to give as far as possible arcs of fire up to direct ahead and astern. In order to reduce the width so that the tanks could be carried by rail these sponsons were removable and could be unshipped for travelling, when they were carried on small wheeled trollies. The inconvenience of this system caused it to be abandoned, and in later patterns of tank the sponsons were so designed that when travelling they could be swung inwards and housed in the width of the tank, or could be unbolted and slid in.

In March 1916, measures were taken to provide the *personnel* to handle the new weapon, and an establishment was framed for a unit. For secrecy this unit, under the command of Col. Swinton, was raised and formed, as a portion of an existing service, under the name of the "Heavy Section," subsequently changed to "Heavy Branch," of the Machine-Gun Corps. This was to provide the *personnel* for the 150 tanks then under construction, without any reserve of machines or man-power. At first the organization was for three battalions of 50 tanks each, but this was altered to six companies of 25 tanks each, each company consisting of four sections of six tanks and one spare tank. Each section was formed of three male and three female machines, and was subdivided into three sub-sections of one male and one female tank. A specially constructed and equipped mobile field workshop was allotted to each two companies. To assist in the formation of this unit a nucleus of officers and men were transferred from the existing Motor Machine-Gun Corps; officers also being obtained from the cadet battalions, and from France, and other ranks being enlisted from the motor trade. Technical *personnel* of all ranks was supplied by the Mechanical Transport Branch of the Royal Army Service Corps.

The first headquarters of the Heavy Branch were at Bisley, where, since there were no machines, the training was of a preliminary nature confined to discipline and gunnery and the use of the Vickers and Hotchkiss machine-guns. Training in gunnery was carried out by means of borrowed guns, and entailed the sending of the men to Salisbury Plain and to the Naval School of Gunnery at Whale Island. So soon as the tanks began to be delivered from the contractors, the training in driving, tactics and shooting from tanks etc., was carried on in a secret area at Elveden in Suffolk, where a facsimile battlefield had been prepared. The whole of this work was carried out under immense difficulties as regards time and the need for secrecy, the main underlying idea of all the preparation being that the rôle of the unit was to assist and help the infantry. By the beginning of Aug. several machines had been delivered, and a certain amount of training in their use had been carried out.

Meanwhile, the Somme offensive having come to a standstill in spite of the power of the British artillery then available, it was decided to use the tanks, or whatever of them were ready, in the renewal of the attack. Two companies of the heavy branch, 50 tanks with 10 spare machines, were accordingly concentrated in France for this purpose by the end of Aug., and training was continued preparatory to taking part in operations. Friday, Sept. 15, was to mark the appearance of the tank in warfare, when the secret of the new weapon which had been so carefully kept would be revealed and the weapon itself put to the test. The whole production of the unit up to this time was a remarkable feat. Not only had a number of entirely new machines been manufactured sufficient for 60 to take the field within six months of the order for them having been placed at a time of great industrial stress, but the secret of their creation, which was known to thousands, had been so well kept that they did actually come as a surprise to the enemy.

It was to assist in the further advance of the British right flank, which had begun so successfully at the opening of the battle 10 weeks before, between the Somme and the Ancre that the tanks were to be thrown into the fight. The IV. Army was to break through the enemy's front between the Combles ravine and Martinpuich and seize Morval, Les Boeufs, Gueudecourt and Flers. On its left the Reserve V. Army was to attack and gain Martinpuich and Courcelette while the French were to press on its right. The cavalry were to follow up through the gap which it was hoped would be created and seize the high ground about Rocquigny–Villers au Flos–Riencourt-lez-Bapaume. Two companies of the tanks were engaged, the bulk with the IV. Army, the rest with the Reserve Army. The general idea of their tactics was that they should start so as to reach their objectives five minutes before the infantry. They were to act in small detachments of two or three machines against the strong points in the enemy's defensive system, lanes being left for their advance in the artillery barrage commencing at zero hour.

The tanks advanced at dawn in a slight mist and came as a complete surprise to the enemy. The operations of those with the XV. Corps of the IV. Army were the most successful; but for various reasons the results of the employment of tanks was somewhat disappointing. Of the 49 machines taking part 32 alone reached their starting points, 9 pushed ahead with the infantry and caused considerable loss to the enemy and 9 others, which did not catch up the infantry, did good work in dispersing of the enemy still holding out at isolated spots; of the balance of 14, 9 broke down and 5 became "ditched." (Ditching was usually caused either by a tank getting into such a position in a deep and wide crater or trench that its engine power was not sufficient to pull it out, though the tracks gripped, or by weight of the machine being taken by its belly on hard ground, in which case the tracks revolved without biting.) One tank gave remarkable help to the infantry held up in front of Flers by wire and machine-gun fire, when by its action it caused the surrender of 300 Germans and enabled the infantry to move on. Another destroyed a field gun. On Sept. 25 and 26, 13 machines acted with the IV. and Reserve Armies. Of these nine were ditched in shell craters, two reached the village of Thiepval and stuck there. But again, as a set-off to mishaps, one single tank on the 26th performed a remarkable feat which demonstrated the potentialities of the machine. Within one hour, and at the expense of five British casualties, it made possible the capture of a strongly held, well wired, trench (the Gird trench) some 1,500 yd. long and strengthened by numerous strong points, which had held up a whole brigade of infantry since the previous evening. The Germans suffered heavy loss, and 8 officers and 362, other ranks, surrendered. On Nov. 13, at the battle of the Ancre after heavy rain, of five tanks that went into action, all became ditched, two machines doing very valuable work before this happened. Next day, in an attack on a field work south of Beaumont Hamel, one machine out of three employed was put out of action by shell fire, and two became ditched. The latter, however, were able to bring so effective a fire on the strong point that it surrendered and 400 prisoners were collected by the tank crews. But, whatever their defects, the tanks had passed with ease through all entanglements and had destroyed many machine-guns, which weapons, indeed, were practically powerless against it.

The employment of the tanks in Sept. 1916 was contrary to the views of those who had originated the Arm, who were responsible for its production and had most studied its action. They held that the utmost value should be obtained from the new weapon and that the secret of its existence should not be given away until a surprise attack could be carried out on a sufficiently extensive scale to give a chance of achieving a decisive success. In this sense the launching of the tanks was a repetition of the error made by the Germans when they released gas on a small section alone on April 22 1915. Whatever may have been the urgency at that time of reviving the momentum of the Somme offensive, which had died away after weeks of great endeavour and immense sacrifice, and of raising the *moral* of the tired troops, and whatever might have been the success of the new weapon, it is doubtful if the small number actually employed could have given a result to compensate for the premature disclosure of the secret, which in potential value was equal to that of the 42-cm. howitzers and the poison-gas of the enemy. Again, not only was a small number of tanks used, but they were employed in driblets in different directions, instead of together in as great a mass as their available number would allow. As an experiment this trial of the tanks was, no doubt, productive of valuable lessons, but they were obtained at the cost of discounting the future. It was in the face of a considerable amount of scepticism that the machines took their place in the battle-line, and those who did not believe in them, without looking beyond the lack of any startling success achieved on a great scale, were not slow in their condemnation. But one thing the tank had definitely proved: *The machine-gun and the barbed wire entanglement no longer ruled the infantry battle.* In the tank, still experimental and imperfect as it was, they had found their master. At last attacking infantry could meet the defence on more than equal terms.

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[1] This scheme was also abandoned and later found necessary.

On the part of the tanks themselves there was mechanical failure of machines, which were the first of their kind, tried under more difficult conditions than those which they had been designed to meet. The specification in which they had been constructed had been based on the requirements of the spring of 1915 at a time when the prolonged shelling, such as in 1916 and later rendered whole tracts almost impassable even by infantry, was undreamt of. At the Somme the tanks had to cross a dry "crumped" area, and at the Ancre a combination of "crumped" area and morass. There were, in addition, breakdowns due to faulty design and to the unexpected wear and tear of certain parts of the machinery, which only experience could have shown should have been of special material and which were, moreover, practically worn out by practice and demonstrations before the action. Failures were also due to the lack of time for the complete training and practice of the crews; to insufficient preparation in the way of reconnaissance and supply services, which for such complicated machines necessitated very complete organization. On the other hand, many of the commanders at whose disposal tanks were placed had no idea of their capabilities, weaknesses or limitations. Nevertheless, the outstanding brilliant exploits of single machines which did not break down, the great saving of life for which the tanks as a whole were responsible, and the demoralizing effect of their appearance on the enemy and the great encouragement afforded to the British infantry, clearly showed that the machines were sound in principle, only needing improvement in detail, and that those handling them required more experience in this new form of warfare.

As a result of its trial it was decided that the new Arm should not only continue, but should be expanded to a force of 1,000 tanks. After the fighting on the Ancre the unit did not again go into action till April of the following year, which allowed of a period for expansion, reorganization and training, and the incorporation of improvements to machines.[1] The expansion of the Heavy Branch of the Machine-Gun Corps was to be on the following lines: there was to be a fighting headquarters in France and an administrative headquarters in England.[2] The six original companies were to be expanded to four battalions in France and the two companies at home to five battalions, or nine battalions in all. The unit therefore reverted to its original battalion organization. It was eventually to comprise three brigades, each of three battalions, each battalion of three companies and a workshop, each company consisting of four fighting sections of five tanks each and a headquarters section of four tanks, or 72 tanks to a battalion. The number of tanks per section was shortly afterwards reduced to four, making 20 per company or 60 per battalion. These brigades were formed at the beginning of 1917, and the organization continued unchanged until June, but though the *personnel* was being raised and trained as far as possible on this extended scale, the supply of tanks did not keep pace, so much so that on April 1, when it was decided that the tanks should take part in the battle of Arras, only 60 Mark I. and Mark II. machines could be counted on for action.

In Feb. 1916, when the original Mark I. tank was still in its experimental stage, designs had been got out for a Mark II. machine and a Mark III. machine, both of which were slightly improved Mark I. tanks. After the Somme battle certain modifications which were found necessary were incorporated, and in Oct., in order to keep up continuity of supply, orders were given for 50 machines of each type (making 250 tanks ordered in all) pending the decision on the design for the 1,000 asked for by the army, in Sept. The chief improvements consisted of the abandonment of the tail, as already mentioned; the addition of "spuds," or fins, to the track plates, to give a better grip; and the provision of improved rollers. The Mark III. machines were also intended to have thicker armour to resist the "K" bullet. In regard to the 1,000 new tanks preliminary orders to collect material were given to the manufacturers in Sept. At the end of the month when it was learnt that these machines could not be ready by March 1 (partly owing to the manufacture of spare parts necessary for the existing tanks), the demand was cancelled, but was renewed two weeks later. This is mentioned to show that military opinion as to the advisability of proceeding with the new weapon was not unanimously favourable. The 1,000 machines were to be of the type known as the Mark IV., which was a much improved Mark I. tank. It was then anticipated that this number could be delivered by the end of June. Owing to various difficulties this estimate was not fulfilled, but sufficient machines reached France in time to equip two battalions for the attack on Messines in May; and it was the standard British tank during 1917 and 1918.

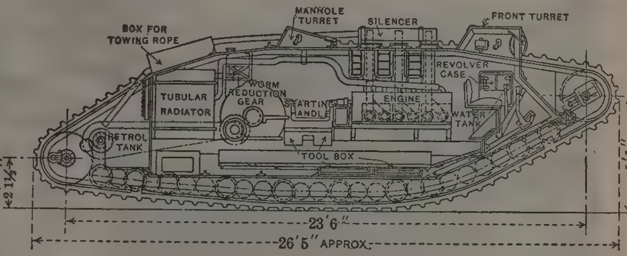

FIG. 3.—Mark IV. Tank.

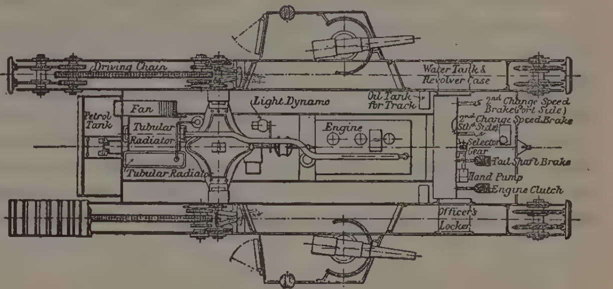

FIG. 4.—Mark IV. Tank.

The Mark IV. tank (see figs. 3 and 4).—The first advance from the original weapon was the same in size and general design, with certain improvements. There was no tail. The track rollers were better. The sponsons could be housed within the tank for rail transport. The Lewis machine-gun was installed instead of the Hotchkiss machine-gun (this was not an improvement and was reversed later). A better radiator was fitted and also a silencer. The width of the driver's cab was increased to allow of wider track shoes. The petrol tanks were placed outside the tank at the stern. A short 6-pdr. gun was adopted. Detachable spuds were fitted to the tracks, and unditching gear provided. The entrances and exits were more accessible.

During the Verdun offensive early in 1916 it had occurred to those responsible for the production of the fighting tank that one reason why the Germans had been unable to keep up the initial pressure of their attack was their inability to bring up their artillery and ammunition over the shelled and entrenched area so as to keep pace with their advance; and that if they had been in possession of guns mounted on self-propelled carriages, or carriers on caterpillar tracks, it would have assisted them greatly. A design was therefore prepared in July of a "gun-carrying" tank (see fig. 5), to carry a 60-pdr. gun or 6-in. howitzer which could be fired from the tank if necessary or conveyed by the tank and fired from the ground. Of these machines,

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[1] The most important improvement was the improvised "unditching beam" which was introduced to assist a tank to extricate itself when stuck. In the later types a specially designed contrivance was part of the equipment of the machine.

[2] Lt.-Col. (afterwards Maj.-Gen.) H. J. Elles, R.E., was appointed colonel commanding the unit in France, Brig.-Gen. F. Gore Anley being appointed administrative commander of the tank training centre in England on Nov. 9. In May 1917 Brig.-Gen. Anley was succeeded by Maj.-Gen. Sir J. E. Capper. The training centre was moved to Bovington in Dorset.

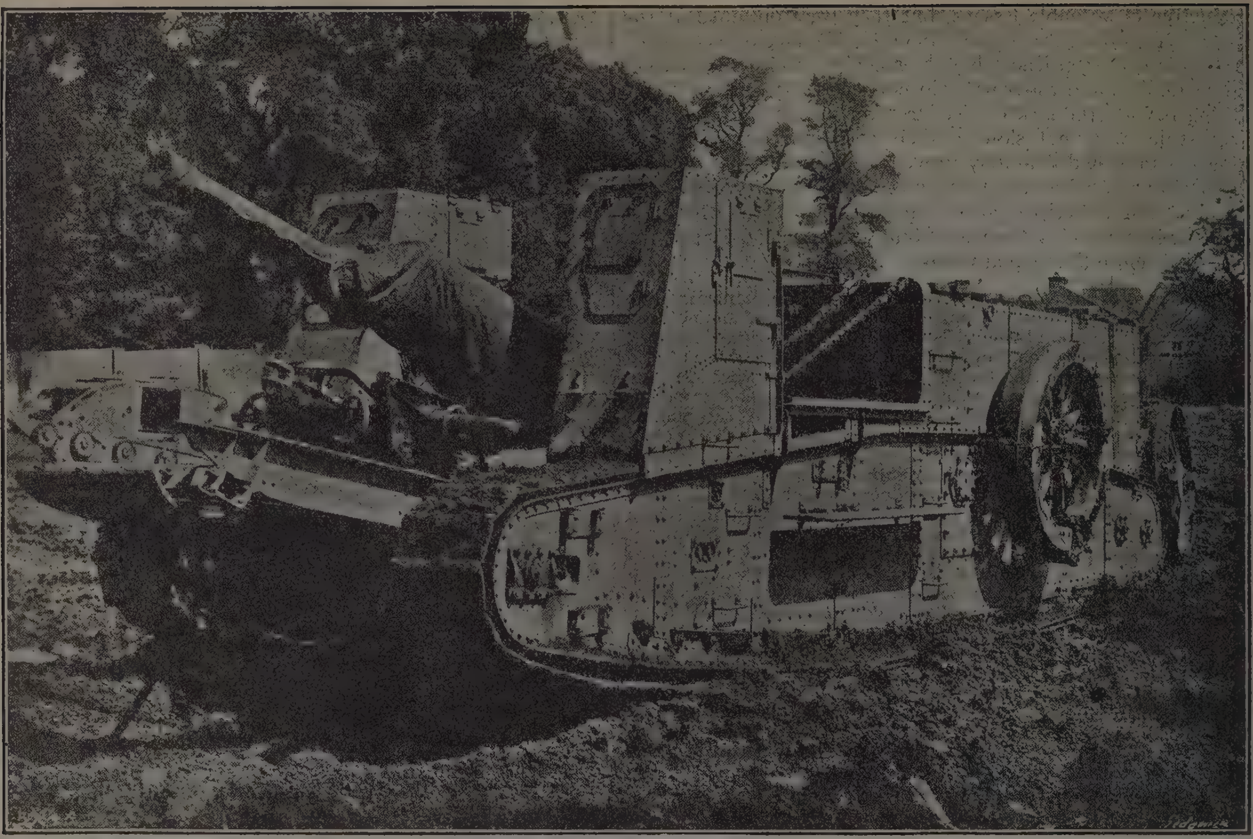

FIG. 5.—Gun-carrying Tank.

48 were made, delivery in France commencing in July 1917. They appear to have been employed as much for the conveyance of ammunition and stores as for the purpose for which they were designed. In Dec. 1916, also, the design of the "Whippet," the Medium Mark A. tank, (see figs. 6 and 7) was commenced. Of this type 200 machines were produced, delivery in France starting at the end of 1917. It was evolved to be complementary to the heavy tanks and to meet the demand for a speedier, handier machine which could be produced in large numbers. Its main points were its increased speed, nominally 8 m. per hour on the flat, and an average across-country of 5 m. per hour, and its lightness, one-half that of the Mark I. machine. It was also easier to transport by rail. Each track was driven independently by a four-cylinder 45 H.P. Tylor engine. Transmission was by cone clutches to gear boxes of the constant mesh type, giving four speeds forward and one reverse. The design was largely due to Sir W. Tritton. Thus, at the end of 1916, in addition to the first type of heavy tank in the field, measures were in hand to supply a much improved pattern of that machine (Mark IV.) and also a lighter type—the "Whippet."

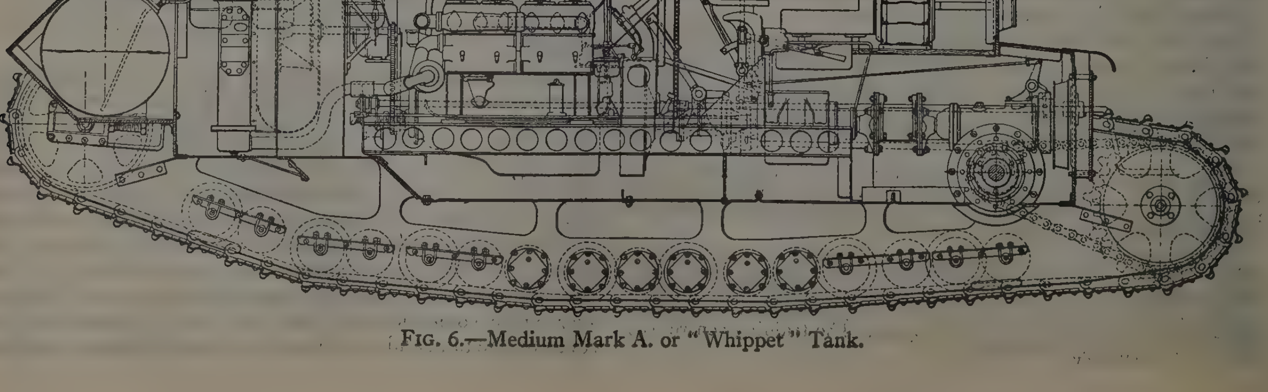

FIG. 6.—Medium Mark A. or "Whippet" Tank.

In the field, though there was still considerable doubt as to the value of tanks, the next six months, from Oct. 1916, were, as had been said, a period of expansion, organization and training, and preparation for the operations of 1917. The training was always handicapped by the paucity of machines; and it was found necessary not only to educate the members of the new arm itself but also other arms and the staff. Headquarters, schools and rest camps and the usual organization of a large unit were established. The next action in which the tanks took part was the battle of Arras on April 9, when an attack was carried out by the I., III. and V. Armies in order to penetrate the German line by a sudden blow and allow of an army corps and two divisions of cavalry to break through. From the point of view of tanks it does not require much comment. Only 60 machines were available, and they were again not employed in a mass for a quick penetration but for "mopping up" operations along the whole front.[1] More complete preparations were made for their coöperation than at the Somme. The battle was prepared by a prolonged bombardment, and was also preceded by heavy rain at the last moment, which combined to produce a sea of mud pitted with craters. The Vimy Ridge was captured by a rush of the Canadians which rendered tanks unnecessary, and on other parts of the front they had varying success, but gave valuable assistance. Against Bullecourt on the 11th, where they attacked without artillery preparation in the snow, the attack was a failure, though two tanks penetrated five miles behind the German front line, when they were captured. Fighting continued till the 22nd. The cavalry were prevented from breaking through by the usual obstacles—barbed wire and machine-guns. It was on the first day of the fight that the first German "tank trap" was discovered consisting of a deep covered-in pit. Again the main lesson learned was that tanks should be used in mass and not dispersed. After this battle an expansion of the Heavy Branch, Machine-Gun Corps, from 9 to 18 battalions (nine of heavy tanks and nine of medium machines) was decided on. But at the end of June this expansion was suspended owing to shortage of man-power, as it was apparently not yet realized to what extent the tanks reduced casualties. Before the next action, the battle of Messines, a certain number of the new Mark IV. tanks had been received and several of the old Mark I. and Mark II. machines had been converted into supply tanks for carrying tank stores to the fighting machines, a very great advantage the want of which had previously been much felt. In the attack on the Messines–Wytschaete Ridge, which started on June 7, 76 Mark IV. and 12 supply tanks took part. The operations in this case approximated to the "assault" in the old form of siege warfare and depended mostly on an intense bombardment, lasting from May 28 to June 7, and the explosion of 20 large mines. During the infantry advance on Wytschaete the creeping barrage proved so effective that tanks were only necessary at different spots to overcome individual machine-guns. They advanced in two lines, the first of 40 machines, going forward at zero (dawn), and the second, of 34 machines, at 3 P.M. to the Oosttaverne line, where their help was very valuable. Apart from the debated point whether the third battle of Ypres should ever have been fought or not, the work of the tanks in it needs still less comment than at Arras or Messines. In spite of remarkable feats accomplished by them, especially the capture of the Cockcroft, a nest of strong points, on Aug. 19 with a loss of 15 infantry, it was, on the whole so far as they were concerned, a failure, and a failure which was inevitable and to be expected under the conditions which existed. They had to act in a low-lying area which had been converted into a potential swamp through the destruction of the drainage system by the artillery of both sides, rendered still worse by the churning up of the surface into a wilderness of craters, which were filled by heavy rain just before the battle. The only means of approach across this morass were the causeways, which were naturally kept continuously under fire by the enemy. Preceded by many days of intense bombardment the attack commenced on July 31, and as it continued the rain made matters worse. That tanks should have been expected to function under such conditions, when, independently of the enemy's action, even the infantry were unable to move forward, is astonishing. It shows that those responsible for the decision to employ them were ignorant either of the situation or the limitations of the machines, or both.

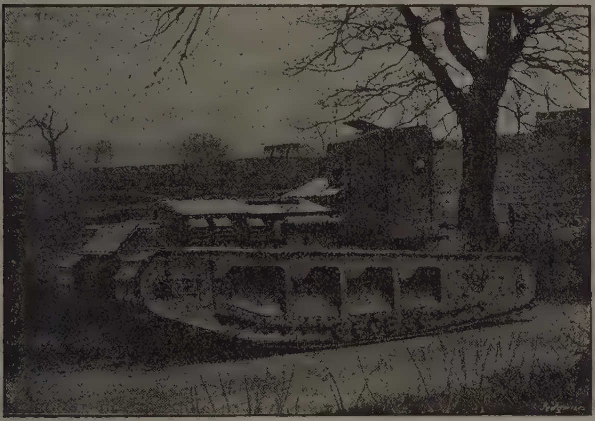

FIG. 7.—Medium Mark A. or "Whippet" Tank.

It was not till Nov. 20, when the tanks had been in France over a year, that they were given an opportunity of showing of what they were capable when employed on a large scale, in a manner calculated to exploit their peculiar attributes, and under favourable conditions. As this was a turning-point in the history of the new weapon it is of importance that it be described in detail.

During 1916 and the greater part of 1917 the tanks had been thrown into the fight in dispersed detachments to assist in overcoming certain points of resistance, and somewhat casually as an aid to the attacking infantry. The conditions, also, had usually been such as to render success doubtful, sometimes impossible, and in any case of a minor nature. In several instances they had succeeded in achieving their immediate object and had undoubtedly saved many lives. In others they had failed. As a consequence it was seriously discussed whether tanks should not be abandoned as useless.

But those responsible for the Tank Corps (the name of the unit had been changed to "Tank Corps" at the end of June) had been concerned in thinking out an operation which would not only be strategically valuable, but would enable the corps definitely to prove its worth and establish a confidence in itself, which, never very marked on the part of General Headquarters, had recently been much shaken. Broadly, the scheme consisted in launching without any preliminary bombardment a surprise attack on a large scale with as many tanks as possible over ground suitable for their action, *i.e.* reasonably hard soil which had not been shelled to pieces. The area chosen was that near Cambrai, in the re-entrant of the Canal d'Escaut between Ribécourt, Crèvecoeur, and Banteux, which consisted of almost unshelled rolling downs of chalk. The attack was originally intended to be of the nature of a "raid" (this was not adhered to in its execution) carried out by an advance at dawn of three lines of tanks, the first of which would make straight for the enemy's guns, previously bombed from the air, to be followed up by the second and third; artillery coöperation to be confined to counter-battery work and the destruction of communications and depots, etc., behind the German front line. The essential points of the plan were surprise and speed. The project was put forward and approved, and the result was the battle of Cambrai, which took place on Nov. 20.[2]

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[1] "Mopping up" consisted of disposing of small bodies of the enemy, especially such as had escaped the bombardment and allowed the first line of the assault to pass them.

[2] The action as fought was in almost every detail the execution of the plan put forward officially for the employment of the tanks by Col. Swinton in Feb. 1916, 22 months previously.

Further details of the plan were that the artillery barrage of shrapnel and H.E. shell should open on the enemy's outpost at zero hour (6:20 A.M.) and be advanced by stages of 250 yd. just ahead of the tanks and concentrated on special points. The tanks were to go forward at zero hour in sections of three machines, sections being allotted to different objectives according to the strength of the latter. Each section was composed of one vanguard tank and two main body tanks. The former was to lead and protect the advance of the two other machines, behind which followed the infantry in parties of varying size, marching in sections in single file. As the Hindenburg trenches, some 12 ft. wide, would have to be crossed each tank was to carry a specially made fascine 10 ft. long and 4½ ft. in diameter to drop into the trenches to assist in the crossing. Special machines were fitted with drag grapnels in order to drag aside the wire entanglements which were known to be exceptionally thick and strong, for the passage of the cavalry. Great precautions were taken to maintain secrecy, upon which so much depended, and extremely careful preparations were made in the way of reconnaissance, the training of the infantry to act with the tanks, the movement of machines, and the formation of dumps of the necessary stores. For instance the preliminary movement of the tanks necessitated 36 special trains, and the material collected in dumps included 165,000 gal. of petrol, 55,000 lb. of grease, 5,000,000 rounds of S.A.A. and 54,000 of 6-pdr. ammunition. Three brigades (nine battalions) of tanks took part in the attack, with two army corps of three divisions of the III. Army, a cavalry corps and 1,000 guns. In all there were 378 (Mark IV.) fighting tanks and 98 administrative machines.

Fog on the morning of Nov. 20 assisted the attack, which was carried out as arranged, the tanks following the barrage and the infantry the tanks. The operation was an amazing success and came as an absolute surprise to the enemy, most of whose infantry were panic stricken and bolted or surrendered, the garrisons of certain strong points alone offering a determined resistance. Assisted by the tanks, the infantry by evening had occupied Marcoing,[1] Bois des Neuf, Premy Chapel, Havrincourt, Graincourt, Aneux, Noyelles. Next day, and on the 23rd, 25th and 27th, further progress was made, but the tank units which had been fighting continuously were disorganized and the crews physically exhausted; and the mistake had been made of not keeping a small proportion of tanks in reserve. On the 27th the impetus of the attack died out with practically no more ground gained than had been won on the first day, where the tanks, starting from a base of 13,000 yd. length, had in 12 hr., and at a cost of some 4,000 casualties, enabled the enemy's zone to be penetrated to a depth of 12,000 yd. (at the third battle of Ypres an equal extent of penetration had taken three months), and 8,000 prisoners and 100 guns to be captured. And their action had obviated the necessity for a preliminary bombardment (which would have cut up the ground and rendered any rapid advance of infantry impossible, and brought a concentration of enemy's reserves), and also the usual wire cutting artillery fire, which together would have cost many millions of pounds. (An estimate places the cost of the preliminary bombardment at the third battle of Ypres at approximately £22,000,000. A similar bombardment at Cambrai would possibly have cost more, as the German wire was on the reverse slopes of the rising ground.)

In numbers the *personnel* of the tank corps employed in the fight amounted to a little over 4,000 of all ranks, or the strength of strong infantry brigade. The fact that there were no larger bodies of infantry ready to reinforce the tired troops and press the advantage gained, and that the cavalry did not break through to Cambrai as was intended, was not owing to any failure on the part of the tanks, which achieved more than had been promised. The absence of any large force to take advantage of the opening made by them tends to show that it was not believed that they could do what they actually did accomplish, and that their complete and extraordinarily speedy success was as much of a surprise to British Headquarters as it was to the Germans. For nearly three years efforts had been made by both sides to force a way through the enemy's position quickly. At Cambrai a door was suddenly flung open and there was no force to press through. The success achieved by the surprise counter-attack by the Germans on the 30th also had nothing to do with the previous action of the tanks, but its effect was to discount the whole British victory including their performance. Against the southern portion of this German counter-attack a brigade of tanks which were hurriedly collected proved their worth in a defensive rôle, and gave invaluable assistance in stopping the onrush of the enemy.

The success of the tanks at Cambrai on Nov. 20, and all that it implied, gave as much food for thought as had the first use of gas by the Germans in 1915, unattended, however, by the horror of the means employed on the first occasion when a surprise penetration was effected by either side. It has been described as the "Valmy of a new epoch in War, the epoch of the mechanical engineer."[2] But it is doubtful if the truth of this statement has been fully appreciated even three years after the war. Even so, the effect of this action on the Allies, and also on the Germans, was immediate and far-reaching. It almost established the fact, for which the protagonists of the tank had been endeavouring to gain acceptance for many months, that the new Arm, used properly, was a serious factor in warfare which could not be put aside and ignored. And yet, though opinion in regard to the tanks had changed, even at that period when the immense losses suffered in the attempted offensives of the previous eighteen months had rendered the problem of man-power so acute, the crucial point was still not realized that an actual saving in life and economy in man-power would be gained by the development and whole-hearted employment on a very large scale of the mechanical Arm. And steps were not at once taken for a great expansion. The increase of the Tank Corps previously deferred was agreed to; but a proposed further expansion, based directly on the experiences of Cambrai, was not approved. And later, in April 1918, even the agreed increased establishment was again temporarily suspended after the German offensive in order to meet the demands for infantry reinforcements, and was not completed until after the striking successes gained by the tanks in July and Aug. 1918.

After Cambrai all ideas of attempting to prosecute the offensive were abandoned, and there ensued a period of preparation for resistance against the attack which was expected as the result of the reinforcement of the German strength on the west, rendered possible by the defection of Russia. To assist in meeting this, the Tank Corps, now of five brigades, or thirteen battalions, with 320 Mark IV. and 50 Medium A machines fit for action, was in Feb. 1918 distributed in detachments over some 60 m. of front.

During the second battle of the Somme, from March 21 to the end of the month, the part played by it was to coöperate in various local counter-attacks, its action being generally useful in assisting to delay the enemy's advance, as the German infantry would not as a rule face tanks until their guns were brought up. But out of the total, some 170 machines alone went into action usually and inevitably in hasty, improvised operations carried out during the general retrograde movement. Many machines were lost and their crews employed on foot as Lewis Gun sections. It was during this period that the new "Whippet" machines made their début with great effect. Generally speaking, the tanks were too scattered for full value to be obtained from their action. The corps also took its share in repelling the second German thrust against the British, which started in the Lys area on April 9, during which three battalions fought, some of the *personnel* of the lost tanks fighting on foot as a Lewis Gun brigade. It was in this quarter, near Villers Bretonneux, that the first duel between tanks—possibly a presage of future warfare—took place.

The lack of decisive results obtained by the small detachments of tanks acting in improvised counter-attacks in the general defensive seems to have revived the lingering prejudices of those who were hostile to the arm, and who maintained that the mass action of Cambrai could never be repeated. However, in spite of this, progress was made in May and June in preparing for the future offensive, the chief point of note being that the new Mark V. (heavy) tanks, which were a great improvement on previous models, being much handier and also more mobile, were arriving at the rate of 60 machines per week. On July 4 occurred the action which probably finally dispelled the doubts of the most conservative and reactionary. This was the surprise attack of Hamel, a deliberate offensive and not a defensive counter-attack, in which recently received Mark V. machines coöperated with the Australians. This fight was an example of a perfectly organized action and of the advantage of previous careful training to act together of tanks and infantry, and was a speedy and complete success, achieved at the low cost of some 700 casualties. One feature was the special power possessed by the new and speedier tank of destroying machine-guns, many of which were rolled over and crushed.

The logic of facts was irresistible, and after this action the coöperation of the tanks was thenceforward accepted, not only as a useful adjunct but as an absolute necessity, for all offensive operations. On July 17, at the battle of Moreuil, one battalion of tanks coöperated with three French divisions in a most successful attack on a similar plan launched after one hour's preliminary bombardment.

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[1] The information of the capture of this village was sent back by a wireless signal tank, and was received at Albert 10 min. after the troops entered Marcoing.

[2] *Tanks in the Great War*, Col. J. F. C. Fuller, p. 153.

July 18, the date of the great French victory of Soissons, marked the turning point of the war. It depended on tanks, and was rendered possible by their proper employment in mass and as a surprise. In fact, as the recent British offensive on a smaller scale had been, it was based on the battle of Cambrai. It was followed by a similar operation, the battle of Amiens on Aug. 8 which opened the British strategic offensive.

This battle was also based on the power of the tank arm, and was designed and organized to derive the utmost value from it and to give it every chance to perform its proper, logical function in a general operation. The tactics to be employed by the tanks were an elaboration of those employed at Cambrai modified by recent experience and adapted to the improved machines available. The attack was carried out by three army corps, with three divisions in reserve, a cavalry corps and 11 tank battalions. In regard to the tank battalions they were now better equipped than they had been. Nine were equipped with the new Mark V. machines (36 each), and two with the "Whippets" (48 each), or in all 420 fighting machines. There were also 42 tanks in reserve, 36 supply tanks, and 22 gun-carriers, or 580 machines in all. The "Whippet" tanks were to act with the cavalry. There was no artillery bombardment, and the tanks advanced with the barrage at "zero" hour. The heavy guns were used for counter-battery work and the field artillery moved forward in close support of the infantry. Noise barrages (made by low lying aeroplanes) were used to drown the sound of the tanks' approach. On the first day the maximum advance of the tanks was 7½ m., and they continued in action for four days till the 11th.

The battle of Amiens was a tremendous blow, both material and moral, to the Germans, who, besides casualties, lost 22,000 prisoners and 400 guns; and the victory was admittedly very largely due to the tanks. Amongst other lessons learned it was again found that these machines, like other arms, required a reserve to keep up the pressure after the first day of action, and that the limit of endurance of the heavy machines before overhaul was three days; that they were suited for trench warfare, the medium machines for open warfare; that the heavy supply tanks should be replaced by a light cross-country tractor; that wireless and aeroplane communication, as then developed, was not so certain as that by galloper; that it was a mistake to tie up tanks to cavalry, for, during the approach they could not keep up, and during the fight were kept back by the cavalry, which under hostile machine gun-fire had to retire or move to a flank until the tanks disposed of the machine-guns; and that machines of greater speed and greater radius of action were necessary. According to one authority,[1] if machines capable of moving at 10 m. an hour with an endurance of some 100 m. had been available, the German forces south of the Amiens–Roye–Noyon road might have been cut off and the end of the war greatly accelerated.

July 18 and Aug. 8 were not only victories for the French and British over the Germans, they were victories over their opponents for the tank arm in each army. In regard to the British it is sufficient to say that up to Nov. 5, their last fight, no attack took place without tanks. They coöperated in every offensive including such important operations as the battle of Bapaume, and the second battle of Arras, the battles of Epehy, Cambrai-St. Quentin (when the Hindenburg line was broken), the Selle and Maubeuge. Latterly, indeed, during the "war of movement" which set in after the Hindenburg line had been passed, advancing infantry when faced by the German rear-guard machine-gun posts almost invariably halted for tanks to come up and dispose of them before they moved forward.

So far as statistics can show what a part they played, the following facts speak for themselves: By the time of the battle of Amiens much of the *personnel* of the Tank Corps had been in action 15 or 16 times, and during the 95 days from that time to the Armistice tanks (to the number of 1,993) were engaged in fighting on 39 days. The casualties, killed, wounded and missing were 598 officers and 2,826 other ranks. These, though heavy in relation to the strength of the unit, which was under that of an infantry division, were not heavy for 39 days hard fighting if it be borne in mind that in pre-tank days it was not unusual for an attacking division to suffer 4,000 casualties in one day often without reaching the objective.

The final despatch of the Commander-in-Chief of the British armies contained the following words:—". . . Since the opening of our offensive on August 8th, tanks have been employed on every battlefield, and the importance of the part played by them in breaking up the resistance of the German infantry can scarcely be exaggerated. The whole scheme of the attack of August 8 was dependent upon tanks, and ever since that date on numberless occasions the success of our infantry has been powerfully assisted by their timely arrival. . . ." It would not be too much to say, that in spite of any artillery assistance, the series of overwhelming, immediate and economical (both in life and treasure) victories won at Amiens and afterwards would have been absolutely impossible without tanks, as would the whole scheme of the strategic offensive which depended for its execution and cohesion on the prompt and certain success of these attacks. And this statement, which is tantamount to an expression of opinion that human bodies cannot vie with armoured machines against wire and machine-guns, is no disparagement of the British infantry. It is one which would be borne out by the survivors of Neuve Chapelle, Loos and the Somme.

After the action of the Somme a few tanks were at the end of 1916 despatched to coöperate against the Turks in Palestine, where the situation was somewhat similar to that which had arisen on the western front. It was doubtful, at first, whether the machines, some parts of which wore out very quickly, would operate in the sandy desert; but it was found that the dry sand was less harmful than the mud of Flanders, and the tanks in fact stood the test well, and covered a surprising number of miles, though they happened to be machines already partly worn out in training. Only eight tanks were sent out, which was far too small a number to enable any very important result to be obtained in a field where the bold use of tanks in force might have had a decisive effect. The terrain favoured their action, and the strength of the defence, doubtless owing to German influence, lay largely in machine-guns. Their entry into action was not a surprise, for the enemy were aware of their arrival in the country; and they were used on two occasions only, at the second and third battles of Gaza, on April 17 and Nov. 1 1917, all the machines taking part.

Though the tasks set before them at both battles would have been more suitable to a force of machines five times their number, they rendered in each case great assistance and saved much loss of life. As a result of their help, which was greatly appreciated by the infantry, who were, of course, chiefly affected, an effort was made early in 1918 to obtain a number of "Whippet" machines for action against the Turkish rear-guard during the further advance. But this demand synchronized with the German offensive on March 21, and no machines could be spared for a theatre peculiarly suited to them.

So far an outline has been given of the main tank operations, and the development and expansion of the unit. The former showed a gradual increase of the scale on which recourse was had to the machines, and an elaboration in the preparations made and the tactics applied. From the 49 fighting tanks which were allotted to the attack at Cambrai, the number rose to 580 of all types at Amiens nearly two years later, the latter being the greatest British tank action fought. And, according to the preparations which were being made at the time of the Armistice, any great offensive in 1919 would have been conducted with thousands of British tanks alone, leaving out of consideration the equally large numbers of French and German machines that would have been engaged.

By Aug. and Sept. 1918 the type of heavy fighting machine had been improved in design, reliability and speed, and a faster medium tank had been introduced. Measures had also been taken to equip, for cross country work, all the battle services for the tanks. There were fighting tanks; supply tanks, to carry up ammunition, drinking water and stores; gun-carrier tanks, used for the same purpose, as well as for conveying artillery and trench mortars, both sometimes dragging sledges similarly loaded; wireless signal tanks; salvage tanks; all working on a coördinated system toward the maintenance or pressure on the enemy with the maximum of efficiency. And to assist in doing this there was a complete repair organization, the central workshops, with its advanced stores and salvage companies. For a major operation, the system of attacking with a small number of machines divided up into separate detachments had been abandoned and the proper tactics of mass attack in as large force as possible in definite formations to meet different conditions, with reserves to keep up the advance, had been adopted. Signal units had been formed. The elementary system of signalling with flags and with daylight lamps to aeroplanes had been elaborated, pigeons were used, and wireless signalling had been reintroduced, and wireless telephony with aeroplanes had been tried, but not with much success. Intimate coöperation with low-flying aeroplanes had been organized, especially in the direction of noise barrages, machine-gunning and bombing the enemy, chiefly of the hostile guns, and dropping information, as also observation for counter-battery work, and smoke-screens were employed. In short the battle was organized to include and harmonize with the new instrument.

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[1] *Tanks in the Great War*, Col. J. F. C. Fuller.

In regard to the future of the tanks, had the war not ended in 1918, certain proposals for expansion for the 1919 campaign, made at the Inter-Allied Tank Committee in Jan. 1918, were again brought up in July, and new establishments for the increase of the Tank Corps to a strength of 34 battalions were sanctioned in Oct. This strength, together with the number of some 6,000 machines which it was hoped to produce for 1919, is in itself evidence of the importance attached to the tank arm at the close of the war. Its strength in the field in Oct. 1918 amounted to 12,355 of all ranks, whilst many thousands more were under training at home.

The work of designing and producing the different types of machines which took the field, or were almost ready to do so, necessitated a very large organization. In addition to the Medium Mark A. (Whippet) machines, of which, as has been stated, delivery began in France at the end of 1917, the following types were evolved.

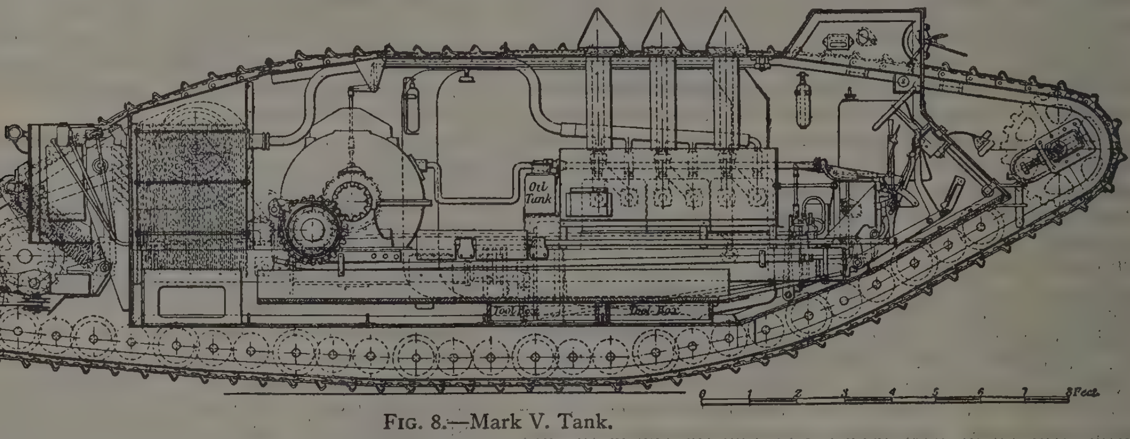

Fig. 8.—Mark V. Tank.

The Mark V. tank (see fig. 8 and table A). This was in design and size the same as Mark IV., but it was superior to it in the following particulars:—The engine, a 6-cylinder Ricardo engine of 150 H.P., was more powerful and was expressly designed for the tank. The manœuvring powers were improved by one-man control and an epicyclic gear. The means of observation were improved. The unditching gear could be worked from inside the machine. Better means of clearing the tracks of mud were provided. The design for this was begun in Oct. 1917 after the experiences of Messines and the third battle of Ypres, and was to meet the requirements as then known. Some of these machines reached France in time for the attack on Hamel on July 4 1918, and this tank was the principal machine of all the subsequent fighting. In all, 403 were made.

The Mark V. Star tank was the same as a Mark V. machine, with 6 ft. added to the middle of its length. It could cross wider trenches (14 ft.) than the Mark V. machine, and could carry about 20 men in addition to the crew. The design was not started till Feb. 1918, 32 machines being made, of which some were delivered in time for the battle of Amiens. The tank was too long to be very handy.

The Mark V. Two-Star tank was the same as the Mark V. Star, but with a 225-H.P. Ricardo engine. Design was started in May 1918, one being made but not delivered before the Armistice.

The Mark VI. tank was intended to be the same size as the Mark IV. with an improved transmission (the Williams-Janny variable speed gear), but did not get beyond the design stage.

The Mark VII. tank. This was 3 ft. 6 in. longer than the Mark IV. and Mark V. It had a 150-H.P. Ricardo engine and a variable speed gear. Seven were made, but none was used in the field.

The Mark VIII. tank. The design for this machine was commenced in Dec. 1917; seven machines were made, but none was employed in the field. It was larger (34 ft. 2½ in.) than any other tank, and was designed so as to be made up of parts manufactured in England and the United States, and was to be engined either with the American 300-H.P. Liberty, or the British 300-H.P. Rolls-Royce, engine. The engine-room was separated from the fighting-chamber by a bulkhead and the ventilation was improved.

The Mark IX. tank (Infantry tank). The design for this was begun in Sept. 1917. Thirty-five machines were made, but none was actually used. It was a long machine with space in the centre to carry 50 infantry or 10 tons of stores.

The Medium B (Whippet) tank. The design of this, which differed from that of the Medium A, was commenced in June 1917. The shape was more like that of the heavy tanks. It had a four-cylinder 150-H.P. Ricardo engine. Forty-five machines were made, but none used. In all, 2,636 British tanks were constructed.

The production of the tanks on the first order for 150, which were in action in 1916, six months after the order had been placed, was, as has been said, a remarkable achievement. After that time supply was carried out by the Mechanical Warfare Supply Department of the Ministry of Munitions, working in conjunction with the War Office and G.H.Q. in France. The subject was handled by a succession of committees, composed of those concerned, which endeavoured to obtain coöperation and the allocation of responsibility as between the army, which demanded machines and changes of design, etc., and those who had to meet these demands. In Aug. 1918, control was taken over by a Tank Board, to coördinate all sides of the question of supply. There were naturally considerable difficulties in administration of the production side of this weapon improvised during hostilities, at a time when the manufacturing resources of the country were already deeply committed in satisfying the urgent demand for munitions of other kinds. The lack of continuity in the demands, also, which fluctuated as the value of the tank varied in the opinion of the army in the field according to its success in action, made continuity of work and accurate forecasts of output almost impossible. There were also questions of obtaining the necessary labour, manufacturing facilities, raw materials, and that of priority amongst so many competing requirements for carrying on the war. The problem was complicated by the multiplicity of special component parts and fittings required, the great wastage of machines from action in the field, and the quite unexpected wastage by wear and tear of certain parts, some of which, as the design of the machines developed, became obsolete before they could be used; and there were the technical difficulties of ensuring efficiency in details, of which the only test could be use in the field.

A great expansion in the sources of supply became necessary as the programmes of construction increased in size, and many engineering firms were engaged in the manufacture of the tanks in addition to the comparatively small number concerned in 1916 and 1917. Before the Armistice the supply of tanks was considered so important that men were relieved from the army to carry on production. The programme for 1919, including Inter-Allied production, which covered over 6,000 machines, required 193,000 tons of steel, 10,000 6-pdr. guns and 30,000 machine-guns, and an expenditure of £80,000,000. By the end of the war, tanks were accepted as being the best and most economical means of arriving at a decision in the field, as the ratio of results obtained to material and man-power absorbed was greater than from any other means. In England development in design has since continued in the direction of the evolution of tanks possessing greater speed and a greater radius of action than that of the more or less embryonic machines which were evolved during the war, and also in the production of machines which can function either on land or on water. Success in these directions will endow the machine, originally improvised with the limited object of assisting the infantry to break through an entrenched line, with far greater powers.

French Tanks

It is not remarkable that allies fighting a common enemy, side by side in the same theatre of war and subjected to similar conditions, should have evolved a similar means of meeting them. And it would have been natural had they done this simultaneously, in a common effort, or at least with mutual knowledge from the beginning on the part of each of what the other was doing. Curiously enough, this was not the case with the British and French, the two nations concerned in the creation of the tank. Forced into being by the same causes, a remedy for the same disease, even suggested in form by the same mechanical prototype, the British tank and the French *Char d'Assaut* were conceived separately, and for many months developed on independent lines, the British ignorant of French intentions and the French ignorant of what the British were doing. In the case of the latter, as of the former, it was the difficulty experienced in carrying out the pre-war theories of infantry attack against a prepared defensive which finally led to the new machine, though the effect of the H.E. shell of the French field gun may have prevented its necessity being felt so soon.

The French owed their tank[1] to the foresight and pertinacity of Col. (later Gen.) J. B. E. Estienne of the artillery, who, during the retreat of 1914, perceived the desirability for having some means of transporting infantry under cover across obstacles and swamps and ploughed land. Later, during the summer of 1915, on seeing the caterpillar gun tractors in use in the field by the British, his ideas took a more concrete shape in the direction of a *cuirassé terrestre* (land battleship). This was to be a caterpillar-propelled machine 4 metres long, 2·60 metres broad, 1·60 metres high, weighing nearly 12 tons. It was to be provided with a petrol engine, to travel at a speed of 6 m. per hour on the flat, to be protected by armour up to 20 mm. in thickness, to carry an armament of two machine-guns and one light Q.F. gun for the attack of machine-guns behind shields, and to be capable of crossing trenches two metres wide and forcing its way through barbed wire. It was also to draw an armoured trailer carrying 20 men and equipment. This was worked out in greater detail, but was in essentials the same as the scheme put forward in England in Oct. 1914, except that as projected the *cuirassé* was to be somewhat of a hybrid between a tug to haul a transport filled with men and a fighting machine, and not purely a destroyer which would open out a way for men to advance on their feet. Actually, however, both types were developed as fighting machines. Both, also, were inspired by the Holt tractor, of the existence of which the British originator had knowledge before the war, and of which the French originator first became aware when he saw it at work behind the British lines. Before these machines were introduced by the British in the early part of 1915 for moving heavy artillery, tractors on the caterpillar system were practically unknown in France. Later some brought over from Tunis were employed with the army of the Vosges. After communicating with the commander-in-chief, Col. Estienne on Dec. 1 1915 put forward his ideas in an official letter with a request for an interview. This took place on Dec. 12, which date can be taken as marking the official conception of the French tank. After consultation between Gen. Joffre and Col. Estienne, and discussions between the latter and representatives of the Renault and Schneider works during Jan., the French Army H.Q. submitted to the Ministry of War a demand for 400 tanks. These were to be of the design prepared jointly by M. Brillé of the Schneider Creusot Works, and Col. Estienne. For the French, therefore, this was the commencement of the solution of the problem of mobile protection for the infantry.

In regard to the French tanks, the year 1916 can be taken as one of gestation. The year 1917 covered the birth and infancy of the medium (Schneider and St. Chamond) tanks; the first half of 1918 the adolescence and maturity of the medium machines and the birth of the light (Renault) tank; and the last half of 1918 the adolescence and maturity of the light machine. But the period of gestation before the birth of the new arm, *i.e.* the appearance in the field of the *Artillerie d'Assaut*, or "A.S.," was, as in the case of the British Tank Corps, somewhat lengthy. Its promoters still had much opposition and many obstacles to overcome, for the question of production was handled by more than one department or directorate, a state of things which is usually bound to result in friction and delay. It appears, also, that whilst some officials were impressed with the vital urgency for expedition others were more concerned to conduct matters in accordance with the regular routine of peace procedure. But there was no intervention by an outside department or ministry to save the situation. It is not on record that the French Ministry of Marine collaborated in the creation of the *Chars d'Assaut*. On Feb. 25, after some inter-departmental discussion and trials of a baby Holt tractor, and without waiting for the construction of any experimental machine, an order was placed with the Schneider firm for 400 tanks, then called *tracteurs Estienne*, afterwards known as *Chars Schneider*, to be delivered within six months. This was only two weeks after orders had been placed by the British for the first 100 Mark I. tanks. So far the comparative progress in development of the new arm by the two nations had been as follows:—the idea of the tank had occurred at about the same time to both; the matter had been put forward officially by the British in the third month of the war and by the French 14 months later; the first actual order for machines, given by the British 18 months after war began, was followed by that of the French only a few days later. The British machines, however, took the field six months before those of their Allies. In addition to the 400 Schneider tanks a contract for 400 more machines of a different type was placed with the St. Chamond Works in April, without the knowledge of the commander-in-chief or of Col. Estienne.

Not long afterwards steps were taken for the formation and training of personnel for the new arm at Marly-le-Roi. In June French H.Q. received from British G.H.Q. official intimation of what was being done in England. Col. Estienne visited England, and after inspecting the Mark I. tank in the training area at Elveden reached three conclusions. One was that the two countries should collaborate in the production and coöperate in the use of the new weapon in the field. The second was that neither should forestall the other in employing it and so discount its maximum value for the Allies as a whole. On this Col. Estienne was specially insistent, because it was apparent that the British were far ahead in production and would probably be ready before the French. The third was that as a complement to the heavy, somewhat slow, British tanks, capable of negotiating almost any obstacle, the French should specialize in the production of a speedier and more handy machine, which would be to the British tank what field artillery is to heavy artillery, would perform the duty of a swarm of skirmishers in armour armed with a machine-gun, and would be capable of going wherever an infantry soldier could go. The scheme for light tanks did not meet with a favourable official reception, and sanction for the construction of 50 machines of this type was not given. Nevertheless designs were put in hand by the Renault firm and at the end of Nov. were so far completed that construction could have been started. Though no executive action was taken for some months, except that 150 machines for use as "command" tanks for the units of the *Artillerie d'Assaut* were given, this was the genesis of the Renault tank.

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[1] For convenience the word "tank" will be used generally to describe the French machines.

The French classified tanks in three categories:—

Chars legers, machines weighing under 10 tons.

Chars mediums, machines weighing 10 to 30 tons, which could be transported by rail on ordinary trucks.

Chars lourds, machines which would require specially constructed trucks for transport by rail.

As the medium tanks were the first constructed and used, their description will be given first. Both the Schneider and St. Chamond tanks were smaller and lighter than the British Mark I. or any subsequent pattern of heavy machine, and were, according to British nomenclature, males. The great difference between them and the British heavy tanks was that the designers of the former, in taking the caterpillar tractor as a model, had been content to employ tracks somewhat similarly placed under the body of the machine, and not extending all round it as in the case of the British heavies. The tracks were also shorter than the full length of the body, instead of projecting well beyond it, at least at the front, as was the case with the British Whippets, and the French Renaults, and both tanks had a particularly "underhung" appearance. It was this arrangement of the tracks which militated against the climbing powers of the machines, whilst their comparative shortness limited the spanning powers across a trench.

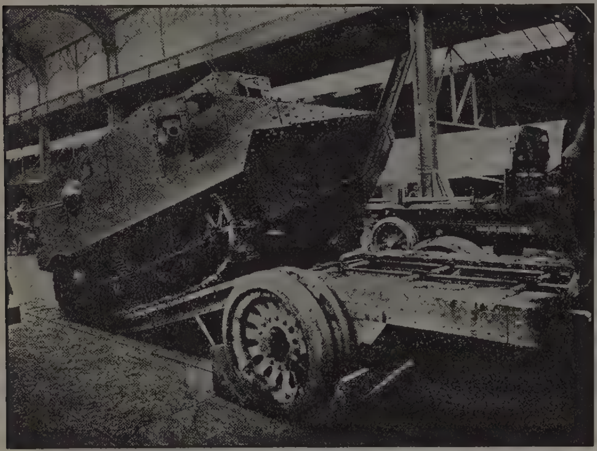

FIG. 9.—French Char Schneider.

The *Char Schneider* (see fig. 9) was 6 metres in length, 2 metres in width and 3·40 metres high. It consisted of an armoured body resting on two horizontal girders with the necessary bracing. The weight was taken by springs on two bogies on each side, which were carried by the track rollers. The track was actuated by a driving sprocket at the rear, there being an idle wheel at the front. The gear-box was at the rear, the radiator in front. Power was given by a four-cylinder Schneider engine of 60 horse-power. The petrol feed was by pressure. Steering was effected by driving the tracks at different speeds. The whole body formed a box of somewhat peculiar shape protected by hardened steel plate of 11·4 mm. thickness on the walls and 5·4 mm. on the roof. There were various openings with movable shutters for observation, etc., and the door was at the back. In front was a steel prow, or beak, to prevent the machine dipping too much when descending into a cavity. The armament consisted of one short 75-mm. gun, of a maximum useful range of 600 metres, mounted on the right cheek of the bows of the machine which could from its position fire only on the right side and not directly ahead. There was also one Hotchkiss machine-gun on each side firing through a spherical shield mounting. For the gun 90 rounds of ammunition were carried and for the machine-guns 4,000 rounds. One officer, one N.C.O., and four men, of whom two were machine-gunners and one a gunner, formed the crew. The officer drove. The total weight of the machine was 13·5 tons and its useful speed from 2 to 4 km. per hour. It could cross trenches of from 1·50 metres to 1·80 metres in width, and carried petrol for 6 to 8 hours' work.

The *Char St. Chamond* (see fig. 10) was a larger and heavier machine. It was 7·91 metres in length, 2·67 metres in width and 2·365 metres or 2·35 high, according to the pattern. It consisted of an armoured body in suitable framework suspended on spiral springs on three bogies on each side, which were carried by the track rollers. The drive was through the rear sprocket. The driving mechanism was petrol-electric and consisted of a four-cylinder Panhard engine of 80–90 H.P. with electric self-starter, a dynamo of 52 K.W. power and two electromotors, one driving each track. Driving was done by a "tramway" control, by which speed and direction were regulated. This system had great conveniences, for the machine could be driven from either end without effort, but it had the drawback of being somewhat complicated and delicate. The petrol feed was by pressure, and the tanks were two superimposed on the left side and one on the right. The whole body formed a box with a square sloping front without any beak. It was enclosed in hardened steel plate of 11 mm. thickness in the front shields, and 8·5 mm. at the sides and 5 mm. on top. On the roof there were three observation cylindrical *capots* with sides of 11-mm. steel above the commander's and driver's ports. The doors were at the sides. The armament consisted of one 75-mm. field gun, except in the first 175 machines which had a special gun, firing ahead in front, and four Hotchkiss machine-guns, one in front to the right of the gun, one on each side and one on the rear face. For the gun 106 rounds of H.E. were carried and for the machine-guns 8,488 rounds of S.A.A. The total weight, loaded, was 24 tons, and its useful speed on the flat 8·5 km. per hour. It could cross trenches up to 2·50 meters in width in good soil. The petrol carried was enough for from 6 to 8 hours. The crew consisted of one officer, one N.C.O., two gunners, four machine-gunners and one mechanic, or nine in all.

During Sept. the first tank of each type arrived at the training centre, where a considerable number of officers and men from different branches of the Service had already collected for preliminary individual instruction. An additional training centre for the formation of units was established at Champlieu, and also a depot for the assembly of *matériel* at Cercottes, near Orleans. It was then decided, also to create the new "*Artillerie d'Assaut*" and the charter of this organization may be said to date from the 30th of that month. Col. Estienne was promoted to the rank of general, and was appointed "*Commandant de l'Artillerie d'Assaut aux Armées*" and representative of the commander-in-chief in tank matters with the Ministry of Munitions, which department had been created and taken over tank production. In Oct., with the arrival of more machines of both types, the *Artillerie d'Assaut* started on its career. It seems that the use of the British tanks at Cambrai, which had been deprecated by the French beforehand, and criticized for the reasons already stated, may have stimulated the French to press on with their own service, though what had been looked upon as the supreme factor of surprise had been discounted.

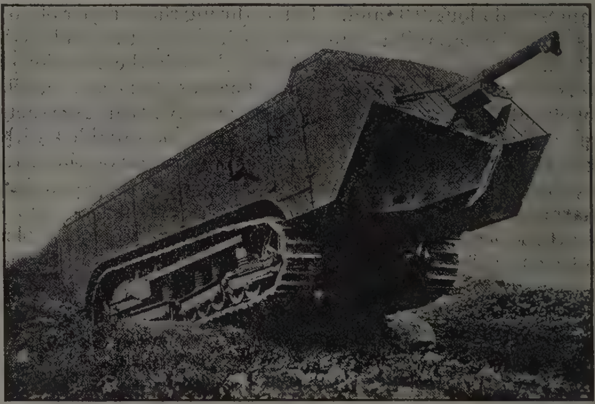

FIG. 10.—French Char St. Chamond.

The work of preparation, including training and equipment, continued throughout the winter, in preparation for the offensive to be undertaken in the spring of 1917. On March 31 1917, the organization of the *Artillerie d'Assaut*[1] was as follows: The tactical unit, under a captain, was the *groupe*, which was divided into four batteries, each consisting of four tanks. A *groupe*, therefore, comprised 16 tanks with a special "command" light tank (Renault). For a Schneider tank *groupe* the establishment was 18 officers and 92 other ranks, for a St. Chamond tank *groupe* 18 officers and 106 other ranks. A *groupement* consisted normally of four Schneider or three St. Chamond *groupes*, but was not rigid. For repair work each *groupe* had its own workshop and a *Section de ravitaillement et de reparations*

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[1] Why this arm was ever called "artillery" is not clear. Its closer connexion with, and resemblance to, infantry was recognized later, and the names of the elements of the organization for the light tanks followed those of the infantry, *e.g.* battalion, company, etc.

(S.R.R.), of 1 officer, 111 other ranks, was allotted to every 10 *groupes*. There was for the whole unit a *Section de parc*, or repair park, similar to that of the Mechanical Transport Service. This was found necessary so soon as tanks had been delivered in any number, owing to the amount of tuning-up, minor repair work and even alterations which had to be done.

Numerous faults at once developed in these entirely new machines (as had been the experience of the British), but thanks to the time available before they went into action, certain defects were discovered and remedied. The first was that some parts of the machines wore out very quickly, necessitating the maintenance of a very large stock of spares. The thickness of steel plate where vertical was not proof against the German "K" bullet, and it was found necessary to add an outer plate of 5·5 mm. to the vertical armour of the Schneider machines, and 8·5 mm. to that of the St. Chamond machines. On the whole the defects discovered in the Schneider tanks were not such as to give reason to suppose that they would not be able to go into action in the spring; but those of the St. Chamond were more serious. The design was found clumsy and the machine liable to ditch. In addition to breakdowns in the power system and failure in details, there was a lack of rigidity in the whole machine, and the tracks of the first machines were too narrow.

Delivery of both types was extremely slow, especially of the St. Chamond machines. At the end of March, though personnel for 15 of the latter was ready, there was not one machine serviceable. At this time, on the eve of the great 1917 offensive of which so much was expected, the *Artillerie d'Assaut*, instead of being in possession of the 800 tanks which were to have been ready by the previous autumn, had received not more than 208 Schneider and 48 St. Chamond machines. There were for this operation, therefore, only 8 fully and 2 partly trained *groupes* of Schneider and 1 of St. Chamond tanks, and not 40 *groupes* as originally contemplated; and of the 160 Schneider machines only one had been fitted with the extra bullet-proof protection. In view of the diminution of the tank force from what was expected to be available, and with the example of the result of the action of the British in the previous Sept. before it, the French High Command had grave doubts whether to make use of tanks in the coming operations or to wait until there should be sufficient to exercise a greater influence. It was finally decided to throw all possible weight into the attack.

April 16 was the baptism of fire of the French tanks, in Gen. Nivelle's unsuccessful attempt to break through the German line along the Chemin des Dames, E. of Craonne.

Eight Schneider *groupes* coöperated with the French V. Army. They were divided into two parts of three and five *groupes* respectively. One party did not succeed in crossing the German line, though a few machines reached it, and it suffered severely from the enemy's guns posted on the Craonne Plateau. The other party succeeded in crossing the enemy's second line, but were not followed up by the infantry, owing to the German machine-gun fire. Two Schneider *groupes* and one St. Chamond *groupe* allotted to the French IV. Army for employment on the 17th were not thrown into the fight, as the German artillery observation posts were not first captured by the infantry—a lesson of the action of the 16th. The offensive failed; and though the new arm showed the utmost devotion and gallantry, and its intervention saved many lives, it did not achieve the success that was hoped. But the conditions were almost as unfavourable for the employment of tanks as they could be, and the tactics employed were not those urged by those responsible for the new arm. The attack was not a surprise, being preceded by a heavy bombardment, which, however, did not succeed in overcoming the German artillery, and was made in broad daylight, without any smoke-screen, against a position which permitted of direct observed artillery fire against the tanks both when approaching and when they reached the enemy's positions. The plan, also, in which certain infantry units had been trained to coöperate, was that the tanks were to attack the German third defensive line after the infantry should have gained the first and second, and were not to advance until after this had been achieved. The Germans, who were prepared for the attack, therefore, had even additional time before the tanks appeared, and the result was that their guns caught many of the machines in column before they deployed.

The machines themselves showed certain faults—they were deficient in speed and climbing capacity, the latter defect being accentuated by the fact that since the Somme the Germans had increased the width of their trenches. They also proved, as was known before would be the case, vulnerable to direct hits of H.E. shell, by which many machines were set on fire. Amongst other points of design in which modification was found necessary was that of isolating the petrol tanks from the interior of the machine, improving the means of communication, the power of observation, the ventilation, and various details of mechanism, and of widening the tracks. On the whole the Schneider machines stood the trial best.

In the next tank attack, carried out on May 5 by the VI. Army, the battle of Laffaux Mill, the three *groupes* employed advanced with the infantry with marked success, especially in the case of the Schneider machines. The counter-battery work of the French was good and the enemy observation posts were destroyed or masked; and the tanks did not remain too long in advanced positions where the infantry were checked.

For nearly six months the tanks did not again go into action. During this period great efforts were made to remedy the defects disclosed, to expedite the delivery of machines, which was much in arrears, and of spare parts, the demand for which (as in England) had been found very greatly to exceed any anticipations, and to augment the establishment of repair units. In preparation for the next operation great care was taken in the training of infantry with the tanks in attack and in tank tactics generally. On Oct. 23 five *groupes* of tanks took part in the battle of La Malmaison along the Chemin des Dames. Their assistance was most valuable.

Owing to previous heavy rain, and the bombardment which had continued for six days and six nights, the ground was extremely difficult, and in the centre the tanks were not of so much help in the first phase of the attack as later. This state of the ground and the lack of surprise again discounted to a great extent the preparatory training undergone by the units of the *Artillerie d'Assaut*. The practice which had been carried out beforehand with the attacking infantry, however, proved of great value, as did the work of the special unditching sections. The ground had been carefully reconnoitred and aerial photographs supplied. The Germans relied on this occasion more on their advanced field guns for defence, and had also organized numerous special machine-gun posts furnished with plentiful supplies of armour-piercing ammunition. But owing to the counter-battery work of the French the tanks were not so much damaged by the German guns as in April, in spite of the fact that the attack was not a surprise. Two days later some St. Chamond machines again operated with success.

Apart from the projected light tanks, the necessity for an improved medium tank had been realized before April 1917, and the subject was under consideration throughout the year. The main directions in which the April offensive showed improvement to be necessary were the desirability of mounting the gun in a turret to give all-round fire, of mounting a 75-mm. field gun in place of the shortened 75, and of increasing the size of the tracks and the power of the engine. Designs for a new medium machine (C.A.3) were prepared in Aug. 1917, but were abandoned after the battle of La Malmaison because the further improvement then found desirable, *i.e.* the provision of 6 to 7 H.P. per ton weight, a trench-crossing capacity of 3 metres, and an ability to climb ahead or astern, showed that the designs were already out of date, and would be more so by the time the machines could be made. At the end of Oct. it was decided to suspend the construction of an improved type of medium tanks and to concentrate on that of the light machines; and in Dec. the idea was finally dropped. The question of providing heavy tanks was taken up at the end of 1916 as a result of the operations of the British machines in Sept., and in order to have available a machine which would be complementary to the light tanks it was hoped would be made. A project was put forward for a heavy tank weighing 38 tons to carry a 105-mm. gun, but its execution was postponed in view of the demands that might be made for other machines. Two experimental heavy tanks, one with mechanical and the other with electrical transmission, were tried, and it was decided to investigate in the direction of still heavier machines.

In regard to the type which will always be especially associated with the French, the *Char leger*, or Renault tank, first suggested by Gen. Estienne in July, and for which designs were prepared in Nov. 1916, the commander-in-chief in that month expressed his desire for 1,000 of such machines. But whereas those responsible for supply had, in the case of the medium tank, pressed forward the construction of one type, the St. Chamond, without military approval of the design, in the case of the Renault every obstacle seems to have been placed in the way of manufacture of this machine, for which army H.Q. and the *Artillerie d'Assaut* were pressing throughout the winter, though various trials were made. In March 1917, the demand of army headquarters was increased, being based on the requirements for an offensive on a 100-km. front. This entailed the production of 3,000 light, 400 medium (improved Schneiders) and 150 heavy tanks. In May an order was given for 1,000 Renault machines in addition to 150 which had been ordered in March as "command" tanks. Discussion as to design, armament and manufacturing facilities and trials continued during the summer of 1917. In Oct. it was settled that in addition to the 1,150 already on order, 2,380 more should be made, or 3,250 in all, the work being distributed between four French factories, the whole to be delivered by the end of July 1918. Of the total, 1,000 machines were expected to be ready by March 31 1918, for the contemplated offensive in the spring, and 1,000 were to be manufactured in the United States, of standard American parts and equipped with Liberty engines. The decision to devote so much money as this entailed and so much of the manufacturing power of the nation at a moment when the demands for munitions of war of other kinds was at its height illustrates the importance now attached to the new arm. The British success at Cambrai seems to have had considerable effect in influencing those who were still sceptical of the value of the tank and of the wisdom of relying on it for future operations. In Jan. 1918 a supplementary order was placed for 470 machines, the final total figure fixed for production in France being 4,000, divided into 1,000 armed with machine-guns, 1,830 with the 37-mm. gun, 200 signal tanks, and 970 for a reserve armed with the 75-mm. gun.

The Renault tank differed greatly from the Schneider and St. Chamond machines. Not only was it considerably smaller, but the tracks were outside the body and not underneath it and extended to a considerable distance in front. Its total length, without the movable tail, was 4·100 metres; its breadth 1·740 metres, and its height 2·140 metres. The body was supported on hollow longitudinal girders by a hinge arrangement at the rear end and suspended on powerful springs in front so that the front of the frame and body were capable of relative movement. Each girder was carried by springs on four bogies supported by wheels running on the tracks. The idle track pulley in front was of larger diameter than the driving-sprocket at the rear and this and the projection of the tracks gave the machine a greater grip in climbing over obstacles. The upper portion of the track ran in spring guide rollers which were arranged to regulate the track tension automatically. The interior of the tank consisted of a driver's compartment in front and the engine-room behind. The crew comprised two, one officer or N.C.O., who was also the gunner, and one man who was the driver. The driver was seated; and also seated, or standing, behind him was the gunner, with his head and shoulders in the turret. The latter revolved on ball-bearings which allowed of all-around fire, and was furnished with a lock and a door at its back. The whole of the machinery, engine, radiator, clutch, transmission gear and petrol tank were in the engine-room, separated by a steel bulk-head pierced by openings closed at will from the driver's compartment. Power was given by a four-cylinder Renault engine of 35 H.P., with the usual transmission. Steering and control could be done by one man. Protection consisted of hardened steel plate 16 mm. thick for the vertical portions (proof against the armour-piercing bullet) and 8 mm. for other parts. The armament was either a 37-mm. Puteaux semi-automatic gun, or a Hotchkiss machine-gun; and 240 rounds including 40 rounds of case shot, or 1,820 rounds of S.A.A. were carried. Fully loaded the female weighed under 6½ tons and the male just over 6½ tons. There were four speeds ahead and astern giving to the tank a maximum speed on the flat of 7·78 kilometres. It could climb slopes up to 45° and span openings up to 1·80 metres in width, in which it was assisted by the movable tail. This was the machine upon which the French relied for the operations of 1918. The question of the provision of Renault wireless signal tanks was taken up in May 1917, and a machine capable of sending and receiving wireless messages was constructed.

In the autumn and winter of 1917 the reorganization and training of the *Artillerie d'Assaut* continued with a view to its expansion. In addition to the medium tanks still being delivered, it was expected, by March 31 1918, to receive 800 of the Renault tanks then due. The establishment of the *Artillerie d'Assaut* was tentatively fixed as follows:—four *groupements* (16 *groupes*) of Schneider tanks, with four repair sections; four *groupements* (12 *groupes*) of St. Chamond tanks, with four repair sections; 36 companies of Renault tanks; one *groupe* depot for Renault tanks; one salvage *groupe*; three park sections. The number of Renault companies was fixed at 30 before the end of the year. The organization of the Renault tanks, which were regarded as an infantry arm, was to be by sections, companies, battalions and later by regiments and brigades. A company comprised three sections of five tanks each and an *échelon de combat* of 10 tanks (of which one was a wireless signal tank),[1] or 25 machines in all. A battalion contained three companies of 75 tanks. Changes were made in the administration, and Marly-le-Roi was given up as a training centre, two army group-training centres being established at Mailly-Poivres and Martigny, the training facilities and auxiliary services generally were increased and elaborated, and the relation of the *Artillerie d'Assaut* to the Ministry of War was defined and simplified. All these preparations were carried out with a view to the coöperation of the tanks in the French offensive in the spring.

When the German advance on March 21 1918 wrested the initiative from the Allies, amongst other results it upset all the plans carefully worked out for the French tanks. Instead of taking part in mass in a great offensive, as intended, whatever tank units existed had now hurriedly to be collected and thrown into the defence. The factor ruling the speed of the creation of the service had all along been the rate at which the *matériel* was delivered. This, for various reasons, was always much behind the scheduled time arranged. On March 21 the medium tanks in a serviceable state fit for immediate use amounted in number to 245 Schneider and 222 St. Chamond, or 467 machines of an obsolescent type, and of the new Renault tank 1 machine ready for action, with the army. (By the beginning of April over 400 had been turned out by the factories. But these were made up of training machines without armament or armour, pattern machines, machines issued to the American army for training, and those under test.) Moreover the approach of the Germans necessitated the hurried evacuation of the tank centre and main park at Champlieu. And so, not only was the new arm, still in its early infancy, forced to face an entirely fresh situation with improvised measures, but part of its organization was suddenly torn up almost before it had taken root. Great efforts were made both to assist in coping with the immediately urgent necessity of checking the enemy's advance and to prepare for subsequent action. Champlieu was reoccupied in the beginning of April, when the progress of the Germans to the north was checked; but a central reserve park farther from the front, near Fontainebleau, and three others were established.

Operations during April and till the end of May were confined to the medium tanks, which alone were available and mobilized. Four *groupements* of Schneider machines were allotted to the III. and I. Armies, joined later by three of St. Chamond machines. All the actions now undertaken were, as was the case with the British tanks, of the nature of minor counter-attacks, and not such as the tanks were best suited for. They took place, on April 5, at Grivèsnes; on April 7 at Sénécat; and on April 8 at Cantigny, the last being in coöperation with the American troops. The most successful was the last, in which the action of tanks had been legislated for. The artillery bombardment was short and portions of ground were left unshelled to allow of the passage of the tanks. Though not actually fighting, the tanks were at this period continually being moved about in readiness, and to save wear and tear the system was adopted of transporting them by road on special "tugs" drawn by caterpillar tractors.

On May 31 the Renault machines received their baptism of fire on the E. of the Forest of Retz. Three battalions of these machines now ready were allotted to the VI. Army, and were brought up by train, on lorries and on tugs. Six sections had to be flung into the fight. Without previous reconnaissance or any liaison with the already exhausted Colonial infantry, who had never seen a tank, they had practically to make a cavalry charge in broad daylight, without a smoke-screen, across a mile of open plateau under observation of captive balloons and without effective support from their own guns. One condition favoured their action; their attack was a surprise.

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[1] Owing to delays in manufacture and difficulty in technical training the first wireless signal tanks did not take the field until July 1918, when after some practice they were found of great value. As has been stated British tanks were fitted with equipment and trained operators ready for the field in July 1916.

Though the tanks succeeded in clearing the enemy out of their positions, their success had no tactical result, for the infantry could not follow up and consolidate the ground gained. But they caused panic, and inspired a nervousness and hesitation amongst the Germans which was invaluable at the moment. This and their subsequent actions carried out during June served to prevent the enemy from penetrating into the forest.

Meanwhile, four *groupements* of medium tanks led and greatly assisted Gen. Mangin's counter-stroke at Méry-Belloy on June 11 against the flank of the German salient between Noyon and Montdidier, by which the enemy's progress toward Compiègne was arrested. The tanks played a great part in this operation which had such strategic importance, but this action was the high-water mark in the career of the medium tanks, for they were becoming worn out and were gradually replaced by the new and more efficient Renault tanks as the latter were produced.

By July considerable progress had been made in organizing and equipping fresh units, and the *Artillerie d'Assaut* was able to coöperate on a large scale in the battle of Soissons, Gen. Foch's decisive counter-stroke of July 18 and following days, against the German salient formed between Château-Thierry and Reims. This was the vindication of the French tank arm. To the X., V., and VI. Armies were allotted respectively six, one, and one *groupements* of medium tanks, and to each three battalions of Renault tanks, or a total for the operations of eight *groupements* of medium and nine of Renault tanks. The battle, which lasted from July 18 to the 23rd and 26th, so far as the tanks were concerned, formed a turning point in the war. The entire operation was based on the action of the tanks; every available machine was thrown into the fight; and they were given a chance of showing what they could do.

The tactics employed were those which had been urged all along by Gen. Estienne and M. Breton, and were a repetition of those initiated at Cambrai. The attack opened with the advance of a mass of tanks without preliminary bombardment, as it happened, in a slight fog, and was a complete surprise. Similar tactics on a smaller scale were made use of again after the first day, but on the 23rd the tanks suffered severely from the enemy's guns. Two battalions of Renaults acted with the VI. Army east of Reims on July 16-17, and coöperated with two medium *groupes* with the IX. Army on July 18 near the Marne, and some with the British on July 23 near Espilly. In these operations, especially the main attack on July 18, the tanks achieved what it had been claimed they would if properly used. On July 30 the commander-in-chief issued a special Order of the Day to the *Artillerie d'Assaut*—"*Vous avez bien mérité de la Patrie*," whilst Gen. Estienne was made a commander of the Legion of Honour and promoted general-of-division.

The battle of Soissons had a great effect on succeeding operations. It established the value of the tanks beyond all doubt, inspired enthusiasm in all that concerned the arm and expedited the manufacture of the machines and the training and organization of new units. Without giving even the list of actions in which the tanks took part to the end of the war, it can be said that the infantry now clamoured for their assistance, in spite of their faults and failings, and they were employed whenever possible. They were asked for by the commander of the VI. French Army when transferred to Flanders, and on Sept. 30 and several days in Oct. were in action. Some were also sent to Salonika. Out of the 120 days between July 15 and Nov. 11 they were used on 45 days, and the casualties suffered amounted to 300 officers and 2,300 other ranks. During 1918 3,988 individual engagements were fought: 3,140 by Renault, 473 by Schneider and 375 by St. Chamond tanks. Toward the end their actions amounted to disposing of the enemy rearguard machine-guns which continually held up the infantry.

By Aug. the machinery of production and training had been so improved that it was found possible to turn out one battalion of Renault tanks (75 machines) per week, which implied a vast increase in the whole of the rear organizations, which were now of a capacity for the continuance of the tank effort on a greater scale in 1919. As in England the production of tanks had become an industry. Though the construction of medium tanks had been abandoned, Gen. Estienne's opinion as to the necessity for heavy machines had not changed from the time in Feb. 1918, when he had asked for 900. But the same influences that had in 1917 retarded the introduction of the light tank were now adverse to the contemplation of heavy machines. To provide such machines an Inter-Allied factory was established, but this was not completed before the Armistice. In Oct., negotiations which had been carried on with the British Government resulted in the promise of some Mark V. and Mark V. Star tanks. Of the latter, 77 were handed over in November.

In Aug., at the instance of Gen. Foch, an Inter-Allied tank school was opened in France. It was equipped with a staff of French and British instructors and various types of British and French machines. This school was for the interchange of views and the establishment of a common basis for tactics and staff work concerned with tanks.

The reliance that had come to be placed on the *Artillerie d'Assaut* can be gauged by the fact that in Oct. 1918 its actual strength in the field amounted to 18,023 of all ranks.

Since the war the French have been continuing their development of cross-country machines. The construction of a very heavy armoured tank was in hand in 1921, while a much lighter machine, the "Kegresse," of Russian invention, had been tried. It consists of the substitution of small rubber tracks for the rear wheels of a motor-car. It is light, cheap, can travel on the flat at a speed of 15 to 20 m. per hour, and can cross any country over which cavalry can pass. An amphibious tank propelled on land by tracks and on the water by a screw has also been tried successfully.

AMERICAN TANKS

Though the tank had not accomplished much in the way of results by the time that the Americans came into the war, in April 1917, its military potentialities were at once appreciated by them, while its mechanical side appealed to their national genius. But hostilities did not continue long enough for them to bring their vast resources to bear on its development. The Americans lost no time in inquiring into the subject, and at once requested information as to designs, etc. At this time there was some doubt as to whether the tanks should not be taken up by the American Marines, but the final decision was in favour of the Army. In June the commander-designate of the American Tank Corps, Col. Rockenbach, arrived in France, and an officer was detailed to inquire into the technical aspect of the tank arm. An Inter-Allied Tank Bureau was also established. In Sept. a scheme for an American Tank Corps, to consist of five battalions of heavy tanks and 20 of light tanks, was approved, and in Oct. an expert technical officer reached England to consider further the question of development.

The question of the provision of machines and spare parts, which had proved such a difficulty with the British and French, was also taken up. It was realized that in matters of design, it would be best for the Americans to profit by the experience of the British and French, whilst relying, as far as possible, on their own resources for *matériel*, and it was decided to adopt a heavy tank of the British type, and a light tank of the French Renault type. As a result of consultations between the British and French Ministries of Munitions and the American commander-in-chief as to joint production, an Anglo-American commission was appointed in Dec. to deal with the question, and in Jan. 1918, an agreement was signed by the two Governments for the manufacture of tanks in France. It contained, amongst others, the following main provisions:—that a factory capable of producing 300 tanks a month, and of being extended to turn out up to 1,200 a month, should be erected in France at the expense of the two Governments; that 1,500 machines, or more if required, should be made during 1918; that, in broad terms, in accordance with national facilities for production all the machinery should be of American and the structure and armament of British manufacture, the armour plate being of American steel, and that the first 600 tanks should be allotted to the Americans, and the remaining output as agreed upon, including sale to the French. The type of machine was to be the "Liberty" or "Allied" tank, which was the British Mark VIII. machine equipped with the Liberty aero-engine.[1] It was decided during the summer that an additional 1,500 of these tanks should be built in the United States, as well as several thousands of Renault machines. The scale of this programme shows what importance was attached to this arm by the Americans. The site chosen for the factory was Neuvy-Pailleux, near Châteauroux, and work was started there in the spring. But the building was not completed till Nov., so this scheme of joint production did not actually come to fruition, and although preparations were made for a vast output of machines in America, by the Armistice the manufacture had only recently reached the stage of production and only twenty odd American-built Renault machines had reached France. All the tank operations in which the Americans took part were therefore carried out with British or French machines.

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[1] The first Liberty tank of British structure and American mechanism was assembled and successfully tried in America in Nov. 1918. One machine was constructed in England by the end of 1918.

As to *personnel*, in Feb. 1918, 500 volunteers from the American army assembled at Bourg in France for instruction, and from the next month onwards three companies of soldier mechanics assisted at the repair depot at Bourron. The establishment of the American Tank Corps was increased in May to 15 brigades (five per army), each consisting of one heavy and two light battalions. Owing to the lack of machines in America it was necessary to send the units of the Tank Corps for training with the machines to England and France, a camp being established at Bovington, in Dorset, the British tank-training centre, for training the heavy tank units, and at Bourg for that of the light tank units under French supervision. In addition to 25 instructional machines, with accessories and spares, previously supplied, 144 Renault tanks, the complement of two light battalions, were handed over in Aug. to the Americans. Two battalions were at once mobilized and took part in the attack of the St. Mihiel salient by the American I. Army on Sept. 12.

The entry into action of these units was somewhat disappointing. The tanks had to travel far from their positions of assembly to the battle, and on the first day they operated over such difficult ground that they did not catch up with the infantry, who were able to move forward rapidly owing to the comparatively feeble resistance of the enemy. On the second day they were unable to obtain petrol, and on the third day they did not have much fighting, but took a number of prisoners. The machines were practically undamaged by the action. Their next operations were with the French in the Argonne, where they were of considerable assistance. From this time until the middle of Oct., when they were re-formed into one company, they were continually at the disposal of the infantry commanders, but did not often take a coöperative part in action, though they travelled miles, being used mostly for reconnaissance and for attacks against strong points which had checked the infantry. After that date they accompanied the American forces in the advance right up to the end. One heavy tank battalion which had been trained in England took the field on Sept. 29 with the American II. Corps, in the attack on the Hindenburg line. On this occasion ten tanks were destroyed by running into an old British minefield, and the American infantry here suffered severely from the German machine-guns. On Oct. 8, the battalion coöperated most usefully with the American II. Corps, and again on Oct. 17, when the River Selle was crossed. Finally they assisted the British on Oct. 23 in the neighbourhood of Le Cateau. This ended the operations of the units of the Tank Corps.

The chief characteristics of the action of the Americans in regard to tanks was their quick appreciation of the value of the arm. But the extent of the preparations made for a continuance of the struggle in this as well as in some other directions prevented a greater part being played by the American tank forces in the field. Had the war continued it would have come into play with overwhelming effect.

Since the Armistice the Americans have pressed on with the development and application of the caterpillar track system for road and cross-country transport generally. Most of their efforts in this direction have been concentrated on the "motorization" of artillery traction, and a considerable amount of literature has been published foreshadowing the future ideal as elimination of the horse for military transport purposes. Experiments have been and are being carried out with different types of self-propelled vehicles on the caterpillar track, and combined wheel and track principles. One machine of the latter type recently covered 251 m. in 17 hours. Of fighting tanks, the Mark VIII. of 35 tons is still the standard heavy machine, but experiments are being made with modified Renault and Ford light tanks, and a water-crossing machine. On the whole the Americans seem to be greatly impressed with the part that will be played by machines in the warfare of the future and have made great steps in applying track propulsion to military uses.

German Tanks

In spite of rumours, the first appearance of the British tanks came as a complete surprise to the Germans. In Dec. 1913, and again toward the end of 1914, proposals had been made in Germany for an armoured automobile on caterpillar tracks; and in the summer of 1915 some experiments in this direction had been carried out; but no steps were taken to proceed with the idea. In Oct. 1916, after the appearance of the British tanks, of which they temporarily captured one, the question of constructing similar machines was taken in hand by a special commission, and drawings were prepared. Construction, however, was postponed, owing to the lack of coal and steel, and to the economic conditions generally. H.Q. appears then to have become doubtful as to the necessity for these weapons, and did not give this service first priority of urgency. This was actually not done until the summer of 1918. This lack of interest or apathy on the part of the Germans came as a surprise to the Allies, for it was anticipated that so soon as the secret was out the enemy would use every endeavour to copy and improve on the machine and press on with mass production so as to make up if possible for the start the Allies had gained. For a long time opinion in Germany remained divided as to the value of the weapon, partly owing to the mechanical imperfections of the original Allied machines and partly owing to the manner in which they were first used, especially during the summer of 1917.

Nevertheless, manufacture of a tank, known as type A.7.V., apparently the result of the deliberations of the commission already referred to, was commenced in the spring of 1917. Only 10 of these machines were ready for the offensive in March 1918, whilst not more than 20 were completed by the end of the war. Designs for a heavier type, also, were started about the same time, of which the first model was to have been ready in Dec. of that year, but it was still unfinished at the end of the war. Experimental construction of a small light tank was also commenced, and orders for these machines were placed in the summer of 1918, to be ready by the spring of 1919. This contract, also, was cancelled at the suspension of hostilities.

The French attack at La Malmaison in Oct. 1917, and then the British attack at Cambrai somewhat changed the aspect of affairs. The British tanks captured by the Germans in their counter-attack after the latter action were collected at Charleroi and repaired; and the question of production in quantity of a German tank based on the British type was considered, only to be dropped, owing to the shortage in man-power. In Jan. 1918, the first "Sturmpanzerkraftwagenabteilung" (Tank Section), of five German A.7.V. machines, was formed and brought with its auxiliary transport up to the western front for training. The captured tanks, also, were organized in sections of five machines. The personnel establishment was on an extravagant scale, no fewer than 176 of all ranks being allotted to a section of German machines, and 140 to a section of captured British machines, as against the British establishment for a similar section of 41 of all ranks. In all, three sections, comprising 15 of their own tanks, and six sections comprising 30 captured machines, were used by the Germans in 1918. Some of the latter were re-armed with 5·7-cm. Russian guns.

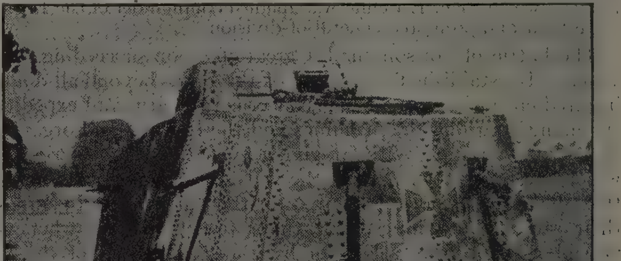

Fig. 11.—German A.7.V. Tank.

The description of the A.7.V. machine (see fig. 11) is as follows:—weight, 32 tons; length, 7 metres; width, 3·2 metres; height, 3 metres; armament, 6 machine-guns and one 5·7-cm. gun; protection, armour 30 mm., 20 mm. and 15 mm. thick; crew, 1 officer, 15 other ranks (mechanics, gunners, machine-gunners); power, two 100-H.P. Daimler engines, each driving one track; climbing capacity, trenches of 2·5 metres width. The German tank was a clumsy machine and a bad climber, owing to the underhung tracks. It was powerfully engined and its tracks were carried on spring bogies which enabled it to cover 8 m. per hour on the flat. The thick armour was proof against armour-piercing bullets at short range and also against light-field-gun shells; but the joints between the thick plates rendered the crew liable to bullet splashes, which was a serious defect.

The Germans used their tanks on nine occasions in 1918, commencing with their advance on March 21, the most successful action being when they captured Villers-Bretonneaux on April 24, 12 German machines coming into action on this occasion. The result of the appearance against the British of hostile tanks, especially on this date and later, on Oct. 8 in the Cambrai sector, when 15 captured British machines were used, was sufficient to confirm their great moral effect and the feeling of helplessness engendered in infantry by them. It showed that it was not only the Germans who could not stand up against the attack of these machines, for the British infantry fell back on the report of the appearance of German tanks as did the German troops at each appearance of the Allied machines, when the Allies were pressing forward. The German tank tactics do not appear to have been very thoroughly thought out, and consisted mostly of "mopping up." This is probably due to the smallness of the number possessed by them and the improvised nature of the arm. Moreover, the belief in their own powers of the members of the tank units must have been somewhat shaken by the official propaganda campaign which had been carried out for months by the High Command to discount the effect of the British and French machines.

According to one authority, the reasons that the Germans did not during 1917 whole-heartedly take up the organization of tanks in large numbers for their great effort in the spring of 1918 were that when they first became aware of their existence it was too late to carry out the successive operations of design, experiment and manufacture in bulk; and that owing to lack of raw material and shortness of man-power the manufacture of the machines would have entailed the cutting down of the production of other war *matériel*. There does not seem to be much force in the first argument, if it be remembered that 80 British tanks were ready equipped in the field within 13 months of the receipt of the specification by the designers, and this without any existing machines to serve as patterns. All along, the attitude of the German High Command seems to have been that of the staff and not that of the troops; and great endeavours were made to inspire the latter with the official views. Though official disbelief was seriously shaken by the surprise of Cambrai, the success of the German counter-attack 10 days later was used, illogically enough, to discount the effect produced by the previous assault by tanks. There was, however, a general and absolute revulsion of feeling after the great French success on July 18 1918, and the British actions of Aug. 8 and 21, which almost amounted to panic at H.Q., and converted both critics and military authorities. There were numerous articles in the German press during Sept. severely censuring the High Command for having neglected to provide tanks for the German forces and to undertake measures against the Allies' machines. Popular opinion became so strong that a stormy debate on the subject took place in the Reichstag in the following month, when the Minister of War made an apology for the neglect to equip the German troops with this weapon. There is no doubt as to the opinion of the German army and the nation on the subject of tanks from then on to the end of the war. For months after the cessation of hostilities the tank was called "*Deutschland's Tod*"—"the Death of Germany."

ITALIAN TANKS

A great part of the theatre of war in which the Italians were operating for so long was too mountainous for tank operations, and the question of the organization of a tank arm was not taken up by Italy until 1918. Manufacture of tanks was then started, and by the time the war came to an end one or more Fiat machines were ready to take the field, but none was actually used.

ANTI-TANK DEFENCE

The tanks used by the British and French during the war were designed to be bullet-proof only, not being strictly speaking "armoured," and were vulnerable to gunfire. The best active defence against them since they were moving targets, was the direct fire over the sights of as light a Q.F. piece as could insure penetration. Any field gun in use during the war, or light Q.F. guns of the "Pom-Pom" type, were sufficient. But as the tanks were mobile and could attack at any spot, often by surprise, to attempt to meet them with special or stationary guns in position would have entailed the distribution and locking up on the mere chance of attack of a prohibitive amount of artillery. The alternative was the provision of suitable guns themselves protected and capable of movement across country, so that they could be concentrated speedily when and where required. In other words, the correct reply to the tank was a type of male tank capable of rapid movement. The Germans eventually produced this reply in principle, in their own A.7.V. tanks, and by re-arming the male British Mark IV. machines and those of the French Schneider and St. Chamond (gunned) types which they had captured. This took place, however, too late and on too small a scale to influence the course of operations. Technically, also, the German machines failed in mobility across entrenched country. In order to effectively attack the German tanks by gunfire armour-piercing shell was required, for they were protected by hardened armour up to 30 mm. (1·2 in.) in thickness.

As the Germans were forced by circumstances to develop anti-tank defence, from which duty the Allies were almost entirely spared, the measures they adopted are here reviewed. Their action, which consisted for a long time largely of injunctions to the infantry not to lose their heads in the event of a tank attack, suffered from the continual inability or unwillingness of the High Command to take this weapon seriously, in spite of the lesson of Cambrai of Nov. 1917, till after the French attack on July 18 1918. In Sept. 1916 the Germans of course had no special means of defence against the tanks, of the existence of which they were ignorant, and these machines had an opportunity on their first appearance never to be repeated. After the Somme battle certain measures of anti-tank defence, seemingly based on a misunderstanding of the nature of the machine, were undertaken, mostly in the direction of obstacles, such as pits, etc., in roads, and indirect artillery fire. After April 1917, it was discovered that neither the British nor French tanks were proof against the "K." armour-piercing bullet, with which the troops had been equipped for use against loop-hole shields, and considerable reliance was placed on this fact. But this discovery did not help the Germans much, the tanks (Mark IV.) used in the next action by the British having had this to a great degree remedied. During that year the value of gun defence against tanks was to some extent realized, attention being mostly given to indirect fire which of all kinds is least effective against moving targets. A certain number of special direct-fire, anti-tank guns often in concrete shelters, were emplaced along the front. But not much attention was paid to the use of direct fire from field artillery normally in the sector attacked. This was not so on the occasion of the French attack on the Crayonne Plateau on April 15 1917, when the guns of the defence of all kinds did great execution among the French machines. At the battle of Cambrai again, some of the German field artillery were most effective against the British machines, one well-concealed gun served by a German major putting 16 tanks out of action.

During the period of preparation for the 1918 offensive the anti-tank rifle, which was a definite step forward, was evolved. This was a heavy, single-loading rifle of 530-mm. calibre, 5½ ft. long, weighing 36 lb., firing armour-piercing pointed bullets. The bullets penetrated the tank plates, though they did not necessarily place a tank out of action; but the weight of the weapon and its recoil hampered free employment by the infantry.

It was after July 18 and Aug. 8 1918, that the German High Command awoke to the danger threatening the German defensive, and indeed issued almost panic instructions. Special anti-tank defence officers were appointed to the different formations; guns were brought up to the front line and emplaced for action against tanks alone; and sections of reserve batteries were allotted to this duty, whilst all batteries (including howitzers) were to take up positions from which they could engage tanks by direct fire. The most efficacious of these precautions was the employment of the mobile guns of reserve batteries which were not so likely to be knocked out by barrage fire as those in positions closer to the front. Tanks became a bugbear, all sorts of precautions in the way of signals to notify their approach were taken, such as the installation of rockets, syrens, Klaxon horns; and permanent alarm posts were established. The passive forms of defence employed were: obstacles in the roads and entrances to villages, such as steel palisades, concrete blocks set sufficiently close together to prevent the passage of tanks and of sufficient height to be unclimbable, and mine craters. In some cases elaborate *chevaux-de-frise* were erected across stretches of the front; "booby-traps" such as tank-pits were laid and certain areas in the later stages of the operations were flooded. Mines were employed to an increasing degree, sometimes in large minefields. It does not require a great amount of explosive to damage a tank, and the mines laid by the Germans were usually electro-contact, or mechanical "tread" mines, which were fired by the weight of a tank passing over them, the charge being a gun or trench-mortar shell. But land mines have the drawback of being dangerous to those who use them, and the greatest damage done to tanks by mines during the war was to the British machines manned by Americans in July 1918, by a British minefield prepared during the retreat in March and forgotten. On the whole, all these artificial obstacles proved a failure, for they could not be continuous, and could be avoided by a cross-country vehicle.

The Germans finally took the obvious step of producing a large-calibre, high-velocity machine-gun firing heavy armour-piercing bullets. This weapon, if fairly mobile, would have been an effective reply to the tank had it been introduced sooner. It was known as the "Tuf" (*Tank und Flieger*), was of 13-mm. calibre and could fire 200 bullets, said to be capable of piercing 30 mm. of hardened steel, a minute. Great efforts were made to produce it quickly and to keep its manufacture secret. Six thousand were to have been ready by April 1919, but by the Armistice none was in the field.

The greatest physical obstacle to the advance of tanks—one form of defence—experienced during the war was mud, and this was intensified by the concentrated and prolonged artillery fire which was generally carried out by both sides. In dry weather this rendered the ground almost impossible to negotiate and in wet weather made it absolutely impassable by any machine moving on the surface of the ground. This was well exemplified during the third battle of Ypres in 1917, when the Germans could not have arranged a better defence against tanks than the morass created in the low-lying battlefield by the British guns. Here the conditions were such as to render futile the employment of tanks which was attempted. The best anti-tank defence beyond this half-natural, half-artificial obstacle, is, as has been said, the fire of suitable, mobile, light Q.F. artillery and carefully disposed minefields. Inundations are likely to be rendered useless by the tank becoming an amphibious machine.

GENERAL CONCLUSIONS

The tank was the one complete British innovation in the war and a great one. The resurrection of an old weapon, it was forced into a fresh existence during hostilities by the needs of the war, and created for a special purpose. In essence it amounted to the addition of bullet-proof plate and armament to an existing agricultural machine which possessed the quality of cross-country mobility. Its immediate purpose was the destruction of the machine-gun—a weapon which, until the tank appeared, was responsible during the war for the loss of more human life than any other, and upon which the Germans at bay, on the defensive, placed so much reliance. With the machine-gun in this connexion is associated the wire obstacle. The combination of the two was the disease for which the tank proved to be the only cure; but, early as the disease was diagnosed, it had grown to be the scourge of the Allies on the western front, whenever they attempted to press forward as demanded by the strategic situation, long before the cure was applied. The tank was the great life-saver of the infantry. To it many thousands of the soldiers of the Allies, principally French and British, owed their lives—infantrymen who but for the tanks would have had to repeat, on a larger scale and possibly abortively, the bloody offensives of 1915, 1916 and the first half of 1917. It took the place of the old stereotyped and expensive artillery preparations, with more certain results, and also reintroduced the surprise factor, which the preliminary bombardment prevented, and which the conditions of trench warfare otherwise rendered impossible without the protection to the infantry afforded by it.

A remarkable feature about the introduction of the British tanks was the fact that they were to a great extent forced on the army by the action of certain enthusiastic individuals, of whom one only was a serving soldier. Some of those, also, who were responsible for the creation of the new weapon, from the beginning formulated the tactics for its employment, which were finally after an inexplicably long period put into practice in the field. This was the case with the British and the French. The British first used tanks in Sept. 1916, and first employed them correctly on a large scale on Nov. 20 1917, 14 months later. The French first used tanks in April 1917, and first employed them correctly, on a large scale, on July 15 1918, also 14 months later. And in each case this happened in spite of the proper method having been put forward, and its adoption urged. The only explanation of this policy is that it was due to inherent conservatism and lack of imagination, incredulity concerning the attributes of the new weapon, failure to understand what they implied, and initially lack of patience.

That the tanks achieved their object was shown by the preparations made by Great Britain, France, the United States, Italy and also Germany for the continuation of the struggle in 1919, and by the fact that their manufacture had begun to take up a large proportion of the munition-producing capacity of three at least of the combatants. In regard to results, it is only necessary to recall one major fact, so far as the British were concerned, *i.e.* that after the era of mechanical warfare, as it has been termed, set in, on Aug. 8 1918, and between that date and the Armistice, 59 British divisions were able to defeat 99 German divisions, a reversal of the proportion usually considered to hold between attackers and defenders. The offensive had at last obtained the superiority; and strength could no longer be estimated by the counting of heads. During the war the German infantry confessed itself impotent against tanks. But since the war not only have the infantry soldiers of other nations come to the same conclusion, but admit that they are often helpless without tanks to assist them. In certain circumstances they demand the assistance of these machines; and they are right. In regard to the influence of the new arm on the result of the war amongst a mass of corroborative evidence, one statement includes and covers all others. On Oct. 2 1918, when the end was fast approaching, the report to the heads of the Reichstag parties made by the representatives of German military headquarters began with the following words[1]:—

> "The Chief Army Command has been compelled to take a terribly grave decision and declare that, according to human possibilities, there is no longer any prospect of forcing peace on the enemy. Above all two facts have been decisive for this issue. First, the Tanks—. . ."

Such an admission, wrung after four years from those who had confidently started the World War, is sufficient.

In regard to the different ways in which tanks established their military value, apart from the actual results achieved, some instructive statistics have been prepared of their action from the aspect of the "economics" of war.[2] In fighting man-power a brigade of 144 tanks has a fire-power equivalent to that of 24 light batteries of six guns each, and nearly 200 more machine-guns than are carried in a division. An infantry division accompanied by one battalion of tanks can attack three times the frontage that can be attacked by a division unaccompanied by tanks. The fighting infantry in three divisions is 21,000 men, of one tank battalion 500. The saving in man-power is therefore 13,500, or 63 %, and with equivalent fire-power the chances of casualties are reduced. As to economy in infantry casualties, the losses on the first day at the battle of Cambrai (a tank battle) were approximately 1,000 per division engaged; at the battle of the Somme (an artillery battle) there were 3,000. Between July and Nov. 1917, when tanks were used on impossible ground 258,000 casualties were sustained by the British; between July and Nov. 1918, when tanks were used on possible

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[1] Report by Col. Bauer, Chief of the Artillery Department.

[2] The Gold Medal (Military) Prize Essay for 1919 by Brevet-Col. J. F. C. Fuller (*Journal of the Royal United Service Institution*, May 1920). These statistics refer to the experience of the British.

TABLE A.—Particulars of British Tanks.

Type of Machine.	Date of Commencement of Design.	Date of First Standard Machine.	Weight in Fighting Trim in Tons.	Horse-Power per Ton.	Length Overall.	Width Overall.	Height to Top of Tracks.	Armour Thickness.	At Normal Engine Revolutions. Speed in Miles per Hour.					Maximum Width of Trench that can be Crossed without Falling in.	Crew.	Number of 6-pdr. Guns Carried.	Number of Machine-Guns Carried.	Theoretical Tractive Force of Machine in First Speed, in Tons.
									First Gear.	Second Gear.	Third Gear.	Fourth Gear.	Reverse.					
					ft. in.	ft. in.	ft. in.	mm.						ft,				
Mark I	Oct., 1915	Dec., 1915	Male, 28 Female, 27	3·75	32 6 with tail, 26 5 without tail.	13 9	7 4½	6 to 12	0·75	1·3	2·1	3·7	0·94	10	8	0, female 2, male	5, female 4, male	23·7
Mark II	Feb., 1916	Jan., 1917	Male, 28 Female, 27	3·75	32 6 with tail, 26 5 without tail.	13 9	7 4½	6 to 12	0·75	1·3	2·1	3·7	0·94	10	8	0, female 2, male	5, female 4, male	23·7
Mark III	Feb., 1916	Jan., 1917	Male, 28 Female, 27	3·75	32 6 with tail, 26 5 without tail.	13 9	7 4½	6 to 12	0·75	1·3	2·1	3·7	0·94	10	8	0, female 2, male	5, female 4, male	23·7
Mark IV	Oct., 1916	Mar., 1917	Male, 28 Female, 27	3·75	26 5	13 6	7 4½	6 to 12	0·75	1·3	2·1	3·7	0·94	10	8	0, female 2, male	6, female 4, male	23·7
Mark V	Oct., 1917	Jan., 1918	Male, 29 Female, 28	5·2	26 5	13 6	7 4½	6 to 14	0·9	1·5	2·6	4·6	0·9	10	8	0, female 2, male	6, female 4, male	27·3
Mark V*	Feb., 1918	May, 1918	Male, 33 Female, 32	4·28	32 5	13 6	7 4½	6 to 14	0·9	1·5	2·6	4·6	0·9	13	8	0, female 2, male	6, female 4, male	27·3
Mark V**	May, 1918	Dec., 1918	Male, 35 Female, 34	6·4	32 5	13 6	7 4½	6 to 14	1·04	1·7	3·02	5·2	1·04	13	8	0, female 2, male	6, female 4, male	36·1
Mark VII	Dec., 1917	July, 1918	33	—	29 10	13 9	7 4½	6 to 12	0	Variable		to	4·25	10	8	0, female 2, male	6, female 4, male	32·3
Mark VIII	Dec., 1917	Oct., 1918	37	8·0	34 2½	12 4	7 6½	6 to 16	1·4	—	—	5·2	1·4	14	8	0, female 2, male	7	42
Mark IX	Sept., 1917	June, 1918	27, unloaded 37, loaded	4·05	31 11	8 1	7 8	6 to 10	0·86	1·4	2·5	4·3	0·86	12½	4 can carry 50 men	None	2	29·2
Gun-carrying tank	July, 1916	Jan., 1917	27, unloaded 34, loaded, with gun and ammn.	3·9	43 0 with tail, 30 0 without tail.	11 0	—	8	0·75	1·3	2·1	3·7	0·94	11½	4 and gun detachment	None	None	23·7
Medium Mark A Whippet	Dec., 1916	Oct., 1917	14	6·43	20 0	8 7	4 6	5 to 14	1·5	3·25	5·5	8·3	—	7	3	None	4	12·4
Medium B	June, 1917	Sept., 1918	18	5·5	22 9½	9 3	5 9½	0 to 14	1·2	2·3	3·8	6·1	—	8	4	None	4	14·0

ground, the Germans lost 284,000 prisoners alone. As to economy in artillery personnel, at the third battle of Ypres 121,000 artillery personnel, were used on a front of 17,000 yd., the maximum penetration attained on July 31 (one day) being 3,300 yards. At Cambrai 4,100 tank personnel carried out the work normally done by the guns on a front of 13,000 yards. The maximum penetration attained in one day was 9,500 yards. As to economy in cavalry personnel, the personnel of all ranks in a cavalry division (without the Royal Horse Artillery) would suffice to man and equip three brigades of Whippet tanks or 540 machines. As to economy in ammunition, at the battle of Arras, on a front of 17,000 yd., 2,007,534 shells, weighing 57,000 tons, were fired; at the third battle of Ypres, on the same frontage, 3,107,363 shells, weighing 93,463 tons, were fired. At Cambrai, on a 13,000 yd. front, 293,149 shells, weighing 5,824 tons, were expended. It is shown that the use of tanks also leads to economy in munition manufacturing man-power, in shipping and land transport, in weight carried by the soldier, in labour on the battlefields, in property damaged, in forage or food, in time and in cost of production. In regard to the latter item the cost of projectiles and explosives alone for 1918 was £329,860,344 and for the undeveloped new arm, tanks, £9,587,960. This inevitably leads to speculation as to what results might have been had Mr. de Mole's suggestion made in 1912 been taken up and developed, even at the cost of 12 hours' conduct of the war in 1918.

The principle of mechanical warfare and the advantage of using power-driven machines instead of human and animal muscle having been established in one particular direction, there is little doubt but that it will be applied in others. In future, there will be larger and smaller fighting tanks developed from those born in the World War. They will be speedier, more powerful and have a far longer range of action. Some will also be amphibious, and all will be less easy to stop than the present somewhat embryonic machines. The principle of track propulsion will be applied to vehicles of all types and not confined to fighting machines, and will to a great extent eliminate the necessity of using roads or railway, and place the movement of armies on a "two-dimensional" basis instead of being on a one-dimensional basis as it has in the past. Future fighting tanks will in certain theatres be able to replace cavalry and may against a civilized enemy be able to carry out, with aeroplanes, those long-distance raids against H.Q. and important points far behind the fighting-line, which since the advent of the machine-gun cavalry cannot execute, will give greater facility both for the release of gas in large quantities, if gas is used, and also for obtaining protection against gas. The fighting machines will be very largely used in conjunction with action in the air, and the two services will be complementary and mutually helpful. Large tracts of roadless country which have to be held against an uncivilized enemy, or a hostile population, will provide the first opportunities for the development of this combination, on account of the saving that will be effected in men and animals, the most expensive and delicate parts in an armed force. In killing-power, mobility, and endurance, one efficient mobile machine with its crew and machine-guns will be able to take the place of many infantry or cavalry soldiers and many horses, and will cost less to maintain and feed. In the United States the possibility of the "motorization" of all war transport and of eliminating the horse was in 1921 being fully discussed, and if the signs are read correctly this will be the general tendency, so that the great wars on land of the future will be practically horseless and conducted by far fewer men in the field and more men in the factory and workshop than has been the case in the past. Strength for war will not in the future be estimated by counting heads, for, beyond the minimum necessary, the greater the number of human beings in a force in the field the greater will be its vulnerability. The introduction of the tank in 1916 upset all the existing values of field defences, and its natural and inevitable evolution will cause a revolution in the methods of war as great as that in tactics caused by its original appearance.

In the compilation of this article reference has been made to the following works:—Clough William-Ellis and A. William-Ellis, *The Tank Corps* (1919); J. F. C. Fuller, *Tanks in the Great War* (1920); D. G. Browne, *The Tank in Action* (1920); Dutil, *Les Chars d'Assaut, leur création et leur rôle pendant la guerre, 1915–1918* (1919); M. Schwarte, *Die Militärischen lehren des Grossen Krieges* (1920).

Figs. 1, 9, 10 and 11 are from *Tanks in the Great War* by Col. J. F. C. Fuller, D.S.O., by permission of the author and Mr. John Murray. Figs. 2, 3, 4, 5, 6, 7 and 8, from "British Tanks" by Sir E. H. Tennyson d'Eyncourt, K.C.B., D.S.O., are reproduced on a reduced scale by permission of the publishers of *Engineering*.

(E. D. S.)

TANNENBERG, a village of East Prussia, 10 m. S.W. of Hohenstein. It has given its name to two battles of great importance in German history, the battle of July 15 1410, in which the Poles and Lithuanians destroyed the forces of the Teutonic Order (*see* 21.905), and that of Aug. 26–31 1914, in which the German VIII. Army under General-Oberst von Hindenburg destroyed the Russian II. Army commanded by General Samsonov. The latter is described in detail under the heading MASURIA, BATTLES IN. For a critical account of the former, the story of which has been overlaid by a mass of legends, see Delbrück, *Gesch. der Kriegskunst*, vol. iii., book iv., ch. 6.

TARKINGTON, [NEWTON] BOOTH (1869–   ), American writer, was born in Indianapolis, Ind., July 29 1869. After studying at Phillips Academy, Exeter, Mass., he entered Purdue University, Lafayette, Ind., but two years later transferred to Princeton, where he graduated in 1893. At first he intended to follow a business career, but after a few years devoted his time to writing. He was elected to the Indiana House of Representatives for the term 1902–3. In 1918 he received the degree of Litt.D. from Princeton. In 1920 he was elected to the American Academy of Arts and Letters. The same year he was engaged as a writer of photo-plays by the Goldwyn Pictures Corporation. His first story, *The Gentleman from Indiana*, was published in 1899, having appeared already as a serial in *McClure's Magazine*. In 1900 his reputation was established by *Monsieur Beaucaire*, which he successfully dramatized (with E. G. Sutherland) in 1901. In 1919 he was awarded the Pulitzer Prize by Columbia University for his novel, *The Magnificent Ambersons* (1918).

His other stories include *The Two Vanrevels* (1902); *Cherry* (1903); *The Conquest of Canaan* (1905); *Guest of Quesnay* (1908); *Beauty and the Jacobin: an Interlude of the French Revolution* (1912); *Penrod* (1914); *Penrod and Sam* (1916); *Ramsey Milholland* (1919); *Alice Adams* (1921). His plays include *Cameo Kirby* (1907); *Your Humble Servant* (1908); *Mister Antonio* (1916); *The Country Cousin* (1917, with Julian Street); *The Gibson Upright* and *Up From Nowhere* (1919, both with Harry Leon Wilson); *Clarence* (1919).

TATA, SIR RATAN (1871–1918), Parsee financier and philanthropist, was born at Bombay Jan. 20 1871, the son of the famous Parsee merchant Jamsetji Nasarwanji Tata (*see* 26.448). He was educated at St. Xavier's College, Bombay, and afterwards entered his father's firm. On the death of the elder Tata in 1904, Ratan Tata and his brother Dorabji Jamsetji Tata (b. 1859) inherited a very large fortune, much of which they devoted to philanthropic works of a practical nature and to the establishment of various industrial enterprises for developing the resources of India. An Indian institute of scientific and medical research was founded at Mysore in 1905, and in 1912 the Tata Iron and Steel Co. began work at Sachi, in the Central Provinces, with marked success. The most important of the Tata enterprises, however, was the storing of the water-power of the Western Ghats (1915), which provided the city of Bombay with an enormous amount of electrical power, and hence vastly increased the productive capacity of the Bombay industries. Sir Ratan Tata, who was knighted in 1916, did not confine his benefactions to India. In England, where he had a permanent residence at York House, Twickenham, he founded (1912) the Ratan Tata department of social science and administration at the London School of Economics, and in 1912 established a Ratan Tata fund at the university of London for studying the conditions of the poorer classes. He died at St. Ives, Cornwall, Sept. 5 1918.

TAUSSIG, FRANK WILLIAM (1859–   ), American economist (*see* 26.456), was during 1917–9 chairman of the U.S. Tariff Commission, which made a special study of commercial treaties and prepared much material for the American Peace Commission in Paris. In March 1919 he was called to Paris to advise in the adjustment of commercial treaties, and in Nov., on invitation of President Wilson, attended the second industrial conference in Washington for promoting peace between capital and labour. He was a strong supporter of the Covenant of the League of Nations. He was the author of *Principles of Economics* (1911; 2nd ed. 1915); *Some Phases of the Tariff Question* (1915); *Investors and Money-Makers* (1915); and *Free Trade, the Tariff, and Reciprocity* (1919).

TEISSERENC DE BORT, LÉON PHILIPPE (1855–1913), French meteorologist, was born in Paris Nov. 5 1855, the son of an engineer. He began his scientific career in 1880, when he entered the meteorological department of the Bureau Central Météorologique in Paris under E. E. W. Mascart. In 1883, 1885 and 1887 he made journeys to N. Africa to study geology and terrestrial magnetism, and during this period published some important charts of the distribution of pressure at a height of 4,000 metres. In 1892 he became chief meteorologist to the Bureau, but resigned in 1896 and founded a private meteorological observatory at Trappes, near Versailles, where he carried out investigations on clouds and the problems of the upper air. In 1898 he published an important paper in *Comptes Rendus* detailing his researches by means of balloons into the constitution of the atmosphere. His discovery of the so-called isothermal layer, or stratosphere as it is now generally called, will always stand out as one of the most important events in the study of the upper atmosphere. He also carried out investigations in Sweden and over the Zuider Zee, the Mediterranean and the tropical region of the Atlantic, and fitted out a special vessel in order to study the currents above the trade-winds. He was elected a fellow of the Royal Meteorological Society in 1903, hon. member in 1909, and was awarded the Symons gold medal of the society in 1908. He collaborated with Hugo Hildebrandsson in *Les bases de la météorologie dynamique* (1907). He died at Cannes Jan. 2 1913.

TELEGRAPH (*see* 26.510*).—Apart from the advances in Wireless Telegraphy (*see* WIRELESS) and Cable Telegraphy (*see* SUBMARINE CABLE TELEGRAPHY), progress since 1910 has been seen in various technical directions. The developments in the United Kingdom and in the United States in some respects have differed, and this article therefore considers them in two sections which differentiate not only certain technical and commercial aspects of the subject but also certain distinctive points of view.

UNITED KINGDOM

One of the most important developments in type-printing telegraphy is the adaptation of the Baudot for duplex working by A. C. Booth in 1905. This forms the basis of all modern multiplex systems, and has led to a great increase in the output and flexibility of such systems with a consequent considerable extension of their use.

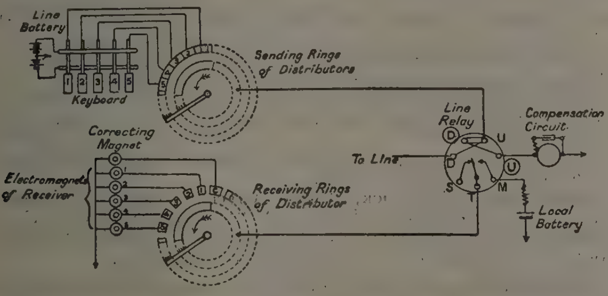

FIG. 1.

Booth-Baudot.—The underlying principle of the Booth-Baudot will be understood by reference to fig. 1. It will be seen that the outgoing signals from the sending rings of the distributor at the home station divide differentially at the line relay and therefore do not affect the receiving apparatus which is connected in the local circuit, via the receiving rings of the distributor. Installations of double, triple, quadruple, quintuple, and sextuple duplex have given excellent results in the British Post Office service during a number of years. The method of driving the mechanism of the Baudot distributors and receivers has been changed from weight driven gear, to electric motor drive. In the case of the receivers, a small series motor with belt drive is used, while the distributors are driven by the La Cour phonic motor. In both cases a considerable saving is obtained in first cost and maintenance expenses with the advantages of more satisfactory working and greater facility in changing apparatus when necessary.

The Carpentier method of automatic transmission on Baudot circuits has recently been reintroduced in the British Post Office, but with several important improvements.

In offices where a large number of keyboard perforators are used, each having its own particular lay-out, the change from one instrument to another caused serious difficulty from an operating standpoint. This difficulty was much felt with the original Carpentier keyboard, in which, owing to the exigencies of the Baudot code, the keys for the numerals were spread over the keyboard instead of being arranged on the first row of letter keys as in most typewriters. Carpentier sought to minimize this difficulty by adding an extra row of keys for the numerals, and a similar arrangement was adopted in the Morse keyboard perforators such as the Gell and the Kleinschmidt.

Messrs. A. C. Booth and A. S. Willmott have now invented a device which enables the keyboard for any type of machine telegraph, whatever the code used, to be arranged exactly as in a typewriter, thus allowing the numerals to be placed in their standard positions without the extra row of keys.

The Booth-Willmott-Baudot keyboard perforator punches the 5-unit code transversely on a paper tape which is of the same size as that used in the Murray and Western Electric instrument (see hereafter), enabling the transmitters of either of these installations to be used in conjunction with it. Switches are provided on the instrument tables so that any particular arm of the multiplex may be worked automatically from a transmitter fed by a Booth-Willmott perforator or by direct-sending from an ordinary Baudot keyboard sender at will.

REFERENCES.—A. C. Booth, "Telegraph Keyboard Perforators," *I.P.O.E.E. Journal* (vol. xiv., p. 72); A. C. Booth, *The Baudot Printing Telegraph System* (1907), I.P.O.E.E. paper; H. W. Pendry, *The Baudot Printing Telegraph System;* A. C. Booth, "The Baudot Duplexed," *I.P.O.E.E. Journal* (vol. iii., p. 336); A. C. Booth, "Progress of Baudot System," *I.P.O.E.E. Journal* (vol. vi., p. 324); "Duplex Baudot Tests," *I.P.O.E.E. Journal* (vol. viii., p. 11); E. Montoriol, "Baudot System in France," *I.P.O.E.E. Journal* (vol. x., p. 25); E. Lakey, "Progress of Baudot Duplex," *I.P.O.E.E. Journal* (vol. xii., p. 216); *Post Office Technical Pamphlet for Workmen, B6.*

Murray Multiplex.—The difficulty experienced by Baudot operators in manipulating accurately the direct-sending keyboards in time with the cadence signal at speeds much in excess of 30 words per minute led Murray to adopt the Carpentier method of automatic transmission in his multiplex system. The main features of the Booth-Baudot system are utilized, but the operators perform on perforators which have keyboards similar to that of an ordinary typewriter and do not have to keep in time with a cadence signal. Each key of the perforator, when depressed, perforates in a paper tape, a particular combination of holes in accordance with the arrangement of the five-unit code adopted by Murray. The tape thus prepared has its perforations across the slip and not longitudinally as in the case of the Murray automatic system, the use of which has been abandoned, so that a great saving in the cost of paper results.

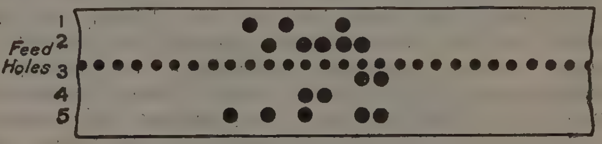

FIG. 2.

Fig. 2 shows a portion of the Murray multiplex transmitting tape perforated to represent the word "telegraph." From the perforator, the tape passes directly into an automatic transmitter, which has five selecting needles, each controlling a contact lever resting

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* *These figures indicate the volume and page number of the previous article.*

normally against a bus-bar connected to the spacing pole of the line battery. When a needle passes into a hole in the tape the corresponding contact lever moves over and makes contact with a bus-bar connected to the marking pole of the line battery. The positions of the contact levers are therefore determined by the perforations in the tape and as each lever is connected to its own particular segment on the sending ring of the distributor, the signals representing a character are sent out to line, one after the other, as the brushes pass over the segments. Immediately the brushes have passed over the last of the segments allocated to a particular transmitter a current impulse is sent from another ring of the distributor through a "cadence" electromagnet in the transmitter, which when operated withdraws the selecting needles that have entered perforations and propels the tape forward sufficiently to bring the next group of perforations into position above the selecting needles. Provision is made for preventing mutilation of the paper tape when the transmitter overtakes the perforator, by arranging for the tightening of the tape to actuate a lever situated between the two instruments. When the lever is pulled down the armature of the cadence electromagnet is prevented from moving. As soon as the tape slackens the lever rises and transmission is continued. For the reception of signals Page printers are employed somewhat similar to those which were used in the Murray automatic system, but differing from them in that the five selecting combs, which determine the letter to be printed, are positioned by electromagnets instead of by a perforated tape. The normal speed of working of each arm of the Murray multiplex is 40 words per minute, although speeds in excess of this may be attained.

REFERENCES.—D. Murray, *Practical Aspects of Printing Telegraphy*, I.E.E. Paper (1911); latest edition of *Herberts Telegraphy*; *Post Office Technical Pamphlet for Workmen, B7*.

The Western Electric Multiplex.—This system is also based on the Booth-Baudot duplex and came into use in 1914. The adoption of a method of correction from the actual working signals themselves, instead of utilizing special correcting signals as in the Baudot and Murray systems, results in a saving of line time and therefore gives a greater output on difficult lines.

The transmitters and perforators are the modern developments of Carpentier's but the printer used types the message in page form instead of on a paper tape as in the Baudot system, from a type wheel which rotates from character to character as may be required. This printer has not given entirely satisfactory results, and is being superseded by one in which type bars are used in place of a type drum and the paper is kept central instead of being moved sidewise to and fro. The phonic wheel distributors are driven by electrically vibrated tuning-forks, which possess an advantage over vibrating-reeds in that they may be placed on the instrument table instead of being fixed to a steady support as is required in the case of reeds.

The Kleinschmidt Electric Co. of New York have recently designed a very compact column printer which may be used on Western Electric multiplex circuits. As in the Murray printer, there are five selecting combs which are operated by electromagnets. When the combs have been positioned, during the reception of a character, certain slots in the combs are thereby brought into alignment allowing a pull-bar attached to one extremity of the required type-bar lever to fall into them. Directly after the combs have been moved and the type-bar lever selected, a contact is closed mechanically, completing a circuit through a printing magnet which, when it operates, causes the selected pull-bar to be impelled forward, thus projecting the free end of the corresponding type-bar lever against an ink ribbon and printing the required character as in a typewriter.

REFERENCES.—P. M. Rainey, "A New Printing Telegraph System," *Electrical World* (April 3 1915); *The Western Union Multiplex System;* (Pamphlet printed by *Telegraph and Telephone Age*); A. H. Roberts, "A New Type Printing Telegraph System," *I.P.O.-E.E. Journal* (vol. viii., p. 193); *Post Office Technical Pamphlet for Workmen, B7*.

The Siemens Automatic System.—The original Siemens automatic system used an 11-unit code actuating a receiver which printed the incoming signals in Roman characters on photographic paper. The preparations required for the received slips, which had to be developed chemically, impaired its usefulness for actual traffic, and the system was superseded in 1912 by one using a 5-unit code and a revolving type-wheel. The latter is now extensively used in Germany and to a limited extent in other countries.

As in the case of the Creed and other automatic systems there are several perforating operators and one transmitting operator at the sending station. The prepared tape from the keyboard perforators is passed through the transmitter over five selecting needles, controlling their upward movement and determining the polarity of the current impulses sent to line during each revolution of a brush over the five segments of a distributor. The sending distributor brush arm is driven by a shunt wound motor whose speed is kept steady by means of a heavy flywheel mounted on the spindle. Unison with the brush arm of the receiving distributor at the distant station is maintained by the actual working signals. The receiving and translating arrangements of the receiver are almost entirely electrical, and printing is effected by the discharge of a condenser through an electromagnet, the armature of which presses momentarily a paper tape against a revolving type-wheel. This tape is afterwards pasted on ordinary message forms as in the Baudot system. In addition to the printing tape, the incoming signals can also actuate a keyboard perforator to provide a perforated tape for retransmission purposes. The system may be worked either simplex or duplex and is capable of giving a maximum speed of 166 words per minute in each direction.

REFERENCES.—*Herberts Telegraphy* (latest ed.); *Post Office Technical Pamphlet for Workmen, B7.* "The Siemens Automatic Fast-Speed Printing Telegraph," *Electrician* (July 11 1913).

The Morkrum Teletype.—This is a single-line system of printing telegraphy which has been recently developed by the Morkrum Co. of Chicago, U.S.A. It may be duplexed, and is suitable for short lines over which the traffic is not very heavy.

The apparatus comprises two units, a keyboard transmitter, and a printer, which are mounted on one base to form a very compact combined sending and receiving instrument. The keyboard is arranged as for a standard typewriter, and is a direct-sending instrument the keys of which when operated allow a camshaft to revolve opening and closing the line circuit according to the 5-unit code. Starting and stopping impulses are sent over the line to start and stop the selecting mechanism of the printer so that from transmission point of view the system has actually a 7-unit code. A feature of the system is the controlling and selecting mechanism of the printer, which is an ingenious combination of the Hughes and Baudot printers. The received message is printed on tape in exactly the same way as in the Baudot printer and afterwards gummed on ordinary message forms.

The maximum speed of operation of the keyboard is limited to 45 words per minute and a device is provided which is actuated when this speed is exceeded and prevents the keys being depressed too rapidly.

The Creed System.—One of the principal drawbacks to the original Creed system was the use of compressed air for working the apparatus, which in a large number of offices necessitated the installation of a special pneumatic plant. Moreover, the pneumatic Creed printer had a maximum speed of only 120 words per minute, so that on lines where the working speed was much in excess of this figure it was necessary to install two printers in order to deal expeditiously with the traffic. The latest Creed instruments, however, have been designed to work electrically; they are much simpler in their construction and give speeds up to 200 words per minute.

For the preparation of the transmitting tapes, Gell and Kleinschmidt perforators are generally used, each of which has a keyboard similar to that of an ordinary typewriter. The depression of a key selects, through a system of levers, the punches required to perforate the holes in the tape for the corresponding signal, and closes a circuit through an electromagnet, the armature of which forces the selected punches through the paper tape. As these perforators prepare Wheatstone slip their mechanism is necessarily much more complicated than that of keyboard perforators designed for a 5-unit code, in which all letters are of the same length, because in the former a differential feed varying from two-tenths of an inch to over one inch is required owing to the varying length of the letters. These machines will work as fast as a typewriter, but 80 words per minute is regarded as the limit for practical purposes.

REFERENCES.—E. Lack, "The Creed Telegraph System," *I.P.O.E.E. Journal* (vol. vi., p. 249); "Description of New Creed Apparatus," *Electrician* (Jan. 21 1921, vol. lxxxvi., No. 4, p. 105); *Post Office Technical Pamphlet for Workmen, B3*.

Gulstad Relay.—In 1898 Gulstad of Copenhagen invented a modified form of polarized relay, known as a vibrating relay, the use of which has enabled much greater speeds of working to be attained on underground and submarine circuits, and in some cases allowed repeaters to be dispensed with. In general construction it is similar to the British Post Office standard relay, but, in addition to the usual line coils, has two extra windings on the same cores. These windings are connected to a local battery in such a manner that the relay tongue is caused to vibrate between the contact points, when the current through the line coils is insufficient to maintain it on either of the contacts.

The principle of the relay may be understood by referring to fig. 3. It will be seen that the ends of the local windings are joined to terminals B and C and their centre to terminal A, which is joined through an adjustable resistance Y to the relay tongue. This resistance is for regulating the local current and keeping it below the value of the steady current through the line coils. Terminal B is connected to earth through a condenser K, while C has a resistance coil X in its earth lead.

Assuming that there is no current in the line coils and that the relay tongue has just reached the marking contact, there will then be a momentary rush of current through the winding AB to charge the condenser K, in a direction to keep the tongue to the marking side, thus preventing any tendency of the tongue to rebound. This charging current dies away rapidly, however, and directly its strength falls below the steady current flowing through the winding AC, the preponderance of the latter causes the tongue to move toward the spacing contact. Immediately the tongue leaves the marking contact, the condenser K discharges through both windings BA and AC in such a direction as to accelerate the movement of the tongue, so that its transit time from one contact to the other is thereby lessened.

When the tongue reaches the opposite contact the condenser K is again charged, but this time from the other pole of the battery; a similar cycle of effects therefore takes place on that side and the tongue moves in the reverse direction. In this manner the relay tongue is kept vibrating, at a speed depending on the values given to the condenser and resistance. In practice the adjustments are such that the rate of vibration of the tongue under the control of the local current is approximately equal to the rate at which the transmitter at the distant station sends reversals at working speed. When this obtains, the signals passing through the line coils merely determine the length of time that the tongue remains in contact with either stop, its movement therefrom being effected by the local current through the local windings as soon as the strength of the line current falls below that of the local current in the coil AC. It is this effect combined with the action of the condenser in lessening the time of transit of the tongue, that enables a higher speed of working to be attained on long and difficult circuits than if ordinary polarized relays were used.

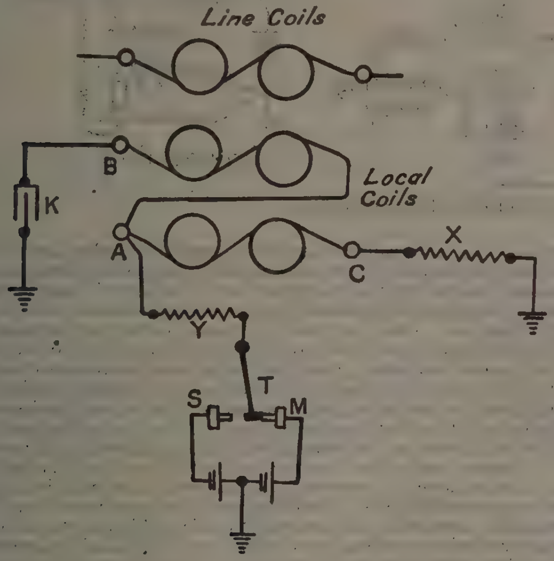

FIG. 3.

In the original Gulstad relay the line coils were not differentially wound; it could be used, therefore, only on Bridge duplex or simplex circuits. To utilize the advantages of the Gulstad principal on differential duplex circuits, the British Post Office has modified the Post Office standard relay, by adding extra windings and terminals. This modified instrument is known as a "G" relay and is equally suitable for differential or bridge duplex working. The internal and external connexions of this relay are shown in fig. 4, in which the dotted lines indicate the extra coils. For the correct reception of the incoming signals a Wheatstone receiver is connected to the relay tongue.

REFERENCES.—E. Lack, "The Gulstad Relay," *I.P.O.E.E. Journal* (vol. vii., p. 183); *Electrical Review* (June 1898 and Aug. 1902); *Herberts Telegraphy* (latest ed.); E. Lack, "Post Office Standard Relay 'G'," *I.P.O.E.E. Journal* (vol. x., p. 34).

Tele-photographic Systems.—In 1909 T. Thorne Baker read a paper before the Royal Institution in London describing his "telectrograph" process of transmitting pictures over long distances. The method, which was used on a large scale by the *Daily Mirror* between London and Paris, is based upon the Bakewell copying telegraph.

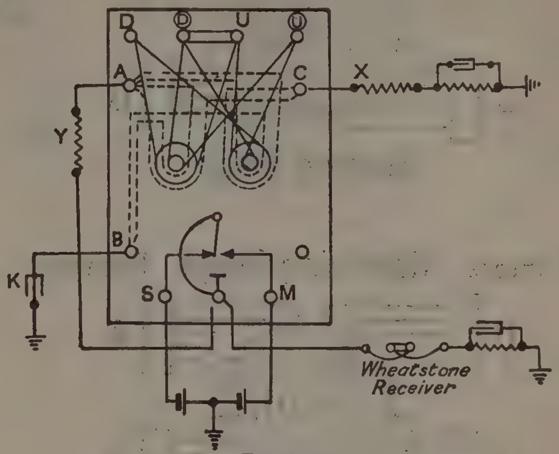

FIG. 4.

Synchronously rotating metallic drums, driven by electric motors, are employed one at each end of the telegraph line over which it is desired to transmit, say, a picture. A half-tone photograph of the picture is first printed upon thin sheet lead and subjected to a process which breaks up the photograph into a number of dotted lines printed in fish glue. This record is fixed round the transmitting drum, which is traversed spirally by an iridium stylus. The contact of the latter with the lead is interrupted every time one of the fish glue dotted lines comes beneath it, for duration depending upon the width of the line. The lead sheet is connected to the line, so that the transmitting instrument sends a series of electric currents whose periods of duration are determined by the width of the lines composing the photograph. At the receiving station, the rotating drum carries a piece of absorbent paper impregnated with a colourless solution, which turns black or brown when decomposed by an electric current. Every brief current through the paper causes a mark to appear, having a width depending on the duration of the current. The arriving currents are therefore arranged to pass through a platinum stylus under which the receiving drum rotates, then through the moistened paper resulting in the production of a number of marks on the paper due to chemical decomposition. These marks gradually combine to produce the picture at the transmitting station.

REFERENCES.—T. Thorne Baker, "Telegraphy of Photographs, Wireless and by Wire," *Royal Institution Proc.* 1908–10, vol. xix.

Foss and Petersen Method.—In this system a high frequency generator capable of producing sparks is used at the receiving station. The sparks so produced are capable of puncturing a paper wrapped round a metal drum which rotates in unison with a similar drum at the sending station.

The line wire is arranged so that when the sending end is connected to earth the generator is partly short-circuited, thus suppressing the sparking. At the sending end the shunting of the generator is effected by means of a contact pin passing over a cylinder on which the writing or illustrations are inscribed in insulating ink so that the shunt circuit is cut out each time the pin passes part of the writing (see Patent Specification No. 105,914, 1917). (W. No.)

UNITED STATES

Technical developments made after 1910 practically revolutionized telegraphy as practised in the United States. These include printing-telegraph arrangements applied to telephone as well as to telegraph circuits, simultaneous telephone and telegraph operation for long small-gauge cable circuits, and the use of alternating currents with resonant circuits in the so-called carrier systems for multiplexing wire conductors.

Radical changes were also made in the arrangements for and the methods of handling telegrams in large offices. Belt conveyers, typewriters, pneumatic tubes, automatic time-stamps and other labour-saving devices came to be used to a large extent. About 75% of all telegrams handled by the Western Union Telegraph Co. over trunk circuits in 1921 were transmitted and

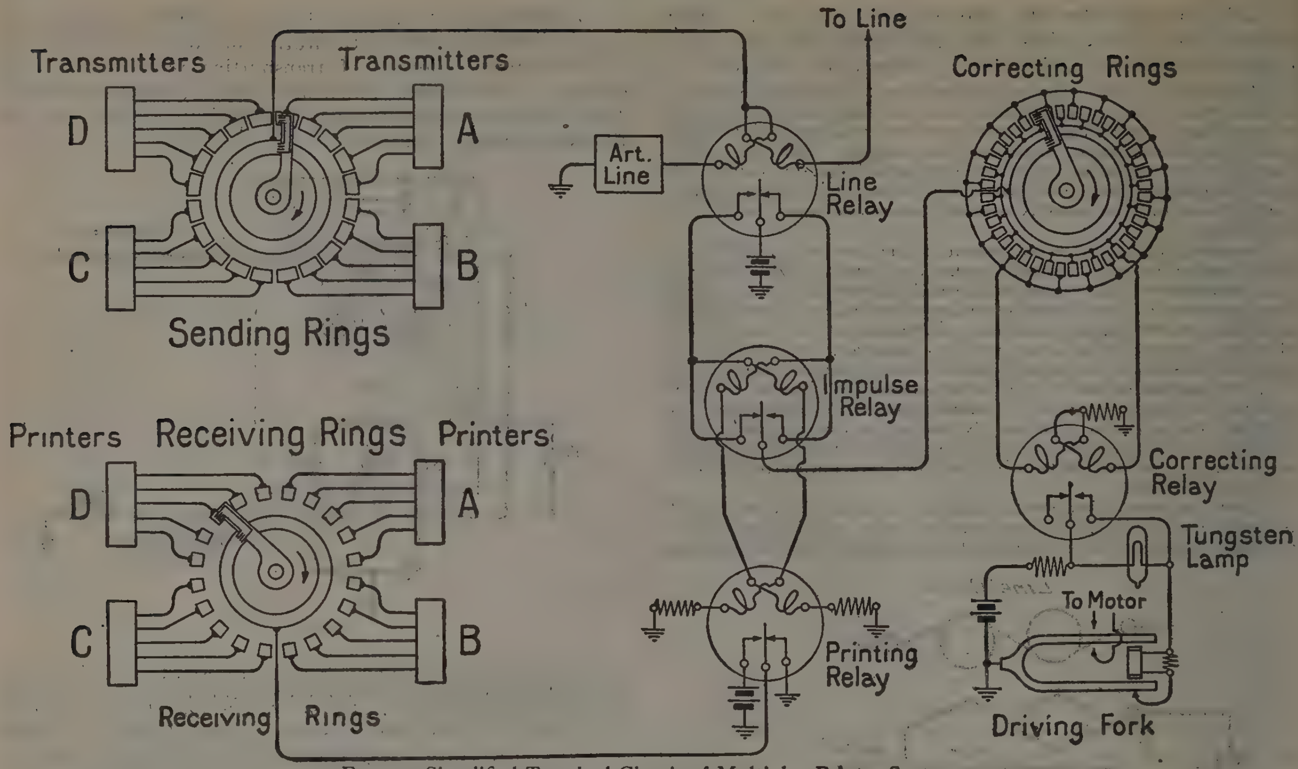
Transmitters
Transmitters
D
A
C
B
Sending Rings
To Line
Art. Line
Line Relay
Correcting Rings
Impulse Relay
Correcting Relay
Tungsten Lamp
To Motor
Driving Fork
Printing Relay
Printers
Receiving Rings
Printers
D
A
C
B
Receiving Rings

FIG. 5.—Simplified Terminal Circuit of Multiplex Printer System.

received by printing-telegraph apparatus. The introduction of machine telegraphy took place after 1910.

Progress can be divided into two general classes: (1) that relating to terminal equipment, such as printers; and (2) that relating to the methods of working lines.

Printing Telegraphy

(*a*) *Multiplex System.*—The multiplex system giving double-duplex, triple-duplex and quadruple-duplex service, as applied in America, was that developed jointly by the Western Electric Co. and the Western Union Telegraph Co. It uses the Baudot code and a system of speed correction for rotating distributors in which correcting impulses are generated from the character signals, thus saving line time.

The fundamental features of one arrangement for quadruple-duplex operation are shown in fig. 5. The sending, receiving and correcting rings are parts of a distributor driven by a La Cour or phonic-wheel motor. The common sending ring is connected to the midpoint of a differentially wound line relay and the common receiving ring to the armature of a printing relay included in the local circuit of the line relay. This local circuit also includes an impulse relay, so arranged that short-current impulses are sent to the common ring of the set of correcting rings when the line relay armature moves from one contact to the other. These impulses come at intervals determined by the signals transmitted by the distant station. There are twice as many correcting segments as sending segments, and these are alternately connected to the windings of a correcting relay. One distributor on a circuit sets the speed for the other and if the corrected distributor is running too fast, the operation of the correcting relay causes the driving fork for its motor to be retarded in its rate of vibration. If, on the other hand, the distributor is running too slowly, the fork is accelerated. It is essential to secure correcting impulses when all printing channels are idle. This is done by reversing the polarity of the marking signals of one or more channels. Various types of printer units have been successfully used with this system. Speeds as high as 50 to 60 six-character words per minute per channel are maintained by operators. The multiplex printer system has thus greatly increased operators' loads as well as the number of telegraph channels which can be obtained from each line circuit. Means have been developed for economically extending the single channels of a multiplex-printer system from the multiplex terminal station to branch offices.

(*b*) *Start-Stop Printer Systems.*—Successful systems giving single-channel working, or two-channel working when operated duplex,

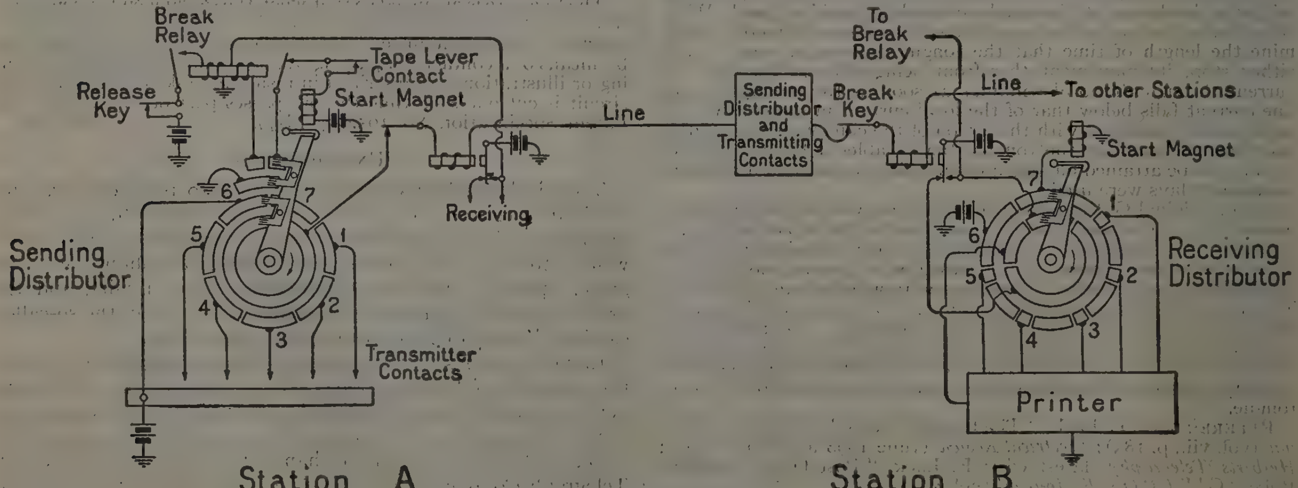
Break Relay
Tape Lever Contact
Start Magnet
Release Key
6
7
5
1
4
2
3
Sending Distributor
Transmitter Contacts
Line
Receiving
Sending Distributor and Transmitting Contacts
To Break Relay
Break Key
Line
To other Stations
Start Magnet
7
6
5
2
4
3
Receiving Distributor
Printer
Station A
Station B

FIG. 6.—Circuit of Start-Stop Printer System.

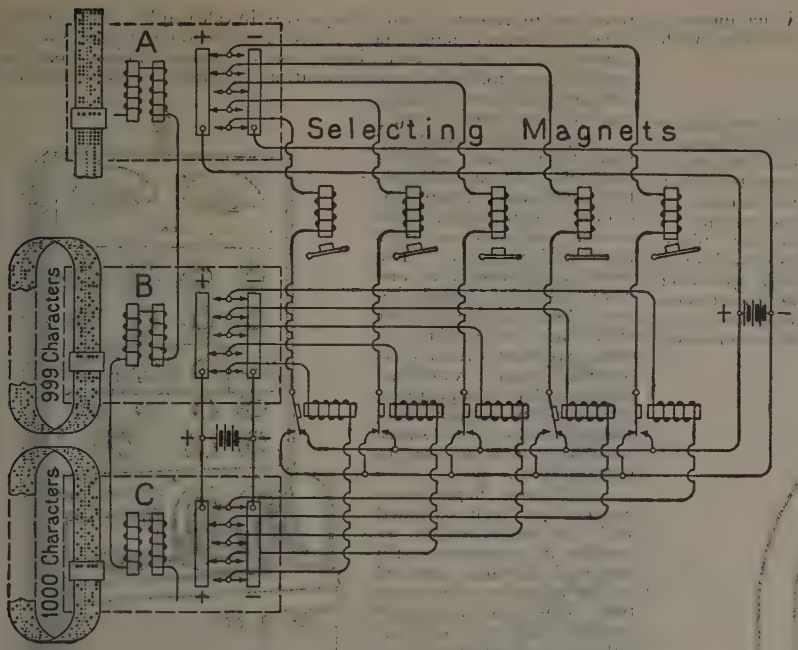

FIG. 7.—Selecting Circuit of Cipher System.

have been developed for inter-communicating purposes among a group of stations. These systems have been used to a considerable extent with telegraph circuits obtained from telephone circuits.

One of these systems employing motor-driven distributors at each station is shown in fig. 6. The sending distributor at one station and the receiving distributor at the other are indicated in detail. The distributor brush arms driven through a friction clutch are normally held stationary by a latch and make one rotation for each character transmitted or received. A start impulse, usually the opening of the line circuit for a brief interval, releases the receiving start latches so that all receiving distributors start rotating. The five impulses of the Baudot code which follow the start impulse are distributed properly to the selecting magnets or elements of a printer by the receiving distributors if their speeds coincide approximately with that of the sending distributor. Close synchronism is not required since all distributors are stopped and caused to start from the same initial position for each character.

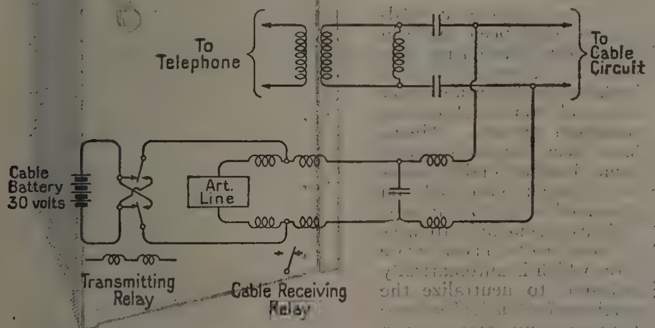

FIG. 8.—Terminal Arrangement for Metallic Telegraph Cable Circuit.

An important feature is the method by which any receiving station can interrupt the sending station and obtain control of the circuit. As shown, this is accomplished if the line circuit is interrupted by the break key during the time the sending brush is passing over the sixth segment when a break relay at the sending station will be energized to open the circuit of the magnet controlling the latch. The release key will then have to be operated to permit further sending. This printing system has been used to a considerable extent for news distribution, where in many cases a number of sending and receiving stations are connected to one circuit and means must be provided to allow any station to obtain control of the circuit. Keyboard arrangements which may be used for perforating tape or for sending directly to the line have been developed and found very satisfactory for this kind of service. The Western Electric type-bar printer has been found very satisfactory for news service. This is provided with a stationary paper platen and a moving type-bar basket. Books containing carbon paper for making a large number of copies and forms holding wax stencil sheets may be readily inserted into the machine. Means are provided for adjusting the strength of the blow of the type bars so that one to twenty copies can be secured.

(c) *Cipher Printing System.*—A printing system for rapidly ciphering and deciphering telegraph messages has been developed. It is thought that cipher messages prepared by this system are absolutely unbreakable. It was successfully applied by the U.S. Army Signal Corps during the war and tests made indicate that messages can be ciphered and deciphered by this means with greater accuracy and many times faster than by other methods.

This system was developed by the engineers of the American Telephone and Telegraph Company. Its principles are illustrated in fig. 7. A message prepared in perforated tape form by the ordinary printer perforator passes through transmitter A. This would ordinarily control the selecting magnets of a printer or an automatic perforator. Key tapes B and C, however, passing through ordinary tape transmitters, control relays which interfere with the normal operation of the selecting magnets so that the resultant selection for any character of the message may be any one of the characters of the Baudot code. The characters of the key tapes are selected at random and B is one unit less in length than C. All tapes are stepped in unison. Repetition in the resultant key will not occur until B has revolved 1,000 times. The proper starting position of the key tapes B and C for any message may be indicated by six characters which may be

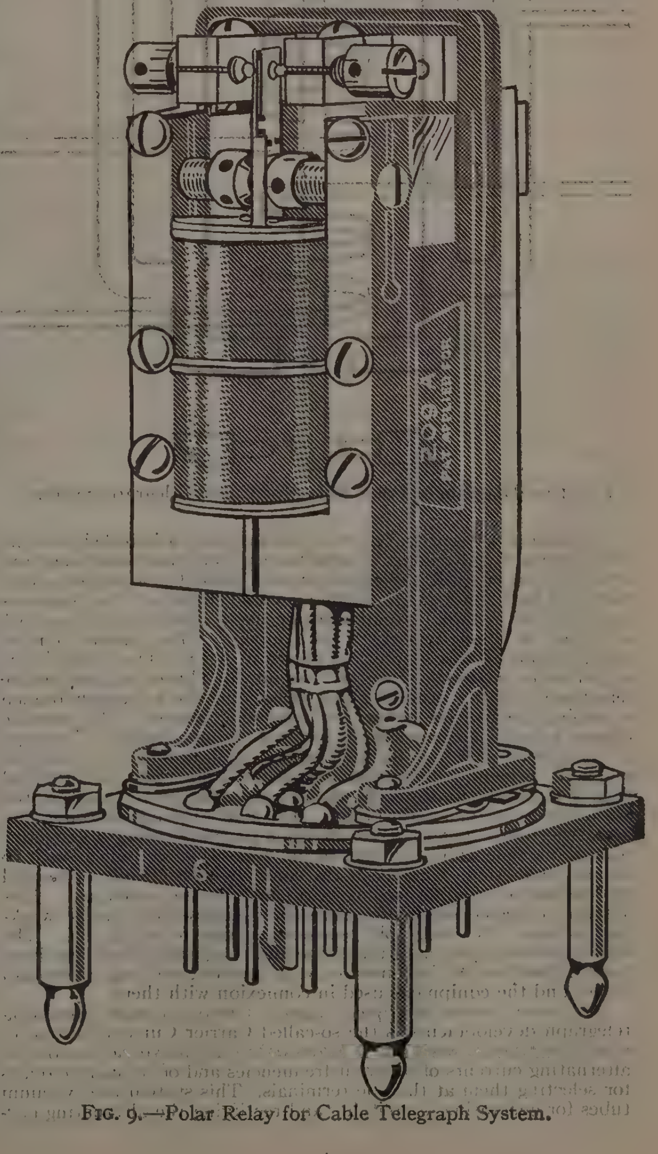

FIG. 9.—Polar Relay for Cable Telegraph System.

ciphered by an additional key. In deciphering the cipher message tape is placed in transmitter A and the characters combined with the proper key to obtain the original message.

Methods of Working Lines

(*a*) *Simultaneous Telephone and Telegraph Working.*—Considerable advance has been made in the technical knowledge of simultaneous telephone and telegraph operation of line circuits. Hand telegraph systems and single-channel printer systems usually operate at dot speeds of 10 to 25 per second and it has been found that in order to secure satisfactory service it is necessary to design line systems to transmit a frequency band of about 100 cycles per second. Since telephone frequencies range from about 250 to about 2,500 cycles per second, it is possible to secure satisfactory telegraph operation from telephone circuits by using frequencies below the lowest telephone frequencies and frequencies above highest telephone frequencies. More than 600,000 m. of telegraph circuits are obtained from telephone circuits in the United States.

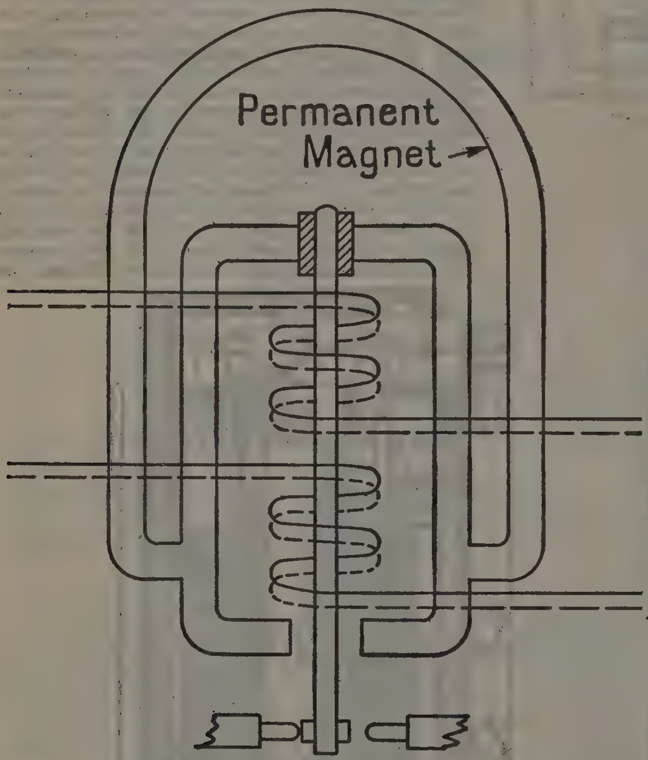

FIG. 10.—Diagram of Polar Relay for Cable Telegraph System.

(*b*) *Metallic Telegraph System.*—The increase in knowledge of the fundamental requirements of simultaneous telephone and telegraph operation has enabled a telegraph system to be developed for operation over long small-gauge telephone cable circuits. This system is arranged for metallic circuit working using a relay operating with a current of approximately 2 milliampères. The general circuit arrangements of this system are shown in fig. 8. The cable circuit is divided by a composite set or filter into two branches, one for the telephone and the other for the telegraph, the telegraph branch absorbing frequencies below the telephone interval. All metallic lines in a single office are supplied from a common battery. The type of polar relay selected for this circuit is shown in fig. 9 and the magnetic principle illustrated in fig. 10. The relay is provided with a Gulstad vibrating circuit and the armature, a reed, is the cross piece of a magnetic bridge. The line windings surround the armature, and a current in one direction causes the armature to move toward one pole while a current in the opposite direction causes it to reverse its motion. Chatter at the contacts is practically prevented by cushioning contact springs attached to the armature. This system has been designed for cables containing as many as 300 working circuits. A telegraph repeater is shown in fig. 11. The simultaneous operation of telephone and telegraph circuits has been carefully worked out in connexion with the design of long interurban cables and the equipment used in connexion with them.

(*c*) *Carrier Current Multiplex System.*—One of the most interesting telegraph developments is the so-called Carrier Current System in which multiplex operation is secured by the use of a number of alternating currents of different frequencies and of resonant circuits for selecting them at the line terminals. This system uses vacuum tubes for generating, amplifying and rectifying the alternating currents and represents a radical departure in telegraphy. The circuits are of high signal quality, very stable in operation and free from the duplex balance difficulties of direct current systems. This system has enabled the following communication facilities to be obtained commercially from a single pair of open wires: Twenty 1-way carrier channels; four 1-way direct current channels; and one and one-half telephone circuits including the phantom. The carrier telegraph circuit is illustrated in fig. 12. The terminal apparatus for one 2-way channel, which repeats between the carrier circuit and the direct current extension circuit, is mounted upon a vertical panel similar in appearance to that of the metallic telegraph system. The same sensitive relays are used in both systems.

(*d*) *Rotary Repeaters.*—Success has been obtained with the use of rotary repeaters in connexion with telegraph circuits operated by the multiplex printer system. This type of repeater restores distorted line signals to their original form and has enabled printer circuits 3,000 m. in length to be operated successfully at high speeds.

(*e*) *Fundamental Telegraph-Transmission Research.*—Considerable attention has been given to the telegraph-transmission problem and improvements have been made in the methods and means for measuring distortion of telegraph signals. The fundamental transmission requirements for different classes of service have been more carefully enumerated and advances made in the design of artificial lines.

(*f*) *Interference.*—Advances have been made in minimizing interfering currents in telegraph circuits both from high-tension power lines and from neighbouring telegraph circuits. Means have been devised to overcome the effect of differences in ground potentials on grounded telegraph circuits. This arrangement introduces a counter-electromotive force which is automatically adjusted to neutralize the earth-potential difference between any two given points.

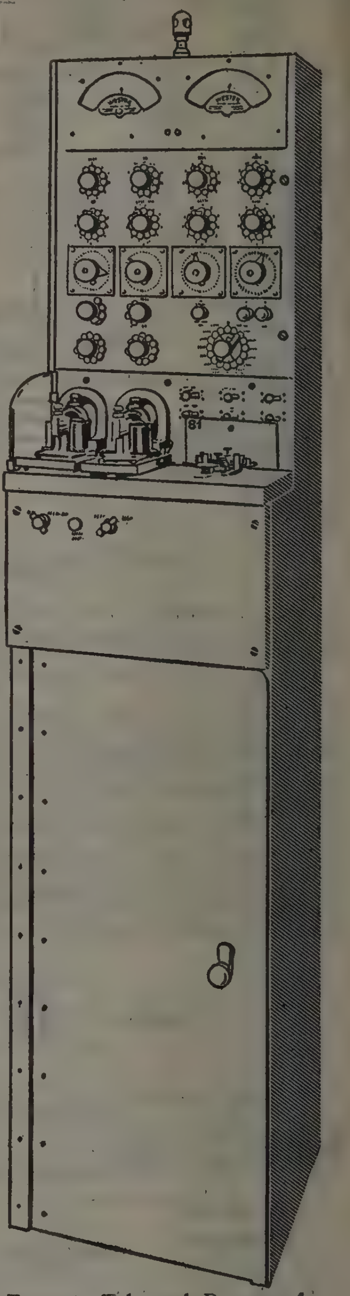

FIG. 11.—Telegraph Repeater for Cable System.

(*g*) *Codes and Sending Machines.*—Codes, abbreviations, typewriters and automatic sending machines are now widely used by operators to increase the capacity of manually-operated telegraph circuits. The automatic machine is merely a vibrating reed mounted in a convenient and portable manner, adjusted to vibrate at telegraph speeds and provided with contacts for controlling the telegraph circuit. A movement of the controlling lever in one direction causes the instrument to transmit a succession of dots, the number depending on the length of time the lever is thus held. A contrary movement sends a dash. This instrument permits higher speeds than are otherwise possible to be maintained with considerably less fatigue on the part of the operator. It may be readily connected with any ordinary telegraph circuit.

Codes and abbreviations for shortening messages are used especially in distributing news. The Phillips Code is one that has been generally adopted and an illustration of its use follows:—

Transmitted message:—

t potus wi ads cgs tsp q pip qsn.

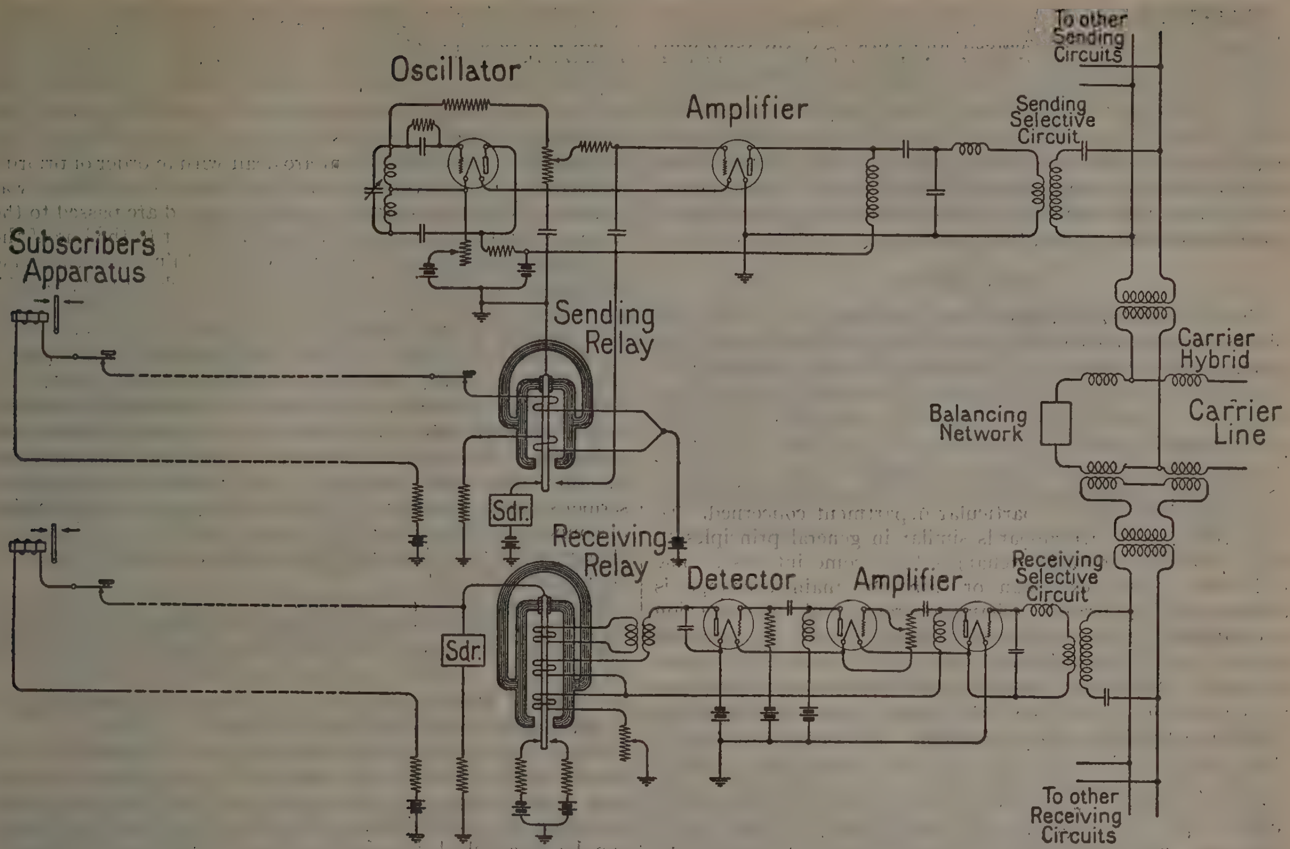
Oscillator
Amplifier
To other Sending Circuits
Sending Selective Circuit
Subscriber's Apparatus
Sending Relay
Carrier Hybrid
Balancing Network
Carrier Line
Sdr.
Receiving Relay
Detector
Amplifier
Receiving Selective Circuit
Sdr.
To other Receiving Circuits

FIG. 12.—Terminal Circuit for Carrier Telegraph Channel.

This would be written by the receiving operator as follows:—

The President of the United States will address Congress this afternoon on the Philippine Question.

Many other schemes are used to save time and cost.

GENERAL BIBLIOGRAPHY.—H. H. Harrison, *The Historical Basis of Modern Printing Telegraphy* (1915); A. C. Booth, *Machine Telegraphy* (1914); H. H. Harrison, *The Story of the Keyboard Perforators* (1917); Maj. O'Meara, *The Various Systems of Multiple Telegraphy* (1911); J. H. Bell, "Printing Telegraph Systems," *American I. E. E.* (Feb. 1920); H. H. Harrison, "The Principles of Modern Printing Telegraphy," *Inst. E. E.* (1915); D. Murray, "Press-the-Button-Telegraphy," *Telegraph and Telephone Journal* (Nov. 1914–July 1915); E. H. Colpitts and O. B. Blackwell, "Carrier Current Telephony and Telegraphy," *American I. E. E.* (Feb. 1921).

MILES OF TELEGRAPH WIRE OF THE WORLD—JANUARY 1 1910, 1914 AND 1920

(Some of the figures—for the most part those for small places not shown separately—are necessarily in part estimated.)

	SINGLE WIRE		
	Jan. 1 1910	Jan. 1 1914	Jan. 1 1920
Great Britain	311,942	313,166	318,759
Denmark	8,048	8,191	8,500
France	379,888	381,000	715,468
Germany	388,412	459,811	486,714
Italy	126,505	129,500	208,210
Norway	13,120	13,211	16,195
Sweden	40,171	42,194	53,300
Switzerland	16,336	16,476	19,085
Other countries in Europe	826,730	929,072	930,000
Total Europe	2,111,152	2,292,621	2,756,231
Japan	97,300	106,946	127,000
Other countries in Asia	399,030	436,763	553,000
Total Asia	496,330	543,709	680,000
Union of South Africa	46,853	54,201	49,432
Other countries in Africa	110,000	122,159	140,000
Total Africa	156,853	176,360	189,432
United States	1,480,000	1,615,000	1,700,000
Canada	153,000	193,277	214,629
Other countries in North America	78,000	86,805	95,000
Total North America	1,711,000	1,895,082	2,009,629
Total South America	143,590	251,990	333,632
Australia	92,909	108,931	147,276
New Zealand	20,188	25,892	29,700
Other countries in Oceania	14,700	19,319	24,160
Total Oceania	127,797	154,142	201,076
Total throughout world	4,746,722	5,313,904	6,170,000

NOTE:—In the case of countries the boundaries of which have undergone change, the figures for each year represent the number of miles of telegraph wire within the boundaries of that year.

Telegraph wire used exclusively for railroad operation and not open to public use has been excluded wherever possible.

TELEPHONE (*see* 26.547).—Various improvements were made during 1910–21 in the mechanism and working of the telephone, apart from the introduction of wireless telephony, which is dealt with in the separate article under WIRELESS. Since operating practice and the application of recent inventions are not always the same in the United States as in Great Britain, some developments which are not common to both countries are described in the section headed *United States*. At the end of that section will be found a table showing the expansion of telephone facilities during the years 1910–21 in all countries.

GREAT BRITAIN

Private Branch Exchanges.—The increasing use of the telephone as between one party and another was early followed by a demand for the means of connecting different members of a firm in the same building without the necessity for providing each with a separate line to the public exchange. A further development required that incoming calls for a large firm should be dealt with at a central point in the initial stage so that after ascertaining the business of the caller he could be placed in communication with the particular department concerned. To meet these needs switchboards similar in general principles to those provided for main exchanges have come into use. The call from a local extension or from the main exchange is answered by the branch exchange operator, and the connexion is completed by the medium of connecting cords, or, on small systems, by circuits with which each line is associated by means of a key. In the latter case the depression of any pair of keys on a common connecting circuit places the two corresponding lines into connexion with one another. On the smaller installations where it is probable that an operator is not always available to give prompt attention to calling and clearing signals, the extension stations signal the completion of their conversation direct to the main exchange and simultaneously to the branch exchange. This enables the main exchange to disconnect the circuit promptly, releasing the main exchange circuit and any junction circuits which may have been occupied by the connexion. The prompt release of these circuits is of extreme importance in the economical working of the whole system. On larger branch exchange systems where an operator is in continuous attendance, the main exchange clearing signals are controlled by the withdrawal of the cord connexion at the branch exchange. The advantage to be gained under this scheme lies in the fact that the extension station can call in the branch exchange operator during a conversation and get an established call from the main exchange transferred to another extension station when required. When a branch exchange is used in conjunction with a common battery or automatic switching system, the current for speaking purposes is fed over the main exchange lines on exchange to extension station connexions, and by means of a power lead from the main exchange in the case of extension to extension connexions.

When associated with automatic switching systems the branch exchange operator is provided with a calling dial, so that on each exchange connexion she can dial the number required by any extension station.

Trunk Line Working.—Trunk or long distance working is complicated by the necessity for recording the particulars of all calls, and because instantaneous connexion cannot always be effected owing to the prohibitive cost of providing lines with such liberality as would ensure a no-delay service at all times.

The system of the British Post Office is worked as follows: A subscriber desiring a trunk connexion calls up his local exchange and notifies his requirements. If circuits are available to the town required on such a basis as to afford a no-delay service, the connexion is effected at once and the signalling and control arrangements are similar to those described for junction working. The operator records the particulars of the call on a ticket which is used for future accounting purposes. Should a no-delay service not be available, the operator records particulars of the requirements herself, or, in cases where lines to the town required terminate at a separate trunk exchange, she extends the subscriber's circuit to the trunk exchange and obtains a direct connexion to a special record operator whose sole business it is to note the particulars of the required trunk connexion. The subscriber is informed that he will be called later and the connexion is then severed. Meanwhile, the ticket is conveyed to the switchboard position where the lines to the town wanted are terminated. Calls at this point are dealt with in order of priority as recorded by the time on the ticket when the demand was initiated. Particulars of the connexion wanted are passed to the distant operator, who extends the circuit direct to the line of the "wanted" subscriber, when such lines terminate in the same exchange, or extends the circuit to a junction, when the "wanted" subscriber is connected to another local exchange, and requests the operator at that exchange to effect the connexion. The trunk operator at the originating town simultaneously effects the connexion direct, or where another local exchange is concerned, by the medium of a junction, to the initiating subscriber, and when both subscribers are on the line, she completes the connexion. The call is controlled by the trunk operators, the junction circuit being equipped in such a manner that the subscriber's signals appear at the trunk exchanges, from which point disconnecting signals are sent automatically to the local exchanges when the connexions between the trunk and the junction circuits are removed.

Trunk exchanges are equipped with relays and lamps for signalling purposes. "Calculagraphs" are employed for stamping the time of commencement and completion of conversation on the tickets. There is also associated with each trunk connexion a device which lights a lamp as soon as the scheduled limit of the period of conversation is reached.

Where the volume of traffic over any route is considerable, the requirements to the distant town may be notified over a separate circuit reserved for the purpose, and the local connexions involving the use of junction circuits to other local exchanges can be established in advance, thus minimizing the time of occupation of the main circuits and securing the greatest possible effective use of the trunk lines.

Manual Exchanges.—The main features of the manual telephone system remained in 1921 what they were in 1910. Improvements had been introduced to some extent, to diminish or eliminate altogether portions of the operator's work, but common battery transmission and signalling, connecting by means of plugs, flexible cord conductors and jacks, lamp calling and supervisory signals—all these remained unaltered.

Among the improvements referred to may be mentioned: Keyless ringing; automatic listening; secret service; ringing tone; automatic ringing cut-off; traffic distribution; ancillary answering jacks.

1. *Keyless Ringing* is the feature of a cord circuit which provides that the ringing of the required subscriber's bell commences automatically on the operator connecting to his line and ceases automatically on the removal of the receiver from its rest by this subscriber. This renders unnecessary the provision of a key for ringing purposes—hence the term "keyless" ringing.

2. *Automatic Listening* is a feature which eliminates the listening key. The operator's telephone is automatically connected to the calling subscriber's line when the answering plug of the cord circuit is inserted in the answering jack of that line. The operator's telephone is later automatically disconnected when, after ascertaining the number required by the calling subscriber, the operator connects the calling plug to the line of the required subscriber.

3. *Secret Service* follows from 2. Automatic listening involves the feature that while conditions suitable for conversation are established the operator's telephone is disconnected—and without the aid of a listening key it is impossible for the operator to listen to a conversation.

4. *Ringing Tone* is a tone (distinctive from that intimating to a calling subscriber that the line he requires is engaged) applied to the calling subscriber's line while the bell of the called subscriber is being rung. Hearing this tone, which intimates that the bell of the called subscriber is being rung, and receiving no reply after a reasonable period, the calling subscriber infers that his correspondent is not available and restores his receiver. This facility reduces the time spent on "no reply" calls, by both operator and subscriber.

5. *Automatic Ringing Cut-Off* provides that the ringing of the required subscriber's bell automatically ceases when the calling subscriber, receiving no reply, decides to abandon the call and restores his receiver to its rest.

6. *Traffic Distribution.*—By means of selecting mechanism the line of a calling subscriber is automatically connected to a disengaged operator's position. This avoids the overloading of any operator and at the same time gives all operators a fair load during busy periods.

7. *Ancillary Jacks.*—Additional calling lamp signals and answering jacks associated therewith placed at different parts of the switchboard. When a subscriber calls, signals are displayed at two or more operators' positions, thus increasing the number of operators who may answer. The object of the arrangement is to provide for the more even distribution of traffic and thus to reduce the answering time of the operators during the rush periods.

Automatic Systems.—The idea of automatic telephony is to substitute for the operator of the manual exchange an electro-mechanical or other switching system, which, controlled in its movement by the action of the subscriber, will automatically select, connect and disconnect circuits as desired. The process of machine switching consists of successive group selection. Exchange switching machines are provided and are placed under the control of subscribers or operators. Considering only the former case, the machines are operated by impulses originating in a subscriber's telephone. The standard impulse now in general use is a disconnexion of the subscriber's loop (the loop having been closed in the first instance by the lifting of the subscriber's receiver). The train of impulses corresponds to the digit signalled. For instance, the signalling of the digit 7 would constitute a series of seven disconnexions of the subscriber's telephone loop as indicated in fig. 1. It will be seen that a complete impulse is 57% of the total cycle.

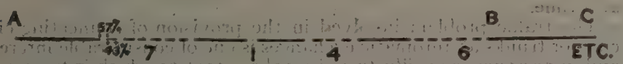

FIG. 1.

When the impulses are passing at the standard rate of 10 per second, this gives an electrical condition at the exchange of sufficient duration to effect reliable operation of the equipment.

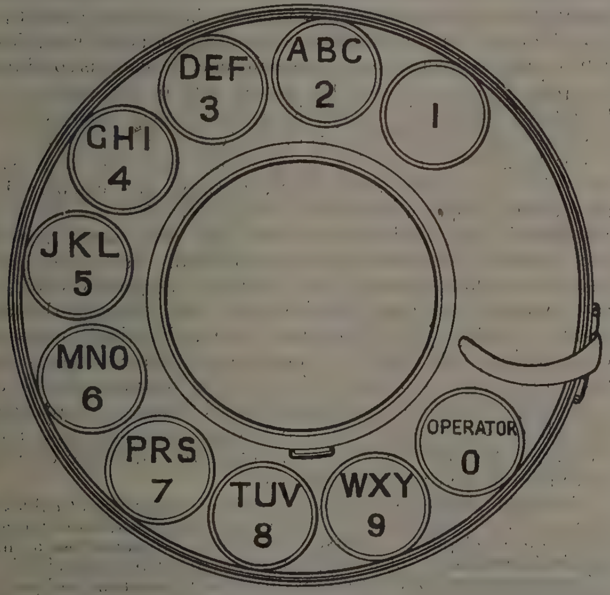

FIG. 2.

On the base of the automatic telephone instrument a circular device, known as the dial, is provided for transmitting the impulses. Fig. 2 shows a full view of the face of a dial that has been designed for use in large cities. It will be seen that there are 10 holes each of which corresponds to a digit, also that eight of the holes contain letters. Dealing first with the digits, the method of operation is for the subscriber to lift his receiver and then if he requires to call "7146" he will operate these digits in turn. To call 7 he will place his finger in the hole corresponding to that digit, rotate the front plate of the dial which is free to move in a clockwise direction until his finger and the finger hole for 7 reach the finger stop shown on the right-hand side of fig. 2. He will then withdraw his finger and the free plate of the dial will return to normal under the influence of a main spring, in doing which the mechanism of the dial will disconnect the subscriber's telephone loop seven times. He will now insert his finger in the hole corresponding to the digit 1 and proceed as before. The impulses passing from the dial will, as has been stated, be transmitted at the rate of 10 a second, and, as will be seen from fig. 1, the short current between the impulses, is only 43% of the cycle. An appreciable interval, by comparison, must occur between the trains corresponding to each digit because the process of manipulating the dial cannot be performed rapidly enough for it to be otherwise.

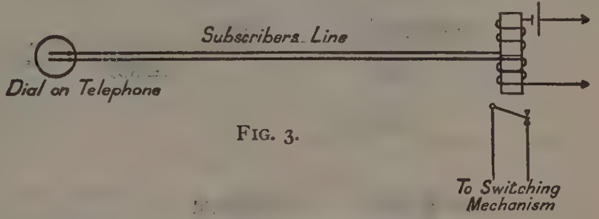

FIG. 3.

In practically all automatic systems the impulse circuit is as indicated in fig. 3, from which it will be seen that the operation of the switching mechanism is controlled by the falling back of a relay armature at the exchange.

The mechanism at the exchange is so designed that by the provision of a sluggish relay or equivalent device certain controlling connexions remain unchanged throughout the whole of the train of impulses, but the long current corresponding to the period between two trains is utilized for effecting a change-over so that each train operates a separate switching device. Briefly the effect is to produce successive selection as already indicated. The operation of the digit 7 in a typical case would operate the mechanism so that an idle outgoing connecting line of the 7th thousand is found. The following digit, 1, will pick out an idle outgoing connecting line to the 1st hundred in the 7th thousand being the 71st hundred. At this point it is common practice to give the subscriber connexion with a switch that can select any one of the 100 lines in the group, so that the next two digits 4 and 6 will call line 46 in the 71st hundred, viz. line 7146.

Automatic systems may in the main be roughly placed in two classes: (*a*) direct impulse systems; (*b*) stored impulse systems.

In the direct impulse system may be placed the systems of The Automatic Electric Co., Siemens Bros. & Co., The North Electric Co., and The Relay Automatic Telephone Co. (including licensees of the firms concerned).

The Automatic Electric Co. and Messrs. Siemens Bros. & Co. manufacture what is known as the "Strowger" system, the switches of which in operating utilize two motions, first, a vertical action in which the brush is not making contact followed by a rotary action in which the brush is either hunting for an idle connecting line in the case of a preliminary switch or moving towards the contact of the wanted subscriber's line in the case of a final switch. Two magnets are involved in this operation. There is a third magnet used for effecting the release at the end of the conversation, the operation of release consisting in the restoration of the moving element to normal, first in a rotary direction by means of a main spring and, secondly, in a vertical direction under the influence of gravity.

Fig. 4 shows the elementary circuit connexions for one of these systems. The calling subscriber on lifting his receiver operates relay "LR" which in turn operates "RR." The impulses are received on "LR" whose armature falls back for each impulse placing an earth connexion intermittently on the circuit of "S" and "VM." Both "RR" and "S" are sluggish relays that release slowly so that the succession of "breaks" and "makes" from the impulses do not affect them. When the long current between two trains of impulses occurs the circuit of "S" is disconnected for a period which is long enough for its operation, and "S" electromagnetically operates the switch "SS" so that "VM" is thrown out of circuit and "RM" is substituted. "VM" is the magnet which operates the vertical stepping by means of a ratchet and pawl device. "RM" similarly effects the rotary stepping. The next train of impulses will clearly operate "RM" after which the change-over devices depending on "S" are made to cut out the accessory mechanical apparatus, leaving only the connexions suitable for giving the engaged signal, ringing the subscriber, and talking. At the end of the conversation the caller hangs up his receiver, the armature of "LR" falls back permanently, "RR" is deënergized and the release magnet "REL" is operated thus restoring the switch to normal: "REL" disengages a detent which permits a coiled spring to restore the wipers or brushes in a rotary direction after which gravity carries them vertically to their home positions at which stage the "REL" circuit is opened at "ON." The transmission system consists of two relays "LR" and "LC" associated with two condensers as shown at the top of fig. 4. This will be recognized as the "Stone" C. B. system (*see* 26.552).

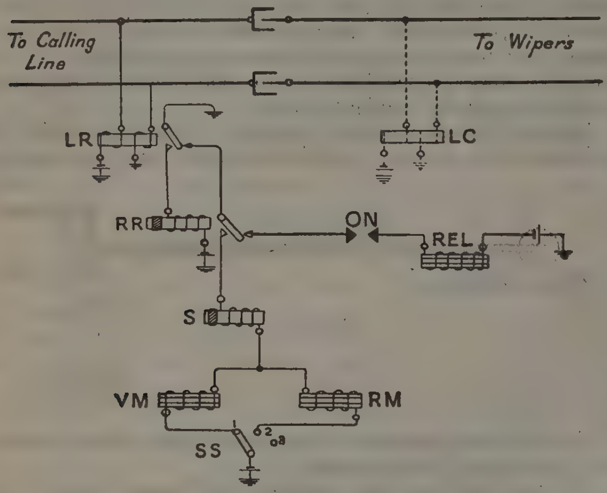

FIG. 4.

The North Electric Co. manufactures a switch operated by direct impulses in which the motions are the reverse of the systems just described. Rotary action, with the brush away from the contacts, is followed by "trunk" hunting in a vertical direction. This permits of vertical contacts which are less liable to the adverse influence of dust than horizontal contacts, and would also permit of a larger number of trunks than 10, being placed in one group without seriously interfering with the design of the equipment.

Both the Relay Automatic Telephone Co. and the North Electric Co. manufacture automatic systems which do not use mechanism as usually understood. The systems consist of aggregations of relays, combined so as to provide a number of connecting or "trunking" paths through the equipment. In the case of the Relay Automatic Telephone Co.'s system the calling subscriber operates his dial in the usual way and at the same time finds an "outgoing" trunk. His impulses operate relay devices known as the "recorder" and the "marker," which latter places an electrical condition on the called subscriber's line so that it immediately operates somewhat like a called line, and finds an idle "incoming" trunk which is placed in communication with the outgoing trunk already seized by the calling party. These two trunks are automatically placed in contact and together form the connecting link for the conversation.

The earliest practical stored impulse system is the "Lorimer" system as used at Hereford (England). In this case the dial as already described is not used, but a lever device is associated with each telephone. The levers are set in definite positions corresponding to the number to be called, and the switches at the exchange are set in motion by the subscriber operating a subsidiary crank that forms part of the calling device. The operation of this crank also winds up the mechanism of the calling device so that the operation of the switches on the exchange can electromagnetically release the calling device and run it down. The running down of the calling device in conjunction with the operation of the exchange switches controls the action of the latter by means of an electrical circuit established through the setting of the levers so that the exchange switches are made to trunk, hunt and find lines in a manner corresponding to the lever setting. The mechanism at the exchange is driven by a motor and can therefore be provided with robust contacts. A subsidiary device known as a pilot switch can be made to operate and alter the connexions between digits or at any other stage of the call so as to control the sequence of switching operations.

The Western Electric Co.'s rotary and panel type systems possess the obvious advantages to be derived from storing connexions and the interpolation of controlling operations at any stage of a call. In both these systems the subscriber's telephone is equipped with a standard dial, and the impulses are taken up by the sender storing device at the exchange. This device is set into position by the impulses and subsequently controls the action of the selective switches in a manner somewhat similar to that indicated for the Lorimer system above mentioned. In the Western Electric Co.'s systems banks of contacts for 200 and 500 lines respectively are employed, as against 100-line banks for direct-impulse systems, so that the number-storing device is also required to perform the functions of a numerical transformer changing the call record from the decimal system as dialled into whatever system is necessary for the correct operation of the switches. An additional feature associated with the panel system of the Western Electric Co. is the provision of a translator which consists of a cross-connecting device so arranged that any number dialled can be converted from time to time into some other number. This is particularly desirable in the case of large cities in which the selection of exchanges is effected by means of a code. It will be seen on reference to fig. 2 that eight of the finger holes have in addition to the digits a group of three letters. These are arranged in alphabetical order from A to Y omitting Q. The use of these letters is to facilitate the calling of subscribers in areas where manual telephones coexist, and where in the ordinary course very cumbersome numbers would otherwise be involved. The arrangement provides a means of facilitating the conversion of an existing manual area to automatic working. The number "Mayfair 2148" is printed in the directory "MAYfair 2148," and so long as any manual exchanges in the area exist the numbers would be passed in the ordinary way, but as automatic exchanges are introduced the subscriber will obtain connexion by dialling "MAY 2148." It will of course be recognized that to dial MAY is really to dial "629," and the switching equipment must be such that the dialling of this code will give the subscriber connexion to an idle junction circuit outgoing to the Mayfair exchange whether that exchange be an automatic or a manual one. Owing to variations in traffic the size of the junction groups to Mayfair will vary from time to time, and redistribution of junction lines in the automatic equipment will be essential. The translator mentioned provides the means whereby this can be effected, because the transformation by means of the "impulse cross connexion field" will make it practicable for "MAY" to be reconverted into any combination of the 10 digits when taken three at a time.

The traffic problem involved in the provision of connecting circuits or trunks at automatic exchanges is one of considerable interest and importance, as is illustrated by the extent to which it figures in the bibliography appended.

Wire Plant.—If the distribution to the subscribers is underground throughout, the main cables are now subdivided into smaller units, bifurcated or multiple branching joints being made between the main and subsidiary cables. The latter cables are accessible in footway boxes, and are terminated in such a way that one or more pairs of conductors can be led direct into any adjacent premises by a small lead-covered paper-core cable. The end of the small cable in the subscriber's premises is terminated in such a manner as to prevent the ingress of moisture.

If, however, the distribution is by means of aerial wires from a pole which is erected to serve a small zone, the cable is continued to a point about 2 ft. below the lowest arm of the pole, and is terminated in a solid or sealed joint from which separate lead-covered leads extend the pairs of conductors to insulators.

For long-distance service up to about 1910 the wires were erected on pole lines along roads, railways and canals. The hard-drawn copper wire of high conductivity (invented by T. B. Doolittle in 1877) is invariably used; and wires weighing from 150 to 800 lb. per mile have been employed. It was necessary to carry the long-distance lines through underground cables in the approaches to large English cities, but owing to the inefficiency of cable wires as compared with aerial wires for speech transmission, the length of underground cable sections was kept down to a minimum. As the long distance service expanded and the number of lines increased it became increasingly difficult to find routes for new pole lines, especially near large cities, and the need for improvement in the efficiency of cable wires became a very pressing matter.

The disadvantages of the earlier types of underground cables as compared with aerial lines were: (*a*) much greater attenuation and distortion of telephonic currents; (*b*) inability to superpose a third circuit, known as a "phantom," on each pair of physical circuits.

Towards the end of the 19th century Oliver Heaviside had proved mathematically that uniformly distributed inductance in a telephone line would diminish both attenuation and distortion, and that if the inductance were great enough and the dielectric conductance not too high the circuit would be distortionless, while currents of all frequencies would be equally attenuated. Following up this idea Prof. M. I. Pupin showed that by placing inductance coils in circuit at distances apart less than half the length of the shortest component wave to be transmitted, a non-uniform conductor could be made approximately equal to a uniform conductor.

Pupin's system of "loading" telephone conductors has been applied in England mainly to underground cables, and many improvements have been made in recent years, so that it is now possible to obtain the same transmission efficiency from an underground telephone circuit as from an aerial circuit of equivalent gauge.

The difficulties encountered in working underground cable circuits were exhaustively investigated by the British Post Office in the first decade of this century, and it was proved that the inability to obtain phantom circuits was due primarily to want of balance between the electrostatic capacity of conductors in respect to (*a*) other conductors and (*b*) to earth. As a result of the earlier investigations the method of laying up the conductors in pairs to form a complete cable was radically changed. A type of cable known as the "quadruple pair" was introduced. In this type the conductors are lapped with insulating paper twinned together in pairs, and are arranged in "cores" each containing four twisted pairs laid up together around a centre, usually of yarn, forming a "quadruple pair" core. The cores are laid up together to the number required and sheathed with lead. This type of cable was a great improvement on the earlier "twin" cables, and permitted the formation of a superposed "phantom" circuit on two physical circuits. Diagonal pairs in the same core are selected for superposing.

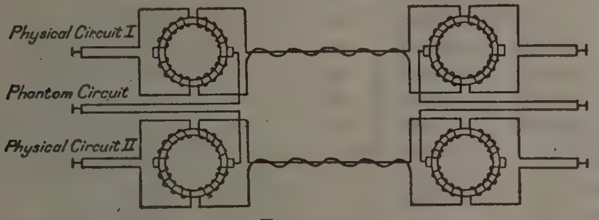

FIG. 5.

In a later type of cable known as the "multiple twin cable" the centre of yarn is dispensed with, and the cable consists of a number of 4-wire cores made up of two 2-wire cores twinned together. The manufacture of this type of cable has been greatly improved in recent years, and cables are now produced with very small out-of-balance capacities between wire and wire, and between wire and earth. It is still, however, necessary to balance the cables after laying by a systematic method of jointing contiguous lengths, whereby conductors are selected and jointed in such a manner as to secure maximum uniformity of characteristics.

A method of loading the phantom circuit in telephone cables was invented by G. A. Campbell and T. Shaw in the United States and patented in Great Britain in 1911. This method was applied to a cable laid between London and Birmingham in 1914 and extended to Liverpool in 1916.

The phantom circuit is obtained by means of specially wound transformers joined across the ends of the physical circuits. The cores of these transformers consist of a ring made up of very fine soft iron wires. Fig. 5 illustrates the method of connecting.

Telephone Repeater.—The art of long-distance telephony was advanced a further and more important stage by the introduction of a practicable type of telephone relay or repeater in 1913.

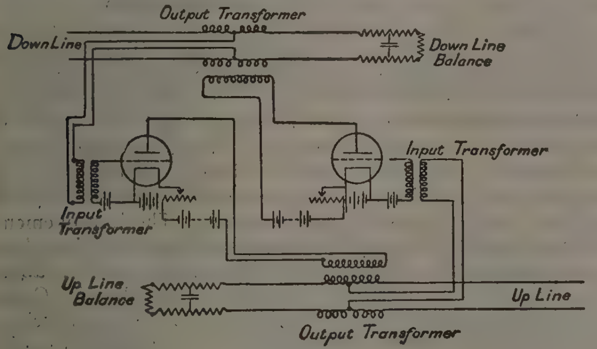

FIG. 6.

The conception of a repeater which could be inserted in a telephone circuit and fulfil the same functions as a repeater in a telegraph circuit is almost as old as the telephone itself. Early attempts at a solution of the problem were invariably in the form of a sensitive microphone attached to the reed or the diaphragm of a receiving apparatus, but the fundamental defects of repeaters of this type, due primarily to the inertia of moving mechanical parts, prevented their successful application in commercial service. It was not until the development of the 3-electrode thermionic tube had reached the stage of commercial production for wireless telegraphy purposes in 1913 that the problem of the telephone repeater could be solved. Since that time progress has been so rapid as to cause almost a complete revolution in long-distance telephony.

A modern telephone repeater for insertion at an intermediate point in a long telephone line consists essentially of two thermionic tube amplifiers, one for the up and one for the down side of the line circuit, associated with apparatus for balancing the line circuits for duplex working, the telephone circuit being necessarily a duplex circuit. The general arrangement is shown in fig. 6.

The telephone repeater may be used to extend the range of speech over existing lines, as for instance a London–Paris line may be extended by a repeater at Paris to any distant city in direct communication with Paris; a second repeater at the distant city may relay the line again to a further point and so on. In fact it may be said that telephonic speech is now possible over any length of wire circuit. Speech through submarine cables is, however, still limited to comparatively short distances.

The most important application of the telephone repeater, and one in which the greatest economies are possible, is in the internal communications of a country. For instance, in order to provide telephonic communication between, say London and Manchester, Leeds, Newcastle and Glasgow, it has hitherto been necessary to erect line conductors weighing on the average 600 lb. per circuit mile. A London–Newcastle line thus requires about 180,000 lb. of copper. It is now possible by using four telephone repeaters at intermediate points between those two cities to provide equally good communication over conductors weighing only 80 lb. per circuit mile, and these conductors may be contained in an underground cable which will carry 240 circuits. The combination of telephone repeaters with underground cables affords a service of greater efficiency than can be obtained from heavy aerial lines, and a service free from interruption by storms.

Fig. 7 is a plan illustrating a scheme for providing telephonic communication between all the important towns of Great Britain by means of underground cables and telephone repeaters. The construction of this extensive system was well advanced in 1921 and was due for completion in 1925.

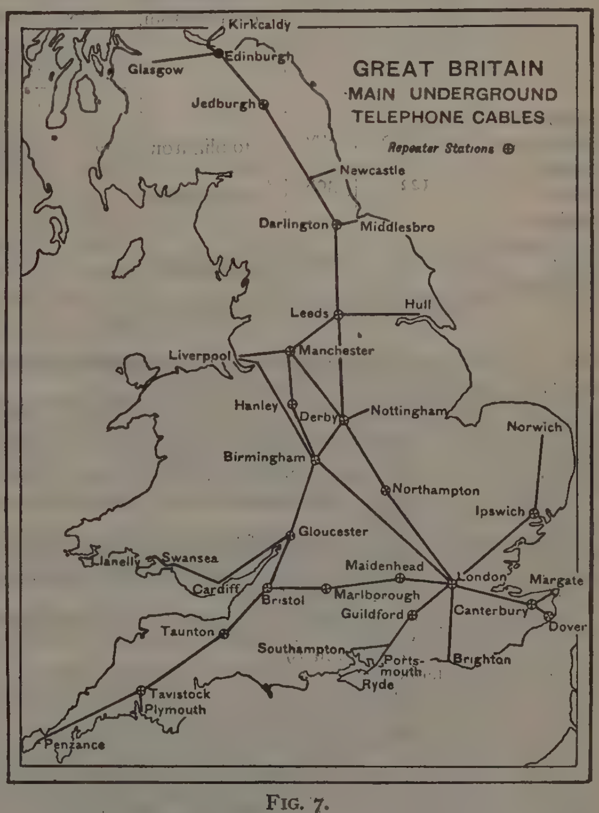

FIG. 7.

A list of representative types of main underground telephone cables in Great Britain is given in the table.

Submarine Telephone Cables.—The problem of loading deep-sea cables with inductance coils, and thus increasing the possible range of speech transmission, was successfully solved in 1910, when Messrs. Siemens Bros. & Co. manufactured and laid for the British Post Office between Dover and Calais a 4-core submarine cable loaded with inductance coils at intervals of one nautical mile. The transmission efficiency of this cable was rather more than three times as good as that of a similar cable without loading coils.

In 1911 Messrs. Siemens introduced a form of balata dielectric as a substitute for gutta-percha in loaded submarine cables on account of the greatly reduced leakance of the former as compared with the

Particulars of Representative Types of Loaded Main Underground British Cables.

Cable	Length	Number of Pairs	Weight per Mile Single Conductor	D. C. Constants of Cable per Mile Loop		A. C. Constants of Loaded Cable per Mile Loop at ω = 5,000			Inductance of Loading Coils	Average Distance between Loading Coils
				Resistance, R	Capacity Wire to Wire, C	Inductance, L	Attenuation Constant, β	Characteristic Impedance, Z_0		
	Miles			Ohms	μF	Henries			Henries	Miles
Leeds–Hull	58·6	48	70	28·7	0·065	0·052	0·0166	897 \3° 4′	0·133	2·55
		6	100 *	—	—	—	—	—	—	
London–Birmingham	109·5	24	100	18·95	0·0575	0·0535	0·01092	905 /5° 41′	0·133	2·5
			100 †	18·38	0·0568	0·053	0·01074	891 /5° 36′	0·133	
		12	150	13·13	0·0697	0·0537	0·00884	864 /8° 40′	0·133	
		14	200	9·62	0·0654	0·0536	0·00664	860 /8° 7′	0·133	
		2	300	6·55	0·0567	0·0547	0·00408	959 /13° 7′	0·133	
		6	150 phantom	6·56	0·1056	0·0345	0·00756	563 /6° 48′	0·0825	
		6	100 phantom	9·5	0·0905	0·0357	0·00926	610 /8° 55′	0·0825	
Birmingham–Liverpool	89·9	24	100	17·9	0·0579	0·053	0·01057	1 062 \1° 4′	0·133	2·5
			100 †	17·32	0·0575	0·053	0·01014	1 069 \2° 57′	0·133	
		12	150	12·44	0·0685	0·0537	0·00846	1 031 \1° 4′	0·133	
		14	200	9·19	0·0572	0·0536	0·00618	1 088 \5° 45′	0·133	
		2	300	6·28	0·0545	0·055	0·00413	1 074 /2° 26′	0·133	
		6	150 phantom	6·22	0·10075	0·0345	0·00682	565 /1° 18′	0·0825	
		6	100 phantom	8·95	0·0864	0·0357	0·00837	615 \2° 11′	0·0825	
				D. C. Constants of Unloaded Cables						
				R	C					
London–Manchester	186·5	160	40	44	0·065	0·109	0·0208	1 298 \2° 35′	0·175	1·6
			40 phantom	22	0·090	0·066	0·1625	857 \2° 11′	0·106	
London–Bristol	122	308	20	88	0·065	0·155	0·033	1 550 \3° 31′	0·175	1·125
			20 phantom	44	0·090	0·094	0·0255	1 023 \2° 58′	0·106	
London–Southampton and Portsmouth ‡	85	254	20	88	0·065	0·222	0·0292	1 855 \2° 33′	0·250	1·125
			20 phantom	44	0·090	0·138	0·0235	1 240 \2° 8′	0·155	

* 100-lb. conductors used for telegraphs. † Not phantomed. ‡ In course of construction.

latter. The effect was to reduce materially the attenuation constant and increase the range of speech in loaded cables.

The improved dielectric was used in a cable laid in Aug. 1912 between St. Margaret's Bay, Dover, and La Panne, Belgium. This cable contained four copper conductors, each weighing 160 lb. per nautical mile and insulated by a dielectric weighing 150 lb. per mile (as compared with 300 lb. per mile in the 1910 Anglo-French cable). The variation of attenuation with frequency is much less in the 1912 cable than in the earlier one.

The Anglo-Belgian cable had another special feature, namely, the provision of loading coils for a third circuit superposed on the two physical circuits. The loading coils for all three circuits were placed together at intervals of one nautical mile.

A similar cable with some further improvements in dielectric and loading coils was laid across the Irish Sea between Nevin, Carnarvonshire, and Howth, co. Dublin, in 1913.

A submarine telephone cable of the continuously loaded type was laid across the English Channel by the French Government in 1912, between the same points as the 1910 coil-loaded cable. The weight per nautical mile of dielectric is the same in both cables, but each copper conductor of the former weighs 300 lb. per mile as compared with 160 lb. per mile in the latter. The transmission efficiency of the cables is practically equal, but the continuously loaded cable provides an additional circuit by superposing. Experiments conducted on this cable in 1914 proved the possibility of obtaining four circuits from a continuously loaded 4-wire submarine cable by introducing an improved method of balancing the electrostatic capacity of the conductors. The fourth circuit has not yet been successful in a coil-loaded cable.

Several additional coil-loaded telephone cables were laid across the English Channel during the war period. Details of these cables are given in the Table.

With equal weights of conductor and dielectric, the relative transmission efficiencies of (*a*) coil-loaded and (*b*) continuously loaded 4-wire submarine cables are as 100 to 75, but the latter may provide four circuits as compared with three in the former. Experience has shown that the maintenance and repairs of coil-loaded cables are attended by difficulties which are not met with in continuously loaded cables.

The introduction of telephone relays has made it possible frequently to use submarine cables of a less efficiency than the coil-loaded cables previously required. Consequently, it is practicable to increase the use of continuously loaded cables, and the modern tendency is in that direction. (W. No.)

UNITED STATES

The more important improvements made in the United States during 1910–21 are briefly described below.

Exchange Cables.—Improvements in the design and the methods of manufacture of cables for use in local exchanges made it possible greatly to increase the number of wires of a given size in a sheath of given size. By employing wires of smaller diameter than those heretofore used the maximum number was still further increased. Cables containing either 900 wires No. 19 A.W.G. (·0359 in. diam.), 1,800 wires No. 22 A.W.G. (·0253 in. diam.), or 2,400 wires No. 24 A.W.G. (·0201 in. diam.) were extensively used in 1921. The improvements which rendered practicable these cables of maximum diam. have been employed also in cables of fewer pairs, thus enabling their diams. to be decreased and their costs reduced. Cables containing the smaller sizes of wire were used as extensively as was justified by their economic balance in relation to other portions of the plant. This resulted in the employment of considerable amounts of No. 24 A.W.G. conductor cable.

For a long time cable sheaths were made of lead alloyed with about 3% of tin, unalloyed lead not having the requisite strength and resistance to corrosion. Extensive research, directed toward finding a cheaper but no less effective alloy, resulted in 1912 in the adoption of lead alloyed with a small amount of antimony. Readjustments in the thicknesses of sheaths and in the composition of the insulating and binding paper produced still further economies.

Loading Coils in Exchange Service.—Many thousands of trunk circuits in multi-office exchanges and circuits connecting large cities with suburban points have been equipped with loading coils, pro-

British Submarine Telephone Cables.

Particulars of Cable	Length	Weight per naut. m.		Loop Resistance per naut. m. of Conductor without loading (at 60° F.)	Alternating Current Constants							
		Conductor	Dielectric		Circuit	Frequency of Test	Added Resistance per naut. m. due to Loading	Inductance (L) per naut. m.	Capacity (C) per naut. m.	*Leakance* Capacity or G/C.	Attenuation Constant per naut. m.	Characteristic Impedance (Z_0)
	Naut. m.	Lb.	Lb.	Ohms.		∽ Per sec.	Ohms.	Henries	µF.			Ohms.
St. Margarets–La Panne III., 1911, coil loaded	47·9	160	150	14·3	Physical	800	11·5	0·100	0·157	12	0·0178	800 $\overline{\diagdown 1^\circ\ 24'}$
					Phantom	800	4·6	0·050	0·314	12	0·0181	400 $\overline{\diagdown 1^\circ\ 16'}$
Nevin–Howth I., 1913, coil loaded	63·3	160	150	14·3	Physical	800	6·8	0·100	0·166	15	0·0150	690 $\overline{\diagdown 2^\circ\ 40'}$
					Phantom	800	3·2	0·050	0·320	15	0·0150	446 $\overline{\diagdown 0^\circ\ 52'}$
Temple Patrick-Port Mora, continuously loaded, 1921	22·0	169	195	13·5	Physical	800	2·0	0·0245	0·195	20	0·025	356 $\overline{\diagdown 3^\circ\ 43'}$
					Phantom	800	—	—	—	—	0·025	—
Abbotscliff–Grisnez III., 1910, coil loaded	21·0	160	300	14·3	Physical	750	6·0	0·095	0·186	120	0·0148	1,000
Abbotscliff–Grisnez IV., 1912, continuously loaded	21·0	300	300	7·6	Physical	1,000	—	0·0135	0·176	109	0·0185	278 $\overline{\diagdown 2^\circ\ 59'}$
					Phantom	1,000	—	—	—	—	0·0185	—
Dover–Sangatte I., 1917, coil loaded	20·8	310	200	7·4	Physical	800	5·2	0·080	0·189	20	0·0112	709 $\overline{\diagdown 1^\circ\ 50'}$
Dover–Dunkirk I., 1917, coil loaded	41·6				Phantom	800	2·5	0·040	0·378	20	0·0114	338 $\overline{\diagdown 1^\circ\ 40'}$
Dungeness–Audrecelles III., 1918, coil loaded	26·0											
Dover–Sangatte II., 1918, coil loaded	21·0	160	150	14·3	Physical	800	6·2	0·100	0·166	20	0·0145	776 $\overline{\diagdown 1^\circ\ 3'}$
Dungeness–Audrecelles II., 1918, coil loaded	27·6				Phantom	800	3·0	0·050	0·320	20	0·0140	395 $\overline{\diagdown 1^\circ\ 2'}$

viding transmission of such a grade as would require from 5 to 10 times as much copper in the cable circuits if loading were not employed. Loading coils have been materially improved by constructing the cores of several rings, each of which is made by compressing finely divided particles of iron with a binding material which acts as insulation between the iron particles. There may be as many as thirty thousand million of these particles in the core of a cable loading coil. These cores are more uniform and stable than the wire cores formerly used and are much less affected by excessive currents which may accidentally come into the circuit.

Long-Distance Telephony—Open Wire.—At the beginning of the decade 1910–20, the limits of telephone transmission were about 1,200 to 1,500 m. in open wire. These limits were extended rapidly so that in 1921 practically all parts of the continental United States were placed in communication with each other over distances of 4,000 m. and upwards, employing overhead wires no larger than those used to give the restricted service of 1910. These improvements were made with only slight changes in the lines and equipment and with no change whatever in the subscriber's station apparatus. They depended upon the development of satisfactory repeaters with their associated apparatus and methods of use. The form of repeater generally employed in 1921 was the 3-element thermionic tube. Devised primarily for radio purposes, it was so adapted as to become a remarkably effective repeater. This required that a large amount of auxiliary apparatus be invented and developed and methods devised for balancing the lines and making them suitable for the operation of this apparatus. The amplifier or repeater receives the minute attenuated telephone currents and sends out currents of exactly the same form but greatly enlarged. The transmission gain which may be obtained with vacuum-tube amplifiers in two-way operation depends on the electrical conditions of the line in which the amplifiers are used. This has a great effect on line design.

Transcontinental Telephony.—By the development of methods by which the loading coil could be applied to the heaviest gauge wires and such wires, when equipped with loading coils, could be operated on the phantom principle, it became practicable, in 1911, to provide telephone service between New York City and Denver, Col., and greatly to improve the transmission of speech between cities less far apart. By the application of the phantom principle to such circuits the available facilities were largely increased so that, between the important telephone centres, notable improvements in service were accomplished. On Jan. 25 1915, the transcontinental line of the Bell System was formally opened for business and after that time commercial service was given between the cities on the Atlantic Coast and those on the Pacific Coast. The service in 1921 was handled over a group of 4 non-loaded wires equipped with telephone repeaters. By using the 2 side circuits and the phantom circuit formed by these wires, 3 simultaneous transcontinental connexions may be established. By means of the addition of compositing apparatus to the circuits the 4 wires which carry 3 telephone circuits also carry 4 telegraph circuits. These 4 telegraph circuits may be arranged to transmit 8 simultaneous messages. The line from New York City to San Francisco is 3,400 m. in length.

Long-Distance Telephony—Cables.—By 1906 a cable 90 m. long was successfully operated between New York and Philadelphia, but, in the then state of the art, that cable could not be used for connexions extending beyond New York or Philadelphia. In 1911, an underground cable was designed capable of giving a satisfactory conversation between Washington and Boston. By 1912, a section of this new cable was laid from Washington to Philadelphia, there connecting with the earlier type of cable to New York. During 1913, a section of the new cable was laid between New Haven and Providence, connecting at New Haven with an earlier type of cable extending to New York and connecting at Providence with an earlier type extending to Boston. Although talking over the whole distance from Boston to Washington was not possible so long as stretches of cable of the older types had to be employed, yet by using the underground in connexion with the overhead, the seaboard cities from Washington to Boston could no longer be isolated by storms destroying the overhead lines. During 1913, the advances in the art of loading and balancing underground circuits together with the repeater developments made it possible to talk satisfactorily by underground wires from Boston to Washington, a distance of 455 m. even though 47 % of the total cable in the line was of the types formerly suitable for short-haul working only. In 1912, talking by underground wire for the first time between New York and Washington represented the longest distance achieved. By 1913, this distance had been doubled. The Boston–Washington cable was several times longer than any other in the world. There were in 1921 several cables working along the Boston–Washington route. During 1919, the extension of the toll cable system from Philadelphia to Harrisburg, Pa., was completed. Taken in combination with the cables already working between Boston and Washington, this gave a through toll cable route from the important points on the eastern seaboard as far west as Harrisburg. In 1921, this cable was extended from Harrisburg as far W. as Pittsburgh, a distance of 192 m. from Harrisburg and 304 m. from Philadelphia. For the greater portion of the distance the cable was supported aerially on poles. The composition of this cable was as follows:—

Section	Quads No. 16 A.W.G.	Quads No. 19 A.W.G.
Harrisburg–Ligonier	16	125
Ligonier–Pittsburgh	19	120

At the intervals of about 60 m. substantial brick buildings were erected for use as repeater stations to house the equipment, apparatus, power plant and test boards that make up a modern repeater station. General plans were completed for extending this cable from Pittsburgh to Chicago.

The installation of these toll cables resulted in economies due not only to the reduced annual charges on additional circuits as required and less expense for routine maintenance, but also to the fact that the losses resulting from storm damage to open wire were avoided, as were also losses in revenue and reaction on the service during storm periods. Much is thus done to stabilize the toll plant and reduce expenditures as well as further to improve the service. By means of the improvements which had been made it became possible to carry on satisfactory talks over wires in cables more than 2,000 m. in length (where commercial conditions justify such cables) and this was accomplished with practically no more copper in each circuit than had been used in the earliest forms of cable which, as lately as 1882, caused serious interference with transmission when employed in lengths of only a fraction of a mile.

Repeater development reacted on the loading art, requiring the development of loading coils of great magnetic stability and uniformity. Such stability is also particularly important on long circuits which are composited for telegraph operation in order to prevent the telegraph from interfering with the telephone transmission. Although these loading and repeater developments greatly extended the use of cables for long-distance transmission they made it imperative to keep open-wire circuits as free as possible from cable in order to prevent the electrical irregularity thus introduced from reacting on the repeater operation.

Submarine Cables.—In 1921, telephone communication was established with Cuba by means of submarine cables connecting Havana with Key West. These cables brought all of the principal places in the United States into telephonic communication with Havana and other important places in Cuba. There were in 1921 3 cables, each about 115 m. in length. Except at the terminating points, the cables were laid some miles apart in order to minimize the danger of simultaneous interruption as the result of accident. The average depth was about 3,000 ft. and in some places depths of more than a mile were reached. The main portion of each cable had a single conductor, two conductors being employed in the shore ends. The main conductor weighed 350 lb. per m. and consisted of 7 strands of copper wire. The conductor bore a wrapping of fine iron wire, this being covered with gutta-percha enclosed in copper tape which served as a return grounded conductor. By the use of multiplex methods each cable handled simultaneously one telephone and two telegraph messages. Each cable is expected ultimately to handle two or more additional telegraph messages. The use of single conductor cables, the telephone amplifiers, the terminal telegraph apparatus, and the devices for permitting the telephone and telegraph to operate simultaneously, all differed from earlier practice.

The largest submarine cable equipped with loading coils in 1921 was that which crossed Raritan Bay from Staten Island to New Jersey. It was upwards of 28,000 ft. in length, was loaded at 5 points and contained 37 quads of No. 16 gauge wires and 12 pairs of No. 22 gauge test wires. Each loading pot was approximately 16 ft. long and weighed 4 tons. The cable was laid in shallow water, the average depth being 10 ft. at mean low tide.

Carrier Current Telephony.—From the earliest days of the telephone and telegraph there were many attempts to develop multiplex transmission of messages. It was while working on the problem of multiplex telegraphy that Dr. Bell had his first conception of the structure of the original telephone. The long series of inventors, scientists and engineers who have contributed to the development of the multiplex art includes Gray, Edison, Mercadier, Pupin, Hutin, Leblanc, Stone, DeForest, Vreeland, Ruhmer, Squier, Wagner and others. In 1918 research experts and engineers of the Bell System completed the development of a commercial multiplex telephone and telegraph system and put it into operation between Baltimore and Pittsburgh. By means of this multiplex system, 4 telephone conversations may be had simultaneously over one pair of wires in addition to the telephone conversation provided by the ordinary methods. Thus, over a single pair of wires, 5 telephone conversations are simultaneously operated, each giving service as good as that provided by the circuit working in the ordinary way.

In telegraphy, as compared with the ordinary duplex telegraph circuit, this multiplex system permits at least a tenfold increase in messages. Although the commercial installations in use in 1921 provided only 4 additional conversations, the limitations as to number of telephone or telegraph messages on a single circuit were determined entirely by economic considerations. The operation may be considered to consist of combining the telephone current with high frequency current, transmitting this combination over a line wire, and, at the receiving end, removing the high frequency current and leaving the telephone current. The high frequency current serves as a " carrier " for the telephone current over the line.

Simultaneous transmission of several telephone currents is accomplished by means of selective apparatus by which one particular receiving channel is made easily receptive to one particular set of high frequency currents and, at the same time, acts substantially as a barrier to the currents of other high frequencies which are carrying telephone conversations other than those which the channel in question is designed to receive.

The operation involves the following steps: (1) Generation of carrier current, (2) Modulation, (3) Demodulations, (4) Separation of channels by selective circuits, (5) Repeaters for amplifying currents of carrier frequency at intermediate points.

(1) *Generation of Carrier Current.*—Carrier currents of various frequencies are for convenience obtained from well-known forms of vacuum-tube oscillators. In general the telephone multiplex frequencies run about 10,000, 15,000, 20,000 and 25,000.

(2) *Modulation.*—This term is applied to the process by which carrier current, produced by an oscillator, is so combined with voice currents from a telephone transmitter that the variations of the latter are impressed upon the former. The carrier and voice frequencies are applied together in the grid circuit of a vacuum-tube modulator together with a steady battery voltage.

(3) *Demodulation.*—This is a complementary process of modulation. Modulation may be thought of as elevating the band of essential speech frequencies to a position adjacent to the carrier frequency, and demodulation may be regarded as restoring this band to its normal position in the frequency scale.

(4) *Separation of Channels by Selective Circuits.*—When a number of channels, each employing a different carrier frequency, are operated simultaneously on a common line, each channel must be connected with the line through selective circuits which transmit only the range of frequencies assigned to that particular channel. Not only must the demodulator assigned to a given channel be prevented from receiving, from the line, currents of other channels, but the sending modulator must be prevented from putting on the line currents or frequencies outside of its assigned band. The appurtenances specially developed for accomplishing this selection in carrier current telephony are known as " band-pass electrical filters."

(5) *Reaction on the Telephone Plant.*—Carrier currents have imposed new requirements as to transpositions and it has also been necessary to develop new types of loading coils capable of transmitting the carrier frequencies, and also extremely uniform in impedance over the whole frequency range.

Limitations.—From the nature of the apparatus and methods employed, the system is not practically advantageous on short lines. In 1921 it was being applied to lines of 250 m. or more.

Carrier telephone systems were in commercial operation between the following points: Baltimore and Pittsburgh, Harrisburg and Chicago, Harrisburg and Detroit, Boston and Bangor, San Francisco and Los Angeles.

Loud-Speaking Telephones.—By the use of vacuum-tube amplifiers in connexion with specially developed transmitters and receivers, supplemented by large projecting horns, the human voice may be magnified thousands of millions of times so that a public speaker can make himself heard by a vastly greater number of people than ever before. By the use of apparatus and methods of this kind developed by the Bell Telephone System, President Harding's inaugural address in 1921 was heard by over 100,000 listeners standing in an open space of more than 10 ac. before the Capitol.

Radio Telephony.—In 1915 the engineers of the Bell Telephone System succeeded in transmitting speech from Arlington, Va., to the Eiffel Tower in Paris, and, simultaneously, to the Hawaiian Islands in the Pacific Ocean. Two experimental radio telephone transmitting and receiving stations were erected on the Atlantic Coast, one near Asbury Park, N.J., and the other near Plymouth, Mass. By means of these stations, radio telephone communication was maintained between the commercial telephone system and two ships experimentally equipped, plying from Boston to southern ports on the Atlantic Coast.

In July 1920 regular commercial radio telephone service was established between Santa Catalina Is. about 30 m. from shore, and the mainland near Los Angeles, Cal., at the latter point making junction with the local and long-distance wires of the Bell System throughout the United States.

The circuit is provided with through-line ringing of a type which is free from interference and there is a superimposed telegraph circuit capable of forming a link in a duplex wire telegraph circuit. The volume and quality of telephone transmission are so good that the radio link is regularly connected, whenever required, with long-distance wire circuits. On several occasions conversations have been carried on between a steamship on the Atlantic and the Avalon office at Catalina Is. in the Pacific, using the transcontinental wire telephone line as the connecting link overland.

Machine-Switching System.—A retrospective examination of the manually operated switchboard discloses the fact that the tendency of development has been continuously in the direction of increasing the number and extent of the operating functions which are performed electro-mechanically and likewise decreasing the amount of time required of the operator for the handling of the connexion. When a point is reached where the operations performed manually at the central office are eliminated, except in the case of certain special classes of calls, the term " automatic " or " machine switching " is applied to the switching equipment.

There are two principal types of machine-switching equipment, the " step-by-step " and the " panel " type. In both the apparatus at the central office is set in motion and controlled by a dial, associated with the substation set, and rotated by the subscriber. The "step-by-step" type of equipment makes use of a series of selectors in each of which contact is made by means of a central arm that can be raised to any desired level and rotated, at that level, to the proper one of a series of terminals arranged in the arc of a circle. This type of equipment is mostly used in the smaller cities and for automatic private branch exchanges. The "panel" type of equipment has been developed to a point where it is now being installed on an extensive scale in a number of the larger cities of the United States. On account of its importance a brief description is given.

Panel Type System.—The panel type equipment is so named because the multiple of the selectors is built in panels. The selectors have, in general, capacity for 500 lines or trunks. The multiple of these selectors consists of punched brass strips about 3 ft. long and one in. wide piled one above the other with insulation between. Since 3 connexions are necessary for each line or trunk, 1,500 of these strips are provided. The strips are divided horizontally into 5 groups or panels of 100 lines or trunks each and are mounted on frames having capacity for 60 selectors each, 30 on each side. The selector consists of a tube running vertically, close to the banks, the tube being equipped with a set of brushes for each bank. The brushes normally are held mechanically so that they do not engage the terminals. At the bottom of the tube, a friction clutch is provided which, by engaging constantly rotating shafts, can cause the tube to be raised or lowered. The brushes are multipled together by wires within the tube, these wires being attached at the top of the tube to feeder brushes which move over insulated feeder strips. The process of selection consists in first mechanically tripping the desired brush into engagement with its multiple bank, next in moving the tube carrying the brushes upward to choose the desired group within the bank, and finally continuing the movement upward to choose the desired subscriber's line or an idle trunk within the selected group. The subscribers' lines appear on the multiple of panel type selectors known as "line finders." The function of the line finder is to make connexion with calling subscribers' lines. It corresponds to the "A" operator's answering cord and the subscriber's answering jack in the manual system. The brushes of the line finder are attached to the brushes of a panel type "district selector" and also to the brushes of a small selector known as a "sender selector." As soon as a calling subscriber's line has been picked up by a line finder, the sender selector selects an idle "sender" out of a common group. When the calling subscriber dials, the pulses are registered in the sender which controls the setting-up of the connexion and is then freed. The sender may be likened to the operator of the manual system. The sender causes the district selector to choose a trunk to the desired office, or, if more than 500 outgoing trunks from the office are required, causes the district selector to pick out an idle "office selector" of the panel type which selects the desired trunk. The trunk incoming to the full mechanical office ends in the sender of an "incoming selector" of the panel type whose function it is, under control of the sender, to pick out an idle panel "connector" having access to the group of 500 lines in which the called subscriber's line may be found. Controlled by the sender, the connector then selects the called line.

Calls from a machine-switching to a manual office are completed over "call indicator trunks." As the calling subscriber dials his call, the district or office selector picks out an idle trunk to the desired office. This trunk ends in a plug before a "B," or incoming trunk operator in the called office. When a call appears on that trunk, the "B" operator depresses a display key associated with that trunk, whereupon the number which is desired in that office is quickly transferred by the sender to a bank of numbered lamps appearing before the "B" operator, and the "B" operator thereupon plugs the trunk into the desired subscriber's line.

For completing calls from a manual to a full mechanical office "key indicator mechanism" is employed. This is a mechanism which indicates to the "A" operator an idle trunk to the desired office which ends at that office at an incoming selector. The "A" operator by using a small 10-button key-set is enabled to control the incoming selector to make connexion through the aid of connectors with the called line desired.

Other Improvements.—In the United States there is a large and growing use of the telephone for communications essential to the operation of both steam and electric railways. The problem of minimizing the disturbing effect upon telephone circuits produced by induction interference from electric light and power circuits has resulted in careful, coördinated work by the power and telephone engineers. Important improvements have also been made in local and toll line operating efficiency.

Organized research has not only enabled the limits of telephony to be greatly extended but, at the same time, improvements and economies have been made in every department of the business.

Telephone Development of the World—January 1 1910, 1914 and 1920.

(Some of the figures—for the most part those for small places not shown separately—are necessarily in part estimated.)

	Jan. 1 1910		Jan. 1 1914		Jan. 1 1920	
	Number of Telephones	Telephones per 100 Population	Number of Telephones	Telephones per 100 Population	Number of Telephones	Telephones per 100 Population
Great Britain	609,274	1·3	780,512	1·7	911,919	1·9
Denmark	87,436	3·2	129,277	4·5	219,460	7·3
France	211,664	0·5	330,000	0·8	418,901	1·1
Germany	968,101	1·5	1,420,100	2·1	1,766,571	2·9
Italy	63,131	0·2	91,720	0·3	107,190	0·3
Norway	57,945	2·4	82,550	3·4	122,796	4·7
Sweden	174,055	3·1	233,008	4·1	388,794	6·7
Switzerland	73,758	2·0	96,624	2·5	138,843	3·5
Other countries in Europe	506,636	0·2	848,918	0·3	925,000	0·3
Total Europe	2,752,000	0·6	4,012,709	0·8	4,999,474	1·0
Japan	109,780	0·2	219,551	0·4	298,000	0·5
Other countries in Asia	44,220	0·01	86,534	0·01	150,000	0·02
Total Asia	154,000	0·02	306,085	0·04	448,000	0·05
Union of South Africa	13,650	0·2	28,889	0·5	42,419	0·6
Other countries in Africa	18,000	0·02	36,207	0·03	53,000	0·04
Total Africa	31,650	0·02	65,096	0·05	95,419	0·07
United States	6,995,692	7·6	9,542,017	9·7	12,668,474	12·0
Canada	239,000	3·3	499,774	6·5	785,108	9·0
Other countries in North America	38,900	0·1	79,157	0·3	110,000	0·3
Total North America	7,273,592	5·5	10,120,948	7·5	13,563,582	9·0
Total South America	75,000	0·2	166,331	0·3	264,737	0·4
Australia	81,040	1·8	137,485	2·8	224,000	4·3
New Zealand	29,680	2·7	49,415	4·6	80,723	6·5
Other countries in Oceania	10,000	0·03	30,481	0·06	54,000	0·1
Total Oceania	120,720	0·3	217,381	0·4	358,723	0·6
Total throughout World	10,406,962	0·6	14,888,550	0·9	19,729,935	1·1

Note: In the case of countries the boundaries of which have undergone change, the figures for each year represent the number of telephones within the boundaries of that year.

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TELPHERAGE (*see* 7.63).—The World War saw, in the Italian army, amazing use made of the system of telpher transport for fighting on the Alps. When, after many years, snow, ice and avalanches will have all but cancelled every trace of the epic deeds performed in those regions, tourists who climb to the crests of the Adamello, the Marmolata, the Tofana and a hundred other peaks will hardly believe that thousands of men lived and fought for years in the very spots that they have reached only with difficulty, with the help of ropes and ice-axes, and in favourable weather.

Before the war it was thought impossible to conduct military operations on the high peaks. It was believed that the ordinary troops would be practically tied to the roads, that a company of "Alpini" with a few mountain guns would be the largest unit that could be used in places where only paths for mules existed, and that the rocky peaks, the snows and the ice, would be reached only by small groups belonging to specialist units, sent there to keep an eye on the enemy.

But from the earliest days of the campaign there happened on the Alpine front something very similar to what had occurred in France after the battle of the Marne, when Germans and French, in their common desire to outflank each other in the direction of the sea, finally reached the sea itself, thus forming one uninterrupted line from the Vosges to the Channel. On the Alps, with the object of capturing or turning the Austrian defensive lines, the Italians climbed higher and higher in ever-increasing numbers, the Austrians doing likewise, until the very tops of the mountains were reached and it became impossible to go farther. The most elevated points of the frontier having been thus occupied, the Italians put themselves in a position to meet enemy attacks as well as to face the inclemency of the climate: a hard and relentless struggle which had to be started afresh every time war operations involved a change of positions.

The first days of the war saw whole companies clinging hand and foot to the rocky summits; battalions encamped and freezing at a height of 3,000 metres. Field guns, drills, photo-electric stations were taken to pieces and carried up bit by bit to giddy heights, and there put together again. Food, water, ammunition were carried for many hours on mules, and thence transferred to columns of men who carried them for long hours more. At times the wounded and the sick had to be removed by securing them with ropes and letting them slide down gullies, or by allowing them to be jolted on stretchers along impossible paths. Very often they had to be attended to on the spot, behind a rock, because their condition did not allow of so painful a transport.

Numberless were the cases of men who, barefooted, with daggers in their mouths, would climb up the most impracticable summits during dark and stormy nights, and surprise the enemy where the latter felt sure that the ravines and precipices which surrounded him were his surest guards. Many times whole supply columns were crushed and buried by avalanches and rocks. Avalanches claimed thousands of victims among the troops on march, in hutments or in trenches. In certain places and at certain periods the danger was so great that when the men went out they were supplied with a long thin rope coloured in red. The colour came off with the damp and stained the snow, thus facilitating the search for men buried underneath.

The colossal work done at such great heights originated unheard-of conditions of defence and of existence. In places where until then a hurried visit with an experienced guide seemed a bold feat, in regions where there was perhaps one isolated Alpine hut in which it was considered an ordeal to spend one or two nights, there were constructed hutments, telegraph and telephone offices, infirmaries, workshops and stores. In such places, at a height of over 3,000 metres, tens of thousands of men spent several winters. To prepare these encampments both for shelter and for defence, it became necessary to excavate in the rock an enormous quantity of vast caves. In some places an underground city was cut in the rock with inter-communicating caves lined with timber and provided with water-pipes, electric lighting, etc. Galleries were excavated in the ice, between the Italian and Austrian trenches, leading under cover to advanced posts or even well into the enemy's lines. Gigantic operations with mines were also carried out. Cutting the rock was rendered possible thanks to the great perfection of the compressed-air drills. During the war the Italians turned out an admirable type of motor-driven air-compressor, which met with success also in the Allied armies. On the Italian front there were 20 large plants for fixed drills and about 4,000 groups of portable drills of from 5 to 45 horse-power. The remarkable skill of the Italian miners facilitated considerably the carrying out of most important and difficult mining operations.

In road-making wonderful results were obtained. Once operations were transferred to the highest and most inaccessible points, where in many cases there was not even the narrowest path, it became an absolute necessity to create means of communication at once. Roads were constructed which allowed heavy artillery and motor lorries to reach points where a few months before only a mountain expert would have trod.

The total length of the roads laid down by the Italian army was in round figures as follows:—

1,600 km. . . . . of roads for mules
1,100 " . . . . . . " " " carts
3,100 " . . . . . . of roads for motor lorries.

But the building of roads could not always meet the requirements of troops operating in Alpine districts. It happened very often that the number of men detailed to a certain point did not justify the building of a road on such difficult ground; or that snow and avalanches in the winter prevented the safe use of means of communication already existing; or that the enemy's fire swept them; or, finally, that the occupation of new positions made it necessary to send supplies out of proportion to the available transport and before there was time to build a road. The difficulty in such cases was skilfully overcome by means of special mechanical transport. Wire railways or "telphers" were provided, thus economizing time, labour and oil, and avoiding congestion of roads. These telphers are a kind of suspension railway. A double metal cable called "bearer" is extended on trestles placed in a straight line at different distances on the sides of the mountain. There are two stations, one at the starting-point and the other at the end of the line. In one of these stations there is a motor which works an endless cable (the "drawer"), to which are fixed two or more small waggons. The cable turns and draws the waggons supported by the "bearer" cable by means of small wheels which run on it.

Different kinds of telpherage plants were used.

1. *Telefori.*—These were provisional lines moved by man power and used in the most advanced zones to supply isolated posts or trenches. Their average length was 500 metres and each could carry about 50 quintals a day.

2. Dismountable *Teleferiche.*—These were run by motors and were put up in advanced zones. Their average length was from 1,000 to 2,000 metres, and each could carry from 10 to 20 quintals an hour. They could be dismounted and were portable, and could be installed even where there were no roads. These lines proved most useful for the transport of supplies in newly occupied positions. When in 1917 the troops of the II. Army crossed the Isonzo and advanced on the Bainsizza (Bainitsa) plateau, they could not communicate with the lines in the rear except by means of the few and bad mule-paths; but after only four days a few telphers were already in working order, and on the tenth day there were no less than 12 doing service. Similar miracles of speed were performed in the new mountain positions between the Brenta and the Piave.

3. Permanent *Teleferiche.*—These were run by motors and were fixed. They were employed at some distance from the lines, and reached a maximum length of 8,000 metres. They could carry about 150 quintals per hour.

Some permanent *teleferiche* were already working before the war for the service of mountain fortresses, and some types of portable *teleferiche* had been studied and estimates prepared. Oil and electric motors were in use.

The telphers covered on an average a rise of 650 metres from the starting-point to that of arrival; but in some cases even 1,500. The trestles were often at very great distances from one another and placed on peaks, while the waggons ran over fearful abysses. In the highest regions the lines often ran at a height of 2,000 to 3,000 metres; a few were installed even at 3,500 metres above sea-level.

On the eve of the retreat from Caporetto, in Oct. 1917, 380 *telefori* and 530 *teleferiche* were in working order. The former had a total length of 190 km., the latter of 630. During the retreat about 550 *teleferiche* and *telefori* were lost or dismounted. At the date of the Armistice there were 270 *telefori* and 460 *teleferiche* run by motors. The former had a total length of 170 and the latter of 640 kilometres.

The telpherage lines laid on the Italian front transported in all 33,000,000 quintals, the load of 330,000 railway trucks.

The service was under a special central administration with a competent staff drawn from the telpher transport companies (one for each army). There was also a department for the supply and testing of the material and a depot-school with construction and repairing shops. The bulk of the material was built by private concerns, but set up by the military.

The services rendered by the telpherage lines were invaluable. It was only thanks to these lines that it was possible to maintain positions which the troops would otherwise have been compelled to abandon for want of supplies. They allowed detachments to be kept in almost impossible positions even during the winter, as well as assuring an adequate supply of ammunition for guns placed in the most inaccessible positions which men could not have reached if laden with shells. Thousands of lives were saved when their gently sliding waggons were used for the transport of wounded and sick, who were thus spared a lengthy and agonizing journey to hospital. (M. R.)

TENNESSEE (*see* 26.619).—The pop. in 1920 was 2,337,885 as against 2,184,789 in 1910, an increase of 153,096, or 7% as against 8.1% in the preceding decade. The negro pop. during 1910–20 decreased numerically from 473,088 to 451,758, and decreased proportionally from 21·7% of the total to 19·3%. The average density of pop. in 1920 was 56·1% per sq. m.; in 1910 it was 52·4. The urban pop. (in places of 2,500 inhabitants or more) increased from 20·2% of the total in 1910 to 26·1% in 1920. Only two cities, Memphis and Nashville, had in 1920 more than 100,000 inhabitants; only two, Knoxville and Chattanooga, had between 50,000 and 100,000. The following table shows the pop. and increase per cent. for the six cities exceeding 10,000 for the decade 1910–20:—

	1920	1910	Increase per cent
Memphis . . .	162,351	131,105	23·8
Nashville . . .	118,342	110,364	7·2
Knoxville . . .	77,818	36,346	114·1
Chattanooga . .	57,895	44,604	29·8
Jackson . . .	18,860	15,779	19·5
Johnson City . .	12,442	8,502	46·3

Agriculture.—During the decade 1910–20 the interests of the state remained predominantly agricultural. Although the total land area in farms decreased from 20,041,657 ac. to 19,510,856 ac., the improved land increased from 10,890,484 ac. to 11,185,302 ac., and the number of farms increased from 246,012 to 252,774. During the same period the average acreage per farm decreased from 81·5 ac. to 77·2 ac.; but the average value per farm increased from $2,490 to $4,953, and the value of all farm property increased from $612,520,836 to $1,251,964,585. The average value of land per acre in 1920 was $41.40; in 1910 it was $18.53. Of the 252,774 farmers in 1920 214,592 were whites and 38,182 were negroes. Of all farmers 148,082 were owners; 103,885 tenants; and 807 managers. Of the total 11,374 were women. The total value of farm crops in 1919 was $318,285,307, of which amount $144,778,157, or 45·5%, represented cereals; the total value in 1909 was $111,133,210, cereals representing 49·8%. The cereal acreage in 1919 was 4,186,373 ac. as against 4,136,647 ac. in 1909, an increase of only 1·2%. The following table shows comparative acreage, production, and value of the important crops for 1919 and 1909:—

		Acreage	Production	Value
Corn	1919	3,301,075	70,639,252 bus.	$127,150,649
" . .	1909	3,146,348	67,682,489 bus.	45,819,093
Oats	1919	162,417	2,413,409 bus.	2,534,082
" .	1909	342,086	4,720,692 bus.	2,378,464
Wheat	1919	684,497	6,362,357 bus.	14,506,174
" .	1909	619,861	6,516,539 bus.	6,913,335
Hay and forage	1919	1,751,123	1,907,345 tons	49,649,657
Hay and forage . .	1909	1,060,480	1,100,838 tons	12,784,783
Cotton	1919	807,770	306,974 bales	48,808,866
" .	1909	787,516	264,562 bales	17,966,517
Tobacco	1919	138,561	112,367,567 lb.	24,720,869
" .	1909	90,468	68,756,599 lb.	5,661,681

The value of vegetables sold in 1919 was $27,947,250 and of fruits and nuts $7,888,912; the values respectively in 1909 were $10,430,975 and $4,486,281. Of the chief domestic animals on farms in 1920 and 1910 the number and value were as follows:—

		Number	Value
Horses	1920	317,921	$35,582,960
"	1910	349,709	39,320,044
Mules	1920	352,510	51,042,649
"	1910	240,282	32,489,724
Cattle	1920	1,161,846	51,370,208
"	1910	996,529	20,690,718
Sheep	1920	364,196	4,021,678
"	1910	795,033	3,009,196
Swine	1920	1,832,307	19,477,775
"	1910	1,387,938	7,329,622

In 1920 there were 11,835,303 fowls valued at $10,591,690, and 191,898 hives of bees valued at $698,258. In 1919 the reported milk production was 115,119,224 gal.; the value of milk, cream, and butter fat sold and of butter and cheese made was $20,640,849. The office of inspector of apiaries was created in 1911. The Smoky Mountain area (59,213 ac. in Blount and Sevier counties) and the White Top area (33,619 ac. in Johnson and Sullivan counties and Washington co., Va.) were approved for purchase in 1912 by the National Forest Reservation Commission under the Federal Act of March 1 1911 to preserve upland watersheds. In 1920 254,118 ac. of farm land were reported as provided with drainage and 640,479 as needing drainage. Capital invested in drainage enterprises, Dec. 31 1919, totalled $2,925,944. On that date there were completed 777 m. of open ditches and 42 m. of levees; there were under construction 135 m. of open ditches and 10 m. of levees. Most of these enterprises are in the western division of the state, where the tributaries of the Mississippi are utilized. The above figures do not include private supplementary works installed by individual farmers.

Mineral Products.—Tennessee produces most of the copper mined in the southern states. Its entire product of copper, gold, and silver comes from mines worked primarily for copper in Polk county. Lead production, first reported in 1915 (1,660 lb.), amounted to 4,376,000 lb. in 1919. In the latter year gold was valued at $5,662. The silver output was 98,288 oz.; copper 15,623,589 lb.; zinc 47,494,000 lb. Because of strikes the coal amounted to only about 5,000,000 tons. The demands of the World War led to the working of known manganese deposits in 16 counties. In 1916 oil was discovered in Scott county, and later some producing wells were drilled. In 1919 the Bankers Petroleum Co., of New York, obtained large tracts of land in Robertson and Dickson counties, a promising shallow-oil field. In 1910 natural gas was found near Franklin. In 1919 the production of phosphate rock was 473,985 tons.

Manufactures.—The product of manufactures remains relatively small, the value of 1914 being less than 1 % of the total for the United States. Their growth between 1909 and 1914 was as follows:—

	1914	1909
Establishments	4,775	4,609
Wage-earners	74,373	73,840
Capital	$211,423,167	$167,923,784
Salaries	11,828,691	9,186,243
Wages	33,082,987	28,251,591
Cost of materials	123,430,135	104,015,834
Value of product	212,071,489	180,216,548
Value added by manufacture	88,641,354	76,200,714

In 1914 lumber and timber products still led, having a value of $31,430,208. Flour-mill and grist-mill products were valued at $26,413,574; cottonseed oil and cake $11,414,243. There were nine other industries each with a product valued at over $4,000,000; food preparations; foundry and machine-shop products; general shop construction and repairs by steam railway companies; printing and publishing; hosiery and knit goods; cotton goods; patent medicines and druggists' preparations; fertilizers; bakery products. In 1914 84·6 % of the average number of wage-earners were males over 16 years old, 13·6 % females, and 1·8 % children under 16. In 1909 the respective figures were 85·3 %, 11·3 %, and 3·3 %.

Transportation.—On Jan. 1 1919 the total railway mileage of the state was 4,083 m., or 9·79 m. per 100 sq. m. of territory. The chief railways were: Louisville and Nashville 952 m.; Nashville, Chattanooga and St. Louis 903 m.; Southern railway 891 m.; Tennessee Central 291 m.; Illinois Central 143 miles.

Finance.—The balance in the state Treasury Jan. 1 1918 was $368,818. Receipts for 1918 were $7,954,650 and disbursements $7,481,756, leaving a balance, Dec. 20 1918, of $841,682. On the same date the total bonded debt was $11,481,000. On Dec. 20 1912 the balance in the state Treasury was $317,270 and the bonded debt $15,218,600. The number of all reporting banks, June 30 1920, was 546; aggregate resources $489,162,000; capital stock paid in $35,041,000; individual deposits $312,222,000.

Education.—By an Act of 1909 state normal schools were established in Johnson City, Memphis, Murfreesboro, and (for negroes) at Nashville. In Jan. 1911 Bruce R. Payne (b. 1874) was elected president of the George Peabody College for teachers in Nashville. Later in the year this college was moved from South Nashville to a new site adjoining the campus of Vanderbilt University. Arrangements were made for an interchange of courses of instruction between the two institutions. In 1918 the total school pop. was 790,959. The enrolment in the public schools was 604,633 and the average daily attendance 418,709 (368,888 in 1912). The number of teachers was 11,880, of whom 8,375 were women. In 1919 the compulsory school age was raised from 14 to 16 years.

History.—In 1910 Benjamin W. Hooper (b. 1870) was elected governor, following a serious split in the Democratic party over the prohibition question. He was the only Republican elected to state office, and was the first Republican governor since 1883. He took a strong stand for prohibition. The Democratic Legislature displayed much opposition to the governor, and his inauguration was delayed through lack of a quorum until Jan. 25 1911. The regular Democrats passed a bill depriving the governor of the power of appointing the state board of elections, and raising the number of members from three to seven. The bill was vetoed by the governor, and to prevent its passage over the veto the Republicans and independent Democrats migrated to Alabama, where they remained until acquiescence in the veto was forced. The governor also vetoed a bill giving $500 additional salary to each member of the Legislature, but approved an amended bill reducing the increase to $200. In 1911 the Legislature chose Luke Lea (b.1879) to succeed U.S. Senator James B. Frazier. In 1912 Hooper was renominated for governor and was reëlected over Benton McMillin (b. 1845; governor 1899–1903), the Democratic candidate. Robert Love ("Bob") Taylor (b. 1850), U.S. Senator since 1907, died March 31 1912. He was a representative in Congress 1879–81, governor 1887–91 and 1897–9, and unsuccessful candidate for governor 1910. He was long a picturesque figure in state politics and widely known as a popular lecturer. In the gubernatorial campaign in 1886 his Republican opponent was his own brother Alfred Alexander ("Alf") Taylor (*see* below). They stumped the state together, Bob everywhere winning favour by his stories and folk songs and his "fiddle." As his successor to the Senate the Legislature in 1913 chose John K. Shields (b. 1858), a member of the state Supreme Court since 1902 and Chief Justice since 1910. Another prominent politician, James D. Porter (b. 1828), governor 1875–9, died May 8 1912. In July 1915 the city of Nashville was placed in the hands of a receiver, as the result of the disappearance of the city's cash books covering the period 1908–12, and in 1916 the mayor was removed from office for remissness of duty. In Nov. 1915 the mayor of Memphis, the commissioner of fire and police, and the judge of the municipal court were removed from office for failure to enforce the prohibition law. In the presidential election of 1916 Wilson received 152,955 votes and Hughes 116,257. In 1920 Harding received 219,829 votes and Cox 206,558. For the first time since 1868 the Republican presidential candidate carried the state. A Republican governor also was elected, "Alf" Taylor, brother of the former Democratic governor. Taylor received 229,463 votes as against 182,836 for A. H. Roberts, who had been renominated by the Democrats.

Proposals made by the Legislature to call a constitutional convention were defeated in 1916, 1917 and 1920. In Sept. 1916 a new bridge across the Mississippi at Memphis was opened. An Act prohibiting the manufacture of intoxicating liquor in the state became effective Jan. 1 1910; in Oct. 1913 Gov. Hooper called a special session of the Legislature and secured passage of the so-called nuisance bill, intended to close every saloon in the state, forbidding the sale of intoxicating liquor within four miles of any school; in 1915 provision was made for removal from office of state, county, or city officials who failed to enforce the prohibition law; on Feb. 2 1917 Gov. Rye signed a bill forbidding the importation of liquor into the state. The hours of labour for women were reduced to 58 per week after Jan. 1 1914 and to 57 after Jan. 1 1915. In 1913 for the first time the reporting of accidents was required, wherever persons were employed; provision was made for enforcing the installation of additional fire escapes in factories; and a department of workshop and factory inspection was created. The same year an Act was passed providing "that married women be and are hereby fully emancipated from all disability on account of coverture, and the common law as to the disabilities of married women and its effect on the rights of property of the wife is totally abrogated." On April 1 1913 the Legislature ratified the amendment to the Federal Constitution for popular election of U.S. senators. In 1915 a law was passed providing for mothers' pensions. In 1917 the letting of prison labour to private contractors was prohibited, and an Act was passed forbidding the limiting of the output of coal for increasing the price. The same year a State Budget Commission was created, having as its members the governor, the comptroller, the treasurer, the secretary of state, and the auditor. The wilful setting fire to any woods was made a felony. On Aug. 18 1920 the House by 50 to 46 voted to concur in the Senate resolution (adopted Aug. 13 by five to four), ratifying the proposed amendment to the Federal Constitution, providing for woman suffrage. As the 36th state (out of the 48 in the American Union) to ratify, Tennessee brought the number up to the requisite three-fourths. The contest among the legislators was bitter, and there were attempts to rescind the House's action on constitutional grounds. Governor Roberts, however, on Aug. 24, sent certification of the state's ratification to Secretary of State Colby, who on Aug. 26 proclaimed the Federal amendment for woman suffrage to be in effect.

In the World War Tennessee furnished to the army, navy and marine corps 91,386 men. Contributions to the various war loans were as follows: First Liberty Loan $10,924,800; Second $26,043,650; Third $33,783,250; Fourth $55,867,250; Victory Loan $37,555,450.

Recent governors have been: Malcolm R. Patterson (Dem.), 1907–11; Benjamin W. Hooper (Rep.), 1911–5; Thomas C. Rye (Dem.), 1915–9; A. H. Roberts (Dem.), 1919–21; Alfred A. Taylor (Rep.), 1921– (G. C. S.)

TENNIEL, SIR JOHN (1820–1914), English artist (*see* 26.626), died in London Feb. 25 1914.

TERMONDE (*see* 26.645).—Pop. (1914) 10,138. The town, up to 1906, was still considered one of the five "fortified places" in Belgium, but as the fortifications had not been demolished at the time of the German invasion in 1914 the Belgians decided to defend it. In an early attempt to outflank Antwerp the Germans bombarded and took Termonde, setting fire to it and destroying three-fourths of the town, including the Hôtel de Ville and the spire and vaulting of the 15th Century Gothic church of Notre Dame. The Belgians reoccupied the town on Sept. 10 1914; on Sept. 16 the Germans renewed the bombardment and completed its destruction. Von Beseler's army forced the passage of the Scheldt here on Oct. 7.

Rebuilding was being actively carried on in 1921, together with the reëstablishment of its industries of rope making, bleaching, wire drawing and cotton spinning. The old Butchers' Hall has been transformed into a museum.

TERRY, EDWARD O'CONNOR (1844–1912), English actor (*see* 26.660), died in London April 3 1912.

TERRY, ELLEN ALICIA (1848–), English actress (*see* 26.660), appeared as Mistress Page in *The Merry Wives of Windsor* at His Majesty's theatre, London, in 1911, on the occasion of a special performance to celebrate the coronation of King George V., and made her last regular stage appearance as the Nurse in *Romeo and Juliet*, produced by Miss Doris Keane at the Lyric theatre, London, in 1919. Her sister, MARION TERRY (b. 1856), appeared in H. Vachell's *Fishpingle* at the Haymarket theatre in 1916 and in Tolstoy's *Reparation* at the St. James's theatre in 1919.

TETANUS or LOCKJAW (*see* 26.669).—One of the chief triumphs of preventive medicine during the World War was in the treatment of this disease. The appearance of tetanus in the British army during the early days of the retreat from Mons was so terrifying a phenomenon that immediate steps were taken to cope with it. It had been suggested that the disease might be prevented if a dose of anti-tetanus serum was given as soon as a wound was sustained, for, as is well known, some days elapse before the bacilli, which remain in the wound, are able to secrete sufficient poison to precipitate an attack. The suggestion was carried out and was immediately successful. From that time every wound, no matter how slight, was followed as soon as possible by a dose of anti-tetanic serum. The War Office set up a committee for the study of tetanus (1914–8) under Gen. Sir David Bruce.

Sir David Bruce later presented to the Research Defence Society a paper dealing with the results of his labours. Out of 1,242,000 wounded men who were sent home to England 1,458 cases of tetanus arose, giving a ratio of rather more than 1 per 1,000. How favourably this general figure compares with earlier ones is shown by the fact that in Sept. 1914 the ratio of tetanus cases to wounds was 9 per 1,000. In Oct. 1918 the ratio was 0·5 per 1,000. Thus the incidence of cases of tetanus in Sept. 1914 was 18 times as heavy as in the last month of the war.

A sudden fall in the incidence took place in Nov. 1914 when preventive inoculation, which was introduced about the middle of Oct. 1914, had begun to exercise its beneficial effects. The following figures giving the number of cases of tetanus per 1000 wounded men make this clear:—

	Cases of Tetanus		Cases of Tetanus
Sept. 1914	9	Feb. 1915	1·1
Oct. 1914	7·3	March 1915	0·4
Nov. 1914	2·3	April 1915	2·3
Dec. 1914	1·4	May 1915	0·8
Jan. 1915	0·0	June 1915	0·2

The same experience was met with in the French and German armies. As soon as preventive inoculation with anti-tetanic serum became a universal practice the incidence of tetanus dropped sharply and remained small. Later in the war, June 1917, it was ordered that each wounded man should receive not one inoculation as formerly but four, at intervals of a week. This was on account of the fact that the minimizing effect of the serum passes away rather quickly.

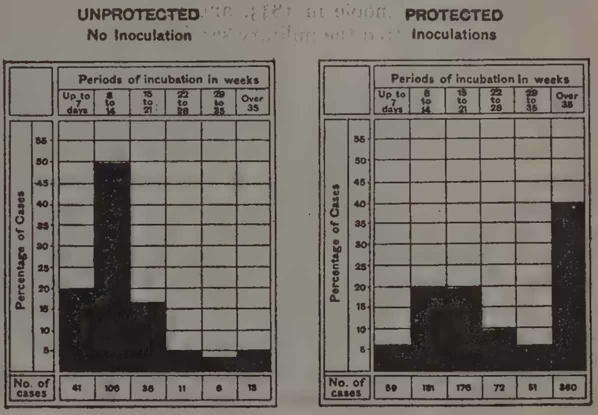

Fig: 1.

The effect is not always to prevent absolutely. But even in those cases in which tetanus does supervene in spite of the inoculations the incubation period is lengthened and the death-rate is lowered. It is well known that, other things being equal, a long incubation period tends to result in a milder attack than a short incubation period, thus any circumstance prolonging the incubation period will also tend to lower the death-rate. The diagram, fig. 1 (after Sir David Bruce), shows clearly how successful were the inoculations in lengthening the incubation period.

In other words only 26·9 % of the inoculated are attacked during the first fortnight, whereas 68·9 % of the uninoculated are attacked. Among the protected 40·0 % have an incubation period of more than 35 days; among the unprotected only 6·5 %. The average incubation among inoculated is 45·5 days, among uninoculated 10·9 days.

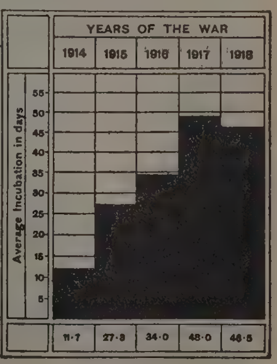

Fig: 2.

Indeed, in each year of the war the incubation period tended to rise, as is shown in the diagram, fig. 2.

Further it was found that the inoculations tended to limit the degree of tetanus, converting what would be generalized cases into local or one-limb cases. The following table illustrates this:—

Tetanus type	Percentages				
	1914	1915	1916	1917	1918
General	98·9	98·6	87·0	76·6	83·5
Local	1·1	1·4	13·0	23·4	16·5

Local tetanus tends to occur in the wounded or injured limb and to be confined to that limb. It is much less severe and far less fatal than the generalized type.

Naturally the death-rate reflected these successes. Among the unprotected and unrecorded the death-rate per cent. was 53·5. Among the protected it was 23·0. The "unrecorded" here undoubtedly include cases which had received a dose. This accounts, in Sir David Bruce's opinion, for the fact that the death-rate is lower than the old pre-serum rate of 85 %.

It is thus evident that the method employed during the war fully justified the hopes which were entertained concerning it, and that an immense amelioration of pain and distress was effected. Indeed, when the terrible character of this disease is recalled it will be seen that preventive inoculation did much to support the *moral* of troops by assuring them of safety, or comparative safety, in the event of exposure to the infection.

See Maj.-Gen. Sir David Bruce, K.C.B., F.R.S., *The Prevention of Tetanus During the Great War by the Use of Anti-tetanic Serum.* (Research Defence Society, Form D2, July 1920.) (R. M. Wi.)

TEWFIK, AHMED, PASHA (1843–), Turkish statesman, was born in Constantinople in 1843, and in 1859 entered the army. In 1870 he quitted the military service and was attached to the translation bureau of the Sublime Porte. He entered the diplomatic service and acted as political agent for the army of the Danube and the Balkans during the Russo-Turkish War (1877–8). He was subsequently attached to the Turkish legation at Athens, where he later became minister. In 1884 he was appointed ambassador to Berlin, but in 1895 was recalled in order to become Minister of Foreign Affairs. After the Young Turk revolution he became grand vizier (1909), but the same year was sent as ambassador to London. In 1912 he was again grand vizier for a brief period. On the close of the World War (Nov. 1918), during which his sympathies were with the Entente, he became grand vizier for the third time, and formed a Government which excluded all members of the Committee of Union and Progress. He resigned in March 1919, but again became head of the Government on the resignation of Damad Ferid Pasha in Oct. 1920.

TEXAS (*see* 26.688).—In 1920 the pop. was 4,663,228, as against 3,896,542 in 1910, an increase of 766,686, or 19·7 %, as against 27·8 % in the preceding decade. The urban pop. (in places of 2,500 or more) was 1,512,689, or 32·4 % of the total as compared with 24·1 % in 1910. The average number of inhabitants per sq. m. increased from 14·8 in 1910 to 17·8 in 1920. The following table shows the growth of the 10 cities in the state having in 1920 a pop. of more than 30,000:—

	1920	1910	Increase per cent.
San Antonio	161,379	96,614	67·0
Dallas	158,976	92,104	72·6
Houston	138,276	78,800	75·4
Fort Worth	106,482	73,312	45·2
El Paso	77,560	39,279	97·4
Galveston	44,255	36,981	19·7
Beaumont	40,422	20,640	95·8
Wichita Falls	40,079	8,200	388·8
Waco	38,500	26,425	45·7
Austin	34,876	29,860	16·8

Agriculture.—The 1910 census gave Texas 417,770 farms, with a total area of 112,435,067 ac., of which 27,360,666 ac. were improved. Owing to the fact that in 1900 the large ranches in the western part of the state were included under farm acreage, there was a decrease in the farm acreage between 1900 and 1910 of 13,361,950 ac., but an increase of 7,784,590 ac. in improved land. By 1910 much of this land had been bought by speculators for sale in small farms and the land was in their hands or in those of purchasers who had not yet begun cultivation, and so was not included under farm acreage. The value of all farm property in 1910 was $2,218,645,164. Advance figures for the 1920 census, subject to correction, gave Texas 435,666 farms. The principal crops for 1920, in the order of acreage (according to estimates of the U.S. Department of Agriculture), were cotton, corn, oats, grain sorghums, wheat, hay, rice, peanuts, sweet potatoes, cowpeas, potatoes, broom corn, barley, sorghum syrup, rye. These crops covered 25,435,000 acres. Their farm value, partly estimated, was $610,787,000. In 1919, at the peak of post-war prices, their value was $1,051,817,000. Texas is a large producer of fruits and vegetables. Ranked according to value of the 22 principal crops produced in the United States, Texas held first place in 1919 and 1920; and first in the value of all crops 1914–20. The average annual yield of corn 1911–9 was 126,600,000 bus.; of wheat 15,300,000 bus.; of cotton 3,600,000 bales. Figures (partly estimates) of the U.S. Department of Agriculture gave Texas Jan. 1 1921 4,500,000 range cattle and 1,184,000 milch cows of the combined value of $213,184,000; horses 1,187,000, valued at $89,000,000; mules just under 800,000, valued at $84,744,000; sheep 3,000,000, $19,335,000; and swine 2,427,000, $28,639,000. In the total value of live stock in 1920 Texas ranked second, between Iowa and Illinois.

Minerals.—The most important mineral products are oil, sulphur, coal and lignite. The first oil in paying quantities was discovered at Corsicana in the central part of the state, in 1894; but keen interest was not aroused until the "Spindle Top" discovery near Beaumont in 1901. Since that time the surface of the state has been covered with leases, and remarkable strikes have been made in a number of places. At the beginning of 1921 production was confined to two general sections—the coast, including mainly Harris and Brazoria counties (Jefferson, Hardin, and Matagorda counties have in the past been good producers); and a region in the northern and north-central part of the state, including chiefly Wichita, Eastland, Comanche, and Stephens counties. The Humble field in Harris county was opened in 1905, Goose Creek in 1911, and Blue Ridge in 1919. The west Columbia field in Brazoria county was also opened in 1919. The Burkburnett field in Wichita county first became important in 1917, Ranger in Eastland county in 1917, and Desdemona and Breckenridge in Comanche and Stephens counties respectively in 1918. Production dropped from 28,000,000 bar. in 1904 to less than 9,000,000 in 1910; rose to 27,644,000 in 1916; 32,413,000 in 1917; 38,750,000 in 1918; 85,312,000 in 1919; and 54,668,000 for the first three-quarters of 1920. Natural gas and natural-gas gasoline were developed as by-products of the oil industry. The value of natural gas marketed in the state rose from $127,000 in 1909 to $5,027,449 in 1918; and natural-gas gasoline in 1918 amounted to 7,326,122 gal., giving Texas fifth rank in that respect. Two sulphur plants in Texas and one in Louisiana were said in 1920 to yield 98 % of all that produced by the United States. One of the Texas plants is at Freeport, near the mouth of the Brazos river, the other is near Matagorda, close to the mouth of the Colorado. The Freeport plant began producing in substantial quantities in 1916, and the next year, under war pressure, delivered 500,000 tons. The Matagorda plant began operation in 1919, producing about 500,000 tons a year. The sulphur lies about 1,000 ft. below the surface and is extracted from wells by "forcing superheated water (and steam) through pipes, dissolving and suspending the sulphur and pumping it back." Bituminous coal production from 1908 to 1918 remained practically stationary, varying from 1,010,000 tons in 1910 to 1,259,000 tons (value $3,140,253) in 1917. The yield in 1919 dropped to 793,000 tons. Lignite is mined principally for state consumption, and the relative backwardness of manufacturing and the competition of other fields keep down the demand. More than 1,000,000 tons were delivered in each of the years 1913–5 and 1917–8. The 1919 yield was 860,000 tons. The value at the mine was slightly under $1 per ton. The original supply was estimated in 1913 at 30,000,000,000 tons, of which about 9,000,000 tons had then been mined. Other minerals of fairly steady yield are silver, worth about $500,000 a year for many years, quicksilver, cement, and clay products. In quicksilver production the Terlingua mine in Brewster county has for more than a decade made Texas second to California only. The highest yield recorded was 10,791 75-lb. flasks in 1917, valued at $1,136,502. Cement production in 1919 was 2,288,000 bar., value $4,176,000; clay products (brick, tile, and pottery) in 1917 were valued at $3,451,806. Salt is produced in fairly steady quantities, and in 1917 yielded 85,181 short tons, with a value of $564,000.

Manufactures.—In 1914 there were 5,084 manufacturing establishments, capitalized at $283,544,000, employing 91,114 persons, and producing an annual value of $361,279,000, of which $108,135,000 was value added by manufacture. The principal industries were those concerned with lumber and timber, cotton-seed products, printing and publishing, oil-refining and allied products, flour and grist milling, and food preparations. The lumber production was 1,350,000,000 ft. for 1918, when Texas ranked sixth in this industry, as it had done in 1910 and 1915.

Commerce.—The noteworthy ports are Sabine, Port Arthur, Orange, and Beaumont in the Sabine district, importing chiefly crude oil, and exporting refined oil and oil products; and Houston, Texas City, Freeport, and Galveston in the Galveston district, which export cotton, grain and sulphur. Houston is a new port, opened in

1915. Its access to the Gulf of Mexico is through the Houston Ship Channel, formed, for the most part, by the widening and deepening of Buffalo bayou. At the beginning of 1921 the controlling depth of the channel was 25 ft. and the width at bottom varied from 110 to 260 feet. The distance from the municipal docks to the Gulf is 54 miles. Unofficial but reasonably dependable figures for 1920 fixed the value of imports through Galveston, including the subsidiary ports of the district, at $30,964,285, and the exports at $627,498,478, making Galveston second to New York as an exporting port, a position which it had held for some years. These figures did not include coastwise traffic. During the year 1,233 vessels cleared for foreign ports, of which 849 were American, 222 British, 29 Norwegian, 26 Italian and 18 Mexican. The bulk of their cargoes was made up of 2,126,717 bales of cotton and 44,726,000 bus. of wheat. Through the coöperation of Galveston county and the Federal Government the Galveston sea-wall was extended and completed in 1920 to a length of 6·3 miles. The total cost of the wall (*see* 11.430) was $4,725,000. The concrete causeway connecting the island with the mainland, 10,642 ft. long, was nearing completion in 1921. The cost was to be $3,750,000, and was to be borne by the county and the railways entering the city. The county and city of Galveston were permitted by state Acts of 1901 and 1903 to apply their state taxes for 17 years to storm defence improvements. In 1917 the privilege was extended for 10 years; and subsequently the same authority was granted to several other maritime counties.

Finance.—The value of all property assessed for state taxation on Aug. 31 1919 was $3,012,819,287. The ratio of assessed value to real value varied from 66⅔% in some cities to 25% in some rural districts. Total receipts of the state treasury for the year were $28,410,724, and total expenditures $27,200,978. On Dec. 29 1920 there were 1,031 state banks, with capital, surplus and undivided profits of $71,768,997. They had individual deposits subject to check of $226,282,045, and time and savings deposits of $35,380,482. On Nov. 15 1920 there were 561 national banks with capital, surplus and undivided profits of $124,633,000; deposits subject to check of $447,898,000; and time and savings deposits of $69,374,000. Of the state banks 176 were members of the Federal Reserve system at the beginning of 1921.

Education.—For 1920 the school pop. (7 to 18 years of age) was 1,271,157; and the number of teachers employed in the public schools was 30,158, of whom 3,515 were negroes. The public schools are maintained by the income from the permanent school fund, by state and local taxes, and by legislative appropriations. The permanent fund consists of lands and interest-bearing notes derived originally from the sale of public lands. In Aug. 1920 it was slightly less than $74,000,000. State taxes for school maintenance are a poll-tax, one-fourth the proceeds of the occupation taxes, and an *ad valorem* tax of 35 cents per $100. The practice of making legislative appropriations to supplement the available school fund began in 1915 with $1,000,000 to aid rural schools. The practice continued, and for the biennium 1919–21 $6,000,000 came from this source for general maintenance. A constitutional amendment adopted in Nov. 1920 removed the limit of 50 cents per $100 which rural districts and unincorporated towns might appropriate for schools. The total available state fund for the year ending Aug. 1921 was $18,564,507, to which should be added nearly $13,000,000 from local taxes. A compulsory attendance law became effective in 1918, requiring, with specified exceptions, the attendance of children between 8 and 14 for at least 100 days each year. The following year a free text-book law went into effect. A law of April 3 1918 requires all public-school work to be conducted in the English language, but does not preclude the teaching of foreign languages.

Administration.—The attorney-general, comptroller, treasurer, and secretary of state head constitutional departments, and all are elective except the last, who is appointed by the governor. The more important statutory departments, in the order of their establishment, are those of the adjutant-general, superintendent of public instruction, state health officer, life insurance and banking commissioner, commissioner of agriculture, Railroad Commission, Live-stock Sanitary Commission, Fire Insurance Commission, the Industrial Accidents Board, the Board of Water Engineers, the Highway Commission, and the Board of Control. All are appointive directly or indirectly by the governor (with approval of the Senate), except the superintendent of public instruction, the commissioner of agriculture, and the Railroad Commission. Their terms vary from two to six years. The Industrial Accidents Board was created in 1913, primarily to administer the Employers' Liability Act. It consists of three members, one of whom must be a wage-earner, one an employer in some industry covered by the Act, and the third a practising attorney. The Board of Water Engineers was created in 1913 to regulate the use of public water for irrigation and all other purposes. The Highway Commission, established in 1917, consists of three members, and is charged with the administration of all highway laws, including that for the registration of motor vehicles. At the close of 1920 there had been completed under its supervision 976 m. of approved highways, costing $5,326,000, of which $1,308,000 was from Federal and $904,000 from state aid. The remainder was paid by the local counties. At the same time contracts were in progress for the construction of 2,039 m. of road at an estimated cost of $23,277,000, of which $8,650,000 was to come from Federal and $1,437,000 from state aid. Federal and state quotas are apportioned in a certain ratio to local expenditure. The Commission reported the registration during 1920 of 427,693 automobiles and trucks and 4,290 other motor vehicles. The state Board of Control, created in 1920, represents an effort to consolidate administration and to coördinate the state budget. It is composed of three members, holding office for six years, one retiring every two years. Its budgets are subject to review and amendment by the Legislature. Departments created during the decade 1910–20, but showing signs of instability, are those of markets and warehouses (including weights and measures) and an Industrial Welfare Commission, created in 1917 and 1919 respectively. The dwindling jurisdiction of the Railroad Commission, suffering from the encroachments of the Interstate Commerce Commission, was somewhat compensated by an Act of March 1919 placing pipe-lines and drilling regulations under its supervision, and another of June 1920 giving it authority over natural-gas production. The Commission reported in Dec. 1918 15,866 m. of railroad in operation, an increase of 1,922 m. since 1910.

History.—After about 1880 prohibition was perhaps the most bitterly contested issue in state politics. A constitutional amendment providing for state-wide prohibition was voted down in 1887 and again in 1911; but was carried in 1919. In the meantime prohibition by local option had made great progress, so that by 1918 more than three-fourths of the area of the state, including the cities of Dallas, Waco and Austin, was dry. The Legislature in March 1918 ratified the Federal amendment, and in April put into effect the "zone" law, prohibiting the sale of liquors within 10 m. of a military, naval, or shipbuilding establishment. In June 1918 statutory state-wide prohibition was established, and doubts of the constitutionality of the Act were ended by the amendment of the next year. The Dean law (July 1919) is one of the most drastic of enforcement Acts. A law of March 26 1918 permitted women to vote in party primaries and nominating conventions; but a constitutional amendment, submitted the next year, to enfranchise women in regular elections, failed. The Legislature nevertheless ratified the Federal Woman Suffrage amendment in July 1919. The effect of the World War is seen in a law of April 2 1918, confining the franchise in primary elections to citizens of the United States; and in another of March 23 1918, amended a year later, providing that assistance should be given at the polls only in the English language and to persons physically unable to write or to those past 60 years of age and unable to read. Aliens could not be debarred from voting in final elections without amendment of the constitution, but preponderance of the Democratic party makes the primary election, in effect, definitive.

The total registration in Texas under the Selective Service Act was 990,522. From the best figures available in July 1921, there were 13,191 voluntary enlistments in the regular army, and 18,573 in the National Guard (transferred to Federal Service in the summer of 1917), and 127,531 inductions (not including officers) under the draft law; while 13,599 men and 6 women served in the regular navy and 4,505 men and 107 women in the naval reserve. The total number in both services, not including all officers, was 177,512. The total losses (officers and men) were 2,722, of whom 1,164 were killed in action, 456 died of wounds, 942 of disease, and 160 from other causes. The wounded numbered 7,331. Figures for the Texan subscription to the First Liberty Loan were not separately available. The eleventh Federal Reserve district, in which the state is included, subscribed $48,948,350. The Texan subscription to the four following loans was $363,273,350. When the Armistice was signed the Emergency Fleet Corp. had wooden ships under construction at Beaumont, Orange and Rockport, and in the Houston Ship Channel. Contracts had been let for 97 hulls and for 18 barges, of which were completed 52 hulls with tonnage of 196,400; and 4 barges aggregating 9,000 tons.

The governors of Texas after 1910 were Oscar Branch Colquitt (Dem.) 1911–5; James E. Ferguson (Dem.) 1915–Sept. 1917; William P. Hobby (Dem.) 1917–21, and Pat M. Neff (Dem.) 1921– . Mr. Ferguson was removed from office by impeachment and was succeeded, *ex officio*, by Lt.-Gov. Hobby, who was subsequently elected for one term, 1919–21.

(E. C. Ba.)

THAYER, ABBOTT HANDERSON (1849–1921), American painter and naturalist (*see* 26.728), died at Dublin, N.H., May 29 1921. During the World War he worked in England on the development of camouflage.

THAYER, WILLIAM ROSCOE (1859–), American writer, was born in Boston, Mass., Jan. 16 1859. He studied at St. Mark's Academy, Concord, N.H., travelled with a private tutor in Europe, and graduated from Harvard in 1881, in the class with Theodore Roosevelt. For several years he was assistant editor of the Philadelphia *Evening Bulletin*, then returned to Harvard, receiving the degree of A.M. in 1886. When the *Harvard Graduates' Magazine* was established in 1892 he was appointed editor, serving until 1915. In 1903, at the International Historical Congress at Rome, he represented both Harvard University and the American Historical Association, and in 1906 was their representative at the Italian Historical Congress in Milan. He was a member of the Harvard Board of Overseers from 1913 to 1919. In 1902 he was made Knight of the Order of the Crown of Italy, and in 1917 Knight of the Order of Saints Maurizio and Lazaro. In 1918 he was elected president of the American Historical Association. He was best known for his works on Italian history, especially *The Dawn of Italian Independence 1814 to 1840*, 2 vols. (1893); *A Short History of Venice* (1905), and *The Life and Times of Cavour*, 2 vols. (1911). His other works include *Italica* (1908); *The Life and Letters of John Hay*, 2 vols. (1915); *Letters of John Holmes* (1917); *Theodore Roosevelt—An Intimate Biography* (1918); *Democracy: Discipline: Peace* (1919, lectures at Brown University); *Volleys From a Non-Combatant* (1919); and *The Art of Biography* (1920, lectures at the university of Virginia).

THEAL, GEORGE McCALL (1837–1919), British historiographer, was born in Canada, where his family had long been settled. When 19 he went to Sierra Leone, removing two years later to Cape Colony, where he became a schoolmaster. He quickly developed an interest in the natives and in the history of the country. In 1877, on behalf of the Government he settled a dispute with the Gaika Kaffirs, and thereafter joined the Cape Civil Service, being attached to the Native Department. Shortly afterwards he was also appointed Keeper of the Archives, and in 1891 was made Colonial Historiographer, which position he held until 1905. Before joining the Civil Service he had published in one volume a *History of South Africa* and the first fruits of his Bantu studies were embodied in *Kaffir Folk Lore* (1882). From the time he obtained access to the Cape archives he devoted himself to research. In 1895 he was commissioned by Cecil Rhodes, then Prime Minister of Cape Colony, to go to Europe, where he stayed several years examining the Portuguese archives at Lisbon, the Dutch archives at The Hague and the British in London. He constantly enlarged and revised his *History* which in its final form was in eleven volumes, the first dealing with ethnography and conditions up to 1505, the others carrying on the story of S. Africa up to 1884. Theal also published official *Records of the Cape Colony, 1793–1827*, in 36 slim volumes, *Records of South East Africa* in nine volumes, and many other works, some in Dutch.

Theal's industry never flagged. He died at Wynberg, Cape Province, on April 17 1919, in the act of correcting the proofs of the last two volumes of his history. The founder of what may be called the Dominions school of historians, he was himself a chronicler rather than an historian. His passion for research brought to light a mass of unknown or forgotten documents of high value, but his narrative is overloaded with details, is essentially domestic, and not always impartial. He lacked the wider vision which sees events in their true perspective. Theal was given the honorary degree of Litt.D. by the Cape University in 1899; he had previously been made an hon. LL.D. of Queen's University, Kingston, Canada.

THERMIT, AND THERMIT WELDING.—Thermit is a mixture of aluminium powder and iron oxide. On ignition the reaction, $8Al+3Fe_3O_4=9Fe+4Al_2O_3$, gives a temperature estimated to be between 2,300° and 2,700°C. The reaction, stated in weights, means that 217 parts of aluminium plus 732 parts magnetite (iron oxide) equals 540 parts steel plus 409 parts slag, or approximately 3 parts of aluminium plus 10 parts of magnetite will produce, on combustion, 7 parts of steel. This steel represents about one-half of the original thermit by weight and one-third by volume.

Thermit was discovered by Dr. Hans Goldschmidt of Essen, Germany, in 1895, while trying to reduce chromium and manganese. Dr. Goldschmidt's principal discovery related to a simple and safe method of ignition, as the action of aluminium when mixed with various oxides, sulphides, and chlorides was well known. Fine aluminium will not burn below the temperature of molten cast iron, and previous experimenters had resorted to heating their mixtures in a crucible. This made the initial temperature so high at the moment of ignition that there was an explosion. Dr. Goldschmidt obtained ignition of a cold mixture by means of a barium-peroxide fuse, which was set off by a storm match. Later magnesium powder or ribbon was used, being set off in the same way. A red-hot iron rod may also be used to set off the magnesium, which in turn ignites the thermit. Dr. Goldschmidt's original American patent No. 615,700 was granted March 16 1897, and related principally to the use of aluminium as a reducing agent for the production of carbon-free metals such as cobalt, chromium, magnesium, tungsten, etc., by what is now known as the aluminothermic process.

Thermit is now used considerably in the foundry for purifying iron and steel in the ladle. For this purpose the thermit is placed in a can on the end of a rod and plunged to the bottom of the molten metal. The intense heat generated tends to liberate many impurities which are carried away in the slag. The principal and better-known use, however, is in welding.

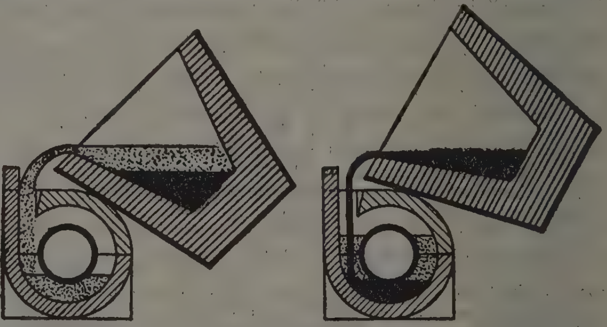

Fig. 1.—Showing the action of Thermit when poured into a pipe welding mould.

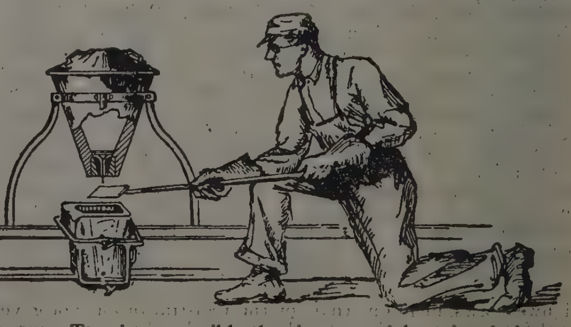

Fig. 2.—Tapping a crucible showing a partial sectional view.

Thermit Welding.—Two methods are employed, known as the plastic and the fusion. The first is used for welding pipe and the latter for solid or large sections. In the plastic method, in which the thermit is used merely for heating purposes, the ends of two pieces of pipe are machined square and clamped in a cast-iron mould with the ends butted together. This mould is in two parts, so arranged that the pipe ends may be forced together when heated. The thermit is placed in an open-top crucible lined with magnesia-tar, and ignited. After the reaction takes place the slag rises to the top of the molten metal, and is first poured into the mould as shown at the left in fig. 1. This slag forms a protective coating on the pipe and on the inside of the mould, and keeps the thermit from melting or burning through. At the right the thermit is shown flowing into the mould and forcing out the bulk of the slag, but leaving a coating as mentioned. When the pipe ends become plastic they are forced together, completing the weld. After cooling the mould is easily knocked off, since the slag coating prevents adhesion. To weld a pipe takes from ¾ to 1½ minutes.

In fusion welding on solid sections, in which the thermit mixture forms a casting holding the parts together, a special V-shaped magnesia-tar-lined crucible, open at the bottom, is used. The hole in the bottom is closed by a headed plug, covered with refractory sand, which may be pushed upward. This crucible is placed over the mould, as shown in fig. 2, the proper amount of thermit put in and ignited. After the reaction, which takes about 35 seconds, the plug in the bottom is pushed up and the molten thermit allowed to run into the mould. In this method great care is taken to keep the slag from contact with the surfaces to be welded, and consequently enough thermit must be used to fill the mould before the slag on top of the melted metal can enter.

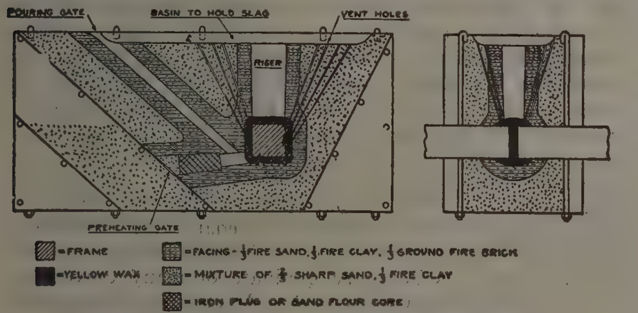
POURING GATE
BASIN TO HOLD SLAG
VENT HOLES
RISER
PREHEATING GATE
=FRAME
=YELLOW WAX
=FACING-⅓ FIRE SAND, ⅓ FIRE CLAY, ⅓ GROUND FIRE BRICK
=MIXTURE OF ⅔ SHARP SAND, ⅓ FIRE CLAY
=IRON PLUG OR SAND FLOUR CORE

FIG. 3.—Sectional view of typical Thermit mould.

A typical mould for heavy sections is shown in fig. 3. In preparing to weld, the surfaces to be joined should be cut or set so as to be ½ in. or more apart. Yellow wax is then built up around the joint in the same shape as the weld is to be. Next the mould box is placed and sand rammed up round the wax, wooden patterns being placed for the pouring gate, riser and preheating gate. The mould is vented, the patterns withdrawn, and a gas or oil flame used to melt out the wax. The heating is continued until the sections to be welded are red-hot. This prevents chilling of the thermit, which is poured in after the preheating gate has been plugged. The steps in making a typical thermit weld on a locomotive frame are graphically shown in fig. 4. Thermit welding is largely used in repairing broken rudder frames, propeller shafts, locomotive frames, steel rolling-mill pinions and other heavy sections, but it cannot be economically used for welding thin sheet metal sections. Welds have been made where from 3,000 to 4,000 lb. of thermit were used.

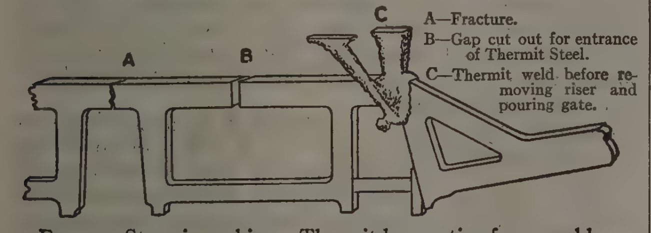
A
B
C
A—Fracture.
B—Gap cut out for entrance of Thermit Steel.
C—Thermit weld before removing riser and pouring gate.

FIG. 4.—Steps in making a Thermit locomotive frame weld.

For commercial purposes there are now produced three varieties of thermit, known as plain thermit, railroad thermit and cast-iron thermit. The plain thermit is simply a mixture of aluminium and iron oxide, as already given. Railroad thermit is plain thermit with the addition of ⅝ % nickel, 1 % manganese and 15 % mild steel punchings. Cast-iron thermit is plain thermit with the addition of 3 % ferrosilicon and 20 % mild steel punchings. The names of these mixtures indicate their principal uses. (E. VI.)

THOMAS, AUGUSTUS (1859–), American playwright, was born in St. Louis, Mo., Jan. 8 1859. He was educated in the public schools, for several years worked in railway freight offices, and, after serving as special correspondent for various newspapers, became in 1889 editor and proprietor of the Kansas City (Mo.) *Mirror.* As a youth he had been a member of local amateur dramatic companies and had tried his hand at dramatic composition. One of these early pieces, *Editha's Burglar*, based on Mrs. Burnett's story of the same name, was enlarged to a four-act play and presented with great success at the Madison Square theatre in New York in 1889. This led him a little later to devote all his attention to the drama. His play *Alabama* (1891), depicting the old-time South, contributed to the removal of sectional prejudice resulting from the Civil War. His numerous dramas include *In Mizzoura* (1893); *The Hoosier Doctor* (1898, by many considered his best); *Oliver Goldsmith* (1900); *Soldiers of Fortune* (1902); *The Earl of Pawtucket* (1903, highly successful in England); *Mrs. Leffingwell's Boots* (1905); *De Lancey* (1905); *The Embassy Ball* (1905); *The Witching Hour* (1909); *As a Man Thinks* (1912); *Mere Man* (1912); *Indian Summer* (1912).

THOMAS, JAMES HENRY (1878–), English Labour politician, was born at Newport (Mon.), of working-class parents, Oct. 3 1878, and was educated in the board schools. He started at nine years' old as an errand boy, but he soon passed into the service of the Great Western Railway Co., first as engine-cleaner, afterwards becoming fireman and engine-driver. He was elected town councillor of the famous Great Western railway centre, Swindon, and became chairman of the Finance Committee and of the Electricity and Tramways Committee. At an early date he associated himself with the development of the policy of unions among the railway servants. He became president of the A.S.R.S. in 1910, and for many years was secretary of the National Union of Railwaymen, and the most powerful voice in deciding their policy. He was elected to Parliament in the Labour interest for the great Midland railway centre, Derby, in 1910. For some years he took no very prominent part in Parliamentary life, being actively engaged outside in the interests of his railwaymen, who, besides many smaller disputes, came out in a body in the great strike of 1911. Another matter of vast importance in which he was deeply involved, was the organization of the so-called "Triple Alliance" between the unions representing coal-miners, transport workers, and railwaymen. When the war came, he took his stand, with the bulk of the Labour leaders, on the national and patriotic side; but, like many of them, deprecated the introduction of compulsory service, until it should be clear that the necessary men could be got in no other way. In Sept. 1915 he declared in Parliament that trade unionists were absolutely against conscription, that to introduce it might provoke revolution. Nearly every branch of his own railwaymen's organization, he said, had not only passed resolutions against the policy, but had threatened on its introduction to stop work. There were many who questioned at the time the justice of his estimate of the workmen's feelings; and, though he renewed his vehement protest against the first Military Service bill in Jan. 1916, and though the Labour party in conference condemned the measure, there was no difficulty in applying it and no agitation arose for its repeal. Even against the stronger measure of the following April only nine Labour members were found to go into the lobby on the second reading. Throughout the war Mr. Thomas, while securing large advances of wages for the railway servants, used his unique influence with them in composing disputes and preventing any stoppage which should interfere with national interests; and for this considerable service he was made a privy councillor in 1917. It was a bitter blow to him when in Sept. 1918 the rank and file disregarded an agreement which the executive of the National Union of Railwaymen had come to with the Government for an advance of 5s. for adults and 2s.6d. for boys. In spite of this, there was a general strike of railwaymen in S. Wales, and the disturbance spread partially to London and elsewhere; but the courts, on the application of the Board of Trade, prohibited the Union from paying strike pay, and the movement collapsed. In disgust at his advice being disregarded, Mr. Thomas resigned the secretaryship of the Union, but was eventually persuaded, on promises of better discipline, to resume office. He approved of the subsequent decision of the Labour party to sever itself from the Coalition, and to appeal to the electorate in Dec. 1918 for independent support, announcing as his own battle-cry "No more war." He was once more returned at the head of the poll for Derby, and by a huge majority. After the war he became a more prominent figure both in Parliament and in the national life. He made a strong speech in support of the Labour amendment to the Address in 1919, stating that he stood both against Bolshevists and against profiteers. He called upon the Government to deal with the reactionaries in Labour disputes as they would with Bolshevists, and upon the employers to recognize that the working classes could no longer be treated by them as hewers of wood and drawers of water. He welcomed both the bill establishing a Ministry of Health and that establishing a Ministry of Transport; but he warned the House of Commons not to expect cheaper passenger fares and freight charges; the railwaymen would not allow themselves to be sweated for the benefit of the travelling public. But, once again, his real activity was outside. In the disputes in March 1919, between the railwaymen and the Government, he was the chief leader of the men, and at a moment of crisis he flew across to Paris to discuss the question with Mr. Lloyd George, then in attendance at the Peace Conference. The terms which he finally arranged with the Government, involving an approximate addition of over £10,000,000 per annum to the railway expenditure, included a standard week of 48 hours, and a standard wage for that week; for the fixing of the new standard rates of wages negotiations were to be continued. In the last week of Sept. he suddenly announced that a crisis had arisen in these negotiations, and after a futile conference with the Government on Sept. 25, a strike began without further notice on Sept. 26. Neither the community nor the Government was intimidated; and Mr. Thomas used his power for peace, and for a settlement, after ten days, on terms not materially different from what the men might have had at first. His efforts for the men had already, it was calculated, amounted to a permanent annual increase in the railway wage bill of £65,000,000, and an increase of 50%—which in Aug. 1920 became 75%—in passenger fares, and more than 50% in goods rates. In 1920 he and his executive were faced by the difficult problem of the refusal of Irish railwaymen to handle munitions of war; and the only solution he and they could suggest was that the Government should cease to send such munitions and that the Labour party should make an appeal to the Irish people—a solution which ministers, of course, could not accept. His own policy for Ireland was the gift of Dominion Home Rule. During this year he published a book *When Labour Rules*, in which he, speaking, of course, only for himself, depicted the kind of policy which Labour in power would favour—such as the right to work, development of nationalization, better homes, shorter hours, state endowment of motherhood, great extension of university facilities and a national theatre and opera.

THOMPSON, SILVANUS PHILLIPS (1851–1916), English physicist, was born at York June 19 1851, and educated at a school in Yorkshire belonging to the Society of Friends, of which body he was a lifelong member. He went later to the Royal School of Mines, having previously received a B.A. at London University when he was only eighteen. He obtained a B.Sc. from London University in 1875 with high honours and a D.Sc. in 1878, when he became professor of experimental physics in University College, Bristol. There he began his lectures on electrical science which brought him invitations to lecture all over the United Kingdom and made him a power in both the scientific and industrial worlds. In 1881 appeared his *Elementary Lessons in Electricity and Magnetism*, twice reprinted in 1882 and 16 times in the ensuing 12 years. A new edition was called for even as late as 1914. Two other courses of lectures were published in volume form, *Dynamo-Electric Machinery* (1882), and *The Electro-magnet and Electromagnetic Mechanism* (1891). By that time he had removed to London, becoming professor of Physics in the City and Guilds of London Technical College, Finsbury, in 1885 and subsequently its principal. He was elected a fellow of the Royal Society in 1889. In his desire to bring science home to the imperfectly educated he published anonymously *Calculus made Easy* by "F.R.S." (1910), written in colloquial style. His deep interest in religion, which led to his recognition in 1903 as a minister of the Society of Friends, inspired *The Quest of Truth* (1915) and a posthumous work *A Not Impossible Religion* (1918). He also published biographies of Reis, Faraday and Kelvin. He died in London June 12 1916.

See *Silvanus Phillips Thompson, D.Sc., LL.D., F.R.S.*, by his wife and daughter (1920).

THOMSON, SIR JOSEPH JOHN (1856–), British physicist, was born near Manchester Dec. 18 1856 and was educated at Owens College, Manchester, and subsequently at Trinity College, Cambridge, where in 1880 he graduated as second wrangler. In the same year he was elected a fellow of Trinity College, and became second Smith's prizeman. In 1883 he was appointed lecturer in Trinity College, and in the following year Cavendish professor of experimental physics in the university of Cambridge, a position he occupied until his resignation in 1918. He developed a great research laboratory of experimental physics, attracting numerous workers from many countries and colonies; advances were made in the investigation of the conduction of electricity through gases, in the determination of the charge and mass of the electron and in the development of analysis by means of positive rays. He was elected a fellow of the Royal Society in 1884, became president of the Cambridge Philosophical Society in 1894, president of Section A of the British Association in 1896, and president of the Royal Society in 1915. In 1905 he held the professorship of physics in the Royal Institution, London, in addition to his Cambridge professorship. He was knighted in 1908 and awarded the O.M. in 1912. He was the recipient of many British and foreign awards and honours, amongst these being the Royal and Hughes medals of the Royal Society in 1894 and 1902 respectively, the Hodgkins medal of the Smithsonian Institute of Washington in 1902, the Nobel Prize for physics in 1906, enrolment as honorary graduate of many universities, and as honorary fellow of numerous American and continental scientific academies. During the World War he presided over several research committees and he assisted various Government departments in an advisory capacity. In 1918 he was appointed master of Trinity College, Cambridge, and in the following year was elected to a newly established professorship of physics in the Cavendish Laboratory, where he continued to prosecute his researches. In addition to a large number of publications in the *Proceedings of the Royal Society* and the *Philosophical Magazine*, he has published *A Treatise on the Motion of Vortex Rings* (1884); *The Application of Dynamics to Physics and Chemistry* (1886); *Recent Researches in Electricity and Magnetism* (1892); *Elements of the Mathematical Theory of Electricity and Magnetism* (1895, 5th ed. 1921); *The Discharge of Electricity through Gases* (1897); *The Conduction of Electricity through Gases* (1903); and, with Prof. Poynting, a number of text-books upon physics.

THORNE, WILL (1857–), British Labour politician, was born at Birmingham Oct. 8 1857. He started work at the age of seven in a ropeworks, attending the wheel of a rope-spinner for ten hours a day, and on Saturday afternoons and Sunday mornings toiled in a barber's shop. He afterwards became a gas-worker, and in 1889 he helped to found the National Union of Gas Workers and General Labourers, becoming its general secretary. This union (under the title of the National Union of General Workers) had in 1921 a membership of over 600,000. He became a member of the parliamentary committee of the Trades Union Congress in 1894. He was chairman of the Congress in 1912. In 1900 he contested West Ham unsuccessfully in the Labour interest, but in 1906 was elected to Parliament and came to the front as an active and energetic member of his party. At the general election of 1918 he was returned with a majority of 11,505. From 1890 he was a member of the West Ham town council, being elected mayor in 1917. He had been a member of the Social Democratic Federation since 1883.

THORNYCROFT, SIR WILLIAM HAMO (1850–), English sculptor (*see* 26.881), was knighted in 1917. His more recent works include the King Edward memorial at Karachi (1915), and "The Kiss" (1916), now at the Tate Gallery.

THÓRODDSEN, THORVALDR (1855–), Icelandic geographer, was born on the isl. of Flatey, in Breidifjördr, Iceland, June 6 1855, the son of Jón Thóroddsen (*see* 26.881), the poet and novelist. His father's death in 1868 left the family in poor circumstances, but the boy went to school at Reykjavik and in 1875 to the university of Copenhagen, where he studied natural science and geography. In 1876 he was sent to Iceland by the

Danish Government with Prof. Johnstrup to investigate the causes of the eruption which had occurred the previous year at Askja in Dyngjufjöll, and this proved the beginning of a long series of Icelandic explorations. In 1880 he was appointed master at the school of Mödruvellir in northern Iceland, and in 1882, 1883 and 1884 made extensive explorations in the interior. From 1884–6 he travelled in England and on the Continent, and in 1886 was appointed master of the school at Reykjavik. Until 1898 he made a journey of exploration nearly every year, the later expeditions being undertaken from Copenhagen, where he settled in 1895. Reports on his work appeared from time to time in the Danish *Geografisk Tidskrift*, but he also produced various important works, including *Oversigt over de islandske Vulkaners Historie* (1882); *Vulcane im nordöstlichen Island* (1891) and *Landfraedissaga Islands* (1892), a monumental work for which he collected material from the beginning of his career. Thóroddsen received many honours from universities and learned societies, and was awarded the gold medal of the Swedish and the La Roquette medal of the Paris Geographical Society.

THURINGIA (*see* 26.901), a Territory and Free State of the German Reich. Pop. 1,508,025. Area 11,763 sq. kilometres.

On April 30 1920 the union of the Territories Saxe-Weimar-Eisenach, Saxe-Meiningen, Saxe-Altenburg, Saxe-Gotha, Reuss, Schwarzburg-Rudolstadt and Schwarzburg-Sondershausen, in one Territory "Thuringia," was recognized by a law of the German Reich, on the basis of article 18, section 2, of the Constitution of the Reich. The consequence was thereby drawn from the abolition of the dynasties, whose policy of dynastic interests had in former centuries caused the disintegration of central Germany into small states. The removal of these dynasties had been effected in the Thuringian States, as in the Empire in Nov. 1918, by the method of revolution. A noteworthy exception was Schwarzburg-Rudolstadt, where the republic was established by a law enacted conjointly by the sovereign (the Prince of Schwarzburg-Rudolstadt) and the Diet.

The unification of the Thuringian States in one single State was preceded by the union of the two principalities of Reuss into one democratic State of Reuss. On the other hand the personal union of the two States of Coburg and Gotha was dissolved, and each of them went its own way. In all the States of Thuringia elections were instituted after the revolution by the revolutionary Governments for Constituent Assemblies to vote new constitutions. Only in Gotha was the meeting of the new State Assembly delayed. The Council of Workmen and Soldiers in that Territory was subject to Communist influence and endeavoured to establish a Councils (Soviet) Republic. Gotha had to be occupied in Feb. 1919 by detachments of the *Reichswehr* (regular army of the Reich). The workmen replied by a general strike which lasted more than a month. When the Assembly met, the Government of Gotha, which was composed of Independent Socialists, submitted the draft of a constitution which attempted to maintain the system of Councils (Soviets). The work of framing constitutions in all the Thuringian States had meanwhile been anticipated by the movement for forming a unified single State of Thuringia.

Steps in the direction of a union had been taken in some of the States of Thuringia before the revolution, but it was only by the revolution that the path was cleared. All the Thuringian States, with the exception of Saxe-Meiningen and Saxe-Coburg, concluded a "treaty of community" (*Gemeinschaftsvertrag*) in order to prepare for their amalgamation. They formed a kind of federated state with an organ of legislation, the *Volksrat* (Council of the People), and an organ of administration, the *Staatsrat* (State Council). Saxe-Meiningen subsequently joined this Community of States; in Saxe-Coburg a great majority of the citizens decided on Nov. 30 1919 for union with Bavaria, which was ratified by a law of the Reich on April 30 1920. on the basis of article 20 of the Constitution.

The *Volksrat* of Thuringia passed a law on Jan. 28 1920, by which it assumed the right to include within its competence the enactment of a constitution for the State of Thuringia. Nevertheless, there was to be reserved for the first Diet (*Landtag*) of the new State, which was to be elected on the basis of this constitution, the right of making alterations in the constitution within a period of three months by ordinary legislation. On May 12 1920 the provisional constitution voted by the *Volksrat* (Council of the People) was promulgated. On March 11 1921 the newly elected Diet (*Landtag*) ratified this provisional constitution with certain amendments. The birth of the new State dates from May 1 1920, the day on which its establishment was voted by a law of the Reich. While the Thuringian Community of States (*see* above) was organized on the lines of a confederation, what was in contemplation is a single, unified State. For the period of transition, however, the separate Thuringian States continued to exist as communities or territorial regions (*Gebiete*); their former constitutions remained in force as regional regulations (*Gebietssatzungen*). If any disputes should arise between the Territory of Thuringia and the former Thuringian States, the Court of Jurisdiction for State affairs (*Staatsgerichtshof*) was to decide them; for the settlement of financial differences a court of arbitration, half of whose members were to be elected by the Thuringian Diet and half by the popular representative assemblies of the former States concerned, was to be set up.

In accordance with the Constitution of the Reich, Thuringia is a republic with parliamentary government. The Diet, as in the other Territories, consists of a single Chamber elected on a system of proportional representation. It can be dissolved by a popular vote (*Volksentscheid*). The peculiarity of the Thuringian Constitution is that the committees of the Diet may call in experts to supplement their membership. The executive power is in the hands of the Ministry, which is formed on the principle of equal colleagues (*Kollegialprinzip*) and consists partly of members who hold office and partly of members who hold no office and who are designated State Councillors (*Staatsräte*). The members of the Ministry are appointed by the Diet. The president of the Ministry is chosen by the Ministry and is merely its chairman. The Thuringian constitution does not provide for any President of the State. The legislative prerogatives of the Diet are limited, as in the other German Territories, by the right of the people themselves to vote laws; the people can be invited to give their vote (referendum) upon a law which has already been passed and may likewise by their own initiative cause the expression, in a vote, of their will (*Volksbegehren*).

(W. v. B.)

THURSTON, ERNEST TEMPLE (1879–), English novelist, was born at Halesworth, Suffolk, Sept. 23 1879. At the age of 16 he published two volumes of verse. Two years later he published his first novel, *The Apple of Eden* (1897, republished 1905), followed by *Traffic* (1906); *The Evolution of Katherine* (1907); *The Realist* (1907); and two widely differing but very successful novels, *Sally Bishop* (1908) and the *City of Beautiful Nonsense* (1909). His later work includes, on the realistic side, *The Antagonists* (1912) and *Richard Furlong* (1913); and on the sentimental side *The Greatest Wish in the World* (1910); *The Garden of Resurrection* (1911); *Enchantment* (1917) and *The World of Wonderful Reality* (1920). He dramatized his wife's novel, *John Chilcote, M.P.* and one or two of his own, and wrote also, as original plays, *Driven* and *The Cost* (1914), and *The Wandering Jew* (1920).

His wife, KATHERINE CECIL THURSTON (d. 1911), was born at Cork, the daughter of Mr. Paul Madden. She married Mr. Thurston in 1901, but in 1910 her marriage was dissolved on her own petition. She was well known as a writer of novels, notably *The Circle* (1903); *John Chilcote, M.P.* (1904); *The Gambler* (1906) and *The Fly on the Wheel* (1908). The second of these, a study of dual personality, created a considerable stir, both as a novel and as a play. She died at Cork Sept. 6 1911.

TIBET (*see* 26.916).—In Feb. 1910, at the approach of a small Chinese force, which had invaded Tibet under Gen. Chun Ling from Szechuen, the Dalai Lama fled to India and was deposed by imperial decree. In exile at Darjeeling, he appealed for British intervention at Peking, but the British Government declined to dispute the authority of the *de facto* Government in Tibet. At the same time, H.M. Government took occasion to draw the attention of the Government at Peking to the necessity for strict adherence to the terms of the treaty concluded in April 1906, and particularly to the inviolability of the frontiers of Nepal, Bhutan and Sikkim. The last two years of the Manchu dynasty witnessed the restoration of China's effective suzerainty in Tibet from the border marshes to Lhasa, a result chiefly due to the energetic and capable administration directed by Chao Erh-feng, viceroy of Szechuen.

But the province of Szechuen was among the first to be reduced to anarchy by the upheaval of the revolution of 1911, and after the assassination of Chao Erh-feng, the authority of China as suzerain power in Tibet was speedily challenged and overthrown. When the news of the revolution reached Lhasa, the Chinese garrison hastened to throw off its allegiance and following the example of the troops in China, indulged in lawlessness and looting at the expense of the civil population. The latter, led by the ever-restless lamas, took up arms against the invaders and the Chinese garrison found itself cut off from its base and besieged. Desultory fighting continued until the return of the Dalai Lama from India; peace was then (Aug. 1912) locally concluded, under an agreement by which all Chinese troops (with the exception of the Chinese resident's body guard) evacuated the country, departing via India after depositing their arms at Lhasa. By this time China's garrisons had been expelled and her authority overthrown in eastern Tibet by the semi-independent chieftains of that region. The Government of the republic at Peking, desiring to recover the prestige thus lost, authorized the despatch of a punitive expedition, consisting of forces raised by the military governors of Szechuen and Yünnan. The expedition started from Chengtu in July 1912; it had reached and captured Batang in Aug., when, as the result of representations made by Great Britain at Peking (Aug. 19), its advance was stopped and the project subsequently abandoned.

The British Government, in requesting China to abstain from these military operations in Tibet, took the ground that such action constituted a violation of the treaty of 1906. While China's suzerainty was not disputed, the Government could not consent to the forcible assertion of full sovereignty over a State which had established independent treaty relations with Great Britain. The Chinese Government was therefore invited to negotiate a new tripartite agreement defining the status of Tibet. To this communication China replied on Dec. 23; meanwhile the expedition had been countermanded, but desultory fighting continued between Szechuen troops and the Tibetans of the border marshes. The Chinese Government's reply justified its military operations, on the ground that the Tibetan trade regulations of 1906 gave them the right to police the trade marts and protect lines of communication. The republic, it declared, had restored the Dalai Lama to his former position and titles and had no intention of making Tibet a Chinese province, but would scrupulously respect the traditional system of Tibetan Government. Reference was made to the Indian Government's unfriendly act in preventing communication between China and Tibet, via India, and the hope was expressed that this policy might be reconsidered; but the Chinese Government saw no reason for negotiating a new treaty. Before the end of the year, the last of the Chinese forces had been driven out of Tibet, and on Jan. 11 1913 the Dalai Lama proclaimed the independence of the country by concluding a treaty with the Living Buddha (Hutukhtu) of Urga (Outer Mongolia). In April, hostilities were resumed by the military governor of Szechuen; at the same time negotiations with the Dalai Lama were opened by President Yuan Shih-k'ai, who sent a delegate to Chamdo to discuss terms of peace. In May the British Government renewed its proposal for a tripartite conference, which was ultimately accepted. The conference opened at Simla on Oct. 13; Great Britain was represented by Lt.-Col. Sir A. H. M'Mahon, China by Mr. Ivan Chen, and Tibet by her prime minister, Long Chen Shatra.

China's position at this conference was generally negative; while promising not to convert Tibet into a Chinese province, the Peking Government asked that Great Britain should respect China's position as suzerain and undertake not to annex any portion of the country. Great Britain proposed the creation of an Inner and an Outer Tibet, the former to enjoy autonomy, the latter under Chinese control. The Tibetan representative asked for complete independence and frontier rectifications. The result of the subsequent negotiations, which continued till July 1914, was a draft treaty, which the Chinese Government declined to ratify. It provided for Tibetan autonomy and recognized China's position as suzerain power, while limiting the representation of that power to a Resident with a suitable guard at Lhasa. It differentiated between the complete autonomy of Inner and the semi-autonomy of Outer Tibet. China's refusal to ratify this treaty was not due to any definite objection to its specific conditions, but to her unwillingness to accept the geographical definition of the frontiers of Outer Tibet, as proposed at Simla.

After the break-up of the conference, the Chinese Government agreed to the suspension of all hostilities against Tibet pending a renewal of negotiations, and for the next three years a state of armed vigilance was maintained on the Szechuen border. In July 1917, however, a fresh cause of strife occurred in the arrest of two Tibetans by Chinese troops near Chamdo. The Kalong Lama's request for negotiations on the subject was refused, and the armistice was broken by the Chinese general commanding in the marshes, without reference to Peking. In the fighting which ensued, the Tibetans proved victorious; by Feb. 1918 the Chinese garrison at Chamdo was surrounded, and the whole country to the eastward, as far as the right bank of the Yangtse, in the hands of the Tibetans. Chamdo surrendered in April, and the Chinese proposed to negotiate for peace. In July an armistice was arranged, at the instance of Mr. Teichman, the British vice-consul; this was followed by a peace conference at Chamdo, at which it was agreed to suspend hostilities for a year, the Tibetans retiring within the boundary of Derge and the Chinese to Kansue. In Sept. 1919 the Chinese Government at Peking proposed a renewal of the negotiations abandoned at Simla in 1914 and gave evidence of its desire to put an end to hostilities; on the Tibetan side there were also indications of a desire for peace. The situation, however, was (and remained) complicated and difficult by reason of the fact that the authority of the Peking Government was ignored by the usurping provincial satraps of Yünnan and Szechuen, and also because the delimitations of any permanently satisfactory frontier for Outer Tibet presented serious problems, ethnological as well as strategic and political.

See *Blue Book on Anglo-Tibetan Relations* (1910); Sven Hedin, *Trans-Himalaya* (1913); Reginald Farrer, *On the Eaves of the World* (1917); *The China Year Book* (1919). (J. O. P. B.)

TIDES (*see* 26.938).—The present century has seen a marked increase in the interest taken among foreign scientists in the study of the tides, while in Great Britain the subject again received much attention after the close of the World War.

Observation.—The automatic tide gauges which are distributed along the coasts (in Great Britain very irregularly and chiefly according to the needs or caprices of harbour authorities) require much more attention than it has been the custom to pay to them. The errors in both elevation and time of their elevation-time graphs should be determined by independent observation at least once a day, as such errors very easily attain serious dimensions.

But the outstanding scientific need of the present time is for off-shore observations. Not only do the great tidal movements of the ocean remain practically unobserved, but in the middle of the Irish Sea, for example, there is a discrepancy of 40 m. between the co-tidal lines of different authoritative charts.

Off-shore elevations have been recorded by personal soundings (at the Dutch lightships, for example) but a number of attempts have been made to construct a self-registering gauge which, when placed on the bottom of the sea, will give a continuous pressure-time record. From such a record it is of course easy to pass to an elevation-time relation. Up to 1921 the gauge which appeared to have met with most success was that of M. Favé, of the French Marine, and even this had not worked in water of depth greater than 200 metres.

Continuous current observations are required at all depths. A knowledge of currents is of immense importance both commercially and scientifically, and the effect of currents on mines during the World War caused much attention to be paid to them by naval authorities. Tidal currents are oscillatory, but observed currents have, as a rule, a residual drift which is of particular importance in general oceanographical or fishery research.

Surface currents have been measured by floating logs (as for most of the data published by the British Admiralty) but series of observations at frequent intervals, especially of currents below the surface, are usually made by current meters. One of the commonest of these—the Ekman meter—registers the mean speed and direction of the current during the interval of time it is in operation, the former by a small propeller actuating a revolution counting apparatus and the latter by a vane attached to an apparatus dropping shot into sectorial boxes on a compass card. It has thus to be hauled up to the surface for each reading. Continuous recording instruments are much needed and though some have been invented they do not appear to have been much used. Owing chiefly to the trouble of keeping a meter fixed relatively to the bottom, the accurate measurement of currents is a matter of great difficulty. Other data for residual currents or drifts are given by observations of weighted bottles or other forms of floating bodies, or by instruments so contrived as to float near the sea bottom.

General Distribution of Off-shore Tides.—Much attention is now paid to the "amphidromic points," at which there is no rise and fall of the water and out from which the co-tidal lines radiate. Harris' charts of co-tidal lines contain a number of these points and so does the new chart of R. Sterneck (*Sitzb. d. Akad. Wissensch., Wien*, 129, 1920), which is based on all available data.

All recent charts of co-tidal lines for the North Sea agree in placing an amphidromic point in the southern region, and one of the services of the Favé gauge has been to give fresh observational verification of its existence (*Comptes Rendus*, 151, p. 803, 1910).

Dynamical Theory of the Tides.—As regards the tidal dynamics of completely defined bodies of water, the only basins which had yielded to mathematical treatment up to 1914 were those of a flat circular sea, the depth of which was a function only of the distance from the centre, and an ocean covering the whole globe with the depth a function only of the latitude. The details for zonal basins of uniform depth have since been worked out by G. R. Goldsbrough (*Proc. London Math. Soc.*, 14, 1914; 15, 1915).

Two attempts have been made, however, to bring some of the latest results of pure mathematics to bear on the general problem. In 1910 Poincaré published his transformation of the dynamical equations from the differential to the integral form (*Leçons de Mécanique Céleste*, t. 3). The theory of integral equations has grown up almost entirely since 1900; its results are perfectly general and are stated explicitly in terms of direct operations. But in the case of tidal problems the arithmetical labour necessary to carry out these operations is so prodigious as to prove quite prohibitive even for the reproduction of known solutions: nevertheless, the theory is valuable for the establishment of existences.

Utilizing these existence-theorems J. Proudman (*Proc. London Math. Soc.*, 18, 1917) has been able to specify the tidal state of an ocean by means of an infinite number of coördinates of the Lagrangian type, and then to transform the differential equations into an infinite set of linear algebraic equations. This has afforded a real prospect that the number of geometrically simple basins for which the tidal dynamics is completely known, may be increased.

The explanation, on dynamical principles, of the observed features of tides in small seas has been considerably advanced, chiefly by A. Defant and R. Sterneck. See *Denkschr. d. Akad. Wissensch., Wien*, 96 (1919). *Sitzungsberichte*, 123 (1914), 124 (1915), 129 (1902). The method of treatment only applies to elongated bodies of water and applications have been made to the Red Sea, the Persian Gulf, the English Channel, the Irish Sea and the Adriatic Sea. The motion is assumed to consist of a longitudinal oscillation sustained chiefly by the tides outside, with a transverse surface gradient sustained by the longitudinal current through the earth's rotation.

Other parts of the dynamical theory which have undergone development are those relating to slowly rotating seas and oceans, limiting forms of long period tides and the diffraction of tidal waves. See Rayleigh, *Proc. Roy. Soc.* (A) 82 (1909); J. Proudman, *Proc. London Math. Soc.*, 12 (1913), 13 (1913), 14 (1914). In this connexion it may be mentioned that there is an erroneous statement in 26.957 §34, to the effect that the existence in the ocean of continental barriers would have the same effect as that attributed by Laplace to friction. In the actual oceans limiting forms of long period tides are possible which do not take the "equilibrium" values.

Harmonic Analysis.—From 1883 up to the present time the standard harmonic development of the generating potential has been that of G. H. Darwin. Quite recently A. T. Doodson has made a new development, working to a much higher order of approximation than Darwin, and has found that there is a very large number of other constituents which, while certainly being smaller than those of Darwin, are not very much smaller, and in their aggregate may be important. In other words, the convergence of the series of constituents is not so rapid as has been assumed.

A corresponding state of affairs exists with regard to *over tides and compound tides*. For certain British stations A. T. Doodson, being led by dynamical principles, has found it possible to obtain a practically complete representation of the quarter diurnal tides, but it involves many more harmonic constituents than have ever been sought for by the customary methods. This representation is susceptible of very simple algebraic statement and numerical application but cannot be used on the existing predicting machines.

The present state of analysis is not satisfactory. *The harmonic constants* do not represent completely the records analysed: for certain British stations the discrepancy may have a quarter-diurnal range of one foot and a semidiurnal range of one foot.

J. Proudman (*British Assoc. Report*, 1920, p. 323) has given an account of British work on harmonic analysis with a bibliography and lists of analyses made.

Tide Tables cannot be regarded as satisfactory even for such practical purposes as docking large vessels or navigating over shallows, while for a hopeful study of meteorological effects they are almost useless. The main deficiency appears to be one of analysis of records; for others, see A. T. Doodson, *Brit. Assoc. Report*, 1920, p. 321.

When the astronomical tides can be predicted with the same degree of accuracy as the resultant tides can be observed, there appears to be no reason why short date predictions of meteorological tides—obviously of great importance—should not be attempted.

Atmospheric Pressure and Wind.—The effects of meteorological influences on the tides have been much studied, especially by the Scandinavians. As regards the relative importance of atmospheric pressure and wind, a general conclusion appears to be that at a station in the immediate neighbourhood of a wide expanse of deep ocean, the direct pressure effect predominates, whereas at a station in a landlocked and shallow sea, the wind effect predominates. The detailed study of these effects is rendered very difficult by the uncertainties in the predictions of astronomical tides, and most investigations have dealt with mean effects over long intervals of time. There is much literature on the subject: see for example D. la Cour, *Danske Meteorologiske Institut, Meddelelser*, 1 (1913), 4 (1917); R. Witting, *Fennia* 39, 5 (Helsingfors 1918). The 1917 memoir of la Cour is a detailed study of the effects of a storm.

Friction.—If tidal motion were everywhere non-turbulent then the amount of friction in the oceans would be quite insufficient to account for the outstanding discrepancy between theory and observation in the motion of the moon. See R. O. Street, *Proc. Roy. Soc.* (A) 93 (1917). But the motion associated with large tides in shallow seas is undoubtedly turbulent and though this has long been recognized it is only recently that numerical estimates of its amount have been made. See G. I. Taylor, *Phil. Trans.* (A), 220 (1920). H. Jeffreys, *ibid* 221 (1920), concludes that the total amount of friction is just about sufficient to account for the discrepancy mentioned. He takes the chief contributing areas to be Bering Sea, the Yellow Sea, Malacca Strait and the American N.W. Passage.

History and Bibliography.—To the list of outstanding names in the history of the theory of the tides should be added those of G. H. Darwin and H. Lamb. The chief contributions of the former were his elaboration of the methods of harmonic analysis and his far-reaching cosmogonical deductions as to the consequences of tidal friction. The chief contribution of the latter is in connexion with steady motions and the discrimination of free oscillations in the general dynamical theory. Additions to the list of books on tides are R. A. Harris, *Manual of Tides* v. (1907); H. Poincaré, *Leçons de Mécanique Céleste*, t. 3 (1910) and O. Krümmel, *Handbuch der Ozeanographie*, B. 2, C. 3 (1911). (J. P.*)

TIENTSIN, China (*see* 26.963).—After the Chinese revolution of 1911 the political and social importance of Tientsin considerably increased, inasmuch as it became an unofficial place of residence, and often of refuge, for high Chinese officials in times of trouble, and a neutral ground convenient for the conferences of the northern military governors. The number of Chinese residents in the Foreign Concessions steadily increased after 1912 and building operations continued unabated. The World War naturally led to a greatly increased demand in most branches of the port's export trade, so that, in spite of floods, famines and brigandage, business was very prosperous after 1915. Local industrial enterprise was stimulated by the curtailment of imports from Europe and a lack of shipping facilities. In 1919 it received a fresh impetus from the boycott of Japanese goods, with the result that many new factories were established for the manufacture of goods heretofore imported.

The city produces cotton yarn in steadily increasing quantities, seed and groundnut oils, canvas, leather, soap, candles and numerous articles for domestic consumption; its chief exports during the war were furs and skins, wool, bristles, strawbraid, carpets and prepared eggs. The value of the export trade in 1919 was 71 million taels, as against 51 millions in 1918, and 42 millions in 1917. Tientsin's prosperous growth was indicated by the opening of four new Chinese banks in 1919. The coal trade, from the Kailan Mines in Chihli and the Peking Syndicates in Honan, has greatly increased since the adoption of the system of Anglo-Chinese coöperative working.

In Sept. 1917 the Foreign Concessions and the trade of the port suffered severely from floods, which burst the banks of the Grand Canal and inundated all the plain surrounding the city. Before normal conditions could be restored in the British, French and Japanese Concessions, the municipal councils were compelled to surround them with dikes and pump out the water. This flood also produced a shoaling of the river bar at Taku, with results seriously prejudicial to the trade of the port. With a view to preventive and remedial measures, a Joint Commission for the improvement of waterways in Chihli was formed in 1918, upon the recommendation of the Haiho Conservancy Board, under the presidency of Hsiung Hsi-ling, with the assistance of European engineers and experts; in addition to the local work of river conservancy, this Board is charged to report on ways and means for restoring the navigability of the Grand Canal between Tientsin and the Yellow river, which has been for many years impracticable at certain seasons.

The foreign garrisons (American, British, French, German, Japanese and Russian) stationed at and around Tientsin under the terms of the Peace Protocol of 1901, for the protection of railway communication between Peking and the sea, were considerably increased after the outbreak of the revolution in 1911. At the end of 1913 their combined forces at Tientsin amounted to 6,000 men; but in the autumn of 1914 most of those belonging to the belligerent Powers were withdrawn. In March 1917 the Chinese Government took over charge of the German Concession; on Aug. 14 the Austrians were similarly dispossessed. Since then, both Concessions have been administered, in accordance with preëxisting municipal regulations, by the Chinese authorities. (J. O. P. B.)

TILAK, BAL GANGADHAR (1856–1920), Indian nationalist leader and orientalist, was born July 23 1856, at Ratnagiri, where his father, a Chitpavan Brahman, was an educational officer. At the Deccan College, Poona, he graduated in arts with honours in 1876, and took the LL.B. degree in 1879. In the following year he took the lead in providing secondary and higher education in Poona under Indian direction by founding an English school and the famous Fergusson College. Tilak conducted law classes till 1890, by which time he had become the sole proprietor as well as the editor of the two weekly papers, the *Mahratta* (in English) and the *Kesari* ("Lion" in Mahratti) which he and his friends had founded in 1880. These were the chief printed media of his anti-Government propaganda; but he took every advantage of public activities, such as membership of the local municipality and the organizing of Shivaji and Ganpati celebrations, to work upon the prejudices and passions both of the masses and of the educated minority. Identifying himself with Brahmanical orthodoxy he bitterly opposed social reforms. His violent condemnation in 1897 of the plague prevention regulations was followed by the assassination of the local plague commissioner (Mr. Rand) and a young British officer driving with him at the time. Convicted of sedition, he was sentenced to 18 months' rigorous imprisonment, but he was released within a year under pledges of good behaviour. In prison he pursued the Vedic studies which had already given him a place in oriental scholarship. His elaborate paper on "The Orion, or Researches into the Antiquity of the Vedas," read at the International Congress of Orientalists, London 1892 (published at Poona, 1893), was followed in 1903 by his "Arctic Home in the Vedas" —expounding a theory of extremely remote Aryan origins which has failed to secure the acceptance of other scholars. Tilak was twice elected to the Bombay Legislature for triennial terms. Again indicted for sedition in June 1908, he was sentenced by a Parsi judge (Mr. Justice Davar) to six years' transportation, afterwards commuted on account of age and health to simple imprisonment at Mandalay. On release in 1914 he actively promoted the home-rule campaign, and at last succeeded, after the death in 1915 of G. K. Gokhale, in his prolonged struggle to secure for his party control of the Indian National Congress. A libel suit he instituted in London against Sir Valentine Chirol for statements made in *Indian Unrest* (1910) ended in a verdict for the defendant with costs (Feb. 21 1919). On returning to India he refrained from definite association with the non-co-operation cult. His death in Bombay, Aug. 1 1920, was followed by demonstrations of mourning throughout India, showing his remarkable hold on the popular mind.

Tilak's formative part in the cult of Indian unrest is shown in the *Report of the Rowlatt Sedition Committee*, 1918. His speeches are collected with an appreciation by Aurobinda Ghose in *Lokamanaya B. G. Tilak*, Madras, 2nd edition, 1920. (F. H. Br.)

TILLETT, BENJAMIN (1860–), British Labour politician, was born at Bristol, Sept. 11 1860. He started work in a brickyard at eight years and was a "Risley" boy for two years. At 12 years he served for six months on a fishing smack, was afterwards apprenticed to a bootmaker and then joined the Royal Navy. He was invalided out of the navy and made several voyages in merchant ships. He then settled at the London Docks, and organized the Dockers' Union of which he became general secretary in June 1887, taking a prominent part in the dock strike of 1889. He was subsequently one of the pioneer organizers of the General Federation of Trades, National Transport Workers' Federation, National Federation of General Workers, International Transport Federation, and the Labour party. For many years he was an alderman on the L.C.C. After standing for Parliament unsuccessfully four times, he was elected in 1917 as Labour member for N. Salford. In 1910 he published *A Brief History of the Dockers' Union*, commemorating the 1889 dockers' strike, and in 1911 *A History of the London Transport Workers' Strike.*

TIME (*see* 26.983).—The progress of wireless telegraphy has greatly simplified accurate determination of Greenwich time and consequently of longitude.

Determination of Time.—The chief difficulty in determining local time from observations of the altitudes of celestial objects is that of getting a satisfactory horizon. In the case of airships the view of the horizon is much interfered with by cloud, and the dip of the horizon is a more important and uncertain factor than in ordinary navigation at sea. When the airship R34 crossed the Atlantic in 1919 observations were made from a "cloud horizon" the height of which could not be known with accuracy. During the World War several sextants were designed in which the use of a pendulum or level enables the altitude of celestial objects to be determined without reference to the horizon, but they have not come into general use.

For the determination of Greenwich time at sea astronomical methods have been practically abandoned, and extreme accuracy in chronometers is no longer necessary. Signals are sent out daily at specific instants of Greenwich mean time from such stations as the Eiffel Tower, Lyons, Nauen, Annapolis, Darien, Honolulu and Cape Town, and it should be possible to pick up one or more of these signals at any point on the earth's surface. The time shown by a chronometer can, therefore, be checked by wireless at least once a day, and since the astronomical observations made by a navigator for ascertaining local time are accurate only to 1′ of arc, corresponding to 4 sec. of time, a chronometer which can be relied on to within 4 sec. a day is sufficient. This is far within the limit of modern chronometers.

A new method of determining positions on the earth's surface, independently of time altogether, has recently become possible, although it is still far short of attaining the desired degree of accuracy. The direction of a wireless transmitting station can now be determined by the receiving station to within about 3°, and if the directions of two transmitting stations are known the position of the receiver can be found. Accuracy is of course greatest where the two transmitting stations subtend a wide angle, and the best results are obtained when the wireless waves can be sent out from the point, the position of which is to be determined and the directions found by two land stations. The method promises to be of great service in aerial navigation, and for ships near the coast in foggy weather. In the beginning of 1921 nine wireless direction stations in the British Isles, sixteen in France, four in Germany and one in Italy were available for navigational purposes.

The position of buoys in the North Sea has been determined by the time required by sound to reach special receiving apparatus at fixed points on the coast. This method was introduced soon after the Armistice in Nov. 1918, but its application is limited to distances of 100 or at most 200 miles.

Accurate Determinations of Time and Longitude.—The precision of time observations has been greatly increased by the use of the self-registering micrometer in observing transits. With this micrometer the personality of different observers is reduced to $0^s.01$ to $0^s.02$, so that the exchange of observers for longitude determinations is only necessary in work of the very highest accuracy. The sending and receiving of rhythmic wireless time signals has reached such a degree of accuracy that the clocks at distant stations can be compared to $0^s.01$ or less. It should therefore be a simple matter to make accurate longitude determinations. The value of the new methods was fully established in the determination of the difference of longitude between Paris and Washington in 1913–4, when the result obtained was $5^h 17^m 36^s.653 \pm {}^s.003$.

Standard Time.—The use of a system of zones of standard time has been considerably extended.

Greenwich time is now (1921) adopted in the British Isles, Spain, Portugal, Belgium, France and the Faroe Islands. Mid-European time (1 h. fast on Greenwich) is used in Germany, Denmark, Italy, Switzerland, Norway, Sweden, Austria and the western parts of the Balkan peninsula; and E. European time (2 h. fast on Greenwich) in the eastern parts of the Balkan peninsula, including Greece. Time in Iceland is 1 h. slow on Greenwich. Russia still adheres to Pulkovo (Pulkowa) time, 2 h. 1 min. fast on Greenwich. Divisions of less than an hour are used in several British colonies. Standard time in the E. African Protectorate is 2 h. 30 min., in India 5 h. 30 min., in Indo-China 6 h. 30 min., in S. Australia 9 h. 30 min., in New Zealand 11 h. 30 min. fast; in British Guiana 3 h. 45 min., the Sandwich Is. 10 h. 30 min., Samoa 11 h. 30 min. slow. In all other countries adopting standard time the most suitable whole hour is employed. The standard zones in Brazil are from 2 to 5 h. slow on Greenwich. Uruguay, the Argentine Republic and Siam adopted standard time in 1920.

In the United States in 1918 to the four zones already established (1883) was added a fifth for Alaska alone. Standard time for this zone is based on 150° W. longitude. Standard time in the four other zones is based, as from the beginning, on the 75th, 90th, 105th, and 120th meridians. The marking of the limits of the various zones lies with the Interstate Commerce Commission, and they may be changed at its discretion. The first four zones differ from each other 1 h. in standard time; the fifth differs from the fourth by 2 hours. The first zone is 5 h. slow on Greenwich.

Until recently no definite time system was employed at sea, each ship adopting the local time corresponding to its position at a certain instant, usually noon. In 1919 a system of hour zones similar to that used on land, previously adopted in the French and Italian navies, came into official use in the British navy, a change which will greatly facilitate the interpretation of entries in ships' logs. The "zone description" of each zone is denoted by a positive or negative number equal to the number of hours slow or fast on Greenwich.

The central zone or Zone O lies between long. 7½° E. and long. 7½° W.: the zones to E. of this are numbered −1, −2 . . . −12, and those to W. +1, +2. . . +12. Zone 12 is divided centrally by the 180th meridian (the date line) and the + or − prefixes are used in its two halves. Near land the boundaries between the zones are modified so as to agree with the time used ashore.

Civil and Astronomical Times.—The civil day reckoned from mean midnight, instead of the astronomical day reckoned from mean noon, is to be adopted in the *Nautical Almanac* in 1925, and a similar change has been decided on for the *Connaissance de Temps* and the *American Ephemeris.* The same course will probably be followed by astronomers, but some confusion may arise if the old expression "Greenwich Mean Time" is employed in a new sense.

TINAYRE, [MARGUERITE SUZANNE] MARCELLE (1872–), French novelist, was born at Tulle, Corrèze, in 1872. She was educated at Bordeaux and Paris, and in 1889 married the painter Julien Tinayre. Her earliest novel was *Avant l' Amour* (1897); but the one by which she is best known is *La Maison du Péché* (1902). Her later works include *La Rebelle* (1905); *La Consolatrice* (1907); *Madeleine au Miroir* (1912); *L'Ombre de l'Amour* (1910); *La Douceur de Vivre* (1911); and *Le Départ; Août, 1914* (1915). She also published in 1910 a book of travels, *Notes d'une Voyageuse en Turquie.*

TIRE (*see* 26.1006).—The modern motor vehicle (*see* MOTOR VEHICLES) would not be possible without some cushioning or shock-absorbing medium at the periphery of its wheels. India rubber, properly fashioned and fabricated with metals and fabrics into tires, plays an essential part in providing this necessary cushion. Structurally, tires are divided into two main classes: solid rubber and pneumatic. The cushioning properties of solid tires are due to the elasticity of the rubber and the design of the tread, while in the pneumatic type compressed air is the cushioning medium; the rubber tire in this case serving as a flexible, yielding container for the compressed air. In both classes the various types are made in a progression of sizes, varying in outside diameter to give the proper road clearance, and in width to accommodate properly the weight the tires have to support.

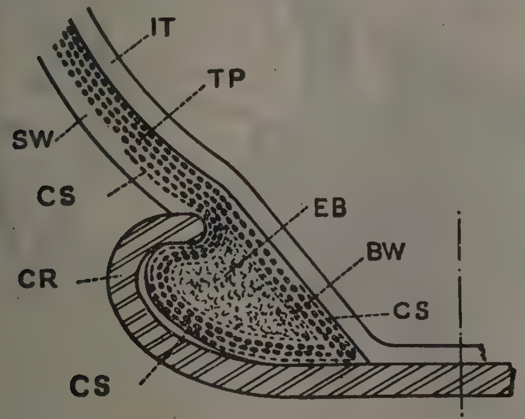

FIG. 1.

History from 1910 to 1921.—This period opened with the motor vehicle industry served by clincher or beaded edge pneumatic tires (fig. 1) of square woven fabric not larger than 5½ in. in section, suitable for use on passenger cars only, and giving 3,000 to 4,000 m. service. The trend of tire development had only recently settled on this clincher type as the most logical of the many inventions, and the shortcomings of the product were varied and numerous. Americans, following British design, were especially unfortunate in having a great deal of premature failure due to "rim cutting." This clincher type was also difficult to apply to the rims in the larger sizes, and troublesome security bolts were necessary to keep the tire from creeping around the rim. Progress in tire development has been influenced by three considerations: first, the method of attachment to the rim; second, increase in the durability of the tire; and third, the development of new types of tires for new fields of usefulness. The principle of the Dunlop-Welch wired-on bicycle tire had been tried experimentally in motor vehicle tires by using a bulky inextensible wire bead fastened to the wheel rim with "straight-side" bolted-on flanges. This straight-side tire idea first became practical for motor vehicle use in 1907 when an American manufacturer offered to the American public in perfected form his "detachable" straight-side rim and tire. Its progress was slow because of competitive hindrances, but by 1910 the detachable rim had become so much appreciated that the clincher tire manufacturers were obliged to furnish some sort of a detachable tire. The result was the "quick-detachable" (Q.D. clincher), a tire fitting a detachable clincher rim and having its beads shaped like the regular soft bead clincher but with an inextensible wire bead core like the straight-side tire. During this period of development the Q.D. clincher served admirably as a transition type.

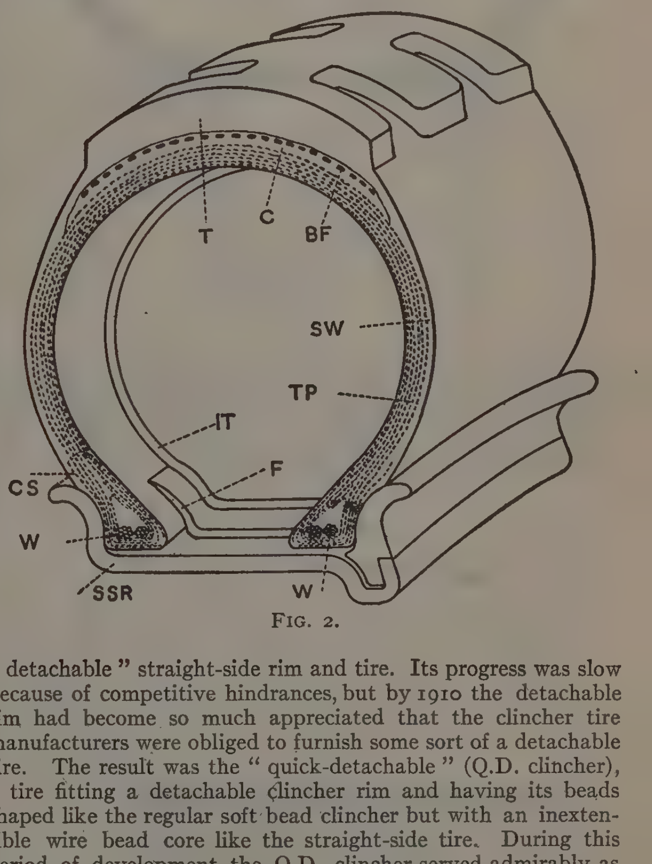

FIG. 2.

The merits of the straight-side (fig. 2), however, gradually made it more popular than the Q.D. clincher, with the result that the last Q.D. clincher rims were made in 1916. In the meantime the European demand continued to be for the clincher type exclusively, while except in the Ford sizes, they were discontinued in American production. American army vehicles and motor vehicles exported on straight-side tires have recently opened a market for straight-side in other countries. The year 1921 found the situation as follows: bicycles were fitted with single tube tires in America and wired-on tires in Europe.

Motorcycles were fitted with clincher tires both in America and Europe, and aeroplanes with either clinchers (fig. 3) or wired-on according to the demand. Passenger cars were fitted with European Standard clincher tires for European productions. American small cars took $3\frac{1}{2}$-in. American Standard clincher tires, while cars using larger than $3\frac{1}{2}$-in. took American Standard straight-side tires. All American "motor trucks" using pneumatics operated on straight-side tires, and for solid tire equipment took pressed-on, channel base tires (fig. 4).

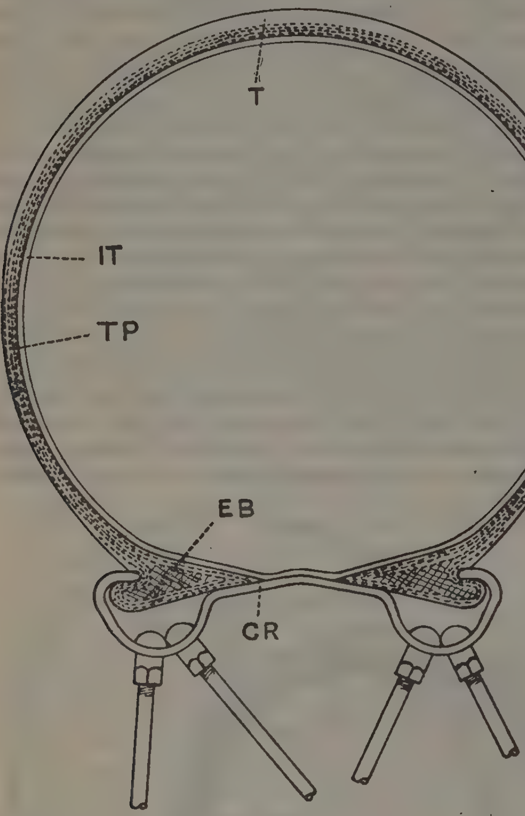

FIG. 3.

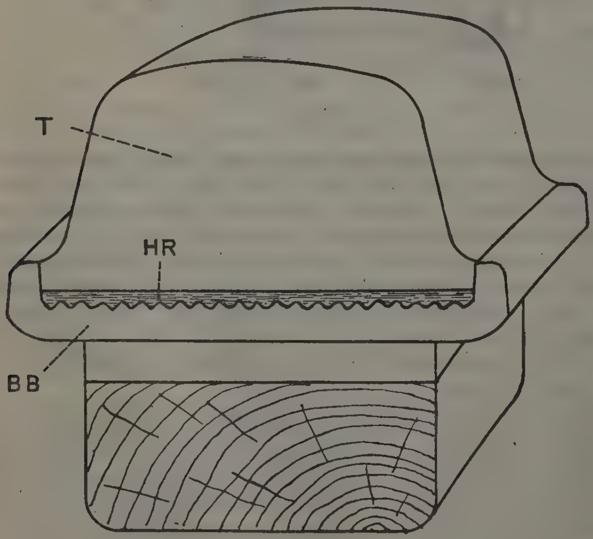

FIG. 4.

European "lorries" were fitted with the typical English band tire (fig. 5). Progress in details of design, materials, and methods of manufacture was very gradual, the general idea being always to build a "balanced" tire, that is, one in which all parts were equally durable. There are practically no formulae or theories on tire design (except the rubber compound formulae) of value to the tire manufacturer; whatever good qualities any particular make of tire embodies are the result of persistent and constant experimentation, combined with the policy of the individual company controlling the standard of quality which it desires to offer to the public. The square woven tires of 1920 averaged 5,000 to 6,000 m. of service. There was one outstanding development during the period 1910–20, namely, the "cord construction." The cord idea was old, having been used in bicycle tires in the 'nineties, but the "square woven tire duck" appeared to be more practical for motor vehicle tires.

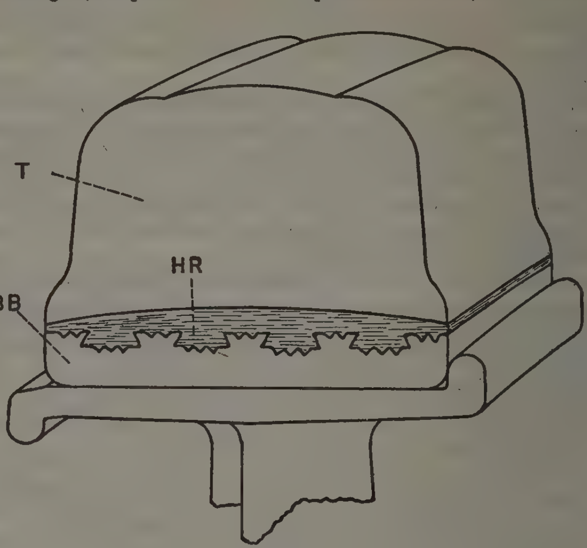

FIG. 5.

About 1912 electric automobiles in America created a demand for "power saver" tires to which the tire makers responded by offering special casings of cord fabric structure for which exceptional resiliency and lack of internal friction were claimed. Not at all durable at first, as they were gradually perfected the leaders of the industry became convinced that this was to be the quality tire of the future (fig. 6).

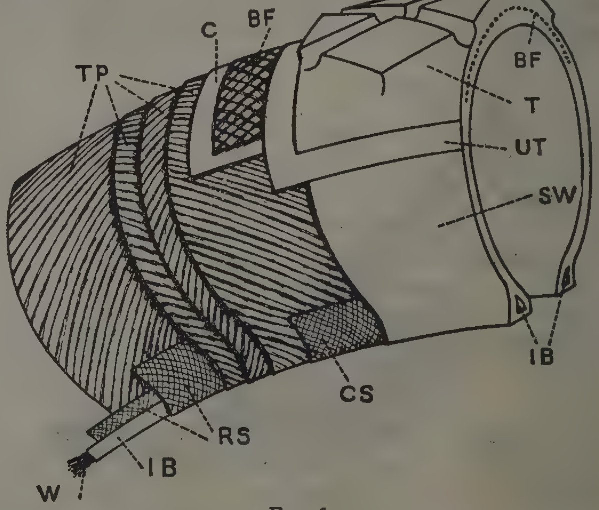

FIG. 6.

Ply separation and fabric breaks in cord tires are effectively prevented because the cords, being completely insulated from each other, provide a flexibility of the "carcass" without chafing, that greatly reduces injury from under-inflation and overloading. Development in the two-ply "cable" cord construction and the "multi-ply" construction paralleled each other. In 1920 the merits of the multi-ply construction had prevailed to such an extent that the "cable" cord was no longer made. After the World War European tire manufacturers began to duplicate American multi-ply cord construction in their millimeter beaded edge sizes. The cord tires of 1920 averaged 7,000 to 8,000 m. of service. Durability was also materially improved by increasing the cross-section size of the tires. In 1920 practically all American straight-side cord tires were made 10% over the nominal size. Also the tire manufactures gradually succeeded by persistent educational work, in getting car manufacturers to fit tires adequate for the loads to be carried. During this decade a new use was developed for pneumatic tires, namely their application to motor trucks up to $3\frac{1}{2}$ tons capacity. The movement made very little progress from 1910 to 1915. "Dual" (or twin), square-woven fabric tires in passenger car sizes were first tried. Then square-woven fabric tires of 8-in. and 9-in. sections were employed with results encouraging enough to justify putting a limited number on the market. By 1916 automobile cord tire construction had been mastered sufficiently for trial in the truck sizes. Success with 6-in., 7-in. and 8-in. sections immediately demonstrated the superiority of the cord construction and was followed by regular demand from the public. The 9-in. and 10-in. sections were used to some extent but their future was in 1921 uncertain. The typical solid tire of 1910 was the British "pressed-on" band tire then in use in Europe and soon to be duplicated in America. These tires were fitted to the wheels by simply forcing or pressing on with a special press, but in the absence of conveniently located tire presses, some American manufacturers adapted the metal base idea to a "bolted-on" design (called "Demountable"), having bevels on the inside edges of the steel band so arranged that hoop-shaped "wedges" could be fitted to mount the tire, the whole assembly being bolted in place with "side flanges." Early metal base tires in America failed prematurely from fracture of the exposed hard rubber at the edge of the base band due to rough streets. To remedy this the band was made in "channel" form and the hard rubber protected by the side of the channel. In 1913 as an experiment, a "channel base" tire made to press directly on the S.A.E. (Society of Automotive Engineers) standard wheel without traction plate or staples, previously considered necessary, was tried. The experiment was successful, and this new type was so much simpler and less expensive that it rapidly superseded all other types in America. In 1915 wide single solid tires were introduced in America (8 in., 10 in., 12 in. and 14 in. wide) on the rear of heavy trucks in place of dual or twin tires. In 1920 wide singles and duals were almost equal in popularity.

The growth of pneumatic tire production in the United States is shown by the following figures, those for 1913, 1914, 1915, 1918 and 1919 being estimates:—

1913	6,588,000	1917	25,845,656
1914	8,983,000	1918	21,000,000
1915	12,840,000	1919	35,000,000
1916	18,564,957	1920	32,400,000

Structure, Materials and Manufacturing.—Solid tire structure is clearly shown in figs. 4 and 5. The tire maker's problem is to attach the tread rubber, which must be of highest quality, to the wheel. This necessitates a steel foundation band, a thin layer of hard rubber specially compounded to adhere to the steel, to which the tread rubber will also adhere. No practical way of making the tread rubber adhere to the steel is known. The component parts of the straight-side pneumatic tire are indicated in figs. 2 and 6. The bead portion has imbedded in it a circular inextensible wire core, usually of many strands in the form of braid, cables, or coils (to give a certain amount of flexibility). This wire anchors the tire to the rim, prevents it from blowing off, and gives rigidity enough so as to prevent the tire from creeping on the rim when inflated. The body or "carcass" of the pneumatic tire consists of bias "plies" of cotton fabric impregnated with adhesive rubber "friction," insulated from each other by a thin "skim coat" of the rubber, and having the edges of the plies folded or "tied in" alternately over and round the wire bead core. (*See* fig. 7 showing detail of a typical bead "tie-in.")

Since the function of the carcass is to serve as a strong yet flexible container for the inner tube with its charge of compressed air, the specifications covering the fabric call for great strength, uniformity of weight, freedom from grit, and particular grades of long staple cotton (Arizona, Sea Island, Egyptian, Sacalarides, Pealer, etc.). The two general classifications are: first, "square-woven" fabric, weighing $17\frac{1}{4}$ oz. per sq. yd., woven from warp and filling, twisted of 11 strands of No. 23^s yarn and having a tensile strength of 425 lb. per in. of width (both warp and filling) for the best fabric. The number of plies used are $3\frac{1}{2}$-in. 4-ply, 4-in. 5-ply, $4\frac{1}{2}$-in. 6-ply, 5-in. 7-ply. Second, "Cord" ply-fabric, which is primarily a warp composed of parallel cords of combed Arizona or Sea I. cotton resembling fish line and weighs 14 oz. per sq. yard. The parallel cords would get snarled up in the tire building processes, so for handling purposes it is necessary to weave a single light filling thread into the cord, $2\frac{1}{2}$ picks per inch. Each cord, $(((23^s)5)3)$ cabled yarn, has a tensile strength of 20 lb. In cord tires the cords of each ply must cross those adjacent, consequently the direction of the bias is reversed in the successive plies, which number as follows: $3\frac{1}{2}$-in. 4 plies, 4-in. 6 plies, $4\frac{1}{2}$-in. 6 or 8 plies, 5-in. 8 plies, 6-in. 8 or 10 plies, 7-in. 10 plies, 8-in. 12 plies, 9-in. 14 plies, and 10-in. 16 plies. As mentioned above, the tire plies are "tied in" round the wire bead core. To make a bead proof against rim cutting, etc., the most improved designs include narrow reinforcing strips of frictioned fabric (*see* figs. 1 and 7). The outermost of these is named the "chafing" strip. The outside of the carcass is entirely covered with rubber; the sides with a "sidewall" layer, $\frac{1}{16}$-in. thick, and at the tread portion with "cushion stock," "breaker fabric," "undertread," and "tread." The tread is the thick, tough, firm, wear-resisting face of the tire which is in contact with the road surface. The forces and stresses of vehicle operation are so severe in their tendency to tear the tread from the carcass that tire makers have found it impracticable to attach the tread directly to the carcass, and have had to resort to the interposition of the soft elastic adhesive "cushion" and open mesh "breaker fabric" to taper off the severity of the shearing stresses that would loosen the tread. Another very important function of the cushion and breaker is to prevent fabric rupture of the carcass by softening and spreading the intensity of impact of rough roads. The design and quality of the tread rubber must be worked out to wear at least as long as any other part of a balanced tire. The simplest smooth tread is a thin crescent in cross section; and in the case of non-skid designs they are generally crescent cross section with geometrical depressions or protuberances. The physical properties most desired are toughness, to resist cutting and chipping, and attrition resistance to provide against abrasion from road surface friction.

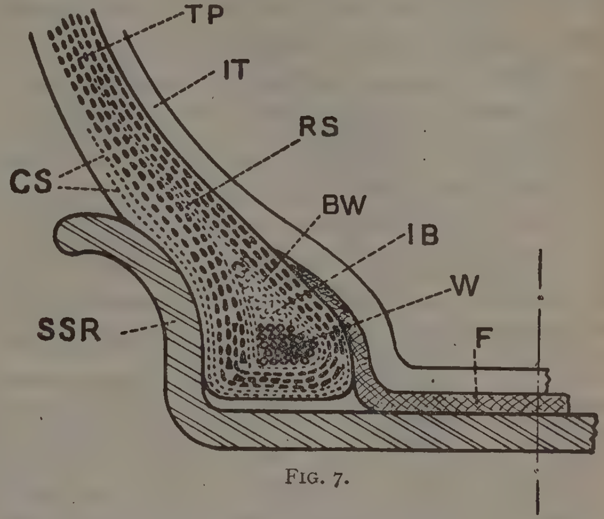

FIG. 7.

There are no particular differences of design for the inner tubes; nearly all makes resemble each other very closely. Highest quality rubber with little or no compounding except sulphur is used for grey tubes. The best red tubes are compounded with antimony sulphide. To be satisfactory the tube must hold air; not crack nor check in storage; not stretch out of shape; not stick to the casing; not split nor tear easily; not be affected by heating; and must be repaired easily. "Flaps," made of inexpensive rubberized fabric, are used in straight-side tires to prevent the tube from being pinched or nipped under the edge of the bead, and to keep water and rim rust away from the tube.

Only general ideas of manufacturing can be mentioned. First, there is "stock preparation"; the rubber and "compounds" are mixed, the fabrics "frictioned" and "skimcoated" with rubber, gauged to a very exact thickness, the frictioned fabrics cut to proper widths on a machine called the "bias cutter," the cushion, undertread, and sidewall stocks are sheeted out and cut to width on the calender, the tread rubber is prepared either on the calender or the "tubing" machine, and the bead wires are padded with rubber and frictioned fabric and cold pressed into shape. (*See* RUBBER for stock preparation.) "Building" the tire is the next step. A "core" in shape and size like the inside of a finished tire used as a building form, is mounted on a stand which permits the core to revolve. The tire plies are drawn taut around the core and rolled down smooth one after another, and at the proper time the bead is put in position. After the last ply is in place the tie-in at the bead is made; the building is finished by adding the sidewall, cushion, breaker strip and tread. During the decade 1910–20 tire building changed from all hand work to a combination of hand and machine building. In addition to saving labour, the machines turn out more perfect work. The final step is the vulcanizing or "curing." Fundamentally this is simply the processes of subjecting the "uncured" tire to a definite degree of heat for a definite length of time while the tire is confined under pressure in a strong iron "mould" (with an iron "curing core" or inflated "air bag" inside the tire). The heat effects chemical changes in the rubber compounds just as in cooking. Quality in a tire is very dependent on the curing. Not only must there be an optimum cure but the mould pressure must not disturb the fabric lest "buckles" or "mould pinches" be formed. This last is so important that many manufacturers resort to the more expensive double cure process—the carcass is semi-cured to "set" the rubbers and fabrics with much less danger of fabric displacement, after which the tread is cemented in place and the cure finished.

Tire Troubles.—For the purpose of general analysis in pneumatic tire service, five major tire troubles are recognized. They are: (1) unsatisfactory tread wear; (2) separation either (*a*) between plies of fabric or (*b*) of tread from carcass; (3) fabric ruptures; (4) bead troubles; and (5) tube troubles. In each case it is possible to classify pretty completely the origins of the mischief. Of course, many instances of premature tire failure are due to defects of design, materials or manufacture; on the other hand, by far the more frequent cause of tire trouble is abuse in the hands of the user as outlined below:—

Unsatisfactory Tread Wear	caused by	Abrasion Wheels out of alignment Too much power Improper use of brakes Skidding Abrasive road surfaces Under-inflation Sharp stones cutting tread Deterioration from oil
Separation (*a*) between plies of fabric (*b*) of tread from carcass	caused by	Excessive flexing Riding under-inflated Riding car tracks Overloading Riding flat Abuse of rough roads Cuts Heating from speeding Water-soaked fabric
Fabric Ruptures	caused by	Overload Over-inflation Under-inflation Stone bruises Premature ply separation Cuts Exposed fabric water-soaked Speeding on rough roads
Bead Troubles	caused by	Bent rims Under-inflation
Tube Troubles	caused by	Riding flat Leaky valves Puncture Heating from speeding Pinching under bead Tears from rough handling Neglect of spare tube

Solid tire troubles are confined to premature wear in the form of cutting, chipping, and breaking large chunks out of the tread; disintegration in the heart of the tire due to the accumulation of the heat of internal friction on long trips (rubber is such a poor conductor that heat is not adequately dissipated by windage); and separation of the whole mass of the tread rubber from the steel base-band. This last is a defect in materials or manufacture except in cases where external abuse fractures the hard rubber. In order to cushion a specific load properly a tire must not have too high air pressure; on the other hand, under-inflation results in excessive flexing which in turn brings on premature ply separation and fabric breaks. Experience has demonstrated that a pneumatic tire should not flex more than 11% (for large tires) to 15% (for small tires) of the section diameter of the tire. Recommendations designed to advise vehicle manufacturers and users as to the proper conditions under which the tires should be used are given in their "carrying capacity" schedules, as indicated in the following table.

Carrying Capacities and Inflation Pressures of Pneumatic Tires
S.A.E. Standard.

	For passenger cars				For commercial vehicles	
Tire Size	Fabric tires		Cord tires		Cord tires	
	Max'm load per tire lb.	Air pressure lb. per sq. in.	Max'm load per tire lb.	Air pressure lb. per sq. in.	Max'm load per tire lb.	Air pressure lb. per sq. in.
3 ″	375	45	400	40	..	..
3½″	570	55	600	50	..	..
4 ″	815	65	850	60	850	70
4½″	1,100	75	1,200	70	1,200	75
5 ″	1,500	85	1,700	80	1,700	80
6 ″	..	..	..	..	2,200	90
7 ″	..	..	..	..	3,000	100
8 ″	..	..	..	..	4,000	110
9 ″	..	..	..	..	5,000	120
10 ″	..	..	..	..	6,000	130

(J. E. HA.)

TIROL (*see* 26.1010), an Austrian Territory, divided by the Treaty of Peace of St. Germain into two separate parts—*Northern Tirol* and the district of *Lienz*. Northern Tirol is bounded on the E. by Salzburg, on the N. by Bavaria, on the W. by Vorarlberg and Switzerland and on the S. by Italy (German Southern Tirol). It lies mostly in the valley of the Inn, the northern part in the Kalk-Alpen and the southern in the schists and the central zone of the eastern Alps. The southern frontier almost coincides with the watershed between the Inn and the Adige. In the N., Tirol extends into the basins of the Lech and the Isar. The "*Föhnstrasse*" of the Brenner renders the cultivation of maize possible in some parts of the Inn valley. The new Territory has an area of about 4,787 sq. m. and its pop. was in 1910, 304,713, in 1920, 306,156 (64 per sq. mile). The area of the Lienz district is about 763 sq. m.; pop. in 1910 about 29,000.

The population is almost entirely German and Roman Catholic (1910, 98·9%). The proportion of males to females in 1910 was as 1,000 to 981 but in 1920, 1,000 to 1,053.

For administrative purposes Northern Tirol is divided into seven districts and the autonomous city of Innsbruck, the capital (pop. in 1920 55,659). Lienz is a district of itself. Other important places besides Innsbruck are Hölting bei Innsbruck (pop. 9,503), Schwaz (pop. 7,385), Hall (pop. 6,984), Kufstein (pop. 6,662), Lienz (pop. 5,756), Wörgl (pop. 4,030), Landeck (pop. 3,919).

Agriculture and Forestry.—In 1910, 23·7% of the present Tirol was unproductive. Of the productive areas (1910), 5·9% was arable, 0·2% gardens, 7·4% meadows, 41·5% pasturage (almost entirely high summer grazing lands) and 44·9% forest.

Cattle-raising and farming on the high lands are well-developed industries, although less care is bestowed on them than in Switzerland. But in 1918 there were only 159,398 head of cattle (of which 91,219 were cows) and 24,421 swine. The Tirolean breeds of cattle are highly esteemed. Forestry also holds an important place among the industries of this Territory.

Minerals.—The salt mines yielded 15,000 tons in 1915 (9% of the whole Austrian output) at Hall bei Innsbruck. The production of lignite, 40,000 tons in 1915 (scarcely 2% of the Austrian output), is chiefly from Häring in the Unter-Innthal. Copper, lead, zinc, antimony and sulphur and asphalt are also mined.

Manufactures.—Industry is still little developed although the use of the abundant water power is rapidly increasing; there are electrical stations at Innsbruck and elsewhere. Mention should be made of the wood, iron, textile, earthenware and glass industries. Innsbruck is as yet hardly an industrial city but has commercial importance and is visited by great numbers of tourists.

Communications.—Mountain railways from Innsbruck to the Stubai-Thal and to Mittenwald, the junction for Munich, have led to a great development of tourist traffic and are of marked importance for trade and industry.

REFERENCES.—Norbert Krebs, *Länderkunde der österreichischen Alpen* (1913); Jos. Blaas, *Geologischer Führer durch die Tiroler und Vorarlberger Alpen* (1902); H. v. Ficker, *Klimatographie von Tirol und Vorarlberg* (1909); Widmann, *Geschichte von Tirol; The Unity of Tirol* (Memorandum of the Academic Senate of the university of Innsbruck, 1919).

TIRPITZ, ALFRED VON (1849–   ), German admiral and politician, was born at Küstrin March 19 1849. He entered the Prussian navy in 1865, and by 1890 had risen to be chief-of-staff of the Baltic station in the Imperial navy. In 1892 he was in charge of the work of the chief-of-staff in the higher command of the navy. He was promoted to be rear-admiral in 1895, and in 1896 and 1897 he was in command of the cruiser division in east Asiatic waters. In 1899 he reached the rank of vice-admiral and in 1903 that of admiral. For the long period of 19 years, from 1897 to 1916, he was Secretary of State for the Imperial navy, and in this capacity advocated the navy bills of 1898, 1900, 1907 and 1912 for increasing the German fleet and successfully carried them through the Reichstag. In 1911 he received the rank of grand-admiral, and he retired in 1916.

The best account of Adml. von Tirpitz's naval achievements and political activities is contained in the book which he published in 1919 under the title of *Erinnerungen*. In that book he shows how gigantic was the task of creating the new German navy with which Great Britain had to reckon at the outbreak of the World War. Not only had a whole array of subsidiary industries to be established and supplies of raw materials secured; thousands of skilled workmen and hundreds of directing personalities of strong character and exceptional ability had to be found and trained. It has been customary to attribute the creation of the German navy to the Kaiser William II., and it is true that in large part the initiative for successive increases, and the demagogic appeals by which they were supported, originated with the Emperor. On the other hand, it was Tirpitz who not only conducted the practical advocacy of these schemes in the Reichstag, but also organized the service of propaganda in the German press and on the platform, putting popular pressure on the parliamentary representatives of the nation and constraining them to agree to the enormous expenditure which these schemes entailed. William II. was often a hindrance as well as a help, and Tirpitz gives instances in which the work of the construction departments and even that of the Secretary of State were interrupted or hampered by wild-cat Imperial projects for the construction of architecturally impossible vessels or of mechanically impossible machinery. One of these projects, on which an elaborate report had actually to be submitted to the Emperor, was a device for which it was claimed that it had solved the problem of perpetual motion. In the conduct of the naval war the official rôle of Tirpitz was confined to reporting and advising at general headquarters, the actual conduct and initiative in operations being in the hands of the higher command of the navy at Wilhelmshaven, subject to the Emperor's approval or veto. Tirpitz advances two contentions; first, that he would have sent the navy into decisive action at an earlier stage of the war; secondly, that he would have made an earlier and more ruthless use of the German U-boats; but his opponents traverse both these claims, and in particular assert that as Secretary of State he had neglected the construction of submarines, so that Germany entered the war with a comparatively small supply of these vessels.

In the political sphere Tirpitz was a bitter opponent of Bethmann Hollweg, whom he charged with indecision, half-heartedness and nebulous conceptions of the necessities of German policy. His own experiences in the Reichstag, and the close contact with the political parties which his advocacy of successive naval bills had involved, made him a master of political intrigue. During the years which immediately preceded the war, as well as during the first 18 months of the conflict, he was himself a candidate for the office of Imperial Chancellor, in the sense that many of the reactionary Conservatives and of those who advocated a ruthless conception of policy in peace and war regarded him as their political hope. Lord Haldane, in his book *Before the War* (1920), records his impression of Tirpitz when he visited Berlin in Feb. 1912 in order to make tentative proposals for an agreement regarding the limitation of new construction. Bethmann Hollweg, Lord Haldane thought, was willing to entertain the British suggestions; it was Tirpitz who behind the scenes offered a most strenuous opposition to any restrictions. Tirpitz himself maintains that his naval aspirations were directed not towards a war with Great Britain, but to the creation of a state of naval equilibrium or of German superiority, which would have enabled Germany to insist upon the unreserved coöperation of British policy in her world aims. It was probably true that Germany's policy was directed rather towards being so strong at sea as to make England unwilling to fight her unless absolutely necessary, than towards actually challenging British naval supremacy. But this policy was, in any case, bound to make England peculiarly sensitive to provocation by Germany,—a point which was ignored by the champions of a great German navy. Tirpitz's book, in so far as his statements may be trusted, throws much light upon the circumstances in which German policy was directed or drifted in July 1914 into paths which inevitably led to war. He enlarges in particular upon what he considers the folly of the declaration of war upon Russia (*see* BETHMANN HOLLWEG). He is naturally influenced to some extent in what he says by his poor opinion of Bethmann Hollweg's capacities and by his own thorough knowledge of the Emperor's fickle and impetuous character.

His resignation in 1916, and the stages of his relations with the Emperor and the Higher Naval Command which led to it, are described in his *Erinnerungen* with almost tragic vividness. Tirpitz remained a leading figure in the political agitation against the Chancellor's policy and was selected as president of the "Vaterlandspartei," a political association started in Sept. 1917 under reactionary auspices to combat all attempts at peace by compromise, and to advocate the prosecution of the U-boat warfare with extreme ruthlessness. This association offered a vigorous opposition to the movement, which succeeded only when it was too late, for obtaining alterations in the constitution limiting the power of the Emperor and laying the foundations of real parliamentary government in the Empire and in Prussia.

After the revolution Tirpitz was one of those against whom German popular animosity was chiefly directed as being the inspirer of the naval and world policy which led to the war, and also the most powerful influence in prolonging it. He was one of those who found it inadvisable to remain in Germany, and he departed to find a refuge in Switzerland. After the republican Government seemed fairly established, and the reign of law and order was being restored, he returned; but, possibly on account of his advanced age, did not appear during 1921 to be taking any further part in political intrigue or agitation. (G. S.)

TISZA, STEPHEN, COUNT (1861–1918), Hungarian statesman (*see* 26.1017). During the Coalition Ministry (1906) Tisza retired into private life on his estate of Geszt. It was only in the House of Magnates that he expressed his views against the extension of the franchise. When Count Khuen-Hedervary took office in 1910, Tisza was his most earnest and effective opponent in the country. His return to the political arena took place during a period of obstruction. In 1912 he became president of the House of Deputies, and on July 10 1913 again returned to power as prime minister. When the World War broke out a truce was arranged between Tisza and the Opposition, but it did not last long, and in 1917 he was compelled to resign. Though hitherto he had been the most zealous adherent of Dualism and the partnership with Austria, he declared for the scheme of personal union after the manifesto of King Charles on Oct. 17 1918, the Pragmatic Sanction to hold good on the question of national defence, but with a separate Hungarian army and separate diplomatic representation abroad. When he saw no prospect of winning the war he pleaded for a peace in common with Germany on the basis of President Wilson's Fourteen Points. On Oct. 31 he was assassinated in his villa by men in military uniform, said to have been worn as a disguise.

Tisza had a power over Austria and Hungary such as had hardly ever been exercised before by an adviser of the Crown. He was distinguished by his determination and inflexible convictions, and was opposed to any policy involving weak concessions. In the newspapers *Magyar Figyelö* (Hungarian Observer) and *Ignazmondó* (Truth), he published articles on many subjects; in addition he published the historical study *Von Sadowa bis Sedan* (in Hungarian and German).

See the biography by Karl Szaz (Hungarian); and David Angyal, *In Memory of Stephen Tisza* (Hungarian). (E. v. W.)

"TITANIC" DISASTER, 1912.—No single event in 1912 could compare, in the intensity of its universal appeal to human emotion, with the awful disaster to the British steamship "Titanic." At 2:20 A.M. on April 15, that great White Star liner, the largest afloat, on her maiden voyage, went to the bottom of the Atlantic in lat. 41° 46′ N., long. 50° 14′ W., about 2¾ h. after striking at full speed on an iceberg, with a loss of 1,513 souls out of 2,224 on board.[1] It had been supposed that such a vessel was unsinkable, and the tragedy raised numerous questions as to methods of ship construction, and additional provision of life-saving equipment. The "Titanic" had nominally boat accommodation for double the number saved, and the 20 boats launched were meant to hold 1,178 persons instead of the 652 they actually contained when they left the ship; moreover, the disaster occurred under exceptional conditions for getting people safely off, in the way of smooth water and fine weather. The most salutary lessons seemed to lie in the following directions: first, improved design and construction so as to provide a really unsinkable ship; secondly, greater precautions in navigation and look-out—for the "Titanic" was going at 18 knots (according to Lord Mersey an "excessive speed"), though it was known that icebergs were exceptionally numerous on the course; thirdly, better and more regular organization on shipboard—by boat drill (there had been none on the "Titanic") and otherwise, for the emergency of having to abandon ship; and fourthly, a compulsory service of wireless on all liners, working day and night—for it was one of the most lamentable incidents in the whole terrible story that the "Titanic's" wireless call for help, picked up all over the ocean and nobly responded to by the "Carpathia" (Capt. Rostron), 70 m. off, fell on deaf ears on the "Californian" only 8 or 10 m. away.[2] The full record of the disaster is contained in the reports of the inquiries held at once in America by a committee of Congress under Senator Smith, and later in London by a special commission presided over by Lord Mersey (report issued July 30). Painful and difficult though it was to distribute blame in such a case, there could be little doubt that the loss of life—817 passengers out of 1,316, and 696 out of a crew of 908—was much greater than ought to have been possible. Capt. E. J. Smith (b. 1853), a highly experienced seaman, who had been for 38 years in the service of the White Star Co. and who now went down with his ship, seems to have been averse from taking steps at first which might cause a panic on board; otherwise there should have been time, if adequate means of organization and of commanding discipline had existed, not only to get more people into the boats but to improvise rafts. In naval circles the opinion was strongly held that this should have been done, since the injuries received by the ship made it certain that she would sink in a given time. If so, there was a weakness in the higher command, or the means provided for exercising it in the organization of the crew on the "Titanic," for which no merely material equipment could compensate. A natural expectation of security had been engendered, alike among the owners, officers and passengers of these magnificently appointed liners, which, until a crisis actually came, had made it almost unthinkable that it could come in that way; but the fact remains that responsibility for the lives of passengers rests with those who control the ship. In this case, it was not the inadequacy of the physical means of escape that accounted for the large proportion of the lost who remained on board; it was the inadequate organization for purposes of using them, and inadequate information as to the necessity. Apart from that, both Great Britain and America could mingle sorrow and pride over many fine incidents of the tragedy, with its long death roll of prominent people from both sides of the Atlantic. When it came to the sending away of the boats, the order was "women and children first." The figures of the 711 saved by the "Carpathia" (including about 60 who were picked up in the boats after the ship went down) speak for themselves:—Women: first class, 140 out of 144; second class, 80 out of 93; third class, 76 out of 165; crew, 20 out of 23. Children: first class, 6 out of 6; second class, 24 out of 24; third class, 27 out of 79. Men: first class, 57 out of 175; second class, 14 out of 168; third class, 75 out of 462; crew 192 out of 885. Altogether the percentage of women saved was 74·35, of children 52·29, of men 20·27. The comparatively small proportion of third-class passengers saved was shown to be purely accidental and not due to any preference being deliberately given to others; they were handicapped, however, by their quarters being remote from the boat deck, and by so many of them being unable to speak or understand English.

TITTONI, TOMMASO (1855–), Italian statesman, was born in Rome 1855. His father, Vincenzo, a tenant farmer on a large scale at La Manziana, had taken part in the defence of the Roman Republic under Garibaldi in 1849, was exiled by Pius IX., and reëntered Rome in 1870 through the breach of Porta Pia. Tommaso Tittoni was educated first at Naples, and subsequently at Oxford and Liége. He began his parliamentary career as deputy for Civitavecchia in 1886, sitting on the Right, but he resigned his seat in 1897, having been appointed prefect of Perugia; three years later he went to Naples in a similar capacity, and in 1902 he was raised to the Senate. When Giolitti became premier for the second time in 1903, Tittoni became his Foreign Minister. He aimed at improving relations with Austria, and also tried to bring about a reconciliation with France; it was in fact under his auspices that President Loubet visited Rome. On the resignation of Giolitti in March 1905 Tittoni became interim premier for a few days and remained in the Fortis Cabinet as Foreign Minister. His proposal to reduce the duty on Spanish wines in connexion with an Italo-Spanish commercial treaty aroused a storm of indignation among the agricultural classes and caused the fall of the Cabinet on Dec. 24 1905; and although Fortis composed a new administration, Tittoni did not enter it. A few months later he was appointed ambassador in London (March 1906), but in May, on the fall of the Sonnino Cabinet and the return of Giolitti to power, he was again summoned to the *Consulta*. He continued the policy of improving relations with Austria, which did not contribute to his popularity; after the annexation of Bosnia and the Herzegovina his imprudently worded speech at Carate created the illusion that Italy was to be compensated, perhaps by the cession of the Trentino, and the disappointment when nothing of the kind materialized greatly weakened his prestige. He remained in office until the fall of Giolitti in Dec. 1909. In April of the following year he was appointed ambassador in Paris. When the World War broke out, in spite of his Triplicist policy he openly expressed himself in favour of Italian neutrality, and on Italy's entry into the war he was careful not to compromise himself with Giolitti's attitude. But he was not at his ease in the French capital and in Nov. 1916 he resigned from the Paris embassy. On the fall of the Orlando Cabinet in June 1919, the new Premier Nitti chose Tittoni as Foreign Minister and first delegate at the Peace Conference, but the severe strain of the work told on his health and he was forced to resign in November. He was chosen president of the Senate in Dec., and soon after was appointed Italian delegate on the Council and Assembly of the League of Nations, but ill-health again forced him to relinquish both appointments. In 1910 he had published a volume of speeches, which was translated into English, and in 1919 he brought out a work on political conflicts and constitutional reform.

TOBACCO (*see* 26.1035).—In 1913 the quantity of tobacco retained for home consumption in the United Kingdom was: unmanufactured 94,079,343 lb., and manufactured 1,896,668 lb. The year 1914 showed the beginning of the abnormal business in the factories. In that year, apart from tobacco sent to H.M. forces through the bonded factories, the quantity retained for home consumption was: unmanufactured 99,415,786 lb., and manufactured 1,585,411 pounds. In 1915 the amount of unmanufactured tobacco retained for home consumption rose to 106,516,337 lb.; the following year it was 101,719,199 lb.; and then from 1917, when the total was 104,501,452 lb., the amount went to 106,566,549 lb. in 1918 and to no less than 142,826,314 lb. in 1919. With imported manufactured tobacco, including cigars, cigarettes and snuff, the total consumed in 1919 was 145,344,604 lb. In 1914 the amount of unmanufactured tobacco which went through the factories and was consumed represented a consumption per head of population of 2·16 lb.; in 1919 it was 3·09 lb. per head.

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[1] The exact figures remained doubtful, but those given are from Lord Mersey's report.

[2] Apart from the "Californian's" wireless operator having gone to bed, however, Lord Mersey was satisfied that if her captain had realized the situation properly she could have saved "many, if not all, of the lives that were lost"; for evidence showed that distress rockets sent up on the "Titanic" were actually seen from the "Californian," though no action was taken in response to them. The incredibility of such a disaster appears, in that case, to have paralysed the capacity for interference.

The imports of tobacco into the United Kingdom by no means follow in the same ratio as the figures of consumption. When the World War broke out, thanks to the tradition of the trade and the prudent foresight of manufacturers, there were large stocks in the country. In view of the heavy requirements, fresh importations of raw tobacco were secured as before, but when the submarine activity added to the already urgent call upon shipping, imports dropped off very considerably and tonnage was only allowed sparingly for tobacco freights. The import of unmanufactured tobacco in 1913 was 162,365,925 lb.; in 1914 it was 158,692,857 lb.; 1915 202,650,863 lb.; 1916 164,265,861 lb.; 1917 46,543,060 lb.; 1918 171,639,313 lb. and in 1919 348,906,624 lb. It will be seen that the curve of imports drops in 1916 and is much lower still in 1917, and that so soon as shipping became available the depleted stocks of manufacturers were promptly renewed. Manufacturers had been purchasing but shipment had been held up. In addition to the manufactured tobacco imported in 1919, the following manufactured products were also brought into the country in that year: cigars, 1,670,735 lb.; cigarettes, 4,460,535 lb.; other tobacco, including snuff, 1,755,447 lb.

Before examining the Control Board's activities and retail prices in England it is interesting to note how the Treasury got on in the matter of revenue and under the influence of taxation which was several times heavily increased. The net receipts of British Government revenue in each year ended March 31 were as follows: 1913–4 £18,263,479; 1914–5 £19,272,007; 1915–6 £25,743,149; 1916–7 £27,342,339; 1917–8 £33,285,107; 1918–9 £46,231,430; 1919–20 £60,857,917. This crescendo of revenue gains was the result of two principles working together: the war impetus given to the use of tobacco, including the fact that ladies were in many cases smoking as well as men, and secondly the increased tax. The rate of unstripped tobacco leaf containing 10% or more of moisture, which was 3s. 8d. per lb. in 1914, was raised to 5s. 6d. per lb. from Sept. 22 1915, and this rate lasted till May 1917, other duties such as that on manufactured tobacco being correspondingly increased. On May 3 1917 the duty was increased from 5s. 6d. per lb. to 7s. 4d. but out of deference to the working-classes this increase of 1s. 10d. was reduced on July 15 to an increase of 11d. only, which brought the tax down to 6s. 5d. per lb., at which it remained from July 16 1917 to April 22 1918. The yield kept on the up-grade, notwithstanding the duty, and on April 23 1918 the duty was raised to 8s. 2d. per lb. at which it remained, the 1921 budget having left the main tax unaffected.

There were, however, some specialties in English taxation of distinct note apart from the ordinary tobacco duties. These special features consisted in the application of preferential treatment to empire-grown tobacco and in a surtax on imported cigars. On and after Sept. 1919 the ordinary duties were reduced by one-sixth in the case of tobacco consigned from, and grown, produced or manufactured in, the British Empire. On and after April 1920 an additional duty of 50% *ad valorem* was imposed on imported cigars, reduced by one-third in the case of cigars entitled to preferential rate of duty. This surtax was abolished as from May 10 1921.

War Supplies.—In examining the actual consumption of tobacco one has not merely to consider the imports and revenue figures. There was the large quantity of duty-free cigarettes, cigars and tobacco supplied to H.M. forces, whether in the form of rations or sent out duty free from manufacturers' premises, on orders obtained through tobacconists and from other sources. The dimensions of this most essential portion of the tobacco consumption can be gauged by several indications beyond the broad fact that every soldier or sailor who desired to smoke was well supplied. For instance the British Government chemist in his report for 1916 announced that the samples of tobacco exported on drawback numbered 32,004 or appreciably more than double the highest number examined in any previous year since the introduction of the drawback regulations in 1863. The number of laboratory certificates issued in connexion with samples was 81,889, an increase of no less than 48,179 over the corresponding number for the previous year. This was due to the dispatch of tobacco for the Expeditionary Force. The most direct indication however is afforded by the customs and excise report. This document for 1917–8 records the fact that, apart from ships' stores, the following were in that year the weights of cigarettes, etc., sent to the British Expeditionary forces and on which drawback was granted: tobacco, 123,256 lb.; cigarettes, 7,080,449 lb.; cut, roll, cake or other manufactured tobacco, 5,877,968 lb.; snuff, 525 lb. These figures include the large quantities of cigarettes supplied through tobacconists sending customers' orders to the manufacturers for sending out duty-free tobacco, and also orders sent from firms and other organizations who specialized in soldiers' parcels. They do not include the considerable number of parcels of cigarettes bought from a tobacconist's duty-paid stock and forwarded in a composite parcel by the soldier's friends. At a Navy and Army Canteen surplus stock sale in Aug. 1920 over 80 million cigarettes and 100 tons of tobacco were disposed of, 60 million of the cigarettes and the tobacco being sold for export only. The cigars for disposal were for the most part replaced into trade channels.

The British Tobacco Control.—The control of food in the United Kingdom, for war purposes, was followed by that of tobacco. The form of control was defined in two orders issued under the Defence of the Realm Regulations. One was called the Tobacco Restriction Order (No. 1) 1917, dated May 24 1917, and made by the Board of Trade under Regulations 2F and 2JJ, and the other the Tobacco Restriction Order (No. 2) 1917, dated July 11 1917. These two orders between them put the grip of the Board of Trade firmly upon every shred of tobacco which entered the country or was in stock, and controlled its movements, sale and price. The powers given were so full that an immoderate use of them could have paralysed the industry. The fact was that the control was a complete success, alike from the military or munition point of view, from the public point of view, and, greatest feat of all, from the trade point of view. The control lasted from its inception by the Restriction Orders named down to Jan. 11 1919 when the Board of Trade revoked the Orders, stating that "the effect of this revocation is that from the date named all powers exercised by the tobacco control board in regard to the control, importation and distribution and prices of tobacco will be abolished." During the period of control the board had systematized powers in regard to production, manufacture, treatment, use, consumption, transport, storage, distribution, supply, sale or purchase of or dealing in tobacco; they had power to place stocks at the disposal of the Board of Trade; any person delivering tobacco had to keep a record of the quantities delivered; tobacco sold by manufacturers, importers and wholesale dealers was ordered to be as nearly as possible of the same description and was to be sold in similar quantities and under like conditions and to the same customers as in the year 1916. In view of the shortage of shipping and the consequent necessity of economizing the available supplies of tobacco in Britain, an order was made bringing under control the stocks of manufactured and unmanufactured tobacco (of the latter a census was taken) and prohibiting the owners of stocks from dealing with them otherwise than as authorized by the Board of Trade. The order also provided for the regulation of the prices at which tobacco might be sold as from June 1 1917. No restrictions were imposed on the supply of tobacco to H.M. forces overseas. The Control Board at first consisted of the following: Mr. Lancelot Hugh Smith (chairman), Major F. Towle (quartermaster-general's department), and Mr. Gerald Bevan. They were assisted by an advisory committee, representative of all sections of the tobacco trade. The work of the Control Board was arduous; they were called upon to make numerous decisions and the way in which they exercised their powers helped the trade to keep going, guaranteed fair prices to the public and gave general satisfaction. A retail price schedule was issued, and one of these had to be exhibited prominently by every dealer in tobacco. Non-compliance rendered the tobacconist liable to a fine.

The Control Board's issue of Restriction Orders was to conserve supplies, but as time went on, owing to the large requirements of H.M. forces and the continued heavy demand at home, it became evident that the supply to the army might be jeopardized and a rationing system rendered necessary unless additional importations were allowed. The diminution of stocks in the bonded warehouses rendered some step advisable. The Control Board, therefore, though originally formed to restrict, now appeared in a new rôle, that of encouraging supplies, and in Jan. 1918 it was reported that the board were asking that tobacco should, with food and ammunition, be given priority of importation. From March 12 1917 there had been a restriction of clearances. The daily amount of tobacco allowed to be delivered out of warehouse or ship's side was restricted to the daily average quantity for the year ended Dec. 31 1916. But now that more tobacco was needed the question of further imports became urgent. Eventually an arrangement was made by which the British-American Tobacco Co., who had chartered the steamers of the Garland line, should bring in a supply for what became known in control circles and in the trade as "necessitous manufacturers." The result was that all were able to carry on.

Germany and France.—The difficulties of war-time conditions were thus successfully grappled with by the British Control Board. France, under its State *Régie*, did not do so well. It was reported in Dec. 1917 that under the stress of prolonged war the tobacco *régie* had practically broken down. It became well-nigh impossible to buy either tobacco or cigarettes in France. It was stated that owing to the intensification of consumption, due in part to women smoking, the monopoly administration had been taken unawares. Whatever the explanation, the State control did not produce the good results which control of an industry founded on private enterprise brought about in Great Britain. Still France was not so badly off as Germany and Austria. In Oct. 1917 permission was given by the German Government for the manufacture of tobacco-like substances without the employment of tobacco. These substitutes were allowed to be introduced into the trade and were made subject to the tobacco tax.

A schedule of permissible substances was drawn up. What the substances were was made evident to the trade in England by the photographic reproduction in the English trade paper *Tobacco* of advertisements from the *Süddeutsche Tabakzeitung.* One of these advertisements read: "Beech, Chestnut, Lime, Maple, Plane, and Vine leaves in withered and quite dry condition, sound and cleanly sorted in sacks for instant delivery, against banker's security will be purchased. Samples asked for." Another advertiser offered for sale "Cherry leaves, tobacco brown, can be promptly delivered." Meanwhile the proportion of German-grown tobacco in cigars had increased until they were hardly fit to smoke. Large consignments of tobacco acquired by the manufacturers of Bremen, Hamburg, and Dresden from the Balkans were destined for the army, the civil population having to rely upon the substitutes. A similar shortage was experienced in Austria. In both countries drastic control regulations were enforced.

United States.—In accordance with an Act of Congress, approved April 30 1912, the Bureau of the Census collects and publishes (quarterly since 1916) statistics of leaf tobacco held throughout the country. The statistics deal with all manufacturers who during the preceding calendar year produced more than 50,000 lb. of tobacco, 250,000 cigars, or 1,000,000 cigarettes; and dealers who had on an average more than 50,000 lb. of leaf tobacco in stock; included also is the imported leaf tobacco held in bonded warehouses and bonded manufacturing warehouses. No account is taken of smaller establishments or of amounts held by growers.

On Oct. 1 1912 (first official report) there were on hand 1,047,404,560 lb.; on April 1 1921 1,818,781,268 pounds. In every case the April report was the largest, as by that time the gathered crop has been sold. The largest production is "Bright yellow," from Georgia, North Carolina, South Carolina, and Virginia (571,148,382 lb. held April 1 1921); "Burley," from Indiana, Kentucky and Ohio (399,001,690 lb.); and "Dark fired," from Kentucky and Tennessee (178,847,170). Of "Cigar" types the "Pennsylvania" usually ranks first (93,918,626 lb. held April 1 1921); other important types are "New England," "Ohio," and "Wisconsin." A census of the tobacco crop was taken every 10 years after 1839 and of acreage after 1879. The peak of production was reached in 1920 with 1,508,064,000 lb., estimated; the largest producing states were Kentucky (467,500,000 lb., 550,000 ac.), North Carolina (384,120,000 lb., 582,000 ac.), and Virginia (177,390,000 lb., 240,000 ac.). Since 1869 Kentucky has been the leading state. For 1920 the estimated average yield per acre for the United States was 796 lb., as against 894 in 1911, the record year; the variation of production among the states is remarkable, ranging from 600 lb. per ac. in Georgia to 1,510 in Pennsylvania. Of the two recognized classes of tobacco—"Cigar" and "Chewing, Smoking, Snuff and Export"—the former constitutes only one-sixth of the production.

The peak of average prices was reached in 1919. That year the farmers sold 1,440,979,349 lb., ranging from 17 cents in Pennsylvania to 65 cents in Louisiana. The averages for these states in 1911 were 9½ and 31 cents respectively; in 1920 20 and 40 cents. In the latter year Alabama led with 55 cents.

Although the United States surpasses all other countries in tobacco production, there are large imports of leaf for cigars and cigarettes. In 1920 imports were 82,231,396 lb., of which 18,856,091 lb. came from Asiatic Turkey, chiefly for cigarettes. Cuba furnished 23,616,999 lb., Porto Rico 14,728,645 lb., and the Philippine Is. 1,842,613; the Netherlands 7,720,255 lb. and the Dutch East Indies 2,102,664 pounds. Imported cigars and cheroots come chiefly from the Philippines (over 5,000,000 in 1920). Over five-sixths of tobacco imports enter through the district of New York.

Exports of domestic tobacco and tobacco products from the United States amounted in 1920 to $288,693,799 as against $306,861,519 in 1919. Of cigarettes there were exported 15,833,870,000, valued at $35,977,374; of these over 8,500,000,000 went to China, over 2,000,000,000 to Italy, and over 1,000,000,000 each to British India and the Straits Settlements. Most of the tobacco exports pass through the district of New York.

On Jan. 1 1920 there were in the United States 13,591 tobacco factories, of which 11,483 produced cigars, 1,871 tobacco and snuff, and 237 cigarettes; of bonded manufacturing warehouses there were 13 producing cigars, 2 cigarettes and tobacco, and one tobacco. New York has the greatest number of establishments. The tax on tobacco is an important source of Government revenue. The amount collected rose from $3,097,620 in 1863 to $88,063,948 in 1916. Revenue in 1917 was $103,201,592; in 1918 $155,757,278; in 1919 $204,982,560; in 1920 $294,267,609.

The war period in America has been reviewed in a report of the U.S. War Industries Board. Herein it is stated that men in service used on an average from 60% to 70% more tobacco than they did in civil life. The civil population, due probably to increased prosperity, the cutting down of alcoholic beverages and the sentiment developed by the various campaigns for supplying "smokes" to soldiers, used 15 to 20% more tobacco. No important control beyond some conservation in methods of packing was found necessary, though a price-fixing plan was under consideration when the war was closed. The demand from Europe, it was pointed out, as well as from the U.S. manufacturers, continued to increase, and when producers saw in the autumn of 1917 that they could successfully increase the price of their manufactured articles, even in face of the increased revenue taxes, very high prices for leaf were assured. It was not until the middle of 1917 that the price of finished products began to rise. The advance was steady and rapid, reaching, 200% of normal on many products by Sept. 1918. The tax on tobacco was increased in Oct. 1917 and Feb. 1919, but these increases formed a relatively small part of the increase in prices.

Leaf Prices.—The unprecedented consumption of tobacco products both in America and Europe reacted on the growers, who planted large crops which they sold under favourable conditions. Prices of the raw material steadily mounted owing to the competition. A really accurate estimate of the effects of war conditions on the price of raw tobacco would detail the various grades and growths and show the alteration as it affected each. The bright cigarette tobaccos of Virginia and the Carolinas were among those which commanded very greatly increased prices, but perhaps the best way of dealing with the question is to take the average prices from 1913 to 1919. The statistical abstract for the United Kingdom gives these average prices in pence per lb. for unmanufactured tobacco as follows: 1913 9·92; 1914 9·75; 1915 8·92; 1916 9·44; 1917 15·47; 1918 21·93; 1919 26·29. Thus it is seen that manufacturers were paying more and more for leaf tobacco, but prices later became more moderate. The cost of eastern leaf from Macedonia and other oriental countries was somewhat high in 1921, but was likely to get lower with increased production.

Waves of Fashion.—Long before 1914 the cigarette had already grown so in public favour that it was rapidly supplanting the pipe and cigar. The war intensified the process. Up to 1914 the most esteemed cigarettes were of the finest Turkish or of bright Virginia tobacco. If anything, the Turkish cigarette was the more used by the fastidious smoker. War conditions caused the cigarette of Turkish or Macedonian tobacco gradually to diminish and the British forces did their arduous work for the most part (and especially after the stocks of the better class Turkish cigarettes had become scarce) on cigarettes of American tobacco. Cigars were of course in request in officers' messes and among certain people at home. Pipes were used by comparatively few. After the Armistice both the cigarette and the cigar, but mostly the latter, seemed to be yielding ground to the pipe. Great Britain has for many years been the home of smoking mixtures in which various kinds of tobacco are blended to make a satisfactory pipe mixture. These mixtures are much appreciated too in America, to which country there is a fair export trade. The British-made briar pipe also sells well in the United States. An influence towards making pipe smoking once more the fashion was the imposition in 1920 by the British chancellor of the exchequer of the *ad valorem* surtax of 50% on imported cigars. This made imported cigars too dear and gave the impression to the public that all cigars were dear. When Mr. Austen Chamberlain subsequently stated, on April 25 1921, in the House of Commons, that "the surtax has lowered the revenue instead of raising it and has entirely failed to justify itself. Let others learn by the mistake I committed," he might have added that the surtax had temporarily killed the cigar trade.

British Empire Tobacco.—A new prospect was opened in the economic history of tobacco by the institution of the principle of preferential fiscal treatment of tobacco grown, produced, or manufactured in the British Empire. A reduction in the tax of one-sixth is acting as a stimulus to the young tobacco-growing industry of British Africa from Cape Colony to Rhodesia, of Canada and of some other portions of the empire. Growers in the United Kingdom and Ireland have also been encouraged by an allowance. This preferential taxation will probably be found of greater significance to the tobacco manufacturing industry and to the smoker than is even the attainment of the laudable object of helping the tobacco farmers of the empire. A quasi-monopoly such as that possessed by the United States and the Balkans does not economically suit the direct buyer (the manufacturer) or the eventual buyer, the smoker. A widening and multiplication of the sources of supply must have a steadying effect on prices. The lesson of the war was that, quite justifiably under the new conditions, very heavy prices had to be paid for all tobacco, whether from America, Nyasaland or elsewhere. For many years the Imperial Tobacco Co. have been large buyers of African tobacco. Their headquarters in Africa are at Blantyre, where they have encouraged the grower. Tobacco grown in Ireland and also in England has been put on the market with some success. In the British system of taxation a rebate of one-third of the excise duty was allowed on tobacco grown in Ireland for experimental purposes prior to 1909, and on tobacco grown in Great Britain up to 1913 inclusive. From those dates arrangements have been made under which certain grants sanctioned by the Treasury are applied in encouragement of the industry. In 1918 the following quantities were grown: England and Wales, 31,844 lb.; Ireland, 77,978 lb.; total, 109,822 lb.; net receipt of duty, £34,482. In 1919: England and Wales, 78,825 lb.; Ireland, 77,837 lb.; total, 156,662 lb.; net receipt of duty, £60,785. (E. S. C.)

TOGOLAND (*see* 26.1046).—This German protectorate in W. Africa was conquered by Anglo-French forces in 1914, and German sovereignty was renounced by the Peace Treaty.

For some years preceding 1914 efforts had been made to reconcile the natives to German rule. This process began in the schools, where the children were taught to sing the German national anthem and to wave German flags; the teaching of English formerly common in the mission schools was abandoned. But the emigration of natives to the Gold Coast, which had resulted from the harsh methods of Herr W. Horn (governor 1902–5) and other officials was still marked in 1913, while on the east there was a similar attraction to Dahomey. Herr Horn had been dismissed for misconduct; his successor, Count J. von Zech, was more conciliatory to the natives and gave much attention to the development of railways and trade. In 1912 Germany made a departure in its colonial appointments by sending out as governor a member of one of the reigning families, Duke Adolf Friedrich of Mecklenburg, who was known as leader of an expedition which had crossed Africa. The duke was on leave when the World War broke out. He had, however, seen the linking up of Togoland to Germany by submarine cable (Jan. 1913), the extension of agriculture and an expansion of exports.

Maj. von Döring, the acting governor, had the advantage in the critical days of July 1914 of direct communication with Berlin by a wireless station at Kamina, which had just been erected. He made preparations to invade Dahomey, on the assumption that Great Britain would not enter the war. When this supposition was proved to be wrong Maj. von Döring received instructions from Berlin to propose that Togoland and the adjacent French and British colonies should remain neutral. The offer was made to the local authorities concerned but was rejected, in the case of the British by order of the Colonial secretary in London. The chief concern of Berlin in regard to Togoland was to preserve the use of the Kamina wireless station, through which they could communicate with all the other German colonies in Africa, and when the neutrality offer failed, orders were issued for the defence of Kamina. Von Döring made no attempt to defend the coast region: Senegalese Tirailleurs from Dahomey under Capt. A. Castaing occupied Little Popo (Anecho) on Aug. 6 and Togo on Aug. 8. Meanwhile an officer, Capt. E. B. Barker, had been sent under a flag of truce by the acting governor of the Gold Coast to Lome on Aug. 6 to demand the surrender of Togoland to the British. Twenty-four hours' delay was given; on Capt. Barker's return on the 7th he found that the German troops and Maj. von Döring had retired and that the official left behind had instructions to surrender the colony as far as a line drawn 120 km. N. of Lome. The next day co-operation between the French and British forces was arranged and the chief command given to Capt. F. C. Bryant, senior officer on the spot on the Gold Coast.[1]

Capt. (tempt. Lt.-Col.) Bryant reached Lome, by sea, with two companies of the Gold Coast Regt., on Aug. 12—a total strength of 57 Europeans and 535 natives with 2,000 carriers. He marched N. along the railway towards Kamina, being joined by Capt. Castaing's French contingent (three Europeans and 155 natives) on Aug. 18. The enemy had blown up the railway bridge over the Chra river and strongly entrenched a position in dense bush N. of the stream. This position was attacked on Aug. 22, but was not carried. The German force consisted of 60 Europeans and 400 native soldiers, and they had three machine-guns which were used to good purpose. The German losses were slight, the Allies' casualties were 73 (including 23 killed) or 17% of the force engaged. During the night the Germans evacuated their position and fell back on Kamina. Maj. von Döring had probably learned that a separate French column from Dahomey was within two days' march of Kamina and that a second British column was also approaching that place from the west. While Col. Bryant was preparing to attack Kamina, the Germans, on the night of Aug. 24–5, blew up the wireless station and on Aug. 26 after vain efforts to obtain terms, von Döring surrendered unconditionally. There were found to be 206 Europeans in Kamina. In the previous fighting five Germans had been killed and 32 taken prisoner. Thus southern Togoland was in the hands of the Allies; in the northern part Yendi surrendered to a British force of one officer and eight men on Aug. 18, while a French column of 630 rifles under Capt. Bouchez, coming from Upper Senegal, covered 310 m. in 20 days in the height of the rainy season and occupied Sansanne Mango and the rest of Togoland with little opposition. Many of the German native troops deserted to the French. Some 200,000 rounds of soft-nosed bullets issued by the German authorities were captured. The conquest of Togoland—a region the size of Ireland—was notable not only for its rapidity and neatness of execution, but for the fact that the operations were conducted entirely by the local authorities and by the troops on the spot when the war began—in this respect the little campaign was unique. After the conquest the country was divided for administrative purposes into British and French zones, the British occupying the western part, including Lome. The natives settled down rapidly under their new masters.

By decision of the Supreme Council May 7 1919, the mandate to administer Togoland was given to Great Britain and France. An agreement of July 10 1919 divided the country into areas to be administered by Britain and France respectively. This agreement, which left the port and district of Lome to Britain, caused some dissatisfaction in French colonial circles and was amended by a convention of Sept. 30 1920 when in exchange for an enlarged area in the interior Lome and the whole of the seaboard—but 32 m.—went to France. The formal transfer of Lome to France followed in Oct. 1920. In the N. the area acquired by Britain included Yendi and adjoining districts, thus bringing the whole of the Dagomba country under British control. Of the total area of the German colony 13,500 sq. m. came under the British mandate and 20,200 sq. m. under the French mandate. Of the pop., estimated (1920) at 1,250,000, some 850,000 lived in the French area. Europeans, mostly British and French officials and traders, numbered about 500. There was also an energetic colony of Syrian traders.

The railways fell within the French area. They consisted (1921) of a line from Lome N.E. to Atakpame, completed in 1911 and 102 m. long; from Lome along the coast to Anecho (27 m.) and from Lome N.W. to Palime (74 m.). They are all of metre gauge. The principal articles of commerce are products of the oil and coconut palms, cotton, maize, cocoa, live stock, rubber, sisal and other fibres. Of these the most important are palm oil and kernels. There is a considerable transit trade between the Gold Coast and Lome and between Anecho and Dahomey. In 1910 exports were valued at £360,000, and imports at £570,000. In 1913, the last full year of German rule, exports were valued at £455,000 and imports at £530,000. Cotton yarns, textiles, hardware and building material were the chief imports. In 1913 Germany took 60% of the exports and supplied 42% of the imports. After the Allied occupation trade for several years was mainly with neighbouring countries and the United Kingdom. In 1918 the value of exports from Lome reached £434,000, and the value of imports £385,000. In 1919 the figures were: exports £880,000, imports £680,000. After 1914 the cultivation of maize, cotton, sisal and cocoa increased—the cocoa exported in 1919 was worth £140,000, the cotton £120,000.

Togoland was the only German protectorate in Africa which had become self-supporting, revenue rising from £132,000 in 1909 to £169,000 in 1913. The Germans levied a poll tax of 6 marks on the natives; on the Allied occupation direct taxation was abolished. Under the British and French the respective portions of Togoland continued to be self-supporting. The British portion was attached to the Gold Coast Colony, the French portion to Dahomey. Local autonomy was preserved. In Aug. 1920 the French established in their area an administrative council, on which non-officials, including one native, had seats, with a consultative voice in drawing up the budget.

See *Togoland* (1920) a British Foreign Office handbook, with bibliography, and for the 1914 campaign the British White Paper *Correspondence relating to the military operations in Togoland* (Cd. 7872, 1915). See also A. F. Calvert *Togoland* (1918). (F. R. C.)

TOKUGAWA, YOSHINOBU [KEIKI], PRINCE (1837–1913), Japanese statesman, was the last Shogun of the Tokugawa Government (*see* 26.1047), succeeding the 14th Shogun, Iemochi, in 1866. At that time already a man of matured intellect and high capacities, although his succession had been obtained by the conservatives, he soon displayed an advocacy of liberal progress. He showed great diplomatic tact in the solution of the feuds between the Satsuma and Chosu, and also in opposing the anti-foreign agitation supported by the latter. Realizing after a year's time that the proper government of the country was impossible if continued on the lines of feudalism, which was a bar to all progress and a source of continual internal strife, the Shogun handed in his resignation to the Emperor on Oct. 14 1867. This act of sacrifice was the prelude to the dawn of the enlightened Meiji era at the beginning of 1868. The anti-foreign agitation ceased, the Emperor received and treated as honoured guests the representatives of foreign Powers, and Japan was thrown open to the world. Tokugawa, having renounced his shogunate rights, retired to a strictly private life from which he never emerged. He even renounced the succession to his title for his direct heir in favour of a collateral branch of the family. The Emperor Meiji accepted that renunciation, but he gave him another title of prince to be bequeathed to his own son.

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[1] It may be noted that the Colonial Office attempted to direct the movement of troops on the Gold Coast from London. Capt. Bryant, however, "did not see fit" to modify his plan of operations.

TORONTO (*see* 27.52), the chief city of Ontario, Canada, is the second city in size in the Dominion. In 1911 its pop. was 376,538; in 1921 the estimated pop. was nearly 600,000. Canada's greatest manufacturing district centres about Toronto. The city contained in 1921 about 1,400 factories employing 85,000 hands and producing goods annually to the value of $300,000,000. The bank clearings in 1920 amounted to $5,410,214,802, Montreal being the only Canadian city that surpassed Toronto in this respect. Fourteen of the chartered banks of Canada had their headquarters in Toronto in 1921.

Buildings erected since 1911 include St. Paul's Anglican Church, a fine edifice in the early English Gothic style, seating 3,000 persons; the Timothy Eaton Memorial Church, the greatest architectural ornament of Canadian Methodism, erected by the Eaton family at a cost of nearly $1,000,000; a 20-storey office building by the Royal Bank of Canada; a similar building by the Canadian Pacific railway, and several buildings for the university of Toronto. For several years preceding 1921 a large new Union station was under construction, and in that year was close to completion.

The Toronto hydro-electric system is one of the largest municipal supply undertakings on the continent of America. The management of the distributing system of the city was vested in 1911 in a board of three commissioners. The history of the enterprise has been one of phenomenal growth. Over 171,000,000 k.w. hours were sold during 1917 with a connected load of over 169,000 H.P.

The total assessed property in the city in 1919 was $642,816,090, an increase of 900% since 1885. A project was under way in 1921 for the building of a 63 m. boulevard driveway by the municipality. The main boulevard which would be 33 m. long and from 100 to 500 ft. wide would completely encircle the city. Toronto took over its own street railways from a private company in 1921, and has since operated them for the benefit of the municipality. The Toronto Exhibition, the largest annual exhibition held on the continent of North America, drew 1,201,000 visitors in 1919. The construction of the Welland Ship Canal, which was in hand in 1921, was expected to make the port of Toronto accessible to the larger vessels plying on the Upper Lakes. A scheme for the development of the harbour, which had been begun previous to 1917, was well under way in 1921. The project included the reclaiming of Ashbridge's Bay, known now as the Harbour Terminal Industrial District, the improving of the waterfront, the deepening of the harbour, and the construction of permanent breakwaters and concrete piers.

Toronto University has benefited greatly by large gifts from Sir John and Lady Eaton, Sir Edmund Osler and Sir Joseph Flavelle. In connexion with it a School of Engineering Research was founded in 1917 and a Faculty of Music was inaugurated the same year. A department of Social Service was founded, and in war time the university established courses for the training of masseuses that drew students from all over Canada. Hart House, a magnificent building in the Gothic style, was built by the university during the war and housed a number of war activities. It contains quarters for both the students' and Faculty unions, a dining hall, a gymnasium, a theatre and extensive offices for undergraduates' use. Dormitory residences were secured for students in the departments of Political Science and Medicine, and new residences were opened for woman students. An Electrical Engineering building, to cost $350,000, was under construction in 1921, and a University Press was also being built. The attendance at Toronto University in 1921 was well over 5,000, the highest university attendance in the British Empire.

TORPEDO (*see* 27.53).—In the World War of 1914–8 the torpedo played a most important part, especially as employed by the German submarines during the "ruthless" submarine campaign, which reached its height in April 1917, when enormous losses were caused by it to British and Allied merchantmen and fishing vessels. The total losses of British merchant ships due to submarines during the period Aug. 1914 to Nov. 1918 amounted to over six and a half million tons, and a very large proportion of this can be ascribed to torpedoes. In addition, British naval losses by torpedo over the same period included:—6 battleships, 5 cruisers, 3 light cruisers, 10 leaders, T.B.D's and T.B's, 4 submarines and 36 miscellaneous craft. Among these were H.M.S. "Goliath," a battleship of 12,950 tons, sunk by a Turkish T.B.D. in May 1915 in the Dardanelles. That the torpedo menace largely influenced Adml. Jellicoe's tactics at the Battle of Jutland is plain from his own book (*The Grand Fleet, 1914–1916*). At Jutland the Germans on their side sustained considerable loss or damage from torpedoes; the battleship "Pommern" and the light cruisers "Frauenlob," "Wiesbaden" and "Rostock" were sunk in this way, and 10 other ships were hit, three of which subsequently sank from other causes. The Germans fired between 60 and 70 torpedoes during the action and obtained two hits, one on the "Marlborough" and one on the "Shark"; the latter ship was sunk.

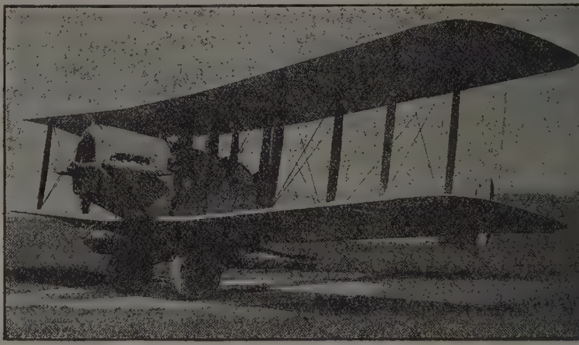

FIG. 1.—Aeroplane carrying torpedo.

Apart from their use of the torpedo by larger ships, torpedo-boats and destroyers, the World War saw them also made the weapon of the coastal motor boat (C.M.B.), the development of which in 1916 had been made possible by the installation of the internal combustion engine. The first operation on record carried out by British C.M.B's armed with torpedoes was an attack on German T.B.D's off Ostend, several destroyers being sunk. These C.M.B's operated from Dunkirk. Subsequently C.M.B's were extensively used off the Belgian coast, and played a most important part in the blocking operations at Zeebrugge. They were also largely used in the Baltic (notably at Kronstadt) and Caspian Seas, and also at Murmansk.

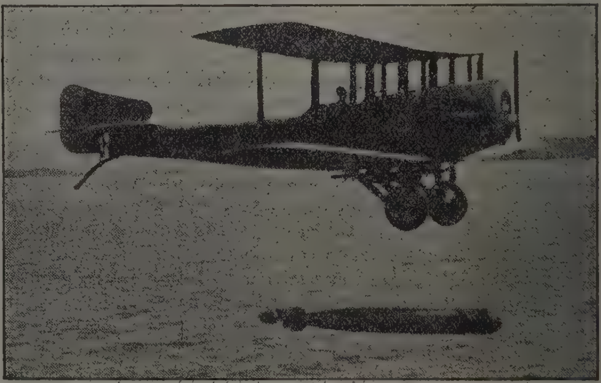

FIG. 2.—Discharge of torpedo from aeroplane.

A more novel use was the discharge of torpedoes from aeroplanes (*see* figs. 1 and 2). It is claimed that this was first accomplished in 1911 by an Italian, one Capt. Guidoni, who released a 350-lb. torpedo from an 80-H.P. Farman machine. In the same year the matter was taken up by various British naval experts who realized the possibilities of this form of attack from the air. Notable amongst these was Comm. (later Adml.) Murray Sueter. Adml. Fiske of the U.S. navy was also writing on the subject as early as 1912. By the end of 1913, the first British flight was carried out with a Sopwith seaplane carrying a 14-in. torpedo off Calshot, Southampton, and special machines were subsequently ordered by the British Admiralty. During 1914 experiments were proceeded with using "Short" seaplanes, and a specially light torpedo was designed for aircraft purposes. When the World War broke out, it was realized that means would have to be provided to carry the torpedo planes into proximity to their objectives, and H.M.S. "Engadine" and "Riviera" were fitted out for North Sea operations. Later, in May 1915, H.M.S. "Ben-my-Chree" was sent out to the Dardanelles as an aircraft carrier. She carried two torpedo seaplanes, in addition to reconnaissance aircraft. In 1916–7 the first torpedo planes were produced capable of flying off a ship's deck. About this time British naval authorities became convinced of the value of torpedo aircraft, and a large number were ordered. Delivery commenced in 1918 concurrently with special training of torpedo plane pilots, and in Oct. H.M.S. "Argus" embarked the first completed squadron of torpedo planes. In the first instance, experimental work was concentrated at Felixstowe in 1916, and in 1917 a torpedo seaplane school was established at Scapa Flow, which latter station was closed down after the Armistice. A torpedo seaplane school was also opened at Gosport, and experimental work and training is now carried out from here, pilots being embarked from time to time on board the aircraft carriers attached to the fleet.

In Aug. 1915 an attack was made on a 5,000-ton merchant ship by a short torpedo seaplane from H.M.S. "Ben-my-Chree" in the Dardanelles. A hit was obtained amidships, and spray and flying fragments observed. A few days later three Turkish ships at anchor were attacked, one being hit and subsequently gutted by fire, though the hull was salved. In the early part of 1917, the Germans, who had a squadron of torpedo planes at Zeebrugge, made several attacks on British merchant ships in the Downs. Three were sunk and one enemy aircraft shot down.

Construction.—In the British service the 18-in. and 21-in. torpedoes are the only sizes now made; the former are supplied for use in submarines, C.M.B.'s and aircraft, and the latter in capital ships, light cruisers and destroyers.

Constructed of steel plating, except for the air chamber, and of circular cross section, the profile of the torpedo is cigar-shaped, with a blunt-shaped head, a parallel portion and a fine run aft to the tail. Commencing from the forward end, the torpedo is divided into six compartments:—the head, the air vessel, the balance chamber, the engine room, the buoyancy chamber, the tail. These may be described as follows. (1) *The Head.*—There are two types, the War-head containing the explosive and the Collision-head used for practice. The former carries a charge of T.N.T. which is detonated on contact by a device known as the pistol, through the medium of a detonator of fulminate of mercury and a suitable priming charge. The pistol itself consists of a metal body which is screwed into the War-head and carries a striker which has externally projecting arms. On one of these arms, coming into contact with any object, the striker is forced in against the resistance of a shearing pin (which is provided for safety), and the detonator is struck. This in turn detonates the "primer" and the main charge. In the case of the "net cutter," used when attacking ships protected by nets, the action is similar, but the cutter is provided in addition with sheering devices for cutting through the meshes and opening up a hole sufficiently large to enable the torpedo to pass through. Nets are not now carried by modern capital ships of any nation, but the net cutter might be of use against net-defended bases. The Collision-head, used for practice, is a steel shell partially filled with cork to insure buoyancy in case of impact with a target ship. It is brought up to approximately War-head weight by filling it with water before practice running, and is so constructed that, on hitting, the fore part collapses, thereby lessening the blow on the plating of the ship and the shock on the torpedo itself. To facilitate recovery, an indicating light is fitted in a pocket in the Collision-head, consisting of phosphide of calcium in a tin container. On coming in contact with water this chemical has the property of spontaneously bursting into flame, which shows on the surface, thereby indicating the position of the torpedo. (2) *The Air Vessel.*—This consists of a special nickel-steel forging containing the compressed air which provides the motive power of the torpedo. It is closed at either end by special dome-shaped pieces, screwed and sweated into place. To the sides of the vessel are secured the lugs or brackets which take the weight of the torpedo in the case of above-water discharges and the stresses on the torpedo on discharge from submerged tubes. (3) *The Balance Chamber* is rivetted and sweated on to the after end of the air vessel, and forms a watertight compartment which contains the depth-keeping mechanism, the heater apparatus and the supply of fuel (either alcohol or petroleum in some form) in a special flask. In this compartment is also situated the charging valve and the stop valve in the main air pipe, which enables pressure to be isolated when it is necessary to remove the after part of the torpedo for examination of engines, etc. The depth-keeping mechanism, Mr. Whitehead's secret, consists of a pendulum weight and a hydrostatically operated valve, linked together by rods in such a manner that the weight corrects departures from the horizontal trim of the torpedo, whilst the valve keeps the torpedo at its set depth. Their joint action operates the horizontal rudders of the torpedo through the medium of a small air engine termed the servomotor. (4) *The Engine Room* is the next compartment abaft the balance chamber. It is not watertight, and together with the "buoyancy chamber," to which it is rivetted and sweated, forms what is known as the "afterbody." This portion of the torpedo is secured to the "air vessel—balance chamber" portion by a number of screwed bolts, which allows of the torpedo being easily "parted" for examination of the mechanism in the engine room. This mechanism consists of: (*a*) the engines, which are of the single-acting four-cylinder Brotherhood type; (*b*) the steering engine or servomotor; (*c*) the starting valve and counter gear; (*d*) the reducing valve, which maintains a constant reduced working pressure at the engines, irrespective of the air-vessel pressure, thus insuring an approximately constant speed throughout the set range; (*e*) oil bottles for lubricating various working parts. The starting valve is operated by an air-lever which projects through the shell of the torpedo and is thrown aft by a downward projecting bolt in the torpedo tube on discharge. In addition to opening the starting valves, the air-lever in its backward movement presses against a rod which releases the gyroscope. The counter gear, which is mounted on the starting valve casing is a piece of mechanism driven off the engines for stopping the torpedo at a pre-determined range. Off the counter is also driven the ignition gear, whose function is to fire the cordite igniters in the "heater" arrangement at a pre-determined moment, and start the combustion of the air and fuel. In the earlier torpedoes, the counter also operated the "sinking gear." This gear can be set to "float" for practice or "sink" for action and when set for the latter adjustment a small valve is lifted at the end of the run and water is admitted into the buoyancy chamber, thus sinking the torpedo, which might otherwise remain a dangerous floating mine. (5) *The Buoyancy Chamber* provides a large proportion of buoyancy of the torpedo, and consists of a thin sheet-steel shell, strengthened up by internal angle rings, to enable it to withstand external pressure, due either to immersion at great depths or to impulse pressures on discharge. To the foremost bulkhead of this compartment are secured the engines. Two watertight tubes run through it, one centrally carrying the propeller shaft, and the other to one side carrying the rod connecting the servomotor or steering engine, and the horizontal rudders. The sinking valve is on this bulkhead. The remaining fittings in this compartment consist of the gyroscope which is fixed to suitable brackets secured to the shell, and the gyroscope rudder rod, which passes through a watertight gland in the after bulkhead. A watertight removable door is also fitted at the bottom of the chamber to obtain access to the gyroscope. This piece of apparatus consists of a comparatively heavy bronze wheel, delicately mounted in ball bearings in an inner horizontal gymbal. This in turn is mounted in an outer vertical gymbal capable of rotational movement within the framework of the instrument. The wheel is initially spun at a high rate of revolution about its axis in the inner gymbal, due to the release of a strong spiral spring in torsion. This release takes place when the air-lever is thrown aft on discharge, after which the whole system of wheel and gymbals is freed from external constraint. The design is such that all axes of rotation of wheel and gymbals meet in a common point at the centre of gravity of the wheel. Consequently, in theory, if the instrument is in adjustment there are no external forces acting on the wheel or system except friction and windage, and, following the well-known dynamical laws of rotating bodies, the spinning axis tends to maintain its direction in space no matter how the apparatus is moved bodily. Practically, of course, slight errors do creep in, due to minute manufacturing differences, etc., but if the gyroscope is in good condition, the effect of these is barely noticeable until the initial wheel speed has dropped considerably. It will therefore be seen that the axis of the spinning wheel provides a datum line, the direction of which is the direction of the gyro wheel on release, *i.e.* in the longitudinal axis of the tube and torpedo. Subsequent deviations of the torpedo from the correct line in a horizontal plane, cause relative movement of the spinning axis, and fore and aft line of the torpedo. These relative movements are communicated to a delicate rotary valve through the medium of a small pin mounted on the outer gymbal. This rotary valve controls the air supply to a small steering engine which operates rudders on the vertical fins, so bringing the torpedo back to its original direction. (6) *The Tail* is a non-watertight conical steel shell carrying the horizontal and vertical fins and rudders. The fins are fixed to the tail and the rudders are carried in suitable brackets on their after edges. This portion of the torpedo also contains the gearing which enables the two four-bladed propellers to be driven in opposite directions off the same engine. The provision of two propellers is necessary in order that the torpedo shall remain upright during the run, and these are so shaped that the turning effect of one is balanced by that of the other.

The Director.—The name of "director" is given to the sight by means of which the firing officer is enabled to fire the torpedo at the correct moment. This he does by pressing a key which completes the circuit of the electrical portion of the firing gear at the tube. There are a number of types of sight extant, each of which has been designed to suit special conditions, chiefly as regards environment, *e.g.* the director on an above-water tube in a torpedo-boat destroyer, the director in the conning tower of a capital ship, etc. The same underlying principle obtains in every case. Suppose, a torpedo be discharged (*see* fig. 3) from A so as to hit a ship steaming in the direction BC at C. B is the position of the enemy ship at the moment of firing. Completing the triangle on a convenient scale, clearly

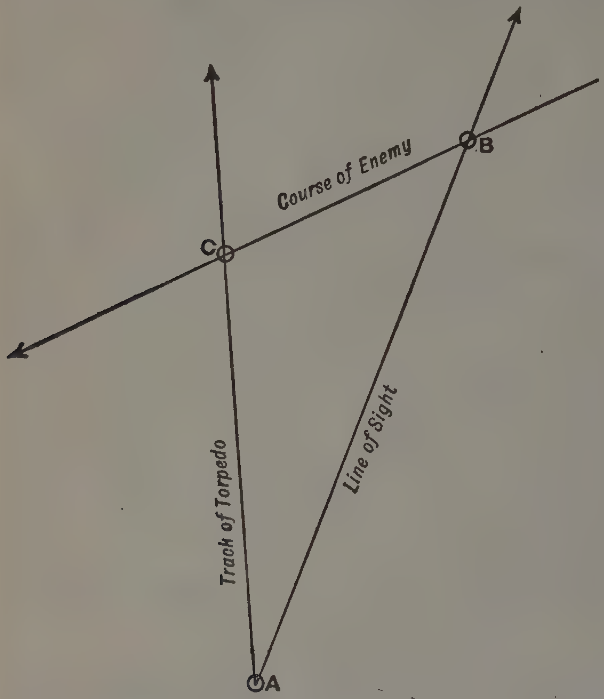

Fig. 3.—Diagram illustrating the principle of the Director Sight (A) on own ship at moment of firing, (B) target ship at moment of firing, (C) position of target when torpedo hits.

AC is to BC as "speed of torpedo" is to "speed of sailing"; and AB is the line of sight, its length and direction representing the velocity and direction of the torpedo relative to the target. Alternatively AC is to BC as the "running range of torpedo to hit" is to the "distance the target moves during time of flight of torpedo," and the length of AB is a measure of the firing range. In addition, if AC is taken to represent the maximum running range of the torpedo, the length AB is a measure of the maximum "possible shot" range under a given set of conditions as regards enemy speed and course. If the range-finder range when the sights come on is greater than that represented by the length AB, the torpedo will not reach its objective. It is obvious that a set of three bars, arranged so as to be capable of sliding and pivoting over each other, provide a torpedo sight which can be graduated so that the possible shot range can be read off direct after the sight is adjusted and torpedo fire withheld if necessary. Earlier types actually took this form, a foresight being fitted at the B end of the bar AB and a backsight at A.

It will be seen that the chances of obtaining hits with torpedoes are almost entirely dependent on the correct estimation of the enemy's course and speed, and the officer handling the instrument has to be a highly skilled specialist in these duties. It will also be seen that the *effect* of errors in estimation will vary in direct proportion to the number of ships comprising the target, and to the running range to obtain a hit, and are inversely proportional to the speed of the torpedo, for any particular speed of enemy. It is therefore clear that attacks on single ships under way are not likely to be successful unless carried out at short range, and that to insure success against an enemy fleet at long range, it is necessary to fire a large number of torpedoes. A large proportion of these will be wasted, but a torpedo-infested zone will result, which the enemy will find difficult to avoid, unless he is prepared to make large alterations of course, and these will undoubtedly affect the efficiency of his gunfire very seriously. The most obvious way of producing these torpedo-infested zones is to employ large numbers of torpedo-boat destroyers against the enemy, but this must not be considered to be an argument for the abolition of torpedo tubes in big ships, the mere fact that torpedoes are carried by opposing capital ships having a considerable bearing on the tactics employed and the ranges at which the action is fought. (W. M. M. R.)

TOSTI, SIR FRANCESCO PAOLO (1846–1916), composer and teacher of singing, was born at Ortona, Abruzzi, April 9 1846. He began his musical studies at Naples at the age of 14. In 1876 he paid his first visit to England; five years later he was appointed teacher of singing to the Royal family and settled in England. He published many songs, which from the first had a wide success, the most famous being "Goodbye," "Ask Me No More," and "For Ever." He was knighted in 1908. He died at Rome Dec. 2 1916.

TOURNEUX, JEAN MAURICE (1849–1916), French man of letters (*see* 27.107), died in Paris Jan. 13 1916.

TOWNSEND, MEREDITH WHITE (1831–1911), English journalist, was born at Bures, Suffolk, April 1 1831, and educated at Ipswich grammar school. In 1848 he went out to India, and four years later became editor of the *Friend of India*, acting also for some years as *Times* correspondent. In 1860 he returned to England and purchased the weekly *Spectator* (*see* 19.562). With R. H. Hutton he was joint-editor until 1898, and he was largely instrumental in making it an established success, writing most of the political articles and the opening paragraphs every week. His two chief publications were *The Great Governing Families of England* (1865), written in conjunction with Langton Sanford, and *Asia and Europe* (1901). He died at Little Bookham, Surrey, Oct. 21 1911.

TOWNSHEND, SIR CHARLES VERE FERRERS (1861–), British general, was born Feb. 21 1861, and joined the Royal Marines in 1881. He served at Suakin in 1884, and in the Nile expedition of the following year. He joined the Indian army in 1892 and was present in the Hunza-Nagar operations of that year. He greatly distinguished himself by his gallant defence of the Chitral fort during its prolonged siege in 1895, for which he was rewarded with the C.B. and a brevet majority. Then, in 1897–8, he served with the Egyptian army in the reconquest of the Sudan and won the D.S.O., shortly after which he was transferred to British Infantry. He served for some months in the field during the S. African War, was promoted colonel in 1904, was for some time on the staff in India, afterwards commanded a district in S. Africa, and was promoted major-general in 1911. He was then for some months in charge of a Territorial division at home, after which he went to India to command a brigade.

In April 1915 he was sent to Mesopotamia to take over command of the 6th (Indian) Division in that theatre of war. Aided by some other troops his division worked its way up the Tigris, driving the Turks out of more than one fortified position, and on Sept. 28 Townshend signally defeated the enemy near Kut-el-Amara and occupied the town, while detachments pursued the enemy halfway to Baghdad; shortly afterwards he was instructed to advance and occupy that city. On the move being made, he encountered the enemy in superior numbers at Ctesiphon, and after severe fighting was obliged to effect a retreat of 120 m. to Kut, and there he and his force were speedily hemmed in. A skilful and resolute defence was made, lasting 143 days till the end of April 1916 but then, supplies being exhausted and all efforts at relief having failed, he was obliged to capitulate. He was rewarded with the K.C.B. for his services. He remained a prisoner of war near Constantinople until Oct. 1918, when he acted as intermediary between the Porte and the Allies in adjusting the Armistice. He retired from the army in 1920, and entered Parliament as member for the Wrekin division of Shropshire.

TOY, CRAWFORD HOWELL (1836–1919), American Hebrew scholar (*see* 27.114), died in Cambridge, Mass., May 12 1919. In 1913 he published *Introduction to the History of Religions*.

TRACTORS.—The petrol tractor for agricultural and kindred purposes is a development of the steam traction engine, widely used for operating grain threshers and to a small extent for ploughing. Steam ploughs were used toward the end of the 19th century on the large ranches of the north-western section of the United States, in Canada and in Egypt. Their usefulness was limited, however, owing to their great weight, which resulted in the packing of the soil and in rather inefficient operation. When the weight of the petrol engine was greatly reduced by motor-car engineers, about 1900, the idea of substituting that type for the heavy steam plant naturally suggested itself.

The first petrol tractors seem to have been those built by the Huber Mfg. Co., of Marion, O., in 1898. These were not successful and only 30 were completed. In 1901 the Hart-Parr Mfg. Co., of Charles City, Ia., engaged in the manufacture of petrol tractors, and, although this company met with many difficulties, it was successful and, after 19 years of continuous manufacture, produced in 1920 5,000 tractors. There are two general types of agricultural tractor, the wheeled and the crawler, or caterpillar, types. The crawler type, in which the weight is spread over a large supporting surface on the ground, can pass over marshy land where the wheeled tractor would be mired, and when used for pulling barrows, seeders and other implements over ploughed ground, does not pack the soil as a wheeled tractor would. Early technical development was chiefly toward large tractors, designed to operate from 6 to 12 plough bottoms, because the only farmers who then took an interest in tractors were the owners of large ranches in western America. The largest producers of petrol tractors in the United States between 1905 and 1913 were manufacturers whose main line was general agricultural machinery and steam traction engines, such as the International Harvester Co., the J. I. Case T. M. Co., and Emerson-Brantingham Co. The large petrol tractors of that period were crude in design and very heavy; their frames were built up of heavy rolled channels, and they had driving wheels of enormous diameter. Their great weight naturally rendered them inefficient, for a large proportion of the engine power was consumed in moving the tractor itself. The oil-pull tractor shown in fig. 1 is characteristic of tractors of that period.

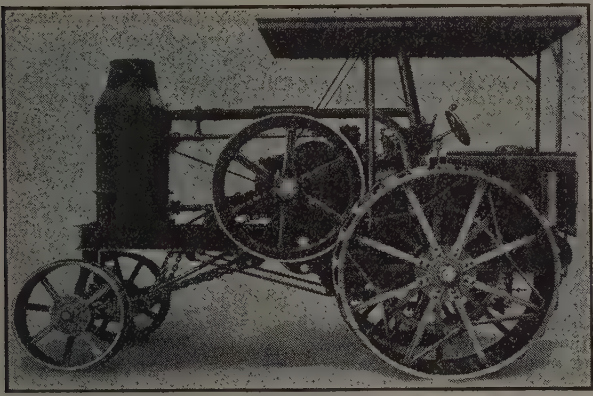

FIG. 1.

Agricultural Tractors.—Tractors are usually rated in terms of the number of 14-in. plough bottoms which they will pull. In 1920, of 100 models on the American market capable of pulling two or more bottoms, 20 were two-plough tractors; 42 three-plough; 17 four-plough and the rest were capable of pulling five or more ploughs. Table 1 shows the production of tractors in the United States each year from 1909 to 1920.

Table 1. Tractor Production in the United States.

1909	2,270	1915	21,900
1910	4,500	1916	29,670
1911	7,400	1917	62,742
1912	11,400	1918	132,697
1913	7,450	1919	136,162
1914	10,400	1920	203,300

According to a statement issued by the Ministry of Transport, there were 10,161 agricultural tractors in the United Kingdom in 1921. Of the tractors produced in the United States 14,854 were exported in 1917, 36,351 in 1918, 19,693 in 1919, and 29,143 (valued at $30,850,000) in 1920. It will be seen from the above table that a slump in tractor production occurred in 1913. It was in 1912 that the business in the large tractors of 6-to 12-plough capacities reached its zenith, and thereafter it declined rapidly. The first popular small tractor, the Bull, was brought out the following year, and in 1914, no fewer than 3,000 tractors of this make were sold. Although smaller, it was still of the same crude design as the larger machines, with exposed gears, plain bearings and similar features. About 1916 a number of engineers with motor-car experience entered the tractor field, and as a result of their efforts tractor design was greatly improved. Before 1920 many farm tractors were designed to use paraffin as fuel, because paraffin was considerably cheaper than petrol, and the conditions of engine operation on a tractor (constant speed and steady, heavy load) made it comparatively easy to burn paraffin with a moderate degree of success. Petrol, however, proved much more satisfactory in the average engine, and when in 1919 the price of paraffin advanced sharply, tractor users generally turned to petrol. The consumption of petrol in gallons per acre is less, there is less difficulty in cold weather and the oil in the crank case does not lose its lubricating value so quickly. For the sake of economical manufacture many of the earlier small tractors were made with only three wheels, but the buying public did not approve of this feature of construction, and the typical 1920 wheeled tractor had four wheels, two in front steering and two in the rear for driving. The Twin City 12–20 H.P. tractor shown in fig. 2 is a good example of the lighter tractors based on motor-car practice. The following is a composite description of a 1920 model three-plough tractor, the features mentioned being those found on the greatest number of models of this capacity; there was a four-cylinder, four-stroke vertical engine at the front, of about $4\frac{3}{4}$-in. bore by 6-in. stroke, adapted to burn either petrol or paraffin. Ignition was by a high-tension magneto with impulse starter. (The latter device consisted of a spring attachment for magnetos specially developed for use on tractors, which made it unnecessary to "spin" the heavy engines in order to generate a spark in the magneto.) The carburetor was fitted with an air cleaner, which prevented gritty dust from getting into the engine and rapidly wearing out the cylinder barrels. These air cleaners usually acted on the centrifugal principle, but in the lava-ash districts on the Pacific coast it was necessary to employ air washers, owing to the lightness of the dust. Behind the engine there was a friction clutch, and then came the change-speed gear, which gave two forward speeds and one reverse. The higher forward speed was for regular use in ploughing and the lower for emergencies, for ploughing up steep inclines, in heavy soil, etc. Then there was a further reduction by gears to the rear axle. The engine speed was limited by a governor to about 800 revolutions per minute, and as the ploughing speed was about $2\frac{3}{4}$ m.p.h., with 48-in. driving wheels, a reduction of roughly 40 to 1 had to be provided between engine crankshaft and rear axle or rear wheels. In the early tractors the final drive was through exposed bull gears directly on the driving wheels, but the typical 1920 tractor had all its gearing enclosed and protected from dust and mud, which is an important feature in a machine operating in the fields during the wet season as well as when the soil is dry and dusty. The wheelbase of the tractor was 96 in. and its weight about 5,000 pounds. The wheels were built up of rolled rims and flat spokes riveted to the hubs and rims. The driving wheels were provided with angle-iron lugs to increase the traction, and the front wheels with central skid rings to make the steering more positive. The front axle was swivelled to the frame at the middle, to permit the wheels to accommodate themselves to uneven ground. In addition to the pivot joint a spring could be used between the axle and the frame at the front to relieve shocks. These 1920 tractors were provided with a belt pulley for operating threshing

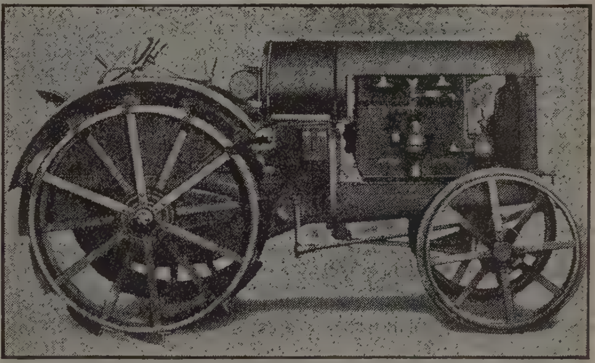

FIG. 2.

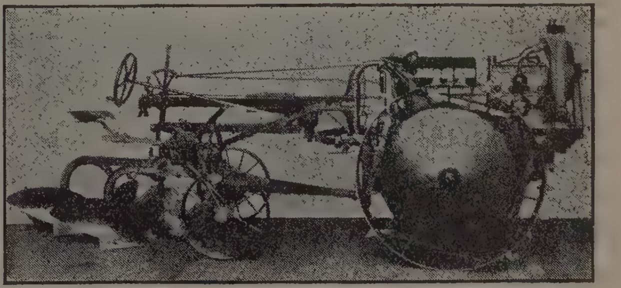

FIG. 3.

machines, wood saws, silo fillers, etc. It was customary to apply a double horse-power rating; for instance, a three-plough tractor was often rated as a 12–25 H.P. machine. This signified that the tractor could develop 25 H.P. on the belt and 12 H.P. on the drawbar, the difference of 13 H.P. being required for moving the tractor itself over the field. In 1917 the Society of Automotive Engineers standardized tractor belt speed at 2,600 ft. p.m. and the drawbar height at 17 inches. Another class of wheeled tractor, having only two wheels, is exemplified by the Moline Universal illustrated in fig. 3. This is intended for cultivating as well as for ploughing and similar work, and has the necessary clearance to pass over plants 2 ft. or more high. Another feature is that, by means of an extension to the control apparatus, it can be operated from the implement drawn, thus dispensing with the need for an extra man in operating a self-binder, for instance. The crawling tractor had one or two continuous-chain tracks on which it ran and which it carried with it. That portion of the chain track in contact with the ground had transverse projecting bars or depressions which caused it to grip the ground firmly, while the upper side of the lower portion of the chain formed a smooth track on which rolled idler wheels carried on the frame of the tractor. The power from the engine was transmitted through a suitable reduction gear to a pair of toothed wheels which engaged with teeth or rollers on the inner side of the track and, when power was applied by letting in the clutch, the tractor rolled ahead on the track and the track at the same time rolled forward. The power was applied to the two chain wheels through a differential gear, and in order to steer a tractor of this kind, one track was held stationary by means of a brake on the shaft of its chain wheel, while all the power was applied to the other chain wheel. The Cletrack tractor shown in fig. 4 was one of the smallest tractors of this type. Much of the development work in connexion with crawler tractors was done in California, where the Holt, the Best and the Yuba, all tractors made in large sizes, originated. The Holt, which is called a Caterpillar, became the prototype for the "tanks" which played such an important part in the World War. In 1920 many of these large crawler tractors were used for other than agricultural purposes—for example, in oil-fields, in lumbering and in road-building; and the city of New York that year purchased a large number for use in clearing the streets of snow. The lumbering or logging work done was mainly in swampy districts where previously it had been impossible to work with horses except in winter when the ground was frozen, whereas the crawler tractor made logging in such districts possible the year round. The weight on the track of a crawler tractor of the 1920 type was as low as 5 lb. per sq. in., and such a tractor could go into boggy places where no wheeled vehicle could follow.

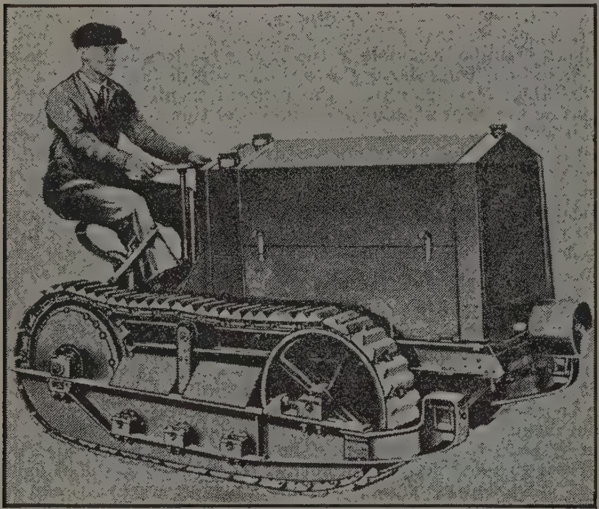

FIG. 4.

In 1919 the Legislature of the state of Nebraska passed a law providing that thereafter no tractor should be sold in that state until the manufacturer had first submitted a sample tractor for trial to the Agricultural Engineering Department of the university of Nebraska and the tractor had satisfactorily met the test required. The manufacturer must also satisfy the state authorities that he is maintaining an adequate supply of repair parts within the state. This legislation was the result of complaints of farmers that manufacturers were overrating their tractors. The result was that, during a period when 66 tractors were tested, the makers of 8 were compelled to increase their rated engine speed, 13 lowered their horse-power rating, 14 changed some part and 4 withdrew.

Cost of Tractor Ploughing.—The three chief items of cost in tractor ploughing are fuel, depreciation and labour. At the tractor trials held at Lincoln, England, in the autumn of 1919, the fuel consumption per ac. averaged almost exactly 4 imp. gal. for ploughing in heavy clay soil, and 3 gal. for ploughing on cliff lands. In the corn belt of the United States, where the soil is comparatively light, it has been customary to reckon on a fuel consumption (either petrol or paraffin) of 2·5 U.S. gal. (2 imp. gal.) per acre. On the other hand, in a bulletin of the U.S. Department of Agriculture on "The Gas Tractor in Eastern Farming," a fuel consumption of 3½ U.S. gal. per ac. is made the basis of cost calculations of the eastern section, and in the tractor trials held at Harrisburg, Pa., in 1919 the average fuel consumption of all tractors using paraffin worked out at 3·28 U.S. gal. (2·62 imp. gal.) per acre. The fuel consumption in tractor ploughing varies both with the character and condition of the soil and with the depth of ploughing. The average depth of ploughing at Lincoln was 5¾ inches. The resistance of the soil (drawbar pull) averaged 11·5 lb. per sq. in. for the heavy clay soil and 9 lb. per sq. in. for the cliff land. In the corn belt of the United States the soil resistance generally varies between 5·5 and 7 lb. per sq. in., and this explains the low fuel consumption in ploughing there. The estimate here given of the cost of ploughing one acre is based on the results of an inquiry by the U.S. Department of Agriculture among 400 tractor farmers in the Dakotas concerning their experiences in 1917 and 1918. Only one change is made from the estimate of the department, namely, the assumption of a tractor life of seven instead of nine years, which latter figure is admittedly too high. The answers to the questionnaire yielded the averages shown in Table 2.

Table 2. Average Cost and Performance of Tractor Ploughing in the Dakotas.

	Two-plough Tractors	Three-plough Tractors	Four-plough Tractors
First cost . . .	$1,050	$1,460	$2,000
Full working days per year.	45	52	64
Acres ploughed per 10-hr. day	6·3	8·5	10·9

Other factors on which the estimate is based are the following: Cost of petrol, $.276 per U.S. gal.; paraffin, $.152 per gal.; lubricating oil, $.50 per gal.; grease $.10 per lb.; repairs, 4% of first cost per year; depreciation on a 7-year basis; man labour at $4.00 per day; interest at 6% on the average investment (one-half of total investment). Such items as housing, insurance and taxes are neglected.

Table 3. Cost of Tractor Ploughing in the Dakotas 1917–8.
(Dollars per acre)

Size of Tractor	Total Cost of Ploughing		Fuel		Oil
	Petrol Tractor	Paraffin Tractor	Petrol	Paraffin	
Two-plough . . .	2·21	1·915	0·69	0·395	0·075
Three-plough . .	1·975	1·68	0·69	0·395	0·075
Four-plough . . .	1·757	1·462	0·69	0·395	0·075
Other Items					
	Grease	Repairs	Depreciation	Man Labour	Interest
Two-plough . . .	0·02	0·15	0·53	0·635	0·11
Three-plough . .	0·02	0·13	0·49	0·47	0·10
Four-plough . . .	0·02	0·11	0·409	0·368	0·085

With the data here indicated it is possible to make a close estimate of the cost of tractor ploughing under different conditions, as all the basic costs are given. The average soil resistance in the Dakotas may be assumed to be 8 lb. per sq. inch. In heavier soils the area ploughed per day will be less in substantially the inverse ratio of the soil resistance (provided the latter is not excessive). This is borne out by estimates of the ploughing capacities of the tractors which competed in the Lincoln trials of 1919, made by the judges of the event. Averaging the estimates for heavy clay soil (soil resistance 11·5 lb. per sq. in.), and reckoning on the basis of a 10-hr. instead of an 8-hr. day, the following results are obtained: Two-plough tractor, 4½ ac., three-plough tractor, 5⅝ ac., four-plough tractor, 6⅔ acres.

To the American and Canadian farmer the advantage of the tractor is not so much that it reduces the cost of ploughing as compared with horses, as that it enables one man to work a much greater acreage. Approximately one-third of several hundred tractor farmers in Illinois circularized by the U.S. Department of Agriculture had increased their acreage by purchasing tractors. Another great advantage is that the tractor permits work to be done quickly when the weather is favourable. For instance, a southern Illinois farmer estimates that in his neighbourhood the yield of Indian corn is reduced by 1 bus. per acre for every day that planting is delayed after May 8. In 1920 the spring was so wet that he was able to work in the field only the first day and the last day of April, not a day in between; but when the weather turned he was able, owing to his tractors, to get his crop in quickly.

Power farming has proved particularly advantageous in the wheat belt of Kansas. For the best yield the land must be ploughed in Aug., when the temperature is often above 100° F. in the shade and very little work can be accomplished with horses. The tractor works as efficiently at this temperature as in winter. Moreover, the tractor can be used also for threshing, and the old practice of contract threshing has been largely superseded by the plan of four or five farmers owning a small threshing machine coöperatively and helping each other thresh their grain, each using his own tractor as the motive power. A three-plough tractor is generally recommended for a 20x36 in. grain separator. Sometimes it is necessary to get a crop into the ground very quickly, and, with a double shift of operators, tractors can then be operated continuously day and night.

Interest in farm tractors increased greatly in Europe during and following the World War. In 1919 and 1920 tractor trials were held at Lincoln, England, the first under the auspices of the Society of Motor Manufacturers and Traders and the second under that of the Royal Agricultural Society. The French Government in 1920 paid a bonus of 25 % on the purchase price of tractors of domestic manufacture and 10 % on tractors of foreign manufacture. During the war the British, French and Italian Governments contracted for large numbers of farm tractors in the United States. In 1919 there was an international tractor demonstration and test at Säbyholm, Denmark, in which Danish, Swedish, German, British and American tractors were entered. Several demonstrations were also held in France in the years immediately following the World War; French engineers paid particular attention to tractors for use in vineyards, which must be very narrow. Those for use in orchards, on which a number of American manufacturers specialize, must be very low. A somewhat distinct type is the garden tractor for the cultivation of row crops and general work in market gardening. The Beeman, the first model of this type, was put on the market in 1915, and in 1919 about half a dozen other tractors of this type were brought out. For rubber-tired road tractors, see MOTOR VEHICLES; for artillery tractors, see ARTILLERY.

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TRACY, BENJAMIN FRANKLIN (1830–1915), American soldier (*see* 27.127), died in New York City Aug. 6 1915.

TRADE BOARDS.—An important factor in the regulation of wages in England is now represented by the functioning of the trade boards. The Trade Boards Act of 1909 was passed, as a result of considerable agitation on behalf of workers who were employed under "sweated" conditions, with a view to providing machinery by which their wages might be raised to a more satisfactory level.

This Act applied at once to four trades, namely: (1) readymade and wholesale bespoke tailoring and any other branch of tailoring in which the board of trade considered the system of manufacture was generally similar to that prevailing in the wholesale trade; (2) the making of boxes or parts thereof made wholly or partially of cardboard, chip, or similar material; (3) machine-made lace and net finishing and the mending or darning operations of lace curtains and lace finishing; (4) hammered and dollied or tommied chain-making. Provision was further made that the Act should be applied to other trades by Provisional Order if the board of trade was satisfied that the rate of wages prevailing in any branch of those trades was exceptionally low as compared with that in other employments. These Provisional Orders required confirmation by Parliament.

In addition to the trades originally specified four trades were subsequently added under the Provisional Order procedure, making a total of eight. The small number of trades to which the Act of 1909 was applied was due partly to the fact that the procedure by Provisional Order was necessarily a slow and cumbrous process, and partly to the severe limits imposed by the provision that a board could only be established where wages were exceptionally low.

In 1918 an amending Act largely extended the scope of the previous Act. During the World War the whole basis of the payment of wages to women had been altered by the Orders made by the Minister of Munitions under Section 6 of the Munitions Act of 1916; and, for a number of women largely in excess of a million, the provisional rate at the conclusion of the war was in the neighbourhood of 7d. to 8d. per hour. It was recognized that if upon the return of peace the protection offered by the Munitions Acts was suddenly withdrawn a reduction of wages of a very disturbing character might ensue, and that it was desirable that the large number of persons, both men and women, in the unorganized trades, should have a similar measure of protection to that which had been already offered by the Trade Boards Act to those whom it covered.

The new Act made two amendments of a far-reaching character:—

(*a*) The minister was empowered to apply it to any specified trade "if he is of opinion that no adequate machinery exists for the effective regulation of wages throughout the trade, and that accordingly, having regard to the rates of wages prevailing in the trade, or any part of the trade, it is expedient that the Act should apply to that trade."

(*b*) In place of the procedure for application of the Acts by Provisional Order, provision was made for the making of a special Administrative Order, the latter a shorter process than the former, although revision of the minister's proposals by Parliament is still provided for.

Further amendments made by the new Act extended the powers of trade boards with regard to the classes of rates of wages which they could fix, and gave them also the right of requiring Government departments to consider any proposal concerning the conditions in their trade which they might care to make.

The effect of the new Act was to make the Acts applicable to a much larger area of industry and to render legislation no longer a means of protection for sweated trades only. This extension of the scope of the Trade Boards Acts, apart from its desirability, having regard to the special conditions likely to prevail during the reconstruction period, was recommended also by the Committee on the Relations between Employers and Employed, presided over by Mr. J. H. Whitley, M.P. This Committee subsequently recommended that, while joint industrial councils should be established for trades which were sufficiently organized to control their own wage matters, it was equally desirable that trade boards should be established for trades which had not yet reached that degree of organization on both sides which would make possible the complete observance of agreements arrived at between organizations. It was made clear that there was no conflict between the two forms of joint organization, and that each was adapted to and intended for a different degree of organization in the trades concerned. In practice the principle indicated by the Whitley Committee was the guiding principle in the establishment of joint industrial councils and trade boards.

A rapid extension of existing trade boards followed, with the result that, at the end of 1920, 49 additional trade boards for England, Scotland, Wales and Ireland had been set up in the following trades, covering about 3½ million persons:—

Great Britain.

Boot and shoe repairing.
Brush and broom.
Button making.
Coffin furniture and cerement making.
Corset.
Cotton waste.
Flax and hemp spinning and weaving.
Fur.
General waste.
Hair, bass and fibre.
Jute spinning and weaving.
Laundry.
Linen and cotton handkerchief, etc.
Made-up textiles.
Paper bag.
Perambulator and invalid carriage.
Pin, hook and eye and snap fastener.
[1] Retail bespoke tailoring.
Readymade and wholesale bespoke tailoring.
Rope, twine and net.
Stamped or pressed metal wares.
Tobacco.
Toy.
Wholesale mantle and costume.

England and Wales.

Aerated waters.
Dressmaking and women's light clothing.
Grocery and provisions.
Hat, cap and millinery.
Milk distributive.

Scotland.

Aerated waters.
Dressmaking and women's light clothing.
Hat, cap and millinery.
Milk distributive.
Grocery and provisions.

Ireland.

Aerated waters.
Boot and shoe repairing.
Brush and broom.
Dressmaking and women's light clothing.
Flax and hemp spinning and weaving.
General waste.
Hat, cap and millinery.
Laundry.
Linen and cotton handkerchief, etc.
Milk distributive.
[1] Retail bespoke tailoring.
Readymade and wholesale bespoke tailoring.
Rope, twine and net.
Tobacco.
Wholesale mantle and costume.

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[1] Previously the Readymade Tailoring Trade Board (1909). In 1919 two new boards were constituted.

The Trade Boards Acts provide for the appointment of joint bodies, consisting of an equal number of employers' and workers' representatives, together with a minority, usually three or five, independent members known as appointed members. In trades in which women are employed one of the appointed members is a woman. The members of trade boards are all appointed by the Minister of Labour (originally the president of the Board of Trade), who, in the appointment of the employers' and workers' representatives, is bound to consult the organizations on each side respectively. The appointed members are impartial persons of standing nominated by the minister. The procedure of the boards is regulated by statutory regulations made by the Minister of Labour. Such regulations usually make provisions for a method of voting, and the regular reconstitution of the board; in all cases it is provided that no new appointment shall be made to the board by the minister until the board has had an opportunity of being heard. The boards are provided with secretarial assistance by the Ministry of Labour. They have power to form district committees for such areas as they may consider to be necessary, the members of which, like the members of the boards themselves, are appointed by the Ministry of Labour.

The boards are compelled, unless the Minister of Labour relieves them of the duty, to fix a general minimum time-rate for the workers engaged in the trades concerned. A trade board must also in certain cases fix special minimum piece-rates on the application of an employer. A board has power also, if it so desires, to fix general minimum piece-rates, guaranteed minimum time-rates, overtime-rates, rates for special classes of workers, rates for special areas, rates for special processes, rates for any class of work in any special process or in any special area and piece-work basis time-rates. Rates may be fixed so as to come into operation successively on the expiration of specified periods, or to be valid during a specified period. For the purposes of fixing overtime-rates a trade board may declare what are the normal number of hours in the trade during which ordinary rates of wages are payable, but they have no power to limit the number of hours worked.

In fixing a minimum rate so as to apply to any class of workers in a trade, a board may attach to the fixing of the minimum rate a condition that workers who are members of a class must be holders of a certificate from the trade board, or, if the persons are learners, such conditions as the trade board considers necessary for the instruction of these persons in the trade.

Decisions of trade boards come into obligatory operation by confirming order of the Minister of Labour, and the determinations of trade boards have no force until so confirmed. A board's proposals must be published for two months, during which time employers or workers may lodge objections. On the expiration of the two months the board may proceed to fix the rates. If, in the light of objections, they wish to make substantial alterations, they must issue new proposals. The rates when fixed are sent to the Minister of Labour, who must forthwith take them into consideration and, except in special circumstances, either make an order within a month making the rates obligatory or refer them to the board for reconsideration. By this procedure all those engaged in the trade are fully informed as to the proposals, and are given full opportunity of making observations on them, and, further, Parliament, through the Minister of Labour, can be assured that conditions harmful to the general interests of the community are not made binding by statutory rates. If district committees have been established, a trade board, before proposing rates, is compelled to give the district committee concerned an opportunity of being heard on the subject.

The Minister of Labour may at any time direct a trade board to reconsider rates of wages which may be in operation, although he has no power himself to fix rates of wages.

When rates of wages have been made operative they are enforced by inspectors appointed by the Ministry of Labour, and penalties for offences, such as non-payment of rates of wages, failure to post such rates, or keep records, are punishable by fine or imprisonment.

A trade board has power to exempt employers from the payment of minimum rates of wages in respect of workers who, through age or infirmity, are rendered incapable of earning the minimum time-rate, provided that the cases cannot suitably be met in the opinion of the board by employing the worker on piece-work.

Apart from the fixing of minimum rates of wages, the certification of learners and statutory and wage-fixing duties, the trade boards also act as joint consultative bodies for their trades, and have been so recognized by the Government for the purpose of advising them as to the training of disabled men, the training of apprentices, the settlement of disputes and other important matters.

In Sept. 1921 a Committee of Inquiry into the working of the Trade Boards (which was being severely criticized in various quarters) was appointed by the Ministry of Labour, under the chairmanship of Viscount Cave. (H. Wf.)

TRADE UNIONS (*see* 27.140*).—The history of Trade Unionism in the United Kingdom and in the United States, during 1911–21, is dealt with in detail, in separate sections, below; and in the various articles under country headings information regarding foreign countries will be found. The industrial unrest of the years immediately preceding the World War was not by any means confined to Great Britain, and in the chief industrial countries notable developments took place in the growth of trade unionism. Trade unions in such countries as France, Germany, Belgium and Austria, where the movement was of comparatively early growth, received large accessions of membership, and trade unions arose in other countries where any form of labour association had been hitherto unknown. Even before the war, however, there were certain notable exceptions. In Russia and Japan, for example, every form of trade union was illegal, and persons participating in trade union organizations did so at the risk of death or imprisonment. Trade unions, therefore, in those countries, either were secret associations working underground, or masqueraded under the guise of friendly societies or other bodies of a similar character. The war had many diverse effects on the various trade union movements. In the Central European countries the privations of the last two years of the war were reflected in a great falling-off in trade union membership. In Germany this was more than compensated for by the reliance of the Republican governments which followed the Armistice upon the help of the trade unions. This brought to the trade unions a great number of new members, with the result that in 1920 the German trade union movement was actually the largest in the world. In Hungary, on the other hand, the "White" government of the regent Horthy, which succeeded the short-lived Soviet republic of 1919, put down Trade Unionism with the utmost severity, some 70% of the leaders being executed. In the new States created by the Treaty of Versailles, trade unionism was in 1921 generally weak, owing to the existence of strong nationalist movements which absorbed the energies of the population; but in some, such as Czechoslovakia, having a large industrial element, there was a trade union movement of some size. In Russia, on the other hand, the trade unions were an integral part of the Soviet Government, and hence the inducement to the average workman to become a trade unionist was greater than in any other country.

International Trade Union Associations.—The chief international trade union body is the International Federation of Trade Unions, to which most of the chief national trade union bodies are affiliated. Its headquarters are in Amsterdam, and in 1921 it had a membership of just under 24 millions. There was an International Federation of Trade Unions in existence before the World War, to which 19 countries were affiliated, with a membership of about seven and a half millions. The structure of this Federation was extremely loose; its activities included the issue of statistics and reports, the passing of resolutions on social legislation, the promotion of unity within the national movements, and the arrangement of international appeals for funds; but as a whole it was of little importance. For instance, the British Trade Union Congress was not affiliated, Great Britain's representative on the International being the General Federation of Trade Unions. Its centre was at Berlin. During the war this Federation fell to pieces, and a new one, the present Federation was founded in 1919. Twenty-four countries were affiliated in 1921, the most important exception being the American Federation of Labor.

The structure of the International Federation of Trade Unions remains very loose. It endeavours to promote the interests of the affiliated bodies and of trade unionism in countries not affiliated, to prevent international blacklegging, to provide funds for purposes laid down in the rules and to promote combined action on questions of trade union interest. In 1920 the Federation attempted, in pursuit of the last object, to carry out a blockade of the White Government in Hungary by international action, but the blockade was unsuccessful. The Federation makes no attempt to interfere with the policy or organization of its affiliated membership. In contrast, the International Council of Trade and Industrial Unions (the "Red" Trade Union International) was found to act, in its own words, as a "militant international committee for the reorganization of the trade union movement." Its headquarters in 1921 were at Moscow and it was dominated by the ideals and influence of the Russian Communist party. It would only accept as members trade unions or minorities of trade unions which it recognized as revolutionary bodies. Besides these two general groupings, there were in 1921 a number of international federations of workers in different trades, of ever varying membership and importance. A list of these, with their membership, where known, and headquarters, is given in the table on page 744.

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* *These figures indicate the volume and page number of the previous article.*

A table is also given showing comprehensively the membership of trade unions in different countries after the war. This table does not take into account some minor associations and trade unions which are not for various reasons affiliated to any of the important central bodies. Nor does it include overlapping membership, *e.g.* in Great Britain the General Federation of Trade Unions, whose members are also affiliated to the Trades Union Congress. In such countries as Brazil, Armenia, Lithuania, Turkey, Ukraine, China, the state of organization is not sufficient to include them. In some countries which have been included the figures of membership given are approximate only. This is naturally the case where trade unionism is subject to severe repression, or where a particular organization, such as the Industrial Workers of the World in the United States, has come under the ban of the executive.

Membership of Trade Unions in Different Countries after the War.

	Central Organization	No. of Trade Unionists Affiliated	Membership of International Federation July 1921
EUROPE:			
Austria (1919)	Trade Union Commission	928,146	1,000,000
Belgium (1920)	Industrial Branch of Parti Ouvrier Belge	670,000	718,410
Bulgaria (1920)	General Federation of Trade Unions (Social Democratic)	28,000	4,000
Czechoslovakia (1920)	Federation of Czechoslovakia Trade Unions	352,000	740,000
	Federation of German Trade Unions	360,000	..
Denmark (1919)	Federation of Trade Unions	277,392	279,255
	Association of Free Trade Unions (Syndicalist)	80,000	..
Esthonia (1919)	Trade Union Congress	30,000	..
Finland (1920)	Trade Union Federation	55,000	..
France (1920)	Confédération Générale du Travail	1,500,000	1,500,000
Germany (1919)	Allgemeiner Deutscher Gewerkschaftsbund	7,338,132	8,000,000 ..
	Hirsch-Duncker Trade Unions	102,108	..
	Federation of German Trade Associations	1,700,000	..
	Independent Unions (1918)	214,360	..
	Alliance of Clerical and Technical Employees (1918)	270,000	..
Great Britain (1920)	Trade Union Congress	6,505,482	6,600,000
Greece (1920)	General Confederation of Labour	60,000	170,000
Holland (1920)	Federation of Trade Unions	250,000	216,581
	National Labour Secretariat (Syndicalist)	50,000	..
	Christian Trade Union Federation	70,000	..
	Roman Catholic Trade Union Bureau	150,000	..
Holland (*continued*)	General Trade Union Federation (non-political)	50,000	..
Hungary (1920)	Ungarländischer Gewerkschaftsrat	215,000	152,441
Iceland	Four Trade Unions	Not	known
Ireland (1920)	Irish Trades Union Congress and Labour Party	300,000	..
	Membership of Ulster Unions	40,000	..
Italy (1920)	Confederazione Generale del Lavoro	2,000,000	2,055,773
	Unione Sindacale Italiana	150,000	..
	General Secretariat of Professional Unions (Catholic)	100,000	...
Latvia	. . . . .	25,000	30,000
Luxemburg (1920)	Commission Syndicale de Luxembourg	27,000	27,000
Norway (1920)	National Trade Union Federation	150,000	150,000
Poland (1920)	Trade Union Congress	948,000	403,138
Portugal (1919)	Confederação General do Trabalho	100,000	..
Rumania (1920)	Trade Union Wing of Social-Democratic Labour Party	200,000	..
Russia (1920)	All-Russian Congress of Trade Unions	5,222,000	..
Spain (1920)	Confederacion General del Trabajo	800,000	240,113
	Union General de Trabajadores	300,000	..
Sweden (1920)	National Federation of Trade Unions	280,987	277,242
Switzerland (1920)	Federation of Trade Unions	225,000	223,558
Yugoslavia (1920)	Centraluo Radmitchko Sindikalno Vetche	250,000	25,000
AMERICA:			
United States (1920)	American Federation of Labor	4,079,740	..
	Industrial Workers of the World (1919)	about 70,000	..
Canada (1919)	Dominion Trades and Labour Congress	173,463	260,000
	Total Trade Unionists in Canada	378,047	..
	"One Big Union" (1920) about	40,000	..
Argentina (1920)	Federacion Obrera Regional Argentina	70,000	749,518
	Other Unions and Federations	40,000	..
Chile (1920)	No Central Authority	c.20,000	..
Mexico (1921)	Regional Confederation of Labour	c.500,000	..
	Syndicalist and Communist Federation	..	..
Peru	Federation of Artizans and General Federation of Workers	c.25,000	25,000
ASIA:			
India	Indian Trades Union Congress	unknown	..
Japan	Japanese Federation of Trade Unions	unknown	..
	Federation of Trade Unions of Western Japan	unknown	..
AFRICA:			
South Africa (1920)	South African Industrial Federation	60,000	60,000
AUSTRALASIA:			
Australia (1919)	No Central Body	627,685	..
New Zealand (1920)	New Zealand Workers' Union and Alliance of Workers	82,553	..

International Trade Union Federations and Estimated Membership, 1919–1920.

Industry	Membership	Headquarters
Agriculture	2,133,835	Holland
Baking	..	Switzerland
Bookbinding	249,667	Switzerland
Boot, Shoe, and Leather Trades	..	Germany
Building Trades	800,000	Germany
Carpenters	..	Germany
Commercial and Clerical Employment	1,000,000	Holland
Diamond Workers	27,000	Belgium
Factory Industry	2,417,300	Holland
Food and Drink Trades	331,374	Switzerland
Fur Trade	..	Germany
Glass Trades	..	Germany
Hairdressing	..	Germany
Hat Trades	..	Germany
Hotels and Restaurants	200,000	Holland
Lithographic Printing	..	Belgium
Metal Trades	3,200,000	Switzerland
Mining	2,606,215	Great Britain
Painters	74,470	Germany
Paviors	..	Germany
Post Office	520,000	Austria
Pottery Trades	..	Germany
Printing Trades	..	Switzerland
Saddlers	..	Germany
Mercantile Marine	..	Belgium
State and Municipal Employment	..	Holland
Stonemasons	155,350	Switzerland
Tailoring Trades	..	Holland
Textile Trades	..	Great Britain
Tobacco Trades	..	Holland
Transport (excluding Railways and Mercantile Marine)	2,560,000	Holland
Woodworking Trades	800,000	Holland

UNITED KINGDOM

The history of British trade unionism in 1911–21 was one of almost continuous and unparalleled expansion. Not only did the percentage of trade unionists in all trades materially increase, and the trades and industries in which trade unionism was previously almost unknown reach a comparatively well-organized condition, but the status of trade unions enormously increased and their programmes and policy were canvassed in quarters where before 1910 they met with no attention.

In numbers alone the growth is sufficiently remarkable. At the end of 1910 the Board of Trade reckoned the total number of trade unionists as 2,435,704; at the end of 1919 the official figure was 8,023,761. At the annual Trades Union Congress of 1910 the number of trade unionists represented was 1,639,853; in 1921, it was 6,389,123. This increase was not, of course, evenly distributed between the several industries, though all received a certain share. It was most remarkable on the railways and in agriculture, among employees of the State, such as postal workers and civil servants, among semi-skilled and unskilled workers and women, in several minor industries, particularly those affected by the Trade Boards Acts, and in the later years among professionals and "salary-earners." Draughtsmen, foremen, architects, professional engineers, actors, law clerks and commercial travellers are only a few of the classes in which trade unionism found a new foothold, while in professions such as teaching and journalism it gained a great deal of ground.

The causes of this great increase are many, some operating generally and some in particular cases only. Undoubtedly a very potent factor in all cases was good trade. Trade unions have always, throughout their history, tended to flourish in times of good trade and to decline in trade depressions, when unemployment makes the weekly contribution a serious drain on their members' pockets, and unemployed benefit uses up the central funds. The years from 1910 to 1914 were years of comparatively good trade, and, after the first shock of war was over, they were followed by such a trade boom as had never been known. With five millions of workers withdrawn to the colours, needing to be clothed and provisioned and supplied with munitions, the demand for the services of those who remained was enormous. There was practically no unemployment during the war, and, although wages did not begin to rise until many months after the war started, they yet rose much more rapidly than trade union contributions, so that the worker found the burden of contributing to a trade union relatively light. The boom continued long after the Armistice, and it was not until 1920–1921 that the subsequent depression began to be heavily felt.

The factor of good trade would reflect favourably upon trade union membership whether in war or peace; but the war years gave an impetus of another kind to organization on trade union lines. From the Treasury Agreement (March 1915) onwards, the Government recognized the trade unions in essential industries as part of the economic and political structure of the country. They were called in to assist in the production of munitions, to share in the running of Government controls, in such cases as the Cotton and Wool Control Boards, and particularly to coöperate in the selection of men for the army. In many cases the trade unions succeeded in gaining exemption for men engaged upon certain occupations, and at one time certain unions were even empowered to issue Trade Cards to their members, protecting them from military service. They were also of necessity consulted in the "dilution" and "substitution" of labour, and they entered into a very large number of agreements fixing the conditions upon which dilutees should be employed, the wages they were to receive, and the restoration of normal practices at the end of the war.

At the same time the cost of living was rising rapidly, and the trade unions were the bodies concerned with demanding commensurate increases in wages. Thus the average worker found that whether he wished to preserve his standard of life, to retain his exemption from the army, or to secure his job against his return, the best way was to become a member of his trade union; and the Government, which preferred in general to negotiate with representative bodies, whether of workmen or employers, contributed in no small degree to their growth.

Again, certain legislative enactments played a large part in increasing trade union membership. Of these, undoubtedly the most important was the National Insurance Act of 1911, with its subsequent amendments. The Act of 1911 was divided into two parts, Health and Unemployment Insurance, and these parts were subsequently amended by separate Acts. Under the Act dealing with Health Insurance, State benefit payable to insured persons who fell ill is administered by Approved Societies, and a number of trade unions, in order to secure closer contact with the workmen in their industries, decided to form Trade Union Approved Societies for the purpose of administering Health Insurance. Many trade unions thus gained a number of members who joined for health insurance and became full trade unionists, as in most cases they were not allowed to join the Approved Society only.

Unemployment Insurance was originally a much smaller experiment, covered by Part II. of the 1911 Act; but it gained considerably in importance when the Government in 1920 compulsorily included under unemployment insurance all the industries of the country in which there was any appreciable amount of unemployment. Under the new Act, trade unions which ordinarily paid unemployed benefit were allowed, subject to certain conditions, to administer the State benefit to their members, an allowance being made to them, under certain conditions, for administration costs, and a considerable number of them availed themselves of these provisions. Some trade unions, particularly those catering for skilled workers, also act as labour exchanges for their trades, notifying vacancies and supplying workers, where they are wanted.

Two further enactments, the Trade Boards Act of 1909 (amended and widened in 1918), and the Corn Production Act of 1917, which set up Agricultural Wages Boards with power to fix binding rates of wages, did much to increase the membership of trade unions, particularly in lowly paid industries. It is a commonplace of trade union organization that very low wages make labour difficult to organize, and the Trade Boards and the Agricultural Wages Boards, by raising the rates of the lowest paid classes, enabled them for the first time to afford trade union contributions. The results of this can be seen from the agricultural industry, whose trade union membership rose to approximately 300,000 in the summer of 1921, when the repeal of the Corn Production Acts abolished the Agricultural Wages Boards. Something of the same result was achieved by the fixing of rates of wages under the Munitions of War Acts for women and unskilled workers in the munitions trades, and their subsequent stabilization for a year and a half after the Armistice.

The last of the causes contributing to trade union growth is impossible to estimate in terms of figures. From 1910 onwards the working classes showed a diminished faith in political action, and a belief in industrial action, strikes and the power of large industrial organization. The theories of French Syndicalists and American Industrial Unionists, and later of English Guild Socialists, began to gain ground, and these all stressed the importance of strong trade unions, and the necessity for "blackleg-proof" organizations. All these tendencies combined to drive the workman into his trade union, and to induce him to canvass among his fellows, and the assumption that a worker must be a trade unionist steadily gained ground.

Nearly every trade union showed an actual increase of membership in the decade. But beside this, there was a marked tendency towards larger industrial groupings. A large majority of the trade unions known to the Ministry of Labour are small local societies, survivals of an earlier period, having in many cases no more than a hundred or two hundred members, and of no practical importance. Even in 1910 practically the whole effective force of the trade union movement was confined to about a hundred societies, and further amalgamations, speeded up by the Trade Union Amalgamation Act of 1917, which lessened the restrictions upon amalgamation, had by 1921 reduced the number to something like fifty. Thus, large national associations have come into existence on the railways, in road and water transport, in the Post Office, the iron and steel trades, the building trades and the woodworking trades, and the distributive industry; the various unions of general workers are now united in a single federation, and many other schemes of union were in 1921 either in process or under discussion. The movement towards federation is no less important than the amalgamation movement proper. In many cases, where the existence of many trade unions on differing financial bases render amalgamation difficult, there are often formed strong federations which fulfil many of the functions of a single organization. Of this kind are the federations in the building, printing and transport industries, and among general workers. In contrast to this unitary tendency must be mentioned the newer unions of non-manual workers, who are in most cases organized separately from their manual fellows, but even here the tendency to federate or in other ways to ally themselves with the unions of manual workers is evident.

This tendency towards large aggregations must be set down partly to the increased integration of capital since the beginning of the century, and partly to the theories of workers' control and industrial unionism, which have been making rapid headway. The day of the small master, and even of the single firm, is all but over, and the tendency of workers in the employ of one employer or of one company to unite in a single union is a natural sequel. The influence of the movement towards workers' control is equally obvious. Where trade unions were content to be "continuous associations of wage-earners for the purpose of maintaining or improving the conditions of their employment" (S. & B. Webb, *History of Trade Unionism*, 1892 edition), the "craft" or "kindred craft" union, which organized together workers employed on a single process or on processes nearly related, was a sufficient instrument. But as the plans of the Syndicalists, the Guild Socialists, and others for the "control of each industry by the workers engaged therein" gained ground, the old craft union was regarded as ineffective, and plans were made on all sides for the absorption of all workers engaged in a single industry into one organization. Many of the important amalgamations mentioned above are due to this idea, though it must not be assumed that the whole or even the major part of the British trade union movement is organized on industrial lines. Craft unions and "kindred craft" unions continue to exist in a number of trades; many amalgamations are directed merely to the abolition of competing craft unions, as in the printing industry; and there is the further complication of the General Labour unions, which, beginning by enrolling the real "general labourer," the man whose skill is in the strength of his muscles, and who shifts from industry to industry as he finds an opening, have gone on to organize the mass of semi-skilled workers which machine industry requires, and even in certain cases to compete with the skilled unions on their own ground. There is thus no clearly defined principle governing the whole of British trade unionism, and bitter disputes over membership have not by any means ceased to occur; but the tendency to unite, by differing means in differing cases, the trade unionists of a single industry with one another, and even, as in the case of the Triple Industrial Alliance of miners, railwaymen, and transport workers, to unite several separate industries, made very great progress during the decade.

Apart from increase in membership, the trade union movement as a whole gained considerably in consideration and importance after 1910. This was shown in two ways. The trade unions secured, by general public consent, a much larger place in the mechanism of society than they had hitherto held, and at the same time they steadily turned their attention to new fields of activity. Before the passing of the Trade Disputes Act in 1906, the trade unions were hardly recognized as a political factor of importance. Even in 1910, though their importance had greatly increased and they were known to be the main support of the Labour party, that support had in many people's opinion been knocked away by the Osborne Judgment; and both before and after the Trade Union Act of 1913 enabled trade unions to take a direct part in politics, the view was openly expressed in many quarters that trade unionism was a dangerous growth, unwisely fostered by the legislature, which would be well advised to sweep it away at the first favourable opportunity. Dismissal of workmen for belonging to a trade union was comparatively frequent, and many strikes were fought on the question of the right of a trade union to negotiate on behalf of its members. The great Dublin strikes of 1913, the most considerable industrial upheaval before the war, arose out of Mr. W. M. Murphy's refusal to recognize the Irish Transport Workers' Union as a body competent to negotiate with him on behalf of his employees. Similarly, up to and during the war the three unions of railway workers were engaged in a struggle to obtain recognition from the general managers of railway companies, who, during the war, formed the Railway Executive Committee for administering the railways under Government control. The position was entirely changed by 1921. The Government itself had contributed to raise the status of the trade unions during the war, offering them a semi-partnership on many industrial questions, and both the Government and the larger employers found that they preferred on the whole to negotiate with organized than with unorganized bodies of workmen. During the war, for instance, the practice gradually grew up of appointing a representative of organized labour to any committee whose subject was of importance to the working classes, and such representatives were generally chosen from the trade unions. Recognition given at headquarters could not be denied locally; trade unionists *qua* trade unionists were appointed to Local War Pensions Committees, Food Advisory Committees, and the like, and were generally recognized as qualified to speak on behalf of their fellow-members. The result was to raise the trade union movement to a position such as it enjoyed in no other country save Germany or revolutionary Russia. Although cases might still be known where workmen were discharged because their individual trade union activities were not approved by their employers, the "victimization" of a man simply for being a member of a trade union was no longer likely to occur. Discrimination is, however, occasionally exercised both by public and private employers against a particular union's claim to organize a particular section. Thus the Railway Clerks' Association was long forbidden to speak on behalf of station masters. The most important instance of this is the Government's refusal to permit members of the police forces to belong to the Police and Prison Officers' Union.

All this growth has naturally led trade unions to expand their activities, and in many cases to amend their internal administration. The constitutions of some unions in 1921 dated back 50, 60 and 70 years, and were obviously inadequate to the changed situation, so that many experiments in altering them had come under discussion. One particular point of contention, the "shop branch" versus "residence branch" controversy, is dealt with below. Other difficulties centre mainly round the representation, in a large union, of the interests of different crafts and sexes, the method of electing the governing body, the relative power to be assigned to the governing body, to the officers, and to the members themselves, the amount of local autonomy, financial and otherwise, to be granted, and so on. Different unions adopt different solutions. The executive committee or council, for example, is generally elected by vote of the members, either by districts (as in the Iron and Steel Trades Association), or by departments (as in the National Union of Railwaymen); but it may also be elected by general vote of the whole union. Only two important unions, the Amalgamated Engineering Union, and the United Society of Boilermakers, have adopted the principle of an executive committee in permanent session. In some unions the executive committee is theoretically the final governing body, though in such cases the practice of taking a referendum upon most questions of importance really leaves the decision in the hands of the members; others have a general council or delegate meeting sitting for some time which has power to override the decisions of the executive committee on certain subjects; most, though not all, held at fixed intervals a conference or meeting of representatives to receive the report of the executive committee and to discuss policy. The merits of delegate and other representative conferences and of ballot, secret or otherwise, in ascertaining the will of the membership is one of the problems most frequently canvassed among the trade unions. In some cases the general secretary and other officers are appointed and paid by the executive committee, in others they are elected by vote of the members. It will readily be understood that the latter method gives in effect much more power to the secretary than the former, and the position of a trade union secretary and the extent to which he is able to speak for his union and to conclude binding arrangements on its behalf is another problem claiming much discussion.

Differences of practice also exist with regard to the autonomy of branches and sections of trade unions, and the method of declaring or calling off a strike. Some societies allow great freedom of action to their branches and district committees or councils; others, such as the Iron, Steel and Kindred Trades Association, retain all contributions in the hands of the head office, and only allow money to be spent by branches or districts for purposes specifically approved by the central organization. Between these two extremes there is room for a large variety of different methods. Some unions specifically provide in their constitutions that a ballot of the membership must be taken before a strike is declared. In many other cases this is secured by the general practice; and some unions, such as the Miners' Federation insist further that a two-thirds majority in favour of a strike must be secured. The National Union of Railwaymen, on the other hand, allows a strike to be declared by the executive committee, without prescribing any consultation of the membership. Local strikes may in some cases be declared by the local committee, but in most cases, since the strike pay is centrally administered, the sanction of the central office is necessary for a local strike, and the central executive has also power to order the men back to work. All these problems of administration require the services of trained men, and the position and education of the trade union official has begun to receive consideration. The trade unions have been slowly coming to the opinion that the work of a trade union official is specialized and requires special training; salaries have been raised, and classes and summer-schools for trade union officials and organizers are regularly held. Specialization, however, upon organizing and routine work often tends to remove the trade union official from contact with and understanding of the problems of the members whom he serves, and this difficulty has not yet been satisfactorily solved.

Trade unions have gradually extended their activities in many new directions, of which the principal are politics, education, and the control of industry. The political Labour party in its origin rested upon the support of the trade unions; but in 1909 their political activities appeared to have received a check. This was removed by the passing of the Trade Union Act in 1913, which enabled every trade union, after the prescribed ballot had been taken, to collect contributions for political purposes. By 1921 almost every trade union had its political fund, lists of Labour candidates backed by trade union money appeared, and locally the trade union branches played a regular part in the activities of local Labour parties and supported Labour candidates at local elections. Trade unions also began to show considerable interest in the education of their members. During these years the movement towards adult working-class education experienced a great revival. The Workers' Educational Association a body which in connexion with the universities ran a large number of evening courses and summer-schools for working-class students, was supported by the trade unions, some of which became actual partners in its work. The Central Labour College—now the Labour College—a residential college for students of Marxian economics, founded in 1909 by a secession of students from Ruskin College, and subsequently supported by the National Union of Railwaymen and the South Wales Miners' Federation, extended its activities; and class-centres called Labour colleges, on more or less Marxian lines, were set up in Manchester, Glasgow and elsewhere. Trade unions provided a number of scholarships for their members at the Labour colleges and at Ruskin College, Oxford; and in 1921, when the General Council of the Trades Union Congress was set up, a resolution was carried to provide for the unification of working-class education under it.

Trade union interest, however, has not been confined to education proper. The *Daily Herald*, a newspaper founded during a printers' strike in 1912 by the London Society of Compositors, was supported by Labour and trade union funds, and became an important political force, although it was forced temporarily to become a weekly soon after the outbreak of war. Later, in 1913, the trade unions revived an ancient project of running their own newspapers, and the *Daily Citizen* appeared as the first daily newspaper entirely owned and conducted by the British trade union movement. This paper had a short career, and ceased publication in 1915, mainly owing to war conditions, but the trade unions played a large part in the reissue of the *Daily Herald* as a Labour daily, early in 1919. Besides the daily papers, there are a number of local weeklies and monthlies to which trade unions contribute, and some of them also run papers and printing presses of their own. The Labour Research Department, which in 1916 became a federal body composed of trade unions and other Labour bodies contributing to the endowment of research into the history and problems of the Labour movement, shows the increasing interest of the trade unions in specialized research work.

The inclusion of the phrase "control of industry" (*see* Guild Socialism) in the aims of the trade unions has played a considerable part in forming their policy, although it has not been generally translated into fact. In the early years of the century, most trade unions, like the Labour party and the Socialists, were assumed to be in favour of the transference of the important industries of the country to the ownership and control of the State. The experience of workers in State-owned industries, notably in the Post Office, suggested that this was inadequate to fulfil trade union aspirations, and between 1911 and 1921 most of them altered it to a demand for "nationalization of industry, with control by the workers engaged therein," amounting in some cases to a demand for a National Guild (*see* NATIONALIZATION). The establishment of a National Guild was part of the official programme of the Union of Post Office Workers (founded in 1920). Perhaps the fullest exposition of the new demand was made by the Miners' Federation in its programme presented to the Coal Commission in 1919, but by the autumn of 1921 it had only been translated into action in the building industry. The unprecedented shortage of houses following the war encouraged the Building Trade Unionists of Manchester to form a Building Guild, which offered to produce houses at cost price for the City Council, themselves controlling and providing the labour, guaranteeing full pay in sickness and bad weather to all members of the Guild, and relying upon the credit of the municipality to obtain the necessary materials. The example proved infectious, and after many experiments had been made in different towns, the National Building Guild was formed in 1921, with a number of branches, prepared to undertake work upon the same terms for local authorities or private companies or persons. In every case the Guild was initiated by the local branches of the Building Trade Unions, and none but trade unionists were admitted to membership.

Pre-war Developments.—Trade union history from 1910–1921 falls into three well-marked periods: the period of industrial unrest which had already begun by 1910 and which increased in intensity right up to the outbreak of war, the war period, and the revival of activity immediately following the Armistice. The two latter, as has been observed, coincided with great trade union prosperity, which continued unbroken for some months after the Armistice, and gradually came to an end, as the slump in trade became more pronounced, from 1920–1921. It may be said that the miners' strike, in the summer of the latter year, and the subsequent acceptance by the miners of heavy reductions in wages, brought to an end the first post-war period in trade union history (*see* STRIKES).

The years 1910 to 1914 were years of growing industrial unrest. The chief factor underlying this was the steady rise in prices after the year 1906, which more than offset the slight increase in money wages, and produced a feeling in the workman's mind that his real wages were imperceptibly disappearing. Retail prices in London, which in 1906 stood at 2% above the figure for 1900, had reached, in 1911, 9·4% and in 1914, 16·8% above that figure.

Four of the industrial disputes which occurred during those years were of importance in trade union history—the railway and transport strikes of 1911, the miners' strike of 1912, the Dublin strikes of 1913 and 1914, and the London building lock-out of 1914. The principal interest of the first series of strikes lies in the fact that the railwaymen's unions succeeded in paralysing for some days the greater part of the railway system of the United Kingdom, and thereby brought home to many who had not previously realized it, the potential power of trade unionism. The actual disputes, though partly connected with wage-rates, centred mainly around the question of recognition by the employers of the unions of shipping and railway workers. In the former case the owners agreed after some time to negotiate with the trade union representatives, and a settlement was eventually reached; in the latter, a Royal Commission was set up to investigate the working of the Conciliation Board, established in 1907, which had given rise to many complaints, and the Commission's report was accepted by both sides in conference, although the point of "recognition" of the trade unions was never conceded by the railway companies, and remained in dispute until the end of the war. An important result of these strikes was the consolidation of the railwaymen's trade unions. The existence of several separate unions was felt to be a weakness, and in 1913 three of them united to form the National Union of Railwaymen, which enrolled members rapidly and became by far the largest trade union representing railwaymen.

The coal dispute of 1912 brought to the forefront one of the most important principles of trade unionism, that of the legal minimum wage. In the case of "sweated" industries, this had been recognized in the Trade Boards Act of 1909 but had not yet been applied to comparatively highly-paid workers, although in many industries, minimum rates, established by agreements between both sides, but not enforceable at law, were in existence. These rates varied generally from district to district. The principle of a legal minimum, it should be stated, does not necessarily demand that the minimum should be national in its scope, though many trade unions, especially during the war, demanded national minima, and even a national minimum wage for all workers. The Miners' Federation first claimed that miners working in abnormally unfavourable places should be guaranteed a minimum daily rate, and, when this was refused by the coal-owners, extended their demand to cover all men and boys working in coal-mines, and further put forward a schedule of minimum district rates for the various coal-fields. The strike was terminated by both sides' acceptance of the Miners' Minimum Wage Act. This Act provided that rates should be fixed by joint boards, representative equally of mine-owners and mine-workers, in each of 22 specified areas. If the two sides of any board failed to agree upon a rate, the rate should be fixed by the chairman. The Miners' Federation thus secured the principle of a minimum, but failed to get their schedule generally adopted. They were very unwilling to accept this position, but the ballot having failed to disclose a two-third majority in favour of continuing the strike, it was declared at an end.

The Dublin dispute raised the question of "recognition" in a more acute form, and also provided many examples of "sympathetic" strike action. The employers in Dublin, as a protest against the aggressive trade union policy of the Irish Transport Workers' Union, discharged its members in their employment, bound themselves not to employ in future members of the union, and in many cases insisted that applicants for work should sign a form undertaking to have no dealings with the union. This action roused a great deal of feeling both in Ireland and Great Britain; sympathetic strikes occurred, and in British ports dockers and railwaymen refused to handle goods loaded in Dublin by non-union labour. The imprisonment of James Larkin on a charge of sedition greatly increased the upheaval. Dublin shipping was practically paralysed by a general strike of dock labourers, and large contributions in money and in kind were sent to the Irish Transport Union by English trade unions and the Coöperative Wholesale Society. The points in dispute were never definitely settled, but the strike petered out gradually in the early months of 1914.

Two important pieces of legislation, the National Insurance Act of 1911 and the Trade Union Act of 1913, were passed during this period.

The War Period.—On the outbreak of war, a general truce between Capital and Labour was immediately arranged. Outstanding disputes, such as the building lock-out, were settled by one side giving way, or by compromise. Trade unions such as the National Union of Railwaymen, which had prepared a national programme of demands, delayed its presentation indefinitely, and the number of industrial disputes dropped from 682 in the first seven months of 1914 to 107 in the last five. For some time trade union history was in abeyance, until the rapid rise in prices and the necessity for increased production, in the munitions trades in particular, turned public attention to it again. The natural concern of most of the unions, as soon as the cost of living began seriously to rise, was with negotiating increases of wages. Other developments of interest took place mainly in two directions, of which the first was the abrogation of trade union conditions and the establishment, over a large number of trades, of compulsory arbitration under the Munitions of War Acts, and the effect of these two upon trade union government; and the second, the tendency, already mentioned, of the Government and the employers' association to admit the trade unions to a quasi-partnership on certain questions—a partnership which endured, as a rule, only as long as rising prices made increased wages both possible and inevitable (*see* LABOUR SUPPLY).

The necessity for greater production, particularly of munitions and other stores required for the army, early began to be felt, and a series of strikes upon the Clyde brought the question to the fore. The Committee on Production, appointed by the Government in Feb. 1915, reported that one great difficulty in the way of increased production lay in the existence of certain rules and customs of the trade unions. These "trade union conditions" became of considerable importance during the war. Every trade union of any size had before the war certain regulations, some written, but mostly unwritten, under which its members were allowed to work. These regulations related mainly to the class of labour which was permitted to perform any particular job, to the length and character of apprenticeship required, the rates to be paid, and the conditions under which work was to be done. Thus, certain jobs were reserved to fully-skilled craftsmen, had to be paid at the craftsmen's rate, and might only be performed by men who had received a certain training, which in some cases occupied several years. The demand for munitions in large quantities, and the loss of many thousands of skilled men to the army, made it inevitable, in the first place, that semi-skilled and unskilled workmen should be "upgraded" on to skilled work, in order that the necessary increase in the amount of skilled work performed should take place, and secondly, that a great number of new workers should be introduced into the munitions industries, many of whom would only be able to receive a comparatively short training. The Government therefore, in March 1915, invited a number of the leading trade unions in the industries concerned with war production to the famous Treasury Conference, attended by all the unions invited with the exception of the Miners' Federation, at which it was agreed (*a*) that strikes and lock-outs in the munitions industries should cease for the period of the war, wage disputes being settled under a system of compulsory arbitration; (*b*) that the trade unions would relax for the period of the war such of their customs as were necessary for the purpose of accelerating war output, it being understood that all such customs should be restored at the end of the war, and that, where labour of a lower degree of skill (such as women's labour) was introduced on work hitherto performed by skilled men, the rate of wages previously paid should not be reduced; (*c*) that the Government would limit the profits of owners in the munitions industries. The latter clause was made a condition of coöperation by the Amalgamated Society of

Engineers and was put into force under the Munitions of War Acts. Profits in other industries were dealt with by means of the Excess Profits Duty. The Treasury Agreements were given legislative force for the trades concerned with the supply of munitions under the Munitions of War Act of 1915. The Act reaffirmed the Treasury Agreements with regard to establishments "controlled" by the Minister of Munitions: it set up machinery for compulsory arbitration in wage disputes, limited the profits of controlled establishments to one-fifth in excess of their pre-war standard, forbade munition workers to leave their employment without permission from a munitions tribunal, ordered all customs restricting production or employment to be suspended for the period of the war only, and provided that "the relaxation of existing demarcation restrictions or admission of semi-skilled or female labour shall not affect adversely the rates customarily paid for the job." In practice, disputes arising out of the last clause claimed an enormous proportion of trade union attention during the war. In 1916 the Minister of Munitions found it necessary to take powers, in an amending Act, to fix general minimum rates for women employed in the munitions industries, but the Government was freely accused of breaking its pledges to the trade unions in the matter of wages to be paid to substituted labour, and as dilution proceeded apace during the war the controversy became more and more bitter.

The clauses in the Act dealing with restoration of the suspended customs were also the subject of dispute. These clauses merely stated that the suspension should be for the war period only, and made no explicit provision for their restoration. The trade unions contended that the Government was pledged to bringing a Bill for their restoration, and negotiations on this subject continued throughout the war period. Eventually, nearly a year after the Armistice, the Restoration of Pre-War Practices Act was passed, which provided that, where the existence of a pre-war practice could be proved, it should be incumbent upon the employer to allow its restoration.

The institution of compulsory arbitration in the munitions industries had one remarkable effect in the government of trade unions. As the trade unions concerned had practically pledged themselves not to strike for the period of the war, and as drastic penalties were provided under the Munitions Acts for any workman who struck, it followed that any strikes which did take place in the munitions industries must be unofficial, that is, conducted without authorization, or dispute pay, from trade union leaders. It was not to be expected that disputes would not arise, but these disputes fell to be conducted in the main, not by recognized trade union officials, but by unofficial committees elected from the workmen in a particular shop or factory, and known generally as Shop Stewards' or Workers' Committees. This had relation to an interesting problem of trade union organization.

Shop Stewards.—Originally, nearly all trade unions were built up of local branches, composed of all the men working at a particular trade who lived in a particular district. In the early days of machine industry, when towns and factories were comparatively small, this seemed the natural arrangement. Men working in a particular factory generally tended to be in the same residential branch, which thus achieved a trade as well as a neighbourhood unity. But as factories increased in size, and large urban aggregations became the rule, this unity disappeared. Workmen residing in a particular London suburb might be spending their working life in any one of a dozen widely separated and entirely different establishments, and might be faced with quite different industrial problems. This resulted in a stagnation of trade union branch life, which was reflected in a meagre attendance at branch meetings, and created one of the greatest problems of the trade unions. The favourite solution of the difficulty, advocated particularly by the Industrial Unionists, Guild Socialists and latterly by the Communists, was the break-up of the old residential branches, and the reformation of the trade unions in branches composed of all members who worked together in a single establishment, the several trade union branches in such establishments then to join their forces to make a single industrial unit for the whole. Certain steps in that direction had already been taken before the war. The Miners' Federation, for example, had always based its organization upon branches composed of all the men working at a single pit or group of pits, the printers' trade unions had in every printing works committees of very ancient establishment, known as chapels, and the engineering trade unions had in most cases officials, called "shop stewards," who were responsible for the inspection of the contribution cards of members at their place of work—in order to see that they were "genuine trade unionists"—and for various other minor duties. These shop stewards, both those officially recognized by the trade unions, and others unofficially appointed by the trade unionists in a particular works, enjoyed during the war a great access of importance. They included, in a majority of cases, the most active members of the trade unions, and those most imbued with the policy of "workers' control," and though general advances in wages and the broad principles of dilution and substitution were negotiated by the national bodies, all the concrete details of both the latter processes and the application of wage advances had to be dealt with on the spot, and an active man who was not deterred by possible fines and imprisonment under the Munitions Act, could wield real power in big engineering centres. Practically all the important munitions strikes of the war period were conducted by the shop stewards, two of those which excited great public attention being the Clyde strikes of 1916, which resulted in the temporary deportation from the Clyde area of a number of the leading shop stewards, and the widespread engineering strikes of May 1917, caused by the proposal to extend dilution and substitution from the production of munitions of war to ordinary commercial work. These strikes succeeded in their object, and throughout the war dilution was confined to public work.

The shop-stewards' movement attained its greatest importance in the engineering industry, because of the existence of compulsory arbitration, the enormous increase in engineering work, and because, owing to the multiplicity of trade unions catering for skilled and unskilled engineers, common action in the localities had been hitherto difficult to secure, and the appearance of a single flexible instrument uniting all sections resulted naturally in a great increase of activity. Parallel movements did, however, exist in industries connected with the production of munitions, and in other industries such as shipbuilding, cotton and woollen textiles. The shop stewards in these industries occasionally made common cause with the engineering shop stewards on questions of policy, but except in shipbuilding they were of very much less importance. The shop-stewards' movement during the war contained a large revolutionary element which was hostile to the employing class and in many cases to official trade unionism, and aimed at securing workers' control of industry. The existence of this element led ill-informed observers to conclude that the shop stewards as a whole were a revolutionary force, and to attack them as dangerous and unpatriotic. In fact, even in the centres such as the Clyde, in which the revolutionary element was strong and vocal, and inclined to defy the executives of the trade unions on principle, there were throughout the war many shop stewards who aimed at no more than the recognized trade unions' objects of wages, hours and conditions of employment and had no concern with industrial theories. Shop stewards were in fact a recognized feature of trade unionism before the war. The Amalgamated Society of Engineers, in particular, demanded that shop stewards should be recognized as official spokesmen of the union on certain matters, and succeeded in carrying their point after lengthy negotiations. This agreement applied, of course, only to official stewards, who are now recognized by the Employers' Federation in the engineering trade as part of the official trade union machinery. At the end of the war, with the stoppage of work on munitions and the discharge of large numbers of workpeople, the importance of the unofficial element of the shop-stewards' movement declined rapidly, and public attention was therefore almost entirely diverted. The official trade unions resumed control of policy and disputes, the revolutionary elements among the shop stewards became part of the general Communist movement, and the rest returned to ordinary trade union activities, such as those laid down in the shop-stewards' agreements of 1918 and 1919. The influence of the movement on trade union government remained, however, and may be seen in various proposals for remodelling trade unions on a "workshop branch" basis.

Trade Union Action under War Conditions.—Compulsory arbitration had always been heartily disliked by the British trade union movement, and, but for the war, it is exceedingly doubtful whether it would ever have been accepted. The acceptance by the trade unions of war conditions, however, made its introduction possible, and although it did not by any means prevent the occurrence of a strike, when a dispute reached a certain point of bitterness, a large number of disputes, particularly in the munitions industries, which under other circumstances would have resulted in strikes, were settled under compulsory arbitration. The clauses, however, which enabled a dispute in a non-munitions industry to be "proclaimed" under the Munitions Act, and thereby rendered illegal, were less successful, and their unsuccess can be readily understood from a single instance—that of the South Wales mining strike of 1915.

The Miners' Federation, which had not been a party to the Treasury Agreements, had never abrogated its right to strike, and the South Wales Miners' Federation, its largest constituent, was the first body to challenge the Munitions Act. In the summer of 1915 the South Wales miners threatened to strike for the purpose of enforcing a revision of a wage agreement under which they had worked for five years, and though the dispute had been "proclaimed" under the Munitions of War Act, the strike nevertheless took place. It was clearly impossible to apply the penal clauses of the Act to a body of 200,000 miners, and after some discussion a settlement was reached which conceded to the miners the majority of their demands. Other important disputes, such as the strike of employees of the Coöperative Wholesale Society in 1918, were also "proclaimed" under the Munitions Act, but in every case the number of men who left work was sufficient to enable them to defy the proclamation.

Consideration of the miners' case leads us to the second important branch of trade union activity during the war, namely that of securing wage advances to their members. For some time this activity was practically in abeyance, unions having agreed, at the beginning of the war, to hold over their demands for an advance in their members' standard of life. Only certain sections, such as the railwaymen, to whom an advance was known to be overdue, obtained any additions to their wages during the first six months of the war. This, however, was partly due to the assumption that the war would be of short duration; and when it appeared that this was not to be the case, and further that food prices and employers' profits, particularly at first in the shipping trade, were rising very rapidly, the trade unions changed their policy, and by the spring of 1915 it may be said that as far as wage claims were concerned, the industrial truce had come to an end. All trade unions began to put forward claims for increased wages, these claims, for the most part, being based on the rise in the cost of living; and although in the first two years it was not invariably held to be a sufficient ground and wages rose comparatively slowly, by 1917 it was generally accepted, and arbitrators and Government tribunals were usually willing to consider claims based upon it.

Very early in the war the system of granting wage advances in the form of "war bonuses" was introduced, the railwaymen being the first to accept it. A "war bonus" was an advance explicitly granted owing to "the abnormal conditions arising out of the war," and it was argued, though not stated in any award, that "war bonuses" ought therefore to lapse automatically when these conditions were removed. The trade unions never accepted this interpretation, and both during and after the war negotiations were continually in progress for converting war bonuses into permanent wages. Certain permanent advances were in fact granted, usually in the early stages of the war, before the system of war bonuses had become general, but subsequently it became the rule for all wage advances in the majority of trades to be granted in the form of war bonuses, which amounted to anything from 20 to 40 shillings a week in the skilled trades. War bonuses were generally granted nationally to all members of the particular trade concerned, on a flat rate. This conceded an important point in trade union principle. It had always been the object of most trade unions, particularly those whose members are paid by time, to establish a national minimum wage or guaranteed rate for their trade. Before the war, *national minima*, legal or otherwise, were rare; in the better organized trades, distinct minima had been secured, but in many cases there was no standard at all, and individual wages had to be negotiated with individual employers. The war, particularly in its later stages, gave the trade unions an opportunity for standardizing wages. Actual national minima were not secured in many instances, but in a number of trades, notably in building, printing, baking, tramways, gas and electricity supply, several area rates were fixed which between them covered the whole country, and in far more the principle of national advances or war bonuses, applying equally to every worker in the industry, was secured. This was the case, for example, with all subsequent advances to miners, all advances to railwaymen, and practically all advances in the munitions industries. The volume of wage negotiations undertaken by trade unions during the war was naturally enormous, but most of it was detailed negotiation for separate trades or branches of a trade. Towards the end of the war there was a movement to consolidate all war advances in the permanent wage rates, and to establish new minima for each industry; but the trade slump which began in 1920 strengthened the resistance of the employers to the principle, and many set-backs were recorded.

From 1915 onwards the Government began to make more and more use of the trade unions both in political and industrial questions. The general course of events was for the Government to initiate a particular piece of legislation without the coöperation of the trade unions, and then to amend its administration in order to admit the trade unions as partners. Thus the recruiting of men for the army was originally entrusted entirely to the administration of the staffs of the War Office, but it was found that this led to the crippling of essential industries by the sudden withdrawal of large bodies of skilled men, and also gave rise to a great deal of industrial unrest. Accordingly, trade unionists were invited to sit on the important committees dealing with recruitment, and in most of the chief industries the Government adopted the method of discussing recruitment with the representative bodies of employers and workmen. The mines, in particular, were practically excluded from the operations of the Military Service Acts, special colliery recruiting courts, composed of representatives of miners and mine-owners, with a Government chairman, being set up under the authority of the Home Office, to deal with the recruitment of miners for the army. In the munitions industries a scheme was put into operation in 1917 under which certain trade unions catering for skilled workers were allowed to issue "trade cards" to their members protecting them from military service, but this scheme met with a great deal of opposition from other trade unions as well as from the employers, and was dropped. In addition to participating in recruiting, trade unions during the war acted as the defenders of members whom they believed to be unjustly taken into the army, and concerned themselves with other cognate questions, such as the securing of civil rights to enlisted men.

In the case of Government control of industry, the same progression is visible. The early cases of Government control were administered by civil servants, without official coöperation either by trade unions or employers' associations. Later the Government adopted the principle of consultation of the trades concerned through associations of employers, and many industries were administered under Government control by boards consisting of civil servants and representatives of commercial interests. This was the most frequent form of control; but in two important industries, cotton and woollen textiles, the trade unions were taken into partnership. The Wool Control Board was set up in the autumn of 1917, after several experiments had failed, and consisted of eleven representatives each of the employers, the trade unions, and the War Office Contracts Department. It had a free hand in organizing the civilian trade in wool and in allocating supplies of wool—bought by the Government—to the various firms. The Cotton Control Board, set up a short time previously, was composed in a somewhat similar way. It administered the Raw Cotton Order, prohibiting the purchase of cotton except under licence, restricted the amount of machinery which was allowed to run upon work other than Government orders, and when the supplies of cotton were insufficient to keep all members of the industry in employment, the Board levied the firms which were working full time in order to pay allowances to unemployed workmen, thus putting into practice a principle on which many trade unions insist, namely that each industry should provide for the maintenance of its own reserve of labour. The Food Ministry, again, when reorganized by Lord Rhondda, set up a Consumers' Advisory Council, on which the trade unions were officially represented, and Food Vigilance Committees and War Pensions Committees were among the local bodies to which they regularly sent delegates.

These experiences of partnership with the trade unions, and the existence of the control of industry propaganda, induced the Government, when in the spring of 1917 industrial relations appeared to be very much embittered, to appoint a committee to consider means of improving the relations between employers and employed. The report of this committee—known as the Whitley Report—recommended that in each of the well-organized industries joint standing industrial councils, representative of employers' associations and trade unions, should be set up to discuss all matters affecting the industry. The Government officially adopted the report (though for some considerable time it refused to set up Whitley Councils in the Civil Service, the Post Office, and other Government establishments) and between 1917 and 1919 50 or 60 such councils were set up, but they did not produce much permanent result. For trade unionism, their chief importance lies in the fact that they brought large accessions of membership to some unions (since no workman could be represented on an industrial council, save through a trade union), and that they facilitated the fixing of national and area minimum rates. They were also used by the Government as the regular channels for disseminating information and receiving advice from the trades concerned. The trade unions, however, showed no great enthusiasm, discerning in them possible taints of profit-sharing and compulsory arbitration, to both of which trade union policy is definitely opposed, and were inclined to be definitely favourable to them only in State-owned industries. So long as wages and profits continued to rise no very serious disputes occurred, but as soon as the fall began several councils were abandoned owing to disagreements on wage questions (*see* INDUSTRIAL COUNCILS).

A few months after the issue of the Whitley Report, the passage of the Corn Production Act led to a great revival of trade unionism among the agricultural labourers, who since the failure of Joseph Arch in the 'seventies had been almost untouched by trade unions. The Corn Production Act guaranteed a minimum price to the farm and a minimum wage to the farm-workers; and boards, representative of the employers and the three trade unions organizing farm-workers, the National Union of Agricultural Labourers, the Workers' Union and the Scottish Farm Servants' Union, were appointed to determine what the minimum should be in the different counties. The work done by these trade unions in forcing up the minimum rates and in assisting their members to claim arrears of pay due to them under the Act, brought them in a large number of new members up to the time of the repeal of the Act and the disbandment of the wages boards in the autumn of 1921. The Trade Boards Act was also drastically amended in the following year, with the result of extending legal minimum rates, fixed by tribunals representing employers and workers, to between 50 and 60 new trades and stimulating trade union organization within these trades.

The only other development of importance to the trade union movement during the war was the revision, early in 1918, of the constitution of the political Labour party, which led to an extension of the political activities of the trade unions. Under the new constitution the trade unions were, as before, the main constituents of the national Labour party, but more attention than before was given to the organization of local parties in the constituencies, and a number of trade unions took part in the formation of local Labour parties or in adding a political wing to the activities of trade councils. Nearly every trade union had by this time taken a ballot of its members enabling it to establish a fund for political action, and the results of this were seen in the increased contributions, local and national, of trade unions to the Labour party, and the number of Labour candidates, supported largely by trade union funds, who stood in the general election of 1918. No trade union which has set up a political fund has applied that fund to the assistance of any other party than the Labour party.

After the Armistice.—Up to the end of the war no further development of special importance took place. The trade unions were chiefly occupied with enrolling new members, negotiating wage advances, dealing with fresh proposals for the "combing-out" of industrial workers for the army, and in other activities mentioned above. With the Armistice, however, a revival took place, and every trade union formulated a programme of advance. The programmes differed in individual cases. All included shortening of hours, consolidation of war advances into permanent wages, and the establishment of national or area minimum rates; and some added nationalization with workers' control, and full maintenance, by the industry or the State, for workers out of employment. The movement for shorter hours first took shape. During the war, the working hours in many industries had been reduced, generally to 48 or 50, and researches made under Government auspices had established the fact that long hours of work did not result in greater production. The Factory Acts, however, and other legal enactments governing the hours of work remained unaltered, and there was a general demand for the enactment of a universal 48-hour minimum for all labour, when, in Jan. 1919, a series of strikes in favour of a 40- or 44-hour week broke out in many of the industrial centres. These were suppressed, but almost immediately the trade unions began to put forward their programmes, of which the most complete was that of the Miners' Federation, which included a national advance of wages, a shorter working week, and a full scheme for the nationalization of the mines and their administration under boards composed of representatives of the Miners' Federation and of the Government. On this programme a national mining strike was threatened. There was also grave unrest on the railways and in the engineering industry, and a great industrial upheaval was generally predicted. To prevent this, the Government appointed the royal commission on the coal industry (the Sankey Commission) and also called together a large national industrial conference, representative of employers' associations and trade unions, to discuss necessary changes in the laws governing industrial conditions. The Committee elected by the conference (on which the unions in the Triple Industrial Alliance refused to serve), after long discussion, agreed upon changes relative to hours, wages, and the relief of unemployment. It had been understood that proposals agreed upon by both sides of the conference would be translated into legislation, and upon this basis the discussions had been held; but when the time for legislation came, fresh difficulties were discovered, and the legislation was never introduced. Finally in 1921 both sides of the conference, finding their efforts useless, tendered their resignations. Individual reductions in the hours of labour, however, continued to take place during 1919, but these had no legislative force. The Coal Commission sat in session for a long time, taking evidence from widely differing sources, and creating a great public sensation by the appearance for the first time of trade union advocates cross-examining the leading owners of mines and mining royalties. An advance of wages and a shortening of hours was recommended and became law in the summer. On the question of nationalization the Commission was divided; the members appointed by the Miners' Federation recommending the acceptance of the miners' programme, while the mine-owners' representatives declined to accept it. The chairman's report, recommending nationalization with a measure of workers' control, but conceding only a part of the miners' demands, was presented to the Government, which after some deliberation declined to accept it. The miners thereupon threatened a strike, and brought the matter up before the meeting of the Trade Union Congress in the autumn, but failing to obtain adequate promise of support from their fellow trade unionists by March, they decided to accept the situation. The Coal Commission was the first instance of a tribunal, equally representative of employers and trade unions, being set up under Government auspices to pronounce upon a particular dispute, and considerable disappointment was expressed in trade union circles at the Government's refusal to carry out its findings. The precedent was, however, followed in the Industrial Courts Act of the same year, under which the Minister of Labour was empowered to refer any dispute to an industrial tribunal similarly constituted. This Act was used by the trade unions in several instances, notably in the case of disputes at the docks and on the tramways, to obtain a public hearing of their claims. When the trade depression came, however, the Industrial Courts Act was not used. The employers preferred to present their demands for wage reductions direct to the trade unions, and the attempts of the latter to invoke the assistance of the Act were uniformly unsuccessful. During the year the trade unions continued to press forward claims for shorter hours, wage advances, and consolidation of war wages, and in most cases met with some meed of success. The exception was a strike of policemen in London and some other large centres for an increase of wages, which was met by the immediate dismissal of all policemen on strike, the disbandment of the National Union of Police and Prison Officials, and its replacement by a Police Federation under official auspices and prescribed in an Act of Parliament. The disbanded union, however, continued to exist as a rallying ground for the dismissed policemen. This is the sole occasion in Great Britain in recent years when membership in a trade union has been made illegal.

The railway strike of the autumn, which arose out of a wage dispute, was remarkable for the extensive counter-preparations made by the Government. The Government, as well as adopting for the first time the practice of inserting advertisements of its offers and arguments in the public press—a practice which was followed by the National Union of Railwaymen—organized an extensive system of road motor transport, and arranged for the enrolment of volunteers prepared to work on the railways. These preparations were repeated on a more extended scale in the spring of 1921, when a strike of the three unions composing the Triple Alliance was feared, and the Emergency Powers Act of 1920 very considerably strengthened the hands of the executive in dealing with a strike in an "essential industry." The establishment of the principle that the Government was immediately concerned in the case of strikes in "essential industries" to see that necessary services were carried on materially affected the position of the trade unions in those industries. The railway strike ended in a compromise under which the National Union of Railwaymen accepted rates of wages which rose and fell automatically with the rise and fall in the Government figure of the cost of living, a means of adjusting wages which had already been accepted in a number of other trades (*see* STRIKES).

Early in 1920 the unparalleled shortage of working-class houses led to the remarkable development known as the Building Guild movement. This was the most direct application yet seen of the industrial theories of the Guild Socialists (*see* GUILD SOCIALISM). A Government committee had previously estimated the shortage of working-class houses at five hundred thousand, but owing to the very high cost of building and materials, the dearness of credit, and the difficulty of recalling to the building industry the many operatives who had left it in the depression prior to the war, hardly any building was in progress. Under these circumstances, led by Mr. S. C. Hobson, a Manchester Guild Socialist, the building trade unionists of Manchester formed themselves into a Building Guild, and offered to build houses for the Manchester Corporation and other local authorities in Lancashire at cost price plus a percentage to cover office expenditure, incidental charges, and the cost of maintaining every member of the Guild at full wages in sickness, bad weather, or unemployment, thus putting into practice the principle, advocated by many trade unionists, that each industry should be responsible for the full maintenance of all its workers, whether or not there was work available for them at any particular moment. No profits of any kind went to members of the Guild. The credit of the local authority was to suffice for the purchase of plant and materials, many of which were in the first instance bought with the assistance of the Coöperative Wholesale Society. The tenders of the Manchester Guild were accepted in a number of instances, though the limitation placed by the Government on the total number of Guild contracts which could be placed by local authorities considerably restricted their field, and the example of Manchester was followed by over a hundred bodies of trade unionists in various parts of the country, including London, which in the following year united to form a single National Building Guild. The Government's restriction of their work upon public contracts led the Guilds to solicit work from private companies and persons, which in a number of instances was secured. Trade Union Guild Councils, formed for the purpose of inducing other industries to take up the idea, were set up in several districts, and the furnishing trade was among the first to follow suit. The particular interest of the Building Guilds, distinguishing them from other experiments in industrial self-government by the working-classes, lies first in the absence of profits, secondly in the principle of industrial maintenance of all workers, thirdly in its limitation to trade unionists, and fourthly in the coöperation of technical as well as manual workers, representatives of architects and surveyors being given a place on the Guild committees.

With all these various developments trade unions had attained an important place in social life by the end of 1920. But in that year the trade prosperity came to an end. The trades producing for export had been gradually losing practically the whole of their European markets owing to the financial collapse of a great part of Europe, and their workmen were discharged in large numbers. This in its turn reacted upon the home market; there was a sharp fall in wholesale prices, a general and rapid decline in trade, resulting in the total unemployment of between one and two million workpeople in the summer of 1921. As soon as the trade depression became apparent, there was a general move to reduce wages. The legislation confirming war rates of wages for a time had expired during the previous year, and the way was therefore clear for immediate reductions. In many of the minor trades, where trade unionism was weak, these were enforced immediately, the widespread unemployment inclining the workers to accept any reduction rather than run the risk of losing their employment; the well-organized trades were faced during 1921 with demands for wage reductions, of which that presented to the miners was the most important.

Council of Action.—One event of this period needs describing in some detail, because it was the most successful attempt of the trade union movement to intervene in foreign politics. The events in Russia, since the revolution of 1917 and the establishment of the Bolshevik Government in Nov. of that year, had been followed with great interest by trade unionists. More from sympathy with anti-capitalist Governments in general than because any but a few of its members were in agreement with Bolshevik theories, the Labour movement had for long opposed Allied intervention in Russia, and isolated protests, such as that of the dock-workers who refused to load a ship with munitions intended for use against the Bolshevik Government, had been made from time to time. When in the summer of 1920 it appeared that Poland, then at war with Russia, was likely to receive active help from the French and British Governments, the trade union movement rose in protest. The members of the Parliamentary Committee of the Trade Union Congress and the Executive Committee of the Labour party formed themselves into a Council of Action, called a conference of the governing bodies of all the important trade unions, and this conference announced to the Government that a general strike would be called if Great Britain were to enter the Polish war. It was obvious that the general feeling among trade unionists was entirely in agreement with this declaration, and the protest was successful. No active assistance was given to the Polish Government. After the emergency was over, the Council of Action, despite attempts to place it on a permanent basis, gradually ceased to function. During the crisis local Councils of Action, consisting generally of the trade unions affiliated to the local Trade Councils, or Labour party, were formed in most of the large towns. These also gradually lapsed after the crisis was passed (*see* SYNDICALISM).

Post-war Problems.—The Miners' Federation, during the previous year, after the failure of an attempt to force a reduction in the selling-price of coal—the first important instance of a trade union trying to interfere with the price of its product—had accepted a settlement under which wages varied nationally with the quantity of coal produced. As a result of this settlement, during the following months the quantity of coal produced was considerably above what could be disposed of at a profit. The Government then announced the termination of their control of the coal industry which had been exercised during the war, and of the subsidy which had been previously paid. The mine-owners therefore gave notice of a series of heavy reductions in wages, varying in the different coal-fields and amounting in some cases to 40 and 50%, and when the Miners' Federation refused to accept these reductions, locked the members out. A "sympathetic" strike of the other members of the Triple Industrial Alliance was announced, and the Government made extensive preparations, including the calling up of the army reserve and the enrolment of a national Defence Force under military discipline, for coping with it; but at the last moment the sympathetic strike was cancelled. The Miners' Federation, after a long struggle, was forced to come to terms, and to submit to large reductions in wages, varying from district to district, and thus their object of securing national minimum rates for mine-workers received, for the time at least, a severe set-back. The issue of the miners' case seemed to settle the fate of other industries. Few trade unions pursued their resistance to wage reductions to the length of ceasing work; and in fact wages in all industries were considerably lowered during the year. Nor were reductions confined to cases in which the rates were a matter of mutual agreement only; the Agricultural Wages Boards, which fixed the rates for the poorly-paid agricultural industry, were swept away on the repeal of the Corn Production Acts, and an attempt was even made to abolish the Trade Boards.

The result of this was to turn the attention of the trade unions from offensive to defensive action, from advancing wages and shortening hours, to holding as much as they could of what they had already gained, particularly in the matter of shorter hours, and from enrolling thousands of new members to keeping those they already had. It was to be expected that some of these would lapse; and there was a distinct fall in membership, particularly among the unions of unskilled workers and women, towards the end of the year. But the fall was considerably less in proportion than had been experienced in any previous period of bad trade, and in the newer unions of non-manual workers, whose members were less affected by unemployment, it was comparatively slight. There was also, of course, a depletion in the large reserve funds which had been built up during the war, when unemployment benefit and strike benefit were both at their lowest level. The new activities of trade unionism, however, were not curtailed as might have been expected. Trade unions continued to find money to pay the election expenses of Labour candidates; they continued to show interest in research and education, and one of the most important schemes, that for unifying working-class education under the Trade Union Congress, was actually passed during the first year of the depression.

Organization in 1921.—British trade unionism in 1921 presented a picture which at first sight appears exceedingly confused. There were upwards of a thousand trade unions, varying in membership from a score to several hundred thousand, and organized upon all manner of different bases, from the pure craft union to the "all-grades" union enrolling everyone, skilled or unskilled, in any industry; and these unions were united in many different federations and cross-federations. Only two or three hundred of these unions were of national importance, the rest being mainly survivals from an earlier date, or local societies organizing localized industries. Even among the larger unions, however, there were important diversities of scope and structure. The largest single unit, the Miners' Federation, was industrial in its character, embracing most of the workers in or about the mines. The Miners' Federation was also the most important instance of a trade union basing its branch membership upon the place of work of its members, most other trade unions, except the postal unions, adhering to the "locality" branch. Another large trade union on an industrial basis was the National Union of Railwaymen, though in this case two other bodies of some size, the Railway Clerks' Association and the Associated Society of Locomotive Engineers and Firemen, also organized certain classes of railway employees. Other industries in which industrial unions of this kind existed were the iron and steel trades, the transport trades, other than railways, the distributive trades, the agricultural industry, and the Post Office, though in all these cases there existed rival societies of considerable importance, in some cases claiming a section of the industry, such as in the case of transport, the sailors and firemen of the merchant service, in some cases such as the Workers' Union in agriculture, ready to embrace the whole. On the other hand, the second largest group, the Workers' Union, was an "all-grades" union open to any workman of any trade, and this form of organization was to be seen, in a somewhat less all-embracing form, in the other general labour unions, which were allied with the Workers' Union in the National Federation of General Workers. The third largest group, the Amalgamated Engineering Union, had yet another basis, being formed by a fusion of kindred craft unions in the engineering trades, open to skilled engineers in all industries, and making little claim upon the unskilled workers in the engineering industry proper. The same principle was to be noticed in the chief trade union of woodmakers and in the clerks' trade union. The confusion was, however, less than would at first sight appear, owing to the existence of federation. Thus the transport trade union was united with other trade unions in the transport industry, by means of the Transport Workers' Federation, a printing federation included the various trade unions in the printing industry, the textile federation most of those in the cotton industry, an engineering and shipbuilding federation those in the engineering and shipbuilding trades, whether they catered for skilled or unskilled workers and so on. Certain bitter disputes continued to exist, of which the chief raged between the National Union of Railwaymen and the engineering and woodworking trade unions over the workers employed in railway shops; but, speaking generally, most of the trade unions concerned with a single class of workers or a single industry, whatever their private disputes, were all represented in the particular federation, and had a means of acting together in case of emergency. This applied for the most part only to the manual workers' unions. The trade unions representing professional, technical and administrative workers were only in a few cases affiliated to the manual workers' federation. They had, however, federations of their own which occasionally entered into coöperation, and individual unions had sometimes close ties with those of the manual workers.

Larger groupings also existed. Of these by far the greatest continued to be the Trade Union Congress, to which all the important trade unions of manual workers and a few of the unions of brain-workers were affiliated. In 1921 an attempt was made to provide out of the Trade Union Congress a more efficient governing machine for the trade union movement by electing its General Council from various industrial groups, instead of, as heretofore, electing it by general ballot vote of the whole Congress. The experience of the Council of Action and of the miners' strike of 1921 had convinced many of the need for a central executive and direction. Trade unions, however, are slow to surrender their individual autonomy, and little but general powers were given to the new General Council at first, though an increase in affiliation fees provided it with additional funds. It was instructed to work in coöperation with the political Labour party in order to arrange for a separation of function between the industrial and political sides of the Labour movement, and for their coöperation in policy. Such separation and coöperation were long overdue. Owing to the much greater age of the Trade Union Congress, it had formed the habit of dealing with political questions long before the Labour party was founded, and continued to do so. It thus happened that the same items, both industrial and political, would appear for discussion both at the Trade Union Congress and at the Conference of the Labour Party, and this led to a great deal of useless overlapping, even apart from cases, such as the miners' demand for nationalization, which might be considered both industrial and political. At the same time the machinery for consultation between the two bodies was very inadequate, and it often happened that they would take opposite lines of policy. The new scheme of coöperation was intended to remedy these defects. An alliance between the trade unions, the Labour party, and the working-class coöperative movement was also frequently proposed, but was never consummated except on specific occasions, though the coöperative societies frequently rendered assistance to members of trade unions in disputes. There were also other general groupings of less importance. The General Federation of Trade Unions, once regarded as a body almost coequal with the Trade Union Congress, had gradually declined in power to the position of a strike insurance society covering about one-sixth of the trade union movement. The Triple Industrial Alliance was founded in 1915 by the Miners' Federation, the National Union of Railwaymen, and the Transport Workers' Federation, avowedly for the purpose of securing united action by those three bodies on industrial questions. At the time of its formation it excited a great deal of interest, and had it ever succeeded in functioning effectively it would undoubtedly have wielded immense power; but owing principally to lack of coördination between its three constituents, it never took effective action upon an important question, and its last failure to act in the miners' strike of 1921 destroyed much of its prestige among the trade unions. Locally the branches of trade unions were united in Trade Councils, which in some cases were separate from and in other cases united with the local Labour party. These Trade Councils, of which there were several hundreds in the United Kingdom, varied greatly in size and importance. In large towns—where the Trade Council could often trace its history as far back as the eighteen-sixties—it sometimes wielded important industrial and political influence, while in remote places it was little more than a rallying ground for a few trade union branches to discuss matters of common interest. The Trade Councils for the most part, being composed of trade union branches with little money to spare, suffered from a lack of funds, though in times of crisis these could be partly increased by means of local levies. Their functions were not generally defined. This meant in practice that they were limited by opportunity, and might include many types of activity, from the providing of a hall for local meetings or a local Labour weekly paper, to the temporary control of the whole life of a town during a general strike.

Ireland.—Irish trade unionism, in its later stages, needs separate treatment. Originally trade unionism in Ireland was a weak copy of the British model; but in the first decade of the twentieth century, it became imbued with ideas derived from the American Industrial Workers of the World. Under the leadership of James Larkin and of Connolly (executed after the Easter Rebellion of 1916) militant industrial unionism attained to great power. Its strongest exponent was the Irish Transport and General Workers' Union, which was the leader in the Dublin strikes of 1913, and subsequently went through a period of severe repression. It survived, however, and in 1921 was by far the largest constituent element in the Irish Trade Union Congress and Labour Party. The latter body, which adopted political as well as industrial functions in 1912, acts far more as a central executive for its affiliated societies than does the British Trade Union Congress. Affiliated to it are all the important Irish trade unions, with the exception of some located in Ulster, which are kept apart from it by political and religious differences. There are also affiliated a large number of Trade Councils (including the Trade Council of Belfast), which in weakly-organized districts serve as organizing centres, workers being invited to join the Trade Council until a branch of the appropriate trade union can be founded. This is an important respect in which the Irish Trade Councils differ from those of Great Britain. The Irish movement was strongly republican in its political policy, and had close relations with Dail Eireann on the one hand, and with the Irish agricultural coöperative movement on the other. Most of the Irish industries are organized in the Irish Transport and General Workers' Union, though in certain cases British trade unions have a large Irish membership. The most important of these are the railway and postal employees (organized respectively by the National Union of Railwaymen, the Railway Clerks' Association, and the Union of Post Office Workers, though a purely Irish Postal Trade Union also exists), the engineering, shipbuilding and woodworking employees in Belfast and Dublin and some other large towns, and some women workers, mainly in the east and north, who are organized in the National Union of General Workers. There are also separate Ulster unions, principally in the textile industries, but trade unionism in Ulster, especially in Belfast, is liable to be rent asunder from time to time by political and religious upheavals.

Legal Status.—There were few changes during 1911–21 in the laws relating to trade unionism. The most important of these was the Trades Disputes Act of 1913, which partially undid the effect of the Osborne Judgment. It provided that any trade union might take a ballot of its membership on the question of establishing a fund for political purposes. If a majority of the members is in favour of its establishment, contributions for political purposes may be levied, but no member can be forced to contribute to the political fund who does not wish to do so. In cases where there is a composite subscription, covering all purposes of the trade union, any member can reclaim that part of his subscription which would be devoted to political purposes. The political fund must in all cases be separately administered from the general funds. The Trade Union Amalgamation Act, passed in 1917, removed some of the previous legal restrictions on the amalgamation of trade unions by providing that, where a ballot is taken upon the question of amalgamation, it will be sufficient if fifty per cent of the membership votes, and if of those voting a majority of twenty per cent is in favour of it. Despite this Act, a number of amalgamations have failed owing to an insufficient total of votes having been recorded, and various devices have been adopted for getting round the difficulty.

Finance.—The finance of trade unions showed little change during the decade. Most trade unions slightly raised their subscriptions during the war, in about the same proportions, so that the unions of skilled workers have still a far higher subscription and provide on the average a larger number of benefits to their members than the unions of the unskilled. Again, most trade unions built up fairly large reserve funds during the war—which were considerably depleted during 1920–1,—but here again the increase was greater in the case of the skilled unions. All trade unions made large use of the levy, which is one of the most important elements of trade union finance. It is obvious that strike and unemployment funds, particularly strike funds, cannot be put upon an actually sound basis, so that in most trade unions the method is adopted, when a particular fund seems to be in low water, or some special object demands that an immediate sum of money be available, of imposing, generally after a ballot vote, a levy upon the whole membership. Thus, a trade union may levy itself to provide assistance to a particular branch or strike, or to another trade union, or to finance the *Daily Herald*, or for any other of a variety of purposes, and the practice of imposing levies frequently renders the obligation of a member to his trade union very much greater than would appear from the subscription rates laid down in the rule book.

AUTHORITIES.—The volume of publications on British trade unionism has increased very rapidly. Official statistics are to be found in the *Labour Gazette*, published by the Ministry of Labour, in the reports of trade unionism issued by the Board of Trade (not since the war), and in the reports of the Chief Registrar of Friendly Societies. Most of the available information will be found collected in the *Labour Year Book*. For the history, organization and theories of trade unions the standard works are *The History of Trade Unionism* (new edition, 1920) and *Industrial Democracy* (new edition, 1920) by Sidney and Beatrice Webb; *Trade Unionism* by C. M. Lloyd (revised edition, 1921); and *An Introduction to Trade Unionism* (1918) by G. D. H. Cole. All these contain full bibliographies. There are also special studies of trade unionism in particular industries. Of these may be mentioned *Trade Unionism on the Railways* (1917) by G. D. H. Cole and R. P. Arnot; *Village Trade Unions* (1920) by Ernest Selley; and *Women in Trade Unions* by Barbara Drake (1920). The standard work on trade union law is *The Legal Position of Trade Unions*, by H. H. Slesser and W. Smith Clark, and a smaller work by H. H. Slesser, *The Law Relat-*

The Progress of British Trade Unionism, 1910–9.

Industry	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Building and	156,985	173,182	203,773	247,685	236,524	234,000	231,000	259,000	324,000	437,000
Woodworking						66,000	69,000	83,000	96,000	125,000
Mining and Quarrying	731,370	752,527	757,351	914,989	912,577	844,000	884,000	944,000	992,000	1,069,000
Metal, Engineering and Shipbuilding	370,093	414,896	479,308	538,751	557,741	641,000	699,000	849,000	952,000	1,074,000
Textiles and	380,541	437,856	479,266	518,871	498,232	449,000	457,000	543,000	616,000	706,000
Dyeing, etc.						64,000	75,000	87,000	91,000	104,000
Clothing and	67,124	74,423	91,832	105,975	102,318	65,000	51,000	78,000	120,000	156,000
Boots and Shoes						49,000	72,000	81,000	91,000	107,000
Railways	116,214	185,513	202,329	326,192	336,671	385,000	425,000	499,000	530,000	624,000
Other Transport (land and water)	129,009	328,023	312,345	374,588	379,016	304,000	313,000	326,000	376,000	528,000
Printing	74,275	77,252	76,949	84,429	92,055	98,000	99,000	113,000	143,000	192,000
Agriculture and	69,171	176,211	187,831	331,234	366,539	26,000	29,000	59,000	130,000	203,000
General Labour						523,000	589,000	815,000	1,205,000	1,491,000
Others, including Pottery, Glass and Chemical						24,000	32,000	42,000	55,000	65,000
Food, Drink, etc.	303,039	349,154	434,515	485,477	488,190	36,000	35,000	36,000	46,000	63,000
Clerks, Shop Assistants, etc.						111,000	120,000	150,000	193,000	267,000
Teachers						129,000	134,000	143,000	167,000	183,000
Public Authorities						244,000	251,000	310,000	353,000	390,000
Miscellaneous Trades						96,000	104,000	123,000	163,000	260,000
Total number of members	2,397,821	2,969,037	3,225,499	3,928,191	3,959,863	4,388,000	4,669,000	5,540,000	6,643,000	8,044,000

ing to Trade Unions (1921). For Irish trade unionism see *The Irish Labour Movement* by W. P. Ryan (1920).

By far the most important up-to-date source of information, statistical and historical, for other countries is the *Labour International Handbook.* See also G. D. H. Cole, *The World of Labour.* For Germany see *Trade Unionism in Germany* by W. Stephen Sanders (1916). For Russia see A. Losovsky, etc., *Trade Unions in Soviet Russia* (1920). (M. I. C.)

UNITED STATES

From 1898 to 1904 craft unions in the United States grew in importance, and made substantial gains by aggressive action. In 1905 with a slackening of business prosperity came a loss of faith in trade unionism as the one sure solution of the problems of the working class. The American Federation of Labor had organized the skilled trades but the unskilled had been practically neglected. The crafts seemed unable to cope with the trusts and with an open-shop campaign which drew employers together. Attempts were made to capture the American labour movement for a more radical class struggle. In 1905 the Industrial Workers of the World were organized. A movement to organize the building trades into an industrial union was resisted by the American Federation of Labor, but resulted in the establishment in 1908 of the Building Trades Department of the Federation. In 1909 the United Mine Workers announced their championship of the principle of collective ownership of the means of production. In 1911 the machinists followed. From 1903 we find increasing tendency toward concerted movements of the railway crafts. In 1908 the Railway Employees' Department was formed in the American Federation of Labor to include all the railway unions affiliated with the Federation. In 1916 the four railway brotherhoods, not affiliated with the Federation, acted together to demand the eight-hour day. In 1912 the national convention of the Federation voted down the minority report of the Committee on Education in favour of the principle of industrial unionism, 72 for and 264 against; voting strength, 5,929 for and 10,983 against. The two miners' unions voted solidly in favour of the change. Others in favour were the bakers and confectioners, iron, steel and tin workers, printing pressmen, railway carmen and journeymen tailors. In 1912 labour was weak economically but strong politically, due to its support of the Democratic party, then coming into power. Public hearings before the United States Commission on Industrial Relations in 1914 brought industrial conditions into the light of public opinion; for the first time a commission representing the Government not only pronounced the trade union movement harmless to the best interests of the country, but gave its unqualified approval to labour organization as an institution indispensable in a democracy. The return of business prosperity in 1916, coincident with the sudden decrease of immigration, gave labour a new economic advantage. In 1917 the Government asked and won coöperation of organized labour in producing military supplies. Organized labour was given recognition on Government committees, and the policy of boards which represented the Government in its relations with its employees was to recognize trade union standards of working conditions. The leadership of the American Federation of Labor was strengthened by the attitude of the Government; possibly it was weakened by the fact that the War Labor Board dealt with groups of disaffected workers in the local unions rather than with the national officers, and so made for decentralized control in the unions. After the Armistice labour was again on the defensive, and the increasing number of the unemployed were more ready than they had been to listen to the philosophy of the radical, who can always promise a steady job and a pay envelope every week in the Utopian state. The membership in the relatively conservative American Federation of Labor increased nearly threefold between 1910 and 1920. In 1910 there was a paid-up membership of 1,562,112; in 1915 1,946,347; and 1920 4,078,740. If we include also the membership of organizations suspended from the Federation, the total for 1920 was 4,509,213. Outside the Federation are the four brotherhoods of railway employees with a membership of over 400,000, the Amalgamated Clothing Workers, 200,000, the Amalgamated Textile Workers, 40,000; and other smaller independent organizations. There are five industrial departments in the American Federation of Labor—building trades, metal trades, railway employees, union label trades, and mining. The six largest of the affiliated unions are the United Mine Workers', the Carpenters' and Joiners', the Machinists', Electrical Workers', Railway Carmen, and the Ladies' Garment Workers.

The National Women's Trade Union League of America was founded in 1903 for the purpose of investigating and giving publicity to conditions of women in industry, and to undertake educational work for wage-earning women, to promote labour legislation and improved labour standards, and to aid trade unions in organizing women. The League stands also for the eight-hour day and the 44-hour week, for a living wage, and for equal pay for equal work regardless of sex. The League is indorsed by the American Federation of Labor and the Canadian Trades and Labour Congress and is represented at their conventions by fraternal delegates. It claims 600,000 trade union women, and has also a large membership of men. It publishes *Life and Labor*, and maintains a training school for organizers. Its headquarters are in Chicago.

The decade 1910–20 saw a movement develop to unionize the teachers as a trade group. The first teachers' union was organized in Chicago in 1902, following the failure of the Teachers' Federation to gain consideration from the school board. As the board insisted that it had no money to pay a "living wage," the teachers investigated city finances, and found that many wealthy corporations had been evading taxes due to the city. In the struggle to force the payment of taxes the teachers received aid from organized labour. Then, at the invitation of the Chicago Federation of Labor, the teachers affiliated with that body. In 1916 the Board of Education dismissed those teachers who had been prominent in trade union activity. In order that these teachers might be reappointed, the union withdrew from the city Federation of Labor. In 1914 the teachers of Cleveland voted to affiliate with the American Federation of Labor, but were prevented by the Board of Education. In 1916 teachers' unions in a number of cities united to form the American Federation of Teachers and affiliated with the American Federation of Labor, but forbade recourse to strikes. The official publication is the *American Teacher.* The first trade union of librarians in the United States was formed in New York City, in 1917, to demand salary increases and a regular system of promotions. In 1918 the Boston Library Employees' Union was organized and affiliated with the American Federation of Labor. Union organizers were active without success at the 1919 and 1020 conventions of the American Librarians' Association.

Trade Agreements.—The economic strength of trade unions is crystallized in trade agreements. Such expression of a joint partnership of Capital and Labour to stabilize industry on the basis of an accepted law is typical of the American labour movement. The earliest national agreement in the United States was that of the iron puddlers in 1866. A national agreement of the stove moulders established in 1891, providing for peaceful adjustment of disputes which might arise, continues in force. In 1897 a general strike in the central competitive district of the bituminous coal-mining industry led to an agreement between the operators and the United Mine Workers' Union. In 1902 the president of the union refused to join in a sympathetic strike on behalf of the anthracite strikers because such action would be disloyal to the agreement. For more than 20 years the International Typographical Union had been arbitrating disputes with the publishers of newspapers. At the convention of the National Publishers' Association in 1900, three publishers were chosen as a committee to deal with labour, to represent, however, not the whole convention, but only those employers who had favoured the measure. Contracts between individual employers and the union had been made prior to this time. This committee effected an agreement with the Typographical Union, to be in force from May 1901 to May 1902, which provided for local boards of three persons, one to represent the publisher, one the union, and the third to be chosen by these two. The board was to decide all disputes in its territory, the *status quo* to prevail until an award should be made. If either party should be dissatisfied with the decision, appeal might be taken to a national board, composed of the publishers' labour committee and the president of the Typographical Union. If they failed to agree, an impartial person was called in. A majority decision was then binding on both parties. In 1902 the agreement was renewed for a five-year period, and again in 1907, revised to eliminate the impartial person from the adjustment boards, and to reorganize the final arbitration board to consist of three members of the employers' committee and three from the executive council of the union. By the end of 1912 the American Newspaper Publishers' Association had in operation a total of 416 individual arbitration contracts: 217 with the Typographical Union, 108 with stenographers' unions, 47 with mailers' unions and 44 with photo-engravers' unions. A fourth national agreement, 1912–7, made local settlements compulsory, since the business of the national board had been impeded by the number of the cases. In 1917 the agreement was renewed until 1922.

In the book and job printing industry the development of central government in 1919 added new features. Coöperating to preserve industrial peace there are four groups of closed-shop employers, united in a national association, and five trade unions, centralized for concerted action in the International Allied Printing Trades Association. In Feb. 1919 representatives of both sides met to discuss coöperation. In April they agreed upon a draft of an International Joint Conference Council, international since Canadian publishing companies were included. The Council was composed of four trade unionists and eight employers; each union representative had two votes. There was no impartial member, two joint chairmen sitting together—a trade-union president and an employer. Meetings were to be held usually every other month, in different places. Resolutions were to be passed unanimously by the Council and accepted by all the organizations represented, after which they were to become law for all member shops in the United States and Canada. Enforcement was left to the executives of the individual organizations. The Council drafted an arbitration code to be used by the members. The Council itself did not settle disputes. Its work has been to give its approval to a general labour policy, expressed as "five cardinal points." It adopted for its slogan "Stabilization and Standardization." The agreement provided that wages should be reviewed semi-annually, should be based on the cost of living and the economic conditions of the industry, to provide at least a living wage; also that employers should introduce a uniform system of cost-keeping, and that voluntary agreements should take the place of strikes and lock-outs. Economic conditions in the industry and cost of living having been determined by scientific investigation, the actual fixing of wages was left to bargaining between the two parties. The unions agreed not to work for employers who did not operate their business under the standard cost-keeping clause, and the employers agreed to employ only union labour. In March 1921 employing printers not members of the Joint Conference Council formed the 48-Hour League of America and called for the abolition of the Council.

Perhaps the most remarkable change brought into any industry by trade union efforts is in the clothing industry, where "sweated" workers have been able to build up a system of industrial government respected by their employers. In Nov. 1909 discrimination against union members by employers led to a general strike of the shirt-waist makers of New York. More than 25,000 girls walked out. Other grievances were: the long overtime worked in the rush seasons, followed by long periods of unemployment; low wages, fines, and subcontracting. The employers formed themselves into a Mutual Protective Association. The police prevented picketing. This aroused public interest in favour of the strikers. The employers individually came to settlement with the girls. The workers gained better conditions, and the principle was inaugurated of adjustment of grievances between employer and representatives of the workers. During the same month, Feb. 1910, which marked the conclusion of this strike, 7,000 shirt-waist makers in Philadelphia struck for concessions similar to those secured in New York. The strike was short; the chief result was a plan for settlement of difficulties by adjustment in the shop, or by appeal to a permanent arbitration board of representatives of the union, the employer and the general public, and a promise not to discriminate against union members. The wage scale was to be fixed for each shop by a committee of that shop.

In July 1910 the cloak and suit makers struck in New York City, 45,000 strong. Their grievances were low wages, the system of subcontracting by which a few of the employees received wages from the employer directly, and engaged their own helpers, whom they "sweated" for a pittance. The strikers also demanded a 49-hour week with double pay for overtime, the installation of power sewing machines, and the closed shop. This last point was the most strongly contested by the employers. Finally a conference was held, with Louis D. Brandeis as chairman. He urged that the strikers modify their demand for the closed shop to one for the "preferential union shop." After some further dispute an agreement on this basis was signed in Sept., which also pronounced in favour of the abolition of home work and subcontracting. But the most notable feature of the agreement was the provision known as the "protocol," which established three joint boards to administer labour conditions in the future. The Board of Grievances, of two representatives from each side, was to take up differences of opinion between employers and employees, and to settle any disputes which might arise. Disputes which could not be settled in this way were to be carried to the Arbitration Board, made up of one representative from each side and an impartial member. The Board of Sanitary Control consisted of two representatives of the employers, two of the union and one for the public, this impartial member to be appointed by counsel for the two sides. This Board determined a standard of sanitation for the shops. "Health strikes" to enforce the findings of the Board were permitted in shops remaining in any condition condemned. These three boards were financed jointly by the employers and the union.

In Oct. of the same year (1910) the men's clothing workers struck in Chicago, to demand shorter hours and higher wages and some method of adjusting grievances. After 19 weeks the strikers, beaten, went back to work but the important firm of clothing manufacturers, Hart, Schaffner & Marx, made an agreement with their employees which established a permanent arbitration board of one representative from each side. There was no impartial member until one year later, when a Trade Board of 11 members was instituted to settle the minor matters which were impeding the work of the Arbitration Board. The impartial chairman of the new board also presided at the old. A third part of the machinery was composed of the individual shop committees which met with the labour managers (employers' representatives) to try to smooth out grievances before bringing them to the Trade Board. In 1913, when the agreement was renewed, provision for the preferential union shop was added.

In Jan. 1913 several trades of the ladies' garment workers struck and secured an extension of the protocol plan to cover a larger number of the trades. A strike in Boston led to its introduction there. The Joint Board of Sanitary Control was extended to cover other ladies' garment workers and also the fur workers of New York. Medical supervision features were added, with individual examinations and preventive work. Early in Jan. the men's garment workers of New York also struck. The president of the United Garment Workers' Union submitted the dispute to arbitration. Many of the members were dissatisfied, and a plan was made to put a new union leader in office at the next national election. When the convention met in 1914, many of the more aggressive delegates found themselves debarred by the committee on credentials. The insurgents retired to another building, held a rival convention and elected officers. The union membership throughout the country was divided in its allegiance to the two groups of national officers, the overall and union label shops clinging to the old leadership, but the mass of the men's and boys' clothing workers acknowledging the new, although for this they were branded as "secessionists" by the American Federation of Labor. During a strike at this time in Baltimore the cutters remained subordinate to the old leaders, the tailors were led by the new, who managed to continue the strike to victory, although without strike funds. The new leaders then organized their forces throughout the country under the new name Amalgamated Clothing Workers of America. This organization, while retaining the craft divisions, adopted industrial unionism as its working principle. The preamble stressed the aggressive character of the new union and the part it hoped to play in the "class struggle"; also the importance of education of the members.

In 1915 the new organization carried on and won two general strikes: a short one in New York, and one of four months' duration in Chicago, which cost the union over $40,000, and was finally lost through exhaustion. But the spirit of the workers was not broken. The year 1916 was marked by disputes in the clothing trades throughout the country. In New York the Manufacturers' Association abrogated the protocol in the cloak and suit trade. After a two months' lock-out and a general strike of 60,000 workers an agreement was made according to which grievances were to be adjusted by direct negotiation between union and employer. The Joint Board of Sanitary Control continued through the period of the strike. Protocols were established in the garment trades in Boston and Philadelphia. The Board of Standards of the dress and waist trade opened a test shop to time and standardize the operations.

In 1917 the Amalgamated Clothing Workers of America led other unions in establishing the 48-hour week by strikes in the different clothing centres. In 1918 they led with the 44-hour week. At the same time the industry in New York adopted an agreement for industrial government similar to that which had been introduced by Hart, Schaffner & Marx in 1910. In Feb. an impartial chairman took up his post. Studies were undertaken by both the union and the employers' association to ascertain the changes in the cost of living relative to wage increases, and an award was made of wage increases varying from 10% to 12·5%. Introduction of the 44-hour week followed in the other clothing centres. The financing of the New York strike by the union, except for contributions of $11,000, was viewed as a notable achievement for workers who until recently had been "sweated" and ill paid. Other firms in Chicago followed the example of Hart, Schaffner & Marx, and similar arbitration agreements were introduced also in the clothing centres of Baltimore, Boston, Rochester, Montreal and Toronto. An attempt of the A.C.W.A. to organize Cincinnati was as bitterly opposed by the old union as by the employers. In Rochester and Chicago, where the work is done in factories, the agreements still held in May 1921. But in New York and Boston, where most of the work is let out to contractors, the impartial machinery broke down in the autumn of 1920; it could not weather the period of industrial depression. The union in New York then went on strike to force the reinstatement of arbitration machinery. By the end of March 1921 the locals of the A.C.W.A. had raised $930,244.54 toward the strike fund. The arbitration plan was renewed July 1921.

In the spring of 1919 during a strike in Lawrence, Mass., the Amalgamated Textile Workers of America were organized. A resolution of the executive board in April 1920 to affiliate with the Amalgamated Clothing Workers was favourably received by the latter in their convention in May. The constitutions of the two organizations are similar. The membership of the A.T.W. in Jan. 1921 was 40,000; that of the A.C.W.A. 200,000. In 1920 the Amalgamated Clothing Workers and the Ladies' Garment Workers were drawing together and affiliation was discussed.

Shop Unions.—In recent years some employers have offered substitutes for trade agreements with organized labour. The Colorado Fuel & Iron Co. recognized committees of its employees as a part of the welfare plan of 1915. In 1918 the Standard Oil Co. introduced a system of conferences with representatives elected by the employees. Committees on health, safety, sanitation and housing were formed, and individuals might present grievances through their representatives. By the summer of 1919, 160 companies in the United States had shop committees in their plants. In some plants elaborate industrial governments have been developed; the best known are those in the Filene store in Boston and the Leitch plan named after its originator, John Leitch of Philadelphia, and modelled on the checks and balances of the U.S. Government. Some employers associate the workers with themselves by profit-sharing and bonus plans. Others offer a "forum" in which workers may meet with the managers to discuss the problems of the business. One firm expressed the hope that the purchase of stock by employees would save it from the dictatorship of absentee financial control.

In 1918 the attention of managers was called to the high cost of the labour turnover. Employment departments were instituted. In the course of placing and training the worker and securing his honest effort in production, and in organizing the working force for the safety movement, the science of personal management has been evolving. Persuasion takes the place of coercion or bargaining. The old "scientific management" introduced in 1911 by Frederick W. Taylor, an engineer connected with the Midvale and later with the Bethlehem Steel Co., looked upon the individual worker as a producing machine; effort to increase earning power was the only human reaction expected from him. The new scientific management obtains production through group action, by a general consensus of opinion in the shop. The labour problem is no longer left solely to the production engineer, who has been trained to deal with the forces of nature, but is given to a new official, a psychologist, the labour manager. The labour department is not responsible for getting out the product, but for building up a permanent and dependable labour force.

Criminal Unionists.—On Oct. 1 1910 the office of the Los Angeles *Times* was blown up and 21 people were killed. On the same night bombs were found in the homes of the publisher of the *Times* and of the secretary of the Merchants' and Manufacturers' Association. On Dec. 25 the Llewellyn Iron-Works, also at Los Angeles, were dynamited. In May 1911 William J. Burns, a detective, secured the arrest, in Indianapolis, of John McNamara, secretary of the International Association of Bridge and Structural Iron Workers, his brother James, and Ortie McManigal. The men were taken to Los Angeles, where they were found to be responsible for these and other dynamite outrages in various parts of the country. McManigal confessed to dynamite plots involving also the McNamaras and others, and the brothers pleaded guilty to blowing up the *Times* building and the iron-works. The criminals were formally repudiated by the American Federation of Labor. An investigation by a Federal grand jury of the dynamite plots led to the indictment of 54 men, many of them officers of the Bridge and Structural Iron Workers. They were tried and 38 were found guilty. Burns was arrested for kidnapping, but acquitted. In June 1916 14 business agents of the Painters' and Electrical Workers' unions of Chicago were found guilty of extortion. The evidence showed that contractors and merchants had been compelled to pay sums ranging from $50 to $200 under the threat of damage to their property. In Nov. 1920 an investigation into the high cost of building in New York City brought to light a conspiracy among dealers in material, building contractors, bankers and labour bosses to keep up the bids for construction work. The labour leader implicated and convicted was President Brindell of the Building Trades Council.

The Industrial Workers of the World, commonly spoken of as the I.W.W., were organized in June 1905 at a convention in Chicago of 203 persons, representing over 40 groups in the working classes. Among the sponsors were the leaders of the Western Federation of Miners, the remnants of the American Labor Union (made up of workers from different industries, but chiefly railwaymen), and the Socialist Trade and Labor Alliance, known to be the economic arm of the Socialist Labor party. The originators of the new association felt that a labour union based on craft autonomy, such as the American Federation of Labor, could not succeed in the struggle of the workers against capital. For success, "one big union," the industrial workers massed in a single army, was felt to be necessary. Moreover, it was thought advisable to get the working class organized beforehand and accustomed to working together in "the same groups and departments and industries that the workers would assume in the working-class administration of the Coöperative Commonwealth." The aim of the new organization, as intended by the founders, was first to provide a new central body in which the existing trade unions, consolidated into industrial unions, could be associated; and second, to organize and add to this nucleus the great mass of the unorganized, unskilled and migratory labourers. The philosophy of the movement, as expressed in the constitution adopted, was that "the working class and the employing class have nothing in common; there can be no peace so long as hunger and want are found among millions of working people and the few who make up the employing class have all the good things of life"; the wages system must be abolished, and the capitalistic form of society must become extinct. This was to be accomplished by direct action; the final solution of the class struggle would be by the "social general strike," when the toilers would "take and hold" that which they produce by their labour. "There is but one bargain that the I.W.W. will make with the employing class—complete surrender of all control of industry to the organized workers." Some of the leaders insisted that political action should be discouraged as useless. This led to the split, in 1908, between the western, or direct-action faction, known as the Chicago branch, and the parliamentarian or doctrinaire group, represented by the Socialist Trade and Labor Alliance, led by Daniel De Leon of New York, which became known as the "Detroit Branch," until in 1915 it took the name of Workers' International Industrial Union. Its official publications are *The Weekly People*, *Industrial Union News*, and *The Socialist*. The Chicago direct-action branch, exclusively claiming the name Industrial Workers of the World, was led by W. D. Haywood. After being sentenced to prison (see below) Haywood fled to Russia in April 1921, leaving the office in Chicago in charge of Roy Brown. Their organs are *One Big Union Monthly*, *New Solidarity*, both published in Chicago, and *The Industrial Worker*, Seattle. Before 1917 they published seven papers in foreign languages. After the war the organization issued 19 publications in 13 languages. The I.W.W. have amended their original constitution to omit the clause calling for political action. At its origin the I.W.W. spoke hopefully of sweeping the working class into its ranks; at the end of its first year it had a paid-up membership of 14,000; in 1907, before the split, of less than half that number; in 1912 the Chicago branch reported 18,387; in 1913 14,851; in Jan. 1917 60,000; on Oct. 1 1919 100,000. The general office had issued 500,000 membership cards to that date. One department, the Agricultural Workers' Union, reported 18,000 members enrolled between April 1915 and Nov. 1916. The turnover between 1905 and 1915 was very high, both as regards members and local unions. In 1915 7·5% of the enrolment had remained in active membership. By 1918 only one-fifth of the number of locals which had been chartered were in existence. The greatest loss was in 1907 when the Western Federation of Miners left the I.W.W. In 1911 it affiliated with the American Federation of Labor, and in 1916 became the Mine, Mill and Smelter Workers' International Union.

The I.W.W. claimed leadership in the McKees Rocks, Pa., strike in 1909, and in the "free speech fights" at Spokane, Wash., and Fresno, Cal., in 1909, San Diego, Cal., in 1910, and Everett, Wash., in 1916. In 1907 the leaders Haywood, Moyer and Pettibone were accused of the murder of the ex-governor of Idaho; they were arrested in Colorado without warrant, carried to Idaho, imprisoned and finally tried. They were acquitted. In 1912 the I.W.W. leaders helped carry on strikes at Lawrence, Mass., and at Paterson, N.J. (*see* STRIKES AND LOCK-OUTS). They were active among the lumbermen in Louisiana. In 1914 they organized the migratory labourers in the harvest-fields, lumber workers, miners and construction workers. In the spring of 1917 the lumbermen of the extreme north-west struck; soldiers rounded up the pickets and threw them into a stockade. By July 50,000 lumbermen were on strike, demanding an eight-hour day and better housing. The I.W.W. were considered responsible for trouble among the miners in Arizona in the summer of 1917 (*see* STRIKES AND LOCK-OUTS). On Sept. 5 1917 I.W.W. offices throughout the country were raided by the Department of Justice, and their property seized. A few days later most of the officials were arrested. The grand jury in Chicago indicted 166 members for conspiracy to interfere with the nation's war programme. Over 1,000 members were arrested; aliens among them were held for deportation. At the trial in Chicago in Aug. 1918 97 of the accused were industrial workers, four were journalists and organizers. Ninety-eight were pronounced guilty, and 93 were sentenced to imprisonment of from 10 days to 20 years. Haywood received 20 years' imprisonment and a fine of $10,000. He appealed, and was released on bail. The sentence was confirmed by the U.S. Supreme Court in April 1921, but, as stated, Haywood had escaped to Russia. At about the same time 46 reputed members of the I.W.W. were arrested in California under the Espionage Act. Others were added to their number. The indictment was added to six times. The defendants believed that the trial was a mere formality, and sat silent throughout the proceedings without offering a defence. They were found guilty and severe sentences were passed. Five of the defendants died in jail. In 1917 the lumber workers substituted "sabotage" for strikes. They would work for eight hours and then quit in a body. If anyone was discharged the whole crew quit. In Nov. 1917 the Construction Workers, an international union of the I.W.W., attempted to hold a convention in Omaha; all attending delegates were arrested and held in prison some time before they were indicted. In Dec. 1918 those who had not been released were allowed to give bond. In the winter of 1917–8 local secretaries of the I.W.W. at various places were tarred and feathered. In Tulsa, Okla., 11 members had this treatment. At Red Lodge, Mont., two members were tortured in the basement of the courthouse.

As organized in 1905 the I.W.W. had 13 industrial divisions, each composed of a group of allied industries grouped together for administrative purposes; also certain locals of mixed occupation. Boundaries of jurisdiction are by industry, not craft. The organization is centralized in a General Executive Board, with power to call strikes and a referendum on agreements between local unions and employers. All acts of the Board may be appealed to the General Convention, and decisions of the Convention are subject to a referendum of the general membership. Local matters are to be settled locally. As amended at the tenth convention, in 1916, the unit of organization became the industrial union instead of the local union; each industrial union to have its own by-laws. Five or more branches in any locality form an industrial union district council. Industrial departments are also provided for by the constitution. There is also the general recruiting union, which takes in the workers from any industry not yet sufficiently organized to have its own industrial union. The only national officers provided by the constitution are the general secretary-treasurer and a general executive board of seven members. Each industrial union has a secretary-treasurer and an executive board of five members. Only wage-earners are eligible to membership in the unions. No officer of the I.W.W. may run for political office without a referendum vote of the entire membership. Since 1919 no officer may hold his position for two consecutive years, but must return to his industrial work after one year of office.

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TRAINING CAMPS, MILITARY.—I. UNITED KINGDOM.—One of the lessons learnt from the Crimean War was the necessity for having troops of all arms quartered in close proximity to one another, and to some open area of ground where they could be trained, both separately and in combination, in military exercises. Two such training centres were then chosen, one at Aldershot in England, the other at the Curragh (Kildare) in Ireland. At these two places in 1855 arrangements were started for the construction of training camps. At Aldershot a scheme was also carried out for permanent barracks for one cavalry brigade, one infantry brigade (of three battalions) and for three batteries each of horse and field artillery. These barracks were afterwards known as Wellington Lines. Besides these permanent barracks, the scheme provided for two hutted camps, known as North and South Camps, accommodating each four battalions or their equivalent. The total accommodation, therefore, in the Aldershot of the period was one cavalry and three infantry brigades, with a proportionate number of artillery, engineers and departmental corps, about 10,000 men at most. The work begun in 1855 was finished in 1858–9.

At the Curragh the camp was designed for 10,000 men in 10 squares, each intended at first for two battalions of 500 each. The squares each consisted of a double row of huts grouped round a common parade ground, the men's quarters being at the sides in huts holding 25 men each, the officers being quartered at a third side in huts holding eight officers in each, and the fourth side of the square being taken up with regimental accessory buildings. This was the original plan, but it was very soon found that it would be better to have each square allotted to a whole battalion and to use the spare huts as married soldiers' quarters, and for increased accessory accommodation. The quartering of two regiments together in the same square, especially if these were of Irish militia, for even a short period of training, was not entirely free from disciplinary trouble.

There was a good deal of misgiving at the time as to the wisdom of providing temporary huts such as these and not permanent barracks. The embodiment of the militia, during the Crimean War, pressed for a larger amount of accommodation than the barracks existing in the country could provide, and the need of training units of troops together was also an urgent matter. Tents, no doubt, were thought of, but the view prevailed that these would be insufficient to provide shelter in the climate of the British Isles for any lengthy period. The difficulty of obtaining materials of a permanent nature, and of getting the quarters erected with sufficient rapidity, except by the use of temporary materials, were, no doubt, the military considerations which led to the decision to build huts, and these coincided with the natural desire on the part of the Treasury authorities to get the work done cheaply. At the time, it was not expected that the huts would last for more than a few years, though as a matter of fact some were in occupation 50 years afterwards.

There were other similar hutments on a small scale at Shorncliffe and Colchester, on exactly the same lines as those at the Curragh and Aldershot.

The huts themselves were built of wooden framing, resting upon dwarf walls of brick, longitudinally and transversely. They were roofed with boarding, covered with tarred felt. The walls were of wooden weather boarding painted, and the lining of the huts was plain boarding, or (in the case of officers' huts) rough canvas papered. The lighting was by windows, much smaller than would now be considered sanitary, and after dark oil lamps were used. Small stoves burning coal were used to heat the buildings, the stovepipes passing through the felted roofs. The water supply, in the case of the Curragh, and of the South Camp at Aldershot, was obtained from wells and reservoirs on War Department land. It was led to open ablution sheds, and as these were fairly near the barracks, the men had no greater difficulty than in a tented camp, in their ablutions. But anything in the shape of baths or hot water was unknown. The latrines were at first on the bucket principle, but very soon after the camps were taken into use, trough latrines with water flushing were adopted. The sewage was treated in a sewage farm at a little distance from the camp, both at Aldershot and the Curragh, the drains leading to it being brick culverts of a type now condemned.

It is of course very easy with our modern knowledge to criticize all this, but the main points of the policy were sound, viz., proximity to open manœuvre ground, and to rifle ranges, the grouping of units and the accommodation of those units in small buildings, both because a small building is more easily adapted to some other use than a large one (when change of policy necessitates reappropriation) and also because it is more easily isolated in case of fire or infectious disease. In this respect the same policy was continued in the great hutting programme of 1914–6 in England, as opposed to the American plan of having large two-storey huts containing each upwards of 100 men.

No hutted camps were built in England again until the S. African War of 1899–1902. Some demands came from S. Africa for hutting material, and huts of corrugated iron roofs and walls, lined with boarding, were accordingly designed and sent to that country. Similar huts were built at several of the new stations at home, which had come into being with the increases to the army authorized in 1899, *e.g.* Deepcut, Blackdown, Bordon, Longmoor and Ewshott in the Aldershot area, Bulford on Salisbury Plain, Kildare in Ireland, and regular summer camps such as Okehampton, Glen Imaal, Kilbride, etc.

When the World War broke out in 1914, a demand arose once more for training centres, and the problem of hutments had again to be dealt with. The types of huts adopted are described in the article BARRACKS AND HUTMENTS: it is here proposed to deal with (A) the principles on which sites were selected; (B) the system of grouping the typical designs so as to form suitable unit hutments; (C) the grouping together of various unit hutments, and (D) the accessory services incidental to such groups of hutments.

(A) *Selection of Sites.*—During the war it was laid down by the General Staff that no sites for important training centres in Great Britain should be situated within 50 m. of the E. coast. As the whole of E. Anglia comes within this limit, this excluded a useful part of England which otherwise might have been utilized. The same objection applied to certain parts of Yorks. and Lincolnshire. It was also desirable not to choose sites near the main lines of railway leading to the principal ports, which had already important and increasing traffic, dealing with supplies and munitions. Consequently, the more westerly parts of England were mainly examined for suitable sites, the most important being in W. Yorks., Staffs. and Shropshire. There were also one or two large camps in Wales.

From the training point of view it was imperative that there should be open ground available at all times of year, for manœuvring and field works, and suitable positions for rifle ranges, for bombing practice, entrenchments and other similar instruction. From the medical point of view it was desirable that the soil should be gravel or chalk (though clay was not an insuperable objection), that there should be good drainage, and generally healthy surroundings, that the water supply should be ample and either pure or capable of being purified. From the supply point of view, besides the obvious importance of being able to issue supplies easily, it was essential that there should be ample means of communication by rail or water or both; that while the site should not be on a main line of railway so as to impede other movements, it should not be far away from existing railways. From the engineer's point of view, besides traffic facilities, it was desirable that materials should be easily procured, water abundant, labour not unreasonably difficult to obtain and supervise, and, if possible, some already established local system of waterworks, drainage works, or electrical power in which, by agreement, the camp might be a partaker.

These requisites are given in the order of importance, but in making the actual selection, perhaps less attention than was wise was paid to the third section, in some instances. Thus Salisbury Plain is an excellent training ground, but it was in the autumn of 1914 already congested with troops, and to initiate the construction of an additional large cantonment there was courting trouble.

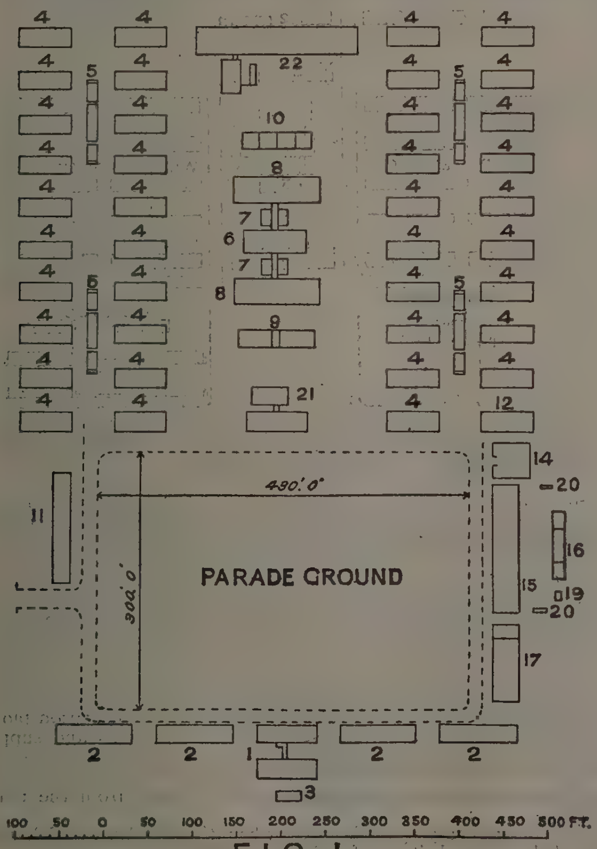

FIG. 1

The Wylye Valley near Salisbury had a number of good sites for small tented camps, and it was situated close to good training ground, besides being healthy and easily drained, but not one of these camping grounds could take more than a brigade, and consequently the two divisions which were quartered there had to be in scattered groups along a line some eight miles in extent, with great subsequent trouble in providing supplies and in administration generally. The above experience indicated that (*a*) divisional camps were the most satisfactory, if the requisite space could be found for them; (*b*) camps of two divisions were possible and good, but a larger number made the problem of administration unwieldy; (*c*) it was best not to construct the huts upon the actual training ground (as the area of such a cantonment absorbed too much of the useful training space available), but that they should be as near to the edge of the training land as possible, so as to minimize the time lost in marching from barracks to training ground and home. As regards engineering materials, there was little actual difficulty in obtaining what was requisite, but the presence or absence of an adjacent market made a very notable difference in the cost of the work, an important factor.

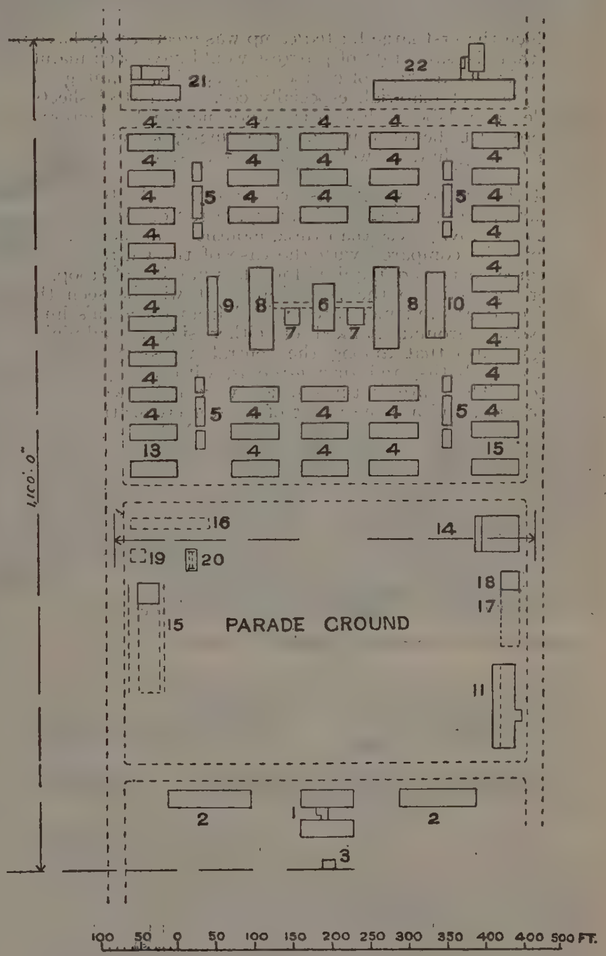

FIG. 2

1. Officers' Mess. 2. Officers' Quarters. 3. Officers' Latrines. 4. Barrack Block. 5. Ablution, Latrines and Urinals. 6. Cook-house. 7. Wash-up. 8. Dining-room. 9. Bath House. 10. Drying-room. 11. Guard House and Offices. 12. Stores. 13. Spare. 14. Coal Yard. 15. Horse Shelter. 16. Harness and Saddle Rooms and Forage Stores. 17. Vehicle Shed. 18. Mobilization Equipment Stores. 19. Dung Pit. 20. Water Trough. 21. Sergeants' Mess. 22. Regimental Institute.

(B) *System of Grouping.*—The grouping together of huts to form a hutted camp for an infantry battalion at war strength is shown on fig. 1. To provide for such a unit, sixteen different designs of huts are needed, but the same designs grouped otherwise can be arranged for most of the similar units of other arms. It will be seen from the plan that the area occupied, 1,100 ft. by 500 ft., has on its centre line the principal buildings, viz. officers' and sergeants' messes, the shower baths, dining-rooms and cook-house, drying-room for wet clothing, and the canteens and recreation rooms; while on either side are the living huts, for officers on either side of the officers' mess and for men, two rows of huts on each side with four groups of ablution-rooms, latrines and urinals. This plan was originally designed with the view of providing at first only the huts other than living accommodation, which it was thought might be given in tents. The very short time available in 1914 between the declaration of war and the approach of winter (only three months at most) would only suffice for the messes, and dining-rooms, etc., to be built, giving a reasonable amount of comfort and shelter during the waking hours, while for sleeping purposes it was thought that, even in winter, tents would be sufficient, leaving the sleeping huts to be built at leisure. Had this scheme been carried out (and afterwards it was found that tents, in winter, for sleeping would not have been impracticable) it might have been quite possible to have housed with a fair amount of comfort the large armies then being raised, taking into account the limited time and materials and labour available. Unfortunately, as it turned out, this compromise was not sanctioned. The rapidity with which the first large hutted camp was erected may have raised a hope that the same rate of progress would have been maintained; but that first camp had, of course, very special advantages in that large supplies of material, especially corrugated steel sheets, were available, and labour difficulties were negligible, factors which later were not to be relied upon. Accordingly, orders were issued to construct living huts as well as the others, and the attempt to do this in the short season available was a failure. Nevertheless, in some of the first camps it was accomplished. At Belton Park at Grantham, a camp for 12,000 infantry, begun on Aug. 24 1914, was occupied on Nov. 3, less than three months from the start, a result which may be compared with the case of the Curragh in 1855–7 where three years were required for a less number of troops.

Reverting again to the typical plan, it will be seen that the officers' quarters and mess are divided from the men's huts by a small parade ground, flanked on either side by administrative buildings. Also that among the central accessory buildings are dining-rooms, baths, and drying-rooms, with a large "regimental institute." These are features which were unknown in the early hutted camps, and are the result of greater civilization and attention to the soldier's improved position. Baths are, moreover, a hygienic necessity and the value of these was insisted upon from the outset. In some of the later hutted camps the dining-rooms were omitted, but the saving effected was hardly commensurate with the disadvantages. Drying-rooms were very useful, for frequently the men's clothing got soaked by rain, but there were difficulties in the practical use of them, and they were not always repeated. Fig. 2 shows an alternative arrangement for an infantry battalion camp. Fig. 3 shows the grouping of typical huts in the case of a field artillery unit. Other units are designed on generally similar lines.

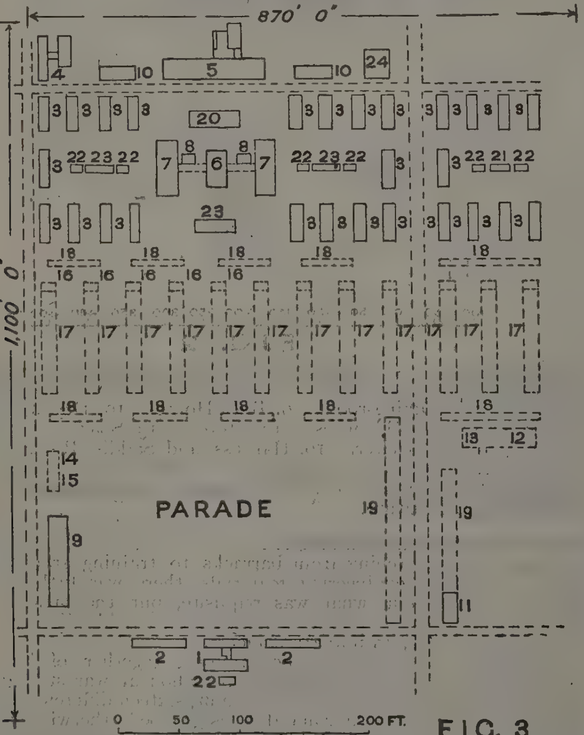

FIG. 3

1. Officers' Mess, etc. 2. Officers' Quarters. 3. Barrack Block. 4. Sergeants' Mess. 5. Regimental Institute. 6. Cook-house. 7. Dining-rooms. 8. Wash-ups. 9. Guard House and Offices. 10. Battery Stores, Brigade Bread and Meat Stores, and Spare Hut. 11. Mobilization Equipment Store. 12. Forage Barn. 13. Granary. 14. Forge. 15. Shoeing Shed. 16. Expense Forage Store. 17. Horse Shelter. 18. Harness and Saddle Rooms. 19. Vehicle Sheds. 20. Baths (32). 21. Ablution. 22. Latrines and Urinals. 23. Drying-rooms. 24. Coal Yard, Dung Pits, Water Troughs.

(C) *Grouping of Unit Hutments.*—The grouping of such unit hutments as have just been described, into a divisional camp or cantonment, can but be considered in taking an actual case, viz. that of Hipswell camp, the northerly half of the large cantonment of Catterick, near Richmond in Yorkshire. The site was not selected until Dec. 1914; some experience had, therefore, been gained in the matter of grouping. In examining this plan (fig. 4) it must be borne in mind that immediately to the S.E. of it lies another divisional camp. Thus the hospital, post-office, power station, army ordnance store sheds, banks, etc., which in the plan appear to be at one corner, are really in the centre between the two divisions. There are 12 infantry battalion hutments, marked A to L. In the actual lay-out there is some irregularity owing to the ground, no attempt being made to preserve a rigid formality of plan which would only be symmetrical on paper, but would necessitate great extra expense in foundations, etc. Yet in each case the broad principles enunciated above as to general grouping have been maintained. It will be observed that branch lines of railway approach each hutment, and each has access to a main road. The engineers and pioneers are near the outer flank of the cantonment, close to ground used for field entrenchments. Between them and the first infantry brigade (A to C) are the field artillery brigades, while the administrative troops are on the extreme N.W. flank. It may be added that the main training ground, rifle ranges, etc., lie on the W. side of the camp. The general slope of the land is from N. to S. towards the brook passing the power station and hospital.

(D) *Accessory Services.*—The accessory services are (i.) Hospital, (ii.) Roads and Railways, (iii.) Water Supply, (iv.) Lighting, (v.) Refuse Disposal and Sewage.

(i.) *Hospital.*—For a large cantonment, a hospital of 600 beds, with an isolation hospital for infectious complaints, is needed. In the theatre of war, this number was of course largely exceeded, and there the unit of each general hospital was 1,000 beds, base hospitals being frequently groups of 10 or more such units. The principles of design, however, are the same, and although in matters of construction detail there may be differences, the following general description is of universal application. Fig. 5 shows the lay-out of a camp hospital, considered as a type. In front on one side are the mess and officers' quarters, on the other side the accommodation for the nursing sisters. Both these are arranged so as to be separate from the hospital itself, though sufficiently near for all practical purposes. It was subsequently found desirable to surround the nurses' quarters with a high fence on the hospital side so as to ensure greater privacy. In front of the main hospital enclosure is the administration block and behind it the operation room. In some of the field hospitals this building was the centre of a series of wards radiating out from it. Groups of wards, in the type figure, are on either side, and in most hutted camps, in England, these were connected with the operating rooms and administration block by covered passages. The kitchen and dining-rooms and supply stores occupy a central position behind the operating room, and the quarters of the hospital orderlies are beyond. The isolation wards are in any convenient position not too far away from the main buildings.

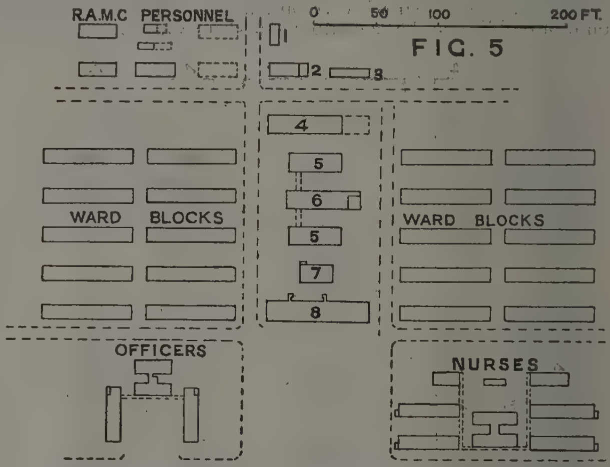

FIG. 5

1. Mortuary, etc. 2. Pack Store. 3. Disinfecting Block. 4. Hospital Supply Department. 5. Dining-room. 6. Kitchen Block. 7. Operation Block. 8. Administration Block.

At the later stages of the war, when the number of sick and wounded increased, it was found that 24 or 25 beds were too few, and much larger wards were designed, but the same general arrangement was continued.

(ii.) *Roads and Railways.*—The ordinary roads of the country where a large hutted camp is situated, will soon be found inadequate for the constant heavy traffic entailed by the occupation, and additional roads will be necessitated. This will be evident from the plan of Hipswell Camp. Consequently early steps must be taken to provide roads of the best construction, preferably concrete 20 ft.

FIG. 4

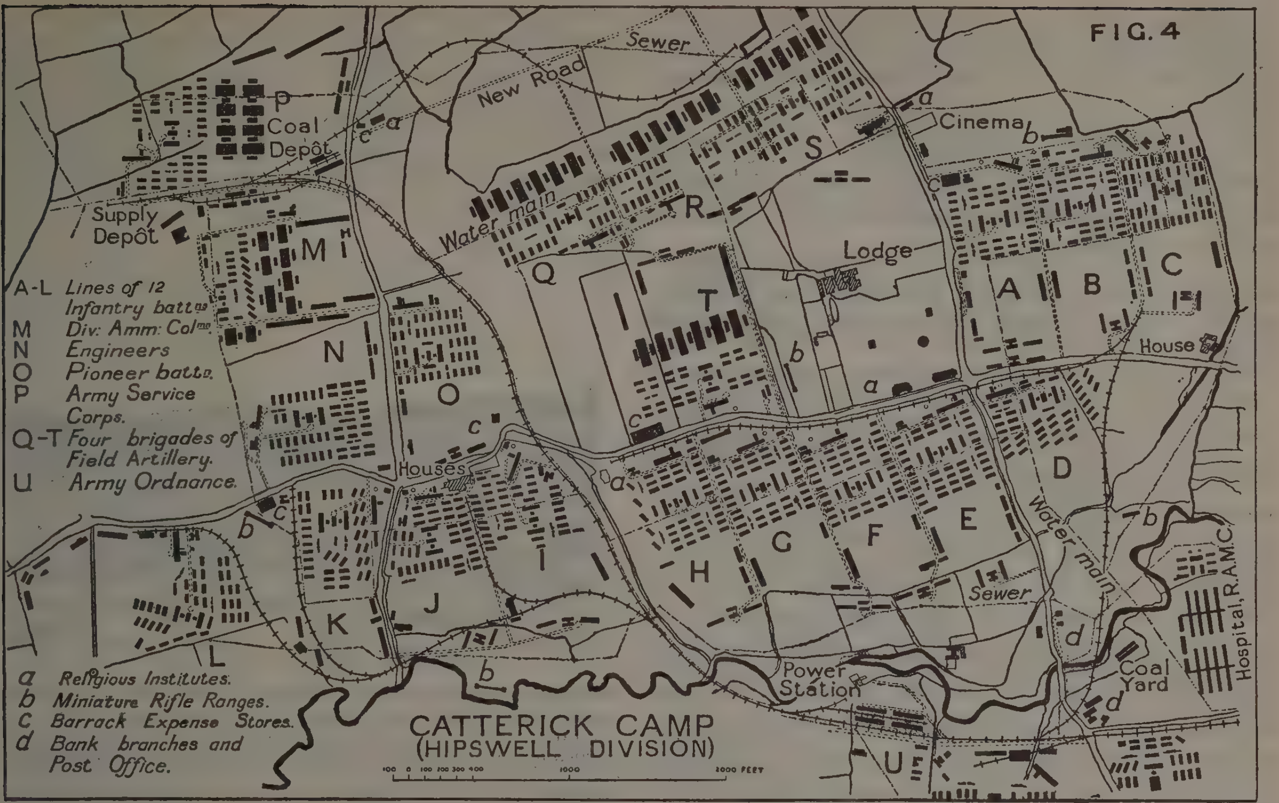

to 30 ft. wide with asphalt surface. Many small bridges will have to be reconstructed. Maintenance of such roads will have to be kept in view. In each unit camp plank paths ("duck boards") will be necessary from the very first, from every hut, otherwise the whole place will become a quagmire.

Railway lines should be laid into every group of hutments (*see* plan of Hipswell Camp, fig. 4) and there should be a branch leading to a main line. The gradients should not exceed 1 in 50 and the curves 600′ radius at a minimum. The construction of these camp lines was, in some cases where the sites had been hurriedly chosen, a matter of very serious difficulty.

(iii.) *Water Supply.*—At Catterick Camp the water was obtained from the river Swale in a valley with steep banks about a mile above Richmond. It was conducted by gravity from a deep pool in the river to a pumping station where, after settling in suitable tanks, it was pumped up to two tanks holding in all one million gallons, where the water was chlorinated. From this position, which is sufficiently elevated from the general level of the cantonment to command all parts by gravity, a 10 in. main leads along the main line of railway, and branches are taken off to each unit camp. A subsidiary storage tank of 100,000 gals. at the S.E. end of the cantonment, about two and a half miles from the main tanks, provides against any inconvenience caused by a temporary breakdown.

(iv.) *Lighting.*—This subject was very carefully considered in the early days of the war and it was decided that electric light would be the safest and best, and by using aerial transmission lines supported on simple poles, it would be as inexpensive as any other form. A scale of lighting for various buildings was then carefully drawn up, upon which the whole system for any grouping of units was easily calculated. In almost every case of a large hutted camp the installation had to be provided *de novo*, for municipal supply was insufficient to enable the current to be brought from the local installation of some adjacent town. A power station was then designed at some central spot and preferably near a stream where water for boilers and for construction tanks could be easily obtained. From this central station transmission lines radiated to various hutments. Occasionally, and especially in camps (those for 1,000 men or less), gas from an adjacent town supply was used.

(v.) *Refuse Disposal and Sewage.*—This subject presented difficulty owing to faulty selection of sites in some cases. For comparatively small camps the removal of solid matter was possible by cartage and incineration; there being several patterns of destructor in the market, it was only a question of erecting one or more in suitable places, and arranging for a regular system of conservancy. But with large bodies of men, 20,000 and upwards, this became very difficult, and in the larger cantonments a regular system of waterborne sewage was adopted. Here, again, coöperation with local bodies was tried as far as possible, but generally the task was too great for town sewers (*e.g.* at Ripon, a town of 9,000 pop., the addition of 42,000 men and 10,000 horses was far too great for the efficient use of the town sewers, and a separate purification plant had to be devised for the camp with an elaborate network of sewers). The sewerage system for the Hipswell Camp is indicated on the plan (fig. 4), as far as the hospital, beyond which point the main sewer is joined by the sewer from the other division (Scotton) and together the main sewer, now 18″ in diameter, proceeds some two miles to the disposal works.

In any case some disposal works are necessary in every camp for the treatment of liquid sullage from lavatories, kitchens, etc. This sullage water is often very foul and had to be carefully filtered—either in primary and secondary contact filter beds, or according to some other recognized method of sanitary engineering.

Other refuse from the camps can be dealt with by some simple form of refuse destructor.

Organization of Constructing Hutted Camps.—The system of organization in America is that each department of engineering has a separate and independent charge, one department doing all the surveys, another the building, another the water supply, and so on. In England the system was that, while the War Office technical staff supplied the type plans, the authorized rules for quantities of water, electric light, etc., the general approval of the order of urgency and of lay-out, and the selection of the contractor who executed the work, the whole of the local work was entrusted to an experienced senior Engineer officer. He had sub-departments under him for roads, railways, water, electricity, sewage, but he was entirely responsible for coördinating their work and for the local application of materials. The actual execution was almost invariably in the hands of a large firm of contractors who worked on a system of cost plus percentage (which has certain defects but which can be worked well on a competitive system). The superintending officer had authority to give instructions to the contractor, and was responsible for the supervision of his work and for regular and periodical payment. The system worked well and expeditiously.

As regards materials, although some of the earlier camps had their walls built of corrugated steel on wooden framing, this material was rapidly exhausted, and the subsequent substitution of timber boarding caused such a famine of all sorts of scantlings and planks that every effort was made to use some other method. Light steel framing filled in with concrete vertical slabs was used with success, and framework with expanded metal plastered over was also used. Both these methods had the advantage of giving employment to such trades as bricklayers and plasterers, and thus not being so entirely dependent on carpenters.

Roofs were for the most part covered with one or another of the many waterproof felts in the market. In some cases corrugated steel sheets were used and a few hutted hospitals were roofed with slates. Floors were in most cases of planking, tongued and grooved, or otherwise rendered impervious to air from below, though in some camps this precaution was omitted, to the great discomfort of the men. In some camps concrete and asphalt floors were used with good result. The interior fittings of the huts, such as pegs and shelves, were very few. Fire buckets and screens to surround and isolate a burning hut were provided, but as a matter of fact, fires were remarkably few, notwithstanding the fact that the huts were heated by stoves. Ventilation was given by large louvred openings in each gable of the hut, and strict orders were issued that two of the windows also should be kept open at all times when the hut was in full occupation.

The cost of the camps amounted to between £20 and £30 per man, all building and engineering services whatsoever being included. The average may be taken at £23. After the war most of the materials were disposed of, in some cases at a profit. Many of the huts were easily adapted at small expense into comfortable cottages of four or five rooms.

Miscellaneous Hutments other than for Troops.—In addition to the hutted camps for brigades, divisions, etc., as above described, there were similar cantonments for (i.) Remount depots, (ii.) Ordnance stores, (iii.) Munition workers, and (iv.) Aerodromes, which deserve some brief description. The broad principles of lay-out and details of construction are of course similar.

(i.) Remount depots to accommodate from 5,000 to 10,000 horses were constructed in England at or near important seaports. The personnel amounted to 1,500 to 2,000 of all ranks whose accommodation was, of course, on the same lines as that already described. The other buildings were stables, offices, forage barns, granaries, veterinary hospitals, as well as power-house, water supply, etc. The stables were open shelters with a longitudinal central wall fitted with mangers on either side and with hanging bails 5 ft. apart, supported on the outer side on pillars which carried the roof. It was most desirable to have mangers, bails, posts, etc., all of iron, as the animals were continually gnawing anything of wood. The best floors were of concrete, with a slight slope to the rear—but in France, where there were many remount depots, rough planking, sleepers or half logs made very satisfactory flooring. A very essential matter was the prevention of cold draughts, and for this purpose either the stables were built close together to shelter each other (fig. 6) or a wind screen was erected outside (fig. 7). In the early days of the war the S. African plan of having about an acre of land fenced in round each group of stables for 50 horses, was tried, but it was found that in the moist climate of the British Isles the ground soon became a quagmire, and the area required was enormous. Later, therefore, the stables were built in parallel lines near one another, a better arrangement for administration and good enough for exercising the animals. The veterinary stables were on much the same principle as the ordinary ones, but there were some loose boxes provided with slings for special cases. A horse bath, *i.e.* a narrow concrete tank with a sudden drop under water at the entering side and a ramp out on the far side, was a most useful adjunct in the veterinary lines, and indispensable in the case of skin complaints.

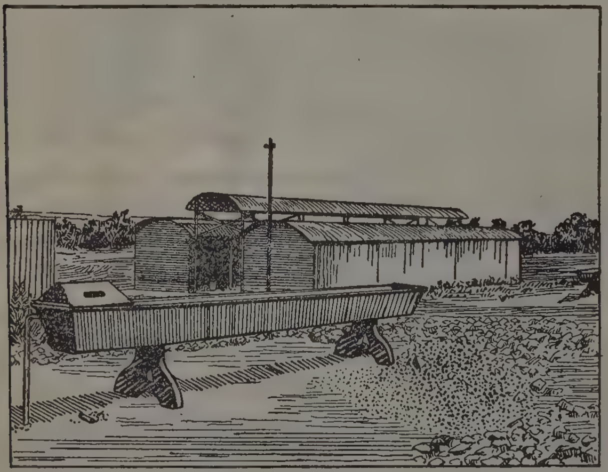

FIG. 6

(ii.) *Ordnance Store Depots* were numerous on lines of communication in France, and in connexion with munition collecting centres in England. The largest of these was at Didcot, close to a railway junction. The depot was divided into two main sections, one for ammunition, the other for ordinary stores. The former had to be at some distance from other buildings, was fenced in and guarded by sentries, and the interior space was divided up so that certain buildings were allotted to different classes of ammunition (shells, small arms, cartridges, etc.) under magazine regulations. The buildings were of a fairly substantial character, well ventilated and lighted, and where necessary, furnished with transporting gear and lifting tackle. The ordinary store buildings consisted of a double line of large steel framed and walled sheds, 400 ft. by 40 ft. in each case, spaced sufficiently far apart to admit between them laterally a double line of rails, so that wagons could be unloaded at one shed, while the other line was open, and on the side of the sheds farthest from the rails there was a metalled road for heavy motor lorries. The floor of each shed should be on a level with the floor of railway trucks, and there should be an outside verandah to the shed, so that trucks can be unloaded under shelter. The distance between sheds longitudinally should be sufficient to allow for cross-over lines from one railway line to the other. As protection from fire is of urgent importance there should be a girdle of fire mains all round the sheds, and an ample supply of water. There are a few other groups of buildings, *e.g.* offices, workshops and open vehicle sheds, but these require no special description.

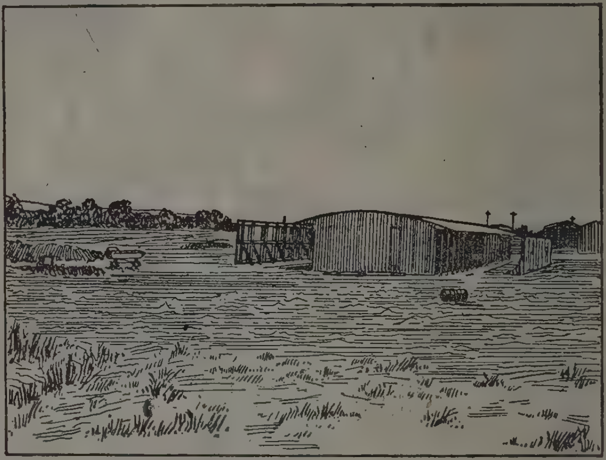

FIG. 7

(iii.) *Hutments for Munition Workers.*—For male workmen and employees the general lines of provision are the same as for soldiers, but with the coming of women into the field of labour, special provision was needed. One of the best arranged works had its women's colony situated on attractive and healthy ground about two miles from the works, the workers being sent to and fro by a light railway, and the special provision at the actual works being limited to dining-rooms and lavatories. At the colony headquarters the huts, which were made as attractive as possible with furniture well chosen, with flower beds and grass lawns surrounding them, consisted of two main groups, viz. the dormitories and the recreation huts. The former were double-storied wooden huts, about 25 ft. span, with a central passage, from which opened on either side little cubicles, about 8 ft. square, the partitions being about 7 ft. high. At the end of the central corridor were the lavatories and baths. Outside were water-closets. The number of women in each block was about 60. The recreation blocks consisted of dining rooms and kitchens in one block and a recreation and games room in the other, where also were the rooms of the lady superintendent.

(iv.) *Aerodromes.*—The accommodation for officers and men corresponded to that of infantry. The aerodrome sheds were sited at the end of the landing ground, a certain portion near the sheds being paved with concrete, asphalt or, in some cases in France, with rough planking. At first, the doors of the aeroplane sheds opened at the sides of the shed, a structural defect which became more accentuated as the demand for wider opening became greater. A fresh design of aeroplane shed, therefore, which gave doors at each end of a large shed, the span in some cases being as much as 100 ft., and the height of the shed 30 ft. to 35 ft., was made out, and all the later aeroplane sheds were built accordingly. Behind the aeroplane sheds were small workshops for minor repairs, and a cellar for the boilers required to heat the piping for maintaining a temperature in winter suitable for the various aeroplanes. Adjacent to the great sheds, but on the other side of a metalled road (for motor lorries) were workshops, lorry sheds, stores for spare parts, ordinary store houses, and power plant. Of these the only special one was for doping aeroplane wings, the poisonous fumes from which necessitated very special ventilation by means of fans. All the above were required in ordinary cases, but special designs had to be made in certain aerodromes used for experimental or other purposes; these however need not be detailed here.

Generally speaking it may be said that the requirements of aviation gave rise to a number of new constructive problems in connexion with hutting, but none of these proved to be insurmountable.

Although the arrangements in the theatre of war followed the above in general design, there were obvious local modifications. In the case of ammunition dumps, for instance, the buildings contained limited quantities of different classes of ammunition, and were constructed with very strong roofs, covered with sand bags or earth, and concealed as much as possible from aerial observation.

The following brief statistics of the Catterick Camp (Hipswell and Scotton divisions) may give an idea of the magnitude of such a task:—The total number of buildings for the two divisions was 2,700, and 240,000 tons of concrete were used. About three-quarters of the huts were of concrete slabs with steel framing, the remainder of frame work and expanded metal plastered. The central power station was of 1,000 kw. Overhead mains transmitted 3-phase current at 3,000 volts to transformers at each battalion hutment, hospital, etc. The lighting of each battalion was arranged in three separate circuits at 200 volts; there were about 12,500 lights and 300 H.P. of motors installed. The total length of high-tension main was about 15 m. and of low-tension circuit 50 miles. The water supply from the Swale was pumped 400 ft. from the river to the chlorinating tanks by electrically driven 120 H.P. centrifugal pumps, one of which could supply water for the whole camp for one day in six hours. The main pipes were 10 in. diminishing to 6 in. and were eight m. in length. There were 40 m. of branch pipes. The sewage outfall drains from 18 in. to 24 in. diameter were taken six miles to the treatment works. There was a complete system of surface drainage independent of the sewage system. The main camp roads totalled 22 m. and there were 70 m. of pathways. The average cost of each hut was £200 and of this 40% was for labour and 60% material. The total cost, including railways, electric installations, etc., was £1,250,000. (G. K. S. M.)

II. UNITED STATES

The presidents of the United States since Washington, almost without exception, had pointed out the need of a certain degree of preparedness in the way of a trained citizenry, arms and equipment, not only as an instrumentality for carrying out national policy at home but as a means of ensuring peace with other nations. Most of them recognized that lack of preparedness for national defence was in itself a temptation to aggressive and predatory nations. They also recognized that unorganized, unequipped, untrained, the United States could not hope to exercise that weight in the world's councils or in maintaining peace and international fair dealing, to which its position and importance entitled it. American politicians had often deliberately misled the people as to what could be done. The result was that, at the time when a world crisis was approaching which was in the end certain to involve the people of the United States, they were, in everything which related to preparedness for defence or to playing their part in the struggle for civilization, asleep. Lord Roberts had already sounded the clear note of warning to England, Kitchener had planned organized defences for the British colonies, but America, warlike yet unmilitary, was doing nothing to prepare for the storm. Impelled by an appreciation of the utter unpreparedness of the United States to meet promptly any military emergency arising from conflict with a first-class Power and by the general lack, not only of knowledge but of interest in the question of national preparedness on the part of the general public, and realizing that such interest could best be built up through the youth of the country, Maj.-Gen. Leonard Wood took up in 1913, as chief of staff of the army, with the Secretary of War, Lindley M. Garrison, the project of establishing certain training camps for duly qualified youth, and obtained his approval. This was the beginning of the Plattsburg idea. It was pushed forward by Gen. Wood in the following three years.

The 1913 camps were held at Gettysburg, Pa., and Monterey, Cal., and were made up principally of college students. The total number in camps was 244. They were known as Students' Military Instruction Camps. The young men who came were an unusually intelligent and earnest lot. Those at Gettysburg formed a permanent organization, which became known as the National Reserve Corps and had for its purpose the building up of a corps of reserve officers. The shield of the corps bore the words "Ready–Organized–Prepared" and its motto was "Striving for Peace but Ready for War." The results at Gettysburg and Monterey were such that these first camps attracted immediate and favourable recognition, and were the seeds from which sprang the Plattsburg camps. The question then presented itself, "Why should not the college and high-school students receive a training for national defence and learn that equality of privilege implies equality of obligation?" President Drinker of Lehigh University and Gen. Wood sent out circular letters to the presidents of many American universities, inviting them to membership in an advisory committee. Those who at first joined the committee were President Drinker, and President Hibben of Princeton, who were respectively president and secretary of the committee; President Lowell of Harvard; Hadley of Yale; Hutchins of Michigan; Benjamin Ide Wheeler of California; Schurman of Cornell; James of the university of Illinois; as well as John J. Finley, commissioner of education, state of New York; and to these were added later the president of Williams College, the president of the university of Alabama, the rector of the Catholic University, Washington, D.C., and a number of others.

The following year, 1914, camps were established at Fort Ethan Allen; Burlington, Vt.; Asheville, N.C.; Ludington, Mich.; and Monterey, Cal. The total number in the different camps was 667. These aroused a gradually growing interest and the Department of War determined that four such camps should be established during the summer of 1915, at Chickamauga Park, Ga.; Plattsburg, N.Y.; Ludington, Mich.; and at the Presidio, San Francisco, Cal. These camps were even more successful than those which preceded them, and the number in attendance was very much larger. Three successful camps in three consecutive months were held at Plattsburg, and camps of a month each at the other designated training points. The total number of men who passed through the camps during this year was 3,406. The camps were no longer limited to students from colleges and high schools but were open to business men and to men from all walks of life who had the necessary physical qualifications. The educational qualifications were moderate, and lack of education was compensated for by initiative, as shown by success in life, the position the applicant held in his community, etc.; in other words, anything which showed sound qualities of leadership. Interest grew apace. There were recruiting committees at the various universities. The World War had broken out, and to all who looked ahead it was evident that America would sooner or later be drawn into the struggle. In 1916 over 16,000 men were passed through the camps. The Advisory Committee and the Students' Recruiting Committees of the various universities were influencing the general public, and the Military Training Association of the United States was formed for the purpose of increasing the attendance. As Plattsburg was the largest training centre, the camps, wherever held, began to be called "Plattsburg Camps," the idea of this intensive training being spoken of as the "Plattsburg Idea."

In 1917, applicants for the camps numbered about 130,000, and had the United States not gone into the war in the spring, well over 100,000 men would have been trained in these volunteer training camps. The men who came to these camps were from every walk of life: bishops, priests, clergymen, rabbis, men from the labour unions, farmers, policemen from neighbouring cities, business and professional men, youths from the colleges.

The outbreak of the World War in 1914 stimulated interest in the training. It must be remembered that the second series of camps, those of 1914, were coming to a close just before the war began. During the winters of 1915–6 and 1916–7 courses were opened in Boston, New York, Providence, Detroit, Pittsburg, Philadelphia and other cities for the instruction and examination of applicants for reserve commissions, and through them were developed a large number of officers who played an important, indeed a vital, part in the training of the great war levies. Speaking of these camps, the chief of staff of the army, in his Annual Report for 1915, said:—

> "The military camps of instruction for students of educational institutions which were held in 1913 and 1914 have been continued this year. As there were no funds available to meet any expenses incident to the establishment of these camps, it was necessary to have them at military posts where the ordinary utilities of the post could be used, or, if at a place other than a military post, the citizens had to incur the necessary expenses in constructing the camps.
>
> ... The reports show that the results have fully justified the establishment of these camps. In addition to camps for students, camps have been authorized at Plattsburg, N.Y., Fort Sheridan, Ill., and San Francisco, Cal., for business men whose interest in the prepared-

> ness of the country for defense prompted them to request that opportunity be given them to prepare themselves so as to perform more efficiently their duties in case the country should unfortunately be involved in war. . . . Aside from the military instructions given these students and business men, I feel that the interest in preparedness which leads these men not only to give their time to the Government, but to incur the expenses of buying uniforms and paying for transportation to the camps, is of great value to the country and should be encouraged by the war department. These camps have passed the experimental stage and there can hardly be any question as to the advisability of continuing them and extending them where the conditions of service of regular troops are such as to permit the department to send troops and instructors to the camps. Men with means probably do not object to paying the necessary funds to get the military training which the Government expects to use in case of need. This, however, does not make it right. Men who are not so fortunately fixed financially should be permitted to show their patriotism and interest in preparing the country for war. If these camps are of value, which undoubtedly they are, and are to be continued, certain necessary expenses of the men willing to give their time should be met by the Government."

In 1916 a series of four camps, each for a month, was held at Plattsburg, N.Y., a camp of one month's duration for boys at Fort Terry, N.Y., and a series of six camps of two weeks' intensive training at Wadsworth, N.Y., for the police of New York City; and a series of three camps, each for a month, at Oglethorpe, Ga.

When the United States entered the World War these hastily but intensively trained enthusiastic men were invaluable. They furnished the nucleus of civilian officers with which to begin the great work of developing 200,000 officers, and added a valuable and indispensable force to the scanty number of regular officers and national guard officers available for the training of the men. In the spring of 1917 the Federal Government took over the whole task and established a series of camps for the training of officers for the war. Under authority of Section 54, National Defense Act 1916, the Secretary of War directed the establishment of 16 Citizens' Training Camps throughout the United States at the following points:—

NAME	FOR CANDIDATES FROM
Plattsburg Barracks, N.Y. (1)	Long I., New York City and adjacent territory.
Plattsburg Barracks, N.Y. (2)	Long I., New York City and adjacent territory.
Madison Barracks. N.Y.	Balance of State of New York and part of Pennsylvania.
Fort Niagara, N. Y.	Balance of Pennsylvania.
Fort Myer, Va.	New Jersey, Delaware, Maryland, District of Columbia and Virginia.
Fort Oglethorpe, Ga.	N. Carolina, S. Carolina and Tennessee.
Fort McPherson, Ga.	Georgia, Alabama and Florida.
Ft. Benjamin Harrison, Ind. (1)	Ohio and W. Virginia.
Ft. Benjamin Harrison, Ind. (2)	Indiana and Kentucky.
Fort Sheridan, Ill. (1)	Illinois.
Fort Sheridan, Ill. (2)	Michigan and Wisconsin.
Ft. Logan H. Roots, Ark.	Arkansas, Mississippi and Louisiana.
Fort Snelling, Minn.	Minnesota, Iowa, N. Dakota, S. Dakota and Nebraska.
Fort Riley, Kans.	Missouri, Kansas and Colorado.
Leon Springs, Tex.	Oklahoma and Texas.
Presidio of San Francisco, Cal.	Montana, Idaho, Washington, Oregon, California, Nevada, Utah, Wyoming, Arizona and New Mexico.

The training camps for officers were ordered to be ready for the reception of reserve officers about May 8, for candidates for commission May 14, and the course of instruction was to begin on May 15, 1917. Minimum age for attendance was 20 years and 9 months; maximum age 44 years. In addition to the foregoing, General Order 119, War Department 1917, established a training camp at Fort Winfield Scott, Cal., for the training of members of the Coast Artillery section of the Officers' Reserve Corps residing within the territorial limits of the Western Department, and a similar camp at Fort Monroe, Va., for the balance of the Coast Artillery Reserve Corps officers. These training camps began operation on Sept. 22 1917. A medical officers' training camp was also established in 1917 at Camp Greenleaf, Fort Oglethorpe, Ga. Other camps for officers were established at the headquarters of the various divisions, the courses being essentially the same as those at the former officers' camps. The period allotted for the development of an officer at the Government training camps was three months. The work was intensive and hard. It was an attempt, in the rush and confusion of war, to produce officers in the minimum period of time. The purpose was to turn out the largest possible number of platoon leaders and a limited number of company commanders and officers of field grade. The same general plan was carried out at the training camps for officers in the Quartermaster Corps, Medical Corps and other staff corps. The courses involved much hard work and were necessarily defective in some particulars, but they served to turn out many tens of thousands of officers with elementary training which was later supplemented by their work with the divisional organizations to which they were assigned.

Theodore Roosevelt gave the full support of his great prestige and influence in the upbuilding of the camps and never lost an opportunity to impress upon the public their importance and to push forward their development. Men too numerous to mention, men who are leaders in every walk of life, coöperated to the limit of their ability in the upbuilding of these camps and in waking the country to an appreciation of the gravity of the situation and the need of preparation. The camps were a great force in firing the public conscience and rousing the people to a realization of their obligation to prepare the country for defence and to do their part in the great struggle then threatening the world. (L. Wo.)

TRANSJORDANIA, EMIRATE OF, sometimes called Kerak, a dominion extending some 200 m. S. from the Yarmuk and from the Jordan eastwards to the desert. It comprises Gilead, Amman, Moab and part of Edom of the Old Testament, and El Belqa, the southern portion of the former Turkish *vilayet* of Damascus. After forming the independent kingdom of Ghassan under a succession of Arab dynasties from A.D. 165 onwards it was conquered by the Moslems during the joint reigns of Amr IV. and Jabala V. and VI. in 637, and under the name of Kerak became one of the six kingdoms into which Syria was divided under the khalifs of Bagdad and the Seljuk Turks. As the Emirate of Kerak it was a separate State during the Middle Ages and again became an independent principality in 1920 with its capital at Amman (pop. 2,300). The other principal towns are Kerak (pop. 2,500), Madeba (pop. 2,000), Es Salt (pop. 8,000), Maʿan (pop. 3,000), Jerash (pop. 1,500). Its inhabitants possibly number 180,000, varying according to the season and the movements of the nomads; they are partly settled Arabs—many of whom are Christians—with some colonies of Circassian Moslems and a number of nomads. It contains many interesting classical and mediaeval ruins. The physical features, flora and fauna are similar to those of southern Syria.

During the Crusades Kerak (*see* 15.753) was the capital of the great fief of the Oultrejourdain and, of its Christian lords, the most notable were Philip de Milly (1161–8), formerly lord of Nablus (1142–61), who surrendered the fief in order to join the Templars, subsequently becoming their Grand Master, and Reginald de Chatillon (1177–87), a former Prince of Antioch (1153–60), who was beheaded by Saladin after the battle of Hattin (1187). Saladin's brother El Adil ("saphadin") took Kerak in 1188 and was its emir until he became Sultan of Egypt (1200). His grandson En Nasr Daʿud, after being deposed from the throne of Damascus (1229), reigned in Kerak for 20 years and recaptured Jerusalem from the Christians in 1239. When the Ayyubid dynasty was overthrown in Egypt, his nephew El Mugith, a prisoner of the new Sultan Aibek, was released by his gaolers in Shobek and placed on the throne of Kerak (1250). He was deposed in 1262 (and later strangled) by Sultan Baibars of Egypt whose own son was glad to find a throne at Kerak after losing that of Egypt (1279). Berekeh's brother Maʿsud, who succeeded him in Kerak, was in turn deposed (1286) and another fugitive Sultan of Egypt, En Nasr, reigned in Kerak (1204–0) until his restoration to power in

Cairo, only to return to Kerak (1308–10) after a fresh deposition while awaiting a second and final restoration. For many years Kerak, which was the treasure-city of the Mameluke sultans in 1355, slipped out of history, and during much of the Ottoman period (1517–1918) enjoyed an uneasy if obscure independence, only coming under direct Turkish civil administration after the construction of the Hejaz railway.

Kerak was captured by the Emir Faisal on April 7 1918. General Allenby's troops operated in Transjordania in the spring of 1918 and the retreating Turkish garrison of Ma'an, forming part of the IV. Army, surrendered to Gen. Chaytor with the Australian Light Horse at Qastal on Sept. 29 1918 which marked the end of the Ottoman period. Transjordania formed part of the Emir Faisal's dominions, even after he lost Damascus, until the spring of 1921, when it was transferred to his brother the Emir 'Abdalla. (H. P.-G.)

TRANSPORT.—Among new economic conceptions resulting from 20th-century progress, the rise of a definite "science and art" of Transport is of outstanding interest.

The Function of Transport.—The function of transport may be described as the transference of persons and things, as and when required by mankind, from one part of the earth to another in a minimum of time and at a minimum of cost, these two factors being closely connected with each other. The axiom of political economy that exchange enables wealth which would otherwise remain unutilized to be used to the best advantage implies *displacement*. Such displacement or transportation is an essential characteristic of that form of exchange which we recognize under the name of commerce, and hence the history of commerce is to a great extent the history of the development of transport. The transport problem is an ever-recurring one which can never be finally disposed of. Only in recent years have its complexities been systematically studied, although the problem must have arisen when the first man had any belongings to move.

The factors governing the development of transport are intrinsic and extrinsic, the former including the nature and quantity of matter to be conveyed, the distance and character of the earth's surface between the two points of carriage, and the apparatus available for bringing the movement into effect. These intrinsic factors are governed and often impeded by certain extrinsic factors, which are mainly political, economic, strategic, and, lastly, the ever-existing element of human nature.

During recent years the importance of efficient transport to civilization has been more and more realized by the leading men in the world of commerce and politics; various schemes have been formulated and put into operation with a view to removing obstructions, and in order that a more comprehensive grasp of the whole subject might be obtained. These include the formation of schools of economics at the universities and elsewhere, which treat the subject as a branch deserving accurate study and scientific inquiry. A definite advance has also been signalized by the formation in the United Kingdom of a Ministry of Transport and of an Institute of Transport; also by the publication of various journals which deal exclusively with the subject.

Those who are intimately connected with the present-day efforts towards a solution of the problem are forced to realize the all-embracing scope of the subject and the difficulties attending its every phase. On the latter aspect of the problem it is interesting to note that as transport becomes more completely organized, it more surely provokes increasing controversy.

Many obstacles have already to a great extent been overcome, and those dealing with the nature of the commodities carried may be instanced as an example. The difficulties attending upon the bulk, fragility, delicacy, and the preservation of certain commodities which in early times formed an unsurmountable obstacle to their carriage, have been solved, and as a result, an increasing traffic in these commodities has taken place. This in turn increased the demand for these commodities, the wants of man having become less elemental and more artificial as the world has become more civilized. Of the extrinsic factors affecting the development of transportation we may instance the colonizers of the Early and Middle Ages, the growth of overseas trade dating from the 12th century, the wonderful impulse given by the "Industrial Revolution" of modern times, and, lastly, military exigencies in war-time.

Generally speaking, the development of transport brings about a tendency to a surplus of wealth. Unless a country produces a surplus of wealth it is unable to reduce poverty to a minimum or to insure that all its inhabitants have a sufficiency of food, clothing and warmth, without which contentment is an impossibility. The cheapening of transport reduces the cost of the necessities of life and thus enables a person to live at a higher standard than would be possible if the whole of his earnings were taken up in obtaining the bare necessities of life. The prosperity of most modern countries has directly followed the improvement of their transport system. Instances of this may be quoted in the case of Great Britain, with its internal system of railways and its vast organized overseas communication of shipping; of America, France and Germany, with their railways and internal waterways. On the other hand, China may be quoted as a country with vast resources and possibilities, but which for the want of transport facilities is not yet developed in proportion to her territory or population. It would not be too much to say that the development of the wealth of any country in the world has been brought about from time immemorial chiefly by the improvement in its transport system. The development of transport acts upon, and in its turn is influenced by, the progress of mankind in the continuance and improvement of the civilization of the world. It affects and promotes the intercourse between different peoples and continents, and it creates opportunities for employing the forces of Nature for the use of mankind by the advancement of science.

In general terms, modern-day transport may be classified into human, animal, and mechanical. In its various forms the latter is carried on by land, road, sea, river, canal, inland water, railway, air and aerial ropeways: these in turn are actuated by the motive powers of gravity, steam, electricity, combustion engines, wind, and water. All these motive powers originate in some form or another in the use and application of the stored-up energy of the elements, and the object of mankind has always been to use these elements to give the best results with a minimum of cost. The progress of mankind has probably lain in this direction more than in any other, and advancement has been made during the past century which would before that period have seemed impossible of attainment.

The History of Transport.—At different periods of their existence the various communities of the world have passed through somewhat similar stages of transport development. We read that canals were constructed in Egypt 3000 B.C., that the Phoenicians crossed the inland seas in ships propelled by oar and wind and carrying 500 men, and that King Solomon drew a portion of his revenue from the caravans which journeyed through his territory. We learn that Babylonian caravans travelled into Phoenicia, Arabia, Syria, and Persia, and that the Egyptians sold chariots in neighbouring countries at an equivalent value of £50, while chariots are first noted in the annals of Britain in 300 B.C. The Greeks, before 1000 B.C., were constructing roads, and providing their harbours with walls and jetties, whereas roads, as such, were practically unknown in Britain nine centuries later.

The first mode of transport undoubtedly was the carrying of commodities on the human form. This mode is still exclusively used among the primitive tribes and to a certain extent even among the most civilized nations. Primitive man, however, early realized the value of waterways as a means of transport, and at first utilized a raft of tree trunks lashed together, a cumbersome method, both in preparation and in use. This raft he guided by means of a stick or branch, the forerunner of our punt pole. He also discovered that skins would float, and, by supporting the skin of an ox or a horse with a light wicker frame, he produced the coracle, a boat which he could propel on the water and carry on his back overland. Later, two or more skins were sewn together to form the shell of the boat, the seams being "caulked" with a resinous substance. The coracle is still in use on certain of the western rivers of Britain. It was an easy stage to build up the raft into a sort of box by using planks for the sides, the planks being sewn together. Here we have the origin of our present-day flat-bottomed boats. Yet again, by the use of fire, early man made a primitive boat by hollowing out the trunk of a tree, which, being shaped as experience has taught, formed the first point in the evolution of the ship. To harness the wind was a further stage, and the gaining of the art of navigation furthered the development of the sailing vessel.

On land, the animals natural to a country—the horse, the camel, the ass—have been employed as beasts of burden from early days. Chariots were in existence thousands of years before the Christian era, but the absence of good roads resulted in a very slow development of land transport.

Coming to Britain in the Middle Ages, we find water transport as the most important means of conveying goods; what little transport was effected on land was by means of pack-horses. Travellers and traders combined in armed companies for protection against marauding bands, and we see long lines of laden horses slowly progressing over tracks so narrow that the animals could seldom pass two abreast. The rolling of a log is supposed to have inspired the idea of the early waggon for transporting materials, and in the 16th century a heavy waggon with broad wheels on a rotating axle, and fixed front wheels, came into use. Its sphere of action was limited to local markets. Such organization as there was lay in the hands of the lord of the manor, who could call upon his tenants for the services of a specified number of waggons and waggoners. Better roads were required. Although the Romans, with their knowledge gained from the Etruscans, did construct many and great roads, organized road-making was practically non-existent from their time until the 16th century, when counties were made responsible for the upkeep of bridges, and parishes were ordered to appoint two road surveyors, who were assisted by compulsory labour. Passenger carriages came into vogue in 1550, but, being springless, had little pretension to comfort.

In 1634 the Sedan chair came into use, and in the same year the first hackney carriages were licensed. In 1650 waggons completed the journey from London to Dover in three or four days. About the same time, springless stagecoaches carrying passengers inside at a charge of five m. for 1s., and luggage at the back, were introduced. By reason of the condition of the roads their rate of travel was only four to five m. an hour; they seldom travelled in winter. In 1658 a coach made the journey from London to Edinburgh at a cost of £4 per passenger, and was more than a fortnight on the way. The post-chaise system was now established. Wealthy people were able to hire horses for their carriages in relays at the various inns, or both the chaise and the horses. A journey from London to Scotland in this manner cost at least £30.

At the beginning of the 18th century, waggons were journeying with goods from London to Bristol, and we read that in 1776 waggons travelled from London to Edinburgh and back in six weeks with a load of four tons, whereas a sailing vessel made a similar journey in the same time, carrying some 200 tons and requiring only four times as many men as a waggon. In 1763 a monthly coach service between the same two towns was instituted, completing the journey in 14 days, and about the same time services to Bath, York, Glasgow, Exeter, and other towns were inaugurated. Coaches with springs appear to have been in use by 1760. Particular attention was now being paid to roads. The famous road engineers, Telford, Macadam and Metcalfe, were at work, and in the 14 years following 1760 some 450 Acts of Parliament authorizing road construction and tolls were passed. The experimental mail coaches of 1784 gave an impetus to road transport. Their speed of six m. per hour was soon increased to 12. Outside passengers were charged about 5d. a m., and those inside, 3d.

Canals had long existed in Holland, and were introduced into France in the 17th century, but although two canals were constructed in Britain by the Romans, one of which, the Fosse Dyke, is still in use, it was not until the 18th century that canal development began in this country. The first important canal was constructed from Worsley to Manchester, at the instance of the Duke of Bridgwater, and was opened for traffic in 1761. It was found that the cost of transport by canal was about one-quarter of that for carriage by pack-horse or waggon for the same distance, and the price of coal in Manchester was immediately reduced by 50 per cent. In 1772 passenger boats, charging 1s. for 20 m., were established on the canal. In 1777 the Grand Trunk Canal, between the Mersey and the Trent, 96 m. in length, was completed, and in 70 years 3,000 m. of canals were constructed in the British Isles by the Companies of Proprietors. Since 1830, with the exception of the Manchester Ship Canal, there has been but little expansion of Britain's canal system. So far as England and Wales are concerned, practically all the canals were constructed by private enterprise without any State financial assistance, but this does not apply to Ireland or Scotland.

Towards the end of the 18th century, experiments with steam-driven vessels were in progress, and in 1788 a small steam-boat was tried in Scotland. Trains hauled by horses over parallel logs of wood had been in use for colliery purposes in the 17th century. Later, the wood was covered with metal plates, and in 1767, cast-iron rails were brought into use.

The coming of the 19th century was heralded by the authorization by Parliament in 1801 of the first public railway—from Croydon to the Thames. Traders paid tolls to the company for the privilege of horse-hauling their own waggons over the line. In 1804 Trevithick's locomotive hauled 70 passengers and 10 tons of goods near Merthyr Tydvil, but the first use of locomotives on public railways was on the Stockton and Darlington line (now part of the North Eastern railway), which was opened in 1825. The first train carried 500 passengers and made the journey of 8¾ m. in 65 minutes. For some years, steam traction was employed for the haulage of goods and mineral traffic only, passengers being conveyed in horse-drawn coaches. The company soon learned that it was impracticable to allow individuals to run their own waggons at will over the line, and as a solution the system of company-owned traction and waggons developed. In 1829 George Stephenson made certain the future of railways by producing his famous "Rocket" type of engine, which attained a speed of 29 m. an hour at its trials. By 1840 there was a regular service between London and Birmingham, the journey occupying from 5 to 6 hours, and Glasgow was brought within a 24-hours' journey. There was also a quarter-hourly service between London and Greenwich. In 1845 over 1,200 railway bills were presented to Parliament, but only a tenth of them received sanction.

Similar progress was made with steamships. In 1807 the "Clermont," constructed by Robert Fulton, began to ply on the Hudson river between New York and Albany. In 1818 the "Rob Roy," a wooden paddle-steamer, travelled from Dover to Calais, and in 1819 the "Savannah," a sailing vessel with auxiliary steam and removable paddles, crossed the Atlantic from Savannah to Liverpool in 25 days. In 1838 two vessels crossed the Atlantic under steam-power only, and the screw propeller, which was invented in 1836, was used on ocean-going craft in 1850.

In 1820 was started the Paris cabriolet, which word was later contracted to "cab," and the "Dandy-horse," the forerunner of the bicycle, and in 1829 the first omnibus made its appearance on the streets of London.

The advent of the "Industrial Revolution" saw in Britain a number of self-contained communities, each more or less dependent on its own resources for necessary commodities, and a transport system which has been described as probably the worst in Europe. The means of transport were limited to river transport, supplemented by teams of pack-horses and waggons, and, in mining districts, by horse tramways. The comparatively bad condition of the roads, and the small amount that could be carried, made conveyance by horse and waggon slow and costly, while transportation by river had only a limited sphere, and even then it was unreliable.

The application of steam as the motive power of machinery cheapened and speeded up production, but labour, iron for the machinery itself, and coal as fuel, were needed. There followed a rapid development of the British coal industry, not only where there were river and sea facilities, but far inland. The iron industry moved its base northward, and there was a speedy growth of large factory areas, with increasing numbers of workers. The workers required food and domestic supplies, the factories required raw materials and coal, and these must needs be obtained from other areas. Improvements in the iron industry gave better and cheaper agricultural implements, and a development in agriculture gave greater supplies of produce ready for moving to the industrial areas. Industry had now reached a stage where production had outstripped its necessary adjunct, transport, and there was a crying need for more efficient and economical methods of transport. For this, capital was necessary, and the increasing wealth which accompanied the industrial development provided it. At first, canals, and, later, railways, played their part in providing the factory districts with raw materials, fuel, and food, and, in addition, along with steam-boats, made possible the distribution of the manufactured articles to an ever-widening range of markets.

Modern Development.—The modern development of transport may be said to date from the "Industrial Revolution," and from that time it has been generally recognized that, where advantages have been granted by the State to various forms of carriers, the rates of charges and the provisions for the safety of the public should be controlled to a certain extent by the State. This has been chiefly in evidence in the case of the railways, which were given compulsory powers by legislation for the acquisition of land and other advantages. In other words, it has been recognized that, as the carriers existed to a large extent for the benefit of the public, it was necessary that individuals should be compelled to sacrifice their private interests for the good of the public generally. On the other hand, it has also been recognized that, the carriers having been given these advantages, the State should protect the public in certain respects.

In Great Britain practically the whole of the transport undertakings have been initiated and carried on by private enterprise, the primary object of the companies from their point of view being the earning of money. For this reason the various companies have of necessity vied with each other in making as much money as possible, and one of the most obvious ways of doing this was by increasing the amount of traffic carried. Inducements were therefore held out of giving facilities to traders in various ways, the chief of which has been the cheapening of the rates. This, however, has taken place as a rule only when there has been competition, and the rate-cutting between the railways at certain periods has reached such a stage that it is very doubtful whether the companies have benefited by it or not. In the case of the railways, which are at the present time the most important of the overland carrying factors of Great Britain, the return on the capital expended has not been very great.

From time to time there have been amalgamations of the railways to a limited degree, and these as a rule have benefited both the railway companies and the public by cheapening the cost of working the undertakings.

A brief summary of each system of transport, with its influence as a factor of transportation, is given below.

Railways.—The evolution of the railway and the invention of the locomotive, with its successful application to railway traction in 1804, inaugurated a new system of transport. Designed primarily to reduce the cost of transport of coal by road and to compete successfully with transport by canal, railways have developed from the isolated small sections in various parts of Great Britain to be at the moment the predominating factor in the world's transport. Indeed the mileage of railway in a country may safely be taken as a criterion of its industrial development.

Railways spread rapidly in Great Britain after their inception, and numerous companies promoted the new mode of transport.

The carriage of coal and other minerals proving immediately successful, the transport of the travelling public became naturally the next development. The first passenger coaches consisted of open trucks with neither roof nor seats, but the discomfort of these led to the evolution of covered coaches, which were provided for 1st- and 2nd-class passengers only. The 3rd-class coach was still roofless, but fitted with benches. The luxurious coaches of to-day, with facilities for dining, sleeping, and, in some cases, baths, are material proofs of the great progress made in this branch of transport.

Locomotives and freight rolling-stock have also developed in accordance with the requirements of the age. Waggons constructed to carry 120 tons and locomotives weighing 244 tons are in use on two or three railways in the United States; but the waggon commonly used has a capacity of only 50 short tons, while the usual weight of locomotives is between 175 and 220 short tons.

The electrification of railways is the latest stage of their development. Applied to the transport of the masses of people congregated in large cities, it has gone far to solve one of the most difficult problems of the present day.

For long-distance travel, electricity has now passed the experimental stage, and no doubt the progress of time will see the displacement of steam by electricity as the motive power for all railways.

Water Transport.—The development of this system has been chiefly confined to sea-borne transport. Although a steamer was first used on a canal, the Forth and Clyde, in 1802, it soon reached salt water, and the s.s. "Comet," built on the Clyde in 1812, marked the commencement of the ocean steamer transport era.

The first form of propulsion, viz. by paddles, was superseded by the screw propeller, which has been found more efficient and suitable for rough waters. Improvements were also effected in the engine room. Simple and compound engines were successfully followed by triple and quadruple expansion engines. These in turn gave way to the steam turbine. Coal is being displaced by oil fuel for steam raising, and we have also the internal combustion engine.

Other important features of development are refrigeration and wireless telegraphy. The former has increased the availability of the food supplies of the world.

In this sea-borne system of transport, competition has resulted in rate-cutting wars, which have not been so evident in the other systems. In cargo rates and passenger fares, competition has at times been very keen, and quotations have reached figures far below an economic level, as for instance at the time when passengers were carried from Liverpool to New York for £2.

Mechanical Road Transport.—This form of transport, although generally believed to be an invention of recent years, was also inaugurated at the beginning of the 19th century, but development was hampered by the excessive road tolls and statutory restrictions, an example being the British regulation which required a man with a red flag to precede every mechanically propelled vehicle. These restrictions operated until 1896, when greater liberty was afforded by the Locomotives on Highways Act of that year. Further freedom has been given by the Motor Car Order, 1904, and the utility of this system has now been fully established.

The earlier types of mechanical road vehicles were steam propelled, but the invention of the internal combustion engine and its application to road transport, associated with rubber-tired wheels, created a revolution, and is responsible for the rapid development of the last generation. Mechanical road transport commenced and operated solely as a passenger transport system until recent years, but in conjunction with the general improvement of roads it has, for distances up to 75–100 m., developed into a form of freight transport in competition with railways, except in the case of long-distance mineral traffic.

Passenger road transport is generally provided by petrol-propelled vehicles, and examples of these are found in high-powered private motor-cars and in public motor-buses carrying 54 passengers.

In the transport of merchandise by road, all three types—petrol, steam and electric vehicles—are used, their respective spheres being dependent upon distance, nature of traffic, regularity of service, etc.

In the development of mechanical road transport may be included the improvements effected in tram-car services. The horse vehicle has been displaced by the electric vehicle, obtaining power through overhead or underground conductors, and this form of transport has contributed very largely to the expansion of the areas of large cities.

Aerial Transport.—This system commenced with the 20th century, but so rapid has its progress been, principally through military stimulus, that by 1921 its success was assured.

The development of the internal combustion engine provided the means of securing adequate power with a minimum of weight which had long been sought in connexion with aerial navigation. France, Great Britain, and the United States joined in the development and while the first decade of aerial navigation was a period of experiment, transport by heavier-than-air machines was sufficiently advanced to be put to practical use at the commencement of the World War in 1914. The potentialities of aircraft in warfare were immediately manifest, with the result that the progress achieved in the development of the air machine was infinitely greater than would otherwise have been the case. This applied equally to the airship or lighter-than-air machine. The internal combustion engine converted the ordinary balloon into a dirigible, and this development continued until the cessation of hostilities in 1918.

Economic Effects.—The consequences of the development of the various systems of transport upon nations and peoples are incalculable. The growth and consolidation of the British Empire may well be attributed to the fact that during the greater part of the 19th century the initiation and supply of transport was provided by Great Britain. She became the carrier of almost all the world's traffic, which, of course, involved the maintenance of the freedom of the seas.

In the United States it is not too much to say that the rapid development of its transport system has enabled the growth of the whole country to develop simultaneously and thus evolve a "United" States instead of a second "divided" Europe.

Viewed from a different angle, we find the conclusions of those political economists who advance the argument that over-population would inevitably lead to starvation have been negatived by the development of transport which, coupled with the use of modern methods of refrigeration, has increased the availability of the world's harvests. The periodical famines in those countries where transport in its modern developments is practically unknown is direct evidence on this point.

The mobility of labour, the importance of which can hardly be exaggerated, had also been increased by transport development to an enormous degree. Its effect on the social condition of mankind is clearly demonstrated when it is observed that, where transport is developed most highly, there also is the social standard highest.

Military and naval operations have been considerably influenced by modern transport. At the battle of Waterloo about 75,000 men were engaged on each side. One hundred years later in the World War 50 million men were engaged in the armed forces of the combatants from start to finish. New railways and roads for mechanical road transport made possible the movements of armies, guns, munitions and necessary supplies. The heavy guns were moved by rail or mechanical road transport, and as if to emphasize the part which transport took in the war, the negotiations for the Armistice were conducted in a railway carriage.

On the naval side, steamer transport was the forerunner of the modern battleship. It was many years after the building of the first steamship when sailing ships of war were discarded, and practically all developments in ocean transport have been adapted to the needs of the navy.

During this wonderful development the Governments of the world generally took little interest in transport beyond enacting restrictive legislation. Prussia was the one exception; for almost from the commencement of railways in that country, the State took an active part in their construction and operation, and after the Franco-Prussian War of 1870–1 adopted the policy of acquiring all the German lines. This was entirely for military reasons, and was accomplished in two decades. There was also Government coöperation in the United States. Various states assisted the railways by land grants and other subsidies, while the Union Pacific—the first American transcontinental railway—was made possible by financial aid from the Federal Government.

The World War of 1914–8 was destined to have far-reaching influences on transport. Until then, except for the fixing of rates and for the ensuring of public safety, the British Government did not interfere with the working of the railways. At the outbreak of the war, however, it became apparent that it would be necessary for the Government to take control of the whole of the British railways, and, as a direct result of former amalgamations, this was done with admirable results. Rolling-stock was pooled, engines being loaned where necessary. The success which followed justified the action taken, and valuable lessons were learned which have proved of great assistance in the consideration of the direction of future development. Similar action was taken in the United States.

The early part of the 20th century was marked by a tendency towards large combinations of capital and labour, one acting and reacting upon the other. This movement, perhaps first developed in the United States as to capital and in Great Britain as to labour, has been gradually increasing, and the state of affairs is now such as to render difficult the existence of any small concern, either of capital or labour, which is not protected by some form of combination with other similar bodies. With other concerns, transport has been largely affected by the Trust movement, and to this cause the Railways Bill of 1921 which amalgamated the railways of Great Britain into four groups was largely due. This arrangement in reality has been a development of the Trust movement.

If modern transport is to develop on economic lines and properly fulfil its functions, the tendency of the future will be toward the standardization of the various forms of transport all over the world. The lessons of the war have emphasized this very strongly, and though the progress may be slow, the future prosperity of the world largely depends upon its being brought into effect.

Operation Principles.—Transport operation deals with the actual movement of passengers and goods, and the methods of operation are dictated by the requirements of both classes of traffic. Any passenger service must be so designed as to satisfy public requirements in respect of safety, convenient times of departure and arrival, connexions for through services, speed, and comfort. Attention must be given in the first instance to what are the main channels of traffic, and these are dictated by the requirements of both commerce and pleasure—in other words, "necessary" and "luxury" travelling.

With goods traffic the conditions are different. One essential difference between passenger and goods traffic is that whilst passenger traffic must conform in some measure to the requirements of the public, goods traffic can, generally speaking, be run more or less at the transport company's convenience, attention being paid at the same time to the needs of the commercial community. The question of safety is not so important here, as evidenced by the more lax regulations governing goods traffic, as compared with passenger traffic, both on land and sea. In the United States, however, safety laws apply to freight trains and passenger trains alike. (*See* RAILWAYS: *United States.*)

Recent developments in block and automatic signalling have made railway operation—where automatic train-stops are in use—as safe as is humanly possible, while shipping is now controlled by adequate safety regulations. If safety in the air were assured, such means of transport would compete more severely with rail and sea services; already the safety and comfort of road transport have opposed to the railways a keen rival.

Another factor in transport operation is speed. In all forms of transport, other things being equal, the demand is for the quickest route.

As to goods traffic in particular, it is probable that the tramp steamer will continue to carry commodities which do not require quick delivery, and the "slow" as distinct from the "fast" goods train will always have its particular use, while a future generation will doubtless use aircraft for the conveyance of goods where the quickest delivery is the main consideration. The speed and convenience of road transport is attracting a considerable volume of traffic formerly borne by rail.

High speed is one of the primary considerations in all forms of transport. The aeroplane attains a speed of 100 m. per hour, the express train 60 m. per hour, the liner 24 knots, and while road motor vehicles can attain the speed of railway trains, other considerations limit their speed on public highways. One of the reasons why canals have fallen almost into disuse in England is that barge traffic is exceedingly slow. In France, the serious competition of the railways was recognized a generation ago, and although the canals were then equipped to furnish efficient service, and steam and motor traffic has to a large extent superseded the slow horse-drawn barge system which in England is still very general, the average speed seldom exceeds four or five m. an hour.

The methods of loading of ordinary goods traffic vary. A well-equipped goods depot has various mechanical appliances for lifting and loading goods on to waggons, but a considerable amount of waggon-loading is still performed by hand. Small parcels require a large amount of manual labour. Oil-loading in bulk is on the other hand a mechanical process. Then again different classes of goods require different vehicles, such as refrigerator vans for meat, fruit and other perishable commodities, vans for explosives, and mineral waggons. Ships, too, are adapted for carrying special classes of goods; grain ships, meat ships, oil tankers, as their names imply, are constructed for conveying particular commodities.

In the United Kingdom goods waggons have a limited loading capacity of ten to twenty tons, with mineral waggons up to forty tons, although two or three railways of the United States use a 120-ton coal waggon. It is obvious that the work involved in loading a goods train is far greater owing to break of bulk than that involved in placing the same load in the hold of a ship.

A very large tanker, for example, can load or discharge about 11,000 tons of oil in 12 hours. Loading the same quantity for conveyance by rail is a much longer process, as at present each oil tank waggon has a limited capacity of about 10 tons. The question of transport in bulk by ships applies not only to oil but to every class of commodity. Docks and harbours are generally well-equipped with cranes and warehouses, and with special appliances such as grain elevators and oil pumps.

Much time and labour are expended at tranship points. Goods are brought to ports by rail for shipment, and the accumulation of cargo for any particular vessel usually commences long before the vessel's arrival. This predicates the necessity for goods warehouses and sheds, so that commodities are properly protected against pilferage, wind and weather, while awaiting shipment. When the vessel arrives, there must be adequate facilities for removing and dispatching her inward cargo before the outward freight is dealt with. Rail facilities on the quayside, as at Manchester, Southampton, and all modern ports, obviously make the process of transhipment much simpler than as at some of the older docks, where, when goods are taken from the ship's hold, they must first be loaded on road vehicles, and thus dispatched to the rail terminus.

The transhipment difficulty is also to be met where through-running facilities for trains do not exist, due to break of gauge, for example. This difficulty has been very acutely felt on the mainland of Australia, where the states have varying gauges, so that inter-state traffic involves transfer or change at several of the boundaries. The importance of the subject has resulted in the appointment in 1920 by the Australian Government of a commission to report on the possible unification of the railway gauge throughout Australia.

The most usual method of local collection and distribution of goods from a dock, station, or goods depot is by means of motor lorries. These have largely superseded horse traffic. In Great Britain, the railway companies perform a certain amount of carting, but many private traders have their own collection and delivery vans, and special carrier companies also assist in this very essential service. The use of motor vehicles for the local conveyance of goods has been so far extended that regular goods and passenger services now operate over long distances throughout the country. For the transport of perishable goods the motor lorry is particularly well suited. It has the advantage of offering door-to-door facilities with one handling at each end. The publication of the first "road Bradshaw" in Great Britain is an indication of the extent to which road traffic now operates.

The haulage of empty stock from one point to another is clearly necessary whenever a centre receives more or fewer waggons with loads than it requires for its own outward traffic. Very few centres receive the same number of loaded waggons as they require for forwarding goods. There must therefore always be a considerable movement of empty waggons. Statistics published by the Ministry of Transport in England show that in that country, at the commencement of 1921, about 30% of waggon mileage was "empty" running. Similar conditions prevailed in the United States. A large proportion of "empty" running is in connexion with mineral traffic. A mining area offers a considerable volume of outward traffic, with very little inward. Occasionally, however, loads can be obtained in both directions. A good example is seen in the case of iron-ore carried from Tyne dock to Consett for use at the iron-works there. The waggons are then used to convey coal from the collieries in the neighbourhood of the iron-works to Tyne dock for shipment. But this case is exceptional. The number of mineral waggons which run empty, or the ineffective dead load, can be reduced by the introduction of higher capacity waggons with a larger proportion of live to dead load.

This question of "empty" running is of equal importance in connexion with shipping. A well-organized shipping company will have its agencies so well distributed to secure return cargoes that loss through running ships in ballast is reduced to a minimum.

One great difference exists between the operation of railways and that of all other forms of transport. Railways operate on their own tracks, property which they must maintain and which has to be adequately staffed and attended. Ships have the advantage of the trackless ocean; aeroplanes and airships, infinite space; road vehicles, the public highway. Canals in Great Britain are different again; the waterways themselves are as a rule owned by various authorities, but the barges and other canal craft are usually owned by separate transport companies and private traders.

It is thus apparent that a railway undertaking must have proportionately a much larger operating staff than any other transport service. This introduces the question of management. The combination of the several factors of transport efficiency is the key to efficiency in operation. For the efficient handling and use of these factors an executive management is required, a management that should not only have full knowledge of the agencies, means and methods required for the particular type of transport operation with which it is concerned, but should also possess ability for the correlation and control of the many resources at its command. Indeed, the whole system of operation depends upon the body of management.

As to what is the best organization for management of a railway there are such wide differences of opinion that it is not possible to suggest that any given or particular plan is the correct one. In England at the head of a railway organization are the directors, presided over by their chairman, who are responsible to the shareholders for the efficient conduct of the undertaking. All questions of policy are settled by the Board of Directors, and the administrative staff, which is controlled by the general manager, who is directly responsible to the Board of Directors, is responsible for the actual carrying out of the work. The general manager cannot actually attend to all the details of operation of a railway: he can however see that the policy of the directors is carried out by the various heads of the departments. The chief executive officers are the chief engineer, mechanical engineer, traffic and goods managers, secretary, legal adviser, and accountant. In America, where one company is responsible for perhaps 5,000 m. of permanent way, the "divisional organization," which decentralizes the management, is more extensively resorted to than in other countries, having less track mileage.

A comprehensive view of the whole system is necessary to any manager or body of managers. The American railways recognized at an early stage that they could obtain a proper survey of the working of the whole system only by the collection and collation of statistics relating to every branch and section of the industry; and the Interstate Commerce Commission in a recent report stated that the successful operation of American railways is highly dependent upon statistics. The value of statistics is now better appreciated in England than formerly, and statistics relating to railway operation, on the general lines of those in use on the North Eastern railway for many years past, are now officially collected and issued. These have the effect of reflecting the operating efficiency of the various lines. They enable a number of units of efficiency to be arrived at, as, for example, the ton mileage, the train mileage, the waggon mileage, the average waggon load, the net ton miles of freight moved per hour, the percentage of time a locomotive spends in effective work, the proportion of standing and running time, and the proportion of time a waggon is moving. The ultimate object of statistics is to enable railways by comparison to find out the weak points and thus to be operated in the most economical and efficient manner.

As regards shipping, the Board of Directors is again responsible to the shareholders, but the managing staff is much smaller in proportion than in the case of railways. Each department has, however, its executive head, viz. marine superintendent, superintending engineer, freight superintendent, victualling superintendent, etc. The operating staff is also much smaller than is the case with railways, and the larger part of a ship's crew is engaged temporarily for a voyage, and when a vessel returns to a home port and the crew is discharged, only a nucleus staff remains. Then again, most shipping companies send their vessels for overhaul to shipbuilders and only carry out minor repairs themselves, unlike the railways, who do most of the repairs to their stock in their own shops.

Economics of Transportation.—The business of transport, whether by land or water or air, is subject, like any other industry, to those economic laws which govern the production, distribution and consumption of the commodities and services required for the satisfaction of the needs of humanity. From the economic standpoint, therefore, it is essential that the cost of the "production and distribution" of transport services and the price at which these services are placed at the disposal of the consumer shall be so related as to yield a reasonable margin of profit to the undertakings concerned. Where transport services are provided and operated by private enterprise, the applicability of this principle is naturally more obvious than in those instances where the enterprise is undertaken by a municipality or State: but even in this latter case the assumption should be that the benefits derived directly or indirectly by the community concerned are sufficiently great to warrant the expenditure which the provision of the service involves.

Railways.—In their efforts to attract traffic, railways have to compete not only with other railways but also with transport services carried on by road, river and canal. In certain circumstances an additional element of competition is to be found in coastwise shipping, and the competitive influence of air transport agencies still remains to be measured. Railway undertakings differ from road service undertakings in that the former ordinarily bear the whole cost of constructing and maintaining the "way," upon which the traffic is carried, whilst the cost of roadways is usually borne, wholly or in part, out of public funds. In the case of inland waterway services also, the expenditure on "way and works" is frequently defrayed out of State resources in countries other than Great Britain; but against this advantage must be set the slowness of inland water transport and the much greater vehicular capacity which railways can offer. The competition of coastwise shipping on the other hand is frequently severe, the cost of carriage by sea being relatively low, whilst in the conveyance of non-perishable goods, rapidity of service may be a matter of little moment.

In the promotion of any new railway the selection of the route to be followed is of the first importance. Upon this depends the expenditure involved in overcoming the physical difficulties to be encountered in the course of construction, and the location of the line should be such as to secure the maximum amount of traffic available. The cost of future operation also depends, in great measure, upon the route adopted.

By the exercise of engineering skill and experience, the total mileage of track may be reduced, and difficult gradients and curves may be avoided, and by these means the subsequent cost of haulage is obviously affected. At the same time savings may be effected in capital expenditure on earthworks, tunnels, bridges and other special works of a costly character.

The location of the line and of the stations, goods depots and sidings in relation to the centres of population, trade and industry, determines to a great extent the amount of traffic and consequently the earnings which will be secured; and the number and position of these stations, etc., will in turn affect both the capital cost of the undertaking and the annual expenditure involved for staff and maintenance. Moreover, as distance is one of the prime factors to be considered in the fixing of rates and fares, it is manifestly desirable that, *ceteris paribus*, the route selected to connect the various traffic points to be reached should be as short as possible. This principle is obviously of particular importance in competitive areas.

In determining the location of the line the question of curvature and gradients calls for special attention. Curves are introduced with a view to avoiding undue expenditure on special works, such as tunnels, bridges, embankments and cuttings, but as a set-off against this, if the curves are anything but flat ones (*i.e.* curves of large radius), there is the resultant increase of wear and tear upon the rails and rolling-stock and increase in the mileage of track, whilst reductions of speed and a greater consumption of fuel may also be involved.

The influence of gradients upon working costs is still more marked. Where they are numerous and severe it may be necessary to employ engines of a heavier and less economical type, with the result that when running on the level sections or on the down-grades there is an appreciable waste of power, whilst the use of brakes is accompanied by an increase of the wear and tear of the rolling-stock of permanent way. In extreme cases it is usually necessary to employ additional ("banking") engines on the up-grades. In some instances the length and weight of trains have to be reduced and the cost of working the line is thus inevitably increased.

In considering the "earnings" of railway companies, or the "price" at which they place their services at the disposal of the consumer, it must be remembered that the undertakings themselves, being quasi-monopolistic in character, are usually subject to regulations imposed by the State. Consequently, in railway working, the economic tendencies which usually determine the price of commodities or services do not operate with entire freedom. At the same time even railway rates and charges, as a whole, must bear some relation to the cost of production.

Railway expenditure, apart from taxes, falls under two main heads: (*a*) working expenses, which include salaries and wages, maintenance and renewal of way and works and of rolling-stock, and also fuel and stores; and (*b*) fixed charges, including interest on capital and also rentals and other similar charges.

The aggregate earnings or gross receipts of a railway undertaking which is run on a purely commercial basis must be sufficient to cover both the working expenses and the fixed charges. The success of the undertaking depends ultimately upon the amount of the gross receipts and upon the proportion of this amount which is absorbed in the payment of working expenses. The volume of the traffic is therefore a matter of fundamental moment. If it be small and incapable of further development, and if the working expenses are already at the minimum compatible with efficiency of service, it may be necessary to charge high rates in order to cover both working expenses and the fixed charges. An increase of rates, to be effective, must, however, be such as to produce an amount which will more than compensate for the loss of traffic which such an increase tends to produce. Successful railway transportation therefore rests upon the following factors: (*a*) economy in the cost of construction and other items by which the magnitude of the fixed charges is determined, requiring engineering skill; (*b*) the maximum development of the traffic available, requiring business capacity; and (*c*) economy in working expenses, which is a matter for a railway expert.

In the fixing of freight charges, account is taken not only of the weight and bulk of the goods conveyed and of the distance for which they are carried, but also of terminal services, such as the loading and unloading of waggons. This charge varies in accordance with the services rendered and the class of goods dealt with. It is also irrespective of the distance the goods are carried. The maximum rates chargeable for goods traffic are fixed by Statute, but on British railways these rates are not necessarily the same in every case. This is not due to any ascertainment of the cost of "production" per unit of service in each case, but to a consideration of the general circumstances of each line concerned. The amount of the fixed charges being known, the density and regularity of the traffic is taken into account. Where the traffic is dense and regular and where fuel is obtainable at a comparatively low cost, there is obviously some ground for establishing lower maxima than would be appropriate for lines in agricultural areas having a light or intermittent traffic. Nevertheless, such differentiation is less common abroad than it is in the United Kingdom.

Service charges and mileage rates differ also according to the varying values of the commodities carried, the differences being determined by an elaborate system of classification. It is extremely difficult to say what proportion of the fixed charges or working expenses of a railway is attributable to the handling of a particular quantity of any particular kind of traffic, because a large part of such expenditures is "joint costs." Consequently railway charges are based very largely upon the consideration of the value of the commodities offered for conveyance. On general economic principles the amount which any commodity can pay for carriage to the market for which it is intended depends upon the amount by which its value in the market exceeds that which it possessed at the point of despatch. The difference between the value of a commodity at the point of despatch and its value in the market is naturally greater in the case of a costly article, and it therefore can bear a higher actual charge without sensibly diminishing the percentage available for profit. The apparently heavy charge payable for the transport of a valuable commodity may increase the cost of that commodity by only a small percentage, whilst in the case of merchandise of low value a similar charge would add a large percentage to the cost of the goods and possibly render them unmarketable. Thus the traffic is usually made to pay "what it will bear" and so long as the aggregate return to the undertaking is adequate, the railway manager is content to carry much traffic at rates which are below the average. This he can usually afford to do, not only because he obtains super-average rates for higher-grade traffic, but also because the additional expenditure incurred by the company in carrying a given quantity of additional traffic is rarely proportionate to the volume of such additional traffic. In the majority of cases the acceptance of additional traffic is accompanied by little addition to the fixed charges which have to be met, and can usually be handled without any proportionate increase in working expenses.

With regard to distance, the rates per mile quoted for freight traffic usually decrease as the distance to be covered increases, for although the cost per ton-mile (or per passenger-mile) for journeys of varying lengths can hardly be gauged with accuracy, it is recognized that long-distance freights are more profitable. Apart from the fact that a long-distance journey may be regarded as having a "wholesale" as distinct from a "retail" character, it enables the railway undertaking to make a fuller use of its plant, whilst the amount of terminal and other work involved is not affected by the greater distance for which the goods are conveyed.

In British practice, railway passenger fares are of three kinds: (*a*) ordinary fares at scheduled rates, (*b*) season-ticket rates, and (*c*) special fares.

Ordinary passenger fares were originally fixed in a somewhat empirical fashion, being arrived at by under-cutting the rates quoted by the other passenger transport agencies which were in operation prior to the advent of the railway era. Nevertheless, the rates which were thus fixed proved to be remunerative without being immoderately so, and it is no doubt because of this that they have usually been recognized as reasonable by the travelling public and the companies concerned.

Similarly, the differentiation which exists between the fares charged to first-class and third-class passengers rests upon an arbitrary basis and is not measured by the actual difference in the cost of the accommodation and haulage. Arbitrary, however, as the method of fixing passenger fares has been, it is the general experience of railway companies that passenger traffic is, on the whole, less remunerative than freight traffic.

Season-ticket traffic being chiefly confined to large urban areas involves heavy expenditure on the construction of lines and stations in districts where the value of land and property is naturally greatest, and where competitive influences are strongest. Another characteristic of season-ticket traffic is that the bulk of it has to be carried within the limits of the morning and evening rush-hour periods, and to meet the requirements of these "peak" hour periods (where trains can get full loads in one direction only), it is necessary to provide a large quantity of rolling-stock which must perforce remain idle during the slack hours of the business day. Against this must be set the fact that the traffic is regular and provides full train-loads with a minimum attention on the part of the station staffs. On the whole, however, the question whether season-ticket traffic is remunerative is debatable, whilst with regard to the low rates chargeable under the system of "workmen's fares" it may safely be said that political and not economic considerations have been the principal determining factor.

"Special" passenger fares are mainly confined to holiday and pleasure traffic. This traffic is naturally mobile and tends to pass readily from one line to another according as the advantages offered by each to the passenger vary in attractiveness. Consequently the traffic is usually secured by purely competitive methods, *e.g.* by advertisement and by the quotation of special fares. The cost of working pleasure traffic is high in proportion to the revenue earned, but good train-loadings are usually obtained, and as much of the traffic is genuinely "additional" it is doubtless a source of appreciable profit.

Apart from the charges for freight and passenger transport to which reference has been made above, railways commonly quote "special rates" for goods traffic which has to be obtained by active competition with other transport agencies. These special rates represent departures from the ordinary schedule, and in Great Britain and the United States a great part of the total weight of goods conveyed by rail is charged for on the special-rate system.

The institution of these rates may in certain cases be due to the presence of waterway or other railway competition. The cost of transport by waterway is normally low and the competition for the carriage of goods of low intrinsic value is therefore severe; and where the competition arises from the presence of another railway, the competing line which possesses the shortest route naturally has an advantage over its competitor. In other cases the competitive influence may be exerted by a road motor service; but from whatever source it springs the question whether the quotation of special railway rates as a means of securing the traffic is justified is one which can only be determined by a consideration of the particular circumstances of each case.

Water Transport.—The expenses of transportation by water, like those of rail transport, fall under two main heads: (*a*) the fixed charges, which do not vary very much with fluctuations of traffic; and (*b*) the working expenses, including the costs involved in the actual movement of goods and passengers, the terminal charges which depend upon the volume of the traffic and not upon the distances for which it is conveyed, and lastly, the general expenses which vary very little with increase or diminution of business. As in railway management, the gross receipts must be sufficient to cover both the fixed charges and the working expenses, and provide a reasonable return upon the capital invested.

With regard to fixed and general charges, water transport services differ somewhat from railways. In the case of transport by sea, there are no considerable general charges for maintenance of way nor any fixed charges consequent upon the construction of such way. Construction is limited to wharves, docks and vessels with this equipment, and can be proportioned more or less directly to the amount of traffic to be carried. There is therefore less likelihood of excess in cost of construction and less necessity to accept additional items of traffic at less than average rates merely in order to make a fuller use of the plant provided.

In the case of canals, or of other waterways on the adaptation of which considerable sums have been invested, the conditions with regard to fixed and general charges obviously present a closer resemblance to those which obtain on railways.

The ownership of wharves on inland waterways is ordinarily distinct from that of the vessels which use them; and wharf charges should be such as to yield in the aggregate a normal return on the capital invested in the purchase of land and in the work of construction, *i.e.* the equivalent of a fair rent for the land occupied, plus a reasonable rate of interest on construction cost.

In water transport competitive influences operate more freely than on railways, and, in the case of ocean services, the choice of route is determined mainly by physical and economic considerations. *Ceteris paribus*, the choice is determined by the location of the centres to be served, and the route taken will follow the shortest lines between them.

In the case of inland navigation the course of a river will itself determine the route to be taken, whilst in the location of a canal the principles which operate are similar to those which determine the location of railroads.

Transport on natural waterways, and especially by sea, is less monopolistic in character than railway transport, the "sea road" being open to all competitors; and at terminals also such water transport is more subject to competitive forces then is usually the case with railways.

With regard to rates for freight, the general principle is that, on the whole, these rates should bear some resemblance to the cost of carriage, whilst with regard to particular articles discrimination may be made according to their character and value. There is, however, one case in which rates for water transport may be far below cost, namely, in those cases where certain goods may be used as ballast. On a particular route, for example, the demand for cargo space for shipments in one direction may be considerable, whilst in the other direction the demand may be very much weaker. In such a case cargoes may be accepted for the return journey at very low rates, apart from the fact that they may prove useful as ballast.

Road Transport.—The principal factor in the modern development of road transport is the advent of the mechanically propelled vehicle, the use of which is rapidly extending. In road motor services, as in the case of other transport agencies, the question of return on capital expenditure is important. The amounts expended upon the purchase of vehicles and upon the purchase of land and the erection of garages (where these are not rented) must be taken into account. Where land and garages are rented, the annual charges thus created must be covered by the gross receipts. Depreciation, repairs and renewals, fuel, and wages must also be provided for.

The responsibility of road motor undertakings for a proportion of the cost of maintaining the roadways which they use is now coming to be recognized, but they still escape the heavy capital expenditure such as the provision of railway way and works involves. In the case of these road undertakings, therefore, the fixed charges are of less importance, and such capital charges as they do incur (*e.g.* in the purchase of vehicles or in the provision of garage accommodation) can be more easily proportioned to the amount of traffic.

The gross receipts, and therefore the rates for freight and passengers, must be such as to cover both the fixed charges and working expenses, and must therefore bear some relation to the costs involved; but in the stage through which road motor transport is now passing there can be no doubt that, in the fixing of rates, the necessity for competing with railway services (especially for short-distance traffic) and with other road motor services is a governing factor.

Air Transport.—The possibilities of transport by air remain to be revealed, but it is significant that, already, regular mail and passenger services have been instituted and that, to a limited extent, the aeroplane is being utilized for the carriage of goods in small parcels. The general economic principles governing this form of transport are similar to those which operate with regard to those other transport agencies which use a way provided by nature and escape the construction and maintenance charges which the provision of an artificial permanent way would involve.

Ownership and Control.—The question whether the ownership and/or control of transport undertakings should be vested in the State, in municipal bodies, or should be in private hands, was in 1921 still the subject of considerable controversy. In some countries State ownership and, with it, State control of railways are accomplished facts, and even the working of the lines is undertaken by the State. In other cases, State ownership is accompanied by a strict control whilst the actual working of the lines is leased to private companies. In yet other instances State control goes hand in hand with private ownership and management, whilst in some cases (as in the United Kingdom prior to the war, and in the United States) railways are privately owned and managed, and are subject only to State "regulation," particularly in respect of matters concerning public safety and the like.

Many tramways are municipally owned and worked, being subject to State regulation in respect of public safety, whilst in the case of water transport State interference is usually limited to the grant of subsidies, coupled with a relative measure of control and with regulations for safety. In most cases, however, transport by sea is subject to safety regulations alone.

The advocates of private enterprise contend that the economic development and operation of transport is best achieved when public interference is absent or is limited to such matters as concern the public safety. They urge that, as public ownership or control involves official management, the great incentive to make a profit—which is the mainspring of private enterprise and stimulates efficiency—is removed. They urge that in the absence of this spur to efficiency, management tends to become slack and wasteful, that the element of political pressure is present, and that the vigorous enterprise which is essential to development and progress is seldom forthcoming. Experience has shown that these contentions are very largely correct.

On the other hand, the advocates of State ownership and control contend that as transport services possess the character of public utilities, they are proper subjects for public ownership and control, that they should be operated in the public interest alone, and that any profits which may result from such operation should properly accrue to the State or to the municipality as the case may be. They argue also that by the centralization of management of which public ownership and control admit, large economies in administrative and overhead charges can be effected, and that the wasteful competition and duplication of services can be avoided.

In weighing up the contentions of these two factions, it should be borne in mind that, whereas private ownership must of necessity be worked on an economic basis in order to exist at all, in the case of State ownership it is impossible to say definitely whether a service is being worked efficiently or economically.

Government Regulation.—The extent and nature of the regulation of transport by Government has varied very considerably at various times and in different countries. Where, as in many countries, the railways and canals have been built or acquired and similarly the roads, to a varying extent, built and maintained, by the State, the extent of Governmental regulation is naturally great. In other cases—notably in Great Britain and the United States—transport has been traditionally regarded as a matter for private enterprise and initiative, and only such measure of control provided as might be necessary in the interests of public safety and general national policy. The present tendency has in all cases been towards a greater measure of control of transport services by the State, due to the increasing realization of the importance of transport in the economic life of a nation.

As regards roads and rivers—the latter having formed the principal channel of communication for many centuries, the State exercised but little control in Great Britain. Roads were regarded essentially as of local interest, the local authorities or private individuals being responsible for such construction and maintenance work as was undertaken. During the eighteenth century considerable improvement of the road system in many parts of England was made by the Turnpike Trusts set up by Private Acts of Parliament, and subsequently by the work of Macadam and Telford. In 1835 the Highways Act abolished the compulsory Statute labour on roads and empowered each parish to levy a rate for road maintenance, and in 1888 the care of the main roads outside urban areas was transferred to the County Councils. During the whole period the general policy adopted had been that of adapting traffic to road conditions rather than vice versa, with consequent restriction of weight of load, and stipulations as to breadth of wheels, and the fixing of conditions for the licensing of public vehicles; but a great step forward, mainly due to the extended use of mechanical road transport, has been the passing of the Roads Act of 1920, which initiated a Road Fund financed by the excise duties on mechanically propelled vehicles, from which grants can be made by the State for the construction, maintenance and improvement of roads, and which provided also for a greater measure of control over vehicular traffic.

As regards rivers, State action was mainly directed to the prevention of obstructions and abuses; and when authorizing the construction of canals—which during the latter part of the 18th and the beginning of the 19th century became the system of transport on which Industrial England mainly depended—these private undertakings, as later in the case of railways, were given compulsory powers to acquire land, and in return Parliament laid down the maximum charges which they might levy. In spite of the variety in the gauge and depth of the different canals, the canal system developed into a virtual private monopoly earning at one time very large profits, and the charges gave rise to much discontent among traders.

The railways suffered from this discontent, not only in the early stages of their development, but for many years afterwards, since the principal care of Parliament for a long time was to avoid the creating of another monopoly. It was at first thought that competition would be assured by the different carriers owning their locomotives and waggons, the railway companies owning only the lines. This was soon found to be impracticable, and reliance was then placed in competition between different undertakings; and it was many years before it was realized to be in the interest of the State that the various companies should work together.

Hitherto Government control in England has been mainly restricted to matters concerning the safety of the public and railway-workers, and to the charges made by the railway companies for the carriage of passengers and goods. The supervisory authority was placed by Parliament with the Board of Trade, a separate railway department being formed subsequently in the Board to deal with all railway matters. Officers of this department inspected all lines before they were opened for traffic, being given power to delay the opening where necessary, and were required to inquire into the causes of all accidents. They had no power to order work to be carried out in any special way, but if their requirements or recommendations were not given effect to, they had the power of refusing to sanction the use of the lines for passenger traffic for which fares were charged. In the case of goods lines and alterations to existing lines, the interests of the public were protected by the fact that if an accident occurred and the Board of Trade regulations had not been complied with, juries would deal very severely with the offenders. In practice, wherever railways have been constructed or operated, the Board of Trade regulations have always been complied with.

The Board of Trade was empowered to act as conciliator to settle, amicably if possible, differences between individuals and the railway companies, and, with a view to giving traders a specially qualified tribunal for complaints against the companies, the Railway and Canal Commission was set up in 1888.

The outbreak of war in Aug. 1914 brought about a remarkable extension in the control of transport service by Government. In Great Britain the Government at once took possession of the railways under the Regulation of the Forces Act, 1871, and during the whole period of the war these were worked on behalf of the Government by the Railway Executive Committee, a standing body formed from among general managers of the principal railway companies. Certain canals were taken over by the Canal Control Committee, and during the period of the war the greater part of the shipping was worked under the direction of the Ministry of Shipping. In 1919 further progress in control was made by the Ministry of Transport Act. This Act brought into being the Ministry of Transport, and placed under the minister the existing powers (with certain exceptions) of other Government departments in relation to railways, light railways, tramways, canals, waterways and inland navigations, roads, bridges and ferries, and vehicles and traffic thereon, harbours, docks and piers. By this Act the minister was charged with the initiation and formulation of a policy for dealing with transportation, and in order to allow time for this and to permit of development in the meantime, he was authorized to retain for a period of two years control of those undertakings which were already in Government possession, and if necessary to take possession similarly of any other undertakings. Very wide powers were given to the minister in regard to these undertakings. He might give directions as to the rates and fares to be charged, and the salaries and wages of employees were under his control. He might order the working or discontinuance of working of an undertaking, or any part thereof, and take steps to see that alterations and improvements were carried out and coöperative working effected which would result in greater efficiency or more economical working. The minister was also empowered to establish and work, directly or indirectly, transport services by land or water. During the period of two years it was thought that the undertakings would be able to make considerable progress, as these powers would enable the minister to authorize the companies to carry out alterations and improvements and to acquire land without the delay and expense involved by the ordinary procedure.

In addition to the above temporary powers, the minister was authorized to make grants and loans for the construction, improvement or maintenance of the various classes of transport services and for the promotion of such services by existing companies, and he was also given powers in regard to the classification of roads, the through running of tramcars, omnibus routes, and the purchase of privately owned railway waggons.

The British Ministry of Transport was formed in Aug. 1919, Sir Eric Geddes being the first minister. It comprised departments dealing with civil engineering, mechanical engineering, development, traffic, finance and statistics, public safety, roads, secretarial and legal. A separate branch was formed to deal with Irish transport questions. In July 1920, the ministry issued a memorandum containing proposals for the future organization of transport undertakings in Great Britain. These provided for the grouping of existing railway companies into seven groups, each of these groups being under the control of a Board of Management composed of representatives of the shareholders and employees; for the fixing of rates to a certain standard revenue, a proportion of any surplus being allocated to a development fund to assist backward districts to develop light railways and other appropriate purposes; for the setting up of permanent machinery for settling railway wages and working conditions. It was also stated in this memorandum that it was intended to confer powers upon the State in relation to the railways (*a*) for the protection of the public, (*b*) for the economical working of the railway systems of the country, and (*c*) to safeguard national interests.

These proposals led to considerable criticism, and as a result of discussion with the railway companies, trading interests, and trades unions concerned, various alterations were agreed upon and embodied in the Railways bill introduced by the Government in the House of Commons in May 1921. This bill was designed to sweep up masses of legislation which had accumulated in the years since railways were first sanctioned by Parliament, and to simplify the relations between the State, the railway companies and the users.

The bill provided for the grouping of railways in four groups, which grouping was to take effect on Jan. 1 1923, and also for a variation of the grouping, provided that the Minister of Transport was satisfied that the variation was not incompatible with the efficient and economic working of the railway system of the country: the machinery by which the amalgamation of the companies in each group was to be effected was laid down in detail, and the scheme when agreed upon by the companies had to be submitted to the Amalgamation Tribunal established by the bill. If the companies were unable to agree upon a scheme, one would be settled by the Tribunal. The Board of Management of each group would be elected by the shareholders, but the proposal that the employees should be represented was abandoned. Elaborate machinery was provided for the fixing and periodical review of rates and fares. It was proposed to set up for this purpose a new court, called the Railway Rates Tribunal and consisting of three members, one a lawyer, one a commercial expert, and one a railway expert. An entirely new system was to be adopted, and the fixed charges would be actual and not maximum charges, that is to say, that except in certain specified cases the railway companies would not be at liberty to charge for any traffic a rate other than that fixed. The proposal to set up a development fund was abandoned, and in order that the railway companies might have every incentive to efficient and economical management, the bill provided that in the event of a company earning a surplus above the standard revenue, 20% of such surplus should go to the company and 80% to the trading community in the shape of reduction of rates.

It was proposed that the Minister of Transport should have power to require any two or more railway companies to conform gradually to measures of general standardization of ways, plant and equipment (including methods of electrical operation, type, frequency and pressure of current), and to adopt schemes for coöperative working or common use of rolling-stock, workshops, manufactories, plant, and other facilities; also, the railway companies might be required, on a proper complaint being made, to afford reasonable services, facilities and conveniences, and the machinery for obtaining authority to construct a light railway was simplified.

In other countries the war has similarly brought about a greater measure of Governmental control. In the United States the railways were taken over by the Government in Jan. 1918, and worked by a director-general of railroads until March 1 1920, when they were handed back to their owners. In the meantime the Transportation Act had been passed, of which the two cardinal features were:—(*a*) the continuance of private ownership and operation as a national policy, and (*b*) the recognition of public interest and duty in respect to the adequacy and efficiency of transportation facilities. The powers and responsibilities of the Interstate Commerce Commissioners have been largely increased by this Act, particularly in relation to the settlement of rates, the economical provision of adequate facilities, the regulation of operation of the railways in times of emergency, and the certification of loans to transport undertakings to enable them to render effective service during the period of transition which followed immediately upon the termination of Federal control.

In Germany the pre-war individual State administrations have been replaced by a central commonwealth administration under a Ministry of Transport established in 1919; and in most other European countries there has been considerable strengthening of the departments dealing with transportation, due to the increasing appreciation of the importance of this factor in the economic life of the State.

International Aspect.—A further question needs consideration, *i.e.* the international aspect of an effective international transport council. Roads, waterways and railroads originally were built for communication between neighbouring towns or districts, and to serve the needs of traffic within each nation, and not as routes from one State to another. Apart from custom and policy, to which must be attributed in earlier times the relatively small amount of commerce between the various European countries, there were great difficulties arising from customs dues, physical obstacles, differences in gauge and plant, and in loading regulations. These difficulties had such serious results that as the need for the interchange of goods became appreciated, endeavours were made to overcome them at various international conventions. Of these, the best known is the Berne Convention, formulated in 1893 as a result of arrangements initiated at a conference of representatives of various Governments held at Berne in 1878. This convention, which has been embodied in the laws of the adhering States, settled many difficulties. It abolished customs dues in intermediate countries on through traffic, specified the rights, liabilities and responsibilities of shipper, carrier and railway company, and provided for the establishment of a permanent association to facilitate settlements between the railways governed by the Convention and for the diffusion among them of information relating to the matters covered by the Convention. Further agreements have been subsequently reached on other important matters, but the need of a fresh and thorough review of the subject from all points of view became increasingly apparent during the first decade of this century. Very little was, however, done until the peace negotiations at Paris in 1919. A strong commission of experts of the Allies was formed to advise on questions concerning transit which arose during the negotiations; and the Covenant of the League of Nations included a declaration that members of the League will make provision to secure and maintain freedom of communications and of transit for the commerce of all members of the League. The expert commission in question continued to work until March 1920, when it was taken over by the Council of the League of Nations and instructed to arrange the Conference on Communications and Transit, which was held at Barcelona in March and April 1921, under the presidency of M. Gabriel Hanotaux. One of the results of this conference, which may have very far-reaching importance, was the creation of a permanent international body, to be known as the Technical and Advisory Commission, to watch the international traffic situation. The Commission will consist of sixteen members and will function as part of the League of Nations organization at Geneva. It will meet at frequent intervals and will arrange for a full assembly of all the members of the Conference or for regional conferences as circumstances may require. It will have duties of advice, initiation and administration, and will also serve as a council of conciliation in the event of a dispute on a traffic question between signatories of the Barcelona Convention. The latter function may lead to the gradual creation of a recognized and authoritative body of international law on traffic questions, which will prove a considerable advance on existing conditions. The Commission will have, as a basis for its decisions, conventions and recommendations agreed upon at the Barcelona Conference, which, however, require to be ratified by the several Governments. The more important of these deal with freedom of transit, waterways of international interest, and international railways. The convention on freedom of transit lays it down that the parties shall facilitate the free transit of persons, goods, vessels, coaching and goods stock or other means of transport by the routes most convenient for international transit. No distinction whatever is to be made as to the nationality of persons, the flag flown by vessels, the origin, points of departure, entry, exit, destination, or the ownership of the goods; no special transit dues are to be levied beyond what is necessary to defray the cost of actual services rendered, and they are to involve no discriminations as regards nationality or ownership. It is expected that many States will act on the recommendations, which declare that the Powers represented at the Barcelona Conference recognize that "any one of these States is entitled on the railways under the sovereignty or authority of any other State to all reasonable facilities for promoting and encouraging the flow of international traffic to and from its territory," and proceed to lay down detailed regulations for the application of these principles. (A. Gi.)

TRANSVAAL (*see* 27.186), since 1910 a province of the Union of South Africa. At the 1911 census the inhabitants numbered 1,686,212, compared with 1,269,951 in 1904, an increase of 32·78%. Whites numbered 420,562 (as against 297,277 in 1904), coloured 1,265,650. Women outnumbered men, the proportion being for all races 89·71 males to 100 females. Of the whites 92·55% and of the coloured 24·30% were returned as Christians. Asiatics numbered 11,072 (9,018 males); of these 10,048 were British Indians, 3,065 having been born in the Transvaal.

In 1918 the whites numbered 499,347, of whom 303,050 lived in urban areas. At the 1921 census the total white pop. was 543,481 (males 284,952, females 258,529). Thus between 1904 and 1921 the whites had almost doubled in number, the increase being principally due to the development of the gold and coal mines. The growth of the white population gave the Transvaal at the 1920 election 13 more seats in the Union Parliament than the province had in 1910.

The chief towns are Johannesburg (total pop. 1911, 237,104, whites only, 1918, 137,166) and Pretoria (total pop. 1911, 57,674, whites only, 1918, 41,690). Besides Johannesburg there were on the Witwatersrand the municipalities of Krugersdorp, Germiston, Boksburg, Benoni, Roodepoort and Brakpan (the last named the centre of the Far East Rand, being created a municipality in 1919), approximately half the inhabitants of the province being concentrated on the Rand.

The chief executive officer is styled administrator, and provincial government is in the hands of a provincial council, the system being the same for all the provinces of the Union (for particulars *see* CAPE PROVINCE). In the five years 1913–4 to 1917–8 the revenue collected for provincial purposes rose from £602,000 to £815,000, native pass fees providing half or more of the receipts. The Union subsidy in the same period rose from £620,000 to £695,000. The two main heads of expenditure were education and roads, bridges, works. The sum spent on education was £665,000 in 1913–4 and £1,143,000 in 1917–8. In 1920 there were 1,040 State schools with 109,700 scholars. There were also 389 State-aided native schools with 26,900 scholars. There was keen controversy over the language question in the schools for white children. By an ordinance of 1911, which came into operation on Jan. 1 1912, instruction up to standard IV. was to be in and through the "home language of the child"; a second medium might then be used if the parents so desired. This arrangement ended an attempt to enforce bi-lingualism and worked very fairly. In other respects the Transvaal was noted for its many educational experiments.

Gold mining retained its position as the chief industry, the Transvaal producing nearly half the world's output. There was a notable increase in the output of coal, and with the provision of railway communication to the Messina mines (situated in the extreme N. by the Limpopo) the production of copper ore rapidly increased. The output of tin from the Bushveld was also noteworthy. Manufacturing industries were developed on the Rand. The province retained its importance as a stock-raising country, and there was a marked increase in the cultivation of maize and tobacco (for statistics *see* SOUTH AFRICA).

Politics and parties in South Africa cut across provincial boundaries, and the history of the Transvaal since 1910 is part of that of the Union. The province presented in its social life many extremes, the conservatism of the back-veld Boer contrasting strongly with the progressive and democratic spirit of the dwellers on the Rand. But both these elements had their counterparts in other provinces. Party feeling was, however, more strongly expressed in the Transvaal than elsewhere, and this led to the introduction of politics into the provincial council, in which, at the election of 1914, the Labour party gained a majority of one. This election followed a great industrial upheaval on the Rand, leading to serious riots and bloodshed. The white workmen on the Rand formed the main strength of the Labour party, though it had also a considerable following in Durban and Cape Town. A considerable number of Boers in the western Transvaal took part in the rebellion of 1914, but the influence of Generals Botha and Smuts kept many Boers loyal to the British connexion, as was shown at subsequent general elections. At the 1920 election the Nationalists, or Separatist party, gained 13, and at the 1921 election 15 out of the 49 Transvaal seats—how evenly the Dutch vote was divided was shown by the narrow majorities obtained in 1921 in the rural areas, while in two constituencies the voting resulted in a tie. The 1920 election had been notable for the success of Labour candidates on the Rand; the election of 1921 saw the Labour representation of the province reduced from 12 to 5 members. Labour organizations were not confined to the whites, but extended to the natives, who showed unexpected powers of combination and arranged strikes on customary European lines. But neither this industrial movement among the natives, nor their demands for political rights, was confined to the Transvaal.

The first administrator was Mr. Johann F. B. Rissik (Minister of Lands and of Native Affairs in the Transvaal as a self-governing colony). He was reappointed for a second term but resigned in 1917 to become a member of the Railways and Harbour Board of the Union, being succeeded as administrator by Mr. A. G. Robertson, who had represented Wakkerstroom in the provincial council. (F. R. C.)

TREE, SIR HERBERT BEERBOHM (1853–1917), English actor and manager (*see* 27.234), died in London July 2 1917. The chief Shakespearean productions of his later years were *Macbeth* in 1911 and *Othello* in 1912. In 1912 he also produced Louis N. Parker's *Drake* and in 1913 his biblical play *Joseph and his Brethren.* In 1914 he produced Mr. Bernard Shaw's *Pygmalion.* During the World War he was active in propaganda work, organizing lectures at His Majesty's theatre and speaking himself frequently in America during his theatrical tours. He published a volume of *Thoughts and Afterthoughts* (1913) and other occasional papers. His sudden death, after a comparatively slight operation, at the age of 63, was felt as a great loss to the contemporary English stage.

See *Herbert Beerbohm Tree: some Memories of him,* collected by Max Beerbohm (1920).

TRENCH, FREDERICK HERBERT (1865–), British poet and playwright, was born at Avoncore, co. Cork, Nov. 12 1865. Educated at Haileybury and Keble College, Oxford, he was elected a fellow of All Souls' College, and in 1891, after some years spent in travelling, was appointed an examiner in the Board of Education. This appointment he gave up in 1908 in order to devote himself to literary work. In 1908 he also became director of the Haymarket theatre, London, and during a short tenure of this position he staged *King Lear* and Maeterlinck's *Blue Bird.* During the World War he worked in Florence for the establishment of a better understanding between Great Britain and Italy. From his school days he had been a writer of verse, and his first volume of poems, *Deirdre Wedded,* appeared in 1901. It was followed by further poems, notably "Apollo and the Seaman," included in *New Poems* (1907), and *Lyrics and Narrative Poems* (1911). Among his later publications were an *Ode from Italy in Time of War* (1915); *Poems with Fables in Prose* (1917); and a poetic play *Napoleon* (1918), which was produced in London by the Stage Society in 1919.

TRENCHARD, SIR HUGH MONTAGUE, BART. (1873–), British air marshal, was born Feb. 3 1873 and joined the army in 1893. He served through the S. African War, was dangerously wounded, and was promoted brevet major. He was then for seven years with the W. African Frontier Force and during that time took part in three campaigns, receiving the D.S.O. in 1906. After returning home in 1910 he joined the Royal Flying Corps and he became assistant commandant at Upavon in 1912. On the outbreak of war in 1914 he was at first left in charge of the central depot at Farnborough, but before the end of the year he was summoned to the front and he shortly afterwards became head of the military wing of the air forces under Sir J. French; this appointment he filled with signal success for nearly three years. He was promoted brevet lieutenant-colonel and brevet colonel in 1915, and advanced to the rank of major-general at the beginning of 1917. On the formation of the Air Ministry at the end of that year he was brought home to become chief of the staff, but he resigned the position in the following April; he was however a few weeks later given command of the "Independent Force," which carried out extensive raids into German territory during the closing months of the struggle. He had been made a K.C.B. in 1918, and on the final distribution of honours for the war he was given a baronetcy and received a grant of £10,000. He was gazetted air vice-marshal on the introduction of the new designations of rank in the air service, and in 1919 he was promoted air marshal and became chief of the air staff.

TRENCH FEVER.—Early during the World War, in 1915, it was noticed that a large number of soldiers in France and Flanders were falling victim to a disease the nature of which was not clearly understood. It was an infectious disease because men were affected who shared the same tents, huts or billets. It bore some resemblance to rheumatism in that pain in muscles and bones was a prominent symptom. It was also rather like influenza except for an absence of nasal catarrh.

The disease at first was given many names. Thus cases were called "P.U.O.," an army term meaning "pyrexia of uncertain origin." They were also called "rheumatism" and "influenza" and "myelitis" and "lumbago." If the cases were seen at a late date when palpitation and breathlessness had become prominent, they were often called "cardiac neurasthenia" or "disordered action of the heart" ("D.A.H.").

Soon, however, it was felt that these diagnoses were inaccurate and a serious attempt was made to study the disease. The earliest contributions to its literature were made by Dr. J. W. McNee, and others who worked with him. Afterwards several Trench Fever Committees were formed by the British medical authorities. One of these worked in connexion with the American Red Cross; another, known as the "War Office Trench Fever Committee," had a hospital in Hampstead. This Committee was presided over by Sir David Bruce; the director of its research work was Col. William Byam. Both Committees infected volunteers and the conclusions reached, though they differed on points of detail, were substantially the same.

Trench fever is a louse-borne disease. The lice do not become infectious at once after feeding on a trench-fever patient; there is a latent period of some 8–12 days before they are dangerous to other people. Thereafter the excreta of the lice, rather than their bites, are infective. If these infective excreta be rubbed into a scratch or scarification trench fever develops in about eight days. The importance of this discovery about the excreta lies in the fact that persons may contract the condition who have never had lice upon them. The excreta is a dry powder, easily blown about, and so apt to reach the clothes. It remains infective for long periods and even when exposed to sunlight. Water on the other hand seems to diminish its infectivity quickly.

The blood of trench-fever patients is infective to other patients when injected into their veins. Thus the parasite circulates in the blood. The parasite is also in the louse excreta. It has not, however, so far been positively identified, though there is a certain amount of evidence, that it is one of the so-called Rickettsia bodies. In this connexion the names of Dr. G. A. Arkwright and Prof. A. W. Bacot must be mentioned.

The disease is protean in its manifestations. A proportion of the cases begin suddenly with great muscular weakness and exhaustion, headache, furred tongue and blood-shot eyes. Other cases come on gradually, the above symptoms increasing daily in intensity. The patient feels very ill and usually develops a temperature-rise to 102°F. or 103°F. Various types of temperature have been described. In some instances there is but one wave lasting two or three days; in other instances a "saddle-back" curve is shown, the temperature falling slightly and then rising again. Some patients relapse definitely on the fifth day, others about the eleventh day. Others again relapse at irregular intervals for long periods, each relapse giving a "spike" of temperature of short duration.

In a few cases there is no rise of temperature. Thus three volunteers were infected with the same batch of louse excreta. All of the three developed symptoms of trench fever but in one instance the temperature remained normal. Yet lice, subsequently fed on this patient, were able to transmit the disease to other volunteers all of whom developed rises of temperature. (For similar disease-carrying by body-lice *see* TYPHUS FEVER.)

The skin pains of trench fever are characteristic. They do not as a rule appear until a few days after the onset. They are of a boring, gnawing character and may be so violent that the patient cannot even bear the weight of the bed clothes. Again they may be very slight or absent.

The diagnosis is easy in early cases but the disease tends to run a very chronic course. In one case a patient labelled as a "neurasthenic" was found to infect lice four years after his initial attack. A percentage of patients become chronic invalids, others develop symptoms of functional heart trouble, others have nervous symptoms. It is probable that all these patients remain infected. The most reliable signs on which a diagnosis can be founded in the chronic stage are: (1) the patient's history, especially the state of his health before and after the initial attack; (2) the nature of his relapses; (3) the tenderness commonly met with on gently pinching the skin of the front of the leg (over the tibiae); (4) the presence of heart or nervous complications, *e.g.* breathlessness on exertion, pain, palpitation, gross tremor, etc.

The treatment is very unsatisfactory. At present no drug is known which will end the condition as quinine will end malaria. Thus it is necessary to attempt to build up the patient's strength against his infection. He should if possible lead an open-air life, he should have exercise, good plain food and cheerful surroundings. Some authorities lay stress on the value of thyroid, gr. 2 daily, in these cases. Others believe in iron tonics. Recent observations have suggested that the muscular weakness which follows the disease prevents the proper opening of the chest in respiration and so interferes with the suction action of the opening chest on the great veins. On this account the wearing of an abdominal belt has been recommended. It causes the patient to breathe with his chest and so tends to the restoration of thoracic movement. The disease is very disabling and its marked tendency to relapse makes it very distressing to the victim, who can never count on his health. Change of weather and wet weather seem specially to conduce to relapses. (R. M. Wi.)

TRENCH ORDNANCE.—The need of some form of easily transportable weapon for bombarding an enemy's works or his men from trenches immediately facing them, instead of from a distant artillery position, has made itself felt throughout the history of siege warfare. The use, in the trenches, of small mortars (known as "cohorns," from the Dutch engineer Coehoorn who designed them) was habitual in the sieges of the 18th century, and the great Carnot early in the 19th century proposed their use on a very large scale for the purpose of attacking personnel protected from direct fire by breastworks. The introduction of rifled ordnance, and the consequent modifications in siege methods, led to the disappearance of these cohorns. Nevertheless the need of a trench-mortar was felt in both of the two great sieges of modern times—Vicksburg and Port Arthur—in which, before the World War, trench fighting was close and prolonged. In these cases mortars of wood and hoop-iron, strong enough to bear the strain of throwing small bombs a short distance, were improvised by the troops themselves. After the experience of Port Arthur, however, European designers took up the question, and several types were worked out, of which three, the Belgian Aasen, the German official "Military Engineering Committee's" design, and the Krupp, initiated progress along three different lines which were followed up in the World War. The first named, which was used in action even before the World War—at the siege of Adrianople, 1913—was the prototype of the light trench-mortars; the second, with few important modifications, remained in service throughout the World War, and represents the adaptation of standard artillery ideas and elements to the new problem, while the third introduced the principle of the "stick-bomb," fired from a small-bore high-pressure cannon. The Aasen, besides opening the series of light trench-mortars, introduced the principle, opposite to that of the Krupp, of low pressure.

The history of trench-mortars in the World War is a record, first of a continually increasing demand which the supply authorities in the various belligerent countries could not meet; then of a period, coinciding with the full development of position-warfare methods of tactics, in which well-designed weapons with ample ammunition supply played an increasingly important part; and lastly of a period in which, under pressure of new tactical needs, the "trench" mortar strives to become a gun of "accompaniment." The tactical employment of trench ordnance, whether in its designed rôle or as accompanying artillery, is dealt with under ARTILLERY: the present article is concerned with the weapons themselves.

The German trench-mortars—handled not by artillerymen but by engineers in their capacity as the technicians of the siege trenches—were used with great effect in the attack of certain of the Liége forts, and a little later at Maubeuge and Antwerp. In this they were carrying out the special duties for which they were designed, and at that stage of the war it was not foreseen that weapons of this class would be required for the equipment of a trench-front hundreds of miles in length. Consequently very few were available when the western front became stabilized, and the demand was made simultaneously from all quarters for some short-range trench weapon capable of curved fire, by which alone the covered enemy could be attacked from covered positions. For the time being, it was impossible for any belligerent to do more than provide stop-gaps in the form either of mechanical throwers (*see* BOMBTHROWERS) or small mortars mounted on wooden beds, which were in fact either artillery shell sawn off at the neck and bored with a vent or else cohorn and other mortars of the smooth-bore era, unearthed from arsenals or museums. But while the troops made shift with these, inventors and designers were producing experimental models which, when approved, were brought out in enormous numbers, with little difficulty from the point of view of manufacture since the designs were deliberately kept simple so as to be serviceable in the roughest conditions.

Setting aside, for the present, direct-fire trench-guns, of which various types came into use for combating machine-gun emplacements, and, later, tanks—trench ordnance for curved fire is classified either according to weight, as light, medium or heavy, or according to the principle of design, as high-pressure or low-pressure. The latter basis of classification is taken here; and it is desirable at once to indicate the specific differences which mark off trench ordnance from normal artillery weapons, applying equally to high-pressure and to low-pressure types.

The most important difference is in *range*. Although by the end of the World War some remarkable results had been obtained by progressive experiments in the direction of increased range, the trench-mortar remained essentially a weapon of less than 2,000 yd. effective range. In the earlier models—save a few—the limit was about 500 yd., while many were incapable of exceeding 250. Even this last range sufficed in some cases, owing to the short distances separating the opposed front lines, and during the period of position-warfare most of the work of light and medium trench-mortars was done at ranges of 400 to 600 yards. The main motive for increasing range was not the desire to reach a more distant target from the front line, but the desire to emplace the trench-mortar at such a distance behind one's own front-line troops that premature explosions—specially liable to occur with improvised ordnance and ammunition—would not affect them. An almost equally cogent motive was the desire to avoid drawing the enemy's reprisal-fire, time after time, upon the same body of friendly infantry. Another motive was the desirability of withdrawing the trench-mortar itself from the effects of fire directed upon the front line, and preventing too close observation of its position by the enemy.

The next point is *weight*. For use in or near the front trenches the trench-mortar must be portable, either as a single unit (as in the case of light mortars) or in parts which severally do not exceed certain limits fixed by experience, either in point of weight or in point of dimensions. For the heavier trench-mortars, having greater range, the limits imposed on those which have to be taken close up to the front line are somewhat relaxed; indeed, the very heaviest, used only in very favourable conditions, is designed for a concrete bed and light-railway transport.

A third point is *simplicity*, or better, in the French phrase, "rusticity." The trench-mortar is by hypothesis subjected to the worst conditions of exposure and handling. From birth it lacks the mechanical finish of standard artillery; it is required in great numbers at a time when all engineering shops for high-class ordnance works are fully occupied and take the pick of the available metal. Then, on service, it is handled in the main by a hastily trained personnel, not all of whom possess the gunner's respect for his gun or the mechanic's pride in his machine. Moreover, the medium and heavy models are in most cases taken down and assembled frequently, and the parts are transported by hand through winding, muddy trenches, or across broken country in the dark. Save perhaps a detachable sight (which is carried by a non-commissioned officer or gunlayer), none of the customary adjuncts of modern ordnance is admissible.

Lastly, the *ammunition*, even of rifled trench-mortars, differs considerably from that of standard artillery. In most cases its design is special to the particular design of mortar, and there is no interchangeability such as that of 6-in. gun and howitzer ammunition. But in all cases, not being exposed to the bore pressures which standard artillery ammunition must endure, it has much thinner walls and a far greater explosive content.

These specific differences will be best realized by comparing a standard heavy trench-mortar with a heavy howitzer of the ordinary kind. The trench-mortar here taken is the Batignolle 24-mm. used by the French, British and Italian armies; the howitzer the German 21-cm., 1910 model, with a somewhat thick-walled shell.

	Shell	Weight of gun exclusive of mounting	Propellant Charge	Bursting Charge	% of Burster to weight of filled shell	Range in Metres
	kgm.	kgm.	grm.	kgm.	%	
Trench-mortar	89	220	720	45	56	1,040
Howitzer	83	2,625	3,200	8	9·7	9,100

Here the trench-mortar shows roughly one-fifth the propellant charge and one-ninth the range, but one-twelfth the weight of gun and six times the shell "efficiency" of the howitzer.

All trench-mortars fire at super-angles; that is, they use elevations of about 47° for their longest range and highest elevations up to 75° or more for the shorter ranges. This enables them to be used from deep and narrow trenches.

The design may now be considered under the three headings of high-pressure smooth-bore, low-pressure smooth-bore, and rifled.

I.—*High-Pressure Smooth-Bore Trench-Mortars.*

The prototype is the Krupp bomb-gun of 1912. This, and all the types presently to be described have "stick-bombs." The stick-bomb is a large-bodied explosive container sometimes spherical ("football" bomb), as in the case of the Krupp and the British 2-in. T.M., sometimes formed to overcome air resistance, as in the Dumézil types. In either case, attached to the base of the projectile is a rod which fits closely into the bore of the mortar—like the rod of a rifle-grenade—and may or may not be fitted with a gas-check disc at its end. The gun itself is either a solidly forged small cannon or a long stout tube, trunnioned at its breech end, and its mounting is supported on a wooden bed. It is fired either by friction tube or percussion lock like an ordinary piece of ordnance, or by the primitive device of lighting a length of match placed in a vent or touchhole. As the base or gas-check of the rod is in contact with the bag containing the propellant charge, the pressures developed in the bore are comparable to those in a regular howitzer, and it is necessary not only for the gun to be stout but for the seating of the rod in the bomb base to be solid and cup-shaped, lest (as sometimes happened) the shock of discharge should drive the rod into the bomb before the inertia of the latter has been overcome. All stick-bombs, owing to the air-drag of the stick, and in the Dumézils and some others to the steadying effect of external vanes, fly nose first, and can be used with ordinary percussion or instantaneous fuzes provided the arming resistance of these is adjusted. Of this class, the most widely used was the Dumézil, designed by General Dumézil, in substantially its final form, as early as June 1915, and subsequently used by the French, Italian, Russian (in a modified form) and American armies, though declined by the British. The "Dumézil No. 2," here described was the standard medium trench-mortar of the French army throughout the last three years of the war. It is simple and easily transported and assembled by unskilled personnel.

The *mortar* (fig. 1) is a stout cannon of forged steel (1) with simple vent-firing and rear trunnions. The maximum pressure with the heaviest bomb is 16 tons to the sq. in. The trunnions (2) are massive and bored through transversely to take a carrying bar or axle. It rests, when assembled for firing, in trunnion seatings formed in the inner parts of two cheek-pieces (4), which are heavy castings with accurately fitting inner faces. The foreparts of these are moulded upward to form elevating arcs forming a collar (3) on the gun slide, the gun being secured at the desired angle of elevation by screwing home the clamping screws. The cheeks (4) carrying the gun rest in a trough (5), attached to the back of which is a curved plate. This curved plate butts against a similar curved plate (10), which is jammed firmly against the back wall of the trench or emplacement. The mortar can thus be laid for direction by sliding the back-plate of the trough (5) along this back-plate (10).

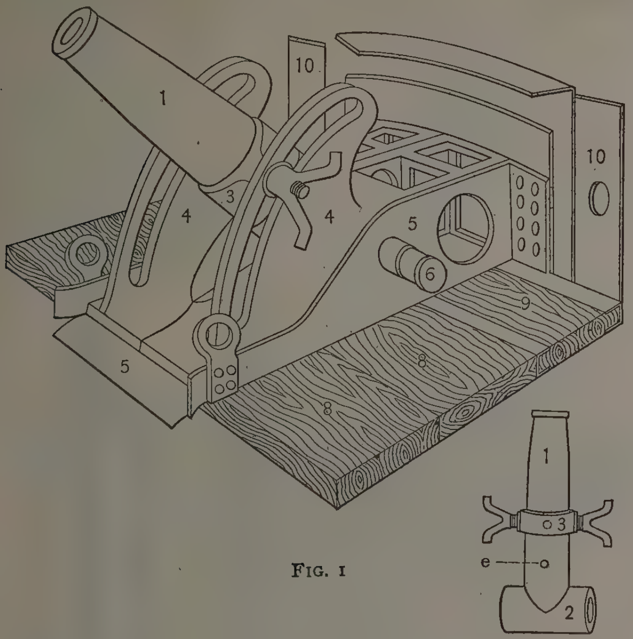

FIG. 1

The bed, in which the system rests without being attached, consists of three planks (8, 8, 9). The system may be moved without being taken down, by means of wooden truck wheels attached to the axle (6) which is passed through to the sides of the trough, the cheeks and the bored trunnion. These accessories were, however, not much used in practice, as only 4 to 5 minutes are required to bring up and reassemble parts in a new position. Various methods of indirect laying for line were employed, as well as direct laying by periscope (excluding axle and wheels). The weights of the various parts are as follows:—mortar, trunnions and elevating collar 165 lb.; two cheek pieces, $143\frac{1}{2}$ lb. each; trough 132 lb.; wall back-plate 106 lb.; three planks 128 lb. Total weight in action 818 lb.

The stick-bombs vary in weight from 35 lb. (burster $13\frac{1}{2}$ lb.) to 99 lb. (burster $50\frac{3}{4}$ lb.). The earlier types, as in the 99-lb. bomb of fig. 2, had three vanes; later, as in the 40-lb. bomb of fig. 3, six were fitted. Some types had considerably more elongated bodies than those illustrated. With a charge of 4 oz., the 35-lb. bomb ranges to 715 yd. at an angle of elevation of 45°, the muzzle velocity being 263 f.s., and with a charge of $4\frac{1}{4}$ oz. a 68-lb. bomb, m.v. 220 f.s., ranges at the same angle of elevation to 490 yards. (C. F. A.)

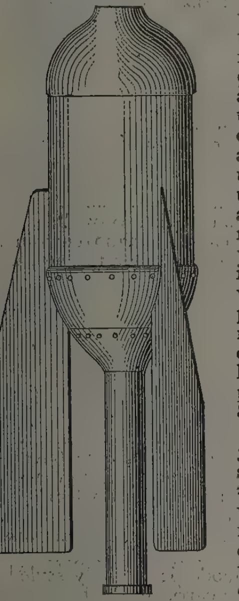
FIG. 2

II.—*Low-Pressure Smooth-Bore Trench-Mortars.*

Trench-mortars of this class are characterized by the fact that the pressure of the propellant gas is reduced by being allowed to expand into an "expansion chamber" of one form or another before beginning to take effect on the projectile. This device enables a thin-walled gun-tube to be used (instead of a true cannon such as the Dumézil above described) with considerable saving of weight. In some types, the firing of the charge was arranged to take place in a separate chamber which communicated by a channel with the expansion chamber, *i.e.* the breech portion of the gun-tube in which the projectile is seated. Such were the Aasen, the Sutton-Armstrong, which was employed as a naval "bombthrower" (*see* ORDNANCE: section *Naval*), and the Temple. The last-named was distinguished by possessing a silencer attachment, which was considered by some authorities as a desirable addition in the period of short ranges and very advanced emplacements.

Of more importance in the history of the World War are those types in which the strong-walled "combustion chamber" does not form a separate component, but is included either in the base of the gun-tube (as in the Batignolles type) or the base of the shell (as in the Stokes). In both of these, the "expansion chamber" is formed automatically by the fact that only certain projections from the shell-base, and not the base itself, rest on the bottom of the bore or chamber-shoulders when in the loaded position.

The principal representatives of the class are the French Batignolles heavy trench-mortar, used also by the British, Italians and Americans, and copied, with modifications, in certain German patterns, and the British light Stokes mortar, which, with its derivative the medium Stokes-Newton, were used by the British and American armies. The *Stokes Mortar*, invented by Sir Wilfred Stokes early in 1915, was considerably improved in the course of the war as the result of experience with the weapon itself and with trench-mortars generally. It was first used in battle at Loos, Sept. 25 1915, when a few 4-in. tubes on bipod mountings, with straw-board-bodied shell, improvised at short notice, were employed for firing smoke shell; but by the battle of the Somme (July 1 1916) both 3-in. and 4-in. mortars (the latter specialized for gas and smoke projectiles) had been issued in large numbers. Thereafter, to the last phase of the war, in which its lightness enabled it to do useful service as an "accompanying" piece, it satisfied all expectations. Each British infantry brigade of 4 or 3 battalions included a battery of 3-in. Stokes. Their principal characteristic was *automatic ignition.*

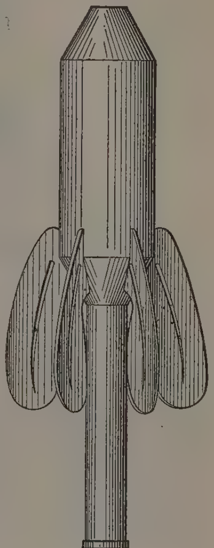
FIG. 3

Although it is believed that the first record of automatic ignition in trench-mortars, where the projectile carried its own propelling charge and igniter attached to the base of the bomb, existed in an early patent taken out in Germany by Messrs. Krupp, no practical use seems to have been made of this, and the first application of the theory of dropping a bomb of this nature down the bore of a mortar, so as to fire the charge and eject the bomb upon impact with the base, was that put forward by Sir Wilfred Stokes. The bomb in its first service form (fig. 4) had a container screwed on to the base, and this took a 12-bore sporting cartridge, the percussion cap of which, after the bomb had slid rapidly down the bore, impinged upon a striker fixed in the base of the mortar. In the 6-in. medium mortar (Stokes-Newton), developed later in the war, the principle of the fixed striker was adhered to, but both the mounting and the projectile differed entirely in design.

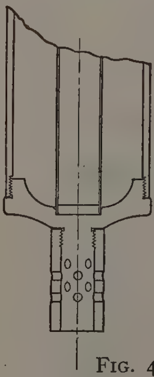
FIG. 4

The barrel of the 3-in. Stokes mortar (fig. 5) consists of a light seamless steel tube (A) drawn down at the base end, which is bumped into a semicircular form having a slight projection in the centre of the axis of the bore. This projection is drilled and threaded to take the striker (H), which, when screwed home, projects into the bore; the size of the combustion chamber is regulated by the extent to which the striker protrudes into the barrel or bore of the mortar. A cap (G) is screwed over the outside of the projection to take the set-back of firing. This cap, which is made of steel, rests in a small depression in the base-plate (C), which is fixed in the ground approximately facing the objective, and at a convenient angle, and has several such depressions placed in an arc to provide for changes of direction. The thin tube or barrel of the mortar has a smooth bore; it is supported above the centre of gravity by a pair of folding legs (B), between the apex of which (when open) and the barrel are the elevating and traverse gears, the latter being attached to the barrel by means of a steel band (*see* fig. 6).

There is no attempt to take up or absorb mechanically the set-back on firing, or the recoil, as the low combustion pressure renders this unnecessary at the ranges used.

As already noted, the 3-in. Stokes was in the British service set apart for the firing of high-explosive bombs (although smoke-producing bombs were added later), while the 4-in. mortar was reserved for gas, smoke and incendiary projectiles. The weight of the 3-in. bomb was given at 10 lb., and of the 4-in. at 25 pounds. The design of the mortar, as between the two types, was only varied in so far as the difference in size rendered this necessary, and the same is substantially true of the design of the bomb. Steel is used in the 3-in. and both steel and cast iron bodies in the 4-inch.

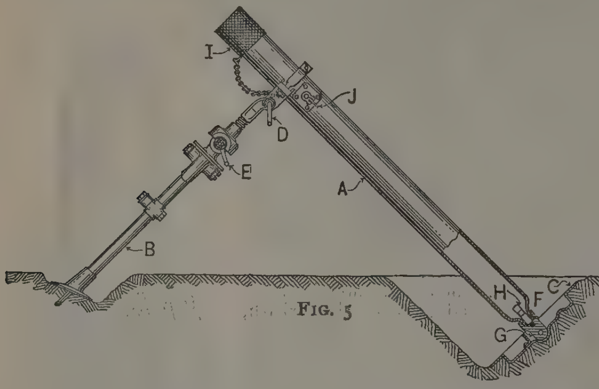

FIG. 5

The first service patterns of bomb, and all subsequent ones up to the introduction of the vaned bomb in the last days of the war, have a cylindrical body, which is provided with 2 bands or "guides" as far apart as the wall of the bomb permits, preferably one at each end of this (fig. 7). The object of these guides is to ensure that the percussion cap falls accurately upon the striker after the bomb has travelled down the inside of barrel. The guides also eliminate friction during the descent of the bomb; windage has to be allowed for (*i.e.* sufficient space to permit the air compressed by the bomb in its descent to escape between the guides and the wall of the barrel). The windage provides an escape for the surplus air and ensures that the acceleration due to gravitation will drive the percussion cap with sufficient force on to the striker to cause ignition. In the 3-in. and 4-in. service designs the working chamber pressure is limited to 2 tons per square inch. At this pressure a range of 1,250 yd. is obtainable with the cylindrical bomb, when using the full propelling charge. This charge is obtained by placing rings of cordite round the exterior of the cartridge container, the container being perforated with a number of small holes, through which the gas from the cartridge escapes into the chamber, thus igniting the cordite rings in passing.

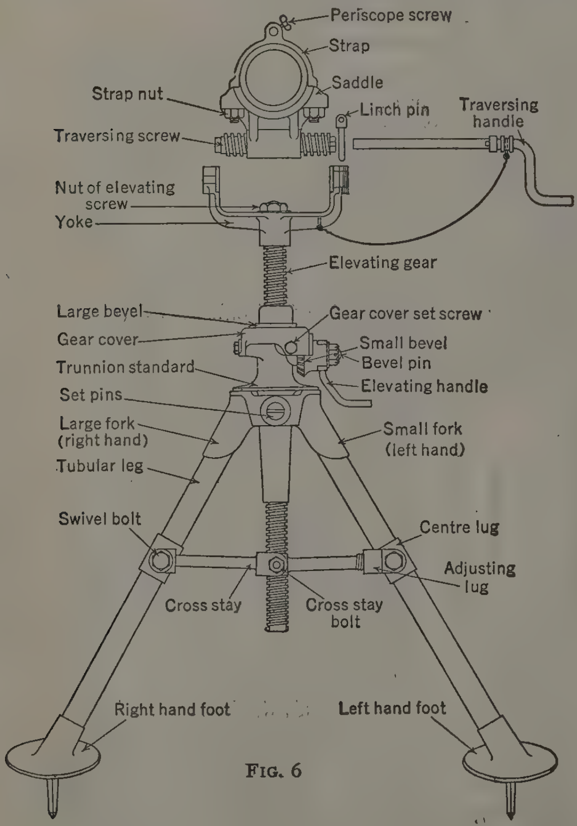

FIG. 6

The steel bomb is made up of ordinary commercial lap-welded steel tubing, cut to the desired length, and of the forged steel head and base which carry the guides and the cartridge container.

As this mortar is not rifled, the bombs (except in the vaned patterns developed later) turn over and over in flight. If then, a burst or impact is desired, fuzes of the ordinary type which require nose-first impact will not serve. A type of fuze was, however, designed, known as the Allways fuze (*see* AMMUNITION: section *Fuzes*), which operates whatever the direction of fall. When time fuzes are required, either for air burst or for delay-action after impact, or because no Allways fuze is available (as was the case for a considerable period in the war), the arrangement most commonly adopted is that seen in fig. 7, viz. a "pistol," which is practically identical with the ignition device of the Mills grenade (*see* GRENADE). The control of the bomber's hand over the lever is here replaced by that of a pin, which secures it till the moment of discharge, when the pin sets back and the lever is free to fly up.

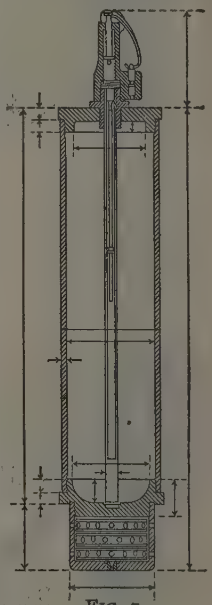

FIG. 7

Bombs with vanes have been designed to obtain greater range and accuracy. As these fly straight, head on, air resistance is diminished. These bombs are stream-lined as far as is possible, while allowing for the guides to be sufficiently far apart for accuracy in impinging upon the striker. An additional margin of inaccuracy in descent down the bore of the mortar is provided for by fitting a cap which holds the needle point over the end of the cartridge, so that, no matter where this hits the striker, the needle will ignite the percussion cap. Safety against accidental dropping is provided by designing the vanes to extend slightly beyond this cover. With vaned bombs, of course, normal types of fuze can be used.

Generally speaking, high-explosive, smoke and gas bombs are all designed to explode upon impact, while incendiary bombs are designed to function in the air as nearly over the objective as possible.

The *Stokes-Newton 6-in. T.M.* is similar, so far as the barrel is concerned, to the Stokes 3-in. and 4-in. A much stronger bedplate, however, is required owing to the increased weight of the projectile and the greater range, and the mounting is quite unlike that of the smaller weapons. Both direction and stability are obtained by means of lugs set radially round the outside of barrel, about midway, and attached to rings in the bedplate. These lugs can be lengthened or shortened by means of turnbuckles in the centre, thus obtaining elevation or depression and traverse at the same time. This method is slower than that used in the 3-in. and 4-in., but has the advantage of tying the mortar well down to the bedplate and ensuring stability. A somewhat similar device, providing for elevation only, is found in certain German and Russian trench-mortars.

The projectile of the Stokes-Newton is similar to the cast-iron vaned bomb of the smaller weapons. It has steel vanes which are placed in the mould and become part of the casting. The propelling charge is guncotton, and this is ignited by a shortened service rifle cartridge, instead of the 12-bore cartridge which is used in the Stokes cylindrical bomb. This bomb is an adaptation of that of the French 240-mm. described below.

The *Batignolles 240-mm.* (*9·45-in.*) *Heavy T.M.* is perhaps the most elaborate of those trench-mortars which stood the test of war. It was brought out in 1915 by the Batignolles Company of Paris, and first used in a great battle in the Champagne offensive of Sept. 25 1915. The model described is the earlier trench type. Later, the piece was lengthened and provided with less primitive firing arrangements. The model finally adopted in 1916 by the British War Office as the standard heavy trench-mortar also had different firing arrangements and a periscopic dial-sight.

The *240 court de tranchée*, as this model is officially styled, consists of four main parts, the piece, the carriage, the baseplate, and the platform (fig. 8). The *piece* consists of two sections screwed together; the lower section, which has very thick walls, contains the chamber proper, in which the propellant charge is housed, and (in this model) an aerial vent to take the 12-secs. length of Bickford fuze which communicates the flame from the gunner's portfire to the powder primer of the charge. The upper or front end of the chamber is not "choked" but on the contrary opened out so as not to impede the rush of gas into the broader "expansion chamber," or lower part of the thin-walled tube. This thin-walled tube contains the vaned bomb (fig. 9), which unlike those previously described in connexion with the Dumézil trench-mortar, has its four vanes exactly in prolongation of the body. This arrangement not only enables the whole of the projectile to enter the bore, but ensures the maintenance of a free expansion chamber as the tips of the vanes, and not the base of the bomb, rest on the curved shoulders of the chamber proper. The bomb is of steel, thin-walled, and its body is built up from three pieces by autogenous welding, the cruciform vanes being secured to the body in the same way after being riveted to each other. A delay-action fuze only is used. With this, the powerful bomb, weighing 192 lb., of which 101 lb. are high explosives, will demolish thirty linear feet of trench work, break down all but heavily protected dugouts, and make a crater in compact clayey earth 10 ft. deep and 30 ft. across.

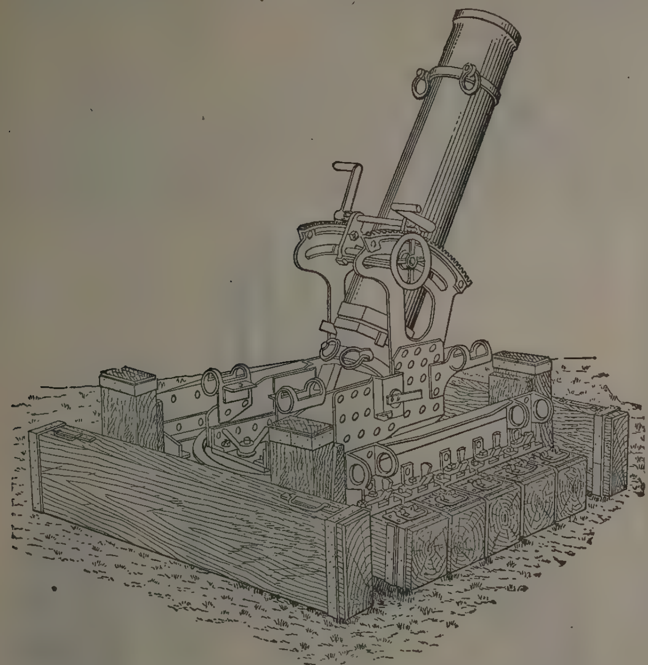

FIG. 8

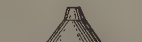

FIG. 9

The piece is rear-trunnioned, the trunnions being firmly held in their seatings in the base of the carriage by a locking device. The carriage consists of a bottom-plate which contains the pivot-seating and the trunnion-seatings, and two side-brackets which are formed at their top edges as arcs for giving elevation. These arcs are toothed, and into them gear small pinions on a cross-shaft secured to a collar on the piece. Below this cross-shaft, and similarly secured to the collar, is another cross-shaft, the ends of which engage in slots in the side brackets of the carriage and carry the clamping arrangements by which the piece is secured rigidly to the carriage when the arc-and-pinion gear have brought it to the desired elevation. The elevation limits are 54° (with certain precautions 45°) for maximum range, 75° for minimum. On its underside the bottom-plate of the carriage has an ingenious arrangement of locking sectors which, when the carriage is placed over the pivot on the baseplate and given a partial turn, engage in a locking-ring on the face of the baseplate. (The ring originally admitted of all-round traverse, but this was later restricted to one of 18° each side of the mid-line, so as to avoid slantwise strain on the platform.) The baseplate is almost square and has on its upper side the locking-ring and pivot above mentioned. From its underside six vertical flanges project downwards. The platform is made up of five heavy square baulks, iron-shod and fitted with distance pieces so that, as they lie in position in the shallow, levelled pit, the four inner flanges of the baseplate can enter between them, while the two outer flanges fit over the outer baulks. Latches on both ends of each baulk engage with projecting tongues on the baseplate. Thus baseplate and baulks together form a steady unit in firing. The unit is further steadied against the horizontal component of the thrust by being wedged, back and front, against end-boards placed against the walls of the pit. The piece is laid for direction by an auxiliary aiming point, any suitable dial-sight being adaptable to the mounting-means of one or another form of dial-sight, a clamp on the bottom-plate of the carriage binding the latter in the desired position of traverse.

All the parts are equipped with sockets for lighting-handspikes, except the piece itself which is carried by two staves passed through the two parts of carrying rings seen in the drawing. But movement in the trenches is as a rule by means of iron barrows pushed by hand. One barrow takes the mortar upright, another the carriage, a third the baseplate and accessories, while the baulks and end-boards are carried by hand.

The weights of the short 240-mm. are as follows: mortar 485 lb., carriage 425 lb., baseplate 510 lb., platform baulks 132 lb. each. Total weight in action (exclusive of wedges, steadying pickets, etc.) 2,080 lb. The loaded weight of the heaviest barrow (baseplate, etc.) is 943 lb. The maximum range of the 192-lb. bomb with a propellant charge of 1 lb. 9½ oz., is 1,125 yd. at 45° elevation and 1,045 at 55°30′. The maximum pressure in the bore is slightly less than 1 ton per sq. in. (150 kgm. per sq. cm.). The lengthened 240-mm. (breech-loading and percussion-fired) ranged with a 179-lb. bomb to 2,265 yd. (m.v. 476 f.s., maximum pressure 3,700 lb. per sq. in.), using a charge of 2 lb. 13 oz., but it required a heavier and more elaborate platform. A still more powerful weapon of the same class was the 340-mm. (13·4-in.), which required a concrete bed and a light-railway track for supply. This carried a 430-lb. shell (high explosive burster 205½ lb.) to a distance of 2,250 yards.

Pneumatic guns, as possessing a high-pressure reservoir and a low-pressure gun chamber, should also be included amongst the low-pressure class of trench ordnance. Owing to their silence and invisibility in action, they possessed marked advantages over the earlier forms of trench-mortar using explosive propellants. But their low power, their complication and liability to get out of order, and as regards some models, their entire dependence on a special form of supply (air or carbon-dioxide bottles) disappointed expectation; and of many ingenious designs put forward in the different belligerent countries, one only was consistently employed in the field. This was the French Brandt, classed as a light trench-mortar, which could obtain its pressure either from a bottle or from a motor-car pump. Its first model, which had a tripod mounting, weighed 48½ lb. for the gun, 35½ lb. for the tripod, and 70½ lb. for the box of accessories and pumps. A later model, firing to a fixed angle only, was much lighter. It threw a 1½-lb. bomb, or rather grenade, very accurately to a distance of 250 yd. but, although much greater ranges were obtainable, the accuracy fell off rapidly beyond that figure. (C. F. A.)

III.—*Rifled Trench-Mortars.*

The Germans were the first to produce an officially designed model of trench-mortar (*Minenwerfer*), and these weapons were used in the earliest sieges of the war. Although this gave German designers a long start in the competition, it did not save the German army from passing through the same phase of crude improvisations, which the French and British armies had to traverse. Bored-out shell mounted on blocks, old bronze siege mortars, experimental pneumatic mortars, and various smooth-bore types all figured in the armament of the German trenches for the first years of the war, and it is not till 1916 that the standard types are found in very large numbers. Thereafter, with the sole exception of a *minenwerfer* copied in principle from the Batignolles 240-mm., the standard types alone were used for general battle and trench service. The older types, so far as they survived, were practically reserved for throwing gas-bombs and other special projectiles. All the standard types of light, medium and heavy *minenwerfer* are rifled, and are derived from the pre-war service weapon. Modifications during the war were few, and did not affect the main elements of the design. They were principally two—the lengthening of the barrel in all three classes, and the adaptation of the light type to a direct-fire carriage, which enabled it to be used with conspicuous success as an "accompanying gun" in the semi-open warfare of 1918. The models selected for description here are the original model of "medium," the new or 1916 model of "heavy" and the light type with and without direct-fire carriage. Rifled trench-mortars were not used in any of the Entente armies.

The characteristic of the German rifled trench-mortar in all forms is that, unlike the stick-bomb weapons and the low-pressure weapons which are radical departures from ordinary artillery practice, they are designed essentially as siege howitzers of reduced weight and power. Recoil-gear is provided, but of a simpler kind than the intricate combinations of elements necessary in a howitzer of high velocity and recoil energy; similarly, to ease the strain of discharge, by reducing the power necessary to propel the projectile, the driving band of the shell is "engraved" in advance. But the arrangement of piece, cradle and buffer, and the form of the shell, is in accordance with the conventional artillery practice.

The "*old*" *model medium trench-mortar* (fig. 10) is a short, thin-walled howitzer of 17-cm. (6·69-in.) calibre, rifled with 6 shallow grooves of uniform twist, 1 turn in 26½ calibres. The length of the rifling is 3·3 calibres. It is muzzle-loading and has percussion-firing gear placed axially on the breech. It is mounted in a ring-cradle which carries, above and below, a combined buffer and spring recuperator of simple type. The piece slides back and forth in the cradle and has the pistons attached to horns above and below the breech. The cradle is centre-trunnioned and the trunnions rest in seatings in a top-carriage of the usual form. The left trunnion carries an elevating arc actuated by a worm-shaft and handwheel on the carriage. This trunnion also carries a panoramic sight (not shown in the illustration), mounted so as to slide on an arc which renders its position independent of the gun elevation. The baseplate, which is of steel, has longitudinal and transverse spades or flanges to enable the mounting firmly to be bedded on the ground.

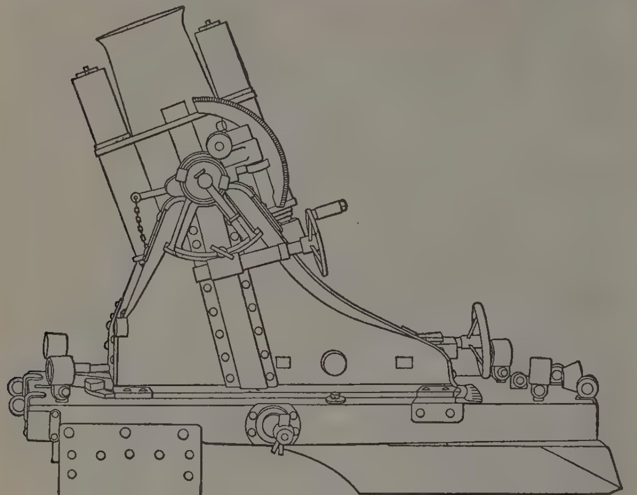

FIG. 10

In the forepart, the baseplate has a vertical pivot and in the rear part an arc, which enables the top carriage to be traversed 12½° either way from the centre line by means of the handwheel seen in the illustration. As in all German rifled trench-mortars care is taken to house in gearing and mechanism so as to keep out mud and dirt. The weight of the whole system in action is 1,064 lb. and the maximum range, with a 109-lb. shell (burster 24½ lb.), is 980 yards. For transport, wooden wheels are fitted to axles on the bedplate and a handspike with a socket formed at the back of the same. The "new" model of medium *minenwerfer* is slightly longer (3·8 calibres rifled length), weighs 1,232 lb. in action, and ranges to 1,250 yd. with the same shell.

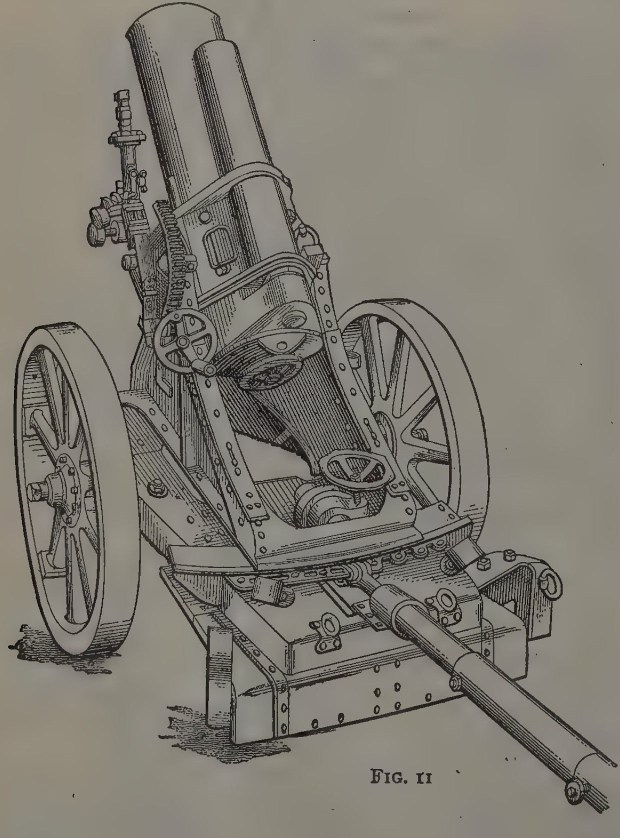

FIG. 11

The heavy *minenwerfer, new model*, shown in fig. 11, is similar in all essentials of design to the above, but like other new models longer than the original model of its class. The details, such as the sight and the traversing gear seen in the illustration, and the elevating gear, etc., seen in fig. 10, are common to old and new models of medium and heavy. The new model heavy has a calibre of 245 mm. (9·8 in.) and has a rifled length of 4·54 calibres. It weighs in action 1,693 lb. and with a 210-lb. shell (103-lb. burster) ranges to 990 yards. The old model has a rifled length of 3·1 calibres and weighs in action 1,362 lb.; with the above shell it ranges to 612 yd. only.

In the light *minenwerfer*, 7·6-cm. (2·9-in.) calibre, of which the "new" model is shown in fig. 12 and the direct-fire carriage in fig. 13, the piece, buffer and recuperator system and bedplate are similar in general to those of the medium and heavy types. But the top-carriage design is entirely different. The ring-cradle (which carries the buffer system as in the other types) is continued on each side to form arms which at their extremities are traversed by an axle, or through trunnion-bar, a few inches above the baseplate level. This bar rests in seatings in a very small intermediate carriage which traverses (through a circle) round a pivot in the bedplate. In the forepart of this intermediate carriage is another cross-axle which at its middle is formed as a socket, taking the foot of a stout elevating screw. This elevating screw (which is cased in leather to protect it from dirt) is clearly seen in fig. 13. It supports the weight of the cradle and piece, to which it is jointed, and elevation is given by screwing up or down.

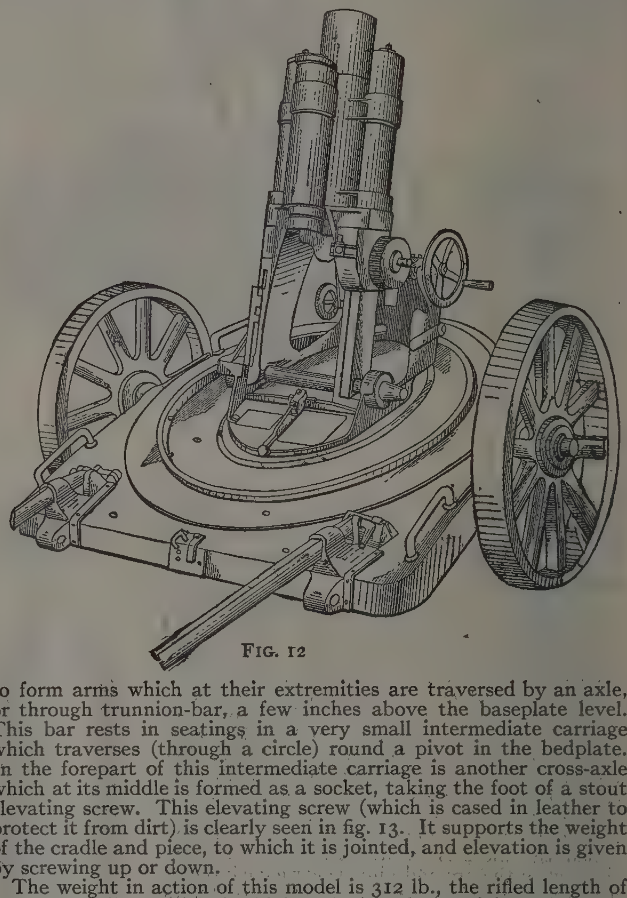

FIG. 12

The weight in action of this model is 312 lb., the rifled length of bore 5·2 calibres, and the high-explosive shell weighs only 9 lb., and, comparing these proportions to those of the heavy and medium shell, it is not surprising to find that it ranges to 1,422 yards. The "old" model was somewhat shorter and lighter, and ranged to 1,150 yd. with the 9-lb. shell.

The light *minenwerfer*, which is also known as the "Ehrhardt," was a very successful weapon, and every German infantry battalion had by 1917 a "light *minenwerfer* section," consisting of 4 of these pieces and a number of the "*granatwerfer*" described under BOMB-THROWERS.

In 1918, in preparation for the expected resumption of "open" warfare, the Germans on the western front adapted the light *minenwerfer* for service as a direct-fire short-range gun of accompaniment for use against undisclosed machine-gun nests and other defences that might be met with in the course of a deep advance. For this purpose the bedplate, already provided with axles, was fitted with higher (29-in.) wheels, and a trail with trail spade was bolted to the small intermediate carriage described above. This trail is peculiarly arranged in the forepart. The cross-axle, or through trunnion-bar, which, in the trench-service mounting, connects the ends of the cradle arms to the intermediate carriage, is, in the direct-fire mounting, connected to a framework in the trail which can be raised or lowered, thus enabling the cradle and mortar, always supported in front by the elevating screw, to assume either the horizontal or slightly elevated position with trunnion-bar high, or the quasi-vertical loading position (shown by dotted lines) with the trunnion-bar low.

The motion of the framework in question is about a transverse axis contained in the trail and is controlled by a shifting level.

Traversing is still about the pivot in the bedplate, and is managed by moving the point of the trail (by means of a small lever) along the broad arc-shaped spade member. The limits of this traverse, viz. with spade bedded, are 11·8° either way from the middle-line. The maximum range with the 9-lb. shell in the direct-fire position high-trunnioned (elevation 38°) is 995 yd., but all angles between 34° and 75° may be obtained by transferring the trunnion-bar to the low position and proceeding as its high-angle platform fire. Both platform-fire and fire from wheels is possible in the high and low positions alike. In movement, the system is either man-drawn or limbered up to a two-wheeled cart drawn by one horse.

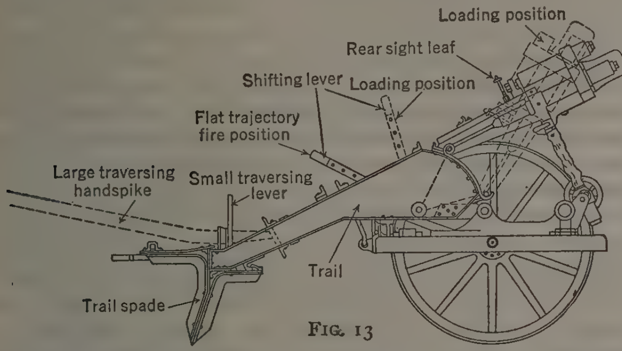

FIG. 13

IV.—*Direct-Fire Trench Ordnance*

In spite of the great defensive powers revealed by the machine-gun in trench warfare, certain local-defence needs made themselves felt in that type of warfare which the machine-gun of rifle calibre could not satisfy. In consequence, a variety of trench-guns were designed or adapted for emplacing as "forward" guns, or "infantry" guns. It cannot be said that this class of trench ordnance possesses any generic characters. A few were specially designed but the majority were field or small naval guns cut down and mounted on low carriages. Captured guns were frequently adapted for this service, when a large enough supply of ammunition and pieces was available, and also hooded quick-firing guns of the 57-mm. class taken from fortress armaments, in which formerly they had figured largely as a standard close-defence armament. Later on, these forward guns were sometimes made mobile again for use as guns of accompaniment. None of these converted types, however, need be dealt with here, and it will suffice to mention more particularly the 37-mm. gun (of French origin, but used also by other armies), not so much because it is representative of a class—which is too miscellaneous for any member of it to be regarded as such—as because it was used on a large scale in the war. It is a direct-fire quick-firing weapon, short in barrel length, mounted on a low-wheeled carriage and provided, as is a field gun, with a shield. It was laid over open sights and fired small, high-explosive shells with percussion fuzes similar to those of the "pompom," which were effective against machine-guns, etc., under light cover. The dimensions and weights of the Russian model of the 37-mm. (which is provided with the recoil-absorbing rubber discs commonly found in Russian designs) are as follows:—calibre 37 mm.; weight of the system in action 396 lb.; of the gun, breech and lock alone 86½ lb.; and of the pointed shell with base-fuze and burster 1·1 lb.; m.v. 1,450 f.s.; max. range on the sights 3,500 yards.

In their later evolution, many of these miscellaneous trench-guns became anti-tank guns. (C. F. A.)

TREVELYAN, SIR GEORGE OTTO, 2ND BART. (1838–), English author and statesman (*see* 27.255), who received the O.M. in 1911, published in 1912 the first volume of his work *George III. and Charles Fox*, and the second in 1914.

His eldest son, CHARLES PHILIPS TREVELYAN (b. 1870), resigned his post at the Board of Education in 1914 as a protest against the policy which involved Great Britain in the war. He lost his seat in Parliament at the general election of 1918.

His third son, GEORGE MACAULAY TREVELYAN (b. 1876), was during the World War commandant of the first British ambulance unit on the Italian front, and received in 1915 the Italian silver medal for valour. He published *Garibaldi and the Making of Italy* (1911); *Life of John Bright* (1913); *Clio, a Muse, and other Essays* (1913); *Scenes from Italy's War* (1919). He married in 1904 Janet Penrose, elder daughter of Mrs. Humphry Ward. She published in 1920 *A Short History of the Italian People.*

TRIPOLI (*see* 27.288).—As the result of the war of 1911–2 between Italy and Turkey, the vilayet of Tripoli, together with that of Bengazi (Cyrenaica), passed from Ottoman to Italian rule. The newly acquired territories were jointly styled Libya Italiana, but Tripolitania and Cyrenaica were organized as distinct entities with separate administrations and governors.

History.—The war of 1911–2 (*see* ITALO-TURKISH WAR) ended without any formal acknowledgment of Italian sovereignty by the Porte. At an early period of the conflict, on Nov. 11 1911, when the Italians held little more than the town of Tripoli, a royal decree declared that both vilayets were placed "under the full and complete sovereignty of the kingdom of Italy." This was a political move, confirmed (in Feb. 1912) by the Italian Parliament, taken to make plain Italy's intentions to Germany and Austria, her partners in the Triple Alliance (*see* AFRICA: *History*). When, in view of the situation in the Balkans, the Turkish Government opened peace negotiations neither Tripoli nor Cyrenaica had been conquered, and the negotiators came to an unsatisfactory "face-saving" arrangement. By an agreement signed at Lausanne on Oct. 15 the Ottoman Government bound itself to issue, within three days, a *firman* renouncing Turkish sovereignty; the form used made the Sultan declare "I concede to you (the inhabitants of Tripoli and Cyrenaica) full and complete autonomy." But at the same time the Sultan was to nominate not only an official to protect Ottoman interests but a religious chief, while the Sultan's name, as Caliph, was to continue to be pronounced in public prayer by the Moslems.

The formal treaty of peace signed at Lausanne three days later (Oct. 18 1912) made no mention of the Italian annexation, but provided for the evacuation of the vilayets by Turkey. France was the first Power formally to recognize the new position created; by a declaration signed at Paris on Oct. 28 the two Governments agreed not to put any obstacles in the way of measures which they should judge opportune in Libya and Morocco respectively. This was in fulfilment of a Franco-Italian agreement reached in 1902, an agreement in which Great Britain acquiesced.

In Tripolitania the article of the Treaty of Lausanne requiring the immediate recall of the Turkish troops was carried out. Neshat Pasha and his force of 2,500 regulars embarked for Constantinople, while the garrisons in the interior, largely composed of natives (Arabs and Berbers), disbanded, or joined the Turks and Senussites in Cyrenaica. The Italians then took in hand the pacification of the interior. The tribes of the Jefera (coast zone) submitted with little difficulty, but there was stout opposition from the Berbers of the adjacent hill region. Suleiman el Baruni, the powerful Berber chief of the Jebel Nefusa, was the principal opponent of the Italians. He had represented Tripoli in the Turkish Parliament, had been created a pasha, was an ardent supporter of the Pan-Islamic movement, and now set up a kingdom in the hills. After having maintained his independence for the greater part of 1913 Suleiman was beaten. He fled to Europe—to reappear at a more convenient season. The occupation of the rest of the province by the Italians presented little difficulty. Murzuk, the capital of Fezzan, was entered unopposed on March 3 1914 by a column under Col. Miani. With the occupation of the oasis and town of Ghat by Col. Giannini on Aug. 12 following, every place of importance in the province was garrisoned by the Italians. In these operations, besides battalions from Italy, troops from Eritrea and native partisans (Arab and Berber) were employed.

Meanwhile, as soon as the coast region had been pacified, the Italians set to work with great energy to improve harbours, make roads, build railways, found schools, open hospitals, organize sanitary and police services and encourage agriculture and trade. By the middle of 1915, when the work had to be abandoned temporarily, a good deal had been accomplished. National feeling had been highly gratified by the acquisition of what was looked upon as the "natural heritage" of Italy, and money and men were forthcoming for the task of regeneration. Many Italians were anxious to settle in the country as agriculturists—but this movement the administration wisely discouraged. Towards the Arabs and Berbers a policy of trust and confidence was adopted, a policy which might have succeeded but for the situation in Cyrenaica. In that province the Treaty of Lausanne had not brought about peace, and Turkish troops aided the Senussites to continue the conflict (*see* Senussi). At the beginning of 1914 the Italians held in Cyrenaica only a strip along the coast. The Senussites were masters in the interior, and thus in a position powerfully to influence the tribes of Tripolitania. Many of the Fezzani were of the Senussi fraternity.

Such was the position when in Aug. 1914 the World War began, Italy however at that time remaining neutral. Towards the end of the next month (Sept. 1914) the Fezzani—instigated by emissaries from the Senussi Sheikh—suddenly rose in revolt and attacked several small garrisons between Murzuk and the coast. By the end of Nov. the rising had assumed large proportion. The Italian Government then ordered that Fezzan should be evacuated, and Col. Miani and his troops fought their way back to the coast. As soon as the Italians had left Murzuk Mahommed el ʻAbid, a brother of the Senussi Sheikh, took over control there and declared himself governor of Fezzan. Miani's withdrawal from Fezzan left the Italian garrison at Ghat—600 m. from the coast—isolated, while the garrison of Ghadames, farther N., was also in danger. Both places adjoined the French frontier, and at the invitation of the French Government the garrison of Ghat marched across the desert to Fort Flattere (a distance of 200 m.), while that of Ghadames withdrew into the Tunisian Sahara. General Tassoni, then governor of Tripoli, whose forces were increased by 6,500 fresh troops, directed the reoccupation of both oases. After hard fighting Col. Giannini retook Ghat on Feb. 18 1915, and shortly afterwards Ghadames was also regarrisoned. But on the eastern side of Tripoli fortune went against the Italians. In an engagement with the rebels between Sokna and the coast on April 29, the Libyan auxiliaries of the Italians went over to the enemy on the field of battle, and the Italian and Eritrean troops were only saved from complete disaster by a skilful retreat to the coast. Turkish, German and Senussi propaganda was very active throughout Tripolitania, and the Italian declaration of war upon Austria (May 23 1915) was the signal for a general rising. In these circumstances the Italians decided to abandon the interior. The withdrawal of the garrisons was not effected without serious losses. In June the troops at ʻAziziya, 40 m. S. of Tripoli city, closely besieged and having exhausted their food, broke out and attempted to reach the coast. Nearly all were killed. The last place evacuated was Ghadames, the garrison on July 19 again crossing into Tunisia. The only places retained by the Italians were the seaports of Tripoli and Homs (Khoms). In this month (on July 15) Gen. Ameglio, governor of Cyrenaica, was also named governor of Tripoli, for the better conduct of the defensive operations. The hostile forces which gathered in the neighbourhood of Tripoli city in the summer of 1915 were beaten back.

The success of the revolt induced the Turkish and German agents in the country, of whom there were a considerable number, to endeavour to bring about revolts in Tunisia and Algeria also. In Algeria they failed, but in the Tunisian Sahara some tribes, aided by forces from Fezzan led by Turkish officers, attacked the French outposts. Sharp fighting in Sept. and Oct. 1915 ended in the reëstablishment of order along the frontier by the French forces. At this time, however, the chief effort of the Turks was in Cyrenaica, where Sidi Ahmad, the Senussi Sheikh, was induced to invade Egypt. The only development of note in Tripolitania until after the defeat of Sidi Ahmad by the British was the reoccupation of the seaport of Zuara by the Italians in Aug. 1916.

In Sept. 1916 Suleiman el Baruni reappeared. He landed at Misurata on the 25th of that month accompanied by German and Turkish officers and in possession of a *firman* from the Sultan, appointing him governor-general of the vilayets of Tripoli, Tunis and Algiers.[1] He was joined at Misurata by Ramadhan el Shtewi, the most powerful local chieftain, an ambitious man who proved a doubtful ally and whose real aim was independence of all other parties. He now, however, helped El Baruni, as did also Nuri Bey. Together they organized a fighting force of 6,000 to 7,000 men, with which all through 1917 El Baruni harassed the Italians, whom he boasted he would drive into the sea. Though he was defeated in four separate engagements the Italians could not follow up their successes. While this fighting was going on Sidi Ahmad's expulsion from Egypt weakened Senussi prestige in Tripoli, and in the summer of 1917 the pro-Turkish party in Fezzan expelled Sidi Ahmad's brother Mahommed el ʻAbid from Fezzan.

Nothwithstanding the failure of El Baruni's efforts against Tripoli city, the close of 1917 saw the supporters of Turkish designs apparently masters of the country. In reality, the Arab and Berber chiefs were split into factions. El Shtewi had established a so-called republic of Tripoli and ruled at Misurata; the Senussi were divided among themselves, and one party of them, under Sidi Idris, had, as early as April 1917, come to terms with the Italians and British. The impossibility of getting the tribes to act together caused Nuri Bey to leave Tripolitania early in 1918. He was succeeded by Ishaq Pasha, who proved a harsh and unpopular commander. The Turkish Government, however, still believed that it would be possible to expel the Italians from Tripoli, and they sent thither Prince Osman Fuad (a grandson of Sultan Murad V.). The prince, who arrived at Misurata by submarine in April 1918, tried to compose the quarrels among the tribes, but did not succeed. The tribes were as jealous one of another as were the Highland clans in the "45," and powerful chiefs exercised independent authority, El Baruni and El Shtewi being the most important. They combined on occasion, and on occasion quarrelled. Such was the position when the World War ended in Nov. 1918.

The task of pacifying the country and restoring Italian authority was more difficult in Tripoli than in Cyrenaica. Sidi Ahmad had fled and Sidi Idris having consolidated his authority over the Senussi fraternity, it was possible to make with him an arrangement which bound the tribes of Cyrenaica. In Tripoli there were a dozen or more chieftains with whom to deal, and the Italians were not prepared to undertake extensive military operations. They extended their direct authority along the coast and entered into negotiations with El Baruni and the chiefs of other tribes. The result was seen in the issue of a royal decree in June 1919 in which natives of Tripoli were given "complete local citizenship," and in the creation of an elective assembly to deal with legislation and direct taxation. The immediately effective part of the decree was that the country should be governed as far as possible through native chiefs, to whom were attached political officers. El Shtewi was the last chief to agree to this arrangement; he became *mutessarif* of Misurata. As token of reëstablished amity the Italian flag was rehoisted at the *ksar* of ʻAziziya on June 12 1919. In Aug. Sig. Vittorio Menzinger was appointed governor of Tripoli to carry out the new policy of ruling through a local Parliament, but the chiefs cared little for such an assembly, being more concerned in consolidating their own authority. El Shtewi, particularly, gave much trouble, and in the first half of 1920 he seized and detained for weeks the commander of the troops at Homs and other Italian officers and men. He aroused the hostility of Ahmad Murad, the chief of the Tarhuna tribe, and in the fighting which followed the Italians did not interfere. A new governor, Sig. Luigi Mercatelli, was sent out in July 1920, and gradually the situation improved. The complete accord reached in Cyrenaica with the Senussi (Nov. 1920) had a tranquillizing effect. As marking the period of calm which then prevailed, the young Crown Prince Humbert in Sept. 1921 visited Tripoli and Bengazi, receiving assurances of loyalty from many chiefs.

In Sept. 1919 an agreement was reached with France rectifying the Tripolitan-Tunisian frontier, which was made to sweep in a semi-circle from the coast, so as to leave to Tripoli the direct routes between Ghat, Ghadames and Tunis. Italy also obtained economic concessions in Tunisia and an agreement as to a common railway policy (*see* Africa: *History*).

Economic Conditions, etc.—The number of inhabitants is unknown; for Tripolitania and Cyrenaica combined it may reach 4,000,000. Tripoli city had (1920) a pop. of about 73,000, and Bengazi 35,000. Europeans, mainly Italians and Maltese, number some 10,000. Most of the country is desert and there are no perennial rivers, but there are numerous fertile oases and grazing grounds. The chief crop is barley; the date palm, the olive and the fig tree flourish. There are large supplies of esparto grass, and saffron and henna are grown. The people possess large numbers of cattle, sheep and goats, and camels, and there are good possibilities of developing the country's pastoral resources. Salt is the only mineral exploited. There are valuable sponge "fisheries" valued roughly at £50,000 yearly.

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[1] To soothe his wounded feelings Sidi Ahmad was in Nov. 1916 given by the Turks the title of "Viceroy of Africa."

Both pastoral and agricultural development depend largely on irrigation works. As it is, neglect of cultivation (caused by constant tribal wars, overtaxation and the stoppage of the slave trade) has notably enlarged the desert area; this is obviously the case in Fezzan, where much might still be done to reclaim lands recently fertile. There is little prospect of any great revival of the trade between the central Sudan and Tripoli and Bengazi—ostrich feathers, ivory, and embroidered leather goods are, however, still brought across the Sahara by camel caravans.

The value of exports (Tripoli and Cyrenaica combined) was £213,000 in 1914, sunk to £93,000 in 1916, and had risen to £300,000 in 1918. The chief exports were skins, henna, ostrich feathers and sponges.

The figures of imports in these war years bore little relation to normal trading, imports being largely for Government services. The imports in 1914 were valued at £1,638,000, in 1918 at £3,039,000. Since 1912 the bulk of the trade has been with Italy. Colonial revenue, some £600,000 in 1914, was estimated at £1,000,000 in 1920–1. Expenses considerably exceed revenue; in 1914 the budget was balanced at £2,835,000, in 1920–1 at £5,080,000. Large sums were spent on public works, still larger sums on defence, military expenditure in 1920–1 being put at £1,650,000. In that year 1,030 officers and 25,000 men were stationed in Tripoli (16,000 being Italians). In Cyrenaica there were 540 officers and 17,000 men (6,800 Italians). The non-white troops are principally Abyssinians from Eritrea.

In 1920 there were 157 m. of railway; the principal lines were along the coast westward from Tripoli city to Zuara and southward from Tripoli by 'Aziziya to beyond Gharian. Submarine cables were laid in 1912 between Syracuse and Tripoli and Bengazi; several wireless stations were also erected. Shipping is mainly in Italian hands.

See *A Handbook of Libya*, a British Admiralty publication (1920), and *Italian Libya* (1920), a British Foreign Office handbook, with bibliography; the *Rivista Coloniale* of Rome, and the *Bolletino* of the Italian Geographical Society. (F. R. C.)

TROTSKY, LEV (1877–), Russian Communist leader, of Jewish origin, originally named Leiba Bronstein and often described as Leon Trotsky, was born in 1877, near Elisavetgrad, in the province of Kherson, S. Russia. He studied in a public school at Odessa and afterwards in the university there. He soon joined the left wing of the Social-Democratic party, took part in students' disorders, and was expelled from the university. In 1898 he was arrested for his activity as a member of the "League of Workmen of South Russia," and three years later he was deported to Ust-Kut, on the Lena river, in Siberia. He arrived at the place of his exile at the beginning of 1902, but immediately escaped, and made his way to Geneva, where he took a prominent part in the work of the Russian Social-Democratic group. He collaborated in the *Iskra*, a paper which was founded in 1901 by Lenin, Plekhanov, Martov and others. A follower of the extreme Marxian doctrine, and an irreconcilable enemy of the Liberals, Trotsky tried to create a unified Socialist party in Russia, and he spent his time till the revolution of 1905 in constant travels to and from Russia. At that time he was already well known in Russian revolutionary circles. The events of the revolution of 1905 found him in Russia, where he was publishing the paper *Borba* ("The Struggle"). He took a leading part in the direction of the revolutionary movement, and was one of the organizers of the "Soviet of Workmen of Petrograd"; he became a member of the executive committee and later on vice-president of that body. He was arrested on Dec. 5 1905, with other members of the Soviet, by order of Count Witte's Government. After a year of solitary confinement, he was tried and condemned to perpetual deportation to Siberia. At the beginning of 1907 he arrived at Obdorsk, on the shore of the Arctic Ocean, but he escaped again, took residence at Vienna, and became a constant contributor to the *Arbeiterzeitung*. In 1907 he was present at the International Socialist Conference at Stuttgart, and in 1910 at that of Copenhagen. In 1910 he attended the Pan-Slavonic Congress at Sofia, where amid general consternation he delivered a vehement speech against the union of the Slavonic nations. In 1912 he was one of the organizers of the secret conference held at Troppau by the Russian revolutionary organizations abroad.

At the beginning of the World War, Trotsky as a Russian subject was obliged to leave Vienna, and he established himself first at Zurich and later in Paris, where he collaborated in the Russian paper *Golos* (afterwards *Nashe Slovo*). He strongly criticized the Socialist parties of Germany and of the Entente Powers for supporting their Governments in the war and voting for the war credits. He was one of the organizers of the Zimmerwald Conference, but, together with Lenin, he refused to sign the Zimmerwald manifesto, which he considered to be too moderate. In Sept. 1916 the publication of *Nashe Slovo* was suspended by order of the French Government, in consequence of a rebellion among the Russian troops at Marseilles, which was traced to the anti-militarist propaganda of that paper. Trotsky was arrested and ordered to leave France. Switzerland refused to receive him, and he was deported to Spain, but he was arrested again by the Spanish Government almost on the day of his arrival at Madrid. At the beginning of 1917 he sailed for the United States and took part in New York City in the publication of the Russian paper *Novy Mir*.

After the revolution of March 1917 Trotsky immediately started for Russia, but was arrested by order of the British Government and interned in a prisoners' camp at Halifax. He was released by a special intercession of Milyukov, who was at that time Russian Minister for Foreign Affairs. He arrived in Russia in May, and developed the greatest activity in Petrograd as one of the leading members of the Bolshevist party. He was one of the organizers of the Bolshevist rising on July 16 and 17, and was arrested at the beginning of Aug. for "organizing and participating in armed rebellion," but soon released by order of Kerensky. On Oct. 8 he was elected president of the Petrograd Soviet, and after the Oct. revolution he took the portfolio of Foreign Affairs and later that of War in the Council of the Commissaries of the People. He took a leading part in the political activity of the Soviet Government, representing the extreme left wing of the Communist party, and, as such, often opposed the more moderate programme of Lenin. He signed the peace of Brest Litovsk, and, in spite of his former anti-militarist declarations, became the organizer and the commander-in-chief of the Red Army. He introduced again an "iron discipline," more relentless than that practised under the Tsarist régime; deserters and disobedient soldiers were shot; a system of extensive espionage kept officers and men in constant terror; mercenary corps of Letts, Chinese, Kirghizes and Buriats were formed for the purpose of coercing and destroying the Russian elements. Particular attention was paid to the formation of specially trained detachments of cadets, devoted to the Communist régime and ready to serve it on every occasion, like the Janissaries of old Turkey. Trotsky and his friends did not shrink before a plan of a general militarization of industry. In a speech delivered at a meeting of the Third Conference of the Soviets in Moscow, he said: "All artisans will be sent into the works and transferred from one place to another, according to the indication of the Government. We will have no pity for the peasants; we will make labour armies of them, with military discipline and Communists as their chiefs. These armies will go forth among the peasants to gather corn, meat, and fish that the work of the workmen may be assured." A Moscow wireless reported that in another speech (*The Times*, March 4 1920) he declared that "The First Army of Labour so far includes 240,000 Red Army men, 7,000 civilians and employees, 7,000 military horses and 156,000 private horses." In a review of the First Army of Labour he wrote: "The Red Army detachments make a formidable labour force, certainly more efficient than, for example, those civilian detachments mobilized for the clearing of snow. The military detachments have all the advantages of proper organization and the precise order of stern discipline. The fundamental condition of the productivity of Labour Red Army men, and of workmen in the Soviet economy in general, is the arousing of the spirit of emulation. The organization of this spirit is the most important problem of economic reconstruction, and without this subjective force nothing will help, neither peat, nor coal, nor petrol, nor the removal of the blockade. It is necessary to take all measures to foster the feeling of labour conscience, both in the coöperative institutions and in the individual." At a congress of the Soviets at Moscow a resolution was passed on April 4 in favour of his proposal that labour should be organized on the principle of military conscription and obligatory work; also that the inspection of labour should be confided to special inspectors, instead of local Soviets.

Within the Soviet Government organization, as it still held power in 1921, Trotsky, Dzerjinsky and Bukharin were the leaders of the extreme left of the Communist party, and, as such, had repeatedly opposed Lenin when the latter was inclined to conciliatory measures; but the outside world generally associated the names of Lenin and Trotsky together as the embodiments of Russian Bolshevist rule. (P. Vi.)

TSCHAIKOVSKY, NICHOLAS VASILIEVICH (1850–), Russian revolutionary politician, was born in 1850, at Viatka. He spent the first part of his life on his mother's estate, and studied at a public school at Viatka and later on in St. Petersburg. In 1868 he entered the St. Petersburg University and got his degree in chemistry in 1872. He took part in the "Narodniki" (populist) movement, and became one of its leaders, working for the creation of a system of societies for self-education. These societies organized lectures and provided their members with cheap and well-selected books. They had a considerable influence on the moral and political development of a whole generation of the Russian "intelligentsia."

But under the political régime of Russia in the 'seventies no public body or society could act freely if its activity was not fully approved by the Government. Every kind of repression was used against the promoters of the "narodniki" movement; and Tschaikovsky was twice arrested. Under these conditions the new party soon lost its educational character and became a revolutionary and terrorist association. Tschaikovsky did not approve of this new tendency and joined the social-religious group, which received the name of "God-men" because its members tried to find in themselves a reflection of God.

In 1874 Tschaikovsky left Russia, and a year later he went to the United States with a small party of men and women who shared his political views and religious feelings. They founded a communistic settlement at "Cedar Vale," near Wichita, in the state of Kansas, and tried to work out their new religious and social teaching. The experiment proved a failure. After two years of hard experience, Tschaikovsky and his friends were obliged to recognize that mankind was not yet ready for the communistic life which they believed to be an imminent development of the future. They regarded communistic life as senseless without a constant feeling of the presence of God in the case of each member of the community, and this essential condition could not be achieved. Therefore they returned to the "old world of antagonism." The awakening was especially hard for Tschaikovsky, who not only found it necessary to reconstruct his conception of the world, but had a family to keep and no means of livelihood. He worked for some time as an ordinary workman in a shipbuilding yard and in a sugar factory near Philadelphia. His health broke down and with his family he joined the religious community of the Shakers, where he remained for a year.

In 1879 he returned to Europe, and in 1880 took up his residence in England, renewing his active participation in the Russian revolutionary organizations abroad; he was a member of the "Red Cross of the Narodnaia Volia," and organized the supply of revolutionary literature to Russia. During the first Russian revolution of 1905–6 he made a tour of America, lecturing on the subject and collecting funds for the struggle against the Imperial régime. In 1907 he returned to Russia. There he was arrested on a charge of conspiracy against the Government and spent 11 months in the St. Peter and St. Paul Fortress at St. Petersburg. He was released on bail, £5,000 having been collected by his friends, chiefly in England and America. In 1910 he was brought to trial and discharged for lack of proof. He remained in Russia and took a great interest in the work of coöperative organizations.

During the World War he was very active under the flag of the Russian Red Cross, supplying food to the population of the fighting area. After the revolution of 1917, he was elected member of the Council of Soldiers, Workmen and Peasants, formed at Petrograd, where he used his influence to fight the Bolshevist propaganda. He was also elected member of the Constituent Assembly. After the Bolshevist revolution, as a member of the "Committee for the Salvation of the Motherland and of the Revolution," and of the "Committee for the Defence of the Constituent Assembly," he helped to organize the struggle against the Bolshevists.

In 1918 he was one of the founders of the "Union of the reconstruction of Russia," an anti-Bolshevist organization of the left parties of Moscow. He was also elected member of the Ufa Directorate. On his way to Siberia, he came to Viatka, where he took the lead in an insurrection against the Bolshevists and entered into negotiations with the Allied force at Archangel. He took part in the *coup d'état* of Aug. 2 at Archangel and became president of the Supreme Administrative Board of the North Region. After the break-up of a conspiracy of monarchist officers, he organized the Provisional Government of the North Region under his own leadership. Tschaikovsky was sent by his Government to Paris, where he represented the interests of the North Region before the Peace Conference. He was a member of the "Russian Political Delegation" in Paris till its dissolution in Feb. 1921. (P. Vi.)

TUBERCULOSIS (*see* 27.354*).—Since the *bacillus tuberculosis* was discovered by Koch in 1882, the various forms of disease caused by its invasion have been in the forefront of medical research. The disease is known to have existed amongst the earliest civilizations. Bony tuberculous lesions have been described in Egyptian mummies, and in the Nubian collection of bones in the Royal College of Surgeons, London, are two specimens, respectively of the dates of about 3,000 and 2,000 B.C., presenting all the characteristics of tuberculous disease of the spine. Tuberculous disease of the lungs is known to have existed in very early times. The old Greek Hippocrates (born 460 B.C.) first applied the term "phthisis," and a description of its clinical manifestations may be found in his writings and those of Celsus, Aretaeus and Galen. Before the discovery of the bacillus its effects in different parts of the body were classified as distinct diseases, receiving different names:—"consumption" or phthisis for pulmonary tuberculosis, struma or scrofula for bone or gland tuberculosis, lupus for tuberculosis of the skin, and *tabes mesenterica* of the intestinal glands.

Pathology.—Affected tissues invaded by the tubercle bacillus undergo typical changes, become inflamed, break down and perish. By the irritation which the bacilli excite, epitheloid cells are proliferated from the normal cells of the tissues, forming a tubercle, in which is usually present a "giant" cell surrounded by smaller epitheloid cells encompassed by a zone of leucocytes. Scattered amongst these cells tubercle bacilli may be found. Later the tubercles undergo degenerative changes (caseation) proceeding further to abscess formation. Repair may take place by cicatricial formation of fibrous tissue, these fibrous nodules sometimes undergoing calcareous degeneration. Bayle, in the latter part of the 18th century, first described the tubercular nodule, and its distributions in other organs than the lungs.

One organ or part of the patient attacked is generally the seat of these tubercular nodules, some of which may become confluent, but the disease may take the form of an acute specific fever, clinically somewhat resembling typhoid fever, with widespread dissemination of the infection. In this form the disease is so severe and rapid, that many of the tubercles have not time to get beyond the initial stages of their development

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** These figures indicate the volume and page number of the previous article.*

before death occurs. Such a manifestation is termed acute miliary tuberculosis. The intra-cellular or extra-cellular toxins produced by the tubercle bacillus in the course of its development are the cause of many of the pathological features associated with the disease the bacillus produces.

The tubercle bacillus is a minute rod-like, often slightly curved, organism, $1{\cdot}5\mu - 3{\cdot}5\mu$ in length and $0{\cdot}3\mu$ in breadth. It may stain uniformly or present a beaded appearance, the unstained beads being regarded by Koch as spores. Metchnikoff advanced the view that the bacillus as ordinarily met with is but a stage in the developmental cycle of a filamentous fungus. The organism is regarded by many as a member of the streptothrix group belonging to the hyphomycetes or mould fungi. It stains with difficulty but retains its stain, once received, with remarkable tenacity, resisting decolorization by strong acids and hence called acid-fast.

Exposed to direct sunlight or ultra-violet radiation it is rapidly slain but is of retentive vitality under certain conditions. Dr. Stenhouse Williams has shown that it remains viable and virulent in cow-dung on pasture land for at least five months, and in dung stored in the dark for twelve months, a discovery of great importance and significance in veterinary practice. It retains its virulence and capacity for development for six weeks or longer in decomposing sputum and for six months in dried sputum. The thermal death point varies between 65°C. and 90°C. and Swithinbank has shown that it will survive a temperature of -186°C. for 42 days.

Certain antiseptics are fatal to the tubercle bacillus, 5% carbolic acid will slay it in less than a minute, and endeavours have been made to destroy the organism in living tissues by the administration of drugs, but hitherto without demonstrable success. Methylene-blue and certain copper salts injected into guinea-pigs infected with tuberculosis, can be demonstrated in their tubercle bacilli, and a fascinating, but hitherto unfruitful line of chemotherapeutic research has thus been opened up, aiming at the destruction of the tubercle bacilli while parasitic in their host.

The tubercle bacillus is widely parasitic through the animal world, but different animals show widely varying degrees of susceptibility. Generally, domesticated animals are more liable to infection than wild, and captive wild animals than those in their natural state. Domestic cattle are particularly prone.

Much controversy has arisen as to the communicability of tuberculosis from animals to man. After Koch had thrown doubt on its probability at the British Congress on Tuberculosis in 1901, the British Government appointed a Royal Commission to enquire into the relationship of human and animal tuberculosis. In the second interim report of the Commission, issued in 1907, the conclusions arrived at were: "That there seems to be no valid reason for doubting the opinion, never seriously doubted before 1901, that human and bovine bacilli belong to the same family. On this view, the answer to the question—Can the bovine bacillus affect man?—is obviously in the affirmative. The same answer must also be given to those who hold the theory that human and bovine tubercle bacilli are different in kind, since the 'bovine kind' are readily to be found as the causal agents of many fatal cases of human tuberculosis." In later years the investigation has been further pursued. Pulmonary tuberculosis is rarely bovine in origin, and non-pulmonary tuberculosis does not appear to be so commonly bovine as previously supposed, the latest researches (up to 1921) in England going to show that probably approximately some 30% of cases of non-pulmonary tuberculosis are of bovine and 70% of human origin. While cows are the commonest domesticated animals infected, tuberculosis occurs in pigs, less commonly in dogs, cats, and but rarely in horses and sheep. Tuberculosis in rats has been demonstrated. In domestic fowls another variety of the tubercle bacillus, the avian, is found. Even reptiles, fishes and invertebrate creatures such as worms may be infected. While bovine bacilli are capable of infecting the human subject, especially in childhood, avian bacilli are of little human pathogenic significance.

In the evolution of pulmonary tuberculosis, human or, very rarely, bovine bacilli may be detected in the sputum, and usually are demonstrable in tuberculous pus derived from any focus. The bacilli may also sometimes be found in the blood or stools of infected subjects.

Channels of Infection.—Congenital origin, though rare, has been proved to exist. By Cobbett it has been regarded as commoner than usually supposed. Tubercle may be introduced by direct inoculation. Much more commonly the infection is produced by inhalation of dried sputum as dust into the lungs, or by the ingestion of tuberculous material into the alimentary canal. Cornet has estimated that as many as 7,200,000,000 bacilli may be expectorated by a consumptive patient in the course of a day, and it requires little consideration to show what a ready means is thus presented of infection. Recognition of this fact is of importance in prophylaxis. The vehicle of infection by ingestion is commonly tuberculous milk or butter. The portal of entry, carious teeth, tonsils or some portion of the intestine. Fatal bovine infection, though rare in adults, is not uncommon in children. Dr. Cobbett has calculated that about one-third of all fatal cases of tuberculosis in children under five is attributable to a bovine source, a matter of great importance to farming interests and preventive medicine. There is reason to believe that the relative incidence of bovine or human infection may vary according to locality. Thus in Scotland, bovine infection is probably relatively commoner than in England.

Contagiousness of Tuberculosis.—Tuberculosis is not contagious in the sense that such diseases as measles and other of the exanthemata are. The danger of infection of healthy subjects where reasonable precautions are taken, as in institutions for the tuberculous, is extremely remote. But under conditions due to overcrowding, bad hygiene, imperfect nutrition, when lowered resistance is encountered, where massive doses of bacilli are absorbed and contact is intimate and prolonged, the danger of infection is very real. The vexed question of marital or conjugal tuberculosis has been much discussed of late and should not be neglected.

Predisposing Causes of Infection.—In discussing infection, attention should be drawn to the "soil" of the patient as well as to the "seed" sown. There is variation in both individual and racial susceptibility. Thus the Irish are said to be relatively susceptible, the Jews immune. "It has been learned of late years that the number of individuals who can be shown by radiography, tuberculin tests, and autopsy findings to have some focus of tuberculosis is enormously in excess of those who are usually classed as tuberculous" (Bushnell). Tuberculous infection amongst civilized communities is well-nigh universal. The tubercle bacillus may remain latent in the individual for indefinite periods, may rapidly and in varying degrees give rise to local lesions or generalized dissemination. Its innocuousness depends both on the good health of the individual attacked, his immunity inherited or acquired, and the absence of conditions calculated to break down that immunity. Amongst the more important factors likely to facilitate morbid infection are heredity, a constitutional liability to the disease, general debility due to various circumstances; poverty and its associated conditions; overcrowding, insanitary surroundings, bad hygiene, insufficient or unsuitable food, exposure, trauma, alcoholic excess, insanity, syphilis and other diseases; unfavourable climatic influences, occupations, etc. Dr. Browning has shown that the common age-period of phthisis may vary in different localities. Thus, it is earlier in the Shetland Is. than in London. The age of maximum mortality appears to be increasing. In the middle of the 19th century it was 25 to 35 years; in 1921 it was 45 to 55 in males, 35 to 45 in females.

Control and Eradication of Tuberculosis.—With the discovery of the causal factor of this disease and an ever-extending acquaintance with the conditions favouring its pathogenicity, it became possible to initiate, investigate and undertake scientific methods for its control and eradication. The problem, however, is of infinite complexity. Up to 1921, no certain method of immunization against infection had actually been discovered, and no specific treatment comparable to that employed in dealing with syphilis had been devised. Till the uninfected population can be safely immunized against tuberculosis and the infected population cured by specific measures, the laborious and often complicated methods now employed, constantly improved and elaborated, will constitute both our means of prophylaxis and of attempted cure. Tuberculosis is protean in its manifestations and the methods directed against the disease are of corresponding variety. Certain general principles in treatment may, however, be laid down. These comprise the adoption of all those measures calculated to increase the patient's power of resistance and preserve and restore the part or parts attacked. Life in the open air under suitable climatic and good hygienic conditions, with ample and easily assimilated food, rest while the disease is acute, absence of worry or fatigue, graduated exercise later, and education in the mode of life to be followed are details of first importance. Drugs are chiefly of value in the treatment of symptoms and complications. The introduction of tuberculin by Koch raised vast hopes which have not been fulfilled. Numerous varieties of tuberculin have since been manufactured and employed which still fall short of the anticipations of their originators. Sir Almroth Wright placed tuberculin therapy on a more scientific basis: his opsonic theory giving promise of a means of scientific administration and control. In 1887 Sir Robert Philip introduced the scheme known as the Edinburgh system for the coördination of efforts, applicable to all phases of the tuberculosis problem. It has the tuberculosis dispensary as the centre of its activities, with trained physicians and nurses for educating, treating and directing the patient, examination of contacts, distribution of patients requiring institutional care to the tuberculosis hospital or sanatorium where advanced cases can be segregated, and early cases receive curative treatment. Later, facilities are given for continued aftercare or treatment and training in a farm colony. The scheme is a practical and comprehensive one and has been the pioneer of other analogous efforts elsewhere. The value of this coördination of methods cannot be sufficiently emphasized.

Marcus Paterson by graduated exercise has shown how much may be safely and advantageously done by auto-inoculation of the patient by his own tuberculin. Varrier-Jones at Papworth has demonstrated the value of the tuberculous colony with facilities for treatment of pulmonary tubercle in all stages of the disease, and where prolonged segregation in village settlements is encouraged under reasonable conditions. The patient is trained and his labour subsidized. The value of rest in the treatment of all forms of acute tuberculous disease has inspired surgical interference for securing more complete rest to the diseased and damaged lung in the hope of procuring cure. Forlanini demonstrated the feasibility of introducing by injection gas into the chest to secure the collapse and rest of a tuberculous lung. This manœuvre, introduced into Great Britain by Lillingston and others, has proved of considerable value in carefully selected cases. This method of treatment is known as the induction of artificial pneumothorax and has proved of dramatic value in the treatment of many patients who were in an apparently hopeless condition.

In non-pulmonary conditions such as tuberculous disease of the bones, joints and glands, for long the condition was regarded as a local disease, comparable to a malignant tumour. This "tuberculome" conception, aided by the discovery of anaesthetics and antiseptics led often to extensive operations being undertaken with a view to the extirpation of infected tissues. The results in the more severe conditions were frequently unsatisfactory, the mortality both direct and indirect high, deplorable orthopaedic results frequent, sinus formation and subsequent secondary infection common. The present trend of surgical opinion is avoidance where possible of severe radical measures and the adoption of conservative treatment. While the disease is acute the patient is kept at rest, the part affected immobilized, orthopaedic measures are employed to prevent or correct the severe deformities which are frequent in tuberculous lesions of the bones and joints, tuberculous abscesses are evacuated, preferably by aspiration. Later, when ambulatory treatment is permissible the lesions are suitably immobilized in appropriate splints. Institutions for these cases should be specially designed and staffed and situated in suitable localities at the seaside or in the country. Auxiliary methods of treatment such as heliotherapy (sun treatment), X-ray treatment, etc., play an important part. As treatment is necessarily lengthy it should be associated with education for children, technical training for adolescents, and occupation for adults. In this way the monotony of long enforced recumbency is relieved and the *moral* of the patient preserved. The value and low mortality of such treatment may be illustrated by Table 1. showing the results achieved at the Treloar Cripples' Hospital, at Alton.

TABLE 1. *Analysis of results of treatment of patients suffering from surgical tuberculosis at the Lord Mayor Treloar Cripples' Hospital, Alton, Hants., from the opening of the Hospital in Sept. 1908 to Jan. 31 1921.*

Lesion	No. admitted	No. discharged	Disease arrested	Improved	Unimproved	Removed or Transferred	Died	Average length of stay in days
Spine . . .	920	810	674	22	24	68	27	503·2
Hip . . .	880	768	710	18	2	25	13	413·1
Knee . . .	333	304	282	7	—	11	7	334·7
Other . . .	354	315	265	16	5	19	9	259·8
	2487	2197	1931	63	31	123	56	382·5

During the decade 1910–20 greatly increased public interest was manifested in serious and organized endeavours to deal with the tuberculosis problem. In England and Wales prior to the passing of the National Insurance Act, 1911, it was competent to sanitary authorities, under the powers of section 131 of the Public Health Act, 1875, to provide dispensaries and residential institutions for the treatment of persons suffering from tuberculosis, and some authorities had initiated a campaign of prevention and treatment. At the beginning of 1912, 1,500 beds in institutions had thus been provided by British sanitary authorities for treatment of tuberculosis; 57 sanitary authorities also had contracted for use of beds in private sanatoria; 30 tuberculosis dispensaries had been established by local authorities; and 50 by voluntary effort. The need for a national campaign assisted by contributions from the British Exchequer became evident. This need was recognized by the National Insurance Act, 1911, which included provision for "sanatorium benefit" of insured persons. Under this Act and the Finance Act, 1911, a capital sum of £1,500,000 was made available in the United Kingdom for the treatment of tuberculosis. After the passing of the National Insurance Act a departmental committee on tuberculosis was appointed to report upon the consideration of the problem in its preventive, curative and other aspects. The recommendations of this committee had an important influence on subsequent policy. Compulsory notification of pulmonary tuberculosis was enforced in 1912, and of all forms the following year. In July 1912 domiciliary treatment of insured patients suffering from tuberculosis was approved by the Local Government Board. Schemes for the institutional treatment of tuberculosis became gradually formulated. The extent to which official schemes had been brought into operation in England and Wales may be gathered from the following figures. On April 1 1921, the number of approved dispensaries was 411; officers and assistant officers for tuberculosis, 341; residential institutions, 418; the number of beds available in these institutions was 17,352; the total gross maintenance cost of tuberculosis schemes for 1919–20 was £1,953,992. The amount of Government grant for 1919–20 was £619,941. All this was accomplished notwithstanding the severe setback to anti-tuberculosis endeavour which was an inseparable effect of the World War.

On July 1 1919 the powers of the Local Government Board in relation to the tuberculosis schemes of local public-health authorities and of the Insurance Commissioners in relation to the administration by the Insurance Committees of the sanatorium benefit of insured persons under the National Insurance Act 1911 devolved upon the Minister of Health, and one central department was made responsible for the guidance and supervision of the work of the two classes of local bodies principally concerned (apart from Poor Law authorities) in the conduct of measures for the prevention and treatment of tuberculosis. The National Health Insurance Act, 1920, was further designed to simplify administration by providing for the discontinuance of sanatorium benefit within 12 months of the passing of the Act, and insurance patients needing institutional treatment for tuberculosis may obtain it at the hands of the local authorities under the schemes undertaken for the provision of such treatment for the population generally of their respective areas. This transfer of authority came into force on May 1 1921. The Tuberculosis Act 1921 carried this legislation a step further by enabling local authorities to provide approved schemes for the treatment of all patients suffering from all forms of tuberculosis, and on their failing to do so empowered the Ministry of Health to deal with the matter, debiting the cost to the authorities concerned.

Table 2. *Mortality in England and Wales from Tuberculosis (all forms) per Million Pop. 1912–4, 1917, and 1918.*

	Males			Females			Persons		
	1912 to 1914	1917 (Civilians only)	1918 (Civilians only)	1912 to 1914	1917	1918	1912 to 1914	1917 (Civilians only)	1918 (Civilians only)
All crude ages standardized	1,569 1,546	2,072 2,334	2,153 2,518	1,167 1,168	1,303 1,314	1,373 1,378	1,361 1,347	1,624 1,801	1,694 1,924
0	2,063	1,915	1,741	1,701	1,631	1,417	1,883	1,774	1,580
5	566	662	632	572	694	682	569	678	657
10	442	573	611	685	892	920	564	733	766
15	927	?	?	1,214	1,719	1,789	1,071	?	?
20	1,478	?	?	1,326	1,643	1,888	1,398	?	?
25	1,774	?	?	1,369	1,489	1,723	1,561	?	?
35	2,233	?	?	1,405	1,523	1,613	1,804	?	?
15–45	1,681	3,240	3,681	1,342	1,570	1,733	1,505	2,104	2,328
45	2,437	2,590	2,592	1,208	1,249	1,321	1,798	1,892	1,924
55	2,283	2,316	2,192	1,004	1,018	1,050	1,608	1,649	1,604
65	1,421	1,540	1,484	767	798	1,057	1,129		
						791	1,057	1,129	1,102
75	649	649	740	496	490	464	558	554	574
85 and upwards . .	260	527	295	246	218	233	251	328	255

Provisional death-rate per million living from (i.) all causes 1920 12,360
(ii.) all forms of tuberculosis 1920 1,128

In April 1919 an important inter-departmental committee was appointed jointly by the Local Government Board and Ministry of Pensions, " to consider and report upon the immediate practical steps which should be taken for the provision of residential treatment for discharged soldiers and sailors suffering from tuberculosis and for their reintroduction into employment, especially on the land." The report of the committee laid stress on the fact that " the problem of the tuberculous ex-soldier or sailor is only one aspect of the national problem of dealing with tuberculosis," and considered that " the best interests, both of the country and of the ex-service man, will be served first by making the best possible use of all existing means of treatment, and then by expanding, improving, and increasing these means as rapidly as possible." It reported that existing accommodation was most seriously inadequate in quantity, and advocated in addition to the development of schemes for the institutional treatment of tuberculosis, provision of facilities for the training, both occupational and vocational, of sanatorium patients in suitable industrial and other occupations, and also for their permanent settlement, after training, in village communities where they could earn a livelihood under sheltered conditions. Owing to considerations of economy, the recommendations of this committee as to developments on the lines of training colonies, village and industrial settlements, were temporarily hampered, but doubtless are destined to fructify as economic conditions improve. Valuable information as to the development of Public Health schemes for the treatment of tuberculosis is in the annual reports of the Chief Medical Officer of the Ministry of Health and other Government publications.

While the above records official encouragement and exhortation in the measures calculated to assist in the eradication and treatment of tuberculosis, tribute should be paid to philanthropic and other agencies which have been at work, and which have afforded valuable information on the lines on which policy should be directed. By progressive legislation voluntary work has tended to become more and more subsidized by the state. An instance of such combined activity on a large scale is afforded by the King Edward VII. Welsh National Memorial Association, which was founded in 1910 for the prevention and eradication of tuberculosis and other diseases in Wales. For the furtherance of this aim Wales (with Monmouthshire) is divided into 14 dispensary areas with a tuberculosis physician having a central dispensary in each area. In each area there are a number of visiting stations at which patients are seen and examined at frequent intervals. There were 90 of such visiting stations in 1921. In addition, hospital beds and sanatoria are provided for the treatment of all forms of tuberculosis. From its inception up to 1921 the association's officers had examined 76,500 patients. Of these 7,800 were treated at sanatoria and 14,200 at its hospitals.

Table 3. *Notification of Tuberculosis in England and Wales (from the 1920 Report of the chief medical officer of the Ministry of Health, Cmd. 1397).*

	Pulmonary		Non-pulmonary		Total—All forms	
	Notifications	Cases	Notifications	Cases	Notifications	Cases
1913	91,866	80,788	38,583	36,351	130,449	117,139
1914	86,081	76,109	25,237	23,388	111,318	99,497
1915	73,359	68,309	22,573	22,283	95,932	90,592
1916	75,796	68,109	24,521	22,799	100,317	90,908
1917	76,183	68,801	22,514	20,884	98,697	89,685
1918	79,025	71,631	20,215	18,942	99,240	90,573
1919	67,123	61,154	17,775	16,357	84,898	77,511
1920	63,732	57,844	16,694	15,488	80,426	73,332

Table 4. *Mortality from Tuberculosis (England and Wales).*

	Deaths from Pulmonary Tuberculosis			Deaths from other forms of Tuberculosis		
	Males	Females	Total	Males	Females	Total
1911	21,985	17,247	39,232	7,242	6,646	13,888
1912	21,568	16,515	38,083	6,238	5,730	11,968
1913	21,034	16,021	37,055	6,623	5,798	12,421
1914	21,812	16,825	38,637	6,264	5,397	11,661
1915	23,630	18,046	41,676	6,715	5,904	12,619
1916	23,238	18,307	41,545	6,488	5,825	12,313
1917	23,670	19,443	43,113	6,689	6,132	12,821
1918	24,756	21,321	46,077	6,271	5,725	11,996
1919	19,581	17,081	36,662	4,969	4,681	9,650
1920	18,184	15,285	33,469	4,734	4,342	9,076

Tables 2 (by courtesy of the Ministry of Health), 3 and 4 give details as to the incidence of tuberculosis in Great Britain. Commenting on these tables, Sir George Newman remarks on the considerable decline in the number of new cases, of both pulmonary and non-pulmonary tuberculosis in 1919; in 1920 there were 3,310 fewer new cases of pulmonary tuberculosis than in 1919. Regarding Table 3 he states that the causes of increase of tuberculosis mortality during the war are generally ascribed to underfeeding or lack of particular varieties of food materials, greater industrial employment of women (often in unfavourable conditions and under much stress and strain), exposure and fatigue, and the great outbreak of influenza. Similar increases were observed in other countries, both neutral and those directly engaged in the war. It is significant that the increase during the war was particularly great in lunatic asylums and among women aged 20–25 years—many of whom were employed in munition works. Sir George Newman further adds: " The past history of the decline of tuberculosis is full of instruction as to the future." He suggests that we should (i) fortify the powers of resistance of the individual to disease; (ii) prevent the spread of infection; (iii) undertake all the general health reform which is necessary; (iv) educate and lastly—we must revise and apply in a proper and effectual way *the particular methods* with which we have made a substantial beginning—notification, domiciliary and dispensary treatment, the sanatorium, the training colony, the village settlement and the proper means of after-care. The local administration of these matters should be unified under the local authority and its medical officer of health.

References.—Sir R. D. Powell and P. H. Hartley, *Diseases of the Lungs and Pleurae* (6th ed., 1921); Sir W. Osler, *Principles, Practice of Medicine* (9th ed., 1920); Sir T. Clifford Allbutt, *System of Medicine* (1905–11); G. E. Bushnell, *Epidemiology of Tuberculosis* (1920); Louis Cobbett, *Causes of Tuberculosis* (Public Health Series, 1913); a series of international studies by many authors, *The Control and Eradication of Tuberculosis* (1911); also various official publications from the Ministry of Health and elsewhere.

(H. J. G.)

United States

An extraordinary decline in the mortality from tuberculosis in the United States decreased the rate for the whole country from 202 per 100,000 inhabitants in 1900 to 160 in 1910, 21% less, and to 114 in 1920, 29% less than in 1910 and 43·5% less than in 1900. In New York City the decline was even more notable, the rate being 280 for 1900, 210 for 1910 and 126 for 1920; this was a fall of 25% between 1900 and 1910, 40% between 1910 and 1920 and 55% between 1900 and 1920. In 1900 the New York City rate was 39% in excess of the rate for the United States; in 1910 it was 31% higher; but by 1920 conditions had so improved that it was only 11% higher. The chance of dying from tuberculosis in New York City in 1920 was about one-third that in 1900 and a little more than half that in 1910. Such a remarkable improvement in so crowded a city is unparalleled in the history of tuberculosis.

During the decade 1910–20 the fall in the death-rate was by no means uniform. Between 1912 and 1915 the mortality from tuberculosis throughout the country was almost stationary (150 in 1912 and 146 in 1915), while between 1916 and 1918, the period of the World War and the epidemic of influenza, the rate rose from 142 to 150. Virtually the same conditions obtained in New York City (201 in 1912, 196 in 1915, 182 in 1916 and 188 in 1917). The greatest decline was after 1918: from 184 in 1918 to 126 in 1920 for New York City and, during the same period, from 150 to 114 for the United States.

Tuberculosis* Death-Rate of New York City and of the United States† 1900 to 1920

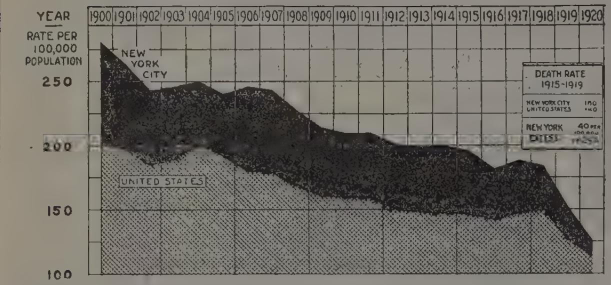

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
New York City	280	264	243	246	250	240	246	238	227	214	210	210	201	199	200	196	182	188	184	152	126
United States	202	197	185	189	201	192	180	179	168	161	160	159	150	148	147	146	142	147	150	126	114
N.Y. Rate Excess	78	67	58	57	49	48	66	59	59	53	50	51	51	51	53	50	40	41	34	26	12
Per Cent Excess	39	34	31	30	24	25	37	33	35	33	31	32	34	35	36	34	23	28	23	17	11

* All forms of tuberculosis. † U.S. Registration area which in 1920 included 82% of the population or 87,486,713 inhabitants.

G. J. Drolet, Statistician
New York Tuberculosis Association.

The registration of deaths became more exact and complete. A consideration of the conditions described on page 358 of Vol. XXVII. as being widespread late in the 19th century shows how much registration had been needed. Registration, the creation of state, not Federal, legislation was provided for only gradually by the necessary state laws. In 1910 the Registration Area of the United States covered 58·3% of the population; by 1920 nearly three-fourths of the states, with about 80% of the population of the country. The fact, therefore, that the tuberculosis death-rate shows a marked decline at the same time that the reporting of deaths has come under better control accentuates the great improvement. As has always been the case, pulmonary tuberculosis accounts for about seven-eighths of the deaths from tuberculosis of all forms. In 1920 the rate (pulmonary tuberculosis) for large cities ranged from 54 per 100,000 for Portland, Oregon, to 281 for Denver, to which city many tuberculosis patients have resorted. Chicago's rate was 83 and Philadelphia's 121; Boston's was 126, the same as that of New York City.

The decline in mortality was due to many factors, which in 1921 could not be formulated and estimated. The influenza epidemic played its part, but in a manner not definitely understood. The great wave of this disease swept the country in the autumn of 1918. It is significant that for the first time on record there was in that year a marked autumnal increase of tuberculosis deaths above the normal. For example, in Oct. 1917, the deaths from tuberculosis in New York State were 1,089, a rate of 122·2. This was an average incidence which had been maintained for years. In Oct. 1918, the month of the influenza epidemic, 1,520 deaths from tuberculosis were reported—an increase of about 50%. Oct. 1919 showed only 813 deaths, and Oct. 1920 726 deaths. It is conceivable that influenza carried off thousands of consumptives who would have contributed to the tuberculosis mortality later; and, that these potential deaths for later years, thus compressed into 1918, reduced the rate during the succeeding years. Nevertheless, influenza can have been only one of several or many factors. Economic and social movements played their part. It seems certain that tuberculosis to no small extent has yielded to the remarkable organized efforts directed against it in the United States.

The keynote of the American struggle against the disease has been organization. Founded in 1904, the National Tuberculosis Association developed into probably the most effective public health body in the United States. With its subsidiary state and local societies it reaches into every hamlet. Few men and women, interested actively in tuberculosis, are working otherwise than in connexion with the National Association. Perhaps its greatest achievement is that it calls the attention of a vast proportion of the population to tuberculosis and educates them in it through its unique way of raising funds to carry on its work. Every year, during the month of Dec. its subsidiary societies sell, at one cent each, stamps called Christmas seals, which may be used (not as postage) to fasten and embellish envelopes. Their sale in 1921 had reached the enormous yearly total of more than 500,000,000 and yielded more than $4,000,000 for the work of the Association.

Treatment.—The elements of the routine treatment of tuberculosis changed but little during 1910–20, but therapeutic resources expanded greatly. In 1920 there were more than 600 sanatoria for the treatment of pulmonary tuberculosis in the United States. These were maintained by states, cities, counties, private individuals and corporations, and by endowments. Under N.Y. State law every county must erect and maintain an institution for the care of its tuberculous population. Some trade unions and fraternal organizations established sanatoria for their members. The Metropolitan Life Insurance Co. of New York built for its employees one of the best sanatoria in the country. The trend away from sanatorium treatment which is to be observed on the continent of Europe has not been manifest in the United States. Artificial pneumothorax is the only surgical measure which has gained anything like a vogue: American observers are unanimous as to its usefulness in selected cases. Heliotherapy and phototherapy for surgical tuberculosis were used, but only sporadically, and very few reports as to their results appeared in American medical literature. Chemotherapy was under extensive experimentation at the Phipps Institute in Philadelphia and at the University of Chicago: results have not warranted its application to human tuberculosis. Tuberculin treatment is practised with more discrimination than formerly.

The decade was notable for the use and development of the X-ray in the diagnosis of pulmonary tuberculosis. As an aid to diagnosis it became indispensable in routine tuberculosis practice. It is the better American opinion that the roentgenologist must work hand in hand with the practitioner and that good diagnostic judgment is attained only by the proper analysis and evaluation of information yielded by physical examination, laboratory procedures and X-ray observation together: no single one of these will alone suffice in routine diagnosis. Diagnosis of tuberculosis by tuberculin was practically abandoned, few cases having proved amenable to this method.

The practitioner of 1920 regarded tuberculosis from a point of view quite different from that of 1910. The relatively recent disclosure that tuberculosis exists as a latent infection in almost all people and that infection confers a measure of specific immunity to reinfection gave rise to the almost necessary presumption that adult pulmonary tuberculosis develops from infection acquired in childhood and that the adult is insusceptible to exposure to infection from without. By 1915 this opinion had become almost a dogma. But during 1918–20 opinion became less positive; an increasing number of studies by American authorities showed that conditions are only relative. Although early infection and immunity therefrom are conceded, it is maintained that infection is capable of complete healing and that immunity may greatly diminish or even disappear; and that, therefore, there is every likelihood that reinfections—and active disease from them—are possible at any period of life.

The study of tuberculosis and medical education in connexion with it received a great impetus from several directions. The Phipps Institute at Philadelphia was established at the opening of the decade; a tuberculosis research laboratory at Johns Hopkins University in 1916; and one in connexion with the National Jewish Hospital for Consumptives at Denver in 1918. Edward L. Trudeau, the recognized pioneer and leader of tuberculosis activities in the United States, died in 1915. During the last year of his life there was planned the Trudeau School of Tuberculosis, the first of its kind, to give systematic instruction to physicians. This held its first session at Saranac Lake, N.Y., in 1916, and was so successful that several others were established in other parts of the country. As a memorial to Trudeau, funds were raised to establish the Edward L. Trudeau Foundation, which aims to carry on research work and the Trudeau School and assist in the administration of the Trudeau Sanatorium. In 1916 *The American Review of Tuberculosis*, a monthly scientific periodical, was founded by the National Tuberculosis Association. It was in 1921 the only tuberculosis journal in the United States and had done much to stimulate the study and investigation of the subject.

Perhaps the most significant and unique achievement of the period was the Framingham (Mass.) Health and Tuberculosis Demonstration. Supported by the Metropolitan Life Insurance Company and the National Tuberculosis Association, this agency undertook a tuberculosis survey of a community of 15,000 people, to extend through six years. The work began in 1916. By 1920 the greater part of the population had been studied in its medical, economic and sociological relations. The survey established many facts, which seemed likely to serve as important data upon which future campaigns against tuberculosis might be based. Between 1916 and 1920 the tuberculosis death-rate of the community fell from 121·5 to 64·5 per 100,000. At the same time it was shown that the ratio of active cases to deaths was 9 or 10 to 1, instead of 3 to 1, the ratio which records of the community had previously shown. The survey supplied standards of diagnosis and treatment, of case detection, of school, factory and home control, of necessary expenditures against tuberculosis, etc., which promised to be of service not only to the whole nation but to the world at large.

(A. K. K.)

TUNISIA (*see* 27.393).—The pop., according to the 1911 census, consisted of 1,739,744 natives; 11,300 Maltese and 50,477 Jews. There are but few Arabs, the majority of the population being Arabic-speaking Mussulman Berbers. The chief feature of the European population is the presence of large numbers of Italians, who compete with the French in influence, and who have certain privileges with regard to language and education. According to the 1921 census the European pop. amounted to 156,125, of whom 54,477 were French, 84,819 Italian, and 13,509 Maltese. These figures show an increase of 8,000 in the French inhabitants since the census of 1911, and augur well for the further development of French immigration to the protectorate.

Since 1905 Tunis has had a Consulting Conference formed by 45 French members chosen by universal suffrage, and 16 natives, one of whom is Jewish, nominated from among the notables by the Government. This body expresses its views on all financial matters of interest to Tunis, whenever any fresh reforms place further burdens on the country.

The country is essentially agricultural, and cereals are raised on a large scale. In 1919, 514,861 hectares were under wheat, and produced 1,450,000 quintals. Vines are grown intensively over 23,246 hectares, and in 1919, 444,157 hectolitres of wine were produced. Olive trees cover a section of the country, and produced 191,836 quintals in 1919. The export of olives has a promising future. Fishing and the sponge industry occupy quite a number of the population. Iron and zinc are another resource, 360,453 tons of iron were extracted in 1919, their value being 14,500,000 francs. The chief mineral wealth of the protectorate lies in the immense phosphate deposits, which are worked on a big scale. In 1919, 815,385 tons were extracted, of a value of 36,692,325 francs; this is a considerable drop, for in 1915 the tonnage figure was 1,075,214 tons. There are valuable quarries and mineral springs. General trade in 1919 amounted to 487,789,000 francs, of which 285,761,000 francs represented imports. The share of France in the imports was 92,309,893 and of Great Britain 67,106,084 francs. Of the exports France absorbed 129,932,000, and Great Britain 15,670,000. In 1918 the total general trade amounted to 436,990,000 francs, 207,442,000 francs of which were imports. In the last normal year before the World War, the figure was 322,918,000, of which 144,256,000 francs were imports.

TUPPER, SIR CHARLES, BART. (1821–1915), Canadian statesman (*see* 27.410), died Oct. 30 1915.

TURBINES, STEAM (*see* 25.823 and 842).—The progress of the steam turbine during 1910–21 was very marked both as regards size and efficiency. The pure Curtis type, in which velocity compounding exists at every pressure stage, has been abandoned, except possibly for very small powers, and the design of impulse turbines now follows generally along the lines first laid down by Rateau, and developed principally by Rateau and Zoelly. A single Curtis wheel is frequently used to absorb the velocity due to the expansion of the steam in the first stage, as this practice permits of a greater heat drop in that stage, so that the pressure and superheat are considerably reduced before the steam is admitted to the body of the turbine. Velocity compounding is recognized as less efficient than the abstraction of the energy of the steam by single impulse blading, but the practical advantage of obtaining a large heat drop in the first stage is often considered to outweigh a slight loss of efficiency. The typical impulse turbine of to-day consists of a horizontal shaft carrying a number of disc wheels, each furnished with a single row of blades around its circumference, and running in its own separate compartment. The diaphragms which separate the compartments contain nozzles which are so proportioned that the steam expanding in them from the pressure which exists in one compartment to that in the next acquires just the velocity which can be efficiently absorbed by the wheel in the second compartment. The description later of a modern impulse turbine will make clear its construction and principles of action.

The reaction machine still maintains its position as regards efficiency and, like the impulse machine, is employed for very large powers. In modern machines, although the thermodynamic principles are identical with those of the earlier machines, there has been a considerable change in details of construction. The modern reaction turbine is frequently fitted with a velocity compounded impulse wheel, upon which the steam acts before passing to the reaction blading, the reason for this being the advantage of reducing the temperature and pressure of the steam before it is admitted to the body casing. It is not unusual to design the impulse wheel so that it absorbs about one quarter of the available energy of the steam, with the result that the drum may be materially shortened, the number of rows of reaction blading greatly reduced, and the cost of the turbine lessened. Other features which are typical of modern reaction machines are the great care taken to eliminate causes of distortion in the casing, by avoiding ports and irregularities of the metal. The casing is always made as symmetrical as possible.

The Reaction Steam Turbine.—Enormous progress has been made with the reaction turbine invented by Sir Charles Parsons, both as regards size and efficiency, and corresponding mechanical developments have taken place in the design. Land turbines of more than about 10,000 K.W. capacity are usually constructed in two or more parts, each part being a complete turbine, but utilizing only a portion of the total pressure drop of the steam. Sometimes the parts are placed side by side, each driving an independent electric generator, but otherwise they are arranged in tandem on a continuation of the same shaft.

This latter arrangement is illustrated in fig. 1, which shows a section through a large modern two-cylinder machine constructed by Messrs. C. A. Parsons & Co. Ltd. The steam passes from left to right through the blading of the high-pressure cylinder, and is then conducted by means of the circular external pipe to the centre of the low-pressure cylinder. Here it divides, flowing axially in each direction through the blading to the exhaust branches whence it passes to the condenser beneath. The low-pressure cylinder is built on the "double flow" principle in order to avoid the excessive length of blades and size of exhaust branch which would otherwise be required. In turbines of the reaction type there is a difference of pressure between the two sides of every row of blades, and there is thus a corresponding tendency for the steam to leak past the row without passing through the blading. This leakage was a source of considerable inefficiency, and to minimize it, the custom was to employ the smallest practicable radial clearance between the tips of the blading and the opposing surface of the drum or casing. These fine clearances were a source of weakness, as in the event of a slight distortion of the parts by straining or uneven heating, or in case of vibration occurring, there was always a chance of contact occurring, and the danger of this resulting in a stripping of the blades. In order to avoid the fine radial clearances with their attendant danger, Messrs. Parsons introduced the system of end-tightened blading, which now represents their standard practice for the high-pressure end of the turbine where the density of the steam makes fine clearances essential. This is illustrated in fig. 2.

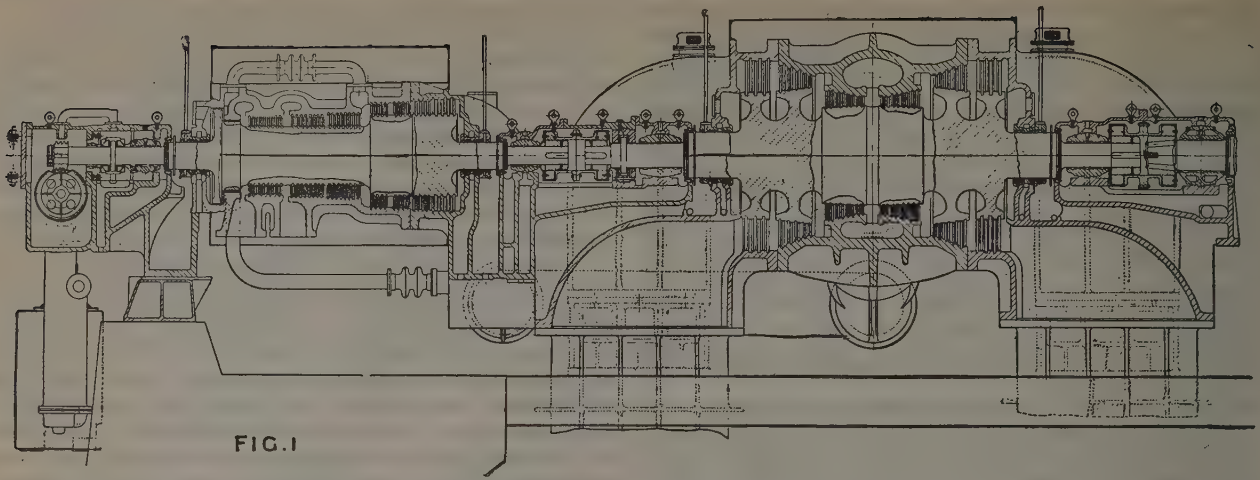

FIG. 1

It will be noted that the spacing pieces at the roots of each row of blades project above the surfaces of the rotor and cylinder, as the case may be, and form a continuous barrier. There is a thin brass shrouding strip rivetted to the free ends of the blades, which projects over the side of the blades and is almost in contact with the barrier of the next row. The space between the projecting edge of the shrouding strip and the adjacent barrier forms the actual working clearance which can be adjusted to any desired amount while the machine is running. The radial clearances between the shrouding and the surfaces of the rotor and casing are never less than $\frac{3}{16}$ in., so that contact is out of the question. Considerably greater economy is said to be obtainable with this type of blading.

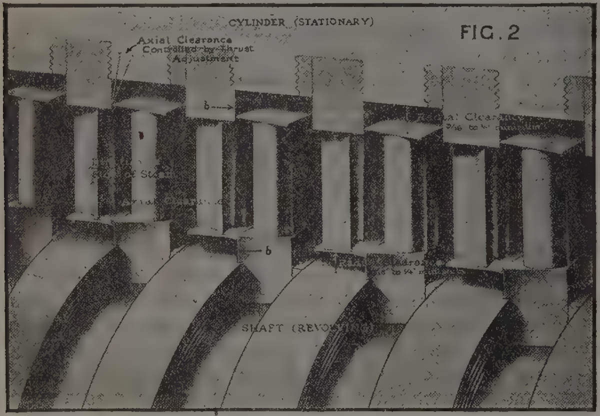

FIG. 2

The modern type of blading is illustrated in fig. 3. The blades, made of drawn brass strip, are assembled in units, complete with spacing pieces and shrouding. The blades and spacing pieces are brazed solidly together at the roots, and circumferential serrations are then cut in the solid part as shown.

The following table gives the results actually obtained with certain large turbo alternators of the Parsons Company:—

Installation	Chicago	Carville	Lots Road	Dunstan
Date of test	Nov. 1918	Nov. 1919	June 1916	Mar. 1921
K.W. Economical rating	20,000	10,000	15,000	12,000
K.W. Output	21,227	9,991	15,047	11,967
Speed, r.p.m.	750	2,442	1,000	2,400
Gauge pressure at stop valve, lb.	202·4	251	176·5	175·7
Temperature at stop valve, deg. F.	548·7	687	524·3	607·1
Superheat, deg. F.	159·8	281	146·1	229·2
Vacuum, ins. Hg.	1·13	0·96	0·97	1·02
Heat drop, B.Th.U. per lb.	408	459·4	402·8	421·2
Steam consump. per K.W.H.	10·84	10·04	11·82	10·80
Efficiency ratio	77·4	73·98	71·80	75·20
Thermodynamic efficiency	25·31	25·7	23·35	24·70
Length of time turbine had been working	5 years.	2½ years.	3 years.	4 years.

In all cases the instruments used were calibrated before and after the tests, and the steam consumption was obtained by weighing the condensate, so that a very high degree of accuracy was obtained. The tests go to show, incidentally, that reaction machines do not fall off in efficiency after several years' operation under commercial conditions of service.

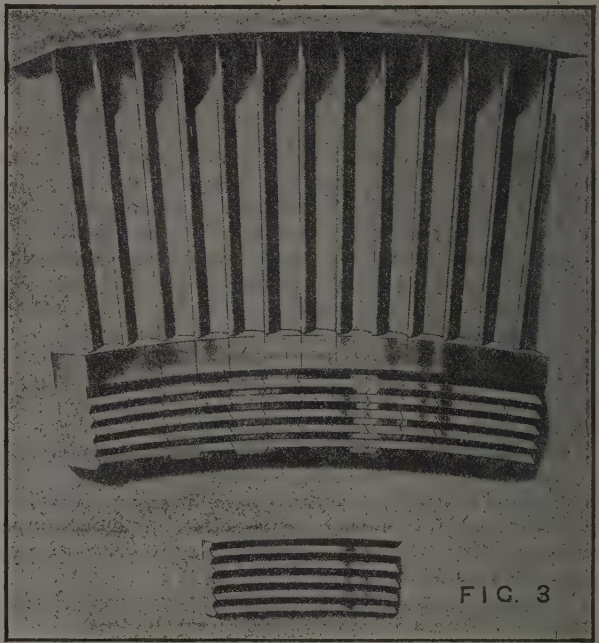

FIG. 3

The Impulse Steam Turbine.—The Rateau steam turbine is a typical modern multistage impulse turbine. Fig. 4 shows a longitudinal section through a machine of this type constructed in 1919 by the Metropolitan Vickers Electrical Co. for the Dalmarnock power station, the machine in question having a maximum continuous rating of 18,750 K.W. at a speed of 1,500 revs. per minute. The shaft carries altogether 15 wheels keyed upon it, each wheel running in a separate compartment. The diaphragms dividing the compartments from each other are fitted with nozzles, in which the steam undergoes successive partial expansions in its progress through the turbine, and from which it emerges with a velocity due to the drop in pressure which it has undergone. This velocity is abstracted by the action of the blading which the steam enters after issuing from each set of nozzles, the steam being brought more or less to rest and the energy due to its partial expansion appearing as useful mechanical work on the shaft.

In all large machines of this type, especially when they are working with a high vacuum, the volume of the steam at the low-pressure end becomes so great that the length of the turbine blades at this part tends to become excessive. In the machine in question a part of the steam, after having passed through 10 wheels, being then at a pressure of about 4 lb. abs. is passed out of the casing and used to heat the boiler feed water, the feed heater for this purpose being shown in section in the illustration. This practice diminishes, to a certain extent, the volume of the steam which passes through the remaining wheels, but in the machine illustrated, the makers have employed a special device to permit a reduction of the length of the last row of blades. The steam which enters the last wheel but one, is divided into two parts, that which acts on the outer annulus of the blade ring passing away directly to the condenser, and only that which acts on the inner annulus being afterwards conducted to the final wheel. The blading on the last wheel therefore only deals with about half the weight of steam which passes through the preceding wheel, and it can handle this amount at a very reduced pressure.

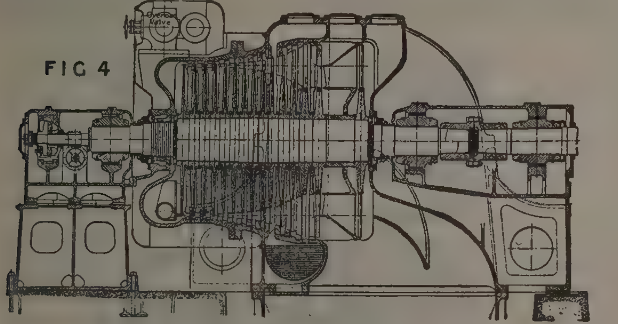

FIG 4

A rigid coupling is fitted to connect the turbine shaft with the shaft of the alternator, and the turbine shaft is located axially by means of an adjustable thrust block of the Michell type which takes care of any unbalanced end pressure along the shaft.

The mean diameter of the blading of this machine is 84 in. and the length of the last row of blades is 24 inches. The mean circumferential velocity of the blading is 550 ft. per second, the tip velocity of the longest blades being 708 ft. per second. The turbine is designed to work with a stop-valve pressure of 250 lb. per sq. in., a temperature of 650° F. and a vacuum of 0·9 in. of mercury, thus having an available heat drop of 455·2 B.Th.U. per lb. of steam. Under these conditions the guaranteed steam consumpion is 10·2 lb. per K.W.H., this figure being the same for both 15,000-K.W. and 18,750-K.W. load.

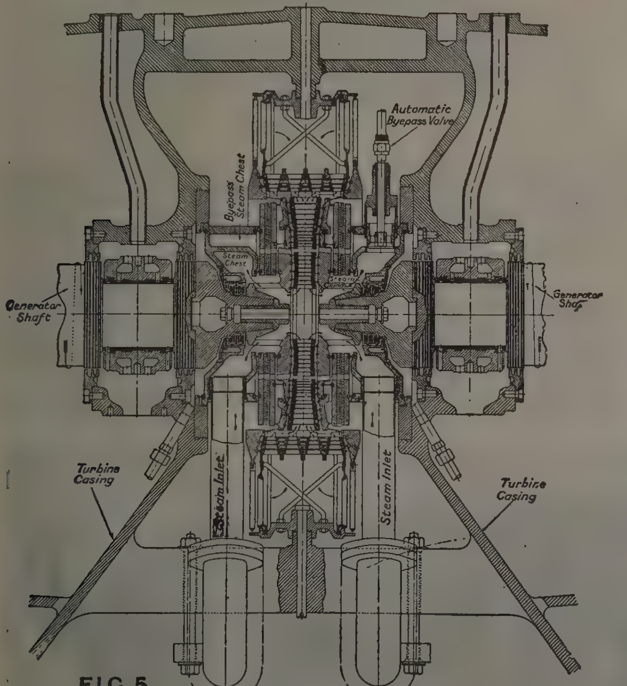

FIG. 5

The Ljungstrom Steam Turbine.—In the early days of the reaction turbine, a number of machines were built by the Hon. C. A. Parsons in which the steam passed radially outwards between two discs carrying rings of blades projecting axially from their opposed faces, one disc being stationary and the other driving the shaft of an electric generator. Mechanical difficulties were experienced, principally due to the distortion of the discs by uneven heating, and the design was soon completely abandoned in favour of the axial flow type. In the year 1910 Messrs. Birger and Frederic Ljungstrom of Stockholm built an entirely new type of radial flow reaction machine which was conspicuous not only for its mechanical merits but for its great efficiency. The Ljungstrom turbine is now being developed in sizes up to 30,000 K.W. capacity, and is manufactured in Great Britain by the Brush Electrical Engineering Co. and in the United States by the General Electric Company. The steam is admitted between two discs and in its passage from their center to their circumference it passes through concentric blading rings mounted alternately on the faces of the discs. The discs revolve at equal speeds in opposite directions, so that the relative blade speed is twice as great as in an ordinary machine of the same revolutions and diameter, with the consequence that for equal efficiency the number of blade rings is only one quarter as great. Each disc is fastened to the end of a separate alternator shaft, and as the turbine comes up to speed, the alternators come automatically into synchronism and operate in parallel so that they act virtually as a single machine.

FIG. 6

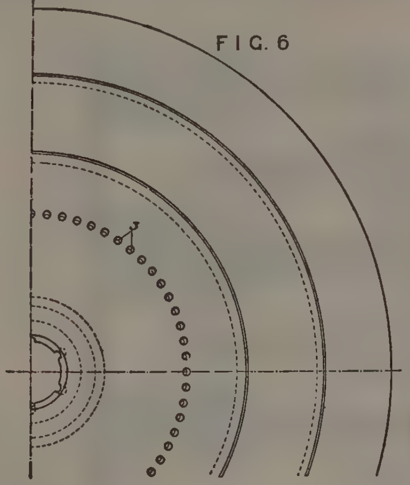

FIG. 7

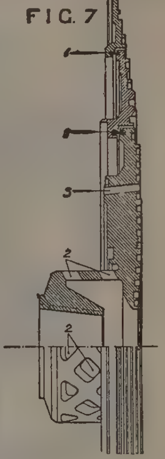

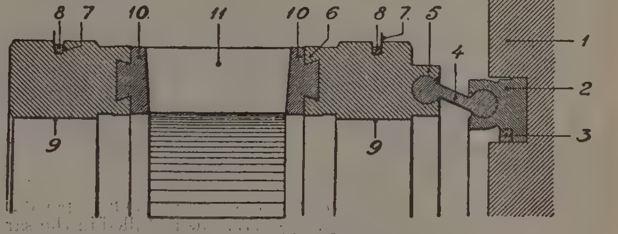

FIG. 8

The mechanical construction of the Ljungstrom turbine is unique. Fig. 5 shows a section through a machine to develop 5,000 K.W. at 3,000 revs. per minute, the illustration including the two ends of the alternator shafts, upon which the turbine discs are mounted. The construction will be better understood by reference to figs. 6–10 which show the most important details to a larger scale. The steam enters the turbine through the branched pipe shown in fig. 5 and thence passes to the centre of each disc through the holes marked 2 in figs. 6 and 7, which illustrate the disc alone. It will be seen that the face of the disc contains a number of circumferential grooves. Each groove carries a blade ring, shown to a larger scale in fig. 8, in which 1 represents the disc; 2 a seating ring; 3 a caulking strip; 4 an expansion ring; 5 and 6 rolling edges; 7 steam packing strips; 8 caulking strips; 9 strengthening ring; 10 dovetail profile ring; 11 the blade itself. These blade rings are interleaved as they project alternately from the discs, and steam leakage is checked by the thin fins 7. The blades are made from drawn steel strip and are welded solidly into the strengthening rings 10.

The conical steel expansion ring, 4, is a particularly important feature of the blading system, and similar rings will be seen at 1 in fig. 7, where they serve to connect the three parts of which the disc is composed. The ring of holes shown at 3 in fig. 7 is to admit the extra steam necessary for overload conditions, the inner rings of blading being then short circuited. The pressure of steam in the blading naturally tends to thrust the discs apart. It is therefore balanced by an arrangement of "dummies," or labyrinth discs, as shown in fig. 5. A detail of the labyrinth, to a larger scale, is given in fig. 9. To prevent the high-pressure steam leaking along the shafts, these are fitted with labyrinth packings, a portion of one of these packings being illustrated in fig. 10. The whole packing consists of a number of rings keyed alternately to the shaft and to the housing and having deep grooves turned circumferentially in the sides. The rings interleave in the manner shown, the edges of the grooves being bent down so as practically to make contact with the walls of the grooves in the adjacent rings. An extremely effective and compact labyrinth is thus formed.

The efficiency of the Ljungstrom turbine is remarkably high for machines of moderate capacity. Independent tests of a 1,500-K.W. machine, after 15 months' service, have shown a steam consumption of 11·95 lb. per K.W.H., with steam at 208 lb. per sq. in. abs. and 569° F. temperature, and a vacuum of 1·29 in. Hg. The no-load consumption of the same machine was only 1340 lb. per hour, or 7·5% of the full-load consumption.

The appearance of a complete Brush-Ljungstrom turbo-alternator is shown in fig. 11.

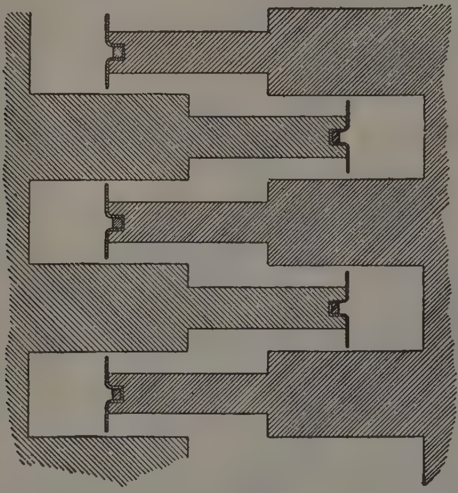

FIG. 9

Steam Conditions in Turbines.—The steam consumption of a turbine depends not only upon the excellence of its mechanical design but upon the amount of heat in every pound of steam delivered to the turbine which is available for conversion into work. The available heat may be increased by increasing the pressure and temperature of the entering steam and by lowering the pressure at which it is exhausted. Progress in these directions is limited by constructional difficulties, but nevertheless striking advances have been made. The best practice of the time may be exemplified by the 10,000-K.W. machine installed in 1910 at the Carville station of the Newcastle Electric Supply Co., which operated with steam at 190 lb. per sq. in. gauge pressure and a superheat of 150° F. at the stop valve, and a vacuum of one in. of mercury. Under these conditions there was an available heat drop of 407·2 B.Th.U. per lb. of steam. In 1916 a machine of 11,000-K.W. was installed in the same station with a stop-valve pressure of 250 lb. gauge, a superheat of 244° F. and a vacuum of one in. of mercury. This change in steam conditions increased the heat drop to 450·2 B.Th.U. per lb. of steam. In 1921, a machine having an economical rating of 25,000 K.W., installed at Manchester, utilized a stop-valve pressure of 350 lb. gauge, a superheat of 264° F. and a vacuum of 0·9 in. of mercury, thus working with an available heat drop of 484·7 B.Th.U. per lb. of steam. It may be taken that modern practice sanctions steam pressures up to 350 lb. per sq. in., temperatures up to 700° F. and vacua as high as 29·1 in., with the barometer at 30 inches. No commercial reciprocating engine could work under such steam conditions with anything like the efficiency a turbine would show in similar circumstances.

Speeds of Turbines.—The principal use of steam turbines on land being to drive electric generators, the speed at which these can be run controls to a large extent the speeds for which turbines can be designed. Continuous current turbo generators are comparatively small in size and few in numbers, and as these are almost exclusively driven through reduction gearing on account of the difficulties of commutation at high speeds, their characteristics do not materially affect the design of the turbines. All large land type turbines are directly coupled to alternators and as the frequency of alternation is standardized in Great Britain at 50 and 25 cycles per second, and in the United States and Canada at 60 cycles per second, the speeds of turbines have to be correspondingly standardized. If F denotes the frequency, and N the number of pairs of poles of the alternator, then $\frac{F\times 60}{N}$ denotes the only possible speed, in revolutions per minute, at which the turbine can be run. In Great Britain the standard turbine speeds are therefore 3,000, 1,500, 1,000 and 750 revs. per minute, while for 60 cycles they are 3,600, 1,800, 1,200 and 900 revs. per minute. It is naturally desirable to build any turbine for the highest speed at which the desired output can be economically obtained. Considerations of stress limit the dimensions for a given speed, and the dimensions limit the volume of steam which can be

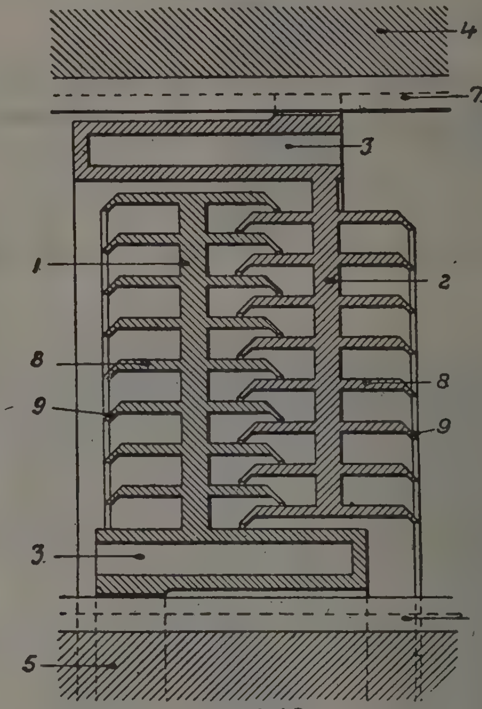

FIG. 10

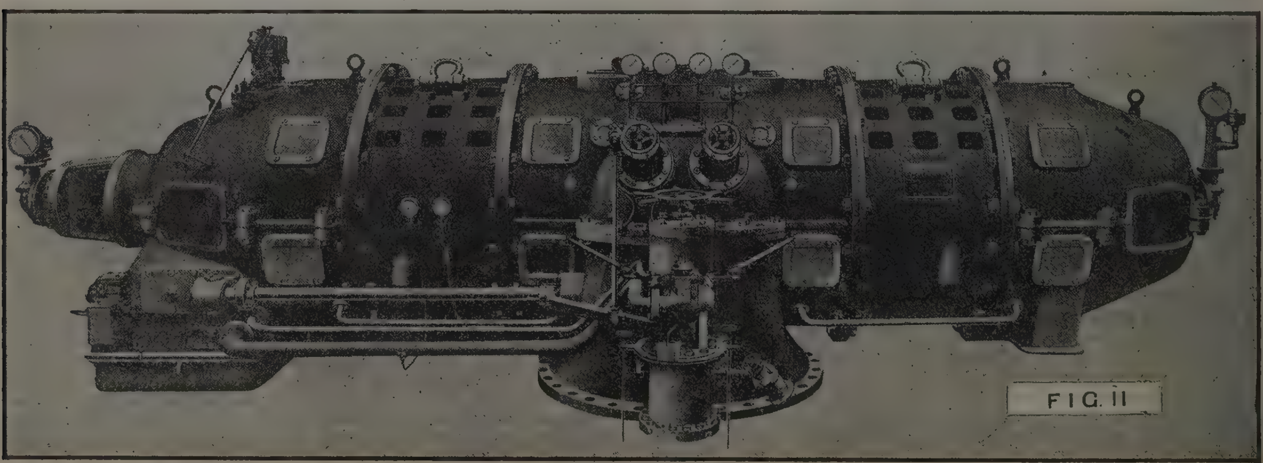

FIG. 11

efficiently utilized, so that in practice a fairly definite limit of power corresponding to each speed is obtained.

Turbo alternators have been satisfactorily built, having a maximum continuous rating of over 6,000 K.W. at 3,600 revs., the limit of economical rating for this speed being at the present time about 5,000 K.W. At 3,000 revs. per minute the maximum continuous rating is about 13,750K.W., the economical output being 12,500 K.W., the machine built in 1921 for the Liverpool corporation being of this size. There are several turbines with a maximum continuous rating of 30,000 K.W. running at 1,800 revs. per minute, and at 1,500 revs. per minute, a continuous rating of 35,000 K.W. appears to be about the present limit, both for impulse and reaction machines. Machines of this size and speed were installed in Chicago in 1918, and in Paris in 1921. In machines of 30,000 K.W., and over it is not uncommonly the practice to use two or more generators, the whole unit really consisting of mechanically independent high- and low-pressure turbines. Certain units built by the Westinghouse Co. in the United States have a maximum rated output of even 60,000 K.W., but these in fact consist of three independent turbo generators, through which the steam passes in series. This multiplication of cylinders and shafts is of course the usual custom in connexion with marine turbines.

The practice of dividing a turbine into two parts, namely a high- and a low-pressure cylinder arranged in tandem, was first introduced many years ago and the design has been standardized for the larger machines of the reaction type. It has the advantage that the separate casings are shorter and less liable to distortion than an equivalent single casing, while by making the low-pressure drum of larger diameter and of the double flow type, the requisite area for the enormous volume of the low-pressure steam is conveniently provided for. The importance of this will be realized from the fact that in a modern turbine the ratio of expansion of the steam may be over 800·1. Fig. 1 shows a section through a two-cylinder tandem turbine as constructed by the Parsons Co., and fig. 12 illustrates the appearance of a two-cylinder side by side arrangement as used with gearing for marine purposes.

Governing of Steam Turbines.—The speed regulation of turbines is effected by a centrifugal governor driven by worm gearing from the main shaft, which acts in the case of all reaction machines by controlling the pressure at which steam is admitted to the casing. In machines constructed either wholly or partially on the impulse principle, the governor may open up successively extra nozzles or groups of nozzles as the load increases. Loads in excess of the maximum economical load are sometimes provided for by admitting steam to the turbine at some intermediate point, thus raising the pressure there above the normal full load pressure and enabling the turbine to do more work, although at a somewhat reduced efficiency. The by-pass valves for this purpose may be hand operated, but as a rule they are under the control of the governor and are thus automatically opened when the extra steam is required to maintain the speed. In view of the close governing required on turbo generators and of the size and weight of the valves which have to be operated, it is the universal practice to employ a relay arrangement on all but the smallest machines, the governor merely controlling the position of a small balanced piston valve which admits oil under pressure to one side or the other of a piston which does the actual work of operating the valves. The pressure oil is supplied from the lubrication system of the turbine.

Bearings and Lubrication.—The old sleeve bearing, originally devised by Sir Charles Parsons and employed on his earlier machines, has been entirely superseded and turbine bearings are now constructed on ordinary lines, differing only from slow-speed bearings in their proportions and in the provision necessary for their proper lubrication. The bearings are made in two halves, split horizontally, the interior working surfaces being of white metal cast and anchored into the "steps" which are of cast iron or bronze. These are usually fitted with shimplates to provide a fine vertical and lateral adjustment, and are frequently supported in spherical seatings to permit of a certain amount of self-alignment. Safety strips, often of bronze, which normally lie slightly below the surface of the white bearing metal, are usually provided. These are intended to carry the weight of the shaft safely in the event of the white metal being melted out, and thus prevent injury to the blading until the machine can be stopped. In all turbine bearings the important thing is to insure a copious supply of lubricating oil, not so much for lubrication as to carry off the heat generated by friction and to maintain the bearings at a reasonable working temperature. Water-cooled bearings have been used by some makers, but the most approved practice is to rely on the flow of oil through the bearing to keep its temperature down. Oil is usually delivered to the bearings at a pressure of about 15 lb. per sq. in., a gauge being provided on each bearing to indicate whether the pressure is being maintained. On modern turbines an automatic device operated by the oil pressure is fitted, which shuts the machine down in case of any failure of the oil supply.

Bearings up to 8-in. diameter are usually bored larger than the shaft to the extent of about 0·004 in. for every in. of shaft diameter. In larger bearings the clearance is proportionately less. This somewhat large clearance enables the heat to be carried away by the continuous wash of fresh cool oil. The shaft, when running, is kept out of metallic contact with the bearing by a thin film of oil continually dragged underneath it by its rotation. It is this film which supports the shaft, and the pressure of the latter on the bearing must therefore not be greater than the film can stand. Theory and experiment both indicate that the greater the surface velocity of the shaft, the more effectively is the film established, and the greater therefore the permissible load on the bearing. But the fact that bearings have to start from rest, when the film is imperfect, imposes a practical limit to the load which can be imposed.

A formula connecting permissible pressure with velocity, given by Mr. F. H. Clough, is $P = 17\sqrt{V}$, in which P denotes the pressure in pounds per sq. in. of projected area, and V = velocity of surface of shaft in ft. per second. This is said to be applicable to bearings of normal design in which the length is from twice to three times the diameter. Many designers, however, use the rule that $P \times V$ must not exceed 5,600, a simple rule which gives good results in practice, and probably has a considerable margin of safety when the speeds are high and when there is no vibration. One large manufacturing firm is said to take the permissible pressure per sq. in. of projected area as ranging from 167 to 235 when the velocity ranges from 20 to 73·5 ft. per second. Modern practice is to give P a value not exceeding 150 lb. in bearings where the velocity is not greater than 30 to 35 ft. per second, and the temperature comparatively low, say, 100° to 110° F. Such conditions would apply to low speed marine turbine bearings. The bearings of land turbines usually work at temperatures from 120° F. to 160° F., but the latter temperature should not be exceeded, as not only is the oil injured, but its viscosity is so low that the supporting film is thinned and the margin of safety becomes low.

For the heat generated in a turbine bearing Stoney gives the formula B.Th.U. per hour $= \frac{190\, l.\, d.\, v}{t.\, 32}$ in which l and d are respectively the length and diameter of the bearing expressed in in., v is the velocity of the surface of the shaft in ft. per second, and t is the temperature on the Fahrenheit scale. The same authority quotes the following formula as often used in slow-speed marine practice: B.Th.U. per hour $= l \times d \times v^{1\cdot38}$. Treating the heat which escapes by radiation and conduction as negligible, these formulæ give the heat which has to be carried away by the oil and extracted by the oil cooler. This heat of course is the equivalent of the work lost by friction in the bearing. The increase of temperature of the oil passing through the bearing should not exceed 10° to 20° F., and if the specific heat of oil be taken at 0·31 the minimum quantity of oil required for each bearing may be readily calculated. In practice it is advisable to increase this calculated fig. by from 30 to 50%, to allow a margin for steam heat travelling along the shaft and other contingencies.

Mechanical Gearing of Turbines.—The De Laval steam turbine, consisting of a single impulse wheel running at a speed of 30,000 to 10,000 revolutions per minute according to the size, has always contained reduction gearing as an integral part of the machine because such speeds are far too high for driving ordinary machinery. Turbines of this type have, however, only been built for powers up to a few hundred horse-power, and although the use of reduction gear may be dated from the introduction of the Laval turbine in 1886, it never became a recognized practice for large powers until it was developed by Sir Charles A. Parsons as the solution of the problem of marine propulsion. De Laval had shown that it was possible to transmit power satisfactorily through mechanical gearing running with a circumferential velocity of over 100 ft. per second. The gears he used were of the double helical type with a spiral angle of 45 degrees. The reduction ratio was usually about 10:1, and the pitch of the teeth varied from 0·15 in. to 0·26 in., according to the power of the turbine. The De Laval gear embodied all the features which have been found necessary to the successful performance of modern gears transmitting several thousand horse-power through a single pinion. The double helical form of tooth of comparatively fine pitch has been retained, as this design eliminated end thrust and insured silent running by reason of the number of teeth simultaneously in contact. Ample lubrication of the teeth by means of oil jets was also employed by De Laval, who succeeded in producing durable and satisfactory gears which had an efficiency of about 97 per cent. These gears are used up to about 600 H.P. which is the commercial limit of the type of turbine for which they are designed.

Steam turbines of any type, designed with due regard to efficiency and cost of manufacture, require to run at a far higher speed of revolution than is practicable for screw propellers, especially when the latter are employed to drive ships of moderate speed. The coupling of a turbine, therefore, directly to a propeller shaft involves a compromise in design, in which the speed is greater than desirable for the propeller yet so low as to require the turbine to be of greater size and weight and of lower efficiency than it would otherwise be. In the case of high-speed vessels direct coupling afforded a commercially acceptable solution of the problem of turbine propulsion, and for vessels of eighteen knots speed and over, such as warships, passenger liners and cross-channel boats, the direct coupled turbine soon became the recognized driving power. But ordinary cargo vessels and tramp steamers, with an average speed of 10 or 12 knots, were outside the practical field of the steam turbine until speed reduction gearing was available to couple a high-speed turbine with a slow moving propeller. It was really the problem of the slow speed ship which brought about the development of marine turbine gearing, and now that the mechanical difficulties have been overcome, the direct coupled marine turbine is likely to be largely displaced by the geared turbine in all classes of vessels.

The first example of marine turbine reduction gearing appears to have been in 1897, in connexion with a twin screw launch, in which the Parsons Marine Steam Turbine Co. fitted a 10-H.P. turbine driving the two shafts by means of helical gearing having a speed ratio of 14:1. The result appears to have been entirely satisfactory. Other experiments followed, and in 1909, the "Vespasian," a cargo vessel of 4,350 tons displacement, was fitted with geared turbines driving a single propeller. This vessel had previously been equipped with triple expansion reciprocating engines of the usual type, and before these were removed they were put into perfect order, and very careful tests were made to determine the efficiency and performance of the vessel. The geared turbines drove the same shaft and propeller as the engines had done and were supplied with steam from the same boilers. The power developed was about 1,000 H.P. and the shaft ran at 70 revs. per minute, the gear reduction ratio being 19·9:1. The installation of the turbines resulted in an increase of about one knot in speed for the same coal consumption, and the results of the trials were highly satisfactory in every respect, and convincing as to the advantages of geared turbines over reciprocating engines. After the "Vespasian" had run 18,000 m. in regular service, the pinion was examined and found to be in perfect condition, the wear not exceeding 0·002 inches. (See *Trans. I.N.A.* 1910 and 1911.)

The success of the "Vespasian" led to rapid developments. In 1910 the British Admiralty adopted gearing, the torpedo boats "Badger" and "Beaver" being the first warships to be equipped with geared turbines. In these vessels each L.P. turbine drove its shaft directly, but the H.P. and cruising turbines were geared to a forward extension of the turbine spindles. At full load about 3,000 H.P. were transmitted through each set of gearing. Six years later complete gear drives had become the standard practice for British war vessels of all types and by 1920 some 652 gears, transmitting an aggregate of 7,280,000 shaft H.P., were fitted, or on order for the royal navy (Tostevin, *Trans. I.N.A.* 1920).

The appended particulars of H.M. battle cruiser "Hood," of 144,000 shaft H.P., which was completed in 1920, will indicate the development of gearing for turbines and will at the same time indicate the proportions which have been adopted.

Gearing of H.M.S. "Hood."

Horse-power of H.P. turbine	17,500
Horse-power of L.P. turbine	18,500
Revs. per minute H.P. turbine	1,497
Revs. per minute L.P. turbine	1,098
Revs. per minute propellers	210
Diameter of pitch circle, in H.P. pinion	20·174
Diameter of pitch circle, in L.P. pinion	27·51
Diameter of pitch circle, in gear wheel	143·787
Number of teeth H.P. pinion	55
Number of teeth L.P. pinion	75
Number of teeth gear wheel	392
Circular pitch, in.	1·1533
Normal pitch, in.	0·9985
Helical angle of teeth	29° 57′
Effective width of pinion face, in.	73·25
Number of teeth engaging	36·6
Total length of tooth contact, in H.P. pinion	128·8
Total length of tooth contact, in L.P. pinion	132·9
Load in lb. per in. on total Width of tooth face (=P) H.P.	965
Load in lb. per in. on total Width of tooth face (=P) L.P.	1030
Value of K in formula $P=K\sqrt{P.D.}$ H.P.	215
Value of K in formula $P=K\sqrt{P.D.}$ L.P.	196
Velocity of pitch line ft. per second	132

The earliest practice with regard to marine gearing was to use a helical angle of 23° in conjunction with a normal pitch of 0·75 inches. Subsequently a helical angle of 45° which had been found successful in the De Laval gears was adopted with the idea of securing quieter running, but modern practice favours an angle of about 30°, as teeth cut at this angle will run silently, while their less inclination to the axis of the shaft results in increased efficiency and greater effective strength. The usual angle of obliquity is 14½°, and the normal pitch except for the very largest gears is nearly always 0·583 inches. The permissible pressure in lb. per in. of axial length of the pinion is determined by the formula $P=K\sqrt{D}$ in which D is the pitch diameter of the pinion in in. and K is a constant which has a value usually between the limits of 160 and 230. This formula represents the practice of the Parsons Co., who have a preponderating experience on these gears. There is reason for believing, however, that the pressure might be made more directly proportional to the pitch diameter. A circumferential velocity of 150 ft. per second on the pitch line has been successfully employed, and it is possible that this might be exceeded with safety.

For turbine gearing the British Admiralty specify that the pinion shall be made of oil-hardened nickel steel, containing not less than 3·5% of nickel and from 0·30 to 0·35% of carbon, with an ultimate tensile strength of 40 to 45 tons. The gear wheels are to be of steel of 31 to 35 tons ultimate tensile strength with 26% elongation in two inches.

It is essential that the teeth of turbine gearing shall be very effectively lubricated, and to insure this, oil under a pressure of from 5 to 10 lb. per sq. in. issues in jets which flood the teeth immediately before they come into engagement. A further point of primary importance is that the fitting and alignment of the gears must be as perfect as possible and great care must be taken to maintain and insure these conditions. In America the practice has been adopted of carrying the pinion on a floating frame with the object of permitting a certain amount of self-alignment, but the required correction is of such a very small order of magnitude that the advantages of the system are doubted by many engineers.

Gearing of British naval turbines is exclusively of the single reduction type, but double reduction gearing has been largely introduced into cargo vessels during recent years, with the object of efficiently using turbine machinery for ships of comparatively low speed without involving too large a reduction ratio for a single pair of gears. The general design follows—*mutatis mutandis*—that of single reduction gear.

Numerous tests have been carried out to determine the mechanical efficiency of gears of the kind described. The mechanical efficiency of a single reduction gear at full load should be over 98%, and 98·5% has been recorded. With double reduction gear the efficiency is about 97·0%. These figures include bearing friction. No method of obtaining speed reduction by hydraulic or electrical methods has yet been devised which will approach the efficiency obtainable with mechanical gearing.

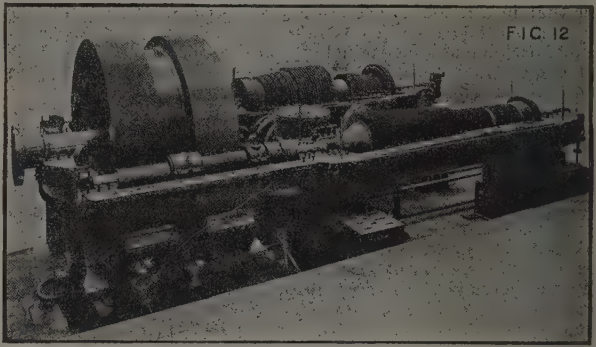

Fig. 12 gives a good idea of the shafts of the Cunard liner "Transylvania," built by Scotts Shipbuilding & Engineering Co. Ltd. An exactly similar set of machinery was fitted to drive the other shaft. The "Transylvania" was the first Atlantic liner to be fitted with geared turbines. The vessel had a length of 548 ft. and a gross tonnage of 14,500. Each set of turbines and gearing was designed to develop and transmit 5,500 shaft H.P. and they drove the vessel at 16·75 knots. The turbines ran at 1,500 revs. per minute and drove the propellers at 120 revs. per minute, the ratio of the gearing being therefore 12·5:1. In the illustration the pinion in the foreground is driven by the high-pressure turbine, the steam from which operates the low-pressure turbine on the other side of the gear wheel. The astern turbine, consisting of an impulse wheel followed by a comparatively few rows of reaction blading, is seen on the forward end of the low-pressure turbine. The size of the machinery is indicated by the fact that the gear wheel is 10 ft. in diameter and 5 ft. wide.

THEORY OF THE STEAM TURBINE

Throughout the ensuing section, heat is expressed in foot pound centigrade units, and the symbols employed have the following meanings:—

H = Total heat in one lb. of steam.
H_w = Total heat in one lb. of steam at the supersaturation limit or Wilson line.
H_s = Total heat in one lb. of steam at the saturation line.
V = Volume of one lb. of steam in cub. ft.
V_w = Volume of one lb. of steam in cub. ft. at the Wilson line.
V_s = Volume of one lb. of steam in cub. ft. at the saturation line.
$V\phi$ = Volume of one lb. of steam in cub. ft. after an isentropic expansion.
p = Absolute pressure in lb. per sq. in.
t_s = Saturation temperature (centigrade).
ϵ = Efficiency ratio.
η = Hydraulic efficiency.
u = Thermodynamic head expended in isentropic expansion.
U = Thermodynamic head expended in a practicable expansion.
γ = Index for adiabatic expansion.
λ = Index for an expansion at constant efficiency.

w = Flow of steam in lb. per second.
v = Number of pressure stages in an ideal turbine.
n = Number of pressure stages in a practicable turbine.
h' = Blade height of an ideal turbine, in in.
h = Blade height of a practicable turbine in in.
$\bar{d}$ = Mean diameter in in. of a row of blades.
D = Drum diameter of a reaction turbine.
J = Joules equivalent.
$K = \Sigma\left(\frac{\bar{d}}{10}\right)^2\left(\frac{\text{RPM}}{100}\right)^2$ moving rows only being included in the summation.

From the standpoint of hydraulics there is a somewhat close analogy between a steam turbine and one operated by water. An essential feature in both cases is that the potential energy which a fluid possesses in virtue of its pressure is utilized to maintain a flow through a set of nozzles or guide vanes. In the ideal case of frictionless flow the energy possessed by unit mass of the fluid is the same whether it be at rest in the reservoir or whether it forms part of the jet and has accordingly a kinetic energy due to its velocity. The theoretical velocity of efflux of a gas can accordingly be determined by equating the kinetic energy to the work which the same mass of fluid could perform were it allowed to expand, behind the piston of an ideal engine, from the pressure of the reservoir down to that of the receiver into which the discharge takes place. In thus expanding behind a piston, W, the theoretical work done per lb. of the fluid is given by the equation

$$W = 144\frac{\gamma}{\gamma-1}p_0\,V_0\left[1-\left(\frac{p_1}{p_0}\right)^{\frac{\gamma-1}{\gamma}}\right]$$

where W denotes the work in foot pounds, p_0 and p_1 the initial and final pressures, respectively, expressed in lb. per sq. in., while V_0 represents the original volume of the fluid in cub. ft. at pressure p_0 and γ is the index of adiabatic expansion, on the assumption that the relationship between the volume and the pressure during such an expansion can be represented by the formula

$$p^{\frac{1}{\gamma}}\,V = \text{constant.}$$

By the principle already stated, the theoretical velocity of efflux will be obtained by writing

$$\frac{v^2}{2g} = W = 144\frac{\gamma}{\gamma-1}p_0\,V_0\left[1-\left(\frac{p_1}{p_0}\right)^{\frac{\gamma-1}{\gamma}}\right] \text{———} (1)$$

From this expression it appears that as p_1 becomes smaller and smaller v becomes greater and greater. When, however, the velocity of efflux becomes equal to the velocity of sound in the escaping fluid, any further reduction in p_1 occasions no increase in the weight discharged from the nozzle per second. This follows because the velocity at which any impulse is transmitted through a medium is the same as that of sound in the medium. Hence, if, starting from an equality of pressure in reservoir and receiver, the receiver pressure is progressively reduced, "news" of each successive reduction is transmitted back along the jet into the reservoir at the speed of sound, and as a consequence the pressure gradients there undergo a readjustment and the flow into the nozzle is increased. Once, however, the speed of issue exceeds that of sound, no "news" as to any further reduction in the external pressure can reach the interior of the reservoir. The pressure gradients therein consequently remain unaltered, and the weight of fluid fed to nozzle per second remains unchanged. This reasoning, which originated with Osborne Reynolds, applies to all cases of the efflux of fluids, although in the case of a liquid such as water it has no practical significance, as the head necessary to generate a velocity equal to that of sound in water would be many miles in height.

In the case of superheated or supersaturated steam, the speed of sound is attained when the ratio of the lower pressure p_1 to the upper pressure p_0 is equal to 0·5457. No further reduction of the lower pressure will increase the weight of steam flowing per second, but final velocities of efflux greatly exceeding the velocity of sound can be attained by making use of a nozzle converging first to the throat and then slowly diverging again. The theoretical velocities under such conditions can be calculated from equation (1).

In practice the actual velocity of efflux is less than the theoretical on account of losses due to nozzle friction. The maximum weight which can be discharged per second from a convergent-divergent nozzle is fixed by the area of the throat. In the case of steam, for each sq. in. of throat area the maximum weight which can be passed per second is

$$w_{\max} = 0{\cdot}3155\sqrt{\left(\frac{p_0}{V_0}\right)}$$

where p_0 denotes the absolute pressure of supply in lb. per sq. in. and V_0 the corresponding specific volume of the steam in cub. ft. per lb. This equation holds whether the steam is superheated or wet.

In equation (1) above, the work due from one lb. weight of steam under pressure p_0 is expressed in ft. lb., but in steam turbine practice it is generally more conveniently expressed in heat units, and the convenience is the greater because the equation $p^{\frac{1}{\gamma}}V$ = constant, is an inexact representation of the relationship between pressure and volume in the adiabatic expansion of steam. By working in heat units this difficulty is avoided.

If lb.-centigrade heat units be adopted, the theoretical velocity of efflux is given by the relation $v = 300{\cdot}2\sqrt{u}$ where u denotes the adiabatic heat drop and is conveniently measured from a Mollier chart, of which many have been published. A diagrammatic chart of this kind is reproduced in fig. 13, in which the ordinates represent entropy, and the abscissæ are total heats of steam (*see* 25.827). The curves drawn on the chart represent lines of constant pressure, constant temperature or constant wetness. The use of the chart is best illustrated by an example. To find the velocity of efflux from a nozzle supplied with steam at an absolute pressure of 200 lb. per sq. in. and at a temperature of 300° C., which is discharging into a receiver maintained at an absolute pressure of 120 lb. per sq. in., the point A is marked on the chart at a position corresponding to the initial conditions and a straight line is drawn horizontally (*i.e.* with constant entropy) to cut the 120-lb. pressure line at B. The length AB, as measured by the scale of total heats, represents 30·6 lb. centigrade heat units. The theoretical velocity is therefore $300{\cdot}2\sqrt{30{\cdot}6} = 1{,}660$ ft. per second nearly.

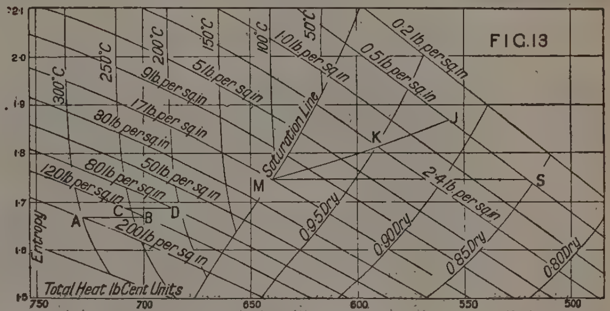
FIG.13

Owing to nozzle friction the actual velocity will be less than this figure, which has accordingly to be multiplied by a coefficient, the value of which is commonly taken to be 0·95 or 0·96. With convergent-divergent nozzles the loss is much greater. The function of the moving wheel of an impulse turbine is to convert the kinetic energy of the jet into useful work on the shaft. The method of drawing a velocity diagram and estimating therefrom the probable efficiency of conversion is explained in the earlier article on STEAM ENGINE (25.843). With impulse steam turbines a stage efficiency of about 0·80 can be realized if the blade velocity be sufficiently high. To obtain such an efficiency the ratio of blade speed to steam speed should be about 0·47. For commercial reasons this figure is seldom obtained, but if δ represents the actual ratio of blade speed to steam speed, and δ_1 the ratio corresponding to maximum efficiency η_1, then the efficiency η corresponding to δ can be obtained from the equation

$$\eta = \eta_1\left[\frac{2\delta}{\delta_1} - \frac{\delta^2}{\delta_1^{\,2}}\right].$$

A steam impulse turbine generally consists of a series of elementary turbines or stages arranged in succession on the same shaft. Suppose the first of the series has unit efficiency and expands the steam from a pressure of say 200 lb. per sq. in. and a temperature of 300° C. to a pressure of 120 lb. per sq. inch. Then, as shown above, in the absence of frictional losses, the state of the steam as delivered to the next elementary turbine would be represented by the point B on the chart, fig. 13, where the pressure is 120 lb. per sq. in. and the total heat 698·2 lb. centigrade heat units. The whole of the 30·6 units due in an adiabatic expansion from the initial conditions to a final pressure of 120 lb. per sq. in., would in the assumed case of a perfect turbine be converted into useful work on the shaft. In practice, however, only a part of this adiabatic heat drop will be usefully converted, the remainder being wasted in friction and added as heat to the steam, before it is delivered to the next elementary turbine, or stage. If the efficiency of conversion is 0·7, the heat which would be added to the steam in the above example will be $0{\cdot}3 \times 30{\cdot}6$, or 9·18 lb. centigrade units, thus making the total heat of the steam on delivery to the second stage $698{\cdot}2 + 9{\cdot}18 = 707{\cdot}4$ nearly. This gives point C on the chart.

If it be assumed that the second stage expands the steam down to 80 lb. per sq. in., the adiabatic heat drop will be found as before by drawing a horizontal line from C to cut the curve for 80-lb. pressure at D. The length of this line as measured on the scale of total heats is 22·8 lb. centigrade heat units. If, as before, we assume that but 0·7 of this is converted into useful work, the remainder being added to the steam as heat, the total heat of the steam as delivered to the third stage will be $707{\cdot}4 - 0{\cdot}7 \times 22{\cdot}8 = 691{\cdot}5$ heat units, giving us the point E on the chart as representing the condition of the steam as supplied to the third stage. Proceeding in this way, a series of "state points" can be marked on the chart, each of which represents the condition of the steam as supplied to the next elementary turbine of the series.

So long as the steam is superheated or supersaturated its volume can be determined, when the pressure and total heat are known, by Callendar's equation

$$V = 2{\cdot}2436\,\frac{H-464}{p} + 0{\cdot}0123.$$

The relation between the volume, pressure and temperature under the same condition is

$$(V-0{\cdot}016) = \frac{1{\cdot}0706\,T}{p} - 0{\cdot}4213\left(\frac{373{\cdot}1}{T}\right)^{\frac{10}{3}}$$

in which T denotes the absolute temperature on the centigrade scale. With wet steam expanding in a condition of thermal equilibrium the volume of the steam is equal to the volume of dry saturated steam at the same pressure, multiplied by the dryness fraction as read from the chart. Since the steam in passing through a turbine never does expand in a condition of thermal equilibrium, this case is of no practical importance.

If u_1 denotes the adiabatic heat drop for the first stage of the series, u_2 that for the second stage, and so on, then the aggregate of these values of u for the whole series will be greater, the greater the number of stages into which the whole turbine is divided. The ratio of the aggregate to the value of u obtained when the whole of the expansion is effected in a single stage, is known as the "reheat factor" R. In the case of a reaction turbine the number of stages is so great that the expansion may, for practical purposes, be considered as effected continuously instead of in a series of steps. In this case the reheat factor for superheated or supersaturated steam can be read off from the diagram fig. 14, which is reproduced from Martin's *New Theory of the Steam Turbine.*

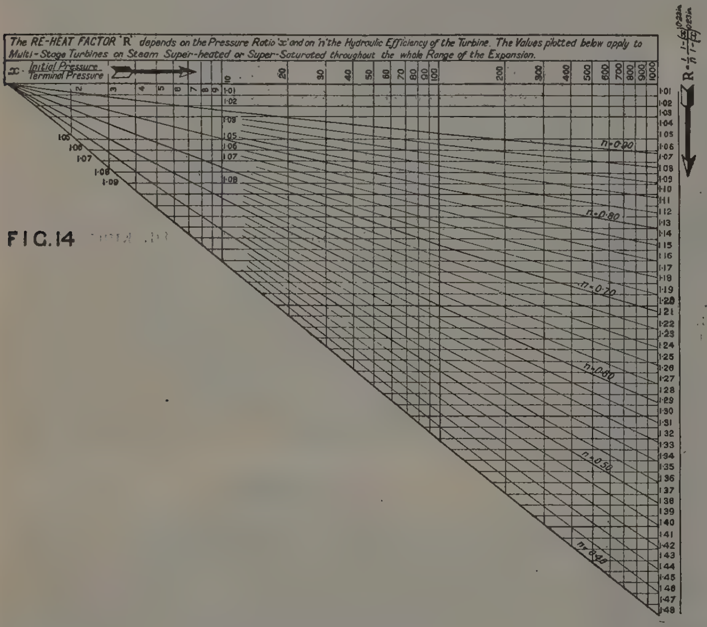

FIG. 14

The "efficiency ratio" of a turbine is denoted by ε, and is defined as the ratio which the useful work W actually done by the steam bears to that which would be performed by a turbine of unit efficiency, so that $W = \epsilon u$. The hydraulic efficiency, denoted by η, is defined as the ratio of the work done to the total effective thermodynamic head, which head, as pointed out above, is always greater than u in the case of a multistage turbine, as it is the sum of the values of u for each stage. We thus have

$$W = \eta U = \eta R u, \text{ so that } R = \frac{\epsilon}{\eta}.$$

The hydraulic efficiency η of a turbine is a much more fundamental property than the efficiency ratio ε, and remains unaltered whatever the number of elementary turbines or stages, into which the whole turbine is divided, or whatever be the total ratio of expansion. In the ideal limiting case in which the expansion is carried down to zero pressure the efficiency ratio is always unity, whatever the hydraulic efficiency may be.

Where the heat drop per stage of a turbine is small, it cannot be measured with accuracy from a chart but must be calculated from formulas or derived from steam tables, of which Callendar's are the most reliable and self-consistent, and accord best with the most trustworthy experimental data. Callendar's formula for the adiabatic expansion of superheated or supersaturated steam is

$$p^{-\frac{13}{3}}\,T = \text{constant}$$

where T denotes the absolute temperature.

In a continuous expansion of superheated or supersaturated steam effected with a hydraulic efficiency η, the relation between volume and pressure during the expansion is represented accurately by the expression

$$p^{\frac{1}{\lambda}}\left(V - 0{\cdot}016\,\frac{\lambda}{1{\cdot}3}\right) = \text{constant} \text{———————} (2)$$

$$\text{where } \frac{1}{\lambda} = 1 - 0{\cdot}230773.$$

A closely approximate expression has been given by Callendar in the form

$$(H-464)\,p^{-\frac{3}{13}\eta} = \text{constant} \text{———————} (3).$$

In practice $\frac{\lambda}{1{\cdot}3}$ in equation (2) may be taken as unity without involving serious error; and since, along the saturation line, the relation between pressure and volume is represented very approximately by the equation

$$0{\cdot}9406 \log p + \log (V - 0{\cdot}016) = 2{\cdot}5252,$$

the point at which the saturation line is crossed in a continuous expansion, effected with an efficiency η, can be found approximately by combining this equation with (2), which gives:

$$\frac{1}{\lambda}\log p + \log (V - 0{\cdot}016) = \frac{1}{\lambda}\log p_0 + \log (V_0 - 0{\cdot}016).$$

The pressure thus obtained can be plotted on the steam chart as at M (fig. 13). A single additional point representing the state of the steam at some intermediate pressure gives the "condition line" in the superheated field with sufficient accuracy as the curvature of this line is always very slight. The condition line for wet steam expanding in thermal equilibrium is best obtained from the chart. To this end a horizontal line is drawn from M to cut the exhaust pressure line at S. The length MS then represents, on the scale of total heats, the adiabatic heat drop for an expansion from M in a condition of thermal equilibrium. Denoting this by u_s the corresponding useful work done is ϵu_s and the heat wasted in friction is $(1-\epsilon)u_s$.

If we add this wasted energy to the total heat corresponding to the point S we get J as the state point representing the condition of the steam as finally discharged. A similar procedure gives us the state point K at some intermediate pressure, and the three points M, K, J suffice to fix with practical accuracy the condition line for wet steam expanding from M to S in thermal equilibrium.

From a condition line the total heat of the steam corresponding to any pressure can be read off, and the corresponding volume then obtained as already described. The condition line for steam expanding beyond the saturation line in a condition of thermal equilibrium, has, as already mentioned, no practical significance in steam turbine work. Once the saturation line is passed the expansion never proceeds in thermal equilibrium. This discovery renders obsolete the theory of the steam turbine working with non-superheated steam, as understood up to the end of 1912, at which time attention was directed anew to certain remarkable anomalies observed in experiments on the discharge of non-superheated steam from nozzles. Numerous careful experiments had shown that the weight discharged was often in excess of what the then accepted theory declared to be possible. In discussing these results in *Engineering*, Jan. 10 1913, Martin pointed out that the experiments of Aitken and Wilson on the sudden expansion of dust free vapour afforded conclusive evidence that in expanding through a nozzle, the steam must be in the supersaturated condition and not in thermal equilibrium, so that the accepted theory was based on a fundamental error. Stodola succeeded in confirming this conclusion by direct experiment. He studied, under very strong illumination, the appearance of jets of steam discharged from a nozzle and found that the steam exhibited no signs of condensation occurring until the pressure had been reduced far below the saturation point. Finally, in 1915, Callendar, in a paper published in the Proceedings of the Inst. Mech. Engineers, gave an exhaustive study of the whole question and showed that the anomalies observed in nozzle experiments entirely disappeared if the steam were considered to remain in a supersaturated condition up to a point beyond the throat of the nozzles. Moreover, under such an assumption, the computed frictional losses became in good accord with those observed in experiments with air. There is however, of course, a point beyond which steam cannot be expanded without condensation occurring. From experiments of C. T. R. Wilson, H. M. Martin calculated the following table giving the properties of steam at the supersaturation limit, or the "Wilson line" as he called it ("A New Theory of the Steam Turbine," *Engineering* 1913):—

TABLE 1. *Properties of Steam at the Wilson Line.*

Temperature at Wilson Point.	Pressure at Wilson Point.	Volume at Wilson Point.	Total Heat at Wilson Point.	Equilibrium Temperature.	Equilibrium Volume.	Entropy at Wilson Point.
t_w	p_w	V_w	H_w	t_s	yV_s	γ_w
deg. C.	lb. per sq. in.	cub. ft. per lb.	F.P.C.	deg. C.	cub. ft. per lb.	
0	0·9888	295·30	593·79	38·52	325·85	1·9098
10	1·739	173·33	598·28	49·41	191·50	1·8641
20	2·935	106·11	602·64	60·33	116·91	1·8220
30	4·764	67·339	606·85	71·19	74·218	1·7825
40	7·478	44·091	610·90	82·13	48·474	1·7476
50	11·39	29·732	614·75	93·00	32·666	1·7141
60	16·86	20·566	618·36	103·89	22·575	1·6830
70	24·36	14·531	621·70	114·80	15·957	1·6537
80	34·41	10·506	624·56	125·66	11·537	1·6261
90	47·60	7·720	627·47	136·57	8·638	1·5998
100	64·64	5·778	630·01	147·48	6·353	1·5748
110	86·28	4·389	632·10	158·40	4·832	1·5508
120	113·37	3·376	633·89	169·48	3·713	1·5278

Along the Wilson line the relation between pressure and volume is given with considerable accuracy by the equation

$$0{\cdot}9401 \log p_1 + \log (V - 0{\cdot}016) = 2{\cdot}4651.$$

At the supersaturation limit moisture is formed and settles out in the form of minute droplets.

To proportion rationally the blading of a steam turbine it is necessary to know the relationship between the pressure and the volume, or between the pressure and the total heat of the steam during the expansion. The discovery that wet steam does not expand through a turbine in a condition of thermal equilibrium, whilst affording an explanation of certain anomalies experienced in practice, has raised new difficulties, since we are no longer in a position to determine with certainty the volume of wet steam at different points of the expansion. So long as the expansion is not carried beyond the supersaturation limit, or the "Wilson line," the behaviour of the steam is in accord with the equations given above. At the supersaturation limit, however, an overdue change abruptly occurs, and it is a matter of general experience that when a condition of unstable equilibrium is suddenly upset the subsequent phenomena are commonly incalculable. In such cases there is frequently found to be a period of transition during which "repeat" experiments fail to give consistent results. Once, however, the transition is fairly effected, a new steady state is generally established. In the case of steam, this steady state appears to be obtained if the expansion is continued considerably beyond the supersaturation limit. In this steady state, such evidence as is available goes to show that the water of condensation which remains suspended in the steam in the form of minute droplets, has a temperature approximating to that of saturated steam of the same pressure, whilst the gaseous portion of the steam has a temperature corresponding to that of steam just on the point of condensing at the supersaturation limit. The dryness fraction of the exhaust steam from a turbine is therefore given approximately by the relation

$$y = \frac{H_e - t_s}{H_w - t_s}$$

where H_e denotes the total heat in one lb. of the exhaust steam, t_s the temperature corresponding to saturation at the same pressure while H_w is the total heat of one lb. of dry steam at the exhaust pressure but at the limit of supersaturation, as given in table 1 above for various pressures. The volume V_e of the exhaust steam is equal to yV_w where V_w is taken from a table similar to table 1.

In general, engineers express exhaust pressures as so many in. of mercury. The standard barometric height is taken as 30 in. of mercury, and a vacuum of 29 in. of mercury, corresponds therefore to an absolute pressure of one in. of mercury, or 0·491 lbs. per sq. inch. Values of H_w, V_w, and t_w for different vacua are tabulated below:—

TABLE 2.

Vacuum (in. of mercury).	t_w (°C).	H_w lb. centigrade units.	V_w cub. ft. per lb.
29	−11·37	588·59	569·3
28	−0·15	593·67	296·3
27	+ 6·98	596·92	202·5
26	+12·21	599·22	154·5

It will be seen that the determination of V_e depends upon a knowledge of H_e, whilst $H_e = H_1 -$ indicated work done.

The indicated work done in the expansion of wet steam can only (as matters stand to-day) be found as the result of experience with actual turbines, and our knowledge is accordingly empirical in character. If we take steam expanding from the saturation line to ordinary exhaust pressures, the following rule for the effective thermodynamic head U_s engendered is in good accord with experience $U_s = \psi u_s$. Where u_s denotes the adiabatic heat drop, assuming the expansion from the initial to the final pressure to be effected under condition of thermal equilibrium, whilst

$$\psi = 1{\cdot}1070 + 0{\cdot}02212 \frac{x}{100} - \eta\left(0{\cdot}1638 + 0{\cdot}0286 \frac{x}{100}\right).$$

In this expression x denotes the ratio of the initial pressure to the exhaust pressure and η is the hydraulic efficiency, which is taken to be the same as if the turbine were operated with steam in a superheated condition throughout the whole range of expansion.

The coefficients in this formula for ψ have been selected so as to make the indicated work done the same as if computed by Baumann's empirical rule (*Inst. E. E.* 1921), but the relatively small amount of work done by expansion below the saturation line is attributed to the effective thermodynamic head being less than if the expansion had been effected under conditions of thermal equilibrium. Baumann's empirical rule on the other hand assumes that the efficiency decreases by 1% for every 1% of moisture in the steam, the latter being assumed to expand in thermal equilibrium.

From the above expression for U_s we can find H_e from the general relation $H_e = H_1 - \eta U$; and from this we can calculate V_e as already explained.

To determine the volume of the steam at other points of the expansion it is perhaps sufficient in the present state of our knowledge to use an interpolation formula which shall give correctly the initial and final volumes at the saturation line and at the exhaust, and which shall also give correctly the work done between these two limits. No doubt there is force in the argument that as we know accurately the relation between the volume and the pressure of the steam in expanding down to the Wilson line, it would be more logical not to make use of an interpolation formula until the necessity actually arose by this line being crossed, but in the present state of our knowledge the simpler procedure seems adequate for practical needs. It is certainly nearer the truth than the assumption hitherto adopted, that the steam expands in thermal equilibrium.

Callendar has devised a very simple and easily applied interpolation formula which satisfies the required conditions. It may be written as

$$\log (H - C) = \log A + u \log p.$$

The value of the constants are determined by writing

$$\frac{H_1 - C}{H_2 - C} = \frac{p_1V_1}{p_2V_2} = \left(\frac{p_1}{p_2}\right)u,$$

In practice it is seldom necessary to determine either A or u, whilst C is most easily obtained by writing

$$H_1 - C = \frac{(H_1 - H_2)\ p_1V_1}{p_1V_1 - p_2V_2}.$$

The use of the formula will be made clearer by taking a practical example. Thus, suppose dry saturated steam at a pressure of 20 lb. per sq. in. to be expanded down to a vacuum of 29 in. with an hydraulic efficiency of 0·7. (This efficiency is low for a modern turbine but the method is of course applicable whatever the value of η.) Then from Callendar's steam tables it will be found that $H_1 = 642{\cdot}82$ centigrade heat units; $V_1 = 20{\cdot}08$ cub. ft. per lb., whilst $u_s = 125{\cdot}46$ units. In this case $\frac{x}{100} = \frac{20}{49{\cdot}1} = 0{\cdot}4075$, so that $\psi = 0{\cdot}9932$ and $U_s = 124{\cdot}61$ centigrade heat units. The "indicated" work done is therefore $0{\cdot}7 \times 124{\cdot}61 = 87{\cdot}23$ and hence $H_e = H_2 = H_1 - 87{\cdot}23 = 555{\cdot}59$. The dryness fraction at exhaust is therefore given by $y = \frac{555{\cdot}59 - 26{\cdot}09}{588{\cdot}59 - 26{\cdot}09} = 0{\cdot}9413$, so that $V_e = yV_w = 0{\cdot}9413 \times 569{\cdot}3 = 535{\cdot}9$ cub. ft. per lb.

Had the steam expanded in thermal equilibrium and an equal amount of work been taken out of it, its volume on exhaust would have been 594·4 cub. ft. per lb. Hence at high vacua the volume of steam to be provided for at exhaust is some 10% less than on the old theory in which it was assumed to expand in thermal equilibrium.

The requisite data for constituting Callendar's interpolation formula are now available. Thus we have $p_1V_1 = 401{\cdot}6$; $p_2V_2 = 263{\cdot}1$; whilst $H_1 - H_2 = 87{\cdot}23$. Hence

$$H_1 - C = \frac{401{\cdot}6 \times 87{\cdot}23}{38{\cdot}5} = 253{\cdot}0.$$

Thus $C = 389{\cdot}8$ and $H_2 - C = 165{\cdot}8$.

We therefore get $\log (H_1 - C) - \log (H_2 - C) = 0{\cdot}1835$

and $\log p_1 - \log p_2 = 1{\cdot}6099$.

We divide each of these differences by 10 (say) and can then calculate corresponding values of log (H − C) and log p by repeated subtraction of these dividends, giving the figures tabulated in columns 2 and 3 in table 3 below. To determine corresponding values of log V we proceed in an exactly similar manner, determining the difference between log V_1 and log V_2 and repeatedly adding one tenth of this difference until the value of log V_2 is obtained. This latter procedure is based upon the general relation

$$H_1 - H = \eta U,$$

so that

$$-dH = \eta dU = \frac{144}{J}\eta V dp$$

and thus

$$V = \frac{J}{144}\eta\frac{dH}{dp}.$$

But on differentiating Callendar's relationship above, we get

$$\frac{dH}{dp} = \mu\left(\frac{H-C}{p}\right)$$

which gives us

$$V = \frac{J}{144\eta} - \mu\frac{H-C}{p}.$$

Since by hypothesis η is constant we may write this as

$$\sigma \log V = \log (H-C) - \log p.$$

But log p is a linear function of log $(H-C)$ and therefore so also is log V. It may be noted that log V is accordingly also a linear function of log p, so that this interpolation formula gives between p and V a relationship of the type $pV^{\lambda}=$constant. But the value of the integral of Vdp is adjusted so as to bring the total work done into accord with the data. The formulas for V and $H-C$ are, in short, empirical interpolation formulas and must be regarded as such. They are not absolutely consistent with each other but the discrepancy is small enough to be negligible in practice.

TABLE 3.

Section.	log $(H-C)$	log p	log V	log $\frac{H-C}{\eta}$	$\frac{H-C}{\eta}$	U	V
A	2·40310	1·30100	1·30280	2·55800	361·4	0	20·08
B	2·38475	1·14001	1·44543	2·53965	346·5	14·9	27·89
C	2·36640	0·97902	1·58806	2·52130	332·1	29·3	38·74
D	2·34805	0·81803	1·73069	2·50295	318·4	43·0	53·79
E	2·32970	0·65704	1·87332	2·48460	305·2	56·2	74·70
F	2·31135	0·49605	2·01595	2·46625	292·6	68·8	103·8
G	2·29300	0·33506	2·15858	2·44790	280·5	80·9	144·1
H	2·27465	0·17407	2·30121	2·42955	268·9	92·5	200·1
I	2·25630	0·01308	2·44384	2·41120	257·8	103·6	277·8
J	2·23795	$\bar{1}$·85209	2·58647	2·39285	247·1	114·3	385·9
K	2·21960	$\bar{1}$·69110	2·72910	2·37450	236·8	124·6	535·9

To avoid an accumulation of errors and to facilitate checking, the values of the intermediate logarithms in the above table are tabulated to five figures but only four of these are significant. When the additions and subtractions are accurately carried out the values in the last line of the table must be the values at the exhaust with which the calculation was started. The convenience of this check is so great that it is advisable (even at the expense of the slight inaccuracies involved) to use this type of interpolation formula even in the case of steam superheated throughout its expansion, although in this case exact relationships between the different functions can be stated.

Knowing U, the general characteristics of a turbine intended to operate with a given hydraulic efficiency can be very readily determined.

Thus if we define K as

$$K = \Sigma\left(\frac{d}{10}\right)^2\left(\frac{\text{R.P.M.}}{100}\right)^2$$

where d denotes the mean diameter in in. of a moving row of blades, and the summation includes the moving rows only; the efficiency of the turbine is a function of $\frac{K}{U}$, as will be readily understood from the obvious consideration that K is proportional to the mean square of the blade speed, whilst U is proportional to the mean square of the steam speed. If the hydraulic efficiency be plotted against $\frac{K}{U}$ the resultant curve is an ellipse, but this ellipse is not symmetrical about the axis along which $\frac{K}{U}$ is measured. The equation to this ellipse is

$$\left(\frac{\eta}{\eta_1}+\frac{K}{U}\frac{U_1}{K_1}\right)^2 = 4\frac{K}{U}\frac{U_1}{K_1}$$

where η_1 denotes the maximum value of η, and $\frac{K_1}{U_1}$ is the corresponding value of $\frac{K}{U}$.

The relation between η and $\frac{K}{U}$, as determined by the collation of actual test figures is given in figures 15 and 16. In both cases the expansion is assumed to be continuous in character instead of being effected in finite steps, a circumstance which slightly lowers the apparent hydraulic efficiency of the impulse machine, but the error is small and moreover cancels out when the curve is used for purposes of design.

When the steam is initially superheated the value of U to be used in the formula is given by $U=U^1+U_s$ where U^1 represents the thermodynamic head expended down to the saturation line and $U_s=\psi u_s$ as explained above.

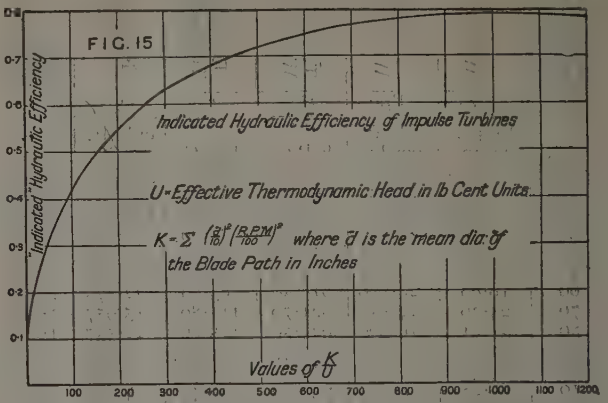
FIG. 15

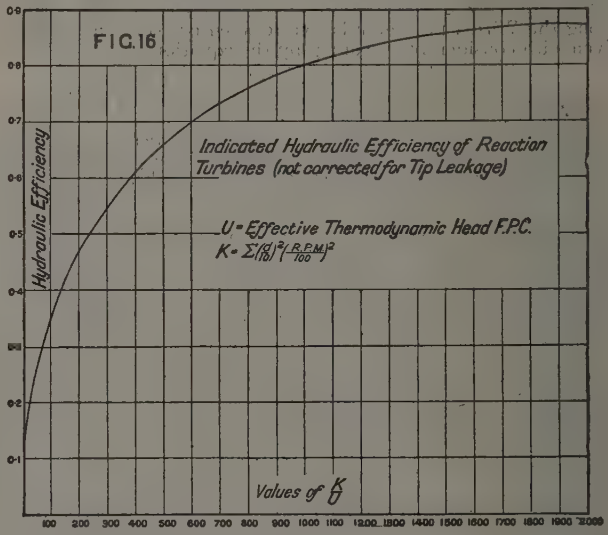
FIG. 16

Suppose that an impulse turbine which is to operate with dry saturated steam supplied at a pressure of 20 lb. absolute and exhausted at a vacuum of 29 in. mercury is to run at a speed of 1,500 revs. per minute, the mean diameter of all the blade rows being 44⅞ in. whilst the designed hydraulic efficiency is 0·7. Then from fig. 15 it will be seen that $\frac{K}{U}=436$. Hence as from table 3 the total thermodynamic head is 124·6, the value of K must be 124·6 × 436 = 54,330.

But if ν be the number of stages

$$K = \nu\left(\frac{44{\cdot}875}{10}\right)^2\left(\frac{1500}{100}\right)^2$$

whence $\nu = 12$, so that a turbine of 12 stages with wheels of 44⅞ in. mean diameter will give the required efficiency. If ν does not turn out to be an even number, it can be made so by suitably adjusting the value of $\bar{d}$. Intermediate values of ν are directly proportional to the corresponding values of U and a series of such values calculated with an ordinary 10-in. slide rule, which is amply accurate for the purpose, are as follows:—

Section	A	B	C	D	E	F
U	0	14·9	29·3	43·0	56·2	68·8
ν	0	1·435	2·82	4·14	5·41	6·63
log p	1·3010	1·1400	0·9790	0·8180	0·6570	0·4961
Section	G	H	I	J	K	...
U	80·9	92·5	103·6	114·3	124·6	...
ν	7·79	8·91	9·98	11·01	12·0	...
log p	0·3351	0·1741	0·0131	−0·1479	−0·3089	...

The values of ν are fractional, but they are used merely for curve plotting, the values of the different functions corresponding to integral values of ν being read from the curves. Thus in fig. 17 log p has been plotted against ν and it should be noted that the curve is by no means represented by a straight line. Since ν is proportional to K it follows that if in any turbine log p when plotted against K gives a straight line, that turbine, whether of the impulse or reaction type, cannot be designed to operate with uniform efficiency. In the diagram fig. 17 the values of log p represent the pressure of the steam after discharge from the preceding stage, stage No. 1 being thus conceived as being preceded by an imaginary stage No. 0. A corresponding plot of the volume would, however, give not the volume at discharge from the guide blades, but this volume as increased by the heat generated in the passage of the steam through the moving buckets. All stages being similar, the effective thermodynamic head at each stage is the same. But the apparent thermodynamic head, obtained by dividing the total thermodynamic head U by the number of stages, is somewhat greater than the adiabatic heat drop at each stage.

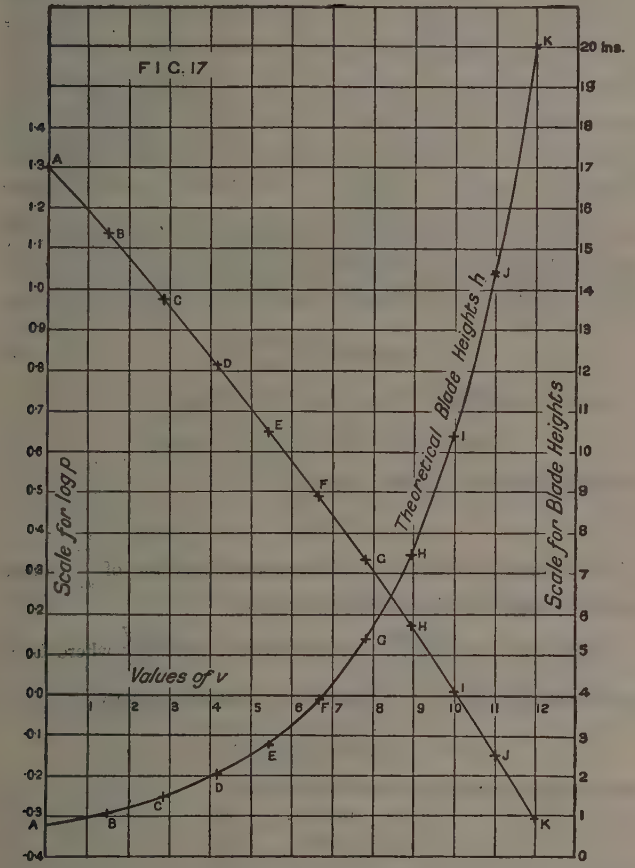
FIG. 17

According to what has been stated above, the velocity of discharge from the guide blades of a stage is commonly taken as $v = 300{\cdot}2 \times 0{\cdot}95\sqrt{u}$ where u is the adiabatic heat drop. The weight W discharged per second per sq. ft. of guide blade area is

$$W = \frac{v}{V\phi} = \frac{300{\cdot}2 \times 0{\cdot}95\sqrt{u}}{V\phi}$$

where $V\phi$ represents the volume of the steam after an adiabatic expansion between the pressure above and below the stage. Instead of calculating these values it is more convenient to utilize the known values of U and V and to correct the above formula by using an appropriate coefficient ψ. As there are 12 stages in the present case we get $\frac{U}{12} = \frac{124{\cdot}6}{12} = 10{\cdot}38 = q$, and the above equation may therefore be written

$$W = f\,\frac{300{\cdot}2 \times 0{\cdot}95\sqrt{10{\cdot}38}}{V}.$$

An interpolation formula for f which is applicable for the ordinary range of turbine efficiencies and for convergent guide blades is $f = 1 + 0{\cdot}13\,(1-\eta)\sqrt{x-1}$ where x denotes the ratio of the pressure above and below the stage. The coefficient f is readily evaluated by the ordinary slide rule with quite sufficient accuracy.

In the case under consideration we note from the curve fig. 17, that when $v = 1$, $\log p = 1{\cdot}197$ so that $x = 1{\cdot}27$ and f is therefore $1{\cdot}023$.

The area available for flow through a row of guide blades is $\frac{\pi h' \bar{d} \sin a}{144}$ where h' denotes the blade height in in., and a is the "effective" angle of discharge, allowing if necessary for the fact that the blades are of finite thickness. Hence if w be the weight of steam flowing through the turbine per second

$$h' = \frac{wV}{6223\, f'\, \bar{d}\, \sin a \sqrt{q}}.$$

Taking $\sin a = 0{\cdot}30$, $\bar{d} = 44\tfrac{7}{8}$, $q = 10{\cdot}38$ and $w = 10{\cdot}3$ lb. per second, this expression reduces to $h' = {\cdot}03732V$. Values of h' thus calculated for the values of V given in table 3 are plotted in fig. 17 and from the curve thus obtained we read off the theoretical blade heights at the different stages. These are:—

Stage No. . . .	1	2	3	4	5	6
Theor. blade height in in. . . .	0·94	1·18	1·51	1·95	2·48	3·24
Stage No. . . .	7	8	9	10	11	12
Theor. blade height in in. . . .	4·30	5·65	7·69	10·48	14·40	20·0

In practice the nearest even dimensions will be substituted for the calculated heights. The calculated heights for the last three stages are inconveniently long, but they can all be reduced to say 9 in. by suitably increasing the effective angles of discharge. Some builders moreover increase the pressure drop at the exhaust end, and would accordingly combine stages 11 and 12 into one. These expedients decrease the efficiency but are cheaper than the alternative of constructing the low-pressure end on the double flow principle.

The high-pressure end of a turbine can be proportioned in a manner exactly similar to that described, but as the steam there is commonly superheated, the problem is correspondingly simplified and need not therefore be discussed here. It is, however, usually necessary to construct some of the high pressure stages as partial admission stages and it is also a common practice to have a large pressure drop at the first stage with the object (at some sacrifice of efficiency) of making a large initial reduction in the temperature and pressure of the steam, so that the high pressures and temperatures are confined to the nozzle-boxes of the first stage. To the same end a velocity compounded wheel is frequently used in the first stage. The general theory of these wheels is described in Prof. Ewing's article (*see* 25.844), but it may be observed that in practice it has been found necessary to adopt empirical methods of designing such wheels. If designed as pure impulse wheels operated with a fluid which is "freely deviated" the results are very disappointing. One rule which has been used is to assume that only 85% of the total heat drop of the stage is utilized in the nozzles, and of the residue that 5% is utilized in each of the three sets of blading. The wheel therefore works to some extent as a reaction turbine.

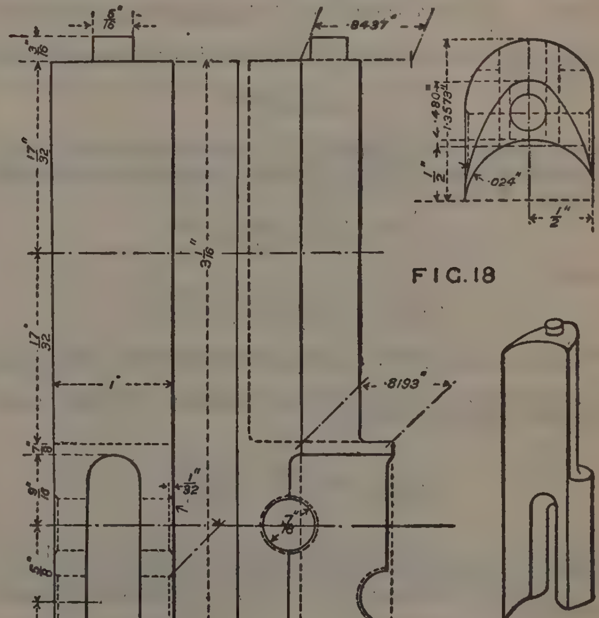
FIG. 18

Speaking generally, the principle of "free deviation" as embodied in some water wheel designs is inadmissible in steam turbine practice, in which the moving blades should be just sufficiently long to avoid "spilling" of the steam delivered to them from the guide blades. As to the exact form of the moving blades, this does not appear to be of primary importance within reasonable limits, as, although the practice of different makers varies considerably, all impulse turbines exhibit much the same efficiency under corresponding conditions. Typical Rateau blading is illustrated in fig. 18. The discharge angle is commonly about 30° save at the last row of blading where it is increased to 35°.

As regards nozzle and guide blade efficiencies, generally, reliable experimental data are still lacking. It has been assumed that the efficiency of convergent guide blades is a maximum when the speed of efflux is equal to the velocity of sound, and though this is not improbable from *a priori* considerations no conclusive evidence in support of the view has yet been forthcoming, and turbines which attempt to embody this theory have not shown the slightest superiority over competing designs. A great drawback to high steam speeds is the liability to excessive wear of the blading, and in this respect reaction blading has a great advantage over impulse blading in addition to the higher inherent efficiency of the former. This higher inherent efficiency depends upon the fact that the overall efficiency of a steam turbine depends upon its stage efficiency, a stage being defined as the section of a turbine comprised between two successive heat drops. In the case of impulse turbines for each successive heat drop, frictional losses are experienced in two elements, namely, the nozzles or guide blades and the moving buckets, whereas in a reaction turbine at each heat drop there is loss in one row of blading only.

The Design of Reaction Turbines.—The proportioning of a compound reaction turbine is a somewhat intricate problem, and as a preliminary it will be convenient to discuss the flow of steam through a series of openings or stages. At each of these a certain thermodynamic head q is expended, and this is not, in general, the same for each stage. If however U denote the total thermodynamic head expended in forcing the steam through n stages we have

$$\Sigma_1^n q = \mathrm{U} = \int_0^n \frac{d\mathrm{U}}{dn}\,dn.$$

Now Laplace's theorem in the calculus of finite differences may be written

$$\Sigma_1 q = \int_0 q\,dn + \frac{q-q_0}{2} + \frac{1}{12}(\Delta q - \Delta q_0) - \frac{1}{24}(\Delta^2 q - \Delta^2 q_0) + \&c.$$

If we neglect the terms comprising the differences we get

$$\Sigma_1 q = \mathrm{U} = \int_0 q\,dn + \frac{q-q_0}{2},$$

so that

$$\frac{d\mathrm{U}}{dn} = q + \tfrac{1}{2}\frac{dq}{dn}.$$

Now $d\mathrm{U} = \frac{-144}{\mathrm{J}}\mathrm{V}dp$ whilst if (as it is frequently permissible to assume) the velocity of flow at each stage is proportional to $\sqrt{q}$ we may write

$$q = \mathrm{F}v^2 = \frac{\mathrm{F}w^2\mathrm{V}^2}{\Omega^2}$$

where F denotes some coefficient, w is the weight of steam flowing per second, V its specific volume, whilst Ω denotes the area through the stage. Making this substitution for q we get

$$-\frac{144}{\zeta}\frac{1}{\mathrm{F}w^2}\frac{dp}{\mathrm{V}} = \frac{dn}{\Omega^2} + \tfrac{1}{2}\frac{dq}{q}$$

whence

$$n\left(\overline{\frac{1}{\Omega^2}}\right) + \tfrac{1}{2}\log_\epsilon\frac{q}{q_0} = \frac{\mathrm{I}}{w^2}\int_0\frac{dp}{\mathrm{V}};$$

here $\overline{\frac{1}{\Omega^2}}$ is the mean value of $\frac{1}{\Omega^2}$ when plotted against n and I is a factor depending on the coefficient of discharge. Substituting for q, the above expression reduces to

$$n\left(\overline{\frac{1}{\Omega^2}}\right) + \log\frac{\frac{\mathrm{V}}{\Omega}}{\frac{\mathrm{V}_0}{\Omega_0}} = \frac{\mathrm{I}}{w^2}\int_0\frac{dp}{\mathrm{V}}.$$

In the case of an ordinary dummy Ω is constant, and the law of expansion is expressed in this case by $p\mathrm{V}=$constant. Whence if the coefficient of discharge be unity we get, on making the proper substitutions

$$w = 68\,\Omega\sqrt{\frac{p_0}{\mathrm{V}_0}\,\frac{1-\frac{1}{x^2}}{n+\log_\epsilon x}}.$$

Here x denotes the ratio of the initial pressure to the final pressure. The logarithmic term becomes of great importance when n is small and renders the formula reliable under very extreme conditions.

Suppose it is desired to replace n openings in which the area is varied in direct proportion to the volume of the steam, by n openings all of equal area, the weight of steam passed per second, and the total pressure difference remaining constant. If we neglect the small change such a substitution will make in the value of $\int\frac{dp}{\mathrm{V}}$ and assume that the velocity of discharge at each stage is still proportioned to $\sqrt{q}$ we get

$$\Omega^2 = \frac{n+\log_\epsilon\frac{\Omega n}{\Omega_0}}{n}\left(\overline{\frac{\mathrm{I}}{\Omega^2}}\right) \text{———} (4).$$

Use will be made of this formula in proportioning the blading of a reaction turbine.

Let it be required to proportion the blading for a double flow reaction machine, the conditions being similar to those assumed for the impulse turbine discussed above, save that the total discharge will be assumed to be 27 lb. of steam per second, that is to say, 13·5 lb. each way, whilst the speed is to be 2,400 revs. per minute. The hydraulic efficiency will be taken as 0·7, as before, so that the quantities already tabulated in table 3 can be used without modification.

If it were practicable to construct a reaction turbine with all its blade rows of the same mean diameter, the problem would be as simple as that of the impulse machine, and we shall, in the first instance, compute the blade heights for such an ideal turbine and from the figures thus obtained we shall deduce the blade heights required for the practical machine.

In this ideal turbine the blade heights are varied so that the ratio of blade speed to steam speed is everywhere constant and from the perfect uniformity of conditions it follows that q (the thermodynamic head expended at any stage) is also constant and proportional to v^2. Since the blade speed is also proportional to its mean diameter, we may write

$$q = \beta^2 d^2\left(\frac{\mathrm{R.P.M.}}{1000}\right)^2$$

where β is a coefficient. From this it follows that

$$\Sigma q = \mathrm{U} = \beta^2\,\Sigma\,(\bar{d})^2\left(\frac{\mathrm{R.P.M.}}{1000}\right)^2 = \beta^2\,2K$$

where K is defined as above. Hence

$$\beta^2 = \frac{\mathrm{U}}{2K}.$$

If the hydraulic efficiency be decided on, the value of $\frac{\mathrm{U}}{K}$ can be obtained from the curve plotted in fig. 16.

Again since $v = \frac{144\,w\mathrm{V}}{\pi h'\bar{d}\sin\alpha}$ we may write $\sqrt{q} = \mathrm{G}\frac{w\mathrm{V}}{h'\bar{d}}$ where G is some constant. But $\sqrt{q}$ is, as already shown, equal to

$$\sqrt{\frac{\mathrm{U}}{2K}}\,\bar{d}\left(\frac{\mathrm{R.P.M.}}{1000}\right)$$

and equating these two expressions we get

$$\mathrm{G}\frac{w\mathrm{V}}{h'\bar{d}} = \frac{\mathrm{R.P.M.}}{1000}\,\bar{d}\sqrt{\frac{\mathrm{U}}{2K}}$$

or

$$h' = \frac{1000\mathrm{G}}{\mathrm{R.P.M.}}\,\frac{w\mathrm{V}}{\bar{d}^2}\sqrt{\frac{2K}{\mathrm{U}}}.$$

The value of G must be determined experimentally, and from careful tests it appears that for normal Parsons blades h' may be written as,

$$h' = \frac{616}{\mathrm{R.P.M.}}\,\frac{w\mathrm{V}}{\bar{d}^2}\sqrt{\frac{K}{\mathrm{U}}} \text{———} (5).$$

It may be added, however, that the value of the coefficient is not quite independent of the efficiency, and whilst the value 616 is appropriate to an efficiency of 0·7 it increases to 678 for an efficiency of 85%.

For a reaction turbine having an hydraulic efficiency of 0·7 it will be seen from the efficiency curve that $\frac{K}{\mathrm{U}}$ has the value 600, and if $\bar{d}$ be taken as 49 in. we get for the total number of rows (fixed and moving) corresponding to the expenditure of a thermodynamic head U, the expression

$$\nu = \frac{2K}{\bar{d}^2}\times\left(\frac{1000}{\mathrm{R.P.M.}}\right)^2 = \frac{1200\,\mathrm{U}}{\bar{d}^2}\left(\frac{1000}{\mathrm{R.P.M.}}\right)^2 = 0{\cdot}08677\,\mathrm{U}.$$

Taking the values of U from table 3 the corresponding values of ν are entered in the fifth column of table 4. Taking the steam passed as 13·5 lb. per second each way, we get for h' the expression

$$h' = \frac{616}{2400}\times\frac{13{\cdot}5}{49^2}\sqrt{600}\times\nu = .03535\,\nu.$$

From this the values of h' given in the sixth column of table 4 have been deduced.

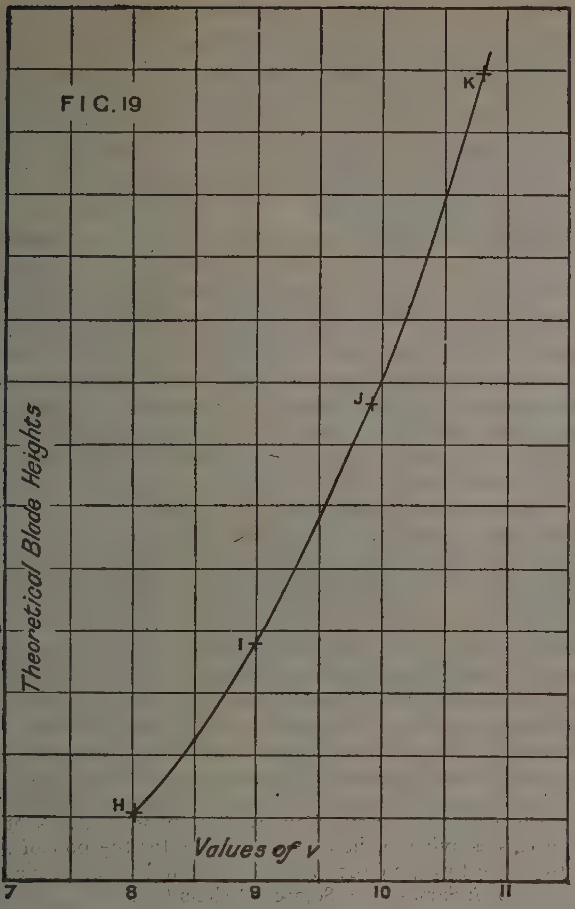

FIG. 19

In fig. 19 the blade heights corresponding to sections H, I, J and K have been plotted, and from this graph we find that in the ideal turbine, if we have a stage at $\nu = 10{\cdot}81$ then the blade heights at stages 9·81 and 10·81 will be as follows:—

ν	8·81	9·81	10·81
h	9·20 in.	13·14 in.	18·94 in.

TABLE 4.

Section	log p	U	V	ν	h'	$h'(\bar{d})^2$	h	$\frac{dn}{d\nu}=\frac{h}{h'}$	n
A	1·3010	0	20·08	0	·710	1704	1·045	1·477	0
B	1·1400	14·9	27·89	1·306	·986	2367	1·431	1·452	1·89
C	0·9790	29·3	38·74	2·542	1·37	3287	1·940	1·416	3·69
D	0·8180	43·0	53·79	3·73	1·90	4565	2·60	1·370	5·34
E	0·6570	56·2	74·70	4·88	2·64	6339	3·47	1·311	6·89
F	0·4961	68·8	103·8	5·97	3·67	8792	4·58	1·250	8·28
G	0·3351	80·9	144·1	7·02	5·09	12230	5·97	1·172	9·56
H	0·1741	92·5	200·1	8·03	7·07	16980	7·68	1·087	10·68
I	0·0131	103·6	277·8	8·97	9·82	23570	9·79	·996	11·70
J	$\bar{1}$·8521	114·3	385·9	9·93	13·64	32740	12·40	·910	12·60
K	$\bar{1}$·6911	124·6	535·9	10·81	18·94	45470			

As the first step to the design of a practical turbine the blades at $\nu = 9{\cdot}81$ and $\nu = 10{\cdot}81$ must be replaced by two blades of equal height, say $\bar{h}$, which must be such that these two blades will pass the same weight of steam per second as the blades they replace. As a first approximation, the required height is equal to the height given in fig. 19 corresponding to $\nu = \frac{9{\cdot}81 + 10{\cdot}81}{2} = 10{\cdot}31$. This height is 15·7 inches. This approximation with blades so long in proportion to the drum diameter is not a very good one, although when the blades are not excessively long this simple rule gives quite good results. To determine a more accurate value of $\bar{h}$ we make use of equation (4) which in this case may be written as

$$(\bar{h})^2 = \frac{2 + \log_e \frac{18{\cdot}94}{9{\cdot}20}}{2} \cdot \frac{6}{\left(\frac{1}{9{\cdot}20}\right)^2 + 4\left(\frac{1}{13{\cdot}14}\right)^2 + \left(\frac{1}{18{\cdot}94}\right)^2}$$

where the factor on the right is the mean value for the value of $\frac{1}{\Omega^2}$ as deduced from Cotes' rule for the mean value of a function defined by three equidistant coördinates, and which is exact for any curve which can be adequately defined by 4 ordinates.

From this expression we get $(\bar{h})^2 = 216{\cdot}2$, whence $\bar{h} = 14{\cdot}7$, showing that the provisional value obtained from the diagram was about 7 % too long. It is only at the L.P. end of a turbine, however, where the blades are long and where the pressure drop per blade is high, that the error attains any such magnitude.

If we use semi-wing blades for these two rows, the height will be two-thirds of the figure given, or 9·8 inches. Let it be taken at $9\frac{3}{4}$ in., so that the drum diameter is $49 - 9\frac{3}{4} = 39{\cdot}25$ in., and to this diameter the blading of the ideal turbine must be reduced by means of an appropriate "transfer" formula.

If h denote the height of the blades after transfer to a drum of diameter D and h' the height of the blades of the ideal turbine as already calculated, all of which have the same mean diameter $\bar{d}$. Then we must have $h(h+\text{D})^2 = h(\bar{d})^2$ and $\frac{dn}{d\nu} = \frac{h}{h'}$.

Here n denotes the number of blade rows in the practical turbine corresponding to ν rows of blades in the ideal turbine.

Values of $h(\bar{d})^2$ are tabulated in column 7 of table 4 and from these values the corresponding values of h are readily deduced by means of a slide rule. This is done by assuming a provisional value of h. Calling this provisional value a a better value of h is got by writing

$$h = \frac{h' d^2}{(a + \text{D})^2}.$$

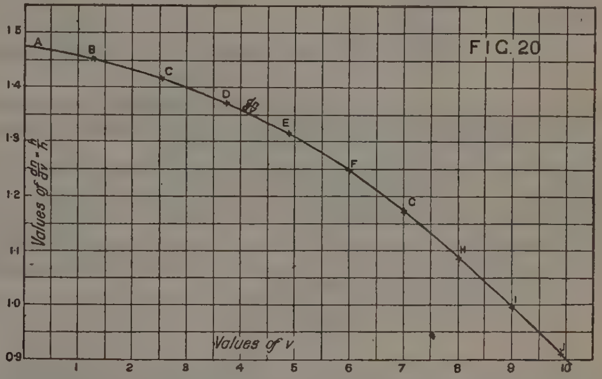

FIG. 20

A still closer value is then obtained by repeating the process. At the end of each operation the value of $\frac{h}{h'}$ is also found, and is entered in the adjoining column. These values of $\frac{h}{h'} = \frac{dn}{d\nu}$ have been plotted in fig. 20 and from them the value of n corresponding to any stated value of ν can be determined, by means of Cotes' formula which may be written

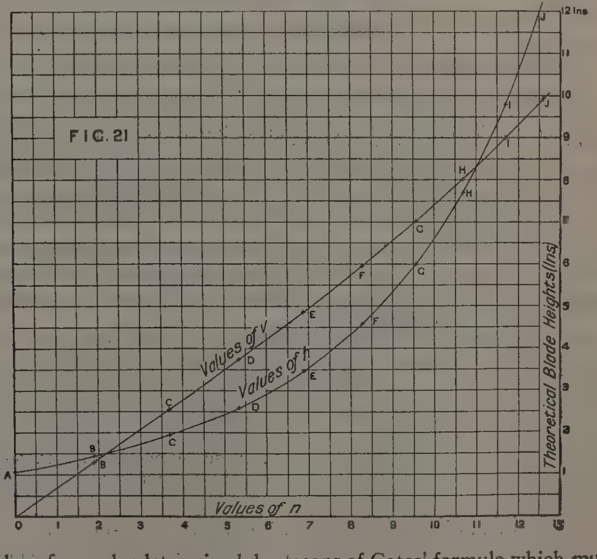

FIG. 21

$$n = \frac{\nu}{6}\left\{\left(\frac{dn}{d\nu}\right)_0 + 4\left(\frac{dn}{d\nu}\right)_{\frac{\text{N}}{2}} + \left(\frac{dn}{d\nu}\right)_{\text{N}}\right\}.$$

Thus with $\nu=9{\cdot}92$ we note that $\left(\frac{dn}{d\nu}\right)_o=1{\cdot}477$, $\left(\frac{dn}{d\nu}\right)_N=\cdot 90$ and $\left(\frac{dn}{d\nu}\right)_{\frac{N}{2}}=1{\cdot}311$, whence $n=12{\cdot}60$. Proceeding in this way the figures in the last column of table 5 are obtained. In fig. 21, h is plotted against n as also is ν^{NP}.

Stages 9·81 and 10·81 of the ideal turbine have already been dealt with so that in proceeding further with the design we start with stage 8·81 of the ideal turbine. From fig. 21, it appears that $\nu=8{\cdot}81$ corresponds with $n=11{\cdot}51$ and from the curve of blade heights we get the following values for h

$$\begin{array}{cccc} n = & 9{\cdot}51 & 10{\cdot}51 & 11{\cdot}51 \\ h = & 5{\cdot}94 & 7{\cdot}87 & 9{\cdot}38 \end{array}$$

As before, an approximate value of $\bar{h}$ to replace the blades at 10·51 and 11·51 is the value of h at $n=11{\cdot}01$. This value of h is 8·31 inches. Replacing the blades at the high pressure stages $n=0{\cdot}51$ and $n=1{\cdot}51$ the same method gives us $h=1{\cdot}29$ inches.

If we determine the corrections for these two extremes the corrections for the intermediate groups can be determined with sufficient accuracy by linear interpolation. Equation 4 in this case becomes

$$h^2(h+D)^2=\frac{n+\log_\epsilon\frac{h'_n}{h'_o}}{n}\,\frac{6}{\frac{1}{h_o^2(h_o+D)^2}+\frac{4}{h^2_{\frac{N}{2}}\left(h_{\frac{N}{2}}+D\right)^2}+\frac{1}{h_n^2\,(h_n+D)^2}}$$

which gives h as 8·259 in. in place of 8·31 in. as read from the curve.

At the high-pressure end of the turbine the calculated value is 1·321 in. as against 1·33 as read from the curve.

It will be seen that with the blading thus derived the pressure at the first row of guide blades is that corresponding to $n=-0{\cdot}49$ instead of to $n=0$ as it should be. By plotting log p against n we find that the pressure correspondiug to $n=-0.49$ is 21.5 lb. per sq. in. instead of 20 as assumed. This can be corrected by slightly increasing the height of the first group of blades, for which purpose we can use the approximate expression

$$\frac{h_c}{h}=\frac{\sqrt{p_c^2-p_o^2}}{\sqrt{p_1^2-p_o^2}}.$$

In this expression h_c denotes the corrected value of h, p_c the pressure corresponding to $n=-0{\cdot}49$, and p_1 the designed pressure in front of the first row of guide blades, whilst p_0 denotes the pressure on discharge from the group.

We thus get $h_c=1{\cdot}45$, so that the computed blade heights are as follow:—

TABLE 5.

Group No.	I.	II.	III.	IV.	V.	VI.	VII.
No. of moving rows in group	1	1	1	1	1	1	1
Calculated blade height in in.	1·450	1·710	2·960	3·540	5·320	8·310	9·800
Allowance for tip clearance	0·093	0·096	0·108	0·123	0·141	0·171	0·186
Net calculated blade heights	1·357	1·614	2·842	3·416	5·179	8·139	9·714
Actual blade height	$1\frac{3}{8}$	$1\frac{5}{8}$	$2\frac{7}{8}$	$3\frac{1}{2}$	$5\frac{1}{8}$	$8\frac{1}{8}$	$9\frac{3}{4}$

The length of the blades in group No. VII. is for semi-wing blades as previously explained. In the above table the allowance for tip clearance is not the actual tip clearance, but the amount by which the blade heights must be reduced in order that no more steam shall pass than if there were no tip clearance whatever. This allowance has been taken as 0·002 in. per in. of drum diameter plus 0·010 in. per in. of blade height, and this amount is subtracted from the computed blade heights.

It should, perhaps, be noted that whilst in the ideal turbine the velocity of efflux from a stage is strictly proportional to $\sqrt{q}$ this condition is only approximately fulfilled in the case of a turbine with constant drum diameter.

Had the above turbine been designed to run at 1,000 revs. per minute instead of 2,400, many more rows of blading would have been necessary, and to avoid large losses by the carrying over of kinetic energy to the exhaust a larger drum would have been advisable.

It may be mentioned that the normal blades for which the coefficient in equation 5 applies are of the old type with the opening gauged to about one-third the pitch, these blades being the ones used in the turbine from the test of which the coefficient was deduced. Certain makers now use a different form of blade having a parallel tail, a departure which it is difficult to justify.

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(R. H. P.; H. M. M.)

TURKESTAN, WEST (*see* 27.419).—After the revolution in Russia, Western (or Russian) Turkestan became a member of the Federation of Soviet Republics. It was divided into five provinces: Semiryechia, Syr Daria, Ferghana, Samarkand and Trans-Caspia. The exact position of the native states of Bukhara and Khiva, which were later occupied by the Soviet Government, remained obscure. Each of the five provinces, by the constitution of the Republic, is governed by a provincial Executive Committee or council which sends representatives to Tashkent, the capital, where the Central Executive Committee of the Republic meets. This Committee consists of 75 members, sending representatives to Moscow to the meetings of the Central Committee of the All-Russian Federation of Soviet Republics, but the Turkestan Republic showed itself very little inclined to accept the control which the Central Committee at Moscow endeavoured to maintain. The Turkestan Committee elects a small council, forming a kind of cabinet and having control of the different branches of the administration. The right of voting being confined to members of the Communist party, the Government represented by no means one really elected by universal suffrage but rather a dictatorship of the lower classes. The Russians in Turkestan form only about 5% of the total pop., and since most of the rural Mussulman pop. take no part in the voting, the country is governed to all intents and purposes by men elected by the very small proportion of Russians of the lower classes living in the towns. Figures for the pop. of some of the large towns in 1916 were:—Khokand, 112,000; Namangan, 103,000; Samarkand, 89,000; Tashkent, 201,000. All trade and industry were in 1921 at an absolute standstill owing to Bolshevism.

Great success had attended the cultivation of cotton, and the high prices obtained for the Turkestan article (most of which is grown in Ferghana, where 742,000 acres were cultivated in 1915), coupled with the increase of railways, led to the abandonment of corn in favour of the cultivation of cotton, and, although W. Turkestan is a good wheat-producing country, cereals were actually imported from Russia and Siberia and cotton exported in exchange. Factories for cleaning and baling raw cotton and for extracting cotton oil were set up, and employed a large number of people, mostly in Ferghana. These factories were worked by crude oil from the Baku wells. The total area under cotton in 1916, including that grown in Khiva and Bukhara, was 1,838,215 acres, yielding about 18,000,000 poods or 290,000 tons of raw cotton.

The cultivation of vines had also increased, and wine industries had been initiated, chiefly in Tashkent and Samarkand. A larger product of the vine was in the form of raisins and currants, of which quantities were exported to Russia.

Large quantities of fruits—apples, pears, quinces, peaches, nectarines, apricots, grapes and melons—were exported by special trains to central Europe, where the Turkestan crop was received a short time before the south European supplies ripened.

Minerals remained for the most part unworked, though the profitable coal fields and oil wells in Ferghana were used when disturbances in Trans-Caspia cut Turkestan off from the Baku oil, on which it relies entirely for its industrial life. Mining is hampered by the lack of roads and by the want of machinery.

A very large industry in Bukhara is the export of Astrakhan lamb skins (called locally Karakul). Enormous flocks of these sheep are kept in the deserts around Bukhara. Attempts to breed these sheep in other countries have always resulted in a deterioration in the quality of the skins owing to some peculiarity of climate. Before the World War about $1\frac{1}{2}$ million skins were obtained annually at a cost of 6 to 8 roubles each.

There are practically no branch roads in Turkestan, and the only means of transport in bulk is either by wagon on the few main roads, or by railway. The largest new railway project is the Semiryechenskaya railway. This line was intended to leave the Orenburg–Tashkent line at Arys (146 versts N. of Tashkent) and go to Vierni, a distance of about 900 versts. Actual construction was completed to Burnoi (220 versts) when Bolshevism came to crush all enterprise and initiative. Some work was done E. of Burnoi, but the line was not laid and no trains ran in 1921 beyond Burnoi. It was intended later to continue this line from Vierni to Semipalatinsk (about 900 versts) and join up with the Trans-Siberian line. Important railway lines were constructed from Kagan (the station on the main line 10 m. S. of Bukhara City) to Karshi and Kerki, whence the line runs up the right bank of the Oxus to Termez on the Afghan border. A branch runs from Karshi to Kitab, and the intention was to join Kitab to Samarkand. All these lines were destroyed by the Bukharians in 1918 but could presumably be easily repaired. The total length of these railways in Bukhara was about 400 m. and there are, in addition, lines from Andijan to Jalalabad coal-fields, about 45 m., from Khokand to Namangan, about 57 m., and from Fechenko (N. E. of Skobelev) to Sharikhan, about 11 miles. (F. M. B.)

TURKEY (NATIONALIST).—An organized State of Nationalist Turkey, in its wider aspect an Anatolian State created by Turkish Nationalists in 1919–20, was the outcome of the terms of peace dictated to the Ottoman Empire by the victorious Powers after the war of 1914–8. A severe peace was expected by the Turkish rulers and people. They were resigned to the loss of Turkish Arabia, Palestine, Syria, Mesopotamia; to stringent foreign control of Turkish finance; to the reimposition of the Capitulations; to international control of the waterway between the Aegean and the Black Sea; and to measures for the protection of Christian populations in Turkish territory. Such curtailments of territory and supervision of their internal affairs would doubtless have received their reluctant acquiescence. But the surrender of Ottoman territory—of Smyrna and Thrace—to Greece as part of the terms of peace was a matter that touched all Turks to the quick. The Turkish Nationalist movement received its first great impulse when a Greek force, acting on a decision of the Supreme Council, occupied Smyrna and the surrounding territory in May 1919. Nationalist plans were rapidly matured and put into execution.

General Mustafa Kemal Pasha, an officer who had fought with much credit in the defence of Gallipoli, left Constantinople early in June 1919, ostensibly for his military district in Asia Minor. On June 19 he outlined the Nationalist plan for saving the country at a public meeting held at Khavsa, 50 m. inland from Samsun. It was the official opening of the Nationalist movement. In brief, the scheme was to create a government and army in the heart of Asia Minor to resist the partitioning of Turkish territory within "Armistice limits." The definition of area referred to the armistice of Mudros of Oct. 30 1918, and thus excluded Mesopotamia, Syria and Arabia from the territory to be preserved, but included Smyrna and Thrace. For this area Nationalists professed willingness to accept a single Great Power as mandatory; they would not, however, accept more than one. The movement spread rapidly. A provisional government was set up at Erzerum in August. In Sept. a National Congress was held at Sivas, which affirmed the purpose not only of maintaining the integrity of Ottoman territory within armistice limits, but of upholding the Caliphate and Sultanate. A few weeks later the seat of the government was changed to Angora, as a more central position. By the end of 1919 the Nationalist movement had been accepted by nearly the whole of Asia Minor, and the Ottoman Government at Constantinople became a government representing little, and wielding no authority.

Behind the Nationalist movement was the military class of Turkey, and the still powerful secret society known as the Committee of Union and Progress. In fact, though the movement represented on the part of the people a genuine patriotism and desire to resist what was deemed as aggression, it is doubtful if the Committee were not its real founders. At all events Talaat Pasha, Enver Pasha, Djemal Pasha, Sais Halim Pasha, and many other Committee leaders became exceedingly active in the Nationalist cause. They gave it, too, the Panislamist policy which the Committee had followed when in power behind the Ottoman Government at Constantinople. Owing to this connexion between Turkish Nationalism and Panislamism Moslem sympathy was excited in British India. Doubtless the agitation was arranged, but nevertheless it carried weight. A "Caliphate Committee" to oppose the imposition of harsh terms of peace on Turkey was formed, and a delegation sent to London. The delegation laid much stress on a speech made by Mr. Lloyd George on Jan. 5 1918, in which he said: "Nor are we fighting to deprive Turkey of its capital, or of the rich and renowned lands of Asia Minor and Thrace which are predominantly Turkish in race." This speech the delegation, and other supporters of a lenient policy towards Turkey, claimed as a pledge. At the Peace Conference of the Allies held in London early in Feb. 1920, to discuss the terms of the Turkish peace, it was decided to leave Constantinople in the possession of Turkey. At this time the Nationalists began military operations against Cilicia. Turkish troops drove the French out of Marash and other places in this region, and used their success to massacre great numbers of Armenians. Simultaneously the Nationalists organized resistance in Thrace under Col. Jaffas Tayar Bey.

The Government at Constantinople were now taken with the idea that they could suppress the Nationalists from within. They sought to rally to their side the sober and religious masses of the Turkish population by the joint influence of the Sultan as Caliph and of the Sheikh ul Islam. An Imperial decree was also issued declaring the Nationalists rebels. At the same time a military effort was made by sending Anzavour Pasha with a considerable force to occupy Brusa. But the appeal of the Caliph and the Sheikh ul Islam had little effect; the decree as to rebels was ignored; and Anzavour Pasha's force deserted to the Kemalists before Brusa was reached.

The Supreme Council sitting at San Remo finally decided the terms of the Turkish peace in April 1920, and the treaty was handed to the Turkish delegates on May 9. The terms of the treaty caused the fiercest hostility in Angora. The Great National Assembly declared for resistance to the last, and formally denied the right of the Constantinople Government to conclude any treaty on behalf of Turkey. It declared further that no treaty made by that Government would be recognized by the Nationalists. It was evident now that nothing but the application of force by the Allies would compel acceptance of the treaty by the Government at Angora. On the proposal of M. Venizelos, then the Greek premier, the Allies therefore entrusted the task to Greece of dealing with the Nationalist forces in western Asia Minor, and imposing the treaty. In support of Greece the Allies undertook minor naval operations. During June and July 1920 the Greek armies conducted a campaign in which they overran the part of Asia Minor lying westward of a line drawn from Brusa to Ushak in the valley of the Menderez. A Greek army also occupied Thrace. As the result of these operations, which destroyed any hope the Ottoman Government may have had of obtaining better terms by delay, the treaty was signed by the Ottoman delegates on August 20 1920.

In spite of their defeat at Greek hands the Nationalists showed no inclination to accept the treaty. Instead, they turned more and more towards Bolshevik Russia, with hostility to the Allies as the common cause in pursuit of which each could assist the other. Arms, munitions and money were the chief Nationalist needs; and for her own ends Russia, to some extent, supplied them. In return she took the opportunity for spreading Bolshevik principles in Asia Minor, though with little success among Moslems, who held that Bolshevik theories were in opposition to the teachings of Mahomet. Towards the end of 1920 the Government of Constantinople made an attempt at peace with the Nationalists by sending a "Mission of Reconciliation" to Angora. But this effort, too, had no results. Nothwithstanding defeat in the West, and risings and discontent within the area over which they had power, the Nationalist Government was in a fairly strong position. Nothing but force could overthrow them, and the nature of the country and absence of roads made the application of such force from outside a dangerous and exceedingly difficult undertaking. They were in alliance with Bolshevik Russia. Their country was self-supporting. They had but to wait, and time would assure their ultimate success.

Meanwhile Bolshevik Russia and Nationalist Turkey endeavoured to secure better land communications between their territories, to bring, in fact, their territories to a common frontier. Russia was established in the Transcaucasian Republic of Azerbäijän; but between Turkey and Azerbäijän lay the Armenian Republic of Erivan; and the line of railway from Azerbäïjän to Turkish territory passed through the hostile Armenian State. In Sept. 1920 the Nationalists, in agreement with Russia, therefore began military operations against the Republic of Erivan. The upshot was that by the end of Nov. the Republic was crushed, its territory occupied, many thousands of its people massacred, its Government overthrown and replaced by a Soviet Government which accepted Russian mediation and onerous terms of peace. These included the cession of the districts of Kars and Ardahan to Turkey, together with additional territory traversed by the railway from Azerbäïjän to the Turkish frontier.

Nationalist leaders had always urged that time was on their side. During Dec. 1920 the elections in Greece overthrew the Government of M. Venizelos; and the return of the ex-King Constantine took place the same month as the result of a plebiscite. These events changed the whole policy of the Allied Powers towards Greece. But a settlement of Turkish questions remained as necessary to the Allies as ever. They therefore invited the Greek and Turkish Governments to send delegations to a conference in London in Feb. 1921, for the purpose of reaching, if possible, a compromise on the Treaty of Sèvres. The condition was made that the Turkish Delegation should include representatives of Angora. The conference finally made an offer to the two delegations, to be accepted or rejected as a whole by their Governments. The offer proposed various important changes in the Treaty, including evacuation of Constantinople by the Allied garrison, an increase in the strength permitted the Turkish army, and the granting of autonomy to the Smyrna zone under Turkish sovereignty, and a Christian governor. These terms were promptly rejected by the Greek Government, who then reopened hostilities against the Nationalists in opposition to Allied advice. The Greek aim was to reach Angora, and destroy the Nationalist army. At the end of March, however, the Greek army was heavily repulsed before Eskishehr and compelled to retreat to its original positions before Brusa and Ushak. At the beginning of July another Greek offensive was made, this time on a much greater scale. Afium Kara Hissar, Kutahia, and Eskishehr were captured, notwithstanding determined Turkish resistance, and the advances continued along the railway towards Angora. But in a great battle at the end of Aug., on the line of the Sakaria river, the Greek army failed to break through the Turkish entrenchments, and again retreated, this time to positions covering Eskishehr and Afium Kara Hissar. (W. J. C.*)

TURKISH CAMPAIGNS.—Under this general heading the operations in the World War involving Turkey in (1) the Caucasus, (2) Mesopotamia, (3) the Sinai area, and (4) Syria, are described.

(I.) Operations on the Caucasus Front

A firm grasp of the military-geographical conditions on the Russo-Turkish frontier is an essential preliminary to an understanding of the operations in the Caucasus. In this region war, though waged with modern weapons, must be conducted by very old-fashioned methods; for the absence of railways and the rarity of good roads on the Turkish side from the first militated against, and indeed largely precluded, strategic mobility. In the vast area, 600 m. long by 300 wide, bounded by the S. coast of the Black Sea, the Russo-Turkish frontier, Lake Urmia and a line thence by Urfa to Angora, not a single railway exists. The only roads are the steep mountain track from Trebizond to Erzerum, a somewhat easier main road from Angora by Sivas and Erzinjan to Erzerum, the very steep mountain road from Kharput to Erzerum which at Garib meets the road crossing the wild Armenian Taurus from Diarbekr, the highway Mosul–Bitlis–Mush–Erzerum, and lastly the old caravan route from Erzerum by way of Bayazid into Persia. The only other means of communication are narrow tracks, made by use only and impossible to trace after a snowfall; they serve to indicate to the troops their lines of advance, but can in no sense be said to facilitate their march. Transport, apart from pack-animals, can only move in the few roads mentioned and even on these, which are all in bad condition, only with extreme difficulty. The rivers as a rule can only be crossed at the fords, as any bridges have long ago broken down, for in Turkey no attempt is made to keep up the roads, the high dues levied for this purpose disappearing into the pockets of the officials.

It must always be remembered that a Turkish army operating in the region of Erzerum has a line of communications over 600 m. long to the nearest railhead at Angora or Ulu Kyshla, from which points every shell has to be brought up by camel transport, taking six weeks in transit. It would, therefore, have been of urgent importance to the Turks, for this reason alone, to gain complete command of the Black Sea, which would have made it possible for them to send supplies for the army by sea from Constantinople to Trebizond and thence overland by the comparatively short route to Erzerum. However, they only succeeded for a short period at the beginning of the war, in asserting a sufficient superiority over the Russian Black Sea fleet to allow of safe transit by sea to Trebizond, and it became impossible to count on this. The present writer had in 1913 drawn up for the Turkish general staff a memorandum, in which he fully discussed and recommended the reconstruction of the wholly antiquated fortress of Erzerum, of which the newest works dated from 1864, the erection of barrier forts to secure the Trebizond road, and other measures aimed at facilitating future operations in this area. But this important problem received no attention, and the future theatre of war was left in such a condition as to render impossible the defence of the frontier against a resolute attack.

The main theatre of war of the eastern Anatolian campaigns of 1914–8 was Turkish Armenia. The geographical area of Armenia had no clearly defined limits, having become nothing more than a geographical term for the districts of Russia, Persia and Turkey, which were inhabited by people of Armenian nationality. The geographical limits of Armenia are clearly defined only in the Caucasian isthmus, where the boundary is formed by the little Caucasus, stretching south-eastward between Tiflis and Akhaltsikh. In Persia the Armenian population in the province of Azerbäïjän melts gradually into the Persian from Lake Urmia eastward. To the S. the ethnographic boundary corresponds more or less with the line of the Armenian Taurus and the parts of the Taurus stretching from the Cilician frontier to the Euphrates gorge; but northern spurs of Kurdistan jut out into Armenian territory, *e.g.* especially in the region of Dersin, which extends with its population of Kurdish tribesmen, who have a mortal feud with the Armenians, to just S. of Erzinjan. In the W. conditions are the same as in Persia. As one goes towards Sivas, the Armenians melt away into the Turkish Mahommedan population, while to the N. Lazistan cuts off the Armenian highlands from the sea. The course of the Juroch may be taken as the frontier between Pontus and Lazistan on the one side and Armenia on the other. In all this "Armenia" there is no territory inhabited exclusively by Armenians. As against this, countless Armenians are dispersed all over Turkey, and these communities of the dispersion are frequently, as in Adana (Cilicia), numerically strong and economically predominant.

Turkish Armenia is in parts a fertile land, but the climate is most unfavourable from the military point of view. Long cold winters, with heavy and frequent snowfalls, render almost impossible all strategic movement, and large bodies of troops are always in danger of decimation by frost and hunger, while the short summer brings with it oppressive heat. Turkish Armenia, inside the stupendous mountain range which cuts it off from Russian Armenia, is a tangled mass of hills and valleys. The differences in height between the mountain ridges and the deep-cut gorges is very marked. The population is poor and scattered, so that in areas hundreds of square miles in extent there are neither tracks nor habitations to be found. Much of Turkish Armenia has never really been explored, and the representation of it on the maps is largely mere guesswork. Erzerum itself is one of the highest placed towns in the world; it stands over 6,000 ft. above sea-level. Its population was estimated (much too highly) at 120,000 in 1913.

For the Russians the strategic situation was much more favourable than for the Turks. Preparations for the eventuality of a war with Turkey had for some time been taken in hand by the Russian general staff. Russia fully realized the importance of possessing the Armenian plateau, with its Christian population and great mineral wealth. The frontier fortress of Kars, which with its whole district had passed to Russia in 1878, was modernized, placed in a permanent state of defence, and well provided with guns, ammunition and supplies. A lateral line through Transcaucasia from Baku by way of Tiflis to Poti on the Black Sea was constructed, from which branch lines led to the Turkish frontier. The network of roads was also carefully completed and the frontier area thus converted into an excellent base for strategical deployment.

From the first, then, the Russians had the better strategic position. In this country whichever side was nearest to its railways was bound to have a decisive strategical advantage over the other, especially if in addition it possessed a better network of roads. Enver Pasha, however, failed to realize this. As a strategist he was a hopeless amateur, who believed that his personal will in Constantinople could remedy in a moment the age-old defects of the Turkish military system and the Turkish general staff.

Long before Russia, in Nov. 1914, declared war on Turkey, Gen. Liman von Sanders had planned to create a diversion in favour of the German and Austrian armies in the eastern front by landing several Turkish corps near Odessa and advancing into the Ukraine, where he hoped to rally the numerous German colonists to his standards. This scheme may be considered to have been the one great strategic error which could be laid to the account of Liman von Sanders: for it violated all those canons of prudence, the disregard of which the general himself so often and vigorously censured in the projects of others.

Liman von Sanders earmarked for this operation the I., IV., V. and X. Corps, and proposed to lead the army in person. It is easy to understand that the Turkish High Command looked with disfavour on this plan, if only because it needed all its available forces for operations in the Turkish theatre of war. The project of effecting a landing at Odessa held out no promise of success; for the expedition could never have ventured far from its ships, and could therefore have exercised no effect on the general strategic situation. It might perhaps have served as a centre for a rising in the Ukraine, whose agents were in Constantinople. But, in view of the military strength of Russia at that time, the success of such a rising was more than doubtful. The adventurous scheme was finally abandoned on Sept. 18 1914, largely because the commander of the fleet considered it impossible to guarantee either the smooth disembarkation of the troops or the maintenance of the line of communications by sea between Odessa and Constantinople. The Corps comprising the I. Army were also needed for political reasons in the Adrianople area, where they were to be used to cover the rear of Bulgaria against a Rumanian attack, should the former commit herself to an offensive against Serbia.

For Liman von Sanders' scheme was now substituted Enver's great plan for an advance against Russia, to be carried out by the III. Army, assembling in Sept. and Oct. at Erzerum, under the incompetent Hasan 'Izzet Pasha (not to be confused with the Ahmad 'Izzet who later became commander-in-chief).

This army consisted of the IX. and XI. Corps, the 2nd Cav. Div. and the so-called 2nd Res. Cav. Div. made up of Kurdish irregular bands. This reserve cavalry, useless for fighting purposes, showed great skill in massacring and plundering the defenceless Armenians whenever opportunity offered. In Nov. the X. Corps also joined the III. Army. The condition of the troops may be gathered from a report of the middle of Nov. 1914, according to which the X. Corps alone was short of 17,000 overcoats, 17,400 pairs of boots, 23,000 tents and 13,000 packs—and this just before the Armenian winter, in a country where bivouacking is unavoidable on account of the settlements being far too thinly scattered to allow the housing of large bodies of troops. The III. Army was brought up to strength by reserves from E. Anatolia; they were excellent military material, but shortage of clothing and food in the autumn soon caused them to desert in masses.

Enver's plan of operations involved a frontal advance by the XI. Corps along the Erzerum–Sarikamish road, combined with an attack against the Russian right flank by the two other corps moving to the left over the mountains in the direction of Olti, with the idea of cutting the Russians off from Kars and capturing that fortress. The present writer repeatedly told the Turkish High Command that the whole operation was impossible of execution, and Liman von Sanders endeavoured in a personal interview with Enver to dissuade him from carrying out his plan, which was foredoomed to failure. The latter, who had an exaggerated idea of his own capacity, refused to listen to advice or to take warning. Not only would he not see that his scheme was impracticable, but he expressed to Liman von Sanders his ultimate intention of marching by way of Afghanistan against India. No better proof could be desired of Enver's incapacity to understand what strategy means.

As a matter of fact the scheme as it stood was never put into execution, for the Russians anticipated it by undertaking an advance on Erzerum with a Cossack division and a mixed bde. Hasan 'Izzet attacked them at Köprü Keui on Nov. 8, and by the 12th he had succeeded in taking the Russian positions. Meanwhile, however, the I. Caucasian Corps had taken up a position in rear near Asap, which resisted all the efforts of the Turks to storm it, though they gained ground at certain points. The Turks were already running short of ammunition and the arrival of parts of the II. Turkestan Corps to reinforce the Russians seemed to indicate that the Turkish superiority in numbers would shortly be lost, if it had not already been so. Hasan 'Izzet therefore withdrew the III. Army, gave up all idea of any further offensive, and turned his attention to completing the equipment and supply services of his troops, who were even now beginning to suffer privations. This wise decision must largely be attributed to the influence of his German chief of staff, Guse. The losses of the Turkish army in these first encounters amounted to 1,500 killed, 5,600 wounded—no inconsiderable proportion of the effective strength of the army, estimated at some 90,000 men.

At this point, however, Enver took the bit between his teeth. He ordered a detachment which had been assembled under a German officer at Haidar Pasha to be transported across the Black Sea and landed W. of Batum, and to advance thence into Russian territory—in fact, to attack Russia. The detachment pushed forward boldly to Ardahan, where it encountered overwhelming hostile forces and had to retire to the Russo-Turkish frontier. Enver himself, burning with impatience, and his German chief of staff, Bronsart von Schellendorf, who also was no strategist, sailed on board a warship for Trebizond. Leaving Constantinople on Dec. 6 he reached Erzerum on the 21st, and, taking over the command of the III. Army, set to work at once to carry into action his pet scheme outlined above. The various corps received the following missions. The IX. Corps was to drive the Russians from the pass between Erzerum and Olti and advance on the latter place. The X. Corps, moving from Erzerum northward, was to wheel round south-eastward in front of Olti in order to cut the line of retreat of the enemy in conjunction with the IX. Corps, marching parallel to it. The Russians would then be attacked frontally by the XI. Corps, as soon as the turning movement succeeded.

This scheme was a real piece of geometrical strategy, which in view of the bitter cold, the deep snow and the miserable equipment of the Turkish army was bound to turn out disastrously. Enver, however, persisted in his attempt to ape the deeds of Alexander the Great, and the operation proved a complete failure. The IX. Corps successfully forced the pass, but got utterly out of hand in the tangle of snowclad and pathless mountains. With its units inextricably mixed up it encountered near Sarikamish a superior and well-ordered enemy force, and suffered a complete defeat. The X. Corps, which had an even longer road to traverse, also arrived piecemeal on the battlefield on Jan. 4 1915, when the IX. Corps was already pouring back in complete disorder. The X. Corps shared its fate and retreated in disordered haste over the mountains. Enver attempted to retrieve the position by attacking with the XI.

Corps. Naturally enough, this isolated attack was broken without producing any effect beyond making it possible for the remnants of the IX. and X. Corps to escape to Erzerum.

The III. Army, which owing to the heavy snow had been unable to take its field artillery with it, had suffered appalling losses, which were due not so much to the fighting as to the fact that the troops had had to bivouac in the snow without tents and practically without food. An epidemic of typhus now broke out in its ranks. After the offensive the strength of the army had been reduced to the following totals: IX. Corps 2,000, X. Corps 2,400, XI. Corps 2,400, Artillery and 2nd Cav. Div. 4,800; or 12,400 in all. The army had thus lost 86 % of its effectives, and had suffered a disaster which for rapidity and completeness is without parallel in military history. The miserable survivors were in a pitiable condition. Enver Pasha, with Bronsart von Schellendorf, at once left the army, handing over the command to Havis Hakki Pasha, his brother-in-law, and returned to Constantinople; he never again during the World War attempted to conduct operations, though he often interfered with the decisions of the other army commanders with disastrous results. Thus, soon after the defeat E. of Erzerum, he ordered the despatch of the V. Corps to that theatre from Constantinople, and was only at the last moment persuaded by Liman von Sanders to cancel his instructions. During his return journey he also announced that no orders other than his own should be carried out by the troops, and instructions to this effect were sent to all the Turkish armies. The greatest confusion would have resulted had not the Grand Vizier cancelled this ridiculous order. Havis Hakki Pasha dying in Feb. of typhus, the command was given to Mahmud Kiamil, who knew next to nothing of strategy and owed his rise solely to political considerations and his influential connexions.

It was an undeserved piece of good fortune for Turkey that the Russian losses and the increasing severity of the weather forbade any pursuit, and that the situation on the Polish front was absorbing all the available Russian troops and preventing the despatch of reinforcements to the Caucasus. There ensued therefore a cessation of all activity in this quarter, and Mahmud Kiamil had time to reorganize his army. By occupying the Id and Olti passes he secured his left flank against any raids and surprise attacks which the Russians might be planning. Farther still to the left the small detachment which had carried out the push into Ardahan was wintering at Artvin in Russian territory. It consisted of 1,000 regulars, reinforced by volunteers raised in Constantinople by the Committee of National Defence with the assistance of the German military representatives. More of these somewhat inferior troops were sent to the detachment in Feb. and March, and it was resolved to attempt a *coup de main* against Batum. The fortifications of the town, however, though antiquated, were quite sufficient to repel the attack of these unorganized and half-trained men, and the enterprise was a complete failure. This was all the more unfortunate for Turkey, as she had found herself unable, despite the presence in the Black Sea of the "Goeben" and the "Breslau," which were manned by German crews but had been transferred to the Turkish fleet, to maintain uninterrupted command of that sea. During 1915 the two German ships, the only effective portion of the Turkish navy, were needed to coöperate in the defence of the Dardanelles; so the Russians were able once more to venture out to sea and shell the coal-mines of Zunguldak and Eregli and the town and harbour of Trebizond. Henceforward the line of communication of the III. Army by sea had to be given up, and it now ran overland along the railway from Haidar Pasha (opposite Constantinople) by Konia, to Ulu Kyshla (in the Taurus N.E. of Adana), where everything was loaded onto carts and camels, and proceeded by road via Kaisariyeh and Sivas to Erzinjan, there to be distributed. The length of this line from the railhead at Ulu Kyshla to the main depot at Erzinjan was some 475 miles.

Mahmud Kiamil, with the assistance of the German Lt.-Col. Guse, who was still chief of staff, succeeded during the winter months in bringing the strength of his army up to 35,000 men; most of the new recruits, however, had had little or no training. His small army had to hold a wide front of some 220 m. from the Black Sea to Lake Van, and in these circumstances Mahmud Kiamil kept the main body of his army concentrated round Erzerum, and protected the rest of the front only by small detachments. This was not difficult, particularly in winter, since few passable paths led over the frontier mountains, which are in places over 9,000 ft. high.

The Russians were not strong enough to fight a battle along the Sarikamish–Erzerum road. They therefore had recourse to wide turning movements, but not until May 1915, when the snow on the roads had melted. They first pressed the Turks back from the Olti pass and pushed on to Turtum. This village lies in a wild and precipitous valley in the midst of the high mountains, and here it was therefore possible for the Turkish reserves to stem the Russian advance. The Id pass was also occupied by the Russians. While the attention of the Turkish Higher Command was thus attracted to the N., far stronger Russian forces began, likewise in May, an offensive over the passes of the Aghri Dagh (W. of Bayazid) in the direction of Lake Van, capturing the weakly defended villages of Dutak and Melassgirt and threatening Van and Bitlis. At the same time the Armenian population rose in arms. A Turkish division, hurriedly despatched to Bitlis, suppressed the rebellion with awful savagery, but the Russians continued their advance from Melassgirt on Bitlis, and on July 13 drove its defenders out.

Again fortune favoured the Turks. The Russians, presumably too weak to venture forward, contented themselves with what they had gained. Before them to the W. of Bitlis lay the high plateau which stretches eastward from Diarbekr. Strong Russian forces might have either descended thence on Mosul and down the Tigris, thus facilitating the British operations against Bagdad, or might have pushed forward in the Euphrates valley on Kharput and turned the whole line held by Mahmud Kiamil's army, which was known to be in no fit state to offer serious resistance, and would have no alternative but to retire hurriedly on Erzinjan or to accept battle before Erzerum with its front facing S.W., with the certainty of complete destruction if it were defeated. However, nothing was done. A few detachments crossed into Persia (Azerbäijän) and occupied Urmia and a few other places W. of the lake of that name. Here, however, they were cut off by a belt of stupendous mountains over 115 m. wide from the Mosul plain, so that this enterprise had no strategic effect and merely exercised some political influence in bringing over to the side of the Russians the Armenian and Persian population of that region.

Summer passed, and as early as Sept. the first snow fell. Mahmud Kiamil had now increased his army to a strength of 58,000 men, and had in addition assembled some 20,000 recruits in special training camps in Erzerum. The governor of Erzerum was a German, Gen. Posseldt, who exerted himself in every way to put the antiquated works of the fortress in a state of defence. Lack of all material, even wood, however, prevented the construction of anything except earth-works. Erzerum drew all its wood and fuel in peace-time from the Pontic Alps, whence it had to be carried for 115 m. in carts. The Russian bivouacs near Melassgirt were constructed of wood brought up all the way from the mountain forests W. of Kars.

Although Erzerum was by no means a strong fortress, some 60 guns in its outer works and some 40 in the inner line being out of date, it was of great importance as the only road junction in the whole theatre of operations, as the capital of an area disaffected towards Turkey and the central *point d'appui* of a weak army. In Oct. 1915 the situation in Mesopotamia appeared so serious that the Turkish Supreme Command, all being quiet at Erzerum, took away from Mahmud Kiamil two divisions (the 5th and 6th) and sent them to Bagdad. And just at this moment the Russian Grand Duke Nicholas assumed command on the Russian Caucasus front, and brought with him not only reinforcements and material, but—still more important—the will to utilize them to the full.

Nicholas had no need to resort to turning movements, and decided to attack the centre of the Turkish front and break through to Erzerum. The offensive began on Jan. 11 1916, up the Aras valley, and by the 14th the Turkish positions E. of Erzerum had been carried. It was unfortunate for the Turks that at this moment Mahmud Kiamil had been called away to Constantinople, and that his German chief of staff, Col. Guse, was on sick leave after a severe attack of typhus. The temporary commander of the III. Army, ʿAbdul Kerim Pasha, was not equal to the situation. The Turkish forces, after losing heavily in a series of rearguard actions, took up a position on the heights N. and S. of Erzerum which had been hastily fortified. The Russians, who expected to overrun these defences at the first attack of their advanced guards, were checked for the moment; but a second assault, delivered by strong forces against the left of the Turkish line from Kara Gobek, proved decisive of the fate of the fortress, which fell into Russian hands on Feb. 15 1916, the troops of Gen. Yudenich advancing by surprise against the southern front, where no attack was expected.

The defenders of Erzerum had certainly put up a good fight, and the Russian claim to have captured in the fortress 100,000 prisoners, 437 guns in the inner and 374 guns in the outer forts and 200 field guns was certainly greatly exaggerated. The whole Turkish army, if we deduct the heavy losses suffered, was barely 50,000 strong, and the whole artillery of the fortress amounted to barely 10% of the figures given by the Russians.

The Turks, however, whose *communiqués* were easily the most inaccurate of all those issued by the belligerents, sent home on Feb. 16 an entirely fanciful account of what had happened: "On the Caucasus front," it ran, "in the violent position fighting which has continued for the last three days despite the cold and snow, the enemy lost 5,000 dead and 60 prisoners." The loss of Erzerum was not even mentioned, and even the Sultan and his entourage only heard of it some months later; and even when the facts were finally announced to the world the importance of the place was minimized and its evacuation represented as being a voluntary withdrawal on the part of the Turks. The Grand Duke Nicholas, far from resting content with his victory, vigorously followed up the Turks in their disordered retreat, and occupied Mamakhatun. On Feb. 24 the remnant of the beaten army crossed the Euphrates at Kotur. Mahmud Kiamil, who had resumed his command, was now replaced by Wahib Pasha; the greater part of the artillery and material had been left behind in the retreat, and he only succeeded with great difficulty in getting his troops across the river, which here flows from N. to S., and into position on the right bank on the heights of Baiburt. The V. Corps, which was arriving in haste and piecemeal from European Turkey, assisted in checking the Russian advance. In the coastal sector the detachment at Artvin, though reinforced by some units of the V. Corps, was assailed by superior forces and compelled to fall back after stubborn fighting. Maj. Hunger, the German commander, succeeded in making a renewed stand 20 m. E. of Trebizond, but by the middle of April the Russian 123rd Div. forced him back once more and occupied Trebizond.

The Turkish strategic situation had now become serious. The possession of Trebizond allowed the Russians to open up a much shorter line of communications across the Black Sea from the Ukrainian and Crimean seaports, and gave them a base close behind their front. The disadvantage of having this base behind the right wing of their army could be compensated for by reinforcing this wing, so as to avoid any possibility of its being forced away from its line of communications, while the land route to Erzerum from Kars was still in use and would be available to supply the whole army if necessary.

The Turks, therefore, had to expect that in the forthcoming spring the Grand Duke Nicholas, whose forces were continually being reinforced from the Caucasus, would resume the offensive on a large scale. The Turkish Supreme Command was now freed of all anxiety from the side of the Dardanelles, but it still maintained three armies, the I. (Essad Pasha), the II. (Ahmad ʿIzzet Pasha) and the V. (Liman Pasha), massed in the Constantinople–Adrianople area, thousands of miles from the theatres of operations, in Mesopotamia and eastern Anatolia.

The loss of Trebizond finally aroused Enver Pasha to a realization of the full extent of the strategic danger in the E., and in March the II. Army was directed to the E. Anatolian front. It was to deploy on the line Lake Van–Mush–Kigi, and advance against the Russian flank and rear in the general direction of Erzerum; it was to be brought up to a strength of 10 divisions by the addition of the forces already in the area of operations, and to be reorganized in four corps. The commander, Ahmad ʿIzzet Pasha, had been promoted commander-in-chief of the Turkish army after the Dec. armistice in the Balkan War.

The strategic plan adopted by the Turkish Supreme Command for the II. Army was as usual excellent in theory but impossible of execution. The idea of throwing a whole army on the flank and rear of the Russians must certainly have seemed seductive to anyone sitting over a map in Constantinople; for it seemed to promise a strategic encirclement, it followed famous precedents, and there was plenty of room for the manœuvre. In practice, however, the plan paid no attention to the actual conditions of time and space. The II. Army was despatched in the spring by rail from Constantinople to Ulu Kyshla; the line, which was a single one, with enormous intervals between stations, was already serving as the line of communication for the Palestine and Mesopotamia armies, so that any *rapid* transport of the II. Army was out of the question. The Turkish Supreme Command made a grave miscalculation in assuming that the army would be assembled and ready for the advance in 40 days; the distance from the railhead at Ulu Kyshla to the area of concentration (some 400 m.), which had to be covered on foot, would itself have taken up all that time. The amateur strategists at Turkish H.Q. took no account of these matters, and were mightily surprised when the event disappointed their expectations. As a matter of fact by July 8 the leading troops of the II. Army (III. Corps 7th and 11th Div.) had barely passed Malatia, and the rest of the army was still on the railway in August.

Meanwhile the situation on the III. Army front was going from bad to worse. At the end of May it had carried out a few successful minor operations; Mamakhatun and Surmene (E. of Trebizond) had been occupied, and the army command, which was now at Gumuskhane, misconceiving the general situation, proposed to carry out a powerful offensive S. of Trebizond early in July. For this purpose it suggested that the units of the II. Army already available should push forward without delay to the area S. of Erzerum—an advance which, with the weak forces which ʿIzzet Pasha had at his disposal, could only have been effective as a demonstration or a piece of bluff. But even this could hardly have succeeded, in view of the excellent intelligence as to the Turkish movements which the Russians were known to have, and ʿIzzet Pasha rightly declined to fall in with the scheme. As a matter of fact the Russians had full information as to these happenings, and especially the progress of the transport of the II. Army, and seized their chance to attack the III. Army in July, before the II. Army's menace to their flank could become effective. This was the best solution of their problem of operations on the inner line, and it met with complete success. On July 7 the Turkish III. Army was driven from Erzinjan and Baiburt with heavy losses in men, guns and material, and was able to make another stand only on the line Kemach (on the Euphrates 30 m. W. of Erzinjan)–Chadali Pass–Tireboli on the Black Sea. The most serious result of this defeat was the complete demoralization of the defeated troops; thousands of deserters, plundering and robbing, flooded all the country as far back as Sivas; columns and transport melted away in panic on the appearance of the Russian cavalry, who had broken through the Turkish line at two points and suddenly appeared in its rear. The III. Army reported in Aug. that 13,000 deserters had rejoined their units, but the governor of Sivas estimated that some 30,000 were still at large in his area. The fact that the Mahommedan population in the area evacuated by the Turkish army fled in terror before the advance of the Russians added to the indescribable confusion.

When ʿIzzet Pasha with the III. Corps advanced at the end of July into the zone of assembly allotted to the II. Army the situation was as follows. In the hilly country S. of Bitlis was the 5th Div., which had been driven from that town by the Russians, and the 8th Div. was in the hilly country S. of Mush. 'Izzet formed them into the XVI. Corps. N.W. of them were only a few small detachments, holding the main roads as far as the Elmali valley, in which stood the 11th Cav. Bde. as the extreme right wing of the III. Army.

'Izzet Pasha's intention was to assemble the main body of his II. Army at Diarbekr and the smaller part at Kharput, and only then to advance in the direction of Erzerum and the country to the E. of it. He knew that in front of him the reinforced IV. Caucasian Corps had taken over the task of guarding the flank of the Russian main army.

This plan, however, was not carried out. The Turkish Supreme Command, in view of the disaster to the III. Army and the reports of constantly arriving Russian reinforcements, urged 'Izzet to attack before the assembly of his forces had been finished. 'Izzet had no option but to obey, though he was under no illusion as to the result. He wished at least to concentrate all his few available forces on the left wing of his area of deployment and to make a push into the district W. of Erzerum, in order to relieve the pressure on the III. Army. But this also proved beyond his powers. The 1st, 14th and 53rd Divs., which had arrived at the end of July and the beginning of Aug., were pushed forward against the Russians, who were still being reinforced on the front opposite the II. Army; a few local successes were achieved, and 'Izzet Pasha on Aug. 10 decided to renounce a general offensive and to hold and fortify the line Kigi–Ognot heights S. of Mush.

Thus ended the geometrical strategy of the Turkish Supreme Command, which had from the first been based only on wishes and hopes rather than on definite realities. The administrative deficiencies in the II. Army had been, as usual in Turkey, so great as alone to ruin all hope of success. The army was sent forward into wild and mountainous country, in which only mountain artillery and columns of pack-animals could be moved, and it was supplied with only 18 mountain guns and with ox-wagons for transport—and far from enough even of these. Figures as to the number of cattle in the deployment area were accepted without verification, and proved to be exaggerated some five fold. Those responsible for the supply services were, as ever in Turkish wars, quite incompetent to make the best of what turned up, and very disposed to steal the little that was available. Under such conditions the best plans are of no avail, for they can never be translated into actual practice.

Meanwhile Wahib Pasha was displaying praiseworthy energy in reorganizing the III. Turkish Army, of which the headquarters were at Andria. Divisions were formed out of the old corps, regiments out of divisions, battalions out of regiments. The army was divided into two "Caucasian Corps," the I. and II., the former comprising the 5th, 11th and 37th Caucasian Divisions. But even these combined divisions were very weak. The volunteer formations and other irregular bands proved wholly useless, and were soon broken up. German motor transport columns, established in the winter of 1916–7 on the line of communications of the III. Army between Ulu Kyshla and Sivas, prevented a threatened catastrophe due to starvation. All Wahib Pasha's efforts, however, could not restore the spirit of the III. Army and give back to it that confidence which was essential to the prosecution of a successful offensive.

The II. Army, when its concentration was completed, was composed of the XVI., II., IV. and III. Corps. Mustafa Kemal (later to become famous as leader of the Nationalist army) was the army commander. 'Izzet Pasha was entrusted with the general direction of the II. and III. Armies operating on the Armenian front, and moved his H.Q. to Kharput.

The II. Army, which had its H.Q. at Diarbekr, was experiencing even greater difficulties in the matter of its communications than was the III. In the winter, however, the strain was eased by both sides going into winter quarters, as in the old days. Only in the passes small observation detachments stood facing each other. In Nov. most of the troops were moved back into more sheltered districts, so that the Turkish and Russian winter quarters were some 30 to 40 m. apart, about the equivalent of five days' march in this difficult country. The Turks, however, were still short of food. As early as Nov. the men were getting only one-third of their regular rations, the pack-animals had themselves to find what meagre pasturage they could, and to find any was soon impossible on account of the deep snow; the cavalry horses were getting only 1½ kilogrammes of oats. Hundreds of animals died every day. Again and again outposts, patrols and whole detachments of men were found starved or frozen to death in the holes of the rocks. In the terrible cold, which when snowstorms raged might well chill to the bone even the warmest clad men, the majority of the troops had only their summer clothing. The percentage of sick grew higher day by day. The sanitary arrangements were in the highest degree defective, so that these miserable beings lived and died in boundless wretchedness. In the hospital at Kharput alone the average deaths in the winter of 1916–7 amounted to 900 per month. Medical requisites were insufficient, and there were no means of combating the plague lice and the epidemic of typhus which followed it. Of the III. Army 60,000 men perished between July 1916 and the spring of 1917, and in the autumn of the latter year barely 20,000 men remained at the front.

The strategic position in Armenia at the beginning of 1917 was extremely unfavourable to the Turks. The Russians, who had obtained undisputed control of the Black Sea, had massed such strong forces in front of the II. and III. Armies that there could be no idea of a Turkish offensive. At the same time railways were being built from Sarikamish by Hasan Kala to Erzerum and from Trebizond and Gumuschane, on the completion of which the Russians in their turn would be in a position to resume the offensive without being hampered by transport difficulties. This offensive might be directed either against the front of one of the two Turkish armies, or from Lake Urmia along the southern shore of Lake Van against the almost unprotected flank of the III. Army. In view of the fact that a new English advance against Bagdad was in preparation, this latter seemed very probable, and Liman von Sanders did rightly in asking the Turkish Supreme Command, in the late autumn of 1916, to hold another army ready at Mosul. The proposal, however, was rejected by Enver. It would also have been sound policy to have placed the II., III. and VI. Armies (the latter being at Bagdad) under one command; for the transference of forces between Armenian and Bagdad fronts could not be carried out quickly enough from Constantinople, and a junction of the Russian and British fronts by an extension of the former by Urmia and the western frontier of Persia was shortly to be expected. A Russian offensive from Persia against Mosul would certainly place both the III. and the VI. Turkish Army in a perilous position. The completion of the railway from Igdir by Bayazid to Kara Kilissa and its continuance by Tutak and Melassgirt seemed to indicate the probability of a Russian offensive against the right of the II. Turkish Army. The offensive against Mosul did not in fact take place; but this omission was a serious error on the part of the Russians and a piece of good fortune for the Turks, on which they had no right to count. However, Liman von Sanders' request for the establishment of a single command was rejected by the Turkish Supreme Command. The relations between Enver and Liman had in fact gradually become so strained, that Enver made a point of refusing anything that Liman wanted.

The Grand Duke Nicholas had, for his part, been making energetic preparations during the winter of 1916–7 for a powerful new offensive. The III. Turkish Army was opposed by the V. Caucasian, II. Turkestan, and I. Caucasian Corps; the II. Turkish Army by the VI. and IV. Caucasian Corps as far as Van. Thence to the W. of Lake Urmia came the II. Caucasian Cav. Corps and a number of detachments (fortress regiments from Kars, frontier guard units, Armenian and Assyrian irregulars). The VII. and I. Caucasian Cav. Corps prolonged the front from Sauj Bulak along the Persian frontier to W. of Kermanshah.

But the Grand Duke's plans, which in view of the wretched condition of the Turkish armies must have led to a complete victory and perhaps driven Turkey out of the war in the summer of 1917, were never carried out. This was in part due to the fact that all available Russian forces were being concentrated for Brussilov's great offensive in Volhynia, but mainly to the outbreak of the Russian revolution, which checked all large operations in Asia. When the revolution broke out in April the advance had not begun. In the course of the winter there had been nothing but local skirmishes for the possession of a hill or pass, which, whether they turned out to the advantage of Turks or Russians had no influence on the general strategic situation.

The outbreak of the revolution was taken by many of the Russian troops as a signal that the war was at an end, though there were formations which still maintained their cohesion and discipline. The Turks, however, were prevented partly by the general military situation of Turkey and partly by the peculiar difficulties of the II. and III. Armies, from seizing and exploiting their advantage as they might have been expected to do. The rapid progress of the English towards Bagdad had necessitated the despatch of reinforcements to that theatre, and the maintenance of the Palestine front also absorbed large forces, so that there were neither men nor material left over for the Caucasian front. The two armies, barely 40,000 strong in the spring of 1917, were now formed into the "Caucasian Army Group" under 'Izzet Pasha, whose H.Q. were still at Kharput, and who had now been provided with a German chief of staff, Maj. von Falkenhausen. All this, however, did not in any way make it possible to resume operations. Typhus was still raging; in Feb. the II. Army lost 42 of its few doctors from this cause. There was so little wood that the delousing stations could not be heated. The deportation of the Armenian population had left the fields untilled, and the villages deserted and in ruins. Of the craftsmen who exhibit a multitudinous activity behind the armies on the European fronts there was not a sign, and even the workshops which had been busy in peace-time were deserted. The supply often broke down entirely. A shameless traffic in waggons went on on the single railway from Haidar Pasha to Ulu Kyshla, which served the Palestine, Mesopotamian and Caucasian fronts. These waggons, which should have been used for military purposes, were privately hired out by officers and officials to contractors and war profiteers at high prices, and on this railway an illicit carrying trade was developed on a gigantic scale. The higher authorities, who also took their quota of profit, were not inclined to interfere. So for the sake of these brutes thousands of brave Anatolian soldiers perished of cold and starvation without even knowing the true cause of their miserable death.

The reports of the hopeless military position in 1917, which were sent to Berlin by the Turkish Supreme Command, were from first to last lies, and served only to increase the exaggerated estimate of themselves which obsessed the minds of the German Supreme Command as well and caused the loss of every opportunity of arriving at peace of understanding.

When Bagdad fell to the English on the night of March 10–11, the chance offered itself of a successful Russian offensive on Mosul either westward from Lake Urmia or from the region of Lake Van southwards. Had it been carried out even by one good corps it could not have failed to be successful. During the whole of 1917 some 15 infantry and 2½ cavalry divisions remained on the Russian front facing the Turks, but nothing important was undertaken. The front from Trebizond to the Diala near Bagdad, where it connected with the English line in Mesopotamia, measured over 600 m. from flank to flank, and afforded far greater scope for free strategic manœuvres than the narrow fronts in France, which were actually filled with guns and men. Warlike activity was only resumed in E. Anatolia, however, when Russia at the end of 1917 entered into negotiations with the Central Powers. The political event which decided the resumption of the offensive by the Turks, which took place early in 1918, was the notification by the Turkish plenipotentiaries at Brest Litovsk on Jan. 17 that a Russian retirement from all the area occupied by them in Asia Minor was an essential preliminary to the conclusion of peace. At the same time the Ukrainian delegates were asked by the Turkish delegates how far they were interested in the retention of the Caucasus by Russia. On their replying that they had no interests in the Caucasus, the Turks resolved to conquer it, and obtained Germany's consent to their doing so, though at the time they did not disclose to her all their ulterior designs.

The Russians retired at the end of Jan. 1917, and in Feb. the Turks advanced across the line Van–Erzerum–Trebizond. The Turkish armies, which together could muster only the strength of a weak army corps, were in such poor condition that even the small, unorganized Armenian bands, who opposed them, were able to give them greater trouble. Their *communiqués* at this time were full of stories of great victories which never took place.

The forward march was carried out in two columns. The northern one, feeling its way very cautiously along the coast of the Black Sea, reëntered Trebizond on Feb. 24; the other reached Erzinjan on the 14th, and moved thence by Mamakhatun on Erzerum. Nothing was seen of the Russians, who, as a matter of fact, had long since recrossed the frontier; only a few desperate Armenians endeavoured to dispute the reoccupation of their country by their hereditary tormentors. The Turks were held up for some time by these bands in front of Erzerum, which they only "recaptured" on March 11, and revenged themselves by the usual revolting barbarities on the unhappy Christian population.

While Erzerum was being taken, the left Turkish column advancing from Trebizond was approaching the frontier between Chopa and Magriali, and the political problem of the provinces of Kars, Ardahan and Batum, the occupation of which had been the motive of the advance, became acute. Their interest in these provinces caused the Turks to commit their last and decisive strategic blunder, the greatest of which they had been guilty since 1914. The Turkish Government considered these operations in the Caucasus to be of the first importance, although the true decisive theatre for Turkey in 1918 was Palestine. Instead of concentrating in Palestine the few troops it had available, the Supreme Command withdrew troops and war material from that front and despatched them to the "East Caucasian Group." Even the small German contingent, which formed the backbone of the Palestine army, was also sent to the Caucasus. Liman von Sanders' words to Count Bernstorff, the German ambassador in Constantinople, written in June 1918, were fully justified by events: "The Turks are sacrificing all Arabia, Palestine and Syria to these boundless undertakings of theirs in Trans-Caucasia. Germany will some day be burdened with the responsibility for this."

Enver and the German High Command had, however, succeeded in completely deceiving the German ambassador as to the Turkish objective, for the latter, in reply to Liman von Sanders, wrote on June 21 that the German Jäger battalion was being transferred from Palestine to Georgia, "not in response to Turkish wishes, but, on the contrary, for the purpose of restoring order in the Caucasus, so as to allow of the whole Turkish army being transferred thence to Mesopotamia by way of Urmia and Tabriz." This, of course, could have been done more quickly and easily if the Turkish army had never advanced from Armenia into the Caucasus. The motive of the Caucasus adventure lay deeper. Enver's idea of attacking India, childish as it was, had yet proved enticing to the German High Command, and the strategic base for an invasion of India by way of Persia was actually established in the Caucasus in the summer of 1918. And this at a time when the decision of the World War was ripening on the front in France!

Considerations of an economic nature, it is true, carried great weight in the minds of the German Supreme Command at this time. The output of the Rumanian oil wells was insufficient; and it was therefore thought necessary to occupy Baku, and to despatch petroleum thence to the Black Sea by the Tiflis railway. It has been necessary to mention these considerations in order to make clear the motives of the Turkish operations in 1918.

After the occupation of Erzerum the southern Turkish column reached Olti, the first objective of the Turks in the winter of 1914–5, on March 26. Meanwhile the coast column was moving on Batum. The Georgians, however, who, naturally enough, had little sympathy with the Turkish "restorers of order," banded themselves together to oppose their further advance. The latter were not even able to keep a firm hand on insurgent Armenia. Behind their backs Armenian bands even succeeded in occupying Erzerum for a time and thereby interrupting all movement on the Turkish line of communications. Meanwhile Georgian bands had occupied Batum. The Turks attacked the town and stormed the advanced positions on April 9; one fort fell on the 10th, two others on the 11th, and on the 14th the town surrendered. The Turkish Supreme Command seized the opportunity to telegraph to the world at large the most incredible stories of victory.

Early in April Nuri Pasha, who was now in command of the "East Caucasus" Army, pushed a strong column from Lake Van in the direction of Kars. Vostan, at the S.E. corner, and Arnis, at the N.E. corner of the lake, were occupied after violent conflicts with Armenian bands, who fought with the utmost fierceness. Van fell on April 7.

While this column was advancing on Kars by way of Kara Kilissa, the Erzerum column, which had been brought to a halt after the above-mentioned capture of Erzerum by Armenian bands, pushed forward by Sarikamish, and the two columns thus converged on Kars. As there was no strategically effective enemy to overcome, the operation was successful, despite the late arrival of the Van force. The Erzerum column approached Kars on April 5, after driving off some Armenian irregulars near Sarikamish; the Van column made slow progress through the revolted province of Bagasia, arriving at Kara Kilissa April 18.

On the 26th the Turkish *communiqué* reported the "storming" of the fortress of Kars (which was apparently undefended) with the capture of 860 guns. This number was considerably in excess of the truth. There is no doubt, however, that the provisions secured in the fortress considerably facilitated the further prosecution of the operations. The column advancing along the coast had meantime pushed on from Batum to Kobuleti and Ozurgeti on the edge of the Caucasus mountains.

The Turks now felt themselves to be masters of the situation, and their pretensions became so outrageous as to lead to serious controversies with the German Government, which, for the first time in the war, was compelled to protest energetically against their exorbitant claims. It had, however, only itself to blame for their exaggerated estimates of themselves.

In the middle of May the plenipotentiaries of the Government of Northern Caucasia addressed a note to all the Powers, announcing the formation of an independent state, separated from Russia. Transcaucasia, however, remained in a complete state of confusion, though the proclamation of the independence of the country by the assembly which met early in June at Baku was plainly directed against Turkey. What exactly was meant by Transcaucasia, however, must have been obscure even to the assembly, for a few days earlier there had been set up under Turkish auspices three independent states, known as the Georgian, Tartar (Azerbäïjän) and Armenian Republics. Necessity had compelled all three to conclude treaties of perpetual amity and alliance with Turkey, who had every intention of annexing these weak states at the earliest possible moment.

Enver did everything to strengthen his political army in the Caucasus. Accelerated promotion and doubled pay were promised to the officers serving with it, with the result that many officers, who were urgently required in Palestine, got away from that theatre, where they received no pay at all.

In the summer the Caucasus Army was increased to six complete divisions, which were stronger than they had been at any time since 1914, numbering 9,000 men each. The transport of these troops, and their reserves, material and supplies absorbed all the fuel available, so that no trains could be sent to the Palestine Army, on whose fighting force the ultimate decision of the war depended. The Pan-Islamic idea, which had been propagated since the beginning of the war, had produced a complete confusion of mind and robbed Enver and his entourage of the last vestige of that strategic sobriety which alone could now save Turkey from ruin. Every week 14 coal trains were sent from Germany to Constantinople; of these seven—far more than were necessary—were kept for the use of the capital itself; 2,500 tons were shipped by way of the Black Sea to the E. Caucasian Army, and the rest was absorbed by the Anatolian railway—or in other words the war profiteers, who filled whole trains with their goods and paid out untold sums in bribes to the railway officials to give them priority of passage.

The E. Caucasian Army extended itself in Transcaucasia and N. Persia, from Lake Urmia to Arax, during the course of the summer, without troubling themselves in the least about the dangerous English offensive against Mosul, where 4,000–5,000 Turkish soldiers were posted in conditions of the utmost misery.

The few events that followed in Transcaucasia were of little military interest, and consisted mainly of a few petty scuffles without influence on the general situation, and unsuitable for inclusion in a strategic narrative. Even the despatch of a German division to Georgia in the summer of 1918 had no other object than the furtherance of those plans, on the futility of which we have already insisted.

Nuri Pasha, with Bolshevik help, certainly succeeded in expelling from Baku a small British force which had crossed the Caspian and occupied the town on Aug. 12. This incident, however, had no effect on the strategic position. In Persia Nuri pushed forward to Tabriz.

The final conclusions as to the Transcaucasian operations may be summed up as follows. The position of Turkey and of the Central Powers in 1918 was such that a military victory was out of the question. This fact, however, was recognized neither by Ludendorff, who wasted the defensive strength of the German army in a purposeless spring offensive, nor by Enver, who was obsessed by his vast schemes for annexation of territory. The despatch of a strong German division to the Caucasus, and the operations of large German forces in the Ukraine in the summer of 1918, when the war was being lost in France, show the kind of strategic conception then prevalent. In the case of Turkey the theatres of war which had to be supplied with men and material were too numerous for the resources available. When the Russians collapsed in 1918 a wise strategy would have considered the elimination of one theatre of operations as a relief to be accepted with gratitude, and would have, as a natural consequence, transferred all the forces thus liberated to the Palestine front. Such a course would of itself have relieved the pressure on the Mesopotamian front, which could no longer be saved by direct means. The underlying idea ought to have been that a tenable military position in Palestine would have been more favourable, in the event of negotiations for peace, than any conquests in the Caucasus, which would have to be given up again in case of military defeat. Enver, and with him a whole series of Turkish and German military men, had never had that conception of the limits of the possible which is the prime characteristic of every great strategist. They mistook the elaboration of immense and impracticable schemes for genius, whereas true genius consists of getting the best possible results from the material available. The events on the E. Anatolian front also serve to prove very clearly that strategy is an art not to be mastered, even with the best will in the world, by a layman such as Enver, and that it is governed almost entirely by the geographical conditions of the theatre of operations. This should have been recognized by the office strategists of Constantinople, who had no clear grasp of the geographical conditions of the country in general or in detail, and failed to realize that strategical manœuvres which seem highly promising on the map may be impossible of execution in practice. In the German schools of strategy, and also in Turkey, so-called military geography was before the war treated with complete contempt, as it was believed that it tended to limit freedom of strategic conception. The campaigns in the East proved that freedom of strategic conception, unless based on accurate geographical knowledge, is not only profitless but a fruitful cause of defeat. Finally, the war in Eastern Anatolia may teach us one valuable psychological lesson, which was insufficiently appreciated by the Turkish Supreme Command. The form of a strategic movement has of itself no driving force; the vital factor, in strategic force too, is the troops. Now the spirit of the troops depends mainly on their physical condition. An army called on, when insufficiently clad and underfed, to face the snows of winter soon loses its fighting value. If strategy depends on the efficiency of the troops, this in its turn depends on the efficiency of the supply and transport services, and the administration of the army in general. Only when this organization is in good order and working well can the leading strategic conception be, in the true sense of the word, free. On this simple truth the strategy of the Turks during the World War always suffered shipwreck, even when they had better leaders than those who appeared during the war in Armenia. (F. C. E.)

(II.) MESOPOTAMIAN OPERATIONS

The Anglo-Indian operations of 1914–8 in Mesopotamia, which ended in the military occupation of almost the whole of that extensive region, were in their initial stages conceived on comparatively modest lines. They were at the outset undertaken merely with the object of (1) protecting the Anglo-Persian oil installations of the Qarun; (2) occupying the greater part of the Basra vilayet, so as to secure possession of the Shatt al ʿArab and to maintain control of the districts immediately round the head of the Persian Gulf; and (3) impressing the Arabs and others in this and neighbouring regions and influencing thereby the inhabitants of the territories intervening between the Ottoman Empire and India. It was foreseen in London and at Simla that the Ottoman Government would be likely, under instigation from Berlin, to send troops in this direction, for the purpose of harassing the Indian executive by stirring up trouble in Persia and Afghanistan; and steps had been taken to deal with the contingency before relations between the Entente Powers and the Porte were actually broken off. The Poona Bde. of the 6th Indian Div. had been dispatched to an island near the head of the Persian Gulf in the middle of Oct., and on Nov. 7, two days after the British Government declared war on Turkey, these advanced troops appeared in their transports at the mouth of the Shatt al ʿArab.

The fort guarding the entrance to the estuary was taken after a brief bombardment, and the brigade then disembarked and encamped some miles up-stream on the right bank. On learning this the Turks hurried all available forces down from Basra to bar the way to the invader; but, the rest of the 6th Div. under Sir A. Barrett having arrived, they were attacked on the 17th and effectually overthrown. Basra fell on the 21st. The vanquished Osmanlis for the most part retired to Qurna, at the junction of the Euphrates with the Tigris, the point where the water-way ceases to be navigable for ocean-going vessels proceeding upstream; but Barrett promptly pushed troops to a point higher up, and the place surrendered on Dec. 9. Considerable Ottoman reinforcements had, however, been on the way from Bagdad towards Basra since the arrival of the Anglo-Indian expeditionary force in the Shatt al ʿArab, and these now began concentrating, partly in the direction of Ahwaz and menacing the oil-fields, and partly about Nasiriya on the Euphrates. Threatened in a measure on either flank, and necessarily dispersed owing to having many posts to hold, the 6th Div. was not comfortably situated; but, as the Turkish fighting forces which had come down from the N. were not as yet organized for active operations nor in an aggressive mood, the invaders were enabled to consolidate their position, and they were little interfered with during the first three months of 1915.

The Indian Government was, however, anxious to obtain a stronger hold upon the district already occupied, and so in March it was decided to raise the expeditionary force to the strength of an army corps. Early in April Sir J. Nixon took over command from Gen. Barrett, who with limited means had conducted the campaign with signal skill and judgment, and Gen. Townshend at the same time assumed charge of the 6th Division. The last units of the new division (the 12th) had arrived by the middle of the month. These changes, as it turned out, synchronized with a marked increase of activity on the part of the Turks; for they appeared in some force near Qurna and also seriously threatened Ahwaz; they were, however, driven off with no great difficulty at both points. Encouraged by these successes, Nixon decided to assume the offensive and to occupy ʿAmara, a town of some importance 60 m. N. of Qurna on the Tigris, but considerably farther if following the sinuosities of the stream. This task was entrusted to Townshend, who carried it out by making free use of water-transport of all kinds for moving his troops. Aided by a naval flotilla, on May 31, he signally defeated a hostile force which tried to bar the way; and then, as the result of a bold stroke, on June 3 made himself master of ʿAmara, capturing 17 guns and 1,800 prisoners. This operation accomplished, Nixon resolved on a blow against Nasiriya. The heat was now intense; but, in spite of this, portions of the 12th Div., relying for mobility largely upon water transport, took possession of the town after some hard fighting on July 25, another 17 guns with 1,000 prisoners being the prize of victory. The Anglo-Indian army which had descended upon this corner of the Ottoman Empire could then fairly claim that it had achieved the object for which the campaign had been originally undertaken.

Its triumph had been all the more creditable seeing how seriously it had suffered from want of transport, and taking the inadequacy of its administrative branches into consideration. It must be remembered that the Indian Government had accepted heavy commitments in other fields of military action. Two divisions had been dispatched to the western front. Large forces had been furnished for the protection of Egypt. The E. African campaign also at that stage was an Indian undertaking. The military organization of the great British Asiatic dependency had not in pre-war days been framed with the idea of prosecuting martial operations on an ambitious scale overseas. Large reserves of trained men did not exist to fill those gaps in the ranks that contests with well armed antagonists bring about in the present day. The available departmental services—notably the medical service—had been starved. The troops now operating at the head of the Persian Gulf were, moreover, faced by quite exceptional difficulties, owing to the insufficiency of that shallow-draught water transport upon which their efforts and their maintenance virtually hinged.

Unfortunately, the success which had hitherto attended the combinations of Generals Barrett and Nixon inspired the civil and military authorities at Simla with the desire for a more ambitious programme in Mesopotamia than that which had been contemplated in Oct. 1914, and they readily fell in with Nixon's proposal that an advance up the Tigris to Kut should be undertaken. The Home Government agreed. This meant an advance of some 180 m. up-river into the heart of the enemy's country by troops who had already undergone much hardship, the maintenance of the force depending upon a flotilla that was barely adequate for the purpose and that would become entirely inadequate were the strength of the force to be increased above that of the division and the cavalry brigade already told off for the undertaking. News had come that a Turkish force was assembling at Kut under Nur ed Din Bey. Although Nixon made strong representations with regard to his lack of water transport, he perhaps hardly made the danger of advancing beyond ʿAmara unless this were substantially increased sufficiently clear to authorities far away from the scene of action. Nor, perhaps, was the virtual impossibility of rapidly augmenting it realized. Townshend was charged with carrying out the proposed advance and early in Aug. his 6th Div. began gradually to push forward up the Tigris. On Sept. 14 he concentrated his force at Sheikh Saʿd.

On the following day he drove an advanced Turkish force in disarray out of a fortified position at Abu Rumman on the right bank of the Tigris, about 15 m. from Kut, and he then halted for some days to admit of supplies coming up and of reconnoitring the lines which the enemy had established on both banks of the river about Es Sinn. On the 28th he attacked Nur ed Din in his entrenched position and completely defeated him, taking 1,650 prisoners, 13 guns and much war material, and the cavalry pursued the fleeing Osmanlis as far as ʽAziziya, halfway from Kut to Bagdad. The enterprise had in fact been carried out with a success equal to its audacity.

Kut was a locality of some strategical significance. Issuing here from the Tigris, the Shatt al ʽArab creates a link with the Euphrates at Nasiriya. The natural route for troops from Bagdad proceeding to the lowest reaches of the Euphrates immediately above Qurna would be by way of the Tigris and the Shatt al Hai. Therefore, installed in his new position at Kut, Townshend in a measure blocked both the routes from Upper Mesopotamia to Basra—that following the Tigris right down to Qurna, and that turning off by the Shatt al Hai. Kut was furthermore the most important place between ʽAmara or Nasiriya and Bagdad, and its capture was calculated to exert a considerable moral influence over the Arabs who dwelt in this region and who were disposed to be troublesome. But almost the whole of the Anglo-Indian troops in the theatre of war, apart from detachments required for garrison duty nearer the Persian Gulf, had now been projected into an isolated situation far within the enemy's territory; they were, moreover, depending upon a long line of water communication, not easy to protect against marauding attacks and served by only a restricted number of steamers and smaller craft. But for the severe defeat suffered by the Turks at Es Sinn, the disposition of the invading forces at the beginning of Oct. would have justified some anxiety.

But the idea of pushing on to Bagdad had already taken shape even before the occupation of Kut. The Aug. discomfiture in the Gallipoli Peninsula (*see* DARDANELLES CAMPAIGN), coupled with a belated realization that the Dardanelles venture would not succeed, had rendered the Home Government eager for some dramatic achievement in Mesopotamia. The Indian Viceroy had advocated an advance to Bagdad when the start up the Tigris from ʽAmara was materializing. Townshend's gratifying triumph acted as a stimulus to these aspirations, and during the month of Oct. there was much inter-communication between London, Simla and army headquarters in Mesopotamia on the subject of a further advance. Nixon intimated early in the month that he was strong enough to open a road to Bagdad under the circumstances then existing, but he did not consider himself able to hold the city if taken. The question of even reaching the place, however, depended in reality upon whether the advance were to take place before the enemy was reinforced. The military authorities who were consulted at home, while admitting the possibility of capture, regarded permanent retention as out of the question with the limited forces available; they declared that, if Bagdad was to be held, the army in Mesopotamia must be reinforced by two divisions. Influenced by political considerations, however, the Home Government became more and more insistent. The dispatch of the two Indian divisions that were on the western front at the time to the Persian Gulf was under consideration, but it could not be promised at the moment. Although no reinforcements could be sent him, and although had they been sent him they could not have taken part in the operation owing to the time that must elapse in getting them to the theatre of war and owing to the absence of water transport to move them and to feed them when they got there, Nixon was on the 31st informed that he might advance on the city.

Townshend had pushed large parts of his force from Kut on to ʽAziziya while the discussion was proceeding. He found that the Turks were less demoralized by the reverses they had met with than had at first been supposed, and they had been given time to rally and to reorganize. His own troops had been severely tried, and all his units were short of establishment. He entertained serious misgivings as to progressing farther, in view of the isolation of his force, of the length of his communications, and of the manifest insufficiency of that water transport which was the governing factor in any operations that he might have to undertake. Even after receiving his orders to advance, he was unable to move for a fortnight owing to time lost in getting up supplies to ʽAziziya and in organizing for the hazardous effort. On Nov. 11, however, the advance began, and on the 21st the Turks were dislodged from a fortified position at Laj. It was known that the enemy was in strong force at Ctesiphon and had constructed elaborate entrenchments at that point; news had also come that hostile reinforcements were expected. A night march was therefore carried out, and at dawn Townshend attacked. The assault was most successful in the first instance. Two lines were carried and many prisoners were captured. But strong Ottoman reinforcements arrived on the battlefield while the fight was still in progress, and these recovered much of the ground that had been lost earlier in the day. For three days the two armies remained facing each other at Ctesiphon, the Turks being much superior in numbers and their array gradually swelling as fresh troops arrived from Bagdad. Townshend was in the meantime making all preparations for a retreat and was getting his wounded away—a service of no small difficulty owing to the insufficiency of transport. Then on the night of the 25th he moved off.

His losses since quitting ʽAziziya amounted to 3,590—nearly one-third of his strength. Except in respect to cavalry, the enemy enjoyed a great advantage in numbers, and as soon as the retreat began the Arabs started harrying the retiring force. Still, thanks to Townshend's skilful dispositions and to the resolute marching of his weary troops, no great difficulty was experienced in evading grave molestation during the first four days of the backward march. But, owing to the flotilla of supply transports, barges and fighting craft being delayed by the shoals, and to some of the craft getting aground, a halt had to be called on the 29th. This enabled the pursuing Ottoman columns to come up, and on Dec. 1 they delivered a resolute attack upon the Anglo-Indian force, but the assailants were beaten off after a sharp encounter and the retreat was then resumed. It had been necessary to abandon three steamers, but so great was the effect of the stalwart resistance offered by Townshend's sorely tried little army that it was little interfered with during its last three days of retreat. It assembled at Kut on Dec. 3, having suffered another 1,000 casualties since quitting Ctesiphon, but bringing in the 1,600 prisoners taken on Nov. 22.

So—for the moment—ended the Bagdad adventure. On Dec. 3 the first of the reinforcements spoken of six weeks before (when London and Simla were pressing for an advance) had only started a few days on their four weeks' voyage from France to the Shatt al ʽArab. Military authorities had admitted the possibility of a successful dash on the city, but had denied the possibility of so small a force holding the city unless reinforced; and even had additional troops been available in the country, the water transport to get them up the river was lacking. When Townshend moved forward the best to be hoped for was that he might reach his goal and might then escape if he straightway hurried down the Tigris again. Seldom in the history of war has a military force been committed to an undertaking so unwarrantable.

But worse, from the British point of view, was to follow. For, with the approval of the Home and Indian Governments, Nixon decided that Townshend should stop where he was, although if he did so he was bound to be invested. They assumed too readily that he would be relieved ere his supplies ran out. So his sick and wounded, his cavalry, most of the flotilla and a proportion of his animals were sent off down Tigris, although the civilian population was unfortunately allowed to remain; preparations for a siege were put in hand; and on the 8th Kut was hemmed in on all sides. Its situation in a deep loop on the left bank of the river rendered the place readily defensible against attack, and the German Field-Marshal von der Goltz, who had just taken supreme command of the Ottoman forces in Mesopotamia, perceived that unless it fell to an early assault the main task of his advanced troops would be to guard against a relief. Nur ed Din had four divisions at his disposal, and on the 10th, 11th and 24th he delivered unavailing onsets upon the narrow front that was not covered by the river. Then the siege became a blockade, part of the Turkish army moved down the Tigris to Sheikh Saʽd and ʽAli Gharbi, and the work of constructing formidable lines at Es Sinn on the right bank of the river, and athwart a defile on the left bank between the channel and the Suwaikiya marshes, was taken in hand. About the end of the year Khalil Pasha assumed command.

Meanwhile the 7th and 3rd Indian Divs. had begun to arrive in the Shatt al 'Arab in the middle of Dec., and Gen. Aylmer took charge of the troops who were to undertake the relief of Kut. Units as they disembarked were pushed on to 'Amara and proceeded thence up the Tigris. The urgency of joining hands with Townshend forbade delay. There was no time to organize the force properly, it lacked powerful artillery for dealing with entrenchments, and the shortage of river transport multiplied its difficulties. The Turks were nevertheless driven out of 'Ali Gharbi and were on Jan. 6 1916 defeated with heavy loss at Sheikh Sa'd. Three days later Aylmer again defeated them, whereupon they fell back to the lines of Hanna at the entrance to the awkward defile on the left bank of the Tigris. The relieving force had hitherto triumphed over every obstacle; but when on the 21st it essayed the storming of the Hanna position the effort failed; and so numerous were the casualties, coming on the top of losses in the previous actions, that Aylmer had to pause in his offensive and to await reinforcements. About the same date Sir P. Lake succeeded Sir J. Nixon in chief command.

Lake set himself to rectify organization in so far as means permitted, to place Aylmer's line of communications on a better footing, to improve the medical arrangements (which had broken down under the stress of Ctesiphon), and to develop the wharves at Basra and Qurna. Material of all kinds was, however, deficient, and the sands were running out. The Home Government transferred the 13th Div. from Egypt to Mesopotamia on receipt of the bad news from Hanna; but it was now too late to so expand the water transport as to enable the growing Anglo-Indian army to act with real vigour and independence during the few weeks that Townshend could still hold out. Aylmer attempted no forward movement during Feb.; but on the night of March 7–8, without waiting for the 13th Div., he advanced from near Sheikh Sa'd against the Es Sinn position, intending a surprise. This involved a long march in the dark hours; when day broke part of the force had not arrived; and although the Turks were at first in no great strength the attack was delayed. Then when the assailants after a pause of some hours advanced against the reinforced enemy, they were beaten back, and they had to retire to Sheikh Sa'd, having suffered severely in the combat.

The garrison of Kut was already on much reduced rations; but Gen. Gorringe, who had succeeded Gen. Aylmer, could make no fresh attempt for nearly a month owing to transport and supply problems. However, on April 5 the 13th Div., under Gen. Maude, stormed the Hanna lines and penetrated well into the defile on the left bank of the Tigris; but, when first the 7th Div., and then the 13th Div. attacked the Sanna-i-yat lines at the farther end, they were in each case repulsed. Kut could hold out only a few days longer, so Gorringe now tried to advance to the right bank. After making some progress on the 17th in spite of almost insuperable difficulties caused by floods, this movement was brought to a standstill. A final effort was made against Sanna-i-yat by the 7th Div. on the 22nd, which nearly succeeded. Then on the night of the 24th a steamer loaded with provisions tried to run the blockade but failed, and on the 29th Kut with its garrison of 9,000 British and Indian troops surrendered. The attempts to relieve it had cost 24,000 casualties.

The tidings of this very grave mishap gave rise to profound dissatisfaction in the United Kingdom, a dissatisfaction that was aggravated by information gradually leaking out with regard to the sufferings of the sick and wounded after the retirement from Ctesiphon. It was feared that so unmistakable a reverse to British arms in Asia might exert a more untoward influence in the East generally than in the event proved to be the case. As a result of strong feeling in the public mind a commission was, it may be mentioned, set up a few months later by Act of Parliament to inquire into the operations that had taken place in Mesopotamia. The commission did not report till nearly a year later, when the military situation in the land of the Two Rivers had come to be very different from that which had prevailed in May 1916 after the fall of Kut. Its conclusions were to the effect that much in connexion with the undertaking of a campaign on so ambitious a scale without adequate forethought and efficient preparations was worthy of blame, and it animadverted in strong terms on the very unsatisfactory character of the medical arrangements during the early stages of the venture.

No reference has been made hitherto to the Russian forces in Persia. These, based on the Caspian Sea, were actually in occupation of a considerable area of the Shah's northern territories. They did not, however, represent a large body of troops, they were operating in a region of wide extent, and the avenues leading from the tracts in their occupation towards the plains of Iraq traversed rugged and unproductive uplands. For military contingents so situated to have afforded any practical help to the Anglo-Indian army during the critical months that followed Townshend's advance from Kut, was virtually prohibited by the conditions. Nor did their activities furnish indirect assistance to their allies by withdrawing any appreciable proportion of the Turkish forces serving under von der Goltz and Khalil Pasha from the theatre of war on the Tigris.

In view of the disaster which British arms had met with—a disaster directly traceable to those in authority drifting into a comprehensive scheme of warlike operations without providing the necessary means for prosecuting the campaign—it was decided that Kut must if possible be reoccupied. The hot season was, however, at hand. The troops had suffered exhausting trials and had met with cruel loss. Water transport, as well as artillery and war material of almost every kind, remained inadequate. There could be no question of resuming the offensive on the hand-to-mouth lines on which the advance from 'Amara had been initiated a year before, and which Gen. Lake had been obliged to continue when striving against time to relieve Townshend; so that a prolonged pause became inevitable. Von der Goltz had left Mesopotamia and the Turks, as it turned out, manifested no inclination to advance from the scene of their recent triumph—they withdrew, on the contrary, from Es Sinn and formed an entrenched camp nearly all round Kut, while holding on to Sanna-i-yat—and a period of several months in which no active operations took place set in.

Great developments, however, in the meantime took place on the Anglo-Indian line of communications, as also at Basra and Qurna, thanks to Gen. Lake's representations and to his powers of organization. A reasonable amount of heavy artillery was gradually accumulated. A narrow-gauge railway was laid down leading from Sheikh Sa'd to Es Sinn. Landing facilities at the ports were much improved. An additional division arrived from India. Gen. Gorringe was in July succeeded in charge of the troops at the front by Gen. Maude, who, a few weeks later, replaced Sir P. Lake as army commander.

Although much had been effected by the outgoing army commander in respect to organization, Maude realized that there was yet vital work to be done before his forces could act with effect in this peculiarly conditioned theatre of war. A master of administration and endowed with phenomenal energy, he was resolved not to commit his troops to a formidable undertaking until they were furnished with all that was necessary to insure their mobility and their tactical efficiency. From Sept. till the close of Nov. he laboured unceasingly at the base, enjoying full support from the War Office in London, which had definitely taken over charge of the campaign from the Indian authorities. By the begininng of Dec. he had been furnished with enough river craft, his supply arrangements were in a sufficiently forward state, and he had furthermore a sufficiency of war material at his command, to justify his embarking upon offensive operations of a far-reaching kind, and on the 13th he struck suddenly and with signal success.

Being in occupation of the right bank of the Tigris to a little above Es Sinn, while blocked on the left bank by the fortifications of Sanna-i-yat, the Anglo-Indian army, astride the river, was by the conditions of the case necessarily disposed in échelon, with its left well pushed forward and its right withdrawn. It was organized in two army corps, the I., under Gen. Cobbe, on the right on both banks of the water-way, the II., under Gen. Marshall, on the left. Maude's plan was to start by pushing his left still farther forward, to clear the right bank of the Tigris of the enemy to well above Kut, and, when these dispositions had in due course taken effect, to force the lines of Sanna-i-yat with his right. So long as Sanna-i-yat remained in Ottoman hands his flotilla could not advance above that point; but, with the railway from Skeikh Sa'd running to Es Sinn, his troops operating on that side of the Tigris could be supplied, provided they did not advance more than a few miles. Marshall, being on the left, opened the attack by forcing the Shatt al Hai, after a night march, and by capturing some of the Turkish defences which formed a bridgehead S. of Kut. During the struggles that ensued, lasting several weeks, Khalil Pasha's forces offered a stout resistance, and although Maude's operations on the right bank of the great river were uniformly successful, they proceeded slowly and by successive stages. It was not till the middle of Feb. that the whole of the Turkish entrenched camp on that bank was in Anglo-Indian hands and that the Ottoman troops had withdrawn across channel.

No sooner had this part of the programme been accomplished than, on the 17th, Gen. Cobbe attacked Sanna-i-yat. The effort failed for the moment; but five days later the lines were assaulted again, and they were at last carried after a desperate contest in which the Turks lost very heavily. On the same day Marshall's II. Corps by a brilliant feat of arms forced a passage across the Tigris at Shumran. There was then no course left to the Ottoman commander but to abandon Kut in haste and to withdraw his forces as best he could up the left bank of the river. Maude's flotilla instantly pushed up to the front past Kut, which fell automatically into his hands, and the Anglo-Indian army in Mesopotamia could then claim to have won a victory that went far towards wiping out the discomfitures of the previous year. Within the space of two months the military situation had been completely transformed as the result of a happily conceived and resolutely executed plan of campaign that had been rendered possible by prescient and comprehensive organization in rear of the fighting front.

But Maude was not the man to tarry after gaining a signal triumph and thereby to give his vanquished opponents breathing space to recover. His supplies guaranteed by the arrival of his water transport, he pushed on along the left bank of the Tigris on the heels of the fugitive Turks, his troops ready for any exertion in their enthusiasm and full of confidence in their leader. The river channel between Kut and 'Aziziya has many loops and bends, making it difficult for a naval force and a military force to act in tactical concert, but on the 26th the British gunboats, steaming up almost ahead of the mounted troops, destroyed or captured practically the entire Ottoman flotilla after a sharp combat. Great prizes in war material as well as many prisoners were also made by the advancing army. Keeping his own counsel, as was his wont, the army commander had from the outset of his active operations contemplated an immediate advance on Bagdad after expelling the enemy from Kut, and he now requested permission from the Home Government to make the historic city his objective. He received the requisite sanction. But he found himself obliged, in spite of his eagerness to press on, to halt for some days at 'Aziziya for fear of outrunning his supplies—a check which enabled the rear of his army to close up and which afforded the troops a welcome rest, although the brief relaxation in the pursuit gave the Turks time to occupy defensive positions covering the capital.

All being ready, the Anglo-Indian army resumed its advance on March 4, whereupon it was found that the enemy had abandoned Ctesiphon and retired behind the Diala. This river represented a serious military obstacle, and when an attempt was made to force the passage the Turks were discovered to be in such strength and to be so favourably posted that the effort proved in the first instance unsuccessful. Maude thereupon threw a bridge across the Tigris and passed the cavalry and the I. Corps across the channel. Then, his troops pressing forward on either bank, the Diala was forced by Gen. Marshall, opposition on the other side of the Tigris was gradually overcome, and by the 11th the City of the Caliphs was in British hands, the enemy having withdrawn northwards, unable to stem the resolute advance of the victors. Maude, however, allowed no pause in his offensive operations to take place. Cobbe, pushing up the right bank of the Tigris along which a stretch of railway ran as far as Samarra, heavily defeated a Turkish force which attempted to bar his progress at Mushaida, while Marshall cleared the triangle of country between the Tigris and the Diala in the direction of the Jebel Hamrin. Russian forces in Persia had been penetrating into the mountainous country on the Turko-Persian borders while Maude was advancing from Kut, and it had been hoped that they might coöperate effectively with an Anglo-Indian column which was pushed into the hills towards Khanivin; but this project did not materialize. Marshall, however, conducted a most successful campaign on the Shatt al Adhaim during the month of April, inflicting a number of severe defeats upon the Turkish XIII. and XVIII. Army Corps in that direction, and Cobbe completed the operations on the right bank of the Tigris by the capture of Samarra with many prisoners and much war material. Then, having secured possession of a wide area of fertile territory to the N. of Bagdad and driven the enemy in confusion into the deserts and uplands beyond, Maude was at last enabled to afford his victorious troops rest—just as the hot weather set in.

The virtual conquest of Mesopotamia in a four and a half months' campaign had been brought about by the resolute execution of a plan of operations based on correct calculation of requirements. It had been a triumph of forethought and of strategical and tactical skill on the part of a chief who followed up his successes relentlessly and who inspired his subordinate commanders and his troops with his own unconquerable spirit. Neither the stout resistance offered by the Ottoman troops at the outset and which they had maintained even after the tide began to set against them, nor yet the formidable defences which their engineers had elaborated around Kut, had in reality proved the greatest stumbling-block to be overcome. The vast extent of the theatre of war, the lack of communications, and the fact that fighting forces advancing from the Shatt al 'Arab must almost inevitably adhere to the line of the Tigris constituting virtually one long military defile, had interposed even greater obstacles in the path of conquest. But those obstacles had been surmounted as a result of appropriate and effectual organization consummated during the months which had immediately preceded Maude's advance; and during the torrid summer of 1917, when little fighting took place, he was busily engaged in perfecting administration in the territory won, improving communications, and preparing for a fresh offensive in the cold weather.

A railway was constructed from Kut to Bagdad, as the intervening section of the Tigris channel was shallow and awkward to navigate. Sanitation and policing were secured in the capital. Comfort and recreation were provided for the troops. Steps were taken to tap the supply resources of the fertile districts in occupation of the army. A division that had been in reserve at Nasiriya was brought up to the front. Great efforts were for a time made to arrange for coöperation with the Russian forces in Persia; but the influence of the revolution in Petrograd made itself more and more felt in that quarter as the weeks passed, and before Maude started his autumn campaign it had become manifest that little was to be hoped for from that direction. Indeed the situation in Armenia was becoming such as to affect adversely the prospects of the Anglo-Indian host operating in Mesopotamia, and in the late summer there were indications that under German instigation the Turks were contemplating an effort to recover Bagdad. This merely made Maude the more anxious to resume the offensive, and on Sept. 28 he struck his first blow by the capture of Ramadi on the Euphrates, with much booty. This victory was followed by successful operations in clearing the Jebel Hamrin and by the capture of Tikrit on the Tigris at the beginning of Nov. A few days later, however, the army commander was struck down by cholera, and he died on the 10th. He was succeeded by Sir W. Marshall.

Above Tikrit and extending N. for a long distance, the country traversed by the Tigris is a sterile tract, hilly and broken at some points; the ordinary route from Bagdad to Mosul does not therefore follow the river but takes a line to the E. through Kifri and Kirkuk. Maude had intended to conduct his main advance by this line—a plan of operations which would make it possible for the Russians in Persia to coöperate should they be prepared to do so. The death of the distinguished general, just at the moment when the project was about to be put in execution, created some delay, but his successor set troops in motion through the Jebel Hamrin in Dec. and Kifri was occupied in Jan. Having secured that point, Marshall in the middle of Feb. determined on a sudden advance of his extreme left wing up the Euphrates. Hit was captured, and on the 19th a complete victory was gained over the Turks who had retired up the river from that place; they consisted of the 50th Div., which was surrounded and captured, 5,000 prisoners and all its guns being taken. Difficulties of transport in the meantime hampered the force moving forward beyond Kifri, the distance from railhead being considerable, but on April 29 the Ottoman forces were heavily defeated on the road to Kirkuk, losing 3,000 prisoners, and a week later that town was occupied, much war material falling into the hands of the Anglo-Indian army. In view of the distance of the place from the railway the army commander however decided to withdraw his troops from the place after the booty had been evacuated; the troops then fell back to Kifri, and, the hot weather having now set in, active operations practically ceased for five months. The collapse of Russian fighting power in Armenia had enabled the Ottoman staff to move troops from there down to Mosul and northern Mesopotamia, and scarcely any assistance had been received from the side of Persia; but Gen. Marshall's first campaign had nevertheless been remarkably successful and his position to the N. of Bagdad had been effectually consolidated.

In the meantime a special British mission, sent off in Jan. under charge of Gen. Dunsterville and originally intended for Tiflis with the object of coördinating resistance of Armenians, Georgians and Russians to the Turks threatening Transcaucasia, had been endeavouring to maintain satisfactory relations with the Russians in Persia, and had arranged for supplying food to certain parts of that country which were almost famine-stricken. The allocation of a considerable amount of motor transport to this latter service had indeed somewhat hampered Marshall's operations about Kirkuk and the Persian border. Great difficulties were placed in Dunsterville's way by Russian officials who were tending towards Bolshevism, while open hostility was displayed by certain of the Persian tribesmen. Some Russian troops, however, remained loyal to the Entente and, coöperating with these, small bodies of British troops were gradually pushed up to establish a line of communications between the Anglo-Indian army in Mesopotamia and the Caspian Sea at Enzeli. During the early summer resistance to the Turks in Transcaucasia was gradually breaking down, and at the beginning of July the last of the organized Russian fighting forces in Persia proceeded thither by ship. On the Ottoman troops appearing before Baku shortly afterwards, Dunsterville sailed for that city in Aug., followed by a brigade of British infantry.

He found a complex and disturbing situation to prevail. The Armenian garrison was unreliable. The attitude of the Russian officials was suspicious. Bolshevik armed craft were afloat on the Caspian. The lines constructed for the defence of Baku were of such extent as to require a large force to man them. It soon became apparent that the safety of the city depended entirely upon the meagre British force as the Armenian soldiery displayed little stomach for combat. For a very few weeks Dunsterville and his men did what they could to save the place; but on Sept. 14 the Turks broke through the outer defences, and that night the British reëmbarked and returned to Enzeli, whereupon Baku fell into the enemy's hands. A somewhat risky venture had proved unsuccessful, but it had at least prevented the dispatch of some of the Ottoman troops in Transcaucasia to confront the Anglo-Indian army in N. Mesopotamia.

On news of the fall of Baku reaching London—it occurred just when the season was suitable for commencing active operations in the theatre of war farther to the S.—Marshall was instructed to occupy Mosul, an undertaking for which he had been preparing during the summer. The best of the Turkish divisions in Mesopotamia were at this time assembled astride of the Tigris at Fatha, where the river breaks through the Jebel Hamrin range of hills. A naturally strong position had been assiduously fortified, and the enemy possessed a second fortified position a few miles higher up at the confluence of the Lesser Zab and a boat bridge was established at that point. Realizing that a frontal attack would be hazardous and that, owing to the extreme ruggedness of the ground in the immediate vicinity of the hostile lines a turning movement of the ordinary kind was out of the question, resolved nevertheless to strike a decisive blow, Marshall determined on a combination of war by which adequate mobile forces would be thrown right across the Ottoman communications between Fatha and Mosul. He entrusted the conduct of these operations to Gen. Cobbe, and arranged for a column to advance simultaneously by Kirkuk towards Mosul.

The final campaign in Mesopotamia lasted only a single week, the movement beginning on Oct. 23. Two cavalry columns, that with the shorter distance to cover being accompanied by some infantry, crossed the Jebel Hamrin many miles E. of Fatha and passed the Lesser Zab a long way above its junction with the Tigris. In the meantime the 17th and 18th Divs. advanced against the Ottoman position, the 17th on the right bank and the 18th on the left bank of the Tigris. Finding himself threatened in rear, Isma'il Hakki Pasha, who commanded the Turks, withdrew from the Fatha position to that higher up, followed by the two Anglo-Indian divisions, while the cavalry columns made for the Tigris many miles above the confluence of the Lesser Zab and placed themselves across Isma'il Hakki's line of retreat. The 18th Div. forced a passage across the Lesser Zab on the 25th, whereupon Isma'il Hakki withdrew those of his troops that were on the left bank of the Tigris across the river, and pulled up his bridge. On the 26th the 17th Div. was pressing the Turkish main body on the right bank, and that same day the outer one of the cavalry columns forded the river and began moving down that side of the channel. On the 27th and 28th the 17th Div. was heavily engaged, before it finally made itself master of the enemy's position at the confluence of the Lesser Zab, whereupon Isma'il Hakki retired N. to Sherghat, but on the 29th the last hope of the trapped Ottoman force was destroyed owing to a relieving column from Mosul being defeated by the cavalry. All that day Isma'il Hakki resisted the advance of the Anglo-Indian forces on Sherghat, but on the morning of the 30th, just as the 17th Div. was about to launch a final attack, the white flag was displayed and the 14th and the bulk of the 2nd Turkish Divs. surrendered.

Eleven thousand prisoners, 51 guns and much war material were taken as a result of Cobbe's brilliantly successful operations. Two days later tidings of the signing of the Armistice arrived. The Kirkuk column had, in the meantime, been working its way forward, almost unopposed, toward Mosul. That city was occupied within a week; and so, in a blaze of triumph for the Anglo-Indian forces, the long-drawn-out campaign in Mesopotamia, in which they had experienced both extremes of fortune, came at last to an end, concurrently with the most sweeping tactical success gained by either side during the course of the struggle.

(C. E. C.)

(III.) The Sinai Campaign, 1916–7

When the Dardanelles expedition came finally to an end during the first days of Jan. 1916, the British troops which had been engaged on the Gallipoli Peninsula were dispatched to Egypt, there to refit and reorganize, and to undertake the defence of Egypt against a possible attack by the Turks, who were now freed from any menace on the shores of the Dardanelles. On Jan. 10, the evacuation of Cape Helles having been successfully completed, Gen. Sir Charles Monro handed over his command to Gen. Sir Archibald Murray and returned to France. Sir Archibald Murray's instructions were to protect Egypt against attack from the E., and to maintain a general strategic reserve of troops for the whole Empire, ready for use wherever required. The reorganization, reëquipping and refitting of the war-worn troops from the Dardanelles was the first consideration. In measure, as this progressed, the "general strategic reserve" was drawn upon to meet the exigencies of other theatres of war; and by the end of June 1916 nine divisions, three infantry brigades, a number of Indian units, and a number of heavy artillery batteries had left Egypt, most of them for the main theatre in France and Flanders. By July, therefore, Sir Archibald Murray's force available for the defence of Egypt against attack from the E. had been reduced to four divisions, three dismounted yeomanry brigades, one mounted division, one mounted yeomanry brigade, and a few Indian and garrison battalions.

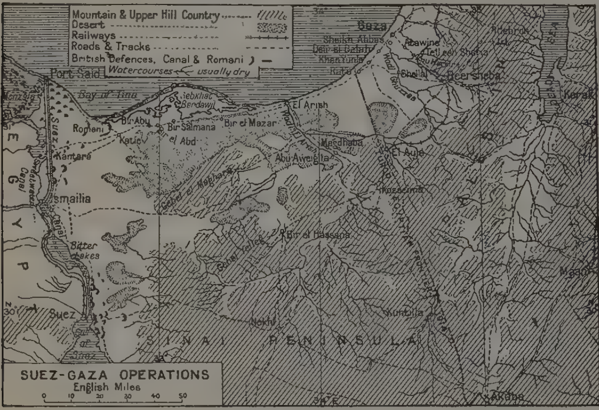

SUEZ-GAZA OPERATIONS

During this period, the first half of the year 1916, the scheme of defence on the E. of Egypt had undergone very considerable modification. The rapid depletion of Sir Archibald Murray's force rendered modification essential, while the Russian victory at Erzerum in the spring, and the fact that no Turkish attack on a great scale was to be apprehended during the hot weather, rendered it also practicable. In Jan. Sir Archibald Murray had taken over a scheme, prepared with Lord Kitchener's personal approval, for the construction of a great defensive system, suitable for withstanding an attack with heavy artillery, of which the front line was some 7 or 8 m. of the Suez Canal, and which extended from the head of the Gulf of Suez to the Mediterranean. By Feb. 15, however, Sir Archibald Murray had already written to the chief of the Imperial general staff pointing out that this scheme of defence was very wasteful in men and material, and recommending an advance across the Sinai Peninsula towards the Egyptian frontier, with dispositions for an active instead of a passive defence. He showed that strategically the true base of the defensive zone of Egypt against invasion from the E. was not the 80 odd miles of the Suez Canal, but rather a line less than half as long near the frontier running S. from El 'Arish. From El 'Arish it would be possible to oppose any advance against Egypt directed along the N. Sinai road; to attack in flank an invader moving on the lines of approach farther to the S.; and to undertake rapid offensive operations against enemy concentrations in S. Palestine. Five divisions and not less than four mounted brigades would be required, but this was a considerably smaller force than would be needed adequately to hold the great defensive system prepared from end to end of the Suez Canal. Moreover, the farther the defence was removed from the Nile delta the less would be the unrest and the chances of disturbance in Egypt in the event of attack by the enemy.

As a first step Sir Archibald Murray proposed in Feb. an advance to a suitable position E. of Katia on the N. Sinai road, and the construction of a railway to that place. Katia itself is some 25 m. E. of the Suez Canal, and its importance lay in the fact that round it, and in the district immediately to the E. of it, it is possible to find or to obtain in shallow "wells" a considerable supply of drinkable though brackish water. It was the only district in which any considerable force of the enemy could possibly be collected, and for a time maintained, within striking distance of the Suez Canal. The organization of camel transport for the troops undertaking this advance was immediately put in hand, and the construction of the railway was begun. By the end of May Sir Archibald Murray had established a strong position near Romani, about 20 m. E. of the Suez Canal at the head of the Bay of Tine. This position was held by the 52nd Div., and from it the Australian and New Zealand Mounted Div. was able to keep under constant observation the whole of the "watered" district round, and E. of, Katia. More advanced positions, E. of Katia, were in course of preparation. A standard-gauge railway had reached Romani, and water from the Sweetwater Canal had been brought there by pipe-lines. Lieutenant-General Hon. H. A. Lawrence was in immediate command of this northern portion of the forces in the Sinai Peninsula. Meanwhile the enemy had not permitted this advance to take place entirely undisturbed. Towards the end of April he had made a partially successful raid, which penetrated to some considerable distance W. of Katia and caused the loss of three and a half squadrons of yeomanry besides other casualties. His raiding force was, however, driven off without difficulty, and for about three months he gave no further sign.

By about the middle of July preparations were well in hand for undertaking the advance across the desert to El 'Arish and the Egyptian frontier. Railhead was some 30 m. E. of the Suez Canal. The construction of a large filter plant at Qantara, of a series of storage reservoirs, and of a great new pipe-line had been ordered, with a view to supplying the troops throughout the advance and as far as El 'Arish with half-a-million gallons of water a day from the Sweetwater Canal. Large numbers of camels were being collected, and all manner of equipment designed to facilitate the passage of the desert—from "pedrails" for the wheels of the artillery to wire-netting for roads—was being procured and tested.

Then on July 19 an enemy force was found to be advancing, and to have entered the eastern part of the area of "wells" and palm groves which extends about 18 m. E. of Katia. By the 24th this force had come to a standstill within 10 m. of the Romani position on a line on which it entrenched itself. From that day until the end of the month there was little further movement. During this period it became fairly clear that the enemy's force consisted of the Turkish 3rd Div., of three regiments, with a number of machine-gun companies, mountain artillery, some batteries of 4-in. and 6-in. howitzers and a body of Arab camelry. It was commanded by the German Col. Kress von Kressenstein.

Sir Archibald Murray was in no hurry to force the issue. His troops were in a strong position with all their requirements close at hand, while the enemy, if he attacked, would fight with a desert behind him and very far from his base. All that Sir Archibald required was time to complete the provision of camel transport for Gen. Lawrence's force so as to render its mobility adequate for counter-attack or pursuit, or for attack eventually if the enemy should refuse to take the initiative. General Lawrence was, therefore, reinforced, till he had under his orders the 52nd and 42nd Divs., a brigade of the 53rd Div., two battalions of the 54th Div., a dismounted yeomanry brigade, the Australian and New Zealand Mounted Div. and a yeomanry brigade. By Aug. 1 over 10,000 transport camels had been provided for this force. An independent mobile column, composed of camel corps with a few squadrons of yeomanry and light horse, had also been organized for coöperation from the section of the Canal defences which lay to the S. of that for which Gen. Lawrence was responsible.

Not until Aug. 3 did the enemy disclose his intention, but on the night of the 3rd–4th he launched an attack against Gen. Lawrence's southern flank with the aim of outflanking and enveloping the British force. General Lawrence's prepared defences extended from the sea on the N. southward for some 5 or 6 m., into a region of heavy sand-dunes, with the southern flank refused. The enemy's blow fell first on the Australian Light Horse, the Australian and New Zealand Mounted Div. being posted on Gen. Lawrence's right. These troops were obliged very gradually to give ground, while from daybreak on the 4th the enemy's attack developed also against the British centre and left-center, held by troops of the 52nd and 53rd Divisions. The enemy was evidently now fully committed. He appeared, however, to have miscalculated to some extent the direction of his main enveloping attack. As his captured air-reconnaissance reports subsequently showed, he was probably unprepared to find the British right flank extended so far S., and consequently failed to direct his enveloping movement sufficiently far to the westward. General Lawrence had the 42nd Div. in reserve at Pelusium station, 5 or 6 m. W. of Romani, and he ordered this division up to his right in order to be ready to attack the enemy's outer flank. Sir Archibald Murray, meanwhile, ordered the independent mobile column to move out wide round the enemy's flank against his left rear. Naval coöperation was afforded by monitors, whose fire from the sea helped to keep down the fire of the enemy's heavy howitzers.

The enemy's containing attack against the British left and centre was not pressed; his force was insufficient for any such purpose. His main enveloping attack, in a waterless region of soft sand and high dunes, had spent its force by the early afternoon. The march of the 42nd Div. from Pelusium had been delayed, but long before its leading troops could come up the mounted troops, with the reserve of the 52nd Div., had begun to press back the enemy's left, and by nightfall had removed any danger on the southern flank. At daybreak on the 5th the southern front was completely cleared, the 42nd Div. advancing on this flank. Farther N. the 52nd Div. moved out in a south-easterly direction against the enemy's right wing, which assumed the rôle of rearguard, while the mounted troops on its right pressed on eastward. These converging movements drove the enemy back to Katia in the course of the day.

On the morning of the 6th the enemy was found to have retired from Katia, and the mounted troops took up the pursuit. The Turkish rearguards fought stubbornly against the direct pressure of the mounted troops. The independent mobile column with its camelmen, however, working right round the enemy's southern flank, fought a very skilful and successful little action on the 7th which no doubt had a great effect in hastening the retreat; and by the evening of the 8th the enemy was at Bir el ʿAbd, some 20 m. E. of the Romani battlefield.

On Aug. 9 the mounted troops made an attempt to envelop the enemy's position and to cut off his further retreat. This attempt was unsuccessful, and a direct dismounted attack was launched which also failed to dislodge the Turks, who made several determined counter-attacks. During the 10th and 11th the situation at this point remained unchanged. But in the meantime the independent mobile column again worked round the enemy's left and fought a sharp action on the 11th, as a result of which the enemy evacuated Bir el ʿAbd during the night. The pursuit had to be abandoned on the 12th, and the remnant of the Turkish force retired to El ʿArish.

Out of a force of about 18,000 troops the enemy must have lost about half. Four thousand prisoners, a mountain battery and a number of machine-guns were left in Gen. Lawrence's hands, besides other booty; but the enemy was able to withdraw his heavy howitzers in spite of the difficulty of moving them through the soft desert sand. It is impossible to say under what pressure Col. Kress von Kressenstein undertook this forlorn hope, nor what real prospects he or his superiors conceived it to offer. It failed completely, with the loss of half the force employed. Yet even so Kress may perhaps be accounted fortunate. Somewhat earlier and more vigorous handling of the 52nd Div. against the enemy's right, at the time when his left began to give way on Aug. 4–5, might have rendered it very difficult to extricate any considerable portion of the Turkish force. Again, as was indicated by the successes of the miniature independent mobile column during the pursuit, wider envelopment, especially on the southern flank, by the mounted troops might have effected more than the direct pursuit actually undertaken, and might have cut off the retreat of more of the enemy's troops and guns. It should be said, however, that the weather was exceedingly hot and trying for white troops; the difficulties of watering in the desert were very great; and the going in the soft sand of that part of Sinai was so bad that the infantry rate of marching was reduced to $1\frac{1}{2}$ m. a day.

After this action the enemy remained about El ʿArish on the Egyptian frontier, with an advance force at Bir el Mazar, over 40 m. E. of Romani. Apart from a successful reconnaissance in force against Bir el Mazar, carried out by the Australian and New Zealand Mounted Div. in the middle of Sept., no further fighting took place for a considerable period. The enemy, made nervous by the proof of extended radius of action given by the appearance of Gen. Lawrence's mounted troops before Bir el Mazar, withdrew all his forces to the neighbourhood of El ʿArish.

The instructions given to Sir Archibald Murray by the War Cabinet about this time were to the effect that the policy in Egypt was to be mainly defensive, though all preparations should be made for an advance on El ʿArish. Sir Archibald took occasion to point out that he adhered to his previously expressed opinion that, in order both to occupy El ʿArish and to be able effectively to operate from that neighbourhood against an invader on any of the routes crossing Sinai, he required at least five divisions and four mounted brigades. Actually at this time he had only four divisions available for the defence of Egypt on the E., though he disposed of a sufficiency of mounted troops. Nevertheless, in the situation as it then was, he signified his willingness to defend Egypt and to undertake the advance on El ʿArish with the troops actually at his disposal.

After the action at Romani, therefore, arrangements were actively pressed forward for the advance across the desert to El ʿArish and the Egyptian frontier. In Sept. Gen. Lawrence left to take up a new command elsewhere, and was succeeded by Lt.-Gen. Sir Charles Dobell, to whom Sir Archibald Murray now entrusted the whole of the forces in the Sinai Peninsula and on the Suez Canal. Sir Charles Dobell's command was called the "Eastern Force" of the Egyptian Expeditionary Force.

In the great ebb and flow of the war as a whole, the autumn of 1916 marked, almost everywhere, a turning-point. In the main theatre in the W. the great battle of the Somme roared to a conclusion far more momentous than appeared to those who were looking only for a definite breaking of the German line. In the Russian theatre, on the other hand, high-water mark had been reached in the summer, and Brussilov had been checked. In Rumania von Falkenhayn and later von Mackensen swept over the country to the lines of the Sereth. In the Balkans Gen. Sarrail had captured Monastir, but his offensive had failed to bring relief to the Rumanians. Greece was in a state bordering on chaos. Everywhere in Europe the superficial signs seemed to indicate either turn of tide or definite ebb. In the eastern theatres affairs seemed somewhat better. The Russian front had been reconstituted in Armenia, though there was little progress anywhither. In Mesopotamia, since the fall of Kut, the hot weather and the necessity for reorganization and preparation had forced a suspension of active operations. Only in the Sinai desert was any forward movement in progress,—one of the least of all the eddies of the war. In Arabia, the Grand Sherif of Mecca had proclaimed independence of Turkey.

The new Government in England, pressed by man-power questions after the losses in the Somme battle and increasingly feeling the submarine menace, probably turned its eyes rather naturally to the eastern theatres for something to show in the way of success, when Sir Stanley Maude's preparations should have been made, the Arabs should be in motion, and Sir Archibald Murray nearing El ʿArish. In any case it was pointed out to Sir Archibald Murray early in Dec. that the gaining of a military success in his theatre was very desirable. Sir Archibald Murray continued to adhere firmly to his original opinion that a fifth division would be necessary if he was to hold and to operate from El ʿArish, and he asked for a sixth division if he should be required to make any further advance. In reply, he was told that the War Cabinet was not prepared to send him additional troops. He was to make the utmost effort during the winter, but his primary mission was the defence of Egypt.

In the meantime the movement on El 'Arish had progressed with such speed as was possible where the pace had to be set by that of the construction of the railway and pipe-line. Early in Dec. Gen. Dobell's advanced guard, which was called the Desert Column, came under the command of Lt.-Gen. Sir Philip Chetwode. This force varied in strength from time to time according to circumstances. On Dec. 10, when railhead was within 20 m. of El 'Arish, and the final advance was in view, Gen. Chetwode had under his command the Australian and New Zealand Mounted Div. and the 42nd and 52nd Divs.

The enemy had about 1,600 infantry in El 'Arish with supporting forces at Magdhaba and Abu Aweigila, and he held the only water supplies. The supply of water for the final advance of the Desert Column required the most elaborate arrangements and the establishment of a large reserve of water, rail-borne from Bir el 'Abd, at railhead. Thus the movement had to be delayed till Dec. 20. Just before the advance of the Desert Column the enemy hurriedly withdrew, and Gen. Chetwode's mounted troops, surrounding El 'Arish after a 20-m. night march on Dec. 20–21, found the place unoccupied.

The nearest Turkish force was at Magdhaba, about 20 m. S. of El 'Arish, and consisted of some 1,600 infantry with four mountain guns. During the night of Dec. 22–23, Gen. Chauvel, commanding the Australian and New Zealand Mounted Div., led a column composed of the majority of his mounted troops and the Imperial Camel Bde. against this force. The enemy's position was reached in the early hours of the morning. Some sharp fighting ensued. The enemy was practically surrounded by mid-day; but no water having been found for his horses Gen. Chauvel was faced with a situation in which, if he could not force the enemy's surrender before nightfall, he would have had to withdraw. By the late afternoon, however, the enemy's stout resistance was overborne, and practically the whole of his force was killed, wounded or captured. Four guns and 1,282 prisoners were taken, at a cost of under 150 casualties.

After this the enemy withdrew the few small posts which he had maintained farther S. within the borders of Sinai, and the only Turkish force remaining in Egyptian territory was a detachment about 2,000 strong near Rafa, the frontier post on the "road" into Palestine, some 25 m. E. of El 'Arish. On the night of Jan. 8–9, Gen. Chetwode moved out against this force with the greater part of the Australian and New Zealand Mounted Div., a mounted brigade (yeomanry) and the Imperial Camel Bde. The long night march was carried out with remarkable speed and efficiency; the enemy was completely surprised, and found his position almost entirely surrounded as day broke. As at Magdhaba, however, he offered a very determined resistance, and again he held the only water obtainable for Gen. Chetwode's horses. In the middle of the afternoon a small relieving force approached from Shellal; this force was, however, neither in time nor strong enough to effect its purpose. At one time it looked as if the Turks might hold out long enough to force Gen. Chetwode to relinquish his hold; but by 5:30 P.M. their resistance had been worn down and their position taken. The whole of the Turkish force, with its commander, was accounted for, and Gen. Chetwode returned to El 'Arish with over 1,600 unwounded prisoners, four mountain guns and other booty, his own casualties being less than 500.

As a result of these two actions—both admirable examples of the tactics of mounted troops relying on fire action—the Sinai province of Egypt was finally freed from the enemy.

The defender who holds the country between Gaza and the sea on the W. and Beersheba on the E. commands the access to S. Palestine from the direction of Egypt. East of Beersheba, a mountainous country, lacking roads and water, opposes a barrier which could only be overcome by preparations so long and arduous as hardly to admit of their inception. At the beginning of 1917 the enemy held Gaza and Beersheba, and, after the actions at Magdhaba and Rafa, began to concentrate his advanced force at Shellal, a point on the Wadi Ghuzze nearly equidistant from Gaza and Beersheba, and some 7 or 8 m. in front (from the Turkish point of view) of the general line between those places. From Shellal he was in a position to watch the approaches to Gaza and to Beersheba, and to cover his lines of communication to those places—especially the railway to Beersheba from the north. Behind the advanced position which the enemy began to prepare at Shellal lay the line of ridges which, running almost direct from Gaza to Beersheba, dominated the open plain to the S.W. and formed a naturally favourable line on which to organize a strong defensive position to bar the way into S. Palestine.

Meanwhile, the desert railway having been pushed on through El 'Arish to within a few miles of the Egyptian frontier, Gen. Dobell advanced his headquarters to El 'Arish before the end of Feb. Sir Archibald Murray, so far from receiving the fifth division which he had always held to be necessary for the further prosecution of the campaign, was now required to send one of his divisions to France—the 42nd. This left available for the eastern force only three divisions, the 52nd, 53rd and 54th, with the nucleus of a fourth—the 74th—to be formed from dismounted yeomanry; but the satisfactory position of affairs in Egypt and the western desert enabled the available mounted troops to be increased to two mounted divisions.

It had by now been made clear to Sir Archibald Murray that the forward policy of Dec. had been altered. The general situation of the Allies, envisaged as a whole, had developed and wore a new aspect. Naturally there could be no ground for surprise at any alteration or transformation of the policy governing the conduct of operations in one of the very minor theatres. On Jan. 11 1917, the day on which, in France, the British attack was launched against the Beaumont Hamel spur, Sir Archibald Murray was told that his primary mission was the defence of Egypt during the summer months and the preparation of an offensive campaign in the autumn. Meanwhile Beaumont Hamel developed into the great German retreat in the west. Nearer to Egypt, the Rumanian retreat came to an end—Wallachia lost but Moldavia held; and Gen. Maude's victorious campaign in Mesopotamia carried him from success to success past the ill-omened Kut to the capture of Bagdad.

Nor were these happenings without effect upon the attitude of the Turks on the confines of Egypt. Early in March the enemy evacuated his positions near Shellal before he could be attacked. His general intention appeared to be to avoid battle, trusting to the severe limitations set to the pace of Gen. Dobell's advance by the difficulties of overcoming the desert. Thus he would conserve his strength, retain his liberty of action in other directions, and choose his ground at leisure for an eventual contest *à outrance* in S. Palestine. Obviously this did not suit Sir Archibald Murray's plans.

In the early days of March the Turkish dispositions were as follows: rather less than a division (say 7,000 fighting troops) held Gaza; about a division was in the neighbourhood of Tellesh Sharia, roughly half-way between Gaza and Beersheba and 15 m. distant from either; and a small garrison occupied Beersheba. In these circumstances, apart from the desirability of foiling the enemy's Fabian tactics, to which reference has been made, Sir Archibald Murray was influenced by other considerations of more or less weight. In order to make adequate preparations for a serious autumn offensive, in accordance with the instructions of the War Cabinet, it was necessary to move railhead forward, and for this purpose it was necessary to advance to within a few miles of Gaza and to seize the line of the Wadi Ghuzze. Further, the enemy's detachment at Gaza was a day's march distant from any supporting troops; by an operation of the same nature as—though on a greater scale than—those at Magdhaba and Rafa it might be disposed of by a *coup de main*. Finally, such a *coup de main*, if successful, might result in Gaza passing not only temporarily, but perhaps permanently into British hands. If so, the effect would be to open the gate into S. Palestine and to make it impossible for the Turks to hold the naturally strong Gaza–Beersheba line as their first line of defence, when the time came for the main effort later in the year.

General Dobell commanding the Eastern Force, and Gen. Chetwode commanding the Desert Column under him, agreed that the chances of capturing Gaza by a *coup de main* were on the whole favourable. General Dobell reported accordingly to Sir Archibald Murray, being careful, however, to add that all would depend on whether or not the enemy's resistance could be broken before nightfall on the day of attack; if the decision should be longer delayed the Turkish force from Tellesh Sharia would probably interfere, and water difficulties might in any case make it necessary to draw off the attacking force. On the whole Gen. Dobell thought the game worth the candle. Sir Archibald Murray, after hesitation, signified his consent.

The problem with which Gen. Dobell had to deal was no easy one. Surprise and celerity were the two essentials. In order to retain the element of surprise he must strike while yet his advanced base was so far off that the Turks should think themselves securely beyond his reach. Actually, when the operation was launched, his railhead was full 20 m. from Gaza. This involved an exceedingly difficult series of approach marches to the place of concentration, in a country where water was very scarce, supplies wholly lacking, and concealment by day very hard to secure. A considerable portion of the force had three consecutive marches to make under these conditions in order to reach the scene of action undiscovered. The movement once started, therefore, no alteration or postponement was possible without the practical certainty of its being discovered, and the chance being lost for all. Moreover, in order so far as possible to insure a rapid decision, Gen. Dobell was obliged to employ a large force. There were two and a half Turkish divisions—somewhat weak, it is true—at, and within a day's march of, Gaza. General Dobell employed the Desert Column (two mounted divisions and the 53rd Div.), the 52nd and 54th Divs. and the Imperial Camel Bde. But even the difficulties of moving this force in secrecy to a place of concentration 20 m. in advance of railhead were less than the difficulties of providing it there with the necessary ammunition, water and supplies, and of maintaining that provision during the action. The whole of the transport of the Eastern Force had to be pooled and rearranged. The troops had to be deprived of all but the barest minimum. Fifteen "trains," each carrying one day's supplies for a mounted division or a division, were improvised in about as many days. Camel water convoys were prepared. Ammunition columns were specially grouped and organized. Every available horse, mule and camel, every available cart and waggon, Ford car and caterpillar tractor, whatever its normal use, was pressed into this service. The troops marched with the barest essentials. And, as the result—no small feat of organization—two mounted divisions were given a 30-m. radius of action, two and a half divisions a 20-m. radius of action, and the remaining half division what was required to enable it to protect and assist the line of communication from railhead forward.

In essence, then, the operation was a raid on a great scale, and, as has been said, Gen. Dobell made it clear that he considered that success depended on his being able to force the surrender of the Gaza garrison before dusk on the day of attack. He came within an ace of succeeding.

The concentration took place successfully and without alarming the Turks by the night of March 25–26. In the early hours of March 26 the mounted troops crossed the Wadi Ghuzze to surround Gaza from the N. to the S.E.; thus they would be in a position to cut off the retreat of the garrison and to prevent or much delay the arrival of Turkish reinforcements whether from the N. or from the direction of Tellesh Sharia. The 53rd Div., which was to attack the enemy's position on the heights E. and S. of Gaza, of which 'Ali Muntar was the chief feature, followed the mounted troops, and was in turn followed by the 54th Div., to support the 53rd and to protect its exposed right flank.

The mounted screen was in position, though not without delay, yet in good time. The infantry was late owing to a cause which no one could either have foreseen or prevented. As dawn broke a dense fog spread over the land from the sea. The troops could only grope their way slowly and uncertainly. They were delayed in reaching their position of deployment. No attack could be delivered until the fog had cleared. Nor did the fog clear until 8 o'clock, when two precious hours had been lost. At the end of the day those two hours would in all human probability have made victory complete.

By 10 A.M. the battle was joined. By the early afternoon the 53rd Div. had fought its way close to its objectives. But the Turkish position was very strong, and the ground over which the attackers fought their way forward was absolutely devoid of cover. General Chetwode, then, ordered the Australian and New Zealand Mounted Div. to attack the town from the N. and N.E., while the Imperial Mounted Div. and the Camel Bde. were to extend so as to take over the screen on the N. of Gaza as well as on the E., though the Turkish reinforcements were already seen to be approaching from N., N.E. and S.E.

Before 5 o'clock the 53rd Div., strengthened by a brigade of the 54th, had taken 'Ali Muntar and had pushed beyond the crest of the line of heights overlooking Gaza. The Australians and New Zealanders were in the north-eastern outskirts of the town, fighting among the cactus hedges. N.E. and E. of the battle, the weakened mounted screen held off the enemy reinforcements, but was being slowly forced to give ground.

Two more hours of daylight were required. Gaza lies in, and is bordered by, an immense labyrinth of great cactus hedges, impossible to fight through and clear by night. The 53rd Div. and part of the 54th were extended on the hills over Gaza on a line facing nearly N.W. Below among the houses and cactus hedges was the Gaza garrison, still not surrendered. Bearing down on the very point of the exposed right flank of the 53rd Div. was a strong Turkish force, now within a few miles. Approaching the back of that same exposed right flank was another strong Turkish force, also within a few miles, coming from the direction of Tellesh Sharia. The thin mounted screen could not long delay these forces; no water had been found for the horses all day, and it must in any case be soon withdrawn. Part of the 54th Div. protected what was now the rear of the 53rd on the Mansura and Sheikh 'Abbas ridges S. of Gaza. One brigade of the 52nd Div. was available and no more. This was far from sufficient to protect the right of the 53rd Div. in its actual position, and at the same time to join it securely with the 54th. The one day's fighting, for which alone it had been possible to make effective arrangements as regards water supply, was drawing to a close. No water had been found in the Wadi Ghuzze or elsewhere by the parties detailed to search for it; and the water supply of the troops already engaged was now a matter of some anxiety. Half an hour before sunset, then, there were two alternatives. One was to launch the 53rd Div. and the Australian and New Zealand Mounted Div. down into Gaza in an attempt by night to clear up, or even to drive back into the Wadi Ghuzze, the disorganized remnants of the garrison, while using the 54th Div. and the Imperial Mounted Div. as a rearguard during the night. The other was to withdraw the mounted troops while the way between Gaza and the Turkish reinforcements was still open, and to form some sort of line on the ground won, by advancing the left of the 54th Div. and retiring the right of the 53rd until the two flanks met in a secure junction. General Dobell thought the former alternative, on a dark night, in unknown and extremely intricate country, with strong enemy reinforcements already on the very outskirts of the battle, too hazardous. General Chetwode, who was at this time at Gen. Dobell's command post, emphatically agreed.

The second alternative was, therefore, adopted, and Sir Archibald Murray, who had come up in his travelling *poste de commandement* on the railway to Khan Yunis, within a few miles of the action, was informed accordingly. Several hours later Gen. Dobell received from Cairo the decipher of an intercepted wireless message sent by the enemy commander in Gaza indicating his intention to surrender. This message had been sent in the early evening. Its receipt by Gen. Dobell was too late. But even had it reached him earlier it is not easy to see how, with darkness actually falling and the enemy's reinforcements at hand, he was to have taken advantage of it. The two hours' fog on the morning had destroyed his opportunity.

The new dispositions ordered were successfully taken up during the night—not without protest from the commander of the

53rd Div., who had to withdraw his right from 'Ali Muntar. Early on the 27th his patrols again occupied the hill. But the Gaza garrison had now been reinforced, and the patrols were driven off again. The point of junction of the 53rd and 54th Divs. was now the apex of an acute salient. The latter division, in order to join the former, had had to leave the Sheikh 'Abbas ridge, on which the Turks now appeared. The 54th Div. and the Camel Bde. on the S.E. face of this salient were heavily attacked. All attacks were repelled, but the position towards the apex of the salient grew more and more precarious. General Dobell, therefore, ordered a further retirement during the night of the 27th–28th to a strong position on the W. bank of the Wadi Ghuzze. This movement was successfully carried out and the action came to an end.

The advance to the Wadi Ghuzze had been effected, covering the further progress of the railway. The enemy had been brought to battle and was now pinned to the Gaza–Beersheba line. Nearly a thousand of the enemy had been taken prisoner, besides two guns, and he had lost several thousand killed and wounded. The cost of this to Sir Archibald Murray was some 4,000 casualties. Gaza, however, and its garrison had escaped, though this was owing to climatic conditions against which both commander and troops were powerless.

In spite of the fact that an unkind fate had snatched away the fruits of complete success just as they were within Gen. Dobell's grasp, in Sir Archibald Murray's view the military results of the action had justified his anticipations. The enemy had been brought to battle, and had been severely mauled, and the advance of the railway to the Wadi Ghuzze was assured. It will be remembered that the instructions under which Sir Archibald Murray was acting at this time were to defend Egypt during the summer and to prepare for an offensive campaign in the autumn. The railway could now be pushed forward sufficiently to admit of what would be required.

Meanwhile, within three days of the Gaza action, Sir Archibald Murray suddenly received altered instructions. The general strategic situation was again changing. In France the great German retreat was slowing to a halt on the Siegfried line; the preparations for the battle of Arras were in hand, and farther S. the second battle of the Aisne was shortly to begin. In Russia the revolution was fairly launched. In Mesopotamia Sir Stanley Maude was driving the Turks far from Bagdad towards Samarra. Sir Archibald Murray was ordered accordingly, on March 30, in view of the altered situation, to make his objects the defeat of the Turks S. of Jerusalem and the occupation of that city. Sir Archibald replied that he still required the five divisions which he had always considered necessary for a further advance—an estimate from which he had never varied; he also indicated that the prospects of a rapid advance were to say the least doubtful. In reply, he was instructed to push his operations with all energy, though no additional troops could be sent to him, since it was considered that, in view of the military situation of the enemy, his present force would suffice. Undoubtedly the latter portion of this instruction was unhappily expressed. The War Cabinet, with the whole strategic situation in its view, was no doubt more competent than Sir Archibald Murray to judge of the advisability of taking certain risks on the Palestine frontier, so there can be no question but that the alteration in the instructions was justified. But Sir Archibald Murray, on the other hand, was more competent than the War Cabinet to judge of the actual military situation of the enemy opposed to him, and of the probable sufficiency for their task of the forces of which he disposed. However, immediate preparations were begun for a renewed offensive, and on March 30 Gen. Dobell moved forward the Eastern Force headquarters to Deir el Belah, on the coast some 8 or 9 m. from Gaza.

If anything was to be done quickly, as the War Cabinet's new instructions evidently contemplated, there was nothing for it but a renewed attack on Gaza. Already Gen. Dobell's thoughts had been turned in the direction of Beersheba; but, in discussing with Sir Archibald Murray the question of operating by his right, he was constrained to say that it was difficult to estimate how long a delay would be involved in the preparations necessary for such an undertaking. The whole of the existing organization, and in particular the position of the railway running close to the sea-coast, restricted the area in which it was immediately possible to undertake serious operations on the confines of the desert to within a very strictly limited distance from railhead. To prepare for an effective operation farther to the right would involve weeks of preparation and rearrangement. Sir Archibald Murray decided, therefore, to attack Gaza again, and instructed Gen. Dobell accordingly.

In any case a vast amount of preparation had to be made. The Turks were daily increasing their force on the Gaza–Beersheba line, and it was evident that Gen. Dobell's troops, specially lightly equipped for the passage of the desert, would have to be organized for the battle on more normal lines. The divisional artilleries, which had had to be reduced in the desert, had to be increased again; heavy guns and howitzers had to be railed up and heavy artillery groups formed. A few tanks were brought up, and the troops had to be instructed in methods of coöperation with this new weapon which they had never before seen; they had also to learn the use of gas shell and smoke-clouds. New large-scale maps had to be made and issued, including trench maps hastily prepared and incessantly revised from aeroplane photographs. Aircraft coöperation with the artillery had to be reorganized. The latest methods, in these and a hundred other matters, found advantageous by experience in more important theatres, had to be hurriedly assimilated by an army which had just painfully emerged from a 15-months' sojourn in the wilderness, and whose last pitched battle, so to speak, had been fought on the Gallipoli Peninsula. The limited capacity of the communications and transport available made the organization of the supply of ammunition and engineer stores a matter of great complexity. Preparations for water supply were far more difficult and arduous still. Arrangements had to be made for bringing up rail-borne water from pipe-line head at Rafa to Deir el Belah, and for pumping it thence by a small pipe-line into tanks prepared in the Wadi Ghuzze. Scores of wells were sunk in the wadi. Several hundred thousand gallons storage capacity was prepared at these wells, and by repairing and filling the great underground grain-reservoirs of the natives in the neighbourhood. Scores of prepared crossing-places over the Wadi Ghuzze had to be made and allocated to the various formations, arms and transport. Between March 30 and April 15, however, all this work was practically completed, and Sir A. Murray brought up his advanced G.H.Q. to Khan Yunus, on the railway about 6 m. S.W. of Deir el Belah.

By this time the enemy had five divisions and a force of cavalry in line, and he had been considerably strengthened in heavy artillery. The Gaza defences were now strong and well wired, and the Turkish trench system extended S.E. from Gaza for some 7 m. to the Atawine ridge. Farther to the S.E. the defensive system was less continuous, but one division was about Tellesh Sharia (16 m. from Gaza) and between that place and Atawine. Beersheba was also held.

General Dobell disposed of the 52nd, 53rd and 54th Divs., the still incomplete 74th Div. in process of formation from dismounted yeomanry, the two mounted divisions of the Desert Column, and the Imperial Camel Bde. The French battleship "Réquin," and H.M. Monitors 21 and 31 were also to coöperate by fire from the sea when the time came. General Dobell had planned his operations in two stages. The first stage was limited to securing the outer defences from the sea to Sheikh 'Abbas, a commanding feature rather over 4 m. S. of Gaza. The second included the attack on the 'Ali Muntar position and Gaza.

The first stage began at dawn on April 17, and success was complete. The 52nd and 54th Divs. took all their objectives by 7 A.M. with but few casualties. The 53rd Div. on their left pushed forward reconnaissances along the coast. One mounted division protected the right of the 54th Div.; the other watched and immobilized the enemy's force about, and W. of, Tellesh Sharia. The ground gained was consolidated, and final preparations for the second stage completed on the 18th.

On the 19th the bombardment of the enemy reopened at dawn, the "Réquin" and the two monitors now joining in the battle. At 7:15 A.M. the 53rd Div. launched its attack along the coast. A quarter of an hour later the 52nd and 54th attacked—the former astride the ridge running S.W. from ʿAli Muntar, the latter, with the addition of the Imperial Camel Bde., immediately on the right of the 52nd. Farther to the right again the Imperial Mounted Div. made a dismounted attack on Atawine, while the Australian and New Zealand Mounted Div. protected the extreme right flank, and prepared to take advantage of any success gained by the Imperial Mounted Div. The 74th Div. was in reserve W. of Sheikh ʿAbbas.

The 52nd Div. was the first to be checked, after progressing about half-way to its objective at ʿAli Muntar. This resulted in checking also the progress of the 53rd Div. on its left, and the left of the 54th Div. on its right. The right of the 54th Div., however, entered the enemy's works at Khirbet Sihan, just W. of the Atawine ridge, while the containing attack of the Imperial Mounted Div. was successful in occupying the defenders of the Atawine works. But the situation of the 54th Div. was far from favourable. Owing to the continued inability of the 53rd to make headway its left was exposed to heavy enfilade fire from ʿAli Muntar, while its right, with the Camel Bde. thrust far forward, was subjected to a series of determined counter-attacks. In this position, reached in the early afternoon, the battle swayed with little change for the rest of the day. Air reconnaissance indicated that the enemy's reserves had not yet been drawn in, and Gen. Dobell, though moving part of the 74th Div. closer up, would not be the first to launch his last reserve, especially in view of the fact that it was the 52nd Div. which was checked and that the reserve brigade of that division had not yet been employed.

Towards evening Gen. Dobell reported the situation to advanced G.H.Q., when Sir Archibald Murray instructed him by telephone that all ground gained must without fail be held and the attack resumed under cover of an intense artillery bombardment at dawn on the 20th. General Dobell issued his orders accordingly, and as night fell every preparation for the pursuance of the offensive was actively in hand. Between 10 and 11 o'clock at night, however, Gen. Dobell was in communication with the Desert Column and all his divisional commanders, who by this time had received more detailed and accurate reports of the situation on their respective fronts. These reports made it clear that the enemy's resistance nowhere as yet showed any signs of weakening, that the British casualties amounted to some 7,000, and that the prospects of being able to make any considerable further progress without a much longer, more intense, and less hurriedly planned artillery preparation, were, to say the least, dubious. By 1 A.M. the new artillery plan, including the divisional arrangements, was ready. General Dobell was not satisfied that in the time, and with the means available, the prospects of success were sufficient to warrant the immediate resumption of the action. Telephonic communication with divisional commanders and their artillery chiefs more than confirmed his doubts. General Chetwode, commanding the Desert Column, was equally clearly of opinion that the prospects were not sufficiently favourable to justify a hurried resumption of the attack. About 4 o'clock in the morning, therefore, Gen. Dobell issued orders to postpone further operations, with Sir Archibald Murray's assent.

The ground gained was consolidated during April 20 and following days. The enemy made no serious counter-attacks. It became clear that, before Gaza, there was nothing for it but the deliberate methods of trench warfare. The alternative involved long preparation, new communications, and an eventual movement far away in the direction of the British right flank. On April 22 Sir Archibald reported to the War Office that with his present force he could not count on more than a local success; and here the Sinai campaign proper came to an end.

There was no further considerable action during the spring or summer. The opposing lines stabilized, and there ensued a period of preparation and training, of trench-raiding, and of enterprises by mounted troops and camelry in the direction of Beersheba, and against the railway running S. from that place which was demolished. But the Sinai desert had been conquered and passed. The defence of Egypt was secure. And room had been gained for the preparation of a great offensive campaign in the autumn. Thus the mission assigned to Sir Archibald Murray at the beginning of the year had been fulfilled. Meanwhile, at the headquarters of the Eastern Force, where Lt.-Gen. Sir Philip Chetwode had now succeeded Sir Charles Dobell, the plans were already in course of preparation which were to become the basis of the great campaign fought in the autumn by Gen. Sir Edmund Allenby, who succeeded Sir Archibald Murray in the Egyptian command in June. (G. P. D.)

(IV.) THE PALESTINE CAMPAIGN

The successful defence of Gaza on April 19 1917, when Gen. Kress von Kressenstein for the second time in little more than three weeks had beaten off formidable British attacks, was followed by a prolonged pause while both armies went into "summer quarters." Every effort was made on both sides for a resumption of the struggle in the autumn, and by the beginning of Aug. 1917 the German staff, realizing that the next British effort was likely to be considerably more formidable than the last, represented to Constantinople that the Gaza–Beersheba line was inherently weak in that its left flank was "in the air," and that the only remedies were either readjustment, involving withdrawal, or reinforcement on a generous scale.

Unhappily for the Ottoman cause political ambitions came into conflict with military necessities. The loss of Bagdad on March 11 1917 had been a blow to the prestige of the Sultan, more severe in that it followed upon that of Mecca, and the Pan-Islamic party in the capital was insistent that steps should be taken to retrieve the loss and rehabilitate the Ottoman Khalifates in the eyes of the Moslem world by a triumphant recovery of the city of the Khalifs. In this contention the Pan-Islamic leaders were supported by Berlin, where the influence of alliterative war cries indicative of future trade domination was strong. "Berlin to Bagdad" still reigned in official and public esteem, not yet supplanted by "Hamburg to Herat."

In consequence of this political counter-attraction Constantinople sent men and supplies for the reconquest of Iraq (Mesopotamia), until it was persuaded to realize that the Palestine front, if starved of needed reinforcements, would inevitably give way in a *débâcle* which might permit an active enemy to advance up the whole length of Syria and establish himself on the Upper Euphrates, thus cutting off the whole of the force in Mesopotamia from communication with Constantinople except by way of the railless and mountainous Armenia and Kurdistan. The Pan-Islamists fought hard for their policy and succeeded in delaying the dispatch of troops to Palestine until the middle of October. It was then too late, but this was not realized.

As soon as Constantinople had accepted the principle that the presence of a powerful British striking force in front of Gaza constituted a menace to the operations destined for the recovery of Bagdad, Marshal von Falkenhayn, in command of the Yilderim Army Group, then at Aleppo, was directed to drive the British back into the Desert of Sinai. The marshal planned to strike at the British right flank, which, it was thought, had probably been weakened in order to mass troops upon the left for the expected third assault on Gaza. It was proposed to start this Turkish offensive about the middle of Oct., which would forestall the British offensive, calculated by the German staff to be due in the first week of November.

Serious difficulties, however, arose which fatally delayed the completion of these dispositions. In the first place the Turkish transport was poor. The sector of the Turkish lines of communication from Bozanti, the then railhead from Constantinople or, rather, Haidar Pasha on the Asiatic shore of the Bosporus, to Beersheba, was under the Syrian Western Arabia command of which Ahmad Jemal Pasha was G.O.C.: unfortunately this politician was jealous because the command of the Yilderim Group, which since the beginning of July 1917 had included his own army, had been given to a German. He made trouble and caused delays in the working of a system which could not really have been efficient even if worked with perfect goodwill.

As the Taurus and Amanus tunnels were not yet open for ordinary traffic, all stores coming from the W. to Bozanti had to break bulk there and, reloaded into narrow-gauge trucks, to be taken through the tunnel by compressed air engines, or hauled by lorry, mule or camel to Dorak, where they were again packed into standard-gauge trucks. The same performance had to be repeated at Baghche for transport across the Amanus to Islamié. Stores could be taken thence in standard-gauge trucks as far as Rayak, where they had to break bulk for the fifth time to be restowed in narrow-gauge trucks for Damascus, where, owing to lack of railway rolling-stock, a portion was sent to the front by lorry via Jisr Banat Ya‘qub on the Jordan, Nazareth, Nablus and Jerusalem. Where railway rolling-stock was available fuel was often scarce, locomotives had to be adapted to burn wood, and instances occurred of this being supplied in unsuitable lengths, so that trains were delayed while the crews cut up the wood afresh before it could be fed to the furnaces.

General Allenby, however, having brought his railway right up to the front and constructed a strategic development of his pipe-line in addition, to the considerable improvement of his local water supplies, determined to forestall the impending Turkish offensive. His force was disposed along a front of some 22 m. from Gaza to Gamli and beyond to where the Desert Mounted Corps had detachments as far inland as Asluj, 38 m. from the coast. On the eve of the British attack the rival forces were disposed as follows. Facing one another in the strongly fortified Gaza sector were the Turkish VIII. Army (Gen. Kress von Kressenstein) consisting of the XX. Corps (3rd, 7th and 53rd Divs.—the 7th being in reserve near Herbie, 10 m. behind the line) and the XXII. Corps (16th, 26th, Fakhr-ed-Din Bey, and 54th, Nasuhi Bey, Divs.) aligned out towards Tellesh Sharia, opposing the British XXI. Corps (Lt.-Gen. Sir E. Bulfin) consisting of the 52nd (Lowland), Maj.-Gen. Hill, the 54th (East Anglian) Div., Maj.-Gen. Hare, and the 75th Div., Maj.-Gen. Palin. The British XX. Corps (Lt.-Gen. Sir P. Chetwode), consisting of the 53rd Welsh Div. (Maj.-Gen. Mott), the 60th London Div. (Maj.-Gen. Sir J. Shea) and the 74th Yeomanry Div. (Maj.-Gen. Girdwood), was wheeling into position in support of the Desert Mounted Corps (Lt.-Gen. Sir H. G. Chauvel), consisting of the 4th Cav. Div. (Maj.-Gen. Sir G. Barrow), the Australian and New Zealand Mounted Div. (Maj.-Gen. Sir E. W. C. Chaytor) and the Australian Mounted Div. (Maj.-Gen. Hodgson); this was concentrating near Khalasa for its swoop upon Beersheba, held by Ahmad Feizi Pasha's VII. Army consisting of the III. Corps (Ismet Bey)—composed of the 24th Div. (Wilmer Bey), the 27th (Arab) Div. in Beersheba itself, with the 3rd Cav. Div. in front of it, and the XV. Corps, which was hardly constituted as yet, its 19th Div. (Sedad Bey) being still in the XX. Corps area behind Gaza on its way to the front, and its 20th Div. being still on the lines of communication S. of Aleppo and not destined to arrive even at Ramleh, far in the rear, until Nov. 6. General Allenby further had the support of certain warships, H.M.S. "Grafton" (a "blister"), four monitors, 15, 29, 31 and 32, the destroyers "Staunch" and "Comet" and the gunboats "Amphis" and "Ladybird," which were able to enfilade the Turkish positions near Gaza and destroyed important ammunition dumps.

During the night of Oct. 30–31 1917 the British XX. Corps had moved forward to positions of deployment, and at dawn, when the Desert Mounted Corps had got right round to the E. of Beersheba, the 60th and 74th Divs. were ready to close in from the W., while the 53rd Div. at Abu Irgeig threatened the Turks along the Wadi Saba front in such a position as to break through them and take in flank any reinforcements which might be sent down to the Turkish III. Corps in Beersheba.

At 05:55 (5:55 A.M.) on Oct. 31 a hundred field guns and howitzers opened against a Turkish front of 4,500 yd., while the 96th Bde. R.G.A. was engaged in counter-battery work. At 08:30 the 181st Bde. (Brig.-Gen. Da Costa) of the 60th London Div. captured the first Turkish position; at 12:15, the guns having moved up to cut the Turkish wire, the main assault was delivered and all objectives gained by 13:30, whereupon the 230th Bde. (Brig.-Gen. McNeill) of the 74th Div., which had formed the extreme left of the main assault, coöperated with the 160th Bde. (Brig.-Gen. Pearson) of the 53rd Div. against the Wadi Saba front and rolled up all the Turkish defences as far as the Beersheba–Tell el Fara road. Meanwhile the cavalry had completed their wide swing round from the E., and after hard fighting the 2nd A.L.H. Bde. (Brig.-Gen. Ryrie), belonging to the Anzac Mounted Div., was astride of the Hebron–Beersheba road by 13:50.

At 16:00 the 4th A.L.H. Bde. (Brig.-Gen. Grant), belonging to the Australian Mounted Div., which had reached Iswaiwin by 11:00, moved forward against Beersheba itself. It charged over a succession of strong Turkish positions, demoralized the defence and captured the town at 18:00 with 1,148 prisoners, and was joined at 18:30 by the 7th Mounted Bde. (afterwards 14th Cav. Bde.—then commanded by Brig.-Gen. Wigan), which had turned the Turkish defences on Ras Ghannam.

Immediately upon its capture the Royal Engineers, upon whose careful preparatory work in the provision of pipe-lines and camel-convoys of water the success of the attack had been based, began to develop the wells in hopes of being able to produce enough water for the horses and men, who required 400,000 gal. per day. Fortunately the Turkish evacuation had been so hurried that the wells were less damaged than had been expected, and two reservoirs were left intact. The discomfort of the thirsty cavalry was much enhanced by the fact that a hot *khamsin* blew up off the desert, and on the afternoon of Nov. 3 the water situation was most acute, as all stored water had been drunk, and the output was barely adequate for the demand, and at 16:00 a brigade some 2,000 strong rode into Beersheba with a 48 hours' desert thirst. Fortunately at 17:00 a new well came into working, and by midnight the brigade was watered, consuming some 8,000 gallons.

Owing to this water difficulty the Australian Mounted Div. had to go into reserve temporarily, and actually returned to Karm for water while preparations were made for the next attack against the positions covering Tellesh Sharia. The fall of Beersheba had cost the Turks over 500 killed, 2,000 prisoners and 13 guns, and exposed the left flank of the Gaza position.

The next step towards the final attack on Gaza was the capture of Umbrella Hill by the 156th Bde. (Brig.-Gen. Leggett) of the 52nd Lowland Div., temporarily attached to the 54th Div., at 11:00 on Nov. 1 as a preliminary to the main assault timed for 03:00 on Nov. 2. This attack with its preliminary bombardment caused severe casualties to the Turks and, so far from being able to detach troops from Gaza to strengthen the left flank, the Yilderim command had to bring the 7th Div. into the line. The attack, therefore, of the 54th Div. had the required effect of "pinning" the Turks in the Gaza sector, and cost them over 1,000 dead in the captured positions, 654 prisoners and 3 guns.

Meanwhile, next day Gen. Allenby delivered another heavy blow with his right when the 53rd Welsh Div., temporarily under the Desert Mounted Corps, attacked the VII. Army at Khuweilfe on the extreme eastern end of the line, and by its obstinate fighting against great odds did much to persuade the Turks that the British were trying to make a great turning movement from the E., whereas in point of fact the 10th, 60th and 74th Divs. were about to break the line between the VII. and VIII. Armies in order to make a gap through which the Desert Mounted Corps could pass. After fighting for three days and nights almost continuously against what was left of the III. Corps and the 19th and 26th Divs. brought across from the coastal sector, the positions were captured by the 158th Bde. (Brig.-Gen. Vernon) and held in spite of counter-attacks on Nov. 6 and 7, and on Nov. 8 the division concentrated in Khuweilfe.

The Turks being thus fully occupied on the extreme left of their front and "pinned" by operations at Gaza, Gen. Allenby at dawn on Nov. 6 broke through the middle of their line with an attack against Kawuka with his 10th, 60th, 74th Divs. and the Yeomanry Mounted Div. The Turks opposed him with the right wing of their VII. Army and the left wing of their XXII. Corps, but by 14:30 the 179th Bde. (Brig.-Gen. Edwards) and the 180th Bde. (Brig.-Gen. Hill) had captured Sharia for the 60th Div., while the 74th Div. was stiffly engaged to the right. The Turks, however, still held positions above Sharia, and it was not until 06:00 on Nov. 7 that the 60th Div. was finally able to open the way through the Turkish line for the Desert Mounted Corps. The stout defence made by the VII. Army, the artillery of which was notably accurate, and the XXII. Corps, had delayed the start of the cavalry advance, which was still further hindered by lack of water, and Gen. Allenby was unable to cut off the Gaza troops by a flanking attack from the N.E., the more so as the Turks, under pressure of bombardment by land and sea on Nov. 5 and 6, had begun to withdraw. Their rearguards were unable to hold even the most formidable positions.

Outpost Hill and Middlesex Hill fell to the 233rd Bde. (Brig.-Gen. Colston) during the night of Nov. 6, and by 13:30 on Nov. 7 the 232nd Bde. (Brig.-Gen. Huddleston) had taken 'Ali Muntar itself and a number of strongly fortified works. Farther to the E. the 52nd Div. and the XXI. Corps Cav. had pushed through on the heels of the retiring Turks. The Imperial Service Cav. Bde. (Brig.-Gen. Harbord) actually rode through the ruins of Gaza at 09:00 on Nov. 7. Gaza had fallen, and all that remained for the Yilderim command was to get its armies away.

In places their *moral* was shaken, but for the first stages of the retreat the Turks fought strong rearguard actions, notably at Deir Sineid, where the Turkish XX. Corps four times recaptured the position from the 52nd Lowland Div., and at Huj, where the Turks stood up to a cavalry charge by the 5th Mounted Bde. (Brig.-Gen. Fitzgerald) and served their guns until actually cut down. The VIII. Army retreated along the line of the light railway and the motor road on Ramleh while the VII. Army fell back on Hebron and the main N. road. The line of advance across the Plain of Philistia was easier than that over the hills of southern Judea, consequently British transport was concentrated as far as possible so as to facilitate the advance of the left wing, and the 54th Div. was immobilized at Gaza as all its transport went N. with the rest of the XXI. and Desert Mounted Corps which pressed on regardless of thirst, greatly enhanced by a hot *khamsin* which began to blow on Nov. 19.

The hardest fighting during the pursuit was that at Qatra and El Mughar on the Wadi Tahhana, when the 3rd, 7th and 10th Divs. tried to hold the 52nd Lowland Div. on Nov. 13. In ordinary circumstances perhaps such a pronounced advance of a left wing would have been dangerous, as the VII. Army was still in the Hebron area and even tried to make a diversion, but Gen. Allenby declined to be overawed by a force which he rightly estimated to be largely disorganized and almost destitute of transport. He attached the XX. Corps Cav. to the 53rd Welsh Div. and sent them—to be known as Mott's detachment—to contain the southern detachments of the VII. Army.

General Allenby proposed to push the VIII. Army back beyond Jaffa and contain it while he turned to the E. and struck up through the hills at Jerusalem, upon which the Turks were concentrating. The Holy City, of no great strategic or commercial value in itself, had an immense sentimental value, and the Turks were unwilling to suffer the blow to their prestige which its loss would entail, the more so as Mecca and Bagdad were now no longer in their possession. Ramleh was taken on Nov. 15 and Jaffa by noon next day, while the 54th Div., which had regained its transport, was hurrying up from Gaza, arriving in the Desert Corps area on Nov. 18. Next day the advance toward Jerusalem began and the 60th Div. started N. from Gaza. The 75th Div. had to encounter much resistance near Saris amid the barren and precipitous hills dominating the main road to Jerusalem, while the 52nd Div., moving eastward up the parallel valley of Beth Horon, had turned off up the Beit Likia road in face of Turks on the heights and transport difficulties in the valleys, and the Yeomanry Mounted Div., which was trying to reach the Nablus–Jerusalem road in order to force an evacuation of the Holy City, had even greater difficulties to surmount.

All through Nov. 20 and 21 there was hard fighting during which the Turks were steadily thrust back, a fog being of great value to the 75th Div. just before the attack on the positions covering 'Enab, which the 232nd and 233rd Bdes. (Brig.-Gens. Huddleston and Colston) took at the point of the bayonet at 17:00 on Nov. 20. Kustul and Soba, two dominating positions, were taken next day by the 232nd and 234th Bdes. (Brig.-Gen. Anley), and at 23:45 Nebi Samwil was successfully stormed by the last-named brigade, and contact was established with the 52nd Div. at this point. Both divisions, however, were suffering much from rain and cold winds, and having come straight from an exhausting and rapid advance from the heat-stricken plains, were marching light with nothing to protect them from the cold. In the plain the 54th Div. went into the Desert Corps area to hold the front N. of Jaffa and Ludd, where it was faced by the 3rd, 7th, 16th and parts of the 19th and 20th Turkish Divs., and the 60th Div. arrived near Mejdel from Gaza where it had had to wait until the 54th was off the lines of communication.

The VII. Army, now consisting of the 3rd Cav. Div., engaged against the Yeomanry on the extreme right of the Turkish line, and the 24th, 54th, 26th, 53rd Divs. covering Jerusalem from the W., while the 27th was observing Mott's detachment as a cover against a possible advance from Hebron, now made strong counter-attacks against Nebi Samwil; and although unable to recover it was at least able to prevent either the 75th or the 52nd from taking Ej Jib. It became apparent that for the moment the British thrust had spent itself. Accordingly the wearied divisions which had forced their way so far into the mountains were taken out of the line and sent to rest near Ramleh; their hard-won positions were turned over to the 60th and 70th Divs.

The delay in the British advance occasioned by this necessary relief gave fresh hope to the Turks, who began, after a period of depression, to hope once more that they might retain Jerusalem; accordingly reinforcements were brought down from the N. and across from beyond Jordan by way of Jericho, and by the time that the British were ready to resume their advance after the 10th Div. had arrived from Gaza, the 19th Div. and parts of the 20th, 48th and 49th Divs. had arrived to strengthen the VII. Army, which held a strong series of positions overlooking from the E. the steep slopes of the deep valley of the Sarar (vale of Sorek) and across the Bethlehem road.

After a preliminary concentration during which Mott's detachment was advanced up the Hebron road to within striking distance, and heavy guns had been brought up into the mountains, the general assault which was to result in the fall of Jerusalem began in driving rain at dawn on Dec. 8. The 60th Div. had great difficulty in capturing the "Heart" and "Liver" redoubts, and the strong works at Deir Yesin, and was hampered by the inability of the 53rd Div. to coöperate with its right flank owing to the strenuous Turkish opposition and the bad weather which were delaying its advance. However, by nightfall the British were established on the crests to the E. of the valley of the Sarar, and the 180th Bde. (Brig.-Gen. Watson) of the 60th Div. took Lifta by dusk, and by 07:00 on Dec. 9 the Worcester Yeomanry had moved across the front of the 53rd Div. and got astride of the Jerusalem–Jericho road.

The news of the capture of Lifta started a panic among the Turks, and a disorderly retreat ensued which would have been disastrous for the Turks had not Gen. Allenby been unwilling to allow any hostilities in the immediate vicinity of the Holy City. It was now militarily speaking untenable, and he was anxious to secure a peaceful occupation even at the cost of sparing the Turks in this panic-stricken withdrawal.

At 07:00 on Dec. 9 the last Turkish troops left Jerusalem, 'Izzet Bey, the Mutesarrif, being the last civil official to depart. Before 08:00 the mayor started out to surrender, and by 09:30 Brig.-Gen. Watson, the first British soldier to reach the Jaffa Gate, arrived and posted guards in anticipation of the formal act of accepting the surrender, which was performed by Maj.-Gen. Shea, in command of the 60th Div., soon after 11:00.

Having thus obtained the chief objective of the campaign all that was now necessary was to thrust back the Turks in order to remove the Holy City from danger of long-range bombardment. The first steps towards this were taken on Dec. 10 when the 53rd Div. captured ridges to the E. of the city, and was resumed, after Gen. Allenby's formal entry into Jerusalem on foot, on Dec. 11, in conformity with a general plan for improving the front. The 52nd Div. forced a passage of the Nahr el 'Auja, Dec. 20 and 21, and by pushing the front to a point 8 m. N. of Jaffa made it possible to make use of such harbour facilities as did then exist there. Troops were redistributed along the front, and a number of minor advances were made while everything was being prepared for the expected Turkish attempt to recover Jerusalem, the loss of which had much affected Ottoman prestige. This attempt was made at 23:30 on Dec. 26 by the VII. Army, which had been reinforced by the arrival of the 1st Div. and of troops from across Jordan.

A vigorous attack was made on the sector round Tel el Ful, held by the 60th Div. which, in common with the rest of the XX. Corps, was standing by for a general offensive with which Gen. Allenby had intended to forestall the Turkish counter-attack at dawn a few hours later. Consequently the moment for the VII. Army's attack was unhappily chosen, and while every effort was being made to drive the 60th Div. back on Jerusalem and dislodge the 53rd Div. from its advanced positions the British counter-offensive on the part of the 10th and 74th Divs. started according to plan at 06:30. At 12:55 the Turks, who were beginning to feel the pressure of this advance, made redoubled efforts to break through the 60th Div. which lay astride of the Nablus road only some 4 m. N. of Jerusalem. In spite of their courage and energy the Turks were unable to make any impression on the 60th, and were unable to prevent the 10th and 74th from advancing 4,000 yd. on a 6-m. front by nightfall.

Next day, Dec. 28, the whole XX. Corps advanced, the Turkish transport was harassed by aeroplanes, and the VII. Army, having failed to recapture Jerusalem, found itself on the last day of the year 7 m. farther from its objective than when it had started. So ended the first battle of Mount Ephraim, during which the XX. Corps had gone forward on a 12-m. front to a depth of 6 m. on the right and of 3 m. on the left, occupying the Ram Alla-Bire ridge. The N. front was now secure, but the Turkish XX. Corps still held Jericho and the fords and bridge of the Jordan, and remained in positions more than two-thirds of the way up the steep and almost waterless slope leading up from the E. to the Mount of Olives.

During Jan. the standard-gauge railway was pushed forward across the plain of Philistia, and the problem of transport, which all through the Dec. fighting had had to rely on camels and donkeys or mule-drawn wheels over half foundered roads, was greatly simplified by the opening of Ludd as railhead with adequate sidings on Feb. 4 just after the narrow gauge to Jerusalem from Ludd had been restored to use on Jan. 27. It thus became possible to provide supplies for the large hunger-stricken civil population of Jerusalem and to form an advanced base there for further military operations. These were undertaken on Feb. 19, when the 60th Div., which had changed places with the 53rd, coöperated with the 231st Bde. (Brig.-Gen. Heathcote), lent by the 74th Div., the 1st A.L.H. Bde. (Brig.-Gen. Cox), and the N.Z. Mounted Rifles (Brig.-Gen. Meldrum) of the Anzac Mounted Div., in the capture of Jericho, from which the Turks were driven by 08:20 on Feb. 21 after operations over extremely broken and bad country. The acquisition of Jericho prevented the Turks from making use of the Ghoraniye bridge as a means of communication with their forces beyond Jordan, and enabled the British to get command of the Dead Sea, across which the Turks had been bringing up supplies from the wheat-growing area round Kerak.

In March Gen. Allenby raided across Jordan to Es Salt and 'Amman and damaged the Hejaz railway. To do this it was necessary to capture the Ghoraniye bridgehead on the left bank of the river. General Shea of the 60th Div. was given command of a special force, called Shea's group, consisting of his own division, the Anzac Mounted Div., the Imperial Camel Corps Bde. (Brig.-Gen. Smith), some light armoured cars and guns with bridging-trains. The Jordan was crossed by swimming in spite of the flood-water by 01:20 on March 22 at Hajla as a preliminary to bridge-building, and after hard fighting the Turks lost Ghoraniye. Es Salt was occupied on March 25 at 18:00 by the 3rd A.L.H. Regt., and Brig.-Gen. Meldrum with the N.Z. Bde. reached the Hejaz railway S. of 'Amman at 15:00 on March 27 and cut it. 'Amman itself, however, was successfully held by the Turkish E. of Jordan Group, and the 703rd German Batt. and the Turkish 3rd Cav. Div. which crossed by the Jisr ed Damie from Palestine threatened the lines of communication at Es Salt, which was held by the 179th Bde. (Brig.-Gen. Humphreys) of the 60th Division.

The weather was bad for camel transport, and the camel park at Shunet Nimrin was, moreover, bombed by German aeroplanes; thus the raid, owing to the stout Turkish resistance and the Jordan floods, had been less rapid and less successful than it might have been; but a number of Christian refugees were able to get into safety under cover of the raiding troops, and solid results were obtained in the permanent possession of the Ghoraniye bridgehead and the attraction of some 4,000 or more Turkish troops from the Hejaz to contain it.

The withdrawal of these men and their immobilization just above the Lower Jordan did much to facilitate the operations of the Arab army under the Sherif Faisal, but the Turks had good reason for supposing that this raid was but a single feature in a far wider and more formidable movement on the part of the British, which had been countermanded at the last moment owing to the sudden necessity for sending troops from the Palestine front to help resist the German offensive in France.

As it was, Gen. Allenby by the end of April had to part with his 52nd and 74th Divs., ten British battalions drawn from other divisions, nine yeomanry regiments, five and a half siege batteries and five machine-gun companies, receiving in exchange the 3rd (Lahore) and 7th (Meerut) Divs. of the Indian army from Mesopotamia and Indian cavalry from France—all experienced troops. His reinforcements received, in exchange for his British battalions, were, however, raw troops fresh from India. In May he had to send away 14 more British battalions, and received only a partial equivalent of Indian troops. Thus the character of the force opposed to the Turks was profoundly modified, and its activities were largely suspended during reorganization: yet the Yilderim command, although strengthened by the formation of the Asia Corps with German units in March and the arrival of reinforcements with which the VIII. Corps and the IV. Army were constituted, was unable to make an offensive during these weeks of opportunity. On the contrary Gen. Allenby took pains to sow the seeds of future victory by again raiding into the Oultre Jourdain country, and took Es Salt on April 29; a good deal of fighting ensued, and the raiders were finally turned back by the 24th and 48th Divs. of Turkish infantry and the action of the 3rd Cav. Div. which had been brought across from Palestine by the Jisr ed Damie. Yilderim, however, were deceived by this raid into thinking that the next serious British move would be by way of Gilead towards Damascus; and Liman von Sanders Pasha, who had taken over the command of the group, allowed the 'Amman and Es Salt raids to influence his plans more than the "readjustments of front" in the Sharon and Berukin sectors in April and June, which might otherwise have appeared to him to be directed for the purpose of depriving him of observation posts from which he could overlook some great future concentration.

At the end of the summer, just before Gen. Allenby struck his final blow, the Yilderim Group of Armies was arranged along a front of some 65 m. running from the Mediterranean a little to the N. of Arsuf to a point some 4 m. E. of the influx of the Jordan into the Dead Sea. From his headquarters at Nazareth Marshal Liman von Sanders Pasha commanded the four armies composing the group. On the right the VIII. Army (XXII. Corps, 7th, 20th and 46th Divs., and Asia Corps, 16th and 19th Divs. and 701st, 702nd and 703rd German Bdes.) held some 20 odd miles as far as Furkha. Then came the VII. Army (III. Corps, 1st and 11th Divs., and XX. Corps, 26th and 53rd

Divs.) holding another 20 m. astride of the Nablus road, and running down into the Jordan valley, where it was flanked by the IV. Army (II. Corps, 24th Div. and 3rd Cav. Div. in the Jordan valley, VIII. Corps, 48th Div. and Composite Div. on the hills of Moab). This array of armies and corps would have been exceedingly imposing had the Turkish units of which they were made up been at full strength, but, as it was, the British army commander estimated their numbers as follows: VIII. Army, 10,000 rifles and 157 guns; VII. Army, 7,000 rifles and 111 guns; IV. Army, 6,000 rifles, 2,000 sabres and 74 guns. The Ma'an garrison and the troops on the Hejaz railway were estimated at 6,000 rifles and 30 guns, while the general reserve was 3,000 rifles and 30 guns. All told the troops with which the Turks hoped to hold Syria and what was left of Palestine amounted to some 4,000 sabres, 32,000 rifles and 400 guns, representing a ration-strength S. of Rayak-Beirut of 104,000. Against this Gen. Allenby had at his disposal 12,000 sabres, 57,000 rifles and 540 guns, and arranged his forces so as to strike with an overwhelming force of men and guns at the most favourable point in the Turkish line for making use of his cavalry.

For this purpose the Desert Mounted Corps was brought right across the front and concentrated in the olive and orange groves in the Sarona area. The 60th Div. came from the XX. Corps area and went into the front line at Arsuf, near which the 7th (Indian), 75th and 3rd (Lahore) Divs. were closely concentrated along a front of about 4 miles. The 54th Div. and the French detachment in the foothills immediately E. of Mejdel Yaba formed the hinge upon which the offensive across the plain of Sharon was to pivot. The 31st and 29th Bdes. of the 10th Div. were strung out along a considerable front of some 13 m. from Arura to Rafat, with the 30th Bde. in reserve above the Wadi Ballut. The 53rd Div. held some difficult country in front of Et Taiyibe well to the E. of the Nablus road; and in the Jordan valley a specially formed force, under Maj.-Gen. Sir E. W. C. Chaytor (Australian and New Zealand Mounted Div., 20th Indian Bde., 38th and 39th Royal Fusiliers [Jewish troops], two battalions of the British West Indies Regt. and some guns), was to give the Turks the impression that another offensive in the direction of Es Salt was contemplated.

The necessary concentration of troops in the Sharon sector was effected by a bold policy which left great stretches of the British front either entirely unoccupied or merely watched; and, had the Turkish Intelligence Service been less hampered by Gen. Allenby's counter-espionage measures, advantage might have been taken of the existence of these gaps. As it was, the care with which the concentration was achieved, by silent night marches to the W. while deceptive dust was clearly visible by day going eastward, completely deceived the Turks, who were, moreover, further misled by the strangely faulty reports sent in by the German aeroplane scouts. The ascendancy in the air was so entirely in Gen. Allenby's hands, and had been so for several weeks, that it was only occasionally that the Germans came over, and then at very considerable height, which made observation difficult. That this made for inaccurate observation was amply proved by the German air reconnaissance reports which were subsequently captured with other documents of the Yilderim Group headquarters at Nazareth, since the report for the day before the British advance still shows an entirely erroneous distribution of Gen. Allenby's troops, incorrectly locates his G.H.Q., the headquarters of the XXI. Corps, and even tentatively "identifies" a non-existent division. Thus the surprise for which the British commander had been working was complete.

At 04:30 on Sept. 19 the artillery on the Sharon sector of the front opened, and after a preparation of 15 minutes, during which the whole striking force advanced across the wide "no man's land," the attack was begun at 04:45. The plan provided for a pivoting movement of which the 54th (East Anglian) Div. (Maj.-Gen. Hare) and the French detachment (Col. de Piepape) formed the hinge, while the 3rd (Lahore), 75th, 7th (Indian) and 60th moved like a door opening away from the sea, pushing back the Turks from an ever-widening gap through which the cavalry poured. The Turks were thus overwhelmed and thrust aside. The cavalry began the advance which was to carry the front beyond Aleppo, and behind them the Royal Engineers, while the action was still in progress, began to lay the pipe-line which by 13:00 had reached Jiljulie from the mill-race on the Nahr el 'Auja 7,000 yd. away, and was able to provide 4,000 gal. per hour to the troops in an area where the water supply was wholly inadequate behind the 3rd Div. By 07:30 the 5th Cav. Div. (Maj.-Gen. MacAndrew) was crossing the Nahr Falik, by noon it had reached and crossed the Iskanderune, and the 4th Cav. Div. (Maj.-Gen. Barrow) and Australian Mounted Div. (Maj.-Gen. Hodgson) swept up behind them.

The speed of the advance was entirely bewildering to the Turks, who could get little or no news of its progress, and only realized its results by actual contact, as every artifice had been employed to cripple the Turkish Intelligence Service. A special bombing squadron had been sent out to reinforce the Royal Air Force, which at the opening of the offensive consisted of a brigade with two wings, seven squadrons, and a balloon company; and during the night of Sept. 18–19 a Handley-Page with more than half-a-ton of bombs attacked the German aerodrome at 'Afule. At dawn on Sept. 19 the special squadron attacked all Turkish telephone and telegraph exchanges behind the line, while the corps squadrons bombed the smaller exchanges just behind the front, with the result that Turkish communication by telephone or telegraph was completely deranged. To prevent Liman von Sanders Pasha from becoming aware of the progress of the advance, steps were taken to keep all German aeroplanes from leaving the ground. For this purpose two scouts at a time hovered over the main German aerodrome at Jenin, each carrying four bombs, which were dropped on the aerodrome at any sign of activity. Each pair was relieved while still patrolling over the aerodrome, and, before leaving, came down and fired machine-guns into the hangars. In this way the German air service was immobilized throughout the day, and the Yilderim command deprived of its only remaining means of obtaining rapid information about the British advance. Furthermore, the general attack on the Sharon front had been preceded at 22:00 on Sept. 18 by a vigorous offensive on a smaller scale by the 53rd Div. (Maj.-Gen. Mott), which by attacking the Turkish XX. Corps diverted attention from the coastal sectors in the last hours during which the Turks could use their field telephones.

In this way, by dint of elaborate preparation, the Yilderim command was kept in the dark as to what was happening, and the Turks had to fight as best they might, relying on lines of communication after they had been cut, relying on reinforcements which never knew when or where they were wanted, and were never sent, and finally trying to retreat along roads already occupied by the British. As a final measure to complete the confusion of the Turks, Gen. Allenby, after his first feint by the 53rd Div. and his main attack across the plain of Sharon, put the whole of the rest of his front W. of Jordan in motion, and began to press the Turks northward through Mount Ephraim.

The main advance pressed northward, and while the 5th and 4th Cav. Divs. headed for the plain of Esdraelon in order to seize 'Afule and its railway junction, the infantry [60th (London) Div., Maj.-Gen. Shea, 7th (Indian) Div., Maj.-Gen. Fane, and 3rd (Lahore) Div., Maj.-Gen. Hoskins], turning eastward, began to drive the XXII. Turkish Corps and the Asia Corps into the hill country. The Londoners captured Tul Keram after fighting and marching for 18 m. over heavy sand before dark, driving a mass of retreating Turks and transport into the narrow defile up which the road and railway ran to Nablus. Here the retreat was scourged from above by aeroplanes, which finally blocked the pass by killing multitudes of transport animals across its narrowest part, while the 5th Australian Light Horse Bde. (Brig.-Gen. Onslow), with cavalry of the French detachment, temporarily attached to the 60th Div., made a detour and came into the pass from the N.E. of Anebta, cutting off all hope of retreat from Tul Keram and engaging the extreme right of the Asia Corps, which tried to hold the upper part of the pass so as to facilitate retreat along the Nablus and Messudie roads to Jenin. Individual Turkish units fought well. If they were unaware of the disaster which had befallen their cause, they were at least not oppressed by news of defeat; the opposition encountered by the 3rd and 7th Divs. in the W. was tenacious and well organized, and the XX. Turkish Corps in the E., not realizing the necessity for immediate retreat, even made a successful counter-attack against the 53rd Div., and for the moment recovered some minor positions.

While the infantry hammered away at each other Gen. Allenby's cavalry had broken through the Carmel Range by the historic pass of Megiddo, captured Nazareth with the Yilderim headquarters (dawn Sept. 20), and 'Afule (08:00); and the 4th Cav. Div. after coöperating with the 5th in its capture hastened to Beisan, which was taken at 16:30, while part of the 12th Bde. (Brig.-Gen. Wigan) reached Jisr el Mujami', where the railway crosses the Jordan, at 08:00 on Sept. 21, thus cutting off alike all hope of retreat northward from the Turks and guarding against the possible arrival of reinforcements from Damascus. As additional insurance, raiding parties from the Arab N. Army operating in Gilead had broken the railway near Tel 'Ar'ar and at Muzerib on Sept. 17. Meanwhile the 3rd Australian Light Horse Bde. (Brig.-Gen. Wilson), driving in from the N., had captured Jenin (evening of Sept. 20) in spite of the resistance of a German force, and Turkish troops and transport on the road between Jenin and 'Afule and Jenin and Nablus were plentifully bombed from aeroplanes.

On Sept. 21 at 13:45 Nablus was captured, and the Turks, having in vain endeavoured to retreat along the newly restored Roman road from Nablus to Beisan, only to be the target of aeroplanes while on the way and to find the British at the end of it, tried as a last resort to withdraw the wreckage of the VII. and VIII. Armies down the Wadi Fara road, so as to retire upon Es Salt and the IV. Army crossing over the Jordan by the Jisr ed Damie. This movement was detected by an air scout early on the morning of Sept. 21, and the importance of checking the retreat was at once realized, as the Jordan valley troops had not yet been able to capture the Jisr ed Damie, nor could the fords to the N. of it be guarded even by the cavalry at Beisan in time. All available aeroplanes were at once detailed for an intensive air attack upon this line of retirement; departures from the Ramleh aerodrome were so timed that two machines should arrive over the objective every three minutes, and that an additional formation of six machines should come into action every half-hour. Machines on arriving over the objective bombed it first and then swept down to a low altitude and raked the column with machine-gun fire, crawling uneasily along a narrow road cut out of a precipitous slope, before flying back to Ramleh to replenish with bombs and fresh drums of cartridges.

This form of attack continued from 08:00 until noon, when Chaytor's force came within striking distance of the bridge, and the line of retreat itself was blocked for a distance of 5 m. with countless corpses and carcasses and the debris of 87 guns with their limbers, 55 motor lorries, 4 staff-cars and 842 waggons, all of which had been put out of action by the attacks of the Royal Air Force unaided by any surface coöperation. At 01:30 on Sept. 22 Chaytor's force, which had been pressing all through the previous day, captured Jisr ed Damie, and at 08:00 a Turkish column was observed by air scouts to be moving up towards Beisan from the still unoccupied area E. and N.E. of Nablus. It was bombed from above, while the XX. British Corps shepherded it up toward the 4th Cav. Div., which came down to meet its survivors and patrolled along the left (E.) bank of Jordan to cut off such stragglers as might cross the stream.

Meanwhile the Jewish battalions of Chaytor's force had captured Umm esh Shert ford at 03:00, and by nightfall the 2nd Australian Light Horse Bde. (Brig.-Gen. Ryrie) was in contact with the main Turkish position at Shunet Nimrin. A little later it became apparent that the IV. Army had realized how isolated and unsafe its position had suddenly become, and that it had begun to retire in hopes of reaching Damascus before it was too late. It was, however, vigorously pressed by Chaytor's force, its railway had been cut by the Hejaz Camel Corps of the Northern Army, and the whole country-side appeared to be boiling up into sudden revolt about its path.

The IV. Army still carried a sting in its tail, and although it lost Es Salt by 16:30 on Sept. 23 it held 'Amman gallantly until 15:10 on Sept. 25, in hopes of being able to keep the line of retreat open for the garrison of Ma'an under 'Ali Bey Wahbi, which, though hastening northward amid a perpetual whirl of Arab rifle-fire, was still S. of the town. With all hope of retreat cut off, the Ma'an force became anxious to surrender, and as soon as the 5th Australian Light Horse Regt. was near enough to Qastal to afford protection, the Turks, to the number of over 4,000, with 500 sick and 12 guns, surrendered on Sept. 29. The Australians had some difficulty in saving their prisoners from being massacred by the Arabs who were eager for vengeance and plunder.

The news that the IV. Army was trying to avoid the fate which had overwhelmed the VII. and VIII. caused Gen. Allenby to order his available cavalry to advance upon Damascus, in order to prevent the Turks on the E. of Jordan from reaching it and re-forming in combination with the small force there.

The 5th Cav. Div. was employed during the greater part of Sept. 23 in capturing Acre and Haifa, when the Turks, contrary to the wishes of the Germans, who did not wish to risk the numerous houses of the German colony in a bombardment, put up a stout resistance, and were only quelled by a charge of the 15th (Imperial Service) Cav. Bde. (Brig.-Gen. Harbord). The 5th Cav. Div. then went to Nazareth en route for Damascus with the rest of the Desert Mounted Corps by way of Jisr Banat Ya'qub and the main motor road beyond Quneitera.

At Jisr Banat Ya'qub a stiff resistance was made, chiefly by German technical troops, who had blown one arch of the bridge and formed a laager of lorries and machine-guns commanding the ruin. This delayed the Australian Mounted Div. until the position was turned by the action of the 3rd and 4th Australian Light Horse Bdes. (Brig.-Gens. Wilson and Grant), which crossed the river N. and S. of the bridge late on Sept. 27. The position was taken, but the delay had enabled the 5th Cav. Div. to come up, and by 20:30 on Sept. 28 both divisions had reached Quneitera. To the S. the 4th Cav. Div., having crossed the Jordan at Jisr el Mujami', engaged the Turks on the Zebda–Irbid–Beitras line on Sept. 26, where a good deal of opposition was made, took Irbod during the night, then pressing on through Remte made contact with the Hejaz Northern Army, which had just taken Der'a, a few miles W., at dawn on Sept. 28.

The Arab Camel Corps, with which was Col. Lawrence, had started on its northern raid on Aug. 31, by unfrequented and often waterless paths through the desert from a point near Akaba and had reached the railway between Der'a and Damascus on Sept. 17. The line was wrecked, and in spite of the activity of the garrison and aeroplanes at Der'a the Arabs continued to prey upon the lines of communication, which they kept in a state of disorganization all through the critical days of Gen. Allenby's advance, and now were able to get their fill of fighting in trying to impede the retreat of the IV. Army.

Under the constant pressure of the Desert Mounted Corps and the Arabs, both regular and insurgent, driving in from W., S.W. and S., the IV. Army melted into rout. It still fought when it could, but it was with the spasmodic jerks of a body no longer under control of its brain, and after actions at Kaukab Jasa and Kiswe the end came for the Yilderim Army Group when the Australian Mounted Div., with the French cavalry attached, got across the Damascus–Beirut road on the afternoon of Sept. 30, capturing 4,000 Germans and Turks as they tried to escape along it. Next morning Maj. Olden with men of the 10th A.L.H. Regt. (3rd Bde. A.L.H.) reached the Serail of Damascus, at 06:30 on Oct. 1., just a little ahead of the Hejaz Camel Corps. Damascus had fallen, and a Turkish column trying to reach safety by the desert road to the N.E. was overtaken, attacked and captured near Duma on Oct. 2.

Nor was the victory a day too soon—the British cavalry had been stung by malarial mosquitoes in the plain of Esdraelon, in the marshes round Beisan and in other areas behind the Turkish lines where army sanitation was grossly neglected. The malaria had incubated for a fortnight, and immediately after the capture of Damascus, officers and men sickened by scores—whole regiments were temporarily out of action, and on top of the malaria came a savage visitation of the so-called "Spanish" influenza, which preyed upon captors and captives alike, particularly the latter, whose resisting power had been greatly impaired by the privations of a fortnight's disaster and rout.

There now remained no formidable Turkish force in southern or central Syria, and all that remained for the victorious general to do was to occupy the starving lands which he had liberated and move northward in search of a Turkish formation to attack. The 7th (Meerut) Div. was ordered to march up the coast, and made remarkable progress, leaving Haifa on Oct. 1, occupying Tyre on the 4th, Sidon on the 6th, Beirut on the 8th, and Tripoli (Tarabulus) on the 18th, while the 5th Cav. Div., less affected by malaria and influenza than other cavalry, moved up through the Biqa' along the railway to Hama (Oct. 20), engaged German armoured cars near Khan es Sebil (Oct. 22), and reached Aleppo, which had just been occupied by Arabs, at 10:00 on Oct. 26. The division passed through Aleppo, engaged the Turks on the Alexandretta road, and on the 28th relieved Arab troops at Muslimie junction astride of the Bagdad railway.

During this advance an uncounted number of Turks were killed, 200 German and Austrian officers and 3,500 men, while over 72,000 Turkish prisoners, 360 guns, 800 machine-guns, and large quantities of locomotives and motor transport were captured. (H. P.-G.)

TURNER, SIR GEORGE (1857–1916), Australian politician, was born at Melbourne Aug. 8 1857 and educated at its Central school, proceeding on to its university. He was called to the Victorian bar and in 1889 was elected to the Victorian legislature as member for St. Kilda. Two years later he became Minister of Health and later held office as Minister of Customs, Solicitor-General and Minister of Defence. From 1894–9 he was Premier and Treasurer of his colony and again from 1900–2. From 1901–5 he was Treasurer of the Commonwealth of Australia. He was also president of the Federal Council of Australasia, which came to an end in 1899. He represented his colony at Queen Victoria's Diamond Jubilee (1897) and was then created G.C.M.G. and sworn of the Privy Council. He retired from politics in 1906 and died at Melbourne Aug. 14 1916.

TURNER, SIR WILLIAM (1832–1916), British anatomist, was born at Lancaster Jan. 7 1832. He was educated at various private schools, and afterwards studied medicine at St. Bartholomew's hospital, and graduated M.B. at London University. In 1854 he became senior demonstrator in anatomy at Edinburgh University, in 1867 professor of anatomy, and in 1903 was elected principal and vice-chancellor of the university. He was from 1898 to 1904 president of the General Medical Council, and in 1900 was president of the British Association. He was knighted in 1886 and made a K.C.B. in 1901. Turner was best known as a brain surgeon, and published various valuable papers on the subject. He died at Edinburgh Feb. 15 1916.

TWINING, LOUISA (1820–1912), English philanthropic worker, was born in London Nov. 16 1820. In early life she was an artist, and published *Symbols and Emblems of Mediaeval Christian Art* (1852) and *Types and Figures of the Bible* (1854). In 1853, however, she became interested in movements for social reform, and began the work in connexion with the Poor Law to which she devoted the rest of her life. In March 1861 she helped to establish a home for workhouse girls sent out to service, and in 1864 a Workhouse Visiting Society. In 1867 an act was passed separating infirmaries from workhouses, and after 12 more years of work Miss Twining in 1879 established the Workhouse Infirmary Nursing Association. She was a Poor Law guardian for Kensington during 1884–90, and for Tonbridge Union during 1893–6. She promoted the opening of Lincoln's Inn Fields to the public, helped to start the Metropolitan and National Association for nursing the poor in their homes, did much to secure the appointment of police matrons, and was president of the Women's Local Government Society. She published *Recollections of Life and Work* (1893), *Workhouse and Pauperism* (1898), and many papers on Poor Law subjects. She died in London Sept. 25 1912.

TYLOR, SIR EDWARD BURNETT (1832–1917), English anthropologist (*see* 27.498), died at Wellington, Som., Jan. 2 1917. He was knighted in 1912.

TYPHUS FEVER (*see* 27.508).—This acute specific fever is spread by the agency of the body-louse, and is characterized by a sudden onset, a maculo-petechial eruption, severe toxaemia, lasting some 12 to 15 days, and ending by a rapid lysis. The disease has many synonyms:—Typhus exanthematicus, synochus putrida, spotted fever, gaol fever, famine fever, prison fever, Brill's disease. This last term is often applied to denote a very mild type of the disease occurring in the United States.

Hippocrates mentions the word "typhus," but he applied it to any stuporous and delirious condition and does not appear to have been acquainted with the fever in question. The malady was apparently confused with plague until the 16th century, when Fracastorius differentiated it from the latter disease and called it petechie. During the 18th and 19th centuries typhus fever was well known in Europe, but included typhoid and relapsing fever, from the former of which it was distinguished by a long series of researches beginning with those of Strother, Gilchrist and Huxham in the early 18th century and ending with the classical work of Still in 1837. From relapsing fever typhus was definitely differentiated by Henderson of Edinburgh in 1843.

Climatology and Epidemiology.—Typhus is mostly a disease of temperate and cold climates; in tropical countries it occurs only in the hills or during the cool season. In 1921 typhus was endemic in many parts of E. and S.E. Europe, Poland, Galicia, many provinces of Russia and certain districts of the Balkans. It was endemic also in some parts of Asia, Persia, Afghanistan, and an endemic area exists in India on the W. of the Indus, stretching from Baluchistan in the S. to Yusafzai, Hazara, and Kashmir in the N., and then passing eastwards along the ranges of the Himalayas, where it is especially prevalent at Kulu, and also passing southwards into the district of Rawal Pindi. It also occurs in Indo-China, in N. China and in Japan in the province of Hiogo. It does not occur in Australasia or Oceania. In America it is endemic in Mexico, in certain districts of Peru and northern Chile.

Before the World War it was eradicated from most European countries where hygienic measures for the destruction of vermin were in existence. During the war, extremely severe epidemics raged in the Balkans, Poland and Russia. Epidemics are caused by anything which favours the propagation and dissemination of lice. The principal factors which do so are:—(1) massing together of people of all classes; (2) retaining these masses under conditions which render personal cleanliness and clean clothing difficult or impossible, typically in times of war or famine; (3) a suitable atmospheric temperature, not too high—*i.e.* a temperate zone temperature.

Aetiology.—The disease is spread by means of the body-louse, *Pediculus corporis de Geer* (1778). The virus is apparently present in the blood of a patient from the fifth to the twelfth day, but in greatest abundance from the fifth to the seventh day. The louse requires approximately eight days interval before it becomes infective, and probably remains infective for the rest of its life, but it is not certain whether it passes the virus on to the next generation or not. When an infected louse bites a non-immune human being, a period of six days to ten days elapses before symptoms appear. The virus was reported by Nicolle to be filterable, but more recent investigation has shown this to be doubtful. The guinea-pig and the monkey are susceptible. As regards the nature of the virus, innumerable bacteria and protozoa have been described. In 1921 most authorities favoured de Rocha Lima's theory, viz. that the causative agent is an organism which he has called *Rickettsia prowazeki.* Rocha Lima has given this name to some peculiar, minute, gramme-negative, oval bodies often showing polar staining when stained by Giemsa's method, and found in the epithelial cells of the alimentary canal of lice which have fed on the blood of typhus patients. Attempts at cultivation have so far failed. Brumpt and others do not give any etiological importance to these bodies, as, according to them, they are found also in lice which have not fed on typhus patients. Rocha Lima contends, however, that there are two forms of the parasite, one non-pathogenic, *Rickettsia pediculi,* found only in the lumen of the alimentary canal of lice; and the other, pathogenic, *Rickettsia prowazeki,* which multiplies in the cells of the insect's alimentary canal.

Plotz has described an anaërobic, gramme-positive, bacillus which he now identifies with *Rickettsia prowazeki*. (For similar disease-carrying by body-lice, *see* TRENCH FEVER.)

Morbid Anatomy.—There are no specific anatomical lesions. A certain amount of oedema of the lungs and hypostatic pneumonia is often present. The spleen is enlarged, usually of a dark red colour and juicy red pulp. The liver and kidney show cloudy swelling, and punctate haemorrhage may be present. In the intestine there are no changes in Peyer's patches, and the mesenteric glands are not enlarged. The heart muscle may show cloudy swelling and fatty degeneration. The cerebral spinal fluid may present a slight lymphocytosis.

Symptomatology.—Incubation varies from 4 to 21 days, but is usually about 10 to 12 days. The onset is usually sudden, being characterized by severe headache, pains in various parts of the body, often rigours, marked rise of the temperature, quick pulse, flushed face and suffused eyes, and quickened respirations. The patient complains of extreme weakness. The duration of the fever on an average is 14 to 15 days. During the first 2 or 3 days the temperature continues to rise at night, with remission in the morning, to a maximum of 104 to 105 on the second to fourth day. During this time the tongue becomes dry, swollen, and coated with a thick brown deposit on the dorsum, while the tip and sides of the organ are red. The patient quickly becomes apathetic, drowsy, with dull expression. As the disease progresses, the rapidity of the pulse increases and may reach 140 a minute, and is usually small and of low tension. The respirations are generally quickened and there are usually signs of laryngitis and bronchitis and occasionally bronchial pneumonia. Delirium is known, especially at night.

Definite preliminary rashes are rare. What one generally sees the first two or three days of the disease is a very marked flushing of the face, neck and upper portion of the chest, with a subcuticular mottling of the skin of the lower part of the chest and abdomen (*cutis marmorata*). It should be noted at once that this symptom is far from being specific, a similar flushing being very often noticeable in many cases of Pappataci fever. The true typhus rash appears generally on the fourth or fifth day in the form of small roseolar spots, indistinguishable from typhoid roseola but often more abundant. According to some of the old authorities, it appears first on the arms and legs, but, in the writer's experience of Serbian and Polish epidemics, the rash generally starts on the abdomen and then spreads to the chest, arms and legs. The spots are at first roseolar and disappear completely on pressure, then some of the spots slowly fade away, while others become of darker hue and do not disappear completely on pressure, becoming petechiae, though it is rare for them to develop the dark blue appearance of petechiae in such eruptions as those of purpura. The rash, in a few cases, may remain purely roseolar-like, without any of the spots becoming petechial. In exceptional cases, the rash may be absent altogether: *typhus exanthematicus sine exanthema.* The medical man with little experience of typhus should be on his guard not to mistake for true typhus rash a petechial rash, the so-called Balkanic rash, due to bites of innumerable fleas, composed of numerous perfectly circular dark red petechiae, which is extremely common in the Balkans and in Galicia in peasants and soldiers. Anyone who has not been to those countries can hardly believe how profuse this rash can be. The whole body, with the exception perhaps of the face, is completely covered with it, while the shirt of the sufferer may be absolutely black from the number of living fleas upon it. With a little practice one soon learns to distinguish the two rashes. Each flea-bite shows at first a central haemorrhagic spot surrounded by a hyperemic circular zone, which disappears on pressure. This peripheral hyperemic zone fades away spontaneously within a day or two, while the central haemorrhagic spot remains as a petechial area, which is, as a rule, perfectly circular, not raised, and of a dark red, sometimes copper-like, colour which does not disappear on pressure. In the blood there is often a marked leucocytosis, and a differential count shows a large increase of polymorphonuclears. An interesting feature is the complete absence of eosinophiles in practically every case.

Termination.—On or about the fifteenth day, the temperature generally falls by crisis, or, much more frequently, by rapid lysis which may extend through three to five days.

Convalescence may be slow, and fairly frequently there is danger during this stage, as the general condition may not improve after the cessation of the fever, and death may occur some two to three weeks after defervescence. In certain cases, while the temperature has become normal, the pulse does not improve, and the patient becomes weaker and weaker until he dies.

Complications and Sequelae.—The most usual complications are: parotitis, ending often in suppuration, gangrene of feet and polyarthritis; neuritis, hemiplegia, severe mental depression amounting almost to melancholia (seen during convalescence) may be mentioned, also bubonic swellings; otitis media, abscesses and boils occur, while jaundice, endocarditis, and meningitis are rare, but myocarditis is fairly common.

It is interesting to note that different epidemics of typhus have been reported as being characterized by special features in regard to complications and sequelae; thus, the Serbian epidemic in 1914–5 showed a great tendency to gangrene of the feet, while those of Ireland have generally been associated with bronchial and pneumonic complications. On the other hand, in the recent epidemics in Poland and Galicia, complications have been comparatively rare.

Diagnosis.—The principal data on which to base the diagnosis are as follows:—

(*a*) *Incipient Typhus.*—(1) The sudden onset, often with headache, rigours, and vomiting. (2) The congested eyes and face and the subcuticular mottling of the skin over the chest. (3) The mental confusion and stupor, associated with the log-like attitude of the whole body. (4) The increased percentage of polymorphonuclear in the differential count.

(*b*) *Fully Developed Typhus.*—(1) The typical rash. (2) The history of the sudden onset, etc. (3) Leucocytosis and increased polymorphonuclear percentage. (4) The *Weil-Felix reaction*, viz., the blood of typhus patients agglutinates a proteus-like germ, isolated from the urine of some cases of typhus by Weil and Felix and called by them Proteus X19.

Prognosis.—The case mortality may be from 10 to 50% and greatly varies in different epidemics. It is low in the young and very high in the old. The malady is slightly more fatal in males than in females, while alcoholism and kidney disease are bad prognostics.

Treatment.—This is merely palliative. Patients suffering from typhus should be placed, whenever possible, in airy, well-ventilated wards, and in the summer months tents may be used with advantage. Cleanliness and good nursing are essential. During the febrile attack the diet should consist of broths and milk and soft solids, while plenty of water is allowed to be drunk. The temperature should be controlled by cool sponging and the nervous symptoms by ice to the head, hyoscin, bromides or morphine, while the heart is supported by hypodermic injections of strychnine and digitalin. Special attention should be paid to the mouth and throat. The legs and feet should be kept warm and pressure on the feet, even from the bedclothes, should be avoided, lest it contribute to the production of gangrene. Prostration is extreme in most typhus cases, and a most striking fact is the occurrence of many deaths after the period of defervescence, even when severe complications have not developed. To combat this extreme exhaustion, the administration of alcohol in moderate doses is sometimes useful.

Attempts at specific medication have been made by various authors, and Nicolle has prepared a serum, by injecting horses with emulsions of spleen and adrenals of guinea-pigs artificially inoculated, said to have good results, the dosage being 20 c.c. daily.

Prophylaxis.—This consists in taking every possible measure for the destruction of lice. There is no doubt that heat, whenever it can be employed, is the most satisfactory means for the destruction of lice and their eggs in clothes, blankets, bedsheets, etc. When dry heat is used, a temperature of 68° C. for 15 minutes is the safe standard for routine practice. When steam is used, articles should be submitted to a temperature of 100° C. for 30 minutes to allow the steam to thoroughly penetrate all parts of the clothing. For disinfestation of rooms, barracks, etc., sulphur fumigation is probably the most satisfactory routine method. The rooms, whenever possible, should be sealed and rendered approximately airtight, and then the sulphur fumigation is carried out, using 5 to 8 lb. of sulphur per 1,000 cub. ft., the rooms remaining sealed up for a period of not less than 12 hours.

With regard to the usual chemical insecticides, their utility is somewhat limited; among the liquid ones, petrol is, in practice, probably the best; guaiacol is a powerful licecide but is expensive. Among solid insecticide substances, naphthalene is the most useful and convenient. It is interesting to note that according to Jackson's and the writer's experiments in Serbia insecticide chemicals do not act equally well on lice, bugs and fleas; for instance, pyrethrum (many patent insecticide powders are merely pyrethrum) acts powerfully on bugs while its action on lice is very slight; on the other hand, iodoform, which will kill lice in 10–15 minutes, has no action on bugs and very little on fleas. When an insecticide for general use is required therefore, several chemical substances should be combined, and the following powder has been found fairly efficacious, viz., naphthalene, previously soaked in guaiacol or creosote ʒij pyrethrum ʒij zinc oxide ad. ℥. The wearing of undergarments made liceproof by soaking in crude carbolic acid and soft soap, as recommended by Bacot and others, has been found useful.

In badly infected districts a large number of bathing and disinfecting stations should be established and a general disinfection of people should be carried out. The following procedure, as adopted by the American Typhus Commission with most satisfactory results in the Serbian epidemic of 1914–5, is recommended. The infested person goes into a room, takes off the clothes, which are steamed or boiled, passes into another room where he is bathed, then into a third room where he is sprayed with petrol, and finally into a fourth room in which he receives clean or sterilized clothes. The sterilization of the clothes may be conducted by boiling, but better still by making them into lightly packed bundles and placing them in a truck or room into which steam is blown.

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TYRRELL, ROBERT YELVERTON (1844–1914), Irish classical scholar, was born at Ballingarry, co. Tipperary, Jan. 21 1844. He was educated at Trinity College, Dublin, where he subsequently became a fellow in 1868 and professor of Latin in 1871. From 1880 to 1898 he was Regius professor of Greek at Dublin, and from 1900 to 1904 professor of ancient history. He was a Commissioner of Education for Ireland and one of the original fellows of the British Academy. Amongst his published works were an edition of Cicero's *Letters* (7 vols., the later vols. with Dr. Purser, 1879–1900); *Latin Poetry* (1893); *Sophocles* (1897); *Terence* (1902), and *Essays on Greek Literature* (1909). He died in Dublin Sept. 19 1914.

TYRWHITT, SIR REGINALD YORKE, 1st Bart. (1870–), British Admiral, was born at Oxford May 10 1870, the youngest son of the Rev. Richard St. John Tyrwhitt. He entered the navy in 1883, was promoted lieutenant (1892), commander (1903), captain (1908), commodore (1914) and rear-admiral (1919). He was in charge of a landing party at Nicaragua in 1894. During the World War he commanded destroyer flotillas in actions in Heligoland Bight (Aug. and Dec. 1914) and off the Dogger Bank (1915). He was created K.C.B. in 1917, and in 1919 received a baronetcy, a grant of £10,000 and the thanks of Parliament.

UGANDA (*see* 27.557*).—The area of the protectorate, after taking into account an exchange of certain districts with the Anglo-Egyptian Sudan in 1914, is some 110,300 sq. m., including 16,000 sq. m. of water (chiefly those parts of lakes Victoria and Albert Nyanzas within its limits). The pop., given as 2,843,325 at the 1911 census, was in 1919 officially estimated at 3,318,190 of whom 847 were Europeans and 3,516 Asiatics (mostly Indians). The most numerous races are the Baganda and Banyoro.

Industries, Trade and Communications.—The economic resources of the protectorate greatly increased in the decade 1910–20. This period was marked by the rapid development of cotton-growing—an industry entirely in the hands of the natives—and by the acquisition of numerous plantations by Europeans, who engaged chiefly in the production of coffee and Para rubber. These, with ox-hides, goatskins and ivory formed the chief exports. Sesame seed, red chillies (which grow wild) and ground nuts were fluctuating crops. Cocoa, tea, tobacco and other plantations were started and a beginning was made in the export of timber. Ghee (clarified butter), in considerable quantities, was sold in Kenya Colony (British E. Africa).

At first the cotton produced was mainly ginned in the E. Africa Protectorate, but by 1919 ginneries established at Kampala, Entebbe, Jinja and other centres by European companies ginned and baled all the cotton exported. The value of the cotton exported (most of it taken by Indian merchants for the Bombay market), £165,000 in 1910–1, had increased to £965,000 in 1918–9. The last-named figure was, however, due to the inflation of prices and represented an export of 4,909 tons; in 1914–5 when 6,866 tons were exported the value was only £351,000. In 1919 a tax of 4 cents per pound on all cotton exported was imposed, the proceeds to be devoted wholly to the development of the industry. In 1920 the tax was reduced to 3 cents per pound, and was to so continue for three years. Progress made in the rubber plantations was shown in the increase of exports from 9 tons in 1914 to 113 tons in 1919. Coffee exports increased from 13 tons in 1910 to 2,716 tons (valued at £106,000) in 1919.

External trade is almost wholly through Kenya Colony by rail to Mombasa. The value of the imports, chiefly textiles and hardware, rose from £347,000 in 1910–1 to £744,000 in 1916–7, exclusive of Government stores, specie and goods in transit. (The transit trade is almost entirely with the north-eastern part of Belgian Congo and consists largely in bullion from the Kilo gold mines.) In the same period the value of exports of domestic produce rose from £306,000 to £637,000. The Customs Depts. of the two protectorates were amalgamated in 1917, and since that date no separate statistics have been kept, except in regard to domestic produce. The value of such produce in 1918–9 was £1,247,000.

The development of trade and the work of administration was aided by a well-planned system of metalled roads suitable for motor traffic. A railway 61 m. long from Jinja (by the Ripon Falls) to Namasagali, the first navigable point on the Nile, was begun in 1910 and opened on Jan. 1 1912. It was built entirely by Busoga natives and is called the Busoga Railway. It connects with a line of steamers which serves Lake Kioga and the Bukedi district, where a rich soil and well defined dry season provide excellent conditions for cotton growing. Besides the Busoga Railway there is a 7-m. railway (opened 1915) connecting Kampala, the capital of Buganda, with Port Bell on Victoria Nyanza. It was designed as the first stage in a main line to connect the Victoria and Albert Nyanzas; that is, Uganda and the Belgian Congo. Mechanical transport, introduced in 1908, is much developed. In 1919 Jinja became a station on the Cape to Cairo air route, and the first machines to use its aerodrome arrived in Feb. 1920, coming from Cairo.

The chief towns are Kampala (or Mengo), the capital of Buganda (pop. approx. 40,000); Entebbe, on Victoria Nyanza, the seat of government and 24 m. from Kampala (pop. 12,000); Jinja, chief town of Busoga and headquarters of the cotton industry; Masindi, capital of Bunyoro; Mjanji, a port at the mouth of the Sio river. Kampala, the headquarters of the Buganda Government and of the chief missionary societies, has a number of fine buildings; a new Anglican cathedral, a brick-built domed building with massive stone pillars, was consecrated in Sept. 1919.

Revenue, Administration and Education.—The revenue in 1909–10 was £165,000 against an expenditure of £240,000, the balance being met by an Imperial grant in aid. In that year a poll tax was substituted for a hut tax, and the revenue thus increased. By 1915–6 the revenue had risen to £287,000, while the expenditure was £285,000. This was the first year in which income exceeded outgoings and in which no grant in aid was needed. In 1918–9 the revenue was £351,000 and the expenditure £323,000. The chief source of income is a poll tax on the natives; since April 1919 a poll tax has also been levied on Europeans and other non-natives. An *ad valorem* duty of 10% on imports and an export duty on certain commodities are other sources of revenue.

The administration is on the line of a British Crown Colony. An Order in Council passed in 1911 provided, in effect, that the criminal law should be the Indian Penal code, the civil law generally that in force in England. Much of the protectorate consists, however, of native states governed by chiefs (four of whom bear a title equivalent to king) with the aid of a *lukiko* (council or Parliament). This system of local self-government was extended from 1910 onwards as new districts were brought under control.

Education is entirely in the hands of the missionaries, Anglican and Roman Catholic. The Native Anglican Church (formed by the efforts of the Church Missionary Society) had in 1918 some 40,000 scholars. There are elementary, secondary, high and medical schools as well as theological colleges. The Mill Hill (R. C.) Mission had over 18,000 children in its schools, the White Fathers Mission nearly 20,000. Education is most advanced among the Baganda, the majority of whom (400,000 out of 676,000) profess Christianity. The kings of Buganda, Bunyoro, Toro and Ankole, and their prime ministers, are all Anglicans.

History.—The history of the protectorate since 1910 was one of steady development, in which the missionaries continued to play a leading part. The World War of 1914–8, though it entailed a serious drain on the man-power of the country, only temporarily checked (and that not to a great extent) its progress. In March 1911 Mr. (afterwards Sir) F. J. Jackson became governor, holding that post till April 1917. During his governorship some few hundreds of planters and commercial men were added to the European residents, hitherto almost entirely Government servants and missionaries, but as Uganda is not, and can never be, a "White Man's Country," the problems presented in lands where large numbers of whites and blacks live side by side did not arise.

The readjustment of the south-western and western frontiers in accordance with agreements made in 1910 and 1911 with Belgium and Germany was completed in 1912. The western shores of Albert Nyanza with the adjacent strip of territory were transferred to the Belgian Congo, while to Uganda was added the district of Kigezi (2,056 sq. m.), a highland region (much of it over 6,000 ft.) containing some of the peaks of the Mfumbiro range of active volcanoes. The northern part of Ruanda lies within the district. The formal transfer of the part of Kigezi which had belonged to German E. Africa took place in Jan. 1912. Two years later Kabale was chosen as headquarters of the district.

In April 1914 another territorial change was effected when the northernmost part of the protectorate E. of the Nile was transferred to the Sudan Government, whose administration was extended S. to Nimuli, this giving the Sudan control of the whole of the stretch of the Nile navigable from Khartum. In return the Sudan surrendered to Uganda some 4,000 sq. m. W. of the Nile and N. of Albert Nyanza, an area which had been part of the Lado enclave, leased to Leopold II. of Belgium. These arrangements tended to make the Uganda Protectorate more compact and manageable. By 1915 effective control had been established over the whole protectorate except the district lying W. of Lake Rudolf—an arid region sparsely inhabited by Turkana and other warlike nomads who owned no paramount chief. This remote district was the scene of an extensive gun-running trade with Abyssinians and Somalis, and of raids on peaceful tribes, involving punitive measures. The most important of these expeditions was carried out during April–June 1918 by a combined force from British E. Africa, Uganda and the Sudan. The operations showed the Turkana that though supported by Abyssinian marauders they could not escape punishment, but they were inconclusive, as neither the Sudan Government nor that of Uganda was prepared effectively to administer their portions of the disturbed area.

The outbreak of the World War found Uganda wholly unprepared. At that time, Aug. 1914, the protectorate troops (4th Batt. King's African Rifles) were engaged against the Turkana. For 180 m. W. of Victoria Nyanza the Uganda

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These figures indicate the volume and page number of the previous article.

frontier marched with that of German E. Africa, and for some time it was defended only by a few policemen and mobs of undisciplined spearmen. The Germans, however, let the opportunity pass, and only outpost actions were fought. With the launching of the Belgian offensive in April 1916 Uganda ceased to be in the sphere of active operations. The chief service rendered by Uganda in the E. Africa campaign was the raising of over 10,000 African soldiers, the formation of a native medical corps—this corps was formed through the efforts of Sir Apollo Kagwa, prime minister of Buganda—the supply of over 60,000 trained carriers and some 100,000 "job porters" (*see* East Africa Campaign).

The Baganda, Banyoro, Busoga and other races, throughout, gave the British authorities prompt and continuous aid. The Buganda Government at once mobilized every militarily-fit man. This was done by direction of the Kabaka (King) Daudi Chwa (b. 1896), who "came of age" four days after war began.

During the war some trouble was caused in the Kigezi district by the Nabingi, an anti-white society, which took a sheep as totem, put 2,000 warriors in the field and attacked impartially British, Belgian and German troops. The trouble originated in Ruanda, then under German rule. It was temporarily stopped by the sacred sheep being captured, shot and burnt, but in 1920 the Nabingi, with a new leader and a new sacred sheep, again gave trouble. This society was the only instance of anti-white feeling in Uganda, and affected only a minute part of the protectorate.

On Sir F. J. Jackson's retirement after 23 years' service in E. Africa, Mr. (afterwards Sir) R. T. Corydon was appointed governor (Nov. 1917). A notable event in 1920 was a visit by the Rev. John Roscoe, the chief authority on Baganda ethnology, to study the lesser known tribes of the protectorate.

The problems with which Sir R. T. Corydon had to deal were largely economic and social. The rise in the value, in 1919, of the rupee and the decision of the Colonial Office in 1920 to fix its exchange at 2s. sterling affected Uganda less perhaps than Kenya Colony, but caused a disturbance of trade, while the great fall in the price of cotton from the middle of 1920 onward seriously affected the industry. The introduction by order of the Colonial Office of the differential treatment of Indians enforced in Kenya was another disturbing influence. (*See* Kenya Colony.) A step forward in the political status of the protectorate was the creation of a Legislative Council, to which various sections of the community nominated members. The first session of the Council was held on March 23, 1921. The Indian community, in view of the action of the Colonial Office, declined to send a representative to the Council.

See H. R. Wallis, *The Handbook of Uganda* (2nd ed. 1920), an excellent monograph, by a former chief secretary to the Uganda Government, with bibliography; Maj. E. M. Jack, *On the Congo Frontier* (1914); Rev. J. Roscoe, *The Northern Bantu* (1915); R. Kmunke, *Quer durch Uganda* (1913); R. Lorimer, *By the Waters of Africa* (1917). (F. R. C.)

UHDE, FRITZ KARL HERMANN VON (1848–1911), German painter (*see* 27.563), died at Munich Feb. 26 1911.

UKRAINE (*see* 27.564).—In its more recent application the name of Ukraine refers to a region of south-eastern Europe, embracing districts of South Russia and former Austria-Hungary which are said to be predominantly Ukrainian-speaking and which should, it is claimed, for this reason form an autonomous State. The boundary of this territory was in 1921 undefined, but, broadly speaking, the claim was that it extended from the mouth of the river Dniester in a north-westerly direction to the neighbourhood of Cracow, thence running roughly N. towards Byelostok, then E. slightly by S. to the Volga, then S.S.W. to near Rostov, S.E. to the Caspian Sea and W. to the Black Sea. The independence of Russian Ukraine, the eastern section of this territory, was proclaimed in Nov. 1917, and that of Austrian (western) Ukraine in Nov. 1918; and in Jan. 1919 eastern and western Ukraine united as a "Republic of the Ukrainian People."

The total pop. of this "ethnographic Ukraine," according to the census estimate of Jan. 1914, was 46,012,000, giving a density of 62.3 per sq. km.; of these 32,662,000 were classified as Ukrainians, 5,376,800 Russians, 2,079,500 Poles, 3,975,760 Jews, 871,270 Germans, 435,240 Rumanians and 32,960 Hungarians; or, according to religion, Ukrainian-Orthodox Church 30,653,000, Greek Catholic 6,847,000, Russian Orthodox 4,500,000, Jewish 3,976,000, Roman Catholic 2,000,000 and Protestant 800,000.

The accompanying table shows in fuller detail the area and pop. of the various districts composing the territory, in which, according to the 1914 estimate, the Ukrainian-speaking people are claimed to be in a majority, either absolutely or relatively.

Country.	Province (Government).	Area in sq. km.	Population.		
			Total.	Ukrainian-speaking.	Percentage.
Russia	Chelm (Kholm)	10,455	841,800	447,650	53
	Grodno	13,701	715,600	443,370	62
	Minsk	19,953	469,700	355,920	76
	Volhynia	71,735	4,189,000	2,936,080	69
	Podolia	42,016	4,057,300	3,282,680	80
	Kiev	50,957	4,792,500	3,746,310	78
	Chernigov	38,334	2,234,700	2,050,350	90
	Poltava	45,893	3,792,100	3,523,720	92
	Kharkov	54,492	3,416,800	2,743,710	80
	Kursk	10,531	780,250	440,190	56
	Voronezh	28,890	1,519,950	1,150,310	76
	Don (territory of)	20,861	1,196,600	580,970	48
	Stavropol	17,397	492,500	248,100	50
	Kuban	53,160	1,763,800	1,078,460	61
	Taurida	35,064	1,763,800	805,900	46
	Ekaterinoslav	63,392	3,455,500	2,366,280	68
	Kherson	70,798	3,774,600	1,977,030	53
Rumania	Bessarabia	11,988	787,700	319,210	40
Austria-Hungary (former)	Galicia	54,577	5,378,650	3,415,000	64
	Bukovina	5,276	460,430	301,150	65
	Hungary	6,347	568,490	440,630	78
Total, Ethnographic Ukraine	....	739,162	46,012,000	32,662,000	71 %

Language.—The Ukrainians claim to have a national language of their own, distinct from the Russian and Polish languages. Mr. Ralph Butler, in his *New Eastern Europe* (1919), says: "Whether Ukrainian is a dialect of Russian or a separate language is a vexed question. But if Ukrainian was a dialect in 1914 it is a separate language now: for whatever may be the ultimate destiny of the two great divisions of the Russian people the events of 1917–8 have carved lines which are beyond effacement in the ethnical development of the Ukrainian race. As written by the Nationalists, Ukrainian differs considerably in appearance from Russian; it discards six of the Russian letters and uses three which Russian has not got. The Nationalists have purposely made the orthography as different from the Russian as possible. They have created a neo-Ukrainian literary language from which they have excluded as far as possible all Great-Russian technical terms." The people furthermore claim to have a national culture of their own.

The Ukrainian Movement.—Briefly the history of the Ukrainian Movement down to 1914 is to all intents and purposes the history of the Ruthenians (*see* 23.939), inhabiting the eastern parts of Galicia, of which province they constituted slightly less than half the population. Though subservient to the Polish majority in Galicia, the Ruthenians constituted the intellectual centre for the Ukrainian Movement. The books which were not allowed to be published in Russia were published in Lemberg and Cernowitz, and eastern Galicia became the chief centre of Ukrainian propaganda.

By the Treaty of Pereyaslavl, 1654, the Ukraine received independence, but acknowledged the Tsar as protector of the republic. By this treaty the Ukraine retained complete self-government and the right of maintaining its own diplomatic representatives abroad. By degrees, however, its autonomous privileges withered, and by 1847 the Ukrainians saw their national existence in danger of being merged, in spite of ethnographic differences between the two races, in the general subjection of the Russians. A society called the "Cyril-Methodius Brotherhood" was started to keep the national tradition alive, having not only the literary object of promoting the Ukrainian language (till then only in oral use among the peasants) but also a far-reaching political programme. A federation of autonomous Slavonic states was aimed at.

In 1900 the various Ukrainian political parties began to organize themselves. Of these the most important was that of the National Democrats, founded to fight for equal rights to those of the Poles in Galicia and for the autonomy of the Russian Ukraine as a federated Russian State. In the same year the first Revolutionary Ukrainian party was organized in Lemberg, and in 1905 assumed the name of the Ukrainian Social Democratic Working-men's party. Gradually the efforts of these societies were rewarded by the resurrection of the Ukraine as a result of the break-up of the Russian Empire.

The Ukrainians claim that the relation between them and Russia was purely dynastic, inasmuch as the Tsar was, by treaty, Protector of their State, and that when there was no more a Tsar of Russia they declined to permit the Russian people to succeed to the rights and privileges of their deposed sovereign. They therefore resumed their long dormant autonomy and founded a provisional Government in the summer of 1917. This Government, supported by the Ukrainian National Congress and the Central Rada appointed by this body, refused to recognize the Bolshevist regime under which Kerensky was supplanted in Oct. 1917. Accordingly, the independence of the Russian Ukraine was proclaimed on Nov. 21 1917, and accredited representatives from France and Great Britain entered into relations with it in Dec. 1917 and Jan. 1918.

Then came the Brest Litovsk meeting and the Treaties of Feb. 9 and 11 1918, between the Central Powers and the "Ukrainian People's Republic," treaties which were interpreted by the Rada as a formal recognition of Ukrainian independence, but in effect meant annexation by the Germans. In April 1918 a German *coup d'état* overthrew the constitutional Government. Skoropadski was appointed nominally as Hetman but in reality Dictator, and, until the collapse of the Germans on the western front, spared no effort to destroy Ukrainian independence.

After the signing of the Armistice the succeeding steps in the evolution (and subsequent disintegration) of a Ukrainian State were as follows: In Nov. 1918 came the proclamation of the State of the Ukraine of the West (Ruthenian Ukraine), and the conflict of this State with Poland. On Dec. 14 1918 the old Rada of Russian Ukraine was reorganized into a "Directory," with Vinnitchenko and Petlura at its head. On Jan. 3 1919 the union of the Russian and Ruthenian Ukraines was announced, with Hetman Petlura as recognized head of the constitutional Government of the joint republic, having its seat at Kiev.

Subsequently the Ukrainians with varying fortunes resisted in turn or simultaneously the attacks upon their territory made by the Bolshevists on the one hand and by Gen. Denikin's "White" volunteers on the other.

In Feb. 1920 the nominal Government of the Ukraine presented a note to the Peace Conference asking for recognition as being a *de facto* Administration on the same footing with other states which have arisen amid the ruins of Russia. The note pointed out that the population was firmly opposed to Bolshevistic theories and intent upon independence. It asked for the moral support of "Western Civilization" in its task of overthrowing anarchy, and appealed for material assistance to enable it to reorganize its immense resources. Not only did the Ukraine remain unrecognized, but, by the Peace Treaties, large tracts that were claimed as "Ukrainian" (Galicia, Grodno, Minsk, Volhynia, a part of Podolia, Bukovina, Bessarabia) had been previously assigned to Poland, Lithuania, Czechoslovakia, or Rumania. Against the delivery of eastern Galicia, in particular, to Polish rule, the "Ukrainian Republic" made a strong protest to the United States in Dec. 1919. At about the same date the country was described as dotted with a number of miniature republics consisting of a dozen or so towns and villages fortified for defence, each having its own armed force. Gen. Petlura was in Warsaw, and M. Mazeppa, his prime minister, with the nucleus of the Ukrainian National Government and an army of about 6,000 strong, at Kamenets Podolskiy, and the Government was proving itself totally incapable of organizing the country.

In April understandings were reached with Poland and Rumania, and the Ukrainian army was coöperating with the Poles against the Bolshevist army. On April 27 the Polish Government formally recognized the Ukraine—or what remained of their claim—as an independent State, and accepted the provisional National "Directory," with Petlura as head, as the Government of the country. In May it was officially stated by Mr. Bonar Law in the British Parliament that conditions in the Ukraine had not been settled enough to warrant the recognition by the Allied Powers of any government set up there. Later in the year Petlura's Ukrainian Government was temporarily housed at Reshoff, W. of Lemberg, and in Oct. Gen. Wrangel had temporarily become a power in the Ukraine. By Oct. 23 Petlura had reëstablished his Government at Kamenets Podolskiy, and his troops were pushing on towards Kiev. On Nov. 4, in a written reply to a question in the House of Commons the Government stated that the Ukraine had not been recognized either as a *de jure* or *de facto* Government. By the Treaty of Riga between Soviet Russia and Poland, in Oct. 1920, a further large part of the Ukrainian claim passed to Poland.

Reports of happenings in the Ukraine during 1921 were extremely meagre. The defeat and withdrawal of Wrangel's army had no tranquillizing effect on the region, but was, on the contrary, followed by a crop of serious peasant risings. Petlura and the "Ukrainian People's Government" had their headquarters in southern Poland, at Tarnow.

Resources, Industry and Trade.—The resources of the Russian Ukraine are naturally very great: covering an area nearly equal to that of France, Italy and England combined, this region contains the best part of the Black Earth zone (the granary of eastern Europe), most of the coal and iron, 80% of the beet, 70% of the tobacco and one-third of the live stock of pre-war Russia. According to figures available during peace-time the total national wealth derived from the different branches of industry in this region was over £265,000,000, of which agricultural products amounted to 158, live stock 26·5, metallurgy and mining 37·5, manufactures 30·5, poultry 4·5, forestry 4·5 and other sources 5 millions of pounds.

Of the land, 65% is arable, 10% forests, 12% pasturage, 6% other products and 6% sterile. The grain crop is the main source of agricultural wealth and normally represents 32% of the total production of grain of the whole Russian Empire. The sugar industry occupies second place: in 1910–1 there were 580,000 ac. under sugar-beet cultivation. The manufacture of sugar is by far the chief manufacturing industry and 143 out of the 238 sugar factories in the whole of Russia were situated in Podolia, Volhynia and Kiev. The tobacco industry is also of importance, including the cultivation of Turkish, American and other lower-grade varieties. At the beginning of the war the census of the live stock of the region was as follows: horses 8,000,000; horned cattle, sheep and goats 27,600,000; and pigs 6,300,000; and the export of stock, meat and animal products, mostly through the ports of Odessa and Nikolayev, was approximately:—cattle (horned), 240,000; horses, 15,000; pigs, 130,000; beef, 9,000 tons; pork and dressed poultry, 12,000 tons; eggs, 65,000 tons; hides, 6,500 tons.

The coal-mining industry is located in the Donets-Basin district, which comprises an area of some 8,000 sq.m. the larger part of which falls within the Ukrainian "claim." The better kinds of coal (anthracite, steam and coke) are obtained in the governments of Ekaterinoslav and Kharkov. Taking the percentage of production in 1915, the Don district amounted to 85·6%, other parts of former Russia 14·4%, and the average production in the years 1913–5 was 20 millions of tons annually. The export is normally carried on at Berdyansk and Mariupol. The output of mercury, found in the district of Ekaterinoslav, increased during the war as follows; 64·5 tons in 1913, 115 tons in 1915, and 100 tons in 1917.

The total exports from nine of the Ukrainian governments between 1909 and 1913 averaged £76,000,000 and the total imports £52,000,000. The exports were, cereals 64% and sugar 22 per cent. Commerce is much facilitated by the navigability of the Ukrainian rivers, that of the Dnieper being 1,250 m., the Desna 537 m. and the Dniester 521 miles. (H. W. M.)

UNDERWOOD, OSCAR WILDER (1862–), American politician, was born at Louisville, Ky., May 6 1862. He studied at the university of Virginia (1881–4), was admitted to the bar in 1884, and practised law thereafter in Birmingham, Ala. From 1895 to 1915 he was a member from Alabama of the National House of Representatives, and during his last two years chairman of the Committee on Ways and Means. After the Democrats came into power in 1913 he had a large share in framing the tariff bill passed the same year; but his attempt to establish a House Budget Committee was defeated. In 1914 he opposed the Panama Canal Tolls Repeal bill, but supported the resolution authorizing the President to use armed force in Mexico. He was opposed to the woman suffrage amendment to the Federal Constitution, holding that the question was a state issue. He also opposed the national prohibition amendment. In 1914 he was elected to the U.S. Senate, and in 1920 reëlected. In 1919 he favoured the anti-strike clause of the Cummins railway bill. He was a strong supporter of the Peace Treaty of Versailles without changes; but when its ratification had been blocked by the Republicans, he attempted to bring about a compromise. In Dec. 1919 he offered a resolution in the Senate providing that the president of the Senate should appoint a committee of 10 senators to work out some acceptable plan for adopting the Peace Treaty; but this was blocked by Senator Lodge. In April 1920 he was chosen Democratic leader in the Senate. He was one of the four U.S. delegates at the Washington Conference on the Limitation of Armament which assembled in Nov. 1921.

UNEMPLOYMENT (*see* 27.578).—Subsequently to 1910 the provision made in the United Kingdom for the remedy of unemployment was further fortified and extended. The Unemployed Workmen Act, 1905, was included each year after its enactment in the annual Expiring Laws (Continuance) Act.

The Act empowers local authorities to form distress committees consisting of their own members, of representatives of boards of guardians and of coöpted members possessing special knowledge of problems of distress. Their functions are to maintain a register of unemployed persons, to assist such persons to obtain work, to provide relief works and to assist unemployed persons to emigrate. Funds are provided by Government grants, from charitable money and from a ½d. rate. Hitherto, Government grants have been made to cover the difference between the actual value of the relief work done and the cost of doing it. The annual amount of Treasury grants never exceeded £300,000 (1908), and from 1911 was £100,000, which was not in any year fully expended. No grant had been made from 1913 to 1921. It proved impossible to provide relief work of a kind to which many of the unemployed applicants were accustomed, and consequently workpeople were employed upon work, generally approximating to navvy's work, for which they were unfitted. A heavy financial loss was incurred in almost every case. It proved impossible to obtain anything like a reasonable standard of work or output upon relief works, and employment upon such works was found to be demoralizing to workpeople of a good type. This method of providing for unemployment is discredited.

Labour Exchanges.—Under the Labour Exchanges Act (1909), 61 labour exchanges were opened in Feb. 1910, and this number was increased to 175 in Feb. 1911 and to 272 in Feb. 1912. As the result of the operation of Part II. of the National Insurance Act of 1911, the number of exchanges was further increased to 425 in Feb. 1913, and in June 1920 there were 395 exchanges.

The organization established by the Board of Trade consisted of a central office in London—the Labour Exchanges Branch—and 11 divisional offices, to which areas covering the whole of the United Kingdom were attached. The number of the divisional offices was subsequently reduced to ten and Scotland, Ireland and Wales each formed a division. Labour exchanges were opened in practically all towns with a population of 15,000 or more. Responsibility for this service was transferred to the Ministry of Labour upon its creation in Jan. 1917, central control being exercised through the Employment Department of the Ministry. The facilities provided by the labour exchanges (whose name was changed to "Employment Exchanges" in Oct. 1916) were made available without charge to all employers and workpeople with the exception of "private" domestic servants over 17 years of age. This exception was suspended during the World War and had not been reimposed up to 1921.

It is an important function of the exchanges to bring together unemployed applicants and suitable vacancies which may exist in different districts, when it has been found that the vacancies cannot be filled by applicants from the immediate locality. Arrangements are made, therefore, for the prompt circulation of particulars of vacancies which cannot be filled by local applicants, provided that the vacancies are of a character for which it is probable that applicants from a distance can be obtained. Such vacancies are notified as a rule by telephone to neighbouring exchanges within a defined "Clearing Area," and should this fail, the particulars are circulated more widely. Up to 1914 a system of divisional clearing houses was used. Particulars of unfilled vacancies were sent by each exchange to the divisional office to which it was responsible, and a classified list of all the vacancies so received was issued daily by the divisional office to all exchanges in the division. Lists of unfilled vacancies were also exchanged each week as between the divisions. In Aug. 1914, the system was superseded by the institution of a "National Clearing House" in London. While the immediate circulation of particulars within the "Clearing Areas" was retained, the circulation of lists of vacancies by the divisional offices was abandoned in favour of the circulation of a classified list for the whole kingdom. The information for this publication is received direct at headquarters from the various exchanges; a complete printed list of vacancies is issued once a week to all exchanges, and the list is kept up-to-date by the daily issue of a statement of vacancies to be added to the list and of cancellations of vacancies which have appeared upon it and are no longer open.

In order to enable workpeople who have, through the exchanges, found employment at a distance of more than 5 m. from their homes, the exchanges are empowered to advance the amount of the travelling expenses. Such advances are as a rule recovered through the employer by small weekly deductions from wages. During the World War, and until the Unemployment Insurance Act (1920) came into operation (Nov. 8 1920), tickets for railway journeys, etc., were issued at less than the normal rates by the exchanges to all workpeople for whom the exchanges had found employment. The cost was borne by exchequer funds. Under the Unemployment Insurance Act (1920), the exchanges are enabled in the case of insured workpeople who have found work through the exchanges to remit (at the cost of the unemployment fund) one half of the amount by which railway and other fares exceed 4s. for a single journey.

In cases of strikes and lock-outs it was decided not to deny the use of the exchanges to the employers and workpeople concerned. In such cases the officials of the exchanges are bound to accept from an employer the notification of a vacancy created by the dispute and are further bound to bring to the notice of any unemployed applicant, with the particulars of such a vacancy, the fact that a trade dispute exists at the establishment of the employer concerned. As a rule formal notification of the existence of a trade dispute is made to the exchanges either by employers or workpeople and when this occurs the terms of the notification are laid before unemployed applicants. Travelling expenses cannot be advanced to enable workpeople to travel to vacancies caused by a trade dispute, and particulars of such vacancies are rarely, if ever, circulated to other exchanges.

The Labour Exchanges Act authorized the formation of advisory committees to assist in the management of the employment exchanges. The intention of this provision was to secure the coöperation of representatives of industry in the administration of the exchanges. From 1912 onwards advantage was taken of this provision to form 17 advisory trade committees consisting of representative employers and workpeople in equal numbers; the number of the members of each committee varied from 12 to 36, and the usual number was rather more than 20. The chairman was chosen by the committee itself or, in default of agreement between the two sides of the committee, by the Board of Trade. The areas covered by the advisory trade committees were as a rule large, consisting of as many as five counties. It was the duty of the committees to advise the Board of Trade upon matters referred to them, and the matters so referred were as a rule questions of policy arising in the administration of the labour exchange service, *e.g.* the attitude which should be adopted by the exchanges towards employers and workpeople concerned in trade disputes and the extent to which "references" should be taken up by the exchanges in respect of applicants for employment. It was found that the areas assigned to the committee were too wide to permit of any close association with the current work of individual exchanges, and the restriction of the functions of the committees to the consideration of matters referred to them prevented the development of a sense of responsibility for the conduct of the exchanges. When, therefore, it became evident (in 1917) that upon the conclusion of the World War the exchanges would be faced with tasks of special difficulty in every area, the Minister of Labour, to whom responsibility for the exchanges was transferred upon the creation of that office in Jan. 1917, decided to replace the advisory trade committees by a larger number of local employment committees, associated much more closely with the work of each exchange. Three hundred and two local employment committees were formed in connexion with the 395 exchanges. As a rule, therefore, each committee is associated with a single exchange, and with more than one exchange only in some cases in the provinces where several are situated within a single industrial area.

Members of the local employment committees are appointed by the Minister of Labour, as a rule upon the nomination of local organizations of employers and of workpeople. The chairman of the committee is chosen and appointed by the minister. The committees are responsible for advising the minister upon every phase of the work of the exchanges with which they are associated. They are free to initiate their business and to carry it out through sub-committees. Two hundred and forty-six committees have formed women's departments at the exchanges. Consisting of representatives of every industrial interest of importance in the locality, the committees are in a position to indicate precisely in what ways each exchange should be adapted to local needs so as to be of most service, and further, the committees have since their formation undertaken much detailed work on behalf of individual workpeople upon the books of the exchanges.

Exchange Statistics.—The scale and character of the work done is shown in Table I.

TABLE I.—*Employment Exchanges.*

Year		Registrations	Individuals Registered	Vacancies Notified	Vacancies Filled	Individuals Found Work
Men	1910	920,000	740,221	261,560	219,069	
	1911	1,323,162	978,211	446,035	362,670	268,794
	1912	1,594,236	1,025,332	626,756	513,649	336,341
	1913	2,088,735	1,267,077	714,270	566,150	390,141
	1914	2,316,042	1,381,694	909,383	706,458	507,538
	1915	1,512,335	1,072,213	1,004,970	716,816	577,206
	1916	1,229,171	954,172	909,721	636,095	539,564
	1917	1,167,864	938,725	906,627	623,830	539,396
	1918	1,363,590	1,119,905	977,999	669,732	582,899
	1919	3,601,393	2,897,333	900,970	658,836	598,658
	1920	2,392,553	1,699,924	581,406	454,624	393,623
Women	1910	290,000	232,106	103,007	81,846	
	1911	414,459	307,641	178,446	136,409	97,598
	1912	518,775	360,873	226,276	168,555	118,650
	1913	532,060	351,755	270,325	199,395	133,424
	1914	707,071	476,926	312,344	232,935	160,145
	1915	1,232,891	920,638	493,515	385,101	306,192
	1916	1,921,826	1,501,260	846,196	695,631	615,920
	1917	1,873,706	1,487,728	814,785	706,034	636,269
	1918	1,815,691	1,478,934	808,490	624,220	547,412
	1919	1,927,143	1,568,625	731,320	408,033	341,773
	1920	1,015,113	767,037	469,068	284,451	212,895
Boys	1910	110,000	90,084	62,233	46,728	
	1911	185,108	138,684	106,920	77,881	64,752
	1912	200,403	146,434	130,601	88,086	70,565
	1913	186,574	137,668	143,715	90,387	74,535
	1914	211,898	157,093	157,278	103,280	85,068
	1915	194,864	150,559	161,459	106,716	90,237
	1916	241,314	184,443	148,091	116,900	100,053
	1917	265,668	204,283	146,103	120,525	105,547
	1918	296,673	234,285	148,158	122,054	106,429
	1919	355,547	285,603	155,978	117,166	103,237
	1920	286,003	218,365	133,662	106,938	93,386
Girls	1910	80,000	65,036	32,143	26,670	
	1911	117,718	88,833	57,208	44,450	38,066
	1912	151,890	110,948	78,941	57,940	48,153
	1913	158,524	115,171	94,518	65,921	54,206
	1914	207,441	148,310	100,019	74,236	61,320
	1915	246,047	183,393	137,702	99,506	84,701
	1916	266,378	203,909	145,010	108,609	95,869
	1917	268,142	206,914	131,927	104,834	93,986
	1918	263,110	212,139	132,570	98,706	88,003
	1919	313,570	252,225	163,096	105,928	94,207
	1920	290,931	220,972	127,997	95,695	84,265
Total	1910	1,400,000	1,127,447	458,943	374,313	
	1911	2,040,447	1,513,369	788,609	621,410	469,210
	1912	2,465,304	1,643,587	1,062,574	828,230	573,709
	1913	2,965,893	1,871,671	1,222,828	921,853	652,306
	1914	3,442,452	2,164,023	1,479,024	1,116,909	814,071
	1915	3,186,137	2,326,803	1,797,646	1,308,137	1,058,336
	1916	3,658,689	2,843,784	2,049,018	1,557,235	1,351,406
	1917	3,575,380	2,837,650	1,999,442	1,555,223	1,375,198
	1918	3,739,064	3,045,263	2,067,217	1,514,712	1,324,743
	1919	6,197,653	5,003,786	1,951,364	1,289,963	1,137,875
	1920	3,984,600	2,906,298	1,312,133	941,708	784,169

During the World War and the period of demobilization (Aug. 1914 to the end of 1919) much work of a special kind (see below) was undertaken by the exchanges, and in order to judge the extent to which they are used by employers and workpeople in normal years attention should be directed to the non-war periods.

It should be noted that at the end of 1918 the age-limit for "boys and girls" was raised from 17 to 18. The table shows that the work of the exchange system increased steadily and reached its maximum in the latter years of the World War. The figures for 1920 indicate a return after the exceptional war conditions to a normal scale of work. It appears that the exchanges may anticipate roughly the receipt each year of 3,000,000 registrations by unemployed workpeople, of notifications by employers of 1½ million vacancies and the filling of 1,000,000 of those vacancies. It should be remembered that the latter half of 1920 was a period of industrial decline.

Casual Labour.—Schemes intended to lead up to the regularization of employment were devised at the Liverpool docks, the Goole docks, the South Wales ports (ship repairers), and at Manchester (cloth porters). Of these, the Liverpool dock scheme is the most interesting. Managed by a joint committee of employers and workpeople in the docks, the scheme has led, through a system of tallies issued to approved dock workers, to some limitation in the number of the dockers employed in or about the port. The scheme also provides for a single weekly payment of wages to each man employed, irrespective of the number of separate employers for whom he may have worked. The wage-paying arrangements at Liverpool have not been copied elsewhere, but the method of controlling dock labour by the issue through a joint committee to dock workers of tallies, has become almost universal in British ports and provides a basis upon which it is possible to build schemes to regularize the employment of dockers.

Juvenile Employment.—Since 1910 a separate system of committees for dealing with the employment of juveniles (under 17 years of age to Dec. 1918 and under 18 years of age thereafter) has been in operation (*see* JUVENILE EMPLOYMENT). These committees are either formed by the Ministry of Labour under the Labour Exchanges Act, or by the local education authorities under the Choice of Employment Act, 1910. Their work is, in coöperation with the employment exchanges, to supervise the finding of employment for children; to advise children as to the most promising openings, and generally to take such local action as is calculated to improve the conditions of juvenile employment.

Unemployment Insurance.—On May 4 1911, Mr. Asquith's Government introduced in the House of Commons, as the second part of the National Insurance Bill, proposals for the compulsory insurance upon a contributive basis of 2¼ million workpeople. The bill received the royal assent, Dec. 16 1911. This measure, to the extent to which it brought the employed population within the scope of unemployment insurance, completed the policy for dealing with unemployment which had been begun in 1909 by the passage of the Labour Exchanges Act. Part II. of the National Insurance Act also contained provisions intended to encourage voluntary provision for unemployment in the industries which were not included under the compulsory scheme.

All workpeople employed in the "Insured Trades" as defined by a schedule to the Act were compelled to be insured against unemployment. Contributions were payable as from July 15 1912, and benefit was paid from Jan. 8 1913. The trades concerned were building, construction of works, shipbuilding, engineering, construction of vehicles, ironfounding, together with saw-milling in connexion with, or of a kind commonly done in connexion with, any of the insured trades. Questions as to the precise limits of the insured trades were settled by an umpire appointed by the Crown to act for the whole kingdom. An unemployment fund was created out of contributions from workpeople employed in the insured trades and from the employers of such workpeople. The rate of contributions was 2½d. each from employer and workman for each period of employment up to a week, with reduced rates for workmen below 18 years of age and for periods of employment of adults for two days or less, viz. a joint contribution of 2d. for a week's employment of a juvenile worker or for the employment of an adult for a period not exceeding two days. To the amount so collected the State contributed an amount equal to one-third of the joint contributions of employers and workpeople. It was the duty of an employer to affix to an unemployment book each week, or at the earlier termination of the employment, a stamp of the value of his own and the workmen's contributions, the employer thereafter deducting the amount of the workman's contribution from wages paid to him. The scheme provided unemployment benefit at the rate of 7s. a week during unavoidable unemployment subject to a maximum of 15 weeks' benefit in any 12 months and to the limitation of payment to one week's benefit for every five full contributions paid by the workman. Benefit was not payable to persons under 17 years of age and was payable at half the adult rates between the ages of 17 and 18. The principal statutory conditions for the receipt of benefit were application for benefit in the prescribed manner, namely at a Board of Trade labour exchange or other local office of the unemployment fund; proofs, secured mainly by daily attendance at the labour exchange, that unemployment had been continuous since the date of application; capacity for work, and inability to obtain suitable employment. Proof that the last condition had been satisfied was obtained mainly by an examination of the register of vacancies at the labour exchange in order to see whether suitable employment was available and the offer to the applicant of any apparently suitable work. A workman was disqualified for benefit if he had lost his employment as the result of a stoppage of work due to a trade dispute at the premises at which he was employed; and in such a case the disqualification lasted during the continuance of the stoppage or until the workman had obtained fresh employment in an insured trade. Disqualification for six weeks from the date of losing employment was involved in discharge through misconduct or in leaving employment voluntarily without just cause. Claims to unemployment benefit were decided in the first instance by a statutory "Insurance Officer." From the decision of this officer the workman had a right of appeal to the court of referees consisting of an employer, a workman and an impartial chairman. Further, the insurance officer had the right to refer the decisions of courts of referees to the umpire for final settlement.

Associations of insured workmen were entitled (Section 105, Nat. Ins. Act) to undertake the payment to their own members of unemployment benefit due to them out of the unemployment fund. Such an arrangement involved the payment of the State benefit by the association together with supplementary benefit out of the association's own funds to the value of at least one-third of the amount to be recovered from the State. In order, however, to establish a claim for the repayment of State benefit already paid, the association was bound to satisfy the Board of Trade that the benefit in question had been paid in circumstances which entitled the individual member to receive State benefit. This involved an approximation of the procedure upon claims to receive benefit through an association, to the procedure upon claims to receive benefit direct from a labour exchange.

The insured workman upon becoming unemployed lodges a claim for unemployment benefit at a labour exchange or other local office of the unemployment fund, viz. at one of the 1,048 branch employment offices which have been established in less populous districts for the administration of the unemployment insurance scheme. In lodging his claim the workman indicates whether he wishes to receive his benefit through an association or direct from the office of the unemployment fund. His claim is then examined, and when a favourable decision has been given, benefit is paid to him by the association or at the office at which he made his claim according to his choice. If the workman has chosen to receive his benefit from an association he will sign the "Vacant Book," provided by his association, as a rule each day. Many of the associations concerned have found it convenient to keep their vacant books at the labour exchanges. In July 1913 over 2,000 vacant books of associations having arrangements for the payment of unemployment benefit were lodged at labour exchanges. At that date arrangements had been made by 105 associations with nearly 540,000 members in the insured trades.

In Nov. 1920, immediately before the operation of the Unemployment Insurance Act (1920), when the number of insured workpeople had been increased from 2¼ million to 3¾ millions, some 5,180 vacant books, out of a total of about 8,600 maintained by the trade unions concerned, were lodged at employment exchanges. At that date arrangements had been made by 92 associations with an approximate membership of 1,341,000. The reduction in the number of associations was due to the amalgamation of certain trade unions.

Voluntary Insurance.—Part II. of the National Insurance Act, (1911), also contains (in Section 106) a provision intended to encourage voluntary insurance against unemployment, both in the insured trades and in other trades. The arrangement here was based upon the successful experiment made over a number of years at Ghent, and involved the payment of a subsidy to trade unions or other associations of workpeople which make a voluntary provision for unemployment. Under Section 106, the Board of Trade was empowered in such cases to repay out of moneys provided by Parliament, an amount not exceeding one-sixth of the sum spent by the association out of their own funds upon unemployment benefit, with a limit to the amount so repaid of 2s. per head per week in respect of members who have received benefit from the association. By July 1913, 275 associations with a membership of 1,104,000 had been admitted by the Board of Trade as satisfying the required conditions (as to the methods of proving unemployment, etc.) for receiving the grant. During the 12 months ending in March 1914, a total sum of £15,167 was paid under the section to 347 associations with a membership of 1,401,000, and during the 12 months ending March 1920 £1,678 was paid to 397 associations with a membership of 2,608,273. Considerable difficulty was experienced in the administration of the section in obtaining evidence which would satisfy the Government auditors that the payments upon which the associations based their claims for a grant had been properly made. This difficulty was due solely to the varying standards of clerical competence maintained by the associations in keeping their accounts. The section was allowed to lapse in the revision and general extension of unemployment insurance which was undertaken in 1920.

Rates of Contribution.—The requirements governing the payment of unemployment insurance contributions were devised so as to charge a higher rate of contribution for engagements of less than a week's duration than for engagements for more than a week. At the same time provision was made (Section 99) for an employer, and, subject to the extent to which employers made use of the section, for workmen, to escape this higher charge by engaging workpeople through the labour exchanges and by handing over to the exchanges the work of affixing insurance stamps. When employers entered into an arrangement of this kind they were not charged the higher rate of contribution otherwise appropriate in respect of very short engagements, and as a further inducement to make such arrangements, employers were allowed to hand over to the labour exchanges the work of stamping the health insurance cards as well as the unemployment insurance cards. The intention of this section was to induce employers to give the labour exchanges an opportunity of regularizing employment by "dovetailing" a series of casual jobs so as to afford a reasonable livelihood for a limited number of workmen. Up to July 1913, arrangements under the section had been made by 592 employers in respect of 138,500 workpeople; in July 1914 by 899 employers in respect of 162,192 workpeople and in Nov. 1920 by 124 employers in respect of 29,334 workpeople.

Finally the Act of 1911 contained provisions for reducing the cost of unemployment insurance in respect of workmen who had experienced little unemployment. Thus (Section 94) employers were entitled to obtain a refund of one-third of their contributions in respect of workmen continuously employed by them for 12 months and (Section 96) a refund of the whole of their contributions in respect of periods during which short time was worked. Section 95 enabled workmen who had paid 500 contributions to recover at the age of 60 the amount by which the value of their contributions exceeded the value of unemployment benefit received by them.

Amending Acts.—On Aug. 10 1914, the royal assent was given to an Act amending Part II. of the National Insurance Act upon a number of points, none of them of first-class importance, upon which experience of the administration of the scheme had shown weakness in the principal Act. Thus changes were made in the machinery for the determination of claims to benefit and the arrangements for refunding contributions paid by employers and workmen. The Board of Trade was empowered to exempt workmen upon short time from the payment of unemployment insurance contributions, and associations undertaking the payment of State benefit to their members were definitely required to provide from their own funds benefit equal to one-third more than the amount of the State benefit. The Act of March 16 1915 allowed unemployment insurance contributions to be paid in respect of workmen engaged upon war work abroad.

Extension of Insurance.—In July 1916, the scope of unemployment insurance was extended to include workmen employed upon munitions work, and particularly in the chemical, metal, rubber, and brickmaking industries and in the leather industry. This extension was made in order to bring substantially the whole working population employed in war industries within the scope of insurance, and the operation of the Act was to cease after 5 years or at the end of 3 years after the war, whichever was the later date. As the result of this extension the number of workpeople insured against unemployment became approximately 3¾ millions.

In Feb. 1918 the Minister of Labour was empowered by order to exclude from unemployment insurance any branch of trade which had been brought into insurance by the Act of 1916.

Experience proved that the calculations, upon which were based the rates of contribution and benefit contained in the Act of 1911, erred upon the side of caution. From this cause, but also as the result of the period of good trade which followed 1911, of the practical absence of unemployment during almost the whole of the war period, and of the Out-of-work Donation Scheme during 1919, under which unemployed persons were entitled to a much higher rate of weekly payment than they could obtain under the Unemployment Insurance Act, the unemployment fund stood at £18,030,356 in July 1919. In view of this large reserve fund and of the increasing cost of living, a short Act was passed in Dec. 1919, increasing the weekly rate of unemployment benefit under the Unemployment Insurance Act from 7s. to 11s. The requirements as to the amount of benefit to be provided out of their own funds by associations undertaking to pay State benefit to their members were not affected.

Insurance Act of 1920.—On Dec. 23 1919, Sir Robert Horne, as Minister of Labour, introduced on behalf of Mr. Lloyd George's Government an Unemployment Insurance bill containing proposals for a general extension of compulsory and contributory unemployment insurance. These proposals were approved by Parliament, and the bill received the royal assent on Aug. 9 1920. This Act superseded the previous Unemployment Insurance Acts, but the general character of the scheme of unemployment insurance remained unaltered.

The scope of unemployment insurance was extended to include all persons of the age of 16 and upwards employed under a contract of service or apprenticeship with the following principal exceptions:—persons employed in agriculture and private domestic service; established servants of the Crown; persons employed otherwise than by way of manual labour at a rate of remuneration exceeding £250 a year; persons casually employed otherwise than for the purpose of the employer's trade or business, and persons employed by public authorities and by corporations whose status approximates to that of a public authority, upon the certificate of the Minister of Labour that the persons in question are not subject to dismissal except for misconduct or unfitness to perform their duties, and that the conditions of their engagement make insurance unnecessary.

The rates of joint contributions by employers and employed persons were fixed at 8d. for men; 6½d. for women; 4d. for boys between 16 and 18 years of age; 3½d. for girls between 16 and 18 years of age. Out of these amounts the employed person's contribution is 4d. for men; 3d. for women; 2d. for boys between 16 and 18 years of age and 1½d. for girls between 16 and 18 years of age. To the unemployment fund formed by these contributions the State contributes 2d. for each man's contribution; 1⅔d. for each woman's contribution; 1⅓d. for each boy's contribution, and 1d. for each girl's contribution. The weekly rate of unemployment benefit was fixed at 15s. for men, 12s. for women, 7/6 for boys and 6s. for girls. Payment of benefit is limited to 15 weeks' benefit in any period of 12 months ending early in July each year, and to the payment of one week's benefit in respect of every 6 weekly contributions paid. In general the conditions for receiving benefit and the rules governing disqualification for receiving benefit follow the lines of Part II. of the National Insurance Act, 1911. The Act of 1920 requires, however, that the applicant shall have not less than 12 contributions standing to his credit, and requires him to show that he has attended an approved course of instruction if he has been called upon to do so. By a special temporary provision the Act allows all insured persons who have paid 4 contributions to draw up to a maximum of 8 weeks' benefit during the first 12 months. This temporary arrangement was modified by the Unemployment Insurance (Temporary Provisions Amendments) Act of Dec. 1920 which permitted any person to draw up to a maximum of 8 weeks' benefit during the first year of the operation of the Act upon proving that he had been employed during 10 weeks in the course of the year 1920, or during 4 weeks since July 4 1920 in any employment which is within the scope of unemployment insurance. Arrangements for deciding disputes follow the scheme of 1911.

Special Schemes.—Provision is made in the Act for the management by separate industries of the unemployment insurance of workpeople employed therein. Section 18 of the Act enables the Minister of Labour to approve a "Special Scheme" submitted to him by employers and employees in any industry to which compulsory unemployment insurance applies. The main conditions governing the formation of special schemes are that: (1) The scheme must cover all persons employed in the industry either throughout the country or over some defined area. (2) The benefits, which may include payment for short time as well as unemployment benefit, must be, on the whole, not less favourable than those provided under the general scheme. (3) The State contribution to a special scheme will be limited to an amount not exceeding 3/10 of the contribution the State would have made if the members had remained under the general scheme. (4) The scheme will be administered not by the Ministry of Labour, but by a joint body of employers and employed in the industry specially set up for this purpose.

The Act contemplated the formation of such special schemes before July 1921, and provided for the payment to the responsible body of contributions collected from members of the industry before the scheme is launched. The provisions as to special schemes went far to meet a body of opinion that industries should bear the burden of their own unemployment. When the Act was passed, the Government actually contemplated the formation of special schemes in respect of rather less than 4 million out of a total of some 12¼ million insured workpeople. The event seemed likely to prove that this was a generous estimate.

Provision was also made (Section 20) for the creation of supplementary schemes of unemployment insurance by any industry which did not form a special scheme. Such supplementary schemes might, out of special contributions, provide additional benefits including provision for short time or for unemployment not covered by the general scheme. When approved by the Minister of Labour, supplementary schemes have statutory effect.

The Act of 1920 (Section 17) reproduces Section 105 of the Act of 1911, which enables associations of insured workpeople to undertake the payment to their members of unemployment benefit due from the State fund. Of the various provisions made in the Act of 1911 for the refund or reduction of contributions in certain circumstances, the provision for the refund to workmen at the age of 60 of the amount of the value of their contributions over the amount of benefit received is alone reproduced (Section 25). The Minister of Labour is enabled (Section 31) to arrange for keeping and stamping at an employment exchange the insurance contribution cards and books of workpeople engaged through the exchanges.

Statistics of Insurance.—Table II. shows the extent to which unemployment benefit was drawn in the industries covered by the unemployment insurance scheme since Jan. 1913, when unemployment benefit was first payable. During the operation of the out-of-work donation scheme for civilians (Nov. 25 1918 to Nov. 24 1919) unemployed workpeople as a rule availed themselves of their rights under that scheme, and were debarred from drawing unemployment benefit concurrently.

War Work of the Exchanges.—With the outbreak of the World War, the character of the work done at the employment exchanges was necessarily altered to meet the exceptional conditions, and it continued to change with the development of events until the restoration of more or less normal conditions at the end of 1919. Immediately upon the declaration of war, the exchanges were called upon to assist the war departments in mobilization by the supply of large numbers of skilled and unskilled civilian workmen. Up to Aug. 14 1914, nearly 30,000 workmen were supplied through the exchanges for this purpose. In the earlier months of the war, unemployment upon a large scale was anticipated and was experienced in certain industries, particularly in the textile industries. To meet this situation, the exchanges coöperated in the collection of information as to the extent and character of unemployment with the local representative committees which were formed by local authorities at the suggestion of the Government. The exchanges also assisted in the distribution of special grants in aid of unemployment benefit paid by trade unions, upon the lines of Section 106 of the National Insurance Act, 1911. From Aug. 1914 to March 1915, the amount of such special grants was £74,926. Unemployment decreased rapidly with the progress of recruiting and the development of war industries, and from early in 1915 to the end of the war, the employment exchanges were engaged upon a series of schemes to use the man-power of the nation to the best advantage.

Enrolment Schemes.—In order to obtain a body of mobile skilled labour for munitions work, and in order also to make it possible to put pressure upon employers to make full use of the skilled workmen in their establishments, several enrolment schemes were set on foot whereby selected workmen undertook, in return for guaranteed minimum pay and a subsistence allowance, to work at any place at which they might be required (*see* LABOUR SUPPLY AND REGULATION). Thus enrolment of volunteers was begun in 1916.

Priority of Labour.—From 1916 to the end of the war, a system of controlling the available supplies of labour for civilian war work of all kinds was developed apart from the enrolment schemes. As early as April 1915, certain classes of the employers, mainly those engaged

TABLE II.—*Unemployment Benefit.*
Number of unemployment books remaining lodged at the end of the month.

Month	Year							
	1913	1914	1915	1916	1917	1918	1919	1920
January	115,152	121,267	54,723	19,155	20,273	32,063	Out-of-work donation in operation; unemployment insurance returns suspended.	127,476
February	103,332	97,636	43,257	16,021	21,221	32,445		97,932
March	82,822	81,667	30,085	14,415	21,070	36,873		82,843
April	68,151	74,546	24,517	13,095	21,973	36,412		67,255
May	66,910	73,589	19,009	11,264	23,556	33,079		66,897
June	69,175	80,461	18,607	11,100	25,305	30,080		67,410
July	63,832	83,412	20,730	11,264	25,213	26,442		77,901
August	63,866	145,194 *a*	18,997	11,290	25,006	26,024		82,406
September	73,124	128,038	17,766	10,589	25,682	26,208		103,075
October	75,996	99,282	16,654	13,044	27,487	24,505		120,114 *e*
November	88,493	81,341	17,724	15,944	28,799	33,634 *c*	102,684 *d*	189,916
December	101,712	68,815	22,275	17,612 *b*	28,382		123,344	324,674 *f*

a Outbreak of war.
b Unemployment insurance extended to cover 3¾ million workpeople (in place of 2¼ million).
c Armistice Nov. 11.
d Out-of-work donation for civilians ceased Nov. 25.
e Coal-miners' strike Oct. 15.
f Unemployment insurance extended to cover total of about 12 million workpeople.

in engineering and shipbuilding, were restrained from enticing workpeople to their establishments from employers elsewhere, and were prohibited from seeking to engage workmen from a distance of more than 10 m. otherwise than through the employment exchanges. In 1916, arrangements were made to reach agreement between the various departments responsible for production as to the order in which demands for labour should be met. In their fully developed form, these arrangements involved frequent periodical consultation between the producing departments, and the grading of current demands for labour according to their importance. The labour needs of employers in war industries were graded as entitled to "Super-Priority," "First" or "Second Class Priority," or as not deserving special treatment. Decisions of this character were given upon the demands of employers as notified to the employment exchanges. Such demands from the whole kingdom were brought together in the central clearing house of the unemployment department, and the classified lists of labour demands issued upon this basis were circulated to all employment exchanges. A general list of vacancies was issued by the clearing house in the manner already described, and a special list known as the "Munition Workers' Gazette," relating especially to the most important labour demands in the engineering industry, was issued by the clearing house upon the authority of the Ministry of Munitions. The employment exchanges working upon the information so supplied, were able to influence appreciably the distribution of any local surplus of labour.

War Employment of Women.—With the development of war production, the demands for women's labour became far greater than the supply which was available immediately. In order to obtain control of the distribution of the available supplies of women's labour, Government and controlled factories were required to engage all women through the employment exchanges. Further, a large proportion of the women employed in other factories engaged upon war work was supplied through the exchanges. The exchanges carried out a continuous campaign for recruiting women for these purposes, the total number supplied by the exchanges amounting to more than 1,086,000. Recruiting for the Women's Service Corps was also undertaken by the exchanges. Forty-three thousand seven hundred women were recruited by the exchanges for Queen Mary's Army Auxiliary Corps (W.A.A.C.), 5,700 for the Women's Royal Naval Service (W.R.N.S.) and 16,300 for the Women's Royal Air Force (W.R.A.F.).

Labour from Abroad.—In order to avoid difficulties with British workmen, employers were compelled to arrange the engagement of alien workpeople required for munition work through the employment exchanges. The principal work in this connexion was finding employment for about 65,000 Belgian workpeople.

Release from the Forces.—In the early stages of the war, large numbers of workmen, possessing skill which was of great value upon civil war work, joined the army. Arrangements were made subsequently for the release from the army of a number of these men. The staff of the employment exchanges were largely employed in selecting such men for release.

Substitution.—During 1917 and 1918, the employment exchanges, and the local employment committees from their formation at the end of 1917, were largely occupied upon endeavouring to obtain substitutes for men in civil life who had been certified as available for military service upon the supply of a substitute. This work was one of great difficulty and was carried out with the National Service Department, subsequently the Ministry of National Service.

Work for Demobilization.—Before the conclusion of the war, an elaborate scheme for the demobilization of the forces according to industrial requirements had been elaborated (*see* DEMOBILIZATION AND RESETTLEMENT). The employment exchanges and the local employment committees were responsible for preparing and applying the original scheme of demobilization upon its civil side, and upon the introduction of the "Contract" scheme they continued to assist in the work and were responsible for dealing with the increasing numbers of unemployed ex-service men. The local employment committees performed a very valuable service in pressing upon employers in every area the obligation to reëngage the men who had been employed by them before the war.

The employment exchanges assisted in the redistribution of workpeople which followed upon the conclusion of war contracts. They endeavoured to arrange with employers for discharges to be regulated with a view to fresh employment which seemed likely to be available. Workpeople about to be discharged from war work were invited to supply the exchanges with particulars of their industrial experience with a view to fresh employment being found for them, and some 130,000 workpeople took advantage of this arrangement. The exchanges also supplied free railway passes to munition workers who were returning to their homes or were going to fresh employment. Discharges from war work were at their maximum towards the middle of 1919, that is to say at the time when demobilization of the forces was proceeding most rapidly. The effect of this double stream of workpeople seeking employment is to be seen in the particulars of the payment of out-of-work donation.

Throughout the resettlement period, the work of the local employment committees was of the greatest value. In order to strengthen their organization, divisional councils were formed consisting of representatives of the committees in each division.

Out-of-Work Donation.—Early in the war it had been decided that members of H.M. forces should be entitled to certain payments during unemployment following their discharge at the conclusion of the war. Proposals to extend compulsory and contributory unemployment insurance to the bulk of workpeople engaged upon civil work had not fructified during the war. When, therefore, the end of hostilities was in view, the Government decided that the out-of-work donation scheme should apply to civilian workpeople as well as to all non-commissioned members of H.M. forces. The scheme came into operation on Nov. 25 1918.

In the first instance donation was granted to ex-service men at the rate of 29s. a week with allowances for dependent children under the age of 15 at the rate of 6s. for the first child and 3s. each for other children, for 26 weeks, and at the rate of 20s. a week with unreduced allowances for dependent children for a further period of 13 weeks. The period during which this 39 weeks' donation could be drawn was the period of 12 months following the end of a man's demobilization furlough. Civilian workers were entitled to donation for a maximum period of 13 weeks in respect of unemployment occurring during the six months ending May 24 1919, and the donation was at the rate applicable to the first 26 weeks of the donation paid to ex-service men. In order to be entitled to donation, civilian workers were required to show that they had become employed contributors under the National Health Insurance scheme at least 3 months prior to Nov. 25 1918, or if they were under 16 or over 70 years of age, to produce equivalent evidence of employment. Donation was paid at half rates to persons under 18. Persons who were entitled to out-of-work donation applied to the local employment exchange upon becoming unemployed, and produced evidence that they were qualified to receive donation under the conditions of the scheme. Thereafter the procedure approximated to that adopted in the administration of unemployment insurance; that is to say, donation was refused if it appeared that the applicant had left his previous employment without just cause or as the result of misconduct or of a trade dispute, and donation was withdrawn if suitable work was refused. Disputed claims were dealt with by a local court of referees.

The out-of-work donation scheme was modified in respect of civilians in May 1919 by a postponement until Nov. 24 1919 of the date up to which a total of 13 weeks' donation could be drawn. At the same time the rate of donation for civilian workers was reduced to 20s. for men and 15s. for women, together with unaltered allowances for dependents, and the conditions for the receipt of donation were made more stringent by requiring the applicant to prove employment in 20 weeks during 1918 and by a review by the local employment committees of all applications for donation with a view to their rejection unless the committee were satisfied that the applicant was (*a*) normally in employment; (*b*) genuinely seeking work; and (*c*) unable to obtain it. The donation to civilian workers was also extended by the grant in March 1919 of donations for a further maximum period of 13 weeks (making 26 weeks in all) at the rates and under the conditions applied in May 1919 to the original grant of donation. Out-of-work donation ceased to be payable to civilian workers on Nov. 24 1919. Out-of-work donation to ex-service men was extended in respect of all ex-service men who had exhausted their rights under the original scheme by the grant of a further maximum of the 12 weeks' donation at the rate of 20s. a week without children's allowances during the period Nov. 25 1919 to March 21 1920, a further 12 weeks' donation between April 1 1920 and July 31 1920, and a further 14 weeks' donation between July 31 and Nov. 6 1920. By a further extension, donation was granted to ex-service men up to a maximum of 14 weeks during the period ending March 31 1921. The local employment committees were entrusted with a review of the individual grants of donation upon the occasion of each extension. This review involved very heavy work in all localities, as will be realized from the number of donation policies upon which payment was being made in successive months. There were, for civilians (up to Nov. 1919, when their donation ceased):—in 1918, Dec. 356,707; in 1919, Jan. 625,149; Feb. 782,363; March 753,982; April 689,933; May 384,290; June 233,282; July 177,221; Aug. 141,132; Sept. 100,731; Oct. 135,185. For ex-service men the figures were:—1918, Dec. 23,988; 1919, Jan. 53,554; Feb. 166,257; March 306,263; April 403,467; May 386,921; June 372,843; July 363,663; Aug. 336,952; Sept. 302,272; Oct. 344,242; Nov. 358,823; Dec. 370,610; 1920, Jan. 377,116; Feb. 293,144; March 240,508; April 219,226; May 196,508; June 174,224; July 139,866; Aug. 143,186; Sept. 158,759; Oct. 172,834; Nov. 192,144; Dec. 244,061.

In June 1920, the Minister of Labour appointed an independent committee, under the chairmanship of Mr. G. N. Barnes, M.P., "to examine the working and administration of the employment exchanges in Great Britain and to advise as to their future." The committee presented a report signed by all but one of their number in Nov. 1920 (Cmd. 1054). They found that the employment exchanges are a necessary corollary to the State system of unemployment insurance and they made a number of recommendations designed to insure that the exchanges should be fully effective for their purpose. The committee recommended that the facilities of the employment exchanges should be available to all persons, whether or not they were liable to compulsory unemployment insurance. (J. S. Nc.)

United Kingdom Statistics.

The statistics of unemployment most commonly used—indeed the only statistics available over a long series of years without a special, and laborious, inquiry—are those of unemployment among members of certain trade unions. The principal trade-union statistics of unemployment are therefore given here in Table III. accompanied by some observations as to the limitations of their utility.

It should be remarked at the outset that the figures in Table III. cannot be taken as necessarily an accurate measure of general unemployment; all that can safely be assumed is that they give a fairly trustworthy indication of the *direction* of the curve of rising or falling employment, and some indication of the severity of each successive depression, and of the high-water mark reached by the intervening period of good trade. For this purpose the exaggeration of the fluctuations, due to the preponderance of the metal, engineering, and shipbuilding trades, is no great disadvantage; but it is always necessary to remember that the fluctuations *are* exaggerated by the use of these figures.

It should also be remembered that the figures relate to members of trade unions, and to those only in certain trades, and are almost confined to (i.) men, as distinguished from women or young persons, and (ii.) to skilled men, as distinguished from labourers. It is instructive to examine the constitution of those sections of the work not covered by the trade-union percentages of unemployment given above. These include:—

(i.) All those workpeople, whether in the trades covered or not, who do not belong to any trade union.

(ii.) The great majority of labourers, or of semi-skilled men, whether in the trades covered or not.

(iii.) Practically the whole of the mining industry and of the textile industries; and *the whole* of the railway, tramway, and omnibus services; the gas, water, and electricity services; dock and wharf labour; agriculture; the mercantile marine and sea fishing; the clothing and the boot and shoe trades; commerce, banking, and insurance; retail trade; the Post Office, and other branches of the civil service and of the municipal services; and many other industries and services.

It will be observed that many of the industries and services mentioned are less subject to fluctuations in employment than the metal, engineering, and shipbuilding trades, which preponderate in the trade-union figures. The industries or occupations mentioned may, for the present purpose, be roughly grouped under three headings:—

(i.) Industries or services which are subject to relatively slight fluctuations in employment. Examples are the Post Office, and other branches of the civil service and of the municipal services; agriculture; the railway, tramway, and omnibus services; the gas, water, and electricity services; employment in banks, insurance offices, and commercial businesses.

(ii.) Unskilled or semi-skilled occupations. The men and women employed in these occupations generally either do not belong to any trade union, or else their trade unions are not in a financial position to pay unemployment benefit.

(iii.) Industries which meet fluctuations in trade by other means than the discharge of workpeople. Mining and the textile trades are good examples of this group.

The third group is deserving of somewhat detailed consideration, as helping to define, by contrast, the term "unemployment"—a term which does not, as is sometimes supposed, cover a perfectly definite and clear-cut conception.

The most frequent alternative to the discharge of workpeople is "short time." A factory, for example, may be entirely closed on Saturday, and work only seven hours (instead of eight or nine) on the other days of the week. It is important to observe, however, that, when the time worked is reduced (say) to three days in each week, the worker is entitled, under the present system of unemployment insurance, to unemployment benefit for the remaining days when he is not working (after the first

TABLE III.—*Percentage of Trade Union members unemployed.*

Year	In Metal, Engineering and Ship-building trades	In other trades making returns	Mean of columns (2) and (3)[1]
(1)	(2)	(3)	(4)
1860	1·9	1·8	1·85
1861	5·5	1·9	3·70
1862	9·0	3·1	6·05
1863	6·7	2·7	4·70
1864	3·0	0·9	1·95
1865	2·4	1·2	1·80
1866	3·9	1·4	2·65
1867	9·1	3·5	6·30
1868	10·0	3·5	6·75
1869	8·9	3·0	5·95
1870	4·4	3·1	3·75
1871	1·3	2·0	1·65
1872	0·9	1·0	0·95
1873	1·4	0·9	1·15
1874	2·3	0·9	1·60
1875	3·5	0·9	2·20
1876	5·2	1·6	3·40
1877	6·3	2·5	4·40
1878	9·0	3·5	6·25
1879	15·3	6·1	10·70
1880	6·7	3·8	5·25
1881	3·8	3·3	3·55
1882	2·3	2·4	2·35
1883	2·7	2·5	2·60
1884	10·8	3·5	7·15
1885	12·9	4·2	8·55
1886	13·5	5·6	9·55
1887	10·4	3·9	7·15
1888	6·0	2·3	4·15
1889	2·3	1·8	2·05
1890	2·2	2·0	2·10
1891	4·1	2·7	3·40
1892	7·7	4·7	6·20
1893	11·4	4·0	7·70
1894	11·2	3·2	7·20
1895	8·2	3·8	6·00
1896	4·2	2·5	3·35
1897	4·8	2·1	3·45
1898	4·0	1·9	2·95
1899	2·4	1·7	2·05
1900	2·6	2·3	2·45
1901	3·8	2·9	3·35
1902	5·5	2·9	4·20
1903	6·6	3·4	5·00
1904	8·4	4·4	6·40
1905	6·6	3·9	5·25
1906	4·1	3·3	3·70
1907	4·9	3·0	3·95
1908	12·5	4·8	8·65
1909	13·0	4·4	8·70
1910	6·8	3·4	5·10
1911	3·4	2·7	3·05
1912	3·6	2·7	3·15
1913	2·2	2·0	2·10
1914	3·3	3·2	3·25
1915	0·6	1·4	1·00
1916	0·3	0·6	0·45
1917	0·2	1·0	0·60
1918	0·2	1·2	0·70
1919	3·3	1·8	2·55
1920	3·2	1·9	2·55
1921 End of			
Jan.	8·6	5·8	7·2
Feb.	10·9	7·0	9·0
March	14·0	7·3	10·7
April	20·0	14·7	17·4
May	28·8	16·5	22·7
June	30·8	16·9	23·9
July	27·3	10·1	18·7

[1] It should be observed that this is not necessarily identical with the percentage of trade union members unemployed in *all* trade unions making returns, *taken together*. In the early years of the period the metal, engineering, and shipbuilding trades, which are subject to much more violent fluctuations of employment than most other industries, are over represented. By taking the mean of the fluctuating engineering and shipbuilding figure and of the relatively stable "other trades" figure—in other words, by giving the metal, engineering, and shipbuilding trades a constant "weight" equal to one-half of the total—this source of error is corrected.

TABLE IV.—*Percentage of Insurance Workpeople in receipt of Unemployment Benefit or Out-of-Work Donation.*[1]

Trade	1913	1914	1915	1916	1917	1918	1919	1920[5]
Building	5·1	5·2	2·1	1·2	0·8	0·8	6·4	2·8
Works of Construction				0·4	0·4	0·6		
Shipbuilding	3·5	3·8	0·8	0·4	0·4	0·4	4·8	3·9
Engineering and Ironfounding	2·4	3·4	0·6	0·4	0·6	1·2	8·1	4·9
Construction of Vehicles	2·5	3·5	0·8	0·5	0·4	0·5	4·4	2·2
Sawmilling[1]	2·4	3·3	1·0	0·6	0·6	0·7	5·6	8·4
Other Insured Workpeople[2]	1·2	1·8	0·4	0·2	0·1	0·1	Included below	0·8
Total Insured under Act of 1911	3·6	4·2	1·2	0·6	0·6	1·0	. .	3·9
Iron and Steel Manufacture					0·3	0·3	3·5	1·3
Tinplate Manufacture					0·4	0·4	4·1	2·2
Miscellaneous Metals					0·5	0·9		2·2
Ammunition and Explosives					1·4	2·9	5·1	5·3
Chemicals					0·7	1·2	3·2	2·0
Leather and Leather Goods					0·5	0·8	Included below	3·6
Bricks, Tiles and Artificial Building Materials					0·4	0·6	3·4	1·3
Sawmilling[3] Machined Woodwork and Wooden Cases					1·3	2·1	Included with 1911 Act Sawmilling	2·8
Rubber and Manufactures thereof					1·0	1·1	Included below	2·7
Other Insured Workpeople					1·3	3·5	3·5[4]	4·6
Total Insured under Act of 1916					0·9	1·7	. .	2·7
Total, Insured Industries	3·6	4·2	1·2	0·6	0·7	1·2	6·1	3·5
Number of workpeople insured in the month of July	2,071,000	2,326,000	2,075,000	2,029,000	3,632,000	3,922,000	3,721,000	4,188,000

[1] Sawmilling "of a kind commonly done in connexion with other insured trades." Workpeople engaged in sawmilling actually done "in connexion with" other insured trades are included with the other workpeople in those trades. Other sawmilling was not included at all, prior to the Act of 1916.

[2] These are workpeople engaged in insurable occupations in businesses whose main work is not insurable, *e.g.* engineering operatives on the maintenance staff of a cotton factory.

[3] Sawmilling other than that covered by the Act of 1911.

[4] Includes "other workpeople insured under the Act of 1911"; also leather workers and rubber workers.

[5] Based on the first nine months of 1920, Oct. details not being available owing to the coal strike, and Nov. and Dec. owing to the extension of Unemployment Insurance under the 1920 Act.

three, which constitute "the waiting period").[1] Thus "unemployment" and "short time" are not as is sometimes supposed, mutually exclusive terms. The same applies, of course, in the very common case where workers, during a time of depression, are employed in alternate weeks.

A depression is sometimes met, however, by other devices, entirely different from either "unemployment" or "short time." In the weaving section of the cotton industry, for example, it is a very common practice in times of depression to give a weaver (say) two or three looms to mind, instead of the usual four or six. Again, a common complaint among weavers (by no means confined to periods of acute depression) is that of "playing for warps," *i.e.* of being kept waiting for a supply of the "warp," through which the "weft" threads are woven. Some term is clearly needed to describe all forms of partial unemployment, whereby a worker's production is reduced, and his or her earning power with it. The useful term "under-employment" is coming into use to an increasing extent for this purpose; it is more scientific than the term "short time" and covers a wider ground. It might properly be used, for example, to describe the state of employment of a dock labourer, who presents himself for work at the beginning of each 4-hour spell of work during the week, but is only taken on for three of them. This cannot, with strict accuracy, be called either "unemployment," or "short time"; but it is a very good example of "under-employment."

Table IV. shows the percentages unemployed among persons insured against unemployment under Part II. of the National Insurance Act, 1911, and the various amending Acts. Under the original Act, compulsory insurance was confined to the building trades and construction of works; the engineering, ironfounding, and shipbuilding trades; the construction of vehicles; and sawmilling "in connexion with or of a kind commonly done in connexion with" any of the other insured trades. Under the Amending Act of 1916, however, compulsory insurance was extended to a number of the "munition" trades. Apart from the difference in the trade constitution of the workpeople covered, these figures differ from the trade-union percentages given in Table IV. chiefly in including the labourers and semi-skilled men, who are almost entirely excluded from the trade-union figures. The numbers insured under the Act in July of each year, 1913–20, are shown at the foot of Table IV.

Under the Unemployment Insurance Acts, 1920 and 1921, substantially all persons liable for Health Insurance contribution, except outworkers and persons employed in agriculture and private domestic service, were required to be insured against unemployment. Employees of local authorities, railways and certain other public utility undertakings, members of the police forces, and persons with rights under a statutory superannuation scheme might, in certain circumstances, be excepted. Persons employed otherwise than by way of manual labour at a rate of remuneration exceeding in value £250 per annum were excepted, as were also juveniles under 16 years of age. The number of persons insured under the Act at May 31 1921 was estimated at 12,190,790, of whom 8,829,320 were males and 3,361,470 were females.

Payment of unemployment benefit was made subject to certain statutory conditions and disqualifications. The procedure required the "lodging" of an unemployed person's unemployment book, and the records of books lodged thus afford a measure of the extent to which unemployment was prevalent in the insured industries. As a by-product of the administration of

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[1] Statistics of short time workers are kept separate from those of persons entirely unemployed and are not used in the calculation of the percentage unemployed given in Table IV. Alternate week working is counted as short time.

TABLE V.—*Unemployment in Insured Trades: July 29 1921.*

Industry	Estimated No. of Insured Workpeople			No. of Unemployment Bks. and O.W.D. Policies remaining lodged at July 29 1921			Percentage Unemployed at July 29		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
Building and Works of Construction	1,020,430	9,030	1,029,460	158,065	456	158,521	15·49	5·05	15·40
Shipbuilding	340,160	6,280	346,440	112,767	726	113,493	33·15	11·56	32·76
Engineering and Ironfoundring	1,163,530	101,460	1,264,990	276,107	14,396	290,503	23·73	14·19	22·96
Construction and Repair of Vehicles	294,960	26,440	321,400	31,490	6,050	37,540	10·68	22·88	11·68
Sawmilling and Machined Woodwork	210,610	44,290	254,900	32,224	6,573	38,797	15·30	14·84	15·22
Ammunition, Explosives, Chemicals, etc.	214,500	96,050	310,550	36,849	8,054	44,903	17·18	8·39	14·46
Metal Trades	628,310	203,450	831,760	198,839	43,281	242,120	31·65	21·27	29·11
Rubber and Leather Trades	103,820	65,300	169,120	13,854	8,950	22,804	13·34	13·71	13·48
Bricks, Tiles, etc.	73,100	12,100	85,200	10,507	2,394	12,901	14·37	19·79	15·14
Pottery, Earthenware, etc.	30,040	31,440	61,480	4,102	3,658	7,760	13·66	11·63	12·62
Glass Trades (Excl. optical, scientific, etc.)	32,580	7,770	40,350	10,388	2,104	12,492	31·88	27·08	30·96
Hotel, College, Club, etc., Service	99,150	198,100	297,250	9,737	25,440	35,177	9·82	12·84	11·83
Laundry Service	16,810	85,730	102,540	852	5,281	6,133	5·07	6·16	5·98
Commercial, Clerical, Insurance and Banking	175,660	131,480	307,140	8,006	4,496	12,502	4·56	3·42	4·07
Transport Services	769,500	35,090	804,590	141,306	3,319	144,625	18·36	9·46	17·97
Mining Industry	1,235,780	11,220	1,247,000	120,615	909	121,524	9·76	8·10	9·75
Printing and Paper Trades	205,760	139,630	345,390	18,304	15,407	33,711	8·90	11·03	9·76
Textile Trades	485,770	782,130	1,267,900	59,424	110,338	169,762	12·23	14·11	13·39
Dress	230,530	436,400	666,930	25,208	47,573	72,781	10·93	10·90	10·91
Food, Drink and Tobacco	289,960	195,840	485,800	24,731	21,473	46,204	8·53	10·96	9·51
Miscellaneous Trades and Services	1,208,360	742,240	1,950,600	132,693	46,750	179,443	10·98	6·30	9·20
Total	8,829,320	3,361,470	12,190,790	1,426,068	377,628	1,803,696	16·15	11·23	14·80

these Acts, reliable statistics of unemployment in respect of over 12,000,000 workpeople became for the first time available. At July 29 1921, the number of unemployment books lodged in respect of total unemployment was 1,802,909, while in addition 787 persons were claiming out-of-work donation, making a total of 1,803,696, or 14·80% of the total number insured.

Table V. shows by main industrial groups and by sex the number of persons insured under the Unemployment Insurance Acts, 1920 and 1921, and the number and percentage of persons totally unemployed whose unemployment books or out-of-work donation policies remained lodged at July 29 1921.

Table VI. analyzes the figures in respect of systematic short time working by main industrial groups and by sex.

An applicant for unemployment benefit under the Acts was required to prove continuous unemployment, and it was provided that two periods of unemployment of not less than two days each, separated by a period of not more than two days during which the insured contributor had not been employed for more than 24 hours, or two periods of unemployment of not less than six[1] days each, separated by an interval of not more than six weeks, should be treated as continuous unemployment for this purpose. Persons employed in establishments where, owing to depression in trade, the number of working days had been reduced on a systematic basis in such a manner as to fall within the above provision, were accordingly eligible for benefit. The number of persons claiming benefit in respect of systematic short time working at July 29 1921 was 534,253, or 4·38% of the total number of persons insured. Among males the percentage amounted to 3·15, while among females the percentage was 7·61. (J. H.)

UNITED STATES

There were in 1921 no exact data on the number of unemployed in the United States. Studies made by the Federal Government and by the states were based chiefly on information received from the labour unions, and represented unemployment among organized labour only. For some years Massachusetts published a *Quarterly Report on Employment*, which combined reports from the trade unions and the employment offices, and later also from Boards of Trade, Employers' Associations and editors of trade journals, as well as statistics of building operations in the cities. The publication is continued from March 1920 in the quarterly *Massachusetts Industrial Review*. In 1915 New York State inaugurated the practice of compiling statistics on unemployment from reports received from representative manufacturers of the state. These statistics are published monthly in *The Bulletin and Labor Market*. The Wisconsin Industrial Commission has adopted the New York plan of employment records for statistical studies covering the period since 1915. Other states do not publish regular records.

TABLE VI.—*Short Time: July 29 1921.*

Industry	Number of Short Time Workers claiming U. I. Benefit and Donation, July 29 1921			Percentage on Systematic Short Time July 29 1921		
	Males	Females	Total	Males	Females	Total
Building and Works of Construction	5,930	25	5,955	0·58	0·28	0·58
Shipbuilding	8,945	97	9,042	2·63	1·54	2·61
Engineering and Iron-founding	68,141	2,968	71,109	5·86	2·93	5·62
Construction and Repair of Vehicles	5,310	785	6,095	1·80	2·97	1·90
Sawmilling and Machined Woodwork.	4,846	1,701	6,547	2·30	3·84	2·57
Ammunition, Explosives, Chemicals, etc.	8,653	2,779	11,432	4·03	2·89	3·68
Metal Trades	36,954	12,183	49,137	5·88	5·99	5·91
Rubber and Leather Trades	3,731	2,886	6,617	3·59	4·42	3·91
Bricks, Tiles, etc.	655	71	726	0·90	0·59	0·85
Pottery, Earthenware, etc.	261	87	348	0·87	0·28	0·57
Glass Trades (excl. Optical, Scientific etc.)	1,725	388	2,113	5·29	4·99	5·24
Hotel, College, Club, etc., Service	151	262	413	0·15	0·13	0·14
Laundry Service	33	269	302	0·20	0·31	0·29
Commercial, Clerical, Insurance and Banking	178	100	278	0·10	0·08	0·09
Transport Service	6,489	325	6,814	0·84	0·93	0·85
Mining Industry	4,665	20	4,685	0·38	0·18	0·38
Printing and Paper Trades	6,047	8,725	14,772	2·94	6·25	4·28
Textile Trades	91,696	174,893	266,589	18·88	22·36	21·03
Dress	10,716	36,558	47,274	4·65	8·38	7·09
Food, Drink and Tobacco	2,310	7,207	9,517	0·80	3·68	1·96
Miscellaneous Trades and Services	10,868	3,620	14,488	0·90	0·49	0·74
Total	278,304	255,949	534,253	3·15	7·61	4·38

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[1] Prior to June 30 1921, a period of three days was admitted.

Studies made by H. Hornell Hart of the Russell Sage Foundation show that while the industrial pop. of the United States increased from approximately 19,500,000 workmen in 1902 to about 30,200,000 in 1917, the demand for labour did not increase at the same ratio. In 1902 an average of 2,750,000 workers was out of employment at all times during the year; in 1903, 1906, 1907, 1910, 1917, the annual average fell below 2,000,000; in the depression of 1908 it was 3,500,000 and in that of 1914–5 it was 4,500,000. Throughout the 16 years 1902–17 the unemployed constituted, on the average, 9·9% of the labour force; but it reached 14·1% in 1902, 14·8% in 1908; 15·8% in 1914 and 16% in 1915. On the other hand it fell to 5·5% in 1906, 7·1% in 1916 and 4·7% in 1917. The other years saw fluctuations between these extremes. In 1903, 1906, 1907, 1910 and 1917 the demand for labour was strong; in 1908, 1914 and 1915 it was weak. In the other nine years it varied less, with a little more than 2,000,000 out of work all the time. No such percentages have been calculated for the years since 1917. Common experience was that the interruption of commerce with Europe in 1914 caused sudden business depression. But as the months passed, and especially after Jan. 1915, war contracts called into industry the "reserve army of the unemployed," and led to a labour shortage, acute in some trades, from 1917 until the signing of the Armistice. Then, in the late fall of 1918, contracts were cancelled and workers were laid off. The public continued to buy, however, and men laid off from war work were absorbed in other industries. There continued to be a demand for labour until Feb. and March 1920, then industry in general began to lay off men. By the end of the year the volume of employment in the factories of New York State had dropped off 20% since March, in Wisconsin it had dropped off 22·5% in the same period, but was 13% greater than in Jan. 1915. In New York State employment in Dec. 1920 was 9% greater than in Dec. 1914, and about equal to that in June 1914. In Jan. 1921 employment in Wisconsin declined 11·3%, the greatest decline in any single month since July 1920, making the total decline since the first quarter of 1920, 29.5% and bringing the number employed to the same as in the first quarter of 1915. The number increased 1·6 in Feb. 1921, the first increase in manufacture as a whole since July; the number decreased 4·5% in March, making a total decline since July 1920 of 32·4 per cent. Metal industries suffered most. The climax of unemployment in New York State came in Jan. 1921, but the increase of employment during that month may have been due to seasonal changes rather than to improvement in business conditions. Between Feb. 1920 and Feb. 1921 the number employed in New York State factories had decreased 23 per cent.

In Jan. 1921 an unemployment survey made by the U.S. Employment Service for 35 states and the District of Columbia showed 9,402,000 employed in Jan. 1920 and 6,070,648 employed Jan. 1921, and estimated 3,473,446 as unemployed in the country as a whole. The greatest reduction in employment during this period was that of 82% in Michigan, 50% in Ohio and Indiana, 44% in Illinois, 43% in Connecticut, 38% in Massachusetts, 28% in New York, 32% in Wisconsin, 22% in New Jersey. In establishments studied by the U.S. Bureau of Labor Statistics, the greatest decreases between Feb. 1920 and Feb. 1921 were 44·2% in hosiery and underwear, and 41% in automobile manufactures; the smallest decreases were 2% in bituminous coal-mining and 0·1% in cotton manufacturing.

According to statistics in the *Industrial Employment Survey Bulletin* for Dec. 1921, 1,428 firms, employing each over 500 persons, located in 65 principal industrial centres of the country, were employing 1,567,374 workers on Nov. 30 1921 as against 1,506,614, on Jan. 1 1921, an increase of 60,760, or 3·7%. Of the 14 industrial groups recognized by the U.S. Census, 9 reported an increase in employment in Nov. 1921 over Oct. 1921, viz.: paper and printing; lumber; vehicles for land transportation; tobacco manufactures; iron and steel; chemicals; stone, clay and glass; textiles; and metals and metal products. A decrease was reported by 5, viz.: liquors and beverages; railway repair shops; food products; leather and its products; and miscellaneous industries. Of 65 cities, 40 reported an increase in employment, 24 a decrease, and 1 no change, since Oct. 31 1921; total net increase reported for the month was 7,219.

See: Don D. Lescohier, *The Labor Market;* and Sumner Slichter, *The Turnover of Factory Labor.* (J. R. Co.)

UNITED KINGDOM OF GREAT BRITAIN AND IRELAND.—Information as regards earlier years than those here dealt with will be found in 27.598 *seq.*, and as regards England in 9.408 *seq.*; and similarly in the articles in the earlier volumes on counties and towns in the United Kingdom. See also ENGLISH HISTORY, ENGLISH FINANCE, IRELAND, SCOTLAND, BRITISH EMPIRE, COAL, SHIPPING, RAILWAYS, etc.

Population.—A census of the United Kingdom was taken in April 1911, and one of Great Britain on June 19 1921. On the latter date no census of Ireland could be taken owing to its disturbed condition, and the census in Great Britain was postponed from the customary month of April owing to the coal dispute and attendant industrial troubles. The postponement had certain effects upon the returns, such as enhancing the apparent population of holiday resorts. Preliminary returns for England and Wales, with total figures only for Scotland and other parts of the United Kingdom excluding Ireland, were issued in Aug. 1921 and are utilized in the following tables. Where administrative areas are given, these are for the year 1921, and the population figures for 1911 are adjusted to them.

TABLE I.—*Population 1911, 1921.*

	Area	Population		Pop. per sq. m. 1921 (or +1911)	Increase (+) or decrease (−) %		1921 (or +1911)	
	sq. m.	1911	1921		1901–11	1911–21	Males	Females
England	50,890	34,045,290	35,678,530	701	+10·5	+ 4·8	16,984,087	18,694,443
Wales	7,434	2,025,202	2,206,712	298	+17·7	+ 9	1,098,133	1,108,579
Scotland	30,405	4,760,904	4,882,288	160	+ 6·5	+ 2·5	2,348,403	2,533,885
Ireland	32,360	4,390,219	..	(+135)	− 1·5	..	(+2,192,048)	(+2,198,171)
Isle of Man	227	52,016	60,238	265	− 5	+15·8	27,321	32,917
Channel Islands	75	96,899	89,614	1,194	+ 1·3	− 7·7	41,264	48,350

The preliminary figures for 1921, for England and Wales, reveal an increase in the decennial period of 4·93%, a figure proportionately much lower than ever recorded before. The effect of the World War is clearly seen in the analysis, which gives, for the intercensal period: births registered 8,275,400; deaths registered in England and Wales, 5,266,900; loss due to excess of outward over inward emigration 1,193,750, of which 560,000 is estimated as representing deaths of non-citizens outside the United Kingdom, leaving a net intercensal increase of 1,814,750. The increase % in intercensal periods is given thus for major divisions:—

	1901–11	1911–21
Wales	18·1	9
Midland counties	11·2	5·9
Northern counties	10·3	4·9
London and adjacent counties	11	4·4
Southern counties	9·5	3·9
Eastern counties	7·6	3

The urban pop. of England and Wales is given as 78·1% of the whole in 1911 and 79·3% in 1921; the rural as 21·9% in 1911 and 20·7% in 1921. A future effect of the World War is seen in the increased preponderance of females over males, which, for England and Wales, was as 1,064 to 1,000 in 1901, 1,068 to 1,000 in 1911, and 1,095 to 1,000 in 1921.

TABLE II.—*English and Welsh Counties.*

Name	Area in Statute Acres (Land and Inland Water)	Population 1911	Population 1921	Increase (+) or decrease (−) between 1911 and 1921
England:—				
Bedford	302,942	194,588	206,478	+11,890
Berkshire	454,725	193,101	202,533	+9,432
Buckingham	479,360	219,551	236,209	+16,658
Cambridge	315,168	128,322	129,594	+1,272
Isle of Ely	238,073	69,752	73,778	+4,026
Cheshire	640,791	597,771	625,001	+27,230
Cornwall	868,167	328,098	320,559	−7,539
Cumberland	968,598	213,521	220,437	+6,916
Derbyshire	645,097	560,013	584,703	+24,690
Devonshire	1,660,948	433,162	440,023	+6,861
Dorsetshire	625,612	223,266	228,258	+4,992
Durham	633,058	871,886	943,670	+71,784
Essex	964,443	857,688	918,111	+60,423
Gloucester	785,088	328,964	329,277	+313
Hereford	538,924	114,269	113,118	−1,151
Hertford	404,523	311,284	333,236	+21,952
Huntingdon	233,985	55,577	54,748	−829
Kent	971,990	1,020,965	1,118,129	+97,164
Lancashire	1,054,741	1,699,938	1,746,418	+46,480
Leicester	524,197	249,331	260,332	+11,001
Lincoln:				
Holland	263,355	82,280	85,225	+2,945
Kesteven	469,142	107,832	108,237	+405
Lindsey	963,800	237,843	260,294	+22,451
London	74,850	4,521,685	4,483,249	−38,436
Middlesex	148,692	1,126,465	1,253,164	+126,699
Monmouth	345,048	312,028	358,331	+46,303
Norfolk	1,303,568	321,721	322,914	+1,193
Northants	581,679	213,733	211,507	−2,226
Soke of Peterborough	53,464	44,718	46,954	+2,236
Northumberland	1,278,691	371,474	407,397	+35,923
Nottingham	529,188	344,197	378,476	+34,279
Oxfordshire	474,501	136,435	132,506	−3,930
Rutland	97,273	20,346	18,368	−1,978
Shropshire	861,800	246,307	242,959	−3,348
Somerset	1,032,442	388,836	397,034	+8,198
Southampton	935,195	404,541	410,223	+5,682
Isle of Wight	94,146	88,186	94,697	+6,511
Stafford	707,177	670,380	711,003	+40,623
Suffolk, East	549,241	203,223	211,623	+8,400
Suffolk, West	390,916	116,905	108,982	−7,923
Surrey	452,821	676,027	739,500	+63,473
Sussex, East	517,040	242,146	261,253	+19,107
Sussex, West	401,916	176,308	195,795	+19,487
Warwick	557,527	300,867	342,449	+41,582
Westmorland	504,917	63,575	65,740	+2,165
Wiltshire	864,101	286,822	292,213	+5,391
Worcester	451,144	287,456	301,120	+13,664
Yorkshire:				
E. Riding	741,073	154,768	173,704	+18,936
N. Riding	1,357,899	299,636	325,209	+25,573
W. Riding	1,652,647	1,415,248	1,508,610	+93,362
Wales:—				
Anglesey	176,630	50,928	51,695	+767
Brecknock	469,281	59,287	61,257	+1,970
Cardigan	443,189	59,879	61,292	+1,413
Carmarthen	588,472	160,406	175,069	+14,633
Carnarvon	366,005	125,043	131,034	+5,991
Denbighshire	426,080	144,783	154,847	+10,064
Flintshire	163,707	92,705	106,466	+13,761
Glamorgan	474,607	713,664	814,717	+101,053
Merioneth	422,372	45,565	45,450	−115
Montgomery	510,110	53,146	51,317	−1,829
Pembroke	393,003	89,960	92,056	+2,096
Radnorshire	301,165	22,590	23,528	+938
Total for 62 counties	36,700,304	24,150,992	25,302,076	+1,152,132

TABLE III.—*English and Welsh County Boroughs.*

Name of Towns	Area in Statute Acres	Population 1911	Population 1921	Increase (+) or decrease (−) between 1911 and 1921
82 County Boroughs	640,034	11,919,500	12,583,166	663,666
[1]Barnsley	2,385	50,614	53,670	+3,056
Barrow-in-Furness	11,002	63,770	74,254	+10,484
Bath	5,152	69,173	68,648	−525
Birkenhead	3,909	130,794	145,592	+14,798
Birmingham	43,601	840,202	919,438	+79,236
Blackburn	7,420	133,052	126,630	−6,422
Blackpool	5,189	60,746	99,640	+38,894
Bolton	15,280	180,851	178,678	−2,173
Bootle	1,947	69,876	76,508	+6,632
Bournemouth	6,545	79,183	91,770	+12,587
Bradford	22,881	288,458	285,979	−2,479
Brighton	2,545	131,237	142,427	+11,190
Bristol	18,436	357,114	377,061	+19,947
Burnley	4,620	106,765	103,175	−3,590
Burton-upon-Trent	4,203	48,266	48,927	+661
Bury	5,925	59,040	56,426	−2,614
Canterbury	3,975	24,626	23,738	−888
[1]Carlisle	4,488	52,225	52,600	+375
Chester	2,863	39,028	40,794	+1,766
Coventry	4,147	106,349	128,205	+21,856
Croydon	9,012	169,551	190,877	+21,326
[1]Darlington	4,614	57,328	65,866	+8,538
Derby	5,272	123,410	129,836	+6,426
[1]Dewsbury	6,720	53,351	54,165	+814
Dudley	3,546	51,079	55,908	+4,829
[1]Eastbourne	6,474	52,542	62,030	+9,488
East Ham	3,324	133,487	143,304	+9,817
Exeter	4,705	59,092	59,608	+516
Gateshead	3,132	116,917	124,514	+7,597
Gloucester	2,318	50,035	51,330	+1,295
Great Yarmouth	3,598	55,905	60,710	+4,805
Grimsby	2,868	74,659	82,329	+7,670
Halifax	13,984	101,553	99,129	−2,424
Hastings	4,496	61,145	66,496	+5,351
Huddersfield	11,875	107,821	110,120	+2,299
Hull	9,042	277,991	287,013	+9,022
Ipswich	8,112	73,932	79,383	+5,451
Leeds	28,090	454,155	458,320	+4,165
Leicester	8,582	227,222	234,190	+6,968
Lincoln	6,128	61,346	66,020	+4,674
Liverpool	21,242	753,353	803,118	+49,765
Manchester	21,690	714,385	730,551	+16,166
Middlesbrough	4,159	119,910	131,103	+11,193
Newcastle-upon-Tyne	8,452	266,603	274,955	+8,352
Newport (Mon.)	4,504	83,691	92,369	+8,678
Northampton	3,469	90,064	90,923	+859
Norwich	7,898	121,490	120,653	−837
Nottingham	10,935	259,901	262,658	+2,757
Oldham	4,735	147,483	145,001	−2,482
Oxford	4,719	53,048	57,052	+4,004
Plymouth	5,711	207,449	209,857	+2,408
Portsmouth	7,964	233,573	247,343	+13,770
Preston	3,964	117,088	117,426	+338
Reading	9,105	87,693	92,274	+4,581
Rochdale	6,446	91,428	90,807	−621
Rotherham	5,957	62,483	68,045	+5,562
St. Helen's	7,284	96,551	102,675	+6,124
Salford	5,202	231,357	234,150	+2,793
Sheffield	24,930	460,183	490,724	+30,541
Smethwick	1,929	70,694	75,757	+5,063
Southampton	9,192	145,096	160,997	+15,901
[1]Southend-on-Sea	7,082	70,676	106,021	+35,345
Southport	9,728	69,643	76,644	+7,001
South Shields	2,399	108,647	116,667	+8,020
Stockport	7,063	119,870	123,315	+3,445
Stoke-on-Trent	11,142	234,534	240,440	+5,906
Sunderland	3,357	151,159	159,100	+7,941
Tynemouth	4,372	58,816	63,786	+4,970
[1]Wakefield	4,060	51,511	52,892	+1,381
[1]Wallasey	3,324	78,504	90,721	+12,217
Walsall	7,483	92,115	96,964	+4,849
Warrington	3,057	72,166	76,811	+4,645
West Bromwich	5,859	68,332	73,761	+5,429
West Ham	4,683	289,030	300,905	+11,875
West Hartlepool	2,684	63,923	68,689	+4,766
Wigan	5,083	89,152	89,447	+295
Wolverhampton	3,525	95,328	102,373	+7,045
Worcester	3,662	49,153	48,848	−305
York	3,730	82,282	84,052	+1,770
Wales				
Cardiff	6,489	182,259	200,262	+18,003
Merthyr Tydfil	17,760	80,990	80,161	−829
Swansea	21,600	143,997	157,561	+13,564

[1] County boroughs created since 1911.

TABLE IV.—*Chief Municipal Boroughs and Urban Districts (England and Wales).*

Name	Area in Statute Acres	Population 1911	Population 1921	Increase (+) or Decrease (−)
Aberdare	15,184	50,830	55,010	+4,180
Accrington	3,427	45,029	43,610	−1,419
Ashton-under-Lyne	1,345	45,172	43,333	−1,839
Barry	3,726	33,763	38,927	+5,164
Bedford	2,223	39,183	40,247	+1,064
Cambridge	5,457	55,812	59,262	+3,450
Chatham	4,356	42,250	42,665	+415
Cheltenham	4,726	48,942	48,444	−498
Chesterfield	8,474	55,309	61,236	+5,927
Colchester	11,333	43,452	43,377	−75
Crewe	2,184	44,960	46,477	+1,517
Darwen	5,959	40,332	37,913	−2,419
Doncaster	4,831	48,455	54,052	+5,597
Dover	1,948	43,645	39,985	−3,660
Eccles	2,057	41,944	44,237	+2,293
Enfield	12,602	56,338	60,743	+4,405
Finchley	3,304	39,419	46,719	+7,300
Gillingham	4,988	52,252	54,038	+1,786
Hendon	8,382	38,806	56,014	+17,208
Heston and Isleworth	6,851	43,313	46,729	+3,416
Hornsey	2,875	84,592	87,691	+3,099
Hove	1,543	42,173	46,519	+4,346
Ilford	8,496	78,188	85,191	+7,003
Keighley	3,902	43,487	41,942	−1,545
Lancaster	3,482	41,410	40,226	−1,184
Llanelly	2,069	32,071	36,504	+4,433
Leigh	6,359	44,103	45,545	+1,442
Leyton	2,594	124,735	128,432	+3,697
Lowestoft	3,327	37,886	44,326	+6,440
Luton	3,132	49,978	57,077	+7,099
Peterborough	1,878	33,574	35,533	+1,959
Poole	7,964	38,885	43,661	+4,776
Rhondda	23,886	152,781	162,729	+9,948
Scarborough	2,727	37,224	46,192	+8,968
Stockton-on-Tees	5,465	58,521	64,150	+5,629
Stratford	3,240	42,496	46,535	+4,039
Swindon	4,265	50,751	54,920	+4,169
Torquay	3,906	38,771	39,432	+661
Tottenham	3,014	137,418	146,695	+9,277
Wallsend	3,420	41,461	43,013	+1,552
Walthamstow	4,343	124,580	127,441	+2,861
Watford	2,238	40,946	45,910	+4,964
Wimbledon	3,221	54,966	61,451	+6,485
Willesden	4,385	154,214	165,669	+11,455
Wood Green	1,626	49,369	50,716	+1,347

TABLE V.—*Scottish Counties.*

Name	Area in Statute Acres (exclusive of Inland Water, Tidal Water and Foreshore)	Population 1911	Population 1921	Increase (+) or Decrease (−)
Aberdeen	1,261,521	312,177	300,980	−11,197
Argyll	1,990,472	70,902	76,856	+5,954
Ayr	724,523	268,337	299,254	+30,917
Banff	403,053	61,402	57,293	−4,109
Berwick	292,535	29,643	28,395	−1,248
Bute	139,658	18,186	33,711	+15,525
Caithness	438,833	32,010	28,284	−3,726
Clackmannan	34,927	31,121	32,543	+1,422
Dumbarton	157,433	136,233	150,868	+14,635
Dumfries	686,302	72,825	75,365	+2,540
East Lothian (Haddington)	170,971	43,254	47,487	+4,233
Fife	322,844	267,733	292,902	+25,169
Forfar	559,037	281,417	270,950	−10,467
Inverness	2,695,094	87,272	82,446	−4,826
Kincardine	244,482	41,008	41,779	+771
Kinross	52,410	7,527	7,963	+436
Kirkcudbright	575,832	38,367	37,156	−1,211
Lanark	562,821	1,486,118	1,539,307	+53,189
Midlothian (Edinburgh)	234,325	507,666	506,378	−1,288
Moray (Elgin)	304,931	43,427	41,561	−1,866

TABLE V.—(*Continued*).

Name	Area in Statute Acres (exclusive of Inland Water, Tidal Water and Foreshore)	Population 1911	Population 1921	Increase (+) or Decrease (−)
Nairn	104,252	9,319	8,790	−529
Orkney	240,847	25,897	24,109	−1,788
Peebles	222,240	15,258	15,330	+72
Perth	1,595,802	124,342	125,515	+1,173
Renfrew	153,332	279,066	298,887	+19,821
Ross and Cromarty	1,977,248	77,364	70,790	−6,574
Roxburgh	426,028	47,192	44,989	−2,203
Selkirk	170,793	24,601	22,606	−1,995
Shetland	352,319	27,911	25,520	−2,391
Stirling	288,842	160,991	161,726	+735
Sutherland	1,297,914	20,179	17,800	−2,379
West Lothian (Linlithgow)	76,861	80,161	83,966	+3,805
Wigtown	311,984	31,998	30,782	−1,216
	19,070,466	4,760,904	4,882,288	+121,384

TABLE VI.—*Scottish Burghs, over 30,000 inhabitants.*

Burgh	Population		Increase (+) or Decrease (−)
	1911	1921	
Glasgow	784,455	1,034,069	+249,614
Edinburgh	320,315	420,281	+99,966
Dundee	165,006	168,217	+3,211
Aberdeen	163,084	158,969	−4,115
Paisley	84,477	84,837	+440
Greenock	75,140	81,120	+5,980
Motherwell and Wishaw	65,895	68,869	+2,974[1]
Clydebank	37,547	46,515	+8,968
Coatbridge	43,287	43,909	+622
Dunfermline	29,213	39,886	+10,673[2]
Kirkcaldy	39,600	39,591	−9
Hamilton	38,644	39,420	+776
Kilmarnock	34,729	35,756	+1,027
Ayr	32,985	35,741	+2,756
Falkirk	33,569	33,312	−257
Perth	35,851	33,208	−2,643

[1] Motherwell and Wishaw were united in 1920.
[2] Boundary altered 1911.

TABLE VII.—*Irish Provinces and Counties.*

Provinces and Counties (including County Boroughs)	Population 1911	Inc. or Dec. per cent on 1901	Provinces and Counties (including County Boroughs)	Population 1911	Inc. or Dec. per cent on 1901
Connaught:			Munster:		
Galway	181,686	−5·6	Clare	104,064	−7·4
Leitrim	63,557	−8·3	Cork, E. R.	267,472	−1·9
Mayo	191,969	−3·6	Cork, W.R.	123,718	−6·2
Roscommon	93,904	−7·7	Kerry	159,268	−3·9
Sligo	78,850	−6·2	Limerick	142,846	−2·2
			Tipperary, N. R.	63,958	−5·7
Total Province	609,966	−5·7	Tipperary, S. R.	87,993	−4·8
			Waterford	83,766	−3·9
Leinster:			Total Province	1,033,085	−4·0
Carlow	36,151	−4·2	Ulster:		
Dublin	476,909	+6·4	Antrim	478,603	+3·7
Kildare	66,498	+4·6	Armagh	119,625	−4·6
Kilkenny	74,821	−5·5	Cavan	91,071	−6·6
King's	56,769	−5·7	Donegal	168,420	−3·1
Longford	43,794	−6·2	Down	304,589	+5·2
Louth	63,402	−3·7	Fermanagh	61,811	−5·5
Meath	64,920	−3·8			
Queen's	54,362	−5·3			
Westmeath	59,812	−2·9	Londonderry	140,621	−2·6
Wexford	109,287	−1·7	Monaghan	71,395	−4·3
Wicklow	60,603	− ·4	Tyrone	142,437	−5·4
Total Province	1,160,328	+0·7	Total Province	1,578,572	−0·3

Table VIII.—*Largest Irish Towns.*

	Population	Inc. or Dec. per cent on 1901		Population	Inc. or Dec. per cent on 1901
	1911	Rate per cent		1911	Rate per cent
Dublin and Suburbs:			Belfast	385,492	+10·4
			Cork	76,632	+0·7
Dublin City	309,272	+6·4	Londonderry	40,799	+2·3
			Limerick	38,403	+0·7
			Waterford	27,430	+2·5
Rathmines & Rathgar	38,190	+17·1	Galway	13,249	−1·3
Pembroke	29,260	+13·4	Dundalk	13,128	+0·4
Kingstown	17,227	−0·9	Drogheda	12,425	−2·6
Blackrock	9,081	+4·2	Lurgan	12,135	−3·0
			Lisburn	12,172	+6·2
Total	403,030	+7·4			
Newry	11,956	−3·6			
Portadown	11,727	+16·2	Sligo	11,163	+2·7
Wexford	11,455	+2·6	Kilkenny	10,513	−0·9
Ballymena	11,376	+4·5	Clonmel	10,277	+1·1

Vital Statistics.—In the separate section below (*Medical Examination of the Nation*) the results of the physical census held during the war are discussed. The birth-rate, death-rate, and marriage-rate for the United Kingdom are given in Table IX. for various years down to 1919. The figures per thousand, for 1916 and following years, are based upon estimates of the population in which allowance is made for conditions of military service, and, in the case of the death-rate, upon the deaths and presumed total number of civilians.

Table IX.—*Birth-rate.*

	1910	1914	1916	1918	1919
England	25·1	23·8	20·8	17·7	18·5
Scotland	26·2	26·1	22·8	20·2	21·7
Ireland	22·6	22·6	20·9	19·9	20·0

Table X.—*Death-rate.*

	1910	1914	1916	1918	1919
England	13·5	14·0	14·4	17·6	13·7
Scotland	15·3	15·5	14·6	16·0	15·4
Ireland	17·1	16·3	16·13	18·0	17·9

Table XI.—*Marriage-rate.*

Year	England and Wales		Scotland		Ireland		United Kingdom	
	Total	per 1000	Total	per 1000	Total	per 1000	Total	per 1000
1910	267,721	15·0	30,902	13·0	22,112	10·1	320,735	14·3
1912	283,834	15·6	32,506	13·7	23,283	10·6	339,623	14·9
1914	294,401	15·9	35,028	14·8	23,695	10·8	353,124	15·3
1916	279,846	14·9	31,483	13·1	22,245	10·2	333,574	14·2
1918	287,163	15·3	34,594	14·2	22,570	10·3	344,327	14·7
1919	369,411	19·7	44,137	18·0	27,193	12·2	440,741	18·9

Emigration.—Table XII. shows the number of emigrants, distinguishing English and Welsh, Scottish, and Irish, who left the United Kingdom in 1910 and 1913. During the war emigration decreased, and full particulars for years during and since the war were not available in 1921.

Table XII.—*Emigration.*

Year	English and Welsh	Scottish	Irish	Total
1910	241,767	78,040	50,810	370,617
1913	285,899	59,047	44,662	389,608
In 1915, 104,919 British subjects left for places outside Europe.				

Occupations.—Table XIII. shows the occupations of the people (excluding children under ten years old), as distinguished in six great groups, or unoccupied and unspecified, according to the census of 1911.

Table XIII.—*Occupations.*

	England & Wales	Scotland	Ireland
Government Defence	299,599 205,817	47,408	..
Professional	714,621	81,675	131,035
Domestic	2,121,717	201,066	219,418
Commercial	2,214,031	283,465	97,889
Agricultural and Fishing	1,260,476	227,111	876,062
Industrial	9,468,138	1,226,242	639,413
Unoccupied and Unspecified	12,234,914	1,647,434	2,494,958

Pauperism.—Table XIV. gives particulars in regard to the number of persons receiving poor relief in England and Wales on Jan. 1 in each year.

Table XIV.—*Pauperism.*

Jan. 1st	Institutional	Domiciliary	Lunatics & Casuals	Total
1914	264,292	388,917	108,509	761,718
1915	258,962	394,843	108,255	762,060
1916	226,466	354,325	103,758	684,549
1917	215,283	321,813	100,231	637,327
1918	198,493	296,104	92,188	586,785
1919	183,110	287,244	84,263	554,617
1920	186,273	305,822	84,323	576,418

In Scotland, on May 15 1916, the figures for paupers were 95,857, and on the same day in 1917, 89,779. Figures for Ireland, on Mar. 31 in each year, were: 1914, 76,093; 1915, 73,508; 1916, 68,864; 1917, 67,522.

Agriculture.—(*See* also the article Agriculture). The depression in British agriculture, which set in in 1879 and culminated in 1894, continued to show some abatement down to 1914, although in that year arable land in the United Kingdom amounted only to 19,414,166 ac. against 24,092,075 ac. in 1870, and wheat production only to 7,804,041 quarters against 13,419,496 quarters. British agriculture had turned away from the cultivation of cereals and towards the raising of stock. At the outbreak of the World War, therefore, Britain, as a country importing the vastly greater proportion of its food-stuffs, was faced with the possibility of a shortage and of an adverse effect upon exchanges owing to compulsory importation, at enhanced prices, while countervailing exports necessarily diminished. The researches of various Royal Commissions, the efforts of the Government and public bodies, and the effect of high prices, resulted, from the early part of 1917, in a large extension of arable cultivation, 1,497,293 ac. being added to the area under tillage in Great Britain in 1917–8.

Tables XV. and XVI. show the total area of arable land and of permanent grass in the four divisions of the United Kingdom for each year 1912–20.

Table XV.—*Arable Land.*

June 4th	England acres	Wales acres	Scotland acres	Ireland acres
1912	10,596,843	738,433	3,325,027	4,988,420
1913	10,361,849	696,384	3,301,954	4,978,580
1914	10,306,467	691,787	3,295,487	5,027,082
1915	10,272,673	693,034	3,289,902	4,998,903
1916	10,302,153	748,948	3,303,741	5,050,234
1917	10,454,149	791,957	3,360,562	5,046,008
1918	11,463,679	934,961	3,453,495	5,271,830
1919	11,412,353	896,523	3,408,479	..
1920	11,180,322	839,423	3,380,237	..

Table XVI.—*Permanent Grass.*

June 4th	England acres	Wales acres	Scotland acres	Ireland acres
1912	13,817,650	2,021,764	1,496,307	9,685,358
1913	14,012,946	2,058,203	1,495,965	9,712,567
1914	14,061,042	2,054,708	1,490,694	9,715,684
1915	14,038,071	2,049,322	1,491,495	9,720,785
1916	14,015,840	2,007,143	1,471,765	9,664,043
1917	13,868,721	1,966,654	1,415,761	9,308,546
1918	12,798,361	1,790,511	1,307,606	9,121,145
1919	12,656,945	1,782,132	1,342,996	..
1920	12,667,104	1,820,162	1,358,809	..

Table XVII. shows the production, for the United Kingdom, of certain principal crops.

TABLE XVII.—*Principal Crops.*

June 4th	Wheat Quarters	Barley Quarters	Oats Quarters	Potatoes Tons	Hops (England) Cwt.
1912	7,175,288	7,275,900	20,600,079	5,726,342	373,438
1914	7,804,041	8,065,678	20,663,537	7,476,458	507,258
1915	9,239,355	5,862,244	22,308,395	7,540,240	254,609
1916	7,471,884	6,612,550	21,333,782	5,468,881	307,856
1917	8,040,352	7,184,843	26,020,909	8,603,820	220,719
1918	11,643,000	7,760,000	31,196,000	9,223,000	130,000
1919	8,665,000	7,213,000	25,495,000	6,312,000	189,000
1920	7,104,000	8,211,000	22,609,000	6,374,000	281,000

Fisheries.—The war had a profound effect upon British fisheries. They were restricted not merely by military operations, but also by the diversion of so many fishermen and vessels to naval service. The figures in Table XVIII. illustrate the limitation of production and the increase of prices.

TABLE XVIII.—*Fisheries.*

Year	Wet Fish Landed				Value of Wet Fish £	Value of Shell Fish £
	Eng. & W. Cwt.	Scotland Cwt.	Ireland Cwt.	U. K. Cwt.		
1910	13,117,681	8,709,655	1,041,351	22,868,687	11,382,740	357,314
1913	16,152,374	7,828,350	676,392	24,657,116	14,229,311	463,642
1914	10,124,809	7,440,321	589,996	18,155,126	11,228,829	401,812
1915	5,785,233	2,319,390	550,194	8,654,817	9,776,729	389,174
1916	4,244,181	3,412,030	566,137	8,222,348	10,815,569	437,804
1917	4,051,613	3,079,768	662,755	7,794,136	13,442,654	453,984
1918	4,681,000	3,313,228	760,986	8,755,214	21,132,924	590,211

Minerals and Mining.—Tables XIX. and XX. show the output and value of minerals raised and metals manufactured in the United Kingdom in 1910, 1914, 1917 and 1919, and illustrate the inflation of prices during and since the war. The figures for 1917 also indicate the effect of the war upon output, but at the same time demonstrate that coal production, in spite of all difficulties, was not permitted to decline to the extent that is seen in other cases.

For coal production and statistics see COAL. Iron ore raised in the various counties of the United Kingdom and in the most productive counties in England is shown in Table XXI. in tons for the years 1910, 1915, and 1919.

TABLE XXI.—*Iron Ore Production.*

	1910 Tons	1915 Tons	1919 Tons
England			
Cumberland	1,334,751	1,323,408	982,143
Lancashire	408,090	338,086	231,534
Leicester	560,410	685,137	534,595
Lincoln	2,128,161	2,806,989	2,787,322
Northampton	2,649,539	2,517,150	2,202,177
Stafford	913,006	703,231	704,376
York	6,198,411	4,821,465	3,732,476
England (including other counties)	14,471,108	13,729,146	11,863,597
Wales	41,455	91,299	65,974
Scotland	648,415	375,241	308,721
Ireland	65,037	39,326	15,903

The home production of tin ore (almost exclusively in the S.W. of England) is shown in Table XXII. to have had some revival in 1910–14, with a marked increase in world prices in and about 1912, and a further increase during the war, followed by a decrease at its close.

TABLE XXII.—*Tin Ore Production.*

Year	Tin Ore Tons	Value £
1910	7,572	655,871
1912	8,166	1,012,290
1914	8,085	661,865
1916	7,893	712,142
1917	6,573	784,493
1919	5,156	678,823

Textile Industries.—The quantities of raw cotton imported, exported and retained for consumption are given in Table XXIII. for 1910, 1912, 1914 and subsequent years. The restriction of export imposed by war conditions is most clearly illustrated by the figure for 1918. The figures for wool are given in Table XXIV. on the following page.

TABLE XXIII.—*Cotton.*

Year	Imported lb.	Exported lb.	Retained lb.
1910	1,972,741,120	256,100,768	1,716,640,352
1912	2,805,817,800	323,801,100	2,482,016,700
1914	1,864,133,300	216,263,500	1,647,869,800
1915	2,647,616,100	343,638,000	2,303,978,100
1916	2,171,002,200	237,472,800	1,933,529,400
1918	1,489,083,000	352,000	1,488,731,000
1919	1,958,286,700	121,131,600	1,837,155,100

TABLE XIX.—*Mining Production.*

Description of Metal	1910		1914		1917		1919	
	Tons	Value £	Tons	Value £	Tons	Value £	Tons	Value £
Coal	264,433,028	108,377,567	265,664,393	132,596,853	248,499,240	207,786,894	229,779,517	314,113,160
Iron Ore	15,226,015	4,022,269	14,867,582	3,921,683	14,845,734	6,429,620	12,254,195	7,428,366
Clay and Shale	14,090,320	1,761,410	13,124,361	1,731,779	5,842,675	1,393,858	7,765,965	2,358,522
Sandstone	4,386,281	1,300,705	3,464,528	1,057,096	1,613,379	563,119	1,699,853	971,329
Slate	416,324	1,063,994	318,912	806,196	121,524	366,124	164,098	844,394
Limestone (not chalk)	12,512,736	1,296,169	12,158,441	1,295,512	10,454,717	1,722,199	9,537,495	2,431,627
Igneous Rocks	6,608,705	1,263,410	7,135,243	1,369,242	4,239,405	1,049,121	4,387,703	1,720,932
Oil Shale	3,130,280	860,827	3,268,666	837,249	3,117,658	1,280,007	2,763,875	1,567,050
Tin Ore (dressed)	7,572	655,871	8,085	661,865	6,576	784,493	5,156	678,823
Salt	2,050,630	581,504	2,069,989	560,893	2,013,388	1,318,944	1,908,080	2,079,011

TABLE XX.—*Output of Metals.*

Description of Metal	1910		1914		1917		1919	
	Tons	Value £	Tons	Value £	Tons	Value £	Tons	Value £
Iron	4,975,735	17,008,812	4,786,090	17,953,057	4,688,063	43,271,614[1]	3,808,095	51,511,064
Tin	4,797	738,025	5,056	800,547	3,936	935,407	3,272	842,485
Lead	21,522	283,194	19,378	371,977	11,250	337,500	10,277	289,769
Zinc	4,168	99,823	5,208	121,585	2,735	142,699	2,436	102,951
Copper	449	27,570	341	22,777	187	25,141	144	14,176
Gold Bar	2,427 oz.	8,088	99 oz.	333	..	..	..	..
Silver	136,665 oz.	14,058	146,444 oz.	15,445	75,472 oz.	12,854	68,414 oz.	16,266

[1] Calculated on the value of pig iron exported.

TABLE XXIV.—*Wool.*

Year	Imports lb.	Exports of Imports—lb.	Retained lb.
1910	803,295,083	335,222,545	468,072,538
1912	810,494,862	337,941,504	472,553,358
1914	717,122,475	295,487,373	421,635,102
1915	934,495,242	122,990,049	811,505,193
1916	624,823,286	45,381,652	579,441,634
1918	420,559,105	20,500,264	400,058,841
1919	1,046,704,166	169,474,718	877,229,448

Commerce.—Table XXV. shows the value of imports from other countries to the United Kingdom, and of exports to other countries from the United Kingdom, in 1910, 1915 and 1919; and Tables XXVI. and XXVII. (p. 845) show the chief imports into, and exports from, the United Kingdom.

TABLE XXV.—*Imports and Exports.*

		1910 £	1915 £	1919 £
I. BRITISH POSSESSIONS:—				
India and Ceylon	Imports	48,751,021	74,411,031	124,982,208
	Exports	48,320,012	47,560,290	73,328,775
Straits Settlements, Malaysia and Hong-Kong	Imports	13,692,223	20,925,355	30,665,036
	Exports	8,190,185	6,380,438	11,976,007
Africa	Imports	16,186,605	48,325,974	115,648,393
	Exports	26,566,138	34,840,681	54,281,137
Canada and Newfoundland	Imports	26,238,649	42,206,548	117,843,141
	Exports	20,606,889	13,636,894	16,521,681
West Indies, Bermudas, Honduras and Guiana	Imports	3,232,433	5,707,326	13,486,215
	Exports	3,265,706	2,773,380	3,109,863
Australia	Imports	38,584,370	45,190,148	111,403,971
	Exports	27,652,367	28,965,698	26,306,421
New Zealand	Imports	20,943,142	30,407,581	52,703,816
	Exports	8,652,716	9,373,843	9,593,153
Other	Imports	2,821,823	4,651,264	15,827,859
	Exports	4,048,929	4,888,460	10,503,277
II. FOREIGN COUNTRIES:—				
France	Imports	46,692,355	34,528,585	52,259,323
	Exports	24,930,142	72,119,948	155,593,536
Germany	Imports	62,094,634	526,886	3,202,516
	Exports	37,432,603[1]	155,673	549,575
Belgium	Imports	19,195,974	2,931,025[2]	10,110,373[2]
	Exports	10,886,704	624,207	49,202,523
Holland	Imports	18,527,965	23,418,757	21,658,430
	Exports	12,695,074	18,036,837	34,315,945
Denmark, Faeroe, Iceland, Greenland	Imports	19,671,884	22,894,308	9,791,098
	Exports	5,580,865	8,008,689	34,972,425
Norway	Imports	6,630,746	13,690,481	17,067,379
	Exports	4,033,195	7,286,938	27,437,672
Sweden	Imports	11,825,079	19,801,659	35,583,568
	Exports	6,697,967	6,278,672	24,483,000
Austria-Hungary	Imports	7,511,865	48,531	505,813
	Exports	4,001,053	..	1,459,448
Rumania	Imports	3,184,414	5,276	2,742
	Exports	1,826,652	492,378	5,585,085
Greece	Imports	2,286,871	3,934,622	10,440,500
	Exports	1,545,863	2,467,439	6,914,713
Italy	Imports	6,458,736	11,258,452	14,635,183
	Exports	12,530,583	13,929,053	27,756,885
Spain	Imports	15,351,086	20,764,004	39,010,162
	Exports	6,231,797	7,261,540	12,668,021
Portugal	Imports	3,470,873	5,318,000	13,879,719
	Exports	6,328,622	4,703,533	9,579,873
Russia	Imports	43,644,648	21,424,998	16,370,377
	Exports	12,252,556	13,432,172	12,993,681
Turkey	Imports	4,668,076	1,303,348	9,284,659
	Exports	8,636,666	433,087[3]	22,160,138[3]
Japan	Imports	4,327,299	9,379,432	23,871,012
	Exports	10,121,919	4,876,655	12,913,373
China	Imports	5,529,530	7,034,852	23,052,935
	Exports	9,171,672	8,545,505	20,969,728
II. FOREIGN COUNTRIES (*Continued*):—				
Netherlands India	Imports	4,029,389	14,474,398	22,394,183
	Exports	4,075,825	6,162,284	9,029,752
Other Countries in Asia	Imports	1,238,856	2,562,891	3,113,541
	Exports	1,312,710	1,757,576	3,411,910
Egypt	Imports	21,004,468	..[4]	..[4]
	Exports	8,717,330	..	..
U.S.A.	Imports	117,607,435	237,773,576	541,553,171
	Exports	31,446,730	26,167,551	33,913,239
Mexico and Central American States	Imports	3,582,859	4,520,801	8,641,032
	Exports	3,342,446	771,452	2,313,059
Brazil	Imports	17,496,568	8,256,879	10,821,100
	Exports	16,426,985	5,151,470	10,741,637
Argentina	Imports	29,009,738	63,876,814	81,730,319
	Exports	19,097,985	11,516,158	21,217,210
Chile	Imports	5,181,737	9,585,247	7,344,655
	Exports	5,479,556	1,791,131	4,779,253
Africa	Imports	1,413,642	1,974,844	3,581,519
	Exports	1,747,570	1,999,297	6,063,998
South America	Imports	9,131,443	11,247,707	25,874,754
	Exports	7,200,996	4,481,388	9,556,626
Other Countries	Imports	17,038,588	27,541,750	39,804,960
	Exports	9,330,539	7,998,131	17,738,366
Total for British Possessions	Imports	170,450,266	271,825,227	582,570,639
	Exports	147,302,942	148,419,684	205,620,314
Total for Foreign Countries	Imports	507,806,758	580,068,123	1,043,585,573
	Exports	283,081,830	236,448,764	593,015,062
Grand Total	Imports	678,257,024	851,893,350	1,626,156,062
	Exports	430,384,772	384,868,448	1,798,635,376

[1] From German possessions in W. Africa.
[2] Includes Belgian Congo after 1914.
[3] To territory formerly Turkish, now occupied by other Powers.
[4] Included under British possessions from 1915.

The proportion of imports and exports per head of population of the United Kingdom was approximately as follows:—

Year	Imports			Exports		
	£	s.	d.	£	s.	d.
1910	15	2	0	9	11	8
1912	16	7	3	10	14	2
1914	15	2	4	9	6	11
1915–1919 Average	25	3	6	11	15	0

Parliamentary Representation.—Under the Representation of the People Act, 1918, there was a complete redistribution of seats. Tables XXVIII. to XXXV. show the new Parliamentary arrangements for England, Wales and Scotland.

TABLE XXVIII.—*London Parliamentary Boroughs.*

Name of Borough	No. of Members	Name of Borough	No. of Members
Battersea	2	Lambeth	4
Bermondsey	2	Lewisham	2
Bethnal Green	2	Paddington	2
Camberwell	4	Poplar	2
Chelsea	1	St. Marylebone	1
City of London	2	St. Pancras	3
Deptford	1	Shoreditch	1
Finsbury	1	Southwark	3
Fulham	2	Stepney	3
Greenwich	1	Stoke Newington	1
Hackney	3	Wandsworth	5
Hammersmith	2	Westminster	2
Hampstead	1	Woolwich	2
Holborn	1		
Islington	4	Total	62
Kensington	2		

TABLE XXVI.—*Imports into the United Kingdom.*

Imports	1910 £	1912 £	1914 £	1916 £	1919 £	1920 £
Grain and flour	77,298,383	88,496,284	79,636,269	133,253,132	154,801,757	231,712,529
Meat	48,878,947	49,079,559	63,215,056	94,050,999	173,861,571	141,557,025
Other principal articles of food and drink:						
Butter	24,493,450	24,354,193	24,014,276	18,964,002	19,854,427	24,634,294
Sugar	24,554,209	25,149,661	32,118,170	37,367,675	53,927,868	72,958,737
Tea	11,381,056	13,125,689	14,221,496	17,745,317	33,050,853	26,928,953
Wine	4,248,814	4,287,426	3,630,313	3,511,822	18,167,077	13,147,753
Coffee	2,305,555	2,518,521	3,549,038	4,727,426	5,982,804	4,522,327
Fish (preserved)	3,371,565	2,887,767	4,584,321	9,290,131	12,177,696	11,127,603
Cocoa and chocolate	1,169,530	1,604,274	1,523,630	2,300,731	2,323,484	5,032,532
Principal fruits:						
Apples	2,189,309	2,507,024	2,046,824	2,741,102	6,245,874	9,324,700
Oranges	2,267,474	2,348,375	2,323,235	3,087,175	9,445,154	8,017,095
Bananas	1,698,556	1,964,200	2,434,751	2,211,245	3,908,393	6,468,719
Tobacco	4,624,782	6,359,115	7,463,068	7,364,308	41,653,708	33,584,169
Raw materials:						
Cotton	71,711,908	80,238,960	55,350,626	84,729,677	190,771,416	256,765,237
Wool	37,332,470	36,567,818	34,246,722	39,730,623	104,753,205	93,957,397
Oils	37,548,960	37,418,767	41,332,056	63,356,728	130,994,512	151,905,135
Wood and timber	26,207,329	28,357,158	25,343,111	40,163,994	72,306,469	82,164,620
Textile materials, excluding cotton and wool	12,803,327	18,578,100	15,367,670	23,840,128	28,818,186	36,798,326
Hides and skins	12,882,326	13,690,265	12,727,066	13,784,590	29,508,074	31,976,823
Metallic ores, excluding iron	8,970,272	9,059,505	9,533,465	13,679,870	12,343,018	17,711,627
Iron ore, etc.	6,261,471	6,219,050	5,487,344	12,136,066	11,983,278	20,799,861
Manufactured articles:						
Yarns and textile fabrics	32,049,602	44,870,344	37,767,686	33,584,048	45,029,820	87,562,067
Metal, excluding iron and steel	24,699,194	31,197,428	29,604,332	39,048,339	35,215,276	39,221,892
Leather	11,824,741	14,342,926	13,478,148	16,188,901	37,362,572	19,715,078
Chemicals	11,259,685	12,545,758	12,064,430	28,622,052	23,068,847	35,315,326
Iron and steel (not machinery)	9,086,214	12,961,991	10,877,249	11,214,097	11,309,908	29,005,826
Paper	6,413,718	7,234,437	6,791,191	8,327,405	13,014,623	30,252,181
Machinery	4,470,898	6,820,683	6,712,499	7,988,039	15,066,659	19,961,401

TABLE XXVII.—*Exports of Home Produce.*

	1910 £	1914 £	1916 £	1918 £	1919 £	1920[1] £
Cotton yarn and manufactures	105,871,208	103,266,538	118,307,992	118,307,992	240,977,605	401,682,535
Iron and steel manufactures	42,976,671	41,667,830	56,673,705	36,843,078	63,484,265	128,942,618
Woollen yarn and manufactures	37,516,397	31,499,885	46,905,649	49,865,941	98,431,697	134,969,462
Coal	37,813,360	42,202,128	50,670,604	52,416,330	92,297,685	99,627,146
Machinery	29,271,380	31,363,093	20,217,598	16,120,463	32,670,013	63,457,987
Chemicals	18,568,136	19,508,061	27,565,087	22,663,148	29,502,610	40,729,760
Textiles (not cotton or wool)	13,481,198	12,982,261	15,817,943	11,126,189	21,253,385	45,037,326
Metal manufactures (not iron)	10,352,354	10,283,283	12,720,016	9,003,158	15,337,212	25,867,965
Clothing	12,717,587	14,531,674	16,941,093	11,818,335	17,562,933	48,887,862
Leather and leather goods	4,686,485	4,685,015	4,897,503	1,551,378	7,360,317	11,672,599
Ships	8,770,204	6,932,554	1,290,585	1,047,334	2,328,331	2,306,267

[1] From preliminary returns.

TABLE XXIX.—*Provincial English Parliamentary Boroughs.*

Name of Borough	No. of Members
Accrington	1
Ashton-under-Lyne	1
Barnsley	1
Barrow-in-Furness	1
Bath	1
Batley and Morley	1
Birkenhead	2
Birmingham	12
Blackburn	2
Blackpool	1
Bolton	2
Bootle	1
Bournemouth	1
Bradford	4
Brighton	2
Bristol	5
Bromley	1
Burnley	1
Bury	1
Cambridge	1
Carlisle	1
Cheltenham	1
Coventry	1
Croydon	2
Darlington	1
Derby	2
Dewsbury	1
Dudley	1
Ealing	1
East Ham	2
Eccles	1
Edmonton	1
Exeter	1
Gateshead	1
Gloucester	1
Great Yarmouth	1
Grimsby	1
Halifax	1
Hartlepools, The	1
Hastings	1
Hornsey	1
Huddersfield	1
Hull (Kingston-upon-Hull)	4
Hythe	1
Ilford	1
Ipswich	1
Kingston-upon-Thames	1
Leeds	6
Leicester	3
Leigh	1
Leyton	2
Lincoln	1
Liverpool	11

TABLE XXIX.—(*Continued*).

Name of Borough	No. of Members
Manchester	10
Middlesbrough	2
Morpeth	1
Nelson and Colne	1
Newcastle-under-Lyme	1
Newcastle-upon-Tyne	4
Northampton	1
Norwich	2
Nottingham	4
Oldham	2
Oxford	1
Plymouth	3
Portsmouth	3
Preston	2
Reading	1
Richmond (Surrey)	1
Rochdale	1
Rochester (with Chatham and Gillingham)	2
Rossendale (incl. Bacup, Haslingden and Rawtenstall)	1
Rotherham	1
St. Helens	1
Salford	3
Sheffield	7
Smethwick	1
Southampton	2
Southend-on-Sea	1
Southport	1
South Shields	1
Stockport	2
Stockton-on-Tees	1
Stoke-on-Trent	3
Sunderland	2
Tottenham	2
Tynemouth	1
Wakefield	1
Wallasey	1
Wallsend	1
Walsall	1
Walthamstow	2
Warrington	1
Wednesbury	1
West Bromwich	1
West Ham	4
Wigan	1
Willesden	2
Wimbledon	1
Wolverhampton	3
Worcester	1
York	1
Total	193

TABLE XXX.—*Welsh Parliamentary Boroughs.*

Name of Borough	No. of Members	Name of Borough	No. of Members
Cardiff	3	Merthyr Tydfil	2
Carnarvon District (Bangor, Carnarvon, Conway, Pwllheli, Criccieth, Llandudno, Llanfairfechan, Penmaenmawr, Nevin)	1	Newport	1
		Rhondda	2
		Swansea	2
		Total	11

TABLE XXXI.—*Scottish Parliamentary Boroughs.*

Name of Borough	No. of Members	Name of Borough	No. of Members
Aberdeen	2	Kirkcaldy District (Kirkcaldy, Buckhaven, Methil, Innerleven, Burntisland, Dysart, Kinghorn)	1
Ayr District (Ayr, Ardrossan, Irvine, Prestwick, Saltcoats, Troon)	1	Leith	1
Dumbarton District (Dumbarton, Clydebank)	1	Montrose District (Montrose, Arbroath, Brechin, Forfar, Inverbervie)	1
Dundee	2	Paisley	1
Dunfermline District (Dunfermline, Cowdenbeath, Inverkeithing, Lochgelly)	1	Stirling and Falkirk (with Grangemouth)	1
Edinburgh	5		
Glasgow	15		
Greenock	1	Total	33

TABLE XXXII.—*English County Divisions.*

Name of County	No. of Divs. and Members	Name of County	No. of Divs. and Members
Bedford	3	Leicester	4
Berks	3	Parts of Lindsey (Lincolnshire)	4
Bucks	3	Middlesex	10
Cambridge	1	Norfolk	5
Chester	9	Northampton (with Soke of Peterborough)	4
Cornwall	5	Northumberland	3
Cumberland	4	Nottingham	5
Derby	8	Oxford	2
Devon	7	Salop	4
Dorset	4	Somerset	6
Durham	11	Stafford	7
Essex	8	Suffolk, East	3
Gloucester	4	Suffolk, West	2
Hants	6	Surrey	7
Hereford	2	Sussex, East	4
Hertford	5	Sussex, West	2
Holland with Boston (Lincolnshire)	1	Warwick	4
Huntingdon	1	Westmorland	1
Isle of Ely	1	Wilts	5
Isle of Wight	1	Worcester	4
Kent	11	York, East Riding	3
Parts of Kesteven (Lincolnshire) and Rutland	2	York, North Riding	4
Lancaster	18	York, West Riding	19
		Total	226

TABLE XXXIII.—*Welsh County Divisions.*

Name of County	No. of Divs.	Name of County	No. of Divs.
Anglesey	1	Glamorgan	7
Brecon and Radnor	1	Merioneth	1
Cardigan	1	Monmouth	5
Carmarthen	2	Montgomery	1
Carnarvon	1	Pembroke	1
Denbigh	2		
Flint	1	Total	24

TABLE XXXIV.—*Scottish County Divisions.*

Name of County	No. of Divs. and Members	Name of County	No. of Divs. and Members
Aberdeen and Kincardine	3	Lanark	7
Argyll	1	Linlithgow	1
Ayr and Bute	3	Midlothian and Peebles	2
Banff	1	Moray and Nairn	1
Berwick & Haddington	1	Orkney and Shetland	1
Caithness & Sunderland	1	Perth and Kinross	2
Dumbarton	1	Renfrew	2
Dumfries	1	Roxburgh and Selkirk	1
Fife	2	Stirling and Clackmannan	2
Forfar	1		
Galloway	1		
Inverness and Ross and Cromarty	3	Total	38

TABLE XXXV.—*University Constituencies.*

Name of County	No. of Divs. and Members	Name of County	No. of Divs. and Members
Oxford	2	St. Andrews, Glasgow, Aberdeen, Edinburgh	3
Cambridge	2		
London	1		
Wales	1		
Durham, Manchester, Liverpool, Leeds, Sheffield, Birmingham, Bristol	2	Total	11

As compared with the former distribution of seats, London boroughs, in the Act of 1918, gained 3 members; other boroughs gained 33 (31 new boroughs were created and 44 old boroughs were abolished); the counties lost 5 members; the universities gained 6 members, the newer universities being represented for the first time. Membership of the House of Commons totalled 707:—England 492 (an addition of 31), Wales 36 (addition of 2), Scotland 74 (addition of 2), Ireland (the Act did not cover Irish redistribution), 105. On the extension and revision of the franchise under the Act, *see* ENGLISH HISTORY.

Local Government.—Some important changes were made in the municipal status of towns in England and Wales in the years preceding 1920. Barnsley, Carlisle, Darlington, Dewsbury, Eastbourne, East Ham, Southend-on-Sea, Stoke-on-Trent, Wakefield and Wallasey became county boroughs. Aylesbury, Buxton, Devonport, Fowey, Llanelly and Stourbridge became municipal boroughs. The following were created urban districts:—Ardwick-le-Street, Axminster, Beddington and Wallington, Bedwas and Machen, Bentley with Arksey, Bletchley, Bungay, Chorleywood, Coulsdon and Purley, Cwmamman, Haslemere, Letchworth, Leyland, Long Benton, Market Drayton, Mitcham, Oadby, Prudhoe, Seaton Delavel, Spenborough, Stratford and Wolverton, Tilbury, Yiewsley. The following urban districts changed their names:—Ynseynhaiarn to Portmadoc, Ystradyfodwg to Rhondda, Merton to Merton and Morden, New Shoreham to Shoreham-by-Sea, Preesall with Hackensall to Preesall, Hunstanton to New Hunstanton, Hucknall Torkard to Hucknall, Newbold and Dunstan Whittington to Whittington and Newbold. The Greater Birmingham scheme, which came into operation Nov. 9 1911, included in the city of Birmingham the former borough of Aston Manor and certain urban districts. (O. J. R. H).

MEDICAL EXAMINATION OF THE NATION

In order to appreciate the nature and scope of the physical census of men of military age carried out in the United Kingdom by the Ministry of National Service during the last years of the World War, it is necessary to recapitulate briefly the phases through which the recruiting arrangement for the British army passed during the earlier stages of the war.

Before the war the British army was a voluntary army, and only men between 18 and 30 years of age of good physique and free from any physical defect were accepted for enlistment. It was laid down that the height and chest measurements of each recruit should accord with each other and with his age in conformity with the official table of standards. Each recruit whose physical condition did not conform to these standards was regarded as unfit and not accepted. In short, the army accepted for service only the best human material.

At the outbreak of war in Aug. 1914, there was a tremendous rush of recruits to the colours, and perforce attempts were made to deal, on the same simple plan, with the tens of thousands of men who besieged the recruiting offices. The need for soldiers was clamant, irresistible, and there was no time to devise another method. The result was inevitable—the army was flooded with men who after a few weeks or months of service broke down and proved useless. The authorities then saw that in this war they were confronted with a new problem—men had to be provided on a scale never before contemplated and the man-power resources of the country were to be strained to the utmost. The army needed would have to employ men of different degrees of physical fitness, since the available number of perfectly fit men would not be adequate for all the needs of the country. It was therefore necessary to classify recruits according to their fitness for the very varied duties for which the army required men—the old simple division into "fit" and "unfit" was no longer sufficient: recruits must be classified or graded so that as far as possible every man called up for service should be allotted to the particular occupation in the army for which he was fitted by his training and degree of physical fitness. Accordingly, a system of categories was introduced whereby recruits were classified by medical boards as being fit for general service, field service at home, garrison service, labour or sedentary work; as experience of this system accumulated various modifications and sub-divisions of these categories were subsequently introduced to meet the difficulties which arose in their application in practice.

Meantime, on Jan. 27 1916, the first Military Service Act, which provided for the compulsory service of unmarried men between the ages of 18 and 41, came into operation, and on May 26, a like obligation was imposed on the married between those ages. By this time, the difficulty of categorization was becoming painfully evident; it consisted essentially of the fact that the category was not a purely medical classification but rather a kind of administrative shorthand founded upon medical information. In other words, medical boards were required to perform the functions of a posting board, as well as their proper medical function of assessing the degree of physical fitness of the men examined. The attempt to combine these functions failed, as in the light of experience we can see it was bound to fail, and was in fact the cause of the growing volume of dissatisfaction which became steadily more general and more emphatic during the latter half of 1916 and the early months of 1917. The examination of men called up under the Review of Exceptions Act in April 1917 caused a storm of hostile criticism; this led to the appointment of the Shortt Committee, which, in Aug. 1917, recommended to the House of Commons that the whole organization and administration of examination should be transferred from the War Office to civilian control. Accordingly, the Ministry of National Service—the Department entrusted with this work—assumed these duties as from midnight Oct. 31 1917.

The immediate medical duties of the Department were: (1) To introduce a new system of grading—the grade of each man to be determined by physical considerations alone—to replace the system of categorization in which administrative as well as medical considerations were taken into account; (2) to lay down definite standards of physical efficiency for the guidance of members of examining boards; (3) to establish National Service Medical Boards for the examination of men of military age.

As regards the personnel of the boards, great care was taken to select suitable chairmen who were generally whole-time medical officers. Members of the boards (1 chairman and 4 members constituted a board) were drawn from a panel of local civilian doctors of good standing—a system which made for efficient work, economized the medical man-power of the country and was at the same time elastic. These boards were established at convenient centres all over Great Britain. At first they numbered 97 and were soon examining some 80,000 men per month. The number of boards steadily increased to cope with the increasing work. In April 1918 285,631 men were examined, in May 456,999, and in June 475,416; by this time the number of boards was 209. After this the pressure relaxed somewhat, and the numbers in succeeding months were July 371,923, Aug. 158,544, Sept. 97,694, Oct. 110,255.

From the outset instructions were issued to boards that they were to grade all men brought before them according to their physical fitness at the time of examination in conformity with the following standards:—

Grade I.—Those who attain the full normal standard of health and strength and are capable of enduring physical exertion suitable to their age. Such men must not suffer from progressive organic disease, nor have any serious disability or deformity. Minor defects which can be remedied or adequately compensated by artificial means will not be regarded as disqualifications.

Grade II.—Those who for various causes, such as being subject to partial disabilities, do not reach the standard of Grade I. They must not suffer from progressive organic disease. They must have fair hearing and vision, be of moderate muscular development, and be able to undergo a considerable degree of physical exertion of a nature not involving severe strain.

Grade III.—Those who present marked physical disabilities or such evidence of past disease that they are not considered fit to undergo the degree of physical exertion required for the higher grades. Examples of men suitable for this grade are those with badly deformed toes, severe flat-foot, and some cases of hernia and of varicose veins (others are indicated later under the headings of the various diseases and disabilities). The third grade will also include those who are fit only for clerical and other sedentary occupations, such as tailoring and bootmaking.

Grade IV.—All those who are totally and permanently unfit for any form of military service.

In order to assist the boards in their task of grading, and to insure uniformity as far as possible through the country, instructions were also issued to them indicating the effect of some 60 common disabilities and diseases upon the grading. Thus, in the Ministry of National Service, a department was created with the administrative machinery requisite not only to supply the armed forces with recruits, but also to survey the physical fitness of the male population of military age and so provide a physical census of the human material at the disposal of the country for all its needs. It is evident that, until categorization with its administrative factors was abandoned and grading by physical considerations alone introduced, true inferences as to the health and fitness of the male population could not be drawn from the statistical returns of recruiting. With the introduction of the new system on Nov. 1 1917, the statistical returns at once became of great value, and provided for the first time a physical census of part at least of the population.

The number of examinations completed during this last year of the war with the numbers placed in each grade is shown in the accompanying table:—

Medical Examinations (Period Nov. 1 1917 to Oct. 31 1918).
No. of Examinations and Reëxaminations.

Grade I.	871,769	(36·0 %)
Grade II.	546,276	(22·5 %)
Grade III.	756,859	(31·3 %)
Grade IV.	250,280	(10·2 %)
Total	2,425,184	

It will be noted that of the 2,425,184 examinations 871,769 resulted in the man being placed in Grade I., 546,276 in Grade II., 756,859 in Grade III., and 250,280 in Grade IV. In other words 36 % were placed in Grade I., *i.e*, were judged to have attained the full normal standard of health and strength, and to be capable of undergoing physical exertion suitable to their age; 22 % were placed in Grade II., *i.e.* were judged to be capable only of undergoing such physical exertion as did not involve severe strain; 32 % were placed in Grade III., *i.e.* presented marked physical disabilities or such evidence of past disease that they were not considered fit to undergo the degree of exertion required for the higher grades; 10 % were placed in Grade IV., *i.e.* were judged to be totally and permanently unfit for any form of military service. This result may be summarized by saying that of every 9 men of military age in Great Britain in the year under review 3 were perfectly fit and healthy, 2 were definitely below the normal standard of health, 3 were unfit to undergo anything but the most moderate degree of exertion, and the remaining man was a chronic invalid.

Exception has been taken to these inferences on the ground that these grading results are not a true reflection of the health of the nation for two reasons:—

First, that the grading was inaccurate. In reply to this criticism it is to be observed that men dissatisfied with their grading had the right to appeal to an independent tribunal against their grading, and that the number of men whose grading was altered on appeal was less than 0·4% of the total number of examinations, in other words an independent tribunal only altered the finding of the board in between 3 and 4 cases out of every 1,000. Further, though we do not know to what extent grading was found by actual experience in the army (the only real criterion) to represent truly the degree of physical fitness, it is certain that any conclusions we may reach from the grading results will, if anything, lead us to overrate the physical fitness of our manhood, since every factor in the situation contributed toward grading men too high rather than too low.

Secondly, that the men examined were the dregs of a population exhausted by 3 years of war. This criticism, though natural and self-evident at first sight, is inadmissible principally for the reason that it is made in ignorance of the extent to which fit men of military age were employed in such industries and occupations as agriculture, mining, shipbuilding, and munition works, and protected from recruitment by law during the earlier years of the war, remaining in civil life until in the fourth year of the war these industries had to be "combed-out" in response to the increasing strain upon the diminishing reserve of man-power. Analysis shows that the men examined during the year under review belonged to one of the five following groups:—

(1) Men in the protected industries, which in the nature of things employed a high proportion of the physically fit, and this group was numerically much the largest.

(2) Men who were now refused further exemption by tribunals owing to the urgent demand for men caused by the military situation.

(3) Lads who attained the age of 18 years during this year; in number 261,137.

(4) Men who had been previously rejected when the need for soldiers was less urgent.

(5) Men between 41 and 51 who became liable for military service under the Military Service No. 2 Act of April 1918.

Inasmuch as group (1), the largest, comprised an abnormally high proportion of the physically fit, group (4) an abnormally low, and group (2) an average proportion, while groups (3) and (5) were a "virgin soil," we can hardly escape the inference that in the aggregate the men examined during the year under review represented the manhood of military age from the standpoint of health and physique, and that therefore the observations made at their medical examinations form a trustworthy criterion of the national health.

With this general picture before us, we may well and rightly ask what are the causes of this great mass of physical inefficiency which low grading means and to what extent is it preventable. After all, the large majority of babies are born healthy, and the conditions and environment subsequent to birth are created by mankind and are capable of a large range of modification. It will be readily understood that such a mass of records and observations require full and detailed analysis before complete conclusions as to the lessons obtained can be reached. While a complete analysis was not yet available in 1921, the matter had been sufficiently explored to reveal several striking results.

First, as to the causes for which such a large proportion of men were placed in Grades III. and IV., viz., 1,007,139 or 41·5% of the total number of examinations. Men placed in these grades, it must be remembered, presented such marked physical disabilities or such evidence of past disease that they were only considered fit to undergo the most moderate degree of exertion, and some were so incapacitated as to be totally and permanently unfit for any form of military service. The reasons for 2 out of every 5 men of military age being so physically unfit clearly requires explanation. The largest group of men in these two grades which has been analysed is 160,545 men, examined in the London region during the period Jan. to Oct. 1918; of these 82,645 were placed in Grades I. and II., the balance of 77,900 (48·5%) falling to Grades III. and IV., namely 60,031 (37·4%) in Grade III. and 17,869 (11·1%) in Grade IV. In the case of the Grade III. and Grade IV. men in this large group the accompanying table shows the disease or disability on account of which they were so graded.

Disease or disability	No. of men placed in Grades III. & IV.	Percentage of numbers examined	Percentage placed in Grade IV.	Percentage placed in Grade III.
1. Valvular disease of heart	12,562	7·9	1·6	6·3
2. Deformities, congenital and acquired (including flat-foot, hammer toe, kyphosis, etc.)	8,605	5·3	·0	4·3
3. Diseases of circulatory system (other than V. D. H.) including varicose veins	6,275	3·9	·6	3·3
4. Diseases of lungs and bronchi (other than tuberculosis) and of respiratory system	6,188	3·8	·6	3·2
5. Pulmonary tuberculosis	4,327	2·6	2·0	·6
6. Functional diseases of heart	3,385	2·1	·1	2·0
7. Wounds, injuries, etc., including traumatic deformities, amputations, etc.	3,335	2·0	·3	1·7
8. Diseases of ears	3,162	1·9	·3	1·6
9. Diseases of nervous system (other than insanity and epilepsy)	3,066	1·9	·5	1·4
10. Poor physique	2,967	1·8	·2	1·6
11. Defective vision	2,620	1·6	·2	1·4
12. Rheumatism	2,445	1·5	·1	1·4
13. Hernia	2,179	1·3	·2	1·1
14. Diseases of digestive system	2,170	1·3	·2	1·1
15. Diseases of eyes	1,886	1.1	·5	·6
16. Deafness	1,708	1·0	·2	·8
17. Epilepsy	1,265	·7	·5	·2
18. Hæmorrhoids	1,140	·7	·05	·65
19. Skin diseases	1,053	·6	·15	·45
20. Diseases of generative organs and of genito-urinary system (other than venereal disease, albuminuria and glycosuria)	983	·6	·075	·525
21. Albuminuria	951	·5	·3	·2
22. Tuberculosis (other than pulmonary)	911	·5	·3	·2
23. Insanity	656	·4	·3	·1
24. Syphilis	556	·3	·1	·2
25. Glycosuria	214	·1	·1	..
26. Venereal disease (other than syphilis)	162	·1	·02	·08
27. Other diseases	3,129	1·9	·375	1·525
	77,900	48·5	11·1	37·4 11·1
				48·5

Broadly speaking, this table shows that of this large group of men of military age half were found to be suffering from organic disease of one kind or another of a severity sufficient at least to render them incapable of a normally active life. It will be observed that diseases of the heart were the most frequent disability. Valvular disease 12,562 (7·9%) and functional disease 3,385 (2·1%) made up 15,947 cases of heart disease in all, or 10·0% of the number examined. There had been no previous opportunity of gauging the frequency of heart disease among the population, but it can be safely stated that such an incidence as one in ten among men in the prime of life would never have been expected. It indicates the importance that should be attached to insuring that adequate treatment is given to all cases, and to the infections such as rheumatism in which it frequently originates especially in the earlier years of life.

Another figure which naturally attracts attention is that for tuberculosis; 4,327 had pulmonary tuberculosis, 911 had tuberculosis of other organs, 5,238 in all, or 3·1% of the number examined. Of these 3,874 (2·3% of the number examined) were cases sufficiently advanced or sufficiently active to warrant the boards in relegating the men to Grade IV., *i.e.* totally and permanently unfit for any form of military service. Great doubt and difficulty have always attended all attempts to estimate the frequency of tuberculosis; a disease of many manifestations, it is often impossible to prove its existence in a given case and frequently impossible to exclude it. It is rather striking to find that 2·3% of this large group of men presented sufficiently definite evidence of its existence to enable the examiners to reject them as useless for any form of military service. This experience was not limited to London, for we find that in Liverpool among 20,704 men the incidence was 2·15% and in Yorks, in a group of 24,281 men, 2·37%. The close correspondence of the incidence found among these 3 large groups of men in different parts of the country suggests very strongly that the figures are trustworthy, and represent with accuracy the frequency of active or established tuberculosis in men in the 3rd, 4th and 5th decades of life.

Apart from specific diseases another feature of this table which invites comment is the 2,967 men (1·8% of the number examined) who were found fit only for the lower grades on account of poor physique. Now the physique of an individual is to be regarded as the effect upon him of his inheritance and environment—it is the net result of all the factors which combine to make him what he is physically. In the absence of evidence of actual racial degeneration poor physique must be attributed to the environment of the individual—to the conditions of life to which he has been subjected. Any evidence that indicates the standard of physique prevailing among men of military age will therefore afford a valuable criterion of the extent to which modern conditions of life do or do not permit of healthy bodily development. Measurements of the height, weight and chest girth are commonly accepted as the practical criteria of physique, and the records of these measurements provide us with an opportunity of investigating and comparing the physique of the men examined.

Now, though the anthropometrical observations made as part of the physical examination of men of military age had not in 1921 been fully worked out, the figures already available are of interest and importance; thus in a group of 71,000 men of all ages between 18 and 41 in the W. Midland region it is shown that at 18 years the average height was 65·6″, at 25 years 66·1″, at 35 years 65·9″, and at 40 years 65·8″. On comparing these figures with those of the report of the Anthropometrical Committee of the British Association in 1883, it is found that they are in every case well below the averages then found which were, at 18 years 66.6″, at 25 years 67·5″, at 35 years 68·0″, and at 40 years 67·9″. Indeed, these recent W. Midland figures are less favourable than those of Group IV. (the poorest class in the Anthropometrical Committee's report), viz. artisans in towns, and much less favourable than those of Group I., the professional classes in the same report.

Height in Inches.

Age	18 years	25 years	35 years	40 years
W. Midland . . .	65·6″	66·1″	65·9″	65·8″
Group IV.	66·6″	67·5″	68·0″	67·9″
Group I. . . .	68·2″	69·1″	69·1″	69·6″

On the average, therefore, the W. Midland heights are about 1½″ below the average stature quoted in the anthropometrical report of 1883.

Turning to the weight tables for the same group of W. Midland men the salient feature is that in no age group in any of the constituent areas (Birmingham, Burslem, Dudley, Worcester, Coventry, Shrewsbury, Hertford, Leamington, Walsall and Wolverhampton) is there a higher average than 137½ lb. Among all the 240 groups in the series only 71 show an average weight of 130 lb. or over, while in all the 24 age groups in Birmingham (which include nearly 20,000 men) there are only 5 groups of 130 lb. and upwards, and no age group under 30 years reaches an average of 130 lb. Comparing the Birmingham figures with those of the Anthropometrical Committee's report (with a deduction of 9 lb. for clothes) it is found that the Birmingham figures are lower throughout to the following extent: at 18 years 11½ lb., at 20 years 14 lb., at 25 years 13¼ lb., at 30 years 21 lb., at 35 years 27·5 lb., at 40 years 21·6 lb. The other industrial communities (Burslem, Dudley, Walsall, Wolverhampton and Coventry) show similar deficiencies. The agricultural communities (Worcester and Shrewsbury) show the best weights, but still below those found by the Anthropometrical Committee to the extent shown in this table:—

Weight in Pounds.

Age	18 years	25 years	30 years	35 years	40 years
Worcester . . .	10 lb.	11 lb.	20¾ lb.	22 lb.	21 lb.
Shrewsbury . .	2½ lb.	9 lb.	19¾ lb.	24 lb.	23 lb.

These comparisons speak for themselves.

The average stature and weight of individuals furnish a valuable criterion of the health and physical capacity of a community, and these figures clearly indicate the deleterious effect of modern conditions of life upon the population. This conclusion is further borne out by an investigation of the principal measurements of groups of Grade I. men from every area in Great Britain, which show that the average for a Grade I. man is as follows:—

Height	Weight	Chest girth
5 ft. 6 in.	127·2 lb.	35 in.

Due precautions were taken to insure that these groups were as far as possible representative of the whole, and the results in different parts of the country showed surprisingly small variations from the average. We must therefore conclude that a man presenting the above measurements is to be regarded as an average specimen of the male Briton, who has attained the full normal standard of health and physique—a conclusion which can hardly be regarded with satisfaction. With regard to Grade I. youths of 18 years, similar data for all areas are unfortunately not available, but the average for a considerable group in the N.W. region worked out as follows:—

Height	Weight	Chest girth
5 ft. 5 in.	117·3 lb.	33·4 in.

If we accept this group of youths as representative (and there is no reason to think it is not so) and compare these figures with the corresponding measurements of the Grade I. men, we find that the average increase between 18 years and full development is 1 in. in stature, 9·9 lb. in weight, and 1·6 in. in chest girth. Now we know from the experience of the army, both in peace-time and during the war, that much better results can be obtained by making youths and young men live a hygienic life, with proper food and attention to their physical development. The present figures therefore show clearly that the average conditions of life to-day have produced and are producing physical results on the rising generation which are greatly to be deplored.

One other table printed in the report is of special significance—comment is superfluous.

Average Measurement of 36 Youths of 18 Years Rejected for Poor Physique.

Height	Weight	Chest girth
4 ft. 9 in.	84 lb.	29·9 in.

In conclusion let us consider the main facts of this physical census in the light of the method of comparisons suggested by Prof. Arthur Keith. He shows that on theoretical grounds it is to be expected that the complex quality of physical fitness is distributed among a healthy population in the same proportions as has been found for the distribution of other physical attributes. If this reasoning is correct we ought to find in a healthy population that the numbers of men in each grade of fitness bear a constant relation to each other in the following proportions:—

Grade I.	70 %
Grade II.	20 %
Grade III.	7·5 %
Grade IV.	2·5 %

Actual experience testifies to the truth of this inference: thus a "comb-out" of miners (a group of the community known to enjoy a good standard of health and physique) in the summer of 1918 yielded the following result:—

Grade I.	76 %
Grade II.	12 %
Grade III.	10 %
Grade IV.	4·2 %

Another group of miners yielded Grade I. 76%, Grade II. 19%, Grade III. 11%, Grade IV. 3%. Results such as these (and there are numerous other examples) prove the soundness of Prof. Keith's reasoning, and show that in healthy sections of the community his standard is reached and even exceeded.

This standard may be represented graphically, and it is instructive to place alongside this representation of what we may regard as the normal standard for a healthy community a similar graph representing the proportions actually found in the total gradings during the whole year's work in Great Britain (the figures have been given above).

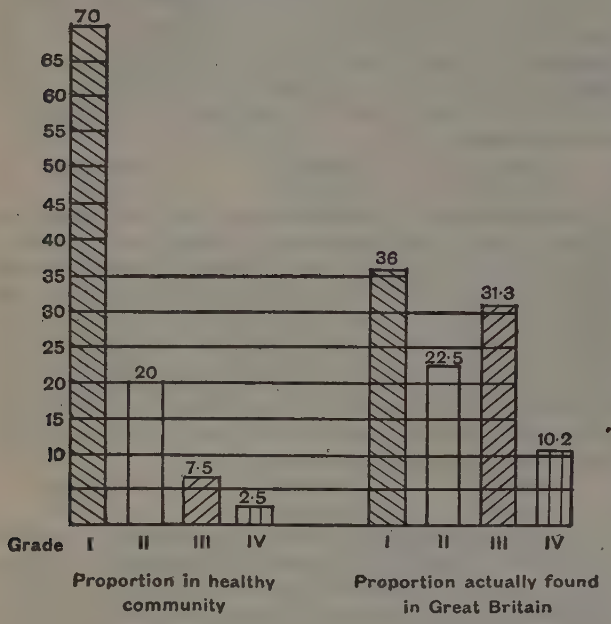

These two diagrams show graphically the differences between the relative proportions of men of the four grades of fitness actually found and the standard relative proportions in a healthy community. In actual numbers the difference works out as follows: Among the 2½ million examinations there was in Grade I. a deficiency of 825,000, in Grade II. an excess of 61,000, and the alarming excess of no less than 575,000 in Grade III., and 190,000 in Grade IV.

With such results before them the committee which presented the report express surprise that with human material of such physical quality it was found possible to create the invincible armies which overthrew the Germans. We may well share their surprise, and indorse their opinion that the spirit of the race, which alone made this possible, deserves that no effort should be spared to ameliorate the conditions which had brought about such deplorable effects upon the national health and physique.

(H. W. K.)

The Post-War Army

The development of British military organization from 1910 to the end of the World War is treated under the heading ARMY, section *British Army*. The period immediately following a war of any importance usually sees many changes in army organization based upon the experiences gained during the war, and the years directly following the War of 1914–8 were no exception in this respect. The years 1919–21 were devoted to incorporating into the British army organization various essential innovations which a war of such magnitude was bound to produce.

Generally speaking, the war had shown that the broad framework of army organization, as it existed in 1914, had been built upon sound lines. In certain respects, it is true, defects had been found in this organization, *e.g.* an inelasticity in the system which failed adequately to provide for the expansion entailed when a nation is absorbed into military service; but these defects were connected more with details than with broad principles. Army reorganization had still to provide for an expeditionary force, trained garrisons for maintaining the various parts of the Empire, and home defence. To make provision for carrying out these duties, therefore, the after-war army was organized, in its main outlines, similarly to what it had been in 1914. This organization may be described as an expeditionary force, formed almost entirely of regular soldiers with their reserves, backed up and supplemented by the militia; whilst the territorial army, composed of troops which would require several months' training on mobilization to fit them to take their place in the field, would be available for expanding the expeditionary force, should a state of national emergency arise.

It may be noted that the old name "militia" once again found a place in army nomenclature (although this force had not yet been finally reconstituted by the end of 1921); when organized its functions were to remain identical with those of the Special Reserve in 1914. Briefly, these may be enumerated as completing the establishment of the expeditionary force on mobilization and providing drafts for the regular units during the first few months of war, after those provided from the regular reserves have become exhausted. The militia is also required to produce on mobilization certain technical personnel, whose work in war, being akin to that performed in peace, would need but little military training to fit them to take their place in regular units in the field. The rôle of the reorganized militia, therefore, may be considered as the definite one of being a reserve to the regular army, without any idea of its units being employed as a separate force. It may further be noted that the name of the old territorial force has been changed to that of "Territorial Army." The special functions of this army remain the same as they were in 1914; but the organization to enable those duties to be carried out has been altered in conformity with the lessons learnt during the war. The after-war territorial formations, in fact, have been shaped into an exact counterpart of their prototypes in the regular army, and this has entailed certain units, which had existed in 1914, becoming surplus to requirements; such units had either to be merged into new ones or disbanded. It was on this account that many of the old mounted yeomanry regiments became surplus to the actual needs of the army, and were offered conversion into other arms of the service which the war had shown to be necessary for modern war, but which had no place in the pre-war territorial organization, *e.g.* army field artillery brigades and armoured car companies. Similarly surplus infantry battalions were asked to convert into other arms of the service in which the pre-war territorial army organization was deficient. The establishment of the territorial force in 1914 was some 314,000, all ranks. The establishment of the reconstituted territorial army in 1921–2 was some 220,000, all ranks.

Whilst the broad outlines of army organization remained in 1921 practically identical with what existed in 1914, the organization of the various formations for war underwent some modifications. Notably was this the case in the additions made to the Royal Artillery and Royal Engineers, both in army and divisional troops, and the new units were added as a result of war experience, *e.g.* Tank Corps, Signal Corps. But whilst changes naturally had to take place, the infantry allotted to formations still remained unchanged; for instance a division comprised 3 infantry brigades as formerly, and infantry brigades once again were composed of 4 battalions, as in 1914, instead of the 3-battalion brigades which force of circumstances had imposed towards the latter part of the war.

Broadly speaking, the greatest changes which have been made in army organization may be attributed to two main causes:—necessity for increased firepower and improved mechanical science. As coming under the former heading, first and foremost may be cited the artillery. Yearly, as the war had progressed, heavier and still heavier calibres of artillery had been brought into the field; and the number of guns which had been considered sufficient in 1914, had been multiplied several times by the end of the war. The reorganization of the artillery, therefore, had to take into account, and make provision for, this increased need of artillery.

The peace organization of the artillery includes not only horse and field artillery but also medium artillery as well. On the other hand the horse-drawn 60-pdr. battery, which formed part of the divisional artillery in 1914, no longer exists. In pre-war days the heaviest mobile gun or howitzer figuring in the British artillery organization was the 6-in. howitzer. During the war ordnance of heavier calibre was introduced into the field, and the new peace organization provides for this. Provision is also made for anti-aircraft artillery.

Not only in the artillery has the war led to changes in organization, but practically all arms have undergone some modifications as its result. During the war Hotchkiss guns were introduced into the cavalry, and Lewis guns into the infantry; both these weapons still remain as part of the peace organization of these two arms. The machine-gun also continues to find a place in their organization, as was the case in 1914. In this connexion it may be noted that during the war a Machine-Gun Corps was built up. Shortly after the war ended, however, this corps ceased to form part of the peace organization, because the machine-gun was considered to be a weapon of not sufficiently distinctive type to justify its being considered a separate arm of the service when its rôle was obviously ancillary to both cavalry and infantry.

Under the heading of improved mechanical science, the outstanding feature is the tank. Its success during the war had insured it a place in the army reorganization. It was now incorporated as the Tank Corps. This corps, which is capable of expansion, consists in peace of 4 tank battalions, a depot and an artificer-training battalion. In addition there is an experimental establishment. In peace the organization of a tank battalion consists of 3 companies, each of which is split up into 3 sections. Another product of the war, somewhat akin to the tank and consequently incorporated as part of its organization, is the armoured-car. Armoured-cars are organized in companies. During the war armoured-cars proved so highly efficient for use in some of the outlying portions of the Empire, that their inclusion as part of the peace organization was indicated. But it remained uncertain in 1921 how far the Tank Corps organization might develop.

Another corps which has arisen in the application of science to war, is the Signal Corps. Before the war the Signal Service was in its infancy. The whole service then consisted of 66 officers and 1,534 other ranks, who formed part of the Corps of Royal Engineers. The war showed the need for rapid, accurate and alternative methods of communication, and the result was the formation of the Signal Corps. This corps is so organized as to be capable of division into several self-contained units; thus a divisional signal company not only controls all the signal communications at divisional headquarters, but it detaches a section for work with each infantry brigade, and other sections for work with the divisional artillery. The corps is responsible for dealing with all forms of communication, both visual, airline, cable and wireless, also for despatch riding.

Mechanical science has also led to a much greater use of mechanical transport than had ever been contemplated in pre-war days. The reliability maintained by M.T. vehicles has had the effect of gradually lessening the numbers of horse-drawn vehicles in the army. This can be seen by the increased number of M.T. units now forming part of the peace organization of the R.A.S.C. compared with the number existing before the war.

The war also showed that the 1914 organization included an insufficient number of Royal Engineers allotted to divisions. In 1914 the number of field companies with divisions was two. This new peace organization makes provision for an additional one, and provides as well for the carrying out of the larger R.E. services required by divisions, *e.g.* electric lighting of divisional headquarters, water supply, accommodation, etc. Moreover, as a result of the war, the Royal Engineers make provision for electrical and mechanical companies. The special rôle of these companies is the repair and construction of electrical installations, mechanical plant and installation of workshops.

It was not only in organization that the war led to changes, but it also had the effect of causing improvements to be made in the education of the soldiers. It was felt that greater advantage might be taken of the age at which the majority of youths entered the army to continue their education. For this reason a new corps, called the Army Educational Corps, was included as part of the army organization. This is a small corps composed mainly of officers, which took the place of the pre-war army schoolmasters. Both at home and abroad officers of the Army Educational Corps are distributed among the various units whose chief duty it is to coördinate the education in the various units and to set out the lines on which it is to be carried out.

Yet another addition was made to the peace organization of the army shortly after the war in the shape of the Corps of Military Accountants. This is a completely new corps, by which is meant that it had no counterpart of any description in the pre-war organization. It is a small corps with an establishment of approximately 1,000, all ranks. The purposes for which it was formed was for the compilation of cost accounts.

The development of aerial navigation caused a separate Air Ministry to be set up during the war. This arrangement was continued in the after-war organization; so that whereas in 1914 the Royal Flying Corps formed part of both the navy and army organization, this is no longer the case; the Royal Air Force being almost entirely divorced from army administration.

Shortly after the war alterations and additions were made to the rates of pay of both officers and other ranks throughout the army. In pre-war days the rates of pay varied in different corps; this procedure ceased and a universal rate for all corps was substituted. The additions were based on the high cost of living existing at the date of alteration, and were subject to revision after five years. As an example, the pay per annum of a second lieutenant and a private in the infantry in pre-war days was approximately £96 and £24 respectively. Their respective rates of pay under the new rates worked out at £237 and £59.

Before the war the total peace establishment of the regular army, exclusive of India, comprised some 9,500 officers and 163,000 other ranks. In 1921–2 the establishments of the regular army, again exclusive of India, made provision for 15,000 officers and 186,000 other ranks. (B. B.-H.)

UNITED STATES, THE (*see* 27.612*).—This article describes the development of the United States from the close of the first decade of the 20th century, as shown roughly by the census of 1910 and the Congressional elections of that year, to the close of the Washington Conference early in 1922. This period of 12 years, covering the World War and America's part in it, the shifting of the United States from the position of a debtor to that of a creditor nation, a vast increase in wealth and world influence, and many other changes scarcely less important, is from an international as well as a domestic point of view one of the most important in American history. The main facts of the period are outlined in this article, but for many of the details other articles must be consulted; and the reader who would consider the full perspective should read those as well as this, as should also the reader who desires detailed information on any one point. The articles on the various states contain details of their respective population, agriculture, manufactures, education and political history; data more local appear in articles on the more important cities. A full list of the articles relating to the United States will be found in the Classified Table of Articles which precedes the List of Contributors at the end of Vol. XXXII., but we may name here the leading articles in the more important divisions of the subject. Details of population, supplementing the various summaries contained in the first section, *Statistics*, of the present article, will be found in the articles on separate states and in the articles Negro and Public Assistance. Many economic questions are treated fully in such articles as Banking, Federal Reserve Banking System, Federal Farm Loan Board, Excess Profits Duty, Income Tax, City Government, Interstate Commerce, Conservation Policy, Insurance, Cost of Living, Food Supply, Rationing, Marketing, Price Control, Profiteering, Profit-Sharing, Savings Movement, etc. For industrial development see also the articles Shipping, Railways, Telegraph, Telephone, and Electricity Supply, as well as those on important industries such as Coal, Copper, Cotton and Cotton Industry, Dyeing, Petroleum, Iron and Steel. Various phases of labour are discussed under Arbitration and Conciliation in Labour Disputes, Labour Legislation, Labour Supply and Demand, Strikes and Lockouts, Trade Unions, Unemployment and Wages. For social and welfare work, read also Housing; Hospitals; Juvenile Employment; Children, Laws Relating to; Liquor Laws; Prohibition; and Public Assistance. For recent developments in education, arts and letters, see besides the articles on Harvard, Yale, Princeton, etc., the articles Education, Medical Education, Architecture, Arts and Crafts, Painting, Sculpture, American Literature. For recent changes in the status of women, see further Woman Suffrage; Women; Women's Employment; Women Police; Women, Legal Status of. The section *History* of the present article may be supplemented by articles such as Army, Ship and Shipbuilding, World War, Liberty Loan Publicity Campaigns, Munitions of War, Women's War Work, Washington Conference, and by the biographies of political leaders and public officials. The present article has eight sections: *Statistics*, *Agriculture*, *Finance*, *Taxation*, *Social and Welfare Work*, *The American Labour Movement*, *Military Law*, and *History*, in the order named.

I.—Statistics

In 1920 the pop. of the United States (excluding all outlying possessions) was 105,710,620, as compared with 91,972,266 in 1910. The rate of increase between these two dates, 14·9%,

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**** These figures indicate the volume and page number of the previous article.***

was considerably less than in the preceding decades. Never before in a 10-year period had the rate of increase fallen below 20 per cent. The decline was due to the large falling off of immigration in the last half of the decade, and in some slight degree to the epidemic of influenza in 1918, as well as to the casualties resulting from the World War. It was estimated that the pop. of the outlying possessions was 12,148,875, of which the Philippine Is. furnished more than 10,000,000. The total pop. of the United States with its outlying possessions in 1920, therefore, numbered 117,859,495. Excluding the outlying possessions, the total addition to the pop. in the decade 1910–20 was 13,738,354 as compared with nearly 16,000,000 in the previous decade.

The accompanying table shows the pop. by territorial divisions and component states, with changes between 1910 and 1920.

Increase of Population

	1920	1910	Increase	Increase per cent
NEW ENGLAND				
Maine	768,014	742,371	25,643	3·5
New Hampshire	443,083	430,572	12,511	2·9
Vermont	352,428	355,956	−3,528	−1·0
Massachusetts	3,852,356	3,366,416	485,940	14·4
Rhode Island	604,397	542,610	61,787	11·4
Connecticut	1,380,631	1,114,756	265,875	23·9
	7,400,909	6,552,681	848,228	12·9
MIDDLE ATLANTIC				
New York	10,385,227	9,113,614	1,271,613	14·0
New Jersey	3,155,900	2,537,167	618,733	24·4
Pennsylvania	8,720,017	7,665,111	1,054,906	13·8
	22,261,144	19,315,892	2,945,252	15·2
EAST NORTH CENTRAL				
Ohio	5,759,394	4,767,121	992,273	20·8
Indiana	2,930,390	2,700,876	229,514	8·5
Illinois	6,485,280	5,638,591	846,689	15·0
Michigan	3,668,412	2,810,173	858,239	30·5
Wisconsin	2,632,067	2,333,860	298,207	12·8
	21,475,543	18,250,621	3,224,922	17·7
WEST NORTH CENTRAL				
Minnesota	2,387,125	2,075,708	311,417	15·0
Iowa	2,404,021	2,224,771	179,250	8·1
Missouri	3,404,055	3,293,335	110,720	3·4
North Dakota	646,872	577,056	69,816	12·1
South Dakota	636,547	583,888	52,659	9·0
Nebraska	1,296,372	1,192,214	104,158	8·7
Kansas	1,769,257	1,690,949	78,308	4·6
	12,544,249	11,637,921	906,328	7·8
SOUTH ATLANTIC				
Delaware	223,003	202,322	20,681	10·2
Maryland	1,449,661	1,295,346	154,315	11·9
District of Columbia	437,571	331,069	106,502	32·2
Virginia	2,309,187	2,061,612	247,575	12·0
West Virginia	1,463,701	1,221,119	242,582	19·9
North Carolina	2,559,123	2,206,287	352,836	16·0
South Carolina	1,683,724	1,515,400	168,324	11·1
Georgia	2,895,832	2,609,121	286,711	11·0
Florida	968,470	752,619	215,851	28·7
	13,990,272	12,194,895	1,795,377	14·7
EAST SOUTH CENTRAL				
Kentucky	2,416,630	2,289,905	126,725	5·5
Tennessee	2,337,885	2,184,789	153,096	7·0
Alabama	2,348,174	2,138,093	210,081	9·8
Mississippi	1,790,618	1,797,114	−6,496	−0·4
	8,893,307	8,409,901	483,406	5·7
WEST SOUTH CENTRAL				
Arkansas	1,752,204	1,574,449	177,755	11·3
Louisiana	1,798,509	1,656,388	142,121	8·6
Oklahoma	2,028,283	1,657,155	371,128	22·4
Texas	4,663,228	3,896,542	766,686	19·7
	10,242,224	8,784,534	1,457,690	16·6
MOUNTAIN				
Montana	548,889	376,053	172,836	46·0
Idaho	431,866	325,594	106,272	32·6
Wyoming	194,402	145,965	48,437	33·2
Colorado	939,629	799,024	140,605	17·6
New Mexico	360,350	327,301	33,049	10·1
Arizona	334,162	204,354	129,808	63·5
Utah	449,396	373,351	76,045	20·4
Nevada	77,407	81,875	—4,468	—5·5
	3,336,101	2,633,517	702,584	26·7
PACIFIC				
Washington	1,356,621	1,141,990	214,631	18·8
Oregon	783,389	672,765	110,624	16·4
California	3,426,861	2,377,549	1,049,312	44·1
	5,566,871	4,192,304	1,374,567	32·8

There was no change beween 1910 and 1920 in the relative rank of the territorial divisions, and only minor shiftings for most of the states, California rising from 12th to 8th place. The territorial divisions may be further condensed into geographic sections—north (comprising New England, Middle Atlantic states, and the two North Central divisions), south (comprising the South Atlantic and South Central divisions) and west (including the Mountain and Pacific states). This gives the following distribution:—

	1920	Per cent of total	Increase over 1910	Rate of increase
North	63,681,845	60·2	7,924,730	14·0
South	33,125,803	31·3	3,736,473	12·7
West	8,902,972	8·5	2,077,151	30·4
Total U.S.	105,710,620	100·0	13,738,354	14·9

More than one-half the increase in pop. was found in the north, and the rate of gain in this section was greater than in the south, but less than in the west represented by the Mountain and Pacific Coast states.

Sex.—By sex the pop. in 1920 was divided: males 53,900,376; females, 51,810,244. This gives 104 males to 100 females. The excess of males is attributable in part to immigration, for in the foreign-born pop. the males greatly outnumber the females. In a few states the females are in excess of males; in Massachusetts the number of males was 96·3 to 100 females; in Rhode Island, 97. This is probably due to the inflow of female operatives to the textile factories. In some of the far-western states the proportion of males to females runs very high, as in Nevada, 148·4; Wyoming, 131·3; Arizona, 121·9. The mining industry accounts for these differences. The two sexes in these sections, however, are nearer in numbers than in 1910. In the earlier year the ratio of males for the Mountain states was 128 to 100 females, while in 1920 it fell to 115·7. In the Pacific states the ratio dropped from 130 to 114. This is evidence that these sections are rapidly approaching the standard forms of family life which obtain in the older portions of the country.

Negroes.—The negro pop. in 1920 was nearly 10% of the total pop.—10,463,131 in a total of 105,710,620. This was an increase of 635,368 or 6·5% since 1910, as compared with 11·4% in the previous decade, and 13·8% between 1890 and 1900. The percentage of negroes in the total pop. is diminishing; in 1900 it was 11·6%; in 1910, 10·7% and in 1920, 9·9%. The number of negroes per 1,000 whites was 132 in 1900; 120 in 1910 and 110 in 1920. Although complete data are not available, it is believed that the birth-rate of negroes declined between 1900 and 1920 while the death-rate did not greatly change. The negro element in the south barely held its own in the 10 years 1910–20, numbering 8,912,259 in 1920 as compared with 8,749,427 in 1910. This was a gain for this section of less than 2 per cent. In the south as a whole the percentage of negroes in the total pop. declined from 29·8 to 26·6. In 1920, in South Carolina and Mississippi the negroes still outnumbered the whites; in Kentucky, Tennessee, Alabama, Mississippi and Louisiana, however, there was an actual falling off in the negro population. There was a marked gain in the number of negroes in the north, 9·43%, showing that negroes were migrating in considerable numbers to the industrial centres of that section. The negro pop. of Michigan increased from 17,000 in 1910 to over 60,000 in 1920. (*See* NEGRO.)

The number of Indians declined from 265,683 in 1910 to 242,959 in 1920. This apparent decrease, however, is probably due to the fact that in 1910 persons with only slight traces of Indian blood were enumerated as Indians, and in 1920 were classified as whites.

The Chinese also decreased in number, as might be expected from the policy of exclusion; in 1910 there were 71,531 and in 1920 61,686. The number of Japanese, however, increased from 72,157 to 111,025, or 53·86 per cent. About 30,000 of this increase is credited to California and a little over 4,000 to the state of Washington.

Foreign-born.—The foreign-born white pop., owing to the check in immigration resulting from the World War, increased but slightly, from 13,345,545 to 13,712,754, or 2·7 % between 1910 and 1920, as against an increase of 30·7 % between 1900 and 1910. The numerical increase in this group of the pop., 367,209, was much smaller than in any preceding decade since 1850. This element increased between 1910 and 1920 in 20 states and the District of Columbia, and decreased in 28 states: in the previous decade there was a gain in every state except five. Arizona and Texas showed the largest rate of increase, 67 % and 50 % respectively, due to Mexican immigration. Table 1 shows the foreign-born whites for the four states having over 1,000,000 of this element in 1920. In 1910 the foreign-born whites constituted 14·5 % of the total pop. of the United States and in 1920, 13 per cent. The nativity of the white pop. in 1920 is shown in Table 2. Little over one-half of the total white pop., 55·3 %, was native-born with native-born parents. In New England only 30·8 % were in this group; and in Massachusetts less than one-third, 31·9 %. According to the post-war map, the countries from which had come the largest numbers of foreign-born whites who were in the United States in 1920, were Germany, 1,686,102; Italy, 1,610,109; Russia, 1,400,489; Poland, 1,139,978; Canada, 1,117,878; Ireland, 1,037,233; England, 812,828; Sweden, 625,580; Austria, 575,625.

TABLE 1. *Foreign-born Whites.*

State	1920	1910	1900	Per cent increase 1910–20	Per cent increase 1900–10
Illinois . . .	1,204,403	1,202,560	964,635	0·2	24·7
Massachusetts .	1,077,072	1,051,050	840,114	2·5	25·1
New York . .	2,783,773	2,729,272	1,889,523	2·0	44·4
Pennsylvania .	1,387,298	1,438,719	982,543	−3·6	46·4

TABLE 2. *Nativity of Whites, 1920.*

	Number	Per cent
Native parentage	58,421,957	55·3
Foreign parentage	15,694,539	14·8
Mixed parentage	6,991,665	6·6
Total native-born	81,108,161	76·7
Foreign-born white	13,712,754	13·0
Total white	94,820,915	89·7
Negro	10,463,131	9·9
Other non-white races . . .	426,574	0·4
Total pop.	105,710,620	100·0

The following figures show the total number of foreign-born whites in certain states, with the foreign country which had furnished the largest number in that state: California, 681,662 (Italy, 88,502); Illinois, 1,204,403 (Germany, 205,491); Massachusetts, 1,077,534 (Ireland, 183,171); Michigan, 726,635 (Canada, 164,502); Minnesota, 486,164 (Sweden, 112,117); New Jersey, 738,613 (Italy, 157,285); New York, 2,786,112 (Italy, 545,713); Ohio, 678,697 (Germany, 111,893); Pennsylvania, 1,387,850 (Italy, 222,764); Texas, 360,519 (Mexico, 249,652); Wisconsin, 460,128 (Germany, 151,250).

In connexion with the problems of Americanization the statistics of citizenship of the foreign-born whites are of interest. In 1920 12,498,334, or 94 % of this element, were 21 years of age and over; 6,928,027 were men and 5,570,307 were women. Table 3 shows the number in 1920 naturalized, those who had taken out first papers, aliens and those for whom no reports were obtained.

TABLE 3. *Naturalizations, 1920.*

	Men		Women	
	Number	Per cent	Number	Per cent
Naturalized . .	3,314,577	47·8	2,893,785	52·0
First papers . .	1,116,698	16·1	77,558	1·4
Alien	2,138,205	30·9	2,226,690	40·0
No reports. . .	358,547	5·2	372,274	6·7

In 1910, 45·61 % of the men were naturalized as compared with 47·8 % in 1920, and only 8·6 % had taken out first papers, as compared with 16·1 % in 1920.

Statistics of immigration are often inaccurately used, no allowance being made for departures. Increasing facilities in ocean transportation, and the higher wages received by immigrants, enabling them to travel, led to a constant stream of departures in the decade 1910–20. In order to determine the net increase of pop. by immigration, it is necessary, therefore, to determine both arrivals and departures. Table 4 compiled by the Bureau of Immigration, shows the changes for the 11 years 1910–20.

TABLE 4. *Immigrants, in thousands.*

	Admitted			Departed			
	Immigrant	Non-immigrant	Total	Emigrant	Non-emigrant	Total	Added to pop.
1910 . .	1,042	156	1,198	202	178	380	818
1911 . .	878	152	1,030	296	222	518	512
1912 . .	838	179	1,017	333	282	615	402
1913 . .	1,198	229	1,427	308	304	612	815
1914 . .	1,218	185	1,403	303	330	634	769
1915 . .	327	107	434	204	180	384	50
1916 . .	299	68	367	130	111	241	126
1917 . .	295	67	363	66	80	146	216
1918 . .	111	101	212	94	99	193	19
1919 . .	141	96	237	123	93	216	21
1920 . .	430	192	622	288	140	428	194

Beginning with 1915 there was a marked decline in immigration, due to the World War. In the five years 1910–4, the total number of immigrants was 5,174,000, and in the succeeding five years ending in 1919, only 1,173,000.

Immigrants may be classified (1) as to race or people and (2) as to country of last residence. The first is of importance as an index of the contribution of ethnic traits and characteristics; and the second as throwing light upon previous training of immigrants in social and political institutions. Tables 5 and 6 show immigration by race and by countries, for a few of the most important groups, for the years 1910 and 1920.

TABLE 5. *Immigrant Aliens, by Race.*

Race or people	1920		1910	
	Number	Per cent of total	Number	Per cent of total
Croatian and Slovenian .	493	—	39,562	4
Dutch and Flemish . .	12,730	3	13,012	1
English	58,366	14	53,498	5
French	27,390	6	21,107	2
German	7,338	2	71,380	7
Greek	13,998	3	39,135	4
Hebrew	14,292	3	84,260	8
Irish	20,784	4	38,382	4
Italian, North . . .	12,918	3	30,780	3
Italian, South . . .	88,882	21	192,673	19
Lithuanian. . . .	422	—	22,714	2
Magyar	252	—	27,302	3
Mexican	51,042	12	17,760	2
Polish	2,519	—	128,348	13
Portuguese. . . .	15,174	4	7,657	7
Ruthenian	258	—	27,907	3
Scandinavian . . .	16,621	4	52,037	5
Scotch	21,180	5	24,612	2
Spanish	23,594	5	5,837	—

TABLE 6. *Immigrant Aliens, by Country.*

	1920		1910	
	Number	Per cent of total	Number	Per cent of total
Austria	268	—	135,793	13
Hungary	84	—	122,944	12
Germany	1,001	—	31,283	3
Greece	11,981	3	25,888	2
Italy	95,145	22	215,537	21
Russia	995	—	186,792	18
England	27,871	6	46,706	5
Ireland	9,591	2	29,855	3
Norway	4,445	1	17,538	2
Portugal	15,472	4	8,229	1
Sweden	5,862	1	23,745	2
Turkey in Europe . .	1,933	—	18,405	2
Turkey in Asia . . .	5,033	1	15,212	1
British North America .	90,025	21	56,555	5
Mexico	52,361	12	18,691	2

It will be observed that in 1920 there was a change in the racial composition of immigration as compared with 1910. The proportion of Italians was about the same, but immigration from eastern European stocks fell off. Immigration from Austria, Hungary, Germany and Russia practically stopped after 1917. Immigration from the northern border, of both English and French Canadians, and from the southern part of Mexico, had greatly increased. Until the World War, Europe was the chief source of immigration to the United States, furnishing 90 % of the total. The percentage coming from Europe fell, however, to 60 % in 1915, 50 % in 1916, 45 % in 1917, 28 % in 1918 and 17 % in 1919. In 1920 it rose to 57 %. After the war the return movement to Europe increased, and in 1920 emigration to that continent was in excess of immigration from it. This excess was due to emigration to south-eastern Europe rather than to the northern and western sections. The proportion of females among the immigrant aliens in 1920 was 42·4%, as compared with 33·4% in the years 1910–4. For Greeks the female percentage increased from 9 to 20, and for Italians from 5 to 48. This suggests that the immigration of these peoples might prove to be more permanent than in the past.

In 1917 a literacy test was imposed upon immigrants, exemptions being made in certain cases, as for example, to those who came to the United States to join relatives or who would have been subject to religious persecution at home. As a result only 15,094 illiterate immigrants 16 years of age and over, or 4·4%, were admitted in 1920. During the years 1908–17, 1,617,000 illiterate immigrants 14 years of age and over were admitted. Undoubtedly the new restriction should show in the course of the decade 1920–30 a marked effect upon the degree of illiteracy in the United States. By the Immigration Act passed in 1921 the number of immigrants admitted from any one country in the year July 1 1921 to June 20 1922, was restricted to 3% of the persons of that nationality resident in the United States in 1910. Only 358,000 immigrants, therefore, could be eligible for admittance during the year 1921–2. The United Kingdom was limited to 77,200; Germany to 68,000; Italy to 42,000; Russia to 34,200 and Poland to 25,800.

Urban and Rural Population.—The tendency of the population to concentrate in towns and cities continued unabated. In 1910 the percentage of the pop. living in urban territory (that is, in cities and other incorporated places of 2,500 inhabitants or more, and in towns of that size in Massachusetts, New Hampshire and Rhode Island) was 46·3 per cent. In 1920 the percentage was 51·4, showing that more than one-half of the pop. was then living in urban territory as defined by the Census Bureau.

Table 7 shows the pop. of cities having 50,000 inhabitants or more in 1920 with comparison for 1910.

TABLE 7. *Cities with 50,000 Inhabitants or More.*

Rank		1920	1910	Percentage increase
1	New York, N. Y.	5,620,048	4,766,883	17·9
2	Chicago, Ill.	2,701,705	2,185,283	23·6
3	Philadelphia, Pa.	1,823,779	1,549,008	17·7
4	Detroit, Mich.	993,678	465,766	113·3
5	Cleveland, O.	796,841	560,663	42·1
6	St. Louis, Mo.	772,897	687,029	12·5
7	Boston, Mass.	748,060	670,585	11·6
8	Baltimore, Md.	733,826	558,485	31·4
9	Pittsburgh, Pa.	588,343	533,905	10·2
10	Los Angeles, Cal.	576,673	319,198	80·7
11	Buffalo, N. Y.	506,775	423,715	19·6
12	San Francisco, Cal.	506,676	416,912	21·5
13	Milwaukee, Wis.	457,147	373,857	22·3
14	Washington, D. C.	437,571	331,069	32·2
15	Newark, N. J.	414,524	347,469	19·3
16	Cincinnati, O.	401,247	363,591	10·4
17	New Orleans, La.	387,219	339,075	14·2
18	Minneapolis, Minn.	380,582	301,408	26·3
19	Kansas City, Mo.	324,410	248,381	30·6
20	Seattle, Wash.	315,312	237,194	32·9
21	Indianapolis, Ind.	314,194	233,650	34·5
22	Jersey City, N. J.	298,103	267,779	11·3
23	Rochester, N. Y.	295,750	218,149	35·6
24	Portland, Ore.	258,288	207,214	24·6
25	Denver, Col.	256,491	213,381	20·2
26	Toledo, O.	243,164	168,497	44·3
27	Providence, R. I.	237,595	224,326	5·9
28	Columbus, O.	237,031	181,511	30·6
29	Louisville, Ky.	234,891	223,928	4·9
30	St. Paul, Minn.	234,698	214,744	9·3
31	Oakland, Cal.	216,261	150,174	44·0
32	Akron, O.	208,435	69,067	201·8
33	Atlanta, Ga.	200,616	154,839	29·6
34	Omaha, Neb.	191,601	124,096	54·4
35	Worcester, Mass.	179,754	145,986	23·1
36	Birmingham, Ala.	178,806	132,685	34·8
37	Syracuse, N. Y.	171,717	137,249	25·1
38	Richmond, Va.	171,667	127,628	34·5
39	New Haven, Conn.	162,537	133,605	21·7
40	Memphis, Tenn.	162,351	131,105	23·8
41	San Antonio, Tex.	161,379	96,614	67·0
42	Dallas, Tex.	158,976	92,104	72·6
43	Dayton, O.	152,559	116,577	30·9
44	Bridgeport, Conn.	143,555	102,054	40·7
45	Houston, Tex.	138,276	78,800	75·5
46	Hartford, Conn.	138,036	98,915	39·6
47	Scranton, Pa.	137,783	129,867	6·1
48	Grand Rapids, Mich.	137,634	112,571	22·3
49	Paterson, N. J.	135,875	125,600	8·2
50	Youngstown, O.	132,358	79,066	67·4
51	Springfield, Mass.	129,614	88,926	45·8
52	Des Moines, Ia.	126,468	86,368	46·4
53	New Bedford, Mass.	121,217	96,652	25·4
54	Fall River, Mass.	120,485	119,295	1·0
55	Trenton, N. J.	119,289	96,815	23·2
56	Nashville, Tenn.	118,342	110,364	7·2
57	Salt Lake City, Utah	118,110	92,777	27·3
58	Camden, N. J.	116,309	94,538	23·0
59	Norfolk, Va.	115,777	67,452	71·6
60	Albany, N. Y.	113,344	100,253	13·1
61	Lowell, Mass.	112,759	106,294	6·1
62	Wilmington, Del.	110,168	87,411	26·0
63	Cambridge, Mass.	109,694	104,839	4·6
64	Reading, Pa.	107,784	96,071	12·2
65	Fort Worth, Tex.	106,482	73,312	45·2
66	Spokane, Wash.	104,437	104,402	
67	Kansas City, Kan.	101,177	82,331	22·9
68	Yonkers, N. Y.	100.176	79,803	25·5
69	Lynn, Mass.	99,148	89,336	11·0
70	Duluth, Minn.	98,917	78,466	26·1
71	Tacoma, Wash.	96,965	83,743	15·8
72	Elizabeth, N. J.	95,783	73,409	30·5
73	Lawrence, Mass.	94,270	85,892	9·8
74	Utica, N. Y.	94,156	74,419	26·5
75	Erie, Pa.	93,372	66,525	40·4
76	Somerville, Mass.	93,091	77,236	20·5
77	Flint, Mich.	91,599	38,550	137·6
78	Jacksonville, Fla.	91,558	57,699	58·7
79	Waterbury, Conn.	91,715	73,141	25·4
80	Oklahoma City, Okla.	91,295	64,205	42·2
81	Schenectady, N. Y.	88,723	72,826	21·8
82	Canton, O.	87,091	50,217	73·4
83	Fort Wayne, Ind.	86,549	65,933	35·4
84	Evansville, Ind.	85,264	69,647	22·4
85	Savannah, Ga.	83,252	65,064	28·0
86	Manchester, N. H.	78,384	70,063	11·9
87	St. Joseph, Mo.	77,939	77,403	0·7
88	Knoxville, Tenn.	77,818	36,346	114·1
89	El Paso, Tex.	77,560	39,279	97·5
90	Bayonne, N. J.	76,754	55,545	38·2
91	Peoria, Ill.	76,121	66,950	13·7
92	Harrisburg, Pa.	75,917	64,186	18·3
93	San Diego, Cal.	74,683	39,578	88·7
94	Wilkesbarre, Pa.	73,833	67,105	10·0
95	Allentown, Pa.	73,502	51,913	41·6
96	Wichita, Kan.	72,217	52,450	37·7
97	Tulsa, Okla.	72,075	18,182	296·4
98	Troy, N. Y.	72,013	76,813	−6·2
99	Sioux City, Ia.	71,227	47,828	48·9
100	South Bend, Ind.	70,983	53,684	32·2
101	Portland, Me.	69,272	58,571	18·3
102	Hoboken, N. J.	68,166	70,324	−3·1
103	Charleston, S. C.	67,957	58,833	15·5
104	Johnstown, Pa.	67,327	55,482	21·3
105	Binghamton, N. Y.	66,800	48,443	37·9
106	East St. Louis, Ill.	66,767	58,547	14·0
107	Brockton, Mass.	66,254	56,878	16·5
108	Terre Haute, Ind.	66,083	58,157	13·6
109	Sacramento, Cal.	65,908	44,696	47·5
110	Rockford, Ill.	65,651	45,401	44·6
111	Little Rock, Ark.	65,142	45,941	41·8
112	Pawtucket, R. I.	64,248	51,622	24·5
113	Passaic, N. J.	63,841	54,773	16·6
114	Saginaw, Mich.	61,903	50,510	22·6
115	Springfield, O.	60,840	46,921	29·7

TABLE 7—(*Continued*).

Rank		1920	1910	Percentage increase
116	Mobile, Ala.	60,777	51,521	18·0
117	Altoona, Pa.	60,331	52,127	15·7
118	Holyoke, Mass.	60,203	57,730	4·3
119	New Britain, Conn.	59,316	43,916	35·1
120	Springfield, Ill.	59,183	51,678	14·5
121	Racine, Wis.	58,593	38,002	54·2
122	Chester, Pa.	58,030	38,537	50·6
123	Chattanooga, Tenn.	57,895	44,604	29·8
124	Lansing, Mich.	57,327	31,229	83·6
125	Covington, Ky.	57,121	53,270	7·2
126	Davenport, Ia.	56,727	43,028	31·8
127	Wheeling, W. Va.	56,208	41,641	35·0
128	Berkeley, Cal.	56,036	40,434	38·6
129	Long Beach, Cal.	55,593	17,809	212·2
130	Gary, Ind.	55,378	16,802	229·6
131	Lincoln, Neb.	54,948	43,973	25·0
132	Portsmouth, Va.	54,387	33,190	63·9
133	Haverhill, Mass.	53,884	44,115	22·1
134	Lancaster, Pa.	53,150	47,227	12·5
135	Macon, Ga.	52,995	40,665	30·3
136	Augusta, Ga.	52,548	41,040	28·0
137	Tampa, Fla.	51,608	37,782	36·6
138	Roanoke, Va.	50,842	34,874	45·8
139	Niagara Falls, N.Y.	50,760	30,445	66·7
140	East Orange, N. J.	50,710	34,371	47·5
141	Atlantic City, N. J.	50,707	46,150	9·9
142	Bethlehem, Pa.	50,358	12,837	292·3
143	Huntington, W. Va.	50,177	31,161	61·0
144	Topeka, Kan.	50,022	43,684	14·5

The cities with increases of over 100% were Detroit, Mich., due to the development of the automobile industry; Akron, O., the home of several large rubber factories which manufacture tires for automobiles; Flint, Mich., also an automobile city; Tulsa, Okla., a centre of oil activity; Gary, Ind., a city recently built up by the U.S. Steel Corp.; Bethlehem, Pa., also a steel city; Knoxville, Tenn.; and Long Beach, Cal. With the exception of Bethlehem, no one of these cities is in the east.

Nearly one-fourth of the gain in the total pop. was due to the growth of the 12 largest cities, which in 1920 all had more than 500,000 inhabitants each. In 1910 there were only eight cities with a pop. of 500,000 or over. In the earlier year 12·5%, or one-eighth of the total pop., lived in cities of this size; in 1920 the proportion was 15·5%. In 1910 there were 42 cities with a pop. between 100,000 and 500,000; in 1920 there were 56.

Occupations.—The proportion of the pop. engaged in gainful occupations increased from 38·3% of the total pop. in 1900 to 41·5% in 1910. This was largely due to the greater number of females receiving wages. In 1900 the percentage of females 10 years of age and over in gainful occupations was 18·8; in 1910, 23·4, a gain of 4·6 per cent. The percentages for males for the two dates respectively were 80 and 81·3, a gain of only 1·3 per cent. Table 8 classifies those engaged in industry according to the principal divisions of occupations.

TABLE 8. *Industrial Occupations.*

Occupation	Number		Per cent.	
	1910	1900	1910	1900
Males:—				
Agricultural pursuits	10,760,875	9,404,429	35·8	39·6
Professional service	1,151,709	827,941	3·8	3·5
Domestic and personal service	2,740,176	3,485,208	9·1	14·7
Trade and transportation	6,403,378	4,263,617	21·3	17·9
Manufacturing and mechanical pursuits	9,035,426	5,772,641	30·0	24·3
All occupations (male)	30,091,564	23,753,836	100·0	100·0
Females:—				
Agricultural pursuits	1,807,050	977,336	22·4	18·4
Professional service	673,418	430,597	8·3	8·1
Domestic and personal service	2,620,857	2,095,449	32·5	39·4
Trade and transportation	1,202,352	503,347	14·9	9·5
Manufacturing and mechanical pursuits	1,772,095	1,312,668	21·9	24·7
All occupations (female)	8,075,772	5,319,397	100·0	100·0

Table 8 does not include all those engaged in economic services. Many children and wives work for their parents or husbands; technically they do not receive wages and consequently are not recorded as engaged in gainful occupations, but in reality they contribute to the household economy. If these be included, approximately two-thirds of the pop. was engaged in some degree of creating wealth or in services which might be valued in economic terms. Nearly one-third of all the workers were engaged in agricultural and allied industries, and a little over one-fourth in manufacturing and in tool industries. If we divide the pop. of the United States into groups according to age, the following were the percentages of each age-group engaged in gainful occupation in 1910:—10 to 13 years, males 16·6% and females 8·0%; 14 to 15, 41·4% and 19·8%; 16 to 20, 79·2% and 39·9%; 21 to 44, 96·7% and 26·3%; 45 years and over, 85·9% and 15·7%; 10 years and over, 81·3% and 23·4%. There was a slight decrease between 1900 and 1910 in the two lower age-groups for males and a slight increase for females. More than 8 out of 10 of the gainful workers in the United States as a whole in 1910 were 21 years of age and over, and about 95 out of 100 were 16 years of age and over.

Education.—In 1918 there were 20,853,516 children enrolled in the public schools, constituting 70% of the pop. from 5 to 18 years of age. There were 650,709 teachers in the public schools, or one to every 32 pupils. Of the teachers 16% were males. The total expenditure for public schools was $763,678,089 or about $37 per pupil. The above enrolment of pupils includes 1,735,619 attending public high schools. In addition there were 158,745 pupils in private high schools and academies. There were over 300 public and private normal schools with an enrolment of nearly 140,000. Universities, colleges and schools of technology numbered 672 in 1918, having 44,600 students of preparatory grade, 239,707 students of collegiate grade, and 14,406 graduate students. Nearly one-half of the students of collegiate grade were female. Professional schools in 1918 numbered 424, as follows: theology 141, with 9,354 students; law 101, with 11,820 students; medicine 72, with 13,802 students; dentistry 37, with 8,314 students; pharmacy 54, with 4,053 students; and veterinary medicine 19, with 1,250 students. (*See* EDUCATION, section *United States.*)

The statistics of illiteracy for 1920 showed a diminution compared with those for 1910. The Census Bureau classifies as illiterate any person 10 years of age or over who is unable to write in any language, regardless of ability to read. Illiterates in 1920 numbered 4,931,905, or 6% of the pop. at least 10 years of age, as compared with 7·7% in 1910. The proportion of illiteracy for the individual states in 1920 ranged from 1·1% in Iowa to 21·9% for Louisiana. Illiteracy is very marked in those states in which the colored pop. or the foreign-born pop. is relatively large. In 1910 nearly one-third (30·4%) of the negroes were recorded as illiterate, but this showed a marked decrease from 44·5% in 1900. Of the native whites of native parentage only 3·7% in 1910 were illiterate, but in six of the southern states the percentage ran over 10%.

Vital Statistics.—In 1915 the Census Bureau began the annual analysis and publication of birth statistics based upon data obtained from state registration records. In 1919 the birth registration area covered nearly three-fifths (58·6%) of the total population. The birth-rate varied in the five-year period 1915–9 from 25·1 per 1,000 in 1915 to 22·3 per 1,000 in 1919. The ratio of male births was 1,057 to 1,000 female births. The fecundity of foreign-born mothers was much greater than that of native mothers. For example, in Connecticut, although the white married women of foreign birth, age 15 to 42, constituted only 46% of the total pop. of white married women of that age group, they gave birth to 57% of the children. In Massachusetts 49% of foreign-born mothers gave birth to 53% of the children; and in New York 43% of foreign-born mothers gave birth to 49% of the children. The first and second children formed 50% of all children born to native white mothers, while only 34% born to foreign-born mothers were first and second children.

The registration area for mortality statistics covers more than three-fourths of the population. Between 1900 and 1921 the death-rate varied from a minimum of 13·5 per 1,000 in 1915 to 18 per 1,000 in 1918. This latter high rate was due largely to the great influenza pandemic. The rate of infant mortality (the number of deaths of infants under one year of age per 1,000 born alive) for the registration area in 1918 was 83 for the white pop.; for negro pop., 131; and for the total pop., 87.

A third nation-wide compilation of statistics of marriage and divorce was made by the Bureau of Census, covering the year 1916. There were 1,040,778 marriages, or 10·5 per 1,000 of the population. In some of the southern states the rate ran as high as 11·9 per 1,000. There were 112,036 divorces. The statistics were not analyzed to show ratios of divorce to marriage, but only the ratios to population. For the whole country the ratio of divorce was 112 per 100,000 population. In New England the ratio was 80, Middle Atlantic states 43, Southern states 59, and Pacific states 210. Of the divorces 31·1% were granted to the husband and 68·9% to the wife.

Religious Bodies.—For statistics of Christian churches, see the article CHURCH HISTORY: section *United States.* Statistics of membership in Jewish churches are unsatisfactory for purpose of comparison with other denominations, for they are restricted to heads of families. In 1920, according to returns published in the *Year Book of Churches* by the Federal Council of Churches, there were 2,960 Jewish congregations with a membership of 260,000; 784 Sunday-schools with a membership of 108,534. These figures may be compared with the report of the Bureau of Census which gives 1,901 congregations and 357,135 members for the year 1916. According to the *American Jewish Year Book* for 1920 there were in 1918 3,390,300 Jews as against 1,777,185 in 1907. According to the same authority nearly one-half, or 48·6%, of the Jews resided in the state of New York in 1918, and 45% in New York City. It is estimated that 26% of the total pop. of New York City is Jewish. Between 1907 and 1918 the Jewish pop. of New York state increased from 905,000 to 1,603,923; Pennsylvania, from 150,000 to 322,406; and Illinois, from 110,000 to 246,637. It was also estimated that the Jewish pop. constituted about 3·2% of the total pop. of the United States; in New York it was 15%; in Connecticut and Massachusetts 5% and in Maryland 4·5%. Jewish immigration 1899–1919 numbered 1,551,315, or 10·4% of the total number of immigrants.

Agriculture.—During the decade 1910–20, the number of farms showed a slight gain, 1·4%. In 1920 there were 6,448,343 as compared with 6,361,502 in 1910. A comparison of these numbers with the total pop. shows that in 1910 there was one farm for every 14 of the pop., and in 1920 one farm for every 16. The decrease in the number of farms was particularly marked in states east of the Mississippi; for example, in Connecticut 15·5%; Massachusetts 13·4%; New York 10·5%; Ohio 5·6%; and Illinois 5·8%. In New England the number of farms decreased by 32,238, giving in 1920 one farm for every 47 persons. The total farm acreage increased somewhat more rapidly than the number of farms, from 878,798,325 ac. to 955,883,715 ac., nearly 8·8%. The greater portion of this increase was due to the use of land for dry farming in the arid states of the Rocky Mountain section and also to the enclosure of large areas for grazing. In 1919 there were 507,000,000 ac. under cultivation. One half of the total land area of the United States was in 1920 included in farms, as compared with 46·2% in 1910. Of the 956,000,000 ac. included in farms, 88,000,000 in 1919 was devoted to corn; 73,000,000 to wheat; 73,000,000 to hay; 38,000,000 to oats; and 33,000,000 to cotton. Nearly one-third of the farm area and nearly one-sixth of the total land area is used for the growing of these five products. The average size of farms slightly increased between 1910–20, from 138·1 ac. to 148·2 acres. Notwithstanding the small increase in the number of farms, and of acreage in farms, the value of all farms, lands and buildings increased from $35,000,000,000 in 1910 to $66,000,000,000 in 1920, or 90%. This increase, however, was due largely to the abnormally high prices prevailing in 1920, rather than to new investments and improvement of property. For the same reason the average value of land and buildings per farm for the United States as a whole greatly increased, rising from $5,471 in 1910 to $10,284 in 1920. In 1910 62·1% of farms were owned by their cultivators and in 1920 60·9%. In New England, New Jersey, New York and Pennsylvania, there was a decline in tenancy but there was a marked increase in the Mountain and Pacific states. During the decade 1910–20 native white farmers increased from 4,721,063 to 4,917,386; foreign-born white farmers decreased from 669,556 to 581,068; coloured farmers increased from 920,883 to 949,889. The countries furnishing the greater number of foreign-born farmers were, in 1920, Germany (140,667), Sweden (60,461), Norway (51,999), Canada (48,688), Russia (32,388), Austria (30,172), England (26,614), Denmark (25,565), Italy (18,267), Poland (17,352), Ireland (16,562), Holland (15,589), Finland (14,988), Switzerland (13,051), Mexico (12,142), Scotland (7,605), Hungary (7,122), France (6,119).

The United States is an agricultural country, but the question is frequently asked whether agriculture is keeping pace with the growth of the population. A comparison of the annual crop for the three-year period 1907–9 with that for the period 1917–9 for corn, wheat, and oats gives the following:—

	Average 1917–9 bushels	Average 1907–9 bushels
Corn	2,828,000,000	2,678,000,000
Wheat	833,000,000	679,000,000
Oats	1,459,000,000	856,000,000

A comparison of these figures with the population at the respective dates shows that the *per capita* product of corn is slightly less, that of wheat and oats greater.

Table 9 shows the estimated annual crop of some of the most important agricultural staples for each of the 10 years, 1910–9.

TABLE 9. *Annual Crops; in millions.*

	Corn (bus.)	Wheat (bus.)	Oats (bus.)	Cotton (bales)	Irish potatoes (bus.)	Tobacco (lb.)	Wool (lb.)
1910 . .	2,886	635	1,186	11·6	349	1,103	321
1911 . .	2,531	621	922	15·7	293	905	319
1912 . .	3,125	730	1,418	13·7	421	963	304
1913 . .	2,447	763	1,122	14·2	332	954	296
1914 . .	2,673	891	1,141	16·1	410	1,035	290
1915 . .	2,995	1,026	1,549	11·2	360	1,062	286
1916 . .	2,567	636	1,252	11·4	287	1,153	288
1917 . .	3,065	637	1,593	11·3	442	1,249	282
1918 . .	2,503	921	1,538	12·0	412	1,439	299
1919 . .	2,346	945	1,055	11·3	290	1,372	307

The annual production of cotton did not greatly change in the 10 years 1910–9, running about 11,000,000 bales (500 lb.). Domestic consumption, however, slowly increased, leaving a smaller amount for export. During the five-year period, 1910–4, the average annual export was 8,811,000 bales, and in the five years 1915–9, 6,310,000 bales, a decline of 28 per cent. The production of wool also remained fairly constant, approximating 300,000,000 lb. annually. Imports in the years 1915–9 were greater than ever before and the total consumption therefore larger, as exports were insignificant. The average annual consumption, domestic and foreign, 1910–4, was 509,000,000 lb., and 1915–9 690,000,000 lb. Since 1914 the United States has been dependent upon foreign countries for more than one-half its wool consumption as compared with two-fifths, or even only one-third in the earlier years of the century.

Strenuous efforts were made during the World War period, even before the entry of the United States, to increase the production of wheat. In 1916 the average farm value per bus. for the first time since the decade following the Civil War, was above $1. A record crop was produced in 1915, amounting to over a thousand million bushels. The average annual production for the five years 1910–4 was 697,000,000 bus., and in the succeeding five years 1915–9, 822,000,000, giving an average annual increase of 125,000,000; on the basis of an annual *per capita* consumption of five bus. this provided bread for 25,000,000 people. In the years 1910–4 the average annual export was 125,000,000 bus., and in 1915–9, 240,000,000 bushels.

The domestic beet-sugar industry during the 10 years 1910–9 became firmly established. Until 1907 the volume of beet-sugar production was less than that of cane sugar; in later years it has been far in excess. The production, in millions of pounds, was 1,775 in 1910 (cane 750, beet 1,025); 1,937 in 1915 (cane 493, beet 1,444); and 2,091 in 1919 (cane 569, beet 1,522). The outlying possessions of the United States (Porto Rico, Hawaii and the Philippine Is.) provide an amount of sugar approximately equal to that produced at home. This, however, does not meet the demands of domestic consumption, and the United States is still dependent upon foreign countries for half its needs. The annual *per capita* production of sugar was approximately 80 lb. in 1920 as compared with 70 lb. in 1900.

The crops of hay, sweet potatoes, rye, barley, and rice, as estimated by the Department of Agriculture for 1910 and 1919, are seen in Table 10.

In 1919 the production of apples was 26,174,000 bar., of which one state, Washington, yielded one-fourth (6,440,000 bar.). The peach crop amounted to 50,690,000 bus. valued at a little over $100,000,000. In 1918 1,525,792 ac. were devoted to truck crops.

The number of cattle on farms in 1920 was 66,652,559, as compared with 61,803,866 in 1910. This increase did not keep pace with the growth in population. The number of swine was 59,346,409 as compared with 58,185,676 in 1910, and again the increase was not in proportion to population. The number of sheep as estimated by the Department of Agriculture in 1920 was 48,615,000 as against 52,447,861 in 1910. The wool product in 1919 was 307,459,000 lb. as compared with 321,363,000 lb. in 1910. In 1919 the product of Wyoming was 33,415,000 lb.; Idaho, 22,145,000 lb.; Montana, 17,750,000 lb.; Utah, 15,800,000 lb.; New Mexico, 15,076,000 lb.

The Department of Agriculture in its *Year Book* of 1918 estimates that 350,000,000 ac., or nearly one-fifth of the land area of the United States, is too rough or hilly for the successful cultivation of crops. It may, however, be adapted to the growth of forests or used for grazing purposes. Nearly one-third of the land area, or 600,000,000 ac., receives insufficient rainfall for the profitable production of

TABLE 10. *Hay and other Crops.*

	1919		1910	
	Amount	Farm Value	Amount	Farm Value
Hay (short tons) . . .	91,326,000	$1,839,967,000	60,978,000	$747,769,000
Sweet potatoes (bus.) . .	78,091,000	124,844,000	59,938,000	40,216,000
Rye " . .	88,478,000	119,041,000	34,897,000	24,953,000
Barley " . .	165,719,000	200,419,000	173,832,000	100,426,000
Rice " . .	41,059,000	109,613,000	24,510,000	16,624,000

crops at normal prices and affords no possibility of irrigation. A total of 40,000,000 ac. is absolute desert. It is estimated that 200,000,000 ac. of forest, "cut-over" land, and woodland including that in farms, could be used for crops after clearing. This, if divided into farms averaging 160 ac., would provide 1,250,000 farms, or an addition of about 20% to the number of farms in the country. Moreover, 60,000,000 ac. of swamp land can be drained, and 30,000,000 ac. of potentially irrigable land can be converted into farms if available sources of water supply are fully utilized. In all there are about 850,000,000 ac. of land at present in crops and potentially available. A little over 1,000,000,000 ac. of non-arable land consist of 360,000,000 ac. of absolute forest land, 615,000,000 ac. of grazing land, 40,000,000 ac. desert land and 40,000,000 ac. in cities, roads and railway rights of way. It is also estimated that 360,000,000 ac. of forests will not be sufficient to supply a population of 150,000,000, but that 450,000,000 ac. will be needed for that number. To provide food, therefore, more intensive methods of farming will be required. For corn the average yield per ac. in the five years 1900–4 was 24·2 bus., and in 1915–9, 26·3 bushels. The yields for wheat were 13·4 and 14·3 bus.; for oats 31 and 33·7 bus.; and for barley 25·7 and 25·6 bus., respectively, for the two periods. (*See* also the section *Agriculture.*)

Manufactures.—A census of manufactures was taken for 1914 and another for 1919. The results of the latter had not been fully published by Jan. 1922. The manufacturing industries as a whole did not increase so rapidly in the five-year period 1909–14 as in the previous five years, but showed great increase in the next five, ending in 1919 (preliminary figures). This is seen from Table 11.

TABLE 11. *Manufactures.*

	Establishments	Wage-earners	Value of products	Value added by manufacture
1904	216,180	5,468,383	$14,793,903,000	$6,293,695,000
1909	268,491	6,615,046	20,672,052,000	8,529,261,000
1914	275,791	7,036,337	24,246,435,000	9,878,346,000
1919	288,376	9,103,200	62,910,202,000	..
	Increase	Increase	Increase	Increase
1904–9	24·0%	21·0%	39·7%	35·5%
1909–14	2·8%	6·4%	17·3%	15·8%
1914–9	5·0%	29·4%	159·0%	..

Arranged by the 14 general groups of industries according to the classification of the Bureau of Census, Table 12 shows numbers of wage-earners and capital invested.

TABLE 12. *Groups of Industries.*

Group	Wage-earners		Capital in millions of dollars	
	1914	1909	1914	1909
Food and kindred products	496,234	411,575	2,174	1,697
Textiles and their products	1,498,664	1,438,446	2,811	2,488
Iron and steel and their products	1,061,058	1,026,553	4,282	3,579
Lumber and its remanufactures	833,529	911,593	1,723	1,570
Leather and its finished products	307,060	309,766	743	659
Paper and printing	452,900	415,990	1,433	1,134
Liquors and beverages	88,152	77,827	1,016	874
Chemicals and allied products	299,569	267,261	3,034	2,167
Stone, clay and glass products	334,702	342,827	987	858
Metals and metal products other than iron and steel	262,154	249,607	1,014	867
Tobacco manufactures	178,872	166,810	304	246
Vehicles for land transportation	263,076	202,719	803	521
Railway repair shops	365,902	304,592	418	277
Miscellaneous	594,465	489,480	2,048	1,490
All industries	7,036,337	6,615,046	22,791	18,428

The industrial group having the largest number of wage-earners in 1914 was the textile, but the iron and steel was first in capital invested; although the chemicals and allied products group had only 4% of the wage-earners, it was credited with 13% of the total capital; leather and its finished products, which employed 4% of the wage-earners, had less than 4% of the capital.

Table 13 shows the distribution of manufactures in 1909 and 1914 by the three geographic divisions—North (New England, Middle Atlantic, and East and West North Central states), South (South Atlantic, and East and West South Central states), and West (Mountain and Pacific states).

TABLE 13. *Geography of Industries.*

Section	No. of wage-earners		Capital (millions of dollars)		Value of product (millions of dollars)		Per cent increase
	1914	1909	1914	1909	1914	1909	
North	5,558,049	5,197,138	18,122	14,278	19,555	16,827	16·2
South	1,161,660	1,129,307	3,046	2,502	3,186	2,637	20·8
West	316,628	288,601	1,623	1,197	1,505	1,208	24·7

In 1914 the North manufactured 81·2% of the product according to value; the South, 12·8%; and the West, 5·9%. New York retained in 1914 first place among the states in manufactures, producing 15·7% of the total value of the product; Pennsylvania was second with 11·7%, followed by Ohio and Massachusetts. Manufacturing establishments as a rule are in large cities. In 1914 cities with a pop. of 100,000 and over, having 24% of the total pop., had 40% of the wage-earners who manufactured 43% of the value of the total production. Ten cities, New York, Chicago, Philadelphia, Detroit, St. Louis, Cleveland, Boston, Buffalo, Pittsburgh, and Milwaukee, with a combined pop. of approximately 13,473,000, or nearly 14% of the total pop., manufactured 25% of the total product value. Districts outside cities having a pop. of 10,000 or over and having 61% of the total pop., had only 33% of the wage-earners, and manufactured only 30% of the total production. Some manufacturing industries tend toward local concentration: for example in 1914, measured by value of product, Michigan produced 62·9% of all the products of the automobile industry in the United States; Massachusetts 43% of the boot and shoe industry; Connecticut 43% of brass, bronze and copper products, and 62% of fire-arms and ammunition; California 25% of canning and preserving products; Illinois 40% of the agricultural implement industry; New York 43% of men's clothing, 73% of women's clothing, 96% of men's collars and cuffs, and 59% of leather gloves and mittens.

Preliminary figures for the census of 1919 showed for value of product an increase of nearly 160% over 1914. This remarkable gain is far in excess of that of any previous five-year or even that of any 10-year period. Table 14 shows the specific industries, which in 1919 manufactured a product valued at more than $500,000,000.

Complete data were not yet available in Jan. 1922 to show how far the increases shown in Table 14 were due to higher prices and how far due to greater volume of production. To illustrate this distinction the following figures are taken from the preliminary bulletins of the Bureau of Census, to show quantity production in 1914 and 1919 with respective values at each date. In the silk industry there was manufactured in 1914 242,000,000 yd. of broad silk, and in 1919, 307,000,000 yd.; the value more than trebled in the period, from $137,720,000 to $435,935,000. Pig-iron production increased in quantity from 23,269,000 tons to 30,543,000 tons, or 31%, and in value 151%; coke from 22,788,000 tons to 30,097,000 tons and in value more than doubled, from $304,234,000 to $770,101,000; window glass decreased in quantity from 401,000,000 sq.ft. to 369,000,000 sq.ft., but the value more than doubled, increasing from $17,496,000 to $41,106,000. Oil-cloth and linoleum also decreased in quantity from 127,038,000 sq.yd. to 125,448,000 sq.yd., but increased in value from $25,598,000 to $68,110,000. Fertilizers decreased in quantity from 8,432,000 tons to 8,291,000 tons, but gained in value from $153,000,000 to $280,000,000. In quantity, sole leather increased from 18,075,500 sides to 19,715,800 sides, and in value from $116,188,000 to $218,830,000. In food products lard increased in quantity from 1,119,189,000 lb. to 1,372,550,000 lb., and in value more than trebled, $120,414,000 to $415,817,000; condensed and evaporated milk increased from 884,647,000 lb. to 2,096,973,000 lb., and in value from $59,375,000 to $293,569,000; beet sugar decreased in quantity from 1,486,948,000 lb. to 1,426,890,000 lb., but increased in value from $58,590,000 to $138,100,000; cleaned rice increased in quantity from 674,872,000 lb. to 1,062,813,000 lb. and in value from $21,655,000 to $83,462,000; wheat flour increased from 116,403,770 bar. to 132,478,513 bar. and in value from $543,840,000 to $1,436,589,000. The growing demand for automobiles greatly expanded not only their manufacture but also the refining of petroleum, and the rubber industry. The number of passenger cars manufactured in 1919 was 1,657,000 as compared with 569,000 in 1914 for all motor vehicles. The petroleum refining industry showed a phenomenal development. The output of gasoline increased in five years from 1,195,000,000 gal. to 3,637,000,000 gallons. The increase in quantity was 204% and in value 540%. In 1919 the refineries used 358,000,000 bar. of crude petroleum of which 38,000,000 was of foreign origin and 320,000,000 domestic. The manufacture of rubber goods greatly expanded. Two-thirds of the value in 1919 was represented by tires. The maximum production of lumber was reached in 1908, 42,000,000,000 ft.; in 1918 it was 32,000,000,000 ft., the decline being due to the

TABLE 14. *Individual Industries; dollars in millions.*

	1919	1914	Per cent. increase
Automobile bodies and parts	674	130	418
Automobiles	2,388	503	373
Boots and shoes	1,152	502	129
Bread and other bakery products	1,406	492	186
Butter	583	243	140
Cars and general shop construction and repairs by steam railway companies.	1,278	514	149
Cars, steam railway, not including operations of railway companies	540	195	176
Chemicals	695	200	242
Clothing, men's	1,158	458	153
Clothing, women's	1,184	474	150
Confectionery and ice cream	637	210	203
Cotton goods	1,878	677	177
Electrical machinery, apparatus and supplies	1,014	335	203
Flour-mill and grist-mill products	2,193	878	152
Food preparations not elsewhere specified	663	219	203
Foundry and machine-shop products	2,321	867	167
Furniture	574	266	116
Iron and steel, blast furnaces	794	318	118
Iron and steel, steel works and rolling-mills	2,813	919	206
Knit goods	686	259	165
Leather, tanned, curried and finished	929	367	150
Lumber and timber products	1,401	715	96
Lumber, planing-mill products, not including planing-mills connected with saw-mills	561	308	82
Oil and cake, cottonseed	570	212	169
Paper and wood pulp	794	332	139
Petroleum refining	1,645	396	315
Printing and publishing, book and job.	601	307	96
Printing and publishing, newspapers and periodicals	892	496	80
Rubber goods, not elsewhere specified.	980	224	338
Shipbuilding, steel	1,454	66	2,103
Silk goods	685	254	170
Slaughtering and meat-packing, wholesale	3,714	1,454	155
Smelting and refining, copper	633	444	42
Sugar, refining, not including beet sugar	731	289	153
Tobacco, cigars and cigarettes	886	315	181
Worsted goods	676	276	145

fact that readily available timber was becoming less and less accessible. Portland cement is manufactured in larger amounts and has a wide use in the building industry. During the years 1900–9 the average production was 33,000,000 bar.; in 1916 it reached 95,000,000 barrels. The production of tin plates, terne plates, and taggers tin showed a steady development; in 1910 the production amounted to 1,370,788,000 lb. and in 1919 to 3,301,624,000 lb. An export trade was developed, the export of domestic product rising from 26,168,000 lb. to 527,462,000 lb.; import of this product has practically disappeared.

The cost of new buildings in the principal cities is estimated by the U.S. Geological Survey as follows:— 1910, $726,437,000; 1911, $687,507,000; 1912, $738,990,000; 1913, $673,221,000; 1914, $619,752,000; 1915, $700,413,000; 1916, $839,706,000; 1917, $569,011,000; 1918, $344,622,000; 1919, $1,019,491,000. The figures show that, although the war checked building, the total value of the buildings constructed in 1919 was much greater than in any preceding year; the cost for 1919 was swollen by high prices and does not accurately represent the volume of new building, measured by physical units.

After 1909 there was but a slight increase in the number of manufacturing establishments, notwithstanding the gain in the number of wage-earners and value of product. In 1914 there were 275,791 establishments, with 7,036,337 wage-earners, and products valued at $24,246,000,000, or $87,916 per establishment; in 1919, 288,376 establishments with $62,588,000,000, or $217,000 per establishment. In 1914, 2,476,006 wage-earners, or more than one-third (35·2%), were in 3,819 establishments, an average of nearly 650 workers per establishment; nearly one-half (48·6%) of the value of the product was manufactured in this small group of establishments. Of the 8,263,153 persons engaged in manufactures in 1914, 6,613,466, or 80%, were males, and 1,649,687, or 20%, were females.

Minerals.—The value of mineral products, as estimated by the U.S. Geological Survey, increased from $1,992,406,000 in 1910 to $5,543,456,000 in 1918. Nearly three-fourths was represented in 1918 by five products, as follows (in millions of dollars):—pig-iron 1,181 (412 in 1910); bituminous coal 1,492 (469 in 1910); anthracite 336 (160 in 1910); copper 471 (137 in 1910); petroleum 704 (128 in 1910). Lead increased in value from $30,855,000 in 1910 to $76,667,000 in 1918; zinc from $27,268,000 to $89,618,000; aluminum from $8,956,000 to $41,159,000; natural gas from $70,756,000 to $157,000,000; and cement from $68,752,000 to $113,555,000. Platinum had a remarkable development, the product increasing from 8,665 oz., valued at $478,688, in 1915 to 59,753 oz., valued at $6,417,980, in 1918.

The production of iron ore increased from 56,889,734 long tons in 1910 to a maximum record of 77,870,553 tons in 1916. In 1918 the production was slightly less, 72,021,202 tons. In the latter year this was manufactured into 39,054,644 tons of pig-iron. More than half of the iron ore produced is mined in Minnesota amounting to 43,263,240 tons, followed by Michigan 17,587,416 tons; Alabama mined 6,121,087 tons. In 1912 the National Conservation Commission estimated the total supply of iron ore profitable to mine at 4,784,930,000 long tons, and 75,000,000,000 tons not worth mining. According to this estimate the profitable ore deposits might be exhausted in 60 years, allowing for no increase in annual rate of production. The ore deposits being worked in 1921 were for the most part on the surface in the region of the Great Lakes. (*See* IRON AND STEEL.)

The production of anthracite coal in 1910 was 75,433,246 tons (of 2,240 lb.); in 1919 78,653,751 tons, an increase of 4 per cent. The bituminous coal production in 1910 was 417,111,142 short tons as compared with 459,971,070 tons in 1919 (preliminary estimate of the Geological Survey), a gain of 10 per cent. About two-thirds of the coal consumed goes into the production of power, about equally divided between the industries and transportation; about one-sixth is used as a raw material, for making products employed industrially, as coke, gas, and coal-tar products; and about one-sixth for heating homes and other buildings. (*See* COAL.)

The mining of copper does not follow a regular ascending curve of production. It reached the high point in 1906, 409,735 long tons; declined in 1907; rose to 487,925 tons in 1909; again declined in 1910; rose to 555,031 tons in 1912; fell to 513,454 in 1914; and again advanced to 860,648 tons in 1916. In 1916 more than one-third was produced in Arizona, which has become the principal producing state. In the same year it was estimated by *The Mineral Industry* that the world's production was 1,373,200 long tons. After 1916 there was a marked decline in production. (*See* COPPER.)

The increased demand for gasoline for automobiles raised the price and led to vigorous efforts to discover new supplies of petroleum. During 1908–19 the production in California more than doubled; in Texas trebled; in Oklahoma more than doubled; in Wyoming new oil-fields were opened. The total production in 1920 was 443 million barrels, as against 281 millions in 1915 and 179 millions in 1908. For details *see* PETROLEUM. The Director of the U.S. Geological Survey estimated in 1920 that the country's oil resources were over 40% exhausted, and that the supply at the existing rate of consumption would be exhausted within 20 years (*see* FUEL). Between 1908 and 1916, when active exploration was carried on, the reserve was enlarged by only 1,200 million barrels. Attention has been turned to the possibility of extracting petroleum from the oil shales of Utah, Colorado and Wyoming.

The volume of natural gas produced has risen steadily since the beginning of the century. In 1910 the production was 509,000 million cub. ft., and in 1919, 1,726,000 million cubic feet. Natural gas is found in 23 states, but chiefly in West Virginia, Pennsylvania, Ohio, Oklahoma, and California. Some 2,100 cities and towns are supplied. One-third is used for domestic purposes and two-thirds for industrial plants. The production in 1910 and 1918 is shown in Table 15. The average value in 1910 was 13·9 cents per 1,000 ft. giving a total value of the product, $70,800,000; in 1918, 21·3 cents per 1,000 ft. and $154,000,000 total value. About 15,444,000 ac. of land were controlled by natural gas producers in 1917.

TABLE 15. *Natural Gas Production; in million cub. ft.*

	1918	1910
West Virginia	265,000	191,000
Pennsylvania	123,000	127,000
New York	8,000	6,000
Ohio	61,000	48,000
Louisiana and Texas	49,000	8,000
Illinois	4,000	7,000
Oklahoma	124,000	50,000
Kansas	28,000	59,000
California	40,000	3,000
Other states	19,000	10,000
	721,000	509,000

The production of gold reached its maximum in 1915, valued at $101,035,700; during the war it declined owing to advancing prices of materials and labour and the decreased purchasing power of gold (*see* GOLD). In 1919 the production was valued at $58,488,800, less than in any year since 1897. California furnished $17,398,000; Colorado $9,736,400; Alaska $9,036,000. Silver likewise reached its maximum in 1915, amounting to 74,961,075 fine Troy oz., valued at $37,397,300. In 1919 the bullion produced was less, 55,285,196 oz., but owing to the high price the production was worth $61,966,412. Montana and Utah seemed to be forging ahead as the great silver-producing states, Nevada remaining stationary.

Fisheries.—According to an estimate made by the Bureau of Fisheries the annual fishery product during the decade 1910–9 amounted to 2,500,000,000 lb., for which about $80,000,000 was paid to the fishermen. The industry employs about 200,000 persons. The total quantity of fish landed at Boston and Gloucester, Mass., and Portland, Me., the three principal fishing ports in New England, amounted in 1919 to 196,481,000 lb. having a value to the fishermen of $7,548,000. Cod represented $2,332,000 and haddock $2,788,000. The product of the fisheries of the Great Lakes in 1917 was 104,269,000 lb., valued at $6,295,000. One-half of the product, 53,529,000 lb., was ciscoes (whitefish). The product of the fisheries of the Gulf states in 1918 was 130,924,000 lb., valued at $6,510,000. The principal products were: mullet, 28,641,000 lb.; shrimp, 27,143,000 lb.; and oysters, 23,754,000 lb. At Seattle, Wash., the fishing fleet landed in 1919 13,651,000 lb., valued at $1,530,000. The principal product was halibut. The total catch of salmon and steelhead trout on the Pacific coast in 1919 including Alaska was 767,000,000 pounds. It is estimated that the annual yield of oysters for the whole United States is about 30,000,000 bus. giving a return to the fishermen of nearly $15,000,000. About one-sixth, 5,942,000 bus., come from the New England coast, and over one-half, 18,906,000 bus., from the coast of the Middle Atlantic states.

Production.—Professor Edmund E. Day of Harvard has made an ingenious statistical study of the physical volume of production in the United States for the period 1888–1919, published in *The Review of Economic Statistics* (Harvard University, Sept. 1920–Jan. 1921). His conclusions are shown in Table 16. With 1899 as the base (100) index numbers for subsequent years were calculated for agriculture, representing 12 important crops; for mining, representing 10 minerals; and for manufacturing, representing 12 groups, covering 34 branches of manufacture. The indices for pop. are added in order to compare the growth of production.

TABLE 16. *Index Numbers of Production.*

	Population	Agriculture	Mining	Manufacture
1899	100·0	100·0	100·0	100·0
1900	101·8	100·6	105·7	101·0
1901	103·8	89·3	114·6	112·4
1902	106·0	113·7	122·7	123·5
1903	108·1	105·0	135·0	125·5
1904	110·3	116·0	136·3	123·2
1905	112·4	117·5	161·6	144·4
1906	114·5	125·0	169·9	155·0
1907	116·7	112·4	185·9	156·3
1908	118·9	118·8	154·2	132·7
1909	121·0	118·1	189·4	163·4
1910	123·1	123·2	201·6	166·0
1911	125·3	117·0	194·4	158·3
1912	127·4	138·1	216·7	181·4
1913	129·6	122·1	227·2	187·1
1914	131·6	135·0	202·6	171·4
1915	133·2	141·0	227·6	187·2
1916	134·8	124·9	267·0	218·6
1917	136·5	135·0	277·2	215·2
1918	138·1	133·2	279·6	214·0
1919	139·7	137·6	228·4	195·3

Table 16 shows that the physical volume of agricultural production has closely followed the growth of population. As Prof. Day points out, "Mining output, on the other hand, completely outdistanced population growth. Since 1897 the development of mining has been phenomenal. . . . Crops are an annual harvest from a soil the fertility of which scientific cultivation carefully preserves; mineral production is a continuing exhaustion of irreplaceable natural deposit. Mining typically lives upon its capital; agriculture upon its income. The rate of production in mining is consequently open to an acceleration which in agriculture is altogether impossible. . . .The fluctuations of manufacturing output appear to be much more cyclical than the variations in agricultural production. In general the fluctuations of production in manufacture resemble closely those in mining."

Commerce, Foreign and Domestic.—Extraordinary movements in foreign commerce, due to the World War, began with 1915. During the years 1900–9, inclusive, the excess of exports over imports of merchandise varied in value from a maximum of $666,000,000 in 1908 to a minimum of $351,000,000 in 1909. Beginning with 1915 the annual excess was over a thousand million dollars, reaching in 1919, $4,016,000,000. Table 17 shows the movement by years, and the excess of exports over imports in each year. The excess of exports over imports in trade with European countries was even greater than the balance from total trade with all countries, amounting in 1919 to $4,437,000,000. Trade with South America uniformly showed an excess of imports over exports, ranging from $66,000,000 in 1911 to $308,000,000 in 1918; and trade with Asia also gave adverse balances ranging from $121,000,000 in 1911 to $408,000,000 in 1918. The figures given here relate to values of exports and imports, and do not, even approximately, reflect the changes in the physical volume of foreign commerce. For some of the commodities recorded in official statistics of exports and imports it is possible to give quantities as well as values; for others only values. In order to illustrate the influence of prices on abnormal values of commodities entering into foreign trade, quantities are given in Table 18 of exports for five commodities: wheat, cotton, bacon, mineral oil and tobacco; for other principal commodities only values are stated.

TABLE 17. *Foreign Trade; in millions of dollars:*

	Exports	Imports	Excess
1910	1,745	1,557	188
1911	2,049	1,527	522
1912	2,204	1,653	551
1913	2,466	1,813	653
1914	2,365	1,894	471
1915	2,769	1,674	1,094
1916	4,333	2,198	2,136
1917	6,290	2,659	3,631
1918	5,920	2,946	2,974
1919	7,920	3,904	4,016
1920	8,228	5,278	2,950

It will be observed from Table 18 that the quantity of wheat increased six times, while the value increased nearly fifteen times, and the quantity of cotton was less in 1919 than in 1910, but its value more than doubled. High prices also influenced imports, as seen in Table 19. The quantity of coffee imported increased a little over 50%, while the value more than trebled; and the quantity of sugar 67%, but its value 245%.

The enormous excess of exports of merchandise over imports, which began to be so marked in 1915, resulted in unprecedented gold transfers to the United States. In 1916 the import of gold exceeded the export by $403,760,000, and in 1919 by $685,255,000. Thus in two years the gold holdings were increased by $1,089,000,000. In the years 1918–9 $366,000,000 of this gold was exported, leaving a net additional balance of $723,000,000. This was in large part reflected in the increase of gold money in circulation, which rose from $590,000,000 in 1915 to $1,112,000,000 in 1919.

Railways and Canals.—There was but little new railway construction in the years 1910–21. In the five years 1915–9 less than 5,000 m. of new railway was built, not as much as was constructed in one year in the period 1902–7. In 1919 the miles of track in operation were 253,350 as compared with 242,107 in 1910, a gain of less than 5 per cent. The railways, however, did more work. Passenger-miles increased from 32,338 millions in 1910 to 39,477 millions in 1917, or 22%, and freight-ton-miles from 255,017 millions in 1910 to 394,465 millions in 1917, or 54 per cent. The average tons per freight train increased from 380 to 597. In 1917 1,264 million tons of freight (excluding duplications) were moved by the railways as against 968 millions in 1910. More than one-half of the tonnage carried was the products of mines, coal being by far the largest item. The average number of passengers carried per train rose from 56 to 65. The number of railway employees increased but slightly, from 1,699,420 in 1910 to 1,833,732 in 1917. Electric railways, mostly used for passenger service, have been extended more rapidly than steam railways. In 1907 there were 25,547 m. of electric line and in 1917, 32,548. The number of employees rose from 221,429 to 294,826 and the number of revenue passengers from 7,441 millions to 11,305 millions. (*See* RAILWAYS.)

In 1916 the Bureau of Census made a study of transportation by water. According to this report the tonnage employed on the Great Lakes and the St. Lawrence river in 1916 was 2,737,491 tons as compared with 2,392,863 tons in 1906, a gain of 14·4 per cent. The freight carried was 125,384,000 tons as against 75,610,000 tons in 1906, a gain of 65·8 per cent. Of this, 73,000,000 tons was iron ore, 30,000,000 tons coal, and 6,000,000 tons grain. The freight handled by the Lakes' fleet represented nearly one-half, 48·6%, of the water-borne freight shipments reported for the United States as a whole in 1916 as against 42·6% in 1906. Tonnage on the Mississippi river and tributaries declined greatly, from 4,412,000 tons in 1906 to 1,621,000 tons in 1916. Vessels operating on canals declined both in number and in tonnage. In 1906 the number of such vessels was 2,140 with a tonnage of 259,491; in 1916 the number was 2,049 with a tonnage of 196,426. The decline was on the canals of New York state, where the tonnage dropped from 209,152 tons in 1906 to 115,290 in 1916, showing that the efforts to develop canal transportation in that state had not been successful. The freight carried on the Sault Ste. Marie Canal, connecting lakes Superior and Huron, fluctuated during the decade 1910–9, between 53,477,000 tons in 1911 and 91,888,000 tons in 1915; in 1919 it was 68,236,000 tons.

Mails, Telephone and Telegraph.—Postal statistics show a slight extension of post routes, exclusive of rural delivery routes, from 435,488 m. in 1910 to 455,498 m. in 1919; the number of city carriers from 29,168 to 35,024; the mileage of rural delivery service from 993,068 to 1,143,467; and the number employed in railway mail service from 16,795 to 19,683. The telephone was rapidly

Table 18. *Exports of Principal Commodities, 1910–9.*

	Wheat		Cotton, raw		Bacon		Mineral Oil		Tobacco, unmanufactured		Wheat Flour	Copper	Lard	Automobiles and parts, not including engines and tires	Cotton manuf.	Iron and steel manuf.	Leather, and manuf. of
	Bushels (mil.)	Dollars (mil.)	Bales (mil.)	Dollars (mil.)	Lbs. (mil.)	Dollars (mil.)	Gallons (mil.)	Dollars (mil.)	Lbs. (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)
1910	24	23·5	7·1	530·8	128	17·9	1,502	94·1	329	36·1	43·0	90·4	45·9	13·2	35·6	195·0	53·5
1911	33	30·4	8·6	517·1	198	24·2	1,769	105·9	370	42·2	52·8	98·2	54·5	19·2	45·7	242·5	57·0
1912	62	59·6	10·7	623·1	192	23·5	1,883	124·2	411	46·9	49·3	123·0	52·2	23·8	52·5	290·5	64·4
1913	100	95·1	8·6	575·5	213	28·0	2,137	149·3	444	52·9	56·9	143·4	60·7	33·3	55·5	295·4	60·0
1914	174	187·2	6·3	343·9	184	25·6	2,240	139·9	347	43·9	62·4	116·0	48·6	34·2	50·1	201·3	67·9
1915	206	282·6	8·4	417·0	524	69·8	2,329	142·9	434	32·5	96·2	117·3	48·3	111·6	95·8	390·9	156·1
1916	150	226·7	7·0	545·2	593	87·1	2,607	201·7	484	62·8	86·5	204·9	56·0	120·7	129·3	871·3	159·7
1917	106	245·8	4·8	575·3	578	123·1	2,651	253·0	252	45·6	138·4	333·7	75·4	120·3	158·8	1,242·0	122·5
1918	111	260·6	4·1	674·1	1,105	316·0	2,715	344·3	407	122·9	244·7	195·1	144·9	96·7	181·0	1,035·3	91·7
1919	148	356·9	6·6	1,137·4	1,190	373·9	2,493	343·7	777	260·0	293·5	117·3	238·0	151·7	273·1	968·5	303·2

Table 19. *Imports of Principal Commodities, 1910–9.*

	Coffee		Hides and Skins		Silk, manuf.		Sugar		Wool, manuf.		India-Rubber, manuf.	Cotton, manuf.	Fibre, manuf.	Vegetable expressed oils	Wood, and manuf. of
	Pounds (mil.)	Dollars (mil.)	Pounds (mil.)	Dollars (mil.)	Pounds (mil.)	Dollars (mil.)	Pounds (mil.)	Dollars (mil.)	Pounds (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)	Dollars (mil.)
1910	804	73·7	461	86·1	—	70·1	4,195	113·9	180	36·1	110·4	67·0	28·9	27·3	54·5
1911	800	97·2	425	81·5	—	69·3	4,134	100·4	156	25·5	87·9	65·8	30·6	23·9	51·8
1912	943	130·5	615	121·1	30	79·8	4,317	118·5	238	42·2	111·2	67·0	44·5	24·5	57·7
1913	853	104·7	498	105·9	34	92·8	4,762	97·1	152	28·8	84·9	65·4	50·7	26·7	60·6
1914	1,011	104·8	556	112·3	31	92·6	5,418	127·2	260	58·3	74·7	60·3	49·1	24·5	63·2
1915	1,229	113·8	646	127·4	37	94·8	5,286	179·2	423	95·0	115·5	42·2	44·8	21·0	59·8
1916	1,167	118·8	726	172·6	41	149·8	5,532	227·6	449	125·5	164·5	53·8	65·5	37·5	77·2
1917	1,287	122·6	631	209·7	43	189·8	4,944	222·5	421	171·6	239·5	53·8	95·8	63·4	98·6
1918	1,052	99·4	362	108·0	49	194·2	5,171	242·3	454	251·8	149·2	39·8	114·4	107·6	98·3
1919	1,334	261·3	745	306·5	56	341·9	7,024	394·3	446	216·8	221·6	52·6	81·8	123·0	111·6

extended. In 1917 there were 28,827,000 m. of single wire in this service as compared with 12,999,000 in 1907. The number of employees nearly doubled during this period, increasing from 144,000 to 244,000. The Bell telephone system operated in 1919 23,281,000 m. of wire, of which 3,334,000 was for long-distance toll service. The number of daily exchange messages of this system alone was 30 millions and of toll messages one million. The telegraph systems made but little extension between 1907 and 1917. In the former year there were 239,646 m. of pole line and in the latter year 241,012. The number of messages sent increased over 50%, from 101 millions to 155 millions; and the number of employees from 26,827 to 49,608. (*See* Telegraph and Telephone.)

The automobile became an important factor in terminal transportation. Motor-car registration increased nine times between 1912 and 1920, numbering (not allowing for duplicate registration) in the latter year 9,211,295. This represents a motor car for approximately every 11 of the population. (*See* Motor Vehicles.)

Shipping.—Owing to the great activity in shipbuilding during the World War the tonnage of the American merchant marine showed a marked increase between 1910 and 1919, rising from 7,508,100 tons in 1910 to 16,324,000 tons in 1920. Nearly one-fifth, or 3,138,700 tons, was employed on the Great Lakes. The tonnage on the western rivers continued to decline, being only 120,230 tons in 1920. Sailing vessels decreased both in number and tonnage, and steam vessels declined in number from 12,452 to 8,103, but increased in size. The average tonnage of a steam vessel in 1910 was 394 tons, and in 1919, 1,359 tons. During the five years, 1910–4, the tonnage of new steam vessels built was 1,106,000 tons; and in the next five years ending in 1919, 4,948,400 tons, or more than four times as much. In 1920 new construction amounted to 3,880,639 tons. American shipping is engaged in two distinct branches of trade: coastwise trade between domestic points, and foreign trade. The tonnage in foreign trade increased from 1,076,152 tons in 1914 to 9,928,595 tons in 1920. Coasting tonnage remained about the same. It is estimated that the new tonnage, constructed under the emergency of the war, represented an expenditure of $3,000,000,000, a sum greater than the book value of all the world's merchant shipping in 1914, aggregating 49,000,000 tons. (*See* Shipping.)

A notable change has taken place in the nationality of shipping entering and clearing from American seaports. Until 1916 the tonnage of vessels sailing under foreign flags for many years was approximately three times as great as that under U.S. registry; in 1920 U.S. tonnage (26,242,332) equalled foreign tonnage (26,178,328).

The total tonnage of vessels entering at all ports from foreign countries increased from 40,235,800 tons in 1910 to 52,420,600 tons in 1920, and the tonnage cleared from 39,705,900 tons to 56,072,300 tons. The tonnage of British shipping entering at seaports of the United States fell from a maximum of 20,416,000 tons in 1914 to 11,237,000 tons in 1919. German tonnage entering in 1915 was 5,035,000 tons, and in the years 1916–9 was practically nil.

National Wealth.—In 1912 the Bureau of Census made an estimate of the wealth of the United States shown in Table 20, amounting to $187,700,000,000.

This gave an average of $1,965 for each person as compared with $1,165 in 1900. More than one-half the wealth consisted of real estate and improvement, largely due to the increase in value of urban real estate. In 1916 the value of taxable real estate in New York City alone was nearly $8,000,000,000.

Unofficial estimates of the national wealth have been made by statistical experts for dates later than 1912. That of W. R. Ingalls, of the U.S. Bureau of Mines, published in the *Annalist*, Sept. 13 1920, gives $216,600,000,000 for the year 1916. Other estimates run as high as $400,000,000,000. These figures, however, have little significance as evidence of domestic welfare. High prices increased appraised valuation; and high valuation, *e.g.* of real estate, may be a burden upon the productive efforts of the community.

The income-tax statistics published by the Commissioner of Internal Revenue throw light upon the distribution of wealth. In 1918 the number of personal income-tax returns was 4,425,114. The net income reported was $15,924,639,000; the tax collected on this income was $1,127,722,000; 34·3% of those making returns reported an income of from $1,000 to $2,000; 33·8% an income of $2,000 to $3,000; 21·1% an income from $3,000 to $5,000; and 7·2% an income of from $5,000 to $10,000. Incomes of $1,000,000 or more were reported by 67 persons. Of the total tax, New York state paid $354,000,000, or 31·4%; Pennsylvania, $138,000,000, or 12·2%; Illinois, $85,000,000, or 7·5%; and Massachusetts paid

TABLE 20. *National Wealth, 1912.*

Items of Wealth	Total Value (in thousands of millions of dollars)	Per cent of Total	Amount *Per Capita*
Real property and improvements	110·7	59·0	1,150
Live stock	6·2	3·3	65
Farm implements and machinery, etc.	1·4	0·7	14
Manufacturing machinery, tools and implements	6·1	3·2	63
Gold and silver coin and bullion	2·6	1·4	27
Railway and equipment including Pullman and private cars	16·2	8·7	171
Street railways	4·6	2·4	47
Telegraphs	·2	·1	2
Telephones	1·1	·6	12
Shipping and canals	1·5	·8	16
Irrigation enterprises	·4	·2	4
Privately owned waterworks	·3	·1	3
Privately owned electric light and power stations	2·1	1·1	22
Agricultural products	5·2	2·7	53
Manufactured products	14·7	7·8	153
Imported products	·8	·4	8
Mining products	·8	·4	8
Clothing and personal adornments	4·3	2·3	45
Furniture, carriages, etc.	8·5	4·5	88
Total	187·7	100·0	1,965

$81,000,000, or 7·2%. Of the personal income, 73% was from personal service and 27% from property. Corporations reported a net income of $8,362,000,000, of which those connected with metals and metal products returned $2,053,000,000 and those connected with transportation and other public utilities $1,054,000,000. The income, war profits and excess-profits taxes from corporations amounted to $3,159,000,000 of which those connected with metals and metal products paid 31·76%, or $1,003,000,000. (*See* INCOME TAX and EXCESS PROFITS TAX.)

Public Finance.—The two main sources of Federal revenue are customs duties and internal revenue duties. Revenue from customs although nearly as large in 1920 as in 1910 was relatively unimportant; in 1910 it yielded $333,683,000 as compared with $289,934,000 from internal revenue. After that year internal revenue was the larger. Receipts were as follows:—

	Customs	Internal Revenue
1910	$333,683,000	$ 289,934,000
1911	314,497,000	386,875,000
1912	311,322,000	380,456,000
1913	318,891,000	405,120,000
1914	292,320,000	442,350,000
1915	209,787,000	415,670,000
1916	213,186,000	512,702,000
1917	225,962,000	809,366,000
1918	182,759,000	3,696,043,000
1919	183,429,000	3,840,231,000
1920	323,537,000	5,399,149,000

On account of the war new taxes were levied, the personal income tax was increased, and excess-profits tax added. The income from these two sources was, in 1918, $2,839,028,000; in 1919, $2,600,784,000; and in 1920, $3,958,000,000. Transportation taxes in 1919 yielded $238,000,000. Tobacco duties yielded in 1910 $58,118,000 and in 1919 $206,003,000; spirits and fermented liquors in 1910, $209,000,000 and in 1918, $483,000,000. The total ordinary receipts in 1919 were $675,512,000, or $7.48 *per capita*, and in 1919 $4,647,604,000, or $43.79 *per capita*. Total ordinary expenditures increased from $660,000,000 in 1910 to $15,365,000,000 in 1919, a *per capita* increase from $7.30 to $144.77. Expenditures for the War Department increased from $158,000,000 in 1910 to $9,273,000,000 in 1919; for the Navy Department from $124,000,000 to $2,019,000,000. The interest on the public debt increased from $24,742,000 in 1917 to $1,024,024,000 in 1920. Until 1917 the net public debt remained fairly stationary for many years. In 1916 it was about $1,000,000,000; in 1917 it rose to $1,909,000,000; in 1918 $10,924,000,000, and in 1919 $24,331,000,000. For the Fourth Liberty Loan, the subscriptions were $6,959,000,000 from 22,777,680 subscribers, or 21·9% of the total population. Of the subscriptions 53% were for $50, the total in this class making 10% of the total amount subscribed.

The net cost of government, distinguishing between the United States, states, and cities having a pop. of over 30,000, as tabulated by the Bureau of Census for 1919, was:—United States, $15,740,133,000 ($149.78 *per capita*); states, $635,370,000 ($6.05 *per capita*); cities over 30,000 $1,202,324,000. Of the $635,000,000 representing the cost of state Governments, $543,000,000 was devoted to current expenses of the general departments, the balance representing payments for outlays and interest on state debts. Of the $543,000,000 for general departmental services, $183,000,000 was expended for schools, $134,000,000 for charities, hospitals and corrections, and $62,000,000 for highways. The revenue receipts of states were $675,000,000, of which $237,000,000 came from the general property tax; $104,000,000 from special property taxes, as $46,000,000 inheritance tax, and $43,000,000 corporation stock taxes; $123,000,000 was derived from business taxes; and $48,000,000 from licences other than business, for the most part from the use of motor vehicles. The net indebtedness of states in 1919 was $520,000,000 or $4.95 *per capita*. With this may be compared the net indebtedness of the Federal Government amounting to $24,331,000,000, or $232.95 *per capita*, and for cities having a pop. of over 30,000, $2,698,000,000.

Of the total governmental-cost payments for cities having a pop. of over 30,000, 754 millions was for current expenses of general departments; 238 millions was expended for schools, 72 millions for highways; 61 millions for sanitation, 65 millions for fire departments, 81 millions for police departments, and 65 millions for charities, hospitals and corrections. In addition 67 millions was expended for public service enterprises, two-thirds of which was for water-supply systems; 157 millions for interest on debt; and 256 millions for outlays; representing costs of new property and equipment. The governmental-cost payments of 10 large cities for 1919 were as follows:—New York, $232,061,926 (*per capita*, $42.28); Chicago, $93,515,758 (*p.c.*, $35.66); Philadelphia, $67,027,257 (*p.c.*, $37.64); Detroit, $34,738,091 (*p.c.*, $36.86); Cleveland, $29,617,643 (*p.c.*, $38.84); St. Louis, $24,188,963 (*p.c.*, $31.75); Boston, $37,042,131 (*p.c.*, $50.13); Baltimore, $16,372,941 (*p.c.*, $25.12); Pittsburgh, $25,527,430 (*p.c.*, $44.09); Los Angeles, $24,716,666 (*p.c.*, $44.81). (*See* also the section *Finance*.)

Army.—On June 30 1920 the enlisted strength of the army was composed of 15,451 officers and 184,904 men, making a total of 200,355. Of the total 149,869 were on duty in the United States, 19,319 in the Philippine Department, 4,519 in Hawaii, and the remainder were scattered in China, Panama, Alaska, Porto Rico, and Siberia, with the U.S. army in Europe, and at sea. By branches of service the army was composed of Infantry, 52,560; Cavalry, 16,777; Coast Artillery, 16,145; Field Artillery, 15,757; Air Service, 9,358; Corps of Engineers, 4,877; Signal Corps, 4,948; Staff Corps and Departments, 47,165; General Officers and aids, 195; Philippine Scouts, 7,149; and miscellaneous, 25,368. As a result of service in the World War it was estimated by the Chief of Staff of the War Department in 1919 that there were nearly 4,000,000 men and 200,000 officers fit and trained for war. (*See* ARMY.)

Navy.—Owing to the war with Germany, the navy, both in vessels and men, was greatly increased. In 1912 there were 323 vessels fit for service, and 42 under construction; in 1920 the respective numbers were 795 and 165. The principal classes of vessels in 1920, fit for service, were:—battleships 37, armoured cruisers 8, cruisers 26, destroyers 249, submarines 98. In addition there were under construction, 11 battleships, 24 cruisers, 70 destroyers and 50 submarines. In 1910 the number of officers in the regular service was 2,645 and enlisted men 45,076; in 1920 the respective numbers were 8,765 and 116,760. In addition the marine corps contained in 1910 9,659 and in 1920 19,685. (*See* SHIP AND SHIPBUILDING.)

BIBLIOGRAPHY.—Relating to the *Thirteenth Census of the United States, 1910* are the following volumes: I. *Population, General Report and Analysis* (1913); II–III. *Population, Reports by States* (1913); IV. *Occupation Statistics* (1914); V. *Agriculture, General Report and Analysis* (1913); VI–VII. *Agriculture, Reports by States* (1913); VIII. *Manufactures, General Report and Analysis* (1913); IX. *Manufactures, Reports by States* (1912); X. *Manufactures, Reports for Principal Industries* (1913); XI. *Mines and Quarries, 1909* (1913). Much of the material in these volumes is summarized in the *Abstract* (1913), and is graphically represented in the *Statistical Atlas of the U.S., 1914*.

The Census of Manufactures, 1914, appeared in 2 vols. in 1918–9. Important volumes on special topics have been recently published by the Bureau of the Census: *Negro Population 1790–1915* (1918); *Indian Population in the United States and Alaska, 1910* (1915); *Religious Bodies, 1916:* part I, *Summary and General Tables* (1919), part II, *Separate Denominations* (1919); *Insane and Feeble-Minded in Institutions, 1910* (1914); *Benevolent Institutions, 1910* (1913); *Deaf Mutes in the United States, 1910* (1918); *Paupers in Almshouses, 1910* (1915); *Prisoners and Juvenile Delinquents, 1910* (1918); *Statistical Directory of State Institutions for Defective, Dependent and Delinquent Classes* (1919); *Wealth, Debt and Taxation, 1913* (3 vols. 1915); *Central Electric Light and Power Stations and Street and Electric Railways 1912* (1915); *Telephones and Telegraphs, 1912* (1915); *Transportation by Water, 1916* (1920). The Bureau of the Census has also published a series of volumes on *Financial Statistics of Cities* and on *Financial Statistics of States* and continues the annual compilation on *Mortality Statistics*, begun in 1900. As the registration area is constantly enlarged, these latter statistics are of increasing value.

The Federal Department of Agriculture issues many statistical bulletins relating to crops, supplies and stocks of staple commodities.

The most important of these are summarized in the *Year Book of the Department of Agriculture.* The U.S. Geological Survey of the Department of the Interior issues frequent bulletins on mineral products and stocks which are annually gathered together in the volume *Mineral Resources of the United States.* Statistics of commerce are compiled by the Department of Commerce and published in an annual volume, *Foreign Commerce and Navigation.*

The U.S. Tariff Commission has also published several volumes in which commercial statistics are rearranged for use in tariff discussion, as *The Wool-Growing Industry.* Price statistics both for retail and wholesale trade are gathered and published by the Federal Bureau of Labor Statistics. A valuable series of studies on price statistics of different groups of commodities during the World War was published under the editorship of W. C. Mitchell by the War Industries Board, under the titles *History of Prices during the War* and *Government Control over Prices.* The Bureau of Labor Statistics also issues frequent bulletins showing wages in different trades in different parts of the country. The Interstate Commerce Commission issues an annual report, *Statistics of Railways.* Shipping statistics are published in the *Annual Report of the Commissioner of Navigation.* Immigration statistics are published in the *Annual Report of the Commissioner of Immigration.* Statistical tables in regard to the Federal finances are to be found in the *Annual Report of the Secretary of the Treasury,* sometimes known as the *Finance Report.* This contains abstracts of the reports of the Comptroller, Treasurer, Commissioner of Internal Revenue and Director of the Mint. Of especial value for recent years are the annual reports and the monthly bulletins of the Federal Reserve Board. The bulletins contain a great variety of commercial and trade statistics collected by the 12 different reserve banks. More detailed statistical data may be found in the monthly bulletins issued by the several district banks.

The most serviceable single source-book is the annual volume, *Statistical Abstract of the United States,* first issued in 1878, published by the Department of Commerce. This assembles data on area and population, including census returns, immigration, and vital statistics; education and school statistics; agriculture, forestry and fisheries; manufactures and mines; occupations, labour, and wages; internal communication and transportation; merchant marine and shipping; foreign commerce; consumption estimates; prices; money, banking, and insurance; public finance and national wealth; army, navy, civil service, pensions, and election statistics. Most of the statistics are derived from official publications, but when they are wanting, reliance is placed upon private statistical agencies.

A useful statistical handbook relating to finance, crops, railways, trade and commerce is *The Financial Review,* an annual published by the *Commercial and Financial Chronicle* (New York).

In addition to Government statistics the following volumes should be noted: W. I. King, *The Wealth and Income of the People of the United States* (1917), a scholarly analysis and interpretation of official statistics; Raymond Pearl, *The Nation's Food* (1920), a volume growing out of the author's work as chief of the Statistical Division of the U.S. Food Commission during the war. The Committee on Economic Research of Harvard University has published an important work, *Indices of General Business Conditions,* by W. M. Persons (1919). (D. R. D.)

II. AGRICULTURE

For the conditions of agriculture in the United States before 1910 *see* 1.414; for recent statistics *see* the section *Statistics* of the present article; for general progress since 1909 in biological, chemical and bacteriological research *see* article AGRICULTURE 30.71; for development in any one state *see* the article on that state. For various aspects of progress *see* also, in vol. 32, the index-heading AGRICULTURE and the other index-headings naming the various crops, products, processes, machines, etc.

The main characteristics—economic rather than technical—of agricultural activities in the United States during 1910–20 were the result of significant changes which must be traced through a period of more than one decade. The ten years ending with 1920 witnessed the close of an important epoch and the opening of a new epoch in the agricultural history of the United States. The closing epoch might well be called the pioneer epoch, that of agricultural expansion, or of agricultural exploitation. The new epoch might be called that of agricultural readjustment, development, or utilization. The names by which these two epochs are known are of little importance, but it is of great importance that all who are interested in the development of American agriculture get clearly in mind the fact to which all other facts in this connexion are subsidiary, namely, that ever since the beginning of American agriculture and down to the decade 1910–20 there was ample and fertile field in the West for the expansion of agriculture, but that during 1910–20 virtually the last of the arable part of the public domain passed into private ownership. There was no longer land available for homes for the surplus population from the older portions of the country. The western agricultural migration, which began almost with the first settlements on the Atlantic coast, was, owing to natural barriers and the absence of adequate transportation systems and other causes, more or less sporadic and irregular until about 1860.

The Agricultural Frontier in 1859.—In 1859 the frontier of agricultural development as determined by density of population of 6 or more to the sq. m., or the production of 100,000 bus. of wheat per county per annum had been pushed westward to include portions, varying in size, of the states of Michigan, Wisconsin, Minnesota, Iowa, Nebraska, Missouri, Kansas, Arkansas, Louisiana and Texas. For the next 50 years there was a steady western and northern agricultural movement, until in 1910 virtually the only agriculturally unoccupied territory in the great plains was in Montana, Wyoming, western South Dakota, northwestern Nebraska, southwestern Kansas, New Mexico and western Texas. During the following decade 1910–20 virtually all the agricultural land that remained in the above described regions went into private ownership. By 1921 all the public domain suited to agriculture without irrigation, east of the Rocky Mountains, had ceased to be open to homestead claims and was undergoing agricultural development.

The Agricultural Frontier in 1920.—The 5,000-ft. contour on the eastern slope of the Rocky Mountains is generally considered the western boundary of the great plains, but to simplify computation the great plains may be regarded as including four-fifths of the area of Montana, one-third of Wyoming, one-half of Colorado, one-half of New Mexico, and all of Texas. The tract which came into agricultural production during 1860–1920 includes four-fifths of Montana; one-third of Wyoming; one-half each of Colorado and New Mexico; all of North and South Dakota, and Oklahoma; about seven-eighths of Minnesota; over one-half of Wisconsin; over two-thirds of Michigan; nearly one-half of Iowa; all but six counties (2,494 sq. m.) of Nebraska; all but 10 counties (4,684 sq. m.) of Kansas; all but 25 counties (19,356 sq. m.) of Texas; 14 counties (10,607 sq. m.) in Missouri; 28 counties (20,939 sq. m.) in Arkansas, and all but 27 counties (16,212 sq. m.) of Louisiana; the entire area amounting to no less than 1,096,607 sq. m., or 701,828,480 acres. Not all of this is arable land, but a higher percentage of it is arable than that of any other equal area on the North American continent, and contains at least 250,000 sq.m. of the richest agricultural land on the continent. More than half the total wheat crop of the United States for 1920 was grown in this area.

Coincident with the settlement of this plains region east of the Rocky Mountains was that of the inter-mountain and basin region and of much of the Pacific slope. The percentage of arable land west of the Rocky Mountains is much less than in the plains of the Mississippi Valley and the Lake region, but in the aggregate an immense area of land was brought into cultivation west of the Rockies during 1860–1920. There, as in the plains, practically all the land suitable for agriculture was appropriated and developed. There remained only small valleys and isolated areas and some Indian reservations that were to be soon thrown open to settlement. New reclamation projects were expected to develop, but if all the potentially agricultural land west of the Rocky Mountains were to be developed during 1920–30 the area would be small in comparison with that developed in each decade during 1860–1920. And it is probable that during 1920–30 as much land classed as farm land may be found unfit for that purpose and be devoted to other purposes, such as grazing and forestry, as will be brought into cultivation.

The significance of these facts does not seem to impress as it should either the public or the farmers. The habit of western migration, bred into the American people, during three centuries of practice is about to be broken.

The exhaustion of the public domain means that there is no longer available each year, as there was during 1860–1920, an area of virgin land in the Mississippi Valley, averaging 18,277 sq. m., or 11,697,280 ac., that is to say an area equal to one-third of the state of Iowa. It means that increased agricultural production by the simple process of breaking up virgin prairie is virtually at an end, so that future increases in food production must be attained by a more effective utilization of the land already occupied as farms.

The Increase of Agricultural Production and of Population for 60 Years.—The accompanying tables have been prepared from data contained in the 1920 Yearbook of the Department of Agriculture and the 1920 Census Reports. The yields of grain stated in these tables are not those of the Census Reports, but are the averages of the yields given in the Yearbook for each of the 10 years in each decade, except those for 1860 which represent the single year 1859, and for 1870 which represents the average for four years, 1866–9 inclusive. It is believed that this gives a better expression of the facts than using for each decade a single year's yield, such as is given in the Census Reports.

The two crops, wheat and corn, are chosen as an index of the general agricultural production for each decade since 1860. It is believed that they will serve the purposes of this discussion as well as or better than the more complex indexes used for more detailed investigation.

It will be seen that the proportionate increase by decades in population has been declining, having been 26·6% for 1860 and 14·9% for 1920, the greatest decrease in any decade having been between 1910 and 1920. There has been no such progressive decrease in production of either wheat or corn. The highest proportionate increase in the production of wheat was in 1880, when it was 49·3% over that of 1870. The highest proportionate increase in the yield of corn was also in 1880, when there was an increase of 41·9% over

1870. The percentages of increase of both wheat and corn for 1870 are not very trustworthy, because, as has been said, the yields used in the census of 1860 were the yields of the single year 1859 and those for the year 1870 were the averages of four years—1866–9 inclusive. From 1880 to 1920 there was a general decline in the average increase in production of wheat. In the case of corn its regularity was broken by reason of the very low rates of increase for the decade reported in the census of 1900. This was due to a succession of crop years with unfavourable weather conditions and to a general business depression. The production in bushels per capita of both wheat and corn has been quite constant. There has, therefore, been a regular increase in the bushels per capita of wheat from 5·5 bus. in 1870 to 7·4 bus. in 1920, and an increase in corn from 22·2 bus. in 1870 to 26·2 bus. in 1920. Dividing the percentages of increases for decades by 10 to give the annual percentage of increase shows that the average annual increase in the production of wheat in the United States for a period of 60 years (from 1860–1920) is to the annual increase in population as 2·91 is to 2·25 and that of corn for the same period is as 2·28 is to 2·25.

Both population and production have been increasing at a lessening rate. The retardation in the increase in population has been somewhat greater than that of production, as is indicated by the increase in the per capita production of wheat from 5·5 bus. to 7·4 bus. and of corn from 22·2 to 26·2 bus.

The proportionate rate of increase in production of wheat for the decade ending with 1920 was 13·9% and for corn 11·2%, and for population 14·9%.

TABLE I.—*Wheat Production and Population.*

Years.	Population.	Production.	Increase in Production Bus.	Percentage Increase of Production.	Percentage Increase of Population.	Bushels Per Capita.
1860	31,443,321	173,105,000	—	—	—	—
1866 to 1869	38,558,371	212,156,000	39,051,000	22·6	26·6	5·5
1870 to 1879	50,155,783	316,820,000	104,664,000	49·3	26·0	6·3
1880 to 1889	62,947,714	444,078,000	127,258,000	40·2	25·5	7·1
1890 to 1899	75,994,575	556,674,000	112,596,000	25·4	20·7	7·3
1900 to 1909	91,972,266	684,434,000	127,760,000	23·0	21·0	7·4
1910 to 1919	105,710,620	779,560,000	95,126,000	13·9	14·9	7·4
			Averages	29·1	22·5	6·8

TABLE II.—*Corn Production and Population.*

Years.	Population.	Production.	Increase in Production Bus.	Percentage Increase of Production.	Percentage Increase of Population.	Bushels Per Capita.
1860	31,443,321	838,793,000	—	—	—	—
1866 to 1869	38,558,371	854,278,000	15,485,250	1·8	26·6	22·2
1870 to 1879	50,155,783	1,212,013,000	357,735,000	41·9	26·0	24·2
1880 to 1889	62,947,714	1,692,019,000	480,006,000	39·6	25·5	26·9
1890 to 1899	75,994,575	1,995,190,000	303,171,000	17·9	20·7	26·3
1900 to 1909	91,972,266	2,486,274,000	491,084,000	24·6	21·0	27·0
1910 to 1919	105,710,620	2,765,041,000	278,767,000	11·2	14·9	26·2
			Averages	22·8	22·5	25·5

It becomes evident that the record of the annual production of wheat and corn through a period of 60 years, and its relation to the increase in population as indicated by the figures given in the accompanying tables, is a safe index of the agricultural requirements for the future, the conclusion is that if the general agricultural production of the country can be increased at the rate of 2% per annum for the future, the per capita production of wheat and corn, and probably of most other staple agricultural products, can at least be maintained at the ratio of the decade 1910–19.

The Agricultural Problem of the Future.—Had conditions in all parts of the world remained substantially as they were in 1914, the chief problem in 1921 would have been how to maintain in later years an increase of 2% per annum in the agricultural production of the United States, notwithstanding that virgin land could no longer be counted upon. This is a problem that prior to the World War would have engaged the most earnest effort of American farmers and the various agricultural agencies and organizations, both Federal and state. It would have presented difficulties of adaptation, adjustment, and development. The question of actual field production would have been a minor one as compared with such questions as transportation and distribution, the securing of efficient farm labourers at reasonable wages, and the opportunity for the farmers to purchase at prices comparable with the prices of farm products the things that a farmer has to buy to conduct his business and to live in comfort. Given conditions favourable in these respects, agricultural production undoubtedly could have been increased for many years after 1921 at a rate of 2% per annum. There are many ways in which this increased production could have been brought about: by clearing and bringing into cultivation waste land already included in farms; by draining swamps, and by developing water to enlarge existing irrigation projects; probably most of all by more intensive methods of agriculture. The agriculture of the United States had been and in 1921 still was an extensive, rather than an intensive, agriculture, and properly so. So long as land was plentiful and men were scarce the extensive system was to be encouraged. But as land began to become scarce and men plentiful there came almost unlimited opportunities for the intensifying of agriculture. While this need for closer farming was being discussed the World War brought with it a new set of problems that engaged the attention of the farmers as well as other citizens.

Prices of Farmer's Products and of Commodities He Buys.—The most pressing problem in 1921 was the disproportion between the prices of those things the farmer has to buy and those he has to sell. This difficulty was as great when he paid for labour as when he bought commodities.

Wages of Farm Labour.—The Bureau of Crop Estimates of the Department of Agriculture published in the Yearbook for 1920 a table giving the wages paid farm labourers from 1866 to 1920. Arranging these figures for the different classes of farm labourers as index numbers, and calling the wages of 1913 100 as a base, gives the following results:

Wages—Agricultural Labour.

		1913	1920	1921	Index No.	
					1920	1921
A	By the month with board	$21.38	$46.89	$29.48	219	138
B	By the month without board	30.31	64.95	42.65	214	141
C	Day labourer at harvest, with board	1.57	3.60	2.12	229	135
D	Day labourer at harvest, without board	1.94	4.36	2.80	225	144
E	Day labourer, not harvest, with board	1.16	2.86	1.60	247	138
F	Day labourer, not harvest, without board	1.50	3.59	2.17	240	145

Farm wages declined during 1921. The best information available, Nov. 20 1921, was that wages were about as follows (A) $29.48, (B) $42.65, (C) $2.12, (D) $2.80, (E) $1.60, (F) $2.17. These figures would give an index number about 145, or an increase of about 45% for 1921 over the wages of 1913. In the diagram, fig. 1, the figures for "Day labour, not harvest, without board" have been used as they are considered the most trustworthy. Men of this class are usually married men who either own their own homes or rent them from their employers. They are less inclined to drift than those who are boarded by their employers, and who are usually single and "footloose." The married man who works by the month and boards himself frequently has house, garden, firewood and sometimes milk and pork provided by his employer. This is probably the most stable class of farm labour. It does not, however, yield a conclusive index of the changes in wages because changes in the value of the perquisites above mentioned tend to complicate the calculation.

The index number for the wages of day labourers, not for harvest, without board were as follows:

Year	1913	1914	1915	1916	1917	1918	1919	1920	1921
Index No.	100	97	98	108	135	175	208	240	145

Discussion of Diagram.—Fig. 1 (p. 864) shows the index numbers of farm crops, live stock, commodities and farm labour for each year from 1913 to 1921, inclusive.

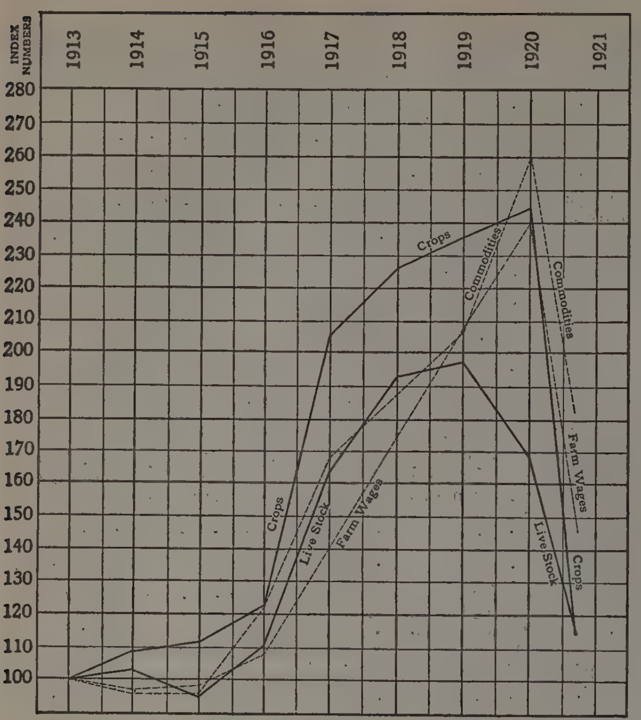

FIG. 1.

Index Numbers of Farm Crops, Live Stock, Commodities and Farm Labour Each Year from 1913 to 1921 Inclusive.

The two outstanding facts are that in every year from 1913 to 1919 the farm crops index stood higher than any of the others, and that from 1913 to 1918 the farm wage index stood as low as or lower than any other.

Tables III., IV., and V. are based upon data prepared by the Bureau of Crop Estimates, and published by authority of the Secretary of Agriculture.

TABLE III.—*Index Numbers of Farm Prices of Crops.*

The index numbers of average prices to farmers of the United States of 10 leading crops (wheat, corn, oats, barley, rye, buckwheat, potatoes, hay, cotton, and flax) represent about four-fifths of the value of all crops and may be regarded as representing the trend of all crop prices. (Base 100=average for 12 months of 1913.)

	1921	1920	1919	1918	1917	1916	1915	1914	1913
Jan. 1 .	129	241	221	214	149	105	103	108	90
Feb. 1 .	123	252	211	220	159	114	114	107	91
Mar. 1 .	120	255	209	234	168	112	117	109	92
Apr. 1 .	113	271	220	234	183	114	117	109	92
May 1 .	104	294	238	229	228	116	122	110	94
June 1 .	109	309	249	221	236	118	120	113	98
July 1 .	106	304	252	222	235	118	113	112	100
Aug. 1 .	109	268	267	228	250	120	113	112	102
Sept. 1 .	109	239	258	238	227	131	108	115	111
Oct. 1 .	—	202	235	235	225	133	104	111	113
Nov. 1 .	—	163	227	219	212	145	101	103	109
Dec. 1 .	—	135	230	215	205	152	98	100	108
Average	112	244	235	226	206	123	111	109	100

TABLE IV.—*Index Numbers of Farm Prices for Live Stock.*

Index numbers of average prices to farmers of the United States, for live stock. (Base 100=average for 12 months of 1913.)

	1921	1920	1919	1918	1917	1916	1915	1914	1913
Jan. 15 .	120	173	192	179	121	92	94	100	91
Feb. 15 .	117	177	192	180	134	100	92	103	95
Mar. 15 .	123	178	200	186	152	107	92	105	101
Apr. 15 .	112	181	214	193	166	112	94	105	104
May 15 .	109	177	218	197	168	114	97	104	101
June 15 .	104	175	213	194	167	114	98	103	102
July 15 .	109	176	222	195	163	114	97	105	103
Aug. 15 .	113	172	221	202	168	114	96	109	102
Sept. 15 .	—	174	191	206	182	119	96	108	102
Oct. 15 .	—	166	174	196	186	114	99	102	102
Nov. 15 .	—	147	169	190	177	115	92	97	99
Dec. 15 .	—	121	164	191	181	116	89	94	98
Average	113	168	197	192	164	111	95	103	100

TABLE V.—*Index Numbers of Commodity Prices, Excluding Farm and Food Products.*

Based upon the Bureau of Labor index numbers of wholesale prices of all commodities from which were deducted the commodities representing the foods, and farm products group. (Base 100=average for 1913.)

	1921	1920	1919	1918	1917	1916	1915	1914	1913
Jan. . .	205	246	191	173	153	109	94	98	102
Feb. . .	194	257	192	175	152	112	95	97	102
Mar. . .	186	263	186	179	160	115	93	98	100
Apr. . .	180	272	184	182	162	118	93	97	100
May . .	177	278	187	184	170	118	95	96	100
June . .	173	277	196	188	178	120	94	96	100
July . .	171	272	205	192	182	118	96	96	100
Aug. . .	169	271	217	193	177	119	95	95	100
Sept. . .	—	267	221	196	175	124	96	96	100
Oct. . .	—	257	225	195	166	120	98	93	100
Nov. . .	—	234	230	198	168	140	101	92	99
Dec. . .	—	220	237	196	169	148	105	94	97
Average	182	259	206	188	168	122	96	96	100

A study of the diagram (fig. 1) confirms the evidence from many other sources that farmers engaged primarily in crop production were reasonably prosperous from 1913 to 1916 inclusive, and that during 1917, 1918 and 1919 they enjoyed unprecedented prosperity followed by two years of heavy losses; the high prices of the early months of 1920 having broken before the products could be marketed and the cost of commodities and farm wages remaining high. It also shows that the live stock grower was only just able to keep pace with the increasing cost of necessary commodities, and but little ahead of the steadily rising farm wages that he had to pay. The conditions of agriculture on Dec. 1 1921, as shown by Tables I., II., III. and V., and fig. 1, indicate that never before in the history of American agriculture had the farmers been confronted with so serious a situation. Unless the prices of what the farmer must sell could be brought into proper relation with prices of what he must buy—commodities and labour—agricultural production would necessarily be so greatly reduced as to bring about a serious shortage of food and textile products, for farmers cannot continue to produce crops at a loss not only of their time, but also of their money.

When, however, the agricultural situation is more closely studied it becomes apparent that even though a proper relation could be restored between the prices of farm products, farm labour, and the commodities the farmer has to buy, many of the farmers would be still unable to operate their farms profitably.

During the decade 1910–20, throughout the first half of which the farmers enjoyed normal prosperity and throughout the latter half of which their prosperity was the greatest ever enjoyed by American farmers, the rural population increased only 5·4% while the urban population increased at the rate of 25·7%. That is to say urban population increased nearly five times as rapidly as the rural population, increased movement to centres showing that farm life and farming had come to be disliked, notwithstanding their new advantages: improved roads, rural free mail delivery, telephones, automobiles, farm electric lighting plants and modern water and heating systems, all developed rapidly during the ten years in question.

Although there were 86,864 or 1·4% more farms in the United States in 1920 than in 1910, there were 23,627 or ·6% fewer farm owners. Of the 3,925,090 farms operated by their owners in 1920, 41·3% were mortgaged as against only 33·6% in 1910.

The value of the land and buildings of mortgaged farms was $6,330,236,951 in 1910, and in 1920 $13,772,729,610, an increase of 117·6%. In 1910 the mortgaged indebtedness was $1,726,172,851; in 1920 $4,012,711,213, an increase of 132·5%. The increase in value ranged from 21% in New Jersey to 480% in Arizona. The increase in mortgaged indebtedness ranged from 10·2% in Rhode Island to 625·7% in Montana. The increase per cent in mortgaged indebtedness by geographical divisions was as follows: New England 56·8; Middle Atlantic 45·5; East North Central 101·0; West North Central 136·3; South Atlantic 161·8; East South Central 194·6; West South Central 154·0; Mountain 379·4; Pacific 215·6.

The average value of land and buildings on all mortgaged farms in 1910 was $6,289, and in 1920 it was $11,536, an increase of 117·6%. The average debt per farm was $1,715 in 1910 and $3,361 in 1920, an increase of 132·5%. The debt per cent value was 27·3 in 1910 and 29·1 in 1920, the figures being based on 1919 values. These declined and debts increased during 1920 and 1921, and at the end of 1921 it was believed that changes would continue in the same direction, until a shortage of food should increase prices.

There was difference of opinion as to the significance of the heavy increase in mortgaged indebtedness. The published reports of the Bureau of Census do not indicate at what time during the decade this increase took place, nor the purposes for which the money represented by the mortgages was used: whether as purchase money for the land upon which it was placed, for buildings, or other improvements upon the land, for farm equipment, or for the purchase, operation, and the incidental expenses pertaining to the ownership of an automobile.

Conditions during 1910–5, unforeseen in the beginning of that period, favoured investors in agricultural land and in farm improvements. Values doubled and in some instances quadrupled during 1910–20. And many of those who borrowed to make such investments were enabled during 1915–26 to repay in what were called "thirty cent dollars," because inflated prices made currency redeemable in gold seem worth less than before. Indeed many farmers thus repaid not only the capital they had borrowed, but also their small floating debts, so that when deflation began in the summer of 1920 they could face without fear the inevitable hard times, in which economic readjustments must be made.

Unfortunately not all farmers were safe. Some, because of local crop failures or other unavoidable circumstances—and others, more numerous, because they had yielded to the spending craze that swept the country in 1918 and 1919—found themselves in the summer of 1920 possessed of much property, both real and personal, some of which had been acquired at war-time prices, but heavily indebted and with credit exhausted. It was largely owing to their difficulties that during the decade the mortgaged indebtedness of farmers so largely increased.

The Internal-Combustion Engine as an Agricultural Factor.—In the decade ending with 1919 there was a great development of the internal-combustion engine and adaptation of it not only to the labour, but also to the health, comfort and enjoyment of the American farmer. (*See* articles: INTERNAL-COMBUSTION ENGINES; TRACTORS; and MOTOR VEHICLES.) It came to be used directly in the automobile, truck, tractor, pumping plant, electric lighting plant; for cutting silage, grinding feed, shelling corn, threshing grain, sawing wood, operating spraying machines and fruit-grading machines; and for many other power purposes. The internal-combustion engine, generating current, also indirectly operates the washing machine, the electric iron, electric fans, the vacuum cleaner, electric heating pads, and (through small portable motors) serves for separating milk, churning, meat grinding and many other household purposes.

A general farm of 150 to 200 ac. growing fruit, a small dairy herd, some truck and general farm crops, was no longer considered well equipped unless it had all the facilities above mentioned and perhaps a milking machine also, if the dairy herd was large. Seven separate internal-combustion engines and an equal number of small electric motors probably would be needed for all these purposes. Such a plant undoubtedly would be a good investment if it were judiciously selected and bought at a fair price, provided always that (1) the farm and the system of farming were adapted to the use of a tractor, (2) that the farmer or some member of his family had the necessary mechanical skill to see that this equipment were properly operated and kept in repair, (3) that the capital of the farmer was sufficient to provide such a plant, and (4) that the income of the farm was sufficient to support such a plant without seriously interfering with the other requirements of the family and the farm business.

Seldom, if ever, are all the above-mentioned conditions fulfilled, but the measure in which they can be approximated will determine the advisability of the purchase of all the above-mentioned equipment, except the automobile. This must be considered apart, for, although any part of a full farm equipment may be misused, the extent to which the privileges conferred by the automobile may be abused is almost without limit. The choice of the make of automobile is a simple matter, so far as mechanical construction is concerned. The buyer gets about what he pays for in any standard make. It is the use to which the car is put rather than its quality which makes it advantageous or harmful. Whether it will contribute to the efficient handling of the farm is not the only question. If the car is used chiefly to take the family away from home and to encourage waste of time and money, then it is a poor investment.

Automotive Statistics, for 1921, published by the Motor List Company of Des Moines, Iowa, states that 3,243,051 automobiles are owned by farmers in the United States. As already mentioned, the increase in the mortgaged indebtedness of the farmer-owned farms of the United States from 1910 to 1920 was $2,286,538,362. If those 3,243,051 automobiles cost $705.06 each, which is a fair estimate, they would nearly equal in value the amount of the increase in mortgaged indebtedness between 1910 and 1920. This correlation is accidental; no one believes that those 3,243,051 automobiles were bought with money secured by executing mortgages aggregating $2,286,538,362 upon farm property. It is nevertheless probable that some of the purchase money would have been better used to pay off mortgages.

Farm Labour.—Mention has been made of the changes in farm wages during and since the World War. The changes in the price paid per day or per month, or in the index numbers, ought to, but do not, fully represent the changes in the costs of units of labour performed. Before the war most farm labourers were willing to give 10 hours of faithful work for a day's pay. The migration of labour during and after the war, by reason of enlistment or employment in cities or in large manufacturing plants, brought many farm labourers into contact with men who preach inadequate work as a duty. Many of the farm labourers were demoralized, and near large cities it became almost impossible to get an honest day's work at any price. For this reason although the figures in the present article indicate that the price of labour is about 50% more than before the war, the actual cost of labour is from two to three times as much as it was. This is a factor of great importance in all readjustments of the cost of farm products.

Farmers and Consumers.—There was little in the agricultural outlook in Dec. 1921 to encourage the farmers to plan even normal production in 1922, for corn was then selling at from 19 to 28 cents on the farms of North and South Dakota, Minnesota, Nebraska, Iowa, and Kansas; much of the 1920 crop remained unsold; and nearly all farm products were selling at much lower prices than in 1913, although both labour and the commodities the farmer had to buy were much higher. It was evident that farmers must retrench in every practicable way, hiring as little labour as possible; reducing the scale of farm operations as nearly as possible to the point where the farmer and his family could do all the work. They must burn corn or any other agricultural product for fuel, whenever the farm price of that product fell below the cost of equivalent coal, wood, gas, or oil—after adding to the price of such fuel, at the railway station or waterside, the cost of hauling the fuel to the farm and the agricultural products from the farm.

Much could be done toward reducing cash outlay by making each farm produce as much as possible of the food for the family. Much, also, might be accomplished by a system of community exchange. With good roads, automobiles and trucks every farm family should be provided with virtually all necessary food products without expenditure for products, freight or middleman's profit.

In respect of food this generation by reason of the ease and rapidity of communications and country road transportation is better able to develop community self-sufficiency than any previous generation. If there were a demand for home spinning and weaving machinery on a large scale, as there is on a small scale, for home knitting machines throughout the country, homespun clothing again would take its place on the farm. As has been said already, good roads, rural mail delivery, the telephone and the internal-combustion engine have removed practically all but one of the objectionable features which drove many from farm life. That objection is that farming does not yield as large a revenue in proportion to the capital invested and the intelligence, business ability, and enterprise possessed by the farmer, as do other business or professional careers. This must cease to be the case, or American farmers will not continue to produce food and clothing for the rest of the population.

There has been and will continue to be much discussion and agitation of this subject in the public press and on the floors of Congress. Some legislation had already been enacted by 1922 for the purpose of helping the farmer, and further measures were in prospect. It is doubtful whether any real headway can be made in solving the producers' problem until there is an actual and very severe shortage of food in the country. When this occurs, the farmers will obtain fair prices for their products, and may then be able to resume the operation of their farms at full capacity, and to take up the great agricultural problem of the future, which is the adaptation, adjustment and development of the fixed agricultural area of the United States, so that it may continue indefinitely to meet the constantly increasing demands of an increasing population.

(E. C. C.)

III. FINANCE

The movement of public expenditures and receipts in the United States during the decade 1910–20 presents as its most important aspect an instructive contrast between conditions of peace and those of war and readjustment. When the decade opened, education was the largest expenditure, taking all divisions of Government into account; and the financial operations of the state and local Governments were twice as large as those of the national Government. Expenditures, taxes and public debt, it is true, had all been increasing for some time both in the aggregate and *per capita*; but the wealth (expressed in money) of the country had more than doubled between 1900 and 1912, the average rate of the general property tax had decreased between 1902 and 1912, the Federal debt *per capita* was decreasing, and Federal expenditures *per capita* were lower between 1910 and 1914 than in 1908 and 1909. There was, of course, constant protest against rising taxes and "extravagant public expenditures," but the total tax burden was probably increasing less rapidly than wealth or income, and this was certainly true of Federal taxes. War changed all this. Education and the developmental functions yielded first place to military activities; Federal finance threw into the background state and city finance; reduction of the aggregate debt ceased and in less than two years of war the interest charge of the Federal Government alone had become greater than the entire cost of running the Federal

Government before the war. The Federal Government's expenditures and revenues in peace, war and reconstruction are presented in Table I., in which it should be noted that the figures represent net expenditures and net revenues, the expenditures of each department being credited with the earnings of that department and the tax receipts being similarly reduced by the refunds allowed during the same period.

From 1910 to 1916, inclusive, the net expenditures of the Federal Government showed no striking tendency to increase, being only $35,000,000 greater in 1916 than in 1910. The net expenditures for the army and navy were only $23,000,000 greater in the fiscal year 1916 than in the fiscal year 1914, which closed so far as Americans knew to the contrary amid conditions of secure peace—a striking commentary upon the attitude of the Administration in power toward preparedness. Between 1917 and 1919, however, the net expenditures of the army and navy rose from $668,852,948 to $11,192,817,468. It is needless to add that this expansion checked the development of the civil functions. Even before the World War, expenditures for the army, navy, pensions and interest upon old war debt absorbed about two-thirds of the Federal expenditures, leaving less than one-third for the civil functions. But in 1920, at the close of the decade, the expenditures chargeable to war consumed three-fourths of the very much greater aggregate. The total expenditures for primary governmental functions, research, education and development, and for public works, representing the civil functions, were actually less *per capita* in 1919 ($2.21) than in 1910 ($2.24), the principal reductions coming in the expenditures for public works which amounted to $54,332,139 in 1919 as contrasted with $79,503,701 in 1910. In 1920, after the war, the expenditures for civil purposes rose materially; but considering the fall in the purchasing power of money, even the later and higher figures suggest decrease in the equipment, personnel and efficiency of the civil branches of the Government.

The *cost of the war* may be estimated with rough accuracy, defining such cost as the excess of the expenditures which actually occurred over the amounts which probably would have been expended had the war not taken place. The Secretary of the Treasury (*Annual Report*, 1920, p.105), assuming that expenditures on a peace basis during the three fiscal years 1917–9, would have been $1,000,000,000 a year and during the following fiscal year $1,500,000,000, estimated the net war expenditure to June 30 1920 at $33,455,000,000, and the net war-tax receipts, *i.e.* the excess of the annual tax revenue over the normal tax revenue of peace-times, at $10,703,000,000. On this basis, 32 per cent of the special war expense was paid from special war taxes. Mr. E. B. Rosa, in his authoritative analysis, *Expenditures and Revenues of the Federal Government*, makes a more careful estimate, for the four years 1917–20, of the "excess of expenditures over the estimated normal expenditures on a pre-war basis," and reaches a figure of $35,427,730,074, against which he places an estimate of the special war revenue, *i.e.* "the excess of revenue over the estimated cost of government on pre-war basis," $11,818,699,300. Mr. Rosa's estimate agrees with that of the Secretary of the Treasury in indicating that one-third of the special war costs were paid from special war revenues. In both cases loans to foreign Governments, $9,500,000,000 in round figures, are included in the war costs.

Federal revenues during the decade were revolutionized. At its beginning in 1910, customs supplied more than one-half the total receipts; and customs together with the duties on distilled spirits, beverages and tobacco produced more than 95% of the total net revenues. The income tax (special corporation excise tax) was then in the first year of its collection and yielded less than 4% of the total. By the end of the decade, customs and the old duties on alcoholic beverages were subordinate. In the year 1920 customs yielded less than 6%, and the combined duties on imports, distilled spirits, beverages and tobacco yielded only 14% of the total tax revenue; while the income and profits taxes produced $3,956,936,003 or nearly 70% of the total net tax revenue, which was large enough in this year of readjustment to meet the entire current cost of the Government and to create a surplus of more than $1,000,000,000. Other noteworthy developments of this decade from the viewpoint of revenue are found in the introduction in 1916 of the Federal estate or inheritance tax, the development of the excess-profits tax, the loss of one of the most important of the older taxes through the adoption of Federal prohibition, and the reëstablishment of the Tariff Commission. The most significant change, however, was the revolutionary readjustment of taxes by which a system of taxation, predominantly indirect and regressive, gave way to a system predominantly direct and progressive.

Public credit supplied during the war two-thirds of the revenue or receipts. Details concerning the management and yield of the huge war loans are given in the article LIBERTY LOAN PUBLICITY CAMPAIGNS. Here the subject can only be briefly treated in its connexion with the plan of the Government for the financial management of the war. That plan was based upon the policy of sedulously avoiding the use of Government paper money; of raising at least one-third (and, if possible, one-half) of the necessary revenue by taxation; of keeping the inflation which inevitably accompanies war to a minimum, by restricting "non-es-

TABLE I. *Average Annual Net Expenditures and Revenues of U.S. Government for 7 Pre-War Years, 3 War Years, and in 1920.* (*a*)

	Average 1910–6	Average 1917–9	1920
EXPENDITURES (net)			
Primary governmental functions	$ 97,718,290	$ 124,509,073	$ 224,110,594
Research, education and development	25,329,328	33,692,610	57,368,774
Public works	85,408,910	59,857,380	85,071,042
Army and navy	256,971,389	6,302,322,105	1,348,892,747
Pensions and care of soldiers	165,439,944	236,816,982	329,261,746
Obligations arising from World War (*b*)		1,205,255,174	1,634,695,094
Interest	23,605,213	115,853,240	920,131,128
Total expenditures (net)	654,473,074	8,078,306,564	4,599,531,125
REVENUE (net)			
Customs	273,486,931	181,403,815	296,274,230
Internal revenue	368,324,751	2,774,804,615	5,379,353,020
Tax on bank circulation	3,690,489	4,036,586	7,172,598
Post-office war revenue		55,489,500 (*e*)	4,913,000
Total revenue (net)	645,502,171	2,997,238,016 (*e*)	5,687,712,848
PUBLIC DEBT, LOANS AND TRUST FUNDS			
Public debt transactions (*c*)	−11,401,317	−8,085,631,219	1,184,098,321
Loans and trusts (*d*)	− 4,982,411	3,210,794,518	513,885,254

(*a*) Table adapted from E. B. Rosa, *Expenditures and Revenues of the Federal Government*, Table 14.
(*b*) Expenses of Railroad and Administration, Shipping Board and other special war activities.
(*c*) The minus sign indicates an excess of public debt receipts over public debt disbursements.
(*d*) Consists principally of seignorage in 1910–6; and of loans to European Governments in 1917–9 and in 1920.
(*e*) Post-office war revenue given as annual average for the two years collected, but averaged over three years, 1917–9, in computing the total.

sential" commercial credit, encouraging subscribers to the Liberty and Victory loans to pay for them from current savings; and (in minor degree) by repressing unnecessary consumption through the adequate taxation of personal incomes and the use of luxury taxes. Financial preparation for a long war, perhaps of three years, was made, with due appreciation of the fact that in the early months the most effective contribution of the United States would take the form of generous supplies of goods and credit to the Allies. As stated by R. C. Leffingwell, Assistant Secretary of the Treasury, who more than any other one man guided the credit operations of the Government during the war:—

> "The Treasury's war problem was to meet the financial requirements of the Governments of the United States and the Allies promptly and without stint, and to meet them so far as possible from the saved incomes of the people, avoiding avoidable inflation. These objectives must be pursued in such ways as would not interfere with, but on the contrary facilitate, the mobilization of the Nation for war purposes and the production and transportation of munitions."

As the principal credit instrument with which to achieve these ends, the Government used, for the most part, terminable bonds with moderate but adjustable maturities (in no case exceeding 30 years), partially subject to taxation, issued every six months from the beginning of the war to May 1919, at interest rates which because of the conversion privilege varied with the changing credit conditions but were always high enough to stimulate the instinct of saving, yet low enough to utilize fully the patriotic fervour of the people.

In order to avoid credit strain, with its demoralizing effects upon interest rates and business, the huge bond issues were preceded by practically monthly issues of short-dated tax and loan certificates, to be taken up by the payments for taxes or by the subscriptions to Liberty Bonds. When the war debt was at its peak, at the close of Aug. 1919, the gross debt amounted to $26,596,701,648 (or to $25,478,592,113, deducting the net balance in the general fund); of which short-time Treasury certificates constituted $4,201,139,050. As an essential part of the credit machinery, the Treasury adopted as particularly suited to the decentralized character of the country's banking system, upon which the burden of distributing the war loans fell, the device of "payment by credit," by which banks subscribing for Government loans held their subscriptions as a credit to the account of the Government until the Government called for the funds. This reduced the credit strain by preventing the concentration of funds in the Government coffers, and "developed the further advantage that in the difference between the rate borne by the securities and the rate charged on the deposit, banks found some compensation for their time, trouble and the loss of deposits, resulting from the sale of securities to investors" (Leffingwell). This method of payment by credit has been criticized both as paying huge sums to the banks for creating credit which could have been as easily manufactured by the Government itself; and also as productive of inflation. Neither charge will bear analysis. The banks lost rather than gained by the Government's absorption of the investment resources of the people and by the repression of "non-essential industry"; and the device checked rather than stimulated inflation. If the Treasury had actually drawn into the reserve banks and its own offices the proceeds of these great loans, not only would it have demoralized the money market and increased money rates, but after a period of agitation—perhaps panic—there would have been heavy calls for discounts upon the reserve banks and "upon the re-deposit of the proceeds of certificates, depositary banks would be put in possession of loanable funds. . . . It was better to make one bite of the cherry and to avoid the money strain and inflation which would have been inevitable if the money had been first drawn out of the banks and then re-deposited with them" (Leffingwell).

In its decision of the momentous credit questions arising during the war, the Government steered a middle course, avoiding the mistakes which characterized the Civil War financing in the United States and much of the European financing during the World War. One set of critics urged much greater reliance upon short-time debt. Another set urged long-time bonds, "sold over the counter," at interest rates high enough to keep the bonds at par when the inevitable post-war reaction set in. The Government took the intermediate course, utilizing but not abusing the patriotism of the people on the sound assumption that no rate of interest could have been sufficiently high to float these huge issues on a commercial basis alone. And its use of anticipatory short-time certificates was designed not only to prevent money stringency during the war, but to keep some pressing war debt current for extinguishment in the prosperous time which usually follows the termination of a great war. "No administration could have resisted the pressure for reduction of taxes and increase of expenditures if the war debt at its maximum of $25,300,000,000 had been funded, and it had subsequently appeared that taxes and salvage would more than meet current expenditures. The time to pay down a war debt is immediately after the war" (Leffingwell). With the depression that set in in 1921, the Government introduced successfully the device of selling notes running from three to five years along with the more temporary Treasury certificates. And the same middle course was taken, with the results already stated, between the proposals to exempt Government obligations entirely from taxation and to subject them to all Federal taxes at full rates; between those who counselled "conscription of wealth" and those who would have paid practically the whole cost of the war with credit devices of one kind or another. One mistake, the issue of Government paper money, was wholly avoided, and bank credit utilized in its place. But every effort was employed to draw the borrowings from actual savings and to get Government securities as rapidly as possible out of the banks into the hands of investors. These efforts succeeded; on June 1 1921 (according to reports from banks transacting over 40% of the commercial banking business of the country), less than $600,000,000 of the long-time debt of $15,271,000,000 outstanding, only $186,412,000 Victory notes (out of $4,022,000,000 outstanding) and $184,086,000 Treasury certificates (out of $2,572,000,000 outstanding) were pledged with these banks as security for loans and discounts.

The management of the credit operations of the war was not without its shortcomings. The preferential discount rate for loans secured by Government obligations may have been a mistake; perhaps, too, much use may have been made of bank credit and not enough use of taxation—particularly of taxes on the consumption of luxuries and on incomes of the moderately rich; and it seems unquestionable that, owing to inability to gauge the exact time and amount in which the subscriptions to the Liberty loans would be paid, there was an overlapping of Treasury certificates and of bond subscriptions, with the result that the Treasury balance throughout the war was unnecessarily large. But these errors and defects were of secondary importance. The smoothness and efficiency with which the credit machinery worked during the World War—particularly in contrast with its inefficient management during the Civil War—indicate that in essentials the credit policy of the Government was sound and its administration remarkably efficient. The response of the people to the call for bond subscriptions, the cheerfulness with which the heavy war taxes were borne, and the absence of even a temporary breakdown in the credit mechanism with which the war was financed, were all admirable.

State and local finance were affected in unexpected ways by the war. At the beginning of the decade under review, state Government in particular was undergoing an unusually rapid expansion; and both state and municipal expenditures were increasing nearly twice as rapidly as those of the Federal Government. The tax burden, in the case of the state and local Governments, was increasing but not so rapidly as expenditures; increasing deficits were the rule; and the public debt both in total amount and *per capita* was increasing. The situation at the beginning of the decade and the principal financial movements throughout the decade are suggested in Tables II. and III. It should be noted that the Federal expenses or cost payments in Table II. do not include payments made for the purchase of obligations of foreign Governments; and that the *per capita* statistics quoted in Table III. represent net expenditures and revenues after deduction of working credits and tax refunds.

TABLE II. *Governmental Cost Payments*[1]

Year	States		United States		Cities having a pop. of over 30,000	
	Total	*Per capita*	Total[2]	*Per capita*	Total	*Per capita*
1919	$635,370,153	$6.05	$15,740,132,791	$149.78	$1,202,323,639	$34.67
1918	561,000,635	5.42	9,312,169,079	89.16	1,144,629,589	33.35
1917	513,063,487	5.04	2,405,932,009	23.40	1,081,865,678	32.53
1916	505,399,448	5.05	1,048,225,180	10.36	1,043,594,297	32.34
1915	490,707,827	4.99	1,047,834,967	10.44	1,057,125,696	33.92

[1] Bureau of Census, *Financial Statistics of States*, 1919, p. 30.

[2] Amounts for the United States represent the total payments of the United States less payments for investments (consisting principally of obligations of foreign Governments), payments for reduction of the public debt, and the excess of national bank-notes retired over deposits for their retirement.

TABLE III. *Net Expense and Tax Revenue, Per Capita, for All State Governments and for Municipalities Having a Population of over 30,000: 1910–9.*[1]

Year	States		Municipalities having a pop. of over 30,000	
	Per capita net expense	*Per capita* tax revenue	*Per capita* net expense	*Per capita* tax revenue
1910	..[2]	..[2]	$25.13	$21.64
1911	..[2]	..[2]	26.04	21.76
1912	..[2]	..[2]	26.06	22.32
1913	..[2]	..[2]	26.5	22.16
1914	..[2]	..[2]	..[2]	..[2]
1915	$4.11	$3.74	27.63	23.16
1916	4.10	3.67	26.12	23.84
1917	4.00	4.06	26.10	24.82
1918	4.25	4.48	26.55	25.14
1919	4.73	5.06	27.48[3]	27.22[3]

[1] From E. B. Rosa, *Expenditures and Revenues of the Federal Government*. Tables 18, 19.

[2] Data not available.

[3] Computed and inserted by the writer of this article.

It is evident from the tables that the financial operations of the state and local Governments were affected by the events of the war. That the expansion of their activities would be checked, was to be expected; but that the state and local Governments in the face of the heavy Federal war taxes should seize the occasion to adopt or approach the policy of "pay as you go" was, perhaps, not to be expected. Nevertheless this has taken place. City expenditures *per capita* were not only less in 1919 than in 1915, but the tax revenue which was seriously deficient in the earlier year had in the later year increased almost to the point of meeting governmental costs. And beginning with 1917, the receipts of the state Governments as a whole have exceeded their expenses. In 1919, for instance, 31 states "realized enough from revenue to meet all their payments for expenses, interest and outlays and to have a balance of $50,192,314 for paying debt" (U.S. Census Bureau, *Financial Statistics of States* 1919, p. 30). In 17 states there was a deficit aggregating $15,378,246. Much of the economy has been achieved by discontinuing public works or improvements or refraining from those contemplated, and the cost of those public works which have been undertaken has in increasing degree been met from tax revenue rather than the proceeds of loans. In 146 of the principal cities, for instance, the *per capita* payment for capital outlays in 1918 was only $7.51 as contrasted with $10.18 in 1909. Despite opinion to the contrary, Government ownership by states and cities has not expanded during recent years. Public-utility enterprises have developed less rapidly than other branches of the Government and far less rapidly than private business. According to official statistics, these public enterprises yield a substantial profit over the costs incurred, more than three-fourths of the net earnings from these sources being credited to the water departments owned by municipal Governments.

Looking to the revenues of the state and local Governments, the general property tax was still preëminent in 1921. Nearly one-half of the total tax receipts of the states and nearly nine-tenths of those of the cities, were derived from this source. Among the states, the relative importance of the property tax was slowly declining; but among the cities, in recent years it had slightly increased. Among the state Governments, taxes on business had been rapidly increasing and yielded more than half as much as the property tax itself. With the repression of public improvements, due to the war, both the absolute and relative yield of special assessments had fallen off. In general, the drain upon the national income created by Federal taxes and loans had forced upon the state and local Governments measures not only of economy but of parsimony, and it is probable that their efficiency had correspondingly suffered.

Budget Procedure.—Methods of financial administration made substantial progress during the decade under review. The old and generally inefficient "state boards of equalization" had in many states given way to central tax commissions charged with the power and duty not only of securing greater equality in the distribution of the tax burden but of supervising the work of local assessors, administering the more important corporation taxes and usually also the state inheritance taxes. The work of the property assessors had noticeably improved in recent years, particularly in the cities. In a majority of the states, some more or less effective budgetary system had been introduced; and in an increasing number of commonwealths the county and local divisions were being required to follow a prescribed budgetary procedure. Tax limit laws, designed to check local expenditures, had in several states been adopted or revived in improved form; and their effectiveness was being studied with great interest by those interested in governmental economy and efficiency. In the state Governments administrative progress had temporarily taken the path of centralization, and the events of the war had greatly centralized the fiscal machinery of the Federal Government. So far as the tax machinery of the Federal Government is concerned, it is apparent that despite heroic efforts the burden of the war taxes had been too heavy to permit its work to be kept current; and here, at least, it was generally conceded that the path of improvement lay in decentralization. The crowning administrative events of recent years had been the self denying ordinance adopted by the House of Representatives, by which in the future the old appropriation committees would be combined in a single committee on appropriations, and the introduction of a national budget system, by the passage of the Budget and Accounting Act of 1921.

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IV. TAXATION

The movement by which taxation has supplied, with the passage of time, an increasing share of the public revenue of the United States, was accelerated by the events of the decade 1910–20. At its beginning, according to the general financial survey of the national, state and local governments made by the Bureau of the Census for the year 1912–3, public expenditures were met to the extent of approximately 5% from loans, 70% from taxes, 4% from special assessments, and 21% from interest, rentals, departmental or commercial earnings, and miscellaneous sources. During the World War, borrowing took first place, and probably not more than one-half of the aggregate public expenditure was met by taxes. But in the fiscal year 1920, the Federal Government began actively to reduce its short-dated debt; and in that year Federal, state and local revenues were larger than expenditures. Of these revenues (despite the large amounts realized by the Federal Government from salvage and other non-tax sources) taxes supplied over 80% of the total. From the financial standpoint—as a source of revenue compared with taxation—Government ownership is not gaining in importance. In the states and cities, the earnings of public service enterprises shrank in relative, though not in absolute, importance during the decade; and in the national budget, postal earnings, Panama Canal tolls and similar receipts have been dwarfed by the huge tax levies necessitated by the war. Federal taxes, which before the war were of smaller amount than city taxes, became after it larger than all state and local taxes combined; and the leading Federal tax, the income tax, displaced the property tax from its old position at the top of American public receipts. In the fiscal year 1913, property taxes supplied over one-half of the revenue receipts of all divisions of Government, while the yield of income taxes was comparatively insignificant. In the fiscal year 1920 property taxes produced less than one-sixth, while income and profits taxes produced at least one-third and possibly as much as 40% of the total taxes collected in the United States.

Federal taxes at the beginning and end of the decade 1910–20 are contrasted in Table I. which portrays statistically the supersession of customs duties by the income and profits taxes; the beginning of the decline of the tax on alcoholic beverages caused by prohibition legislation—a decline which is disguised in the table by the inclusion of new taxes on non-alcoholic beverages, introduced since the beginning of the World War; the introduction of the Federal estate or inheritance tax; and the multiplication of internal taxes on articles of common consumption. In the past it has been customary to contrast " direct taxes " such as income and inheritance taxes, which are supposed to rest in the main where first imposed, with " indirect taxes " such as those on tobacco and beverages, which, however collected in the first instance, are supposed to be paid eventually by the producer or consumer. Interpreted with reservations, the distinction is serviceable. It will be noted that in 1910 customs, liquor and tobacco taxes—regressive taxes on consumers—yielded over 95% of the total tax revenue; while in 1920 the same taxes augmented by similar taxes on " luxuries," attendance at amusements, and transportation and insurance, produced only 25% of the total. Progressive income, profits and inheritance or estate taxes produced over 70% of the total in 1920. It is obvious that the war revolutionized the character of the Federal tax system in the direction of what has been called " liberal democratic finance." However, in July 1921 the income and profits taxes were falling off more rapidly than the indirect taxes on consumption, owing to business depression; there was a recrudescence of protectionism, and a strong movement to introduce a general sales tax. It seemed probable, at that time, that for the fiscal year ending June 30 1922 indirect taxes would supply from 30% to 40% of the total tax collections. The " consumer " would be thus paying no small share of the national tax bill.

State taxes and other receipts during the period 1915–9 for which general statistics could be obtained are analyzed in Table II. The net revenue receipts of all states for the year 1919 amounted to $670,183,918, and the net governmental-cost payments to $635,370,153, from which figures the general meaning of the percentages given in the table may be inferred. In arriving at the " net revenue receipts," there have been excluded the proceeds of bond issues and of sale of investments or supplies, refunds returned by reason of error or otherwise, and bookkeeping items representing transfers between governmental departments. The term " net governmental-cost payments " is applied to actual payments for expenses, interest and outlays, less counterbalancing payments and receipts, refunds received on account of error or otherwise, and departmental transfers. By " outlays " is meant capital outlays for permanent property. With these explanations, the more important developments in the field of state taxation and finance during the latter half of the decade may be inferred from Table II. Taxes increased in the aggregate from $364,543,797 in 1915 to $527,819,167 in 1919, but the relative importance of taxes among the total receipts decreased slightly. As a source of state revenue, property taxes were declining in importance, while business and other licence taxes were increasing. Earnings of public enterprises, together with rents, interest and charges for highway privileges—commercial earnings in their general character—were comparatively speaking stationary. For the three years 1917–9 state receipts exceeded state expenses by a substantial margin.

TABLE I.—*Tax revenues of Federal Government: 1920 and 1910.*
(From E. B. Rosa, *Expenditures and Revenues of the Federal Government.*)

	1920	1910
Income and excess profits	$3,956,936,003	$20,959,958(*a*)
Distilled spirits and beverages	197,332,105	208,601,600
Tobacco	295,809,355	58,118,457
Transportation, insurance, etc.	307,769,841	—
Luxuries, automobiles, candy, furs, etc.	270,971,064	—
Estate or inheritance	103,635,563	—
Capital stock of corporations, brokers, etc.	95,141,732	—
Stamps on legal documents	81,259,365	—
Admissions to amusements	89,710,525	—
Miscellaneous	9,014,694	2,277,204
Total internal revenue	$5,407,580,251	$289,957,220
Customs—net revenue after refunds, etc.	296,274,230	323,519,307
Tax on national bank circulation, net	7,172,598	3,333,011
Postal war revenue	4,913,000	—
Total tax revenue	$5,715,940,080	$616,809,538

(*a*) Corporations only—excess tax measured by net income.

City taxes and the relative importance of other classes of municipal receipts are analyzed in Table III., which is based upon the revenue receipts of 146 of the larger cities of the United States for which comparative statistics are available for a period of 17 years. The net revenue receipts of these cities increased from $439,126,723 in 1903 to $1,103,665,750 in 1919; and the net governmental cost payments increased from $514,189,206 to $1,113,599,879 in the same interval. The net revenue receipts thus increased 151% while the cost payments increased less than 117%. In 1903 the receipts constituted only 85·4% of the expenditures, but in 1919 the receipts amounted to more than 99% of the expenditures. There is thus no foundation for the current statement that because they may issue bonds " free from taxation," American cities have been led in recent years to borrow unduly.

Table III. describes in figures the more significant movements among city taxes and receipts during recent years; the material increase in the relative importance of the general property tax, the decline of the liquor taxes, the shrinkage in the use of the special assessment since the outbreak of the war, and the slight decrease in the importance of earnings of public service enterprises. Expressed in absolute figures, the total net revenue receipts rose from $21.14 *per capita* in 1903 to $35.26 in 1919; receipts from the general prop-

TABLE II.—*Relative importance (percentage distribution) of net revenue receipts and net governmental cost payments of all states: 1915–9.* (From Bureau of the Census, *Financial Statistics of States*, 1919, p. 33.)

Year	Net revenue receipts													Per cent. of net governmental cost payments represented by:—				
	Per cent. obtained from:—										Per cent. required for meeting:—		Per cent. available for outlays and other purposes	Payments for:—				Net revenue receipts
	Taxes.			Business and non-business licence	Special assessments and special charges for outlays	Fines, forfeits, and escheats	Subventions, grants, donations and pension assessments	Earnings of general departments	Highway privileges, rents, and interest	Earnings of public service enterprises	Expense	Interest		Expenses of general departments	Expenses of public service enterprises	Interest	Outlays	
	Property	Special	Poll															
1919	50·9	2·0	0·3	25·5	0·7	0·4	2·6	12·3	4·8	0·5	81·3	2·9	15·8	85·3	0·4	3·1	11·2	105·5
1918	50·8	2·1	0·4	25·5	0·5	0·4	2·2	12·4	5·2	0·6	81·5	3·2	15·3	84·4	0·4	3·4	11·8	104·1
1917	53·5	2·6	0·4	22·5	0·6	0·4	2·1	12·0	5·3	0·5	82·6	3·3	14·1	83·0	0·4	3·3	13·2	101·1
1916	55·5	1·7	0·5	21·1	0·6	0·4	2·9	11·5	5·3	0·5	87·6	3·3	9·1	79·8	0·3	3·0	16·8	91·5
1915	58·7	0·5	0·7	20·6	0·5	0·4	1·6	11·1	5·3	0·6	83·9	3·2	12·9	77·2	0·4	2·9	19·4	92·5

erty tax increased from $12.98 *per capita* in 1903 to $23.29 in 1919; and the earnings of public service enterprises rose from $2.42 *per capita* in 1903 to $3.61 *per capita* in 1919. As stated above, the relative importance of the last class of receipts declined slightly during the period under review.

TABLE III. *Relative importance (percentage distribution) of net revenue receipts of 146 cities for specific years: 1903–19.*

(From Bureau of the Census, *Financial Statistics of Cities*, 1919, p. 55.)

Year	The general property tax	Taxes on the liquor traffic	Licence taxes other than on the liquor traffic	Other taxes	Special assessments	Subventions, grants, gifts, donations and pension assessments	Earnings of public service enterprises	Other revenues
1919	66·0	2·8	1·5	3·3	5·6	4·1	10·2	6·4
1917	64·3	3·6	1·5	2·3	7·8	4·0	9·9	6·6
1915	62·4	4·4	1·4	2·0	8·5	4·2	10·0	6·9
1913	62·4	5·0	1·5	2·0	8·2	4·5	9·9	6·6
1911	61·9	5·2	1·5	2·0	8·4	4·6	10·6	5·8
1909	61·0	5·9	1·5	2·3	8·4	4·9	10·9	5·3
1907	59·4	6·6	1·5	2·5	8·2	4·8	11·2	5·8
1905	61·5	5·9	1·5	2·2	7·9	4·7	11·4	5·0
1903	61·4	6·3	1·3	2·2	7·6	4·3	11·5	5·5

The most important aspects of American taxation during the decade 1910–20 are those connected with the rates and the aggregate burden of taxation. Direct taxes were pushed to a height thought to be impossible before the war. The maximum rate under the Federal income tax is 73%, and this is supplemented in some places by a state income tax which, in Wisconsin for instance, exceeds at the maximum 13 per cent. Corporations have been subject to equally drastic taxes. The war profits tax for 1918 was 80% on profits in excess of a deduction which in the average case only slightly exceeded 10% of the invested capital; and corporations paid in addition a 12% income tax, a capital stock tax, and state or local taxes which frequently exceeded (in theory, at least) 2% of the capital value of the property of the corporation.

In addition there were miscellaneous Federal taxes important enough to have produced over fifteen hundred millions of dollars in the year 1920. This unprecedented taxation placed upon business a serious burden, brought about a complexity of law and procedure hitherto unknown in the United States, and threw upon the administrative machinery tasks difficult enough to cause grave congestion and delay. In July 1921 there was a systematic effort, particularly among business men, to replace the direct taxes in large part by a flat tax at a low rate (1% was usually recommended) upon all sales of goods, wares and merchandise. It was urged primarily in order to "simplify" the tax system, to take the place of the excess profits tax and reduce the rates of the income tax. Its opponents attacked it as an attempt to shift the burden of taxation from those who had income or profits, and were thus "able to pay," to the general class of consumers; and asserted that it would discriminate in favour of the "combination" and against the independent or single-process business. In the United States this controversy assumed an importance worthy of historical record. It marked a reaction from the high tide of direct taxation which during the war supplied more than three-quarters of the entire tax revenue. It was also worthy of record that in the midst of the industrial depression prevailing in 1921 there was no discernible movement in favour of meeting the expenses of Government by the issue of paper money or by borrowing.

In state and local taxation real progress toward the solution of the more important problems was made during the decade. The gradual abrogation of the old "iron rule of constitutional uniformity" (taxation of all classes of property at the same rate) continued. Gradually, but without material setback, law and practice were being modified so as to adapt the general property tax to the peculiar needs of the different classes of property or business, such as forest land, the mining industry, and public service enterprises. Low rates were in a constantly increasing number of jurisdictions applied to money and securities, which go into hiding if an attempt is made to tax them at the rate applicable to real estate and tangible property; or this class of intangible property was exempted from the property tax and subjected to special taxes such as the mortgage registry tax, or the income tax. With three exceptions all American states employ some form of the inheritance tax. With the Federal Government imposing an estate tax which rises to 25% where the net estate exceeds $10,000,000; and the state Governments employing several mutually inconsistent bases of taxation, for example, taxing the transfer of all corporate shares owned by resident decedents and the transfer of all corporate shares in domestic corporations owned by non-resident decedents, problems of double or multiple taxation were becoming particularly serious; and an almost unbearable situation promised to arise unless in some manner state and Federal laws could be made both uniform and consistent. Automobile and hunting licence taxes were rapidly increasing in importance, and together yielded approximately as much as the state inheritance taxes (about fifty million dollars a year). In recent years there has been a marked improvement in the administration of state and local taxes, particularly in the work of assessment. Much of this is attributable to the development of state tax commissions charged usually with the assessment of state-wide corporations, the administration of the income tax where such a tax is in force, the equalization of assessments among local districts, and the supervision of the work of the county or local assessors. It is worthy of note that in recent years the movement for the segregation or separation of state and local taxes has abated. In 1921 there was a marked tendency towards centralization of administration and the collections by state officials or under state supervision of taxes which are later returned in part to the local divisions of government.

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V. SOCIAL AND WELFARE WORK

The 20th century has seen an extraordinary development in the field of social-welfare work in the United States. The number of persons interested—whether as volunteers, serving on boards and committees, or as contributors of financial support, or as salaried employees—has multiplied manyfold. Appropriations from taxes, annual contributions for the current work of privately supported organizations, and endowments by men and women of wealth, have increased enormously. New forms of social work have come into existence, and the older forms have improved their methods, as well as extended their scope. Principles have been formulated; standards have been set up; training courses have been established; general instruction has been introduced into the colleges and universities, and even to some extent into the secondary schools; a technical literature has been produced; intelligent discussion of social problems in the popular periodicals and the daily press has become common.

Social work in the United States displays certain marked characteristics which distinguish it from corresponding activities in other countries. (1) There is greater variety. In the field of private charity individual initiative has had free play, little hampered by legislative restrictions or by precedents, and comparatively little by the control of church authorities. The administration of public charitable and correctional institutions and welfare legislation are not, as in England or France, national undertakings, but for the most part fall under the jurisdiction of the states, and even within the states the bulk of responsibility lies with local authorities of city, town or county. This situation has favoured experimentation. (2) The relative amount of social work undertaken on private initiative, as compared with that done by the State, is far greater than elsewhere. (3) In private philanthropy, the relative amount carried on under religious auspices is far less. (4) Throughout the whole system of charity and correction, both public and private, there is more hope. In comparison with older countries, there has been little poverty and degeneracy in America at any period. Even in the oldest cities there is no pauper class. (5) In the United States public and private relief, charity and correction, the care of sick, criminal or indigent individuals, and the efforts to improve housing, to provide facilities for recreation, and so on, are coming to be regarded as component parts of a complicated system, not as separate and distinct departments in the economy of the nation. (6) Finally, there is in American social work something of the readiness to "scrap" machinery, processes and plants, which is characteristic of American industry. Indeed, the ultimate object of all social work, from the American point of view, is to make social work unnecessary; and every social agency which is efficiently accomplishing its immediate purpose is more or less consciously working for its own extinction. Social work, therefore, is constantly changing.

Legally, the responsibility for the relief of the poor in America rests ordinarily upon their immediate relatives. Children and in some states grandchildren, parents and in some states grandparents, even brothers and sisters, may be compelled by law to furnish, if able, the necessaries of life to the indigent. The laws in American states do not uniformly recognize what in England is called the "right to relief." In New York, for example, an able-bodied man who has no visible means of support and no regular occupation is not, under the law, a "poor person," but is a "vagrant." On his own confession before a magistrate he may be accepted as a public charge, but technically he is punished, not "supported." Harsh as the law sounds when thus stated, it corresponds to the fact that for able-bodied adults in America there is always practically some alternative to starvation besides vagrancy.

Public Relief.—Although a legal right to relief is not formally recognized, there is a tacit assumption that any kind of misfortune which threatens life or physical well-being should be provided for; and that if relatives, friends, or voluntary agencies do not make such provision, the State must, or at least should, do so in some way (*see* PUBLIC ASSISTANCE: section *United States*).

By the end of the 19th century public opinion had recognized that the almshouse was not a suitable place for tramps, vagrants, and disorderly persons; for children; for the insane, feeble-minded, epileptic, blind, and deaf; for confinement cases; cases of acute illness and contagious disease; but that these should be provided for in special institutions. These theoretical conclusions, however, were by no means completely or uniformly embodied in practice. In many of the newer states, with no correctional institutions except gaols and State prisons, the courts still habitually committed certain minor offenders to the almshouse. Seventeen states in 1900 still maintained their dependent children in almshouses. The greatest progress towards specialized care had been made in the case of the insane, but in most of the states institutions for them were overcrowded, while in many a certain number of insane were still to be found in the county poorhouses or even in the gaols; and the horsewhip was still advocated by some of their official guardians for quieting the violent. State schools for blind and deaf children had been generally established, but there was practically no provision for the instruction of persons who became blind, or deaf, or otherwise disabled in adult life. There were only 26 public institutions for the feeble-minded in the country, and special provision for epileptics was rare. Even in so advanced a state as New York there were about as many "idiots," feeble-minded, and epileptic in the almshouses as in the special institutions for their care. There were still many large cities and towns which had no general public hospitals; confinement cases were generally admitted to the almshouse, and as there was almost no public provision, and little under private auspices, for the care of consumptives, many of these also were found in the almshouses. Except in certain northern cities and in some of the southern states, outdoor relief was generally given by local public officials in the form of groceries, fuel, clothing, and sometimes in money. This and the undifferentiated almshouse were still the public provision available for the majority of dependents.

Private Philanthropy.—Parallel with the various public agencies were many which had been established, and were conducted, under church auspices, or by incorporated societies or less formal associations of private individuals. The private institutions which existed in 1900 were chiefly orphan asylums, hospitals, and homes for the aged. Most churches gave charitable assistance on occasion to their own members, and the larger ones had a Ladies' Aid Society, or a St. Vincent de Paul Society, or some other agency for the purpose. In the cities there were "bread lines" and "soup kitchens" and temporary shelters for the homeless. In many places there were non-sectarian general relief societies, such as the New York Association for Improving the Condition of the Poor, and in about 100 cities there was a Charity Organization Society, or Associated Charities, or United Charities. There were also many societies for assisting certain classes in their own homes—widows, for example, or members of a particular nationality; or for giving some particular kind of help, such as legal aid. There were 161 societies for the protection of children from cruelty and neglect; and a considerable number of societies performing one or more of the functions of the pioneer Children's Aid Society of New York—to find homes in families for homeless children, to conduct lodging-houses and reading-rooms for newsboys, and in other ways to promote the welfare of city "waifs." "Fresh-air societies" existed to provide outings for city children. "Visiting nursing associations" had demonstrated the value of such service, and some 40 to 50 had been organized, with an aggregate force of not more than 140 nurses for the entire country. In the larger cities and industrial centres day nurseries had been established for the convenience of wage-earning mothers and to reduce the number of children who were candidates for institutional care.

Treatment of Criminals.—Reformatory schools for juvenile delinquents, which had naturally come into existence much earlier than reformatories for adults, were to be found by 1900 in four-fifths of the states—more of them for boys than for girls, even in proportion to their numbers as delinquents. Juvenile courts were at the beginning of their development. Probation also was only beginning to receive attention. Growing out of the privilege of the court to suspend sentence after conviction, it had been the practice in connexion with adult offenders throughout Massachusetts for 20 years, and was established by statute in New Jersey in 1899, but had not spread farther. As applied to children, it had not yet been tried. Probation, indeterminate sentence, reformatory institutions, special courts for children, and even specialized treatment for women and children offenders, were still novelties. Fixed sentences, determined by the nature of the offence, without reference to the needs of the offender, were the rule; and they were served for the most part under conditions dictated by the theory of retribution rather than of reformation. As the characteristic charitable institution of America is the town or county almshouse, so the characteristic correctional institution was and is the county gaol and town "lock-up." Generally small, with poor sanitation, frequently "fire-traps," they are described by a committee of the National Conference of Charities and Correction in 1900 as "foul dens, infested with vermin, reeking with dirt and filth." Boys and girls arrested for a trivial first offence, professional criminals, prostitutes and innocent persons awaiting trial were "herded together" in idleness, dirt, and bad air.

State Supervision.—To insure a certain standard in the conduct of public charitable and correctional institutions, state boards had been established in over half the states. These were of two main types: (1) advisory boards, with authority to inspect, report, and make recommendations, relying for their influence chiefly on the power of publicity; and (2) boards of control, with full executive powers and executive responsibility. The former type was considerably in the majority.

Preventive Philanthropy.—Of "preventive philanthropy" or "constructive social work" there was very little at the beginning of the 20th century. Interest in providing playgrounds and small parks in congested districts and public baths had been growing for several years. The New York Tenement House Committee had begun work in 1899, and was laying the foundations of the modern housing movement. The Consumers' League had exposed the horrors of sweat-shop work, and was preparing the way for a general concern about industrial conditions. But the conspicuous educational agency at this period was the social settlement. Beginning with the Neighborhood Guild on the lower east side of New York City, the number of settlements had increased to over one hundred.

Twentieth-Century Developments.—One of the ideas which became dominant among social workers early in the 20th century was that "prevention is better than relief." A second, in the picturesque phrase of Jacob A. Riis, was that "a man cannot live like a pig and act and vote like a man." Both these ideas grew out of the experiences of men and women who were engaged in work for the relief or the reformation of individuals, or who were living among the poor in social settlements. Out of these ideas naturally developed the organized social movements which are characteristic of contemporary American philanthropy. Conspicuous among them are the movements for the prevention of tuberculosis, for the diminution of infant mortality, to promote the health of children, for the control of cancer, for the reduction of venereal disease, for the prevention of blindness, to abolish extortionate charges for loans secured by salaries and pawnable property, to promote wholesome recreation, to diminish child labour, to further industrial education, to advance the interests of the negro, to reform criminal law and procedure, to prevent insanity, to improve housing conditions, to improve and standardize labour legislation.

Each of these movements is represented by a national organization—some of them by several—and in most of the cases a large number of local societies or committees also exist, more or less closely affiliated with the national body. Their central feature is educational propaganda, based on the study of facts. Millions of dollars were spent to this end in the two decades, 1900–20, and remarkable ingenuity was used in devising effective methods. Simple "literature," presenting clearly the essential facts (about the nature of tuberculosis, for example, and the precautions which should be taken), printed in alluring style and translated into many languages, photographs, lantern slides, posters, motion pictures, standardized exhibits; monologues by clowns, plays, lectures to use on the phonograph; Christmas seals; a press service supplying material to newspapers all over the country; a "tuberculosis day" or a "child labour day" in the churches and in the schools; lectures and motion pictures at county fairs; travelling exhibits touring the countryside—such are some of the methods in use.

Research and Surveys.—Another result of the interest in prevention and in underlying causes was to stimulate research into social conditions. The new organizations which have just been mentioned were obliged to begin operations by collecting data. Charity organization societies, settlements, and others among the older philanthropic agencies, began to delve into their records, or into their unrecorded experiences, for knowledge about social conditions. Several heavily endowed "Foundations" were established—notably the Russell Sage, the Rockefeller, and the Carnegie—with research as one, if not the primary, object. For about a decade, beginning about 1902–4, many studies were made. In 1907 the "Pittsburgh Survey" was undertaken by the committee in charge of the publication then known as *Charities and the Commons* (now *The Survey*), with financial support from the Russell Sage Foundation, and with coöperation from many of the social and sanitary movements of the country and from many citizens and organizations of Pittsburgh. It was an attempt to present a bird's-eye view of the conditions in an industrial wage-earning centre. This survey, published later in six volumes, had immediate practical results in Pittsburgh itself. It had a wider influence—because of the dramatic prominence assumed in *it* by industrial accidents, the twelve-hour day and the seven-day week—in impressing on America the evils of overwork and of the outworn theory of employers' liability. It also established the "social survey" as a method of research. There have been only one or two other surveys equally ambitious, notably one of Springfield, Ill., conducted by the Russell Sage Foundation's Department of Surveys and Exhibits; but less comprehensive surveys have been made under various auspices in many cities, and although this method has at times been absurdly applied, it has done a great deal to establish the sound principle that plans for improvement should be based on an understanding of actual conditions.

Reaction on Relief and Correction.—The New York Charity Organization Society enlarged its activities (1897–1905) by establishing a Tenement House Committee, a committee on the prevention of tuberculosis, a committee on criminal courts, a school for the training of social workers, and the weekly journal already mentioned, *The Survey*. Other societies created similar committees, or undertook other educational work as an adjunct to their original function. All these new activities, in turn, had a reflex influence on the older forms of social work. As the idea of prevention gained ground, those who were engaged in the relief of the poor found their task growing more complex. In particular, they found themselves obliged by the logic of their new knowledge to examine into the health of each member of the family, to see that physical defects in children were corrected, that the family diet was suitable and sufficient, that the home was decently sanitary, that incipient physical and mental troubles were properly treated; to make it possible for children to stay in school at least as long as the law required, and preferably beyond that age; for mothers and fathers who were ill to have adequate medical treatment and convalescent care; and to supplement the income, if necessary, sufficiently to secure these essential conditions. Hospitals and dispensaries came to see the connexion of their institutions with the homes of their patients, and "hospital social service" was devised. Provision for the insane, for the tuberculous, for delinquent children and adults, was extended in both directions—to reach them at an earlier stage of their difficulties and to watch over them after discharge. Prevention of infant mortality led back to prenatal care and instruction of mothers. Rehabilitation became the conscious goal in philanthropy and correction.

Training Schools.—The Summer School of Philanthropy, begun in 1898 by the Charity Organization Society of New York, was expanded in 1903–4 into a two-year course of special training for graduate students and persons who had had the equivalent of a college course, with instruction which included both study of principles and practice and which was recognized by Columbia University as of graduate standard. Within a few years similar schools, affiliated more or less closely with educational institutions, but, like the New York school, owing their existence to social workers, were established in Boston, Chicago, St. Louis, Philadelphia, and Richmond, while instruction on the same general plan was introduced in a considerable number of colleges and universities. By 1920 such training was offered by most of the leading educational institutions of the country, either as graduate or undergraduate work in the departments of the social sciences. No new independent schools have been established for a decade or more, and one of the most important of them (the Chicago School of Civics and Philanthropy) has recently (1920) been discontinued on the creation of a Graduate School of Social Service Administration in the university of Chicago. Whether or not social work has become a "profession" is a question of merely academic interest, but it has become a recognized occupation, engaging large numbers of men and women with high qualifications, and offering salaries which compare favourably with those available in the teaching profession and the ministry.

Formulation of Standards.—From their study of methods social workers were led to formulate standards, and this has been done with special success in matters of legislation. The Uniform Child Labor law, prepared by the Commissioners on Uniform State laws of the American Bar Association and adopted by the National Child Labor Committee, and the essential features of a Workmen's Compensation law as advocated by the American Association for Labor Legislation, are conspicuous examples, to the influence of which the statute books of most of the states bear witness. National leagues of societies engaged in similar work have been organized and have promoted uniformity of methods in their several fields. Aside from those which are purely legislative, the standards which have had the greatest influence are those formulated by the White House Conference on the Care of Dependent Children, held by invitation of President Roosevelt Jan. 25–6 1909, and by the Conference on Child Welfare Standards, held under the auspices of the Federal Children's Bureau 10 years later. The unanimous recommendations of the White House Conference were adopted as a *quasi* creed or constitution by the child-welfare workers of the country. The Children's Bureau Conference, held in 1919, at the close of the "Children's Year," had a far wider scope. It considered the essentials to child-welfare from every point of view, and drew up minimum standards for children entering employment; for the protection of the health of children and mothers and for the protection of "children in need of special care."

Coördination.—In recent years social workers have developed a new sense of the interrelations of social agencies. As affecting case-work, this has showed in an increased appreciation of the idea of registration which had been one of the cardinal principles of the charity organization movement. Under the new name of "confidential exchange" or "social service exchange," there has been established in the leading cities a central record of the families known to the various social agencies, so that each society may learn which other agencies may be, or have been, interested in any particular family and may consult with them. Furthermore, social workers began to think of particular agencies and particular methods as elements in the community's equipment, to consider what place each one should occupy, what its appropriate function was, and what was needed to supplement it. In other words, they began to make "programmes": for a comprehensive campaign against tuberculosis; for a charity organization society in a small town; for an adequate system of care for the insane; for State legislation on behalf of children—"children's codes," as they are called, presenting a harmonized plan of desirable laws; and so on. The national associations in the different educational movements not only outlined in a general way the elements in a "campaign" against the particular evil of their concern, but also suggested concrete programmes for local organizations. Councils of social agencies have been organized in some cities to promote mutual understanding and the development of a community programme, while the financial federations which have been developed for joint raising of funds have, as an incident to their main purpose, perhaps been the strongest influence of all in this direction. Since the World War it has become obvious that there is need for coördinating the work of the national agencies also.

Financial Federations.—The financial federations bid fair to establish themselves as an integral feature of social work in America. Before the end of the 19th century bureaux of advice and information had been created by the charity organization societies in several of the large cities, supplying information about organizations and individuals and appealing for contributions. Beginning with Cleveland about 1900, the chamber of commerce in various cities had established a "charity endorsement committee," which made up a list of approved agencies for the convenience of its members, who, with their families, constituted a large part of the giving public. As social agencies multiplied, competition became so intense that protests from harassed contributors led to the idea of financial federation, viz. that all the agencies in a community which depended on voluntary contributions for their support should form an association, agree on a joint budget for the next year, throw into a common pool their contributors' lists and other information about sources of income, present their united needs to the public in a single campaign, and share in the results in proportion to their budgets. Jewish charities were the first to do this successfully, but by 1917 there were general federations in several cities. When the war brought demands from a host of new and old organizations, in sums that had never before even been imagined, a development of the fundamental idea in federations was forced. "War chests" were set up in some 300 cities by the summer of 1918, to raise the money asked for by the American Red Cross, the Y.M.C.A., the Y.W.C.A., the War Camp Community Service, and other "war work" agencies, and in some places the local charities also were included in the chest. The general satisfaction felt with the experiment led a number of the cities to convert their war chests into "peace chests" or "community funds," and by March 1921 at least 30 important cities had adopted this method of raising their funds. A great deal more money is secured in this way than by separate competitive appeals; a much larger proportion of the population contributes (20–30% instead of an estimated 2–10%); less expense is involved and less annoyance to contributors. The strongest argument in favour of financial federations, however, is that through joint budget-making, joint study of community needs, joint planning for community welfare, they tend to dissipate the narrow institutionalism of the agencies concerned; while, on the other hand, they increase the public interest in the social work of the community, and provide a channel through which the public may register its judgments of the social agencies and share in directing their development.

Increased Reliance on Government.—Even before the war there was a noticeable tendency away from the old American individualism and distrust of government. Supervision over private social work has been extended, and there has even been a tendency towards some degree of public control. Recourse has been had to legislation to establish minimum standards of housing, of working conditions, even of wages, to protect women and children in industry, and otherwise to promote social welfare; and such legislation has been increasingly sustained by the courts. The great cost of adequate provision for the sick and adequate hygienic education of the well, together with the growing recognition that, to be adequate, such measures must reach all citizens, have made it inevitable that they should be undertaken largely by public authorities. Boards of health have accordingly extended their control over infectious diseases, established sanatoria and all sorts of clinics, distributed much information, and maintained nurses and physicians to visit the poor in their homes and give them oral instruction. Public schools have added physicians, nurses, psychiatrists, dentists and "visiting teachers" to their staffs, have offered evening classes and vocation schools and public lectures and opened their buildings as "community centres," as well as admitted into the curriculum new subjects. Three-fourths of the states have established bureaux of child welfare or child hygiene.

There has even been an extension of public out-door relief, which had fallen into disrepute during the 19th century. Partly as a result of the new conviction that children were better off with their mothers than in institutions or in foster homes, partly from a sudden appreciation of the service performed to the State in the bearing of children and a determination that the State should recognize this service, most of the states of the Union (beginning with Missouri in 1911) made special provision for payments of "widows' pensions" or "mothers' allowances," "mothers' aid," "funds to parents," or "mothers' compensation," to mothers who without this assistance might be obliged to place their children in institutions.

Reliance on the State has gone so far as to demand assistance in promoting social welfare from the Federal Government. Its taxing power has been invoked to discourage the employment of children in factories, mines and quarries, in order to extend some protection to the children in the more backward states. Financial aid for vocational education and (by a measure passed in 1920) for the reëducation of industrial cripples, has been granted by the Federal Government to the states in proportion to their population and their own appropriations. The Department of Agriculture has done social work on a substantial scale in rural districts. The Bureau of Labor has been erected into a separate department, with corresponding increase in importance. A children's bureau, placed almost by chance in the Department of Labor, was created in 1912, at the instance of the social workers of the country.

The World War and Social Work.—The first effect of the war on social work in America, while the United States was still neutral, was to strengthen and improve it. Sympathy for sufferings in Europe quickened sensitiveness to social problems at home. A little later the appeals for war relief tended to drown those of the familiar everyday agencies at home. This was not an unmixed evil, for it compelled scrutiny of plans within each organization to determine what could be spared with least disadvantage. When the United States entered the war, in April 1917, social work leaped into unprecedented prominence. Many of the wonted social problems were intensified and some new ones created, especially by the operation of the draft and the establishment of training camps; while a new demand for persons with experience in human problems sprang up in government departments and war industries. A fervour developed for service, especially for service to American soldiers and sailors and to the civilian sufferers in the Allied countries. The Red

Cross organized its Home Service Sections to minister to the needs of the families of men in service; its Bureau of Refugees and Relief in France and other activities on behalf of the civilian populations in European countries. With official encouragement, the seven "*moral*-making agencies," as they were called —Y.M.C.A., Y.W.C.A., Knights of Columbus, Jewish Welfare Board, Salvation Army, American Library Association, War Camp Community Service—undertook to occupy the leisure of the soldiers and sailors, in training at home or on duty abroad. They provided physical, social, and spiritual comforts, mental diversion and entertainment.

The Federal Government, through the system it adopted of allotments and allowances to the families of men in service, compensation for death and disability, reëducation of the disabled, and war-risk insurance; through the Housing Corporation; the Federal Employment Service; the Division of Venereal Disease in the Public Health Service; the thrift campaign of the Treasury Department; the educational work of the Food Administration; and other undertakings, plunged into social work on a gigantic scale. Much of it, unfortunately, though wisely conceived, was badly executed, but it strengthened the demand that the Federal Government should in the future make more substantial direct contributions to social welfare.

The established forms of social work fared badly under the competition of these new activities. Financial support was difficult to secure, and—what was more serious—many agencies saw their staffs sadly depleted by the superior appeal of war work. Young, inexperienced persons were frequently the only ones available for positions of responsibility. On the other hand, many capable men and women who would not otherwise have been attracted to social work have entered it permanently, and many more have had experiences which cannot fail to be of advantage to social work in the future because of the interest and knowledge acquired. Aside from this increase in the popularity of social work and in the general understanding of social problems, a conspicuous effect of the war was to hasten the process of nationalization which had been going on for half a century. This is shown not only in the disposition to expect more active participation by the Federal Government, but in a consciousness of the national character of the problems of education, health, and adequate income; in a prominence accorded to certain elements of the national life, hitherto comparatively neglected, such as the rural population, the negro, the foreign-born. Topics in which interest has been intensified are education, recreation, physical efficiency, venereal disease, mental defects, "community organization," retraining of cripples and other handicapped adults and their restoration to a place of usefulness and self-support in the community.

In general, the effect of the war has been to confirm the principles of social work and to commend them to a larger public. In the treatment of criminals, however, it has been the opposite. For the moment, at least, it seems that much of the progress painfully made in the course of the 19th century has been brushed away. There has been a reversion to the principles of vengeance and retribution in dealing with civilian lawbreakers. A reaction in favour of the death penalty and of severe and even brutal sentences has displaced the sentiment that certainty of punishment is more efficacious as a deterrent than severity.

Practical Advance.—In these 20 years of the 20th century, ideas have far outstripped practice. Both ideals and practice have made great strides in advance, but the gap between generally accepted theories and actual provision is as wide as it was in 1900. By way of summary: what difference have the 20 years made to the individuals whose welfare is at stake?

The task of helping those who are in economic difficulty is done more thoroughly. A larger proportion of those who need assistance receive it; a larger proportion receive a kind and an amount adapted to their needs; individual and family situations likely to produce dependence later are more frequently recognized and corrected. There were in 1920 over 300 "family social work societies," as compared with 100 at the beginning of the century. The home service sections of the Red Cross, continued in many small towns and rural communities after the World War, supply something corresponding to the general relief society or family society in the cities. Public relief has been extended by the all-but-universal provision of "mothers' allowances," which, however, are generally inadequate in amount or incompetently supervised. An organized system for assuring prompt relief in any community visited by a disaster has existed since 1906 under the auspices of the Red Cross. In theory rehabilitation is accepted as the object of the social agencies which have to do with children or with family groups or individuals capable of ultimate self-support, including the public departments which administer outdoor relief. Available resources for recreation and education, for physical and mental examination and treatment, are utilized more fully. Money is spent more freely, especially to ensure adequate food, sanitary homes, the recovery or preservation of health, to keep families together, and to keep children in school. In public institutions diet has improved, and in general the physical conditions are better. Here and there the almshouse has been transformed in accordance with the theories of the 20th century, and through the continued growth of specialized institutions its population is gradually decreasing and it is losing its place of preëminence among the social agencies of the country. It is still, however, much the same institution that it was 20 years ago, and it still affects far too many persons to justify the indifference still shown it. In other respects, too, there has been little advance in provision for those who reach old age without resources and without relatives who can take care of them: accommodations in private homes for the aged have not increased substantially; the plan of placing them in families under supervision has nowhere had much attention; and thus far there has not been much sentiment in any state in favour of old-age pensions, nor much evidence brought forward that they are needed.

Children (the other class of natural dependents), in their character as the most responsive subjects for both preventive and constructive efforts, have aroused a new and scientific interest. The case of the child who must be supported wholly or in part by other than his parents or near relatives has improved more than that of the aged. There are more chances than there were 20 years ago that arrangements will be made for him to stay with his own mother or that he will be placed in some family where he will at least have the training of family life; if the latter, that the home will be chosen with reference to his particular requirements, and that in case of mistake it will be discovered before his future is jeopardized. If he goes to an institution, it is more likely to be one in which he is regarded as an individual, and in which the life is organized for the benefit of the children rather than primarily for ease and economy of administration. The capital invested in old-style congregate institutions and the initial cost of replacing them by a plant on the cottage plan retards the tendency in this direction. Few institutions of the old type have been constructed in recent years, and some old institutions have moved out from the city into a colony of small home-like buildings, permitting better classification of the children and a more nearly normal life, but the process of displacement is slow, the 19th-century city institution still predominates. While in the best institutions, and the best placing-out agencies, physical and mental examinations are given to the children and more careful attention is paid to the correction of defects than in the average family, such skilled professional care is still the exception rather than the rule.

In provision for the cure and prevention of disease and for the promotion of health these 20 years have seen the most marked advance. Ill health as a cause of individual inefficiency, poverty, and even crime; good health as the foundation of individual welfare and happiness; preventable disease as one of the greatest and least excusable social evils; physical efficiency as a national ideal—these ideas have created a large proportion of our current social work, and materially modified most of the rest. General hospital accommodations and dispensary service have increased at a rapid rate, considering the investment required. Although there is not yet suitable provision for more than 20% of the tuberculous in need of institutional care, still nearly all of the 60,000 beds in the 689 sanatoria and special hospitals, day camps and preventoria (Jan. 1 1921) have been provided since 1900. This is true also of most of the convalescent homes, the many specialized clinics—prenatal, "baby," dental, venereal disease, psychiatric, etc.—the medical examination of school children, the nursing service of schools and health departments. The level of knowledge about tuberculosis and other preventable diseases and about personal hygiene has risen perceptibly. A new type of agency is now becoming prominent—"health centres" and "well-baby clinics," for example—directed towards the preservation of the health of those who are well.

Provision for the treatment of mental disease also has continued to increase, until in 1920 there were 232,680 patients in institutions; and the tendency already well established in the 19th century towards public care, by the state rather than by local units, has progressed until, in all but 8 states, all insane who are public charges are in state hospitals (*i.e.* not in almshouses or other county or city institutions). In 12 states there were, in 1921, psychiatric hospitals, psychiatric wards in general hospitals, detention hospitals, or other provision for the temporary care of mental cases. The corollary, however, is that in 36 states there is no such provision and in these 12 only a fraction of the population is thus served. The hospitals in most states are sadly overcrowded. Notwithstanding this pressure, the Scotch plan of boarding out selected cases of certain types, which has long been followed with success in Massachusetts, has not been adopted elsewhere. National prohibition, however, has already cut down the number of admissions to the alcoholic wards, and it may be that this influence will enable the states within the next few years to match accommodation with applications. A few institutions undertake to keep watch over the patients discharged as cured or improved, and a few private organizations supplement the work of the public institutions in this way, and also try to avert the development of insanity in incipient or suspected cases brought to their attention. In New York a state system of clinics has been organized under the joint auspices of the state hospitals, the state Department of Health, and the Committee on Mental Hygiene. In general, however, the prevention of mental disease and the promotion of mental hygiene are comparatively rare.

For mental defectives provision has increased rapidly as compared with that at the beginning of the century, but slowly as compared with the need. There were about 40,000 feeble-minded in institutions in 1920, which was twice as many as in 1910, but not more than 6% of the estimated total in the country. There were still, in 1921, 14 states which had no separate institution for such patients. In the conduct of the institutions the tendency is towards making them less custodial in their atmosphere, more medical and educational, less like a poorhouse, more like a combination of hospital and school. Special classes for backward children were maintained in 1921 in over a hundred cities, but the aggregate enrolment of over 20,000 represents only a small portion of such children even in these cities.

In connexion with crime the greatest advance has been made in the case of juvenile delinquents, who are now treated rather like neglected children than like criminals. Nearly three-fourths now come before courts intended especially for children's cases, the best of which have facilities for thorough physical and mental examinations and social investigation, and before judges who are expert in this work. All the states except Wyoming had made by 1919 some provision for probation for juvenile offenders, and about half the juvenile courts had a probation service in operation. Children in small villages and the country are hardly touched by these new methods. The proportion of juvenile delinquents sent to institutions is smaller than 20 years ago, and these institutions have become in some instances excellent schools. They have made more progress than those for dependent children in transforming their plants and their methods to correspond with current theories. The interests of adult criminals have not advanced so much. It is more generally admitted, however, that every correctional institution should be a "reformatory," and more of them are than formerly. There is increased attention to physical conditions and needs, better ventilation, improved sanitation, more physical exercise, and in the reformatories some use is made of psychological tests and some attention paid to the correction of physical defects. The value of academic instruction and of productive occupation is more generally realized in the state prisons, and the reformatories also provide vocational training. The old perplexity of how to prevent prison labour from competing with free labour has ceased to be a practical problem, with the general acquiescence of organized labour on the "state use" system. Contract labour, however, is still found in many state prisons, and there has been little progress in making the work of the man in prison contribute to the support of his family at home. The convict lease system in the South has almost disappeared. A few county gaols have been remodelled, and a few others have been replaced by farm colonies. The use of probation for adult offenders has increased, though less rapidly for juvenile delinquents.

Private enterprise in the field of correction has concerned itself chiefly with furthering the movement for juvenile courts and probation; promoting specialized provision for women offenders, including policewomen and separate detention houses; developing protective work, especially for girls; securing the establishment of night courts and special courts for cases involving family desertion and other domestic relations; and in a few places, intermittent efforts to secure a rational treatment of beggars, drunkards, and other misdemeanants. Interest in 1921 seemed to centre round protective work for young offenders; the need of separating the feeble-minded from those of normal mental powers in reformatories and of distinguishing between them throughout the correctional system; problems of court organization and procedure, including the proposal for merging juvenile courts and the so-called domestic relations courts into "family courts," to deal with all cases involving family life.

While it would be out of the question to review in this place the progress which has been made during the 20th century in the general standard of living and the conditions under which the mass of Americans live and work, still so large a part of the social work of these 20 years has been consciously directed towards this object that it would be equally impossible to omit all reference to it. The contribution of organized social work cannot be definitely disentangled from that of any of the other factors which have been influential in bringing about these improvements, but it is patent to any student of the period that it has been an important factor. The educational social movements, through their research, their programmes, their publicity and their propaganda, have to a large extent enlisted the interest of the other factors, determining which questions should have precedence, and how they should be presented to the public.

"Welfare work" in mercantile and industrial establishments has an obvious historical association with those kinds of social work which deal with health, housing, recreation, and the standard of living. In America, however, it is now generally conceived, not as an expression of altruistic interest on the part of the employer, but rather as a subdivision of personnel administration. Scientific management, industrial medicine, vocational guidance and other factors have influenced its development.

In many instances welfare activities have begun with a rest-room, a lunch-room, first-aid appliances. From these modest beginnings they have expanded to include everything which might directly or indirectly increase the efficiency of the workers. Their home life, savings, investments, education of children, and social opportunities have been included. Industrial goodwill between the management and the workers has come to be looked upon as an asset to be cultivated. The Y.M.C.A., and other agencies which prefer to avoid industrial controversies and to operate within the "zone of agreement," have found here a useful and congenial field. (L. Br.; E. T. D.)

VI. The American Labour Movement

The labour movement in the United States has been distinguished from that in other countries by being less class-conscious, more individualistic and opportunist. Although there are Socialist factions, and some leaders favour industrial unionism, the majority of organized labour clings to the tactics of federated crafts, and does not aim further than to increase wages, decrease hours and improve the conditions of employment through agreement with the employer. The American labour movement has not been led by "intellectuals." The leaders have come from the ranks—one explanation of the characteristic opportunism and lack of a social philosophy. The great majority of American working men do not want a Labour party in politics; they do not consider themselves a separate class in the body politic. The American political parties antedate the formation of modern economic classes. Class parties are discountenanced as "un-American." A politician in any party may present himself as a "friend of labour." Moreover, the system of checks and balances of the Government offers resistance to change, and the division of sovereignty between state and Federal Government makes legislative reform measures difficult of passage. More can be accomplished with equal effort by trade-union methods. What part the American Federation of Labor has taken in politics has been to advise the working men to reward their friends and punish their enemies at the polls.

During the World War an attempt was made, without success, by the machinists of Connecticut to form a Labor party. In Nov. 1918 leaders of the Chicago Federation of Labor proposed a Labor party, and suggested 14 planks for the platform, which ranged from the right of labour to organize and bargain collectively to representation of labour as such in all Government departments. Eleven of the planks closely resembled the reconstruction programme of the American Federation of Labor. In Jan. 1919 the Labor party of Cook county (Chicago) was formed, with an official organ *The New Majority*. In April an Illinois state Labor party was formed at the convention of the state Federation of Labor. It elected several mayors and other officials. The same year there sprang up also a Pennsylvania state Labor party, the American Labor party of Greater New York and the Working People's Non-Partisan Political League of Minnesota, which last had the object of coöperating with the farmers' Non-Partisan League. In Nov. a national Farmer-Labor party was organized in Chicago, which aimed to draw together the working man and the farmer. This party nominated a president for the national election; 272,514 votes were polled for him, or 1% of the total votes cast. Other political parties, having as their aim better conditions of labour, are the Socialist party, the Communist party and the Communist Labor party, both of which latter split off from the Socialist party in Aug. 1919, and the Socialist Labor party (organs, *The Socialist*, the *Weekly People*). In the spring of 1920 the Michigan branch of the Communist party became the Proletarian party.

Labour and the World War.—In 1916 when President Wilson established the Council of National Defense he appointed Samuel Gompers, president of the American Federation of Labor, one of the seven members composing the advisory commission, to be in charge of all policies affecting labour. As chairman of a labour committee Gompers appointed about 350 persons, representatives of capital and labour, Government officials and others with technical qualifications, who effected a permanent organization as the full Committee on Labor of the Council of National Defense, April 2 1917. This committee early urged that legislation protecting labourers be not weakened during the war. Such was the sentiment also of labour organizations and civic associations generally. When, in the early spring of 1917, it appeared that the United States would enter the war, Gompers called a conference of the Executive Council of the American Federation of Labor with the presidents of international and national unions, heads of industrial departments and representatives of the railway brotherhoods. Those present at this conference, March 12, offered their services to the country in the event of war, and issued a call to members of their organizations to follow this lead. In order to secure the constant support of the Government by American wage-earners, the conference urged the adoption of trade-union standards for all war work, equal pay for equal work regardless of sex, the representation of organized labour on all committees which fixed policies for war work, and provision that special exertion of workers in war emergencies should not benefit chiefly the employers by increased profits. On April 17, at a meeting of the Council of National Defense and its Advisory Committee, Gompers gave his pledge that organized labour would support the Government to win the war. In the summer of 1917 the American Alliance for Labor and Democracy was formed by trade unionists, social reformers and non-pacifist socialists to counteract the pacifist propaganda of the People's Council of America. But some members of the trade unions opposed the pro-war stand of the leaders, and formed the Workmen's Council for Maintenance of Labor's Rights; this died out during the next year.

In Nov. the national convention of the American Federation of Labor passed a resolution that the United States was in the war for democracy against autocracy. The convention urged that organized labour be represented at the Peace Conference; that there be no reprisals against conquered nations; the independence of all nationalities; a league of free nations to maintain peace; certain labour standards to be accepted by international agreement as a part of the Peace Treaty and a plan for controlling employment during demobilization. In Feb. 1918 the Executive Council of the American Federation of Labor issued a statement that "this is labor's war."

Early in 1918 the War Labor Policies Board was created, to administer the relations with labour of the Federal Government in its capacity as employer. It aimed to secure uniformity of conditions in all Government work and to stabilize the working force. It took a stand for prohibition of child labour and prison labour, in favour of the right of labourers to organize, a living wage, equal pay for equal work, the basic eight-hour day, and some definite system of settling labour disputes. To meet the grievances of employees on Government work, the National War Labor Board was established in April 1918 to serve as a final court of voluntary arbitration. The American Federation of Labor was given representation on the Emergency Construction Board, on the Fuel Administration Board (the president of the United Mine Workers was assistant to the Fuel Administrator), on the Woman's Board, on the Food Administration Board, and on the War Industries Board. In connexion with the administration of the Military Conscription Law organized labour was given representation on each District Exemption Board. Trade unionists were sent to Russia on the Commission of Investigation in the spring of 1917.

The Mooney Case.—Thomas Mooney, a labour organizer, was accused of having placed the bomb which exploded in the street of San Francisco during the "Preparedness Day" parade, July 22 1916, killing six persons instantly, mortally wounding four more, and injuring 40 others. Mooney pleaded not guilty, but he was sentenced to death. Many organizations of labour protested that the trial was not a fair one. Execution was postponed several times. It then appeared that much of the testimony on which he had been convicted was perjured. This was substantiated by the report of the investigation of the U.S. Department of Labor in July 1919, which condemned the conduct of the trial. Request for retrial, however, was refused, as not provided for by the constitution of California. Radical labour urged a general strike May 1 1918, to protest against letting the verdict stand. At Mooney's request the plan was dropped. In Nov. the governor of California commuted the sentence to life imprisonment. A plan for a general strike July 4 1919, to demand a new trial, was not taken up by the conservative unions.

International Relations.—During the war American labour awoke to an interest in international affairs. The American trade unions sent no delegate to the Inter-Allied Labour Conference in London in 1918, but that year the American Federation of Labor sent three small groups to Europe to confer unofficially with trade unionists in the Allied countries. The American Federation of Labor refused to be represented at the international labour conference in Berne held after the signing of the Armistice, on the ground that the conference would not express fairly the opinion of labour in the Allied countries. The proposal of American labour for an inter-Allied labour conference at Paris was not accepted. In July 1919, American delegates were present at the International Trade Union Conference in Amsterdam, at which they took issue with the German delegates, and opposed the resolutions passed for the lifting of the Allied blockade of Germany and Russia and those criticizing the labour sections of the League of Nations. Since the United States had not ratified the Peace Treaty, American labour could not be officially represented at the meeting of the Labour Department of the League of Nations held in Washington in the autumn of 1919. The American Federation of Labor Convention of 1919 by a large majority endorsed the labour clauses in the Peace Treaty. The Convention also passed resolutions asking that immigration be stopped for two years, to prevent the underbidding of American labour in the home market.

In 1918 the American Federation of Labor took steps to establish friendly relations with organized labour in Mexico. A conference of trade unionists of the two countries in June urged a conference on the question of the Mexican frontier and a federation of the labour movements of both countries for the protection of workers employed across the border from their homes. In Nov. the conference was held at Laredo, Tex.; 150 delegates were present, representing the United States, Mexico, Central America and Colombia. The U.S. Secretary of Labor was present. A permanent organization was launched. A second conference was held the next year in July in New York.

Reconstruction Programmes.—In July 1919, the national convention of the American Federation of Labor endorsed a programme for reconstruction which advocated first "democracy in industry," that is, workers to have a voice in determining the conditions under which they work "equivalent to the voice which they have as citizens in determining the legislative enactments which shall govern them." The corollary is seen as the right to organize in trade unions. The programme urged better wages to prevent "underconsumption" and consequent unemployment, and to make possible the maintenance and improvement of the American standard of life; the 8-hour day and the 44-hour week; equal pay for equal work regardless of sex; special protection of the health of women; prohibition of labour by children under 16, and compulsory part-time school attendance until the age of 18; the elimination of the middleman; curtailment of the power of the U.S. Supreme Court; Federal supervision and control of corporations; Government ownership or regulation of public utilities; development of waterways and waterpower; a graduated land tax; a special tax on idle lands; progressive taxes on incomes and inheritances; assistance to farmers; the development of Government experiment farms; municipal aid to home-building; workmen's compensation with state insurance; better educational advantages for children and adults; establishment of public employment agencies controlled jointly by capital and labour; and the regulation of immigration so as to facilitate Americanization and to prevent flooding of the labour market in periods of unemployment. The Federation reaffirmed its non-partizan political policy, urged the restoration of freedom of speech and assembly and went on record as opposed to a standing army. At the 1919 convention the Federation voted its support to the "Plumb plan" for Government ownership of the railways and their operation by a board representing equally the executives, the other employees, and the public. The United Mine Workers at their convention in 1919 passed a resolution favouring public ownership of the mines.

Since 1917 the general public has had, as never before, a definite conception of "American" labour standards, endorsed by such Government agencies as the wartime labour boards, the Council of National Defense, and by the consensus of opinion of certain groups in the industrial relations conferences, and of leaders in the national life. These standards include, in general, safety and sanitation in the shop and the home, accident and health insurance, special protection of women and children, abolition of "home work," the eight-hour day and the six-day week, the "living wage," industrial training and a public employment service. The majority of American working men and women have as their aim the attainment of these standards: not ownership or control of business. The labour movement is a struggle for power to gain control of the "job"—not the business—adequate wages, short hours, security of employment, and sufficient responsibility to command respect and sustain interest in the work to be done.

Education in the Labour Movement.—In recent years there has been developed in the United States a movement on the part of working people to further their education, with a double aim: to give to working people a share in the culture which has been largely the possession of the propertied classes, and to fit them to understand and meet the problems of the modern industrial order. The leaders are trade unionists and socialists who resent the control of education by the class that also controls industry, and who wish to teach their own view of society; also impartial educators, idealists, eager to bring to the many the culture of the few, and to extend to adults educational advantages now provided generally for children. The Rand School of Social Science in New York City, established in 1906 by private gifts, is owned by the American Socialist Society. In 1918–9 the enrolment, including correspondence students, was over 5,000. The school has some five or six regularly appointed instructors. Courses are also given by teachers from colleges near by and by trade-union leaders. The Workers' Training Course, from Nov. to May, prepares leaders for the socialist and labour movements. The Department of Labor Research publishes the American Labor Year Book. The school maintains also a reference library and reading rooms and a book store. In 1914 the International Ladies' Garment Workers' Union took up educational work for its members, in coöperation with the Rand School. About 150 members attended classes at the school. Later classes were held in public-school buildings under the auspices of the union. More advanced classes were given under the name of the Workers' University of the I.L.G.W., especially for business agents and union officials. In 1918 under the leadership of the United Cloth Hat and Cap Makers the United Labor Education Committee was organized in New York City by six labour organizations for the promotion of education among their members, about 200,000 in that city. This committee has conducted weekly courses, in different parts of the city, in art, labour, history, science and elementary English and physical training, and has also provided concerts and motion pictures. It has introduced lectures and musical programmes in connexion with the trade-union shop meetings. The committee planned a workmen's theatre where for popular prices a higher class drama will be presented than can be found in the majority of the theatres of the city. In April 1919 the Trade Union College organized by the Boston Central Labor Union opened with 160 students. Courses, open to all members of the American Federation of Labor and their families, are given in the evening in one of the public schools by members of the faculty of Harvard University and other institutions.

Other labour colleges, under the control of local trade or industrial unions or local federations of unions, are: The Workers' Institute, Chicago; The Workpeople's College, Duluth; The Workers' University, Philadelphia; The People's Lyceum, Philadelphia; Trade Union College, Washington, D.C.; The Women's Trade Union College, Chicago; Hobo College, Chicago; Trade Union College, Minneapolis; People's College, Fort Scott, Kan.; The People's Institute, San Francisco; The Proletarian University, Detroit and other cities; Workers' College, Seattle, Wash.; The Amalgamated Textile Workers' School, Paterson, N.J.; Labor College, Tacoma, Wash. The Trade Union College of Pittsburgh has been organized. The Clothing Workers of Rochester maintain an educational director. The Labor Temple at Los Angeles is under the control of the school-board, and the Community School, Baltimore, has a private management.

All these colleges are financed by small tuition fees, by contributions and by guarantee funds. As a rule the teaching force is not permanent, but the courses depend on volunteers from neighbouring colleges or from the labour movement. Classes are usually in the evening, one hour of lecture followed by one of discussion. The subjects taught are various phases of economics: law, civics, history, English, public speaking, psychology, sociology, biology, hygiene, art, music. In connexion with the colleges plays and motion pictures are shown. The Waistmakers' Union of New York City has purchased a summer camp near the Delaware Water Gap where members may spend their vacations. The Boston local has built a vacation house on Cape Cod. Bryn Mawr College held a two months' summer school for wage-earning women, which opened in June 1921. Students are supported on scholarships raised by trade unions and other groups of industrial women. It is probable that the education of working men and women will be carried on through coöperation with the extension work of the state universities. Teachers are now sent out from the universities to conduct classes where they have been organized in a community. Correspondence courses offer advantages to isolated students. There has been some public opposition to the labour colleges, where these have been suspected of radical propaganda. In 1918 the Department of Justice conducted raids on the Rand School and on the Proletarian University of Detroit.

The reconstruction programme of the American Federation of Labor included actual universal education, for all ages, in all communities, for which public schools and universities were to be developed. The programme stated: "It is also important that the industrial education which is being fostered and developed should have for its purpose not so much training for efficiency in industry as training for life in an industrial society."

The American Labour Press.—The growth of the American labour press has been rapid. Each international and national union has its official organ, and the trade unions of most large cities publish their local labour papers. Well known are the *Cleveland Citizen*, the *Denver Labor Bulletin* and the *Seattle Union Record*. Some state federations of labour publish bulletins. The monthly *American Federationist* of the American Federation of Labor had a circulation (1920) of 100,000. Among the more important trade union papers are: *The Bricklayer, Mason and Plasterer; Carpenter; Cigarmakers' Journal; Justice* (Ladies' Garment Workers); *Garment Worker; Machinists' Journal; Miners' Magazine; International Molders' Journal; Plumbers, Gas and Steam Fitters' Journal; Seamen's Journal; Shoe Workers' Journal; Textile Worker; Federal Employee*, and the periodicals of the railway brotherhoods. The Chicago Federation of Labor publishes the *New Majority* (circulation 15,000), as national official organ of the Farmer-Labor party. Jewish workers have the *Freie Arbeiter Stimme*, New York, and *Vorwaerts*, of New York, daily circulation about 158,000. The *Chicagoer Arbeiterzeitung* is a German socialist paper. *Zukunft*, a Jewish socialist monthly paper, New York, has a circulation of 65,000. The Amalgamated Clothing Workers publish weekly papers in six languages: English, Yiddish, Italian, Polish, Bohemian and Lithuanian. The Industrial Workers of the World publish the *One Big Union Monthly*, and *New Solidarity* (circulation 10,000), both of Chicago. The Socialist Labor party publishes *The Socialist* and the *Weekly People*, New York, and the *Industrial Worker*, Seattle. The *New York Call*, a socialist daily, has a circulation of 21,800. Radical labour and socialist groups have published many short-lived periodicals of small circulation. During the war the Post Office Department revoked the second-class mail privileges of 25 papers, and held up one or more editions of a number of others.

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(J. R. Co.)

VII. MILITARY LAW

The U.S. army is subject to a system of military law which had its origin in, and was at first the same as that of, Great Britain. In the French and Indian Wars the colonists had fought side by side with British regulars and under the same rules and regulations. When they revolted they continued the system of military law with which they were already familiar. So little necessity for change existed that even the antiquated language of the British Articles of War was retained and some of it is still found in the American code. Passing over the earlier enactments of separate American colonies for the government of their respective contingents, such as those adopted in 1775 by the local Legislative Assemblies of Massachusetts Bay, Connecticut, Rhode Island and New Hampshire, we find that the Second Continental Congress in 1775 adopted practically the whole British Code of 1774 and furnished the foundation for the Articles of War as they have been known since then in the United States. Reënacted, with enlargements and modifications, in 1776 and amended in 1786, this code survived the adoption of the Federal Constitution and was continued in force by successive enactments until 1806.

In the United States, under the Constitution, the power of establishing military law rests with Congress. It was not, however, until 1806 that Congress concerned itself much with the military code, the Articles of War. In that year the Articles were redrafted and reënacted though there were no material changes from the Articles as they had existed during the Revolution. Nor did the next large redraft in 1874 include any great changes. Occasionally an Act of Congress would make some change, sometimes, but more frequently not, specifically amending an Article of War. If the effect was that of an amendment the Article was considered as changed. Such Acts were those of 1890 and 1898 establishing the summary court and abolishing the field-officers court; and finally the summary court supplanted the two remaining inferior courts, the garrison court and the regimental court.

In 1910 the Judge-Advocate-General undertook the systematic and logical arrangement of the Articles of War. In 1916 he presented his project to Congress and it became a law. This draft presented no fundamental changes; it was rather a compilation made with the idea of bringing the code to date by incorporating late statutes, by deleting obsolete material and dropping quaint phraseology, and by systematizing the presentation. In short it was a logical up-to-date statement of the greater part of the military law of the nation, rendering it quickly accessible. Not all the statutes, customs or regulations governing rights and procedure were placed in the new code, but by it the President was authorized to prescribe by regulations the procedure, including modes of proof, in cases before military tribunals, so long as such regulations were not inconsistent with the new Articles; and all such prescribed regulations were required to be laid annually before Congress. Under this authority a new manual for courts martial was published by the authority of the President, and in this was embodied so much of custom and regulation that it became a complete exposition of the military laws.

This was the code in effect when the United States entered the World War, and by it its armies were governed during that conflict. Only one important addition was made before the Armistice, and that was by an executive order establishing in fuller detail the power of review of the records and proceedings of general courts martial. Shortly after the Armistice a bill was introduced in the Senate (Sen. 64, 66th Congress, 1st Sess.) which, if enacted, would have made many and vital changes in the administration of military law. Chief among the radical changes proposed were those of making enlisted men members of general courts martial; of establishing a civilian court of military appeals; and of injecting into the principal courts martial a new functionary with powers so extensive and of such a kind as to constitute him the administrator of discipline. At the time the Senate was considering this bill a board of officers was convened by the War Department to recommend any changes it believed to be necessary in the Articles of War and in the methods of procedure which then obtained in the administration of military justice. After considering numerous recommendations from the army at large the board submitted a detailed report accompanied by a redraft of the Articles of War.

At the same time General Crowder, the Judge-Advocate-General, redrafted the Articles of War upon lines that he thought advisable in view of the experience gained during the war. The draft prepared by him was accepted by Congress with little change and became a law June 4 1920, though most of its provisions did not go into effect until six months later. The radical views as expressed in the Senate bill were rejected and the administration of military discipline was left to the military authorities.

This new code contains 122 Articles. In 85 Articles there are no changes except the formal variations made necessary by the creation of grades before unknown, such as warrant officers and nurses, and other analogous alterations. This leaves 37 Articles, a little more than one-fourth, in which there have been substantial changes. Many of these, however, are only statutory enactments of rules already established by administrative interpretation, orders, or customs of the service. Only about 20 Articles contain really new matter and of these it will be necessary to consider here only the more important.

Probably the most important of the changes is that effected by Article $50\frac{1}{2}$ which creates a Board of Review in the office of the Judge-Advocate-General. Until Jan. 1918 the reviewing authority acted upon a court-martial sentence and immediately ordered it executed if he did not disapprove. By an order of Jan. 1918, it was directed that no sentence of death or of dismissal or dishonourable discharge not suspended should be executed until the record of proceedings of trial had been reviewed in the office of the Judge-Advocate-General or branch thereof. The effect of the new article was to establish by statute much the same procedure. The Board of Review consists of three or more officers in the office of the Judge-Advocate-General, and functions in the following classes of cases:

(*a*) Where the President is reviewing or confirming authority or where he has ordered a rehearing.

(*b*) Where the sentence does not require approval or confirmation by the President, but involves death, dismissal or dishonourable discharge not suspended or confinement in a penitentiary, unless, in the two latter cases, the sentence is based upon a plea of guilty.

All other general court-martial records are examined in the office of the Judge-Advocate-General, but do not go to the Board of Review unless found insufficient to sustain the findings and sentence, in which case the record is submitted to the Board of Review. When the Board of Review has acted, its action is submitted to the Judge-Advocate-General. If there be an agreement between the Board of Review and the Judge-Advocate-General that the record is legally sufficient to sustain the finding and sentence, the reviewing authority is notified and the sentence is forthwith ordered executed. If the Board and Judge-Advocate-General agree that the record is not sufficient to sustain the findings and sentence, the findings and sentence are by virtue of the statute vacated and the record is returned to the reviewing authority for action. In case of disagreement between the Board and the Judge-Advocate-General the record is transmitted to the Secretary of War for the action of the President. Provision is made for more than one Board of Review if business requires such and for a branch of the Judge-Advocate-General's office like that in France during the World War.

Another change is that in connexion with a rehearing of a case. In civil cases the defendant asks for a new trial and by so doing is held to waive the guarantee against repeated jeopardy. In the military procedure, if on examining a record prejudicial error be found, the accused receives the benefit of it without any affirmative act on his part. In other words, the appellate review is automatic. This requires some modification of the rules governing new trials before civil courts. It is accordingly provided that no proceedings shall be deemed a trial until final action by the reviewing authority. When a hearing is ordered it is to take place before a different court and the accused cannot be tried for any offence of which he was found not guilty by the first court nor can a sentence be imposed more severe than that of the first court.

Still another change is that which forbids the reviewing authority to return a record to the court for increase of sentence or reconsideration of an acquittal. And the reviewing authority is not permitted to act upon a record until he has referred it to his staff judge-advocate, but this reference was always customary. The prohibition against cruel and unusual punishments is broadened but not more than the customs of the service have already broadened it, and the President is authorized to set limits of punishment in time of war as well as in time of peace. Under the new code voting upon challenges and upon the findings and sentence is by secret ballot, and the majority ballot has been extended, so that a death sentence must be by unanimous vote, sentence to imprisonment for life or over 10 years by three-quarters vote and all other sentences by two-thirds vote.

The new Articles provide for the appointment on each general court martial of a law member who rules upon all objections to the admissibility of evidence and, subject to reversal by the court, rules upon other interlocutory matters except challenges. The investigation of charges before reference to trial has been extended and possibly to an extent such that resulting delay prevents the swift application of justice. But a large part of this procedure is ruled by regulation and can be changed when found necessary.

Another innovation is that of peremptory challenges, each side being allowed one, except that the law member can be challenged only for cause; and the trial judge-advocate's right to challenge is made statutory. The punishing power of summary courts is reduced. The disciplinary powers of commanding officers to handle offences without trial has been somewhat extended, but yet not made so extensive as to lead to unreasonable punishment; and this power extends to junior officers in time of war, but no officer shall be subjected to a forfeiture of more than one-half of one month's pay.

Under the new code there are three classes of courts—the summary, special and the general courts. The summary court consists of one officer and the limits of punishment are one month's confinement and forfeiture of two-thirds of one month's pay. The limits of punishment of the special court are six months' confinement and forfeiture of two-thirds pay per month for six months. The limits of punishment of the general court are established by the President under his statutory power to fix such limits both in peace and war, except where a specific punishment is made mandatory by the particular Article of War, as is dismissal under the 95th Article.

In 1913 the Judge-Advocate-General succeeded in establishing a method of restoration to the colours of men who had been sentenced to severe punishment. This included the establishment of detention barracks, called disciplinary barracks, and a system of drills and vocational training, by means of which a prisoner could earn honourable restoration to his position lost by his offence and sentence therefor. This procedure received Congressional sanction in 1915 and the process of reclaiming those who have made mistakes is probably the most enlightened of all systems of modern penology.

In addition to the foregoing there are many laws, statutory in character as well as those of regulation and custom, that could be properly classed as military laws. But as these are mostly administrative in character they are not usually considered in a brief account of military laws. Among these are the Acts of Congress reorganizing the army, establishing the pay of grades, and making appropriations for the expenses of the army. These laws are administrative and only incidentally affect military justice, but the organization of the army in 1921 was to a great extent covered by the Act of June 4 1920, the Act which also contains the Articles of War already described. (H. A. W.*)

VIII. History

Conditions in 1908.—The year 1908 seemed one of the quietest in recent American history. The seven previous years of President Roosevelt's administration had been marked by lively contests between the executive and Congress, and also between the Government as a whole and the railways and other strong financial and industrial organizations; but the President possessed the fullest authority and influence. He had established a supremacy in many legislative matters, had carried out a vigorous foreign policy, and might have gone on to a third term had he wished. Instead, he chose to put forward William H. Taft, Secretary of War in his Cabinet, and previously head of the Government of the Philippine Is., as his choice for the Republican candidate in the impending presidential election. With that powerful backing Taft was nominated, and in the election of Nov. 1908 easily defeated William J. Bryan, for the third time the Democratic candidate. The Republican party cast 7,700,000 votes against the Democrats' 6,400,000 and secured 321 of the 483 electoral votes. The Republicans also had a clear majority in both Houses of Congress. The country was prosperous, contented, and aroused by the positive and constructive policies of President Roosevelt and of several state governors, who had furnished the country an example of the possibility of personal leadership by state and national executives, as against the leadership of self-constituted groups which had been usual in both state and national Legislatures.

The people of the United States were much more conscious of themselves in 1908 than in recent periods, because they had come to recognize the variety of their make-up. The total pop. in 1910 in the continental United States was 92,000,000. Of these, only 50,000,000 were native whites of native parentage; while 13,000,000 were foreign-born and 19,000,000 others were of foreign-born or mixed parentage. The negroes and Indians were 10,000,000. This meant that out of the white pop., three-eighths were substantially foreign, and nearly one-half went back to a foreign ancestor not more than two generations behind them. Nearly one-half of this half came from S. or E. Europe. The urban pop. (in places having more than 2,500 inhabitants) was 43,000,000, or 46% of the whole. Here were elements of greatness and also of dissension and bitterness. Race riots, except where the negro was concerned, were very infrequent, because the non-English-speaking groups tended to establish "islands" of population in the great cities and manufacturing towns and live by themselves. Their children, however, went to public schools, learned English, and began to consider themselves Americans.

Americans were of various kinds. Everybody in the United States except the American Indian is an immigrant from some other country or a descendant of an immigrant. The main race groups were, first, the descendants of the colonists, who were mainly Anglo-Saxons with some Germans and Scotch-Irish and small elements of other races. The descendants of that ante-Revolutionary population naturally thought of themselves as the preëminently American-born Americans. Next in the account were descendants of the foreigners who began to come over in great numbers about 1820. Lastly came the large number of recent immigrants and their children. In 1910 there were in the United States, 2,266,535 unnaturalized aliens, many of whom expected to return to their native country; or if they remained, to cleave to their own kind, use their native language and keep up their own schools, language press, and home connexions.

The country was not yet aroused to the dangers arising from this mixture of unassimilated races. The theory was that in the 20th century, as in the 18th and 19th, all comers would find the United States the great "melting pot." The process was one in which the public schools were supposed to play, and did play, an important part. Few voices were raised against admitting not only western Europeans, whose languages and customs were much like those of the United States, but men and women from E. and S.E. Europe and from W. Asia—Russians, Poles, Jews, Bulgarians, Greeks, Turks, Serbians and many other races. The only bar to immigration based on race in 1908 was the prohibition of Chinese immigration and the practical exclusion of Japanese labourers by a "gentlemen's agreement" with the Japanese Government (1907), which undertook to refuse passports to Japanese labourers intending to come to the United States. There was as yet no organization, public or private, to aid the in-comer in acquiring the language and knowledge of the Government of his adopted country. There was no intelligence qualification, no provision that a man who sought naturalization should be able to read, write, or understand the language of the nation he wished to join. Some of the states permitted an alien to vote if he had filed a declaration of intention to become a citizen, without even troubling themselves to see that he carried out that intention. The undigested load was becoming heavy.

The immigrants were not the only burden on the State. Millions of American-born, many of them descended from the old colonial stock, were poor and ignorant and criminal. The southern mountaineers, the frontier farmers, the loggers and the miners, included a host of men and families who lived a rough life. Parts of the rich United States were infested by tramps and vagabonds. In the wealthiest cities there was grinding poverty and degradation in the slums. The situation was saved by general prosperity and the American spirit of cheerfulness, and of confident waiting for things to come right. Furthermore, out of the most unpromising conditions arose some of the strongest figures in American history. Presidents Jackson, Lincoln, Johnson and Grant were all children of the rude frontier. Two other race problems complicated the social and political life of the country. The American Indians were a small group of only about 250,000, most of them living in tribes on Government reservations. The problem was to make them individuals; but in 1908 they were still a race group. The negroes, about 10,000,000 in number, were unorganized as a race, and were scattered over a large area, mostly in the South. Descendants of forced immigrants, they had no culture and no traditions but those of the United States. The results of their former servitude still clung about them; they were shut out from their constitutional suffrage in some of the southern states. Legally equals of the whites, they were subject to humiliating discriminations, and both in N. and S. were held in an inferior social position from which there was no escape.

Defects in Government.—The units of American society were held together by a complicated, but strong, democratic Government, well fitted to rule a diverse population. The political forms were familiar to every schoolboy—a group of (in 1908) 46 states, each with its own government, rigidly cast by the traditional principle of "checks and balances" into three departments; legislative, executive, and judicial. A national Government, also balanced, had under the Federal Constitution large powers in national affairs. A widely distributed franchise was almost equivalent to universal suffrage for adult males. There was a belief that the courts were the highest authority, not only as to questions of personal rights and duties, but as to the validity of the laws and acts of the other two departments. In addition a third type of government in the city, town and county, set up by the states, was considered to be an essential part of the system. This combination of governments governed reasonably well. It was expensive, it was not highly skilled, but it performed its tasks to the general satisfaction of most of the people. It was supported by the conviction of a large part of the population that it was the "best Government on earth."

The boast of the United States was its equal opportunity; the pride of the United States was its popular government, in which the will of the people was the only ultimate force. As a nation, Americans believed that they had, more than any other country in the world, the blessings of personal liberty, of free public education, of sharing in their government, of impartial judges. Everybody was supposed to have a fair chance in life. Few Americans could bring themselves to realize that equal opportunity was denied to those who chanced to be outside the advantages of education and of contact with their fellows; that the personal liberty of workers in mills, mines, or cotton-fields was much restricted; that some 10,000,000 negroes were subject to legal and social discrimination; that the public schools failed to reach at least one-fourth of the children who needed enlightenment and instruction; that the actual government of the country was in many communities carried on by a self-selected group of men who dictated nominations, controlled legislation and decided policies; that in matters of property or even personal rights, court proceedings were long, expensive and uncertain.

In the organization and conditions of business could be traced another startling contradiction between the word and the fact. Nominally all kinds of business not prohibited by law were open to all comers in free and honourable competition. In reality, by 1908 a great number of both employers and employees were engaged in a combat outside the laws, constant and conscienceless. Although the country grew wealthy fast, and commercial transactions increased, the small dealer or manufacturer or miner found himself shut in by a thick growth of corporations which had the great advantage of limited liability and the privilege of operating through the country under the legal fiction that a corporation was a "citizen" in the constitutional sense of the word. It was hard for individuals and firms to compete with corporations, and hard for small corporations to compete with large ones in the same line of business. For many years the steady accumulation of capital tended to flow into these expanding units, a process veiled by the use of parallel and "holding" corporations. The railways were among the most conspicuous of the large corporations, because everybody used them and because they, too, tended to combine into larger and more powerful units. The whole system was under suspicion, because railways and some other large corporations made it their business to get control of majorities in city and state Legislatures, and of party management. For example, the governors of California were in effect designated by the heads of a railway company. The states could not deal adequately with these powerful bodies because most of the railways and many of the other corporations operated from state to state, and could not be controlled at either end by anything short of Federal power.

The appeal to Congress for action, first against railways and then against other corporations, had led to the Interstate Commerce Act of 1887 and the Sherman Anti-Trust Act of 1890. It was a centralizing process; the more Congress did, the more eager became the desire to push Congress to restrict, and then to make restrictions still closer. The U.S. Supreme Court fell in with this process more readily than could have been expected of a body so conservative and so withdrawn from the arena of dubious business methods. Yet, notwithstanding a few decisions against railways and "trusts," the powerful corporations prospered and increased. They were bound to live, because they were economically effective; they found means of carrying on immense lines of business in an orderly manner; they supplied the demand. Their profits were large, but they gave employment to multitudes of every degree of skill.

Political organizations were on nearly the same basis as business companies—they also grew bigger and more powerful and gathered into fewer groups. Nominally, parties are simply associations of voters for common ends. Actually, they are armies acting under commanding leaders who in many cases hold no offices. The evils of this "invisible government" were apparent. Many states and cities were badly governed by unscrupulous men who were tools of the leaders, or by too competent men who plundered their fellow citizens. The average voter was honest, but stood by his party. Committees of voters, non-partisan leagues and citizens' parties tried to organize the voters for reform, but no permanent improvement was made. The political philosophy of the Americans was based on the belief that mankind was steadily growing better. Hence a tendency to look to laws and political devices to correct the ills of popular government. Millions of voters believed that if they could only get laws enough, they could break the power of the "bosses" and chain the corporations. They overlooked the fact that the real evil was the party managed by men who made politics a business, who were responsible for "getting out the vote," and always got out the votes of their friends, who knew from long experience that the weary and listless voter at last would cease to protest. On the other hand, the pressure of the trusts on small corporations and individuals was felt by masses of voters who protested against the corporations that felt strong enough to break the law and defy the voters. There was a glacier-like force of public opinion that could break down all opposition. What was most needed was the leadership of bold and far-seeing men. Roosevelt, a man of the type needed, retired to private life when President Taft was inaugurated, March 4 1909.

Political Reform.—When Roosevelt left the presidency the position of President was at the highest point of authority that it had ever known. Most Presidents are obliged to strive with Congress in behalf of their policies, inasmuch as their only means of officially proposing legislation is through public messages, and their heads of departments work directly only through Congressional committee hearings; American tradition is against the framing of bills by the executive, and the President's initiative is limited. Most Presidents have found their principal legislative influence in the veto, by which they have the weight of one-sixth of both Houses. President Roosevelt followed the McKinley method of emphasizing his wishes by personal discussion with members of Congress. He did more; he revived the Jacksonian method of announcing a legislative plan, and if Congressmen hung back, of appealing over their heads to the country at large.

This policy was adopted by President Taft, who was not afraid of a fight and who saw the advantage of assuming that the President was the natural party leader. William H. Taft had many of the qualities of leadership. He was large, happy, genial, fond of his many friends; a cheerful, balanced man. He was also experienced in the public service. Born in 1857, he graduated at Yale, and became a lawyer and a state judge in Ohio. In 1890 he was made solicitor-general of the United States and thus introduced into the Federal service. He was then selected as a Federal circuit judge and his decisions were valued. In 1900 he was appointed chairman of the Philippine Commission and was the first civil governor of the Islands. From 1904 to 1909 he was Secretary of War in Roosevelt's Cabinet, and proved himself an excellent executive. He made few enemies and had a most powerful friend in the President, who selected him as his successor. Throughout his career, including the presidency, he was an easy and popular speaker, a head of the Government who worked well with his associates and subordinates. Nevertheless, from the beginning of his term he found obstacles in his way. As an avowed successor to Roosevelt's policies he drew upon himself the opposition of Roosevelt's enemies. At the same time it soon became apparent that he was not relying on Roosevelt's friends.

President Taft's Cabinet was as follows: Secretary of State, Philander C. Knox of Pennsylvania, a man by experience and temperament, allied with the "stand pat" element of the Republican party; Secretary of the Treasury, Franklin MacVeagh, of Illinois, a business man of large experience; Secretary of War, Jacob M. Dickinson of Tennessee, succeeded in 1911 by Henry L. Stimson of New York; Attorney-General, George W. Wickersham of New York; Postmaster-General, Frank H. Hitchcock of Massachusetts; Secretary of the Navy, George von Lengerke Meyer of Massachusetts; Secretary of the Interior, Richard A. Ballinger of the state of Washington; Secretary of Agriculture, James Wilson of Iowa, remaining from the time of McKinley; Secretary of Commerce and Labor, Charles Nagel of Missouri. In the building of the Panama Canal Colonel Goethals continued as chief engineer. Maj.-Gen. Leonard Wood, as chief of the general staff, urged reform in the organization of the army, and the training of additional officers. Ballinger very soon involved himself in a bitter controversy with Pinchot, a warm personal friend of Roosevelt, over alleged irregularities in the disposal of public lands in Alaska. Ballinger was sustained by the President and a committee of Congress; but public pressure was such that he was obliged to resign, March 6 1911, and was succeeded by Walter L. Fisher of Illinois.

Taft's appointments were in the main good, including the elevation of Justice White to the chief justiceship of the Supreme Court, and the appointment as a justice of Charles E. Hughes, previously governor of New York. Nevertheless, a few months after the President's inauguration, his influence on Congress declined and he lost his hold on two powerful elements in his own party. The important business men—capitalists, bankers, managers of corporations, commonly called the "interests"—thought him disposed to interfere with them; while he found himself out of accord with the rising spirit of reform which aimed to give better expression to the will of the voters as a whole as against party leaders and political organizations.

Here was a critical point in popular government; for in practice it was almost impossible to elect a candidate unless he was on some party ticket. A small group of men, politely called the "organization," or more harshly the "bosses," in many states and cities had control of the machinery of the nominating conventions. Where they could not dictate a candidate, they could usually defeat the selection of any man whom they disliked or distrusted. Their power extended to national nominating conventions, particularly in the Republican party, because the Republican delegates from southern states, which almost always voted Democratic, were elected to national conventions by a handful of Federal office-holders and other professional politicians. Complaints were abundant everywhere of "hand-picked conventions," of delegates who sat silently in their seats until informed by their "organization" for what men they must vote. The solidifying principle was that the bosses' candidate could usually count upon the steady, regular members of the party.

A method of selecting candidates long practised in some parts of the country now spread rapidly through the Union; this was the primary, under which candidates were selected for each party by the ballots of the members of the party. The primary undermined the convention system, which in some states was even prohibited. From nominations for local officers it spread by 1911 to state officers in two-thirds of the states; and after 1910 began to be applied to the choice of delegates to the national conventions. For a time the system seemed a great success; it opened opportunities to enter public life, and killed off unpopular leaders. An unforeseen effect was that the official ballots were made upon the basis of party nominations, with an opportunity for independent voting. The primary was therefore a public and effective election, which practically brought the party system into the domain of public law, as a part of the Government.

The distrust of conventions and controlled elections extended to the numerous and powerful bosses in city and state Legislatures. Three new devices were set at work to curb them and to interest the electors in public measures. The first of these, the referendum, was by 1909 spreading rapidly through the western states. It was a means of checking legislative action contrary to public sentiment. The system, both in local and state government, can be traced from colonial times; and most 19th century state constitutions were submitted to a popular vote, and also many statutes, if the Legislatures so directed. The referendum system furnished a mechanism, usually imbedded in state constitutions, by which a statute on the demand of a sufficient number of voters could be held back from effect until submitted to a vote of the electors. The state of Oregon was one of the earliest and most thorough-going in this reform.

What was to be done if the Legislature refused to enact a statute demanded by the people? How could this negative force be overcome? By the initiative, through which a designated number of voters could unite on a measure, which must then be submitted to the electors for their suffrages. Both the initiative and referendum were attacked on the ground that they were contrary to republican government, inasmuch as they substituted direct action for representation. The referendum had been so long and widely used that it was hard to make out a case against it. The initiative was based on the general principle that the ultimate source of authority is not the Legislature or any public officer, but the people at large. In a test case (Feb. 1912) the Federal Supreme Court declined to rule that the initiative and referendum were contrary to a " republican form of government "; and no further attempts were made to upset them on constitutional grounds.

A third branch of this system of appeal to the people was the recall, under which a public officer chosen by popular vote, and in a few cases those who were appointed in some other way, could be subjected to an election; and, if the majority decided against them, they would be thereby removed from office. The system began in the far western states and never spread so widely as the other two methods mentioned. In 1911–2 the recall came before Congress in connexion with the proposed constitution of the new state of Arizona, which included a provision for the recall of judges. President Taft vetoed the Act of admission because of this provision. The state therefore withdrew the clause, was duly admitted in 1912, and thereupon proceeded to reinsert the recall. In practice, recalls proved to be few, and recalls of judges very few. A still wider application of the principle of responsibility of functionaries to the voters was the recall of judicial decisions, which was advocated by Roosevelt in 1912 and was applied in one state, Colorado.

Popular elections were applied to the choice of Federal senators, first by an indirect method of pledging members of the Legislature, invented in the state of Oregon. The Senate contained some members who could never have passed the ordeal of popular election, yet were frequently re-elected by the Legislature. The result was the 17th Amendment, submitted by Congress June 12 1912, and added to the Constitution May 31 1913, under which all elections to the Senate from that time were to be made by direct popular vote. Another evidence of a rising feeling of responsibility in Congress was a statute (Aug. 7 1911) requiring candidates for the House and Senate to submit statements of the money raised and expended in their behalf and limiting the amount that they might themselves spend. One purpose of both these measures was to make it difficult for men to purchase their way into the Senate. On July 13 1912 Senator Lorimer of Illinois was practically expelled from the U.S. Senate for buying legislative votes.

Experience has shown that the load of responsibility placed upon the voters by these new measures was sometimes more than they were willing to bear. The scanty primary votes, and the inattention to some of the referendum and initiative questions put on the ballots, were seized upon as showing that the voter was interested only in men. On the other hand, the ballots of most cities, towns and states were loaded down with long lists of officers to be chosen at each election, so that the " vote for men " was in many cases a vote in the dark. The result was an agitation for the reform commonly known as the " short ballot," by reducing the number of elective officers and increasing the officers to be appointed by the few elective officials. Working difficulties were found in many of these reforms, and it was hard to keep the public keyed up to the necessary pitch of thought and attention at every election. It was evident, however, that the American people intended to free themselves from the shackles of what Elihu Root styled " invisible government."

Social Questions.—The spirit of discontent extended to many questions outside of politics. Throughout Taft's administration there was an increasing pressure for " equal suffrage "—that is, woman suffrage—which was introduced in the territory of Wyoming in 1869, gradually spread among the far western states, and then worked its way eastward. Inasmuch as the voters for the more numerous branch of the state Legislature are also voters for members of Congress and for presidential electors, women began to take part in national affairs, and one of them was a delegate in the Republican National Convention of 1908. As the number of suffrage states increased, it was natural to look forward to a constitutional amendment which would abolish sex distinction for voting and indirectly for office-holding.

Both state and national Governments were compelled to deal with the question of alcoholic beverages. From the earliest times there had been some restriction on liquor selling and liquor sellers as well as punishment for undue use of intoxicants. By 1909 in almost all states there was some form of general legal restriction: prohibition or local option or high licence or a state dispensary system. These laws were enforced more or less strictly within the state or communities to which they applied. The question became national, however, because the liquor trade transported its wares from one state to another; and that brought it within the Interstate Commerce clause of the Constitution and the Interstate Commerce Act. There was a long, running fight between the opponents of the liquor trade, Congress, the state Legislatures, and the Federal courts, which finally passed upon the validity of various Acts passed by the Federal Government regulating transportation. Eventually Congress adopted the policy, by the Original Package Act of 1890, of prohibiting shipments of liquor into prohibition states; and this law sustained the test of the U.S. Supreme Court. Pure food laws in force before 1909 were supplemented by the Drug Label Act (Aug. 23 1912), which greatly aided in preventing the adulteration of drugs.

Many questions arose out of immigration. The laws forbade the entry of labourers under a contract to work in the United States, of convicts, insane persons, and (after 1907) diseased persons; but the execution of such laws was slack. The first statute looking toward decided control of immigration was that of Feb. 1907, which increased the grounds of exclusion, and at the same time provided a plan to help the immigrants to find work. It also created an Immigration Commission, which in 1910 made a report in 41 volumes, strongly recommending the sifting of immigrants by testing their ability to read and write some language; but bills to that effect were twice vetoed by President Taft. Meanwhile, the number of immigrants rose in the decade 1901–10 to an average of a million a year. New machinery for registering departures brought out the fact that from 300,000 to 500,000 annually returned to their old homes, so that the rate of increase of population by immigration was no larger than it had been for 50 years. The alarming fact was that the immigration from W. Europe fell off, while great numbers of ignorant and unskilled people crowded in from Russia, Austria-Hungary, and other parts of E. Europe. Still, the newcomers found work and their employers found a profit in employing them.

Finances and the Tariff, 1908–13.—Every growing unit in the country—from a small school district to New York State—was harassed by questions of taxation and expenditure. The U.S. Government also searched for new resources, and found them in the income-tax, a method familiar in European countries and open to the individual American states. An income-tax had been levied by Congress during the Civil War, and again in 1884, when it was set aside by the odd decision of the U.S. Supreme Court that it was a direct tax which could be levied among the states only in proportion to their representation in Congress. Successful agitation brought about, July 13 1909, the submission of a 16th Amendment, to remove the restriction, and it was declared adopted by the necessary three-fourths majority of states, Feb. 25 1913.

June 25 1910 a postal deposit Act was passed which created a vast savings bank, of which many post-offices were the local branches. The new form of savings attracted foreigners who were accustomed to a similar system in their own countries; and in 1920 the deposits had risen to $157,276,322. Another new resource of the Federal Government was a tax upon corporations levied on net income (Aug. 5 1909). The immediate proceeds were small—only about $30,000,000 a year; but corporations were obliged to file accounts which showed their net income, and thus to give access to facts about their profits and methods. The more important question of reorganizing the national banking system so as to furnish a strong national institution was debated from 1908 to 1912, and was the subject of an elaborate report by a National Monetary Commission; but no action was taken at that time. The net Federal debt was $1,000,000,000, which was only about $11 per head of the population.

A financial resource as to which Congress had sole authority was the tariff. Under strong pressure from members of the party to carry out the promises of the Republican Convention of 1908, President Taft, a few days after his inauguration, summoned Congress to meet in special session, for a "revision." As usual there was a long controversy which resulted, Aug. 5 1909, in the Payne-Aldrich Tariff Act. The administrative features were good. The act created a permanent court of customs appeals, with power to determine finally all questions as to the value of imports; and also a Tariff Board, expected to make investigations and recommend specific measures which Congress would adopt. As to rates, the Act was not very different from its predecessor, except for a decided increase of duties on cotton and silk manufactures. There was a loud outcry that the "revision" called for by the party platform was plainly a revision downward and not upward. President Taft argued against the textile schedules, but signed the bill and in a speech at Winona, Minn., Sept. 17 1909, surprised the country by declaring that it was the "best tariff bill that the Republican party has ever passed." When in the next Congress the Democrats had a majority of the House, they passed a series of bills, covering a farmers' free list, woollens and cottons, which were carried also in the Senate by the aid of low-tariff Republicans; all these were vetoed by President Taft. In the campaign of 1912 the tariff played very little part. It was accepted that a considerable revenue must be raised by import duties; and the large import trade showed that the existing tariff was not prohibitive.

Trusts and Transportation.—During the 20 years ending with 1910 it had become clear that the most difficult question before the U.S. Government was the regulation of the vast aggregates of capital, commonly called trusts, which were combined into corporations and aimed at the control of particular lines of business, and also of the railways, which, as general transportation agencies, were of great importance in connexion with every kind of industry and trade. For many years Congress had been struggling with this question, and the result was two lines of restrictive statutes, headed by the Interstate Commerce Act of 1887 and the Sherman Anti-Trust Act of 1890. Upon these and the amendments to the Interstate Commerce Act was built a structure of decisions of the U.S. Supreme Court, sometimes annulling provisions of the statutes, more often altering decisions by the Interstate Commerce Commission. Partly to carry out and partly to avoid these decisions, the Mann-Elkins Act of June 18 1910 widely extended the Interstate Commerce Acts by including telephones, telegraphs, express and sleeping-car companies, and setting up a Commerce Court which was to hasten decisions on transportation questions. Armed with these new powers the Commission reduced some freight rates and raised others. December 2 1910, the Supreme Court dissolved the combination of the Union Pacific and Southern Pacific railways as contrary to the laws against mergers. The Commerce Court proved a failure; its decisions were received by the public as an unreasonable attempt to control the Commission; and in 1914 Congress refused appropriations, and the President was obliged to abandon it.

Federal control of railways on the whole worked well. It secured uniform appliances and a system of rates based on successive decisions of the Interstate Commerce Commission. This Commission was a striking example of disregard of the great principle of separation of powers inasmuch as it was a rule-making body, an executive body, and a court which interpreted its own rules, subject as to some questions to appeal to the Federal Courts. The great problem of the trusts was much farther from a solution than that of the railways, because the large corporations were linked together through the holding and manipulation of stocks by capitalists and banks, and through the so-called "interlocking of interests." Furthermore, except for Treasury processes for collecting taxes, there was no public agency other than the Department of Justice to call into action the anti-trust laws in specific cases and exact penalties for their violation.

The process of forming new and powerful corporations, frequently by the union of previous companies or firms, grew more active from year to year. Capital was abundant, vast riches lay in the development of mines and oil-wells and in manufactures and trade. The constant tendency was to combine and systematize so that such large lines of business as the production and manufacture of oil, the mining of iron ore and the manufacture of steel, the weaving of cotton, woollen and other textiles, the manufacture of tobacco, packing of meat, making of cordage, were rolling up into larger and larger corporate units. Above all, the railways which stretched throughout the country and were indispensable to business of every kind had consolidated into great systems which destroyed competition.

The only effective way of dealing with large corporations whose activities extended from state to state was to bring suit against them for monopolizing or conspiring to monopolize in their lines of trade. These were difficult matters to prove against corporations of great resources. Hence it was considered a triumph when, May 9 1911, the U.S. Supreme Court rendered decisions against two of the most powerful trusts, the Standard Oil Co. and the American Tobacco Co., the latter on an issue which had been pending since 1906. The minds of a majority of the Court worked in a roundabout way. It held that the anti-trust legislation must be interpreted by the "standard of reason;" namely, that a combination was not unlawful or against the public interest unless it actually caused a restraint of trade and commerce among the Federal states or with foreign nations. Having thus set up a "rule of reason" which Congress had refused to enact, and created an example of judicial legislation, the Court proceeded in both the pending cases to hold that the companies were guilty of attempts to monopolize their lines of trade, and had tried to cloak their monopoly by setting up a variety of intertwined companies, thus concealing their transactions. The Court, therefore, upheld the justice and constitutionality of the Sherman Act, but as to penalties, the Court contented itself with ordering the offenders to disintegrate. The companies reluctantly and slowly went through the process of reorganization, but their stocks immediately rose on the market—a sufficient proof that the court decisions were more favourable than had been expected. Thenceforth the "rule of reason" required that positive proof must be adduced that a great combination was doing harm before it could be touched; the general danger of vast aggregations of capital was left out of account.

Another form of unlawful behaviour by trusts was their misuse of the patent laws. The question arose whether the maker of a patented device could insist that the purchaser must use also the seller's unpatented appliances in connexion with the materials employed. On this point the Supreme Court went through various stages of opinion. In the Dick case (March 1912) it held that such restrictions on the purchaser were legal. About two months later it held, in the "Bathtub Trust" case, that there could not be a monopoly of the product of patented machinery.

Labour Questions.—A long time was needed to make the discovery that closely connected with the railway question and the trust question was the legal and economic status of those who labour. Beginning in the 18th century with the English legal principle that a combination of labourers to raise their wages was unlawful, the United States changed its position and early accepted and for many years acted on the counter principle that strikes were lawful. No legal obstacle was put in the way of the organization, first, of local trade unions, then of nation-wide unions for single trades, and finally of national unions combining many trades. To this was slowly added by the unions the principle of the "right to labour," which means both that it is the duty of the community to see that the worker has a job, and also that at least the skilled workers have a kind of title in their employment, so that it is contrary to good morals for a "scab" to take the place of a striker. When the railways came under Federal supervision and control, the railway employees, especially the skilled workers, began to feel that they, as well as the shipping and travelling public, were entitled to protection by the Government. When, during Roosevelt's administration, the President designated an informal commission to negotiate a settlement of a wage dispute in the anthracite coal-mines in Pennsylvania, he made almost the first acknowledgment that such industries as fuel production and steel-making were national in their character and required national regulation.

The legal position of labour unions in these controversies was brought to a head by suits of national importance against unions.

The first test case was that of the Buck Stove and Range Co. against the American Federation of Labor, which was really a suit between a national labour union and a national organization of manufacturers. The charge was that the Federation, by posting the Company in its publications as "unfair" to labour, was boycotting and thus infringing legal rights. In its evolution the case turned into long-drawn-out proceedings against Samuel Gompers, president of the Federation, for contempt of court, on the ground that he had refused to obey a court order to abandon the boycott. After seven years of shifting of the case from one court to another, Gompers escaped the 12 months' imprisonment to which he had been sentenced. In 1910 a suit was decided against a union of the Danbury (Conn.) hatters, who had attempted to boycott the products of a local hat manufacturer. The jury found a verdict of $74,000 damages, part of which was eventually collected from members of the local union who had property, and refunded by the general trades union.

These court trials accented the labour controversy and led to violent strikes. In the midst of them sprang up a new labour organization, the Industrial Workers of the World (I.W.W.), which was an attempt on a large scale to organize the unskilled labourers, and also to reach the goal of one big union for all trades. The movement was unwelcome to the unions of skilled labour, because the unskilled were so much more numerous that they could always outvote the skilled, and were sure to insist on an equalization of wages, which would reduce the rates of the highly paid. For several years, strikes were frequent and often accompanied by acts of violence. In several instances labour unions supported their leaders in arson and murder. One such case was the blowing up of the Los Angeles *Times* building in Oct. 1910, for which two brothers named McNamara, one of them secretary of the International Association of Bridge and Constructional Iron Workers, were convicted and sentenced.

Another phase of the labour situation was the spread of employers' liability laws through various states, and an Act of Congress of April 22 1908 for the protection of employees of interstate railways. Minimum Wage Acts also were passed in a few states with the purpose of protecting the employees in industries that required chiefly unskilled or slightly skilled women. In June 1912 Congress added to its previous enactment of an eight-hour maximum regular day for public employees, by providing that all contract work for the Federal Government must also be on the eight-hour basis. The effect of these movements was that labour came to be recognized as one of the elements of production that must be considered; as most of the labourers were voters they brought to bear powerful influences on state Legislatures and Congress in favour of labour. On the other hand, the courts, particularly those of the states, were slow to recognize the changes in industrial conditions which made protection of wage earners necessary, and many statutes intended for the betterment of labour conditions were held invalid.

In addition, the courts began to use a system of labour injunctions; workmen, labour unions and members were forbidden to perform acts, which if performed would presumably be a violation of a statute and would therefore lead to prosecution, in which the question of guilt or innocence would be settled by a jury. If the offense were transformed by the injunction into a defiance of the Court, then the Court itself would decide on the responsibility and affix a penalty not specifically laid down in any statute. Labour was opposed to unlimited immigration, and nearly all the measures for restricting immigration were originally proposed by labour unions, particularly the convict and contract labour Acts. For many years there was a Labor or Socialist Labor national party, which regularly nominated a candidate for the presidency and cast a small popular vote. It did not succeed because there was a standing Socialist party which cast from half a million to a million votes and absorbed the Socialist vote; while the labour leaders saw that if they withdrew from the main political parties they would set the farmers and traders and professional men against them. Hence, in all the shifts of politics very few avowed Labour candidates were elected to the state Legislatures or Congress. Labour agents and agitators failed therefore, to influence the public at large—their speeches and literature were little regarded outside their own constituencies. Furthermore, the members of the labour unions, about 5,000,000 all told, were not more than one-eighth of those men and women in the United States who worked with their hands.

Foreign Relations, 1907–13.—In the pressure for action on social and political matters, foreign affairs received even less than the usual meagre attention given them by the American people. The tradition of isolation was a strong force in the public mind, notwithstanding the rapidly growing foreign trade and the influence of the great number of immigrants. The thing that brought the United States closest to European complications was the possession of the Philippine Is., which made the United States an Asiatic power, and compelled it to be interested in the fiscal and territorial conditions of China on the basis of the "open door" system proposed by Secretary Hay in 1901. In the western hemisphere the Americans upheld the Monroe Doctrine as applied by Roosevelt to prevent the use of force by European countries to collect debts and claims from delinquent American powers. Three steps had already been taken in pursuit of the Caribbean policy: the protectorate of Cuba, the Panama Canal undertaking, and the lodgment in San Domingo.

In the Hague conference of 1907 the U.S. delegates urged arbitration; and in accordance with the general principles put forth at that conference, Secretary Root in 1908 secured 25 arbitration treaties with as many countries. The United States and Great Britain arranged (Jan. 27 1909) to refer to the Hague tribunal their long-standing dispute on the Newfoundland fisheries, the first really important case brought before the tribunal. The result was a decision (Sept. 7 1910), which brought to a satisfactory termination the difficulty. President Taft, through Secretary Knox, secured in 1911 arbitration treaties with Great Britain and France. The Senate insisted on inserting in these documents a reservation of all questions involving what Roosevelt called the "vital interest, the independence or honour of the nation," and in 1912 it refused to approve them. A long-standing difficulty with Russia caused by the refusal of the Russian Government to recognize passports issued to Jews and some other people, was suddenly accentuated when, on Dec. 18 1911, the commercial treaty with Russia was abrogated. Trade relations went on for the time, however, without a treaty.

In 1911 the Republican majority under President Taft's leadership proceeded to a policy of commercial reciprocity with Canada, thus reviving the principle of the treaty of 1854 which went out of effect in 1865. An agreement was made with the Canadian Government by which each side should reduce or abolish duties on certain raw products and manufactures. For the first time in American history such an international arrangement was to be brought about by legislation on both sides, instead of by a formal treaty. With great difficulty the necessary bill was pushed through Congress (July 1911); but two months later the Canadian electors refused to support the Liberal Government which had negotiated the reciprocity agreement, and the plan broke down with the refusal of Canada.

Conditions in the Latin-American states did not remain harmonious. The United States ever since the Spanish war had been gaining territory and power to the southward. The arrangements of 1902 made Cuba practically a dependency; and from 1906 to 1909 it was found necessary to resort to those treaty rights and set up a provisional Government, supported by American troops. The Panama Canal was now approaching completion and the little republic of Panama, which it bisected, nominally an independent state, was in fact under complete American control. President Taft continued the occupation of San Domingo, the consent of the Senate to a treaty to that effect having been obtained in 1907. In 1911 he secured a convention by which Nicaragua ceded certain small islands on its Atlantic and Pacific coasts and gave exclusive canal privileges to the United States. Although the Senate did not ratify the treaty, President Taft practically took possession of Nicaragua and this occupation continued throughout his term. Another foreign question arose out of the possession of the Panama Canal. As the Canal approached completion, an Act of Congress was passed Aug. 27 1912 for laying tolls on shipping, from which American ships engaged in coastwise trade were to be relieved. The British Government lodged a protest (Dec. 9) on the ground that by its treaty with the United States the Canal was to be opened on equal terms to the ships of "all nations"; President Taft, however, stood by the Act, and the question was passed on to the next Administration (*see* PANAMA CANAL).

Still more serious were the relations with Mexico, where, in 1910, a revolution headed by Madero, assailed the presumedly solid Government of Dictator Diaz and drove the latter after a few months out of the country. Mexico was thrown into confusion, and President Taft found it necessary to place troops on the border; in 1912 he proclaimed an embargo on the export of arms or military supplies to Mexico. Meanwhile the concessions and property of Americans in Mexico were threatened or destroyed, and there were many cases of robbery, forced loans and murder. The Americans who had interests in Mexico began a steady pressure for intervention by the United States. The nationals of other countries were suffering from the same disorder and violence; but the temper of the United States was strongly against any show of force by other Governments, because it might be a direct or indirect violation of the Monroe Doctrine.

Across the Pacific, clouds rose on the diplomatic horizon. Chinese immigration had long been prohibited, but the commercial treaties with Japan allowed a reciprocal freedom of residence and trade to the nationals of the two countries. The immigration of Japanese was very distasteful to the people of California, who undertook to restrict Japanese children to separate schools. Behind this difficulty was the rising power of the Japanese and their national spirit, greatly enhanced by their victory over the Russians in 1905. In 1908 Roosevelt sent around the world a powerful naval fleet which visited Japan and was received with elaborate courtesy by a welcoming Japanese squadron exactly equal in number, ship for ship. In the Root-Takahira reciprocal note of Dec. 1 1908 (which was never submitted to the Senate), the United States practically admitted Japan's special interest in Asiatic affairs. In Dec. 1909, Secretary Knox suggested the nationalization of the Manchurian railways by China, which proved to be unacceptable both to Japan and Russia. The Japanese were evidently acquiring a sense of their special and almost exclusive rights to influence on the Asiatic mainland. The question of immigration was settled for the time being by renewal of the commercial treaty, July 24 1911; the previous "gentlemen's agreement" was continued, according to which, while not yielding its claim to a right of immigration into the United States, the Japanese Government pledged itself not to issue passports to labourers. There still seemed to be a feeling in the United States that the Japanese had in mind an imperial policy, and when in 1912 it was rumoured that they were trying to get possession of Magdalena Bay in Mexico, the Senate adopted the Lodge resolution against foreign occupation of territory near by which might be a point of vantage against the United States.

Politics, 1909–12.—In the action of Congress on many important issues as above described no party lines were drawn; though such measures as the tariff and the new taxes were distinctly Republican. As often happens when a party is firmly seated in power, the Republicans began to divide. On the tariff, some members from middle western states, particularly Minnesota, voted against the Payne-Aldrich measure because their constituents could see in it no advantage to themselves. Another influence which tended to divide the Republican party was resentment against the Speaker of the House, Cannon of Illinois, who exercised the powers that had been accumulating in the hands of Speakers for a hundred years. By his control of the proceedings of the House, by his appointments of committees, and by his power to refuse recognition of members who desired to take part in debate or submit proposals, he was practically the legislative premier. Through the combining of these powers the Speaker virtually had a veto on any measure or proceeding which he did not like. This concentration of authority in the Speaker, and a few chairmen of committees whom he designated, in many ways tended to unity and responsibility in legislation; but Cannon kept too tight a hand; hence, March 19 1910, a group of Republican "insurgents" joined hands with the Democrats of the House to reduce his power. By these and later changes in the rules, the power to appoint committees and to direct legislation was taken from the Speaker and never restored. The Speaker became simply a partisan moderator.

A new issue upon which both parties were divided was covered by the general term "conservation." The United States, though most of the arable land had passed out of its possession, was still, as owner of a vast area of public lands, the possessor of great tracts of forest, of mineral lands, and of water power. President Roosevelt became interested in stopping the waste of timber and minerals, in preserving part of the gifts of nature for future generations, and in retaining public ownership of the utilities of the country, particularly the forests and streams. The policy of conservation had hardly gone further than the reservation of large areas of forest land until 1910, when statutes provided for a new classification of land and for the reservation of coal by the Government. Congress in 1902 had provided for a system of irrigation, the cost to be advanced by the Government and repaid in instalments by the users of the water. This statute underwent various amendments so as to give greater encouragement to settlers. In 1910 large areas, previously held as forest lands, were thrown open to settlement. Under a statute of March 1911, considerable areas of mountain land were purchased in the Appalachians on the theory that their control would protect the watersheds of navigable rivers. Congress also reserved forever several scenic areas, particularly Rocky Mountain National Park in Colorado, Glacier Park in Montana, and later the Grand Canyon of the Colorado.

The Progressive Movement.—In the confusion of statutes, executive orders, proceedings of the Interstate Commerce Commission and Supreme Court decisions, it was difficult to see how far the country was really advancing in its attempt to control capital and satisfy labour. The only clear result was that the Republican party was weakening, and that President Taft's popularity and influence were lessening. The diminution of power vested in the Speaker was an evidence both of discontent and of willingness to disregard party lines; and the State and Congressional elections of 1910 were unfavourable to the Republicans. The insurgents, who soon came to be called Progressives, gained most of the Republican districts in the west; and the Democrats gained about 50 seats in Congress, which transferred to them the control of the House; while in the Senate they had 41 of the 92 members.

The dissatisfied Republicans began to look forward to the presidential election of 1912, and a group of them gathered about Senator La Follette of Wisconsin as a leader and presumptive candidate. Meanwhile the state Legislatures were passing primary laws some of which included the choice of delegates to national nominating conventions. La Follette had broken into the Republican party organization in his own state, secured the governorship, and entered the U.S. Senate, where he violated the traditions of that conservative body by making speeches without waiting the usual length of time. Taft's friends and supporters naturally expected that the President would be renominated.

All these calculations were upset by the greatest personality in the country, Theodore Roosevelt. A few weeks after leaving the White House (1909) he undertook an expedition to Central Africa, and before returning made a series of visits to the countries of W. Europe. He was received as the ex-President of the most important of republics and as a commanding personage; immense crowds greeted him as a world celebrity. He returned to the United States June 18 1910 to find political conditions little to his liking. Most of his friends had disappeared from the Administration; his policies, particularly as to conservation and the more rigorous control of the trusts, seemed to him to have been slighted. Without any open breach of personal friendship Taft did not satisfy the ex-President, and the two drifted apart. On the other hand, the insurgent Republicans included some of Roosevelt's warm friends. It was impossible for him to remain silent, for he was called upon to speak in all parts of the country. Aug. 31 1910 at Osawatomie, Kan., he set forth a programme which he called "the new Nationalism," favouring publicity of the accounts and proceedings of trusts, a tariff commission, a graduated income-tax, a proper army and navy, conservation, protection of labour, and the direct primary with the recall of elective officers. This was a programme which could not be accepted by the conservative or "stand-pat" Republicans, with whom, by this time, President Taft, was included.

Nevertheless, throughout 1911 Roosevelt made no direct movement towards standing for the presidency. He publicly attacked Taft's position on the trusts in the columns of *The Outlook* of which he had become an editor, and openly classed himself as a Progressive. Meanwhile several of the western states, particularly California under the guidance of Gov. Hiram Johnson, had accepted a radical programme of political and social reform. A formal breach with Taft and the open candidacy of Roosevelt seemed inevitable. The crisis came when, Feb. 2 1912, La Follette suffered a physical and mental collapse which put him out of consideration; and on Feb. 12 President Taft in a speech alluded to the Progressives (evidently having Roosevelt in mind) as "Extremists—not Progressives; they are political emotionaries, or neurotics." This was taken as a challenge and a few days later Roosevelt openly declared himself a candidate, adding, "My hat is in the ring." Primaries or conventions had already been held in several states which would have instructed their delegations to support Roosevelt if they had known his purposes; in another large group of states, and those for the most part states that formed the backbone of the party, there was still time to organize and select delegates favouring Roosevelt.

Election of 1912.—As the convention held at Chicago approached, the lines of battle were developed. Behind Taft were Barnes of New York, Penrose of Pennsylvania, Crane of Massachusetts, and other "stand-pat" leaders. Among those in favour of Roosevelt were Garfield of Ohio, Pinchot of Pennsylvania and a strong body of Republican governors. Roosevelt himself had come to Chicago, established headquarters there, and thrown his immense energy and enthusiasm into the campaign. The convention was a scene of unusual excitement. Out of the 1,076 delegates something near 400 were pledged to Roosevelt, and there seemed a good chance of gaining for him some of the southern delegates, of whom a large number were negroes who recognized Roosevelt as favourable to their race. The decision was not made in open convention, but in the preliminary meetings of the national committee (chosen in 1908), which was strongly "stand-pat"; for that committee had to decide upon the right of claimants to be inscribed in the preliminary roll of delegates. The Roosevelt managers entered contests for many seats and had an especially strong case as to Missouri, Washington and two seats for California. In the end, every contest except that of Missouri was settled in favour of the Taft claimants. Even then the combination was almost broken. Notwithstanding the fact that the temporary organization was in the hands of Roosevelt's enemies, among them Elihu Root, his former Secretary of State, a test vote for temporary chairman showed 558 votes for Root against 502 for the anti-Taft forces. The shifting of 30 delegates from one side to the other in all probability would have brought about a "stampede" to Roosevelt; and those delegates Roosevelt would have had if he had thrown his "hat into the ring" two months earlier.

The conservative Republicans being thus in control, there was nothing for the Roosevelt men to do but to protest to the last. Roosevelt advised his delegates to take no further part in the proceedings. At the final roll-call, June 22, there were 561 votes for Taft, 58 scattering, and 107 for Roosevelt, besides 344 Roosevelt men not voting. In the last issue, therefore, Taft had a majority of 50 votes out of 1,070. Fairbanks of Indiana was nominated for Vice-President. In the minds of the conservative Republicans Roosevelt was extinct. He had entered the convention, been defeated, and he must bow to the will of the majority. In the minds of Roosevelt and most of his followers the nomination was a violation of the principles of popular government. At a great meeting held the same night Roosevelt openly advised a bolt. This was duly accomplished by a formal Progressive Convention which met in Chicago in Aug. and nominated Roosevelt for president and Hiram Johnson, of California, for vice-president.

Meanwhile the Democratic Convention at Baltimore met under the guidance of William J. Bryan, who had no hope of being the candidate himself but proved to be in a position to dictate the choice. He declared open war upon the capitalistic delegates, one of whom was sitting on the platform. The apparently sure candidate was Speaker Champ Clark of Missouri, who received a majority of the votes, but under the rules of the Democratic Convention requiring a two-thirds majority, he was finally defeated by Woodrow Wilson, governor of New Jersey, owing to the vigorous support of Bryan. Gov. Marshall of Indiana was nominated for vice-president. The platforms of the two old parties were of an usual type. The Republicans as usual declared for protective duties. The Democrats stood by their platform of a tariff for revenue only, additional regulation of the railways and presidential preference primaries. The Progressive platform was a general programme of political reform and "an enlarged measure of social and industrial justice."

It was not the platform, however, but men that appealed to the voters. The issue was really Roosevelt, Taft, or Wilson. Not for 50 years had there been so stirring a campaign. All three candidates took the field; and for the first time in presidential campaigns "soap-box" speakers appeared in large numbers on the streets of the cities. From the first it was clear that the real fight was between Roosevelt and Wilson, since Taft had to bear the unpopularity of the Republican party and also the Progressive charge that the Chicago Convention had given him a stolen nomination. The Progressives were well organized and their convention and campaign included many women. The final question was whether Roosevelt could draw to himself a sufficient number of Democrats to reduce the Democratic vote below the winning point. He was hopeful as to some of the southern states in which he had many warm friends and supporters.

The result in Nov. showed that the voters in the main stood by their regular candidates. The total popular Democratic vote, more than six and a quarter million, was only about 120,000 less than in 1908. The total Taft and Roosevelt vote combined was almost exactly the same as that of the Republicans in 1900. Roosevelt polled about four million popular votes to two and one half millions for Taft; but he carried only six states with 88 electoral votes against 40 states and 435 votes for Wilson. The only Taft states were Utah and Vermont with a total of eight electoral votes. Notwithstanding the ignominious defeat of their candidate, the Republican party was still intact with its "stand-pat" leaders, its "organization," and its control of state and local politics. On the other hand, Roosevelt had built up what seemed to be a new national party controlling four million votes, and he hoped for a continuation of that party as a power in the individual states and in national politics.

Woodrow Wilson.—The centre and soul of the Progressive movement was Theodore Roosevelt because of his ardent habit of mind; he felt intensely; he spoke with tremendous energy and deep conviction; he was accused by his critics of "inventing the Ten Commandments"; he was not only the head of a party, he was the head of a political cult (*see* ROOSEVELT, THEODORE). In that respect he was closely paralleled by Woodrow Wilson, who, on March 4 1913, was inaugurated as President. Wilson's life had been much less adventurous and varied than that of Roosevelt. Born in Staunton, Va., in 1856, of Scotch Presbyterian ancestry, son of a minister, he graduated from Princeton in 1879, essayed the practice of law in which he made no success, then studied political science and was a professor in several colleges, finally returning to Princeton. From 1902 to 1910, he was president of that university. In 1885 he published his first and most remarkable book, *Congressional Government*, which was a searching criticism of the weaknesses of the American legislative committee system and the separation of executive officials from legislation. He was an easy and attractive speaker, and had a remarkable literary style shown in several books on government and in an elaborate history of the United States. He moved much about the world, and mixed freely with people in and out of his profession, in which he was a leading figure. As administrator of a great university he chafed against the conservatism of his colleagues, and found he could not bring himself to share the responsibilities of direction with others (*see* WILSON, WOODROW). In 1910, a favourable year for the Democratic party, of which he had always been a member, he was put forward for the governorship of New Jersey by friends who looked farther than that office, particularly the journalist, George Harvey. New Jersey went Democratic, and during 1911 and 1912 Gov. Wilson had opportunity to show his skill as a party leader and his interest in reform. He made himself responsible for the "seven sisters," a group of measures dealing with direct primaries, corrupt practices, workmen's protection and control of trusts, and especially public service corporations, somewhat on the plan of the Federal Interstate Commerce Commission.

In 1912 when the Democratic party was looking for a candidate, Woodrow Wilson was put forward against Champ Clark, the experienced political chieftain. He was taken up by Bryan who saw in him first of all, an exponent of the political principles for which Bryan had stood for many years. He was wise enough to see that the party needed a leader and a President who could meet the Progressives on their own ground. He persuaded the Democratic Convention to nominate Wilson, who had a special advantage in his southern birth but was little known among the ranks of the party. Bryan also aided him by drafting a platform hardly less progressive than that of the Progressive party. The split in the Republican party rendered Wilson's election inevitable. On the eve of his inauguration he published a collection of his speeches, chiefly delivered in the preceding campaign, under the title of *The New Freedom*. It was in effect a confession of political faith, a forecast of what the President intended, a summing up of the fundamentals of American government. He protests against the political conditions and methods of the time, finds economic conditions even worse, and points out the baleful influence of corporations and trusts on parties and Governments. The book advocates publicity and action by popular vote as the remedy for the ills which the writer so clearly sees.

On entering office the first duty of the President was to select his Cabinet. It was only reasonable that Bryan, the most prominent man in the party, who had been three times its candidate for presidency, should enter it; but not that he should be made Secretary of State, an office for which he had little training and as little adaptation. A new Cabinet office had just been created by Congress, the secretaryship of the Department of Labor, to which was appointed W.B. Wilson, a former member of Congress and a strict labour organization man. Lindley M. Garrison, Secretary of War, and Franklin K. Lane, Secretary of the Interior, were strong men. Albert S. Burleson, Postmaster-General, and Josephus Daniels, Secretary of the Navy, had no adequate training for their duties. David F. Houston of Missouri was made Secretary of Agriculture, William G. McAdoo, Secretary of the Treasury, and James C. McReynolds, Attorney-General. Most of the members of the Cabinet were men who could be trusted to follow the President's lead. One remarkable figure, not included in this list, was Col. E. M. House of Texas, who for six years was the President's most trusted counsellor and political friend without holding any political office. The President's judicial appointments were good, including one man, Louis D. Brandeis, as justice of the Supreme Court, against whom a propaganda was raised because he was supposed to be unduly radical and favourable to labour. In the minor civil service Wilson carried out his principles by enlarging the classified list of posts which could be entered only by competitive examinations.

Although a genial man, who could be a delightful companion, full of experience and of Scotch Presbyterian humour, President Wilson from his first day in the White House cut himself off from most of his countrymen. There were none of those receptions open to all, which had delighted President Roosevelt; none of those sessions with newspaper correspondents that Taft had thought not beneath his dignity. The President's theory was that he must husband his time so as to consider his views upon public questions; nor did he expect the members of his Cabinet to act as antennæ for him, to test the currents of public sentiment. He gauged the public mind for himself. He had a powerful mind, an amazing skill of expression, and an intense belief in the power of ideals to arouse and inspire a people. Furthermore, he stood by the political programme indicated in his book *The New Freedom*. He thought he had no need of conferences, of feeling the public pulse, of mixing with members of Congress and party leaders, of personally greeting the average voter who so much appreciates a word from the President.

Finance and Tariff.—The election of 1912 carried with it a safe Democratic majority in the Senate and a two-to-one majority in the House, so that the responsibility for legislation was clear. Champ Clark again had the empty honour of the Speakership. April 8 1913, the President created a surprise by appearing in person to address the two Houses of Congress jointly at the opening of a special session, instead of sending the written message which had been invariable since 1800. This practice he followed throughout his administration, with great effect. It was part of his conception of the presidency. He was not only chief magistrate of the nation, but head of the Democratic party, and practically the premier of the Government from whom ought to proceed plans for important legislation. May 26 1913 he publicly denounced the lobbyists in Congress who he declared, were endeavouring to control tariff legislation; and Congress accepted the rebuke. He disdained the arts of Jefferson or McKinley in soothing individual congressmen; he revived and enlarged Roosevelt's practice of telling the country what Congress ought to do. Furthermore, he had in his mind a sheaf of statutes which he believed the country needed.

The special session was called particularly to frame a tariff Act, the outline of which was contained in his first address. Representative Underwood, chairman of the Committee of Ways and Means, gave to the new measure his name and large experience. The purpose of the statute was to enlarge the free list of raw materials, foodstuffs, and some manufactures, to make a moderate reduction of the protective duties, and to correct some of the things which made the Payne-Aldrich Act unpopular. It was with but one exception the first measure for tariff reduction enacted since the Civil War. Included in the statute was an income-tax, at last made possible by the adoption of the 16th Amendment (Feb. 25 1913), which was expected to supply any revenue which might be lost by the reduction of duties (*see* INCOME TAX, *United States*). The tax was low: 1% on incomes from $3,000 to $20,000 a year, and a sliding scale on larger incomes, with 6% as a maximum. A Tariff Commission was created to make researches into the workings of the Act and try to find out what was the actual difference between the cost of labour in the United States and in foreign countries. The Republicans naturally fought the bill throughout, but it became a law, Oct. 3 1913.

The powerful influence of the President was again exerted to secure a systematic banking system, with the result that (Dec. 23 1913) the Owen-Glass Federal Reserve Bank Act was added to the statutes (*see* FEDERAL RESERVE BANKING SYSTEM). The principle was no longer to rely on separate national banks, each chartered as a separate entity and having no official connexion with other banks, but to create a national institution, which was to be divided into 12 regional banks, in each of which was a body of directors, besides the central organization in Washington. In these 12 subdivisions clustered such banks, whether national or state-chartered, as chose to accept; but pressure was put upon national banks to go into the new system. The Federal Reserve banks were authorized and expected to rediscount commercial paper discounted by the local banks. The new institution was also to issue a new form of paper money. Federal Reserve banks were authorized to act as depositories and fiscal agents for the Government. It was about a year before the system could be put into operation, but it was from the start recognized as a great improvement and a large national asset. At the same time a Rural Credits Act was passed (July 17 1916), which created a special group of banks to lend money to farmers on the security of their farms. Both banking systems worked smoothly. The Federal Reserve banks greatly increased the elasticity of the currency; the effect of their operations up to 1920 was virtually to add an immense sum to the circulating medium of the country.

Transportation, 1914–6.—Experience showed that it was much easier to secure regulation of the railways than of other corporations. In 1914 the Interstate Commerce Commission began for the first time to sanction small increases in rates. Under a statute of March 1 1913 the Commission was authorized to enter on an elaborate valuation of the railway property throughout the country as the basis of a judgment as to what was a reasonable profit (*see* RAILWAYS: *United States*). The Supreme Court supported recent legislation by compelling the pipe-lines to accept the status of common carriers, and by breaking up some of the railway combinations, particularly that of the New York, New Haven and Hartford, which had tried to monopolize the steam, trolley, and steamship lines in southern New England. Down to the middle of 1916 the railways were doing well on the prevailing low rates for passengers and freight.

A new transportation problem developed as the Panama Canal approached completion; for this was the first great agency of transportation which was owned and managed by the U.S. Government. President Wilson undid the work of the previous Congress so far as it gave special privileges in the canal to American vessels. He used to the utmost his personal influence in supporting a bill repealing the discrimination in favour of American-owned vessels, of which the British Government had complained; it became an Act, June 15 1914. On Aug. 15 the first steamer passed through the Canal from sea to sea and in a few months the Canal was paying its own way. Temporary slides closed it for a few months; but in 1916 traffic was resumed and by the close of the fiscal year 7,046,407 tons of shipping had made use of the new international waterway since its completion. The success of the Panama Canal called attention to the possibilities of water transportation. A canal across Cape Cod, constructed by private capital, was opened July 29 1914. The state of New York spent a hundred million dollars in enlarging the Erie Canal which was then allowed to remain almost unused. Various plans were urged for an artificial waterway from the Great Lakes to the Gulf, ignoring the fact that the Ohio and Mississippi rivers had almost ceased to be used for traffic. Internal canals were all subject to the difficulty that they could not compete with the railways which received freight at any place in the United States for delivery at any other place; while in the northern part of the country ice prevented winter traffic on canals.

A new question of transportation was arising through the rapid development of motor vehicles. At first a plaything, then a luxury, by 1908 they were spreading throughout the country, for pleasure, for convenience, for professional work; then, as the motor-truck developed, for general transportation. These machines could not well be operated on the ordinary country roads or on some of the city streets; and the attention of the whole country was called to the absolute necessity of good roads. The old system of privately owned toll roads and bridges had almost disappeared, and the only way to accommodate this new traffic was to build roads at the public expense. Some of the states had for years been aiding the rural localities in this process. As soon as good roads were built, however, the public discovered to its consternation that they would soon wear out unless kept in order at great expense. In 1916 Congress passed an Act appropriating approximately $85,000,000 to be paid in about five years to such states as would contribute equal sums for good roads.

The Trusts, 1914.—Just before President Wilson took office, an investigation was begun of the so-called shipping trust, composed of some American and various foreign companies, which was charged with a monopoly of a large part of the business of marine transportation by steamers. A few hours before the end of President Taft's term a congressional committee reported against the "great and rapidly growing concentration of the money control and credit in the hands of a few men." The Supreme Court in its decisions followed this spirit of opposition to the growth of combinations. President Wilson urged successfully a radical amendment of the Sherman Act and the result was the Clayton Anti-Trust Act (Oct. 15 1914) against discriminating freight agreements, interlocking directorates and holding corporations. The field of governmental action was thereby very much enlarged. In June 1914 in a suit involving the International Harvester Company, one of the largest of the manufacturing corporations, the U.S. Supreme Court upheld state anti-trust laws. The ring of law and justice seemed to be drawing closer round the great offenders; yet these offenders still flourished, and huge corporations, such as the U.S. Steel Corp., paid dividends on thousands of millions in stock and bonds.

Another branch of the same attack on the money power was the Federal Trade Commission, created Sept. 26 1914, which was an attempt to find means of dealing with corporations engaged in interstate commerce other than banks and common carriers. It received large powers of investigation, and the very important authority to institute hearings as a preliminary to suits. In the same direction were the "blue sky laws" passed in this period by many states, to break up the practice of floating the stock of companies which had no property more substantial than the atmosphere. By these statutes and active prosecutions the Democratic party was put on record as the enemy of the enemies of the people. Unfortunately, the more the laws, the more the need for laws; while there was still what Roosevelt called the "twilight zone" of business action, an area in which neither state nor national laws were operative.

Labour 1913–7.—The example of capital, in rolling itself into masses too great to be controlled by ordinary means, was followed by labour, which during this period took the field most successfully. The American Federation of Labor was a loosely woven council of representatives from the great trade organizations; it did not undertake to call strikes, though it was likely to support them. Its agitation and its publications were lively; and it had great effect in bringing about combined and simultaneous demands for the various items in the labour programme. The leaders fixed upon an eight-hour day (commonly interpreted as 48 hours a week) as the basic working time; by which they meant that any work beyond the eight hours was overtime, to be paid for at extra rates. The eventual demand was for a "time and a half" rate (each hour to be counted as an hour and a half) for ordinary overtime, and "double time" for Sundays and holidays. The next item was the minimum wage, which made its way slowly and was not altogether acceptable to labour, since it tended to end the employment of feeble and old persons who could not earn even the minimum wage. Another demand was that American citizens should have the preference over aliens in employment. The Supreme Court set aside an Arizona statute in that direction, and affirmed a somewhat similar New York statute. Labour in general was unfriendly to child labour and was, therefore, interested in a Federal statute of Sept. 1 1916. Since Congress had no right to regulate child labour directly, it stretched the Interstate Commerce clause of the Constitution to cover the prohibition of the transport of products made by child labour under specified conditions. This Act was afterwards set aside by the Supreme Court. Some of the states set up public employment bureaus. Many labour acts were contested and nullified by the state courts; but there was an unmistakable gain in public sentiment favouring protection of labour.

As the labour unions gained in numbers and strength they used their energies in favour of the "closed shop," that is, a system by which union men refused to work in any establishment where men not members of the union were also employed. Their object was to bring everybody in that particular trade into the union so as to form a firm front. From this idea rapidly developed the system of sympathetic strikes, in which members of one union back up another union by refusing to handle or use or transport products of non-union labour. Thus a factory employing a thousand hands might be compelled to stop work because it directed two or three non-union men to clean a truck, or because it bought machinery built by non-union labour—hence boycotts and perhaps ruin for employers who had no difficulty or quarrel with their own workmen.

Never in the history of the United States had there been so many and so violent strikes as from 1913 to 1917. In New York 150,000 garment workers were unionized and they struck. In May 1916 nearly a million men in various states were out of work because they or some other union had struck. The I.W.W. organized long and tumultuous strikes among the silk weavers of Paterson, N.J., and the textile workers of Lawrence, Mass. More than half of these strikes were attempts to get higher wages; many of them aimed at new working conditions, and very often sought working rules which would add to the wages without increasing the service. In the trying years of 1916–7 there were violent strikes directed not only against non-striking workmen, but against the public peace—for instance, among the Michigan ironworkers and the Spokane lumbermen. In 1913 there were armed conflicts in Colorado. In July 1917 at Bisbee, Ariz., the tables were turned. A kind of vigilance committee seized and carried out of town, with orders not to return, about 1,200 striking miners and their friends. When after many months a trial was obtained in the state courts for those responsible for this illegal action, it was found that no jury would convict.

The most serious of all these labour struggles was the threatened strike in 1916 of the large and very powerful unions of railway employees. A day was set for a general strike all over the country. The companies refused to make further concessions, believing that a few days of strike would bring the public to their side. President Wilson intervened and all but compelled Congress to pass (Sept. 3 1916) the Adamson Act by which a basic eight-hour day was secured with *pro-rata* for overtime. This turned out to be in effect a large increase of wages. The Supreme Court upheld this statute, which went to the furthest verge of the Federal Government's authority over labour matters, and formed a basis for the increases of following years.

Social Movements, 1913–7.—These struggles between the railways and the courts, between the trusts and Congress, between labour and state Governments, between strikers and the President of the United States, are part of American history, because they were vital to the welfare of the country. Combinations, both of capital and labour, were too large to be dealt with by any kind of private organization, or by the local and state Governments. Neither the capitalist nor the labourer respected the restraint of state legislation. It was apparent that in the long run the country would go back to the "might makes right" of the middle ages, unless some peaceful settlement could be made by a force that must be respected. Yet the ordinary plain citizen was not much disturbed by these contests, unless he held stock in a trust or his son was a member of a trade union. The first concern of most people is their bread-getting, and the greater part of the population was earning its bread daily. The farmers everywhere were aroused, for they looked on railways as hostile to their interests, by overcharging for carrying their products, and they resented the trusts which they believed raised prices. The storm centre was in Washington, where President Wilson stood intent on finding the remedy for these difficulties.

The anti-liquor forces steadily developed strength. They urged out-and-out prohibition and secured it in more than half the states. At the end of 1917 war prohibition was enacted by the Federal Government and also prohibition in the district of Columbia. December 19 1917 a two-thirds majority was secured in Congress for a prohibition constitutional amendment—the 18th amendment—which was at once submitted to the states. Woman suffrage also advanced steadily. When it appeared in 1915 that a third of the male voters in the conversative eastern states of Pennsylvania, New Jersey, New York and Massachusetts favoured woman suffrage, the result was beyond doubt. Congress submitted an amendment in 1919. Thus changes that had been 50 years on the way finally were brought about by the force of public opinion.

A change was also visible in the attitude of the country toward immigration which Congress was determined to reduce by an intelligence qualification. Wilson followed the example of Taft by vetoing the new bill not once but twice; yet on Feb. 5 1917 it was passed over his veto. Besides a literacy test it raised the head-tax to $8 and excluded oriental labourers coming from certain geographical areas which did not include Japan but did apply to Hindus and Malays. Causes connected with the World War at the same time brought about a reduction in the number of immigrants.

Educational Progress, 1909–21.—The decade following 1909 was marked by a new sense of the possibility of general education, and the responsibility of the various governments within the United States for a more direct, searching and practical type of education. The country was accustomed to a system of graded public schools, offering the "common school education," and leading up to the few surviving endowed academies, and the thousands of public high schools, which were expected to "prepare" the small proportion of young men who went on to institutions of higher education. This system had been enriched in various ways.

By 1910 girls were given about an equal chance in the public elementary and secondary schools, and in a large number of coeducational colleges and universities, besides a small group of high-class colleges open to women only. Secondary education was subdivided into literary, commercial and industrial schools. The institutions of higher learning set up new professional departments including the intensive study of education and separate schools of science, engineering, agriculture and other specialties. Private enterprise created a great number of so-called business colleges, and a few very efficient trade schools. The prestige of the classics and of the so-called culture courses was declining; and the most conservative universities moderated their requirements for entrance and offered degrees to men and women on a variety of specialized and technical courses. The number of students in the higher institutions increased to 355,131 in 1918.

Nevertheless there was general complaint that the schools did not relate themselves to the life of the community in which the children were to pass their later lives. It was a common experience that the numerous boys and girls who left school at from 12 to 16 years of age, and even the graduates of the secondary schools, did not take hold readily of trades or business, and were hard to "break" to new tasks. For many years a remedy had been sought in manual-training schools, mostly secondary, which undertook to help the boy and girl to meet the manufacturer and employer by specific training in shop practice. The new steel town of Gary, Ind., introduced a general system of industrial schools, in which the pupils in the lower grades took various kinds of shop work. A National Society for the Promotion of Industrial Education became the focus of a movement to organize what now became generally known as vocational education throughout the country.

A national commission was appointed by President Wilson, in 1914, to consider the whole subject. The Federal Government was making annual grants to the state agricultural and mechanical colleges, founded by the Morrill Land Grant of 1862. This idea of grants-in-aid was incorporated into the report of the commission, and into the resulting Smith-Hughes Act, Feb. 22 1917, which provided the machinery and laid out the outlines of plans for action throughout the Union. It created a Federal Board for Vocational Education which framed an elaborate plan for instruction in the four vocational fields of agriculture, commerce, industry and home-making. The Act promised to appropriate Federal funds rising to about $7,000,000 in 1925 and thereafter, to be paid to such states as would match these funds dollar for dollar.

The underlying idea was that training for life-tasks was to be carried on in regular public schools alongside the usual culture studies; that it ought to begin in the lower grades and run all the way through; that it ought to apply to girls, particularly in the fields of home life and women's industries; and that it ought to offer facilities for those already employed, through continuation and part-time schools.

Private enterprise went alongside this movement by building up advanced engineering and trade schools of a high type, such as the Carnegie Institute at Pittsburgh; by improving the private commercial schools, and establishing advanced schools of business training in colleges. Some of the great manufacturers, especially in the automobile trade, set up schools within their own works.

When the United States plunged into the World War in 1917, and it was discovered that a vast number of young men were physically and intellectually unfitted for military service, a new influence was brought to bear in favour of a type of public education which would help to make citizens. The Government established a variety of vocational schools to train men for the numerous specialties of military service. It made great use of the shops and other vocational facilities of the existing schools and colleges. When the war was over, those institutions were used by the Government for "rehabilitation," preparing partially disabled soldiers for self-support. At the same time the schools and colleges of the traditional cultural type advanced in resources and efficiency, many of them taking on vocational subjects as suitable for higher education. Great sums were raised by special "drives" among the alumni and friends of the endowed institutions, and the state universities were allotted hitherto unheard-of grants. The strictly vocational schools were admitted into fellowship with the other institutions. The students fraternized, joined in athletic contests and alumni associations and university clubs. There seemed room for both the old and the new types of national education. (*See* EDUCATION: section *United States*.)

Foreign Policy, 1913–7.—Woodrow Wilson was naturally a man of peace, and so was Secretary Bryan. At the outset of the administration they set themselves to aid the cause of general peace by enlarging the plan of arbitration treaties which had been urged by Root and Taft. Secretary Bryan prepared a definite project for treaties by which the parties should pledge themselves in case of difficulties to submit their grievances and claims to a special arbitration commission; and to abstain from war or preparations for war until the commission should have had time to report. This method avoided the difficulty which had either wrecked or weakened previous arbitration treaties, namely the exclusion of certain matters from arbitration. On the other hand, under such treaties no country would be bound to accept the finding of a commission. The presumption was that a sensible nation would submit to the judgment of an impartial tribunal. There was little difficulty in concluding more than 30 treaties upon this basis in the course of a year. They were never effective, and they disregarded the fact that since the first suggestion of general arbitration on a large scale by the Hague Conference of 1899, there had been five important wars, in not one of which had any contestant expressed a desire for arbitration by an impartial tribunal. The truth was that the American people as a whole had been little accustomed to international questions and had no definite foreign policy.

The Government of the Philippine Is. was altered by setting up the first Filipino Assembly in 1908. Under President Wilson, Gov.-Gen. Cameron Forbes was withdrawn and Burton Harrison was appointed his successor, to carry out a policy of liberalization and preparation for independence. The Filipinos were allowed to hold a majority of the seats in the Commission, which was a kind of administrative upper House. Natives were substituted for Americans in many of the civil offices. The Filipinos were thus given a definite opportunity to govern themselves. In response to the pleading of President Taft, Congress in 1909 grudgingly included them within the customs boundary of the United States and thus in practice abandoned duties on goods arriving in the United States from the islands. The Jones bill proposed even greater local powers. As enacted Aug. 29 1916, it greatly enlarged the power of the popular part of the Government, and the Commission ceased to exist. The bill promised that the Filipinos should be given their independence when their ability to govern themselves should be demonstrated. In April 1919 President Wilson publicly declared that he was ready to grant complete independence. There was no answering sentiment in the United States, perhaps because the World War had made it clear that so feeble and unarmed a state could not hope to live without the continued protection of the United States.

At the other end of the American empire, Cuba, while nominally independent, remained a protectorate of the United States. March 2 1917 the Porto Ricans were for the first time made American citizens and received a popular Government of two elected Houses, possibly a preparation for statehood. President Wilson continued the practical administration of San Domingo which dated back to Roosevelt. He also took military control of Haiti in 1914 and followed it by a treaty which was ratified by the Senate Feb. 28 1916. He carried even farther Taft's policy in Nicaragua by a treaty (ratified by the Senate Aug. 14 1914) which converted that State into a virtual protectorate. Another area came under control of the United States by a treaty for the annexation of the Danish West Indies (Aug. 4 1916); these islands were duly organized under the title Virgin Is. of the United States. Little opposition was made to this creation of a virtual empire, including dependent provinces. No reluctance was shown by the American people in extending their borders, their influence and their naval stations, so as to include portions of the West Indies. They were unconsciously preparing the way for a policy of Caribbean activity, under which the United States would take that predominance in the West Indies which Great Britain had held for over a hundred years.

Latin America and the Orient, 1913–7.—The peaceful policy of the United States towards its neighbours was severely tested by disturbances in Mexico. Soon after Wilson's inauguration in 1913 Madero, president of that turbulent republic, was murdered and Gen. Huerta, an insurgent officer, thereupon declared himself the head of the State. The almost invariable policy of the United States had been to recognize any *de facto* head of any Latin-American Government, without inquiring into the source of justice of his title. To President Wilson and to many others it seemed an iniquity to recognize murder as a proper means of changing a Government. He therefore adopted what he called a policy of "watchful waiting." He steadily refused to recognize Huerta, who was compelled to battle for his dictatorship against Carranza, the bandit Villa and other rival revolutionists. Not having recognized Huerta, Wilson was not in a position to protect American rights of life and property in Mexico. Some years later a record was published of 112 murders or violent deaths of Americans. All Wilson could do was to declare neutrality as between Huerta and his rivals. In April 1914 a trifling dispute arose as to a salute of the American flag and Wilson, apparently yielding to strong public sentiment, ordered the navy to attack and capture Vera Cruz, of which the United States remained in possession for some months. The real object appears to have been to discomfit Huerta, who was compelled to flee the country. Two years later, further and more serious trouble arose when the brigand Villa raided the town of Columbus, N.M., and killed several soldiers and civilians. The Government of Mexico had no control over Villa, and President Wilson ordered a military expedition under Gen. Pershing to advance into the interior of

Mexico, which remained about eight months, without capturing Villa or accomplishing any other definite result. The three friendly nations of Argentina, Brazil and Chile—commonly known as the "A B C Powers"—offered a kind of mediation; and after many months of delay, at their suggestion Carranza was recognized as president by the United States. But disorder continued; neither life nor property was safe. Not till 1921, after 11 years of civil war and immense destruction of life and wealth, did Mexico emerge from the state of revolution which had been its chronic condition before the time of President Diaz.

The long controversy with Mexico was highly disturbing to the intention of the Administration to cultivate close relations with Latin-America in general. In spite of four pan-American congresses and several scientific congresses, in spite of the visits of Roosevelt and Secretary Root and Secretary Knox to S. America, and the opening of the short route to the W. coast through the Panama Canal—there could be no harmony if the United States were to continue annexing small and defenceless Latin-American nations and engaging in undeclared wars with Mexico. President Wilson sought to relieve apprehensions in this regard, and in a speech at Mobile Oct. 27 1913 declared that the United States had no designs on the territory or independence of its Latin-American neighbours. Colombia, too, had a grievance arising out of the loss of the isthmus when the Panama Canal Zone was annexed in 1904. Wilson gave his approval to a treaty to pay $25,000,000 to Colombia and to include an apology for the disagreeable events of 1904; but he could not push his measures through the Senate, though a similar treaty, minus the apology, was ratified by the succeeding Administration in 1921.

In regard to the Far East, Wilson had little opportunity to develop a policy. He began by disavowing the plans made under the advice of President Taft for a concert of American bankers with those of other countries to lend money to China. He continued, on the same lines as the Taft Administration, to argue with the people of California because they insisted on passing a statute restricting alien ownership of lands by Japanese residents. The World War soon made the United States and Japan temporary allies, and on Nov. 2 1917 the Lansing-Ishii note, on the same plan as the Root-Takahira note of 1908, set forth that the United States recognized Japan's "special interests in China." In the deeper currents of East Asiatic diplomacy the United States did not enter until after the war.

Outbreak of the World War, 1914.—Long before the domestic and foreign policies of the United States reached the results described in the preceding sections, the United States was brought face to face with new and vital problems arising out of the war. That the country was peaceful in 1914, and expected to remain indefinitely at peace, is shown by the lack of anything that could be considered national military preparation in the terms of modern warfare. When on Aug. 4 1914 President Wilson issued a proclamation of neutrality as between the two groups of European nations just engaging in a gigantic struggle, the authorized military establishment was about 107,000 men of whom some 87,000 were enrolled. The United States had not one military aeroplane of approved type; had only four modern heavy field guns and no transport for them; had not a trench bomb nor a mine-thrower; nor considerable supplies of any weapons or equipment except 800,000 excellent rifles; nor any officers experienced in the kind of warfare used in the recent South African, Manchurian, Balkan and Tripolitan campaigns; nor any instruction camps for officers or men. The navy included a fleet of battleships recently built, but was weak in small and swift vessels and particularly in submarines, though it had the great advantage of trained crews accustomed to the strategic units of sea warfare. For the protection of the Texas border, and as a second line in case of an invasion of Mexico, militia was available, but when called out later proved to be of little service. The tradition of a hundred years led the American people to expect no wars and in case of danger to rely on hasty volunteer enlistments. Bryan, in many respects a far-sighted man, publicly declared that the nation needed no preparation, for it could raise a million men between sunrise and sunset.

The foreign policy and the diplomatic organization of the United States were not fitted for such a crisis. Apparently not one of the American ambassadors realized the imminence of war in Europe or warned the Department of State of trouble; although Theodore Roosevelt as far back as 1909 had detected the hostile attitude of Germany toward the United States. The traditional diplomacy of America was based on the Monroe Doctrine as a principle that would keep European Powers out of the Americas, and therefore out of dangerous controversies with the United States. On the other hand, the principle of isolation forbade the United States to take any part in European crises or wars. Friendship with all nations had been the avowed policy of many successive presidents. If nations fought among themselves, the United States expected to remain neutral. As a neutral it stood by the principle of "freedom of the seas," by which was meant in particular the right to carry on commerce with all belligerents, in case of war, subject to the limitations of the then acknowledged international law as to contraband and blockade. Moreover, the United States during the Civil War had laid down principles of "continuous voyages," which it could not refuse to accept so far as its own commerce was concerned. Yet probably not one voter in ten had any clear notion of the external policy and principles of his Government, or understood that such a war as broke out in 1914 must deeply affect the United States, and might at last draw it into the struggle.

The diplomatic activities of the United States at the beginning of the war created no difficulties. Thousands of American tourists and residents were caught in the mobilization of the great European armies, and on Aug. 8 1914 $5,500,000 was sent over by the Government on a U.S. steamer to aid in bringing them home. A few weeks later relief was organized on a large scale for the Belgian people, most of whose country was overrun and held by the Germans. From year to year this system of relief was enlarged, so as to include French refugees as well as those who were still in the devastated portions of France, the unhappy peoples of Serbia and Asia Minor and other non-combatant sufferers, besides the sick and wounded of the contending armies. The agents of the American Red Cross and similar organizations were received in most parts of the war area, and privileged to work at the front and to carry on their operations within the warring countries. Supplies costing more than $1,500,000 were sent to Europe by the American Red Cross before the United States entered the war. This work of mercy put these unofficial representatives of the United States in the position of exponents of American neutrality.

Difficulties of Neutrality, 1914–7.—From another point of view the United States was compelled at once to take into account the relation between the war and American industries, commerce and finance. Very soon after hostilities began, loans were sought by most of the belligerent Governments. Large amounts were placed in the United States by Great Britain, France and Russia. The German Government floated several small loans, chiefly among their nationals and former nationals. President Wilson for a time advised Americans against aiding either side in that way and issued a proclamation (Aug. 18 1914) advising that the people remain neutral "not only in act but in word and in thought." Such neutrality was impossible, because the natural course of neutral trade put the United States at once in the position of a source of supplies of every kind for any belligerent that could transport them. Probably not a dollar of the loans placed in America ever crossed the Atlantic in cash; as fast as the money was borrowed it was spent in the United States for the purchase of food, clothing, animals and especially munitions. Though the privileges of this trade were in theory equal, in practice it was decidedly unfavourable to the Central Powers. In the first weeks of the war German commerce was driven from the seas and more than 80 German steamers took refuge in ports of the United States. The Allied command of the sea very nearly cut off trade of any kind between the United States and Germany and her allies; while commerce continued in ever-increasing volume with England and France. This disparity led to violent protests on the part of the German Government, supported by

Germans and pro-Germans in the United States, and also to lawless acts perpetrated or directed by agents dispatched by the German Government for the purpose of buying up or paralysing the munition factories.

In addition to this controversy as to munitions and other supplies there was the question of the German methods of carrying on war, and particularly of the treatment of the occupied areas of Belgium and France. Neither the State Department nor any considerable number of American statesmen saw any obligation under the Hague neutrality treaties of 1907 to go to war for the defence of Belgian neutrality; nevertheless the German policy aroused deep and lasting resentment. Within a few weeks after the war broke out the United States realized for the first time that its population included hundreds of thousands of citizens of the belligerent countries, many of whom were liable to military service and attempted to return to their homes in order to serve. The road for recruits was blocked for the Germans and their allies, but open for the English, French and later for the Italians, Serbians, Greeks and Armenians. No neutrality proclamation could prevent these men from believing in their native countries, defending them by argument, and going over to fight for them if possible. For the first time in a hundred years the United States found within its own borders the sharpest division on questions of foreign policy.

On the other hand, the war trade brought immense profits. The favourable balance of trade rose from $691,000,000 in 1913 to $1,768,000,000 in 1915 and $3,000,000,000 in 1916. This prodigious debit was balanced by about $3,000,000,000 sent to the United States in securities and gold, besides $2,000,000,000 in foreign war bonds. Under these circumstances genuine neutrality was out of the question; and while direct commerce with Germany and Austria was almost cut off, enormous shipments continued to the western Allies. A decided preponderance of sympathy developed toward these countries which were profitable customers and also were in close and almost undisturbed intercourse with the United States, and, as time went on, seemed to be fighting against a ruthless, arrogant and dangerous autocracy.

International Controversies, 1914–7.—The internal tension of the United States was tightened by the incidents of the war and especially by the controversy over submarine warfare. The practical issue was the insistence of Germany on the right to use new weapons, tactics and procedures of war, without submitting to the limitations supposed to be provided by international law, without mercy to non-combatants, on the basis of a law of necessity, and supported by all the physical and political force of the German Empire engaged in war. No able-bodied German man or woman was really a non-combatant; all Germans insisted that they must regard all civilian enemies as combatants. In so far as contact in the field was concerned they carried out their theory unhesitatingly. They introduced the use of poison gas and bombing aeroplanes; they murdered civilians and practically enslaved Belgian men and women. There was no way to stop them except by conquest, and conquest was impossible without using these new methods of warfare. On the sea their principle was the same, but the execution was different because it brought them into controversy with neutrals and especially with the United States.

Great Britain, which in the London Maritime Conference of 1912 had shown some disposition to enlarge the privileges of neutral commerce, seized American ships and shipments, and arbitrarily extended the list of contraband, until (Dec. 26 1914) a dispatch signed by Secretary Bryan, but known to be the work of President Wilson, made a protest. Some of the incidents of the British practice as to neutral vessels were given up; but in the course of 1915 the British Government took up the American principle of "continuous voyages," and eventually extended it so as to cover shipments to neutral ports in cases where those shipments were likely ultimately to reach Germany, or would replace products of the neutral countries that could thus be spared to Germany eventually, or if the neutral countries declined to make a hard and fast agreement not to reship. In 1916 the British were practically blockading neutral ports and capturing vessels, American and other, wherever they liked. The Central Powers, which were in no position to interfere with neutral trade by ordinary cruising, as an offset to this very effective system set up a new war practice, on principles never before asserted, by using submarines as commerce destroyers. On Feb. 4 1915 this practice was asserted as a right. The American Government at once protested, and President Wilson at one time declared that any use of submarines against merchant ships was contrary to international law. He based his protest chiefly on the failure of the Germans to observe the usual rules as to safety of life for ships' crews and passengers, when submarines sank merchant vessels. The fact was, and it was perfectly clear to the large majority of thinking Americans, that whatever the state of international law on that subject, belligerent or neutral vessels carrying Americans and American property, and also American merchant ships, were sunk by the Germans whenever they felt so disposed.

The crisis came through the destruction of the British passenger liner "Lusitania" May 7 1915, with the loss of 113 American lives—all neutral in the war, all non-combatant. That sinking was a deliberate act of the Germans to test the temper of the United States. Apparently they were greatly surprised when the people of the United States rose in resentment. President Wilson, who had months before notified Germany that "strict accountability" would be demanded, insisted on a protest such as could not be ignored. Mr. Bryan thought milder measures sufficient, and on that issue resigned the Secretaryship of State, June 8 1915, and was succeeded by Robert M. Lansing. The correspondence went on for months until, after the sinking of the British steamer "Sussex," while plying across the English Channel, and the killing of more Americans, on May 4 1916 Germany informed the American Government that merchant ships would not be sunk without warning and the opportunity to save non-combatant lives. Meanwhile, throughout 1915 and 1916, a constant series of attacks was made on the United States or its citizens within the boundaries of the country through systematic violations of the neutrality laws of the United States by Germans and Austrians. These acts caused the dismissal of the Austrian ambassador to the United States and of the two most obnoxious members of the German ambassador's staff. The whole status of neutral trade was changed by the ruthlessness of the Germans, who drew upon themselves the belief that they would hesitate at nothing during the war.

"*Preparedness.*"—By the end of 1915 it became clear that the war would be long and destructive; and that, with or without their own desire, the people of the United States might find themselves involved. The whole world was taken by surprise by the new methods of warfare, and the United States was visibly in no position to attack across the sea or to defend itself against the kind of warfare which was by this time going on all over the world. President Wilson desired peace. As late as a day or two after the sinking of the "Lusitania" he spoke of there being such a thing as "a nation that was too proud to fight." The speech containing these words was, however, prepared before the sinking of the "Lusitania," and in his message of Dec. 1915 he urged national defence and the protection of American shipping by placing it all in the hands of the Government. The movement in favour of preparedness grew, and the President in Feb. 1916 favoured a bill for concentrating the national forces, and abandoning the idea of a Federalized army composed of state militia contingents. Because the President refused to use upon Congress the influence that had carried through so many measures, Garrison, Secretary of War, resigned and Newton D. Baker of Ohio succeeded him. The only result was the passage of a weak and inadequate bill.

Long before this time the war had brought about a violent change in the economic conditions of the country. The great demand for foodstuffs raised the price of grain and other farm products. "The high cost of living" became a political issue. The munition factories offered unheard-of wages and drew hundreds of thousands into improvised towns, thus inaugurating a movement for the increase of wages in other industries. One of the unexpected effects of the war was a great change in immigration. Hundreds of thousands of men left the United States for Europe to join the various armies; and the countries at war were not likely to allow anybody to evade military service by going to America. Net immigration fell from 1,218,480 in 1914 to 298,826 in 1916.

Election of 1916.—In the midst of the turmoil and confusion of business and public policy caused by the war came the preliminaries of the Presidential election of 1916. The sharp difference of opinion as to the responsibility for, and the conduct of, the war was reflected in Congress, which included many ardent friends of the western Allies, others without a doubt pro-Germans, and a much larger number who desired to keep the United States out of war, no matter what happened overseas. President Wilson, though of Scotch-Irish descent and much inspired by English law and history, carefully abstained from taking sides; but the aggressive submarine policy of Germany made necessary a much sharper tone toward, and much more direct and insistent demands on, the Germans than in the case of the English. He was not only President with complete control of all diplomatic negotiations, he was the acknowledged head of the Democratic party; he was also commander-in-chief of the army and navy of the United States. He felt the need of caution, particularly because a growing group of men inside and outside Congress, among them Roosevelt, were coming to the conclusion that eventually the United States would have to go into the war.

During the early part of 1916 the President was studiously neutral and careful. In April the little force under Pershing was withdrawn from Mexico. May 4 the President succeeded in securing from Germany the promise to refrain from submarine warfare on neutrals. In June the great national nominating conventions met, in which the attitudes of the President and his opponents upon the war were issues. As usual the Republican Convention came first, and was called in Chicago for June 7. A strong effort was made by those friends of Roosevelt who had returned to their relations with the Republican party to make him the Republican candidate. One result of the complaints regarding the Convention of 1912 was that the Republican National Committee recommended a change in the basis of representation in the Convention, which reduced the representation of those southern states in which the Republican vote was very small. Such a reduction, if made four years earlier, would have brought about Roosevelt's nomination. Nevertheless, in most of the states the "stand-pat" Republicans had control of the party machinery including the primaries, and Roosevelt showed little strength in the Convention. The Progressives, who in Nov. 1914 had cast 1,800,000 votes for Congressional and state candidates, met in convention in Chicago side by side with the Republicans. Their purpose was to make such a demonstration of strength as would compel the Republicans to nominate Roosevelt as the only means of healing the breach. That effort failed because it became evident that a large number of the Progressives throughout the country would vote for any candidate nominated by the Republican Convention who seemed likely to carry out the Progressive principles, and they gave up all hope of electing Roosevelt on a third-party ticket. The Republicans nominated Justice Hughes of the Supreme Court who had been a reform governor of New York State. No course was left to Roosevelt but to refuse the nomination offered by the Progressive Convention. The days of the Progressive party were numbered.

In the Democratic Convention, June 14, there was practically no opposition to Wilson and his running-mate Marshall. The platform in many respects was similar to that of the Republicans. Both favoured woman suffrage, conservation of national resources, and national enforcement of child-labour laws; both approved the Monroe Doctrine. But in opposition to the Republicans the Democrats upheld tariff for revenue only; they endorsed the promise of ultimate independence to the Filipinos; they commended the establishment of a Federal trade commission; and they approved a merchant marine owned and operated by the Federal Government. In the campaign Roosevelt publicly supported Hughes, though he felt no enthusiasm for him. He was more interested in questions of neutrality and in the moral support of the hard-pressed Allies than in the election. Hughes and Wilson, especially the former, canvassed the country, which was not interested in the questions of tariff and immigration but was eager to know what would be the effect of the victory of one party or another on foreign relations. The only "slogan" that caught the public ear was favourable to Wilson: "He kept us out of war." The result was the reëlection of Wilson, who received about 9,000,000 popular votes against 8,500,000 for Hughes. The electoral vote, however, was very close and was finally decided by majorities of a few hundred in New Hampshire, Minnesota and especially California.

Peace or War, 1917.—Although the election had been so close, President Wilson stood in a very strong position in the United States and in the world. He was reëlected. His policy, whatever it was, was approved. He felt that he had the nation politically united. The Administration soon began to take a firmer tone in protesting against the Allied system of neutral blockade. Meanwhile the Allies were hard pressed. During the summer of 1916 the Russians made their last aggressive campaign against Austria-Hungary. Rumania entered the contest Aug. 28 1916 but was defeated by the Germans by the close of the year. England, France and Italy were holding the western lines with difficulty. It seemed to President Wilson that only the one great neutral nation could bring about peace. Dec. 18 1916, six weeks after the election, he sent an appeal to the warring Powers to take some steps to come to an understanding of each other's demands. In a later document, Jan. 27 1917, he suggested a "peace without victory," which should give the right of self-determination to the different national units. The western Allies responded courteously. The practical German answer was a brief note communicated by Ambassador Bernstorff to Secretary Lansing Jan. 31 1917, announcing that the Germans would shortly resume submarine warfare without mercy. High military authority in Germany had decreed that this was the way to win. They were convinced that the Americans would never sacrifice the large profits of export trade and incur the huge expenses of war merely for the sake of a question of neutral maritime rights.

Nevertheless it was announced Feb. 4 that the United States was using its influence to persuade other neutrals to sever diplomatic relations with Germany, and immediate steps were taken to make the navy ready for war. Unfortunately, the United States at that moment was not in a position to assemble even so small a land force as 30,000 men and send it abroad. It had no organized transport service to carry numbers of troops or their supplies. For a time the President dallied with a plan of maintaining official neutrality while arming merchant ships and authorizing them to defend themselves. This measure, proposed to Congress Feb. 26, certainly would have brought about war in a few days, by an engagement between some American merchant ships and a submarine. Although Congress was ready to grant to the President almost any power, this armed ship bill was killed by a filibuster in the Senate, which the President characterized as the act of "a little group of wilful men representing no opinion but their own." The Administration then took steps to arm merchant ships without Congressional authority. One result of the controversy was the adoption by the Senate March 8 of a mild and cumbrous method of cutting short debate by closure.

During Feb. and March 1917 a few American vessels and one belligerent vessel having Americans on board were torpedoed by German submarines. It was apparent, therefore, that Germany would not desist from these atrocities, and that the United States must resort to war. The President called Congress in special session for April 2. Congress, elected the previous Nov., contained a small Democratic majority in both Houses and welcomed the first woman representative in the person of Miss Jeannette Rankin of Montana. On Feb. 8 the Government published an intercepted German despatch to the Mexican Government asking the Mexicans to join in the war, promising them the "former Mexican provinces," long incorporated in the

United States. This so-called "Zimmerman Note" further suggested that Mexico induce Japan to desert the Allies and join her in war on America. The participation of the United States in the war was now inevitable. A formal declaration signed by the President April 6 after a House vote of 373 to 50 and a Senate vote of 82 to 6, stated that war had been already begun by Germany. Relations with Austria and Turkey were at once broken off, but the declaration of war with Austria was delayed until Dec. 7 and no declaration was ever made against Turkey.

Though the breach with Germany was initiated by a Democratic President and passed by a Congress in which the Democrats had a small majority, it was a spontaneous national action representing the practically universal belief that the United States could no longer live in peace with such a nation as Germany had become. In a succession of brilliant speeches President Wilson had developed the idea that it was the duty of the American people to make the world "safe for democracy." Moreover, there was widespread sympathy with the three western Powers closest to the United States in their political principles and system of government. Righteous wrath was aroused by the German treatment of the people of Belgium and other conquered countries. In some minds existed a genuine and well-grounded fear of a future attack upon the United States by Germany if the resistance of the Allies should be destroyed. Amid all the motives for the war, the one thing clear was that the American people recognized Germany as an enemy, and the enemies of Germany as natural friends and partners in the great enterprise of subduing "the Hun." (*See* also WORLD WAR.)

War Measures.—Passionate national spirit, patriotism, and urgent reasons for war were all useless unless the United States could enroll, train, equip, convey, and continuously supply an immense army. By improved methods of coping with submarines the British were giving such protection to their merchantmen as to keep up their connexions with the centres of food, raw materials and munitions. The American navy, though the vessels were good and the crews skilled and well commanded, was in no position to give direct aid in the process of destroying the German army and still less the German navy. The main service to be rendered by the United States must clearly be to raise and convey to the fighting front a large force of American troops. Under the Act of 1916 nothing had been done toward organizing an efficient expeditionary force—a real army was still to be made.

One saving service the United States was able to do at once: it could help the western Allies in their pressing financial difficulties. Besides the immense industrial production of military and other supplies, the country was blessed with an abundant surplus of foodstuffs. The main crops of 1915 and 1916 were large and prices high. The U.S. Treasury and banks were holding about $3,000,000,000 in gold, which was one-third of the world's supply. Federal taxes were low and little felt. The new income-tax was just beginning to be significant. The total Government income for the fiscal year 1916–7 was $1,118,182,978.

Soon after the declaration of war by the United States, missions from the various Allied countries were sent to America to suggest from their experience plans for coöperation. The British Mission, headed by Arthur Balfour, British Foreign Secretary, and including military and naval officers as well as financiers, reached Halifax April 20 and proceeded to Washington. The French Mission, headed by René Viviani, the former Premier, and including Marshal Joffre, landed at Hampton Roads April 24. Other missions came from Italy, Belgium, Russia, Rumania and Japan. Conferences were held with officials of the U.S. army and navy departments with regard to the prosecution of the war. Afterwards the French Mission travelled through the eastern and middle western states, visiting Chicago, Kansas City, St. Louis, Springfield (Ill.), Philadelphia, New York, and Boston; it was everywhere welcomed with enthusiasm, Marshal Joffre being hailed as a hero. With the Japanese Mission an important agreement was signed (the so-called Lansing-Ishii Agreement), which recognized Japan's special interests in China, but provided for a continuance of the "open door" policy for commerce in that country. The commissioners from the European Allies asked for immediate financial assistance. Under Acts of Congress beginning Oct. 17 1917, the Allies received credits which amounted eventually to $9,500,000,000: this was supplied to take up the floating debts held in the United States and to purchase more supplies. This material support, backed by the moral support given by America, was a great encouragement to the Allies through the winter campaign of 1917–8.

These enormous payments were among the results of the so-called Liberty loans. April 24 1917 was passed the first loan Act, under which some 4,000,000 people joined in offering in June $3,000,000,000 to the Government. Three later issues of Liberty bonds followed, and in 1919 an issue of Victory notes. The result was an increase of the interest-bearing debt from $972,469,290 on Dec. 31 1916 to $25,234,496,000 in 1919. These loans were supplemented by the War Revenue Act of Oct. 17 1917, which laid a variety of new taxes, increased the income-tax heavily, and combined with it an excess-profits tax, the purpose of which was to bring into the Treasury unreasonable profits likely to be made in the war industries.

All limitations on raising an army were discarded. Volunteers were authorized as in previous wars. Ex-President Roosevelt asked permission to raise a division of which he might take command, and Congress gave its authority for such a special force, but the President refused him a commission. It was soon seen, however, that the only fair and helpful method was to call out all able-bodied men within certain ages. May 18 the Selective Service Act was passed, which provided for raising the regular army and National Guard to authorized strength, and also the enlistment of 1,000,000 men by "selective draft." There was abundant raw material, but it took time and energy to make it available. A system was provided for registering all men of military age. When they were compelled to appear for physical and mental examination the astounding facts were revealed that one-fourth were illiterate, one-fifth were physically unfit for military service, and another fifth defective but not enough so to prevent their serving. (See the table below.) When called up, the men had to be clothed, housed, fed and drilled. Thousands of officers were necessary, and training camps, both for men and officers, were established on a vast scale. Eventually about 4,000,000 men out of 11,000,000 registrants were inducted into the service.

Table Showing Rejections of Draftees for Physical Defects by Local and Camp Boards, Compiled by Maj. Albert G. Love, Office of the Surgeon-General.

	Local Boards	Camp Boards	Total
1. Infectious diseases (excluding tuberculous and venereal)	1,415	351	1,766
2. Tuberculous	69,935	15,446	85,381
3. Venereal	5,796	9,342	15,138
4. General	31,772	13,878	45,650
5. Nervous system	37,873	8,717	46,590
6. Mental alienation	40,167	12,930	53,097
7. Eyes and their annexa	91,755	25,531	117,286
8. Ear	30,794	8,699	39,493
9. Nasal fossae	1,892	1,257	3,149
10. Throat	1,216	3,416	4,632
11. Circulatory system	110,527	31,769	142,296
12. Respiratory system	8,365	4,448	12,813
13. Digestive system	42,900	42,928	85,828
14. Genito-urinary system (non-venereal)	7,186	1,843	9,029
15. Skin and cellular tissue	5,949	2,535	8,484
16. Bones and organs of locomotion	113,287	58,533	171,820
17. Congenital malformations and ill-defined	97,889	20,864	118,753
Total defects	698,718	262,487	961,205
Cases with two defects in one man (rejected men only)	149,619	55,865	205,484
Total men rejected for above causes	549,099	206,622	755,721
Total men examined, not defective in those respects	3,215,002	2,538,451	
Total men examined	3,764,101	2,745,073	
Total number of men in Class 1 available who were not inducted	469,929		
Total number of defective men included in the 2,745,073 who were not rejected, but accepted for military service	848,482		

Nothing could conceal the hard fact that no considerable force could be made ready in less than about a year from the declaration of war. In May 1917 a few American destroyers reached England. June 8 Gen. Pershing, who had been selected as commander-in-chief, arrived in England. June 26 a small detachment of U.S. troops reached France. From that time contingents continued to arrive, thus giving to the Allies the assurance that succour on a vast scale was being organized. New branches of military service were established, among them the Chemical Warfare Service which provided materials for lethal gases and for gas-masks and other means of resisting the enemy attacks. Congress, July 24, appropriated $640,000,000 for aviation. The whole land was full of unwonted and startling preparations. By Aug. about 700,000 men were enrolled in the army and 230,000 in the navy. Nevertheless, on Dec. 31 1917 the total number of troops in France was only 176,665.

Control of Industry and Transportation.—The establishment of huge war industries for making guns, munitions, clothing, and the varied supplies for a vast army put a great strain on the industry and transportation of the United States. The country was called upon to feed its own people, the army that was preparing to go abroad and, in considerable part, the Allied armies. Aug. 10 1917 a Food Control Act gave the President powers never before conferred with regard to food and fuel (*see* FOOD SUPPLY). Herbert C. Hoover, of California, who had distinguished himself in the management of the Red Cross in Europe and especially in Belgium, was made Food Administrator with large powers. Before the war ended he had established "meatless days," "wheatless days," and "porkless days"; the price of grain was fixed; eventually the farmers were assured $2.20 a bushel for their wheat crops, which was more than twice what had been considered a good price before the war. The winter of 1917–8 was very severe and coal shipments were delayed both by storms and by pressure of war industries; so that even New York City was for a few days almost without fuel. The warming of buildings and houses was cut to the lowest point. Dr. Harry A. Garfield, president of Williams College, was made Fuel Administrator, and carried through drastic measures for stimulating production, regulating shipments and distributing the supply.

During 1918 these sweeping war powers were rigorously applied. In the food bill was a provision against the use of grain for the manufacture of liquor. Later, manufacture for sale was entirely prohibited by Congress as a war measure. On March 19 1918 Congress passed a Daylight Saving law, for putting the clocks one hour ahead of Standard time from March to October. On March 21 the Federal Control Act placed the management of all the railways in the country in the hands of the Government during the war, and for a period after its close (*see* RAILWAYS). Secretary of the Treasury McAdoo was made director-general of the railways; later Walker D. Hines, an experienced railwayman, succeeded him. President Wilson declared all telephone and telegraph wires to be under the control of the Government and appointed Postmaster-General Burleson to take charge.

One of the most serious needs of the time was a fleet adequate to carry across the Atlantic the army and its supplies and then keep up the shipments of reserves and munitions. The merchant marine of the United States registered for foreign trade was in 1914 only 1,066,288 gross tons. Most of the food and munition tonnage, which was immense, was carried up to 1917 in British or neutral ships, some in French and Italian. The Government then undertook the great task of improvising a merchant fleet (*see* SHIPPING). After a contest between those who insisted on steel ships and those who thought they could be supplemented by wooden vessels, construction was authorized in both materials. But the war was over before any considerable number of new ships were completed, and the wooden ones were a failure.

The Army and Navy at the Front.—The sea duty was strenuous but less dangerous than army service at the front. Beginning with patrol work on the American coast as soon as war was declared, the activities of the U.S. navy extended to coöperation with the British and French in the hunting down of submarines and the protection of convoys. No German fleet gained access to the high seas, but in 1918 one or two commerce destroyers succeeded in doing a little damage to Allied commerce. In the laying of the North Sea mine barrage, extending from the Orkneys to Norway and completed by July 29 1918, the U.S. minelayers placed 56,611 out of a total of 70,263 mines. The American navy had some part in blockading the Austrian coast of the Adriatic, and participated in maintaining that Allied command of the sea which in the end was fatal to Germany. One of the most remarkable feats accomplished by the United States during the war was the development of a convoy system whereby over 2,000,000 troops were carried safely 3,000 m. overseas to France. In this work the utmost secrecy was necessary and there was little to appeal to the public mind. On entering the war the United States was wholly unprepared to transport a large expeditionary force; but in June 1917 a few cruisers and transports were provided and the first troops sent across. This convoy was attacked by submarines, but no boat was damaged and no lives were lost. The convoy system was generally adopted. At intervals vessels assembled and sailed on definite routes under the protection of destroyers. Under Rear-Adml. Albert Gleaves the cruiser and transport service was rapidly increased, eventually comprising 24 cruisers and 42 transports, besides 4 French men-of-war and 13 foreign merchant vessels, manned by 3,000 officers and 41,000 men. By a system of zigzag courses, camouflage and protection by swift destroyers the German submarines were rendered almost powerless. Of the escort protecting the convoys up to the Armistice the United States furnished about 83% (Great Britain 14% and France 3%). Of American troops, according to the report of the Secretary of the Navy (1920), 911,047, or 43·75%, were carried on U.S. navy transports, and 41,534, or 2·5% on other U.S. ships. The rest were carried chiefly in British ships. The peak of movement for any one day was reached on July 9 1918 when 75 transports, carrying 171,630 men, were on the high seas. The record month also was that of July, during which 306,350 troops were embarked. So successful was the convoy system that not one east-bound American transport was torpedoed by the German submarines; only three were sunk on their return voyage—the "Antilles" (Oct. 17 1917, 70 lives lost), the "President Lincoln" (May 31 1918, 26 lives lost), and the "Covington" (July 1 1918, 6 lives lost). The "Mount Vernon," returning from France, was torpedoed Sept. 5 1918, but made port; 36 lives were lost. Only three fighting ships were destroyed by the enemy—the patrol-boat "Alcedo," a converted yacht (Nov. 5 1917, off the French coast, 20 lives lost), the torpedo-boat destroyer "Jacob Jones" (Dec. 6 1917, off the British coast, 62 lives lost); and the cruiser "San Diego" (July 19 1918, sunk by a mine off the New York coast, 6 lives lost). Interned German vessels were used as transports, the "Leviathan" alone (the former "Vaterland") making ten voyages to France and carrying almost 100,000 troops. Other large U.S. transports were the "President Grant," 9 voyages, carrying all told about 80,000 men; the "George Washington," 9 voyages, about 46,000 men; the "America," 9 voyages, about 37,000 men; the "Agamemnon," 10 voyages, about 35,000 men.

The first notable appearance of American troops was at Cantigny May 28 1918. On June 6 there was a fierce engagement between the Americans and the Germans at Belleau Wood. During July 15–18 American troops, posted at Château-Thierry, desperately and successfully held the German forward movement. By Aug. about 1,500,000 soldiers had reached France. During Sept. 11–13 the Americans were given the task of clearing the Germans out of the St. Mihiel salient, their first independent action. From Sept. 26 to Nov. 11 the American army was engaged in the sanguinary Meuse-Argonne campaign, finally capturing Sedan and breaking the German lines. In these brief and territorially limited operations the American army, of which not more than 600,000 actually came within reach of the enemy, lost through casualties about one-third of those engaged.

The work of frenzied preparation and the steady drives on land and sea would have been impossible but for a new kind of organization of the War Department and other parts of the Government machinery at Washington. Under the Overman

Act of May 20 1918 the President was authorized to rearrange the departmental work and to transfer bureaux according to his discretion. Large numbers of civilian men and women were brought into the War, Navy and other departments, some on salaries, others as "dollar-a-year men"—that is, men who for one reason or another could not enter the army but desired to serve their country at their own cost. The pace was severe, the administration complicated. The main object was to start things moving, without due regard, at times, to immediate results or costs. Plans were made with a view to a prolonged war. The sudden cessation of hostilities found the Government in possession of vast stores of supplies, now unneeded and inviting waste. There was a large accumulation of raw materials but comparatively little of finished product. The most glaring contrast between expenditures and results was in the construction of aircraft. In April 1918 Gutzon Borglum, the distinguished sculptor, and other civilians charged that the aircraft production was extravagant and inefficient. Charles E. Hughes was appointed by the President to make an investigation; he later reported that waste and confusion and inefficiency existed but that there was no wilful plunder of the Government on the part of anyone. Notwithstanding such errors large armies were speedily raised, dispatched and reached the front in time to give decisive aid to the Allies.

During the campaign of 1918 efforts were made to extend the possible field of enlistment by the passage of the Man Power bill of Aug. 27. All men between 18 and 45 were required to register with a view to service if needed, and 11,000,000 were registered. On Aug. 17 it was reported that some 3,000,000 men were with the colours at home and abroad. By a statute of Oct. 6 1917 provision was made for a system of military and naval insurance available for all men in the service. General Pershing officially reported that at the date of the Armistice, Nov. 11 1918, there were in Europe 2,071,463 American officers and men (approximately 82,000 officers). Only about 15,000 soldiers had returned to the United States. On the same date, according to figures compiled by the War Department, the number of troops encamped in the United States was 1,634,499, including 104,155 officers. The casualties up to Nov. 18 1918 were: killed in action, 35,556; died of battle wounds, 15,130; died of other wounds, 5,669; died of disease, 24,786; total deaths, 81,141; wounded 179,625; missing, 1,160; prisoners, 2,163; total casualties, 264,089.

War Activities at Home.—Immediately after the declaration of war the American people through official and unofficial channels made preparations to give support by civilian service and money contribution. One of the first war measures of President Wilson was to designate, April 14 1917, a Committee on Public Information, composed of the Secretaries of State, War and Navy, and one civilian, George Creel, journalist, as chairman. It was designed to be the official source of news relating to Allied war activities and issued a daily *Bulletin*, widely distributed for the special use of the press. Newspapers were requested to coöperate and to refrain from publishing unauthorized war news. The Committee kept up a lively system of publicity throughout the war, and at times was accused of providing favourable information even when things did not go altogether well. Its publicity work was aided by the National Board for Historical Service, created April 28 1918 at a conference of historians at Washington. Numerous pamphlets, maps and moving pictures were prepared and a nation-wide organization effected for furnishing a patriotic speaking service of "four-minute men," who by arrangement with the purveyors of public amusements made brief talks before their audiences. By an executive Act of Oct. 12 1917 a Censorship Board was established for censoring all communications—mail, cable, radio—passing between the United States and foreign countries. Its members consisted of representatives of the Secretary of War, Secretary of the Navy, Postmaster-General, War Trade Board, and the chairman of the Committee on Public Information. Control of all radio stations within the jurisdiction of the United States had been placed under the Secretary of the Navy April 6 1917; on April 28 the transmission of cable messages between the United States and foreign countries had been placed under the same supervision and international telephone and telegraph messages under the Secretary of War; censorship of the mails began Nov. 2, under the direction of the Post Office Department. This last provision was of great service in enforcing the Trading with the Enemy Act, in suppressing enemy propaganda, and in preventing the disclosure of military information to the enemy.

As early as Aug. 29 1916 a Council of National Defense, created by Act of Congress, had been approved and on March 3 1917 was fully organized. Its duty was the "coördination of industries and resources for the national security and welfare" and the "creation of relations which render possible in time of need the immediate concentration and utilization of the resources of the nation." Composed of the Secretaries of War, Navy, Interior, Agriculture, Commerce and Labor, it utilized the counsel of an Advisory Commission of seven persons, each one a specialist in one branch of industry. After America entered the war this Council devised the ways and means for efficient production and transportation of the essentials of war. Under it were later created several special organizations such as the War Industries Board (succeeding the earlier General Munitions Board), created July 28 1917, for assuring the prompt equipping and arming, with the least possible disadjustment of normal industrial conditions, of whatsoever forces might be called into the service of the country; the Purchasing Commission, formed Aug. 28 1917, for coördinating the purchases in America of supplies for the Allies; the Emergency Fleet Corp. of the Shipping Board, incorporated April 16 1917 for the purchase, construction, equipment, lease, charter, maintenance, and operation of merchant vessels in the commerce of the United States (*see* MUNITIONS). Early steps were taken also to conserve the supply of food and fuel. At the request of the Secretary of War (April 9 1917) the various states also organized State Councils of Defense, which supervised such matters as the conservation of food, sale of Liberty bonds and draft registration.

On April 21 1917 the Council of National Defense appointed a Woman's Committee, with Dr. Anna Howard Shaw as chairman, to coördinate the patriotic work of the women throughout the country. Divisions were organized in every state, and within a year four-fifths of all counties had subdivisions. Through these organizations the country's needs were promptly reported and all households mobilized for thrift. On April 2 1917 a General Medical Board was established under the Council. Through its aid medical officers were recruited, various committees were appointed and advice given in the interest of camp sanitation and health of the soldiers.

Hardly less important than production was transportation. The Advisory Commission of the Council of National Defense created a Committee on Transportation and Communication, with Daniel Willard, president of the Baltimore & Ohio railway, as chairman. Already in Feb. 1917 a Special Committee on National Defense had been appointed by the American Railway Association. Railways were requested to adopt measures for the most efficient handling of freight. At a meeting of the presidents of the important railways, held in Washington, April 11, plans were made for organizing an executive committee, composed of the presidents of five railways and of two *ex-officio* members one each from the Council of National Defense and the Interstate Commerce Commission, with Fairfax Harrison as chairman. This Committee, popularly known as the Railroad War Board, undertook to secure unity of operation among all railways, to subordinate private interests, and to eliminate competition. It continued to work until Dec. 28 1917, when the President placed all railways under Government control. William G. McAdoo, Secretary of the Treasury, was named as Director-General of Railroads, and under him was organized the U.S. Railroad Administration. By an Act approved March 21 1918 each railway, during the period of Federal control, was allowed compensation equivalent to its average income during the year ending June 30 1917; it was further provided that the roads should be kept in good repair and with equipment equal to that assumed by the Government. It was an emergency war measure and Federal control was not to last longer than 21 months after the end of the war. The country was divided into regions, each under a regional director, and methods were devised for rapid transportation of troops and supplies. The roads were returned to private ownership on March 1 1920. On April 11 1918 the important coastwise steamship lines also were placed under control of the Director-General of Railroads. At the latter's suggestion the four large express companies had combined in May 1918 under the name American Railway Express Co. which on Nov. 16 was placed wholly under control of the Railroad Administration.

Authorized by a joint resolution of Congress, dated July 10 1918, the Government assumed control of telegraph, telephone and marine cable systems, under the U.S. Telegraph and Telephone Administration, directed by Postmaster-General Albert S. Burleson. Radio control was already under the Navy Department. The telegraphs and telephones were taken over Aug. 1 1918. Contracts as to compensation were made with various companies, including the American Telephone and Telegraph Co., and the Western Union Telegraph Company. The Postal Telegraph-Cable Co. refused to enter into a contract, but was given compensation. There was considerable opposition to the taking over of the wires, due to the fact that the Postmaster-General was an avowed advocate of Government ownership, and it was surmised that he would use his influence for permanent Federal control. The cables were not taken over until Nov. 16 1918, five days after the signing of the Armistice, an action which aroused much criticism. They were returned to their owners May 3 1919. The telegraphs and telephones were returned Aug. 1 1919.

On Oct. 6 1915 a Naval Consulting Board had been organized, with Thomas A. Edison as president, and after the outbreak of the war it was associated with the Council of National Defense. Through various committees it studied such questions as those connected with life-saving appliances, explosives, mines and torpedos. At the same time many scientists were engaged in research throughout the country under the National Research Council, organized by the National Academy of Sciences with the support of President Wilson.

In order that available capital might be turned into channels contributing to the successful prosecution of the war, two agencies were devised. In Jan. 1918 the Secretary of the Treasury asked the Federal Reserve Board to pass upon all proposed issues of securities that should be referred to it. The Board formed a Capital Issues Committee for this purpose, and all banking institutions were asked to refrain from assisting in the floating of new securities until passed upon by the Committee. In general, approval was given only to such issues as contributed to the winning of the war or to the promoting of national welfare. This committee, however, had no legal status. Accordingly by Act of Congress, April 5 1918, there was created a Capital Issues Committee of the same nature, with authority to investigate and pass upon all issues, with certain specified exceptions, of securities of $100,000 or more. However, it was not empowered to require the submission of such securities to its investigation or to impose acceptance of its decision. The production of non-essentials was discouraged and many doubtful enterprises were repressed. The committee became inactive after Dec. 31 1918. It had investigated issues totalling about $3,800,000,000, of which amount about $900,000,000 had been disapproved. The same Act that created the Capital Issues Committee also created the War Finance Corp., the purpose of which was to encourage production of war essentials by providing funds for approved enterprises. With authorized capital of $500,000,000 furnished by the Government, it was placed under the direction of the Secretary of the Treasury and four associates. Up to Oct. 31 1918, requests for loans had been made amounting to $323,329,000 and loans amounting to $67,716,000 granted. At that time the net earnings of the Corporation had reached $2,169,000. A special War Credits Board was created Nov. 20 1917 for supplying loans to producers of munitions of war, its policy being to supply funds when not available elsewhere. Up to May 1919 loans of about $248,000,000 had been made, of which sum $163,000,000 had been repaid.

By the Espionage Act of June 15 1917 the President was empowered to control exports. A Bureau of Export Licenses was created through which were issued permits for shipments to foreign countries. The object was to prevent, so far as possible, American goods from reaching the enemy. Later this Bureau was placed under the Exports Administrative Board, created Aug. 21 1917. After the passage of the Trading with the Enemy Act of Oct. 6 1917 this Board in turn was merged with the War Trade Board, organized by executive order of Oct. 12 1917, and consisting of representatives of the Departments of State, Treasury, Agriculture, and Commerce; the Shipping Board, and the Food Administration, with Vance McCormick as chairman. The War Trade Board undertook the control of imports as well as exports, and aimed to strengthen the blockade and to injure Germany's trade. With the aid of a Bureau of Enemy Trade a list was prepared of firms throughout the world with whom Americans should not trade. This Enemy Trading List was distributed for guidance among Americans engaged in foreign trade. Trade agreements were made with neutral countries, allowing them to receive American goods under conditions intended to prevent their reëxport to the enemy.

The importance of securing the coöperation of labour was recognized from the first. One of the six members appointed on the Advisory Commission of the Council of National Defense was Samuel Gompers, president of the American Federation of Labor. On April 2 1917 Gompers called a conference at Washington, which was attended by representatives of labour, employers, and social workers. The result was the organization of a Committee on Labor of the Council of National Defense, designed to advise as to the relations between labour and employers during the war. Suggestions were issued through the Council of National Defense and requests made that no changes in existing standards be made without the Council's approval. Labour conditions were investigated, information published, and efforts made to settle disputes without interruption of work. During the summer of 1917 serious labour trouble arose in the west in connexion with the production of such important war materials as copper, lumber, and oil. A special commission, popularly known as the President's Mediation Commission, was appointed by the President, Sept. 19 1917, with William B. Wilson, Secretary of Labor, as chairman, and Prof. Felix Frankfurter, of the Harvard Law School, as secretary and counsel. A thorough study of labour conditions was made and many disputes settled. A report made Jan. 9 1918 formed the basis of all subsequent labour adjustments. In Jan. 1919 the Secretary of Labor called a conference, inviting employers and labour to send five representatives, each side to choose a chairman to preside on alternate days. Plans were formulated for governing relations between employers and employees, recommending, among other things, that the right of collective bargaining should be conceded on both sides; that no change should be made in existing conditions as to the "open" and "closed" shop; that women replacing men should be paid on an equal basis; and that the minimum wage should insure reasonable comfort for the worker's family.

Following a suggestion of the conference there was created, April 9 1918, a National War Labor Board, whose membership, chosen by the Secretary of Labor, was identical with that of the labour conference, and consisted of 12 members. It acted throughout the war as a "supreme court" in settling labour disputes. To supplement the work of this Board there was appointed, May 13 1918, a War Labor Policies Board, intended to be representative of all the Governmental producing agencies, for the purpose of standardizing wages, hours of labour, housing conditions, draft exemption, and employment of women.

A matter of great importance was the recruiting of labour and its directing into necessary industries. After America's entrance into the war several existing services under the Department of Labor were enlarged and new ones created. The U.S. Employment Service, under the Bureau of Immigration, with offices throughout the country, assumed Aug. 1 1917 the task of recruiting unskilled labour for all war industries, excepting farms and railways. Private employment bureaux were closed. Much skilled labour, also, was secured for shipyards and camp construction. From Jan. 1 1918 up to the signing of the Armistice, about 2,400,000 workers had been placed in essential industries. Later this Service undertook to find employment for ex-service men; and from Dec. 1 1918 to Sept. 27 1919 out of 758,474 registrants, 474,085 were duly placed (*see* DEMOBILIZATION AND RESETTLEMENT). The influx of labour in the industrial centres created a serious housing problem. In Feb. 1918 in the Department of Labor there was organized a Bureau of Industrial Housing and Transportation. On May 16 Congress appropriated $60,000,000 (later increased to $100,000,000) for providing adequate housing facilities for labourers and their families. By Act of June 4 1918 the President was authorized to form a corporation for carrying on this work. Accordingly, on July 10 1918 the U.S. Housing Corporation was incorporated under the laws of New York. The personnel was the same as that of the Bureau of Industrial Housing and Transportation. Elaborate preparations were made for erecting dwellings, dormitories, and cafeterias, but actual construction had not proceeded far before the Armistice.

In addition to these and other official organizations several private agencies were established which had the goodwill and aid of the authorities and raised large sums for the comfort and health of the soldiers in the service, the care of the sick and wounded and aid to refugees and non-combatants in the war zones. Chief among these was the American National Red Cross, which during a single drive raised $100,000,000 and was to be found wherever there was fighting, sickness, suffering, or starvation. At the date of the Armistice its total membership was 19,928,022; the number of women giving their services in Red Cross workrooms was 8,000,000; supplies had been furnished to the amount of almost $76,000,000. Special attention to the social welfare of soldiers in camps both in America and overseas was given by the Y.M.C.A., Y.W.C.A., Knights of Columbus, Salvation Army, Jewish Welfare Board, American Library Association, and War Camp Community Service. An attempt was made to coördinate the work of these various organizations through the War Department Commission on Training Camp Activities, which also acted in an advisory capacity in connexion with the prevention of the sale of intoxicating liquor and the discouragement of brothels near the camps.

The Government formally took charge of all foreign trade Feb. 15 1918, and seized not only all German ships interned in U.S. ports since the war broke out, but also ships under the Dutch and other neutral flags, and impressed them into war service. Under the Webb Act of April 10 1918 the Government went to the extent of permitting combinations for foreign trade, which would otherwise have been in violation of the anti-trust Acts.

Enemies in the United States.—While the people of the United States were practically a unit in favour of a vigorous prosecution of the war, there were a few, chiefly foreign-born or sons of foreign-born, who were opposed to the war or more often to the nations in concert with which and partly for whose salvation the United States was fighting. Ever since 1914 the country had been irritated and aroused by a series of illegal, violent and often murderous acts which were traced to German and Austrian agents. For example, determined efforts were made to blow up the international bridge at Vassalboro, Me., and the locks of the Welland Canal, by men acting within the boundaries of the United States. Bopp, German consul-general at San Francisco, was convicted and imprisoned for aiding German vessels in the Pacific in defiance of neutrality laws. Rintelen (after the war specially rewarded by the German Government) was sent to the Federal prison at Atlanta for aiding in placing bombs on outgoing vessels with intent to destroy them. In 1910 Eugene V. Debs, Presidential candidate four times of the Socialist party, was sentenced to ten years' imprisonment for advising men not to enlist in the army. Victor Berger, member of Congress from Wisconsin, was convicted and sentenced for disloyalty, then reëlected to Congress, which refused to seat him.

The I.W.W. took advantage of the general confusion to engage in a campaign of disturbance and violence in the west; as many as 97 leaders of that order, including William Haywood, were convicted of disloyal conduct by one court at one time. These prosecutions were supported by the Trading with the Enemy Act of Oct. 6 1917, the Espionage Act of June 15 1917, and the Act of April 18 1918 as to alien enemies. Several thousand German and Austrian citizens who were believed to be dangerous were interned. On Dec. 19 1918 two pro-German editors were punished for disloyal utterances in a German-American paper. These prosecutions against American-born citizens, naturalized citizens and unnaturalized foreigners continued for two years after the end of hostilities. The authorities were particularly incensed by an open propaganda carried on by Russians and others in favour of Bolshevism as a principle of Government and a substitute for the institutions of the United States. In Dec. 1919 some 250 alien anarchists were placed on a Government transport and taken to Russia. On Dec. 25 1921 President Harding commuted the sentences of Debs and 23 others who had been convicted under the Espionage Act, but a number of persons remained in jail under sentences for disloyal action.

The Armistice and the 1918 Elections.—All at once this tremendous energy, these costly preparations, this enrolling of millions of men, this unceasing action of the great national relief societies, were interrupted by the end of the war in western Europe. The fierce campaign of 1918 was the final effort of the Germans. For the second time in the war they came almost within striking distance of Paris, but were repelled by the bravery of the French and British combined with the new armies from America. No one can say positively that the American army in the field was the chief element that insured victory; but there is not a doubt that the triumphant success in raising, drilling and transporting incessantly provisions and supplies, was to the German mind convincing and disheartening evidence that the Government and the people of the United States, with all their power and potentiality, would stand by the Allies indefinitely. November 11 1918, by the Armistice in which the American armies shared, the Germans admitted their defeat and at once began to evacuate the occupied regions and also portions of their own national territory.

This climax came a few days after the state and Congressional elections of the autumn of 1918. The war was a national war. Enlistments, whether volunteer or by draft, had no relation to politics. Nobody paid any attention to the party affiliations of officers or men or civilian administrators and aids. Nevertheless, Oct. 15, a few days before the elections, President Wilson took the strange course of issuing a circular letter urging the voters to return a Democratic majority to the Senate and the House, because, if the Republicans were successful, it would be considered an imputation upon the President. The warning was in vain; in fact, it probably helped the Republicans materially. The result of the election made the new House decidedly Republican and the Senate Republican by two votes. It was apparent, therefore, that the Administration in making the necessary adjustments after the war must take into account the preponderance of the opposition in both Houses of Congress. Several changes came about in the Cabinet at the end of 1918. McAdoo resigned and was followed in the Treasury by Carter Glass, a representative from Virginia, who gave way in turn to Houston, transferred from the Department of Agriculture, where he was succeeded by Meredith. February 13 1920 Secretary Lansing was practically removed by President Wilson for "insubordination," and was succeeded in the State Department by Bainbridge Colby.

Throughout the year 1918 the influence of Theodore Roosevelt was steadily growing. He was by his whole nature a supporter of the war. He and his four sons volunteered for service, though, as he put it with plaintive humour: "Wilson has kept *me* out of the war." He was recognized as a Republican and the most powerful Republican. Even his strongest political enemies admitted that the party must reckon with him. As the months passed it became clear that he would be nominated by the Republican Convention of 1920 and in all probability would be elected President. But he died suddenly, Jan. 6 1919, leaving behind him a long roll of achievements and a place among the greatest of American statesmen and world figures.

Peace and the Treaty.—Two great tasks remained when active war ceased. The first was to secure a settlement and register it in a treaty or series of treaties, thus returning so far as possible to normal international relations. The second was to reconstitute the world and to protect it, if possible, against future wars. A third task for the United States was its internal reconstruction by putting an end to the special war laws and conditions and by readjusting business, transportation and labour.

The first two of these tasks are described in detail elsewhere (*see* PEACE CONFERENCE and LEAGUE OF NATIONS). In addition to the suggestions made in the winter of 1916–7 President Wilson put forward on Jan. 9 1918, during the height of the war, "fourteen points" (*see* WILSON, WOODROW) which he considered a necessary basis for the peace of the nations and a subsequent world agreement. These points he enlarged in later addresses to twenty-seven. The Germans afterwards asserted that the points were an essential part of the Armistice. One week after the signature of that document President Wilson decided that he would attend the necessary Peace Conference in person. As soon as Congress assembled he announced that purpose and designated as peace commissioners with himself four others—Secretary Lansing, Col. House of Texas, his most intimate friend and political adviser, Gen. Bliss of the army, and Mr. White, formerly minister to France. These commissioners were not passed upon by the Senate, only one of them was a Republican, and not one was a member of either the Senate or the House. To Republicans it seemed that the President meant it to be a Democratic peace as well as a Democratic war. In the Peace Conference President Wilson, as representative of the richest and most powerful nation in the world, became one of the four representatives of the four Great Powers—Great Britain, France, Italy and the United States—who engineered the Treaty.

President Wilson was deeply interested in the League of Nations; and, when he found that the French were not ready to adopt such a plan without some guarantee of protection, he signed a treaty of alliance between the United States, France and Great Britain pledging the United States to join in war in case of the invasion of France by Germany. No one familiar with the temper of Congress and of the American people should have supposed that such a treaty would be ratified. President Wilson returned home for a short stay (Feb. 24–March 4), defending the general terms of the Treaty and the Covenant of the League of Nations, of which he was the most significant draftsman. He returned to Paris and on June 28 1919, he and the four commissioners signed for the United States the formal Treaty of Versailles, including the Covenant of the League of Nations, which was interwoven into the text of the Treaty. Upon one of the subjects covered by the territorial adjustments of the Treaty in which the people of the United States felt a deep national interest—the continued occupation of Shantung by the Japanese—the President reluctantly gave way and consented to its retention by the Japanese, in spite of the general adverse opinion in the United States.

The Treaty had many powerful supporters in the United States among all parties, particularly ex-President Taft, the League of Free Nations and the League to Enforce Peace, in which A. Lawrence Lowell, president of Harvard University, was the leading spirit. The Senate, which had the constitutional right to pass upon the Treaty by a two-thirds majority, was divided into strongly opposed groups. Most of the Democrats, under the lead of Senator Hitchcock, followed the President in favouring the Treaty with the Covenant as it stood. A group of Republicans, headed by Senator Lodge of Massachusetts, favoured "amendments" to the Treaty and "reservations" as to the League which would have maimed but not killed the two projects. The contest ostensibly centred about Art. X. of the Treaty, under which the members of the League undertook "to respect and preserve as against external aggression the territorial integrity and existing political independence of all members of the League," and agreed that in case of need the Council should "advise upon the means by which this obligation shall be fulfilled." This group expressed fear lest the United States be drawn into foreign wars and insisted that "no American soldiers or sailors must be sent to fight in other lands at the bidding of the League of Nations." The President, on the other hand, regarded Art. X. as the heart of the whole Treaty. Another group wished reservations that would practically destroy the document. A small but implacable junto, headed by Borah of Idaho and Johnson of California, were against both the Treaty and the Covenant in any form or with any reservations.

The President declined at the critical moment to accept either amendments or reservations, except certain minor alterations approved by himself. Senator Knox of Pennsylvania proposed a resolution intended to put an end to the fictitious state of war with Germany. It was passed by both Houses, but was vetoed by the President (May 27 1920). After strenuous debate and by a test vote, Nov. 19 1919, the Senate refused to ratify the Peace Treaty with reservations—the vote being 55 to 39 in favour, but not the necessary two-thirds. Thus after five months' discussion the Treaty was rejected, and the United States was left in the absurd situation of remaining at war with Germany and Austria though all hostilities had ceased a year before.

President Wilson until the last moment believed that he could force ratification of the Treaty by his logic and influence. September 26, while on a speaking trip through the country in favour of the Treaty, he was struck down by paralysis; when he rallied sufficiently to think of public business he continued to hope that he would recover. His Cabinet and closest friends joined in an attempt to minimize the extent of the President's illness, though for months he was unable to see even members of his Cabinet. Had he possessed his usual mental force, the result would probably have been the same. The difficulty with the Treaty and the League was that both were signed by a body of so-called commissioners who represented no lawful authority except that of the President. The only one who held public office or responsibility was Lansing, who by his own account fundamentally differed from the President at Paris but always surrendered his convictions. Whether President Wilson, or the statesmen who opposed him in the Senate, had the clearer view of the state of the world and the duties of the United States, whether the opposition could have been avoided by taking counsel with a larger group of competent men, cannot now be decided. The fundamental fact is that the opposition to the Covenant was strong enough to prevent the ratification of the Treaty even with serious reservations: the representatives of the United States at Paris were out of accord with the constitutional treaty-making power of the nation. Since the President had the last word in framing treaties, nothing could be done.

Rehabilitation.—The task of *post bellum* economic adjustment was entirely within the control of the people of the United States, except so far as foreign trade was involved. The census of 1920 showed a pop. of 105,000,000 in the continental area and 12,000,000 more in the dependencies. At the end of the war the Federal Government by war statutes was controlling the food supply and its distribution, manufactures, the coal supply and shipments, railways, telegraphs and telephones, foreign commerce and shipping, the care of the property of aliens through an Alien Property Custodian, as well as the conditions of interstate labour and of labour in other fields, through a War Labor Administrator, and a National War Labor Board. For foreign commerce there was still a Shipping Board, an Emergency Fleet Board, a War Trade Board and a War Finance Board. Two million American soldiers were overseas and wanted to come home as soon as possible. The average cost of living was about 80% higher than in 1914. The United States had spent on the war about $35,500,000,000, including $9,500,000,000 loaned to the Allies. Congress was willing enough to impose high taxes, and the people were ready to pay them; but expenditures after peace came continued on a scale far beyond any previous experience of the country. This complicated condition was to be readjusted by a Government made up of a President physically unable to perform his duties, a Senate and a House opposed to him in politics, and a group of abnormal war agencies. No swift or judicious result could be expected.

In the course of six months after the Armistice, about two-thirds of the troops were brought back, leaving behind them enormous stores, large parts of which were sold at heavy discounts to European Governments. General Pershing, the only military man of high rank whose achievements caught the public eye, received the reward of the permanent rank of general. By 1920 the only American troops left in Europe were an Army of Occupation of about 17,000. In Sept. 1919 the American Legion incorporated by Act of Congress was formed to look after the interests of the ex-soldiers.

Two constitutional amendments crystallized some of the results of the war. The various prohibition measures passed by Congress, on the ground that the use of liquor impeded the success of the war, were powerful aids to the general arguments against liquor. Many of the states had absolutely prohibited the sale of liquor and on Jan. 16 1919 the 18th Amendment, prohibiting the manufacture, sale, transportation or gift of intoxicants (submitted in 1917) was ratified by 36 states (eventually 45 states). It went into final effect Jan. 15 1920, enforced by the Volstead Act (passed Oct. 28 1919, over the President's veto), which declared all liquors containing more than one-half of 1% of alcohol to be intoxicating and therefore prohibited (*see* PROHIBITION).

The active war patriotism and service of women, together with the votes they already enjoyed, caused Congress June 1919 to submit the 19th Constitutional Amendment, annulling all sex restrictions of suffrage. It was warmly supported by the former Progressives and by President Wilson, received its 36th ratification Aug. 24 1920, and went into force August 26.

Railways and telephones were restored to their owners. Federal control over fuel stopped; but the abnormal number of executives and clerks in Washington and elsewhere remained under pay. Congress provided for the men disabled in the war by establishing hospitals and by giving to the weak and maimed an opportunity to acquire some trade or calling by which they could make a living. This system enlarged the functions of the Federal Vocation Board created by the Vocational Education Act of Feb. 23 1917. Trade and oversea transportation were discouraged by the financial conditions of the European nations that had been accustomed to trade with the United States. All the war countries in Europe except Great Britain were on a paper-money basis, and a dollar in gold in Oct. 1920 would buy 15 French francs, 26 Italian lire or 71 German marks; even the English sovereign was as compared with the dollar at a discount of 25%. These conditions demoralized international exchange. Transportation in the United States was much disturbed because of the great increase in the money cost of labour and supplies. Feb. 28 1920 Congress passed the Esch-Cummins Transportation Act for the return of the railways to their owners, with certain guarantees of compensation for a period of six months and a stipulation directing the Interstate Commerce Commission to make rates yielding a return of 5½% to 6% for a period of two years. Sea traffic was confused, and in 1921 became almost profitless because of the increased number of ships which were competing for a decreasing amount of business.

The most serious trouble was with labour. Railwaymen and many other skilled employees received wages amounting in some cases to more than double the figures of 1914, and naturally were unwilling to relinquish their advantages. Whenever there was an attempt to reduce wages there was a strike. New York and other ports were several times almost paralysed by strikes of longshoremen or officers and crews of ships. In Aug. 1919, under President Wilson's direction, the Government threatened to use military force to break a railway strike. The police force of Boston struck Sept. 9 1919 as a protest against an order not to join the American Federation of Labor. The strikers stood by and saw without protest scenes of riot and pillage. They were all dismissed and Governor Coolidge of Massachusetts, in replying to a telegram from Samuel Gompers, declared that "there is no right to strike against the public safety by anybody, anywhere, any time." In 1916 there was a strike of 600,000 bituminous coal-miners in the west. Notwithstanding conferences and boards and mutual understanding there was no national or state machinery that could effectively deal with these troubles.

Political Overturn of 1920.—As the months passed, dissatisfaction grew. The soldiers received in many states a money bonus varying in amount, and demanded a similar bonus from Congress. The general public complained bitterly against the "high cost of living," while many corporations continued to make war profits in time of peace. Salaried men, people living on investments, holders of life-insurance policies and depositors in savings banks, saw their incomes and expectations reduced by the fall in the purchasing power of the dollar. The Democratic party was paralysed by internal difficulties over the Peace Treaty and by lack of the trusted leadership of the President. The Republicans had broken the foreign policy of the Administration and were in possession of a majority of both Houses, but had no fixed policy of foreign relations or reconstruction.

In the winter and spring of 1920 Presidential candidates began to develop. General Leonard Wood, formerly chief-of-staff of the army, who had been refused a foreign command during the war, was put forward by a large group of Republicans. Governor Lowden of Illinois had a considerable following. A movement was made in favour of Hoover, well known for his services on the Commission for Relief in Belgium and other relief agencies and also as Federal Food Administrator. When the Convention assembled at Chicago June 9 1920, it proved to be impossible to nominate any of the three, and Senator Harding of Ohio received the nomination backed by a strong group of stand-patters to whom, however, he seems to have made no pledges as to policy or appointment. Governor Coolidge of Massachusetts was put on the ticket as vice-president.

The Democratic Convention held at San Francisco was confronted with a similar difficulty. Woodrow Wilson had already served two terms and was known to be physically unable to perform the duties of the office. The leading candidates were McAdoo of New York, formerly Secretary of the Treasury, and Attorney-General Palmer of Pennsylvania; but after many ballots the nomination went to Governor Cox of Ohio, a man little known in national affairs, with Franklin D. Roosevelt, a cousin of the former president, as vice-president. The Republicans had the lead in the campaign, in which for the first time women were eligible to vote in every state. The result was a complete triumph for the Republicans, who elected Harding by a popular majority of about seven million and an electoral majority of 404 against 127 for Cox, besides securing solid majorities in both Houses of Congress.

March 4 1921 Woodrow Wilson accompanied the President-Elect to the Capitol as the last act of his official life. He had been president for eight years, during six of which he was the undisputed leader of his party and of the nation. Except for a few not very important measures passed over his veto, up to the summer of 1919 he had his way with Congress and with the people. He was responsible for a group of important revenue, banking and labour laws. He had a great hold on the affections and opinions of millions of his fellow citizens, and maintained the country's dignity in war and peace. He had the people behind him in entering the war. He stood behind the measures for organizing and transporting millions of American soldiers. For a time in Paris he was the foremost man in the world, and he succeeded in inducing foreign statesmen, not much interested in, and at heart disliking, the project, to accept a League of Nations. At the height of his career he suddenly lost control as war president of the whole country, was no longer accepted as unquestioned head of his party, and ceased to be the one man who could appeal from Congress to the people. Before illness disabled him, he had already lost his hold upon the minds of the majority of his fellow countrymen.

His work was transferred to a new man less experienced in politics, for a short time a quiet member of the U.S. Senate, whose task it was to take over the discordant elements and build out of them a national policy. President Harding accepted this new responsibility and began his administration under favouring auspices. An excellent impression was created throughout the country by his choice of a Cabinet above the average, several members being chosen in the face of strong opposition from the professional politicians. The members were: Charles E. Hughes, State; Andrew W. Mellon, Treasury; John W. Weeks, War; Harry M. Daugherty, Attorney-General; Will H. Hays, Postmaster-General; Edwin Denby, Navy; Albert B. Fall, Interior; Henry C. Wallace, Agriculture; Herbert C. Hoover, Commerce; James J. Davis, Labor. The new President early showed tact and ability in leading his party in favour of constructive action. Within four months the epoch-making bill providing for a Federal budget system was passed by Congress and approved (June 9 1921). This was in line with the President's constant appeal for economy, which led him also to urge postponement of legislation for the grant of a Federal bonus to ex-service men in view of the existing burden of taxation. He displayed keen interest in all attempts to restore business to a sound basis and urged prompt action in the assistance of the railways. By nature conservative, he laboured to bring the country back to a state of "normalcy," to use a favourite word of his own. Treaties of peace negotiated with Germany, Austria and Hungary were ratified by the U.S. Senate Oct. 18 1921.

Of world-wide importance was his call for a conference of the different Powers bordering on and interested in the Pacific Ocean, to be held in Washington and to discuss both Pacific questions and the question of limitation of armament.

The conference assembled Nov. 11 1921, "Armistice Day," and closed Feb. 6 1922. The participants were the United States, Great Britain, France, Italy, Holland, Belgium, Portugal, China and Japan. Important agreements were signed:—to limit construction of capital warships; against improper use of submarines, and against gas warfare; for maintenance of Pacific insular possessions; and on other questions involving relations with Japan and China (*see* WASHINGTON CONFERENCE).

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UNITED STATES NAVAL ACADEMY (*see* 27.736).—The expansion of the Naval Academy in the period 1910–20 began before the entry of America into the World War. In 1912 the six-year course (including two years at sea as "midshipmen") was discontinued, and midshipmen were commissioned ensigns immediately upon graduation from the Academy. By Acts of Congress in 1916 and 1917, the number of annual appointments to the Academy allowed to each senator, representative, and delegate in Congress was increased from two to five; presidential appointments from 10 to 15, and appointments of qualified enlisted men from 15 to 100. Thus the total number of authorized appointments reached 3,126; and the number of midshipmen increased from 758 in 1910 to 1,230 in 1916, and in 1920 to about 2,200. Since 1920, physically qualified candidates have been allowed to enter either by examination or by certificate from a recognized school.

As a war measure, the class of 1917 was graduated in March of that year, and the class of 1918, after a period of intensive study, in the following June. The course was reduced to three years; but by cutting down examination periods, holidays, and reviews, and increasing the academic year to nine months, practically the same work was covered. In 1919 the four-year course was resumed. Between Sept. 1917 and Jan. 1919, five reserve officer classes, composed chiefly of former enlisted men who were graduates of technical schools, were quartered at the Academy for periods of about three months' training. In this way 1,622 officers were added to the service as temporary ensigns. The post-graduate school for officers, established in 1912 in the former marine barracks near the Academy, was suspended during the World War, but reopened in 1919 with about 50 student-officers. These spend a half-year or year at the post-graduate school before continuing their studies in civilian technical institutions. To provide for increased attendance, in 1918 two wings accommodating 1,100 additional midshipmen were added to Bancroft Hall, an extension to the Marine Engineering Building was completed in 1919, and a new Seamanship Building in 1920. In this period, the discipline and the course of studies were modified progressively to meet changed requirements. In 1919 the civilian corps of instructors was reorganized with increased pay and systematic promotion. The staff of the Academy increased from 146 officers and civilian instructors in 1910 to nearly 300 in 1921. (A. H. S.)

UNTERMYER, SAMUEL (1858–), American lawyer, was born at Lynchburg, Va., March 2 1858. He was educated at the College of the City of New York and at the Columbia Law School (LL.B. 1876). He was admitted to the bar in 1879 and practised thereafter in New York City. Between that time and the end of 1921 he was counsel in many celebrated cases covering almost every phase of corporate, civil, criminal and international law. As counsel for H. Clay Pierce he prevented the Standard Oil Co., after its dissolution in 1910, from dominating the Waters-Pierce Co. In the same year he effected the merger of the Utah Copper Co. with the Boston Consolidated and the Nevada Consolidated Co.'s involving more than $100,000,000. In 1912, as counsel to the Kaliwerke Aschersleben and the Disconte Gesellschaft in the controversy arising out of the control of the potash industry by the German Government, he assisted in bringing about a settlement. In 1903 he undertook the first judicial exposure of "high finance" in connexion with the failure of the U.S. Shipbuilding Co., organized only a year before as a consolidation of the larger shipbuilding companies in America including that subsequently known as the Bethlehem Steel Co. As a result of the sensational exposures connected with that company a reorganization was effected under the name of the Bethlehem Steel Co., in which Mr. Untermyer became a large shareholder. After this he conducted a number of similar exposures. In 1911 he delivered an address, entitled, "Is There a Money Trust?" which led the following year to an investigation in which he appeared as counsel, by the Committee on Banking and Currency of the Federal House of Representatives. This so-called Pujo Money Trust Investigation resulted in the passage of a mass of remedial legislation. Mr. Untermyer for years agitated before Congress and state Legislatures such measures as the compulsory regulation of stock exchanges. He for many years conducted agitations and wrote magazine articles dealing with reforms in the criminal laws, the regulation of trusts and combinations and other economic subjects. He was counsel for many reorganization committees, including those of the Seaboard Air Line, the Rock Island railway, the Central Fuel Oil Co., and the Southern Iron and Steel Co. In 1915 he acted as one of the counsel for the U.S. Government in the suit brought against the Secretary of the Treasury and the Comptroller of the Currency by the Riggs National Bank of Washington, D.C., which charged there was a conspiracy to wreck it; the defendants were cleared. He took an active part in preparing the Federal Reserve Bank law, the Clayton bill, the Federal Trade Commission bill, and other legislation curbing trusts. He was a delegate to the Democratic National Convention in 1904, 1908, 1912, and delegate-at-large for the state of New York in 1916. He was a strong supporter of President Wilson's administration. After America entered the World War he was adviser to the Treasury Department regarding the interpretation of the income tax and the excess profits tax laws. He was appointed by President Wilson to serve on the U.S. section of the International High Commission, which sat at Buenos Aires, in 1916, for the purpose of framing uniform laws for the Pan-American countries. In 1920–1 he was counsel for the Lockwood Committee, appointed by the state Legislature to investigate an alleged conspiracy among the building trades of New York City. It was charged that labour leaders were using their power by extorting bribes for the prevention of strikes, by preventing independent bids and by forcing building awards to favourites. Many illegal acts were disclosed and numerous convictions secured. Robert P. Brindell, who was at the head of the labour council of the building trades with a membership of 115,000 was prosecuted by Mr. Untermyer, who conducted the case in person as a special attorney-general, and convicted of extortion and sentenced to from five to ten years in state prison. At the end of 1921, when the prosecutions were being continued, more than 600 indictments had been found as a result of the investigation and many more were said to be impending. There were more than 200 convictions including pleas of guilty by employers, labour leaders and others and over $500,000 had been collected in fines. In connexion with the exposure of abuses and acts of illegality among the labour unions, all unions in the state were required, under the threat of criminal prosecution and of submitting to incorporation, to amend their constitutions and by-laws by eliminating these abuses; this they all agreed to do. It was shown that in many of the building trades both manufacturers and dealers, often with the collusive aid of labour leaders, had organized to fix prices and prevent competition. Subsequent prosecutions established the fact that these and other unfair practices were an important element in preventing building operations and increasing rental charges for dwelling property. Public opinion, especially in view of the housing shortage, reacted sharply to these revelations, and it was felt that Mr. Untermyer's work in this connexion had been performed with admirable public spirit, energy and courage. It was generally believed, moreover, that the evils brought to light by the committee were not confined to New York, and a demand for similar investigations arose in other parts of the country.

Mr. Untermyer was an ardent believer in the Zionist movement and was President of the Koren Hayesod, the agency through which the movement was conducted in America.

UNWIN, RAYMOND (1863–), English architect, was born at Rotherham, Yorks, in 1863, and educated at Magdalen College school, Oxford. He received his earlier training in an engineer's office and later as an architect. He was for many years associated in practice with Barry Parker in Buxton. Interesting himself more particularly in housing as a social question he acquired a reputation as an authority on the laying-out and designing of "Garden-Cities," being responsible for the first English example at Letchworth. The planning of many other garden suburbs, villages and estates was carried out from his designs. Amongst them are the layout and buildings at New Earswick, Yorks, for the Joseph Rowntree Village Trust, and the Hampstead Garden Suburb in the N.W. district of London. In 1914 he was appointed the first chief town-planning inspector to the Local Government Board, and, immediately on the outbreak of the World War, director of the housing branch under the Ministry of Munitions. Here he was responsible for the layout of many buildings for the new township of Gretna, and for Mancot Village, Queensferry, and much other work. He also during the war served on departmental committees dealing with small holding buildings, building by-laws, and building materials research. After the war he was appointed chief architect dealing with site planning, and, subsequently, deputy director of housing, under the Ministry of Health. He published *Town-planning in Practice* (translated into French and German), and (with Barry Parker) *The Art of Building a House*.

URUGUAY (*see* 27.805).—The pop. at the end of 1918, the latest figure available, was 1,429,585. This represented a growth of 34% since 1908. The average density increased from 12·9 per sq. m. in 1908 to 19·2 in 1918, the latter being greater than that of any other S. American country.

The administration of President Claudio Williman (1907–11) marked a definite period of progress and stabilization. Since no serious armed attempt was made to overthrow the Government, its efforts could be largely concentrated on educational progress and internal development. The first child-labour legislation was adopted, the death penalty abolished and a model penitentiary and a tuberculosis sanitarium were established. The Agronomical Institute of the university of Montevideo, which was opened on Sept. 15 1906, developed into a National Agricultural College modelled on the best European and U.S. institutions, and distracted the attention of the rising generation from revolution as a profession. The first chilled meat plant was opened in 1907, and a large and thoroughly modern packing and freezing plant at Montevideo in 1912. In 1920 Uruguay had two freezing plants, 13 salting plants, three canning and three tongue-preserving factories and a large factory for liquid extract of meat. Through rail communication between Montevideo and Rio de Janeiro was completed in 1911 by the connexion of various railways in southern Brazil, and so increased the points of contact between Brazil and Uruguay.

The social and educational progress of the country continued during the second administration of José Battle y Ordóñez (1911–15), who succeeded Williman. Hours of labour were further regulated, a National Insurance Bank was established and many experts were brought from the United States and Europe to advance various phases of education, particularly industrial and agricultural. The first S. American International Conference of Agricultural Defence was held at Montevideo on May 2 1913, and $200,000 annually was appropriated for free seeds for farmers. A law of July 12 1911 set aside $100,000

Uruguayan gold for encouraging immigration. While only 262 immigrants arrived in 1908, the number reached 2,455 in 1910 and 5,358 in 1913, a tribute to the continued stability and prosperity of the country.

In May 1910 ratifications were exchanged of the boundary treaty concluded in Oct. 1909 between Uruguay and Brazil; this settled several minor but long-pending questions in a satisfactory manner. A subsequent treaty of May 7 1913, since carried out, provided for delimiting and marking the boundary. Brazil ceded to Uruguay "the waters and navigation" of Lake Mirim and the Yaguaron river, and the contracting parties agreed not to fortify their new frontiers.

Uruguay continued to prosper under her next president, Feliciano Vieira (1915–9), who surrounded himself with able advisers of the young and progressive group which continued to dominate Uruguayan affairs. Most of them had studied or travelled abroad. Baltasar Brum, Vieira's successor in the presidency, had been Minister of Foreign Affairs in the latter part of Vieira's administration, when the growing pro-Allied sympathies of Uruguay were crystallized by the entry of the United States into the World War.

The Uruguayan Government, which had been pro-Ally, did not hesitate to express its sympathy with the action of the United States in declaring war, acting on the principle that "any act perpetrated against one of the countries of America in violation of the precepts of international law as universally recognized shall constitute an offence against all of them and consequently cause a common reaction in all," a statement largely inspired by dislike of Germany's submarine policy. On June 19 1917 President Vieira issued a proclamation stating that Uruguay would not regard as subject to the restrictions applicable to a belligerent any American nation which, in defence of its own rights, finds itself at war with nations of other continents. A month later a U.S. squadron under Adml. Caperton visited Montevideo and was received with great popular enthusiasm and pro-Ally demonstrations; while the Luxburg disclosures and the Argentine Congress's vote in Sept. (*see* ARGENTINA) for a rupture of diplomatic relations with Germany further stirred Uruguay. Finally, on Oct. 6 1917 President Vieira formally broke diplomatic relations with Germany, having been authorized to do so by a Congressional vote of 74 to 23, and on Oct. 15 a presidential decree stated that the rules of neutrality would not be applied to the Entente Allies. July 4 and 14 were proclaimed national holidays, in recognition of the national holidays in the United States and in France, and although no military or naval aid was sent to the Allies, Uruguay's sympathies continued with them until the end of the war. On Nov. 9 1917 the eight German merchant vessels in Montevideo harbour were seized by the Uruguayan Government and were chartered by the U.S. Emergency Fleet Corp. A credit of 15,000,000 pesos (approximately £3,000,000 at normal exchange) was advanced to England by the Uruguayan Government at 5%, to be used for the purchase of supplies in Uruguay, and a visiting British warship was most cordially welcomed. No less than five new branches of foreign banks were opened at Montevideo between 1915 and 1921, one of them from the United States and one from Canada. Uruguayan trade with the United States greatly increased during this period.

For some time Battle y Ordóñez and his followers had been urging a new constitution to replace that promulgated on July 18 1830, and in 1916 a Constitutional Convention met to discuss one which had largely been composed and influenced by Battle himself. The convention concluded its task in Oct. 1917, and the new constitution came into effect March 1 1919. The most important change in it was the definite separation of Church and State, making all religions free. The Roman Catholic Church, though no longer recognized as the state religion, was given control of such places of worship as had been already wholly or partly constructed by funds from the national treasury. Members of the clergy may be chosen as representatives or senators. Decentralization of the formerly strongly centralized Federal Government was brought about by the installation of popularly elected assemblies and autonomous councils of administration to regulate the local affairs of the departments, with control over the municipalities. The chief-of-police in each department, however, is paid by the national treasury and is directly subordinate to the president of the republic, who appoints and removes him. For the first time in the history of American constitutions the executive power is divided. It is shared between the president (elected by direct vote for four years) and an administrative board composed of nine members elected by a popular vote for a six-year term, one-third of its members retiring every two years. The president coöperates with this board, which directs the affairs of the departments of Finance, Public Instruction and Public Works, the president controlling those of the Interior, Foreign Relations, War and Marine. Minority representation is protected by a system of plural voting, and for the first time in S. American constitutions the adoption of woman suffrage is sanctioned for national or local elections, but a two-thirds majority of all the members in each chamber of the Legislature is required for its adoption. The General Assembly, composed of two Houses, is charged with the interpretation of the constitution, and also elects the justices of the Supreme Court. Perhaps the fact that Uruguay spends more money on education than on her combined army and navy (in 1915 there was one school in Uruguay for every 900 inhabitants, 63% of the children of school age attending school), best illustrates her prospects of progress under this new and liberal constitution.

Uruguay's youngest president, Baltasar Brum, took office on March 1 1919, shortly after travelling, while Minister of Foreign Affairs, in the United States and throughout S. America. He had developed a strongly pro-Ally and pan-American policy while Minister of Foreign Affairs, and he surrounded himself with an able and progressive cabinet. The visit of Mr. Bainbridge Colby, U.S. Secretary of State, to Montevideo in Dec. 1920, to return President Brum's visit to the United States two years before, caused renewed expressions of pan-American solidarity, which were intensified by the continued numbers of young men and women sent to the United States to study and the reduction of the average passenger voyage from New York to Montevideo from 24 to 17 days. Uruguay ratified the Peace of Versailles in 1919, and also concluded obligatory arbitration treaties with Great Britain and Italy in that year.

Economics.—The public debt of Uruguay was $129,774,119 in 1900 and $154,733,367 in 1916, which shows a very small relative increase. Agricultural development favoured the increase of small holdings and of peasant proprietors. In 1908 there were 43,874 rural holdings and in 1916 57,974. In 1916 there were 11,472,852 sheep, 7,802,442 meat cattle, 567,154 horses, 303,958 swine, 16,663 mules and asses, and 12,218 goats. The accompanying table, given in U.S. dollars, contains the latest available statistics of foreign commerce:—

Imports into, and Exports from, Uruguay.

From or to	Imports		Exports	
	1907	1917	1907	1917
United States	$3,556,336	$11,009,259	$2,415,632	$26,218,746
Great Britain (United Kingdom)	11,965,605	6,054,393	3,089,343	19,358,161
Argentina	2,650,335	8,421,124	8,419,392	12,376,146
Brazil	1,813,018	6,677,020	6,346,753	1,299,622
France	4,057,487	1,429,274	7,961,725	16,180,680

The trade with Spain was not important. In 1907 Germany stood second among the countries supplying Uruguay's imports. In 1917 she only supplied Uruguay with $106,733 worth of merchandise.

(C. L. C.)

UTAH (*see* 27.813).—The pop. of Utah in 1920 was 449,396, an increase over 1910 of 76,045 or 20·4%, a rate of increase 5·5% greater than that of the United States as a whole. The density of pop. increased from 4·5 persons per sq. m. in 1910 to 5·5 in 1920. The urban pop. increased from 46·3% in 1910 to 48% in 1920.

Before 1891 the two political organizations in the state were known as People's party and Liberal party, closely corresponding to Mormon and anti-Mormon. These old names ceased to be used in the decade 1910–20; there was an evident desire to forget the old feuds between Mormons and non-Mormons who alike composed the Republican and Democratic parties, and political divisions were no longer on religious lines. Utah has been Republican since its admission as a state in 1896, excepting in 1896, when the electoral vote was cast for Bryan, and in 1916, when the presidential vote was for Wilson and a Democratic governor and other state officers were elected.

Recent governors have been William Spry (Republican), 1909–17; Simon Bamberger (Democrat), 1917–21; Charles R. Mabey (Republican), 1921– . Bamberger, the only governor of Utah not connected with the Mormon Church, was born in Germany of Jewish parents. Joseph Fielding Smith, president of the Church of Latter Day Saints from 1901, died in Nov. 1918. He was a nephew of Joseph Smith, founder of the Mormon Church. His successor was Heber J. Grant.

The state's most important irrigation enterprise, the Strawberry Project, begun in 1906, was practically completed in 1918. By means of a tunnel 4 m. long through the Wasatch Mts., water is brought from a drainage basin on the E. side of the mountains into the Utah valley, 45 m. away. The reservoir in Strawberry valley, covering 8,100 ac., 7,600 ft. above sea-level, has a capacity of 280,000 ac. ft., of which only 75,000 are to be used annually until the project is enlarged. Use was begun Sept. 1913, and in 1920 70,000 ac. were irrigated from it. The state's irrigated acreage in 1909 was 458,273; in 1919 722,772; and works existed capable of irrigating 944,727 acres. Two canyons, Brice's and Little Zion, are reserved as national parks.

In Aug. 1909 Earl Douglass, a geologist, while conducting an expedition sent out by the Carnegie Museum of Pittsburgh, discovered in Uinta county the first complete skeleton of a dinosaur. Excavations for its removal revealed a deposit, the most extensive yet found, of fossil remains of extinct animals. The spot, embracing 80 ac., was set aside in 1915 by the U.S. Government and named Dinosaur National Monument.

Amendments to Constitution.—Section 3 of Article 10 was amended Nov. 8 1910 to provide that funds from the state tax for high schools be apportioned among cities and school districts according to attendance at high schools, so long as the schools are maintained at a standard fixed by the state Board of Education. Section 4 of Article 13 was amended to provide that after Jan. 1 1919 metalliferous mines and mining claims be assessed at $5 per ac. and in addition thereto at a value based on some multiple or submultiple of net annual proceeds. All other mines or mining claims and other valuable mineral deposits, including coal or hydrocarbons, are assessed at full value, as are also machinery and surface improvements. Article 22, Miscellaneous, was amended by adding Section 3 prohibiting after Jan. 1 1919 the manufacture and sale of intoxicating liquor containing in excess of one-half of 1 % of alcohol. Amendment to Section 7, Article 13, approved by referendum Nov. 1920, provided for a minimum appropriation for school purposes from state funds, of $25 for each child of school age. Amendment to Section 5, Article 16, gave the Legislature power to make recovery in fatal cases definite, thereby eliminating long suits, enabling dependents to obtain definite amounts without expense, and protecting them against settlements at less than the law provides.

Government.—By an Act of the Legislature, passed in 1911 to take effect in 1912, government by a board of five commissioners was made mandatory in all cities of the 1st class; and in cities of the 2nd class by a board of three commissioners; cities of the 3rd class remained under mayor and councilmen. An Act of 1919 authorized levying of taxes for libraries and gymnasiums in cities of the 3rd class and in unincorporated towns.

Education.—In 1919 Utah enacted much legislation extending the educational work of the state. Among things provided for were the establishment of standard high schools in voting precincts having 1,200 or more school population; vocational education; part-time schools for those excused for necessary employment; health education supervisors and school nurses; care for physical welfare of children of pre-school age; free dispensaries and clinics; Americanization by requiring persons not speaking English to attend evening schools; county public libraries; libraries and gymnasiums in cities of the 3rd class and unincorporated towns. By 1920 legal provisions had been made for public schooling, including kindergartens, for all children from 4 to 18 years old, and for supervision of the activities of all children of school age for 12 months in the year. Class-room instruction was not extended over the usual vacation periods, but each student was to enroll for "out-of-school" activities in which he and his parents might be directly interested. Credit for such work systematically done was to be given on the school records. Improvement of equipment and teaching staff resulted from consolidation of many rural schools. While in 1909 685 public schools were reported and in 1920 only 683, increase of enrolled pupils from 84,804 to 117,406 reflected the increased provision for public education. The average attendance in 1920 was 97,008. The total expenditures of 1919–20 were $8,353,133. The total number of teachers in 1909 was 2,255 (1,645 women) and in 1920 3,739 (2,824 women). The average salary of high-school principals in Salt Lake City in 1920 was $3,750; the lowest salary paid any teachers in the rural schools was $502. The Branch Normal School at Cedar City, formerly connected with the university of Utah, was transferred to the supervision of the Agricultural College. There were in 1920 46 tax-supported libraries, 22 of the buildings being Carnegie gifts.

Agriculture.—The number of farms in Utah in 1920 was 25,662, an increase of 18·4 % over 1909. The farm acreage was 5,050,410, of which 1,715,380 ac. or 34 % were improved. The value of lands and buildings in 1920 was $243,751,758; of implements and machinery $13,514,787; of live stock $54,008,183; showing respectively an increase over 1910 of 107·4 %; 202·5 % and 87·6 %. The average value of land and buildings per farm was in 1920 $9,499 as compared with $5,423 in 1910. Of all farms operated by owners in 1920, 47·6 % were mortgaged as compared with 28·9 % in 1910. Of the 25,248 white farmers, 21,276 were native and 3,972 foreign-born. Of native white farmers 18,683 were owners, 268 managers, and 2,320 tenants. Of foreign-born white farmers, 3,652 were owners, 25 managers, and 295 tenants. The 414 coloured farmers comprised 239 owners, 3 managers, and 172 tenants. There were 627 women farmers, including 609 owners, 1 manager and 17 tenants.

Crops.—The total value of crops in 1919 was $58,067,067, an increase of 219 % over 1910. In order of value the chief crops were hay and forage; cereals; sugar beets; potatoes and other vegetables; fruits and nuts; clover and alfalfa seed. As compared with that of 1909 the acreage of oats, 61,825, showed 23·5 % decrease; wheat 268,457, increase of 50·5 %; barley, 15,938, decrease of 40·4 %. The average yield of oats per ac. in 1919 was 27·9 bus.; of wheat 15·3 bus.; barley 22·9 bus. The total acreage of hay and forage in 1919 was 549,967 with a total production of 1,031,609 tons. There were 12,047 ac. in potatoes, a decrease of 15.2 % as compared with 1909; the average yield per ac. was 136·8 bus. as against 169·5 in 1909. The production of strawberries in 1919 was 484,792 qt.; raspberries 363,801 qt.; apples 759,696 bus.; peaches 883,950 bus.; cherries 123,477 bus. The acreage of sugar beets in 1919 was 93,359 as compared with 27,442 in 1909, an increase of 240 per cent. In beet production (1,338,000 tons) Utah ranked next to Colorado in 1920. In that year there were sugar factories in 18 towns, and their product totalled 153,200 tons. The value of the sugar production in 1920 was approximately $30,000,000.

Live Stock.—On Jan. 1 1920 the number of beef cattle was 397,563; dairy cattle 108,015; value of beef cattle $16,806,429; dairy cattle $5,821,441. The number of horses was 125,471 valued at $9,642,418; of sheep 1,691,795 valued at $18,881,529; of goats 29,512 valued at $253,100; of swine 99,361 valued at $1,551,880.

Industries.—Important industries in 1920 were meat-packing; creameries and condenseries; canneries; flour and cereals; candy; salt; metal and sheet iron; cement and lime. The following table, from the U.S. census of 1920, gives a comparative summary of manufactures for 1919 and 1909:—

	1919	1909
Number of establishments	1,160	749
Wage-earners	18,868	11,785
Capital	$140,785,034	$52,626,640
Cost of materials	$110,154,349	$41,265,661
Value of products	$156,933,071	$61,989,277

Mining.—The production of gold in Utah has been decreasing steadily since 1908. In 1920 the value was $1,949,000. More than half the gold of 1920 was from the Bingham district, about 30 % from the Tintic district, and the rest from Park City and other camps. Most of the gold was produced from silicious, copper, and lead ores treated at smelting plants. The largest producers of gold were the Utah Copper Co., U.S. Mining Co., Deer Trail, Chief Consolidated, Utah Consolidated, and Grand Central mines. The value of silver output in 1908 was $4,479,209 and in 1920 $12,664,000, the latter a slight decrease from 1919. The Chief Consolidated Mine at Eureka continued to be the largest producer of silver in the state, and the Tintic Standard followed closely. Although production of copper in 1920 was somewhat less than in 1919, it was considerably greater than a decade before. In 1908 the copper output was valued at $12,851,377 and in 1920 $19,991,000. The Utah Copper Co. at Bingham produced nearly 9,000,000 lb. a month throughout the year. In 1908 lead mined in Utah was valued at $3,728,655; in 1919 $6,562,940; in 1920 $10,939,000. The largest producers of lead were the Utah Apex, U.S. Mining Co., Tintic Standard, Chief Consolidated, Utah Consolidated, Silver King Coalition, Daily Judge, Ophir Hill, and Eagle and Blue mines. The largest increases were those of Chief Comsolidated and Tintic Standard in the Tintic district. The zinc product increased from $68,646 in 1908 to $323,465 in 1919 and $487,000 in 1920. In 1908 the production of coal was 1,846,792 tons; in 1918 the output of Carbon county alone was 4,607,192 tons; and in 1920 the total state production was 6,125,000 tons. (G. E. F.)

VACCINE THERAPY.—Since the discoveries of Pasteur it has become recognized that a very large number of the diseases from which human beings suffer are due to infection of the tissues by living micro-organisms, most of which belong to the simpler forms of plant life.

Immunity from such infections may be natural or may be acquired. By natural immunity we understand a natural resistance to infection by certain micro-organisms which are known to have pathogenic properties for other species of animals. It is known, for instance, that microbes which produce a rapidly fatal disease in one kind of animal are quite innocuous when introduced even in enormous numbers into another kind.

As an example of an acquired immunity may be taken the immunity conferred as a rule for a lifetime by an attack of measles or chicken-pox. The individual who has once overcome such an infection is usually immune from a further attack, even though exposed to infection.

It is this fact which led Jenner to try to confer immunity against smallpox by producing a modified mild "attack" by vaccination with calf lymph. It is now admitted that such vaccination does confer immunity, and that even should infection occur the disease runs a mild course.

Since the discovery of bacteria as causative agents of disease, much study has been devoted to the part played by the cells and fluids of the tissues in recovering from bacterial infections. Evidence has been sought for response on the part of the body to the bacterial invasion. It is to Metchnikoff that we owe the knowledge that the white blood corpuscles and other cells of the body react to the introduction of bacteria into the tissues. Enormous numbers of these cells congregate at the site of invasion and engulf the microbes (phagocytosis). As Sir John Burdon Sanderson aptly put it, the white blood corpuscles act as the policemen of the body.

It was soon learnt, however, that this is not the only way in which the body reacts to microbic infection. Buchner was able to show that the tissue fluids and the blood serum in particular acquire new properties as a result of bacterial infection, properties which render them highly injurious to the invading microbes. It was shown, for instance, that if actively mobile typhoid bacilli are brought into contact with the blood serum of a normal individual the bacilli are but little affected by the serum. On the contrary, if the bacilli are brought into contact with the serum of an individual convalescent from typhoid fever their mobility ceases, they are massed into clumps (agglutination) and finally killed (bactericidal action) and dissolved (bacteriolytic action). Sir Almroth Wright was able to demonstrate that a further property is acquired by the serum, namely an increased power to render the bacteria more readily ingestible by the phagocytic cells (opsonic action). Exactly how and where these new properties are acquired is not yet known, but one of the most striking facts emerging from the study of these reactions is that they are directed against the particular micro-organism which has invaded the tissues; the reactions are said to be specific. Thus the blood serum of a patient convalescent from typhoid fever, which is strongly bactericidal for the typhoid bacillus, behaves like a normal serum when brought into contact with any other kind of bacteria. Similarly, while an attack of typhoid fever confers immunity against a second infection by the typhoid bacillus, it confers no immunity from infection by other bacteria, even those so closely related as the para-typhoid bacilli.

It must be admitted that recent work goes to confirm the opinion that there is a concomitant non-specific response common to the reaction against all microbic infections, but this does not detract from the importance of recognizing the highly specific nature of these immunity reactions.

A very important step forward was taken when it was demonstrated that the body responds to the introduction into the tissues of dead bacteria in the same way as it does when living bacteria invade the tissues, for this made possible artificial immunization. To attempt to confer immunity against any microbic disease by the introduction of very small numbers of even attenuated living bacteria is fraught with manifest dangers, for the bacteria are capable of multiplication in the tissues and are no longer under control. To attempt to confer immunity against disease by the introduction of dead microbes into the tissues is a different matter, for the dosage can be regulated and the bacteria cannot multiply in the tissues.

Thus it was that Sir Almroth Wright proposed to confer immunity from typhoid infection by inoculation into the healthy tissues of a standardized suspension of dead typhoid bacilli in physiological salt solution (typhoid vaccine). The immense benefit derived from such inoculations was fully demonstrated during the World War 1914–8. Wright's studies in immunization had demonstrated that it was possible to confer immunity against microbic infections by the inoculation of bacterial vaccines into healthy individuals. It seemed at first that nothing but harm could result from the inoculation of such vaccines once the tissues had become infected. It appeared, indeed, as if to do so were merely to add more poison to a system already being poisoned. Such, however, is not the case. Pasteur was the first to show, in connexion with rabies, that beneficial results could be obtained by inoculating vaccine during the incubation period of the disease. But it was the discovery by Wright that the rapidity with which a specific response to the inoculation of a vaccine occurs depends on the dose of vaccine given, and that this response occurs very rapidly if the dose is an appropriate one, which opened up the whole field of vaccine therapy. Wright showed that the inoculation of too large a dose of vaccine can lead to a state of lessened resistance to infection and that no immunizing response follows. But this so-called negative phase can be modified as regards severity and duration by the adjustment of the dose, even to the point of its virtual disappearance, and nevertheless a good immunizing response follows. And such a satisfactory response occurs when vaccines are inoculated into an already infected individual. This means that, if the gravest generalized infections be excepted, there is not in microbic diseases a wholesale poisoning of the tissues of the body. There is infection of certain tissues and others remain healthy or, at all events, capable of an immunizing response. And it is to the power of these healthy tissues to respond that we turn in vaccine therapy. Just as the tissues of a healthy individual inoculated with an appropriate vaccine respond by elaborating protective substances against the microbe or microbes contained in that vaccine, and such response confers immunity on the individual, so do the healthy tissues of an infected individual respond to a vaccine containing the infecting microbe, and such a response raises the resisting power of the individual to the infection.

Now infections by microbes can broadly be divided into two classes: (*a*) generalized, and (*b*) localized. By a generalized infection we mean that the microbes and their products have ready access to the blood and lymph stream, and thus exert their baneful influence not only locally but at a distance on various tissues of the body. In a localized infection, on the other hand, the microbes affect a particular region of the body only and the remaining regions are not at all or only quite secondarily affected. From what has been said before, it is obvious that in the first class vaccine therapy has but a limited sphere of application; in the second class it has a very wide one. For it is on the satisfactory response of the tissues that the success of vaccine therapy depends and this will bear definite relationship to the healthiness of the tissues; further, the gravity of the infection must necessarily enter into account, just as a small war calls for but a small effort, whilst a great war, in which the life of a nation is at stake, calls for a maximal and sustained effort.

When it is borne in mind that the substances elaborated in response to the inoculation of a vaccine are largely carried to the site of infection by the blood stream, it will be realized that the success or failure of vaccine therapy depends largely on the blood supply of the affected area. So long as the newly elaborated anti-bacterial substances can come into contact with the bacteria, success may be anticipated, but when barriers to their arrival exist, success is limited or denied by the extent or completeness of the barriers. Thus in acute lobar pneumonia the affected area of the lung is occupied by an impenetrable clot of blood; little good can therefore be expected from vaccine therapy once this clot has formed and as long as it remains. But this does not preclude the exploitation of vaccine therapy in pneumonia in the earliest stages of the disease or after resorption of the clot has begun. Fortunately, in the majority of infections there is no such general disturbance of the blood supply to the infected area; in such case it surely follows that a supply of blood rich in protective substances must constitute an advantage, as against a supply of blood poorer in such substances. It will be realized from these remarks that the utmost care is needed in the accurate bacteriological diagnosis of each infection before vaccine therapy is employed, and the vaccine must be prepared with care as to sterility and specificity.

The administration of the vaccine needs the knowledge not only of general medicine but of bacteriology and the principles of active immunization against microbic infections.

The Vaccine.—For practical purposes bacterial vaccine may be defined as sterilized and enumerated suspensions of bacteria, the liquid medium being either physiological salt solution or dilute nutrient broth. The bacteria must be isolated in pure culture and strictly identified by the usual tests. The microbes thus identified are usually inoculated on to the surface of a solid medium (*e.g.* agar-agar) and, after growth has occurred, the bacterial colonies are floated off into sterile physiological salt solution. The suspension thus obtained is placed in a hermetically sealed tube and thoroughly shaken, if necessary by mechanical means, so as to break up the colonies and obtain an even suspension. A small sample of the suspension is then removed for enumeration, the tube once more hermetically sealed and the whole placed in a water bath at 60° C. for one hour. This temperature has been found to be sufficient to kill most of the pathogenic bacteria without profoundly altering their chemical composition. Sterility of the vaccine is not, however, presumed and each one is subjected to cultural control before being certified sterile.

The enumeration of the suspension may be carried out in various ways. The original method of Wright is as follows:

It has been the practice for some 25 years to enumerate the corpuscles of the blood in a counting chamber of known depth and ruled with squares of known size. Wright, therefore, mixes an equal quantity of blood and the bacterial suspension. Films of the mixture are made and appropriately stained for microscopic examination. An adequate number, about 500 usually suffices, of red blood corpuscles are counted in a series of fields of the microscope and at the same time the number of bacteria seen is noted. The number of red blood corpuscles per cub. mm. has previously been determined in a counting chamber, so that all that remains to be done is to work out the proportion of bacteria to red cells and so to arrive at the number of bacteria per cub. mm. or cm. of the suspension. There are technical difficulties in the way of enumerating certain bacteria, *e.g.* the tubercle bacilli; in these cases the bacterial growth is weighed, and the dosage, instead of being expressed in millions of microbes per cub. cm., is given in milligrammes or their fractions, *e.g.* a usual dose of a staphylococcus vaccine will be 250,000,000 cocci, whilst that of a tubercle vaccine would be 0·0001 milligrammes.

A vaccine made from cultures obtained directly from the patient to be treated is said to be an autogenous vaccine. A vaccine made not directly from cultures obtained from the patient but from cultures of the same species of microbe as that which is infecting him is termed a stock vaccine. In general it may be affirmed that autogenous vaccines are nearly invariably to be preferred to stock vaccines, whilst in the case of certain microbes they are indispensable. Stock vaccines, however, are usually effective, save time and expense and have very wide application. Latterly attempts have been made to reduce the toxic action of the bacterial suspensions and so-called sensitized and detoxicated vaccines have been recommended, but it is doubtful whether these procedures constitute a useful advance.

The accompanying table gives a summary of the microbes from which vaccines are commonly prepared, together with the minimal and maximal effective doses in which they are administered.

Vaccines are administered by hypodermic injection and the inoculations are painless.

Where the minimal effective dose is employed the inoculation is not followed by any local or constitutional disturbance. If there is any sensible constitutional change, that change is in the direction of increased well-being. When a medium dose is inoculated there may be a small amount of local tenderness and a transient aggravation of the patient's symptoms, or slight constitutional disturbance, malaise, headache and possibly a slight rise in temperature. But none of these negative phase effects are at all marked except where an excessive dose has been employed.

	Autogenous vaccine advisable	Stock vaccine adequate	Effective doses	
			Minimal	Maximal
			million	million
Acne bacillus	In some cases	Generally	5	500
Staphylococcus	. .	Generally	50	1000
Streptococcus	In most cases	. .	1	50
Pneumococcus	Generally	. .	5	50
Influenza bac.	Generally	If polyvalent	10	500
B. of Friedlander	Generally	. .	5	100
B. coli	Generally	. .	1	100
M. catarrhalis	Generally	. .	5	100
Bordet's bac.	. .	Generally	50	500
Diphtheria bac.	Often	Often	10	50
Gonococcus	. .	Generally	1	50
Actinomyces	. .	Generally	1	25
Meningococcus	. .	Polyvalent	50	1000
M. melitensis	. .	Generally	30	100
B. typhosus	. .	Yes	10	100
B. paratyphosus A	. .	Yes	10	100
B. paratyphosus B	. .	Yes	10	100
Tubercle bac.	(?)	Nearly always used	$^{1}/_{500,000}$ mg.	$^{1}/_{1000}$ mg.

It is outside the sphere of this article to enumerate the various diseases in which vaccine therapy finds application, but a few in which vaccines have proved of exceptional value may be mentioned.

Boils, carbuncles and other staphylococcal infections usually yield readily to treatment by staphylococcus vaccine. Erysipelas, puerperal septicæmia, acute surgical septicæmia and septic wounds are conditions benefited by treatment with a streptococcus vaccine. Certain forms of rheumatism, arthritis and fibrositis are relieved and the progress of the disease is arrested by treatment with an appropriate vaccine, and the same may be said in the case of certain cases of bronchial asthma, chronic bronchitis and recurrent colds.

The distressing symptoms of inflammation of the bladder due to infection by the bacillus coli are relieved and may entirely disappear under treatment with an autogenous vaccine.

Tuberculous disease of the glands, skin and joints is amenable to treatment with a tubercle vaccine, and in rigidly selected cases the same holds good for tuberculosis of the lung.

It may be confidently asserted that, with increasing knowledge, vaccine therapy will find wider application and will become recognized as a valuable weapon in the combating of microbic diseases.

(A. C. I.)

VACHELL, HORACE ANNESLEY (1861–), English novelist and playwright, was born at Sydenham, Kent, Oct. 30 1861. Educated at Harrow and the Royal Military College, Sandhurst, he received a commission in the Rifle Brigade in 1883. In 1894 he published his first novel, and in 1897 the first to make its mark, viz. *A Drama in Sunshine.* Subsequent novels included *John Charity* (1900); *Brothers* (1904) and *The Hill* (1905), both Harrow school stories; *The Waters of Jordan* (1908) and *The Fourth Dimension* (1920). He is the author of many plays, some, such as *Searchlights* (1915) and *The Case of Lady Camber* (1915) original; others, such as *Her Son* (1907) and *Quinney's* (1915), dramatizations of his own novels, or like *Fishpingle* (1916), afterwards issued as novels; whilst others again, *e.g. Who is He?* (1915) and *The House of Peril* (1919), were dramatized versions of novels by other authors.

VAIL, THEODORE NEWTON (1845–1920), American capitalist, was born on a farm in Carroll county, O., July 16 1845. When a child, he moved with his parents to New Jersey, studied at the Morristown Academy, and for two years studied medicine with an uncle. Meanwhile he had become interested in telegraphy. In 1866 he went with his parents to a farm in Iowa, but two years later became station agent and telegraph operator on the Union Pacific at Pine Bluffs, Wyo. Then he was appointed clerk in the railway mail service and his efficiency led to his being called to Washington, D.C., in 1873, where he was made assistant-superintendent of railway mail service, rising in 1875 to general superintendent. In 1878 he was made general manager of the American Bell Telephone Co., and for the next seven years was actively engaged in the development of the telephone business, for which he foresaw a great future. In 1885 he resigned from the Bell Co., and was elected president of the newly organized American

Telephone and Telegraph Co., which in 1900 acquired the American Bell Telephone Co. In 1887 because of ill health Vail retired and spent the next nine years in travel and on his farm at Lyndonville, Vt. During a visit to S. America he became interested in traction problems and in 1896 installed an electric railway system in Buenos Ayres, and later introduced telephone systems in many S. American cities, enlisting British capital for these enterprises. In 1904 he retired to his farm but in 1907 was again induced to accept the presidency of the American Telephone and Telegraph Co. When this company in 1910 bought control of the Western Union Telegraph Co., Vail was made president of the latter also, and introduced many changes, including "night letters" at reduced rates. When in 1914, as the result of a threatened suit by the Government, the Western Union was again segregated, Vail remained president of his old company. After the taking over of the wires in Aug. 1918 by the Government as a war measure, he was appointed adviser by the Postmaster-General and urged unified control of all cables, telegraphs and telephones. When the wires were returned in 1919 to private ownership he was elected chairman of the board of directors of the American Telephone and Telegraph Co. In 1920 the gross earnings of the company were $103,946,988, net earnings $70,686,904, number of miles of wire owned 25,377,404. Vail died in Baltimore April 16 1920. The value of his estate was estimated at about $2,000,000. He left $100,000 each to Princeton and Dartmouth, and $200,000 to be divided equally among Phillips Exeter Academy, Middlebury College, Harvard, and the Massachusetts Institute of Technology. To the last named he left also his large collection of books on electricity.

See A. B. Paine, *In One Man's Life* (1921).

VAMBÉRY, ARMINIUS (1832–1913), Hungarian Orientalist and traveller (*see* 27.876*), died at Budapest Sept. 4 1913.

VANBRUGH, IRENE (1872–), and **VIOLET** (1867–), English actresses, youngest and eldest daughters respectively of the Rev. R. N. Barnes, Prebendary of Exeter cathedral.

VIOLET VANBRUGH was born at Exeter June 11 1867, and married Mr. Arthur Bourchier, the actor, in 1894, their marriage being dissolved in 1918. She first appeared in London at the Criterion theatre in 1886, and later toured with Toole. In 1889 she was with the Kendals both in London and in America, and in 1892 played Anne Boleyn at the Lyceum in Henry Irving's production of *Henry VIII*. After her marriage she played leading parts in many of her husband's productions, both in Shakespearean and modern drama. Amongst her rôles may be mentioned Queen Katherine, Portia, Lady Macbeth (which she also played in 1911 at His Majesty's theatre), Yanetta in *The Arm of the Law*, and the heroines of many modern comedies by Sutro, Henry Arthur Jones and others.

IRENE VANBRUGH was born at Exeter Dec. 2 1872 and married Mr. Dion Boucicault (b. 1859), the actor, in 1901. She first appeared in London at the Globe theatre in *Alice in Wonderland*. Like her sister she played with Toole, remaining with him for four years and touring with him in Australia. Subsequently she acted with George Alexander at the St. James's theatre, with Arthur Bourchier at the Royalty and with Charles Wyndham at the Criterion in Jones's play *The Liars*. Her first notable successes were as Sophy Fullgarney in Pinero's *The Gay Lord Quex* (1899), Letty Shell in his *Letty* (1904) and Nina Jesson in *His House in Order* (1906). She also appeared with distinction in various short plays by Barrie, especially *Rosalind* and *The Twelve Pound Look*, and in other modern dramas.

VANCOUVER (*see* 27.883), in British Columbia, the chief Pacific port of the Dominion of Canada, was estimated to have a population of nearly 200,000 (the suburbs of North Vancouver, South Vancouver and Point Grey included) at the end of 1920. Vancouver proper had a population of 100,400 in 1911. As the natural western outlet for the Prairie Provinces, Vancouver had expected to gain materially by the opening of the Panama Canal. Not until the spring of 1921 was the first cargo of wheat carried to England by sea direct from Vancouver, but the success of that experiment made probable a speedy development of a new trade for the British Columbian port.

With one of the finest natural harbours in the world Vancouver has grown in importance as a port during recent years. Already the terminal point for British, Australasian and Asiatic terminal lines, Vancouver was the prospective terminal in 1921 for a new Pacific line to be inaugurated by the Canadian National Railways. Government contracts had then been let for further improvements on Burrard Inlet (the chief of Vancouver's three harbours) for greater dockage and for a system of car ferries crossing the Inlet to carry freight from the city to North Vancouver without transfer. In 1920–1 the Canadian Pacific railway built a pier of concrete and steel, equipped with all modern freight-handling devices, at a cost of $1,500,000.

The Dominion Government in recent years has erected a grain elevator with a capacity of 1,250,000 bushels. Shipbuilding became a prominent industry during the years of the World War and as many as 5,000 men were at one time employed in the shipbuilding yards. In 1920 Vancouver had approximately 543 industries employing 28,800 people. They included lumber and shingle mills, pulp and paper mills, salmon, halibut and herring fisheries, foundries and structural steel works, sugar refineries, shipyards, etc. The output in 1917 was $57,172,309. Clearing-house returns for Vancouver in 1919 were $577,670,063. In that year 108,111,090 ft. of lumber were exported by sea. The customs revenue in 1920 amounted to $9,202,940. Exports in that year were $39,535,283, and imports $49,256,913. Shipping passing through the port in 1919 was approximately 23,000 vessels of 10,691,411 tons register. Building was quiescent for several years preceding 1919. In that year the building permits amounted to $2,271,411. Shaughnessy Heights is a wealthy suburb developed since 1911 by the Canadian Pacific railway.

The foundation of the university of British Columbia brought about a closing down of the British Columbia branch of McGill University and a transfer of the staff, equipment, etc., of the latter to the new college. The newly founded university made use at first of temporary buildings in the city, but just before the war secured extensive grounds for a campus and buildings at Port Grey. Construction was delayed by the war but was begun in 1921.

Granville I., a large block of reclaimed land near the retail business district, has of late years been providing excellent sites for industries, such sites being served with trackage, wharfage, electric power, etc.

VANDERLIP, FRANK ARTHUR (1864–), American banker, was born at Aurora, Ill., Nov. 17 1864. After leaving the public schools he studied for a time at the university of Illinois and at the old university of Chicago. In 1889 he became a reporter on the Chicago *Tribune* and in 1890 was made its financial editor, but resigned in 1894 to accept the associate editorship of the *Economist*, a paper published weekly in Chicago. His contributions to it attracted wide attention and he was frequently called upon to deliver addresses. On March 4 1897 he became private secretary to the U.S. Secretary of the Treasury, Lyman J. Gage, and four months later was appointed by President McKinley assistant Secretary of the Treasury. On resigning in 1901 he was elected vice-president of the National City Bank, of New York City, and in 1909 president, serving in the latter capacity for ten years. Before taking up his work in 1901 he spent a year in Europe studying financial and industrial conditions. When the War Savings Committee was appointed by Secretary of the Treasury McAdoo, to promote the sale of War Savings Certificates during the World War, he was made chairman, serving from Sept. 1917 to Sept. 1918. He was chairman of the board of directors of the American Industrial Corporation and director in many organizations, including the Haskell & Barker Car Co., the Midvale Steel & Ordnance Co., and the Union Pacific R.R. Co. He was a trustee of the Carnegie Foundation for the Advancement of Teaching. He was the author of *The American Commercial Invasion of Europe* (1902, the result of his studies in Europe); *Business and Education* (1907); *Modern Banking* (1911) and *What Happened to Europe* (1919).

VAN DYKE, HENRY (1852–), American writer, was born at Germantown, Pa., Nov. 10 1852. He studied at the Brooklyn Polytechnic Institute, and after graduating from Princeton in 1873 and from the Princeton Theological School in 1877, he spent two years at the university of Berlin. In 1879 he was ordained a Presbyterian minister, was for three years stationed at Newport, R.I., and from 1883 to 1900 was pastor of the Brick Presbyterian Church, New York City. In this capacity his preaching gave him a national reputation. From 1900 he was professor of English literature at Princeton. During 1902–3

***These figures indicate the volume and page number of the previous article.**

he was moderator of the Presbyterian Church in the United States. In 1908 he was appointed American lecturer at the Sorbonne. He was a member of the American Academy of Arts and Letters, and in 1909 was elected president of the National Institute. In 1913 he was appointed by President Wilson minister to Holland and Luxemburg, but resigned in 1917. When after the fall of Liége in 1914 von Jagow handed to Mr. Gerard, the American ambassador in Berlin, the note to Belgium, offering full reparation for damages, in case free passage to France were granted German troops, Van Dyke flatly refused to act as intermediary. From the first he championed the cause of the Allies in the World War, and after America's entrance into the war he served as a naval chaplain. Dr. Van Dyke was an eloquent speaker. His books, both prose and in verse, give him a high place in modern American literature. Among his best works are his "outdoor essays," especially *Little Rivers* (1895) and *Fisherman's Luck* (1899). His publications include *The Reality of Religion* (1884); *The Poetry of Tennyson* (1889); *The Other Wise Man* (1896); *Ships and Havens* (1897); *The Toiling of Felix, and Other Poems* (1900); *The Poetry of the Psalms* (1900); *The Blue Flower* (1902); *Days Off* (1907); *The House of Rimmon* (1908); *Out-of-Doors in the Holy Land* (1908); *Collected Poems* (1911); *The Bad Shepherd* (1911); *The Unknown Quantity* (1912); *The Lost Boy* (1914); *Fighting for Peace* (1917); *The Valley of Vision* (1919); and *Golden Stars* (1919).

VAN HORNE, SIR WILLIAM CORNELIUS (1843–1915), Canadian financier (*see* 27.894), died at Montreal Sept. 11 1915.

VAN'T HOFF, JACOBUS HENDRICUS (1852–1911), Dutch chemist and physicist (*see* 27.896), died at Steglitz, near Berlin, March 1 1911.

VASSAR COLLEGE (*see* 27.946).—During the period 1910–20 the endowment of Vassar College grew from about $1,500,000 to $3,118,904.40 with 800 ac. in campus and farm. Student enrolment is limited to 1,000, the number that may be housed on the campus; but the pressure for admittance and the difficulty of estimating withdrawals make it impossible to maintain this limit with exactness, and the enrolment for 1921 was 1,106, the faculty numbering 142. The funds available for student aid in one form or another amounted in 1921 to $456,371.55. Students are admitted on passing the examinations set by the college entrance examination board, or by an examination covering three years of preparation in four selected subjects; this latter method takes the place of entrance by certificate from approved schools. The physical equipment of the college, exclusive of faculty residences, includes 27 buildings, seven of them dormitories, and a farm of 675 ac., with vegetable gardens and a model dairy.

Student self-government is in effective operation, the students themselves assuming responsibility for most of the regulations governing attendance and conduct, and for the management of the Students' Building and the Good Fellowship Club House, and for all extra curriculum activities, including the providing of various money-making occupations for self-supporting students. The facts that the price for rooms and board is the same for every student, the rooms being selected by lot, that there are no sororities or other clubs to which membership is not absolutely open, and that no admission fee may be charged to any campus meeting, all help to maintain a democratic spirit.

Among the notable war-time services of Vassar were the farm unit, the reconstruction units, and the training camp for nurses. In the summer of 1917 Vassar undertook the experiment of student labour on the college farm. Its success led to many similar enterprises throughout the country. Volunteers were accepted for the summer of 1918 to work in two shifts of six weeks each. They were housed in one of the campus buildings, paying their board out of their wages, working eight hours a day, and undertaking every form of farm work, as well as work in the model dairy, and drying, canning and preserving in the college kitchens. The Vassar units for service abroad, one under the American Red Cross, and a canteen unit under the Y.M.C.A., were financed by alumnae and undergraduates, with assistance from the Red Cross, and served in France. The Red Cross reconstruction unit included trained nurses, a dietitian, a doctor and social workers. Much of the rehabilitation work at Verdun was in their charge. The summer training camp for nurses was organized under the direction of the Red Cross and the National Council of Defense. Five hundred graduates of colleges for women entered upon a course of training for three months at Vassar and two years in a hospital, leading to the degree of registered nurse. One hundred and ten colleges were represented in this training camp, the probationary nurses coming from 46 different states of the Union and three British colonies. (B. J.*)

VAUGHAN WILLIAMS, RALPH (1872–), English musical composer, was born at Down Ampney, Oct. 12 1872. He was educated at Charterhouse and Trinity College, Cambridge, where he took the degree of Mus. Bac. in 1894. He studied further at the Royal College of Music, and also at Paris and Berlin. He took the degree of Mus. Doc. at Cambridge in 1901, and in 1919 received an hon. musical degree from the university of Oxford. His works include *Toward the Unknown Region* (1907); *Willow-wood* (1909); *Sea Symphony* (1910); *On Wenlock Edge* (1911); *London Symphony* (1914; Carnegie award 1917) and many fine songs, including arrangements of traditional melodies.

VAUGHAN WILLIAMS, SIR ROLAND LOMAX BOWDLER (1838–1916), English judge, was born in London Dec. 31 1838, the fifth son of the Rt. Hon. Sir Edward Vaughan Williams. He was educated at Westminster and Christ Church, Oxford, where he took his degree in 1860. He was called to the bar in 1861, and was made a Q.C. in 1889. In 1890 he was raised to the bench of the Queen's Bench division, in 1891 was transferred to the Bankruptcy division, and in 1897 became a lord justice of appeal. In 1906 Vaughan Williams was appointed chairman of the royal commission on the disestablishment of the Church in Wales. He retired from the bench in 1914, and died at Abinger, Dorking, Dec. 8 1916. His book *The Law and Practice of Bankruptcy* (1870; latest ed. 1915) is a leading authority.

VAZOV, IVAN (1850–1921), Bulgarian poet and writer, was born at Sopot in Bulgaria in 1850, and received his first education in the Sopot village school. Later on, he went to Russia to continue his studies. His first literary efforts took the form of essays and songs describing the sorrows of the Bulgars under Turkish rule, their hopes for a free united Bulgaria, their disappointment when the Treaty of Berlin divided the Bulgarian people once again. His most important work is the novel *Pod Igoto* (Under the Yoke), which has been translated into many European languages. *Pod Igoto* gives a simple and convincing picture of village life in Turkish times and of the heroes of the struggle for freedom. Among Vazov's other works are *The New Graves of Slivnitza* (Serbo-Bulgarian War of 1885–6); *The Kazalarska Czaritza; Borislav* and *Towards the Abyss*, two of his best plays. Vazov, who identified himself with the sufferings and joys of the people, is honoured throughout the country as the national poet and as a true patriot. His jubilee was officially celebrated in 1920 and he was awarded a pension from the State. He was the first Bulgarian writer whose works had been read outside Bulgaria. He died at Sofia Sept. 22 1921.

VENEREAL DISEASES (*see* 27.983).—There are three distinct diseases included under the term "venereal"—gonorrhoea, syphilis, and soft chancre, of which the first two are of primary importance in relation to public health. The advance in our knowledge of venereal disease, its prevention and curative treatment, during 1910–21, may be regarded as the outcome of experience upon a large scale based upon the following discoveries:—(1) the specific organism of syphilis by Schaudinn; (2) the inoculation of monkeys by Metchnikoff and protection therefrom by the application of a 33% calomel cream ointment; (3) the application by Wassermann of the Bordet haemolytic test to syphilis; and (4) the discovery by Ehrlich of "606" (salvarsan) as a rapid curative agent of syphilis. All four discoveries may be said to have laid the foundation of all modern methods of medically dealing with this disease.

The discussion of the whole subject at the International Medical Congress held in London in 1912, and the change in the attitude of a large section of the public and the press, eventually led up to the appointment of a British Royal Commission in 1913. The report of the Commission, published in 1916, was strongly supported by a National Council for Combating Venereal Disease, and ultimately an Act of Parliament was passed which made provision for the carrying out of its recommendations.

Scientific Advances.—During 1910–20 the so-called parasyphilitic diseases, general paralysis of the insane, and tabes dorsalis (locomotor ataxia), were proved to be the direct result of active proliferation of the spirochaeta pallida, in the brain and spinal cord respectively, of these two diseases. This knowledge was due to the discovery by Noguchi and Moore of spirochaetes in the brains of 12 out of 70 brains of persons dying of general paralysis. Confirmation of this was soon at hand in all civilized countries where these diseases occur. Mott was able to find the spirochaete pallida in the brains of 66 out of 100 successive fatal cases. Inasmuch as the cerebro-spinal fluid invariably gives a positive Wassermann reaction in general paralysis, it may be inferred that the spirochaete is always present. A large experience in the services during the World War has shown that in spite of modern energetic treatment a certain proportion of cases give a positive reaction of the cerebro-spinal fluid, and there is evidence to show that when generalization of the organism takes place in the secondary stage, its implantation in the substance of the central nervous system may occur; and it is these cases which subsequently develop this fatal and incurable disease, general paralysis; incurable because neither the mercury nor the arsenobenzol compounds are able to enter the substance of the nervous system and destroy the specific organism. This is a practical point of the greatest significance, for it shows that the only way to avoid this and other fatal incurable diseases is the adoption of curative treatment in the primary stage, as emphasized in the report of the Royal Commission. But even better is the adoption of prophylactic measures, by which the organism is killed while it is still on the surface of the body; for many persons may not know that they have been infected owing to the fact that the sore is not of a typical nature and in a number of cases is therefore regarded by the doctor or patient as a soft sore or chancroid; consequently only local treatment is adopted; or it may be that the sore causing little pain or discomfort leads to the patient neglecting treatment until it is too late.

A. Marie and Levaditi have recently put forward the view that there are two forms of specific organism—a neurotropic spirochaete, which seeks the nervous system, and a dermatotropic one which seeks the skin. Although there are no morphological differences discoverable in the organisms, yet certain clinical epidemiological and experimental facts support this argument.

Prevalence.—The returns of the Registrar General in England, as was shown in the report of the Royal Commission, are liable to many fallacies, which invalidate the accuracy of any deductions that could be made from them. The returns of deaths, which may unquestionably be assumed to be due to syphilis with the exception of general paralysis and aneurism, are very limited; yet we know that a large proportion of the deaths from organic brain and spinal cord diseases is due to this cause, likewise a large proportion of valvular and other diseases of the heart. Evidence was given at the Royal Commission showing that 5% of syphilitics subsequently developed general paralysis, also that 10 years is the average time for the brain symptoms to develop and several years then elapse before a fatal termination. It follows that the prevalence of syphilis in a community 12 to 13 years previously may be gauged by the percentage of deaths from general paralysis in any given year. Possibly this would be a more accurate method of estimating, to some extent, the prevalence of syphilis in a community than even the statistics afforded by the early treatment centres, for a large number of people suffering with the disease, even now, do not come under observation on account of avoiding the social stigma.

Death from general paralysis is about four times as great in men as in women; it may be assumed therefore that syphilitic infection is four times as frequent in men as in women. The incidence of general paralysis is about the same in all classes but it diminishes as we rise in the social scale in women. The inference is obvious as regards venereal disease and the social status of women. In the juvenile form due to congenital syphilis it occurs equally in the two sexes. Gonorrhoea, not being a direct cause of death, although of many chronic and even fatal diseases especially in women, rarely enters into the returns.

An attempt was made by the Royal Commission to estimate by the application of the blood test the prevalence of syphilis. Thus the present writer tested the specimens of blood withdrawn from a vein by Sir John Collie from 500 apparently healthy men applying for service in the L.C.C., and found that 9·2% gave a positive reaction. These, and many other statistics from various sources, notably hospitals, poor-law infirmaries, asylums for lunatics, idiots and imbeciles, and institutions for the blind and the deaf, published in the report, showed that a large percentage of the population had been infected with syphilis, and that a very large proportion of these people were suffering from a disease or disability directly or indirectly due to infection.

From the mass of evidence collected it was roughly calculated by the Royal Commission that probably 10% of the population had been infected with syphilis. This corresponds with the statistics of the United States:—

> "The results of a survey by the Wassermann test of adults admitted to hospitals (apart from venereal clinics) in five large cities of the United States showed 9·5% positives out of a total of 15,264. Vedder obtained 13% positive reactions in 11,933 recruits for the U.S. army in 1916, 15% of 856 candidates for the police force, and 5% of 3,203 candidates for commissions in the army. It is worthy of note that in the same locality that gave 5·8% positive Wassermanns, Warthin found evidence of syphilis in 30% of post-mortem examinations. Hence Jeans concludes that the minimum of syphilitics in the United States is 10%, and the probable percentage twenty."[1]

It was assumed from the evidence before the Royal Commission that a much larger percentage of the people had suffered with gonorrhoea; inasmuch as one attack of this disease does not give immunity and relapses of an apparently cured infection frequently occur, it follows that reliable statistics of admissions for gonorrhoea are difficult to ascertain by the rate of admissions. Altogether it would not be an unfair estimate to assume that 20% to 30% of the population prior to the World War had suffered with venereal diseases.

The Annual Report of the Chief Medical Officer of the Ministry of Health for 1920 stated that the Ministry had based its policy upon the recommendations of the Royal Commission on Venereal Disease, 1916. The principal recommendations were thus summarized:—(*a*) Confidential registration of cause of death. (*b*) Extension of facilities for diagnosis. (*c*) Organization by the local authority of means of free treatment for all classes at convenient hours and under suitable conditions. (*d*) Improved professional and public education. (*e*) A grant-in-aid of 75% of total cost incurred in approved schemes. (*f*) Treatment in army and navy, poor-law institutions, prisons, etc. (*g*) Prohibition of all advertisements of remedies and unqualified practice. (*h*) Recognition by the Government of the National Council for Combating Venereal Diseases.

The Commission recommended that "no system of notification of venereal diseases should be put in force at the present time," and they condemned "unqualified practice" by chemists, herbalists and others as "disastrous" and "one of the principal hindrances to the eradication of those diseases," and they stated that "the most urgent requirement is to secure to every patient the freest and earliest possible access to medical assistance when there is suspicion of venereal disease. This implies, *inter alia*, that all temptation for the patient to have resort to an unqualified person shall be removed."

The National Council for Combating Venereal Diseases was established to promote and assist by propaganda and lectures the programme of the Royal Commission; it had the approval and support of the Local Government Board and of the Ministry of Health. Still, in spite of moral teaching, lectures, propaganda and early treatment centres, an alarming incidence of venereal disease occurred in the British armies and in those of the Dominions during the World War. Some idea of the prevalence of these diseases may be gained by reference to a statement by the late Sir William Osler (*Lancet*, May 26 1917):—

> "The last quoted figures for the British army at home are (Hansard, April 23): 71,000 cases of gonorrhoea, 21,000 cases of syphilis, and 6,000 cases of soft chancre. In the Canadian army to March 31 1917, there have been 18,335 cases of venereal disease—figures which have stirred public opinion in the Dominions to boiling point."

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[1] Medical Science Abstracts and Reviews. Published for the Medical Research Committee, vol. i., 1919–20, p. 397.

There are many facts which show that there has been, in consequence of the war, and in spite of the application of the measures recommended by the Royal Commission, a very considerable increase in the prevalence of venereal diseases in the United Kingdom (see evidence by Dr. Sequeira, Miss Ettie Rout and others in the report of the Committee of the Birth-Rate Commission).

Table 1, taken from the Annual Report of the Chief Medical Officer of the Ministry of Health for 1920, indicates the extent to which the clinics were utilized in 1920. From this table it appears:—(*a*) that in the fourth year of the scheme there were approximately 85,000 cases of venereal disease and 19,000 cases which proved not to be venereal disease, the total number of new cases being 105,000 and the attendances 1,488,000; (*b*) that there was a rapid increase of "new" cases of venereal disease in 1918 and 1919 and a stationary position in 1920. The term "new cases" can only be relative, and does not afford a basis for calculations of incidence; (*c*) that if the army estimate of the relative frequency of gonorrhoea and other venereal diseases ($2\frac{1}{2}$ to 1) be correct for the civil community, only a small proportion of the cases of gonorrhoea in the country came under treatment at the clinics; (*d*) that the total attendances (and the ratio of attendances to patients) had increased greatly, and that the number of persons who were apprehensive of their condition and who came to the clinics for diagnosis had increased—two facts which suggest that the clinics were better appreciated.

TABLE 1.—*Experience of British Clinics, 1920.*

England and Wales	Number of persons dealt with for the first time.						Total Number of Attendances	Number of Clinics at end of year
	Syphilis	Soft Chancre	Gonorrhoea	Total V. D.	Other than V. D.	Total new cases		
1917	..	..	..	..	..	29,036	204,692	113
1918	26,912	806	17,635	45,353	6,622	51,975	488,137	134
1919	42,134	2,164	38,499	82,797	15,447	98,244	1,002,791	160
1920	42,805	2,442	40,284	85,531	19,654	105,185	1,488,514	190

The total expenditure of British local authorities was £116,000 in 1917–8, £214,000 in 1918–9, £287,000 in 1919–20; towards which the Ministry of Health provided grants of £84,000, £145,232, and £224,716.

Owing probably to financial reasons and inefficiency of some of the clinics there were indications of a change of policy by the Ministry of Health, for in the above-mentioned report it was stated:—

> "It cannot be too clearly understood that the best way of dealing with most cases of these diseases is through the skilful private practitioner. For a substantial portion of this problem the public clinic should be looked upon as a temporary organization pending the time when the practitioner is ready, available, competent, and properly equipped to undertake effective treatment. Certain patients require hospital treatment, but the authority should not needlessly establish institutions if and when the ordinary channels of medical practice are available and reliable, or can be made so."
>
> "I am bound to advise that if the work of these clinics is not properly done—if it is casual, superficial or perfunctory—they should be disapproved by the Ministry. It is better to have only a few clinics well-organized and scientifically controlled than a large number which are not thus administered. These statements indicative of a change of policy in the future may find an explanation in a study of the statistics (see Table 2) relating to the number of patients discharged from venereal disease centres as having completed treatment. This table shows that 29% of syphilitics and 33% of persons suffering from gonorrhoea ceased to attend before completing a course of treatment. Nearly three times as many as those who were discharged after completion of treatment and observation and accordingly can be definitely tabulated as cured and non-infective. These facts seem to show the necessity of adopting some disciplinary measures to combat the evil, such as exist in the United States."

TABLE 2.—*Patients at British Treatment-Centres.*

	Syphilis	Gonorrhoea	Total
(1) Number of persons dealt with during 1919 and 1920	105,619	87,792	193,411
(2) Number of persons who ceased to attend:—			
(*a*) before completing a course of treatment	30,459	28,869	59,328
(*b*) after completion of a course of treatment, but before final tests as to cure	9,350	6,481	15,831
(3) Number of persons discharged after completion of treatment and observation	8,240	13,300	21,540
(4) Number of persons who on the 1st of Jan. 1921 were under treatment or observation	47,894	28,822	76,716

Prevention.—Sir Archdall Reid, in his work on the prevention of venereal disease, complains that no reference was made in the report of the Royal Commission of the value of Metchnikoff's discovery. The National Council strenuously opposed what they termed "the packet system" but the facts had to be faced. Early curative treatment and moral suasion by propaganda and lectures had not effected the purpose which most of the members of the Royal Commission believed and desired they would. Sir Bryan Donkin, in a letter to *The Times* in Jan. 1917, first called attention to the necessity of the adoption of immediate self-disinfection in accordance with the discovery of Metchnikoff. He cited the remarkable success attending the simple measures of immediate self-disinfection adopted at Portsmouth by Sir Archdall Reid. Reid states in his book that one in 1,000 solution of permanganate of potash, carried in a flat screw-stoppered bottle with a swab of cotton wool, proved a simple and cheap means by which he obtained successful results. The directions were that the soldier should immediately after exposure to infection thoroughly swab the exposed surfaces with the fluid; and he states on p. 130:—"Immediately venereal disease vanished from my units. For six months not a single case occurred. In two years and four months, during which quite 20,000 men must have passed through my hands, only seven men were infected. Of the seven cases, six of gonorrhoea and one of syphilis, all could be accounted for by drink or negligence."

A controversy as to the right or wrong of such treatment thus arose which eventuated in a number of eminent medical men leaving the National Council for Combating Venereal Diseases to form the Society for the Prevention of Venereal Disease by immediate self-disinfection. While not discouraging continuance of efforts by moral persuasion, athletics, education and early curative treatment, this Society realized that immediate self-disinfection either by calomel cream or permanganate solution, was essential supplement to the before-mentioned measures; recognizing as the members of this Society do, that a large proportion of the adult population are not, and in our present social conditions, cannot or will not remain continent. It may be assumed that both the societies are animated with the same desire, and it was hoped that by the establishment of a special committee of the Birth-Rate Commission in June 1920, in order to take expert evidence on the value of the various measures for the prevention of venereal diseases, unanimity on the part of the two societies might arise. A report on "The prevention of venereal disease" by this Committee was issued in Feb. 1921. The report states (p. 21):—"The Committee is of opinion that any administrative or legal difficulties that may at present prevent individuals, who desire to do so, from purchasing such disinfectants from chemists, on their own initiative as a protection against venereal disease should be removed; and that the section of the Act dealing with this matter should be rendered more explicit and amended if necessary;" but up to June 1921 no result had been achieved as regards action by the Government or by way of settling the essential point of difference between the two societies.

The supporters of the S.P.V.D. maintain that if 183 curative treatment centres (which cost the State £300,000 in 1920) are necessary, a similar number of prophylactic centres are more necessary. Now the National Council advised the Government to establish what they call Early Ablution Centres where skilled but delayed disinfection would be carried out. There are so many obvious defects in this system when applied to the civil population, together with the enormous cost which would be thrown upon the present overburdened ratepayers, that even in June 1921 there was only one in operation (in Manchester), and only four other possible prospective centres. The London County Council and many boroughs had refused to adopt this method of dealing with these diseases, and most thinking people are of opinion that the onus of keeping clean and thus avoiding the spread of infection should be thrown on the individual who lays himself open to infection by promiscuous intercourse. In respect to prophylaxis therefore the policy of the National Council had entirely failed to deal with the problem, and it was the contention of the S.P.V.D. that the only practical preventive measure is, " immediate self-disinfection " and that all hindrance to facilities, such as the law forbidding chemists in England to sell prophylactics for the specific purpose of rendering an individual safe, when contemplating promiscuous sexual intercourse, should be abolished.

The National Council and its supporters could not deny the fact that immediate self-disinfection, if properly carried out, was an efficient method of prophylaxis; but on moral grounds they strongly objected to its employment, as condoning promiscuous sexual intercourse and thereby leading to increased risk of infection and a false security, because it could never be carried out efficiently by the civil population. Colonel Harrison, adviser to the Ministry of Health, who was responsible for its application in the army, supported the National Council in this contention. He stated that his experience showed that he was wrong in his estimation of the value of self-disinfection as a means of prevention of venereal disease in the army, and that it did not meet with the success that he anticipated. On the other hand there is the experience of Sir Archdall Reid, and the equally successful results obtained in the navy by Commander Boyden (see p. 227, Report of Birth-Rate Committee, and Archdall Reid's *Prevention of Venereal Diseases*, appendix pp. 437–442). Also Capt. Walker's results: " During Aug. and Sept. 1917 (64 days) a little over 5,000 officers and men came on leave to Paris, of whom 1,038 developed venereal disease or about 20 per cent. This closed the leave to Paris. Leave was reopened on Nov. 8 1917. . . ." " The actual results from Nov. 8 1917 to March 31 1918 was stated by Capt. Walker to be only 3% of infections among the men on leave to Paris." This great reduction was the result of prophylactic measures (*Public Health*, Sept. 1918). Although on a small scale compared with those of Col. Harrison, these results tended to prove that the personal equation plays an all-important part not only in respect to the faith, intelligence and desire of the man who employs self-disinfection as a means of prevention, but in the faith, intelligence and desire of the commanding officers and medical officers whose duty it is to see that the excellent army instructions, which were promulgated, were enforced and the necessary disinfectants provided. Indeed, had disciplinary measures been adopted and applied both to the individuals who became infected and to the medical officer in charge if carelessness or negligence in carrying out the instructions had been proved, far better results would no doubt have been obtained. Moreover, early detection of the practice of men seeking infection in order to escape service at the front, which became so prevalent as to necessitate classification as " self-inflicted wound," would have been easy and the practice prevented. Again, it is argued against chemists being allowed to sell specific prophylactics that it would lead to increase of venereal disease by the assumption of the purchaser that they might serve as a curative agent. Perhaps the strongest argument in favour of the efficacy of the adoption of immediate self-disinfection as the best means of prevention of venereal disease is the fact that at Portsmouth, where Sir Archdall Reid carried on his work, the Medical Officer of Health, Dr. Mearns Fraser, overcame the opposition of clergy and others to this mode of treatment, and advice and information on immediate self-disinfection was in 1921 given there by posters and on application to the Health Department at the town hall.

The policy of the Ministry of Health was thus stated by the Chief Medical Officer of the Ministry of Health:—

> Facilities are now being provided for disinfection, as well as irrigation and other intermediate treatment, at the various kinds of treatment centres approved by the Ministry and elsewhere under medical supervision (Annual Report, 1920, p. 122).

The experience of the American army, with State control in the United States, supports the view that, to make any system efficient, disciplinary measures and notifications are desirable, but this can only be done when all obstacles to prevention are removed. Ignorance, prejudice and false sentiment must be banished and the public educated to regard venereal disease like any other infective disease:—

> " Prophylactic treatment stations were established during the war in all the camps and in towns in the vicinity of camps in the United States and in France. These stations were under the supervision of American officers and in charge of carefully trained non-commissioned officers. Soldiers were not only instructed in the course of their training that prophylactic treatment does, in many cases, prevent the development of venereal disease but they were also under orders to apply for treatment after having exposed themselves. If a soldier developed venereal disease his record was examined to ascertain whether prophylactic treatment had been taken and if this duty had been omitted, the soldier was subjected to trial by court-martial to ascertain why preventive measures had not been undertaken and to undergo punishment in case neglect became evident. Inquiry into the effectiveness of this system establishes the fact that under favourable conditions, prophylactic treatment was effective in over 90% of the cases received. It was found that apparent failures resulted from four causes:—(*a*) delay in seeking treatment; (*b*) incompetence on the part of the attendant giving the treatment; (*c*) previous history of venereal disease indicating a recurrent attack; (*d*) false statements on the part of the soldier." (" Combating Venereal Disease in Armies," *International Journal of Public Health*, published by the League of Red Cross Societies, Jan.–Feb. 1921, vol. ii., No. 1.)

State Control.—The measures adopted in the United States to control venereal disease are described in the reports of the Public Health Service. These measures are as follows:—(1) Notification of cases of venereal disease to the health authorities, the records to be secret; (2) isolation and treatment in detention hospitals of infected persons who are unable or unwilling to take measures to prevent their becoming a menace against others; also measures for the suppression of prostitution; (3) educational measures, including information of the general public concerning the nature and manner of spreading of venereal diseases and the steps to combat them; (4) extension of facilities for early diagnosis and treatment; (5) prohibition of prescribing by druggists. These principles have been carried into effect in many of the states by rendering persons who are a danger to the public health on account of venereal disease subject to quarantine, and certain standards are laid down which have to be followed before discharging patients as non-infectious.

In Pennsylvania the following measures have been adopted. The work of the Department has been divided into three parts: medical, educational, and law enforcement. There are certain measures concerning the Medical Department, making for economy and efficiency, which are at variance with those adopted by the British Ministry of Health. These are as follows:—

> There are 30 public clinics for the treatment of venereal disease, over which the Department of Health has entire supervision and for which it assumes all financial responsibility. In these clinics free treatment is given to those patients whose economic condition will not permit treatment either by private physicians or by clinics charging a fee. Upon entrance to clinics, patients are questioned as to their ability to pay for services. Those able to pay a private physician are referred to outside doctors who are registered with the clinics. If in position to pay only a small sum, they are referred to hospital clinics which charge a nominal fee. Indigent patients are treated free in the state clinics.
>
> Continuance of treatment of a patient is insured by sending a notice to return for treatment. If this does not effect a return, the clinic makes use of the legal machinery at the disposal of the Department of Health.
>
> Through an Act of the State Legislature passed in 1921, there has been placed at the disposal of the Department of Health a modern 400-bed hospital for the care and treatment of syphilitic patients who are menaces to the public health.
>
> Immediate treatment (venereal prophylaxis) for those exposed to disease has been approved by the Pennsylvania State Department of Health. Prophylaxis as used in the army by means of stations is impractical in civilian life. Tubes containing material for self-disinfection are given the Department's approval, after

being tested. The material usually employed is after the formula of Metchnikoff. The tubes are on sale in drug stores.

Self-disinfection in Women.—All authorities are agreed that self-disinfection in women under most circumstances is not likely to be attended by the same satisfactory results as in men, on account of the different anatomical construction of the genital organs. Dr. Morna Rawlins and Lady Barrett, in giving evidence before the Birth-Rate Commission in England, said that they would not recommend its use for several reasons. It would be employed for contraconception, and if the permanganate solution were used it might lead to the spread of the infection to the uterus. Sir Archdall Reid in his book discusses the subject, and refers to the opinion of Miss Ettie Rout, who was for years in France with the New Zealand and Australian forces. Although Miss Rout was not a doctor she had an extraordinary experience and knowledge of the subject. She points out that there is far more danger to women in outdoor relationships than in indoor relationships, and she supports this statement by the fact that the weekly average of soldiers infected was doubled and afterwards still further increased when the licensed houses in Havre were put out of bounds in April 1918, simply because immediate self-disinfection was not available to the women (or to the men) and they were not under medical supervision. Similarly in Amiens, Abbeville and other places, the amount of disease increased for the same reason. In her evidence before the Committee of the Birth-Rate Commission she stated that a weak permanganate solution was in use at the St. Louis Hospital, Paris.

Syphilis and Pregnancy.—Dr. Amand Routh, who has made a special study of this subject, estimates that at least 20% of the ante-natal and neo-natal deaths are due to congenital syphilis. Experience shows that treatment of the mother is very satisfactory, for she can be cured and the offspring prevented from becoming congenital syphilitics.

Modern Curative Treatment.—Sufficient time has now elapsed since Ehrlich's great discovery of the arseno-benzol compound known as salvarsan or "606" to appraise the value of this drug or its equivalents in the treatment of syphilis. It was at first believed that it would entirely replace the old mercurial treatment, but the greatest success has been attended by a combination of the two. Numerous other arseno-benzol compounds of a similar nature to the original "606" have since been introduced, and, although it is generally considered that they have not such a powerful influence on the disease, yet neo-salvarsan or its equivalent preparations are now almost universally employed, because the technique of administration is so much simpler. When salvarsan was introduced, a misapprehension of its curative effect arose in the mind of the public and many members of the profession; for it was believed that a few intravenous injections of the drug would suffice to effect a cure, and this might seem probable if, in conjunction with the patient showing no active symptoms, the blood previously positive in its reaction became negative. Under such circumstances the patient believed, and sometimes was led to believe, that no further treatment was necessary. Experience has shown that not infrequently serious consequences were the result. Therefore most authorities recommend what is termed "intensive treatment," namely a course of intravenous and intramuscular injection of an arseno-benzol compound combined with mercury in the form of intramuscular injections or inunctions. Periodic courses extending over two years are required. The Wassermann reaction of the blood is taken before treatment is commenced and the strength of complement fixation estimated before and after each course of treatment. The curative effects of the drug can thus in a measure be estimated. For ill-effects of salvarsan treatment and standards of cure, see pp. 114–5, *Annual Report of the Chief Medical Officer of Ministry of Health*, 1920. It will be observed that of 193,411 persons dealt with during 1919–20 there were 59,328 who ceased to attend before completing a course of treatment. Many of these were still infective.

Evidence given before the British Royal Commission showed that energetic "intensive treatment" employed in the primary stage before the Wassermann reaction was positive and therefore the spirochaete had become generalized in the body, had led to a complete cure in a number of cases. This was shown by the fact that although the spirochaete of syphilis had been found in the sore yet the Wassermann reaction was negative and remained so. A still more convincing proof of cure, in such cases, was the fact that re-infection has been known to occur. It is necessary to state that, owing to faulty technique and short cuts in performing the Wassermann reaction, cases have been reported as negative by one observer and positive by another. In some of these cases the patients were obviously suffering from disease, the result of a previous infection, in others there was no clinical sign. The Commission rightly laid stress upon the necessity of employing a standardized method to avoid error and thus avert very serious consequences, medical and medicolegal. Most authorities lay more stress upon the examination of the cerebrospinal fluid than the blood in diseases of the nervous system, presumably of syphilitic origin, as a means of diagnosis. Experience shows that many persons may be in good health or at any rate not suffering from any obvious clinical syphilitic disease, and yet give a positive Wassermann reaction of the blood, for the organism may be locked up in some functionally indifferent tissue, but a positive reaction of the fluid shows that the spirochaete is in the central nervous system and if it is not causing any clinically recognizable symptoms there is a positive danger that it may at any time do so. When once the cerebrospinal fluid is found to give a positive Wassermann reaction it is doubtful whether any treatment will make it negative. This fact shows how extremely difficult it is for the drug to attack the organism when once it has gained access to the substance of the central nervous system. It was for this reason that Swift and Ellis introduced the treatment of general paralysis and tabes by spinal intrathecal injections of salvarsanized serum; but it was found to have no advantages over the usual methods of treatment, and only a few authorities now employ it and claim successful results.

All those who have had experience in the prevention and treatment of venereal disease consider gonorrhoea and its complications the most difficult to deal with. It is not implied therefore that the effects of gonorrhoea are so serious as syphilis, but owing to the fact that the organism when it has invaded the deeper structures is not easily eradicated, a patient thinking himself cured, because he suffers no pain, may unwittingly infect his wife or other women. As there are immense numbers of these carriers it is easily seen how difficult is the problem of prevention of gonorrhoea; and this difficulty is greatly increased by the fact that this disease is not looked upon as serious; whereas all the evidence given before the Royal Commission showed that many serious diseases especially affecting women were due to gonorrhoeal infection. It is a frequent cause of disease of the reproductive organs, and sterility is a result. Its ill-effect upon the health and happiness of the nation is far greater than is generally imagined. If the complex medical and social problem involved in venereal infection is to be dealt with nationally on sound lines it is essential that the full confidence and support of the public must be obtained. This can only be done by getting the people, as the late Sir William Osler said: "to realize that it is a great communicable disease, many of whose victims are innocent."

The following works may be consulted for further information:—*System of Syphilis* (Oxford Press); The Report of the Royal Commission on Venereal Disease with appendices (1916); Report on the Prevention of Venereal Disease by the Special Committee of the Birth-Rate Commission; *Manual of Military Urology* (American Red Cross Association); *Medical Science*, abstracts and reviews, published by the Council of Medical Research (vols. i. and ii.); Sir William Osler, "The Campaign against Syphilis," *Lancet* May 26 1917; Sir Archdall Reid, *The Prevention of Venereal Disease;* Reports of the Public Health Service, U.S.A., 1920; Report of the Chief Medical Officer of the Ministry of Health, 1920. (F. W. Mo.)

VENEZUELA (*see* 27.988).—The permanent additions made to the population of Venezuela by immigration during 1910–20 were slight. The official year book for 1912 stated that the total number of persons arriving at Venezuelan ports in that year was 9,615, while the total departures were 7,981. It gave the approximate pop. of the republic as 2,632,754.

Venezuela's constitution of 1909 declared that the republic be composed of 20 states, 2 territories, and a federal district. These states made provisions regarding their boundaries and territorial divisions by laws passed prior to March 16 1912. In Oct. 1912, the Federal district was made up of two departments, Libertador and Vargas, which were subdivided into 20 parishes or municipalities. The states had been divided into 147 districts and these subdivided into 597 municipalities. The territories had been organized into 10 municipalities. The Venezuelan constitution of 1914 allowed the main territorial divisions to remain as they were when established under the constitution of 1909. On June 14 1916, Congress enacted an organic law for the Government of the Federal territory of Delta Amacuro, which divided it into four municipalities and vested its government in the president of Venezuela according to certain prescriptions.

Communications.—Twelve railroads of some importance were operating in Venezuela in 1920 with a total mileage of about 600 m., and an invested capital of some 200,000,000 bolívares. Steamships plied up the Orinoco river to Ciudad Bolívar and thence to ports in the interior. Some ocean vessels entered Lake Maracaibo. La Guaira and Puerto Cabello were ports of call for important American and European steamship lines. During the rule of President Gómez, beginning in 1908, considerable attention was given to interior communications. Shortly after becoming president he conceived the idea that the construction, improvement, and repair of important Venezuelan roads was a most urgent public work. From Dec. 1908 to Dec. 1913, the construction or repair of several highways was undertaken by the national Government. Among these were the roads from La Guaira to Caracas, from Caracas to Guatire, and from Rubio to Uracá, which was macadamized. In some years the expenses for highway construction and maintenance constituted the major portion of the expenditures of the Department of Public Works. Plans were made for a comprehensive system of roads. On Aug. 11 1916, a presidential decree provided for the construction of the great western highway from Caracas to San Cristóbal through the states of Miranda, Aragua, Carabobo, Cojedes, Portugesa, Zámora, and Táchira. On Dec. 19 1915, another decree provided for the construction of the great eastern highway from Caracas through the states of Miranda, Anzoátegui, and Bolívar to the interior of Guiana.

Foreign Commerce.—According to official statistics in 1913 the total imports of Venezuela amounted to 93,420,225.90 bolívares. (Nominal value $.193 or 9.4d.) The imports from the leading countries were as follows: 35,979,980.03 bolívares from the United States; 22,260,593.57 from the British Empire; 13,404,073.91 from Germany; 8,218,689.19 from Holland; 5,666,611.43 from France; 3,744,276.53 from Spain; 2,878,928.50 from Italy; 1,184,266.30 from Belgium; and 66,575.84 from Colombia. In 1913 the total exports of Venezuela amounted to 152,765,749.04 bolívares. The countries taking the largest shares were: France, 51,751,523.27 bolívares; the United States, 43,914,670.33; Germany, 28,827,814.24; England, 11,394,058.90; Holland, 3,675,353.30; Colombia 2,151,434; Austria-Hungary, 2,051,273 and Italy, 1,308,325. According to statistics compiled by the Pan-American Union, the chief imports into Venezuela in 1918, exclusive of parcel post shipments, were as follows: cotton textiles, 16,709,753 bolívares; drugs and medicines, 4,242,157; machinery, 3,190,315; flour, 3,039,409; automobiles and accessories, 1,562,495; leather and leather goods, 1,135,198; paraffin, 1,625,949; wines, 1,303,388; stearin, 975,865; and soda, 921,384. The total imports in 1918, according to official statistics, amounted to 77,244,950.23 bolívares. Imports from the chief countries were as follows: United States, 46,564,983.71 bolívares; England, 22,396,903.23; Colombia, 2,264,753.23; Spain, 2,240,538.71; France, 1,770,621.41; Italy, 920,720.50 and Holland, 759,104.55. The chief articles exported in 1918, according to figures compiled by the Pan-American Union, were as follows: coffee, 38,568,176 bolívares; cacao, 19,798,054; rubber, 6,947,320; sugar, 5,481,139; corn, 3,987,698; cattle and hides, 3,249,060; tobacco, 3,179,902; gold, 2,348,914; frozen beef, 2,545,935; asphalt, 1,560,193; and petroleum, 1,041,742. According to official statistics, the total exports of Venezuela in 1918 came to 102,659,153.74 bolívares. The countries taking the largest quota were: United States, 46,382,272.70 bolívares; Holland, 17,640,887.74; England, 17,098,261.82; France, 10,068,966.33; Spain, 8,913,919.10; Italy, 1,142,422; Cuba, 719,151.05; and Colombia, 612,203. During the World War the trade of Venezuela with the Central Empires altogether ceased, while her commerce with the Allies and with neutral Powers much increased, the United States securing a large part of the trade.

Government.—On May 18 1914, a Congress of Deputies from the Venezuelan states adopted a new constitution for their union. That constitution declared that the Venezuelan states reciprocally recognized their autonomy and equality, and that they retained all sovereignty which was not delegated to the central Government by the constitution. The states agreed to promulgate constitutions that would harmonize with the fundamental law and agreed to see that the national constitution, laws, and orders were obeyed. Early in June assemblies at the capitals of the respective states ratified the new form of Government, which was accordingly proclaimed in force June 13 1914. This constitution provided that the right of suffrage was to be exercised by male citizens 21 years of age or over. Foreigners who took part in political controversies (*contiendas*) could be arrested, confined, or expelled by order of the president. Executive power was vested in a president and a cabinet of ministers appointed by him. The president was to be elected for a seven-year term by the secret vote of Congress. During the temporary absence of the president from the capital his functions were to be exercised by a minister whom he designated. Among the extensive powers vested in the chief executive were the following: to administer the Federal district and the two Federal territories; to issue decrees and regulations for the better execution of the laws; to negotiate loans as provided by Congress; to grant certificates of naturalization; to appoint national officials whose appointment was not otherwise provided for; to convoke an extraordinary session of Congress; to declare war when authorized by Congress; to negotiate treaties with foreign nations; and to proclaim martial law throughout the republic. Article 137 of the constitution stipulated that the provisional president and vice-presidents of the republic should hold office until the new constitutional functionaries were inaugurated. Article 138 stipulated that the commander-in-chief of the national army should exercise his functions until the inauguration of the constitutional president of the republic. Legislative authority was granted to a Congress composed of a Senate and a Chamber of Deputies. The Senate was to be composed of two Senators from each state chosen by its Legislative Assembly for three years. The Chamber of Deputies was to be composed of members chosen from every state and from the Federal district by popular vote for three years at the ratio of one deputy to every 35,000 inhabitants. Congress was to meet annually on April 19 at the capital for a session of 70 days. Judicial authority was vested in a Supreme Court designated the *Corte Federal y de Casación* and in other tribunals established by law. The Federal Supreme Court was to be composed of seven judges who were to be elected by Congress for a term of seven years. Clauses defining powers of this court provided that it should take cognizance of accusations against the president and other high officials. It was given jurisdiction over cases involving claims against the nation, cases relating to foreign diplomatic agents in Venezuela, cases arising from contracts made by the president, and cases involving conflicts between laws or decrees. State or Federal.

Army and Navy.—In 1912 Venezuela purchased a vessel of about 1,000 tons from the United States, which was re-christened the "Mariscal Sucre" and made the flagship of the navy. About 1915 the Venezuelan navy was composed of two cruisers, three gunboats and two transports with a personnel of a few hundred men. The standing army was composed of some 9,000 infantry, artillery and cavalry. In addition there was a reserve which was estimated to consist of about 100,000 men. By a law published in June 1919, military service was made compulsory for all adult male citizens, with certain exceptions. Every man was obliged to serve in the army or navy for two years in peace-time and during war at the president's pleasure. Until they became 45 years of age those soldiers were to compose part of the reserve. A decree of April 17 1920 provided for a military aviation school at Maracay.

Education.—According to the official year book for 1912 there were in that year in the republic 1,408 elementary schools attended by 45,515 children. There were in attendance at 52 graded schools 4,853 pupils. On Dec. 19 1914 a fundamental law concerning education was enacted. This law provided that primary instruction should be compulsory and free for all children from 7 to 14 years of age. Secondary education, furnished in *lyceos* and *colegios*, should comprehend two successive courses: one of a general character, and another of a special type giving training in philosophy and letters, in physical and natural science, or in physical and mathematical science. A decree of March 1915 provided that the national Government should maintain a school of fine arts, furnishing instruction in music, declamation and the plastic arts; commercial schools at Caracas, Maracaibo, and Ciudad Bolívar; a school of arts and crafts for males and another for females; and a training school for nurses. In 1916 decrees were issued which founded at Caracas a number of institutions for higher education, such as a school of political science, a school of pharmacy, and a school of dentistry. Decrees were issued in the following year which established in that city a museum of natural history and an institute of fine arts. Besides the facilities furnished by various educational institutions in the capital city, there is the *Universidad de los Andes* at Mérida.

Finances.—The financial condition of Venezuela has improved in recent years. On Dec. 31 1913, the total indebtedness of the Venezuelan Government amounted to 176,460,251.14 bolívares. Of this 61,607,179.53 bolívares was domestic, while the balance was foreign debt. The domestic debt was thus classified:—

	Bolívares
National domestic debt, consolidated at 6%	54,699.59
Script at 1%	38,165.62
National domestic debt, consolidated at 3%	59,960,572.36
National domestic debt, consolidated without interest	1,204,639.83
Current indebtedness	349,102.13
Total	61,607,179.53

The foreign debt was as follows:

	Bolívares
National debt at 3% by diplomatic conventions	9,843,791.61
Provisional script (Spanish)	1,600.00
Diplomatic debt at 3%, issue of 1905	105,007,680.00
Total	114,853,071.61

In Aug. 1914 the Government of Venezuela issued a decree ordering a reduction in the number of offices and a decrease of 25% in official salaries. This was followed by other economies. Claims of French citizens against Venezuela amounting to 13,000,000 bolívares were adjusted by a protocol of Jan. 14 1915, at 3,000,000 bolívares. For the satisfaction of this obligation a non-interest bearing debt was provided, the arrangement being that it was to be cancelled by the payment by Venezuela of 57,692.31 bolívares monthly. The national revenue for the fiscal year 1917–8 amounted to 53,253,686.06 bolívares; while the expenditures came to 52,948,924.48 bolívares, leaving a surplus of 304,761.78. Revenues for that year were derived from the following sources:—

	Bolívares
Customs duties, consular fees, etc.	24,544,127.42
Cigarette tax	6,317,345.85
Liquor tax	7,437,183.09
Salt monopoly	6,725,814.75
Stamps	4,295,891.95
Stamped paper	177,520.90
Inheritance taxes	179,965.92
Other sources	3,575,836.18
Total	53,253,686.06

On July 13 1919, the national domestic debt of Venezuela was as follows:—

	Bolívares
National domestic debt, consolidated at 3%	46,623,077.29
Script	2,098,652.50
Treasury bonds	349,102.13
Total	49,070,831.92

Upon the same date the national foreign debt was as follows:—

	Bolívares
National debt at 3% by diplomatic conventions	9,208,291.61
Provisional script (Spanish)	1,600.00
Diplomatic debt at 3%, issue of 1905	84,511,750.00
Non-interest bearing diplomatic debt as arranged in 1915	230,769.12
Total	93,952,410.73

The total indebtedness of the Venezuelan Government on July 13 1919 thus amounted to 143,023,242.65 bolívares. The bolívar was relatively stable during the World War. The exchange value of the U.S. dollar measured in bolívares at different dates was as follows: July 1914, 5.30; April 1917, 5.14; April 1918, 4.32; Jan. 1919, 4.25; and Dec. 1919, 5.16. An official estimate in 1919 stated that there were in circulation some 25,000,000 bolívares of bank-notes; 49,000,000 in silver coin; while the gold in circulation and in reserve came to 62,000,000 bolívares. In July 1920 eight companies had banks in Caracas. Two indigenous institutions were the *Banco de Venezuela* with a capital of 24,000,000 bolívares and with more than a score of agencies, and the *Banco Caracas* with a capital of 6,000,000. The Royal Bank of Canada had a bank in Caracas and four branches in other cities. The National City Bank of New York had a bank in Caracas and four branches in other cities and towns. The *Hollandische Bank voor West-India* had a bank in the capital city. The Mercantile Bank of the Americas of New York City had established a central bank in Caracas with branches at La Guaira, Puerto Cabello, and Maracaibo. The Commercial Bank of Spanish America Limited—affiliated with the Anglo-South American Bank Limited—with a capital and reserves of 200,000,000 bolívares, had banks in Caracas and Puerto Cabello. The Deschanel International Corporation of Venezuela, affiliated with a corporation of that name in New York City, with a capital of some 1,260,000 bolívares, had established banks in Caracas and La Guaira. Another important institution of Venezuela was the *Banco de Maracaibo*, with a capital of 937,500 bolívares.

History.—When in Nov. 1908, President Castro left Venezuela to visit Europe, the first vice-president, Juan Vicente Gómez, a wealthy land-owner and an efficient military leader, was given the presidential power. In decrees of Nov. 23 1908, Gómez appointed a general secretary and confirmed the existing Cabinet appointments. On May 3 1909 he issued a decree announcing that he was exercising the powers of President of Venezuela, and after suppressing opposition to his rule in certain quarters, he was acclaimed President Dec. 19 1909. Under the constitution of 1909, on Aug. 27 1910, Congress elected Gómez constitutional President for four years. In June and July 1911, Venezuela celebrated with appropriate ceremonies the centenary of her declaration of independence. During the rule of Gómez diplomatic relations with foreign nations that had been ruptured were resumed, and Venezuela undertook to pay her obligations to foreign nations upon which payments had lapsed. Upon an attempt of ex-President Castro to regain his power, President Gómez issued a proclamation on Aug. 3 1913, announcing that as the peace of the republic had been disturbed by Castro, he (Gómez) was leaving the capital to undertake a campaign for the restoration of public order. Upon the following day he entrusted his authority to José Gil Fortoul, president of the council of government. On Jan. 1 1914, he reëntered Caracas at the head of his army and at once reassumed the powers of President.

According to the constitution the term of office of President Gómez ended on April 19 1914. Upon that day a Congress of Deputies from the Venezuelan states adopted a provisional constitutional statute for the Union. That statute declared that all laws not inconsistent therewith should remain in force. It further provided that this Congress should elect a commander-in-chief of the national army at the same time that it elected a provisional president of republic. Congress was also to frame a new pact of union for Venezuela, which should be submitted to the assemblies of the states for approval. The period of provisional rule should last until the new constitution had been ratified by the states and until the constitutional functionaries had taken their posts. On the same day Congress elected Victorino Márquez Bustillos, who had been Minister of War and the Navy, provisional president. By a decree of the same day Provisional President Márquez Bustillos appointed his ministers of state, making César Zumeta Minister of the Interior. Congress elected General Gómez commander-in-chief of the national army. On May 3 1915, the Congress chosen under the constitution of 1914 unanimously elected Gen. Gómez President of the republic for the term ending April 19 1922. However, the President-elect did not assume the presidency. The provisional president continued to exercise the president's authority while Gen. Gómez remained commander-in-chief of the army with the title President-elect of the republic. Among the members of the first Cabinet of Provisional President Márquez Bustillos were C. Zumeta, Minister of the Interior; M. Díaz Dodríguez, Minister of Foreign Affairs; Román Cardenas, Minister of Finance, and Felipe Guevara Rojas, Minister of Public Instruction.

Boundary Disputes.—Protocols signed in Caracas in 1905 between Brazil and Venezuela acknowledged those portions of the Brazilian-Venezuelan boundary which had been surveyed by their commissioners as the true boundary line. In Feb. 1912, these nations agreed to select commissioners to determine their boundary between Cucuy and the Salto de Hua. In 1914 those commissioners proceeded to mark that part of the boundary line exactly. By a treaty signed in 1881 Venezuela and Colombia agreed to submit their long-standing boundary dispute to the arbitration of the King of Spain, who was to fix the line which in 1810 separated the captaincy-general of Venezuela from the viceroyalty of New Granada (Colombia). The award of the Spanish monarch was given on March 16 1891. Subsequently, however, a heated correspondence took place between Colombia and Venezuela about this line, mixed commissions delimited a part of it, and Colombia proceeded to take possession of regions which clearly belonged to her. Venezuela objected to this action and at times war seemed imminent. By a treaty signed at Bogotá on Nov. 3 1916, the contending nations agreed to submit to an arbiter the question whether or not Colombia had the right to enter upon the possession of territory that belonged to her by the award or whether she should postpone such occupation until the boundary line had been fully drawn. The parties agreed that both states should remain, for the time being, in the possession of territories which they held at the date of the treaty. As arbiter they selected the President of Switzerland, who, after pronouncing his decision, was to appoint Swiss engineers to demarcate exactly the boundary where it had not been surveyed. In July 1917, when ratifications of that treaty were exchanged the parties changed the arbiter to the Swiss Federal Council. On June 24 1918, that council made known the regulations which should be followed in the arbitral procedure. Both parties presented their last arguments to the arbiter and a decision was pending at the close of 1920.

International Relations.—Although Venezuela did not publish a proclamation of neutrality upon the outbreak of the World War, yet on Aug. 12 1914, the Minister of the Interior sent instructions to officers of custom houses directing them to maintain neutrality in the conflict. Seven days later, at the instance of the Minister of Foreign Relations, the Minister of the Interior addressed to the chief executives of the states, the territories, and the Federal district, circulars informing them that the Venezuelan Government would maintain the strictest neutrality and directing them to prevent individuals from aiding any of the belligerent nations. Upon being informed by the U.S. minister of the rupture of diplomatic relations with Germany, on Feb. 23 1917, Ignacio Andrade, Venezuela's Minister of Foreign Relations, informed the envoy of the United States at Caracas that his country would fulfill all her duties as a neutral and would not relinquish any of her rights: "She wishes to preserve her relations of peace and friendship with all of the belligerent nations and to maintain the most perfect neutrality." Although the sympathies of many of her intellectual leaders were with the United States, yet Venezuela maintained her neutral policy throughout the struggle. In March 1920, Venezuela's minister at Paris filed his Government's adhesion to the League of Nations.

See *Alta Comisión Internacional, Sección Venezolana* (Caracas, 1919); *Annual Report of the Council of the Corporation of Foreign Bondholders* (London, 1910); *Anuario Estadístico de Venezuela* (Caracas, 1915); *Boletín Comercial e Industrial; Informaciones Consulares y Comerciales publicadas por la Dirección de Política Comercial del Ministerio de Relaciones Exteriores* (Caracas, 1920); *Constitución de los Estados Unidos de Venezuela sancionada por el Congreso de Disputados Plenipotenciarios de los Estados en 1914* (Caracas, 1914); L. V. Dalton, *Venezuela* (London, 1912); *División Político-territorial de la República* (Caracas, 1912); J. V. Gómez, *Mensaje que el General Juan Vicente Gómez, presidente provisional de la República, presenta al Congreso Nacional* (1910–1); F. Guevara Rojas, *El Nuevo Régimen de la Instrucción en Venezuela* (1915); *Itinerarios de Venezuela* (1914); *El Libro Amarillo de los Estados Unidos de Venezuela* (Caracas, 1910); *Memoria que presenta el Ministerio de Obras Públicas á las Cameras Legislativas* (Caracas, 1911); *Memoria que presenta el Ministro de Relaciones Interiores al Congreso Nacional* (Caracas, 1910); *Monthly Bulletin of the International Bureau of American Republics* (Washington, 1910); *Proceedings of the first Pan-American Financial Conference* (Washington, 1915); Pan-American Union, *Venezuela, General Descriptive Data* (1909); *Recopilación de Leyes y Decretos de Venezuela* (vols. xxxiii., 1913). (W. S. Ro.)

VENIZELOS, ELEUTHERIOS (1864–), Greek statesman, was born at Mourniés, in the island of Crete, on Aug. 23 1864, of a family that emigrated from Mistra (near Sparta) to Crete in 1770. His father, a merchant of Canea, took an active part in the Cretan patriotic movement and was therefore exiled by the Turks in 1866, but returned to the island in 1872. Young Eleutherios was educated in the schools of Syra and Athens, and then studied law at the university of Athens, taking his degree in 1887. Returning to Canea, he took up the practice of law, but, like most Cretan lawyers of that day, he soon was drawn into political life. In the insurrection of 1889 he was compelled to fly from the island and take refuge in Greece; after tranquillity was restored, he returned and was elected a member for Canea to the Cretan Assembly. It was not till 1897 that Venizelos came into prominence as one of the leaders of the Cretan uprising of that year, which culminated in the removal of Turkish rule from Crete (1898). Venizelos was in command of the insurgents' camp on Akrotiri, which was shelled by the united European squadrons on Feb. 21 1897. A few days later, he received at this camp the British, French and Italian admirals, who came under a flag of truce to negotiate a settlement between the insurgents and the Turks. These two incidents form the first occasion when Venizelos came into official contact with the Great Powers.

In 1898 Prince George of Greece landed in Crete as High Commissioner of the Great Powers, and a few months later, upon Sphakianakis' retirement, Venizelos became the head of the Cretan executive. He soon found himself at variance with the Prince, who inaugurated in Crete very much the same autocratic policy that his elder brother, King Constantine, subsequently adopted in Greece in 1915–7. Finally, a complete rupture took place in 1904 between the Prince and Venizelos; the Venizelist party were defeated at the polls by the personal canvassing of the Prince and the united efforts of the other Cretan party leaders, already jealous of Venizelos' rising star. Venizelos then organized a revolt at Therisso, which was partially successful but which died out after a few months, yet not until it had made the Prince's position in the island untenable. In 1905 the Prince departed, resigning his office as High Commissioner, in which he was succeeded by M. Alex. Zaimis. From 1905 to 1909 Venizelos' activities alternated between those of chief of the Cretan executive and those of leader of the Opposition. More than once during this period the Cretans came into sharp conflict with the four Great Powers; but Venizelos' wisdom and moderation prevented any rupture and maintained friendly relations with the Powers.

In 1909 the Military League at Athens, which headed a bloodless revolution against the existing political corruption and Court favouritism in Greece, found itself in need of a sound political adviser. As such, Venizelos went over to Athens at the invitation of the League three times within four months. He persuaded both the League and King George of the necessity of convening a National Assembly for the revision of the Constitution, as the only safe and satisfactory way out of the dangerous situation. The elections for this Assembly were held in the summer of 1910, and Venizelos himself (who had never ceased to retain his Greek citizenship, while in Cretan political life) headed the poll at Athens. His arrival at the Greek capital in Sept. was greeted with tremendous popular enthusiasm. Such was his unlimited mastery over Greek public opinion at that time, that at a nod from him the Royal family would have been expelled ignominiously. But Venizelos had come to Greece to establish reform and pacific progress; and little as he respected any member of the Royal family, he was fully conscious of the set-back that Greece's internal tranquillity and foreign relations would receive by a fresh change of dynasty or by the doubtful experiment of a republic. His first great work in Greece was the revision of the Greek Constitution, which was successfully accomplished in 1911. Simultaneously, he was busily reorganizing the public services, especially the army and navy, the former through a French, the latter through a British, mission. Within the short space of a year and a half he prepared the ground for the Balkan League, which had hitherto been universally looked upon as a Utopian project. By May 1912, the League was practically an accomplished fact, but a fact so successfully dissimulated that the outside world knew nothing of the League's existence. Only Russia, as the traditional protectress of the Southern Slavs, was in the secret. Other Greek statesmen, and notably Tricoupis, had worked for a Balkan League but failed, partly, no doubt, owing to adverse circumstances, but partly also because of Greek unpreparedness for war and of the inflexibility of the Greek claims. Venizelos was, it is true, favoured by circumstances—the Balkan races just then had been drawn together in self-defence against the newly fledged tyranny of the Young Turks in Macedonia and Thrace, while the military revolt of 1909 had swept the Greek political stage clear of nearly all the corrupt parties, that hitherto had blocked the wheels of the nation's progress. But even so, the Balkan League would never have sprung into being but for Venizelos' higher vision, and his supreme courage in consenting to an alliance with Bulgaria, without a preliminary agreement as to the division of the Turkish spoils in case of victory.

When the World War broke out, Venizelos hastened, in the dark days which preceded the first battle of the Marne, to offer Greece's aid and adhesion to the Entente. This courageous offer, made at a time when the situation in France was so menacing, was never forgotten by the Allies, though declined for the moment on purely military grounds. A few months later (Jan. 1915) the Allies themselves asked for the coöperation of Greece in their plans for the Dardanelles expedition, and promised Greece, in exchange, extensive territory in Asia Minor. But

Venizelos' decision to accept this offer was incontinently vetoed by King Constantine; and Venizelos was forced to resign, though supported by a strong parliamentary majority and an all but unanimous public opinion. In the general election which followed (June 13 1915), despite the desperate efforts of the King and his party, the Venizelist party were returned with a large majority. But, contrary to all constitutional requirements, three full months were allowed to pass before Venizelos was summoned to resume office, the King's illness being made an excuse. When finally Venizelos formed his new Cabinet, the Dardanelles expedition had already failed, and another crisis was at hand. In the preceding spring Serbia had driven back the Austrian armies out of her territory; but now a fresh Austrian invasion was imminent, and Bulgaria was plainly bent on revenging herself for her disasters of 1913 by preparing to attack Serbia in the flank. According to the terms of the Greco-Serbian Treaty of 1913, Greece would, in that case, be bound to come to Serbia's aid. Bulgaria mobilized her army in Sept. 1915, and on the following day Venizelos obtained the King's signature to the decree mobilizing the Greek army. Two days later, Venizelos made an important statement in the Greek Chamber, declaring that, if Bulgaria attacked Serbia, she would have to face the Greek army as well. This declaration was received by the Chamber with loud cheers. King Constantine thereupon sent for Venizelos, and, after telling him that he would never consent to Greece drawing the sword against the allies of Germany, asked for his resignation. To the Premier's remonstrance that, after the recent verdict of the general election in favour of his policy, the Crown was not entitled to refuse its sanction, Constantine replied that in matters of foreign policy he did not consider himself bound to follow the national will, feeling himself "personally responsible to God alone." In the face of this attitude, Venizelos thought it best to resign once more (Oct. 1915); and after a Zaimis Cabinet had vainly endeavoured to obtain the support of the Venizelist majority in the Chamber, the latter was dissolved (for the second time within six months) and a new election ordered for Dec. 19 1915. This time Venizelos, as a protest against the King's unconstitutional proceedings, called upon his party to abstain from the polls; and as a result, only 230,000 votes were cast, as against 720,000 in the previous election. In consequence of this abstention of the Venizelist electors, no Venizelist was elected, and the new Chamber consisted almost exclusively of the old politicians, whom the military revolt of 1909 had swept out of politics.

Venizelos spent that winter and spring (1915–6) in endeavouring, through the press (he founded a newspaper called the *Keryx*), and by public mass meetings, to force the King to see the folly of his course. But after the surrender of Eastern Macedonia to the Bulgarians (Aug. 1916) he gave up all hope of converting Constantine to his views. On Sept. 25 1916 he took ship with his leading partizans for Crete, whence he sent out his proclamation to the Greek people, calling upon all true patriots to disavow Constantine and his fatal policy and to flock to the standard of the Entente. Proceeding on to Salonika, he established there a "Provisional Government of National Defence," which was in Dec. 1916 duly recognized by England, France and Russia, though not by Italy. His call for volunteers was responded to with enthusiasm by all parts of Greece not held by Constantine's troops, and 60,000 men were soon gathered at Salonika.

When at last England and France proceeded to dethrone King Constantine, Venizelos returned to Athens a few days after his removal (June 27 1917) and took over the government of the whole of Greece. His first measure was to convoke the Chamber elected in June 1915, whose dissolution by Constantine in Nov. of the same year was considered as a violation of the spirit, if not of the strict letter, of the Constitution. Venizelos then ordered a general mobilization of the Greek army and formally declared war against Germany and her allies. His path was beset by many serious difficulties. The German propaganda had done its work so thoroughly that a large section of the community were now entirely out of sympathy with Venizelos' war policy. Nearly one-half of the officers of the army and navy were against him and the Entente. These were given their choice between adhesion to the new regime and dismissal from the service. The large majority chose the latter; and thus 1,800 officers were retired on small pensions, and became a dangerous leaven for all subversive activities against the Government. Three distinct mutinies broke out while the newly mobilized reserves were being moved to the front. A large proportion of the public officials and judiciary were also disaffected; their removal from their posts was a matter of elementary prudence for a Government engaged in a war of such magnitude.

After the Armistice of Nov. 11 1918, and the assembling of the Peace Conference at Paris, Venizelos took up the diplomatic struggle for the rights of Greece. Between Nov. 1918 and Aug. 1920 he and his colleagues of the Greek delegation were almost continuously absent in Paris or London. He returned a few times for a brief sojourn to attend the meetings of the Greek Chamber; but there could be no rest for him until the Treaties of Neuilly and of Sèvres were finally signed. Never before had a Greek statesman achieved such magnificent results for his country. Never before had a representative of a small nation won such admiration or played such a brilliant part in a great international gathering. Yet no sooner was his triumph complete, than an attempt was made upon his life by a couple of young Greek naval officers (Tserépes and Kyriakos); and three months later, the Greek elections gave a crushing majority to his political opponents. Greek history is indeed full of such acts of popular ingratitude to public men, from Aristides the Just down to Charilaos Tricoupis.

Many explanations have been given of Venizelos' amazing overthrow in the hour of his greatest triumph. He himself attributed it to the war-weariness of the Greek people, that had been under arms with almost no intermission since 1912. His political enemies ascribed it to the determination of the Greek people to "regain their liberties" and to punish his "tyranny." It is, no doubt, the fact that a large section of the Greek people had been led to regard the situation in this light. The wildest stories were circulated in the press about the oppressive character of the Venizelist regime of 1917–20. Venizelos was accused of having cast 80,000 people into prison, shot several thousands of his political enemies, and dismissed 20,000 public servants. As a matter of fact, the aggregate number of persons imprisoned or interned or placed under police surveillance never exceeded 1,600. The only executions were those of military ringleaders of mutinies or military spies, after due public trial and conviction by courts-martial; the total number of these executions was 63. There were also some 9,000 dismissals of public servants for political reasons; but nearly all of these men were subsequently reinstated by the Venizelist Government itself, after they had sworn allegiance to the new order of things. When Venizelos' successors came into office in Nov. 1920 there were not more than 300 or 400 of these dismissed public officials still out of service by their own choice. There were, nevertheless, numerous acts of petty tyranny and injustice, that could be laid at the door of the Venizelist administration, during Venizelos' prolonged absence at the Peace Conference. Some of his lieutenants abused their power or failed to prevent such abuse by others. Many notorious bad characters had managed to creep into posts of influence and used their position to wreak personal vengeance or to enrich themselves at the expense of the public or the public treasury. But it may be doubted if, even so, the elections would have gone against Venizelos, had it not been for two other factors. One was the sudden death of the young King Alexander a bare fortnight before the election. This reopened the question of the succession to the throne; and although Venizelos, as a desperate makeshift, proposed Prince Paul, Constantine's youngest son, as King, the utter insignificance of this boy candidate only threw Constantine's own claim to restoration into stronger relief and gave a fresh impetus to the efforts of his party. Had Alexander lived until after the election, Constantine would hardly have succeeded in making his return good. The other factor in Venizelos' defeat was the blind over-confidence of his partizans; many Venizelists in Athens and the larger cities neglected to vote.

The total vote polled by the Venizelist party throughout Greece was actually 436,781 as against 525,642 cast for all the other parties. Venizelos himself received a huge majority in Athens and Piraeus, but was defeated by the vote of the rural population of Attica. It is evident therefore that the large majority of anti-Venizelist deputies returned to the Chamber (256 out of 369) did not in any way correspond to a real anti-Venizelist majority in the electorate at large. After the election, and Constantine's return to Athens as King, a noticeable revulsion of feeling set in, especially in provinces where the anti-Venizelist vote had been strong. But up to Sept. 1921, when the great Greek statesman was occupied in cementing his domestic happiness by a second marriage in England, and the Greek army in Asia Minor was engaged in costly military operations against Turkey by way of making up for the loss of his powerful diplomacy, Venizelos himself had taken no further steps towards a restoration of his active influence in the national politics. He had been left a widower in 1895, with two sons, Kyriakos (b. 1893) and Sophocles (b. 1895); and his second wife, to whom he became engaged in Paris in the summer of 1921, the wedding being celebrated on Sept. 15 in London, was Miss Helena Schilizzi, heiress of a Greek Chiot family established in England.

See C. Kerofilas, *Eleutherios Venizelos* (1915); S. B. Chester, *Life of Venizelos* (1921).

VERDUN, BATTLES OF (1916–7).—On Dec. 6, 7 and 8 1915, the commanders-in-chief of the Allied armies on the western front, Sir Douglas Haig (Great Britain), Gen. Alexieff (Russia) and Gen. Cadorna (Italy), met together at Chantilly for a conference presided over by Gen. Joffre (France). The question to be considered was the best method of applying the suggestion of M. Briand, who had been president of the council of French ministers since Oct. 20 1915, for united action on an united front. It was decided to start a general offensive simultaneously on all fronts as soon as the British army had been able to obtain and train the expected reinforcements, and as soon as the Russian army, which had been severely tried by the 1915 campaign, had been reorganized as to men and war material, and the French army had its full complement of heavy artillery, trench mortars and ammunition reserves. Until the fulfilment of these necessary conditions it was impossible to fix a date for the offensive; it was, however, to take place as soon as possible. In the event of the enemy foreseeing the Allied attack and attacking one part of the front first the defender should be assisted by his Allies to their utmost powers.

On Feb. 18 Gen. Joffre chose the Somme as the theatre of the Franco-British offensive, and wrote to Sir Douglas Haig that the attack should take place about July 1. But the German High Command had decided upon a winter offensive. Maj.-Gen. Erich von Falkenhayn, who had relieved Gen. von Moltke as commander-in-chief of the armies in the field, was in reality generalissimo of the Central Powers; the Austrian High Command had suggested to him that nearly the whole of the Austrian forces should be directed against Italy, and that nine new German divisions should be sent as reinforcements to the Russian front. When once Italy was put out of action 400,000 Austrians would then be available to take part in the battle against France. Falkenhayn, however, rejected this proposal because he did not believe that a defeat upon a frontier of such extent would cause Italy to lay down her arms.

At the end of Dec., in a memorandum to the Kaiser, Falkenhayn reviewed the situation to the following effect. England, he said, was the soul of the Entente and the implacable enemy of Germany; she was exhibiting to-day the same tenacity that she showed in her historical struggles against the Low Countries, Spain, France and Napoleon. But in order to exhaust the resources of Germany she could hardly count on anything but a war of attrition; and Falkenhayn recognized that in reality time was on the side of the Entente. It was then necessary to strike a blow at England. But where? It was not possible to bring about a decision in the East; any success would be purely of a local nature, without influence on the course of the war. In France the marshy soil of Flanders was an obstacle up to the middle of the spring; and as regards the British positions farther south, the objectives were too distant and their conquest would necessitate the employment of 30 divisions at least, which in point of fact the German army did not possess, and experienced officers were lacking to form the nucleus for new formations. Since England was out of reach, it was necessary to deprive her of her weapons, which were the Allied armies, and to give up the idea of a direct attack against the British armies. "Obviously this is a pity from the point of view of what our feelings are towards our chief enemy in this war," said Falkenhayn, "but it is necessary to accept the situation. Above all the enemy must be struck at through submarine warfare carried out to its limit. There was no sort of imprudence in risking the hostility of America. Because of the strong current of political opinion which is favourable to Germany it is doubtful whether the United States could decide to take any active measures on the European continent. It is still more doubtful whether they would be able to intervene in time with sufficiently strong forces. In order to destroy the tools of England on the Continent, Austria-Hungary has demanded that Italy should be attacked. This scheme, however, must be discarded: its realization would have as its only result the securing of future advantages for Austria-Hungary, but it would not have any immediate influence on the war taken as a whole. Even if Italy abandoned the Entente (and this is difficult to admit) her defection would not have an appreciable effect on England. The military aid of Italy is so little, and Italy in any case is so much under the thumb of England that it would be strange to make any mistake in this appreciation of the situation. Interior troubles which may be expected in Italy at no long date will paralyze the power to fight in that country.

"The same thing," continued Falkenhayn, "applies to Russia. Her internal distress will soon oblige her to change her tune. An offensive on a grand scale is impossible for her in winter. In addition strategic objectives are not to be found: the capture of St. Petersburg would much complicate the question of supply; an advance against Moscow would lead us into the desert; the Ukraine is a granary, but we must wait for the settlement of the Rumanian question before pursuing the occupation of it. All the Allies then have been successively eliminated: only France remains. France," Falkenhayn repeats, "has almost arrived at the end of her military effort, with a devotion that has been after all admirable. If her people can be made to understand clearly that there is nothing more to be hoped for from a military point of view, the worst will be over and England will find herself without her best sword. A break-through carried out in mass, an operation which is doubtful and beyond the power of our forces, is not necessary in order to reach this end. Even by the employment of limited effectives our aim can probably be reached. Behind the French line on the western front there are objectives which are within accessible range, and for which the French Command would have to fight to the last man."

Falkenhayn saw then the solution in a terrible conflict of attrition fought out on a limited front against the French army by the German army; the latter holding the initiative in attack could manipulate it according to circumstances and limit itself in effort and in losses. Two objectives presented themselves, Belfort and Verdun. The capture of either would have an enormous moral effect in France. Between these two Falkenhayn chose Verdun, for the following military reasons. "The French lines here are still at a distance of about 20 km. from the German lines of communication. Verdun is always the most powerful *point d'appui* for every attempt of the enemy to make untenable the German position in France and Belgium by the employment of relatively weak effectives."

This noteworthy report by Falkenhayn is full of the most detailed comments on the general situation of the Central Powers and on the conduct of the war as seen at that time by the German High Command. It displays naively his hate for England and contempt for the United States. It should be compared with William II.'s speech on June 15 1918 to the Great General Staff, on the occasion of the anniversary of his coronation, when after three victorious offensives he was persuaded of certain victory and was already on the way to the Capital: "The German people did not clearly see, when war broke out, what meaning it would have. I see it very clearly. It was a question of a struggle between two conceptions of the world. Either the Prussian, German, or Teutonic conception of the world, where right, liberty, honour and morals should triumph, or the Anglo-Saxon conception, which implies abandonment to the idolatry of money. The peoples of the earth work as slaves for their masters the Anglo-Saxons, who hold them under the yoke. These two conceptions struggle one against the other. It is absolutely necessary that one of the two should be overthrown."

In addition it is worthy of note that, in conjunction with the detailed and fairly exact appreciation on the internal state of Russia and Italy, a total misapprehension existed concerning the material situation and especially concerning the *moral* of France; the whole plan of campaign was based on the fact that France was nearly at the limit of its effort towards the end of 1915, and that it would only be necessary to create a certain friction on the French front to bring about a rapid exhaustion of the army and of the nation. Subsequent events showed in a striking way the fallacy of this idea.

Besides the reasons given by Gen. von Falkenhayn there were others which pointed to Verdun as the objective of a German offensive. The German commercial element, whose influence in the councils of the Imperial Government and amongst the military High Command was considerable, had represented in a memorandum to the Emperor the necessity of annexing the Briey basin, the mineral wealth of which would be a happy adjunct to the Sarre coal: this peace aim could be kept quiet, for the war map was evidently to play the chief rôle in those future negotiations which the supposed exhaustion of the Entente seemed to foreshadow. Moreover, the Imperial Crown Prince commanded the Army Group which was detailed to attack Verdun, and the honours which were to come to him therefrom would assure the future of the dynasty.

As soon as it was decided to attack Verdun local actions followed one another along the whole western front in order to divert the attention of the Allies; in Champagne, at Tahure, from Jan. 8–12, an operation took place followed by important works which accompany the preparation of an offensive on a grand scale; on Jan. 24 in Flanders at Nieuport and Hetsas; on Jan. 23 in Artois at Thélus and at Givenchy on the 28th; in Picardy on the 29th at Frise; in Alsace at Seppois on Feb. 13.

The chief aim was not to reach the objective laid down for each attack; it was a question of studying under what conditions and to what degree the preparation, lasting several days, thought up till then to be necessary, could be cut down by increasing the number of batteries, and through the rapidity of the rate of fire, of the German artillery. In 1915 the attacks carried out in Artois and in Champagne by the armies of the Entente had necessitated a preparation lasting from six to eight days. They gave the enemy time to meet the attack. In 1916 the German army was trying to regain the advantage of surprise.

Local Situation.—During 1915 the French front at Verdun had played only a severely defensive rôle, rigidly set down by the High Command. The capture of Liége, Namur, Antwerp, Maubeuge and several other siege forts in France, had forced the admission that permanent fortifications had had their day. Whilst generalizing too hastily about certain experiences, the details of which were still not well known, it was admitted that every limited objective on which modern artillery was able to concentrate its fire should be smashed up in a few hours. Isolated defence of strong points and entrenched camps was no longer considerable; every detached fort became a nest for shells and could be defended only by evacuating it and by fighting outside. From this crept in the idea of submerging permanent works in a defensive zone, a "fortified region" making them a part of the whole scheme of defence.

Further, in a decree of Aug. 3 1915 siege forts had been suppressed with their autonomous organization within an enclosed perimeter, which implied the consequence of an isolated defence. This gave back to the armies powerful artillery immobilized in the interior of the country (2,300 heavy guns with 1,600,000 rounds and 1,800 field guns with 1,450,000 rounds) and territorial troops which were needed for urgent work on the front. Under the conditions under which the war was being fought it was inevitable, and this decree seemingly marked the definite end of the permanent fortifications which were to render such great services during the battle of Verdun.

Prolonged and well-directed bombardments by the most powerful artillery left the armour-plated turrets intact; the deep concreted shelters remained constantly in use, and the troops found these instant and safe shelter—hot food, provisions in food and munitions which prevented them from reaching the last extremity of exhaustion. The forts of old design needed deepening considerably, but they served their purpose usefully. One thing is certain, and that is that the officers commanding sectors which were attacked did not pay sufficient attention to the defence of the forts and fortified works.

The transformation of the entrenched camp of Verdun into a "fortified region" modified considerably the conditions of defence. The closed ring became an open chain; in addition, the salient on the right bank of the Meuse was very exposed, and quite rightly it appeared necessary to organize a second position on the left bank of the Meuse which would enable the continuity of the front to be reëstablished, should it be necessary to abandon the whole of the right bank to the enemy. But the manual labour and the engineering stores were lacking for the rapid construction of these important works; in 1915 the preparation for the offensive in Artois and Champagne had absorbed the greater part of available material, and on the entire front the requirements remained great, for every sector commander cried out for manual labour and material for work which was always urgent. The requirements of Gen. Herr, who commanded the fortified region of Verdun, were met only very sparingly. Towards the end of 1915 he gave warning of the preparations for attack opposite his front, but Gen. Gouraud made identical remarks about the front opposite the IV. Army, which he was commanding in Champagne, where the enemy was feigning the preparation of an offensive. The French High Command believed, moreover, that in the event of Verdun becoming the objective of the German offensive, that offensive would be made on both flanks of the old entrenched camp: on one side between the Argonne and the Meuse, on the other opposite St. Mihiel; the salient formed by the French positions on the right bank might then become untenable. It was hardly likely that the German High Command would limit itself to a frontal attack directed against a sector which was crowded with powerful and permanent fortifications. It was in this sense that Hindenburg himself addressed a reproach to his predecessor, and Gen. Herr inclined to the same view. It was necessary then to concentrate his efforts on the whole of the fortified region; this meant dispersal of effort, as the means at his disposal were very limited. This scarcity had not only been pointed out to the Army Command, but to the French Government and to Parliament. Colonel Driant, deputy of Nancy, had spoken to the Army Commission, of which he was a member, about the dangerous situation in which the whole defence of the French front in Lorraine was left, without labour or material. Making these complaints their own, the Army Commission had them transmitted to the Minister for War, Gen. Gallieni, who asked Gen. Joffre for explanations on Dec. 16. The next day Gen. Joffre explained the arrangements that he had taken on all the French front, and stated—a little quickly perhaps—that they were realized at Verdun; and he complained that the Government might compromise discipline in the army if they welcomed grievances and requests of his subordinates. General Gallieni replied, in the name of the council of ministers, that the Government retained all its confidence in the commander-in-chief, and that there was no question of a conflict of authority.

Meanwhile the construction of narrow-gauge railways, and the establishment of ammunition parks and new batteries, were being disclosed in Champagne at the same time as in Lorraine, and these indications became further noticeable in front of

Verdun, and particularly on the northern front. On Jan. 20 Gen. Joffre sent Gen. de Castelnau there on a mission. The latter had been made chief of the staff of the group of French armies with the consent of the Government. After having stated that the resources placed at the disposal of Gen. Herr had been utilized judiciously and to the greatest degree possible, Gen. de Castelnau insisted that these resources should be increased; and this was sanctioned. From Feb. 1 onwards work was pushed forward actively, thanks to two reinforcing territorial divisions—but it was very late. The general effect of the measures undertaken by the enemy made it clear that the attack would materialize on the northern face of the salient on the right bank, between the village of Ornes and the Meuse. An army was concentrated to the rear of the threatened region: four army corps and considerable heavy artillery. The threat, however, on the Champagne front was not yet dispelled, and it seemed imprudent to determine the position of these reserves prematurely by bringing them into the line. As it was foreseen that the only standard-gauge line of supply—the line Verdun–St. Menéhould—would be cut in case of attack, the Verdun–Bar-le-Duc road was widened to six and then to eight metres in order to allow the continuous passage of two files of vehicles. Mensien, a small metre-gauge line, was improved so that the tonnage it could deal with was increased from 400 to 1,800 tons a day. These communications indeed appeared to be extraordinarily inadequate in comparison with the German network of lines, comprising 14 ordinary-gauge and 3 metre-gauge railways. They were, however, sufficient for the supply of the French troops.

General Herr had only a total of nine active divisions and six regiments of heavy artillery at his disposal on both banks of the Meuse as against nineteen German divisions, supported by a concentration of artillery hitherto unequalled.

The German line had been quiet for many months; to the rear great preparations had been observed, but in the front lines none of those approach works, considered as essential to the execution of an attack, had been made. At this period of the war, and for a long time after, it had been thought indispensable to place the attacking troops at an assault distance of between 200 and 250 metres, sheltered in parallel take-off trenches, in order to shorten as far as possible the distance to cover over open ground, at the same time avoiding "prematures" of their own artillery during the destruction of the enemy trenches and defences; the attacker had taken care not to reveal his intentions by digging these parallel trenches, which the French expected in order to be certain of a coming attack; he remained in his lines, at places 800 metres from the French trenches, because no defender would be in a fit state to fire after such an unheard-of bombardment as was being prepared; the French batteries destroyed or disorganized were no longer to be feared.

The German Attack and its Progress.—On Feb. 21, at 07.15 hours (7:15 A.M.), on a cold dry day, the German bombardment began with great violence on both banks of the Meuse; it stretched over a front of 22 km. and was particularly intense on the northern front of the right bank.

Simultaneously, the destruction of the first and second positions was carried out by the medium calibre guns (150 mm.—210 mm.) and the fortified works by the large calibre guns (280 mm., 305 mm., 380 mm. and 420 mm.). Six observation balloons and numerous aeroplanes directed the fire on this narrow zone. From 08.00 hours all telephonic communications were cut everywhere; many shelters fell in; the barbed wire disappeared; trenches and communication trenches were practically levelled out by the afternoon. The craters made by the huge shells gave to all the countryside an appearance like the surface of the moon.

At 16.00 hours the intensity of the bombardment reached its zenith. At 16.45 the German infantry left their trenches between the Hautmont wood and Herbebois, on a 4-km. front. Detachments of wire-cutters and pioneers, about 50 strong, preceded the successive waves which followed one another at a distance of 80 to 100 metres. The German officers had assured their men that they would penetrate the French positions with arms slung and without encountering resistance, as the artillery bombardment would have destroyed everything, both men and material obstacles. This assurance, however, had still to be realized. The French heavy artillery, although it had recently been reinforced, remained very inferior to that of the enemy and caused him little damage. The field artillery on the other hand opened fire at 13.00 hours, instead of commencing the bombardment in the morning as was laid down in the orders of the Army Group; it was increased at 16.00 hours and caused some losses when the attack was launched.

Some elements of the trenches were still in being with their defenders; groups came up out of the few shelters that were untouched, and they fought bravely, although scarcely under cover; here and there a machine-gun came into action and inflicted considerable losses on the massed enemy; on such a restricted front, these local resistances were sufficient to delay the German attack considerably, very feebly on the left, but a little more strongly on the right. On the evening of the 21st the first line trench was captured on the attack front, and the Germans gained a footing at certain points in the support trenches.

The following day, the 22nd, the German attack, led by the VII. Reserve Corps, the XVIII. and III. Active Corps, slowly followed up their success against the XXX. Corps under Chrétien, when the 72nd Div. under Bafst lost the village of Hautmont and the Caures wood, where, after a heroic resistance, they lost Col. Driant and Maj. Renouard.

Of the 14 battalions which he had in reserve Gen. Chrétien had used 8, and he received a brigade, which nearly made up his losses. His 51st Div. under Boullangé lost a little ground, but its counter-attacks stopped the enemy.

However, on the 23rd the 72nd divisional commander, influenced by the loss of Hautmont which thereby threatened his rear, evacuated the village of Brabant, which remained isolated on the Meuse; he received the order to retake it but could not succeed; the 51st Div. lost the important position of Wavrille. The whole of the French first position was captured, and the line now ran through Samogneux, the Fosse wood and Ornes. It was really the second position, which was linked up with the first at Ornes.

The 24th witnessed the crumbling in of this line. Samogneux was taken before dawn, the Fosse wood during the day; Beaumont, taken and retaken several times during the day of the 24th, fell during the night; and it became necessary to evacuate Ornes, outflanked on all sides. Then the enemy reached the heights of Talon and approached Douaumont. The situation appeared so serious that Gen. Herr asked permission to evacuate the Woevre plain and to draw back his front eastward to the Meuse heights; Gen. de Langle de Cary, commanding the Army Group, insisted on obtaining the sanction of Gen. Joffre for this withdrawal; he hoped to hold on on the front—Talon heights–Louvemont–Douaumont–Vaux—long enough to enable him to evacuate the right bank, which he thought to be inevitable. He even stopped on the left bank the elements of the XX. Corps which were reinforcing the XXX. Corps under Chrétien.

It was now a question of deciding on the abandonment of Verdun. Should it be held at all costs and risk a disaster, if the bridges over the Meuse should come under enemy fire before the troops and artillery would have the time to cross them? Three times during the course of this sanguinary battle the same question arose, and three times Gen. Joffre settled the matter with the same calm and imperturbable tenacity. He replied to Gen. de Langle de Cary: "I approve in advance of the decisions that you will take as regards the withdrawal to the heights of the Meuse of the troops dispersed in the Woevre, if you judge it to be indispensable; you are the sole judge of the necessities of the battle. But you must hold facing N. on the front between the Meuse and Woevre with all the means at your disposal. Use the whole of the XX. Corps without hesitation. To engage it is necessary in order to enable the reinforcing divisions to arrive; you must hasten their march to the Meuse."

General de Castelnau, his chief-of-staff of the army groups, left during the night, and after his arrival at the headquarters of the Army Group he telephoned to Gen. Herr confirming the orders of the commander-in-chief. On the 25th Gen. Joffre telegraphed simultaneously to Gens. de Castelnau, Pétain and Herr: " Yesterday, Feb. 24, gave the order to resist on the right bank of the Meuse to the N. of Verdun. Every commander, who, under these circumstances, gives an order to retreat, will be arraigned before a council of war."

It is true that great is the glory of those who carried out this order, and who by their military prowess, their knowledge of their men and their personal action, won this great battle. The chief actor, who from the first act to the last scene of the drama never ceased in removing from others the heavy burden of responsibility —that chief actor was Gen. Joffre. History must not forget this.

General de Langle de Cary accordingly issued his orders: he laid down that on the right bank they should hold fast facing N.; the movement of the XX. Corps, provisionally suspended, was to be continued; he evacuated the Woevre, however, withdrawing to the fort of the Meuse heights.

General de Castelnau arrived at 7 A.M. at Gen. Herr's headquarters, and his presence alone brought calm and relief. The 37th and 153rd Divs. had been engaged as brigades and even as regiments; these reinforcements had been sufficient to limit the progress of an attack which had been carried out on too narrow a front.

During the 25th the XX. Corps under Balfourier relieved the XXX. Corps under Chrétien, whose two divisions had lost 61% of their effectives (16,000 out of 26,000). The 37th Div. under Bonneval, believing its right to be on the point of being outflanked, evacuated the height of Talon and that of Poivre and withdrew to the Belleville height, a withdrawal of seven kilometres. A fortunate initiative stopped the enemy by an artillery barrage, and enabled the 39th Div. to regain the great part of the ground which had been given up. But if the enemy had been able to fight desperately on that day he would have engaged untried reserves at a propitious moment; he would at least have reached the foot of the Belleville height, and this advance would have made the occupation of the right-hand exceedingly difficult. On the left bank the whole French line would have been taken in rear and forced to retreat. As the German attacks were limited between the Meuse and in the Woevre, the arrival of an adequate number of reinforcements was sufficient to close the breach.

In the centre fighting had been continued the whole day round Fort Douaumont; Number 155 turret had fired almost unceasingly for four days; the fort had no garrison except the crew of 23 gunners, who manned this work, and who, at the end of their tether, slept after the fall of night. A patrol of the 24th Brandenburgers, finding the drawbridge lowered, entered the fort and settled themselves there without firing a shot. Such was the result of a badly understood order, which converted entrenched camps into fortified regions; it was due, perhaps, to insufficient liaison between two units in the first line, who should have got into touch in Fort Douaumont instead of maintaining themselves, one to the E. and the other to the W. of the fort, which at the beginning of the battle found itself 8 km. within the French lines without a garrison of its own. It was for the local commander to occupy it; but the prejudice against permanent fortification was such that no one on the spot thought about it. On the evening of the 24th Gen. Chrétien had, moreover, ordered his sector commanders to occupy all works. The important work of Hardaumont, which completed the defence of the Douaumont and Vaux forts, had no garrison, and was likewise abandoned to the enemy without the slightest resistance.

The day was a bad one. The capture of Douaumont was announced to the whole world in a triumphal *communiqué:* " To the E. of the Meuse, in the presence of His Majesty the Emperor and King we have gained important successes. In a vigorous advance the Brandenburg regiments reached the fort and village of Douaumont, which they captured by assault."

This glaring travesty of the truth made this name symbolic of a great victory; but when, taking up the challenge, the French were to retake Douaumont, the value which the Germans gave to its possession was to be the measure of their defeat.

General Joffre sent for Gen. Pétain to come to Chantilly; the latter had been supervising in the rear the training of divisions sent back in succession to rest. After Joffre had given him his instructions he sent him to take over the command of the army in process of formation on the left bank of the Meuse, which was to intervene when the right moment arrived. General de Castelnau thought that the moment had already arrived when Gen. Pétain appeared on the scene, as events were getting beyond the powers of the cadre of the fortified region, whose general staff was not adequate to direct operations of such importance.

General Pétain took over command on Feb. 26. He brought the I. Corps under Guillaumat into line on the left of Balfourier's XX. Corps. The front was immediately put into a state of defence foot by foot, and vigorous counter-attacks were carried out. The front was divided into sectors; the heavy artillery which had arrived was assigned to each; the Bar-le-Duc–Verdun road (the sacred way) which was cracking up under the ever-increasing weight of the motor lorries, was constantly repaired by gangs of territorial troops and doubled by lateral tracks.

The situation remained confused; it was the German *communiqué* which informed Gen. Pétain of the capture of Douaumont, and then he was nervous about the forts of Vaux and Souville, nearer to Verdun and not yet threatened.

The struggle was very lively on the Douaumont summit. The French line went beyond the fort to the E. and to the W. and hemmed it in; it was round this point, now of first importance, that the battle raged. It was only on March 4 that the line became stabilized for some weeks at a distance of 200 metres from the fort. There is no doubt that the counter-attacks carried out rarely gained any appreciable ground, but they broke up the German offensive, which was disconcerted by this new feature of the defence. General Joffre reiterated the necessity of these counter-attacks; he wrote to Gen. Pétain on Feb. 27: " At the present juncture of the battle, you feel as I do that the best method of checking the effort, which the enemy will make, is to attack in our turn." On March 1 he wrote: " You have now at your disposal forces outnumbering those opposed to you. . . . above all it is necessary for you to take the initiative in offensive actions with definite objectives in view."

The German attack now progressed on the right bank exceedingly slowly. All along the Meuse it was harassed by the fire of the defence, which caught it obliquely and even in rear.

At last the Crown Prince decided to broaden his attack fronts on the left bank of the Meuse, attempting too late to rectify the original error of his offensive.

On March 4 he asked his army groups to make a supreme effort to take Verdun, " the heart of France." After a bombardment lasting two days he attacked on March 6 with two divisions. The French, however, had been expecting it for 15 days; after a fair resistance they gave up the crossing of the Forges stream, and that part of their line which was under the fire of enemy guns from the right bank and which could no longer be held except by very strong outposts. The following day the Germans continued their advance, paying for their progress more and more dearly, and they were stopped in front of Mort Homme.

From the 8th–11th the battle was extended simultaneously on both banks. Unimportant progress was made on the left bank, but Mort Homme held steadfastly, as did the Poivre height on the right bank. The Germans advanced to the outskirts of Fort Vaux, whose capture they announced in a new resounding *communiqué:* " Fort Vaux as well as the numerous adjoining fortifications has been captured in a brilliant night attack by the Posen reserve regiments. . . . ." One can only imagine that the German prisoners led into the fort must have been taken for victorious attack troops. The next day the *communiqué* had to be contradicted; the turretted fort had become " a heap of ruins " and had been evacuated.

The first *communiqué* could very well have been the result of a mistake, but the second was a lie. Evidence from both sides, and notably from soldiers' letters, testifies to the desperate character of the struggle during these days, and to the bravery displayed by friend and foe alike. The French troops particularly

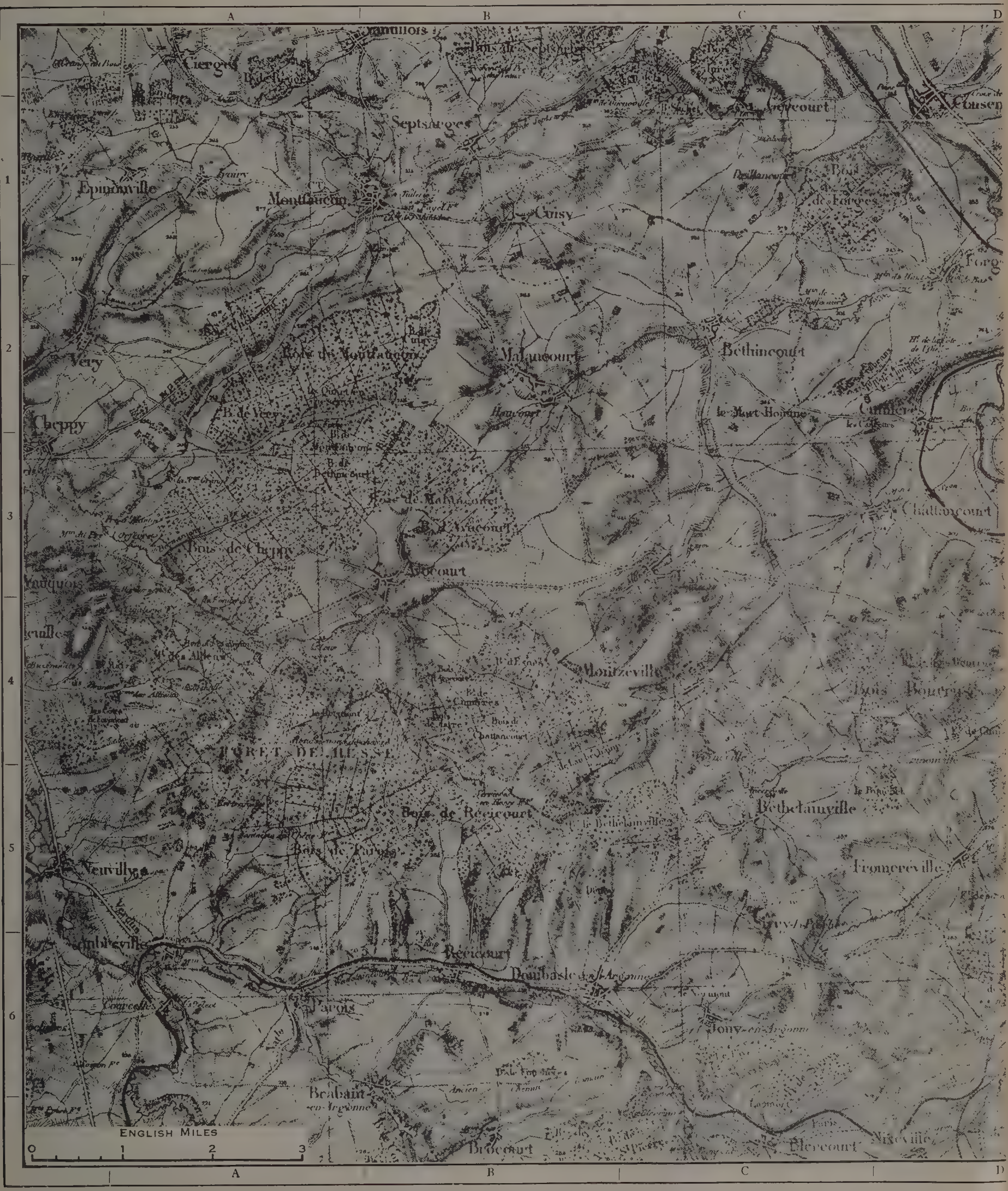
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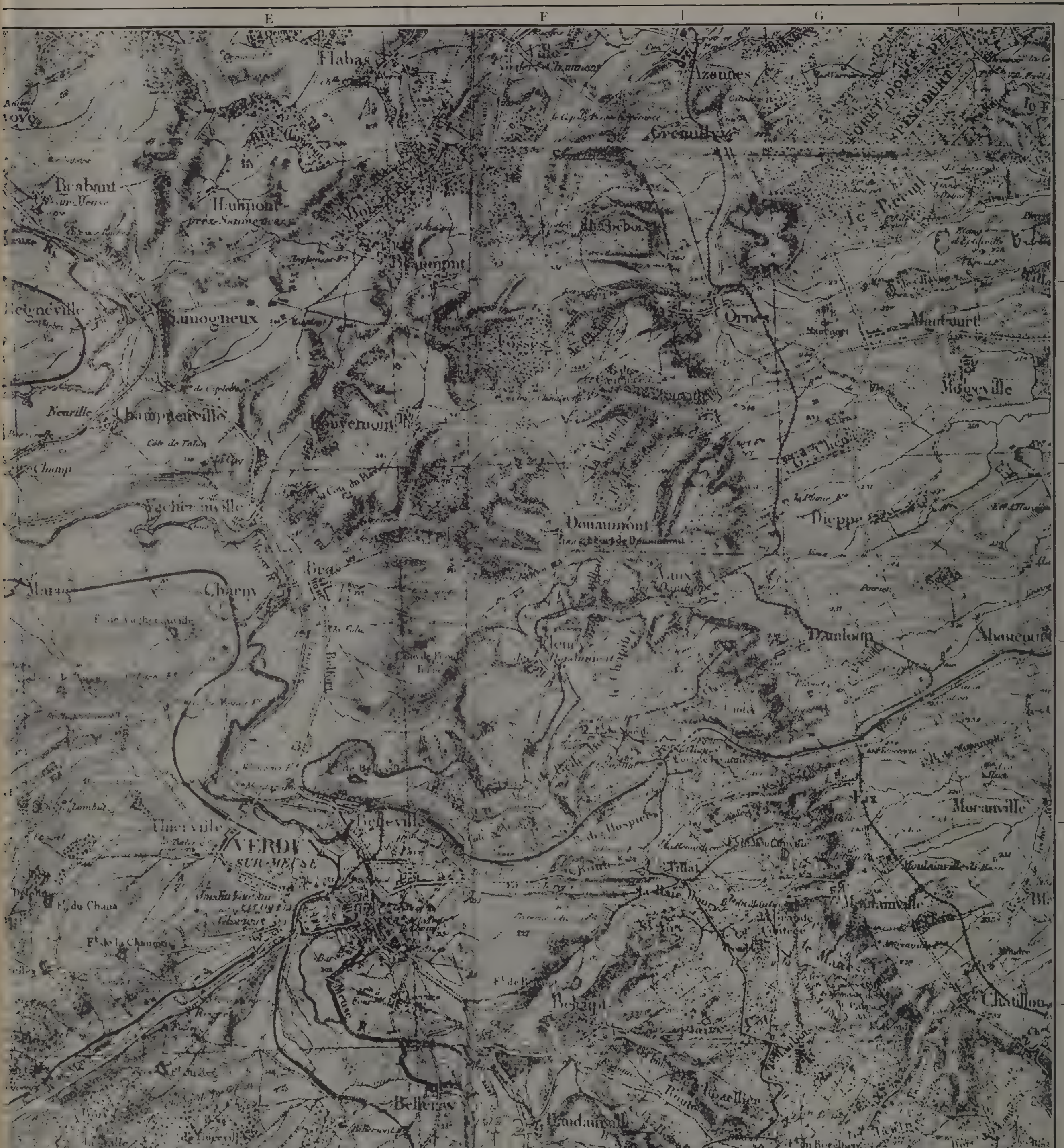
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Le Breuil
Regnéville
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Ornes
Maucourt
Fosses
Mogeville
Neuville
Champneuville
Louvemont
Côte de Talou
Vacherauville
Douaumont
Fort de Douaumont
Dieppe
Bras
Charny
Vaux
Fleury
Damloup
Abaucourt
Belleville
Moranville
Thierville
VERDUN SUR MEUSE
Tavannes
Eix
Châtillon
Belrupt
Haudainville
Belleray
Dugny

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noticed the Bavarian troops among their enemies, whose blood was shed unsparingly by the Prussian command.

General Joffre thought that he had won the first trick in this terrible game. In historic words he thanked the soldiers of Verdun. "Germany hoped," he told them, "that the capture of Verdun would strengthen the courage of her allies and would convince neutral countries of her superiority. She had not reckoned with you . . . the struggle is not over, because the Germans must have a victory. You will take it out of their hands. Of you it will be said: they barred to the Germans the way to Verdun."

The generalissimo dared then to tell his soldiers that the battle would continue; he took up the challenge of the enemy, who attached a moral importance to the capture of Verdun, for want of a strategical importance which it had not. The Germans had not obtained the rapid "break-through" which they had hoped for, and their objective was limited to the capture of forts on the right bank of the Meuse, purely a local rectification of front. They were reduced to give this objective an importance purely fictitious—"Verdun, the chief stronghold of our chief enemy, the head and heart of France," etc., etc.

General Joffre's victory was enhanced by these same declarations of the enemy. He frequently visited the front, for two or three days at a time. He kept Gen. Pétain's second army under his own immediate command, thus relieving of responsibility the intermediary "group of armies," a formation often useless, sometimes harmful, always heavy and slow, unless under the command of a striking personality; as long as Verdun was to be the sole theatre of operations Gen. Joffre was to exert there his direct personal action. He was thus able to calculate exactly what forces he could employ there, because he had to keep in reserve effectives necessary for the French offensive which was being prepared on the Somme, according to the plan of operations decided upon in Dec. 1915, and the execution of which he was following through imperturbably. Sir Douglas Haig had been quite willing to extend his front so as to free the X. French Army, which force could then be employed as reinforcements for Verdun; the British general offered to contribute directly to the battle that was being fought; but Gen. Joffre declined his offer as he wished the whole of the British forces to be available for the forthcoming offensive.

On March 12 and 13 the German bombardment was renewed on both banks of the Meuse with great violence; on the 14th a small advance brought the attack line nearer to the Mort Homme, but it was stopped by some successful counter-attacks.

On the 16th the village and fort of Vaux successfully resisted violent assaults repeated five times. On the 20th, however, after a furious artillery bombardment, the Germans seized the Avocourt wood, poorly defended by troops, who apparently allowed themselves to be unduly influenced by jets of burning liquid used in great quantities. However, on the following days, the attackers attempted to debouch from the wood in vain; well-directed artillery fire stopped any advance.

Prepared at leisure, a French counter-attack retook this wood on the 29th; it created a salient in the lines and might serve as a base for an advance which would embarrass the whole position. A violent struggle lasted four days for the possession of this ground, which finally remained in the hands of the French.

But against this the whole Malancourt salient fell into German hands; the French were obliged to evacuate Bethincourt and to fall back on the S. bank of the Forges stream; they even lost the summit of Mort Homme.

On the right bank the end of March witnessed the gradual advance of the Germans, slightly going beyond the village of Vaux. On April 2, descending the slopes of Douaumont, they seized the Caillette wood and crossed the Baril ravine; no defensive line, nor any reserve troops, separated them any longer from Fort Souville. They had even gone beyond the barrage fire of the French artillery.

At this moment the 5th Div. under Gen. Mangin came into line, and forestalling the hour for relief hurled in its first regiment to counter-attack. Uncertainty concerning the ground given up deprived the artillery of all accuracy in its fire, which was not able to support the counter-attacking line, but this uncertainty was the same for both sides. It was above all necessary to stop the enemy where he was, and then to drive him back. All arrangements were made during the night, and the fight was resumed on the 3rd with a first success of good omen.

On the following days the artillery was able to regulate its fire, the Caillette wood was recaptured completely, all the approaches to Souville and to the N. of Vaux were largely freed, in spite of German reinforcements. It was noticeable that this division had lost fewer men in recapturing the ground than the former division in losing it. The idea gained ground of continuing with the same troops so as to retake Douaumont.

The 5th Div. was sent back to rest, and the plan of attack, which anticipated an advance on the part of the division on its left, was drawn up. That division, however, lost ground instead of gaining it, and the objective now to be reached was altogether *en flèche;* as the adjoining divisions were not considered to be in a state to take part in the operation, the base of the attack became too narrow. Nevertheless it was launched on the 22nd about midday. After a fairly satisfactory artillery preparation, with magnificent dash it reached the fort in 11 minutes and occupied the superstructure with the exception of the northwestern angle.

To right and left the objectives laid down were reached almost entirely. The enemy, however, held on to the interior of the fort, and the outside was soon swept by his artillery fire; the machine-guns, in turrets which had not been knocked out, were soon augmented by others brought gradually into action.

The German reinforcements came up after the 23rd, because they were ready for this attack; the French reinforcements were too far back, and the officer in control of the attack did not have them under his orders. The struggle lasted two days, but the fort was lost again on the 28th.

Then the struggle broke out anew round Fort Vaux. The bombardment increased in intensity each day at the end of May; Damloup was taken on June 2 and the fort surrounded on three sides. The Germans finally occupied the superstructure, but Maj. Raynal continued the defence with steadfast heroism.

The fort fell on June 7. Its fall uncovered Fort Souville, already threatened by the German advance down the slopes from Douaumont; Thiaumont farm fell, the Caillette wood was retaken; and it seemed as if the heroism of the French soldiers was to be powerless in face of this advance, which appeared to be in some way mechanical.

General Pétain had taken over command of the group of French armies in the centre, and Gen. Nivelle of the Verdun army. General Pétain had already drawn the attention of Gen. Joffre to the gravity of the situation in May. He referred to it again on June 11, and insisted that the offensive to be undertaken on the Somme should take place as soon as possible. General Joffre replied the following day that he had made all his dispositions with this end in view, but that it was necessary to continue the struggle at all costs on the right bank, and even to risk the loss of batteries which could hardly be withdrawn.

The German advance, however, continued on the right bank, in spite of the energy of Gen. Nivelle, who repeatedly ordered counter-attacks, both immediate and instinctive.

The whole effort of the attacker was concentrated on this ground, an effort which amounted to a major operation having as its first objectives the work of Froide Terre, the village of Fleury and Fort Souville. Once that line was reached the old forts on the height St. Michel-Belleville would be easily seized, and the French would be hemmed in against the Meuse with its bridges under German artillery fire. Nineteen regiments belonging to seven different divisions were to be engaged; the reinforcements and reserves were brought up close to the front line in order to take advantage of the first successes, and to insure the strength and continuity of the effort. It was the most important and heaviest attack that Verdun had ever had to bear.

The artillery had been strongly reinforced, and began its preparation from June 20 with an intensity hitherto unheard of. On the morning of the 23rd the first-line trenches were literally ploughed up, and the German infantry hardly found a single defender at the beginning of the attack, which reached the Baril ravine, Fleury, the Thiaumont work, and even penetrated the moats or ditches of the Froide Terre work, where the advanced elements had been taken prisoner. The French counter-attacks, however, stopped the German attack. General Mangin, who commanded this section of defence, launched unceasing counter-attacks. They hurled themselves against the German attacks but their advance at first was very slow; however, that of the enemy was stopped and his will was soon to be conquered. The stubbornness of the two adversaries was equal, and the course of the battle reached a dead-lock, but it was felt that the battle had already assumed another aspect.

However, on the evening of the 23rd the situation was serious, as the German wave was very near to beating against the Belleville height, the last stronghold to keep it from Verdun.

It reached the head of the ravines coming down from Froide Terre towards the Meuse, and the Poivre height was in danger of being submerged and its defenders taken in rear. General Nivelle, commanding the army, conferred with Gen. Mangin. Both were in agreement in thinking that it was necessary to counter-attack to the utmost; the threatened front was in a position of unstable equilibrium, and its only salvation was to be found in a movement forwards; Gen. Nivelle approved the orders issued in consequence. On his return to his headquarters he found Gen. Pétain, who satisfied himself that all measures were ready for the evacuation of the right bank, prepared down to the last detail. The positions for withdrawal by echelons were fixed in advance, in such a way that this masterly retreat would not leave a single trophy of war to the enemy. There was to be found in Gen. Pétain an admirable steadfastness of soul. With the exception of Gen. Nivelle not one of his subordinates suspected his fears. When he asked that opinion should be prepared for the retreat to the left bank he was thinking of those at home; to his soldiers and their officers he continued to show an impassive countenance, and he kept on saying, "We shall have them!"

For the third time Gen. Pétain pointed out the gravity of the situation to the commander-in-chief. A third of the French artillery was on the right bank and would be lost in case of a reverse if it was not withdrawn before the German artillery could fire on the bridges over the Meuse, and three days were needed to carry out this withdrawal; it would be wise to begin it.

General Joffre, however, was imperturbable. He replied on the 26th that the preparation for the Franco-British offensive had commenced, and repeated that Verdun should be defended on the right bank; should there be a loss of material as a result of this decision the commander-in-chief would assume the entire responsibility for it. When the telegram that he had ordered to be written to the above effect was handed to him by his chief-of-staff, the latter drew his attention to this decision and to the responsibility which he was assuming thereby. "I have taken many others," said placidly the general as he signed. He explained the general situation to the Minister for War, who had invited him to hurry on the Franco-British attack; the launching of the offensive had been subordinated to the reinforcement of the British and Russian armies in men and material; the hour had struck, and the guns on the Somme made their thunder heard. The offensive, previously fixed for June 29, was postponed till July 1 on account of bad weather, which hampered the artillery preparation. But it was on that date that it had been fixed by Gen. Joffre on Feb. 18, three days before the attack on Verdun, which had not succeeded in advancing or delaying it a single day.

The French Counter-offensive.—The end of June had witnessed the arrest of the German advance by French counter-attacks. The ground, which had been won at one blow on the 23rd, was regained step by step; on the edges of the Thiaumont work the conflict always remained fierce enough; vibrations on the front decreased in magnitude, but its general tendency was towards the N. and to the detriment of the assailant. The work—or rather the small protuberance which marked the site of the work—was taken and retaken to such a degree that it changed hands 16 times during the summer; the slight advances which had carried the German line beyond the craters were gradually reduced, and from this side the initiative in attack belonged to the French.

On the other hand the German offensive continued to progress slightly in the direction of Fleury-Souville. The French had been almost completely thrown out of the village, which they had partly retaken on June 27.

The Crown Prince carried out anew a strong attack against Fort Souville. On July 11, after a violent artillery preparation and a storm of asphyxiating shells which enveloped the attack zone, he hurled 13 regiments belonging to 5 different divisions in between the slopes E. of Thiaumont up to the Vaux-Chapitre wood. The attack made a little progress on the 11th, very little on the 12th; a small detachment, however, was taken prisoner on the superstructure of Fort Souville. Certain counter-attacks organized unexpectedly had limited the gain of this strong offensive, very costly as it was in men, to a depth of 400 metres to the S. of Fleury on a front of 800 metres. By sheer tenacity a well-organized counter-attack led to the recapture of all the ground lost, resulting in the capture of many prisoners. After July 20 it was the French who attacked, in front of Souville as well as round Thiaumont. After the 11th Mangin's command was increased on this sector, and this unity made possible the powerful concentrations of artillery fire. Local attacks could be preceded by preparation on a large front, and thus leave the enemy uncertain as to the precise point where the action would unfold itself. Often several attacks would be carried out at the same time several kilometres distant from one another.

These minor operations were organized in detail, and numerous prisoners were taken along the whole front. This had its influence on the strength of the German troops, on their moral and physical condition, and on the march of reliefs and bringing up of supplies, which presented targets to the harassing fire carried out at night. The trenches to be attacked were covered by the fire of the 75's, which put up a barrage behind and prevented the escape of the defenders; at the same time the heavy artillery pounded them, either killing or burying the defenders; before the attack it often happened that whole detachments came out and surrendered themselves, declaring the position to be untenable. The advance of the attack was preceded by artillery fire from field guns which moved on at the same pace as the attacking infantry; this was the "creeping barrage," which made its appearance after the end of June. The French thus obtained the maximum results with the minimum losses. During the months of July and Aug. they took 3,500 prisoners, and their advance was continued.

The village of Fleury, retaken and lost again at the beginning of Aug., remained in the hands of the French from Aug. 17 onwards. The whole of the Fleury-Thiaumont crater was French, and the outskirts of Souville were well cleared on the north-east. But the enemy now attacked Souville on the E., issuing from Fort Vaux. He gained about 1,200 metres, and the pressure was disturbing. The unity of command then made itself felt between the Meuse and the Woevre, and produced its full results; at the beginning of Sept. the enemy was thrown back from the positions which he had just taken, and confined to the outskirts of Fort Vaux, from the other side of a crater whose inner slopes provided a good position for the defence of Souville.

The French losses had been heavier than the German during the first period, but the proportion was now reversed.

Hindenburg, who had just assumed command, proposed to the Kaiser that the attacks should be discontinued, and explained this decision as follows: "The battles which were fought in this region exhausted our strength as does a wound that will not heal. It was evident that this adventure did not leave us the least hope from whatever point of view, and its continuation cost us much more men than it did our enemy. Our advanced positions were exposed everywhere to the enemy's flanking fire; liaison with the front line was exceedingly difficult. The battlefield was a veritable hell, and the troops considered it rightly as such. To-day, after a retrospective study, I do not hesitate to say that from the purely military point of view, it would have been more to our advantage to improve our position in front of

Verdun by voluntarily giving up the greater part of the ground taken. However, in the autumn of 1916, I thought it necessary to postpone that decision: we have sacrificed in this affair a great part of our best troops, and up to that time we allowed our people to hope that the struggle would terminate gloriously for us. Further, if we had withdrawn at that moment, it might have made the too facile impression that all our sacrifices had been in vain. I wished to avoid that strain on the *moral* of our population, which was already highly tried. In suspending our attacks on Verdun we counted on our adversaries themselves adopting, in this region, a purely defensive attitude; our hope was not realized. At the end of Oct. the French launched a counter-attack on a large scale on the right bank of the Meuse; it was boldly carried out and overwhelmed us. We lost Douaumont and we had not the troops to retake this monument of German heroism."

The conditions under which that action unfolded itself were as follows: In front of Souville and of the line of forts a stout barrier had been formed, which included several well-organized positions; the battle had died down on the right bank, and the French renewed the offensive from the Meuse to the Woevre, and regained their superiority over the enemy. On Sept. 13 the President of the French Republic came to bring to the martyr town the cross of the Legion of Honour and the decorations which the sovereigns of Allied countries had conferred upon it. From the casemates of the citadel, during a ceremony of moving simplicity, he pronounced an eloquent speech which consecrated the victory. But he had to keep all his fascination for the word which was at last to be spoken. Events had proved that every well-organized attack always commenced with success, and that it was exceedingly difficult to limit a victorious advance.

Now above all was it necessary to throw back the enemy from that barrier which had at last been remade. The hour had passed for those little attacks which aimed at the recapture of a few hundred metres; they had enabled them to get rid of successively the small or large pockets which the German line had dug into the French, but it was only by carrying the whole line forward at one bound that ground could be gained to advantage. An operation on a grand scale was called for.

General Nivelle entrusted Gen. Mangin with the study of this task. The latter considered the recapture of Douaumont as a possible consequence of success; this scheme was adopted after discussion, and the fort did not come into it except as one of the objectives of the attack. The same applied to Fort Vaux. The main object thus became the reconstitution in its integrity of the barrier of forts round Verdun.

General Mangin had all the necessary means at his disposal to bring this operation to a successful issue. He had a very powerful mass of artillery—289 field and mountain guns (calibre 65 to 96 mm.) and 314 heavy guns (100 to 400 mm.); 3 divisions in the front line, with 2 Senegalese battalions and 1 Somali battalion; 3 divisions under his immediate orders in the second line; while the adjoining divisions on the front of attack each placed a regiment in the line. The enemy opposed him with 7 divisions but they were very dispersed in depth: 16 battalions were in the first line; 6 in immediate support and in the zone to be taken; 11 in near support, which were all to be engaged on the evening of the attack; 25 in reserve, who would later come up to fill in the gaps. The French had located 209 German batteries (about 800 guns) capable of coming into action when the offensive began. After three days of destructive bombardment they feigned a general attack. The ruse was completely successful, and 158 batteries were disclosed; these were under counter-battery fire the next day, the day of the attack, to such effect that only 90 batteries opened fire that day, and then only under unfavourable conditions. The initial artillery superiority of the Germans had then disappeared. This was foreseen in the scheme of attack; the French commander knew that the means at his disposal would be inferior at the beginning to those of the defence, but would become superior during the action.

The infantry strengths were almost equal on both sides. The disposal of the German divisions on very narrow fronts, and somewhat hemmed in, lent itself less to manœuvre than did that of the French divisions, whose front was quite double, but above everything else the experience of former actions had shown the efficacy of the methods employed in this zone; a barrage of field guns falling behind the trenches nailed the defenders to them whilst the heavy artillery and the trench mortars made them indisposed for the fight. At the same time the fire of other heavy guns filled up the openings of the deep shelters, which in times of quiet served as strongholds for the defence; when the assault waves started, preceded by the creeping barrage from 70 to 80 metres in advance, they would not find more than rare local resistance, and would advance up to the deep shelters whose occupants would be taken prisoner. General Mangin was able to inform Gen. Joffre and Gen. Nivelle that two hours before the attack 22 German battalions had been almost completely wiped out. As far as the forts were concerned they were laid open; it was impossible to determine their capture with the same degree of certainty as that of the conquest of ground, but the occupation of the superstructure was certain and the capture of the whole appeared to be a matter of two to three days at the most.

If a success of this nature could be foreseen with such certainty, it was not due to an accumulation of material of war, since, at the beginning of the struggle the German artillery was undeniably much superior in numbers, in range, in rapidity of fire, and even in calibre (with the exception of a few French guns of 400 and 370 mm., whose fire was solely directed against the forts); nor was it due to the employment of masses of infantry which would overwhelm the enemy by sheer weight of numbers, since the density of the attack was thin so as not to expose more men to loss than those actually required to obtain the desired result. It was due to the use of logical methods, of well thought-out artillery bombardments, which gave them a superiority over the enemy and which compensated in large measure for inferiority in numbers and material; it was due, too, to the dash of the French troops and their confidence in their leaders. It was, however, further due to a perfect understanding in the command. The army commander provided his subordinate, who was in charge of the attack, with all the means at his disposal, and if they were not available he could ask for them from headquarters. Another factor was a thorough knowledge of the particular zone, and the experiences gained in this zone by the same leaders and the same staffs, who had been on the spot during a bitter struggle that had lasted several months. The result was assisted by the mistakes of the enemy, who had practically everywhere only one line of defence, in front of which he had been able to set up only elementary obstacles. These conditions were to be found again on the same field of battle two months later; but they were exceptional and weighed very heavily in favour of the French.

The artillery preparation, which commenced on the 20th and continued to the 24th with increasing intensity, produced its usual effects. The Germans gave themselves up singly or in little groups; a strayed carrier-pigeon brought in a message of distress from a battalion commander, who said that his troops were not in a state to fight. Finally, at 11.40, the artillery lengthened its fire and the French infantry left their assault trenches. A dense fog hid their advance from the enemy, who did not open fire till 12 minutes after zero time, when the two front waves had crossed his first trenches. The objective was reached in an hour, and it was consolidated very rapidly. In the first instructions the pause was to have been for half-an-hour; the commander of the groups of armies, considering it advisable to consolidate the position, the conquest of which was practically certain, had insisted that it should be much longer, and after discussion had finally fixed the pause for two hours. The bombardment, however, had been most thorough; a 420-mm. shell had brought about an explosion which was followed by a fire; one would have thought that it would have been a great advantage to hurry on and to profit by the confusion. Gen. Mangin, too, had fixed the time for consolidation as one hour.

The 38th Div. under Guyot de Salins formed the left wing. His colonial Moroccan regiment penetrated into Douaumont fort, which the Germans had evacuated the day before owing to the threat of explosion but were occupying again. They were putting their machine-guns into position, but the rising tide of the assailants overwhelmed them.

In the centre the dash of the 133rd Div., known as "La Gauloise," under Passaga, had overcome all obstacles; and it had established itself in the angle N.E. of Douaumont and by the pool at Vaux. On the right, in front of the 74th Div. under Lardemelle, the artillery preparation had been insufficient against some centres of resistance, and the advance had been more difficult. More powerful artillery, which had become available, smashed the framework of the fort; long-range guns enfiladed the casemates (the surface which faced Verdun was covered with only ordinary masonry instead of being concreted); and finally the advance in the direction of Douaumont enabled field guns to be brought into action on the only position from which they could fire on the very steep slopes to the E. of the fort, whose communications were thus cut. The pressure of the infantry continued after the 9th Div. under Audlauer had relieved Lardemelle's division; the enemy evacuated the fort and Gen. Audlauer installed himself there on the 3rd. He occupied the villages of Vaux and Damloup.

The recapture of the Douaumont and Vaux forts was an important event, which consecrated the victory of Verdun in the eyes of the whole world; 6,000 prisoners emphasized it. This great success, however, called for its complement.

On Oct. 21 Gen. Mangin had pointed out to Gen. Nivelle the necessity which obtruded itself, after the capture of the objectives assigned for the operation on the 24th, of seizing the crater Douaumont-Hardaumont and the Poivre height, both of which had direct observation into the positions which were to be conquered, and of clearing the way round Fort Douaumont. General Nivelle then considered a combined operation, but he was very limited by the means at his disposal. The front of attack must not be beyond that of one for three divisions, but it might be possible to have a break of continuity in the centre. The ammunition would be only that which could be economized out of the daily allowances. General Mangin, however, insisted on the advantages of an attack from the Meuse to the Woevre, even should it be necessary to wait for the necessary troops and munitions. It was this scheme which the command finally agreed to. Before Mangin's group the German front was held by five divisions in the front line and by four in the second; the latter could intervene in one night, 247 batteries having been identified (960 guns approximately).

The French attack had 4 divisions available in the first line, 4 in the second, and 740 guns. It was, accordingly, inferior to the defence, but it could count on the results obtained on Oct. 24. The artillery in actual fact rapidly established a superiority over the German artillery, thanks to deeper penetration; 13 German artillery officers were captured, whose evidence confirmed in detail this undoubted superiority. As far as the infantry is concerned the smashing in of the front trenches led to the complete destruction of the 13 battalions defending them, and to the partial destruction of the 13 battalions in support in the zone to be conquered, so that the attack could then meet the slight initial numerical inequality.

The enemy, forewarned by the experience of Oct. 24, had organized three lines of resistance defended by a network of barbed wire; further the distance of the final objective introduced a greater element of chance; it was, accordingly, necessary to have more elasticity in the mechanism of the creeping barrage and to vary its application. It was laid down in the attack orders of Mangin's group that: "Each objective must be seized at the first onset and with one bound—the pace to be 100 metres in four minutes. The infantry to be preceded at a distance of 70 to 80 metres by percussion shell and at 150 metres by shrapnel, time and percussion. Further, when circumstances demand it and when it is possible, owing to long-range observation, artillery fire will be carried out in conjunction with the advance of the infantry; general officers commanding divisions will organize, with this end in view, the closest possible liaison between infantry and artillery."

The great obstacle to the organization of the attack was the state of the ground, which was frightfully cut up by 10 months of repeated fighting; in the slushy clay, where the water oozes out at any altitude, the shellholes, nearly touching one another, were at this time covered with ice. Without a complete fitting up of the ground every attack would come to grief in the mud. It was necessary to construct 25 km. of roads, several of which were planked with wood, 10 km. of Dreauville line, and a very great number of telephone systems. Everywhere supply and ammunition dumps had to be made and camouflaged battery emplacements; water tanks and pipes had to be fitted up, etc., etc. The inclemency of the weather, very severe on the Meuse heights, made these works particularly arduous. All the soldiers, however, realized their necessity, and they were completed in five weeks with wholehearted self-denial and with great spirit by the divisions who succeeded one another in this zone, right up to the time when the attack divisions went into line.

On Dec. 15, about 10.00 hours, the French regiments, after as complete an artillery preparation as was possible, issued from their trenches and attacked from the Meuse to the Woevre. On the left, the 126th Div. under Muteau seized Vacherauville and the Poivre height, where it established itself; the 38th, under Guyot de Salins, once again on the ground of its former exploits, seized Louvemont; the 37th under Garnier-Duplessis advanced as far as the Caurières wood, fighting step by step; the 133rd ("La Gauloise") under Passaga captured the Hardaumont work and the village of Bezouvaux. The advance, which had slowed down at certain points, carried the attack on the 18th to the second objective. At the same time, after the 15th, offensive reconnaissances had gone right beyond their objectives, and, protected by their creeping barrage, destroyed guns and captured prisoners to the number of 11,387, including 284 officers. By adding the number of killed and seriously wounded the total losses of the enemy could not be estimated at less than 25,000, on a front of 10 kilometres. One hundred and fifteen guns were taken and destroyed, and the defence of Verdun was now established on the narrowest part of the Meuse heights and in an excellent position.

The moral effect of this victory was great on both sides. Ludendorff speaks of it in the following terms: "The blow which we then received was a particularly hard one. We suffered great losses and also lost important positions. The effort exerted during the year had been too great. The elasticity of our troops had been weakened by the immobility of the defence, by the powerful artillery of the enemy, and in consequence of our own losses. On the western front we were completely exhausted."

The Germans drew many useful conclusions from these events, and recognized noticeably the impossibility of reducing the defence to lines of regular trenches, too visible targets for the opposing artillery. The French learnt from them the brilliant confirmation of the methods employed on Oct. 24. Without in any way decrying this success, it should be remarked that the most distant objectives (3 km.), which according to the fixed time-table should have been reached in a few hours, had been conquered only on the fourth day. Indeed, this was not the condemnation of the methods used, nor of the time-table fixed in advance in particular; but it went to show the necessity of foreseeing that this time-table could not be followed, and that it was necessary to manœuvre, because the advance does not always develop with mechanical precision. On Dec. 12 Germany, for the first time, made overtures for peace, overtures which appeared to slacken the energies of the Government, of the armies and of the peoples of the Entente.

In thanking his victorious troops Gen. Mangin enumerated the results obtained, and the hopes that they could picture in the future. He added these words: "Admitting themselves incapable of conquering us on the field of battle, our savage aggressors dare to hold out to us a clumsy snare in the shape of a premature peace. While still picking up new arms they cry 'Kamerad.' You know that gesture. Our fathers of the Revolution refused to treat with the enemy as long as he was soiling the sacred ground of our country, as long as he was within our natural frontiers, as long as the triumph of right and of liberty over the tyrants was not assured. And we will never treat with that perjured Government to whom treaties are but a scrap of paper, with assassins and butchers of women and children. After the final victory, which will render them incapable of doing hurt, we will dictate to them our will. To their hypocritical overtures France has replied through the muzzle of your guns and by the points of your bayonets. You have been good ambassadors for the Republic; she thanks you."

Capture of Mort Homme, Height 304 and Chaume Wood.—The Verdun front remained comparatively quiet until the middle of the summer of 1917, when it was livened up in Aug. with a brilliant stroke by the II. French Army under Guillaumat. The French command had provisionally given up the offensive on a large scale having as its object the break-through, whether immediate or as a consequence to the slow using-up of the enemy. It contented itself with attacks with limited objectives, having as their aim the improvement of part of the front whilst inflicting on the enemy losses more considerable than their own. The French command was able to carry through these local actions with extremely powerful forces, and thus assured their success. The operations on Aug. 20 had as its object the improvement of the French positions between Avocourt and Bezouvaux.

From the 13th onward artillery preparation was begun; 2,400 guns, 1,100 of which were large-calibre guns, were employed. On a front of approximately 20 km. on the Meuse four army corps were deployed, two on each bank, each having two divisions in the first line and two in the second. The army kept two divisions in reserve. To meet this attack, so long and carefully prepared, the Germans had six divisions in the front line, three on each bank. The front held by a division was 3 km. on the left bank and 2,800 metres on the right. Behind them were five so-called "divisions of intervention," two on the right and three on the left bank, with one division in army reserve in the vicinity of Montmédy. The defence had 380 batteries (about 1,500 guns).

The French artillery, which thundered for eight days, accelerated its fire on the 20th at 04.00 hours. At 04.40 it lengthened and the infantry assaulted, preceded by their creeping barrage. The enemy did not start his counter-barrage until 12 minutes afterwards. On the left bank the XIII. Corps seized all its objectives in the Avocourt wood and to the E. of Height 304, which fell after open fighting. The XVI. Corps captured Mort Homme and made numerous prisoners in its deep tunnels; the Moroccan division under Degoutte took Cumieres, the Corbeaux wood and the Oie height. On the right bank the XV. Corps captured the Talon height after daybreak and the important position of Height 344, then advanced in the bend of the Meuse as far as Champ and Champneuville. The XXXII. Corps under Passaga captured the German positions to the S. of Beaumont Fosse wood and the outskirts of the Chaume wood.

The rapidity of the advance had disconcerted the enemy; the counter-attacks prepared in advance could not materialize, and the "intervention" divisions contented themselves by remaining where they were. During the night, however, the Germans attempted to react, without success.

On the 21st the French XV. Corps took Samogneux and the XVI. Corps the Oie height and Régneville.

On the 24th the famous position Height 304 fell. All the French objectives were reached. Seven new German divisions were hastily called up to hold the front, which became definitely stabilized on the left bank on the 24th. On the right bank the XXXII. Corps improved its positions in the direction of Beaumont and the Chaume wood on Aug. 26 and Sept. 8. On Sept. 9 a violent attack against Height 344 was repulsed. The captures amounted to 9,100 prisoners, 30 guns and 22 mine-throwers. Verdun was to a great extent cleared by this very successful operation. (C. M. E. M.)

VERDY DU VERNOIS, JULIUS VON (1832–1910), German general and military writer (*see* 27.1019), died Sept. 30 1910.

VERGA, GIOVANNI (1840–1922), Italian novelist (*see* 27.1021), died at Rome, Jan. 27 1922.

VERHAEREN, ÉMILE (1855–1916), Belgian poet (*see* 27.1023), produced in 1912 a tragedy, *Hélène de Sparte*, which was performed in German and Russian, besides French. His later poems include *Les Rythmes souverains* (1910); *Les Villes à pignons* (1910); *Les Fleurs du Soir* (1911); *Les Plaines* (1911) and *Les Blés Mouvants* (1912). On the outbreak of the World War Verhaeren came to England, where he received hon. degrees from various universities. During his exile he published *Les Ailes rouges de la Guerre*. He was killed at Rouen while attempting to enter a moving train, Nov. 27 1916.

VERMONT (*see* 27.1025).—The pop. of the state was 352,428 in 1920 as compared with 355,956 in 1910, a loss of 3,528 or 1%. This was the first time that the pop. had been less than in the preceding decade, though several times the gain had been very slight. The movement within the state was distinctly toward the urban districts. Of the total pop. of 1900 22% lived in cities and villages of 2,500 and over, in 1920 27·8%, and in 1920 31·2%. Of the 14 counties only six show an increase in population. The number of towns showing a decrease was 186 in a total of 248. There is no radical change in the character of the population, the proportions of native and foreign remaining about the same, with a tendency toward increase of Canadian immigrants. The following are the cities having a pop. of 5,000 or over and the percentage of increase for the decade:—

	1920	1910	Percentage increase
Burlington	22,779	20,468	11·3
Rutland	14,954	13,546	10·4
Barre	10,008	10,734	−6·8
St. Albans	7,588	6,381	18·9
Montpelier	7,125	7,856	−9·3

Agriculture.—The number of farms in Vermont in 1920 was 29,075 as against 32,709 in 1910, a decrease of 3,634 or 11·1%, but the acreage of improved land increased from 1,633,965 in 1910 to 1,691,595, a gain of 3·5%. The value of all farm property was $222,736,620, an increase over the 1910 figures ($145,399,728) of 53·2%. Of this value $82,938,253 was in land and $76,178,906 in buildings. The average value per farm was $7,661, with $2,853 in land and $2,620 in buildings, respective increases of 72·4%, 59·8% and 58·1% over the 1910 figures, which were $4,445 for all property, $1,785 for land and $1,657 for buildings.

In 1919 the leading crops with their yields and values were as follows:—

Crops	Acreage	Quantity	Value
Cereals, total	133,621	3,916,959 bus.	$5,171,758
Corn	21,186	937,375 "	1,687,275
Oats	83,097	2,396,349 "	2,396,349
Hay and forage	991,757	1,748,358 tons	29,581,464
Vegetables	..	..	7,387,254
Miscellaneous crops	..	..	3,622,443
Fruits	..	..	1,957,515

The total number of cattle in 1920 was 435,480, including 14,200 beef cattle and 421,280 dairy cattle. Dairy cows numbered 290,122. The value was $28,502,803 for all cattle, and $23,027,209 for dairy cows. The production of milk for 1919 was 122,095,734 gallons. The total value of all dairy products, excluding home use of milk and cream, was $27,207,813. For 1917 the reports show a value of dairy products handled in factories of $13,372,838. Vigorous efforts were being made to develop coöperative marketing, especially of dairy products. A decision of the Interstate Commerce Commission in 1916 abolished the leased-car system of shipping milk, and made possible the open-car system. This made it practicable to ship in smaller quantities. A state law was passed providing that any corporation using the word "coöperative" in its business name must provide (1) that voting shall be based on the number of shareholders and not of shares held; (2) that interest or dividends on paid-up capital shall be limited to 6%; (3) that a reserve fund shall be set aside, not less than 10% of the net profits annually, until the fund amounts to not less than 30% of the paid-up capital stock; (4) that the remainder of the earnings shall be distributed by uniform dividend on the basis of purchase and sale through the corporation by shareholders or the amount of raw material furnished; and (5) that not more than 10% of the capital stock shall be owned by any one member. Under this law there were, in 1920, 29 coöperative dairy plants incorporated, of which 27 had already begun business. The Commissioner of Agriculture estimated in that year that one-third of the entire dairy products of the state was being marketed through these plants. In addition to this movement there was being organized, in 1920, the Vermont Coöperative Creameries, Inc., a federation of coöperative enterprises for the purpose of securing collectively certain services beyond the reach of the separate plants, such as the buying of supplies, the selling of products, and standardized accounting.

Manufacture.—The reports for the five-year period 1914–9 show a substantial increase in the manufacturing activities of the state, due in large measure to demands of the World War. The number of establishments increased from 1,772 to 1,790, or 1%; persons engaged from 37,217 to 38,845, or 4·4%; salaried employees from 2,726 to 3,550, or 30·2%; wage earners from 32,704 to 33,491, or 2·4%; capital increased from $79,847,000 to $134,314,391, or 68·2%; value of products from $76,990,974 to $168,108,072, or 118·3%; value added by manufacture from $34,285,254 to $72,935,491, or 112·7%. In 1919 Vermont had 15 manufacturing industries the value of whose products were over $1,000,000 each, namely: marble and stone; woollen and worsted goods; paper and wood pulp; lumber and timber products; machine tools; butter; condensed milk; flour-mill and grist-mill products; other food preparations; knit goods; foundry and machine cars; general ship construction and repairs by steam railway; furniture planing-mill products; bakery products.

History.—In 1915 a workmen's compensation law was enacted, denying common-law defences to those employers who did not elect to operate under the provisions of the law. The statute covers all public and industrial employment except domestic service and cases where 10 or less are employed. Beginning in 1912 a series of Acts was passed leading to the organization of a state Board of Charities and Probation and more systematic provisions for the care of dependent, neglected and delinquent children. This movement has been extended to include widows' pensions in certain cases. In 1917 an important step was taken in the direction of coördinating the work of some of the many state departments, commissions, and boards. A state Board of Control was established by law, composed of the governor of the state, the state treasurer, the auditor of accounts, the director of state institutions, and a fifth person to be appointed biennially by the governor and Senate. This Board of Control meets regularly once a month. All state boards, institutions, commissions, officers and departments, other than judicial officers, must make monthly reports to the Board of Control. The Board has general supervisory powers over the various state activities, and may investigate any phase of their work. The Board makes its report biennially to the state Legislature.

Following an extensive educational survey, the public-school system of the state was radically reorganized in 1915, making the seventh form of administration that has been tried since 1845. Under the system adopted the office of state superintendent was abolished. In its place was established a State Board of Education consisting of five members appointed by the governor, one each year for a five-year term. This Board has general powers of supervision and management of the public educational system, and employs as state commissioner of education a trained and experienced educator, whose term of office is indefinite, being removable by a majority vote of the Board. The Board also appoints a number of superintendents with powers of supervision, and the state commissioner has power to appoint a suitable number of state supervisors when approved by the Board. The supervisors coöperate with the superintendents and supplement their work.

In 1919 the Legislature authorized the state Board of Health to divide the state into 10 sanitary districts, and to appoint for each a district health officer in place of the town health officers. This Act entirely reorganized the public health work of the state. The district officers are full-time officers and serve under the pay of the state. The public health work is much more effectively carried on than before, being after 1919 under five separate divisions, each under the direction of an expert supervisor.

Up to the signing of the Armistice Vermont had supplied for the World War over 15,000 men. Some of this number had gone across the line and enlisted with the Canadian forces before the spring of 1917. Of those in service more than one-half were sent over-seas. The deaths were: killed in action, 119; died of wounds, 47; total deaths, 612. The total wounded were 778. Total casualties recorded were 1,390.

The state has remained consistently Republican in politics since 1856, not excepting 1912, the year of the Progressive party campaign. The recent governors of the state, all Republican, have been: John A. Mead, 1910–2; Allen M. Fletcher, 1912–5; Charles W. Gates, 1915–7; Horace F. Graham, 1917–9; Percival W. Clement, 1919–21; James A. Hartness, 1921– .

(G. G. G.)

VERRALL, ARTHUR WOOLLGAR (1851–1912), English classical scholar, was born at Brighton Feb. 5 1851. He was the son of a solicitor, and was educated at Wellington and at Trinity College, Cambridge, where he graduated as second classic in 1873, becoming fellow and tutor of his college. He published editions of many classical plays, especially the *Medea, Agamemnon* and *Choephoroe*. In 1895 appeared *Euripides the Rationalist*, followed in 1905 and 1910 by editions of most of Euripides' plays. He was an original critic, with views of his own, often expounded in the *Classical Review* and other journals. In February 1911 he was appointed to fill the new King Edward VII. professorship of Literature at Cambridge, which had been endowed by Sir Harold Harmsworth, later Viscount Rothermere. He died at Cambridge June 18 1912.

VICTOR EMMANUEL III. (1869–), King of Italy (*see* 28.28). When in 1915 Italy declared war on Austria, the King at once went to the war zone, remaining there until the Armistice, appointing his uncle Ferdinand, duke of Genoa, Royal *Luogotenente* of the kingdom to act in his stead. At the front he lived in a most unassuming manner at the "Villa Italia" near Udine, and after Caporetto near Padua, constantly visiting the trenches and the most exposed positions, as well as the military hospitals. He took the deepest interest in everything concerning the army and the welfare of the troops; but, although nominally commander-in-chief, he never interfered with the conduct of the operations nor in the matter of appointments, and he allowed himself only the same amount of leave as any other soldier. After the conclusion of the Armistice he returned to Rome on Nov. 14 1918 and had a triumphant reception. He visited Paris and the French front with the Crown Prince (Dec. 19–21), and subsequently London.

After the birth of his son and heir Umberto, Prince of Piedmont (Sept. 15 1904), the King's family was increased by two more daughters, Giovanna, born Nov. 13 1907, and Maria, born Dec. 26 1914. He was devoted to his wife and children, and to study; and he took a special interest in numismatics, having in 1910 and 1913 already published two volumes of his monumental work on the coins of Italy, the *Corpus nummorum italicorum*. After the war he made over to the nation a large number of royal residences in various parts of Italy, a heritage of the days when Italy was divided into a number of separate states, each with one or more royal or ducal palaces and villas. Among the most famous of these are the Pitti Palace in Florence, the villas of Castello, La Petraia and Poggio a Cajano in the neighbourhood of that town, the royal palaces of Milan, Venice, Genoa, Naples, the villa Capodimonte near Naples and the "Neapolitan Versailles" at Caserta. Some of these buildings were turned into hospitals and homes for war victims, and others into museums.

VIENNA (*see* 28.50), the capital of the Austrian Republic, is situated in Lower Austria, but under the Constitution has in all matters which concern itself the status of an independent Territory. Under these special conditions, the *Gemeinderat* (or city council) exercises the rights of a *Diet* (or states assembly). In 1910, Vienna had a pop. of 2,031,498, but in 1920 only 1,842,005. In 1910 86·9% of the inhabitants were Roman Catholics; 3·7% Evangelicals; 8·6% Jews and 0·7% of other faiths. The proportion of males to females was in 1910 1,000 to 1,086; in 1920, 1,000 to 1,163. The non-German minority shown by the census of 1910 (98,430 Czechs and 8,954 others) greatly decreased after 1918.

VILLA, FRANCISCO (1872–), Mexican bandit and revolutionary, was born Dec. 4 1872 at Las Nieves, Zacatecas. He was outlawed for murder, and a price was put on his head by President Díaz. He joined Madero in 1910 for the sake of immunity, served under Huerta, and in 1914 joined Carranza, but quarrelled with him over military jealousies and presidential aspirations. He opposed Carranza in the Convention at Aguascalientes, led a campaign against him and occupied Mexico City in April and again in Nov. 1915, but was defeated by Obregon and driven to the border, where surrender under guarantee was denied him. On Jan. 12 1916 he led the Santa Ysabel massacre, in which a special train carrying a party of American mining men was held up and 19 of the number shot, and also the raid on Columbus, Tex., in March 1916, when the city was fired and 17 of the inhabitants killed. A punitive expedition under Gen. Pershing crossed the border March 16, and operated in the border states for 11 months, but did not succeed in capturing Villa. After Obregon's seizure of the presidential power in 1920 Villa was eliminated from political and military activity, and settled in the *hacienda* La Canutilla, Durango. (H. I. P.)

VILLARI, PASQUALE (1827–1917), Italian historian and statesman (*see* 28.76), was invested in 1910 with the order of the Annunziata. He died at Florence Dec. 5 1917.

VINCENT, GEORGE EDGAR (1864–), American educationist, was born at Rockford, Ill., March 21 1864. He was a son of John Heyl Vincent (d. 1920), a bishop of the Methodist Episcopal Church and one of the founders of the Chautauqua Assembly in 1874 (*see* 6.19). After graduating from Yale in 1885 he began editorial work and in 1886 was made literary editor of the Chautauqua Press. Henceforth he was active in the work at Chautauqua, was president of the Chautauqua Institution from 1907 to 1915 and thereafter honorary president. In 1892 he was appointed fellow at the university of Chicago, receiving his Ph.D. in 1896. He taught at Chicago as instructor, assistant professor, associate professor, and from 1904 to 1911 as professor of sociology. He was dean of the junior colleges from 1900 to 1907 and then for four years was dean of the faculties of arts, literature and sciences. From 1911 to 1917 he was president of the university of Minnesota. In 1917 he was chosen president of the Rockefeller Foundation in New York City; he had been a member of the General Education Board since 1914. He was author of *An Introduction to the Study of Society* (1895, with Albion W. Small) and *The Social Mind and Education* (1897).

VINOGRADOFF, SIR PAUL (1854–), Anglo-Russian jurist (*see* 28.100), was knighted in 1917. His more recent works include *Common Sense in Law* (Home University Library, 1914), *Self-Government in Russia* (1915), and editions of various works for the British Academy and Selden Society. During the World War he gave valuable assistance to the British Foreign Office in connexion with Russian affairs.

VINTON, FREDERIC PORTER (1846–1911), American portrait painter (*see* 28.101), died in Boston, Mass., May 19 1911.

VIRGINIA (*see* 28.117).—The pop. in 1920 was 2,309,187; an increase since 1910 of 247,575, or 12%, as against an increase for the decade 1900–10 of 207,428, or 11·2%. Negroes numbered 690,017, as compared with 671,096 in 1910. The urban pop. (in places having more than 2,500 inhabitants) was in 1920 29·2% and in 1910 23·1% of the whole.

The pop. of the principal cities and its increase were:—

	1920	1910	Percentage Increase
Richmond	171,667	127,628	34·5
Norfolk	115,777	67,452	71·6
Portsmouth	54,387	33,190	63·9
Roanoke	50,842	34,874	45·8
Newport News	35,596	20,205	76·2
Petersburg	31,012	24,127	28·5
Lynchburg	30,070	29,494	2·0
Danville	21,539	19,020	13·2
Alexandria	18,060	15,329	17·8

The great increase in Newport News, Norfolk and Portsmouth was largely due to industries related to the World War.

Agriculture.—In 1920 Virginia ranked as twenty-third state in value of agricultural products, $187,038,000 as compared with $100,531,000 in 1908. The production of the staple crops was:—

	1920	1909
Corn (bus.)	50,100,000	38,295,141
Wheat "	11,425,000	8,076,989
Oats "	4,818,000	2,284,495
Rye "	864,000	438,345
Barley "	405,000	253,649
Buckwheat (bus.)	540,000	332,222
Tobacco (lb.)	177,390,000	132,979,390
Hay (tons)	1,235,000	823,383
Peanuts (bus.)	4,416,000	4,284,340
Potatoes "	13,608,000	8,770,778
Cotton (bales)	19,000	10,480

An important element was the increased activity of the State Department of Agriculture. In addition to seed testing and the inspection of fertilizers a division of markets was established and plants were opened to supply lime to farmers at cost. Fruit crops in 1920 were large, the production of apples being 15,210,000 bus., peaches 1,470,000 and pears 296,000.

Minerals.—The mining and quarrying industry in 1919 showed a considerable increase since 1909 in the number of enterprises, a slight increase in the capital invested, and a large increase in the value of products. But there was a decrease in the number of individual mines and quarries and a slight decrease in the number of persons engaged in the industry. The statistics were:—

	1919	1909	Per cent Increase
Enterprises	202	150	34·7
Mines and quarries	216	244	−11·5
Persons engaged	15,537	15,960	−2·7
Wage earners	14,547	15,257	−4·7
Capital	$57,035,775	$55,992,693	1·9
Value of products	29,363,449	8,795,646	233·8

Virginia in 1920 was the leading state in the production of iron pyrites and soapstone, third in the production of lime and manganese, and sixth in mineral waters. The figures for mining and mineral water industries in 1919 were as follows:—

	Estabs.	Capital	Product
Coal	109	$48,978,261	9,111,454 tons
Iron	14	895,555	308,000 "
Manganese	47	2,489,400	13,665 "
Mineral waters	18	848,283	1,745,105 gal.
Pyrites	5	2,550,854	143,427 tons (1918)
Soapstone	4	617,887	$527,524
Millstones, and sand and gravel	6	522,152	$733,074
Slate	..	3,654,000	$264,275
Miscellaneous ores	..	1,587,491	1,313,439 tons
Lime	..	..	26,700 "

Manufactures.—Manufacturing industries made less progress than agriculture between 1910 and 1920. The following statistics for 1919 are the preliminary figures of the 14th Census; those for 1909 from the 13th Census:—

	1919	1909
Establishments	5,603	5,685
Capital invested	$464,517,000	$216,392,000
Materials	372,041,000	155,320,000
Value of products	641,810,000	219,794,000
Value added by manufacture	269,769,000	108,719,000
Wage earners (average)	119,368	105,676

Government.—Between 1910 and 1920 10 amendments to the state constitution were adopted. Local government was the subject of four amendments. In 1910 the state constitution was amended to permit the re-election of county treasurers and commissioners of revenue, and in 1912 another amendment permitted the re-election of city treasurers and commissioners of revenue. In 1912 the Legislature was empowered to classify cities according to population and to provide forms of city and town government, but cities with over 50,000 pop. were permitted to have special forms of government. Under this amendment the Legislature provided for general charters under the commission, or manager, form, but in 1920 another amendment was ratified which permitted Legislature to provide special forms of government for any city on condition that the sections of the constitution regarding franchises, changes in city boundaries, public debts and the assessment of property were not violated. In 1920 another amendment removed the requirement of residence within the municipality as qualification for appointment to office in a city government when technical training was requisite. In 1920, also, the construction of roads was made a proper subject for state debt, and other amendments bearing on education were adopted.

Finance.—The valuation of property assessed for taxation in 1910 was $756,194,480; in 1920 it was $1,459,762,653. In 1910 the public debt was $24,956,959; in 1919 it was $23,561,823. In 1910 the state's income and disbursements combined were $11,333,490; in 1920 they were $18,442,324. The long-standing controversy between Virginia and West Virginia concerning the division of the state debt as it existed in 1860 was finally settled in 1915 by the Supreme Court of the United States. The amount to be assumed by the state of West Virginia was fixed at $12,393,929 (*see* WEST VIRGINIA). Between 1910 and 1920 notable reforms were made in taxation and financial administration. A special tax commission was appointed in 1910 to recommend measures for the segregation of property for taxation. In 1912 the commission recommended the establishment of a permanent tax commission with power to investigate and to submit plans. A second special commission was then appointed; in 1915 a majority report recommended a revision of assessments under a permanent tax commission, and a minority report favoured immediate measures for segregation. The minority report was adopted, and the tax laws were revised as follows: the state levy on on real estate and tangible property was restricted to educational purposes, and state and local levies on intangible property were apportioned at 65c and 30c per $100 respectively; a permanent tax board was created consisting of the governor, the auditor, and the chairman of the State Corporation Commission, with power to employ assistants, whose duties are to collect information relating to taxation, to make recommendations to the Legislature, and to supervise the work of local tax boards. In 1918 local governments were denied the right to levy income taxes, and in the same year a special tax of eight cents per $100 was levied, four-eighths of which was to be applied to state elementary schools, three-eighths to the construction of roads, and one-eighth to the eradication of tuberculosis. In 1919 an additional tax of seven cents was levied for roads. In 1916 a commission on efficiency was constituted to recommend more efficient methods of state and local financial administration, and in response to its recommendations a state budget law was enacted in 1918 which gave the governor large powers over appropriations from the state treasury.

Education.—The school revenue, which in 1910 was $4,407,853, amounted in 1920 to $13,791,864, the expenditure *per capita* of attendance increasing from $14.77 to $39.48 and the length of the school term from 140 to 147 days. In this period the number of state high schools of all grades increased from 360 to 394. In 1912 an additional state normal school for the training of teachers was established at Radford. In 1918 a general property tax was added to the existing sources of school revenue which yielded approximately $660,000. In 1918 school attendance of all children between the ages of 8 and 12 for 16 weeks was required. Teachers' pensions have been provided for, and the pensions disbursed in 1920 amounted to $10,000. In 1918 the Legislature provided for an Educational Commission to make a survey of the educational laws and conditions and to make recommendations for reform and improvements. Its report was made in 1920, and in accord with its recommendations the Legislature in that year submitted for ratification the following amendments to the constitution: legalizing the membership of women on school boards, removing the limitation on county and district school tax rates and all limitation on the Legislature in enacting compulsory attendance laws, and giving the Legislature the power to fix the duties of the State Board of Education. Among statutes enacted in 1920 looking to the improvement of the school system were laws encouraging a nine months' term in rural communities, making the school age 7 to 20 years, provision for a school census, encouragement of rural high schools, conferring on the state superintendent the right to nominate candidates for positions as teachers, provision for physical education and medical inspection, and placing the state institutions of higher education on an all-year basis of operation.

History.—In 1912 the work of children under 12 years of age in coal mines was prohibited and the 10-hour day for children in factories was extended to workshops and mercantile establishments, with the exception of packing and fruit industries between July 1 and Nov. 1, mercantile establishments in towns of less than 2,000 pop., and Saturday work in mercantile establishments. In 1918 the mimimum age for employment was raised to 16 years. In 1914 the commitment of insane criminals to asylums by judicial investigation and order before trial for the crime committed was provided for, and in 1916 the State Board of Charities and Correction was required to register all the feeble-minded in the state, to take measures for their commitment to asylums, and to instruct parents in the care of feeble-minded children; it was also authorized to supervise private institutions for the feeble-minded. Two institutions for the feeble-minded are supported by the state, one for white patients near Lynchburg and one for negroes near Petersburg. In 1916 the office of public defender for cities of 50,000 or more pop., with the duty of defending the poor in lawsuits, and state compensation was authorized for attorneys appointed by courts to that duty. In 1918 a Mothers' Pension law was enacted which allowed city and county governments to make payments to widows with children under 16 years of age. In the same year the principle of the uniform Family Desertion Acts was adopted, and an Industrial Commission was provided to administer a workmen's compensation system.

Three sanatoria for the treatment of tuberculosis have been established, the Catawba Sanatorium in Roanoke county (1909), Blue Ridge Sanatorium near Charlottesville (1920), and Piedmont Sanatorium for negro patients near Burkville (1918). In 1918 a state orthopædic hospital was established at Richmond. In 1914 the Virginia Home and Industrial School for Girls, a private institution, became the property of the state, and since then three other reformatories have been taken over. In 1919 the State Prison Board was reorganized and reforms in prison management were adopted, notably better medical care of prisoners, investigation of their mental condition, provision for recreation, and elementary and industrial education. In 1914 a State Forestry Commission was established. In 1916 the State Board of Health was given control over all water supplies which might endanger public health. A state art commission was constituted in the same year.

In the World War Virginia supplied 81,140 men to the army, navy and marine corps and subscribed $263,948,400 to the Liberty and Victory loans.

In every state and national election between 1910 and 1920 the Democratic party had a majority. In 1909 William Hodges Mann (Dem.) was elected governor, his term being from 1910–4; he was succeeded by Henry Carter Stuart (Dem. 1914–8, and in 1917 Westmoreland Davis (Dem.) was elected, his term of service beginning in 1918. (W. K. B.)

VIRGIN ISLANDS (*see* 28.126).—The group of the Virgin Is. formerly known as the Danish West Indies was purchased by the United States from Denmark in 1917 for $25,000,000, the formal transfer taking place March 31 of that year. This group consists of the islands St. Croix, St. Thomas and St. John, together with about 50 smaller ones, most of them unnamed and uninhabited. These and the islands Vieques and Culebra ceded to the United States by Spain in 1898 now compose the Virgin Is. of the United States. The language of the people is English, although the islands had been under the Danish flag for 245 years. The total area of the three principal islands is about 132 sq. m.; St. Croix, the largest, had, according to the U.S. census of 1917, a pop. of 14,901; St. Thomas had 10,191; and St. John, 959, a total of 26,051, of which 7·4% were white, about 80% negroes and the remainder of mixed races. Illiterates constituted 24·9% of the pop. 10 years of age and over. The largest city in the islands, Charlotte Amalie, on the island St. Thomas, had in 1917 a pop. of 7,747. The other towns, Christiansted and Fredericksted on the island of St. Croix, had pop. of 4,574 and 3,144 respectively; these three towns embrace approximately 60% of the total population.

The principal industry, the production of sugar, rum and molasses, is confined to St. Croix. The importance of St. Thomas is due to its magnificent harbour, where the repairing and provisioning of vessels constitute practically the sole industry. In 1920 the U.S. Shipping Board completed an oil-fuelling station here with a capacity of 110,000 bar. St. John and St. Thomas produce the finest bay oil and bay rum in the world. In 1918 exports of bay rum amounted to 26,531 gal. valued at $29,101, and in 1919 these returns were more than doubled. There were, in 1917, 430 farms containing an area of 69,892 ac., which was 82·4% of the total land area. There were 6,084 persons, or 41·6% of the working population engaged in agriculture and animal husbandry, and 380 persons in fishing.

The total trade of the islands in 1919 was valued at $4,196,037, compared with $3,141,775 in 1918. Exports advanced from $1,249,346 in 1918 to $1,919,525 in 1919, while imports increased from $1,892,429 to $2,276,512. The major portion of this commerce was with the United States, being in 1918 more than seven times as great as with all foreign countries, and in 1919 about four times as great. The total exports of the islands to the United States in 1918 were valued at $1,137,501, 82% being sugar, compared with $1,593,130 in 1919, of which sugar constituted 88%. Of the other exports to the United States the chief were rum, hides and skins, and cabinet woods. Of exports to foreign countries in 1919, spirituous liquors to Denmark constituted about 44% and bay rum about 18%. The principal imports from the United States are breadstuffs, meat and dairy products, iron and steel products, cotton manufactures and coal. Since 1918 fuel oil from Mexico has constituted a large proportion of the imports. Many of the provisions imported are resold as ships' stores, while nearly all of the coal and fuel oil imported are used for bunkering ships at St. Thomas.

Since the transfer of the islands from Denmark, their administration has been under the U.S. Navy Department. The first governor was Rear-Adml. James H. Oliver, who was relieved April 8 1919 by Rear-Adml. Joseph W. Oman, U.S. navy. The latter was succeeded in April 1921 by Capt. Sumner E. W. Kittelle. When the United States took over the islands educational facilities were limited, but steps have been taken to improve conditions. Improvements have been made also in the municipal hospitals and along sanitary lines generally, especial attention having been paid to infant welfare work. (W. R. Ma.)

VISCONTI-VENOSTA, EMILIO, Marquis (1829–1914), Italian statesman and diplomat (*see* 28.129). After representing Italy at the Algeciras Conference the Marquis Visconti-Venosta retired into private life, but on account of his great experience, profound legal and political culture and sound judgment, he was often consulted by his Government, especially on questions of foreign affairs. He explicitly approved of Italy's declaration of neutrality on the outbreak of the World War. He died in Rome Nov. 28 1914.

VISTULA-SAN, BATTLES OF THE.—In the Austro-German autumn campaign of 1914 against Russia (*see* Eastern European Front Campaigns; also Map, Plate I., under same heading), the battles of the Vistula and the fighting on the San, with the battle of Chyrow, from Sept. 9 to Nov. 5, form a series of operations which are described below.

The retreat of the Austro-Hungarian armies in the middle of Sept. to the San and the area around and S. of Przemysl had hardly been completed when the Russian forces made ready to cross the San at its mouth with a view to enveloping Dankl's army, both at that point and on the left bank of the Vistula.

After the recent heavy fighting, in which Austria-Hungary had drawn upon herself alone the whole weight of the superior force of Russia, her army was exhausted and anything but fit to hold the San against the on-coming, steadily increasing mass of Russians. And yet if they were allowed to advance any further, not only would the Austro-Hungarian army be shattered but one of the main German industrial areas—Upper Silesia—would be in danger. For the protection of this area and the support of her ally, it was necessary for Germany to send immediate reinforcements. Negotiations to this end began between the two army commands by the middle of September.

Considerable portions of the German VIII. Army had been set free after the successful battles on the Masurian lakes. While the Austro-Hungarian armies were shaking off the enemy, a IX. German army under the command of Gen. von Hindenburg had been constituted in S. Poland and Upper Silesia out of the German XI., XVII. and XX. Corps, the Guard Res. Corps and a combined Corps, together with the 8th Cav. Division. This army was drawn up for deployment along the line Przynów–Lelów–Wolbrom–Cracow by the end of September.

On Sept. 16, protected by the Przemysl fortress, which was left to its fate, and the bridgeheads of Sieniawa and Jaroslaw, evacuated on Sept. 18 and 20 respectively, the Austro-Hungarian armies resumed the retreat which led them back to the line of the Dunajec, the Biala, and the farther side of the Carpathian ridge, by the end of the month. The Russians attempted no real pursuit, but sent only weak forces after them to beyond the Wislok. They regarded the Austro-Hungarian army as worn-out, and turned their attention to preparing a powerful push through Poland into the heart of Germany.

The Austro-Hungarian armies, after re-establishment, were to join the German IX. Army in a new offensive which aimed at beating the Russians and relieving Przemysl.

The Austro-German Advance on the San–Vistula Line (Oct. 9 1914).—The idea underlying the new offensive was as follows: Hindenburg's army was to advance on the stretch of the Vistula between Zawichost and Ivangorod and envelope the Russians from the north. The Austro-Hungarian armies were to advance with a small group on the N. bank of the Vistula, but with their main forces to the S. of the river by way of Rzeszow and Krosno to the San and on Przemysl, while the II. Army moved forward correspondingly in the region S. of Przemysl.

The Russians were well aware of these measures, and as soon as the advance of the Allies began they abandoned the siege of Przemysl and withdrew their forces remaining in Galicia to the San and to the E. and S. of Przemysl, where they fortified their positions. Their main strength they concentrated in the first instance at Ivangorod, and later at Warsaw, in order to fall on Hindenburg's northern flank and thus compel the Allies to retire. As early as Sept. 22 the latter received the first news of the formation of a Russian IX. Army in the region round Ivangorod, and from this time reports kept pouring in of the shifting of strong Russian forces northward. It therefore became incumbent upon the Austro-Hungarian army to make a vigorous onslaught on the Russians, in order to contain as large a number of their forces as possible. The demand thus made upon it that army was in a position to meet only conditionally owing to the superiority of the Russians, who had meanwhile been reinforced by Siberian and Caucasian troops.

While on Oct. 4 the main forces of the Austro-Hungarian armies were advancing eastward S. of the Vistula, the German XI. Corps at Opatow and the Austro-Hungarian 3rd and 7th Cav. Divs. at Klimontow on the N. of that river came upon the enemy and drove him behind the stretch of the San between Sandomierz and Zawichost by Oct. 5. The Austro-Hungarian main forces in the area S. of the Vistula encountered at first only Russian cavalry. Until the San was reached only comparatively slight resistance was offered by the Russians. Only the IV. Army, of which the command had been taken over by the Archduke Joseph Ferdinand in the beginning of Oct., and the N. wing of the III. Army had to battle with and overcome strong Russian forces round Rzeszow, Lancut, and Barycz on Oct. 7 and 8. The I. Army, after some brief combats, was able to drive over the San the portions of the Russian V. Army which had remained in the angle of the San and Vistula. By Oct. 10 the Russians were over the San and behind Przemysl, with the exception of parts of the Russian III. Army, which held out until Oct. 12 at Jaroslaw on the W. bank of the San.

While the advance was still in progress news came of a northward diversion of the Russian V. Army. Large Russian forces were also debouching from Ivangorod and Warsaw. All the indications pointed to the fact that the Russians had transferred their centre of gravity to the Warsaw–Ivangorod stretch of the Vistula. The original plan of forcing the Vistula with Hindenburg's army between Zawichost and Ivangorod could not now be carried out. Instead, while the Austrian I. Army advanced gradually down the Vistula to the mouth of the Kamienna, Hindenburg was to cross the Vistula below Ivangorod, having first driven the Russian forces from Warsaw and Ivangorod back across the Vistula. The Austro-Hungarian main army was to make a vigorous effort to force the San and once more push on toward Lublin and Chelm.

Battles of Warsaw and Ivangorod (Oct. 10–Nov. 5).—The advancing corps of Hindenburg's army came into contact with large Russian forces to the S. of Ivangorod and Kalwarija and at Mszczonow-Grojec, and these they drove back on Oct. 10. South of Warsaw, where the resistance offered was only slight, the German corps gained ground, taking Blonie; but at Ivangorod and Alexandrya the attacks of the III. Caucasian Corps made things very uncomfortable for them.

The Russian offensive advance across the Vistula below Zawichost seemed to be getting well under way. The German IX. Army was reinforced without delay by two divisions on its right wing, and three more divisions of the I. Army were pushed forward into the Radom–Ilzanka area. To Hindenburg's left wing were sent two Landwehr Brigades and the Austro-Hungarian 7th Cav. Div., which, with the German 8th Cav. Div. was formed into a Cav. Corps under Gen. von Korda.

The fighting persisted stubbornly on both sides. In view of the constant Russian reinforcements, Hindenburg could achieve a decisive success neither at Warsaw nor at Kalwarija or Ivangorod. When, on Oct. 15, his left wing was forced back at Blonie-Grodisk, the Allied Army Commands were more and more inclined to think that the Russian main attack was about to be launched from Warsaw with two armies, the II. and V. Armies. The Allies decided to meet this attack by the German IX. Army on the line Lowicz–Skierniewice–Rawa–Nowemiasto–Radom. The Austro-Hungarian I. Army meanwhile was to concentrate seven divisions in the Radom–Ilzanka sector in readiness for an attack on Ivangorod. This concentration of the I. Army was completed by Oct. 21. The IX. Army held its ground against the numerical superiority of the Russians until Oct. 19, when, after Korda's Cav. Corps had dispersed a Russian Cav. Corps near Sochaczew, it retired to the above line.

Simultaneous attempts to force the San were made by those portions of the Austro-Hungarian I. and IV. Armies posted on the lower San, but though partial successes were achieved, no tangible results were possible in view of the Russians' powerful counter-attacks, particularly as the Russians had succeeded in taking the W. bank of the San at Biellny, Zarzecze and Monasterz. For this brought the X. Corps of the Austro-Hungarian I. Army over to the W. bank of the Vistula, and the IV. Army had to take over the defence of the whole line of the San. To the W. of Warsaw the Russians were extending still further westward, and bringing up forces to the Lower Bzura, where the Russian I. Army was being formed.

On Oct. 21 Hindenburg and Dankl were grouped for attack in the order arranged, and on the 22nd Dankl advanced to the assault. In the battle of Ivangorod which followed (Oct. 22–7), some fine initial successes were obtained by the I. Army and the German Guard Res. Corps fighting on its left wing, but the 37th Honved Div., fighting on the right wing, was placed in a very critical position by the extremely violent attacks of the Russian XXV. and XIV. Corps. Embittered fighting persisted for the next few days on the I. Army's front. On Oct. 24, Hindenburg was attacked along the whole of the front by the Russian II. and V. Armies, but was able to repulse all their assaults. On Oct. 26 the Russians drove their right wing forward through Gadin, Osmolin and Lowicz. Here four Russian Corps forced back two German Landwehr Bdes., Korda's Cav. Corps and some German Landsturm. Hindenburg's main force, four Corps strong, was opposed by six Russian Corps, and the seven Austro-Hungarian Divs. posted in the direction of Ivangorod had to cope with double their own numbers.

As there was no prospect of a successful issue, and as an enforced retreat had in places already set in, the battle was broken off on Oct. 27. Leaving Dankl's army to put up an obstinate resistance along the line Kielce–Gura–Opuczna–Opatow–Sandomierz, Hindenburg led his army back to the line Sieradz–Jedrziejów. The Guard Res. Corps was to remain on the left wing of the I. Army, while Field-marshal Lt. Freiherr von Haner's Cav. Corps, newly formed out of the 2nd, 3rd and 9th Cav. Divs., was to constitute a liaison between the two armies.

Battle of the Opatowka (*Oct. 31–Nov. 2*).—The Russians pursued the Austro-Hungarian I. Army with their IX. and IV. Armies, the German IX. with their V. and II. Armies. Meanwhile the newly formed I. Army on the Russian right wing advanced on Kutno. By Oct. 30 the Austro-Hungarian I. Army had reached its position and strengthened it technically against all emergencies. On Oct. 31 the columns of the Russian IX. Army appeared at Opatow and proceeded to attack violently both there and on the Opatowka. At Kielce the fighting was of secondary importance, but E. of Opatow the Russians were aiming at a break-through. On Nov. 2 Dankl's right wing retired behind the Koprzywianka, exposing the flank of the Austro-Hungarian IV. Army fighting on the far side of the Vistula.

In view of the vigorous Russian pursuit and the impossibility of holding the Koprzywianka any longer with troops that were already greatly exhausted, the Austro-Hungarian higher command agreed to the retreat behind the Nida proposed by the I. Army command. On Nov. 3 the I. Army with the Guard Res. Corps, reached the area W. of the Czarna and Czarna Nida and on the 4th shook off the Russian IX. Army completely. On Nov. 5 the army crossed the Nida and on the 6th continued its march into the area round Cracow.

The German IX. Army, which remained practically unmolested during the whole retreat, commenced its further retirement to the Silesian frontier in the night of Nov. 3 and 4, arriving there on the 5th.

Battle of Chyrow (*Oct. 13–Nov. 2*).—The Austro-Hungarian II. Army had advanced to the S. of the III. Army, without encountering enemy opposition, but under the most unfavourable conditions imaginable. The leading division reached Kroscienko on Oct. 9, only to find the Chyrow defile, through which the advance to the area E. of Przemysl was to be made, blocked by the Russian XXIV. Corps. Gen. von Tersztyánszky's column (the IV. Corps), which had pushed on further to the E., reached Turka after taking the Uszok pass by hard fighting.

The II. Army came up against strong enemy forces, firmly established in well-prepared positions on the heights S. of Stary Sambor, and on those opposite the S. wing of Boroević's army. With its main force, the VII. and XII. Corps, the II. Army attacked the enemy's position S. of Czyszki, on both sides of the Blozewka hollow and at Starasol. Tersztyánszky's group, coming from the S. was to take the heights S. of Stary Sambor and push forward with one column (the 38th Honved Inf. Div. and 5th and 8th Cav. Divs.) through the Bystrycza valley to Sambor. Working in harmony with this attack, the S. wing of the III. Army, which was opposed by numerically superior Russian forces, was also to push forward. Gen. von Boroević reinforced this wing by bringing up the III. Corps and the 23rd Honved Inf. Div. from the area N. of Przemysl, where they had just driven the Russians across the San. The II. Army aimed at forcing a decision with Tersztyánszky's group. But while the preliminary battles were being successfully conducted there, a heavy Russian counter-attack set in in front of the left army wing. This led to very heavy fighting on the heights S. of Stary Sambor, at Slochynia, Blozew Gorna and Towarnia, and necessitated the putting in of all available reserves. The right army wing was able to achieve some successes in fighting down the Russian opposition, but an advance on the left wing by the XII. Corps was quite impossible, for there the Russians were doing their utmost to break through to Chyrow and Dobromil. The 20th Honved Inf. Div. and 34th Inf. Div. fighting on that wing had to be withdrawn to the area E. of Towarnia and toward Blozew Gorna, and from Grodowice to Slochynia, and even after the 17th Inf. Div. came on the field they could not stand against the overwhelming onslaught. Just when the situation looked most threatening, the 12th Inf. Bde. of the III. Corps arrived on the battlefield, and although not able to turn the scale it relieved the pressure on the Honved Inf. Div., which was the most exhausted.

On the morning of Oct. 16, the Russians were resuming their attacks, when the III. Corps made its counter-attack directed against the heights of Czyszki, Guty and Wegrzeliska. But though the coming into action of the III. Corps brought some relief to the fighting divisions, no success could be expected in view of the continuous vehement Russian attacks, and more especially, the devastating flank fire from the Czyszki and Magiera heights. To conquer these heights Boroević now brought up the XI. Corps also to the area S. of Przemysl. But in the night of Oct. 17–8, the Russians once more pushed forward with strong forces into the Blozewka hollow, and threw back the 22nd Inf. Div. onto the heights E. of Nowemiasto. The 34th Inf. Div. was likewise forced to give ground, and Blozew Gorna was given up to the enemy. On Oct. 19, the XI. Corps, advancing through Stroniowice and Tyszkowice on Mizyniec and Chodnowice, flung themselves into the battle, and drove the Russians back. Close by, a little further S., the 44th Inf. Div. stormed the Magiera height, and the advance of the III. Corps was made considerably easier. When the 23rd Honved Inf. Div. attacked from Byblo, it carried the whole front with it. The 22nd Inf. Div. recaptured Sanoczany, the 6th Inf. Div. seized Blozew Gorna, and the 28th Inf. Div. worked its way through to the edge of a wood opposite the Wegrzeliska height. The danger of a break-through now seemed to be finally averted.

Meanwhile Tersztyánszky's group on the right wing of the II. Army had also had some hard battles. In the Bystrycza valley the 38th Honved Inf. Div. column, which had gone on ahead, succeeded in beating back through Zalokiec, Podbuz and Uroz the Cossacks who had been pushed forward to protect the Russian left wing. But on Oct. 18 the Russians brought up new forces through Boryslaw with which to attack this column in flank, whereupon the column had to be taken back to the heights W. of Zalokiec and Podbuz. In the meantime Gen. Hofmann's Corps, destined for the defence of the Carpathians, which had advanced over the Beskid Pass on Oct. 8, had taken Stryj and despatched a group to Drohobycz. This group came up in front of Drohobycz on Oct. 21, but the Russians in the meantime had attacked Gen. Hofmann with greatly superior forces, so that the detachment sent to Drohobycz had to intervene at Stryj. It was therefore unable to procure any relief for the II. Army particularly as Gen. Hofmann had also been forced to retreat.

Simultaneously with this, the attack along the whole front of the II. and III. Armies was continued. In the case of the III. Army this culminated in the attempt to capture the Czyszki heights and in the defence of the Magiera height against the Russians who were longing to regain it, while the II. Army aimed at relieving the enemy pressure on the right wing. But by Oct. 23 the great numerical superiority of the Russians at this point had become evident, and the II. Army command found it necessary to bring back the IV. Corps—consisting of the 38th Honved Inf. Div., the 31st Inf. Div. and the 1st, 5th and 8th Cav. Divs.—without delay to the heights N.E. of Turka. The XII. Corps was to remain on the heights W. of Stary Sambor, and the IV. Corps was brought up from the III. Army to fill the gap between the two. The Russians kept touch with the retreating divisions but for the moment attempted no sort of pursuit.

The III. Army, stricken with cholera and short of munitions, had not been able to achieve any real success up to Oct. 26. On the afternoon of that day a general attack was delivered by the III. Army with the object of relieving the II. Army, but as this also failed almost completely the front was technically strengthened and the reserves were taken out of it and placed at the disposal of the II. Army.

Meanwhile the Russians had not molested the II. Army's right wing to any extent, but directed their energies toward the gap between the IV. and XII. Corps, where they hoped to break through. Their attack on Oct. 26 across the Holownia height had begun to look like a break-through, when Field-marshal St. Krautwald's group of the III. Army, together with two newly arrived Landsturm territorial brigades and a few march battalions, came to the rescue. The IV. Corps, as soon as it had recovered a little from the recent heavy fighting, went over to the attack, and took the Bzeniec, Podzemen and Zwihonka heights.

The attack by Krautwald's group and the IV. Corps had good results. By Oct. 31 the Russian VII. Corps had been driven from the stubbornly defended Holownia height. As this attack progressed, the XII. Corps and, shortly after, the III. Army joined in. On the morning of Nov. 2, the whole of the II. Army was engaged in the attack. Hofmann's Corps, which had retired on Skole after the abortive advance on Drohobycz, also joined in the renewed attack on Stryj. The XII. Corps came up close to Stary Sambor and up to the Kundieska height. The IV. Corps approached the strong Russian position Lisyj height—Zalarski height and the heights E. of Podbuz.

Just as the battle at Chyrów seemed at last to be taking a favourable turn, after the II. Army had received reinforcements, and the reconstruction of the railways leading to Chyrów and Przemysl promised a considerable improvement in the service of munitions and supplies, there came the order to retire, an order totally unexpected by the troops of the II. and III. Army engaged in the attack.

The army higher command had already informed the army commands on Oct. 27 of the unfavourable situation in the bend of the Vistula, and announced the possibility of the breaking off of the battle. The position of the armies fighting on the San, at Przemysl and at Chyrów, had been made untenable by the withdrawal of the German IX. Army and the Austro-Hungarian I. Army from the line Sieradz–Kielce, and from the Opatówka to behind the Nida—practically to the Silesian frontier. In spite of the successes just achieved on the S. wing, therefore, the Austro-Hungarian armies had again to be led back, in view of the general situation. In Upper Silesia, in the Cracow area and in Western Galicia, a new grouping of the Austro-Hungarian armies was to be undertaken, under the protection of the Carpathian ridge, in readiness for a new offensive in better circumstances in conjunction with the German IX. Army—which was also to be reorganized.

The retreat was begun in the night of Nov. 2–3, by the left wing of the Austro-Hungarian IV. Army, and by the right wing, now amalgamated with the III. Army. Both these and the II. Army broke contact with the enemy in the night of Nov. 4–5. (E. J.)

VITAMINE, the term now employed to designate certain substances contained in foods. The exact nature of these substances is not known, but they have been shown to be necessary to the normal development of young animals (including children) as well as to the maintenance of health and well-being in adults. They are very labile substances which, existing abundantly in raw foods, especially in uncooked fruits and vegetables, become seriously attenuated or altogether destroyed by cooking, desiccation, decortication and other refining processes. There are probably a great many vitamines in natural foods—live or quick foods, as they are called—but up to the time of writing three only have been isolated. These are (1) the anti-scorbutic factor; (2) the water-soluble B.; (3) the fat-soluble A.

The Anti-Scorbutic Factor.—As long ago as 1734 J. E. Bachstrom observed that the disease known as scorbutus or scurvy appeared to be related to the ingestion of salted, preserved and dried foods. The disease in question was alarmingly prevalent among mariners on long distance sailing vessels, and the British navy was annually decimated by this scourge. The introduction of fresh vegetables and fruits into the dietary of the sailors was found to afford them complete protection against the disease, but the knowledge thus empirically gained was not followed by any scientific investigation, and though the door was thus widely opened to the discovery of vitamines, these important substances were destined to lie *perdu* for nearly 200 years. This anti-scorbutic factor is the most fragile of the three which have so far been isolated. It is present in large quantities in all uncooked fruits and vegetables, and it is interesting to note that the popular idea that foods which have been kissed by the sun have a greater value than those which have not, finds some justification in the fact that vegetables grown above ground are much richer in the anti-scorbutic factor than root vegetables. This factor is well represented in fresh milk, but boiling, pasteurization, or evaporation completely destroys it. The activity of the anti-scorbutic factor is much increased by germination; thus, beans, peas, or the grains of wheat or barley in the ordinary dry quiescent state contain no anti-scorbutic factor, but if they be placed in water and allowed to germinate, they immediately acquire this vitamine in large quantities. There is a practical application of this interesting fact which should not be lost sight of by travellers in inaccessible regions.

The Water-Soluble B.—Prof. Gowland Hopkins of Cambridge published in 1912 an article entitled "Feeding Experiments Illustrating the Importance of Accessory Factors in Normal Dietaries,"[1] in which he called attention to the serious effects upon the health of animals which resulted from the absence from their food of certain hitherto unrecognized principles. In the following year Casimir Funk[2] claimed to have isolated a "Factor X" which corresponded to the absent principles described by Hopkins to which he gave the name of Vitamine, in the mistaken belief that the factor in question contained an amino-acid. In spite of its faulty derivation the name caught on, and the word vitamine is now employed to include any of those essential substances which Hopkins unfortunately described under the term "accessory." The experiments of these two observers showed that the absence of the factor now known as the Water-Soluble B. was the cause of the disease known as beriberi, which a Dutch physician, Dr. C. Eykman, had in 1897 associated with the custom of eating polished or decorticated rice by the natives, to the exclusion of all other foods. Beriberi is a disease of the nerves, and it was found that other similar affections of the nerves, pellagra for example, could be experimentally produced by withholding this vitamine, and cured by reinstating it in the dietary; hence the term "anti neuritic" by which it is sometimes known. This factor is essential to the normal growth, development and well-being of young animals. It is present in great abundance in all quick or natural foods, in grains and eggs. It is also present in the brain, liver, sweetbread and kidneys of animals, whereas from muscle or ordinary meat it is relatively absent. Yeast contains this vitamine in large quantities. In the vegetable kingdom, the leguminosæ afford it, uniformly distributed throughout their substance; whereas in cereals it is confined to the outside covering; hence the importance of unpolished rice and whole meal bread. It is soluble in water, especially in slightly acidulated water, and in alcohol, but not in fats. It resists a relatively high temperature; it is present for example after boiling for a short period, but is destroyed at 120° C.

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[1] *Journal of Physiology* (1912), p. 425.

[2] *Ueber die physiologische Bedeutung gewisser bisher unbekannten Nahrungbestandteile der Vitamine. Ergebn. Phys.* (1913), 13, p. 125.

This vitamine, as indeed the whole conception of vitamines in general, was first described in 1901 by Dr. Eugene Wildiers of Antwerp (1878–1908) under the name of Bios.[1] In a paper which appeared in *La Cellule* (Louvain) on April 2 1901 entitled "Nouvelle substance indispensable au développement de la levure," this young Belgian observer set forth a good deal of the knowledge which we now possess, but no notice was taken of his work, and his conclusions were arrived at independently by a different route about 12 years later.

The Fat-Soluble A.—In the year 1913 the third vitamine was described by McCollum and Davis.[2] Its absence was shown to provoke a disease of the eyes, characterized by œdema of the lids, ulceration of the cornea, blindness and ultimately death. These lesions, even when in an advanced state, were cured by the exhibition of the vitamine. The absence in some degree of this factor is held responsible by some for the disease known as rickets. Its presence is certainly necessary to the growth and normal development of young animals. It is found (*a*) in certain animal fats, *i.e.* milk, butter and glandular tissue; (*b*) in the green leaves of edible plants. It is thus interesting to note that though present in essential organs or so-called "noble" tissues, it is absent from connective tissue and reserve tissue, such as lard or the subcutaneous animal fats. Olive oil and other vegetable oils do not contain this vitamine, whereas cod-liver oil contains it in large quantities. Fat-Soluble A. is soluble in oil, but not in water. It resists high temperature better than the other two.

Such was the state of our precise knowledge in 1921 concerning these elusive substances. If only from the confused and cacophonic nomenclature, it is evident that this knowledge was still in a very embryonic state. That there is, in this matter, a very wide field of interesting and fruitful research awaiting us is obvious from the fact that the discovery of the vitamines has entirely altered our conceptions of the causes and origins of disease. Until lately disease was regarded as a sin of commission by some unseen and subtle agency; the vitamines are teaching us to regard it in some degree at any rate as a sin of omission on the part of civilized or hypercivilized man. By our habit of riveting our attention upon microbes and their toxins we had sadly neglected the side of the question which concerns itself with our own defences. We sterilized our children's milk against the bacillus, and in so doing we deprived it of its vitamines and thus lowered the resisting power of the victim, not to one microbe only, but to all. The importance of vitamines has taught us that the naturally nourished child is practically immune from the majority of the diseases which in spite of our bacteriological and hygienic knowledge have been raising the infant death-rate to a figure which was as surprising as it was appalling. But it is to be remembered that in order to attain to this immunity a child must be born healthy; it must have been suitably nourished during its intra-uterine life, and this can only be attained by feeding the prospective mother upon foods which contain the necessary vitamines in such an abundance as will satisfy the physiological needs of two. The gross diseases due to absence of vitamines, such as scurvy, beriberi, pellagra and xerophthalmia, called the "deficiency diseases" (*maladies de carence*) are characterized by symptoms which are acute and unmistakable, but it is certain that long before these acute symptoms appear there will have been a general ill-defined departure from normal health, called by the French *carence fruste* or *hypo-carence*, and the condition may never pass beyond this stage. It is thus not only futile but actually dangerous to seek to estimate, as has often been done, the minimum amount of vitamine which will insure protection from obvious disease. What is required is not the minimum but the optimum. Amongst these conditions of *hypo-carence* may be mentioned the majority of the maladies due to the deficient action of the internal secretory or endocrine glands, such as the thyroid, thymus, supra-renals, pituitary, gonads and others, which have already been shown to suffer severely from deprivation of vitaminous foods. In the same category of *hypo-carence* are also to be placed many of the so-called metabolic diseases such as gout, arthritis, diabetes and others. These may be occasioned directly by the vitamine deficiency, or indirectly by starving one or more of the endocrine glands of the all-essential principles. As might easily be supposed, this relative lack of vitamines is peculiarly liable to show itself in the gastro-intestinal tract. Digestive difficulties and intestinal inertia, appendicitis and colitis have been shown in a great number of cases to have been due to a lack of vitamines in the ordinary foods, a fact of which anyone may convince himself in the matter of the widely distributed disease known as intestinal stasis or chronic constipation. It has often been remarked that dental caries or defective teeth is an evil which has seemed to be very much on the increase during the last 20 years; the period, that is, during which all fresh and unsterilized foods have been withheld from the young in order that they may be fed on devitalized pap which, in addition to requiring no mastication, is, by boiling and other culinary processes, completely deprived of the vitamine content so necessary to the proper development and eruption of the teeth themselves. Vitamines have already revolutionized our ideas on dietetics. The erstwhile stereotyped proportions of the proximate principles, proteins, carbohydrates, fats and salts which were considered essential to bodily health have been so altered by the discovery of the vitamines that the whole question will have to be investigated and studied afresh, and the ineffable theory of calories which was based on the curious assumption that the behaviour of food in the human body was identical with its behaviour in a test-tube, will retire to the limbo of things well forgotten. The discovery of the vitamines presents would-be scientists with a much-needed lesson in humility. It reminds us that, in evolving man, Nature provided him with the foods necessary to his growth, development and well-being, and that in interfering with these natural foods by cooking, sterilizing and refining, he has sacrificed their efficacy, sometimes to his greed, but more often to his arrogant assumption of superior knowledge, with the result that he has not only promoted the prevalence of preventable disease, but has actually created others which but for his misdirected energy would have had no existence.

REFERENCES.—Report on Vitamines, Medical Research Committee (British Government, 1919); Weill and Mouriquand, *Alimentation et maladie par carence* (1919); Dr. G. Houbert, *La question des vitamines* (1920); Raoul Lecoq, *Les nouvelles théories alimentaires* (1920). (L. Wi.)

VOGÜÉ, EUGÈNE MELCHIOR, COMTE DE (1848–1914), French author (*see* 28.172), died in Paris in 1914.

VOLUNTEERS (*see* 28.208).—The reorganization of the Volunteer Force in Great Britain, founded in 1859, as a Territorial Force fully constituted with staffs, troops and services, took place in 1908; and when this was completed, no units of the Volunteers continued in existence as such, except a few companies in the Isle of Man. The Volunteer Act, however, was not repealed.

At the outbreak of the World War, the existing organization of the British army, consisting of Regulars, Special Reserve, and Territorial Force, filled up its establishments generally, and the Territorial Force formed duplicate units, while the depots and surplus resources of the Regular army and Special Reserve formed the nucleus of the "New Armies." But over and above these, which were normal, or derived from normal organizations, there began in Aug. 1914 a widespread effort throughout Great Britain to prepare for the contingency of invasion by voluntary military training. Everywhere local units sprang up. These had no official status, all expenses being privately borne; and the organization and administration were vested in local committees.

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[1] "*Vitamines et Stomatologie*," par H. Allacys, "*Revue Belge de Stomatologie*," No. 9, Sept. 1920, p. 377.

[2] "The Necessity of Certain Lipins in the Diet during Growth," *Journ. Biol. Chem.* (1913), p. 167.

In Nov. 1914, the British Government, realizing the necessity for making every provision for a possible invasion, granted recognition to these voluntary formations under the title of Volunteer Training Corps. They were affiliated to a body in London called the Central Association Volunteer Training Corps, which was made responsible by the War Office for their training and administration. A uniform enrolment form was prescribed, and the following conditions of service were imposed by the Army Council:—(1) that only those should be enrolled who, through age, were not eligible to serve in the Regular or Territorial armies, or were unable to do so for some genuine reason, and in the latter event agreed to enlist if called upon to do so later; (2) that it should be open to army recruiting officers to visit the corps at any time, and to recruit any eligible members whose presence in the corps could not be justified; (3) that no form of attestation involving an oath should be permitted. Clothing, equipment, arms and financial assistance were not provided by the Government; local appeals for funds were issued, and met with considerable success, many municipalities making generous grants. Whenever they were available, exempted men with military experience were appointed instructors. Buildings for drill purposes were hired where they were not lent by Territorial Force associations, and miniature rifle ranges were constructed. Some corps, owing to the patriotic generosity of individuals, were provided with uniforms of green-grey, as well as rifles. Every volunteer was supplied with a red brassard worn on the left arm when he was in plain clothes, inscribed with the letters "G.R.," showing his status as a combatant.

Many feared that this volunteer movement might provide a hiding place for shirkers from military service, but on the contrary, it proved a most powerful recruiting organization; over a million men passed through its ranks into the Regular army, the preliminary training they had received as Volunteers contributing materially to their efficiency. By the end of 1915, some of the corps had attained considerable proficiency in elementary drill, but the shortage of arms, and the inexperience of many of the instructors, militated against a high standard of efficiency.

The Volunteers were eager for the status of soldiers; and in March 1916, the King invited lords-lieutenant of counties to submit offers from corps willing to enroll under the Volunteer Act of 1863. The response was general. In May 1916, regulations for the reconstructed Volunteer Force were issued, which provided for the raising of Volunteer regiments on a county basis under county commandants. Owing to the wide distribution of the personnel of various battalions, a uniform strength could not be insisted on, but minimum and maximum establishments were laid down. The force was to be called out for actual military service only in the event of imminent invasion, as notified by royal proclamation, although at other times voluntary offers of temporary service either by corps or individuals could be accepted. Motor corps, field ambulance sections, and certain specialist units such as signal and electric light companies, were subsequently formed in order to complete the defence schemes for the commands.

The original organization proved unsatisfactory, as it called for no medical examination and imposed no drill obligation. In Jan. 1917, under powers conferred by a Volunteer Act passed in 1916, it was therefore decided to form special sections of the Volunteer Force, with qualifications as follows:—

Section A.—Men over military age, free from organic disease, who were able to stand service conditions in garrisons at home, to march at least 5 m., to see to shoot with the aid of glasses, and to hear well. In addition they had to be free to vacate their civilian employment on the occurrence of a national emergency.

Section B.—Exempted men of military age, with practically the same conditions as Section A.

Section C.—Lads under military age, but of not less than 17 years, of the same physical standard as for A. and B.

Section D.—Men who were not eligible for, or were unwilling to become, members of Sections A., B., or C.

Section P.—Special constables, who, in the opinion of the chief constable of the county could undertake this duty without interfering with the proper performance of their duties as special constables.

Section R.—Men employed in Government departments, on war work, and railway employees.

Officers and men of Sections A., B. and C. were required to sign an agreement to serve for the duration of the war, and to carry out a definite number of drills per month, becoming liable to penalites under the Army Act if they failed to fulfil their obligations. The sum of £2 was granted to the Territorial associations concerned for each Volunteer on his satisfying the prescribed authority that he had attained the requisite standard of efficiency. It was then the duty of the association to provide him, as a first charge on the grant of £2, with uniform, the balance, if any, being available for general administrative purposes.

The retention of Section D. men, who undertook no obligation, was a weakness to the force, and Sections P. and R. were also of little value, as they could not be depended upon to be available when required, and afforded to many a means of avoiding military obligations. Just before the Armistice, War Office instructions were issued ordering the discharge of all Volunteers over 55 years of age, and also of all who refused to agree to serve for the duration of the war. This would have had the effect of reorganizing the force on a really sound basis.

In Sept. 1916, the general administrative control of the reconstituted Volunteer Force was transferred to the director-general of the Territorial and Volunteer Forces at the War Office, the local administration in the counties being undertaken by Territorial Force associations, in consultation with county commandants. The Central Association Volunteer Training Corps then became mainly an advisory body. A senior staff officer for Volunteer services was appointed to each command and was made responsible to the general officer commanding-in-chief.

Voluntary efforts of service by corps or individuals were accepted by general officers commanding-in-chief of commands, and all kinds of pre-emergency duties were undertaken. When so employed, Volunteers were not entitled to army pay and allowances, but received free travelling warrants, and an allowance at the rate of 5d. per head for each complete period of six hours worked; this amount being paid to the corps for the provision of rations. The following were some of the duties thus undertaken. There was a complete scheme for guarding the various lines of communication by Volunteers, and many men carried out this guard duty on a "rota" system, which enabled them to carry on their normal work as well. A large amount of trench digging, principally in connexion with the London defence scheme was also undertaken. Much useful pre-emergency work was performed by the R.A.S.C., M.T. (V), in evacuating ambulance trains, distributing men arriving home on leave from the different theatres of war, conveying wounded to and from hospitals, and in the provision of transport necessary in the training of other branches of the force. The services of the R.G.A. (V) were in some cases utilized, on a "rota" system, in manning the guns of batteries on the coast at night, men attending at 7:30 P.M. and leaving at 5 A.M. the following morning. And Volunteers, especially in London, were employed on anti-aircraft duties.

Service in the Volunteer Force was not allowed to interfere in any way with the operation of the Military Service Acts, which subsequently withdrew a large number of the original Volunteers. These men were replaced by others, who, though fit and capable, were very busily employed on work of national importance, and were not only for the most part lacking in enthusiasm, but had little time for training. The Military Service Act of 1918 made service in the Volunteer Force compulsory for men exempted by military tribunals. This, of course, meant the administration of conscripts into a so-called "Volunteer" Force.

The formation of special service companies of the Volunteer Force for a limited period of whole-time service, replacing personnel of T.F. cyclists battalions on the E. coast, was undertaken in June 1918. In almost every county the Volunteers were most desirous of carrying out this duty. But the minimum period of service was fixed at two months, and strict medical limitations were laid down. Consequently there was difficulty in obtaining the necessary number. The total so employed was 484 officers and 7,777 other ranks, which was considerably short of requirements.

In Nov. 1918, the Volunteer Force consisted of:—11 companies of R.G.A.; 11 engineer corps; 1 signal and transport column; 63 motor volunteer corps (R.A.S.C., M.T.) (V); 282 infantry battalions; 1 pioneer company, and 22 medical corps; with a total strength of 254,826 all ranks. In Oct. 1920 the War Office issued instructions for the disbandment of the Volunteer Force. These instructions excepted the R.A.S.C., M.T. (V), of which the strength was:—468 heavy sections of transport, 79 light sections of transport, 92 sections of transport for field ambulance, 3 sections of transport for motor air-line sections, and 7 sections of transport for signal companies. These units were required for special-transport duties, and were not disbanded till March 31 1921, when they received the special thanks of the Army Council. As a mark of appreciation of the services rendered by the Volunteer Force, the Army Council decided to allow officers to retain honorary rank on retirement, and granted them the right to wear uniform on special occasions. (R. E. G.)

VORARLBERG (*see* 28.211).—The pop. in 1910 was 145,408; in 1920 only 133,033 (132 per sq. mile). In 1900, 88% of the area was productive, and of this 51·3% was grazing land, 29·4% forest, 15·3% meadow, 0·5% gardens, and 3·45% arable. Vineyards occupied less than 0·1%. The most important towns are Bregenz, the capital (pop. in 1920 12,102, the town itself 7,488); Dornbirn (13,764); Feldkirch (4,593); Bludenz (5,488). Rieden, the suburb of Bregenz, is a manufacturing centre.

VOSGES, BATTLES IN THE, 1914–8.—The Vosges mountains (*see* 28.214) rise sharply to the N. of Belfort. From the groups of the Ballons, which reaches a height of more than 1,200 metres, the main ridge runs N. by the Drumont, the Grand Ventron (1,309), and the Hohneck (1,366). North of the Bonhomme pass (949) the ridge falls gradually to 558 metres at Saales, near the headwaters of the Bruche, one of the Alsatian tributaries of the Rhine. From the Saales gap the ridge rises to Mont Donon and Prancey, each over 1,000 metres high, and is prolonged through a series of vast forests as far as the Saverne valley. From the Ballon d'Alsace to the Donon, the Vosges form a mass of mountain with steep slopes, narrow deeply cut valleys and swiftly flowing torrents, a terrain always difficult and often impossible of passage away from the roads. The summit of the ridge generally takes the form of a swollen saddle, wooded in places but usually covered with the large grassy swards known as the Chaumes (Calvi Montes). These Chaumes are wind swept all the year round, very hot in summer and very cold in winter, and the snows which cover them completely from Oct. onward only disappear in early June. Both slopes of the ridge are clad with magnificent fir and pine forests, which end just below the crest in a thin ledge of bushes bending before the wind. The fall of these slopes is steeper on the Alsatian side than on the other; immediately below the crest a cliff of granite rocks or sandstone falls almost vertically, often in the southern part of the Vosges, for some 250 metres. From the foot of this wall begins a gentler slope extending all the way to the Rhine valley. On the Lorraine side, however, the mountains descend much less steeply in a series of ridges towards the Moselle and the Meurthe. The points of passage, formed by the roads crossing the ridge, acquire considerable importance owing to the absence of such crossings elsewhere. These points of passage, moreover, are not numerous. In the group of the Ballons the pass of Bursang, with the smaller passes of Oderen and Bramont, lead from the Moselle valley to the Thann valley. At the foot of the Hohneck the pass of the Schlucht leads from Gerardmer to Munster and Colmar; to the N. the Bonhomme and Louchpach join the valleys of the Vologne and the Weiss. The pass of Ste. Marie unites Ste. Marie-aux-Mines and Schletstadt; the gap of Saales leads from Prorenchers to Schismeck; and, lastly, a road which passes over the summit of the Donon leads from Celles to Molsheim and Strasbourg. The only railways across the Vosges were the two main lines from Strasbourg to Nancy, by Saverne, and from Mulhouse to Belfort by Dannemarie, together with the narrow gauge railway from Gerardmer to Munster. On the French side of the Vosges small branch lines ran up into the mountains to St. Dié, Gerardmer, Cornimont and Bursang, and other branch lines on the Alsatian side ran from the Strasbourg-Mulhouse railway to the heads of all the Vosges valleys.

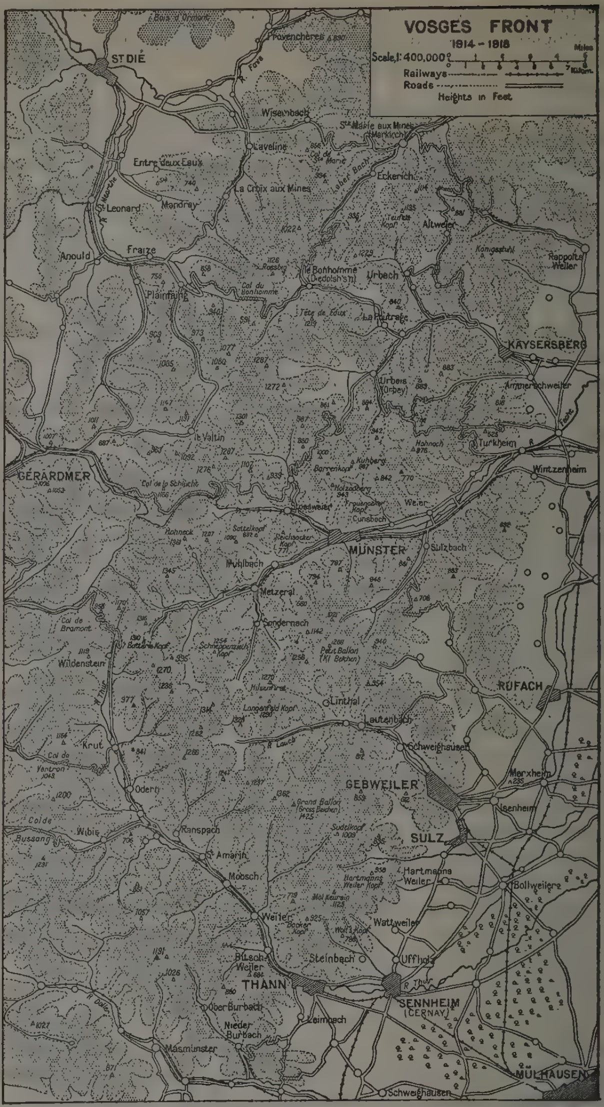
VOSGES FRONT
1914 - 1918
Scale, 1: 400,000
Miles
Kilom.
Railways
Roads
Heights in Feet
Bois d'Ormont
Provenchères
ST DIÉ
R. Fave
Wisembach
Ste Marie aux Mines (Markirch)
Laveline
Col de Ste Marie
Entre deux Eaux
La Croix aux Mines
Laber Bach
Eckerich
R. Meurthe
St Leonard
Mandray
Teufels Kopf
Altweier
Anould
Fraize
Königsstuhl
Rappolts Weiler
Rossberg
le Bonhomme (Diedolshs'n)
Urbach
Col du Bonhomme
Plainfaing
Tête de Faux
La Poutroye
KAYSERSBERG
Urbeis (Orbey)
Ammerschweier
le Valtin
Hohnach
Turkheim
Kuhberg
Barrenkopf
GERARDMER
Col de la Schlucht
Holzaderg
Wintzenheim
Frauenacker Kopf
Weier
Cunsbach
Hohneck
Sattelkopf
Reichsacker Kopf
MUNSTER
Sulzbach
Muhlbach
Metzeral
Col de Bramont
Sondernach
Batterie Kopf
Schnepfenrieth Kopf
Petit Ballon (Kl Belchen)
Wildenstein
R. Thur
Hilsenfirst
Linthal
RUFACH
Langenfeld Kopf
Lautenbach
Krut
R. Lauch
Schweighausen
Col de Ventron
Merxheim
GEBWEILER
Oderń
Grand Ballon (Gross Belchen)
Isenheim
Col de Bussang
Wibis
Ranspach
Sudelkopf
SULZ
St Amarin
Mobsch
Hartmanns Weiler Kopf
Hartmanns Weiler
Bollweilere
Mol Keurain
Weiler
Bocker Kopf
Wolf's Kopf
Wattweiler
Bitsch Weiler
Steinbach
Uffholz
THANN
R. Thur
R. Doller
SENNHEIM (CERNAY)
Ober Burbach
Nieder Burbach
Leimbach
Masmunster
MULHAUSEN
Schweighausen

The frontier imposed on France in 1871 by the Treaty of Frankfort reached the crest of the Vosges, after cutting the gap of Belfort at the Ballon d'Alsace, and followed the watershed as far as the Donon; thence it changed direction from N. to N.W., and following a purely artificial line left all the upper Saar valley to Germany, cut the Seille at two points, and reached the Moselle 2,000 yd. below Pont-à-Mousson. From the military point of view this frontier left French Lorraine in a regular salient. General Sèré de Rivières, the far-sighted and skilful creator of the French defensive system, had therefore been compelled to go back to the Moselle to organize the barrier blocking the roads from the frontier. This barrier consisted of the two fortresses of Epinal and Belfort, connected by a line of forts along the upper Moselle. The importance of Belfort lay in the fact that it formed the right flank pivot of the whole defensive system, blocking as it did the gap between the Jura and the Vosges, and commanding the ground as far as the Swiss frontier. On their side the Germans had progressively strengthened the line of the Rhine by constructing the fortress Istein facing Mulhouse, improving the old strongholds on Huningen and Neubrisach, and turning Strasbourg into a great entrenched camp, extending its action by means of the forts of Mutzig and Molsheim as far as the Bruche valley.

The Position in the middle of Sept. 1914.—The work carried on by either side for 40 years had made of the Vosges region a military area in which it was impossible to move without encountering some natural or artificial obstruction, defended on one side or the other by numerous garrisons. It was there, nevertheless, that hostilities between Germany and France actually started in the early days of Aug. 1914. After a few weeks fighting, however, the main offensives had been stopped in one place or another; and the position of the two adversaries towards the middle of Sept. was as follows:

On the western slope of the Vosges the Germans had been checked and obliged to retire on Sept. 7. In the Lunéville area they had maintained their hold on the Parois forest and Badonvillers. North of St. Dié, which they had evacuated on the 11th, they held the Ormont ridge and the vicinity of the Saales gap. On the Vosges crest their occupation of the Violu and the Bernhardtstein secured to them the pass of Ste. Marie-aux-Mines; a little further to the S. they held the Tête-de-Faux, commanding the Bonhomme pass. The pass itself was in the hands of the French, who, since the withdrawal of the army of Alsace, held all the crest from there to the south. The German counter-offensive had been stopped on this side facing the Schlucht on the summit of the Luige ridge, commanding the valleys of the Weiss and the Fecht; at Metzeval, blocking the upper Fecht valley, the Grand Ballon de Guebwiller was held by French outposts, and a French division occupied the Thur valley as far as Thann, the gate of the Sundgau. In the Sundgau itself the outpost line of the Belfort garrison had been pushed forward to Lauev, Mortzwiller, Dieffmatten, Traubach, Gommersdorf, Ballersdorf, Suarce, and Réchézy.

On the French side the forces in the Vosges consisted of three infantry divisions and ten Alpine groups, forming, under the command of Gen. Putz, a " Vosges group " attached to the army of Gen. Dubail. The troops in the gap belonged to the Belfort garrison and were under the governor-general Thévenet. On the German side the troops holding the gap of Saales belonged to von Falkenhausen's army detachment. Those in the Upper Vosges and the Sundgau belonged to the army detachment under von Gaede. Both consisted principally of Ersatz and Landwehr troops, von Gaede's strength being equivalent to five divisions.

From mid-Sept. onward the operations in the Vosges assumed the character of local and disconnected actions, always bloody and often prolonged. These actions may be dealt with here in succession, in each of the secondary theatres—the region of St. Dié, the eastern slope of the High Vosges, and the Sundgau.

The Region of St. Dié.—The Ormont ridge, on which the Germans halted after their retirement, was too close to St. Dié to be left by the French forces in their hands, and on Sept. 17 the 152nd were ordered to drive them from it. The task was no easy one, and for three days the gallant regiment of Gerardmer vainly attempted to maintain their footing on the slopes, which were stubbornly defended and swept by machine-gun fire. On the 20th it delivered a new surprise attack without preliminary bombardment from W. to S. The hostile resistance was as stubborn as ever, but after immense exertions two companies gained a footing on the summit, and despite fierce hand-to-hand fighting and heavy counter-attacks, the mountain remained in French hands at the price of 600 dead.

At the end of Oct. serious fighting took place around the Ste. Marie-aux-Mines pass for the possession of the Tête-de-Violu, commanding the pass to the west. After a series of actions, lasting from Oct. 31 to Nov. 12, the French Alpine troops held the hill, the pass itself remaining in the hands of von Gaede's Landwehr men.

On Dec. 2 Alpine troops stormed the Tête-de-Faux facing the Bonhomme pass on the Alsatian slope, thus securing the pass. On Christmas eve violent hostile attacks, intended to dislodge them, were repulsed by the bayonet and destroyed by the French artillery, and the enemy retired leaving over 500 dead.

The early months of 1915 were passed by both sides in entrenching themselves, but in April violent combats broke out for the possession of the promontory of the Ban-de-Sapt, N. of St. Dié, between Saales and Moyen Mautiers; the trenches were so close together and so strong that both sides had recourse to underground warfare. German and French mines and countermines were exploded one after the other, destroying the defences, and blowing great craters, the possession of which was hotly contested, with bomb and bayonet. After some months of this the French at the end of July had definitely secured possession of the Ban-de-Sapt by their occupation of hill 627, dominating the promontory and the hamlet of Launois in advance of it.

From now onward the positions on both sides were stabilized, and remained so for three years, during which trench mortars and machine-guns were daily in action, and frequent patrol encounters took place, without the fighting ever becoming as intense as during the first year of the war.

In Nov. 1917 the French were relieved by the Americans in the St. Dié sector, where the division under Menohery completed its training and underwent its baptism of fire.

The Eastern Slope of the High Vosges.—On the eastern slope of the High Vosges, between the Schlucht and Cernay, position warfare began in Sept. 1914. Trench systems were gradually dug and often hewn out of the rock. On the crests they were in places so near as to touch each other, and bristled with accessory defences. Elsewhere they were farther apart, separated by valleys and deep ravines. The German positions facing W. were close up against the mountains, but the Alsatian plain behind them facilitated the supply of materials, artillery and reinforcements, and by affording convenient billets rendered easier the task of the command. The French had the advantage of the ground, but there was no inter-communication between the valleys, the heads of which they occupied. The roads leading to the rear were poor, and the supply of ammunition and material of all kinds was proportionately difficult. Bivouacking on the crest was uncomfortable and even impossible in cold weather, while the exercise of command was much impeded by the poverty of communications.

The fighting in this region was necessarily of a local character, and exercised no influence on the general course of the operations; but owing to the stubbornness of the two adversaries its intensity was often such as to involve losses quite disproportionate with any possible results. On the French side the army detachment of the Vosges, under Gen. de Maud'Huy, thus became the VII. Army, which included practically all the available Chasseurs Italiens, while on the German side von Gaede's detachment also increased to the size of an army, in which some of the best troops of the German Empire often fought.

These local combats attained their greatest intensity during 1915, and the names of the sectors in which they took place, such as the Fecht and Linge valleys, and Hartmannswillerkopf, appeared in the communiqués for several months.

A severe winter, to which the troops were not yet inured, had for a time suspended operations, but at the end of Feb. 1915 the Germans became active in the Fecht valley, and after several vain attempts to push their line forward in front of Munster they occupied the Reichackerkopf on March 21. On April 17 the French retaliated by occupying the Schnepfenrieth, and a few days later the Sillackerkopf; once in possession of these two heights they drove the Germans from Steinbruck on the Fecht and advanced to the outskirts of Metzeral. During the whole of May fighting went on on both banks of the Fecht, and the French succeeded, after great efforts, in getting up sufficient artillery to render the valley untenable as far as Munster. They then between June 19 and 23 captured Metzeral and Sondernach, and picked up over 700 prisoners in the bottom of the valley. During the course of the following weeks the Germans made several attempts to recapture these villages, but without success, and eventually they turned their attention to the Linge ridge further to the north, activity in the Fecht being henceforward confined to artillery and patrols.

The Linge is a spur, some 3,000 ft. high, situated in front of the main ridge between the Weiss and Fecht valleys. The Germans had occupied it in Sept. 1914, and had constructed a maze of trenches with a thick belt of barbed wire and flanked by redoubts of machine-guns. Owing to the fact that the Linge hindered inter-communication between the upper Weiss and upper Fecht, the French decided in July 1915 to occupy it. The operation was an extremely difficult one, for it was necessary for them to come down from the heights, pass through a marshy valley, and scale steep rock-strewn slopes under hostile machine-gun fire; moreover the troops and supplies necessary for the operations had to be brought up from the rear by inferior mule tracks. After ten hours' intense bombardment, the assault was delivered on July 20 1915, and the struggle swayed to and fro uninterruptedly until the end of August. On this small peak there fell more than 50,000 shells; 7 German brigades came into action one after the other against 16 French Chasseurs battalions and 2 infantry regiments, and at the end of severe and costly fighting both sides remained face to face on the crest in trenches which were held unchanged until the end of the war.

The Hartmannswillerkopf, or, as the French soldiers soon began to call it, the "Vieil Armand," is a spur 95 metres high, thrown out to the N. of Cernay into the Alsatian plain by the Molkenrain (1,125 metres), itself an offshoot from the Ballon de Guebwiller (1,425 metres), the highest peak in the Vosges. This spur, with its steep slopes, commands the village from which it takes its name, at a distance of some 700 yards. Its sole advantage from the military point of view lies in the fact that it affords good observation over the Alsatian plain, from Isenheim to Mulhouse. The French therefore had advanced their outpost line up the Thann valley by Willer and Goldbach to the summit of the spur. Its possession by the French naturally annoyed the Germans, and on one wintry day in Jan. 1915 they surprised and captured the French post on the summit, and installed themselves there. In a short time they succeeded in transforming the position into a practically impregnable fortress. Trenches and belts of wire were constructed on all the crests, dug-outs were tunnelled out on the steep eastern slopes, a road was constructed to the summit, and aerial cable set up for the transport of supplies, and concrete shelters for troops and munitions erected, while subterranean passages gave access to all the advanced posts.

The loss of the Hartmannswillerkopf caused no apprehension to the French, who still remained in possession of the Grand Ballon and of the Molkenrain, nor could it even be said to cause them any real inconvenience, as they had no intention of taking the offensive in Alsace. Unfortunately pride spoke louder than reason, and a series of useless struggles, which the higher command did not intervene to stop, were undertaken to recover the lost position. The fighting went on for months under very difficult conditions for the French. On the slopes facing Goldbach the heroism and self-sacrifice of the French troops in their hastily dug trenches were unevenly matched against the facilities for defence and attack which had been accumulated by the patient labour of their enemies. Attack and counter-attack alternated during the whole of 1915, and French and Germans alike suffered fearful losses.

Of all these fruitless combats of 1915 the most characteristic were perhaps those which took place at the very end of the year. The 7th, 13th, 27th, and 53rd battalions of Chasseurs and the 152nd Infantry Regt. on the French side were engaged against the German 12th Landwehr Div., the 187th Ersatz brigade and parts of the 19th Reserve Division. On the cold winter morning of Dec. 21 the 152nd dashed forward under a crushing fire from trench mortars and machine-guns. Its waves advanced, broke, reformed, and advanced again, destroying with bombs every obstacle in their path; decimated but triumphant they reached the summit and even passed beyond it in their rush, chasing the routed enemy down the further slopes. At the end of the day the exhausted victors, who had made more than 1,500 prisoners, halted and passed the night where they were, without even being able to reform. The Germans meanwhile were concentrating a powerful artillery and massing their reserves to recover the lost ground. The German counter-attack took place on the morning of the 22nd. The French 152nd, extended in one long, thin line which was outflanked and broken through by the enemy, was exposed on the steep slopes to a hostile bombardment to which their own guns could not reply; it struggled desperately all the morning, although the men, exhausted by the previous day's fighting, had to make head against the onset of fresh hostile troops thrown in in whole battalions. After eight hours' fighting the heroic regiment was surrounded in the depths of the ravines, and amid the tangle of rocks was entirely overwhelmed. Forty-eight officers and 1,950 men were killed or taken; the rest cut their way out at the point of the bayonet, and rejoined the reinforcements which, though too late to succour their comrades, still held the summit of the "Vieil Armand." The Chasseurs hung on to the crest, and the fierce struggle continued for several more days until the Germans outflanked their position on the north and forced them to retire to their original lines.

A protest was made by the French Parliament against these useless sacrifices of Dec. 1915, and the Minister of War intervened to forbid all local actions not demanded by strategic considerations, and serving no purpose but to increase casualties. This put an end to the fighting which had made the name of the Hartmannswillerkopf famous throughout the world, and from now until the end of the war the two adversaries remained facing each other on the crest, and no further action took place save harmless exchanges of rifle fire. The actions of the Linge and the Hartmannswillerkopf had in this one year of 1915 cost thousands of human lives. Nowhere on the front had there been displayed more courage, more tenacity, more self-sacrifice, but the results had been absolutely *nil*.

From mid-Sept. 1914 onward neither of the two adversaries was in a position to manœuvre offensively in the High Vosges. The strategic defensive was here imposed on both alike by the course of the campaign, and by the local conditions. In the circumstances the task of the commanders was simply to observe the enemy, to strengthen their own positions, and to remain prudently alert without undertaking any local offensives which could only be foredoomed to failure.

The Germans, who disposed of ample resources and good communications in the Rhine valley, should have been content to hold the mouths of the Vosges valleys in strength, while keeping their reserves billeted in the Alsatian plain ready to manœuvre if necessary against any isolated columns which attempted to be debouched from the mountains. The French on their part had an excellent opportunity of applying to the existing situation on the Vosges crest the defensive principles adopted so successfully by Marshal Berwick in the Alps in 1709. A system of solid defences at the heads of the valleys, covered by small advanced posts and supported in rear by well sheltered reserves which could be rapidly moved to any threatened point, would have needed for its successful application a good road running N. and S. on the western slopes of the mountains and connecting up the roads to the various passes. Unfortunately no such lateral road existed, so that the Fecht and Thur valleys were absolutely isolated from each other. This fact explains, though it does not excuse, these attacks on the Linge and the Vieil Armand, which eventually assumed proportions far greater than had been originally intended.

In this respect however the situation began to improve after the spring of 1915. The Governor of Belfort then took in hand the construction of the good and well-concealed road between Massevaux and Willer, connecting the Doller and Thur Valleys. Later the commander of the VII. Army constructed another from the Thur valley road at Kruth along the heights, below the crest which passed behind the Schlucht and extended as far as the Luchpach pass. This new road, together with a few cross tracks, supplied the long-felt need of a lateral line of communication between Massevaux and the Bonhomme pass. It thus became possible to construct strong defensive systems on the heights, and to erect quarters for the reserves and supply parks served by aerial cables further back. A narrow-gauge railway was made from Bursang to Wesserling, so that by 1916 the VII. Army in the Upper Vosges was sufficiently well equipped to be able to fulfil its rôle with complete security. The Germans, on their side, refrained henceforward from partial attacks which could lead to no useful result. The sector thus became one of the quietest on the western front, and up to the end of the war no further fighting took place apart from artillery activity and patrol encounters. Morton's American division came into line here for the first time in 1918, prior to taking part in the decisive battles in that year on the Meuse.

Operations in the Sundgau in front of Belfort.—The headquarters of the 57th Div. had been transferred to Dannemarie on Sept. 18 1914. When this transfer had been completed, the offensive reconnaissances of the Belfort garrison were pursued with renewed vigour; they were even pushed as far as Altkirch and Waldighoffen, and their advance facilitated the occupation by outposts of the passages of the Largue between St. Ulrich and Seppois and the garrisoning of Pfetterhouse by custom-house officers from Chavannate. Toward the end of Sept. the organization of the Belfort garrison was unexpectedly changed by the departure of the active brigade which the Governor was ordered to despatch to the Meuse within 24 hours, and by the demands on its magazines made by the generalissimo in order to increase the reserves of the armies in the field. Batteries of 155 mm. short guns were formed from the artillery in the fortress; the stocks of 75 mm. ammunition were almost entirely depleted, and the loss of the active troops was not completely compensated for by the insufficiently trained territorial battalions which took their place, though the numbers in either case were about equal. As against this the Germans in the Sundgau were receiving important reinforcements; and the French reconnaissances, in the course of their daily encounters, met with an ever-increasing resistance. In view of these circumstances the Governor of Belfort made a careful calculation of his forces, and toward the end of Oct. proceeded to redistribute the troops which he considered could be allotted to the defence of the forward positions, leaving in the fortress only the minimum consistent with safety.

According to these arrangements the 57th Div. remained between Guvenhatten and Strueth as the centre, and, so to speak, the spinal cord of the new disposition. A northern group, equivalent in strength to a mixed brigade, held the interval between Guvenhatten and the Doller on its left, while a similar group was established on its right to occupy the front from Strueth to Pfetterhouse. The infantry of these two groups consisted only of territorial battalions, and the artillery of a few 75 mm. guns borrowed from the 57th Div., and some 90 mm. batteries formed from the reserve artillery of the fortress. All units were ordered to fortify their positions and to cover their fronts by means of heavy and medium calibre batteries borrowed from Belfort.

Two divisions of French reservists and territorials were thus in close contact with the enemy on a front of 20 m.—a line which would have been far too thin but for the fact that its flanks rested on the frontier and on the mountains, and its rear on Belfort. But the main strength of the dispositions lay in the fact that Belfort remained, for all the troops drawn from the garrison and operating in front of the forts, a centre of command which unified all their efforts, and a point of support which could sustain or receive them in case of need.

The new distribution of the French forces in the Sundgau marked the opening of a period of activity which was employed in consolidating the ground held, in rectifying the line, and carrying out small and methodical advances as far as the increasing hostile resistance permitted, until the limit of expansion permissible and the limited forces available was reached. The northern group first strengthened its position at Thann, establishing its heavy artillery on the heights of Roderen, and then established itself solidly on the left bank of the Soultzbach. It then swiftly assumed the offensive on Nov. 7; by the 10th it had pushed forward beyond Michelbach and thus rendered it impossible for the enemy to pursue his attacks against Thann, which was now in a pronounced re-entrant and could henceforward only be bombarded. On Dec. 2 Aspach-le-Haut fell to the combined efforts of the troops from Thann and those from Belfort, but the northern group was held up before Aspach-le-Bas and the Kalberg, which the Germans had converted into a regular fortress. It therefore turned its attention to the right bank of the Doller, occupied Pont d'Aspach station, penetrated on two separate occasions into Burnhaupt-le-Haut, but without being able to remain there, and finally established its right early in Jan. 1915 at the S.E. angle of Langelittenhag wood.

Meanwhile, in a series of successful operations, the 57th Div. had occupied Hecken, Falkwiller, Gildwiller, and penetrated into Buchwald and Keibacker woods. The advance of the northern group to Langelittenhag secured the division's left, and shortly after its front was firmly established on the eastern edge of the forest between the Soultzbach and the Spechbach. Beyond this forest lay the village of Ammertzwiller, which was strongly fortified and held; an attempt to storm it on Jan. 25 1915 failed owing to want of effective artillery support and lack of munitions, and was not repeated, and in front of Dannemarie, the villages of Balschwiller, Ueberkummen and Eglingen were taken and the 57th Div.'s front was pushed forward to the far bank of the Rhine–Rhone canal.

On the right of the 57th Div. the southern group, which was at first almost completely isolated, also set to work to gain ground by small partial offensives; the infantry advanced by slow degrees, consolidating the ground gained at each stage, and thus gradually succeeded in settling and straightening the general line of the front. On the extreme right it was pushed forward to the middle trench of the Largue, below Largin mill. At the same time the position of Pfetterhouse was put in a state of defence, and a 155 mm. battery was placed in position on the slopes S. of the village for counter-battery work against the hostile artillery near Mornach. In front of Seppois the occupation of the Largue valley was completed by the capture of the Entre-Largues salient, which encroached on the heights of Bisel, and further to the N. the southern group's outposts occupied a line in front of and more or less parallel to the Seppois-le-Bas–Largitzen road.

North of Largitzen the line of advanced posts was at first drawn in rear of a group of lakes in the middle of Hirtzbach wood. Later, when the southern group was reinforced, infiltration northward became possible, and the front was pushed forward to the eastern edges of the communal forests facing Carspach and Hirtzbach. Then on Jan. 25 1915, while the 57th Div. attacked Ammertzwiller, the southern group coöperated by advancing S. of the canal, the hostile positions were overrun and our troops crossed the Aspach road, but the check to the 57th Div. leaving them in a salient, they had to be withdrawn, having effected only a small permanent advance in Carspach wood. The action of Jan. 25 1915 was the last effort made to carry out an advance in the Sundgau. The outpost line of the Belfort garrison had then been advanced to a front from N. to S. along the edge of the Brickerwald in front of Michelbach, thence by Pont d'Aspach station, the S.E. corner of the Langelittenhag, the eastern edges of the Buchwald and of Gildwiller wood, Eglingen, the salients of Carspach wood and the communal forests, the crest of the slopes between Seppois and Bisel, the Entre-Largues and Largin mill. To the N. this outpost line joined with that in the Petit Doller, in front of Thann; to the S. it rested on a tongue of Swiss territory known as the Bec-du-Canard, between the Banholtz and Courtavon wood.

The Belfort garrison had employed the offensive-defensive method to the utmost possible limits in carrying on operations for five months, despite the constant depletion of its forces and munitions by the High Command, and in establishing itself firmly between the Petit Doller and the upper Largue; its resources in men, artillery and ammunition were too small to allow of more being done. The objects laid down by the governor in the dark hour at the end of 1914 had, moreover, been practically achieved. The fortress had been made strong enough to inspire a salutary fear in the Germans; the gap was barred and the barrier had been pushed far enough forward to secure Belfort against possible bombardment, save from the ineffective bombs of raiding hostile aircraft. Finally the Belfort troops had set foot as conquerors on the soil of Alsace—that soil whose inhabitants had twice been rendered desperate by the French retirements; they had re-established the prestige of their country at little cost in blood, and had had the honour of restoring to France a portion of her beloved lost provinces.

From Jan. 1915 onwards, only patrol actions, exchanges of rifle fire and intermittent bombardments either of the trench lines or of the billets and communications in rear, disturbed the calm of the upper Alsatian front. Belfort was shelled from long range but remained inviolate. The front itself underwent no change, and in the hour of victory in Nov. 1918 it was still as the garrison of Belfort had made it at the end of 1914, close on four years before. For all that time the pivot on which rested the right flank of the Allied armies had remained firm, and these armies had been able to carry on their operations with no fear for their communications, while the centre of France, secured against attack, had been able to turn all its resources towards winning the war. (F. T.)

VOYSEY, CHARLES (1828–1912), English theistic preacher, was born in London March 18 1828. Educated at Stockwell grammar school and St. Edmund Hall, Oxford, he was ordained in the Church of England and held various curacies up to 1860, when he became curate of St. Mark's, Whitechapel. Thence he was ejected for heterodox doctrine, and went to St. Mark's, Victoria Docks, and later to Healaugh, near Tadcaster, where he was first curate and then vicar. But in 1869 he was summoned before the chancery court of the diocese of York for heterodox teaching, and deprived of his living. He appealed to the privy council, but the decision was upheld. He then established a theistic church in London, where he continued to preach and teach up to the time of his death. He died at Hampstead July 20 1912.

WAGES.—In the following article, which should be read in connexion with those on Cost of Living and Prices, the changes in wages during 1909–20 are considered.

United Kingdom.—In the movement of wages in recent years it is specially important to distinguish between rates of wages and earnings. Rates of wages are time-rates, sums payable for work in a definite time (hour, week consisting of a recognized number of hours and, rarely, a longer period) or piece-rates (sums payable for the performance of a definite task, or as additions to or in combination with time-rates, when the rate depends both on the quantity produced and the time taken in producing it). Earnings are the sums actually received by an employee, generally computed for a week or a year; the term is used specifically when the amount received on piece-rates is in question, and is also used to include payments for overtime in the case of time-workers. Time-rates are generally stated for the normal week or if the rate is an hourly one, as in the building trades, both for the hour and for the normal week; to get a comparable statement for piece-rates it is necessary to compute the average earnings of a number of men who worked normal hours. In modern times a statement of time-rates generally relates to rates agreed to by associations of employers and employees or umpired by the Government; these are frequently minimum rates and the relation between minimum rates and the average of those actually paid to a group of work-people can only be ascertained by special inquiries, such as those undertaken by the Board of Trade in 1886 and 1906. The assumption has to be made that between such inquiries average rates have kept the same proportion to minimum rates, which is only true over a short period and in the absence of disturbing causes. For piece payments the assumption that earnings move by the same percentage as the rates can never yield more than an approximation to the facts, and during the war such an assumption would be completely invalid even if reference was only made to earnings in a normal week, since there were very important changes in facilities for production, in the effort put into the work and in the nature of the work. In the absence of any general information about earnings, statistics in the war period must be confined to statements of time and piece-rates, which do not give a true picture of the economic position of the working class in that time; in 1920, however, industry was more nearly normal and overtime was relatively uncommon, so that a comparison of rates in 1920 and 1914 is not altogether misleading. In making such a comparison the general reduction of hours in 1918 and 1919 must be borne in mind; generally at the dates of reduction piece-rates and hourly rates were raised so as to give approximately the same earnings for the reduced as for the longer week, and weekly rates were the same before and after the reduction, but in some industries an increase for the week was arranged at the same time.

Table 1 shows the general movement from 1890 to 1914. The first column, computed from the XVII. *Abstract of Labour Statistics*, gives the average of a number of changes of time and of piece-rates. The second and third columns depend on additional data (see Bowley, *Elementary Manual of Statistics*, 1920, and Wood, *Statistical Journal*, 1909, p. 103, and 1912–3, p. 220), and give the computed averages based on the numbers in various occupations at the different dates, thus allowing for the relative increase of numbers in the better-paid industries. These figures should be taken in conjunction with the change in retail prices (*see* Cost of Living); the rise in wages from 1902 to 1913 was neutralized by the falling value of money.

Average annual earnings, allowing for unemployment and overtime, for all wage-earners in the United Kingdom (excluding shop assistants), men, women, boys and girls, are estimated at £51 in 1913 (*Change in Distribution of National Income*, Bowley, 1920, p. 13); average family earnings were probably between £95 and £100 annually. For full week's work the average earnings of a man were about 31s., for a woman 14s., for a boy 11s. 6d., and for a girl 8 shillings. There were very few changes between 1913 and the outbreak of the war.

Table 1.—Estimates of money earnings of all wages earners in the United Kingdom (expressed as percentages of their level in 1913).

Not allowing for changes in relative numbers	Labour Abstract	Allowing for changes in relative numbers	
		Bowley	Wood
1890	86	83	83
1	87	84	83
2	86	84	83
3	86	84	83
4	85	84	83
5	84	84	83
6	85	84	83
7	86	85	85
8	89	88	85
9	91	90	88
1900	95	95	91
1	94	94	91
2	93	92	90
3	92	91	90
4	92	90	90
5	92	90	89
6	94	92	93
7	97	97	97
8	96	95	95
9	95	94	94
1910	95	95	95
1	95	96	..
2	98	99	..
3	100	100	..

The dates and amounts of increase of rates of wages in the period 1914–20 may be illustrated by the records in a number of selected industries. The summary in Table 2 is taken from Bowley's *Prices and Wages in the United Kingdom*, 1914–1920 (1921), pp. 105–6.

Table 2.—Estimate of movements of time-rates (for normal week) and of piece-rates in the United Kingdom, 1914–20. (Average rates expressed as percentages of those in 1914).

	1914 July	1915 July	1916 July	1917 July	1918 July	1919 July	1920 July
Bricklayers	100	103	108	123	160	188	228
Bricklayers' labourers	100	103	113	133	180	225	284
Printers (compositors)	100	100	105	120	157	196	246
Railwaymen	100	110	120	155	195	225	280
Dock labourers	100	101	130	150	193	209	266
Cotton operatives	100	105	110	110	157	202	205
Woollen and worsted operatives	100	115	126	144	164	196	239
Engineering artisans	100	110	111	134	173	199	231
Engineering labourers	100	..	..	154	213	255	309
Shipbuilding: Platers' time-rates	100	..	..	130	169	193	223
Coal-mining	100	113	129	136	187 Aug.	224	260 May 254 Aug.
Agriculture: England and Wales	100	112	..	..	189	226	277
General rough average of percentages	100	105 to 110	115 to 120	135	175	210	255 to 260

The increases in the first two years of the war often took the form of a weekly war-bonus of the same amount for artisans and labourers (in some cases greater for the latter) to meet the rise of food prices (*see* Cost of Living and Prices). In 1917 the usual method of changing miners' wages by percentage was replaced also by flat increases of 2s. or 3s. a shift to all underground workers, and no percentage increase was given till March 1920. In engineering and other trades in which munition work formed an important part an addition of 12½% to time-workers and 7½% to piece-workers reckoned on weekly earnings was awarded in

1917–8, but all time-rates (artisans and labourers) in engineering had been raised 7s. weekly before this award, and after it subsequent increases were a flat weekly rate for time-workers and piece-workers alike. Before the war certain proportions had been established, by the working of economic forces modified by collective bargaining, between the earnings (whether time or piece) in various occupations and industries; the effect of these uniform increments was to modify these proportions very considerably. Some of the results are evident from Table 2 (p. 939) and can be studied also in the subsequent tables. In the six years building and engineering and dock labourers' wages had increased by a markedly greater percentage than those of building or engineering artisans or of compositors. In 1914 the bricklayer's labourer's wage was two-thirds of the bricklayer's, in 1920 it was nearly nine-tenths. To some extent the result was due to a definite effort to raise the standard of living of the lowest-paid workers; the minimum rates fixed by the Trade Boards were in 1920 generally three times those in 1914; agricultural wages in Dorset were raised from about 14s. to 46s. but in Yorks from about 21s. to only 49s. No such tendency, however, is observable in the cotton industry, where the old method of percentage changes has been maintained; in the woollen industries percentage changes are still the rule, but increments are not given on the amount by which any pre-war earnings exceeded 30 shillings. In the reductions made in the early part of 1921 there was an expressed desire on the part of the workers that decreases should be uniform for all grades; reductions on this basis tend to restore the pre-war proportions.

Most wage arrangements from 1917 to 1921 were dominated by the increase and subsequent decrease in the cost of living. The woollen industry was the first to arrange changes by a definite formula relating them to the official index number of that cost (Sept. 1919). The railway agreement of Jan. 1920 included a similar formula, and some other industries have followed the same plan. Generally the increase on wages is somewhat less by the formulæ than if the percentage changes of the index number were applied to the whole of standard wages, *e.g.* the railwayman gets only 1s. when the index number rises 5% of its 1914 level, which would only be sufficient if his standard wage was 25s. or under, if the official index truly measured the cost of living; a fall in prices is therefore to the advantage of persons whose wages are thus determined.

Besides the movement already described there has been a tendency to remove local and occupational differences in wages by levelling up lower rates to higher. As a result of the Transport Workers' Inquiry (1920) the rates in all ports were raised to 8s. for the four hours half-day, whatever the previous amounts, and some differential payments for special work were abolished. In successive awards of minimum wages in agriculture the county minima show less deviation. In 1917 the increases since 1914 in all engineering wages were levelled up to 7s. whatever the previous advances, but this award and subsequent national flat increases do not include all increases; nominally the rates in Jan. 1920 were pre-war time-rates + 7s. to make permanent time-rates, + 26s. 6d. war wage, + 12½% on earnings. Actually the average of 120 districts for ironfounders shows an increase of 8s. 8d. in permanent time-rates and that of 189 districts for turners an increase of 9s. 2d.; these increases in the averages arise from the fact that in the districts where wages were much below the average in 1914 the increases were 12s. or more, and throughout the list it is seen that the lower the wage the greater the increase. In the printing trade before the war wage changes were made by local bargaining, but in May 1919 the districts in England and Wales were arranged in six groups and the London district, and the standard rates were fixed at 77s. 6d. (minimum time-rate, compositors, jobbing) in London, 75s. in Liverpool and Manchester, and 3s. less in successive groups till in the lowest it was 60 shillings. Subsequent wage changes have been flat national increases, amounting by June 1920 to 17s. 6d. Prior to the grading there was considerable variation within each group. In other industries, also, there has been a tendency to standardize wages in groups of localities and to make changes nationally. The movement is partly connected with a desire to establish a national minimum and to raise the wage of the worst paid, and partly to avoid competition from low-paid districts and a consequent cutting of rates. It is doubtful how far the pre-war rates were differentiated by economic causes, the local demand for the products of the industry, the possibility of family earnings because of the presence of other trades, the relative cost of food and rent, and how far by accident and custom. It is certain that where real wages were specially high the most skilled workmen were to be found. The partial removal of these differences must have wide-reaching effects on local distribution of industry, whatever their cause. Also the change in the proportion of wages of different grades, discussed in the previous paragraphs, must tend to diminish the supply of skilled labour.

The rates expressed by the percentages in the preceding tables are all for the normal week. After the Armistice English workmen were at first more anxious to secure better conditions of work than higher wages, especially as it was not then anticipated that prices would rise further. In 1918 and 1919 an 8-hour day was generally adopted. More correctly this should be described as a 48-hour week in many industries; *e.g.* in textile factories 48 hours are distributed between Monday to Friday and Saturday morning, whereas in building and dock labour overtime is payable after eight hours on any day and there is a Saturday half-holiday; the normal week is 44 hours. In mines, hours per shift were reduced from eight to seven, and, if 11 shifts are worked in a fortnight, weekly hours from 44 to 38½. In many industries work is done in two spells instead of three in a day, work before breakfast being abolished; this tends to diminish lost time, but in other cases the time lost in starting and stopping is taken out of a shorter day and is relatively more important. There are no sufficient figures to show what has been the net effect on output, but if output per hour of nominal work has neither increased nor diminished, and there are no compensating factors, wage-cost per unit output rose in the six years 1914 to 1920 not in the rates 100 to 255 or 260 as in Table 2, but 100 to 280 or 290, since weekly hours have diminished more than 10%.

In the following paragraphs details of wage changes are shown for a number of industries, in illustration of the general movements now outlined.

Time-rates.—In Table 3 illustrative figures are given. London builders' summer hours were reduced from 50 to 44 weekly between July 1919 and July 1920. Leeds and Birmingham turners' hours were reduced from 53 to 47 and Manchester printers' from 50 to 48 between July 1918 and July 1920. London dockers' daily hours were reduced from 10 to 8 between July 1918 and July 1919. No other changes of hours took place in the period. Turners' rates are typical of artisans in the engineering trades.

Table 3.—Illustrative standard time-rates of wages.

	London		Leeds	Birmingham	Manchester	Port of London
	Bricklayer	Bricklayer's labourer	Turner		Printer (compositor)	Docker
July	Hourly rates		Weekly rates		Weekly rates	Daily rates
1909	10½d.	7d.	34s.	37s.	36s. 6d.	5s.
1914	11½d.	8d.	37s.	38s.	38s. 6d.	5s. 10d.
1915	11½d.	8d.	40s.	40s.	38s. 6d.	6s. 4d.
1916	12½d.	9d.	41s.	43s.	40s. 6d.	6s. 10d.
1917	13½d.	10d.	49s.	51s.	50s.	7s. 10d.
1918	15¼d.[1]	11½d.[1]	57s.[1]	59s.[1]	70s.	10s. 6d.
1919	21d.	17d.	65s. 6d.[1]	67s. 6d.[1]	75s.	11s. 8d.
1920	28d.	25d.	76s. 6d.[1]	78s. 6d.[1]	92s. 6d.	16s.

[1] In these cases 12½% was added to the weekly earnings, whether they were as here stated for normal hours or increased by overtime. Thus the bricklayer's effective rate in July 1918 was 18·9d. per hour.

Building.—The general movement of builders' wages in the United Kingdom is shown in Table 4 (XVII. *Abstract of Labour Statistics*, Cd. 7733, p. 66; *Labour Gazette*, May 1919, p. 172, April 1920, p. 170, and Feb. 1921, p. 62). The increase from 1909 to the end of 1913 was 4·4%. The lesser percentage for weekly than for hourly rates, shown in Table 4, is due to the reduction

Table 4.—Average of rates in a large number of towns.

	Bricklayers				Painters				Builders' Labourers			
	Hourly		Weekly		Hourly		Weekly		Hourly		Weekly	
	Amount	Percentage	Amount	Percentage	Amount	Percentage	Amount	Percentage	Amount	Percentage	Amount	Percentage
1914 Aug. 4	9·9d.	100	40s. 7d.	100	8·8d.	100	36s. 3d.	100	6·5d.	100	26s. 11d.	100
1919 April 30	18·6d.	188	..	..	17·9d.	203	..	..	14·9d.	229	..	..
1920 Feb. 29	22·0d.	223	83s. 7d.	206	21·5d.	244	81s. 5d.	224	18·5d.	284	70s. 3d.	261
1920 Dec. 31	27·5d.	278	100s. 10d.	248	27·1d.	308	99s. 3d.	274	23·8d.	365	87s. 3d.	324

of hours. It will be seen that nearly the same number of pence per hour was added in each occupation; and consequently the percentage increase is the greater the lower the initial wage.

Engineering.—Similar figures are given in Table 5 for engineers. The increase from 1909 to the end of 1913 was 3·6%. During 1915 increases of 3s. or 4s. were given to the majority of artisans and labourers in the engineering trades on time-rates, and 7½% or 10% on piece-rates and in 1916 a similar increase on time but not on piece. In April 1917 permanent time-rates 7s. (in some cases 8s.) and piece-rates only 10% above the pre-war level were arranged for both artisans and labourers, merging the former increments. War bonuses were subsequently granted as follows: April 1917 5s., Aug. 1917 3s., Jan. 1918 5s., Aug. 1918 3s. 6d., Dec. 1918 5s., Dec. 1919 5s., March 1920 and May 1920 each 3s. and 7½% on piece-rates.

Table 5.—Average of weekly time-rates (including bonuses) in a large number of towns.

	Turners		Moulders		Labourers	
	Amount	Percentage	Amount	Percentage	Amount	Percentage
1914 Aug. 4	38s. 11d.	100	41s. 8d.	100	22s. 10d.	100
1919 April 30	76s. 10d.	197	79s. 10d.	192	58s. 3d.	255
1920 Feb. 29	82s. 5d.	212	85s. 6d.	206	63s. 11d.	280
1920 Dec. 31	89s. 2d.	229	92s. 3d.	221	70s. 4d.	304

In addition to these increases, aggregating 39s. 6d. for time-workers and 25% for piece-workers, an addition of 12½% on weekly earnings was granted to skilled munition time-workers in Oct. 1917, and a similar 7½% to piece-workers in Jan. 1918. This new increase was extended during the early part of 1918 to unskilled munition workers, to all engineers, to builders first on munition work and then to all, to iron and steel manufacturers, and to a number of allied trades.

By June 1920 a turner's wage for a normal week of 34s. in 1914, had increased to at least 73s. 6d.+12½%=82s. 8¼d. A labourer's wage had increased from 22s. to 69s. 2½d.

Hours in engineering were generally reduced in Jan. 1919 from 53 or 54 to a uniform 48 weekly.

The increases awarded to piece-workers were less than those to time-workers because the former were during the war able to work with greater facility and to make a great amount of overtime. The earnings of time-workers were also greater during the war; that is indicated by the above rates for normal hours.

Railways.—Earnings of all workmen employed by railways averaged 25s. 4½d. in a selected week in Dec. 1909, and 25s. 10d., 26s. 8½d., 27s. 4½d., 27s. 11d. in successive Decembers; the increase from 1909 to 1913 is 10% (XVII. *Abstract of Labour Statistics*, p. 66). The average for a normal week, however, when overtime earnings are omitted, and men employed in railway workshops are excluded, is estimated at only 26s. 6d. at the end of 1913.

A flat increase was given to all grades in Feb. 1915 of 3s. to men earning less than 30s., 2s. to those earning more. In Oct. 1915 this was raised to 5s. for all, in Sept. 1916 to 10s., in April 1917 to 15s., in Nov. 1917 to 21s., in April 1918 to 25s., and in Nov. 1918 to 33s.; at the last-named date the average wage for the normal week was about 59s. 6d.

In Aug. 1919 for drivers and firemen, and in Jan. 1920 for other grades, new standard rates were established at about 38s. above the pre-war level, and at the same time wages of the worse-paid grades and districts were levelled up. In Jan. 1920 a sliding scale of wages was introduced by which all wages were to rise or fall 1s. weekly for every five points that the cost-of-living index number rose or fell above its level in Dec. 1919 (125% above the pre-war level), but wages were not to fall below certain levels well above those of 1914. In addition to these changes a general increase was granted in June 1920 varying from 2s. to 7s. 6d. or 8s. 6d. and perhaps averaging 4s. 6d. Under the cost-of-living scale wages were raised 3s. in April, 2s. in July, 2s. in Oct. 1920 and 1s. in Jan. 1921 and reduced 4s. in April 1921.

In 1919 the week was reduced to 48 hours, beyond which overtime rates were payable (see *Labour Gazette*, Oct. 1919, p. 416, and June 1920, p. 290).

Agriculture.—In England and Wales the average cash weekly wages of ordinary agricultural labourers were estimated in 1907 at 14s. 9d., earnings (including piece payments, etc.) at 16s. 8d., and allowances in kind (including low rent) at 10d., making 17s. 6d. in all (Cd. 5460). Cash wages rose about 3½% by the end of 1913 according to one estimate (XVII. *Abstract of Labour Statistics*, p. 66) which gives 15s. 3d., but are computed at 15s. 10d. (with allowances at 1s.) in the estimates quoted in the *Report of the Committee to Inquire into the Cost of Living of Rural Workers* (Cmd. 76, p. 23, 57 *seq.*); in this report estimates are also given for 1918. By April 1915 average cash wages had risen to 17s. 10d. and by Aug. 1917 to 22s. 3d. (*Labour Gazette* June 1915, p. 200 and July 1917, p. 239). In Aug. 1917 a minimum rate of 25s. (to include the estimated value of allowance) was established by Parliament; in the summer of 1918 minimum rates were established for each county ranging from 30s. to 36s.; in May 1919 the range became 36s. 6d. to 42s.; in May 1920 a further increase was given, especially large in the lower-paid counties, making the range 42s. to 48s., and in Aug. 1920 they were further raised by 4s. (in two counties 4s. 6d.), making the range 46s. to 52s.: the lower rate applied to 35 out of 52 counties, and 52s. was paid in Cheshire alone, where the recognized hours were 54. In the fixing of minimum wages the hours of work corresponding to them are defined and overtime rates are payable for additional hours; in June 1919 the summer week was 54 and the winter 48 hours, and in Oct. 1919 summer hours were reduced to 48.

Piece-Rates—Cotton.—In the cotton trade no alteration was made in the method of arranging wage changes during the war. The wages of the great majority of operatives are paid by piece-rates, which are fixed in relation to standard lists, and changes are made by adding a general percentage to all rates depending on the standard. In recent years local differences have been merged and piece-rates in Lancs. and Cheshire move in accordance with percentage changes either in the preparing and spinning Bolton or Oldham lists or with the Blackburn and uniform weaving lists. Table 6 shows the changes from 1909 to 1921. Changes took place only at the dates shown till after April 1921. In July 1919 the weekly hours were reduced from 55½ to 48, and piece-rates were raised in the ratio 215:245 (= 48: 54·7) to compensate. If the hourly output had been exactly maintained, the increase above the standard would have been 172½% in May 1920.

Earnings, however, depend not only on piece-rates but also on the number of hours and efficiency of work, and are affected by modifications of machinery and in management. The *Labour Gazette* gives monthly statistics of earnings from which it can be judged that (after an acute depression at the beginning of the war) they rose more rapidly than piece-rates in 1916 and 1917. Subsequent movements are indicated by Table 7 (Bowley, p. 179).[1]

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[1] These are the earnings of all persons employed by certain firms and are affected to some extent by changes during the war.

Earnings increased as rapidly as rates in 1919 and the first half of 1920, after which there was a depression in trade.

Table 6.—Piece-rates of cotton operatives. (Percentages of recognized standards.)

	Preparing & Spinning.	Weaving.
1909	105	100
1912		105
1915 June	110	105
1916 Jan.	110	110
June	115	110
1917 Jan.	115	115
Feb.	125	115
July	125	125
Dec.	140	
1918 June	165	
Dec.	215	
1919 July	245	
1920 May	315	

Table 7.—Piece-rates.

	Piece-rates	Earnings
1914	100	100
1918 Jan.	133	142
June	157	143
Aug.	157	156
1919 Jan.	205	215
June	205	211
July	233	220
Aug.	233	228
1920 April	233	239
May	300	310
June	300	302

Wool and Worsted.—In these industries the organization of wages and their changes is less standardized than in the cotton industry, and a much larger proportion of operatives are paid by time. Between 1909 and 1914 we have to depend on employers' statements to the Board of Trade (*Labour Gazette*, monthly) of average earnings, and from these it appears that earnings increased in the ratio 93 to 100 in these five years, whether owing to changes of rates or to better trade.

During the war earnings advanced very rapidly owing to the great demand for woollen goods, and the following figures relate to time-rates for the normal week or to piece-rates.

The most complete statement for the first three years of the war relates to the Huddersfield district. Here weekly bonuses were given to all workers (whether on time- or piece-rates) in rough proportion to their pre-war earnings, as follows: April 1915 6d. to 2s., Jan. 1916 6d., April 1916 1s. to 2s., Oct. 1916 1s. to 2s.; in Jan. 1917 the bonuses were increased especially to those with the highest earnings and the aggregates since July 1914 were 3s. 6d. to all earning 10s. weekly or less before the war, 5s. to those earning between 10s. and 15s., 6s. 6d. to women earning over 15s. and to men earning 15s. to 20s., and 10s. to men earning over 20 shillings.

In June 1917 a common system was arranged for most of the districts and occupations in the Yorkshire woollen and worsted industries. Instead of the war bonuses 50% was added to the time-rates customary before the war and this was increased successively to 60% in Oct. 1917, 72½% in March 1918, 81¾% in Aug. 1918, 104¾% in Nov. 1918 and 107% in Feb. 1919; after March 1918 the percentage was only given on 30s. if the basic rates exceeded this sum. Male piece-workers were given $\frac{16}{20}$ths and female piece-workers $\frac{17}{20}$ths of these sums, the percentages being based not on piece-rates but on pre-war earnings. In the spring or summer of 1919 an additional 10% was added to the basic rates. From Sept. 1919 the increases were related to the cost-of-living index number, and the addition moved upwards 10% on the original basic rates for every complete 10 points added to the cost-of-living number, these increments were at first not applied to the 10% added in 1919, nor to the excess of basic wages over 30s., and consequently rates moved rather less rapidly than the cost of living as officially measured. In Dec. 1920 the "cost-of-living" wage was 175% of the basic rate, and owing to other changes the whole increment (to operatives where pre-war earnings were under 30s.) reached 216% for time-workers, 181% for male piece-workers and 190% for female piece-workers.

Hours were reduced in March 1919 from 55½ to 48 weekly, and in compensation piece-rates were increased 15% in addition to the increments already described, while weekly time-rates remained unchanged.

Coal-Mines.—The majority of men working in or at coal-mines in the United Kingdom are paid piece-rates, which used to be increased or lowered by agreed percentages in the various districts at frequent intervals, subject to a minimum day's payment for underground workers. The percentage levels reached in the principal districts from 1909 to 1917 are shown in Table 8.

Table 8.—Piece-rates in coal-mines (expressed as percentages of their amount) in July 1914.

	Northumberland	Durham	Federated Districts	South Wales	Scotland	General average
End of 1909	86	92	91	89	86	90
1910	87	91	91	91	86	90
1911	84	88	91	90	86	89
1912	92	93	94	95	97	94
July 1914	100	100	100	100	100	100
" 1915	109	107	115½	111	118	113
" 1916	141	120	127½	132	136	129
Feb. 1917	147	132	132½	146	136	136

In Sept. 1917 the adjustment by percentages in the different districts was given up, and, the mines being controlled by the Government, uniform movements over the whole country were arranged. In Sept. 1917 and also in June 1918 uniform increases of 1s. 6d. per day or shift were granted to all men, and a further increase of 2s. in Jan. 1919 resulted from the reports of the Coal Industry Commission. Evidence to this Commission showed that the average of all workers before the war was 6s. 6d. per shift and in Nov. 1918 as a result of the percentages increases and the bonuses of 3s. was 12s. 6d. In July 1919 the maximum time of a shift was reduced from eight to seven hours, piece-rates being increased to compensate for the shorter time. In March 1920 an increase of 20% on the wages paid before Sept. 1917 was added, bringing the average to nearly 17s. a shift; in Oct. 1920 after a strike further increases in proportion to any increase in output were arranged; in the early months of 1921 the demand for export coal fell off, and when control was removed on April 1 the miners refused to work at the lower rates offered.

Iron and Steel Manufacture.—Wages in these industries are generally related by a sliding scale to the selling price of the product. The movements in different districts have been so divergent that it is not possible to give a summary account of their results, but the following figures are illustrative.

In Cleveland (Yorks) ironstone mining, on Aug. 1917 piece-rates had risen 60% over those of July 1914; from that date to April 1920 the same additions were made as in coal-mining.

In Cleveland and Durham pig-iron manufacture, blast-furnace operators' wages were in successive Julys, 1915 to 1919, respectively 8, 31, 44, 57, and 92% above July 1914, and in Oct. 1919 108% above. In Nov. 1919 a new percentage basis was changed. In addition a bonus of 5d. per shift was added in Feb. 1915 and raised to 10d. in April 1917, and a war wage of 1s. 6d. per shift was added in Aug. 1918.

In Northumberland, Durham, and Cleveland iron manufacture, iron millmen's rates were in Julys, 1915 to 1920, respectively 7½, 50, 67½, 82½, 147½, and 187½% above those of July 1914; some bonuses were granted but merged in subsequent increases.

Minimum Wage under the Trade Boards Acts.—Under the Trade Boards Act of 1909 minimum wages were established in the following industries. Chairmaking (1910), lace finishing

(1911), paper box making (1912), tailoring (1912), confectionery (1915), shirtmaking (1915), tin box manufacture (1915), hollow ware (1916). Under a subsequent Act of 1918 new powers were given to the Ministry of Labour, and a number of other industries in which the organization of the workers was imperfect and the wages low were included in the scope of the Acts. The Acts are not confined to women's wages only, but affect numbers of men in tailoring and other industries.

The hourly rates fixed in 1912–6 for women varied from 2½d. to 3¼d., the lowest in 1914 being 2¾d. The rates rose gradually during the war, but in many cases, owing to the higher earnings possible to women in munitions and other work, more than the minimum rates were in fact paid. More considerable increases took place in 1919 and 1920, and by the end of 1920 8½d. or 9d. was the common rate. A normal week, usually 48 hours, has been fixed, after which higher overtime rates are payable. Piece-rates are fixed so as to give an average worker more than the minimum time-rate.

Wages in other Countries.—Apart from the United States, there are very few authentic computations of the general movement of wages or earnings during the war. Sporadic statements of wages in particular industries exist, but they are of little use when a general view is desired. So far as the information goes it indicates that wages in the neutral and Allied countries followed much the same course as in the United Kingdom. The nominal weekly rates increased later than prices in 1914–8 and gained rapidly (in spite of reduction of hours) in 1919–20, till at the beginning of the depression in the autumn of 1920 it was doubtful whether wages expressed in commodities were higher or lower than in 1914.

The following paragraphs summarize the available statistics. For their relation to prices *see* COST OF LIVING.

Norway.—Up to the summer of 1918 wages as a whole appear to have increased about 90% since 1914. For April 1919 we have detailed statements such as follow, which indicate a general increase of 160 to 180%. Wage rates are compared with those in 1914 taken as 100. Bricklayers, urban 254, rural 271; carpenters, urban 282, rural 279; bricklayers' labourers, urban 291; excavators, urban 301, rural 281; urban painters 281, bakers 288, shoemakers 309, tailors 244, carters 282, dressmakers 238, laundry workers 229; agricultural labourers (not provided with food and lodging) 279; State employees, railway guards, etc., 276, gangers and pointsmen 264, head engine drivers 231, assistants 261, postmen 258. By new collective agreements in April and May 1919 hourly earnings in factories were increased till in July 1919 they are stated at 341 (1914=100), but weekly hours were reduced from 55½ to 48. Unskilled labourers' rates are stated as 388 in Nov. 1919.

Finally an employers' association estimated that in May 1920 skilled adults' hourly wages were 382 in export industries, 398 in other industries, 349 in handicrafts, and for women generally 407, as compared with 100 in 1914.

Denmark.—Hourly wages generally: 1914, 100; 1918, second quarter 170, third quarter 200; 1919, first quarter 224, second 257, third 338, fourth 352; 1920, first quarter 358, second 376, third 398. During 1919 daily hours were reduced till they were generally 8 in 1920 as compared with 10 in 1914. In 1919 (third quarter) hourly wages on the same basis were for male workers, skilled 330, unskilled 366, and for women 353. In April 1920 collective agreements made future changes proportional to the cost of living.

Greece.—The Minister of National Economy (Greece) gives the figures shown in Table 9 for Athens as corresponding closely with those for other parts of Greece.

Table 9.—Wages in Greece.

	Drachmas	
	1914	1920
Daily wage-earners:		
Dockers	3·50 to 4	30 to 40
Bricklayers	4 to 4·75	18 to 20
Carpenters	4 to 7	18 to 25
Painters	5 to 6·50	20 to 25
Smiths	4 to 6	15 to 20
Printers	3	17 to 25
Turners	3·80 to 6·50	8 to 15
Boiler-makers	3·50 to 6·50	12 to 15
Fitters	2·50 to 6·50	6 to 16
Tailors	6 to 7	25
Miners	3 to 5	5 to 10
Monthly wage-earners:		
Corn mill workers	100 to 140	305 to 420
Textile operatives	180 to 200	720 to 820

Germany.—It is estimated that earnings including overtime had increased 34% in industries generally between March 1914 and Sept. 1916, while hourly rates had probably increased 25%. In Sept. 1918 the average daily wage of male adults is stated as 12·46 marks and of women 6·01 marks, compared with 5·17 and 2·28 marks in March 1914 (241 and 264 if the earlier wages are taken as 100). The Federal Statistical Office gives weekly earnings for male adults as 35 marks for the year ending July 1914; if this is taken as 100 subsequent figures are Aug. 1919 286, Feb. 1920 486, Nov. 1920 686. Factory inspectors at the end of 1919 reported a tendency to approximation between wages of unskilled and skilled workers.

Austria.—The Austrian Trade Union Commission reported that in Oct. 1920 men's wages (in currency) were from 22 to 27½ times the rates in July 1914 and women's 20 to 25 times.

New Zealand.—The *Official Year Book* for 1919 contains an elaborate analysis of the minimum wages payable from 1901 to 1919 in 26 occupations. Wages do not necessarily move exactly with their minima, but in unskilled trades they are in fact generally the rates paid. The results are shown in Table 10, the level in 1911 being taken as 1000 in each occupation.

Table 10.—New Zealand. Minimum hourly rates.

	Skilled occupations	Semi-skilled occupations	Unskilled occupations	General average (weighted in proportion to the numbers in occupations)
1901	929	915	940	932
1905	964	939	955	954
1910	992	991	1001	996
1912	1009	1006	1004	1006
1913	1024	1067	1025	1036
1914	1073	1078	1102	1087
1915	1073	1086	1113	1094
1916	1095	1147	1193	1152
1917	1124	1188	1250	1200
1918	1208	1247	1297	1258
1919	1352	1439	1451	1418

The occupations included are bakers, boiler-makers, bookbinders, paper-makers, bootmakers (male), bricklayers, builders' labourers, butchers, carpenters, coach-builders, coal-miners, drivers (horse), engineers, fell-mongers, flour millers, freezing works employees, furniture makers, grocers' assistants, iron and brass moulders, painters, plasterers, plumbers, seamen, slaughtermen, tailoresses, waterside workers, and woollen mill operatives (male). The *Year Book* for 1920 (p. 279) gives statistics for average wages in all but the smallest factories and workshops (Table 11).

Table 11.—New Zealand. Average annual wages.

	Males		Females	
	Amount	Percentage	Amount	Percentage
1900–1	£81·9	71	£31·3	62
1905–6	88·5	77	41·9	83
1910–1	115·1	100	50·6	100
1915–6	133·5	116	56·7	112
1918–9	159·4	139	68·8	136

Australia.—The *Official Year Book* for 1920 contains two statements relating to recent movements of wages from which Tables 12 and 13 are compiled. About 240,000 males and 80,000 females of all ages are included in the returns.

Table 12.—Australia. Average annual payment per employee.

	Males		Females	
	Amount	Percentage	Amount	Percentage
1913	£123·3	97	£47·7	97
1914	126·9	100	49·5	100
1915	128·0	101	50·2	101
1916	133·7	105	50·8	103
1917	143·5	113	54·5	110
1918	146·1	115	58·4	118

Table 13.—Australia. Average weekly wages in industries.

	Adult Males			Adult Females		
	Rate		Percentage	Rate		Percentage
	s.	d.		s.	d.	
1914 April	55	2	100	27	2	100
1914 Dec.	55	7	101	27	5	101
1915 "	56	6	102	27	4	101
1916 "	60	8	110	28	5	105
1917 "	64	2	116	30	5	112
1918 "	66	5	120	31	9	117
1919 "	74	11	136	37	1	137

(A. L. Bo.)

United States.—That a large proportion of unskilled workers in the United States was paid wages, even in 1921, far too low for decent self-support is a fact confirmed by many wage investigations and well known even to those only slightly familiar with industrial conditions. Before the era of unprecedentedly high prices caused by the World War, it was the consensus of expert opinion that a weekly wage of $8, or more, was necessary under urban conditions for the maintenance of a self-supporting woman in simple decency and working efficiency, and that a man with a wife and three children needed $15 to $20 weekly. Yet a study made in 1914 of women's wages in the United States led to the conclusion that 75% of female wage-earners received less than $8 weekly, 50% less than $6 and 15% less than $4; and that the incomes from these wages were further reduced approximately 20% through lost time and unemployment. The pay of unskilled male workers was at a correspondingly low level. Frank H. Streightoff, in his discussion of American standards of living, estimated that at least 6,000,000 adult males, married as well as single, received less than $600 a year, or $12 a week. More intensive investigations bore out these figures. The U.S. Immigration Commission in 1907–10 studied many typical households of both native- and foreign-born, in 16 industries, and found that more than half the male heads of families earned less than $500 a year, and nearly two-thirds less than $600. The New York State Factory Investigating Commission examined the pay-rolls of over 2,000 stores and factories during the autumn, winter and spring of 1913–4, a year which may be regarded as normal, and found that of 57,000 women and girls, approximately 34,000, or 60%, earned less than $8 in a typical week. Of 14,000 married men, 7,000 earned less than $15. The causes of these low wages were: the lack of strong labour organizations and collective bargaining among this group of wage-earners; the belief of unskilled women wage-earners that their work was temporary; and the competition of married women who were only partially self-supporting; also a failure on the part of employers to recognize a relation between wages and productivity. In the United States, until the outbreak of the World War, the situation was further complicated by the stream of immigration, which furnished an abundant supply of cheap labour and provided still another barrier, in the shape of divergent language and customs, in the way of union organization.

During the war the wage level was appreciably raised, but owing to the great rise in prices that accompanied the change it is doubtful whether real wages were materially increased, except perhaps in a few war industries and in certain occupations covered by especially liberal Government wage awards. The average rate of wages failed to keep pace with the rising cost of living. Between Nov. 1918 and Jan. 1919 a study by the New York Industrial Commission of the earnings of 32,000 women in the same industries which had been covered by the Factory Investigating Commission in 1913–4 indicated that 60% of those in factories and 61% of those in stores received less than $14 a week, the equivalent of $8 in 1913. The average weekly wage of both sexes in many representative New York factories was $24.83 in Sept. 1919, while in eight large industries for which data were collected by the National Industrial Conference Board, the average weekly wage for male workers was $24.24 in Sept. 1918 and $23.37 in March 1919. In the skilled trades the effect of trade unionism was to increase wage rates: union minimum rates as provided in agreements with employers rose above the 1913 rate 99% for hourly rates and 89% for full-time weekly rates, exclusive of overtime, paid for at an increased rate.

The demand for increased wages has been the most frequent cause of strikes since 1915, as was to be expected in a time of steadily advancing living costs. Many of the strikes or threatened strikes were settled by Government agency. Considerations which influenced the arbiters were: the concept of a minimum living wage; increases in the cost of living; the desire for standardization, both within a given industry and in a given territory; increase in productive efficiency; and the effect of overtime work in increasing weekly wages. The National War Labor Board created a Cost of Living Section associated with the Bureau of Labor Statistics. The minimum requirement for an average American family of five members was found to be, for New York City, in June 1918, $1,350 to $1,400; in Dec. 1918, $1,500. Therefore, if the eight-hour day were observed, 55–60 cents an hour would be the lowest which might properly be received by the breadwinner. It was, however, expected that overtime would be worked, and lower rates were set, 40–45 cents an hour.

Before the war there were inequalities in wage rates in different parts of the country and between union and non-union workers; the tendency of war-time adjustments was to establish standards. But the rates of pay of the unskilled rose more rapidly than those of the skilled. Wages of unorganized common labourers increased 100 to 200%. These men had formerly been paid less than enough to maintain an "American standard of living." During the war there was such a demand for their services that wages rose as employers bid against each other. In certain cases the Government agencies fixed arbitrary standards to prevent a flow of labour back and forth between localities and between establishments. There were great differences in wage increases gained by skilled workers. The least increases were in the building trades, which before the war had been among the best-paid employments; but men engaged in shipbuilding received increases greater than the average for the trade. The U.S. Bureau of Labor Statistics estimated that the cost of the working-class standard of living doubled between 1913 and 1920. The cost of food increased 118%, as calculated from the prices of 22 food articles reported to the Bureau. The accompanying table shows the increase per cent for both cost of living and wages. This wage index is computed by the present writer on the studies of wages in 12 important industries, made by the U.S. Bureau of Labor Statistics. The index number computed is a simple, unweighted, arithmetical average of average full-time wages, with 1913 used as a basis. Increases in the trades studied were as follows: bakery trades, 1913 $18.14, 1920 $41.28; boot and shoe, 1913 $17.28, 1920 $29.32; building trades, 1913 $24.33, 1920 $44.18; cotton manufacturing, 1913 $10.17, 1920 $29.05; iron and steel, 1913 $28.47, 1920 $68.84; metal trades, 1913 $21.62, 1920 $42.37; mill work, 1913 $14.48, 1920 $41.19; printing, 1913 $19.56, 1920 $35.89; silk manufacturing, 1913 $12.39, 1919 $21.99; woollen, 1913 $10.14, 1920 $35.18; farm labour, without board, 1913 $7.58, 1920 $16.24; railroads, 1913 $21.94, Jan. 1920 $25.91.

	Cost of Living	Wages
1913	100	100
1914	103·0	100·2
1915	107·4	103·3
1916	113·3	117·5
1917	140·5	134·4
1918	165·8	157·5
1919	190·2	185·5
1920	208·2	206·4

The increase of the cost of living was in advance of the increase of wages for the whole period from 1913 through 1919, except possibly during 1916. The discrepancy was greatest in 1918. The purchasing power of wages, measured by the cost of food, fell more in 1917 than in any year since 1890. The drop was one of 17·7% in the purchasing power of 1913. From the middle of 1908 to the middle of 1921 the purchasing power of wages continued to be less than in the period 1890–1907. The purchasing power of wages ("real wages") was greatest in 1896 and in 1900. Total "real income," however, was not necessarily greatest in these two years, due to changes in the volume of employment. It appears that the prices of labour are influenced by the changes in business conditions, but to a less degree than the prices of commodities. In general, the average wage declined after 1893, recovered in 1896, and dropped again for the years 1897 and 1898. In 1899 the wage began to advance, halted in 1904, and dropped slightly after 1907; beginning with 1909 the upward course was resumed, with a slight drop in 1914. This upward movement continued to 1920, and was especially rapid after 1916. In the various industries there were differences in the degree of the movement of wages. The fluctuations in the iron and steel industry were numerous, as were also those in silk and cotton manufacturing. On the other hand, changes in the bakery and building trades were less noticeable. However, no industry escaped a reduction in wages after 1893, and none failed to register a large advance after 1916.

From 1914 to 1918 the purchasing power of hourly wages seems to have decreased considerably. But, due to steadiness of employment and to the overtime worked, actual weekly earnings may have increased. In 1919 and the early part of 1920 wages and wage rates rose more rapidly than the cost of living. The conservative and carefully compiled budget for 1918, drawn up by the Philadelphia Bureau of Municipal Research, specified $1,637 as necessary to support a family of five in the "minimum standard of health and comfort." This standard is lower than the "standard of health and decency" adopted by the Bureau of Labor Statistics. Cost of living is no higher, and may be lower, in Philadelphia than in other industrial centres. The Philadelphia budget in Nov. 1919 required $1,803 and in Aug. 1920 $1,988. If the increase was distributed evenly throughout the nine months, the average wage in manufacture was insufficient to support this standard. The deficiency in the case of textiles was between $450 and $570; in boots and shoes and paper manufacturing and in printing, more than $400; and in furniture manufacturing, more than $700. By 1920 the situation was better; although only in one industry studied, the manufacture of rubber goods, was the average full-time yearly income able to support the standard. If retail prices of food are taken as an index of living costs, *union hourly* real wage rates in 1918 were 20% lower than the average for 1890–9, and full-time real *union weekly earnings* probably 25% lower, due to the decrease in the number of hours worked. Allowance must be made for the fact that food prices rise more rapidly than cost of living as a whole, and for the fact that the figures here refer to *union scales of wages*, which often represent the minimum wage actually paid. The total income of most workers increased during the war period, due to steady employment; to the overtime work, usually at increased rate of pay; and to the fact that the war called into industry more members of the family than are ordinarily wage-earning. It is necessary to call attention to the fact that unemployment has never been taken into consideration in computing "real wages." Until a coefficient of unemployment has been found, no chart of "real wages" will be able to show the actual state of well-being of the wage-earning class. The average retail price of food in 1920 was 103% higher than in 1913. During 1920 it continued to rise; the highest point reached was 119% higher than in 1913, in June and July 1920. After that the prices fell and reached a point in April 1921 52% greater than in 1913. According to the philosophy of employers, as living costs fall, wage rates also should fall. However, by April 1921 earnings had already decreased owing to the decrease in available employment. It is not agreed that the 1913 standard of living was adequate: workers who have emerged from the "minimum of subsistence" level are loth to return to an acceptance of insufficient purchasing power.

The Bureau of Labor Statistics reported changes in rates of wages between July 1 1920 and March 31 1921. The total number of changes reported was 2,714, of which 1,689, nearly two-thirds, were increases. Two-thirds of the increases in the three months of 1921 were in the printing and publishing industry. The largest number of decreases were in the textile industry. The largest number of decreases reported were in Jan. 1921, the largest number of increases in July, Aug. and Sept. of 1920. The most frequent cut in wage rates was between 10 and 20%; 30% also was reported in a large number of cases. It must be remembered that *per capita* earnings decreased still further, due to the decrease in the volume of employment. Under the agreement between employers and union in the men's clothing industry in Chicago, wages were reduced in April 1921 5% for those who had received a 5% increase in 1919 and 10% for all others, except that no wages were to be reduced below $15 for the full-time week. In the same month the board of referees in the ladies' garment industry in Cleveland ordered the restoration of the July 1919 wage scale, with some exceptions. The reasons given were, first that the cost of living had not continued to rise as had been expected but had fallen, and, second, the serious business depression. To secure the workers continuity of income, the employer was ordered by the award to retain the satisfactory worker 20 weeks in each half-year or to pay an unemployment benefit of two-thirds the weekly wage, the employer's liability to be limited to 7½% of his direct labour cost for the guaranteed period. In July 1921 the U.S. Railway Labor Board, after hearings, ordered a 12% reduction in wages on 102 railways.

Babson's Statistical Organization reported the total earnings of employees in the manufacturing establishments in New York State in July 1921 as the smallest since May 1919. According to this study, wages reached a peak in Dec. 1918 at 120% greater than in June 1914, and again in Sept. 1919 at 129%, from which they rose to the highest peak in March and June 1920 with 177%. By April 1921 they had fallen to 95% greater than in June 1914.

REFERENCES. The most comprehensive studies of wages in the United States are those made by the U.S. Bureau of Labor Statistics, and published in special bulletins and in the *Monthly Labor Review*. Wages of farm labourers are reported to the Department of Agriculture. Wages of railway employees are published by the Interstate Commerce Commission. See generally Alexander M. Bing, *War Time Strikes and their Adjustment* (1921); David Friday, *Profits, Wages and Prices* (1920); Frank H. Streightoff, *Distribution of Incomes in the United States* (1912); National Industrial Conference Board Research *Reports*, 20, 31. Also the following articles:—I. M. Rubinow "The Recent Trend of Real Wages," *American Economic Review* (vol. iv., Dec. 1914); F. W. Jones, "Real Wages in Recent Years" (*ibid.*, vol. vii., June 1917); C. E. Persons, "Woman's Work and Wages in the United States," *The Quarterly Journal of Economics* (Feb. 1915). (J. R. Co.)

WAGE-SYSTEM IN INDUSTRY.—The normal systems of payment for the work of persons employed in industry under the capitalist system are wage-payment and salary-payment. It is not easy to draw an absolute line of distinction between these two forms of payment. Wages are usually paid weekly, and salaries over a longer period—monthly, or quarterly, for example. There are, however, cases of weekly salaries, and of wages paid monthly. Moreover, a good many of the supervisory grades in various industries are paid what is called an "upstanding wage," which in many of its conditions approximates rather to the salary basis of payment than to the wage as ordinarily understood. Usually the salary-earner possesses a higher status and a slightly greater measure of security than the wage-earner. Wages are, as a rule, paid only for hours actually worked, subject to the conditions mentioned below, and any period of illness or suspension of work for any cause, whether under the worker's control or not, involves a cessation of the payment of wages. Salary-earners, on the other hand, are in many cases paid during periods of sickness, and are usually paid for a full week, or month, even if some spells of enforced absence from work or failure of work due to some other cause are included. There are, however, very many intermediate varieties between the continuous salary paid throughout the whole year, and the wage paid only for hours actually worked. The salary-earner, it should be remarked, is usually entitled to a longer period of notice, from a month upward, than the wage-earner, who can usually be dismissed or suspended on a week's notice or less. The period adopted as a basis for the calculation of wages differs from trade to trade, and even from district to district or factory to factory within the same trade. In some cases the basis is hourly, in others a weekly rate of wages is laid down. In either case, there may be, but in the majority of cases is not, what is termed the "guaranteed week," that is, a guaranteed minimum weekly payment, irrespective of the number of hours of employment which the employed person is actually able to secure. In certain other cases, notably that of the dockers, there is the "guaranteed day," but not the "guaranteed week." The demand for greater measure of security than is afforded by hourly payment, without any guarantee of the week or the day, has increased, and a number of trades have secured concessions giving them guarantees of one sort or another.

Broadly speaking, the methods of remunerating the wage-earner under the wage-system can be divided into two main groups: (1) time-payments, and (2) "payment by results," although there are many intermediate varieties, and disputes often arise on the question whether a particular system is or is not to be regarded as "payment by results."

(1) Under the time-work (or "day-work") system, the worker's remuneration varies with the time which he actually spends on the employer's business. Thus, carpenters and joiners in certain districts in the building industry in Great Britain have a time-rate of 2s. an hour, and the majority of grades on the railways have time-rates varying from 65s. per week upward. These time-rates are practically always fixed in relation to a definite number of hours in the week, and if a larger number of hours has to be worked, the hours in excess of the standard week are termed overtime, and are usually remunerated on a slightly higher hourly rate—"time and a quarter," "time and a third," "time and a half" or "double time," for example. Extra payment is also frequently made for work done during the week-end or at night ("night-shift"). The time-work system operates throughout a large number of trades, including the greater part of the building industry and the railway and road transport services, and almost the whole range of non-manual employment. In many other industries it is found side by side with various systems of "payment by results." In almost every time-work industry there are some piece-workers; and in almost every piece-work industry some time-workers. A particularly obnoxious form of time-work is that known as "task-work," under which the worker is required to perform a definite amount of labour in return for a time wage, but receives no additional remuneration for higher output. This is strongly opposed by trade unions and does not prevail at all in organized industries in Great Britain.

(2) Under the term "payment by results" are comprehended many different methods of wage payment, the common factor among them being that, to a greater or less extent, the worker's earnings under them vary with the amount of output which he, either individually, or in conjunction with a group of his fellow-workers, is able to produce. The amount of work produced may not be the sole factor determining his remuneration under a system of "payment by results"; for such systems are very frequently, and in the organized trades usually, accompanied by guaranteed minimum or standard time-rates, which the worker is entitled to receive irrespective of the actual output which he produces. Strongly organized trade unions in many industries have consented to accept "payment by results" only on the condition that the standard time-rates of wages shall be guaranteed irrespective of output (*e.g.* engineering).

The simplest form of "payment by results" is that known as "piece-work." Under this system, a price is fixed for each unit of the commodity upon the production of which the worker is engaged, *e.g.* if the worker is turning out screws, a price will be fixed per hundred, or per gross of screws, this price being calculated, in theory at least, according to the time which is estimated to be necessary for the performance of the operation in question. Sometimes, as in the "time logs" in the tailoring trade, the piece-work price is expressed not in terms of money, but in terms of hours, and the worker is paid for so many hours at the standard rate, irrespective of the time actually occupied on the job. "Straight" piece-work systems vary very much in complexity. Where the operations are simple, and the character of the goods produced uniform, piece-work prices can be laid down with almost mathematical accuracy; but as soon as provision has to be made for a wide range of different products complications almost inevitably arise. These complications are of two kinds. The cotton industry in Great Britain is almost entirely a piece-work industry; but, despite the immense variety in the types of cotton goods produced and the variation in the times required for the spinning and weaving of different types of goods, piece-work rates can be devised to correspond with practically mathematical accuracy to the time required for the job because of the high degree of standardization at which the industry has arrived. The piece-work lists agreed to by the weaving trade unions and the cotton manufacturers are immensely complicated, and only skilled technicians are able to understand them. The universal acceptance of piece-work in the cotton industry is mainly accounted for by the fact that, under the system which has been adopted, a given amount of effort can be approximately relied upon under normal conditions to produce equivalent earnings.

This is much more difficult to secure in such an industry as engineering, where the products are far less uniform and where also the machinery which the worker is called upon to manipulate is far less standardized, so that it may take very different times to do the same job on two different machines. The fixing of piece-work prices in the engineering industry in Great Britain is therefore a constant source of friction, and it has been found impossible to express, in any tables corresponding to the cotton piece-work lists, the fair remuneration for most forms of work on engineering products. Piece-work prices in the engineering industry are a constant subject of workshop and trade-union bargaining, and there is a strong resistance in many sections of the industry to the introduction of piece-work, largely because there is not, as in the cotton industry, any simple method of arriving at a fair price, and the system thus produces constant allegations of "speeding up" and "price-cutting" on the one side, and of "speeding down" and "restriction of output" on the other. Where, owing to special circumstances, it is regarded as impossible to fix in advance a piece-work price for a particular job, the worker, especially in the engineering and shipbuilding industries, is sometimes paid what is called a "lieu rate," *e.g.* "time and a third" or "time and a half" for the hours actually occupied on the job in lieu of a fixed piece-work price.

The other main system of payment by results is the system of "bonus on output." Under this system the worker is normally paid a time-rate irrespective of output; but, if the output exceeds a given minimum, an additional bonus, calculated upon this excess output, is paid. There are literally hundreds of different methods of calculating this bonus. The system to which the greatest attention has been attracted in recent years, both in Great Britain and in America, is the "premium bonus system" in its various forms, of which the two best-known are the "Halsey" and the "Rowan" premium bonus systems. Under both these systems, a "basis time" is fixed for the accomplishment of the piece of work in question. If the work is done in less than the basis time, the workman is paid, over and above his time-rate of wages, which is guaranteed, a bonus, proportionate in one way or another to the time saved. The effect of this method of payment is that, under both the Halsey and the Rowan system, the labour cost of the job to the employer falls with every increase in output, while at the same time the earnings of the workman increase, but not in proportion to the increase in output. The simpler of the two best-known premium bonus systems is the "Halsey" system, so called after its inventor Mr. F. A. Halsey, an American efficiency engineer. Under this system, the workman is paid a fraction, usually either a third or a half, of his time-rate for time saved. Thus supposing the time allowed for an operation is 12 hours, and a worker, whose time-rate is a shilling an hour, does it in 9 hours, he will be paid at his time-rate for the 9 hours, and in addition will receive payment for a further hour or for an hour and a half, according to the particular variety of the system adopted.

The Rowan system is more complicated. The simplest way of explaining it is to say that for every 10% that is saved on the time allowed, the workman receives a 10% increase in earnings. The more complicated way is to quote the quite unnecessarily abstruse formula which is usually adopted by those who desire to explain the system. This formula is as follows:—

$$\text{Bonus} = \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time taken.}$$

There are all manner of modifications of these two systems, in the direction both of greater simplicity and in that of greater complexity. The advocates of "scientific management" have been especially active in devising fresh variations in the method of payment, intended to stimulate the workers' productive efficiency in the fullest degree. Efficiency engineers often contend that it is necessary to work out a different formula for each type of operation in order to apply in each case precisely the right stimulus to increased output. Most of these systems are based in one way or another on the premium bonus system in one or other of its two forms, or on the so-called "differential piece-rate" system advocated by Mr. F. W. Taylor, the founder of "scientific management." Under this system, two different piece-rates are fixed for the same job, and at the same time a standard output per hour is laid down. When the worker reaches or exceeds the standard output he is paid on the higher piece-rate; when he falls below the standard of output he is paid on the lower piece-rate. Day-work rates are not guaranteed. The object of this system is stated to be the elimination from the job of the less efficient worker by discouraging him with the offer of a lower piece-work price. It is impossible to attempt to chronicle the many different bonus and piece-work systems which have been put forward in Great Britain and America. The Ministry of Munitions in England, during the World War, accumulated a list of many hundreds of different systems which were actually in operation in the British engineering shops alone. It is particularly in the engineering and kindred industries that this wide diversity of forms of wage-payment exists.

It should be noted that both the piece-work system and the various bonus systems and adaptations of them can be operated either on an individual or on a collective basis. Under the individual system a single worker is remunerated in accordance with his individual output. Under the collective system a group of workers is treated as a unit, and the piece-work price or bonus is paid in respect of the output of the whole group. Collective systems are most often found where the work itself necessarily involves collaboration, and where it is therefore difficult or impossible to separate the individual contribution of the workers engaged upon it (*e.g.* "squad" or "gang" work). It has, however, been applied also in a large number of cases over a considerably wider area in the form of an output bonus paid on the work of a whole shop or factory. In these cases, bonus is sometimes paid only to workers directly engaged on production; but in other cases auxiliary workers, such as foremen, millwrights, maintenance workers, and even workers on the staff, may share in the pool. Many such systems were adopted in shell factories in various countries during the war.

A variety of collective "payment by results" is that which is known as the "fellowship" system. Under this system, the workers themselves form groups on a voluntary basis, and share out among themselves, either through the office of the firm, or by a subsequent re-division of the sums paid through the office, their collective earnings. This system usually operates among "fellowships" of skilled workers in a particular craft or in closely related crafts.

There are many different ways of sharing out the payment made under collective systems of "payment by results." The most usual method is that each worker included in the group shares in the payment in proportion to his time-rate and to the hours worked on the job. Sometimes, however, the pool, or any surplus over the time-rates of the workers concerned, is equally shared, and sometimes regard is paid only to one or other of the two factors mentioned above. In a few cases a specially large share in the pool is offered as an inducement to a leading worker, or to a few leading workers; but the system in this form approaches the system of "sub-contracting," which is universally objected to by the trade-union movement.

"Sub-contracting" is usually understood to mean a system under which one worker undertakes a piece of work which requires the coördinated labour of a group of workers. The sub-contractor receives the whole sum paid for the execution of the job, making, subject to any limitations that may be laid down in his contract, his own wage contract with the workers under him, and retaining any surplus for himself. Often a sub-contractor, himself paid "by results," remunerates the workers under him on a time-work basis. It is generally recognized that the sub-contracting system is open to grave abuse, and with the advance of trade-union organization it has been gradually eliminated from industry, surviving only in a comparatively small number of cases. The outstanding instances of it in the past have been the "butty" system in the mining industry, which still exists in one or two British coalfields, and the methods of payment which used to be adopted in many sections of the iron and steel industry.

Distinct from both the piece-work system and the various bonus systems is the system of "commission," which is applied in a certain number of occupations. Under this system the worker receives a commission on "takings" or on profits either as his sole mode of remuneration, or as an addition to a minimum wage or salary. This is the position of most workers in the insurance business, and of a number of managerial and semi-managerial workers in the distributive trades. It is also found occasionally in other occupations.

The attitude of employers and workers towards these various systems of wage-payment differs widely from case to case. Recently, attention has been mainly concentrated on the endeavours of employers to introduce systems of "payment by results" into industries in which time-work systems are at present largely in operation, *e.g.* building, engineering, shipbuilding. Usually these attempts have met with strong trade-union opposition. It must not, however, be concluded that employers are universally favourable or trade unions universally opposed to "payment by results." The position differs from industry to industry. In the textile industries, and in a number of the less-organized occupations, "payment by results" has been introduced and maintained not merely with the acquiescence, but often at the instance of the workers, who have seen in it an opportunity of securing higher earnings. At the other extreme, the worst forms of "sweating" in industry are very frequently found in conjunction with the time-work system of payment. In the past, trade unions have usually favoured, or at least not opposed, "payment by results" in those industries in which a standard of measurement can be found of such a character as to insure that, under normal conditions, a given amount of effort expended will result in a given amount of output, and therefore of earnings under the system. On the other hand, the unions have generally been opposed to the introduction of "payment by results" in those industries in which no such standard can be laid down, as well as in other cases where it has been contended that "speeding up," consequent upon the inducement offered for higher output, would have the effect of impairing the quality of the work done (*e.g.* building). Where "payment by results" has been accepted in industries of this latter type, a struggle has often followed over the question whether the right of the organized workers to bargain collectively over the fixing of piece-work prices or "basis times" shall or shall not be recognized. This struggle is still in progress over a wide range of industries; but the fixing of piece-work prices and "basis times" is still normally done by the employer or his representative, subject only to protest by the workers or their representatives.

It should be noted that the growth of "scientific management" has given a great impetus to the introduction of "payment by results," and has also considerably affected the methods adopted by employers in fixing piece-work prices or "basis times." In the great majority of factories, other than textile factories, in which systems of payment by results are in operation, piece-work prices are still fixed in a very haphazard fashion, and modified from time to time in accordance with actual experience of their working. But, where one feature or another of "scientific management" has been introduced, experiments have been made designed to introduce a greater scientific accuracy into the fixing of prices and times. The methods which have been introduced with this object are mainly those of "time study" and "motion study." "Time study" means an attempt, by actual observation of the doing of a particular job, either by a selected worker or in a number of selected cases, to fix the time which ought to be occupied in the doing of it by a normal worker. "Motion study" means the observation of the doing of a job with a view to eliminating all surplus motions, and to the laying down in detail of the method by which it can be done with the maximum of efficiency and in the least possible time. The former method has been adopted by a number of firms in Great Britain, the latter in comparatively few cases. Both are largely in operation in America. "Time study" and "motion study" are usually resented by the workers employed, and are regarded as devices adopted by the employer with a view to "speeding up." It is also contended that both, and especially "motion study," result in making work more monotonous and in taking such variety of initiative as remains to the worker under modern factory conditions out of his hands and in concentrating control in the hands of a small body of expert rate-fixers, or "time-study" and "motion-study" experts.

Where piece-work or bonus systems are in operation, friction is very likely to arise because there is a constant suspicion on the part of the workers that the employer is endeavouring to "cut" piece-work prices and to "speed up" the slower workers to the pace of the more rapid. Employers, on the other hand, allege that workers deliberately slow down with a view to forcing up piece-work prices. It is impossible to estimate the relative productivity of workers under time-work systems and under systems of "payment by results"; but it may be taken as certain that no system of "payment by results" which has yet been devised has succeeded in eliminating friction or the possibility of "price-cutting" on the one hand, and "restriction of output" with a view to securing higher prices on the other. Perhaps the nearest approach to the elimination of these two factors is in the cotton industry; but the comparatively smooth working of the piece-work system in this case is mainly due to the peculiar standardized character both of the product and of the machinery. The cotton "price-list" system cannot readily be adapted for use in the majority of industries.

REFERENCES.—There are only two books giving a general survey of the various wage systems. These are (1) *Methods of Industrial Remuneration* by D. F. Schoss (Williams and Norgate), which was written a good many years ago, and is now in many respects out of date, and (2) *The Payment of Wages* by G. D. H. Cole, which is the most recent study. See also, for conditions in England, *Industrial Democracy* by Sidney and Beatrice Webb, and *The Works Manager To-day* by Sidney Webb. There is an immense literature dealing with scientific management in relation to "payment by results." Reference may be made especially to *Scientific Management and Labour* by R. F. Hoxie; *Scientific Management* by C. B. Thomson; *Scientific Management* by F. W. Taylor; *Scientific Management* by H. B. Drury; *Efficiency* and other works by Harrington Emerson; *Work, Wages and Profit* by H. L. Gant; and *A Rational Wages System* by H. Atkinson. For premium bonus systems, see *The Premium System of Paying Wages*, published by *The Engineer; The Rowan Premium Bonus System* by W. Rowan Thompson; and *The Premium Bonus System, Report of an Enquiry*, published by the British Trades Union Congress. A great deal of information will also be found in the following reports issued by the Board of Trade: "Report on Collective Agreements" (1910) and "Report on Standard Piece-Rates." Unfortunately, however, no new or revised editions of these have been issued since some years before the war. See also the *Final Report of the Commission on Industrial Relations*, published by the U.S. Government in 1915. (G. D. H. C.)

WAGNER, ADOLF (1835–1917), German economist (*see* 28.235*), died in 1917.

WALLACE, ALFRED RUSSEL (1823–1913), British biologist, (*see* 28.275), died at Broadstone, Dorset, Nov. 7 1913. In 1910 he received the O.M. Among his latest publications were *The World and Life* (1910) and *Social Environment and Moral Progress* (1912).

WALLACE, SIR DONALD MACKENZIE (1841–1919), British author and journalist, was born Nov. 11 1841, the son of Robert Wallace of Boghead, Dumbartonshire. He was educated at the universities of Edinburgh, Berlin and Heidelberg and at the École de Droit, Paris. Even in his Edinburgh days he spent his vacations abroad and became proficient in modern languages, and when he completed his legal studies at Heidelberg he was already 28 years of age and was contemplating a career as a German professor in comparative law. He was, however, invited by a friend to visit Russia, and became so much interested that he remained there for six years. His *Russia* (1877), a volume dealing comprehensively with the country, had a great success, and was at once recognized as a classic; it was translated into many languages and was revised and reissued by its author both in 1905 and 1912. Shortly after its first appearance Mackenzie Wallace became correspondent of *The Times* in Petrograd; in 1878 he was moved in a similar capacity to Berlin, thence to Constantinople, and after the battle of Tel-el-Kebir (1882) to Egypt. From 1884–9 he was in India as private secretary to the Viceroy, Lord Dufferin, and to his successor, Lord Lansdowne. He accompanied the Tsarevich Nicholas during his Indian tour 1890–1 and the Duke of Cornwall (afterwards George V.) during his colonial tour in 1901. From 1891–9 he was director of the foreign department of *The Times*. In 1899 he undertook the editorship of the New Volumes (issued in 1902 as the 10th edition) of the *Encyclopædia Britannica*, which had been projected by *The Times* as a supplement to the 9th edition, with Dr. A. T. Hadley, then president of Yale University, as his American co-editor; but he felt somewhat overpowered by his task, and after April 1900, when Mr. Hugh Chisholm was brought in by *The Times* to assist his labours, Sir Donald left the editorial work in the sole charge of his younger colleague. He was made by Edward VII., with whom (as with Queen Victoria) he had long been on confidential terms, one of his official household, and was also included in that of George V. He had been created K.C.I.E. in 1887, and was made K.C.V.O. in 1901. In addition to his book on Russia he published *Egypt and the Egyptian Question* (1883) and *The Web of Empire* (1902). He died at Lymington Jan. 10 1919. A thorough diplomat of wide culture and personal charm, and one of the most remarkable linguists (speaking some twenty languages) and raconteurs of his time, he was also one of the most modest and unselfish of men. He was probably better informed than any other man of his day in the secret history of international politics, but he was also discretion personified in using his knowledge. One of his last important pieces of work for *The Times* was in 1905 at the Peace of Portsmouth (N.H., U.S.A.), which he attended as its correspondent, and he was able there to give valuable advice, in carrying the negotiations to a successful issue, to the Russian delegates, with whom he exercised considerable authority.

WALLACE, WILLIAM (1860–), British musical composer, was born at Greenock July 3 1860, the son of a doctor in good practice. He was educated at Fettes College and Glasgow University, where, with the view of entering the medical profession, he graduated M.B. in 1885 and M.D. in 1888. He afterwards specialized in ophthalmology, studying at the Moorfields eye hospital, and also at Paris and Vienna. His musical education was partly received at the Royal Academy of Music, but he remained there for less than a year, and was largely self-taught. His orchestral works include *The Passing of Beatrice* (1892); *The Creation, a Symphony* (1899); *Pelleas and Melisande* (1900); and the symphonic poems, *Wallace* (1905) and *Villon* (1909). He also published some fine songs and collections of songs (often to his own words), including *Freebooter Songs* (1899) and *Lords of the Sea* (1902) and *Three Songs of Blake*. He was for a period secretary of the Philharmonic Society. In addition to being a connoisseur of art in most forms, Wallace published several literary works of distinction. Of these *The Divine Surrender* was a mystery play; his books on musical history and theory, *The Threshold of Music* (1908) and *The Musical Faculty: its origin and processes* (1914), are both important in their way. Also he translated the operatic texts of Strauss's *Feuersnot*, Berlioz's *Faust*, *Le Chemineau*, *Muquette* and the poems of many songs by Sibelius and Weingartner. At one time he edited *The New Quarterly Musical Review*, and he was a frequent contributor to various magazines. During the World War he entered the R.A.M.C. as a captain, and acted as ophthalmologist to the Colchester military district, inspector of ophthalmic centres in the Eastern Command, and ophthalmological specialist for the London district, and he published various articles in scientific journals on the vision of the soldier and war injuries to the eye. In this way he made effective use of his earlier professional training. He married in 1905 Ottilie, daughter of Lord M'Laren, herself a sculptor who had been a pupil of Rodin; as deputy

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**** These figures indicate the volume and page number of the previous article.***

assistant director of the W.R.W.S. she also did useful work in the war, and was given the O.B.E.

WALLENBERG, KNUT AGATON (1853–), Swedish statesman, was born in 1853, the eldest son of André Oscar Wallenberg (1816–1886), who in 1856 founded Stockholms Enskilda Bank. He went through the training of a naval officer, but in 1874 joined the directorate of the bank, was managing director during the years 1886–1911, and became chairman in 1917. This bank, under the control of K. A. Wallenberg and his brother Marcus, took a prominent place in the Swedish banking world and in the industrial life of the country. Through their good connexions abroad both brothers contributed much toward enabling Sweden to establish good economic relations with other countries. Both have played an important role in the developing of the iron-ore industry in northern Sweden. K. A. Wallenberg, in conjunction with the Crédit Lyonnais, introduced Swedish bonds into the French market in 1890, and during two decades he coöperated powerfully in taking up Swedish, Norwegian, Danish and Finnish state loans. In the Banque d'État de Maroc, which resulted from the Algeciras Conference, K. A. Wallenberg had a hand as a member of the governing board in Paris, a position in which he was succeeded in 1920 by his brother Marcus. K. A. Wallenberg was concerned in the founding of the Banque des Pays du Nord in Paris in 1911, and also in that of the British Bank of Northern Commerce in London in 1912, which in 1920 was amalgamated with C. J. Hambro & Son as Hambro's Bank of Northern Commerce, known as Hambro's Bank Ltd. since July 1 1921. He was a member of the town council of Stockholm from 1883–1914, a member of the First Chamber of the Riksdag from 1906–19, chairman of the Swedish Bankers' Association (" Svenska bankförening ") from 1909–14, and a member of the Stockholm Chamber of Commerce from 1912–4 and again from 1918 onwards. He was one of the founders of the commercial high school (" Handelshögskolan ") in Stockholm and its first donor. When Hammarskjöld formed his Government in 1914 (*see* SWEDEN), K. A. Wallenberg joined it as Foreign Minister, retaining this post until 1917. In 1918 he and his wife devoted 25 million kroner to the " Knut and Alice Wallenberg Foundation," the purpose of which was to further religious, social, scientific and educative movements and to support trade and industry.

His brother, MARCUS WALLENBERG (1864–), became an officer in the navy, and, after juridical studies and practice, joined the directorate of Stockholms Enskilda Bank and became managing director 1911–20, and later chairman. He founded or reorganized a large number of industrial enterprises, taking a chief part, for instance, in the financing of the mining-fields of northern Sweden, and founding in 1905 Norsk Hydro-elektrisk Kvaelstof Aktieselskab in Norway, of which he became chairman. He was one of the founders of the Norwegian Central Bank, of the Swedish Bankers' Association, and the Industrial Union of Sweden (" Sveriges industriförbund "), besides having taken the initiative in founding the Taxpayers' Association (" Skattebetalarnes förening ") in 1920. He became a member of several committees on banking and stock exchange questions, and a member of the Economic Council. The Swedish Government sent him to London as Swedish negotiator in 1916–7 and 1917–8 for bringing about an agreement with the Allied Powers regarding trade and shipping and finance questions. He was a member of the Neutral Powers' financial section of the Supreme Economic Council from Feb. to June 1919 in Paris, took part in the meeting at Amsterdam in 1919 which arranged for the International Financial Conference in Brussels in 1920, at which he was Sweden's representative. He was a member of the Committee of the Economic and Financial section of the League of Nations.

WALLER, LEWIS (1860–1915), English actor (*see* 28.283), died at Nottingham whilst on tour Nov. 1 1915, shortly after making a striking success at Wyndham's theatre, London, in *Gamblers All.* His wife, whose stage name was Florence West, died Nov. 14 1912.

WALSH, WILLIAM JOHN (1841–1921), Roman Catholic Archbishop of Dublin, was born in Dublin Jan. 30 1841, and was educated at St. Laurence O'Toole's seminary, Dublin, afterwards entering the Catholic University and St. Patrick's College, Maynooth. In 1867 he became professor of dogmatic and moral theology at Maynooth, was appointed vice-president of the college in 1878, and in 1881 succeeded Dr. Russell as its president. Four years later he became Archbishop of Dublin on the death of Dr. McCabe. Archbishop Walsh, besides being an energetic worker and writer, was a keen politician, and was conspicuous for his extreme Nationalist opinions. He was one of the witnesses before the Parnell Commission of 1888–9, and served on many committees and boards, chiefly educational, becoming in 1891 a commissioner of education in Ireland. He would have nothing to do with the suggestion for settling the difficulty of Catholic higher education in Ireland by establishing a Roman Catholic faculty of theology in Trinity College, an institution which he attacked as a centre of Protestant influence, and insisted on the need for a university with a " Catholic atmosphere." In 1908 he became a member of the Dublin Statutory Commission appointed under the Irish University Act, which established the Catholic National University, of which he became chancellor.

In proportion as the Nationalist party seemed disposed to compromise with the Government, Dr. Walsh drew away from it; and after the concessions made to Ulster in 1914, and more especially after the rebellion of 1916, he threw his influence more and more on to the side of the extremists. In the election of Dec. 1918 he voted for a Sinn Fein republican candidate.

Dr. Walsh produced various volumes of addresses on religious and educational subjects, and also published *A Plain Exposition of the Irish Land Act of 1881* (1881); *The Queen's Colleges and the Royal University of Ireland* (1883–4); *The Irish University Question* (1897); and two attacks on Trinity College, Dublin, *Trinity College and the University of Dublin* (1902) and *Trinity College and its Medical School* (1906). He died in Dublin April 9 1921.

WALSINGHAM, THOMAS DE GREY, 6TH BARON (1843–1919), was born July 29 1843. He was educated at Eton and Trinity College, Cambridge, and succeeded his father in 1870. He was an enthusiastic entomologist and sportsman, and for some years travelled widely, making collections of specimens of all sorts, many of which he presented to the natural history section of the British Museum. In 1876 he was made a trustee of the British Museum; he was also a fellow of many learned societies and high steward of the university of Cambridge. He died Dec. 3 1919.

WARBURG, PAUL MORITZ (1868–), American banker, was born in Hamburg, Aug. 10 1868. After graduating from the Realgymnasium in 1886 he entered a banking house. From 1889 to 1892 he studied banking in England and France; then for the next ten years was engaged in the banking business in Hamburg. In 1902 he went to New York, where he became a member of the banking house of Kuhn, Loeb & Co. He was naturalized in 1911. He was an early advocate of a centralized banking system in the United States and in 1914 was appointed by President Wilson one of the original members of the Federal Reserve Board. In 1916 he was appointed vice-governor of this board, succeeding Frederick A. Delano, and in 1917 was reappointed. In 1918, at the end of the period of his appointment, he retired, wishing to relieve the Administration of any embarrassment that might follow his renomination. Considerable opposition to his holding the place had arisen after America's entrance into the World War, because of his German birth. On accepting the Government office he had resigned from Kuhn, Loeb & Co., as well as from numerous directorates, including the National Bank of Commerce, the U.S. Mortgage & Trust Co., Wells, Fargo & Co., the Westinghouse Electric & Manufacturing Co., the B. & O. R.R. Co., the National Railways of Mexico, and the Rockefeller Foundation. He was the author of *Essays on Banking Reform in the United States* (1914).

WARD, SIR ADOLPHUS WILLIAM (1837–), English man of letters (*see* 28.319), was knighted in 1913. His history *Germany 1815–1890* (1st vol. 1916, 2nd vol. 1917) was a notable addition to his published works, together with various chapters in the *Cambridge History of English Literature.*

WARD, GENEVIEVE (1837–), English actress, was born in New York March 27 1837, the daughter of Col. Samuel Ward, and at the age of 18 married Count Constantine de Guerbel. She studied singing in Italy and in Paris, and made her first appearance under the stage name of Ginevra Guerrabella at Bergamo in the opera *Stella di Napoli* (1855). She further appeared at Milan in *Lucrezia Borgia* (1856), in Paris in *Don Giovanni* (1859), in London in *Robin Hood* (1861) and in New York in *La Traviata* (1862). Loss of voice due to an illness obliged her to leave the operatic stage in 1862 and for some years she taught singing in New York, but in 1873 she came to England and began a long dramatic career, appearing first at the Theatre Royal, Manchester, as Lady Macbeth. In March 1874 she first appeared in London in *The Prayer in the Storm* and later played with Charles Wyndham in *The Hunchback* and at Drury Lane as Rebecca in *Ivanhoe* (1875). Her most popular success was as Stéphanie de Mohrivart in H. C. Merivale's and F. C. Grove's *Forget-Me-Not*, produced by herself at the Lyceum theatre, London, Aug. 21 1879, and subsequently played over 2,000 times all over the world. Increasing years found her talents as an actress in full vigour, specially in Shakespearean parts, and as late as 1920 and 1921 she repeated her old rôles of Volumnia in *Coriolanus* and Margaret of Anjou in *Richard III.* at the "Old Vic" theatre in London. On her 84th birthday, March 27 1921, she was created D.B.E. She published a volume of reminiscences (with Richard Whiteing), *Before and Behind the Curtain* (1918).

WARD, SIR JOSEPH GEORGE, Bart. (1857–), New Zealand statesman, son of Thomas Ward, merchant, was born at Emerald Hill, Melbourne, April 26 1857, and was privately educated in Melbourne and at the state school, Bluff, N.Z. His first employment in New Zealand was as a boy of 13 in the department over which he was afterwards to preside as Postmaster-General with conspicuous success for more than 20 years. At the age of 21 he started business on his own account as a produce merchant, and began a connexion with municipal politics which lasted many years. He entered Parliament as Liberal member for Awarua in 1887, and retained the seat for more than 30 years. On the formation of the Ballance Ministry in 1891 he joined it as Postmaster-General, and filled the same office in successive Liberal administrations until 1912, and afterwards for four years in the National Government (1915–9). The value of his energy and enterprise in this capacity was acknowledged even by his opponents. In 1901 the success of his efforts to give New Zealand penny postage was rewarded by his being made a K.C.M.G., and at various postal conferences he distinguished himself by his pioneer advocacy of an All-Red Cable service and universal penny postage. In the Seddon Government he held other important portfolios, which included those of Colonial Treasurer and Minister of Railways, and his appointment as Minister of Public Health (Nov. 8 1900) is believed to have been the first such appointment in the world.

After Seddon's death, Sir Joseph Ward, who had on several occasions filled the position of Acting Premier during his late leader's absence from New Zealand, succeeded to the Premiership Aug. 6 1906 and held it till his resignation March 28 1912. (For his principal achievements in that capacity, the gift of a battle-cruiser to Great Britain and the institution of compulsory military training, *see* New Zealand.) After acting as leader of the opposition till Aug. 1915 Sir J. G. Ward joined with Mr. Massey, the Reform party's leader, then Prime Minister, in forming the National Government, in which the Reform and the Liberal parties were equally represented in order to avoid party strife for the period of the war. In the National Government thus established Sir J. G. Ward's principal office was that of Finance Minister. With Mr. Massey he went to London to represent New Zealand at the Imperial War Cabinet and War Conference meetings of 1917 and 1918; and he also attended the Peace Conference at Paris in 1919 as a member of the British Empire delegation. Shortly after his return with Mr. Massey from Paris Sir J. G. Ward dissolved the coalition by resigning his place in the National Government (Aug. 22 1919), and at the general election at the end of the year his party was defeated and he himself lost his seat. His own defeat was due in part to a sectarian agitation directed against him on the ground of his alleged bias as a Roman Catholic in favour of those of his own faith.

In addition to the occasions already mentioned Sir J. G. Ward represented the Dominion at the Imperial Conferences of 1907, 1909 (Defence) and 1911. At the 1909 Conference he strongly supported the ideal of an undivided Imperial navy. He was appointed to the Privy Council in 1906, and received a baronetcy in 1911. During his various Imperial missions he received the freedom of London, Edinburgh and other British cities, and the hon. degree of LL.D. from the universities of Cambridge and Edinburgh and Trinity College, Dublin. He married in 1883 Theresa Dorothea de Smith (C.B.E. 1919), and had a family of four sons and one daughter.

WARD, LESTER FRANK (1841–1913), American geologist and sociologist (*see* 28.320), died in Washington, D.C., April 18 1913. His numerous minor publications, together with biographical notes, were issued under the title *Glimpses of the Cosmos*, 6 vols. (1913–8), the last five volumes posthumously.

WARD, MARY AUGUSTA [Mrs. Humphry Ward] (1851–1920), English novelist (*see* 28.320), died in London March 24 1920. Since 1910 she had published *The Case of Richard Meynell* (1911), a study of Modernism and in a sense a sequel to *Robert Elsmere; The Mating of Lydia* (1913); *The Coryston Family* (1913); *Delia Blanchflower* (1914); *Eltham House* (1915); *A Great Success* (1915); *Lady Connie* (1916); *Missing* (1917); *The War and Elizabeth* (1918); and a posthumously published novel, *Harvest* (1920). She had also in 1918 published her memoirs, *A Writer's Recollections*, and during the World War she undertook, for propaganda purposes and with a view to enlightening the American public, a journey through the English munitions areas and two journeys in France, the results of which were published as *England's Effort* (1916); *Towards the Goal* (1917) and *Fields of Victory* (1919). From the great fatigue of the second French journey, undertaken in winter and in her 67th year, she never entirely recovered. Her work for children has been commemorated by the raising of a fund to further endow the Passmore Edwards Settlement, in Tavistock Place, London, re-named after her the Mary Ward Settlement.

WARD, WILFRID PHILIP (1856–1916), English man of letters, was born at Ware Jan. 2 1856, the second son of William George Ward (*see* 28.321). Educated at St. Edmund's College, Ware, Ushaw College, Durham, and the Gregorian University of Rome, he became lecturer in philosophy at Ushaw College in 1890, and examiner in mental and moral science to the Royal University of Ireland 1891–2. In 1906 he became editor of *The Dublin Review*. He was the author of numerous books: *The Wish to Believe* (1884); *The Clothes of Religion* (1886); *W. G. Ward and the Oxford Movement* (1889); *W. G. Ward and the Catholic Revival* (1893); *Lives* of *Cardinal Wiseman* (1897), *Aubrey de Vere* (1904), *Cardinal Newman* (1912), and several volumes of essays. He died in London April 8 1916. A biographical notice of him, written by his wife, Josephine Mary (b. 1864), daughter of J. R. Hope-Scott, was published as a preface to his *Last Lectures* (1916). Mrs. Ward was also the author of several distinguished novels, including *One Poor Scruple* (1899); *The Light Behind* (1903); *Great Possessions* (1910); *The Job Secretary* (1911) and *Not Known Here* (1921).

WAR GRAVES.—I. British Forces.—One of the most interesting pieces of organization resulting from the World War is represented in the Imperial War Graves Commission, which was constituted on behalf of the Governments and peoples of all parts of the British Empire, and charged with the care in perpetuity of the graves of their sailors and soldiers.

History.—Early in Sept. 1914 a mobile unit, under the command of Maj.-Gen. Sir Fabian Ware, was formed in France, with the approval of Lord Kitchener, by the British Red Cross Society to search for "missing" on the line of the British retreat from Mons, along which the Germans were then being forced back. While similar work was being carried out from Paris, also under the auspices of the British Red Cross Society, this mobile unit operating between Lille and Amiens was found marking and registering graves in that area when the British army moved north from the Aisne. Sir Nevil Macready, then Adjutant-General to the British Expeditionary Force, perceiving that both the unprecedented number of casualties and the personal interest of the whole British public in the New Armies would demand attention to the graves of the fallen beyond that which was provided for in the existing organization of the Adjutant-General's Branch, transformed this unit, in Feb. 1915, into a department of his branch. The work increased so rapidly that it was soon found necessary to promote the department to the status of a Directorate of the British Army, and later to create a corresponding department of the War Office, with the title Directorate of Graves Registration and Enquiries.

By the autumn of 1915 the number of registered graves scattered over the countryside or situated in established communal or British military cemeteries had reached considerable proportions. Discussions therefore took place between the British officers responsible for the organization and the French Government, with a view to insuring the permanency of the British graves and cemeteries and their security from disturbance. The result was the passing of the French Law of Dec. 29 1915, one of the most generous and interesting enactments made by one nation on behalf of others. The law provides that all Allied graveyards on the soil of France shall be acquired by the Government of the Republic at its own expense and that the rights of ownership shall be enjoyed in perpetuity by the Allied nations concerned. This practical tribute to the valour of the British armies was profound in its effect on the relations between the two Allies during the war.

Under this law it was possible for an "association régulièrement constituée" by an Allied government to be entrusted with the care of its graves in France. The result was the establishment in Great Britain (Jan. 1916) of a National Committee for the Care of Soldiers' Graves, the presidency of which was accepted by the Prince of Wales. In its establishment there was to be found the germ from which developed the Imperial War Graves Commission, a body of wider powers and much deeper significance.

By May 1916 the extension of the fighting to more distant battlefields than France and Belgium had very greatly increased the work of the department. In the same month Graves Registration units were established in Egypt, Salonika, Mesopotamia and E. Africa. The large and rapidly growing number of casualties made it evident that the care of the graves after the war and the erection of permanent memorials would be a task too extensive for a body with the limitations of the National Committee to undertake. Among these limitations was the lack of direct representation of the Dominions and other parts of the Empire, whose soldiers were falling and being buried side by side with those of the United Kingdom. The first Imperial Conference since the beginning of the war was to be held in March 1917, and it was felt that this was an opportunity of suggesting to the Governments of the Empire the creation of an Imperial body responsible equally to the British and Dominion Parliaments, to whom the great work could be entrusted. In a memorandum addressed to the Prime Minister, dated March 15 1917, the Prince of Wales, as president of the National Committee, suggested that the formation of "a joint Committee of the Governments of the Empire, or a statutory body of Commissioners somewhat on the lines of the Development Commission," should be proposed to the forthcoming Imperial Conference. The question was accordingly laid before the Conference on April 13 1917, when a resolution was passed praying His Majesty to grant a Royal Charter for the constitution of an Imperial War Graves Commission, which should be empowered to care for and maintain the graves of those fallen in the war, to acquire land for the purpose of cemeteries and to erect permanent memorials in the cemeteries and elsewhere. The charter was passed under the Great Seal on May 21 1917, and the Commission, of which the Prince of Wales became president, was duly established.

Constitution.—The provisions of the charter stipulate that the members of the Commission shall be:—

"The persons for the time being holding the offices of: Our Principal Secretary of State for War (*ex-officio* Chairman), Our Principal Secretary of State for the Colonies, Our Principal Secretary of State for India; and First Commissioner of Our Office of Works and Public Buildings, . . . and such persons as may be appointed by the Governments of Canada, Australia, New Zealand, South Africa, and Newfoundland . . . ," and "such other persons, not exceeding the number of eight in all, as may from time to time be appointed members of the Commission by Royal Warrant under the sign manual of the Sovereign for the time being."

The nomination by the British Overseas Dominions of their representatives and the selection of non-official members of the Commission were completed in Oct. 1917, under the chairmanship of the then Secretary of State for War (the Earl of Derby), and the persons nominated were appointed by Royal Warrant on the 26th of that month. In every case the Dominions nominated their High Commissioners or official representatives in London.

The first non-official members were: Sir William Garstin, Harry Gosling, Rudyard Kipling, Gen. Sir C. F. N. Macready (then Adjutant-General to the Forces, subsequently succeeded in that office by Lt.-Gen. Sir G. M. W. Macdonogh, who was appointed to fill one of the vacant unofficial memberships, thus indicating that the Adjutant-General for the time being should always be a member of the Commission), Gen. Lord Plumer, Adml. Sir Edmund S. Poe, Maj.-Gen. Sir Fabian Ware (subsequently appointed permanent vice-chairman).

One of the first duties which the newly formed Commission had to perform was, in the words of the resolution of the Imperial Conference on April 23, "to prepare an estimate of the probable cost of carrying on the work entrusted to them and to submit the same to the Governments of the United Kingdom and Overseas Dominions with their recommendation as to the proportion that should be borne by each."

The Commission's deliberations on this question resulted in the double proposal laid before the next Imperial Conference on June 17 1918, that £10 per grave should be taken as the probable cost of the construction of cemeteries, and that the cost of carrying out the decisions of the Commission should be borne by the respective Governments in proportion to the numbers of the graves of their dead. It is hardly necessary to emphasize the significance of the adoption of this proposal; a precedent may thus have been established with far-reaching effects; at any rate a most interesting experiment in coöperative administration among the nations of the British Commonwealth had been initiated. It is based on the principle that each shall be financially responsible in proportion to the amount of service rendered on behalf of the whole. In this connexion it is important to note that estimates are presented yearly in identical form to each of the participating Governments, the respective Parliaments being asked to vote a proportion of the total in accordance with the decision of the Imperial Conference of 1918 referred to above. The Commission administer the grants in aid thus received through a finance committee, which meets regularly at short intervals and on which the British Treasury is represented. The principle of complete coöperation runs through all the work of the Commission, the participating Governments being represented in the administrative personnel, both in London and abroad, on the same proportional basis as has been adopted for the sharing of expenditure.

Policy.—While their constitutional history was thus developing, the Commission were busy arranging for the discharge of their responsibilities. One of their first acts was to lay down as a guiding principle that the graves of all ranks and ratings should be treated on a basis of absolute equality.

With this principle as a foundation on which to build, the Commission, desiring that the various proposals which had been placed before them as to the best method of discharging their responsibility should not become the subject of controversy, invited Sir Frederic Kenyon to report to them, the following being the terms in which the matter was referred to him:—

"Sir Frederic Kenyon's duties will be to decide between the various proposals submitted to him as to the architectural treatment and laying out of cemeteries, and to report his recommendations to the Commission at the earliest possible date.

"1. He will consult the representatives of the various churches and religious bodies on any religious questions involved.

"2. He will report as to the desirability of forming an advisory committee from among those who have been consulted, for the purpose of carrying out the proposals agreed upon.

"The Commissioners are of opinion that no distinction should be made between officers and men lying in the same cemeteries in the form or nature of the memorials."

The recommendations of Sir Frederic Kenyon's report, which were adopted by the Commission, may be briefly summarized as follows:—

1. That the principle of equality of treatment should be expressed by the erection of uniform headstones over the graves of all officers and men who, in the words of the charter, may have died from wounds inflicted, accident occurring or disease contracted while on active service during the war.
2. That each cemetery should have a great memorial stone and a tall cross as central monuments.
3. That isolated graves should be concentrated into selected cemeteries.

It remained for the Commission to put the scheme into execution. Officials were appointed and made responsible for the organization and carrying out of the work in the different areas, and by the spring of 1918 the new establishment was on a practical basis.[1] In France and Belgium the preparation of architectural designs was entrusted to Sir Edwin Lutyens, Sir Reginald Blomfield and Mr. Herbert Baker; in Egypt, Macedonia, Italy and the United Kingdom to Sir Robert Lorimer; in Gallipoli and Palestine to Sir John Burnet; and in Mesopotamia to Maj. Edward Warren. In each of these areas there were assistant architects responsible to the principal architects named.

Work.—The type of regimental headstone finally selected by a committee consisting of Sir Frederic Kenyon, Sir C. J. Holmes, Mr. D. S. MacColl and Mr. Macdonald Gill, was of a design frequently found in churchyards in the United Kingdom. The dimensions are: height 2 ft. 6 in., breadth 1 ft. 3 in., thickness 3 inches. Each stone as a rule bears at the top the badge of the regiment or unit. Then follow the military details with the name of the deceased and the date of his death, below which is carved the symbol of his faith, while at the foot of the stone is engraved a personal inscription chosen by the next-of-kin.

Of the two central monuments the great altar-like Stone of Remembrance, designed by Sir Edwin Lutyens, bears the inscription chosen by Mr. Rudyard Kipling, "Their name liveth for evermore." The other memorial is the great Cross of Sacrifice designed by Sir Reginald Blomfield, to the shaft of which is fixed a crusader's sword of bronze. (*See* Plate.)

The preparation of cemetery registers, which will present a complete record of the fallen, is also a feature of the Commission's work. Each register will as a rule contain a map showing the situation of the cemetery, a plan giving the position of the grave, and an alphabetical list of those buried or commemorated in the cemetery, with a short addition, generally giving, among other details, age and parentage furnished by the next-of-kin.

To these duties must be added that of honouring the dead who have no known graves. This is no small task, for of these there are more than 250,000 and the precise form of the memorials was still in 1921 under consideration.

Nor did the Commission's responsibilities end here, for the commemoration of the navy's dead was also entrusted to them. In each of the three ports which throughout Britain's naval history have been intimately associated with the sea service a site was chosen for the erection of a memorial (which will also act as a sea-mark), bearing the names of those lost or buried at sea. These memorials were designed by Sir Robert Lorimer in consultation with the Board of Admiralty.

With equal generosity Belgium made provision similar to that of France for the acquisition of land for British cemeteries on her territory. Other countries followed the lead of France and Belgium. Measures of similar intent were passed by Italy in June 1918, and by Greece in Sept. 1920, while in Nov. 1918 the Egyptian Government promised to present to the Commission as a free gift the land on which British or Dominion soldiers were buried, as also did the Government of Palestine in Nov. 1920.

Several of the enactments described above were followed by treaties or agreements. In Nov. 1918 an Anglo-French Agreement was signed enabling the Commission to act in France. An important clause provided for the establishment of an Anglo-French Committee (of which distinguished French and British officers are members), to represent the Commission in their relations with the French authorities, and to present claims for land for cemeteries, or for memorials by which some gallant exploit or feat of arms may be commemorated.

The Commission is represented by similar agencies with similar powers in Belgium, Greece, India, Canada, Malta, Gibraltar, Palestine and Mesopotamia. The Canadian Agency is responsible to the Commission for the entire execution of its purposes in Canada, the United States of America and Siberia; a committee established in India, in consultation with the Indian Government, is in the same way responsible for that country and Aden.

The unprecedented nature of the task with which the Commission was charged is obvious; its complexity and magnitude will be realized when it is remembered that the 600,000 known graves for which they were responsible were scattered all over the world in many different countries with different laws and customs, some of them the enemy countries with whom special provisions were made in the Treaties of Peace to ensure the graves being respected; and there are no less than 15,000 burial places in different parts of Europe and the East where British sailors and soldiers rest, the great majority being in civil cemeteries containing small groups of graves, but some 1,500 of them being cemeteries of considerable size, the largest containing 12,000 graves. As has been seen, the permanent construction work carried out in these cemeteries is of a simple but durable kind, but the Commission's gardeners set to work immediately after the Armistice, without waiting for the erection of the permanent headstones, planting shrubs, grass and flowers, taking as their guiding principle the words of Sir Frederic Kenyon's report: "There is no reason why cemeteries should be places of gloom; but the restfulness of grass and the brightness of flowers in fitting combination would appear to strike the proper note of brightness and life." It is hoped that these cemeteries may become a permanent landmark in the history of civilization.

When the Commission's policy was first announced it met with some criticism, particularly as regards equality of treatment as expressed by the principle of uniformity. This criticism found expression in a motion in the House of Commons. The debate which took place on this occasion (May 4 1920) has been described as one of the most moving in the history of the British Parliament. The result, by which the motion was negatived without a division, must have removed from the minds of the commissioners any fear that the sympathy of the country was not with them in the course they were pursuing.

II. FORCES OF FRANCE AND THE UNITED STATES.—While, as a rule, the Allies adopted similar methods of commemorating the fallen to those described above, the great differences in the numbers of their casualties and in the conditions obtaining in the different countries rendered certain divergences unavoidable.

France, on whose soil lay over three million dead, was faced with the problem of honouring her fallen soldiers without clogging the wheels of industry and agriculture, which were beginning to revive under peace conditions, even in the devastated areas where the graves lay thickest. The British helped to solve the difficulty by concentrating all isolated graves into cemeteries which would forever mark the British battle-line. The French adopted the further expedient of giving the next-of-kin the opportunity of having their dead re-buried at the State's expense in the churchyard or burial-ground of their native place, while those who were left would rest in great national cemeteries constructed by the State as a lasting monument to the heroism of the soldiers who died for France.

Many of the fallen soldiers of the American Expeditionary Force were borne back across the Atlantic to rest in their native land. The execution of this difficult task demanded careful organization, and it says much for the enthusiasm and the capacity of the staff of the Cemeterial Branch of the American

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[1] The head office was set up in London, which will remain the permanent headquarters of the Commission.

WAR GRAVES

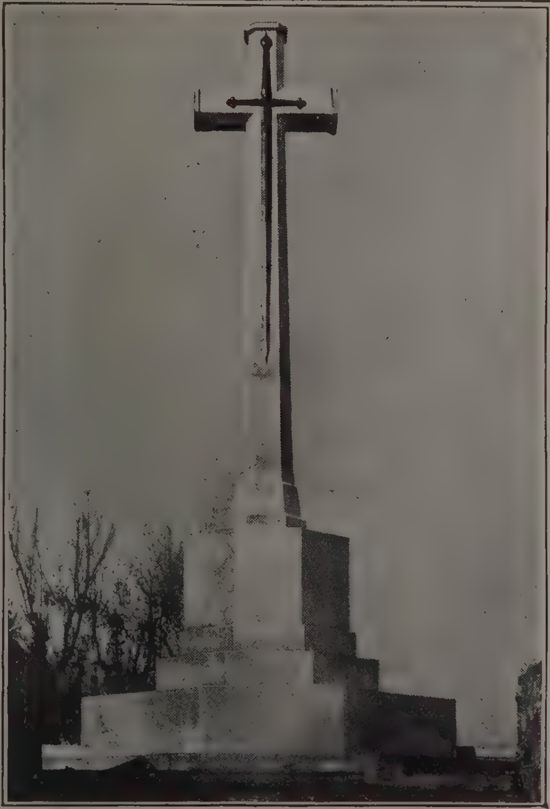

"CROSS OF SACRIFICE" (BRITISH)

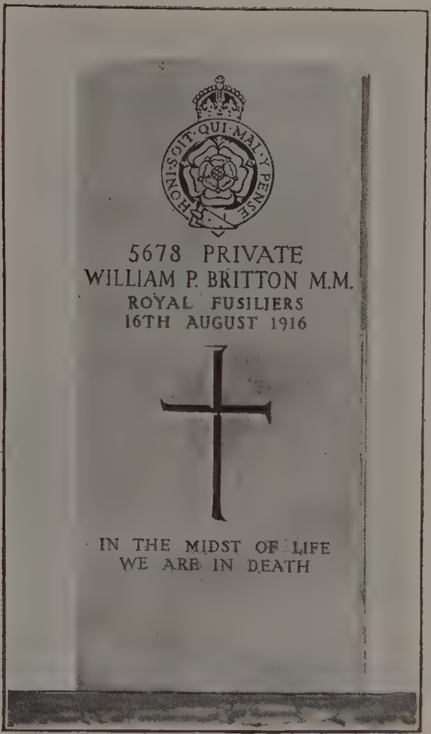
HONI·SOIT·QUI·MAL·Y·PENSE
5678 PRIVATE
WILLIAM P. BRITTON M.M.
ROYAL FUSILIERS
16TH AUGUST 1916
IN THE MIDST OF LIFE
WE ARE IN DEATH

WAR HEADSTONE (BRITISH)

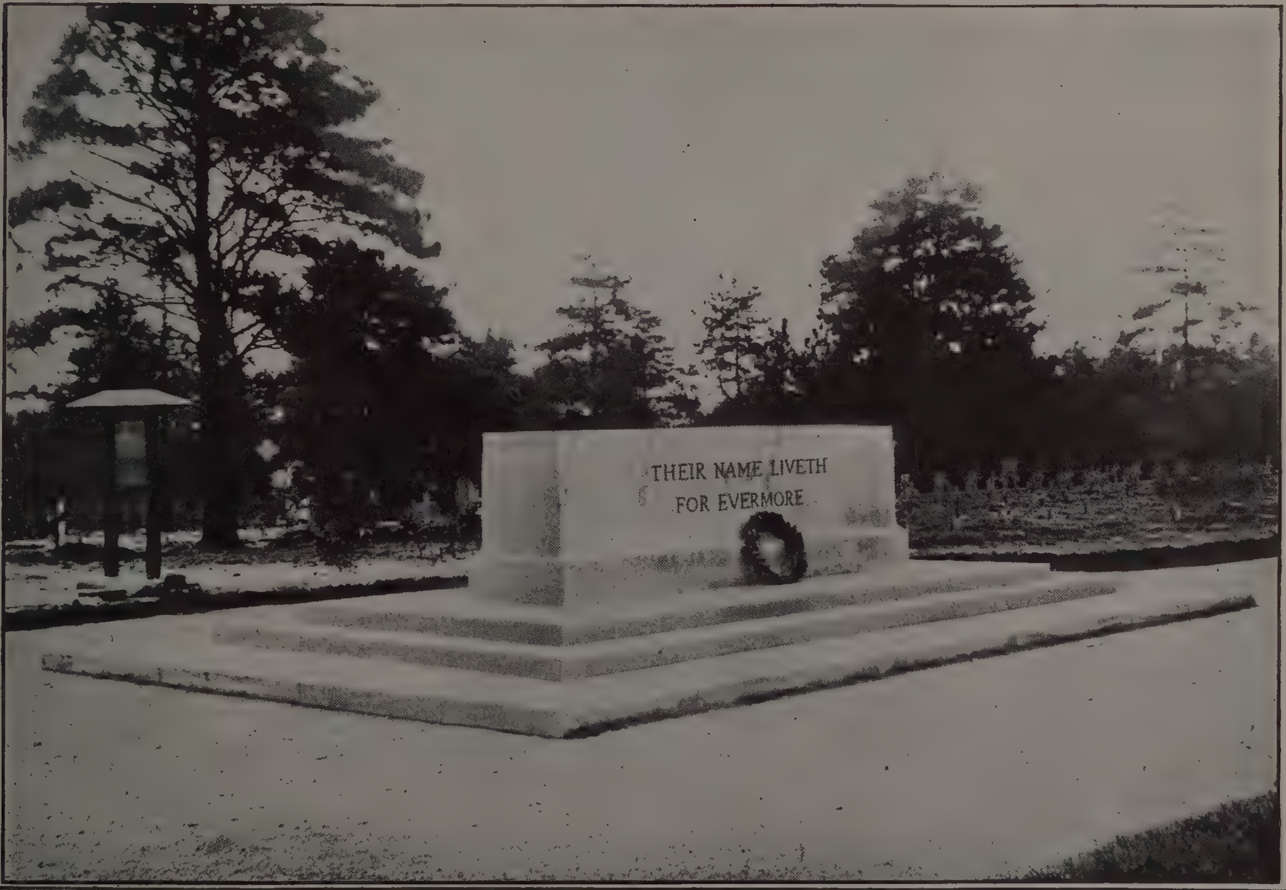
THEIR NAME LIVETH
FOR EVERMORE

"STONE OF REMEMBRANCE" (BRITISH)

War Department that it was carried out with so much success; it would have certainly been impossible but for the fact that American death casualties did not amount to much more than one hundred thousand, a comparatively small number compared with that of the British Empire, whose losses approximated to the enormous total of one million men. It is probable that the American War Department would have hesitated before undertaking a task even of the magnitude mentioned had it not been for the fact that, before a single American battalion had left the shores of the United States, a pledge had been given that no American soldier who died fighting for his country and for the liberties of nations should be left to lie on foreign soil except at the express wish of his next-of-kin.

Many Americans were taken from British military cemeteries, where they were buried under stress of battle with their British comrades-in-arms. It was hoped that the empty spaces left after the removal of such French and American soldiers would be marked by memorials which would remind posterity how the armies of France, America and the British Commonwealth fought and fell together in the defence of a common ideal.

Those Americans left to rest in France were grouped together in three or four great cemeteries, the land being acquired by the French Government on behalf of the sister Republic under the law of 1915. The plan of construction of these cemeteries is based on the principle of uniform treatment of the graves, a principle which has for some considerable time found favour in America in the planning of cemeteries. Indeed the United States may justly claim to be the first nation to put this conception into practice, the most notable example being Arlington National Cemetery, where the men who died in the Civil War and in the Spanish-American War of 1898 lie buried. It is possible that the conspicuous success with which Arlington Cemetery has been designed had a share in influencing the Imperial War Graves Commission in the construction of the British war cemeteries on somewhat similar lines. (F. W.)

WAR LOAN PUBLICITY CAMPAIGNS.—In connexion with this account of publicity relating to war financing in Great Britain, the article Liberty Loan Publicity Campaign and the *United States* section of the article Savings Movement will afford a broad view of the activities in these two countries. Prior to the outbreak of war in 1914, Government loans in Great Britain were subscribed by a very limited circle of large investors, businesses and corporations. Publicity in connexion with the floating of them began and ended with the issuing of a prospectus, its publication in the Press, and its distribution by a limited number of bankers and stockbrokers. In order, however, to raise the vast sums of money required by the Government for the prosecution of the war, other and far bolder publicity methods had to be inaugurated during 1914–9. It was necessary to appeal to a very much wider circle of subscribers—a circle eventually no narrower than the whole population of the British Islands—and to urge investment in War Loans as a patriotic duty. The first attempts at the application of modern methods of publicity to the flotation of War Loans were on a limited scale, being hampered by official reluctance to depart from traditional procedure and a prejudice against any lapse from official "dignity." A slight expansion of newspaper advertising, at first not widely departing from mere "publication of prospectus" advertising, and the use of posters displayed in the streets and on hoardings, marked the beginning of a new state of things. The work of the War Savings Committee from 1916 onwards, together with news of the successful publicity work in the U.S., helped to reconcile British officialism to an increase of activity in this direction.

By the time the so-called "Victory" Loan was floated, early in 1917, newspaper advertising had increased both in volume and effectiveness. Many more posters appeared on the hoardings. The services of local authorities were invoked, and public meetings were held, up and down the country, at which speakers drew attention to the country's pressing need of money and appealed openly for subscriptions. A great mass meeting in Trafalgar Square, held under the auspices of ministers of religion, was an outstanding publicity feature in connexion with the Victory Loan and was the forerunner of many similar gatherings.

It was, however, in connexion with the campaign for National War Bonds, which were first offered to the public in Sept. 1917, that organized publicity on behalf of British war-loan subscriptions displayed the fullest measure of its possibilities and achieved its greatest success. The National war Bonds were short-dated securities continuously on offer—in contrast to earlier loans the subscription lists for which had remained open only for some weeks. They were introduced by Mr. Bonar Law, the then Chancellor of the Exchequer, in order to inaugurate a period of "continuous borrowing"—to provide a method by which the public could subscribe each week the weekly cost, or more than the weekly cost of the war. It was hoped by this means to avoid the dislocation of the money market and the inflation of currency (due to borrowing from banks for purposes of subscription) which had been found to attend the previous "closing date" loans.

Despite attractive terms the subscriptions for National War Bonds for the first two or three weeks were distinctly disappointing. Starting at an exceedingly low weekly total the receipts rapidly fell, and it says much for the extent to which publicity methods had already justified themselves that in Nov. 1917 the Chancellor of the Exchequer, faced with the prospect of the failure of the whole new scheme of continuous borrowing, saw fit to appoint Sir George (then Mr.) Sutton, the chairman of the Amalgamated Press Ltd., as Director of Publicity for the War Bond campaign—with an entirely free hand as to methods employed, and, within very wide limits, a free hand as to expenditure. The result was a complete change, from the first week of Dec. 1917, when the War Bond publicity campaign could have been said to be really started.

The backbone of the campaigns was undoubtedly newspaper and periodical advertising. This advertising was practically continuous, though very widely varied. The appeal of it was cast and recast in a hundred ways. It struck first the finance note, the self-interest note, the explanatory "see what you get and what security" note, and then the loftier note of patriotism, of service, of exhortation to duty. The advertising was intensely human, written to appeal not merely to business men but to the people at large. It reached its highest pitch of emotional appeal during the terrible spring of 1918 when the Germans, pushing far into the Allied lines, threatened Amiens, and the whole British nation hung breathless upon the march of events. During those dark weeks the War Bond advertising told, almost day by day, the story of England in terms of Belgium; pointing out the inevitable and hideous consequences of defeat, and urging the duty of supporting with money the brave men then fighting.

Another point to be noted about the press advertising was its topicality. Appropriate "copy" was actually kept standing for immediate publication in the event of certain contingencies such as a great victory, or (on the other side of the picture) the air-bombing of important British towns.

It was recognized that in order to sustain interest in War Bonds over a long period the steady appeal of the press advertising required reinforcing by periods of special activity. The necessary stimulus was obtained by the organization throughout the country of special "weeks" such as "Tank Weeks"—"Business Men's Week"—"War Weapons Weeks"—"Feed the Guns Weeks." The main features of these were similar. They consisted essentially in the provision of some spectacular feature round which the appeal for subscriptions could centre. Tanks, for instance (then just newly invented), each with an officer and crew, took up their stand for a week at a time in the leading towns and cities. Officials of the Bank of England and of the Post Office accompanied the tanks, and very many million pounds' worth of bonds were sold by them.

The effect of the visit of a tank to a town was that for one week at least that town talked and thought of nothing but War Bonds. Local papers devoted columns to descriptions of the amount of business done, and local firms and business men vied with each other to subscribe the largest amounts.

Leaflets (which were frequently dropped from aeroplanes in order to obtain the maximum of spectacular effect), posters, speakers, etc., were, of course, supplied by the Director of Publicity for each tank in each town.

"Feed the Guns" weeks were run on the same principle, the tanks being replaced by giant howitzers fitted with an ingenious device whereby the bonds sold could actually be stamped in the breeches of the guns themselves.

"Business Men's Week," which was held simultaneously throughout the country, and "War Weapons Weeks," which were worked town by town, were run somewhat differently. In both these cases the cities and towns of the country were assessed to subscribe amounts calculated on a basis of £2 10s. od. per head of population, and this amount instead of being expressed in figures was expressed as some definite weapon of war which the amount in question would suffice to purchase. Thus a large city would be asked to subscribe sufficient in a week to purchase one or more battleships, a smaller town enough to purchase a cruiser, a township enough to purchase a squadron of aeroplanes, a village enough for a howitzer.

This dramatic method of presenting each community with an opportunity to achieve concrete expression of its duty as a community brought splendid results. Scarcely a town or city in the country failed to perform its task, and during very many of the weeks sums far in excess of the assessments were subscribed. Liverpool, for instance, asked to purchase a battleship, invested sufficient during its week to purchase no less than six!

All these separate campaigns of special weeks were "led off" by spectacular displays in Trafalgar Square, London, which was transformed for each occasion into something resembling a huge circus. Tanks or guns, as the case might be, were "parked" and surrounded with skilfully built imitation trenches and entanglements; barriers and huts were erected, painted scenery was provided to form a background, giant posters almost hid the façades of the National Gallery and the buildings surrounding the Square, and hundreds of thousands of people were attracted of a class which could probably not have been reached by any other form of appeal. Vast business was done during these Trafalgar Square weeks, sums running into many millions being invested during each. So great was the enthusiasm roused that some business firms actually marched down their employees with bands and flying flags to make their purchases of bonds during the prevailing excitement.

Not content with waiting in Trafalgar Square for subscriptions to come to them, two of these huge tanks snorted and puffed, day by day, through the streets of the city, calling at the offices of the leading insurance firms to collect applications for War Bonds. As a tank does not move swiftly it was necessary to limit this privilege of a "personal" call to firms desirous of investing £50,000 or over.

Government carrier-pigeons were also used, with great success from the point of view of publicity, to bring in applications from a distance to Trafalgar Square.

Another important publicity aspect of these special weeks was the opportunity each provided for an important official opening. Thus "Business Men's Week" was preceded by a great public meeting in the Connaught Rooms at which the Chancellor of the Exchequer was the chief speaker and to which all the leading bankers of the kingdom were invited. It is probable that from the financial point of view no more influential gathering than this has ever taken place. "Feed the Guns Weeks" were introduced by another great meeting at the Guildhall, addressed by the Chancellor of the Exchequer and the Rt.-Hon. A. J. Balfour.

The extent of the response to these special weeks was enormous, as may be judged by one of them only, the "Business Men's Week," which brought in £160,000,000—nearly eight times as much as the average weekly total.

Apart, however, from greatly increased purchases, these special weeks, "booms," and "stunts" were very valuable as yielding a continuous "news" story. The problem before the publicity director was to maintain interest in War Bonds week after week and month after month; and had the campaign once been allowed to become a matter of routine, lacking new incidents, the "news" story of it would perforce have dropped out of the columns of the press. As it was, so great was the variety and so many the incidents that a full-size news agency had to be installed at headquarters, where a large staff was kept busily engaged in collecting news by telegram and telephone from all over the country and passing it on to the press.

A successful publicity device was the inter-town War Bond Race. The race, of course, was to secure the largest total of local holdings in War Bonds, and, promoted and fostered by the Publicity Director, it went gaily on for months—the varying position of the leading cities, now one leading, now another, forming for over a year an almost staple article of news.

Many other publicity devices were employed, among which the following may be noted:—

(1). Arranging with the Postmaster-General to adopt a cancellation mark carrying the words "Buy War Bonds," so that practically every citizen received a daily reminder of his duty on the envelope of every letter received. (2). A letter signed by the Chancellor of the Exchequer urging investment as a patriotic duty—sent out by the Bank of England with each dividend on a Government security. (3). A letter signed by the chairmen of banks to the individual depositors urging that deposits should be reduced and the money invested in War Bonds. (4). A letter sent out by limited liability companies simultaneously with the dispatch of their dividend warrants, urging that the amount of the dividend should be at once invested in War Bonds.

These letters ran, of course, into many millions, and the drafting, preparation, and printing of them was not the least arduous of the tasks which the Publicity Director and his staff had to face.

After the Armistice a closing date for War Bonds was announced, and a very extensive final appeal was organized which brought the total of investment in them up to the magnificent figure of £1,600,000,000—subscribed in under 17 months.

The publicity in connexion with War Bonds more than justified itself. It established the feasibility of the hitherto untried system of continuous borrowing; it secured a total of subscriptions far in excess of anything that the Chancellor of the Exchequer had contemplated; and it did, in fact, finance the war to a finish.

Publicity in connexion with post-Armistice loans—notably the Thanksgiving Loan of 1919 (popularly termed the "Joy Loan")—was conducted on similar lines. War, which altered and remodelled so much that had appeared fixed, certainly brought a new spirit and a new method into the floating of Government loans in Great Britain. The success achieved was so marked as to make it unlikely that any future Chancellor of the Exchequer would embark upon any big loan issue without first assuring himself of the services of the most influential publicity adviser. (G. A. S.)

WARRE, EDMOND (1837–1920), English educationist, was born in London Feb. 12 1837, the son of Henry Warre, of Bindon House, near Wellington. He was educated at Eton and Balliol College, Oxford, where he had a distinguished career, taking a double first (1856 and 1859). In 1859 he was elected a fellow of All Souls. He went to Eton in 1860 as assistant master, and in 1884 was elected Headmaster, a position which he retained until 1905. After a period of retirement he was in 1909 appointed provost of Eton in succession to Dr. James Hornby, but during the greater part of his provostship he was incapacitated by ill health from taking any very active part in the government of the school. He was an hon. chaplain to Queen Victoria (1885–1901), and later occupied the same office in the households of King Edward VII. and King George V. He was created M.V.O. in 1901, C.B. in 1905, and C.V.O. in 1910. He died at Eton Jan. 22 1920. He took much interest in sport at Eton, and the high standard of rowing to which the Eton eights attained was due in a large measure to his coaching. His 45 years' connexion with Eton thoroughly identified him with its traditions and ideals, and, without being remarkable either as scholar or as teacher, he wielded a personal influence which has seldom been surpassed.

WARREN, WHITNEY (1864–), American architect, was born in New York City Jan. 29 1864. After studying at the

École des Beaux Arts, Paris, under Daumet and Girault (1885–1894), he began the practice of architecture in New York, later becoming associated with Charles D. Wetmore under the firm-name of Warren & Wetmore. They specialized in railway architecture, hotels, business buildings and residences, and were architects for the New York Central, Michigan Central, Canadian Northern, and Erie railways. Their numerous structures in New York City include the Chelsea docks and the hotels Belmont (1905), Vanderbilt (1910), Biltmore (1912), and Commodore (1916). During and following the World War, Warren supported actively the claims of Italy in the Adriatic. He was an intimate friend of d'Annunzio, and was appointed diplomatic representative in the United States of the " Free State of Fiume." In 1920 he was chosen by the International Committee to reconstruct the library of the university of Louvain, destroyed by the Germans in 1914. He was a member of the Institut de France, the Académie des Beaux Arts, the Royal Academy of St. Luke (Rome), and other foreign academies. He was the author of *Les Justes Revendications de l'Italie: la Question de Trente, de Trieste et de l'Adriatique.* Many of his addresses, delivered 1914–9, were published and widely distributed.

WASHINGTON, BOOKER TALIAFERRO (*c.* 1859–1915), American negro teacher and reformer (*see* 28.344), died at Tuskegee, Ala., Nov. 14 1915, as the result of a breakdown due to overwork. His last public address was delivered on Oct. 25 before the national conference of Congregational churches in New York City. At Tuskegee he was succeeded by Robert R. Moton. He was the author of *My Larger Education: Being Chapters From My Experience* (1911) and *The Man Farthest Down; a Record of Observation and Study in Europe* (1912).

See D. F. Riley, *Life of Booker T. Washington* (1916).

WASHINGTON, District of Columbia (*see* 28.349), the capital city of the United States, increased in pop. from 331,069 in 1910 to 437,571 in 1920, a gain of 106,502, or 32·2% as compared with 52,351 or 18·8%, in the preceding decade. Of the 1920 pop. 326,860 were white, 109,966 negro and 745 of other races (chiefly Chinese, Japanese, Filipino and Indian). With the entrance of the United States into the World War in 1917 Washington not only assumed new importance among world capitals, but it became the centre from which practically every significant activity in the United States, commercial and industrial as well as military and naval, was directed. Existing Government bureaus were expanded beyond precedent and many new ones were created. These activities brought to Washington within a single year 60,000 new residents, a large percentage of whom remained after the war came to an end. An acute shortage of housing facilities developed, and the Government was forced to commandeer every available building, as well as to construct a number of new ones.

Buildings.—In order to carry on the war work of the Government a number of temporary office buildings for the use of various departments were erected on the Mall between 3rd and 9th Streets. On B Street N.W., between 17th and 21st Streets, two large structures of the factory type, of cement and iron, were erected for the War and Navy Departments. One of the largest buildings in the capital, the Arlington Building, of stone and iron, was erected (1919) on the site of the old Arlington Hotel on Vermont Avenue and H Street N.W. for the use of the War Risk Bureau. Most of the other buildings constructed during the war period were of a temporary character, being designed merely to meet an emergency. Of this class were the Government hotels on the Union Station Plaza erected for war workers as late as 1919 and in use in 1921. There were in all 14 of these emergency buildings, two of which were used for administrative purposes. Among the new permanent buildings were the City Post Office (1914), near the Union Station; the building for the Department of the Interior (1917), occupying the block between E, F, 18th and 19th Streets N.W.; the Bureau of Engraving and Printing (1914), 14th Street between C and D Streets S.W.; the Treasury Department Annex, on Pennsylvania Avenue opposite the Treasury Building. The capacity of the Navy Yard was increased by the erection of three large buildings for a machine shop, gun shop, and joiner shop. New buildings were leased by the Government for the Department of Commerce, Department of Labor, Railroad Administration, Bureau of the Census, branches of the Department of Agriculture, and other executive organizations. Near Brightwood, about 4 m. north of the city proper, is the Walter Reed General Hospital, first established in 1905 for the U.S. army. To extend its capacity, a number of additional buildings were constructed during the war, mostly of a temporary or semi-permanent character. The grounds embrace 97 ac. and it is next to the largest army hospital in the United States, the maximum capacity being 2,650. The grounds and buildings cost $2,575,000. In the Mall, adjoining the Smithsonian Building on the west, is the Freer Art Gallery (1920), built at a cost of $1,000,000 and donated to the Government by Charles Lang Freer of Detroit, Mich. In 1921 the construction of the $5,000,000 Shrine of the Immaculate Conception, in the grounds of the Catholic university, was begun, and the erection of the Episcopal cathedral of St. Peter and St. Paul, at Mt. St. Alban, was well under way. When completed it will have cost $5,000,000. In a commanding position at 16th and S Streets N.W. is the House of the Temple (1915), headquarters of the southern jurisdiction Scottish Rite Masons. It is of white marble, of Egyptian and Grecian architecture, 212 by 217 ft. in size, and cost $1,000,000. The Pan-American Building, a white marble structure on 17th Street N.W., at the entrance to Potomac Park, was dedicated in 1910. It cost $1,100,000, of which the American republics contributed $250,000 and Andrew Carnegie $850,000. Near it are the Red Cross Building (1917) and the building of the Daughters of the American Revolution (1910), both in white marble. The Georgetown, or Key Memorial, Bridge, which spans the Potomac river at Georgetown, was expected to be completed in 1922, the estimated cost being $2,100,000. It is of reinforced concrete with seven arch spans, one of which is 208 ft. in length. Its total length, including piers, is 1,452 ft. 9 in.; the width of deck is 70 feet.

Streets and Parks.—Much improvement has been made in the thoroughfares and parks. The flats and lowlands along the Potomac river have been beautified and provided with picturesque driveways. Provision has been made for new parks and additions to those already existing. Asphalt pavement has been laid on 172 m. of city streets and avenues. The principal business section of the city now includes Pennsylvania Avenue from the Capitol to the Treasury Building, F, G, and H Streets running east and west, 7th, 9th and 14th Streets running north and south and Connecticut Avenue. A zoning law of 1920 restricts certain businesses to prescribed areas, and regulates the height and character of new structures.

Monuments.—The Lincoln Memorial, occupying an elevation in Potomac Park near the Washington Monument, was practically complete in the spring of 1921 at a cost of about $3,000,000. It is a rectangular edifice of white marble surrounded by 36 Doric columns, one for each state of the Union at the time of Lincoln's death. The principal interior feature is a marble statue of Lincoln by Daniel C. French; on the walls within are lettered the Gettysburg Address and phrases from the second Inaugural Address. The memorial was designed by Henry Bacon and erected under the direction of a commission appointed by Congress in 1911. Across the Potomac river, in Arlington National Cemetery, are the amphitheatre and chapel erected at the instance of the Grand Army of the Republic in memory of all soldiers, sailors, and marines who have fought under the flag of the United States, and also intended to provide a place of assembly for the observance of Memorial Day. The amphitheatre is an enclosure with a colonnade of white marble; the turf is left uncovered and open to the sky. The chapel has a seating capacity of 5,000. The two buildings were completed shortly after the outbreak of the World War at a cost of $825,000. Statues and monuments erected during the decade 1910–20 include Christopher Columbus by Lorado Taft, Union Station Plaza; John Paul Jones by C. H. Niehaus, Potomac Park; a monument to Maj. Pierre Charles L'Enfant who designed the plan on which the city has been built, in Arlington Cemetery; the Butt-Millet Fountain, Daniel C. French, sculptor, Thomas Hastings, architect, erected near the Washington Monument as a memorial to two men who lost their lives in the " Titanic " disaster (1912) and the James McMillan Fountain, Herbert Adams, sculptor, Thomas Hastings, architect. The Grant statue, nearing completion on the east front of the Botanic Garden, is the work of Edward P. Casey, architect, and Henry M. Shrady, sculptor, and will have cost about $240,000. During the World War the statue of Frederick the Great, in the Army War College grounds, was removed. Flannery's Abraham Lincoln, at John Marshall Pl. and D Street, also removed, was to be replaced.

Education.—The Wilson Normal School, 11th and Harvard Streets, was erected in 1913 at a cost of $257,000, and an expenditure of $1,493,000 was made for the site and building of the New Central High School (1916), at 11th and Clifton Streets. The enrolment in the graded schools in Jan. 1921 was 53,840, and in the high schools, 8,735. There were 2,096 teachers—1,442 white, 654 negroes. More than one-third of the pupils were negroes.

Manufactures.—In 1919 there were in Washington 595 manufacturing establishments (exclusive of Government industries) whose products were valued at $68,826,570, of which $37,886,470 was added by manufacture. There were engaged in those industries 14,101 persons, whose salaries and wages amounted to $18,856,410. In value of products there was an increase of 137·5% over 1914, and in salaries and wages an increase of 119·1%. Some of the principal industries in 1919 were: newspapers and periodicals, $11,898,000; bakery products, $10,626,000; meat-packing, $5,012,000; ice cream, $4,101,000. Statistics of governmental industries are shown in the table at the top of page 956.

Census Year	Persons engaged		Expenditures			Cost of Materials
	Total	Wage-Earners	Total	Salaries	Wages	
1919 . . .	22,423	20,169	$59,074,889	$3,540,566	$29,794,728	$25,346,438
1914 . . .	11,639	10,614	17,862,758	1,122,927	10,614,466	5,902,954
1909 . . .	11,470	10,657	15,508,250	1,016,745	10,663,040	3,807,626

The figures are in each case for 11 establishments, and include principally engraving and printing, instrument manufacture, and the naval gun factory. The marked increase in the figures for 1919 was due to the abnormal activity brought about by the war.

History and Finance.—During the participation of the United States in the war there was employed in the Government departments a maximum of 117,760 civil service employees, but this number had been reduced in 1920 to 86,846. The personal U.S. income taxes collected in the city of Washington in 1918 amounted to $8,669,100. Local taxes collected in 1920 amounted to nearly $3,000,000 on personal property and $8,633,278 on realty. The total value of assessable real estate was $426,623,630. The amount contributed by Congress for municipal expenses was more than $8,000,000. In 1920 private building operations amounted to $22,638,862, and for the 10 years 1910–20 to over $151,000,000.

During the war the District of Columbia furnished 24,853 troops and subscribed $127,129,650 for the purchase of Liberty and Victory Bonds and War Savings Stamps, and for contributions to Y.M.C.A., and other war funds. (J. C. P.*)

WASHINGTON (State) (*see* 28.358).—The pop. in 1920 was 1,356,621, an increase of 214,631, or 18·8%, over the 1,141,990 of 1910, as against an increase of 120·4% in the preceding decade.

The density of pop. was 20·3 per sq. m.; in 1910 17·1. The urban pop. (in 35 places of 2,500 or more) was 55·2% of the whole, as against 53% in 1910. The pop. of the eight cities having more than 15,000 was:—

	1920	1910	Increase per cent
Seattle . . .	315,312	237,194	32·9
Spokane . . .	104,437	104,402	
Tacoma . . .	96,965	83,743	15·8
Everett . . .	27,644	24,814	11·4
Bellingham . . .	25,585	24,298	5·3
Yakima . . .	18,539	14,082	31·7
Walla Walla . .	15,503	19,364	−19·9
Aberdeen . . .	15,337	13,660	12·3

The most significant change in the characteristics of the pop. was the increased number of Japanese and especially of Japanese women. In 1900 there were 5,617 Japanese, or 1·1% of the total pop., 96·7% being males. In 1910 the Japanese had increased 130·2% to a total of 12,929, which was still 1·1% of the total pop., 86·9% being males. In 1920 there were 17,114 Japanese, or 1·3% of the total. The rate of increase was 32·4% and the percentage of males had declined to 65·3. One reason for the proportional increase of females was the privilege, prior to the legislative session of 1921, of acquiring title to land in the names of native-born children of Japanese parents.

Agriculture.—During the decade 1910–20 the number of farms increased from 56,192 to 66,288; the acreage of improved land from 6,373,311 ac. to 7,129,343 ac.; the value of all farm property from $637,543,411 to $1,057,429,848. The average value of land per acre in 1910 was $44.18; in 1920 $60.22. The following table shows the change in acreage, production, and value of the chief crops for the decade 1909–19.

		Acreage	Production	Value
Wheat . .	1919	2,494,160	41,837,909 bus.	$91,206,642
	1909	2,118,015	40,920,390 "	35,102,370
Oats . .	1919	191,673	8,073,481 "	8,073,481
	1909	269,742	13,228,003 "	5,870,857
Barley . .	1919	84,568	2,249,856 "	3,374,792
	1909	171,888	5,834,615 "	3,331,930
Indian corn .	1919	34,799	901,905 "	1,623,433
	1909	26,033	563,025 "	404,367
Potatoes .	1919	55,132	5,866,710 "	12,320,093
	1909	57,897	7,667,171 "	2,993,737
Hay and forage	1919	1,064,130	2,013,913 tons	47,717,065
	1909	742,741	1,399,597 "	17,200,252
Sugar beets .	1919	5,363	46,386 "	500,969
	1909	1,270	6,556 "	38,007

Crops of increasing importance are bulbs, flowers, vegetable seeds, flax, filberts, and English walnuts. Prohibition increased enormously the demand for berry-juices. Three-fifths of the loganberries produced in the United States come from Washington (1,157,778 qt. in 1919, valued at $208,402). The evergreen wild blackberry (supposed to have been introduced from Hawaii) is spreading through the river valleys, and the fruit is shipped in carload lots to the canneries. In 1919 the state ranked first in the production of apples and third in hops (1,615,761 lb., valued at $727,092). The growth of the chief orchard crops between 1909 and 1919 was as follows:—

		Production	Value
Apples . . .	1919	21,568,691 bus.	$38,823,641
	1909	2,672,100 "	2,925,761
Peaches . .	1919	1,544,859 "	3,321,449
	1909	84,494 "	118,918
Pears . . .	1919	1,728,759 "	3,025,331
	1909	310,804 "	328,895
Plums and Prunes	1919	785,920 "	1,532,546
	1909	1,032,077 "	600,503

The following table shows the growth in number and value of domestic animals during the decade 1910–20.

		Number	Value
Horses . . .	1920	296,381	$25,069,336
	1910	280,572	29,680,849
Mules . . .	1920	23,091	2,930,813
	1910	12,185	1,776,297
Milch cows . .	1920	289,635	23,648,537
	1910	186,233	7,988,133
Sheep . . .	1920	623,779	7,750,407
	1910	475,555	1,931,170
Swine . . .	1920	264,747	5,049,249
	1910	206,135	1,674,927

In 1917–8 condenseries used 205,657,654 lb. of whole milk to produce 1,844,097 cases of condensed milk, valued at $8,870,825. Cream and butter were sent to the cities from 110 creameries. In 1919 in 19 factories the production of cheese was 2,004,365 lb., valued at $348,669.

During the decade 1910–20 the irrigated farms increased from 7,664 to 13,271; irrigated acreage from 334,378 ac. to 529,899 acres. The Reclamation Service of the Federal Government has impounded the waters in Keechelus Lake (Kittitas county) and other lakes to serve large projects in the Yakima valley. The Kittitas county project under the state law was designed to reclaim 70,000 ac.; the Klickitat county project to irrigate 90,000 acres. The largest enterprise is the Columbia Basin project, to utilize the waters of Pend Oreille lake and river for the irrigation of 1,750,000 acres.

Mining.—The value of gold production decreased from $840,000 in 1911 to $280,000 in 1919. The amount of silver produced increased from 230,000 oz. to 299,000 oz.; copper from 196,000 lb. to 1,320,000 lb.; lead from 848,000 lb. to 1,700,000 lb.; zinc from 25,000 lb. to 39,000 pounds. Coal mined in 1911 was 3,573,000 tons; in 1919 3,100,000 tons. During the decade 1910–20 five new cement plants were established in the state, and large quantities of Portland cement exported. Of increasing importance are clay products, such as paving brick, sewer pipe, and terra cotta.

Manufactures.—The following table shows the growth of manufactures 1909–14.

	1914	1909
Number of establishments	3,829	3,674
Wage-earners (average)	67,205	69,120
Capital	$277,715,262	$222,261,229
Salaries	11,504,088	9,826,579
Wages	51,703,052	49,766,368
Cost of materials	136,609,309	117,887,688
Value of products	245,326,456	220,746,421
Value added by manufacture	108,717,147	102,858,733

The chief items were lumber and timber products, flour-mill and grist-mill products, slaughtering and meat-packing, butter, cheese and condensed milk, printing and publishing, malt liquors, canning and preserving. In 1914 the state ranked twenty-third in value of products and twenty-seventh in number of wage-earners.

Water Power.—Chief Engineer Merrill, of the Forest Service, U.S. Department of Agriculture, has prepared a chart showing the distribution of water-power resources in the United States. The total represents 54,000,000 H.P.—Washington is shown to exceed all other states, with 16% of the total, California being second with 14·5%, and Oregon third with 12·3 per cent. Efforts were being made in 1921 to secure Government control of trunk lines for the distribution of hydro-electric power.

Ports and Commerce.—During and immediately after the World War the commerce passing through the district of Puget Sound was second only to that of New York. A law approved on March 14 1911 authorized the organization of ports, and where these are made coextensive with the areas of first-class counties they become ports of the first class. These have elaborate powers of taxation and management. Seattle, Tacoma, Aberdeen and other cities have taken advantage of this law to improve their harbours and to build great wharves and other conveniences to handle the increasing commerce.

Highways.—The state has embarked upon the task of providing an extensive system of improved roadways. These include the Washington link of the Pacific Highway, intended to extend from Alaska to the Straits of Magellan, another highway around Puget Sound to the Pacific; and highways across the Cascade Range and eastern Washington. The Federal Government maintains the Mt. Rainier National Park and the Olympic National Monument. Efforts were being made in 1921 to preserve the Mt. Baker and the Mt. Adam national parks. National forests include 12,000,000 ac. within the state. The Legislature has created a state Park Board authorized to receive lands for parks and to preserve strips of native forest growth along the highways.

History.—Ernest Lister, Democrat, became governor in 1913 and was reëlected in 1916. He died June 14 1919, and was succeeded by Lt.-Gov. Louis F. Hart, Republican. Governor Hart was elected to succeed himself in 1920. He recommended what is known as the Governor's Administrative Code of 1921, one of the most significant changes in the state government since its organization. It was enacted by the Legislature, and many boards of commissioners were abolished. The work formerly in their hands was entrusted to appointive officers.

Commerce with many nations developed rapidly during the decade 1910–20. In Seattle there were in 1921 24 resident consuls representing foreign countries. By far the greater number of vessels coming to ports of Puget Sound were under the Japanese flag. Branches of Japanese banks were established. In 1921 the Legislature passed a law restricting alien ownership of land, aimed especially at the Japanese. It provides that: an alien shall not own land or take or hold title thereto; no person shall take or hold land or title to land for an alien; land now held by or for aliens in violation of the constitution of the state is forfeited to and declared to be the property of the state; land hereafter conveyed to or for the use of aliens in violation of the constitution or of this Act shall thereby be forfeited to and become the property of the state. The word "alien" is so defined that it does not include an alien who has in good faith declared his intention to become a citizen of the United States, but does include all other aliens and all corporations and other organized groups of persons a majority of whose capital stock is owned or controlled by aliens or a majority of whose members are aliens. During the World War many yards were established for the building of steel and wooden ships. A special railway was built into the spruce forests of Clallam county to get materials for airplanes. The Federal Government established a permanent cantonment at Camp Lewis, near Tacoma. A naval training station was established on the campus of the university of Washington in Seattle.

Progressiveness was shown in such legislation as the working men's compensation law (1911), initiative and referendum (1913), recall of public officers (1913) and aid for destitute mothers (1915). To meet the high cost of government the Legislature in 1921 enacted laws levying a poll-tax on every person between the ages of 21 and 50, and a tax of one cent on each gallon of gasoline used by motor vehicles; the tuition charges in state institutions of learning, and the fees for licences for automobiles and for fish-dealers and others were also increased.

During the World War the state supplied to the army 45,154 men; navy 11,887; and marine corps 1,767. The state's subscriptions to the Liberty loans were: First, $17,070,650; Second, $38,481,100; Third, $42,907,950; Fourth, $70,189,650; Fifth, $45,024,150. (E. S. M.)

WASHINGTON CONFERENCE, 1921.—Preliminary invitations to a conference at Washington on the limitation of national armament were issued by President Harding on July 10 1921 to Great Britain, France, Italy, and Japan. On Aug. 11 formal invitations were sent to these Powers, to China, and later to Belgium, the Netherlands, and Portugal, President Harding having been authorized by Congress, in an amendment to the Naval Appropriations bill signed July 11 1921, to arrange for the Conference. The President made it plain that he regarded disarmament questions as closely linked with the Pacific and Far Eastern problems. As American delegates Mr. Harding designated Secretary of State Hughes, Elihu Root, Senators Lodge and Underwood; the British Empire was represented by Mr. Balfour, Lord Lee of Fareham, Sir Auckland Geddes and Sir Robert Borden, as principal delegates; France by Premier Briand, M. Viviani, M. Sarraut, and M. Jusserand; Italy by Sig. Schanzer and Sig. Ricci; Japan by Prince Tokugawa, Admiral Kato, and Ambassador Shidehara; China by Mr. Wellington Koo and Mr. Sze.

The Conference assembled Nov. 12 1921, was addressed by Mr. Harding, and elected Mr. Hughes as its chairman. The latter at once placed the American proposals on naval disarmament before the gathering; they were so precise and far-reaching as to cause general surprise. Reviewing the failure of previous attempts at disarmament and emphasizing the existing opportunity, Mr. Hughes proposed that there should be a naval "holiday": "for a period of not less than 10 years there shall be no further construction of capital ships." He then presented a definite plan for the scrapping of certain of the older capital ships and of capital ships under construction, and the restriction of capital ship replacements by an agreed maximum of tonnage, as follows:—for the United States and Great Britain 500,000 tons each, for Japan 300,000 tons—a "5-5-3" ratio. Discussion of the tonnage allowance for France and Italy was reserved for later consideration. The directness with which Mr. Hughes stated his case struck a note which evoked hearty response from the delegates and the public, and he was at once supported by the British delegation. "We can no longer content ourselves," Mr. Hughes said, "with investigations, with statistics, with reports, with the circumlocution of inquiry. . . . The world wants a practical programme which shall at once be put into execution." At the second plenary conference, held Nov. 15, the representatives of France, Japan, and Italy also accepted the principles of the Hughes proposals, leaving the technical details for consideration by the experts.

In the plenary session of Nov. 21 the subject of military armament was introduced by Mr. Hughes, who said that the United States had followed its traditional policy of reducing its own regular military establishment to the smallest possible basis. He recognized, however, the special difficulties existing in Europe. M. Briand explained the attitude of France as based on her need for security in Europe; expressing the readiness of his country to take any steps necessary to ensure peace, he emphasized the necessity of a genuine atmosphere of peace, a "moral disarmament," before physical disarmament could be attempted. This atmosphere, he maintained, was lacking—chiefly because of what France regarded as the warlike attitude of Germany, the carefully maintained system which made it possible for her suddenly to convert a huge number of "civilians" into troops, and the availability of her war industries. France, he claimed, had already reduced her army by a third and was planning to reduce it by a half. Complete demobilization, however, was impossible for her under the conditions existing in Germany and Russia. M. Briand concluded with an appeal for the moral support of France by other nations, and this evoked a sympathetic response from the other delegates. Sig. Schanzer of Italy, however, made plain the desire of his country that "the general limitation of land armaments may become a reality within the shortest space of time." The result of the attitude of France was to establish the impracticability of discussing any definite plan for the limitation of armies. A sub-committee was appointed, however, to consider the questions of air-craft, poison gases, and the rules for the conduct of war.

The agenda of the Conference were dealt with by two committees of the whole, one composed of the delegates of the five principal Powers to deal with limitation of armament, the other, composed of delegates of all nine Powers, including China; Belgium, the Netherlands, and Portugal, to deal with matters affecting the Pacific and the Far East.

Meetings of these committees and their sub-committees, beginning with their first sessions, Nov. 14 and 15, were held in the Pan-American Building and were not open to the public. Lengthy communiqués were published on the progress of the discussions, and their results were reported formally at the open plenary sessions, of which six were held. The decisions reached were in regard to navies, including submarines; poison gases; the Pacific Ocean and its islands; and Chinese affairs.

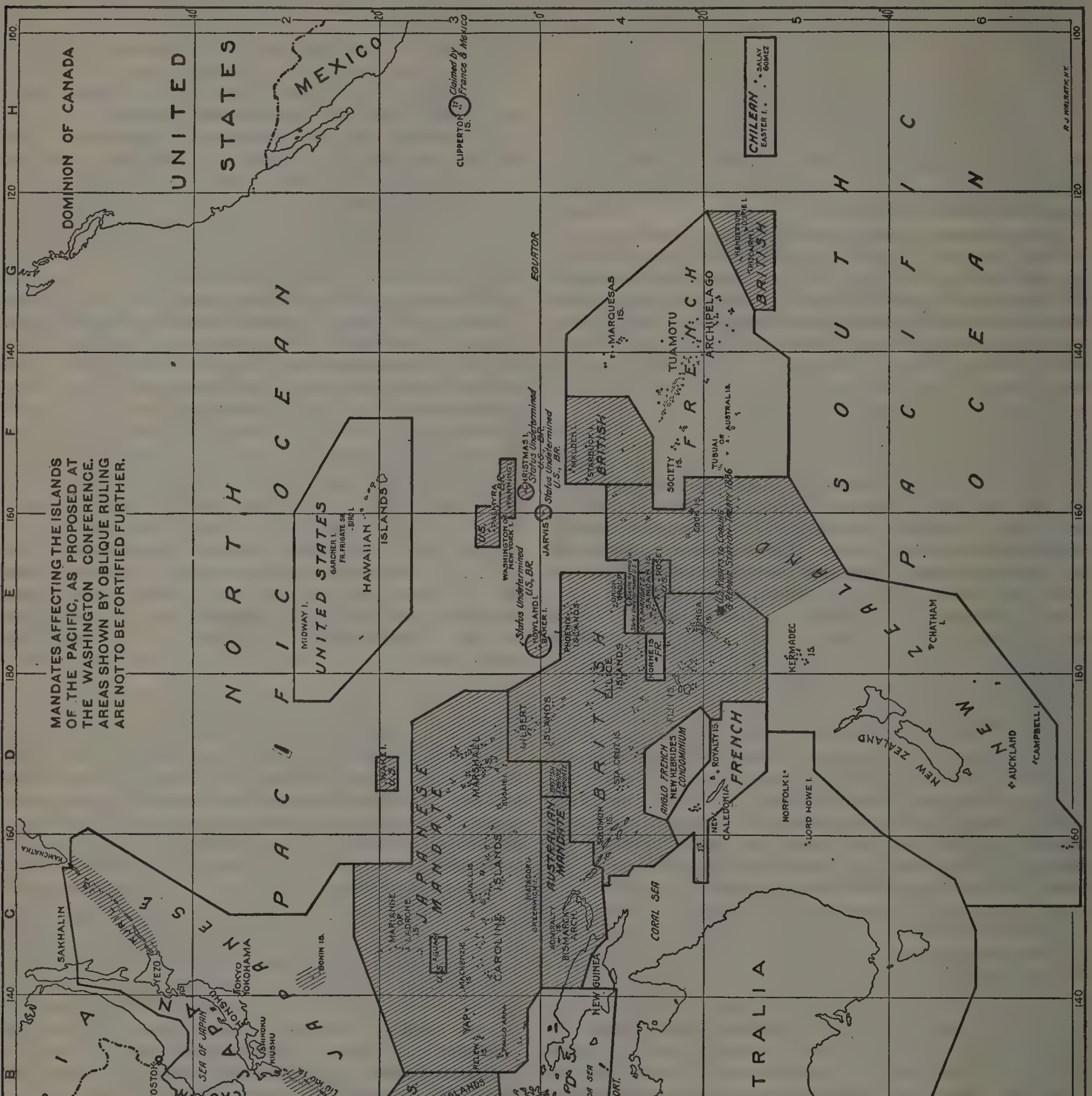

MANDATES AFFECTING THE ISLANDS OF THE PACIFIC, AS PROPOSED AT THE WASHINGTON CONFERENCE. AREAS SHOWN BY OBLIQUE RULING ARE NOT TO BE FORTIFIED FURTHER.

DOMINION OF CANADA
UNITED STATES
MEXICO
CLIPPERTON IS.
Claimed by France & Mexico
CHILEAN
EASTER I.
SALAY GOMEZ
NORTH PACIFIC OCEAN
SOUTH PACIFIC OCEAN
EQUATOR
UNITED STATES
MIDWAY I.
HAWAIIAN ISLANDS
GARDNER I.
FR. FRIGATE SH.
BIRD I.
U.S.
PALMYRA
WASHINGTON OR NEW YORK I.
FANNING I.
CHRISTMAS I.
Status Undetermined U.S., BR.
JARVIS
HOWLAND I.
BAKER I.
MARQUESAS IS.
TUAMOTU ARCHIPELAGO
FRENCH
BRITISH
HENDERSON
PITCAIRN
DUCIE I.
SOCIETY IS.
TUBUAI OR AUSTRAL IS.
MALDEN I.
STARBUCK I.
COOK IS.
SAMOA
PHOENIX ISLANDS
TONGA
ELLICE ISLANDS
HORNE IS. FR.
FIJI IS.
KERMADEC IS.
CHATHAM I.
NEW ZEALAND
AUCKLAND
CAMPBELL I.
GILBERT ISLANDS
JAPANESE MANDATE
MARSHALL IS.
WAKE I. U.S.
CAROLINE ISLANDS
MARIANNE OR LADRONE IS.
GUAM U.S.
YAP
PELEW IS.
AUSTRALIAN MANDATE
BISMARCK ARCH.
ADMIRALTY IS.
SOLOMON IS.
STA. CRUZ IS.
ANGLO FRENCH NEW HEBRIDES CONDOMINIUM
NEW CALEDONIA
LOYALTY IS.
NORFOLK I.
LORD HOWE I.
CORAL SEA
AUSTRALIA
NEW GUINEA
BANDA SEA
PORT.
NETHERLANDS
CELEBES
CELEBES SEA
BORNEO
JAVA
SUMATRA
CHRISTMAS I.
COCOS OR KEELING I.
BRITISH
INDIAN OCEAN
U.S. PHILIPPINE ISLANDS
MANILA
FORMOSA TAIWAN
HONGKONG BRITISH
MACAO PORT.
CHINA
FR. INDO CHINA
SIAM
BURMA
JAPAN
JAPANESE
TOKYO
YOKOHAMA
BONIN IS.
KIUSHU
SHIKOKU
HONDO
YEZO
SEA OF JAPAN
CHOSEN
VLADIVOSTOK
SAKHALIN
KAMCHATKA
SIBERIA
CHINA
R. J. WALRATH, N.Y.

communiqués were published on the progress of the discussions, and their results were reported formally at the open plenary sessions, of which six were held.

The committee on armament discussed fully the maximum tonnage and ratio of capital ships to which each Power should restrict itself; and on Dec. 20 a provisional agreement was reached. Japan maintained (Dec. 20) that 60 per cent of the quota proposed for the United States and Great Britain—on the 5-5-3 plan—was insufficient for her defensive needs, and asked that it be increased to 70 per cent; her delegates were especially unwilling to sacrifice the "Mutsu," a new capital ship (in large measure paid for by popular subscription) which, under the Hughes plan, would have to be scrapped. This obstacle was overcome by permitting Japan to retain the "Mutsu," on condition that an older ship, the "Setsu," should be scrapped. This change gave Japan two post-Jutland ships and an increased capital-ship tonnage, to offset which it was agreed that the United States should complete two ships still in process of construction, and that Great Britain should construct two new vessels not to exceed 35,000 tons each. In replacement tonnage the ratio was to stand thus: United States and Great Britain 525,000 tons each, and Japan 315,000 tons—a ratio of 5-5-3. This agreement was stated to be contingent upon a suitable arrangement for France and Italy, who had been offered a replacement tonnage of 175,000 each. But M. Sarraut, representing France, held out for an aggregate of 350,000 tons, to be constructed on a replacement basis from 1925 onwards. The controversy was finally laid before M. Briand, who had returned to France; he agreed to accept for France the capital-ship ratio of 1·75 as against 1·60 for the United States and for Great Britain, but made his consent conditional on the obtaining of a larger proportion of auxiliary craft and submarines, which were regarded by France as purely defensive weapons. "The idea which dominates the Washington Conference," he telegraphed, "is to restrict naval armaments which are offensive and costly. But I do not believe that it is the programme to deny to a nation like France, which has a large extent of coasts and a great number of distant colonies, the means of defending its communications and its security."

The French reply settled the problem of capital ships, but a warm controversy was provoked over submarines, Mr. Balfour, on behalf of the British delegation, proposing the complete abolition of the submarine, on the ground that it was an inhuman agent of warfare, effective only in illegal attacks upon commerce. Mr. Hughes proposed a reduction of submarine tonnage for the United States and Great Britain to 60,000 apiece, and approximately the *status quo* for France, Japan, and Italy (31,500 for the first two, 21,000 tons for the last). But the French delegates refused to accept less than 90,000 tons for submarines and 330,000 for cruisers and auxiliary craft. Mr. Balfour then made it plain that, failing action against the submarine itself, Great Britain could accept no limitation for anti-submarine craft.

As a result, the treaty, as finally agreed upon by the five major Powers, did not include limitation of total tonnage of submarine or auxiliary craft. Limits, however, were placed upon the total tonnage of aircraft carriers and upon individual tonnage of capital ships and cruisers, as well as upon the calibre of guns carried.

The failure of the British attempt to abolish the submarine was mitigated by the passage of a series of resolutions presented by Mr. Root and later embodied in a treaty. As accepted, they stated the rules of international law as to "visit and search" on the high seas, and declared that belligerent submarines are not exempt from these rules. They invited the adherence of all civilized Powers to this statement. In the third place, they recognized that the use of submarines as commerce destroyers was practically impossible without violation of these rules, and that prohibition of such use should be accepted as a law of nations; they declared the assent of the contracting Powers to such prohibition and invited that of all other nations. No definition of a merchant ship was adopted. In the fourth place, they declared that commanders of all ships transgressing international rules should be subject to punishment for piracy. Aircraft limitation was rejected by the Conference, after a technical report of the sub-committee had declared limitation to be impracticable, but an inquiry commission was appointed. The abolition of the use of poison gas in international warfare, on the other hand, was advocated by the Naval Committee Jan. 7 1922, on the motion of Mr. Hughes, and prohibition of poison gas was embodied in a treaty.

In respect of the problems of the Pacific one of the most important accomplishments of the Conference was the drafting of a new treaty, presented at the plenary session Dec. 10 1921, between the United States, Great Britain, France and Japan. It pledged each to respect the rights of the others in relation to their insular possessions and insular dominions in the Pacific, to accept mediation in case of controversy over these possessions, and to open frank discussions if their rights were threatened by any other Power. The treaty was to remain in force for 10 years, and upon its ratification the Anglo-Japanese Alliance was automatically to be terminated. A reservation accompanied the treaty embodying provisions to the effect that it should not be deemed an assent on the part of the United States to "mandates" granted in the Pacific under the Peace Treaty of Versailles, and should not preclude agreements relative to mandated islands.

The reservation also excepted from arbitrable controversies questions lying within the domestic jurisdiction of the contracting Powers. To the treaty was later appended also a second agreement, defining the phrase "insular possessions and insular dominions" in such a way as to exclude Japan proper from its scope. The representatives of the United States and Japan also signed a treaty regarding Yap, according to which the United States was to have free access there on a footing of entire equality with Japan in all that related to cable and radio service, and received certain privileges and exemptions in relation to electrical communications. Subject to various conditions the United States consented to the administration by Japan of the mandated islands in the Pacific north of the equator.

Chinese problems were presented Nov. 16 1921 by Mr. Sze in the form of ten points, which the Conference was asked to adopt. They called for recognition of the territorial integrity and political and administrative independence of China, the "open door" neutrality, and the complete removal of all political, jurisdictional, and administrative restrictions upon the Chinese Republic.

The general attitude of the Conference towards China was crystallized Nov. 21, when four resolutions presented by Mr. Root were adopted. They declared the intention of the Powers to respect the sovereignty, the independence, and the territorial and administrative integrity of China, their desire to maintain the principle of equal opportunity for the commerce and industry of all nations, and their agreement not to seek special rights or privileges. Details of specific arrangements to be enforced led to long discussions. A resolution was adopted (Dec. 24) providing for the voluntary withdrawal of foreign post offices from China Jan. 1 1923, on condition that China should maintain efficient service and continue the supervision of the foreign co-director general. The problem of extra-territorial rights could not be settled definitely, but it was referred to an international committee for intensive study and report within a year. The demand for the withdrawal of foreign troops from China was referred to a sub-committee, and finally it was agreed that, while the principle of withdrawal was accepted, the issues raised should be made the subject of inquiry, in order to determine the conditions upon which withdrawal must depend. On the other hand the Powers passed a resolution urging China to reduce the large military forces maintained by the military governors. The relinquishment of foreign leaseholds in China was not actually secured (though Great Britain announced her readiness in this respect if other countries would join her); but China's fight for "open diplomacy" was virtually won when a resolution was passed (Dec. 8) pledging the nine Powers not to enter into any agreement that might impair the force of the four Root resolutions. As regards the customs tariffs, the demand for China for complete autonomy was not granted, nor the request made, in view of the nation's financial necessities, that her quota be raised from 5% to 12½%. It was decided, however, that China's customs revenue should be increased by $46,000,000 silver annually, through an advance to 5% effective, a surtax of 2½%, and a surtax not exceeding 5% on luxuries. Other resolutions included agreements that foreign radio stations should transmit only Government messages, that there should be no unfair discrimination in railway rates, an expression of hope that the railway system might be unified under Chinese Government control, and an agreement for the establishment of a Board of Reference for Far Eastern Questions.

The question of the Japanese occupation of Shantung entailed long negotiations, which at times seemed dead-locked, especially those relating to the Tsing-tao–Tsinan-fu railway. Largely through the mediation of Mr. Hughes and Mr. Balfour a separate agreement was finally reached between Japan and China and signed Feb. 4. It provided for the return to China of the former German leasehold and 50-km. zone in Shantung, and the withdrawal of Japanese troops and gendarmes; China was to purchase the Tsinan-fu railway for $30,000,000, but, before complete redemption, there were to be appointed a Japanese traffic manager subject to the direction of the Chinese managing director, a Japanese accountant, and a Chinese accountant of equal rank. Japan renounced all rights to foreign assistance stipulated in the Chinese-German Treaty of 1898, and relinquished the maritime customs at Tsing-tao and former German public properties. As to Siberian problems, Baron Shidehara made a full statement to the effect that it was "the fixed and settled policy" of Japan to respect the territorial integrity of Russia, and to observe the principle of non-intervention in the internal affairs of that country, as well as the principle of equal opportunity for the commerce and industry of all nations.

The decisions taken by the Conference were embodied in seven treaties and various supplementary resolutions. (1) *Five-Power Naval Treaty*, designating specifically the capital ships to be retained by each of the contracting Powers and determining the ratio of capital ship replacement: 525,000 tons for the United States and Great Britain, 315,000 tons for Japan, 175,000 tons for France and Italy each—or 5-5-3-1·66. This treaty also limited the tonnage of individual capital ships to 35,000 and the calibre of guns to 16 inches; individual cruisers were limited to 10,000 tons and their guns to 8-in. calibre. Aircraft carriers were limited in general to an individual tonnage of 27,000, with a total tonnage of 135,000 for the United States and Great Britain, 81,000 for Japan, 60,000 for France and Italy each. With certain exceptions, the *status quo* was to be maintained with regard to fortifications and naval bases in the Pacific. (2) *Five-Power Treaty Relating to the Use of Submarines and Noxious Gases in Warfare*, embodying the resolutions described above. Accompanying these treaties were two resolutions for a commission of jurists to consider amendment of the laws of war and limitation of their jurisdiction. (3) *Four-Power Treaty*, between the United States, Great Britain, France, and Japan, relating to insular possessions and insular dominions in the Pacific, accompanied by the declaration of the United States. (4) *Four-Power Treaty*, between the same Powers, relating to the foregoing, and defining "insular" so as to exclude Japan proper from its scope. (5) *Nine-Power Treaty*, relating to principles and policies to be followed in matters concerning China, as described above. This was supplemented by ten resolutions embodying the decisions taken as to a Board of Reference, extra-territoriality, foreign postal agencies, foreign armed forces, unification of railways, Chinese military forces, existing commitments of China or with respect to China, the Chinese Eastern Railway. The treaty embodied the Root resolutions as its Article I, and strongly emphasized the principles of the "open door." (6) *Nine-Power Treaty*, relating to Chinese customs tariffs. (7) *Chinese-Japanese Treaty*, regarding Shantung. Two other treaties connected with the work of the Conference were: *United States-Japanese Treaty*, regarding Yap; and the *Six-Power Treaty*, allocating German cables in the Pacific. The Conference on Limitation of Armament was formally terminated Feb. 6 1922. On March 1 the U. S. Senate ratified, by a vote of 67 to 22, the treaty with Japan regarding Yap. (C. Sey.)

WATERHOUSE, JOHN WILLIAM (1847–1917), English painter (*see* 28.370), died in London Feb. 10 1917.

WATERLOW, SIR ERNEST ALBERT (1850–1919), English painter (*see* 28.381), died at Hampstead Oct. 25 1919.

WATER SUPPLY, MILITARY.—The problem of military water supply bears the same relation to similar work in civil life that military bridges do to those of ordinary construction; that is to say, although the ultimate object, and the underlying principles, are the same, the circumstances of construction are so different that the whole subject requires separate consideration. It has been long recognized that military bridges form a distinct branch of the art of war. Experience now points to the fact that water supply must be similarly treated. Of its great importance there is no question. The whole of the military operations in a campaign may turn on its adequate provision. The health and comfort of the troops and animals depend on this more than on any other supply question. Railways demand its provision, both in quantity and quality. It is therefore a matter both of operations and of administration, besides being an engineering problem of the utmost complexity.

In the following account of the most recent experience and practice connected with this subject, the purely engineering aspects of the problem will not be considered, and hydraulic calculations, sources of supply and the calculations entailed, well sinking and boring, pipe line design, reservoir dams and all other similar purely engineering technicalities will be omitted. It is proposed to consider the matter only in its military subdivisions.

I. *Personnel.*—The duties of officers and other ranks charged with water supply are broadly to carry out the engineering work involved in the obtaining and storage of water, and in the arrangements for insuring its purity till it reaches the custody of the troops supplied, and also to control all means of its distribution. There should be in all this organized work every care taken to ensure standardization of practice; there must be an adequate and competent executive staff, and efficient subordinates. On the staff of the engineer-in-chief of an army there should be an officer of high rank and of water experience, especially in charge of the whole control from the front to the base. There should be water engineers, under the chief engineers of the various formations, whose duties will be not only to carry out work actually ordered, but to reconnoitre, think out schemes, and generally to have such a grasp of the technicalities of the problem in relation to the whole military operations, that their advice may be of value to the army, corps and divisional commanders in considering the possibilities of operations. It is obviously of the very utmost importance that the general staff should keep the water engineers informed, to the fullest possible degree, as to impending developments, so that water policy may be framed accordingly.

As a general rule the field units of engineering carry out water supply as part of their normal duties, but in large operations they may be so fully occupied otherwise that it is necessary to provide special units for water duties. These would comprise (*a*) water supply companies, each about 8 officers and 250 other ranks, for general water work; (*b*) lorry or barge purification units, each 5 officers and 120 other ranks, for operating purification plant; (*c*) water control units, each 1 officer, 46 others, for provision of turn cocks, police at water points, etc.; (*d*) water transport companies, 7 officers, 300 others for distribution by rail, road or canal, and (*e*) well-boring sections, each 2 officers and 74 others for wells.

The equipment for these will vary according to the circumstances of the country. Obviously the water transport companies will have to be provided with many motor lorries fitted with tanks, and the purification companies with mobile laboratories. The above approximate sketch of the various units required will, however, indicate the nature of the equipment to be provided.

II. *Quantities to be Provided.*—In any water supply scheme the aim should be to provide as much water as can be *advantageously* used, for abundant supply means health and comfort. But concurrently, there must be rigid control of distribution so as to ensure reduction of waste. In giving, therefore, certain approximate estimates of quantities required, it must be noted that, in hot climates especially, circumstances may call for considerable modification.

Men require, in semi-permanent camps with water-borne sewage, baths, etc., 30 gal. per head per diem; in standing camps, without water-borne sewage, 15 gal.; in temporary camps, 5 gallons. The absolute minimum is 1 gal. at rest, and on the march for periods not exceeding three days at a time ½ gallon. Horses in temperate climates drink 6 to 10 gal. a day and the absolute minimum is 3 gallons. A horse drinks 3 gal. at a watering, and takes 6 minutes to drink it. In hot countries and with much work horses may require more than 10 gallons. Oxen and mules drink as much as horses, sheep and pigs about 1 gal. per diem, camels 10, with 20 every third day. A camel takes 20 minutes to water and drinks in two bouts with an interval of 10 minutes.

In hospitals and standing camps allow per diem, for each slipper bath 200 gal., W. C. 30, lavatory basin 20, urinal 40, yard tap 40, each vehicle washed 10 gallons.

On railways each broad-gauge locomotive needs 7,000 gal. per diem, each metre-gauge locomotive 2,500, 60-cm.-gauge 1,800. Horizontal stationary engines of compound modern type need 2 gal. per H.P. hour, and for the non-condensing type 4 gallons. For broad-gauge locomotives an alternative figure is 120 gal. per train mile. They require also for washing out about 3,000 gal. every 7 or 14 days. Boilers require about 20 gal. per H.P. hour under normal conditions. Petrol and oil engines require for cooling at rate of 7 gal. per H.P. hour and 35 gal. tank capacity per 6 H.P.

III. *Distribution under varying Tactical Conditions.*—(*a*) When a forced landing is contemplated, arrangements must be made for sea-borne water, in quantities much in excess of requirements, for accidents are almost certain to happen to some of the water-bearing vessels. Even if it is known that water does exist on shore, such precautions are necessary, for, in event of hostile resistance, it is more than likely that a retreating enemy will damage the existing supplies. Parties of engineers, provided with the proper plant and tools, must be told off beforehand for water-supply work on landing, and extra water carts, pack animals with filled receptacles, etc., should accompany the troops.

(*b*) When disembarkation takes place on friendly territory, watering arrangements—standpipes, fillers for water bottles, troughs for animals—must be provided near the points of concentration. The sites for such filling points must be carefully chosen so as not to impede concentration. Such work as this should be carried out by an advanced party of engineers, assisted by any local help available.

(*c*) For troops on the march, in a country reasonably well supplied, the procedure is for an engineer officer with a party of men equipped for testing the quality, and noting the quantities of water, to go ahead, fix watering places for men and animals, if possible improve the local conditions and generally make all arrangements so that everything may be ready in plenty of time before the troops arrive. But if the march is in a land that has no natural supplies or where the quality and quantity is doubtful, the problem is different. The first thing to establish is an initial watering point (I. W. P.) or points, as far forward as possible before the advance takes place. Water must be collected there in temporary tanks and so arranged that lorries can be filled quickly therefrom and dispatched regularly.

Adequate arrangements for the reception of the lorry-borne water must be provided at forward-water points, where the tank lorries can be quickly emptied into other improvised tanks whence they can be drawn by the troops in their water carts. At ½ gal. per man and 5 per horse per diem a division requires about 300 tons of water and this means 150 to 300 lorries according to the state of the roads, each lorry doing one trip per day. With pack animals, in countries where no roads are available, the same principles apply, only in addition to the contents of the receptacles carried for the troops, an allowance must be made for the carrying animals' own requirements.

(*d*) During position warfare there are three areas to be considered—forward, concentration, and back. The forward area, *i.e.* between front line and the rear of the heavy artillery zone, will require only drinking water for the fighting troops. This will be distributed (apart from any existing sources) usually from water carts or lorries filling at "points" in rear. Tank trucks on light railways and pipe lines to water points may possibly be used, but this is not so usual. While existing supplies should be utilized as much as possible, it is obvious that the greatest precautions against contamination are imperative. Distribution by water carts (holding 118 gal.) and water lorries, *i.e.* ordinary motor lorries fitted with two or more tanks, can be made where roads exist with sufficient security against hostile fire. They convey water from the supplies in rear to storage tanks of temporary construction. These "spill tanks" in the forward area should be small, numerous, and not too near each other so as to distribute risk of damage by hostile action. Sheltered positions, convenient for the troops, should be selected for their location. In some soils (*e.g.* in chalk) it is possible to mine underground tanks holding large quantities, and to bring supplies of water on light railway trucks. With heavy batteries in the vicinity of light railways such tank trucks can be used to deliver water to individual units. Storage for the daily supply must be arranged in such cases. A piped supply to a forward area is hardly practicable within 5,000 yd. of the line, where shelling is active. Such a system requires much care in maintenance, will be subject to great risk of damage and therefore to waste of water, hence it should not be adopted without full consideration of other alternatives. If adopted the general plan should be very simple, with as few branches as possible from main lines. It is better to construct radiating lines from the source rather than multiply branches. All pipes should be buried with 3 ft. of cover; although this involves their being out of sight, it is less disadvantageous than the exposure to shrapnel and frost. Protected shelters for pipe repairs and maintenance parties, together with supplies of tools and special fittings, must be arranged at intervals along the lines. As frequent breaks may be expected, frequent storage points must be provided; these will generally be a series of small tanks, say 400 gal. each, dug in and fed direct from the mains. Such points must be arranged to serve an area of the defence or made for the supply of dressing stations, etc. The ground must be well drained and all possible protection from shell fire must be given. The last stage of the travel of the water consumed by the troops in the front line must be by manual labour. Receptacles such as petrol tins may be used, and when filled may be carried to forward dumps on pack animals, tram lines, etc., so as to minimize hand carriage as much as possible, but in the last resort men have to be carriers. At the battle of Messines pipe lines were used to take water forward from catch pits on the Kemmel Hills, from sterilizing barges on the Lys, and from existing lakes, the quantity being 45,000 to 60,000 gal. daily. Arrangements were made to transport the water to the troops by pack animals and carrying parties. During the attack, water reached the troops within 20 to 40 minutes of the capture of positions. This is one instance out of many which illustrate the application of the principles above generally described.

It is in the concentration area (the line of demarcation between this and the forward area being taken as the rear of the heavy batteries) that the main source of supply and main arrangements for distribution to the forward area will be carried out. There will be in addition extensive arrangements for troops in reserve, casualty clearing stations, etc. Whether a comprehensive pipe system should be constructed, whether there should be a number of pumping stations, or whether there should be one or two main installations, are matters which will have to be carefully considered in the light of local circumstances and available labour and plant. In any case a thorough system of control with personnel trained in manipulating the various valves governing the branches, and a time-table giving equitable distribution, will have to be organized. The concentration area will be divided up into water areas with water "points" whence fighting units can draw their supplies by means of their water carts, but there will be casualty clearing stations requiring special attention where water should be laid on to standpipes near kitchens, ablution rooms, operating rooms, etc.

In the back areas the circumstances resemble those of a semi-permanent camp. The requirements will be for divisions in billets, reinforcement camps, schools of instruction, etc., and the arrangements only differ from those in regular encampments in cases where in villages, etc., it is found more convenient to have water cart points rather than piped supplies laid on to camping grounds.

(*e*) Before and after an attack the water supply arrangements include the supply during concentration, and keeping up supply as the troops advance. In the former case the work is very much as already described for position warfare. Every endeavour must be made to develop resources rapidly and secretly on all parts where attack is contemplated, and the most thorough training must be given to the technical troops in the rapid extension of the water system. In Palestine prior to the great attack, material was brought during night to the farthest advanced positions, and concealed in orange groves, etc., while the personnel was drilled in rapid laying of pipes and erecting of pumping plant. The supply after the initial advance will depend on the nature of the country and the initial success, and the most complete and accurate intelligence of the water resources of the country is of paramount importance. While the construction of pipe lines in the rear of an advancing army may be of the utmost value in securing a position won (as at the Somme in 1916), it is hopeless with a rapid advance (as in Palestine in 1918), so that in this case either independent sources of supply must be relied on, or transport by lorry must take place, and this places a tremendous strain on the transport organization and is, therefore, not lightly to be considered. Where pipe lines are decided upon, it is well to take them in entirely fresh installations rather than attempt to extend existing systems.

(*f*) A few details may be added of various constructional matters common to all phases of operations.

"Filling points" are tank and standpipe installations where water carts, lorries, "dixies" and water bottles are filled. Preferably there should be separate standpipes and approaches for carts and for lorries, so that the one may not impede the other, but all the standpipes should be such as can be equally used by either. There should be provision off the main road for waiting vehicles (within call of the "point" police).

As there is a limit to the number of horses that should be watered at one point, it is best to establish numerous small "watering points," with 200-ft. run of troughs as a maximum, and to locate the positions of the stables accordingly. The troughs should be near a road, but not next a main road where strings of horses would impede traffic, and, above all, horses must not cross a road to reach the troughs. The approaches to the troughs and the standings must be well made, drained and fenced in; otherwise the whole place becomes a morass. The frontage for each horse at the trough is about 2½ feet. In an actual instance 6,000 cavalry horses per hour were watered at 500 ft. of trough, using both sides. This works out at 12 horses per ft. of double troughing, each horse being 5 minutes inside the enclosure. Probably the best figures for general use are 6 minutes each horse and 2½ ft. frontage. If watering is to be on both sides the trough should be at least 3 ft. wide. Canvas troughs (600 gallons) are 36 ft. long, and should be in strong framing.

Where, as is often the case in Oriental countries, water lies deep below the ground, necessitating the use of pumping machinery, the watering of large numbers of animals becomes exceedingly difficult. In the Palestine campaign the water distribution unit was 1 lift and force pump, with hose, and 1 600-gallon trough, which unit with good management could water some 180 horses or 54 camels per hour. Only 18 camels can use a trough at the same time, and each relay takes 20 minutes to water. The requirements of a division are about 100,000 gallons a day, so each field company of Water Engineers carried 12 water units, or 36 per division. For the men's drinking water 10 large canvas tanks each holding about 1,500 gallons are needed. For storage, while at rest, large canvas bucksails, specially proofed and holding some 7,000 gallons, are useful, but it has been found better to construct tanks of masonry or planking and to reserve canvas tanks for mobile use. Copper vessels, holding 12 gallons, called *fantassis*, were used for camel transport.

Some notes may here be given about Oriental methods of raising water. The *shadoof* is a bucket hung by a rope to a horizontal swinging pole, slung from a vertical standard and weighted at the end furthest from the bucket. It can raise about 1,500 gallons an hour from a depth of 6 feet. The Persian wheel or *sakkieh*, a system of small jars working on an endless band round a vertical wheel above a well, and actuated by oxen or camels turning a horizontal wheel,—can raise 3,000 gallons an hour from 40 feet. The *charsa*, or skin bag, worked by a bullock hauling a rope attached to the bag over a pulley above the well, can raise 1,500 gallons from 40 feet.

IV. *Distribution in Standing Camps and Cantonments.*—This is a comparatively easy problem. Certain quantities of supply will have to be assumed, in accordance with experience in similar cases, at various points, and then the sizes of the pipes can be calculated by ordinary hydraulic rules. But it is well to keep the sizes of the pipes fairly uniform, giving rather larger than the calculated diameters, both because the data on which the calculations are based are at best conjectural, and because it is well to avoid a multiplicity of different sizes. In designing the system it should be arranged that "dead ends" of pipes are avoided, *i.e.* that the possibility of water remaining stagnant in an isolated length of pipe should be reduced to a minimum. Supply will be from an existing town main, or from some independent source (well, river, etc.) whence the water is pumped to an overhead service reservoir that overlooks and can supply by gravitation the whole system.

V. *Purification of Water.*—A safe water *may* be turbid in appearance and even disagreeable to taste and therefore repulsive; a dangerous water *may* be clear and palatable and therefore attractive. War experience has shown that few waters are so foul that they cannot be rendered safe by suitable treatment. The aim of purification is to obtain an effluent which is not only safe, but is palatable, of good appearance and attractive.

Water for horses is not usually purified. Almost any clear river or pond may be used in the crude state, and the instinct of the animals often leads them to refuse a contaminated water, even if it looks pure. In many cases in Flanders in the World War water from ponds and marshes, though foul and repulsive, was made quite potable by simple treatment. The military value of this fact is evident. Broadly speaking the purifying processes are those which remove suspended matter, and those which render innocuous bacteria which would be harmful.

English waterworks practice in civil life relies almost entirely on the action of the gelatinous film forming on the surface of a sand filter, for removing bacteria, but the processes of sedimentation, filtration and oxidation, which purify water in natural streams and lakes, can be imitated by artificial means working more rapidly than the ordinary sand filter process. Sedimentation can be accelerated by the addition to the water of an alum solution. Filtration can be effected by passing the water under some pressure through a porous medium; oxidation of bacteria by agents such as chlorine in measured quantities. In the field the steps taken are to precipitate the suspended matter by alum solution and then to treat the clear water by chlorination. The former process, though helpful in the latter treatment, is not in itself sufficient to produce a potable water. Chlorination is generally effected by introducing into the water a solution of calcium hypochlorite (bleaching powder) by means of the Horrocks apparatus. This is designed so that a test may be readily applied by men of intelligence to ascertain the condition of the water as regards free chlorine, and to calculate from this the amount of bleaching powder which must be introduced in order to destroy bacteria.

The apparatus for chlorination consists of a box containing six cups to be filled with the water, two tin spoons each holding 2 grammes of bleaching powder, a special cup for the chloride of lime solution, glass bottles containing a test solution of zinc iodide and starch (which has a certain colouring effect on water containing free chlorine), pipettes, stirring rods, etc. The method of using is to put varying quantities of the test solution in each of the six cups of water and observe after half an hour. From the coloration of the water, bleaching powder in proportionate quantities is added for every 100 gal. of water in the chlorinating tank.

Poisons can be removed from water by various chemical processes, though it may be easier and cheaper, and certainly safer, to transport other water by road or rail rather than trust to remedial measures. A contaminated well can be rendered usable in a few days by cleaning out and continuous pumping, and in the case of organic pollution by the addition of large quantities of bleaching powder, followed by pumping out after a period of rest.

VI. *Plant and Machinery.*—The British service water cart (Mark VII.) holds 118 gal. and consists of a galvanized iron cylinder, together with filtering apparatus, two pumps, a box for small stores, a sterilizing kettle, the whole being mounted on a wooden frame with cranked axle and wheels for horse draught. The two filters are placed on the frame in front of the cylindrical tank and can be used either separately or together. Each consists of a steel cylinder in which is contained a cloth-covered steel reel and a chamber for the clarifying powder.

Tank lorries are ordinarily improvised from ordinary motor lorries by mounting two 300-gal. tanks anchored to a wooden frame bolted to the chassis, with a 2-in. pipe connecting the tanks and a 2-in. draw-off. These tanks should have internal baffle plates to reduce the swaying action of the water in travelling. Another method is to sling canvas tanks from framing on the lorry.

The Norton tube well, a perforated tube with hard driving head, and driven by blows from a "monkey," is useful in obtaining supplies near the surface in certain soils. Used with a lift and force pump they are suitable for small installations, but they only yield 200 gal. per hour. They were very useful in the cavalry operations in the Sinai peninsula, where water was, by their use, frequently obtained in the dry beds of *wadis*.

The lift and force pump, which is an article of store, can lift water through a suction hose from 20–28 ft. and force it to a height of 60 ft. above its former level. It consists of a horizontal barrel 4½ in. bore with a double piston working with a 4-in. stroke and operated by a crank pivoted above the barrel and worked by manual power. The suction hose comprises four 12-ft. lengths of prepared hose, internally wired, and at the end there is a strainer, a perforated steel drum. The delivery hose consists of one 30-ft. length of 2-in. canvas hose. This pump is very handy and easily worked by unskilled labour.

Other pumps for manual power are the semi-rotary for small deliveries up to 30 gal. a minute (an ordinary piston and plunger pump) and the chain helice pump, which is an endless chain, or spirally wound band, with a weight at the end suspended and worked by a vertical wheel at the top of the well. The surface tension of small quantities of water adhering to the links of the chain, or the spiral band, is not broken in the rapid movement of the rising chain until it is discharged at the summit of the circuit. It is a very simple form of pump, but only suitable for small discharges.

Of the many patterns of power pumps there are comparatively few that meet the needs of an army in the field, in respect of being easily transported, reasonably free from chance of breakdown, and economy of fuel. It is important that the types used in the field should be few and that parts should be standardized so as to facilitate repairs. There should always be a number of spare parts accompanying each machine, and there should be other spares kept for general use at store depots. All suction and delivery connexions especially should be standardized. As a motive power, high-speed internal combustion engines are generally of most use, if properly connected with the pump and operated by competent personnel. Slow and medium-speed oil engines may be found very useful.

A pumping set will generally consist of (i.) prime mover, direct gear, or belt coupled to (ii.) pump with valves, strainer, suction piping and foot valves (iii.) starting gear for engine or motor, set of spanners, etc. Different classes of pumps will be required for delivery to tanks near the supply, hasty installations on pipe lines, deliberate installations for rest camps, etc., and pumping from deep wells. The variety of pumps suitable for each class is considerable. Mention, however, may suitably be made of the air lift pump, which, on account of its having no working parts below ground, and for several other reasons, is the most useful form of pump for military work. Such a pump can be mounted on a lorry and can go round a series of wells, pumping from each the day's supply into an extemporized reservoir and then going on to the next. It is a device for raising water by compressed air introduced in a vertical tube connected with the rising main, either concentrically with that pipe, or in a separate tube parallel to it. The utility and efficiency of this device has been amply tested in war, and much attention and valuable experience has been devoted to the theory and practice of its use.

As regards pipe-laying, cast iron pipes, though ordinarily used in civil water supplies, with their lead joints are unsuitable for military work because of the relatively heavy weight as compared with steel tubes of the same diameter; also they are brittle and unsuited for rough handling, and the jointing takes more time than the screwing up of steel tubes. The latter should, therefore, be invariably used in the field. As a rule they are not made of larger diameters than 6 in., but larger pipes can be obtained, and many miles of 10-in. and 12-in. pipes were put down in the Sinai peninsula in 1916. For most purposes wrought iron screwed and socketed piping is suitable; the British standard threads for the pipe ends should be insisted on, and the whole should be capable of standing a test of 300 lb. per sq. in. (690-ft. head). If in mountainous country (as with the British in Italy, where heads of 2,000 and 4,000 ft. had to be negotiated), the pipes must be of the *hydraulic* type, with special joints.

Many special fittings are required with a pipe system, elbows, tees, crosses, etc., and many devices for control and delivery, such as valves, taps and stop cocks. The main point to remember is that there is no economy in having inferior and cheap fittings, for the waste of water which follows their use costs far more than the extra cost of water and more reliable articles. (G. K. S. M.)

WATSON, JOHN CHRISTIAN (1867–), Australian politician, was born at Valparaiso, Chile, April 9 1867, when his parents were on their way as emigrants to Australasia. He was educated at the public school of Oomaru, N.Z., and as a boy began work as a compositor. He also made an early entrance into politics, attaching himself to the Labour party, which came into prominence during the great strike of Australian dock and transport workers. He was president of the Sydney Trades and Labour Council in 1890. From 1894–1901 he was a member of the N.S.W. Legislature, where he opposed plural voting and inclined towards protection as a means for keeping up the white man's wages. Consequently after federation, as a member of the Commonwealth Parliament he gave his support to Sir Edmund Barton and Mr. Deakin and exacted in return legislation in labour interests. For a short time in 1904, on the resignation of Deakin, he formed a Labour Ministry, but resigned after a few months, though he continued to lead the Labour party until a tariff, of which he could approve, had been passed by Mr. Deakin in 1908. He then retired from public life.

WATSON, SIR WILLIAM (1858–), English poet (*see* 28.414), was knighted in 1917. His later poems include *The Heralds of the Dawn* (1912); *The Muse in Exile* (1913); *Retrogression* (1916); *The Man Who Saw* (1917) and *The Superhuman Antagonists* (1919).

WATTERSON, HENRY (1840–1921), American journalist (*see* 28.418), was among the first to urge, in 1911, the nomination of Governor Woodrow Wilson as Democratic candidate for president. In Aug. 1918 he retired from active editorship of the Louisville (Ky.) *Courier-Journal*, remaining "editor emeritus." On March 2 1919 a special edition of this paper was published, containing tributes from his admirers throughout the world.

In April he severed all connexion with the paper because of its support of the League of Nations which he opposed. He died at Jacksonville, Fla., Dec. 22 1921. He was the author of *Old London Town* (1910); *History of the Manhattan Club* (1915) and "*Marse Henry*": *an Autobiography* (1919).

WATTS, SIR PHILIP (1846–), British naval architect, was born in Kent May 30 1846, and was educated at the College of Naval Architecture, becoming a constructor to the Admiralty up to 1885. From 1885 to 1901 he was director of the War Shipping department of Armstrong, Whitworth & Co. at Elswick (subsequently returning as a director of the company in 1912); but in 1901 he was appointed Director of Naval Construction at the Admiralty. This post he held until 1912, when he was succeeded by Sir Eustace Tennyson d'Eyncourt (b.1868) and became Adviser to the Admiralty on Naval Construction. In this capacity he played an important part when the World War came, and it was his fate, as the designer of the first "Dreadnought," to see the use that was made of the fleet which he had brought into being in previous years. He was a member of the royal commission on the Supply and Storage of Liquid Fuel (1912), and of the Council of the Royal Society. He was created K.C.B. in 1905.

WATTS-DUNTON, [WALTER] THEODORE (1832–1914), English man of letters (*see* 28.422), died at Putney June 6 1914.

WAY, SIR SAMUEL JAMES, 1ST BART. (1836–1916), Australian lawyer and politician, was born at Portsmouth April 11 1836. He went to Australia in 1853 and was called to the South Australian bar in 1861, becoming Q.C. ten years later, Attorney-General in 1875 and Chief Justice of S.A. in 1876. He entered the House of Assembly 1875, and in 1890 was lieut.-governor. He administered the government of the Colony ten times between 1877 and 1890, and in 1897 became the first representative of the Australasian Colonies on the Judicial Committee of the Privy Council. He was created a baronet in Aug. 1899. He did much to help Australian sheep-breeding, and introduced the improved Shropshire sheep into Australia. He died Jan. 6 1916.

WEAVER, JAMES BAIRD (1833–1912), American lawyer and political leader (*see* 28.439), died at Des Moines, Iowa, Feb. 6 1912.

WEBB, SIR ASTON (1849–), English architect, son of Edward Webb, a distinguished engraver and painter, was born in London May 22 1849. His architectural education was in the office of Banks & Barry (the latter the son of Sir Charles Barry), but it was to his own self-study—and in particular to his power of sketching during his many travels, rather than to his pupilage instruction, that his expression in design and planning are to be ascribed. One of his earliest commissions, on establishing himself in practice, was the restoration of the important Norman church of St. Bartholomew's, Smithfield (1880), a work which lasted through several years. But Webb's peculiar distinction lies in the large number of important buildings for which he has been responsible. Many of these were the result of competitions and include the Victoria Courts at Birmingham, the Assurance offices in Moorgate St., and the Christ's Hospital school at Horsham, all carried out in partnership with Mr. Ingress Bell. His roll of important buildings is a long one, and may well be headed by the completion of the Victoria and Albert museum, South Kensington, and its close neighbours the Royal College of Science and the Imperial College of Technology. The first of these was the successful design in a very keenly contested competition. The plan has the merit of being simple and easy to grasp; the long vistas it presents, the octagon hall, and the galleries are treated boldly and with dignity of proportion. The Admiralty entrusted to Sir Aston the new Britannia Royal Naval College at Dartmouth, and, in conjunction with Mr. Ingress Bell, he carried out the Royal United Service Institution building, Whitehall, and that for the university of Birmingham. The National Monument to Queen Victoria, opposite Buckingham Palace, was, again, the result of a competition, and included a fine but simple lay-out of the Mall and other approaches to the site occupied by the central feature which embodies the noteworthy sculptural work of Mr. Brock. The unworthy setting and background offered to this fine monument presented by the cement-fronted elevation of Buckingham Palace, for which John Nash and, later, Blore were responsible, led to the long talked of recasting of the front toward the Mall, and this work was placed in the hands of Sir A. Webb. He also designed the entrance from Charing Cross to the Mall, which is ingeniously masked by a building with curved frontages, in order that the change in the line of access at this point may not be noticeable. He was responsible for a large number of private houses—including Yeaton-Pevery, Shrewsbury—and for churches—both new and restored—in Worcester, Burford and Witley, and the French Protestant church, Soho. In 1902 Webb was elected president of the Royal Institute of British Architects, and in 1905 was presented with the institute's gold medal. He was made a Royal Academician in 1903, received his knighthood in 1914, and in 1919, on the death of Sir Edward Poynter, was elected president of the Royal Academy. This was an unusual honour to be awarded to an architectural member, and one for which in the long history of that society there had only been one precedent—that of James Wyatt in 1805, and even in his case the election was never officially confirmed.

WEBB, SIDNEY (1859–), British Socialist and author (*see* 28.455). From 1909, when Mr. Webb, with his wife, Beatrice, was actively organizing opinion in favour of the Minority Report of the Poor Law Commission, he continued to play an influential part in the Labour and Socialist movement. He became one of the commissioners under the Development Act in 1913. His election upon the national executive of the Labour party in the early part of the World War brought him into a still closer connexion with the responsible leaders of Labour, and two years later the entire constitution of the Labour party was remodelled and a programme constructed (*Labour and the New Social Order*), which was closely in accord with Mr. Webb's views and policy. During the war Mr. Webb and his wife served on numerous departmental and other committees. In opposition to the majority report of the War Cabinet Committee on Women in Industry, Mrs. Webb put forward a Minority Report which was afterwards (in 1919) published separately. At the general election of Dec. 1918 Mr. Webb stood unsuccessfully as Labour candidate for London University (in which he held the professorship of Public Administration), being second in the poll. In the coal crisis of the spring of 1919 he was appointed a member of the Coal Industry Commission and also put forward in evidence a complete scheme of nationalization of the coal-mines. In the same year he was appointed to the Central Committee set up under the Profiteering Act of 1919. Among the publications of Mr. and Mrs. Webb after 1906, the following were the most important:—*English Local Government: The Manor and the Borough* (1908); *The Break-up of the Poor Law* and *The Public Organization of the Labour Market* (1909); *English Poor Law Policy* (1910); *The State and the Doctor* (1910); *The Story of the King's Highway* (1913); *The History of Trade Unionism* (new and revised ed. 1920); *A Constitution for the Socialist Commonwealth of Great Britain* (1920) and *The Consumers' Coöperative Movement* (1921). Mr. Webb also produced *Grants in Aid* (1911); *How to Pay for the War* (1916); *The Works Manager To-day* (1917); and *The Story of the Durham Miners* (1921). Mr. and Mrs. Webb were concerned in the founding of the weekly *New Statesman* in 1913, and have been since 1895 active movers in the development of the London School of Economics and Political Science (university of London).

WEBER, SIR HERMANN (1823–1918), British physician, was born at Holzkirchen, Germany, Dec. 30 1823, the son of a German father and an Italian mother. He studied medicine at Fulda, Marburg and Bonn, where he took his M.D. degree in 1848. His residence at Bonn brought him into touch with the English colony there, and through this connexion he received the position of house physician at the German Hospital, Dalston, London. When this appointment came to an end, he started in private practice, having become a naturalized British subject, and studied at Guy's Hospital with the object of obtaining an English qualification (1855). Weber came into great prominence as a pioneer of the open-air treatment for tuberculosis, and himself spent many winters in Switzerland in charge of patients. In 1899 he was appointed a delegate to the Berlin congress on the prevention of tuberculosis, and the same year was knighted. He retired from practice at the age of 80, but retained his health and vigour till his death, which took place in London Nov. 11 1918, in his 95th year.

WEDMORE, SIR FREDERICK (1844–1921), English art critic and man of letters (*see* 28.466), was knighted in 1912. He published that year his *Memories*, a book of reminiscences, social and literary. He also published *Painters and Painting* (1913) and a novel, *Brenda Walks On* (1916). He died at Sevenoaks Feb. 25 1921. His daughter, Millicent Wedmore (b. 1879), herself the author of two volumes of verse, helped him to edit during the World War *Poems of the Love and Pride of England.*

WEEKS, JOHN WINGATE (1860–), American public official, was born at Lancaster, N.H., April 11 1860. He graduated from the U.S. Naval Academy in 1881, served two years as midshipman, then resigned from the navy and became a civil engineer. From 1886 he was assistant land commissioner of the Florida Southern Railroad. In the latter year he helped to organize the banking and brokerage firm of Hornblower & Weeks, Boston, Mass., of which he was a member until 1912. His interest in the navy meanwhile continued. In 1890 he joined the Mass. naval brigade, was made captain, and during the Spanish-American War commanded the second division of the auxiliary U.S. naval force on the Atlantic coast. From 1894 to 1900 he was a member of the Mass. military advisory board and of the military board of examiners; in 1896 he was a member of the board of visitors of the U.S. Naval Academy. He was elected alderman of Newton, Mass., in 1900, was reëlected for two terms, and then elected mayor (1903–4). In 1905 he was chairman of the Mass. Republican State Convention. During 1905–13 he was a member of the national House of Representatives and as a member of the committee on banking and currency took an active part in framing the Aldrich-Vreeland Currency bill. In 1913 he entered the U.S. Senate, succeeding Winthrop Murray Crane, but was defeated for reëlection in 1919. As a member of the Senate committee on military affairs during the World War he took part in investigations which resulted in a reorganization of the ordnance and quartermaster departments as well as the aircraft production board. In 1921 he entered the Cabinet of President Harding as Secretary of War.

WEISMANN, AUGUST (1834–1914), German biologist (*see* 28.499), died at Freiburg-in-Baden Nov. 6 1914. His latest publications were an estimate of Darwin's work and *Die Selectionstheorie*, both published in 1909.

WEISS, BERNHARD (1827–1914), German Protestant New Testament scholar (*see* 28.499), died in 1914.

WEKERLE, ALEXANDER (1848–), Hungarian statesman (*see* 28.500), was again appointed prime minister on Aug. 20 1917, and resigned in a public sitting of Parliament in 1918 (*see* Hungary). At the time of the Bolshevist rule in Hungary he was held prisoner as a hostage.

WELBY, REGINALD EARLE, 1st baron (1832–1915), English civil servant, was born at Harston, Leics., Aug. 3 1832. He was educated at Eton and Trinity College, Cambridge, and accepted a Treasury clerkship in 1856. There his financial ability soon showed itself and his rise was rapid, especially after W. E. Gladstone became Chancellor of the Exchequer. Finally in 1885 he became permanent secretary to the Treasury. He was made K.C.B. in 1882, G.C.B. in 1892, and a peerage was bestowed on him on his retirement. After that event he became an alderman of the London County Council and in 1899 was elected its chairman. He died in London Oct. 30 1915.

WELDING (*see* 28.500).—This article discusses Electric Welding and Gas-Torch Welding. For Thermit Welding, see the separate article Thermit and Thermit Welding.

(1) Electric Welding.—An important development known as Spot Welding has taken place in recent years. It is a modification of the Thomson process, peculiarly applicable to uniting overlapped sheets of metal by welded "spots" or localized areas of union of the sheets in place of riveting them. It has the merit of leaving little or no projection or deformation on the outer surfaces of the sheets so united.

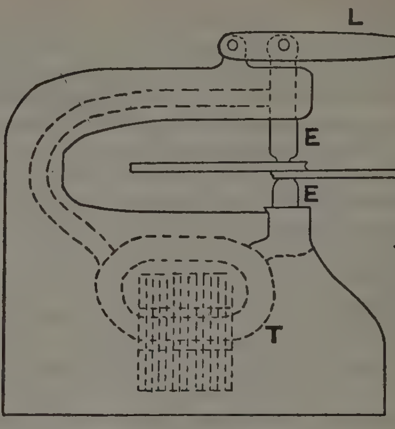

Fig. 1.

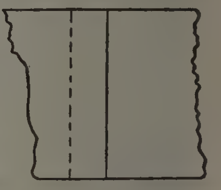

Fig. 2a.

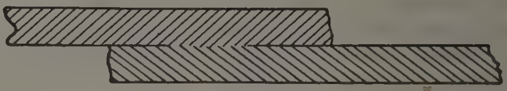

Fig. 2b.

The machine for such work is called a "spot welder," and usually has two electrodes arranged in a vertical line, one above the other. The electrodes consist of short, heavy, blunt copper bars, E E (fig. 1) (water-cooled in the larger machines); the upper electrode E is made movable up and down under control of a manually operated pressure lever, L, or by a piston actuated by air or water pressure controlled by a valve. The opposed ends of the electrodes, which bear upon and form contact with the sheets to be united, are usually chamfered or given the form of frustums of shallow cones. This reduces resistance loss in the electrodes and adds to their rigidity and durability. The electrodes, as in other resistance welders, are made the terminals of the heavy secondary circuit of a welding transformer, T, the usual single turn of large section. The current is large, but is delivered to the work at low voltage. The weld which unites the sheets is a spot, usually round in form, confined in extent to the area covered by the ends of the electrodes. The opposed faces of the sheets are thus locally and quickly heated to welding temperature, and the pressure of the electrodes causes complete union; such welded spots are successively made at intervals over any extent of surface of the sheets, as in riveting (see fig. 2, a and b). While spot welding has been found to be best adapted to the union of overlapped sheets or edges of comparatively thin metal, plates of $\frac{1}{2}$ in. or more in thickness may be spot-welded by heavy welders constructed for the purpose. In some of these, for mechanical and electrical reasons, two spot welds are made simultaneously by the same current passed in series through two spots covered by two pairs of opposed electrodes connected in series in the welding circuit. Another form of welding, known as "projection" welding, is akin to spot welding, differing therefrom, however, in the use of electrode faces which do not in themselves determine the welded area or spot, and in permitting the instantaneous union of plates or pieces at many parts of their surfaces. This is accomplished by forming raised spots or projections on one or both pieces, which when brought together form the paths for current and consequent development of welding heat irrespectively of the other parts of the plates, and irrespectively also of the electrode contact with the sheets, such contact covering a wide extent of the pieces to be welded, and serving to press them together as the projections between them become heated and softened.

Roller Welding.—Roller welding, applicable to forming continuous lapped seams in sheet metal work, has attained in late years some considerable importance. In this operation the overlapped edges of the sheets to be united are passed steadily between an upper copper roll with an edge of the width of seam weld desired, and a conducting mandrel, plate, or similar copper roll forming the under electrode. The weld so formed is a line or strip of a width determined by the width of the contact surface of the welding roll. Thin steel tubes with lap welds are made by this method, and it has also found application in the construction of thin metal containers such as steel thermos bottles, the parts of which are united without solder.

Snap Welding.—This term is now commonly applied in connexion with the Thomson resistance process to welds made by light contact of the pieces during heating, followed by quick application of heavy pressure to force the heated surfaces together. With iron and steel the method secures a very strong weld and the heating is confined closely to the weld itself. Moreover, there is a saving of time and often of energy.

Percussion Welding.—If an electric condenser of large capacity be discharged by wire terminals of relatively small section made to approach each other in line, the discharge occurs with a flash of light at or before actual contact, depending on their potential difference. With sufficient capacity of condenser the restricted areas of the opposed ends of the discharge wires are brought superficially for an instant to a high temperature, and if immediately pressed into firm contact will weld or unite. In percussive or percussion welding the condenser (or, better, a polarization battery of limited capacity) is charged from any suitable source of electric energy and its terminals attached to the work pieces, which are then brought into percussive contact, as by arranging to have one of them fall toward the other from an appropriate height determined by experiment. The percussion may be assisted by a weight or spring suitably adjusted. The discharge occurs as above described, and the heated opposed surfaces are brought instantly together by the forcible impact. A weld may thus be obtained between the pieces. The rise of temperature is confined almost entirely to the thin layer of metal forming the joint. The heating effect is thus more local than in any other form of welding. It is applicable to small work and it extends to a considerable degree the practical possibilities of electric welding. The stored energy of an electro-magnetic circuit may also be employed for the instantaneous discharge demanded by percussion welding.

Electric Arc Welding.—Stimulated in large measure by the need of rapid ship construction in the World War, and the modern extension of electric supply, that form of fusion welding in which the electric arc is employed has in the past few years grown rapidly in importance and extent of application. Many forms of arc-welded joint in steel structures have already been to a degree standardized. The arc terminal applied to the work (usually the negative electrode when direct current is used) is a wire or rod of mild steel, mounted in a suitable holder manipulated by the operator, upon whose skill the perfection of the work largely depends. These electrode wires ordinarily vary in diameter according to the scale of the work or current strength used, and range from $\frac{3}{32}$ in. to $\frac{3}{16}$ in. or more. As the welding wire is rapidly consumed in the operation of fusing a joint, it is constantly fed forward. Automatic arc welders have been devised and in these the arc separation is controlled automatically and the wire also fed automatically from a reel. In operation the arc voltage may be from 10 to 20 volts and the current traversing the arc may be from 80 to 200 amperes or more. The welding is attended by much sputtering and projection of fused and superheated globules of iron from the end of the wire electrode toward the cooler and heavier masses of the work pieces. In fact, the deposition of metal on the work is possibly due to a jet of iron vapour from the electrode wire, carrying fused iron globules as a result of explosive boiling of the iron. This action would be a natural consequence of the central area of the end of the electrode wire being at the highest temperature, as it loses heat by radiation less readily than the outer surface of the wire at the arc. This central area reaches a temperature of about the boiling point of iron. The temperature of the arc is so high that the surface of the work pieces, however massive such pieces may be, is penetrated and fused so that incorporation of the metal of the work and that from the welding electrode wire takes place. The welding may be regarded as a progressive filling or plastering action by condensed iron vapour and fused iron. The operation is facilitated by coating the electrode wire lightly with mineral films, such as lime, which probably act by furnishing volatile material which adds to the stability of the arc. Depending on the strength of current in the arc and the skill of the operator, from 1 lb. to 2 lb. of metal per hour may be deposited in effecting the welds, and about 80% of the metal of the wire used enters the welds, the remaining 20% being vapourized, burned into oxide, or scattered in small globules. When plates of over $\frac{3}{16}$ in. in thickness are to be butt-welded they should be bevelled before abutting them, so that a groove of not less than 60° flare shall be provided, to be filled with the fused metal (see fig. 3.). Where the plates meet at an angle, as in fig. 4, the fused metal is deposited either at *a* or *b*, or both.

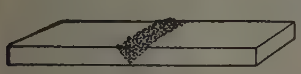

FIG. 3.

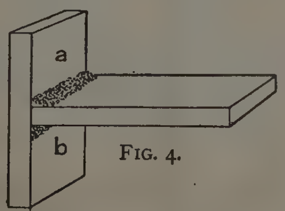

FIG. 4.

Arc welding can be carried on even upon the under side of the work (such as a boiler or tank *in situ*). In this case the electric arc is at the upper end of the welding wire, and the disadvantageous position results in the rate of forming the welds being about 60% of that in ordinary work. The actual rate at which seams can be made in arc welding naturally depends upon the thickness of the plates to be united, the kind of joint to be made and other conditions. With automatic machines on small work it may rise to about 2 ft. per minute, while in heavy work by hand operation it may not exceed 2 in. per minute. Ordinary arc welds on steel may possess a tensile strength of as high as 50,000 lb. per sq. in., but there is almost negligible elongation. Cast iron is amenable to arc welding when proper precautions are taken. Likewise bronze and copper may be arc-welded, a favourable condition for which is preheating of the work pieces. Arc welding has usually been done by the use of direct current, and special dynamo generators are constructed for supplying the current, such generators having been designed with regulating characteristics suitable to welding. The alternating-current arc is, however, adaptable to welding, provided the frequency is not too low. Arc welding covers a large field of application, constantly extending. It is employed in the construction of tanks, and is especially useful in caulking the seams of tanks which must retain oil or thin liquids without leak. It is revolutionizing the fabrication of many structures of iron and steel, and is much used for repair work. It is readily applicable to joining broken pieces and to replacing metal worn away in use, of which the restoration of rail surfaces of tramways *in situ* is now a familiar instance. It is generally found to be less costly in application than the other forms of fusion welding, such as that by the use of oxygen blowpipe or thermit welding. (E. T.)

(2) GAS-TORCH WELDING.—Gas-torch welding is variously known as "autogenous" welding, "oxy-acetylene blowpipe" welding, "hot gas flame" welding, "fusion" welding, and other terms which are more or less inaccurate, general, and confusing. The gas combinations more commonly used for torch or blowpipe welding are either oxygen-acetylene or oxygen-hydrogen. Of these two, oxy-acetylene is in more general use for welding, while oxy-hydrogen, on account of its longer flame, is generally used to supply heat for steel-cutting torches. The oxy-acetylene flame has a maximum heat under ideal conditions of about 3,400° C., and oxy-hydrogen about 2,000° C.

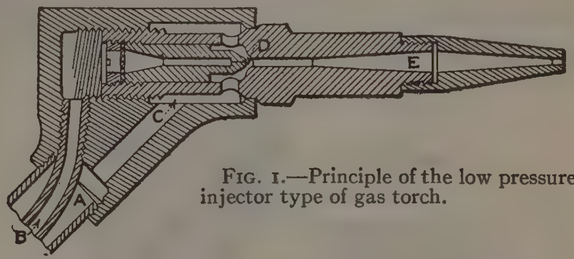

FIG. 1.—Principle of the low pressure or injector type of gas torch.

The use of a blowpipe or torch in some form was known to the ancients, but the high-temperature gas flame is a development of the last quarter of a century, and especially the past ten years. The application of the oxy-acetylene torch to metallic welding dates experimentally from 1901 and commercially from 1903; Edmond Fouché, Paris, who did considerable experimenting in conjunction with Picard, is generally credited with making the first really practical torch. The early torches used both oxygen and acetylene under high pressure, but this proved too dangerous, and a low-pressure or injector type was next used. Following this was the Gauthier-Ely positive or medium pressure torch, which used both gases under moderate and independent pressure. The injector and the positive-pressure types are the ones now in commercial use. The development of the latter is largely due to Augustine Davis and Eugene Bournonville.

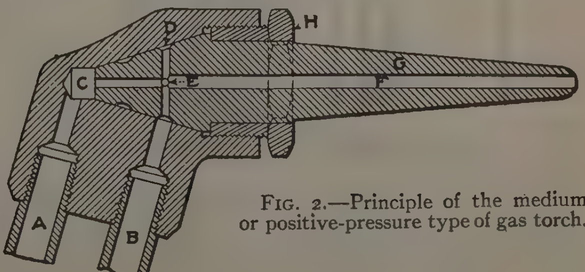

FIG. 2.—Principle of the medium or positive-pressure type of gas torch.

The fundamental principle of the low-pressure or injector type of torch is shown in fig. 1. The acetylene enters at A and the oxygen at B. The acetylene, at less than 1-lb. pressure, goes to chamber C, from which it is sucked by the oxygen, under 5 to 30-lb. pressure, pouring out of nozzle D, and is carried along with the oxygen into the mixing chamber E. The thoroughly mixed gases issue from the nozzle of the torch, where they are burned.

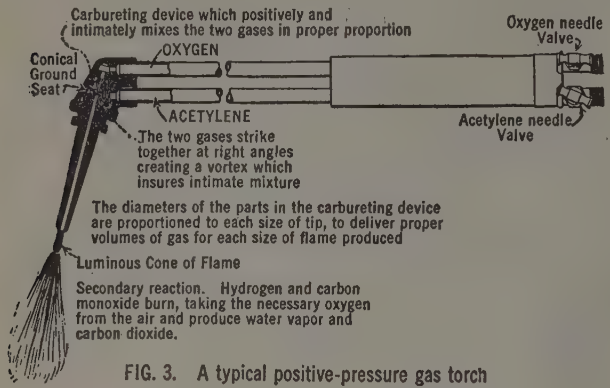
Carbureting device which positively and intimately mixes the two gases in proper proportion
Oxygen needle Valve
Conical Ground Seat
OXYGEN
ACETYLENE
Acetylene needle Valve
The two gases strike together at right angles creating a vortex which insures intimate mixture
The diameters of the parts in the carbureting device are proportioned to each size of tip, to deliver proper volumes of gas for each size of flame produced
Luminous Cone of Flame
Secondary reaction. Hydrogen and carbon monoxide burn, taking the necessary oxygen from the air and produce water vapor and carbon dioxide.

FIG. 3. A typical positive-pressure gas torch

The positive-pressure torch principle is illustrated in fig. 2. Here the oxygen, at from 1 to 14-lb. pressure, enters at A, and the acetylene, at from 1 to 24-lb. pressure, enters at B. The oxygen enters the small chamber C and thence out through the centre hole. The acetylene goes to chamber D and also out through the centre hole. The two gases start to mix at E and are thoroughly mixed in the channel F in the torch nozzle G. A typical positive-pressure torch is shown in fig. 3. Torches are made with tips set at various angles from 90° to straight, the latter being principally used in welding and cutting machines. Where the work is heavy the tips are water-cooled. In welding very thin metal the edges are often turned up or "flanged" and the torch used to fuse them together without using any additional metal. On heavier work the edges to be welded are V-eed out at an angle of from 60° to 90°, and this channel is filled in by using a welding rod or wire, care being taken to obtain perfect fusion between the old metal and new. Welding of this kind is progressive, as the welder gradually works along the channel, filling as he goes. The torch is given a weaving motion from side to side in order to fuse the sides of the V and to puddle in the added metal from the rod. On all torch welding work allowance must be made for expansion and contraction, and on repair work of complicated design, like an automobile cylinder, preheating with charcoal, gas-and-air torches, or other means is usually necessary. Preheating is also sometimes resorted to in order to save the more expensive gases. Nearly all of the common metals may be welded with the gas torch, though some are more difficult than others. Steel ship or boiler plate is about the easiest, though aluminium, cast iron, copper, and many alloys present no serious difficulties.

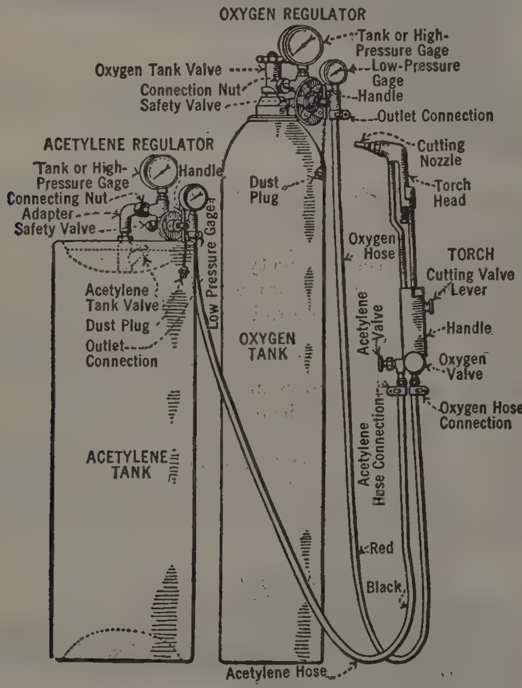
OXYGEN REGULATOR
Tank or High-Pressure Gage
Oxygen Tank Valve
Low-Pressure Gage
Connection Nut
Handle
Safety Valve
Outlet Connection
ACETYLENE REGULATOR
Cutting Nozzle
Tank or High-Pressure Gage
Handle
Dust Plug
Torch Head
Connecting Nut
Adapter
Safety Valve
Low Pressure Gage
Oxygen Hose
TORCH
Cutting Valve Lever
Acetylene Tank Valve
Dust Plug
Outlet Connection
Acetylene Valve
Handle
OXYGEN TANK
Oxygen Valve
Oxygen Hose Connection
Acetylene Hose Connection
ACETYLENE TANK
Red
Black
Acetylene Hose

FIG. 4. Typical oxy-acetylene cutting unit

The set-up for a welding outfit is practically the same as that of the one for cutting shown in fig. 4. A cutting torch, however, differs from a welding torch in that it has a separate high-pressure oxygen vent. The cutting of steel and wrought iron is based on the fact that a jet of oxygen directed on to a previously heated spot of steel causes it to ignite and burn away rapidly in the form of iron oxide. The oxide runs or is blown out of the cut or "kerf," in a stream, provided the torch is fed along properly. The tips used for cutting may have one or several heating jets preceding or surrounding the cutting oxygen jet. Only steel or wrought-iron can be successfully cut on a commercial scale, though channels or slots may be melted in any metal. A typical job of steel plate cutting is shown in fig. 5, and a typical cutting torch in fig. 6. Cast iron is cut with difficulty, and only by using a special tip and highly preheating the oxygen in a positive-pressure torch or by using an excess of acetylene and an unusually large tip on the low-pressure types.

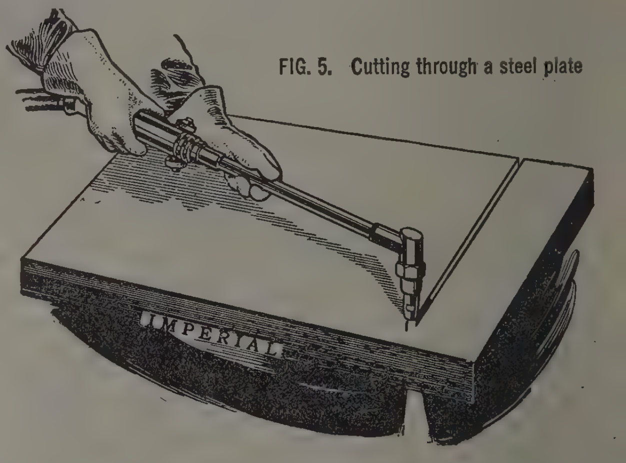

FIG. 5. Cutting through a steel plate

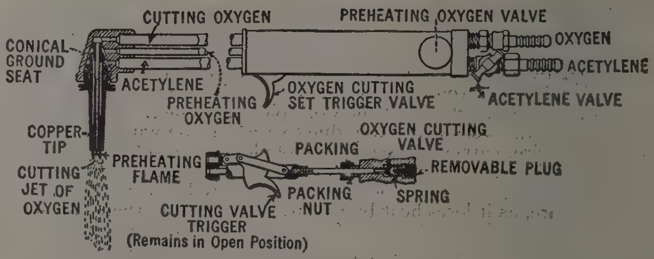
CUTTING OXYGEN
PREHEATING OXYGEN VALVE
CONICAL GROUND SEAT
OXYGEN
ACETYLENE
ACETYLENE
PREHEATING OXYGEN
OXYGEN CUTTING SET TRIGGER VALVE
ACETYLENE VALVE
COPPER-TIP
OXYGEN CUTTING VALVE
PACKING
CUTTING JET OF OXYGEN
PREHEATING FLAME
REMOVABLE PLUG
PACKING NUT
SPRING
CUTTING VALVE TRIGGER (Remains in Open Position)

FIG. 6. A typical cutting torch

The same sources of gas supply are used in cutting as in welding. These are commonly cylinders or drums containing the gases under pressure up to 225 lb. per sq. in. and from 100 to 300 cu. ft. capacity for acetylene, and 1,800 lb. per sq. in. and from 100 to 200 cu. ft. capacity for oxygen or hydrogen. Acetylene, however, may be generated on the premises, in which case the pressure must not exceed 15 lb. per square inch. Obviously pressure as great as that mentioned for cylinders must be reduced for use in the torch and for this purpose regulators are used which automatically keep the gases supplied to the torch close to the pressure for which they are set. Gas-torch welding machines that are practically automatic are in use in many large plants for straight or circular seam welding of drums, cylinders, tubes, kettles and the like. Cutting machines are much more commonly used than welding machines. The cutting machines range from the simple, hand-fed, straight-line cutters to complicated motor-driven automatic machines that will cut rounds, squares, ovals or other patterns. One type of cutting machine is made on the pantograph principle, and by following a template or pattern the operator can use two torches and cut two separate steel plates at once. A cutting machine will, as a rule, cut a narrower and more even kerf than can be done by hand. Under favourable conditions a machine can be made to cut a kerf not over $\frac{1}{32}$ in. wide, while a careless or inexperienced operator with a hand torch may cut a kerf $\frac{1}{8}$ in. or more in width. (E. VI.)

WELFARE WORK IN INDUSTRY.—Human beings possess intelligence, and their well-being depends on psychological as well as on physiological make-up. Mental and physical activity are necessary to health. From the industrial point of view both require to be maintained in order to ensure the efficiency which represents for the employer a contented personnel, and for the employed not merely physical health, but a "worth while" life.

The development of industrial processes brought about during the last century and a half by the application of mechanical power has introduced greater variations into the conditions of life and of work than formerly existed. During the period while control was being established over the efficiency of mechanical devices, the relation of the worker to these devices, and study of the efficiency of human beings in relation to altered conditions of work, were largely neglected. Nevertheless, industrial development in England, as elsewhere, has been followed step by step by "occupational" legislation, controlling employment in factories, mines, workshops and other places, aimed at protecting physical health. But knowledge of how to protect health lagged for many years behind the rapid alterations which were taking place; and the hurry onward to develop wealth-producing industries left no time for taking full advantage of what knowledge did exist. Certainly no organized effort was made during the 19th century to acquire new knowledge, and little or no recognition was given to the new psychological influences brought into existence even though their effect upon the workers was manifested in riots and strikes.

The commencement of the 20th century saw a few far-seeing employers coming to appreciate that their workers were individuals with whom personal contact must be established and maintained, and that modern industrial concerns were far too large to permit of this contact being established by a busy works manager. These employers delegated this side of their duties to definite persons, entrusted with supervision of the *welfare* of their workers. The result of this action was in every case markedly successful, and 30 British factories in 1913 sent representatives to a conference held at York. Nevertheless, previous to the World War the possibilities of welfare work were undeveloped. One of its results has been to attract more and more attention to its importance.

Welfare work, as such, may for convenience be considered alone. In practice it cannot be separated from supervision of health. The difference between health supervision and welfare is the difference between supervising the health of domestic animals such as prize cattle and of human beings. Mere provision of healthy surroundings and of means for personal hygiene does not meet the needs; there must be appeal to and coöperation with those concerned. The true spirit of industrial welfare work cannot be fostered merely by enforcing compliance with legal requirements. Welfare work means something different; it means educating and training each individual worker to take an intelligent interest not only in his own health and efficiency but also in that of his fellow workers, and in that of the industrial establishment of which he forms a part. Legal requirements can but seldom go further than fixing a minimum standard of accommodation needed; they cannot deal with the personal idiosyncrasy of workers, or establish a code of healthy etiquette, or ensure personal coöperation.

The unprecedented demand in the United Kingdom for munitions during the World War called for action to meet varying needs more rapid and elastic than that of ordinary peace requirements. In 1915, on the formation of the Ministry of Munitions, Mr. Lloyd George appointed the Health of Munition Workers' Committee who promptly recommended the adoption of welfare supervision for munition workers, using the following words of a well-known employer in support:—"If the welfare workers have the confidence of the employees, and are always in touch with them, they will naturally be the medium whereby matters occasioning dissatisfaction or misunderstanding can be investigated and put right. By suggesting and advising upon improvements in conditions of work that may be helpful on the business side, by initiating and supervising recreative and other clubs, societies and classes, by visiting the sick, by endeavouring to foster the spirit of good fellowship amongst all grades of employees, and by being ready to give advice and assistance in matters affecting individual employees personally and privately—by these and other methods welfare workers may find means of giving practical effect to the desire of employers to realize their obligations towards their workers." The Committee also issued a series of valuable memoranda dealing with workers' food and industrial canteens; employment of women and of juveniles; hours of work; industrial efficiency and fatigue; sickness, injury, and special industrial diseases; ventilation and lighting; washing facilities; and eyesight in industry. These various memoranda formed the basis of work undertaken by a special section established in the Ministry of Munitions entrusted with the welfare and health of workers.

Officers of the factory department (lent for the purpose by the Home Office) directed the work, which is historically important since thereby the foundations of industrial welfare were laid, and for the first time official propaganda going ahead of legal requirements and statute law were largely and successfully employed. The work was essentially advisory rather than punitive; it aimed at pointing out the lines reforms should take, and assisting and expediting in every way the carrying out of improvements. The following memoranda, issued by the Ministry of Munitions, indicate the scope of the work which was being initiated:—

I. Welfare for Women and Girls

The experience which has now been obtained in National and other factories making munitions of war has demonstrated that the post of welfare supervisor is a valuable asset to factory management wherever women are employed. Through this channel attention has been drawn to conditions of work, previously unnoted, which were inimical to the well-being of those employed. The following notes have, therefore, been prepared for the information of employers who have not hitherto engaged such officers, but who desire to know the position a welfare supervisor should take and the duties and authority which, it is suggested, might be delegated to her.

It has generally been found convenient that the welfare supervisor should be directly responsible to the general manager, and should be given a definite position on the managerial staff in connexion with the Labour Employment Department of the factory. She is thus able to refer all matters calling for attention direct to the general manager and may be regarded by him as a *liaison* between him and the various departments dealing with the women employees. The duty of a welfare supervisor is to obtain and to maintain a healthy staff of workers and to help in maintaining satisfactory conditions for the work. In order to obtain both a satisfactory staff from the point of view of health and technical efficiency, it has been found to be an advantage to bring the welfare supervisor into the business of selecting women and girls for employment.

Her function is to consider the general health, physical capacity and character of each applicant. As regards those under 16 years of age, she could obtain useful advice as to health from the certifying surgeon when he grants certificates of fitness. The management can, if they think fit, empower her to refer for medical advice to their panel doctor other applicants concerning whose general fitness she is in doubt. The selection of employees furnishes the welfare supervisor with a valuable opportunity for establishing a personal link with the workers. Her function is thus concerned with selection on general grounds, while the actual engaging of those selected may be carried out by the overlooker or other person responsible for the technical side of the work. In this way both aspects of appointment receive full consideration.

The management may find further that it is useful to consult the welfare supervisor as to promotions of women in the factory, thus continuing the principle of regarding not only technical efficiency but also general considerations in the control in the factory.

The welfare supervisor should ascertain what are the particular needs of the workers. These needs will then be found to group themselves under two headings:—

(*a*) Needs within the factory—Intramural Welfare.
(*b*) Needs outside the factory—Extramural Welfare.

Intramural Welfare.

The welfare supervisor may be made responsible for the following matters:—

(*a*) General behaviour of women and girls inside the factory.—While responsibility for the technical side of the work must rest with the technical staff, the welfare supervisor should be responsible for all questions of general behaviour.

(*b*) Transfer.—The welfare supervisor would, if the health of a woman was affected by the particular process on which she is engaged, be allowed, after having consulted the foreman concerned, to suggest to the management the possibility of transfer of the woman to work more suited to the state of health.

(*c*) Night Supervision.—The welfare supervisor should have a deputy for night-work and should herself occasionally visit the factory at night to see that satisfactory conditions are maintained.

(*d*) Dismissal.—It will be in keeping with the general suggestions as to the functions of the welfare supervisor if she is consulted on general grounds with regard to the dismissal of women and girls.

(*e*) The maintenance of healthy conditions.—This implies that she should, from the point of view of the health of the female employees, see to the general cleanliness, ventilation and warmth of the factory and keep the management informed of the results of her observations.

(*f*) The provision of seats.—She should study working conditions so as to be able to bring to the notice of the management the necessity for the provision of seats where these are possible.

Unless the factory is a small one it would hardly be possible for the welfare supervisor to manage the canteen. The management will probably prefer to entrust the matter to an expert who should satisfy the management in consultation with the welfare supervisor on the following matters:—

1. That the canteen provides all the necessary facilities for the women workers; that is to say, suitable food, rapidly and punctually served.
2. That canteen facilities are provided when necessary for the women before they begin work so that no one need start work without having taken food.
3. That the canteen is as restful and as comfortable as possible so that it serves a double purpose of providing rest as well as food.

Supervision of Ambulance, Rest Room and First Aid.—While not responsible for actually attending to accidents, except in small factories, the welfare supervisor should work in close touch with the factory doctor and nurses. She should, however, be responsible for the following matters:—

1. She should help in the selection of nurses, who should be recognized as belonging to the welfare staff.
2. While not interfering with the nurses in the discharge of their professional duties, she should see that their work is carried out promptly, and that the workers are not kept waiting long before they receive attention.
3. She should supervise the keeping of all records of accident and illness in the ambulance room.
4. She should keep in touch with all cases of serious accident or illness.

It would further be useful if she were allowed to be kept in touch with the Compensation Department inside the factory with a view to advising on any cases of hardship that may arise.

Supervision of Cloak-rooms and Sanitary Conveniences.—The welfare supervisor should be held responsible for the following matters:—

1. General cleanliness.
2. Prevention of loitering.
3. Prevention of pilfering.

The management will decide what staff is necessary to assist her, and it should be her duty to report to the management on these matters.

Provision of Overalls.—The welfare supervisor should have the duty of supervising the protective clothing supplied to the women for their work.

Extramural Welfare.

The welfare supervisor should keep in touch with all outside agencies responsible for:—

1. Housing.
2. Transit facilities.
3. Sickness and maternity cases.
4. Recreation.
5. Day nurseries.

In communicating with any of these agencies it will no doubt be preferable that she should do so through the management.[1]

Records.

A. The welfare supervisor should for the purpose of her work have some personal records of every woman employee. A card-index system is recommended.

B. The welfare supervisor should have some way of observing the health in relation to the efficiency of the workers, and if the management approved this could be done:—

(*a*) By allowing her to keep in touch with the Wages Department. She could then watch the rise and fall of wages earned by individual employees from the point of view that a steady fall in earnings may be the first indication of an impending breakdown in health.

(*b*) By allowing her to keep in touch with the Time Office she should be able to obtain records of all reasons for lost time. From such records information can be obtained of sickness, inadequate transit and urgent domestic duties, which might otherwise not be discovered.

(*c*) By keeping records of all cases of accident and sickness occurring in the factory.

II. WELFARE SUPERVISION FOR BOYS

The suggestions contained in this memorandum are founded on the experience of employers who have in actual operation the whole or part of the scheme. Nothing is suggested that has not been proved to be successful in its result.

The essence of the scheme lies in placing on some member of the staff the responsibility for the general well-being of the boys.

In large firms there is enough work to occupy the whole time of an officer.

In smaller firms various alternatives have been adopted:—

1. The services of an officer are shared by two or more firms.
2. An officer already on the staff is given special duties as regards the boys.
3. An officer is specially appointed, but has placed on him other duties in addition to those connected with the supervision of the boys.

Among the duties performed by such an officer the following are the more important of those usually placed upon him:—

Engagement.—1. He will keep in touch with the employment exchanges and the special advisory committees frequently attached to such exchanges. In this way he will secure valuable information relating to the health and school career of the boy.

2. He will interview boys and parents, explain to them the nature of the work and the importance of good time-keeping, and will take up references.
3. He will arrange for suitable boys to be brought before the heads of departments who will decide whether the boys shall be engaged. In some cases the actual engagement is left to him.
4. He will see that an Engagement Form is filled up; and in the case of indentured apprentices, carry through the indenture.
5. He will, especially during the first weeks of employment, keep in close touch with the boy, and assist him in the various difficulties which confront a boy on first entering industry. He will consult with the foreman as to the suitability of the boy for the work on which he is engaged.

Progress and Discipline.—1. He will receive reports from foremen on the boys' progress; will consider complaints, and, in the event of threatened dismissal, will see the boy before a decision is reached. (In no case has the Department discovered any evidence to show that foremen resent this procedure.)

2. He will see the boys from time to time and afford them opportunity of making complaints to him.
3. He will send reports to parents on the boys' general progress, wages, and time-keeping; and occasionally visit their homes.
4. He will discuss with heads of departments schemes of transfer, promotion and training. In the case of indentured apprentices he will see that undertakings are carried out.

Continued Education.—1. He will consider schemes for securing attendance at Continuation Classes.

2. He will offer inducements to secure regular attendance.
3. He will discuss with the Education Authority:—

(*a*) The question of technical training in the cases of boys who are learning a trade.

(*b*) The question of general education of other boys.

4. He will obtain from the head of the school reports on the boys' progress and attendance.

Health.—1. He will endeavour to become acquainted with the information contained in the report of the school doctor.

2. He will be present at the medical examination of the boys at the factory, and note the doctor's recommendations.
3. He will give special attention to ailing boys, and cases of sickness, and endeavour to ascertain the cause.
4. Where lodgings are in demand, he will keep a list of suitable lodgings.
5. He will endeavour to secure that the boys obtain suitable food; and may be made responsible for the general supervision of the canteen and messroom, and for the arrangements for heating carried food.
6. He will be responsible for seeing that boys obtain First Aid in case of accident; and may be entrusted with the duty of supervising the First Aid equipment.
7. He will encourage boys to use overalls; will see that the washing and sanitary arrangements are adequate and in good condition, and will supervise order and decency in their use.

Thrift.—He will be responsible for the initiation and carrying out of thrift schemes, as for example:—

1. By the voluntary stoppage of a certain weekly sum from wages.
2. By weekly collection.
3. By payment of good conduct bonus to the boys' credit.

Recreation.—1. He will be responsible for organizing outdoor games; and for the management of a recreation room, if such exists.

2. He will consider the question of forming a Cadet Corps or Scout Troop.

Records.—He will keep systematic records of each boy.

The work was throughout closely interlocked with action taken from the summer of 1915 onwards by the Central Control Board (Liquor Traffic) to establish and maintain (by themselves or through agents) refreshment rooms for the sale or supply of refreshments. Employers in England were during the war stimulated to pursue welfare schemes and erect canteens by being permitted to write off expenses against excess profits duty.

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[1] The work referred to above as "extramural" was the direct outcome in many of its features of the activities initiated by the Women's Employment Committee, appointed at an early period of the war by the Home Office and the Board of Trade.

Welfare schemes were found to be best conducted through the assistance of welfare committees elected by the workers themselves and representative of all classes of labour employed. In this way is obtained from the beginning the support and coöperation of those for whom the work exists. A strong welfare committee is invaluable; through it an ambulance corps and shop committee for accident prevention can be formed; sickness and emergency funds can be raised and administered; recreation, mental and physical, can be organized; grievances real and imaginary, can be settled; order and discipline maintained; etiquette and a high moral tone established; and canteen complaints discussed and remedied.

A standard has been suggested for the staff necessary for a welfare department, as follows:—

Welfare supervisors for women and girls:—up to
300 workers, one welfare supervisor
a further 300 workers, one assistant supervisor
a further 450 workers, a second assistant supervisor
a further 600 workers, a third assistant supervisor

Total 1,650 women and girls, one senior welfare supervisor and 3 assistants. After this number one assistant should be added for every 600 workers.

Welfare supervisors or apprentice masters for boys:—up to
100 boys, one welfare supervisor
a further 200 boys, one assistant supervisor
a further 350 boys, a second assistant supervisor
a further 500 boys, a third assistant supervisor

Total 1,150 boys, one senior welfare supervisor and 3 assistants. After this number one assistant should be added for every 500 boys.

Welfare supervisors for men:—These officers are usually combined with those acting for boys; and in such cases the scale suggested in the case of women and girls may be taken as a guide. Examples of officers acting for men only are not yet sufficiently numerous to base a scale upon.

While activity on these lines (which came to an abrupt termination on the cessation of hostilities) was still in progress, the Home Office in 1916 consolidated much of the ground won by obtaining powers under the Police, Factories, etc. (Miscellaneous Provisions) Act, Section 7, enabling the Secretary of State by order to require occupiers of factories to make reasonable provisions relating to "arrangements for preparing or heating, and taking, meals; the supply of drinking water; the supply of protective clothing; ambulance and first-aid arrangements; the supply and use of seats in workrooms; facilities for washing; accommodation for clothing; arrangements for supervision of workers." Under these powers a number of orders were made referring to:—

Ambulance and First-Aid at blast furnaces, copper mills, iron mills, foundries and metal works.
Ambulance and First-Aid at saw-mills and wood-working factories.
Drinking water.
Dyeing, use of bichromate of potassium or sodium in.
Fruit preserving.
Glass bottles and pressed glass articles, manufacture.
Laundries.
Oil-cake mills.
Seats in shell factories.
Tanning, use of bichromate of potassium or sodium in.
Tin or terne plates, manufacture of.
All textile factories, printworks, bleaching and dyeing works, and rope-spinning works with reference to providing protective clothing, cloakrooms, messrooms, washing facilities, seats, First-Aid and ambulance.

Not only did the Home Office through these orders proceed to enforce the provision of welfare accommodation but the way was prepared for further action by issuing a series of valuable advisory pamphlets, well illustrated, which set forth in a practical way how the orders can be complied with. The titles of these pamphlets suggest their contents:—*Welfare and Welfare Supervision in Factories and Workshops; Messrooms and Canteens at Small Factories and Workshops; Protective Clothing for Women and Girl Workers; Seats for Workers in Factories and Workshops; First-Aid and Ambulance in Factories and Workshops; Ventilation in Factories and Workshops.*

Evidence of the way in which the extension of welfare work has been stimulated is to be found in the coming into existence of (*i.*) the Welfare Workers' Institute with headquarters at 11, Adam St., Adelphi, W.C.2, and (*ii.*) the Industrial Welfare Society, 51, Palace St., Westminster, S.W.1. Both bodies have a large membership and local branches in industrial areas; women supervisors mainly support the former and men the latter. Both publish good monthly journals, *Welfare Work* and *The Journal of Industrial Welfare.* The effect now exerted upon conditions of labour, social contentment and general betterment in industry is hard to overestimate.

Reference has so far been confined to the welfare movement in reference to factory employment, where it has been most pronounced; but action has not been confined entirely to this field. As long ago in England as 1872 the Metalliferous Mines Regulation Act called for the provision of accommodation for enabling persons employed in metalliferous mines to dry conveniently and change their clothes. In 1910 the Mines Accidents (Rescue & Aid) Act gave power to make orders relating to:—

(*a*) The supply and maintenance of appliances for use in rescue work and the formation and training of rescue brigades.

(*b*) The supply and maintenance of ambulance appliances and the training of men in ambulance work.

The Coal Mines Act of 1911 contained, too, an important clause providing for accommodation and facilities for taking baths and drying clothes where the majority of workmen employed in a mine desire such. Unfortunately this clause was a dead letter except at some half-dozen collieries. But under the Mining Industry Act, 1920, welfare work for miners should receive a great impetus. This Act provides a fund, derived from a levy of 1d. a ton on the output of each mine every year, to be applied for purposes connected with social well-being, recreation, and conditions of living of workers, and with mining education and research. This fund may amount to about £1,000,000 a year and its allocation is entrusted to an expert committee. The result cannot fail to be of intense interest.

For welfare work in the United States, see section V. of the article UNITED STATES.

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WELLHAUSEN, JULIUS (1844–1918), German biblical scholar and Orientalist (*see* 28.507), died in 1918.

WELLS, HERBERT GEORGE (1866–), English man of letters (*see* 28.514), published subsequently to 1910 a long list of notable novels, including *The New Machiavelli* (1911); *Marriage* (1912); *The Passionate Friends* (1913); *The Wife of Sir Isaac Harman* (1914); *The Research Magnificent* (1915); *The Soul of a Bishop* (1917); *Joan and Peter* (1918). He also produced, in fiction form, a discussion on immortality, *The Undying Fire* (1919); a philosophic work, *God, the Invisible King* (1917), and a number of books and pamphlets suggested by the World War. Of these, *Mr. Britling Sees it Through* (1916) was serious fiction, whilst *An Englishman Looks at the World* (1914), *The World Set Free* (1914), *The Peace of the World* (1915), etc., were war pamphlets. He also published two humorous stories in 1915, *Boom* and *Bealby*, and in 1919–20 he completed his encyclopædic *Outline of History*, which was first published in monthly parts. In 1921 he published *The Salvaging of Civilization.* (*See* ENGLISH LITERATURE.)

WEMYSS, FRANCIS WEMYSS-CHARTERIS-DOUGLAS, 10TH EARL OF (1818–1914), British politician, was born at Edinburgh Aug. 4 1818, and was educated at Edinburgh, Eton and Christ Church, Oxford. He entered the House of Commons in 1841 as Lord Elcho, as Conservative member for E. Glos., holding the seat until 1846. From 1847 to 1883, when he succeeded his father in the peerage, he sat for Haddingtonshire and from 1852 to 1855 was a lord of the treasury. Lord Wemyss was best known for the part he took in encouraging the Volunteer movement (1859). From 1859 to 1879 he commanded the London Scottish, and was also one of the founders of the National Rifle Association (1860), presenting it with the Elcho challenge shield for a yearly competition. He retained his vigour and energy almost till his death, which took place in London June 30 1914, at the great age of ninety-five. He was succeeded by his fourth but eldest surviving son, Hugo Richard, Lord Elcho (b. 1857).

WERNER, ANTON ALEXANDER VON (1843–1915), German painter (*see* 28.523), died in Berlin Jan. 3 1915.

WERNHER, SIR JULIUS CHARLES, 1st Bart. (1850–1912), British S.A. financier, was born at Darmstadt in 1850, entered a banking house in Frankfort, and early in 1870 came to London as a clerk. On the outbreak of the Franco-German War he returned to Germany to take his place in the army, and was present at the fall of Paris. At the end of 1871 he was sent by Mr. Jules Porges, diamond merchant of London and Paris, on a mission to Kimberley. There he remained till 1880, when he was transferred to London as English representative of the firm of Porges and Wernher, interested not only in diamonds but in the gold mines of S. Africa. In 1888, when the Kimberley diamond mines were amalgamated by Cecil Rhodes and Alfred Beit, he became a life governor of the De Beers Corporation. Beit was now a member of his firm, and in 1889, when Porges retired, the name of the firm was changed to Wernher, Beit & Co. (*see* 3.659). Out of his enormous fortune, Sir Julius Wernher, who was created a baronet in 1905, spent large sums on public objects, including education; he gave £10,000 to the National Physical Laboratory and, with Beit, endowed the S. African University with £500,000. He died in London May 21 1912.

WERTHEIMER, CHARLES JOHN (1842–1911), art collector, was born in London Feb. 17 1842, of German-Jewish parentage. He early devoted himself to the collection of china, pictures and *objets d'art* of all kinds, travelling widely with this purpose in view, and amassing a wonderful collection. He suffered a considerable loss in 1907, about £40,000 worth of treasures being stolen from his London house on Feb. 12. He died in London April 25 1911. His collection was sold after his death and realized a very large sum.

His brother, Asher Wertheimer (1844–1918), entered his father's art galleries in Bond Street, and later assumed control of the business. He made many noteworthy purchases, the most famous being the acquisition of the Hope collection of Dutch pictures (1898) and, in conjunction with M. Seligmann of Paris, the Cheremeteff collection of Sèvres porcelain (1906), which was exhibited in Bond Street. He died at Eastbourne Aug. 9 1918. By the terms of his will, the splendid series of portraits of the Wertheimer family by J. S. Sargent was left to the nation, after the death of his wife.

WESTERMARCK, EDWARD ALEXANDER (1862–), Finnish anthropologist, was born at Helsingfors Nov. 20 1862. Educated at a lyceum in his native town and at the university of Finland he became professor of moral philosophy at his own university; but he came to England about 1890 and in 1907 was appointed professor of sociology at the university of London. He made a special study of primitive marriage and ethical origins and has published *The Origin of Human Marriage* (1889); *The History of Human Marriage* (1891); *The Origin and Development of the Moral Ideas* (1906); *Marriage Ceremonies in Morocco* (1914) and other scientific papers.

WESTERN EUROPEAN FRONT CAMPAIGNS, 1914-8.—The story of the successive campaigns in Belgium and France during the World War, embracing the continuous struggle on the western front from Aug. 2 1914 to Nov. 11 1918, is dealt with below under four main sections, representing the phases into which it naturally divides itself:—viz. the "open" warfare campaign of 1914, which ended without decisive victory to either side in the open field and left the armies "stabilized" on a continuous line from Nieuport to the Swiss frontier; the three years of trench-warfare campaigns, 1915–7; the great German offensives of March–July 1918, which, breaking the stability of the trench-warfare system, re-introduced a condition of semi-open warfare; and finally, the allied offensive which synchronized at its outset with the last German attack effort, and closed with the Armistice at 11 a.m. on Nov. 11 1918.

I. The Campaign of Aug.–Nov. 1914

France's Defence Problem.—During the years which followed the Franco-Prussian War of 1870–1, a *guerre de revanche* for the reconquest of Alsace and Lorraine was very frequently discussed in France. But it implied aggressive action against Germany, and those who judged with reason and not with sentiment knew very well that such action was impossible. In fact, Germany, at every international crisis that arose, asserted, sharply and menacingly, her readiness to accept a challenge, while France prudently yielded and avoided a conflict.

It may be observed that, under similar military systems—that is, under laws of universal military service—the effort of France could not surpass the effort of Germany, for France counted less than 40 million inhabitants against the 65 to 70 millions of Germany. Presuming equality of national effort, the *vis viva* of France in relation to that of Germany would be in the proportion of 4 to 7; and this calculation makes no allowance for the fact that in Germany all factors combined to exalt the army, to intensify war preparation, and to produce solid cadres and reserves, while in France the tendency of politics was to depreciate the army and to lower its quality, to minimize its training periods, and to depress its military spirit. It is not unfair to say therefore that the possible warlike power of Germany was at least double the possible warlike power of France.

If, next, we cast a glance at the theatre of the possible war, we see at once that France had no natural frontier with respect to Germany, and was obliged to make good this defect by a system of fortresses and entrenched camps—a form of defence which it is exceedingly difficult to maintain at such a level as to be capable of resisting at any moment an artillery that itself is constantly evolving in the direction of increased power. On the side of Germany, on the other hand (even leaving out of consideration her first-class fortresses, for which money was never lacking), there was a line of defence of the very first order, the Rhine—impossible to turn even if the neutrality both of Holland and of Switzerland were violated, for its flanks rest on the Alps and the sea. There are not in Europe two lines of defence of this value, and it was reinforced by a chaplet of entrenched camps. Supposing then that, in spite of the conditions mentioned, France somehow contrived an initial superiority, her penetrative effort could in no case pass the Rhine, while, in a German penetration of France, Paris was within measurable reach.

From the point of view of numbers, the French alliance with Russia might seem at first sight not only to redress the balance but even to weigh down the scales heavily in France's favour. The effective utilization of these numbers was, however, subjected in practice to grave limitations. The strategic conditions of what came to be called the eastern front are discussed in the article Eastern European Front Campaigns, and here it is only necessary to say that these conditions and in particular the paucity of railway communications and of rolling-stock in Russia—evident from a glance at any map of central and eastern Europe—left it within Germany's power to use by far the greater part of her forces in an initial campaign against France. These forces might, from the relation of the two populations concerned and the characters of their respective politics, attain a figure almost double those of France. In such a contingency, the French armies almost might be crushed under a very considerable numerical superiority; the Germans could sweep up to Paris; and there probably the war would end. Germany would rapidly bring back her armies to deal with Russia, aided both by the general E.–W. orientation of her railways and by their perfect technical preparedness. That the German plans did not always take this form, that the soundness of its principle was a matter of considerable controversy, within the German General Staff as well as in military publications, and that the numerical German superiority was not in fact attained, may be freely admitted. But, as the most dangerous alternative that France had to consider, this plan was found to be taken on the logical basis upon which the military policy of the defence should be build up. Whether Germany's own allies would coöperate in such an invasion, and if so, to what extent, was doubtful. Austria's main effort would have to be made in the East; and as regards Italy, it was known that her obligation under the Triple Alliance would become operative only if one of her Allies was defending itself against attack. On the other hand, the *Entente Cordiale* between England and France had enabled the latter to concentrate her naval effort in the Mediterranean, and the details of possible coöperation on land, for some years before 1914, had been studied by the British and French general staffs in concert. But England reserved to herself complete freedom to decide for or against intervention if and when the case arose. It was not till Aug. 2 1914 that Sir Edward Grey engaged that the British navy would protect the Channel coast of France, and not till the actual violation of Belgian neutrality by Germany that the British Government declared war on their own account.

Armies require, for their operations, zones with fronts proportionate to their effectives, for it is obvious that they should neither occupy a space so vast as to deprive them of the density necessary for powerful action, nor on the other hand be so overcrowded that their component parts cannot each contribute at the proper time its share in the effort towards a common object. The proper width of these zones depends on the balance of many factors between two reasonable limits; but, above all, it is necessary that all the elements that are to be brought into action at the same time should have at their disposal enough routes, more or less parallel, leading to the objective, and that these routes should be approximately *at deploying interval* apart. Now if Germany attacked France without violating any neutralities, the available width between Switzerland and Luxemburg was practically the same as it had been in 1870. The frontier had changed its position. It is true that Strassburg and Metz were comprised no longer in France but in Germany, and to that extent Germany had gained. But, apart from the fortresses, this frontier was only a conventional line, devoid of strategic interest. The space available for the deployment of the armies, and the distance in a straight line from one neutral frontier to the other, had not altered. Further, not all this space was equally utilizable; the Vosges region, for instance, which was very unsuitable for military operations, formed a large part of it. Thus if the available zone of the Franco-German frontier had seemed somewhat cramped even in 1870, it was far more so—and was becoming impossibly so—for the much larger armies of 1914. If the Germans violated no neutrality, it was out of their power to bring into play the *ensemble* of their attacking forces, and this fact gave to the French army—presumed to be numerically much inferior—an immense advantage. With its fortresses of Belfort, Épinal, Toul and Verdun, the French front of contact was very strong, and moreover, organized both to resist any brusque attack of the nature of a "bolt from the blue" and to enable the French army on mobilization to concentrate close up to the frontier without fear of being disturbed. Such, at any rate, was the adopted French view, though the experience of the war, which brought into play destructive engines of a power formerly unimagined, suggests grave doubts as to its accuracy.

In any case, it was clear that, if the Germans wished to obtain in a short time a success decisive enough to put France out of action, or at least to cripple her sufficiently to enable a large part of their forces to be sent against Russia, the violation of one or another national neutrality was a necessity for her—that of Switzerland if it was decided to envelop the French right, that of Belgium and of Luxemburg if the French left was to be the object of the manœuvre. It was not necessary to violate the neutralities of both flanks, but military opinion was divided as to which would be selected. Each had its partisans in the German General Staff, and neither possibility was ignored by the French. At first sight, the passage through Switzerland might seem the more difficult. But, examined more closely, it loses most of its difficulties. For, in effect, the operation would consist in slicing off such a corner of Switzerland as would give the necessary number of roads, railways and Rhine passages (which could, of course, be multiplied in the sequel). For this, the Jura region alone would be enough; and the Swiss forces, massed on the flank of the invaders, would be held in check by another army, presumably Austrian. For it must be borne in mind that the Swiss army could not have been mobilized and concentrated quickly enough to hold the line of the Rhine in sufficient strength to bar access, and that Switzerland possessed not a single fortress to support it. On the other hand, the probability of the Belgian route being the one chosen—as it was—was indicated by the systematic and prolonged German preparation of rail facilities on that front.

Thus, for many years, it had been regarded as certain that part of the German army of invasion would traverse either Belgium or Switzerland. But it was not possible to foresee the proportioning of forces that would be adopted by the Germans on the thus extended front, for the high development of their railway network, and the consequent flexibility of their concentration transports, gave every facility for changes of plan and variants. Further, it was naturally to be presumed that they would make efforts to secure in advance the agreement of the state whose territory they proposed to borrow, and the success or otherwise of these diplomatic moves would necessarily react on the proportioning of forces on the military front. And this was true whether the Germans sought by way of Belgium to reach Paris and deal France a mortal blow by capturing the capital, or by way of Switzerland to cut France in two. In either event, the French armies of the eastern frontier, once turned, would have no alternative but retreat.

The French General Staff naturally foresaw that, since the holding of Russia would devolve upon Austria, the French army would probably have to struggle alone against greatly superior German forces (possibly against a preponderance of almost 7 to 4, as previously stated). The first effort must be directed towards establishing a well-prepared and fortified front, proportioned to the forces available, and to locate this as near to the Alsace-Lorraine frontier, whence the enemy could launch a direct attack at any moment, as was possible without exposing the army to the risk of a surprise. In the next place, the possibilities of attack through both Belgium and Switzerland must be guarded against. To extend the line of battle sufficiently to secure both approaches, or even one of them, in an adequate manner, would involve such a weakening of the whole front as would enable the enemy to attack anywhere with a certainty of finding only a third to a quarter of the French forces against him. Any such plan was contrary to all the principles of war, and therefore unthinkable. A completely defensive line must extend from Dunkirk to the Vosges, the Donon, and thence, in order to guard the Swiss frontier as far as Bellegarde, to the Rhine; at the rate of one army corps to 7·5 km. of front, this line (750 km.) would require 100 army corps, without reckoning reserves, to secure it—or more than four times the whole of the numbers available. If the violation of Belgium could be taken as certain the Swiss frontier need not be considered; the line would then run from Belfort to Dunkirk, a length of 550 km.; but 73 army corps—more than the entire French army—would even so be required for its defence. However, if the French staff acted on this assumption, the German army would undoubtedly abandon the Belgian plan and advance through Switzerland; in which case the French army would be turned on the right in such a way that the forces sent to secure the northern frontier could not possibly arrive in time to stop the enemy from crossing the plains of the Saône and coming down into the basin of the Seine. Such a disposition was therefore impossible. The French force must occupy the centre of the line, in Alsace-Lorraine, which was the part most threatened, and be ready to oppose on the north or the south according to the enemy's decision. Accordingly, the following dispositions were made. They are the key to the whole of the first period of the war.

The choice of the first line of defence, to be held against direct attack, was determined by the necessity of fixing it at a sufficient distance from the fortress of Metz, the outer defences of which almost touched the frontier, so that the zone of action of the entrenched camp extended into French territory in the Woëvre plain, which could not be defended. The most advanced line of battle considered practicable was that of the Meuse slopes, which dominate the Woëvre and continue into the neighbourhood of Verdun. This accordingly became an entrenched camp, which had to be raised to the highest pitch of efficiency as a counter to Metz, the "loaded pistol pointed at the heart of France." The line of battle was based on Verdun, and, consolidated by forts constructed on the Meuse slopes, passed in its natural course through Toul and then through the good defensive positions afforded by the left slope of the valley of the Moselle. Between Épinal and Mirecourt these heights lay further from the river, and accordingly the French line drew away from Épinal to arrive at a hill called the Côte de Vivine. Thus the entrenched camp of Épinal, on the Moselle, lay in the advance of the battle-line, and enabled an offensive flank movement against the left of the enemy attack to be made under the protection of its artillery. Behind this first very solid line, which could be held by forces very inferior to those of the enemy, a whole series of positions were available in case of a retreat, in the valleys of the rivers flowing south and north.

The front being rendered secure from direct attack, there remained the question of the two flanks, in the event of an invasion by way of either Belgium or Switzerland. Facing the road from Switzerland there was a great concave arc of positions commanding the plain of the Saône and based on entrenched camps, *i.e.* Belfort, Épinal, Langres and Dijon. In front of these stood Besançon, in a position to divide and delay the invading stream. Facing the Belgium road, with Verdun, which acted as a sort of left shoulder, as the starting point, was a returning arc marked by the entrenched camps Reims, Laon and La Fère. In advance of these positions Maubeuge played a part corresponding to that of Besançon on the other side.

The enemy must take a certain line to traverse either of the neutral countries, even supposing that he met with no opposition. This would allow time for the French reserves to form, and for the first-line army to concentrate along the Verdun–Toul–Épinal line, to prepare positions facing N. on the left flank of an invader from Belgium or facing S. on the right of an invader from Switzerland, and to be ready to attack, in either event, at the favourable moment. Reason and prudence dictated these dispositions, in view of France's isolation, separated as she was from her Russian ally, and of the fact that Germany and Austria had the advantage of "interior lines."

The dimensions of the two flanks—from Verdun to Reims–Laon–La Fère, and from Belfort to Épinal–Langres–Dijon, respectively—were in accordance with the resources provided by the French recruiting laws in force for some years after 1872; but they had become insufficient for those given by the law of 1889, which greatly increased the military sacrifices demanded from the nation and added considerably to the war effectives. The result was that the flank facing an attack from Belgium, instead of ending at the Laon–La Fère system, which was becoming useless, was prolonged as far as Paris, which, as an immense fortified camp, must, by the mere fact of its presence, play a supremely important part, as was seen in 1914. Compared with this great entrenched camp, Reims itself was quite secondary. As for the other flank, it could be continued indefinitely beyond Dijon, by means of the formidable defensive positions provided by the mountains of the Côte-d'Or, which commanded the plains of the Saône. No new fortifications had been considered necessary. The line of battle opposed to Metz could also, because of the increased military resources, be prolonged N. of Verdun, still keeping the edge of the Meuse slopes up to Stenay and even beyond, so as to constitute a threat to the German right, on condition, however, that this right did not extend into Belgium. In the event of a turning movement by way of Belgium, the French left was not to go beyond the Verdun shoulder, and thence would trend away into a defensive, refused flank.

An alternative policy, that of entering Belgium and by reinforcement enabling the Belgians to hold the line of the Meuse, was the subject of a good deal of consideration in French military circles before the war. It involved, however, an extremely complex problem. The attitude of Belgium on the question of admitting French and British forces had been one of marked reserve, although there had been *pourparlers* at different times between the Belgian and the British authorities; and in fact it was not till Aug. 4 1914 that Belgium asked for the support of England, France and Russia, undertaking herself the defence of the fortified places. Yet, even had Belgium accepted British and French aid earlier and a united Allied front been formed along the Meuse, the strategic situation thus created would have been very difficult, owing to a cause which was operative whether the French advanced to the Belgian Meuse or not. The line of the Meuse runs N.–S. between Mézières and Maestricht, while the direction of the frontier between Mézières and the Vosges is substantially E.–W. A German concentration in the region Aachen–Trier would therefore occupy a zone midway between these two lines, and could act in the direction of either as circumstances dictated. Thus, whether the French army, flung northward, was to go as far as the Belgian Meuse or only to the French territory adjacent, was certainly a question of very great local significance, because the 300-km. line of defence from the angle to the sea, destitute of natural defences and weak in artificial, was distinctly inferior to the short, strong, well-fortified line Givet–Namur–Liége. But it did not alter the fact that the German forces concentrated between Aachen and Trier might, after perplexing the defence by demonstrations, fling their weight upon the line between Mézières and Verdun, break it by means of superior numbers, and so gain a position not only between the separated halves of the French but also nearer to Paris than either.

These conditions, together with Belgium's hesitating attitude, practically imposed the defensive principles upon which the French General Staff must proceed. Obscured as they were by the dramatic events of Aug. 1914,—by the glorious insistence of Belgium, the French offensives into Alsace, Lorraine, and the Ardennes, the tidal wave of the German I. and II. Armies traversing the Belgian plain and northern France,—it was nevertheless on these principles that the German effort was shipwrecked. For in Sept. 1914 the breakwater of the defence was established solidly on the line, marked substantially by the Vosges, the natural defences of Lorraine, the Côte de Meuse, Verdun, the Montagne de Reims and the advanced defences of Paris, which strategic reasoning had already indicated as the basic line of defence for France in the given conditions.

These conditions include other alternatives than the one selected by the Germans; and it may be asserted that, given the fact of Belgium's resistance and of England's intervention, the course taken by the Germans was—as against the alternative of a violation of Swiss neutrality, which would have occasioned much less concern to England than that of Belgium, and even as against that of a frontal forcing of the Lorraine defence, which perhaps was not as invulnerable as it was believed to be—the course which was the least disadvantageous for France.

(H. Be.)

The French "Plan 17."—The characteristic of all French plans of concentration up to those bearing the No. 16 was that they were all applications of the defensive principles outlined above, differing only in detail, and providing for an initial defensive phase of operations out of which an appropriate counter-offensive would arise when the occasion was ripe. From 1912 onwards, however, a new school of thought had begun to prevail in the French General Staff. The teachings of Colonel (afterwards General) Loiseau de Grandmaison, the constant improvement of the mobilization scheme in details, the sharper tone of policy and sentiment after the Agadir crisis, all combined to create a "younger school" in the staff which did not admit that the army was so inferior in power or war-readiness that the defensive need be assumed *a priori*, as had hitherto been the case. Military France, like the rest of military Europe, was caught by a wave of enthusiasm for the offensive *per se;* doctrines and text-books were revised, senior officers, and generalissimo-designate, having predilections, real or alleged, for the defensive, were got rid of; and as soon as it became clear that the process of mobilization and concentration had been sufficiently accelerated, "Plan 17" was drawn up, with the immediate general offensive in full force as its keynote.

"Plan 17," issued to commanders-designate of armies and their chief-of-staff in Feb. 1914, was based on certain assumptions which may be summarized as follows: On the right wing, the hypothesis of a German invasion through Switzerland was assumed to be so improbable that only an echelon of three reserve divisions, and these available for active operations towards Belfort, was allotted to that flank. On the left flank, the problem was far more delicate and difficult, as it depended on whether or not Belgian neutrality would be violated, and, if so, how far N. the right of the German forces would extend. It was involved with two other questions, that of the attitude of Belgium and that of the strength of the German army; neither of these was answered very definitely, and the assumptions of the plan proved substantially incorrect. Belgian aid was not counted upon—indeed, in one important detail provision was made for the case of the Belgians not interfering with a German march-through—and the German army for battle purposes was assumed to contain only some 20 or 21 active corps, the reserve divisions, it was thought, not being available till after an interval, and then only for subsidiary functions such as sieges and railway guarding. The conclusion drawn was that the German right, in case Belgian territory was taken in, would extend to the limit of the Ardennes —*i.e.* the Belgian Meuse—at the farthest, if as far. But the hypothesis of a frontal attempt of the Germans to break through between Longwy and the Vosges, without touching Belgian territory, was the basis of the plan; and the measures to be taken in case Luxemburg and the Belgian Ardennes came into the theatre of war were embodied in a "variant." It was supposed, in addition, that attempts might be made by the Germans in Lorraine or the Woëvre to break into the French concentration areas in the first days of hostilities; and a very strong protective system (drawn back in the Woëvre out of range of a sortie from the Metz outer defences) was provided against this emergency, the augmentations of the peace effectives brought about by the "Three Years Law" having made this possible. On to this protective system, constituted by one corps of each front-line army, the remaining corps were to graft themselves as they arrived, and the whole was to be ready for active operations on the 12th day of mobilization. It was assumed—correctly—that the Germans would attack, and—incorrectly—that their attack would be a simultaneous onset of fairly evenly distributed forces; and it was argued that a French offensive, debouching with startling rapidity, would create a situation with which the German military system was not elastic enough to deal.

These active operations, if Belgian territory remained untouched, were to be a general offensive of four armies with another immediately behind them, directed eastward from the Meuse below Verdun and northeastward from the Nancy–Vosges front, northward from Belfort; and, if Luxemburg and Belgium were infringed, an equally general offensive with all five armies in line, those of Alsace and Lorraine directed as before, but those of the Woëvre and the middle Meuse northeastward and even northward according to the positions found to be occupied by the German right. In either case the central army, besides helping its neighbours as required, was to drive back all sorties from Metz and begin the investment of that place.

The dispositions of the plan were as follows: The *I. Army* (five corps, two cavalry divisions and army artillery) was to attack with its main body from the concentration area west of the Vosges in the direction Baccarat–Saarburg–Saargemünd; the right, VII. Corps and a cavalry division based on Belfort, to advance into upper Alsace, rouse the population to a revolt, and hold as large a German force engaged as possible; between the VII. Corps and the main body, a smaller force in the Vosges was to maintain liaison and by descents into Alsace to coöperate with the advance from Belfort.

The *II. Army* (five corps, two cavalry divisions and army artillery), grouped initially about Nancy and Lunéville, on the left of the I., was to attack in the direction Château Salins–Saarbrücken. The improvised fortifications of Nancy in the first stage, and a group of reserve divisions issuing therefrom in the later stages, were to protect the left of this army against Metz; and the I. Army, developing its advance along the Vosges, was to guard the right, coöperating in the battle of the II. Army with all the forces not absorbed by the flank along the Vosges.

The *III. Army* (three corps, three reserve divisions, one cavalry division and army artillery) was to connect this "principal attack" in Lorraine with the other "principal attack" mentioned below, first by holding the Côte de Meuse between Verdun and Toul, next by repelling sorties from Metz and blocking up the west front of that fortress, and lastly by giving support to the attacks of the neighbouring armies.

The *V. Army* (five corps, two reserve divisions, one cavalry division and army artillery) had to deal with two alternatives, those of violation or non-violation of Belgian territory. In the latter case, it was to drive eastward from its concentration area N. of Verdun and the Argonne across the Meuse, dropping in its progress a flank-guard to watch the Belgian frontier; its objects were to defeat and drive northward all German forces encountered, and to storm or invest, according to circumstances, the fortifications of Thionville (Diedenhofen), guarded and assisted on its right by the III. Army. In the first alternative, it was to be so disposed that it could both attack northeastward on Neufchâteau and Florenville in the Ardennes, and guard its left rear with a special detachment.

The *IV. Army* (three corps, one cavalry division and army artillery), concentrated behind the III., was the general reserve. It was destined to be used either on the right or on the left of the III. Army according to which of the two "principal" attacks —Lorraine or Ardennes—needed additional weight. If the offensive of the V. Army was directed upon Neufchâteau and Florenville, the IV. Army was to come in between the V. and the III., and fight its way in the direction of Arlon. Behind the right were to be three reserve divisions, ready to follow up the VII. Corps and take over the guard of the Rhine as it advanced. Behind the left, but not definitely allocated to the V. Army, were to be three more reserve divisions about Vervins, with a somewhat indeterminate mission. A corps of several cavalry divisions was to form about Mézières in the first days of mobilization on the left of the protective system, and thereafter to operate eastward or northeastward into the Ardennes as required. Its supporting infantry was to occupy the bridges between Dinant and Namur if the Belgian Government did not do so.

This was the plan which was carried into effect when war came in August 1914. As early as Aug. 2, it was decided to act on the hypothesis of a German movement through the Belgian Ardennes, the seizure of Luxemburg by the German advanced guards on that day being a sufficiently suspicious indication. But during the following days the French General Headquarters were confronted with a mass of definite and indefinite information which it was hard indeed to appraise. On the protective line, apart from two severe local fights, at Mangiennes in the Woëvre and Lagarde in Lorraine—the first a French, the second a German victory—there were no events and no important indications. To the N. of the left flank, want of liaison, and, it must be added, of mutual confidence, made it difficult for the French to gauge exactly what the Belgian army would do, and especially what was happening at Liége. That fortress was attacked on Aug. 5, and its capture (*see* LIÉGE) was announced as a *fait accompli* on Aug. 7, yet for many days thereafter the gathering masses of the Germans between Aachen and the Ardennes seemed to make no move.

The British Expeditionary Force (four divisions and a cavalry division) was about to land in France, but it was not comprised in "Plan 17." A secret appendix to the plan, known to a few, provided for a hypothetical "Army W." landing from overseas and proceeding to the region of Valenciennes and Maubeuge, but the way in which this army (should it materialize) might best be employed could not be seen until the rôle of the French V. Army had become clearer. Meantime, it was to double the part of left echelon which was assigned to the French reserve formations about Vervins.

But meantime, the troop-trains were arriving in the concentration areas, and the broad "Plan 17" had to be replaced by an operation order "No. 1." On the morning of Aug. 8, therefore, General Joffre, general-in-chief of the "Armies of the North-East," issued his specific instructions.

The French Offensive.—The enemy, it seemed, had grouped his main forces in the region of Metz, in front of Thionville (Diedenhofen), and in Luxemburg, with some 12 divisions in Lorraine and Alsace and an undetermined force which included parts of 10 divisions in the Liége and Ardennes regions. This main force (Metz–Luxemburg) seemed to be pointing westward, but might equally well swing southward, pivoting on its fortifications. The French armies were, consequently, to take the offensive—which was to be as *foudroyante* as possible—and with all forces in combination to seek to bring the enemy to decisive battle, resting their right flank on the Rhine. In order to ensure simultaneity and unison in the battle effort, it was laid down that the left wing armies might have to hold back, so as not to become involved in battle with German masses traversing the southern Ardennes or northern Woëvre, or both, before the right wing had advanced and made effective contact with its opponents.

The *I. Army* (Gen. Dubail), composed as in "Plan 17," was, instead of merely coöperating with and flankguarding the II. (as in the plan), to become the main offensive element in Lorraine and Alsace. Its VII. Corps, with a cavalry division, was to break into upper Alsace at once from Belfort, to drive back all forces it met, and, progressively reinforced by the three reserve divisions from Vesoul, to gain ground towards the fortified barrier Strassburg–Molsheim, destroying bridges and blocking-up bridgeheads on the Rhine as it advanced. The main body of the army, with a frankly E.N.E. direction, was to push towards the front Fenestrange (Finstingen)–Saarburg–the Donon, and to drive back its opponents on Strassburg and into lower Alsace.

The *II. Army* (Gen. de Castelnau), composed as in the plan, was now to play the part of auxiliary to the I. Its first objective was to be the front Delme–Salins–Dieuze, and its axis Château Salins–Saarbrücken. It was to flankguard towards Metz, and, moreover, to leave two of its five corps in the region of Toul at General Joffre's disposal.

The *III. Army* (Gen. Ruffey), constituted as in the plan, was disposed in the Woëvre facing Metz, and was to be ready either to counter-attack any German forces emerging from the Metz region or to take the offensive northward, with its left on Damvillers, according to the situation. The two corps taken from Castelnau would probably be employed in concert with this army, either in repelling a counter-offensive from Metz or in a northward movement.

The rôles to be given to the *IV.* and *V. Armies* were now defined more precisely. The IV. (Gen. de Langle de Cary) was to group itself between Argonne and Meuse, and the V. Army (Gen. Lanrezac) to condense between Vouziers and Aubenton, ready either (*a*) to attack any German army which traversed the Meuse between Mézières and the line Damvillers–Montfaucon or (*b*) to cross the Meuse themselves for the Ardennes–Arlon offensive. The II. Corps, hitherto the left wing of the protective system and attached to the V. Army, was now added to the IV. Army and directed to hold firmly to the northern outliers of Verdun and the left flank of Ruffey's army. Beyond the flank of Lanrezac was the group of reserve divisions about Vervins; the cavalry corps operating E. of Mézières and Montmédy was expected, if and when forced back over the Meuse, to take positions about Marienburg and Chimay. The rôle of "Army W." was as yet quite unsettled, as also was that of the Belgians.

Such was the order which initiated the "Battle of the Frontiers," the opening of the World War on the western front. The intentions may be, and have been, criticized, but they are clear. The general offensive of the French right wing, fixed for the 12th day of mobilization (Aug. 14), was directed N.E. and E.N.E. into the Rhine lands behind Strassburg and Molsheim, with a subsidiary effort in Alsace which would make good a front facing Molsheim–Strassburg–Neu Breisach and the upper Rhine fortifications, and, in case of success bringing the I. Army to behind Strassburg, besiege that fortress. The general offensive of the left was to be timed to coincide with the decisive phase of the operations of the right, but placed according to the progress of the main enemy armies which were presumed to have their right flank not farther N. than Mézières and their left flank on or in the fortified region Metz–Thionville.

But the possibility of arranging for the whole system to take its time from Dubail was made doubtful by a geographical factor—the Meuse. Had the areas in which the IV. and V. Armies were to act formed a single region, it would have been different, but the critical question was how to get these two armies over the Meuse at the exact moment determined by events in Lorraine, which might also be the very moment at which the German masses from Luxemburg themselves arrived on the river. It was this disturbing factor, quite as much as any events to the N. of Mézières, which governed the development of the French scheme. The details of this development, so far as concerns the left wing, are extremely complex and must be studied in the documents reproduced in F. Engerand's *Briey*, Joffre's *Préparation de la guerre et conduite des opérations*, Lanrezac's *Le plan de campaigne français*, and the anonymous *Le Plan XVII.* (publ. Payot). Here only a summary can be given.

By Aug. 13, the eve of the day fixed originally for the general offensive, the order of Aug. 8 had ceased to apply integrally to the left wing. While Dubail and Castelnau were to advance on the front Donon–Saarburg–Saarbrücken, as previously indicated, and a new and stronger army of Alsace under Gen. Pau was to carry out that part of the scheme which the VII. Corps had just attempted with disastrous results (*see* FRONTIERS, BATTLES OF THE: section *Alsace*), Ruffey, de Langle de Cary and Lanrezac were directed according to a new scheme which was independent in time as well as place of operations in Lorraine. It was now clear that the German northern group was stronger than had been supposed, but the evidence of its intention to cross the Meuse above Liége and sweep round through the Belgian plain seemed less convincing than the probability of its descending southward, and the French Command, after much interchange of views with Lanrezac, decided to push part of the V. Army northward into the region W. of Givet as a defensive precaution, and with the remainder and the IV. and III. Armies to carry out a series of preparations which would suit either of two hypotheses. If the Germans moving westward through the Ardennes were well advanced, they were to be struck by an offensive against the front, flank and rear, as soon as they were thoroughly involved in the crossing of the Meuse; if, as now seemed more probable, they were grouped with greater density in the northern and northeastern parts of the Ardennes, there would still be time for the V. and IV. Armies to advance before battle, not only over the Meuse, but also over the Lemoy and the lower Chiers. In that event the III. Army, which, with various mobile forces belonging to Toul and Verdun and the corps of the II. Army reserved to the general-in-chief by the order of Aug. 8, could assemble a considerable force, was to divide into a defensive group facing Metz and an offensive group which would aim northward, conforming to the right of the IV. Army, which would make good the lower Chiers; while the V. Army, holding defensively on the Meuse at Givet, was to reach the front Beauraing–Gedinne–Paliseul–Cugnon.

On Aug. 14, the offensive in Lorraine opened. Its progress was slow, but not marked by any untoward incidents up to Aug. 19. It was independent of events to the left of the Moselle except in so far as sorties might emerge from the S. and S.E. fronts of Metz, against which contingency the defensive group of the III. Army, the two reserved corps near Toul, and the echeloned left wing of the II. Army, were an adequate safeguard. On the other wing, however, obscurity still prevailed. Though Lanrezac was becoming more and more uneasy as to his left flank, and the Belgians, standing on the Geete line, called for support, nothing positive as to the German dispositions revealed itself, but on the evening of the 15th the veil was, partly at least, torn away. The part of Lanrezac's army which was stationed in the angle of the Sambre and Meuse became engaged with a large force of the enemy at Dinant. This consisted in reality only of cavalry and light infantry, but was estimated by the French commander, Franchet d'Espérey, as an army corps at least. At the same time, information came in tending to show that the Germans in the Ardennes included sixteen divisions. Moreover, the impression was formed both by Franchet d'Espérey opposing them and by the French cavalry commander skirting their southern flank, that the Dinant Germans were flankguarding a much more considerable force engaged in passing the Meuse below Namur; and Lanrezac energetically insisted on the fact that such large enemy forces could not conceivably be intended to operate entirely on the right bank of the Meuse. A remarkable absence of troops, at the same time, was reported by the French aviators reconnoitring the Arlon region. Thereupon Joffre formed a new plan. The V. Army, except one corps (already attached to the IV.), and its two reserve divisions, reinforced by one of the reserve corps on the Moselle and by forces from Algeria, newly arrived, was to join the forces already in the angle of the Sambre and Meuse, and to coöperate with the Belgians and the British—both of which armies now for the first time figured in the scheme of operations—in attacking the front and outer flank of the German "northern" forces, while the IV. Army was to prepare to debouch from the front Sedan–Montmédy in the direction of Neufchâteau against the "southern" enemy group (formerly presumed to be the "main" one) advancing from Luxemburg on the front Sedan–Damvillers; and the offensive portion of the III. by Étain and Jametz, was to be ready to march on Longwy, to break into the rear of this force. But this manœuvre was merely sketched out by preparations, and next day the veil descended again. The supposed movement of German masses over the Belgian Meuse was unconfirmed, and indeed denied; and without for the moment devoting more attention to the details of the coöperation to be obtained between the three distinct and independent commands W. of the Meuse (especially as Sir John French indicated Aug. 21 as the earliest date at which the British could come into action), Joffre's headquarters merely sent the cavalry corps withdrawn from the Ardennes to get into touch with the right of the Belgian positions on the Geete and—as a precaution against minor inroads through the Belgian plain into the industrial region of Lille—began the transfer to Arras of some ill-equipped territorial divisions, which, under General D'Amade, had hitherto watched the Italian frontier. It was to the proposed offensive of the IV. and especially of the II. Army that Joffre devoted his principal attention. For, on the estimate which had been formed of the German strength—which, however, was radically incorrect because it ignored the presence of reserve corps in immediate proximity to active corps—it seemed to certain of the directing brains at Vitry-le-François that the more forces the Germans placed west of the Belgian Meuse the slighter would be the resistance to be expected about Neufchâteau and Longwy and the better the chances of cutting the enemy in two by the offensive directed on these points.

From day to day the situation developed without becoming quite clear (for the Germans veiled their dispositions with the utmost success), and Joffre held stubbornly to the conception of his Neufchâteau–Longwy offensive. Lanrezac's anxieties and those of the Belgians increased, but they served only to confirm the impression that the drive into the Ardennes would, if properly timed and directed, reap a great harvest; and the declaration of Sir John French that he would not be able to begin operations till Aug. 23, instead of Aug. 21, caused the scheme of a combined operation N. of the Sambre to recede still farther into the background. On Aug. 20, Joffre, estimating that all the German forces destined for the Meuse had by that time passed out of the region Audun-le-Roman, Arlon, Luxemburg, gave the orders which launched the IV. Army into the Ardennes and the III. on Virton and Longwy.

The period of *nuances* was at an end. On that very day, on the one flank, Dubail's and Castelnau's offensive, which had penetrated to Morhange, Saarburg and the Donon, met defeat (*see* FRONTIERS, BATTLES OF THE: section *Lorraine*). Castelnau drew back hastily towards Nancy–Lunéville; Dubail, in spite of the exposure of his long right flank in the Vosges (which Pau's methodical advance from Belfort had done little to shorten), took down his left more steadily; but almost in a moment both were back in their concentration areas, followed by the eager enemy. On the other flank, the German masses facing the Belgian army front, hitherto screened by their cavalry, had at last declared themselves on Aug. 18, and the Belgian army, threatened with separation from Antwerp, yet most unwilling to give up the expectation of British or French support on its S. flank, was falling back from one position to another. Its decision to close up northward and fall out of the main operations was, it must be recognized, put off to the last possible moment, but the disconnectedness of the Allied movements left no alternative. For at that date Sir John French was not ready; and in the angle of Sambre and Meuse, Lanrezac, a prey to new and not ill-founded anxieties regarding his liaison with de Langle de Cary, was, with Joffre's approval, standing fast till Aug. 23, the date British coöperation should arrive.

In spite of the anxieties and disappointments caused by these events, Joffre held firmly to his intention. On the morning of Aug. 21 the executive order for which the IV. and III. Armies were waiting was sent. For the situation was now clear, and the plan of breaking through between the German manœuvre-masses and their fixed pivot, which in one form or another had been consistently followed in the period of obscurity, seemed destined now to have its reward. But there was one fundamental miscalculation. The old error which had led the professional soldiers of Napoleon III.'s day to regard the Prussian citizen-army as a "sort of militia," had reappeared in the form of a contempt for "reserve" formations. It was a mere matter of calculation that Germany's resources permitted her to create such formations; but that they should figure in the *masse de choc* was regarded as incredible. Yet it was true; and thus, instead of meeting a battle-army of 42 to 50 divisions with an array of 73 French, 6 Belgian and 4 British, as anticipated, the Allies encountered in reality one of 77 divisions, *i.e.* an equivalent instead of a much inferior force. This was especially important as bearing on the prospects of success in the Neufchâteau and Arlon directions. Strength was encountered where weakness was expected, and the relatively small numerical superiority of the attack did not suffice.

The story of the battles of Longwy and the Ardennes, of Charleroi, and Mons, will be found in detail in the article FRONTIERS, BATTLES OF THE. Here it must suffice to say that the French offensive into the Ardennes and towards Virton–Longwy–Audun-le-Roman met with general failure, and in some places with disaster; that the German II. and I. Armies, swinging on Huy as a pivot, swept down upon the French V. Army at Charleroi and the British Expeditionary Force at Mons, and bore them back; and that on Aug. 25 at 22:00 hours (10 P.M.) Joffre's orders were issued for a general retreat. The German plan of campaign had prevailed, and the German Command had the initiative in its hands.

At this point, then, the story of the operations is most conveniently told from the point of view of that side which dictated their course.

The German Plan of Campaign.—For the Germans, a war against France was essentially part of a two-front war. The resources of the country not being equal to simultaneous offensives against France and Russia, the choice had to be made between (*a*) standing on the defensive against France while seeking a decision in battle in the East, (*b*) waging a defensive war on both fronts, and (*c*) striving to crush France while standing on the defensive in the East. Of these (*b*) was held to be excluded by the presumed impossibility, for an industrial state, of enduring a long war, as well as by obvious military objections; (*a*) was never completely excluded, and had until some ten years before the war been the fundamental war-plan of the German General Staff; while (*c*) had in those last years obtained general acceptance, owing to the difficulty, for Germany, of waiting till the slow-moving Russians could be brought to action and defeated in a battle of the first magnitude. Whether, in view of the increased strength of the defensive on the one hand and the increased war-readiness of Russia on the other, the adoption, once more, of alternative (*a*) was not the best policy for Germany in the circumstances of 1914, is an open question; but, in fact, (*c*) was maintained and carried into effect.

But this increased readiness of Russia made it imperative for the Germans to protect East Prussia by a force at least sufficient to offer a step-by-step defence of that province and also, with their main armies reduced to that extent, to obtain a decision of the war in the West at the earliest possible moment, so as to release the greater part of the forces which had gained it for service in the East. The proportioning of means to the two theatres, therefore, was a very difficult problem, admitting of many *a priori* solutions, which might bring either victory or ruin.

The solution that found most adherents was that of Count von Schlieffen, chief-of-staff of the German army, in the first years of the present century. On assuming office, he had both restudied the draft plans of campaign and the tactical doctrines in vogue, and he had come to these conclusions: (*a*) that an offensive of maximum power, carried so far as to put France out of action definitively, was the only way to secure freedom of action in the East; (*b*) that this offensive, to secure the result aimed at—nothing less would suffice—must be developed on so broad a front as to grip and out-wing the most northerly and the most westerly points of France's defensive dispositions; (*c*) that a maximum density must be sought for on the right wing, even at the cost of exposing Lorraine and the Rhine lands to invasion.

The first of these considerations led to the acceptance—contrary to all the traditions of the German army—of the principle that not only active, but reserve, Ersatz and every other category of soldier must be effectively used. Schlieffen even proposed an intimate mixture, practically an amalgamation, of active and other elements, and aimed at putting into the field—in case of a *single-front* war, it is true—no less than 114 divisions against France. The second consideration led to the idea of a swing through Belgium and northern France far wider than that which was actually carried out. The route of the outer flank, which in spite of its extension beyond all probable French defences was to have a defensive echelon following on, was to touch Dunkirk, Abbeville, Rouen and pass round by Chartres, far to the W. of Paris—which would be invested automatically—so as to march in upon Auxerre and Troyes from the east. The line Ghent–Maubeuge–Thionville was to be reached on the 22d and the line Amiens–Rethel–Thionville on the 31st day of mobilization; that is, not hurry but certainty and power were to be the executive rules.

The third consideration, however, led to an even more remarkable result than the second. Of the 114 divisions no fewer than 101 were to operate N. and W. of the Thionville pivot, Lorraine, Alsace and the Rhine lands being committed to 13, of which two were allocated to the fortresses. The *leitmotiv* of extreme density on the right occurs in all Schlieffen's drafts and schemes. "Macht mir nur den rechten Flügel stark" were his half-conscious dying words. In a second scheme, based on the *two-front* war, which provided for a defence force in East Prussia approximately equal to that which von Moltke actually placed there in 1914, the total force was lessened to that extent, but the ratio of about seven divisions N.W. of Thionville to one S.E. of that pivot was maintained.

When von Moltke, the younger, succeeded Schlieffen, the above plans were gradually blunted, first because the idea of making the active army a simple kernel for soldiers of all categories was accepted only in part, and secondly because the growing war-readiness of the French army, the fever of offensive spirit that had obviously seized it, and after 1913 its very high peace-strength, made it increasingly likely that the French would open the war with a determined offensive into Lorraine and the Rhine lands. In these circumstances so drastic a depletion of the forces to the left of Metz as that contemplated by Schlieffen did not commend itself to Moltke, who found a compromise in allocating one-quarter of the whole available force, instead of one-eighth, to the defensive (or defensive-offensive) front, and holding large quantities of empty rolling-stock on the Rhine in readiness to transfer a proportion of this quarter to the right wing as soon as circumstances should allow this to be done. The amplitude of the swing was, however, undeniably diminished thereby.

In one point, Schlieffen and Moltke were agreed—the necessity of pushing out beyond the line of the Belgian Meuse. In both schemes therefore the quick seizure of Liége and a deployment foreground beyond that fortress figured as an indispensable preliminary to the operations proper.

The German plan, to which effect was given in August 1914, provided as follows: (*a*) A protective system was formed all along the line, consisting, not as had been expected of complete formations, but of single brigades of infantry (with a proportion of other arms), brought up from their peace stations without waiting to receive and equip their reservists. These brigades took over from the local troops the positions of the line that their respective army corps were to occupy, and their reservists rejoined by parties. (*b*) There was a concentration of the remainder of each corps, after mobilization in the usual way, behind its own representatives in the protective system. This concentration of the active corps was completed by the 14th day of mobilization (Aug. 15). (*c*) Concentration of reserve corps, as a rule immediately behind or to a flank of the corresponding active corps, was completed by the 16th day (Aug. 17). (*d*) Concentration of other formations, Ersatz divisions and mixed Landwehr brigades, was completed from the 11th to the 17th day. (*e*) The six advanced, peace-strength brigades of the corps intended to assemble about Aachen were employed as a striking force under General von Emmich, which without waiting for siege artillery was to attempt to storm Liége at once, if the Belgians did not agree to let the Germans pass. The German ultimatum to Belgium was handed in late on the evening of Aug. 2 (1st day of mobilization), and required an answer within twelve hours. There is reason to believe that, on Belgium's refusal, a proposal was made to Holland to allow the use of the Maestricht tongue as a gateway into the Belgian plain, but, whether this be so or not, it was only on the evening of the 3rd day of mobilization that the striking force crossed the frontier.

The order of battle, and allocation of the German forces N. of the pivot, was as follows: I. Army (General-Oberst von Kluck), five corps, assembled behind the Maestricht tongue (Jülich–Krefeld area); II. Army (General-Oberst von Bülow), seven corps, including one attached from I. Army, assembled facing the Liége frontier (Aachen–Malmédy–Euskirchen); III. Army (General-Oberst von Hausen), four corps, assembled in the area St. Vith–Wittlich–Bittburg; IV. Army (Duke Albrecht of Württemberg), five corps, assembled in the area Luxemburg (seized Aug. 2)–Trier–Diekirch–Wadern; V. Army (Wilhelm, German Crown Prince), five corps, assembled in the area Metz–Thionville–Saarbrücken.

Thus twenty-six active and reserve corps (52 divisions)—with a number of Landwehr brigades to follow—were allocated to the five armies of the moving wing, of which nearly half were to cross the Meuse between Namur and the Dutch frontier as soon as the way was clear. The remainder were to traverse the Ardennes from E. to W. in echelon from the right (III. Army) and to prepare to wheel gradually S.W. in proportion to the progress of the I. and II. Armies on the other side of the Meuse.

The 2nd Cavalry Command was of three divisions in front of the I. and II. Armies; the 1st Cavalry Command of three divisions in front of the III.; the 4th Cavalry Command of two divisions in front of the IV. They were individually responsible to the Supreme Command, except when from time to time placed at the disposal of certain armies. Similarly, the armies were in principle directly subordinate to the Kaiser's headquarters, *i.e.* to General-Oberst von Moltke, Chief of the General Staff, unless temporarily paired, as was the case at the outset, with the I. and II. Armies, of which Bülow was in general charge.

The organization of the forces E. and S.E. of Metz was somewhat different. Rupprecht, Crown Prince of Bavaria, was appointed not only Chief of the VI. Army, but "Commander-in-Chief in the Rhine lands," a title with wider implications than that of an army commander, and his task included the protection of the left flank of "the Army" or "the main forces." He had under him his own VI. Army (five corps, of which four were Bavarian), the VII. Army of General-Oberst von Heeringen (three corps) and the 3rd Cavalry Command (three divisions), in addition to the war garrisons of Metz, Strassburg, and the upper Rhine defences (Neu Breisach, Istein). These 16 active and reserve divisions were to be supplemented a few days later by 6½ Ersatz divisions, and mixed Landwehr brigades, which were grouped in some cases in "Landwehr Commands."

In all, the formations assigned to the western theatre of war comprised 68 active and reserve divisions, 6½ Ersatz divisions, 17½ Landwehr brigades and 10 cavalry divisions.

The First Operations of the Germans.—The first operations to be carried out were: (1) The seizure of Liége and of as large a foreground as possible beyond; (2) the securing of the left flank of "the Army," and the attraction of as many French divisions as possible to Lorraine and Alsace, by the living and passive forces under Prince Rupprecht. Both these essentials having been provided for, the five armies (I.–V.) were to proceed at once to the main task, which was to be a great "wheel through Belgium into France, pivoting on Thionville–Metz," in which wheel the II. and I. Armies were to govern the pace. The II. Army was to swing on the arc Liége–Wavre, the I. following in echelon on the arc Tongres–Brussels, flankguarding towards Antwerp, whither, it was presumed, the Belgian field army would retire. No very distant objectives were fixed. When Liége and the region W. of the Meuse had been occupied, and the cavalry divisions of the I. Cavalry Command had fixed the situation of the Belgian army, of the British forces expected to land at Ostend, and of the French forces which might be pushed into Belgium from the S., specific orders could be given. Meanwhile, the problem was to deploy the two highly condensed armies of Kluck and Bülow on the W. side of the Meuse, in spite of Liége and of the Belgian field army. On this, as the I. and II. Armies were to give the time to the rest, the whole movement depended; but while the III., IV. and V. Armies awaited developments, the 2nd and 4th Cavalry Commands were to push through the Ardennes and towards Damvillers, in order to clear up the situation in the Meuse valley from Namur to St. Mihiel—a mission which naturally brought about a series of conflicts with the French cavalry, and, above Stenay, with the French protective infantry system in the Woëvre. In point of information, this cavalry activity probably yielded only confirmations of the obvious, but it was invaluable in veiling the army movements when later these were begun.

The Liége operation is described under LIÉGE. There was no surprise, Belgium having mobilized her available forces at an early date in the European crisis; and five out of six brigade attacks on the night of Aug. 5–6 failed. One, however, penetrated into Liége, and for some days neither the German nor the Belgian, British or French Commands seem to have been able to form a clear view of the situation, as the fort-ring held out. Reconnoitring patrols of the German 2nd Cavalry Command, which passed the Meuse near the Dutch frontier simultaneously with parts of the attacking force, learned nothing of the Belgian dispositions, and the main body remained near its bridge. On Aug. 8 the situation at Liége was clear enough to enable the cavalry to push westward, and in the days following it established the front of the Belgian field army as lying approximately on the Geete line from S. of Jodoigne to Diest. But on Aug. 12, the attempt of the Germans to work round to the left of this position was checked in a severe local action at Haelen. The Liége forts, meantime, had to be reduced by super-heavy siege artillery, one by one, and it was not till Aug. 15 that the masses of the German I. and II. armies were able to begin to cross into the area comprised between Liége and the Geete. The resistance of the Liége forts had put back the start of the great wheeling movement for four days.

Thus the difficult and essential preliminary operation of seizing a bridgehead beyond the Meuse did not pass off quite according to programme. It had often been alleged that the Germans had obtained a long start in their concentration by means of surreptitious mobilization. That this was not actually the case has been shown by a study published in 1920 by the Belgian General Staff; but even had such a mobilization taken place, it would not have helped to solve the problem of Liége. All that infantry could contribute to its solution, the first six peace-strength brigades contributed. The rest was a matter of siege artillery, and it must be regarded as a serious flaw in Moltke's plans that this artillery did not put in an appearance on Aug. 6 instead of on Aug. 10.

On the other flank, the operations in Lorraine and Alsace, which were to maintain the "pivot" of the wheel against French attack proceeded more favourably than had been anticipated—too favourably, as the sequel was to show. The problem was difficult, and *a priori* reasoning could not assist its solution materially. For here, much more than on the Belgian flank, events depended upon the independent will of a great enemy army which was equally capable of the offensive or of the defensive-offensive; and although the tendency of French military thought in the last years before the war had evidently been towards the former, it was not clear how far this tendency had actually gone. Prince Rupprecht's task included not only the maintenance of the Metz–Thionville pivot but the attraction of as large a force of the French as possible; and if their old policy of defensive-offensive still held good, then, in order to set up this attraction, he must attack. If not, although attack would not be necessary, a much larger proportion of the total force than that which Schlieffen had thought sufficient would have to be allotted to the front E. of Metz. For Schlieffen had reckoned with certainty on a defensive-offensive policy in his opponents, and had argued therefrom that no deep inroad of large forces into the Rhine lands would in fact be attempted by the French, when a tidal wave of seventy to a hundred German divisions was advancing through northeastern France. But the situation was quite different if the French offensive in full force was to be launched at the outset, while the tide in the N. was still dammed up. For these reasons, Prince Rupprecht was given about one-quarter of the total available forces, and instructed: (*a*) to take the offensive over the Lorraine frontier in order to draw upon himself as much as possible of the enemy's forces, in the event of these being handled according to the old policy; (*b*) to prepare a great defensive system, Metz–Lower Nied–Saar–Vosges–Strassburg, against the contingency of an immediate powerful offensive of the French; (*c*) in the latter event, to suspend the offensive initiated in accordance with (*a*), and to draw back from line to line till the Saar was reached, where a standing defence would be made in conjunction with counter-attack on the French left from the Metz–Nied system. In the least likely alternative of only minor forces of the French being met with in Lorraine, Prince Rupprecht might utilize the Metz system to cover the transfer of part of his forces W. of the Moselle for coöperation with the V. Army. Upper Alsace was to be held against light forces, but evacuated step by step if seriously invaded. The VI. Army with the 3rd Cavalry Command was assembled accordingly in Lorraine, the VII. Army (minus two expected Italian cavalry divisions) in Alsace; and mobilized and civil labour on a large scale was employed in creating the "Nied" position, which ran from where the newest Metz works touched that river to its mouth N.W. of Saarouis.

The French I. and II. Armies, ready for operations as soon as the Germans, spared the latter the necessity of testing their intentions by advancing on Aug. 14 in great force. Accordingly, the German VI. Army drew back from position to position, while the VII. Army, which had defeated the first inroad of the French VII. Corps at Mülhausen, likewise drew back gradually before the army of Pau, dispatching part of its forces by Zabern to the upper Saar to assist the VI. Army's defence, and preparing with the remainder to hold the line Schirmeck–Molsheim–Strassburg firmly. But this withdrawal, after making all preparations for the offensive in the first place, was only unwillingly and half-heartedly carried out by Rupprecht's headquarters. And when, on Aug. 17, news arrived from Moltke that the French advance into Lorraine was, after all, not their main offensive, Rupprecht determined to fight on the line of his rear-guards on Aug. 20. Thus, just at the moment when the French had decided to push their offensive without further hesitation, the Germans changed their policy into one of flank attack. The battles of Morhange (Mörchingen) and Saarburg followed (*see* FRONTIERS, BATTLES OF THE: section *Lorraine*), in which the Germans were victorious. A hot pursuit was initiated, and with that disappeared for the time being all possibility of drawing off any part of Prince Rupprecht's forces for the benefit of the " Army." Moltke's rolling-stock on the Rhine waited in vain. The Commander-in-Chief in the Rhine lands had brilliantly performed both his tasks, but he had become a commander of two ardent armies who could see only the enemy in front of him.

The German Advance through Belgium and France.—Once the Liége foreground had been secured, and the pivot of Thionville–Metz been made firm, there was no need, in Schlieffen's opinion, for overhaste in the development of the main operation, which required principally power. Moltke, on the other hand, sought to remedy the reduction of power on the striking wing by urging it to speed. This was not easy, for the administrative and technical marching arrangements required for drawing the five or six corps of the I. Army through the narrow tunnel between Liége and the Dutch frontier were complicated, while Bülow's II. Army displayed no great energy in crossing the Meuse above Liége. Thus the Belgian main army was left undisturbed on the Geete—the most forward position which it could safely adopt in view of the risk of being outflanked by a German movement through Dutch territory—till Aug. 19, when, threatened with severance from Antwerp, it began to retire westward with but little fighting. Even then, however, the task of the German I. Army was by no means clear. The possible arrival of a British Expeditionary Force on its outer flank was a standing menace, and until the true right flank of the system, Bülow's II. Army, had begun its advance in earnest its protective echelon (I. Army) could not operate to any purpose. On the evening of Aug. 19—the 18th day of mobilization—the outer flank of the wheel had only reached the line Thildonck–Tirlemont (I. Army)–Sart Ribsart–Mehaigne (II. Army), while the armies traversing the Ardennes were at Marche (III.) and Bastogne–Arlon (IV.) respectively. The V. Army was just beginning to draw out of the Thionville area towards Longwy. On Aug. 20, learning that a large French army had been assembled in the Charleroi region, Bülow prepared its encirclement by beginning to wheel-in not only the II. Army's right wing but the I. Army (then under his orders) as well; but as the coöperation of the III. Army moving on Dinant was intended, that army, as well as the I., had to be given time, and the concentric blow upon Lanrezac was fixed for Aug. 23, while the left wing of the II. Army was to attack Namur from both banks of the Meuse. Had these measures been carried out, the " vast wheeling movement " would, on the 22nd day of mobilization, have occupied the line Nivelles–Charleroi–Dinant–Neufchâteau–Arlon–Thionville instead of the line Ghent–E. front of Maubeuge–Sedan–Thionville, as Schlieffen had planned for that day. But the fact of being a few days in arrear was of small importance relatively to the fact that, instead of continuing to swing out, the German line would be beginning already to roll in. The essential principle of the movement, that of outflanking not only the momentary position, but also any and every position of the enemy's left wing, was sacrificed. The British Expeditionary Force, unlocated, lay outside instead of inside the scope of the wheel.

But during Aug. 20–23 events crowded upon one another at almost every point of the German line. The left wing of the II. Army stormed Namur, with the powerful aid of the super-heavy artillery (this time deployed from the outset), while the right became engaged front-to-front with Lanrezac (*see* FRONTIERS, BATTLES OF THE: section *Charleroi*). The I. Army, advancing in echelon to the battlefield indicated by Bülow, but seeking still to preserve both its rearward echelonment and its power of extending outwards, came into contact, with its left wing, with the British Expeditionary Force in the neighbourhood of Mons (*see* FRONTIERS, BATTLES OF THE: section *Mons*). Meanwhile, the German III. Army, drawing out of the W.S.W. direction in order to coöperate in the battle proposed for Aug. 23, had lost touch with the situation of Bülow's army (apparently through the neglect of the latter to keep Hausen posted as to events on the Sambre), and the IV. Army in the heart of the Ardennes had already begun to wheel forward and southward in order to protect Hausen's left when it received the full weight of the French IV. Army's offensive from the Chiers. Lastly, the V. Army, on which a defensive attitude was at first imposed by the Supreme Command, managed to convert its defensive, flushed by success in the battle of Longwy, into a flank offensive which threatened to create a gap between the five armies and the Thionville–Metz pivot, on which they were to wheel. (*See* FRONTIERS, BATTLES OF THE: section *Ardennes.*)

Thus, at almost every point, local situations and the initiative of army commanders and troops turned the smooth and regular tide into a series of eddies. On the German side, as on that of the Allies, the northern half of the battle of the Frontiers was a chain of fierce local battles which only a very strong Higher Command could take in hand, either to straighten the links or to reforge them in a different pattern.

From that point to the battle of the Marne, the contest is less between schemes, less even between armies, than between the capacities of the two Supreme Commands.

At the head of the German armies was a man in indifferent health, by nature kindly rather than insistent, one for whom responsibility was rather a burden than a source of strength. He carried, moreover, the strain of watching and attempting to direct affairs on the eastern front. His opponent was a different man and differently placed. Essentially authoritative in temperament, sound in health, and concerned with one task only, Joffre was a commander in the full sense where Moltke was a responsible adviser only. Leaving the details of planning to his staff, and in particular to General Berthelot, Joffre devoted himself entirely to the rôle of commanding. His personal activity in the days after the battle of the Frontiers is astonishing, but it is essentially of the moral and not the operative kind—deciding, encouraging, punishing—the rôle of King William I. in the war of 1870–1, and one which the Emperor William II. was unable to sustain in 1914. Add to the factors weighing against Moltke, the prestige and confidence of his army commanders, most of whom had won victories, none sustained defeat, whereas no French subordinate general had obtained an important tactical success, and it is evident that the higher control was necessarily firmer on the side of the French than on that of the Germans.

The prevailing impression on the German side after the battles along the frontiers was that a decisive victory *had* been won, and that the next phase was to be one of exploitation. The consequences of this impression, which soon penetrated to General Headquarters, were: (*a*) the decision to send six corps (two from each portion of the line) to the East Prussian front; (*b*) freedom of action granted to the V. Army to cut loose from contact with Thionville and join in the general pursuit by a movement round the N. of Verdun; (*c*) non-interference with Prince Rupprecht's pursuit in Lorraine; and (*d*) a new orientation of the I., II., III., IV. and V. Armies, which, abandoning the "wheel," were to advance in line in a general S.W. direction, with the I. Army heading for the lower Seine, the II. for Paris, the III. for Château-Thierry, the IV. for Epernay, and the V. for Vitry-le-François, the last-named flankguarding against Verdun and the first preserving a defensive echelon on its right.

The new orders were issued on Aug. 27, after the battle of Landrecies–Le Cateau had accounted for all undisclosed British forces and established the feebleness of the French cordon to the left of them, while the III. Army was well S. of Rocroi and the IV. bordered the Meuse from Sedan to Stenay. They were not executed with the certainty and confidence of an exploitation. The V. Army, in the act of letting go its connexion with Thionville–Metz, had on Aug. 25 exposed its left flank to a very sharp offensive of the defensive portion of the French III. Army now styled "Army of Lorraine," under General Maunoury, whose progress had been stopped only by orders from Paris. The French III. and IV. Armies, quickly rallied from their Ardennes–Longwy defeats, gave ground only slowly and with frequent counter-strokes (*see* FRONTIERS, BATTLES OF THE: section *Ardennes*), and the German III. Army was continually drawn southward, off its line of advance, to assist the IV. in real or supposed crises. Thus a great gap opened up between the III. Army and the II.; and the latter, uneasy as to its left flank, gradually drew away into a southerly direction, while Kluck's I. Army continued S.W. on Amiens. Almost immediately thereafter, the I. Army began to come into contact with French forces, distinctly superior in number and in quality from those hitherto met on this outer flank. While driving these back in various minor actions, and expanding ever westward in so doing, it was suddenly checked and caused to swerve southward by demands for assistance from the II. Army, which, unsupported on its left by the III., found itself counter-attacked, with a vigour that had not been observed since Charleroi, by Lanrezac (*see* GUISE, BATTLE OF). This crisis, like similar crises on a smaller scale in the area affecting the IV. and III. Armies, passed away after a time, but the disintegration of the German mass-movement had now reached a climax. Apart from regulating special questions between armies as they arose, the German Higher Command had not intervened in the conduct of operations since its instruction of Aug. 27. On the night of Aug. 31, the I. Army, in the vain hope of seizing the left flank of the British or of Lanrezac, had pushed its left far to the S. to the Aisne below Soissons, while its right was in the Lassigny hills and W. of Montdidier and even farther north. The II. Army had not progressed beyond the Guise–St. Quentin battlefield, its front facing due S. between Essigny-le-Grand and Vervins; the III. Army on the contrary was on the upper Aisne on both sides of Rethel, the IV. astride the northern Argonne between Semuy and Buzancy, the V. wrapping itself round the N. side of Verdun while still maintaining considerable forces in the Woëvre facing the E. front of that fortress, and the Côte de Meuse. Two corps had left for the eastern front, belonging not to the subsidiary armies in Lorraine but to the striking wing. One corps had been left to face the Belgians in Antwerp, one and a quarter corps to besiege Maubeuge, other detachments here and there to guard lines of communication or to invest small French forts such as Givet. The only new forces on their way to the West were the two divisions of the IX. Res. Corps and certain Ersatz brigades, all of which were needed to support the dangerously weak cordon of the III. Res. Corps facing Antwerp and to be on the spot in case of a Russian and British landing at Ostend, rumours of which at this time filled western Europe.

In Lorraine, the pursuit from the battlefields of Morhange and Saarburg had led the German VI. and VII. Armies in a southerly direction, substantially on Rambervillers and Charmes. Forced to condense into two main groups by the fort of Manonviller—a work condemned as useless by peace-time critics—and by the forest of Parroy, they had exposed their right flank to counter-attack by the restored army of Castelnau, which held the fortifications N. and E. of Nancy and the north flank of the so-called Trouée de Charmes. This French counter-stroke not only gravely imperilled Prince Rupprecht's army—for Manonviller resisted long enough to act as an anvil to Castelnau's hammer—but deprived the German Command in Lorraine of its initiative. With that loss, it forfeited all real power of holding larger French forces in its front; and though the German Supreme Command, in the same confident general instructions of Aug. 27 which initiated the southwestward pursuit of the I.–V. Armies, ordered the Bavarian Prince to break through the French line in the direction of Neufchâteau on the upper Meuse, it soon appeared that Joffre had the "inner line." He could take troops from Lorraine for other service, while his opponent could only continue costly holding attacks that did not hold.

On Sept. 1 the German Supreme Command gave up the conception of a general southwesterly pursuit, which, by its incidents, had not only lost its direction but brought the armies into a very irregular array and resumed the original conception of the wheel pivoting on Thionville, or rather, in the new situation, on the troops of the V. Army facing the N. side of Verdun. By now, however, with losses and detachments, the frontage of such a sweep was reduced by the front of a whole army, if not two armies. The appearance of French active and reserve forces N. of Paris made it clear that a protective echelon—such as had always been prescribed and rarely formed by the I. Army—would have to follow the rear of the army on the outer flank, and, moreover, the gap between the II. and III. Armies must be closed. The new general instructions, therefore, prescribed that the II. Army should steadily drive the French in a southeasterly direction, followed in echelon by the I., which was to watch Paris and break up the communications leading thither. But almost immediately after the I. Army, still well in advance of the II., received this order, one of its corps, exploiting a local advantage, crossed the Marne at Chézy and Château-Thierry, and Kluck determined to support it rather than withdraw it. The Supreme Command made no protest, all the more so as he reported evidences of real dissolution in the ranks of the retreating enemy. Kluck pushed on. The echelon facing Paris was maintained, but it was growing thinner and thinner. On Sept. 4 the Supreme Command, in increasing uneasiness, limited the offensive front still more. Not only was the I. Army to stand fast between the Oise and the Marne, but the II. Army was to wheel outwards and fill the space between the Marne and the upper Seine. The III. Army, now become the operating wing, was to march on Troyes and to the E. thereof, continuing in close liaison with the IV. and V. while the Lorraine armies were to renew their attempt to break through the upper Moselle front.

The final phases of the battle in Lorraine represent the endeavour of exhausted forces to carry out their part in this scheme. The central and western portion came to nothing, for although Kluck began at 23:00 hours (11 P.M.) on Sept. 5 to counter-march his army so as to fill the space between the Oise and the Marne, now guarded only by the last relic of his echelon, and Bülow gained ground between the Marne and the Seine as far as Montmirail and the marshes of St. Goud, General Joffre had, on the afternoon of Sept. 4, issued the command to his armies to face about and attack.

The Preparation of the Counter-Offensive.—While on the German side we see the battles of the frontiers followed by a high-spirited chase in which the driver was able to keep little more than the semblance of order in his team, on the French side the picture is one of an astonished and confused, but in no sense a routed citizen-army, too clear-sighted to believe itself betrayed and yet too ignorant of the ensemble to see where miscalculations had led to disaster. In the hands of one who had specialized in the art of inspiring confidence, whose silence even was imperturbable, and whose career had been spent not in technical subtleties of operations but in varied branches of administration, it had every chance of early recovery, provided that it was handled according to a definite policy and not exposed to incidents. This definite policy was laid down in a general order of Aug. 25, which began with the phrase: "As it has proved impossible to carry out the projected offensive, the next operations will be regulated so as to constitute on the left,—by means of the IV. and V. Armies, the British army, and new forces from the eastern front,—a mass capable of resuming the offensive while the others hold up the enemy for the required time." Following this cool and convincing statement, the detail paragraphs prescribe a retreat to the line Braye-sur-Somme–Ham for the British, to Vermand–Moy for the offensive portion of the V. Army, to La Fère–Laon–Craonne–St. Erme for the defensive wing of that army, to the middle Aisne for the IV. Army and to the Argonne–Verdun line for the III. "From this situation the offensive will be resumed," said the order. On the left of this line a barrage against cavalry inroads was to be formed between Picquigny and the sea, and either between Domart and Corbie or between Picquigny and Villers-Bretonneux there was to be formed a new army, soon to be designated the VI., and composed, as regards its staff and several of its divisions, of the troops which had just defeated the left of the German Crown Prince as it sidled past Étain. This was to be ready for action on Sept. 2, and the direction of its offensive would be either St. Pol–Arras or Arras–Bapaume, according to the position of the extreme right of the Germans. The British would attack on Bertincourt or Le Catelet, according to the situation, the V. Army wing on Bohain. The right of the V., the IV., and the III. were to defend the line laid down and eventually to attack from it. To the I. and II. Armies went the laconic instruction, "the rôle of these armies is, to endure."

But the pressure of the German pursuit in its first freshness did not admit of the British coming to a halt on the line ordered, and when the elements of the new VI. Army began to assemble about Amiens the battle had passed far to the south of them. Similarly, with the V. Army, the battle of Guise, which may be considered as a section of the proposed general offensive, led to small results because the British element was wanting on its outer flank. The controversies which have arisen as to the rapidity of the British retirement from the battlefield of Le Cateau to behind the Oise need not here be discussed, for it is more than doubtful in any case whether the state of the French army, in its ensemble on Aug. 31, justified the risk of incurring final defeat. Be this as it may, Joffre put aside all temptations to exploit the local successes at Guise on the Meuse, and in a new general order of Sept. 1 laid down that the VI. Army and the British having insufficiently checked the enemy's turning movement, the whole system must pivot about its right continuing to retreat, until the left of the V. Army should be free from the menace of envelopment. Then the armies would take the offensive, this time utilizing the position of the III. Army, protected by Verdun on the N. and the Côte de Meuse on the E., to strike the chief blow. The position from which the offensive would be resumed was now well back from Paris, which was to be left to itself (though Joffre suggested that its troops might coöperate in the general offensive), the V. Army behind the upper Seine (Nogent), the detachment Foch (IX. Army) and the IV. Army behind the Aube and S. of Vitry, the III. Army, augmented by defence troops borrowed from the Côte de Meuse and possibly by troops from the Lorraine front, N. of Bar-le-Duc. The British and the VI. Army were to constitute with Galliéni's local troops a Paris group which should hold the Seine from Melun to Juvisy, and the E. and N.E. fronts of Paris.

Thus was prepared the initial situation of the battle of the Marne. The scheme as outlined at first underwent many modifications, due to the ardent initiatives of Galliéni in Paris, and of Sarrail, commander of the III. Army, S. of Verdun, as well as to other causes. These are discussed in the article MARNE, BATTLE OF THE. Here it is not necessary to analyse too closely the form projected for the battle. Essentially, the fact to be retained by history is that a great army, in retreat after failure, could be energized, ordered to turn about, and launched to the attack, by a modern commander-in-chief whose influence must filter through a complex hierarchy before reaching the fighting soldier. Many had believed this to be an impossibility, and they were proved wrong. The operative scheme of the battle of the Marne and even its apparent barrenness of specific military results, are of insignificant importance compared with the fact that the battle of the Marne was actually fought. (X.)

The "Race to the Sea."—The establishment of the German defensive on the line of the Aisne, prolonged across the plain of Champagne, which ended the Marne battle, did not put an end to the Anglo-French offensive. The front between Compiègne and Verdun was stabilized here and there, but the battle of movement continued at the free extremity, that is, to the W. of Compiègne, and beyond. This new offensive has improperly been called the "Race to the Sea." In reality it was not a question of reaching the coast as quickly as possible, so as to obtain there an absolute protection against turning movements. If it had been so, the shortest line for the Allies, and the easiest to hold, would have been that of the Somme, from Compiègne to Montdidier and Amiens. To the estuary of the Somme, this line does not measure much more than 100 km., while the line from S. to N., which was that of the actual "Race to the Sea," ended N. of the Yser and was nearly double that length, presenting features of very various nature, among which some entirely lacked defensive value.

The truth is that the offensive, which was throughout the policy of the French Command, did not stop at the Marne victory. On Sept. 11, when the VI. Army (Maunoury) arrived at Compiègne, the Commander-in-Chief gave the order for this force to place immediately as many troops as possible on the right bank of the Oise. On Sept. 17 he indicated his plan by ordering the formation, on the left wing, of a force capable of parrying a flanking movement by the enemy as the best precaution to be taken. But Sir John French has stated that on the very next day (Sept. 18) General Joffre informed him that he was developing a new plan which aimed at attacking and enveloping the German right flank. The enemy, moreover, showed by his method of occupying the ground that the initiative no longer rested with him.

At the extreme end of the Allied line on the Oise the valley of the Aisne cleaves its way through a forest-clad massif, cutting it in two S. of the Aisne; the larger part of this mass consists of the forest of Compiègne and the northern part is the forest of Laigne. If the Germans, very skilled in turning forests to military account and manœuvring in them, had retained any hope of resuming the offensive against the Allied left flank, they would have occupied the forest of Compiègne in order to make it the starting point of their turning movement and force the Allied left to retreat towards Paris. But they abandoned that front; nor did they retain the forest of Laigne, on the plateau to the N. of Attichy. The offensive impulse in the World War was thus on the side of the Allies and they kept it until the fatal day of Russia's defeat on the eastern front. Until that time every attack which resulted in the gain of ground came from the Allies, who, save for a few occasions, methodically pushed back the enemy from one entrenched position to another. The Germans had later to defend their right flank, more and more threatened as it became more and more prolonged. And, as the best way of arresting the progress of the Allies would have been to strike at their offensive, they tried without ceasing to outflank them, while they were resisting in front.

Thus the "Race to the Sea," viewed as a whole, consisted in establishing an offensive Allied flank against the German right, and, this flank being always unsupported at one extremity, in German efforts to seize this extremity from two directions. These attempts, on either side, taking place farther and farther from Compiègne, appeared as a "Race to the Sea"; but in reality neither side was deliberately making for the coast. The S.–N. direction taken by the line of contact was not sought by either opponent; it resulted from the balance of forces.

It is evident that, whatever resources on either side were furnished by reserves and new formations, the extension of the front of contact over a length of 200 km. was only possible on condition of leaving much thinner forces on the stabilized front than had been required for the battle of movement, from Aug. 20 to Sept. 12. In proportion as the lines extended to the N., transferences took place, depleting the line from Belfort to Compiègne, as had already been done in the Vosges and in Lorraine, to enforce the regions where the struggle was being carried on in open country.

As regards such transferences, the advantage was with the Germans, because they occupied the interior of the angle whose apex points to Compiègne, while the Allied troops had to be moved around this point.

On the German side, the manœuvre brought 18 new army corps into the line. On the Allied side it resulted in the transference of the II. Army (de Castelnau) between the Oise and the Somme; the formation of the X. Army (Maud'huy), N. of the Somme, and the VIII. Army (d'Urbal), which included the Belgian army, brought back from Antwerp; and lastly in the shifting of the British army into Flanders. To these transfers and new creations must be added various formations constituted on the spot, of which the most important was a group of territorial divisions placed under the orders of General Brugère. Some of these formations had already joined in the offensive after the battle of the Marne, notably at Amiens, which they had cleared of the German units scattered through Picardy and Artois. This ensemble was placed under the command of General Foch, but was only brought to completion by degrees. The successive steps will now be described.

The first offensive action against the German right began on Sept. 11, in accordance with the order given by General Joffre. It was carried out by the VI. Army, with one additional corps on the right bank of the Oise. It immediately encountered energetic resistance on the Aronde, a small tributary prolonging the depression of the Aisne valley on the opposite side of the Oise. On the northern bank of this stream wooded heights extend between Compiègne, Lassigny and Noyon, and surround Ribécourt—names which all became famous during the war.

The VI. Army had a difficult task in the subduing of them, and could hardly have achieved it, threatened as it was with an attack in flank, without the help of the II. Army (de Castelnau), which, detraining in the Clermont–Beauvais area, had to cover 30 or 40 km. in order to outflank the German right. At the same time the cavalry and the territorial divisions of General Brugère extended the movement towards the north.

The resulting battles were prolonged until the end of Sept. with alternations of success and reverse, through Lassigny, Roye, and Chaulnes, as far as Péronne. From Péronne to Lassigny, where the wooded hills ceased, the terrain consisted of undulating plains, where no line of battle could be found. It was thus the balance of forces that determined the front of contact, which was gradually fortified on either side.

On Sept. 24 the French retook Péronne and lost it again. This little place, in a hollow, offering no possibility of outlook or of action outside its walls, had no military value. The positions which should have been occupied in the circumstances were the heights of the Somme above Péronne which formed a very considerable obstacle. The great value of this line, especially facing eastward, owing to the command of the country in that direction given by the heights, did not escape the German staff, and for a long time their efforts were directed towards preventing the Allies from securing the heights, by the defence of improvised fortifications, at some distance in front of them. Later it will be seen how these lines were linked up with that of the Ancre.

It will now be shown how, after the preliminary fighting, the German front became established between the Aisne and the Oise. A salient is always a weakness. The front was fixed from E. to W. along the Aisne; and the flank resolving itself into a new front running N. and S. the German line exhibited a right-angle salient pointing towards the forest of Laigne. It was very largely to smooth out this salient that the line was traced behind the forest in such a way as to form a great arc instead of a point. South of the portion of the line of the Somme between Péronne and Ham it was necessary to connect this arc with the fortified line S. of Péronne; the line Chaulnes–Roye–Lassigny was thus strongly indicated as the connecting line.

On Sept. 23 there was fighting near Lassigny, on Sept. 25 near Roye, and on Sept. 29 in the same places and also at Chaulnes, where the Allies were repulsed, as they were at the salient itself. On Oct. 1 the fighting-line extended to near Arras. It will be seen how it came to be fixed on the N. of Péronne.

The old fortress of Arras, which was no longer more than half fortified, but whose citadel had been maintained in good condition, was a *point d'appui* for the Allies. The interval, 40 km. wide, between Arras and the Somme, provided some features which were favourable to the establishment of a line. First, near Arras, there was the little valley of the Crinchon. The stream itself is unimportant, but its banks afford positions which are good in default of better ones. Next, a connecting line had to be ensured over about 15 km., from N. to S., across the undulating plateau, to the course of the Ancre, which forms a deep ravine both above and below Albert. The river bends in a S.W. direction as far as Corbie on the Somme.

Thus the line traced by the depression favourable to a line of resistance forms a series of zigzags: the Ancre near Albert, the Somme from Corbie to Péronne, the Somme from Péronne to Ham. It was because of this peculiarity that the Germans, when they were defending the line of the Ancre, opposite Albert, could not make use of the section of the Somme between Péronne and Ham, because it was 20 km. to the rear. Their solution consisted therefore of drawing a line through the Corbie salient, behind which lay Combles, transformed into a magazine and supply depot. This brought them in front of the section of the Somme between Péronne and Ham.

During the "Race to the Sea" the fighting round Albert and Arras (*see* ARTOIS, BATTLES IN) began at the end of Sept. and on Oct. 1 respectively. The X. French Army then came into the line. The Germans were already strongly entrenched on the Thiépval plateau, opposite Albert, where they were to pile up the defensive works which the British were to capture, one by one, two years later.

On Oct. 2–3 the X. Army (Maud'huy) made an effort to seize the German flank at its northern extremity by moving forward to Douai, where there had been for some time a detachment of the territorial army, which did not succeed in maintaining its hold. But the Germans opposed with heavy forces of infantry and cavalry. The French were pressed back; the enemy occupied Lens and made a vigorous but unsuccessful attack on Arras. For a long time afterwards the Allies' line left Lens in possession of the Germans, lying farther westward on a line from Arras towards Béthune. Arras was included indeed, but the important positions of Vimy and Notre Dame de Lorette, of which the Germans would not lose hold, were cut off. Their importance consisted in their facing N.E. and later their capture necessitated long and painful effort.

The German cavalry was in all the country which lay beyond in the N.; it occupied Ypres and Bailleul, and sent out patrols still farther forward. The situation was very difficult for the Allies, and its improvement was an urgent matter. The VIII. Army (d'Urbal) had its base at Dunkirk, but it was still inadequately constituted. The French cavalry and General Brugère's territorial divisions were maintaining an arduous and very fatiguing struggle. At that moment the British army, which could now be withdrawn from the Aisne, as that front was strong and solid and could be held by a small force, was summoned N. Reinforcements were also brought from the eastern area, and lastly the Belgian army, no longer of any use in Antwerp, came to take its place in the ensemble. The story of the siege of Antwerp and of the escape of the Belgian field army from the place is told under ANTWERP.

At the time of the fall of Antwerp Sir John French and General Joffre met at Doullens, on Oct. 8. The British II. Corps arrived on Oct. 12 near Béthune and Aire, and was able to attack the enemy's flank in a combined operation with the X. French Army. The III. Corps detrained at St. Omer on Oct. 12; the I. followed. Finally the IV. Corps, supporting the Belgian army in its retreat, would rejoin the rest.

It is evident that if the organization and transport of the new army corps which were to swell the forces of Sir John French had been accomplished more quickly, and the N. of France occupied earlier, that region would have been more easily freed from the enemy invasion, and the blow at his flank aimed at by the Command would have resulted instead of the "Race to the Sea." But it must not be forgotten that Great Britain created this new army *ab ovo*—a stupendous military effort—and that armies cannot be improvised. Until about Oct. 8, the Germans had only cavalry in the regions around to the north of Lille. It was then strengthened by the arrival of a strong army corps, which came from the neighbourhood of Antwerp by way of Courtrai.

The Lille Question.—On Oct. 8 the enemy arrived before Lille. The fortress closed its gates and resisted with the few troops that it possessed. The Germans did not trouble to attack it in earnest. They contented themselves with bombarding the town from a distance and demolished about a thousand houses. On Oct. 13, after five or six days of bombardment, Lille yielded. This short resistance was not useless, for it enabled the British army to take up its position behind Lille and to consolidate it. The question of Lille gave rise to much discussion in France. The arguments cannot be examined here, but a few words must nevertheless be said on the subject. If it had held out longer, it might have formed part of the battleline, like Reims, in which case it would inevitably have been destroyed, and with it the industrial towns of Roubaix and Tourcoing. Should the sacrifice have been made? The British front would have gained about 15 km. on the E. but the general line would have passed along the Yser on the N. and through Arras on the S. just the same. It would, moreover, have been difficult to find a good connecting line to link up Lille and Arras, across country very ill-adapted for defence, especially in the southern half. If the defence of Lille had been included in the general scheme of operations from the beginning, a very strong garrison must have been left there, proportional to the extent and number of works of the entrenched camp. It would have had to be an immobilized force whose task was to immobilize an enemy force also, as at Maubeuge. But it would not, any more than Maubeuge, have hindered the enemy's turning movement. Thus, to assume the resistance of Lille, until the arrival of the British army at the beginning of Oct., is to assume that it could have sustained a siege and bombardment from the last week in Aug. onwards—that is, for over 40 days. The fate of other isolated fortresses, such as Liége and Antwerp, leaves no doubt that this would have been impossible.

On Oct. 12 a junction was effected between the Belgian army, retreating towards Ypres with the French marine fusiliers, and the II. British Corps (General Smith-Dorrien) in the region between Béthune and Bailleul, along the canal and the Lys, while the III. Corps (General Pulteney) marched on the left of the II. towards the line running from Armentières to Ypres, to occupy the heights of Messines, later so fiercely disputed. On Oct. 13 the British cavalry, which held the left of the advance, took the heights which stretch between Cassel and Messines (Mont Noir, Mont des Cots, etc.) and which are of great military importance. On Oct. 14 the II. Corps entered Bailleul. The same day General Byng's cavalry division arrived at Ypres, with a French territorial division.

Definition of the Front of Contact.—Although the struggle never ceased and a great German offensive was immediately prepared in Belgium against the left of the line, at Ypres, on the Yser, the "Race to the Sea" must be considered to have ended on Oct. 15 1914, the date on which the Allies occupied the whole front from Ypres to the sea. At that date the left, on the Yser, was at Nieuport, and possessed a bridgehead at Lombartzyde in advance of the line of the river and near its mouth. The Yser front passed through Dixmude. To the S. of that town it is delimited partly by the course of the river, which spreads out like a fan a little farther to the S., partly by the Ypres canal, after passing the ancient fort of Krocke. Then it goes beyond the canal to the villages situated farther E. on the stream of the St. Jean, in order to arrive at the heights which surround the basin of the Yser and its tributaries, reaching them at Gheluvelt, on the road from Ypres to Menin. It held the crest and the heights as far as Messines. The French were on the left, from Nieuport to Dixmude; the English on the right, on either side of Ypres: the Belgians were between the two, their feeble effectives occupying only a small portion of the front.

From the beginning the Yser front was well selected and lent itself well to defence, not so much owing to the obstacle formed by the Yser, as because the country behind, much cut off by water-courses, was very ill-adapted for an offensive by large masses. At the same time, this part of the front, which was entirely defensive, had not its full value until it was flooded. The dykes were burst open on Oct. 22, the floods then gained ground little by little as they rose higher. The effect was not obtained very rapidly, because the whole volume of water in the basin is not great. It did not hinder the enemy from crossing the river below Dixmude on Oct. 26, and penetrating thence to a depth of 4 km. till he was stopped by the lines in the rear, and especially by the railway embankment. But two days later the Germans were forced to retreat, partly by the Allied counter-attacks, partly by the water, which was spreading and rising. The part of the line which passed in front of the Ypres canal near the little river St. Jean could not be made very solid, but it was necessary in order to form a link with the Gheluvelt heights. But the true line of battle, which overlooked a large stretch of country to the E., was only attained in the last phase of the war, with the capture of the entire line of heights in the direction of Staden, at least as far as Westroosebeke, the point where the ridge is crossed by the high road from Ypres to Ghent. Also, during the whole of the first period of the struggle, the British army was always very vigorously attacked around Ypres and at Ypres itself. The most important *point d'appui* was the portion of the heights lying directly to the S. of Ypres, Wytschaete and Messines,—that is, the eastern end of the line of the Monts de Flandre, which run from Messines to Cassel and appear again farther on to the N. of St. Omer. These hills are of immense importance in the whole defence of Flanders. This was seen in the last phase of the war, when they fell into the hands of the enemy as far as Bailleul, and it took very hard fighting and the greatest energy to arrest his progress in this direction and to stave off still more fatal consequences.

Between the promontory of Messines and the cliff formed by the heights of Notre Dame de Lorette and of Vimy, above the plain of Lens, stretched a sector with a front of nearly 50 km. which afforded no continuous line of any length, and included only isolated strong-points, sometimes in a position favourable to the Allies, sometimes to the enemy. Those most useful to the Allies were the ridges of Messines and Vimy. The first was taken by the Allies on Oct. 15 1914; the second was at first occupied by the French, and later their success was repeated by the British. The French front line passed 2 km. to the west of Notre Dame de Lorette, the key to the position. The attack on this point began on Oct. 20; but the conquest of the whole ridge necessitated efforts which were renewed up to the middle of April 1917.

In the plain, about midway between Messines and Arras, is a point relatively stronger than the rest, owing to the canals and marshes which protect its approaches. This is the little town of La Bassée, occupied and strongly fortified by the Germans; and for a long time it delayed the progress of the British army. The difficulty of the advance towards Vimy was very largely owing to the part played by La Bassée in preventing the British in the plain of Lens from taking part in it, in striking at the rear of all their attempts in the neighbourhood of Lens, especially those which aimed at outflanking the town on the north. But hard as were the local struggles in the Messines–Vimy sector, no great action ever developed there until 1918: first, because as regards an Allied action a great offensive in the direction of Lille would have been very risky unless it was led up to by a more strongly protected movement either to the S. in the region of Arras, Peronne and Ham, or in the N. towards Belgium; secondly, because as regards a German action, the sector to be conquered to carry out a flank offensive against the Allied left was that of Ypres and the Monts de Flandre.

Such was the real meaning of the German project *Nach Calais!*, which cost the army of William II. so dearly. For the Germans, to engage themselves in the Messines–Vimy sector, in order to reach St. Omer, would have been to run into the jaws of a pair of pinchers formed on the N. by the Monts de Flandre and on the S. by the ridge of Vimy–Notre Dame de Lorette, extending to the S. of Béthune and Brie. It would have meant the formation of a salient, which would be more vulnerable the farther it was pushed in the direction of Calais. The result of all this was that almost up to the end of the war the front passing through Armentières and Arras underwent very little change.

It has already been related how the front was determined first between Arras and Albert, then S. of Albert in front of the Somme between Péronne and Ham, and lastly as far as the salient opposite the forest of Laigne. The attack on this very strongly fortified part of the German front was only begun in the early part of Dec. 1914.

At that time the French still held Thiépval wood on the enemy slope of the Ancre. Farther S., some fluctuations occurred on the plateau, in the region of Chaulnes and Roye. But there was no great action other than the Anglo-French general offensive, which developed between July 1916 and March 1917.

All this leads to the conclusion that the last half of Oct. 1914 may be considered to mark the end of the "Race to the Sea," and the establishment of equilibrium, except for local fluctuations, along the whole length of the immense line of contact. (H. Be.)

II. Trench Warfare, 1915–17

While weary British troops were handing over their lines in the salient to their French comrades at the close of the first battle of Ypres (*see* Ypres and the Yser, Battles of) and they had time to think of other things than the grim struggle that had just ended, it dawned upon them that the war in the west had entered upon a new phase. The trench barrier had been completed from the North Sea to the Swiss frontier, and a war of movement and manœuvre, for which most of them had been trained, had become impossible. This was a development which had not been foreseen by the military world of Europe and it took it by surprise. For the Germans this surprise was less unpleasant in the winter of 1914–15 than for the French and the British. When their second great effort to win the war in the west had failed they had decided to adopt a defensive policy in France and Belgium while they attacked in the east. Therefore they could regard the difficulties of attack upon trench lines and the restrictions of manœuvre with some complacency, while they were better prepared for the new type of warfare than were either of their opponents, more particularly the British. The fortifications of the French and Russian frontiers had compelled the Germans to study closely the art and science of siege warfare and to make preparations for such warfare. They had assimilated the experiences of the Russo-Japanese War and had learnt from them to their profit. Therefore trench mortars, hand and rifle grenades, searchlights and pistol lights, and the possibilities of mining, were to them no novelty; and having the plant ready for the manufacture of the material required for siege warfare, and considerable stocks of such material already in store, it was not difficult for them to meet quickly the demands made by their soldiers in the trenches on the western front.

The British army was in very different case. Its chiefs before the war believed that it would be employed only in a war of movement, and the study of siege warfare had been confined to a small body of engineers, amongst whom it was largely theoretical. All the money to be found for the Army Votes had been used in the training and equipment of the Expeditionary Force, and there was none left for the provision of the material required for the attack of fortresses. The cost even of hand grenades, with which experiments had been made when the reports of British observers in Manchuria came home, was held to be prohibitive. For these reasons the winter of 1914–15 was for the British infantry in France and Flanders a period of unmitigated suffering. The ebb and flow of attack and defence had left the Germans almost everywhere along the British front in possession of the higher and drier ground, while in the low-lands of Flanders water was found at a few feet and even sometimes a few inches below the surface; under incessant rain, parapets melted away unless held up by sand-bags constantly replaced, but the British army had not sand-bags in sufficient quantities. The construction of communication trenches was all but impossible, and material had to be brought up to the front lines by parties floundering through the mud at night. Lying in sodden trenches, before an enemy who possessed weapons which they had not, the British infantry endured at this time a longer and in many respects a severer test of their constancy than in some of the worst crises of the war. The strain upon the French was less severe because a small part only of the French army had to endure the incomparable mud of Flanders, and from the first it was better provided with H.E. shell, while the greater military resources of France made it possible to meet the new conditions more readily.

Operations in 1915.—While the soldiers in front were enduring and slowly learning to mitigate the horrors of trench warfare, those behind were planning. There were not lacking active brains in Paris and in London who saw that the assaults upon the ever-widening barriers of barbed wire and the evermore serried lines of trenches must prove a slow and bloody business. These brains sought eagerly for a way round the barrier which would lead to a speedier and less costly victory, and so began the controversy between "Easterners" and "Westerners" which endured while the war lasted. There were signs early in 1915 of preparation for an Austro-German attack upon Serbia; and Mr. Lloyd George, inspired by his friends in France, proposed at once to save a weak Ally and to attack the weakest link in the opposing chain by transferring the bulk of the British army to the Balkans and reinforcing it with the New Armies as they became ready for the field. Both the French and the British commanders-in-chief hotly opposed this proposal. The lines of communication through Serbia were long and difficult, and it was very doubtful whether they could be made to maintain an adequate force. The transference of the British army to the Balkans must in any event have taken many months, during which it would have been condemned to an inactivity of which the enemy on the inside of the circle, with not only shorter but better communications, would certainly have profited. The Balkan enterprise was therefore condemned, and the immediate outcome of the controversy on the British side was the starting of the Dardanelles adventure.

Joffre's plan was simpler. He desired to attack on the western front at the earliest possible moment and with all possible force. It was argued at the time, and has repeatedly been argued since, that it would have been better to have awaited the development of the British army and the increase of the Allied artillery and the improvement of their stock of munitions, and to have employed the interval in gaining advantages over less formidable foes in other theatres of war. To these arguments Joffre's answer was that the Germans were in occupation of a great part of France, that near Noyon they were only 50 miles from Paris, on the Somme they were barely 20 miles from Amiens, the main junction connecting the British and French in Flanders and Artois with the remainder of the French troops, while farther N. they were little more than 40 miles from Calais. At the beginning of 1915 he was assured of a definite numerical superiority over the Germans in the W., but the Germans had not nearly reached the limits of their man-power, and they might at any time call a halt on the Russian front, and by reversing the process which they had carried out after the first battle of Ypres bring back troops to France. A successful German attack at any one of a number of parts of the western front might gravely cripple the Allied armies, for German guns might be brought up to within range of Paris or of Calais, or the enemy might again occupy Amiens. The French commander-in-chief maintained that the security of the western front must be a paramount consideration in Allied strategy, and that to secure the position in the W. it was necessary to drive the Germans farther back.

Sir John French was in general agreement with Joffre's views. He at first desired a combined naval and military attack upon the coast of Belgium, but on receiving representations from Lord Kitchener that neither the men nor the munitions required for this operation could be made ready in time, he abandoned this proposal and set himself whole-heartedly to coöperate in Joffre's plans. These plans comprised a grand attack by the British army N. of the La Bassée canal and by the French northern group of armies under Foch on the front between the La Bassée canal and Arras. The hope was that this attack would give the Allies the Vimy Ridge and compel the Germans to evacuate Lille. In order that Foch might have the forces necessary for such a battle it was agreed between the commanders-in-chief that the British should relieve the French troops, who had occupied the Ypres salient when Haig's men had been withdrawn from it after the first battle of Ypres. Sir John French had at the end of 1914 received one more regular British division, the 27th, made up by Kitchener from foreign garrisons, while another, the 28th, arrived early in January. The 1st Canadian

Div. disembarked in France in the second week of February. This gave him a total of 13 infantry and 5 cavalry divisions, besides a number of selected territorial battalions. These reinforcements allowed him to form his command into two armies, the first under Sir Douglas Haig and the second under Sir Horace Smith-Dorrien, and at the same time to extend his front gradually N. into the Ypres salient.

A further integral part of the preparation for the spring campaign consisted of a number of attacks intended to divert the enemy's attention from the Artois front and to gain experience in the tactics of trench warfare. One of these attacks was carried out by the French during the winter against the salient of St. Mihiel, when they learnt that the position (which appears from a map to be almost untenable) could with the aid of trenches and barbed wire be made very formidable. Other attacks were made in Champagne on either side of the Perto and in Flanders. In the latter of these British troops coöperated by a minor attack opposite Wytschaete, which had very little success. In fact on the whole the Germans gained the chief success in this preliminary sparring, for in the middle of Jan. 1915 they made an attack upon the lines which had been held during the battle of the Aisne by the British army, N. of that river near Soissons, and drove the French back to the S. bank.

The British army, which like other European armies, had been trained to believe in the supreme virtue of attack, had since the beginning of the war, with the exception of the short period of the advance to the Marne and the Aisne, been compelled to fight defensively, and Sir John French desired to give it a wider experience of attack upon entrenchments. For this purpose he had been carefully saving up artillery ammunition by strictly limiting the amount to be expended in the routine of trench warfare, and he calculated that he would have sufficient at his disposal to allow him to engage in a considerable battle early in March. He entrusted the execution of this battle to Sir Douglas Haig's I. Army, which was directed to attack the German lines near Neuve Chapelle, an operation which it was hoped would result in a favourable position for the further battle which was to be undertaken later in coöperation with Foch. The battle of Neuve Chapelle opened on Mar. 10 with what was in those days held to be a very heavy bombardment. This bombardment was followed by an infantry assault, which was at first successful, and carried the village of Neuve Chapelle, but was soon brought to a standstill by the enemy's machine-guns. In this battle the British first experienced the difficulty of bringing up reserves at the right time through roads blocked by the débris of battle and over ground scarred by trenches and torn by shell-fire. On the whole, however, both the French and the British were impressed by the result of the bombardment, which was held to promise great things when there should be more guns and more ammunition. Preparations for further battles therefore went forward.

The Germans, guessing what was on foot, were not slow to interfere with these preparations. On April 17 a portion of Smith-Dorrien's II. Army attacked and gained a footing upon Hill 60, an important feature on the S. face of the Ypres salient. The Germans, counter-attacking, promptly regained possession of the hill and followed up this success by a far more serious enterprise on April 22. By then Foch's preparations for the attack on the Vimy Ridge were far advanced, and to obtain the troops he needed for the coming battle he had greatly weakened the French forces left in the N. portion of the Ypres salient. Against this portion the Germans launched waves of poison gas discharged from cylinders, which completely overwhelmed the French troops, who had no protection against this utterly unexpected barbarity. The flank of the 1st Canadian Div. was completely exposed, and for a short time a definite breach was created in the Allied line. Fortunately the Germans were unprepared for the extent of their success, and had not the troops at hand to take immediate advantage of it, while the gallantry of the 1st Canadian Div. and the 28th Div. held the enemy at bay until reinforcements could be brought up. The first complete British territorial division to arrive in France, the 46th North Midland Div., was fortunately in the neighbourhood, and these and other reinforcements, some contributed by Foch from the reserves he was holding in readiness for his battle, sufficed to save Ypres and to patch up a new line.

But the second battle of Ypres, if it did not give the Germans all the success they might have attained had they been ready to follow up the first success gained by the employment of a method of attack which no civilized nation had conceived to be possible in modern war, at least gained a great part of their purpose by weakening the forces and exhausting the meagre supply of ammunition which the Allies were accumulating for their projected battle.

That battle began on May 9 with an attack by the I. British Army under Sir Douglas Haig on either side of Fromelles, and an attack by the I. French Army, commanded by General d'Urbal but under the direction of Foch, on a much wider front which extended from the Scarpe to the N. of the Souchez. The British attack made very little progress and it was soon evident that the preliminary bombardment had not sufficed to destroy sufficiently the enemy's defences, or, what was of greater importance, to overcome his machine-guns. Sir John French, however, felt himself bound by his agreement with Joffre and Foch to keep the enemy occupied on his front as long as possible, and the battle of Fromelles became merged in the battle of Festubert by bringing the front of attack slightly S. into what it was hoped would prove more favourable ground. The experience of Festubert was, however, hardly more favourable than that of Fromelles, for again the German machine-gunners checked all real progress, while the lack of artillery ammunition became more and more felt. The situation was made more difficult in this latter respect by renewed German attacks in the Ypres salient upon the II. Army, now under the command of Sir Herbert Plumer. The situation of the British army in Flanders was somewhat eased by the arrival of five more divisions of territorials, followed by the first of the New Army divisions, the 9th, but it was lack of shell rather than lack of men which forced Sir John French to stop his attacks, and the battle of Festubert petered out on May 25.

Meanwhile, on the British right, Foch was making encouraging if slow and very costly progress. In the battle of Souchez the villages of Ablain St. Nazaire, Carency, Neuville St. Vaast and Thélus were carried by d'Urbal's men, who fought their way doggedly up the W. slopes of the Vimy Ridge. The French found the German machine-guns to be the chief obstacle to progress and the prime cause of casualties, particularly in the villages, in which the enemy's machine-gunners fought indomitably from cellar to cellar and in a certain elaborate series of works which became known to fame as the Labyrinth. The French had by this time embodied the flower of the manhood of the nation in their army, and the splendid gallantry with which Foch's regiments fought their way forward in the battle of Souchez, enduring tremendous losses but ever gaining ground, if only at the rate of a score or two of yards per day, towards the crest of the Vimy Ridge, was never surpassed in the whole long war. When the British ceased their attacks on May 25, Foch had made enough headway to encourage him to believe that he could gain the whole ridge, and he determined to continue the battle alone. But for this he wanted more troops, and an extension of the British front, which would set free Frenchmen, while both he and Joffre were fearful lest the New Army divisions preparing to leave England should be sent to the Dardanelles. The French commander-in-chief therefore wrote, at the end of May, a letter to Kitchener which contains the key to the developments of the following months. It ran as follows:—

> "The retreat of the Russian army, consequent upon the temporary failure of its offensive, will doubtless allow the Central Powers to withdraw, at least for a time, a certain number of army corps which they will be able to use on another front, but it is probable that the greater part of these will be required to meet the situation created by the entry of Italy into the war.[1] The situation of the Russians, who will be for some time to come unable to undertake a decisive offensive, and the difficulties of ground which the Italian

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[1] The Italian troops crossed the frontier at midnight May 24–25.

theatre of war presents until the Italian armies are able to debouch into the plains, show clearly that the principal effort of the Allies must be made in France. The developments of Arras[1] have proved that it is tactically possible to break the German front, but that for success an even more powerful effort is required, and that it is necessary to attack simultaneously at a number of points. France has at the present time 2,200,000 men engaged on her N.E. front and has reached the limits of her man-power. She can maintain her armies at their actual figure but she cannot increase them. The solution of the problem is then in the hands of England. If she sends us her New Armies we shall be able to make not only an English and a French effort but an English effort and two French efforts simultaneously at the most favourable moment and with great power. The British forces, reinforced by the New Armies, will be given zones of operation proportionate with their strength. They will retain their present zone, extending it on both flanks to the N. of Ypres and to the S. of La Bassée canal, and they will take over the zone to the S. of Arras towards the Somme. They will thus lie on either side of the French X. Army, which will hold the front of attack which it has organized. The alternation of French and British troops has always given the best results. The principal effort of the English armies will be directed between the left of the French X. Army and the La Bassée canal and will extend to the N. of the canal; thus it will be linked up with the French attack in the neighbourhood of Arras.

"Of course, if the Germans are compelled to fall back before all the British forces are in line, their whole strength will be directed towards exploiting the success won in the direction of Antwerp and of Brussels. We owe it to ourselves and to our Allies to make a great effort now. It is therefore at the present time of the highest importance that the New British Armies should be dispatched as rapidly as possible and at dates and under conditions fixed beforehand, so that definite plans of operations may be drawn up in agreement by the two commanders-in-chief. I am firmly convinced that our action will be decisive, if it is combined and coördinated."

This letter shows that Joffre had not, at the end of May, much hope that Foch would capture the Vimy Ridge, but the latter's fiery spirit would not permit him to admit failure while the prize seemed to be within his grasp, and he persuaded the commander-in-chief to let him continue the battle. So the battle of Souchez, which had begun on May 9, dragged on until July 13. Twice Foch's men won their way to the crest of the ridge, only to be driven back, and at last Joffre called a halt and decided to prepare for the greater effort of which he had written to Kitchener. In that letter Joffre had indicated that he proposed to renew the attempts on the Arras front to take the Vimy Ridge, while the British army fought on the left of the French X. Army, but he had said nothing about the second French effort. This he designed to be the principal blow to be delivered in Champagne, to the E. of Reims. To obtain the French troops for this campaign he required the British army to extend its front to the right and left, and also to relieve de Castelnau's VI. Army on the Somme front. The remainder of the summer was occupied by these changes, which became possible as the New Army divisions arrived from England. The 2nd and 3rd of these reached France, disembarked at the end of May, and 6 more before the end of July, so that by then the 4 divisions and the cavalry division of Mons had in 11 months increased to 28 divisions and 5 cavalry divisions. These reinforcements enabled a British III. Army to be formed under Sir Charles Monro, which took over some 17 miles of front from a point to the S. of Arras as far as the Somme, eventually extending its lines to the S. of that river. Haig's I. Army prolonged its right S. of the La Bassée canal to the neighbourhood of Lens, and thus found itself facing the open plain of Loos, while Plumer's II. Army relieved the remaining French troops in the Ypres salient and brought its left into contact with the right of the Belgians.

While these movements were in progress, vast preparations were taking place on the battle-front. Guns, trench mortars, shells and military stores of all kinds had accumulated in hitherto undreamt-of quantities. Joffre and his staff had it in their minds at this time that they were engaged in operations in the nature of a huge siege, and that the essential was to blow a practicable breach in the enemy's lines through which the infantry could be poured to the assault. A study of the previous battles of trench warfare had convinced them that with sufficient guns and sufficient ammunition this was possible. The output of the French factories had been increased enormously, and though the British Ministry of Munitions had hardly yet begun to be productive, still the supply of heavy guns and shells for the British army had been greatly increased and it was equipped to reply effectively to the German gas. For these reasons the hopes which Joffre had expressed in his letter to Kitchener were very generally shared in the Allied armies. The one fly in the ointment was that there had been a renewal in the British Cabinet of the controversy between the "Easterners" and the "Westerners" and Mr. Churchill had pressed with all his eloquence and skill for a decisive campaign which should open the road to Constantinople. The result was a compromise, and three of the New Army divisions had gone to the East. Some compensation for this was obtained by the arrival of two more New Army divisions in France, and by the formation of a Guards' division, which had been made possible by the creation of new battalions of Guards and the replacement of those already in France by other battalions. This gave Sir John French an additional army corps, which he kept in his hands as a reserve.

Joffre opened his autumn campaign on Sept. 25. In addition to his great attack in Champagne, Foch with the French X. Army attempted once more to storm the Vimy Ridge, while Haig's I. Army attacked between the La Bassée canal and Lens, in conjunction with a secondary British attack to the N. of the canal and demonstrations on the front near Armentières. The general plan of the N. battle was that Foch, having carried the Vimy Ridge, should advance E. to the S. of Lens, while Haig pushed E. through Loos to the N. of Lens and joined hands with Foch beyond that town. In this way the Allies would avoid the mass of ruined buildings and miners' cottages which composed the town and would form admirable refuges for the German machine-gunners. The tactical methods to be employed on both the S. and N. battlefields were similar in conception, that is to say, there was to be a great rush forward of the assaulting infantry as soon as the attack had been adequately prepared by the artillery, and the reserves were to follow hard after the first-line troops. Only in the matter of the preparation of the attack was there any essential difference in the methods to be employed by the British and the French. The former had determined to replace an intense bombardment by a discharge of gas from cylinders similar to that from which they had suffered in the second battle of Ypres.

Of the British share in the general plan, the demonstrations in front of Armentières proved quite ineffective, while the attack N. of the La Bassée canal failed. On the front opposite Loos, however, the discharge of gas surprised the Germans and overcame the resistance of their first-line troops, though it caused some casualties among the British themselves and made it difficult to direct the attack. Despite this, the first wave of British infantry passed through and beyond Loos, when it appeared that they only needed the prompt arrival of the reserves to secure a very considerable success. Sir John French had, however, kept these back until he saw how the battle progressed, and when they arrived late in the evening the New Army division which formed two-thirds of the reserve found great difficulty in making their way through the confusion of the battlefield under conditions entirely strange to them, and were unable to confirm the first success won, so that, though Loos was held, German counter-attacks recovered a considerable part of the ground gained, and in particular the important Hill 70, which dominates Loos on the north. Worse still, Foch's attack on the Vimy Ridge failed almost completely and the Germans remained in possession of the crest. This alone condemned the N. attack to failure, for the British front of battle was not large enough to insure a breach in the enemy's defences sufficiently wide to be exploited successfully. The remainder of the battle of Loos, which lasted until Oct. 15, resolved itself into the repulse of a number of fierce German counter-attacks, which ended in mutual exhaustion, with the British in possession of the salient extending round Lens to the La Bassée canal.

The great battle in Champagne was an even more severe disappointment, because more had been expected. The first news from the field aroused high hopes. The first two German lines of defence were carried on a wide front, and many prisoners and guns were captured, while on the fourth day of the battle the third German line, which was believed to be the enemy's last system of defence, was for a time breached near Sainte Marie; but again the solution of the problem of bringing up reserves at the right time and in good order was not found, while the enemy's reserves, which came up fresh through country which had not been fought over, arrived in time to fill the breach. The battle of Champagne ran on into Nov., developing into a series of struggles for tactical points of importance, but ended with no material change in the position won by the French at the end of the fourth day of the battle.

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[1] The battle of Souchez.

So the campaign of 1915 closed on the western front, with the Allies still asking themselves how it was possible to get through the trench barrier and drive the Germans from France and Belgium. The great bombardment followed by the assault in mass had failed, and some other method of attack was required.

Ere the year closed a new problem had developed in the Near East, which had its repercussion on the western front. German, Austrian and Bulgarian forces had overrun Serbia, and the Allied Governments had decided to send a relief expedition to Salonika. Part of the troops required for this new enterprise came from the Dardanelles, but more were needed and these had to be supplied from the western front. Five divisions of French troops under the command of General Sarrail were ordered off, and were accompanied by the three British divisions of the III. Army which had been holding the line S. of the Somme, the 27th, 28th, and 22nd. It was also decided to spare the two divisions of Indian infantry which had proved such a timely reinforcement at the time of the first battle of Ypres, the horrors of another winter of trench warfare in Flanders, and they were sent off to Mesopotamia. This reduction of the British army was made good by the arrival in France before the end of the year of the 2nd and 3rd Canadian Divs. and the 16th Irish Div., and of the 21st, 23rd, 24th, 25th, 26th, 36th and 38th New Army Divs., so that the strength of the British army in France and Belgium stood at 36 divisions and 5 cavalry divisions, a combatant strength of about 750,000 men. The Allies on the western front had therefore at this time about 3,100,000 men, opposed to 2,000,000 Germans. These figures gave rise to anxious discussion as to what superiority of numbers was necessary to ensure success under conditions of trench warfare, and whether and how the Allies could obtain the necessary superiority.

While these discussions were going on important changes took place in the Allied Command. Joffre had hitherto been nominally chief of the French General Staff. He was now definitely appointed commander-in-chief of the armies of the N.E., with de Castelnau as his chief-of-staff. In the British army Sir John French was brought home to command the troops in Great Britain and was succeeded by Sir Douglas Haig, with General Kiggell as his chief-of-staff, while Sir William Robertson, who had been chief-of-staff to French, became chief of the Imperial General Staff at the War Office.

Operations in 1916.—In Dec. 1915 the first serious attempts to obtain unity of action between the Allies took place, and a conference of commanders-in-chief and chiefs-of-staff of the British, French, Belgian, and Italian armies, attended also by representatives of the Russian and Japanese armies, was held at Joffre's headquarters. At this conference it was agreed to attack the enemy as early in 1916 as possible, sufficient time being allowed for the training of the New Army divisions that the British army was receiving, and for the reëquipment of the Russian armies. These plans, however, never matured, because the enemy anticipated them, and it is therefore unnecessary to refer to them further.

During Dec. 1915 and Jan. 1916 the Germans developed considerable activity along the front and made local attacks at Nieuport on the North Sea coast, against more than one point in the Ypres salient, at Givenchy on the Vimy Ridge front, on the Somme, and in Feb. on the Alsace front. The majority of these attacks took the form of experiments in various methods of bombardment which the Germans wished to test in view of a greater effort which they were planning. There had not been wanting signs that the enemy were preparing an attack on the Verdun sector; and considerable anxiety having been expressed as to the adequacy of the French defences on that part of the front, General de Castelnau was sent thither by Joffre, and he ordered certain improvements, but the time was lacking to give full effect to his recommendations (*see* VERDUN). In fact, the Allied defences at this period of the war were notably inferior to those of the Germans. The Allies had spent the greater part of 1915 either in carrying out the vast preparations necessary for an attack in trench warfare or in attacking, and had little energy or labour left for the elaboration of defences. The Germans on the other hand had been on the defensive throughout the year, and they enjoyed the great advantage of being able to employ upon their entrenchments forced labour from Belgium and the occupied provinces of France, and the large number of prisoners they had captured on the Russian front. Further, they had immediately behind their zone of battle the forests of Alsace and of the Ardennes, which provided them with an almost unlimited amount of timber. The Allies could only find labour either at the expense of the fighting troops or of the munition factories, and the British army was forced to import the greater part of the timber it required. It was not until much later in the war, when elaborate arrangements were made for the provision of native labour, and for the exploitation of the French forests, that conditions became at all equal in these respects.

It was the superior strength of their defences which enabled the Germans, while inferior in numbers on the whole front, to concentrate sufficient force for a great attack upon one part of that front. That attack opened on a front of nine miles on the banks of the Meuse opposite Verdun on Feb. 21, 5 German divisions attacking 2 French divisions. The enemy at once gained a startling success, penetrating the French defences, and on the fourth day of the battle capturing Fort Douaumont, one of the chief of the outlying works of the fortress of Verdun. This success was greater than any yet gained by the Allies in attack, though their relative superiority in men on the battle-fronts had been far greater than that of the Germans at the beginning of the battle of Verdun. The Germans won their successes mainly by the skilful handling of their medium and heavy guns, of which they had assembled a great number for the attack. They had before the war made a much closer study of the use of heavy and medium howitzers, both for field and siege warfare, than had either the British or the French, and they had numbers of gunners highly trained in their use, while careful experiments in bombardment, carried out before the battle, bore good fruit. It is to these causes that the tactical success won by the Germans in the first days of Verdun may be attributed. At Mons 5 German divisions had attacked 2 divisions of the British II. Corps, but the Germans had not had time to bring up their heavy artillery and at the end of a day's fighting had done little more than drive in the British outposts, while at Verdun, with the help of a mass of heavy guns, 5 German divisions had overcome 2 French divisions and gained such a position as menaced seriously the French fortress. The result was, therefore, a tactical victory for the German artillery.

Joffre dealt with the crisis promptly. De Castelnau was sent again to Verdun and arranged with Langle de Cary, who commanded the group of armies of the Centre, a command which included Verdun, as to the disposal of the reinforcements which were hurrying to the battle-field and as to the methods of defence. Joffre also sent with these reinforcements General Pétain, who arrived on Feb. 26 and assumed command in the battle-zone. The German attempts to gain ground beyond Douaumont were repulsed, and the French commander-in-chief had time to look round and survey the whole position. He had at once realized that the enemy was in deadly earnest. "*C'est la bataille,*" was one of his first remarks when he heard of the German attack. He had immediately requested Haig to relieve his X. Army on the Arras front, and had asked Kitchener to hasten the dispatch of British reinforcements to France. Two more New Army divisions and 1 Territorial division had reached France from England in January, while 3 more New Army divisions and 3 more Territorial divisions from England were to be in France before the end of May. The Dardanelles Expeditionary Force was being rapidly reorganized and refitted in Egypt by Sir A. Murray, and 2 British, 4 Australian, and 1 New Zealand divisions were expected to come from that country to the western front before the end of June. Haig had lost in Jan. one more division, which had gone to Salonika, but reinforcements would give him by the middle of the year an increase of no less than 15 divisions to his strength in Dec. 1915.

Both commanders-in-chief were agreed that the principles on which the plans of battle in 1915 had been drawn up required modification. It was seen that the analogy of the great siege did not hold, that something more was required than to blast a great breach in the enemy's lines and then to launch a great assault. The something more was the defeat of the enemy's reserves, which came up fresh and in good order to meet troops when the assault had been thrown into some confusion. It was agreed, therefore, that the first object of battle should be to draw in and exhaust the enemy's reserves, and that until that object had been achieved no decisive success could be expected. So long as the enemy continued to attack Verdun, it would, on this principle, be to the advantage of the French to endure these attacks provided always that the enemy gained no success which would affect seriously the strategical position on the whole front, and provided that the exhaustion of the French man-power was not excessive. Joffre therefore proposed to fight defensively at Verdun as long as possible, but to be ready to strike back as soon as the situation there appeared to him too dangerous, or as soon as the French army was approaching the limits of endurance. He therefore asked Haig not only to relieve the French X. Army but to prepare to attack N. of the Somme on a front as wide as the resources of the British army would permit, and undertook to support that attack with a French attack S. of the river on a scale which would depend upon the effect of the battle of Verdun upon the French army.

The Germans had at this time arrived at a very similar theory of battle. The chief of their General Staff, Falkenhayn, has said that he believed the strain of the war upon France to be such that a break might occur if the strain could be increased. This was not an unduly optimistic appreciation of the position if it be remembered that in the previous May Joffre had told Kitchener that France had then reached the limits of her capacity to expand her military forces. Materially Falkenhayn was not far wrong, but he understood the psychology of his enemies no better than other Germans, and he failed to appreciate the spirit of France. The maxim of Verdun—"*on ne passera pas*"—became for France an inspiration as potent as the influence of Jeanne d'Arc. The object of the Germans in the battle of Verdun was to bleed France white, while the object of the Allies during that period was to wear down the military power of Germany as the preparation for striking the *coup de grace.* So upon both sides the theory of the war of exhaustion developed.

During March, April and May the struggle for Verdun continued, the Germans in their several attacks gaining sufficient ground to encourage them to make a new effort now on the right bank of the Meuse, now on the left. During all this fighting the reputation of two of the defenders of Verdun increased steadily, and in May General Pétain succeeded to the command of the group of armies of the Centre, General Nivelle taking his place in command on the actual front of battle.

Between Jan. and July the British strength in bayonets and sabres grew from 450,000 to 660,000, and there was a more than corresponding increase in artillery and aircraft. This enabled Haig to fall in completely with Joffre's wishes, and as soon as the relief of the French X. Army was completed he set about preparing for the great attack on the front N. of the Somme. The growth of the armies made necessary the creation of a IV. Army under the command of Sir Henry Rawlinson. The III. Army was now commanded by Sir E. Allenby, and Sir Charles Monro, who had gone out to supervise the evacuation of the Dardanelles, returned to command the I. Army. British troops now held a continuous line from the Yser canal to the Somme, and were actively preparing to take upon themselves more of the brunt of the war on the western front, a burden of which nearly seven-eighths had hitherto fallen on their French comrades. This preparation entailed enormous labour, for it not only involved the accumulation of immense stores and piles of munitions of all kinds on the selected front of attack, the construction of miles of roads, railways and trenches and many other preliminaries of a great attack in trench warfare, but also the completion of the training of hitherto untried troops. The British army was, in fact, in process of becoming a national army. The old regulars were now little more than a small leaven of the whole lump, and though the new troops arrived in France with considerable knowledge of their duties as cavalrymen, infantrymen, gunners and airmen, they had had little opportunity of learning to work together as part of a great machine. The problem of training was the more complicated because of the great variety of new weapons and methods which had been developed since the outbreak of war; and to teach each part of the army the powers and limitations of every other part, and the whole to work together in combination, was a very heavy task. To this task Haig at once addressed himself, and formed behind the lines schools of instruction in every branch of trench and battle warfare, while careful arrangements were made for the training in attack of divisions when out of the line. All this busy work behind the lines did not mean any cessation of activity on the front, and during these months of preparation a long series of raids into the enemy's trenches were planned and executed, raids which gave the new troops valuable experience and kept the enemy on continual tenterhooks.

In the latter part of May the German Crown Prince redoubled his attacks on the Verdun front, and on the 21st the Germans stormed the Mort Homme hill on the left bank of the Meuse, for which they had been struggling for weeks. Pétain at once called Joffre's attention to the gravity of the situation, and pressed for an early beginning of the counter-offensive on the Somme, but Joffre was anxious to give Haig as much time as possible for the training of his troops, and made Pétain endure yet longer. Fire from the Mort Homme hill had long impeded German progress on the right bank of the Meuse, but with the hill in their possession the enemy in the beginning of June began to press hard on that bank and on the 7th captured Fort Vaux. Thereupon Pétain renewed his representation to Foch, who in consultation with Haig decided that the battle of the Somme should begin on July 1. The preliminary bombardment was begun a week earlier, on June 24, the day on which the Germans, after capturing Fort Thiaumont, stormed the village of Fleury and attained the farthest point in their progress towards Verdun. While this preliminary bombardment was in progress, a bombardment so intense that the guns could be heard in England, no less than 70 raids were carried on the British front between Ypres and the Somme, and gas was discharged into the enemy's lines from 40 different points. The troops which were about to attack the German trenches from Gommécourt to the Somme included the flower of British manhood, and no more splendid body of men has ever gone forward to battle. British aircraft had already gained the ascendancy over the enemy's airmen, and the British army was now well equipped with machine-guns, trench mortars, bombs, gas-projectors, and all other new appliances which experience of trench warfare had shown to be necessary; the tunnellers had proved themselves to be more than a match for the enemy's mines, and for the first time in the war there was a sufficiency of heavy and medium guns and an assurance of an adequate if not abundant supply of shells. Expectation therefore ran high.

The results of the first attack were a heavy disappointment. The main attack was delivered by Rawlinson's IV. Army between the Ancre and Maricourt, about a mile N. of the Somme, where they joined hands with the French VI. Army commanded by General Fayolle, who was to attack astride the river under the general direction of Foch. This main attack was combined with a subsidiary attack by the IV. Army N. of the Ancre, and yet another by the III. Army upon the Gommécourt salient. Upon July 1 both the subsidiary attacks and the whole left of the main British attack failed completely and with heavy loss, but the right of the main attack and the whole of the French attack made such good progress as to warrant the continuance of the battle. The British failures were in the main due to want of experience in the artillery. More than two-thirds of the British batteries engaged had been created since the outbreak of war, and at that time they did not possess sufficient ammunition to gain such practical experience in intense bombardment as the Germans had given their gunners before the battle of Verdun. The chalky soil of the Somme hills lent itself to the construction of deep dugouts, of which the enemy had a great number, and to prevent his men from coming out of these in time to meet the British infantry special and very accurate methods of artillery preparation were required. In default of these the infantry yet again found themselves checked on the greater part of the front by the deadly German machine-guns, and it was mainly through the devoted valour of the infantry through the first days of the battle that the gains made by the right of the IV. Army were confirmed and extended. The first successes won by Foch's men along the river itself were greater and were obtained at less cost, partly because the Germans, overrating the effect of the battle of Verdun, had not expected attack from that quarter, and partly because of the better preparation of the attack by the French artillery, the French having a far larger number than the British of trained gunners for the expansion of that arm. The lesson of the first days of this great battle is that the creation of new armies during the course of a war is an even more intricate and difficult business than had been imagined, even by those who, knowing some of the difficulties, had undertaken the creation of Kitchener's armies with devotion and enthusiasm.

One of the results of the events of the first days of the battle was that Sir Douglas Haig decided to divide his fighting front between two armies. He directed Rawlinson with the IV. Army to exploit the advantages won on the right, and formed on his left a V. Army under Sir Hubert Gough which was to keep the enemy busy on its front and act as a pivot to the IV. Army. The battle was fought out in three phases, the first being the struggle up the slopes from the valleys of the Ancre and of the Somme to the S. crest of the Somme plateau, the second the struggle for possession of the plateau, the third phase consisting of the advance down the N. slopes. The first phase was consummated by a brilliant night attack by the IV. Army on July 14, and on July 17, the British and French troops N. of the river were abreast of the French S. of the Somme, who had for some time been established opposite to Péronne. The whole front of attack could again move forward together. The second phase constituted a long series of fierce struggles, the Germans bringing up more and more troops and disputing every yard of ground, so it was not until Sept. 9 that the British, with the French on their right, were able to look down upon the N. slopes of the plateau and the plains beyond.

By this time two of the objects for which the battle had been fought were gained. The Germans, forced to transfer troops to the Somme, had to relax their pressure on Verdun. The French retook Fort Thiaumont on June 30, while throughout July they slowly regained part of the ground which had been won from them, and on Aug. 17 drove the enemy out of Fleury. Verdun was no longer in danger, and Pétain and Nivelle were able to plan at leisure counter-attacks on a more extensive scale. The second object of the battle of the Somme, the exhaustion of the enemy's reserves, was being obtained as surely. When the battle began, the front attacked by the British was held by 6 German divisions, that attacked by the French by two. In the 2 months 36 German divisions had been engaged on the British front, 18 on the French. In the 6 months of Verdun the Germans had employed 43 divisions in battle, so that their defence on the Somme was far more exhausting than their attacks at Verdun.

At the end of Aug. the failure of Falkenhayn's plans was publicly admitted by his supersession by Hindenburg, with Ludendorff as his chief assistant. The latter, after visiting the fields of Verdun and the Somme, found the German position on the western front to be one of great gravity, and the chief problem confronting him to be how to stop "the progressive falling off" of the German fighting power. The situation of the Allies had improved marvellously since June, when men were wondering how long it would be before the Germans entered Verdun. Not only had Verdun been saved and the Germans been forced to fight desperately on the defensive, but the Italians had driven back the attacking Austrians in the Alps and had then passed themselves to attack on the Isonzo. On the Russian front Brussilov had won great victories on the Bukovina, and Rumania had entered the war, too late certainly to profit by Brussilov's success, but none the less adding apparently another ally to those who confronted the Central Powers. The whole machinery of the Allies was, for the first time, simultaneously at work, and Joffre's strategy appeared to be triumphant.

It was in these encouraging circumstances that the third phase of the battle of the Somme began on Sept. 15. The attack of that day was made famous not only by the successes won, which were considerable, but by the fact that tanks then made their first appearance in battle. There has been much controversy as to the wisdom of this step (*see* Tanks). The experts have maintained that the value of this invention was discounted by premature use, that it should have been kept in reserve to surprise the enemy when large numbers of the new weapon were ready, and that it should have been first used on ground more favourable than a shell-torn battlefield. It was decided to employ tanks in the Somme battle for two reasons. Firstly, so much having been gained at great cost, the moment seemed to have come to press the enemy with every available means. The chief obstacle to the progress of the infantry continued to be the German machine-guns, and tanks were reputed to be the ideal means of overcoming machine-guns. If it would have been foolish not to have pressed the advantage won, it would have been criminal to have withheld from the sorely tried infantry the protection and aid which was at hand. The second reason was that experience was required in the use of tanks in battle. It was necessary to learn both how the tanks would comport themselves when put to the highest test, and how they would work in combination with infantry and artillery. The effective coöperation of infantry, tanks and artillery undoubtedly went a long way towards winning the war in 1918, but it is a legitimate belief that this coöperation would not have resulted unless experience had been gained in 1916.

Despite the employment of tanks, and despite the splendid valour of the infantry of the New Armies, the resistance of the enemy was not broken in the third phase of the battle of the Somme. The days were growing shorter and the weather became uncertain, while the enemy, drawing troops from all parts of the front to prevent his line from breaking, fought with fine courage. By Nov. 17, when rain and mud put an end to the battle, the Germans had engaged no less than 127 divisions. The enemy's reserves had indeed been worn down; in the valley of the Ancre he was hemmed by Gough's V. Army into an awkward salient, but the weather had broken and it was too late to reap the harvest on the battle-front. The first fruits of the Somme were garnered elsewhere.

On Oct. 24 Nivelle began an attack on the right bank of the Meuse, and on the following day recaptured Fort Douaumont. This conspicuous success was followed by the recapture of Fort Vaux on Nov. 2. The battle ended in a complete victory for the French, 6 French divisions overcoming 7 German divisions at surprisingly small cost. Nivelle and Mangin, who commanded the army corps engaged, became the heroes of France. The victory was largely due to the skilful handling of massed artillery, and the Nivelle method became famous. Its fame was extended when, on Dec. 14, a second attack won an even more brilliant success, which made Verdun quite secure and brought in 11,387 prisoners and 115 guns, again at small cost.

When the statesmen of Paris and London compared the results of these two battles at Verdun, which had resulted not only in important gains of ground but in the capture in a few days' fighting of more than 17,000 prisoners, with the slow bludgeon work of the Somme in which the British army in four and a half months had captured 38,000 Germans at a tremendous price, they began to think that they had at last discovered the man for whom they were looking so anxiously.

Operations in 1917.—On Nov. 11 1916 Joffre assembled his second conference of commanders-in-chief to consider plans for the following year. It was agreed that the Germans were in great difficulties on the western front, and that the situation of the Allies was more favourable than it had ever been. The fighting strength of the British army had grown to about 1,200,000 men, and it was known that considerable further reinforcements would reach France during the first few months of the year. The fighting strength of the French army had been increased by the incorporation of native troops to about 2,600,000, so that, including the Belgians, the Allies disposed of about 3,900,000 men against about 2,500,000 Germans.

Joffre declared that the French army could maintain its strength for one more great battle, but that thereafter it must progressively decline, as France had no longer a sufficient number of men of military age to replace losses. He therefore warned Sir Douglas Haig that during the coming year the burden must fall more and more upon the British army, a position which the British commander-in-chief readily accepted. Germany had recently created a number of new divisions, some of which had been employed against Rumania, but it appeared probable that the transfer of these divisions to the western front would be delayed if Russia was able to be active on the eastern front, and of this the great improvement in the supply of munitions for the Russian army held out promise at this time. It was also agreed that, in view of the probable decline in strength of the French army later in the year and the promised reinforcement of the British army, the relative superiority of the Allies on the western front would be greater in the spring of 1917 than at any time which could be foreseen with certainty. For all these reasons it was decided to take the earliest possible opportunity of pressing the advantage won by the battle of the Somme, and of continuing the process of exhausting the enemy's reserves as preparation for an effort which should be decisive. All the armies of the Entente were to be ready to attack in the first fortnight of Feb., the British army between the Vimy Ridge and Bapaume, the French armies between the Somme and the Oise; and the French attack was to be followed soon after by another in Champagne to the W. of Reims. It was further understood between Joffre and Haig that these attacks would, if necessary, be followed by further attacks by the British army in Flanders. During the winter the British army was to do its utmost to press the enemy on the Somme battlefield, and to prevent him from recovering from his embarrassment there.

The underlying ideas of this plan were primarily that the policy of exhausting the German reserves should be resumed at the earliest possible moment, and secondly that the utmost effort should be made to complete the work begun on the Somme. The commanders-in-chief believed the situation to be such that victory could be won in 1917, but they were under no illusion as to the possibility of ending the war by one great blow to be delivered in the spring. Joffre followed up the results of this conference by issuing general instructions embodying the decisions reached, and in these instructions he directed that the first British and French attacks, that is to say, those to be delivered between Vimy and Bapaume and between the Somme and the Oise, were to be ready by Feb. 1.

No sooner were Joffre's plans completed than a series of intrigues against the French commander-in-chief came to a head. A number of officers of the French General Staff regarded with dismay a proposal to give more and more of the task of consummating victory to the British army and less and less to the French army. They found many supporters among the politicians in Paris, and these were reinforced by others, who feared that the "war of exhaustion" and the process of wearing down the enemy's reserves would end in exhausting France before it exhausted Germany. The cry therefore went up that it was time to have a change in the Higher Command. Foch, whose bloody assaults upon the Vimy Ridge had not been forgotten, was held to be too much of a "hammer and tongs" fighter, and he was placed on half-pay, while the state of the defences of Verdun before the German attack began was brought up against Joffre. So he was given a marshal's baton and an honorific position in Paris, and Nivelle reigned in his stead.

The new commander-in-chief at once made a drastic change in Joffre's policy and plans. He proposed to increase the weight of the French attack; and in order that he might obtain the French troops necessary he proposed that the British should relieve the French VI. and XX. Armies and extend their front S. across the Somme as far as the Amiens–Roye road. In return he proposed that Haig should modify his plans for keeping up the pressure on the Germans on the Somme battlefield during the winter, and that the date of the combined attacks should be postponed until Mar. 15. This meant a delay of six weeks in launching the attacks planned by Joffre, and the enemy would be given time to recover from the effects of the Somme. But it became clear, as Nivelle's plans developed, that there was to be an even more complete change of plan than this. He proposed to apply on a great scale the methods he had employed with such success at Verdun, and to return to the policy which had been discarded after the failure in Champagne in 1915. He intended, by skilful employment of a great mass of artillery, to overcome the enemy's resistance in his front lines, and then to pour in to the assault a great reserve which should break through the trench barrier completely and so change the whole strategical position on the western front.

Early in Dec., 1916, there had been a change of Government in Great Britain, and Mr. Lloyd George had become Prime Minister. He had made up his mind that the Somme had been a costly failure, and was eagerly looking for some method of winning the war which should be speedier and less costly in life than that of a "war of exhaustion." He therefore welcomed a general who promised a short, sharp and decisive battle, which would be over, one way or the other, within a comparatively short time. So at a conference held at Calais at the end of Feb. 1917, it was agreed between the British and French Governments that the British army should be placed under the general direction of Nivelle for the forthcoming operations. This decision violated a fundamental principle of military organization. A general of division is not, while still in command of his division, placed also in command of an army corps which includes other divisions, for the good and sufficient reason that if his attention is absorbed by the details of one unit or of one part of the front, he cannot simultaneously give proper attention to the other units or to other parts of the front. The right course would have been to have given Nivelle the general charge of the whole western front and to have appointed another commander-in-chief for the French army. The results of this mistake soon became apparent. On the last day of the Calais Conference news arrived from the British V. Army that there were signs of a German withdrawal in the valley of the Ancre. Some time before, the British airmen had discovered that a great new system of defensive works had been constructed by the enemy covering Douai, Cambrai and St. Quentin, the system which became known to the Allies as the Hindenburg line; and not long after the report from the Ancre came in there were indications that the Germans were preparing to retire from the whole of the Somme battlefield into this line. But Nivelle, not being in close touch with happenings on the British front, did not believe in a German retreat, and issued to Haig orders which were not compatible with the changed situation, and in certain matters went far beyond the agreement reached in Calais. This led to friction, which was adjusted at a further conference in London. By then it had become apparent that the Germans were in retreat on the whole front between Arras and the Aisne near Vailly. The Germans, relieved from pressure on their front during the winter, had prepared for their retreat systematically and brutally. The whole country which had been in their occupation W. of the Hindenburg line was devastated, villages were burnt, roads and railways destroyed, fruit trees cut down and everything of any value was removed, and mines which exploded at a touch were prepared with diabolical ingenuity. In these circumstances a rapid pursuit became impossible, and the Germans were able to delay the advance of the Allies by rearguards, while they removed their heavy artillery and established their main bodies in the Hindenburg lines.

This manœuvre, planned and successfully carried through by Ludendorff, effected a great change in the situation to the benefit of the Germans. Not only did it materially shorten their front and thereby enable them to increase their reserves, but their troops exchanged the battered defences of the Somme battlefield with its awkward salients for the strongest lines which had yet been built upon the western front. Further, the enemy had withdrawn from a considerable part of the front which Nivelle had intended to attack, and this made necessary a further postponement of his battles, but he still adhered to the main features of his plan. In the altered circumstances grave doubts arose in the minds of some of the senior French generals as to the feasibility of this plan, and when these came to the ears of the French War Minister, M. Painlevé, he assembled a Council of War on April 6, on the very eve of the offensive, at which criticisms of the plan were presented by certain of the commanders who were to take a leading part in its execution. Nevertheless, the French Government decided not to interfere with Gen. Nivelle. It is difficult to conceive of a more unfortunate prelude to a great battle. However, these doubts and hesitations of the leaders were not known to the rank and file of the army or to the French people; and when, on April 9, the spring campaign began by an attack by Allenby's III. Army on the enemy's lines E. of Arras, and by the Canadian corps with one brigade of the 5th Div. on the Vimy Ridge, and met with an immediate success, hopes soared high. The French public was deeply impressed by the rapid capture of the Vimy Ridge, which had for so long resisted Foch's attacks, and great things were expected when the French army advanced.

The second of Nivelle's blows was delivered by the group of armies of the centre, now under Franchet d'Espérey, against the German front in the neighbourhood of St. Quentin; but Franchet d'Espérey was here in contact with a part of the main Hindenburg line, and he had neither the time nor the means to prepare effectively for an attack upon their formidable defences. The operations of the centre group of armies, which had been intended to be an important part of Nivelle's programme, dwindled therefore into little more than a demonstration, which took place on April 14 and had no material results. Nivelle's main battle, which took place on the front between Reims and Anizy, began on April 16. It had been planned that the assaulting troops should on the first day of battle break through the first three German lines. The attack was made by Mangin's VI. Army and Mazel's V. Army, with Duchesne's X. Army and a mass of cavalry in reserve ready to exploit their success. Antonine's IV. Army struck in to the E. of Reims on the 17th. The left of Mazel's attack failed almost entirely; and elsewhere, though the first German line was captured, little progress was made beyond it. The dream of a rapid rupture of the enemy's front had to be abandoned, and a fresh plan of battle had to be formed.

One of the first results of the failure of Nivelle to realize his hopes was that he had to request Haig to press his attacks to the E. of Arras with all possible vigour, so as to keep the largest possible number of Germans occupied in that quarter. This entailed a prolongation of the battle of Arras into a period when gains became small and were only purchased at great price. None the less Haig decided that the situation made it necessary to support the French with all his power, and he fought on till May 17, by which time the British front was established some 4 m. to the E. of Arras and in the plain to the E. of the Vimy Ridge. While Haig was thus battling in the N., Nivelle on the Aisne front had brought his X. Army into his front line, and by slow and bitter fighting had won his way up the Chemin des Dames ridge, of which he captured the eastern portion. Early in May it was quite evident that there was no prospect of such a break-through as had been planned, and on the 15th the French Government replaced Nivelle by General Pétain, while General Foch, recalled from semi-retirement, became chief of the staff in Paris. Pétain's first task was to wind up the operations on the Aisne front, and the battle ended definitely on May 20.

The spring campaign had proved a failure in comparison with what might have been, and still more in comparison with what Nivelle had promised, but its results were far from being insignificant. The German retreat in March, which was a direct consequence of the battle of the Somme, had at last brought about the attainment of one of the objects for which Joffre had been striving for so long. The Allies had now more elbow room on one of the most vital parts of their front, that which covered directly the roads to Amiens and Paris. Had the Germans in March 1918 started from the positions which they held in Feb. 1917, and had their attacks progressed at the same rate, they would have entered Amiens on the second day of the battle, which would have ended with the German guns bombarding Abbeville and communication between the French and British armies severed. It is therefore not too much to say that the retreat which was forced upon the Germans by the battle of the Somme saved the Allies in the following year. But how much greater might the results have been if the plan formed by Joffre and Haig in the previous Nov. had been followed—if the Germans had been pressed on the Somme battlefield during the winter, and if they had been attacked early in Feb. before their plans for retreat had been completed. Despite all the difficulties with which the successful conduct of that retreat by the Germans had confronted them, the Allied armies had in the battles of April and May captured 62,000 prisoners, 446 guns, and 1,000 machine-guns, and had gained positions of the first importance; 57 divisions had been compelled to fight upon the French front and 99 on the British front. Had Nivelle been content to follow Joffre's example, and to prepare methodically for the exhaustion of the German reserves without overtaxing the endurance of the sorely tried French army before attempting to break through the enemy's lines, he might have claimed a conspicuous success for his first campaign. But the hopes which he had roused had been extravagant, and the dejection when they were not realized was correspondingly great. The dejection was increased by the news of the Russian revolution, and by exaggerated reports of the losses in the Aisne battles; and it was hardly alleviated by America's entry into the war, for it was well understood that American troops could not be ready to take their places in the firing line during 1917. The immediate consequence of this dejection was the outbreak of a series of mutinies in the French armies, which so affected the *moral* of the French troops that Pétain found it necessary to appeal to Haig to keep the enemy engaged while he restored the confidence of his men.

If the attention of the Germans was to be occupied by the British armies it was necessary that they should be forced to fight. Upon any part of the British front S. of the point where it bends S. from the Belgian frontier N.W. of Lille it was possible for the Germans to repeat their manœuvre of March and avoid a battle by retiring into another system of defences, for in doing this they would be merely abandoning a portion of French territory which was of no great value to them, while they might by this method economize sufficient troops to enable them to fall upon the French. On the Belgian front they could not fall back without risking their hold upon the ports of Ostend and Zeebrugge, which were to them important bases for their submarine campaign, and without endangering the security of the chief aerodromes from which their air attacks upon England were made. For these reasons Haig decided to press the enemy with all his available means upon the Belgian front, and on June 7 he began this campaign with the battle of Messines. This battle was most skilfully and thoroughly prepared by Sir Herbert Plumer, and was fought and won by his II. Army. The battle began with the explosion of a number of huge mines, the secret of which had been preserved by constant and devoted watchfulness on the part of the miners, who had tunnelled beneath the enemy's lines many months previously and awaited patiently the opportunity for their use. The effect of these explosions, combined with a very skilfully planned bombardment of massed guns of all calibres, was such that, except in the right of the attack in the neighbourhood of Messines, the infantry, for once, had little to do. The whole of the Messines-Wytschaete ridge was captured at comparatively very light cost, and the Ypres salient, a name of ill omen for the British army since Oct. 1914, disappeared.

The strength of the British army in combatant troops was now at its greatest. Haig had 64 divisions and 10 cavalry divisions under his orders, and a mass of heavy artillery, tanks and aeroplanes. It was well that this was so, for the army was to be called upon to endure greatly while Pétain and his men got their second wind. Nor was it only the situation on the western front which called for resolute action, for the condition of the Russian army was far more critical than that of the French army. Kornilov had, on July 1, begun an offensive, and if he was supported and encouraged by success in the W. it was still possible that the Russians might continue to be a powerful factor in the war.

With these heavy responsibilities on his shoulders, Haig began on July 31 the second battle of Ypres, with a great attack by the V. Army, which had been moved N. for the purpose. This attack was combined with a subsidiary attack by the French IV. Army under General Antoine on the British left. The object was to gain possession of the Passchendaele ridge, so as to be able to sweep with gun-fire the plains beyond it toward Zeebrugge and Ostend. This achieved, a combined naval and military attack, which had been secretly prepared in England, was to be made on the Belgian coast, which it was hoped would gain possession of the ports and so relieve the British Admiralty of some of the many anxieties caused by the German "U." boats. In preparation for the landing the British took over from the French the lines on the Belgian coast near Nieuport and moved other troops up to the coast behind these lines. The position at Nieuport, which consisted of a narrow strip of ground, with the Yser at its back, was not easy to hold against determined attacks, and before the British preparations for defence were completed the Germans attacked and captured the lines E. of the river. This was an inauspicious beginning, but worse followed, for the weather broke immediately after the battle began and then followed a rainfall unprecedented for August.

The plan of battle was to deliver a series of blows, each with an objective limited by the support which the artillery could give without changing position. It was believed that the experience of Messines and of Verdun had shown that this would allow the infantry to reach their objective without heavy loss. Ludendorff, however, met this method of attack by a new method which he called the elastic system of defence. He made no attempt to hold his front lines in strength, but withdrew the bulk of his infantry from the zone which would be most heavily bombarded and relied mainly upon machine-guns in concrete "pill-boxes" to break up the British infantry attack, and upon counter-attacks by the troops whom he had held back. But it was less this method of defence than the mud of Flanders which prevented British progress. The opening battle of July 31 gave the British possession of the whole of the Pilken Ridge, of the German first line of defence between Nordshoote and Klein Zillebeke, a front of 10 m., and of most of the German second line, but it was not until Sept. 20 that the enemy's third line was penetrated, and not until Oct. 4 that the British were established on the high ground between Broodseinde and Becelaere. The difficulty of getting guns and ammunition forward through the slough of mud prevented the delivery of a rapid succession of blows, each with a limited objective, as had been planned, and in the event a more terrible strain was imposed upon the British troops than in any other battle of the war. As in the case of the battle of the Somme, the first fruits of the third battle of Ypres were reaped elsewhere than on the battle-front. The Germans, forced to send more and more troops into the fiery furnace which blazed in the Ypres ridges, were compelled to leave the French alone, and Pétain had time to restore the confidence of his army. Part of his method was the delivery of very carefully prepared attacks on a comparatively small front, supported by a great mass of artillery which should leave the infantry little more to do than to occupy the ground won. The first of these attacks was delivered by Guillaumat's II. Army on the Verdun front, and was completely successful, ending with the French in possession of all the ground which the Germans had won in 6 months fighting in 1916. This was followed by a more important attack delivered on Oct. 23 by Maitre's VI. Army, which gave the French the whole of the Chemin des Dames ridge, and resulted in the capture of 11,000 prisoners and 200 guns. Then and not till then Pétain expressed himself as satisfied that his immediate purpose was achieved.

The British troops, struggling in the mud of Flanders, could not be told the reasons which had called for a supreme effort from them, and the terrible struggle through the mud, unrelieved by any conspicuous success, was a heavy strain upon them. As events turned out it would probably have been wiser to have brought the third battle of Ypres to a close immediately after the French had won the Chemin des Dames, but at that time the British were within a short distance of the crest of the Passchendaele ridge, while information received at G.H.Q. showed that the strain upon the German army had been far greater and that there had been a very appreciable lowering of the *moral* of the German troops. Haig had yet another blow in preparation. The continued bad weather and the slowness of the progress had caused the abandonment of the project of landing on the Belgian coast, and all hope of driving the Germans from the Belgian ports had gone, but there still appeared to be an opportunity of profiting from the exhaustion of the German reserves before the winter gave them a period for recovery, as it had after the battle of the Somme. A final reason for continuing the struggle was that on Oct. 24 an Austro-German attack had been launched in Italy, and at Caporetto had broken through the Italian lines. It was therefore of importance to keep up the pressure upon the Germans on the western front. So the third battle of Ypres was continued, until the ridge and village of Passchendaele were captured on Nov. 3.

A fortnight later Byng's III. Army attacked the German front opposite Cambrai. This battle opened a new era in trench warfare. One of the outstanding difficulties which the trench barrier had created was that it had hitherto eliminated one of the chief resources of generalship, surprise. The time and labour required to prepare for a great bombardment, and the accumulation of the huge stores of material of war on the selected front of battle, made it impossible to conceal intentions from the enemy. But at Cambrai these difficulties were overcome by using a great number of tanks, brought up secretly to take the place of the bombardment in breaking the enemy's defences. The attack was made upon one of the strongest parts of the Hindenburg system, but the tanks successfully broke through, and the surprise was complete. At Messines the guns had left nothing for the tanks to do, and in the third battle of Ypres they had been defeated by the mud of Flanders, but at Cambrai they came into their own. One thing alone was lacking as far as their part in the battle went. The coöperation between the tanks and the artillery in the later stages of the attack was not complete, so that numbers of tanks fell easy victims to the German guns, a lesson of which advantage was taken in 1918. Of greater importance was the fact that 6 French and 5 British divisions had been transferred to Italy to help the Italian army to stem the disaster of Caporetto, so that Haig had not the troops to complete and extend the first successes won at Cambrai. It is a typical illustration of the advantage which their central position conferred upon the Germans that several of the British divisions which would have been invaluable at Cambrai had not reached the Italian front at the time when the Austro-Germans were checked on the Piave and the battle of Caporetto came to an end. So the German counter-attacks won back a good part of the ground which Byng had gained in the first advance, and the battle of Cambrai ended on Dec. 7 in one more disappointment for the Allies.

The campaign of 1917 on the western front had been fatally hampered by the change of plan which had been made by

Nivelle when he succeeded Joffre. That change had permitted Ludendorff to prepare for and carry through the retreat into the Hindenburg line, and had postponed the date of the Allied offensive from Feb. 1, the date fixed by Joffre, until April 9—a delay of nine precious weeks. As Joffre, had anticipated, it had been necessary for the British army to bear the brunt of the fighting, but it would have done so under very different conditions if the Germans had been hustled back into the Hindenburg line, as they were in Sept. 1918, and if Messines had been fought at the beginning of April, and the third battle of Ypres had begun on May 30 instead of July 31. The battle of Cambrai might then have synchronized with the last offensive of the Russian army, and the combined effect might well have been such as to have saved that army from dissolution, for adequate French and British reserves would have been available in France to support Byng's attack, and the war might have ended victoriously in the autumn of 1917. As it was, the battles of 1917 showed clearly that the solution of the problems of trench warfare at which Haig and Joffre had arrived was correct. It was first necessary to exhaust the German reserves and then to strike a surprise blow or series of surprise blows. Cambrai had shown how surprise might be achieved. But all this experience, which had been purchased at great cost, had been acquired too late to be put to profit in 1917, owing to the fatal delay in opening the campaign of that year. The collapse of Russia was definite and complete, and the Germans were transferring their divisions from E. to W. as rapidly as their railways could carry them. The French divisions had since the middle of the year been gradually reduced in strength, as France had no longer the men to replace the losses in the ranks, and now Pétain found himself compelled to cut down the number of his divisions. The British army was not receiving from home the men to fill the gaps caused by the bloody fighting of Passchendaele; and Haig, early in 1918, was compelled to follow the example of the French and reduce the strength of his divisions, while 11 British and French divisions had been removed to Italy. True, American troops had reached France, but it was improbable that they would be able to take their place in the line of battle before the middle of the summer. In April 1917 there were in France and Belgium 64 British, 108 French and 6 Belgian divisions, or 178 in all, opposed to 128 German divisions. At the end of the year there were 59 British, 98 French and 6 Belgian divisions, a total of 163, opposed to 175 German divisions. Further, the British and French divisions were considerably weaker at the end of the year than they had been at the beginning, though this was offset, to some extent, by a corresponding reduction in the size of the German divisions. Most important of all, there were still large German reinforcements, which might amount to as many as 40 divisions, and did, in fact, amount to 32, ready to come across from the Russian front. The Allies could only obtain reinforcements in the shape of formed divisions by withdrawing troops from Palestine and Salonika, and to this their statesmen were opposed. So fate decreed that at the very time when the Allies had at last found out how to breach the trench barrier, they were thrown willy-nilly on the defensive, and had to prepare to meet the greatest effort which Germany had yet made in the west. (F. B. M.)

III. GERMAN OFFENSIVE, 1918

The military situation of the Central Powers at the end of the year 1917 and the beginning of 1918 has been thus described by Ludendorff in his *Memories of the War:*—

> "Throughout the latter half of 1917 I had strained every nerve to bring about the results that had now been attained, sparing myself no more than I spared others. The western front had held, the Italian army was defeated and the Austro-Hungarian armies in Italy were inspired with new courage. The Macedonian front was holding out. In the east the armistice negotiations were finished and the way to peace lay open to the diplomatists. Negotiations at Brest Litovsk were to begin about Christmas. There was a prospect of our winning the war. Only in Asia Minor had there been any hitch, but the great events in Europe had pushed them into the background."

Under the influence of this hopeful outlook the German Supreme Command decided in favour of a decisive battle in the western theatre of war in the spring of 1918. This decision was justified in the first place by the collapse of Russia. Fortune had favoured the Central Powers there, apart from their own military successes. Yet these might be regarded by them as having made good fortune deserved. The problem of a "war on many fronts" had been clearly comprehended, and the principle of first completing the work that had to be done in the east had been consistently maintained. But the fortunes of war are seldom all on one side—as Hindenburg and Ludendorff were to discover. The peace negotiations in the spring of 1918 dragged on so long in Trotsky's hands that not only did a new appeal to arms, though a brief one, become necessary, but the final result was merely an "armed peace." This involved keeping strong German forces tied up in the east to secure the treaty and profit by it, and prevented the best use being made of these forces in the decisive battle of the war on French soil. But the fact remains that the chief presupposition—indeed, the indispensable one—on which the Supreme Command founded their project was the breaking up of the enemy in the east. By the end of March 44 divisions had gone to the west, followed in April and May by 15 other divisions, among which were 3 of cavalry.

It was a question of considerable importance whether, and to what extent, the participation of the Austro-Hungarian forces in the coming decisive battle would be possible. The Italian army, though not destroyed by the short autumn campaign of 1917, had been so thoroughly beaten, and was so unstrung morally, that it might reasonably be neglected as a military factor for the next few months. The offensive there had also had the important result of drawing off 11 French and English divisions from the French theatre of war to Italy. The duration of Italy's collapse was, of course, uncertain. It would presumably end automatically when the Central Powers dropped their menacing attitude. All the more was it important to maintain this. But it was not considered necessary to keep German fighting forces in the Italian theatre of war to this end. The *moral* of the Austro-Hungarian army had risen so markedly since the success of the last offensive that it seemed equal to carrying out this task without German support. The 6 German divisions in Italy were accordingly withdrawn during the winter, and were in the French theatre of war by the end of March. The German Supreme Command would have liked to use the Austro-Hungarian army to still greater advantage in the general scheme by bringing over a number of good fighting divisions and some heavy artillery to take a direct part in the forthcoming battles in France. This had been agreed upon in principle at a conference between Ludendorff and General von Arz on Nov. 3. The matter was further discussed in writing up to the beginning of Jan. 1918. But in the meantime other influences were at work, opposing the designs of the two Supreme Commands. According to Gen. von Arz the Austrian Emperor and Empress were averse to sending Austrian troops to fight on French soil against the French; and the non-German nations of the Austro-Hungarian Monarchy, supported by the Social Democrats, were strongly opposed to taking part in the war in the west. The German Supreme Command, on being informed of this, sent Gen. von Cramon, their representative with the Austro-Hungarian army in the beginning of 1918, "a definite order to insist upon a binding declaration." Arz replied that no Austro-Hungarian divisions would be available until peace had been concluded with Russia and Rumania, but that artillery could be sent, though it would be deficient in munitions. This offer was accepted.[1] General von Cramon succeeded in persuading Hindenburg and Ludendorff, in spite of the doubts which these proceedings had aroused in them, to make another request for the coöperation of Austro-Hungarian divisions in the western theatre of war. But Cramon's intervention with General von Arz in the meantime did not succeed. General von Arz explained to him in the end in strict confidence that it would not be agreeable to those in high places if infantry were sent to the west. As a last resource now the German Supreme Command tried to stir up its ally to an attack in Italy. On March 15

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[1] Von Cramon, *Unser Oesterreichisch-Ungarischer Verbündeter* p. 6. The number of heavy batteries sent was 46.

Hindenburg implored General von Arz to arrange for an immediate offensive by the Austro-Hungarian armies in Italy, to relieve the German army in its difficult decisive battle. After some hesitation Arz replied on March 27 that he would rally all the means at his disposal and deliver a blow against Italy at the end of May which should completely break her.

Germany was thus left to carry out the decisive battle on French soil on her own resources. There were three enemies to be reckoned with: England, France and America. The British had borne the chief burden of the fighting during the latter half of 1917, when the great battle in Flanders had towered over all other events in significance. In spite of the lost ground in the Ypres sector, and the unavoidably heavy loss in fighting power, it could in the end be registered as a German victory in so far as the English had failed to achieve their strategic aim, the destruction of the German submarine base in Flanders. For the estimation of future prospects, at least as important as this happy issue was the apparent failure of the British attack system—with its unreserved employment of masses in a battle of *matériel*, and its methodical conduct of the offensive as a series of thoroughly prepared attacks with objectives limited in space and, once chosen, rigidly adhered to. It was believed that this system revealed a lack of capacity for operative manœuvring inherent in British leadership and in the British army. The tank battle at Cambrai in Nov. was looked upon as a further proof of this. Should the Germans succeed in bringing about a war of movement again in the west, their conviction was that they would prove themselves superior to the British.

Contrasted with the powerful effort that the British had put forth to gain the victory in Flanders, the ends for which their French allies were striving in the second half of 1917, after the failure of the great Aisne offensive, were apparently more modest. The local attacks to which they confined themselves at Verdun and later in the Laffaux corner turned out favourably for them, it is true, and inflicted considerable losses on the Germans. But on the whole their cautious strategy led to the deduction that the moral depression of the French nation and the army, which had set in after the battle of the Aisne, and was not hidden from the Germans, had not been overcome. Not that the German Command was likely to regard the spirit of France as permanently paralysed; on the contrary it was considered certain that the French army, in the following spring, would enter the struggle for final victory completely refreshed and stronger than before. In comparison with England she was the militarily stronger opponent, more skilled in strategy and tactics, and more dangerous.

When it had to be decided upon which of the two the German blow was next to fall, a success over the British therefore suggested itself as being more easily and certainly obtainable. Added to this there was the consideration—decisive from a political standpoint—that the principal enemy, England, would probably be more inclined for peace when she herself had suffered a crushing defeat. In this respect the estimated value of the respective opponents had altered considerably from that made by Falkenhayn, which had passed muster two years earlier. The war in which England was fighting with her own forces on the European continent was, since the battle of the Somme, no longer a "side show." She was, on the contrary, now conducting it with all her available forces, with the utmost tenacity and with her own weapons. For the rest it might be assumed that when the German "hammer blow" fell on the one enemy, the other would not stand idly looking on, but would either directly assist his ally or proceed to a relief offensive. One hammer blow would not suffice. A general battle was therefore launched. Ludendorff dwelt on this in making his report to the Kaiser on Feb. 13 1918 at Schloss Homburg, when he said:—

> "The battle in the west which the year 1918 will bring presents the biggest military problem ever set before an army. France and England have grappled with it in vain for 2 years. . . . It must not be imagined that we are going to have another such offensive as in Galicia or Italy. It will be a stupendous struggle, beginning in one place and continuing in another, and will take up a long time."

As regards the relative strengths of the two sides, the German High Command cherished no illusions as to any marked numerical superiority for their own forces. The strength of the German army in the west was brought up to 194 divisions by the addition of divisions brought up from the eastern and Italian theatres. The Entente forces in France in Feb. 1918 were estimated at 167 divisions. If the 11 French-English divisions in Italy, which were easily available, were added to these, there remained only a slight superiority in the number of divisions on the German side. In artillery the German western army was not even quite as strong as its opponents. Ludendorff based his decision on the theory that the totals of the two fighting forces would balance each other. A factor which counted for much with the Germans was the physical condition of the army. An offensive attack best suited the character of the nation and the tradition and training of the troops. It was the more powerful form of warfare. Germany owed to it all her previous tangible successes. The ordinary citizen could see, through all his heartfelt longing for peace, that his efforts could only be rewarded when Germany had overthrown her enemies. Here and there, it is true, the same disintegrating influences which were undermining the war spirit at home could be seen at work in the army. But the influence of the good elements, which far outweighed the rest, stamped the whole as an excellent body of men. Their "will to win" was not indeed inspired purely by victory for its own sake. The attack was longed for also as a deliverance from the terrible battering which they had endured for years with resignation and with courage.

It now became supremely important to find out the precise moment at which the American forces would actively intervene. In a review of the situation drawn up by the German Supreme Command in the winter of 1917–8 it was stated:—

> "The United States are forming an army of about 50 divisions, of which three only have as yet landed in France. One of these is at the front to be trained. The two others are in need of more training behind the front. By the spring of 1918 the American forces in France may reach a strength of about 15 divisions. The mass of the divisions will only be suitable for use on quiet fronts. Only the 3 divisions now in France may be expected to take part in a spring offensive. The corps of officers is not yet trained for war on a large scale. On these grounds the independent use of large American units in difficult positions will be out of the question at present. The drafting of reserves and the arming and equipment of the American troops are good. Training is still inadequate. But the first regiment put in at the front fought well during a German attack, and it is therefore to be expected that the American soldier, after more training and experience, will prove himself a worthy opponent."

In another calculation, made in Dec. 1917, the Supreme Command estimated the whole of the American forces that had been landed in France up to the spring at 450,000 men at most. A larger number was not to be expected on account of the lack of shipping for transport. The mass of this army could not be ready for an attack by the spring of 1918. The value of the Americans at first would therefore lie in their power to set free English-French divisions on quiet fronts. As a matter of fact this calculation of the American strength was too generous. The total number of Americans landed in France up to the end of March 1918 has been stated by the American Secretary of War at just under 370,000. Of these only 144,000 were included in the 5 fighting divisions. The fact that the Germans did not at once realize the full extent of the increase in American transports, from April onward, in response to the urgent demands of England and France, does not actually affect their review of the situation at the end of 1917 and the beginning of 1918. When Hindenburg and Ludendorff resolved on the decisive attack they were entitled to hope for so crushing a victory over the English and the French by beginning operations early that the palm of victory could not be snatched from them again even by very considerable masses of American troops, whose intervention would only become effective in the later war of movement. Supposing—as a basis for the actual starting-point of the offensive—the Germans to be in possession of the line Doullens–Amiens by the beginning of April, which was within the realm of possibility, the annihilation of the British army might be completed within that month. Meanwhile the battle against the French would have broken out in full force. During the months of May and June a decisive defeat had to be inflicted on them also. If that succeeded, the

Americans—whose troops were for the most part not yet sufficiently trained for a war of movement—would merely be swept into the general debacle. Entirely inexperienced in the leading of great masses, they would hardly change the decrees of fate.

The Germans had of course to take into account the fact that even a complete military victory by the Central Powers in 1918 on the continent would not end the war, so long as the will of Lloyd George in England was unbroken. Again, should the Entente by a great effort succeed in readjusting the situation on the continent, the war of starvation could be carried on with greater effect in proportion as the submarine menace diminished. The question was therefore whether the Central Powers, after subduing their enemies on the continent of Europe, could still hold out economically. The opening of the Ukraine had come so late that it was extremely doubtful whether its resources would be available in time to stave off the threatened economic collapse of the nations of the Quadruple Alliance. Ludendorff had no illusions upon this point, being convinced that it was absolutely essential to have his military offensive in the west accompanied and supported simultaneously by a political offensive on a large scale on the English home front. This would be directed toward bringing about the fall of Lloyd George and persuading the English nation to accept rather Lord Lansdowne's efforts in the direction of peace. It was for the political leaders to call into being and carry out a propaganda offensive of this nature. The commander-in-chief could only demand it—and this he did.

As early as the middle of Jan. 1918, Ludendorff had handed in to the Imperial Chancellor, with a strong personal recommendation, a memorandum for a German political offensive drawn up by Colonel von Haeften. But this urgent warning to the political leaders of the State met with no response. The politicians were unmoved. Once more, on June 3 1918, Ludendorff made another passionate appeal to the Chancellor to undertake a political offensive against the English home front, again sending a memorandum by Colonel von Haeften, which this time included a detailed plan of campaign. But it was unavailing.

The question arises here whether the German Supreme Command would not have done better, at a moment when they were militarily strong, to attempt their utmost to induce the political heads of State to prepare the way for peace. Ludendorff's published memoirs show that it was never opposed to efforts aiming at an honourable peace that would safeguard the existence of the German Empire. But all the attempts in this direction made by the political leaders found the Allied Governments unresponsive, and were regarded merely as signs of internal weakening in the Central Powers. Ludendorff was to see for himself, shortly before the beginning of the great spring offensive, how little the attitude of the Entente statesmen had changed and how hopeless and damaging the renewal of any such attempt would prove. According to a credible report from a neutral country, Washington's readiness to enter into official peace negotiations depended upon the following preliminary conditions: the unconditional evacuation of northern France and Belgium; the payment of reconstruction expenses; Alsace and Lorraine to be made independent; the annulling of the treaty of Brest Litovsk, just concluded in the east; reference of all eastern questions to a peace conference to be summoned by the Entente; and a complete change of the Government system in Germany on lines to be laid down and enforced by President Wilson later. A commander-in-chief who, in the spring of 1918, should have pressed the political leaders to pave the way for peace negotiations under such conditions, without having tried for a decision on the field, would have been cursed by his fatherland.

Plan for a Break-through at St. Quentin.—Suggestions for an offensive had been made by the higher command of Prince Rupprecht of Bavaria's army group after the English offensive in Flanders had died down in the beginning of Nov. 1917. The suggestions culminated in the proposal to launch the main attack from the Armentières–La Bassée front in the direction of Hazebrouck against the right flank and rear of the British, on the assumption that they would certainly concentrate their forces in Flanders in the coming spring for a renewed break-through operation in the direction of the German submarine base. The Allies would then obviously be in a difficult operative position. The mass of their fighting forces would be crowded up on the extreme N. wing of the whole western front. To bring up strategic reserves would take time. On their left flank and rear lay the sea. For the British in particular, strategically less trained as they were, it would not be easy to deploy their closely packed masses in the direction of the right flank and to cover their threatened communications, all the more so as a large part of their non-mobile fighting material was rigidly fixed. Tactically the prospect of breaking through the front was a good one, since the attackers would be faced by few positions technically very strong. It was, however, recognized that the country would be a difficult one in which to follow up the attack, which would be hemmed in between two commanding ranges of hills, and still further confined to the left by the La Bassée canal. It would therefore have to advance mainly in the wet Lys depression, and the ascent to the Bailleul and Hazebrouck heights would have to be carried by fighting. On account of the wet ground the operation would probably have to wait until the middle of April. General Ludendorff fully acknowledged the advantages of the proposed operation, but laid stress on the serious difficulties presented by the ground, and above all on the point that the attack, being dependent on the weather, could not be made early enough. He considered that an attack in the region of St. Quentin offered better prospects. When the line of the Somme–Péronne–Ham had been captured, the attack could proceed in a N.W. direction, resting its flank on the Somme, and might succeed in rolling up the British front. The higher command of Crown Prince Rupprecht's army group held to its own point of view, however, that the attack on the line Armentières–La Bassée in the direction of Hazebrouck—code name "St. George"—was to be preferred on tactical and strategical grounds to any other offensive setting in farther to the south. Their reasons were thus stated in a memorandum of Nov. 20:—

> "In consideration of the general political situation and the appearance on the scene of the Americans, the attack should clearly be made as soon as possible. On the other hand a decisive effect can only be attained if the objective, *i.e.* the mass of the British army, is securely united in massed groups in Flanders. This condition of security can only exist when the British in Flanders are preparing to attack. Our offensive can only set in when this has become a certainty. The British *must* attack in Flanders again in the coming year. They are forced to do so by our submarine base. We may therefore count on it with certainty and make a strategic use of the situation. Side by side with these considerations arises that of the difficult nature of the ground in the Lys depression, which makes it imperative *not to attack too early*. From previous experience and observation it would appear that considerable difficulty may be expected with the ground and the water up to about the middle of April. . . . The British in Flanders have similar ground conditions to consider. If *they* proceed to the offensive, *our* attack at Armentières–Estaires would presumably be possible also. We should do best therefore—both as regards the operative effect and the state of the ground—to wait until the British attack in Flanders. It will then be necessary at first for us to give way before the enemy offensive in Flanders and—so far as possible—on the French front also. If we accept the defensive battle, we shall have to tie up such strong forces in the process that we shall not be powerful enough for an attack. We can without hesitation afford to retire as far as the line Vladsloe–W. of Roselare–Werwicq, as the submarine base will still be covered."

Opposition was also raised in some quarters to an attack from the La Bassée canal front to the corner of Bullecourt, on the ground that it would come up against a strongly fortified system, and that no rapid result at the start could be expected. The enemy would, it might be assumed, gain time for bringing up his reserves from the north and the south. "Unless the circumstances change considerably in our favour there is a danger of the operations resulting in a pocket being formed in the front and not in a decision in the war of movement."

The idea of an attack delivered from the II. Army's front—code name "Michael"—was criticized as follows by the higher command of Prince Rupprecht's army group:—

> "Decisive operations by the II. Army can only aim at a break-through of the enemy front and the attainment of the best possible results in the war of movement against the enemy's reserves. The

Somme—an unusually powerful obstacle—will serve as a support for the left flank. The main idea of an operation on the II. Army front must therefore be to break through the enemy front in the first place, in order to protect the left flank against the French and roll up the enemy front toward the north. The operation would then be continued in the area between the Somme and the Pas de Calais against the enemy forces there, as a war of movement with a N.W. direction. The enemy would have his back to the sea. There would be a prospect of a decisive victory if the operation were pushed far enough forward. The progress of the operation in detail after the successful break-through would depend upon the measures taken by the enemy, and cannot be foreseen. Operations of this order presuppose strong forces, considerably stronger than would be necessary for the "St. George" scheme. The advantages of this scheme are that in the II. Army area operations are possible at all seasons; that the enemy positions—excepting those S. of St. Quentin—are not strongly built up and are but thinly occupied at the moment; that the question of strong enemy reserves need hardly be considered, as the British will make their attack in Flanders, and the French are not likely to make theirs against the II. Army. If the French should prepare an attack at St. Quentin, the German attack would have to set in farther to the north. The disadvantages are that the operations would lead through the ruined tract of country 'Alberich,'[1] and would involve crossing the wide area of the Somme battle, strewn with positions and craters; that the II. Army front runs from N.W. to S.E., while the direction desired for the main operation is N.W. It therefore becomes considerably more difficult to roll up the enemy front towards the N.W. after the successful break-through.

"The attack would first have to be made in a W. direction as far as the Somme, and could only later develop toward the N.W. A certain amount of time would necessarily be wasted before the operation of movement came into swing. This would give the enemy an opportunity of bringing up his reserves, the network of railways being favourable for the purpose."

Although General Ludendorff and the chief of the general staff of Rupprecht's group of armies, General von Kuhl, were agreed on the main point that the offensive should be directed against the British, the chief of the general staff of the German Crown Prince's army group, Count von der Schulenburg, held at first a directly opposite view, considering an attack on the French to be the better policy. "England, with her dogged self-confidence," he said, "is not likely to end the war on account of a partial defeat of her army. She will be more inclined for peace when the power of the French is broken by a heavy defeat." Count Schulenburg's proposal was "to attack in the Argonne and to the E. of it, and simultaneously to carry out a strong attack from the St. Mihiel region in a W. direction. The objective of the attack would be Verdun, and, if possible, the destruction of the portion of the French army enveloped by the attack. The wooded, indistinct character of the deployment area would make it easier to hide the preparations for attack. The attacks would have a good chance of success if managed as a surprise. The French would never get over the loss of Verdun. If the seizure of the fortress were combined with a decisive victory over a portion of the French army, which would mean depriving the French of the possibility of a really promising offensive in 1918, the French nation and its army would be swept by a great wave of depression:—

"The British are certain to attack in Flanders if we attack the French at Verdun. A French offensive may be predicted with equal certainty if the British are attacked. If the Supreme Command is not in a position to execute a big attack, and at the same moment fight a defensive battle in another place, there remains the possibility of evading the enemy attack on the threatened front by retreating. This could be carried out by the VII., I. and III. Armies, and also to a limited extent in Flanders presumably, but not E. of the Argonne or on the V. Army's front."

The armistice concluded with Russia on Dec. 15 made a considerable difference in the general situation. Russia no longer counted as a military factor, and the balance of power in the western theatre of war had now readjusted itself in favour of the Germans in consequence. All the reports received pointed to the conclusion that the Entente Powers would for the present limit themselves to a strategic defence, and would refrain from a great offensive until strong American forces became available. This was all the more probable because the effect of the submarine war so far could not apparently be considered so successful as to force Great Britain to undertake the destruction of the German submarine base in Flanders at an early date. This change in the situation removed the principal presupposition on which Gen. von Kuhl's proposed offensive at Armentières–La Bassée in the direction of Hazebrouck was based. The close massing of the British main forces in Flanders in the coming spring could not be relied on. It was far more likely that the Allies would distribute their reserves behind the front and place them in readiness round important railway junctions. It could not be denied that the operative conditions for a break-through in the St. Quentin region might also be unfavourably affected. The possibility of a French relief offensive had still to be faced.

In these circumstances Ludendorff refrained from laying down any definite direction for the attack against the British for the time being, reserving his decision until he could see how the situation developed. On one point only did he insist—the moment of the offensive must be fixed as early as possible on account of the Americans. With this in view the Supreme Command issued an order on Dec. 27 1917 for the preparation of several attacks on different parts of the front. The preparations were to be pushed forward so as to be complete by the end of March.

Count Schulenburg's original proposal—an enveloping operation at Verdun—had not yet been rejected, but was for the present only to be treated as a rough draft, the German Crown Prince's group using it as a foundation for an offensive from Champagne and the W. of Verdun on Clermont, and Duke Albrecht's group for an attack over the Meuse, S. of Verdun (code name "Castor and Pollux").

On one point the Supreme Command was now quite clear. The offensive must not take the form of a battle of *matériel*, such as the Allies had over and over again attempted, invariably without results. German aims would not be furthered by an offensive which condemned the forces to months of strain. The break-through must be made to lead up to a decisive operation in the open field. This could only be done if the enemy's trench system were overrun so rapidly that the reserves he had brought up could not arrive in time to intercept the blow behind the dinted-in front. A prompt and complete success was only conceivable at the moment of the surprise. This could only be attained by observing the strictest secrecy with the troops concerned in the attacks. Each army must be convinced that the attack which it was preparing was intended to be the one actually selected. To this end all preparations for attack, in respect of laying out communications, shelters, aerodromes, etc., were to be spread over the whole army front as far as possible. The placing of the troops in readiness was to come later, and was to be undertaken outside the selected battlefield by various large groups which could be quickly and secretly formed up for deployment in different directions by train and by night marches. Another feature was to be the deception of the enemy, who was to be perplexed by the semblance of an attack on the whole army front (artillery registration and so forth), by partial actions with limited objectives, and by feints of great attacks in other places. All the attack preparations were to be carefully observed on the ground and from the air, to see that they were not attracting attention. Although it might be impossible to prevent the enemy from discovering the direction of the attack in time, it might reasonably be hoped to keep him in uncertainty as to the movement and the scope of the attack, and the form which it was to take. Success therefore depended very considerably on the most rapid execution of the attack itself.

On Jan. 24 the Supreme Command decided which of the attacks should be carried out. The choice fell on the "Michael" operation in the zone of the XVII., II. and XVIII. Armies. At the same time the XVIII. Army was ordered to be transferred to the German Crown Prince's group of armies with the Omignon brook for its northern boundary.

In preparing for the Michael attack, the XVIII. Army's direction was to the N.E. of Bapaume, the II. Army's to the N. of the Omignon brook, and the XVIII. Army's to the S. of the Omignon brook on both sides of St. Quentin. The XVII. Army was to prepare a simultaneous attack S. of the Scarpe (code name "Mars South"), and the VII. Army another S. of the Oise across the front of the Crépy group (code name "Archangel"). The Michael operation was to take place about March 20, the Mars South and Archangel attacks a few days later after the regrouping of the necessary artillery and mine-throwers. The aim of the Michael attack was to be a break-through of the enemy front as far as the Somme on the line Ham–Péronne, and an advance, in conjunction with the Mars attack, on the right back of the Somme through Péronne–Arras. The Archangel attack had merely to make a diversion, and try to seize the heights E. of the Oise-Aisne canal.

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[1] "Alberich" was the code name for the destruction of the ground surrendered on retreat to the Siegfried positions in the spring of 1917.

The Supreme Command also gave instructions that preparations for the attack over the Lys depression at Armentières–Estaire (St. George I.) and towards the Ypres salient (St. George II.) by the VI. and IV. Armies were to be pushed forward so as to be completed by the beginning of April. The idea of an enveloping attack at Verdun ("Castor and Pollux") was allowed to drop, as the chief of the general staff of army detachment C. had held out only very moderate hopes of success for an offensive S. of Verdun across the Meuse. On the other hand, in the event of a great French attack in Champagne, there was some thought of letting the III. Army fall back within certain limits, while the I. Army delivered a flanking counter-attack.

Ludendorff thus held fast to his plan of directing his offensive blow against the British. In choosing the Michael instead of the St. George operation, he was influenced chiefly by the fact that it would be independent of seasons and weather conditions and could therefore be carried out earlier. The tactical attack would, moreover, fall on a particularly weak spot in the enemy's front.

The idea of a diversion on a large scale, to take place either before or simultaneously with the Michael operation, was abandoned, as it seemed necessary to use all the available forces for carrying out successfully the one great blow as planned. On the other hand the Supreme Command arranged for deceptive measures to be taken at various points on the armies' front, *e.g.* a lively artillery battle on the St. George and Archangel fronts; partial actions on the I. and III. Armies' fronts, particularly at Verdun; a long-range artillery battle on the Lorraine front. These commenced in some cases in the beginning of March, and were continued in the days immediately preceding the battle and until after it was well started.

On March 10 Hindenburg sent out a definite order fixing the morning of March 21 for the attack. According to this order the centre of gravity of the operations lay in the XVII. and II. Armies both at the beginning and during the later development. After achieving the first great tactical aim—the cutting off of the British in the Cambrai sector, the offensive was to be carried N. of the Omignon brook in the direction of Albert–Arras and beyond, where the British front was to be dislocated by the VI. Army. The XVIII. Army was only required to cover the left flank S. of the Omignon brook, and to this end to take possession of the Somme and of the Crozat canal. Its deeply echeloned right wing could be extended northward to Péronne in case of necessity. An additional order from the German Crown Prince's army group in the meantime paved the way for the idea of a new move by the XVIII. Army by contemplating the possibility of its advance over the Somme and the Crozat canal. General von Hutier, commanding the XVIII. Army, at once grasped this idea—it had probably occurred to him before—and, in a document handed in to the army group on March 15, proposed as the XVIII. Army's task "as soon as the Somme and the Crozat canal had been crossed, to draw upon itself the French reserves designed for the support of the British and beat them, and to break the communications between the British and the French. . . . The sooner the army reached the line Chaulnes–Roye, the more chance would it have of meeting the French while they were still deploying, and the better the prospect of bringing about the war of movement." The Higher Command of the army group passed on the proposal with the additional note: "the more the French counter-offensive spends itself on Rupprecht's army group, the more effectually will the proposed operation hit the French. The enemy will be quick to recognize its decisive meaning and the threat to his capital. We may, therefore, expect a very strong resistance, and on that account the operation must be launched by powerful forces."

Ludendorff's attitude toward this proposal is not known. It would appear from a conversation over the telephone with General von Kuhl on March 20 that he had already weighed the possibility of accommodating himself to the idea if circumstances so shaped themselves, since he now intimated his intention of fixing the centre of gravity for the advance of the XVII. Army in the direction of St. Pol, and that of the II. Army in the direction of Doullens–Amiens—in case the XVIII. Army should meet with strong French opposition on the line Bray–Noyon if not earlier.

The peace training of the German General Staff was based on the strategic and tactical principles of its former chief of many years' standing, Count Schlieffen. Although a declared champion of the Cannae idea, the Count had also definitely accepted the break-through in his reflexions and teachings, though only under the conditions of a war of movement. In choosing the spot for the break-through Count Schlieffen considered the tactical weak spot within the enemy's lines to be of the first importance as a clue. At the same time there must be the possibility of following up a successful assault and break-through by an operation in a useful direction. He therefore considered a simultaneous attack against the whole enemy front to be the best means of breaking through, as by this their forces would be tied up, the reserves engaged and the shifting of troops to another place prevented.

When Ludendorff in 1918 was faced with the problem of the break-through, it was *not* under the conditions of a war of movement. The outward appearance of the war had fundamentally changed in the war of positions which had lasted for years. The defence was established along the whole front in a modern field position constructed according to a technique based on experience. The German attacking force was therefore confronted everywhere with the task of overcoming the opposition of the enemy in its tactically strong positions. For this he needed—at whatever point the break-through was attempted—the means employed in siege warfare, in particular a large quantity of heavy artillery and flame-throwers. For all that, however, the enemy positions were not everywhere equal in their tactical power of resistance. The ground, constructional work, density of occupation, formation of reserves, and value of the defence troops, showed many points of difference, and admitted of the sorting out of strong and weaker portions of the front. Ludendorff formed his decision quite in the spirit of Schlieffen's teaching. He, too, spied out the enemy's weakness. For the choice of the English front the leading political motive was probably primarily responsible, but the decision also happened to be in agreement with the military considerations. For although the British and French troops, in respect of their power of resistance, in tactical defence might be assessed at equal value, the British were inferior to the French in the skilled handling of masses, in the art of defensive battle and in power of strategic manœuvre. The weak points within the 140-m. British front in question, Armentières–La Bassée and St. Quentin, had undergone an exhaustive critical examination by the Higher Command of Rupprecht's army group. If Ludendorff decided to attack at St. Quentin it was because he would be hitting the enemy at his weakest point.

Military critics have raised the objection that Ludendorff let himself be swayed too much by tactical considerations and neglected the demands of strategy, seeing his own task from the very beginning only as a battering performance, consisting of a succession of independent hammer-blows. There is nothing to support such views. Rather is it evident that Ludendorff, here as always, was basing his strategy on the prospect of a promising tactical battle in complete accordance with the Schlieffen ideas. The attack delivered from Lens in the direction of St. Pol, as recommended by the French Gen. Buat, was extremely difficult tactically and did not offer any guarantee of a prompt initial success. But on this everything depended. Moreover, Ludendorff, in placing the attack where he did, had had visions of one great definite strategic aim, to break through the front of the

British army on its S. wing, cut it off from the French, and by pressing on its right flank and attacking it from the front cause it to waver and fall to pieces and force it back to the coast. What was that but a "Cannae operation," in which a natural obstacle—the sea—took the place of Hasdrubal? A second natural obstacle—the Somme—was to serve the German left wing, advancing in deeply echeloned formation, as a protection against a French flank attack. The difficulties presented by the unavoidable traversing of the ruined Alberich area, and the Somme battlefield with its craters, were fully recognized, particularly as regards shelter and the bringing up of fresh drafts. These difficulties would diminish, however, as soon as the operation reached out into the country as yet untouched by battle, to the W. of this zone. Only in case that did not succeed would the disadvantages of this wilderness as a permanent stopping-place become evident.

On one point indeed, and that the most vital, did Ludendorff's procedure differ from Schlieffen's form of strategy. The German attack was directed, not against the whole enemy front, but against a limited section only. The perfectly obvious reason for this was that the fighting forces and battle requirements came nowhere near being sufficient for such an undertaking. The question is, whether it would have been possible and desirable to carry out the Schlieffen idea in a general sense, if not literally. The aim of the attack on the whole front was to engage all the enemy's forces, particularly his reserves, who might otherwise in due course intercept and choke off the break-through, just as it became ripe for operative development. Ludendorff saw the danger of this quite clearly, and sought to avert it by feint attacks on as many parts of the front as possible, by threats of a great attack and by partial actions on a small scale. These measures undoubtedly had a great temporary effect. Pétain refused to send more than 3 divisions to Haig's hard-pressed front on March 24, on the ground that Ludendorff's main attack was to be at Reims, where the artillery battle had already begun. But the effect of these measures lasted only a short time, of course, and were limited as to material. The enemy's reserves were not absorbed, but could still, though after much delay, be moved and brought up to the decisive battlefield. It would certainly have been more in accordance with the Schlieffen idea if, alongside of these feint attacks and reaching beyond them, a serious diversion had been undertaken shortly *before* the main attack began. It would have had to be carried out by a strong but strictly limited number of troops, to give promise of a prompt initial success and to have a limited objective. For this purpose, so far as the British front was concerned the "St. George" operations across the Lys depression were not possible, on account of the season and weather conditions. In Flanders the circumstances were similar. There remained only the VI. Army front between the La Bassée canal and Arras. It may be questioned whether the attack, which was tactically very difficult here, would have succeeded to a sufficient extent in its object of tying up the strong enemy reserves. There were, in any case, important reasons for the decision not to make a preliminary diversion at this point in order to have a more powerful force to put in to the decisive battle itself.

On the French front things were essentially different. It was of the utmost importance that if the proposed operation were to succeed it should be secured from a strong flank attack by the French, and not be brought to a standstill by a relief offensive on a large scale. It is known that Ludendorff had intended the VII. Army to execute a diversion. But this was to take place *after* the great offensive had begun, and could not therefore have the effect of drawing off strong reserves of the enemy in a wrong direction and holding them fast there. The diversion would also be too closely in touch with the main attack as regards space. Several places had been proposed for a German diversion on the French front, such as the Chemin des Dames region and Champagne. Verdun was less suitable on account of the large force that would be required. The front of Duke Albrecht's army group in Alsace (Breuschtal) also seemed suitable. If the attack were made there the French reserves would be far away from the critical point of the coming decisive battle.

As far as the actual number of good attack divisions was concerned there were ample forces available. The spring offensive opened on March 21 with 62 divisions. Up to the close on April 5, 92 divisions had been put in, and even so not all the divisions available for attack purposes had been used up. This powerful mass would probably have been even more effective if it had not been used exclusively and directly for the break-through operation itself, but had been devoted in part to putting the French reserves into fetters at another place. General Buat even goes so far as to say that only by a series of diversions, delivered simultaneously or in rapid succession in different places, could the operative success of the break-through have been guaranteed. He admits however—and herein lies the point of the decision—that this method was impracticable for Ludendorff owing to lack of sufficient forces. For it was a question not only of having in readiness the required number of divisions but the massing of artillery, flame-throwers, airmen, munitions, motor columns and numerous other necessities of war. Of these the Supreme Command had not enough available for the furnishing of a powerful diversion immediately before or at the time of the main attack, if this was delivered on the scale planned. A diversion was therefore only conceivable in the event of a reduction of area or material in the main attack. But any reduction of this sort would have lessened the chance of a great and rapid victory on the spot selected, the indispensable condition of the undertaking.

The conclusions are that not only was the application of Schlieffen's theoretical ideal form for an operative break-through—the attack on the whole front—out of the question for Ludendorff, but the attempt to conform to the underlying idea in a modified form by executing a diversion on a large scale was not to be recommended in the spring of 1918, since the forces were insufficient. In practice the disciple was forced by existing circumstances to fall short of the master's theoretical standard laid down in time of peace.

But is it, as Buat thinks, the fact that the idea of the operative break-through was foredoomed to failure? Strategy is a system of makeshifts. This fundamental saying of Moltke's was fully appreciated by Count Schlieffen. Ludendorff had to act in accordance with it. If the enemy's reserves could not be tied up in another place and kept away from the scene of the main battle, and if, therefore, they might be expected to turn up there sooner or later, the work of the battle and the execution of the operative scheme would certainly be made more difficult. Whether the attacker, in spite of this, would have the strength to achieve not only a tactical victory, but the complete strategical success, which involved the destruction of the enemy, was the supreme question which only the god of battles himself could answer. If the reward due to his passionate efforts was withheld, he would have to moderate those efforts and reconcile himself to closing down the offensive and accepting the battle of *matériel* and its attendant overstraining of his forces. The first great hammer-blow would then at least have had the effect of a diversion. It would have accomplished its aim according to the Schlieffen idea of operations by shattering and absorbing a large portion of the enemy fighting forces. It was then for the command to show its skill in launching, as quickly as possible, a new attack to bring about a decision with the yet unused forces from another well-selected and prepared position.

This then was the problem of the break-through as it presented itself to the German Supreme Command.

The Great Battle.—As the Germans had not the means for equipping all the divisions on the western front equally, and as the essential value of the different divisions also varied for reasons connected with drafting, they were forced to limit themselves to a certain number of those which seemed most suitable for the purpose of the attack. These were the so-called mobile divisions. Altogether 52 of these divisions were made available for the beginning of the Michael operation. Besides these there were 10 divisions in the line directly taking a part in the attack, making in all 62 divisions. They were distributed as follows: XVII. Army, 15 mobile divisions and 2 divisions in the line; II. Army, 15 mobile divisions and 3 divisions in the line; XVIII.

Army, 19 mobile divisions and 5 divisions in the line. The Supreme Command had kept 3 mobile divisions for the time being at its own direct disposal. These were brought up to the region of Douai shortly before the beginning of the offensive so as to be more readily available for carrying out the Mars attack, for which they were originally intended.

The bringing up of the attack formations that were destined at once for the offensive began at the end of Feb. and was completed according to plan. On March 10 the bringing up of munitions began. During the last few nights the artillery, flame-throwers and divisions were formed up for deployment. On the morning of March 21 came the attack, delivered simultaneously by all three armies on the whole front—over 47 m. wide—from Croisilles to La Fère. It came as a surprise to the British III. and V. Armies. Contrary to the expectations cherished, the offensive made less progress in the first days in the case of the XVII. Army and the right wing of the II. Army than on the left wing of the II. Army and particularly in the case of the XVIII. Army, on account of the powerful British resistance. The cutting-off of the Cambrai salient failed because of the enemy's timely evacuation. In consequence of this the Supreme Command on the afternoon of March 22 ordered the XVII. Army to extend the success of the II. Army by an attack aimed particularly in the direction of Bapaume, and to prepare for the attack on both sides of the Scarpe (Mars) with strong forces to the N. of it.

When it became evident, on the morning of March 23, that the XVIII. Army and the left wing of the II. Army were advancing unchecked towards the W. and would in all probability reach their nearest objective, the Somme, on that very day, an order was issued for continuing the operation, as soon as the line Bapaume–Péronne–Ham should have been won. "The XVII. Army will attack with strong pressure in the directions Arras–St. Pol, the left wing in the direction of Miraumont. The II. Army will take the direction Miraumont–Lihons; the XVIII. Army will take the direction Chaulnes–Noyon and will send strong advanced troops through Ham." The three divisions held in reserve were now given to the XVII. Army.

Through this order the whole operation was pushed a long way to the left. The XVIII. Army, which was originally to have extended its front northward to Péronne on reaching the Somme, thereby releasing forces from the II. Army to carry on the attack N. of the river, had now instead to cross the Somme and advance its right wing in a slightly S.W. direction toward Chaulnes. There were thus portions of the II. Army left S. of the Somme as well as the XVIII. Army. The Somme was therefore no longer used as a support against a French flank attack, for the offensive now took a N. direction along the whole front, N. and S. of the river, with the operative aim of separating British and French.

This most fateful decision of March 23 arose from the tactical consideration of exploiting the XVIII. Army's comparatively easy success to the benefit of the general battle situation, by making a rapid forward push. Had the XVIII. Army stopped at the Somme and the Crozat canal, as was originally intended, extending with its right wing only northward to Péronne, its fine initial success would have had no effect on the advance of the attack farther to the N., which had up till then not quite come up to expectation. If, on the other hand, it had carried its attack across the Somme and the canal toward the W., in conjunction with the S. wing of the II. Army, the enemy, who was still holding out against the XVII. Army and the N. wing of the II. Army, would have been threatened on his right flank. From the strategical standpoint the decision was even more difficult and more vital. The fundamental idea of the Michael operation had from the first always been that of beating the British and the British only. The French were only to be held off from intervention by flank action. To this end the whole of the XVII. and II. Armies were to find a field for operations to the N. of the Somme. The reinforcements sent by the Supreme Command were also to follow in this direction, being mainly disposed in échelon in rear of the II. Army's left wing for the purpose of taking over the flank protection down the Somme from Péronne. At a later stage there were probably some portions of the XVIII. Army similarly engaged N. of the Somme. This whole strategical idea would have fallen to pieces if the strong natural obstacle of the Somme had been relinquished as a support at this point. It was clear that the left wing of the armies, entrusted with the offensive solution of its task on the far side of the Somme and the canal, would very soon not only draw upon itself considerable enemy forces, but would gradually have to prepare for a counter-offensive steadily increasing in strength. It had therefore to be reinforced from the reserves, which thus, as well as a portion of the II. Army, were no longer available for use in the direction followed by the main operation. But despite these apparent disadvantages the decision must be approved from the strategical standpoint also. The position of the XVII. Army and the north wing of the II. Army, as it was on the morning of March 23, made it doubtful whether the strong enemy resistance here could be broken in time to arrive at operations in the open field at all before the arrival of enemy reinforcements. There was a danger that not only the British but the French might throw strong forces on to the battlefield N. of the Somme, and so block the break-through in or close behind the British trench system. This was made easier by the contact with the positions E. of Arras, which had been maintained. The Somme—at Péronne or farther to the W.—would then serve the defender just as well for a safe support as the attacker had hoped it would serve him. It would also form an excellent obstacle for the front farther on up to Ham. As the direct intervention of the French, according to the way in which things turned out, had to be reckoned with, everything depended on hindering them from carrying it out systematically. The French must be caught up into the whirlpool of destruction. But this could only be done by forcing their Bray–Noyon front and attacking impetuously in the open.

In the days that followed Gen. Ludendorff held stubbornly to his operative aim of separating the British and French. The distribution of the reserves that had been brought up later was organized accordingly. The centre of gravity of the XVII. Army's advance, originally directed toward St. Pol, was now, on March 24, shifted more to the S. toward Doullens. The course of the battle on the whole front, up to March 25 inclusive, justified the expectation of achieving its ambitious aim. As the XVII. Army had pushed its way through the whole system of enemy positions and had advanced with its S. wing to beyond the Ancre, it too began to operate in the open field. The situation was now such as to warrant the attempt to dislodge the enemy front, both at Arras and farther to the N., by frontal attacks; and the Mars attack on both sides of the Scarpe was fixed for March 28.

The first faint doubts as to the possibility of carrying out the main operation to its full extent might have been aroused by the experiences of the XVII. Army on March 26. Its S. wing, on which everything depended, gained very little ground beyond the Ancre. As, however, in the meantime the II. Army's right wing had achieved the difficult crossing at Albert, there was hope that the XVII. Army's advance would also quickly get into its stride again. On all the rest of the front the brilliant progress of the offensive so far, particularly the impetuous forward push of the II. Army in the direction of Amiens and that of the XVIII. Army toward Montdidier, raised expectations of a continuation full of promise. Ludendorff proposed to bring about the separation of his opponents by a gradual concentration of the II. and XVIII. Armies against the French, and to this end the Somme below and at Amiens had to be reached and also the Avre. But the far-reaching aims of the Supreme Command were not to be realized. On March 27 the XVII. Army's offensive came to a standstill, and the next day brought the failure of the Mars attack on both sides of the Scarpe. At this point, therefore, the operation against the British was finally abandoned. Ludendorff decided to attack their front as soon as possible in a different place, and ordered the immediate preparation of an attack on the VI. Army's right wing on the Lys front in the direction of Hazebrouck. It would, however, probably be 8 or 10 days before this could begin. Otherwise the continuation of the Michael operation, as it had turned out, seemed to promise success only in the direction where there was still movement, that is, on the S. wing of the II. Army and with the XVIII. Army. As the intervention of the French so far gave the impression of being precipitated, it was concluded that the opponent had not yet fully organized his forces. The point was to keep him from doing so now. The coöperation of the II. Army's N. wing, now held fast on the Ancre, in the forward wheel toward the Somme below Amiens, could indeed no longer be counted upon. It seemed, therefore, all the more urgent to get possession of Amiens, the strategically important railway junction, by the quickest means, and also to cross the Avre. The centre of gravity of the offensive was therefore laid exclusively on the inner wings of the II. and XVIII. Armies in the next few days, all reserves being switched off in that direction. However, no real progress could now be made in the direction of Amiens. A last attempt on April 4 broke down before the enemy resistance, which had visibly increased.

The close of the Great Battle left the Germans in possession of a narrow salient stretching far out toward Amiens. This position had its dangers, which necessitated perpetual watching, and kept strong forces tied to the spot. On April 24 the II. Army tried to improve its positions between the Somme and the Avre by a partial attack, which after a passing success at Villers-Bretonneux ended in a recoil. After this for a long time no important battle actions took place on this section of the front.

The Michael operation had not achieved the full operative success, but had nevertheless dealt the British a heavy blow and crippled their fighting power for a long time to come. More than 40 British divisions were seriously affected, and also about 20 divisions of the French army which had been drawn in.

In the light of subsequent criticism, the question arises whether General Ludendorff's leading idea would not have had more chance of being realized if the decision of March 26 had limited the objectives aimed at in one direction or the other. Persistence in the double intention of dividing the opponents and simultaneously dislodging the British at and N. of Arras by frontal shock had the effect of dissipating the still available attack energy of the reserves, and made it impossible to focus on a single object the largest possible part of the forces still capable of a great effort. In view of the general outlook the only limitation worth considering was one which would have facilitated the progress of the Michael operation by temporarily renouncing the Mars attack and the proposed frontal attacks farther N. which went with it. The danger then would have been that the British, not being threatened from the front, would throw all their available reserves on to the battle-field as it now stood, and also release forces from their front for the same purpose. It would be the task of the XVII. Army and the portion of the II. Army fighting on the Ancre to continue their attacks and so draw these forces upon themselves, preventing a flanking attack against the German main operation in the direction of Amiens. It was for the moment less important to gain much ground in the direction of Doullens, provided that the decisive blow on Amiens on both sides of the Somme were kept going. Supposing that the 5 divisions which had been put into the attack on both sides of the Scarpe had been used in the continuation of the Michael operation with the XVII. Army and on the right wing of the II. Army from March 27 on, it would have been possible by this time to shift a number of reserves toward the S. to the decisive wing. A portion of these reserves did gradually find their way to the wing S. of the Somme a few days later, together with a number of divisions which had been engaged in the previous fighting. But they arrived too late, and the offensive had meanwhile come to a standstill. The conclusion is that events might have shaped themselves more favourably, from an operative standpoint, if the decision of March 26 had limited itself to the separation idea, laying increased stress on this at the cost of the intention to break up the whole British front at the same time.

Finally, there is no doubt that the Germans, by their last attempt to get possession of Amiens, put too great a strain on their available forces. However strong the grounds for this, it should have been of supreme importance to the Germans to avoid the wearing effect on their fighting force of a battle of material. This would have been easier to accomplish if a decision had been made by the end of March to close down the Michael operation. Instead, the attack on April 4 placed the inner wings of the II. and XVIII. Armies in the salient over against Amiens on both sides of the Avre in so difficult a fighting position that, whatever the result, the reserve strength which was still coming in had to be committed and was used up.

German Attacks—April, May, and June.—Closely connected with the Michael offensive, which came to a standstill on April 5, was the VII. Army's Archangel attack which followed. Between April 6–8 the right wing of this army threw back the enemy from its positions S. of the Oise through Amigny and Coucy le Château to beyond the Ailette. The ground gained made an improvement in the difficult rearward communications of the XVIII. Army's left wing. Following immediately upon this came the resumption of the great operations by the Georgette attack on the Lys front. General Ludendorff had had this attack in view since the end of March, and had prepared it at first as a diversion only. When it became clear in the beginning of April that the Michael offensive would not lead to a complete operative success, the Georgette attack was extended in its scope and aims to an operation for forcing a decision. It was proposed to break through the British–Portuguese front in the direction of Hazebrouck–St. Omer and then to continue the operation through St. Omer–Béthune and as far to the S. as possible. The VI. Army was to attack on the front Armentières and the La Bassée canal with its centre of gravity on Hazebrouck; the left wing at first only to wheel in on the general line Aire–Béthune–La Bassée canal; the centre to push through toward Hazebrouck and the heights W. of it and to seize the canal crossings between St. Omer and Aire; the right wing to take possession of the commanding heights to the E. and S. of Godewaersvelde and then to take the direction of the barrier of heights at Cassel. The IV. Army, attacking one day later from the line Hollebeke–Frelinghem, was to attach itself with a strong left wing. Armentières was to fall by envelopment. Beyond all these there was a proposal for the IV. Army to attack in Flanders from the Houthoulst Forest in the direction of Poperinghe, with the object of cutting off the Ypres salient.

The enemy's situation seemed favourable to the Germans. The British had hardly any more fresh reserves to draw on, so that the only reserve to be considered consisted of divisions worn out by fighting. The Portuguese stationed on the Lys were not credited with any great power of resistance.

Seventeen divisions from the VI. Army and 4 from the IV. Army were placed in readiness, and the necessary artillery was brought up, some of it being obtained by regrouping from the Michael front. In the course of the operation 14 more divisions, mostly from the zones of the XVII. and II. Armies, were put in.

The attack by the VI. Army, beginning on April 9, took the opponent at first by surprise. On this same day the whole stretch of the Lys at Sailly was conquered. But the battles of the next few days, though successful, were obstinate and costly, and already it appeared doubtful whether the attack would develop into a break-through. The left wing had not succeeded in taking Festubert and Givenchy or in reaching the canal. On the other hand there could be no question of stopping the offensive immediately, as the inner wings of the VI. and IV. Armies were still fighting in a difficult tactical position. Their position improved, however, with the seizure of the Neuve Église and Bailleul heights, but in general the gains of ground were only local. The advantages of the initial surprise were forfeited and the opponent found time to organize his resistance more and more thoroughly. The hope of being able to set the interrupted operation in motion again by a surprise assault on the Belgian front, delivered by the IV. Army from the Houthoulst Forest, vanished when it became known on April 16 that the enemy was eluding the carefully built-up attack from the Ypres salient by slipping away behind the Steenbeek. The IV. Army higher command considered that on account of the difficult ground the attack across the Steenbeek had no chance of success unless it were newly organized, and postponed the execution from day to day. As since April 17 the French had been established at Wytschaete the arrival of further French reënforcements had to be reckoned with.

On April 20, therefore, General Ludendorff ordered the beginning of the offensive. With a view merely to improving the tactical situation of the inner wings of the VI. and IV. Armies the attack on Mt. Kemmel was carried out on April 25. The piecemeal capture of Festubert and Givenchy did not succeed.

On May 1 Ludendorff came to the decision to place Rupprecht's army group and also the XVIII. Army on the defensive for the time being. The Georgette operation had, apart from destroying the Portuguese, undoubtedly inflicted another heavy blow on the British army. Its losses in the defeats of March and April might be estimated at not less than half-a-million men. The fact that Foch was forced to send about 18 French divisions and 6 cavalry divisions to Flanders suggested that the British alone were not in a position to resist the pressure put upon them. It was also an important point for the German Supreme Command that it had for many weeks had the lead in the western theatre of war and had forced the opponent to stand on the defensive. Yet it could not record any operative success in this new place. Then, too, the Michael and Georgette offensives had used up a large number of forces—113 divisions—and this fact weighed heavily. Taken in conjunction with the difficulties about drafts there was no doubt that the balance of forces was gradually becoming unfavourable to the Germans.

It is indeed questionable whether the German command had it in its power to raise this strategically unsatisfactory result to the level of a striking success. With the forces actually available, and those that were put in, it would hardly have been possible, even if certain errors in the subordinate command had been avoided. The greater part of the divisions used did not belong to the mobile divisions, which had been trained and equipped for the attack, and others were worn out by fighting. There was, therefore, a certain lack of the necessary freshness and tenacity in attack. If the German Supreme Command had decided at the end of March to stop the Michael offensive and desist for the time being from the attack on the Archangel front, there would have been fourteen more unused divisions available at the beginning of the Georgette attack. With this additional strength considerably more pressure could have been exercised, particularly by the IV. Army, to the N. of Armentières and N.E. of Ypres.

With the situation as it stood at present the difficulties in the way of forcing the decision of the war before the Americans made themselves felt were growing. In spite of this Ludendorff remained unshaken in his aim, clearly recognizing that the Germans could now only achieve a success through their own initiative and by working against time. All the clever advice that subsequent criticism felt obliged to offer Ludendorff is met by the objection that by none of it could the victory of the Germans have been achieved. If the Allies were now allowed time, and were able at a self-chosen moment to use their fighting force, with its ever-growing superiority in personnel and material, for their own final blow, the war might be given up as lost at once.

The necessary forces were lacking for an immediate fresh German offensive. During the next few weeks it was imperative that the mobile divisions, some of which had been overtaxed, should be allowed to rest and freshen up again. By May 27 the German reserves had been brought up to 81 divisions again, exclusive of the transport movement from the east. Of these 58 had been resting.

The direction which the operations were to take had now to be decided. The French and British now formed a united front, and the former plan of beating each separately was no longer in question. At the end of April there were from 10 to 12 French infantry divisions and 6 cavalry divisions established in Flanders. In front of the German XVII. Army at Doullens was the French X. Army with from 5 to 6 divisions. At Amiens and S. of it stood a group of from 12 to 14 fresh French divisions. As Foch had also released about 20 divisions by putting in territorials and Americans and economizing on numerous sectors, he now had at his disposal a reserve of over 60 French divisions. About half of these he kept to defend the coast and at Amiens, the other half being apparently distributed in readiness before the fronts of the remaining army groups. An offensive to force a decision against those sectors of the front held almost exclusively by the French from the Somme to the Swiss frontier promised the Germans a far-reaching operative success, at whatever point it might be attempted. The one sharply-defined objective in this connexion was Paris. But on the way there an encounter with the French army, prepared to defend it to the uttermost, was certain; and a defensive battle for them would have various advantages. On the other hand if a German attack should sooner or later find itself stuck fast on the way to Paris or in Champagne—as might almost certainly be predicted—the Germans would be in an unfavourable position for operating, with their line bent more or less far forward toward the S.W. or S. There seemed more prospect of success in resuming the offensive on the Michael—or Flanders—front, where the objectives were not fixed so far away. After all, the Germans had covered half the distance from St. Quentin to Abbeville in March well within a week. If they could succeed in doing this again with the same bulk and expansion, they would throw the enemy forces opposing them into the sea. But even with less success at first they might hope so to cramp their opponent's freedom of movement that his power of prolonged resistance would weaken, and he would be completely crushed by renewed hammer-like blows. The German Supreme Command therefore sought to gain their strategical aim as before in an attack on the northern part of the enemy's front. Clear on this point, it was again confronted, as in the spring offensive, with the choice between carrying out the operations in Flanders or farther S. against the Arras–Amiens front.

Acting on the suggestion of the Higher Command of Prince Rupprecht's army group, General Ludendorff in the beginning of May decided on the Flanders attack. The determining factor was the knowledge that an attack from the Michael front in the direction of Doullens would tactically be extremely difficult, depending for its success on a simultaneous side-attack from the region of Béthune, for which the forces were not adequate. But as there were still strong French reserves in Flanders at the time, Ludendorff decided not to lead the attack against Poperinghe–Hazebrouck until a diversion in another place had drawn off considerable portions of this reserve from the Flanders front, leaving it weakened in consequence. At the suggestion of the Higher Command of the German Crown Prince's army group, a diversion—offensive within a limited area from the VII. Army front on the Chemin des Dames across the Aisne as far as the Vesle—code name "Blücher," was given preference over an attack by the I. Army in Champagne, E. of Reims, because its clearly defined aim offered the promise of a line suited both to a prolonged defence and a continuation of the attack. The VII. Army's task was limited to carrying the offensive over the Aisne sector on both sides of Soissons and over the Vesle as far as the heights to the S.W. and S.E. of Soissons and S. of Fismes, while the right wing of the I. Army was to accompany the attack westwards past Reims and nearly up to the Ardre. There was also an idea of letting the XVIII. Army push forward its left wing across the Oise to split up the counter-offensive.

By choosing the Blücher attack Ludendorff was again faithful to his principles in selecting a markedly weak spot in the enemy's front. There were at this time in the front line only 6 French divisions—of which 2 were worn out and 1 weakened by illness—and 2 British divisions which had been defeated in March and April. As regards reserves, there were supposed to be 2 fresh French divisions and 2 that had previously been beaten in the region between Compiègne and Reims. As against these the VII. Army had 29 divisions, the I. Army 4 divisions at its disposal. The Supreme Command reserved the right of taking back strong artillery forces from Rupprecht's army group and the powerful fighting divisions drawn back behind their front. This time, too, the attack was to break out as a complete surprise, and be relieved by opportune feints on different parts of the other armies' fronts. Owing to the comprehensive preparations the Blücher attack could not be launched until nearly the end of May.

It began on May 27 and succeeded beyond all hopes. By the evening the VII. Army's centre had reached the Vesle on both sides of Fismes, the wings holding back somewhat. The morning of the 28th brought an emphatic reminder from Ludendorff that the object was to get possession as quickly as possible of the high ground W. of Braisne, S. of Fismes and Bazoches and N.W. of Reims. The right wing was to advance by means of a sharp attack to a line on the high ground between the Oise and Aisne canal and the Aisne in a W. direction. The successes of the 28th enabled fresh orders to be given for advancing the objectives of the centre and left wing to Fère en Tardenois–the heights S. of Coulanges–the S. front of Reims. If the opponent evacuated the territory between the Aisne and the Oise, the XVIII. Army was to draw up forces on the S. bank of the Oise about Noyon and to gain ground in the direction of Compiègne. On May 29 the successes on the VII. Army's front were spreading rapidly, and orders were given at noon for the attack by the left wing of the XVIII. Army and the VII. and I. Armies to be continued in the direction of Compiègne–Dormans–Epernay and the block of hills between the Vesle and the Marne, S. of Reims, taken as a protection against Chalons. The progress of the VII. Army corresponded to these instructions. The I. Army, which had had difficulties to contend with, received an order on the morning of May 30 to reënforce its right wing from the centre, and shoot out its fighting line to the S. and S.W., thereby facilitating the envelopment of Reims. The VII. Army meanwhile had reached the Marne on the 30th with its centre, and on the following day gained a good deal of ground in the direction of Villers Cotterêts, but the two wings of the attack did not seem able to make any further progress. The Supreme Command was for the moment inclined to send portions of the VII. Army over the Marne to push forward on Epernay, with the idea of getting the attack of the I. Army into swing again. But this scheme was dropped in consideration of the state of the troops and the strength of the enemy's resistance. The I. Army was to have a rest, and then be required only to undertake partial actions with limited objectives and to capture Reims. The Supreme Command was now anxious to get the centre of gravity fixed on the W. front of the VII. Army in the direction of Villers Cotterêts and La Ferté Milon, in order to attract powerful French forces. Reënforcements were therefore sent up from the zones of the other army groups. But the VII. Army attack in a W. direction made no more progress to speak of in the beginning of June, as the French had established themselves here in great force by hurrying fresh troops on to the scene.

The continuation of the offensive now depended on the progress of the attack launched on June 9 from the S. front of the XVIII. Army on the Matz brook and the Aisne above Compiègne (code name, "Gneisenau"). But this attack by the XVIII. Army did not have the anticipated success, which would have justified the immediate opening of the Flanders offensive, but came to a standstill on April 11. A blow delivered by the VII. Army against Villers Cotterêts to the S.W. of Soissons on the following day also failed, and as the immediate continuance of partial actions by the I. Army did not look like succeeding either, a lull set in along the whole new front of the German Crown Prince's army group in the middle of June.

The Blücher attack was not looked upon as an operation to force a decision, but rather as a diversion. The fact that the original limited objectives were exceeded in consequence of the unexpectedly favourable course taken by the attack is not incompatible with the leading idea, which aimed at holding and destroying the greatest possible number of the enemy's forces. This aim was fulfilled. The total number of the French engaged in the defence against the Blücher offensive was estimated in the beginning of June at over 40 infantry and 3 cavalry divisions. On the Marne the wavering French lines were only saved by fresh American divisions. This time the Germans spared their troops by avoiding costly independent battles of only local importance. At the same time the development of the tactical success should not have brought about an unfavourable operative situation at the close of the offensive. But this was exactly what happened. As the wings had not succeeded in getting the region of Compiègne and Reims, with its hilly country, under their control, a new sack-like bulge had been formed in the German position, with the flanks bent far back, to maintain which strong new forces would have to be put in. The rearward communications of the VII. Army were particularly unsatisfactory owing to the lack of railways. This unfavourable operative situation could perhaps have been avoided if from the beginning strong pressure had been used to push forward the right wing along the Oise to the Marne, and the I. Army to Reims, at the cost of some of the excessive amount of ground gained in the centre. Later attempts to work up the operation from the centre were impaired by the gradually failing fighting strength of the troops. According to Ludendorff a subordinate command also failed to carry out a swift and powerful advance through Soissons. The advance of the VII. Army's right wing along the Oise, which began later, was inadequately provided with the means of attack, and the Gneisenau attack by the XVIII. Army W. of the Oise, which followed, was apparently even less well prepared; neither could retrieve the results which could presumably have been obtained without much effort at the very beginning of the offensive, had the forces on the VII. Army's right wing been differently grouped. The disadvantageous strategic situation at the close of the attack corresponded with the tactically difficult fighting position in which the tired-out German divisions were confronted with the active defence offered henceforth by the French and Americans.

The German Offensive in July.—The effect of the Blücher attack very soon made itself felt on the front of Rupprecht's army group, where no little relief was felt. The enemy's fighting activity diminished, and a portion of French reserves intended for the support of the British vanished from the scene. All the same, this degree of slackness on the enemy's part did not seem to the German Supreme Command to warrant the carrying out of the planned and prepared attack on the Flanders front (code name "Hagen") for the present. They hoped first, by carrying out another of the diversions on the front of the German Crown Prince's army group, to rob the British of the last of their French support, and even in certain circumstances to force them to send direct help themselves to their hard-pressed ally.

On June 14 Ludendorff arranged for the German Crown Prince's army group to attack with the VII. Army across the Marne, E. of Château-Thierry and between the Marne and Reims (code name "Marneschutz"), and with the I. and III. Armies between Reims and the Argonne (code name "Reims"). July 10 was the date aimed at for the beginning of the offensive. About 10 days later, after a rapid regrouping of the necessary artillery and so on, the Hagen attack was to be executed by Rupprecht's army group in Flanders. Ludendorff in his *Memoirs* gives the reasons for selecting new points of attack on the French front as follows: "The greater part of the enemy's reserves were to be found within the curve formed by the XVIII. and VII. Armies in the direction of Paris, only weak forces being left between Château-Thierry and Verdun. The Supreme Command intended this time also to attack the enemy where he was weakest."

The underlying idea of the VII. Army's far from simple operation on both sides of the Marne toward Epernay was inspired by the desire to escape from the tactically constrained position brought about by the pocket on the Marne. By flattening out the left flank of the pocket by eastward pressure, not only would the army's rearward communications be widened, but the danger which perpetually threatened the right flank would be diminished. While the necessity of supporting this flank on the sector from Villers Cotterêts to the Marne during the attack was pointed out to the VII. Army, the forces needed for such support were not placed at its disposal. It is not by any means clear on what grounds the decision was taken to extend the diversion very considerably toward the east by calling in the III. Army. It was probably in the hope mainly of splitting up the enemy defences along as wide a front as possible. General Buat points out that the offensive, if successful, would have opened up brilliant strategic possibilities, such as extending the successful advance in the direction of Bar le Duc and rolling up the whole defensive position in the Argonne and toward Verdun. A shortening of the German position from Château-Thierry through Chalons to St. Mihiel would have been infinitely valuable.

On the other hand the 44-m. front required such large forces to occupy it that, contrary to the original intention, it was necessary to fall back on some of the divisions set aside for the Hagen attack in rear of the Rupprecht group's front. The inevitable consequence was the postponement of the date provisionally fixed for the Flanders attack to the beginning of August. Also the preparations for the combined Marneschutz-Reims attack proved so extensive and took up so much time that the date had to be put forward to July 15 at the cost of preserving secrecy. Once more the execution depended upon surprise.

Through carelessness and treachery the German plans became known to Foch to a great extent during the first half of July. He had found time for adequate preparation of his defence, which was skilfully adapted to meet the German conduct of the attack. In this way the offensive in the case of the I. and III. Armies came to a standstill everywhere in front of the French main position. The VII. Army succeeded, after a successful crossing of the Marne, in shattering the main line of defence in several places. But here, too, far-reaching results were unobtainable. On July 15 the German Supreme Command ordered the cessation of the attack for the III. Army, and on the 16th refused to allow the I. Army to continue after an attempt had proved vain. The VII. Army continued to advance with great difficulty until July 17 in some places. The offensive blow had in fact completely failed, because it fell upon an enemy who was not taken by surprise but was prepared to offer a resistance as obstinate as it was skilled.

Ludendorff lost no time in drawing his conclusions from the unexpected turn in the general situation, and immediately ordered the withdrawal of the right attacking wing of the VII. Army behind the Marne. He was determined to regroup his forces with all possible speed for the Hagen attack in Flanders. Hardly had the necessary steps been taken, however, when, on the morning of July 18, Foch's flank attack fell on the insufficiently supported W. front of the VII. and IX. Armies. Owing to the disproportionate initial success of this attack, the execution of the Hagen attack had to give place to the pressing necessity of putting fresh forces into the VII. Army and bringing it back behind the Vesle. This was the turning point in the conduct of the war in 1918, and at the same time in the whole of the World War. The German offensive had met first with a sudden interruption, then with its final close, owing to the initiative of the opponent. From this time onward the German Supreme Army Command was subject to the strategical law of the enemy.

If we pass in review the many plans of attack entertained by the German Supreme Command—the Flanders attack, for instance, was, if circumstances permitted, to be followed by an offensive on Paris or Amiens—the impression is easily formed that the leader of the German operations was no longer pursuing a definite operative aim, as at the beginning of the spring offensive and for some time afterward, but had as his sole object the shattering of the enemy by independent hammer-blows delivered one after another at tactically advantageous points. But all these hammer-blows represented not the end but the means by which the final decisive operation should be prepared, facilitated and brought to a successful issue with the highest degree of certainty and the least effort. One misgiving undeniably arises in considering this method. The limitation of the available attacking forces and fighting material made it impossible to make the individual blows follow each other so quickly that the enemy would have no time to recover between each, to a certain extent, to make good the losses he had suffered, to prepare his defence against fresh blows, or even recover so far as to proceed to counter blows himself. The question is therefore whether a different procedure, after the close of the May-June offensive at latest, might have had more chance.

Possibly the necessary forces for the Hagen attack in Flanders, which was to have been the decisive operation, might have been mobilized by the middle of July if it had been decided to sacrifice the whole of the territorial gains, which were exhausting and difficult to maintain permanently, made up till then in the Michael and Blücher offensives, by a retreat movement on a large scale by which the fronts of the XVII., II., XVIII. and VII. Armies would return to their starting positions. With these forces a new and overwhelming surprise attack in a totally different form might have been sprung on the enemy, which would prevent his throwing his released forces straight on to the Flanders front and there avoiding a crash. What Hindenburg and Ludendorff had achieved with unexampled skill in Nov. 1914, immediately after the great retiring movement through S. Poland, by advancing from a newly selected position to a flank attack on the right wing of the Russian main army, could have been repeated in the summer of 1918 on French-Belgian soil when the general situation was strategically favourable.

In view of the complete failure from the outset of the attempt to realize their daring and far-reaching projects, there has been too much of a tendency to accuse the German Supreme Command of misjudging the situation, overestimating the working value of their own instrument of war and underestimating the enemy. Yet it was under no illusions as to the difficulties that it was essential to overcome. It was clearly recognized that time was now, more than ever before, a factor on the side of their enemies. The British had regained their strength, the French were not yet sufficiently shaken, and the Americans were bringing unexpectedly large masses of troops to France with amazing rapidity. To set against these factors the German commander-in-chief could count on no more reënforcements of any kind. No additional force for attacking purposes could be extracted from the divisions left in Russia and Rumania, which had already given up all their men under the age of 32. The drafting reserve from home was becoming more and more meagre, bringing in only 28,000 men for the infantry in June as against 44,000 in May. It was composed mainly of returned lightly wounded men, and those who had recovered from sickness. The average strength of the German battalion in the field had sunk by the middle of July from the original 850 men to 660. The actual front strength was even considerably lower than this number. The process of disintegration within the army caused by the prevalence of revolutionarily minded elements, did not escape the notice of the Supreme Command. Taking all in all, there was no doubt that the fighting value of the troops was no longer on the same level as at the beginning of the spring battle.

In spite of this there was no compelling reason to doubt the adequate striking power of the jagged though not blunted weapon of the German army, so long as its intentions and plans were kept absolutely secret, as before, and the blow was once again aimed at one of the enemy's weak spots.

Unfortunately for the Germans, their method of attack had now lost its magic effect on the enemy, who had found times and means to organize his resistance accordingly. The July offensive had been made with the greatest circumspection and thoroughness of preparation, just as before; and the attacking forces were certainly not deficient in courage or endurance. But an essential factor in the success of the undertaking was lacking—no commander-in-chief can do without luck. Hitherto the luck had been generally with Ludendorff. Now, at the decisive moment of the World War, it deserted him, and went over to his opponent—his equal in determination and will-power, and now his superior too in strength. If Ludendorff had had the luck at Reims in July 1918 which attended him at Tannenberg, history might have acclaimed him the greatest commander of all time, because he had remained true in spite of everything to himself and his belief in his star. But this was not to be. (W. F.)

IV. THE ALLIED OFFENSIVES OF 1918

The fourth and last phase of the war was ushered in by the failure of the German Champagne-Marne attack of July 15 and the success of the Allied counter-attack at Soissons on July 18, the results and far-reaching consequences of which came as a surprise to German and Allied commanders alike. Von Hertling, the German Chancellor, has written: "We expected grave events in Paris for the end of July. That was on the 15th. On the 18th even the most optimistic among us understood that all was lost." To make clear the significance of that statement it is necessary to review briefly the condition of the opposing armies previous to the Soissons attack.

It was indeed well known to both sides that the German army was nearing the end of its offensive strength, but just how nearly German *moral* had been drained neither side fully appreciated until later for, superficially, it was good. The French army, on the other hand, was well known to be at its lowest ebb of *moral*. The French soldier, since April 1917, had ceased to be a war machine unit who could be depended on blindly to follow his leader and had assumed a certain independent thinking rôle. Discipline had slackened and orders to attack or defend stubbornly had lost their force unless the soldier wished to attack or defend stubbornly. Pétain considered, early in July, that, although he had a number of rested divisions in reserve, he had not a single division which could be relied upon to push home and exploit an attack successfully. Of such as he had the Moroccan Div. was rated the best. The superiority of the British *moral* had been offset by the numerical weakness of their battalions, and, although they were holding their own doggedly, their confidence in their allies had suffered a severe strain and grew still further impaired as the lower units became intermingled. The American army was, of course, as yet an undetermined factor.

It was therefore with a certain amount of reasoned justification that Ludendorff, aware of these conditions, to which moreover he added an amazing underestimate of the strength of the American effectives in France, conceived that one more push directed against the French army would put it into headlong flight and thus pave the way for a similar stroke against the British. The adverse factors in the Champagne-Marne project were, first, that the method of attack, the so-called "Riga model," now lacked the element of surprise, since the methods of concentration for it were now too well known to make concealment possible, and its success was further discounted because Pétain had discovered the tactical means of effectively stopping such an attack; second, that Ludendorff had overcentralized his command. No army group commander or army commander was called on or permitted to exercise judgment or decision; he could only carry out the plans devised by Ludendorff and his staff by methods similarly devised and prescribed. In the lower ranks of officers this benumbing influence was, if anything, still more strongly felt. Meanwhile, synchronously with his success in thus centring the power of decision in his own hands, Ludendorff had become preoccupied with a multiplicity of problems which had no immediate relation to the conduct of the army on the western front. Germany's allies, her own internal questions, the Russian and Near East situations, were all constantly taking his time and distracting his attention from the western front, although nothing on that front could be done without his dictation. A further cause of weakness was that propaganda, among soldiers and civilians alike, had been overdone. Although the soldier indeed still responded to propaganda, it was only to the most extreme statements. Therefore in order to stiffen in the men the will to fight more resolutely in the attack planned for July 15 they were told that the French were already beaten and exhausted; that the British were ready to go out of the war; that the American army could not get to France, and that, even if it could, it could not fight; that the Champagne-Marne attack was to be the "peace-assault" which would end the war if successful, although as a matter of fact the utmost which Ludendorff really expected of it was that it would pave the way for a similar attack on the Lys. When therefore this attack of July 15 failed, and the French army showed itself anything but a beaten force, and when, three days later, the supposedly non-existent Americans established alike their presence and their fighting ability by marching through the German lines S. of Soissons in a fashion which compelled the evacuation of the whole Marne salient, the scales dropped from the eyes of the German soldier. To him the war was now lost; it was time to go home. Thereafter, curiously enough, while no longer crediting his own official propaganda, the German soldier became most receptive to Allied propaganda, and looked to it for the truth.

On the Allied side conditions and conceptions were in general more correctly adjusted. The French leaders knew the weaknesses of their opponents, but were also cognizant of their own, and they were more successful psychologists in dealing with their own men. The British army, having again been recruited up to fighting strength, felt that it had nothing further to fear from the worn-down German army so long as the French line held. The American army, supremely confident in every rank, longed only for the opportunity to disprove the belittling judgments of its opponents and to remove the doubts of its allies as to its fighting capacity. Further, the Allied High Command had the supreme merit of being not only in capable hands but, to a rare degree, decentralized. The attention of its leaders was not distracted from its own field by the necessity of solving distant problems in politics or diplomacy, and was backed in all the principal Allied countries by statesmen who in every way supported and aided the military chieftains, without, on the whole, unduly interfering with the conduct of the armies. Although the Supreme Command was nominally in the hands of Marshal Foch, he was a coördinator of efforts rather than a dominant military commander; and in fact he lacked the staff which would have been necessary for such a control as that exercised by Ludendorff over the German armies.

The plan for the Soissons counter-attack of July 18 was not a new one. As early as the German offensive on the Aisne (May 27), it had been proposed by a member of Gen. Pétain's staff, had been approved by his chief, and its details had been worked out. Marshal Foch had likewise favoured it, although hesitatingly, because of the attitude of the authorities in Paris. The difficulties of execution at that time lay in finding divisions of "attack-class" for the spear head at the crucial point. By the middle of July, with the increasing number of American divisions, which had gained and were gaining battle experience, that difficulty disappeared. On July 11 Pétain, on Pershing's insistence, again urged this plan upon Marshal Foch, purposing now to make it immediately after the long-awaited German Marne attack. Foch gave it his approval, not indeed with any hope of gaining thereby any decisive advantage, but rather regarding it as a desirable counter-stroke to the German assault.

The striking success of this counter-attack, which in two days gained and held control of the German communications in the Marne salient, and thereby compelled its evacuation, brought to the Allied leaders, as it did to many in Germany, the discovery that the tide of victory had already turned. On July 24 Foch arranged a meeting of the commanders-in-chief at Bombon, to discuss the means of following up this success and of preserving to the Allies the initiative thus unexpectedly gained.

The chief misgiving of the French Government at this time, now that Paris had been rendered secure through the driving of the Germans back from the Marne, was the lingering apprehension that the enemy might still drive a wedge between the French and the British armies at Amiens. It was therefore particularly welcome that Field-Marshal Haig should propose an attack on the Amiens salient to be made by the newly formed Australian corps, now in that sector and desirous of making the attack, together with the Canadian corps, which had not yet been engaged in the year's battles. At this meeting also it was decided to assign to the American army the reduction of the St. Mihiel salient as its first distinctive operation, but meanwhile to employ this new army in completing the reduction of the Marne salient. All the commanders-in-chief at this meeting expressed themselves as favouring a continuation of offensive action, yet still with the idea of keeping the German army busy, of wearing it down, of seizing favourable occasions and localities for attacks to gain prisoners and material and reconquer useful bits of territory, rather than with any thought of a systematic plan for ending the war by victory before winter.

During the two weeks following this conference the German army was forced back slowly from the Marne salient, now become a mere pocket, which was, however, held stubbornly because in this area there had been captured from the French, in May, vast quantities of munitions and military supplies of all kinds and of materials which were urgently needed in Germany, but which there had not been time or facilities for removing. In addition a vast amount of German material had been brought up for the maintenance of the army on the Marne front, and for the July 15 attack. Much of this was irreplaceable, and the German army had to fight to gain time to remove as much of it as possible.

Ludendorff, who had been present with his army during the Champagne-Marne drive, was not especially disheartened at its result and had gone to Flanders hoping to recoup his failure in Champagne by hastening the preparations for his offensive next in contemplation in the Lys salient. It was there that he received news of the Soissons reverse. He immediately realized the threatening consequences to his armies of this Allied counter-thrust, and returned to Avesnes to arrange the necessary withdrawal from the salient.

Materially this retrograde movement did not seriously compromise the German army, since, except during the penetration by the three assault divisions (two American and one Moroccan) S. of Soissons on July 18 and 19, the withdrawal was made slowly and in good order, inflicting as heavy losses on the attackers as the Germans themselves suffered. But Ludendorff soon recognized that the Lys offensive would have to be indefinitely postponed and the troops destined for it used in easing the situation in the Marne salient, where the Allied forces—French, British, American and Italian troops—were now pressing vigorously from all points. What Ludendorff apparently failed to gauge correctly at this time was the resultant damage to the *moral* of the German army; neither did he yet, seemingly, share the conviction, which had now been brought home to the German people and to Germany's allies, that all hope of ending the war by a German victory was gone, and that the only question left impending was whether it would end by a compromise or by the utter defeat of the Central Powers. Had the German High Command faced at this time the logic of the situation and made a decision to do, after the "Second Marne," what most German officers have since agreed should have been done after the first battle of the Marne, namely, to retire to the line of the Meuse and re-form, subsequent history might have differed materially from the actual events.

As proposed by Haig on July 24, the Australian and Canadian corps on Aug. 8 attacked side by side the German salient facing Amiens, supported by a French corps on their right and a British corps on the left. This attack was one of the most brilliant and tactically interesting episodes of the war, and showed Ludendorff again that the much disparaged tanks were, on ground suitable for their employment, a potent factor in a surprise attack. Although the sector against which the assault was launched was held by first-class troops, the German divisions were overrun and virtually annihilated as organized units. This attack dealt a stunning blow to the pride of the German High Command, a deadly one to the weak *moral* of the troops, and produced a corresponding exhilaration in the British army, all ranks of which could now clearly see that a complete and final inversion of rôles had taken place.

The shock was felt throughout Germany and reacted strongly upon the Government. The unsuccessful Marne attack, with the subsequent withdrawal from the Marne salient, although manifestly a lost battle, had, nevertheless, been one initiated by the German High Command on a battle-field of its own choice. The battle of Amiens could not be so interpreted. The Allies had here initiated the attack and it had been completely successful. Ludendorff correctly names Aug. 8 as the "Black Day" of the German army in the war. So grave was the crisis felt to be that a conference of army leaders and members of the German Cabinet was called to meet at Spa on Aug. 13. It was there agreed that further prosecution of Germany's war aims was hopeless, and that a peace would have to be negotiated at the first favourable opportunity, that is, at the first turn in the military situation even temporarily favourable to Germany. That looked-for turn never came. Under the persistent Allied attacks the German army reserves steadily dwindled, munitions and supplies lessened, and *moral* evaporated.

The day following the Amiens success Foch decided not to put the American army—which now had some 1,250,000 men in France—in on the Vesle, where the situation was virtually stabilized, but to assign it at once the task of reducing the St. Mihiel salient (*see* WOËVRE, BATTLES IN).

The battle of Amiens was followed up by a French attack between the Oise and the Aisne on Aug. 20, which forced the German line back on Chauny. Still more serious for the enemy was the attack by the British III. Army, on Aug. 21, N. of the Somme, on the line Bapaume–Péronne, which brought another crisis. By the end of Aug. the military situation had become sufficiently defined to enable the Allied leaders to look beyond a mere driving of the German army back to its strongly fortified lines of the previous winter, popularly known as the Hindenburg line, and to make plans for its rupture in a way to reap the largest strategical as well as tactical fruits of victory.

For this the British army, now fully restored in man-power and in high *moral*, and the American army, untouched by war weariness or reverses, inspired by an almost religious fervour of belief in the righteousness of the cause in which it was fighting, were of necessity regarded as the chief Allied weapons. The French army was tactically a trained and skilled army, but could no longer count on any large reserves of man-power to replace losses, and the general feeling among the French that their country had already been "bled white" in the war led to the not unreasonable contention by Government and people that, while France must still do her share to the end, her army must from now on be spared as much as possible, since in any event French losses in man-power would far exceed that of any other nation in the war.

Foch, therefore, determined on two main offensives: the British, supported on their right by the French, were to break the Hindenburg line in the direction of Cambrai–St. Quentin; the Americans, after completing the reduction of the St. Mihiel salient, which had been assigned as their first task, were to break through the German lines of defence N. of Verdun, supported on their left by French armies, and to advance in the direction of Mézières. In other words, the German line in northern France, constituting as it did a huge salient, was to be attacked in the simple orthodox manner by pinching in the two flanks. Of these two the Americans had possibly the harder task, for the Verdun front was well adapted to and thoroughly organized for stubborn defence, and, inasmuch as the railway communications through Sedan–Mézières were essential to the German army so long as its front lay W. of the Meuse river, the Verdun front, only 50 m. in front of this railway line, was bound to be defended with all the vigour and skill still remaining in the German army. Connecting these two attacks, the French army was to continue its operations to throw back the Germans beyond the Aisne and the Ailette. Such was the Allied plan formulated in Foch's directives of Sept. 3.

By the end of Aug. the German High Command ordered the evacuation of the Lys salient, and it was completed Sept. 6.

On Sept. 2 the attack of the British III. Army N. of the Somme was extended northward, E. of Arras, to include the I. Army reinforced by the Canadian corps; and as a result the whole German army fell back to the so-called Hindenburg line, which the Germans themselves designated the *Siegfried Stellung*. There they hoped to gain time to reorganize the depleted units.

This withdrawal, and the accumulating evidences of increasing demoralization in the German army, made it evident to Allied military leaders that offensive operations on a still larger scale could be safely initiated; and Marshal Foch, in a conference with the British and Belgian commanders-in-chief at Cassel Sept. 9, arranged for a fourth offensive, on the extreme northern part of the western front, to force the Germans back towards Ghent.

On Sept. 12 the American I. Army, as previously agreed upon, attacked and captured the St. Mihiel salient.

During the latter part of Sept. German H.Q., harassed and preoccupied by the crucial events which were taking place in other theatres, either gave insufficient heed to the precariousness and difficulties of the German military situation on the western front or were too stunned by their sudden and general reversal of fortune everywhere to be able to grasp and cope with them. Ludendorff, it is true, had two lines in rear reconnoitred: one from the Dutch frontier–Bruges–Valenciennes; the other Antwerp–Brussels–Namur–the line of the Meuse; but neither line solved the problem, nor could it be held in the face of a victorious pursuing enemy. The desideratum was to find a secure position for the army's winter respite from active operations, and time for the resting, reorganization and recruitment of the armies. It was possible to accomplish this only by a timely withdrawal, to the line of the Meuse at least, if not to the frontier. But Ludendorff still clung to the idea of holding every foot of French territory until the last possible moment.

On Sept. 26 the final Allied offensive, prepared by the directives of Foch, began. The American army under Pershing and the French IV. Army under Gouraud attacked on the Verdun and Champagne fronts (*see* MEUSE-ARGONNE, BATTLE OF). On Sept. 28 the Belgians, supported by a French army under Degoutte and the British II. Army under Plumer, attacked the line from the coast southward beyond Ypres (*see* YPRES AND THE YSER, BATTLES OF, *Part iv.*). On Sept. 27 the British III. and I. Armies, including the Canadian corps, had attacked on a front of 13 m. in the direction of Cambrai, and on the 29th the British IV. Army under Gen. Rawlinson, after a heavy bombardment lasting two days, attacked the St. Quentin sector.

The American and Belgian attacks had the advantage of coming as a complete strategic surprise; but, in the case of the Meuse-Argonne front, the depth of the fortified zone behind the front lines enabled the German reserves to be brought up and increasingly strong resistance to be made. Both British attacks were made against strongly organized positions held by the best troops the Germans still had; but on the front of the British I., III. and IV. Armies the enemy was already virtually on his rearmost prepared line, the attack was not unexpected, and both opposing armies appreciated thoroughly the consequences of victory and defeat. If driven from the Hindenburg line the weakened German army must thereafter fight in the open. The contest was therefore bitter to the point of desperation, but, even with the aid of the elaborate system for defence afforded by the long-prepared Hindenburg line, the struggle proved unequal, and the German army was forced back with heavy losses, to begin its retreat through the open country.

The German High Command had not appreciated the risk of accepting battle on the Hindenburg line, or else had over-estimated either the strength of the position or the remaining fighting capacity of the troops. Once the line was broken, however, they awoke to the situation. On Sept. 28 Ludendorff and Hindenburg agreed that the end had come; on the 29th the Foreign Minister was informed of the army's desperate plight; on Oct. 1 Hindenburg and the Kaiser went together to Berlin, and on Oct. 4 the first peace offer was sent to President Wilson.

On the battle-front the Allies were not permitting events to lag, and this same day renewed efforts were made on all fronts. The French V. Army under Berthelot had advanced from the Aisne and on Oct. 6 reached the Suippe. On Oct. 7 Foch ordered the attack on the right flank, extended to include the heights E. of the Meuse. On Oct. 8 the British I. and III. Armies renewed their attacks, and in three days drove the Germans back beyond the line of the Selle river–Le Cateau.

Between the two sectors of the Allied main right and left flank offensives lay the strong defensive German positions W. and S. of Laon. On Oct. 9 these positions were abandoned by the enemy, and the whole German line between the Scheldt and the Aisne began its retreat. By Oct. 10 the American I. Army had penetrated to the last line of German defences on its front, the *Kriemhilde Stellung*, and cleared the Argonne forest, while on its left the French IV. Army reached the Aisne.

On Oct. 10 a new directive of Foch gave more distant objectives to the armies; the Northern Flanders Group was to advance toward Belgium; the British armies, debouching from the front Solesne–Vassigny, were to push both in the direction of Mons and toward Avesnes; on their right the French I. Army was to push up the Oise; while the French and American armies between the Aisne and the Meuse were to continue their northward movement. The Marshal defined the purposes of these converging attacks to be to force the Germans back on the rough Ardenne forest, where communications were lacking and a modern army would have difficulty in maintaining itself.

On Oct. 12 the French X. Army of Mangin, on the left of the V., reinforced by an Italian corps, passed the Aisne and occupied the Chemin des Dames. On Oct. 14 the army group under King Albert renewed its attack on the front from the Lys to Dixmude. The Germans were unable to hold; Lille had to be abandoned, and, under the combined pressure of this and the British attack, the whole German line N. of Cambrai rolled backward in disorder, toward the Scheldt, closely pursued. The Americans also attacked on the 14th, with important gains W. of the Meuse.

On Oct. 17 the British IV. Army and the French I. Army attacked the hastily improvised German line between Le Cateau and the Oise. On the 20th the III. Army attacked the line of the Selle, supported by the I. Army astride the Scheldt. Both attacks succeeded.

The conditions of the fighting are best understood by referring to the German reserves. From 69 divisions in reserve when the attack of Sept. 26 was begun the German army had been reduced by Oct. 15 to 26 divisions in reserve, of which only 9 were rested. Of the divisions in line many were unfit for combat, but could not be replaced.

Toward the end of Oct. the dissatisfaction in Berlin and elsewhere with the Government had become intense. The people felt that the war had been mismanaged and that they had been deceived. In an attempt to appease them Ludendorff was dismissed on Oct. 25, and his place as quartermaster-general was taken by Gen. Groener. But it was too late to save either the Cabinet or the Monarchy, for with the disaster to the army from the vigorous Allied attacks of Nov. 1 and following days the Kaiser was forced to abdicate on Nov. 9.

On Nov. 1 the Allied armies began their final drive. On the right the American I. Army on the Meuse-Argonne front effected a clean break through the German lines, and began an active pursuit which was only stopped by the Armistice on Nov. 11. On the left of the American armies the French IV. Army was equally successful. Farther N. the British I. Army attacked the line of the Rhônelle river and completed the evacuation of Valenciennes. This attack was followed on Nov. 4 by a general attack by the British I., III. and IV. Armies, on a 30-m. front, from Valenciennes to the Sambre, N. of Oisy. In spite of serious natural obstacles, having to force the crossings of the Sambre on the right and to penetrate the forest of Mormal in the centre, the line was advanced 5 m. on Nov. 4. This battle finally broke the German power of resistance, and the German army began a retreat along the entire northern front, though it still offered stiff resistance to the British I. Army on Nov. 5 and 6.

On Nov. 9 the important railway centre and fortress of Maubeuge was taken and the II. Army crossed the Scheldt on its entire front. On Nov. 11 the Canadian 3rd Div. captured Mons. Farther N. the Belgian army stood before Ghent.

On Nov. 9 Foch had telegraphed all commanders-in-chief: "The enemy, disorganized by our repeated attacks, yields on the entire front. I appeal to the energy and initiative of the commanders-in-chief and of their armies to render decisive the results gained." On the same day the German delegates presented themselves at Rethondes to ask terms for an armistice, which were accepted on Nov. 11.

During the last week's fighting the outbreak of the revolution in Germany, interrupting as it did the service of communication and the forwarding of supplies, had combined, with the pressure on the front, the depleted and disorganized condition of the troops, and the absence of any available reserves to replace broken and worn combat units, to render further resistance on the part of the Germans an impossibility. Had the Armistice not been concluded a great *débâcle* would have been the result.

Preparations had been made to extend the attack on Nov. 14 to include the Lorraine front E. of Metz, an attack which the German army was as little prepared to meet as it was to resist the advance of the whole Allied line to the north. But this proved unnecessary to secure the Allied war aims. (A. L. C.)

WESTER WEMYSS, ROSSLYN ERSKINE WEMYSS, 1ST BARON (1864-), British admiral, was born in London April 12 1864, the 3rd and posthumous son of James Hay Erskine Wemyss of Wemyss Castle, Fife. He entered the navy in 1877, was promoted lieutenant 1887, commander 1898, captain 1901, rear-admiral of 2nd Battle Squadron 1912–3, and of the 3rd fleet 1914, vice-admiral 1916 and admiral of the fleet 1919. He commanded a squadron during the landing of the British troops in Gallipoli (1915), was commander-in-chief in the East Indies and Egypt (1916–7), Second, and shortly afterward First Sea Lord of the Admiralty (1917–9), and member of the War Cabinet (1918). He was created K.C.B. (1916), G.C.B. (1918), and raised to the peerage (1919).

WEST INDIES, BRITISH (*see* 4.607* and separate articles on the various islands).—For administrative purposes, British Guiana and British Honduras are usually regarded as an integral part of the British West Indies, with which they have much in common. These two colonies are, therefore, included here. The area of the group remained unchanged in 1921, no new possessions having been acquired by Great Britain in the Caribbean and no territory alienated. The total pop., according to the latest estimates available in 1921, was:—Bahamas, 59,049; Barbados, 200,368; Jamaica, 891,040; Turks and Caicos Is., 5,615; Cayman Is., 5,564; Antigua, 32,865; St. Kitts, 22,415; Nevis, 11,596; Anguilla, 4,230; Dominica, 40,315; Montserrat, 10,182; Virgin Is., 5,557; Trinidad and Tobago, 386,707; Grenada, 74,490; St. Vincent, 53,210; St. Lucia, 51,505; British Guiana, 305,991; British Honduras, 43,586.

The Supply of Labour.—Though Barbados has a redundant population, the labour supply in the rest of the West Indies was insufficient for agricultural requirements, and the position had been aggravated by the emigration of British West Indians to Cuba, to which island they were tempted by the promise of higher wages, which did not, however, always materialize. Toward the end of 1919 this form of emigration began to assume serious proportions, no fewer than 21,573 labourers leaving Jamaica for Cuba, whilst only 6,457 returned. Recruiting for Cuba was also actively carried on in Barbados. With the slump in prices in 1921, however, the tide set in to some extent in the opposite direction, many labourers returning to their homes. In the British West Indies it was beginning to be realized that it is only by the payment of suitable wages, improved housing conditions and the offer of other amenities, that labourers can be induced to remain in their island homes. In British Guiana the shortage of labour was particularly acute, and with a population averaging only 3·3 to the square mile, no development of the hinterland on a large scale was possible.

In 1913, Mr. James McNeil and Mr. Chimman Lall visited the British West Indies to report on the system of indentured immigration prevailing in British Guiana, Jamaica and Trinidad, and though their report was favourable, Lord Hardinge, the then Viceroy of India, announced in the Indian Legislative Council in April 1916 the determination of the Government to abolish the indenture system. It was at first proposed to terminate the system gradually in order that the colonies might have time to adjust themselves to the change; but in practice emigration from India was completely suspended in the same year. In 1919, the need for labour having become acute in British Guiana, a deputation comprising representatives of all classes of the agricultural and commercial communities visited England to urge upon the India Office and leaders of Indian public opinion, who were then in London, the desirability of the resumption of Indian immigration on a free colonization basis. Representatives of the deputation and of the West India Committee subsequently visited India, where they interviewed prominent leaders and the members of the Government, who agreed to send a commission to British Guiana to report on the suitability of that country for receiving immigrants. The appointment of this commission was, however, delayed, it being felt desirable to await the views of the public in India regarding the proposals for dealing with the Indian question in Kenya Colony before proceeding further with the matter. In July 1921 an offer of the Indian Government to send a deputation to British Guiana was under consideration.

Government and Administration.—The question of political federation of these scattered colonies, which was discussed periodically, had failed up to 1921 to awaken any marked degree of enthusiasm in the several communities. Indications were not wanting, however, to show that a better understanding was being gradually brought about, in spite of the continued difficulties of communication. This was no doubt attributable to the work of a series of intercolonial conferences from 1899 to 1921, the main object of which had been to bring about a greater degree of uniformity in all matters of common interest concerning the British West Indies. All proved eminently successful, the Customs Conference in 1919, for example, having resulted in the adoption of uniformity of definition and arrangement of the West Indian tariffs, whilst the conference on law in 1916 was followed by the establishment of a West Indian court of appeal for the colonies lying to windward of the Caribbean. A further step in the direction of closer union has been the formation of an Associated West Indian Chamber of Commerce, which held conferences in Trinidad in 1917 and Barbados in 1920. In 1920–1 Grenada, St. Lucia, and St. Vincent individually petitioned the King for the substitution of representative government for the crown colony system. In the case of Grenada, the Secretary of State for the Colonies, to whom the matter was referred, consented to advise the King to approve of the introduction of the elective system into the constitution, the council to consist of the governor, as president, six official, three nominated unofficial and four elected unofficial members, the electives to be chosen by the people on the basis of the system of elected representation, already operative throughout the island in municipal affairs in the case of the district boards. The petitions of St. Lucia and St. Vincent, on the other hand, were rejected on the grounds that the signatories were not sufficiently representative in character.

In 1920 the Prince of Wales made Barbados his first port of call in his empire tour in H.M.S. "Renown," and visited in succession Trinidad, British Guiana, Grenada, St. Lucia, Dominica, Montserrat, Antigua and Bermuda on his homeward voyage. His Royal Highness, who was received with manifestations of the greatest loyalty wherever he went, took the opportunity of refuting the suggestion that Great Britain might be willing to dispose of her West Indian possessions to a foreign country in part settlement of her debt.

The World War.—The British West Indies contributed generously in men, money and produce toward the prosecution of the World War. Many hundreds of West Indians came over to England independently to enlist, and a contingent comprising 15,601 officers and men was recruited voluntarily for active service. The numbers of men recruited in the various islands, British Guiana and British Honduras, were:—

	Officers	Men
Barbados	20	811
Bahamas	2	439
British Guiana	14	686
British Honduras	5	528
Jamaica	303	9,977
Trinidad and Tobago	40	1,438
Grenada	4	441
St. Lucia	5	354
St. Vincent	..	305
The Leeward Is.	4	225
	397	15,204

The men were embodied in the British West Indies Regt., which served with distinction in France and Flanders, and also in Egypt and Palestine, where they participated in the victorious advance to 'Amman. The total casualties were: Killed or died of wounds, 185; died of sickness, 1,071; wounded, 697. Private contingents were also sent over for enlistment by the Trinidad Merchants' and Planters' Contingent Committee and the Barbados Citizens' Contingent Committee for recruitment in the United Kingdom. In order to provide for the welfare of the West India and Bermuda military contingents, and of men coming over independently to serve in His Majesty's forces during the war, the West Indian Contingent Committee was formed in London at the instance of Mr. Bonar Law, the then Secretary of State for the Colonies, in 1915. The total contributions made by the British West Indies toward the cost of the war, relief funds, etc., amounted to over £3,250,000, the most notable amount included in that figure being the annual contribution of £60,000 for 40 years voted by the Jamaica Legislature.

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* *These figures indicate the volume and page number of the previous article.*

Trade.—The war brought about a remarkable revival of prosperity to the British West Indies, the total trade of those colonies rising from £25,809,884 in 1913 to £43,637,324 in 1919. The chief staples, sugar, rum, molasses, cacao, cotton and arrowroot, all commanded greatly enhanced prices, the only industry, indeed, that reaped no benefit being that of the production of lime and lime products in Dominica, which was adversely affected by the lack of shipping facilities and by import restrictions in the United States. Some anxiety was caused in 1912 by the decision of the Imperial Government to withdraw from the international convention for the suppression of sugar bounties and cartels, but the remaining high contracting Powers, having decided to adhere to that agreement, no ill effects resulted. Though Great Britain withdrew from the convention she decided to adhere to the principles of it and not to give a preference to sugar produced within the Empire or to cane over beet. In Aug. 1918 she gave to the signatories of the convention six months' notice of her intention to resume complete liberty of action in respect of her policy with regard to sugar, and the Finance Act of 1918 provided for the granting of a preference of one-sixth off the duties on sugar, molasses, tobacco, coffee, cacao and other products imported from within the Empire into the United Kingdom, and a preference of 2s. 6d. per gal. on rum.

Following an inquiry by a royal commission, of which the late Lord Balfour of Burleigh was chairman, in 1909, a conference was held at Ottawa in 1912 between representatives of the Dominion and the British West Indian colonies, the Bahamas, British Honduras and Jamaica excepted, to consider the question of closer trade between Canada and the West Indies, and on April 9 in that year an agreement was signed providing for a reciprocal trade agreement, the basis of which was a mutual preference of 20% on the chief products of the countries concerned, with a minimum preference on flour in favour of Canada, of 12 cents per 100 lb. and 15 cents on 96° test sugar not over No. 16 Dutch Standard in colour in favour of the British West Indies. Certain concessions which the Canadian refiners had enjoyed of importing foreign sugar at the British preferential rates were withdrawn. The agreement came into force on June 2 1913, and Grenada gave her adhesion to it in the same year.

In 1920 a further conference was held at Ottawa at which all the West Indian colonies, and also the Imperial Government, were represented. A new agreement was signed on June 18 1920 and brought into force in May 1921, under which Canada agreed to give to British West Indian products a tariff preference of 50%, whilst the British West Indies similarly agreed to extend to Canadian products tariff preferences of 50% in the case of Barbados, British Guiana and Trinidad, 33⅓% in that of British Honduras, the Leeward Is. and the Windward Is., 25% in Jamaica, and 10% in Bahamas, the Legislature of which colony afterwards voluntarily increased the preference to one of 25%. Certain products were again specifically dealt with, the preference on Canadian flour entering the West Indies being not less than 1s. per 196 lb. and that on West Indian sugar being not less than 83.712 cents per 100 lb. on 96° test. The Government of Canada further agreed to endeavour to arrange for a weekly freight, mail and passenger service, with steamers of 5,000 to 6,000 tons burthen, capable of steaming 12 knots per hour, between St. John (New Brunswick) or Halifax (Nova Scotia), down the islands lying to windward, British Guiana and back, the colonies contributing £27,000 per annum; also a service of freight, mail and passenger steamers of 3,500 tons burthen, capable of steaming 10 knots, from Canada to Nassau (Bahamas), Jamaica, Belize (British Honduras), and back, fortnightly, the colonies concerned contributing at the rate of £13,000 per annum toward any loss involved in the event of the service proving unremunerative. The Canada-British Honduras service was inaugurated in Jan. 1921. A declaration appended to the agreement recommended for favourable consideration the laying of British-owned and British-controlled cables as soon as possible, to connect Bermuda with Barbados, Trinidad, British Guiana, the Windward Is., the Leeward Is., and Turks Is. or Jamaica.

Communications.—In the matter of steamship communication the British West Indies were decidedly worse off after the war than before it. In 1915 the Royal Mail Steam Packet Co. terminated the transatlantic contract steamer service on the ground that they had been precluded from using their terminal port at Southampton. In the same year the fortnightly intercolonial contract service was also terminated by mutual agreement between the company and the colonies concerned. For some time thereafter the company continued to berth small passenger steamers for the West Indies at irregular intervals; but this service was also brought to an end in 1920, and passengers between the West Indies and the mother country were afterwards compelled to travel by foreign steamers, cargo boats, or *via* Canada or the United States. An intercolonial service was performed in 1921 by direct steamers running between St. John (New Brunswick) and Halifax (Nova Scotia), down the islands, and back. Under the Canada-West Indies trade agreement referred to above this service was to become a weekly one. The British Government, toward the close of the year 1920, agreed to contribute two-thirds of the cost of a temporary transatlantic steamer service for three months if the West Indian colonies would provide one-third, but this proposal was not acceptable to all the colonies concerned, mainly because it was felt that the steamers which it was proposed to use were unsuitable. In 1921 the British Government further offered to contribute £90,000 per annum toward a subsidy for a transatlantic steamer service, and proposals were made for the invitation of tenders. This proposal was, however, rejected by Trinidad, which in 1921 enjoyed a fortnightly mail and passenger service provided by the Royal Netherlands West India Mail, free of expense to the colony. The Dutch line agreed in June 1921 to allow their steamers to call at Barbados as well as Trinidad.

Agriculture.—In 1919 Visct. Milner appointed a committee to consider the desirability of establishing a tropical agricultural college in the West Indies, and in the event of their decision being favourable to report on the subject generally. The committee issued their report in 1920, favouring the establishment of a West Indian agricultural college in Trinidad. The proposals having commended themselves to the majority of the West Indian colonies, the agricultural college committee was called together again in the autumn of 1920 with a view to making the necessary arrangements for the incorporation of the college and for carrying out the plans generally. The objects for which the college was established are to afford to young men opportunities for instruction in the principles of agriculture and in the cultivation and preparation for market of tropical produce of every kind, including especially sugar and its by-products, rum and molasses, cacao, coffee, cotton, coco-nuts, rice, citrus and other fruits (notably bananas), and dyewoods, many of which commodities constitute the raw materials employed in the manufactures of the mother country; for the training of scientific investigators in matters pertaining to tropical agriculture amid suitable surroundings; for creating a body of British expert agriculturists well versed in the knowledge of the cultivation of land in the tropics, and of scientific advisers possessing an intimate knowledge of the means of combating pests and diseases, the control of which is fundamentally essential to the successful development of agriculture in the tropics. Attached to the college will be a model sugar factory, the various units of which have been contributed by the principal British sugar machinery manufacturing and allied firms.

Industries.—Sugar remained the principal staple. This industry was developed by the extension of the central factory system, whereby the canes from the surrounding estates, as well as those grown by peasant farmers, are dealt with at a central base, the concentration thus effected permitting of the instalment of machinery by which the maximum amount of sugar can be extracted from the cane. Thanks to the devoted care given to cultivation, and to the assistance of the local agricultural scientists who make it their constant aim to combat insect pests, the cacao industry, which is mainly centred in Trinidad and Grenada, continued to prosper. The Jamaica banana industry suffered from a succession of hurricanes in 1915, 1916 and 1917, but afterwards showed rapid recovery. The cultivation of citrus fruit on the other hand made little progress—except in Dominica, where the lime industry continued steadily to increase after the war—owing to the prohibitive import duties in the United States and the inadequacy of shipping facilities for fruit between the West Indies and Canada and the United Kingdom. The Sea Island cotton industry, which owed its development in the West Indies to the ravages of the boll-weevil in the United States, received a check in 1920, through the appearance of the still more dreaded boll-worm in St. Kitts and Montserrat, to which it was brought by a Brazilian vessel. A comparatively new industry, which made rapid progress, was that of rice. Formerly rice was imported into British Guiana in large quantities for the consumption of East Indian immigrants. Now that colony not only produces enough rice for its own requirements but also a substantial surplus which is available for export to the neighbouring colonies. The exports of rice from British Guiana rose from 45,223 lb. in 1905 to 18,110,400 lb., besides 4,390,051 lb. of paddy, in 1920.

Almost as rapid has been the development of the petroleum industry in Trinidad. The existence of petroleum deposits in Trinidad has long been recognized. As far back as 1864 the Trinidad Petroleum Co., promoted by Mr. H. B. Sheridan and the 11th Earl of Dundonald, started drilling for oil at La Brea. Oil was struck, but competition with the new oilfields in the United States proved too formidable, and this and other causes forced the company into liquidation. Two years later, a civil engineer, named Derwent, started boring at Aripero. He, too, struck oil, but failed to make a financial success of the venture. No further steps were taken toward winning oil until about 1900, when Mr. Randolph Rust, a local resident (Mayor of Port of Spain in 1921), imported modern oil-boring machinery and successfully struck oil at Aripero in 1901. Other prospectors came on the scene, and in 1910 followed the successful flotation of the Trinidad oilfields, and Trinidad enjoyed such a boom as no West Indian colony had experienced, at any rate for many a long day. On April 27 in the following year Sir George Le Hunte, the then governor, opened the valve at the end of the pipe line on Brighton pier, thus inaugurating the new industry, which has since been developed at a rapid rate. With many new wells being drilled it was certain that the production of oil, which in 1920 amounted to 72,905,947 gal., would undergo material expansion. (A. E. A.)

WESTINGHOUSE, GEORGE (1846–1914), American inventor and manufacturer, was born at Central Bridge, N.Y., Oct. 6 1846. In 1856 his father moved to Schenectady, N.Y., and began to manufacture farm implements. The boy early displayed inventive talent and when 15 designed and constructed a rotary engine. He entered the Union army in the Civil War in 1863 but in 1864 was appointed third assistant engineer in the navy. At the close of the war he resigned and entered Union College, but in his sophomore year, on the advice of the president, he withdrew to devote his time to mechanical invention. In 1865 he had invented a device for replacing derailed cars and also a reversible steel railway frog, but from lack of capital was unable to develop a business in Schenectady. In 1868 he went to Pittsburgh and arranged for the manufacture of his devices, which he himself sold to the railways. In 1869 he patented his air-brake and organized the Westinghouse Air Brake Co. In 1872 he invented the automatic air-brake (*see* 4.414). This brake was quickly adopted by railways in America and gradually in Europe. He also developed a system of railway signals, operated by compressed air with the assistance of electrical contrivances. In 1885 he acquired certain patents for alternating current machinery. In June 1912 he received the Edison gold medal for "meritorious achievement in connexion with the development of the alternating current system for light and power." In 1893 this system was installed at the Chicago Exposition. Later his Pittsburgh establishment built dynamos for the power plants at Niagara Falls, for the rapid transit systems of New York City, and for the London Metropolitan railway. Westinghouse also devised a method for conveying gas through long-distance pipes thus making it a practicable fuel. In 1910 he was elected president of the American Society of Mechanical Engineers. He died in New York March 12 1914. He was president of some 30 corporations with a capital of about $200,000,000, employing more than 50,000 persons.

WESTLAKE, JOHN (1828–1913), English jurist, was born at Lostwithiel, Cornwall, Feb. 4 1828. He was educated at Trinity College, Cambridge, where he graduated in 1850. He was called to the bar in 1854, and attained a great reputation as an authority on international law. In 1874 he became a Q.C. and bencher of Lincoln's Inn, and in 1885 successfully contested the Romford division of Essex in the Liberal interest. In 1888 he became professor of international law at the university of Cambridge, a position which he held until 1908. He was also an hon. president of the Institute of International Law, and from 1900 to 1906 a member of the Hague arbitration court. He died at Chelsea April 14 1913.

His works include *A Treatise on Private International Law, or the Conflict of Laws* (1858; 5th ed. 1912); *Chapters on the Principles of International Law* (1894); *International Law*, Part I., *Peace* (1904; 2nd ed. 1910); Part II., *War* (1907).

WESTON, AGNES (1840–1918), English philanthropic worker, was born in London March 26 1840. In 1868 she took up hospital visiting and parish work in Bath, and through beginning a correspondence with a seaman who asked her to write to him, developed into the devoted friend of sailors, superintendent of the Royal Naval Temperance Society and founder of the Royal Naval Sailors' Rests, or clubs for sailors, at Devonport and Portsmouth. She published *Life Among the Bluejackets* in 1909. She died at Devonport Oct. 23 1918. Shortly before her death her work for the navy had been recognized by the bestowal of the G.B.E.

See S. G. Wintz, *Our Bluejackets, Miss Weston's Work* (1894).

WEST POINT (*see* 28.558).—The following important buildings were completed at West Point after 1910: the Administration Building, East Academic Building, Riding Hall, two new cadet barracks, cadet chapel and chaplain's quarters, artillery barracks and artillery stable, cavalry barracks and cavalry stable, eight sets of officers' quarters, two apartment buildings each containing eight sets of officers' quarters, and a cadet laundry. By Act of May 4 1916, the number of cadetships authorized at the academy was increased to 1,332. By authority of the War Department, April 1915, candidates were permitted, in lieu of passing the regular entrance examination, to qualify for admission upon the presentation of satisfactory certificate of previous academic work in accredited institutions. By Acts of 1919 and 1920, the pay of cadets was fixed at $780 per annum and one ration per day or commutation thereof at the rate of $1.08 per day. The World War and the demand for trained officers led the War Department to direct the graduation of the First or Upper Class April 20 1917, and of the Second Class Aug. 30 1917. The next year the need for officers resulted in the graduation of three classes, the first, June 12 1918, and the second and third together, Nov. 1 1918. A class of new cadets was admitted at an irregular time, Nov. 2 1918, and provision was made for a temporary one-year course. After the Armistice the War Department directed, May 12 1919, that the course of instruction be fixed for three years, but the following year Congress specified that the course should be four years. The academic authorities thereupon reorganized the curriculum in the light of the most recent military and educational experience.

The new schedule contained the following salient features: (1) The upper classes on duty undergo military training June 15 to Aug. 30 at a regular army cantonment away from West Point; (2) The new Fourth Class enter the academy July 1 and receive at West Point preliminary military training until Aug. 30; (3) During the academic year, extending from Sept. 1 to June 15, tactical drills and supervised athletics alternate daily (except Wednesdays and Saturdays) after 4 P.M. for all cadets; (4) Academic instruction be given during periods between 8 A.M. and 4 P.M. in the following subjects to the respective classes—*Fourth Class*, mathematics, English, French and surveying; *Third Class*, mathematics, English, French, political history, drawing and theoretical tactics; *Second Class*, natural and experimental philosophy, chemistry and electricity, Spanish, military hygiene; *First Class*, military engineering, law, military art and history, ordnance and gunnery, economics and government. Ten Saturdays throughout the year were set apart for lectures to the whole corps by eminent men.

The number of graduates of the academy 1910 to 1920 inclusive was 1,959. The superintendents since 1910 have been: T. H. Barry (b. 1855) 1910–2; C. P. Townsley (b. 1855) 1912–5; John Biddle (b. 1859) 1916–7; S. E. Tillman (b. 1847) 1917–9; Douglas McArthur (b. 1880) 1919–22. (L. H. H.*)

WEST VIRGINIA (*see* 28.560).—In 1920 the pop. was 1,463,701, as against 1,221,119 in 1910, an increase of 242,582 or 19·9%. The urban pop. (for places of 2,500 or more) increased from 18·7% in 1910 to 25·2% in 1920. The density of pop. was 60·9 in 1920; 50·8 in 1910. The following table shows the growth of the ten largest cities for the decade 1910–20:—

	1920	1910	Percentage increase
Wheeling	56,208	41,641	34·9
Huntington	50,177	31,161	61·0
Charleston	39,608	22,996	72·2
Clarksburg	27,869	9,201	202·9
Parkersburg	20,050	17,842	12·4
Fairmont	17,851	9,711	83·8
Bluefield	15,282	11,188	36·6
Martinsburg	12,515	10,698	17·0
Morgantown	12,127	9,150	35·5

Agriculture.—Of the land area of the state 62·2% in 1920 was in farms and 57·7% was improved. The number of farms, which was 96,685 in 1910, decreased to 87,289 in 1920 (9·7%). The total farm acreage decreased from 10,026,442 to 9,569,790 (4·6%), but the total value of all farm property increased from $314,738,540 in 1910 to $496,439,617 in 1920 (57·7%). The value of farm lands and buildings increased from $264,390,954 to $410,783,406; implements and machinery from $7,011,513 to $18,395,058; and live stock from $43,336,073 to $67,261,153. The number of farms reported as being mortgaged grew from 9,525 in 1910 to 10,274 in 1920. Of these 7,878 in 1910 and 9,031 in 1920 reported the amounts represented by the mortgages—$5,592,533 and $11,205,953 respectively. The average debt per mortgaged farm was $1,241 in 1920 and the average rate of interest 5·9%. Native-born white farmers predominate in the state. Of the 87,289 farms in the state in 1920 86,785 were operated by white farmers, of whom only 752 were foreign-born, and there were only 504 coloured farmers, compared with 708 in 1910. Of the native white farmers 71,181 were owners, 1,071 managers and 13,781 tenants. The number of horses on farms in 1920 was 169,148, compared with 176,530 in 1910. Mules increased from 11,577 to 14,981; cattle from 560,770 to 587,462; and chickens from 3,106,907 to 4,027,510; while sheep decreased from 566,952 to 509,831; and hives of bees from 111,673 to 89,873.

The value of all crops for West Virginia in 1919 was $96,537,459, compared with $36,167,014 in 1909. The 1919 value of the corn crop was $29,768,131; oats $3,054,668; wheat $8,395,097; hay and forage $23,746,574; potatoes $6,461,619; tobacco $2,731,338; apples $7,540,491; peaches $1,518,784. The variations in production of the chief crops in 1909 and 1919 is shown in the following table:—

	1919		1909	
	Ac.	Bus.	Ac.	Bus.
Corn	568,219	17,010,357	676,311	17,119,097
Oats	169,915	3,054,668	103,758	1,728,806
Wheat . . .	298,036	3,747,812	209,315	2,575,996
Buckwheat . .	31,095	537,883	33,323	533,670
Potatoes . . .	34,526	2,809,398	42,621	4,077,066

The extension of agricultural teaching, which was established at the West Virginia University in 1913, has been an important factor in the development of scientific agricultural methods.

Mining.—In mineral productions West Virginia ranks second among the states of the Union. The total value was $125,111,280 in 1913 and $133,633,229 in 1914. Oil production, which in 1900 was 16,195,675 bar., declined to 9,095,296 in 1907. It increased again to 12,128,962 bar. in 1912, but steadily declined thereafter. The production in 1916 was 8,731,184 bar., valued at $21,914,080. In 1918 it was only 7,866,628 bar. (the lowest since 1893), but in 1920 it reached 8,173,000 barrels. In the production of natural gas West Virginia since 1906 has ranked first among all the states. The production, which had reached 119,100,392 thousand cub. ft. in 1906, steadily increased (except in 1908 and 1914) to 308,617,101 thousand cub. ft., (valued at $57,389,161) in 1917; but in 1918 declined to 265,160,917 thousand (valued at $41,324,365), and in 1919 to approximately 201,500,000 thousand (valued at $40,304,500).

In 1909 West Virginia, overtaking Illinois, became the second coal-producing state of the Union, but in 1920 dropped to third. Coal production in West Virginia, which had reached 22,647,207 short (net) tons in 1900, and 61,671,019 in 1910, continued to increase steadily, reaching in 1914 71,707,626 short tons, valued at $71,391,408, and furnishing employment to 78,363 persons. The industry became especially active when the United States entered the World War. In 1916 the production increased to 86,460,127 short tons, valued at $102,366,092, and in 1918 to 89,935,839 short tons, valued at $230,508,846. In 1919 it was 75,500,000 short tons, and, together with coke production 1,454,000 short tons, gave employment to 91,566 persons. In 1920 it was 87,500,000 tons. The production of coke, which steadily increased until 1910, when it reached 14,217,380 short tons, valued at $7,525,922, thereafter steadily diminished to 1,391,446 short tons in 1915, again increased to 3,349,761 in 1917, and in 1919 decreased to 1,454,000 short tons. The increase of coal production after 1910 was partly due to strikes in Ohio and other middle-western states. The determination of the United Mine Workers to unionize the mines of West Virginia led to a bitter and prolonged labour war, which began in 1912 in the Cabin Creek and Paint Creek collieries of the Kanawha valley, and resulted in losses aggregating nearly $6,000,000. This secured for the union a foothold in West Virginia. In Sept. and Nov. 1919 organized miners from the Kanawha region threatened an armed invasion of Logan County to force the unionization of that field. In order to prevent possible disturbance Gov. Cornwell asked for and obtained a regiment of Federal troops. In 1920 an attempt to unionize the miners along the Norfolk & Western railway finally precipitated an armed conflict between detectives and union miners at Matewan, in Mingo county, resulting in the death of seven detectives and the mayor and the terrorization of the community, and necessitating a call for Federal troops and the establishment of military control.

Manufactures.—In 1914 West Virginia was in importance of manufactures the 28th state. The number of establishments was 2,749, with an invested capital of $175,995,011, and a production valued at $193,511,782. The number of persons employed was 79,353 (11% more than 1909), earning $51,377,760. The leading industries were lumber and timber, steelworks, rolling-mills, tinplate and terneplate, glass, leather, railway cars and shop construction, flour milling and the manufacturing of clay products. The state ranked second in the production of glass, and also in the production of tinplate and terneplate, and eighth in the value of clay products. The Federal Government constructed on the Kanawha in 1918 two large plants, a projectile plant at Charleston and a high-explosive plant at Nitro, at an expenditure of over $60,000,000.

Transportation.—Transportation facilities continued to improve after 1909. The railway mileage, which in 1912 reached 3,557 m. by the completion of the Virginia railway (139·6 m.), by the construction of the coal and coke railway from Elkins to Charleston (196·75 m., recently acquired by the Baltimore & Ohio Railway Co.), and by the completion of the Hampshire-Southern branch of the Baltimore & Ohio to Moorefield and Petersburg, was further increased in 1913 by the extension of the Monongahela River railway southward to Fairmont (1913) and by several shorter branches. The railway mileage in 1919 was 3,892.

Banks and Banking.—The condition of the banks in West Virginia in 1920–1 was as follows:—

	National Banks, 1920	State Banks, 1920–1
Number . . .	122	227
Capital . . .	$11,573,000	$17,597,932
Surplus . . .	$7,739,000	$11,047,231
Loans . . .	$100,545,000	$150,617,886
Deposits . . .	$134,436,000	$170,370,924

Education.—In 1920 the total school pop. was 448,670, the total school enrolment 341,977, the average daily attendance 253,395. The *per capita* cost of education was $25.18 based on enumeration, $44.57 based on average daily attendance. The total number of teachers was 11,406. The average annual salary paid teachers in all grades was $581. The total number of school-houses was 6,956. The expenditure for all common schools was $11,291,563 and for state educational institutions $1,850,906, making a total of $13,141,469 for the educational system of the state. The value of all public school property was estimated at $25,639,697, and the value of state educational institutions at $2,775,000. In 1920 a compulsory school law was enacted. The development of the high schools has been a prominent feature of recent educational growth. This was partly due to the appointment of a state high school supervisor in 1909 to direct the establishment and standardization of the high schools. In 1921 the state had 172 classified high schools with 1,129 teachers, and an enrolment of 20,000 (about 3,000 graduating each year), and high school property valued at $10,000,000. In 1920 the high schools received state aid amounting to $118,000. The enrolment of candidates for degrees in West Virginia University increased from 800 in 1909–10 to 1,596 in 1919–20, and the total enrolment for the same period increased from 1,200 to 2,800, or 1,992 exclusive of short-course students. The members of the faculty increased from 62 to 141, of whom 56 were full professors, 17 were associate professors and 27 were assistant professors. The total number of women students increased from 619 to 975 in the same period. Under the Act of 1919 the control of all educational affairs of the state, from the lowest school to the university, was vested in a state board of education composed of the state superintendent (as executive officer) and six members appointed by the governor. The board has an advisory council of three coloured citizens.

Finance.—The receipts of the state for the fiscal year June 30 1920 was $19,901,931, the disbursements $19,570,122. The total bonded indebtedness Jan. 1 1921 was $11,663,700. In 1919 the total assessed value of real estate ($769,648,033), personal property ($371,602,428) and public utility property ($349,522,672) was $1,490,773,133. In 1909 the Legislature enacted a business licence tax which by July 1920 produced $226,204. In 1915 it placed on corporations and companies a special excise tax, which was increased by an additional excise tax in 1919. The two Acts produced for 1919–20 approximately $600,000.

Constitutional Amendments.—An amendment providing for prohibition was ratified in 1912 by a majority of 92,342. Another amendment proposed in 1917 and ratified in Nov. 1918 provides that an itemized and classified budget shall be prepared by the board of public works, and presented to the Legislature for its guidance in determining appropriations. A third amendment ratified in Nov. 1920 provided for two periods of every regular session of the Legislature—one of 15 days in Jan., primarily for presentation of bills, and another of 45 days in March–April, primarily for consideration and action on bills. The same amendment increased the salaries of members of the Legislature to $500 a year. A fourth amendment, ratified in Nov. 1920, authorized the Legislature to provide for a system of state roads under control and supervision of state officers, and to bond the state to a maximum of $50,000,000, if necessary.

Administrative Changes.—By Act of 1911 a state Department of Agriculture was created in 1913 and placed under the Direction of the commissioner of agriculture, an elective officer who is also a member of the board of public works. The office of highway inspector, created in 1907, was abolished in 1911; and a state bureau of roads (four members) was created in 1913. By Act of 1913 a public service commission of four members (reduced to three by Act of 1915) was created. At first it had jurisdiction over the newly established workmen's compensation fund, which later was administered by a state commissioner. Under the Yost law of 1913 the state tax commissioner is *ex officio* state commissioner of prohibition.

By Act of 1919 a department of public safety (state police) was established to relieve the military arm of the state and to aid in establishing the system of private peace officers. By Act of 1915 the membership of the House of Delegates (previously 86) was increased to 94.

Welfare Legislation.—A state tuberculosis sanatorium established by Act of 1911 was opened for patients in 1913 at Terra Alta. A similar institution for coloured people was opened in 1919. Revision of laws relating to medicine and health in 1913 marked the beginning of a new era in sanitary legislation. In 1914 a hygiene laboratory was established. In 1915 a state department of health was created, with a commissioner as executive officer, two new divisions, vital statistics and child welfare, were added by Act of 1919.

History.—Apart from the economic and educational movements above described, the outstanding event of the decade ending 1920 was the adjustment of the long-standing "Virginia debt question." It arose from the formation of West Virginia as a separate state in 1863 and at various times had been a prominent issue in state politics. A U.S. Supreme Court decision of 1911 tentatively fixed West Virginia's share of the old debt at $7,182,507.48 (leaving the question of interest for later adjustment), and by a later judgment of 1915 against West Virginia fixed the total obligations at $12,393,929.50 ($4,215,622.28 and accrued interest from Jan. 1 1861), with a decree that this total amount should draw interest at 5% until paid. In Feb. 1917 Virginia filed application for a writ of *mandamus* against the Legislature of West Virginia to compel the levy of a tax to pay the judgment; but the court deferred action in order to give West Virginia a reasonable opportunity to act without compulsion. The total amount of principal and interest on Jan. 1 1919 was $14,562,867.16. Of this amount West Virginia, by Act of March 31 1919, arranged to pay $1,062,867.16 in cash and the balance by an issue of "listable" 3½% bonds in favour of Virginia, payable in 1939 (or earlier). Bonds amounting to $12,366,500 were delivered to the Virginia debt commission at Richmond, Va., on July 3 1919. The remaining bonds ($1,133,500) were held in escrow pending the filing of remaining outstanding Virginia debt certificates.

The state continued Republican in politics, but party division resulted in the election of a Democrat to the governor's office in 1916. The governors since 1909 have been: William E. Glasscock, 1909–13; Henry D. Hatfield, 1913–7; John J. Cornwell, 1917–21; Ephraim F. Morgan, 1921– .

BIBLIOGRAPHY.—J. M. Callahan, *Semi-Centennial History of West Virginia* (1913); Thos. C. Miller and Hu. Maxwell, *History of West Virginia and its People* (1913); John T. Harris, *West Virginia Legislative Handbook* (1920). (J. M. C.*)

WHARTON, EDITH [Newbold Jones] (1862–), American writer, was born in New York City in 1862. She lived much in Italy and France. She married Edward Wharton, a Boston banker, in 1885. She began her literary career as a writer of short stories, her first story, "Mrs. Manstey's View," appearing in *Scribner's Magazine* in 1891. Her first long novel, *The Valley of Decision,* appeared in 1902, the scene being Italy toward the close of the seventeenth century. Her novel, *The House of Mirth,* appeared in 1905 and was highly successful. In 1908 it was translated into French by Paul Bourget, who called it the greatest American novel. It was dramatized with the help of Clyde Fitch, but had slight success. After the outbreak of the World War she edited in 1915 *The Book of the Homeless,* sold for the benefit of Belgian refugees; and later for services she was made a chevalier of the Legion of Honour of France. Her works include *The Greater Inclination* (1899); *The Touchstone* (1900); *Crucial Instances* (1901); *Madame de Treymes* (1907); *The Fruit of the Tree* (1907); *The Hermit and the Wild Woman* (1908); *Tales of Men and Ghosts* (1910); *Ethan Frome* (1911); *The Custom of the Country* (1913); *The Age of Innocence* (1920).

WHITBREAD, SAMUEL (1830–1915), English politician, was born at Cardington, Beds., May 5 1830, the son of Samuel Charles Whitbread, M.P. for Middlesex and grandson of Samuel Whitbread, M.P. for Beds. (*see* 28.597). He carried on the family tradition both in brewing and in politics, controlling the brewery founded by his great-grandfather from 1867 to 1889, and then becoming chairman of the company to which it was transferred. Like his father and grandfather he sat in the House of Commons as a Liberal, representing Bedford from 1852 to 1895. He died at Biggleswade Dec. 25 1915.

WHITE, ANDREW DICKSON (1832–1918), American educationalist (*see* 28.599), died at Ithaca, N.Y., Nov. 4 1918. His later works included *Seven Great Statesmen in the Warfare of Humanity With Unreason* (1910) and *The Work of Benjamin Hale* (1911). In 1913 he published a new edition of *The Warfare of Science and Theology in Christendom.*

WHITE, EDWARD DOUGLASS (1845–1921), American jurist, was born on a plantation in the parish of Lafourche, La., Nov. 3 1845. His father was seventh governor of Louisiana. He was educated at Mount St. Mary's, Md., Georgetown (D.C.) College, and, after the outbreak of the Civil War, at the Jesuit College in New Orleans. During the latter part of the war he served as a private in the Confederate army. He studied law in the office of Edward Bermudez, later chief justice of Louisiana, was admitted to the bar in 1868, and practised law in New Orleans. In 1874 he was elected to the state Senate, and four years later was appointed associate justice of the Louisiana Supreme Court. In 1891 he was elected to the U.S. Senate, and before completing his term was appointed, in 1894, associate justice of the U.S. Supreme Court by President Cleveland. In 1910 he was appointed chief justice by President Taft. Many of his notable opinions were delivered in connexion with the Sherman anti-trust law. Of special importance were his opinions requiring the dissolution of the Standard Oil Co. and the American Tobacco Co. in 1911. As chief justice he administered the oath of office to President Wilson in 1913 and 1917, and to President Harding in 1921. He died at Washington, D.C., May 19 1921.

WHITE, SIR GEORGE STUART (1835–1912), British field-marshal (*see* 28.599), died in London June 24 1912.

WHITE, SIR WILLIAM HENRY (1845–1913), English naval architect (*see* 28.602), died in London Feb. 27 1913.

WHITEAVES, JOSEPH FREDERICK (1835–1909), British palaeontologist (*see* 28.602), died at Ottawa Aug. 9 1909.

WHITLOCK, BRAND (1869–), American diplomat and writer, was born at Urbana, O., Mar. 4 1869. He was educated in the public schools, became a newspaper reporter in Toledo, O., in 1887, and was appointed political correspondent on the Chicago *Herald* in 1890. Three years later he accepted a clerkship in the office of the Secretary of State of Illinois, where he remained until 1897. Meanwhile he read law and was admitted to the bar (1894). In 1897 he returned to Toledo and practised law until 1905, when he was elected mayor. He was reëlected for three succeeding terms, but in 1911 declined the nomination for a fifth term. In 1913 he was appointed by President Wilson minister to Belgium and in 1919 his post was raised to ambassador. This office he continued to hold under President Harding until the close of 1921. Before he had been in Belgium a year the World War broke out and the German invasion took place. Although the other diplomatic bodies followed the Belgian court to Havre, Whitlock insisted on remaining in Brussels in order to render any possible aid to the oppressed people. It was largely due to his urgent advice that Brussels did not resist and thus escaped even more ruthless devastation. In the early days of the war he gave protection to many German residents who had been unable to leave the country. By his firm attitude toward the German military officials he saved many innocent Belgians from death; but his activities in behalf of Edith Cavell were unavailing as he was misled at the last moment by false promises by the Germans. After the formation of the Commission for Relief in Belgium, its operations were placed wholly under his direction. Food and clothing were provided for destitute civilians whose means of sustenance had been destroyed. His ceaseless work in their behalf won the gratitude of all the Belgians; and although worn out by the physical strain he refused to quit his post until the signing of the Armistice in Nov. 1918, when he returned to America for a short rest. He was decorated with the Grand Cordon of the Order of Leopold by King Albert (1917), and was made burgher of Brussels (1918) and of Liége (1919) and Honorary Citizen of Antwerp (1919).

The Belgian Government awarded him the Civic Cross of the First Class (1919). He was elected a member of the American Academy of Arts and Letters.

An excellent account of the German occupation is given in his *Belgium; a Personal Narrative* (1919). His other writings include *The 13th District: a Story of a Candidate* (1902); *Her Infinite Variety* (1904); *The Happy Average* (1904); *The Turn of the Balance* (1907); *Abraham Lincoln* (1909, in the *Beacon Biographies*); *The Gold Brick* (1910); *On the Enforcement of Law in Cities* (1910; enlarged form, 1913); *The Fall Guy* (1912); *Forty Years of It* (1914, a description of "democracy's progress in a mid-western city") and *Walt Whitman: How to Know Him* (1920).

WHYMPER, EDWARD (1840–1911), British explorer and mountaineer (*see* 28.617), died at Chamonix Sept. 16 1911.

WHYTE, ALEXANDER (1837–1921), British divine (*see* 28.617), retired from the ministry of Free St. George's in 1916, and from his position as principal of New College, Edinburgh, in 1918. He published *The Apostle Paul* (1903) and *Thirteen Appreciations* (1915). He died at Hampstead Jan. 6 1921.

WILBERFORCE, ALBERT BASIL ORME (1841–1916), English divine (*see* 28.630), died May 13 1916.

WILBRANDT, ADOLF (1837–1911), German novelist and dramatist (*see* 28.631), died at Rostock June 10 1911.

See E. Scharrer-Santen, *Adolf Wilbrandt als Dramatiker* (1912), and *Jahrbuch und Deutscher Nekrolog*, XVI., Totenliste 1911, p. 84.

WILEY, HARVEY WASHINGTON (1844–), American chemist, was born in Kent, Ind., Oct. 18 1844. He was educated at Hanover (Ind.) College (A.B.1867; A.M.1870), Indiana Medical College (M.D.1871), and Harvard (B.S.1873). He was professor of Greek and Latin at Butler College, Indianapolis, (1868–70); state chemist of Indiana and professor of Chemistry at Purdue University (1874-83); and chief chemist of the U.S. Department of Agriculture (1883–1912). He was elected president of the American Chemical Society in 1893, and from 1899 was professor of Agricultural Chemistry at the George Washington University. He frequently represented the United States in scientific meetings abroad. He was specially interested in preventing food adulteration, and antagonized many food packers by opposing the use of benzoate of soda as a preservative. In 1911 his enemies urged his dismissal from the Department of Agriculture on the technical charge that an expert in his department had received recompense exceeding the legal rate. Later in the year President Taft wrote a letter wholly exonerating Dr. Wiley, but failed to take the obviously proper steps to remove from the Department a hostile member, with whom Dr. Wiley had to come into constant contact. Accordingly, Dr. Wiley resigned in 1912. Henceforth, he devoted himself largely to the cause of pure food by lecturing and writing.

His numerous publications include *The Sugar Industry of the United States* (1885); *Principles and Practice of Agricultural Analysis* (1894–7; revised edition, 1906–14); *Foods and Their Adulterations* (1907; third edition, 1917); *Influence of Food Preservatives and Artificial Colors on Digestion and Health* (1904–7, with several collaborators); *1001 Tests of Foods, Beverages, and Toilet Accessories, Good and Otherwise* (1914); *The Lure of the Land* (1915), and *Beverages and Their Adulteration* (1919). He also edited a series of *Health Readers for Schools* in 1919.

WILLARD, DANIEL (1861–), American railway official, was born at North Hartland, Vt., Jan. 28 1861. He graduated from the Windsor (Vt.) high school in 1878, studied for a year at the Mass. Agricultural College, Amherst, and in 1879 began his railway career as track labourer in Vermont. He rose to fireman, then to engineer, and for twenty years held various positions on several roads, including the Minneapolis, St. Paul and Sault Ste. Marie in its early days. In 1899 he was made assistant manager of the Baltimore and Ohio R.R., and two years later assistant to the president of the Erie R.R., of which he soon became first vice-president and general manager. From 1904 to 1910 he was second vice-president of the Chicago, Burlington and Quincy R.R., and after 1909 was also president of the Colorado Midland and vice-president of the Colorado and Southern. In 1910 he was elected president of the Baltimore and Ohio. In Oct. 1916 he was appointed a member of the Advisory Commission of the Council of National Defense, and the following March chairman of the commission. After America's entrance into the World War, he was appointed in July 1917 a member of the special committee of the Council of National Defense to secure mediation in case of strikes on war contracts. In Nov. 1917 he was appointed by President Wilson chairman of the War Industries Board, charged with devising and expediting means of producing the Government's industrial requirements for effective warfare. In Jan. 1918 he resigned in order to devote personal attention to the Baltimore and Ohio Railroad. After the Government had taken over the railways as a war measure a Federal manager displaced him as operating head of his road, but he remained president in charge of its corporate affairs, in which position he continued when the U.S. Government gave up control of the railways.

WILLARD, EDWARD SMITH (1853–1915), British actor, was born at Brighton Jan. 9 1853 and first appeared in *The Lady of Lyons* at Weymouth at the age of sixteen. He toured first with E. H. Sothern and then joined various stock companies, coming to London in 1875 and playing Antonio in *The Merchant of Venice* with Charles Rice in 1876. After a varied experience in Shakespearean and other plays he was engaged by Wilson Barrett in 1881 for the Princess's theatre, London, and until 1886 played leading parts in many melodramas, the most notable amongst them being "The Spider" in Henry Arthur Jones's *The Silver King*. In 1889 he produced Jones's *The Middleman* at the Shaftesbury theatre, London, afterward taking it to America. He played Professor Goodwillie in Barrie's *The Professor's Love Story* in 1894 at the Comedy theatre, London. After 1903 he acted only in America, repeating these and other roles; but in 1911 he played Brutus at the Gala performance of scenes from Julius Caesar at His Majesty's theatre, London. He died in London Nov. 9 1915.

WILLCOCKS, SIR WILLIAM (1852–), British engineer, was born in India in 1852 and educated at Roorkee College, India. From 1872 to 1897 he was engaged successively in the Indian and Egyptian Public Works Departments. He designed and carried through the Assuan Dam in 1898, and for this work the C.M.G. was conferred upon him, followed by the K.C.M.G. in 1902. His most important undertaking, however, was the irrigation of Mesopotamia, begun in 1911 at an estimated cost of £26,195,000. The scheme provided for the irrigation of 3,500,000 acres. His published works include *Egyptian Irrigation* (1889); *The Irrigation of Mesopotamia* (1905) and *From the Garden of Eden to the Crossing of the Jordan* (1918). In Jan. 1921 he was put on trial before the Supreme Consular Court of Egypt on a charge of sedition and criminal libel, on account of statements made by him impugning the trustworthiness of the data concerning the Nile irrigation published by Sir Murdoch Macdonald, adviser of the Egyptian Ministry of Public Works. He was found guilty March 11, and on April 16 he was bound over to be of good behaviour for one year.

WILLETT, WILLIAM (1856–1915), English builder, was born at Farnham, Surrey, in Sept. 1856. He made a name for himself in London as a designer of beautiful houses; but his chief claim to fame was his conception and promotion of the system of "daylight saving." Though scoffed at in his lifetime, his idea was taken up and put into practice in 1916, and honour has been paid to Willett's memory, which was denied to him in life. He died at Chislehurst March 4 1915.

WILLIAM II. OF HOHENZOLLERN (1859–), German ex-Emperor and ex-King of Prussia (*see* 28.667). When the hour of the downfall of the German Empire and the Prussian dynasty, following upon the military collapse of Germany, arrived in Nov. 1918, the ex-Emperor's flight to Holland bore in the eyes of his countrymen the aspect of a pitiable incident, rather than of a tragic climax. For a considerable portion of the rest of the world, which had frequently overestimated his personal, as distinguished from his official, significance, his conduct and bearing on the eve of the war, throughout its course, and at the moment of his country's disaster, may indeed have come as something of a revelation. There followed a series of disclosures as to his exploits in previous years, above all that piece of personal diplomacy, the Treaty into which he tricked the still more inadequate Emperor of Russia at their meeting at Björkö on the Russian Imperial yacht (July 23, 24, 1905), and the equally characteristic "Willy-Nicky" correspondence (mainly in 1904–5), so-called on account of the signatures which the two Imperial correspondents appended to their letters. Only the Kaiser's share in that correspondence has (1920) been published.

The Björkö Treaty, which was signed by the Tsar without consultation with the minister responsible for the foreign policy of Russia, represented an attempt by William II. to imitate Bismarck's Treaty of Reinsurance with Russia (1887–1890), which the great Chancellor had concluded behind the back of his ally Austria-Hungary, and which was allowed by his successor, Caprivi, to lapse in 1890 as being "too complicated"—*i.e.* too full of duplicity.

In William II.'s Treaty of Björkö, Russia and Germany engaged "to make foreign disturbers of the peace quiet, and in case of necessity to stand by one another with their armed strength." Count Lamsdorff, then Russian Minister for Foreign Affairs, was "profoundly excited and upset" when he read the document, since, as it stood, it imposed upon Russia the obligation of fighting on Germany's side if Germany were involved in war with Russia's ally, France. It is true that Russia also pledged herself to make every effort to gain France over to this new alliance, the object of William II. being to organize a continental coalition against Great Britain. When Count Witte, on his return from signing peace with Japan at Portsmouth (U.S.A.), was informed by Count Lamsdorff of the terms of the Treaty, he asked: "Does not his Majesty (Nicholas II.) know that we have a treaty with France?" "Of course his Majesty knows that," Count Lamsdorff replied, "but the fact must have slipped from his mind, or, what is more probable, he was befogged by William's verbiage, and he failed to grasp the substance of the matter" (Count Witte's *Memoirs*, English ed. 1921). Count Witte and Count Lamsdorff were afterward able to obtain the abandonment of the Treaty, while Prince Bülow and the German Foreign Office, conscious of the absurdity of their master's achievement, were content to let the Imperial agreement be treated as *non avenu*. In the Willy-Nicky correspondence, which he conducted in bad English, William had endeavoured to hold Nicholas to the bargain by adjuring him, "God is our testator," (*sic*). The correspondence represents an attempt on the part of William to exercise a kind of tutorship over Nicholas even in Russian home affairs and to instill into his mind suspicions both of France and of Great Britain.

During the years immediately preceding the World War William II. was only gradually recovering from the *contretemps* which overtook him in 1908, when Prince Bülow, then Chancellor, repudiated the utterances published on William's behalf in the *Daily Telegraph* (Oct. 28 1908) and exacted from him by the threat of resignation a public promise that he would in future abstain from such personal incursions into the realm of foreign policy. The Emperor nevertheless continued when he visited foreign courts to impress upon those with whom he came into contact his conviction that he was an autocrat in the conduct of Germany's foreign relations.

At the end of Oct. 1910 he visited the Belgian court, accompanied by the Empress, and addressing the King of the Belgians said: "May our relations of confidence and friendly neighbourliness be drawn ever closer! May welfare and blessing be shed by Your Majesty's reign upon your Royal house and upon your people! That is my desire, which springs from the depths of my heart." At the Hotel de Ville he addressed the Mayor, M. Max, who four years later was to be sent to a German prison by the invaders of his country, and spoke of the "sober and industrious" Belgian people, expressing at the same time "our profound gratitude and our warmest wishes for the prosperity of Brussels and for a happy future." When the Emperor delivered these speeches he knew that Count von Schlieffen's plan for violating Belgian neutrality in the event of war with France lay cut and dried in the pigeon-holes of the German General Staff, and it was a plan which he himself had endorsed. In May 1911 he paid his last visit to England, and was present as the guest of King George V. at the unveiling of the monument to Queen Victoria in front of Buckingham Palace, when the King, whose advisers remained ignorant of certain of the Emperor's wilder intrigues and schemes, referred to "the strong and living ties of friendship between the thrones and persons of the two sovereigns."

In Feb. 1912 Lord Haldane visited Berlin in order to discuss proposals for a concurrent limitation in the increase of British and German naval armaments. As Lord Haldane states in his book *Before the War*, the visit was the sequel of a personal initiative of William II. through the medium of Sir Ernest Cassel. The Emperor had been concerned at the state of tension, dangerous to peace, which had attended the Morocco negotiations with France in the previous year. That critical episode had arisen out of the despatch of the German gunboat *Panther* on July 11 1911 to Agadir, not long after William II.'s return from his visit to England. In the meetings of German ministers with Lord Haldane, at one of which (between Lord Haldane and Adml. von Tirpitz) the Emperor was present in the self-imposed capacity of audience or chorus, he manifestly endeavoured for Lord Haldane's benefit to play for the time being the part of a constitutional monarch, exhibiting the balance of the ministerial advice from one side (Tirpitz) and from the other (Bethmann Hollweg) by which he had to guide his course. Lord Haldane's conclusion was that William II., and with him Germany, suffered from the lack of a constitutional system with a responsible government, the ministers being chosen more or less arbitrarily by the Emperor "and chosen in varying moods as to policy. . . . Thus the Kaiser was constantly being pulled at from different sides, and whichever minister had the most powerful combination at his back generally got the best of the argument. He had constantly to fix one eye on public opinion in Germany, and another on public opinion abroad. It is therefore not surprising that Germany seemed to foreigners a strange and unintelligible country." Lord Haldane's opinion gives one aspect of the situation, but hardly takes sufficient account of the wayward personal initiative of William II., springing either from his own conceptions (as at Björkö) or from casual outside influences which his ministers were unable to control. Incidentally it may be mentioned that except, perhaps, for the Eulenburg episode in 1905–7 there was no so-called Court party, although military influences were frequently at work. As Prince Bülow said, the mischief which was done by sudden personal interventions of the Emperor was manifest, but nothing was known of the mischief which had been prevented.

In home affairs there was a fresh Imperial outburst about Alsace-Lorraine in May 1912, when the Emperor threatened the Burgomaster of Strassburg with the withdrawal of the new constitution of the Reichsland, which had been granted in the previous year. The threat was ill-considered, but Bethmann Hollweg defended it in the Reichstag.

In March 1912 William II. paid a visit to the Emperor Francis Joseph at Schönbrunn, and in April he met King Victor Emanuel at Venice by way of preparing for the renewal of the Triple Alliance, which took place on the following Dec. 5. There was a visit of King Ferdinand of Bulgaria to Berlin in June, and in July the Emperor met the Tsar at Baltic Port. An incident which excited considerable attention was the presence of William II. for the first time at manœuvres of the Swiss army, and the favourable popular reception of the Imperial visitor at Berne, Basle and Zürich (Sept. 3–7 1912). A good number of German-Swiss officers had studied military affairs in Germany, and William II., for obvious reasons, seized every opportunity of encouraging the professional sympathies between the two armies, which bore fruit during the World War in the partiality of the Swiss General Staff.

It is noteworthy that during the critical years of the Balkan wars and negotiations, particularly in 1913, William II. kept more than usually in the background. His government was coöperating at the London Ambassadors' Conference for the localization of the conflict and the restoration of peace. He was, nevertheless, cultivating close personal relations, afterward to bear fruit during the World War, with his brother-in-law, Constantine, who had succeeded his assassinated father on the throne of Greece in March 1913. He sent Constantine flattering telegrams on his military prowess, and was consequently able in Aug. 1913 to induce the King of Greece to remove the last obstacle to the Peace of Bucharest (Aug. 10) by withdrawing the Greek claims, as against the Bulgarian, to the Thracian *Hinterland* of Kavala. King Carol of Rumania, at whose request the intervention had taken place, telegraphed to his kinsman, "thanks to you, the peace will be final."

King George V., with Queen Mary, and likewise the Tsar Nicholas II., were present in Berlin at the marriage on May 24 1913 of William II.'s only daughter, Princess Victoria Louise, with Prince Ernest Augustus of Cumberland, at last acknowledged as Duke of Brunswick, a marriage which was described as marking the reconciliation between the Guelphs of Hanover and the Hohenzollerns after the feud which had lasted since the conquest of Hanover by Prussia and the expulsion of the dynasty in 1866. These festivities were followed on June 16 and 17 by brilliant celebrations of the 25th anniversary of the accession of William II., with copious references by German sovereigns and official personages to the military strength of the German Empire under his sway as the guarantee of European peace.

A curious incident occurred in the same month. The Emperor disclosed the fact that one of his predecessors on the Prussian throne, Frederick William IV., had in a political testament recommended his successor, if opportunity arose, to annul the Prussian Constitution which he had granted, or rather imposed, in 1848. William II. announced that he had magnanimously burned this document.

A visit which excited considerable speculation at a later date, when, during the World War, the future of the Russian borderlands became a question of practical politics, was that which William II. paid on June 12 1914 to the ill-fated heir to the Austro-Hungarian monarchy, Francis Ferdinand, and his wife, the Duchess of Hohenberg, at Konopisht Castle in Bohemia. The Emperor was accompanied by Adml. von Tirpitz. It is most probable that, apart from the sustained and ultimately successful efforts of William II. to win the reluctant personal sympathies of Francis Ferdinand (partly by encouraging his ambition to make his wife—who was not of royal birth—Empress when he should succeed to the throne), the object of the visit was to enlist his host's support for the extension of Austrian and inferentially of German naval power and influence in the Mediterranean. The story that the Emperor broached vast schemes for providing, after a contemplated European war, kingdoms for Francis Ferdinand's two sons by resuscitating the Greater Poland of the Jagiellos and by creating a great South-Slav State stretching to Salonika, seems entirely fanciful. A main feature of these alleged schemes was that the hereditary Austrian dominions should politically come into the confederated German Empire. Such an idea was never entertained by any sovereign or government during the Hohenzollern epoch. It had been, indeed, the so-called "Great German" policy of the German Liberals in 1848, but it was rejected by Bismarck and by the ruling classes of Prussia. Its realization, apart from other considerations, would have entailed a diminution of the influence of the Prussian Throne and Government, and an immense strengthening of German Catholicism. It again became, of course, the cherished aspiration of republican Germany and republican Austria after the World War. But it never was an old-Prussian or a Hohenzollern policy.

The news of the assassination of the Archduke Francis Ferdinand and his wife at Serajevo on June 28 1914 reached William II. on his yacht at Kiel during the regatta. His first exclamation, "Now I must begin all over again, my work of years is undone," showed that he had reckoned upon the Archduke as an instrument of German policy when he should ascend the thrones of the dual monarchy. William II. returned from Kiel to Potsdam for a week, and the laying of the mines which caused the world-explosion began. On July 5 Count Hoyos arrived at Potsdam with a letter from the Emperor Francis Joseph containing a memorandum, written before the Serajevo assassination, describing the situation in the Balkans, the menace of the Pan-Slavist agitation, particularly in Serbia, and the changed attitude of Rumania. It was only by cultivating friendship with Bulgaria and by isolating and diminishing Serbia as a factor in the Balkans that these dangers could be averted. The crime of Serajevo, it was added, had only confirmed this estimate of the situation. William II. gave Count Hoyos a reply in which he said that any contemplated action against Serbia ought to be taken without delay, that Russia would certainly be hostile, but that he had long reckoned upon this eventuality. If it came to war between Austria and Russia, Germany would loyally take her stand by her ally. A conference (not, as erroneously reported, a Crown Council, which would have meant the presence of the whole Prussian Ministry) afterwards took place, and was attended by the Chancellor (Bethmann Hollweg), the War Minister (Gen. von Falkenhayn), the Under-Secretary for Foreign Affairs (Zimmermann) and the Chief of the Emperor's personal Military Cabinet (von Lyncker). And on the following day, July 6, there was a conference with Adml. von Kapelle, Tirpitz's right hand man at the Admiralty (Tirpitz was on leave), and with representatives of the War Ministry and the General Staff. It was resolved to take measures of preparation for the event of war, and orders in this sense were issued. At the same time it was arranged that all appearance of unusual excitement or activity should be avoided, and that the Emperor should, according to programme, proceed upon his annual cruise in northern waters. He left for Kiel on the same day, and joined the fleet during its summer manœuvres off Norway. He was constantly kept informed by telegraph of the progress of events. And now began the famous series of his marginal notes, afterward published under the German Republican Government, upon the despatches he received. He was at first enthusiastic for the most energetic measures against Serbia. He suggested that Austria should reoccupy the Sandjak, so as to sever the union of Serbia and Montenegro and prevent Serbian access to the sea. Then "there will be a row at once," he wrote. He deprecated war councils and conferences at Vienna, "because," as Frederick the Great had said, "the timid party always gets the upper hand." On July 19 he ordered the German battle-fleet not to disperse, so that it could at a moment's notice be recalled to Kiel. His chief anxiety at this stage was for the safety of the Baltic, and he wrote an angry marginal note because "the civilian Chancellor (Bethmann Hollweg) had not yet grasped his meaning." He (William II.) must "concentrate his forces on land and sea."

The text of the Austrian note to Serbia was communicated officially to the German Foreign Office on July 22, but the German ambassador in Vienna, Tschirschky, had had it on the previous day, and had probably telegraphed it direct to the German Emperor. It was presented at Belgrade on July 23.

The Kaiser at first exulted over a firmness of which he had thought Austria incapable, and expressed the belief that all Slav states were hollow. "Just tread firmly on the feet of this rabble!"—he added. On hearing that Count Berchtold, the Austrian Foreign Minister, did not desire to take any territory from Serbia he wrote, "Donkey! Austria must retake the Sandjak. . . . Austria must become preponderant over the smaller states at the expense of Russia, else there will be no peace." On the report of Serbian mobilization he recalled the German fleet from the North Sea to Kiel. "If Russia mobilizes, our fleet must be ready in the Baltic, and so it is going home." The chancellor had suggested on July 26 that the Emperor should calm European anxiety by remaining in Norwegian waters, but he was now thoroughly aroused, and on the following day he returned to Potsdam. There he received the text of the Serbian reply, and at first thought it "a great moral success." No doubt the Serbians were liars and orientals, and Austria, he said in a letter to his chancellor, might do well to claim a "*satisfaction d'honneur*" and to exercise "*une douce violence*" by a temporary occupation of Serbian territory as a guarantee.

Anxiety about the attitude of Great Britain was now beginning to influence the Kaiser's mind, and his rage was sudden and great when his ambassador in London reported that Sir Edward Grey regarded the situation as serious and had suggested mediation. He described this as a piece of English pharisaism, and Sir Edward Grey as a "base deceiver, arch-base and Mephistophelian. Great Britain ought to put pressure upon Russia," etc. On July 29 began the rapid interchange of telegrams between the Kaiser and the Tsar, which was to be continued up to and even immediately after the German declaration of war, and in which the object of the Kaiser's frequently rhetorical appeals was to induce Russia to reverse her measures of mobilization against Austria and to refrain from mobilization toward the German frontier. He hoped to score over Russia, by a policy of menace, a diplomatic victory in the Serbian question similar to, but far greater than, that which he had obtained in 1909, when, as he boasted, he had appeared beside his Austrian ally "in shining armour." On July 29 a "Kronrat" with the whole body of the Kaiser's military and political advisers was held at Potsdam, and from Bethmann Hollweg's interview the same evening with the British ambassador (Sir Edward Goschen) and his bid for British neutrality it seems clear that the decision had fallen in favour of war.

After the proclamation of the state of "danger of war" (*drohende Kriegsgefahr*) on July 31, and the delivery of an ultimatum on the same day at St. Petersburg, and after a public mobilization order on the afternoon of August 1, a previously prepared declaration of war against Russia was delivered by the German ambassador at St. Petersburg on the evening of August 1.

Throughout the final episode of the German attempts to secure British neutrality the Kaiser was in a state of violent rage and disappointment, and he gave vent to his feelings in a memorandum to his chancellor on July 30 which may well be the wildest outburst of political passion that a monarch ever committed to paper. He declared that Great Britain had caught Germany in the trap of her loyalty to her Austrian alliance, that this was the crowning success of the policy of King Edward VII., who "though he is dead, is still stronger than I am"; and, finally, he exhorted the chancellor to inflame the Mahommedan world, for "if we are to bleed to death, England shall at least lose India." William II.'s brief exchange of telegrams with King George V., based, as the Emperor's assumptions were, on a false report by his brother, Prince Henry, and on a mistaken account by the German ambassador in London of a telephonic conversation with Sir Edward Grey, may be mentioned in passing. If King George's Government would assure the neutrality of France, the Kaiser was prepared to "employ elsewhere" his troops then moving against her. After Sir Edward Goschen had asked for his passports, a Berlin mob broke the windows of the British embassy. The Kaiser sent an aide-de-camp to the ambassador with an unkingly message, truculently delivered, expressing his regret, but telling Sir E. Goschen that he would "gather from these occurrences an idea of the feelings of the German people respecting the action of Great Britain in joining with other nations against her old allies of Waterloo."

On August 4, William II. opened the session of the last Reichstag of his reign by a war speech, to which he added a personal appeal to the deputies (the Social Democrats alone were absent) to support him "through thick and thin," and individually to shake hands with him in token of their promise to do this. To one of the deputies he said, "Now we will give them (his enemies) a good thrashing."

If during the World War William II. ever attempted to interfere in military dispositions, it is clear that the leaders of the army were successful in preventing his effective intervention. He paid the inevitable visits to the fighting lines at critical moments, especially when a German success was believed to be impending, but there is no reason to believe that he was ever, in accordance with the traditions of his house, under fire. He once or twice narrowly escaped aeroplane attacks, but this was accidental. He lived in his comfortable Imperial train or in a portable asbestos hut, or at Supreme Headquarters at Pless Castle in Silesia, and afterward at Spa. He took no practical military part in the war. His crude rhetoric was from time to time employed in firing the ardour of his troops, as when he exhorted them in Oct. 1914 to destroy French's "contemptible little army," or when in the last year of the war he celebrated the 30th anniversary (June 15 1918) of his accession by describing the struggle as a mortal combat between Anglo-Saxon and Prusso-German ideals. In the eyes of his people his personal prestige did not increase; it distinctly diminished, even before the last phase of open aversion from him. He formally retained the final decision in military as in political affairs. There was a long and bitter struggle between three successive chancellors (Michaelis may be left out of account) and the higher military command on a variety of questions—hypothetical terms of peace, the Brest Litovsk negotiations, the armistice question, and, throughout the war, the best method of maintaining the war-spirit of the population. More than once Hindenburg and Ludendorff threatened to resign, and it was between them and Bethmann Hollweg that William II. had to choose when he parted (July 14 1917) with his first war chancellor. "The Government," as Ludendorff says, "had itself to blame, as it frequently appealed to its agreement with the chief military command, and dismissed proposals and demands on the ground that the military leaders objected."

In naval matters the Kaiser had greater success in resisting the authoritative methods of Grand Adml. von Tirpitz, and carrying out his own policy and Bethmann Hollweg's of holding the High Seas Fleet in reserve, or (as he called it in his order of Aug. 6 1914) "on the defensive." For a long time Bethmann, and perhaps also William II., seem to have hoped that Great Britain might be detached from the Allies, if the struggle for naval ascendency were not too keenly pressed. This hope was chimerical, but Bethmann was not a far-seeing statesman, and the views of the Kaiser, who reckoned upon an intact fleet as a valuable political asset for peace negotiations, were seldom based on sound calculations. Tirpitz found himself compelled to resign on March 16 1916.

William II.'s reputation in peace-time had been largely based upon the spectacular setting which he gave to his policy and upon his rhetorical speeches. All effects of that kind gradually failed him during the World War, and some of them lent themselves to ridicule. In Jan. 1916 he had a meeting with his Balkan ally, King Ferdinand of Bulgaria, at Nisch, when Ferdinand at a banquet addressed him in obsequious terms and exclaimed in unconsciously ambiguous Latin, "*Tu es Caesar et gloriosus!*" The Emperor's part in the attempts to secure a "German Peace" in 1916 and 1917 was singularly unfortunate. The declaration issued on Dec. 12 1916 by Germany and the powers associated with her was manifestly a manœuvre to anticipate President Wilson's peace action, to represent the Allies as blood-thirsty and unconciliatory, and to hearten the German working-classes for the fight. It gave no information as to terms, and it contained no reference to the crucial question of the future of Belgium. What the Kaiser's ideas of peace terms at that date may have been is a matter of inference from what has since become known regarding his attitude some six months later. After the Reichstag's so-called "Peace Resolution" of July 1917, efforts were made to induce the Vatican to interest itself in the question of peace, and ultimately a papal note on the subject was issued. In a document addressed on behalf of William II. to Mgr. Pacelli, the Papal Nuncio at Munich, the Kaiser's peace terms were described as including an indemnity of 30 milliard dollars from the United States and 40 milliard dollars from France. Longwy and Briey, rich mineral districts on the French frontier, were to go to Germany, and Great Britain was to give up Malta. The disclosure of these items in the Imperial document was made in the Reichstag on April 27 1921, by the Independent Socialist, Dr. Breitscheid, Chairman of the Reichstag Committee for investigating responsibility for the origin and prolongation of the World War. In 1917 as in 1916, the only peace which William II. and his military and political backers contemplated was a peace with victory (*Siegfrieden*).

The events which led up to the collapse of Germany and flight of William II. in Nov. 1918 were political as well as military. Even so stout a Catholic conservative as the Chancellor, Count Hertling, had described the Prussian franchise question, for example, as "a matter of life and death for the dynasty." Internal reforms were long overdue, and this one had been promised in the Kaiser's edicts of April and July 1917, though only as a result of the apprehensions excited by the revolution in Russia. The obstinacy of the Prussian reactionary Chamber of Deputies and the Upper House delayed the reform until the monarchy fell. In the Reichstag the Imperial prerogatives—especially the right in certain circumstances to make war and peace—were being dealt with by a committee on the Constitution. Prince Max of Baden's Coalition Government, which included several Social Democrats, was avowedly installed for the purpose of introducing Parliamentary Government as well as for making peace. Here again reform came too late.

On Aug. 14 1918, the alarm which Ludendorff had communicated to the Kaiser regarding events in the field and the *moral* of the German troops had induced William II. and his political advisers to contemplate applying to Queen Wilhelmina of Holland for mediation, but nothing was done for some weeks. In the middle of Sept. the Kaiser addressed to the workmen at Krupp's an appealing speech which showed that he recognized the military situation and the internal conditions of Germany to be almost desperate. He returned at the beginning of Oct. from headquarters at Spa to Berlin.

Meanwhile an urgent appeal by Hindenburg and Ludendorff to the German Government to open negotiations at once for an armistice had revealed the desperate state of affairs at the front to the members of the Government, including the Social Democrats. Shortly after the Emperor's return, the constitutional changes limiting his prerogatives had been adopted by the Reichstag, and the bill was awaiting his signature. On Oct. 28 he accepted the constitutional law in a letter to Prince Max, in which he avowed sentiments with regard to the rights and duties of the representatives of the people which might have saved his dynasty if he had expressed them years or perhaps even some months earlier. The question of his abdication had now definitely arisen and was being ventilated toward the end of Oct. in the Socialist and the Democratic press. President Wilson's frank declaration that he could not trust the word of the existing rulers of Germany gave a great impetus to the discussion. William II. on the throne, whatever might be his revised sentiments, was regarded in Germany as an obstacle to peace. The Independent Socialists had gone further than the other parties of the Left and, through the mouth of their leader, Haase, had declared in the Reichstag that it was no longer a question of the Kaiser alone, but of the Prussian and other German dynasties. The Majority Socialists, who at that stage would have been satisfied with the abdication of William II. and the renunciation of the Crown Prince's rights to the succession, were forced by the attitude of the Socialist left wing to make at least the Kaiser question most urgent. Scheidemann, in his book *Der Zusammenbruch* (1920), gives an account of the reception of the members of the Imperial Government by the Emperor on Oct. 20 1918 at Bellevue Castle in Berlin. It was the first time (with the exception of a parliamentary soirée at the residence of Dr. Helfferich in July 1917, at the time of the so-called Peace Resolution) that William II. had met the new Social Democratic Secretaries of State, men whom he had formerly described in public speeches as "fellows without a country." Scheidemann says that the Emperor, in uniform, advanced holding in his hand a piece of cardboard, on both sides of which on typewritten sheets the words he was to address to his new ministers were pasted. William II. wore a forced smile and moved the cardboard sheet to and fro as if he meant to say "You know how these things are made up." He read the address with a loud voice, and "it would have made an excellent impression," Scheidemann says, "if it had been delivered some years earlier." It expressed the intention that nowhere in the world should there be freer institutions than in Germany. It concluded, however, with a reference to "the last breath and the last blow"—a phrase which was singularly out of place in view of the desperate efforts to obtain an armistice. The Kaiser afterward affably conversed with the Socialists who were presented to him. After he had departed, it was decided by the Ministry that the speech should not be published, as the situation was so far advanced that it would have made a ridiculous impression.

William II. knew what was in the air, and on Oct. 30 he quietly left Berlin for the western front. The revolution now broke out in the navy at Kiel and on Nov. 7 at Munich. Everything had been prepared by the Independent Socialists for the Berlin outbreak which came on the 9th, although another date had originally been contemplated. The Governmental Socialists, unable to control the movement, felt themselves constrained to address an ultimatum on the abdication question to the Chancellor, Prince Max. Emissaries from the Government had been at Spa from Nov. 3 urging the Emperor to abdicate, but he was stubborn and considered that it was his duty to remain and save Germany from Bolshevism. "Moreover," he said, "I should willingly work with the new order and the new Government; various gentlemen in it whom I have met are very sympathetic to me." On the morning of Nov. 9 Hindenburg was early at the Villa Fraineuse, the Emperor's quarters at Spa. The field-marshal had had a thorough discussion of the situation with representatives of the different army commanders, and at one o'clock he sent a final report to the Villa Fraineuse stating that, in the fairly unanimous opinion of the generals, the troops could still be relied upon to fight against the enemy, but would never fight against their own comrades, *i.e.* in defence of the Kaiser and the Prussian dynasty. Meanwhile, abdication was constantly being urged by telephone from Berlin. About two o'clock a precise answer was sent to Berlin that the Kaiser abdicated as German Emperor but not as King of Prussia. The reply came by telephone: "Too late: we have already published his abdication." To the Crown Prince, who had arrived for luncheon, the Emperor said as he departed about three: "Tell the soldiers that it is not true that I have abdicated as King of Prussia." Later, Hindenburg arrived at the Villa with Gen. Groener and Adml. Scheer. It was then "put in the Kaiser's mouth" to abdicate as King of Prussia also. When he left the conference he said to Count Dohna-Schlodien, his aide-de-camp, "You have no longer any Supreme War Lord."

All the afternoon and evening his suite urged him, in view of the feeling among the troops, to escape to Holland. He at first refused, but consented to go and dine in the Imperial train. On the way he said: "I am so awfully ashamed. I cannot find it in my heart to do this. I cannot go away. If there be but one faithful battalion here, I shall remain at Spa." He thus was contemplating a fratricidal war in defence of his crown. In the train one alarming message after another arrived regarding disorder on the lines of communication and concerning the approach of retreating troops to Spa. To those around him the Kaiser said: "At other times I have always known what to do, now I am at a loss." At 10 P.M. Adml. von Hintze urged him to start, for "in an hour it might be too late." The Kaiser finally said: "To facilitate peace for the nation I shall go to Holland. If I went to Germany, it would be supposed that I wanted to rally a new party to help me to make a *coup d'état*." He now considered himself relieved from any duties toward the army, as it had left him in the lurch; nor did he recognize any duty toward the Government which, on its own responsibility, had announced his abdication.

At 5 o'clock next morning,[1] Nov. 10, the Emperor left his train and, with a small suite, fled in motor-cars across the Dutch frontier to Eysden, where he arrived about 8 A.M. According to one account (Lady Norah Bentinck's *The ex-Kaiser in Exile*), he had walked up to a Dutch soldier at the frontier, saying, "I am the German Emperor," and had offered his sword; but no one knew what to do. At 10 A.M. his railway train arrived at Eysden, and he took refuge in it and there spent that day and the following night. Arrangements had meanwhile been made, apparently through the Dutch authorities, with Count Godard Bentinck, who with some reluctance consented to receive him as a guest "for a few days" in his castle at Amerongen. The Imperial train left Eysden at 9 A.M. and at 3 P.M. reached Maarn where Count Bentinck and Count Lynden, governor of the province of Utrecht, were awaiting the ex-Kaiser on the platform. There was a considerable suite in the train, who remained to unpack large quantities of food and wine which they had brought with them. Count Bentinck arrived at Amerongen in his motor-car with the Emperor as evening was falling, and, as the guest entered the house, his first words were "now give me a cup of real good English tea." On Nov. 28 William II. signed his formal abdication at Amerongen, renouncing his rights to the Crown of Prussia and his consequential rights to the German Imperial Crown. On the same day the Empress Augusta Victoria arrived from Wilhelmshöhe Castle to join her husband. His personal suite, which had been a burden to his host, was soon reduced to two officials, a master of ceremonies and an aide-de-camp, but he retained a number of his servants. He seldom ventured, save for motor-car drives, beyond the precincts of the castle, which is surrounded by a moat. He spent most of his time in sawing logs of wood, an occupation in which he was so diligent that he provided the castle with firewood for the whole winter. As souvenirs, instead of autographs, he used to give away small blocks of wood on which he had inscribed his monogram. In June 1920 the ex-Kaiser and the ex-Kaiserin left Amerongen for Doorn, a property which the ex-Kaiser had just purchased, and which is situated near the main road between Utrecht and Arnheim. The house and grounds were henceforth watched by Dutch soldiers. Up to March 1920 the Allies' demand for his extradition was an open question, and notes were exchanged on the subject with the Dutch Government, which officially regarded him as a German refugee but undertook to prevent any political activities on his part. He was believed to have ample means, although it was reported toward the close of 1921 that he had been compelled further to reduce his establishment. In the autumn he managed to send a rhetorical message to a royalist demonstration in Berlin at which Ludendorff was present.

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[1] According to some accounts he departed during the night.

The prevailing German verdict upon William II. after the war was that he had been entirely unequal, by temperament, by capacity and by education, to the task of guiding the destinies of the German nation. His training before his accession had been almost entirely in the school of Prussian militarism, and, notwithstanding his subsequent travels and his intercourse with statesmen and men of affairs in his own and other countries, he retained in many matters the narrow outlook and the modes of expression of the average Prussian officer. In his cosmogony sovereigns and dynasties occupied a place entirely apart, and he regarded himself and a certain number of other sovereigns as occupying their positions by the grace of God, and as endowed with something like infallibility in home affairs. In his public speeches he affected the rhetoric of the Prussian officers' mess-room banquets and seemed quite unable to measure the effect of his words upon international relations. He aspired to guide the art, the intellect, the industry and commerce and even the theology of his country. He never realized that the age had moved beyond him in spheres in which he was essentially a dilettante. He had a lax conception of truth and honour in his personal diplomacy, and was accustomed to shift his standpoint in foreign affairs according to the nationality of the person with whom he was conversing. Dr. Hammann,[1] however, testifies that there were almost inexplicable lacunae in the Kaiser's memory. One of the German verdicts upon him, which does not appear to be far from the truth, was that his intellect and character had never matured.

The Empress AUGUSTA VICTORIA (*see* 28.669), who was at the castle of Wilhelmshöhe (the place of Napoleon III.'s internment in 1870–71) at the time of the Emperor's flight, joined him at Amerongen on Nov. 28 1918. She was already suffering from a heart complaint, and anxiety with regard to her husband and the possibility of his extradition weighed upon her more than upon him. She died at Doorn Castle on April 11 1921. Her remains were conveyed to Potsdam and placed in a temporary mausoleum in the park of the New Palace. The funeral furnished an occasion for some royalist demonstrations in Berlin. The Empress, although she accompanied William II. on many of his political journeys, confined her interests mainly to her family duties and to works of charity. She had been active in promoting Christian enterprises, particularly the building of churches in Berlin. She was regarded as the model of a German housewife and of a *Landesmutter*, as the Germans used to call the consorts of their sovereigns.

Interesting sidelights on the ex-Kaiser's character, reign and education may be found in such books as Bismarck's *Reflections and Reminiscences* (English ed. 2 vols., 1898). The third vol. of these *Gedanken und Erinnerungen* appeared in Germany in 1921, though it is dated 1919, having long been held up by an interdict given in favour of the ex-Kaiser on the ground that the volume contained the text of confidential letters written by him. In 1921 he withdrew the interdict, as most of the obnoxious material had found its way into the newspapers. See also Prince Hohenlohe's *Memoirs* (1906). Recently published books bearing on the subject are Dr. Otto Hammann's *Der Neue Kurs* (1918), *Um den Kaiser* (1919), which contains perhaps the best character sketch of William II., and *Der Missverstandene Bismarck* (1921), also Baron von Eckhardstein's *Lebenserinnerungen*, 3 vols. (1919–21). For the last phase Scheidemann's *Der Zusammenbruch* (1921) and *Die Deutsche Revolution* by Ferdinand Runkel (1919) are useful, and there is a remarkable, if rather highly coloured, short character sketch by Walter Rathenau, *Der Kaiser* (1919). Lady Norah Bentinck wrote a book of some interest, *The ex-Kaiser in Exile* (1921). (G. S.)

WILLIAM, German Crown Prince up to 1918 (1882–), eldest child of William II. of Germany, was born at the Marble Palace, Potsdam, on May 6 1882. He was educated at the Military Cadets School at Ploen in Holstein and at the university of Bonn. After visits to the courts of Vienna and St. Petersburg and an unofficial visit to Scotland he went on a tour with his brother Prince Eitel Friedrich to Constantinople and to the Nile. On his return to Germany he began his military career by serving in the 1st Foot Guards, and accompanied the Kaiser to England (Jan. 19–Feb. 5 1901) on the occasion of the funeral of Queen Victoria. On June 6 1903 he married the Duchess Cecilia, sister of the Grand Duke of Mecklenburg-Schwerin. There were five children, four sons and one daughter, of the marriage. His political and personal interventions in public affairs gave some trouble in the years preceding the war. He was credited with pan-German sympathies, and on one occasion (Nov. 9 1911) he appeared in the royal box in the Reichstag during the debate on the Morocco settlement and demonstratively applauded speakers who were attacking Great Britain and the Imperial Chancellor, Bethmann Hollweg. He was afterward compelled by the Emperor to make amends to the Chancellor. Other ill-advised interventions were in connexion with the Brunswick settlement, in regard to which he questioned (1914) the adequacy of his brother-in-law Prince Ernest Augustus of Cumberland's renunciation of all claim to the throne of Hanover, and again, on the occasion of the conflict in Dec. 1913 at Zabern in Alsace between officers of the garrison and the civilian population, when he despatched telegrams encouraging the officers in their truculent attitude. He had, nevertheless, done a public service in 1907 by calling the attention of the Emperor to the disreputable morals of the court *camerilla*, headed by Prince Philip Eulenburg, which was being denounced in the *Zukunft* by Maximilian Harden. In 1910–1 he paid a visit to Ceylon, India and Egypt, and he published some account of his experiences in his *Jagdtagebuch*. On the outbreak of the World War he was promoted to the rank of Lt.-General and appointed to the command of the V. Army in the west, where his troops were successful in the battles of Longwy and Longuyon on Aug. 22 and 24 1914. In Sept. 1915 he received the command of an army group, and he was nominally in charge of the German operations against Verdun. After the Armistice he represented himself in newspaper interviews as having been sceptical, since the battle of the Marne, regarding the possibility of the ultimate success of the German arms. His flight to Holland speedily followed that of the Emperor in Nov. 1918, and he went to Wieringen, an island in the Zuider Zee. He formally renounced on Dec. 1 1918 his rights of succession to the crowns of Prussia and the German Empire. The ex-Crown Princess and her children continued to reside at Potsdam, where she enjoyed considerable popularity among all classes of the population.

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[1] *Um den Kaiser* (1921).

WILLY, the pen-name adopted by the French novelist HENRI GAUTHIER-VILLARS (1859–), born at Villiers-sur-Orge Aug. 10 1859. He was educated at the Lycée Condorcet and the Collège Stanislas, and afterward adopted a literary career. His early works include a *Recueil des Sonnets* (1878), and various volumes of essays and criticism, including *Essais sur Mark Twain et les Parnassiens* (1882), but he is best known for his novels, many of which were written in collaboration with the actress and authoress Colette Willy. The most famous of these is *Claudine à l'École* (1900), with its sequels *Claudine à Paris* (1901), *Claudine en Ménage* (1902) and *Claudine s'en va* (1903). Willy contributed largely to leading reviews, and also published various plays, including a theatrical version of *Claudine à Paris,* produced in 1902.

WILSON, SIR ARTHUR KNYVET, 3RD BART. (1842–1921), English admiral, was born at Swaffham, Norfolk, March 4 1842, the son of Rear-Adml. George Knyvet Wilson. He entered the navy in 1855, and served in the naval operations of the Crimean War and the Chinese campaign of 1857–8. In 1876 he was appointed to the "Vernon," the torpedo school-ship at Portsmouth. Having reached the rank of captain in 1880, he took part in 1881 in the operations against Alexandria and in 1884 won the Victoria Cross for bravery at El Teb. He became rear-admiral in 1895, was appointed Third Sea Lord and Controller of the Navy in 1897, and in 1901 became Vice-Admiral, receiving the K.C.B. in 1902. From 1901 to 1903 he commanded the Channel Squadron, and from 1903 to 1907 was Commander-in-chief of the Home and Channel Fleets. In 1907 he was promoted by Order in Council to the rank of Admiral of the Fleet, and in 1909 was appointed First Sea Lord in succession to Lord Fisher. He retired in 1912, and received the Order of Merit. He died at Swaffham May 25 1921.

Wilson was from the early 'nineties till practically the end of his life the most universally respected figure in the British navy. Himself the most unassuming man, careless of honours (he refused a peerage) and indeed of his personal appearance, he was a scientific sailor of the highest type, and a recognized master of strategy and tactics, whose advice, in and out of office, carried the greatest weight. He had no party, no favourites, and did not advertise. He was a silent man, whom everyone trusted; and during the World War he was still a power behind the Admiralty, and the ungrudging servant of his country.

WILSON, SIR CHARLES RIVERS (1831–1916), English public official, son of Melvil Wilson, was born in 1831, and educated at Eton and Balliol College, Oxford. He entered the Treasury in 1856, was private secretary to the Chancellor of the Exchequer (Robert Lowe) 1868–73, and was Royal Commissioner for the Paris Exhibition of 1878, having been already appointed Comptroller General of Office for Reduction of National Debt in 1874. Whilst holding this position, he visited Egypt in 1876 and early in 1878 was selected as vice-president of the Commission to enquire into the Egyptian financial situation. Some months later he was nominated Financial Minister in Egypt and, in 1879, he and the Prime Minister, Nubar Pasha, were the victims of a serious outrage by the mob in the streets of Cairo—an incident which was the direct precursor of the Arabi revolt and the British occupation of Egypt in 1882. In April 1880, on the fall of the Khedive Ismail and the inauguration of his son Tewfik as Khedive, Rivers Wilson was appointed president of the Commission for the Liquidation of the Egyptian Debt, with full powers to regulate the financial position of Egypt. On the conclusion of this duty he returned to his post in London, and in March 1885 he became joint British Representative on the Suez Canal Board. On retiring from his post as Comptroller General of the National Debt Office in 1894, he became in 1895 president of the Grand Trunk Railway of Canada. He was created a K.C.M.G. in 1880 and was promoted G.C.M.G. in 1895. He died on Feb. 9 1916.

WILSON, SIR HENRY HUGHES, BART. (1864–), British Field-Marshal, was born in Ireland May 5 1864, and joined the army in 1884. He served in the field in Burma between 1886 and 1888, and was wounded. After some years on the staff at home he went out with the expeditionary force to S. Africa in 1899, and he served there, first with the Natal army, and afterward at headquarters till the end of 1900. The period from 1901 to 1906 he spent at the War Office, and after 1904, in which year he was promoted colonel, he had much to do with working out the organization of the newly created general staff. He then became commandant of the Staff College, a position which he occupied until 1910, when he was appointed Director of Military Operations. In this latter capacity he got into close touch with high French military authorities, and gave special attention to the study of strategical possibilities in the event of war with Germany. He was promoted Major-General in 1913.

On mobilization in Aug. 1914 he was appointed deputy-chief of the general staff to the expeditionary force, and he served in that position for the first five months of the struggle, after which he became principal liaison officer between British and French headquarters in the field. He was given the K.C.B., and at the end of 1915 he took up command of the IV. Army Corps; this he held until the opening of 1917 when he went out as head of a military mission to Russia, returning just before the revolution. He was promoted Lt.-General on his return and was then in charge of the eastern command until Nov., when he was sent to Versailles to act as British Military Representative on the newly established Supreme War Council. In the following Feb. he succeeded Sir W. Robertson as Chief of the Imperial General Staff. The great German offensive of March took place almost immediately after his taking up this high appointment, and he played a prominent part in the steps taken to strengthen Sir D. Haig's forces. The friendly terms on which he stood with the French supreme authorities, no less than with the Home Government, contributed materially to ensure that coöperation between the Allies which so greatly assisted in giving victory to their cause. He had been promoted General soon after taking up the appointment, and on the final distribution of honours for the war he was promoted Field-Marshal, was given a baronetcy, and received a grant of £10,000. In December 1921, however, he resigned his position at the War Office (being succeeded by Lord Cavan); and soon afterwards he ranged himself with the supporters of the Northern Irish Parliament in Ulster of which he was elected a member.

WILSON, JOHN COOK (1849–1915), English philosopher, was born at Nottingham June 6 1849. He was educated at Derby and at Balliol College, Oxford, and in 1874 was elected to a fellowship at Oriel College. After graduating, he studied logic under Hermann Lotze at Göttingen. Returning to Oxford, he became well-known as a lecturer and in 1889 was appointed Wykeham professor of Logic. He died at Oxford Aug. 11 1915. Among his publications were *Aristotelian Studies* (1879, republished 1912); lectures on *Axioms*, on Plato's *Timaeus* (1889) and on the *Traversing of Geometrical Figures* (1905).

WILSON, WOODROW (1856–), twenty-eighth president of the United States, was born in Staunton, Va., Dec. 28 1856. He was baptized with the name of Thomas Woodrow Wilson. The Scotch strain predominated in his ancestry, for his paternal grandfather came from county Down, in Ulster, and his maternal grandfather, Thomas Woodrow, a graduate of Glasgow University, from Scotland. The stern Presbyterianism of his father, a minister of small means but marked capacity as a theologian, early influenced him and left an indelible mark upon his character. His early years were spent in Georgia and South Carolina, where he was deeply affected by the sufferings of the South during the reconstruction period. In 1875 he entered Princeton, graduating four years later. His record for scholarship in college was not remarkable, but he was prominent in debating and literary circles, and became student director of athletic sport.

His most notable achievement was an article written in his senior year, and published in the *International Review*, which analyzed unfavourably the procedure of Congress and formed the basis of his more mature political principles. After studying law in the University of Virginia and following a brief attempt to practice in Atlanta, he decided to pursue his studies in government and history at Johns Hopkins University, where he received the degree of Ph.D. in 1886. His thesis, entitled *Congressional Government* and published in 1885, was a development of the attack upon Congressional methods, and because of its clear and felicitous expression has been reprinted many times. In that year[1] he began his teaching career at Bryn Mawr College, where he was associate professor of History and Political Economy until 1888; after two years as professor of the same at Wesleyan, he entered the Princeton Faculty in 1890 as professor of Jurisprudence and Political Economy. With slight changes in title he served in this capacity until 1902, when he became president of Princeton. As professor he rapidly achieved distinction. His lectures were remarkable for clarity of presentation and brilliancy of phrasing, and the same qualities characterized both his addresses and his published writings. His gift was for generalization rather than plodding scholarship, and after the publication of his thesis his happiest literary efforts were in essay form. They display keen critical capacity, but are not remarkable either for erudition or for striking creative power. As president of Princeton, Mr. Wilson devoted himself to serious reforms of the educational and social habits of the undergraduates. In the hope of elevating the standards of scholarship and of increasing the efficiency of instruction, he inaugurated in 1905 the "preceptorial system," designed through small classes to bring teachers and students into the most intimate relationship. In his endeavours to democratize the social life of the university he met determined opposition. Further difficulties developed from a disagreement with the dean of the Graduate College. Mr. Wilson's policies aroused warm controversy among alumni, faculty, and undergraduates.

While at Princeton, both as professor and as president, Mr. Wilson displayed great interest in political questions of the day, and through his addresses and articles speedily won a national reputation. In Sept. 1910 he was tendered the Democratic nomination for governor of New Jersey. The offer coming at the moment when the prospects for success of his policy at Princeton seemed most discouraging, secured his ready acceptance. Resigning his academic position he entered upon an active electoral campaign which won him the support of progressive elements throughout the state, despite the fact that his candidacy had been inaugurated largely under the auspices of the conservative Col. George Harvey (afterwards U.S. ambassador to Great Britain) and the Democratic state boss, Senator James Smith. In Nov. he was elected by a plurality of 49,000 votes. He at once made it plain that he intended, regardless of the protests of machine leaders, to fulfil his liberal pledges and would assume the leadership of the party for this purpose. As governor he successfully carried through a series of reform measures. Of these the most significant were: a Direct Primaries Law, which, supplemented by an effective Corrupt Practices Act, did much to purify the political atmosphere of New Jersey; an Employers' Liability Act; the creation of a Public Utilities Commission; reform in municipal administration, making possible the adoption of the commission form of government. Elections to the state Senate and Assembly in 1911 gave the Republicans a majority in both Houses and the legislative output was curtailed. Nevertheless his final activities as governor were characterized by the impetus which he gave to the passage of a series of bills, known as the Seven Sisters, directed to the protection of the public from exploitation by trusts.

When in June 1912 the Democratic National Convention met at Baltimore to choose a candidate for President, Mr. Wilson's reputation as an effective reformer had brought his name prominently before the delegates. The convention was apparently controlled by conservative elements and there seemed little chance of the nomination of an anti-machine progressive. But as the struggle to secure the necessary two-thirds vote proceeded, with the conservative forces divided between Champ Clark, Harmon, and Underwood, Mr. W. J. Bryan, leader of the progressive elements threw his dominating influence in favour of Mr. Wilson. It proved decisive, and on the 46th ballot he was nominated, July 2 1912. In the campaign that followed he voiced popular discontent with the conservatism of the Republican administration, which he believed to have been too closely allied with the interests of "privileged big business." His campaign speeches, characterized by a striking phraseology, won much applause, but were remarkable for their high moral tone rather than for originality of thought or policy. Like Roosevelt he demanded a national renaissance of ideals. In matters of immediate concern, such as the tariff, trust regulation, currency, the interests of labour, he insisted that the "rule of justice and right" must be set up. As regarded the future, in matters of conservation and trade, he asserted that great opportunities had been lost through the interlacing of privilege and private advantage with the framework of existing laws: "we must effect a great readjustment and get the forces of the whole people once more into play." His radicalism was of a mild sort and he insisted that "we need no revolution, we need no excited change; we need only a new point of view and a new method and spirit of counsel." The popular temper was responsive to such a tone, but success in large measure could hardly have come to him except for the division of Republican forces through the campaign of Theodore Roosevelt as Progressive candidate. In the Nov. election Mr. Wilson received 435 electoral votes as against 88 for Roosevelt and 8 for Taft; but his popular vote was a million less than that of his two chief opponents, and in only 14 states (all in the South) did he receive a clear majority.

Despite the fact that he was the choice of a minority of the whole people, Mr. Wilson's political position when he assumed office on March 4 1913 was one of remarkable strength. He was supported by a Democratic majority in both Houses of Congress, the Republicans were at loggerheads, and he might expect support from the Progressives for much of his reforming legislative programme. His Cabinet was not distinguished, but it contained certain elements of political and administrative strength, which proved advantageous for the moment, although later it was to become the mark for bitter criticism. The President soon made it plain that he was determined, as in his governorship of New Jersey, to exercise his personal influence and his position as head of the party to initiate and carry through the legislation he had advocated in his campaign. His ascendancy in Congress was soon established. After convoking both Houses in special session on April 7 1913, he delivered his first message in person, reviving the custom that had lapsed since the administration (1797) of the elder Adams. He intervened constantly during this and later sessions, to further the legislation in which he was especially interested.

The first important piece of legislation that resulted from the special session was the Underwood Tariff Act, which was passed in Sept. and signed by the President Oct. 3 1913. It provided for a notable downward revision and naturally met strong opposition from varied industrial interests. Such opposition was overcome largely through the personal efforts of Mr. Wilson, who appealed constantly to public sentiment, notably in an attack upon the activities of hostile lobbyists. The Tariff Act, in addition to lower duties and important administrative changes, introduced an income tax—long advocated by Democrats—which was destined in later developments to counterbalance the loss of revenue resulting from the lowering of the tariff; it weighed heavily upon the industrial interests of the North and increased the growing unpopularity of the President in that region. The Tariff Act was followed by a broad measure of currency reform, the Federal Reserve Act, signed Dec. 23 1913; it is generally regarded as the administration's second great legislative triumph. Mr. Wilson's purpose was to supplant the dictatorship of private banking institutions by a reorganization that should provide funds available to meet extraordinary demands and a currency that would expand and contract automatically. Early in 1914 the President called upon Congress to continue its labours of reform by the regulation of the trusts. After long debate and warm opposition, his appeal was answered by the passing of the Federal Trade Commission Act and the Clayton Anti-trust Act. The latter, besides perfecting anti-trust legislation in several ways, met the demands of labour by declaring that labour was not a commodity, by prohibiting injunctions in labour disputes unless necessary to prevent irreparable injury, and by proclaiming that strikes and boycotts were not violations of Federal law. It further exempted labour associations from the anti-trust laws.

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[1] In 1885 he married Ellen Louise Axson of Savannah, Ga., who died in 1914, leaving three daughters. On Dec. 18 1915, he married Edith Bolling Galt of Washington, D.C.

Mr. Wilson's policy of domestic social reform had thus been developed with surprising legislative success during the first year of his administration. His foreign policy was not so clear-cut and aroused little enthusiasm. It was characterized by an evident desire to concede the rights of other nations to the limit and to avoid any stressing of the power of the United States for the material advantage of its citizens. Definite steps were taken to prepare the Filipinos for self-government. Pressure was brought to bear upon the California state Government to mitigate the severity of its anti-Japanese legislation. The "dollar diplomacy" of the preceding administration was repudiated and American bankers effectively discouraged from participating in the international Chinese loans. As a result of the President's personal demand, Congress repealed the law exempting American coastwise shipping from Panama Canal tolls. Mr. Wilson, however, failed to secure the Senate's ratification of a treaty with Colombia, which contained a virtual apology on the part of the United States and an offer to pay $25,000,000 as reparation for the alleged grievances of Colombia in connexion with the establishment of Panama as an independent country. In the Caribbean, Mr. Wilson's policy differed in principle rather than practice from that of his predecessors; in Nicaragua and Haiti the customs were taken over by U.S. officials. By a treaty signed Sept. 16 1915, a virtual protectorate of Haiti was assumed; in Santo Domingo the precautionary visits of American cruisers were followed in the summer of 1916 by the landing of marines, and in Nov. of that year by the proclamation of a military government under American auspices.

Mr. Wilson's Mexican policy aroused heated criticism. Following the accession of Gen. Huerta to power and the President's failure to arrange a settlement providing for his elimination as dictator, Mr. Wilson resigned himself to what he called a policy of "watchful waiting." Conditions in Mexico were anarchical, and intervention was strongly urged by both American and European commercial interests. To formal intervention the President was definitely opposed, but in April 1914 he was compelled to authorize the occupation of Vera Cruz in retaliation for affronts to American blue-jackets. The proffered mediation of Argentina, Brazil and Chile he gladly accepted, but the resulting protocol of Niagara Falls (June 24 1914) did not provide a basis for peace. Although Huerta fled from Mexico in July, the country continued to be torn by rival factions. American troops were withdrawn from Vera Cruz in Nov. 1914, but it was not until Oct. 1915 that the Government of Carranza was recognized by Mr. Wilson, in company with eight South and Central American Governments. Further complications ensued. The raid into American territory of Gen. Villa, March 9 1916, led Mr. Wilson to authorize a punitive expedition, which soon aroused the protests of Carranza. In May and June the President mobilized the National Guard and sent a force of about 100,000 to patrol the Mexican border. The crisis was tided over by a joint Mexican-American commission sitting at New London, Conn., which brought no definite settlement, but at least postponed hasty action on either side. In Jan. 1917, the last American troops were withdrawn from Mexican soil. The President's policy had not led to stable conditions in Mexico, and the sole advantage secured seemed to be the emphasis laid by the U.S. Government on the principle that it would not take advantage of the misfortunes of a weak neighbour for its own selfish profit.

Foreign affairs after July 1914 were naturally dominated by the World War. President Wilson insisted upon a policy of strict neutrality. This he emphasized not merely by formal proclamation on Aug. 4, but by an address to the American people of Aug. 18, in which he adjured them, in view of the mixture of nationalities in the United States, to be impartial in thought as well as action. His offer of mediation, made on Aug. 5, remained without response, and further attempts at mediation in early autumn proved fruitless. His determination to remain absolutely aloof from European quarrels was underlined in several addresses, in which he insisted that the United States was in no way concerned, and was further emphasized by his opposition to any change in its military policy. America's vital interest in the struggle, however, soon became plain and resulted in diplomatic controversies with the belligerents. Great Britain's attempt to control indirect importation of goods into Germany, by an enlargement of contraband schedules and an extension of the doctrine of "continuous voyage" to conditional contraband, was vigorously opposed by President Wilson, who authorized Mr. Bryan, his Secretary of State, to protest in strong terms. A lengthy interchange of notes followed, which led to no settlement (*see* INTERNATIONAL LAW). The diplomatic controversy with Germany proved more serious. The proclamation of a "war zone" about the British Isles, in which German submarines threatened to destroy enemy merchant vessels with consequent danger to the lives and property of neutrals, was met by a note of Feb. 10 1915, which warned Germany that she would be held to "strict accountability" for the lawless acts of submarine commanders. Mr. Wilson further attempted to find a compromise, based upon a relaxation of the British food blockade and an abandonment of the German submarine campaign. The effort failed and was followed by a series of submarine attacks, which culminated in the sinking of the "Lusitania," May 7 1915, with the loss of over 100 American lives. The President, while he disappointed opinion in the eastern states by a speech in which he reaffirmed his pacific determination, stating that a man might be "too proud to fight," at once set out to win from Germany a disavowal and a promise that merchant ships should not be torpedoed without warning and the saving of the lives of passengers. A lengthy exchange of notes ensued; the pacific Mr. Bryan, Secretary of State, regarding the President's language as too strong, resigned; on the other hand Mr. Wilson's patience with the evasions of the German Government and the continued sinkings by submarines led to bitter attacks upon the President's policy of conciliation, which was stigmatized as anæmic or even cowardly. Mr. Wilson succeeded, however, in securing from Germany a promise not to sink liners without warning (Sept. 1 1915), and continued his efforts to induce Germany to abandon the submarine campaign completely. He was hampered by an attempted revolt of Congressional leaders, who blurred the issue with Germany by introducing resolutions designed to prevent Americans from travelling upon belligerent ships. The President, through his personal influence, secured the defeat of these resolutions in Feb. 1916, insisting that he would not consent "to any abridgment of the rights of American citizens in any respect." Shortly afterwards the issue with Germany was brought to a head by the sinking of the "Sussex," March 24 1916. Mr. Wilson waited three weeks before sending a formal note of protest to Germany (April 19 1916) but couched it in the form of an ultimatum, stating that unless Germany should immediately declare and effect an abandonment of its present methods of submarine warfare, the United States would be compelled to sever diplomatic relations. The German answer, while attempting to make acceptance conditional upon Great Britain's relaxation of the blockade, was in effect a promise not to sink merchant ships without warning and without saving human lives. The submarine issue now seemed less critical.

The diplomatic victory thus apparently secured by Mr. Wilson was utilized in his behalf during the electoral campaign of 1916, in which he was inevitably the Democratic candidate. It enabled his supporters to declare that he had vindicated the rights of the United States successfully, and at the same time had "kept us out of war." The slogan made a strong appeal, especially in the districts of the Middle West. The Republicans, on the other hand, who had nominated Charles E. Hughes, criticized the whole foreign policy of the President. They insisted that he had failed to take prompt action for the protection of American lives and honour, alike in his dealings with Germany and in his handling of the Mexican crisis. They characterized his domestic policy as demagogic, instancing the Clayton Act and the Adamson Act; the latter had been urged on Congress by Mr. Wilson to avert a railroad strike in Sept. 1916, and many citizens regarded it as an untimely surrender to labour threats. They also criticized his attitude on "preparedness," to which the President had been opposed until the close of 1915, and ridiculed the cautious expansion of military and naval forces provided for in the National Defense Act of 1916. In the east and in most industrial centres of the middle west, Mr. Wilson was unpopular, but the election showed his strength in the farming districts west of the Mississippi and on the Pacific coast; in spite of Mr. Roosevelt's return to the Republican fold the President drew largely from the Progressives, and on election day received a slight electoral majority over Mr. Hughes (277 to 254) and a popular plurality of 9,129,606 to 8,538,221.

His re-election enabled Mr. Wilson to proceed with plans for peace proposals to the European belligerents. These he had been preparing since the early summer of 1916, and, regardless of the German peace balloon of Dec. 12 1916, he sent on Dec. 18 identical notes to the belligerents, asking them to state the terms upon which they would consider peace. Informed of the undercurrents of German military circles, he evidently feared that if the war continued, the United States would necessarily become involved; he also hoped that a clear definition of war aims would strengthen pacific elements in both belligerent camps. The German reply was evasive; that of the Allies refused to consider peace until Germany should offer "complete restitution, full reparation, and effectual guarantees." The replies gave the President opportunity to expound what he had come to believe was the only sure basis of an enduring peace. This he did in a speech of Jan. 22 1917, in which he insisted that the peace must be organized by the major force of mankind, thus emphasizing the need of a League of Nations; that no nation should extend its policy over another nation; that no one Power should dominate the land or the sea. There must be a limitation of armaments. As a guarantee of future peace and justice, the ending of the existing war must not be the violation of the rights of one side or the other: it must be "a peace without victory." Further efforts to secure a peaceful arrangement were frustrated by the determination of the German militarist clique to renew the submarine warfare, regardless of the effect on the United States. On Jan. 31, the German ambassador, von Bernstorff, delivered a note to this effect, and four days later the President handed him his papers. He still, however, avoided formal war with Germany, and on Feb. 26 asked for a resolution of armed neutrality, which would permit the arming of American merchant ships for entrance into the barred sea zone. The resolution was blocked by a filibuster. Finally, in view of continued sinking of American ships, the President came to Congress on April 2 1917, and asked for a declaration that a state of warfare existed with Germany. The resolution was passed by the Senate on April 4, by the House on April 6.

President Wilson had always abhorred the exercise of force in international relations, and the war which he at last regarded as necessary was, in his mind, a war to ensure peace. Nevertheless he was determined that it should be waged efficiently and that the mistakes of previous wars should not be repeated. Those mistakes, he believed, had resulted chiefly from the intermixture of politics in military affairs, and from the decentralization of the American military machine. He opposed a coalition war cabinet, as leading to divided responsibility. Military policy was handed over to the military experts. He approved the immediate development of the general staff as the centralizing military organ, and it was upon the recommendation of that body that he urged, against the wish of Congressional leaders, the Selective Service Act. On the advice of the general staff he appointed Gen. John J. Pershing commander of the expeditionary force to France, and, also following that advice, he refused to authorize a volunteer force under Mr. Roosevelt. Similarly the plans for the development of a large army in France were inaugurated and translated into fact by the military experts. As regards conduct of operations the President gave to Gen. Pershing complete authority, and permitted no interference by politicians. In the building of the new army, the President took no direct part, but he used his authority consistently to favour centralization under the general staff. He followed a similar policy in the mobilization of the industrial resources of the nation. He encouraged the centralizing efforts of the Council of National Defense and its committees, and sought always to secure for them executive rather than the merely advisory powers which they at first possessed. He urged the Lever Act, which in Aug. 1917 created a Food and a Fuel Administration, and advocated the taking over of the railroads by the Government in Dec. His policy of economic centralization was ultimately assisted by the many protests against his war policies which were made in the winter, and which centred round the demand for a non-partizan war cabinet or ministry of munitions; for his supporters were able to insist that the more effective handling of war problems demanded not new machinery but greater efficiency of the existing mechanism. The President asked for powers to cut through red tape and rearrange bureaus without reference to Congress. His demands were embodied in the Overman Act, which was passed in May 1918, and which enabled him to grant executive powers to the various boards that had been created. The War Industries Board, released from its dependence upon the Council of National Defense, at once became the centralizing organ of the economic activities of the country. In his war appointments Mr. Wilson disregarded party lines, a notable fact since in political appointments he always showed himself strictly a party man. Republicans such as Hoover, Stettinius, Goethals, Schwab, Vanderlip, were chosen because of their administrative qualities and regardless of political affiliations.

During the war President Wilson consistently developed his ideals of a new international system which should perpetuate peace and assure justice and security to every nation regardless of its material strength. He hoped thus not merely to construct a basis for just peace when the war should end, but to hasten the end of the war by appealing to the peoples of the enemy states against their Governments. The most notable of his speeches was that of Jan. 8 1918, in which he stated 14 points necessary to a just and lasting peace. This, with his later addresses, was ultimately accepted as the basis of the final settlement. Their effect in Germany and Austria-Hungary was not apparent until the military defeat of those empires, but his words acted continually as a corroding factor, weakening the enemy's determination to fight. When in the autumn of 1918 they faced military defeat, they turned to Mr. Wilson offering to accept his Fourteen Points as the basis of peace. The President's insistence upon justice as an essential to a lasting settlement had brought him great prestige in Allied countries, but the chiefs of the Allied Governments hesitated to accept the Fourteen Points in the fear that the material advantages of the victory might be thrown away. They yielded, however, to the persuasive diplomacy of Col. House, who represented the President at Paris, and it was on the understanding that the Fourteen Points (reservation made of "Freedom of the Seas" and inclusion of Germany's promise to make full reparation) should be the basis of the peace that the Armistice was granted to Germany.[1] The President realized, however, that it would be difficult to translate his principles into the actual treaty. Aside from the opposition he might expect from selfish nationalistic interests among the

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[1] The Fourteen Points are set forth in full in the article WORLD WAR, under the subhead *Political History*.

Allies, he lacked unified support at home, where his political opponents called for a " strong peace " that would annihilate Germany; there was little enthusiasm for a League of Nations, which the President regarded as essential to a just and lasting settlement. Furthermore he had weakened his political position at home by a series of tactical mistakes. Of these, the most important was an appeal issued immediately before the Congressional election of Nov., in which Mr. Wilson asked the voters to cast their ballots for Democratic candidates, on the ground that a Republican Congress would divide the leadership at the moment of international crisis. Such an appeal would have been comprehensible if it had been made by a prime minister in a parliamentary country, but Wilson had proclaimed himself the leader of the nation and could not logically also play the rôle of party leader. The Republicans seemed to have some ground for complaining that although they had submerged partizan quarrels during the war, President Wilson was now attempting to capitalize the war and foreign affairs in order to win a partizan advantage. Many voters were antagonized by the appeal, and the elections went in favour of the Republicans. The President thus lost command of the Senate in the next Congress and its Foreign Relations Committee was to be controlled by his political and other opponents. Believing that his presence at the Peace Conference was necessary, if it was not to be dominated by old-style diplomatic practices, Mr. Wilson decided himself to go to Paris, and on Dec. 4 1918 sailed with the other members of the American Commission on the " George Washington." He arrived at Brest on Dec. 13, and was received at Paris, in England, and at Rome with tremendous enthusiasm. For the moment he was the popular hero, both in Allied and enemy countries. But his prestige rested on a precarious footing, and must inevitably diminish when he came to oppose the national aspirations of any people. He was anxious, therefore, to strike off a quick general peace, leaving details for later settlement; but this proved impossible, and formal conversations at Paris began only in Jan. 1919. The President succeeded in winning an early victory when he persuaded the conference to accept the principle of the League of Nations as the basis of the peace, and when, on Feb. 14, he won unanimous approval of the preliminary draft of the covenant. On returning to the United States, however, he found Republican opposition to the league strongly manifested in the Senate, although he had the support of Mr. Taft's influence in that party and in the country. Public opinion seemed to be uninstructed and apathetic as to the President's policies. Going back to Paris in March, he was able to secure the insertion in the covenant of certain amendments required by American sentiment, and the approval by the conference of the final draft of the covenant. But he was confronted by the demands of the French, Italians and Japanese for territorial and economic concessions from the enemy, which he regarded as excessive. Long discussions followed, culminating in Mr. Wilson's acceptance of a portion of the Allied demands, notably the granting of Shantung to the Japanese, of much of the frontier line promised by the Treaty of London to Italy, and the exaction from Germany of what amounted to a blank cheque in the matter of reparations. Such concessions aroused the opposition of liberals in England and America, who insisted that the President had surrendered his principles. Mr. Wilson, on the other hand, acknowledging that certain aspects of the settlement were not ideal, believed that he had won his main contention in securing the League of Nations, which provided the mechanism for eradicating the vices contained in the treaties. In this belief he was supported by another liberal protagonist, Gen. Smuts. On June 29 1919, the day following the signing of the Versailles Treaty, the President sailed for America. His international prestige had suffered from his opposition to national claims, especially that of the Italians to Fiume and of the French to the left bank of the Rhine. Nevertheless, as the bitterness of the moment passed, the magnitude of his accomplishments at Paris became more generally recognized. When the veil of secrecy surrounding the negotiations was gradually lifted, it was seen that the belief that he had been outmanœuvred by Lloyd George and Clemenceau was hardly justified by the facts. Lacking the negotiating ability of Lloyd George and the political experience of Clemenceau, he refused to enter the diplomatic lists with them, but by his manifest candour and sincerity early disarmed his opponents in argument. He said exactly what was in his mind, and was careful that his statements should be fortified by the documents and statistics furnished by his expert advisers.

The strain of the conference had told upon Mr. Wilson's physical and nervous strength. He was thus not well equipped to wage the struggle with his Republican opponents in the Senate which developed upon his presentation of the treaty. Had the President been willing to compromise and accept reservations to the covenant of the league, it is possible that the two-thirds necessary to ratification might have been secured. This course he refused to follow, and it soon became clear that the Foreign Relations Committee would not recommend ratification without serious reservations or amendments. In the hope of winning popular support, the President set forth upon a tour of the country and along the Pacific coast aroused enthusiasm in marked contrast to the coldness of the east. The effort, however, overtaxed his strength, and on Sept. 26 at Wichita, Kan., the President was compelled to give over his tour and return to Washington, where he suffered a complete nervous collapse. The exact nature of his illness was not made public and few realized how serious it would prove to be. Many, however, felt that in view of his inevitable abstention from active work, it would have been wiser for him to retire at least temporarily. As it was, his system had provided for no understudy and the administration was left without a leader. Entirely apart from the confusion thus caused in the conduct of the public business, Mr. Wilson's illness led directly to the defeat of the treaty. There was no one else capable either of leading the fight for ratification without reservations, or with sufficient authority to arrange a compromise. On Nov. 14 the Senate adopted reservations which Mr. Wilson declared would " nullify " (etc., etc.) the treaty; for this reason he urged the Democrats to refuse to vote for the ratifying resolution, which was accordingly defeated on Nov. 19 1919. During the succeeding weeks efforts were made to arrange a compromise. The Republican leaders agreed to soften the language of certain reservations, and the President intimated that he would accept a mild reservation on Article X. of the covenant, which had aroused the chief opposition. Neither side would yield enough, and when on March 19 1920, the final vote was taken on the ratifying resolution, which contained a strong reservation on Article X., Mr. Wilson again urged Democratic senators not to accept. The resolution thus failed of the necessary two-thirds by a margin of seven votes, 57–37. The President appealed to the autumn presidential election in 1920 as the decisive plebiscite. Although he had lost his former control of the party, and the Democratic presidential nominee at San Francisco was not his choice, the Wilsonian policies, including approval of the League of Nations, were inevitably the issue of the elections. In the electioneering campaign, however, the President himself could take no active part, for his physical collapse proved so serious as to confine him to the White House. For the overwhelming victory won by the Republicans, *see* UNITED STATES (*History*). After his defeat Mr. Wilson kept close silence on public matters, and his annual message of Dec. 1920, while it sounded the note of national duty, made no reference to that which lay nearest his heart—the League of Nations. This silence, indeed, he preserved until the close of his administration, March 4 1921. In Dec. 1920 he had been awarded the Nobel Peace prize.

The failure of President Wilson to win the approval of the United States for his peace policies presents one of the most interesting problems of American history. He had led the country through the difficult period of a war unsurpassed in magnitude and culminating in complete victory; in the face of serious obstacles he had forced European statesmen to accept the major item in his programme; he returned home only to be repudiated by his own people. Personal and partizan factors unquestionably contributed to his defeat. In private intercourse Mr. Wilson displayed a personal magnetism, a breadth of culture, and a genial cordiality that are amply attested by his intimates. But in public life he proved unable to capitalize such advantages, possibly because of natural shyness, possibly because physical delicacy restricted his social activities. Roosevelt's capacity for "mixing" with all political and human types he totally lacked. In the formation of his policies he isolated himself and was unable to establish close relations with Congressional leaders. This gave rise to the impression that the President disliked advice, was an ego-centric autocrat, and immediately dispensed with anyone who disagreed with him. Such criticism, by no means a novelty in the case of strong-willed presidents, was utilized by his political opponents and intensified his unpopularity in the industrial centres, especially of the east, an unpopularity which, except for a few months during the opening months of the war, was an outstanding factor in the political situation. Broadly speaking, the criticism does not seem to be fully justified. In matters of what he regarded as principle he was adamant, and he distrusted the judgment of those whose basic point of view was different from his own; but the evidence of those who worked with him, including that of Republican advisers at Paris, is almost unanimous to the effect that he was anxious to secure advice, was tolerant of opinions, and glad to delegate responsibility. The contrary belief was doubtless fostered by Mr. Wilson's inability to build up an efficient secretarial organization, and his incapacity, rather than unwillingness, to apportion effectively the details of administrative labour. His handling of war problems shows clearly his desire to delegate responsibility; once an appointment was made he refused to interfere and consistently protected his appointee from the importunities of politicians.

Political responsibility in general, he believed, should rest with the President. From conviction, rather than from egotism, he sought to emancipate the presidential office from the control of Congressional committees, a control which he earnestly deplored in his earliest writings. The President, he felt, should be the real leader of the nation, and not a mere executive superintendent. The Cabinet he looked on as an executive and not as a political council, and it was always strictly subordinated to his policies. So long as the Democrats held the majority in Congress he was able to translate such ideas into fact, and effectively disposed of all attempted Congressional revolts. This attitude naturally did not allay the political resentments which were inevitably aroused and which were intensified by Mr. Wilson's tendency to regard political opposition as tantamount to personal hostility; when the Democratic majority disappeared he faced uncompromising hostility. He was intensely impatient of partizan obstruction of his idealistic plans, and there is much of the Calvinist in his refusal to temporize or deviate from the path which he believed himself appointed to tread. While in matters of detail he showed at times some capacity for compromise, in matters of principle he displayed the unswerving determination characteristic of the prophet, a trait that is not always conducive to success in the exigencies of modern party warfare. Indeed it is as a prophet, rather than as a statesman that Mr. Wilson should be regarded. No one has preached more effectively the necessity of introducing a moral standard into international politics.

The following are the most important writings of President Wilson: *Congressional Government, a Study in American Politics* (1885); *The State—Elements of Historical and Practical Politics* (1889); *Division and Reunion, 1829–1889* (1893); *An Old Master and Other Political Essays* (1893); *Mere Literature and Other Essays* (1893); *George Washington* (1896); *A History of the American People* (1902); *Constitutional Government in the United States* (1908); *The New Freedom* (1913); *On Being Human* (1916); *International Ideals* (1919). Personal and political biographies of President Wilson have been written by H. J. Ford, *Woodrow Wilson: The Man and His Work* (1916); by H. W. Harris, *President Wilson: His Problems and His Policy* (1917); by W. E. Dodd, *Woodrow Wilson and His Work* (1920); and by his private secretary, Joseph P. Tumulty, *Woodrow Wilson as I Know Him* (1921). All four are eulogistic, especially the last two named. General surveys of Wilson's foreign policy are to be found in E. E. Robinson and V. J. West's *The Foreign Policy of President Wilson, 1913–1917* (1917); and in Charles Seymour's *Woodrow Wilson and the World War* (1921). Editions of President Wilson's State papers have been made by Albert Shaw, *President Wilson's State Papers and Addresses* (1917); by J. B. Scott, *President Wilson's Foreign Policy;* and *Messages, Addresses, Papers.* (C. SEY.)

WIMBORNE, IVOR BERTIE GUEST, 1ST BARON (1835–1914), British politician, was born at Dowlais Aug. 29 1835, the eldest son of Sir Josiah John Guest, 1st bart., of the firm of Guest, Keen & Nettlefold (the Dowlais Iron Works). He was educated at Harrow and Trinity College, Cambridge, and afterwards devoted himself to the management of his large property. He succeeded his father as 2nd bart. in 1852. He stood for Parliament as a Conservative several times between 1874 and 1880, and in the latter year was raised to the peerage. During the Tariff Reform controversy he seceded from the Conservative party, and afterwards sat in the House of Lords as a Liberal. He died at Canford Manor, Dorset, Feb. 22 1914. Lord Wimborne married in 1868 Lady Cornelia Spencer Churchill, eldest daughter of the 7th Duke of Marlborough.

Lord Wimborne's eldest son, IVOR CHURCHILL GUEST, was born Jan. 16 1873, and was educated at Eton and Trinity College, Cambridge. He unsuccessfully contested Plymouth in the Liberal interest in 1898 and served in S. Africa with the Dorsetshire yeomanry in 1900. In 1900 he was elected for Plymouth, holding the seat until 1906, and from 1906 to 1910 sat for Cardiff. In 1910 he was raised to the peerage as Baron Ashby St. Ledgers and sworn of the privy council, while from 1910 to 1912 he was paymaster-general. He became Lord-in-waiting to King George V. in 1913, and in 1914 succeeded his father as 2nd Baron Wimborne. In 1915 he became lord lieutenant of Ireland, but resigned in May 1916, after the Irish rebellion. He was, however, reappointed in Aug. 1916, and remained in Ireland till May 1918, when he was on his retirement created a viscount. He was well known as an enthusiastic sportsman and polo player, and to him was due the organization of the polo team which defeated the U.S.A. in the international match at Meadowbrook, Long Island, in June 1914.

WINCHESTER, England (*see* 28.704).—The pop. increased from 23,378 in 1911 to 23,791 in 1921. In 1912 the necessary work for preserving the cathedral by underpinning the walls and laying new foundations (undertaken in 1905) was completed, and on July 15 of that year the King and Queen attended a great Thanksgiving Service at the cathedral. The total cost of restoration was £113,000, raised by voluntary subscriptions. As much of the work had to be carried out under water varying in depth from 6 to 20 ft., a diver was employed continuously for 5½ years to lay down cement concrete at the base of the new foundations. The work was carried out by Sir Thomas Jackson and Sir Francis Fox. During 1919–21 a large part of the ancient stained glass in the cathedral was also restored.

In 1918 a find of iron currency bars of the early iron age was made on Worthy Down, near Winchester, and, in excavations near the same spot in 1920, some "pit dwellings" were located, the area appearing to be the site of a settlement of that age. The objects found were placed in the city museum. A number of other objects of archæological interest have been unearthed, including a portion of a stone column with its capital and dedication stone to Carinus (A.D. 283–4), the only inscription to that Emperor as yet found in Great Britain. In 1919 the valuable Dale collection of prehistoric and Roman antiquities was purchased and placed in the museum, and the Rosehill collection of prehistoric remains was transferred to the Tudor House museum at Southampton. A map of ancient Winchester, indicating all existing ancient and historic buildings and the sites of those no longer in existence, was issued by the Ordnance Survey in 1920.

A site of 100 ac. in the St. Cross district of the city has been planned on self-contained garden city lines, on which 560 houses were in course of erection in 1921. New county council offices for the county of Hampshire, on Castle Hill, were opened in 1911. The Guildhall was extended in 1914, and the old Tudor Guildhall restored in 1915. A chamber of commerce was established in 1919. During the World War Winchester was a prominent military centre, and some 50,000 troops, including Canadians and Americans, were continually in training there.

WINGATE, SIR FRANCIS REGINALD (1861–), British general and administrator in the Sudan (*see* 28.729). In Dec. 1916 he was appointed High Commissioner for Egypt and relinquished the governorship of the Anglo-Egyptian Sudan, after a successful administration during 16 years. At the beginning of 1919 Sir Reginald Wingate was summoned to London to report on the situation which had arisen in Egypt, and he remained there many months at the disposal of the Government until his resignation in Oct. 1919. He had received the G.B.E. in Jan. 1918, and was created a baronet in June 1920.

WINNIPEG (*see* 28.731), the capital of the Canadian province of Manitoba, had a pop. at the close of 1920 estimated at 198,000 (271,958 including suburbs). The Dominion census of 1911 gave a pop. of 136,035. Winnipeg is the great commercial metropolis of western Canada, its importance having been enhanced since 1911 by the completion of the Grand Trunk Pacific Railway (which later became a part of the Canadian National Railways system). The Hudson Bay railway, intended to link Winnipeg with Port Nelson on Hudson Bay and thus to provide an outlet by sea through the summer months for the produce of the west, was still under construction in 1921. Begun as a private enterprise, it had been taken over by the Canadian National Railways system: its completion was expected to improve further Winnipeg's position as the trade outlet of the west. As the wholesale centre for the prairie provinces Winnipeg housed in 1920 5,000 commercial travellers representing an annual wholesale turnover that exceeded $300,000,000. The assessed value of property in the city that year was $259,419,520. After 1911 Winnipeg grew in importance as a manufacturing centre, and in 1920 had 513 factories and industrial plants, including flour mills, packing houses, structural steel works, rolling mills, tanneries, sugar refineries, clothing, harness, soap, jewellery and dye factories, etc. The output of its industries in 1917 amounted to $98,101,632. The almost unlimited power resources of the Winnipeg river, 100 m. away, led to a scheme for an extensive hydro-electric system, to develop 175,000 H.P., which was in course of construction in 1921. The Civic Power Electric Co. had developed 60,000 H.P., and the Winnipeg Electric Railways had developed 30,000 and had 50,000 under construction in 1921. The building of the Grand Trunk Pacific Railway, Canada's third trans-continental railway, in the years following 1911, opened an important phase in Winnipeg's history. The company's extensive railway shops were located at Winnipeg, and the Fort Garry Hotel was erected by the railway in the heart of the city.

WINTER, JOHN STRANGE (MRS. ARTHUR STANNARD) (1856–1911), English writer (*see* 28.734), died in London Dec. 13 1911.

WIRELESS TELEGRAPHY AND TELEPHONY (*see* 26.529).—Wireless telegraphy and telephony (also called radiotelegraphy and radiotelephony) made enormous progress between 1910 and 1921. This was due chiefly to the improvements and advances, effected in three great inventions, viz.: the three-electrode thermionic tube developed out of the Fleming oscillation rectifying valve, the high frequency alternator, and the Poulsen arc generator of continuous waves. The first of these has given a means of detecting electric waves of immense sensitivity, and also a most effective and easily managed generator of continuous electric waves. The second has provided machines for creating high frequency electric currents, and therefore electric waves, of great power, enabling large long-distance radio stations to be equipped which can signal to any part of the world by day or night. The third has also given an alternative method of generating high-power continuous waves. These generating and receiving appliances quite revolutionized wireless telegraphy and made wireless telephony possible not merely as an experimental feat, but as a practically useful art. In addition to these inventions there have been others such as directive radiotelegraphy, and wire-guided high frequency telegraphy and telephony of immense utility. The application of the thermionic valve in ordinary wire telephony as a repeater is also bringing about improvements of very great importance. Contemporaneously with these achievements investigations have been made of a more scientific character arising out of the study of the nature of electric wave propagation round our globe and of the causes of atmospheric disturbances, called "strays," which have always been the great obstacle to practical radiotelegraphy.

We shall consider briefly the nature of these improvements in turn.

High Frequency Alternators.—It had become clear by 1904 or 1905 that the use of continuous waves in radiotelegraphy would have marked advantages over the then employed damped wave trains produced by condenser discharges, and would be essential for the accomplishment of radiotelephony. The most obvious method of producing such continuous waves (C.W.) was by some form of high frequency alternator. At that time, when wave lengths of 300 to 3,000 metres or 1,000 to 10,000 ft. were mostly in use, this meant the design of machines giving alternating currents having a frequency of 1,000,000 to 100,000,000, and such frequencies seemed unattainable by any ordinary alternator construction as long as the revolving part of the alternator had to carry coils of wire. In low frequency alternating current dynamos, generating currents, reversed 50 to 200 times a second, there is an electromagnet which provides a constant magnetic field through which field coils of wire are moved so as to generate in the latter an alternating current. Either the field coils or the armature coils may be the rotating portion. In the case of alternators required to produce high frequency currents (20,000 to 100,000) it is impossible to rotate coil-wound armatures or fields at the necessary speed, and the most usual solution of the problem is to construct inductor alternators in which the moving part consists merely of a disk or drum of steel with teeth or ridges on its edge or surface, which serve to change the magnetic flux through stationary armature coils, the field coil also being fixed. We can then balance such a drum or disk and so fashion its edge that it can be rotated at a high speed safely. With the increase in capacity and wave length of the aerial wires or antennæ requisite for long distance power stations, frequencies between 20,000 and 100,000 came into use, and attention was again directed to the design of alternators giving such frequencies.

M. Latour has classified these machines into: (1) alternators in cascade, (2) internal cascade alternators, (3) homopolar or inductor alternators, (4) variable reluctance alternators, and (5) alternators with partial utilization of periphery. Although Béthenod in France constructed in 1912 a small machine of type (1), the first alternators of type (2) of 100 kilowatt output, or so, were constructed by R. Goldschmidt about 1912.

In machines of types (1) and (2) we start with the production of a single-phase alternating current of some moderate frequency, say 10,000, and multiply it up to much higher frequencies by taking advantage of a well-known principle called Fresnel's theorem. If there be two equal vectors represented by lines of equal length, which are pivoted to one point and revolve with equal angular velocities in opposite directions, their resultant is a line of constant direction but periodically varying magnitude with amplitude twice the size of that of the revolving vectors. Hence an alternating magnetic field of constant direction may be resolved into two fields of constant magnitude but rotating in opposite directions, each of half the maximum amplitude of the alternating field. If then we pass a direct electric current through the field coils of an alternator and induce in the revolving armature an alternating current say of 10,000 frequency the field due to this armature current may be resolved into two oppositely rotating fields, one of which is stationary as regards the field magnets and the other cuts them with twice the angular velocity of the rotor. This gives rise to a current of twice the frequency in the field coils. The field due to this latter current can again be resolved into two oppositely rotating fields and these induce currents of still higher frequency in the rotor coils. We can so build up currents of frequencies in the ratio of 1, 2, 4, etc. The currents of intermediate frequency can be taken up in circuits comprising capacity and inductance tuned to these frequencies respectively. The current of the highest frequency can be put into an aerial wire and employed to radiate long electric waves of corresponding wave length.

High frequency alternators of the above description were built for the radio station established at Tuckerton, N.J., in correspondence with a similarly equipped one at Eilvese, near Hanover in Germany, and used for trans-Atlantic transmission from about 1912 up to the time of the entrance of the Unite States into the World War.

The third type of high frequency (H.F.) alternator, called the homopolar inductor alternator, is represented by the machines of E.F.W. Alexanderson with disk rotor, and Béthenod-Latour and the Société Française Radio-Electrique with drum rotor.

The principle of these alternators is as follows: a fixed ring-shaped frame or stator has inwardly projecting teeth of laminated iron, and a ringshaped magnetizing coil traversed by a direct exciting current causes magnetic flux to spring across from the teeth on one side (N. poles) to the teeth on the other side (S. poles). This flux traverses the air gap. Over these teeth is a zig-zag armature winding. Between the teeth in the Alexanderson machine revolves a steel disk with teeth cut in the periphery (*see* fig. 1 and fig. 1a).

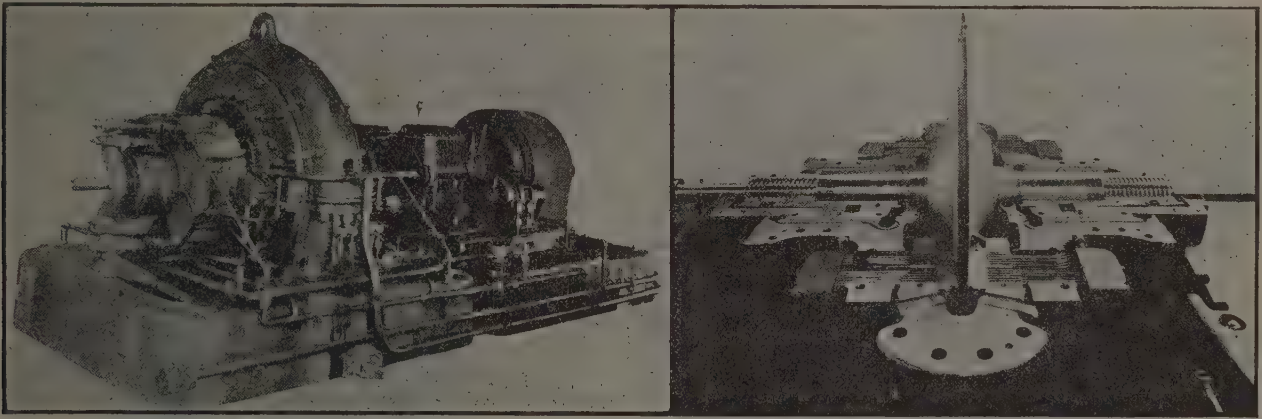

FIGS. 1 (left hand) and 1a (right hand).—FIG. 1, 200 kilowatt Alexanderson high frequency alternator, driven by an electric motor. FIG. 1a.—Half section of the Alexanderson high frequency alternator; showing the inductor disk which revolves between the stator poles. (By permission of *The Wireless Press.*)

The number of teeth in the rotor is half the number of teeth on each side of the stator. These rotor teeth as they pass between the stator teeth decrease the reluctivity of the air gap and increase the magnetic flux passing. Hence as the rotor revolves the magnetic flux linked with the armature circuit is alternately increased and decreased. This creates an electromotive force and a high frequency current in the armature circuit. The only revolving part of the machine is thus a well-balanced rigid steel disk. The field exciting coil and the armature coil are both stationary. Such machines are called in English inductor alternators and in French homopolar alternators.

In the Béthenod-Latour machines the inductor is in the form of a steel drum with exterior of laminated iron in which longitudinal grooves are ploughed out. The stator ring has inward radially pointing laminated iron teeth on both edges, and the magnetic flux, leaving one set of teeth (N. poles), passes down through the drum teeth and up again into the other set of stator teeth (S. poles). The ridges on the drum serve to increase and decrease the flux through the armature wire which is wound zig-zag on both sets of stator teeth.

The peculiarity of the French machine is that the rotor or drum has many more ridges or teeth on it than the stator ring. By this we can obtain the necessary high frequency without dangerous peripheral speed in the rotor, and yet leave plenty of space for the armature winding placed on the stator teeth.

On account of the few turns in the armature such machines give a small electromotive force, but this can be raised by suitable static transformers, one secondary terminal of which is connected to the radiating antennæ and the other to the earth plates. The aerial wire is then tuned to the frequency of the alternator and the necessary wave length. A point of importance is the exact regulation of the speed of the machines which must be kept constant to within 0·1% of the normal. This is achieved by the use of very sensitive governors which control the speed of the direct coupled electric motor which drives the alternator. The signals are made in the case of the Alexanderson machines by varying the inductance of a tertiary coil on the transformer which transfers the energy from the aerial to a non-radiative circuit. By placing condensers in series with the H.F. alternators it has been found possible to run them in parallel, that is two or more together just as in the case of low frequency alternators in electric lighting and power stations.

High frequency homopolar alternators of the Béthenod-Latour type have been built by the Société Française Radio-Electrique up to 220 kilowatts size for the French military radio station at La Doua, near Lyons. To avoid loss of power by air churning these machines are enclosed in an air-tight case in which a partial vacuum is maintained. The speed of the machines is controlled by a Thury governor, and signals are made by short circuiting the armature coils in sections. Two or more machines can be run in parallel, thus giving to the aerial 500 or 600 kilowatts of electric power. Also similar machines are employed in the large French radio station at Croix-d'Hins near Bordeaux, and are installed in the very large French radio station at St. Assise, near Melun, which began to be erected in 1921. Alexanderson alternators of 200 kilowatt power are installed at the American naval radio station at New Brunswick, N.J. This station communicates with Stavanger radio station in Norway (3,554 m.) with Lyons (3,845 m.) and Nauen, near Berlin (3,958 m.) (*see* fig. 1).

The Arc Generator.—We must next mention the improvements made in connexion with the Duddell-Poulsen arc generator. In this appliance an electric arc is formed with a direct current between a water-cooled copper electrode (the positive terminal) and a carbon negative electrode. The arc is inclosed in a chamber filled with coal-gas or kerosene or alcohol vapour, and a powerful transverse magnetic field is made across it (*see* fig. 2). If the arc terminals are shunted by a circuit containing a condenser and an inductance coil, high frequency oscillatory currents will be set up in this latter circuit under certain conditions. Their

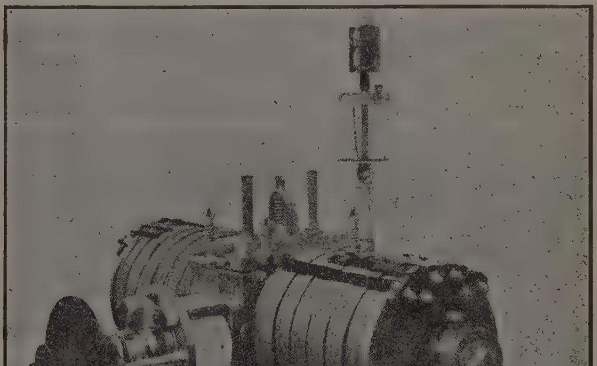

FIG. 2.—25 kilowatt Poulsen arc generator of electric oscillations; showing the electromagnet and arrangement for dropping alcohol into the arc box. (By permission of Marconi's Wireless Telegraph Co., Ltd.)

energy can be inductively transferred to an aerial wire so as to radiate continuous electric waves from it. The arc must be in a certain *active* condition determined by its length and the strength of the magnetic field in order to produce oscillations. Many investigations have been made to elucidate the working of this oscillation-producing arc.

A fairly complete list of these papers is given by P. O. Pedersen in the *Proceedings of the Institute of Radio Engineers* (United States), vol. v, p. 255, Aug. 1917.

In order that the arc may be active, *i.e.* produce oscillations in the condenser circuit, it must be drawn out to a certain length, and the transverse magnetic field must have a certain optimum value, which depends upon the density of the gas in which it is immersed and on the frequency of the oscillations and the strength of the direct current feeding the arc.

Under best conditions the effective or root mean square value of the oscillatory current is $1\sqrt{2}=0{\cdot}7$ of the strength of the direct feeding current. Thus, if the arc is fed with 100 amperes (D.C.), it should give 70 amperes (A.C.) in the oscillation circuit under best conditions: the possibility of this transformation is the result of the negative slope of the characteristic curve of the direct current arc, viz. that an increase in arc current is accompanied by a decrease in electric potential difference and vice versa. Also the necessity for maintaining round the arc a non-oxygenic atmosphere, or one consisting of hydrogen or carbon hydrides or oxides, is due to the fact that in these gases the arc characteristic has a steeper downward slope than in air (see W. L. Upson, *Phil. Mag.* July 1907). The transverse magnetic field is requisite suddenly to extinguish the arc at each oscillation, and so produce an electromotive force in the inductance coil which recharges the condenser in the reverse direction. Broadly speaking then, the operation which takes place is as follows:—if the arc is burning steadily and the condenser is shunted across the electrodes, the result is to rob the arc of some current. Hence the potential difference (P.D.) of the arc electrodes increases. This, however, continues the charging of the condenser in the same direction. Then the latter discharges back through the arc and this lowers the P.D. of the electrodes.

The study of the oscillatory arc by means of the oscillograph by H. Th. Simon, H. Barkhausen, A. Blondel, and P. O. Pedersen has shown clearly the nature of the operations taking place. If no magnetic field, or a weak one is employed, and if the arc is in air only, feeble oscillations are set up in the condenser circuit, and the current through the arc is a pulsatory unidirectional current. This is the case of the Duddell or musical arc which has no use in wireless telegraphy. If a stronger magnetic field is used and if the arc is in a hydrogen or coal gas atmosphere, then much more powerful oscillations are produced, and when the R. M. S. value of the condenser current is equal to, or greater than 70% of the direct current the arc current just falls to zero, or is extinguished at each oscillation. The function of the transverse magnetic field is then to blow out the arc by forcing the stream of electrons outward, and the effect of this sudden rupture is to create a strong adjuvant or assisting induced electromotive force in the inductance coil in the condenser circuit. This continues the arc current in the same direction, and the condenser thus becomes charged in the opposite direction. The process then repeats itself and we have powerful oscillations produced in the condenser circuit.

Although the condenser current is a sinusoidal current, and the arc current has the same form, yet owing to the shape of the dynamic characteristic curve the potential difference of the arc electrodes is an irregular curve with sharp peaks corresponding to the instants of cessation and recommencement of the arc current.

The practical construction of a Poulsen arc generator involves therefore a large electromagnet having poles which project into a box which can be kept full of alcohol, or kerosene vapour or else coal-gas. Into this box project also two electrodes, one of copper, through which water circulates to keep it cool, and one of hard carbon which is kept in slow rotation by a motor. The poles of the magnet are shaped bluntly conical so as to concentrate a powerful magnetic field transversely to the electric arc which springs from the copper (+) to the carbon (−) electrode. The arc is created by a direct current dynamo giving a voltage of 500 or more (*see* fig. 2). A separate shunt-wound dynamo is often employed to excite the electromagnet. In the circuit of the arc supply dynamo choking coils are inserted, and a circuit comprising a condenser of capacity C and an inductance (L) is connected as a shunt to the arc. If the capacity C is measured in farads and the inductance in henrys then the ratio $\sqrt{L}/\sqrt{C}$ is a function of the dimensions of a resistance reckoned in ohms, and should have some value of about 500 ohms or so.

Means must be provided for adjusting the magnetic field to its optimum value (Ho) which depends on the frequency (n) of the oscillations produced, where n is nearly equal to $1/2\pi\sqrt{LC}$, or upon the radiated wave length λ (in metres) where $n\lambda=300$ million metres.

P. O. Pedersen states that $\text{Ho}=a/\lambda-b$ where a and b are certain constants (see "The Poulsen Arc and its theory" *Proc. Institute Radio Engineers*, United States, vol. v, p. 255, Aug. 1917). L. F. Fuller states that $\text{Ho}=\frac{K\sqrt{P}}{\lambda}$ where P is the power furnished to the arc and K is a constant depending on the surrounding gas or vapour. For kerosene $K=4{\cdot}23$; for ethylic alcohol $K=8{\cdot}5$. For a power of 50 kilowatts and a wave length of 7,000 metres the arc in alcohol requires a field of 8,300 C.G.S. units and for a wave length of 20,000 metres and a power of 1,000 kilowatts the field must be 13,500 C.G.S. units. Hence as the air gap is large (generally several centimetres) extremely large magnets are required. For the 1,000 kilowatts arc plant the magnets weigh 80 tons and for the 500 kilowatts plant 65 tons. For smaller sizes of plant the magnet is of the open circuit type and for the larger of the closed circuit type. The arc chamber and magnets have to be cooled by water or oil circulation. From 100 kilowatts size and upwards this arc generator is very widely used in long distance radio stations. It labours, however, under the disadvantage that the signalling cannot be conducted by starting and stopping the arc but only by throwing the aerial out of tune or by deflecting the energy into a non-radioactive circuit. Hence power is equally consumed whether message signals are being sent out or only spacing waves.

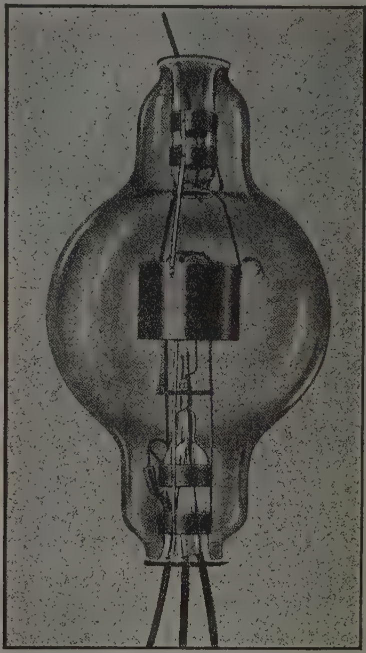

FIG. 3.—Modern thermionic generating valve; showing the cylindrical anode and metal gauze grid, as made by the Marconi-Osram Valve Company. (By permission of Marconi's Wireless Telegraph Co., Ltd.)

The Thermionic Valve.—The third type of high frequency electric oscillation generator which has become of great importance in the last five years is the thermionic valve, which is a development of the Fleming valve (*see* 26.537).

The Fleming valve comprises a glass bulb, highly exhausted of its air, and contains a carbon or metal filament which can be rendered incandescent by an electric current. Around the filament is placed a metal cylinder carried on a wire sealed through the bulb. The peculiar property of it is that, when the filament is incandescent, the space between the filament and cylinder will conduct negative electricity from the filament to the cylinder but not in the opposite direction. Hence the name "valve" given to it. It can, therefore, be used to separate out the two constituents of a high frequency alternating current and "rectify" them into a direct current. This valve was extensively used as a detector of electric waves in wireless telegraphy from 1904 onward as described later. In 1907, Lee de Forest in the United States, after he had become acquainted with Fleming's invention of the valve and its use in wireless telegraphy, added to it an additional element in the form of a grid or zig-zag of wire placed between the cylinder and the filament but carried on a separate terminal. He thus made a so-called three-electrode thermionic valve, a name sometimes shortened into *triode.*

In its modern form a thermionic valve of the latter type comprises a highly exhausted glass bulb having in it a filament of tungsten, or thoriated tungsten or of platinum wire coated with oxides of barium and strontium (*see* fig. 3). This is rendered incandescent by electric current from a storage battery. Around the filament is a spiral of nickel wire or else a cylinder of nickel wire gauze. This is technically called the grid. Around that again is a cylinder of sheet nickel called the plate. The plate and the grid are carried on separate wire stems sealed through the wall of the bulb. Although the three-electrode valve was originally devised as a detector of electric oscillations as described below yet about 1913, or before, it was found that both the two-electrode valve and also the three-electrode valve can produce electric oscillations as well as rectify or detect them. When the filament is rendered incandescent torrents of electrons or particles of negative electricity are emitted from it. If the plate is given a positive potential relatively to the filament by means of a battery called a plate battery, these electrons are attracted to it, and this creates a movement of negative electricity called a thermionic current. If the bulb is highly exhausted and has a grid in it between the filament and plate, the electrons can only reach the latter by passing through the holes in the grid. If the grid is given a negative potential it reduces or stops the thermionic current. If it is given a positive potential it increases the current. The relation between thermionic current and grid potential can therefore be represented by a characteristic curve as shown in fig. 4.

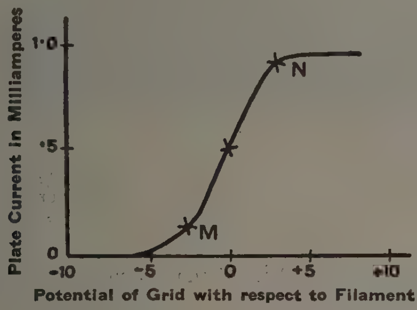

FIG. 4.—Characteristic curve of a three electrode thermionic valve.

The three variables, viz. plate and grid potential (v_p and v_g) and the thermionic current (i_p), may be regarded as three rectangular coördinates which define a characteristic surface, and sections of this, parallel to the $i_p v_g$ axes or $i_p v_p$ axes, delineate the principal characteristic curves. The central portion of this surface, corresponding to zero grid potential, is nearly a plane and has therefore the equation $i_p = av_g + bv_p$ where a and b are certain constants or coefficients.

If we pass a current by means of a high voltage battery from the filament to the plate and send this current also through the primary coil of an oscillation transformer, the secondary circuit of which is connected to the filament and grid, we have an arrangement by which continuous electric oscillations are produced and maintained. For, if properly connected, any variation of the grid potential will increase or decrease the plate current; and this acting through the transformer will in turn create the changes of grid potential which act to sustain the variations of plate current. The action is just like the well-known experiment of the singing telephone. If a magneto-telephone receiver is in series with a carbon transmitter and with a battery, then, when the transmitter is held near the receiver, the latter emits a shrill note. The sound given out by the receiver acts on the transmitter and this in turn actuates the receiver. The energy is drawn in both cases from the battery.

The three-electrode valve so used is called a transmitting valve, and the sustained electric oscillations it can produce, as above described, can be transferred to an aerial wire and cause it to radiate continuous electric waves.

Very large thermionic valves are now made with glass or silica bulbs, a foot or more in diameter, for use as transmitting valves, and numbers of these can be associated together to form a thermionic generator of large power. In this case the high voltage required to pass the plate current through the valve is obtained by the use of a battery of Fleming two-electrode valves which rectify a high tension alternating current of low frequency. A complete valve panel, as it is called, comprises the battery of rectifying valves, and three-electrode valves and also the necessary transformers, induction coils and condensers (*see* fig. 5). Large valve panels are now constructed to transform electric power from 1 kilowatt to 50 kilowatts or more into high frequency electric oscillations of great energy.

Such valve generators are extensively used by Marconi's Wireless Telegraph Co. and others for the production of continuous waves, and are employed at Clifden Station in Ireland for the transmission of wireless messages across the Atlantic Ocean.

Detectors.—We must in the next place notice the improvements which have taken place in means for detecting continuous waves (C.W.) as used in wireless telegraphy. The reader may refer to the earlier article on Wireless Telegraphy (*see* 26.535) for an account of the principal appliances used in connexion with spark or damped wave telegraphy for the detection of electric oscillations, and especially to the section on the oscillation valve or two-electrode thermionic detector, from which other types of improved thermionic detector have been developed. Subsequently to the introduction of the two-electrode, but prior to the advent of the three-electrode thermionic detector, much use was made of *crystal* or *rectifying* detectors.

It will be remembered that the electric waves sent out from the transmitting aerial wire, which are identical in nature with light waves except for their much greater wave length, fall upon an aerial wire at the receiving station, and create in this latter extremely feeble, high frequency electric currents or oscillations which are a copy on a very reduced scale of the electric oscillations established in the transmitting aerial. The strength of these feebly received currents reckoned in amperes (I_r) can be approximately computed from the strength of the currents in the sending aerial (I_s) reckoned in amperes by means of an empirical formula valid up to about 2,000 m. due to L. W. Austin and L. Cohen which is as follows:—

$$I_r = I_s \frac{377\, h_r\, h_s}{\lambda d\, R} \epsilon^{-0{\cdot}0045 d / \sqrt{\lambda}}$$

where h_s and h_r are the heights of the sending and receiving aerial wires in kilometres, d is the distance apart of the stations in kilometres, λ is the wave length in metres, ϵ the base of the Napierian logarithms, and R the total resistance of the receiving circuits in ohms.[1]

The received currents may be something of the order of 5–10 microamperes more or less in the case of long distance working. To detect these feeble oscillations special appliances called detectors are in use. The so-called rectifying detectors do this by converting the received oscillations into feeble unidirectional currents, which in the case of damped waves are equivalent to short gushes of electricity in one direction corresponding in frequency to the condenser discharges in the transmitter. These can then be detected by a telephone, as they create in the latter a musical sound agreeing in pitch with the wave group frequency, and this, by the action of the key in the transmitter, is cut up into *dot* and *dash* audible Morse signals. One of the first rectifying crystal detectors was carborundum discovered in 1906 by H. H. C. Dunwoody in the United States. This material is a crystalline carbide of silicon produced in electric furnaces, and, in certain specimens, as shown by G. W. Pierce, has an electric conductivity 40 or 50 times greater in arc direction than in the opposite along one crystalline axis.

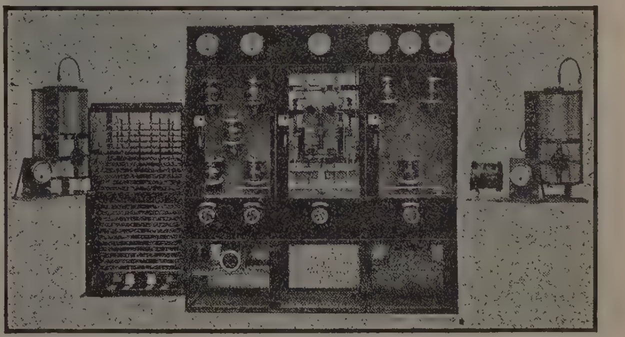

FIG. 5.—Valve panel for generating high frequency oscillations in the transmitters for wireless telegraphy, as made by Marconi's Wireless Telegraph Co., Ltd. (By permission.)

The same properties are exhibited by hessite and anatase as well as by molybdenite and other native sulphides. Furthermore, it was found by L. W. Austin and G. W. Pickard that contacts between certain pairs of substances such as tellurium and aluminium, or zincite and chalcopyrite, also plumbago and galena, have the same kind of unilateral conductivity and can be employed for "rectifying" high frequency oscillations. These crystal and rectifying detectors came at one time into great use in wireless telegraphy.[1]

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[1] The problem of predetermining the electric and magnetic force at any point on a conducting sphere due to a Hertzian oscillator at some point on it is a very difficult one. The reader will find references to the work of Macdonald, Nicholson, Love, Rybczynski, and others in *The Principles of Electric Wave Telegraphy*, Fleming, 4th ed. chap. ix., and also in a paper by Balth van der Pol in *Phil. Mag.*, vol. xxxviii. (Sept. 1919). The final result is that diffraction alone will not account for long distance radiotelegraphy.

The limitation in the power of these crystal or rectifying detectors lay in the fact that the energy used in making the signal is only a portion of that captured by the receiving aerial from the incident waves. An immense improvement was therefore effected by the introduction of the three-electrode thermionic valve, which can act in the manner of a telegraphic relay and employs the received power merely to release a much larger amount of electric power from a local battery, which latter creates the signal in the telephone or other instrument. Moreover, this type of detector is capable of being used in series so as to amplify or magnify enormously the signal-making power.

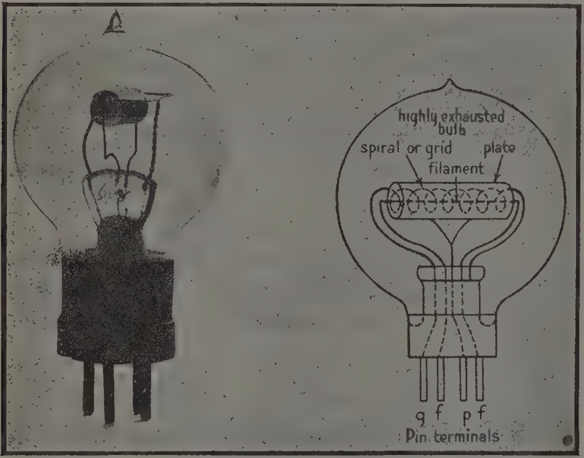

FIG. 6.—Thermionic amplifying and detecting valve of the type usually called the "French" valve with cylinder anode and spiral wire grid surrounding a straight filament.

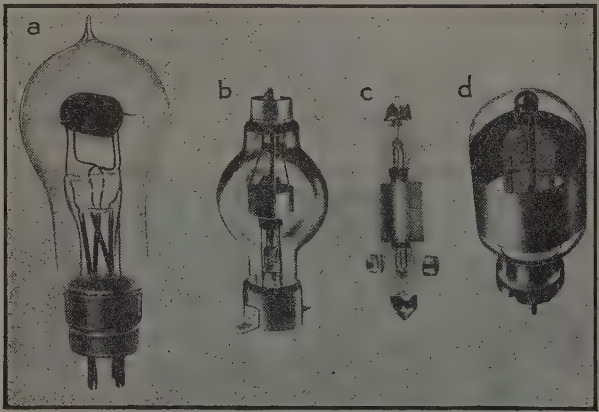

FIG. 7.—Views of various types of three-electrode thermionic valves; (*a*) detecting and amplifying valve; (*b*) transmitting or generating valve; (*c*) amplifying valve of a type made by Marconi's Wireless Telegraph Co.; (*d*) small transmitting valve with gauze grid.

The modern hard or high vacuum thermionic valve as used for reception and amplification is now generally constructed as follows:—a small glass bulb or tube, a few inches in diameter, has sealed into it a filament which can be rendered brightly incandescent by current from a 2-to 3-cell storage battery (4–6 volts). This filament is of drawn tungsten wire, or else platinum coated with oxides of barium and strontium. The bulb is highly exhausted. Around the filament and close to it is coiled a spiral of nickel wire called the grid, and outside that a cylinder of nickel called the plate. The plate and grid are carried on wires sealed through the bulb, and connexions to the grid, plate and filament are brought to four terminal pins at the base fixed to a brass collar (*see* figs. 6 and 7). These pins fit into a suitable socket. A battery of 30 to 200 volts E.M.F. has its negative terminal connected to the filament and positive to the plate, and when the filament is incandescent a stream of electrons (atoms of negative electricity), called the plate current, flows from the filament to the plate through the apertures in the grid wires. This current completes its circuit through a coil of wire in the external plate filament circuit which may be one coil of a transformer. If the grid has a small negative charge given to it the plate current decreases, and, if a positive one, the plate current increases. The relation of plate current to grid potential can be delineated by a characteristic curve (*see* fig. 4). For a certain positive grid potential the plate current becomes saturated and ceases to increase. If the grid and filament are connected to the terminals of the receiving condenser in a wireless telegraph aerial, the incidence of electric waves on the aerial will create alternations of potential in the grid and alternations of plate current, and the amplitude of the plate potential may be five to ten times greater than that of the grid. The thermionic tube is then said to have an amplifying power of five to ten.

If the coil in the plate circuit forms the primary coil of a two-coil transformer the secondary circuit of the latter may be connected to the grid and filament of a second valve, and a second amplification of potential may take place. We can thus employ a series of valves *in cascade* and the total amplification increases as the *n*th power of the number of valves (n) in cascade. Thus if one valve amplifies potential ten times, three valves will amplify 1,000 times and so on.

This use of thermionic valves in cascade has given us detectors of enormous sensitivity. In order to detect damped oscillations we can adopt one of two methods. If we place a small condenser with a leak across its terminals in the grid circuit then the side of this condenser next the grid becomes negatively charged, and the plate circuit of the valve is reduced. This charge leaks away almost instantly and the plate current of the valve rises again. Hence if the incident waves are in "damped trains" a telephone receiver inserted in the plate circuit of the valve will give a sound of the pitch of the train frequency, and this can be cut up into signals. In this case the valve is used as a rectifier as in the case of the Fleming valve. The second mode of use depends upon the form of the characteristic curve. If we employ a small battery of cells to give the grid a certain positive potential we can operate the valve at a point on the curve near to the saturation point so that a small reduction in the potential of the grid lowers the plate current, but a small increment of potential does not increase it. Hence if the grid is connected to one terminal of the tuning condenser of a receiving aerial it will oscillate in potential when a train of electric waves falls on the aerial. This, however, will cause a drop in the plate current and hence a sound in a telephone receiver included in that circuit. If the incident waves are damped or intermittent trains the result is to make a steady musical sound in the telephone of the pitch of the train frequency. Accordingly, by interrupting the groups by the sending key, audible Morse signals can be received.

The above described methods of reception are however only applicable in the case of damped or intermittent trains of waves. If the electric waves are continuous as sent out by an alternator, arc, or valve transmitter, then we can only detect signals made with them by converting the continuous waves into the equivalent of a series of damped trains. This is done by generating in the receiving aerial electric oscillations by a local valve generator which have a frequency differing from that of the incident waves by about 300 to 1,000. The result is to create in the receiving aerial resultant electrical oscillations which fluctuate periodically in amplitude just as "beats" in musical sounds are produced when two organ pipes slightly out of tune are sounded together. The number of beats per second is equal to the difference in the frequency of the two separate oscillations. In the aerial wire these electrical beats can then be detected by any of the types of detector and receiver used in spark wireless telegraphy. This method is therefore called "beat reception." The beats disappear when the signal bringing waves are interrupted at the sending station in making the spaces between the Morse code signals.

One great use of the three-electrode valve, or triode, as it is sometimes called, is in amplifying feeble signals. It has been explained already that when the grid of the valve is electrified positively or negatively it increases or decreases the plate current and, therefore, the plate potential. The amplitude of the plate potential variations may however be five or ten times or more that of the grid potential variations. Hence the valve acts as a relay or magnifier of potential. Again we can interconnect a number of such triodes in series by induction coils so that the variations in plate current of one valve are made to vary the grid potential of the next. Hence by using a series of valves in cascade we can multiply potential variations of the grid of the first valve in a geometric progression and enormously magnify them. The remarkable achievements of modern long distance wireless telegraphy are chiefly due to the use of such cascade amplifiers. In fig. 8 is shown a view of such a detector made by Marconi's Wireless Telegraph Co. in which six valves are used as amplifiers and a seventh valve as a detector. So sensitive are these cascade receivers that it is not necessary to employ any long aerial wire to receive wireless signals from distant stations. It suffices to construct a large rectangle of a few dozen turns of insulated wire called a frame aerial and connect this in series with a condenser of suitable variable capacity and tune the arrangement to the wave length of the wave to be received. This frame is then placed with its plane vertical and in the direction of the sending station. As the incident electric waves sweep over it they set up in the wire very feeble electric oscillations. If a cascade thermionic amplifier is then connected to the terminals of the receiving condenser and appropriate tuning carried out the signals will be heard in the receiving telephone. It is possible to make one small storage battery of three cells provide the electric current for incandescing the filaments, and one battery of 40–50 cells provide the plate currents for all the valves. Very compact and portable multiple valve receivers of this type have been constructed for use in aircraft and for reception of time signals from distant radio stations.

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[1] A fuller description of these rectifying detectors is given in *The Principles of Electric Wave Telegraphy and Telephony* by J. A. Fleming, 4th ed. chapter vi. (1919).

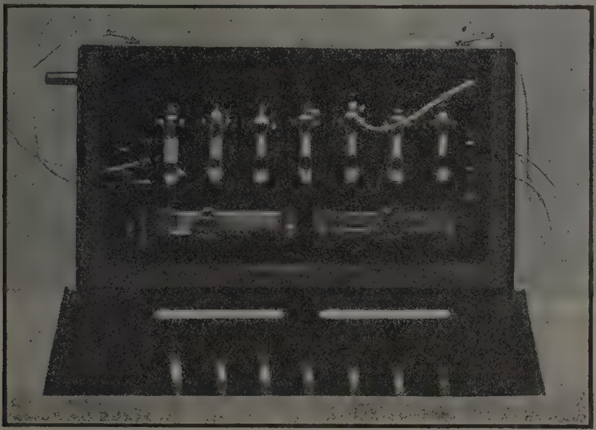

FIG. 8.—Marconi Co.'s type 55; thermionic amplifier with six amplifying valves and one detector as used in wireless telegraphy and telephony. (By permission of Marconi's Wireless Telegraph Co., Ltd.)

Directional Wireless.—The frame aerial has the important quality of being directive; that is, it tells us the direction in which the incident waves are travelling. Hence if two receiving stations at a known distance apart are provided with directive aerials, and if they simultaneously observe the direction of the arriving waves from one transmitting station, which may be on an aircraft or ship, these observations laid down on a chart will enable them to fix the position of the source of the signals. In this manner the position of aeroplanes lost in the clouds or ships in the fog may be found and their exact position communicated to them. There was a considerable development of this directive radiotelephony during the World War of 1914–8.[1] It has been found that there are peculiar difficulties in practising this direction finding at or about the times of sunrise and sunset.

In place of employing a movable frame aerial two fixed nearly closed circuit triangular aerials can be erected with their planes at right angles, and a resonant receiving circuit can be arranged to have a coil which is capable of rotation round a vertical axis but so as to be coupled inductively to both the fixed aerials by coils in the two aerial circuits. If electric waves fall on the aerials and if the movable coil of the receiving circuit is rotated into the azimuth in which it receives signals most loudly the direction of the plane of that coil will determine the line of direction of the transmitting station. It is possible by special arrangements to determine the direction along this line in which the electric waves are travelling. Many coast radio stations are now provided with direction finding aerials, and ships can call up these stations by wireless when in proximity, in case of fog, and have their bearings and exact position given to them. In another method of direction finding the coast station sends out a revolving beam of radiation which has a sharply marked point of zero radiation. The time of revolution of this beam is known, and also the instants when the zero radiation is in the true north and south direction at the sending station. Hence by observing the instants at which the zero radiation is observed at the ship, the ship's bearing with regard to the station can be determined. The station sends out time signals by which to correct the ship's chronometer.

Another ingenious application of radiotelegraphy has been made by Prof. J. Joly to enable ships to find their position in fogs and avoid collisions. For details the reader must be referred to his paper in the *Proceedings of the Royal Society* of London, vol. xcii., A, 1915–6, pp. 170, 176, 252, and also to a paper by H. C. Plumer on p. 377 in the same volume. See also J. Joly, *Proc. Roy. Soc.* Lond., vol. xciv, A, 1918, p. 547.

Wireless Telephony.—The above described improvements in the production and detection of continuous electric waves had by 1921, within a few years, placed wireless telephony on a thoroughly practical basis. It is unnecessary to describe various experimental feats which had been achieved at intervals in this art of radiotelephony, in which the Poulsen arc or some modification was employed to generate the continuous waves (C.W.). All practical radiotelephony now involves the use of the thermionic valve both as a generator of C.W. and as detector.

The general principles of this method are as follows:—one or more three-electrode valves are employed in which the plate and grid circuits are inductively coupled so as to generate continuous oscillations. The plate circuit is also coupled inductively to a radiating aerial wire and continuous waves sent off. The amplitude of these waves has then to be modulated in accordance with the wave form of a speech sound. This is done by means of another three-electrode valve called the control valve. The latter has the secondary circuit of an induction coil connected between its grid and filament, and in the primary circuit is a microphone transmitter and a voltaic cell or two. Hence if speech is made to the transmitter the potential of the grid is varied in accordance with the wave form of the speech. The plate current of this control valve is caused to act upon the plate current or grid potential of the oscillating valve so as to modulate the resulting high frequency oscillations also in accordance with the wave form of the speech made. At the receiving end the received oscillations are amplified by a series of valves and then rectified and passed through a Bell magneto-telephone. The speech sounds are then reproduced by the receiving telephone.

The advantage of this method is that only the ordinary standard telephone transmitter and receiver as used in telephony with wires are employed. To obtain the necessary high plate potentials in the oscillating valves we can either use voltaic batteries (dry cells) or else a small high tension direct current dynamo (1,000–2,000 volts), or else we can rectify a low frequency high tension alternating current by one or more Fleming valves. For aeroplane wireless telephony the plate voltage is supplied by a small dynamo driven by a wind screw which is set in action when the aeroplane flies. A large number of schemes for valve circuits for wireless telephone have been devised. During the war a great amount of ingenuity was expended in devising compact light weight sets of radiotelephone transmitters and receivers for use in aircraft and in the field (*see* figs. 9 and 9a). A problem of practical importance is that of two-way radiotelephony enabling two communicators to speak and hear simultaneously or to "cut in" or interrupt each other as can be done in ordinary telephony. If a single aerial wire has to be switched over from transmitter to receiver there is always risk of confusion owing to both operators trying to speak or listen at the same moment.

In the case of ground stations a practical solution is to use two wave lengths differing say by 5%. At each station there is a transmitter and a receiver say 100 yd. apart. One transmitter is tuned to the distant receiver but the wave length of the home receiver, which is tuned to the distant transmitter, differs by 5%. Each operator then speaks and listens on a different wave length and can "cut in" as he likes.

This method is, however, not applicable in the case of aeroplanes or ships for want of space. One suggested solution is that called the "quiescent aerial." The plate voltage of the oscillating valve is not supplied by a high voltage battery but at most by a few cells, and the remainder of the plate voltage is created by the rectification by the valve of the speech currents induced in the secondary circuit of the microphone transformer. In this case continuous waves are not thrown off from the aerial except in the act of speech to the microphone, and the receiver can then

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[1] See "Direction and Position Finding," by H. J. Round, *Journal Inst. Elec. Eng.* London 1920, vol. lviii, p. 224; also J. J. Bennett, *Nature*, May 19 1921, vol. cvii, p. 363.

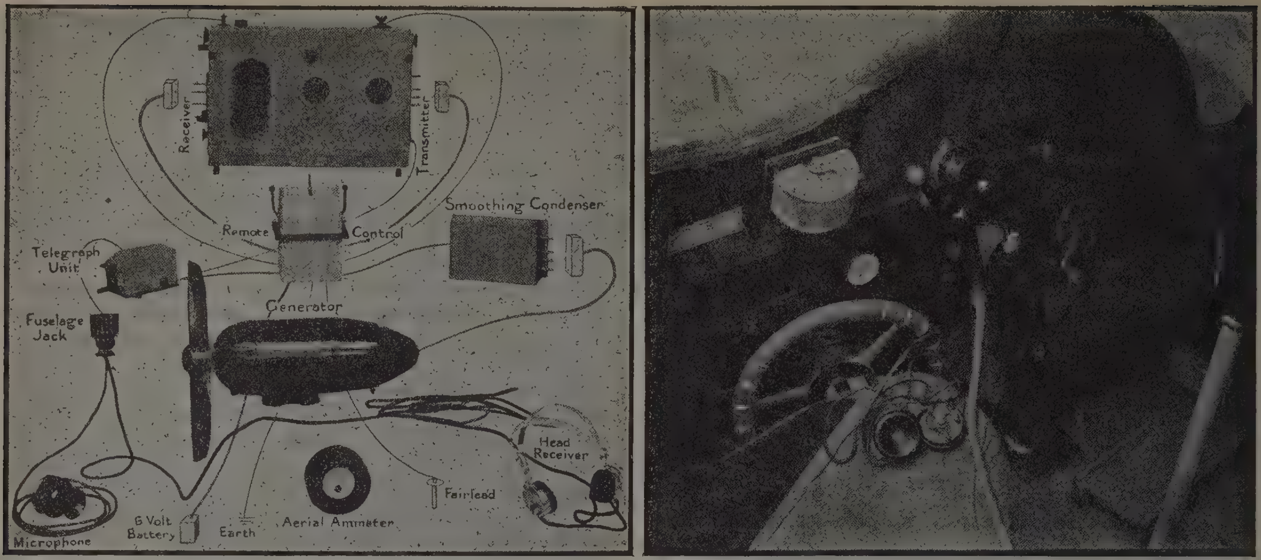

FIGS. 9 (left hand) and 9a (right hand).—The wireless equipment of an aeroplane for wireless telegraphy and telephony. The generator is fixed to the outside of the hull of the aeroplane and driven by a wind screw. Fig. 9a shows the general interior arrangement. (By permission of Marconi's Wireless Telegraph Co., Ltd.)

remain connected with the aerial. The arrangements will be understood from the diagram in fig. 9. The method is, however, not very successful and it cannot be said that two-way radiotelephony with a single aerial wire is a solved problem. On the other hand radio communication to and from aeroplanes up to 150 or 200 m. is now a thoroughly practical matter. The aerial is a wire about 230 ft. in length with a weight at the end which is unwound from a winch when the pilot wishes to communicate. The pilot generally wears a helmet with microphone transmitter opposite his mouth and two receivers over the ears. The transmission of speech from the aeroplane is more easy than reception owing to the great engine and propeller noises; nevertheless it is of immense use in connexion with air traffic as by it aircraft can be guided through the clouds to their destination, and the pilot informed of the conditions as regards fog or cloud at the landing station.

In May 1921 Marconi's Wireless Telegraph Co. carried out very successful demonstrations of practical radiotelephony on the two-wave system between Southwold in England and Zandvoort in Holland—a distance of 125 m. over the North Sea. The wave lengths used were 120 and 125 metres.

A very important use of the three-electrode valve is that of repeating speech currents from ordinary telephone wire circuits to wireless circuits and vice versa. Also this is perhaps the place to point out its extremely valuable qualities as a telephone repeater or relay for long wire circuits. Since the characteristic curve of the triode is nearly flat at the central part it follows that any irregular variations of grid potential are exactly copied by the corresponding variations of plate current. Hence if we connect the secondary terminals of a telephone transformer to the grid and filament of a valve and the primary terminals of another transformer to the plate and filament with plate battery inserted we shall have an arrangement called a *thermionic repeater*, which repeats and amplifies telephonic speech currents. If one or more such repeaters are inserted in a telephone line at intervals they will operate to neutralize the attenuation of the speech currents due to the resistance of the line and enable telephonic speech to be transmitted over larger distances without greater expenditure on the copper line conductor. Thus in the United States the long transcontinental telephone line from New York to San Francisco and Los Angeles has 13 such repeater stations in it, and speech is thus rendered possible over 4,000 m. of line.

In Oct. 1920 a remarkable feat was carried out in telephonic transmission by the aid of thermionic repeaters. A ship four hours out in the Atlantic spoke by wireless telephony to the mainland of the United States. The speech was then repeated into the transcontinental line from New York to Los Angeles and again repeated on to a radio circuit and delivered at Santa Catalina I. about 30 m. out in the Pacific. The speech transmission over this 4,000 m. was as perfect as over any exchange circuit in a large city. It is possible in this manner to speak to flying aeroplanes from the ordinary wire telephone of a town.

Long Distance Stations.—The above improvements in generation and detection of electric waves have not only made radiotelegraphy from ship to ship and ship to shore a certain and indispensable aid to navigation, but have enabled a multitude of long distance radio stations to be established which can maintain communication over distances of several thousand miles. It is now generally agreed that this possibility is due not to true diffraction of these long electric waves round the earth but to the fact that the higher levels of the earth's atmosphere are in a state of permanent ionization due to sunlight or extra-terrestrial causes. This creates a high level reflecting layer which guides the wave round the earth. There are, however, peculiar difficulties and effects at times of sunrise and sunset. In the United Kingdom the Marconi Co. have a large station at Carnarvon, Wales, near Snowdon, which is in correspondence with another at Marion, N.J., United States, for transatlantic working. The British receiving station is at Towyn, about 60 m. from Carnarvon, to enable reception and transmission to be carried out simultaneously. The direct effect of the Carnarvon radiation on the Towyn receiving aerial is neutralized by a balancing aerial (see British Patent Specification No. 13020 of 1911 of G. Marconi). The aerial at Carnarvon is a Marconi directional one, 3,600 ft. in length and 400 ft. vertical height supported on 10 tubular steel masts. The wave length of the radiation is 14,000 metres. The system of wave generation is the so-called timed-spark of Marconi. A direct current high voltage dynamo keeps two sets of condensers charged, and by means of a pair of rotating wheels with studs on their peripheries these condensers are discharged alternately through the primary coil of a transformer, the secondary coil of which is inserted between the aerial and the earth. These two sets of oscillatory discharges are made to follow each other in step and in close sequence by means of a trigger disk discharger which times two discharges so as to constitute in effect a continuous oscillation. The signalling is conducted by switches worked by compressed air which are operated through a relay by electric currents from Towyn. The same company have also a radio station at Clifden in Ireland which corresponds with another at Glace Bay, Nova Scotia. The Clifden station employs large thermionic valves as generators of continuous waves.

The Imperial Wireless Telegraph Committee which reported to Parliament in June 1920 recommended the thermionic valve generator for the imperial stations of the British Empire on the ground that the capital outlay would be less than for arc or alternator stations.

The high power radio stations in the United States comprise one at New Brunswick, N.J. which is equipped with Alexanderson alternators of 200 kilowatts capacity working on a wave length of 13,500 metres. The signals are made by means of a magnetic amplifier which is an independence coil, the impedance of which is varied by means of a small direct current which changes the permeability of the iron core (see *Proc. of the Institute of Radio Engineers*, United States, vol. iv, April 1916, p. 101; a magnetic amplifier for radiotelephony).

The Radio Corporation of America began to build in 1921 a very large wireless station on Long Island which was to have 12 directive aerials, each $1\frac{1}{4}$ m. long, arranged radially around the station. The waves were to be generated by high frequency alternators. The station would cover an area of nearly 10 sq.m. and be the most powerful in the world (see The *Engineering Supplement* of *The Times*, Aug. 1920). Another large U.S. radio station is that at Tuckerton, N.J., containing a Goldschmidt 200 kilowatts high frequency alternator. The radio frequency machine is driven by an electric motor supplied from two direct current generators in Ward Leonard connexion. This station was erected to correspond with one near Hanover, Germany. In France there are four very large radio stations; one at Croix d'Hins near Bordeaux, which was erected by the U.S. army during the war to maintain communications with Washington, contained originally 400–500 kilowatts Poulsen arc generators but is now partly converted to an alternator station. The aerial is carried on 8 lattice towers 800 ft. high (*see* fig. 10).

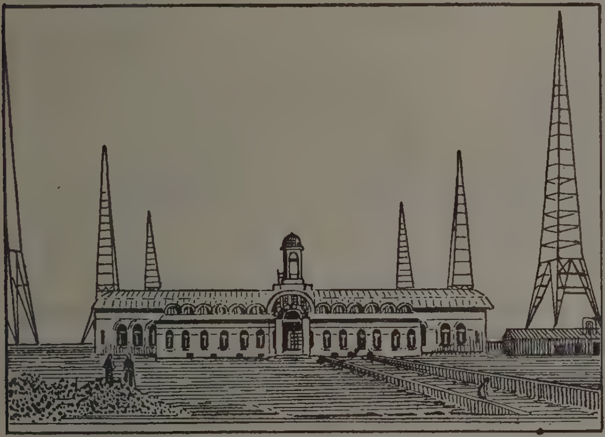

FIG. 10.—View of the large French radio station at Bordeaux erected by the American army during the World War for direct communication with the United States.

Another large French radio station at La Doua, near Lyons, with wave length of 12,000 metres is an arc station; a third exists at Nantes and a fourth is in Paris and employs the Eiffel tower to support its aerial wire.

The French Government began to erect in 1921 two large radio stations at St. Assise, near Paris, for European and world wide radiotelegraphy. These were to be equipped with Béthenod-Latour high frequency alternators and would have 1,500 kilowatts output.

In Germany there is a station at Nauen, near Berlin, which has a range of several thousand miles and wave length of 12,600 metres. This station like that at the Eiffel tower, Paris, sends out time signals at certain hours.

Broadly speaking, we may say that there were in 1921 about a dozen long distance radio stations in the world, which could signal to any part of the world by day or night, making use of wave lengths between 12,000 and 20,000 metres.

BIBLIOGRAPHY.—For the full discussion the reader must be referred to special treatises on radiotelegraphy as mentioned below. J. A. Fleming, *The Principles of Electric Wave Telegraphy and Telephony* (4th ed. 1919); R. Stanley, *Text Book on Wireless Telegraphy* (2nd ed. 2 vols. 1919); W. H. Eccles, *Continuous Wave Wireless Telegraphy* (1921); J. A. Fleming, *The Thermionic Valve in Radiotelegraphy and Telephony* (1918); W. H. Eccles, *Wireless Telegraphy and Telephony* (2nd ed. 1918); Bernard Leggett, *Wireless Telegraphy*, with special reference to the quenched-spark system (1921); J. A. Fleming, *The Scientific Problems of Electric Wave Telegraphy*, Cantor Lectures at the Royal Society of Arts (1919); also the following articles in the *Proceedings of the Institute of Radio Engineers*, United States, are authoritative and useful: vol. ii., 1914, 69, E. E. Mayer, "The Goldschmidt System of Radiotelegraphy"; vol. iii. 1915, 55, A. N. Goldsmith, "Radio Frequency Changers"; vol. iii., 1915, 215, E. H. Armstrong, "The Audion as Detector and Amplifier"; vol. iii., 1915, 261, I. Langmuir, "The Pure Electron Discharge"; vol. iv., 1916, 101, E. F. W. Alexanderson, "A Magnetic Amplifier for Radiotelephony"; vol. vii., 1919, 363, E. F. W. Alexanderson, "Simultaneous Sending and Receiving"; vol. viii., 1920, 3, 87, T. Johnson, "Naval Aircraft Radio"; vol. viii., 1920, 220, M. Latour, "Radio Frequency Alternators"; vol. viii., 1920, 263, E. F. W. Alexanderson, "Transoceanic Radio-communication"; vol. ix., 1921, 83, E. F. W. Alexanderson, "Central Stations for Radio-communication"; the following are references to useful papers on the theory of the thermionic valve: *The Physical Review*, vol. xii., 1918, p. 171, H. J. Van der Bijl, "Theory of the Thermionic Amplifier"; *Proc. Inst. Radio Engineers*, United States, vol. vii., 1919, 97, 603, H. J. Van der Bijl on the theory and operating characteristics of the thermionic amplifier; *Journal of the Institution of Electrical Engineers*, London, vol. lviii., 1920, p. 65, C. L. Fortescue, "The Design of Multiple Stage Amplifiers using Three-electrode thermionic valves"; *ibid.*, p. 670, B. S. Gossling, "Development of Thermionic Valves for Naval Use." For the discussion of the special difficulties introduced by the atmospheric electrical disturbances called "strays," which are vagrant electric waves produced by natural causes, the reader may be referred to a paper by Roy A. Weagant in the *Proc. Inst. Radio Engineers*, United States, 1919, vol. vii., 207, "Reception through Static and Interference." (J. A. F.)

WIRTH, KARL JOSEPH (1879–), German statesman, fourth chancellor of the post-war republican Reich, was born at Freiburg in Baden in 1879. The son of a working engineer, he was educated at the university of Freiburg. In 1908 he was appointed to the chair of Economics at the Technical College of that city; and after his election as a municipal councillor in 1911 he devoted himself to financial questions. In 1913 he obtained a seat as a member of the Catholic Centre party in the diet of Baden, and in 1918 was appointed Minister of Finance. In Jan. 1919 he was elected a member of the Constituent Assembly of the Reich which sat at Weimar. In March 1920, when the Ministry of the Reich was reconstructed after the Kapp *Putsch*, he received the portfolio of Finance, which he continued to hold in subsequent ministries. His task was to carry out the system of increased national taxation which one of his predecessors, Erzberger, had induced the Reichstag to adopt. When in May 1921 the Allied ultimatum on Reparation was presented to Germany and the "Sanctions" enforced on the Rhine, the Fehrenbach–Simons Ministry, which had rejected the London terms, resigned, and Dr. Wirth was called upon to form a new Cabinet. He succeeded in obtaining the coöperation of a number of able Democrats, Catholics and Socialists, including the prominent industrialist and economist, Dr. Walther Rathenau, as Minister of Reconstructions. Wirth himself retained the portfolio of Finance. The new Ministry then accepted the Allies' Reparation terms—132 milliard marks (£6,600,000,000) payable in yearly instalments of £100,000,000 plus the proceeds of a 25% duty on German exports. By Aug. 31 1921 Germany had paid the first half-yearly instalment of £50,000,000; and in the following Oct. Dr. Rathenau succeeded in concluding a comprehensive agreement with France for paying reparations in kind for the reconstruction of the devastated regions.

After the assassination of Erzberger on Aug. 26 1921 the conflict between the Government of the Reich and the reactionary Bavarian Ministry of von Kahr came to a head, von Kahr showing the same recalcitrancy against carrying out the special ordinances of the Reich against reactionary plots as he had previously exhibited in regard to the dissolution of the illegal volunteer force, the *Einwohnerwehr*. Dr. Wirth stood his ground, and ultimately von Kahr was compelled by his own party in Bavaria to resign and make way for a more conciliatory minister-president. The strife which arose out of this acute internal crisis had hardly abated when the announcement in mid-Oct. of the decision of the League of Nations on the partition of Upper Silesia between Germany and Poland aroused wild excitement throughout Germany, and, among other consequences, sent the exchange value of the mark down (Oct. 17) to 750 to the £. Dr. Wirth had not concealed his conviction that the severance from Germany of the rich industrial district of Upper Silesia would fatally affect Germany's capacity to pay further reparation instalments, and the political tension in Berlin again became acute. Eventually Dr. Wirth resigned, but nobody was found able to form a ministry in his place and he resumed office.

WISCONSIN (*see* 28.740).—In 1920 the pop. was 2,632,067, as compared with 2,333,860, in 1910, an increase of 298,207, or 12·8%, the state holding its rank of thirteenth. The density of pop. in 1920 was 47·6 per sq. m.; in 1910 it was 42·2. The proportion of urban pop. increased from 43% in 1910 to 47·3% in 1920. The following table shows the growth of pop. of those cities having 25,000 inhabitants:—

	1920	1910	Percentage increase
Milwaukee . . .	457,147	373,857	22·3
Racine	58,593	38,002	54·2
Kenosha . . .	40,472	21,371	89·4
Superior . . .	39,671	40,384	−1·8
Madison . . .	38,378	25,531	50·3
Oshkosh . . .	33,162	33,062	0·3
Green Bay . . .	31,017	25,236	22·9
Sheboygan . . .	30,955	26,398	17·3
La Crosse . . .	30,421	30,417	—

Agriculture.—The cultivated acreage was in 1919 8,979,000; in 1909 7,980,000. The number of farms in 1920 was 189,295; in 1900 169,795. These increases were due mostly to frontier advance. In the older part of the state, farms tended to become larger and fewer. Of the farms 84·3% were in 1920 in the hands of their owners. These farms produced in 1909 crops worth $138,000,000 and live-stock products worth $260,922,000; in 1919 $445,000,000 and $371,791,000, respectively. The food product per acre increased since 1885 37% as contrasted with 21% for the United States as a whole. The statistics of special crops year by year are meaningless if taken individually, as there is great yearly fluctuation owing largely to the confidence felt by the farmers in the market forecasts furnished in the *Bulletins* of the University of Wisconsin. For instance, in 1917 the university had advised increased tobacco acreage. When war was declared wheat was advised instead, and an unusual amount planted. This wheat acreage was later returned to other crops. There were in 1920 more silos than in any other state, Wisconsin seed had acquired a reputation and a market, and canning factories, creameries, etc., situated near the point of production, fitted raw products for the market. Relatively the leading feature was dairying, in which Wisconsin stood first among the states. The increase in dairy cows from 1,474,000 in 1910 to 2,180,000 in 1920 was attended by great improvement in quality.

Manufactures.—The total value of manufactured products ($695,172,002 in 1914) was not much below that of farm products, but the value added by manufacture was only $277,756,928. The number of establishments rose from 8,558 in 1904 to 9,104 in 1914. Between the same years the number of workers rose from 173,572 to 230,272. The Lake Michigan region showed the greatest growth, owing to the greater cheapness of coal, which is all brought into the state. The great increase in the use of water-power was chiefly for lighting and transportation. In certain industries closely related to agriculture there was a tendency toward decentralization. The manufacture of farm products took first place, although flour decreased, and beet-sugar remained stationary. This position was due chiefly to the expansion of the dairy interests, butter, cheese, condensed and malted milk, etc. In 1880 the lumber cut was 1,542,021,000 ft., mostly white pine; in 1918 1,275,000,000 ft., largely hard wood. The value of lumber products in 1914 was $55,363,000; 473,840 tons of wood pulp for paper, worth $22,049,498, was produced. In 1914 Wisconsin ranked fifth among the states in the value of furniture produced, its value being $22,586,531. Leather remained in 1914 the fourth industry in the state, with a product of $55,362,511. Foundry and machine-shop products were in 1914 $60,698,000, a 12·1% increase over 1909.

Mines and Quarries.—The output of iron ore grew steadily, reaching 1,167,640 tons in 1918. The production of pig-iron increased rapidly, being in 1900 184,794 tons, and in 1919 605,619 tons.

Forests.—The forests still constituted in 1920 one of the great resources of the state, but of decreasing importance both absolute and relative. Measures for fire protection were increasingly effective. Surveys were in progress to determine what of the cut-over region should be reforested and what turned to farm land. The earliest Wisconsin industry, the fur trade, still produced, in 1918, a value of $669,005.20.

Fisheries.—The development of the fisheries was constant. New hatcheries were established at Spooner for pike, at Sturgeon Bay for white fish, and at Sheboygan for blue fin. In 1918 247,079,876 eggs were distributed. The commercial fishing was mostly in the Great Lakes where the catch in 1918 was valued at $792,040. This was less important than the sport fishing under licence in the rivers and streams.

Transportation and Commerce.—The railway mileage in 1917 was 7,667. It varied from year to year owing to the laying and taking up of logging lines. The main system had been complete for years, the state standing fourteenth in the proportion of mileage to area. About 1900 there began a movement for interurban electric lines, and a system was developed extending from the southern boundary to Janesville and to Milwaukee, and up the Fox river valley. In 1919 the mileage of all electric roads, urban and interurban, was 760. There was no recent extension of the interurban system, and suburban extension was less after 1910 than before, owing to the increased use of automobiles. In 1920 there were 277,093 automobiles, and 16,205 motor-trucks in the state. This development of automobile traffic occasioned a demand for better roads, and extensive plans were in process of completion. In the years 1912–8 $23,086,152 was voted for highway construction by local, county and state authorities. Concrete roads proved successful where the foundation was placed below the frost line.

Government.—A constitutional amendment in 1910 granted the state power to acquire and develop water powers and forests; one in 1912 regulated the borrowing capacity of cities and incorporated villages; another in 1912 gave the state powers for creating a park system; and one in 1920 for the enforcement of the prohibition amendment to the U.S. Constitution. In 1911 the salaries of justices of the Supreme Court were increased to $7,500. A law of 1915 allowed voting by absentee electors under certain circumstances, and one of 1918 arranged for voting by enlisted soldiers. The following state boards and commissions were created in or after 1905: Accountancy (1913), Compensation Insurance (1917), Conservation (1915), Engineering Department (1915), Grain and Warehouse (1905), Health (reconstituted 1913), Highways (1911), Industrial (1911), besides boards of examination for licences for architects, boxers, barbers, plumbers, etc., and *ex-officio* boards.

Miscellaneous Laws.—The cigarette prohibition law was repealed (1915), and the laws directed against out-of-the-state insurance companies were modified. A workmen's compensation law was passed in 1911. A law of 1917 provided for the sterilization of defectives and laws of 1913, 1915, 1917 provided for an antenuptial physical examination for men.

Finance.—In 1918 there was raised for general state purposes $14,281,216, the largest item of income being $5,370,305 from the railway companies; of the total, $5,986,661 was returned to the counties in aid of schools, tuberculosis sanatoriums, highways, etc. The tax levy of 1918 produced $12,142,121 for the use of counties, $22,580,567 for cities, towns and villages, and $16,444,671 were school and school district rates. The state income taxes of 1916, paid in 1917, amounted to $9,482,595, of which $603,762 went to the state and the rest to localities in lieu of the general property tax.

Education.—In 1915 a State Board of Education was provided to correlate the educational undertakings of the state. The most important new departure was with reference to vocational education, for which a Board was provided in 1915. A law of 1917 increased the effectiveness of compulsory education for those between 9 and 14; in 1915 aid in transportation was provided for those attending school at a distance from home; 32 cities in 1920 maintained continuation schools. In 1920 the total educational expense by the state and localities was $25,901,282; $2,779,072 for the university, $1,427,959 for normal schools, $10,024,095 for city schools, and $11,361,692 for town and country schools, toward which a great effort at improvement was being made.

History.—Gov. McGovern, elected in 1911, continued the progressive policy inaugurated by Gov. La Follette. The activities of the state Government were increased, their administration being given to commissions composed in part at least of recognized experts, and similar commissions were given power of supervision and control over private activities. The extension of this policy led to a reaction in 1914 and Emanuel Phillip was elected governor on a somewhat reactionary programme. The break, however, proved to be less violent than many expected, and the main features of the legislation of the preceding 10 years were continued. The outbreak of the World War divided sentiment in the state perhaps more than elsewhere in the country. In the 'fifties some German leaders had hoped to make the state essentially German and a centre in America for the development of German culture, as New England was for English Puritanism, but turned to liberalism. This project had failed, but a large element in the state was German-born or of German parentage, and many communities retained German habits and language, and educated their children in Catholic or Lutheran schools conducted in German. While this element was by no means solid in sentiment, the majority sympathized with Germany as opposed to Great Britain and her Allies. When the question arose of the entrance of the United States into the war, this element was opposed to it, and was reënforced by a powerful sentiment in favour of peace. The national representation of the state was divided. Senator La Follette voiced the peace sentiments, and was one of those characterized by President Wilson as "a little group of wilful men." Senator Husting, a Democrat, supported the Wilson administration. The death of Senator Husting necessitated a senatorial election in the spring of 1918, which attracted wide attention as a test of public opinion in the state which was thought least likely to support the war. An active campaign of education was conducted, by means of pamphlets, speeches and organization. The result was the choice in the Republican primaries of Irvine L. Lenroot, who was pledged to support the Administration in its war policy, and who defeated the Democratic candidate in the election which followed. Later Senator Lenroot broke with President Wilson on his peace policy, taking a stand for moderate reservations in the plan for a League of Nations. This stand was endorsed by his reëlection for the regular senatorial term in 1920, when the state gave a large majority also to Harding. In the gubernatorial election of that year, the successful candidate, Mr. Blaine, represented in general the La Follette views, maintaining that the stand taken by that senator was not disloyal, but legitimate opposition. Although many regretted the necessity of fighting Germany, the number who failed to support the United States was negligible.

Gov. Phillip proved an efficient war administrator, working in harmony with the national officials and organizing extremely effective state and local machinery to handle the problems that constantly arose. The state met and exceeded every demand made upon it, for men and for money; the draft was put into operation with success; the administrative effectiveness which had been developed in the preceding 10 years was everywhere in evidence. Wisconsin troops repeated the record they had made in the Civil War. A war history commission planned to put the war record in substantial shape for the future. The Wisconsin National Guard served on the Mexican frontier, 1916–7, and was called into national service for the World War in 1917; its aggregate strength, Aug. 4 1917 was 15,266. The losses of troops from Wisconsin in France were given as 5,735; 71,790 were accepted at camp under the draft laws. To the five Liberty loans $471,194,250 was subscribed. The United War Work Campaign of 1918 produced $4,546,706. Besides this a million had been raised for the Y.M.C.A., nine millions and a quarter for the Red Cross; 8,503 French orphans were adopted, and generous contributions made to all causes of war aid and relief.

The governors of Wisconsin after 1911 were: F. C. McGovern, Republican, 1911–5; Emanuel Phillip, Republican, 1915–21; John J. Blaine, Republican, 1921– .

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WISE, BERNHARD RINGROSE (1858–1916), Australian lawyer, was born at Sydney Feb. 10 1858, the second son of Edward Wise, Judge of the Supreme Court of N.S.W. He was educated in England at Rugby and Queen's College, Oxford, where he won the Cobden prize and was *proxime* for the Lothian Historial Essay, finally graduating 1st-class in law. He was also a prominent athlete, and represented Oxford in the mile race against Cambridge. He was called to the bar at the Middle Temple (1883), then returned to Australia, was elected to the N.S.W. legislature and became Attorney-General of N.S.W. 1887–8, and Q.C. in 1898, being again Attorney-General from 1899 to 1904 and, in addition, Minister of Justice 1901–4. For part of 1903–4 he was Acting-Premier of N.S.W. He did distinguished service to the cause of Federation but was defeated in the elections for the first Commonwealth Parliament, and his abilities therefore were never called upon for Federal service. From 1915 until his death, Sept. 19 1916, he was acting as Agent-General for N.S.W. in London.

WISTER, OWEN (1860–), American writer, was born in Philadelphia July 14 1860. He was a grandson of Frances Anne Kemble (*see* 15.724). On graduating from Harvard in 1882 he intended to devote himself to music. He went abroad for study; but ill-health forced him to return to America, and he spent several years in Arizona and New Mexico. He then entered the Harvard law school, graduating in 1888, was admitted to the bar in 1889 and for two years practised law in Philadelphia. Thereafter he gave his time to literary work. As an undergraduate he had contributed a poem, *Beethoven*, to the *Atlantic Monthly* in 1882. His subsequent publications include the *Modern Swiss Family Robinson* (1883); *The Dragon of Wantley: His Tail* (1892); *Lin McLean* (1898); *The Virginian: a Horseman of the Plains* (1902); *Philosophy 4: a Story of Harvard University* (1903); *Lady Baltimore* (1906); *The Seven Ages of Washington: a Biography* (1907); *Members of the Family* (1911); *The Pentecost of Calamity* (1915, a condemnation of Germany for the World War), and *A Straight Deal: or the Ancient Grudge* (1920). His novels, *The Virginian* and *Lady Baltimore* in particular, established his position as one of the foremost of contemporary American writers. He became a member of the National Institute of Arts and Letters and of the Société des Gens de Lettres de France, and in 1912 was elected a member of the Board of Overseers of Harvard.

WITTE, SERGE JULIEVICH, COUNT (1849–1915), Russian statesman (*see* 28.762), died in Petrograd March 12 1915. His diaries were posthumously published by the Soviet in Pravda in 1918, and a study of his career as Minister of Finance during 1892–1903, by D. A. Lutokhin, appeared in 1915. The *Memoirs of Count Witte*, translated from the original Russian MS. and edited by Abraham Garmolinsky, were also published in New York and in London in 1921.

WOËVRE, BATTLES IN THE, 1914-8.—The military importance of the great plain which separates the Metz ridges from the line of heights along the Meuse was evident as soon as the frontier of 1871 was drawn. On its N. side, a strip of bold undulating country, the axis of which may be taken as Montmédy–Thionville, skirts the Belgian and Luxemburg border, while at the S. it narrows, as the Meuse and Moselle converge toward Toul, to a blunted end facing the Haye Plateau and Toul. Along the Meuse (Verdun–Toul) and along the Moselle (Thionville–Metz) both sides gradually crowned the heights with permanent fortifications. The plain itself, through which the frontier ran along no very well defined line, was not fortified, each side treating it as a sort of foreground or glacis. Generally speaking, this frontier line left the plain to France, but the French ground immediately adjacent to the frontier was practically under the fire of the Metz guns. Hence the war outpost line, which was to protect the concentration of the French main armies, was drawn well back—almost to the verge of the Meuse heights—and no attempt was made to hold the frontier region itself.

This proved, in the sequel, to be of enormous importance. For, from about the end of the 19th century, vast mineral resources had been discovered in the Briey basin or Eastern Woëvre; this lay on both sides of the frontier, and was at the outbreak of war being developed by a Franco-German syndicate. From the military point of view—a short, purely military war being in prospect—no great importance was attached by the French to the evacuation of an untenable stretch of country, but when the war became a prolonged, and largely an economic, struggle, the German occupation and exploitation of the Briey area became a most important asset to the Central Powers.

Nevertheless, after the battle of the Marne and its concomitant fighting on the Meuse died away in Sept 1914, no major offensive took place in this area until the American attack of Sept. 1918. The reasons for this quiescence on the French side were not allowed to appear during the war, and are still rather obscure.

In the following article are described (1) the bitter trench-warfare fighting which—without ever becoming a major offensive—went on continually in 1914–5, around the salient of St. Mihiel—the base of which was the Woëvre plain—and (2) the American operations, which, carried out on a large scale and without reserve, reduced the salient in two days in 1918. (C. F. A.)

(I.) HAUTS DE MEUSE AND WOËVRE, 1914–6

On Sept. 19 1914 the right wing of the French III. Army was carrying out an offensive advance from the Hauts de Meuse in the direction of Mars-la-Tour when the VIII. Corps encountered at Woël an advanced guard of the German army which was being led toward the Hauts de Meuse by Gen. von Strautz. Before the engagement at Woël had assumed any great importance it was suspended by the arrival of an order from Gen. Joffre to the effect that the VIII. Corps was to proceed immediately to Ste. Menehould, where it was to remain in general reserve. Consequently the Germans found themselves confronted only by reserve troops, not yet inured to war, and dispersed over a wide front, when they launched their attacks against the Meuse heights on the 20th and following days.

At Vigneulles Gen. Grand d'Esnon of the 75th Res. Div. was killed and the enemy surmounted the Hauts de Meuse. Before long the German heavy artillery was bombarding the forts of Lionville and Géronville toward the S. and Camp des Romains in front. On Sept. 24 St. Mihiel was in the hands of the Germans, who tried to gain ground W. of the Meuse but could not get beyond Chauvoncourt. In the N. von Strautz's army was held by Gen. Pol Durand's group of reserve divisions which had come to the assistance of the VI. Corps. Toward the S. it was attacked by the XVI. Army Corps at St. Baussant and by the VII. Cav. Div.

The region of Léronville–Marbotte was without defenders, but the Germans did not advance in the direction of Commercy, as their aim was to encircle Verdun. To this end the German Crown Prince attacked to the S. of Varennes and in Argonne simultaneously and the French III. Army thus found itself threatened both to the N. W. and to the S. of Verdun.

The 15th Div. of the VIII. Corps was brought back to Chaumont-sur-Aire to the III. Army Reserve, ready to hasten either to the aid of the V. Corps in the Argonne or toward Chauvoncourt to help the 75th Res. Div.

The 16th Div. was transported by train from St. Menchould to Léronville–Sampigny and placed under the orders of the I. Army headquarters, for the purpose of covering Commercy, and was reinforced on Sept. 28 by the Belfort Brigade. From this moment von Strautz's army, which was composed of Bavarians, had its III. Army Corps bottled up at St. Mihiel and so the "Hernia," called also the "Wedge," came into being. From Les Eparges to the Meuse S. of St. Mihiel, the III. Army put in line the VI. Corps and part of Gen. Pol Durand's group. The Bislée peninsula and the front Koeur-la-Grande–Brasseitte–St. Agnant were held by the VIII. Corps with the 16th Inf. Div. and the Belfort Bde. To the E., in the region of the Bouconville ponds in Woëvre, was the 7th Cav. Div. Still farther eastward the XVI. Corps was attacking fiercely at St. Baussant, urged on by the determined commander of the I. Army.

The zone S. of the St. Mihiel wedge and Woëvre and N. of Toul was assigned to the I. Army. The point of liaison between the I. and III. Armies was on the Meuse below Bislée. Before long the III. Army was put under the command of the I. Army and it was therefore Gen. Dubail who was matched against Gen. von Strautz.

At first the Germans tried to debouch from Chauvoncourt, but without success. Elsewhere, both in the S. and the N., they made every effort to enlarge the wedge while the French attacks were directed toward diminishing it. Hence there resulted partial engagements at Chauvoncourt, in front of Les Paroches, at Les Eparges near the Hauts de Meuse, in the Bois d'Ailly, in the Bois Brulé, near Apremont, and at St. Baussant.

For the beginning of April 1915, Gen. Dubail ordered an attack on a large scale from the N. and the S. to be delivered by several army corps. A force designated the army detachment Gérard, including the I. and II. Army Corps, the Verdun Provisional Div., and the I. Cav. Corps, opened the attack on April 5 and took possession of Fromezey, Gussaniville and l'Hôpital farm (in the region of Étain), but broke down before the intact German wire—for in the marshy ground the artillery projectiles buried themselves deeply.

In conjunction with the attack by Gérard's force an attack was launched by the XII. Corps and VIII. Corps which, however, had no particular results. The fighting lasted from the 5th to the 22nd without achieving anything but the exhaustion of both attackers and defenders.

From that time forward the struggle resolved itself into a series of partial combats. The names Les Eparges, the Tranchée de Calonne, Chauvoncourt, Bois d'Ailly, Bois Brulé, Seicheprey, Bois le Prêtre recur day by day in the *communiqués* of 1915.

On May 5 1915 the VIII. Corps lost in one morning all the ground which it had taken several months to gain in the Ailly wood. There was even a moment when a gap in the line seemed to be broken through and the way opened to Commercy; but the counter-attacks came in time to regain part of the Bois d'Ailly, and restore the situation. In the course of one of these counter-attacks in the woods, a company of the 172nd, led by Commandant d'André, crossed five lines of German trenches in succession and came within sight of St. Mihiel. But here they were confronted by German reserves and surrounded. For three days these heroes resisted all attacks, having nothing but their rifles and the German grenades picked up in the fifth line of trenches. They finally succumbed to hunger and thirst. Justly indeed was this trench named "the thirst trench." When Gen. von Strautz saw Commandant d'André on the day after the fighting was over, he said, "*Vous avez été deux fois blessé, vous étiez au Bois d'Ailly, vous êtes un brave.*"

At Bois le Prêtre, near the Moselle, the fighting was incessant and for the most part to the advantage of the French.

At Les Eparges it was mine warfare. In this the Germans had generally the upper hand, but, as at the Bois d'Ailly and the Bois le Prêtre, the upper hand did not imply the gain of ground desired. In mine warfare the Germans had a very considerable advantage over their opponents in the matter of equipment and especially of boring tools. At the outset the galleries they made in the Crete des Eparges and the colossal dimensions of their mine chambers astonished even the men of the II. Corps, recruited though many of them were from the mining country of the Nord. But, though astonished, they were not dismayed, and feeble as their implements were, they often took their revenge for the mine attacks to which they were subjected.

The characteristic of the army of 1915 was the poverty of its material in comparison to that at the disposal of the enemy. In it was learned the lesson that a nation poor in coal and iron must shed much blood to save itself from slavery.

When in Sept. 1915 the Champagne offensive was launched, quiet set in on the front Les Eparges–Chauvoncourt–Bois d'Ailly–Bois le Prêtre. On both sides, the forces on this front were milked to obtain quality and quantity on the field of the great battle. When it died down, the battered formations came back to rest and recruit—and also to fight, for activity began again in Nov. and Dec. 1915.

In Feb. 1916 the storm burst at Verdun, and in July the other storm on the Somme. Then the front with which we are concerned became so calm that the commander of the VIII. Corps called the Wedge of St. Mihiel a convalescent home.

Here and there, now and then there was a *coup de main*, but the only result was to show both sides the necessity of not relaxing vigilance. The year 1917 came and went without changing either the positions or the attitude of the two parties. The great British offensive of Arras, the great French offensive on the Aisne, the Franco-British battles of Ypres absorbed all the offensive power of the adversaries on the western front. Not till 1918 did the sector Les Eparges–Chauvoncourt–Bois d'Ailly–Bois le Prêtre become again the scene of victory.

In concluding this survey of operations on the front between Les Eparges and the Moselle, it is necessary to underline again the poverty of material and munitions under which the French army laboured. Not only did it possess little heavy artillery, but even the 75's, excellent for barrages, diminished daily and were replaced by B.L. guns of 90 and 95 mm., obsolete since 1900. Track for light railways could not be had. Boring tools were so short that mine warfare in the Forest of Apremont had to be waged with pick, chisel and crowbar. Ammunition was served out by spoonfuls, and at one moment the commander of the eastern group of armies had only 350 rounds per gun for his 75's—half an hour's battle allowance.

These conditions were, of course, not peculiar to the front under consideration, and are introduced here to enable the reader to see how the Higher Command was obliged to apply the great Napoleonic principle of economy of force; to show how it was possible for the Crown Prince to break in the Verdun front or, for that matter, the whole front from the Meuse to Switzerland, for the defenders were few, their guns few, and their shell very few.

WOEVRE, BATTLES IN (BATTLE OF ST. MIHIEL)

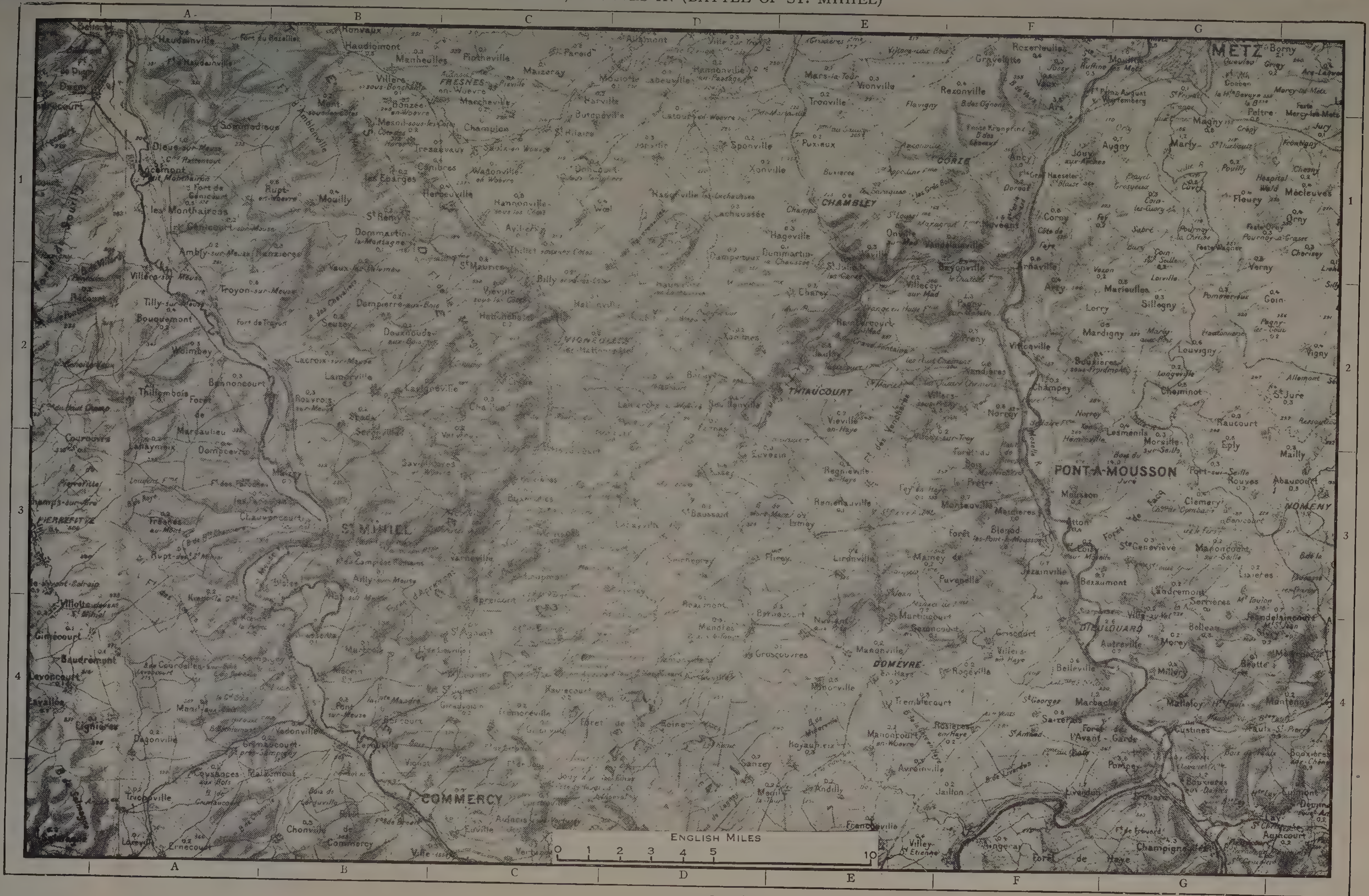
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But it may be seen, too, how a German success was bound always to remain without a sequel, for it was through this conception of the economy of forces that Joffre was able always to keep in hand strong, rested reserves, free guns and unallotted ammunition. (V. L. E. C.)

(II.) Battle of St. Mihiel (Sept. 12 to 14 1918)

For four years the St. Mihiel salient had projected 28 km. deep into the French line, constituting alike a menace and an invitation to attack. Its original purpose, to serve as one of the jaws of a nutcracker attack on Verdun, having failed, it was used in 1916 as the anvil against which von Falkenhayn sought in vain to drive home his hammer-blows against Verdun from the north. In 1918 Ludendorff again hoped through its possession to gain Verdun and much more by the wider encircling attack in Champagne of July 15, but again the attack failed. During all these years also it had remained not only a threat of further German aggression but a serious interruption of French railway communication with Verdun and also with the Lorraine front. In 1915 the French army had twice attacked to compel evacuation of the salient but both attacks had failed, the first, made in April at Les Eparges, with serious losses.

Tactically, the salient afforded a strong defensive position. The Côte de Meuse, a range of hills rising abruptly 500 metres above the Meuse valley on the W. and the Woëvre plain on the E., afforded strong supporting points on the western face of the salient, while Mont Sec and the lower-lying hills S. of the Rupt de Mad were well adapted to a strong defensive organization.

To the general staff of the American Expeditionary Forces the reduction of the St. Mihiel salient had appealed strongly as a favourable initial or try-out operation for the American army as soon as sufficient forces should have arrived to undertake it. The reason for this selection was not so much the material gain to be reaped from it as the consideration that the fresh and eventually preponderant American force should preferably be employed against a part of the line where it could strike a vital blow to the Germans. Metz, the centre of important railway communications and surrounded by coal and iron fields, obviously presented itself as such a region, and, in addition, while the American forces were being gathered for the later major operations, the same installations and lines of communication needed for them could be utilized by the earlier arriving troops to gain an initial success on a smaller scale, mainly for moral effect though also as a factor in troop training.

General Pershing had discussed this view with General Pétain in June 1917, and, after further study of the front, port facilities and railway lines, this had been adopted as the working plan. However, the slowness of the transportation of troops to France during the first year of American participation in the war, and the exigencies caused by the success of the German offensive operations in the spring of 1918, caused the plan to be temporarily laid aside, and, during both spring and summer of that year, American troops in France and arriving were scattered along the western front to meet needs of the moment.

By the end of July the situation had stabilized sufficiently in favour of the Allies to enable the question of reuniting the troops of the American army to be taken up. On July 24 Marshal Foch confirmed the understanding arrived at the previous year, that the first American operation should be the reduction of the St. Mihiel salient, and, a few weeks later, he authorized the transfer to the I. American Army of that sector of the Allied front facing the salient. This transfer occurred on Aug. 30.

By this time the American army consisted of forces far beyond the number requisite for the mere reduction of the salient and the question of their subsequent employment arose. General Pershing desired to exploit the St. Mihiel attack to the utmost; Foch, however, with other plans and considerations in mind (*see* Meuse–Argonne, Battle of), limited the attack strictly to the forcing of the salient, although Pétain, in a conference on Sept. 2, sided with Pershing in desiring the American army to gain at least the German "Michael" position across the mouth of the salient.

By Marshal Foch's direction, Pétain, on Sept. 2, issued the directive for the operation which called for a main attack on the S., to debouch from the plateau Seicheprey-Limey toward the objective Vigneulles–Thiaucourt, and a secondary attack, to debouch from the vicinity Eparges–Mouilly toward the S.E., and in connexion with the main attack, to effect the cutting off of the German forces in the salient. To the main attack there were assigned eight American divisions; to the secondary, one American and one French; the French troops occupying the intermediate sector were to exercise "pressure" against the enemy forces on their front. The wording and the date of this directive and the disproportionate number of American divisions assigned to the main attack, which alone could hope speedily to reach the *Michel Stellung*, suggest that it was originally drafted to carry out Pétain's conception of at least a partial exploitation of the attack, to include the seizure of the *Michel* position, and that, in a subsequent alteration to conform to Foch's insistence on a more limited scope, only the names of the objectives were changed.

General Pershing's order for the attack assigned the main attack to the I. and IV. Corps with two regular divisions to each corps; the secondary attack, on the Côte de Meuse, to the V. Corps, the attacking troops to consist of one American National Guard Div. and one French division; the French II. Colonial Corps in the centre was to guard the adjacent flanks of the main and secondary attacks, to execute deep raids and to be prepared to follow up a withdrawal. At the disposal of the American I. Army for the operation were 2,971 guns, mostly French artillery. The I. Army also had a marked superiority in aviation, thanks to French coöperation and the assistance of the British Independent Air Force.

On the German side the salient was held by Army Detachment C, under Gen. von Fuchs and comprising, on Sept. 12, the date of the attack, eight divisions on the line, organized as three corps groups, and three in reserve.

As early as Sept. 1 a deserter had given the Germans warning of the impending attack, and Ludendorff had at the time seriously considered ordering a withdrawal from the salient, but was deterred by the representations of the army detachment and army group commanders who were confident of their ability to hold, and also by reports from Duke Albrecht's army group in the Vosges region, of American preparations for attack farther south. These feints which General Pershing had caused to be made in the vicinity of Belfort had led to German uncertainty as to the real intentions of the American commander. By Sept. 8, however, the evidences of a coming attack on the salient had become unmistakable and Army Detachment C was ordered to withdraw to the *Michel Stellung*. No need for haste was felt and the preparations were deliberate and methodical. The night preceding the attack the dismounted batteries were being withdrawn and consequently could not be used in the battle.

Preceded by a four-hour bombardment the main attack was launched at 5 A.M., Sept. 12; the secondary attack at 8:30. Deprived of artillery support the German infantry though ordered to hold, made virtually no resistance. The American I. Corps on the right made its objectives in a few hours, and, in spite of German counter-attacks brought by two divisions against it and against the right of the IV. Corps but beaten off, begged permission to continue its advance; but, because of the precise instructions by which the American staff felt itself bound, this permission was refused. The IV. and V. Corps also made their objectives and halted, awaiting orders.

Army H.Q. in this battle, as also in the earlier part of the Meuse–Argonne battle, appears to have had little conception of the difficulty and time required in the transmission of orders on the battlefield and in consequence to have left but little initiative in the hands of subordinates. The result was that the orders for the troops of the IV. and V. Corps to move forward to Vigneulles and effect the cutting off of the salient did not reach the troops concerned until after dark on the 12th so that the connexion, though unopposed, was not effected until the morning of the 13th. Meanwhile the German commander, realizing his hopeless situation, had ordered the evacuation of the tip of the salient, which had not been attacked, and during the night the movement was successfully carried out except for the loss of about 1,000 stragglers.

In the course of Sept. 13 and 14 the troops of the American IV. and V., and French II. Colonial Corps moved forward without serious opposition to the line designated by Marshal Foch facing the German *Michel* position and which the I. Corps had already reached on the 12th.

On the German side the attack showed a complete demoralization in the Higher Command and a lack of initiative in the lower officers. The men showed little will to fight. The advance of the left division of the IV. Corps with one flank uncovered and of the American division of the V. Corps with both flanks uncovered was nowhere taken advantage of.

In regard to the halting of the American offensive the German general staff, in a study of the St. Mihiel attack published for the information of the armies shortly after its occurrence, while giving high praise to the dash and fearlessness of the American soldier, added that the army H.Q., which showed itself so unable to reap the advantages so clearly afforded by its striking initial success, was not to be feared. It is not impossible that Foch, had he himself been in immediate command of the I. Army on the morning of the 12th, or had he been present, might, in view of the manifest military advantages, have felt justified in permitting the Americans to grasp the opportunity offered to complete the destruction of Army Detachment C and to seize and hold the *Michel Stellung*. Indeed Pétain, on the night of the 13th, learning that the German army behind the sector was in great disorder and that the American troops on the right had reached and in some instances gone beyond their objectives, did send an authorization to take the *Michel* position; but by the time this permission was received the opportunity of taking the position cheaply and completing the German rout had passed. Tactically, Foch's avowed purpose would have been better served had Pétain, as long as he was going to prescribe dispositions in detail for the American army, originally called for two main attacks from the two faces of the salient to meet in the centre the first day, advances which the Soissons attack had already shown could be easily made by American regular troops.

Of the troops engaged on the Allied side the Americans aggregated 550,000, the French 110,000. American losses were 7,511, of which considerably more than half were borne by the I. Corps which received the brunt of the counter-attack; French losses were 597. The captures included over 15,000 prisoners and 443 guns. (A. L. C.)

WOLFE-BARRY, SIR JOHN WOLFE (1836–1918), English engineer, was born in London Dec. 7 1836, the youngest son of Sir Charles Barry (*see* 3.443), architect of the Houses of Parliament. He was educated at Trinity College, Glenalmond, and King's College, London, and became a pupil of Sir John Hawkshaw, whom he assisted in the building of Charing Cross and Cannon St. stations and railway bridges. In 1867 he set up for himself, becoming well-known as a railway engineer and traffic expert. Through his initiative and energy the British Engineering Standards Committee was established in 1901, a great step forward in effecting railroad economy. He was made a K.C.B. in 1897. He died in London Jan. 22 1918.

WOLSELEY, GARNET JOSEPH WOLSELEY, VISCT. (1833–1913), British field-marshal (*see* 28.777). The closing years of Lord Wolseley's life were spent in virtual retirement. His health gradually failed, and on March 25 1913 he died at Mentone, the title going by special remainder to his only daughter, Frances. His eminent service to the State had not been forgotten, for he was accorded an imposing public funeral and was buried at St. Paul's; an equestrian statue of him on the Horse Guards Parade was unveiled in 1920. It had not been Lord Wolseley's good fortune to hold responsible positions in the conduct of warfare on a great scale, but he was undoubtedly a brilliant commander in the field. His campaign in Ashanti and his overthrow of Arabi Pasha were model operations of their kind, while the failure to save Gordon and Khartum in 1885 was attributable to delays in starting the expedition, for which he was not responsible. His labours in modernizing the organization and developing the efficiency of the British army—often in face of strong opposition—were of incalculable value to the country. He proved himself at the War Office to be an energetic, far-seeing and able administrator. His insistence upon officers fitting themselves for the duties that they would have to perform in war, and upon their taking their profession seriously, was to bear rich fruit in days when he had retired into the background. An excellent judge of men and of character, he was extraordinarily successful in his choice of subordinates. Cultured, possessing varied interests, well read and of wide experience in many lands, he was in private life a man of unusual charm.

WOLVERHAMPTON, HENRY HARTLEY FOWLER, VISCT. (1830–1911), English statesman, (*see* 28.781), died at Woodthorne, Wolverhampton, Feb. 25 1911.

WOMAN SUFFRAGE.—In the earlier article (under WOMEN, 28.786), the story of the movement for woman suffrage was brought down to 1910. The narrative may here be continued for the United Kingdom up to the passing of the Representation of the People Act in 1918, with some estimate of its results up to 1920, followed by accounts of the growth of woman suffrage in other countries.

UNITED KINGDOM

In the later years of the agitation in Great Britain the constitutional suffragists concentrated their efforts on the formation of public opinion: they sought to form a non-party, non-militant suffrage society in every parliamentary constituency and brought local influence to bear in contested elections to obtain promises of support from candidates of all political parties. They were so far successful as to secure a majority of members pledged to their support in every House of Commons elected since 1886: and in that year, and also in 1897, 1908, 1909, 1910 and 1911, woman suffrage bills passed their second reading, but made no further progress, each successive Government declining to give facilities for the passage of the bills into law. At this period the movement was receiving very valuable support from platform, press and pulpit, besides remarkable help from the theatre in plays by leading dramatists of the day.

In Parliament for several years important support had been given to woman suffrage by leaders of the Conservative party. Among them may be mentioned three successive Conservative Prime Ministers—Lord Beaconsfield, Lord Salisbury and Mr. Arthur Balfour—besides the 7th Duke of Rutland and Lord Iddesleigh, while the younger generation were ably represented by the Earl of Lytton, Lord Robert and Lord Hugh Cecil, and Mr. Alfred Lyttelton. On the Liberal side the leaders, with a few important exceptions (which included Sir H. Campbell-Bannerman, Mr. Lloyd George and Sir Edward Grey), were against it. Among the strongest Liberal opponents during the generation before the World War were to be found Mr. Gladstone, Mr. John Bright, Mr. Joseph Chamberlain, Sir W. Harcourt, Mr. Labouchere, and Mr. Asquith.

In 1908 the death of the suffragist Sir H. Campbell-Bannerman and the succession of the anti-suffragist Mr. Asquith to the Liberal premiership were very disadvantageous to suffrage prospects in the House of Commons. This misfortune was, however, partly counteracted by the emergence of the Labour party, the leading members of which were convinced suffragists; in a short time they induced the party to make woman suffrage a plank in their platform.

The question of "militancy" on the part of a section of the woman suffragists was mishandled from the first by the Liberal Government which came into power in 1906. The Women's Social and Political Union, led by Mrs. Pankhurst and her daughter Christabel, which came into existence about this time, confined its activities to asking inconvenient questions of members of the Government at public meetings. This was in itself a perfectly legitimate method of propaganda. Instead of meeting it by giving reasonable answers, the questions put were in many instances met only by shouts of anger and disapproval or, when written on paper, were contemptuously torn and thrown on the ground. Later, if persisted in, those who asked them were treated with shameful violence. A man at Bradford in 1911, brutally thrown out of a meeting by Liberal stewards, had his leg broken. Women were "frogmarched" out of meetings, and while thus absolutely helpless were violently struck on the face with fists or umbrellas by men in the audience. It should always be remembered that between 1905 and 1908 the militants never answered violence by violence; they suffered violence, but used none. In 1908 they definitely abandoned this policy of non-retaliation; to the last, however, they set limits for themselves, and never shed one drop of blood of either man or beast. But they smashed windows, set fire to churches and country mansions when they were empty; burnt down the refreshment pavilion at Kew Gardens when no one was in it, destroyed the contents of letter-boxes and in one instance of a ballot-box at an election; slashed and cut the Rokeby Venus by Velasquez in the National Gallery and the portrait of Henry James by Sargent in the Royal Academy, and destroyed a case of pottery in the British Museum. On June 4 1913 Emily Wilding Davison tried to upset the Derby favourite during the race at Epsom, and died four days later from her injuries. Her funeral on June 14 was made the occasion of an imposing procession through London.

These and similar actions were intensely irritating, and the punishments meted out were correspondingly severe. But long before violence had been attempted groups of women had been sentenced to three months' imprisonment for nothing worse than making speeches in the lobby of the House of Commons, or shouting in the street. The severe sentences passed upon those who had been guilty of real violence were in the later stages rarely carried into effect; for the militants adopted the hunger strike, and after an interval of, in some cases, only a few days were released because public opinion would not have exonerated the Government if these women had died in their hands. Parliament then passed a piece of panic legislation called Prisoners (Temporary Discharge for Ill Health) Act 1912, immediately nicknamed the "Cat-and-Mouse Act," which enabled the Government to rearrest the hunger strikers when they gave signs of restored vitality. The principal result of this Act was the ridicule which it created at the expense of the Government. Public opinion was greatly excited by all these proceedings. Suffrage was a universal subject of conversation. Anti-suffragists had believed that "militancy" would kill the suffrage movement, and therefore the utmost publicity had been given to every act of violence and to every intemperate speech. But so far from killing the suffrage movement the all-pervading discussion stimulated it as nothing else had ever done. Everyone, high and low, was talking about woman suffrage, arguing either for or against it with vehemence and conviction.

It was a difficult time for the law-abiding suffragists. They objected to "militancy" because they believed the use of physical force as political propaganda was invariably mischievous. They were firmly determined to roast their pig, but not to do it by burning down their house. Over and over again the National Union of Women's Suffrage Societies issued strongly-worded protests against "militancy," and they excluded militants from membership of their societies. They deprecated the use of "frightfulness," whether used by the militants or against them, and urged repeatedly that the real cure for violence was the redress of the grievances which had given rise to it. The fact that men under somewhat similar circumstances had been much more violent and destructive did not create the desire to imitate them. Serious differences thus naturally arose between the two branches of the suffrage movement. Each held firmly to its own view of the case. The militants bitterly resented criticism and made organized efforts to prevent its expression by trying to break up the meetings of the law-abiding suffragists. One effect of this situation was that for the first time since 1886 woman suffrage bills were defeated in the House of Commons, once in 1912 and once in 1913. But other circumstances had contributed to these defeats. There were two general elections in 1910—in Jan. and December. Mr. Asquith and his party emerged victorious from each of them, but in the second his majority was greatly reduced, having fallen from 334 to 124. He had promised at a public meeting in Dec. 1909, if returned to power, to bring in a Reform bill and to allow a woman suffrage amendment to the bill to be an open question for the House to decide. At a later date, in answer to a question in the House, he said, just before the second general election of 1910, that, if his Government were still in power, it "would give facilities for proceeding effectively with a woman suffrage bill, if so framed as to admit of free amendment." The *Times* parliamentary correspondent said that this made woman suffrage an issue before the country at the coming election, and that a majority for the Government would mean that Parliament had received a mandate to carry a measure to that effect. Mr. Asquith was again returned to power, and shortly after these two general elections, *i.e.* in July 1910 and in May 1911, the House of Commons carried by immense majorities second readings of the measure known as the Conciliation bill.

This bill was of a very limited character, proposing to enfranchise only about one million women householders, and it was from the outset opposed by Mr. Lloyd George on the ground that it was not sufficiently democratic. The second reading in 1910 was, however, carried in spite of his opposition. After the general election in 1911 suffrage prospects seemed particularly bright; militancy had been suspended in order to give the Conciliation bill a chance; all the suffrage societies were working harmoniously together, and were relying on Mr. Asquith's promise that, if the bill were given a second reading, opportunities should be afforded in the following session for "proceeding effectively" with its further stages. A bombshell from Mr. Asquith shattered these favourable prospects. He announced on Nov. 7 1911, to a deputation from the People's Suffrage Federation, his intention of introducing during the session of 1912 the electoral Reform bill he had foreshadowed in 1908. He said that this bill would sweep away all existing franchises: that the new franchise would be based on citizenship, and votes were to be given to "citizens of full age and competent understanding," but no mention was made of women. Mr. Asquith, on being asked what his bill would do for them, dismissed the inquiry with the curt remark that his opinions on the subject were well known and had suffered no change; but he reiterated his promises of "facilities" for the Conciliation bill in the session of 1912. If he intended to provoke a return to militancy nothing could have been better calculated to do so. A violent outbreak at once took place. Windows were smashed in the principal shopping streets of London, and personal assaults were made on members of the Government. The constitutional suffragists were as angry as the militants, but had a different way of showing it. Many strong suffragists in the Women's Liberal Federation broke away from their party and gave all their energies to the suffrage cause. Some knowledge of this may have reached Mr. Asquith, for before mid-Nov. he took the unusual course of inviting representatives of the whole woman suffrage movement, militant and non-militant, to attend in a deputation to him: this unprecedented invitation was at once accepted for Nov. 18. The N.U.W.S.S. prepared a series of four questions to put before him:—

1. Was it the intention of the Government that the Reform bill should be passed through all its stages in the session of 1912?
2. Will the bill be drafted in such a manner as to admit of amendments introducing women on other terms than men?
3. Will the Government undertake not to oppose them?
4. Will the Government regard any amendment enfranchising women which is carried in the House of Commons as an integral part of the bill, to be defended by the Government in all its stages?

To each of these questions Mr. Asquith gave the answer, absolutely unqualified: "Certainly." He further said, referring to his own position:—

> "It is perfectly consistent with the self-respect and the best traditions of our public life that, in relation to a question which divides parties, not only the head of the Government but the Government itself should say that, if the House of Commons on its responsibility is prepared to transform or extend a measure which we are agreed in thinking necessary—a measure for the franchise as regards men—and to confer the franchise on women, we shall not only acquiesce in that proposal, but we shall treat it as the considered judgment of Parliament and shall make ourselves responsible for carrying it out."

Twenty-six days after this Mr. Asquith received a deputation of anti-suffragists to whom he gave free rein to an expression of his entire sympathy with their position, and to whom he declared that he regarded "the grant of the parliamentary franchise to women as a political mistake of a very disastrous kind." It was never disclosed how he could reconcile his promise to the suffragists to make himself and his Government responsible, if the House so desired, for carrying woman suffrage, with his belief that it would prove a political mistake of a disastrous kind. His words to the second deputation went far to make his promises to the first worthless; many of his followers interpreted his meaning to be that he relied on them to deliver him, as one of them expressed it, from "the humiliation" of having to keep his word. The first step in his deliverance would be the defeat of the Conciliation bill, and the usual parliamentary devices were employed to secure this end. One of these was to detach from the support of the bill the members of the Irish Nationalist party. This was done by making them believe that the success of woman suffrage would break up the Government and thus prevent the third ratification by the Commons of the Home Rule bill necessary to secure (under the Parliament Act) its passage into law notwithstanding its rejection by the House of Lords. These tactics, aided by a coal strike which caused the absence of 13 Labour members in their constituencies, were successful, and the Conciliation bill, which had been carried on second reading on May 5 1911 by 255 to 88, was defeated on March 28 1912 by 222 to 208. It was a heavy blow to the women's cause, and the most perturbing feature to suffragists in this defeat was the conviction that the same unscrupulous tactics which had secured it would be put into operation against the woman suffrage amendments to the Government Reform bill.

When this was produced it was called a Franchise and Registration bill. It came on for second reading on July 12 1912. In his speech Mr. Asquith took full advantage of the recent defeat of the Conciliation bill. He said: "This bill does not propose to confer the franchise on women; whatever extensions of the franchise it makes are to male persons only." He then referred to the defeat of woman suffrage in March as the "considered judgment of the House," and he dismissed as "an altogether improbable hypothesis the possibility that the House would stultify itself by reversing this judgment during the same session." Notwithstanding this ominous warning Mr. Lloyd George and Sir Edward (afterwards Viscount) Grey continued to be confident that amendments to the Government bill gave suffragists the best chance they had ever had of parliamentary victory. The bill itself, however, made no further progress during 1912; the protracted session lasted all through that year and overflowed into 1913; it was officially announced that committee stage would be taken on Jan. 24. All possible plans were elaborated by the real friends of woman suffrage both inside and outside Parliament to ensure the success of one or other of the suffrage amendments. But the parliamentary air was still thick with intrigue, and many and circumstantial were the rumours that the success of any of the woman suffrage amendments would mean the resignation of anti-suffrage ministers and the break-up of the Government. No official contradiction was given to these rumours until the day before the House was expected to go into committee on the bill.

But the defeat of the bill did not proceed from this source. Three days from Jan. 24 had been allotted for the discussion of the woman suffrage amendments. This stage was, however, never reached. On Jan. 23 Mr. Bonar Law asked the Speaker to give a ruling on the point whether the Government's own amendments, regarding the occupation franchise for men, did not so far alter the bill from that which had received a second reading in July as to make it a new measure and necessitate its withdrawal and reintroduction in its new form. In his reply the Speaker intimated that this was his view, and added that there were "other amendments regarding female suffrage which of course would make a huge difference to the bill if they were inserted." The bill was killed by this ruling. Mr. Asquith did not mend the situation by his treatment of the suffragists, from whom he refused to receive a deputation, and they were more incensed against him than ever when, in lieu of what he himself called "the best chance they ever had," he only offered parliamentary time for the discussion of yet another private member's bill. All the suffrage societies repudiated this offer and did nothing to support the bill, which was brought forward in May 1913 and defeated by 266 votes to 219.

These events, the defeat of the Conciliation bill in March 1912 and the fiasco of the Government bill in Jan. 1913, convinced the N.U.W.S.S. that nothing would now be of any use but a Government bill with the whole weight of the party behind it. They accordingly gave a new interpretation to their election policy. This was, and continued to be, to support the best friend of woman suffrage; but events had proved that a suffrage candidate who belonged to a suffrage party was a better friend than a suffrage candidate whose party was either hostile or neutral. The council governing the N.U.W.S.S. therefore resolved "that in judging which of the two pro-suffrage candidates should be supported in an election, the official attitude of the party to which the candidate belongs should be taken into consideration." An analysis of the division when the Conciliation bill had been defeated showed that 42 members who had been supported by the N.U.W.S.S. as "best friends of woman suffrage" (mostly followers of Mr. Asquith) had voted against it. When party pulled one way and voteless women pulled the other, party proved the stronger. As Labour was the only party which had definitely made suffrage part of its programme, this change threw the influence of the N.U.W.S.S. in elections definitely on the side of Labour; and a special fund, called the election fighting fund, was formed for the support of Labour candidates. The N.U.W.S.S. further resolved under no circumstances to support Government candidates, and to endeavour by all legitimate means to strengthen any party which adopted woman suffrage as part of its programme. By the adoption of this policy they succeeded in 16 months in defeating six Government candidates in by-elections, making a difference of 12 in divisions. They had also succeeded in each of the elections concerned in making the whole place ring with the suffrage agitation. Public opinion moved rapidly and strongly in the suffrage direction, the general view being that suffragists had received less than fair play at the hands of Mr. Asquith and his Government.

A "pilgrimage" organized by the N.U.W.S.S. in 1913 received a remarkable degree of support from the towns and villages traversed on the seven routes by which it approached London. But the N.U.W.S.S. were convinced that a free vote of the House of Commons on their question was an impossibility as long as there was a Prime Minister who was ardently opposed to his own principles when applied to women. They were therefore determined to do everything in their power to reduce Mr. Asquith's majority. They believed that their election-fighting policy gave them an effective and constitutional method of doing this, and looked forward to helping to defeat his party in the general election which, but for the World War, must have taken place not later than 1915. They were full of work in preparation for this, when on Aug. 4 1914 the overwhelming catastrophe of the World War broke out, not only destroying all opportunity of suffrage work but jeopardizing the very existence of representative institutions in Europe.

Suffragists shared to the full in the solemn national consciousness that every ounce of strength would be needed in the gigantic effort which the successful prosecution of the war demanded. Indeed, suffragists realized this more quickly than the Government, which for many months seemed to believe that the war could be carried on solely by the efforts of the male half of the nation, without disturbance of the domestic calm which they believed to be the only legitimate role of the female half: for offers of help from women to provide, and staff hospitals to supply, women for work in public offices, thus leaving an additional number of young men free for military service, were plentifully douched with cold water.

Nevertheless suffragists, whether militant or non-militant, quickly faced the facts and clearly saw what their duty was. The militants instantly abandoned every sort of violence and organized themselves for public service. They formed a Women's Emergency Corps, ready to undertake all kinds of national work which the exigencies of the time required. Others, both militant and non-militant, in spite of official discouragement undertook the organization of hospital units entirely officered by women (*see* WOMEN'S WAR WORK). The N.U.W.S.S. committee on Aug. 3 resolved to suspend immediately all political propaganda and to use their staff, and organizing power in mitigating the distress caused by the war. Their societies, numbering over 500, were consulted by post, and all but two approved this course.

No one claims for suffrage women that they were in any degree singular in the devoted work which they gave to their country during the war. The suffragists were earliest in the field because they were already organized and accustomed to team-work. Women of all classes and all parties threw themselves with zeal and efficiency into every kind of useful patriotic work. Industrial women were beyond all praise, working as they had never worked before, early and late, Sundays and weekdays, to supply the armies with every kind of military equipment. Everyone who came into contact with them bore testimony to their splendid efficiency in departments of skilled work from which before the war they had been rigidly excluded. In March 1915 the Government concluded an Agreement with the trade unions, known as the Treasury agreement, to suspend during the war, in face of the national emergency, the rules excluding women from most of the skilled trades. The Treasury on its part gave a promise not to use the women as a reservoir of cheap labour, and agreed to give women the same wages as men for the same output. This gave an important stimulus to the principle of equal pay for equal work, and went some way also in the direction of establishing industrial freedom for women. The courage of the women in the dangerous trades was as marked as their efficiency. On one occasion 26 women were killed and 30 injured by an explosion; those who remained uninjured displayed the greatest coolness and discipline, and were prompt both in helping the wounded and in continuing the work of the factory. The legend of the innate timidity of women was thus undermined. The tide in this direction rose so high that even Mr. Asquith was floated by it, and in speaking in Oct. 1915 in the House of the heroic death of Edith Cavell, he said: "She has taught the bravest man among us a supreme lesson of courage; yes, and there are thousands of such women, *but a year ago we did not know it.*"

All through 1916 evidence of the conversion of former opponents of women's enfranchisement poured into the suffrage offices. Many of these conversions were of M.P.s, eminent leaders of the press, railway managers, commercial and financial magnates. Liberals very often pleaded militancy as an excuse for their former blindness; Conservatives, in the main, said simply: "I formerly opposed the granting of the vote to women; I thought men by themselves maintained the state; I was wrong; the women have served their country so magnificently that henceforth I shall support their having the vote."

There is no doubt that by 1915–6 the country was by a great majority favourable to the enfranchisement of women. Nevertheless it would have been impossible to induce Parliament to pass a great Reform bill during the war if it had not been that the electoral position of millions of men, caused by their services to their country, was so anomalous as to amount to a public scandal. The parliamentary register, by the direct orders of the Government, had not been revised since 1913. By 1916 it was completely out of date. By-elections had proved its unrepresentative character and it would have been a moral impossibility to take a general election upon it. There were at this time the names of about 8,000,000 men on the register. Of these nearly 7,000,000 qualified as occupiers. The occupation franchise necessitated that the qualifying premises should have been continuously "occupied" by the voter for 12 months since the last 15th July. This meant that a large proportion of the 5,000,000 young men who had voluntarily joined the New Armies since Aug. 4 1914 would, in consequence of their patriotic services, have lost their claim to the parliamentary vote. The men facing death daily, the very men to whom the country was most indebted, would be voteless, whilst those who had evaded similar sacrifices retained their electoral qualification. The position was intolerable, but it was not at first clear how best to amend it. Proposals were made by some M.P.s to create a new franchise based on naval or military service. But this received little general support. The questions: "Why exclude industrial service?" and "What about the services of women?" received no satisfactory answer. Mr. Asquith's Government repeatedly tried to deal with the situation by Special Register bills. These efforts were unsuccessful. Each successive proposal was rejected by the House of Commons with growing symptoms of exasperation. The House wanted a Reform bill; it demanded a new electorate on democratic lines. The Government wanted a Reform bill too, but appeared to believe they could get one to their liking by calling it a Special Register bill. It was long before they abandoned their efforts to get one thing by calling it another. On Aug. 14 1916 Mr. Asquith, on introducing yet another Special Register bill, announced his conversion to woman suffrage; he based it on the ground that when the war was over it would be necessary to revise industrial conditions and that in his view women had a special claim to be heard on the many questions which would directly affect their interests. It was obvious that this was no new condition. Ever since Parliament existed measures had come before it vitally affecting the well-being of women, but on which they had no constitutional means of making their claims heard. But it was not the business of suffragists to point this out. The main difficulty at the moment arose from the plausible plea that, however desirable parliamentary reform might be, it was not the time during the greatest war in history, with the issue still hanging in the balance, to recast the representative system of the country. The reply has just been indicated. The new register and the new qualifications were needed at once unless millions of the most desirable male citizens were to be disfranchised. A good deal of iteration was needed to hammer this into people's heads, and to the end, "This is not the time," continued to be the only effective weapon used against women's enfranchisement.

Mr. Walter (later Lord) Long found a way out of the impasse. He suggested the appointment of a non-party conference, consisting of members of both Houses, selected and presided over by the Speaker, to consider the whole subject of electoral reform including woman suffrage. Mr. Asquith concurred and the House agreed. The conference began its sitting in Oct. 1916 and handed in its report on Jan. 28 1917. In the interval Mr. Lloyd George had succeeded Mr. Asquith as Prime Minister, a change very favourable to immediate action in the direction of woman suffrage. The Speaker's conference unanimously recommended a new franchise for men amounting practically to manhood suffrage; for women it recommended, but not unanimously, household suffrage, including wives of householders, a higher age-limit for women and their admission to the university franchise. This was the scheme subsequently adopted by Parliament. The object of the high age-limit (30) for women was to produce a constituency in which male voters were in a substantial majority. It was believed by suffrage members of the conference that the acceptance of this was essential to success. The anticipated proportion of women to men in the new electorate was as 2 to 3. This expectation proved practically correct. The new register published in 1919 gave the exact numbers: men 12,913,160; women 8,479,156. It may here be mentioned that the United Kingdom is the only country, out of the 28 where women are enfranchised, which created a difference in the qualifications for men and women.

The parliamentary history of the measure based on the recommendations of the Speaker's conference may, as regards woman suffrage, be here sketched. Within a fortnight of his becoming Prime Minister, Mr. Lloyd George intimated to the leaders of the N.U.W.S.S. that he was keen to go forward at once in the direction of women's enfranchisement. This was a month before the Speaker's conference handed in its report. The object was to get an agreed measure supported by every party in the House. This was achieved. On March 28 1917 Mr. Asquith moved a resolution in Parliament calling on the Government to introduce a Representation of the People bill based on the recommendations of the Speaker's conference. Woman franchise was the subject of all the speeches, and the leader of every party supported the enfranchisement of women; the opposition was of the feeblest, and the motion was carried by 341 to 62.

When the bill (*see* WOMEN, LEGAL STATUS OF) was debated, the second reading was carried by 329 to 40, and Clause 4 (enfranchising women) was passed by 385 to 55, or 7 to 1, with a majority within each party into which the House was divided; and again in the last trial of strength the anti-suffrage Die-hards were reduced to a mere handful, the numbers being 214 to 17. After this the N.U.W.S.S. felt the ground sufficiently solid beneath their feet to place a new weight upon it, and, in conjunction with many other women's societies, they urged that the local government franchise for women should be amended on the same principle which the House had already accepted for the parliamentary franchise—namely, to include not only householders but wives of householders. This was at first resisted by the Government, but suffragists outside the House and even many anti-suffragists worked vigorously for it and prevailed. The Government gave way, and the amended clause was accepted on Nov. 14 without a division.

The anti-suffragists in the Lords were a more formidable group than in the Commons. Lord Curzon, president of the Anti-Suffrage Society, was the leader of the House and chief representative of the Government. The inclusion of women in the bill was vigorously resisted in the early stages of the bill by Lord Bryce and Lord Balfour of Burleigh; but there was no real fight upon it until the committee stage was reached and the women's clauses came on. After various skirmishes the battle was joined, an anti-suffrage amendment was moved, and there was a full-dress debate on Jan. 8, 9 and 10, 1918. Lord Curzon wound up the discussion. His speech, for the first five-sixths of it, was a tolerably familiar anti-suffrage oration, but the last sixth was cast in a different mould. He reminded the peers that the House of Commons was the sole constitutional representative of the feelings of the country; that in the Commons woman suffrage had been supported by large majorities of every party, "including the one to which most of your lordships belong." He invited them to contemplate what would happen if they came into collision with the other House on such a question as the representation of the people. He elaborated this point with skill, and ended by saying that to reject the clause would be to embark upon a conflict in which the Lords were certain to be worsted. He declined to be responsible for such a catastrophe, and announced his intention of not voting either for or against the amendment. This was the supreme moment for all suffragists present. They felt at once they were safe without disastrous conflict. The division was: for the clause, 134; against, 71. Thus ended the 50-years' struggle of British women for political liberty. The royal assent was given on Feb. 6 1918. The women's task had been a long one, but they were able to look back upon it with satisfaction. They had accomplished it without one scintilla of direct political power and without appeals to party passion. Their appeal had been to common sense and experience. They challenged their opponents to produce one instance of disastrous consequences following upon the women's vote. Moreover, they had not split the country into rival factions, for the bill was carried by the consent and coöperation of all parties.

Those who had worked for woman suffrage quickly perceived the difference it had made in the attitude of Parliament on almost every proposal which came before it. The parliamentary atmosphere completely changed. Measures for which women's societies had been working unsuccessfully for years, such as the Nurses' Registration bill, and an amended Midwives' bill, were taken up as Government measures, and passed through all their stages without difficulty. The grille in front of the ladies' gallery was removed, and women were admitted to the strangers' gallery. By the spontaneous action of the Government a bill was passed in Nov. 1918 to render women eligible to sit in Parliament. It was not in time to be of much use at the general election which followed in about a fortnight, but Viscountess Astor was returned for Plymouth in Nov. 1919 and Mrs. George Wintringham (widow of the previous member) for the Louth division of Lincs. in Sept. 1921. The increased number of women local electors gave a great impulse to the election of women as town and county councillors and the number of women chosen as mayors steadily increased.

The report of the Lambeth Conference 1920 showed that the Anglican communion was breathing the new atmosphere created by the women's vote. It acknowledged that in the past the Church had undervalued women and had too thanklessly used their work. It stated the belief of the Conference that the Church would be strengthened by making freer use of the spiritual gifts of women, and recommended the opening to them of the diaconate, definitely affirming that the diaconate is an "order," though a minor one, and that a woman appointed to it is not merely "set apart" but "ordained."

These changes vary in importance, but they are significant in that they all point in one direction—giving wider scope to the powers and responsibilities of women and recognizing the use of women's work in every well-ordered state.

Before the general election of Dec. 1918 Mr. Lloyd George and Mr. Bonar Law had given a public promise, if returned to power, "to remove all the existing inequalities in the law between men and women"; but when the new Parliament opened there was no indication in the King's speech of proposed legislation in fulfilment of this pledge. The Labour party, therefore, in the session of 1919 introduced a measure called the Women's Emancipation bill, completely removing every legal inequality between men and women and giving women the vote on the same terms as men. This they carried, notwithstanding Government opposition, through all its stages in the House of Commons; the Government, however, defeated it in the Lords, but not without providing a substitute—the Sex Disqualification Removal Act. This did not reopen the franchise question, but it gave women the right to study and practice law in both its branches, to act as magistrates and to sit on juries. It also made it clear to the universities of Oxford and Cambridge that they had the power to admit women to degrees and membership. Oxford availed itself of these powers without delay, but Cambridge in Dec. 1920 declined to take a similar step by 904 votes to 712, and repeated the refusal twice in 1921.

BRITISH DOMINIONS OVERSEAS

The granting of woman suffrage in Canada was almost simultaneous with its victory in England. It was first adopted in the provinces (except Quebec) in 1916, and by the Dominion in 1917. Canada was well in front of the mother country in the matter of the eligibility of women. Miss MacAdams was elected to the Legislature of Alberta entirely by the votes of soldiers on duty in England and France in July 1917. The first Woman Suffrage Act for the Dominion limited the vote to women who had near relatives serving overseas. Full woman suffrage followed very quickly and almost without opposition in March 1918. In Feb. 1921 Mrs. Mary Ellen Smith of Vancouver was chosen as Speaker of the British Columbian legislature. She, however, declined the speakership, but took office as a member of the Cabinet.

New Zealand had enfranchised its women in 1893, and enfranchisement followed in the Commonwealth of Australia in 1902; therefore, with the exception of S. Africa, all the great self-governing overseas dominions of Britain have given political freedom to women. In March 1921 Mrs. Cowan was elected to the Parliament of Western Australia, the first woman M.P. to be elected in Australia.

Jamaica, S. Rhodesia and British East Africa gave votes to women in 1919 and 1920.

A strong effort was made by Indian women, supported by the Aga Khan and the Begum of Bhopal, to induce Parliament to incorporate in the Government of India Act the principle of woman suffrage. This effort was unsuccessful but not fruitless; important support was given in the House of Commons, and the Act, as finally passed, specifically left the question of woman suffrage to be decided, province by province, by the elected Legislatures of India herself. The newly created constituencies therefore have the power, when they choose to use it, of recognizing the full citizenship of women.

UNITED STATES

American women had been the earliest to make a definite organized struggle for political freedom, having started in 1848, but they were among the last to win. This was in part due to the U.S. Constitution, which can only be amended by a two-thirds majority in both chambers of Congress, and even then the amendment does not become operative until it has been ratified by three-fourths of the 48 states. American suffragists used to say to friends in Europe, "You have to convert one Parliament: we have to convert at least 37 Parliaments." The suffragists worked state by state until there were some 20 suffrage states. The greatest victory thus gained was that in the state of New York in 1917, after America had joined in the war. To win in the "Empire" state was a turning point in the whole struggle. After this, ultimate victory was certain, and the suffragists concentrated on carrying suffrage by constitutional amendment. Theodore Roosevelt in 1912 was the first important presidential candidate who supported woman suffrage. In 1916 and 1920 all the presidential candidates were suffragists. President Wilson during his second term aided the movement by taking the unprecedented course of himself twice urging the Federal amendment upon the attention of Congress. The necessary two-thirds majority was secured in the House of Representatives in Jan. 1918, but there was not a single vote to spare, and the narrow margin weakened the position, especially as the Senate had yet to be won; but in May 1919 the amendment was again brought up in the House and was carried by 304 to 48; and victory in the Senate followed almost immediately. Then came the battle for ratification in 36 states. The first stages were easy and rapid, 11 states giving a unanimous vote in both Houses, and seven more in one or other of their chambers. After this the victories came more slowly until, in May 1920, 35 states had ratified and only one more was needed. The issue was much obscured by the impending presidential election. Both candidates were, as in 1916, suffragists. Both parties probably believed they would gain an advantage if they could plausibly claim that their efforts had given the final victory to women. Tennessee, a Democratic state, voted for the amendment by the necessary majorities in Aug. 1920; legal objections to its validity were, however, raised, but not in time to prevent the proclamation by the Secretary of State in Washington that the 19th Amendment to the U.S. Constitution had been carried. The legal points, however, awaited decision in the High Court. This gave an opportunity for a Republican state, Connecticut, to come to the rescue; a special session was called and the 19th Amendment was ratified on Sept. 21 1920. This made the Tennessee objections negligible for, valid or invalid, the 36th state had now ratified and the following article was added to the Constitution: "The right of citizens of the United States shall not be denied or abridged by the United States or by any state on account of sex." Thus after a struggle of 70 years the women's victory in America was completed.

OTHER COUNTRIES

Before the World War there were only four countries in the world where women exercised the political franchise; by the end of 1920 there were 28—namely, the United Kingdom, Canada, Australia, New Zealand, British East Africa, Rhodesia, Jamaica, Denmark, Norway, Sweden, Finland, Iceland, Holland, Rumania, Serbia, Luxemburg, Germany, Austria, Hungary, the United States; and, among the states newly formed by the peace treaties of 1919, Poland, Esthonia, Lithuania, Latvia, Czechoslovakia, the Ukraine and Palestine.

The charter of the League of Nations contains a clause rendering women eligible for all appointments, including the secretariat. This clause did not remain a dead letter. Besides a large number of women in less responsible positions, Dame Rachel Crowdy was made Director of the Section of National Health, to deal with the white-slave and opium traffic and with the anti-typhus campaign. At the first assembly of the League (Geneva Nov., Dec. 1920) Sweden appointed Mrs. Wicksell and Norway Dr. Kristine Bonnevie as alternate representatives of their respective countries; while Miss Forchhammer of Denmark brought forward in the full assembly the subject of the white-slave traffic and was successful in carrying her proposal to appoint a commission of three persons, one of whom must be a woman, to prosecute a special inquiry on the subject in the Near East. Miss Sophie Sanger was made head of the Legal Section of the International Labour Bureau. In Jan. 1921 Mrs. Wicksell was appointed a member of the Permanent Mandates Commission.

In seeking a cause for so great a development of principles for which comparatively small groups of women, without any direct political power, had worked in some countries for more than half a century, it may probably be found in one circumstance common to them all. In each country a national crisis had arisen on the issue of which the whole fate of the nation depended. National feeling in each had been stirred to its utmost depths. Under its pressure class feeling was minimized; all sorts and conditions of men and women had worked and suffered together for what each felt to be a cause of supreme importance. Men and women acted as friends and comrades when the issue was uncertain, and when the end came the men did not forget the work and the sacrifices of the women. In all countries, whether victors or vanquished, it was universally acknowledged that all through the anguish of the war the women had not been backward either in self-sacrifice, courage or capacity. It was this feeling which broke down the opposition to women's votes in nearly all the warring nations. It was felt also that men by themselves, as a well-known journalist expressed it, had made a mess of the world and needed helpers; men and women together being generally more successful than either men or women by themselves.

AUTHORITIES.—M. G. Fawcett, *Women's Suffrage* (1911); M. G. Fawcett, *The Woman's Victory and After* (1920); E. Sylvia Pankhurst, *The Suffragette* (1910); the files of the *Common Cause*, now *Woman's Leader*, and of the *International Suffrage News; Official Reports of Parliamentary Debates* 1911–1919. (M. G. F.)

WOMEN (*see* 28.782).—The decade 1910–20 saw not only an advance in the position of women, unparalleled in any similar period, throughout the civilized world; it saw also an entire reversal of the public attitude towards their claim to equal citizenship. Yet this is true only of the second half of the period. From 1910–4 there was little or no progress; there was indeed retrogression. By 1910 the "Woman Movement" of the later 19th century had very largely resolved itself into a movement for obtaining the parliamentary franchise, a concentration upon a single object deplored by some but defended by others, who contended that the denial to women of the full rights of citizenship constituted an effective check upon their advance in any direction. The rise and progress of "militant" suffragism in England between 1910 and 1914 (*see* WOMAN SUFFRAGE) did much to alienate public sympathy. It was only the outbreak of the World War which brought about that great and sweeping reform in the position of women which had been accomplished by 1920.

(1) UNITED KINGDOM.—After 1914 changes in the United Kingdom were both numerous and rapid. The shortage of man-power during the war opened up a great diversity of fields of employment (*see* WOMEN'S WAR-WORK), and broke down barriers in the Civil Service and the learned professions, which had hitherto seemed impregnable. Nothing more was heard in the great war departments of those "structural" and other insuperable obstacles to the coemployment of men and women, which figured so largely in the evidence of practically every male civil servant before the Royal Commission on the Reform of the Civil Service, reporting in April 1914. When the institution of the two new orders of honour, the Companions of Honour and the Order of the British Empire, was announced in June 1917, it was declared that the bestowal of these decorations for war services would be irrespective of sex. In Aug. 1917 a resolution to remove the grille in front of the ladies' gallery of the House of Commons was passed by that House without debate. By the

Representation of the People Act (1918) women over 30 gained the parliamentary vote, and by a special Act passed in Nov. they were made eligible as members of Parliament, though the only woman elected at the general election of that year, Countess Markiewicz, refused, with the other Sinn Feiners, to take her seat. The Sex Disqualification (Removal) Act (Dec. 1919) gave women the right to hold practically every other public or professional position pertaining to civil life with the exception of membership of the House of Lords. Even this exception was subsequently removed: on March 2 1922 the Committee on Privileges of the House of Lords favourably passed upon a petition by Lady Rhondda holding that she and the 24 other peeresses in their own right were entitled to seats in the House of Lords.

As an immediate result of the Act women could be admitted to the degrees of any university, whatever the terms of its previous charter. The university of Oxford rose to the height of its opportunity; Cambridge, up to the close of 1921, still lagged behind. In the general election of Dec. 1918 women, who had qualified by residence and examination for degrees not yet conferred upon them, exercised the university franchise by reason of that qualification. The absurdity of such a position appealed to the more logical university. In Feb. 1920 Prof. Geldart introduced a statute into Congregation at Oxford, proposing to admit women to full membership of the university. Two amendments were moved on March 9, one to exclude women from university boards, the other from examinerships, but both were rejected by large majorities. On May 11 the statute was carried without alteration, and three subsidiary statutes, admitting women to all university offices, passed unopposed. Since Oct. 7 1920 the women students of Oxford have enjoyed the same advantages, and been subjected to the same university discipline, as the men. They even wear in slightly modified form the same academic dress at lectures and all university ceremonies. Moreover the gift was retrospective; every woman who had passed the examinations for the degree course and resided not less than 9 terms (three years) in Oxford as a member of a recognized Society of Women Students (such societies being the four women's colleges, or the Society of Oxford Home Students) became eligible for a degree, and on Oct. 14 the degree of B.A. was actually conferred upon a large number of qualified women, the principals of the various colleges and halls and the principal of the Oxford Home Students receiving the hon. degree of M.A. On March 11 1921 the hon. degree of D.C.L. was conferred on Queen Mary, on the occasion of a visit to Oxford in support of the appeal of the Oxford women's colleges for funds to meet the anticipated increase in the number of students anxious to matriculate at a university which offered them full privileges of membership. During the academic year 1920–1 the total number of degrees conferred upon women at Oxford was: B.A. 621; M.A. 345; B.Litt. 9; B.Sc. 3; B.C.L. 1; B.Mus. 2; D.Mus. 1; D.C.L. 1.

At Cambridge the position up to the summer of 1921 remained uncertain and, from the women's point of view, unsatisfactory. On Dec. 8 1920 a proposal to admit women to degrees was decisively rejected by the Senate, the figures being 712 for and 904 against. An alternative scheme to set up a separate university for women at Cambridge, conducting its own examinations and conferring its own degrees, met with no favour and was strongly opposed by the women concerned. When it came before the Senate (Feb. 12 1921) it was rejected by 146 votes to 50. A "compromise" scheme, giving membership of the university and full degrees and making women undergraduates eligible for professorships, lectureships, university boards and syndicates but not for the Senate, was again rejected on Oct. 20 when it was defeated by 908 votes to 694. An alternative scheme for conferring by diploma "titular" degrees on women, carrying with them no university membership, was passed by 1,012 votes to 370. This alternative, however, was unacceptable to the women.

Amongst the learned and academic distinctions won by women during the decade may be noted the presidency of the botanical section of the British Association held by Ethel Sargent (d. 1918) in 1913 and by E. R. Saunders in 1920. In Dec. 1920 Eugenie (Mrs. Arthur) Strong was appointed Rhind lecturer in archaeology and the first woman fellow of the Society of Antiquaries. In 1918 the Founder's Gold Medal of the Royal Geographical Society was bestowed upon Gertrude Margaret Lowthian Bell.

By Section 2 of the Sex Disqualification (Removal) Act women were permitted to become solicitors. Three years earlier (Jan. 1917) a proposal to admit women to the bar had been defeated at its annual general meeting by a large majority, though in Feb. 1917 a bill to permit them to qualify as solicitors obtained a second reading in the House of Lords. On Jan. 1 1920 Mrs. Gwyneth Marjory Thomson (Bebb), who died at the early age of 31, was admitted at Lincoln's Inn as the first woman student for the English bar. She had previously (1913) tested the legality of a woman practising as a solicitor by bringing (with others) a case against the Law Society. On May 7 1920 Miss Tata, a Parsi, was admitted, also at Lincoln's Inn, as a student preparing for the Indian bar. A few women presented themselves for the law examinations at the universities and passed with distinction, Mrs. Thomson obtaining a 1st class at Oxford, and Miss L. F. Nettlefold at Cambridge, and in June 1921 Miss K. Snell of Girton College was placed above No. 1 in Class I. of Part II. of the law tripos at Cambridge. In March 1921 five women passed the intermediate examination for the bar and on May 26 Olive Catherine Chapman passed the final examination.

Seven women (the Marchionesses of Crewe and of Londonderry, Mrs. Humphry Ward, Mrs. Lloyd George, Miss Elizabeth Haldane, Mrs. Sidney Webb and Miss Gertrude Tuckwell) were appointed justices of the peace on Jan. 1 1920. On Jan. 9 Mrs. Ada Summers, mayor of Stalybridge, took her seat as first woman chairman of the bench. In March of that year 24 women were appointed for the county of Lancaster, and in July a large number were appointed for the county of London; appointments were subsequently made throughout the United Kingdom.

On Aug. 6 1920 women jurors were for the first time empanelled, at Bristol. In Jan. 1921 women jurors were first summoned to the Central Criminal Court, London, and were also first called as "special jurors" in the Probate and Divorce Court. The first case which they had to try involved details of an unpleasant character, and some controversy subsequently arose as to the suitability of mixed juries in divorce and other cases. It was, however, generally held that the discretion left to the judge to make an order exempting women from service in cases of a certain kind was sufficient safeguard, and a bill, introduced into the House of Commons by Mr. G. Terrell on April 15 to amend the Sex Disqualification Act by providing that no women should be compelled to serve on a jury, failed to secure support, only 19 members being present when he introduced it.

Shortage of candidates for the medical profession during the World War encouraged a very large number of women students to present themselves. War conditions led to the admission of women students to several of the London general hospitals; before the war they were restricted to the Royal Free Hospital and the School of Medicine attached to it, or to the few hospitals for women, staffed by women. A notable advance was also made in placing the Endell Street (London) military hospital, opened Feb. 1915 by the R.A.M.C., under Dr. Louise Garrett Anderson and Dr. Flora Murray, and by the employment of other women surgeons and physicians under the R.A.M.C. in Malta, Salonika and elsewhere.

Progress in the Civil Service was rapid during the war, when women, as temporary civil servants, held many responsible posts, and were paid on a higher scale than had previously obtained. On May 19 1920 the House of Commons passed a resolution declaring that women employed in the service of the State should have equal opportunities and equal pay with men engaged on the same work. But the power to reserve to men certain departments of the service, given to the Treasury by Order in Council, was widely exercised, and the progress made fell short of the desires and expectations of the women affected (*see* WOMEN'S EMPLOYMENT). On Aug. 5 1921 a debate on the subject took place in the House of Commons on a resolution moved by a private member. A Government amendment to it was agreed to, whereby for a provisional period of three years special conditions were to obtain both as to method of selection and rates of pay, but subsequent conditions were to be the same for both sexes.

No barriers now exist excluding women from any profession, except the army and navy, and ministry of the Church of England or the Roman Catholic Church. In Feb. 1920 Convocation passed a resolution against giving permission, even to accredited women "to preach and pray in congregations composed of women and children," but in July the Lambeth Conference recommended the admission of women to the diaconate and a wider use of their ministry in non-liturgical services. Permission was, however, refused to Miss Maude Royden to preach in a London church at a special Good Friday service in March 1921. The General Assembly of the English Presbyterian Church resolved in May 1921, by 156 votes to 124, to admit women as elders and deacons.

In practically all other directions the field lies open to women. Their achievements during the war proved that they but needed opportunity. The remaining struggle was not for permission to work but for adequate remuneration. "Equal pay for equal work" became their rallying cry. It was inscribed upon the banners of an imposing procession, demanding equality in the Civil Service, which paraded London on April 28 1920; it formed the basis of the protest of women teachers to the Minister of Education (May 1920) and of their demonstration in Trafalgar Square (Nov. 1920) against the proportion (four-fifths) of male salaries allowed them under the Burnham scale. In the industrial world the women's claim to an equal bonus prompted the successful strike of tramway and omnibus workers in London in Aug. 1918. Not inappropriately the National Union of Women Suffrage Societies renamed itself the National Union of Societies for Equal Citizenship.

The problem was no longer political, or even social; it was economic. The removal of the few remaining disabilities of women, such as their inferior share in the guardianship and control of their children, depends in the last resort upon the securing for them, whether in marriage or out of it, of economic independence. Otherwise freedom to control those whom she cannot maintain, or the right to leave a husband when she is incapable of maintaining herself, are illusory rights of little value to a woman. When the last traces of the legal theory that husband and wife are one person, and that the woman, as such, must be under the tutelage or guardianship of parent or husband, have been obliterated, there will still remain need for legislation securing to a woman freedom to work outside her home, or, as an alternative, wages for work within it going beyond bed and board, as well as a fair share of joint earnings. Not till this is accomplished will the theory of equal citizenship have been translated into fact. (J. E. C.*)

(2) UNITED STATES.—The increase in interest in professional work for women in the United States, during the World War, was evidenced by the number of bureaux and associations for the exchange of information in this field. A book published in 1920 by the director of the Intercollegiate Vocational Guidance Association told the story of over 30 groups of professional occupations where women were already at work. An examination of the many branches under the main groups indicated that there was practically no profession women had not entered. The Bureau of Vocational Information published intensive studies of the leading professions, and the National Social Workers' Exchange was organized to place trained workers in professional positions throughout the country. During the World War increased opportunities came to women, both in the accustomed professions and also in new lines of endeavour. It is probably true, however, that most of the professional work, which was considered "new" to women, was "new" only in the sense that it was unknown to the general public. In the case of employment managers, personnel and welfare workers, for instance, women had been employed for some time, but the war increased the number and brought their work vividly before the public.

Industry.—Many of the women taking executive positions in industry had been forewomen and were promoted in the war emergency. In one investigation of 250 plants, 146 employed women executives other than forewomen. The more important positions included those of designers, office or factory managers, employment managers, welfare directors, nurses and occasionally doctors, matrons, lunchroom managers, production supervisors, department heads, statisticians and saleswomen on the road. Later there developed a tendency to employ college women in these positions, and by 1920 at least three universities and a half-dozen schools had offered special training courses. One school alone graduated over 200 women whose salaries ranged from $2,000 to $5,000 a year.

Medicine.—Perhaps the most important demand among the already recognized professions was for an increased number of nurses and doctors. In 1920 there were registered about 40,000 nurses in private practice and about 10,000 in public health work. It was in the latter field where every effort was being made to increase the number to 50,000. The number of women physicians at the same time was about 6,000, and practically all of the American medical schools were open to women, although not always on quite the same terms as for men. Women were not only practising physicians but they also held important positions in surgery, dentistry, laboratory research, and on the staffs of hospitals and medical schools. In addition to the "regular" physician it was estimated that there were about seven or eight thousand women practising osteopathy.

Law.—Since 1869, when the first woman was admitted to the bar in Illinois, the profession of law has claimed an increasing number of women. By 1921 every state in the Union except Delaware had admitted both sexes, and at least 1,600 women were practising in various branches of both civil and criminal law. Out of 129 law schools only 27 then refused admittance to woman students, but among those refusing were two of the leading schools, Harvard and Columbia. In many cases women who were graduate lawyers specialized in one phase of work such as corporation law, patent law, legal research or court work. Others did not enter the practice of law but engaged in work where their legal training became valuable background. Among the important Government positions held by women lawyers in 1921 were those of the U. S. probate attorney, judge of the juvenile court in the District of Columbia, city magistrate in New York City, deputy collector of customs, and county attorneys, treasurers, clerks, probate judges and justices of the peace in various states. Two states have had women assistant attorneys-general, and probably the most important position held by a legally trained woman was that of assistant attorney-general of the United States.

Education.—One of the few professions given over very largely to women was that of teaching. Women almost completely filled the ranks in the elementary public schools, and very nearly so in the higher grades. Men predominated in the colleges and universities, but women held many important positions as faculty members and occasionally as presidents of women's colleges. Many of the higher educational institutions employed women deans to supervise and advise the women students. Salaries for these positions were seldom above $3,000 or $4,000, but occasionally the dean of women held the rank of full professor and received a corresponding salary. Many smaller cities employed women as superintendents of schools, but in 1921 only one or two of the larger cities had engaged women in this position. An increasing number of women were employed in private schools either as teachers or principals, and often private schools were owned and managed by women. Since 1900 particular problems in education have been emphasized and women specialists developed in such fields as manual training, recreation, kindergarten, physical education, vocational training, and the education of the blind, feeble-minded or subnormal.

Immediately following the World War an acute shortage of teachers occurred, due to the large numbers drawn off into better-paid positions. This exodus amounted almost to an "invisible strike" for higher wages and became so serious that schools in many places either closed entirely or were open for only half-day sessions. A movement was started to establish a minimum salary of $1,500 a year in order again to attract women to the profession, but the wave of economy which spread over the legislative bodies in 1921 greatly impeded the efforts to raise the standard of teaching and to secure better educational facilities.

Social Work.—Since 1900 a remarkable increase occurred in the numbers of women engaged in various forms of social service. Women have of course been the traditional bearers of charity and have long been connected with correctional work. But this was largely in the form of volunteer service. With the greater development of paid service, and the desire to treat causes rather than effects, there developed a wide field of work and a large number of workers. Social service was classified by the National Social Workers' Exchange as follows: (1) Social case work, dealing with individuals, as church visiting, family case work, medical social service, probation, protective and prison work, public health nursing and visiting, school visiting, and employment exchange work, both public and private (2) Social group work, including community-centre work, Americanization boys' and girls' club work, playground and recreation work. (3) Social reform work dealing with people as a mass—as housing reform legislation, anti-tuberculosis work, and the promotion of child hygiene. (4) Social research, comprising special investigations, research and statistical work including surveys and exhibits. No fewer than 14 schools for the training of social workers had been established by 1921 and the demand for women with proper training usually exceeded the supply.

Civil Service.—Extensive opportunities for women are to be found in civil service positions offered by city, state, and Federal governments. In 1920 about 200 cities, 11 states and the Federal Government had adopted the competitive civil service plan. The number of women employed in the civil service throughout the country could not be accurately ascertained but a conservative estimate of those in the Federal service in 1920 placed the number at about 50,000 in the District of Columbia alone. During the first half of the year 1919, examinations were held for 260 different types of service with positions varying from that of charwoman at $240 a year to a Federal Trade Commissioner at $10,000.

The plan of the classified civil service aims, on the whole, to give equal opportunity to both sexes. But in practice women are often discriminated against by the custom of excluding them from certain types of service and also by permitting the heads of departments to determine the sex qualifications both for examinations and for appointments. In the Federal Government service, where women were admitted by statute in 1870 at the discretion of the head of the department, the custom of giving preference to men had been so powerful that in the civil service examinations held between Jan. 1 and July 1 1919 women were excluded from over 64% of the positions in scientific and professional services, from 86% of the positions in the manufacturing and mechanical services and from 75% in the medical services. In the work of collecting information from original sources only 4 out of 16 different kinds of positions were open to women. Even the Federal Bureau of Efficiency and the Federal Board for Vocational Education closed its examinations to women.

This policy of discrimination was deeply affected by the shortage of labour during the World War, and the situation was partly remedied when the Civil Service Commission, after an investigation by the women's bureau of the Department of Labor, opened all examinations to both sexes, but with the reservation that heads of departments may specify which sex was desired. This latter provision will need to be modified before equal opportunity is completely secured. There also exists in the Federal service serious discrimination against women in the matter of salary levels and in the classification of grades. During the first two months of 1919, for instance, over 86% of all women appointed received salaries ranging between $900 and $1,300 a year, while only 36% of the men received these salaries. The number of women receiving probational and temporary appointments, in this same period, was about twice as great as the number of men in the same classes. But efforts to remedy this situation are increasingly successful.

Positions most commonly open to women include those of stenographer, secretary, librarian, statistician, editorial and clerical worker. Many departments, however, require women with expert technical training such as biologists, bacteriologists, chemists, dietitians, linguists, draftsmen, doctors, nurses, directors for playgrounds and recreation centres, and specialists in social welfare such as child hygienists and factory inspectors. Public institutions also offer opportunities for women in such positions as matrons, supervisors, inspectors and in the more technical positions as physicians or psychologists. Tenure of office based upon merit, often with a pension upon retirement, is probably one of the most alluring features in civil service work.

General.—The entrance of women into many other professions was given a special impetus during the war, including journalism, advertising, commercial art and banking, where women were employed both as clerks and as officers and directors. Architecture, interior decoration, landscape gardening and motion-picture work attracted an increasing number of women. In motion-pictures women were not only actresses but also title editors, research workers, readers and occasionally directors or even producers. The exceptionally large salaries of $25,000 and $50,000 were occasionally reported, and a rare motion-picture director or a play broker was said to earn $100,000 a year. It is apparent that women have entered a very large number of professions exclusively held by men in earlier years, and their success indicates that they are certain to remain and to carry important responsibilities. (I. O. A.)

WOMEN, LEGAL STATUS OF (*see* 28.784*).—(1) UNITED KINGDOM.—The position of women in England was almost revolutionized between 1910 and 1921. Very little actual change in the law took place between 1882 and 1918, but beneath the surface inevitable changes were impending, and the World War brought about the outward change as probably nothing else could have done. The parliamentary suffrage (*see* WOMAN SUFFRAGE) was granted in the early summer of 1918 to all women over 30 years of age whether single, married or widows;[1] and in Dec. 1919 they were declared eligible for any office.

It may be taken as a general proposition that from the beginning of the year 1920 onwards there has been no difference in the legal position of men and women on account of their sex throughout the United Kingdom, and since that time no woman has been under any civil disqualification by reason of sex or marriage. As far as property was concerned, even under the old law, the non-married woman, whether spinster or widow, held her property on the same terms as a man. She could buy and sell, go to law and make her will just as a man could. The married woman's position before the year 1882 was far different. It is well stated by one who, though born in the United States, became one of England's greatest lawyers, thus: "A married woman is absolutely incompetent to enter into contracts, and has in the contemplation of law no separate existence. She cannot make a valid purchase on her own account even for necessaries, and when credit is given to her there is no remedy but an appeal to her honor" (*Benjamin on Sales*, 3rd ed., p. 32). All this has completely disappeared. The Married Woman's Property Act 1882 was a great step in advance, and the last remnant of the medieval doctrine that for every purpose husband and wife were one person (and that person the husband) disappeared in 1920 when they were made capable of stealing from one another except when living together. A married woman is now as capable of dealing with her own property as a man is.

Married women (and of course all spinsters and widows) can now make their wills and dispose of their property as they wish. In England neither the husband nor the children have a right to any part of it except in the absence of a will. In Scotland the children have a legal share, on which they can insist on their parent's death. A married woman is not obliged to ask her husband's leave to make a will, nor need she make him executor or leave him any part of her property, unless she wishes to do so. Among wealthy people the married woman's position as to property is often controlled by her marriage settlement. The provisions are almost invariably the same, viz. that the capital of the property is in the hands of trustees and the income goes to the wife, who cannot anticipate it. On the death of the wife the husband sometimes has the income for his life. If there are children the capital is divided among them, generally in equal shares. If there are no children or other descendants of the wife the property goes back to the wife's relations, unless she disposes of it by will as she can generally do.

It is, however, an irony that even in 1921, in respect of her motherhood and the custody of her own children, the woman was still inferior to man (*see* 14.514), and also as to inheritance she was still not in such a good position as her husband or brother. In case she does not make a will all her property except her land goes to her husband, whereas if he dies intestate she only gets a third of his property, or half if he has no children (*see* 14.568 and

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[1] By the Representation of the People Act (1918) all the old franchises were swept away. There are now three qualifications for women as parliamentary electors under the Act: residential, university, and as the wife of a local government elector. In her own right a woman may qualify by residence in the electoral area and may in addition have one or more university votes. As the wife of a local government elector she may also have a parliamentary vote, but she may not vote more than once in the same election nor for more than one ordinary constituency in a general election. In addition she has one university vote at a general election. To qualify as a local government elector she must have (*a*) attained the age of 21, be resident in the area on the last day of the qualifying period (Jan. 15 or July 15), have occupied some land or premises in the area for the whole of the qualifying period, or in the alternative (*b*) must have attained the age of 30 and be the wife of a man who is entitled to be registered as a local government elector in respect of the premises in which they both reside. To qualify as a parliamentary elector she must have attained the age of 30 and must be entitled to be registered as a local government elector in respect of the occupation in the electoral area of land or premises of the yearly value of not less than £5, or of a dwelling house, however small the value, or be the wife of a husband entitled to be so registered. This means that the husband must own land or premises in the area of the yearly value of not less than £5. In all the above cases the women must not be under any legal incapacity. A peeress in her own right can be an elector and also a peeress by marriage. There are certain offices, chiefly in Scotland, which if conferred on a woman would incapacitate her as a voter. She must not be a lunatic, an alien or a convict. The wife of a person serving in military or naval forces of the Crown, who would if he were not so serving be entitled to be registered as an elector, is not disqualified. The wife of a "conscientious objector" is not disqualified.

In the case of a university vote the woman elector must be 30 years of age, and fulfil the same local conditions as a man elector, or have passed the final examination and kept the period of residence necessary to qualify a man at the time when the university did not grant degrees to women.

14.714). A very elaborate bill was in 1921 before Parliament intended to give her an equal share with her brothers in her parents' landed property.

The Sex Disqualification (Removal) Act, 1919, provides that no person (whether man or woman) shall be disqualified by sex or marriage from the exercise of any public function, or from being appointed to or holding any civil or judicial office or post or from entering or assuming or carrying on any civil profession or vocation or for admission to any incorporated society (whether incorporated by Royal Charter or otherwise), and a person shall not be exempted by sex or marriage from liability to serve as a juror. The word "person" in English law includes woman as well as man. The Act further provides (*a*) that His Majesty may by order in Council authorize the admission of women to the Civil Service, and reserve to men any branch of, or posts in, the Civil Service in H.M. possessions overseas or in any foreign country; (*b*) that any judge or other person before whom a case is heard may in his discretion on application (in both civil and criminal cases) by either party or at his own instance make an order that the jury be composed of men or women only, or may on her application exempt a woman from service on a jury by reason of the nature of the evidence or issues to be tried. Rules of Court have been made as to summoning jurors, exempting women who are for medical reasons unfit to attend and as to procedure. Section 2 provides for the admission of women as solicitors. Section 3 enables any university to admit women to membership or any degree notwithstanding any statute or charter of such university. The Act overrides all previous statutes, orders in council, royal charters or other provisions inconsistent with it, and applies to the whole United Kingdom.[1]

It will be observed that the qualification to hold office only applies to civil life. Military and ecclesiastical offices are not open to women. On the passing of the Act Viscountess Astor was almost immediately elected to the House of Commons and took her seat as a member, and women were appointed justices of the peace and began to serve on juries. The contrast between the position of women in 1921 and 50 years earlier is certainly very striking. The unmarried woman, both spinster and widow, was equally disqualified formerly from public functions and offices, but she was in the same legal position as a man for the purposes of contract and wrong-doing. In criminal law the married woman as well as the single one has now the same position as a man with some trifling exceptions. The recent Larceny Act, which codifies the law, finally makes it possible for the wife as well as the husband to steal from one another when they are living apart, or deserting, or intending to desert the other. Up to the last-mentioned date the medieval conception that the husband and wife were one person made it impossible for them to steal from each other, just as it formerly made it impossible for one of them to give or convey property to the other. All this is now abolished and, with the exceptions presently stated, a woman, even when married, must be treated in law as a man. This is not however the case with military or ecclesiastical law. A woman is not liable to serve in the forces of the Crown, and she cannot in the Church of England or the Church of Rome be a priest or hold such ecclesiastical offices as are held by men. She is also subject to her husband in ecclesiastical law, and they are regarded for many purposes as one person. She is also by the law of marriage regarded as under the authority of her husband. Her duty is obedience in all things not sinful. The husband has a right to her custody and control. She must live in the house he appoints and sleep with him if he wishes it. She has no remedy except to leave him, and if she does so for such a reason he is not bound to support her. He cannot however legally prevent her from leaving him (*Jackson v. Jackson 1891*). She cannot get damages from him for imprisonment (*Tinkley v. Tinkley 1908*).

The wife can obtain a maintenance order from a magistrate if she separates from her husband on the ground of his assault on her, or his desertion. Orders made abroad can now be enforced in England, and, if made in England, can be enforced against the husband abroad. Maintenance for the children can also be obtained up to 10s. per child (Married Woman Maintenance Act 1920).

In England until the Act of 1874 (36 and 37 Vict. c. 12) the father was the sole guardian of the children of any marriage and was entitled to the sole custody and control of them. The mother had no legal rights whatever. By an Act of Charles II. (1660) the father was given the sole right to appoint a guardian or guardians of his children to act after the father's death so long as they are under twenty-one. By the Guardianship of Infants Act (1886) the mother, if surviving, is the guardian of each child either alone, when no guardian has been appointed by the father, or jointly with the guardian appointed by him. The mother may also appoint a guardian to act after her own and the father's death. Subject to the confirmation by the Court she may also appoint a guardian to act with the guardians appointed by the father. By Section 5 the Court may make such order as it thinks fit regarding the custody of the child and the right of access thereto by either parent "having regard (*a*) to the welfare of the child, (*b*) the conduct of the parents, and (*c*) *the wishes as well of the father as of the mother*." This statute however has been interpreted by the judges to mean that where the father's wishes and the mother's were opposed the father's wishes must prevail. By the Guardianship of Infants bill (1921) the above Act would be wholly repealed. The father and mother in future and for all purposes would be joint guardians, and have joint custody, and have "equal authority, rights and responsibility with regard to every legitimate child, any former rule of law or equity to the contrary notwithstanding." The father and mother would be jointly and severally liable for the maintenance and education of the child according to his or her means on the application of either the father or mother or any other person acting as next friend. Their executors would also be liable.

There is an old saying that lawyers are divided into two classes: those who think man is made for the law and those who think the law was made for man. It is the first class that makes the law unpopular; but it should be remembered that when husband and wife quarrel about their children the task of the judge is a very difficult one. The most difficult case is where they differ in religion. It has been laid down (*Agar-Ellis* case 1878) that the child must be brought up in the religion of the father. In this case he was a Roman Catholic and had not been guilty of misbehaviour. It was decided that the children must not be brought up by their mother on the ground that she might make them Protestants; if the father had been a Protestant and the mother a Roman Catholic she would have been deprived of her children on the same grounds. It was further laid down that no promise by the father before marriage as to the education of his children can be enforced after marriage, as he has a right to alter his mind. The last named decision might well be reversed by statute. In the case of property the husband's agreement before marriage can be enforced, and it seems unjust not to enforce his agreement as to the children. But in cases where the father and mother are of different religions and no promise has been given, it makes the judge's task a difficult one. Hard cases make bad law. and the difficulty lies, not with the judges, but in the real tragedy of these disagreements. (R. TH.)

(2) UNITED STATES.—Although the legal emancipation of women was far advanced in the United States at the end of the 19th century, three things were yet incomplete: (1) full recognition and securing of the individual interests of women in the domestic relations, which were often left unsecured legally because of survival of doctrines or institutions coming down from a state of society in which all women were dependents, and were normally under a sort of guardianship; (2) full logical development of the legal capacity of married women and doing away with the remnants of their common-law disabilities, already long abrogated for the most part in the United States, but surviving here and there in curious local anomalies; (3) legal taking account of the facts of women's physical constitution in their relation to wages and hours and conditions of labour in industry, and securing of the social interest in the individual life of women by adequately protecting them in these connexions.

With the progressive breaking down of the legal conception of the household as an entity ruled from within by a head, and as an agency of social control, it becomes necessary to give legal recognition and protection to individual interests of women in the domestic relations, which at common law were supposed to be secured through the internal economy of the household, or were left unsecured in view of a paramount social interest in the household as a social institution. Summarily, these may be put as *parental* interests—interests of women in the relation of parent and child, and *marital* interests—interests of women in the relation of husband and wife.

Parent and Child.—At common law the father was entitled to the custody of his minor child and the mother had a right to custody only after the father's death. In form this still stands in the books as law, but in substance there has been a complete change within a generation. Equity long ago refused to give effect to the father's common-law right of custody as against the interest of the child, and by taking the equitable doctrine of regard for the interest of the child over into the law, the courts have been able to put father and mother upon an equality for practical purposes in almost all jurisdictions. Yet the common-law doctrine remains theoretically in force in the absence of legislation, and legislation halts. One decision as late as 1905 holds that as between father and mother, the former has a legal right to control the religious training of the children. (*Hernandez v. Thomas, 50 Florida Reports, 522, 536.*)

Husband and Wife.—Marital interests of women include claims against the world at large growing out of the relation of husband and wife, and claims of wives against husbands because of that relation. As interests of personality a wife has claims to the society of her husband, quite apart from any economic advantage; to the affection of her husband, analogous to the legally recognized claim of the husband to the society and affection of the wife; and to the chastity and constancy of the husband as involving her self-respect and honour. These interests, however, are not yet recognized to their full extent and are not fully secured even in legal theory. The first and second are now protected by an action for alienating the husband's affections, which has come to be allowed by the overwhelming weight of American authority. (*Turner v. Heavrin, 182 Kentucky Reports, 65, 1918*). The third is at most but partially recognized and indirectly secured; but it should be said that the obvious inutility of the husband's means of redress, which should be applied by analogy to make the law logically complete, has had much to do with the apparent backwardness of the law on this subject. As an interest of substance the wife may claim to be secured in the marriage relation as an economically advantageous relation, providing her with support and shelter. Where the husband is enticed or induced to abandon his wife or to divert earnings which should be devoted to her support, the courts are coming to recognize this interest directly. (The wife's action was allowed in *Flandermeyer v. Cooper, 85 Ohio State Reports, 327, 1912*: it was denied in *Brown v. Kistleman, 177 Indiana Reports, 692, 1912*.) On the other hand in case of physical injury to, or abduction of, the husband, the wife is still usually denied an action, although the husband may recover in the converse case for "loss of service." No doubt there are practical difficulties here, arising in part from our mode of trial and of assessing damages. Yet the present state of the law, shaped by obsolete conceptions of the position of the wife in the household, is so out of accord with the present-day position of married women that legislative overhauling in the near future is not unlikely. Regarding the claims of the wife against the husband, modern law everywhere has agreed to leave the interest of husband and wife respectively in the society and affection of the other without effective legal sanction as between the two. The claim of the wife to support was recognized fully and secured adequately at common law. Recent legislation setting up domestic relations courts and providing for criminal prosecution in case of non-support has only put more effective administrative machinery behind existing legal duties of the husband. The most serious inequalities in this connexion were in the procedural difficulties encountered in enforcing the wife's legal rights. Domestic relations courts, which have had a considerable development in the U.S. in the last decade, are adapted especially to removing these obstacles (see Smith, *Justice and the Poor*, chap. 11.). It should be noted also that modern legislation, although taking away from the husband all control over the wife's property and earnings and committing it solely to the wife, has left untouched the common-law duty of the husband to support the wife even if she has property and he has none. Some courts go so far as to allow a wife possessed of means who has supported herself out of her separate estate to sue the husband and obtain restitution of the amount thus contributed. (*De Brauwere v. De Brauwere, 203 New York Reports, 460, 1911.*) A few western states, however, now impose upon a wife of means and ability a duty of supporting an indigent and infirm husband, and allow an action by the husband to enforce this duty. (*Hagert v. Hagert, 22 North Dakota Reports, 290, 1911.*)

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[1] Women who wish to be solicitors should apply to the Incorporated Law Society, Chancery Lane, W. C. 2, or barristers to the Benches of the Temple, E. C., or Gray's Inn or Lincoln's Inn, W. C. Nurses and midwives are under the Ministry of Health. There are penalties for using either title without registration.

Disabilities of Married Women.—Unmarried women of sound mind and lawful age were under no common-law disabilities. On the other hand married women were without power to determine their own national character or legal domicile, following their husbands in these respects as a matter of law; were subject to serious disabilities with respect to ownership, use and enjoyment of property; were restricted in their power to sue in the courts; could not convey property; and had no power to contract. Some of these disabilities were rested on a fiction of the legal unity of husband and wife, derived from the position of the husband as guardian of the dependent members of the household in the old Germanic polity and reinforced by certain texts of Scripture, whose authority was decisive in the Middle Ages. Legislation began to abrogate these disabilities early in the 19th century. But it was often far from comprehensive in its scope, and when sweeping provisions were enacted they were often interpreted narrowly because of the doctrine requiring strict construction of statutes in derogation of the common law. There has been a gradual but steady progress in the direction of removing all of these disabilities partly by legislation and partly by judicial decision, and many anomalies which resulted from halfway legislative measures or strict judicial interpretation were in the decade 1910–20 shaken, if not overthrown. With respect to separate domicile of married women and actions by wives against husbands, the social interest in the security of marriage and the family as social institutions of paramount importance has necessarily given the courts pause, since the doctrine that the wife's domicile depended on that of the husband, and that the one might not sue the other, seemed but corollaries of a legal recognition of the family as an entity. Yet when that entity is *de facto* dissolved, these doctrines amount to serious disabilities imposed upon one member. Accordingly in one way or another American courts now recognized the separate domicile of the wife substantially to the full extent of her individual interest in free self-assertion. (*Williamson v. Osenton, 232 U.S. Reports, 619, 1914.*) So also with respect to actions by the wife against the husband. The older Married Women's Acts which in form merely removed disabilities as to property and contract, were long construed as not allowing such actions since they did not do so expressly, and a policy against aggravation of domestic troubles by dragging them into court was taken to be in the way. This sacrifice of the individual interests of the wife to the supposed exigencies of a social interest has now definitely given way, and conservative courts are allowing such actions even under statutes in terms dealing with property rights only. (*Brown v. Brown, 88 Connecticut Reports, 42, 1914.*) The more recent type of statute, providing that a married woman shall have the same legal existence and personality after marriage as before marriage, necessarily permits such litigation. (*Fiedler v. Fiedler, 42 Oklahoma Reports, 124, 1914.*) As to capacity to own, acquire, use and enjoy property, little remains of the old law, and there are but few jurisdictions where legislation might still accomplish anything. In one respect, however, improvement by judicial decision is still going forward. A number of states, by derivation directly or indirectly from Spanish law, have the institution of "community property," in which with respect to certain property, and especially property acquired after marriage, husband and wife are treated legally as a sort of property-owning entity. The older view was that the husband was the administering agent of this collectivity during their joint lives, and hence could dispose of it, alter its form and charge it with his personal debts; and that it could even be taken in execution for his wrongful acts. Recent decisions in some of these jurisdictions, recognizing the individual interest of the wife, hold that the community property is not liable for acts done by the husband outside of the reasonable scope of his authority as agent of the community. (*Schramm v. Steele, 97 Washington Reports, 309, 1917.*) Yet even there a claim for an injury to the wife being an acquisition after marriage and community property, she is not allowed to sue therefore if her husband refuses to join. (*Hynes v. Colman Dock Co., 108 Washington Reports, 642, 1919.*) As to contractual capacity, little remains to be done anywhere in order to give married women full beneficial powers of contracting in their own interest. Yet in more than one jurisdiction privileges which compensated for the older disabilities still remain in force in whole or in part and enable married women to escape from contracts for which as persons of full capacity they ought to be held. This is especially true of contracts of suretyship, by which married women are very generally incapable of binding their separate property.

Protection of Women in Industry.—While American courts have been reluctant to give over, or to construe legislation as abrogating, common-law privileges or disabilities which protected married women when in a condition of legal dependence, they have also been reluctant to uphold legislation restricting freedom of contract on the part of women in industry with respect to hours and conditions of labour and minimum wage. When such statutes were first enacted, they were held unconstitutional as being arbitrary and unreasonable interferences with liberty of contract by a court which had had no hesitation in keeping alive common-law disabilities, that had long ceased to secure any individual or social interest. That decision has been overruled (*Ritchie v. Wayman, 244 Illinois Reports, 509, 1910*), and it seems to be settled that legislation may take account of the facts of women's physical make-up and secure the social interest in a healthy womanhood by regulating the hours of labour of adult females. (*Muller v. Oregon, 208 U.S. Reports, 412, 1908; Bunting v. Oregon, 243 U.S. Reports 416, 1917.*) But it is still a matter of controversy whether this may be carried to the extent of fixing a minimum wage for women employees. (*Stettler v. O'Hara, 243 U.S. Reports, 629, 1917.*) Curiously enough, the political and legal emancipation of women is urged as a reason against such legislation, as if the removal of political and legal disabilities had any relation to, or effect upon, the physical handicaps upon women in industry which are the occasion of these statutes.

Women on Juries.—In 1917 California provided for the drawing of women upon juries. (*Laws of 1917, p. 1283.*) Since the adoption of the Nineteenth Amendment of the Federal Constitution providing for women suffrage, 1920, it has been assumed that women are to sit upon juries everywhere. But in some jurisdictions, out of caution, it is felt that the courts should await express legislation, and in others courts have felt compelled to wait until court-houses and jury-rooms could be adjusted to the novel situation presented by juries of men and women. The conditions under which juries are kept while deliberating upon verdicts and the accommodations for jurors in large cities, where many juries are sitting simultaneously for a great part of the year, are not adapted to the woman juror; and in many country court-houses things are even worse. If no other good results from service of women upon juries, the inevitable improvement of the physical conditions surrounding jury service will be a gain. On the other hand, the expense involved in this improvement and in provision for the custody of juries made up of men and women in important cases, where juries must be guarded closely from outside contact, leads many jurisdictions to hesitate.

(R. Po.*)

WOMEN POLICE.—In Sept. 1914 two distinct bodies of women police were formed in England, with the object of maintaining order amongst girls and young women in the new and exciting conditions brought about by the formation of military camps and the movement of troops in training (*see* WOMEN'S WAR WORK).

The Women Patrols were organized by a special committee of the N.U.W.W., with Mrs. Carden as hon. sec. and chief organizer; and the Women's Police Volunteers were formed by Miss Nina Boyle and other members of the "militant" Women's Freedom League, and within a few weeks were reorganized by Margaret Damer Dawson (d. May 18 1920) as the Women Police Service. The latter was a paid force, dressed in a uniform closely resembling that of the regular male force; the former was mainly voluntary and wore no distinguishing mark except an armlet. The Women Patrols were, however, from the first recognized by the Chief Commissioner of the Metropolitan Police (Sir Edward Henry), who signed the passes authorizing them to patrol streets and public places, and by the Home Secretary (Mr. McKenna), who circularized the chief constables of borough and county police throughout the United Kingdom, inviting them to do the like in their own districts. The Women Police Service received no direct official recognition; but in 1916 they were requested by Sir Edward Henry to supply policewomen for the munition factories throughout the country. In Jan. 1917 the Women Police Service received a grant from the Ministry of Munitions for the expenses involved, and in the same year the Women Patrols received a subsidy of £400 from the Home Office, reduced the next year to £300. With these exceptions, both forces, which originated in private effort, were for long supported entirely by funds privately collected. They conducted their own training, the Women Police Service entirely at their London centre and the Women Patrols not only in London but also at the three schools which they established in Bristol, Liverpool and Glasgow. These combined in the autumn of 1918 to form the Federated Schools for Policewomen and Patrols and received a grant of £1,000 from the Carnegie U.K. Trust, followed by £250 in 1919–20.

In Oct. 1918 Gen. Sir Nevil Macready, who had become Chief Commissioner of Metropolitan Police when Sir Edward Henry resigned in consequence of the police strike in Aug. of that year, decided to form a force of 100 women police for London, to be drawn from the ranks of the Women Patrols. The force, afterwards known as the Women's Patrol of the Metropolitan Police Force, was organized and placed under Mrs. F. Stanley as superintendent, with one assistant superintendent and 10 sergeants, and its status and duties were defined by the Police Order of Dec. 23 1918. The women were not sworn in as constables and were not given the power of arrest. Similar limitations attached to most of the individual policewomen employed by the chief constables of boroughs or counties throughout the United Kingdom. These, in Sept. 1920, numbered 126 for England and Wales, of whom only 33 were appointed with the same status as men, and 14 for Scotland, none of whom were sworn in as constables. They were for the most part women trained by one or other of the two voluntary organizations. In Dec. 1920 certain members of the Women Police Service were engaged by the military authorities in Ireland to assist in searching women suspected of complicity in conspiracy.

The Committee on the Police Service appointed in March 1919 under the chairmanship of Lord Desborough did not deal with policewomen, and on the request of a deputation, which attended at the Home Office Aug. 8 1919, a Home Office departmental committee was appointed in Feb. 1920 to inquire into "the nature and limits of the assistance which can be given by women in the carrying out of police duties and as to what ought to be the status, pay and conditions of service of women employed on such duties." The committee, which included two women, Viscountess Astor and Dame Helen Gwynne-Vaughan, reported July 24 that "there is not only scope but urgent need for the employment of policewomen." They enumerate as "appropriate" duties: "investigations in cases of assault on women and children; investigations under the Children Act 1908, the Immoral Traffic Acts 1902–1912, and similar statutes; attendance at court when cases of female or juvenile offenders are being dealt with; inspection of common lodging-houses (where this falls on the police); supervision of parks and open spaces; visiting of licensed premises, cinemas, registry offices, etc.; prevention of offences by prostitutes; and, generally speaking, any work in connection with offences committed by and against women and children." They recommended: (1) that all policewomen should be sworn in, given full powers of arrest and ranked with the male police, forming an integral part of the police force and being trained and appointed by the chief constables; (2) that their pay should be standardized and approximated to that of the men (60s. minimum as compared with the men's 70s.), and that their allowances should be the same; (3) that their hours should be seven daily; (4) that marriage should be no bar to service; (5) that pensions should be granted on a scale slightly lower than for men, but that gratuities for dependent children should be the same for both sexes.

Up to Feb. 1921 this report had not been translated into action except as regards the pay and allowances to Metropolitan policewomen, which were standardized from Jan. 1 1921. But on Feb. 28 a deputation from the Federated Schools was assured by the Home Secretary that he would advise chief constables throughout the country that, where policewomen were employed, their employment should be regulated by the terms of the departmental committee's report. He added that it was undesirable that the work should any longer be carried on under voluntary organizations. Under Section 10 of the Police Act 1919 the wearing of police uniform by members of unofficial bodies is an actionable offence, and in March 1921 thirteen summonses were taken out against five executive members of the Women Police Service, which resulted on May 4 in fines of 10s. each and £10 10s. costs against the commandant. The name of the service was subsequently changed to the Women's Auxiliary Service, and changes were made in the uniform differentiating it from that of the official policewomen. Its future function was defined as mainly that of training, in London and in Edinburgh.

See *Report of the Committee on the Employment of Women on Police Duties* (1920, Cmd. 887) and its *Minutes of Evidence* (1921, Cmd. 1,133). See also the annual reports of the Bristol, Liverpool and Scottish Training Schools for Policewomen and Patrols, and the annual reports of H. M. Inspector of Constabulary for England and Wales (1917 *et seq.*). (J. E. C.*)

UNITED STATES.—About 300 cities in the United States employed policewomen in 1921, either as single officers of the law or in connexion with special women's bureaus. In many cases positions were secured through civil-service examinations, and promotions were made on the same basis as for men. Probably the largest number of policewomen was found in the cities of Chicago and New York, where the women's bureaus each employed about 30 women, usually in the capacity of police and patrol officers. Their duties were varied but related largely to the welfare of women and children. In Chicago one woman was assigned to the Morals Court, where she assisted the woman bailiff and the probation officers. In New York the women's bureau had attached to its staff a number of men welfare workers. These were usually former policemen who for some reason became incapacitated for regular work and who were assigned to assist in caring for needy cases, particularly among widows and children of former policemen. One city in 1921 announced the appointment of a coloured woman as police officer.

In some cases this wide field for social service attracted high-class women; their duties included probation work, institutional commitments, supervision of dance-halls and places of amusement, juvenile court work and at times physical and psychopathic examinations. This work frequently merged into expert detective work and required a woman to be on duty almost any time of the day or night. The minimum salary seldom fell below $1,000, while the highest was not often above $2,000 a year, except by special legislation. Policewomen were eligible for the retirement pension, which was usually about 50% of their salary. (I. O. A.)

WOMEN'S EMPLOYMENT.—UNITED KINGDOM.—Women have been employed outside their homes in the industries of Great Britain from at least the days of Edward II., when they appear to have washed ore in the Derbyshire lead mines for 1d. a day. During the following six centuries they found their way into one trade after another, until in 1914, at the outbreak of the World War, in spite of their having been in the 19th century almost driven out from their once considerable occupations of agriculture and coal-mining, the total number of women in commerce and industry in the United Kingdom was 3½ million, while another 2½ million were earning wages as hospital nurses, domestic servants, dress-makers in small workshops and outworkers of similar kinds.

The increase that took place during the war was only a million, and yet it probably attracted more discussion than the whole of the steady industrial development which had made the sudden extension possible. This was due partly to deliberate publicity designed to attract women into the factories, partly to the interesting nature of a small part of the work which they undertook;

but it also arose from public ignorance of the share that women were already taking in industry before the war. There was no great industrial group which did not at that time already employ thousands of women; in the building trades there were 7,000, and in mines and quarries nearly the same number. The metal trades held 170,000 women; there were even some hundreds in the Admiralty dockyards. The great exceptions were the shipyards, underground work in the mines, iron and steel foundries and rolling-mills, various branches of engineering and whisky distilling. Other important services, like the railways, used them only for clerical work and cleaning, except of course in posts which could only admit of women, such as those of attendants in women's cloakrooms. Others reserved certain processes for men and gave the rest to women: others were women's trades: others again used men and women interchangeably.

The demarcation that existed between men's and women's work was as a rule definite and well recognized in the trades concerned. The very heaviest types of work were done by men, and so in most cases was work that required any high degree of skill. Such work, moreover, was almost certain to be the subject of trade-union restrictions which effectively prevented employers from using women on it. But these criteria, except at the ends of the scale, were not absolute. Women in many occupations—for instance making chains or gramophone records—were accustomed to handle very heavy tools or lift very heavy weights. Many would not trouble to acquire skill, or were denied the opportunity; but the bad organization of women and their low rates of pay tended to conceal the fact that they were often employed on jobs which a man would have considered at least as semi-skilled, while a few women up and down the country were turning out work which required a considerable technical endowment. The Ministry of Munitions, to take an extreme instance, found optical lenses being ground by women in London which they considered equal to the finest German lenses, and this had been going on for a dozen years. Very few women had such an opening, but all along the middle line, where the work was neither too heavy nor took too long to learn, there were trades and sections of trades where the spheres of the two sexes overlapped, so that on certain parts of the work they were either used interchangeably or one or the other according to district custom.

The best known examples of this are probably the cotton, woollen and worsted weavers, and the machinists in the Birmingham brassware trade, clerks and shop-assistants. But in all such border-lands, as has been said, the tendency before the war was for the low-paid and restricted woman to replace the more mobile and unrestricted man. In most of these cases one type of labour or the other—by no means always that actually used—was probably more suited to the work and economically preferable; but even where employers were sensible of this, they found local customs and prejudices too strong to alter, and the problem was little thought about and never squarely faced.

During the World War.—British industry, therefore, when the war came, was not compelled to start afresh with totally untrained women workers. Less than a tenth of the 4,750,000 employed in Nov. 1918 in agricultural, commercial and industrial occupations, had been altogether ignorant when they entered on war work of at least the routine and discipline of an industrial life, and the majority had really useful experience. It is after all more difficult to learn to handle a power loom or a power-driven sewing machine than it is to change from one of these to a semi-automatic lathe. Employers stated that of the 3,000,000 women employed in industry alone 700,500—a number nearly equal to that of the new entrants into the same occupations—were directly replacing men. This did not mean however that they were necessarily engaged on work that before 1914 had always been done by men. In many instances the work itself was new. Gas-masks, depth-charges and anti-aircraft devices, for example, had not been made in the same way, if at all, before 1914. Sometimes the change made was only nominal, as when a shop full of girls who had been machining bicycle parts, was turned over to the manufacture of rifles, and the processes to be performed on the new object remained unaltered. Again the employment of women on a particular job, though new to the factory in question or even to the district, might be customary in other parts of England or Scotland. The Midlands could show thousands of women pressing, stamping, drilling, milling, dressing castings, core-making, assembling, even working on capstan lathes, and some of these were turning out articles for use in war such as fuzes, adaptors and cartridge cases. Any of these processes, if performed in an engineering shop, was entirely forbidden to a woman or a girl. Finally, there were very great numbers of women who merely replaced men on duties which had formerly been undertaken by either men or women. Familiar examples of trades in which this occurred have already been given. It is not too much to say that the majority of the women war workers were employed on work familiar to their sex, and often not widely dissimilar—except in the conditions under which it was done—from their ordinary occupations.

There were, however, exceptions to this, so interesting that they obscured the true state of affairs. Women on buses, policewomen and landgirls, women teaching in boys' public schools, and perched on ladders washing windows, women in gas-works and steel foundries and marine-engineering shops produced a comprehensive effect which was increased by the uniforms and working-dresses they wore, and by the fact that many of the war-workers were drawn from social classes unused to connecting their women-folk with factory life. There were reasons, too, which led to the position being misrepresented. It was in the interest of each employer, anxious to retain the skeleton of his male staff, to emphasize the length to which he had already carried direct substitution, and the returns made by them were found to reflect this anxiety. Moreover, it was in some districts easier to attract women to work which they believed served the purpose of releasing a man for the Forces than to obtain them for uninspiring women's tasks, where the drudgery and hardship to be faced were not even tinted with glamour.

Numerically, the changes in the employment of women and girls took the following course. The outbreak of war produced immediate unemployment. By Sept. 1914 about 250,000 females (8·4% of those employed in Aug.) had already left their jobs. This was the lowest point. By Feb. 1915 only 1·5% of these were still without work; by April the figures showed a surplus of 2%, and by Oct. 1915 the increase already amounted to 150,000. So far, however, it was still almost entirely in trades recognized as women's, or in work performed by both men and women. Of the 429,000 women and girls who entered the metal trades during the war, only 29,000 had entered by July 1915, though the effect of the Government's efforts to achieve dilution, which was made possible by the conferences held that summer, was shown by the fact that another 20,000 joined during the next three months.

By Oct. 1917 the percentage of women and girls to the total number of workpeople employed in industry, commerce, agriculture, transport and Government establishments had risen from 24% to 36% and nearly 1,500,000 women had been drawn into these occupations. By Nov. 1918 there was a 50% increase in the number of females employed in the same callings, representing 1,750,000, though, as has been stated, the addition to the total number of employed women was only 1,000,000. This is accounted for by the fact that over half of the 750,000 which makes the difference were persons who had previously been employed as dressmakers or domestic servants, while the rest had been outworkers of other types who were drawn into munitions work either by patriotism or by the superior interest and rates of pay. At the same time very large transferences of labour were taking place within the framework of industry, for by no means all of the great trade groups shared in the general war expansion. Thus, while industry proper, on a balance of prosperous and declining sections, showed an increase of just under 800,000, the figures for the textile trades fell by over 50,000, for paper and printing by 7,000, and for clothing by 56,000.

After the War.—From Nov. 1918 the fall in numbers naturally begins, but up to July 1920—which is in some ways a better date for the purpose of comparison than Nov. 1920, though figures for that month will be found in the tables accompanying this article—there were still 28,000 more women and girls in industry than there were in 1914, and 824,000 more women and girls in industry, commerce, the Civil Service, transport, hotels, theatres, etc., taken together. These figures amount to a loss of women for industry of 512,000, between the Armistice and July 1920, as compared with the 800,000 who entered during the war, and for the larger group of occupations already referred to a corresponding loss of 824,000 as against their gain of 1,648,000. On the other hand the 86,000 women in the women's services had all been demobilized, and so had most of the 60,000 women V.A.D.'s, who, however, being voluntary workers, have not been taken account of in these figures. In July 1918 1,458,000 women were stated to be directly replacing men and 1,874,000 were on Government work, including the Civil Service, the women's services and the land army, but not workers in hospitals. The last figure, however, must be accepted with caution, as many of the contracting firms were not in a position to make accurate returns, and others varied in their views of the basis on which their figures should be compiled. Firms accepting contracts to be filled from stock already in their warehouses could not tell, while the goods were in process of manufacture, which part would be bought by the Government and which by private firms, nor which of their private customers were purchasing the articles against Government orders. In addition to this, many workpeople were engaged for part of a day or week on Government contracts, and for the rest of their time on the firm's normal work. Some firms returned all their munitions work—a far wider and vaguer term, and one made continually more wide and vague by various decisions of the Courts—as Government work, and generally there was a tendency, in view of the privileges it conferred, to bring as much under this head as possible, even when the figures were supplied for statistical use.

These increases in the numbers of women employed in 1920 as compared with 1914 are interesting because they seemed to show that the war might result in a permanent growth in the industrial use of women. The natural growth of the population explains a certain part of them, but it should be noted that whereas the number of males employed had grown during the same period by only 177,000 on a 1914 figure of nearly 10,000,000, women had increased by between four and five times that number on a pre-war figure of 3,250,000. This discrepancy cannot nearly be explained by the casualties. Moreover in commerce and finance, where the rise for women is 344,000, there is an actual decrease for men of 155,000. These figures may alter again to the detriment of women; but, except in so far as bad trade causes general unemployment, there is no obvious reason why they should alter much. The replacement of the temporary women workers has not been left to economic factors which might be thought not yet to have operated to their full extent. On the contrary, non-economic pressure has in many cases prevented employers from keeping women they would have wished to keep. Under the Munitions of War Acts certain trades have been compelled to discharge all women and girls brought in to do work formerly done by men or boys. Trade agreements have had the same wholesale effects in other cases, though in both groups of occupations the natural tendency may be deduced from the fact that new firms, not within the scope of the pledges, are making a large use of women. And in addition to this practically every employer of women has been confronted by a campaign, both sentimental and practical and in some cases bitter, against their continued employment. It has been carried on partly by, or on behalf of, the returning troops, and partly by the men in the industries in which women had been working, and has certainly resulted in the dismissal of large numbers of them who were performing their work to their employer's satisfaction. These causes, though effective, are for the most part temporary in their effect, but those that tend to the increased employment of women are more lasting in character. The war advertised the fact that women are suited for a wider range of occupations than most employers—who as a class tend to be ignorant of what is going on in industry outside their own affairs and those of their immediate friends—had realized. They are also on much work very much cheaper than men. Before the war their average wages were about half those received by men for the same work. In many trades during the war this proportion rose to two-thirds. But even in 1921 in the work which women do well, this discrepancy was a good deal greater than the difference which would be warranted by the difference in their value to their employer; and wherever this is so the employment of men on that work, if women are available, must be regarded as a luxury. It is one of which many employers, for good and bad reasons, are most unwilling to deprive themselves, but falling prices and restricted demand will operate to increase the desirability of the women. Further, they themselves had learned to prefer a life outside the home, to employment within it, while the losses of the war and the diminished prosperity of the nation turned for many of them a matter of choice into one of necessity. It might therefore be thought probable that though the bulk of the work to which women were introduced during the war had by 1921 disappeared or been taken from them, their share of paid work outside private houses would remain considerably larger than it was before the war and also more varied, and it was likely that these new opportunities of employment would be large enough not only to absorb the new workers but also to draw upon the supply of those who would formerly have undertaken domestic service or employment in small workshops.

Number Employed.—The table on next page gives the figures of British women's employment for July 1914, Nov. 1918, and Nov. 1920; the numbers employed on Government work; and the numbers stated to be directly replacing men. It should be noticed that they do not include outworkers, or persons employed on their own account, or employers.

Workers Classified.—The first winter of the war did little more than absorb the workers who had been thrown out of employment during its opening months. They moved from one part of the clothing trades to another, from cottons on to woollens, and from cotton, too, on to metals, from little brass rings and tips and handles and discs and plates on to fuzes, from lace on to leather, and from the food trades into the filling factories. The conditions were more or less familiar, and as far as they could they chose work that was similar to their own, for at this stage no arrangements had been made for training any abnormal proportion of new workers. The supply lasted until the beginning of the next year, as is shown by the fact that of the 79,000 women who enrolled in March 1915 for the Women's War Register under 2,000 had been placed by June, as all vacancies were first offered to suitable applicants on the ordinary register of unemployed persons. When these came to an end industry could still be fed from the immense reserve of fit and experienced workers created by marriage. Former employees in the printing and paper trades, textile trades and boot and shoe trades, returned to the workshops in very large numbers, a few going straight on to munitions in the narrower sense, but most preferring to take up their former employment in order to replace men who had entered the army, or the younger women who were beginning to drift away to more enticing work. It was for the sake of the Lancastrian cotton weavers that the policy was adopted of scattering the new National Factories through the chief provincial towns of the north instead of erecting them in the old armament centres under the eyes of the great armament firms, and it was on their skill and experience that the Ministry of Munitions was able to base its new programme.

These married women perceptibly altered the type of woman munition worker. They increased the average age, and, being tied to their homes and so restricted in their field of possible employment, they reduced the amount of wastage. On the other hand they were in certain respects undisciplined—it was never found possible to apply to them, for instance, the provisions of the Munitions of War Act with regard to Leaving Certificates—and their bad time-keeping, due to the pressure of domestic duties, detracted from the value of their work.

Their movement into industry continued roughly all through the autumn and winter of 1915. They came partly as a result of the feelings that were aroused by their husbands attesting or entering the army, and partly as a result of the appeals that the Government were now making to them. By the spring of 1916, however, the supply was falling short. Congestion was increasing in the munitions areas, and many married women, instead of themselves earning wages in the factories, were taking toll of the wages of others, by letting rooms for sums which were sometimes increased concurrently with every increase in wage rates. Demand for women's labour was rapidly growing, and in March 1916 the Central Committee on Women's War Employment (Industrial) was set up by the Home Office and the Ministry of Labour, and established local committees to superintend on the one hand the recruitment of suitable women and on the other their housing, reception and general well-being outside the factory.

British Women's Employment, 1914, 1918, 1920.

Nature of Work	Women and Girls Employed				No. on Government work in July 1918	No. stated to be replacing males in July 1918
	July 1914	November 1918	July 1920	November 1920		
Building	7,000	31,000	9,900	9,900	18,000	11,900
Mines and Quarries	7,000	13,000	9,600	9,500	6,000	6,900
Metal Trades	170,000	597,000	305,000	287,000	534,000	194,200
Chemical Trades	40,000	103,000	71,000	68,000	66,000	33,700
Textile Trades	863,000	818,000	883,000	840,000	335,000	65,500
Clothing Trades	612,000	556,000	571,000	530,000	142,000	45,900
Food, Drink and Tobacco Trades	196,000	231,000	241,000	226,000	37,000	62,600
Paper and Printing Trades	148,000	141,000	165,000	162,000	40,000	21,200
Wood Trades	44,000	83,000	65,000	61,000	40,000	25,600
Other Trades (including Gas, Water, and Electricity under local Authorities)	90,000	156,000	138,000	132,000	73,000 (private firms only)	46,000
Government Establishments (Arsenals, National Factories, Dockyards, etc.)	2,200	247,000	6,300	5,100	225,000	187,000
Total in Industries, including Municipal and Government Establishments	2,179,000	2,976,000	2,464,000	2,330,000	1,516,000 (not including municipal)	700,500 (not including municipal)
Municipal Tramways	1,200	19,000	3,100	2,900	..	..
Tramways and Omnibus Services (other than municipal)	400	9,300	2,700	2,500	..	..
Railways	12,000	66,000	29,000	28,000	..	..
Docks and Wharves	Number of females employed insignificant.					
Other Transport	4,600	21,000	11,500	11,300	..	..
Total in Transport Work	18,000	115,000	46,000	45,000	..	79,500 (excluding municipal tramways)
Banking and Finance	9,500	75,000	56,000	55,000	..	59,500
Commerce	496,000	880,000	794,000	792,000	..	352,000
Total, Finance and Commerce	506,000	955,000	850,000	847,000	..	411,500
Hotels, Public Houses, Cinema Theatres, etc.	181,000	222,000	242,000	235,000	..	44,500
Teachers (under local Authorities)	142,000	154,000	140,000	152,000	..	..
Hospitals (Civil and Military)	33,000	80,000	37,000	37,000	..	..
Other Professions (persons employed by Accountants, Architects, Solicitors, etc.)	18,000	40,000	38,000	38,000	..	22,500
Municipal Services, not covered above	54,000	75,000	74,000	75,000	..	..
Civil Service	66,000	228,000	120,000	112,000	230,000	153,000
Women's Services (Naval and Military)	80,000	..	..	..	80,000	80,000
Land Army	30,000	..	..	..	..	30,000
Grand Total	3,307,000	4,845,000	4,051,000	3,871,000	1,826,000	1,521,500

The new efforts tapped new sources of supply. Along with women from the normal industries of Great Britain totally unskilled workers had now to be engaged. They included dress-making hands, domestic servants, girls from school and married women unused to factory life. Of these the domestic servants, with their more adaptable intelligence, comparative readiness to take responsibility, and good physique, were perhaps the most valuable. They are stated by employers to have been much sought in marriage, and to have affected considerably the habits and outlook of the ordinary industrial workers with whom they were brought into contact. They certainly showed no eager desire to return to domestic service.

The married women were said to be less quick to learn, and less disciplined in the sense of observing regulations. On the other hand they were considered very hard workers, and in some cases—as was natural on the part of women, most of whom were soldiers' wives—formed a definitely anti-strike body during serious industrial disputes. The last class of married women to be touched were perhaps the village women, large numbers of whom were recruited by the land army, and taught afresh the agricultural work which had been familiar to their great-grandmothers. They were difficult to persuade, being shy and unwilling to defy village gossip, and further—as is so often the case with poor men's wives—they were chained to their houses by a lack of proper clothing, neither their coats, their skirts, nor their shoes being suitable or adequate for an outdoor life. It was only when outfits were provided, and the idea of women on the land had become commonplace, that it was possible to induce them to come forward.

The girls from school perhaps suffered more than any other class of women engaging in war work. They were particularly sought after by bad employers, for though quicker than any older woman to train, and often able to produce as much as an adult woman, their rates of pay were very much lower and they could be dismissed as soon as they demanded an adult wage. Even so, however, their pay was enormously more than the half-crown or five shillings they would have received as learners in pre-war days, and this, and the independence of spirit and habit which flowed from it, were supposed to exercise a widespread demoralizing effect. By the end of the war the output of the younger workers was said to have fallen, and great anxiety for their moral condition was felt by parents, officials and certain employers. It is, however, difficult to isolate this alleged fall in output from the general fall in output that was taking place in many industries, or to separate out the factors which caused exceptional demoralization, if any existed, in this particular class. It is certain that the end of the war found them in a more helpless position even than other women. Their training on munitions work was of little use to them when they sought to enter regular industry. It had been restricted as a rule to a few standardized operations on a particular garment or article, and employers refused to accept it as entitling the women to ordinary rates of pay on ordinary work. The learners' rates which they were prepared to give were in many cases little more than pocket money, and always quite inadequate to the support of adult women whose parents were as a rule no longer able or willing to maintain them. By lack of knowledge and of suitable clothing—here again a serious factor—by taste, associations and personal habits, they were disinclined to enter domestic service and unfitted for the life it offered, and at the time of the

Armistice they were acknowledged to constitute a serious problem and a grave responsibility for the Government which had recruited them. Efforts were made to deal with those still juveniles, but the large numbers who had reached the age of 18 during the course of the war were left outside them. At that date they were themselves very generally alarmed as to their industrial prospects, and it was agreed by all those watching the situation, including the trade-union officials, that if immediate training were offered under suitable conditions it would be possible to attract large numbers of them into domestic service, which was not only the one opening available but the direction in which their labours would be socially most beneficial. Schemes agreed to by the trade unions were put forward by the Ministries of Labour and Munitions, but the Treasury, though obliged to permit the payment of unemployment donation to women in idleness, were unwilling to allow the relatively small additional payment which would have coupled it with productive training. A restricted scheme was finally set up which provided training in occupations which had been recognized as women's work prior to the war, and within the limits imposed it was very successful. It was not, however, able to reach the bulk of the women who most needed it or to provide a satisfactory flow of recruits for domestic service.

The other great class which entered wage-earning occupations as a result of the war were the women from secondary schools and universities, who had looked forward to leading idle lives, or to entering the teaching profession. They flowed rather into commerce, finance, the Civil Service and the war services than into industry, but the comparatively small numbers who did enter the munitions factories exercised a disproportionate influence. It was they as a rule who made it possible to set up women foremen, supervisors, and charge hands, and it was generally those better educated women who were first placed on really skilled or technical work. The managing director of the one great marine-engineering shop which trained women to perform the whole of a skilled man's work done in that shop, *i.e.*, to perform any operation of which their machines were capable, accepted only girls from the secondary schools. He stated that in his opinion this degree of intellectual training was essential if they were to learn the work in the time allowed—about six months—and said, too, that his men made far less objection to training them than women of the industrial type whom they regarded as potential black-legs. The Ministry of Munitions Training Department also laid great stress on the importance of general education, going so far as to select only girls with a secondary school education for training in fitting and turning. The educated women had also a good effect upon conditions. Bad employers were restrained by their intelligence and independence from taking advantage of their more helpless companions, and good employers and welfare officers found them a useful channel of communication with the staffs when introducing health services, canteens etc. It is also probably partly due to them that the number of women trade unionists doubled during the war. The figures are said to be 350,000 for 1914 and 660,000 for 1918, but they only pretend to being estimates, and it is probable, owing to the tendency of women to enter their names after a meeting and then to lose all interest and pay no further subscriptions, that they are a good deal too high.

Women of a superior general training were found especially useful in instructing, commanding and supervising other women who had often in the past resented the elevation to authority of one of themselves. In the women's services and the land army this aspect of their work was of the first importance. On the land, particularly, their comparative acquaintance with the country, and their relative indifference to dark and loneliness, persuaded the town recruits to endure the terrors and discomforts of winter, while vestiges of feudal feeling gave them authority with the country women. In fact, wherever the work ceased to be purely physical, and more and more as it took on an intellectual quality the extent of a woman's education was found to determine her aptitude for learning and performing new work. The university women especially, in spite of the fact that those available for war-work were still largely of a uniform type—that which had been preparing itself for the teaching profession—found that their training immensely increased their comparative value in almost every direction, even where their instruction had not led up to, or especially fitted them for, their war duties. It is hardly surprising, however, that the best work of all from a technical point of view was done by those who had been specifically trained for the jobs they undertook, like the women physicians and surgeons and the women employed on scientific research in the National Physical and Chemical Laboratories. It is more to be wondered at that so much could be done by women and girls divorced from familiar surroundings, and set to adapt themselves to entirely novel systems of ideas, and to compress the training time of years allotted to men into a few months or weeks. Not even the atmosphere of the army can have been so foreign to the new soldiers—who as a rule had some notion of its main structure and had often experienced some form of communal existence—as were industrial and even commercial life to the girls who entered them from their day schools and their middle-class homes. And yet they adapted themselves to these new values, not only from duty, but with an enthusiasm and a quickness which seemed to show that the labour, and the variety and the tension, were congenial to their natures.

Quality of Work.—It is not possible here to attempt a final estimate of the qualities their work revealed, but testimony seems to agree on certain points. Above all they were conscientious; they were devoted. As long as they retained interest in their work they endured degrading conditions through monotonous periods of overstrain without apparently accumulating the resentment which from time to time flared out among their male colleagues; instead their health suffered. This tenacity was perhaps due to their stronger imaginative hold on the purpose to which they were giving themselves up. In relation to their environment, on the other hand, they were docile and lacked imagination; as a body they acquiesced in the conditions they found and made no concerted effort to change them. When they felt that the life was intolerable they left it, and the active combative temper of the men roused no response in them. As individuals they were less disciplined than men, less calculable, less impressed by traditions and institutions, giving an effect, for all their high spirits and quickness of tongue, of greater detachment. In the mass they were difficult to organize, elusive, fatalistic, sceptical and inarticulate. If they did combine they were faithful to their leaders, whom they preferred of a sensible and reasoning rather than of an idealistic type. Policy too, to obtain their approval, must be direct, concrete, and likely to produce an immediate effect. They were fortunate in their representatives, and the knowledge, ability and public spirit of the women trade-union officials secured for them an influence to which the numerical proportion of organized women would not have entitled them. Women might well have been proud to support societies to which they owed so much. But they seem as a rule to have left them when they left munitions work. They went back each to her private anxieties and hardships, showing no desire to continue banded together either to protect their interests or to continue their relationship, and seeking no outlet for the sense of injustice which some of them felt. A few of the ex-service women formed clubs and groups under the leadership of their old officers, but not the hundreds of thousands of munition workers, clerks and civil servants whose service took a more democratic form.

Effect on Industry.—It was not without difficulty that trade and industry were adjusted to fit these feminine millions. From the winter of 1914 the Government had been anxious to extend the use of women for the production of munitions, and in the summer of 1915 agreements were signed with the engineering unions which removed in theory the main barrier to their employment on men's work in the metal trades; but it was not until the spring of 1916 that substitution made any real headway. The employers had first to be convinced that they would not cause more trouble than they were worth, the factories had to be prepared for them, the work adjusted to suit their strength and skill, and, hardest of all, the men in each shop persuaded not only to submit to their presence but to coöperate actively in helping them to learn and to carry on their work. The women themselves meanwhile had to be trained. From July 1915 onward the Ministry of Munitions, in conjunction with the Board of Education, was teaching women with great success in technical schools and instructional workshops—for the first year, simple repetition work on shells and fuzes; later, work on aeroplanes and for positions as tool-setters, inspectors or charge hands; and, finally, the really skilled work of fitting and turning.

In all the Government schools trained 45,000 women, and very large numbers were trained by those private firms who preferred to give their own instruction. Under both methods it was found that they were good material, and that the period required before they could be fitted into their niches in the new schemes of mass production was shorter than anyone had thought possible. But the teaching of the women was the least of the trouble. To the last a certain number of employers were hostile to their introduction, and by more or less overt collusion with their staffs could make it impracticable or unsuccessful. Where this was the case the only weapon of the Government was to create a shortage of labour in their works by removing their War Munitions Volunteers and adopting similar coercive measures. This could not always be done in the face of the representations which the firm were nearly always able to secure from the Supply Department with whom their contract was made, that upon its instant fulfilment depended the issue of the war. Employers anxious to support the Government as a rule found the carrying on of their work under war conditions sufficiently harassing with a competent male staff: they could not be expected to welcome a change which meant providing special new accommodation—a much more troublesome matter than might be supposed in town factories where every inch of space was already needed; reconsidering each one of the methods to which they were accustomed, and antagonizing their staffs, in order to bring in labour certain to be relatively inefficient for the time, and of unknown potential efficiency. Their grounds of objection were substantial and their position strong, and it is to the credit of industry that some of the larger firms forestalled the Government in their introduction of women's labour. To effect this it had been necessary to bring the bulk of the work—all of which in some firms had hitherto been carried on entirely by skilled men—within the average capacity of untried and almost unskilled persons. Of the three grades into which it could be roughly divided—skilled, semi-skilled (which included the repetition work), and unskilled and labouring work—the last required the most adjustment and was the least easy to adjust. Every device that was possible was provided, regardless of expense, to minimize the strength required in lifting, hauling, loading, stoking, scraping boilers, and the specially hot and heavy work done in foundries and retort-houses, chemical works and tanneries. At the end of it all, the employment of women on this work was costly and ineffectual. Three women were needed on an average to do the job of two men, and at special points one man's work would occupy two or even three women, while the hardest jobs had now to be performed continuously, instead of as part only of their task, by the remaining men.

On repetition work the sweeping changes that were made were due not so much to the sex of the new operators as to war conditions. The subdivision practised was the natural result of mass production, and has remained where mass production has remained, though men have replaced women at the machines. The fool-proof devices were a protection against the lack of experience of the dilutees, whether men or women, and they too have survived as a means of decreasing worry and improving output.

On neither of these grades, where they already existed as such, did the men make serious opposition to the coming of women. The general unions to which most of them belonged were not before the war the centralized and powerful bodies they are now; they had been able to establish few privileges, and their men were at the mercy of the recruiting officers. They therefore treated the matter as one of individual feeling rather than of labour policy, and were entitled to more gratitude than they received from their country for the unselfish way in which most of them helped the women who were to fill their places and make it possible for them to be spared for the army. It was the splitting up of the skilled work, and the consequent reduction of many of its parts to a semi-skilled rank, which produced the bitter opposition which increased rather than diminished as the war went on. This was due in some degree to mass production but more to the shortness of the training which was all the urgency of the times allowed. The strength of the women was insufficient for labouring work, but by the end of the war it became clear that they did not lack the intelligence and character necessary for the acquirement of an exacting technique. What follows is the official verdict of the Ministry of Munitions:—

"Many women might become skilled mechanics, given the necessary training and experience. But these were precluded by the conditions under which munitions were manufactured. Intensive training sufficed to meet the emergency of the moment but it was no substitute for a thorough apprenticeship; and the (male) apprentices who were up-graded under schemes of dilution suffered like others from premature specialization. Subject to this limitation, there were few branches of skilled work which some women did not execute with success. They made tools and gauges to the finest limits, they set up complex automatics, they machined and fitted the most delicate mechanisms, they inspected the rifling of guns and mastered the use of the micrometer and vernier, they conducted scientific tests in the laboratory, they acted as charge hands and forewomen."

Had the war continued they would have been used upon this work in increasing numbers. As things were, however, it was more economical, given the large output, to train them and the male dilutees with them, to do one particular part of the complex job which a skilled man had been accustomed to carry out, and whose more difficult portions only were now left for him. Most of the work of a skilled category given to women was actually work which had been treated in this manner. For such subdivided tasks they were found perfectly suitable, and the checks to their more extensive use were, in the first place, the uneconomical rates of wages which the men's unions had imposed as the price of dilution; and secondly, the almost desperate opposition with which their employment was met by the skilled men. It was not only the employers who objected to giving a woman the full rate of a skilled man when all she could do was one among his many different jobs: the men actually working with them, however much they agreed in principle with the system of the rate for the job, could not bear with equanimity the sight of raw, unqualified women receiving wages almost equal to their own.

The obstructive policy pursued by the skilled unions was directed as much against mass production in general as against women in particular. They knew that the women must go after the war; but they feared, not unnaturally, lest the new methods and processes should stay, which meant working toward a state when the skilled man who could not find employment in the tool-room, or as a supervisor, or on experimental work, would find himself degraded to the position of a machine-minder, with his privileges gone, the interest of his life as a craftsman gone, his standard of living in danger, and the prospect before him of becoming gradually merged in the masses of the semi-skilled. Much of this had happened in America, and the utterances of certain employers gave ground for thinking that in England it was at least desired. In small sections of the metal trades they could almost see it coming to pass. On sheet-metal work, for instance, machines and processes were brought in by which women and boys could perform rapidly and cheaply work which had been slowly done by hand by skilled sheet-metal workers. The men were released for the army and left knowing that their work would be gone if ever they came back. It was no wonder that opposition was felt at such a time to this acceleration of the process by which industry develops for the benefit perhaps of future generations but to the hurt of those whose whole equipment for life is their suitability to one of its changing industrial phases.

If this was the origin of the continued disputes that attended the incoming of the women, they were embittered by the fact that nothing was more vague, or varied more from district to district, than workshop practice with regard to demarcation of work. Some shops were entirely staffed by skilled men and apprentices; others did the same work with a few skilled men and a residuum of semi-skilled machinists, unskilled men and boys. Claims were put forward by the unions that work should be treated as skilled and carry the skilled man's rate—which would have covered half the work habitually done by boys; and the employers on their side seemed to consider that the slightest change in a job handed over to women dropped it at once to the minimum labouring rate. These quarrels, at first more or less local, so far from being settled were growing in intensity when the Armistice removed their cause. They did not begin until the autumn of 1915, when the introduction of women on to certain machines in Glasgow opened the troubles on the Clyde.

As will have been gathered, permission to employ women on men's work in the engineering trades had been gained at the price of a wages settlement, intended not so much to benefit the women as to protect the skilled man's rate. It maintained piece-prices and stated that the skilled man's time-rate must be paid to women undertaking a skilled man's work. These compacts, known as the Shells and Fuzes Agreement and the Treasury Agreement, were arrived at in March 1915 between the Government and the engineering unions, and it was hoped that dilution would immediately follow upon them. Unfortunately they did not produce the results expected, and in July it was found necessary to supplement them by statutory powers under the Munitions of War Act. In Sept. the new Ministry, impelled by a pledge given by Mr. Lloyd George in July that there should be no sweated labour in the munitions trades, appointed a committee to settle the wages of the women, who were by this time fast entering the metal trades. The committee, representing the Ministry, the trade and the women, recommended the time-rate of £1 a week for women on men's work other than skilled men's work. This rate, though finally nearly doubled by the awards issued from time to time by the special Arbitration Tribunals to which claims for increases were referred by the Ministry of Munitions, remained the basis of their payment throughout the war, and the standard by which wages were unavoidably fixed for other classes of women. Thus women on munitions work other than men's work came finally to a basis rate of 5½d. per hour. The £1 rate was imposed on the National Factories—already among the largest employers of women—and handed on as a recommendation to private munitions firms, a method which was found inadequate to ensure payment. It was therefore embodied in a Statutory Order, binding upon all controlled establishments under Sec. 5 of the Munitions of War Act. From that moment State regulation of the wages of women on munitions work, under pressure from trade unions representing both the women entering and the men displaced, became more comprehensive every few months, until at the time of the Armistice the Ministry of Munitions' orders covered about 2,000,000 women employed in 27 trades, and a similar number were covered by arrangements made with the Admiralty and the War Office. The work of dealing with women's wages was then taken over by the Ministry of Labour in accordance with the provisions of the Wages (Temporary) Regulation Act, which lapsed only in the autumn of 1920, leaving the general level of women's rates in the trades affected at about three times the very inadequate amounts—11s. to 12s. on an average—that had been usual before the war.

This regulation was the price of dilution, and it was only natural therefore that men anxious to oppose dilution should pick endless quarrels with the interpretation placed upon the wording of the agreements and pledges by the Government departments concerned, and also with their carrying out of their own orders. Into the details of these controversies it is not possible to enter here—the whole subject is covered by the report of the War Cabinet Committee on Industry which sat to consider the question, as well as to deliberate on the theoretical problems of women's wages. On the whole it may be said that the real basis of the men's charges was their objection to dilution and not any important dereliction on the part of the Government. Until the end of 1920 the women in the industries which had been engaged on war work were adequately protected, and they themselves realized this, and showed that they did so by the steadiness and docility with which they continued to work in the face of incitements to unrest. From first to last the time lost by strikes among women on munitions work was negligible, and only one case was brought to light where they were really restricting output.

While this was going on in the munitions trades proper—which included among others shipbuilding, engineering, electrical engineering, ordnance and aircraft work, wire-rope, cables, hemp-rope, tubes, iron and steel manufacture, scientific and optical instrument making, and the manufacture of explosives, chemicals, rubber, asbestos, packing-cases, and tin boxes—the recruiting crisis which took place in the winter of 1915 forced other trades to take steps to denude themselves of men and carry on with women's labour. This was done as a rule under national agreements between the unions in a trade and the employers, and it was generally made clear that the work handed over to women would be relinquished by them at the end of the war. They also dealt as a rule with wages, laying down rates which equalled in some cases—though not as a rule in industries where women were expected to be admitted to truly skilled work—the whole man's rate. For instance, women on men's work on the railways or on process work in the seed-crushing mills, started at the man's minimum rate, but most of the agreements provided roughly for equivalent pay for equivalent work. Allusions were also made to the conditions under which the work was to be done and to measures designed to protect the women from injury to their health. These agreements were concluded without much friction and were carried out as a rule in a generous spirit.

Agricultural Work.—The other great industry where the introduction of women caused trouble was agriculture. In spite of the efforts and the efficient organization of the Women's Land Army, and in spite of the satisfactory work acknowledged to be done by the women, the increase in their numbers during the whole war was only 33,000—less than 50% on the 1914 figures of 80,000. To these must be added some of the women entered under the head of casual labour, but it is not a good turnover for a trade employing so large a number of men. The cause was partly the obstinate refusal of the farmers to employ women—which in itself rose in part from their dislike of parting with labour often consisting of their relatives and always more closely tied to them than the town workman can be to his employer—and partly to the fact that work on the land did not prove attractive to women. The country women were not of the temperament which embraces novelties, and the town women disliked being billeted among the hostile farmers, and also the discomforts of a country winter. In the few districts where the custom survives of women working on the land, such as Eversham, a district of small-holdings, there was further discouragement from the country women, who disliked the introduction of "dressed-up" strangers into the fields where they were accustomed to work in their ordinary long clumsy skirts. It was finally found necessary for the land army to cover the country with an organization which would keep in touch with practically all its members, to provide boots and outfits for recruits, to arrange for camps where women could live together, and in short to abandon the view that women could be expected to go on the land as self-sufficing units. As an army—an alien force imported into the countryside—it was found possible to introduce them to all the lighter and much of the more skilled work of agriculture with excellent results, but it is probable that only after two generations of such employment would the industry be prepared to admit that the experiment had been made and had proved successful.

The Civil Service.—In the army, navy and the air force the prolonged resistance with which the idea of employing women was met for so long came entirely from the employing or official side. By their male colleagues they were received not only with acquiescence but with pleasure, and as they had obviously to live in segregated units they were not grudged their inevitable proportion of responsible and well-paid posts. Into the Civil Service, on the other hand, they were early welcomed; but, once there, only a very few individuals from among the 162,000 recruits, who included numbers of women with university degrees, were given any opportunity of earning any salary that any man might have envied, or of rising to any work superior to that of secretaries and clerks. Where they were found in such positions it was almost invariably either as supervisors of the women staffs or because the work of their branch related to women and the appointment had been made as a concession to public opinion, as in the case of the women in the Ministry of National Service, and the Women's Wages Section, and the Welfare Section, and the Dilution Section of the Ministry of Munitions. The most liberal department in employing women on well-paid work which might have gone to men was the Ministry of Food.

It may be said that, even in the establishment divisions, their appointment represented a victory, for so late as the autumn of 1915 one Service department, employing thousands of women and girls, was refusing to pay any of its women university graduates more than 40s. a week, or to provide the staffs with a single woman in authority to whom they could go if in difficulties. Hardly at all, and only by the new type of minister, was the policy pursued of bringing in distinguished women to deal with special women's problems, although men with special experience were brought in by the dozen. Such an experiment would have been of very great value. The demobilization of these enormous bodies of women took longer than had been expected; in fact, it had hardly begun when the passing of the Sex Disqualification (Removal) Act made it necessary for the Civil Service commissioners to consider the terms on which they should be admitted to the higher grades of the permanent service. The task of framing the general principles under which they might enter was entrusted by them to the newly formed National Whitley Council for the clerical and legal departments of the Civil Service, which, as it happened, was preparing to bring forward a scheme of reorganization for the entire service. This scheme, since agreed to by Parliament, provided that, with certain exceptions, women were to be admitted to the general work of the Civil Service with the same status as men. They were not, however, for an experimental period not exceeding three years, to receive the same pay for their work; and they were not to compete for posts with men but were to be appointed to a special proportion of posts which each department was to reserve for them; nor were they to enter by competitive examination but were to be chosen by a selection board. These conditions, especially that dealing with pay, were accepted by the women's representatives under protest, as they considered that the Civil Service together with the teaching profession were fields in which equal pay was not only eminently just but peculiarly desirable, and its opposite calculated not merely to injure the prospects of the women directly affected but to diminish their opportunities of doing valuable work. It was necessary, however, to accept such terms as part of the temporary bargain, and the Treasury proceeded to appoint a Director of Women's Establishments and to persuade, or endeavour to persuade, those branches of the service—such as the National Physical and Chemical Laboratories—where women scientists selected solely for their ability had been receiving the same salaries as men, to reduce the scales of the women on their staffs in accordance with the new arrangements for the clerical class. They took no steps, however, to admit women to the higher grades of the service, preferring to suggest that the Government should remove from the purview of the Whitley Council the question of the employment of ex-service men in the Civil Service—one of the matters definitely referred to it under its constitution—and hand it over to a committee largely composed of members of Parliament. Under shelter of the recommendations of this committee, which were at once adopted by the Treasury, even though they conflicted with the agreement signed by the same officials, the principle of admitting women to the general work of the service was abandoned, and ex-service men were appointed to all posts of which it could not definitely be said that it was impossible to employ anybody but a woman, including a number which had always been filled by women because they were concerned with the health, welfare, wages, or conditions of women. The appointments were made possible by a process of combing-out which took no account of qualifications, knowledge, or experience, and concerned itself solely with financial considerations.

On Aug. 5 1921 a debate took place in the House of Commons on the regulations framed by the Civil Service commissioners for carrying out the Whitley scheme. It was pointed out on behalf of the women that the regulations ran counter to two separate votes of the House in favour of equality of treatment; and a motion was brought forward designed to secure for women the same pay and the same conditions of service as are enjoyed by men doing the same work. Under pressure from the Chancellor of the Exchequer a compromise was finally accepted under which the regulations were confirmed for three years; a promise was given that after that time women should be admitted in the same way as men—except that the Civil Service commissioners should have power not to appoint a woman to any post for which they considered a woman unsuitable—and work under the same conditions as men, except that they might not marry; and that the question of equal pay was for further consideration. It was also promised that women establishment officers should be appointed in departments employing considerable numbers of women; but a motion to the effect that some women should be admitted to every grade was not accepted.

Industries Chiefly Affected.—The most striking transfers of work from men to women naturally took place in the aircraft and metal munitions trades, because it was they which expanded most during the war, and they also were the objects of special pressure from the dilution authorities. What that pressure amounted to may be shown by the fact that in Jan. 1918 firms working for the Admiralty, which controlled its own dilution, employed 458,000 males and 52,000 females, while firms working for the War Office, Ministry of Munitions and Air Force employed 476,000 males and 235,000 females. In Nov. of the same year the Royal Naval Torpedo Factory, Greenock, employed 2,706 males and 372 females—13.7%; while Woolwich Arsenal employed 40,000 males and 24,000 females, or 60% of females.

Next perhaps comes transport, with its uniformed women driving cars, collecting tickets and acting as conductors, guards, goods porters and signal-women. After these and the land, the change was most easily seen in the brewing industry, and in hotels and public-houses, both of which successfully employed large numbers of women on men's work during the war. Possibly 25,000 women came on to aircraft wood-work during the war.

In aircraft work, women in one Government factory by the end of the war were making the entire fuselage, including the really skilled work of propeller-shaping, and all over the country they were making, covering, and doping the wings, and doing all but the heaviest erecting. This is essentially mass-production work, as every smallest stick is cut to its size before the women touch it, and, as such, it is women's and not men's work, and peculiarly suited to them.

Women's Work Characterized.—It may be said that now for the first time the industrial capacity of women has been minutely considered by critics both hostile, impartial, and biased in their favour. The results of this scrutiny, from whatever source, are favourable, and fairly uniform. The women were more adaptable than the mass of observers had supposed them, they possessed more latent intelligence and greater physical strength, and they withstood far better the effects of monotony. On the other hand, as compared with men, they possess certain general defects which may be summed up as follows: insufficient strength; lack of initiative; lack of interest in the technical side of their work or desire to improve their position by training or qualifying for work requiring more skill or responsibility; comparatively bad health; lack of care in dealing with machines, materials and tools supplied by the employer; lack of steadiness—shown in the frequency with which they left their situations; their bad time-keeping and irregular attendance. It was also frequently given by employers as a reason against their employment that, where they were working with men, the men's output tended to decrease until it was no more than the women's. Excluding labouring work, they were said as a rule, when on men's work, to be worth two-thirds of a man, but where details were given the discrepancy appeared to be less. On some work—light repetition work or work where skilful fingers were required—they were universally acknowledged to be better than men, turning out more work and more contented. On more skilled work demanding more individual variation they were said to produce from 40% to 60% of a man's output. These complaints were put forward as characteristic of women, but it seems possible that some at any rate were characteristic rather of the conditions under which women work in industry. The first contention—that they lack the strength of men—is of course true, though women are stronger than the pre-war employer with his underfed girls was apt to imagine. The progressive improvement that took place in the health and output of those employed under anything approaching reasonable conditions with regard to hours and lodgings showed the effect that good wages, good food and a certain amount of care will produce in even a few months. Moreover, a great deal of the work that men are now expected to do is not only too heavy for women but too heavy for men as well, and ought not to be imposed on any human being. The result of this is that men employed industrially are more and not less adversely affected by the conditions of their work than women, though their health again is greatly superior to that of married women working in their homes—the most suffering class in the community. But, obviously, women are not so suitable as men for heavy work and cannot be made so by any methods which can be foreseen. The most carefully planned schemes all ended by being prohibitive in cost. Another group of defects, their lack of discipline, their bad time-keeping and bad attendance, were really alleged against the married women hampered by household duties. Single women were as good time-keepers as men. If they changed their situations more often it was often due to preoccupations arising out of the war. They wanted to be near the hospital to which their brother or lover had been sent, or they wished to change from shells to aircraft work because their man had entered the air force. All this population of women was preoccupied: often too they had taken up work for the first time without much considering the wages paid and, as the pinch of the war made itself felt, found themselves obliged to go where they could earn enough to keep themselves.

Their lack of initiative and ambition was put down by the employers as due to their knowledge that the work was temporary, and would be brought to an end either by the end of the war or by marriage. The trade unions frequently added that employers, for the same reason, would not be willing to give women a lengthy training. It is probably true that the majority of wage-earning women are so affected by the expectation of marriage that they are unwilling to expend mental effort on their work. But it should be remembered, on the one hand, that the wages of women before the war were so low as seriously to affect their vitality, and, on the other, that the experiment of offering them training in skilled work had never been made. They are perfectly ready to learn weaving, or the skilled work in the dressmaking and millinery trades. The experience of the war would seem to show that a minority of women would welcome it and benefit by it in other occupations. Another thing shown by the war is that apprenticeship periods for the skilled trades, though convenient both for masters and men as long as the school-leaving age remains where it is, are far longer than is necessary to secure industrial efficiency. A skilled worker cannot be produced in six months, but that does not mean that his apprenticeship must last for five or seven years. If anything were to occur which modified this period the increased employment of women on skilled work would become more feasible.

Lack of initiative, lack of care and lack of attention to detail are more fundamental charges. They are possibly true, though to what extent they are true can hardly be proved by the experiment made under war conditions. Most of the women had been living in circumstances which precluded the development of initiative or a scientific thoroughness. Very few minds show initiative with regard to a totally unfamiliar technique so fenced about with terrors as engineering, so immemorially fixed as work on the land or so trivial as most clerical occupations. Nor, to put it mildly, was women's initiative encouraged during the war, though without it there would have been no women doctors and no women in the fighting services. And as those responsible for the education of naval officers know, this quality, like others, reacts to stimulation. What is certain is that in the strength and skill of its women the war showed that Great Britain possesses a valuable industrial resource, whose wider use under suitable conditions would benefit both the women themselves and the industries they entered. Before such conditions can be established, however, a number of problems must be faced, including the determination of the proper ratio of a woman's wage to that of a man performing similar work. (A. B. W.)

UNITED STATES

In 1916 there were probably about 10,000,000 women wage earners in the United States, comprising about one-quarter of the total number of persons gainfully employed. In manufacturing there were about 1,500,000, three-fourths of whom were in the food, textiles, tobacco and wearing-apparel industries, but very few in those industries producing implements of war. The first demands for women were met, as in England, by drawing seasoned workers from such industries as the lighter textiles, millinery, corset-making, domestic service, laundries, stores and offices. After the supply of seasoned workers was exhausted, efforts were turned toward securing women outside the wage-earning class. Married women, many of them former industrial workers, were urged to return to industry. Part-time work was offered and occasionally a day nursery was established. In one city an organized publicity campaign for new workers resulted, after the first two weeks, in a 50% increase in employed women and after the first four weeks in a 100% increase. It was estimated that about 4,000,000 women were employed in war trades and that 2,500,000 remained in the newer fields in 1919.

English experience taught the American authorities to keep the most skilled men at home where they could continue in their usual fields of work, but in attempting to supply the increased demand for workers two main problems arose; first, to secure women to fill routine or semi-skilled positions; second, to secure in those industries which were greatly swollen by war demands not only routine workers but also skilled employees. The demand for additional women in war industries was well illustrated by conditions in the iron and steel industry, where, in 1916, less than 4% of the employees were women. During the war in every branch of this industry the number of women employed increased, between the first and second draft, from 18% to over 200%. In the industry as a whole the increase was nearly 70%, while the number of men increased only about 5% and in some branches actually decreased in numbers. In 111 plants making explosives only 73 women were reported in 1914, whereas after the second draft, 25 plants employed nearly 12,000 women. In this industry women constituted about half the total employees. In the manufacture of hand grenades, about 19 out of every 20 were women. In one gas-mask plant with 12,000 employees, 8,500 were women.

Industries showing the largest per cent of increase in the number of women after the second draft were cars, steam and electric railways, automobiles, metal and metal products, lumber and its remanufacture, chemicals and allied products. Industries showing decrease in per cent of women employed were textiles, hat and cap making, tobacco and tobacco products. Industries showing the greatest ratio of substitution were motor-cycles, bicycles and parts, cars, steam and electric railways, automobiles, airplanes, seaplanes and parts, ship and boat building, agricultural implements, lumber and its remanufacture and iron and steel; the latter industry substituted by far the largest number of women. In practically no case did all the different establishments in any industry employ women and an even smaller number substituted them for men. The practice of the employment and substitution of women was largely a matter determined by the individual establishment. In iron and steel, for example, out of 2,140 firms reporting after the second draft, only 1,011 employed women and only 430 substituted women for men.

Before the war women were employed in clerical work in connexion with the railways and as ticket sellers on a few street railways. One of the most striking war innovations was the employment of women in such positions as station agents, ticket sellers, cleaners, section hands, and elevator operators, in connexion with the railways, and as conductors on the street railways. It is estimated that by Oct. 1918 there were over 100,000 women employed on the railways, and many large cities had installed women as conductors on the street cars. In N.Y. State alone 2,180 were substituted for men on the steam roads and 1,346 on the electric roads. In this state a law was passed limiting hours of women on street cars to nine a day and prohibiting night work between 10 P.M. and 6 A.M. In Wisconsin hours were limited to eight a day and night work was prohibited between 5 P.M. and 8 A.M., which practically prevented the employment of women on street cars during the rush periods. Other large cities employing women and limiting their hours were Chicago and Boston as ticket agents, and Kansas City, Detroit and Cleveland as conductors. In the latter city a controversy occurred over their continued employment, involving several hearings before Federal authorities. The men's union was strongly opposed to them and finally secured an agreement with the company to dismiss all the women and reinstate the men which was carried out early in 1919. A similar situation arose in Detroit with a similar result, but in Kansas City the union did not oppose the women and the War Labor Board ordered equal pay for equal work. In most cases the women were out of the service by 1921, but on railway work 81,000 were reported as still employed in Jan. 1920. The majority of these were in clerical positions, but there has been also a permanent increase in the number of women employed as station agents, ticket sellers, watchmen, and in the business offices. When the roads were under Federal control, the minimum monthly salary for clerical positions was fixed at $87.50, while executive positions often commanded as much as $225 a month.

Efficiency.—The new fields of work tested, as never before, the abilities of women. Although before the war women were employed in practically every kind of work, they were usually occupied on routine or standardized processes. But the war opened to them a new door. "Instead of 'tending' or 'tripping' or 'feeding work,' measured and marked for her, into a machine especially adjusted or constructed to perform a specialized or standardized process, the emergency created by the war forced the experiment of teaching the woman worker to read blue prints, to understand the characters of different metals, to grasp the purposes and capabilities of various machine tools, to adjust their mechanism, to set up, to measure and to mark her own work and be responsible for its quality as well as for its quantity." In these new fields there were of course failures, due sometimes to personal defects—but more often to ill-advised assignment of tasks, lack of proper instruction and supervision such as was so successfully carried on in English munitions work, and also because of lack of proper equipment and accommodations for women. It must also be pointed out that because of America's shorter war period there was but little time for technical training. Although a few trade schools were utilized, reports indicate that training was usually done by the "foremen," "forelady," "skilled operators," or "the gang boss." On the whole, however, testimony of manufacturers from all parts of the country, as reported by several independent investigations, agreed that the women were unquestionably successful. The output of women, according to 66 firms out of 99 in the important metal trades, "was equal to or greater than that of men in the operations in which both were employed." In another investigation from 50% to 90% of the managers in a variety of industries reported that the production, attendance, and promptness of women was equal to or greater than that of men. Employers stated: "On our 24-in. Fellows gear shapers the women turn out from 20 to 30 more pieces in a 9-hour day than men." "In our filling and burring machines . . . they overrun the men about 250 pieces." "On our drill press work . . . they have increased the production 1,200 pieces in a 9-hour day." The president of a recording and computing machine stated: "In the machine department women became expert and got out much greater production in running turret lathes, punch presses, bench lathes, milling machines, drill presses, grinding machines and engraving machines, and in addition to the operation of these machines we taught them to grind their tools, to act as job setters, and to superintend some of the departments. In the inspection department practically every inspector was a woman. In the assembly departments, as well as in the inspection departments, all were women, and they did better work and got out more production than men whom we tried on the job at various times without success. We found, too, that we could place as much, if not more, dependence on women in coming to their work and remaining on the job, which accounts for our having the lowest turnover in help in any factory ever heard of, which was less than 4% per year. We taught women to inspect tools and check them over according to the drawings after they came from the tool shop, in which department women became expert." Although much of the work done by women was repetitive and semi-skilled, requiring mainly dexterity and lightness of touch, yet testimony shows that they frequently and successfully competed with the highly skilled men.

Standards of Work.—In Oct. 1918 the Women in Industry Service (later the Women's Bureau of the Labor Department) formulated certain standards intended to govern the employment of women. These standards were indorsed by the War Labor Policies Board and after the Armistice were revised to serve as a basis for a programme for reconstruction. The recommendations included the 8-hour day, Saturday half-holiday, one day of rest in seven, and the prohibition of night work between 10 P.M. and 6 A.M. They urged equal pay for equal work and an occupational, rather than sex, determination for wage rates, with a minimum which would cover the cost of living for dependents as well as for the individual. Proper conditions of work were specified, and included the prohibition of employment where poisons which are more injurious to women than to men were used. The standards also urged that joint negotiations between employers and employees be established for enforcement purposes. The War Labor Policies Board ordered all contracts of the Federal Government to require full compliance with the labour laws of the state in which the goods were manufactured.

Hours, Wages and Conditions.—With but few exceptions pressure of work did not reach the high pitch which England experienced, and, on the whole, hours and conditions of employment in the United States did not greatly change as a result of the war; the United States profited also by England's experience in regard to the futility of excessive hours of labour, and although many attempts were made to enact state laws which would abolish or lower the existing standards, public opinion was against this movement and on the whole these attempts failed. Less than a dozen states had laws prohibiting the night work of women and the practice of the Federal Government of referring to the state labour departments for investigation any request for permission to exceed legal hours, resulted in a fairly general conformity to existing legislation. In a few cases where night work was not prohibited by law, women did take their turn in the night shift.

Rates of wages during the war fluctuated greatly and several intensive studies were made. One of the larger studies reported only wage rates and showed that in the majority of cases women's wages were admittedly lower than men's. Probably the most exhaustive study was made in N.Y. State by the Women's Bureau of the Labor Department. This study covered 117 plants and 13,643 women who replaced men. Of these women 56% received only two-thirds to three-fourths of the wages paid the men for the same work. Two-thirds of the women received less than $15 a week, and only 190 received $20–$25 a week. From this study it appeared that wages had practically no relation to production or to efficiency. In 11 plants reporting that women produced more than men not one woman received as much as the men and the majority received about three-fourths of the men's wage. Several states and the Federal Government established minimum wage rates in certain occupations for the war period ranging between $13 and $16 per week. A Federal report indicated that in practice the time-rates of women seldom equalled those of men. Piece-rates were frequently the same for both sexes, but the guaranteed wage for the women was usually lower than for men. Another report stated that women's wages ranked about with those of boys—and often with pre-war standards for boys.

General Results.—An important test of woman's efficiency was her permanence in these newer occupations. On this point one investigation reported that "of all plants employing women in men's places over one-half are going to retain every woman so employed, second that 82% are going to retain all or part of the women so employed." In the leading war agency and implement industries the proportion of women per 1,000 wage earners in 1914 was 65; in Oct.–Nov. 1918, 139; in Aug. 1919 the proportion was 100. The reasons for retaining women were of course varied. In addition to questions of efficiency other factors entered. It has already been pointed out that women's actual wages were almost universally lower than men's. Many employers frankly gave as their reasons for retaining women: "greater production at lower wages"; "better work at lower wages"; "they produce more and demand less"; "to fight the union." One report stated that "women are staying at their new posts primarily because they permit manufacture at less cost per unit of production and with less friction between management and workers."

On the whole, and particularly in comparison with England, there was very little special machinery created during the World War to deal with problems of women in industry. Canteens were set up here and there, an occasional day-nursery was established, employment management and personnel work were stimulated, welfare work and supervision were frequently introduced, but there was no large movement to direct and supervise "dilution," no munitions tribunals with their "leaving certificates" and but few attempts on the part of the Government, either state or Federal, to regulate wages. Except in a few cases there were no serious clashes with men's trade unions, and the post-war problem of women in men's places adjusted itself without state interference.

The principal sources of information are: (1) *The New Position of Women in American Industry*, published in 1920 by the Women's Bureau of the U.S. Department of Labor, Washington, D.C.; (2) *The Industrial Replacement of Men by Women in the State of*

New York; published in 1919 by the Bureau of Women in Industry of the N.Y. State Industrial Commission, N.Y. City; (3) the publications of several manufacturers' organizations, such as the National Industrial Conference Board, N.Y. City, and the chambers of commerce of various cities. (I. O. A.)

WOMEN'S WAR-WORK.—It would be impossible here to attempt to describe the special war-work done by women of all the belligerent countries in 1914–8; and this article is confined to an outline of women's war-work as organized in the United Kingdom and the United States, beginning with the former.

United Kingdom

The general dislocation which ensued in industry threw numbers of women workers in the United Kingdom out of employment. At the same time women of independent means, moved by patriotism, came forward in large numbers with offers of voluntary service. It soon became apparent that the well-meant action of the non-professional women was likely to press heavily on the position of the unemployed wage-earners; and accordingly on Aug. 20 Queen Mary inaugurated the "Queen's Work for Women Fund," technically a branch of the National Relief Fund, to provide employment for as many as possible of the women thrown out of work by the war. The Queen's collecting committee, with Lady Roxburgh as hon. sec., raised the money, but the administration of the fund was in the hands of the Central Committee on Women's Employment, a Government Committee under the chairmanship of the Marchioness of Crewe, with Mary Macarthur (d. 1921) as hon. secretary. The problem of the Committee was to help to adjust the dislocation of industry, so that unemployed firms and workers in a slack trade might ease the overpressure in other trades. Firms unused to Government work were assisted to undertake War Office contracts, and orders were placed with small establishments employing women, who would otherwise have had to relinquish their businesses. Over 70 special relief workrooms, through which about 9,000 women passed before Feb. 1915, were managed by women's employment sub-committees of the local representative committees set up by the Government Committee on the Prevention and Relief of Distress. Articles made in them were not offered for sale, and were supposed to be educative to the worker. New branches of the toy-making industry, in which there was a possibility of capturing German trade, were started in various private relief workrooms, and became paying business concerns.

The distress among the professional classes caused by the dislocation of work was very great, and the Professional Classes War Relief Council, consisting of representatives from the chief professional institutions and the principal societies organizing relief work, was formed to cope with the trouble in Oct. 1914. The Council dealt chiefly with education, maternity assistance, training, and the organization of concerts for the employment of musicians, who, as a class, were particularly hard hit. The Society for Promoting the Employment of Women opened an educated women's war emergency training fund for a year, which trained out-of-work governesses and journalists to take posts in banks; and hostels were opened by various private committees for ladies in distress owing to the war.

On Aug. 3, before the official declaration of war, the executive committee of the National Union of Women's Suffrage Societies under its president, Mrs. Fawcett, decided to suspend political action (*see* Woman Suffrage) and devote the organizing capacity of the Union to meet the changed conditions. Within a week the London branch, with Miss Philippa Strachey as secretary, had started a free bureau under the name of "Women's Service" to direct the efforts of the thousands of non-professional women eagerly desirous of finding useful work. Over 1,300 volunteers were placed before the end of 1914. Many young women began at once to prepare themselves for nursing, joined Voluntary Aid Detachments, and worked in auxiliary hospitals. The raising of funds and making of comforts for the units of the original Expeditionary Force absorbed others, and the arrival of the Belgian refugees in England before the end of Aug. caused the formation of 2,500 local Belgian relief committees, of whom the members were mostly women. Clubs to help the wives of soldiers and sailors were started by the Tipperary League under Mrs. Juson Kerr, the British Women's Patriotic League, and others. The Women's United Services League under Lady French and Lady Jellicoe coördinated and registered the work done by war clubs throughout the kingdom. A large number of women devoted themselves at once to the work of the Soldiers' and Sailors' Families Associations, and to the work of the Officers' Families Fund founded by the Marchioness of Lansdowne in 1914.

Already in the early months of the war it became evident that the abnormal conditions arising from the quartering of large numbers of soldiers in barracks and camps, and of convalescents in hospitals, would give rise to social dangers, and that steps should be taken to deal with the situation. A militant suffrage society, the Women's Freedom League, formed the Women's Police Volunteers, under Miss Nina Boyle, in Sept. 1914. This Corps was reorganized shortly after as the Women Police Service under Miss Damer Dawson (d. 1920), and Miss Allen. To cope with the same evil the National Union of Women Workers called an emergency meeting of their rescue and preventive subcommittee in Sept. 1914. As a result a corps of "Women Patrols" was formed to work under the official sanction of the Commissioner of Police in the metropolitan district, and of the Chief Constables in the provinces (*see* Women Police).

I. *Voluntary Organizations and Corps.*—The first of the new corps of women called into existence to meet war conditions was the Women's Emergency Corps, originated by Miss Decima Moore, and launched Aug. 6 1914 in coöperation with Miss Lena Ashwell, the Hon. Evelina Haverfield, Miss Eva Moore and Mrs. Kingsley Tarpey. In addition to relief workrooms, and the registration of the innumerable voluntary offers of service characteristic of the first months of the war, schemes were started under its auspices which developed independently, after the parent corps had met the "emergency" conditions of dislocation of labour and refugee relief. The collection of surplus food from the London markets for the unemployed and for Belgian refugees developed into the National Food Fund, which raised £163,615 in gifts of food and money before the end of the war. The Women's Volunteer Reserve, founded in 1914 as a branch of the Women's Emergency Corps by the Hon. Evelina Haverfield, with the Marchioness of Londonderry as hon. colonel-in-chief, "to provide a trained and disciplined body of women ready to assist the State in any capacity," did military drill, wore khaki uniform and saluted their officers. The founders' idea that, as signalers, despatch riders, telegraphists and motorists, they might set men free for the firing line, was premature in 1914, but anticipated the need actually met later by the women of the Army Service Corps and Q.M.A.A.C. In practice the Reserve consisted of working girls who gave their leisure time to organized voluntary work in canteens, hospitals, workrooms and clubs. After Mrs. Haverfield had left the W.V.R. to work in Serbia with the Scottish Women's Hospitals, Mrs. Beatty and Mrs. Kilroy Kenyon formed the Women's Reserve Ambulance (Green Cross Corps) in June 1915, a fresh organization on somewhat similar lines to the W.V.R., but confining its activities mainly to London, whereas the most successful branches of the W.V.R. worked in the provinces till the end of the war. Other somewhat similar corps for the organization of part-time workers were the Women's Auxiliary Force, founded in 1915 by Miss Walthall and Miss Sparshatt, and the Liverpool Home Service Corps. The latter was started in May 1915 by Miss Phyllis Lovell and had branches throughout Lancashire. In Aug. 1915 it formed a Police Aid Detachment which worked in conjunction with the Lancashire police.

Public opinion with regard to the "khaki" women was reflected in a "Punch" cartoon for Dec. 15 1915, showing a gallant Highlander curtseying to take a lady officer's salute. They outlived this ridicule, and in 1918 the salute was officially adopted by the women of the Auxiliary Army Services. Nevertheless by the spring of 1915, when the country began to feel the drain of its man-power, the Marchioness of Londonderry realized that a less military corps of women would attract many of those anxious to come forward to carry on the work of the country. In July she founded the Women's Legion, which from the first was intended to be a corps of paid women replacing paid men. A khaki uniform was worn and the women were subject to regulations and discipline. Ultimately over 40,000 were enrolled. This corps was the link between the independent voluntary associations of women, such as the Emergency Corps, formed on the outbreak of war, and the official women's services, two of which (described below) were sections of the Women's Legion.

Throughout 1915 and 1916 efforts were made by voluntary organizations such as the Women's Legion and the Women's Defence Relief Corps, under Mrs. Dawson Scott, as well as by the Government, through the War Agricultural Committees of the Board of Trade, of which 63 had been set up before July 1916, to induce women to offer their services on the land and to persuade farmers to accept them. The Women's Farm and Garden Union was the most important of the bodies which had dealt with women's work on the land before the war, and, realizing that each individual woman was an object lesson for good or ill to the farmers whose favour had to be won, the Union started a system of training farms in the autumn of 1915. Early in 1916 the Government provided a grant, and the Women's National Land Service Corps under Mrs. Roland Wilkins was launched as a war off-shoot of the Farm and Garden Union, to deal with emergency war-work on the land. By the end of the year the demand for women had become greater than could be met by a small voluntary association, and, as the result of a deputation from the Corps to the Minister of Agriculture, the Women's Land Army was instituted early in 1917 as a Women's Branch of the Board of Agriculture. The Corps continued to act as the agent of the Land Army for organizing the supply of educated women as seasonal workers. In all 9,022 workers were sent out, and in 1918 the flax harvest was saved by 3,835 holiday workers from the Corps.

By the spring of 1915 shell-work for women was beginning; in March women tram conductors started work at Glasgow, and girls were employed as telegraph operators in Liverpool. But women were impatient at the slowness of the progress of industrial substitution and at the uselessness of the Women's War Service Register compiled by the Board of Trade in March 1915. The suffrage societies urged the Government to face the need for the recognition of the claim of women to be employed on war production, and in July 1915 a procession and deputation to Mr. Lloyd George was organized by Mrs. Pankhurst to assert this claim. In connexion with the demand for skilled workers, the London Society for Women's Suffrage, which promoted the introduction of women into occupations hitherto reserved for men, started a Munitions and Aircraft Department in July 1915, and arranged the first training classes in oxy-acetylene welding. The pupils were the first women welders to enter the engineering trade, and after two years the Ministry of Munitions assumed financial responsibility for the school.

Messrs. Beardmore in Glasgow and Messrs. Vickers at Barrow-in-Furness and at Erith employed women on shell-making in the spring of 1915. In order to ease the strain due to Sunday work, a band of Women Relief Munition Workers, educated women of the leisured class, were organized by Lady Cowan and Lady Moir and trained in the rough turning and boring of 4·5 shells and 18-lb. shrapnel at Erith; they bound themselves after training to undertake week-end shifts for six months.

In 1915 and 1916 work in canteens, hostels and clubs, formed by voluntary agency in connexion with the welfare of munition workers, absorbed a large number of voluntary women workers. Lady Lawrence obtained permission to enter the almost sacred precincts of Woolwich Arsenal in May 1915 and organized the Munition Workers Canteen Committee, which provided light refreshments at many munition factories and had 1,250 workers. The movement for establishing munition and dock workers canteens, essential for the health of the worker and the consequent output of munitions, dates from this initial effort. About 500 canteens for munition and dock workers were started by 12 voluntary societies:—the Munitions Auxiliary Committee of the Y.M.C.A.; the Y.W.C.A.; the Church Army; the Salvation Army; the Church of England Temperance Society; the National Peoples' Palaces Association; the Y.M.C.A., Scotland; the British Women's Temperance Association, Scotland; the Glasgow Union of Women Workers; the Women's Volunteer Reserve; and the Women's Legion. The latter employed 2,000 paid whole-time canteen workers, but it is estimated that over 10,000 voluntary part-time workers were in attendance at less than 130 out of the 500 canteens.

The Munitions Auxiliary Committee of the Y.M.C.A. under the presidency of Princess Helena Victoria opened 183 of these 500 canteens and had over 10,000 women workers. In all, between 35,000 and 40,000 women gave their services to the Y.M.C.A. in England during the war. The canteen work was undertaken to meet an emergency and to set the canteens going more quickly than would have been possible under any other system. But it was wasteful of voluntary labour, and in 1916 the Central Control Board became the responsible authority for the organization of industrial canteens in munition works throughout the country, and encouraged the employment of paid workers.

The steady withdrawal of men from civilian to military life led in 1916 and 1917 to a remarkable expansion in the scope and volume of women's work (*see* WOMEN'S EMPLOYMENT). The growth of the Women's Services, and the demand for women as substitutes for men in industrial occupations and in the Civil Service, caused a consequent diminution in the number of voluntary workers and in the relative importance of the voluntary corps.

II. *The Women's Services.*—The Women's Services were of two types. First came those composed of "enrolled" women in the legal sense, who were in the direct employment of the War Departments, and whose contracts brought them within the regulations of the Defence of the Realm Act. The women could be enrolled as "mobile" workers for home service only, or for service at home and abroad; or as "immobile" workers, recruited for local employment, who could not be required to move away from the district. Secondly came those composed of "non-enrolled" women in the legal sense, who did not render themselves liable to penalties under the Defence of the Realm Act and might be engaged on an annual or weekly contract. Some services enrolled their women for a year only and others for the duration of the war.

(A.) Enrolled Women

The Army Nursing Services.—Before the war the only women's auxiliary army services in existence were Queen Alexandra's Imperial Military Nursing Service and Reserve, and the Territorial Force Nursing Service. The V.A.D.s, founded in 1909 under the British Red Cross Society and Order of St. John of Jerusalem, developed a section of 12,000 V.A.D. nursing members, enrolled under the War Office in 1915 for service in military hospitals, and a section of 6,000 General Service members, enrolled for general service in connexion with military hospitals in 1917.

The Q.A.I.M.N.S. expanded from a corps of 800 trained nurses to 10,304; and the T.F.N.S. from 2,738 nurses ready to serve when war broke out to 8,140 (*see* NURSING).

The Military Massage Service.—The Military Massage Service started its career in Aug. 1914 under the name of the Almeric Paget Massage Corps. It was maintained by Mr. Almeric Paget (afterward Lord Queenborough) and Mrs. Almeric Paget (d. 1916), and consisted of 50 fully-trained masseuses who, early in Sept. 1914, were distributed among the principal military hospitals in the United Kingdom, this number being shortly increased to 100. Lady Essex French was hon. secretary.

The next development of the work of the Corps was in Nov. 1914, when a massage and electrical out-patient clinic was opened in London for the treatment of wounded officers and men, financed till Dec. 1920 by Mr. and Mrs. Paget. During the war over 200 patients were treated in the clinic daily. It was inspected by the Director-General Army Medical Service in March 1915 and subsequently became the model for the massage and electrical departments in the convalescent hospitals and command depôts throughout the United Kingdom. Early in 1915 the War Office officially recognized the Corps by making it the body to which all masseuses and masseurs engaged for service in military hospitals must belong. An advisory committee was instituted by the War Office, which laid down the standard of training and qualifications required and formed subcommittees to select the candidates. Thus the admission of untrained or partially trained personnel was prevented, and the interests of the patients and of the massage profession were safeguarded.

In Dec. 1916 the word "Military" was added to the title of the Corps, and in Jan. 1919 it became known as the Military Massage Service by Army Council Instruction.

It was not until Jan. 1917 that military masseuses were required for service overseas, but from that date up to six months after the signing of the Armistice 56 masseuses served in France and Italy; 3,388 masseuses and masseurs had been enrolled in the service and there were over 2,000 actually at work on the day the Armistice was signed. (The Regulations for the Corps are set out in A.C.I. 779, 1,262 and 1,146 of 1917, and 65,308 and 489 of 1919.)

The Women's Legion, Cooks and Motor-drivers.—In July 1915, a scheme was originated by the Marchioness of Londonderry, founder and president of the Women's Legion, which was approved by the Q.M.G., and put into operation at Dartford Camp convalescent hospital, for taking over the whole of the kitchens and installing women cooks. The objects were to release men for the work which women could do; to improve the cooking and cleaning of the camps and to introduce economies and variety in the feeding of the troops. The experiment proved a success; other camps were taken over, and an A.C.I. of Feb. 1916 defined the position of the cooks. The first Commandant was Miss Lilian Barker who, when she became welfare superintendent at Woolwich Arsenal, was succeeded by Dame Florence Leach. Mrs. Long, who lost her life in the torpedoing of the "Warilda," was hon. secretary. Ultimately 4,000 women cooks and waitresses replaced men in camps and convalescent hospitals in Great Britain; they signed a contract for a year, but were not enrolled until the organization became part of the Women's Army Auxiliary Corps in Sept. 1917. Those who transferred retained the right to wear the Women's Legion badge.

Women motor drivers, mechanics and storekeepers were first employed as substitutes for men of the R.A.S.C. in April 1916, and of the R.F.C. in the following September. The women were recruited and put into uniform by the Women's Legion under Miss Christobel Ellis, and were paid by the army. There was no enrolment until the Section was taken over by the W.A.A.C. in 1917.

This arrangement lasted only a few months, and in Nov., at the instigation of Lady Londonderry, the army abandoned the scheme for centralizing the administration of women working in the army in one corps, and it was decided that overseas drivers should enrol in the W.A.A.C., but that drivers for home service should again belong to the Motor Transport Section of the Women's Legion. They were enrolled for a year only, instead of for the duration of the war, as in the W.A.A.C., and came under the Q.M.G.'s Department; 647 Flying Corps drivers were transferred to the W.R.A.F. in 1918. Ultimately about 2,000 women were attached to areas and battalions throughout Great Britain, and after the Armistice several hundred drivers were sent to France to replace the demobilized mechanical transport men.

Women's Forage Corps, R.A.S.C.—In July 1915, women supervisors were enrolled under the War Office for the duration of the war to arrange for the transit of hay from the farm to the station and to forward it to its ultimate destination. The urgent need for increased substitution caused a special women's branch of the Forage Department, known as the Women's Forage Corps, to be inaugurated in March 1917 under Brig.-Gen. Morgan. Mrs. Athole Stewart was appointed superintendent and 4,200 women were enrolled as 1st. and 2nd.-grade officers and industrial members, for a year or the duration of the war. They were distributed throughout Great Britain and Ireland and wore khaki uniform. The industrial members took the place of privates in the R.A.S.C. and worked as hay balers, sack makers and menders, sheet repairers, thatchers, chaffing hands, transport drivers and clerks. The substitution of women did not depreciate the quality of the work.

Queen Mary's Army Auxiliary Corps.—In Dec. 1916 the War Office ordered Gen. Lawson to enquire into the number and physical categories of men employed out of the fighting area in France. On Jan. 16 he reported that in his opinion 12,100 men might be replaced by women to begin with. He added:—" In the last year or more in England the employment of women has developed to an immense extent through lack of men, and has been attended with remarkable success. Women have taken up various forms of male employment, which, by many, had been deemed impossible for the sex. They have found their way into work in all branches of life and have proved their capacity for it. In the army at home the success has been conspicuous and women are to be found working in numerous offices and cooking in many of the home military establishments. Results have shown that the sex difficulty has not been anything like what some have predicted. The women have been hard at work and felt they were out for the job and the men have respected them, and their experience at home has been, I understand, almost unanimous in this respect."

On Jan. 24 1917 the suggestion was put forward by Sir Nevil Macready, adjutant-general, that women employed in the army should be part of the army, entirely distinct from any outside organization and established in the War Office under his Department. This scheme materialized under the name of the Women's Army Auxiliary Corps, known popularly as " W.A.A.C.'s." Mrs. Chalmers Watson took up her duties as Chief Controller at Headquarters on Feb. 18 and Dame Helen Gwynne Vaughan as Chief Controller in France. Below the Chief Controllers were a staff of controllers and administrators, all women. A special branch of the War Office, known as A.G. 11, was formed to assist in getting the Corps into working order so that it could fit into the army machinery. A Women's Auxiliary Corps of the R.A.M.C. organized the medical boards in England and France, of which Dr. Jane Turnbull was president at home, and Dr. Laura Sandeman in France. At the end of a year Mrs. Chalmers Watson resigned for urgent family reasons, having accomplished the pioneer work of the Corps and won a recognized position in the army for her women in the face of many difficulties. She was succeeded by Dame Florence Leach, then known as " Controller in Chief." When Dame Helen Gwynne Vaughan was made Commandant of the W.R.A.F. in Sept. 1918, Miss L. Davy became Chief Controller in France. The full charter for the organization of the Corps was finally completed at the end of June 1917.

The women were enrolled as mobiles for home service only, or for home or foreign service, and for the duration of the war; they received a special rate of pay, not civilian or military, and were not enlisted under the Army Act. At first substitution overseas only had been contemplated, but by March the number of women recruited by the Department of National Service was so great that Home Commands were included in the scheme. Recruiting was afterwards carried on through the Employment Department of the Ministry of Labour. In Dec. 1917, owing to the shrinkage of available woman-power, an immobile branch was formed. Women employed in the Ordnance Army Pay Department and Record offices at home were not made to join the Corps. A khaki uniform with distinguishing badges was worn. In all there were 1,200 officials and 56,000 women, of whom 9,500 were the outside number employed in France at any one time. This figure was made up of women working in the Calais, Boulogne, Etaples, St. Omer, Abbeville, Dieppe, Rouen and Havre areas and on the lines of communication, chiefly at army schools, and in certain offices at G.H.Q. A number were employed with the Expeditionary Force canteens, mostly at officers' clubs. They were drafted to every type of office and domestic employment, and to bakeries, ordnance and motor transport depôts. In the spring of 1918, when the R.A.F. was formed, 7,000 women, including nearly the whole of the immobile branch of 1,800, transferred to the W.R.A.F.

When the American Expeditionary Force arrived in France and was prevented by shortage of transport from bringing over American women clerks, 500 members of the Corps under a Chief Controller, Miss Horniblow, who was succeeded by Miss Gordon and finally by Mrs. Vernon Lloyd as Deputy Controller, were transferred to the American camps at Bourges and Tours. Mrs. Vernon Lloyd was subsequently made Deputy Controller in Cologne, where over 100 Q.M.A.A.C. officials were employed with the army of the Rhine in the Censor's Department, under the provost marshal, and in ordnance. A small contingent was attached to the British military mission in Berlin for over a year. Queen Mary assumed the title of Commandant-in-Chief of the Corps in the spring of 1918.

A Q.M.A.A.C. unit attached to the Director-General of Graves Registration at St. Pol was in being in 1921.

Women's Royal Naval Service.—The W.R.N.S. was instituted as part of the navy at the end of Nov. 1917 when Sir Eric Geddes, the First Lord of the Admiralty, outlined what was required. The Director, Dame Katharine Furse, was asked to put up a scheme for the organization of the service, which was accepted with small amendments giving her more powers than she had set out. She had the opportunity of starting with a staff of women of considerable experience in organization and asked for Miss Edith Crowdy to be appointed as her deputy. The Director was the executive head, responsible only to the Second Sea Lord. No naval officer was available to assist her, and from the first the navy encouraged the greatest possible independence in the organization of the service. The formation of another service of women under the Air Board was already in contemplation, so that the W.R.N.S. (or Wrens) was from the first organized with a view to handing over all the members working in Royal Naval Air stations; 2,033 ratings were transferred to the administration of the W.R.A.F.

For the purpose of calculating allowances the following relative ranks were agreed to:—

W.R.N.S.	R.N.
Director	Rear Admiral
Deputy Director	Commodore (2nd class)
Assistant Director Medical Assistant Director	Captain
Deputy Assistant Director Divisional Director	Commander
Deputy Divisional Director Principal	Lt.-Commander
Deputy Principal	Lieutenant
Assistant Principal Quarters Supervisor	Sub-Lieutenant
Superintending Section Leader Chief Section Leader	Chief Petty Officer
Section Leader	Petty Officer
Leader	Leading Hand
Woman	Seaman

There were 12 Divisions: Devonport, Portsmouth, The Nore, Harwich, London, Humber, Tyneside, Scotland, Ireland, Liverpool, Cardiff and the Mediterranean. After the Armistice, stations were set up at Ostend and Zeebrugge under the Nore Division.

The ratings were enrolled for the duration of the war and paid on a civilian basis. Coöperation with the Employment Department of the Ministry of Labour on similar lines to that already set up in connexion with the Q.M.A.A.C. was arranged for the purpose of recruitment. As it is estimated that at the time when the W.R.N.S. was being formed over a million and a half additional women had already been drawn into industrial and commercial occupations, as munition workers and substitutes for men in the Forces, the recruiting up to the high standard required was made more difficult; but in spite of this excellent results were obtained. The service consisted of women living in hostels (mobiles) and of women living in their own homes (immobiles) in almost equal proportions. The women were largely recruited from naval families, and this contributed to the keen service spirit shown.

A total of 608 officers were appointed; 6,880 women were enrolled and 785 absorbed from women already employed in naval establishments, before the formation of the Wrens. On Nov. 21 1918, the date of maximum strength, there were 6,392 ranks and ratings.

The officers, other than those engaged in the organization, welfare and discipline of the women, replaced naval officers for the following work:—coding and decoding, intelligence work, confidential books, secretaries, telephone exchange, paymasters, accountants, gas mask work, and observation station. The ratings were employed as ledger clerks, clerks, shorthand typists, victualling store assistants, telephone operators, postal sorters, stewards, cooks, general domestic workers, orderlies and messengers, porters and storewomen, bakers, tailoresses, gas mask workers, gardeners, fitters, turners, boiler cleaners, boot cleaners and painters, wiring hands, net mine workers, depth charge workers, armourers, sailmakers, tracers and draughtswomen, photographic workers, technical storekeepers, valve testers and wireless telegraph operators.

Blue uniform with distinguishing badges was worn by all ranks and ratings. The service was demobilized in Dec. 1919.

The Women's Royal Air Force.—On April 1 1918 the R.A.F. was formed by the amalgamation of the R.F.C. and the R.N.A.S. Seven thousand women in Q.M.A.A.C. and 2,033 in the W.R.N.S. had been attached to R.F.C. units and to R.N.A.S. stations before the amalgamation. These were transferred to the W.R.A.F. and formed the nucleus of the service. The chief superintendent was Lady Gertrude Crawford, who was succeeded in May 1918 by Miss Violet Douglas Pennant as Commandant. Dame Helen Gwynne Vaughan, hitherto Chief Controller Q.M.A.A.C., France, was appointed Commandant in Sept. 1918. Mrs. Pratt Barlow was Deputy Commandant, and Miss K. Curlett Assistant Commandant over-seas.

Five hundred and sixty-six officers and 31,764 other ranks passed through the Service, the strength at the time of the Armistice being rather over 25,000. (The constitution and regulations were similar in outline to those of the Q.M.A.A.C. and the W.R.N.S.) The Service consisted of mobiles and immobiles in approximately equal proportions. In addition to the administrative, clerical and domestic work common to all the Services, the women were employed on meteorological work and as despatch riders, dopers, painters, acetylene welders, carpenters, magneto repairers, photographers and drivers. Fabric workers did duties of all kinds from the covering of aeroplane wings to the mending of the finest balloon silk. The uniform was first khaki, then blue, with the badges of the R.A.F.

The corresponding rank of officers and other ranks is shown below:

W.R.A.F.	R.A.F.
Commandant	Air Commodore
Deputy Commandant	Group Captain
Assistant Commandant Class 1	Wing Commander
" " " 2	Squadron Leader
Administrator	Flight Lieutenant
Deputy Administrator	Flying Officer
Assistant Administrator	Pilot Officer Observer Officer
Senior Leader	Warrant Officer 2
Chief Section Leader	Sergeant
Section Leader	Corporal
Member	Aircraft man

The medical arrangements for the W.R.A.F. were in the hands of Director of Medical Services R.A.F. under whom Dr. Laetitia Fairfield served as Woman Medical Director. A woman medical officer was on the medical staff of each of the R.A.F. Areas, and a medical woman was detailed for duty at each of the W.R.A.F. depôts and larger camps. They had hon. rank corresponding to that of the R.A.F. medical officers and by means of regular inspections and efficient care, preserved a high standard of health.

In March 1919 the first overseas draft embarked for service in France and 500 officers and other ranks formed part of the Air Force of Occupation on the Rhine. Demobilization took place March 31 1920.

In relation to the W.R.A.F. the experiment was tried of running a women's service as nearly as possible (having regard to the fact that the women were enrolled and not enlisted) as a part of the force to which it was attached. Thus correspondence was carried out through the usual Air Force channels; officers and other ranks of the W.R.A.F. were under the orders of senior R.A.F. officers; women officers were attached to the staff of the Air Officers commanding areas and were allowed to sign for them letters dealing with the W.R.A.F.; the officer in charge of W.R.A.F. inspection was a member of the staff of the Inspector General R.A.F. and the Commandant was stated in Air Ministry weekly orders to be on the staff of the Master General of Personnel and instructed to sign letters dealing with W.R.A.F. in the same way as directors and heads of independent branches; so that her correspondence, like theirs, carried the authority of the Air Council. The same principles were followed in the medical arrangements. By these means the need of a special section of R.A.F. officers dealing with the W.R.A.F. was obviated; economy was effected, and the administration of the W.R.A.F. was carried out on Air Force lines. The result was indicated by the terms of Air Ministry Weekly Order No. 1110 (promulgated Oct. 7 1920):

"In issuing orders for the final disbandment of the W.R.A.F. the Air Council desire at the same time to express their appreciation of the good work done by the Force both during and after the period of hostilities. In spite of much difficulty and in the face of hostile and unjust criticism, the W.R.A.F. has left a record of which it can well feel proud. During hostilities the good work it accomplished went far towards enabling the R.A.F. to reach that dominating position in the air which had such a direct influence in the achievement of the final Victory. Subsequent to the Armistice, when it was necessary to disperse a large number of airmen to civil life, it was the W.R.A.F. which made it possible for the R.A.F. to meet the demands made upon it, and maintained the services at the Aerodromes until new male personnel could be enrolled. The necessity for the demobilization of the W.R.A.F. is now imperative, but in returning to civil life, Commandant Dame Helen Gwynne Vaughan, D.B.E., Officers and Members may feel assured that they carry with them a debt of gratitude from the Nation."

(B.) NON-ENROLLED WOMEN

Anti-Gas Department.—On April 22 1915, at the battle of Ypres, the Germans first made use of poison-gas, and within 36 hours some sort of improvised mouth pad had been issued to every man in the line. Anti-gas work was begun at once, and men worked night and day to devise a really sound method of protection. Early in June 1915 Miss Beaver was appointed superintendent of the Camden Laundry Smoke Helmet Impregnating Station, where the work of drying and packing gas helmets had been largely carried on by members of the Women's Emergency Corps. When it was decided that gas helmets could be repaired for re-issue after use at the front, Miss Beaver and Miss Carey Morgan were sent out by the War Office to organize depôts for repair work with French labour at Abbeville and Calais. They were at once given the status of officers of the Army Ordnance Department, but were not actually gazetted till June 1916. They wore a nigger brown uniform with the badges and buttons of officers of the Army Ordnance Department. Six V.A.D.s were attached to the Abbeville depôt and four to Calais; they afterwards transferred to the W.A.A.C. as Administrators. The French depôts closed down when the "box respirators" had superseded the helmet types and the repair as well as the manufacture was carried out in England.

Practically the whole of the work on gas-mask manufacture was performed by women. There were 34 factories employing 12,000 under the immediate control of the Anti-Gas Department and 160 contractors employed a further 90,000 on work for the Department. In Aug. 1917 a number of educated women were trained for inspection work on the mask of the respirator and drafted out to the factories. They wore an indoor uniform of scarlet and were called "red-coats." Ultimately 800 to 1,000 of these were appointed, and 100 were promoted to the duties of check inspecting, formerly performed by sergeants of the Anti-Gas Department. They were known as sergeants also, and were interchangeable with the men. A few lady superintendents were appointed over "sergeants" and "red-coats," and Miss Carey Morgan was made officer in charge of the principal repair factory. In all about 50,000 respirators were issued.

Army Pay Corps.—The Army Pay Department was one of the earliest in the army to substitute female clerks. In July 1915, 479 were working and by Jan. 1 1916 there were 4,556 female clerks and 13 lady superintendents. The engagement was a weekly one and there was no form of contract till Aug. 1917. By that time the demands made for women by the W.A.A.C. and other organizations were so insistent that a form of agreement to serve for the duration of the war and three months afterwards was signed by the superintendents and a portion of the women doing skilled and semi-skilled work. These wore a badge but no uniform, and by March 1918 there were 5,171 of them out of a total of 17,500. Miss Constance Holmes, lady inspector, was responsible for the welfare of the women under Sir J. T. Carter, "Accounts 2," War Office, who was "at a loss to find words to adequately express his appreciation of the valuable work performed by the Women Clerks for the Army Pay Department during the war."

Army Remount Department.—Owing to the withdrawal of male personnel from Remount Depôts, women accustomed to hunting and to the superintendence of considerable stables of horses, were employed on remount work early in 1915. The first women's establishments were organized near Pangbourne by Mr. Cecil Alden, who worked on a contract basis for the War Office, employing what labour he chose. In 1915 he had 10 depôts for the stabling of 520 convalescent horses from veterinary hospitals in the vicinity of Aldershot, and half the depôts were staffed by women. They did the entire work from beginning to end, and horses were issued fit to units direct from their stables.

The next women's depôt was organized near Chester by Mrs. Rigby, and from these beginnings the employment of women spread until nearly 200 were working as grooms in 15 depôts directly under the Remount Department. The Charger depôt at Russley Park under Lady Birkbeck was the largest staffed entirely by women, and at Dr. Rimington's depôt near Chester women schooled horses rejected by their units as incurably vicious.

Navy and Army Canteen Board.—When the Navy and Army Canteen Board (then called the "Army Canteen Committee") started operations in April 1916, only 20 women clerks were employed. During 1917 the Board's activities were enormously expanded to include catering for the Imperial Overseas Forces and for the American and Allied Troops. It was decided in March 1917 to institute a N.A.C.B. Women's Corps in mobile and immobile sections, and by the date of the Armistice the women employed in connexion with canteen organization in the mobile corps numbered 10,000 and the clerical staff in the immobile corps 2,000. After the Armistice 500 members of the Q.M.A.A.C. and 8 officers were transferred to the N.A.C.B. Women's Corps to carry on the work in France during the dispersal of British troops, and 120 went with the army of occupation to Cologne. Although the women wore uniform and were under the orders of the chief superintendent working under the Department of the Controller of the N.A.C.B., they were not enrolled. The written agreement signed had no binding force and they could leave when they liked.

In addition to these groups of non-enrolled women in the direct employ of the War Departments, there were at the time of the Armistice 5,000 civil service clerks working on Army Records, 10,000 clerks employed by the War Office, and 17,500 miscellaneous industrial workers belonging to the Hospital Labour Staff, and the A.S.C.

Women's Land Army.—In Jan. 1917, a Women's Branch of the Food Production Department of the Board of Agriculture was set up under Dame Meriel Talbot as Director and Mrs. Alfred (Dame Edith) Lyttelton as Deputy Director. Two appeals were issued for the Branch by the Women's Section of the Department of National Service in March 1917; the first appeal to women to join a mobile Land Army on a year's enrolment ultimately secured 45,000 recruits, of whom half had to be rejected on medical and other grounds; the second appeal to village women for their part-time services, under the organization of group leaders and forewomen in the Land Army, gradually trebled the number of part-time workers already on the land.

Arrangements for recruitment were subsequently revised, and a scheme of coöperation between the three Departments concerned (viz. Board of Agriculture, Women's Branch, Ministry of National Service and the Employment Department, Ministry of Labour) was adopted early in 1918. Under this scheme women were given a choice of enrolling for a year or for six months, and arrangements were made with the Women's Forage Corps, R.A.S.C. and the Forestry Corps, Timber Supply Department, Board of Trade, for their recruits to be dealt with by the same machinery. With regard to Scotland a Scottish Women's Land Army was formed on somewhat parallel lines in which 1,816 women were enrolled. In addition 6,860 unenrolled women were placed in agricultural work. The employment of women as part-time workers was also stimulated and organized, and it is estimated that there were in Sept. 1918 300,000 women part-time workers and 16,000 whole-time workers actually engaged in agricultural work in England and Wales. This triumph, in the face of innumerable difficulties and at the cost of an elaborate and expensive organization, was due to the combined efforts of the Women's Branch at Headquarters, and the Women's War Agricultural Committees. These Committees set up in each county by the Board of Trade in 1915 and 1916 acted as its agents and conducted the local administration of the Land Army by means of the 13,000 women who served on them in a voluntary capacity. Between March 1917 and May 1919, 23,000 women passed through the training centres. Returns relating to 12,657 women made in Aug. 1918 show the distribution of the types of work done: 5,734 milkers, 293 tractor drivers, 3,971 field workers, 635 carters, 260 ploughmen, 84 thatchers, 21 shepherds.

The workmanlike and becoming uniform of overall, breeches and leggings contributed largely to the success of the Corps.

Special steps were taken to supply workers for seasonal work in connexion with the fruit crops, flax weeding and pulling and potato picking; coöperation was established by the Employment Department of the Ministry of Labour with the National Land Service Corps, who by arrangement with the Board of Agriculture undertook the supply of educated women for holiday work.

The work being done for food economy in the villages by the Women's Institutes (which had been founded in England in 1915 by the Agricultural Organization Society on the model of those in Canada) was so important that a special section of the Women's Branch of the Food Production Department was formed in 1917 to undertake their propaganda. These Institutes bid fair to become a permanent feature of country life, and owe much to the increased interest in rural matters due to the widespread employment of women on the land during the war.

Women's Forestry Service.—The Women's Forestry Service under Miss Rosamond Crowdy was instituted under the Timber Supply Department of the Board of Trade in 1917. In 1916 a considerable number of women had been employed by contractors in the cutting and measuring of timber, but it was not till early in 1917 that the first two Government camps for training women in the felling and preparation of timber for sleepers and pitprops were opened by the Women's Section of the Department of National Service, acting as agents for the Timber Supply Department of the Board of Trade. The first Government training camp for timber measurers was started in Aug. 1917 at Wendover under Mrs. Donald, through which 370 educated women passed. They learned to measure and mark off where a tree should be sawn and find the cubic contents of the logs, and were afterwards put in charge of timber gangs consisting of 20 to 30 cutters. In some cases women had the entire charge of a saw-mill with men working under them. The two camps for cutters were given up, as it was found that training was unnecessary when the women were put out to work in gangs under skilled forewomen. Private employers were supplied with 144 such gangs for felling, cross cutting, marking and measuring of timber between 1917 and 1919. About 3,000 women were engaged on the work, and wore an appropriate uniform with distinctive badges.

The King's Thanks.—On June 29 1918, an address of homage was presented to the King and Queen on the occasion of their silver wedding by the Chief Woman Inspector, Employment Department, Ministry of Labour acting on behalf of the organizations of full-time women workers engaged on work of national importance under the control of state departments, and of whole-time women workers engaged in public utility services under local authorities. A procession of 2,540 women in uniform led by the V.A.D.s as the senior service, formed into six companies, eight abreast, facing the dais in the quadrangle of Buckingham Palace. Princess Mary stood by the King and Queen wearing her V.A.D. uniform. The King's reply to the address of homage contained the following words:—

"When the history of our Country's share in the war is written no chapter will be more remarkable than that relating to the range and extent of women's participation. This service has been rendered only at the cost of much self-sacrifice and endurance. Women have readily worked for long hours and under trying conditions in our factories and elsewhere, to produce the supplies of munitions which were urgently needed at the front and to maintain the essential services of the country. As nurses and V.A.D. workers they have laboured in hospital for the care of the sick and wounded with even more than the accustomed devotion which has characterized our Red Cross Service since the days of the Crimean War. They have often faced cheerfully and courageously great risks both at home and overseas in carrying on their work, and the Women's Army has its own Roll of Honour of those who have lost their lives in the service of their country. Some even have fallen under the fire of the enemy. Of all these we think to-day with reverent pride."

Only the women actually belonging to the Army, Navy and Air Force took part in the Peace Procession. The W.R.N.S. marched with the Navy and Q.M.A.A.C. with the Army. The Army Nursing Services, the V.A.D.s, the F.A.N.Y., and the Military Massage Service formed part of the R.A.M.C. contingent; the Women's Legion and the Forage Corps marched with the R.A.S.C.; and the W.R.A.F., incorporated with the R.A.F., brought up the rear.

III. *Voluntary Organizations.*—When war broke out there was an eager desire on the part of professional and non-professional women to work in France and Belgium. The passport restrictions were less stringent at first than they afterwards became, but it was never easy for women to obtain permission to work in France in connexion with the British armies. The French and Belgians, who had fewer trained women workers of their own, and were in greater need of help at the beginning of the war, accepted offers from organizations which the British authorities had rejected. Thus the privilege of undertaking the considerable amount of work actually performed by women in connexion with the British armies, even before the formation of the Q.M.A.A.C., had been won with difficulty and was highly valued.

In 1914 Rachel, Countess of Dudley (d. 1920), Lady Sarah Wilson, the Duchess of Westminster, Lady Norman and Lady Hadfield established hospitals for the British at the bases in France in which every bed was of value in the early days of stress. After a few months the army took over Lady Dudley's hospital as No. 32 Stationary; the Duchess of Westminster's became No. 1 Red Cross and Lady Hadfield's No. 5 Red Cross. In 1916, the units of Millicent Duchess of Sutherland and of Lady Murray, which had previously been open for the French, were accepted for the British as No. 9 Red Cross and No. 10 Red Cross. These voluntary units were staffed with Red Cross and St. John's nurses, who were encouraged to enrol in the Army Nursing Services when they had obtained a knowledge of active service conditions. Nursing V.A.D.s were employed from the beginning in addition to hospital orderlies. Princess Louise's convalescent home for nursing sisters was opened at Hardelot in 1914 by Sophie Lady Gifford under the British Red Cross Society, and transferred to Cannes in 1917 as a winter home for the sisters.

On Aug. 12 1914 Dr. Garrett Anderson and Dr. Flora Murray offered the services of a hospital unit staffed by women doctors and nurses to the French wounded. Within a week the offer was accepted, and within a month the unit, which was the first formation to be entirely officered by medical women, had collected sufficient funds and started for Paris, under the name of the Women's Hospital Corps. Owing to the pressure of work in the north at the end of Oct. Dr. Garrett Anderson and Dr. Flora Murray decided to divide their staff and establish a branch of the unit at Wimereux. This new hospital was accepted by the British Army Medical Service. In Feb. 1915 Sir Alfred Keogh offered the Women's Hospital Corps the charge of a military hospital in London which opened at Endell Street in May.

In 1916 85 women doctors were attached as civil military practitioners to the R.A.M.C. at Malta to help care for the 27,000 wounded in the hospitals. As this experiment proved a great success, 39 others were sent with R.A.M.C. units to Salonika, and in Jan. 1918, the first medical women, of whom there were ultimately 36, went to Egypt. Four women doctors were attached to British military hospitals in France. They did not wear a distinctive uniform, and none of the 331 medical women who served under the War Office at home and abroad held military rank.

Women belonging to the Red Cross organization worked at the British Red Cross Society headquarters in France, recruiting Red

Cross nurses and tracing the wounded and missing. On Oct. 21 1914 the first V.A.D. unit, composed of 16 members and 2 trained nurses, under Dame Katharine Furse as officer in charge, arrived at Boulogne. On Oct. 26 they founded No. 1 V.A.D. rest station, Gare Centrale, Boulogne, in three French wagons and two passenger carriages and within 24 hours had given hot drinks to a thousand wounded from the first battle of Ypres. Under the Principal Commandant, Dame Rachel Crowdy, who succeeded Dame Katharine Furse in France, this work expanded in all directions until there were five rest stations for the feeding of patients on ambulance trains; two detention stations for the care of the personnel of veterinary hospitals and remount camps; six convalescent homes for nurses and W.A.A.C.s, and six motor convoys—all run and staffed by V.A.D.s. In Holland and Switzerland they were able to work for prisoners of war. In Salonika, Malta, Egypt and Italy they started kitchens attached to hospitals for the supply of invalid diets, and organized and staffed canteens for ambulance trains and convalescent homes for army nurses. In Italy they staffed motor convoys. At the beginning of the Gallipoli campaign two military hospitals went to Egypt without female personnel, on the assumption that they were destined for the peninsula, and had to depend on voluntary women helpers of all nationalities till trained nurses and V.A.D.s. could arrive.

Early in 1918 the British Section of the First Aid Nursing Yeomanry affiliated to the British Red Cross Society. This earliest women's military corps had been founded in 1909, and reorganized by Mrs. McDougall, in 1910, to assist the R.A.M.C. in time of war by providing mounted detachments with horse ambulance wagons, to take over wounded at clearing stations and convey them to base hospitals. When war broke out the services of the corps were offered to the British authorities without success, but were accepted by the Belgian army in Oct. 1914. With the ideal of working for the British always before her, Mrs. McDougall asked the War Office in July 1915 to reconsider the employment of women drivers of the F.A.N.Y. for driving motor ambulances at any British base. Although this was at first refused, renewed applications resulted in a F.A.N.Y. motor convoy starting work at Calais under Miss Franklin on Jan. 1 1916, for the transport of all British sick and wounded in the district. The F.A.N.Y. drivers were voluntary workers and supplied their own uniforms and traveling expenses; the Army gave rations; the British Red Cross Society kept up the ambulances, and in Aug. undertook complete financial responsibility in connexion with the cars. As a result of the success of this experiment, V.A.D. motor convoys were instituted in six other bases, and on Jan. 1 1918 the St. Omer convoy started work with 22 F.A.N.Y. drivers and 12 V.A.D. drivers under F.A.N.Y. officers. On May 18 1918 they worked through a particularly severe air raid and won 16 Military Medals in one night.

The great need for clubs where the army nurses and women workers could obtain rest and relaxation from hospital work was recognized by Princess Victoria early in 1915, when she formed a committee in London to finance such clubs at all hospital centres. The first was opened at Wimereux in Feb. 1915, and 10 others followed at Étaples, Camiers, Rouen, Le Tréport, Trouville, Calais, St. Omer, Abbeville and Paris. These clubs were a recognized unit under the administration of the Director-General Medical Services. In 1919 a club was also opened at Cologne. Lady Algernon Gordon-Lennox acted as Director in France and Germany.

The British army in France employed French labour for necessary industrial work such as the making of camouflage, repair of gas-masks and the salvage of clothing and war material. But in Jan. 1917 Messrs. Tarrants, who had a contract for building army huts, were allowed to send 100 trained women carpenters to Calais, where in collaboration with French female labour they made 37,000 huts. The women lived in a camp for two years under quasi-military discipline and were to a certain extent the prototype of the W.A.A.C.

On Nov. 4 1914 Lady Angela Forbes, who had a house at Étaples, started a free buffet for the wounded in the waiting-room of the Gare Maritime, Boulogne; this was the earliest of all the voluntary canteens provided for the British troops in France. In the following month Lady Mabelle Egerton opened her "Coffee Shop" at Rouen Station. From these individual efforts huts and canteens, maintained by authorized organizations, spread to every British camp in France. As time went on the authorities compelled the few privately conducted enterprises to affiliate to larger organizations. Lady Angela Forbes' original buffet became an Expeditionary Force canteen and her hut at Étaples was taken over by the Salvation Army; the Rouen Coffee Shop was affiliated to the Church Army in 1917; and in March 1918, by order of the Adjutant-General, only 10 voluntary organizations were authorized to work in the zone of the armies. These were the British Red Cross Society, the Y.M.C.A. and Y.W.C.A., the Salvation Army, the Church Army, the Scottish Churches Huts, the United Army and Navy Board, the Soldiers' Christian Association, the British Soldiers' Institute and the Wesleyan Soldiers' Institute. All these organizations had huts for men at the bases very largely staffed by women; but these were few in number compared to the huts and tents close behind the firing-line to which women could not go.

In Dec. 1914 Princess Helena Victoria formed the Ladies' Auxiliary Committee of the Y.M.C.A., to assist in providing recreation huts and reading-rooms for the troops in France and to send out concert parties. The Committee, under the chairmanship of Princess Helena Victoria, with the Countess of Bessborough (d. 1919) as hon. sec., selected the ladies to take charge of these huts, voluntary workers living at their own expense and signing on for four months' service. The work grew rapidly, until there were Y.M.C.A. huts, largely staffed by women, in all the bases in France, providing for the spiritual, material and educational needs of the men. Women workers were sent to Italy and Malta, and huts in Egypt and in Palestine as far north as Aleppo were also partly staffed by women. In 1918 the War Office gave permission for Y.M.C.A. huts to be opened in Holland for interned officers and men, and these were entirely staffed by the female relatives of the prisoners of war, a special fund being raised by the Association to pay the expenses of those who could not afford to travel and live at their own cost. Sixteen hostels for relatives of wounded in France were also staffed by women workers, of whom more than 1,860 passed through the Committee's hands for service abroad as canteen helpers, secretaries, librarians, motor-drivers, storekeepers, lecturers and teachers. In 1918–9 a certain number had their expenses paid, and the secretaries and motor-drivers received salaries.

The provision of entertainments was under the direction of Miss Lena Ashwell, the first concert being given at Harfleur on Feb. 8 1915; at one time there were 25 parties in France, giving concerts at the rate of 14,000 a year. In addition permanent concert parties worked continuously at 12 bases, and 6 theatrical parties were stationed at Paris, Havre, Abbeville, Dieppe and Étaples. Two concert parties went to Malta and a third to Egypt. £108,000 was raised for the work.

Although the hardships of camp conditions were ameliorated as much as possible for the W.A.A.C., the unaccustomed military discipline in a foreign country was trying in many ways, and the women badly needed the friendly help of an outside organization. In May 1917 Miss Ethel Knight of the Y.W.C.A. went to France under the auspices of the Y.M.C.A. to establish huts for them on the same lines as those which had proved so great a boon to the men. By the middle of 1918 there were 23 Blue Triangle huts in all the chief Q.M.A.A.C. camps, where the women could behave as though they were at home, and forget the discipline of army and camp life. Adjoining each there was a chapel or quiet room, but in the hut itself everything possible was done for the entertainment and recreation of the girls. Central clubs were also established in seven towns, and there was a rest-house at Le Tréport, a tea-garden at Havre and the Lady Carisbrooke marquee in the Q.M.A.A.C. rest camp.

Within 24 hours of the declaration of war Lady Bagot propounded her scheme that a hospital should be sent to the front manned and equipped by the Church Army. It was established at Caen under the French Red Cross. In Feb. 1915 the first of the Church Army recreation huts in France was opened at Rouen; these were staffed by voluntary workers, mostly women, who also paid their own expenses. About 500 altogether worked in Church Army huts in France and Germany.

A recreation hut for convalescent soldiers at the Colomn Camp, Boulogne, was opened by the Catholic Women's League under Mrs. Baynes in March 1915 and remained open until after the Armistice. Other huts in France followed. This was the only society which undertook concerted Catholic work on an organized plan during the war, though the Catholic Club, which had no organization or society behind it, maintained eight huts in the war zone staffed by 100 women and 18 men.

The Church of Scotland and the United Free Church of Scotland acted jointly, under the name of the Scottish Churches Huts, to carry on work similar to that of the Y.M.C.A. at the bases in France, up the line, in Malta and Egypt and in the Army of Occupation. The Salvation Army had a large organization to work among the troops, and women Salvationists laboured among Australian and American troops in huts in France, besides carrying on extensive hospital visitation and work amongst the homes of the bereaved in the United Kingdom.

The Women's Emergency Canteens, formed early in 1915 under Mrs. Wilkie with the idea of working for the French only, catered for the British also in the canteen opened at the Gare du Nord, Paris, in April 1915, which was a rendezvous for all Allied nationalities on leave. Early in 1917, when the Australians and Canadians visited Paris on leave in very large numbers, Miss Lily Butler opened a "Corner of Blighty," the pioneer leave club in Paris, to help them to spend their time as pleasantly and profitably as possible. Everything was given free of charge, and a staff of 45 voluntary women workers entertained 44,000 men in the first 10 months of the 2½ years for which the club was open.

Six months later the British Army and Navy Leave Club was opened and was the pioneer residential club in Paris for soldiers and sailors on leave. Baron D'Erlanger lent the house, and Miss Decima Moore and the Rev. A. S. V. Blunt were hon. secretaries. In the two years that it was open 59,102 men were registered and 701,546 meals were served. A body of uniformed Women Guides looked after the comfort of the men, and free entertainments on a large scale were organized.

As a result of the success of this club, the British Empire Leave Club at Cologne was originated and organized on the same lines by Miss Decima Moore, Hon. Director-General, who raised the funds with a London Committee under Baron D'Erlanger as chairman. Each department was conducted by a voluntary woman worker drawn from one of the proved women's war organizations, who wore the uniform of her society, and did her last piece of war-work for the British in an officially recognized institution opened at the invitation of the army.

IV. *Voluntary Work For Allies.—Scottish Women's Hospitals.*—On Aug. 12 1914 Dr. Elsie Inglis, president of the Scottish Federation of Women's Suffrage Societies, proposed that the Federation should equip a hospital "staffed entirely by women, if not required at home to be sent abroad." Within a week the War Office had declined the offer of a unit, and on Aug. 20 overtures were made to the embassies of Belgium, France and Russia. Mrs. Fawcett agreed that the N.U.W.S.S. should join in the appeal for funds, and by the end of the war £449,000 had been collected. In all, 14 different hospitals staffed entirely by women were mobilized and worked for the Belgian, French, Serbian and Russian armies. The first opportunity of service came when typhoid broke out in the Belgian army; on Dec. 5 1914 Dr. Alice Hutchison and Dr. Phillips, with 10 trained nurses, were put in charge of the typhoid annexe of Dr. de Page's hospital at Calais, where they worked for three months, until the epidemic had been overcome. On the same day the first complete unit under Dr. Ivens, consisting of 3 surgeons, 2 physicians, a radiologist, 10 trained nurses and as many dressers and orderlies, arrived in Paris on their way to the Abbaye de Royaumont, which had been allotted them by the French Red Cross. In this ancient edifice, founded by St. Louis, French wounded were tended by the Scottish women till Feb. 1919. An offshoot of the hospital, established at Villers-Cotterêts in huts in the spring of 1917, was evacuated before the German push on May 30 1918, being the last hospital in the district to remain at work. In both hospitals 10,861 patients were treated.

The Girton and Newnham unit worked uninterruptedly under the French War Office for four years. It went to Troyes in May 1915 with Dr. Louise McIlroy as C.M.O. and with Mrs. Harley (d. 1917) as administrator. As the hospital was entirely under canvas, it was ordered to accompany the French Expeditionary Force to Salonika in Oct. 1915, and went for a short time to Ghevgeli. The unit then settled down in Salonika for three years and opened an orthopædic department for disabled Serbian soldiers.

The remaining S.W.H. units worked for the Serbian army. The first went to Kragujevatz under Dr. Eleanor Soltau in Dec. 1914, and was the second British unit to arrive in Serbia in time for the typhus epidemic. With an equipment of 100 beds, Dr. Soltau had to take 250 patients immediately on arrival, and in March took charge of two fever hospitals as well. Three of the staff died of typhus. The next unit went out in May under Dr. Alice Hutchison to Valjevo, and was detained at Malta for a fortnight to look after British wounded from the Dardanelles, the one occasion on which a S.W.H. unit worked officially for the British army. By this time the typhus epidemic was over and a long peaceful summer intervened before the autumn invasion. The staffs of the two fever hospitals formed a camp hospital at Mladanovatz under Dr. McGregor, and Dr. Hollway with some sisters took over a Serbian hospital of 200 beds at Lazorovatz. Both these were evacuated at once when the storm of invasion broke out in Nov.; Dr. McGregor's party joined the great retreat through Albania; and Dr. Hutchison's party, with Dr. Inglis, who had come out to Serbia in May, remained working for the Serbs at Krushevatz, as prisoners of the enemy, from Nov. to Feb. 1916. The Austrians then sent them home.

In Aug. 1915 a party of Scottish women under Dr. Mary Blair had been sent to Serbia to reinforce Dr. Alice Hutchison's unit at Valjevo. As the invasion was pending they went to Salonika instead, to wait for work, and when it was decided that the Serbian civilian refugees were to accept the hospitality of the French Government at Corsica, this unit was invited to be in charge of the medical affairs of the colony. The hospital remained open at Ajaccio till April 1919 and treated 1,704 in-patients and 15,515 out-patients.

Among these were many of the Serbian soldiers who had accomplished the retreat through Albania, and after two months' rest were re-equipped to form a second Serbian army. A new S.W.H. unit, called the "America" unit, under Dr. Agnes Bennett, with a transport column under Mrs. Harley, was formed to accompany this army to Salonika. In Sept. 1916 they went to Ostrovo, to act as a casualty clearing station for the push to Monastir, and after the fall of the town a dressing station was opened at Dobreveni. The unit worked at Ostrovo till Nov. 1918, and then went to Vranja in Serbia, under Dr. Elmslie, till Oct. 1919, and coped with another typhus epidemic. Mrs. Harley, Gen. French's sister, left to do relief work in Jan. 1917, and was killed by a stray shell.

On her return from Serbia in Feb. 1916 Dr. Inglis spent six months in England trying in vain to obtain authority to take a unit to Mesopotamia for the British. Then the Serbian Government asked her to equip and maintain a field hospital, with a motor transport column attached, for service with the newly formed Serbian division, consisting of ex-Austrian subjects, who had allowed themselves to be made prisoners by the Russians and were attached to their army. The unit started in Aug. 1916 in charge of Dr. Inglis herself, with Mrs. Haverfield commanding the transport column, and went to the Dobrudja. They only had 19 days of work for the Serbs before becoming involved in the retreat of the Russian army, and while the Serb division was resting the unit worked for the Russian Red Cross. Once again they had to retire to Galatz, and then were helped by the British Armoured-Car Corps to get to Reni, where they were able to settle down for eight months and work for the Russians. An offshoot of the hospital under Dr. Chesney went to the Rumanian front. The Russian Revolution had meanwhile broken out, and the demoralization of the Russian army was so complete that Dr. Inglis was determined to prevent the Serb division from being sacrificed on that front in order to stiffen up the Russian *moral*. She sent two members of the unit to England to deliver a memorized message of 2,500 words to the Foreign Office, and, after pressure from the British Government, the Russians permitted the Serb division to go to Archangel, and the Admiralty sent transports to bring them to England. Although by that time Dr. Inglis was very ill, she insisted on waiting to return home with the Serb division, and as the first Admiralty transport was filled by the Russians with refugees, she had to wait for the second. They landed at Newcastle-on-Tyne on Sunday, and on Monday Nov. 27 1917 she died. The "Elsie Inglis" unit, equipped immediately after her death, left for Serbia in Feb. 1918, under Dr. Annette Benson, and worked at the first dressing station behind the lines during the Serbian offensive that preceded the Armistice. The transport column followed on the heels of the victorious army into Serbia.

Work for French and Belgian Armies.—At the beginning of the war the regulations affecting the entry of British subjects into France and Belgium were not strict, and as the British authorities discouraged voluntary offers, British organizations, individuals and groups of friends gave lavishly of funds, stores and the service of trained nurses to the French, Belgian and Serbian allies. Millicent Duchess of Sutherland had installed an ambulance of 8 trained nurses and a surgeon at Namur by Aug. 17, and by Aug. 24 they were all prisoners of the Germans. The British Red Cross Society sent out 12 parties of nurses to Belgium before the end of Sept., and 25 parties to different voluntary units in France before the end of the year, besides two parties to Serbia and one to Montenegro.

The second hospital unit to be officered by medical women only was organized by Mrs. St. Clair Stobart as administrator, under the name of the Women's Imperial Service Hospital, and left for Antwerp to work under the Belgian Red Cross Sept. 20 1914. It consisted of 6 doctors, 10 nurses and 10 orderlies under Miss Sally McNaughtan (d. 1916), who described the 14-days' work in *An Englishwoman's Diary of the War*. The wounded were evacuated just before the entry of the Germans. Within three weeks of their return the unit was re-formed and worked at Cherbourg until March 1915 under the French Red Cross.

Miss Sally McNaughtan had stayed behind at Ostend and joined the Hector Munro Ambulance Corps, a mixed body to which Miss May Sinclair, Lady Dorothie Feilding (the first woman to win the Military Medal), Mrs. Knocker and Miss Chisholm belonged. During this time of greatest hardship for the Belgian army the corps established a hospital at Furnes, to which ambulance drivers brought in wounded under fire. Early in 1915 Mrs. Knocker and Miss Chisholm left the corps and started a dressing station of their own at Pervyse, close to the Belgian lines, where they served the soldiers till both were badly gassed in their dug-out in April 1918. Miss Sally McNaughtan ran a portable soup kitchen for the Belgians in Furnes during the winter of 1914–5 and laid the seeds of the illness to which she succumbed in 1916. During this first winter of the war the Belgian army was in deplorable need of help, and Lady Bagot, who worked at Dunkirk in Nov. and Dec. 1914, dressing wounded at the station, raised funds to establish a transportable "Hospital of Friendship" at Adinkerke, which became the surgical section of the Hôpital d'Évacuation for the Belgian army. It was too close to the front for nurses to be allowed to work there, but Lady Bagot herself remained there for two years, before handing it over to the Belgian authorities. To meet the dearth of hospital requisites and clothing, Mrs. Bernard Allen started the Belgian Hospital Fund in Jan. 1915, which collected £25,000 in money and £25,000 in kind and aided 137 Belgian military hospitals and convalescent depôts in France and Belgium, and 30 colonies for refugee children, besides providing a club for soldiers, a recreation hut for the front, a hospice for refugees and 450 surgical outfits for regimental doctors.

During the battle of the Yser in Oct. 1914 the Belgian wounded poured into Calais, and Mrs. McDougall, of the First Aid Nursing Yeomanry, who had offered the services of the corps to the Belgian army, was asked to take over two old schools full of wounded as a hospital. There was no equipment, and the unit worked incredibly hard to produce a good military hospital out of nothing. The workers, with the exception of the trained nurses, paid all their expenses and subscribed to the hospital as well. From Nov. to Jan. 1915 they established a regimental aid post for the Belgians at Oostkerk, and during the height of the typhoid epidemic ran a convalescent home as an offshoot of the Lamarck hospital. The convalescent soldiers were drafted off in large numbers to the Camp de Ruchard near Tours, and there the F.A.N.Y. maintained a hut for them, with a canteen and cinema, and paid a trained nurse to look after the consumptives.

The motor-drivers originally belonging to the Lamarck hospital, who also conveyed the Belgian wounded from the clearing hospital to all the other hospitals in Calais, were officially attached to the Belgian Corps de Transport when the Lamarck hospital closed in Oct. 1916. This unit continued to drive for the Belgian army till after the Armistice and went with it to Bruges and Brussels. Belgian civilians who remained in the little strip of land not occupied by the enemy were in desperate plight too. King Albert's Civilian Hospital Fund was founded, by Mrs. Oliphant Murray and the Duchess of Buckingham and Chandos, to help Belgian state civilian hospitals abroad; the Belgian Canal Boat Fund, with Mrs. Agar Adamson as founder and Mrs. Innes Taylor as organizer in Belgium, fed and clothed 300 families in and about Furnes till June 1919; and the Belgian Front Relief Fund, under Miss Georgie Fyfe, evacuated 1,341 Belgian children from the war area into France and Switzerland, and repatriated them all at the end of the war, besides maintaining a maternity hospital at Vinckem for four years.

The work for the French was more extensive still. There were three Red Cross societies in France; the Société de Secours aux Blessés Militaires, the Association des Dames Françaises, and the Union des Femmes de France. As only the last named had a committee in London, a British Committee of the French Red Cross was called into being by the French ambassador towards the end of 1914, in order to allocate the services offered by British volunteers to the best advantage of all three societies. At the end of 1917 the Anglo-French Committee of the Joint War Committee, which had been formed in Jan. 1915 tc sift the credentials of British applicants for Red Cross work with the French, united with the British Committee. By this date 8,537 certificates had been granted to British volunteers for work in France. As the French army bore the brunt of the fighting for the first two years of the war their hospital problem was acute, especially as the nuns had left France before a sufficient number of nurses had been trained to replace them. To help fill the need, Miss Grace Ellison founded the French Flag Nursing Corps, which organized the supply of 250 British trained nurses, paid by the French Government, to help in the improvisation of the enormous number of French hospitals needed to cope with the rush of wounded. The Urgency Cases Hospital, a unit of first-class surgeons and 20 fully trained nurses, raised on the initiative of Miss Eden, hon. sec. of the National Union of Trained Nurses, went to Revigny in March 1915 to receive the worst cases on that section of the front. In July 1917 it was taken over by the British Committee of the French Red Cross. About 30 other units for the French were equipped by voluntary effort and staffed by British nurses and V.A.D.s, including Miss Bromley Martin's hospital at Arc-en-Barrois, the Johnston-Reckett unit at Ris-Orangis, Lady Sykes' hospital at Malo-les-Bains, the Michelham Foundation in Paris, the Ulster unit supported for two years by the Ulster Women's Unionist Council, the Martouret hospital and Ceret convalescent home of Mrs. Allhusen, the Sanatorium Beausoleil of Miss Lind-af-Hageby, Lady Eva Wemyss' hospital at Compiègne, Lady Guernsey's at Fécamp, Mrs. Symons' at Rimberlieu, Lady Tangye's at Paris Plage and others. In addition a large number of V.A.D.s worked in French hospitals and held positions of considerable responsibility.

The French Wounded Emergency Fund, which had branches throughout Great Britain for the making of comforts, was founded in Nov. 1914, with Miss Evelyn Wild as hon. sec., in order to give assistance to the French military and *bénévole* hospitals, as distinguished from the auxiliary hospitals run under the three French Red Cross societies. In May 1916, 2,755 French hospitals were classed as military, 1,552 as *bénévole* and 1,225 as auxiliary. By March 1918 the Fund had helped military hospitals in 1,200 different French towns, and £163,000 had been raised in money, and £75,000 in kind. Canteens were also established in many of the military hospitals. The French authorities placed a devastated sector on the Somme under the care of the Fund, and after the Armistice much work was done in the devastated areas.

On the closing of the Lamarck hospital at Calais the F.A.N.Y. transferred their personnel to staff a hospital for the French at Port à Binson, Marne, which opened in Jan. 1917. In the summer of 1917 the Corps began supplying ambulance units for the French army. There were finally three: S.S.Y.2, S.S.Y.4, and S.S.Y.5. The F.A.N.Y. officer commanding each unit held official rank in the French army as an officer. After the Armistice the S.S.Y.2 drivers were the first women to go into Germany with their ambulances to bring back prisoners of war. The Hackett-Lowther ambulance unit of women drivers under Miss Toupie-Lowther was attached to the second Army Corps of the 3rd French army in 1918 as S.S.Y.3. This was the only women's unit allowed to do front-line work; the cars were sent to the advanced "postes de secours," and the entire section was mentioned in despatches, which carried with it the right to have the Croix de Guerre painted on their ambulances. During 1919 the women's convoys did civilian relief work in the devastated areas.

The Women's Emergency Canteens, an independent Society under Mrs. Wilkie, and an offshoot of the Women's Emergency Corps, started a canteen at Compiègne in Feb. 1915 with a recreation room, which was the first of its kind. Another canteen was opened for four years at the Gare du Nord, Paris, with 60 beds attached, which was used by British and Allied soldiers, and all Belgians were fed free there for two years. Other smaller canteens were run for a time as offshoots of the one at Compiègne.

Canteen work under the "Oeuvre de la Goutte de Café" started by M. Duquesnoy early in the war, absorbed a very large number of British women workers, who were selected and sent out to France by the British Committee of the French Red Cross. The canteens were of four types, those at railway stations; those at *foyers de cantonnement* or recreation rooms attached to rest camps; those for the provision of invalid diets at *depôts d'éclopp*é*s*, and those at *depôts d'isolés* for men rejoining their regiments. The earliest railway canteen was opened at Hazebrouck in Feb. 1915, and moved to Doullens, where the work was very heavy during the Somme offensive; thousands of wounded from Gommecourt came through in a few days, and the helpers were sometimes working for 19 hours at a stretch. Many of the canteen workers had narrow escapes during the German push of 1918, when they had to evacuate suddenly with the Germans on their heels. A large number of the helpers were elderly women who worked extraordinarily hard, paid all their own expenses and faced all the hazards of war.

Work for the Serbian Army.—The first British women who worked for Serbia during the war left London with Madame Grouitch, the American wife of the Serbian minister at Nish, on Aug. 12 1914, and went to the Serbian 1st reserve hospital at Kragujevatz; the hospital material was exhausted in a few months, and it was as a result of the pitiful stories that reached home from this band of women that the Serbian Relief Fund was formed. Miss Flora Sandes and Miss Emily Simmonds, who belonged to the original party, raised a private fund, took out 108 tons of hospital material to Valievo in Jan. 1915, and nursed typhus in a Serbian hospital, doing operations and dressings for 12 hours a day, till both caught the disease.

The plight of Serbia during the first winter of the war, harried first by the Austrian invasion and then by the typhus epidemic, was so terrible that hospital after hospital was sent out from Great Britain by the Serbian Relief Fund, the British Red Cross Society, the Wounded Allies Relief Committee and the Scottish Women's Hospitals. All these took out trained nurses and many had women doctors, but, with the exception of the Scottish Women's Hospitals, the only two units under women administrators were financed by the Serbian Relief Fund. The first Serbian Relief Fund surgical unit under Lady Paget, the wife of Sir Ralph Paget, who became the British Commissioner for Serbia in 1915, reached the country in Nov. 1914 before any of the others, and did heroic service at Skoplje under appalling conditions. From Nov. to Jan. there was an unending stream of Austrian and Serbian wounded and in the second half of the month the typhus epidemic assumed serious proportions. Lady Paget, who had previously worked in Serbian hospitals in Belgrade during the Balkan wars of 1911 and 1912–3, organized a typhus colony in collaboration with the British Red Cross Society unit, for the isolation of the cases, which opened on March 1. Very few nurses could be spared from the surgical hospital, as over 90% of the staff were off duty for sickness between Nov. and February. Lady Paget herself, two sisters, two doctors, some Serbian voluntary assistants and Austrian prisoner orderlies coped with beds at the colony for 300 typhus patients. Between March 6 and 24 sixteen workers went down with the disease, including Lady Paget, and for a week one sister remained in charge of 300 patients. Then she was relieved by four nurses from the second Serbian Relief Fund unit (Lady Wimborne's). By May the epidemic was overcome and not a case left in the town.

Plenty of hospitals had arrived in the country by this time and, as there had been no fighting since Dec., the surgical units found themselves with little to do. Mrs. St. Clair Stobart, who commanded the 3rd Serbian Relief Fund unit, which was entirely staffed by women, landed in Serbia in April 1915, and at once began to utilize her medical personnel for the far greater needs of the civil population. She put up a wayside dispensary by the hospital camp, where 12,000 people were treated in a few weeks, and established six others in country districts during the summer. At the end of Sept. the Austrians, Germans and Bulgarians began massing on the frontiers and Mrs. Stobart was invited to accompany the Serbian army to the front with a part of her unit as a flying field hospital. They moved forward for a few days, but on Oct. 17 the great retreat of the Serbian nation began, and thousands of people trekked for three months over the Albanian mountains down to the sea at Scutari. Mrs. Stobart rode at the head of her column all the way, for 800 m., and brought it through intact.

Lady Paget with all her staff decided to remain with the hospital at Skoplje and allow themselves to be taken prisoners by the Bulgarians, in order to continue to care for the Serbian wounded of their own hospital and of the other hospitals abandoned by their staffs. She was allowed by the Bulgarians to distribute the hospital stores of food and clothing to all destitute refugees irrespective of nationality. Early in Dec. the Germans arrived, and in Feb. permission was given for the unit to leave the country. Lady Paget had accomplished the purpose for which she had stayed, having been able to superintend the distribution of all the stores and money.

Miss Flora Sandes, who was in England when the Bulgarians declared war, went back at once, and was officially attached to the ambulance of the 2nd Infantry Regiment. When the retreat began, the Commandant of the Division told her that her presence would encourage the soldiers; so, as the ambulance could not travel, she enlisted in the 2nd Infantry Regiment as a private and retreated through Albania with the Serbian army. When the army was re-formed she was promoted corporal, sergeant, and lieutenant, and went through every engagement with her regiment till she was wounded; she returned again to the front and was not demobilized till 1919. Whilst on active service, in coöperation with Mrs. Haverfield, she organized a Comforts Fund for the Serbian soldiers in the trenches, and raised money for the Sandes-Haverfield canteens, which worked directly under the Serbian army.

Work for the Russian Army.—In Sept. 1915 a British Committee, with Lady Muriel Paget as hon. sec., raised funds to equip an Anglo-Russian hospital for work under the Russian Red Cross Society. The hospital of 200 beds was formally opened in the palace of the Grand Duke Dmitri at Petrograd in Feb. 1916 in the presence of the Empress and a brilliant company. At the beginning of May, during the offensive of Gen. Brussilov a field hospital of 100 beds was attached to the Russian Guards, with a motor ambulance column of 22 ambulances; the Anglo-Russian hospital also took charge of 120 beds in a Russian hospital at Lutsk, providing the nurses and doctors. Over £100,000 was raised. Mrs. Wynne, an original member of the Hector Munro Ambulance Corps in Belgium, took a unit of motor ambulances to Russia in 1915, and was attached to the First Caucasian ambulance unit on the Persian front. The conditions proving too rough for her 50 H. P. cars, she transferred them to the column of the Anglo-Russian hospital. The Revolution put an end to the work, and Lady Muriel Paget and her staff had to travel home *via* Siberia and Japan, taking a month to cross Siberia in a third-class carriage.

The N.U.W.S.S. raised the Millicent Garrett Fawcett Maternity unit for work among the Russian refugees at a cost of over £12,000, and the Great Britain to Poland Fund, and the Polish War Victims Relief Committee worked as long as political circumstances permitted for the Polish refugees.

Work for the Italian Army.—Soon after Italy joined the Allies in May 1915, the British Committee in aid of the Italian wounded raised funds to finance the first unit of the British Red Cross Society in Italy, which arrived on the Isonzo front in Sept. 1915. A field hospital at Villa Trento, staffed by British sisters and V.A.D.s under the Joint War Committee, broke down the Italian rule against employing women nurses at the front.

In Dec. 1915 Lady Helena Gleichen and Mrs. Hollings, who had been trained as X-ray operators and had raised private funds to purchase motor-cars fitted with X-ray apparatus, were attached as a radiographic unit to the 6th Army Corps of the 3rd Army. The British Red Cross Society provided additional staff and cars. After six months they were attached to the headquarters staff of the 2nd Army and were present at both battles of Gorizia. Between Dec. 1915 and Oct. 1917, 12,600 X-ray examinations were made.

Mrs. Watkins, who raised her own funds for two years, and was helped by the British Red Cross Society, went to Italy in Sept. 1915 with a staff to set up station canteens for the hospital trains at Cervignano and San Giovanni Manzano, the railroads on the Isonzo front. In July 1917 she undertook the feeding of the wounded in the clearing station of Dolegna, and during Aug. an average of 1,600 wounded were dealt with in 24 hours. It was due to her initiative that the first recreation hut for soldiers of the 2nd and 3rd armies was opened by the Italian army in the spring of 1916. Mrs. Watkins and her helpers undertook the organization of 14 others, which proved so successful that the Supreme Command took up the idea and were building 100 huts just before the retreat of Oct. 1917. Mrs. Wynne, on her return from Russia, worked with her motor ambulances for the Italian Red Cross.

V. *Voluntary Effort in Supplies, Etc.*—The outbreak of war found voluntary effort for the fighting forces entirely unorganized, apart from the Regimental Associations in connexion with the regular battalions of the regiments comprising the pre-war army. The British Red Cross Society and Order of St. John were the only organizations that supplied hospital requisites for the sick and wounded. These could obviously not expand sufficiently fast to meet the new needs, and Queen Mary's Needlework Guild, with Lady Lawley as hon. sec., came into being on Aug. 10 1914, with the more general object of "organizing a collection of garments for those who will suffer on account of the war." The King and Queen and Princess Mary gave the lead in promoting funds to send a present for Christmas 1914 to every person wearing the King's uniform and to every nurse at the front, and Queen Alexandra presented each nurse in the regular army nursing services in France with a fur-lined cape, hood and muff.

It is estimated that the value of goods in kind presented to soldiers and sailors by voluntary effort in the first year of the war was £5,000,000, and funds were formed to collect in bulk such articles as air pillows, Christmas puddings, gloves, handkerchiefs, hot-water bottles, Bovril, letter cases, razors, respirators, "tubs for Tommies," periscopes, field glasses, wire cutters, sandbags, matches, cigarettes, tobacco, mouth organs, hospital bags, walking sticks and eggs. Some of these funds continued till the end of the war. The National Egg Society provided over 44,000,000 eggs for hospitals in four years. Lady Smith-Dorrien's Hospital Bag Fund distributed over 2,500,000 bags before Jan. 1 1918; Lady Roberts' Field Glass Fund produced on an average 300 field glasses a month; Miss Gladys Storey's Bovril Fund sent Bovril to all the fronts throughout the war; the Glove Waistcoat Society made 55,000 windproof waistcoats out of old gloves, and John Penoyre collected over 100,000 sweaters. By the sale of worn-out silver thimbles and oddments of silver and gold, the Silver Thimble Fund under Miss Hope Clarke raised over £60,000 and provided 15 motor ambulances, 5 motor hospital launches 2 motor dental surgery cars, besides large donations to the Red Cross and other funds for soldiers and sailors. The Vegetable Products Committee for naval supply under E. Jerome Dyer despatched 50,000,000 lb. of vegetables to the fleet, estimated in cash value at £1,250,000. Every town had its own fund to send parcels to prisoners of war, and the packing was done by voluntary women workers.

Outstanding private comforts funds were those started by Lady French and Lady Jellicoe, which closed down at the end of the first winter campaign, when the needs of the army and navy were for the moment satisfied. The one comforts fund inherited from the Boer war was Queen Alexandra's Field Force Fund, which opened in Oct. 1914, with Mrs. William Sclater, who had organized it in S. Africa, as hon. secretary. Gifts were sent out in response to definite requests from commanding officers, and by the Armistice over £80,000 had been raised.

The universal desire to make something for the man on active service caused a multitude of uncorrelated work parties to spring up all over the country, and it was clear that before the second winter campaign some general scheme of coördination was essential if the best use was to be made of the energy and enthusiasm of a vast band of voluntary needle workers. In Sept. 1915 the department of the Director-General of Voluntary Organizations, with Sir Edward Ward as Director General, was formed as a branch of the War Office, without funds, to establish county, city, borough, and district associations throughout Great Britain under which it was proposed to affiliate existing voluntary bodies. The organization dealt with supplies to combatants and to men in military hospitals. Regimental organizations were recommended to continue and extend their work, and the Joint War Committee and Queen Mary's Needlework Guild were recognized as separate and independent organizations.

From Aug. 10 1914 till Feb. 1919 St. James' Palace was the collecting centre for the 15,500,000 articles that were sent in by the members of Queen Mary's Needlework Guild all over the world. Six hundred and thirty branches with a membership of 1,078,839 persons were formed in Great Britain alone. The need for hospital dressings had been realized early and the first Surgical Branch Depôt was started by Miss McCaul in 1914, with Mrs. Gibson as general manager; this became the Central Surgical Depôt of the Guild, which sent 11,000,000 articles direct to Allied hospitals and hospital ships. The first orthopædic branch was the Surgical Requisites Association started at Mulberry Walk, Chelsea, which became the central orthopædic branch of Q.M.N.G. with 1,000 members and 44 branches. This depôt was a centre of instruction for all the institutions engaged in orthopædic work, owing to the inventions made by the workers. Elinor Hallé first utilized papier-mâché as a material for arm cradles, and then devised a light boot, with a papier-mâché back, for drop foot, which was in such great demand that centres were opened for making them throughout France and Italy as well as in Great Britain and India. A Papier-Mâché Surgical Appliances Department at Simla had 11 branches.

A process of making the papier-mâché waterproof for baths by using a cuprammonium solution of cotton wool instead of paste for the final layers of the papier-mâché, was invented by Miss Acheson. This medium was adapted for splints, and permission was obtained for voluntary workers to visit the military hospitals and take plaster casts from the limbs of the patients, on to which the splints were moulded, so that the utmost amount of pressure could be brought to bear without causing pain. This method of making splints for special cases became generally adopted by other depôts. Many elaborations of the splints were invented by Mrs. Sanyer Adkin; in the words of Sir Robert Jones, the department was an "inspiration."

The Red Cross and St. John's working parties were recognized as a distinct body under the Joint War Committee. They continued as before primarily to supply the auxiliary and voluntary hospitals, and sent their surplus to the military hospitals when asked to do so by the D.G.V.O. During the war 2,823 workparties were registered at the Central Workrooms at Burlington House, which were established in Oct. 1915 to coördinate the work. Over 30,000,000 articles were produced by the branches; 540,000 gifts were contributed by the 1,617 registered home workers, and 800,000 things were made by the 1,202 members of the Central Workrooms. The independent bodies of workers not belonging to Queen Mary's Needlework Guild or to the Joint War Committee were dealt with by the D.G.V.O., who invited the workparties to assemble their workers into groups covering certain areas under the Army Council's scheme. The comforts were issued to combatants through a "Comforts Pool" in each theatre of war, and to military hospitals according to the demands of the officers commanding hospital units. A total of 88,000,000 articles of clothing and surgical comforts estimated at a value of £5,000,000 were supplied to combatants, patients in military hospitals, allies and prisoners of war, by the 267 recognized head associations, composed of approximately 400,000 workers, grouped into 2,983 branches, all financially independent. These ranged from bodies of village women and shop girls to factories like the Belgravia War Hospital Supply Depôt and the Kensington War Hospital Supply Depôt; the latter with an average daily attendance of 1,200 workers turned out 6,000,000 articles, making a speciality of elaborate orthopædic appliances. A number of men did valuable work in the woodwork annexes of the depôts.

In addition to comforts made by hand the D.G.V.O. sent out 232,599,191 cigarettes, 256,487 lb. of tobacco and 62,193 games. The supply of books to the troops was in the hands of Dame Eva Anstruther, who had established the Camps Library in Oct. 1914 (afterwards affiliated to the D.G.V.O.) and despatched 16,000,000 books and magazines to fighting men. The War Library, run by Mrs. Gaskell and Dr. Hagbert Wright under the British Red Cross Society, furnished 6,000,000 books to the hospitals.

The provision of artificial teeth and dental treatment for soldiers and sailors was undertaken by the Soldiers and Sailors Dental Aid Fund under Miss Banister Fletcher. When it was founded in Dec. 1914 there was no arrangement for the supply of dentures to soldiers; but from March 1915 onwards the War Office gave a grant to meet the cost of treatment for their own men, and in Nov. took over the work. The Fund was reconstituted later under the name of the Ivory Cross, to provide treatment for discharged service men, for Home Army men and for the mercantile marine.

Ten thousand people, mostly women, worked in 1918 for the welfare of soldiers on leave in the London area alone, under the control of the General Officer Commanding the London District. In that year 3,068,135 men, 232,495 officers and 28,450 cadets were accommodated in rest houses in London. The Maple Leaf Club, the Victoria League Club and Peel House (started by Mrs. Moncrieffe and Mrs. Graham Murray) had been opened as residential clubs for the Overseas forces in the autumn of 1915, on the same lines as the Union Jack Club, founded as a memorial to the men who had lost their lives in the Boer War. Motor volunteer corps, such as the Motor Transport Volunteers, the Y.M.C.A. Baltic Night Transport, and the Women's Reserve Ambulance (Green Cross Corps) drove nearly a million men from station to station in 1918, and 8,000,000 men were fed at the free buffets at Victoria, Paddington, London Bridge, Liverpool Street, Euston, Waterloo and Charing Cross the same year. These buffets were maintained and staffed in night and day shifts entirely by women voluntary workers, and 12,000,000 men were fed during the war at Victoria station at a cost of £60,000. Similar buffets were organized at the big junctions in the provinces, such as Preston. It is impossible to estimate the additional number of women who worked throughout the country in canteens for soldiers in training and on home service.

Parallel with the supply of tangible comforts such as food and clothing went the provision of entertainment for men in camp and patients in hospital. The "Music in War Time" committees, subsidized in part as relief work for musicians by the Professional Classes War Relief Council, gave 15,000 concerts in hospitals and camps at home, 2,000,000 wounded soldiers being entertained in the Manchester area alone. Individuals and organizations such as the Y.M.C.A. at home, the Lena Ashwell concert parties at the front, the Three Arts Club and the Soldiers Entertainment Fund, did the same work.

The labour of the nursing staff in hospitals was lessened by the organizations which provided drives for the wounded, free bus rides and river trips, and arranged for the visitation of patients and the teaching of handicrafts. The friendships formed in hospital led to voluntary after-care work for the disabled. (For a list of funds, associations and societies for the assistance of service and ex-service officers, men, women, and their dependents, see 114/Gen. No. 6198, compiled by the secretary C.3 department, War Office.)

The Auctioneers and Estate Agents Institute of the United Kingdom bought the Star and Garter Hotel, Richmond Hill, as a home for the totally disabled in 1915 and presented it to Queen Mary; a sum of £224,000 for the building was raised by the British Women's Hospital Committee under the chairmanship of Dame May Whitty as a tribute from the women of the Empire.

VI. *Work for Belgian Refugees in Great Britain.*—In Aug. 1914 the gaze of the Allies was focussed upon Belgium, where one of the greatest tragedies of history was being enacted. After the first accounts of the German atrocities perpetrated at Visé and Liége, but before the extent of the German invasion of Belgium was foreseen, it occurred to Lady Lugard that a large number of Belgian women and children might be brought to the protection of English hospitality, by means of the organization recently improvised in Ulster for the removal of Irish women and children from the area which in July 1914 threatened to become a theatre of war. Preparations on these lines proceeded, with the coöperation of Ulster, the Catholic Church, the Foreign Office, the Local Government Board and the Belgian Government. Meanwhile the situation in Belgium was becoming more acute, and on Aug. 22 an official of the Exhibitions Branch of the Board of Trade, who was in Belgium on business, announced to Lady Lugard that he hoped to arrive from Ostend on the 24th with a transport carrying from 100 to 1,000 Belgians. Within two days the War Refugees Committee was formed to provide for them, mainly by the exertions of Lady Lugard and Mrs. Alfred Lyttelton. Lord Hugh Cecil became chairman and Viscount Gladstone treasurer. The response of the first appeal in the press brought offers of private hospitality for 100,000 persons, and not one of the refugees who poured into the country in an increasing stream was left without food, lodging and a warm welcome from the 500 volunteers who at first did the work. But the Committee was not rich in funds. A large proportion of the money, subscribed in England for the Belgians, went to the Belgian minister's fund for Belgian relief, which was earmarked to be spent upon the Continent. £106,500 was subscribed to the War Refugees Committee, and this had to be conserved for the expenses of organization, and for emergency relief. It was soon obvious that a national exodus could not be dealt with by private effort alone. In the House of Commons, on Sept. 9, Mr. (afterwards Sir) Herbert Samuel, then President of the Local Government Board, offered the hospitality of the British nation to Belgium, and from that day a department of the Local Government Board, under Sir Frederick Willis, worked in close relation with the War Refugees Committee. At first the Belgians had been received in refuges improvised by the War Refugees Committee; but it was then arranged that the Local Government Board should provide accommodation for the refugees in London and should superintend their reception at the ports and bear the cost of their transport. The War Refugees Committee was to allocate the refugees to private hospitality and organize the transport.

The Women's Emergency Corps had provided a body of interpreters to meet trains early in Aug. and did valuable work for the Belgians of the middle and upper classes who were able to pay their way temporarily. The greatest rush occurred during the week after the fall of Antwerp, when 26,000 refugees arrived at Folkestone and were welcomed by the local committee; 2,000 a day were dealt with in London by the allocation department of the War Refugees Committee under Dame Victoria Samuel (Mrs. Gilbert Samuel), and 6,000 a day by the transport department under Mr. H. Campbell. The occupation of Ostend by the Germans on Oct. 17 closed the Belgian coast, and all refugees arriving in England after that date came by way of Holland, and in far smaller numbers.

The early refugees had borne the first onslaught of German fury, and families arrived separated from each other and with no material possessions whatsoever. British women, protected from the same fate by the sea, and with few opportunities at that time of helping actively with other war work, poured out money and sympathy lavishly on the Belgians. By Jan. 1915, it was estimated that private hosts had spent £2,000,000 on hospitality. The central register of refugees compiled under the Registrar General's Department showed that 265,000 refugees arrived in England; they cost the Government approximately £3,500,000; but the total spent on them by private hosts and local committees was estimated in 1917 as at least £6,000,000. Over 6,000 Jews were cared for at the cost of the Jewish community in London. 2,500 local Belgian relief committees, of which about 1,500 were really effective, were formed in Great Britain, to which the refugees, after spending a few days at the Government refuges, were allocated by the 100 voluntary allocators of the War Refugees Committee; by the allocators at the office of the Belgian consulate, working in the same building; as well as by the Catholic Women's League and the Women's Emergency Corps. Four large refuges holding 8,000 persons, at Alexandra Palace, Earl's Court, Edmonton and Millfield House, were managed for the Local Government Board by the Metropolitan Asylums Board, and during the period of the greatest rush several boards of guardians lent other buildings. Edmonton and Earl's Court through which 100,000 refugees passed, remained open till the end of the war.

When the local relief committees, originally organized by the Earl of Lytton, had received their refugees from headquarters, they worked in complete independence. The Glasgow Corporation Belgian Refugee Committee under Mr. Alexander Walker acted as a central authority for receiving and distributing refugees all over Scotland. The Scotch committees raised £360,000. Liverpool, Manchester, Birmingham and Exeter, to mention only a few, looked after many thousands of refugees each. The university of Cambridge invited professors and students from the four Belgian universities to come into residence and organized lectures for them and hospitality for their families. The Chelsea Committee, with Mrs. Erskine Childers as hon. sec., started industries for the refugees on a large scale, and spent £72,000 of English and American money. The National Food Fund and the Belgian Refugee Food Fund, with the substantial assistance of the Smithfield Markets Belgian Relief Fund (which divided gifts of meat between the two funds), supplied an allowance of free food to hostels and Belgian households in London; this made it possible for a large number to do without other financial assistance.

In Jan. 1915, owing to the natural drying up of the sources of private hospitality, the Government undertook to make grants in aid to refugees when private offers were not available, and in this way wholly or partially maintained an average of 6,500 persons till May 1919. In Nov. 1915 it took over the cost of the staff of the War Refugees Committee. When this organization took definite shape, it consisted of a staff of 400 paid workers, who by degrees assumed the places of the original volunteers, though some of these continued to give their services till the end of the war. Lord Gladstone was chairman of the managing committee and Mr. Algernon Maudsley, who had assisted the committee from the earliest days of the war, hon. secretary. The health department, which made provision for chronic, maternity, convalescent and dental cases all over the country, was organized by the Countess of Sandwich in Oct. 1914 and afterwards by Dame Victoria Samuel. Viscountess Gladstone was at first in charge of the education department, and Mrs. Alfred Lyttelton of hostels and flats for the use of refugees passing through London. Mrs. Henn Collins and Mrs. A. S. Webbe looked after undesirables and organized rescue work.

In the first months of the war, owing to unemployment at home and to the feeling that the Belgians might soon be able to return to their own country, the refugees were discouraged from seeking paid work. But when this policy was reversed, it became the chief duty of the relief committees to help their guests to find employment. During 1915 factories for the manufacture of war material, established by the initiative of the Belgians themselves, were staffed with Belgian labour, and 65,000 refugees obtained work through the labour exchanges. Ultimately, nearly all the refugees, except those of the professional classes, were absorbed into the economic life of the country. This did not mean that they were all entirely self-supporting, owing to the high rent of furnished rooms and to the difficulties besetting exiles in a foreign country. Lady Lugard's hospitality committee and the Duchess of Somerset's housing committee established hostels for the propertied and professional classes, where the Government allowance was supplemented by a private fund. A scheme for assistance with the rent of furnished flats in London on a large scale, devised by Mrs. Alfred Lyttelton, proved an immense boon to all classes of refugees.

In the first week of Oct. 1914, the Wounded Allies Relief Committee organized the transportation of the first wounded soldiers from Belgian hospitals to England. Auxiliary V.A.D. hospitals, mobilized, but not at the time needed for the British, opened with enthusiasm to receive the Belgians. 40,000 wounded soldiers came to England, many to return shortly to the front. The first of the five King Albert military hospitals, established in England by the Belgian Government, opened at Highgate in Dec. 1914. By degrees the seriously wounded were concentrated in this hospital, which remained open till 1919, and the discharged drafted to a Belgian reëducation camp in France.

Owing to the large number of refugees in England, the Belgian soldier at the front had to be helped to spend his leave with his relatives. The Local Government Board, from Jan. 1916 onwards, bore the expenses of his journey; a special channel service transporting 300 men a day was organized; the transport department of the War Refugees Committee under Mr. H. Campbell arranged the distribution of 185,000 men to their families, and the British Club for Belgian Soldiers was opened from voluntary sources as a residential club for men without friends or relatives.

Gradually much help was organized for their compatriots by the refugees themselves. A "Union de Comités" under M. Émile Vandervelde, Ministre de l'Intendance de l'Armée Belge, which had its headquarters in London, coördinated the work of approximately 20 Belgian funds chiefly for Belgian soldiers. Mme. Edmond Carton de Wiart, Mme. Maton, wife of the Belgian military attaché in London, and Mme. Pollet, wife of the consul-general for Belgium, took a prominent part in the charitable activities of the Belgian community.

During four and a half years of exile the Belgians grew to feel at home in a strange land, and when the time for repatriation came, many were loth to go. The expenses of repatriation were borne by the British Government at a cost of £243,000 and in Oct. 1920 a monument was erected on the Thames Embankment from a fund raised by the ex-refugees themselves, in memory of their exile in Great Britain during the war. (A. E. C.)

UNITED STATES

When the United States entered the World War in April 1917, but one organization depending mainly on the efforts of women was officially recognized by the Government: the Red Cross. On May 6 1917 the Red Cross had 562 chapters with a membership of 486,194. At the signing of the Armistice, it had more than 3,500 chapters and upwards of 8,000,000 regular volunteer women workers. These women produced in 20 months over 371,000,000 relief articles, including surgical dressings, garments for the wounded and the refugees, and a variety of comforts and conveniences for soldiers and sailors. The value of their output was about $94,000,000. The Red Cross enrolled during the war 23,822 women as nurses. They served in the military and naval hospitals in the United States, Europe, and the Near East, as well as in convalescent homes for soldiers and sailors and in relief work for adults and children both in the United States and overseas. They worked in 700 Red Cross canteens in the United States and 130 in France, serving refreshments to moving troops, giving them medical care, transferring them when sick, and in other ways aiding and cheering them.

When war was declared many large national organizations of women applied to the Government for instructions. The Council of National Defense appointed at the end of April 1917 a committee of nine women (afterwards increased to eleven) with Dr. Anna Howard Shaw as chairman, to form a plan by which the women of the country could be utilized. This committee selected a woman in each state as a temporary chairman, requesting her to call together the heads of all national organizations of women in her territory to elect permanent officers for a state division. This state division was in turn to organize county committees and each county was to form a division in each city and town. This work of organization was carried on so rapidly that by Dec. 1917 the county organization was complete in 23 states, and a year later there were county chairmen in more than 80% of all the counties in the country. Seventy-three different national organizations of women coöperated. Through these divisions it was possible to convey at once to practically all of the women of the nation the requests of the Government.

The plan of work which the women's committee laid out included the following departments: (1) registration for service, (2) food production and home economics, (3) food administration, (4) women in industry, (5) child welfare, (6) maintenance of existing social service agencies, (7) health and recreation, (8) educational propaganda, (9) Liberty Loan work, (10) home and foreign relief. The specific tasks for these departments originated either in requests or suggestions of the Government or in plans made by the committee itself and approved by the Government. Two months after the women's committee was created it was requested by the Government to enrol the women of the country in a league to support such plans for food conservation as the food administration might present. In a few weeks 5,223,850 pledge cards were signed. The signers were the nucleus of a women's food army which, throughout the war, responded to every request for the conservation, substitution or production of foods made by the food administration. Throughout the war, the women's committee continued to serve the Government in similar drives. For some months the committee gave active assistance to the national women's Liberty Loan Committee created by the Secretary of the Treasury, and in 1918, at the request of the agencies responsible for furnishing nurses to the army, including the Red Cross, and the surgeon-general's office undertook a campaign to enrol students for the U.S. student nurses' reserve. While 5,000 student nurses had been asked for, 13,880 were enrolled, and by the end of Dec. of that year 7,730 of these had been placed for training.

The National League for Women's Service, an organization formed after a study of the activities of Englishwomen, some weeks before the United States went into the war, developed an extensive motor corps, carried on a variety of services to soldiers and sailors, and effectively supported all drives. The Y.W.C.A. organized in June 1917 a war council, under which it developed a variety of service clubs, both in the United States and overseas, particularly France. The hostess houses of the association at the home camps of both white and coloured soldiers looked after women visitors, a service which proved of such value that the War Department at the close of the war took the work under its educational and recreational branch. Some 50 buildings were turned over to the Government by the war works council of the Y.W.C.A. Overseas the association conducted service clubs which served Red Cross nurses and other women workers. Both in France and in the United States this organization carried on industrial service clubs near large manufacturing centres.

The employment of women in war industries began in the United States in the winter of 1914–5 with the manufacture of supplies for the Allies. The percentage of women to men in the 19 leading war industries increased from 6·5% in 1914 to 7·7% in the latter part of 1916. In the next two years, to the close of 1918, the proportion rose in these industries to 13·9 per cent. A conservative estimate places the number of women employed in factories (food, textile and war supplies) by the end of 1918 at 2,139,100—an increase of between five and six hundred thousand over the number employed in these industries in 1914, the date of the last official census. These women were trained to perform a variety of skilled and semi-skilled tasks in the metal trades, in electrical and chemical occupations, in the making of fine instruments, in wood, rubber and leather work, all trades which had been considered beyond their capacity. The substitution of women for men on street railways and subways, in railway yards, banks, offices, shops and hotels and in agricultural pursuits, increased steadily until the signing of the Armistice.

This invasion of industry and commerce by women was accompanied by an effort to preserve existing legal safeguards and to ensure suitable living and working conditions. In 1918 Congress established a women's bureau in the Department of Labor, the aim of which was to develop the most effective use of women's service in production for the war, and at the same time to prevent their employment under injurious conditions. The bureau adopted a set of standards governing women's employment. Although created for the war emergency, the woman's bureau in June 1920 was made a permanent section of the Department of Labor.

No official nation-wide registration of women for war service was ever made; plans for such registration were completed by the women's committee of the Council of National Defense and approved by the Government, and it was left to each state to decide whether or not there was a need for registration in its territory. But it is a fact that practically all the women of the United States were doing volunteer war service at the time of the Armistice. They served in the food army, in the farm army, in the chapters of the Red Cross, in the many drives for funds, and in many other less conspicuous but essential activities backed by the Government.

(I. M. T.)

WOOD, SIR HENRY EVELYN (1838–1919), British field-marshal (*see* 28.789). The field-marshal, who retained his mental and bodily vigour almost to the end, died at his Essex home Dec. 2 1919 and was buried at Aldershot. His record in Zululand indicated unmistakable capacity for command in presence of the enemy, and he was perhaps unfortunate in that his presence during the hostilities with the Boers in 1881 and at Alexandria in 1882 afforded him no further opportunities of a similar kind. From the period when he was chief at Aldershot dates the introduction of military training on practical lines into the British army, and during a prolonged and distinguished career as a soldier he proved himself a keen reformer and an untiring worker, wrapped up in the profession which he adorned.

WOOD, SIR HENRY JOSEPH (1869–), English conductor and musician, was born in London March 3 1869. His musical education was largely received at the Royal Academy of Music and when only ten years old he became deputy organist at St. Mary's, Aldermanbury. As a conductor, he first appeared in 1889, when he joined the Rousbey opera company, and for some years he toured with various companies, including the Carl Rosa (1891). In 1895 the Queen's Hall concerts were started under a system of guarantees, with Henry Wood as conductor and Robert Newman as manager. Under his conductorship the standard of English orchestral playing was notably raised, and his work for music in London was deservedly honoured by a knighthood in 1911. He married, first, in 1898, a Russian lady, Princess Olga Ourousoff (d. 1909); second, in 1911, Muriel, daughter of Major Greatrex.

WOOD, MRS. JOHN [Matilda Charlotte] (1833–1915), English actress, was born at Liverpool Nov. 6 1833, the daughter of Henry Vining, and first appeared on the stage at Brighton at the age of eight. As a young girl she played leading parts in comedy at the Theatre Royal, Manchester, and in 1852 appeared there as Ophelia. After her marriage she acted for some years in America, beginning in 1854 with *The Loan of a Lover*, followed by many other parts. She opened a theatre of her own in New York in 1863 but returned to England in 1866. From that time until her retirement from the stage in 1905, she was in the first rank of robust comedy actresses. Her management of the Court theatre between 1883 and 1891 saw the production of many of Pinero's best comedies. Later she appeared in elderly rôles in most of the Drury Lane melodramas, her last appearance being in Hall Caine's *The Prodigal Son* in 1905. She died at Birchington-on-Sea Jan. 11 1915.

WOOD, LEONARD (1860–), American soldier, was born at Winchester, N.H., Oct. 9 1860. He graduated from the Harvard Medical School in 1884, was appointed assistant surgeon with the rank of first-lieutenant in the U.S. army in 1886, and at once joined Capt. Lawton's expedition against the Apaches in the southwest, resulting in the capture of Geronimo. For distinguished services he was awarded the Congressional Medal of Honor. In 1891 he was promoted captain and full surgeon, and later, while stationed in Washington, D.C., was President McKinley's personal physician. Here he became the close friend of Theodore Roosevelt, then Assistant-Secretary of the Navy. On the outbreak of the Spanish American War in 1898 Wood was commissioned colonel of volunteers, and together with Roosevelt, as lieutenant-colonel, raised the famous regiment of "Rough Riders," composed of western ranchmen and cowboys as well as members of prominent eastern families eager to serve under these two strenuous leaders. For conduct at Las Guasimas and San Juan Hill, Wood was promoted brigadier-general July 1898 and in Dec. major-general of volunteers. He was military governor of Cuba from 1899 to 1902 when the Cuban Republic was established. Under his guidance great improvements were made in schools and sanitation. Meanwhile he had been honourably discharged from voluntary service and appointed brigadier-general in the regular army Feb. 1901. In March 1903 he was sent to the Philippines and in Aug. promoted major-general. For three years he was governor of the Moro Province and during 1906–8 was commander of the Philippines Division. In 1908 he returned to America as commander of the Eastern Department for a year. In 1910 he was special American ambassador to the centenary celebration of Argentine independence. On his return he was appointed chief of staff, serving until 1914, when he was again given command of the Eastern Department. General Wood often had disapproved the policies of the War Department, and as early as 1908 had urged preparedness. To him was largely due the establishment of a summer camp at Plattsburg for training civilian officers, which was taken as a model for other camps of the kind after America's entrance into the World War. In 1915, when he gave unofficial indorsement to the proposed formation of the American Legion whose purpose was to establish a body of some 300,000 men ready for immediate service, he was rebuked by the Secretary of War. Just before America's entrance into the World War in 1917 it was announced that the Eastern Division, then under Gen. Wood's command, had been divided into three divisions, and Gen. Wood was assigned to the Southeastern Division, with the alternative of choosing either Hawaii or the Philippines. As a soldier desiring active service he naturally chose the American post; but the apparent motive of the War Department to humiliate him aroused criticism. He was later transferred to Camp Funston, where he trained the 89th Div., N.A. In Jan. 1918, while in France, presumably preparatory to bringing his troops there, he was painfully wounded by the explosion of a French mortar. After his return to America he was on the point of embarking with the 89th Div., when he was suddenly assigned to the Western Department, no reason being given. It was generally understood that his name was not on the list of officers submitted by Gen. Pershing as acceptable for duty overseas. By change of orders he was returned to Camp Funston, where he trained the 10th Div. of the regular army and other troops. In 1919 he was put in command of the Central Department, with headquarters at Chicago. In 1920 he was a prominent candidate for the presidential nomination at the Republican National Convention. He led on the first four ballots and never fell below second place. When the supporters of Governor Lowden, his chief competitor, were released after the eighth ballot, they swung to Senator Harding, a "dark horse," who was nominated on the tenth ballot, with 692½ votes to 156 for Gen. Wood. In 1921 Gen. Wood was sent on a special Federal mission to the Philippine Is. to report on conditions there. During his absence he was appointed head of the university of Pennsylvania. In Oct. 1921 he retired from active service in the army and was appointed governor-general of the Philippines. He was granted a year's leave of absence from the university of Pennsylvania, but it was thought that he might be able to assume his academic duties in Oct. 1922. He was the author of *The Military Obligation of Citizenship* (1915, lectures at Princeton and elsewhere); *Our Military History, Its Facts and Fallacies* (1916); and *Universal Military Training* (1917).

See I. F. Marcosson, *Leonard Wood, Prophet of Preparedness* (1917); Joseph H. Sears, *The Career of Leonard Wood* (1919); and *Leonard Wood on National Issues* (1920), compiled by Evan J. David.

WOODGATE, WALTER BRADFORD (1841–1920), British oarsman and barrister, was born at Belbroughton, Worc., Sept. 20 1841. He was the eldest son of Canon Henry Arthur Woodgate, who was a fellow of St. John's College, Oxford, and Bampton lecturer in 1838. He was educated at Radley College, and Brasenose College, Oxford, and during his undergraduate course he founded Vincents' Club. In 1872 he was called to the bar; but it is as a first-class oarsman and journalistic critic of rowing that he is remembered. He rowed for his own college, and in 1862 and 1863 in the winning eight for Oxford. In 1864 he won the Diamond sculls after a dead heat two years previously (*see* 23.784), and in 1865 he was in the winning eight for the Grand Challenge Cup at Henley. He contributed the volume on *Boating* to the Badminton Library, and also wrote *Oars and Sculls, and how to use them* (1889) and the *Reminiscences of an Old Sportsman* (1909). He was also the author of *A Modern Layman's Faith* (1893) and of one or two novels. He died at Southampton Nov. 1 1920.

WOODS, HENRY GEORGE (1842–1915), English divine, was born at Woodend, Northants., June 16 1842. He was educated at Lancing and at Corpus Christi College, Oxford, where he had a distinguished career. In 1865 he became a fellow of Trinity, and in 1866 was ordained. He was a tutor at Trinity from 1866 to 1880, and bursar from 1867 to 1887, in which year he was elected president of Trinity. He resigned the presidency of Trinity in 1897, and from 1900 to 1904 was rector of Little Gaddesden, Herts, and chaplain and librarian to Lord Brownlow at Ashridge Park. In 1905 he succeeded Ainger as Master of the Temple. He died at the Master's House, Temple, July 19 1915.

His wife, MARGARET LOUISA WOODS (b. Nov. 20 1856), poet and novelist, was married to him in 1879. Her first novel, *A Village Tragedy*, appeared in 1887, and her first volume of verse, *Lyrics and Ballads*, in 1889. Later novels included *Esther Vanhomrigh* (1891); *The Vagabonds* (1894); *Sons of the Sword* (1901), and *The Invader* (1907). In *The Princess of Hanover* (1902) she essayed historical drama. In 1913 her *Collected Poems* were published.

WOODWARD, HENRY (1832–1921), English geologist (*see* 28.804), died at Bushey, Herts, Sept. 6 1921.

WOODWARD, HORACE BOLINGBROKE (1848–1914), English geologist (*see* 28.804), died Feb. 5 1914.

WOOL (*see* 28.805).—The functions of "supply" and "demand," of "free-trade" and "controlled trade" in the wool industry, during the decade 1910–20, form a very interesting study for the economist. The situations before, during, and after the war are best shown separately:—

I. BEFORE THE WAR (1911 to 1914)

(*a*) *Wool Production.*—The best available statement of the world's sheep and wool production is given in Table 1; it includes figures of the pre-war and post-war periods.

TABLE 1. *The World's Sheep and Wool.*[1]

	Sheep		Wool in lb.	
	Pre-war	Post-war	Pre-war	Post-war
Europe	177,981,207	171,026,261	803,400,043	751,104,667
Australasia	96,189,727	107,467,005	645,132,880	852,122,484
S. America	118,638,046	72,342,762	482,640,707	487,180,000
N. America	54,053,409	49,549,458	303,473,000	327,829,531
Asia	92,318,419	96,735,546	273,146,000	326,505,000
Africa	63,432,755	69,114,685	219,919,000	219,919,000
Central America and W. Indies	710,380		750,000	750,000
Total	603,323,943	566,235,717	2,728,461,630	2,965,410,682

[1] Chiefly from the *Wool Review* of the National Association of Wool Manufacturers, United States.

From these statistics the following interesting deductions are to be drawn. It is somewhat surprising to find Europe heading the list of wool-growing continents. This is largely due to the flocks of European Russia: 320,000,000 lb. of wool (pre-war) are credited under this head, and this probably explains the source of German wool clothing during the latter days of the war. What had become of this huge quantity latterly was not on record in 1921. Incidentally it would certainly appear that the continent of Europe as a wool-growing continent had not claimed the attention merited. In most respects Europe compared more than favourably with other continents, and it was only owing to the diversity of interests, languages, etc., that this was not more in evidence. If the nations of Europe would all pull together, that continent would probably have more to give to the world than to receive.

Europe and North America, being by far the greatest manufacturing centres in the world, have practically consumed the whole of the very large surplus stocks from the other wool-growing countries, apparently in the proportions of 80% for Europe and 20% for North America. The marked difference in the weights of the fleeces produced as indirectly shown by this table is obviously worthy of careful consideration.

(*b*) *Wool Distribution.*—The detailed figures respecting local supplies, importations and reëxportations are very confusing. The figures in Table 2 may be taken—with exceptions to be presently noted—as an indication of the wool each important manufacturing country received. One or two questions here arise. The United Kingdom is credited with manufacturing 90,000,000 lb. approximately of a 120,000,000 lb. clip. It must not be forgotten, however, that a very considerable amount of the world's wool supply passes through the London or Liverpool wool sales, as is shown by Table 3:—

TABLE 2. *Wool-manufacturing Countries.*

Country	Imported for Manufacturing	Local Supplies	Total
1. France (1909)	623,000,000	75,000,000	698,000,000
2. United Kingdom (1911)	490,307,000	90,000,000	580,307,000
3. United States	251,000,000	304,000,000	555,000,000
4. Germany	517,000,000	25,600,000	542,600,000
5. Russia	94,000,000	320,000,000[1]	414,000,000[1]
6. Belgium	355,000,000	1,000,000	356,000,000
Austria, Hungary, Italy and the Netherlands follow in the order named.			

[1] These figures require careful consideration. Probably a large proportion of this wool is usually manufactured in other countries—notably Germany and Britain.

TABLE 3. *United Kingdom Imports and Exports* (1911).

	Imports	Exports	Retained
Colonial	659,511,000		
Foreign	135,004,000		
Totals	794,515,000	304,208,000	490,307,000

The colonial (and foreign) wool not accounted for by Table 3 is no doubt sold direct to the manufacturing countries. This is indicated by the sales of South African wools for the year 1913 (Table 4).

TABLE 4. *Distribution of South African Wools.*

	1913	1919
United Kingdom	96,028,737	96,462,203
Germany	61,123,713	—
Belgium	20,695,225	12,662,059
France	4,898,212	9,588,452
Italy	924,852	43,002
United States	221,522	71,502,522
Japan	—	39,800,648

An analysis of S. American exports would, no doubt, show by far the larger porportion of S. American wools passing directly to Belgium, France, Germany and the United States, a large quantity, of course, passing through the Antwerp sale-rooms.

(*c*) *Tendencies in Production and Distribution.*—In wool production from 1910 to 1914 there is little to note. S. Africa made a valiant attempt to improve both the quality and quantity of her wool, and succeeded in both objects to a certain extent. In Australia certain developments of sheep-growing districts are to be noted, but these, with the increase in the weights of the individual fleeces, probably only just served to balance losses through drought and in other directions. Falkland Island wool (fine crossbred) made a name for itself as a good hosiery wool, but unfortunately the increase up to 1914 was not great. S. America generally proved disappointing, in view of the demand for its wools, not only from the European continent but also from Great Britain, following the decline in the prejudice against them.

Undoubtedly the greatest wool problem prior to the war was the provision of a sufficient quantity of fine merino wool. This is illustrated in Table 5. S. Africa partly met this deficiency, but Australia pinned her faith on mutton rather than on wool, so that the tendency to eliminate the pure-bred merino is still in evidence.

TABLE 5. *New Zealand Wool.*

	Total Sheep	Merinos
1910	23,480,707	1,868,805
1917	25,270,386	1,063,491
1920	23,914,506	803,589

So far as the distribution of the wool manufacturing industry was concerned there was an undoubted tendency in Britain to relinquish wool manufacture owing to severe competition. The continental European competition took the form of efficiency in manipulation and excellence in the goods produced. How Yorkshire was going to face the importation of certain continental goods was a problem—and one that had still to be faced after the war. The competition with the United States was apparently controlled by the tariff charges, but it is more than probable that the excellence of American manufactured goods was already beginning to tell against European importations; although America still had to start her export trade. Yorkshire, however, appeared to be falling between two stools—she was not producing goods of the excellence of the continental styles and thereby forcing a way into neutral markets; nor was she organized on such a scale that she could face the United States' markets—indeed the American manufacturers were surpassing her in scale of organization. It would not be overstating the case to say that the year 1914 opened with many misgivings so far as the British wool manufacturing industry was concerned. The war came, and temporarily dominated everything. But the conditions of 1914 were likely to reappear afterwards, and would have to be faced sooner or later.

II. THE WAR PERIOD (1914 to 1918)

The Slump in Trade.—Fear of the unknown naturally created the trade slump observable during the early months of the World War. Britain, a country whose very life depended upon the importation of the raw material and exportation of the semi-manufactured or fully manufactured article, naturally had most to fear. This fear was further aggravated by the fact that British manufacturers had huge financial interests involved with Germany; and, conversely, Germany had financial interests with Britain. With trade universally in a state of suspended animation, and the sequence of delivery of goods and payment of accounts seriously interfered with, many British firms—and especially those in the wool, top and yarn trade—were at once in serious financial difficulties. The Government, however, tided over the difficulty by the "moratorium," which, by the "time easement" given, enabled the greater proportion of firms eventually to meet their liabilities.

A period of suspense followed, during which the exact trend of many matters was being worked out. By the middle of 1915, however, the idea that, when the British and French armies got going, they would sweep the Germans back into the Fatherland, had practically gone. In the meantime Germany had been swept from the seas. It was now evident that Germany, from the wool point of view, would have to be self-contained, neither importing raw wool[1] nor exporting manufactured goods; that France was seriously incapacitated as a manufacturing country owing to the invasion of much of her manufacturing territory; that Russia would seriously have to draw upon British stocks of manufactured goods; in fact, that Britain must be the mainstay of the Allies—and of the world, with the exception of the United States and Japan—so far as wool manufactured goods were concerned. The extent to which Germany deliberately crippled France both during the war period and subsequently will be realized from the following quotation from the *Yorkshire Observer* in March 1921:—

> "The Fourmies District remained practically the whole time away from actual fighting range and did not suffer from gunfire, but, this notwithstanding, the destruction by hammer, pick, dynamite and fire was complete, the Fourmies woollen plants having always proved most serious competitors of those of Germany. The enemy reached the district on Aug. 26 1914, and left it on Nov. 9 1918. When they arrived there were 75 textile works in full activity; they destroyed all except five worsted spinning plants, one woollen spinning plant and one combing plant. The steam engines were broken or otherwise damaged; the boilers removed and rendered unserviceable, the safes were broken into and all records of manufacture, samples, reference data, representing 30 years of activity, removed to Germany. . . ; Immediately the Germans occupied the northern departments of France, not a single wool-combing machine was left throughout the country; there remained in activity throughout the land only 160,000 worsted spindles out of 2,400,000; only half the total of 700,000 woollen spindles; only about 11,000 weaving looms out of 56,000."

By 1916, two other factors had come into play. The drain on the man-power of Great Britain was becoming serious. But it was now fully revealed that in the wool industry there was a vast surplus of labour ready to maintain output, at least at a very high rate. By April, scarcity of shipping was threatened. Thus early in 1916, if the serious limitation of the supply of raw materials was not actually felt, it was in sight.

The Difficulties Leading to Wool Control.—The British War Office, having in the very early days of the war experienced the difficulty of clothing in khaki the large army in course of formation, organized itself to overcome this difficulty, and by the inevitable restrictions indirectly placed on the manufacture of civilian clothing had so far succeeded fairly well in its direct object. But by the early days of 1916 the War Office was seriously alarmed at the future prospects of supplies of raw materials and sought outside advice. As illustrating the method of working the following may be taken as typical. On Feb. 2 1916 a War Office official (who, incidentally, knew nothing of wool) visited the university of Leeds and asked for certain estimates respecting British combs and spindles, to be supplied to him four days later when the Army Council would meet to discuss supplies. In Table 6 the figures then supplied are given, and alongside the estimates are given also the actual figures, kindly supplied some years later by the same official. The estimate for 1916 was 337,500,000 lb., as against an actual production of 309,443,185 lb., based on the first half of 1917.

The following figures were also supplied on the same date:—

Wool available for use in the United Kingdom	800,000,000 lb.
Less clothing wools used in the woollen trade	200,000,000 lb.
Available for combing	600,000,000 lb.
Less shrinkage and tearage in scouring and combing (40%)	240,000,000 lb.
Wool available for "tops"	360,000,000 lb.

The estimated shrinkage and tearage of 40% would have been much too low—as average Australian merino gives a shrinkage of about 50% and a tearage of from 5 to 1 to 8 to 1—but for the endeavour made to save shipping space by shipping in the scoured state only, and by reason of the large quantities of washed home-grown wools and low-yielding colonial crossbreds included. The effect of this is clearly shown (Table 7) in Mr. Norman Rae's figures published in the *Yorkshire Observer* of Friday, Aug. 10 1917. From these figures it is evident—(*a*) that the Government by 1917 had fears of being unable to

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[1] With the exception noted with reference to Russian wools.

TABLE 6. *Estimates (Feb. 1916) and Figures.*
(Output of combs per annum.)

Combs			1,500 combs long wool and crossbred each combing 600 lb. per 10 hours		1,500 combs Botany each combing 300 lb. per 10 hours	
Actual 1914	Estd. 1916	Actual 1915	Estimated 1916	Actual (1917)[1]	Estimated 1916	Actual (1917)[1]
2,823	3,000	2,956	225,000,000	206,655,428	112,500,000	92,869,516

(Output of worsted spinning spindles per annum.)

Spindles			2 lb. per week per spindle estimated	
Actual 1904	Estd. 1916	Actual 1916	1916	Actual (1916)[1]
3,000,000	3,000,000	3,241,714	300,000,000 lb.	300,241,712 lb. (The 1915 actual was 253,879,664 lb.)

[1] Large quantities of scoured colonial wools were being imported. Certain worsted wools were also being drawn and spun without being combed, thus eliminating "less tearage."

TABLE 7. *Stock Dec. 31.*

Schwartze % Type	%	Greasy lb.	Clean lb.
72 N.Z. greasy crossbred	70	50,656,000	35,459,000
45 Aust. greasy merino	45	49,438,000	21,258,000
85 " scoured crossbred	85	33,704,000	28,648,000
" mtg. gsy. crossbred	72	17,901,000	12,888,000
" mtg. gsy. merino	43	4,638,000	1,994,000
73 " low wools	75	40,223,000	30,167,000
60 " mohair, etc.	80	17,807,000	14,245,000
	68·69 %	237,213,000	162,935,000
Private British	78	21,701,000	16,926,000
Government British	78	51,053,000	39,821,000
Total	70·87 %	309,967,000	219,682,000

Yield as above . . . 219,682,000 lb. (clean)
Leaving out skins, yield at 50% (instead of 70·87%) . . . 154,983,000 lb. (clean)

Increase (wool under-estimated) . . 64,698,500 lb. (clean)
Skins, 7,238,000 lb., not included.

keep the Allies' wool industries supplied with wool, and much under-estimated the yields—although they had the Leeds University suggestion of 40% for yield and tearage before them; (*b*) that the industry was feeling the shortage of wool and was regarding the future with misgivings; (*c*) that leading wool men thought it actually expedient to question the Government figures, and, if possible, to obtain at once a greater wool distribution; (*d*) that as subsequent figures seem to show, the university figures of 40% average loss between raw wool and finished top and the other figures supplied were most nearly correct, and would have served well as a basis to work upon. All these figures, however, are chiefly useful as illustrating the difficulties involved not only in estimating the workable supplies of wool during the war period but in estimating the yields and in averaging up the quantities of clean wool which the actual deliveries might be expected to give.

How serious was the problem of supplying wool to the home trade, and to such of the Allies as could manufacture it, is shown in Tables 8 and 9. To the quantities shown in these tables should be added something over 300,000,000 lb. of remanufactured materials, probably derived as follows (in 1914 figures):—Of the wool manufactured in Great Britain, 500,000,000 lb., about ⅓ (166,000,000 lb.) is retained at home, and about half this (or 84,000,000 lb.) is torn up each year; rags imported amount to 100,000,000 lb.; so that the total remanufactured materials (excluding noil) amount to 184,000,000 lb. But this is probably an under-statement, as the figures collected by the Board of Trade during the war period show an average approximating to 200,000,000 lb. Thus it would appear that the woollen industry of Great Britain roughly consumes per annum: —200,000,000 lb. greasy wool[1], 200,000,000 lb. remanufactured materials, and 60,000,000 lb. of noil, or a total of 460,000,000 lb.

These figures reveal—(1) the continuous reduction in the quantity of British wool grown and, excepting during the war period, manufactured in Britain; (2) an increase in supplies of colonial and foreign wools, if we take into account the fact that there is possibly still some of the 1919 period wool to be accounted for; (3) the increase in the quantity of colonial and foreign wool manufactured in Britain; (4) the large increase in the foreign and colonial importation in 1915; (5) the effects of the German submarine campaign on the 1918 importation, and the making up of lost ground in 1919; (6) the fact that the average importation of colonial and foreign wool for the five years ending 1919 is much below the five years ending 1914. Had wool gone elsewhere, or had it not been grown? It may be noted (7) that Turkey mohair (sent to Britain by parcel post during the first year of the war) would disappear until 1919, the large increase shown on 1919 being no doubt partly Turkey mohair and partly Cape mohair; and (8) that alpaca, being free, was largely employed to take the place of merino wool during 1917 and 1918, —the clipping of immature fibre led to the marked increase in 1918 and the consequent reduction in 1919.

TABLE 8. *Pre-war Supplies of Raw Materials.*
(In millions of lb.)

Average for five years finishing	1899	1904	1909	1914	1919
British wool: Grown	137	136	133	131	120
Manufac. Britain	114	104	94	95	105
Colonial and foreign wool Imported	715	607	707	782	724[2]
Manufac. Britain	376	342	388	463	647
Skin wool	34	30	35	35	30
Pulled wool	132	145	193	206	163
Mohair, Alpaca, etc.	28	37	41	42	21

[2] This figure is explained in Table 9.

TABLE 9. *War Period and Post-war Period Supplies of Raw Materials.*
(In millions of lb.)

For years	1915	1916	1917	1918	1919
Imported—					
Foreign wool	87	54	44	17	. .
Colonial wool	838	564	578	396	. .
Totals	926[3]	618[3]	623[3]	413[3]	1,042[3]
Imported—					
Mohair	. .	. .	3·5	5·6	29·4
Alpaca	. .	. .	5·5	7·0	3·8
Camels' hair	. .	. .	2·7	2·3	4·8

[3] Average for five years = 724 (*see* Table 8).

These facts and figures, although somewhat prematurely placed here, may be usefully borne in mind in studying all phases of the subject.

In April 1916 the Army Contracts Department of the War Office began to commandeer hosiery yarns on the financial basis of a fixed margin to cover the processes of manufacture. A little later restrictions were imposed upon the export of raw wool—possibly owing to rumours of it reaching enemy countries and certainly because wool supplies for home purposes were becoming very restricted. By June 1916 the War Office knew that further control was almost certainly inevitable, and circulated compulsory requests for particulars of stocks of wool, tops and yarn, which requests, of course, were very disquieting to the trade. Later in the same month, so serious was the position judged to be that the War Office prohibited the opening of the British wool fair of Kettering, and, eventually, after some debate, purchased the whole of the British clip at 35% above July 1914 prices. The British clips of 1917 and 1918 were also bought.

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[1] This figure is questionable as large quantities of so-called clothing wools may be employed for combing purposes.

Anxiety with reference to the possibility of supplying the army with the wool goods it really needed continually increased. In April 1917 the open market for wool was closed and the sales by auction abolished. In May, in anticipation of the lack of wool to keep the factories going and of labour disturbances, an army council order was issued which resulted in the reduction of working hours in the factories from 55½ per week to 45 per week, unless permission was obtained from the director of army contracts to work full time. This order was not withdrawn until May 18 1918, following the enormous demand for flannel goods.

Following the revolt, already referred to, of Yorkshire manufacturers in Aug. 1917, due to War Office restrictions of supplies and of estimates of future supplies, and following the failure of the trade itself to supply reliable data, came the formation of a "Board of Control."

Wool Control.—The Board of Control was organized with Sir Arthur Goldfinch as director of raw material supplies, Col. F. V. Willey as controller of wool supplies, and Sir Charles Sykes as director of wool textile production. The department was housed in the Great Northern Hotel, Bradford, and was given complete control of both supplies of raw material and output of finished clothing. The activities of the department followed briefly the following lines:—(1) A reasonably exact basis of "yields" was ascertained and all wools dealt with on the "clean wool" basis. (2) Reliable statistics were obtained and made the basis of the distribution of supplies of raw materials. (3) A method of "rationing" the margin of wool supplies (about 20% of the available supplies) available for the civilian trade was worked out. (4) Difficulties of a minor nature, such as the supply of oils for oiling wool, soaps for scouring, etc., were faced and usually satisfactorily surmounted. (5) A standard clothing scheme was introduced, the intention of which was, no doubt, good, and its failure only to be attributed to the failure to employ the technical skill actually available in the industry in the designing and displaying of the goods manufactured. Exhibitions were held up and down the country and attracted much attention, but little demand for the fabrics was exhibited. Last, but perhaps not least, the department had to face the problem of relinquishing control on the termination of the war. Those who know the anxiety caused, years before the war was over, by the clearly foreseen difficulties of disbanding an enormous army, will know something of the anxieties of the Wool Control Board to close down with credit to itself and no less to either the wool grower or the wool manufacturer.

Provision for After the War.—The Armistice brought with it the determination of those whose trade had been taken from them by the Wool Control Board to oust the Board and regain their own back again. The Board's function, on realizing the inevitable, was to dissolve (1) with credit to itself, and (2) with due regard to the interests of the wool growers and wool merchants, of the wool manufacturers, and of the consuming public. With the huge demand for goods following the Armistice prices soared up and up, and it was only human that the Board should tend to retain command to its own financial advantage, and also to attempt to prevent undue inflation of values to the detriment of the consuming public. So far as British wools were concerned the removal of control was so simple that no preliminary action was considered necessary, and the restrictions were actually removed in time for the wool fairs in 1919.

To meet the difficulty with reference to Australian wools the Imperial Government had decided to purchase the Australian clip for one year after the war. To further facilitate matters, a Wool Council, which included imperial representatives, was formed by the War Office.

With reference to the interests of the manufacturers and consumers the Government again asked for advice from the university of Leeds through one of its representatives. In a personal interview with the official in question the probable trend of trade after the war was outlined and the suggestion given that, in view of the almost certain shortage of immediately available supplies and the huge demand for fine merino wools, certain manufacturing restrictions—such as spinning only to fine counts of yarn—should be imposed. Unfortunately this suggestion was not sufficiently acted upon, with the result that the army's revolt from rough khaki to fine blue serge sent merino wools soaring up to unthought of heights, all other qualities following suit. The intention of the Wool Council was undoubtedly good, but again the direction of the matter was primarily in the hands of those who knew little or nothing about the wool industry, who could not even judge who were giving them sound advice and who were giving them questionable advice. It may be conceded that to control speculation under the conditions prevailing from 1918 to 1921 was apparently impossible. Apparently the only thing to be done was to unload stocks as rapidly as possible—although one authority did suggest that the way to reduce prices was to keep large stocks of wool and not to sell.

During this period there was much unrest in the labour world and a great deal of talk about "profiteering." As an indirect result of this the Whitley Act was passed by Parliament, and note should here be made of the endeavours made by the British woollen and worsted industries to take advantage of this Act and form "Industrial Councils" composed of employers and employees, also of the formation of the "National Wool Textile Industrial Council," the final draft-constitution of which—prepared by Mr. Ernest Marsh (chairman) and Mr. G. H. Wood (secretary)—as adopted on Dec. 10 1918, was as follows (*Yorkshire Observer*, Nov. 27 1918):—

"The title selected is the National Wool (and Allied) Textile Industrial Council, and its objects are defined as follows:—

To promote the development of the industry and to secure that wages, methods of production, and conditions of employment shall be systematically reviewed and decisions agreed upon which shall have as their object the improvement of the relations between employers and employees.

In furtherance of these objects the Council shall:—

(*a*) Consider wages, hours, and working conditions in the industry as a whole, and the fixing of standard rates of wages for similar occupations in the industry. It shall also consider the employment of scientific and agreed methods of fixing wages, and of adjusting wages to new conditions, and the securing to the employees of a share in any increased prosperity of the industry;

(*b*) Consider the best means of securing the highest efficiency of the industry, including any improvement in machinery, invention, or method by which the prosperity of the industry is to be increased; secure that such invention or improvement in method shall give to each party a fair distribution of the benefits derived from the increased efficiency; utilize to the fullest extent the practical knowledge and experience of the workpeople, and secure that such knowledge may receive consideration;

(*c*) Consider the existing machinery for the settlement of differences between different parts and sections in the industry, and the establishment of regular methods of negotiation on anticipated issues between employers and employees, and upon differences which may be reported with a view to the prevention of differences and their equitable adjustment;

(*d*) Consider the supervision of the entry into and training of employees for the industry, and coöperation with the educational authorities in arranging educational facilities for the industry in all its branches;

(*e*) Make comparative studies of the workings and methods of the industry in this and other countries, and when desirable publish reports;

(*f*) Secure to the workman a greater share in and responsibility for the determination and observance of the conditions under which he works, in so far as it relates to his material comfort and well-being; make efforts for the decasualisation and permanent security of employment, having regard to the conditions surrounding changes of occupation between one employer and another; consider means toward the improvement of conditions with a view to removing the danger to health in the industry, and toward providing special treatment where necessary for employees in the industry;

(*g*) Make reports to Government departments and local authorities of the needs and opinions of the industry; consider any questions bearing on such matters which may be referred to the Industrial Council by the Government or by a Government department; consider jointly all proposed legislation affecting the industry and take joint action where such legislation is likely to interfere with its prosperity;

(*h*) Consider the best means of insuring the observance of the decisions of the Council and of agreements made between organizations of employers and employees;

(*i*) Consider means whereby the employers and employees shall be brought within their respective associations."

This Council steadily extended its activities, and may ultimately be the deciding factor in helping Great Britain to maintain and possibly to extend her manufacturing position.

Another indirect result of the war was the development of industrial and scientific research. The university of Leeds (so far as the wool industry was concerned) here took the lead, and, in conjunction with the West Riding County Council and with the help of many prominent manufacturers in the various manufacturing districts, raised approximately £5,000 per annum for a period of five years. With the development of the Government Department of Scientific and Industrial Research, however, came the question of overlapping, and the university, while naturally retaining its own research status, not only gave way to the new department but strenuously helped in the development of "The Research Association for the Woollen and Worsted Industries" now housed in Leeds. This Research Department is designed to cover the requirements of Great Britain and Ireland.

III. After the War (1918 to 1921)

Withdrawal of Control from British Wools.—Under political pressure the Government freed the wool fairs of 1919 from State control. But a curious tendency now made itself felt. Owing to the limitation of supplies of colonial crossbreds and other crossbred wools, woollen manufacturers had been constrained to use British Down wools and Down crosses. These were discovered to possess just the characteristics sought for in certain woollen goods. They were also the wools sought for by the hosiery manufacturer; and as hosiery now took a wonderful development the Down wools went soaring away in price, at last almost rivalling colonial merinos. When the slump came, Down wools stood out against it even longer than merinos, and it seemed probable that when trade should revive Down wools would again come into their own. In view of the great future before Down wools it was regrettable that more British farmers did not follow the suggestion to grow Down crosses, as strenuously advocated by qualified representatives of the universities of Edinburgh and Leeds.

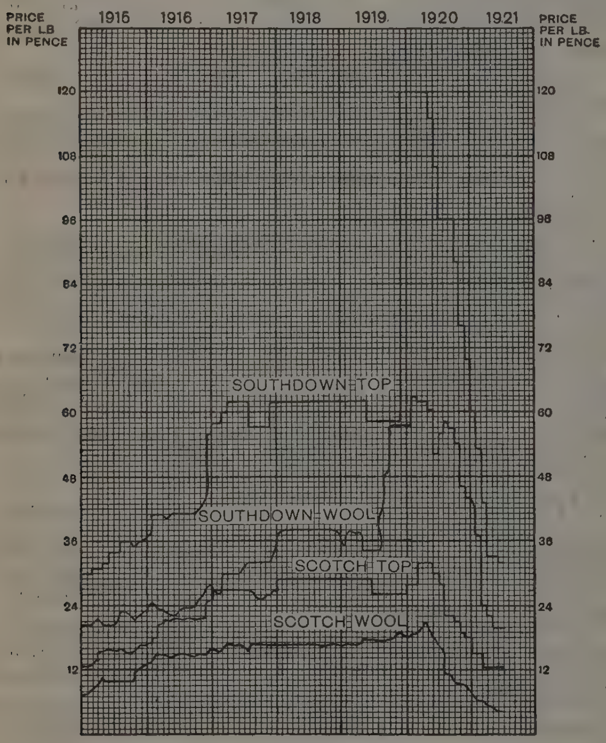

CHART 1

Values of British Wools and Tops (1911 to 1921).

The changes in values of British wools and tops are shown for the decade in Chart 1.

Of course the high values shown in this chart are fictitious in more senses than one, but it would seem that if the 1921 prices of these wools had been brought to the 1914 basis they must be so cheap that demand for goods manufactured from them would have been immediate. Probably the large stocks of manufactured goods still held in 1921 by the middleman kept the prices of these goods at an artificial height and thus lamentably interfered with trade.

Withdrawal of Control from Colonial Wools.—The Wool Council of the War Office on the cessation of hostilities found itself in great difficulties with reference to colonial wools. Just as on the outbreak of war no one knew what would happen, so in this case it was impossible to foresee whether the enhanced values of the war period would be maintained or prices rapidly fall. If prices had rapidly fallen it is possible that the wool grower would have held the Wool Council to its bargain, and no one could well have found fault with their attitude. But prices rapidly rose, and so it came about that the colonial wool grower felt aggrieved that he was not going to profit by the enhanced wool values like the home wool grower. Thus it came about that the Imperial War Council agreed to share the very substantial prospective profits with the colonial wool grower. Unfortunately much of the 1919 wool had not been brought under the hammer before the slump started (May 1920), but it was stated that, after the British Treasury had been reimbursed for the expenditure it had incurred, there was at the end of 1920 a clear profit of £14,000,000, half of which belonged to the growers, bringing their total receipts up to £180,896,059. In addition to this there remained unsold (Dec. 1920) 1,800,000 bales, half of which belonged to the growers.

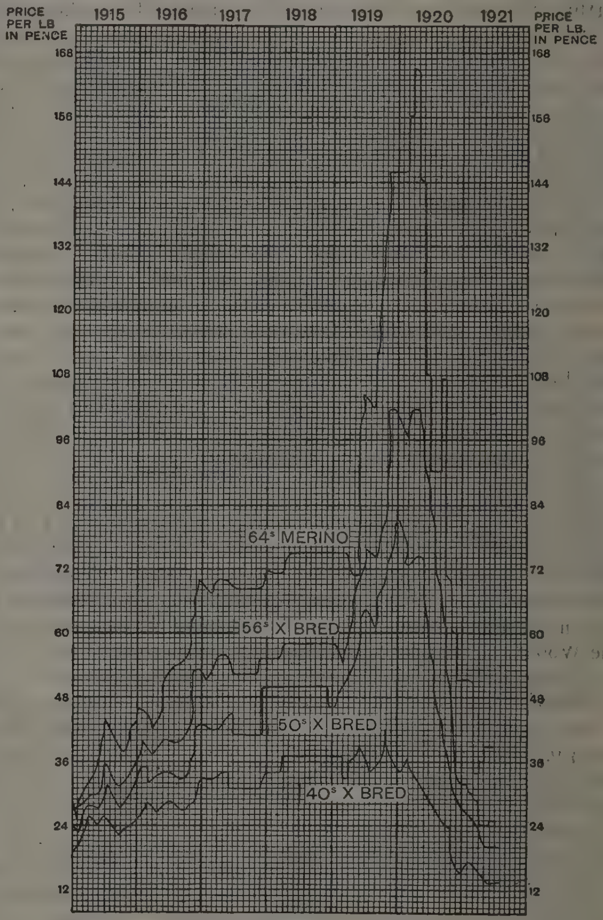

CHART 2

Values of Colonial Wools and Tops.

The change in the values of colonial wools and tops during the decade are shown in Chart 2.

Up to May 1920 the endeavour of the Wool Council was rather to maintain than to inflate values, and much fault was found with the Council for not making greater progress with the disposal of the wool to hand—the manufacturers were crying out for it. To meet this demand the Antwerp sales were reopened on Oct. 25 1919 and extensive sales in the United States of America were also promoted, one of the first being held in Philadelphia in Sept. 1919. Apparently the fall in the prices of wool was almost coincident with the release of ships for transport. Unfortunately few realized the large stocks of wool on hand—or rather they estimated their consumption at the 1919 rate and consequently minimized their stocks. Thus it came about that, following a period when every conceivable bale of wool was called for and (from the sellers' point of view) ought to have been placed on the market, came a period when with bated breath one heard the word "unloading," and all too soon new wool and old wool were on the market together.

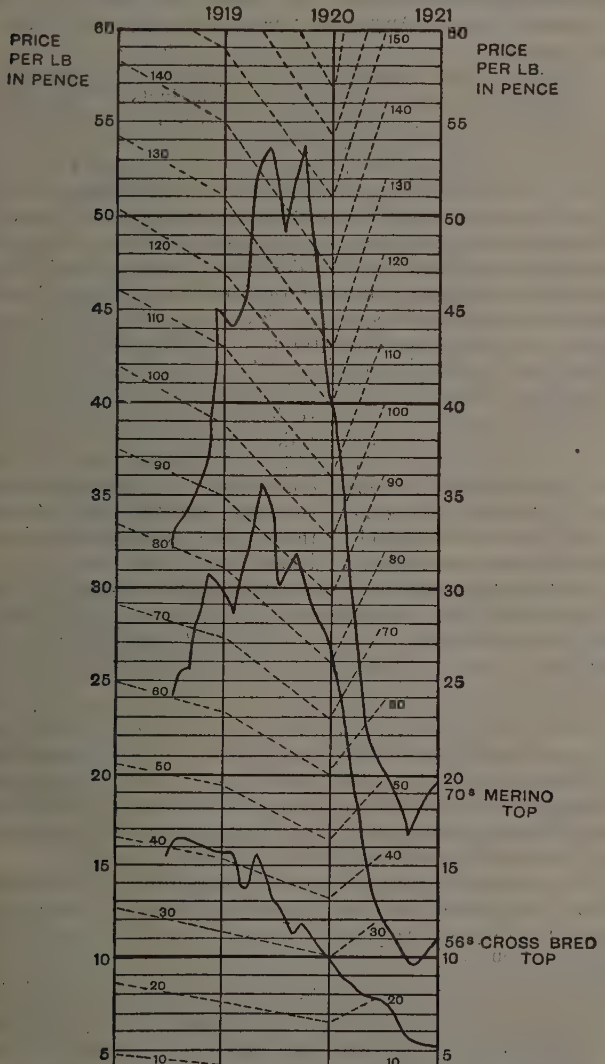

CHART 3

Wool Values Adjusted to 1914 Values.

Adjustment of Sale of Old and New Wool.—In the early days of 1920 those starting new works in the colonies, India and elsewhere, were asking—can we obtain sufficient wool to run our factories? And there was every inducement to wool growers—particularly growers of the finer sorts—to extend operations. Toward the end of 1920 almost all factory building the world over was suspended or carried on very leisurely; and with the fall in wool values many sheep breeders were already looking on wool as an almost valueless by-product. Probably both extremes were wrong. Table 10 gives a fair idea of the world's wool stocks about the end of 1920 or early in 1921.

TABLE 10. *World's Wool Stocks* (*Approximate*)[1]

Wool in England (held by the B.A.W.R.A.)	1,600,000 bales
" " Australia " " "	800,000 bales
Cape wool (held by B.A.W.R.A.)	100,000 bales
U.S.A. surplus stock (Oct. 1 1920)[2]	1,000,000 bales
S. American wool	5,000 bales
Total	3,505,000 bales

[1] No doubt small stocks were held elsewhere.

[2] Two years' stocks said to be accumulated.

Prior to the war the world's yield of wool was about 2,728,461,630 lb., and it might be taken that about this amount was yearly absorbed. It would thus appear that the surplus wool on hand was equivalent to about 14 or 15 months' normal world's consumption.[1] Now if there were serious depletion of stocks of manufactured goods, and if there were likely to be a greater demand from the better paid workers of the world, and from countries likely to demand wool goods which previously had not consumed such goods in great quantities (India for example), then the stock of wool would appear hardly sufficient to meet the probable demand. Possibly these brighter conditions might have been realized, but for over speculation in the wool industry and the general slump in prices. Actually, however, what did happen was that the countries which could purchase were inundated with the goods which, under normal conditions, would have been spread over a broader field and the slump followed storage of goods and lack of sales. The reaction probably went much too far—for the home market in Britain was good in the middle of 1921. But the Wool Council had not only to face this surplus of wool but the new wool (1920 clip and in prospect the 1921 clip) coming on to the market at the reopened sales in Australia. The adjustment of this prospective difficulty was exemplified as shown in table 11 in the quantities of old and new wools—offered, sold and withdrawn—in both London and Australia in June 1921. Of these quantities, about 79,500 bales, of which approximately 76,000 bales were colonial, were sold; 44,000 bales were taken for export, including 2,000 bales Punta Arenas and Falkland Islands; 8,000 bales went to America. At the April 1921 London sales the reserve prices of the old wool were so high that no bids were forthcoming and all of this wool was withdrawn. Owing to the formation of the British Australian Wool Realization Association not being completed, or rather its policy not being decided upon, all the Australian old wool sales for April 1921 were also cancelled.

TABLE 11. *London Colonial Wool Sales* (Feb. 22 to March 5 1921).

	On Government Account	On Importers' Account
	Bales	Bales
Sydney	24,567	9,889
Queensland	4,991	6,435
Port Philip	12,862	3,274
Adelaide	5,286	1,542
Tasmania	2,648	279
Western Australia	3,599	10,507
New Zealand	20,264	10,213
Cape	..	3,134
Punta Arenas	..	3,487
Falkland Islands	..	577
River Plate	..	165
Sundries	..	724
Total	74,217	50,226

The difficulties of adjustment, actually realized later, were foreseen and deemed so great that when Mr. Hughes (Prime Minister of the Commonwealth and a stalwart fighter for the development of Australian wool industries) proposed to form an association of Australian wool growers and British Government representatives, with the object of realizing at reasonable values the large stocks of wool held in Australia and England, the Wool Council accepted the proposed control. Indirectly the Wool Council was apparently sacrificing the possibility of cheap wool for the manufacturers of this country: but it regarded the pocket of the whole country as coming first and the manufacturers' demand for cheap wool as coming second. The Australian Board was thinking chiefly of the interest of the Australian grower. The association was registered in April 1921, as follows:—

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[1] The U.S.A. normally holds 400,000,000 lb. of wool in stock.

> "British Australian Wool Realization Association, Ltd., Caxton House, West Tothill Street, Westminster, London, S.W.1. Incorporated in the State of Victoria, Australia. Registered April 14, to acquire and take over (*a*) one-half share of, or interest in, all Australian wool bought by the British Government through the Government of the Commonwealth of Australia and still undisposed of, and in all real and personal property acquired in connexion therewith and still undisposed of; (*b*) one-half share of, or interest in, any surplus profit on resale of Australian wool so bought still undistributed. Also to take over and assume one-half of all or any liabilities and obligations connected with and chargeable to such wool, property and surplus profits not yet liquidated. Nominal capital £25,000,000 in 25,000,000 shares of £1 each. Names of persons authorized to accept service; Sir Arthur Horne Goldfinch, K.B.E., 8 Rosecroft Avenue, Hampstead, London, N.W. (Governing Director British Australian Wool Realization Association, Ltd., Delegate General Chilean Nitrate Producers Association); James Alexander Cooper, C.B.E., F.S.A.A., Mentmore House, Uxbridge Road, Kingston on Thames, Surrey (Assistant Governing Director, British Australian Wool Realization Association)."

With the lack of demand for goods and consequent lack of consumption of wool the world over, even the best merino continued to fall in value up to May 1921, and the poorer sorts in some cases were below 1914 values (*see* Chart 3). Whether the enhanced values realized in May by both merinos and crossbreds would be maintained was questionable. Table 11, from the *Yorkshire Observer* of May 16, showed a turn of the tide—if there were no set-backs. Demand from the United States in anticipation of the new tariff might be, at least in part, the explanation. Germany had already commenced to buy wool.

TABLE 12

1914	Description	1921	1921
July d. per lb.		May 7 d. per lb.	May 12 d. per lb.
	Combing		
32	70's super fleeces	40/42	40/44
30½	64/67's good medium fleeces	35	36
30	60/64's good medium fleeces	27	30
28	64's good pieces	30	33/36
27	60's good pieces	30	33/36
27	60's good pieces	23	26/28
29	58/60's good medium fleeces	30	30
26	56's fine crossbred fleeces	24	24
23½	50/56's fine crossbred fleeces	17	18
18	46/50's crossbred fleeces	14	15
17	46's crossbred fleeces	12	13
16	44's crossbred fleeces	10	11
15½	36/40's crossbred fleeces	9	9
	Capes		
27	10/12 months' combing Capes	28/30	None
24	6/7 months' good clothing Capes	None	None
	Carbonizing		
26	60/64's good carbonizing pieces	23	26
25	60/64's carbonizing pieces and bellies	20	24
20	64's average locks	16	18
—	64's average lambs	20	20

IV. PROSPECTS IN 1921

Wool Manufacturing.—Australian combed tops were on the Bradford market, on the American market, and were also being worked up in Japan in 1921. Did this presage a re-distribution of the world's wool manufacturing industry, and if so what was the line of distribution likely to be followed?

The astounding prosperity of the British wool-manufacturing industry following the Armistice attracted world-wide attention, and it was but natural that every one with any connexion with the industry the world over should wish to share in the prosperity. There were two types of country in which the development of manufacturing would undoubtedly be attempted, and in which the attempt is undoubtedly justified, (1) the wool-producing continents or countries, Australasia, S. Africa, and S. America, and (2) new wool-consuming countries such as India, Japan, Brazil. In Australia some few mills were developing before the war, and after the war, under private enterprise, stimulated by the energy of Mr. Hughes and others, and, in some cases, further encouraged by the mother-country financiers. Australia made strenuous endeavours to develop a huge wool-manufacturing industry. Her ideal was to manufacture one-tenth of her wool production per annum—say, 50 to 60,000,000 lb., and in 1921 nearly 40 wool manufacturing mills were already in existence. Similarly South Africa, stimulated by Gen. Enslin, was also making a bid for wool manufacturing.

In the case of Australia no forethought or skill was being spared. The mills were being equipped with the finest machinery—French-made combs, for example, had so far been given preference over the speedier but less exact British (Noble) combs—and the best skilled workers were engaged in many of the mills. Excellently combed Australian tops were already on the Bradford market.

So long as profits remained high and high rates of wages were maintained, the appeal to the financial instincts of the worker, even in the case of Australia, might be expected to hold him in the mill. But if the conditions of 1914 came round again and the skill and temperament of the newly developed Australian industry were pitted against the skill and temperament of the older industrial countries, which would win out? Broadly speaking, in anything beyond combing it would be the older countries' fault if they did not dominate. Again, with the need for harder conditions in the factories which must almost inevitably follow severe competition, it was a question which operatives would best stand the strain. Australia, and possibly S. Africa and S. America, might develop quite considerable wool manufacturing industries, but it would seem inevitable that the old manufacturing countries would almost entirely retain their hold on the bulk of the world trade in manufactured wool goods.

In the case of India, Brazil and more particularly Japan, it was probable that the growing demand for wool goods would be only partly met by local production, and for some years to come the outside demand of these countries for manufactured goods seemed more likely to develop than to contract.

So far as the British wool-manufacturing industry is concerned everything depended upon (1) the introduction of scientific method into the works; (2) efficiency in manipulative skill, and (3) efficiency in organization. With reference to the first and second points the introduction of automatic machinery was day by day placing an enhanced value on careful, thoughtful workmanship. The Englishman likes to get a job done, he prefers "driving force" to thoughtfulness. The continental controllers and workers are too often years ahead of the British managers and workers; in thoughtful outlook the American managers and workers are up to the British in bulk production and threaten to pass them even in excellency of output.

With reference to the third point, organization depends upon both directors and workers. An unsympathetic attitude on the part of either will lead to trouble and disaster. The scale of organization had probably been set by the United States. There the Arlington mills each day treat the fleeces of about 35,000 sheep—say, 200,000 lb. of wool: and this is said by no means to be the largest wool manufacturing company in the United States. Along with this enormous organization goes an efficiency in organization and cleanliness in installation which puts most European mills to shame. The American manufacturer has no time to develop that "secrecy" which is far too much in evidence in European concerns; he relies upon progressive efficiency.

To sum up, it would seem that while wool-growing countries may develop quite considerable wool-manufacturing industries, these will not be to the exclusion of the older manufacturing countries. On the other hand, American enterprise (and possibly Japanese enterprise) will severely test the resources of the older industrial countries, and success will rest in the future with the country developing the most thoughtful captains and rank and file of industry.

(*b*) *Wool Production.*—During the high prices period of 1918 to 1921 the demand for wool was so great, and future prospects for the wool-grower seemed so rosy, that likely and unlikely fields for the development of sheep-breeding were considered. With the slump in prices the future prospects of the wool-grower suffered an apparent eclipse. No doubt in 1920 prospects were considered too rosy, but equally in 1921 prospects were regarded in altogether too sombre a light. A few broad glances at the situation will clear the way.

If we take the United States as practically a self-contained country, and allow the approximately ten million negro population (wearing little or no wool) to balance the extra wool required for garments in the northern states, where cold winters have to be faced, we get this interesting result:—Wool consumed, 600,000,000 lb.; population, 100,000,000; or 6 lb. of wool per head per annum. Even if we allow for a considerable quantity of re-manufactured material and also for the negro population, this can only be regarded as a "miserable statement," for the 6 lb. is greasy wool yielding about 3 lb. of clean wool, or half a suit or half a dress length per annum for each male and female in the United States. In this allowance are included the imports of wool materials (other than raw wool) amounting to an average of over 30,000,000 lb. per annum. Neither Great Britain, France nor Germany shows any advance on this.

The world's wool statistics and population only serve to emphasize the lack of supplies; for taking the pre-war figure (given in Table 1) of 2,728,461,630 lb., and allowing an average yield of 60% clean wool, this leaves about 1,400,000,000 lb. of clean wool to serve for a world's population of 1,606,542,000 or ·9 lb. of wool per male or female. To make this discrepancy even clearer, however, take only the population of Britain, Canada, Australia, the United States, France, Germany, Austria, European Russia and the Netherlands—these total up to approximately 282,000,000 souls, consuming hardly 6 lb. per head per annum. The problem of the future would seem to be:—How to develop such conditions of livelihood the world over that the greatest possible number become substantial purchasing (or exchanging) units?

What possibilities of increased supplies are there? These may be grouped under two heads: (1) an increased yield from the present flocks, and (2) the opening up of new tracts of sheep-rearing land. The first point is admirably illustrated by particulars taken from Table 1, the weights of fleeces for the several continents working out as follows:—

Europe	$\frac{8034}{1780}$	5 lb. per fleece.
Oceania	$\frac{645}{96}$	7 " " "
S. America	$\frac{4826}{1186}$	4 " " "
N. and Central America	$\frac{3042}{547}$	6 " " "
Asia	$\frac{2731}{923}$	3 " " "
Africa	$\frac{2199}{634}$	3 " " "

In some cases the sheep-lands are too poor to be expected to do better, but it will probably be found that this is very rarely the case. It is stated, for example, that Herdwick sheep, living on Cumberland hills which will hardly support rabbits, will produce fleeces from 5 lb. to 10 lb. weight. But what may be effected through careful selection is best illustrated by the following record of New South Wales flocks:—

Period	Sheep	Average Weight of Fleece	Total Weight
1890–3	60,000,000	3 lb. 9 oz.	213,700,000
1900–3	36,000,000	6 lb. 3 oz.	222,750,000
1916–9	35,000,000	8 lb. 7 oz.	295,310,000

Thus with 25 million fewer sheep in 1916 as against 1890 some 80,000,000 lb. more wool was produced. Great Britain has seriously taken these figures to heart, and under the auspices of the Research Association for the Woollen and Worsted Industries strenuous endeavours are being made, (*a*) to increase the quality and yield of the well-established breeds of sheep, and (*b*) to improve the quality of the wool in certain mountain types by crossing with better quality sheep, especially Down sheep.

With reference to the second point, although nothing like the development of a second Australia is to be expected, it is already obvious that marked developments of sheep-growing tracts of land may be expected. In the spring of 1921, for example, Col. Robert Stordy, on behalf of the Peruvian Government, sailed from Britain with cargoes of Southdown, Suffolk Down, Shropshire, Rambouillet (merino) and Soay rams, with the object of developing wool growing in Peru. Wool analysis of the Peruvian wools grown in 1921 on the degenerate sheep of the country, as analyzed by the university of Leeds, revealed remarkable qualities specially acceptable to the hosiery manufacturer. The development of Peru as a wool-growing country is one of the most fascinating possibilities.

The Duke of Devonshire, Governor-General of Canada until 1921, was specially interested and concerned in the development of the prairie lands of the Dominion on the four years' rotation basis, and one of the years will mean sheep. Thus it is quite possible that in the near future Canada will produce more wool of the Down type and possibly of the merino type: for if Russia can raise merinos amid the snows of winter, why not Canada? The Indians and Japanese are both making inquiries with the idea not only of improving the breed of such sheep as they have but also of developing large tracts of land which probably could well carry sheep.

(*c*) *Wool Distribution.*—The question as to where the wool of the world will be distributed for manufacture and re-distributed for wear, is largely a matter of surmise. and, after the extraordinary change from the conditions prevailing in the early months of 1920 to the conditions prevailing in the early months of 1921, even the most reliable authorities hesitated to commit themselves. If the world becomes more stabilized, and the suppressive effects of vested interests on the one hand and of "ca'canny" on the other are brought within reasonable limits, then it may be that conditions as rosy as 1918 to 1921 will return with accompanying similar conditions in other industries. To meet such conditions, should they arise, will necessitate the employment of every possible type of automatic machine, and a developed skill depending on the quality of "thoughtfulness" on the part of the individual worker in using such automatic machinery. It will thus be evident that forethought, efficiency and skill will play a greater part than ever in deciding the peoples to whom the bulk of the world's wool shall pass to be manufactured. Australia will undoubtedly manufacture an increasing quantity of wool—but she may possibly grow an even greater quantity than that demanded to balance for the manufacturing in her own mills. S. Africa, S. America, India and Japan will no doubt all claim their quota for manufacturing purposes. But the great bulk of the wool will be manufactured elsewhere: and it is safe to say that will be where scientific method and scientific management and a broad, humane outlook dominate. And the manufactured material of course will go to those peoples who have something to offer in exchange.

It is true that the immediate outlook in 1921 was dark. But the reason why was becoming apparent. And when this was fully realized the world would be well on the way to adjust its economic condition to facilitate production and exchange to the advantage of all its peoples. (A. F. B.)

WOOLDRIDGE, HARRY ELLIS (1845–1917), English musical antiquary, was born in 1845. He studied art, and became a student of the Royal Academy in 1865, about the same time commencing his researches into early music. He received various commissions for artistic works, the most important being a reredos for St. Martin's church, Brighton, and the frescoes in St. John's church, Hampstead. At the same time his reputation as an authority on music was steadily rising, and in 1895 he was elected Slade professor of Fine Arts at Oxford, a post which he held until 1904. His chief works on music are a new edition of Chappell's *Popular Music of the Olden Time*, which appeared under the title *Old English Popular Music* (1893) and *The Polyphonic Period*, parts I. and II. (vols. i. and ii. of the *Oxford History of Music*, 1901–5). He died in London on Feb. 13 1917.

WOOLWORTH, FRANK WINFIELD (1852–1919), American merchant, was born near Rodman, N.Y., April 13 1852. He was reared on a farm, studied in the public schools, and graduated from a business college at Watertown, N.Y., in 1872. He began his career as a clerk in Watertown, and it is said that a bargain counter in his employer's store first suggested to him the idea that resulted in the establishment of the long chain of "five and ten cent" stores that bear his name. Early in 1879 he opened at Utica, N.Y., his first "five cent" store which, however, was a failure. Later in the same year he established a similar store at Lancaster, Pa., followed by another at Harrisburg. The chain in 1920 was composed of about 987 "five and ten cent" stores in the United States, 94 in Canada, and 81 in England. When the F. W. Woolworth Co. was incorporated in New York in Dec. 1911 he became president. In 1912 the Woolworth building in New York City, costing $13,000,000, was completed from the designs of Cass Gilbert. It is 760 ft. high, has 57 storeys, and, excepting the Eiffel Tower in Paris, is the tallest building in the world. The gross sales of the company in 1920 amounted to $140,918,981 and the net profits $9,775,251, as compared with $119,496,107 and $10,361,557 respectively in 1919. Woolworth died at Glen Cove, L.I., April 8 1919, leaving an estate appraised at $27,000,000.

WORDSWORTH, ELIZABETH (1840–), English educationalist, was born at Harrow June 22 1840, the eldest daughter of Christopher Wordsworth, afterwards Bishop of Lincoln, and hence a great-niece of the poet. She was educated at home and lived a home life until in 1879 Lady Margaret Hall was founded at Oxford, largely owing to Miss Wordsworth's energy and organizing capacity, and she became its first principal. Her social gifts and powers of clever conversation made her a prominent figure in Oxford life. She retired from her post at Lady Margaret Hall in 1909, but continued to live in Oxford and to be an active member of its council. In Oct. 1921 the university of Oxford conferred upon her an hon. M.A. degree. Miss Wordsworth contributed many charming tales to *Aunt Judy's Magazine*, edited by Mrs. Gatty (*see* 11.530), and also published various devotional books and volumes of verse and essays. In collaboration with J. Overton, she published in 1888 the *Life of Christopher Wordsworth*.

WORDSWORTH, JOHN (1843–1911), English divine and scholar, was born at Harrow Sept. 21 1843, the son of Christopher Wordsworth, afterwards Bishop of Lincoln, and grand-nephew of the poet. He was educated at Winchester and New College, Oxford, where he had a distinguished career, and after a short period as a master at Wellington College was elected a fellow of Brasenose and took orders (1867). He became widely known both as a Latin scholar and as a theologian, being elected Bampton lecturer in 1881 and Ireland professor of exegesis in 1883. In 1883 he became a canon of Rochester and in 1885 Bishop of Salisbury. His works include *Fragments and Specimens of Early Latin* (1874); *Old Latin Biblical Texts* (1883 and 1886), vol. ii., in conjunction with Dr. Sanday and Rev. H. J. White; *The Episcopate of Charles Wordsworth* (1898); *Teaching of the Church of England for Information of Eastern Christians* (1900); *The Invocation of Saints and the 22nd Article* (2nd. ed. 1910). He died at Salisbury Aug. 16 1911.

WORLD WAR, THE.—The military history of the World War is told in these New Volumes in separate articles dealing with campaigns and battles; and a general account of the war at sea is given in the article Naval Operations (supplemented by separate articles on the battles of Jutland, Dogger Bank, Coronel, Heligoland Bight, Falkland Islands, Zeebrugge, and on the Goeben and Breslau affair, together with those under the headings of Submarine Campaigns, Blockade, Minesweeping and Minelaying and Convoy). As regards the land operations, reference to the separate headings under which the military history is narrated may best be made here by a brief *résumé* of the course of the war.

The war opened simultaneously on three fronts in Aug. 1914. These fronts were the western, the eastern and the Serbian, and the continuous story of the major operations on these fronts will be found under the respective headings: Western European Front Campaigns, Eastern European Front Campaigns and Serbian Campaigns, together with Salonika Campaigns. In the west the German invasion of Belgium and France was marked by the five-fold battle of the Frontiers (*q.v.*)—in Alsace, Lorraine, Ardennes, at Charleroi and at Mons—by the sieges of Liége, Namur and Maubeuge (*qq.v.*), and by the battle of Guise (*q.v.*). Its culmination in the battles of Sept. 4–20 is told in detail under the heading Marne; and the development of the northern flanks of the opposed armies towards the sea, at the same time as Antwerp (*q.v.*) fell to the Germans, is dealt with under the headings Artois (*A*, *B.*), and Ypres and the Yser (part I.).

On the eastern front the Russian invasion of East Prussia, with its battles of Tannenberg and the Masurian Lakes, is dealt with in detail under the heading Masuria, Battles in (parts I., II.), while the main conflict between the Russian and Austrian offensive efforts in Galicia and Poland during August and early September is described under Lemberg (part I.). The subsequent united efforts of the Austrian and German armies in Poland and Galicia to stem the onset of the "steam-roller" may be divided into periods characterized by the battle names Vistula-San (*q.v.*), and Lodz-Cracow (*q.v.*). The first siege of Przemysl will be found under that heading. The three Austrian invasions of Serbia are described in the general article for that front, mentioned above.

The year 1915, a year of stabilization on the western front, was one of open warfare on the eastern. Beginning with the battle of the Carpathians (*q.v.*) and the second siege of Przemysl (*q.v.*) on the one flank, and the "Winter Battle" of Masuria (*see* Masuria, Battles in, part III.) on the other, the operations, after a pause, took shape as a general Austro-German offensive from May 1. The right half of this offensive preceded the left by two months, and its successive episodes are marked by the battles of Gorlice-Tarnov and the San (*see* Dunajec-San and Przemysl), the battles of Grodek, Lemberg and Stryi (*see* Lemberg, part II.), and by the later episode of Rovno (*q.v.*). At a certain stage in the development of these operations, their left wing becomes one branch of a double-envelopment aimed at the rear of the Russian centre in West Poland; this branch is the campaign from the Tanev river against Brest Litovsk (*q.v.*), while the other is the offensive of the "Gallwitz army" from Przasnysz, across the Narew into the interior of the corridor followed by the Russians in their retreat (*see* Narew, Battles of the). The final efforts of the Germans to isolate the retreating Russians, which ended in ill-success and in the formation of a stable trench-line, as in the W., are dealt with in the general military narrative of operations on the eastern front, named above.

In the E. the entry of Turkey into the war led to the expedition against the Dardanelles (*q.v.*), and to the renewal of the offensive of the Central Powers against Serbia in the autumn of 1915 (*see* Serbian Campaigns), which closed with the conquest of Serbia on the one side, and the creation of a new minor front at Salonika on the other (*see* Salonika Campaigns). The campaigns in Asia Minor are dealt with under the general heading Turkish Campaigns, of which the several sections describe the operations which took place in the Caucasus, in Mesopotamia and in Sinai and Syria.

In the W. the years 1915, 1916, 1917 are essentially the "trench-warfare" period. The battles of Ypres in 1915 (*see* Ypres and the Yser, part II.), of Neuve Chapelle, Carency, Souchez and Loos (*see* Artois, Battles in, *C*, *D*, *E.*) respectively, the minor offensive of Crouy, the winter battle in Champagne (*see* Champagne, parts I., II.), and the trench-warfare fighting in Argonne (*q.v.*) and Woëvre (*q.v.*), culminated in the great French offensive of Sept. 25 1915 in Champagne (*see* CHAMPAGNE, part III.), but without materially affecting the stability of the trench-warfare conditions. The year 1916 opened with the great German blow at VERDUN (*q.v.*), which forestalled the Allied offensive of the SOMME (*q.v.* part I.): these two great names fill the history of the 1916 campaign in the west. In 1917 a first essay in operating under a united command was made by the Allies in the spring campaign, and produced the Arras battles described under ARTOIS (*F, G, H.*), and the Aisne offensive of April (*see* CHAMPAGNE, part IV.); the results were disappointing, and the parts of the inter-allied machine fell asunder, the British taking up the weight of the task in the battles around Messines, Ypres, Passchendael, etc. (*see* YPRES AND THE YSER, part III.), and in the "tank-battle" of CAMBRAI (*see* ARTOIS, section I.), while the French carried through two battles of limited objective, described under CHAMPAGNE (part IV.) and VERDUN.

Meantime, the entry of Italy into the war in 1915 had created new military relations in the Mediterranean basin. Austria had established a new defensive front on the Isonzo, and, shortly after the Verdun offensive of her ally, had struck a similar blow on the Tirol front at Asiago. The unity of operations in the Italian theatre of war makes it possible to refer the reader to a single heading, ITALIAN FRONT CAMPAIGNS, with the subordinate articles therein referred to, for the story of the war in this region from first to last.

On the Russian front, the year 1916 saw a final effort of Russia, in spite of losses, to regain lost ground and to help her Allies. The battles, after an isolated winter battle known as the "New Year's fight," described under the heading STRYPA-CZERNOWITZ, fall into two main groups, those of the spring and those of the summer and autumn, in which the battles of NAROCH LAKE (*q.v.*) and LUCK (*q.v.*) are the central episodes.

The spring of the final year, 1918, finds the focus of military events in Europe placed on that section of the front in France which lies north of the Oise. Here, on March 21, the great German offensive broke through the lines of the British V. Army (*see* SOMME, part II.); here also, on April 9, a second effort was made at the LYS (*q.v.*). In summer, the German attacks of May 27 on the Chemin des Dames (*see* CHAMPAGNE, part V.), of June 9 on NOYON (*q.v.*), and of July 15 on both sides of Reims (*see* CHAMPAGNE, part VI.), culminate, and the period of Allied counter-attacks under united command begins with July 18 (*see* CHAMPAGNE, part VII.), Aug. 8 (*see* SOMME, part III.), Aug. 21 (*see* SOMME, part IV.) and St. Mihiel (*see* WOËVRE), to assume at last a coherent and decisive form in the three simultaneous offensives of the Americans in the MEUSE-ARGONNE (*q.v.*) battle, of the British in the battle of CAMBRAI-ST. QUENTIN (*q.v.*) and the Belgians, British and French in the last battle of YPRES (*q.v.*).

As regards the origin of the World War, its history is told in the article EUROPE, in the final section of which its results on the national reshaping of Europe after the war are analyzed. Reference on both these aspects may also be made to the historical and geographical sections of the articles dealing with each country involved in the war. But during the war itself the political aspects ceased to be merely European: it became a World War. The general international politics throughout its course are therefore dealt with under the present heading, in the article below, as distinctively world-history, by way of continuation of the historical article under EUROPE which deals with the international politics of Europe up to August 1914. (H. CH.)

POLITICAL HISTORY OF THE WAR[1]

From the moment hostilities began in 1914, it became the absorbing aim of all the combatant countries to win the war; but each of them placed a different interpretation upon the meaning of victory, and that meaning also varied with their fortunes, the eclipse of this or that belligerent, and the entrance of fresh forces into the arena. The war aims of Great Britain were tersely stated in general terms by Mr. Asquith at the Guildhall on Nov. 9 1914, when he declared: "We shall never sheathe the sword, which we have not lightly drawn, until Belgium recovers in full measure all and more than all that she has sacrificed, until France is adequately secured against the menace of aggression, until the rights of the smaller nationalities of Europe are placed upon an unassailable foundation, and until the military domination of Prussia is wholly and finally destroyed." France and Russia, while agreeing with these objects, mentally put a more concrete interpretation on victory: to France the symbol of victory was the restoration of Alsace-Lorraine with further guarantees against a repetition of 1870-1; while Russia desired to exorcise Prussian apparitions "in shining armour" at Petrograd and to secure control of Constantinople and the Straits.

The Original Combatants.—Germany was less single-minded in her ideas. The mass of her people had been persuaded that the war was one of defence against a Pan-Slav peril and hostile encirclement by other Powers; but the bourgeois classes looked for *Weltmacht* in the shape of commercial and colonial expansion, while Bernhardi expressed the mind of Prussian militarists when he demanded three years before the war that "France must be so completely crushed that she can never cross our path again." Behind such ebullitions was a growing conviction in the Prussian mind that the Prussian system of government could not long maintain itself against social democracy without fresh tributes to the efficacy of the sword. "This danger," wrote Prince von Bülow, "must be faced and met with a great and comprehensive national policy under the strong guidance of clear-sighted and courageous governments, which whether amicably or by fighting can make the parties bow to the might of the national idea." "Nor," concluded Bernhardi, "must we think merely of external foes who compel us to fight. A war may seem to be forced upon a statesman by the condition of home affairs." To Austria the compulsion came from the attitude of Yugoslavs within her borders; and her original war aims probably did not extend beyond the reduction of Serbia to dependence and the consequent eclipse of Russian prestige in the Balkans. For Belgium and for Serbia the object of the war was primarily self-defence; although in Serbia's case successful self-defence would inevitably bring with it the prospect of increased influence in the domestic affairs of the Habsburg Empire. Japan was bound to intervene by her alliance with Great Britain, but a positive inducement to fulfil its terms was held out by the opportunity of conquering Kiaochow and excluding Germany from Far Eastern waters.

Not much choice had in fact been left to these original combatants by the circumstance of past policy which had driven them into the war. Other Powers had freer hands and a market in which they could sell their alliance to buyers who would bid high. They could intervene or hold aloof, and the nature and extent of the price they set on their services would modify the war aims of those whose cause they espoused. The course, the objects, and the end of the war were profoundly affected by the gradual expansion of the hostile groups.

The leading part played by Germany in the movements which precipitated the outbreak is emphasized by the fact that Austria, having declared war on Serbia on July 28, remained at peace with all other States for several days after Germany had drawn the sword. It was not until Aug. 6 that Austria declared war on Russia, nor until the 10th and 12th that France and Great Britain declared war upon her, nor until the 27th that she declared war on Belgium, the German invasion of which had dragged in Great Britain three weeks before. So far as Austria was concerned, the Triple Alliance had been purely defensive, and it had not even bound her to defend Germany against France, unless Russia also intervened. Italy, on the other hand, had been bound to assist Germany against a French attack; and the legends about French aggression, which Germany propagated in the early days of Aug., were meant for Italian as much as for British consumption. Italy had, however, under wise guidance, refused to believe in French aggressiveness, and had declared her neutrality on Aug. 1 on the ground that her intervention was not required by the terms of the Triple Alliance. Her abstention on this occasion was probably the greatest service she rendered to the Entente during the war, for it released from the Franco-Italian frontier some hundreds of thousands of troops without whose assistance the battle of the Marne could hardly have been won. Her example may also have been the last straw in the balance which determined Rumania, despite its Hohenzollern King and its Austrian alliance, to stand aloof from the struggle.

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[1] For side-lights on conflicting national viewpoints in connexion with particular episodes, and for greater detail in regard to them—the accounts being still sometimes irreconcilable as between representatives of the different countries concerned,—see the separate historical articles under country headings: especially ENGLISH HISTORY, UNITED STATES (*History*), AUSTRIAN EMPIRE (*Foreign Policy*), GERMANY (*History*), FRANCE (*History*), ITALY (*History*), JAPAN (*Foreign Relations*), SERBIA (*History*), YUGOSLAVIA (*History*), CZECHOSLOVAKIA (*History*), GREECE (*History*).

The Neutral States.—Neutrality was expected from the other European States, whatever their sympathies might be. Holland's traditions were more friendly to Germany than to Belgium, but they were obliterated by the wanton invasion of Belgium's neutrality, and Bethmann Hollweg's argument that a German annexation of Belgium would be useless without the acquisition of Dutch territory was not calculated to assuage alarm. But more immediate perils dictated Dutch neutrality. There was no reason to suppose that Entente forces, which protected only a tiny corner of Belgium, could have saved a single acre of Dutch territory. Holland, with its wealth of capital and agricultural produce and its harbours, would have fallen an easy prey to Germany, while the remnants of its colonial empire might have gone the way the Cape of Good Hope and Ceylon had gone during the last occupation of Holland by an enemy of Great Britain. Holland was wise in its neutrality, and even the Entente probably benefited more by it than it would have done by Dutch intervention. It was certainly well for Great Britain that in 1917–8 German submarines had no Dutch ports for bases which could not be blocked as the exits from Bruges were in April 1918.

Denmark was in the like case, albeit with an ancient grievance against Germany in the wrongful detention of Danish Slesvig. But again, Denmark could not have been defended against German invasion, and Danish coasts and ports would have been invaluable to German submarines. Denmark, too, was wise to eschew belligerency and seek to develop its influence in conjunction with its Scandinavian colleagues. Of these, Norway sympathized with the Entente, and might, but for the fear of Sweden, have been driven by German piracy into war. Sweden's affections were more divided. The Labour party, led by Branting, was, if not pro-Entente, at least averse from intervention on Germany's side. But the upper and bourgeois classes were strongly German in sympathy and inclined to *activism* in that direction. This affection was partly due to cultural development, but more to a greater fear of Russia which had been aggravated by the fate of Finland and Russian designs in the Åland Islands. The Baltic was, like the Adriatic, the scene of a triangular duel; but the Russian menace in the Baltic was greater than the Teutonic menace in the Adriatic. Sweden's fears of Russia counterbalanced Danish and Norwegian grievances against Germany, and the Scandinavian States found a basis for neutrality in an equilibrium of antipathies.

Spanish neutrality was the resultant of similarly antagonistic domestic feelings. The King, with his English wife, was pro-Entente, but the Catholic and conservative upper classes were pro-German, while the democratic factions, hankering after revolution, took the opposite side. Portugal was, as it had been since its war of liberation and the marriage of Catherine of Braganza, an ally if not a pawn of England; and the prospective agreements which England and Germany had just made for the division of its colonies had not sufficed to transfer its allegiance from the one to the other beneficiary. No one expected Switzerland to abandon its neutrality; and the Balkans were left as the principal sphere of diplomatic competition. Greece had a Prussian Queen and a King who was a Prussian field-marshal, but a prime minister whose sympathies and confidence were whole-heartedly on the Entente side. Bulgaria, as a result of the Treaty of Bucharest in 1913, had no sympathies at all, but a comprehensive grievance against all her neighbours who had robbed her of the fruits of victory over Turkey, and against the Great Powers which had acquiesced in that spoliation. Her object was simply to discover the probable winner, and back it with all her resources in the hope of getting back all she could from the losers. For the moment she would wait and see.

Turkey was nearer to a decision. She had long been wooed by the Kaiser. In 1898 he had declared himself the friend of all Mahommedans, whose-soever subjects they might be; and the circumstance that, outside Turkey, they were mostly the subjects of Great Britain, Russia, or France gave point to his policy. The Turkish revolution of 1908 and the machinations of a so-called party of progress, led by Enver and Tal'at, made no difference to the growth of Turco-Teutonic affection. England had afforded but a half-hearted support against the Russian advance toward Constantinople; she had assisted in the liberation of Greece and the Balkans, and had helped herself to Cyprus and Egypt and other fragments of the dismembered Turkish Empire; and her friendship seemed but the nether millstone to the upper millstone of Russian aggression. Moreover, by August 1914 the antagonism between England and Russia, on which 'Abdul Hamid relied, had disappeared in an alliance in which, so far as the Near East was concerned, Russia would be the predominant partner; and the interpretation which Russia put on that entente was illustrated by a crown council held in St. Petersburg on Feb. 6 1914 to discuss the means for securing the Straits and Constantinople. The appointment of the German Gen. Liman von Sanders to reorganize Turkish forces was the retort which naturally commended itself both to the Turk and the Teuton.

The Turkish mind was, however, slow to move; it was no light matter to reverse the traditional policy of centuries and embark on war with a Power which had long regarded the maintenance of the Turkish Empire as one of the first of British interests. The Kaiser believed that he had Turkey in his pocket, but no one knew what her attitude would be. When the German admiral made for the Dardanelles with the "Goeben" and the "Breslau" on Aug. 8–9 his course was dictated by necessity and not by plan, and he was even prepared to force his way up the Straits if peaceful admission were refused. As late as the 5th the German embassy at Constantinople had reported that it was undesirable for him to arrive there yet. He was, however, received with open arms. Turkish opinion had been profoundly irritated by the commandeering of two Turkish dreadnoughts which had been built in British dockyards out of the proceeds of a patriotic Turkish loan; officers of the British Naval Mission in Turkey were superseded, and, in spite of the Grand Vizier's opposition, Enver, the Minister of War, was mobilizing Turkish forces for an attack on the Suez Canal. Plans for Anglo-French naval coöperation in the Mediterranean had to be abandoned and British ships detached to blockade the Dardanelles and safeguard the Red Sea, while troops were hurried from India to Egypt. Twice before the end of Aug. Sir Louis Mallet, H.M.'s ambassador at Constantinople, mooted the possibility of forcing the Dardanelles, but expressed the opinion that success was doubtful without military coöperation and that failure would be disastrous. He succeeded, however, in prolonging the resistance of the Grand Vizier to Enver's designs and in delaying the breach until toward the end of Oct.

Turkey's Entry.—By that time the German Government had determined to cut the Gordian knot of Turkish indecision. The western campaign was coming to a deadlock before Ypres, the first German attack on Warsaw had failed, and a great Austrian effort was being planned to punish Serbia for her success in resisting attacks in the Balkans. On Oct. 28 Souchon sallied out of the Bosporus into the Black Sea with the combined German and Turkish squadrons, and on the 29–30th he mined Sevastopol harbour, sank a transport, and bombarded Odessa, Theodosia, and Novorossisk. Souchon alleged that the transport was a minelayer laying mines in Turkish territorial waters; and while the rival parties were still discussing the rival versions, Russia, having in Sept. secured a neutrality engagement from Rumania which was not communicated to her allies, declared war on the 31st without their connivance. The British and French ambassadors had already been instructed to follow their Russian colleague; on Nov. 1 they left Constantinople, and on the 3rd Adml. Carden bombarded the forts of the Dardanelles. Russian precipitation had, however, only hastened the end. Enver's troops had long been on the march toward the Suez Canal, and on Oct. 27 British outposts at El 'Arish and Nekhl had been withdrawn.

The entrance of Turkey into the war as Germany's ally was the first great diplomatic success achieved by either of the belligerent groups, and it did more than anything else to extend the sphere of the war and to increase in particular Great Britain's anxieties and obligations. Britain had little contact with Austria, and not much more with Bulgaria. Even Germany, apart from her naval ambitions, presented few points of direct conflict; they arose indirectly, either through the menace to Britain's allies in France and Belgium, or through the doors which Turkey now opened to German penetration. These led so far and in so many directions threatening British interests that, as they were gradually revealed in 1914–5, it seemed to many that they represented the original motive of Germany's aggression. Through Turkish dominions lay the overland route not merely to India but to Egypt and E. Africa; and both paths were strewn with inflammable material. Britain ruled over something like half the Mahommedans of the world, and for many of them the Sultan of Turkey as Caliph was their head. Even more dangerous might Germany's propaganda, backed by German military success, become in the midst of other discontented elements in India and in Egypt. With these under German and Turkish influence, the ferment might spread throughout the greater part of Asia and of Africa. Even the sea routes, on which the life of the Empire depended, would become unsafe when threatened on their flanks; for the problem has not yet been solved of how to command the sea in distant waters against an enemy holding the neighbouring lands and using the submarine. More immediately the entrance of Turkey into the war imposed upon Great Britain the task of defending the naval position in the eastern Mediterranean, the route through the Suez Canal, Egyptian territory, the Persian Gulf and the overland route to India against Turkish and Arab attacks. Incidentally it cut off Russia from her least indirect and irregular communication with her allies. Fortunately, the action of Japan limited these anxieties and relieved the Entente of the greater part of the burden of eradicating German power in the Far East. A Japanese ultimatum, which had been expected a little earlier, was delivered to Germany on Aug. 15 demanding the unconditional surrender of Kiaochow; it expired on the 22nd, and next day Japan entered the war.

Turkey's intervention had an immediate effect upon the status of her former provinces held by Great Britain. Cyprus was annexed at once; a British protectorate was proclaimed over Egypt on Dec. 17 with the connivance of France, whose protectorate over Morocco was recognized by Great Britain on the 24th, and on the 18th the Khedive 'Abbas II., who had thrown in his lot with his Turkish suzerain, was deposed in favour of his uncle Husein, who further received the title of Sultan. Egyptian opinion accepted the change, and Turkey's efforts to reconquer her lost dominions were frustrated by the necessities of self-defence in the Dardanelles and on all her Asiatic frontiers. Before the Russians could move across the Caucasus, divisions of the Indian army had sailed up the Shatt al 'Arab and begun that chequered advance which led them from Basra to Mosul. Not the least of the political effects of Turkey's action was to bring India into the war to a far greater extent than would have been possible had British participation been restricted to European fronts. Over a million native Indian troops were eventually engaged, and they assisted materially in the conquest of Mesopotamia, Palestine, and Syria. Before long Arabia, too, turned against the Turks, and found in Turkey's participation in the war the opportunity to emancipate itself from Turkish rule.

Russia's Claims.—For the moment, however, these were unforeseen developments, and the more immediate effect of Turkey's intervention was to bring within the sphere of apparently practical politics ambitions which belonged to an older world. The breach which Russia had helped to precipitate opened up the prospect of giving effect to the deliberations of the Russian crown council of Feb. 6 1914. The subject was not apparently broached by Russia to her allies until they, for reasons of their own, had committed themselves to an enterprise which would render it possible for Russia to reap its fruits—unless, indeed, it was really with an eye to securing Constantinople and the Straits by means of allied efforts that Russia despatched on Jan. 2 1915 an urgent request for some diversion to relieve Turkish pressure in the Caucasus. This is not the place to trace the growth of the Dardanelles expedition, which after the premature bombardment of Nov. 3, was keenly taken up by Mr. Churchill. The political and strategical motives for it seemed adequate. There remained no flank to turn on the western front; an unbroken line of trenches stretched from the North Sea to the Alps; and neither side could break the deadlock. On the other hand, the flank might be turned by sea power operating in the Dardanelles, an enemy knocked out by the capture of Constantinople, communications restored with Russia, the Teutonic path barred to the East and to Egypt, and two if not three new allies found in Greece, Rumania, and Bulgaria, who uniting with Serbia and linking up Russia with a fourth potential recruit in Italy, might sweep upon Austria-Hungary and threaten an attack on Germany's southern frontiers which would destroy the bastions she had made on her eastern and western fronts.

Such was the prospect which Allied vision discerned and Russia proposed to convert into territorial substance. On March 4, when England and France had been committed to the enterprise, Russia handed in a memorandum to the British and French ambassadors at Petrograd, in which she explained her ideas. Most of what was left of Turkey in Europe, including Constantinople, the western shores of the Bosporus, of the Sea of Marmora, and of the Dardanelles, and Thrace as far as the Enos-Midia line, was to become Russian territory. So, too, were the islands in the Sea of Marmora, Imbros and Tenedos outside the Dardanelles, and the coast of Asia Minor from the Bosporus to the mouth of the Sakaria and across to the gulf of Ismid. On the other hand, the middle zone of Persia, declared neutral by the agreement of 1907, was to be assigned to the British sphere of influence, while Arabia was to become independent. By March 20 both the British and French governments had signified their assent to these proposals. Russia was still the predominant partner in the military alliance, her armies were overrunning the Carpathians and the Bukovina, and the anticipated collapse of Austria discounted the need to respect Balkan susceptibilities.

The agreement was secret, but Russian secrets had a habit of leaking out to her enemies during the war. Nor, indeed, did British or French politicians conceal their conversion to the justice of Russia's demands, while they ignored in their comments the impression it would produce upon wavering minds in the Balkans. The effect was to give Turkey the unaccustomed part of champion of Balkan independence; for with Russian ambitions fulfilled, no other Balkan power could have been more than a client State. Greece saw her aspirations—more legitimate at least than those of Russia—thwarted for ever by Allied complaisance; Bulgaria seemed to have struggled in vain under Stambolov to free herself from Russian tutelage, and to be doomed to perpetual servitude; Rumania lost hope of righting the wrong of 1878 and redeeming the Rumanians of Bessarabia; and only Serbia, which looked to the Adriatic, was content with this prospective Russian monopoly of the Black Sea and the Straits and dominance of the Aegean. The intervention of Turkey had given a predatory turn to the thoughts of the Entente; and, so far, the diplomacy of the war had tended to show an increasing disrespect for the liberties of little nations.

The war was not, however, making much progress on those lines. In the Near East Russia's difficulty lay not in securing her Allies' assent to her aspirations but in providing for their realization. This she was totally unable to do, and her contribution to the Dardanelles campaign, which was to have taken the form of a hundred thousand men landed on the N. coast of Thrace and a naval attack on the Bosporus, came to nothing. Great Britain and France were not merely to assent to Russia's schemes but to give them effect; and they were not such as would enlist support in the Balkans. Venizelos was apparently prepared to land two Greek divisions, but they would almost certainly have been inadequate, and it was more than Hohenzollern interests that prevented the embarkation. Bulgaria would have bowed to the accomplished fact, but no sane politician could have expected her to help Russia into Constantinople. The western Allies themselves were deeply committed to an offensive with their maximum force on the western front, and reluctantly doled out belated troops for the Dardanelles. So the ill-starred enterprise dragged on to its inevitable end. Success may sometimes redeem the worst of policies and plans, but the failure of the Dardanelles expedition precipitated the evils it had sought to prevent, drove Bulgaria into the enemies' camp, and handed the Balkans over to the Teutonic alliance.

Italy's Entry.—The next diplomatic move was more successful. The better mind of Italy had been shown by her refusal to acquiesce in an Austrian attack on Serbia in 1913 and to back up her Allies in Aug. 1914; and the tradition of Garibaldi and Mazzini had already inspired Italians to enlist under Ricci Garibaldi for service in France. The gibe of the French diplomatist that Italy would rush to the rescue of the conqueror was disproved by her quiescence when the Germans were at the gates of Paris; and popular Italian sympathies were undoubtedly stirred by the wrongs of Belgium and of Serbia. But in Italy, as in other countries, there was at first a hiatus between the soul of the people and the diplomacy of her government. It was Baron Sidney Sonnino who was mainly instrumental in negotiating the secret Treaty of London on April 26 1915. He had been convinced that Italy's interests required her intervention on the side of the Entente. He believed in a balance of power which Italy might turn to her own advantage. The seizure of Tunis by France in 1881, and fear lest the Mediterranean might become a French lake, had driven Italy into the Triple Alliance and the bosom of her hereditary Austrian enemy; and fear lest the Adriatic should fall under Teutonic domination if the Entente were defeated, and under Yugoslav influence if it won, drove Sonnino in 1915 out of the refuge of neutrality. In either event it was only by Italian belligerency that the situation could be redressed in Italy's favour; and Sonnino's calculations were that, if the war did not end in a decisive victory, Italy would probably get more out of a semi-victorious Entente than out of a semi-victorious Germany. Germany might, indeed, throw the Habsburg dominions into the melting pot as part of a general liquidation, and recognize Yugoslav independence; but she would keep Trieste for herself and Fiume for Hungary, which would be worse for Italy than the *status quo*.

Better terms could be obtained from the Entente, and Sonnino sought a fulcrum for his bargain in the concessions he demanded from Austria. Both Austria and Italy were pledged to the principle of reciprocal compensation in case either was forced to disturb the *status quo* in the Balkans. Austria argued that the invasion of Serbia involved no permanent territorial change; but Sonnino retorted that during the Turkish-Italian War Austria had declared that an Italian bombardment of the Dardanelles or even the use of searchlights against the Turkish coasts would constitute a claim for Austrian compensation. In March 1915 Burian admitted the principle of the Italian claim, and under pressure from Germany conceded the Trentino to avoid a breach. But there was no guarantee that the concession would be regarded as binding in the hour of victory, nor would Burian budge an inch with regard to Gorizia, Trieste, the Dalmatian islands, or Valona. Sonnino had naturally less compunction in demanding from the Entente Powers their recognition of acquisitions to be made at the expense of their enemy than he had in requiring the surrender of territory from his ally; and in the Treaty of London, signed on April 26 1915, he made full use of this opportunity. To the Entente it seemed that victory was all that mattered, and victory appeared to be doubtful without Italian assistance. It was useless to talk about placing the rights of the smaller nationalities upon an unassailable foundation if insistence upon all those rights prevented any foundation at all. Nor apparently did any of the Entente governments appreciate at that time the view which the smaller nationalities involved in the bargain took of their rights.

The complete dissolution of the Austro-Hungarian Monarchy was not then, declared Salandra four years later, considered as a possible war-aim; and it was under the impression that peace would still leave the Habsburg Empire a formidable foe to Italy that the Entente agreed to the terms which ultimately threatened to break up the Peace Conference in 1919 and provoke a fresh war between Italians and Yugoslavs. Thus Italy was to receive the Trentino up to the Brenner Pass; this would give her all the advantages of a strategic offensive against Austria which Italy complained that Austria had possessed against her, and would subject to Italian rule a quarter of a million Germans. She was to acquire Istria, including Gorizia, Trieste, and Pola, but not Fiume, and western Dalmatia including the harbours of Zara and Sebenico, a protectorate over central Albania and the sovereignty of Valona. The Adriatic would thus become an Italian lake. In the E. Mediterranean she was to have entire sovereignty over the Dodecanese which she had occupied since the Turco-Italian War, and in the event of a complete or partial partition of Turkey was to receive the province of Adalia and its adjacent littoral. She was to be compensated for any British and French colonial expansion in Africa by similar extension of territory in Eritrea, Somaliland, and Libya, and to be paid a share in the war indemnity corresponding to her sacrifices. The signatories were pledged to secrecy and to support Italy in opposing papal participation in the negotiations and settlement of peace. Italy in return undertook to wage war with all her resources against all the enemies of the Entente, to commence hostilities within a month, and to sign the declaration of Sept. 5 1914 by which the Allies engaged to make no separate peace. But while she denounced the Triple Alliance on May 3 1915 and declared war on Austria on the 23rd, she did not announce her adhesion to the pact of Sept. until Nov. 30 and remained at peace with Germany until Aug. 27 1916. Salandra subsequently claimed this delay as an important service rendered to his country, and Tittoni justified it on the ground that no date had been specified in the treaty, although her Allies in giving their consent to it noted her declaration that she would "actively intervene at the earliest possible date, and at any rate not later than one month after their signature."

The secrecy of the treaty exonerates the Italian people from the charge of being actuated by its materialistic motives when they enthusiastically supported intervention in May 1915 and defeated Giolotti's attempt to drive Salandra from power. But the treaty was soon revealed to the Yugoslavs with results which materially helped the Austrian cause. Great indignation was expressed during the Peace Conference of 1919 at the admission of Yugoslavs to plead their cause, and the Italian premier Orlando exclaimed that it would be as proper to call in the Germans, since Slovenes and Croats had fought throughout the war on Austria's side. But some at least of their persistence was due to the Treaty of London, which proposed to transfer hundreds of thousands of them merely from a familiar to an unfamiliar alien domination. The upshot was largely to reinforce the small pro-Austrian party among the Yugoslavs, and to place obstacles in the way of Italy's march to Trieste. Similarly deterrent was the effect of the Italian claim to the purely Greek Dodecanese and her Albanian pretensions upon the popular mind in Greece. Italy was not, however, alone to blame. On the eve of her decision a Pan-Slav society in Petrograd adopted and published abroad a resolution to the effect that in view of Russia's victorious progress across the Carpathians the projected Italian intervention was belated and undesirable; and the first use which Serbia made of the promised accession of strength was, as soon as Italy was at war, to dash across to the Albanian coast where Serb and Italian ambitions conflicted. It was not the imperialism of Italy which delayed the intervention of Rumania, to whom an Entente loan had been guaranteed three months before; nor was it the ineffectiveness of Italy's attacks across the Isonzo. It was the military defeat of Russia in Galicia and Poland, and Great Britain's failure in the Dardanelles, that provoked the next accession of strength to the enemies' cause.

Bulgaria's Entry.—Bulgarian neutrality had always been precarious, and the Government itself had difficulty in restraining its irregulars and *komitajis* from raiding the Serbian frontier. A serious affray of this sort occurred on April 1 at Valandova while King Ferdinand was still waiting upon events, but by July the Russian *débâcle* in Galicia and the British failure to make much advance in the Dardanelles convinced him that Germany would win, and on the 17th a treaty was concluded which offered Bulgaria, in return for her intervention, the whole of Serbian Macedonia and Albanian Epirus; she was also allowed to extort from Turkey a strip of territory along the Maritsa controlling that river and Adrianople. Belated efforts had been made to buy off this new enemy, but it was not until Aug. 23 that the Serbian *Skuptshina* was brought to recognize "the sacrifices indispensable for the preservation of the vital interests of her people." They would have preferred more heroic measures, and in vain begged the Entente to authorize a Serbian attack on Bulgaria before the latter got her blow in first. The normal correctitude of the Entente was reinforced by the fact that Serbian aggression would release Greece from her treaty obligations to assist Serbia if attacked by Bulgaria. It did not foresee the autocratic dismissal of Venizelos by Constantine on Oct. 6, the acquiesence of the Greek parliamentary majority, and Constantine's repudiation of his treaty obligations when Bulgaria took the offensive. It was carefully synchronized with Mackensen's invasion from the N.; and, taken on two fronts, Serbia was in a desperate position. The British and French troops hastily transferred from Gallipoli to Salonika were too late even to assure the Serbs a retreat down the Vardar; and they had to make their perilous way across the trackless and snow-clad mountains of Albania to the inhospitable shores of the Adriatic. The outposts followed the centre of the Entente position in the Balkans; Montenegro was overrun by Austria; and the British evacuated Gallipoli, keeping Salonika as a thorn in the enemy's side and a bridle on Greek vagaries.

Christmas, 1915, marked the climax of German success in the war. She had easily held her western front with inferior forces against wasteful and premature Allied attacks, while she conquered Galicia and Poland, and with Bulgarian help overran Serbia and made a corridor to Turkey and the East. Von der Goltz was already in Mesopotamia organizing the Turkish forces which saved Bagdad from Townshend in Nov. 1915 and then captured his army in Kut in the following April; while Egypt had to withstand Arab attacks on the W. and Turkish attempts in the Suez Canal. But it needed a longer and stronger arm than even Germany possessed to strike with much effect across the torpid body of the Turkish Empire and the sands of Syrian and Arab deserts. Russia more than atoned for the British failure before Bagdad by the rapid and brilliant seizure of Erzerum in Feb. 1916, and then pushed on S. to Mush, Bitlis, and Van, and W. to Trebizond. On June 7 the Grand Sherif of Mecca threw off his allegiance to Turkey, occupied Jidda and Yambo', laid siege to Medina, cut the Hejaz railway and was joined by tribes farther S. who captured Aunfuda; on Dec. 16 he was recognized as King of the Hejaz by Great Britain. Between March and Sept. Smuts conquered nine-tenths of German E. Africa, while Portugal threw in her lot with Great Britain to assist in the campaign; and, although the week after the fall of Kut did not seem a happy moment for the conclusion of the Sykes-Picot Agreement of May 9 1916, its arrangements for British, French, and neutral zones in Mesopotamia, Syria, and Palestine were intelligent anticipations of the future. Germany's oriental visions were unsubstantial, and her Balkan allies would not be much help toward a decision on the western front. She had merely secured immunity for her eastern frontiers and relief from fear lest Austria should collapse, while she turned her forces once more to the W. for a blow at the heart of France before the first serious Allied offensive matured. The Marne had taught her the risks of the far-flung line, and she now selected the shortest route to a vital spot at Verdun.

Rumania's Entry.—France saved herself in the titanic conflict which followed; but Germany, too, was hardly less successful in her resistance to the Franco-British attack on the Somme, while with her left hand, so to speak, she bolstered up Austria's stand against the unexpected and vigorous assaults which Brusilov launched in July, and then crushed Rumania when on Aug. 27 the fifth Balkan state ventured into the turmoil of war. Rumania, long shivering on the brink, chose an unfortunate moment to plunge. Her case was a replica of Italy's; there was a *Romania iridenta* (as the Rumanians spell it) across the Carpathians, subject to worse treatment from Magyars than unredeemed Italy suffered at Austria's hands. There were also strategic frontiers to be rectified, and a semi-circular state to be rounded off. By the secret treaty with Rumania which was signed by Italy, France, Great Britain, and Russia, Rumania was to receive the Banat, the whole of Transylvania, a large slice of Hungary up to a line from Szeged on the Theiss through Debreczen to half-way between Csap and Szatmar-Negeti, as well as the Bukovina up to the Pruth, "the most ethnically unjust of all the secret agreements made during the war,"[1] which only the subsequent and separate peace of Bucharest in May 1918 released the Allies from their obligations to enforce. Nothing was naturally said about the Rumanes under Russian rule in Bessarabia or Bulgarians under Rumanian sway in the Dobruja. The treaty had been drafted on Aug. 8, but Stuermer objected that the Great Powers must not be bound to continue the war until all Rumania's territorial aims had been achieved, and Briand agreed to waive the point. Bratiano, however, threatened to resign, and on Aug. 12 the Tsar apparently yielded. The Allies were to advance from Salonika on the 20th and Rumania to declare war on the 27th.

Sarrail's plans had, however, been betrayed by two of his officers, and it was not until Sept. 7 that he could move. Rumania kept to her bond, and attacked Transylvania on Aug. 28. Her subsequent disasters were attributed to her neglect of Entente counsels and wishes in attacking Transylvania instead of Bulgaria; but the criticism was unjust. There was apparently no stipulation about the direction of Rumania's action, and she had hopes that Bulgaria might not intervene. Justification for aggressive war must always be found in a political and not a strategical motive. Rumania had a legitimate grievance against Austria-Hungary in the treatment of *Romania iridenta;* she had none against Bulgaria whom she had robbed in 1913. Even on strategical grounds her conduct might be defended; her ruin was wrought, not by Bulgaria, but by Falkenhayn's Austro-German attack through the passes, and their progress would have been even more rapid had Rumania launched her armies against Bulgaria. She might have withstood Falkenhayn, had Russia done her duty and sent adequate forces into the Dobruja to oppose Mackensen and carry out the threats she had uttered against Bulgaria in 1915, while Rumanian neutrality barred their execution. The Entente Powers had, in fact, simply looked to Rumania to pull their chestnuts out of the Balkan fire; they had no idea that the battle of the Somme had left Germany in a condition to make an effort elsewhere like Falkenhayn's; while the creeping paralysis which had overcome Russia suggested the tale of a secret understanding between her ambiguous Premier Stuermer and the Habsburgs to partition Rumania, Wallachia to go to the Habsburgs and Moldavia to Russia. Before the end of the year Bucharest had been captured and the Rumanian armies driven behind the Sereth, while Sarrail's offensive in the S.W. barely reached Monastir. From the Aegean to the Carpathians, and from the Adriatic to the Black Sea, the Balkans had become a solid Teutonic block.

Peace Moves, 1916–7.—The moment appeared favourable for Germany to make overtures of peace. The Kaiser had discussed the idea in a letter to his Chancellor, Bethmann Hollweg, at the end of Oct.; on Dec. 12 a note was addressed to President Wilson and the Pope, and the matter was made public in the Reichstag. The note was based on Germany's success; she and her allies, it declared, "have given proof of their indestructible strength. . . . Their unshakeable lines resist ceaseless attacks. . . . The latest events have demonstrated that a continuation of the war cannot break their resisting power. The general situation much rather justifies their hope of fresh successes." These they would forego for the sake of peace. "They do not seek to crush or annihilate their adversaries" and "they feel sure that the propositions which they would bring forward . . . would be such as to serve as a basis for the restoration of a lasting peace." These they did not specify; nor, indeed, had they made up their minds on the point. Eighteen months earlier the "Six Associations" representing German industry and commerce had demanded as conditions of peace "a colonial empire adequate to satisfy Germany's manifold economic interests," the military and economic control of Belgium, the annexation of the French coast and its hinterland from the Belgian frontier to the Somme, of Briey, Longwy, Verdun and Belfort, of "at least parts of the Baltic provinces," and had declared that the surrender of any occupied territory "in which so much German blood has been spilt and so many of our best and noblest have found a grave, would do violence to the sentiments of our people and to their conception of an honourable peace." Bethmann Hollweg would not have countenanced such preposterous demands; but Ludendorff was more influential, and in vaguely describing the terms which alone reached the enemy with his approval, he uses phrases which might be made to cover them all except the annexation of the Channel ports and their hinterland.

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[1] *History of the Peace Conference*, i. 184.

Whatever their official conceptions of peace, the Teutonic allies dared not avow them in public, and the absence of substantial proposals convinced their opponents that the note about peace was a mere manœuvre of war, a continuation of the German offensive designed to complete the disintegrating work of German arms and to break up the Entente by playing off one Power against another. Consciousness of the real perils of such a conference gave an angry tone to the note in which the Entente replied on Dec. 29, and it consisted of a comprehensive indictment of Germany's conduct during the war, with particular reference to Belgium, and of a categorical refusal "to entertain a proposal which was devoid alike of sincerity and of substance."

Almost simultaneously but quite independently President Wilson addressed an inquiry to both belligerent groups on Dec. 18. He admitted that he was embarrassed by the coincidence because his note "may now seem to have been prompted by the recent overtures of the Central Powers," and the popular voice in Entente countries was convinced that he was "playing Germany's game." Clearer sighted observers discerned in it the President's first step toward intervention on the Entente side. It was, in effect, a request for information about the intentions of the belligerents, and resembled the inquiry which Great Britain addressed to France and to Germany with respect to Belgium's neutrality. The answers then determined British intervention, and the answers to Wilson's note helped him to make up his mind, or rather that of his people. "What," he asked, "did the two sides mean by the general terms they used of the war? The concrete objects for which it is being waged have never been definitely stated. The leaders of the several belligerents have . . . stated those objects in general terms. But, stated in general terms, they seem the same on both sides. Never yet have the authoritative spokesmen of either side avowed the precise objects which would, if attained, satisfy them and their people that the war had been fought out. The world has been left to conjecture what definitive results, what actual exchange of guarantees, what political or territorial changes or readjustments, what stage of military success even would bring the war to an end." Germany brushed aside the request on Dec. 26 by reaffirming her contention that a direct exchange of views between the belligerents was "the most suitable way of arriving at the desired result," and proposing "the speedy assembly, on neutral ground, of delegates of the warring States."

The Entente reply was more considered and was not completed until Jan. 10 1917. Demurring to the President's "assimilation" of the two belligerent groups, the Allies expressed their disbelief in the possibility at the moment of attaining "a peace which will assure them reparation, restitution, and the guarantees to which they are entitled by the aggression for which the responsibility rests with the Central Powers." They proceeded to indicate as their objects the restoration of Belgium, Serbia, and Montenegro with indemnities; the evacuation of the invaded territories of France, of Russia, and of Rumania with just reparation; the "reorganization of Europe"; the "restitution of provinces and territories wrested in the past from the Allies by force or against the will of their populations; the liberation of Italians, of Slavs, of Rumanians, and of Czechoslavs from foreign domination; the enfranchisement of populations subject to the bloody tyranny of the Turks; the expulsion from Europe of the Ottoman Empire." In a covering despatch dated Jan. 13, which was one of the most important and effective State papers of the war, Mr. Balfour demonstrated that "a durable peace can hardly be expected unless three conditions are fulfilled. The first is that existing causes of international unrest should be, as far as possible, removed or weakened. The second is that the aggressive aims and the unscrupulous methods of the Central Powers should fall into disrepute among their own peoples. The third is that behind international law and behind all treaty arrangements for preventing or limiting hostilities some form of international sanction should be devised which would give pause to the hardiest aggressor." It would, perhaps, be hyperbole to call Mr. Balfour the author of Mr. Wilson's policy, but its future outlines could hardly have been more accurately indicated.

Germany's first "peace offensive" had failed, to the deep disappointment of her people and her Government. Her situation was, indeed, imposing rather than substantial. Apart from a corner of German E. Africa, her colonies had all been lost; the battle of Jutland had terrified her high seas fleet into ignominious inaction; and on the western front Hindenburg had prepared a comprehensive retreat. In Oct. the *Vorwärts* had been suppressed as a minority Socialist organ and subjected to official inspiration. Ominous creaking began to be heard in the joints of her Austrian ally. Francis Joseph had died on Nov. 21, giving place to the more pacific Charles, and the murder of Count Stürgkh on Oct. 27 was followed by a rapid succession of three prime ministers in Dec. and by the substitution of Czernin for Tisza's henchman Burian as Foreign Minister. Peace had become a popular aspiration, and when the Allies rejected the offer, astonishment mingled with consternation. "*Jetzt ist alles verloren,*" exclaimed a German officer interned in the Engadine. Nor did the opening months of 1917 belie this gloomy German forecast. The German retreat to the Hindenburg lines, sound enough in itself, depressed a public accustomed to judge by the map. Sir Stanley Maude's spectacular conquest of Bagdad gave a sinister turn to the Berlin-Bagdad vision. Sir Archibald Murray was at the gates of Gaza, and, if Maude's campaign were a precedent, would soon be in Damascus. Above all there loomed the threatened breach with the United States, which would make the ultimate defeat of Germany inevitable save by a miracle. Corresponding elation appeared on the Entente side; even sober critics thought that the war would soon be won with the substitution of Mr. Lloyd George for Mr. Asquith in Dec., and in Jan. 1917 a highly successful "Victory" loan was launched in England on the basis of triumph within eight months.

Allied War Aims.—Prospective victors made haste to divide the contingent spoil. France demanded, and Russia agreed, on Feb. 14 1917 to the Rhine as "a permanent strategical frontier against a Germanic invasion." Besides the restoration of Alsace-Lorraine, the new boundaries were "to be drawn up at the discretion of the French Government so as to provide for . . . the inclusion in French territory of the entire iron district of Lorraine and of the entire coal district of the Saar valley." The rest of the territories on the left bank of the Rhine were to be separated from Germany, constituted an autonomous and neutral state, and garrisoned by French troops until all the conditions of peace had been completely satisfied. Mr. Balfour on Dec. 19 1917 affirmed that the British Government had never desired, encouraged, or approved of this idea; but it was publicly advocated by one of his colleagues in the Cabinet. In return Russia insisted upon, and France recognized, Russia's "complete liberty in establishing her western frontiers." The meaning of this had been specifically explained by Sazonov a year earlier, on March 9 1916: "It is particularly necessary to insist on the exclusion of the Polish question from the subjects of international discussion and on the elimination of all attempts to place the future of Poland under the guarantee and the control of the Powers." Since that date, the Central Powers had, on Nov. 5 1916, proclaimed the independence of Russian Poland, and on the 15th the Tsar issued an ambiguous statement to which Mr. Asquith and M. Briand endeavoured to give a precise interpretation. In his general order for Christmas Day, the Tsar did, indeed, refer to a "free Poland," and the Allied note of Jan. 10 1917 averred that his intentions had thereby "been clearly indicated." But an imperial commission, appointed to determine what was meant by the phrase, narrowed it down in Feb. 1917, as Gourko relates, on the ground that "a free Poland would fall under Germany's influence." Others of Russia's imperialistic aims had been recognized in the spring of 1916, at the time of the Sykes-Picot Agreement about Syria and Mesopotamia, and she had secured Erzerum, Trebizond, and Turkish territory as far as a line running through Mush, Sert, Ibn 'Omar, and Amajia to the Persian frontier. On July 3 1916 by a treaty which was to be "kept in complete secrecy from everybody except the two high contracting parties," Russia and Japan had bound themselves to safeguard China "against the political domination of any third Power entertaining hostile designs toward Russia or Japan"; and in Jan.–Feb. 1917 the Entente Powers, by another secret treaty, recognized the concessions which Japan had extorted from China on May 7 1915 by means of an ultimatum. Japan thus became the territorial if not the spiritual heir of Germany in the Shantung peninsula and acquired a lien on China's economic development.

The opening of the campaign of 1917 proved, however, delusive, and its later stages postponed to an indefinite future the realization of these secret agreements. The Hindenburg lines justified the hopes the Germans had placed upon them; and while the British won a considerable success at Vimy, the French effort in Champagne and along the Chemin des Dames was a costly and disastrous failure. The German submarine campaign was hardly less disastrous to the shipping upon which Great Britain and her Allies relied for their ability to continue the war; the British offensive in Flanders was a depressing disappointment, and Murray failed to force the gates of Palestine. The doubtful success of Entente arms corresponded to the dubious methods and aims of its diplomacy; and a candid survey of the secret agreements, to which the Entente Powers had committed themselves, suggests a serious doubt whether, if victory had been won early in 1917, it would have been worth the winning or would have resulted in a happier world than that which had existed before the war broke out. Not all of the Powers were, indeed, committed to all of the agreements; but each of them had staked out claims for new conquests and fresh subject-peoples, and not one had proposed to sacrifice a single acre on the altar of self-determination. Nor, in the hour of imperialistic victory, would it have been British or American statesmanship which would have interpreted the "freedom" of Poland, the "autonomy" of Germans on the Rhine, the rights to self-government claimed by Czechoslovaks, Dalmatians, or Armenians, or the liberties of little nations in the Balkans or the Baltic. There would, in the event of victory early in 1917, have been no League of Nations, no "minorities clauses," no mandates, no guarantees for better domestic rule by states or better regulation of their external affairs. Russia might even have remained an autocracy fortified by success, and the Tsar have supported the cause of autocracy in Germany and in Austria. Cruel as were the sacrifices exacted from the western Powers by the deferment of hope and by Russia's collapse, criminal as were the means by which the Bolsheviks imposed their new tyranny upon the Russian people, the destruction of Tsardom may seem to have been in the long run the greatest service Russia rendered in the war. No one would claim perfection for the work of the Peace Conference of 1919, but what sanity it showed was mainly due to the fact that the one autocracy in the Entente had disappeared and its place in council had been more than filled by the great republic of the West. The diplomatic atmosphere was purified by the change, and power shifted towards an idealistic left. Great Britain, instead of representing as hitherto the extreme of moderation, presently found herself holding the balance between France, which, with the elimination of Russia, came to represent the right of annexation, and the United States, which ultimately put two million men in the field and did not ask for an acre in return. Gradually a programme was evolved which did not require the veil of secret diplomacy; a reformed band of Allied and Associated Powers gathered behind its banner of freedom most of the democracies of the world; and the war entered on a course which made a fight to a finish a rational policy.

The Russian Revolution.—The Russian revolution and American intervention together form the turning point of the war even more from the diplomatic than from the military point of view. But the one was needed to complete the other: without the revolution American intervention would still have left the Entente with a dubious face and a divided mind; without American intervention the Russian revolution would have robbed the Entente of its victory. Nevertheless, the coincidence of the two events appears to have been accidental. The revolution came first by some three weeks, and the Ides of March were fatal to the Russian Caesar. Its effects upon the war developed step by step with the progress of internal change, but from March 1917 fighting almost ceased upon the Russian fronts. The Cadet party, which was led by Miliukov and controlled the Provisional Government, would have continued the war for the sake of the Straits and Constantinople; it was straightforward on Poland, and on March 30 frankly recognized its independence. But power passed more and more into the hands of the Soviets, who wanted a general peace which would give each nation what it possessed before the war and each proletariat a good deal more. There were to be "no annexations and no indemnities," save such as each proletariat was entitled to levy upon its own capitalists and bourgeoisie. For this purpose the Soviets on May 12 proposed an International Labour Congress at Stockholm and on the 30th invited the Allies to restate their war aims. But even the Soviets did not yet demand a separate peace, and while on April 10 Russia renounced her imperialistic aims, on the 15th Czernin's offer to that effect was declined.

On May 13, however, the Russian Provisional Government fell, and Kerensky became the leading spirit in a new and more socialistic administration. He believed that only the success of Russian arms could guarantee the orderly progress of the revolution, and did his best to withstand the propaganda of the Bolsheviks, who were destroying discipline, urging peasant soldiers to go home and garner the fruits of the revolution in the shape of the land, and denouncing the wickedness of Russians killing their brother German socialists. Lenin's Bolshevik insurrection on July 16 was suppressed, but the miasma of his doctrine proved fatal to Kornilov's spirited offensive in Galicia; and as soon as the Germans counter-attacked, Russian troops threw down their arms and fled, massacring the officers who sought to stop them. By the end of July Russia had lost all her gains in Galicia; in Aug. a similar riot in the Russian contingent in Rumania nearly ruined the latter's gallant resistance which defeated the Germans at Marasheshti; in Sept. the Germans forced the Dvina and captured Riga, and in Oct. occupied Oesel, getting into touch with Finland. Kerensky now became a convert to the necessity of a dictatorship, but repudiated Kornilov when on Sept. 7 he moved troops on Petrograd to effect it; and on Nov. 7 another Bolshevik insurrection transferred the dictatorship to Lenin and Trotsky, who began *pourparlers* for peace.

Russia had gone effectively out of the war faster than the United States came in; but she left a blazing trail behind her, and sparks from the conflagration started a smouldering fire on German soil which was never extinguished. Bolshevik pacifism seemed a ridiculous gesture in face of Prussian arms, but its moral effect was by no means contemptible. "Looking back," writes the archmilitarist Ludendorff, "I can see that our decline obviously began with the outbreak of the Revolution in Russia." After all, the original ground or pretence upon which the war had enlisted democratic support in Germany was its appearance as a war of defence against autocratic Pan-Slavism. When Russia had destroyed the Tsardom, repudiated its aims, and laid down its arms, Germans who were not militarists or capitalists might well ask for what they were fighting; and on June 27 Hindenburg pointed out to the Kaiser the decline in German *moral*. So, while the elimination of Tsarism gave greater reality to the moral claims of the Entente, it deprived those of the Central Powers of their substance; and the war became more nakedly a struggle between militarist imperialism and democratic idealism. A practical illustration was afforded by the formation of a Polish army in Russia and a Polish legion in France at the moment when the Polish legion in Austria had to be disbanded.

Czernin seems to have been the first among Teutonic statesmen to realize the change in the position and to seek to capitalize a situation in which the Habsburg Empire had nothing more to gain and everything to lose. Her soil was now rid of the Russian invader; Italy had made no serious impression, and Trieste was in no danger; Serbia only existed in exile, and Rumania trembled on its brink. On the other hand, the prolongation of war and Russian contagion might stir a series of domestic revolutions. Hence his conference with Bethmann Hollweg on March 27, his offer of peace to Russia in April, and his suggestion that Germany should cede Alsace-Lorraine to France while Austria handed over Galicia to Poland with a view to the subjection of both to German control; hence, too, the meeting of the Austrian Reichsrat on May 30 for the first time since the war began.

Ludendorff placed his heel on these proposals, and Czernin then turned his attention to the German Reichstag, where a complicated struggle was waged between Ludendorff's militarists and Bethmann Hollweg's politicians, who were beginning to react to popular discontent and the effect of Russian developments. "Bethmann Hollweg and Czernin," writes Ludendorff, "were both completely obsessed by the Russian Revolution. Both feared similar events in their own countries." On July 6 Erzberger, who was perhaps in Czernin's confidence, opened the attack with revelations about the non-fulfilment of official hopes from the submarine campaign and demanded a "peace of understanding." On the 11th the Kaiser was constrained to sign a rescript promising universal, direct, and secret suffrage for Prussia after the war; as a set-off to this Bethmann Hollweg was forced to resign on the 13th, being succeeded by Michaelis, a mere official who said what he was told and contradicted himself when occasion or his superiors required it. Then on the 19th the Reichstag passed by 214 to 116 votes a resolution in favour of peace "without indemnities or annexations," which Michaelis accepted only "as he understood it." It was timed and tuned for the Stockholm conference, which German and Russian Socialists were allowed to attend, while British and French were not, and probably also for the Peace Note which the Pope launched on Aug. 1, and which France and England, being estopped by their secret agreement with Italy, left President Wilson to answer.

President Wilson's Policy.—From that time onward for two years President Wilson became the principal spokesman of the Allied and Associated Powers; but it appears that the Russian revolution had exercised so far a more potent influence on the Central Empires than the intervention of the United States. Russia was their immediate neighbour on a frontier of a thousand miles. America was four thousand miles away, and it was long a German delusion that American troops would be kept out of Europe by the same submarines on which Germany relied to bring Great Britain to terms; and to arguments not backed by mailed fists Germany was indifferent. She had made up her mind to take what risk there was when in Feb. 1917 she resumed her unrestricted submarine campaign; and that approaching resolve had helped to determine her simultaneous refusal to state her war-aims in response to the President's invitation.

The coincidence seems to have been largely a matter of accident. Originally elected President in 1912 by a minority vote owing to the split in the Republican party between Roosevelt and Taft, Mr. Wilson was reëlected in 1916 after a close contest in which neither of the opposing American parties had made war with Germany a plank in its platform; and without the prospect of an unprecedented third presidential term, Mr. Wilson enjoyed in his second a freer hand than any other democratic statesman. But he was obviously tied by the traditions and public opinion of a community diverse in origin, in interests, and in outlook, spread over vast areas, separated by thousands of miles from the European conflict, and inured to the idea of splendid isolation "We are," said President Wilson on March 5 1917, "a composite and cosmopolitan people. We are of the blood of all the nations that are at war." Action was impossible until there was some common measure of agreement in a heterogeneous people, and it was not easy to unite on a basis of intervention a Federal democracy whose one common principle in foreign policy was abstention from European quarrels. The Monroe Doctrine, as understood by modern interpreters, implied that the United States would resent and resist European intervention in a S. American war, however gross might have been the aggression, and however much it might have shocked the European conscience. So far as the Western Hemisphere was concerned, the United States claimed to be the keeper of the conscience of the world, and it thought that claim was only tenable so long as it washed its hands of conscience so far as Europe was concerned. Intervention on behalf of Belgian neutrality or even protest against its violation might open the door to retorts in kind and break down the quarantine which the democratic republic had sought to impose upon Old World infection.

But the war put the finishing touch to the obsolescence of the schismatic doctrine of two worlds and two human consciences. It was only a practicable dogma provided either that the United States kept not merely its conscience but its people, its capital, its commerce, and its shipping on its side of the Atlantic; or that the Old World observed those rules of international law and conscience which had commended themselves to the American people. In other words, so far from there being two worlds, the Old must accommodate itself to the New; and the most hardened believers in the Monroe Doctrine rebelled against the idea that Germany could indefinitely sink American ships and kill American citizens without provoking a war, which America could not wage without giving its conscience a passport to Europe. "As far as the United States is concerned," writes Dr. J. B. Scott, "the cause of its war with the Imperial German Government is the submarine . . . for the law could not be changed to suit the submarine." Nor was the Monroe Doctrine compatible with the enforcement of the American conception of the freedom of the seas or with the maintenance of neutral rights; and a long series of incidents convinced the American public that its cause could not be isolated. "The challenge," said President Wilson, "is to all mankind"; and when he intervened, it was not merely in defence of American rights but of a common humanity.

The outstanding episode in the slow and painful process by which the American people were brought to realize the dilemma between war and the surrender of their principles must be briefly indicated. A series of events, which, in the despatch of Secretary Bryan, the Government of the United States had observed "with growing concern, distress, and amazement," culminated on May 7 1915 when the "Lusitania" was torpedoed without warning, and 114 American and nearly a thousand other lives were lost; and on the 13th he intimated that his Government would not "omit any word or act necessary to the performance of its sacred duty of maintaining the rights of the United States and its citizens and of safeguarding their free exercise and enjoyment." But he resigned when acts seemed likely to follow words, and the President's second "Lusitania" note was signed on June 9 by Mr. Lansing. Bryan's resignation was not, however, without its effects; and the words continued while more American lives were lost in each succeeding month.[1] The most definite action was taken in Sept. against Germany's less powerful and less pernicious ally, when Dr. Dumba, the Austrian ambassador, was required to leave on account of his complicity in the intrigues of J. F. Archibald and other Teutonic agents. A graver crisis was reached with the torpedoing of the Channel steamer "Sussex" on March 24 1916. "The Government of the United States," wrote Mr. Lansing on April 18, "has been very patient. . . . Unless the Imperial Government should now immediately declare and effect an abandonment of its present methods of submarine warfare against passenger and freight carrying vessels, the Government of the United States can have no choice but to sever diplomatic relations with the German Empire altogether." On May 4 the German Government made some concessions, and as President Wilson expressed it on April 2 1917, "somewhat restrained the commanders of its undersea craft." The reason for its complaisance, given later on by Bethmann Hollweg, was that it had not yet sufficient submarines to carry out unrestricted submarine warfare effectively.

That time came with the beginning of 1917. The decision was taken on Jan. 9, and it was Germany's real answer to the President's note of Dec. 18. But it was based on a serious miscalculation. The German naval authorities thought it would compel Great Britain to sue for peace within six months, and Bethmann Hollweg has cast the responsibility for its effects upon them. Hindenburg's plea that the Chancellor failed to inform him of the impression it would produce in America is less convincing, for Ludendorff says that "we reckoned that the adoption of the submarine campaign would effect a favourable decision for us, at latest before America's new troops could participate in the war." So American intervention was anticipated and discounted. But eighteen months were yet to pass before American intervention took a form which was materially to disconcert Ludendorff's military calculations. For more than a year diplomatic relations had practically been severed between the United States and Austria-Hungary, and it did not at once appear that the resumption of unrestricted submarine warfare would be followed by more drastic American action with regard to Germany.

On Jan. 22, ignorant of Germany's decision, Mr. Wilson addressed Congress on the results of his note of Dec. 18, and sketched the conditions which would justify the United States in guaranteeing peace with a view to making it permanent.

> "In every discussion of the peace that must end this war it is taken for granted that that peace must be followed by some definite concert of power which will make it virtually impossible that any such catastrophe should ever overwhelm us again. . . . Such a settlement cannot now be long postponed. It is right that before it comes this Government should frankly formulate the conditions upon which it would be justified in asking our people to approve its formal and solemn adherence to a League of Peace. . . . No covenant of coöperative peace that does not include the peoples of this New World can suffice to keep the future safe against war. . . . It will be absolutely necessary that a force be created as a guarantee of the permanency of the settlement. . . . There must be, not a balance of power, but a community of power. . . . But the implications of these assurances . . . imply, first of all, that it must be a peace without victory. . . . Only a peace between equals can last. . . . And there is a deeper thing involved than even equality of right among organized nations. No peace can last, or ought to last, which does not recognize and accept the principle that governments derive all their just powers from the consent of the governed, and that no right anywhere exists to hand peoples about from sovereignty to sovereignty as if they were property. . . . Statesmen everywhere are agreed that there should be a united, independent, and autonomous Poland. . . . And the paths of the sea must alike in law and in fact be free. The freedom of the seas is the *sine qua non* of peace, equality, and coöperation. . . . The question of armaments, whether on land or sea, is the most immediately and intensely practical question connected with the future fortunes of nations and of mankind. . . . I am proposing, as it were, that all nations should with one accord adopt the doctrine of President Monroe as the doctrine of the world; that no nation should seek to extend its polity over any other nation or people . . . that all nations should avoid entangling alliances. . . . There is no entangling alliance in a concert of power. . . . These are American principles, American policies. We could stand for no others."

But while it was "inconceivable that the people of the United States should play no part in that great enterprise" of laying "afresh and upon a new plan the foundations of peace among the nations," the present war must first be ended, and the United States would "have no voice in determining . . . the treaties and agreements which would bring it to an end," only "in determining whether they shall be made lasting or not by the guarantees of a universal covenant."

American Intervention.—Such was the President's frame of mind when, nine days later, on Jan. 31, Bernstorff communicated Germany's revocation of its pledge of May 4 1916 and its decision to recommence unrestricted submarine warfare on Feb. 1. On Feb. 3 he simply and literally fulfilled his threat of April 18 and "severed diplomatic relations with the German Empire altogether." "I take it for granted," he said to Congress, "that all neutral governments will take the same course," but "we do not desire any hostile conflict with the Imperial German Government." On the 26th he pointed out that the caution of shipowners and consequent congestion of commerce "might presently accomplish, in effect, what the new German submarine orders were meant to accomplish, so far as we are concerned," and proceeded to arm American merchant ships; but he was "not now contemplating war or any steps that need lead to it. . . . War can come only by the wilful acts and aggressions of others."

It came with speedy steps. Germany denied the right of neutrals to use arms at all, and intimated that the armed guards placed on American merchant ships would be treated as pirates. "Armed neutrality," confessed the President, "it now appears, is impracticable." There had, too, been intercepted a note dated Jan. 19 from Berlin to Mexico, proposing in the event of war an offensive and defensive alliance between Germany, Mexico, and Japan, and the reconquest of Mexico's "lost territory in New Mexico, Texas, and Arizona"; and on April 2 Mr. Wilson advised a special session of Congress "to declare the recent course of the Imperial Government to be in fact nothing less than war against the Government and people of the United States." "We are," he had declared in his second inaugural address on March 5, "provincials no longer. The tragical events of the thirty months of vital turmoil through which we have just passed have made us citizens of the world. There can be no turning back." And now "the world must be made safe for democracy." "The great, generous Russian people have been added in all their native majesty and might to the forces that are fighting for freedom in the world, for justice, and for peace. Here is a fit partner for a League of Honour. . . . We have no selfish ends to serve. We desire no conquest, no dominion. We seek no indemnities for ourselves, no material compensation for the sacrifices we shall freely make. We are but one of the champions of the rights of mankind." The resolution was passed in the Senate on April 4 by 82 votes to 6, and in the House of Representatives on the 5th by 373 to 50, and on the 6th the President declared war. Austria was not included, but Tarnowski, Dumba's successor, had been refused recognition, and relations were suspended; on April 13 they were severed with Turkey.

The President's somewhat naïve assumption that all neutral governments would follow his lead into armed neutrality had been promptly belied; and all European neutrals excused themselves. They were even less likely to follow him into war; but New World States, which were more immune from the consequences, were more amenable to his example. Cuba declared war on April 7, and on the 8th Panama associated itself with the United States. Brazil broke off diplomatic relations on April 11, Bolivia on the 13th, and Guatemala on the 27th, Honduras on May 17 and Nicaragua on the 19th, Haiti on June 15, Costa Rica on Sept. 23, Peru on Oct. 6 and Uruguay on the 7th, and Ecuador on Dec. 9. Brazil declared war on Oct. 26, while the Argentine declared her benevolent neutrality on April 11: but Chile and Venezuela remained neutral without benevolence. The contagion, however, spread into the Eastern Hemisphere: Liberia severed diplomatic relations on May 8 and declared war on Aug. 7: Siam declared war on July 22, and China on Aug. 14. *Securus judicat orbis terrarum:* but the world of little States needed some security before it would pronounce judgment. Nevertheless, more than half the States of the world had now declared war on, or broken off diplomatic relations with, Germany and her three allies; the Entente had become a War League of Nations; and the peace that would be made in case of victory would represent the judgment of the world and be very different from that contemplated in the secret agreements.

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[1] See a provisional list of these and other crimes in J. B. Scott, *Diplomatic Correspondence*, pp. ix.–xv.

But there was a yawning gulf between judgment and execution, and a painful interval between the President's declaration and the time when, in Ludendorff's words, "America became the decisive power in the War." Financial coöperation began to relieve the strain at once, and naval coöperation to ease the submarine situation in May; and at the end of June the so-called "sentimental Division" arrived as an earnest of what was to follow on the field of battle. But as late as March 1918 there were only five American divisions in France, of which two were untrained; and meanwhile the endurance of the European Allies was sorely tried. The French army was seriously demoralized by the failure of Nivelle's offensive, and Caillaux began to undermine its political fortitude. The sinking of 25% of British merchantmen at sea in April was an almost more fearful menace; Russia had become a broken reed; the British campaign in Flanders proved a disappointment; Stockholm was holding out the lure of a "peace by negotiation" to Labour: Mr. Henderson resigned from the British Cabinet on Aug. 11; the Pope had appealed on the 1st for a peace on the basis of the *status quo*, disarmament, and arbitration; and tentative discussions were proceeding by more or less authorized agents in Switzerland. Michaelis secured an equivocal answer to the Pope's note in his effort to please both his militarist and his parliamentary masters. But the situation in Germany was as equivocal as its Chancellor: for while at the end of Oct. he was replaced by Hertling, a *persona grata* to the Pope as the first Roman Catholic Chancellor of Protestant Germany, for receding from the July resolutions, Germany was receding quite as fast with the apparent improvement in her military situation. "The future will show," declared Czernin after the Armistice, "what superhuman efforts we made to induce Germany to give way. That all proved fruitless was not the fault of the German people . . . but that of the leaders of the German military party, which had attained such enormous power in the country."

Greece in the War.—The only set-back had been the constrained entry of Greece into the Entente fold. Since the dismissal of Venizelos in Oct. 1915, Constantine had governed by means of phantom ministers; and in May 1916, acting under his orders, the Greek commanders admitted Bulgarian forces into Forts Rupel and Dragotin, the keys of the Struma valley, while in Aug. Greek garrisons surrendered Seres, Kavalla, and Demirhisar to the same racial enemies. This was too much for the better part of Greece. A revolution broke out at Salonika, which swept over Crete, Mytilene, Samos, Chios, and the other Greek islands in Sept.; and a provisional government of insurgent Greece was formed under Venizelos, Condouriotes, and Danglis, which was tardily—owing to Russian and Italian influence—recognized by the Entente and declared war on Bulgaria. But Constantine controlled the mainland of Old Greece, and constantly intrigued against the Entente. At length, in June 1917, Tsarist protection having been removed by the Russian revolution, the Entente intervened by force of arms, and Constantine was deposed on the 11th and removed to Switzerland. Venizelos returned to Athens on the 21st, and on the 30th diplomatic relations were severed with Germany and Austria. The high-handed proceedings of the Entente were, no doubt, necessary measures of war; but Venizelos had to pay the penalty later for the violent patronage he had enjoyed, and the Entente needed the moral support which President Wilson gave it in the drastic reply he returned to the Pope's peace note on Aug. 27. To deal with Germany by way of peace upon the plans proposed by His Holiness would, the President declared, "involve a recuperation of its strength and a renewal of its policy."

Brest Litovsk.—The recuperation of its strength was exemplified in Oct. by the further advance into Russia and the Italian disaster at Caporetto: and the renewal of its policy was seen at Brest Litovsk. On Nov. 20, a fortnight after the successful Bolshevik revolution, Lenin proposed to all the belligerents a general armistice and discussion of peace, and on the 29th Germany accepted the invitation. The armistice was concluded at Brest Litovsk on Dec. 15. The Bolsheviks inserted a clause to the effect that German troops were not to be transferred from the eastern to the western front; but the Germans simply ignored it. It was mainly for that purpose that they signed the armistice; the idea of a great offensive on the W. had already occurred to them, and in Nov. and Dec. 24 divisions were transferred. Austria's main idea was much the same: "peace at the earliest moment," said Czernin, "is necessary for our own salvation, and we cannot obtain peace unless the Germans get to Paris, and they cannot get to Paris unless the eastern front is free." Czernin, and possibly even Kühlmann, the German Foreign Secretary, were prepared for such terms as might have secured this freedom and given Ludendorff a reasonable prospect of getting to Paris; but the grasping nature of the militarists stood in their own way. A preliminary conference at German Headquarters on Dec. 18 agreed to demand the acquisition of a protective belt of territory along the Russian-Polish frontier, and a personal union of Courland and Lithuania with Germany or Prussia, and to suggest the evacuation of Esthonia and Livonia by the Russians in the interests of self-determination.

At the Conference of Brest Litovsk, which opened on the 22nd, Kühlmann and Gen. Hoffmann represented Germany, Trotsky and Joffe the Bolsheviks, and Czernin Austria-Hungary. The Bolsheviks insisted on open diplomacy, and the arguments of the diplomatists were published throughout Europe from day to day by wireless telegraphy. This was essential for their schemes, for they relied upon propaganda to rouse the proletariats in all the belligerent countries to demand a cessation of the national wars which divided their forces, in order to combine them in a universal revolutionary movement. Their proposals were the evacuation of all conquests, restoration of independence to all nations subjected during the war, self-determination for those which had not previously secured independence, and no indemnities. Czernin replied for the Central Powers on the 25th, accepting the principles of no forcible annexations and no indemnities, but making the whole bargain conditional upon the acceptance of a general peace by the Allied and Associated Powers, who were given until Jan. 4 to signify their assent. No formal reply was made by them to the invitation; but one of the most important results of the Brest Litovsk negotiations was to clinch the case for a restatement of the Entente aims in the war.

Peace Moves, 1917–8.—Russia had asked for that restatement as far back as May 30, and in a communication addressed to the Provisional Government on June 9 President Wilson had replied that "no people must be forced under sovereignty under which it does not wish to live. No territory must change hands except for the purpose of securing those who inhabit it a fair chance of life and liberty. No indemnities must be insisted on except those that constitute payment for manifest wrongs done. No readjustments of power must be made except such as will tend to secure the future peace of the world and the future happiness of its peoples. And then the free peoples of the world must draw together in some common covenant . . . that will in effect combine their force to secure peace and justice in the dealings of nations with one another." On Nov. 18 M. Clemenceau, the new French premier, spoke slightingly of a League of Nations, remarking that he was only out to win the war; and the Bolshevik publication of the Secret Agreements which began on the 22nd revealed the gulf which separated the Old World ambitions of the Entente Powers from the objects for which Mr. Wilson had told revolutionary Russia "we can afford to pour out blood and treasure." On the 29th Lord Lansdowne published a letter in the *Daily Telegraph* (*The Times* having declined to give it publicity) coupling a demand for a restatement of war aims with a more dubious proposal for peace negotiations. To the latter suggestion Wilson made an effective reply by declaring war on Austria on Dec. 4, and fulminating against German power as "a thing without conscience or honour or capacity for covenanted peace" and refusing to negotiate until the "German people have spokesmen whose word we can believe" and "those spokesmen are ready in the name of their people to accept the common judgment of the nations as to what shall henceforth be the bases of law and of covenant for the life of the world. . . . Our immediate task is to win the war." But even he had not grasped all the implications: "We do not wish in any way to impair or to rearrange the Austro-Hungarian Empire," and it was left to France to recognize on Dec. 19 the Czechoslovak forces as "an autonomous army."

The Fourteen Points.—The initiative in a comprehensive and radical restatement of war aims was taken in a British Labour Memorandum, which was adopted without amendment by a special Labour conference on Dec. 28 and was then, with changes due to President Wilson's address of Jan. 8 1918, accepted by the Inter-Allied Labour and Socialist Conference in London on Feb. 22. Basing itself on Wilson's principle that "the world must be made safe for democracy," it emphasized the necessity, and sketched a plan, for a League of Nations, declared that the problem of Alsace-Lorraine was one of right and not of territorial readjustment, demanded restoration and reparation for Belgium and the Balkan States (with a Customs and Postal Union for the latter), the independence of Poland with access to the sea, the liberation of subject peoples from Turkish rule with the neutralization of the Dardanelles, condemned German annexation in Livonia, Courland, or Lithuania, and "the aims of conquest of Italian imperialism," and while "not proposing as a war aim the dismemberment of Austria-Hungary" protested against regarding "the claims to independence made by the Czechoslovaks and the Yugoslavs merely as questions for internal decision." Most of these aims were accepted in principle by Mr. Lloyd George on Jan. 5 after consultation with Dominion statesmen, Labour leaders, and Lord Grey and Mr. Asquith; but he made some notable concessions to what seemed to be the realities of the situation, and disclaimed any idea of fighting to "alter or destroy the imperial constitution of Germany," "to destroy Austria-Hungary," or even "to deprive Turkey of its capital or of the rich and renowned lands of Thrace, which are predominantly Turkish in race"; and he seemed lukewarm about the League of Nations. Then on Jan. 8, in an address to Congress, President Wilson laid down his famous "Fourteen Points," demanding:—

I. Open covenants of peace, openly arrived at, after which there shall be no private international understanding of any kind, but diplomacy shall proceed always frankly and in the public view.

II. Absolute freedom of navigation upon the seas, outside territorial waters, alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants.

III. The removal, as far as possible, of all economic barriers and the establishment of an equality of trade conditions among all the nations consenting to the peace and associating themselves for its maintenance.

IV. Adequate guarantees given and taken that national armaments will be reduced to the lowest point consistent with domestic safety.

V. A free, open-minded, and absolutely impartial adjustment of all colonial claims, based upon a strict observance of the principle that in determining all such questions of sovereignty the interests of the populations concerned must have equal weight with the equitable claims of the Governments whose title is determined.

VI. The evacuation of all Russian territory and such a settlement of all questions affecting Russia as will secure the best and freest coöperation of the other nations of the world in obtaining for her an unhampered and unembarrassed opportunity for the independent determination of her own political development and national policy and assure her of a sincere welcome into the society of free nations under institutions of her own choosing; and, more than a welcome assistance also of every kind that she may need and may herself desire. The treatment accorded to Russia by her sister nations in the months to come will be the acid test of their goodwill, of their comprehension of her needs as distinguished from their own interests and of their intelligent and unselfish sympathy.

VII. Belgium, the whole world will agree, must be evacuated and restored, without any attempt to limit the sovereignty which she enjoys in common with all other free nations. No other single act will serve as this will serve to restore confidence among the nations in the laws which they have themselves set and determined for the government of their relations with one another. Without this healing act the whole structure and validity of international law is forever impaired.

VIII. All French territory should be freed and the invaded portions restored, and the wrong done to France by Prussia in 1871 in the matter of Alsace-Lorraine, which had unsettled the peace of the world for nearly fifty years, should be righted, in order that peace may once more be made secure in the interest of all.

IX. A readjustment of the frontiers of Italy should be effected along clearly recognized lines of nationality.

X. The peoples of Austria-Hungary, whose place among the nations we wish to see safeguarded and assured, should be accorded the freest opportunity of autonomous development.

XI. Rumania, Serbia, and Montenegro should be evacuated; occupied territories restored; Serbia accorded free and secure access to the sea; and the relations of the several Balkan States to one another determined by friendly counsel along historically established lines of allegiance and nationality; and international guarantees of the political and economic independence and territorial integrity of the several Balkan States should be entered into.

XII. The Turkish portions of the present Ottoman Empire should be assured a secure sovereignty, but the other nationalities which are now under Turkish rule should be assured an undoubted security of life and an absolutely unmolested opportunity of autonomous development, and the Dardanelles should be permanently opened as a free passage to the ships and commerce of all nations under international guarantees.

XIII. An independent Polish state should be erected which should include the territories inhabited by indisputably Polish populations, which should be assured a free and secure access to the sea, and whose political and economic independence and territorial integrity should be guaranteed by international covenant.

XIV. A general association of nations must be formed under specific covenants for the purpose of affording mutual guarantees of political independence and territorial integrity to great and small states alike.

The Humiliation of Russia.—In introducing these points President Wilson referred to the Brest Litovsk negotiations as having been broken off, and described "the whole incident" as "full of significance." There had, indeed, during the interval allowed for the Entente to reply, been a violent disagreement between Ludendorff and Kühlmann, who was supported by Czernin and Hertling. On Dec. 28 the militarists secured a German declaration to the effect that the representative bodies existing in the occupied territories under German protection expressed their "self-determination" and that plebiscites were superfluous. On Jan. 2 Trotsky denounced these claims as hypocritical, and proposed to change the seat of the conference from Brest to Stockholm. He reappeared at Brest, however, on Jan. 7, asseverating that the Bolsheviks would make no peace that was not "just and democratic": and there followed weeks of discussion on the meaning of "self-determination" and its methods of expression. Trotsky's flank was turned by the appearance of delegates from the Ukraine asserting their independence of Russia. They represented only the middle-class Rada, while Ukraine revolutionaries sided with the Bolsheviks, seized Kiev, and overran most of the Ukraine. The Rada thereupon signed a peace with the Central Powers on Feb. 9, which gave Polish Kholm to the Ukraine and sowed the seeds of discord between the two nationalities, and invited the Germans and Austrians to drive the Bolsheviks out of the Ukraine. They were willing enough; food was their real quest, and alarming strikes had already broken out in Vienna, Berlin, and elsewhere.

These seemed to give Trotsky the leverage he had been seeking, and on the day the Ukraine treaty was signed he issued a wireless call to the German army to refuse obedience to the Kaiser. Next day he declared war to be at an end, but refused to sign a German peace. On Feb. 13 Germany denounced the armistice, and on the 18th recommenced the march toward Petrograd and the occupation of the Ukraine. There was no organized resistance; the peace of Brest Litovsk was signed on March 3 and ratified by a congress of Soviets at Moscow, after a three days' debate, on the 16th. The Baltic nationalities were surrendered by Russia for their fate to be determined between themselves and Germany; the Ukraine treaty of Feb. 9 was accepted by the Bolsheviks; Russia was also required to cede the districts of Kars, Ardahan, and Batum to Turkey; commercially she was made a preserve for the Central Powers; and the two million German colonists in Russia were exempted from the legislation of, and allegiance to, the Bolshevik Government. Trotsky had given up foreign affairs on March 8 and devoted himself to the more promising task of organizing a Red army; it was left for Lenin to persuade the Soviets of the necessity of temporarily bowing to the inevitable. Consequential and similar treaties were signed between the Central Powers and Finland on March 7 and with Rumania, provisionally, on March 5 and finally on May 7. German control over their commerce, industry, and finance was established in both, and Rumania further ceded the Carpathian crests and the Dobruja.

Germany and the Fourteen Points.—These deeds were a more convincing reply to President Wilson's "Fourteen Points" than the disingenuous speeches made in concert by Kühlmann and Czernin at Berlin and Vienna on Jan. 24. The Central Powers had been given the opportunity of demonstrating the interpretation which they put on victory; and there could not remain the slightest doubt that they would impose similar, if not severer, conditions upon the rest of the world if they got the chance. Nothing could have been more sinister or more impressive than the complete contradiction between their words to Powers which they did not yet control and their deeds to those which they did; and whatever criticisms might be made of the ultimate settlement, they would have to be based not on the ground that the Central Powers suffered more than they deserved, but that the penalties were impolitic and fell on the wrong shoulders. The treaties were approved of by all parties in the Reichstag except the Minority Socialists and the Poles; and early in March the Minority Socialists lost a seat at Nieder Barnim.

There was little more for diplomacy to say. It was obvious, although the fact was not universally recognized, that the speeches of Teutonic ministers afforded no basis for negotiation, since from Brest Litovsk onward the German G.H.Q. superseded the Government; but it was a blunder on the part of the supreme war council at Versailles to issue on Feb. 4 a statement that it would not accept Hertling's and Czernin's professions and had decided on a vigorous prosecution of the war, thereby creating the impression that the same supersession of the civil by military power was also taking place in the Entente. Nevertheless, President Wilson did, indeed, on Feb. 11 give a useful definition of Four Principles on which the settlement must be based; and he used what his Secretary of State, Lansing, subsequently denounced as an explosive expression when he declared that "'Self-determination' is not a mere phrase. It is an imperative principle of action which statesmen will henceforth ignore at their peril." But he was in closer touch with the realities of the situation when on April 6, commenting on the contrast between Hertling's professed acceptance of those four principles and the militarist terms dictated at Brest Litovsk, he declared: "Germany has once more said that force, and force alone, shall decide whether justice and peace shall reign in the affairs of men, whether Right as America conceives it or Dominion as she conceives it shall determine the destinies of mankind. There is, therefore, but one response possible from us: force, force to the utmost, force without stint or limit, the righteous and triumphant force which shall make Right the law of the world, and cast every selfish Dominion down in the dust."

It needed, however, a crisis to elicit an adequate display of American force on fields where the issue would be decided. In the previous Nov. the Kaiser had declared that the only means to secure peace was for Germans to hew their way through those who would not make it; and the terms of the Treaty of Brest Litovsk are intelligible only on the assumption that he relied upon a German offensive on the western front to constrain the Entente to recognize those terms if not to accept similar ones for themselves. From the beginning of the German offensive on March 21 until the first Austrian peace-note on Sept. 15 the pen gave way to the sword. Czernin resigned on April 15 after his controversy with Clemenceau over the Sixte of Parma *pourparlers* in the summer of 1917, but the fact that he was succeeded by Burian indicated a stiffening rather than a relaxation of the Austrian attitude. Nor had the growing discontent and the declining *moral* of the German people any effect upon the diplomatic situation, although in Jan. strikers had demanded peace on the basis of self-determination without annexations or indemnities, and crowds in Berlin had vociferated against a fresh offensive on the western front.

War Weariness.—More potent than social ferment in Germany was imperial disintegration in Austria. The disaster at Caporetto had a wholesome effect upon the Italian attitude toward the Yugoslavs, and the revelation of the secret Treaty of London by the Bolsheviks gave more progressive opinion in Italy an opportunity of expressing itself. In Feb. 1918 a committee was formed to promote an understanding with the Yugoslavs, and on March 7 Signor Torre on a visit to London arranged with Dr. Trumbitch the holding of a congress of oppressed nationalities at Rome. It met early in April, and on the 10th produced the "Pact of Rome," by which the "unity and independence" of the Yugoslav nation, "known also as the nation of Serbs, Croats, and Slovenes," were recognized as a vital interest for Italy, and the completion of Italian unity as a vital interest for the Yugoslavs. It was also mutually agreed to defend the freedom of the Adriatic against every enemy present or future, and to decide amicably the territorial questions between them on the basis of nationality and self-determination. This entente was of the utmost value in promoting the successful Italian resistance on the Piave in June and victory in Oct. President Wilson hastened to bless the practical application of his own principles; on June 28 he asserted that all branches of the Slav race must be completely freed from German and Austrian rule; on Sept. 3 he formally recognized the Czechoslovak National Council as a belligerent Government; and on Oct. 18 in reply to the Austrian peace-note declared that he was no longer at liberty to accept the "autonomy" of these peoples—as indicated in the tenth of his Fourteen Points—as a basis of peace, but "is obliged to insist that they, and not he, shall be the judges of what action on the part of the Austro-Hungarian Government will satisfy their aspirations and their conceptions of their rights and destiny as members of the family of nations."

For the time, the success of the German offensive made all talk about terms of peace irrelevant except on the German side, where it generally took the form of repudiating the peace resolution of July 1917. But before the end of April confidence began to wane, first at G.H.Q. and then in the public mind in Germany itself. The difference was that the worse the situation became, the more determined Ludendorff grew in his persistence, and the more sceptical the public showed itself of his success; the reason was that the militarism of the German Government became more and more involved in the fortunes of the war. On June 24 Kühlmann in a long speech let fall the phrase, "an absolute end can hardly be expected through purely military decisions alone"; and a fortnight's disputation over his meaning ended in his resignation at Ludendorff's behest on July 9. It had become heresy, in the waning prestige of militarist orthodoxy, to dispute what the German G.H.Q. could do; and Kühlmann's successor was von Hintze, its nominee without any pretence of that "parliamentarization" which both the Reichstag and President Wilson had demanded as a preliminary to peace. On July 4 President Wilson laid down four great ends of the war, which he said "can be put into a single sentence. What we seek is the reign of law, based upon the consent of the governed and sustained by the organized opinion of mankind." Next day Mr. Lloyd George said the Kaiser could have peace to-morrow if he would accept the President's terms. But Ludendorff's conception of the reign of law was the will of G.H.Q. sustained by German arms, and he was desperately bent on giving it effect.

He refused to admit in words that his increasing lack of success and resources, or even Foch's counter-offensive on July 18, had made his position hopeless. But he confessed that Aug. 8 was Germany's "black day," and on the 14th at a crown council at Spa the Kaiser decided that negotiations must begin on the first suitable occasion. The Austrian Emperor and Burian emphasized the need on the 15th, and wanted to begin at once. A fortnight was spent in arguing, and on the 30th Austria threatened an independent overture. But both parties assumed that defensive war could still be successfully carried on in France, while the offensive submarine inclined the enemy to a peace which would leave the Central Empires their ill-gotten gains in the east; and they were at the moment engaged on the supplementary treaties of Brest Litovsk, which, as signed on the 27th, compelled the Bolsheviks to oppose the Entente forces in N. Russia, to renounce sovereignty over Esthonia, Livonia, and Georgia and to pay heavy gold indemnities, and riveted the German economic yoke more firmly than ever. The German public and even the civil government looked helplessly on while G.H.Q. wasted their opportunities for peace. There was no foresight, and no discussion of any terms that might have satisfied enemies whom Germany found it increasingly difficult to resist. Civil intelligence had abandoned its functions for so long to the soldier that it was simply atrophied for lack of use; and it was not until late in Oct. that ministers screwed up their courage to action independent of General Headquarters.

Concluding Stages.—By that time the Hindenburg defences on which the army and public relied had broken down. On Sept. 2 the Wotan line was pierced, on the 12th the Americans wiped out the St. Mihiel salient, and on the 15th, the day on which the Bulgarian line in the Balkans was broken, Austria addressed a peace-note to belligerents, neutrals, and the Pope proposing a confidential and non-committal discussion in some neutral country. President Wilson replied on the following day that the United States " can and will entertain no proposal for conference upon a matter concerning which it has made its position and purpose so plain "; and Austria retired from the diplomatic struggle. German G.H.Q. were not reduced to a suppliant attitude until the 29th, the day on which Bulgaria signed her armistice and went out of the war, abandoning the whole of the Balkans to the Entente. Meanwhile Allenby had destroyed the Turkish armies in Palestine, the Hindenburg lines in front of Cambrai had been broken, and a combined offensive in Belgium had undermined Germany's hold on the coast. On the 27th President Wilson added " Five Particulars " to his " Fourteen Points," " Four Principles," and " Four Ends." Some details, he said, were needed to make his general terms " sound less like a thesis and more like a practical programme." But even these particulars were less terms of peace than principles which must govern those terms, and they were as follows:—

> *First*, The impartial justice meted out must involve no discrimination between those to whom we wished to be just and those to whom we did not wish to be just.
>
> *Second*, No special or separate interest of any single nation or any group of nations can be made the basis of any part of the settlement which is not consistent with the common interest of all.
>
> *Third*, There can be no leagues or alliances or special covenants and understandings within the general and common family of the League of Nations.
>
> *Fourth*, And, more specifically, there can be no special selfish economic combinations within the League, and no employment of any form of economic boycott or exclusion, except as the power of economic penalty, by exclusion from the markets of the world, may be vested in the League of Nations itself as a means of discipline and control.
>
> *Fifth*, All international agreements and treaties of every kind must be made known in their entirety to the rest of the world.

Two days later Hertling and all his ministers resigned in order that the Kaiser might be provided with an administration supported by the Reichstag to meet the President's objection to negotiating with an autocratic government; but the Kaiser in accepting this principle would only say that it was his " will that men who are supported by the confidence of the people should, to a large extent, participate in the rights and duties of the Government." Prince Maximilian of Baden was appointed German Chancellor, and he had to deal with a veritable panic at G.H.Q. Ludendorff was in despair. " To-day, " he declared, " the soldiers hold their ground; it is impossible to foresee what may happen tomorrow . . . the peace offer must be made to-day." Hindenburg was hardly less emphatic: " Every day of delay will cost thousands of brave soldiers their lives." So on Oct. 4 a first peace-note was despatched by Germany. The appeal was to President Wilson alone, asking him to take steps for the restoration of peace. The German note accepted the Fourteen Points as a programme; the Austro-Hungarian note, which followed on Oct. 7, accepted also the Four Principles of Feb. 11 and agreed that the Five Particulars should " also be taken into account."

The President's replies to these and to the succeeding notes constituted a process of depriving the German Government one by one of possible loopholes of escape, and of the means, such as defensive warfare on French soil, delay for recuperation, and the submarine campaign, by which Ludendorff still hoped that the situation might be improved. On Oct. 8 he pressed for more specific acceptance of his principles, declined to propose an armistice unless the Central Powers consented " immediately to withdraw their forces everywhere from invaded territory," and pointedly asked whether the German Chancellor was merely speaking for the imperial authorities who had so far conducted the war. Satisfactory assurances were given by Germany on the 12th with regard to the first; but as to the second she proposed a mixed commission, and as to the third was not conclusive. Her acceptance of the first justified the President, as he said on the 14th, in being frank with regard to the other two points; the process of evacuation and terms of the armistice must be left to the advice of the military authorities, but no arrangement could be accepted which did not guarantee the present military supremacy of his Government and its Allies. Nor would he or they consent to consider an armistice so long as German submarines continued their sinking of passenger ships, and German troops the pillage and destruction which marked their withdrawal. With regard to the democratic character of the German Government, he referred to his " Four Ends " speech of July 4, in which he had plainly intimated that if the Germans wanted peace they must change their constitution. To the Austro-Hungarian note he returned a separate reply on the 18th, explaining his change of attitude toward Czechoslovak and Yugoslav " autonomy."

Both Governments made in reply concessions, in view of which the President said on the 23rd he could not decline to take up the question of an armistice with his Allies. He had therefore transmitted the correspondence to them; but he pointed out that extraordinary safeguards would have to be demanded in view of the fact that " the power of the King of Prussia to control the policy of the Empire is unimpaired . . . that the nations of the world do not and cannot trust the word of those who have hitherto been the masters of German policy." If the Government of the United States " must deal with the military masters and the monarchical autocrats of Germany . . . it must demand not peace negotiations but surrender. Nothing can be gained by leaving this essential thing unsaid."

The German reply was dated the 27th. Incidentally that was the date of the Austrian *débâcle* on the Piave; but Germany's action was dictated by events nearer home. Almost the last vestige of the Hindenburg defences had disappeared. But Ludendorff had recovered his obstinacy, if not his nerves, and urged the rejection of Wilson's terms. At last the civilian ministers acted on their own responsibility, and Ludendorff had to resign on the 27th. Next day, when the High Seas Fleet, the submarine having been barred, was ordered out, it mutinied; and the German note merely intimated that the German Government awaited the proposals for an armistice. But the President's Allies had still to be heard; and on Nov. 5 he informed Germany that they reserved complete freedom of action at the Peace Conference with regard to the freedom of the seas, and understood by " restoration " " compensation for all damage done to the civilian population of the Allies and their property by the aggression of Germany by land, by sea, and from the air." No reference was apparently made to the Secret Agreements, which therefore would not be binding on the Conference.[1]

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[1] *See* PEACE CONFERENCE for the actual proceedings.

Germany raised no further objections, and on Nov. 7 the Armistice Commission met. It continued its deliberations, to the accompaniment of popular insurrections and monarchical abdications, until on the 11th an Armistice was signed on the day that Americans fought their way into Sedan and Canadians into Mons. Verily a New World had been called in to redress the balance of the Old. For subsequent events see especially articles on GREECE, RUSSIA, OTTOMAN EMPIRE, and other countries of Eastern Europe. (A. F. P.)

WRANGEL, PETER NICHOLAIEVICH, BARON (1879–), Russian general, was born in Petrograd in 1879, the eldest son of an impoverished Baltic nobleman of Swedish descent. His father, Baron Nicholas Igorevich, held an important post in the International Bank, at Petrograd. At the age of 20 Wrangel entered the Mining Institute at Petrograd and finished its course brilliantly. He served as private in the Horse Guards for one year. Leaving the regiment with the rank of N.C.O. he went to Siberia and worked there as a mining engineer until the Russo-Japanese War. At the beginning of that war he joined the Trans-Baikal Cossack Regt., which he left at the end of hostilities with the rank of captain. He retained his rank in the Horse Guards, which he rejoined after the war, thus devoting his life to the military profession. At the beginning of the World War he was in command of a squadron, but was soon promoted colonel, received the St. George Cross and was made A.D.C. to the Tsar. In 1915 he was appointed commander of a Cossack regiment at the Galician front. Later he rose to the command of a Cossack division. Wrangel was among the first officers who joined Gen. Kaledin in his fight against the Bolsheviks, and after Kaledin's suicide he took part in the organization and struggle of the volunteer army under Alexeyev and Denikin, and distinguished himself especially by the defence of Tsaritsyn. After the disastrous retreat of Gen. Denikin, from Orel to the Black Sea, Wrangel was appointed on April 4 1920 commander of the volunteer army. Men and officers of the army were demoralized, and the lack of munitions and food supplies made the situation almost desperate. Fortunately for Wrangel, the Bolsheviks considered the volunteer army to be out of action, and they had to send a large part of their forces against the Poles who were approaching Kiev. This made it possible for Wrangel to attempt the reconstruction of the southern army; and for some time his attempt was successful. His nomination to the post of commander-in-chief corresponded with the attempt of Mr. Lloyd George to induce the volunteer army to begin peace negotiations with Soviet Russia. In a note to this effect the volunteers were warned that, in case of refusal, they would be deprived of all British support; this note was handed to Gen. Denikin on April 4, and seems to have been one of the chief causes of his resignation. Replying to this proposition Wrangel refused to enter into direct negotiations with the Bolsheviks, and asked the Allies to guarantee the life and safety of his troops and of the refugees under his protection. These negotiations proved eventually a failure. In the meantime Wrangel did his best for the reorganization of the army and the administration. A Council was formed which continued the work of Denikin's Government. Krivochin was nominated president of the council; Peter Struve received the portfolio of Foreign Affairs, Bernadsky that of Finance. The Government was modelled on the basis of personal dictatorship. In the " Statute " published on April 14 it was proclaimed that the " Ruler and Commander-in-Chief of the armed forces of South Russia holds full military and civil power without any limitation whatever." It was intended that this temporary dictatorship should lead in the future to the reconstruction of Russia. The main points of Wrangel's programme were outlined by Struve in an interview to the representative of an English paper in the following way:—

> " The seizure by the peasants of large properties should be recognized wherever it has actually taken place. It constitutes the starting point for wide agricultural reform destined to assure the peasants the full ownership of the land which they cultivate. The agrarian revolution which has taken place in favour of peasants would thus be legalized, and, to the profit of the new owners of the soil, would result in an agrarian organization based on the principle of private property, which corresponds beyond doubt to the aspirations of the peasants." (These principles served as a foundation to the " Rules for the transfer of agricultural land to the tillers of the soil " of March 25 1920.) " The future organization of Russia should be based on an agreement between the existing political formations. The union of the different parts of Russia, at present divided, in a large federation would be founded on voluntary agreement between them, resulting from the community of interests, and, above all, from economic needs. This policy in no way seeks to enforce union by violence. Whatever may be the future relations of the different parts of Russia now separated from one another, the political organization of these territories and the constitution of their federal union should be founded on the free expression of popular will by means of representative assemblies elected on democratic basis. The underlying motive of Wrangel and those who supported him in attempting to establish themselves in Southern Russia was the conviction that while, sooner or later, the Bolshevist system must come to an end, it is nevertheless essential that its disintegration should be assisted by outside action."

The reorganization of the army by conscription proceeded successfully, and the events of the Polish front as well as the shortage of food in Crimea obliged Wrangel to try a new offensive. On May 25 he began an advance on the whole front, combined with landings on the coast to the east and west, which resulted in a series of defeats for the Bolsheviks. The whole of the fertile corn lands of the Taurida Province were occupied, and the position of the army was greatly strengthened. At the end of June the new line of the front passed approximately through Berdyansk (Sea of Azov), Tokmak (Sevastopol-Kharkov railway), Alioshki (on the Dnieper, near Kherson). The front of 30 km. had been extended to one of 250 kilometres.

With the defeat of Poland Mr. Lloyd George renewed his proposals as to settlement with the Bolsheviks at the conference of Spa. On the contrary, on Aug. 11 the French Government issued a statement which declared, " that taking into consideration the military successes and the growing strength of the Soviet Republican Government " it was recognized by France as the *de facto* Government of Russia under the obligation of recognition of Russian debts, and the promise to follow a democratic policy with regard to domestic affairs.

Wrangel and his Government tried to follow these advices in spite of the opposition of a section of the Russian society. But the heavy hand of the military dictatorship made itself often felt in spite of the democratic programme. For example, in his order of Oct. 3 Wrangel prohibited all " public speeches, sermons, lectures and conferences tending to arouse political or national disorder." His relations with the Caucasus, Ukraine, Poland and other territories, which had been parts of the Russian Empire before the revolution, were of vital importance for the success of the undertaking. The principle of federation was proclaimed and resulted in the agreement of July 22 (Aug. 4) between Wrangel on the one side and the Atamans of Don, Kuban, Terek and Astrakhan on the other. Complete self-government was granted to the Cossacks in their internal organization and administration, but the direction of foreign relations and of military affairs was reserved for the Commander-in-Chief. A delegation of the Paris Ukrainian National Committee was received by Wrangel at Sevastopol on Sept. 23, and established coöperation of the non-separatist Ukrainians with Wrangel. In order to facilitate the organization of a special Ukrainian administration and the formation of Ukrainian military units, a Commissioner for Ukrainian affairs was appointed in Wrangel's Government with the rank of Minister. Wrangel was also recognized as the supreme chief of the anti-Bolshevik movement by the leader of the Siberian Cossacks, Ataman Semenoff, and the chiefs of different independent guerilla units acting in the south of Russia, the best known of whom is Makhno. Wrangel successfully repulsed all Bolshevik attacks until the end of Oct., and even found it possible to extend the area of his occupation. An official *communiqué* at the end of Oct. reports " that between May 25th and October 25th the Russian army had captured 70,500 prisoners, 250 guns, 17 armoured trains, 21 armoured cars, hundreds of horses, and considerable amount of other booty." But these successes were only of a short duration. Peace with Poland had freed considerable Bolshevik forces, which were transferred to the southern front against Wrangel. The small army numbering 45,000 trained soldiers was unable to defend a front of 400 km. against the overwhelming number of Bolsheviks, well provided with heavy artillery and unlimited munitions. The isthmus of Perikop had to be abandoned in consequence of a turning movement by the Reds across the "Putrid Sea." On Nov. 15 Sevastopol was occupied by the Bolsheviks.

The evacuation of the army and of thousands of refugees was carried out in good order under the personal supervision of Wrangel, who was the last to leave on board the "Korniloff." A total of 130,000 people were evacuated, of whom 70,000 were soldiers (30,000 fighting men, and 40,000 from the rear), about 7,600 wounded, the rest being civilians. One hundred and fifty million fr. were advanced by the French Government for the relief of the army and refugees, who were in the most awful condition. The refugees were sent to Lemnos, to Egypt and to Yugoslavia.

Wrangel hoped that the evacuation would enable him to keep his army together as a fighting unit to be used at the first opportunity against the Bolsheviks. The excellent discipline and gallantry of the troops and their devotion to their chief favoured such a plan; but it could not be effected without the support of the Allies, and this resource proved to be exhausted.

The French Government, which had done most for the forces in the Crimea, was unwilling to continue a policy which it considered hopeless. M. Leygues, the successor of M. Millerand as prime minister, demanded categorically the disbandment of Wrangel's army, and the General was directed to announce to the troops that he was not their chief any more and that they were free to disband. About 10,000 were "repatriated" to Soviet Russia, about 12,000 accommodated in Serbia and Brazil. The best part of the army kept together in the camp of Gallipoli in their regimental formations, maintaining—according to the testimony of foreign officers—excellent discipline and sturdy spirit. The problem as to what was to be done with these picked troops was still unsolved in the winter of 1921. France had withdrawn her support; Serbia had taken over 5,000 cavalry to serve as frontier guards; the rest were expecting assistance from Russian institutions abroad, such as the Russian embassies in Washington and Tokio, and from the intervention of the League of Nations. (P. Vi.)

WRENBURY, HENRY BURTON BUCKLEY, 1st Baron (1845–), English judge, was born in London Sept. 15 1845. His father was for many years vicar of St. Mary's, Paddington, and Arabella Buckley, the author of *The Fairy Land of Science* (1878), was his sister. He was educated at Merchant Taylors' school and Christ's College, Cambridge, being ninth wrangler in 1868. In 1869 he was called to the bar, and rose to a position of eminence as an authority on company law. He became a Q.C. in 1886 and a bencher of Lincoln's Inn in 1891, while from 1883 to 1898 he was a member of the Bar Committee and the Bar Council. In 1900 he was made a judge of the Chancery division, and in 1906 became a lord justice of appeal and a privy councillor. He retired in 1915, and was raised to the peerage, his high legal authority adding strength to the House of Lords. Lord Wrenbury founded in 1904 the Buckley scholarship in political economy at Cambridge, later styled the Wrenbury scholarship, to be held by scholars from Merchant Taylors' school. His *Law under the Companies Acts* (1873; 9th ed. 1909) is a standard work.

WRIGHT, SIR ALMROTH EDWARD (1861–), British bacteriologist, was born at Middleton Tyas, Yorks, Aug. 10 1861. He was educated at Dublin University, and afterwards studied law, subsequently obtaining his medical and scientific education at the universities of Leipzig, Strassburg and Marburg. In 1887 he became a demonstrator of pathology at Cambridge; in 1889 went to Sydney as lecturer in physiology, and from 1892 to 1902 was professor at the army medical school at Netley, being then appointed professor of experimental pathology in the university of London. He was knighted in 1906. Sir Almroth Wright came into prominence primarily by his remarkable researches into the problems of parasitic diseases. He introduced the system of anti-typhoid inoculation (*see* 20.775, 783), and also did much valuable work on the preparation of other vaccines and toxins, while he carried out many important experiments in bacterial infection and in measuring the protective matter of human blood. He acted as a consulting physician to the army in France from 1914–9, and was in 1918 created K.B.E. He has published *System of Anti-Typhoid Inoculation* (1904); *Principles of Microscopy* (1906) and *Studies in Immunisation* (1909), besides many papers in medical and scientific periodicals. In 1913 appeared *The Unexpurgated Case against Woman Suffrage,* which provoked much discussion.

WRIGHT, WILBUR (1867–1912), American inventor, was born near Millville, Ind., April 16 1867. He was the son of Milton Wright, a bishop of the United Brethren in Christ. He secured a high-school education in Richmond, Ind., and Dayton, O. Together with his brother Orville he opened a shop for repairing bicycles at Dayton in the early 'nineties. The Wright brothers early became interested in the problem of flying, and from about 1900 made many experiments with gliding machines at Kittyhawk, N.C. On Dec. 17 1903 such a machine with a petrol motor attached flew 260 yd., the first successful flight of an aeroplane; and on Oct. 5 1905, near Dayton, they accomplished their first successful long flight, more than 24 m., at the speed of 38 m. an hour. In spite of this proof of the practicability of flight in heavier-than-air machines, they were unsuccessful in enlisting financial support in America. In 1908 Wilbur Wright went to France, and on Sept. 21 won the Michelin prize by a flight of 56 miles. This brought him international fame. In Dec. of the same year he made from Le Mans, France, a flight of 77 m. in 2 hours and 20 minutes. In 1909, during the Hudson-Fulton Exposition in New York City, he flew from Governor's I. up the Hudson river to Grant's tomb and back, travelling 21 m. in 33 minutes and 33 seconds. On March 3 1909 Congress awarded the Wright brothers a special medal. Later the U.S. Government purchased a machine for $30,000, and afterwards the invention was officially adopted by the U.S. army. The French patents were sold for $100,000. After 1910 Wilbur Wright gave up public flying and devoted his time to mechanical improvement of the Wright machine. He received many medals and honours from European countries. He died at Dayton, May 30 1912.

His brother, Orville Wright (1871–), was born at Dayton, O., Aug. 18 1871. He was educated in the Dayton schools, worked with his brother Wilbur in the bicycle repairing business, and was closely associated with him in all his experiments in developing a practicable aeroplane. He shared in the many honours awarded by foreign countries, and after the death of his brother became director of the Wright Aeronautical Laboratory at Dayton. In 1913 he received the Collier trophy for developing the automatic stabilizer. In 1915 he was appointed a member of the U.S. Naval Consulting Board. The same year the Wright Aeroplane Co. sold its patents to a New York syndicate, Orville Wright remaining chief engineer.

WRIGHT, WILLIAM ALDIS (1836–1914), English man of letters (*see* 28.847), died at Cambridge May 19 1914. His last publication was *The Hexaplar Psalter* (1911). In 1912 he resigned the vice-mastership of Trinity College, Cambridge, and lived in retirement till his death.

WUNDT, WILHELM MAX (1832–1920), German philosopher (*see* 28.855), died at Leipzig Sept. 1 1920. His principal work was done before 1907. At the outset of the World War he published an address justifying Germany, and his *Die Nationen und ihre Philosophen* (1915) eulogizes German thought and culture whilst belittling those of England and France.

WÜRTTEMBERG (*see* 28.856). Pop. according to 1919 census, 2,518,773. During 1910–1921 the constitutional question in Württemberg passed through decisive developments. The constitution dating from Sept. 20 1819 was one of the oldest in Germany. Created by a contract between the King and the Assembly of Estates, it was based upon the people's will and could, for that very reason, be maintained almost without alteration for close upon a century.

The first alteration of any importance was made in 1906, when Württemberg introduced, before any other German state, the proportional system of election for the Second Chamber of the Diet. The result of the elections of 1906 was such that the two Liberal parties on the one side and the Catholic Centre and the Conservatives on the other were equally strong, so that the Social Democrats held the balance. The elections of 1912 brought about a fresh grouping of parties. The Conservatives and the Catholic Centre (forming together the so-called "Black-and-Blue *bloc*") returned as many deputies as all the other parties together, with the consequence that very keen opposition developed between the Right and the Left. The composition of the Ministry, it is true, was not affected by the constellation of parties, as the government of Württemberg was not on the parliamentary system. The Weizsäcker Ministry remained in office and continued to conduct its policy on the liberal lines which had always been followed in Württemberg. The demand for the appointment of parliamentary ministers, which had been vigorously prosecuted by the Democratic (non-Socialist) party during the World War, was rejected by the Weizsäcker Ministry, notwithstanding its liberal tendencies, until the change in the constitution of the Empire under Prince Max of Baden's chancellorship in Oct. 1918 compelled the Württemberg Government to give way. The Weizsäcker Ministry resigned. A new Ministry was formed, containing a member of each of the four parties, the Catholic Centre, the National Liberal, the Democrats and the Social Democrats. The Democrat Liesching was made president of the Ministry. This new Ministry was going to meet on Nov. 8, but on Nov. 9 the revolution broke out in Stuttgart and on Nov. 10 the Liesching Cabinet resigned. A provisional Government was formed, consisting at first entirely of Social Democrats. The most extreme members of this Government, however, were ejected on Nov. 11, and a member of each of the three parties, the Centre, the Democrats and the National Liberals, entered the Cabinet. After the disturbances which broke out in Jan. 1919 the Independent Socialists left the Ministry, and its composition then remained unaltered until the general election of the year 1920.

The King, William II. (born 1848), had abdicated on Nov. 30 1918 and retained only the title of Duke of Württemberg. He subsequently lived mostly at Bebenhausen Castle in the Black Forest, where he died on Oct. 2 1921. The headship of the family passed to Duke Albrecht of Württemberg. The abolition of the monarchy in Württemberg was solely a consequence of the fall of the Hohenzollern monarchy in the empire. The King of Württemberg himself had enjoyed great popularity, which extended into the ranks of the Social Democrats. The democratic tendencies which had always prevailed in Württemberg had, after the revolution, the favourable effect of enabling the Territory (*Land*) to settle down with comparative rapidity, and the coöperation of the so-called "bourgeois" (*i.e.* non-Socialist) parties with the Social Democrats took place without any serious friction.

After Nov. 9 1918 Württemberg experienced no further political convulsion of a serious character. The disturbances of Jan. 1919 were quickly suppressed. The attempt of the extremists among the working classes to cause disturbances by a general strike was frustrated by the action of the railway officials in paralysing the communications with Stuttgart. The Bavarian Communist insurrection produced no effect in Württemberg; it was, on the contrary, suppressed with the aid of Württemberg troops before it could spread across the border. During the so-called Kapp "Putsch" (March 1920) the Government of the Reich and the National Assembly removed for a short time from Berlin to Stuttgart because they felt that they would be safest in the capital of Württemberg.

The provisional Government of Württemberg issued on Nov. 2 1918 regulations for the election of a Representative Assembly which should meet and vote the new constitution. The elections of Jan. 12 1919 resulted in the return of 52 Social Democrats, 38 Democrats, 31 members of the Catholic Centre, 25 Conservatives and 4 Independent Socialists. The Assembly first confirmed the Government in office and then proceeded to deal with the new constitution. It was voted on April 26 against a minority of nine by the whole of the rest of the House. Most of the Conservatives were amongst the majority; the minority consisted of a few Conservatives and the Independent Socialists. Württemberg was the second state of the Reich which deduced the consequence of the revolution by setting up a new constitution; Baden alone preceded it. The constitution of Württemberg naturally resembles that of Baden in many respects, but also differs from it in several important particulars. Moreover, the constitution which came into force on May 23 1919 was not definitive. As the constitution of the Reich had considerably restricted the rights of the separate states which composed it, a reconsideration of the constitution of Württemberg became necessary and large sections of it were eliminated. On Sept. 25 1919, exactly 100 years after the adoption of the first Württemberg constitution, the new constitution was finally voted.

The constitution of Württemberg could not fail to resemble that of the other German states, since the constitution of the Reich prescribes for all the states that they must be republics and have a parliamentary government. The powers of the state in Württemberg proceed from the people and are transferred by the people to the Diet; the people can, however, resume the powers of the state by dissolving the Diet or by giving a popular vote (*Volksabstimmung*) on a law. Such a vote may be passed either upon a referendum or upon a popular initiative. In contrast to Baden, there is no compulsory referendum.

The Diet transfers the executive power to the Government. At the head of the Government there is the Minister-President, who has the title of President of the State (*Staatspräsident*); but in Württemberg, as in Baden, there is no head of the state independent of the Diet. The Ministry is formed by the Diet's electing the President of the State, who selects the Ministry in accord with the Diet. (The same procedure is followed in Bavaria and Baden.) The administration, however, is not conducted by the Ministry as a whole, but by individual ministers. A peculiarity of the Württemberg constitution is that councils (*Beiräte*), formed from the different classes according to occupations (*Berufsstände*), are attached to the ministries. Elections for the Diet take place every four years. No provision is made for a dissolution of the Diet except that, as already mentioned, the Diet can be dismissed by a vote of the people.

The constitution of Württemberg was framed by those parties which restored order in the country after the revolution—the Social Democrats, the Democrats and the Catholic Centre. At the elections of June 1920 these parties, particularly the Social Democrats and the Democrats, were considerably weakened, while the parties to the Right and the Left of them gained. As in the Reich the result of the general elections compelled the Government to resign; the Württemberg Government took this course, although there was no absolute necessity. The new Government of Herr Hieber was composed of members of the Democratic and the Catholic Centre parties, but was nevertheless supported by the German People's Party (former National Liberals) and the Social Democrats. The change of government did not entail any essential alteration in the policy of Württemberg. (W. v. B.)

WYNDHAM, SIR CHARLES (1837–1919), English actor (*see* 28.872), died in London Jan. 12 1919. In 1916 he married, as his second wife, Miss Mary Moore, who had been for many years his leading actress and his partner in management. His last appearance on the stage was made in a revival of *Mrs. Dane's Defence* at the New theatre, London, in 1912.

WYNDHAM, GEORGE (1863–1913), English politician and man of letters, was born Aug. 29 1863, the eldest son of the Hon. Percy Scawen Wyndham, and grandson of the 1st Lord Leconfield. His mother was Madeline Caroline Frances Eden, daughter of Sir Guy Campbell, 1st baronet; and through her he was great grandson of Lord Edward Fitzgerald, the Irish rebel. He was educated at Eton and Sandhurst, obtained a commission in the Coldstream Guards in 1883, and served through the Suakin campaign of 1885. But his military career was a very short one. Interested as he was in soldiering, his eager temperament impelled him still more to adventure in politics and letters. He left the army in 1887, married Sibell Mary, daughter of the

9th Earl of Scarbrough, widow of Earl Grosvenor, mother of the 2nd Duke of Westminster, and became private secretary to Mr. Balfour, at the time Irish Secretary, a position which he held till 1892. In 1889 at the age of 26 he entered Parliament as Conservative member for Dover, and retained the seat till his death. In 1898 he was appointed financial secretary to the War Office, a post in which he distinguished himself during the Boer War, in particular by a brilliant defence, in the debate on the Address in 1900, of the conduct of his office in regard to intelligence and reinforcements. But his chief claim to political remembrance is based on his tenure, from 1900 to 1905 (after 1902 as a Cabinet minister), of the office of Chief Secretary for Ireland. Having been private secretary for several years to the most successful chief secretary of modern times, he started with a large store of experience, and his appointment was regarded with benignity even by the Nationalists on account of his descent from Lord Edward Fitzgerald. His early work in Ireland met with general approval. He developed enormously the policy of land purchase, which the Unionists had found to exercise such a calming and beneficial effect; and the Land Purchase Act which he successfully carried in 1903 was the most comprehensive measure of the kind ever submitted to Parliament. He entertained hopes of arranging some form of local government which should sufficiently meet Nationalist hopes; and with this in view appointed an eminent Anglo-Indian, Sir Antony (afterwards Lord) Macdonnell, who was known to be a decided Home Ruler, to the permanent secretaryship in 1902, giving him at the same time greater authority and wider scope than is usually conferred on a civil servant. The Unionist party, both in Ireland and in England, became suspicious of the tendencies of his administration, and he was driven to resignation. He never held office again, but he was very active in support of the causes which he had at heart, such as tariff reform, and woman suffrage; he was a keen critic of Lord Haldane's army reforms, and threw himself vigorously into the "die-hard" campaign of 1911.

This varied political activity was however but a portion of his life. He was also a man of letters, possessed of fine taste and a graceful style. Here his genius was stimulated by his friendship with W. E. Henley, who dedicated a book to "George Wyndham, soldier, courtier, scholar." His principal published work was an edition of *Shakespeare's Poems* (1898); but he wrote also on North's *Plutarch* and Ronsard. The Admirable Crichton of his day, he was keen alike on field sports and the arts, the friend and admirer equally of Cecil Rhodes and of Rodin, a railway director and a yeomanry colonel. Oxford, Edinburgh and Glasgow gave him honorary degrees; the two Scottish universities made him lord rector.

By his father's death in 1911, Mr. Wyndham came into possession of his beautiful house, Clouds, in Wiltshire. Two years later, at the early age of 50, he died in Paris, of congestion of the lungs, after only a few hours' illness. Lady Grosvenor survived her husband. They had one son, Lt. Percy Lyulph Wyndham, who followed his father in the Coldstream Guards, was married in 1913, a few weeks before his father's death, and was killed in action in France on Sept. 15 1914, leaving no child.

WYOMING (*see* 28.873).—The pop. of the state in 1920 was 194,402 as compared with 145,965 in 1910, an increase of 48,437 or 33.2%, as against an increase of 57.7% in the preceding decade. The density of pop. was two per sq. m. in 1920. The urban pop. (in places having 2,500 inhabitants or more) in 1910 was 43,221, or 29.6% of the whole; in 1920, 57,348, or 29.5%. The rural pop. was 102,744 in 1910, 137,054 in 1920. The cities in Wyoming having a pop. in 1920 of over 5,000 and their percentage of increase were:—

	1920	1910	Percentage Increase
Casper	11,447	2,639	333·8
Cheyenne	13,829	11,320	22·2
Laramie	6,301	8,273	23·5
Rock Springs	6,456	5,778	11·7
Sheridan	9,175	8,408	9·1

The increase of pop. has been chiefly elsewhere than in the southern parts of the state, which had been the first to be settled.

Agriculture.—The number of farms was 6,095 in 1900, 10,987 in 1910, 15,748 in 1920. The acreage of all crops was estimated for 1920 as 1,826,000. The number of sheep in 1919 was 4,000,000 valued at $49,200,000. In 1920 the number was 3,200,000 valued at $32,640,000, being one-fifteenth in numbers and value of the total sheep in the United States. The estimated product of wool in 1919 was 33,415,000 lb., the average weight per fleece 8·5 lb. The total number of neat cattle in 1919 was 1,180,000 valued at $75,580,000; in 1920 there were 869,000 valued at $47,370,000. Other figures are correspondingly higher for 1919. In 1920 there were 258,000 horses valued at $11,925,000; mules 4,000, valued at $360,000; and swine 63,000, valued at $1,159,000. Other agricultural products of Wyoming and their value in 1920 were as follows:—

Crop	Ac. sown	Production	Value
Hay, cultivated	740,000	1,850,000 tons	$22,200,000
Hay, wild, salt and prairie	360,000	360,000 tons	5,148,000
Oats	300,000	11,400,000 bus.	7,068,000
Wheat	254,000	5,080,000 bus.	6,858,000
Corn	65,000	1,560,000 bus.	874,000
Barley	28,000	1,008,000 bus.	1,109,000
Potatoes	27,000	3,375,000 bus.	4,050,000

The irrigated area was 1,133,302 ac. in 1909, 1,209,527 in 1919. In 1920 the acreage capable of irrigation was 1,799,361. There were, in 1918, 978,681 ac. of land used for dry farming.

Mining.—The annual gross value of Wyoming's mineral products at the places of production was estimated at $68,250,000 for 1920. In 1917 the state ranked ninth in the output of bituminous coal with 8,575,000 tons valued at $16,593,619; in 1918 it was 9,300,000 tons; in 1919 7,145,000 tons (the decrease being attributed to labour shortage). The largest product comes from Sweetwater, Lincoln and Sheridan counties. The total production of coal to the end of 1917 was 148,000,000 short tons. Copper mining has decreased, the annual production averaging in value about $200,000. The gypsum production in 1917 was 55,804 short tons valued at $197,867. The average output of iron ore was about 500,000 tons, worth $1,500,000 at the mines. A deposit of carnotite (uranium, radium), accidentally discovered near Lusk in Niobrara county, produced in 1919 71·86 tons valued at $382 per ton. Most important in the state's mining development is the petroleum industry. In 1918 the output was 12,596,287 bar., in 1919 13,580,000 bar., and the estimate for 1920 16,000,000 bar. of crude oil, valued at over $45,000,000 at the wells. There were 17 fields in the state where oil was produced for market. About one-half the state's output was from Salt Creek field in Natrona county. Converse county came next in 1919 with 3,267,302 bar., Hot Springs followed with 2,151,867 bar., and Park with 773,893 bar.

Manufactures and Railways.—Wyoming's manufactures continue to be of little relative importance, aside from the petroleum refining industry to which this great increase of 1919 is due. The following figures are from the census report:—

	1919	1909
Number of establishments	576	268
Persons engaged	8,095	3,393
Value of products	$81,445,394	$6,249,078
Value added by manufacture	39,194,866	3,640,889

Of the 8,095 persons engaged 3,057 were wage-earners in the steam railway construction and repair shops. Railway mileage in 1917 was 1,924 m. as compared with 1,623 in 1909.

Education.—The educational system was reorganized in 1919 by Act of the Legislature providing for an elective state superintendent of public instruction, a state Board of Education appointed by the state superintendent with the approval of the governor, and a commissioner of education appointed by the state Board with the approval of the governor.

History.—Wyoming in 1921 was still governed under its first constitution. The six amendments which had been adopted gave additional powers to the Legislature—notably for workmen's compensation measures, highway construction and protection of live stock from disease. An eight-hour day for underground work in mines was established in 1909. A direct primary law was passed in 1911, and a Mother's Pension Act in 1915, the latter to be administered by the county commissioners. A Public Service Commission was established in 1915, composed of members of the state Board of Equalization, with power to supervise and regulate any public utility doing business in the state. In 1919 a "blue sky" law was passed. In the same year the Executive Budget system was adopted. In 1921 a system of rural credits, to be managed by a Farm Loan Board, was provided for, and an Act passed allowing towns of 1,000 inhabitants or more to adopt the commission-manager form of government. By an Act of 1919 the commissioner of taxation was replaced by a state Board of Equalization with power to increase or decrease the assessed value of any class of property in any county. The law of 1909 limiting county taxes was replaced by the Act of 1911 grading the tax limit according to the assessed valuation of the county. A beginning was made in 1921 in the revision of the taxation system by provision for an effective inheritance tax. The bonded debt was reduced from $140,000 in 1910 to $99,000 in 1918, but in 1920 it was increased to $1,935,000, due to the issue of bonds for the construction of roads.

Wyoming has been normally a Republican state in politics, but Republican control was seriously threatened for some years, beginning with the Insurgent Republican movement of 1910. Joseph M. Carey headed that movement, and a combination of Insurgent Republicans and Democrats resulted in the election in 1910 of Carey as governor, and of a majority of Democratic state officials. But the Republicans retained their control of the state Legislature throughout the decade 1910–20, and controlled the judiciary until the Act of 1918 providing for election of judges on a non-partisan ticket. Frank W. Mondell (Rep.) was reëlected as the state's one representative in Congress in 1910 and in every succeeding election of the decade. Clarence D. Clark (Rep.) was reëlected to the U.S. Senate in 1910 and Francis E. Warren (Rep.) in 1912 and again in 1918. In 1914 John B. Kendrick (Dem.) was elected governor by a vote of 22,387 to 19,174 for his Republican competitor; in 1916 he was elected to the U.S. Senate over Clark (Rep.) by a vote of 26,324 to 23,258. In 1918, however, the Republicans won the elections by substantial majorities, and in 1920 they swept the state for both state and national tickets. The presidential vote in 1912 was 15,310 for Wilson, 14,560 for Taft, and 9,232 for Roosevelt; in 1916 it was 28,316 for Wilson and 21,698 for Hughes; in 1920 it was 35,091 for Harding and 17,429 for Cox.

During the World War Wyoming supplied to the U.S. army 11,393 men, to the navy 638, and to the marine corps 111. The subscriptions to the war loans, in each case exceeding the state's quota, were as follows: First Liberty Loan, $1,568,900; Second, $5,132,650; Third, $6,737,000; Fourth, $10,183,150; Victory Loan, $6,862,250.

The recent governors have been: Joseph M. Carey (Prog.), 1911–5; John B. Kendrick (Dem.), 1915–7; F. L. Houx (acting, Dem.), 1917–9; Robert D. Carey (Rep.), 1919– . (L. A. W.*)

YACHTING: *see* SPORTS AND GAMES.

YALE UNIVERSITY (*see* 28.899*).—In 1919 President A. T. Hadley announced his decision to resign the presidency of Yale at the close of the university year; and on June 22 1921 his successor, James Rowland Angell, was inaugurated. Developments in 1910–20 were marked in many respects. The university's endowment increased from $11,967,166.29 to $24,048,730.45. The university began to be the beneficiary under the will of the late John W. Sterling of New York City, a graduate of Yale College, of about $20,000,000, held by trustees for the university under his bequest. The money was to be used for memorial buildings and devoted "to some extent to the foundation of Scholarships, Fellowships or Lectureships, the endowment of new Professorships and the establishment of special funds for prizes." At the same time the university's property holdings were augmented, and several important buildings constructed, including the Osborn Memorial Laboratories, the Sloane Physics Laboratory, the Dunham Laboratory of Electrical Engineering, the Mason Laboratory of Mechanical Engineering, Sprague Memorial Hall (Music), the Brady Memorial Laboratory (Pathology), Artillery Hall and the Artillery Armoury, and the magnificent Memorial Quadrangle, the gift of Mrs. Stephen V. Harkness, of New York City. This quadrangle includes seven courtyards in collegiate Gothic, designed by James Gamble Rogers of New York City, and erected at a cost of several million dollars. It is recognized as one of the most perfect groups of modern Gothic buildings in the world.

The number of students in 1920 who were candidates for a degree was 3,214, practically the same as ten years earlier. Educationally the university underwent a thorough reorganization in its administrative and educational system to meet modern conditions. The medical school was allied to the New Haven hospital and placed on full-time basis; the law school introduced the requirement of a college degree for entrance, except for Academic Seniors; the undergraduates' courses in the Sheffield Scientific School were placed on a four-year basis; and the higher engineering degrees were transferred from the scientific school to the graduate school. Several new university officers were appointed, including a Provost, who represented the Faculties before the Corporation and assisted the President in the educational administration of the university; the Dean of Students, who was primarily concerned with student *moral;* and a Dean of Freshmen, who had under his jurisdiction all undergraduate freshmen. These were formed into what is called the Freshmen Year, at the close of which undergraduates pursued three years of study in the Sheffield Scientific School leading to the degree of Bachelor of Science, or three years of study in the college leading to the degree of Bachelor of Arts, or in the case of students without Latin, Bachelor of Philosophy. The admission of all students was centralized in a Board of Admissions, under a chairman appointed by the Yale Corporation.

In connexion with the literary activities of the university the Yale University Press was started in 1908, by Mr. George Parmly Day, the treasurer of the university, under an agreement with the university by which all books published and bearing the Yale name must receive approval in advance by the Yale University Council's Committee on Publications. The Press was affiliated with the Oxford University Press, and became an important publishing agency in America for works of a literary and scholarly character. The number of books published in 1919 was seventy-eight. The number of books sold was 184,145. The *Yale Review* was transformed in 1911 into a quarterly review under the editorship of Wilbur L. Cross, Dean of the Yale Graduate School, and it is recognized as one of the most representative organs of sober thought in America.

Eight thousand Yale men, including graduates, former students and students, entered the military and naval services of the United States during the World War. The university had the most important artillery school in the country outside of Fort Sill and Camp Zachary Taylor. It also had one of the largest naval training units, and was the centre of the scientific work of the chemical warfare service. It was also the seat of the leading army laboratory school. Two hundred and twenty-five Yale men lost their lives in the service of their country. A memorial has been dedicated in their honour. (A. P. S.)

YAMAGATA, ARITOMO, PRINCE (1838–1922), Japanese field-marshal (*see* 28.902), died in Odawara, Japan, Feb. 1 1922.

YANUSHKEVICH, NIKOLAI (1868–), Russian general, was born in 1868 and entered the army in 1888. He passed through the academy of the general staff, and was appointed on the general staff. By 1909 he had reached the rank of general, but all his service was spent in the offices of the War Ministry, out of contact with troops. Very strict as a bureaucrat, he earned the special favour of the War Minister, Sukhomlinov, and, though he was quite untrained in the leading of troops in modern warfare (at the academy of the general staff he had taken an administrative course), he was, thanks to his even temper and enterprise, quickly promoted to the higher posts. Just before the World War he was appointed head of the general staff. Unable to introduce improvements, he limited himself merely to formal direction, which toned in well with the régime which the careless War Minister, Sukhomlinov, had established. With the declaration of war Yanushkevich, as head of the general staff, became the head of the staff of the supreme commander-in-chief. But at the commencement of operations, feeling himself completely unprepared for leadership on active service, he withdrew and left the work in the hands of his subordinates.

YARMOUTH (GREAT YARMOUTH), Norfolk, England (*see* 28.905).—The pop. had increased from 55,905 in 1911 to 60,710 in 1921. A new art school was opened in July 1913, and the esplanade was extended northward by about ¼ m.; in 1921 a town-planning scheme of a very comprehensive nature was in course of preparation. Yarmouth was subjected to zeppelin and other aircraft raids on Jan 19 1915, April 24 1916, and Jan. 14 1918, and was bombarded from the sea on two occasions (Nov. 3 1914 and Jan. 26 1915); the material damage was slight.

YEATS, WILLIAM BUTLER (1865–), Irish author (*see* 28.909). In 1911, after the death of his friend J. M. Synge, Yeats wrote the essay *Synge and the Ireland of his Time.* His fervent Irish nationalism had been tried somewhat during his encounter with a section of the Irish public at the time of the *Playboy* disturbances in the Abbey theatre, and was further tried when the Dublin corporation refused a building for Sir Hugh Lane's collection of pictures. These affairs suggested to him a good deal of topical verse, especially in the most important of his later volumes, *Responsibilities* (Cuala Press, 1914). The volume includes the lines, familiar now in Ireland, "Romantic Ireland's dead and gone"; and as if to dwell a little longer in the Ireland of his earlier years, he wrote an account of these in *Reveries over Childhood and Youth* (1915). In his poetical work, from this period, he seemed to write with Synge's ideal of the poet in his mind, as one who "uses the whole of his personal life as his material." *The Wild Swans at Coole* (1917) marks the beginning of his preoccupation with the special doctrines expounded (1918) in *Per Amica Silentia Lunae*, a little prose treatise which the reader who wishes to understand Mr. Yeats' later work must study. Some of the poems in *Michael Robartes and the Dancer* (1920) are concerned with the events of 1916 in Ireland (the volume contains a sort of palinode to "Romantic Ireland's dead and gone"), but the author had become more and more a poet of esoteric doctrine. In literature and on the platform he had become a champion of belief in survival after death, a subject which interested him chiefly because of the possibility it offered of necromancy and "magic." "I have always," he says, "sought to bring my mind close to the mind of Indian and Japanese poets, old women in Connaught, mediums in Soho."

**** These figures indicate the volume and page number of the previous article.***

He was one of the first to welcome the English poems of Rabindranath Tagore, for whose *Gitanjali* he wrote an introduction. Another late influence with him was represented by the Noh-plays of Japan, and he wrote an essay on the subject which is included in the prose collection, *The Cutting of an Agate.* Under the Japanese influence he wrote his plays *At the Hawk's Well* (1917), and *Two Plays for Dancers* (1919). He married in 1917 Georgia Hyde Lees, by whom he had first a daughter and in 1921 a son.

An elaborate critical study of Mr. Yeats' poetry, by Forrest Reid, appeared in 1916; also, in the series "Irishmen of To-day," *W. B. Yeats: The Poet in Contemporary Ireland*, by J. M. Hone; there is a good account of Yeats' work in *Ireland's Literary Renascence*, by Ernest A. Boyd (1916).

YELLOW FEVER (*see* 28.910).—In 1918 the study of this disease was carried a stage forward by the discovery of Noguchi that the disease could be transmitted to guinea-pigs, and that the blood of these, examined by dark-ground illumination, contained numbers of a delicate Spirochæte which he called *Leptospira icteroides.* This organism is closely allied to the *Leptospira icteroidæ morrhagiæ*, the organism of infective jaundice.

It was found possible to cultivate the new organism under anærobic conditions without excessive oxygen supply in solid media containing blood serum. Different strains of the organism vary greatly in virulence. Some are so virulent that 0·0001 c.c of a culture is sufficient to induce fatal symptoms in a guinea-pig. The organism is killed within ten minutes at 55° C. and by desiccation or freezing. It is an extremely delicate filament, 4–9 μ in length by 0·2 μ in breadth. It breaks up into a number of refractile granules, and the virus can pass through Berkefeld filters V. & N. The organism is scanty in the blood of yellow fever patients.

Those early statements were confirmed by later work, and the chain of evidence in favour of this organism being the cause of Yellow Fever was well-nigh complete by the middle of 1921. Noguchi prepared a serum by infecting horses with his organism, and this exercised marked curative effects on guinea-pigs when administered within a short period of the time of infection. It was further found possible to infect a guinea-pig from a culture of the organism and then use a mosquito (*Stegomyia fasciata*) to carry the infection from this animal to another. The whole course of the disease could thus be reproduced by means of new organism. (R. M. Wi.)

YOSHIHITO (1879–), 122nd Emperor of Japan, third son of the Emperor Meiji (Mutsuhito), was born on Aug. 31 1879, at Tokyo. The Prince was physically somewhat weak during his early life and Marquis Tadayasu Nakayama and Marchioness Nakayama were appointed his guardians. On the eighth anniversary of his birthday the Prince was proclaimed heir apparent, the first and second sons of the Emperor Meiji having died in infancy. In Sept. 1887 the Prince commenced attending the Peers' school and on Nov. 3 1889 he was declared Imperial Crown Prince. In 1892 the Crown Prince was appointed to the rank of a first lieutenant in the imperial army, and two years later left the Peers' school to continue his studies at the palace under private tutors. In 1895 he was promoted to the rank of captain and in 1897 took his seat, in accordance with prescriptive right, in the House of Peers. In 1898 he was promoted to the rank of major of infantry and appointed a lieutenant-commander in the imperial navy.

On May 10 1900 the Crown Prince married Sadako, fourth daughter of the late Prince Michitaka Kujo, and on April 29 1901 a son, Hirohito, was born, followed by a second son, Prince Yasuhito, on June 25 1902, and a third, Prince Nobuhito, on Jan. 3 1905. In 1903 the Crown Prince was promoted colonel in the army and captain in the navy and in 1909 lieutenant-general and vice-admiral. On July 30 1912, at the moment of the demise of his father, the Crown Prince ascended the throne; but, owing to the national mourning, the formal ceremony of enthronement did not take place until Nov. 1914. In the following year a fourth son, Prince Takahito, was born on Dec. 2.

YOUNG MEN'S CHRISTIAN ASSOCIATION (*see* 28.940).—For several years before the World War the British Y.M.C.A. had been doing effective work in the summer camps of the Volunteers and Territorials. When the war started it had therefore the necessary experience, together with trained personnel and a programme adapted to meet the needs of men on active service. It entered the field at once, and within ten days of the outbreak of war had opened up 250 different centres for the recreation and welfare of the troops in all parts of the United Kingdom. The whole organization of the Y.M.C.A. was brought to bear on the national emergency, and the Red Triangle, unknown before the war, soon became as familiar as the Red Cross itself. It touched the men at every point and in almost every place. It became a habit—they found it in the training camps; the base camps overseas; the support trenches, and sometimes even in those in the front line. The Y.M.C.A. meant warmth, shelter, comfort and rest to the soldier on active service under Christian auspices. It was a counter-attraction to the "wet" canteen, and helped to keep the men from undesirable places in the towns and villages adjacent to the camps. It kept them in touch with home—more than a thousand million sheets of writing paper and envelopes being sent out from headquarters in London for free distribution at home and overseas. The steadying effect of the work on the *moral* of the men was universally admitted. Sports and competitive games were organized on a large scale by the Association at a time when the army authorities had no leisure to devote to looking after the recreation of the troops. Education classes and lectures were included in the programme, and the Y.M.C.A. was appointed agent for carrying out the army scheme of education on the lines of communication in France. From May 1918 till the end of the following year 70,067 separate students were enrolled in the educational classes, and over 670,000 attended the lectures on the lines of communications. Wimborne House, London, was loaned by Lord Wimborne as headquarters of the overseas library, and more than a million books and magazines were sent to the front. The total cost of the educational work, which was carried out under the direction of a special committee on which all the universities were represented, exceeded £140,000. More than 150,000 concerts by professional artists were given, and in every case admission was free.

The primary object of all the work of the Association was the building and safeguarding of character. Religious work amongst the troops was organized on an extensive scale. Testaments, Gospels and religious booklets were distributed in hundreds and thousands. Family prayers in the huts usually closed the proceedings for the day, and, wherever possible, a quiet room or chapel was included as part of the equipment. Many distinguished preachers and evangelists served with the Y.M.C.A. The huts and tents were placed at the disposal of the official chaplains—Protestant and Catholic alike—every Sunday morning, and similar facilities were extended to the Jewish chaplains.

Personnel.—Twelve members of the Y.M.C.A. won the Victoria Cross during the World War, and the names of 2,621 are inscribed on the Roll of Honour in the central building in Tottenham Court Road of those who were killed or died when on active service. For its war work the Association had to depend almost entirely on men over military age or disqualified for active service, together with clergy and ministers of all denominations, whilst for the first time in its history women took a considerable part in the executive work of the Association. At one time there were as many as 40,000 ladies working under the Red Triangle. A splendid lead was given by H.H. Princess Helena Victoria, ably assisted by some of the leading ladies of the United Kingdom.

The Navy and Mercantile Marine.—During the war men of the Royal Navy had comparatively little shore leave, but many large institutes were opened in the naval bases and extensively used. After the Armistice work was opened up for the men of the British fleet based on Copenhagen. Y.M.C.A. cabinets, each containing a small library, writing materials, games, a gramophone and records, were supplied gratis to 200 centres for the use of men serving on coastguard, wireless, hydrophone and war signal stations.

Munitions.—To meet an urgent national need the Munition Workers' Auxiliary Committee was formed in 1915, with H.H. Princess Helena Victoria as president and Lord Derby as chairman. Two hundred canteens were opened before the end of 1918 in shell factories and other munition centres. Fifteen large hostels were established and more than 50 million meals supplied at cost price. Seven thousand voluntary women workers assisted. Lectures and concerts were given.

Prisoners of War.—In 1915 welfare work was initiated in the German prisoner-of-war camps at home by the late Mr. F. L. Porter, of the English National Council, but ultimately it was handed over to the American Y.M.C.A., and under their aegis extended to most of the European countries. In the British internment camps in Switzerland centres were opened at Murren, Leysin, Seeburg, Interlaken and Geneva, whilst in Holland the Association operated at Groningen, The Hague, Scheveningen, Rotterdam, etc.

Officers.—A similar work for officers to that carried on for the ordinary soldier was developed on the same lines, though on a smaller scale. The late Lord Brassey lent his mansion in Park Lane as a Y.M.C.A. club for overseas officers, and hostels were opened in London and the provinces, and also overseas.

Y.M.C.A. Work in London.—Tottenham Court Road, the White City and the Crystal Palace were amongst the biggest centres of Y.M.C.A. activity in London during the war. Ciro's was a popular mixed club. £250,000 was spent on erecting and equipping hostels for troops passing through the City, and from Dec. 1 1918 to Aug. 13 1919 1,359,494 service men slept in the Y.M.C.A. hostels in the metropolis, and 1,068,913 in those in the provinces. The grand total from Jan. 1916 to Nov. 1919 was 5,478,774. Primarily for the benefit of overseas troops, enquiry kiosks were opened up by the Y.M.C.A. International Hospitality League in Trafalgar and Leicester Squares, Charing Cross, Victoria and Euston stations, the Strand, and in Parliament Square. From Jan. 1918 to April 1921 826,338 men were dealt with by Y.M.C.A. street patrols; 1,195,496 were welcomed in the social rooms; 55,008 provided with free hospitality and entertainment in private homes; thousands of men were taken from the streets and assisted to their quarters; 301,548 were kept from the temptations of the streets by free entertainments in theatres and other places of amusement; 170,637 were piloted round historic London by honorary guides, whilst no fewer than 2,197,840 enquiries were actually registered at the enquiry bureaux.

Motor Transport.—969,970 service men on leave were conveyed free of any expense from station to station and from hut to hut by the Y.M.C.A. volunteer night motor transport during the war, and 254,000 after the Armistice. These figures apply to London alone, but similar service was rendered in many other parts of the country.

On the Western Front.—The Y.M.C.A. started work for the men of the B.E.F. in France in Nov. 1914. Centres were opened in all the bases, and, later, the Red Triangle appeared on ruined buildings, cellars and dug-outs up the line. In the great German advance in the spring of 1918 no fewer than 198 Y.M.C.A. centres were destroyed, involving a loss of £158,000. At the time of the Armistice there were more than 1,700 workers in France. Specialized work was carried out for Chinese coolies in 124 huts, and many centres were devoted to the use of the Indian troops and others opened for the Portuguese. 69,300 service men on leave stayed in the three Y.M.C.A. hostels in Paris. Seventy-seven Y.M.C.A. cinemas in France were attended by 35,000 men nightly. Y.M.C.A. service to the walking wounded and to the relatives of the dangerously wounded was given free of charge, and after the war many of the huts were retained as hostels for relatives visiting graves, and others for men working in the devastated areas.

In Italy 82 centres were operated by the Y.M.C.A.

Y.M.C.A. Work in the East.—There were 10 Y.M.C.A.'s in Malta, serving especially the hospitals and convalescent camps, and one in Gibraltar.

The Indian National Council did effective war work in Egypt and Palestine, France, England, Mesopotamia, and also in East Africa, where there were 51 war Y.M.C.A.'s, 32 being for British troops, 6 for Indians and 13 for Africans. In India there were 115 war Y.M.C.A.'s, 74 for British and 41 for Indian troops, and altogether 412 full-time salaried officers were employed. In Mesopotamia 102 centres were operated by 100 secretaries. The Y.M.C.A. had two steam launches on the Tigris. In Egypt there were 15 centres in and around Cairo, where the *bourse* was acquired as a hostel for troops, and the Esbekia gardens as a recreation centre. The Y.M.C.A. penetrated south as far as Khartoum and Port Sudan, and was established in 35 centres in the canal zone, 6 in Alexandria, and others in Cyprus, Beirut, Suez, Port Said and Aden. In Gallipoli work was opened up in Anzac Bay and at Cape Hellas. Thirty-five centres were opened in the base camps in Palestine and 25 actually in the front line, with extensions as far as Damascus and Aleppo. There were 65 on the Salonika front, and others in the islands of the Aegean and Adriatic. In 1915 a relief ship, the s.s. "Nero," was despatched with comforts and delicacies for the men serving in the Dardanelles.

Russia.—The main operations of the Association commenced in July 1918, and continued until the evacuation of the North Russian Expeditionary Force. In the Archangel district 35 centres were opened and 4 railway coaches were equipped as mobile Y.M.C.A.'s. In the Murmansk district there were 21 centres.

The Armistice.—With the close of hostilities a much wider field had to be covered; the men were more scattered, and transport—never easy—became increasingly difficult day by day. With the Armistice there came a constant flow of repatriated prisoners of war across the frontiers, whose first contact was with the Y.M.C.A. The men were practically starving, and more than 7,000 were fed in Brussels alone, whilst large numbers were dealt with at Mons, Rotterdam, Aachen, Antwerp, Valenciennes, Vermelles, Nancy, Metz, Amiens, Lille and other centres. At all of these places, as well as at Cannon Street station in London, refreshments were given free at a cost to the Association of £50,000.

The Y.M.C.A. accompanied the British troops to Germany, and 5 big centres were opened up in Cologne, 3 at Düren, 79 for the use of corps troops, 6 on the lines of communication, and 8 on the Rhine demobilization boats.

Operations were on a big scale in Belgium, where a very strong Belgium Y.M.C.A. developed. Five thousand meals were served daily at the central Y.M.C.A. in Brussels, where there was sleeping accommodation for 1,600 men. The Hotel Weber was the largest Y.M.C.A. in Antwerp. Big centres were opened in Namur, Bruges, Ghent, Mons, Tournai, Roubaix, Aachen, Liége, Ostend, Zeebrugge, Spa, Beverloo and other places.

In Constantinople there was a large central Y.M.C.A. and tea gardens overlooking the Golden Horn, whilst several other branches were opened in the vicinity. In the Dardanelles centres were opened at Chanak, and Kum Kale. In the Caucasus there were centres at Batum, Tiflis and Baku. In southern Russia at Taganrog, Novorossisk and Ekaterinodar. There were eight posts on the Vardar and Doiran fronts. A mobile railway Y.M.C.A. ran between Salonika and Constantinople. There were three Y.M.C.A.'s on the Danube, and seven along the Anatolian railway.

In Serbia centres were opened at Monastir, Uskub, Velles, Nish, Belgrade and Mitrovitsa.

Work for Ex-soldiers.—During the closing stages of the war a Y.M.C.A. labour exchange was opened in London. Within two and a half years 29,000 ex-service men had been placed in situations, and more than 19,200 enquiries registered regarding pensions, allowances and other matters of vital interest to the ex-soldier. Seven large hostels and many huts were set aside for the use of demobilized men in London, and others in the provinces. Training schemes were carried out at Kinson (Dorset), Woldingham and in London.

Finance.—The total net cost of the work in all the war areas (excluding goods purchased for sale) was £8,189,406. This cost was met as follows: gifts from the public, £2,848,374; grants from American, Canadian and Australian Y.M.C.A.'s, £448,082; *gross* "profits" on sale of refreshments, £3,625,522; receipts from beds, baths and billiards, £369,756; proceeds of sales of properties and equipment, £212,574; sundry other receipts, £78,321; payment by War Office in respect of services rendered, £610,500. That left the Association with a surplus in hand of £3,723 with which to begin its extensive and costly after-war work for the troops.

It is interesting to note that out of every £1 spent on the war work of the Y.M.C.A. 6s. 11d. came from the public; 1s. 1d. from the American and Dominion Y.M.C.A.'s; 9s. 9d. from *gross* "profits" on sale of refreshments and receipts from beds, baths and billiards; 9d. from the sale of properties and equipment and sundry sources; 1s. 6d. from the War Office.

It will thus be seen that there were no net profits from the war work whatever. Every penny of the *gross* "profits" on sales of refreshments, etc., was spent upon the work, and the Y.M.C.A. had every reason to be proud of its business record in this matter. The prices to be charged were fixed by the military authorities, so that there was no question of profiteering. The Y.M.C.A. began without any intention of becoming a trading concern in any respect, but it was soon evident that by supplying cheap refreshments it had its biggest opportunity. The scope of the work was enormous; the total sales amounted to £17,387,804, and the percentage of *gross* "profits" was 20·8. The great bulk of the turnover consisted of the sale of penny cups of tea, penny buns, etc. No less a sum than £991,216 was returned to the troops in the form of direct gifts, including free stationery, games and sports, concerts and lectures, hot cocoa and refreshments given free at night in danger areas; to the walking wounded; to returning prisoners of war, and in hospitality to the relatives of the wounded. (A. K. Y.)

UNITED STATES

The activities of the American Y.M.C.A. in connexion with the World War were so extensive and novel in character that its normal routine of work was eclipsed. But the usual educational and physical work continued through the decade 1910–20 and the Association experienced a healthy growth. In 1910 there were in the United States and Canada 2,017 associations with 496,591 members, of whom 91,756 were boys; the total operating expenditures were $7,809,625, and the total net property and funds $60,377,122. In 1920 there were 2,194 associations with 868,892 members, of whom 199,615 were boys; the total operating expenditures were $38,484,800, and the total net property and funds $128,019,000. In the summer of 1916 when the National Guard was sent to the Mexican border, the Y.M.C.A. followed and afforded help and means of recreation for some 150,000 troops. For this purpose over $300,000 was raised during its eight months' service there, and 42 buildings and 6 tents were provided as social centres. The estimated attendance at entertainments during that period was 2,851,316, and free stationery for over 5,000,000 letters was furnished.

The Y.M.C.A. began its work in Europe immediately after the outbreak of the World War in 1914. It helped the French and British troops in Europe and the Near East and the Russians. Arrangements were made with the belligerents, both Allied and Teutonic, for assisting prisoners of war. Huts were erected in the various prison camps, secretaries detailed, and recreation provided for large groups of restless men. In conjunction with the Red Cross, kitchens were built and attendance provided for the sick. During the first 17 months of the war $300,000 was raised in America by the Y.M.C.A. for this work. Before America entered the World War in 1917 the Association had expended in Europe more than $1,500,000. Immediately after the breaking of relations between the United States and Germany the Y.M.C.A. offered its services to the U.S. Government and the offer was accepted. A week later the War Work Council of the Association was organized, and to it was given the task of adapting the usual Association programme of recreation, education, and religious work to the needs of the national army. This Council was composed of some 200 well-known business and professional men, with some members of the Association. Considerable experience in work with soldiers had already been gained by the Association, as noted above. Its activities had made the organization known to military authorities in all countries, and had given it a body of men trained for the new task.

The local Associations in the United States at once opened their buildings and offered their advantages to all men in the U.S. service, an arrangement that continued till three months after demobilization. The raising of funds was put in charge of men prominent in their communities. The first drive was made during one week in April and May, and the second in Nov., the two raising over $58,000,000. The final drive was that of the United War Work Campaign the Association's share of which was $100,760,000. Committees, corresponding to the military departments into which the United States were divided, were formed to secure men and women for the work at home and abroad, the headquarters at New York having special oversight of those going overseas. When the nature of the overseas work and the need of large numbers of secretaries became clear, each candidate was required to take a week's course of preparation, that for the women being held at Barnard, that for the men first at Princeton and later at Columbia University.

Within a month after the declaration of war huts were equipped in the permanent camps already opened in the United States. During the two years following 1,200 of these stations were carried on for the men in training; 952 of them were huts built by the Association, most of them being ready on the arrival of the men. Huts were opened also in the munition and shipbuilding and other government plants, as well as in the internment camps, and work was continued with the troops on the Mexican border, at Panama and in the Philippines. Workers were on more than 5,000 troop trains, and also on the transports, where they showed motion pictures and supplied games, reading matter and such small conveniences as the men lacked. Over 12,000 men and women were on the regular staff, carrying on the varied duties of the hut and transportation service, and besides these were hundreds who gave part time.

The type of building used in the home camps and overseas had been adopted by the Association during service on the Mexican border. It was a wide, low structure, of upright boarding, easily transported in sections. One large room served in the smaller camps as lounge, writing and reading room, library, gymnasium, theatre, church and restaurant, while in the larger camps smaller rooms opening from this main room separated the different activities. The plan of the Association was to provide the men with attractive meeting places, conveniences for letter writing, books, papers, athletics, entertainments, classes and religious services. Lecturers, musicians and actors were on circuit among the huts, and motion pictures, carefully selected by the Community Motion Picture Bureau, were given at most points twice a week.

The work for the American Expeditionary Force in Great Britain, France, Italy, and Siberia, although of shorter duration than that in the United States and reaching fewer men, attracted more attention both because it was carried on under greater difficulties and because it developed features entirely new to welfare work among soldiers and sailors. In Great Britain Eagle Hut in the Strand, London, was the first of the 1,500 "huts" or stations, ranging from hotels and large buildings at sources of supplies to dugouts in the Argonne, which within 14 months were established overseas. More than 8,000 Y.M.C.A. men and women worked overseas with the A.E.F. between July 1917 and Dec. 1919.

The acceptance by the Y.M.C.A. of the army post canteen service, at the request of Gen. Pershing, which set free for military duty many hundreds of officers and soldiers, added greatly to the task of the Association, and being a business foreign to its programme and new to its personnel was handled with much difficulty. In connexion with this work the Y.M.C.A. met with much criticism, some of it probably warranted, much of it hardly fair under the circumstances. Under Gen. Pershing's orders the Association was to obtain the goods, purchasing in the open market, and to sell at prices covering the cost and the transportation charges. The first cargo of supplies was torpedoed. As the sending over of troops increased it became more difficult to secure transportation for the Y.M.C.A. supplies. The Association was therefore early forced to open factories in France, 42 in all, and to manufacture for itself huge quantities of chocolate, cocoa, biscuit, candy and jam, just as it had to manufacture paper in Spain to supply its stationery. This meant high cost and therefore high prices for the commodities and a dissatisfaction among the men purchasing them. Initially the prices charged by the Y.M.C.A. were higher than those charged by the quartermaster's department of the army, and this led to a suspicion, unfounded though very prevalent, that the Y.M.C.A. was seeking to make a profit at the expense of the fighting men. Resentment on this score was increased because of the belief that the people of the United States had contributed huge sums to the Y.M.C.A. for the purpose of giving free supplies to the soldiers. But the Y.M.C.A. had expressly decided at the outset not to give away supplies except at the front lines, and it never solicited funds for this purpose. The prices charged in the canteens were later reduced, and for the most part goods were sold at a loss. At the request of the Association the canteen service was taken back by the army after the Armistice, when officers and men could be spared for this work. Had not the Governments of the United States and France decided to remit transportation charges to all the welfare organizations, the Association would have lost about $1,500,000 on its post canteen service. With the remission of these charges, however, it found itself with a balance of $500,000, which was handed over to the American Legion.

Secretaries were attached to each division of the A.E.F., but whether they should go forward with the troops, or how many should go, was decided by the individual commander. The work at the front consisted of the free distribution of cigarettes and whatever other supplies could be brought up, the serving of hot chocolate to the passing troops and work in the field hospitals and dressing stations, the front being the one place where the Association was allowed to work for the wounded. Over 700 Y.M.C.A. men and women were under fire, at Soissons, at Château-Thierry, in the St. Mihiel drive, and in the battle of the Argonne. Fourteen lost their lives and 133 were wounded or gassed in the battle zone, while 67 died from accidents or other causes. The Croix de Guerre was awarded to 41 and the Distinguished Service Cross to four. The entire personnel attached to 12 of the divisions was officially commended for front line service. Two hundred and fifty secretaries, both men and women, were either decorated or received special mention for their services.

Religious work, always a part of the Association programme, continued overseas as in the home camps. The huts were open for services of all faiths. There was always one service on Sunday, sometimes two, and sometimes another during the week. In many of the leave areas there were services daily. Most huts also had classes for Bible study. A special collection of hymns was prepared for use in the huts; much religious literature and many Testaments and portions of the Bible were distributed. A number of well-known clergymen, who had proved their strength with soldier audiences, made a circuit of the army, song leaders often going with them. Direct effort in the line of social purity was made by the Association, both in its practical work with the Hospitality League, on the streets of Liverpool, London and Paris, and in lectures in the huts by men specially fitted for this work.

The entertainment work in England and on the continent began in the fall of 1917 with a few musicians and speakers. Under E. H. Sothern and Winthrop Ames the Over There Theatre League was formed, and under its care singers, actors, magicians, professional entertainers of all sorts, were enlisted for the entertainment of soldiers both in the United States and overseas. The Entertainment Department of the Association and the League together recruited over 1,400 entertainers, many of whom, after the Armistice, became trainers of the 15,000 soldier actors and musicians who made up the soldier shows of the A.E.F. For this department the Association provided instruments, music, costumes, and finally really entered the dramatic profession as owner of four "play factories," which were the centres of training and equipment for the soldier shows. Motion pictures were supplied regularly to all the huts, and were often given in the French village streets where there was no adequate building, and on the roadside, as with the troops on the march into Germany. Films were supplied to U.S. troops in Great Britain, Italy, and Siberia, to the French *foyers* and the Italian *case*, to the Chinese labour battalions, the Portuguese and Russian troops in France, and the prisoners of war. Besides this the Association furnished films to all the other American welfare organizations overseas.

The question of what to do with the American soldiers on leave began to concern both French officials and American officers almost before any men had reached France. The Association proposed that it should take over certain regions, chosen by the French Government and run them as pleasure grounds for soldiers' holidays. The first opened was at Aix-les-Bains which was followed by 35 others the largest being those on the Riviera. Here some of the most famous pleasure resorts of Europe were thrown open to the enlisted men. Many casinos became their clubs. Sight-seeing trips, dances, tournaments, concerts, plays, and motion pictures were provided, and more than a million men were given decent and wholesome enjoyment while on leave.

Though French classes and lectures were provided at the permanent camps by the Association little educational work was done before the Armistice. An educational plan for the whole army, however, was then ready. It included classes for all grades from illiterates to university students, and made use of teachers found in the ranks as well as those brought from the United States for the purpose. It also included privileges at French and English universities. In March 1919 the entire educational work was turned over to the Army Educational Commission. Though demobilization went on too rapidly to permit a full test of this work, it showed itself to be so practical and valuable that it was adopted as a regular part of the U.S. army system.

A special feature of the Association work overseas taken over by the U.S. army was the use of women as welfare workers in the camps. Women were accepted in order to save men for military service, but their duties were supposed to be confined to preparing and serving food. Distinctions of sex in service, however, disappeared under the pressure of work, and women managed *cafeterias* or concerts, religious meetings or "hikes," led dances or maintained "mother's corners," were decorators or scrubbers, as need arose. So evident was the acceptability of service by women that not only have women been included among the welfare workers under the U.S. War Department, but the Associations in the armies of Greece and Poland and the French *foyers* include them in their personnel.

The Soldier's Remittance Bureau was established to meet the difficulty the soldiers had in reaching the army post offices. By this plan any secretary, anywhere, could send a soldier's money home for him free of charge. Money was thus taken not only at the sources of supply but at the front, where days might pass before it could be handed in at the local headquarters, and many more pass before it could reach Paris, by the usual channels. These remittances numbered 351,468, and were sent to destinations in many countries. Only 92 remained undelivered by reason of wrong address or the disappearance of the payees. The soldiers sent home in this way, free of charge, $1,558,339, the average length of time from acceptance to delivery being 62 days.

The favourite athletic recreations of the A.E.F. were informal baseball and group games until after the fighting was over. The Association's part in such activities before the Armistice was mainly in supplying equipment. But before Nov. 11 1918 the physical directors of the Association had proposed an inter-allied meet to celebrate victory. This plan was laid before the commander-in-chief, and, shortly after the close of hostilities, was approved and a committee appointed consisting of two officers and two Association men. The invitations to the Allies were sent out by Gen. Pershing, and the training of teams throughout all the armies went on during the winter of 1918–9. In the meantime a large stadium was building near Paris, the labour being given by the army, the land by the French, and the plans and the material supplied by the Association. For a fortnight in June and July 1919 1,500 contestants competed, representing 18 countries, all fellow soldiers in the World War.

As the result of an increasing volume of criticism, much of which, as already noted, was concerned with the conduct of the canteen service, the Y.M.C.A. in Dec. 1918 invited a committee composed of George W. Perkins, Mortimer L. Schiff and F. S. Brockman, none of whom had been connected with the Y.M.C.A. before the war, to go to France and make an investigation. Subsequently the War Department also undertook an inquiry. In the meantime the attitude of returning soldiers made it evident to the people of America that in France, at least, the Y.M.C.A. was held in less regard by the A.E.F. than certain other welfare organizations. Apart from the canteen question, soldier opinion seemed to point first to an unfortunate selection of some of the Y.M.C.A. personnel, and second to a well-meaning but sometimes officious effort to promote the moral and religious welfare of the A.E.F. It is clear that the validity of such criticisms will depend somewhat on the point of view. In his report on the work of the Y.M.C.A. Mr. Perkins, as chairman, said that in civilian life an organization that is 90% efficient is regarded as satisfactory. "If 10% of the 11,229 people operating in France for the Y.M.C.A. were inefficient," he continued, "it would mean that there were 1,122 men and women who were more or less of a failure. I do not believe anything like this number of people were unsuccessful." While Mr. Perkins found a number of instances of mistakes and bad judgment in the conduct of the Y.M.C.A. work, his general conclusion was that the organization deserved high praise for the manner in which it had accomplished a difficult task. A similar conclusion was reached by the War Department, and on several occasions Gen. Pershing expressed the opinion that the Y.M.C.A. had been unjustly blamed for circumstances over which it had no control.

Although with the return to the United States of the Expeditionary Forces the welfare work for the army and navy was taken over by the War and Navy Departments, at the request of the officers the Association was retained for service with the Army of Occupation in Germany. This work continued with a personnel of about 120, half being women. Huts were continued also for the navy and for the merchant marine in various foreign ports. Another outgrowth of the war work was the Soldier Scholarships. Under grants from the Association some 55,000 ex-service men continued their studies, in colleges, technical schools, or correspondence courses.

Service to prisoners continued throughout the war, and as late as 1921, when there were still Russian prisoners in Germany and Poland. Y.M.C.A. secretaries were with the Czechoslovak troops during their journey across Russia after their internment in Siberia. Association workers also met the thousands of German, Austrian and Hungarian prisoners when they at last reached eastern Siberia; and secretaries either went with them on the transports that finally bore them to their homes, or supplied motion picture outfits, paper, books and comforts for the men's use during the long voyage.

Perhaps the best comment on the war work of the Association is found in the requests from certain of the Allied Governments, whose officers saw the work in France, for its introduction into their armies. In answer to such demands the Association was organized in the armies of Poland, Czechoslovakia, Rumania, Greece and Portugal, and American workers remained with the *foyers* in France.

See also Katherine Mayo, *That Damned Y.* (1920). (V. L. K.)

YPRES (*see* 28.941).—Pop. (1914) 17,497. The town, though never taken by the Germans, was systematically bombarded from Nov. 1914 to May 1915, and it remained a "salient" of the Allied armies throughout the World War. The terrific attacks to which the town was exposed during the war resulted in its almost entire obliteration. The famous Cloth Hall became a scarcely recognizable ruin; of the cathedral of St. Martin, only part of the eastern doorway remained intact, and most of the works of art in the church were destroyed.

YPRES AND THE YSER, BATTLES OF.—Under this heading, accounts are given of the main battles in this area of the Western Front: those of 1914, 1915, 1917 and 1918.

I.—BATTLES OF OCT. 12–NOV. 20 1914

General Situation.—The Belgian army, after its unsuccessful defence of Antwerp, had retired by way of Ghent and Bruges to the line of the Yser, between Dixmude and the sea, where it had established itself by Oct. 12. It consisted of six infantry and two cavalry divisions, in all about 48,000 rifles, with 300 guns; the 2nd, 1st and 4th Divs. in that order from the N. held the front from the coast as far as Dixmude, with two brigades of the 3rd Div. and the 2nd Cav. Div. in reserve behind. A brigade of the 3rd Div., a French Fusilier Marine Brigade, which had been sent up to the N. to assist the Belgian army, and the 5th Div. continued the line from Dixmude to Boesinghe, while the 1st Cav. Div. screened the whole front of the army. Farther to the S. the 87th and 89th French Territorial Divs. were coming into line E. of Ypres, on the left of the British IV. Corps (7th Div. and 3rd Cav. Div.) which was falling back from Ghent, where it had been posted to cover the right flank of the retiring Belgian army, by way of Thielt and Roulers to the S. and E. of Ypres.

To the right rear of the IV. Corps the remainder of the British army was advancing. The II. Corps, detrained at Abbeville, had pushed forward to the line of the Aire–Béthune canal, and was on the 12th advancing further to the line Givenchy–Merville, meeting with stubborn resistance from the German XIII. Corps. To the left front of the II. Corps the French I. and II. Cav. Corps and the British Cav. Corps were driving before them the German IV. Cav. Corps and had reached the area of Vermelles, and Estaires to the S. of the Lys and Merville, Merris, and Cassel to the N. of that river. Behind the British cavalry the III. Corps, detrained at St. Omer, had reached the region of Hazebrouck. The I. Corps was not yet up from the Aisne; in fact its leading units were only entraining on this day and its transport to Flanders was not to be completed till the 19th.

In face of these forces the right wing of the German VI. Army, under Prince Rupprecht of Bavaria, consisting of the XIII. and XIX. Corps, and covered on front and flank by the I., II. and IV. Cav. Corps, were moving into position on both sides of Lille, extending as far N. as the Lys, and beyond. To the N. of this army a new one was moving forward with the object of forcing back the Allied left and securing possession of the Channel ports. This Army, the IV., under the command of Duke Albrecht of Württemberg, consisted of the newly formed XXII., XXIII., XXVI. and XXVII. Reserve Corps together with the III. Reserve Corps, from Antwerp, and the 4th Ersatz Div. These new corps were detraining S. of Brussels on the 12th, covered by the III. Reserve Corps and the 4th Ersatz Div.

The Allied Plan.—On Oct. 4, when it became clear that the forthcoming operations in Artois and Flanders would of necessity be carried out not only by French but also by British and Belgian forces, Joffre had entrusted Foch with the coördination of the Allied contingents in the N. The French X. Army (Maud'huy), around Arras, thus came under Foch's command and formed his right wing, while to reinforce the British in the centre and the Belgians on the left, there was formed an "Army Detachment of Belgium" under d'Urbal, shortly to become the VIII. Army. The instructions given to d'Urbal were that he should assume the offensive as soon as possible from his detraining points in the general direction Roulers–Thorout–Ghistelles, while the British on his right advanced on Courtrai and Menin, and the Belgians on his left along the coast. It was hoped by these means to separate the enemy forces, which were following up the Belgians retiring from Antwerp, from the main body of the German army, and hem them in along the coast, and then to push forward against the right flank and rear of the German VI. Army S. of Lille.

Unfortunately it was found impossible in the event to carry out this far-reaching scheme. Not only was the Belgian army too weak and exhausted to be able to take part in an offensive without a breathing space for rest and refitment, but the first troops of the French VIII. Army only became available on Oct. 23; and by that time the situation had radically altered. It became evident that, so far from being in a position to drive back the enemy, the Allied forces were outnumbered and would do well if they could even hold their own. Consequently, although the idea of an Allied offensive was never entirely abandoned, the necessity for using the various formations as they arrived prevented it from being effectively put into execution.

The First Stages of the Battle of the Yser.—The detrainment of the German IV. Army was completed on the 13th, and its units, moving forward at once, had reached by the 17th the area Bruges–Thielt–E. of Courtrai. The III. Reserve Corps pushing eastward in front of the army, with its right along the coast and its left on Roulers, screened the advance of the newly arrived Reserve Corps. It was then ordered to clear the front by closing up on its right, which had on the 15th entered Ostend. On Oct. 16 it came into contact with the Belgian cavalry and forward posts E. of the Yser, and after two days of desultory fighting forced them to withdraw to their main position.

On the 18th the first encounters took place between the main bodies of the Belgian 2nd, 1st and 4th Divs., holding the Yser line from Dixmude to the sea, and the German III. Reserve Corps, which had been ordered to reach the neighbourhood of Furnes. The advancing Germans early came into contact with the Belgian outpost positions on the E. bank of the river on the line Lombartzyde–Mannekensveere–Schoor–Keyem. The northern part of this line held fast against repeated attacks but by nightfall the Germans had taken Schoor and Keyem; the latter however was recovered during the night. The attacks were renewed next day; the German XXII. Reserve Corps, coming into line to the S. of the III. Reserve, moved against the French and Belgian positions around Dixmude. Keyem and Beerst fell into its hands early in the day; Beerst was retaken about noon by the Belgian 5th Div. and the French Fusilier Marines, who were however forced to fall back in the evening to their former positions owing to the approach of further strong hostile forces (the XXIII. Reserve Corps) astride the railway from Thourout. On this flank the Allied units were now withdrawn behind the Yser, with the exception of the garrison of Dixmude. The preparatory fighting continued on the 20th on both flanks; the III. Reserve Corps, reinforced by the 4th Ersatz Div., attacked and carried Lombartzyde in the N. while to the S. a concentric attack of the XXII. and XXIII. Reserve Corps from three sides was repulsed with heavy loss by the Fusilier Marines holding Dixmude.

The German IV. Army was now completely deployed against the Yser line. The 4th Ersatz Div. in front of Nieuport, the III. Reserve Corps thence to Keyem, the XXII. Reserve Corps around Beerst and the XXIII. Reserve Corps E. and S.E. of Dixmude, in all seven divisions with over 400 guns, were aligned in face of the five Belgian divisions with their 350 guns. On the 21st, after a violent bombardment lasting throughout the night, the Germans advanced all along the line, their young troops fighting with the greatest courage but meeting with little success; and the French and Belgians, at the price of serious losses, held their ground at all points. In the night, however, the III. Reserve Corps succeeded in throwing a temporary bridge over the Yser, in the bend N. of Tervaete, and in passing over to the western bank infantry and machine-guns, while their artillery were brought close up to the stream to cover the advance of strong reinforcements. The 1st Belgian Div.'s counter-attacks failed to retrieve the situation; the Germans not only held their ground but extended it during the 23rd by seizing Tervaete itself to the S. The Belgian 3rd Div. was thrown into action from general reserve, without effecting more than the temporary checking of the hostile advance; during the day, the French 42nd Div., which had carried out a successful counter-attack on the 23rd to the E. of Nieuport, was placed at the disposal of the Belgian Higher Command and transferred near Tervaete, with the object of striking into the southern flank of the German troops who had crossed the Yser.

The French counter-offensive in the centre, supported as it was by all the available units of the Belgian 4th Div., though it failed to throw back over the river the two battalions of the III. Reserve Corps which held the Tervaete bridgehead, was successful in checking any further progress on their part. By the evening of the 24th indeed, both sides were showing signs of exhaustion. The efforts of the 4th Ersatz Div. before Nieuport and those of the XXII. Reserve Corps before Dixmude had met with no success; despite the powerful artillery fire from the heavy German artillery, which had reduced Dixmude to ruins, the Fusilier Marines still held the town, repulsing on the 24th 15 successive attacks. The Belgian army, however, had bought its success at the price of the severest losses; over 25% of its combatant strength had been placed *hors de combat*, and only 180 guns with only from 160 to 190 rounds apiece were left fit for service. The situation appeared to the Belgian Higher Command to demand extreme measures; it was doubtful if their troops could withstand another series of assaults such as those which had just been delivered, and on the 25th it was decided (it is said on the suggestion of Foch) to open the sluices of the Yser and inundate the country E. of the Nieuport–Dixmude railway. The sluices of Nieuport were opened at 4 P.M. on that day, under cover of darkness; the line of defence in the centre was withdrawn to the railway embankment, which it was intended to hold during the few days that must elapse before the slowly moving waters, fed by the successive tides, should engulf the country to the E. and form an impassable barrier.

Before recounting the last German assaults on the Yser front, we must return to the British sector, to the south.

First Stages of the Battle of Ypres.—The presence of the new German IV. Army in his front, and in particular the approach of the fresh Reserve Corps toward the gap at present open between himself and the Belgians, was at this date (the 15th) unsuspected by Field-Marshal Sir John French, whose attention and energies were concentrated on the offensive which he had arranged to carry out in conjunction with the Allied forces to his right and left in the direction of Courtrai and Menin. His instructions to his corps commanders were that the advance should be continued during the next few days on the whole front, the II. Corps on the right advancing due E., the III. Corps in touch with it securing the Lys crossings from Sailly to Armentières, and the cavalry passing over the river at Menin and advancing N.E., while Rawlinson with the IV. Corps on the extreme left moved on and to the N. of Courtrai. The last-named was warned to watch his left, beyond which hostile detachments were reported near Bruges and Roulers.

These operations, undertaken on the 15th and 16th, had hardly begun before it became evident that their continuance on the original lines was no longer warranted by the situation. The resistance met by the IV. Corps on the line Houthem–Gheluvelt–St. Julien–Westroosebeke convinced French that it was indispensable first to clear the hostile forces from the area N. of his left flank. Foch, however, on being asked to assist in this, could promise no more troops before the 22nd at the earliest, as his forces were still assembling. Accordingly, the IV. Corps was ordered to push on along to Menin on the 18th, the 3rd Cav. Div. screening its left, in conjunction with de Mitry's French Cav. Corps, which had come into line on the previous day W. of Houthulst forest. This task Rawlinson felt himself unable to carry out owing to the advance of strong hostile columns, consisting of the XXVI. and XXVII. Reserve Corps, against his left S. of Roulers, and by the evening of the 19th he had fallen back to the line Kruxiseik–Zonnebeke.

On the same day the concentration of the I. British Corps in the N. was completed in the area Poperinghe–St. Omer. French had now given up his ideas as to the possibilities of an Allied offensive and, realizing he was face to face with strong hostile forces which were being rapidly reinforced, began to fear for the weakness of his long and thinly held line, reserves for which were lacking. Although the II. and III. Corps were fighting against powerful positions and had been heavily taxed, French considered that the danger was greatest in the N., where the IV. Corps was holding altogether too extended a front, and that a break through there, while less fatal in its results than a similar disaster in the S., was inevitable unless reinforcements were sent at once. Accordingly the I. Corps was sent N. with orders to advance on Thourout with the object of capturing Bruges, if possible, before the enemy reinforcements, now believed to be in movement across Belgium, could be brought into line. French, however, was not too confident that this would prove feasible, and his instructions to Haig therefore envisaged not only the further prosecution of an eventual success toward Ghent, but also the possibility of the I. Corps having to go to the help of the IV., if the latter were heavily attacked.

Meanwhile the II. and III. Corps and the cavalry were ordered to confine themselves to the defensive, in view of the hostile superiority in their front.

The I. Corps only came into line to the S. of the IV. Corps on the 21st and by that date the advance of this latter toward Menin had, as we have related, come to an end; the 3rd Cav. Div. and de Mitry's horsemen to the N. had also been forced back, while the British Cav. Corps had retired to the Messines–Wytschaete line. To the S. Conneau's French cavalry were in line between the British II. and III. Corps.

It was only on Oct. 21 that the full extent of the menace to the British front burst on French, to use his own words, "like a veritable bolt from the blue." He at once realized that, in face of this overwhelming hostile superiority, all hope of a successful British offensive must be given up and indeed that he might have serious difficulty in maintaining his present positions. The British situation was certainly no easy one, for at the moment all available troops were in line, and the only reserves and reinforcements that seemed likely to be available for some weeks consisted of the Indian Corps, one division of which had just detrained W. of Hazebrouck, two Territorial battalions, and one cavalry and two yeomanry regiments.

Fortunately, French reserves were being hurried up from the S. The first of them, the IX. Corps, began to detrain in the Ypres area on the 23rd. During these three days from the 21st to the 23rd, when the British army was left to itself to withstand the shock of the enemy, it succeeded in holding its own without great difficulty. By the evening of the 21st the I. Corps had even commenced an advance, but the withdrawal of the French cavalry and Territorials on its left, which had been forced back by the advance-guard of the XXIII. Reserve Corps, compelled Haig to halt on the line Bixschoote–Langemarck–Zonnebeke. Here he held his ground against repeated attacks that night and all next day despite the wideness of his front; and, though the positions of the 1st Div. were broken into N.W. of Langemarck late on the 22nd, counter-attacks held up the German advance and finally on the 23rd recovered practically all the lost ground. Meanwhile the rest of the 1st Div. line held its positions against the attacks of the XXIII. Reserve Corps until the evening of the 23rd, when the 2nd Div. was relieved by the newly arrived troops of the French IX. Corps; 24 hours later the 1st Div.'s place was taken by French territorials.

The 7th Div. on the front Zandvoorde–Zonnebeke had also had heavy fighting to do from the 20th onward. The German XXVI. and XXVII. Corps, despite some success against the French on Rawlinson's left, which compelled him to retire that flank somewhat, were unable to make any impression on his front until the 24th, when units of the XXVII. Reserve Corps forced their way into Polygon wood and had to be ejected by the reserves of the 7th, assisted by units of the 2nd Division.

By this time the French Command considered that the time had come to undertake a general offensive. The French IX. Corps had just come into line and the XVI. Corps was on its way northwards. The British 2nd Div. was also available and was ordered to coöperate, as were also de Mitry's cavalry from Bixschoote and the French 42nd Div. along the coast from Nieuport. As a matter of fact the moment chosen was favourable from factors which the Allied leaders could not be aware of. The Germans were suffering from a local shortage of munitions; their new troops had suffered heavily, thanks to their enthusiasm untempered by training and experience and had everywhere been brought to a halt before the Allied lines. But the odds against the attack proved too great. The French IX. Corps and the 2nd Div. to its right made little progress on the 24th, despite their valiant efforts, and the offensive gradually petered out, not without taking heavy toll of the Germans, on the line N. and E. of Langemarck–W. of Poelkapelle, Passchendaele, and Moorslede. The 7th Div. on its front had only been able to hold its ground, and, in view of its weakness after three weeks of incessant marching and fighting, was on the 27th put under the I. Corps, together with the 3rd Cav. Div.; at the same time Haig's two other divisions were again put into line. The right of the 7th was now at Zandvoorde, that of the 1st on the Menin road, that of the 2nd just in Polygon wood.

To the S. of the I. Corps the 2nd Cav. Div. on the 20th held the front from Hollebeke to Messines; the 1st Cav. Div. extending thence to St. Yves; the 3rd Cav. Div. came into line later on the left of the 2nd and three Indian battalions were moved to Wulverghem in support. This part of the front, despite repeated attacks by the German XIX. Corps, remained intact till the 30th. On the right of the cavalry the II. and III. Corps also succeeded in maintaining their general line.

By the evening of the 27th the German IV. Army had been brought to a standstill on the whole front. "The XXVI. and XXVII. Reserve Corps were by this time" (Oct. 24), says the German official account, "completely held up in front of strongly entrenched positions on line Langemarck–Zonnebeke–Gheluvelt. . . . For the time being any further thought of a break-through was out of the question," and the decision which appeared at the moment to be "imminent" on the Belgian front near the coast had not yet been achieved. To assist the efforts of their comrades in this sector, and to cover the bringing up of further reinforcements to drive home the attack against the British line, the XXIII., XXVI. and XXVII. Reserve Corps were urged on to deliver holding attacks on their front. Despite their courage and persistence, the Germans, however, not only failed to make headway but were compelled in places to give back before the Allied counter blows; their only gain was registered at Kruiseik, which was wrested from the 7th Div. on the 28th after to and fro fighting. To the S. also the enemy pressed heavily against the front held by the British II. and III. Corps, assisted from the 23rd onward by a brigade of the Lahore Div. which relieved Conneau's Cav. Here the XIX. and VII. Corps made some headway and by the 29th had pressed the British front back to the line Givenchy–W. of Neuve Chapelle–S.E. of Armentières–Messines, where the Cavalry

Corps' right rested. The fighting was bitter and bloody, so much so that on the 28th the II. Corps, much reduced, had to be relieved by the Indian Corps, under Willcocks.

Meanwhile the French XVI. Corps, which had detrained its leading division on the 26th, was sent forward to reinforce the French IX. Corps S. of Houthulst forest, in order to participate in a new advance in the direction of Roulers. This attack, carried out on the 28th, failed to make much progress, and in the evening the French VIII. Army's line, which was held from N. to S. by the 4th Cav. Div., the 89th and 87th Territorial Divs., the 5th and 7th Cav. Divs., the 31st Div. (XVI. Corps), the IX. Corps, and the 6th Cav. Div., ran from the Yser just above Dixmude by the W. and S. edges of Houthulst forest—W. of Poelkapelle and Passchendaele—to Becelaere. To the left this line connected with the French Marine Fusiliers at Dixmude; to the right with the British I. Corps. Despite the slight progress made on the 28th, d'Urbal's orders were still for the continuance of the offensive.

Final Stages of the Battle on the Yser, Oct. 26–Nov. 4.—We left the Belgians and French on the evening of the 25th, re-forming their lines behind the embankment of the Nieuport–Dixmude railway, with orders to hold that line at all costs until the full effect of the inundation should make itself felt, and forbid any further German attacks. This could hardly be before the 31st, and meanwhile the III. and XXII. Reserve Corps were bringing up their artillery over the river, pushing forward patrols to occupy the ground up to the new Allied position, and making all preparations for a renewal of the attack. By the evening of the 29th these preparations were completed. Only one brigade of the 4th Ersatz Div. was left facing Nieuport, the Marine Div. being brought forward to fill its place; the rest of the Ersatz Div. thus became available for the decisive attack against the Belgian centre. At 6:30 A.M. on the 30th this assault took place under cover of a violent bombardment. The first rush carried the Germans up to within a few yards of the railway embankment; bombing their way forward they swept over it and, taking the defenders in enfilade, drove a wide gap in the Allied line from Ramscapelle to Pervyse, both of these villages falling into their hands. The Belgian 2nd Div. was broken through and the situation was critical in the extreme. A counter-attack by four French and Belgian battalions was immediately put in by Gen. Grosetti, commanding the French 42nd Div., and succeeded in holding up the enemy flood. A second counter-attack, delivered about 4 P.M., penetrated into Ramscapelle, where fighting continued to rage furiously all night. On the flanks of the attack the Allied line of defence had held fast, and the 4th Ersatz Div. and the XXII. Reserve Corps had been held up.

The crisis was past. The German intention was to renew the attack on the 31st, but at 11:30 P.M., as orders to this effect were being prepared, a staff officer from one of the divisions arrived at the headquarters of the III. Reserve Corps with the report that in view of the rise of the river the attack could not be continued. A belt of water 2,000–3,000 yd. wide and reaching as high as a man's waist covered the country behind the German front-line units and threatened to cut them off from their comrades unless they were hastily withdrawn. Accordingly, on the 31st the III. Reserve Corps was ordered back to the E. bank of the river, only weak rear parties being left to cover the movement. By 9 A.M. the Belgians were once more in possession of Ramscapelle and the railway embankment. Farther to the S. the positions held by the XXII. Corps on the W. bank of the river N. of Dixmude were also menaced by the rising tide of water, and the troops holding them were withdrawn on the night of Nov. 1. By the morning of the 2nd there were left of all the German gains on the left bank of the Yser only the villages of Schoorbakke and St. Georges and two farms N. of Dixmude.

On either flank of the Allied line where bridgeheads existed over the river, the first days of Nov. saw a series of small attacks with the object of improving the local positions. Such operations took place on Nov. 3 and 4 in the Nieuport sector, when Lombartzyde was occupied temporarily but lost again. A French attack also took place on the 3rd E. of Dixmude, and others on the 4th against St. Georges and Schoorbakke; but generally speaking, the Germans maintained their positions.

The battle of the Yser, strictly speaking, was over, and the plan of the German Higher Command, to seize the Channel ports and envelop the Allied left flank, had failed thanks to the heroic resistance of the French and Belgian troops. It was estimated that the battle had cost the Belgian army 18,000 casualties, the French some 5,000 (inclusive of the action at Dixmude on Nov. 10), and the Germans some 28,000.

Crisis of the Battle of Ypres, Oct. 29–Nov. 8.—In conjunction with the decisive attacks on the Yser line in the N., the German IV. Army was also preparing for a renewal of the assault on the Ypres front. A new army group was formed, under the command of von Fabeck, consisting of the Bavarian II. and the XV. Corps and the Bavarian 6th Reserve and 26th Div., with some heavy artillery from the VI. Army. This new group, assembling behind the junction of the IV. and VI. Armies, was to come into line on the 28th on the front Wervicq–Deulemont, in order to deliver a decisive attack also on the 30th. Both the German armies already in line were to coöperate.

Their preparatory attacks commenced on the 29th with extreme vigour. The Bavarian 6th Reserve Div., which had preceded the remaining troops of the new group into the battle-line, under cover of the early morning mist drove in the 1st and 7th Divs. at their point of junction E. of Gheluvelt. The reserves of the former division threw them back again out of all but the front trenches they had gained; the losses of the assailants were heavy. But this was only the prelude to the drama about to open. During the night of the 29th–30th the Fabeck group relieved part of the VI. Army Cav. in the line and went forward at 9 A.M. next morning. The XV. Corps on the right, moving with its right on the Menin–Ypres road and with its left on Zandvoorde, fell upon the 7th Div. and pushed them out of Zandvoorde after fierce fighting, but were then checked by the I. Corps reserves. On their left the Bavarian II. Corps advanced, and the French XVI. Corps and the British 3rd and 2nd Cav. Divs., after giving up some ground, made head against the enemy just E. of St. Eloi and Wytschaete. The 26th Inf. Div. failed however to dislodge the 1st Cav. Div. from Messines; a temporary success by the I. and II. Cav. Corps E. of Ploegsteert wood was retrieved by the 4th Div., and the XIX. Corps also failed to hold their gains at Bois Grenier, against the 6th Div.

The situation of the British, despite the fact that they had for the moment held their front intact, gave rise naturally to considerable anxiety at French's headquarters and the promise of Foch, who visited French at 2 A.M. on the next morning, to dispatch strong reinforcements to the I. Corps on the morrow, must have been very welcome. It was agreed that a French force of five battalions and three batteries under Moussy should be put in near Hollebeke, and another detachment at Becelaere; while the 32nd Div. would be sent to support the cavalry astride the Ypres–Comines canal. Before these forces could be brought up on the 31st, the enemy renewed his assaults. The 4th Div. in the S. was first attacked shortly after dawn; the action soon spread to the N., where the 26th Inf. Div. strove with the British Cav. Corps for the possession of Messines. The village was lost at 9 A.M., re-entered at 1 P.M., disputed hotly till dark and finally left in British hands. Farther to the N. the Bavarian 6th Reserve Div. vainly assailed the front of the 2nd and 3rd Cav. Divs., whose sector was taken over before long by the French XVI. Corps; but though the latter on their part delivered a series of counter-attacks, they were unable to achieve much.

The main crisis of the battle, however, was played out N. of the Ypres–Comines canal. Here the Bavarian II. and the XV. Corps had, as early as 10:30 A.M., forced back the 1st Div. front N. of the Menin road and followed this up by a strong attack along the road itself. Eight battalions employed against Gheluvelt quickly overmastered the two battalions in garrison there, and by 1:30 P.M. had seized the village and driven a gap in the British line. The situation was perilous in the extreme; the left of the 7th Div. was enveloped, and the right of the 1st Div. forced back in disorder down the Menin road. At the same time the commanders and some of the staff of the 1st and 2nd Divs. were knocked out by a shell which struck their headquarters; Haig prepared to retire to a line just in front of Ypres and hold on there at all costs.

But the Germans could not exploit their success; the Worcesters, in local reserve, thrown in at 2 P.M., checked the enemy's progress, and secured a position from which they could flank any further advance beyond Gheluvelt. The left of the XV. Corps had been held up by the 7th Div., assisted by the local reserves, and had been unable to exploit the exposure of its immediate enemy's flank caused by the loss of Gheluvelt. The Bavarian II. Corps indeed forced its way forward somewhat against the right of the 7th Div. and the 3rd Cav. Div., but its advance also eventually came to a stand, as had that of its comrades on the right and left of it. A gap which opened in the right wing of the 7th Div. late in the afternoon was opportunely filled by the arrival of the 7th Cav. Bde. which threw back the enemy.

It was clear that the enemy would not desist from his efforts, which had on the 31st brought him so near to success, but that further fierce attacks might be anticipated on the following days. The situation seemed therefore dark enough; the troops of the French VIII. Army, with which it had been intended to assume a large scale counter-offensive against both flanks of the enemy group attacking the British I. Corps, had had to be thrown in piecemeal to support various weak points in the line, and only one division, the 43rd, was left in general reserve W. of Ypres. Certain units even of this division had been sent into line before nightfall on the 31st in the vicinity of St. Eloi.

The fighting on Nov. 1, as was expected, was little if at all less severe than on the two preceding days. The main pressure, however, had shifted from the front of the British I. Corps over the Ypres–Comines canal to that of the cavalry corps. In the N. the enemy's efforts, which were not very vigorous, broke down before the readjusted lines of the 1st and 7th Divs., and the 3rd Cav. Div. The fighting, which had continued all through the night of the 31st–1st around Wytschaete and Messines, had already placed the cavalry corps in a difficult position, their line being broken at several points, and only partly reëstablished; however, the main German attack did not take place till noon, when the Bavarian 6th Reserve Div. and the 26th Div. advanced. Wytschaete, lost between 2 and 3 A.M. on the 31st, was still at this time in German hands, despite the efforts of reinforcements from the 3rd Div., sent up from the S. and from the 5th Cav. Bde. with French units of the 32nd and 43rd Divs., but the village was recovered about 6 P.M. and held firmly by the French. The loss of Wytschaete had been followed by that of Messines; the 1st Cav. Div. were drawn back to an entrenched line N. of Wulverghem, and later relieved by parts of the French XVI. and XX. Corps and of Conneau's cavalry. The situation, which had at one time seemed critical, was thus saved by the arrival of French and British reinforcements, and by the evening gave rise to less anxiety. The attack was continued next day by the Germans, who had put in a new division, the 3rd, on the left of the Bavarian 6th Reserve, and the fight swayed to and fro all day. By the evening Wytschaete and the crest of the ridge had been lost, but the French line was firmly settled on the rear slopes of the ridge to the west.

Gen. d'Urbal had not yet however abandoned all hope of a successful offensive, but the attempts of the French to advance on the 2nd and following days were neutralized by renewed efforts on the part of the enemy, and only in the Merckem–Bixschoote area was some slight progress made. On Nov. 5 d'Urbal received instructions from Joffre, which stated that the Flanders theatre of operations had lost some of its importance since neither Allied nor German attacks could hope to gain any further appreciable result, and that it was intended shortly to withdraw troops from the VIII. Army for use elsewhere.

Meanwhile the British dispositions had undergone some changes; the 7th Div. being relieved by two composite brigades from the II. Corps, and the French IX. Corps taking over part of the I. Corps front.

A renewed period of activity on the British front occurred in a few days, when these reliefs had been barely completed. On the 6th and 7th the 7th Cav. Bde. and units of the 7th and 1st Divs. recovered some ground lost by the French near Zwartelen; attacks on the 7th and 8th against the 3rd Div. E. of Herenthage wood and the 1st Div. and the French farther N. were also successfully dealt with. This was but the muttering before the bursting of the last storm.

The Germans, determined to make one last push for Ypres, formed on the 9th a new army group under von Linsingen, consisting of the XV. Corps and a composite corps, made up of the 4th Div. and a division of the Guard. This was put in on the left of the Fabeck group with orders to drive back and crush the enemy N. of the Ypres–Comines canal. The Fabeck group was to coöperate with infantry and artillery. This attack, timed for the 11th, was to be prefaced by an advance of the whole IV. Army on the previous day from Dixmude S. to Polygon wood. The southern part of this attack however did not get going.

The Final Battle, and the Stabilization of the Flanders Front, Nov. 8–20.—The attack on Dixmude was entrusted to the 4th Ersatz Div. and the XXII. Reserve Corps and took place on Nov. 10. The garrison of Belgian infantry and French Marine Fusiliers had been reinforced by French colonial troops and the Germans had to pay dearly for their success. The bombardment opened at dawn and the infantry attack at 7:40 A.M. It failed and was renewed after further artillery preparation at 9:30 A.M. By 1 P.M. the garrison had been driven from the eastern suburb and the town was assailed from N.E., E., and S.E. After desperate fighting, lasting till nightfall, the Germans succeeded in securing possession of the ruins of Dixmude. The garrison withdrew to the W. bank of the Yser and broke the bridges, but the enemy made only half-hearted attempts to follow them. They claimed to have taken in the town about 1,400 prisoners and much material. Further to the S., in the Bixschoote–Langemarck area, the German attacks made little headway. The British front was not attacked on the 10th.

Its turn was to come on the 11th, when the Fabeck and Linsingen groups attacked on the whole front from the Menin road to S. of Messines, about 9:30 in the morning, after two hours' bombardment. A thick mist veiled and assisted their advance. On the right of the assault the 12 battalions of the Guard struck against the line held by the weakened British 1st and 9th Bdes., and some French Zouaves. Their right broke past the S. side of Polygon wood, and swept the defenders out of Nonne Boschen, but their further progress was stayed on the western edge of this copse, and shortly after noon a counter-attack by the 2nd Oxon. and Bucks. L.I. forced them out of it again. The centre and left of the Guard, after some initial success in Inverness copse and Herenthage wood, were also held up and compelled to abandon most of their guns. Further S. also little progress had rewarded the Germans' efforts. The XV. Corps had to content itself with the capture of Hill 60; the Bavarian II. Corps gained some success N. of Wytschaete; elsewhere the attackers had been kept to their trenches.

This day's fighting was the closing act of the Ypres battle. Both sides were entirely exhausted by close on a month of sustained and bitter fighting, which had thinned their ranks, drained their supply of munitions, and left them no available reserves which could be employed in further effort. On Nov. 15 General d'Urbal came to the decision to suspend further offensive activity, consolidate his position and allow his troops a period for rest and refitment. Joffre, however, felt that the operations on the Flanders front had reached their fitting termination with the repulse of the enemy's last desperate effort to bring about a decision in the open field, and accordingly instructed d'Urbal to hold himself henceforward on the defensive.

The Germans on their side had also come to an end of their resources. On the 17th the German IV. Army commander, after the failure of a final effort by the 4th Div. in Herenthage wood, "decided to give up any idea of continuing the offensive—a decision to which he was compelled by the low fighting strength of his troops and the bad autumn weather which was affecting their health; . . . . the German General Staff fully concurred in the decision."

Meanwhile on the 21st the British were withdrawn from the Ypres salient. French troops took over the front line; the I. Corps and Cavalry Corps remained in reserve; the two brigades of the II. Corps which had been sent up to the N. were also moved back to rest.

The battle of Flanders was at an end, and the armies, their front stabilized along all the line from the sea to Switzerland, settled down with the approach of winter to trench warfare.

(X.)

II. Battles N. of the Lys, 1915

The five weeks' pause in active operations which had followed the battle of Neuve Chapelle was due mainly to the necessity of accumulating ammunition, of which the supply was still far from adequate, but also to the need of timing the next attack to coincide with General Foch's great attack against the Germans N. of Arras. Meanwhile a minor operation carried out by the II. Corps S.E. of Ypres led to extremely fierce local fighting. Where the Ypres–Comines railway cuts through one of the southern spurs of the Broodseinde ridge there is a mound which was of considerable tactical value especially as an artillery observation post. On April 17 1915 this "Hill 60" was successfully stormed by the 2nd K.O.S.B. and 1st Royal West Kents of the 5th Div., but its capture provoked prolonged and vigorous counter-attacks. The hill was lost and retaken more than once and not only the whole of the 13th Bde. but the 1st Devons and 1st E. Surreys of the 14th Bde. and the 2nd Camerons of the 27th Div. had to be thrown into the fight. By the end of a week the Germans had apparently acquiesced in the loss of the position for their counter-attacks died away.

But the struggle for Hill 60 was soon to be eclipsed. During April the British had gradually relieved the French in the Ypres salient. First the 27th Div. took over the line from Zwartelen to Polygon Wood, then the 28th came in on the left to and beyond the Broodseinde cross-roads, by April 17 the Canadian Div., now allotted to the V. Corps, occupied the N.E. face of the salient as far as the Ypres–Poelkapelle road. Thence to the Ypres–Yser canal were French troops, chiefly Africans. It was against this last section that on April 22 the Germans delivered the first gas attack. Some suspicions of this new weapon seem to have reached the Allied Headquarters, but there had been no time for preventive measures, and to the unfortunate Africans the gas-clouds came as a complete surprise. Luckily for the Allies the efficacy of their new weapon surprised the Germans themselves: they hastened to fall upon the Canadians whose left flank the rout of the French had completely exposed, but they had not enough troops to exploit their success.

The Canadians stood the strain of their first serious engagement splendidly. Their front line maintained their positions unshaken; a line was hastily improvised along the Poelkapelle road toward St. Julien to cover the exposed flank and rear of the front line, while local reserves manned the second-line trenches near "Shell Trap Farm" N. of Wieltje in time to check the further advance of the Germans. Divisional and corps reserves were hurried up at once and that evening a counter-attack by the 10th and 16th Batts. temporarily recovered a wood W. of St. Julien. But the position was critical in the extreme. Between "Shell Trap Farm" and the canal a 2-m. gap lay open, Ypres itself was dangerously exposed and all the troops in the salient might have been cut off by a rapid German advance in force. Moreover, during the night of April 22–23 the Germans succeeded in capturing the bridge at Steenstraate over the Yser canal and established themselves on the western bank.

The first need was therefore to close the gap between the Canadians and the French right. But conditions were all against counter-attacks. There was little time for reconnoitring or for coördinating advances, there was hardly any heavy artillery to support them for over 50 French guns had fallen into the enemy's hands. In the course of April 23 attacks were made by a detachment drawn from the reserves of the 28th Div. by the Canadian 1st and 4th Batts. and by the 13th Bde. (5th Div.) hastily fetched up from the rest camp where it was recuperating after its heavy fighting for Hill 60. These attacks did not dislodge the Germans from the position they had already dug and wired along the ridge running westward past Pilckem, but they prevented further advance and by the evening a continuous line had been established from the canal to St. Julien. Elsewhere the position remained unchanged; though heavily shelled and under reverse and enfilade fire the Canadians stuck stubbornly both to their original trenches and to the new flank thrown back to cover St. Julien, and more than one German advance was beaten off.

But with the Germans on the Pilckem ridge their guns could not only enfilade all the roads leading eastward into the "Salient" but could fire into the backs of the troops S. and E. of Ypres whose situation was therefore rendered most unsatisfactory. However, encouraged by promises of large French reinforcements, Sir John French endeavoured to maintain his original position until the French could reëstablish theirs. He had brought up a brigade of the 4th Div. and the newly arrived Northumbrian Territorial Div. (later numbered 50th), while in the course of April 24 the Lahore Div. reached Ouderdom. But before a systematic counter-attack could be launched a successful German attack on the Canadians had changed the position for the worse. On the morning of April 24 an extremely heavy bombardment developed on the original Canadian trenches, followed by the discharge of gas and by infantry attacks in force. The troops N. of St. Julien were overwhelmed and in the course of the morning the Germans, pressing on, made themselves masters of St. Julien and drove its defenders back upon Fortuin. Between Fortuin and the trenches of the Canadian 2nd Bde., which still held out, there was for a time an open gap, but the German efforts to advance were checked by artillery fire at short range and before dark the gap was filled mainly by units of the 28th Div. to whose position, around Broodseinde, the German attacks had now extended though without success. But St. Julien was gone and the next counter-attack had to make the recovery of St. Julien its objective.

This, delivered early on April 25 by the 10th Bde. and various attached units, advanced the line a little, but failed to recover the village. With equal gallantry and equally heavy casualties the Lahore Div. and the French attempted on April 26 to regain the Pilckem ridge, but just as success seemed within reach gas drove the French back and the advanced troops of the Lahore Div., overcome by this new weapon, could not maintain the positions they had reached. The Northumberland Fusilier (T.F.) Bde. attacked St. Julien with the same ill-fortune and meanwhile the Germans had managed despite the stubborn resistance of the Canadian 2nd Bde. to capture most of the Gravenstafel ridge. The 28th Div.'s left, N. of Broodseinde, was thus seriously exposed while simultaneously its infantry attacked it in front, but the arrival of the 11th Bde. (4th Div.) enabled some sort of line to be established across the N. of "the Salient." Still it was only with great difficulty and heavy losses from shell-fire, that the newly arrived units managed to dig themselves in and establish touch with each other. Luckily the German infantry attacks lacked vigour and determination and afforded the defenders welcome opportunities for retaliation.

By the evening of April 26th, however, the situation had not improved. A second attempt by the Lahore Div. (April 27), though gallantly pressed, achieved nothing; the French had made no progress and with the Pilckem ridge firmly held by the Germans the advanced position of the V. Corps was clearly untenable. Accordingly Sir John French decided upon a withdrawal to a new line running N. of St. Jean, N.E. of Wieltje, by Frezenberg, E. of Hooge, through the woods S. of the Ypres–Menin road to join the original line of the V. Corps N. of Hill 60. This line was much less liable to reverse and enfilade fire, but the evacuation of the Broodseinde ridge and Polygon wood meant losing valuable positions only to be recaptured at a heavy cost in the autumn of 1917. The move

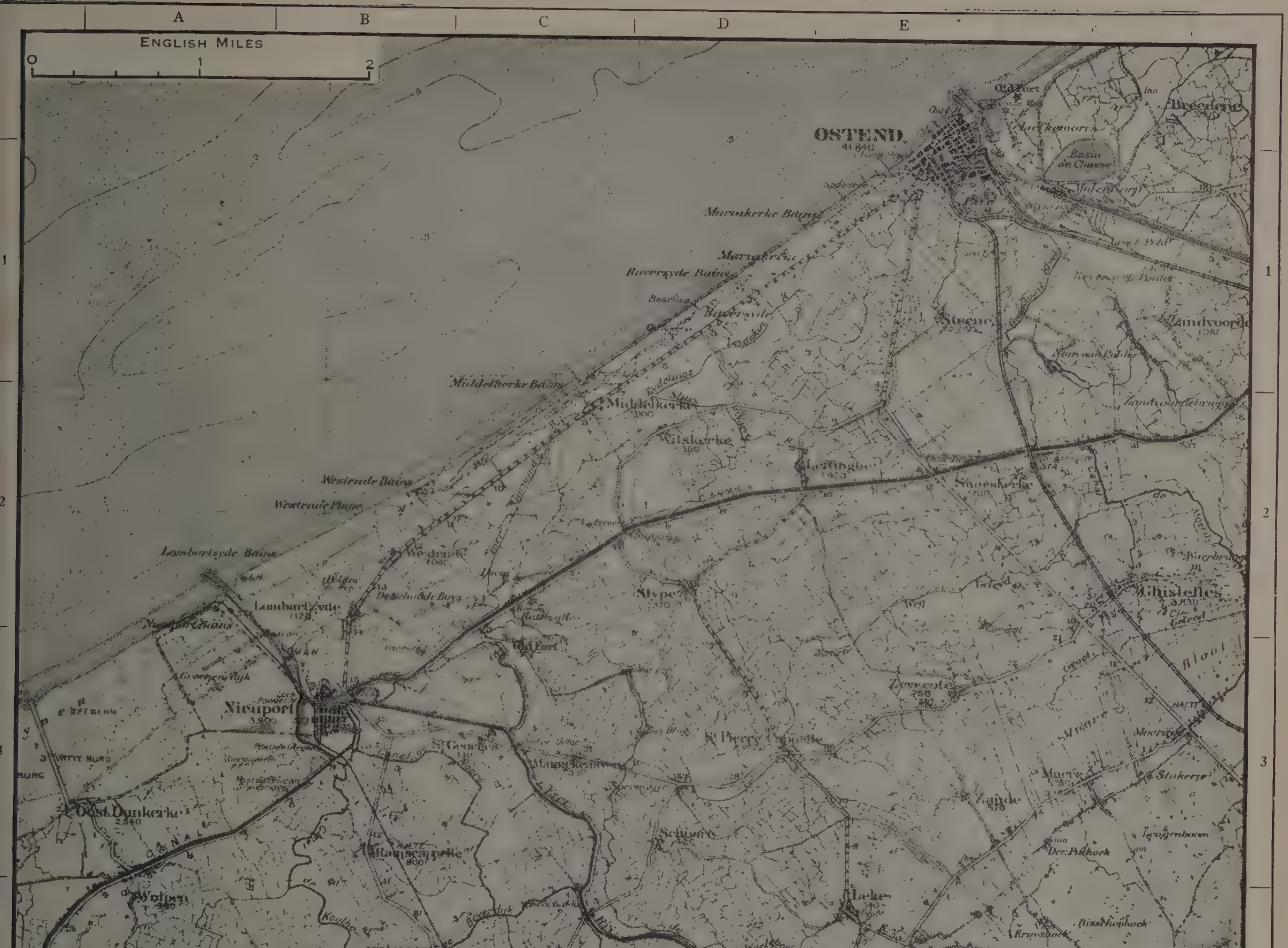
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was, however, postponed to allow the French and the Lahore Div. one more attempt upon the Pilckem ridge but this also achieved nothing substantial and was followed by renewed German attacks and desperate fighting. On May 1 an attempt upon Hill 60 in which gas was effectively used was only just beaten off by the gallantry and steadiness of the 1st Dorsets. Next day a violent attack was launched against the northern face of the salient from St. Julien to the canal, bearing hardest upon the 12th Bde., who suffered terribly from the gas. Prompt counter-attacks by the local reserves, including dismounted troopers of the 3rd Cav. Bde., restored the situation and drove the Germans back with heavy losses while elsewhere the line was successfully maintained. The actual withdrawal, begun on the night of May 2–3 and completed on May 4, was covered by a stubborn defence of the left of 28th Div.'s line N. of Broodseinde by the 2nd Buffs and the 3rd Royal Fusiliers, thanks to which the final stages of the retirement were unmolested by the Germans, who did not indeed discover what was happening until too late to interfere. Their one substantial success was the recovery of Hill 60, recaptured on May 5 by a renewed gas attack.

The evacuation of the advanced position of the V. Corps may be taken as ending the first stage of the battle. Fighting continued, however, for another three weeks during which the Germans delivered three major attacks, on May 8, May 13 and May 24. The first of these broke through the 28th Div. near Frezenberg and resulted despite several counter-attacks in the loss of most of that division's front line, though on its left the 4th Div., which had replaced the Canadians, maintained its position. Between May 8 and May 13 there was particularly bitter fighting round Hooge where the 27th Div. was posted astride the Menin road. After repeated attacks the Germans contrived to make a few lodgments in the line, but their advances in mass formation had given good targets and they lost heavily, more than one local counter-attack meeting with success. South of the road against the 81st Bde. they gained nothing substantial, though N. of it the front trenches had to be evacuated in favour of a line just W. of the Bellewarde wood. The attack of May 13 extended from Hooge to the left of the British line. The exhausted infantry of the 28th Div. had now been relieved by the 1st and 2nd Cav. Divs. acting as infantry on whom fell the brunt of the exceedingly heavy bombardment. This was followed up by infantry attacks which had little difficulty in occupying positions which had been almost obliterated. Counter-attacks by the 7th and 8th Cav. Bdes. (1st and 2nd Life Guards, Royal Horse Guards, 10th Hussars and Essex and Leicester Yeomanry) reached the front line only to be forced back again by the violence of the bombardment, and the day resulted in the establishment of a new line some distance in rear of the original position, while the hamlet of Valorenhoek passed into German keeping and the left of the troops in the Bellewarde position had to be flung back to connect up with the cavalry's new line. On the other flank, however, in front of Wieltje the 4th Div. held firm and inflicted heavy losses on the enemy, retaking such portions of the line as the Germans had temporarily captured.

After May 13 ten days of intermittent heavy shelling and occasional sharp local fighting followed, during which the French recovered Streenstraate and thrust the Germans back across the canal. But the Germans had not finished. Early on May 24 a tremendous bombardment opened upon the whole front from the Menin road, northward. Gas was discharged in great quantities and at certain places, notably Hooge, "Shell Trap Farm" and the Bellewarde ridge, the defenders were completely overcome by the fumes. The Germans therefore had only to advance against positions practically denuded of defenders. Counter-attacks were launched, but without much success beyond preventing the Germans from penetrating deeper than the front line, while just S. of Hooge the determined resistance of the 1st Cav. Div. checked the extension of the German success. During the night of May 24–25 some units of the 27th and 28th Divs., hastily recalled from rest camps where they were seeking to assimilate the large drafts with which they had just been replenished, were put in to try another counter-attack. This, however, failed to recover Hooge or the Bellewarde ridge, and similarly, though the 4th Div. maintained most of its front, its centre had to be retired to a new line through Wieltje.

This fighting, however, marked the last serious German effort on this front. With all the advantages of surprise derived from their use of gas, they had not succeeded in taking Ypres and if they had made substantial gains of ground and had inflicted heavy casualties on the defenders their own losses whenever they had ventured on an infantry advance had been heavy. When viewed as a whole the defence of the Ypres salient during April and May 1915 stands out as a splendid achievement. Many battalions were in the front trenches for three weeks and more on end, without any relief, constantly shelled, subjected to repeated attacks, at a fearful disadvantage in having to face gas-attacks with only the most inadequate and improvised protection. Ground was lost, but the main position was held and the II. Army's tenacious resistance supplies a good example of "economy of forces." When the German attack on Ypres was launched the Allied offensive further S. was about to be resumed. The II. Army was asked to maintain its ground without depending upon the men and munitions needed elsewhere. Only one division of the I. Army was employed in the defence of Ypres and it was not because of any diversion of resources to the Ypres area that the British offensive of May 1915 proved a bitter disappointment.

(C. T. A.)

III. BATTLES OF 1917

Continuous fighting of a violent character took place in the Ypres-Yser region during many weeks in the summer and autumn of 1917, but the operations as a whole may be said to have consisted of two distinct phases. The undertaking started with the brilliantly successful combat lasting only a few hours which has come to be known as the Battle of Messines. There followed a period of comparative lull, although progress was made at some points and although counter-attacks had to be beaten off. Then there were launched immediately to the N. of the scene of the Messines combat a series of attacks at short intervals which gained ground as successive waves do on a rising tide and which lasted for more than four months.

The object in view throughout was the occupation of the whole of the belt of high ground which extends from a point about three miles directly N. of Armentières to near Dixmude, beyond the forest of Houthulst. Its general direction is at first north-eastward to about Gheluvelt, then it turns northward to near Staden, and from that point it veers back westward toward the Yser, N. of the above-named forest. A continuation of somewhat more conspicuous high ground lying N. of Hazebrouck and Bailleul, this belt represents the watershed between the basins of the Lys and of the Yser. It rises generally some 100 to 150 ft. above the great Flanders plain, and it reaches a height of over 200 feet at a few points. Its southern portion in the spring of 1917 inclosed to a great extent the Ypres salient and had been the scene of many desperate encounters during the Ypres-Yser battles of 1914 and 1915; here the Allies' trenches gave them possession of some of the lower slopes on their side of the high ground, although all the upper portion was in German hands. Further to the N. the enemy held the whole of the high ground as well as stretches of plain to the W. of it, as from opposite Gheluvelt the direction of the Allies' front ran north-westward, *i.e.* diverging from the line of heights. The general plan of operations was to begin at the southern end, where the belt of high ground was almost contiguous with the British front, and to work from thence northward. This procedure was indeed almost dictated by the fact that the Ypres salient would have to be extended outward ere full use could be made in later undertakings of the important communications which diverge from Ypres itself toward Bruges and Ghent and Oudenarde. The capture of the line of high ground—its total length was about 23 m.—only represented the first part of the general strategical plan, which contemplated the initiating of subsequent operations in the coast district by another force.

The line which the Allies had been holding to the N. of Armentières since the spring of 1915 formed in plan an inverted letter "S," the lower loop turned to the W., the upper loop turned to the E. and creating the Ypres salient. The lower loop on the other hand represented a pronounced enemy salient jutting into the territory in occupation of the Allies and causing them great inconvenience. Its area consisted almost entirely of high ground which had come to be known as the Messines–Wytschaete ridge. From this dominating position the Germans effectively enfiladed, and to some extent took in reverse, the Allies' trenches to the S. and to the N. of the salient and also commanded the communications leading up to these from the rear, while they overlooked the town of Ypres from within easy field-gun range. Quite apart from any projects for an offensive on a great scale, the filling in of this enemy salient—the wresting of the Messines–Wytschaete ridge out of hostile hands—was bound to ameliorate the situation in Flanders from the point of view of the Entente and to render the task of barring the invader's way toward the Channel ports so much the easier. In framing his plans for the Flanders offensive Sir D. Haig had already decided to make the high ground about Messines and Wytschaete his first objective months before the date when the attack upon the position, formidable by nature and rendered infinitely more formidable by the labour that had been expended upon it, actually took place.

General Plumer and his II. Army, who had been acting as the wardens of the Ypres front for more than two years, had been selected to carry this operation out. To enable the II. Army to bring its full force to bear, the V. Army under General Gough had been transferred from the positions which it had been occupying between the III. and IV. Armies in Artois during 1916, to the Ypres salient and it was thus on the left of the II. Preparations for the undertaking had been afoot since the previous summer but they had only been carried on in earnest during the preceding winter. Moreover all the necessary labour and material had not been available until the prior demands of the Arras scheme of offensive operations had been satisfied, and very strenuous work had consequently to be carried on up to the last moment so as to insure that all would be ready. The preparations included an elaborate railway scheme. Much road construction was an indispensable part of the plan. Special provision for securing an ample water supply had been made. A great force of artillery had been quietly assembled. But the most noteworthy item of all, owing to its virtual novelty, was the carrying into effect of arrangements for a deep mining offensive on a colossal scale. Twenty great mines had been established at the end of galleries running right under the enemy's front line of defence, but one of them had been blown up by the Germans; a total length of 8,000 yards of gallery had, in spite of very active countermining on the part of the enemy, been driven by the tunnelling companies of miners since Jan., and 600 tons of explosives had been distributed between the 19 mines that were effective. The simultaneous explosion of these mines at the moment when the assault was launched was the most remarkable feature in a battle, the exceptionally decisive issue of which was primarily to be attributed to the labour that had been expended in advance, and to the care and forethought of commander and staff which had preceded the opening of the combat. It should be mentioned that the preparations above ground had been carried out under special difficulties owing to most of this area being overlooked from the German lines.

For the defence of this salient which they occupied, and the importance of which they fully realized, the Germans depended upon two separate sets of lines, coinciding in trace with its arc. The more advanced set of lines of the two was close to the trenches that were occupied by General Plumer's troops, and it was at most points pushed down the forward slope of the high ground. The second set of lines on the other hand, which formed an inner curve, followed the crest of the Messines–Wytschaete ridge along most of its extent. The villages of Messines and Wytschaete had been organized as main centres of resistance capable of offering a stout defence, and many farms, hamlets and copses existing along the line had been utilized to form defensive posts. The Germans had moreover also constructed two chord positions stretching along the base of the salient partly on and partly below the reverse slopes of the high ground. The front one of these two positions represented the final objective given to the assaulting columns by General Plumer.

The troops of the II. Army detailed for the enterprise consisted, enumerating them from right to left, of the II. Anzac Corps under Lt.-Gen. Sir A. Godley (Australian 3rd Div., New Zealand Div., 25th Div.), with the Australian 4th Div. in support; the IX. Corps under Lt.-Gen. Hamilton-Gordon (36th Div., 16th Div., 19th Div.), with the 11th Div. in support; and the X. Corps under Lt.-Gen. Sir T. Morland (41st Div., 47th Div., 23rd Div.), with the 24th Div. in support. There were thus nine divisions in front line and three in support. As the final objective of the troops along the whole battle-front was the chord of the arc forming the salient, it followed that the divisions in the centre would have a greater distance to cover than the divisions on the flanks; this had been taken into account and had been provided for in the time-table. The moment of assault was fixed for 3:10 A.M. on the morning of June 7, and at that hour the 19 mines were exploded beneath the enemy's front line with devastating effect. At a number of points the hostile trenches were completely obliterated and their garrisons wiped out, so that when the assailants reached the enemy's front line under cover of a tremendous bombardment, very little resistance was offered and the first objective was secured almost at once. The consequence was that, as had been anticipated in the programme, the advancing infantry could proceed without delay to the execution of their next task, that of carrying the second German line. The capture of this proved more difficult than had that of the front defences. In some of the skilfully prepared localities the enemy detachments would not yield for some time, in spite of the storm of shell pouring down upon them; but such localities speedily became isolated as the assailants pushed on between them, and their fall was not then long delayed. The strongly fortified village of Messines was, according to the programme, taken by the New Zealanders. Wytschaete was captured after a determined struggle by portions of the 36th (Ulster) and of the 16th (Irish) Divs. fighting side by side. On the left, where a trough which is followed by the Ypres–Comines canal cuts through the belt of high ground, the 47th (London) Div. had very formidable obstacles to overcome but pressed steadily forward and took many prisoners. The movements of the attacking side had been somewhat hampered at the outset by the dim light and by the air being dust-laden owing to the great explosions; but as the morning wore on this impediment to advance disappeared. An interesting feature in the opening phase of the battle had been that the tanks told off to assist the advancing battalions had in many cases been unable to get up in time to share in the struggles for the German second line of defence, so rapid had been the movements of the infantry. The operations had proceeded in almost exact accordance with the time-table, and by early in the forenoon all the upper part of the Messines–Wytschaete ridge and of its extension north-eastward to the limit of the battlefield was in the hands of British and Australasian troops. These moreover had consolidated the ground that they had won, and they were holding a line which, along most of its extent, was on the reverse slope of the high ground and overlooked the German chord lines of trenches; guns had also been pushed forward promptly to assist at closer range the advance which was to be made against these as the final operations of the day.

This closing effort took place in the afternoon and it was completely successful, although the enemy showed some disposition to counter-attack and at some points offered a stubborn resistance. So it came about that by the evening the last objective had been fully attained, and that General Plumer and his army had placed an extraordinarily complete and decisive tactical success to their credit. The extent of the success was not to be measured merely by the importance and extent of the area of ground which had been wrested out of the enemy's hands by masterly soldiership. Great captures in men and material had also been effected. 7,200 prisoners (including 145 officers) had been taken, together with 67 guns, 94 trench mortars and 294 machine-guns. Nor had the victory been purchased at a heavy cost in casualties. The total number of killed and wounded—the latter in many cases representing trifling injuries—only amounted to 16,000 in an army of sixteen divisions assailing a position of exceptional strength and that was strongly held. That the defenders realized how thoroughly vanquished they were, was shown by the feeble nature of such counter-attacks as were attempted during the day, as well as by the fact that the conquerors were during the night permitted to consolidate the ground that they had secured, almost unmolested. The battle of Messines was from the point of view of the victors a veritable masterpiece of design and of execution.

Not until the evening of the following day, the 8th, did the Germans adventure a general counter-attack upon the positions which the II. Army had won and which it had by that time prepared satisfactorily for defence. Covered by an intense bombardment, the hostile infantry then advanced to the assault along practically the whole of the new front; but they were beaten off at all points. The enemy drew back somewhat from in front of the southern portion of the ground conquered by the II. Army during the next few days, and on the evening of the 14th General Plumer's troops carried their line forward some distance on either flank. Their front thenceforward for some weeks ran almost in a straight line from where it quitted the line held on June 6, opposite the village of Frelinghien at the southern end, to Observatory ridge, situated a mile E. of Zillebeke, where it joined the line held on the earlier date. This represented a length of about nine miles. In depth, the ground wrested from the Germans opposite the centre of the old enemy salient was nearly three miles.

Some very important re-arrangements in the general distribution of the Allied forces N. of the Lys were being carried into effect about the date of the battle of Messines and during the immediately following weeks, in preparation for the Flanders offensive that was to follow. The actual composition of the different British armies also underwent considerable change. Portions of the old IV. Army were moved N. from Artois, under command of Sir H. Rawlinson, to the extreme left of the Allies' line about Nieuport on the coast; this comparatively small IV. Army was to be expanded at a later date and was to play an important part in the operations, should the earlier stages prove as successful as was hoped. On its right were placed the Belgian forces. On the right of these again, and linking them up with General Gough's British V. Army, was brought in the French I. Army under command of General Antoine, which was to act under the orders of Sir D. Haig. Its right was a little N. of Boesinghe, where it was in contact with the Guards Div. which formed Gough's left; the V. Army front extended from thence to near the Ypres–Comines canal where it joined up with the left of the II. Army.

A pause of some weeks in active operations now took place in Flanders, the time being devoted on the side of the Allies to making the elaborate preparations that were necessary before the contemplated offensive could be launched. The lull was however interrupted by an unfortunate incident on the extreme left of the line. In the coast region, the front between Dixmude and the shore followed a line in rear of the Yser river and canal except quite close to the sea. There it crossed over the enemy's side of the waterway, thereby creating a somewhat isolated patch of territory, occupied by troops whose communications with the rear and with their reserves were dependent upon a few floating bridges. This patch consisted near the sea of sand-dunes which from their nature were particularly difficult to entrench. It had been taken over as it stood by the British 1st and 32nd Divs. of the IV. Army and the 1st Div. was on the left next the sea. Perplexed by the arrival of British troops on the coast and anticipating serious developments in this quarter, the Germans determined to strike a blow against the extremely vulnerable sector of the Allies' front lying on the right bank of the Yser, and they delivered their attack on July 10. The front of the 1st Div. beyond the river was on that day occupied by the 1st Northamptons and the 2nd K.R.R.C. battalions which had been brigaded together since quitting Aldershot in July 1914. Early in the morning the isolated sector was subjected to an intense bombardment by a great number of guns which had been especially concentrated for the purpose. The bridges in rear were destroyed by shell. Dugouts and shelters were flattened out, and the difficulties of the two battalions were much aggravated by the explosions choking their machine-guns and rifles with sand. When the hostile infantry advanced to the attack the small British force was overwhelmed, only a few small parties eventually escaping by swimming the river. But although the enemy by this stroke gained possession of the left of the isolated sector, their effort against its right portion, held by the 32nd Div., failed. No evil result followed to the Allies, apart from the disaster to the Northamptons and Rifles.

Although the capture of the Messines–Wytschaete ridge and of most of the high ground on either side of Ypres–Comines canal gap had put an end to the enemy overlooking Ypres from the S., and tended to limit hostile observation of the place from the S.E., the Germans still dominated it, in a measure, from the E., from the N.E. and from the N. This circumstance exercised a very important influence over the arrangements that were being carried out for the offensive about to be undertaken, the first stage of which was to be directed in the main against the invader's defences sited on the high ground lying in a quadrant round the ruined town.

"The various problems inseparable from the mounting of a great offensive," writes Sir D. Haig in his despatch of Dec. 25 1917, "the improvement and construction of roads and railways, the provision of an adequate water supply and of accommodation for troops, the formations of dumps, the digging of dugouts, subways and trenches, and the assembling and registering of guns, had all to be met and overcome in the new theatre of battle under conditions of more than ordinary disadvantage. On no previous occasion, not excepting the attack on the Messines–Wytschaete ridge, had the whole of the ground from which we had to attack been so completely exposed to the enemy's observation. . . . Nothing existed at Ypres to correspond with the vast caves and cellars which proved of such value in the days prior to the Arras battle, and the provision of shelter for troops presented a very serious problem. The work of the Tunnelling Companies of the Royal Engineers deserves special mention in this connexion. It was carried on under great difficulties, both from the unreliable nature of the ground and from hostile artillery, which paid particular attention to all indications of mining activity on our part."

Preparations for the offensive could not in fact be concealed. The forces with which it was proposed to break out from Ypres and to gain possession of the high ground to the E., further out to the N.E., and still further out to the N., were assembled openly during the latter part of the month of July. The Germans were perfectly well aware that they were going to be subjected to a very formidable attack in this region.

The portions of the coming battle-field that lay nearest to Ypres had already been the scene of fierce combats, which have been dealt with in Parts I. and II. of this article. But certain points in connexion with their topography call for some reference, while the arrangements which the Germans had made for defence must also be described. The little river Steenbeke (or Jansbeke as it is called in its lowest reaches) joining the Yser near Merckem, creates together with its tributary streams, nearly all of which join it on the right bank, a feature that proved of considerable tactical importance during the prolonged operations that followed. The main stream and also the watercourses joining it flow northwestward or westward from their sources on the crest of the high ground between the Ypres–Menin road and the village of Passchendaele, with gentle spurs jutting out between them. The most extensive of these spurs is that between the valley of the Steenbeke itself and the low-lying flats of the Yser immediately N. of Ypres, which had come to be known as the Pilckem ridge; it was from this spur that the town was overlooked from the N. But the general direction of streams and spurs alike being that they run from S.E. to N.W., it followed that an offensive directed north-eastward had to cross them successively and that they tended to provide the defenders with a succession of minor positions. Seeing also that, from about the point where the V. Army was in contact with the II. Army, the main ridge ran in a generally northerly direction, while the front occupied by the V. Army before the attack was launched ran from S.E. to N.W., General Gough's forces which were to carry the operation out, with the French I. Army coöperating on their left, necessarily pivoted on their right and in throwing their left forward were confronted by this succession of minor positions. The shallow depressions representing the valleys of the Steenbeke and its affluents tended to be marshy and to flood and become almost impassable in wet weather.

Anticipating that the Allies would embark on a great offensive in this quarter sooner or later, and becoming aware during the spring that such an offensive was actually in preparation, the Germans had taken steps to meet the eventuality with characteristic thoroughness and ingenuity. Experiences on the Somme, on the Ancre and at Arras, as well as on battle-fronts in Champagne where they had been attacked by the French, had taught them that a continuous system of trenches did not proffer an altogether satisfactory form of defence against the terrific bombardments which the Allies could bring to bear, unless abundant underground cover could be provided; and the nature of the soil in Flanders, with water always near the surface, militated against the creation of subterranean galleries. A continuous line in any case offered a favourable target for guns and was objectionable on that account. They were therefore holding the ground over which attack was expected by a system of numerous disconnected trenches and strong points which were arranged in depth rather than in breadth and which permitted of the forward defences being held by relatively small forces, with the idea of gradually absorbing attack rather than of giving no ground at all. Scattered about were small concrete blockhouses with walls of great thickness which could not be harmed by shell of less than about 6-in. calibre, and which contained garrisons of about twenty men each, with two or three machine-guns; the British soldiers when they came to make acquaintance with them called them "pill-boxes." A defensive system designed after this fashion was more difficult to map by aerial photography than were continuous lines, and a preliminary bombardment directed against it was in consequence necessarily so much the less effective. As their front line near Ypres had been in existence since 1915 and as much labour had been expended upon it the Germans were, however, trusting to the old system to meet the first shock in the event of attack. It was rather in the later offensive operations that the Allies found themselves confronted with the new devices.

The front which Sir D. Haig had decided to extend his initial advance along stretched from opposite Deulemont on the right, to beyond Steenstraat on the left—a distance of over 15 miles. But the most important blow was to be delivered by the V. Army in the middle on a front of approximately 7½ m. between the Zillebeke–Zandvoorde road and the village of Boesinghe (inclusive) on the left. The task of the II. Army to the S. was limited to that of increasing the area threatened, so as to occupy the enemy's attention, only a trifling advance being intended. The French I. Army on the British left was to push forward its right in close touch with the left of the V. Army, with the primary object of securing this against counter-attack from the N. The start of the offensive had originally been fixed for July 25. It was however postponed for various reasons until the 31st. Owing to the enemy having retired out of his foremost trenches along the northern portion of the V. Army front, British and French troops on the 27th crossed the Yser canal (which had hitherto formed an awkward obstacle at this point) about Boesinghe; this enabled bridges to be thrown and it greatly facilitated the attack in the left sector when this took place four days later.

The order of battle of the V. Army (II., XIX., XVIII. and XIV. Corps), enumerating the divisions from right to left, was as follows:—24th, 30th, 8th, 15th, 55th, 39th, 51st, 38th and Guards Div., with two divisions to each corps in support. The French 1st Div. was next to the Guards beyond Boesinghe. Starting at 3:50 A.M. on the 31st, the Allied infantry generally experienced little resistance at first and only began to meet with serious loss when advancing towards their second objectives. This was particularly the case on the right, where the 24th and 30th Divs. were endeavouring to gain possession of all the commanding ground about and beyond Shrewsbury forest and Sanctuary wood to the S. of the Menin road; they failed to push forward more than a few hundred yards. But further to the left the assailants were successful at almost all points, reaching the line of the Steenbeke and capturing St. Julien. The French stormed Bixschoote, which was beyond the furthest objective given them. Even if the check to Gough's right discounted the completeness of the victory, the third battle of Ypres had opened most encouragingly for the Allies. The Pilckem ridge had been wrested from the enemy so that the town of Ypres was no longer overlooked by hostile forces to the N. and N.E., the front had been pushed forward along its full extent, and over 6,100 prisoners (including 135 officers) and 25 guns had been taken by the British alone.

But the weather had broken. July had up till the 31st been an almost consistently fine month, but that morning opened threatening, and rain came on during the course of the day. It fell steadily all that night and continued without cessation for four days, while for several days following the weather remained unsettled. The low-lying clayey soil, pitted with shell-holes, became a succession of muddy pools. The valleys became almost impassable except at a few points. The delay that ensued gave the German troops time to recover from their defeat of the 31st and also to bring up reinforcements before there could be any question of continuing the offensive; it was not indeed until Aug. 16 that improving weather had sufficiently dried the ground to justify the launching of a fresh general attack. This was again undertaken by the V. Army and by portions of the French I. Army on its left, the Menin road marking about the southern limit of the offensive operations. The four corps of the V. Army (II., XIX., XVIII. and XIV.) were disposed in line in the same order as on the opening day, but on this occasion the divisions in front line were in most cases those that had been in support before. The advance was timed for 4:45 A.M., and the operations were quite successful on the left, but the result on the right was even more disappointing than it had been on the 31st and on this occasion comparative failure extended further along the line toward the left. Except for some trifling local gains of ground the II. and XIX. Corps improved their position very little, suffering repulse at most points; nor was the resistance of the enemy purely of the passive kind, for the Germans delivered some determined counter-attacks, and as a result of several hours of fluctuating fighting the troops in front line in the right half of Gough's Army lost heavily. The XVIII. Corps on the other hand did much better, its left division indeed gaining all its objectives, while the XIV. Corps, still further to the left, was entirely successful. Langemarck was taken, the Steenbeke passed along a front of two or three miles, and a large gap made in the German third line of defence. The French advanced their line all along their front and occupied Drie Drachten on the extreme left, on the borders of the inundation area. Still, if the Allies were entitled, upon the whole, to claim victory in view of what had been accomplished along the left half of the battle-front and of their having secured 2,000 prisoners and 30 guns, their arms had met with reverse in the other half. Nor was there reason to suppose that the enemy losses had been more severe than those of the assailants.

The Flanders offensive, unavoidably started late, had now been in full swing for more than a fortnight, and little improvement in the position had been effected in what represented the really vital sector of the front—the ground about the crest of the ridge stretching away from the uplands won at the battle of Messines toward Passchendaele. Up there the line had only been advanced a few hundred yards as a result of two regularly prepared attacks. Unless progress could be expedited at this critical point, there was little prospect of achieving the object for which the offensive had been undertaken. It was clear that a fresh force was needed to deal with the enemy in this portion of the sphere of operations, and the British commander-in-chief therefore decided to extend the left of the II. Army northward and to entrust the attacks against the higher ground to General Plumer, who was to work in conjunction with the V. Army farther to the left. Experiences gained on July 31 and Aug. 16 had moreover shown that new methods of attack were called for. The enemy's elastic system of defence—forward trenches weakly held while formidable reserves were kept in hand to counter-attack before assailants could consolidate such ground as they had won—suggested limitation in the depth of objectives, and it called for special artillery concentrations to deal with the hostile counter-strokes when they were delivered. The requisite measures took some time to carry out and the weather moreover continued unfavourable during the latter part of Aug., rendering the ground so waterlogged that a long interval became necessary to permit of its drying to some extent. In Flanders it may be remarked, as in England, humidity of the atmosphere increases rapidly from about the middle of Aug. onward, so that periods of fine weather have less and less effect in absorbing the moisture of the ground as the season advances. The first half of Sept. however, proved bright and dry and the date of the next attack was fixed for the 20th of that month.

The plan of operations for this day was that the II. Army (consisting from right to left of the 19th, 39th, 41st, 23rd, Australian 1st and 2nd Divs.) was to push forward between the Ypres–Comines canal and a point a few hundreds yards S. of the Ypres–Roulers railway, while the V. Army (consisting from right to left of the 9th, 55th, 58th, 51st and 20th Divs.) was to press forward on its left to as far N. as the Ypres–Staden railway. At no point was it proposed to gain more than a mile of ground in depth, and, except about the Ypres–Menin road and immediately to the N. of this, the furthest objectives given to the various divisions were not more than half a mile in advance of the existing line. The weather unfortunately broke during the night of the 19th–20th; but in spite of this the attacks achieved their object all along the front and the efforts of the II. Army were crowned with brilliant success in a sector where previous attempts had to a great extent failed, the crest of the main ridge on either side of the Ypres–Menin road being wrested from the enemy. The V. Army likewise appreciably improved its position. The losses of the attacking side on this day were relatively small, in view of the importance of what had been achieved, and 3,243 prisoners and several guns were taken.

Sir D. Haig followed up the success of the 20th without delay. A fresh thrust took place along a more restricted length of front on the 26th, from about half a mile S. of the Menin road to a point about a mile and a half N. of the Ypres–Roulers railway. The forces detailed for the enterprise, enumerating them from right to left, were the 39th, 33rd, Australian 5th and 4th Divs. of the II. Army, and the 3rd, 59th and 58th Divs. of the V. Army. The Germans had in the meantime been making desperate attempts to recover some of the ground which they had lost about the Menin road and Polygon wood, but without success; and in spite of their resolute opposition they were unable to prevent the British troops from attaining practically the whole of their objectives on the 26th. The rest of Polygon wood was captured, the British position was improved all along the line, and 1,600 prisoners were taken. That the losses should have been by no means heavy on this day as on the 20th showed how effective an answer the method of the shallow objective provided to the enemy's new plan of defence by depth. The combats of Sept. 20 and 26 having given almost the entire crest of the main ridge into British hands to a depth of a mile and a half in advance of the line taken up on July 31, Sir D. Haig arranged for a very important operation to take place on Oct. 4, the front this time extending from Polygon wood to the Ypres–Staden railway, although a minor advance was also to take place S. of Polygon wood and S. of the Menin road.

There was a severe gale accompanied by torrents of rain during the night of the 3rd, and the weather conditions on the following morning were so unfavourable that the ground was in most parts of the battle-field little better than a morass. The enemy moreover was in great strength, especially in the centre; two fresh divisions had been brought up into the German line and, as it happened, these together with the troops already on the spot were drawn up ready to deliver an assault which was timed to start ten minutes later than the hour that had been fixed for the British advance. The consequence was that when the British artillery barrage opened it caught hostile forces that were gathered in mass and it did great execution. The order of battle of the II. and V. Armies was as follows:—37th Div. of the IX. Corps on the extreme right, athwart the Menin road, then the X. Corps (5th, 21st, 7th Divs.) covering the front up to in front of Polygon wood, then the I. Anzac Corps (1st and 2nd Australian Divs.) reaching as far as the Ypres–Roulers railway, and, on their left again and forming the left of the II. Army, the II. Anzac Corps (Australian 3rd Div. and New Zealand Div.); the V. Army was represented by the XVIII. Corps (48th and 11th Divs.) next to the II. Anzac Corps, with the XIV. Corps (4th and 29th Divs.) on the extreme left. The attacking side gained a signal victory this day. Nearly all its objectives were secured, and the gains were especially important in the centre where a firm footing was won along the main ridge about the villages of Molenaarelsthoek and Broodesinde for a length of a mile and a half; a gentle spur stretching back north-westward from this and known as the Gravenstafel ridge was also wholly secured. A hold was gained further to the left on the important village of Poelkapelle on the Ypres–Roulers road; and along all the central part of the zone of operations the assailants pushed their line forward several hundred yards, thereby taking possession of ground of great tactical importance. 5,200 prisoners were taken, including 138 officers, and, besides a few guns, a large number of machine-guns and trench mortars were amongst the day's captures. Following as it did rapidly upon the successes of Sept. 20 and 26, the combat of Oct. 4 represented a highly satisfactory achievement, which had moreover been accomplished without very heavy sacrifice. It was not indeed the losses encountered in these well-defined actions that gave grounds for anxiety so much as the casualties which occurred day after day to troops that were clinging to exposed positions, where owing to the condition of the ground it was almost impossible to create effective cover.

A good defensive line had however now been secured. As a result of the offensive operations begun by General Plumer on June 7 and continued intermittently for four months, the crest of the long belt of high ground had been occupied from Messines to within a very few hundred yards of the Ypres–Roulers railway and the situation of the Allies in Flanders had been vastly improved in consequence. Possession of the Gravenstafel ridge would moreover enable Sir D. Haig to establish a strong flanking position, which would render it difficult for the Germans to recover the high ground they had lost by a turning movement from the N. But, regarding the Allied offensive in this part of the theatre of war as a whole, the work was in reality only begun. The Houthulst forest, with the long line of high ground forming the quadrant of a circle beyond it, was still in the enemy's hands. Until the ridge had been secured as far as the vicinity of Staden, it would be premature to embark on the second part of the general scheme of operations—attack on the German positions along the coast between Nieuport and Ostend. Sir D. Haig had now to decide whether he should continue his system of gradual advance N.E. of Ypres, or should call a halt.

"The year was far spent," he writes in his despatch. "The weather had been consistently unpropitious, and the state of the ground, in consequence of rain and shelling combined, made movement inconceivably difficult. The resultant delays had given the enemy time to bring up reinforcements and to organize his defence after each defeat. Even so, it was still the difficulty of movement far more than hostile resistance which continued to limit our progress, and which now made it doubtful whether the capture of the remainder of the ridge before winter finally set in was possible. On the other hand there was no reason to anticipate an abnormally wet October. The enemy had suffered severely, as was evidenced by the number of prisoners in our hands, by the costly failure of his repeated counter-attacks, and by the symptoms of confusion and discouragement in his ranks. . . . After weighing these considerations, as well as the general situation and various other factors affecting the problem, among them the desirability of assisting our Allies in the operations to be carried out by them on Oct. 23 in the neighbourhood of Malmaison, I decided to continue the offensive further and to renew the advance at the earliest possible moment consistent with adequate preparation."

That the British commander-in-chief in arriving at this decision was largely governed by considerations to which expression could not appropriately be given in a despatch sent in so early as Dec. 25 1917, there can be little doubt. However favourable Oct. weather might be, the whole of the ridge together with the Houthulst forest was most unlikely to fall into the Allies' hands before the winter set in. The persistent rains had had too great an effect upon the soil for this to recover from it before the spring, even if the rest of the autumn were to be dry and favourable. For the offensive plan, as originally conceived, to be carried out in its entirety even in an ordinary season, Sir D. Haig's forces ought to have attained the positions which they had only secured by Oct. 4, at least two months earlier. But he was aware that the fighting capacity of the French armies was for the moment diminished by grave internal troubles, the Russian collapse had set free large hostile forces which were being rapidly transferred to the western front, and if the British offensive ceased, the enemy would regain the initiative and would be free to assail the French front wherever this happened to be weakest. It followed that the British, in spite of the difficulties in the way, must continue their offensive until the coming of winter put an end for the time being to the danger of a German counter-attack.

The hopes which had been entertained at G.H.Q. that Oct. might bring dry weather after the heavy rains experienced in Aug. and Sept., were doomed to disappointment. The days immediately following the combat of Oct. 4 proved worse than ever, and the troops suffered great hardships besides losing many men from hostile shell-fire owing to the lack of protection; they had to trust for shelter to shallow trenches hastily scooped out to join together adjacent shell-holes. The enemy however had been so roughly handled on the 4th that any counter-attacks which were attempted from the hostile lines had little force in them. In spite of the unfavourable climatic conditions a fresh attack was arranged for Oct. 9, the front on this occasion extending from about the Ypres–Roulers railway to the extreme left near Merckem. The order of battle of the II. and V. Armies was as follows:—Anzac I. Corps (Australian I.), Anzac II. Corps (66th and 49th Divs.), representing the II. Army; XVIII. Corps (46th, 48th and 11th Divs.), XIV. Corps (4th, 29th and Guards Divs.), representing the V. Army. On the left of these again was the French I. Army. The night of the 8th was particularly dark, there was heavy rain, and considerable trouble was met with in mustering the troops for the assault so that this was carried out under conditions of extraordinary difficulty. The advance was on this day, in accordance with the programme, pushed farthest forward on the left and about the left centre. The outskirts of the Houthulst forest were gained by the French in spite of much of the low-lying ground being actually under water, and the British troops on their right made good the ground to a depth of a mile and a half about Langemarck. On the right the assailants were strongly opposed and lost heavily, but they nevertheless gained their objectives along most of their front. 2,100 prisoners in all were taken, with a few guns, and the day's operations could be reckoned as representing a substantial success, if at heavy cost.

A fresh advance was attempted on Oct. 12 in spite of a continuance of the bad weather and of the ground being in a terrible state. It should be mentioned that in all this later fighting forming part of the great Flanders offensive, the Allied infantry were seriously handicapped by lack of heavy gun support. In such a sea of mud the larger types of howitzer could not be got forward, and in spite of bold and skilful handling the field artillery did not provide an effective substitute. With the Germans it was different. Their heavy ordnance when it was required to move was generally traversing ground that had not been torn up by months of shell-fire and where roads were still in being. The front of attack covered on the 12th was approximately the same as that covered on the 9th and the objectives given to the various divisions only called for an advance of a comparatively short distance; but many of the lower valleys were found to be absolutely impassable owing to the floods, and the operation eventually was not persisted in at most points. 1,000 prisoners were taken, but the attacking side lost heavily, and, although the unsatisfactory result of the effort from the British point of view was attributable to the elements rather than to the enemy, this day's fighting amounted to an undoubted reverse to the cause of the Allies.

All hope of making any appreciable gains of ground except in one particular sector was now abandoned by G.H.Q., although the front was slightly pushed forward in the region of the Houthulst forest by dint of some skilfully carried out minor operations during the next few days. The one sector where it was determined to continue the offensive was the ground between the Ypres–Roulers railway and the neighbourhood of Poelkapelle. The II. Army was in possession of the crest of the ridge about Broodseinde and where the railway traverses this; but further to the left the line ran diagonally across the rearward slope of the heights and was commanded from these at short range. Having once pushed forward beyond the front that had been taken up as a result of the successful combat of Oct. 4, it had become almost imperative to secure possession of the village of Passchendaele as well as some rising ground immediately to the N. and N.W. of that place, and to arrange that the line should run back in a westerly direction from this point, at right angles to, and not diagonally across, the ridge. This would create a sharp salient; but Passchendaele was a commanding point, and the lie of the ground between it and Poelkapelle would favour the establishment of a strong defensive line for the winter. Sir D. Haig therefore decided to continue the offensive immediately to the N. of the Ypres–Roulers railway on a narrow front, and in order to give this a fresh impetus he brought the Canadian Corps round from Lens. A number of readjustments of the order of battle of the II. and V. Armies also took place, for some of the troops about Ypres were required for the offensive secretly prepared in the Cambrai region.

The weather after Oct. 12 showed distinct signs of improvement, although at this late season of the year there could be no hope of the saturated soil recovering very appreciably from the effects of those abnormal autumn rains which had proved the most formidable antagonist of the Allies in Belgian Flanders. But the signs proved delusive, for on the 25th, the very day before a fresh attack had been arranged, heavy rain set in again. This operation only covered the front between the Ypres–Roulers railway and Poelkapelle, the main advance being intended to take place in the right centre and right. The troops detailed for the undertaking were, enumerating them from right to left, the Australian 1st Div., the Canadian 4th and 3rd Divs., the 63rd Div., and part of the 58th Div. But what amounted to an independent operation (except in that it must occupy the enemy's attention on a part of the front only about 2 m. from the main attack) was also undertaken on this day by the 5th and 7th Divs. on either side of the Ypres–Menin road. In spite of unfavourable weather and the deplorable state of the ground important progress was made by the Australian and Canadian troops, the latter getting up close to Passchendaele and successfully withstanding heavy counter-attacks in most portions of the ground which they had won. The 63rd and 58th Divs. also reached their objectives, but they were not called upon to push the line forward more than a short distance, their task rather being to link up the ground won by the Canadians with the old line near Poelkapelle. Some hundreds of prisoners were taken. The operation further to the S., on the other hand, which only had a very limited objective, was unsuccessful. The purpose had been to capture the village of Gheluvelt and to improve the position somewhat a little further to the N.; the possession of Gheluvelt on its well-defined spur running south-eastward would create as it were a bastion to flank the forward slopes on either hand. But after very nearly gaining their objectives at the outset, both the 7th and the 5th Divs. were driven back to their starting point, and they suffered heavily in casualties during a furious combat. With the ground in the condition that it was in, rifles were apt to become choked with mud, while percussion shell buried themselves in the swamp doing little harm by their explosion; these conditions however affected both sides equally.

Between the 26th and the 28th Belgian and French troops made an important gain of ground on the extreme left of the line, securing possession of the flats as far forward as the Blankaart lake. And on the 30th a fresh attack was made between the Ypres–Roulers railway and Poelkapelle by the same troops as had fought on the 26th, but on a narrower front this day as most of the high ground in the direction of Passchendaele which Sir D. Haig was anxious to occupy had been captured in the previous combat. Some progress was made; but the Germans offered a very stout resistance at important points, although at others they showed some symptoms of losing heart and some of them even abandoned their posts at the outbreak of the fight. Owing to the front of attack now being restricted and to the object which the assailants had in mind being obvious, the enemy was concentrating a very heavy artillery fire upon the area that formed the battle-field, and in their efforts to get to Passchendaele the Canadians suffered heavy losses on this day. The 63rd and 58th Divs., further to the left and attempting to get forward on lower ground, found this almost impassable and they only advanced their line slightly here and there. But up on the main ridge what had been achieved paved the way for a brilliant success a week later. At dawn on Nov. 6 the Canadian 2nd and 1st Divs. suddenly advanced and captured Passchendaele together with the somewhat higher ground immediately to the N. and N.W. of the village, also taking 400 prisoners. This fine achievement can fairly be set down as the closing incident in what has been called "The Third Battle of Ypres." One or two attempts were made within the next few days to improve the position in the sector where the Canadians had made such substantial gains, and these were partially successful, but they did not appreciably modify the situation.

The prolonged succession of combats, many of them (such as the capture of the Messines–Wytschaete ridge by the II. Army and the very successful operations on July 31 and Oct. 4) reckoning as unqualified victories to the credit of the Allies, had transformed the situation in Flanders. The chain of heights from N. of Armentières to Passchendaele had changed hands. The Ypres salient, vastly extended, so far from its constituting a weak and barely defensible sector of the Allies' front, had become a serious danger to the enemy. Sir D. Haig had secured an excellent defensive position between the Yser and the Lys. Great hostile forces had been kept fettered to the north-western extremity of the western front, striving to maintain possession of a tract that had been captured by the invaders some three years before. But the main object for which the offensive had been undertaken had been only very partially attained. The German hold upon the coast district remained unshaken. The line of high ground to the N. of Passchendaele and circling round beyond the further outskirts of the Houthulst forest, as also that forest itself, remained in the enemy's hands. The third battle of Ypres, chiefly perhaps because of unfortunate delays in starting the operations and of untoward weather conditions after they had been started, had not prepared the way as had been intended for subsequent advance upon Ostend and the great plains N. of the Lys. (C. E. C.)

IV. Battles of September 1918

At the end of Aug. 1918, when the French counter-offensive, commenced on July 18, and the British counter-offensive, begun on Aug. 8th, had both been crowned with success, the initiative in strategy had been definitely taken out of the hands of the German command. The enemy had been driven from the salients of Château-Thierry and Montdidier, which were his conquests of March and May.

Thanks to British shipping, each month 250,000 American soldiers were being landed on French soil, and this increasing wave of troops, young and fresh, gave the Allies a superiority in numbers and *matériel* which grew day by day.

Desiring that the enemy should have no opportunity to recover from disorganization and fatigue, Marshal Foch proposed to continue the operations by a triple attack, to which end three actions were to commence about Sept. 25 at 24-hour intervals.

The American I. Army and the French IV. Army were to attack on both sides of the Argonne in the general direction of Mézières. The British I., III. and IV. Armies and the French I. Army were to push towards Cambrai and St. Quentin, and break through the famous Siegfried position or Hindenburg line. The Belgian army, the British II. Army and certain French divisions, who would presently join them, formed the group of the armies in Flanders under the supreme command of H.M. the King of the Belgians, and would undertake the operations in Flanders. This force in the first place was to secure the Flanders ridge and having conquered this to push on the left wing toward Bruges–Ghent with the object of freeing the Belgian coast, while the right wing would push toward Courtrai–Renaix in such a manner as to cause the evacuation without fighting of that vast inhabited region Lille–Roubaix–Tourcoing.

At the request of King Albert, General Degoutte of the French army took over the duties of chief-of-staff of the group of armies in Flanders.

The German Position.—The Belgian army and the British II. Army were ordered to seize the Flanders heights, the line which, starting from Hill 10 toward the S.E. of Dixmude, reaches Hill 43 at Clercken, passes round the forest of Houthulst by the Stadenberg, passes by Westroosebeke, Passchendaele, Zonnebeke, beyond Ypres to Gheluvelt, Hill 60, Wytschaete and Messines. The line continues to the right toward the W. by Mont Kemmel, Mont Rouge, Mont Noir and Mont des Cats, which form the watershed of the rivers Yser and Lys.

At this period nine German divisions held the sector Dixmude–Armentières: three or four being at rest behind the front line. The first line of German trenches passed by Dixmude, Woumen, the Chateau Blanckaert, Langemarck, St. Julien, Zillebeke, St. Eloi, Wytschaete, Messines, and the river Lys to the W. of Armentières. This was a zone of cover behind which the Germans had echeloned four successive positions, the product of four years of stability which had been strengthened with particular care in 1917 to resist the British offensive that year.

These were characterized by the use of concrete groups, very numerous and strong, of the type of the famous "pill-boxes" of Stirling Castle, Inverness Copse and Poelkapelle. Some of these contained sections of artillery with gunners and ammunition: generally they sheltered one or two sections of machine-guns, the fire of which covered the intervals and afforded flanking fire to each other. Everywhere were vast stretches of a network of barbed wire in front of dugouts and trenches affording an entire continuity of obstacles.

The terrain of the attacks had been entirely overturned by the bombardments in the British offensives of 1917: every vestige of cover had disappeared; only some mounds of walls marked the position of villages; the soil was riddled by the shell-holes adjoining each other; the land drainage system no longer functioned, every ditch was full of water and the field of battle everywhere was a vast and foetid bog (slough) in which progress was arduous. The network of roads was hidden under the mud and any advance would be as difficult for the lines of skirmishers as for the artillery horse-teams and the supply convoys.

The German artillery had the advantage of the commanding positions. Their observation posts on the ridges enabled them to fight effectively over the entire country of the attack. Again, in the centre of the sector assigned to the Belgian offensive stands the forest of Houthulst, a renowned strong-point, and a bastion for artillery which dominated with its fire a great part of the Belgian and British fronts. As Marlborough had said:—"Whoever is Master of the Forest of Houthulst is Master of Flanders."

Plan of Attack.—About Sept. 15 the Belgian army, 12 divs. of infantry and one of cavalry, held a front of 35 km. from the sea at Nieuport-Bains to the northern outskirts of Ypres.

The British II. Army, 10 divs. of infantry (General Plumer), occupied the sector Ypres–Armentières, about 20 km. in length.

The *moral* of the two armies was excellent: the British troops aspiring to seize from the enemy the fruits of their successes in the spring; the Belgians seeing the day at length dawn, which they had so anxiously awaited, when they should leave the lines on the Yser and hasten to the deliverance of their country.

King Albert, commander-in-chief of the group, decided that the first operation should have as its object the conquest of the following objectives. For the Belgian army: Dixmude, Clercken, Stadenberg, Passchendaele, Broodseinde. For the British army: Molenaershoek, Polygon wood, Hill 60. From these points the armies would advance eventually to the attack on subsequent objectives. The Belgian army placed 11 divisions in the line, of which one was a French division; the British army employed six divisions. On the extreme left, two Belgian divisions remained in their sector on the front Nieuport–Dixmude. They were to hold themselves in readiness to push forward on the first order and clean up the left bank of the Yser in the inundated area, and to take the opportunity to release the flood-water. On the extreme right, the British divisions which were furthest S. were to watch for any indication of weakness in the enemy in order to follow up and hasten his retreat. Two divisions of French infantry which were now arriving, and the division of Belgian cavalry, constituted the general reserve.

The Belgian 4th Div. crossing the Yser immediately to the S. of Dixmude was to secure the ruins of the village and seize the former line N. of Dixmude and Zarren and the length of the canal of Houdzaeme. The British 14th Div. formed the flank-guard at St. Eloi. The frontage of the principal attack was—Clercken–Gheluvelt—a little over 20 km. in length, so that the frontage of attack of each division of the first line was about 2 kilometres. The British 9th and 29th Divs. placed two brigades in the first line and one brigade in the second line; the 35th Div. had all three brigades in the first line. All the Belgian divisions uniformly adopted the *carrée* formation: all of their three regiments were together; in each regiment the battalion in the first line pushed straight ahead, the battalion in the second line advanced taking special care to reduce any strong points of resistance and clearing up any such positions overrun by the first line: the battalion in the third line, held as long as possible in reserve, was employed to pass eventually the first line and thus to undertake the continuation of the advance. In this formation the Belgian army had 24 regiments in the front line placed side by side in three lines of battalions. This offensive disposition is noteworthy. Taking everything into consideration, there is no other example in the whole war of the deployment of an army which shows more audacity, more determination, which promised a greater promptitude in employing all units, and greater rapidity in opening up the battle.

The Belgian army, united to a strong contingent of French and British artillery, formed a mass of artillery of 1,550 guns, of which 280 were trench guns and 500 heavy artillery. The British II. Army had about 1,000 pieces, of which half were heavy. Therefore on the actual frontage of the attack Dixmude–St. Eloi (about 25 km.) the Allies possessed some 1,800 guns both heavy and field, independently of trench artillery. The greater part of the Belgian batteries had been placed E. of the Yser canal at Ypres; a certain number held a position to the E. of Martjevaart and also in the peninsula of Luyghem, only those batteries of very long range and insufficiently mobile remained on the W. bank of the canal.

The attack was to be preceded by a violent preparatory bombardment of one duration of three hours. The movement of the artillery during the advance was made the subject of special orders, and it was arranged that in each division of the first line a group of 7·5 would be allotted to accompany it and distributed at the strength of one battery for each regiment of infantry.

Action of Sept. 28.—All the preparations for the attack had been carried out with the greatest secrecy. Artillery action had been very feeble for many days. Batteries and ammunition had been pushed forward and installed in the first lines under cover of careful camouflage; divisions had been concentrated in the sectors of attack and had been deployed for the battle entirely by night marches. On Sept. 28 at 02:00 (morning) the 17 divisions were in their battle positions; a vast body of men ready to march against the enemy with enthusiasm and in perfect order. At 02:30 hours there commenced on the whole front of the two armies a powerful bombardment of preparation which was to last for three hours. At 05:30 hours the infantry left their advance positions preceded by a creeping barrage.

The rain almost at once commenced to fall heavily, making every movement yet more laborious. Overcoming every obstacle they encountered, the Belgians secured in one magnificent sweep the Francken, Preussen and Bayern Stellung.

At 07:30 the last obstacle was passed, except for the northern group, and the field artillery proceeded on their way to accompany immediately the subsequent attacks. The enemy only feebly counter-attacked. The northern group had at the outset encountered a stubborn resistance at the Château Blanckaert which the defenders held to the death, as well as an adjoining farm. These strong-points were not secured until about midday. Beyond the Bayern Stellung the Germans counter-attacked and put up a vigorous defence.

In the northern group the centre of the attack was the conquest of the forest of Houthulst, filled with obstacles and ambushes, and in addition the burnt trunks of trees and torn branches—the result of four years of bombardment—proved an impenetrable entanglement where advance was only possible along the straight drives set at right angles, and these were barred by wire and enfiladed by machine-guns.

On the left, while the Belgian 4th Div. seized Rille and St Pieters, the Belgian 1st Div. secured the Château Blanckaert, Hoog Kwartier, while with a gallant rush the 22nd Regt., having conquered at the point of the bayonet many batteries which the gunners fired until the last moment, arrived at the crossroads of Houthulst at 11:00 hours and occupied it.

On the right, the Belgian 7th Div. drove right through the forest and arrived at the end of the day on the eastern boundary, having conquered it entirely with many dozen of cannon and important material.

In the centre group the Belgian 3rd Div. reached without difficulty the heights by the station of Poelkapelle, where they held up some violent counter-attacks which debouched from the S.E. corner of the forest; these attacks were strongly thrown back as far as Schaap-Ballie, which the division occupied at the same time as the 9th Div. arrived at the outskirts of Westroosebeke.

In the southern group the 6th and 12th Divs., held up by the terrible condition of the ground, reached halfway to the crest-line Westroosebeke–Passchendaele and found the enemy occupying in force this strong position. Further bombardments by the artillery and many assaults left the situation unchanged. Toward the end of the afternoon a strong German counter-attack forced itself into line after line of the 6th Div. However, the 8th Div., which had seized Broodseinde, advanced on Moorslede and at 20:00 hours the 4th Carabineers took Passchendaele by assault. To summarize, the nine Belgian divisions of infantry which had been engaged, accomplished under heavy rain an advance of about 8 km. across the most appalling country bristling with every defensive accessory and abundantly furnished with machine-guns; they had conquered the famous bastion of the forest of Houthulst and captured over 4,000 prisoners besides considerable material.

As for the British II. and XIX. Army Corps, they had reached all their objectives: Becelaere by the 9th Div., Krviseecke by the 29th Div., Zandvoorde by the 35th Div. Thus on the first day over the whole frontage of the Belgo-British attack there had been greatly exceeded the extreme limits of the victories of the third battle of Ypres (July–Nov. 1917)—that battle of giants wherein 51 divisions of British and 78 divisions of the Germans had disputed the same country foot by foot for four months with a vigour unknown in history.

Action of Sept. 29.—It was of importance that this brilliant success should be followed up with the greatest vigour. The following day the battle recommenced at 06:00 hours after artillery preparation of half an hour. It was intended to force the *Flandern II. Stellung.* In the northern group, after the 1st Div. had secured Clercken and Ternst, the 10th Div. conquered Ruvter Hoeck and Zarren. At 09:00 hours the 4th Div. had taken Woumen and Eessen and proceeded to encircle Dixmude. Toward noon the division proceeded to clear up the town. With the central group, the battle was particularly vigorous: the 3rd Div. occupied in the first place Vyewege and in the afternoon made an assault on Stadenberg, which was secured at 16:45 hours after an obstinate fight.

The 9th Div. threw six attacks against Westroosebeke without gaining a foothold.

In the southern group the 8th Div., followed by the 11th Div. and fighting side by side with the British 9th Div., prepared to attack Moorslede when the latter division was carrying Keiberg. About 13:00 hours the 8th Div. found itself 500 metres W. of Moorslede. The attack was made at 14:00 and secured the position after a severe fight, and completely forcing the enemy line, advanced the 7th Regt. toward St. Pieter, on the road Menin–Roulers, which was occupied at nightfall. On the left, the 12th Div. was taking the woods of Kalve and Calliemolenhoeck; to the right the British 9th Div. secured Keiberg and penetrated into Danizeele. During the day's action four fresh German divisions were encountered.

Action of Sept. 30.—On Sept. 30 the 3rd Div. occupied Staden; the Belgian 9th Div. entered the evacuated Westroosebeke and occupied the outskirts of Oostnieuwkerke.

The other divisions undertook by certain local engagements to rectify a frontage which was based on the first line of the *Flandern I. Stellung.* This position, established by the Germans in 1917, was strongly held, abundantly furnished with machine-guns and barbed wire, and supported by the artillery disposed on the whole front from Handzaeme to St. Pieter.

The first days of Oct. marked a halt in the operations. Only on the outskirts of Oostnieuwkerke and of Moorslede were there any lively combats. In front of the British the Germans menaced by the salient of Moorslede were withdrawing progressively their front line to the line of Wedlghem–Comines–Warneton, in front of which the troops of Gen. Sir H. Plumer installed themselves at 17:00 hours.

To sum up, the Belgo-British offensive which was delivered on Sept. 28 gave the most highly satisfactory results.

The progress realized had carried the Allied front about 15 km. from their starting point. The whole of the heights of Flanders was conquered. More than 8,000 prisoners, of which 6,000 were taken by the Belgians, were captured. 500 guns, machine-guns and material in proportion were the spoil of the victors. Thirteen German divisions had been engaged.

This rapid advance carried the Allied divisions beyond the zone of country so deeply cut up during the battles of Ypres. It was not possible to continue the advance before having built up across this historic stretch of mud sufficient communications for food and supplies for the troops. The reëstablishment of a network of communications in this country, so completely cut up and full of water, constituted a delicate and most arduous task, which in spite of all efforts ought to have stopped the operations for a considerable time.

The crisis was most acute for two or three days, and certain divisions existed altogether on food supplies thrown from aeroplanes. Thanks to the most vigilant activity the troops found themselves ready to take up the offensive on Oct. 14. The success took them this time to Bruges and Courtrai, and assured the freeing of the coast and evacuation of the region round Lille.

Battle of Courtrai–Thielt–Thourout.—The battle of Sept. 28–29 had put the Belgo-British in possession of the heights of Flanders, and had taken the Allied armies in one bound beyond the country of the Ypres battles. The reëstablishment of communications across this zone absorbed the first days of Oct. On Oct. 6 the King of the Belgians sent out instructions for the continuance of operations.

The intention of King Albert was that, taking as a base of departure the positions conquered at the end of Sept., the Belgian right flank and the British on the left flank should push vigorously toward the last and seize the knot of communications at Thourout, Thielt and Courtrai.

These points conquered, an advance should be made from Thourout in the direction of Bruges, which would inevitably insure the deliverance of Ostend and of all the coast. Proceeding from Courtrai and combining their movements with the British I. Army which was marching on Valenciennes, the British II. Army would undoubtedly cause, probably without fighting, the liberation of the populous and industrial region Lille–Roubaix–Tourcoing. In consequence the Belgian army, reinforced by the French VII. and XXXIV. Corps, would seize the plateau of Hooglede–Gits and the centres of Thourout, Thielt and Oostroosebeke, and then be prepared to follow the enemy towards Bruges and Ghent. The British II. Army would carry on the front on the Lys from Harlebeke to Menin. It would proceed to follow the enemy as far as the Scheldt. The II. Cavalry Corps and two divisions of French infantry would remain under the immediate orders of the King as a mobile reserve.

From Oct. 7 the corps commanders had caused the necessary cannonade to effect breaches in the wire entanglements and for the destruction of the most important enemy defences. On Oct. 14 the general attack was launched at 05:30 hours without any further artillery preparation.

The German order of battle was as follows from N. to S.:—38 Div. L.; 3 Div. R.; 36 Div. R.; Div. Guards Reserve; 1 Div. R.B.; 6 Div. R. B.; 11 Div. R.; 56 Div.; 12 Div. These divisions had all their three regiments side by side and in each regiment two battalions were placed in the first line. They were on the alert, and the three battalions occupied their battle positions.

However, the first lines of the enemy were quickly captured. The German defence was chiefly based on the employment of machine-guns. The Allied smoke-shells created a dense cloud which in the majority of cases prevented the enemy from making effective use of his weapons. The reply of the German guns was very serious, and very many heavy pieces on rails were employed. In the course of the day, six support divisions were brought into the line: they were used less for counter-attacking than to strengthen the front where broken.

In the evening the northern Belgian group had conquered Handzaeme as well as Cortemarck: the French, assisted by many sections of tanks, had secured Hooglede and Roulers.

The southern Belgian group, led by the valiant 3rd Div., had completely defeated the Guards Reserve Div. and the Bavarian 1st Reserve Div.: they had taken Rumbeke, Ouckene, pushed almost to the gates of Iseghem and captured 1,300 prisoners and many batteries, of which some had both teams and personnel.

Further S., the British forces had thrown back the enemy on the Lys in the neighbourhood of Menin, and had taken Wynberg, the western outskirts of Gulleghem and Wimkel St. Eloi. 20 enemy aeroplanes had been brought down.

On Oct. 15, while the Belgians in the N. gained ground to within 2 km. of Thourout and the British in the S. captured Gulleghem and then Heule, the indefatigable 3rd Div. (Belgian) passed through Lemdelede at 11:00 hours and Cappelle Ste. Catherine, and the 9th Regt. of the line pushed on irresistibly almost to Bavichove near the Lys.

On Oct. 16, after half an hour of artillery preparation, the attack recommenced on the whole front. The northern Belgian group captured the wood of Wymedaele and of Thourout, the French pushing on beyond Lichtervelde and Ardoye; the southern Belgian group occupied Iseghem and Ingelmonster, the 3rd Div. touching the canal at Roulers and the Lys at Oyghem and Bavichove. Thus were gathered the fruits of victory. The enemy front, everywhere completely shaken, beat a retreat. The German Marine Divs. evacuated the coast sector which they had guarded for four years.

Explosions and fires announced that the enemy was destroying his installations and his depots at Middlekerke, Smaeskerke, at Ostend and Guistelles. In the evening the coast-guns, levelled for so many months toward the sea, fired in haste some rounds at the Belgian bivouacs before being rendered useless.

On Oct. 18, in the evening, the Belgian front reached Zeebrugge and Bruges. The British bordered all the Lys from Menin to Harkebeke and penetrated into Courtrai.

On Oct. 20 the Germans were thrown back on the canal of the Lys behind which they momentarily held a position from Eccloo to Deynze. The British II. Army crossed the Lys at Courtrai, occupied on the right Rolleghem and Leers, and made certain the evacuation of Roubaix, while the left was pushed toward Anseghem. By Oct. 31 the British had reached the Scheldt from Kerkhove to Pecq, joining the British V. Army.

The battle of Thourout–Thielt–Courtrai was finished. Under protection of their rear-guards the broken German front turned itself to the E., followed by the Allies as quickly as the restoration of the network of roads permitted.

From Oct. 14 to 31 the group of the armies of Flanders had taken 19,000 prisoners and advanced 50 km. It had gloriously achieved the double mission entrusted to it by King Albert: the region of Lille was entered and set free; the coast and an important portion of Belgian territory had been reconquered.

Belgians, British and French had rivalled each other in their ardour and bravery. The submarine base of Bruges, the famous batteries of Tirpitz, Hindenburg and Deutschland, and more than 100 coast-defence guns of very great calibre remained as trophies taken from the enemy,—marking the downfall of the ambitions of the Germans. (R. VAN O.)

YUAN SHIH-K'AI (1859–1916), Chinese statesman, born 1859, first attained distinction in Korea, when, as Imperial resident and the trusted lieutenant of the Viceroy Li Hung-Chang, he strove to preserve China's suzerainty over the Hermit Kingdom in the years of strife which preceded the war between China and Japan (1894). After that disastrous campaign he held office under the Viceroy Li in Chihli; in 1898 he was in command of an army corps and played a decisive part in frustrating the Emperor's plan of constitutional reform and in supporting the Empress Dowager's reactionary *coup d'etat*. After her return to power he rose rapidly; during the Boxer rebellion, as governor of Shantung, he displayed sagacious foresight in the protection of foreigners, and upon the death of Li Hung-Chang succeeded his chief as Viceroy of Chihli. At the time of the death of the Empress Dowager (1908) he was a Grand Councillor and her most trusted adviser; but upon the accession to power of Prince Chun as regent he was dismissed from office (in retribution for his failure to support the Emperor in 1898) and ordered to return to his native place in Honan (Jan. 2 1909). He remained there, in disgrace, until the outbreak of the revolution in 1911, when the regent and the court, alarmed at the rapid spread of the movement, turned to him for help. By an edict of Oct. 14 he was appointed Viceroy of Hunan and Hupeh and commander-in-chief of the Imperial forces. As military dictator he took the field a fortnight later against the revolutionary army at Hankow. Thereafter, until his death (June 1916) the Government of China, such as it was, lay in his hands. After the abdication of the Manchu Dynasty, which he had done his best to uphold, he accepted the Presidency of the Republic and took the oath of office in March 1912; but he did so with mental reservations which were obvious to those who had followed his career and observed his policy. As President he displayed statesmanship of a high order under conditions of exceptional difficulty. Judged by European standards, his methods were often indefensible, but until he aspired to found a new dynasty in his own person (1915) their ruthlessness and venal expediency were generally accepted by the nation without indignation, and regarded as consistent with time-honoured traditions of rulership. All his efforts of statecraft were steadily directed towards restoring the authority of the central Government, shattered by the revolution, and with it, the principles and practice of benevolent despotism. His monarchical plans were skilfully laid and would probably have succeeded if he had had to deal only with his own people; they failed, and he died a broken and humiliated man, because he had not allowed for the probability of intervention by the Japanese Government. His enthronement as Emperor had been fixed by proclamation for Feb. 9 1916; before that date the Yünnan rebellion had vindicated the "advice" of the Japanese minister at Peking, and the end of his career was in sight. But he declined to resign the Presidency, and died, as he had lived, in harness.

YUDENICH, NIKOLAI (1862–), Russian general, was born in 1862 and entered the army in 1881. Passing out of the General Staff College in 1887, he spent the rest of his military service on the general staff and specially in Turkestan, till in 1902 he became a regimental commander. In the Russo-Japanese War of 1904–5, in which he was wounded, he had the reputation of a valiant and careful chief. He became a general and commander of a rifle brigade in 1905, assistant chief-of-staff of the Caucasian military district in 1907, and chief of the same staff in 1913. Having carefully studied the Caucasus and its army, he was quite prepared for the conduct of operations on this front, and at the beginning of the World War he rendered great services in the crisis and victory of Sarikamish as commander of the II. Turkestan Corps. Soon afterwards he was put in command of all the military forces of the Caucasus, which he held during the operations of 1915 until the arrival of the Grand Duke Nicolai. He continued to serve on this front under the new governor-general and played a leading part in the operations which led to the fall of Erzerum on Feb. 16 1916. In the summer campaign further progress was made, and Baiburt and Erzinjan were taken. Later, when the advance had outrun the organization of the rear, the situation was saved by his prompt manœuvres.

In March 1917, on the departure of the Grand Duke, Gen. Yudenich again undertook the command of the Caucasian armies, but here, as elsewhere, further advance was paralysed by the increasing disorganization of the Russian army. In the course of the civil wars Gen. Yudenich in 1920 carried out a campaign from the Baltic provinces against Petrograd, but unsuccessfully.

YUGOSLAVIA, or JUGOSLAVIA.—The "Kingdom of the Serbs, Croats and Slovenes" (*Kraljevina Srba Hrvata i Slovenaca*), more commonly known as Yugoslavia, came into being in the closing months of 1918 as a result of the collapse of Austria-Hungary and the voluntary union of its Yugoslav territories with the former Kingdoms of Serbia and Montenegro. In point of international law, its existence may be said to date from Dec. 1 1918, when the Prince-Regent Alexander of Serbia formally complied with the invitation of the Yugoslav National Council to assume the regency over the sister provinces also. That the Great Powers were so long in according official recognition to the new state was due to purely political reasons connected with the Adriatic dispute.

Yugoslavia consists of the former independent Kingdoms of Serbia and Montenegro; the triune Kingdom of Croatia–Slavonia–Dalmatia (of which the first two enjoyed special autonomy under the Kingdom of Hungary, and sent 40 delegates from their own Parliament in Zagreb to that of Budapest, while the third was one of the 17 provinces of the Austrian Empire, with a local diet at Zara); parts of the Banat, Bačka and Baranja (which were integral portions of Hungary proper); Slovenia (consisting of portions of Carniola, Carinthia, Styria and Istria, each holding a position in Austria analogous to Dalmatia); and Bosnia-Herzegovina (which was from 1878 to 1918 under the joint administration of Austria and Hungary and had its own diet since 1910). Fiume, which from 1867 to 1918 had been an

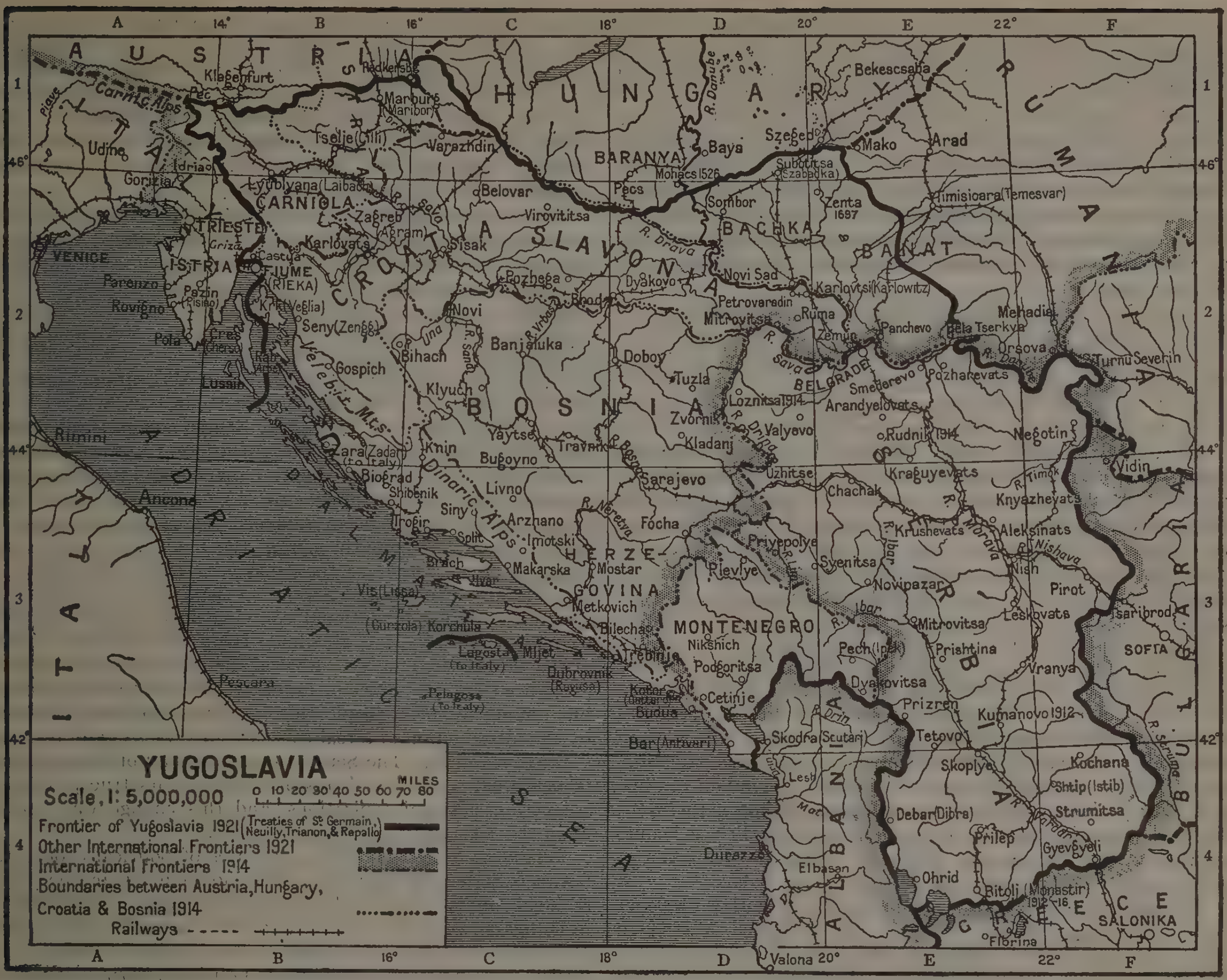
YUGOSLAVIA
Scale, 1: 5,000,000
MILES 0 10 20 30 40 50 60 70 80
Frontier of Yugoslavia 1921 (Treaties of St Germain, Neuilly, Trianon, & Rapallo)
Other International Frontiers 1921
International Frontiers 1914
Boundaries between Austria, Hungary, Croatia & Bosnia 1914
Railways
AUSTRIA
HUNGARY
RUMANIA
ITALY
CARNIOLA
CROATIA
SLAVONIA
BOSNIA
HERZEGOVINA
MONTENEGRO
SERBIA
BULGARIA
ALBANIA
GREECE
DALMATIA
ISTRIA
BACHKA
BANAT
BARANYA
ADRIATIC SEA
Dinaric Alps
Velebit Mts.
Carnic Alps
Klagenfurt
Maribor
Zagreb (Agram)
Lyublyana (Laibach)
Trieste
Fiume (Rieka)
Venice
Belgrade
Sarajevo
Mostar
Dubrovnik (Ragusa)
Cetinje
Skodra (Scutari)
Skoplye
Bitolj (Monastir)
Salonika
Sofia
Novi Sad
Szeged
Timisioara (Temesvar)
Nish
Durazzo
Valona

autonomous unit under Hungary, has by the Treaty of Rapallo been constituted as an independent State. Italy has acquired almost all the Slovene and Croat districts of Gorizia and Istria.

A census of the new State was taken in the spring of 1921, the total pop. being 12,162,900.

Early Tendencies Toward Unity.—The Yugoslav movement was by no means a recent one, as is often assumed. Despite the different traditions of culture due to the rival ecclesiastical influence of Rome and Byzantium, a sense of kinship had survived throughout centuries of separation, and was strengthened by continual migration. The two most notable cases were the formation of the Uskok pirate settlements along the Dalmatian coast in the 16th century, and the settlement of the Serbian patriarch and many thousand Serb refugee families in Slavonia and S. Hungary, at the invitation of the Emperor Leopold I. in 1690. Ivan Gundulić and the brilliant group of poets that gathered round him at Ragusa in the early 17th century, reflected in their writings the little Slav Republic's intimate connexion with its kinsmen of Serbia and Bosnia. The first advocate of the Pan-Slav idea in Russia itself was Križanić, a Croat Catholic priest from Dalmatia, and early writers in favour of Slavonic racial and literary unity were the Slovene schoolmaster Bohoricz (1584) and the Dalmatian Croat Orbini, who wrote in Italian (*Il regno degli Slavi* 1601). The Franciscan friar Kačić, who did so much for the revival of popular poetry in Bosnia and Dalmatia in the mid-18th century, shows similar traces of Serbophil feeling, and the achievements of Dušan and other Serbian Tsars have bulked almost as largely in the modern literature of the Croats as of the Serbs themselves.

The first active impulse toward political unity was given by Napoleon, when after Wagram he erected the Slovene districts and most of Croatia and Dalmatia into a separate Illyrian State, incorporated in the French Empire, but having its administrative capital at Laibach. This short-lived experiment, which inspired the muse of Vodnik, the first Slovene poet of real mark, had its aftermath in the Illyrian movement of the forties, which centred in Zagreb, the Croatian capital. Its real motive force was supplied by Ljudevit Gaj, who combined to a remarkable degree the qualities of author, philologist and political agitator. His two newspapers, the *Illyrian National Gazette* and the *Danica Ilirska* (*Illyrian Daystar*) provided a literary focus for the rising generation; while his reform of Croat orthography, planned on parallel lines with Vuk Karadžić's epoch-making philological work in Serbia, assured to modern Serbo-Croat literature a definitely unitary development. The fact that linguistically Serb and Croat had thus become interchangeable terms, only to be distinguished by the respective use of the Cyrillic and Latin alphabets, inevitably reacted upon the political situation, and served as an incentive to the movement for unity. In somewhat sensational and affected but prophetic words Gaj compared Illyria to a lyre, "a triangle between Skutari, Varna and Villach. Its strained and inharmonious chords are Carinthia, Gorizia, Istria, Croatia, Slavonia, Dalmatia, Ragusa, Bosnia, Montenegro, Herzegovina, Serbia, Bulgaria and Lower Hungary," and "on the great lyre of Europe they must harmonize once more." He saw in the Magyars the chief obstacle to the realization of his dream, and openly warned them that they were "an island in the Slav ocean," which one day might easily engulf them. The alienation of Croat and Magyar—for centuries close allies in the struggle against the Turk—grew rapidly in the 'forties, mainly owing to the aggressive legislation passed by successive Hungarian diets, and tending to curtail Croatia's ancient liberties and extend the sway of the Magyar language. It was a fertile soil for Gaj's agitation, and in 1848 the Croatian nation found in Baron Jelačić a military leader who voiced the Illyrian idea and hoped to realize it in union with the Habsburg Dynasty and the other subject nationalities of Hungary. It is highly significant that Jelačić as Ban of Croatia went hand in hand with the newly elected Serb-patriarch Rajačić: that Croats and Serbs, including many volunteers from the principality of Serbia, fought side by side against Hungary, and that the poet-prince-bishop Peter II. of Montenegro wrote to Jelačić, expressing his solidarity with the movement.

Croatia after 1848.—After the collapse of the Hungarian revolution in 1849, the Croats, in the words of Pulszky, received as reward the same absolutist *régime* which had been imposed upon the Magyars as punishment. Jelačić and Gaj died as disappointed men, and the very general resentment aroused by the ingratitude of Francis Joseph vented itself also against the name of Illyria, which rapidly disappeared from the political arena. But its place was taken more and more by Yugoslavia, which, it should be remarked, was then still used to denote all the territories inhabited by any southern Slav tribe, and so to include the Bulgars no less than the Serbo-Croats and Slovenes. On the intellectual side the new movement found its champion and its Maecenas in Bishop Strassmayer, who for over 50 years devoted the surplus revenues of the wealthy see of Dya Kovo (Djakovo) to national purposes, and was mainly instrumental in founding at Zagreb the southern Slav Academy (1867), the first Croat university (1874) and a modern gallery and school of arts. Historical research and literary criticism flourished under Rački, the first president of the Academy, and his pupils: while Strassmayer did much to revive the Glagolitic, or ancient Slavonic liturgy, and to win for it the favour of Pope Leo XIII. Close relations linked the great Bishop with Prince Michael, Serbia's ablest modern ruler, and with Prince Danilo of Montenegro who assured Michael, "Form the Kingdom of Serbia, and I will mount guard before your palace."

The Dual System.—In the late 'sixties the Yugoslav idea met with a serious set-back. Prussia's victory forced Austria to come to terms with the Magyars: and the bargain was sealed by the *Ausgleich*, or Dual System, at the expense of the lesser nationalities. Within certain limits Croatia's autonomy was respected, but so far from Zagreb being consulted, the terms of the new settlement were in effect dictated from Budapest and only submitted *pro forma* to a carefully "packed" Croatian Diet, after the bargain between Budapest and Vienna had already made of them an accomplished fact. Meanwhile the murder of Prince Michael in the same year deprived Serbia of a great statesman and the movement for unity of a possible head. During the 'seventies Austro-Hungarian policy was increasingly successful in checking intercourse between the Yugoslavs of the monarchy and those outside its bounds. Meanwhile the newly constituted "Party of Right," resting upon a narrow Catholic clerical basis, aimed at the reunion of Dalmatia with Croatia-Slavonia in the so-called Triune Kingdom, within whose bounds it affected to deny the very existence of Serbs. This Pan-Croat ideal was favoured in Vienna as a convenient rival to Pan-Serbism with its centre in Belgrade; but its natural effect was to drive the Serbs of Slavonia and S. Hungary into the arms of Budapest. The insurrection of Bosnia against the Turks only served to increase party discords: for though it aroused the keenest sympathy of all Serbs and Croats, and thus furthered the sense of racial affinity, it gave rise to rival claims upon Bosnia which could be exploited in the interest of Vienna and Budapest. The official policy of Baron Kállay, for 20 years the administrator of Bosnia, was to taboo the name of Serb in the hope of creating a distinct "Bosnian" nationality.

The period between 1883 and 1903 is the most humiliating in the modern history of the southern Slavs. Count Khuen-Hedérváry, as Ban of Croatia, reduced political corruption to a fine art and governed by playing off Croat and Serb against each other, and fanning the dying flames of religious bigotry: while at the same time Serbia under King Milan was reduced to the position of a mere satellite of Vienna. The humiliating secret treaty concluded between Austria-Hungary and Serbia in 1881 had specially pledged the latter to repress any nationalist agitation against the Dual Monarchy, even in respect of that Bosnia for which Serbia had risked her existence four years earlier. Disunion had reduced the Yugoslavs to an almost negligible quantity in Balkan politics.

The National Revival in Croatia.—After the turn of the century, however, a new generation arose both among Croats and Serbs, which had received its education abroad, and especially in Prague, where the ethical and political teachings of Prof. Masaryk exercised a remarkable influence over the progressive youth of all Slav countries. All thinking men were increasingly conscious that no progress was possible until Croat and Serb presented an united front against German-Magyar predominance. The first signs of reviving solidarity came in 1903, when Khuen's rigorous suppression of rioting in Zagreb and several country districts of Croatia, led to demonstrations of protest throughout Dalmatia and Istria. Thirty Croat deputies of those provinces resolved to lay their kinsmen's grievances before the Emperor, and his refusal of an audience played a material part in alienating Croat sympathies from the Crown. It is not uninstructive to note that as the same year 1868 witnessed a setback in both Croatia and Serbia, so the same year 1903 marks a parallel revival in national consciousness in both countries, coincident with the fall of Khuen-Hedérváry and the removal of the Obrenović dynasty. Abroad the new King's position was prejudiced by the hideous crime which led to his accession, but among his own people this was from the first atoned for by the introduction of a real constitutional *régime* and increased political stability. The Serbian court, instead of being a centre of perpetual scandal and misrule, resumed its true position as a focus of national aspirations, and this change was not lost upon the Yugoslavs of "the other side."

Resolution of Fiume.—The advocates of political coöperation between Serb and Croat saw their opportunity in the constitutional conflict which broke out between Crown and Parliament in Hungary: and on Oct. 4 1905 40 Croat deputies from Croatia, Dalmatia and Istria formulated in the so-called "Resolution of Fiume" a complete programme of political reform, and defined the basis upon which solid friendship between Croats and Magyars seemed attainable. The prime movers in this action were Dr. Trumbić, a leading Dalmatian advocate and mayor of Spalato, and Mr. Supilo, also a Dalmatian, the editor of the *Novi List* at Fiume. Ten days later 26 Serb deputies from the various provinces of the monarchy, met at Zara, indorsed the principles embodied in the Resolution of Fiume and declared in favour of joint political action between Croats and Serbs. It is worthy of note that the Resolution of Fiume anticipated the modern doctrine of self-determination by the very explicit assertion that "every nation has the right to decide freely and independently concerning its existence and its fate." On Nov. 14 the Croat and Serb parties in the Diet of Dalmatia publicly affirmed the principle that "the Croats and Serbs are one nation": and this standpoint has never since been abandoned. The Serbo-Croat coalition, formed on the basis of the Fiume Resolution, at once acquired the mastery in Croatia, and even when its short-lived alliance with the Hungarian coalition—in power in Hungary since April 1906—was replaced by acute conflict in the summer of 1907, no amount of repression from Budapest could destroy its solid majority in the Croatian diet. Baron Paul Rauch, the Magyar nominee as Ban, failed, with all his official apparatus, to secure a single seat for his creatures at the general election of 1908, and therefore proceeded to govern without Parliament, by an elaborate system of administrative pressure, press persecution and espionage. Under his *régime* Magyar intolerance of Croat national aspirations joined hands with the designs of the Ballplatz against Serbia in connexion with the impending annexation of Bosnia.

Friedjung Trial.—The treason trial which opened at Zagreb in March 1909 pursued the parallel aims of intimidating the

Serbs of Croatia, of splitting the new-found unity of Serb and Croat and of proving to the outside world the existence of a dangerous Pan-Serb movement organized from Belgrade inside the monarchy and amply justifying the countermove of annexation. None of these aims were attained; for the trial, which turned on the evidence of the police spy Nastić (already chief witness in the doubtful Cettinje bomb trial of 1908) degenerated into a public scandal, owing to the conduct of the judges and public prosecutor, and rallied Croat public opinion in defence of the 53 Serb victims. Serbo-Croat solidarity became still more apparent when the Austrian historian Dr. Friedjung, in the *Neue Freie Presse* of March 25 1909, openly charged the leaders of the Serbo-Croat coalition with being in the pay of Serbia. This article, which was based upon a mass of incriminating documents supplied to Friedjung by the Austro-Hungarian Foreign Office, had been timed to coincide with the outbreak of hostilities against Serbia, and was to have been the first of a series convicting the Serbian Government and dynasty of aggressive and even murderous designs. When at the last moment war was averted by the surrender of Serbia and Russia, an attempt was made to withdraw the article, but the first copies had already been issued: and Count Aehrenthal now had the double embarrassment of the Zagreb trial, which no longer served any purpose of foreign policy, but suited the aggressive game of Budapest against Zagreb, and of a libel action brought against Friedjung by those leaders of the Serbo-Croat coalition whose honour he had impugned. Despite the Ballplatz's efforts at postponement, the trial took place in Vienna in Dec. 1909, and revealed the documents upon which Friedjung had relied, as impudent forgeries concocted by subordinate officials of the Austro-Hungarian legation in Belgrade, with the connivance of the minister, Count Forgács. The responsibility was finally brought home to Forgács by Prof. Masaryk in a famous speech before the Austrian delegation: and Aehrenthal preserved an embarrassed silence when his minister was bluntly compared with Azev, the Russian *agent provocateur*.

The Cuvaj Dictatorship.—The triumphant vindication of Mr. Supilo and his colleagues of the Serbo-Croat coalition gave a fresh incentive to the idea of unity throughout the southern Slav provinces of Austria-Hungary. Rauch's position had become untenable, and he was succeeded by the more moderate Dr. Tomašić, who brought with him from Budapest the concession of a somewhat extended franchise (260,000 instead of 50,000 electors). His attempt to emancipate himself from the control of the coalition at the general elections of Oct. 1910 failed miserably, and after a year of temporizing, he suddenly threw off all pretence at legal forms, dissolved the Diet almost before it had met, and in Dec. 1911 ordered new elections. But in spite of wholesale terrorism he only succeeded in wrenching five more seats from the coalition, and on Jan. 19 1912 was replaced as Ban by a little known official Mr. Cuvaj, who promptly dissolved the Diet before it had even met, and proceeded to muzzle the press, to close the university and to arrest several prominent politicians. On April 3 the Croatian constitution was completely suspended by royal decree, and Cuvaj invested with far-reaching dictatorial powers. An attempt on his life by the student Jukić (June 8) was followed by still more reactionary measures, and on July 11 the autonomy of the Serbian orthodox church in Slavonia and Hungary was also suspended.

The Cuvaj *régime* had a magical effect in furthering the movement for Yugoslav unity. Specially significant were the Memorandum addressed to the throne by 55 deputies of the Croat party of Right, in the Croatian, Bosnian, Dalmatian and Istrian Diets, and the political strike organized by the pupils of both sexes in almost all the middle schools of the Slavonic South. This gave rise to sympathetic demonstrations in many Dalmatian and Bosnian towns, and to a series of interpellations and speeches by the Yugoslav and Czech deputies in the Parliament of Vienna. The Slovenes—clericals no less than progressives—became increasingly active in the Yugoslav movement, and their press began to demand the abandonment of the distinctive Slovene dialect as a hindrance to unity.

Balkan War.—It was peculiarly unfortunate for Austria-Hungary that the Cuvaj *régime* should have been at its very height when the Balkan League achieved its dramatic victory over the Turks. The battle of Kumanovo in particular was greeted with indescribable enthusiasm throughout the Yugoslav provinces. The Serbian and Bulgarian anthems were sung on the streets, collections were made in every village for the Balkan Red Cross funds, and when Austria-Hungary mobilized, protests were heard on every side against the bare possibility of war with Serbia, which to the Yugoslavs would be a veritable civil war. The Austrian Government committed the grave blunder of answering these demonstrations by press confiscations and by the dissolution of the town councils of Spalato and Sebenico. This, however, was promptly countered by a monster meeting of protest at Zara on Nov. 24, attended by all but three of the Serbo-Croat deputies of Dalmatia, and delegates of almost every municipality in the province. Doctor Drinković, leader of the Dalmatian clericals, openly declared that "in the Balkan sun we see the dawn of our day!" and the Catholic Bishop of Cattaro greeted the news from Monastir by reciting the *Nunc Dimittis*. On all sides Serbia was now regarded as the southern Slav Piedmont: and the Dual Monarchy's consistently hostile policy toward Belgrade, and its only too successful efforts to set Serbia and Bulgaria by the ears, intensified the excitement and resentment among its Yugoslav subjects. The Trialist solution (which would have united the Yugoslav provinces of Austria-Hungary in a third state enjoying equality with the two existing partners) rapidly lost popularity, even among the clerical parties, which had been attracted by the prospect of Catholic predominance in such a State.

On Dec. 27 1912 Cuvaj was replaced by a colourless official, Dr. Unkelhäusser, who marked time until a fresh candidate for the post of commissary or dictator was forthcoming in the person of Baron Skerlecz (July 23 1913). This appointment, at a moment when Austria-Hungary was again contemplating war with Serbia, naturally increased the ferment, and on Aug. 18, a determined attempt was made upon the life of Skerlecz by a young American Croat. At length on Nov. 30 Skerlecz was made Ban, the illegal decrees of Cuvaj revoked, and general elections ordered—the fifth since 1906. The coalition maintained its majority, the Government only obtaining ten seats: but though this time the Diet was allowed to meet, no attempt was made to satisfy Yugoslav aspirations or to solve the real issues at stake between Hungary and Croatia. More and more the situation in the south of the monarchy was allowed to drift. The political leaders were far more conscious than either Vienna or Budapest of the volcanic state of public opinion: but when in genuine alarm and from a sense of impotence they attempted to restrain their followers, the only result was a loss of influence over the younger generation, which had become increasingly infected by revolutionary ideas. Among the Yugoslavs the students had always dabbled unduly in politics, and this tendency was accentuated by the widespread unrest and excitement which followed upon the Balkan upheaval. On the eve of war the university and middle-school students had five or six newspaper organs of their own—notably *Jugoslavija* in Prague, *Val* in Zagreb and *Jedinstvo* in Spalato—which advocated more radical action alike in politics and literature. Nor is it surprising that the hotheads among them, fired by the example of Jukić and other would-be assassins of Varešanin, Cuvaj and Skerlecz, should have indulged in terrorist projects. From this group came the young Bosnian Serb students Princip, Čabrinović, Grabež and others, who murdered the Archduke Francis Ferdinand and the Duchess of Hohenberg at Sarajevo on June 28 1914, and thus lit a spark in the European powder magazine.

The World War.—Immediately on the outbreak of the World War measures of extreme severity were taken by the civil and military authorities of Austria-Hungary throughout their Yugoslav provinces. The exact number of persons arrested or interned will probably never be known, but that the Yugoslavs were regarded, and treated, as a hostile population, is abundantly proved by the three following facts, which could be multiplied indefinitely. Doctor Tresić-Pavičić, the Dalmatian-Croat deputy, was informed by one of the judges who examined him that over 5,000 had been imprisoned in Dalmatia, Istria and Carniola. In the single internment camp of Arad there were 3,400 deaths among the victims from Bosnia alone; and Father Nikolić, a Catholic priest from Istria, testified to having himself buried over 2,000 Istrian victims, and Doctor Martinović to a knowledge of 8,000 fatal cases in the Styrian camps. In Dalmatia the leading deputies (*e.g.* Smodlaka, Čingrija, Tresić, Drinković) and many priests, advocates, doctors and other intellectuals were arrested, some being used as hostages and forced to accompany railway patrols, under the threat of instant death in case of sabotage by the population. All the municipal councils in Dalmatia (with the solitary exception of Zara, which had an Italian majority) were dissolved at an early stage in the war. Among the Slovenes of Istria and Carniola there were also numerous arrests, and the *Matica Slovenska*, the chief Slovene literary society, was dissolved and its funds confiscated. Press censorship was of course very rigid throughout the Dual Monarchy, but many Yugoslav newspapers were suppressed altogether. It was perhaps natural that repression should be specially severe in Bosnia. There were wholesale internments, conducted with the utmost brutality: and the horrors of the camps of Doboj, Mostar, Arad, Thalerhof, Möllersdorf, Gmünd, were early in 1918 revealed by Doctor Tresić in the Austrian Reichsrat. After the Archduke's murder the headquarters of various Serbian institutions in Sarajevo had been sacked by mobs, with the open connivance of the police: after the outbreak of war practically all Serb societies and schools were closed in Bosnia. At a later stage the Orthodox calendar and the Cyrilline alphabet were prohibited, and this was actually enforced in Serbia itself during the Austrian occupation, and in the Serbian districts of Hungary from July 1916 onward. Bosnia was also the scene of a succession of monster political trials. In March 1915, 28 schoolboys of Banjaluka were sentenced to terms varying from two years to four months for founding a local Yugoslav society. In July 65 schoolboys from Sarajevo and Travnik received similar sentences, and again in Oct. 38 more boys from Tuzla were condemned to a total of 156 years. In Nov. 1915 at Banjaluka 151 prominent Bosnian Serbs—including 5 deputies and 20 orthodox priests—were put on trial for treason: and eventually 16 death sentences were passed, and terms of imprisonment totalling 858 years and a collective fine of 14 million crowns, were passed. Worse even than this was the system of wholesale expatriation adopted as a punishment for those who had shown a friendly attitude to the invading Serbian army. During the spring of 1915 the official organ at Sarajevo published list after list of Bosnian-Serb families who were thus declared to have forfeited their citizenship: and many thousands of women and children were driven across the Montenegrin frontier, often with only the clothes in which they stood. The motive was avowedly the same which in the Middle Ages led a mediæval garrison to drive the civil population of a town into the camp of its would-be deliverers. With every year of war the number of confiscations of property increased in the Yugoslav provinces, as in Bohemia and Transylvania—vengeance upon the families at home being widely used in order to deter Slav, Italian or Rumanian prisoners from enlisting in the various volunteer corps in process of formation on the Russian, Balkan and Italian fronts. In Croatia alone was there even a semblance of constitutional government. The diet of Zagreb was allowed to meet, and the Serbo-Croat coalition pursued a policy of pure opportunism, avoiding any pronouncement on matters of high policy, but buying a certain relaxation of *régime* in Croatia by supporting the Budapest Government and its nominee Skerlecz. But even this subservient and cautious House sometimes asserted itself: and on one occasion its vice-president Doctor Magdić proclaimed "the nation's constant desire for unification in a single and independent political body."

Yugoslav Propaganda Abroad.—Meanwhile a certain number of Yugoslav leaders had managed to reach foreign soil before the outbreak of war, and during the winter of 1914 constituted themselves as the Yugoslav Committee. Its two foremost leaders were Doctor Trumbić and Mr. Supilo (two of the makers of the Resolution of Fiume) and it also included Doctor Hinković (known as the chief advocate in the Zagreb treason trial), Ivan Meštrović the sculptor, the Slovene deputies Gregorin and Trinajstić, the Bosnian Serb deputies Stojanović, Srškić and Vasiljević, publicists of repute such as Marjanović and Banjanin, and prominent representatives of the Yugoslav colonies in North and South America, such as the scientist Pupin and the shipping magnate Baburica. Their original centre was Rome, but in view of the hostile attitude of the Salandra-Sonnino Government they transferred their activities to Paris and London early in 1915. They were in close and cordial contact with the Serbian Government, but rightly insisted on retaining entire independence of action, their funds being derived from their wealthy S. American supporters, who had long been enthusiasts for the Yugoslav idea. Their first public pronouncement was an appeal to the British Parliament and nation (May 1915) for sympathy with the cause of Yugoslav unity and the dissolution of Austria-Hungary. This formed a natural complement to the unanimous declaration of the Serbian Skupština in Dec. 1914 for a union of Serbs, Croats and Slovenes in one State.

Secret Treaty of London.—The entry of Italy into the war was a serious set-back to the Yugoslav cause, for under the Treaty of London (April 27 1915) she was to obtain, in the event of an Entente victory, wide districts in Gorizia, Carniola, Istria and Dalmatia, peopled by not less than 700,000 Yugoslavs. The frontier was to follow the watershed of the Julian Alps from Tarvis as far east as the Snježnik (Schneeberg) and to reach the sea just east of Volosca, Fiume being expressly reserved to Croatia. To Italy was assigned the northern half of the Dalmatian mainland as far as Cape Planka, and all the islands save Krk (Veglia) and Rab (Arbe) in the N., Solta and Brazza in front of Spalato, and the few which lie to the south of Meleda. The jealously guarded secret was discovered by Mr. Supilo in Petrograd within a few days of the signature of the treaty, and the main facts becoming known in Austria-Hungary, were skilfully exploited by her to rally the Croats and Slovenes in defence of their national territory. It was easy to represent the Entente as having betrayed the interests of Serbia and her kinsmen: and as for a time the Pašić Cabinet, in deference to the narrowly Orthodox influences then all powerful at Petrograd, was prepared to limit its claims to the mainly Serb and Orthodox provinces of Bosnia and Slavonia, and to leave the Catholic Croats and Slovenes to their fate, there was during the summer a certain revulsion of feeling in favour of Austria-Hungary, who appointed a Serb Orthodox frontiersman (Graničar), General Boroević, to the chief command on the Isonzo front. The conquest of Serbia, however, once more closed the ranks of the Yugoslavs, who saw in unity their sole hope for the future: and the desertions to the Entente which were so marked a feature of the first winter, became so rife as to render necessary a drastic revision of the Austro-Hungarian regimental system. Henceforth the various corps lost more and more their territorial character, one nationality was set to watch and control the other, and espionage and delation prevailed.

The Yugoslav Legions.—During the winter of 1915 delegates of the Yugoslav Committee, with the Tsar's special permission, began enrolling volunteers from among the prisoners on the Russian front; and by March 1916 a division of 23,000 men had been concentrated at Odessa, and a second was formed later. Serbian officers under General Živković were sent out, and many officers of the future Czechoslovak legions first saw service in this corps. The Yugoslavs greatly distinguished themselves during the Dobruja campaign (Nov. 1916), and their wounded shot themselves or each other on the battle-field, rather than fall as traitors or deserters into the hands of Austria. It was with this corps that Dr. Elsie Inglis and a detachment of the Scottish Women's Hospitals served as medical unit. After the Russian collapse most of the survivors were gradually drafted through Murmansk, England and France to the Salonika front: one brigade was cut off by the Bolshevik Revolution and had to be evacuated through Siberia. In 1916 the Yugoslav Committee had also set itself to recruiting among its compatriots in America, but in this case its success was hampered by many cross currents of republican, clerical, Austrian and Montenegrin feeling: and those who did actually volunteer showed considerable lack of discipline and were not always treated with the necessary tact by the Serbian military authorities.

The Yugoslavs inside Austria-Hungary.—The accession of the Emperor Charles, and the ferment aroused by the Russian Revolution, led to considerable political changes in both halves of the Dual Monarchy, the most notable being the dismissal of Count Tisza from the Hungarian premiership (May 23 1917), the grant of a general political amnesty, and the summons of the Austrian Reichsrat, which had not been allowed to meet since March 1914. No sooner was political life thus resumed than all the Slovene, Croat and Serb deputies of Austria united to form a "Yugoslav parliamentary Club," which entered into close alliance with the Czech Club. At the opening sitting (May 30) Czechs, Poles and Ruthenes defined their national attitude in formal resolutions, and the Slovene leader, Father Korošec, in the name of the Yugoslavs, demanded "the union of all the Yugoslav territories of the Monarchy in an independent state organism, free from the rule of any foreign nation, and resting on a democratic basis, under the sceptre of the Habsburg-Lorraine Dynasty." The last phrase was treated in some quarters as a proof of confirmed Austrophilism: in reality it was a minimum concession to the existing order, without which its framers could not have continued their activity. By this time it was sufficiently obvious that the Yugoslavs were tacitly if not explicitly agreed upon a triple parallel policy, framed for all contingencies. In Croatia the coalition was more opportunist than ever, and sent its delegates to the coronation of Charles as King of Hungary: by its compliance it obtained the appointment of its own nominee, Mr. Mihalović, as Ban, and was thus able to husband Croatian resources and on occasion to practise passive resistance. It accepted the *status quo* as a working basis, but no amount of pressure could wring from it a disavowal of Trumbić and his colleagues. Meanwhile the opposition parties openly allied themselves with the Yugoslav Club in Austria, which agitated for complete national unity, but saved itself from prosecution by occasional references to the dynasty and absolute silence regarding Serbia. It was left to the Yugoslav Committee abroad to claim independence as well as unity, to repudiate the Habsburgs (in a manifesto on the eve of the Budapest coronation) and to exalt the achievements of Serbia and the Karagjorgjević dynasty. The three groups communicated secretly through Switzerland, and it was felt that the time had come for the exiles to take a fresh step forward, in view of the prominence given to the doctrine of self-determination since the Russian Revolution and America's entry into the war. Moreover the collapse of Tsarism had deprived Mr. Pašić of his strongest support abroad, and forced him to abandon his narrowly Orthodox basis and bring his policy more into line with modern democratic tendencies.

Declaration of Corfu.—After some weeks of negotiation the so-called "Declaration of Corfu" was signed on July 20 1917, between Pašić as Serbian Premier (and in this case as the mouthpiece of all the Serbian parties) and Dr. Trumbić as president of the Yugoslav Committee. The signatories were careful to disclaim all idea of a pact or treaty, and to define the declaration as a mere statement of ideals and principles which could not acquire binding force until ratified by elected representatives of the nation as a whole. It may however be regarded as the birth certificate of the future Yugoslavia, and as fixing the lines of future development. After affirming that the Serbs, Croats and Slovenes constitute a single nation and appealing to the right of self-determination, it declared in favour of complete national unity under the Karagjorgjević dynasty, "a constitutional democratic and parliamentary monarchy, equality of the three national names and flags, of the Cyrilline and Latin alphabets, and of the Orthodox Catholic and Mussulman religions, equal rights for all citizens, universal suffrage in parliamentary and municipal life, and the freedom of the Adriatic to all nations." The future constitution was to be established after the conclusion of peace by a constituent assembly, which "will be the source and consummation of all authority in the State." A week later Trumbić and his colleagues were welcomed on the Balkan front by the Voivode Mišić with an impassioned speech in favour of unity. The Declaration of Corfu made a profound impression in Austria-Hungary, which was heightened by Mr. Lloyd George's speech in honour of Serbia at a luncheon given by the Serbian Society of Great Britain to Pašić (Aug. 8). The Zagreb press could only comment indirectly, but conveyed its meaning by insisting that the Reichsrat programme of May 30 was an absolute minimum. The growing self-confidence of the Austrian Slavs was shown by the bluntness of their refusal to coöperate with the new Premier, Doctor von Seidler, whose offer of portfolios to their leaders drew from Count Tisza a strong protest in the Hungarian Parliament. Under Magyar pressure Seidler explicitly condemned all schemes of federalism, and pledged the Government and even the crown itself not to adopt any reforms which did not leave untouched the existing provincial boundaries. The Czechs and Yugoslavs, finding the door thus shut in the face of their national aspirations, even in the modified Habsburg form, naturally stiffened in their opposition. On Dec. 18 they went so far as to demand national representation of their own at the peace negotiations with Bolshevist Russia at Brest Litovsk.

Pact of Rome.—During 1916–7 Italian public opinion, encouraged by Sonnino and his press organs, had been definitely hostile to the Yugoslavs, whom it denounced as mere Austrian agents. The facts regarding the Yugoslav legions and the services rendered by Yugoslav deserters at Gorizia and in the Trentino were simply suppressed. The disaster of Caporetto (Nov. 1917) had a sobering effect, and the need for solidarity on the part of all the subject nationalities of Austria-Hungary,—a category which included also Italians,—if Italy's chief enemy was to be overthrown, became increasingly apparent. Further causes for alarms were the secret meeting between General Smuts and Count Mensdorv, to discuss a separate peace between Austria and the Entente (Dec. 1917) and the public pronouncements of President Wilson and Mr. Lloyd George in favour of "autonomy" for the subject races, instead of the independence held out to them by the Allied pronouncement of Jan. 1917. In Dec. 1917 Mr. Wickham Steed succeeded in bringing together Trumbić and his colleagues first with General Mola and Signori Emanuel and Chiesi (of the *Corriere* and *Secolo*), and then with the Italian Irredentist Socialist leaders. Their informal discussions laid the basis for more serious negotiations between Trumbić and Signor Torre, representing an influential committee of Italian deputies and senators. The agreement signed between them in London on March 7 1918 laid down the basis of Italo-Yugoslav coöperation: it recognized each of the two nations to be equally interested in the completion of the other's national unity, and in the liberation of the Adriatic. It left territorial questions to be decided amicably after the war, "on the basis of the principle of nationality and self-determination," and mutually guaranteed the rights of national minorities. This agreement is known as the Pact of Rome, because it was publicly proclaimed at a "Congress of the Oppressed Nationalities of Austria-Hungary," held on April 8 in the Roman Capitol. The Yugoslavs were represented by Trumbić and his Committee and by 12 deputies of the Serbian Skupština, the Czechoslovaks by Beneš and Štefanik, the Poles by Zamorski, Skirmunt and Seyda, the Rumanians by Draghicescu, Lupu and Mironescu. Baron Sonnino held aloof, but Premier Signor Orlando, greeted the congress with enthusiasm, and the first result was a combined propaganda on the Italian front, organized by Allied delegates and members of all the national committees. The effect of the congress and of this propaganda was to hasten the disintegration in the Austro-Hungarian army, and the High Command (in a communiqué of July 27) admitted that wholesale defections of the Czechoslovaks and the Yugoslavs had materially contributed to Italy's brilliant stand against the last Piave offensive in June. Unfortunately, while the new Czechoslovak army was recognized by Italy and took its place in the front line, Baron Sonnino, for political reasons, vetoed the formation of similar Yugoslav legions, though General Diaz had consented, and though the Yugoslavs interned at Nocera and elsewhere were clamouring to be enrolled.

Collapse of Austria-Hungary.—Meanwhile the Roman congress was deliberately imitated by an imposing congress at Prague (May 16), at which Czech, Polish, Italian, Rumanian, Slovak and Yugoslav delegates attended. Among the latter were the mayor of Zagreb, the poet Vojnović, and prominent Serb, Croat and Slovene deputies of all parties, including the peasant leader Stephen Radić and the future minister Pribičević. Their resolutions, though necessarily vague, amounted to a pledge of mutual support in the cause of unity and independence. During 1918, the initiative among the Yugoslavs of the Monarchy fell more and more into the hands of the Slovenes, led by Father Korošec since the premature death of Monsignor Krek. The official recognition accorded to the Pact of Rome by Mr. Lansing in the name of America (May 31) was a fresh encouragement: and Korošec, after constituting a Yugoslav National Council for the furtherance of unity, convoked a new Slav congress at Lyublyana (Ljubljana) on Aug. 18. The demonstrative part taken by the prince-bishop Jeglić and the leading Catholic clergy, and the fact that the Emperor's birthday was entirely disregarded, was intended as an answer to those who claimed the Slovene Catholics as a bulwark of the Habsburg throne. The central authority in Austria was steadily breaking down, and the food crisis was rendered still more acute by the widespread formation of "Green Cadres"—well organized armed bands which held positions in the mountains and defied capture. As early as Feb. a mainly Yugoslav revolutionary committee had almost gained control of the Cattaro naval base, which would have fallen into Entente hands if the ringleaders, who crossed the Adriatic for help, had not been detained by subordinate Italian subordinates until the Pola squadron had time to crush the mutiny. Moreover the High Command viewed with alarm the growth of "Septembrist" doctrine among the troops—*i.e.* the insistence upon "peace by September" and a refusal to face a fifth winter in the trenches.

During the late summer the authorities in Vienna and Budapest keenly debated rival plans for solving the southern Slav question—in every case, however, in accordance with Austrian or Hungarian rather than Yugoslav interests. Strangely enough the only attempts to consult the Yugoslavs themselves were an audience to which the Emperor Charles summoned Father Korošec and a journey undertaken by Count Tisza in Sept., with the crown's approval, to Zagreb, Sarajevo and Dalmatia. This last attempt to win support for the Magyar solution was everywhere met with a blank refusal, and in Bosnia especially the Orthodox, Catholic and Moslem leaders united in a manifesto assuring him of their adherence to the full programme of Yugoslav unity. The surrender of Bulgaria (Sept. 30) naturally rendered the nationalities indisposed to concessions, and the Austrian Premier's admission that national autonomy was now inevitable was icily received. The Czech and Yugoslav spokesmen in the Reichsrat insisted upon separate representation at the peace negotiations, and the absolute right to decide their own future State allegiance (Oct. 1).

Events now followed each other with lightning speed. On Oct. 4 Austria-Hungary, in a note to America, accepted President Wilson's speeches as a basis of discussion, and on the 8th Baron Hussarek admitted that the Monarchy's internal structure must be modified, and "full-grown nations" determine their own future. This only precipitated the collapse, and while Count Tisza voiced Hungarian public opinion in declaring the basis of the Dual system to be shattered, the Yugoslav National Council was transplanted from Ljubljana to Zagreb and strengthened by the inclusion of representatives of all parties (Oct. 10). On the 16th the Hungarian Government declared in favour of personal union, and next day Hussarek published an imperial proclamation, dividing Austria (not Austria-Hungary) into four federal units (German, Czech, Yugoslav and Ukrainian) and leaving the Poles to make their own decision. This project was stillborn and pleased no one. Korošec in the name of the Czech and Yugoslav Clubs unreservedly rejected it and claimed that the future of both nations was an international problem which only the future Peace Conference could solve. Henceforth the Yugoslavs acted independently of both Vienna and Budapest: and when on Oct. 21 the news of President Wilson's answer to Count Burián's final peace note (refusing to negotiate save on the basis of a recognition of Czechoslovak and Yugoslav national claims) became generally known, the old *régime* vanished almost as if by magic. Extraordinary scenes took place in many towns, the troops tearing off their military badges with the Habsburg arms, and trampling them underfoot. National councils were speedily formed in Dalmatia and Bosnia, which arranged for the disarmament of the troops pouring northward from the broken Albanian and Macedonian fronts. As early as the 23rd a Croat regiment stationed in Fiume disarmed the Magyar militia and took possession of the town. On the 24th Count Andrássy was appointed joint foreign minister, but the machinery of State had ceased to work, and both the Austrian and Hungarian Cabinets were in *statu demissionis*. On the 28th (the same day on which the Czechoslovak Republic was born in Prague) the military command in Zagreb handed over its authority to the National Council, and next day the diet proclaimed the independence of Croatia from Hungary, and assumed control of Fiume. The arsenals of Pola and Cattaro were already in the hands of the insurgents; and the Emperor Charles, in the hope either of winning the favour of the new *régime* in Zagreb or of throwing an apple of discord between it and the Entente, signed a decree on Oct. 31 making over the whole Austro-Hungarian fleet to the Yugoslav State. This was not unnaturally interpreted by the Italian Nationalists as a proof of collusion between Zagreb and Vienna; nor was it generally known that as early as Oct. 4 Štepanek and Giunio, as delegates of the Czech and Yugoslav revolutionary committees, reached Italy in a fishing-boat, to concert with the Allies a general rising along the coast, but were closely imprisoned in Rome and not allowed to communicate with Doctor Beneš and Doctor Trumbić till nearly three weeks had been lost. But for this delay the fleet might have been in the Entente's hands a fortnight before the final Italian offensive opened on the Piave. Unhappily every step led to a fresh misunderstanding. The action of the Supreme Council in Paris in prescribing the frontier line of the secret treaty of London as the line of occupation under the Austro-Hungarian armistice was keenly resented by the Yugoslavs as a breach with Wilsonian principles. The Allies very properly insisted that the fleet must be surrendered into their hands, but before this could take place a deplorable incident occurred in Pola harbour, the "Viribus Unitis" being blown up by an Italian mine, with a Yugoslav admiral and crew on board. In Italy Baron Sonnino's frankly anti-Slav attitude threw the Pact of Rome into the shade: and the Consulta worked hard to prevent Yugoslavia's recognition by the Allies.

Rival "Great Serb" and "Yugoslav" Programmes.—That this recognition had not already been accorded before the collapse of the Central Powers began was due to disunion among the Yugoslavs themselves. During the summer America gave a lead to the Allies by accepting the Yugoslav programme, and after Austria's failure on the Piave there was a growing disposition on the part of the western Powers to fall into line with Mr. Lansing's very clear pronouncements. But Pašić, free from the restraints of a coalition and from all parliamentary control, had reverted to his original pan-Serb standpoint, and steadily declined to reconstruct his Cabinet on a wider Yugoslav basis. Trumbić on his part could not enter a purely Serbian Cabinet without prejudicing that freedom of choice of his compatriots in the Dual Monarchy, upon which the moral case of the Yugoslavs depended. A series of incidents proved the difference of outlook to be not merely personal but fundamental. In July Mr. Mihajlović, the Serbian minister at Washington, was summarily dismissed by Pašić, the reason being his refusal as a good

Yugoslav to transmit to the American Government a project assigning Bosnia to Serbia as "compensation" in the event of a patched-up peace. On July 25 at the London Mansion House Mr. Balfour publicly indorsed the full Yugoslav programme, as formulated by the Serbian minister, Mr. Jovanović: but the latter's full report to his home Government was answered by a severe snub, and during the winter he too was dismissed for his Yugoslav sentiments. When on Aug. 9 Mr. Balfour officially recognized the Czechoslovak National Council as "trustee of the future Czechoslovak Government," he was ready to extend a similar recognition to the Yugoslav cause, but as a preliminary condition he very reasonably insisted upon unanimity between those who claimed to represent the two groups of Yugoslavs. Pašić adhered to his standpoint, and even the efforts of Venizelos and Take Jonescu to bring him and Trumbić together were unavailing. When in the last week of Oct. the rival statesmen moved from London to Paris, all hope of Yugoslav recognition before the opening of the Peace Conference had vanished, owing to the stiffening in the attitude of Italy.

Zagreb declares Independence.—One of the first steps of the new Zagreb Government was to recognize Trumbić and his committee as its representatives abroad, and to send delegates to Switzerland to discuss the measures for consummating national unity. On Nov. 9 the Declaration of Geneva was signed by Pašić as Serbian Premier, Father Korošec, Doctor Čingrija (mayor and deputy of Ragusa) and Doctor Zerjav (a Slovene Progressive) for the Zagreb Council, Trumbić and four others for the Yugoslav Committee, and Trifković, Drašković and Marinković as chiefs of the Serbian opposition parties. "By this act," it was laid down, "the new State appears and stands from to-day as an indivisible state-unit and as a member of the Society of Free Nations. The former frontiers no longer exist." The Governments of Belgrade and Zagreb were to retain their former spheres until a constituent assembly, elected by universal suffrage, could draw up a new constitution. Yielding to the unanimous desire of the other delegates, Pašić officially requested the Entente to recognize the Zagreb Council as the supreme authority in the ex-Austro-Hungarian provinces, and Trumbić as its accredited representative in the West, until unification could be completed. The repeated efforts made by Pašić to avert so distasteful a decision were held to disqualify him from the leadership of the new united Cabinet, but in order to secure his renunciation it was found necessary to exclude the other party chiefs. This arrangement, however, never really came into force, for the simple reason that telegraphic communications between the West and Serbia were hopelessly irregular, and that events continued to move, with the advance of the Serbian army and civil authorities from the South and of the Italians from the West. On Nov. 8 Gen. Franchet d'Esperey received at Belgrade a Hungarian peace delegation under Count Károlyi, and concluded with them an armistice whose provisions still further complicated the situation. No orders were given for the evacuation of Slovakia; in Transylvania an impossible shaped line was drawn, such as left Cluj (Kolozsvar) and many pure Rumanian districts in Magyar hands; while the Rumanians were incensed by the assignment of Temesvár (Temisoara) and the whole Banat to Serbia. The Serbian army was also allowed to occupy the Bačka, Syrmia and Bosnia-Herzegovina, but no territory farther west: and for a moment it seemed as though an attempt was being made to leave the Croats and Slovenes to their fate and to form an aggrandized Serbia on the lines advocated by Pašić and Petrograd in the summer of 1915. Any such development was, however, averted by the advance of the Italian army beyond the Armistice line, in the direction of Ljubljana. For to meet this danger, the Zagreb Government urgently invited the assistance of the Serbian army, which during the final advance contained a large proportion of Yugoslav volunteers. The first Serbian troops entered Fiume on Nov. 18, and a most dangerous situation arose between them and the Italians in Istria and Dalmatia, which was only very partially mitigated by the dispatch of American military and naval forces to Trieste and Fiume. Much of the blame falls upon the Supreme Council, which shrank from the only effective means of allaying friction—immediate Allied occupation of the disputed zone, pending the decision of the Peace Conference. The Council's occasional outbursts against Italy only rendered Baron Sonnino still more intractable, and irritated Italian public opinion. No satisfactory solution was possible unless the Treaty of London was abrogated, and this involved the abandonment of other secret treaties to which Paris and London clung. America pointedly defined the Adriatic problem as a test case, but amid the pressure of other affairs it was allowed to drift.

Union proclaimed at Belgrade.—The equivocal attitude of the Entente toward the new State naturally hastened the process of union. On Nov. 23 the Zagreb National Council proclaimed the union of the territories under its control with the Kingdoms of Serbia and Montenegro, and invited the Prince-Regent of Serbia to assume the regency of the new State. This decision (passed with only one dissentient voice, but that unhappily Stephen Radić, the peasant leader) took formal effect on Dec. 1, when Prince Alexander, at the formal request of 24 delegates from Zagreb, proclaimed the union and repeated their cry "Long live free and united Yugoslavia." Meanwhile on Nov. 26 a hurriedly convoked national assembly at Podgoritsa had proclaimed the deposition of King Nicholas and his dynasty, and the union of Montenegro with Serbia in the new united State. The first Yugoslav Cabinet was constituted under Protić as Premier and Father Korošec as vice-Premier: Trumbić became foreign minister, and the other portfolios were divided more or less equally between Serbia and the new territories. Pašić was appointed principal delegate at the Peace Conference, with Trumbić, Vesnić (minister in Paris) and Žolger (a Slovene professor who had held office under Seidler in Austria).

The Adriatic Crisis.—Apart from agrarian riots in Slavonia and Bosnia, the transition to the new *régime* was accomplished with remarkable ease. Italy's claims upon Istria and Dalmatia rallied the Yugoslavs to the cause of national unity, and intense indignation was aroused by the action of the Entente in drawing an armistice line against Austria-Hungary almost identical with that prescribed by the secret treaty of London, and in sanctioning Italy's prompt occupation of the disputed territory. Friction was increased by a whole series of incidents along the coast, by the deportation of prominent Yugoslavs to Italy and by the entry of Italian troops into Fiume, despite the protests of the Yugoslav civil and military authorities (Nov. 18). Meanwhile the whole Nationalist press of Italy, actively encouraged by Sonnino and his entourage, opened a fierce campaign against the Yugoslavs and their western supporters, which rapidly developed into agitation against the Allies. By the close of the year the situation had become so envenomed that Bissolati, the foremost Italian advocate of conciliation, found it necessary to withdraw from the Orlando Cabinet, and on Jan. 11 1919 was howled down at a great meeting in Milan. At the Paris Conference there was from the first a deadlock in the Adriatic dispute. Clemenceau and Lloyd George found themselves between two irreconcilable standpoints—between Sonnino, who claimed the liberal fulfilment of their treaty pledges, with the addition of the port of Fiume, and President Wilson, who refused all cognizance of the secret treaties and regarded them as expressly abrogated by the Allies when they accepted his successive notes as the basis of the Armistice. The three western Powers were in the impossible position of judges in a dispute to which one was a party, while the other two were accessories: the only Great Powers from whom an impartial verdict could be expected were Japan, who resolutely held aloof from purely European quarrels, and America, who quite logically regarded the Adriatic as a test case for the application of the new order in Europe. It was on these grounds that the Yugoslavs, from whom the treaty had always been carefully concealed and who had of course never recognized its validity, offered to submit the whole dispute to the arbitration of President Wilson (Feb. 11). On March 3, however, Italy, who had steadily refused to recognize the accomplished fact of Yugoslav unity and insisted on the Conference only admitting the Yugoslavs as a "Serbian" delegation, declined American arbitration and threatened to withdraw altogether from Paris unless their territorial demands were conceded. This in turn strengthened the hands of the extreme section among the Yugoslavs, who now advanced the full ethnographic claim, involving Trieste and Gorizia as well as Dalmatia and Istria, and at the same time increased their demands against Bulgaria, Austria and Albania. Nor was it very easy for the Serbs and Croats to show moderation toward Italy, without appearing to desert the Slovenes, at whose expense, for obvious geographical reasons, the main amputations must inevitably take place. The bad impression made by the claims now submitted to the Supreme Council was only partially removed by a speech of Trumbić and by his proposal to leave the settlement of frontiers to a plebiscite (April 16). This offer was made in the knowledge that the memorandum addressed by President Wilson two days previously to Orlando and Sonnino had met with rejection, and was indeed well calculated to heighten the contrast between the outlook of the two rival nations toward Wilsonian principles. The American note reaffirmed these principles as the accepted basis of armistice and peace, and insisted on applying the same methods toward Austria-Hungary as Germany. It accepted the Brenner as a fair strategic line on the north, but argued that the Treaty of London was no longer applicable in respect of Italy's eastern frontier, since the line which it traced was designed to secure Italy against future Austro-Hungarian aggression, and Austria-Hungary had by now ceased to exist. It then defined what came to be known as "the Wilson Line," which assigned to Italy Gorizia, Trieste and Istria west of the river Arsa, but not Fiume, which must become an international port, nor any points south of it, save perhaps Lissa and Valona: it also advocated the dismantling of the whole eastern Adriatic coast. On April 23 President Wilson followed up this private memorandum by a public manifesto to the Italian nation, in which he repudiated the Pact of London and appealed for the application of the same principles on the Adriatic as those enforced against Germany. Fiume, he declared, must be the outlet, not of Italy, but "of Hungary, Bohemia, Rumania and Yugoslavia." Unhappily, despite its warm assurances of American friendship, this document met with a most hostile reception in Italy, where it was interpreted as an attempt to undermine the position of her spokesmen and so mete out to her a different measure from that prescribed by France and Britain. Thus the proposal entirely failed of its effect, and as Italy, Yugoslavia and America each adhered to its standpoint, and the two western Powers shrank from any constructive policy, a fresh deadlock ensued. At the end of May, however, M. Tardieu suggested a compromise by which the port and district of Fiume with most of eastern Istria and a total population of over 200,000 (mainly Yugoslavs) would form a small buffer state between Italy and Yugoslavia, under the guarantee of the League of Nations. President Wilson adhered to his own scheme, but made it clear that he would not oppose any direct agreement, whatever might be its terms: while the Yugoslavs, though accepting the idea of a buffer state, insisted upon their enjoying at Fiume a status analogous to that of Poland at Danzig, and added the impossible condition of a plebiscite after three years. During the final stages of the German treaty the Adriatic problem was once more shelved, until on June 29 and July 6 armed conflicts took place in the streets of Fiume between Italian and French soldiers, resulting in several deaths. A commission of inquiry was then at last appointed by the Allies, and ordered elections under inter-Allied control and the dissolution of the terrorist "League of Volunteers." But on Sept. 12, the very day on which American and British police were to be installed, D'Annunzio and his Arditi occupied the town, with the open connivance of the Italian naval and military authorities though to the embarrassment of the Roman Cabinet. The Allies, so far from attempting to restore order, withdrew their forces and allowed their authority to be flouted. The fresh deadlock that ensued was by no means distasteful to Rome, which drew encouragement from Wilson's increasing impotence at home and therefore played for time. At last on Dec. 9 1919 the Supreme Council (Clemenceau, Polk and Crowe) addressed a memorandum to Italy, outlining new terms of settlement—viz. the Wilson line (modified so as to leave Albona in Italy), a demilitarized buffer state, a special *régime* for Zara, cession of Pelagosa, Lissa and Lussin to Italy: Valona in full sovereignty, and an Italian mandate in Albania, under the League of Nations. The Italian claim of territorial continuity with Fiume was definitely rejected. Italy in her reply (Dec. 10) insisted on continuity (the real if unavowed motive of which was to control the port of Fiume in the interests of Trieste and Venice, and so retain some hold over Yugoslavia's commercial development), demanded the island of Cherso and the neutralization of the Yugoslav coast, and suggested a triple division—the *corpus separatum* of Fiume to Italy, the port to the League of Nations, and the rest of the buffer state to Yugoslavia. On Jan. 6 1920 Nitti, meeting with no response, wrote to Lloyd George to demand the execution of the Pact of London. At this stage the Yugoslav delegation committed a grave tactical blunder, Trumbić's views being overridden by the Balkan imperialistic aims of Pašić. While pleading for a plebiscite against Italy and doing lip service to an independent Albania within the frontiers of 1913, it added that in the event of any revision of those frontiers Yugoslavia would claim Skutari and all territory north of the river Drin (Drim). The sole justification for such a claim lay in the terms of the Treaty of London, which the Yugoslavs could not adopt as a basis without stultifying their whole position against Italy. But Italy, in her next memorandum to the Conference (Jan. 9) thus found it easier to reaffirm the validity of the treaty, while arguing that as it had envisaged the creation of three separate states (Serbia, Montenegro and Croatia) rather than of a big Yugoslavia, the clause regarding Fiume could no longer be upheld. On Jan. 13 Clemenceau and Lloyd George addressed new proposals to the Yugoslavs, in the form of a scarcely veiled ultimatum. The buffer state was now abandoned, the *corpus separatum* (with territorial continuity) falling to Italy, Sušak to Yugoslavia and the port of Fiume to the League of Nations: Italy was also to receive Lussin, Lissa and the Albanian mandate, while Zara was to be independent under the League. In originating this impromptu scheme, Lloyd George was influenced by secret indications that the Serbian reactionaries, if promised Skutari in return for Fiume, might throw over Trumbić and abandon the Wilson Line and American principles generally. As however Trumbić rallied the Yugoslav delegation to refuse the Franco-British project, Clemenceau the very next day introduced the important modification that Fiume should be an independent state under the League. When the Yugoslavs placed various conditions upon their acceptance, they were bluntly informed that unless they accepted within four days, France and Britain would authorize the literal execution of the Treaty of London, thus leaving Fiume to Yugoslavia, but all northern Dalmatia in Italian hands (Jan. 20). But this ultimatum was rendered invalid by a wire from Lansing, protesting against any settlement without the participation of America. Paris and London having assured Washington that neither concealment nor lack of courtesy was intended, Belgrade found it quite safe to reject the note of Jan. 20, which it pointedly described as "a friendly proposal, not as an injunction." It further expressed its inability to believe that the Powers wished to impose "a treaty concluded unknown to it by third parties, and whose clauses have never been communicated to it." (Jan. 28.) This incident led President Wilson to address to the Allied Cabinets a series of three notes (Feb. 10 and 25 and March 6) which will remain the classic documents of the controversy, and reduced his opponents to silence, though not to surrender.

After their passage the Adriatic question was again allowed to stagnate, the Powers resuming their negative attitude, while advocating direct discussion between the two parties. At last on April 25 Trumbić, having obtained the special sanction of the Belgrade Cabinet, informed Nitti of his readiness to negotiate, and a meeting between the two statesmen did actually take place at Pallanza on May 11: the commercial experts had already reached agreement. But the prospect of a settlement roused the Italian Nationalists to a final effort: the Nitti Cabinet fell, and D'Annunzio, repeating his defiance of Europe, attempted a further raid upon Dalmatia. The continued presence of American warships on the Dalmatian coast alone prevented a series of brawls between Italian sailors and the Croat population from developing into open warfare. Fortunately the new Giolitti and Vesnić Cabinets showed equal moderation and skill in restraining the hotheads on both sides, and the new Foreign Minister, Count Sforza, was assisted by a personal knowledge of Serbian and Balkan problems all too rare among western statesmen. It was not however till the autumn that direct negotiations could be resumed, and by that time the eclipse of President Wilson placed Italy at an advantage. By the Treaty of Rapallo (Nov. 12 1920) Italy acquired a frontier considerably farther east than the Wilson Line, and including the quicksilver mines of Istria, the watershed of the Julian Alps as far as Snježnik (*Monte Nevoso*), almost all Istria with Abbazia and Volosca, and a narrow strip of shore connecting it with Fiume. The *corpus separatum* became an independent unit under the League of Nations, the Croat suburb of Sušak remaining in Yugoslavia and the Baros port being added as an outlet for Yugoslav trade. Zara became a free city under Italian sovereignty, but as a tiny isthmus without hinterland or islands. Italy renounced all claims to Dalmatia, and of the islands retained only Lussin and Cherso. Special linguistic and other privileges were assured to the Italian minority in the Dalmatian towns, but no corresponding charter was granted to the four to five hundred thousand Slovenes and Croats annexed to Italy. The settlement, though far from ideal, involved concessions on both sides: and Italy, though still forgetful of the principles enunciated at the Roman congress, could at least claim to be the only victorious Power which had relinquished its hold upon conquered territory. One practical result of the treaty was that Italy tacitly abandoned the cause of King Nicholas and accepted as inevitable Montenegro's incorporation in Yugoslavia.

The New Frontiers.—The consolidation of the new State was seriously delayed by the prolonged dispute with Italy and by the fact that for nearly two years after the Armistice the danger of an armed conflict could not be overlooked. But in five other directions also the frontiers were unregulated. (1). By the Armistice concluded at Belgrade on Nov. 12 1918 the Serbs were allowed to occupy Temesvár and most of the Banat, the east of which is overwhelmingly Rumanian and which was claimed in its entirety by Rumania, in right of her treaty of Aug. 1916 with the Allies. At the Paris Conference Rumania's enforced conclusion of peace with Germany was treated as absolving the Allies from obligations which were admitted in the parallel case of the Italian treaty: and the necessity of a partition on mainly ethnographic lines was from the first admitted. The special commission, after hearing the views of Trumbić and Bratianu, recommended a line which as nearly as possible balanced the Serb and Rumanian minorities left to Rumania and Yugoslavia respectively, and secured to the latter the essentially Serb districts of Torontál county: but at the instance of the French this line was modified to include Vršac (Versecz) and Bela Crkva (Weisskirchen) in Yugoslavia. This has the disadvantage that while the Serbs are stronger than any other single race in the two towns, their cession involved the loss of many purely Rumanian villages by Rumania, and also her loss of the important railway line connecting Temesvár southward with the Danube. (2). The regulation of the new Yugoslav frontier with Austria proved very thorny. Thanks to the efforts of Trumbić and the Slovene experts in Paris, Marburg (Maribor), a town with a German majority but surrounded by a purely Slovene district, was assigned to Yugoslavia: but under the Treaty of St. Germain a roughly triangular district north of the Karawanken range was referred to a popular plebiscite. The Inter-Allied Commission entrusted with the details was ordered to divide the disputed area into Zone A, mainly south of the river Drava (Drau) and Zone B, consisting of Klagenfurt and its basin, and to hold the plebiscite in the latter, only in the event of Zone A voting for Yugoslavia. After a keen contest between the rival Slovene and Pan-German propagandists, voting took place in Oct. 1920, and resulted in a majority of 12,747 for Austria. The fact that many Slovenes voted against Yugoslavia was largely due to a desire to escape from all military service. Zone B, with Klagenfurt, now automatically passed to Austria. (3). Against Bulgaria the Yugoslav delegation claimed considerable frontier rectifications—(*a*) the Strumnica salient, which threatened the Vardar railway from the east, (*b*) the district of Kochana (Tocana) and the Bregalnitsa (Bregalnica), (*c*) a strip of territory running parallel with the old Serbo-Bulgarian frontier the whole way from Zaječar to Kyustendil, and (*d*) the town of Vidin on the Danube and the salient between it and the Timok. These claims were regarded by the Peace Conference as excessive, and under the Treaty of Neuilly only the two first were allowed, though in place of the third the town and district of Tsaribrod were assigned to Yugoslavia, and thereby the main strategic key to Sofia. This decision is so patently unjust that it has been very widely ascribed to a deliberate design to keep the two countries apart. (4). The Pan-Serb section of opinion in Belgrade, encouraged in this instance by some of the army chiefs for strategic reasons, has always coveted northern Albania: and the Montenegrin Unionists, led by Radović, made every effort to secure the adoption of their full claim by the Yugoslav delegation. This was opposed by Trumbić and all the more progressive elements in the new State, who realized that the claim to Skutari knocked the bottom out of the whole Yugoslav case against Italy and Austria. Thus the advocates of an unscrupulous "deal" on the lines of "Skutari for Fiume" failed to assert themselves, and Yugoslavia pronounced in favour of an independent Albania, merely reserving her right to share the spoils if it came to a general partition. After Giolitti's renunciation of a mandate in Albania the claim to Skutari became untenable, and at last in 1921 the Supreme Council sanctioned the frontiers assigned to Albania in 1913. Yugoslavia's relations with Albania, though simplified by this decision, have been affected by the Albanian counterclaim to Peć, Djakovo and the plain of Kosovo, where since the middle of last century the Albanian element had grown steadily stronger at the expense of the Serbs. The murder of Essad Pasha (June 1920) deprived the Serbs of their chief supporter in Albania: and friction was increased by the bad administration in the Sanjak and Macedonia, by the inability of the Durazzo Government to prevent continual armed raids against Serbian territory, and by the encouragement given from some Serbian quarters to the Mirdite rising in the summer of 1921. (5). The frontier with Hungary was the last to be regulated. The Treaty of Trianon satisfied the most essential claims of Yugoslavia, by dividing the whole Banat (save a small Magyar triangle opposite the city of Szeged) between her and Rumania, and by assigning to her the whole Bačka (except Baja and district), part of the Baranya (forming the angle between Drave and Danube) and the Medjumurje (between Drava and Mur). Thus, in order to secure the town of Subotica (Szabadka) with its large Bunjevac (or Catholic Serb) population, she was allowed to annex not less than 250,000 Magyars. Her claim to Pécs (Fünfkirchen) was disallowed, but owing to the long delay in ratifying the treaty, Yugoslav troops remained in occupation of this district and its valuable coal-mines till Aug. 1921, when at the instance of the Supreme Council it was handed over to Hungary. Meanwhile Pécs had become a centre of the exiled Magyar progressives, who preferred a provisional Yugoslav *régime* to the white terror of Adml. Horthy. On the eve of evacuation an attempt was made in Pécs to reëstablish the Hungarian Republic under Count Károlyi, but owing to the communist views of some of its promoters the Belgrade Government withheld all support, and the movement promptly collapsed.

Internal Politics.—So long as vital frontier disputes were unregulated, the central Government in Belgrade held that elections could not be held, and governed for the first two years through a provisional Parliament, for which no one could claim a really representative character. The deputies for Serbia held mandates which had actually expired as long ago as June 1914, but whose renewal war and invasion had effectually prevented: those for Croatia had been elected in Jan. 1914, those for Montenegro were delegated by the revolutionary assembly of Podgorica in Nov. 1918. But in Bosnia and most of the other provinces the deputies had no popular mandate whatever, beyond being members of the self-constituted local committees which had sprung up amid the ferment of the revolution. Meanwhile the union of so many distinct political organisms had reduced the party system to chaos, and the first two years were taken up by a process of regrouping, the dominant issue being Centralism versus Federalism. In accordance with the Declaration of Corfu, the decision regarding the actual form of the State was left to a constituent assembly: but as the machinery of Belgrade was naturally quite inadequate to the task of administering a country three times the size of the Serbia of 1914, the provincial Governments of Croatia (with the Ban at its head), Slovenia, Dalmatia and Bosnia continued to function, though the local diets were no longer summoned.

During 1919 internal politics centred in a struggle between the Radicals, who still possessed the best party machine and stood for a narrowly Serbian as opposed to a Yugoslav programme, and the newly constituted Democratic party, which absorbed most of the Serbian Opposition parties, the old Serbo-Croat coalition of Zagreb, and the Slovene Liberals. The Radicals of Serbia being conservative in all but name, made a working alliance with the clericals of Zagreb and Ljubljana, and under the leadership of Protić favoured decentralization, combined with concessions to the expropriated landowners. But in the land question the Radical party was paralyzed by its Bosnian wing, which sided with the peasantry: and thus in Sept. Protić was replaced by Davidović, the Democrat leader, and though the Government remained a coalition, its weight was transferred farther to the Left. An internal trial of strength continued throughout the winter between the rival governmental groups, until in May 1920 a breach was only averted by a reconstruction of the Cabinet under Vesnić, who as Serbian minister in Paris since 1904 enjoyed wide prestige, and though a Radical, stood aloof from party dissensions. Under his weaker but more neutral guidance, and aided by the unifying force of the Adriatic crisis, the parties reached agreement upon a new parliamentary franchise, based on universal suffrage. Though otherwise progressive, this law committed the injustice of temporarily disfranchising the non-Yugoslav minorities, on the convenient pretext that they could not claim the vote until the expiry of the two years during which the Treaty of Trianon secures their right to choose citizenship in a neighbouring State. This law was the last serious act of the provisional Parliament, which had shown itself singularly barren in legislation, and contrasts most unfavourably with the first assemblies of all the other "Succession States."

The elections to the Constituent Assembly (Nov. 1920) did not clear up the situation as had been expected. No party secured an absolute majority, and the two strongest, the Radicals and Democrats, being almost exactly balanced, were forced to strengthen still further their unnatural alliance. In open opposition stood (1) Stephen Radić, the Croat peasant leader whom the Democrats had unwisely imprisoned in 1919–20, and who now swept the boards in Croatia with a Republican and Federalist programme and induced his party of 50 to absent itself from the Constituent: (2) the Croat and Slovene clericals, who strongly opposed centralization, and (3) the 58 Communists, led by a small group of extreme theorists, but owing their strength to the subversive elements in the Bačka, Macedonia and Montenegro and the secret aid of the Carlists in Vienna and Budapest. As the coalition lacked the necessary majority, it was reduced to gathering support piecemeal among the more neutral groups: and for this task Pašić, who became Premier in Jan. 1921, was specially qualified. By the promise of 100 million dinars to the expropriated Begs, he won over the Moslems of Bosnia, and by similar methods he detached the Slovene section of the newly founded Agricultural party (Zemljoradnici). But though he was thus able to carry the first reading of the new constitution by 227 to 93 votes, he was faced by the passive resistance of the great majority of Croats and Slovenes, who regarded with suspicion his "Great Serbian" and centralizing aims. It is significant that Protić, hitherto Pašić's most intimate associate, withdrew from the Radical party and from Parliament rather than sanction a constitution so inimical to provincial interests: while Trumbić, the foremost advocate of full national unity, recorded his vote against it. In many quarters it was openly accepted on the ground that any constitution was better than none, and that further delays and discussions would arrest the new State's development and discredit it abroad: but the settlement could not be regarded as definitive. On June 28 (Kosovo Day) the Prince Regent took oath to the new constitution, but the ceremony was marred by an attempt to assassinate him and the premier, by a bomb thrown as they drove back to the palace. This outrage, which was traced to the Communists, provided fresh proof that the Democratic leader Drašković, as Minister of the Interior, was justified in his charges of widespread terrorist conspiracy and even in the much debated Decrees (Obznane) by which he sought to combat them. When then on July 21 Drašković was murdered by a young Bosnian Communist, Parliament resolved on reprisals, and 10 days later passed by 190 to 54 laws of extraordinary severity for "the Defence of the State," terrorist agitation being made punishable by death, prolonged penal servitude or heavy fines. The mandates of the 58 Communist deputies were annulled, and eight arrested as privy to the attempt on the Regent. No less an authority than the ex-premier Protić publicly challenged the constitutional validity of such action.

Despite acute party dissensions and bad administration the new State was in 1921 steadily consolidating itself. Separatism was non-existent, for the cogent reason that there was no point toward which a new irredenta could gravitate: the Habsburg cause had no adherents, save a few discredited traitors who congregated in Graz and Vienna: and communism, which was quite alien to an agrarian and peasant-owned State, owed its passing success to the aftermath of war and the blunders of the middle class rather than to its own attractions. There was general agreement on foreign policy, whose pivots were close alliance with Czechoslovakia, the series of bilateral agreements which made up the Little Entente (Czechoslovakia and Yugoslavia Aug. 14 1920: Czechoslovakia and Rumania April 23 1921: Yugoslavia and Rumania June 7 1921), and the anti-Habsburg agreement concluded with Italy simultaneously with the Treaty of Rapallo (Nov. 12 1920). Yugoslavia's economic recovery had been surprisingly rapid, and the chief problems which confronted her in the autumn of 1921 were how best to exploit her vast undeveloped mineral and agricultural resources, improve her very faulty communications, and root out the illiteracy which was a legacy of alien rule.

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YUKON TERRITORY (*see* 28.945 and 15.847).—Although at one time the pop. of the Canadian province reached 30,000 to 35,000 the decline of the mining industry had reduced it to about 5,000 in 1921. Since the establishment of government in Yukon the administration of justice has been in the hands of the North-West Mounted Police, whose services in preserving law and order have been invaluable.

In the northern portion of the territory the ground below the surface remains frozen throughout the year, but from June to Oct. the climate is warm and sunny and vegetation grows freely in the valleys. Wild fruits such as bilberry, bearberry, crowberry, bog apple, currant, raspberry, foxberry and high-bush cranberry occur, besides numerous species of phanerogams. The Yukon is not an agricultural country, but oats, barley, rye, flax, potatoes, turnips and other garden vegetables are successfully raised. Parts of the territory are wooded with fair sized timber. White and black spruce are the most important trees, reaching 2,400 ft. above sea level: specimens having 21-in. stumps have been noted but the average diameter ranges from 12 to 16 inches. The timber cut is for home consumption. Poplar (two varieties) and canoe birch are found, also willows, alder, juniper and other shrubs, which form thickets and dense undergrowth.

Moose, caribou and sheep are plentiful in most localities, and black, brown and grizzly bears are numerous. Wolverines, marten, lynx, ermine, rabbits and fox are the chief fur-bearing animals. The commonest birds are the Alaska jay, Swainson hawk, northern varied thrush, fox sparrow, grey checked thrush, and there are Hutchin geese, partridge, ptarmigan and ducks of many varieties. The waters of the Yukon are well stocked with fish, especially salmon, whitefish, trout, pickerel and pike.

The old primitive methods of extracting gold have been replaced by dredging and modern hydraulic methods. In 1920 the production of gold from the Yukon territory was 72,140 oz., against 90,705 oz. in 1919. This was obtained almost wholly from the alluvial sands and from the gold ores of the Conrad district. There has been a gradual falling off in production since 1913, when about 283,000 oz. worth $6,000,000 were mined. It was estimated in 1920 that the total output of gold had been over $150,000,000. Coal, copper, silver and other ores are mined and discoveries of silver ores at Kerro Hill have been reported.

The mountain system of the Yukon is the most remarkable in Canada, not only in regard to height and extent of glaciers, but also in scenic grandeur, majesty and imposing nature. It contains Mt. St. Elias, just within Canadian territory as delimited by the joint commission of boundary surveyors (17,978 ft.), and Mt. Logan within 20 m. of it (19,539 ft.). These, along with Mt. McKinley in Alaska, are the highest peaks on the North American continent. (W. L. G.*)

ZAGLUL, SAAD (*c.* 1860–), Egyptian pasha, was the son of a notable in the district of Ibian, Gharbia Province. He was educated at the village school and afterwards at the university of El Azhar, in Cairo. When he had completed his prescribed course of studies, he was, in 1880, appointed editor of the *Official Journal.* Later he was nominated a Moawin under the Ministry of the Interior and eventually became Chief of the Contencieux for the province of Giza. Involved in the Arabi revolt, he was one of the many notables detained on the occupation of Egypt by British troops in 1882. On his release he ceased to hold office and in 1884, when the native tribunals were instituted, he began to practise at the bar. In 1892 he was appointed counsellor of the native court of appeal. Having become proficient in the French language and in the science of law, he obtained his diploma in law. He became Minister of Education in 1906, and under his "enlightened administration" it was said by Lord Cromer (*Modern Egypt,* vol. ii., p. 535) that "education in Egypt made rapid strides in advance." A change of the Ministry during Lord Kitchener's tenure of the Cairo Agency resulted in Zaglul's ceasing to hold the portfolio for Education, but he was appointed vice-president of the Legislative Assembly and he took a special interest in its deliberations until the outbreak of the World War, when the sittings of that body were temporarily suspended.

On the signing of the Armistice Zaglul, who had for long been considered the principal spokesman of the Nationalist party, appealed to the Residency in Cairo for the recognition of Egyptian independence, basing his demand on President Wilson's self-determination policy to which effect had been given by the British Government's issue of a Proclamation defining the status of the other countries liberated from Turkish rule by the war. When his proposal that he and some representative Nationalists should visit London to press their views was refused by the Government, he became discontented, and his attitude was so hostile that he and three others were arrested and deported to Malta. This was the signal for a murderous outbreak in Egypt in which British officers and others were killed, and the country became much disturbed. Zaglul and his friends were later released, and freedom of travel, which war measures had hitherto restricted, was permitted to all. A special Mission under the chairmanship of Visct. Milner was sent to Egypt in Nov. 1919 to enquire into matters and make representations. Zaglul eventually came to London and discussions between him, Adly Pasha and Lord Milner took place, the results of which were published in the "Milner Report." Zaglul returned to Egypt early in 1921, where he represented the extreme Nationalist party in opposition to the more moderate ministry under the presidency of Adly Pasha. At the end of the year, when trouble again broke out in Egypt, Zaglul was arrested once more and deported to Ceylon.

ZANGWILL, ISRAEL (1864–), English man of letters (*see* 28.956*), subsequently to 1909 published various volumes of essays, *Italian Phantasies* (1910), *The War for the World* (1916), *The Principles of Nationalities* (1918) and *The Voice of Jerusalem* (1920); and a novel, *Jinny the Carrier* (1919). In drama he produced *The War God* (1911, acted at His Majesty's theatre, London), *The Next Religion* (1912, London Pavilion), *Plaster Saints* (1914, Comedy theatre), and *Too Much Money* (1918, Ambassadors theatre). He took an active part as a speaker on behalf of the woman suffrage movement, and also as a pacifist during the World War. His attempts, as founder of the Jewish Territorial Organization, in connexion with the Zionist movement, to combine all the Jewish organizations in a scheme for the acquisition of the highlands of Angola as the "Jewish national home" had proved abortive before the outbreak of the World War; and subsequently, when the British Government gave its support to the setting apart of Palestine for this object, Mr. Zangwill and the J. T. O. declined to work with the Zionists on this basis. The J.T.O., however, organized an Emigration Regulation department for deflecting the stream of Jewish emigration from the Ghetto of New York to the southern states of the American Union, west of the Mississippi, a fund being established for this purpose, to which Mr. Jacob Schiff contributed £100,000, the firm of Rothschild £10,000, Baron Edmund de Rothschild £10,000, and M. Brodsky, of Kiev, £10,000.

ZANZIBAR (*see* 28.958).—The pop. of the protectorate was estimated in 1920 at 198,000; that of Zanzibar I. at 115,000 and that of Pemba at 83,000. Zanzibar city had some 36,000 inhabitants. The Arab aristocracy—large landowners—numbered about 10,000; there was an equal number of British Indians and about 300 Europeans, the British colony being the largest.

The transshipment of goods to and from the mainland of E. Africa and the growing of cloves are the chief sources of wealth. In 1919 it was estimated that some 60,000 ac. were under cloves, with about 5,500,000 trees in bearing. The average output 1910–20 was about 14,000,000 lb. Next to cloves comes the cultivation of the coco-nut palm for copra, there being in 1919 about 2,500,000 trees in the islands. In 1911 the clove crop was worth £436,000, in 1913 £412,000, and in 1918 £595,000. Copra exports in 1911 were valued at £203,000, in 1913 at £216,000, and in 1918 at £151,000 (having been worth £299,000 in 1917).

Apart from cloves and copra most of the exports figure also as imports, being goods in transit. Zanzibar, however, suffered to a considerable extent by the extension of direct steamship communication between Europe and India and the mainland of E. Africa, goods formerly transshipped at Zanzibar being taken direct to or from Mombasa, Tanga and Dar es Salaam. But if Zanzibar ceased to serve as a gigantic go-down or storehouse for the whole coast, it retained its position as the chief city of E. Africa and remained the headquarters of the principal Indian merchants trading with E. Africa. It also retained the dhow traffic, being visited yearly by hundreds of boats from the coast of Arabia and the Persian Gulf. The construction of a concrete wharf 1,300 ft. long, with a minimum of 30 ft. alongside, in progress in 1920–1, and other harbour improvements made Zanzibar port more accessible to shipping. The gross tonnage of shipping clearing the port in 1910 was 1,087,000; it rose to 1,502,000 in 1913, but fell, largely owing to war conditions, to 547,000 in 1916 and to 378,000 in 1918. It had risen to 582,000 tons in 1919. Imports (including bullion and specie) were valued at £993,000 in 1910, at £1,103,000 in 1913, at £2,366,000 in 1918 and at £1,934,000 in 1919. Exports in 1910 were valued at £1,033,000, in 1913 at £1,048,000, in 1918 at £2,133,000 and in 1919 at £2,444,000. The bulk of the trade is with India, England and E. Africa.

Revenue rose from £204,000 in 1910 to £407,000 in 1919; in the same period expenditure increased from £189,000 to £323,000. More than half the revenue is derived from customs. There was a public debt at the end of 1919 of £100,000.

History.—Sayyid Ali bin Hamud, the Sultan, a young man who had been educated at Harrow, who kept his court on European models and was fond of travel, abdicated in 1911 while on a visit to Europe. He died in Paris in Dec. 1918. Ali was succeeded by his brother-in-law Sayyid Khalifa ben Harud, a great nephew of Sultan Bargash. Khalifa, born at Muscat, Aug. 27 1879, had attended the coronation of George V. and was proclaimed Sultan on his return from London, Dec. 1911. He proved whole-heartedly loyal to the British, and his moderating influence did much to steady Moslem opinion in E. Central Africa during the war.

In July 1913 the control of the protectorate was transferred from the Foreign to the Colonial Office. Mr. Edward Clarke, the British Agent since 1909, had died at Zanzibar in the previous Feb. Under the Colonial Office the governor of British E. Africa (Kenya Colony) was appointed High Commissioner of Zanzibar, the local administration being in the hands of a British Resident, to which office Maj. F. B. Pearce was appointed in 1914. The Resident also took over the functions of first minister, a post which had been filled by Capt. F. R. Barton. The Sultan became president of the Protectorate Council, on which three Arab notables sat as unofficial members. The council has advisory powers only, but decrees of the Sultan are binding when countersigned by the British Resident.

During the war Zanzibar served as a base for the British naval squadron. On Sept. 20 1914, while the ancient cruiser

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*** These figures indicate the volume and page number of the previous article.**

"Pegasus" was at anchor in the roadstead, undergoing repairs, it was sunk by the German cruiser "Königsberg," losing 25 killed and 80 wounded out of a crew of 240. The "Königsberg" also sank the guard ships "Cupid" and "Khalifa"—thus destroying the Zanzibar navy. About 5,000 Zanzibari served as carriers in the E. African campaign and the inhabitants contributed £70,000 to war funds.

In 1917 Sayyid Khalid, who for a brief period in 1896 had usurped the throne and had then taken refuge in German E. Africa, where he had since remained, surrendered to a British force. He was deported to St. Helena, whence in 1921 he was transferred to the Seychelles.

See F. B. Pearce, *Zanzibar, The Island Metropolis of Eastern Africa* (1920); J. E. Craster, *Pemba, The Spice Island of Zanzibar* (1913); the annual reports to the British Colonial Office.

(F. R. C.)

ZEEBRUGGE.—Among the British naval operations in the World War none created more interest than the attack on the Germans at Zeebrugge and Ostend, on the Belgian coast, in 1918. Ever since the German occupation of the Belgian coast, Zeebrugge had been a source of anxiety to the Dover Patrol. There the German torpedo craft and German submarines lay in a safe base only some 60 m. from the Straits, a danger to the Downs and a constant menace to British transports and trade in the Channel. Vice-Adml. Sir Reginald Bacon had contemplated an attack on it with monitors, but the Admiralty had disapproved, and it was not till the appointment of Rear-Adml. Sir Roger Keyes in Dec. 1917, that preparations were actually begun. The main object of the enterprise was to block the harbours of Zeebrugge and Ostend.

The actual harbour of Zeebrugge is small and is formed by a long curved mole on the western side, whose assault was an important part of the operation. This mole was 1½ m. long, connected with the shore by a viaduct built on steel pillars. On the outside the western wall rose 27 ft. 10 in. above high water, with a ledge 2 ft. 9 in. wide running along it about 12 ft. above high water. The parapet on top was some 3 ft. wide with a drop of 4 ft. to a ledge 12 ft. wide which ran 16¾ ft. above the quay. The quay on the harbour side was 27 ft. wide, equipped in the usual way with cranes and three large sheds and shelters. At the outer end was a battery of 3 5·9-in. guns, and a narrower portion ran on to the lighthouse where 6 4-in. guns, were mounted.

The general plan of operations was simple. Three old cruisers, "Iphigenia," "Thetis" and "Intrepid" (all built about 1891), filled with cement, were to enter the harbour and be sunk at the entrance to the ship canal to Bruges. The "Vindictive," supported by two auxiliary vessels "Iris II." and "Daffodil," was to assault the mole on its outer and western side and by creating an impression that this was the main operation, divert the enemy's fire from the blocking ships. As Bruges was accessible by canal from Ostend, Ostend was to be blocked at the same time by the old cruisers "Brilliant" and "Sirius." The main obstacle to the enterprise lay in the powerful batteries. On the 40 m. of coast-line there were mounted 153 guns, including 6 15-in., 4 12-in., 33 11-in., 1 9·4-in., 23 8·2-in., 73 5·9-in., 6 5-in., 11 4·7-in., and 52 4-in. The coast positively bristled with guns. Only 3 m. E. of the Zeebrugge canal stood the Kaiser Wilhelm II. battery (known at Dover as the Knocke) armed with 4 12-in. with a range of 41,000 yd. One and a quarter m. W. of Ostend was the Tirpitz battery with 4 11-in. ranging 35,000 yd., and 3 m. E. of the town was the Deutschland (old Jacobynessen) equipped with 4 15-in. ranging 43,500 yards.

The approach to the entrance of the ship canal at Zeebrugge was under the fire of the Goeben battery of 4 8·2-in. guns at 1,000 yd., and the chance of success depended largely on an effective smoke screen.

The attack on the mole was to be made by the "Vindictive" (Capt. Alfred B. Carpenter), an old cruiser of 5,750 tons, 320 ft. long, 24 ft. draught specially fitted for the occasion, assisted by the "Iris II." (Comm. Valentine Gibbs) and "Daffodil" (Lt. Harold G. Campbell), two Liverpool ferry boats of large capacity and light draught. The viaduct of the mole was to be blown up by two submarines, C1 (Lt. Aubrey Newbold) and C3 (Lt. Richard D. Sandford). A strong body of 15 destroyers was attached to the Zeebrugge force under Capt. Wilfred Tomkinson ("Phoebe," "North Star," "Trident," "Mansfield," "Whirlwind," "Myngs," "Velox," "Morris Moorsom Melpomene," "Tempest" and "Tetrarch" to escort the force and cover it to seaward; "Termagant," "Truculent" and "Manly" to screen the Zeebrugge monitors). A force of 18 coastal motor boats (55 ft. long, 3 ft. draught, 35 knots, 2 18-in. torpedoes) under Lt. Arthur E. Welman accompanied the expedition, of which 8 were allocated for the smoke screen, 5 to support the "Vindictive," and 4 to attack vessels inside the harbour. With them were 33 motor launches under Capt. Ralph Collins for smoke screens, and inshore rescue work. Out to seaward were the two monitors "Erebus" and "Terror" for bombarding the batteries. The Rear Admiral's flag flew in the destroyer "Warwick."

The three old cruisers "Thetis" (Comm. R. S. Sneyd), "Intrepid" (Lt. Stuart Bonham-Carter) and "Iphigenia" (Lt. E. W. Billyard-Leake) were to act as blocking ships. The two latter were of 3,600 tons displacement, 300 ft. long x 43⅔ ft. x 18½ ft., and the "Thetis" was a little smaller (3,400 tons and 17½ ft. draught).

A similar attempt was to be made at Ostend. There the blocking ships were to be the old cruisers "Brilliant" (Comm. A. E. Godsal) and "Sirius" (Lt.-Comm. H. N. Hardy) of 3,600 tons. They were to be supported by five bombarding monitors ("Marshal Soult," "Lord Clive," "Prince Eugene," "General Crawford," M24 and M26) and covered by five British destroyers ("Swift," "Faulknor," "Matchless," "Mastiff" and "Afridi"), with three British destroyers and six French torpedo boats attending on the monitors ("Mentor," "Lightfoot," "Zubian," "Lestin," "Capitaine Mehl," "Francis Garnier," "Roux," "Bouclier"). Eighteen British motor launches under Comm. Hamilton Benn and four French were attached for smoke screen, inshore and rescue work, and the whole force was under Commodore Hubert Lynes.

The object of the attack on the mole at Zeebrugge was first to seize the battery at the seaward end and prevent it firing at the block ships, and then to demolish the structures on it as far as possible. The battery was 250 yd. from the lighthouse, and to facilitate its seizure the "Vindictive" was to berth nearly abreast of it on the outer side of the wall. It was then to be stormed by three companies of bluejackets—A company under Lt.-Comm. Bayan Adams ("Princess Royal"), B under Lt. Arth. G. Chamberlain ("Neptune"), D under Lt.-Comm. G. N. Bradford; all under Lt.-Comm. Arthur Harrison ("Lion").

Some 150 yd. to shoreward of the battery and 400 yd. from the lighthouse there was a "fortified zone" of barbed wire and machine-guns. As this commanded the "Vindictive's" berth and would form a rallying point for reinforcements from landward, it was to be seized by four companies of Royal Marines—A (Chatham) under Maj. Chas. Eagles, B (Portsmouth) Capt. Ed. Bamford, C (Plymouth) Maj. Bernard Weller, and machine-guns under Capt. Chas. B. Conybeare.

The storming parties numbered 50 officers and 980 men of the Royal Navy, drawn chiefly from the Grand Fleet and the Nore, and 32 officers and 718 men of the Royal Marines. The seamen were under Capt. Henry C. Halahan and the marines under Lt.-Col. Bertram Elliot. Preparations began early in the year. The force was segregated in the Swin (Thames) and specially trained in all its various tasks. The blocking ships were stripped of all fittings and filled with rubble and concrete. The "Vindictive" in addition to her 10 6-in. guns was given a special equipment of 2 7·5-in. howitzers (1 ford. and 1 aft), 1 11-in. howitzer (aft), 16 Stokes mortars, flame throwers, 16 Lewis guns, and 4 1½-in. pompoms. The success of the attack depended largely on an effective smoke screen, and Wing-Comm. F. A. Brock and 60 ratings were lent to the Dover command, where a small factory was set up to prepare the materials for it.

The lessons of history were not very favourable to the enterprise. Naval Constructor R. P. Hobson had tried to block

Santiago in 1898. The Japanese had thrice attempted to block Port Arthur in 1904. None of these attempts had been wholly successful. Let us glance for a moment at the conditions under which the attack was to be made. The distance from Dover to Zeebrugge was 63 miles. This meant that the expedition must start in daylight to be off the port by midnight. The night must be dark and the wind on shore.

Twice the force was assembled and twice unfavourable conditions supervened. On the night of April 11–12, it was within 13 m. of its rallying point. Finally the night of April 22–23 was fixed for the attack. The main force started at 4:53 P.M. on Monday, April 22. The bombardment was to begin at 11:20 P.M., simultaneously at Zeebrugge and Ostend. The smoke screen was to start at 11:40 P.M. The "Vindictive" was to reach the mole at midnight. The "Thetis" was to pass the end of the mole 25 minutes later. The last point of departure was at a point called G in lat. 51° 27′ N., long. 2° 50′ E. This and other points on the route were marked by buoys laid after careful triangulation by Capt. H. P. Douglas and Lt.-Comm. Francis E. Haselfoot. It was here, some 12 m. off Zeebrugge and Ostend, that the vessels took up their formation for attack. The "Vindictive," which had been towing the "Iris II." and "Daffodil," cast them off. The "Sirius" and "Brilliant" shaped course for Ostend, the "Thetis" and her companions eased down. The host of small craft dispersed for their various tasks. The night was overcast, with a light wind from the N.E., and a thick column of smoke soon began to roll down the coast, hiding everything.

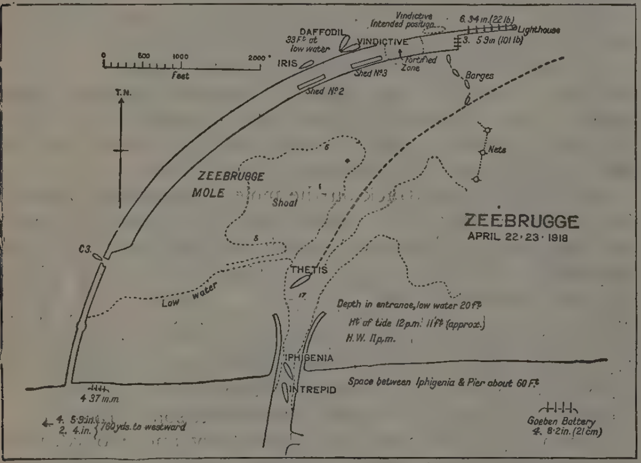
Vindictive Intended position
6. 34 in. (22 lb.)
Lighthouse
DAFFODIL
33 Ft at low water
VINDICTIVE
3. 5.9 in. (101 lb.)
0 500 1000 2000
Feet
IRIS
Fortified Zone
Shed Nº 3
Barges
Shed Nº 2
T.N.
Nets
6
ZEEBRUGGE MOLE
Shoal
ZEEBRUGGE
APRIL 22·23·1918
5
C3.
THETIS
17
Low water
Depth in entrance, low water 20 Ft
Ht of tide 12 p.m. 11 Ft (approx.)
H.W. 11 p.m.
IPHIGENIA
INTREPID
Space between Iphigenia & Pier about 60 Ft
4 37 m.m.
4. 5·9 in.
2. 4. in.
760 yds. to westward
Goeben Battery
4. 8·2 in. (21 cm)

Plan A

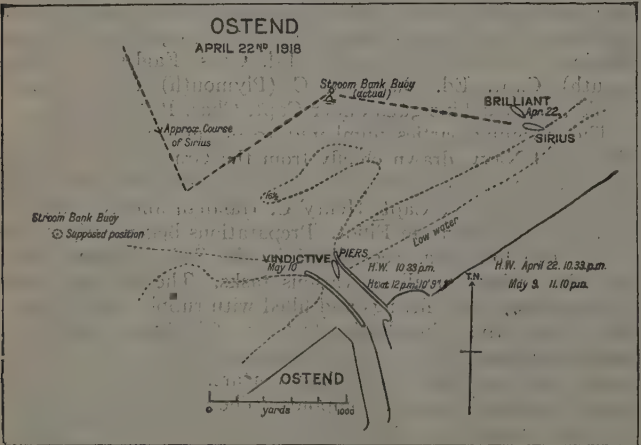
OSTEND
APRIL 22ND 1918
Stroom Bank Buoy (actual)
BRILLIANT
Apr. 22
Approx. Course of Sirius
SIRIUS
16½
Stroom Bank Buoy
Supposed position
Low water
VINDICTIVE
May 10
PIERS
H.W. 10.33 p.m.
Ht at 12 p.m. 10' 9"
H.W. April 22. 10.33 p.m.
May 9. 11.10 p.m.
T.N.
OSTEND
0 yards 1000

Plan B

As they approached the shore about 11:40 P.M. a great star shell soared into the sky, which was soon thick with them shining dimly through the eddies of the smoke. They were close to the harbour when a great disappointment overtook them. The wind, which had died away, shifted to the southward, greatly reducing the efficiency of the screen. The searchlights fastened on the vessels. At 11:56 the "Vindictive" emerged out of the smoke into the full glare of their beams. The mole could be seen 300 yd. on the port bow. Capt. Carpenter increased to full speed and approached it at an angle of 45°. A heavy fire was opened on her and she replied with her port 6-in. battery, the upper deck pompoms and the guns in the fore top. The storming parties drawn up ready to rush ashore lost both their leaders at this point. Col. Bertram Elliot, waiting to lead the Royals just abaft the bridge, was struck down by a shell which did fearful execution forward. Capt. H. C. Halahan at the head of the bluejackets amidships was killed by machine-gun fire.

At one minute past midnight, the ship came alongside the mole. It was intended to do this 300 yd. from the lighthouse abreast of the 4-in. battery, but the starboard anchor was hung up with a strong tide sluicing down the mole, and the ship was carried some 700 yd. from the lighthouse or nearly 400 yd. to landward of the intended spot. The port anchor was dropped and bowsed to with only a shackle (75 ft.) out. A further difficulty now arose. The rush of the 3-knot tide between the ship and mole created a heavy swell which threw the ship off the mole; only two of the 18 brows could reach the parapet, and the ship could not be kept into the mole. Swaying upward with the roll of the ship the two foremost brows came down scraping and grinding along the mole. The naval storming parties led by Lt.-Comm. Bryan Adams ran out along them, followed closely by the Royal Marines led by Capt. and Adj. A. R. Chater. As the seamen got to the wall they leapt down and tried to make the mole grapnels fast (for hauling the ship into the mole), but only one was got in place and a heavy roll broke it up.

This was a critical time, and it was four minutes past midnight when the little "Daffodil" came up and pushed the ship bodily into the mole. Two more brows were got into place and the landing parties got ashore. The "Vindictive's" guns had suffered heavily. The marine crew of the foremost 7·5-in. howitzer had all been killed or wounded. A naval crew from one of the 6-in. guns, which took its place, was almost entirely swept away. In the foretop the Royal Marines under Lt. Chas. Rigby had kept up a continuous fire with their pompoms and Lewis guns till two heavy shells got home on it, killing or disabling everyone there except Sergt. Norman Finch, who though severely wounded continued to fight his gun singlehanded till the top was wrecked by another shell. The "Iris II." with the Chatham company of Royal Marines and D company of seamen had suffered even more severely. She had gone alongside the mole about 150 yd. ahead of the "Vindictive." The swell broke up the scaling ladders. Lt. Claude Hawkings ("Erin"), who led the way, made a grapnel fast and was shot down on the mole. Lt.-Comm. G. N. Bradford ("Orion") got to the top of a derrick with a grapnel, leapt on to the mole, secured it and fell back shot into the water. Comm. Val. Gibbs fell, with both legs shot away. The grapnels tore away, and the "Iris II.," slipping her cable, dropped alongside the "Vindictive" to land her men across her. Here she again suffered heavily. A big shell went through the upper deck and burst just where 56 marines were waiting to charge up the gangways, killing 49 and wounding seven. Another shell in the wardroom killed 4 officers and 26 men. The heavy swell made it difficult to get alongside the "Vindictive," and only a few men had got across when the siren sounded the retire.

To return to the landing on the mole. The 400 yd. or so by which the "Vindictive" overran her position had a considerable effect on the plan. The seamen, instead of dropping down on the battery, had to go back to it 400 yd. along the mole. The "fortified zone," instead of being between the "Vindictive" and the shore, was now between the "Vindictive" and the battery on the mole, increasing the difficulty of an assault.

The seamen of A and B companies under Lt.-Comm. B. F. Adams, got ashore, and dropping on to the ledge below the parapet made their way toward the lighthouse. They came to a lookout station which they captured. Here an iron ladder led down on the quay and three of the party went down it. A machine-gun in the fortified zone was firing on them, and Lt.-Comm. Adams advanced towards it for some 40 yd. and after taking up a position returned to collect more men. Lieutenant-Commander Harrison, severely wounded in the head, arrived about this time and took charge. Lieutenant-Commander Adams met Maj. Weller who gave him reinforcements, but by the time he got back Lt.-Comm. Harrison had led a rush along the parapet, where he and several of his men were killed by machine-gun fire. Able seaman Mackenzie's courage here gained him a V.C., and able seaman Evans was seriously wounded and taken prisoner in trying to bring in Lt.-Comm. Harrison's body. D Company was still in the "Iris II.," but the marines were forming up on the mole to make an assault.

They had been busy at first in the other direction. The first platoon to get ashore made to the right toward the shore and silenced a party of snipers near No. 2 shed. Captain Bamford (awarded the V.C.) joined them and they reached and held a point 200 yd. toward the shore. Another party of marines dropping straight to the mole had established a strong point by No. 3 shed close to the "Vindictive." About 12:20 a terrific roar and a great sheet of flame rose high above the din. The viaduct had gone up, and the mole was secure from landward side. Major Weller now received Lt.-Comm. Adams' request for reinforcements and sent a platoon and the remains of another to help him.

They advanced toward the lighthouse and reached the lookout station, where they were held up again by machine-gun fire. Lieutenant-Commander Adams and his men were some 40 or 50 yd. ahead. Nos. 5, 7 and 8 platoons were forming up under Capt. Bamford for an assault on the fortified zone. This was the position when the signal to retire blared out.

The demolition company (C Company of seamen) had got ashore under Lt.-Comm. Dickinson, but the storming parties were too close to permit of the sheds being blown up, and an attempt to blow up the destroyers was beaten back. The danger of the attack from landward had been removed by the destruction of the viaduct. Submarine C1 had parted its tow and did not reach the scene in time. Lieutenant R. D. Sandford (awarded the V.C.) in C3 had sighted the viaduct about half a mile off, and running into the iron piers at 9½ knots had jammed the vessel with its 5½ tons of amatol hard and fast. The fuze was lighted and the crew of six were pushing off in their little motor skiff when the propellor was torn off by fouling the submarine, and they had to take to the oars. A rain of bullets fell close to them, and struck down two oarsmen in succession. They were 300 yd. away when the viaduct went up, scattering huge pieces of iron and concrete around them.

Another bullet struck Lt. Sandford, but just at that moment the picket boat with his brother (Lieut.-Comm. Francis Sandford) came up and took them off. Meanwhile, in the "Vindictive," Capt. Carpenter had seen the block ships go in. The position of the storming party and of the ship was precarious. None of the mole anchors had grappled. The ship was being held into the mole by the "Daffodil," and if she were disabled it was practically certain that the men in the mole would not get back. He decided it was time to retire. His own siren was riddled through and through, but the order was passed to the "Daffodil," and the shriek of its siren rose above the din.

It was 12:50 A.M. The parties came gradually back, the marines retiring in perfect order, bringing their wounded with them. Capt. T. M. Palmer refused to leave the shore while any of his men were there, and joined the ranks of the missing. Wing-Comm. F. A. Brock, too, never returned. He was last seen fighting on the mole.

A hawser was passed from the "Vindictive," and at 1:10 A.M. the "Daffodil" began to pull her bows off the mole. The hawser just held long enough to swing her bows round, and she got clear. The "Iris II." came under a heavy fire as she left the mole. A large shell carried away the port side of the bridge, mortally wounding Comm. V. Gibbs and Maj. Chas. Eagles. Lieutenant Spencer, though seriously wounded, continued to con the ship and got her clear. Three more shells hit the ship and caused heavy casualties in the crowded decks, but Motor Launch 558 (Lt.-Comm. Lionel Chappell, with Capt. Ralph Collins on board) came up, and throwing a smoke screen round her helped her to get away.

To return to the blocking ships. With the "Thetis" leading they had rounded the lighthouse in a storm of shot and shell. The "Thetis" propeller fouled a net laid at the entrance to the harbour and carried it with her. Both engines brought up, and she grounded 300 yd. from the pierhead. She was under heavy fire, and as she appeared to be sinking, the order was given to abandon ship and blow the charges; they detonated and the ship sank. The crew manned the remaining cutter and pulled to ML526 (Lt. Hugh Littleton) which was lying near.

The "Intrepid" astern had come under heavy shrapnel fire from the guns as she approached the mole, but after rounding it escaped their attention. She had 87 officers and men in her instead of 54, as the surplus had contrived to stay on board rather than miss the fight. She ran right into the canal, and Lt. Bonham Carter went full speed ahead with the starboard engine and full speed astern with the port to turn her round. As the ship commenced to make stern way he blew the charges, and the crews got into two cutters which were picked up by the "Whirlwind" and a motor launch. Lt. Bonham Carter with two officers and four petty officers had got on a Carley raft and floated down the canal. ML582 (Lt. Percy T. Dean, awarded the V.C.) had come right into the canal behind the "Iphigenia," and under a heavy fire picked them up and took them off. All the crew except one were saved. In the "Iphigenia," like the "Intrepid," the engine room ratings had avoided being taken off, so as to be present at the fight. She came under shrapnel fire off the mole, and as she rounded it a star shell showed up the "Intrepid" heading for the canal and the "Thetis" aground. Two shells struck the ship on the starboard side. The canal was hidden by smoke. It lifted for a moment, and the captain, seeing he was heading for the western pier, went full speed astern, then ahead with the starboard engine, and with a barge in front of him drove into the canal. There was a gap between the "Intrepid" and the eastern bank; he steered into it, collided with the "Intrepid," rang the gong to signify the imminent blowing of the charges, went astern and then ahead. She grounded on the eastern bank and the charges were fired. The crew left the ship in the only cutter left under fire. ML282 (Lt. Percy T. Dean) was waiting and took the crew on board, and then making the cutter fast to his stem went out of harbour stern first at full speed. Heavy machine-gun fire was concentrated on her; two officers were dangerously wounded and two of the launch's crew of four killed, but she got clear.

The destroyers had been lying off the harbour, and the "Warwick" now picked up four motor launches, including ML282 overloaded and full of wounded with 101 men of the "Iphigenia" and "Intrepid." ML110 (Lt.-Comm. Dawbarn Young) had come under a heavy fire while trying to show the blockships the way in. She was struck by three shells, which killed or wounded half the crew and wrecked the engines. Her captain, hit in three places and mortally wounded, gave orders to the last, but died before reaching Dover. The "Warwick," "Phoebe" and "North Star" had been cruising off the mole to screen the force from torpedo attack. The destroyer "North Star" losing her bearings in the smoke had emerged from the smoke screen and coming under a heavy fire was reduced to a sinking condition. The "Phoebe" (Lt.-Comm. Hubert Gore-Langton) attempted to tow her out, but the hawser was shot away once, and parted another time. She was therefore abandoned and sunk. By 1:30 it was all over and the force was on its way back to Dover. The "Vindictive" in terrible disarray arrived there soon after 8 A.M. on April 23. The "Iris II.," limping behind her, reached home at 2:45 P.M. Her commander had died that morning.

Meanwhile things had gone badly at Ostend. The blocking ships "Brilliant" (Comm. Alfred Godsal) and "Sirius" (Lt.-

Comm. Henry Hardy), escorted by the Harwich destroyers "Tempest" and "Tetrarch," arrived off the coast. The motor launches under Comm. Hamilton Benn were busy laying a smoke screen, supported by the "Faulknor" (flying Commodore Hubert Lyne's broad pendant), "Lightfoot," "Mastiff," "Afridi," "Swift" and "Matchless." The wind was blowing lightly from the N.W., but about 11:50 shifted to the S.W. and blew back the smoke screen. The low clouds and drizzle made visibility difficult, and the Stroom Bank buoy could not be seen at first. Thinking that the ships were perhaps too far to the northward, Comm. Godsal continued on his course for two minutes, when he sighted the Stroom Bank buoy to the N.E. and turned to pass to northward of it. It was not, however, in its normal position (approximately 1 m. W.N.W. of the entrance), but had been shifted about a mile to the eastward. Commander Godsal steered from the buoy for the supposed direction of the harbour. As he looked anxiously out for the pierheads at Ostend, breakers suddenly loomed up on the starboard bow, and before the ship could turn she was ashore. The "Sirius" behind her grounded too. Fire had been opened from shore, and both ships were accordingly blown up where they stranded about a mile east of the piers. ML276 (Lt. Roland Bourke) took off the "Brilliant's" crew, while ML283 (Lt. Keith Hoare) rescued the men from the "Sirius." A second attempt to close Ostend was made on the night of May 9–10 by Comm. Alfred Godsal in the "Vindictive" and Lt.-Comm. Hardy in the "Sappho," an old cruiser of the same class as the "Sirius." This time there was no preliminary bombardment but aircraft were coöperating. Conditions seemed favourable for the attempt. The sea was smooth, the night dark with wind from N.W., but hardly had the ships left Dunkirk when the "Sappho" blew out a manhole joint in her boiler and had to put back.

At 1:30 A.M. the small craft went in to lay the smoke screen. News had previously come in that the Stroom Bank buoy had been removed, and Lt. W. R. Slayter went in a coastal motor boat to place a calcium flare in its old position. By 1:35 the smoke cloud was beginning to come down, and at 1:43 the order was given for the monitors to open fire. A roar of batteries answered from the shore. Two coastal motor boats, CMB24 and 30, dashed ahead and torpedoed the piers. But once again misfortune was to attend the attempt. As the "Vindictive" approached, a thick sea fog rolled up the coast, making it impossible to see anything at over 300 yd. Uncertain as to his position, Comm. Godsal steered to westward and then to eastward, and finally gave orders to CMB23 (Lt. Hon. Cecil Spencer) to light a million-candle flare. Though dimmed by the fog and drizzle, its glare revealed the entrance 200 yd. off. The "Vindictive" steered for it and the guns found her at once. The after control was demolished by a shell which killed everyone in it. The bridge was swept with bullets, and Comm. Godsal ordered everyone inside the conning tower. She was close to the eastern pier when a heavy shell burst close to the conning tower, which must have killed the commander for he was never seen again. Lt. Victor Crutchley took command and tried to turn her up the channel, but she grounded at an angle of about 25° to the pier and lay hard and fast. Engineer Lieutenant Wm. C. Bury blew the charges and she sank. The captain could not be found. ML-254 (Lt. Geoff. Drummond, awarded the V.C.) came alongside under a fierce fire. His lieutenant and deck-hand were killed and he himself wounded in three places, but he managed to embark 39 officers and men, and then backing out of the entrance got clear and just managed to reach the "Warwick." Day was breaking and as the boat was badly damaged she was sunk. ML276 (Lt. Roland Bourke, awarded the V.C.) now returned to the "Vindictive," and after searching and shouting found Lt. Sir John Alleyne and two men, all badly wounded, clinging to a skiff. With three of his own crew killed or wounded Lt. Bourke managed to get out and reach the monitor "Prince Eugene" in safety.

This was the end of an enterprise for which no fewer than nine V.C.s were awarded. Its casualties amounted to a total of 637 killed, wounded and missing.

April 22–23	Killed or died of wounds	Wounded	Missing
Officers	19	29	2
Seamen	56	136	
Marines	93	205	14
"North Star"	21	13	
	189	383	16
May 9–10			
Officers	2	5	2
Men	6	25	9
	197	413	27=637

In judging what was achieved it is necessary to remember that at the end of 1917 and early in 1918 the whole efforts of the navy were directed toward one goal—to counter the submarine. The greatest losses were in the Channel where the Flanders flotilla worked, and the blow they would have received by the blocking of Zeebrugge and Ostend was well worth the risk. It was, however, only partially successful. Ostend, though the width of the entrance was reduced probably to 300 ft., was not closed, and though the ships sunk in Zeebrugge must have caused great inconvenience and delay it may be doubted whether they actually stopped the passage of submarines for more than a month. The entrance was 300 ft. wide; there was still a space of some 60 ft. between the stern of the "Iphigenia" and the pier, and by dredging along the edge and fixing up warping bollards it was made possible to warp submarines in and out at high water. The enterprise had another aspect. The navy chafed at its inactivity and looked eagerly for some outlet where it could get at grips with its enemy. The blocking of Zeebrugge and Ostend offered a good prospect of success and was within a reasonable distance of it. And if it did not wholly succeed, the work of those who took part in it sent a breath of inspiration through the navy and gave all who took part in it a lasting name. (A. C. D.)

ZEPPELIN, COUNT FERDINAND VON (1838–1917), German airship inventor, was born at Constance, Baden, July 8 1838. He was educated for the army and received a commission at the age of 20. He served, as a volunteer, in the Federal army during the American Civil War and whilst in America made his first balloon ascent. Returning to Germany, he saw active service in the Austrian war of 1866 and in the Franco-German War of 1870. In 1891 he retired from the army with the rank of general and thenceforth devoted his energies to the study of aeronautics. In 1900 he built an airship, which rose from the ground and remained in the air for 20 minutes, but was wrecked in landing. In 1906 he made two successful flights at a speed of 30 m. an hour, and in 1907 attained a speed of 36 miles. From that time onwards his airship construction made steady progress, and the success he had achieved was evidenced by the exploits of the Zeppelin airships in the World War. He died at Charlottenburg March 8 1917.

ZHILINSKY, YAKOV (1853–1918), Russian general, was born in 1853. On finishing his course at the Cavalry school in St. Petersburg in 1876 he was given a commission in the Guards cavalry, and in 1883 he was appointed on the general staff. He became in 1899 commander of a dragoon regiment, and in 1900 was promoted to the rank of general. During the Spanish-American War he was one of the foreign military attachés at the American general headquarters. In the Japanese War (1904–5) he was appointed chief of staff of the Viceroy of the Far East, Adml. Alexeyev, and in 1909, when Sukhomlinov became War Minister, Zhilinsky became head of the general staff. At the beginning of 1914 he was appointed to command the troops of the Warsaw military district, and on the declaration of war in 1914 he became commander-in-chief of the north-western front. After the defeat of Aug. and Sept. in eastern Prussia inflicted on his armies (Samsonov's and Rennenkampf's) he was recalled. In 1915 and 1916 he was the military representative of the Russian supreme commander-in-chief at the French headquarters. Zhilinsky was reported killed by the Bolsheviks in 1918.

ZICHY, COUNT EUGEN (1837–1906), Hungarian traveller (*see* 28.979), died in 1906.

ZIEM, FÉLIX FRANÇOIS GEORGE PHILIBERT (1821–1911), French painter (*see* 28.979), died in Paris Nov. 11 1911.

ZIMMERMANN, ARTHUR (1859–), the German Foreign Secretary who, during the World War, conceived the idea of trying to inveigle Mexico into an alliance against the United States, was born May 8 1859 at Frankenstein. After having been vice-consul at Shanghai and acting consul in 1900 at Tientsin, he entered the Foreign Office in 1902 in a subordinate capacity and rose by 1910 to be director of the Political Section. In 1911 he was appointed under-secretary and in Nov. 1916 Secretary of State in succession to von Jagow. In this capacity he addressed to America the note of Jan. 31 1917 on the subject of U-boat warfare. He was also the author of the extraordinary invitation of Jan. 19 1917 to Mexico to enter into an alliance with Germany and to sound Japan as to her willingness to coöperate. For Mexico the price of this alliance was to be the American States of New Mexico, Texas and Arizona. This proposal, which was sent through the medium of the German minister to Mexico, von Eckhardt, was intercepted in America, and President Wilson was in a position to publish it on March 1 1917. With other disclosures regarding German machinations against the United States it materially contributed to rouse American national feeling, which found expression in the decisive votes of the Senate and the House of Representatives on April 5 in favour of declaring war upon Germany. Zimmermann retired on Aug. 5 1917 shortly after the resignation of Bethmann Hollweg. The German Liberals and the governmental Socialists had withdrawn their support from Bethmann Hollweg's Government at the time of the so-called "Peace Resolution" (July 19 1917), largely on the ground that it was inconceivable that the Allies and America should ever negotiate with politicians like Zimmermann and Bethmann, who had been guilty of the note to Mexico and other treacherous proceedings.

ZINOVIEV, GRIGORI [OVSEI GERSHON ARONOR] (1883–), Russian revolutionary politician, was born at Novomirgorod in 1883. He was of Jewish origin and his original name was Aronor, but he was known in early life under the names of Apfelbaum or Radomyslovsky and later adopted several designations, such as Shatski, Grigoriev, Grigori and Zinoviev, by the two last of which he is most frequently called. For many years he was an active member of the Russian Social Democratic Labour party, and attended the London Conference in 1907. The next year he was arrested on a charge of participating in the work of the printing press *Rabotnik*, sentenced to a term of solitary confinement in St. Petersburg and forbidden to reside there in future. He then made his way abroad, and in 1909 was editing the *Social Democrat*, the party's main organ. He was present at the party meeting of Nov. 1915, when a split occurred amongst the Russian Social Democratic members of the Duma, and earlier in that year had attended the Zimmerwald meeting at Berne, consisting mainly of Lenin's group, where arrangements were made to get copies of the *Social Democrat* secretly into Russia and to keep in close touch with Karl Liebknecht and Rosa Luxemburg in Germany so as to ensure the distribution of Lenin's literature to Russian prisoners of war.

After the Revolution Zinoviev returned to Russia and became a prominent member of the Petrograd Soviet, of which he became president after the murder of Uritsky in 1918. In the summer of 1917 the paper *Den* published revelations showing that he had been formerly employed by the department of police, and this statement was not refuted.

Zinoviev became a member of the Petrograd Committee and of the Central Committee of the Russian Communist party, and was first president of the Third (Communist) International. He was also president of the Petrograd Extraordinary Commission for combating counter-revolution, speculation and sabotage, and he occupied the position of president of the Soviet Government in Petrograd.

ZIONISM (*see* 28.986).—The part played by anti-Semitism in the growth of the Zionist movement has often been exaggerated. Zionism is a natural, indeed an inevitable, outcome of the instinct of self-preservation, which is as strong in the Jewish people as in any other; and the conditions which threaten the continued existence of the Jewish people in modern times are not wholly referable to anti-Semitism in any of its phases. They are equally present in countries in which anti-Semitism does not exist, or, if it exists, does not seriously affect the civic, social or economic position of the Jews. In such countries—which include, broadly speaking, all the countries of the western hemisphere except those of the old Russian and Austrian Empires and Rumania—the rapid assimilation of the Jews to the prevailing modes of life and thought is accompanied by an attenuation of the tie which binds them to their people, with the result that emancipation is a more potent enemy of Jewish solidarity and of Judaism than persecution or the milder forms of anti-Semitism. It follows that from the point of view of the Jews, which of course postulates the desirability of the continued existence of the Jewish people and of Judaism, the substitution of conditions of emancipation for conditions of persecution solves one problem only by creating another. Naturally enough, this was not foreseen by Moses Mendelssohn and the other pioneers of Jewish emancipation in Europe. They took it for granted that the Jew, having emerged from the ghetto and divested himself of the external peculiarities which cut him off from European life, would still be able to maintain his religious separateness, and to carry out a specifically religious and moral mission in the modern world. But experience has shown them to have been wrong. Judaism reduced to a set of religious beliefs and practices, or to a moral code with some superstructure of ritual, has no abiding hold on the Jew. The possibility of the continued existence of the Jewish people and of Judaism stands or falls with recognition of the fact that to be a Jew means primarily to be a member of a particular ethnic group. On that basis it is possible to build attachment to Judaism as religion or as moral teaching; without that basis the Jew is powerless to withstand through successive generations the forces of an environment which is always drawing him away from his own tradition, in its religious, ethical and intellectual aspects even more than in its ceremonial aspect. Hence a reaffirmation of the national idea in Judaism is even more readily intelligible as a reaction against the results of emancipation than against persecution.

It is not surprising, therefore, that, when the case for Jewish nationalism was first presented by a Jew in a European language, it was based on the disintegrating effects of assimilation rather than on the sufferings of the unemancipated Jews. In his *Rom und Jerusalem*, published in 1862, Moses Hess delivered a trenchant attack on the theory of German "Reform" Judaism, showed that Judaism could not live except on the basis of the national idea, and foretold a spiritual and political rebirth of the Jewish people in Palestine. Fourteen years later Jewish Nationalism was advocated on similar lines by George Eliot in *Daniel Deronda*. For both writers the essential thing is that the Jewish people should have an opportunity of taking up the broken thread of its history, and of expressing its own spirit and characteristics in a form of life shaped by itself. Considerations based on anti-Semitism are secondary.

Even in Russia, for so long the home of the great masses of Jews and the very temple of governmental anti-Semitism, Zionism was not fundamentally a product of persecution or pogroms. Until well after the middle of the 19th century, the best minds of Russian Jewry saw its hope in emancipation, not in nationalism. They thought that if the Jews of Russia discarded their distinctive language and dress, modified their religious ceremonial so as to make it compatible with European life, and sent their children to Russian schools, they would be admitted to full participation in the life of their country, like the Jews of western Europe, and all would be well. A vigorous propaganda on behalf of *Haskalah*—"enlightenment" or "modernism"—had been carried on for some decades in the Hebrew language, which was used not because of its national associations, but because the apostles of *Haskalah* disdained to write in Yiddish, and no European language was intelligible to those whom they wished to influence. *Haskalah* had made considerable headway against the obscurantism of those who opposed any and every change in Jewish life; and in the ’seventies of the 19th century the liberal policy of Alexander II. seemed to promise success to its efforts to modernize Russian Jewry. But already, within the modernist movement itself, another current of thought had set in. Perez Smolenskin, one of its most gifted champions, who spent the best years of his life in Vienna, had had the opportunity of seeing at close quarters what emancipation meant for Judaism. He had seen that in practice the ideal of being “ a Jew at home and a man outside ” did not work. Hence he became the advocate of a Jewish nationalism based on the “ triple cord ” of the Land (Palestine), the Law (*Torah*) and the Language (Hebrew). When, in 1880, the emancipatory tendencies of Alexander II. gave place to a wave of pogroms and a policy of systematic oppression, the seed sown by Smolenskin bore fruit. While the great majority of the Russian Jews who fled from massacre naturally made for the economically developed countries of the West, where they could be readily absorbed, a few, inspired by the ideal of a national revival, found their way to Palestine, and in the face of incredible difficulties laid the foundations of Jewish agricultural colonization. Supported by the *Chovevê Zion* (Lovers of Zion) in Russia, and later more amply by Baron Edmond de Rothschild, of Paris, these pioneers succeeded in maintaining their footing in Palestine. They were followed by a small but steady stream of immigration, which included many vigorous and self-supporting elements. Innocent of any concern with international politics, these Palestinian settlers accepted the Turkish administration as they found it, and, thanks largely to its very indifference, were able to establish little settlements with complete internal autonomy, to live in their own way, to manage their own affairs, and, not least important, to create a system of Hebrew schools, by means of which the ancient language of the Jews was revived as the speech of the younger generation of Jews in Palestine. This new Palestinian *Yishub* (settlement), strengthened in the early years of the present century by a number of young men and women who went to Palestine with the ideal of working as labourers on its soil, became the basis of the political success which Zionism achieved during the World War. The historic connexion of the Jews with Palestine would not of itself have availed to secure recognition of Jewish national aspirations, had there not been this concrete evidence of the will and the ability of the Jews to rebuild Palestine and their own national life in Palestine.

Side by side with this practical colonization work, the development of Jewish nationalist theory went on in Hebrew literature. The implications of Smolenskin’s idea were worked out more thoroughly, and from a standpoint more in consonance with European thought, by Asher Ginzberg (*Achad ha-Am*), one of the early leaders of the *Chovevê Zion*, who has made his own the conception of Palestine as destined to be in the immediate future the “ spiritual centre ” of the Jewish people—that is to say, the home of a corporate Jewish life expressing in all its aspects the true qualities of the Jew, and serving for that reason as a point of attachment and a source of spiritual influence for the Jews of all the world, who will find in their common association with the spiritual centre a new basis of unity and a new bulwark against absorption by assimilation. This conception, though by no means universally accepted as a complete statement of the philosophy of Zionism, has had a profound effect on Zionist thought for the last 30 years, and, though it designedly leaves on one side the political implications of Zionism, has contributed materially to the final shaping of the political claims of the movement.

The reaction against anti-Semitism has, however, played an important port in Zionist history. In 1882, after the terrible outbreak of pogroms in Russia, a Russian Jew, Dr. Leo Pinsker, published a striking pamphlet, in German, under the title of *Auto-Emancipation*, in which he argued that Judeophobia was an endemic malady among the peoples of the world, analogous to the fear of ghosts, and that the only solution of the “ Jewish problem ” was to be found in the establishment in some suitable territory (not necessarily Palestine) of an autonomous commonwealth of Jews. While Pinsker thus took anti-Semitism as his starting point, he yet showed a certain appreciation of the historical and psychological roots of Jewish nationalism; and when his own scheme of large scale emigration to a hypothetical Jewish territory met with no support, he was nationalist enough to throw himself into the Palestinian work of the *Chovevê Zion*, whose first President he became. The later and more famous brochure of Dr. Theodor Herzl, *Der Judenstaat*[1] (1896), elaborated independently a scheme similar to that of Pinsker, based entirely on the need of a refuge from anti-Semitism, and disregarding completely the inner springs of Jewish nationalism. Herzl’s argument implies throughout that all would be well if only Jews were allowed to assimilate peacefully to their surroundings; and to that extent he stood on the same ground as the assimilationist Jews of western Europe, who had for years been trying—without success—to alleviate the lot of the Jews of Russia and Rumania by bringing about diplomatic intervention with the Governments of those countries. He differed from them only in seeing the futility of their methods and the need for more radical steps. He did, however, assert the unity of the Jewish people (“ we are a people, *one* people ”), and the emancipated Jews of western countries, fearful of anything that might seem to cast doubt on their absolute identification with the nations among which they lived, could not accept a scheme based on such promises. With few exceptions, the Jews of the west met Herzl’s appeal with indifference or hostility; it was the *Chovevê Zion* who rallied to his support with enthusiasm, less conscious of the difference between his philosophy and their own than of the value to their movement of his great personality, vision and influence. Thus there came about a fusion between the older Jewish nationalism, rooted in history and attached by its very nature to Palestine, and the newer so-called nationalism which demanded an autonomous territory in Palestine or elsewhere for those Jews who could not or would not assimilate to their European surroundings. The fusion was not effected without tears. At the first Zionist Congress (Basle, 1897) there was a struggle over the crucial question of the mention of Palestine in the programme of the movement. For Herzl’s scheme of rapid mass-settlement scarcely any country could have been worse adapted than Palestine, with its restricted area, its neglected soil and its importance in international politics; but the nationalist instinct of the Russian Jews won the day; and the Zionist organization tied itself down to the aim of “ establishing for the Jewish people a home in Palestine secured by public law.”[2] The trouble did not end there. For the *Chovevê Zion* the gradual building up of a Hebrew life in Palestine—*Yishub Erez-Israel*—was the fundamental nationalist activity. Herzl, on the other hand, deprecated any “ infiltration ” into Palestine so long as the conditions necessary for full autonomy were not secured. He desired the acquisition by the Jewish people still outside Palestine of a formal charter making Palestine its preserve; immigration on a large scale would follow. The failure of his efforts to secure a charter, and his premature death in 1904, ultimately gave the victory here also to the tendency represented by the *Chovevê Zion*. Thus Zionism emerged from the seven years of Herzl’s brilliant leadership with its pre-Herzlian philosophy and policy substantially unchanged, but with very considerable gains in organization, in prestige, and in the number and diffusion of its adherents. The movement had become world-wide; it had been recognized by the British Government (in the abortive offer of a territory in E. Africa, 1903) as representing the Jewish people; and it had become a powerful leaven in Jewish life, stimulating interest in Palestine and the revival of the Hebrew language in every Jewish community throughout the world. The Zionist organization, though it could not of itself bring about any serious political change in Palestine, was in a position to secure that, if and when the political future of Palestine became a practical question, the claims of Jewish nationalism should not go unheard.

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[1] The current translation “ A Jewish State ” is misleading. The prefix *Juden* has not the qualitative implications of “ Jewish ”; the German *Staat* does not connote political independence so definitely as the English “ State ”; and the emphasis in *Judenstaat* is on the first half of the compound, whereas in “ Jewish State ” it is inevitably on the second. “ A Commonwealth of Jews ” is a better rendering. This point is of some importance, because critics of Zionism have fastened on the term “ Jewish State ” as implying a desire to set up a State based on religious tests—than which nothing could be further from the idea of Herzl and of Zionists generally.

[2] *Öffentlich-rechtlich gesicherte Heimstätte* in the original German. The old translation “ publicly and legally assured home ” (*see* 28.988) is scarcely adequate. In article (4) of the Programme as there set out, “ grants ” should be replaced by “ consents ” (*Zustimmungen*). Zionism has never expected or asked for a financial grant from any Government.

Meanwhile it had to be content with the up-hill work of Palestinian colonization and the education of the Jewish people in the national idea. The number of Jewish agricultural settlements in Palestine grew from about 25 in 1904 to about 45 in 1914. The Hebrew school system developed rapidly, and the project of a Hebrew university in Jerusalem was definitely launched in 1913. The membership of the organization and the capital of the Jewish National Fund grew from year to year, and unorganized sympathy with the Zionist outlook and aims became more and more widely diffused.

The entry of Turkey into the World War called for a renewal of political activity on the part of the Zionist organization, as it obviously meant that the future of Palestine would before long come up for settlement. At the same time, the position of the organization was extraordinarily difficult. With adherents in all countries, both belligerent and neutral, it could not present a united front in international political questions, and the leaders of its various groups could not even take counsel together. The last biennial Zionist Congress had met in 1913; a Congress in 1915 was obviously impossible. Emergency arrangements were made to secure the existence of the organization, but for practical purposes it had to remain in suspense throughout the unexpectedly long period of hostilities. Meanwhile, the need for obtaining express recognition of Zionist claims became more pressing as a result of the British advance into Palestine in 1917. Relations with the principal Allied Governments had already been established, mainly by Dr. Ch. Weizmann and Mr. N. Sokolow, two of the Zionist leaders. As the outcome of protracted negotiations, in which Sir (then Mr.) Herbert Samuel played an important part, the British Government issued on Nov. 2 1917 the "Balfour Declaration," stating that they "view with favour the establishment in Palestine of a National Home for the Jewish people, and will use their best endeavours to facilitate the achievement of this object," and adding provisos to safeguard the rights of existing non-Jewish communities in Palestine and the rights and political status enjoyed by Jews elsewhere. The Allied troops entered Jerusalem soon afterwards (Dec. 9 1917), and in March of the following year the Balfour Declaration had its first practical outcome in the departure for Palestine of a Zionist Commission, which was to "act as an advisory body to the British authorities in all matters relating to Jews or which may affect the establishment of a national home for the Jewish people," and was charged with certain specific tasks in relation to the Jewish population of Palestine. The Commission remained in Palestine as the representative of the Zionist organization, and there directed such Zionist work as was possible during a period of unsettlement and restricted communications. In July 1918 it laid the foundations of the future Hebrew University on Mount Scopus.

The Turks were finally expelled from Palestine in Sept. 1918, and the Zionist policy of the British Government, which had in the meantime been endorsed by all the Allied Powers and by the President of the United States, had its logical outcome in the incorporation of the Balfour Declaration in the Treaty of Sèvres and the acceptance by Great Britain of a Mandate for Palestine on behalf of the League of Nations (San Remo, April 1920). The draft Mandate as printed in a Parliamentary White Paper (Cmd. 1176), recites in its preamble the substance of the Balfour Declaration, whereby "recognition has been given to the historical connexion of the Jewish people with Palestine and to the grounds for reconstituting their national home in that country," and provides *inter alia* that the Mandatory shall be responsible for placing the country under such political administrative and economic conditions as will secure the establishment of the Jewish national home and the development of self-governing institutions (Art. 2); shall recognize an appropriate Jewish agency (provisionally the Zionist organization) as a public body for the purpose of advising and coöperating with the administration of Palestine in matters affecting the establishment of the Jewish national home (Art. 4); shall appoint a special Commission to study and regulate all questions and claims relating to the different religious communities (Art. 14); shall see that complete freedom of conscience is assured to all (Art. 15); and shall recognize Hebrew along with English and Arabic as an official language (Art. 22).

The frontiers of Palestine were defined in a separate convention between Great Britain and France dated Dec. 23 1920, and published in a White Paper (Cmd. 1195). In 1916, before either Government had come into close contact with Zionism, an Agreement (known as the Sykes-Picot Agreement) was made, dividing Palestine into a British and a French sphere of influence. This agreement needed revision in the light of subsequent developments, with due regard to both Arab and Zionist interests as well as to those of the two Powers concerned. The Convention of 1920 defines the frontiers of Palestine in such a way as to comply with the requirements of the historic phrase "from Dan to Beersheba," and to include in Palestine all the modern Jewish agricultural settlements, but not to give Palestine control of the sources of water power which are held to be necessary for its full economic development. On the other hand, the Agreement provides that Palestine is to have the use of the waters of the Upper Jordan and the Yarmuk and their tributaries, after satisfaction of the territories under the French mandate.

The draft Mandate for Palestine was attacked from three sides. Certain Palestinian Arabs, professing to speak in the name of the whole Arab population, objected absolutely to its Zionist provisions. A school of Zionists more or less in the line of the original Herzlian tradition complained that the draft Mandate gave too little to the Jewish people, and that the term "National Home" was too vague, and demanded that explicit provision should be made for the development of Palestine into a "Jewish State" within a fixed period. Lastly, some British politicians and newspapers attacked the Mandate on the grounds that it would involve the British taxpayer in expense with no corresponding return, and that it was unjust to impose a Zionist policy on the Arabs of Palestine against their wishes.

Despite these criticisms, there was every sign up to the end of 1921 that the Government intended to proceed in full accord with the spirit and the letter of the Balfour Declaration. Mr. Winston Churchill, the Secretary of State for the colonies, during his visit to Palestine in April 1921, emphatically declared that the Zionist policy of the Government remained unchanged, while assuring the Arabs with equal emphasis that their rights would be fully respected. The First High Commissioner, Sir Herbert Samuel, had won the confidence of all sections of the population by his impartiality.

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ZIRKEL, FERDINAND (1838–1912), German petrographer, was born at Bonn in 1838. He was educated at Bonn, where he trained as a mining engineer, but a journey he made to Iceland and the Faeroe Is., Scotland and England, and a meeting with Henry Clifton Sorby (*see* 25.431) attracted him to the study of microscopical petrography, then a comparatively new science. He became professor of mineralogy and geology successively at Lemberg (1863), Kiel (1868) and Leipzig (1870), retiring from the last-named post in 1909. He did much to develop the study of petrography, and his *Lehrbuch der Petrographie* (1866; 2nd ed. 1893–4) is a standard work on the subject. He was an hon. D.Sc. of Oxford, and also a foreign member of the Royal Society and an hon. member of the Mineralogical Society. He died at Bonn June 11 1912.

ZOBEIR RAHAMA (1830–1913), Egyptian pasha (*see* 28.992), died at Geili, near Khartum, Jan. 5 1913.

ZOÖLOGY (*see* 28.1022).—It is a sign of the vitality of a science such as zoölogy that its aspect should change from generation to generation. Paths of inquiry which are eagerly followed for one quarter of a century are sometimes almost forsaken during the next. There is change of emphasis and perspective. The reasons for this are mainly four. (1) A great discovery, such as Mendel made, opens up the possibility of conquering a territory hitherto unsubjugated, and this secures the enthusiasm of pioneers. (2) A new idea, such as that of discontinuous variations or mutations, alters the traditional outlook and is bound to affect zoölogical activity, *e.g.* taxonomy in the case mentioned; or a new scepticism, *e.g.* in regard to the transmission of exogenous somatic modifications ("acquired characters"), may prompt effort in reinterpreting facts. (3) A new contact, such as is suggested by the terms biochemistry and biophysics, biopsychology and psychobiology, always means a fresh series of formulations, making, in synthesis, for a more complete apprehension of that well-integrated unity—the Organism—which the various analytic methods seek to understand from different points of view. (4) A new method—such as section-cutting, differential staining, the use of the ultra-microscope, the utilization of statistics—may prove so rewarding that it attracts many recruits to its service, with the result that the trend of zoölogy is for a time markedly in that direction. There are other factors which change the aspect of zoölogy from generation to generation, such as the influence of great masters, like Huxley, Balfour, and Lankester; and the claims of the nation for scientific counsel, *e.g.* as regards agriculture, breeding, fisheries, and insect-pests. Moreover, the reflective intelligence of the scientific workers themselves, who have an ideal of the unity of their science, makes them tend, deliberately or subconsciously, to fill up gaps, as may be illustrated by the relatively recent development of the scientific study of animal behaviour.

For such reasons as have been indicated the aspect of zoölogy has changed considerably since the opening of the 20th century, though it may be safely said that the things that remain much the same are of more importance than most of the novelties. Of some of the significant new departures, which led to notable results in the period 1910–21, account is taken in separate articles, *e.g.* under BEHAVIOURISM, BOTANY, CYTOLOGY, ECONOMIC ENTOMOLOGY, MEDICAL ENTOMOLOGY, EMBRYOLOGY, SEX, GENETICS, MENDELISM, PROTOZOÖLOGY. What is attempted in the present article is a general survey, which may be conveniently arranged under the headings: Morphological, Physiological, Embryological and Aetiological (Evolutionary).

(A) MORPHOLOGICAL ZOÖLOGY

In its full scope morphology has to do with the static relations of organisms, with form and structure, as contrasted with physiology, which is concerned with the dynamical problems of vital activity. The two inquiries are obviously complementary and indispensable. It is a narrow view which affects to despise "purely morphological research"; as is obvious enough when any distinctively new type, like the sedentary ctenophore *Tjalfiella*, or the elusive Okapi, comes under consideration. Yet it must be admitted that zoölogical activity has in some measure turned aside from accumulating details of comparative anatomy at any and every level of analysis. As a discipline descriptive morphology is indispensable, but it is not to be persisted in too long, when there is so much else awaiting investigation. There is a widespread and not unreasonable opinion that morphological researches require some justification beyond their immediate result; they should contribute to our knowledge of affinities, of adaptations, of principles of architecture, and laws of change, as the best morphology has always done.

Causal Morphology.—The distinctive modern change has been the coming together of physiology and morphology, which developed for so long on paths that seldom even crossed. As E. S. Russell says, in his scholarly and critical *Form and Function* (1916), "Until well into the 'eighties animal morphology remained a purely descriptive science, content to state and summarize the relations between the coexistent and successive form-states of the same and of different animals. No serious attempt has been made to discover the causes which led to the production of form in the individual and in the race" (p. 314). The evolution theory offered only a formal solution, and for all practical purposes physiologists took the animal organization as given, not troubling about its mode of origin. Not a few saw the need of definitely tackling the physiology of development, notably Prof. W. His, in his well-known work, *Unsere Körperform und das Problem ihrer Entstehung* (1874), but the credit of founding a new sub-science of causal morphology (*Entwicklungsmechanik*) on an experimental basis certainly belongs to Prof. W. Roux, who has had many followers. The aim of *Entwicklungsmechanik* is defined by Roux to be "the reduction of developmental events to the fewest and simplest causal processes." Two classes of causal processes may be distinguished, as "complex components" and "simple components" of development. "The latter are directly explicable by the laws of physics and chemistry; the former, while in essence physico-chemical, are yet so very complicated that they cannot at present be reduced to physico-chemical terms. . . . They represent biological generalizations, in their way of equal validity with the generalizations of physics and chemistry" (Russell, 1916, p. 319). They are, in fact, the general properties or functions of organized matter, such as assimilation and dissimilation, growth and reproduction, heredity and self-differentiation.

Biophysics.—A special department of causal morphology may be usefully designated biophysics. As in regard to chemical processes, so in regard to physics, there is great promise in those investigations which carry up into the study of organisms the laws and lessons of the inorganic. An auspicious beginning of this difficult task has been made by Prof. D'Arcy W. Thompson, in his *Growth and Form* (1917), one of the foundations of biophysics. The aim of this inquiry is "to show that a certain mathematical aspect of morphology, to which as yet the morphologist gives little heed, is interwoven with his problems, complementary to his descriptive task, and helpful, nay, essential to his proper study and comprehension of form." Factors to be reckoned with are size, the principle of minimal areas, surface tension, equilibrium, the rate of growth in different directions, and the properties of colloids. The essay marks a big advance in the interpretation of form, whether in external structures like molluscan shells, the twisted horns of mammals and the shapes of eggs, or in internal architecture, like that of a bone, where statical and dynamical principles find fine illustration. Luminous also is Thompson's theory of transformations, in which it is shown how a single harmonious deformation may lead from one form of skull or leaf to that of a related type; and how trammels or lines of constraint may determine the action of the expansive forces of growth, now in one direction and now in another. This is more than an approach to the principles of morphogenesis.

Let us state this step of progress concretely. Exact study has shown that the thigh-bone, for instance, is in its proportions and structure mechanically correct. It has great strength with a maximum economy of material, and the internal beams are in their thickness and closeness of spacing demonstrably adjusted to the intensity of the stresses to be withstood. So far well; but the further step is to utilize the principles of physics in accounting, as far as may be, for the vital architecture. A guillemot lays a single top-shaped egg on a narrow shelf of a precipitous sea-cliff. Now Darwin pointed out that when an egg of this shape is roughly jostled by the wind or by the parent bird, it will rapidly rotate on its short axis, but will not roll away from the spot. The mechanical adjustment is simple and effective, but the further question is how far the adaptive result can be accounted for in terms of the physical conditions of pressure, surface-tension and the like, operative on the egg-shell while it is still in the making in the oviduct. It is for the student of biophysics to work this out.

Enough is not yet known of the possibilities of another line of physiological morphology, represented by the work of Prof. C. M. Child, *Individuality in Organisms* (1915), which seeks to interpret structural differences in terms of different rates of metabolism at the various levels or "gradients" of the axis of body-symmetry.

Homoplastic Structures.—Criticism of the concept of homology (resemblance in embryonic origin and fundamental structure) has brought into prominence the kind of resemblance which Sir Ray Lankester called "homoplasy," to which others have applied other terms, such as "convergence." It is a resemblance in types not closely related, and is due to the similar adaptation of non-homologous structures to similar conditions of life. But it is plain that the idea requires careful handling. There are cases where homologous parts become adaptively very like one another, directly or indirectly in relation to similar functioning, as in the case of the "paddles" of ichthyosaurs, turtles, penguins and cetaceans. To such cases it has been proposed to apply the term "parallelism," while Prof. Gadow (1913) has carried the analysis further, distinguishing "isotely" (hitting the same mark), *e.g.* zygodactyl feet of cuckoos, parrots, and woodpeckers, from "homaeotely" (hitting the same target, but not quite the same mark), *e.g.* the jumping foot of kangaroo, jerboa and Tarsius. Both of these have to be clearly separated from what many call true convergence, which Prof. Gadow has called "parately," where the feature has been evolved from parts and material so different that there can be little relationship, if any. The resulting resemblance is more or less superficial. Thus the bivalve shell of Brachiopods has nothing to do with that of Lamellibranchs, and the *bulla auris* of certain extinct reptiles (Pythonomorpha) is probably the quadrate, while that of the cetacea is the tympanic. Similarly, it is probable that the eye was evolved many separate times. Now the well-marked convergence or homoplasy of non-homologous structures depends on a coöperation of factors: *e.g.* (*a*) the widespread occurrence of certain similar hereditary factors which will respond much in the same way to similar environmental conditions; (*b*) the plastic power of similar functioning, operating in individual development; and (*c*) the similarity in the sifting process of natural selection. Along with (*a*) may be included the idea that the number of new departures is probably far from being unlimited; along with (*c*) may be included the idea that the biophysical conditions of stability are within relatively narrow limits; and along with (*b*) the similar moulding of similar functions may be included, as Gadow says, the subtle effects of correlation. It is probable that the continuation of the interesting study of convergence, along the lines indicated by Lankester, and more fully by Willey and Gadow, will lead to a deeper understanding of the principles of organic architecture or morphogenesis. It may also throw some light on classification, for it is worth considering whether the same congeries of characters may not arise more than once, and that not fortuitously. Prof. Gadow refers to his finding in Mexico the burrowing snake, *Typhlops braminus*, previously known from islands and countries of the Indian Ocean basin, a fact which suggests to him that the species had evolved twice. Some would say indeed that three similar domestic dogs might be traced to three different ancestors, a coyote, a jackal, and a wolf. The question also arises whether this promising study of convergence or homoplasy will not also elucidate close pattern-resemblances between forms, in regard to which it is impossible to suggest any genuine mimicry.

The Question of Species.—A huge number of new species of animals are described annually, sometimes several thousand insects in one year. When a collection has to be reported on or a new region explored, there is obvious need for the old-fashioned definition of new species, *i.e.* forms which do not conform to any previously described. To give one of these novelties a new name, if it is marked off by peculiarities of some magnitude (necessarily to some extent a matter of opinion), is practically a much more desirable procedure than the restraint which says: "*Mus n. sp.*, in the vicinity of *Mus sylvaticus*," for this makes subsequent reference intolerably tedious. But several changes may be detected in the zoölogical species-making of to-day. (1) There is no longer much enthusiasm for this line of activity in itself. It is a necessity, a useful discipline; but there is no particular hurry in completing the descriptive catalogue; there are more urgent affairs. (2) The task is now approached with a deeper sense of responsibility, for it is recognized that every peculiarity does not mean a new species. Many peculiarities are transient somatic modifications which are reimpressed on successive generations as long as the same incident factors are operative. Other peculiarities are not beyond the range of the variations which occur within the limits of one family, the progeny of one pair. It is a pious opinion that a new species should be based on numerous specimens, and that something should be known of the genetic behaviour of its peculiarities. (3) More attention is being given to the occurrence of variations and mutations, which, instead of being put in a corner as inconveniences, are now regarded as of no less interest than the rank and file of the species. Polymorphic species, like the ruff, are more interesting biologically than relatively fixed species like the pheasant. (4) But along with this increased and more analytic attention to variations, which have to be studied from the point of view of genetics, and if possible experimented with, there is an increased recognition of the other side—the discontinuity or apartness of species. It is difficult to maintain that the category *species* is univalent throughout, *e.g.* that it has the same value among micro-lepidoptera as it has among birds, but in all sound taxonomy a species is marked by its definite specificity. The tendency is toward a recognition of fixity as even more characteristic than flux. In many cases it seems safe to say that species differ in the presence or absence of unit characters, or in the arrangements of their unit characters, whose gametic factors exhibit Mendelian behaviour. (5) If species differ, like a series of organic compounds or like a series of related minerals, in their internal constitution, then it is no longer necessary to insist on the utilitarian value or adaptive significance of the specificities. That specific characters are often adaptive seems undeniable; that they need have this value is highly improbable (see Bateson, 1913).

Taxonomy Criticised.—Supposing the most satisfactory description of a new species, based on numerous specimens living in known environment, and supposing even some acquaintance with the genetics of the species, we must face the further question whether zoölogical work at this Linnaean level is worth while. It is in a way hodman work, though few do it very well. It is very quantitative work, adding leaves to inherited monographs. It tends to preoccupy the investigator, leaving him with little time or inclination for more adventurous pursuits. It leads to little in itself. Thus there is a widespread conviction that the day of the pure systematist is past, and should be declared as past.

But this is perhaps not more than a wholesome rebound from an unsatisfactory species-mongering. In any case there is another side to the criticism. If a region is to be surveyed in a business-like way, *e.g.* the Zoölogical Survey of India initiated and directed by Dr. Nelson Annandale, there must be a perfectly precise census. For practical purposes it is indispensable that there be no vagueness about the species of (say) mosquito and tick. The meticulous thoroughness, sometimes scoffed at by the impatient, may save the lives of thousands. Moreover, a new type with real taxonomic importance comes every now and then as the reward of drudgery. Nor can it be doubted that an evolutionary study of species, especially when it can be linked to genetic studies of the living material, may lead us nearer the main object in view—the understanding of life. Educationally, it may be doubted if the Linnaean discipline of species-making can be dispensed with without serious loss of efficiency.

Palaeontological Study.—The *differentia* of palaeontology is that it studies organisms in their time relations, in their genetic sequence from age to age. A taxonomy based only on a study of forms extant—"a horizontal section across the tree of life"—may be shrewd, but it is incomplete without the work of the palaeontologist who exposes the relations of the buried branches. It is certain that palaeontological research has done well by zoölogy in this respect, as may be well illustrated by the later work of Prof. D. M. S. Watson on the taxonomy of amphibians, reptiles and mammals, or by the magnificent history of the extinct Equidæ which has crowned the labours of Prof. H. F. Osborn.

Another achievement of the palaeontologists has been their increasingly satisfactory vindication of evolution as a historic process. Thus, to quote Dr. F. A. Bather (1920, p. 67): "if we take a chronological series of apparently related species or mutations, a^1, a^2, a^3, a^4, and if in a^4 we find that the growth-stage immediately preceding the adult resembles the adult a^3, and that the next preceding stage resembles a^2, and so on; if this applies, *mutatis mutandis,* to other species of the series; and if, further, the old age of each species foreshadows the adult character of its successor; then we are entitled to infer that the relation between the species is one of descent." This method of proving filiation is clearly illustrated by work on Ammonites. "Thus, large ammonites of the *Xipheroceras planicosta* group, beginning smooth, pass through a ribbed stage, which may be omitted, through unituberculate and bituberculate stages, back to ribbed and smooth again" (Bather, 1920, p. 68).

It is clear that taxonomic categories based on the study of existing forms must be supplemented by new categories disclosed by the palaeontologists' study of change in time. "Thus many crinoids with pinnulate arms arose from others in which the arms were non-pinnulate. We cannot place them in an order by themselves, because the ancestors belonged to two or three orders. We must keep them in the same orders as their representative ancestors, but distinguish a *Grade* Pinnata from a *Grade* Impinnata" (Bather, 1920, p. 63).

To the palaeontologists are due, we think, convincing proofs that evolutionary change may be sometimes continuous, by gradual transition rather than by saltation. In their contributions to such problems as orthogenesis, the rise and decline of species, the tempo of evolution, and the correlation of organic with cosmic changes, the palaeontologists have certainly kept pace with the "neontologists."

Animal Histology.—Without unduly trespassing on the article CYTOLOGY, we may indicate some general features of recent progress in animal histology. (*a*) The concept of the cell has become more fluid; for we recognize cells without very definite limits living in syncytia, cells with protoplasmic bridges binding them to their neighbours, cells with nuclear dust instead of a nucleus, and so on. Many zoölogists agree with Prof. Clifford Dobell that to speak of a Ciliated Infusorian (let us say) as a single cell is more misleading than useful. It is rather a noncellular than a unicellular being; it has not entered upon the cellular line of evolution; it is a complex organism with much division of labour, and no Metazoan cell can be said to be on a par with it. Similarly, it is a suggestion of a fallacy in calling an ovum a single cell; for it has a complexity beyond imagining, it is a highly endowed implicit organism. (*b*) It is no longer easy to be satisfied with the oft-repeated comparison of a multicellular organism to a colony or regiment of cells. It has become clearer that cellular structure is largely a segregating device for the better working of that division of labour which the intricacy of vital processes demands. (*c*) If we take as a good example the recent *Introduction to Cytology* (1920) by the late Prof. Doncaster, we find that our picture of the animal cell has become extraordinarily complex. In the cell-substance or cytoplasm there are in many cases definitely formed granules or rods (mitochondria) which sometimes have to do with the formation of particular protoplasmic products; there are very frequently strands or rods of the "Golgi apparatus," the significance of which is very obscure; there are also "chromidia" which sometimes appear like migrants from the nucleus attempting to colonize the cytoplasm. In the centre of the cytoplasm floats the nucleus, microcosm within microcosm. It has its differentially permeable membrane; its chromosomes, usually definite in number for each species; its nucleolus, which may be a karyosome of chromatin or a plastosome of plastin; and the karyolymph, bathing both chromosomes and nucleoli. Then there are the centrosomes, which play an important part in organizing the process of nuclear division. But this is not nearly all, for each chromosome is like a necklace of beads threaded on a transparent ribbon of linin, and these beads or microsomes are probably the biological units of the lowest visible grade. In curiously indirect ways it seems possible (Morgan, 1919) to make a sort of map of the chromosomes of an egg-cell, and to say, for instance, that such and such hereditary factors of the fruit-fly Drosophila are located in the upper third of the second chromosome. In some cases it is possible to tell from visible peculiarities in the chromosomes of a fertilized egg-cell whether it would have developed into a male or into a female. These are but illustrations of the increasing precision. (*d*) In another direction, however, modern work has led to simplification, namely as regards cytoplasmic structure. The 19th-century histologists accepted with little question the view that the reticular, fibrillar, or other fine structure seen under high power in fixed and stained cells corresponded to a genuine architectural complexity in the living cell. But the work of Hardy (1899) and Fischer (1899) showed that the alleged structure is mainly of the nature of artefact, and that different structure is revealed according to the histological methods used. The use of the ultra-microscope has confirmed the conclusion that protoplasm in a living condition is a structureless fluid with particles and droplets in a freely movable state—a colloidal system in short. There must be arrangements which permit of the simultaneous occurrence of very different chemical processes in adjacent parts of the cell, but this is not of the nature of a visible cytoplasmic architecture, and it may be of the nature of a temporary gelation (see Bayliss, 1915, chap. i.). (*e*) Just as the early microscopists described and figured many structures under magnification without making them more significant or intelligible, so in the immense library of zoölogical histology there is a prodigious amount of meticulous description that is not very illuminating. Too much of it has been a registration of artefacts; and it may be fairly noted as characteristic of recent years that mere micrography is finding fewer devotees. The achievements of differential staining are giving place to a reasonable biochemical microscopy. For it is plain that the analytical study of minute structure does not justify itself—apart from demonstrating specificity and a succession of plasmic phases—unless it throws light on what happens in the cell-laboratory—the oxidations and reductions, the hydrations and condensations, the synthetic and analytic processes which constitute vital metabolism. These chemical reactions take place with extraordinary speed, which is conditioned by the activity of enzymes, and also with not less extraordinary orderliness, which is conditioned by some localizing (as it were insulating) arrangements of the colloidal system of the cell. But an analogy probably more fitting than that of a laboratory is that of a factory, for it seems clear that cytoplasm, nucleus, centrosomes, mitochondria and so forth are working together, and potent in their inter-relations.

Thus, to take an obvious case, there appears to be, as Richard Hertwig and others have emphasized, a definite volumetric ratio between the nucleoplasm and the cytoplasm of the cell. Interesting results have also rewarded the inquiry into the changes in this relation which occur in regenerative processes, in the growth of tumours, in the segmentation of the ovum, or when a microbe enters a cell, and disturbs its equilibrium.

(B) Physiological Zoölogy

Along the line of comparative physiology the rate of progress during the last 20 years has not been proportionate to the importance and attractiveness of this line of investigation. There have been many individual researches of value, but there has been no adequate continuation of the broad and well-conceived work of Krukenberg 30 years ago. The difficulty is that few zoölogists are expert in biochemistry, without which many paths of physiological research are impassable, and that few biochemists are aware of the many and pressing zoölogical problems that promise great results. It may be doubted whether in the whole range of zoölogy there is any kind of investigation more likely than comparative physiology to yield new knowledge of first-rate importance. Just as the discovery of the significance of the glands of internal secretion (suprarenals, thyroid, etc.) has profoundly influenced the physiology of the vertebrates, so will a deepened physiology of the invertebrata modify the whole science.

Recent Advances.—Although we are still awaiting concerted prosecution of comparative physiology, there have been numerous advances of great interest, of which two or three illustrations must suffice. (*a*) G. H. Parker's working-out of the various grades of nervous activity exhibited by a series of animals from sea-anemone upward is a good example of a physiological inquiry of immediate interest in itself and also important in its bearing on the evolution of behaviour. (*b*) The continuation of the study of animal pigments may be illustrated by the work of Oscar Riddle, and not less interesting are such investigations as those of Gamble on the Aesop Prawn, of Sumner on the changeful patterns of flat-fish (*see* Colours of Animals), and of Minkiewicz on the apparent colour-disguises which some crabs find in the seaweed with which they mask themselves. (*c*) Also very promising is the inquiry (*e.g.* by Holmes and Schmidt) into the varied phenomena of "death-feigning." There is a prospect that it may be possible to arrange these in a series. Beginning with the sudden stoppage seen when the animal passes abruptly into a new medium we are led on to the spontaneous catalepsy of some Phasmids, and thence to "animal hypnosis," and to the subtler forms of death-feint in various birds and mammals. On another series it may be possible to arrange a succession of physiological states, such as extreme fatigue, auto-intoxication, cold-coma, sleep, hibernation, and so on to latent life. Further study of latent life is desirable.

Hormones and Chalones.—As was to be expected, the physiological discovery of the significance of the organs of internal secretion (ductless glands) has had its influence on zoölogy. The fact that stimulating hormones and quieting chalones produced by these ductless glands are distributed through the vertebrate body by the blood, and secure an integration hardly less important than that effected by the nervous system, has shed a flood of light on the functional correlation of parts. The idea of a regulative system is far-reaching. (*a*) It is of importance in connexion with growth and development, as studies of the pituitary body show. (*b*) It sheds light on the ante-natal symbiosis characteristic of mammals, for it is known that hormones pass through the placenta not only from mother to offspring, but from offspring to mother, to the great advantage of both. In such ways clues are being discovered which make it possible to understand how the uterus is prepared for the ovum, and how the milk is ready for the new-born mammal. (*c*) The whole dark subject of secondary sex-characters in animals has been illumined by the discovery of gonadial (testicular and ovarian) hormones which activate the development of the distinctive secondary characteristics of male and female. The internal secretions which pass from the ovary of a duck determine the development of feminine characters and the inhibition of masculine characters. The latter normally remain latent, but if the ovary be removed the duck becomes a more or less perfect imitation of a drake of the same race; and this assumption of masculinity may affect behaviour as well as plumage (Goodale, 1916). (*d*) When acid gastric contents reach the duodenum there is produced in the intestinal wall a hormone which the discoverers (Bayliss and Starling, 1902) called "secretin"; it is carried by the blood to the pancreas, where it provokes a greater production of digestive ferments which are carried by the pancreatic duct to the duodenum, there to discharge their appropriate function. It is for the zoölogist to discover similar automatic regulative processes; and the quest for hormones in invertebrates, suggested by the work of J. F. Gaskell (1914) on the leech, is very attractive. Such an everyday incident as the cat's hairs "standing on end" when surprised by a dog admits of obvious interpretation in terms of the hormone of the suprarenal bodies.

Ecology.—The old "natural history" cultivated a profitable field—the study of the life of organisms in its interrelations, as it is lived in wild nature. Logically classified, it was an enquiry into "the higher physiology," that interplay of organisms, where account has to be taken of more than the internal economy of the individuals concerned. For if physiology be the study of the organism in its dynamic relations it must include the serious study of the intact creature in its natural surroundings, as one of a pair and of a family, as a member of an association and of a fauna. This ecology (or "bionomics") is the oldest department of the science and it is indispensable; the question is how that of to-day differs from Réaumur's or Gilbert White's.

(*a*) Largely through Darwin's influence, there has been an increasing recognition of the complexity of interrelations amid which the organism lives and works. The recognition of the correlation of organisms has been not less profitable than the recognition of the correlations of organs within the body. It is not merely that, for completeness' sake, insects must be studied in relation to the flowers they visit, and the bird in relation to its mate and family, its "territory" and migrations—there is yet more implied in the modern insistence on the concept of "the web of life." As Darwin indicated, it deepens our understanding of natural selection in the struggle for existence. "For in the gradually evolved and ever complexified system of interrelations there is a sieve of extraordinary delicacy, which discriminates between even minute variations to the plus or minus side" (Thomson, 1919, p. 95). Moreover, part of the difficulty of understanding the frequent and general progressiveness of evolution (in the direction of increasing differentiation and integration) may be found in the gradual complexifying of the web of life, *e.g.* in the linkages between flowers and their insect-visitors. "There is established an external system of interrelations which is always becoming more intricate, and this forms the sieve by which variations are sifted. There has been an evolution of sieves which partly accounts for the progressive evolution of the sifted" (Thomson, 1919, p. 96). The importance of recognizing animate interrelations is familiar.

(*b*) Modern "natural history" has become frankly evolutionary. The "*Souvenirs Entomologiques*" of Henri Fabre must be taken as the crowning work of the older school; unquestionably an achievement of genius when we consider the patience, ingenuity, and intimacy of its observation, behind which lay an emotional sympathy, bringing, at times, even scientific reward, and yet an achievement robbed of its fruition by the observer's refusal to take Darwinism seriously, and by an unprofitable pessimism as to the possibility of any evolutionary interpretation whatsoever. A more progressive note is sounded in modern work permeated with the evolution-idea, such as Wheeler's studies on ants or Roubaud's on wasps.

(*c*) A third change, and a welcome one, is that "natural history" is becoming more analytic—which will eventually mean a fresh synthesis. Thus the study of the migration of birds, for so long rather fumbling and anecdotal, has entered on a new phase of precision. This may be illustrated by Dr. Eagle Clarke's careful analysis (1912) of enormous masses of observational material, the utilization of a new ringing method (Landsborough Thomson, 1921), and by the precise experiments of Watson and Lashley (1915) on the homing of terns at the Tortugas.

Another illustration will be found in the still incipient endeavour of the shrewder observers to take advantage of the results of the modern study of animal behaviour. The older naturalists read the man into the beast without let or hindrance or else reacted to the other extreme of regarding animals as automata. It is now recognized as desirable that an attempt be made to describe behaviour with reference to definite categories, of intelligence, instinct, individual habitation, association, tropisms, reflexes, and the like. To mention what may seem at first sight a small matter, Miss Frances Pitt (1920), in studying the well-known method the thrush adopts of breaking snails' shells on a stone-anvil in the wood, takes the trouble to experiment with a young thrush to see whether the behaviour is instinctive or whether it has to be learned. Her account of the bird's gradual learning, by a "trial and error" method, is of real scientific value.

Luminescence.—There is definite progress to record in the study of many animal activities which stand somewhat apart from the everyday life of the body. The inquiry into the nature of animal luminescence is a case in point (see Harvey, 1920). Luminescence is known to occur in no fewer than 36 orders of animals; it is a chemical phenomenon that may manifest itself after life has ceased (bacteria apart); it may be produced *in situ* in the cells in which the photogenic substance is produced, or there may be a luminous secretion that exudes over the surface of the body and forms a glimmering trail in the sea or on the ground; it may have its seat in more or less elaborate luminous organs which often show a remarkable convergence to eyes (the chemiphotic approaching the photochemical). The production of the animal light may be continuous or it may be periodic and even rhythmic. In "fire-flies" the light consists wholly of visible rays, with no infra-red or ultra-violet, and none of the energy is lost in the form of heat. It is practically perfect "cold light." The matter has been probed furthest in Lampyrid beetles, in the small crustacean Cypridina, and in the boring bivalve Pholas, and the result has been to confirm the contention of Raphael Dubois (1887) that a protein substance, luciferase, acts, in the presence of oxygen and water, on another substance, luciferin, which has much in common with peptones. The luciferins of different luminescent animals are different, but all luciferins have a good deal in common, and it is the same for the luciferases. It is probable that luciferase is an organic enzyme or catalyst which oxidizes luciferin, or accelerates its oxidation, with the result that light is produced. It is interesting that the chemical physiology of animal light has outrun its ecologic interpretation. In some cases the light may be no more than the byplay of some physiologically important chemical change, but a biological interpretation is demanded when there is an elaborate luminous organ or a definite arrangement of organs. Unfortunately, however, the interpretations suggested remain more or less of a speculative nature. The light may scare away intruders; it may be a lure attracting booty; it may illumine the surroundings; it may facilitate the recognition of kin; and it may serve as a sex-signal in mating. What seems a physiological byplay has thus been utilized and elaborated in quite different directions.

Tropisms.—On the inclined plane of animal behaviour tropisms occupy a place somewhat above ordinary reflex actions, and it is certain that an understanding of the ways of animals is impossible unless the rôle of tropisms is duly appreciated. This need not involve an attempt to coerce behaviour of a higher order (*e.g.* implying intelligent control) into categories manifestly too small—an exaggeration which sometimes seems to attend the brilliant experimental work of Jacques Loeb (1918). Yet tropisms must be taken account of, and Loeb has shown that they are obligatory or forced movements of the animal as a whole, which more or less automatically secure physiological equilibrium in relation to outside stimuli, such as light or heat, gravity or electricity, diffusing chemicals or water currents. When a moth, constitutionally adapted to nocturnal activity, but positively heliotropic none the less, comes in its flight within the sphere of influence of a lit candle, and has one eye much more illumined than the other, owing to the direction in which it happens to be flying, more intense chemical processes are set up in the more illumined eye. This means that on the illumined side there is a relative increase in the mass of certain chemical products. But stimulations are always passing from the brain of the flying moth to the contracting muscles, and if the physiological symmetry of the brain has been disturbed by the unequal illumination of the eyes, the muscles on the more illumined side are thrown into a state of stronger tonus, with the result that they respond more forcibly to nervous stimulation, and therefore turn the head and body of the moth directly toward the candle near which it is flying. "As soon as the plane of symmetry goes through the source of light, both eyes receive again equal illumination, the tension (or tonus) of symmetrical muscles becomes equal again, and the impulses for locomotion will now produce equal activity in the symmetrical muscles. As a consequence, the animal will move in a straight line to the source of light until some other asymmetrical disturbance once more changes the direction of motion" (Loeb, 1918, p. 14). When elvers go straight up stream against the current, when small crustaceans crowd to the shaded or to the warmer corner of the aquarium, when newly hatched turtles make for the sea, we have to do with tropisms. In many cases, however, even among the lower animals a higher note seems struck. For Jennings (1906) there is trial after trial of different movements, and there is a selection of that which brings relative satisfaction; an interpretation to which this observer adheres, despite criticism from Loeb.

Zoölogical Parasitology.—Progress in the study of parasites has been a very marked characteristic of the zoölogical work of recent years. This is congruent with the increased attention that has been given to the broad fact of the inter-relations between organisms, and details of the important medical results achieved will be found in the separate medical articles on this or that form of parasitic disease (*e.g.* MALARIA, SLEEPING-SICKNESS, BILHARZIOSIS, etc.). The tracking of the life-history of parasites is but a particular instance of this kind of investigation, with a special interest when the parasites affect Man and his domesticated animals and cultivated plants. Good examples are not far to seek—the malaria organism (plasmodium), and the mosquito's share in its development and dissemination; the trypanosomes that cause sleeping-sickness and other diseases, and the tsetse flies and other insects implicated in their transmission; the hookworms (*Ankylostoma* and *Necator*) which depress the vitality of enormous numbers of the inhabitants of tropical and sub-tropical countries; and the species of the formidable Bilharzia (*Schistosomum*) whose life-history, discovered by Dr. Leiper, is bound up with freshwater snails. Apart altogether from the immense practical importance of these investigations, they are full of theoretical interest. Thus, to take the two kinds of Bilharzia in Egypt, one species, *Schistosomum mansoni*, has ova with a lateral spine, is chiefly associated with the snail Planorbis, and produces intestinal bilharziosis; while the other species, *S. Hæmatobium*, has ova with a terminal spine, is chiefly associated with the snail Bulinus, and produces renal bilharziosis—obviously a fine instance of specificity. As several human diseases have now yielded to attack from the zoölogical side, it is not over-sanguine to consider whether there may not be a much-desired clue in the fact that cancer of the stomach of the rat is produced by a nematode whose carrying host is the American cockroach. Very interesting and somewhat surprising is the discovery (see Rennie, White, and Harvey, 1921) that the so-called "Isle of Wight disease" in hive-bees, which spread in a few years all through Britain, is causally connected with the presence of a minute mite, *Tarsonemus woodi*, in the cavity of two anterior tracheæ. More familiar is the demonstration of the fact that true pearls may have a parasitic origin.

(C) EMBRYOLOGICAL ZOÖLOGY

While descriptive morphological embryology continues on lines which require no vindication—we have only to think of recent work on the development of the marsupials and armadillos, of Dipnoi and Echinodermis—it is instructive to notice, in the volumes of the *Journal of Experimental Zoölogy* how many embryological investigations sound the experimental note. There has been great activity not only as regards what is often called "experimental embryology" in the narrow sense, where germ-cells and developing ova are subjected to artificial stimuli, constraints, and disturbances, but also as regards later stages of embryonic life. Here might also be considered the observations of Carrel and others on the prolonged life of pieces of tissue in artificial cultures, and the important researches of Ross Harrison on the growth of a nerve fibre. It is of zoölogical as well as physiological interest that this growth should be closely comparable to the protrusion of a pseudopodium by an amœba.

Experimental Embryology.—In illustration of what may be included under the term "experimental embryology," we may take Godlewski's remarkable cases of the fertilization of an ovum with the spermatozoon of an unrelated animal. A fragment of the ovum of *Echinus*, bereft of a nucleus, was fertilized by the spermatozoon of the Crinoid *Antedon*. The segmentation, the gastrulation, and the formation of the mesenchyme followed the type of the maternal parent, which seems to show that the cytoplasm may count for much in inheritance. The ova of *Sphaerechinus* were fertilized by the spermatozoa of the Annelid *Chaetopterus*, and the union of the two nuclei was observed. But before the nucleus divided, the chromatin from the spermatozoon was ejected, as if the incompatibility was too pronounced. In another set of experiments Godlewski altered the composition of the sea water containing sea-urchin ova, and then introduced the spermatozoa of *Chaetopterus* or of the mollusc *Dentalium*. The result was development, which was followed to the Pluteus stage. The further experiment was made of adding spermatozoa of the sea-urchin to those of the worm or of the mollusc, with the result that no development occurred. Godlewski speaks of the antagonism of the unrelated spermatozoa, and Bohm (1921, p. 27) calls attention to the possible analogy with the antagonistic action of serums derived from distantly related species. Nothing, he says, is more fruitful in biology than the bringing together of two sets of facts which appear at first sight to belong to very different provinces. Enough has been said to indicate the interest of this relatively young inquiry.

Artificial Parthenogenesis.—It was discovered independently by Yves Delage and by Jacques Loeb that ova which do not normally show parthenogenetic or aspermic development may be induced to do so by very varied artificial stimulation. The prosecution of this kind of experiment has made it plain that there are usually two distinct events—the first, a stimulation which induces cleavage but is apt to lead to disintegration; the second, a counteracting or corrective influence which steadies development, acting as a life-saving brake. Thus, to take one of Loeb's methods, if the eggs of the sea-urchin are subjected for a short time to the influence of some fatty acid like butyric acid, cleavage sets in, but it is then necessary to place the ova in hypertonic sea water to keep them on lines of safety. Or, to take one of Delage's methods, the ova may be first activated by a combined application of tannin and ammonia, and then replaced in ordinary sea water. Or, to take Bataillon's method, if the eggs of the frog are first activated by pricking them with a very fine stilet of glass or platinum, and then steadied by washing them with blood, which allows of the entrance of a corpuscle, normal development may follow, and several young frogs, of both sexes, have been reared.

Experimental Teratology.—A good instance of the modern endeavour to supplement the study of form by the study of function, morphology by physiology, may be found in the development of experimental teratology. Accurate descriptions of monstrosities and abnormalities are valuable, but their significance is increased when some light can be thrown on how the peculiarities in question came about. It has been shown that defective nutrition of the embryo, especially at critical stages, may lead to "arrests of development," such as harelip in Man. It has been shown that conditions which bring about local slowing or quickening of the rate of development may result in abnormal asymmetry, coalescence, separation, and the like. But a more precise illustration may be useful. Dr. E. I. Werber (1916) subjected the developing eggs of the American minnow, *Fundulus*, to various reagents, such as butyric acid, which brought about numerous monstrosities in eyes and ears, nostrils and mouth, heart and fins. The chemical intrusion seemed to dislocate and partially dissolve the germinal material, especially toward the head end of the embryo. As one of the results of a disturbance of carbohydrate metabolism is the production of butyric acid, the theory almost suggests itself that a poisoning of a mammalian mother's constitution with butyric acid might account for histolytic monstrosities in the offspring. Werber has also shown that a breaking-up (blastolysis) of the optic club brings about the formation of many lenses. The optic club fragments exert on various parts of the skin which would not naturally form a lens a specific effect, like that of a ferment, which induces multiple lens-formation.

Sex Determination.—Without encroaching on the article SEX, we may notice the general fact that the inquiry has become wholesomely experimental along several distinct lines. (*a*) The striking work of Geoffrey Smith and Potts, following Giard's pioneer observations, has shown that the castration of a male crab by a Rhizocephelan parasite induces an expression of latent feminine and female features. The male put on abdominal limbs like those of a female, and the gonad showed ova; and Smith's theory, stated briefly, was that the parasite alters the composition of the male's blood to or toward a female condition, and that this is naturally followed by the development of latent female secondary characters, or by the regeneration of an ovary instead of a testis from the indifferent residue that remains at the end of the infection. Metabolism-stimulation activates latent sex characters. Using the terminology of *The Evolution of Sex* (Geddes and Thomson, 1889), Geoffrey Smith summed up: "This adaptive regulation consists in the production of at least a partially female condition of anabolism as opposed to a wholly male condition, the female condition being preponderantly anabolic or conservative, as opposed to the katabolic male condition, and, by this change from a katabolic to a more anabolic condition, the animal can withstand better the drain on its system increased by the parasite." (*b*) Many experiments show that latent masculine characters in a female animal, or latent feminine characters in a male, may be activated by changes in the internal secretions of the gonads. (*c*) Baltzer (1914) has shown that if the very young sexually indifferent larvæ of the worm *Bonellia*, just hatched from the eggs, happen to become attached to the proboscis of an adult female, they develop into males; whereas, if they fail to attach themselves and sink into the sand or mud, they develop slowly (almost exclusively) into females. But the story does not end here. Baltzer helped some of the very young free-swimming *Bonellias* to attach themselves to the proboscis of a full-grown female; those that he left attached for a very short time developed into almost perfect females; those that he left attached for a long time became perfect males, if such degenerate pigmies can be called perfect; while those that he left for intermediate periods showed practically all grades of inter-sex. These fine experiments point to a conception of sex as plastic, reversible, constitutional, and quantitative. (*d*) The recent work of Oscar Riddle has made it practically certain that pigeons produce two kinds of eggs which differ in the rate or intensity of their chemical processes. One kind of egg has a low storage capacity, a high oxidizing capacity, and a relatively higher intensity of metabolism; and such a type of egg develops into a male bird. The contrasted type of egg develops into a female bird, while an intermediate type of egg, produced for instance early in the season, will develop into a female bird with an admixture of masculine features. Femaleness in an egg is associated with high storage capacity, less intensity of metabolism, lower percentage of water, higher total of fat and phosphorus, and greater energy value in the yolk as determined by the calorimeter. It is of further interest to notice that analyses of the blood of adult cocks and hens show a persistence of constitutional differences analogous to those which mark the two kinds of ova. These experiments furnish a corroboration of the thesis, suggested in 1889 by Geddes and Thomson, that femaleness is associated with a relative preponderance of constructive up-building, or anabolic processes, and conversely for maleness.

It need hardly be said that what seems to have been made very probable for the pigeon need not hold good in the same way for other animals. Thus in frogs it is probable that all the eggs are alike to begin with, but that there are two kinds of spermatozoa, one with and the other without a special sex-chromosome. If the eggs are quite normal at the time of fertilization the determination of the sex depends on whether the egg is fertilized by a sperm with the special sex-chromosome (which results, it is believed, in a female offspring), or by one without the sex-chromosome (which results, it is believed, in a male offspring). Even clearer cases have been worked out in insects by Prof. E. B. Wilson and others. It does not follow that the physiological condition of the ova is of no importance, for over-ripe frog's ova tend to develop into females. Moreover, the presence of the special sex-chromosome may be associated with certain constitutional differences in the germ-cell—an index as much as a cause.

Regenerative Capacity.—Prof. T. H. Morgan's critique (1901) of Weismann's theory of regeneration as an adaptive phenomenon—occurring in those two animals and in those parts of animals which, in the natural conditions of life, are particularly liable to non-fatal injury, has been followed by interesting experiments and observations. It seems that regeneration often follows the experimental excision of a part which could rarely, if ever, be lost in the ordinary conditions of life. In such cases it seems gratuitous to search for some far-fetched evidence of adaptiveness. It seems more reasonable to regard the regrowth of an excised portion of the body as a special exhibition of a power which is always in operation in the repair of certain tissues, such as the glandular epithelium of an intestine. On the other hand, this will not suffice when there is definite prearrangement establishing a weak breaking plane, as in a crab's claw or a lizard's tail. The fine work of Dr. J. H. Paul (1915) has shown in the case of the shore-crab (*a*) the definite prearrangements at the breaking plane; (*b*) the muscular arrangements that secure the rapid surrender of a captured or broken limb; and (*c*) the presence of a two-flapped membrane, pierced by nerve and blood-vessel, which automatically folds over the wound and prevents hæmorrhage. To this has to be added the way in which the new limb is fully formed within the scar before it is jerked out after a moult. When it is known that a breakage of a leg by a dislodged stone is a common accident among shore-crabs, the adaptiveness of the special arrangements seems more than plausible.

Senescence and Rejuvenescence.—The study of development in the widest sense includes the phenomena of senescence as well as those of adolescence, and there is no doubt that progress is marked by such studies as those of C. M. Child (1915). On an experimental basis, mostly in regard to planarian worms, Child rests the conclusion that as an organism differentiates, it ages, for there is a necessary accumulation of relatively inactive and stable constituents in the colloidal cytoplasmic substratum, and this accumulation involves a decrease in the rate of metabolism, as the flow of a stream may be slowed by what it deposits in its bed. There are indeed counteractive processes of reduction, removal, and de-differentiation, when the metabolic stream may be said to erode its bed instead of depositing more materials. Periods or it may be crises (often seasonal) of rejuvenescence alternate with periods of senescence. Sooner or later, however, rejuvenescence lags and senescence prevails. Exceptions, as Weismann and others suggested, are to be found in the Protozoa, where recuperative rejuvenescence is wellnigh so perfect that it implies bodily immortality. The question rises whether a similar evasion of natural death may not occur also in some simple Metazoa such as hydroid polyps and planarian worms.

In the same connexion may be noticed the observations of L. L. Woodruff on pure-line (all descended from one individual) cultures of the slipper-animalcule *Paramoecium*, which multiplies rapidly by fission. In 1915 he reported on a stock which had kept agoing for over eight years, 5,250 or more asexual generations. There had been no conjugation (which does not occur between members of a pure line) and no artificial stimulation; the secret of continued vitality, so different from the aging observed by Maupas, being abundant food and a thorough removal of waste products from the water. Very suggestive is the periodic, approximately monthly, occurrence of *endomixis* observed by Woodruff and Erdmann (1914), a disruption and reorganization of the nuclear apparatus, similar to that which precedes conjugation in natural conditions. It appears to serve as a process of rejuvenescence, and it serves, perhaps, like conjugation, to provoke variability.

Another correlated idea, to which the work of some palæontologists has pointed, is that one type of animal may differ from another in the relative length of the chapters in the life-history. The pre-natal chapter may be long in one, *e.g.* elephant, and very short in another, *e.g.* opossum; the larval period, long drawn out in a crab, is telescoped down in the crayfish. The young storm-petrel remains many weeks in the burrow; the young mound-bird may run or fly from its birthplace on the day it is hatched. A queen-ant or a queen-bee may live for several years as an adult, while the may-fly sometimes completes its adult life in an evening. The idea is that an arc in the curve of life may be shortened or lengthened in related types, as the adaptive outcome of "temporal" variations. In vertebrate animals it is known that changes in the activity of the glands of internal secretion may hasten or slow down processes of development as well as processes of metabolism.

(D) AETIOLOGICAL EVOLUTIONARY ZOÖLOGY

Heredity.—Prof. T. H. Morgan (1915, p. 7) calls attention to a curious situation which has begun to develop since 1900, when Mendel's law was rediscovered. "The students of heredity, calling themselves geneticists, have begun to draw away from the traditional fields of zoölogy and botany, and have concentrated their attention on the study of Mendel's principles and their later developments. The results of these investigators appear largely in special journals. Their terminology is often regarded by other zoölogists as something barbarous—outside the ordinary routine of their profession. The tendency is to regard genetics as a subject for specialists instead of an all-important theme of zoölogy and botany." It is to be hoped that this severance is only a passing phase, for its accentuation would mean much loss on both sides. "It would be as unfortunate for all biologists to remain ignorant of the modern advances in the study of heredity as it would be for geneticists to remain unconcerned as to the value for their own work of many special fields of biological inquiry." Of clear exposition by investigators like Bateson and Punnett, Castle and Morgan, there is no lack, and the advantages of a synoptic view of the fundamentals of zoölogy as a whole do not need to be enforced by argument.

Referring for due treatment to the article MENDELISM, we may call attention here to three points of general interest. (*a*) In two recently published books we find two extraordinarily discrepant statements in regard to heredity. In one of them Prof. J. P. Lotsy (1916, p. 63) says: "We know absolutely nothing of heredity." In the other Prof. T. H. Morgan (1919, p. 15) speaks of the fundamental aspects of heredity having turned out "so extraordinarily simple," and he elsewhere indicates that the problem of heredity may be regarded as solved. What is the meaning of this startling divergence of statement? The first author had in mind the difficulty of conceiving how all the manifoldness of a well-endowed organism is telescoped down into a microscopic implicit individuality—the germ-cell. The second author was contemplating the precise way in which certain characters of the parents, carried by the chromosomes, are distributed among their offspring. For a large number of cases the modern theory of factors or "genes," located in linear order in the chromosomes, is convincing and clear. (*b*) The list of characters proved to exhibit Mendelian inheritance is always increasing. Many organisms consist, in part at least, of a great bundle of "unit-characters," the factors for which behave in inheritance as if they were indivisible entities. They do not blend or intergrade; they are present in a certain proportion of the progeny; they are normally either there in their entirety or completely absent. It is now recognized, indeed, that one factor or gene may have manifold effects and that one character may be the product of many genes, yet the general idea remains that "the germ-plasm is made up of units that are independent of each other in at least two respects, namely, in that each one may change (mutate) without the others changing, and in segregation and in crossing over each pair is separable from the others" (Morgan, 1919, p. 240). The balance of present opinion seems to be strongly in favour of interpreting all inheritance as Mendelian, but it seems to many not unscientific to say that there is another mode of inheritance which may be described as "blending." There are indeed ways of explaining away blending as due to the coöperation of multiple Mendelian factors, and we are also now being introduced to "Mendelian characters which slowly blend"; but in an article which attempts a general survey it seems just to cite the considered opinion of an experimenter and thinker like Prof. W. E. Castle (1916, p. 218), who writes: "It seems best, accordingly, to attempt neither with Galton to generalize all inheritance as blending nor with Johannsen to treat all inheritance as alternative, but frankly to recognize the existence of two categories of cases distinct in their inheritance behaviour."

Inbreeding and Outbreeding.—Attention has often been directed to the evolutionary importance of inbreeding and outbreeding (exogamy and endogamy), but it is only within recent years that firm foundations have been laid (see East and Jones, 1920). Professional breeders have recognized for a long time that close inbreeding, accompanied by the usual judicious selection and elimination, fixes desirable characters and leads toward a uniform and stable herd; and yet that it has disadvantages, being apt to lead to reduction in vigour, resisting power, fecundity, and even size. Till recently there has been no secure answer to the important question, whether the disadvantageous consequences are actually induced by the close breeding as such, or are simply brought to light and accentuated by it. Experiment has furnished the answer. It has been proved that the close inbreeding of fine stock, associated with the usual selection and elimination, may be persisted in for several generations without any undesirable consequences. Many fine breeds of animals have had very close inbreeding at their beginning; and there seems to be habitual endogamy among bees and ants. In certain forms of "isolation" there is bound to be close inbreeding. Furthermore, it has been shown that the direct result of persistent inbreeding is to segregate within the stock a number of true breeding strains of similar individuals. If there were, at a given time, in a herd, say, four distinct hereditary factors relative to a particular character, such as the colour of the pellage, then if the factors illustrated Mendelian inheritance, the automatic effect of inbreeding would be to segregate four types, pure as regards the particular character in question. But some of the characters which thus become isolated may be undesirable "recessives," seldom seen under ordinary circumstances because they are hidden by their "dominant" counteractives. Thus the undesirable character of albinism, likely to be kept out of expression in conditions of exogamy, is isolated and brought to light in endogamy. These exposed recessives have given inbreeding its bad reputation, but now that the occurrence is understood the elimination of these recessives by the practical breeder becomes a more hopeful task. When the same undesirable qualities occur on both sides of the house, inbreeding tends to their diffusion and exaggeration, yet the result of modern experimenting is clear: "Inbreeding is not in itself harmful; whatever effect it may have is due wholly to the inheritance received" (East and Jones, 1920). But there is another phenomenon, namely the increased "vigour," which often rewards outbreeding. Darwin was strongly of opinion that the gain in constitutional vigour derived from an occasional crossing was a more important biological fact than the loss that often followed close inbreeding, and modern experimenters have confirmed his shrewd judgment. The outbreeding often has advantageous results like those that reward a notable improvement in nurture. There may be an increase in "vigour," resisting power, size, and other good qualities. The reason for this frequently observed "hybrid vigour" is probably to be found in the pooling of diverse hereditary resources of good quality, not in some vague physiological stimulus to the offspring. The general aspects of this kind of inquiry are very important. Thus one of the great trends of organic evolution has been toward the securing of cross-fertilization, though the range of crossing in different cases varies within wide limits. The survival value of this cross-fertilization probably lies in the fact that it promotes variability. It brings about a greater variety of raw material on which selective agencies can work. Similarly, for the wider ranges of cross-fertilization which we call outbreeding, the suggestion arises that this is fundamentally valuable in promoting variability, both in the way of new patterns and fresh vigour. A new light is shed on the process of evolution if we consider the probability that success has rewarded the alternation of periods of exogamy with periods of endogamy. Thus there is a return to the position of Romanes, Gulick, and others, that "isolation" may count for much in evolution. Another ray of light, and a very welcome one, touches the dark problem of sterility. It is suggested by East and Jones that there are two quite different kinds of sterility of diverse origin: (1) Inbreeding tends to sort out homogeneous pure strains and in this sifting out the ability to reproduce may be lost; (2) outbreeding may bring together two germ-cells which are too incompatible, *e.g.* in their chromosomal equipment, to allow of a continuance of the process of germ-cell making. Thus, the *number* of chromosomes in the two parents (*e.g.* horse and ass) may be too discrepant.

Nature or Nurture.—There is a mounting up of evidence as to the influence of environment and function on the developing organism. Just as a certain quantity of food, oxygen, and moisture is essential if the inheritance is to be expressed, so is it with the wider environment of liberating stimuli, and so it is with functioning and exercise. Up to a certain point the chick's lung develops in virtue of the properties resident in the germinal material; beyond that point the development requires that the chick shall breathe. If the word "nurture," which Sir Francis Galton made technical, be used to include all manner of nutritional, environmental, and functional influences, it may be fairly said that modern zoölogy has been marked by an increasing appreciation of the importance of "nurture," as complementary, not antithetic, to the hereditary "nature." As Prof. T. H. Morgan says (1915): "every character is the realized result of the reaction of hereditary factors with each other and with their environment"; and again: "it is a commonplace that the environment is essential to the development of any trait, and that traits may differ according to the environment in which they develop." Gudernatsch has shown that in tadpoles fed on thyroid there is differentiation without growth, while in tadpoles fed on thymus and spleen there is growth without differentiation. Fruit-flies (*Drosophila*) with a peculiar Mendelian abnormality may appear perfectly normal if reared in a dry bottle, but the presence within them of the "factor" for the abnormal character may be demonstrated by rearing their offspring in a damp bottle (Morgan, 1915). Loeb has shown that it is easy to produce a percentage of minnow (*Fundulus*) embryos with defective eyes by adding a very minute quantity of potassium cyanide to the water, or by exposing the developing eggs to low temperature. That is to say, relatively slight environmental changes may so alter the constitution of the developing embryo that a leap is taken in the direction of blindness. Peculiarities in nurtures may enhance or depreciate the hereditary virtues of the organisms; they may induce a modification which serves as a life-saving screen until an innate variation in the same direction has time to establish itself; in cases like mammals and seed-plants the nurtural condition of the maternal parent may influence the vigour of the offspring during the ante-natal symbiosis; changes in nurture, as Tower's experiments (1906, 1918) suggest, may be variational stimuli to the germ-cells.

In regard to the prolonged discussion over the transmissibility of exogenous somatic modifications, the chief need is still for more facts. It is admitted that somatic modifications may have secondary effects on the germ-cells and on the offspring (especially in the case of the viviparous mammals), but this is not the same as the transmission of particular modifications as such or in any representative degree. It is probable, as Agar's experiments (1913) suggest, that long-continued, deeply saturating environmental and functional peculiarities may produce specific substances which enter into the cytoplasm of the germ-cell, or into the embryonic body, and may exert a very definite influence as long as they last; but there is as yet no convincing evidence that the resulting changes grip the constitution permanently. J. T. Cunningham (1908) and others have suggested that particular modifications of an incisive sort may liberate very specific chemical substances, like hormones, and that these may be carried to the germ-cells and accumulate there with subsequent formative (morphogenic) effects. The number of competent zoölogists who hold to some form of Lamarckism should be enough to restrain the impatient from attempting to close this important question or to dogmatize about it. As Prof. E. B. Wilson has wisely said: "In the present defective state of our knowledge we may well grant that there may be many a thing between germ-cell and body that is not yet dreamed of in our biological philosophy." It should be clearly understood that there is no depreciation of the varied importance of peculiarities in nurture on the part of those who are unable to find convincing evidence of the transmission of any exogenous somatic modification. It is incorrect to say that this scepticism leads to the view that individual experience counts for nothing racially. On the contrary, it is through individual experience that germinal variations or mutations are tried and tested.

Evolution Theory.—It would be a contradiction in terms if the Evolution Theory did not evolve. What changes are in process? (1) Some methodological progress has been made in clarifying the concept of organic evolution (see Sorley, 1909). "Organic evolution is a continuous natural process of racial change in a definite direction, whereby distinctively new individualities arise, take root, and flourish alongside of, or in place of, the originative stock" (Thomson, 1920, p. 378). We must also clearly distinguish this from (*a*) the "*genesis*" of a solar system or of a mountain or valley; (*b*) the "*development*" of an organism as an individual; and (*c*) the "*history*" of a human society. (2) Somewhat startling is the suggestion made by Bateson (1914), that we should consider "whether the course of evolution can at all reasonably be represented as an unpacking of an original complex, which contained within itself the whole range of diversity which living things present." "At first it may seem rank absurdity to suppose that the primordial form or forms of protoplasm could have contained complexity enough to produce the divers types of life. But is it easier to imagine that these powers could have been conveyed by extrinsic additions?" In so far as this view means that there is nothing evolved which was not originally in kind involved, that there is nothing of lasting value in the end which was not represented in kind in the beginning, it may be philosophically tenable; but most biologists will probably adhere to the view that organic evolution has been a process of racial epigenesis (not an *evolutio*), with a frequent outcrop of genuine novelties, a synthetic complexifying by creative inventions and by trading with time, rather than an analytic simplification through the removal of inhibitions which allowed the original richness of endowment to express itself with increasing fullness. There was a time when there were no birds or mammals; they came into being, and they were new ideas; they made a new world. (3) While there is practical unanimity among the zoölogists of to-day as to fact of organic evolution, there is a clearer apprehension than there was a generation ago of the detailed difficulties. These difficulties are chiefly of three kinds: (*a*) that little is known with certainty in regard to the pedigree of the great phyla, such as Vertebrates, and as to the way in which the biggest steps were taken, like the passage from Protozoa to Metazoa; (*b*) that there naturally remains much uncertainty in regard to the factors operative in the historic process, and as to the conditions implied in the hereditary or genetic relation between one generation and another; and (*c*) that in regard to the originative factor termed for convenience "variability," our ignorance is still immense. Bateson expressed the mood of many when he said (1913, preface): "That species have come into existence by an evolutionary process no one seriously doubts; but few who are familiar with the facts that genetic research has revealed are now inclined to speculate as to the manner by which the process has been accomplished. Our knowledge of the nature and properties of living things is far too meagre to justify any such attempts." And later in the same work (p. 97), he says: "We have not even an inkling of the steps by which a Silver Wyandotte fowl descended from *Gallus bankiva*, and we can scarcely even believe that it did." (4) It is pessimistic to say that we are no nearer an understanding of the central problem of ætiology, namely the origin of the new, *i.e.* of the variations or mutations which form the raw material of progress or the reverse. The ground has been cleared, though the problem remains unsolved. (*a*) If from the observed differences between the members of the same species there can be subtracted all the peculiarities that are associated with age and sex, and likewise all that can be reasonably interpreted as individually acquired exogenous somatic modifications (directly due to peculiarities of nurture, whether environmental, nutritional, or functional), then we get at the true variations and mutations—inborn, not acquired—endogenous, not exogenous—blastogenic, not somatogenic—expressions or outcomes, not indents or imprints. If there be no convincing evidence of the transmission of extrinsic modifications, as such, or in any representative degree, then they cannot be included, in the first instance at least, among the raw materials for evolution, which are thus confined to what is left when the modifications are subtracted from the total of observed differences. That some at least of this residue, as true variations, are very transmissible, is quite certain. This is the first clearing of the ground. (*b*) But within the large category of inborn changes it seems possible to distinguish minute continuous variations from brusque saltations (Darwin's "sports," Galton's "transilient variations," Bateson's "discontinuous variations," and of course the "mutations" of De Vries; all these being practically the same, though investigated with ever-increasing care). The minute continuous variations, on the other hand, are of the nature of "a little more or a little less," and they show intergrades. Their transmissibility has not been much studied, but has been proved in a few cases. The mutations, whether large or small, are more deserving of the title qualitative; they often show a measure of perfectness from their first appearance, they are without intergrades, they are markedly transmissible, and they are demonstrably at the origin of some new varieties of domesticated animals and cultivated plants. They correspond to, or are implicated in, those "unit characters" of species or varieties which illustrate Mendelian inheritance in their recurrence from generation to generation. Now whether we attend to the continuous or to the discontinuous variations, we can imagine them to arise in the course of the shufflings of the hereditary cards (the chromosomes and their microsomes) during the intricate processes of maturation and fertilization. The reduction or exaggeration of a quality, the dropping out of a character altogether, a "double dose" of a character, a rearranged pattern of hereditary items, may all be interpreted as due to permutations or combinations of hereditary factors or genes during the intricate manœuvres preceding the completion of the fertilization of the ovum. The evidence is very strong that the segregation of the factors of Mendelian characters takes place in the reduction divisions of the germ-cells in the process of maturation. An interesting corroboration has been furnished by the recent experiments of Prof. W. E. Agar (1920) with a parthenogenetic "clone" (pure line) of a hybrid water-flea (*Daphnia pertusa* × *Daphnia pulex*). No reduction divisions occur in a parthenogenetic lineage, and no Mendelian variations occurred. Along with the rearrangements which may be effected in the maturation of the germ-cells—rearrangements in which such phenomena of chromosomal behaviour as "crossing-over" must be taken account of—another possibility of change is afforded at the beginning of each individual life; for there, in all ordinary cases, two very complex systems, of dual origin, become a new unity which normally develops into a harmonious organism. Some modern evolutionists, such as Lotsy (1916), attach great importance to crossing as a cause of variations.

If it be said that such opportunities as have been mentioned could account for nothing more than rearrangements, pluses and minuses, gains and losses, but not for any distinctively novel change, the difficulty of interpretation increases. But even among Mendelians it is sometimes admitted that the factors or genes may themselves change. How this might happen is at present the subject of speculation, but this need not be unreasonable, and it is sometimes backed by the beginning of experiment. Three suggestions may be stated. First, it may be, as Weismann believed, that deeply saturating environmental influences act through the body as variational stimuli on the germ-cells, provoking them to change. It is known that changes in a cell's environment may cause disturbance of the process of cell-division, and this, as Bateson has pointed out, may be the *fons et origo* of germinal variation. Apart from demonstrable external stimuli, it is possible that the chromosomes of the germ-cells may change suddenly like mutating Bacteria, or may undergo age changes, or may exhibit periodic reorganizations, like the remarkable endomixis that occurs about once a month in a "pure line" of *Paramoecium*, or may show rejuvenescence-changes, like those which occur in some cases of regeneration and asexual multiplication. It must be borne in mind that the chromosomes are very complex living bodies, and that differences between species are sometimes the expressions of visible differences in the chromosomes, as Gates (1915) has shown in the case of *Oenothera*.

The Mendelian conception of unit-characters, whose germinal factors or genes behave like discrete unities in inheritance, neither blending nor fragmenting, has had to be corrected by fuller knowledge. Thus Prof. T. H. Morgan (1919) lays emphasis on the conclusions: first, that each gene may have manifold effects on the organism; and second, that every part of the body, and even each particular character, is the product of many genes. The phenomenon of linkage also shows that chains of genes may keep together in inheritance instead of there being free assortment of the various links in the chain. Thus from the idea of extreme particulateness which Mendelism at first suggested, there is a return toward the Darwinian idea, on which Sir E. Ray Lankester, especially, has laid emphasis, of the correlation of variations. Several apparently independent changes may be diverse outcrops due to one disturbance. A change in some particular kind of metabolism may reverberate through the whole body. Another idea of considerable importance is that of temporal variations, that is to say, alterations in the "time" or rate or rhythm of certain metabolic processes, or in the duration of particular phases in the life-cycle. Many changes of great adaptiveness are interpretable as lengthenings out or shortenings down of particular chapters in the life-history. In the influence of internal secretions in backboned animals there is a known method whereby these variations in tempo might be brought about; and it is worthy of notice that in Sebright poultry, where the cocks are hen-feathered, an endocrine secretion depends on a genetic factor inherited in the same way as are other genetic factors (see T. H. Morgan, 1919, p. 243).

Many palæontologists, with remarkable concurrence, have reached the conclusion that an evolving line often changes not by discontinuous steps (saltations or abrupt mutations), but by continuous minute steps. This is well illustrated by Dr. Rowe's study of the species of the sea-urchin *Micraster* in the chalk of S.E. England and just as well by the evolution of Mammalian teeth. Speaking of Tertiary mammals, Dr. W. D. Matthew writes (1910): "The more complete the series of specimens, the more perfect the record in successive strata, and the nearer the hypothetic centre of dispersal, the closer do we come to a phyletic series whose intergrading stages are well within the limits of observed variation of the race."

Whether the individual changes in the past were continuous and minute transitions, like those which Dr. Duerden finds occurring to-day in the ostrich, or were discontinuous and minute saltations, or both, no one can tell; and the question does not seem very important. Even in ordinary growth what seems by one mode of measurement continuous, may be shown by another and finer method to progress rhythmically, even to seeming fits and starts. But the palaeontologist tells us more; he can arrange his species in series in a time-succession. "There is not merely transition, but transition in orderly sequence, such as can be represented by a graphic curve of simple form" (Bather, 1920, p. 73). Moreover, in this seriation there may be gradual increase or decrease as in the number of spines or tubercles, or in the size of horns or digits; and this gives the palæontologist an advantage over the neontologist, inasmuch as he can point to progression or retrogression extending throughout millenia. It is for the neontologist to assist the palæontologist by pointing to determinate variation occurring in generations of living animals; for it may have been by such mode of variability that the seriations of the rock record were produced (see Bather, 1920, p. 74).

There is a growing body of evidence in support of the view that variation is often a very definite kind of organic change. This cannot be assured from the movement of a species as such; for the inferred orthogenesis might be the outcome of selection, sifting out those best adapted to a particular environment which might also be changing in a definite direction, say of increased salinity or aridity. But when large numbers of specimens are procurable, and can be studied in successive years (or centuries in strata), the non-occurrence of variations off the line is significant. If this be so, it is not necessary to look for any particular impulse from within to account for the definiteness. It may be enough to recognize that the unified organization, stereochemical in part at least, must to a certain extent predetermine what variations (other than pathological disintegrations) emerge.

Here may also be mentioned the suggestion of dichotomous variation, as between types of passive and active (anabolic and katabolic) preponderance, and as resulting in contrasts of allied forms, like bee and wasp, moth and butterfly, sheep and goat, and to larger differences as of reptile and bird, even of plant and animal, female and male. (*See* P. Geddes, VARIATION, *E.B.*, 9th ed.; and Geddes and Thomson, *Evolution*, 1911.)

Natural Selection.—The zoölogist of to-day has to face the reconciliation of two sets of facts as regards natural selection. In a few cases, such as Weldon's crabs, it has been demonstrated in actual effective operation, and Cesnola's test of the protectiveness of colouring by tethering green mantises with silk threads on brown herbage and brown variants on green herbage, gave vividly convincing results. Working with "hooded rats," Prof. W. E. Castle selected simultaneously in two opposite directions; and produced one race black all over except for a white patch of variable size underneath, and another race white all over except for the top of the head and the back of the neck, which are black. On the other hand, it has been shown by Johannsen, de Vries, Jennings, Pearl and others that selection does not count for much within pure lines or inbred stocks. Within an inbred race of guinea-pigs, for instance, a *ne plus ultra* may be reached, beyond which no amount of selection is of any avail within the period of experimentation. Abundant "fluctuations" of a quantitative sort occur, but these cannot be used as a basis for selection since they are not transmissible. They are probably for the most part of the nature of somatic modifications.

The estimate of the scope of natural selection is plainly affected by the view taken in regard to the raw materials supplied. If a new position of structural or functional equilibrium is reached by mutational abruptness, there is no need in such a case to burden natural selection with the task of gradually accumulating minutiæ. On the other hand, due attention should be given to de Vries's declaration (1909, p. 83): "Thus we see that the theory of the origin of species by means of natural selection is quite independent of the question, how the variations to be selected arise? They may arise slowly, from simple fluctuations, or suddenly, by mutations; in both cases natural selection will take hold of them, will multiply them if they are beneficial.

and in the course of time accumulate them, so as to produce that great diversity of organic life, which we so highly admire." In the same way, if variations are in large measure definite, natural selection has not to sift out the serviceable from a large casual crop, but it still has its work to do.

The trend of recent zoölogy seems to be toward a confirmation of the central idea in Darwinism—the selection of the relatively fitter variants in the struggle for existence. Thus there is no longer serious difficulty in meeting the criticism that slight initial variations could not have survival value, or that they would be swamped by intercrossing. There is also a deeper appreciation of the fact, on which Darwin so often laid emphasis, that selection is a manifold and often subtle process of sifting. Thus lethal selection must be distinguished from reproductive selection, and the operation of selective processes at many levels, even among germ-cells, must be recognized. The ubiquitous sifting is anything but automatic, since animals often select their environments, instead of being selected by them, and may be in various ways active agents in their own evolution. Natural selection operates in reference to an intricate web of life, and thus a nuance—a shibboleth—may have survival value. There has been an evolution of the sieves as well as of the sifted, for natural selection operates, generally speaking, in relation to an ecological *Systema Naturae*—or system of inter-relations—which has been increasingly elaborated through the ages; and this (along with what may be called organismal momentum) is probably part of the explanation of the *general* progressiveness of organic evolution.

Sexual Selection.—No part of Darwin's theory has met with a more critical reception than his theory of sexual selection; and yet it often has weathered the storm. (*a*) When there is forceful competition among rival males there is some evidence that the less well equipped with weapons will have fewer and less vigorous offspring, or it may be, none at all. This will operate like ordinary natural selection. (*b*) The same may be said of those masculine characters which aid males to find, pursue, and catch the female. (*c*) Sexual selection meant, for Darwin, all the processes of sifting that occur in connexion with mating and pairing, whether the female held the sieve or not; but he firmly believed that in a certain number of cases there is definite preferential mating on the female's part, the more attractive males having a reproductive advantage. While Prof. T. H. Morgan has given, in his *Evolution and Adaptation* (1903), no fewer than 24 reasons for rejecting the theory of sexual selection, many zoölogists believe that the reality of some measure of preferential mating has been placed beyond doubt by the data furnished by Darwin himself (1871) and by the Peckhams (1889), Groos (1898), Cunningham (1900), Pycraft (1913), Julian Huxley (1914), Whitman (1919) and others. It is not necessary to suppose that the female chooses "the best of the bunch" from amongst her unequally endowed suitors; it will be enough if she remains unresponsive to the solicitations of certain of the less generously endowed, who do not arouse her emotional interest to the requisite pitch. This is in agreement with Darwin's own remark about the female bird: "it is not probable that she consciously deliberates; but she is most excited or attracted by the most beautiful, or melodious, or gallant males." It is not necessary to credit the female with a capacity for appreciating slight differences in decorativeness or musical talent or lithesomeness, or with a consistency in allowing these nuances to determine her preferential mating, season after season, generation after generation. It is enough, as Lloyd Morgan says, that "the hen selects the mate which by his song or otherwise excites in greatest degree the mating impulse. Stripped of all its unnecessary æsthetic surplusage, the hypothesis of sexual selection suggests that the accepted mate is the one that most strongly evokes the pairing instinct." But this does not mean that the details do not count; it is rather that each is contributory to a general impression. Each has its effect; but synthetically, not analytically. "Even when the female seems to choose some slight improvement in colour or song or dance, the probability is that she is simply surrendering herself to the male whose *ensemble* has most successfully excited her sexual interest" (Geddes and Thomson, *Evolution*, 1911, p. 172).

It is interesting to inquire into the racial justification of the courtship habits—often so prolonged, elaborate, and exhausting. According to Groos (1898, p. 242) the coyness of the female, which has to be overcome, is an advantageous check to the impetuous violence of the sex impulse. According to Julian Huxley the elaborate ritual of the Great Crested Grebe serves to forge an emotional bond. "The courtship ceremonies serve to keep the two birds of a pair together, and to keep them constant to one another." Pycraft (1913) also insists on the need for psychological interpretation. Karl Pearson suggests that pronounced and persistent preferential mating within a species being differentiated into types may lead to a physiological and psychological "isolation" (*i.e.* narrowing of the range of intercrossing), and thus to "the relative or absolute mutual sterility of the differentiated types, *i.e.* to the origin of species" (*Grammar of Science*, 2nd ed. 1900, p. 418). Finally, it may be noted that the courtship habits must have played an important part in the evolution of sense (*e.g.* the aesthetic sense), and even of mind. This has been well illustrated by S. J. Holmes (1916) in connexion with the evolution of the voice, which began as a sex-call in amphibians, but gradually broadened out as parental summons, infantile cry, and kin-signal, until it became the means of reasoned discourse. That after the last returns the first is obvious in every serenade.

Naturalist Travellers.—From Darwin's *Voyage of the "Beagle"* (1844) and Wallace's "*Travels on the Amazon*" there has been a fine succession of the tales of naturalist travellers. This has been sustained in the last 20 years, and with increasing specialization. In the older narratives there is naturally much that is not definitely zoölogical; in many of the newer the zoölogical or biological note is dominant. We may instance such books as Alcock's *Naturalist in the Indian Ocean*, Hickson's *Naturalist in the Celebes*, Hudson's *Naturalist in La Plata*, Saville-Kent's *Naturalist in Australia*, Semon's *In the Australian Bush*, and Siedlecki's *Java*.

Faunal Evolution.—A line of zoölogical research which has had some fine expressions in recent years is that of constructive faunistic interpretation, following the lead of Wallace in his *Island Life* (1880). One of the best examples is Dr. James Ritchie's *Influence of Man on the Animal Life of Scotland* (1920). Neolithic man penetrated into a country which, after the clean sweep of the Great Ice Age, had been restocked with animal life from the south of England and from the Continent. There were then no domesticated animals, nor aliens like rabbits and rats. But there were elk and reindeer, wild cattle, wild boar, perhaps wild horses—a fauna of large animals on which lynx, brown bear, and wolves levied toll. This post-glacial fauna was the capital with which prehistoric man started, to which he added various imports from abroad, and which at times he likewise taxed heavily. With fine zoölogical scholarship Ritchie traces the changes brought about by domestication, by the destruction of beasts and birds of prey, by deliberate protection in various interests, by the intentional and unintentional introduction of new animals from other countries, and by the cutting down of forests, the spread of cultivation, and other human interferences. While more species have been introduced into Britain than have been exterminated (the fauna having substantially gained in numerical strength), there has been a falling off in what may be called faunistic quality. For many masterly creatures have been replaced by elusive vagrants, and giants by pigmies. "We have, in effect, lost more than we have gained; for how can the increase of rabbits and sparrows and earthworms and caterpillars, and the addition of millions of rats and cockroaches and crickets and bugs, ever take the place of those fine creatures round the memories of which the glamour of Scotland's past still plays—the reindeer and the elk, the wolf, the brown bear, the lynx, and the beaver, the bustard, the crane, the bumbling bittern, and many another, lost or disappearing?" (p. 497). We have singled out this book as an outstanding instance of a kind of zoölogical investigation which is interpretative as well as observational, synthetic and constructive as well as analytic. In its vivid realization of the correlation of organisms, this "study in faunal evolution" continues the tradition of Darwin.

Mechanism and Vitalism.—Coming finally to the "*Magnalia Naturae*," and the diverse attitudes of modern zoölogists to these, as in the long controversy of mechanists and vitalists, we cannot yet say that substantial conclusions have been reached. The conflicts between mechanistic and vitalistic interpretations, between the purely physiological (*i.e.* apsychic) and the psychobiological descriptions of behaviour continue with undiminished vigour. Yet there is progress in the fact that the questions at issue are being defined with increasing precision. (*a*) Everyone allows that there is a chemistry and a physics of the organism; that a chemical and physical (*i.e.* theoretically mechanical) description can be given of much that goes on in the living body; that the chemical and physical analysis of the animal has yielded very important results; and that this kind of description will certainly extend its scope. (*b*) It is widely though not unanimously held that there is little help in the hypothesis that a special form of energy ("vital" or "biotic") comes into operation in organisms, and is convertible into equivalent quantities of other forms of energy. For no one has demonstrated this specific vital energy, much less measured its intensity. As the tendency of science is to greater simplification of the forms of energy, we must agree with Bayliss (1915, p. 31) that "it seems somewhat retrograde to assume a new form of energy, especially as there is no urgent necessity for it. The resources of the known forms of energy are not altogether exhausted." (*c*) Many physiologists occupy the position of Claude Bernard: "There is in reality only one general physics, only one chemistry, and only one mechanics, in which all the phenomenal manifestations of nature are included, both those of living bodies and those of inanimate ones. In a word, all the phenomena which make their appearance in a living being obey the same laws as those outside of it" (*La Science Experimentale*, 1878, p. 116). (*d*) There is, however, a growing body who hold to what may be called methodological vitalism. Without presuming to set limits to the extent to which chemical and physical descriptions may be given of what occurs in a living animal, and without assuming that the concepts of physics and chemistry are stationary (which they certainly are not), it is urged that up to the present the chemico-physical interpretation remains inadequate. For there has not been given any exhaustive physico-chemical description of any total vital operation, such as the contraction of a muscle, still less of any complex case of animal behaviour. And as to individual development we cannot give a mechanical description of the condensation of the inheritance into a germ-cell, nor of the differentiation of the embryo, nor of the regulation phenomena observed when an embryo rights itself after the building materials of its living edifice have been seriously disarranged, nor of the way in which many developing parts seem to conspire toward one result. Similarly as regards organic evolution: we cannot offer a mechanical theory of variability; and the process of selection is much more than mechanical sifting. In short, mechanical formulæ do not fully suffice for answering biological questions. Biology requires categories of its own. (*e*) But when the critic of mechanism advances beyond this, to postulate some further vital agency associated with the organism, operating actively in certain cases, directing the chemico-physical processes so that their results are different from what they would have been apart from its intervention, he has passed to thoroughgoing vitalism. Bergson's "*élan vital*" has much of this character; but the most consistently thought out expression of this doctrine is Driesch's "Entelechy" (*The Science and Philosophy of the Organism*, 2 vols. 1908). Discussions of the problem of vitalism may be conveniently found in Johnstone's *Philosophy of Biology* (1914), and Thomson's *System of Animate Nature* (2 vols. 1920). See also J. S. Haldane (*Organism and Environment*, 1917) in which he discusses the physiology of respiration as a test case, and with suggestiveness for both sides of the controversy.

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ZUIDER (or ZUYDER) **ZEE** (*see* 28.1049).—It was after the draining of several landlocked seas and small sea-arms of the province of North Holland had been successfully completed in the early part of the 17th century that, about the middle of the next century, the idea of the shutting off and draining the entire Zuider Zee first began to be discussed. Serious objections to the initial scheme led to various proposals for the draining of parts of that sea, and eventually to a thorough investigation as to the best means of closing and draining it. This investigation, instituted by the Zuider Zee Society in 1886, gave rise to a scheme put forward in 1891, the execution of which, in a modified form, was begun in 1920.

The requisite bill was introduced in 1913 and was passed almost unanimously by both Chambers of the States-General in 1918. There may perhaps be some cause for wonder that a decision of such import should have been made during war-time. The explanation is that it was just the circumstances of those days, with the shortage of food occasioned by them, which brought into prominence the importance of extending the area of arable land. Moreover, people had still fresh in their memories the severe storm of 1916, which, bursting the Zuider Zee dykes, deluged vast districts of the country.

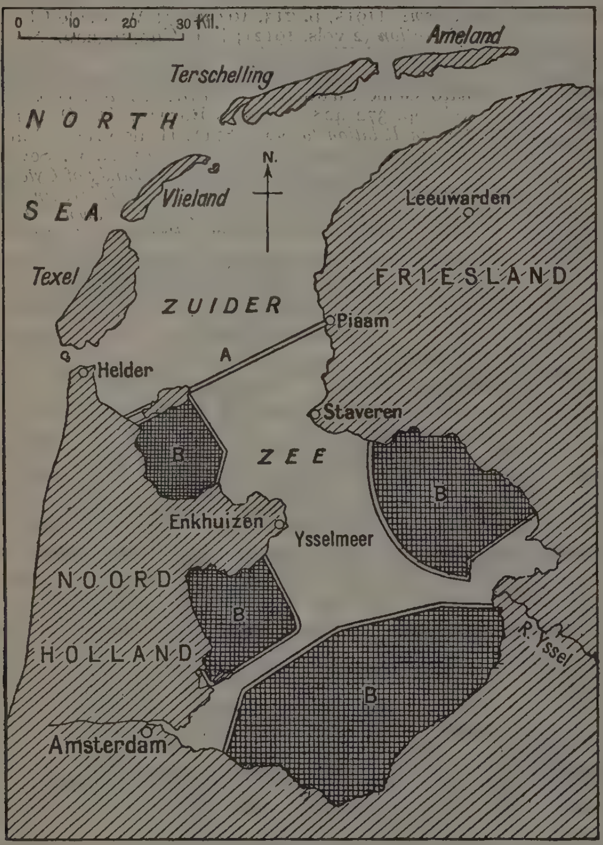

FIG. 1.

The main features of the scheme are indicated in fig. 1. They consist of (*A*) the closure and (*B*) the drainage. The closure is likewise divisible into two parts, namely, from North Holland to the Isle of Wieringen and from that island to Friesland. The combined length of the enclosing dams or barrages is nearly 19 miles. With the completion of the dams 850,000 ac. of the Zuider Zee will be shut off from the North Sea, thus creating a large lake. The dams will afford full protection to the coasts of the provinces bordering on the Zuider Zee for a distance of 152 miles. In the dam sluices will be required to carry off the surplus of water from the enclosed Zuider Zee, and the quantity may at times be very great, since it will include the afflux of the Yssel, an arm of the Rhine. It is therefore deemed necessary to have no fewer than 30 sluices, 33 ft. wide and 13·2 ft. deep. As soon as the closure is complete various parts of the Zuider Zee can be successively dammed and drained. Four inner enclosures (*B*) are contemplated, corresponding to the character of the sea-bottom and other factors.

After deducting the dimensions of dykes, canals, and roads the enclosures will provide 500,000 ac. of land, an area equivalent to that of the cultivated districts of North Holland or of Groningen with a surface analogous in composition to the best clay soil to be found in the country. The remainder of the Zuider Zee bottom consists chiefly of sand, and will, consequently, not be reclaimed. The water covering this area is shown in the sketch under the name of Ysselmeer. Its size is about 580 sq. m., which is thrice that of the lakes of Geneva or of Constance. It will constitute a receptacle for the waters of the Yssel and some smaller rivers, and will discharge them through the sluices into the open sea during ebb tide. As a reservoir of fresh water this Ysselmeer will be able to supply the canals of the surrounding provinces in periods of drought.

The Zuider Zee project has thus a double purpose; in the first place the reclamation from the sea of new fertile provinces; secondly, the security from the encroachments of the sea and the supply of fresh water to the neighbouring provinces. In the initial stages of the work heavy clay was dredged out of the open sea and deposited along the track to be followed by the dam. The cost of the undertaking was calculated in 1914 at about £19,000,000, but it seemed likely in 1921 to be very much more. Ten years were allowed for the construction of the main dam and another 20 years for the completion of the four inner enclosures.

See *Flevo*, monthly periodical devoted to the Zuider Zee reclamation scheme; *Maandberichten betreffende de Zuyderzeewerkens* (monthly). (C. Ly.)

ZULOAGA, IGNACIO (1870–), Spanish painter (*see* 28.1049), had become by 1921 the head of a definite school of Basque and Castilian painters, whose work was marked by a realistic and decorative treatment of contemporary Spanish life, consciously based on Velazquez, El Greco and Goya. His art showed increasing emphasis on silhouette, simplification of form and use of broad masses of sombre colour relieved by splashes of more vivid tints. In his figure compositions a low horizon and a panoramic background were favourite devices for obtaining a decorative monumental effect. Women and the nude figure played an important part in Zuloaga's work. In his portraits, of which typical examples are "Lucienne Bréval in *Carmen*," "Cousin Candida," "The Duke of Alba," and "Countess Mathieu de Noailles," emphasis is on the type rather than the individual, and the combination of realism and simplification tends towards caricature. This also appears in his *genre* paintings of Spanish types, peasants, dancers, bull-fighters, priests and beggars, such as "Old Castile," "The Bottleseller" and "The Witches of San Millan." His landscapes, mainly painted round Burgos, Salamanca and Segovia, have a similar bizarre, fantastic quality. His later work includes "My Uncle Daniel and his Family" (1912), "A Cardinal" (1914), "Toreadors" (1914), "Un Versolari" (1916). An important retrospective exhibition of his work was seen at the 1919 International Exhibition at Bilbao, and he was represented by three portraits in the 1920–1 Exhibition of Spanish Paintings at Burlington House.

See also: L. Bénédite, *Ignacio Zuloaga* (1912); Juan de la Encina, *El Arte de Ignacio Zuloaga* (1916).

INDEX

The Index to the New Volumes XXX., XXXI. and XXXII. of the *Encyclopædia Britannica*, has been prepared on the same system as that used in Volume XXIX. Every Index has its own principles and its own conventions. Those adopted for Volumes I. to XXVIII. need not here be recapitulated; they are sufficiently explained in the preface to Volume XXIX. and in the Rules and Abbreviations which follow it. It is only necessary to add that in this supplementary Index the volume number is not repeated before successive references from the same volume, and that measures have been taken to avoid difficulties arising from variant spellings which have different initial letters, of Arabic and Slavonic names. All abbreviations used in this supplementary Index are explained in the Key beginning on page xv. of Volume XXX.

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Zierkowice, Pol. **30**-888 II. (B2).
Zilfi, Arab. **30**-165a.
Zilina, Czsl. **30**-786 (map).
Zimmermann, Alfred **30**-69d, 451d; **31**-938d.
—, **ARTHUR** **32**-1129a; **30**-539b.
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Zinc **31**-926c; **32**-102b, 496b; France **31**-113b; shells, use in U.S. **30**-120a, **32**-145d, **31**-1102d.
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Zoo-plankton: *see* Plankton.
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For Contributors who wrote only for the 28 earlier volumes see list beginning on page 949 of Volume XXIX.

Further acknowledgment of the collaboration of some of the Contributors named below—and of others, who, while not contributing articles, have by their aid and counsel enriched these new volumes—will be found on pages vii–xiv. of the Preface in Vol. XXX.

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Abyssinia; Africa; Angola; Belgian Congo; Cairo; Cameroon; Cape Province; Dahomey; Delagoa Bay; East African Military Operations; Egypt (in part); *Eritrea; Gambia; German East Africa; German South-West Africa; Kenya Colony; Liberia; Mauritius; Merriman, J. X.; Natal; Nyasaland; Orange Free State; Portuguese East Africa; Rhodesia; Senussi; Sierra Leone; Somaliland; South Africa* (in part); *Sudan* (in part); *Suez Canal; Tanganyika Territory; Togoland; Transvaal; Tripoli; Uganda; Zanzibar.*

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Excess Profits Duty (*United Kingdom*).

CARTER, A. CECIL (d. 1921). (A.C.Ca.) Formerly Superintendent of Siamese Government Students at the Siamese Legation, London. Sometime Principal of King's College, Bangkok.
Siam.

CARTER, REV. HENRY. (H.Ca.) Member of British Central Licensing Control Board (Liquor Traffic), 1916–21. Author of *The Control of the Drink Trade; The Church and the New Age;* etc.
Liquor Laws and Liquor Control (*United Kingdom*).

CARVER, THOMAS NIXON, Ph.D., LL.D. (T.N.C.) Professor of Political Economy in Harvard University. Author of *The Distribution of Wealth; Principles of Rural Economics; Principles of Political Economy;* etc.

Federal Farm Loan System.

CASTELLANI, ALDO, C.M.G., M.D., M.R.C.P. (A.Ci.) Lecturer, London School of Tropical Medicine. Formerly Professor of Tropical Medicine, Ceylon Medical School. Author (with Dr. A. J. Chalmers) of *Manual of Tropical Medicine;* etc.

Typhus Fever.

CASTELLANO, G. (G.C.) Author of *Introduzione allo studio delle opere di B. Croce* (1920).

Croce, Benedetto (in part).

CATON, E. S. (E.S.C.) Editor of *Tobacco.*

Tobacco.

CAVE-BROWNE-CAVE, WING COMMANDER T. R., C.B.E., R.A.F., F.R.Ae.S., A.M.I.Mech.E., A.M.I.N.A. (C.B.C.) In charge of Airship Experiments and Research at the Admiralty and the Air Ministry. Lecturer in Airship Engineering, Imperial College of Science. Airship Member of the Aeronautical Research Committee. Formerly Engineer Officer, R.N. Airship Pilot, 1913. In charge of Non-rigid Airship Design and Construction at Kingsnorth, 1914–8.

Aeronautics (Airships).

CECIL, RT.-HON. LORD ROBERT, M.P. (R.C.) Representative of Great Britain on the League of Nations Commission at the Peace Conference, 1919. Representative of South Africa at the Assembly of the League of Nations at Geneva, 1920. Chairman of the League of Nations Union. See the biographical article: CECIL, LORD ROBERT.

League of Nations.

CHAMBERLAIN, COLONEL WESTON P. (W.P.C.) Army Medical Corps, U.S. Army.

Army Medical Service (United States).

CHAMBERS, SIR THEODORE GERVASE, K.B.E., Assoc.R.S.M., F.S.I., F.G.S. (T.G.Ch.) Vice-chairman and late Controller of the National (War) Savings Committee, Great Britain.

Savings Movement.

CHANDLER, CHARLES LYON, A.B. (C.L.C.) Curator of South American History and Literature in the Harvard College Library. Manager of the Foreign Commercial Department of the Corn Exchange National Bank of Philadelphia. Author of *Inter-American Acquaintances.*

Argentina; Buenos Aires; Paraguay; Uruguay.

CHATAIGNEAU, YVES. (Y.C.) American Distinguished Service Cross. Knight of the Legion of Honour. Lecturer in the University of Belgrade. Author of *"L'Emigration Vendéenne"; Annales de Géographie, 1917; "La Yougo-Slavie," Annales de Géographie, 1921.*

Balkan Peninsula (in part).

CHILCOTT, ELLERY CHANNING, M.S. (E.C.C.) Chief of Dry Lands Investigations, Bureau of Plant Industry of the U.S. Department of Agriculture, Washington.

United States (Agriculture).

CHILDS, W. J. (W.J.C.*) Late of the Intelligence Department of the Admiralty (Geographical Section).

Armenia; Azerbäijän; Cilicia; Georgia; Ottoman Empire; Straits (Dardanelles and Bosporus); Turkey (Nationalist).

CHISHOLM, HUGH, M.A. (H.Ch.) Formerly Scholar of Corpus Christi College, Oxford. Editor of the 10th, 11th and 12th editions of the *Encyclopædia Britannica.* Financial Editor of *The Times,* 1913–20. See the biographical article: CHISHOLM, HUGH.

English History (1910–2); English Literature (in part); *Finance; George V.; Holden, Sir E. H.; Montessori System; World War (Introductory).*

CHREE, CHARLES, Sc.D., LL.D., F.R.S. (C.Ch.) Assistant Director, Meteorological Office, Kew. Past President, Physical Society of London. Hughes Medallist, Royal Society.

Magnetism, Terrestrial.

CHRISTIE, A. H. (A.H.C.*) Late Director, Westminster Technical Institute.

Arts and Crafts (in part).

CHRISTOPHELSMEIER, CARL, B.A., M.A., Ph.D. (C.C.*) Head of the Department of History and Political Science in the University of South Dakota. Author of *The First Revolutionary Step (June 17, 1789); The Fourth of August, 1789;* etc.

South Dakota.

CHURCH, ARTHUR HARRY, M.A., D.Sc. (A.H.Ch.) University Lecturer in Botany, Oxford.

Botany (General Morphology).

CLAY, MAJOR WALLACE L. (W.L.C.*) Ordnance Department of the U.S. Army.

Ammunition (in part).

CLEVELAND, FREDERICK ALBERT, Ph.B., Ph.D., LL.D. (F.A.Cl.) Professor of United States Citizenship, Maxwell Foundation, Boston University. Author of *Organized Democracy; First Lessons in Finance;* etc.

Boston; Massachusetts.

CLIFFORD, SIR HUGH, G.C.M.G. (H.Cl.) Governor of Nigeria. In the Federated Malay States Civil Service, 1883–1903; in the West Indies, 1903–7; in Ceylon, as Colonial Secretary, 1907–12. Governor of the Gold Coast, 1912–9. Administered the British Sphere of Occupation in Togoland throughout the World War. Author of *Studies in Brown Humanity; Further India; The German Colonies;* etc.

Ashanti; Gold Coast; Nigeria.

CLOSE, COLONEL SIR CHARLES FREDERICK, K.B.E., C.B., C.M.G., F.R.S. (C.F.Cl.) Director-General of the Ordnance Survey of the United Kingdom. Author of *Text Book of Topographical Surveying.*

Map; Surveying (in part).

COLE, GEORGE DOUGLAS HOWARD, M.A. (G.D.H.C.) Formerly Fellow of Magdalen College, Oxford. Hon. Secretary, Labour Research Department. Author of *The World of Labour; Self-Government in Industry; Guild Socialism Restated; Social Theory;* etc.

Guild Socialism; Socialism; Wage System in Industry.

COLE, GRENVILLE ARTHUR JAMES, F.R.S., F.G.S. (G.A.J.C.) Professor of Geology in the Royal College of Science for Ireland. Author of *Aids in Practical Geology; Open-Air Studies in Geology;* etc.

Geology (Structural and Stratigraphical).

COLE, MARGARET ISABEL (Mrs. G. D. H. Cole). (M.I.C.) Correspondence Secretary of the Labour Research Department, London, 1917–20.

Profit-Sharing and Co-Partnership (in part); *Trade Unions* (in part).

COLLIER, THEODORE, Ph.D. (T.C.) Professor of European History in Brown University, U.S.A.

Rhode Island.

COLLINGWOOD, R. G., M.A., F.S.A. (R.G.C.) Fellow and Tutor of Pembroke College, Oxford.

Luxemburg.

COLLINS, VARNUM LANSING, A.M. (V.L.C.) Secretary of Princeton University and Clerk of the University Faculty, Author of *The Continental Congress at Princeton; Guide to Princeton;* etc.

Princeton University.

COLLIS, EDGAR LEIGH, M.A., M.D. (Oxon.), M.R.C.P. (Lond.). (E.L.C.) Mansel Talbot Professor of Preventive Medicine, Welsh National School of Medicine. Late Director (Welfare and Health), Ministry of Munitions. H.M. Medical Inspector of Factories.

Industrial Medicine; Welfare Work in Industry.

COLLYER, BRIGADIER-GENERAL JOHN JOHNSTON, C.B., C.M.G., D.S.O. (J.J.C.) Late Chief of the General Staff, Union of South Africa.

German South-West Africa; South Africa (Defence).

COMMONS, JOHN ROGERS, A.B., A.M., LL.D. (J.R.Co.) Professor of Economics, University of Wisconsin. Author of *Documentary History of American Industrial Society; History of Labor in the United States; Principles of Labor Legislation;* etc.

Arbitration and Conciliation (United States); Hours of Labour (United States); Labour Legislation (United States); Labour Supply and Regulation (United States); Profit-Sharing and Co-Partnership (United States); Strikes and Lockouts (United States); Trade Unions (United States); Unemployment (United States); United States (Labour Movement); Wages (United States).

CONGER, COLONEL ARTHUR LATHAM, U.S. Army. (A.L.C.) Distinguished Service Medal (U.S.A.), C.M.G. Legion of Honour. Formerly Co-editor of *The Military Historian and Economist.*

Army (United States); Champagne, Battles in (in part); *Meuse-Argonne, Battle of; Western European Front Campaigns* (in part); *Woëvre, Battles in (Part II.).*

CONSTABLE, WILLIAM GEORGE, M.A. (W.G.C.*) Fellow of St. John's College, Cambridge. Barrister-at-law. Lecturer at the Wallace Collection.

Beerbohm, Max; Besnard, P. A.; Painting (in part).

CONWAY, AGNES ETHEL, M.B.E., B.A. (Dublin). (A.E.C.) Hon. Curator, Women's Work Section, Imperial War Museum. Author of *Child's Book of Art; A Ride Through the Balkans.*

Women's War-Work.

COOLIDGE, REV. WILLIAM AUGUSTUS BREVOORT, M.A. (Oxon.), Hon. Ph.D. (Bern). (W.A.B.C.) Fellow of Magdalen College, Oxford. Author of *Swiss Travel and Swiss Guide-books; Josias Simler et les Origines de l'Alpinisme jusqu'en 1600; The Alps in Nature and History; Alpine Studies;* etc. Editor of the *Climbers' Guide.*

Switzerland.

CORDONNIER, GENERAL VICTOR LOUIS ÉMILIEN. (V.L.E.C.) See the biographical article: Cordonnier, Victor Louis Émilien.

Argonne, Battles of the; Army (French); Frontiers, Battles of the (Part III.); Woëvre, Battles in (in part).

COTTON, HENRY EVAN AUGUSTE, C.I.E., L.C.C. (H.E.A.C.) Formerly Scholar of Jesus College, Oxford, and Advocate of the High Court at Calcutta. Author of *Calcutta Old and New.* Late Editor of *India.*

Banerjea, Sir S.; Gandhi, M. K.; Tagore, R.

COURTNEY, JANET ELIZABETH, O.B.E., J.P. (Mrs. W. L. Courtney). (J.E.C.) Author of *Free Thinkers of the Nineteenth Century.* Joint-author of *Pillars of Empire.* Joint-editor of Index to the 11th edition of the *Encyclopædia Britannica.*

Women (United Kingdom); Women Police (United Kingdom).

CRAM, RALPH ADAMS, Litt.D. (Princeton), LL.D. (Yale), F.R.G.S. (R.A.C.) Fellow of the American Institute of Architects and of the North British Academy of Arts. Hon. Corresponding Member of the Royal Institute of British Architects. Associate of the National Academy. Member of the American Institute of Arts and Letters. Supervising Architect, Princeton University. Member of the firm of Cram, Goodhue & Ferguson. Author of *Church Building; The Ruined Abbeys of Great Britain;* etc. See the biographical article: Cram, Ralph Adams.

Architecture (United States).

CREAGH-OSBORNE, CAPTAIN FRANK, R.N., C.B. (F.C.-O.) Director, Admiralty Compass Department.

Compass.

CROSS, CHARLES FREDERICK, B.Sc., F.R.S. (C.F.C.) Analytical and Consulting Chemist. Member of the firm of Cross & Bevan. Joint-author (with E. J. Bevan) of *Researches on Cellulose; Text-Book of Papermaking.*

Cellulose; Fibres.

CROY, HOMER. (H.Cr.) Author of *How Motion Pictures are Made.*

Cinematograph.

CROZIER, LIEUTENANT-COLONEL C. D., R.G.A. (C.D.C.) Late Director of Inspection of High Explosives, Ministry of Munitions.

Explosives (in part).

CUMMINS, STEVENSON LYLE, M.D., LL.D., C.B., C.M.G. (S.L.C.) Colonel, Army Medical Service (retired). David Davies Professor of Tuberculosis, University College of South Wales and Monmouthshire. Principal Medical Officer, King Edward VII. Welsh National Association.

Influenza.

CUNNINGHAM, WILLIAM JAMES, A.M. (W.J.C.) Connected with several American railroads in operating and executive capacities, 1900–16. Professor of Transportation at Harvard. Assistant Director of Operation, U.S. Railroad Administration, 1918–9.

Railways (United States).

CVIJIČ, JOVAN. (J.C.) Patron's Medallist of the R.G.S. Officer of the Legion of Honour. Professor of Geography in the University of Belgrade. Author of *Das Karstphaenomen; Grundlinien der Geographie und Geologie von Mazedonien und Altserbien; La Péninsule Balkanique.*

Balkan Peninsula (in part).

D'ALBE, EDMUND EDWARD FOURNIER, D.Sc. (London and Birmingham), A.R.C.Sc., M.R.I.A. (E.E.F.D'A.) Inventor of the Optophone. Formerly Special Lecturer in Physics in the Punjab University. Author of *The Electron Theory; Two New Worlds; Contemporary Chemistry;* etc.

Optophone.

DALE, HARRISON CLIFFORD, A.M. (H.C.D.) Fellow of the American Geographical Society. Professor of Economics and Political Science, University of Idaho. Author of *The Ashley-Smith Explorations and the Discovery of a Central Route to the Pacific: 1822–1829;* etc.

Idaho.

DANILOV, GENERAL YOURI. (Y.D.)

Army (Russian, in part); *Kornilov* (in part).

DARLING, CHARLES ROBERT, F.Inst.P., F.I.C. (C.R.D.) Lecturer in Applied Physics, City and Guilds Technical College, Finsbury. Author of *Heat for Engineers; Pyrometry;* etc.

Pyrometry.

DAVIDSON, MAJOR-GENERAL SIR JOHN HUMPHREY, K.C.M.G., C.B., D.S.O., M.P. (J.H.D.) Late 60th Rifles. Member for Fareham Division of Hampshire. Served throughout South African War. Instructor in Staff Duties at the Staff College. On the General Staff in France, 1914–8.

Artois, Battles in (in part).

DAVIES, ALBERT EMIL, L.C.C. (A.E.D.) Hon. Lecturer in Business Finance, Leeds University. Fellow of the Royal Economic Society. Author of *The State in Business; The Nationalization of Railways; The Case for Nationalization; Land Nationalization;* etc.

Nationalization.

DAVIS, HENRY WILLIAM CARLESS, M.A., C.B.E. (H.W.C.D.) Professor of History at Manchester University. Fellow and formerly Tutor of Balliol College, Oxford. Sometime Fellow of All Souls College, Oxford. Member of Advisory Staff of British delegation to the Peace Conference.

Peace Conference.

DAWNAY, MAJOR-GENERAL GUY PAYAN, C.B., C.M.G., D.S.O., M.V.O. (G.P.D.) Formerly Brigadier-General, General Staff, Egyptian Expeditionary Force, and Director of Staff Duties, G.H.Q., France.

Turkish Campaigns (Sinai).

DEVINE, EDWARD THOMAS, Ph.D., LL.D. (E.T.D.) Associate Editor of *The Survey,* New York. Author of *Misery and its Causes; The Normal Life; Disabled Soldiers and Sailors;* etc.

United States (Social and Welfare Work, in part).

DEWAR, CAPTAIN ALFRED C., R.N. (Ret.), B.Litt. (Oxon.). (A.C.D.) Gold Medallist, Royal United Service Institution. Late of the Historical Section, Naval Staff, Admiralty.

Admiralty Administration (British); Blockade; Convoy; Coronel; Dogger Bank; Falkland Islands Battle; "Goeben and Breslau"; Heligoland Bight; Jutland, Battle of; Minesweeping and Minelaying; Naval History of the War; Submarine Campaigns; Zeebrugge.

DEWEY, DAVIS RICH, Ph.D., LL.D. (D.R.D.) Professor of Economics and Statistics, Massachusetts Institute of Technology. Formerly Secretary of the American Statistical Association. Managing Editor of the *American Economic Review.* Author of *Financial History of the United States.* Editor of Francis Walker's *Discussions in Economics and Statistics.*

United States (Statistics).

D'EYNCOURT, SIR EUSTACE HENRY WILLIAM TENNYSON, K.C.B., F.R.S., D.Sc. (E.T.d'E.) Commander of the Legion of Honour. Distinguished Service Medal (U.S.A.). Director of Naval Construction and Chief Technical Adviser to the British Admiralty. Chief Adviser on Tanks to the Ministry of Munitions during the World War. Vice-president of the Institution of Naval Architects.

Ship and Shipbuilding.

DIGBY, LETTICE, F.M.S. (L.D.) Author of cytological papers in the *Annals of Botany, Archiv für Zellforschung,* etc.

Botany (Cytology).

DINES, WILLIAM HENRY, B.A. (Cantab.), F.R.Met.S., F.R.Ae.S., F.Inst.P., F.R.S. (W.H.Di.) See the biographical article: Dines, William Henry.

Meteorology.

DOBELL, CLIFFORD, M.A., F.R.S. (C.Do.) Protistologist to the Medical Research Council. Late Fellow of Trinity College, Cambridge. Formerly Assistant Professor of Protistology and Cytology, Imperial College of Science, London.

Protozoölogy.

DOUGLAS, CAPTAIN HENRY PERCY, C.M.G., R.N., F.R.A.S., A.M.I.C.E. (H.P.D.) Assistant Hydrographer of the British Navy, 1919–21.

Surveying (Nautical).

DOUMENC, COMMANDANT A. (A.D.*) French Army Staff. Officer of the Legion of Honour. D.S.O. Director of the French Army Mechanical Transport Service during the war. Author of *Les Transports Automobiles sur le Front français.*

Motor Transport, Military.

DOW, JOHN STEWART, B.Sc., A.C.G.I. (J.S.D.) Assistant Editor of the *Illuminating Engineer.* Joint-author of *Modern Illuminants and Illuminating Engineering;* etc.

Illuminating Engineering; Lighting, Electric

DOWNING, AUGUSTUS SEISS, A.B., M.A., L.H.D., LL.D. (A.S.D.) Assistant Commissioner for Higher Education and Director of Professional Education, University of the State of New York.
Education (*United States*, in part).

DOWNS, BRIAN WESTERDALE, M.A. (B.W.D.) Fellow and Lecturer in Mediæval and Modern Languages and English, Christ's College, Cambridge.
Cambridge.

DRAGE, GEOFFREY, M.A. (G.Dr.) President of the Central Poor Law Conference, 1906. Vice-president, Royal Statistical Society, 1916–8. Attached to the War Office, Military Intelligence Section, 1916. Author of *The State and the Poor; Reorganization of Official Statistics and a Central Statistical Office; Pre-war Statistics of Poland and Lithuania;* etc.
Poland; Public Assistance (in part).

DRAKE, LIEUTENANT-COLONEL REGINALD JOHN, D.S.O. (R.J.D.) Late North Stafford Regiment and General Staff.
Intelligence, Military (*Secret Service*).

DUFFIELD, W. G. (W.G.D.) Professor of Physics, University College, Reading.
Moseley, H. G. J.

DUNIWAY, CLYDE AUGUSTUS, Ph.D., LL.D. (C.A.D.) President of Colorado College, Colorado Springs, Colo.
Colorado.

DUTT, R. PALME, (R.P.D.) Late Scholar of Balliol College, Oxford. Author of *The Two Internationals.* Editor of *The Labour International Handbook.*
Communism; International, The.

EDDINGTON, ARTHUR STANLEY, M.A., M.Sc., F.R.S. (A.S.E.) Plumian Professor of Astronomy and Experimental Philosophy and Director of the Observatory, Cambridge. Author of *Stellar Movements and the Structure of the Universe; Space, Time and Gravitation.*
Astronomy.

EDDISON, ERIC RUCKER, B.A. (E.R.E.) Controller of the Profiteering Act Department of the Board of Trade (London).
Profiteering (*United Kingdom*).

EDRIDGE-GREEN, FREDERICK WILLIAM, C.B.E., M.D., F.R.C.S (F.W.E.-G.) Special Examiner and Adviser to the Board of Trade on Colour Vision and Eyesight. Author of *The Physiology of Vision.* Inventor of the Colour Perception Spectrometer and Colour Perception Lantern—used as the Official Test of the British Navy.
Colour Vision and Colour Blindness.

EDSON, MIRA BURR. (M.B.E.) Editor of the *Arts and Crafts Magazine* and *Arts and Crafts Bulletin.*
Arts and Crafts (*United States*).

EGERTON, HUGH EDWARD. (H.E.E.) Sometime Beit Professor of Colonial History, Oxford. Fellow of All Souls College, Oxford. Author of *A Short History of British Colonial Policy; Origin and Growth of the English Colonies;* "Canada" (Part II.) in Sir Charles Lucas's *History and Geography of the British Colonies;* etc.
British Empire.

ELLIOT, WALTER ELLIOT, B.Sc., M.B., Ch.B., M.P. (W.E.El.) Secretary, Medical Committee, House of Commons.
Health Ministry; Pensions Ministry.

ELOESSER, ARTHUR, Ph.D.(Berlin). (A.E.) Author of *Die Aelteste Deutsche Uebersetzung Molièrescher Lustspiele; Das Bürgerliche Drama; Litterarische Portraits aus dem Modernen Frankreich.*
German Literature.

ENDRES, MAJOR FRANZ CARL. (F.C.E.) Late General Staff, Turkish Army. Author of a *Life of Moltke; Die Ruine des Orients;* etc. Member of Committee, German League of Nations Union.
Army (*Turkish*); *Balkan Wars* (in part); *Essad; Turkish Campaigns* (*Caucasus*).

ERVINE, ST. JOHN GREER. (St.J.E.) Dramatic Critic of *The Observer.* Author of *The Magnanimous Lover; Mixed Marriage; Jane Clegg;* and other plays.
Drama.

EVEREST, ARTHUR ERNEST, D.Sc., Ph.D., F.I.C. (A.E.Ev.) Joint-author of *The Natural Organic Colouring Matters* (Perkin and Everest). Author of various papers on Colouring Matters, etc. in *Proc. Roy. Soc., Journ. Chem. Soc.*, etc.
Botany (*Chemistry of Sap Pigments of Plants*).

FANNING, LEONARD M. (L.M.F.) Director of Publicity and Statistics, American Petroleum Institute. Formerly Editor of the *Oil Trade Journal.*
Petroleum.

FARMER, R. C., D.Sc., Ph.D. (R.C.F.) Late Chief Chemist, Explosives Department, Ministry of Munitions.
Explosives (in part).

FAWCETT, MILLICENT GARRETT (Mrs. Henry Fawcett), J.P., LL.D.(Hon. St. Andrews and Birmingham). (M.G.F.) See the biographical article: FAWCETT, M. G.
Woman Suffrage.

FEILER, ARTHUR. (A.F.*) On the Staff of the *Frankfurter Zeitung.* Member of the Economic Council of the German Reich. Author of *Die Konjunktur-Periode, 1907–13, in Deutschland; Handelspolitik und Krieg;* etc.
Germany (*Finance*).

FELLOWS, GEORGE EMORY, A.M., Ph.D., L.H.D., LL.D. (G.E.F.) Professor of History and Political Science in the University of Utah. President of the University of Maine, 1902–11. Author of *Recent European History; Outline Study of the Sixteenth Century;* etc.
Utah.

FIELD, CAPTAIN RAYMOND ERNEST, O.B.E. (R.E.F.)
Medals and Decorations.

FISH, CARL RUSSELL, M.A., Ph.D. (C.R.F.) Professor of American History in the University of Wisconsin. Author of *Civil Service and the Patronage; Development of American Diplomacy;* etc.
Wisconsin.

FISHER, IRVING, A.B., Ph.D. (I.F.) Professor of Political Economy at Yale University. Author of *The Nature of Capital and Income; The Purchasing Power of Money; The Rate of Interest;* etc. See the biographical article: FISHER, IRVING.
Dollar Stabilization.

FLACK, WING COMMANDER MARTIN, C.B.E., M.A., M.B. (M.Fl.) Director of Medical Research, Royal Air Force. Author of papers on the medical aspect of flying, etc.
Aerotherapeutics.

FLEMING, ALEXANDER, M.B., F.R.C.S. (A.Fl.) Director of the Department of Systematic Bacteriology in St. Mary's Hospital, London.
Antiseptics.

FLEMING, JOHN AMBROSE, M.A., D.Sc., F.R.S., M.Inst.E.E. (J.A.F.) Professor of Electrical Engineering in the University of London. Fellow of University College, London. Sometime Fellow of St. John's College, Cambridge. Author of *The Principles of Electric Wave Telegraphy and Telephony; The Propagation of Electric Currents in Telephone and Telegraph Conductors; The Thermionic Valve; The Wonders of Wireless Telegraphy;* etc.
Wireless Telegraphy and Telephony.

FLETT, JOHN SMITH, M.A., D.Sc., LL.D., F.R.S. (J.S.F.) Director, and formerly Petrographer, of the Geological Survey of Great Britain. Author or Part-author of many Geological reports and memoirs.
Petrology.

FLEXNER, ABRAHAM. (A.Fx.) Secretary of the General Education Board, New York. Author of *Medical Education in the United States.*
Medical Education (*United States*).

FOERSTER, LIEUTENANT-COLONEL WOLFGANG. (W.F.) Late General Staff, German Army. Chief Ober-Archivrat of the Reichsarchiv. Formerly member of the Historical Section of the Great General Staff. During the World War, General Staff Officer with troops. Chief of the General Staff of the XI. Corps, 1918. Author of *Prinz Friedrich Karl von Preussen; Graf Schlieffen und der Weltkrieg.*
Western European Front Campaigns (in part).

FORD, GUY STANTON, Ph.D. (G.S.F.) Professor of History and Dean of the Graduate School, University of Minnesota. Director of Division of Educational and Civic Publications, Committee on Public Information.
Censorship (*United States*).

FORD, JAMES, Ph.D. (J.F.) Associate Professor of Social Ethics in Harvard University. Sometime Division Manager, U.S. Housing Corporation. Editor of the Report of the U.S. Housing Corporation. Author of *Co-operation in New England;* etc.
Housing (*United States*).

FORSDYKE, EDGAR JOHN, M.A., F.S.A. (E.J.F.) Assistant in the Department of Greek and Roman Antiquities in the British Museum. Editor of the *Journal of Hellenic Studies.*
Archaeology (*Greece*).

FOSDICK, RAYMOND BLAINE, B.A., M.A., LL.B. (R.B.F.) Formerly Commissioner of Accounts, City of New York. Author of *American Police Systems; European Police Systems; Keeping our Fighters Fit;* etc.
New York City.

FOWLER, ALFRED, F.R.S. (A.F.) Corresponding Member, Academy of Science, Paris. Professor of Astrophysics, Imperial College of Science and Technology, South Kensington.
Spectroscopy.

FOX, FRANK, O.B.E. (F.F.) Author of *Australia; Problems of the Pacific; "G.H.Q."* Served in the World War as Artillery officer and as Staff officer.
Australia; Canteens; Supply and Transport, Military (in part).

FRANCIS, PERCY A., M.B.E., N.D.A., N.D.D. (P.A.F.) Technical Head of the Small Livestock Branch, Ministry of Agriculture and Fisheries, London. Late Senior Agricultural Inspector to the Board of Agriculture for Scotland. Superintending Instructor in Poultry-Keeping and Dairying to the Irish Department of Agriculture and Technical Instruction. County Instructor in Poultry-Keeping to the Antrim County Council.
Poultry.

FRANCKE, ERNST. (E.F.*) Head of the Bureau for Sozialpolitik. Member of the Economic Council of the German Reich. Publisher and Editor of *Soziale Praxis.*
Germany (Social and Industrial Legislation).

FRANKLIN, ERNEST LOUIS, F.S.S. (E.L.F.) Member of the Royal Economic Society. Partner in the banking house of Samuel Montagu, London.
Exchanges, Foreign.

FREAR, WALTER FRANCIS, LL.D. (W.F.F.) Formerly Chief Justice and late Governor of Hawaii. Chairman of the Hawaiian Code Commission. Hon. Member of the Royal Geographical Society of Australasia. Author of *The Evolution of the Hawaiian Judiciary.*
Hawaii.

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Connecticut.

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Holland (in part).

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Aeronautics (Aero-Engines).

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Austria, Republic of (History); Eastern European Front Campaigns (in part).

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Denmark (in part).

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Epidemiology (in part).

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Geology (Cosmic).

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Church History (Free Churches; Presbyterian Church of Scotland).

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Alberta; British Columbia; Canada (in part); *Manitoba; New Brunswick; North-West Territories; Nova Scotia; Ontario; Prince Edward Island; Quebec; Saskatchewan; Yukon Territory.*

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Hours of Labour (in part).

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Vermont.

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Bulgaria.

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Pharmacology.

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Champagne, Battles in (in part); *Noyon, Battle of.*

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Child Welfare (United Kingdom); Nursing (in part).

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Agriculture.

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Archaeology (Egypt and Western Asia).

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Milk.

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North Carolina.

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Prices (United States); Profiteering (United States).

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Intelligence, Military (in part).

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Mathematics (Theory of Numbers; Theory of Series; Theory of Functions).

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Roosevelt, Theodore; United States (History).

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Machine-Guns; Sights (in part).

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Electrical Engineering (in part).

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Germany (Administration).

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Motor Vehicles; Tractors.

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Syndicalism (in part).

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Ballistics (in part); *Nomography.*

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Aeronautics (Performance of Aeroplanes).

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Strikes and Lockouts (in part); *Unemployment (United Kingdom Statistics).*

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Rovno, Battle of.

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Army (British Demobilization); Dogs, War (in part); *Marines* (in part).

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Haiti; Porto Rico; Santo Domingo.

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Public Assistance (United States).

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Geography; Malay States, Federated; Malay States, Non-Federated; Netherlands India; Pacific Ocean, Islands of; Straits Settlements and Dependencies; United Kingdom (*Statistics*).

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Geodesy (in part).

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Medicine and Surgery (*Diseases in the World War*).

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Ireland (*Language and Literature*); *Pearse, Patrick.*

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Vaccine Therapy.

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Bridge, Auction.

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Glass (in part).

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Mining, Military; Poison Gas Warfare.

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Air Bombs (in part).

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Army (*Austro-Hungarian*, in part); *Brest Litovsk, Battles Round, 1915; Dunajec-San, Battles of the; Lemberg* (*Lvov*), *Battles Round* (*Part II.*); *Lodz-Cracow, Battles of; Przemysl, Sieges of; Strypa-Czernowitz, Battle of; Vistula-San, Battle of the.*

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Rumania (*History*).

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Munitions of War (*Central Powers*, in part).

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Allenstein-Marienwerder; Ballin, A.; Berlin; Bernstorff, Count; Dresden; Ebert, F; Erzberger, M. (in part); *Eucken, R. C.* (in part); *Germany* (*Political History*, in part); *Saxony; Schleswig; Silesia, Upper.*

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Railways (*British*).

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United Kingdom (*Medical Examination of the Nation*).

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Botany (*Introductory*).

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Red Cross Work (*United States*); *Y.M.C.A.* (*United States*).

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Poultry (*United States*).

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Electrochemistry and Electrometallurgy.

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Munitions of War (*Central Powers*, in part).

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Intestinal Stasis.

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Munitions of War (*United Kingdom*, in part).

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Liquor Laws and Liquor Control (*United States*); *Prohibition.*

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Munitions of War (*United Kingdom*, in part).

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LONG, MAJOR-GENERAL SIDNEY SELDEN, C.B. (S.S.L.) Assistant Director of Supplies, 1909–12. Director of Supplies and Quartering, 1913–4. Director of Supplies and Transport, War Office, 1914–6.
Food Supply (*Feeding of the British Army During the World War*).

LUND, H., M.A. (H.Lu.)
Denmark (in part).

MacBRIDE, ERNEST WILLIAM, D.Sc.(Lond.), M.A. (Cantab.), Hon.LL.D.(McGill), F.R.S. (E.W.MacB.) Vice-President of the Zoölogical Society of London. Vice-Chairman of the Eugenics Education Society. Formerly Professor of Zoölogy in McGill University, Montreal. Professor of Zoölogy in the Imperial College of Science and Technology, London. Author of *Textbook of the Embryology of the Invertebrata;* etc.
Cytology; Embryology; Eugenics.

McCLELLAN, MAJOR E. N. (E.N.McC.) U.S. Marine Corps. Officer-in-charge, Historical Section, Marine Corps.
Marines (*United States*).

McCLURE, WILLIAM KIDSTON, M.A.(Oxon.). (W.K.McC.) Late Correspondent of *The Times* in Rome. Correspondent of *The Times* on the Italian Front, 1915–7. Author of *Italy's Part in the War; Italy in North Africa;* Chapters on Italy in *The Times History of the War;* etc.
Asiago, Battle of; Cadorna, General; Caneva, Carlo; Caporetto, Battle of; Italian Campaigns; Italo-Turkish War.

McCORMICK, SAMUEL BLACK, A.B., M.A., D.D., LL.D. (S.B.McC.) Chancellor Emeritus, University of Pittsburgh, Pa.
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McCORVEY, THOMAS CHALMERS, M.A., LL.D. (T.C.McC.) Professor of History and Political Science in the University of Alabama. Author of *The Government of the People of the State of Alabama.* Contributor to *The Library of Southern Literature* and *The South in the Building of the Nation*, etc.
Alabama.

MACDONELL, ARTHUR ANTHONY, M.A., Ph.D., Hon.LL.D., F.B.A. (A.A.M.) Boden Professor of Sanskrit in the University of Oxford. Fellow of Balliol College, Oxford. Author of *The Turanians and Pan-Turanianism; Eurasian Routes; Vedic Mythology; A History of Sanskrit Literature.*
Pan-Turanianism.

McGRATH, HON. SIR PATRICK THOMAS, K.B.E., LL.D. (P.T.M.) Editor of the Newfoundland *Evening Herald.* President of the Legislative Council, Newfoundland.
Newfoundland.

McKINLEY, ALBERT E., Ph.D. (A.E.McK.) Professor of History, University of Pennsylvania. Secretary, Pennsylvania War History Commission. President, Pennsylvania Federation of Historical Societies.
Pennsylvania; Philadelphia.

M'MAHON, COLONEL SIR ARTHUR HENRY, G.C.M.G., G.C.V.O., K.C.I.E., C.S.I., F.S.A., F.L.S., etc. (A.H.McM.) Foreign Secretary to the Government of India, 1911–4. British High Commissioner in Egypt, 1914–6. See biographical article: M'Mahon, Sir Arthur Henry.
Afghanistan.

MACNAMARA, ERIC DENVERS, M.A., M.D., F.R.C.P. (E.D.M.) Lecturer in Psychological Medicine in the Charing Cross Hospital Medical School. Physician to the West End Hospital for Nervous Diseases.
Psychotherapy.

MACON, WILLIAM WATTS. (W.W.M.) Editor of *The Iron Age*, New York.
Iron and Steel.

MacPHERSON, MAJOR-GENERAL SIR WILLIAM GRANT, K.G.M.G., C.B., LL.D. (W.G.Ma.) Editor-in-Chief of the *Medical History of the Great War.* Formerly Deputy Director-General, Army Medical Service. Author of *Handbooks of the Medical Services of Foreign Armies;* etc.
Army Medical Service (*British*).

MADARIAGA, SALVADOR DE. (S. DE M.) Author of *Shelley and Calderon, and other Essays on Spanish and English Poetry; Romances de Ciego; Manojo de Poesias Inglesas;* etc.
Spanish Literature.

MAGEE, WILLIAM KIRKPATRICK. (W.K.M.) Second Librarian, National Library of Ireland. Pseudonym, "John Eglinton." Author of *Anglo-Irish Essays;* etc.
Synge, J. M.

MAKINS, SIR GEORGE HENRY, G.C.M.G., C.B., LL.D., F.R.C.S. (G.H.M.) Consulting Surgeon to St. Thomas's Hospital, London. Late Consulting Surgeon to the British Expeditionary Force, etc.
Medicine and Surgery (Surgery During the War).

MALCOLM, MAJOR-GENERAL SIR NEILL, K.C.B., D.S.O. (N.M.*) General Commanding British Army of Occupation in Germany. Formerly Instructor in Military History at the Staff College, Camberley.
Tactics.

MANGIN, GENERAL CHARLES MARIE EMMANUEL, K.C.B., etc. (C.M.E.M.) See the biographical article: MANGIN, C. M. E.
Champagne, Battles in (in part); *Verdun, Battles of* (in part).

MANNING, WILLIAM R., Ph.D. (W.R.MA.) Economist, Latin-American Division, U.S. Department of State. Author of *Nootka Sound Controversy* (Justin Winsor Prize Essay of American Historical Association, 1904); *Early Diplomatic Relations Between the United States and Mexico* (Albert Shaw Lectures, Johns Hopkins University, 1913); etc.
Cuba; Havana; Virgin Islands.

MARDON, HENRY WILLIAM, F.R.G.S. (H.W.M.) Commander of the Mejidieh. Formerly Lecturer in Geography and Education in the Tewfikieh and Dar el Ulum Colleges, Cairo. Author of *A Geography of Egypt and the Anglo-Egyptian Sudan;* etc.
Arabia; Ukraine.

MARGOLIOUTH, DAVID SAMUEL, M.A., D.Litt., F.B.A. (D.S.M.*) Laudian Professor of Arabic in the University of Oxford. Editor of Yaqiut's *Dictionary of Learned Men;* etc. Author of *Mohammed and the Rise of Islam;* etc.
Pan-Islamism.

MARTIN, CHARLES JAMES, C.M.G., D.Sc., M.B., F.R.S., F.R.C.P. (C.J.M.*) Director of the Lister Institute of Preventive Medicine. Professor of Experimental Pathology, University of London.
Filter-Passing Germs.

MARTIN, HAROLD MEDWAY, A.C.G.I. (H.M.M.) Whitworth Scholar. Member of the Nozzles Research Committee, appointed by the Institute of Mechanical Engineers. Member of the Lubricants and Lubrication Enquiry Committee, appointed by the Department of Scientific and Industrial Research (London).
Turbines, Steam (in part).

MARTIN, LIONEL ALFRED. (L.A.M.) Director of Henry Tate & Sons, Limited, Sugar Refiners, London and Liverpool. Vice-President of the London Chamber of Commerce. Member of the Port of London Authority.
Sugar.

MARVIN, WINTHROP LIPPITT, A.B., Litt.D. (W.L.M.) Vice-President and General Manager, American Steamship Owners' Association. Author of *The American Merchant Marine: Its History and Romance.* Former Secretary of U.S. Merchant Marine Commission.
Shipping (United States).

MASARYK, THOMAS GARRIGUE. (T.G.M.) President of the Czechoslovak Republic.
Czechoslovakia.

MATHESON, COLONEL JOHN COLIN, R.E. (J.C.M.*) Deputy Chief Engineer, Southern Command. Formerly Chief Instructor in Fortification, School of Military Engineering, Chatham. Fortification Adviser to the Chilean Government. Member of the Belgian Coast Defences Commission, 1919, and of the Heligoland Commission, 1920.
Coast Defence.

MATTHEWS, DR. J. MERRITT. (J.M.M.) Head of the Department of Chemistry and Dyeing, Philadelphia Textile School, 1898–1907; Consulting Chemist and Expert in Textile Chemistry and Dyestuffs since 1910. Editor *Colour Trade Journal* since 1917.
Dyeing (United States).

MAUGHAN, CUTHBERT. (C.MA.) Contributor on Finance, Shipping and Insurance to *The Annual Register,* etc. Representative of Admiralty Section of the British Ministry of Information in North America, 1918.
Insurance (United Kingdom); Shipping (British).

MAURICE, MAJOR-GENERAL SIR FREDERICK BARTON, K.C.M.G., C.B. (F.B.M.) Commander of the Legion of Honour. Croix de Guerre. First Class, Order of St. Stanislas of Russia. Director of Military Operations, Imperial General Staff, 1915–6. Author of *Forty Days in 1914; The Last Four Months;* etc.
Western European Front Campaigns (in part).

MAVROGORDATO, JOHN NICOLAS, M.A. (J.N.M.*) Author of *Cassandra in Troy; Letters from Greece; The World in Chains;* etc.
Greece.

MAXSE, LIEUTENANT-GENERAL SIR IVOR, K.C.B., C.V.O., D.S.O. (F.I.M.) Late Inspector-General of Training to the British Armies in France, 1918–9.
Infantry.

MAXTED, EDWARD BRADFORD, Ph.D., B.Sc. (E.B.M.) Consulting Chemist. Author of *Catalytic Hydrogenation and Reduction; Ammonia and the Nitrides;* etc.
Nitrogen Fixation.

MAY, SIR GEORGE ERNEST, K.B.E., F.I.A. (G.E.M.) Secretary of the Prudential Assurance Company, Limited. Manager to the Dollar Securities Committee.
Dollar Securities Mobilization.

MAYENCE, F. (F.M.) Professor at the University of Louvain.
Mercier, Cardinal.

MAYERN, MAJOR KARL. (K.M.) Late General Staff, Austro-Hungarian Army. Now of the Kriegsarchiv, Vienna. Author of various monographs on the World War.
Carpathians, Battles of The.

MEANS, PHILIP AINSWORTH, M.A. (P.A.ME.) Investigator for the Smithsonian Institution, Washington, D.C. Author of *History of the Spanish Conquest of Yucatan and of the Itzas; A Survey of Ancient Peruvian Art;* etc.
Peru.

MEANY, EDMOND STEPHEN, M.S., M.L. (E.S.M.) Professor of History in the University of Washington. Author of *History of the State of Washington; Vancouver's Discovery of Puget Sound;* etc.
Washington (State).

MELVILLE, LEWIS. (L.M.) Author of biographies of Thackeray, Sterne and William Cobbett, and of many works on the social life of the Georgian period.
Newspapers (in part).

MENDELL, A. E., B.L.I. (A.E.M.) Director of the Analytic Report of the Second Chamber of the States General, Holland.
Holland (in part).

MEYENDORFF, BARON ALEXANDER. (A.M.) Teacher of Russian Law, Institutions and Economics, King's College (London University). Formerly Member of the Russian Duma and Senator. Formerly Privat-Dozent at Petrograd University.
Esthonia; Latvia.

MILEY, SQUADRON LEADER ARNOLD JOHN, O.B.E., R.A.F. (A.J.M.) Design Branch, Directorate of Research, Air Ministry, in charge of Seaplane Development. Assistant Director, Air Department, Admiralty, June 1915 to June 1916; Senior Flying Officer Naval Air Station, Felixstowe, August 1916 to June 1917.
Aeronautics (Seaplanes).

MILL, COURTENAY J. (C.J.M.) Financial Editor of *The Times.*
English Finance; National Debt; Stock Exchange.

MILL, HUGH ROBERT, D.Sc., LL.D. (H.R.M.) Gold Medallist of the Royal Geographical Society. Author of *The Siege of the South Pole;* etc. See the biographical article: MILL, HUGH ROBERT.
Antarctic Regions.

MILNER, HAROLD WOOD, M.Sc., A.M.I.C.E. (H.W.M.*) Executive Engineer, Public Works Department, Government of India.
Delhi.

MISES, LUDWIG VON, Dr.Juris. (L.v.M.) Professor of Political Economy in the University of Vienna.
Austrian Empire (Finance and Banking); Austria, Republic of (Finance and Banking).

MITCHELL, PETER CHALMERS, C.B.E. (Military Division), F.R.S., D.Sc., LL.D. (P.C.M.) Secretary, Zoölogical Society of London. Attached to Directorate of Military Intelligence, War Office, 1916–8. Liaison Officer with British War Mission, 1918. Editorial Staff of *The Times.*
Propaganda.

MITCHELL, SUSAN LANGSTAFF. (S.L.M.) Author of *The Living Chalice; Aids to the Immortality of Certain Persons in Ireland;* etc.
Russell, G. W.

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Harvard University.

MOORE, FREDERICK CECIL, H.M.C.S. (F.C.Mo.) Head of the Sugar and Rationing Department for Ireland during the World War.
Ireland (Statistics).

MORGAN, CONWY LLOYD, D.Sc., LL.D., F.R.S. (C.LL.M.) Emeritus Professor of Psychology in the University of Bristol. Author of *Animal Life and Intelligence; Instinct and Experience;* etc.
Behaviourism.

MORRISON, S. W. (S.W.M.) Board of Trade, London.
Glass (in part).

MOTT, SIR FREDERICK, K.B.E., M.D., LL.D., F.R.S. (F.W.Mo.) Director of the Pathological Laboratory of the L.C.C. Asylums. Consulting Physician, Charing Cross Hospital. Late Member of the Royal Commission on Venereal Diseases.
Shell Shock; Venereal Diseases.

MOTTRAM, JAMES CECIL, M.B.(Lond.), D.P.H.(Cantab.). (J.C.Mo.) Director of the Research Department, Radium Institute. Late Experimental Officer, Camouflage School, G.H.Q. Author of *Controlled Natural Selection.*
Camouflage (Natural); Colours of Animals.

MOYES, RT. REV. MGR. J., D.D. (J.Mo.*) Canon of Westminster Cathedral. Formerly Editor of the *Dublin Review.* Domestic Prelate to H.H. Pope Benedict XV.
Church History (Roman Catholic); Pius X.

MUIRHEAD, JAMES F., M.A., L.H.D., F.R.G.S. (J.F.M.) Author of *America, the Land of Contrasts,* and of Baedeker's Handbooks to London, England, the United States and Canada. Editor of Muirhead Guidebooks,(The Blue Guides).
London.

MULLENDORE, WILLIAM CLINTON, A.B., J.D. (W.C.M.) Attorney-at-Law. Late Assistant Counsel and Liquidator, United States Food Administration. Representative, American Relief Administration, Berlin, Germany, 1920.
Food Supply (United States); Rationing (United States).

MÜLLER-LOEBNITZ, LIEUTENANT-COLONEL WILHELM. (W.M.-Lo.) Late General Staff, German Army. Ober-Archivrat in the Reichsarchiv. Formerly in the Military History Section of the Great General Staff. During the World War served on the General Staff of XII. Corps and VI. and "A" Armies, and as a Regimental Commander. Author of *Der Wendepunkt des Weltkriegs* and other monographs.
Lys, Battles of the; Somme, Battles of the (in part).

MURPHY, WALLACE CARLTON, B.A., M.A. (W.C.M.*) Professor of History in the University of Mississippi.
Mississippi.

NATHAN, COLONEL SIR FREDERIC LEWIS, K.B.E. (F.L.N.) Late Royal Artillery. Department of Scientific and Industrial Research. Director of Alcohol Section Fuel Research Board.
Alcohol.

NEILSON, WILLIAM A., LL.D. (W.A.N.) President, Smith College, Northampton, Mass.
Smith College.

NICHOLSON, JOSEPH SHIELD, Sc.D., LL.D., F.B.A. (J.S.N.) Professor of Political Economy in the University of Edinburgh. Author of *Principles of Political Economy; Money and Monetary Problems;* etc.
Inflation.

NICHOLSON, JOSEPH SINCLAIR, M.A. (J.S.Nc.)
Juvenile Employment (United Kingdom); Unemployment (United Kingdom).

NICKERSON, CAPTAIN HOFFMAN, B.A., M.A.(Harvard). (H.N.*) Late U.S. Army. Member of New York State Legislature, 1916. In the World War served in G.H.Q. Intelligence Staff, American Expeditionary Force, France.
Artois, Battles in (in part).

NICOD, JEAN, Agrégé de Philosophie (Paris), B.A.(Cantab.). (J.N.) Teacher of Philosophy in the Lycée of Laon, France.
Mathematics (Logic and Foundations).

NOBLE, SIR WILLIAM. (W.No.) Engineer-in-Chief, General Post Office, London. Knight of the Order of the Cross of Belgium.
Telegraph (in part); *Telephone* (in part).

NYSTROM, PAUL HENRY, Ph.D. (P.H.N.) Formerly Professor of Economics in the Universities of Wisconsin and Minnesota. Director of the Retail Research Association. Author of *Economics and Retailing; Retail Selling and Store Management; Textiles;* etc.
Marketing.

O'CALLAGHAN, MAJOR-GENERAL SIR DESMOND DYKES TYNTE, K.C.V.O., R.A. (D.D.T.O'C.) Colonel Commandant, Royal Artillery. Secretary, Member and President of the Ordnance Committee. President of the Committee on Explosives. Formerly on the Experimental Staff at Shoeburyness.
Ammunition (in part).

O'GORMAN, LIEUTENANT-COLONEL MERVYN, C.B., D.Sc., M.Inst.C.E. (M.O'G.) Formerly Superintendent of the Royal Aircraft Factory, Farnborough. Consultant to the Director-General of Military Aeronautics. Chairman of the Royal Aeronautical Society, and of the Accidents Investigation Committee of the Air Ministry.
Aeronautics (Introductory).

OLDHAM, RICHARD DIXON, F.R.S., F.G.S., F.R.G.S. (R.D.O.) Author of numerous papers on various aspects of Geology and kindred subjects.
Geology (Dynamical); Isostasy; Seismology.

O'LEARY, MAJOR HERBERT (H.O'L.) U.S. Army. Chief of Small Arms Division, Ordnance Officer, Washington.
Pistol; Rifles and Light Machine-Guns (in part); *Sights (Rifle and Pistol).*

OSBORN, HENRY FAIRFIELD, LL.D., D.Sc. (H.F.O.) Honorary Curator of Vertebrate Palaeontology in the American Museum of Natural History, New York City; and Vertebrate Palaeontologist, United States Geological Survey.
Palaeontology.

OVERSTRAETEN, CAPTAIN-COMMANDANT R. VAN. (R. van O.) Aide-de-Camp to H.M. the King of the Belgians. Graduate of the Staff College. Order of Leopold. D.S.O. Legion of Honour.
Antwerp (Siege of 1914); Army (Belgian); Ypres and Yser, Battles of (Part IV.).

PAIN, MAURICE. (M.Pa.) General Secretary of the French Ministry of the Devastated Regions.
France (Invaded Regions).

PAINE, SYDNEY GROSS, D.Sc., F.I.C. (S.G.P.) Assistant Professor of Bacteriology, Imperial College of Science and Technology, London.
Bacteriology (General and Agricultural).

PALAT, GENERAL-OF-BRIGADE BARTHÉLEMY EDMOND. (B.E.P.) Late French Army. Commanded a Division 1915–6. Author of *La Grande Guerre sur le Front Occidental; Les Batailles d'Artois et de Champagne;* and, under the pseudonym "Pierre Lebautcourt," of *La Defense Nationale, 1870–1* and other works, including a general bibliography of 1870–1.
Champagne, Battles in (in part); *Frontiers, Battles of the* (in part).

PARISH, JOHN CARL, Ph.D. (J.C.P.) Associate Editor of the State Historical Society of Iowa. Lecturer in Iowa History in the State University of Iowa.
Iowa.

PARSONS, FLOYD W., E.M. (F.W.P.) Founder and former Editor of *The Coal Age.*
Coal (United States).

PARSONS, ROBERT HODSON, A.M.I.C.E. (R.H.P.) Member of the Engineering Institute of Canada.
Turbines, Steam.

PATTERSON, WOODFORD, B.A. (W.P.) Secretary of Cornell University.
Cornell University.

PAXSON, MAJOR FREDERICK L. (F.L.P.) Professor of History in the University of Wisconsin. Formerly of U.S. General Staff.
Munitions of War (United States).

PEARSON, SIR ARTHUR, Bt., G.B.E. (died 1921). (A.P.) Chairman of the Blinded Soldiers and Sailors Care Committee. President of the National Institute for the Blind. Author of *Victory Over Blindness; The Conquest of Blindness.* See the biographical article: PEARSON, SIR ARTHUR.
Blindness.

PEARSON, HENRY CLEMENS, F.R.G.S. (H.C.P.) Editor and Publisher of the *India Rubber World*, New York. Author of *Crude Rubber Compounding Ingredients; Rubber Machinery; Pneumatic Tires; Rubber Country of the Amazon; What I Saw in the Tropics;* etc.
Rubber.

PEASE, THEODORE CALVIN, Ph.B., Ph.D. (T.C.P.) Assistant Professor of History in the University of Illinois. Author of *The Leveller Movement; The Frontier State* (*Vol. II.* of *Illinois Centennial History*); etc.
Illinois.

PEELE, ROBERT, E.M. (R.P.*) Professor of Mining in the School of Mines, Columbia University. Hon. Member of the Institution of Mining and Metallurgy, London. Author of *Compressed Air Plant.* Editor-in-chief of Peele's *Mining Engineer's Handbook;* etc.
Mining.

PENDEREL-BRODHURST, JAMES GEORGE JOSEPH. (J.P.-B.) Editor of *The Guardian.*
Church History (*Church of England*).

PHELPS, WILLIAM LYON, M.A., Ph.D., Litt.D. (W.L.P.) Lampson Professor of English Literature at Yale University. Author of *Essays on Modern Novelists; Essays on Russian Novelists; Essays on Modern Dramatists; The Twentieth Century Theatre; The Advance of English Poetry;* etc.
American Literature.

PHILLIPS, PAUL CHRISLER, M.A., Ph.D. (P.C.P.) Professor of History in the University of Montana. Joint-author (with N. J. Lennes) of *The West in the Diplomacy of the American Revolution.* Author of *The Story of Columbus;* etc.
Montana.

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Michigan.

PHILLIPS, WALTER ALISON, M.A. (Oxford and Dublin). (W.A.P.) Lecky Professor of Modern History in the University of Dublin. Member of the Royal Irish Academy. Author of *Modern Europe; The Confederation of Europe;* etc.
Diplomacy; Ireland (*History*); *Putumayo; Round, John Horace; Self-Determination.*

PINCHOT, GIFFORD, A.B. (Yale), **Hon. A.M.** (Yale and Princeton), **Sc.D.** (Michigan Agricultural College), **LL.D.** (McGill). (G.P.) Professor of Forestry, Yale University. U.S. Forester, 1898–1910. President of the National Conservation Association. Pennsylvania Commissioner of Forestry. Author of *The Adirondack Spruce; The Training of a Forester; The Fight for Conservation;* etc.
Conservation Policy; Forestry (*United States*).

PIRENNE, HENRI. (H.P.) Rector of the University of Ghent. Member of the Royal Academy of Belgium and of the Institute of France. Corresponding Member of the Royal Historical Society. Author of *Histoire de Belgique;* etc.
Belgium (*History*, in part); *Fredericq, Paul.*

PIRENNE, JACQUES. (J.P.) Avocat at the Court of Appeal of Belgium. Professor of History to Prince Leopold of Belgium, Duke of Brabant.
Albert, King of the Belgians; Belgium (*History*, in part).

PIRIE-GORDON, HARRY, D.S.C., M.A. (H.P.-G.) Served in the World War. Editor of *A Brief Account of the Advance of the Egyptian Expeditionary Force.*
Hejaz Railway; Palestine; Syria; Transjordania; Turkish Campaigns (*Palestine*).

POLLARD, ALBERT FREDERICK, M.A., Litt.D., F.B.A. (A.F.P.) Professor of English History in the University of London. Fellow of All Souls College, Oxford. Chairman of the Institute of Historical Research. Author of *A Short History of the Great War; The Evolution of Parliament;* etc.
World War (*Political History*).

POLLOCK, COURTENAY EDWARD MAXWELL, R.B.S., F.R.S.L. (C.Po.)
Sculpture (in part).

POUND, ROSCOE, Ph.D., LL.D. (R.Po.*) Carter Professor of Jurisprudence and Dean of the Faculty of Law in Harvard University. Sometime Commissioner of Appeals of the Supreme Court of Nebraska.
Women, Legal Status of (*United States*).

POWER, JOHN DANVERS, M.V.O. (J.D.P.) Vice-chairman, British Red Cross Society. Editor of the Report by the British Red Cross Society and the Order of St. John on their joint war work, 1914–9.

PRESTON, W. E. (W.E.P.)
Silver.

PREUSS, HUGO, Dr.Juris. (H.P.*) Formerly Lecturer at the University of Berlin and Professor Public Law at the Berlin University College of Commerce. Municipal Deputy and Municipal Councillor in Berlin. After the Revolution Secretary of State for the Interior and Minister of the Interior for the Reich up to the German acceptance of the Peace of Versailles. Member of the Prussian Constituent Assembly and of the first Diet of the Free State of Prussia. Bore the leading part in drafting, and carrying through the Constituent Assembly of the Reich, the new Republican Constitution of Germany. Author of *Das deutsche Volk und die Politik;* etc.
Germany (*Republican Constitution*).

PRIBRAM, ALFRED FRANCIS, Ph.D. (A.F.Pr.) Professor of Modern History in the University of Vienna. Member of the Vienna Academy of Science; etc.
Aehrenthal; Austrian Empire (*Austro-Hungarian Foreign Policy*); *Berchtold, Count L.; Burian, R. S. von; Charles* (*Emperor of Austria*); *Czernin, Count; Francis Ferdinand; Francis Joseph I.; Plener, E.*

PRIBRAM, KARL, Dr.Juris. (K.P.) Professor in the University of Vienna.
Austrian Empire (*Economic Conditions*, in part); *Austria, Republic of* (*Economic Conditions*, in part).

PRIESTLEY, HERBERT INGRAM, M.A., Ph.D. (H.I.P.) Associate Professor of Mexican History and Librarian of the Bancroft Library, University of California.
Costa Rica; Guatemala; Honduras; Huerta; Madero; Mexico; Nicaragua; Obregon; Panama; Salvador; Villa.

PRIESTLY, MAJOR R. E., M.C., B.A. (R.E.P.) Author of the *Official History of the Signal Service during the European War, 1914–8; Breaking the Hindenburg Line; The History of the 46th, North Midland, Division;* etc.
Signal Service, Army (in part).

PROCTOR, JOHN CLAGETT, LL.M. (J.C.P.*) Member of the Bar of the District of Columbia. Historian of the Society of Natives of the District of Columbia.
Washington (*D.C.*).

PROUDMAN, JOSEPH, M.A., D.Sc. (J.P.*) Professor of Applied Mathematics, and Hon. Director of the Tidal Institute, in the University of Liverpool. Fellow of Trinity College, Cambridge.
Tides.

RAIT, ROBERT SANGSTER, C.B.E., M.A., LL.D. (R.S.R.) Historiographer Royal for Scotland. Professor of Scottish History and Literature in the University of Glasgow. Author of *The Scottish Parliament; History of Scotland;* etc.
Scotland.

RANKINE, ALEXANDER OLIVER, O.B.E., D.Sc., F.Inst.P. (A.O.R.) Fellow of University College, London. Professor of Physics in the Imperial College of Science and Technology.
Sound.

RAPER, GEORGE. (G.A.R.) Formerly Correspondent of *The Morning Post* in Paris.
France (in part).

RECLUS, MAURICE. (M.R.*) *Conseiller d'État.* Colonial Editor of *Le Temps.*
Algeria; France (in part); *French Equatorial Africa* (in part); *Indo-China, French.*

REED, HERBERT (H.R.*) Sports Editor of *The New York Evening Post.*
Sports and Games (U.S. portion).

REES, JOHN MORGAN, M.A., F.R.Econ.S. (J.M.R.) Lecturer in Economics and Political Science in the University College of Wales, Aberystwyth. Author of *Wages and Costs in South Africa; South Wales Iron, Steel and Tinplate Industries as Affected by the War;* etc.
Syndicalism (in part).

RENOLD, CHARLES GARONNE, M.E. (Cornell). (C.G.R.) Managing Director of Hans Renold, Limited. Author of *Workshop Committees;* etc.
Scientific Management.

RICKARD, LIEUTENANT-COLONEL F. M. (F.M.R.) Royal Artillery. Chief Instructor, Artillery College, Woolwich (assisted by Instructional Staff, Artillery College).
Ammunition (in part); *Magazines and Shell Stores; Ordnance*

RIDDELL, RIGHT HON. LORD. (RI.) Vice-chairman of the Newspaper Proprietors' Association. Chairman of the Weekly Newspaper and Periodical Proprietors' Association. Represented the British Press at the Peace Conference, 1919–21. See the biographical article: RIDDELL, BARON.
Censorship (in part).

RILEY, GEORGE WASHINGTON, Ph.B., D.O. (G.W.RI.) Late President, New York State and City Osteopathic Societies. President, American Osteopathic Association, 1917–8.
Osteopathy.

ROBERTSON, JAMES ALEXANDER, Ph.B., L.H.D. (J.A.Ro.) Chief of the Near Eastern Division Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D.C. Co-editor of Blair and Robertson's *The Philippine Islands, 1493–1898* (55 vols.). Compiler of *Bibliography of the Philippine Islands;* etc.
Guam; Philippines.

ROBERTSON, WILLIAM SPENCE, Ph.D. (W.S.Ro.) Professor of History in the University of Illinois. Author of *Francisco de Miranda and the Revolutionizing of Spanish America; Rise of the Spanish American Republics;* etc.
Bolivia; Colombia; Ecuador; Venezuela.

ROBINSON, COMMANDER WILLIAM MALCOLM MARTYN, R.N. (W.M.M.R.)
Torpedo.

RODD, RIGHT HON. SIR JAMES RENNELL, G.C.B., G.C.M.G., G.C.V.O. (J.R.R.) Grand Cross of St. Maurice and St. Lazarus. Commander of the Osmanieh. Grand Cross of Polar Star. Late Ambassador to the Court of Italy. Member of Lord Milner's Mission to Egypt, 1920. Special Envoy to King Menelek II., 1897. Author of *Customs and Lore of Modern Greece; Poems in Many Lands;* etc.
Egypt (*History*); *Sudan* (in part).

ROGERS, SIR LEONARD, C.I.E., M.D., F.R.C.P., F.R.S., I.M.S. (retired). (L.Ro.) Physician and Lecturer, London School of Tropical Medicine. Late Professor of Pathology, Calcutta. Author of works on fevers in the tropics; etc.
Kala-Azar.

ROSENHAIN, WALTER, B.A., D.Sc., F.Inst.P., F.R.S. (W.RN.) Superintendent, Metallurgy Department, National Physical Laboratory. Author of *Introduction to the Study of Physical Metallurgy; Glass Manufacture;* etc.
Metallurgy.

ROSS, COLONEL SIR RONALD, K.C.B., K.C.M.G., F.R.S., F.R.C.S., Hon.M.D., D.Sc., etc. (R.Ro.) Nobel Medical Prizeman, 1902. Author of *The Prevention of Malaria;* etc. See the biographical article: ROSS, SIR RONALD.
Malaria.

ROURE, RÉMY. (R.R.*) Labour Correspondent of *L'Éclair*, Paris.
France (in part).

RUSHTON, THOMAS ARTHUR. (T.A.R.) Editor and writer on social subjects.
Housing (in part).

RUSSELL, EDWARD JOHN, D.Sc., F.R.S. (E.J.R.) Director of the Rothamsted Experimental Station. Author of *Soil Conditions and Plant Growth; The Fertility of the Soil; Lessons on Soil; Manuring for Higher Crop Production;* etc.
Botany (*Soil Sterilization*).

RUTHERFORD, SIR ERNEST, M.A., LL.D., F.R.S. (E.Ru.) Cavendish Professor of Experimental Physics, University of Cambridge. Author of *Radioactivity; Radioactive Substances and their Radiations;* etc. See the biographical article; RUTHERFORD, SIR ERNEST.
Radioactivity; Matter, Constitution of.

SAITO, HIROSI, M.A. (H.SA.) Secretary of Embassy and Consul in the Japanese Diplomatic and Consular Service. Member of the Japanese Delegation to the Peace Conference in Paris, 1919, and to other Inter-Allied and International Conferences in Europe, 1919–21.
Formosa; Japan; Korea; Sakhalin.

SALISBURY, EDWARD JAMES, D.Sc., F.L.S. (E.J.S.) Lecturer in Botany and Fellow of University College, London. Hon. Secretary, British Ecological Society. Author of *An Introduction to the Study of Plants;* etc.
Botany (*Ecology*).

SALMON, ERNEST STANLEY, F.L.S. (E.S.S.) Reader in Economic Mycology, University of London. Mycologist to the South-Eastern Agricultural College, Wye, Kent.
Botany (*Mycology*).

SALTER, EMMA GURNEY, M.A., Litt.D. (E.G.S.) Author of *Franciscan Legends in Italian Art; Nature in Italian Art;* etc.
Morocco; Rio de Oro.

SANDERS, HERBERT MITCHELL, M.A. (H.M.SA.) Assistant Secretary to the Board of Inland Revenue. Assistant Secretary to the Royal Commission on the Income Tax, 1919–20.
Income Tax (*United Kingdom*).

SANDFORD, ERNEST (E.S.) Secretary to the Lord Mayor of Birmingham. Joint-author (with R. H. Brazier) of *Birmingham and the Great War.*
Birmingham.

SANER, F. D., M.A. (Cantab.), F.R.C.S. (F.D.S.) Surgeon to Out-Patients, Great Northern Hospital, London. Surgeon, Evelina Hospital for Children. Late Consulting Surgeon, British Rhine Army.
Fractures.

SAUNDERS, GEORGE, O.B.E., B.A. (Oxon.), Hon.LL.D. (Glasgow). (G.S.) Correspondent of the *Morning Post* in Berlin, 1888–97; and of *The Times* in Berlin, 1897–1908, and in Paris, 1908–14.
Bethmann Hollweg, T. von; Bülow, Prince von; Delbrück, Hans; Eisner, Kurt; Erzberger, M. (in part); *Eucken, R. C.* (in part); *Tirpitz, Alfred von.*

SCALES, REAR-ADMIRAL ARCHIBALD HENDERSON. (A.H.S.) Superintendent, United States Naval Academy.
United States Naval Academy.

SCANE, JOHN W., M.D. (J.W.S.) Assistant Dean, Faculty of Medicine, McGill University.
Medical Education (*Canada*).

SCHILLER, FERDINAND CANNING SCOTT, M.A., D.Sc. (F.C.S.S.) Fellow and Tutor of Corpus Christi College, Oxford. President of the Society for Psychical Research, 1914. Author of *Formal Logic; Humanism; Studies in Humanism; Riddles of the Sphinx;* etc.
Psychical Research.

SCHOLES, PERCY ALFRED, B.Mus., A.R.C.M. (P.A.S.) Music Critic of *The Observer*, London. Editor of *The Music Student.* Author of *The Listener's Guide to Music;* etc.
Scriabin, A.

SCHUSTER, SIR ARTHUR, Ph.D., Sc.D., D.Sc., F.R.S. (A.S.*) Hon. Professor of Physics in the University of Manchester. Author of *Introduction to the Theory of Optics;* etc. Joint-author (with Sir Arthur Shipley) of *Britain's Heritage of Science.* See the biographical article: SCHUSTER, SIR ARTHUR.
International Science.

SCHÜTZE, HARRY L. H., M.D. (H.L.H.S.) Bacteriologist at the Lister Institute, London.
Bacteriology (*Medical*).

SCOGGIN, GILBERT CAMPBELL, M.A., Ph.D. (G.C.S.) Sometime Scholar of Harvard University. Formerly Assistant Professor of Greek at the University of Missouri. Associate Editor of *The Classical Journal.* Member of the American Editorial Staff of the *Encyclopædia Britannica.*
Hoover, Herbert Clark; Tennessee.

SCOTT, AUSTIN, A.B., A.M., Ph.D., LL.D. (A.Sc.) Professor of History and Political Science, Rutgers College, New Brunswick, N.J.
New Jersey.

SCOTT-MONCRIEFF, MAJOR-GENERAL SIR GEORGE KENNETH, K.C.B., K.C.M.G., C.I.E., Hon.M.Inst.C.E., Late R.E. (G.K.S.-M.) Director of Fortifications and Works, War Office, 1911–8. Author of *The Water Supply of Barracks and Cantonments; The Principles of Structural Design;* etc.
Barracks and Hutments (*United Kingdom*); *Engineers, Military* (*United Kingdom*); *Training Camps, Military* (in part); *Water Supply, Military.*

SCROGGS, WILLIAM OSCAR, A.M., Ph.D. (W.O.S.) Financial writer on the *New York Evening Post.* Formerly Professor of Economics and Sociology, Louisiana State University. Author of *Filibusters and Financiers.*
Louisiana.

SECCOMBE, THOMAS, M.A. (T.SE.) Professor of English Literature, Queen's University, Kingston, Ontario. Assistant Editor of the *Dictionary of National Biography*, 1891–1901. Author of *The Age of Johnson;* etc.
English Literature (in part).

SELLS, HON. CATO, M.A., LL.D. (C.SE.) Commissioner of Indian Affairs for the U.S.A., 1912–21.
Indians, North American.

SETON-WATSON, ROBERT WILLIAM, D.Litt. (Oxon.), Hon. Ph.D. (Prague and Zagreb). (R.W.S.-W.) Lecturer in East European History at King's College, University of London. Author of *Racial Problems in Hungary; The Southern Slav Question; The Rise of Nationality in the Balkans;* etc. Editor of *The New Europe.*
Serbia; Yugoslavia.

SEYMOUR, CHARLES, M.A., Ph.D., Litt.D. (C.SEY.) Professor of History in Yale University, Technical Delegate at the Paris Peace Conference. Author of *The Diplomatic Background of the War; Woodrow Wilson and the World War.*
Harding, Warren G.; Wilson, Woodrow; Washington Conference.

SHAW, W. B. (W.B.S.) General Secretary, Alumni Association, University of Michigan. Author of *History of University of Michigan.*
Michigan, University of.

SHELDON, ADDISON ERWIN, A.M., Ph.D. (A.E.S.*) Superintendent, Nebraska State Historical Society. Author of *History and Stories of Nebraska; Poems and Sketches of Nebraska; Nebraska Constitutional Conventions.* Editor of Nebraska *Blue Book.*
Nebraska.

SIEGER, ROBERT, Ph.D. (R.Si.) Professor of Geography, University of Graz; Member of the Academy of Science, Vienna.
Austria, Republic of (*Introduction; Economic Conditions*).

SILLS, KENNETH CHARLES MORTON, M.A., LL.D. (K.C.M.S.) President of Bowdoin College, Brunswick, Maine. Candidate of the Democratic party in Maine for the U.S. Senate, 1916. President of the Board of Visitors to the Naval Academy at Annapolis, 1920–1.
Maine.

SIMON, LEON, B.A. (Oxon.). (L.Si.) Author of *Studies in Jewish Nationalism.*
Zionism.

SIMON, MAJOR and BREVET-COLONEL M. St. L., C.B.E., R.E. (M.St.L.S.) Assistant Director, Engineering Services, Canada, 1908–10. Staff Captain, War Office (Fortifications and Works), 1911–5. Anti-Aircraft Defence Commander, London, 1916–8. Anti-Aircraft Defence, Independent Force, R.A.F., 1918. Anti-Aircraft Defence, Leeds, 1919. Commander of Northern Air Defences, 1919. General Staff, War Office, 1920–1.
Air Defence.

SINZHEIMER, H. (H.Si.) Professor in the University of Frankfort-on-Main.
Germany (*Factory Councils Law*).

SLATER, JOHN, B.A. (Lond.), F.R.I.B.A. (J.Sl.) Formerly President, Architectural Association, and Vice-president, Royal Institute of British Architects, 1900–4. Member of Appeal Tribunal under the London Building Acts. Author of a *Short History of The Berners Estate;* Joint-author of *Classic and Early Christian Architecture.*
Architecture (*British*).

SMITH, EDGAR FAHS, Ph.D., Chem.D., Sc.D., L.H.D., M.D., LL.D. (E.F.S.*) Late Provost of the University of Pennsylvania, and Emeritus Professor of Chemistry.
Pennsylvania, University of.

SMITH, GRAFTON ELLIOT, M.A., M.D., F.R.C.P., F.R.S. (G.E.S.) Professor of Anatomy in the University of London. Author of *The Ancient Egyptians; The Royal Mummies; Migrations of Early Culture; Evolution of the Dragon;* etc.
Anthropology.

SMITH, STANLEY PARKER, D.Sc., M.I.E.E., A.M.I.C.E. (S.P.S.) Joint-author of *Papers on the Design of Alternate Current Machinery.*
Electrical Engineering (in part).

SOANE, ELY BANNISTER, C.B.E. (E.B.S.) Civil Administration of Mesopotamia. Examiner in Kurdish to the Civil Administration of Mesopotamia. Author of *To Kurdistan and Mesopotamia in Disguise; A Kurdish Grammar; An Elementary Grammar of Kurmanji;* etc.
Kurdistan.

SPALDING, LIEUTENANT-COLONEL GEORGE REDFIELD. (G.R.S.) Corps of Engineers, U.S. Army. Instructor in Supply, General Staff College, Washington, D.C.
Light Railways, Military (in part).

SPALDING, WILLIAM F., Cert.A.I.B., F.R.Econ.S. (W.F.S.) Examiner in Banking, Currency and Foreign Exchange to various public bodies. Author of *Foreign Exchange and Foreign Bills in Theory and in Practice; Eastern Exchange; Currency and Finance;* etc. Sometime Editor of the *Statist* (British Banking Supplement and International Banking Supplement).
Banking (*British*).

SPENCER, LEONARD JAMES, M.A., Sc.D., F.G.S. (L.J.S.) Assistant Keeper in the Mineral Department, British Museum Natural History. Editor of the *Mineralogical Magazine.* Author of *The World's Minerals.*
Crystallography; Mineralogy.

STARK, OSKAR. (O.S.) Member of the Berlin Staff of the *Frankfurter Zeitung.*
Bavaria (*Political History*).

STEVENS, WALTER BARLOW, B.A., M.A., LL.D. (W.B.St.) President, State Historical Society of Missouri. Author of *History of St. Louis; Centennial History of Missouri; Missouri's Travail for Statehood;* etc. Director of Exploitation, St. Louis World's Fair of 1904.
St. Louis.

STOCKING, WILLIAM, M.A. (Yale). (W.St.) Newspaper Editor, 1865–1900. Historian and Statistician, Detroit Board of Commerce, 1903–21. Author of *Under the Oaks; History of the Republican Party;* etc.
Detroit.

STOCKLEY, BREVET-COLONEL ERNEST NORMAN, D.S.O. (E.N.S.) Royal Engineers.
Bridging, Military.

STOKES, ANSON PHELPS, D.D., LL.D. (A.P.S.) Secretary of Yale University. Author of *Memorials of Eminent Yale Men;* etc.
Yale University.

STOPES, MARIE CARMICHAEL, D.Sc. (Lond.), Ph.D. (Munich). (M.C.S.) Fellow of University College, London. Sometime Lecturer in Palaeobotany, Universities of Manchester and London. Author of *Catalogue of Cretaceous Plants in the British Museum,* etc.
Botany (*Anatomy and Palaeobotany*).

STOREY, SOMERVILLE. (S.S.) Literary Critic of *Le Monde Nouveau,* Paris.
French Literature.

STRIEGL, RICHARD, Dr.Juris. (R.Str.) Secretary of the Industrial District Commission.
Austrian Empire (*Economic Conditions,* in part).

SUTTON, SIR GEORGE AUGUSTUS, Bart. (G.A.S.) Chairman of the Amalgamated Press, Limited. Hon. Director of Publicity to the British Treasury, 1917–9.
War Loan Publicity Campaigns.

SWINTON, MAJOR-GENERAL ERNEST DUNLOP, C.B., D.S.O. (E.D.S.) Late Royal Engineers. Author of *The Green Curve; The Great Tab Dope; The Defence of Duffer's Drift.* Official "Eyewitness" with the British Army in France, 1914–5. Originator of the Tank. Raiser and first commander of the Tank Corps.
Tanks.

SYKES, BRIGADIER-GENERAL SIR PERCY MOLESWORTH, K.C.I.E., C.B., C.M.G. (P.M.S.) Formerly British Consul-General, Persia. Late Inspector-General, South Persia Rifles. Author of *History of Persia; Manners and Customs; Glory of the Shia World;* etc. Gold Medallist, R.G.S., 1902.
Persia.

SZEKFU, JULIUS, Ph.D. (J.S.*) Lecturer at the University of Budapest.
Hungary (in part).

TAFT, LORADO, N.A., L.H.D. (L.T.) National Academy of Arts and Letters. Sculptor, Lecturer, and Professorial Lecturer, University of Chicago. Non-resident Professor of Art, University of Illinois. Author of *History of American Sculpture.*
Sculpture (*United States*).

TARBELL, IDA MINERVA, M.A., Litt.D., LL.D. (I.M.T.) Former Associate Editor of *The Chautauquan, McClure's Magazine, American Magazine.* Author of *Life of Abraham Lincoln; The History of the Standard Oil Company; The Tariff in our Times; New Ideals in Business;* etc.
Women's War-Work (*United States*).

TAYLOR, ALFRED EDWARD, M.A., D.Litt., F.B.A. (A.E.T.) Professor of Moral Philosophy in the University of St. Andrews. Author of *The Problem of Conduct; Elements of Metaphysics; Varia Socratica;* etc.
Philosophy.

TAYLOR, ARTHUR H. E., B.A. (A.H.E.T.) Author of *The Future of the Southern Slavs;* etc.
Montenegro.

TAYLOR, RICHARD F., M.B.E., F.S.S. (R.F.T.) Statistician to the Ministry of Mines.
Coal (*United Kingdom*).

THEVENET, FRÉDÉRIC. (F.T.) General of Division, French Army. Formerly Governor of Belfort. Commanded Belfort region in the World War. Author of *La Place de Belfort.*
Frontiers, Battles of the (in part); *Vosges, Battles in the.*

THICKNESSE, RALPH. (R.Th.) Barrister-at-Law. Author of *Digest of Law; Husband and Wife;* etc.
Children, Law Relating to (*United Kingdom*); *Divorce* (*United Kingdom*); *Women, Legal Status of* (*United Kingdom*).

THOMAS, DAVID YANCEY, M.A., Ph.D. (D.Y.T.) Professor of History and Political Science in the University of Arkansas. Author of *A History of Military Government in Newly Acquired Territory of the United States.* Joint-author of *The South in the Building of the Nation; Studies in Southern History and Politics.* Associate Editor of the *Southwestern Political Science Quarterly.*
Arkansas.

THOMASSON, P. DE. (P.de T.) French Delegate to the Saar Commission.
Saar Valley.

THOMSON, ELIHU, A.M., Ph.D., D.Sc. (E.T.) Consulting Engineer of the General Electric Company. Originator of Resistance Electric Welding (Thomson Process).
Welding, Electric.

THOMSON, JOHN ARTHUR, M.A., LL.D. (J.A.T.) Regius Professor of Natural History in the University of Aberdeen. Author of *The System of Animate Nature; The Wonder of Life; The Biology of the Seasons;* etc.
Zoölogy.

THOMSON, SIR JOSEPH JOHN, O.M., D.Sc., Hon.F.R.S.E., LL.D., Ph.D., F.R.S. (J.J.T.) See the biographical article: THOMSON, SIR JOSEPH JOHN.
Gases, Electrical Properties of.

TIDY, HENRY LETHEBY, M.A., M.D.(Oxon.), F.R.C.P.(Lond.). (H.L.T.) Assistant Physician to St. Thomas's Hospital. Physician to the Great Northern Hospital, London.
Encephalitis Lethargica.

TIEKE, HANS, Ph.D. (H.Tk.) Professor of Art History in the University of Vienna.
Austrian Empire (Art).

TODD, JOHN AITON, B.L. (J.A.T.*) Lecturer in Economics, Balliol College, Oxford. Author of *The World's Cotton Crops;* etc.
Cotton and Cotton Industry.

TOVEY, DONALD FRANCIS, Master of Music (Hon., Birm.), Mus.D.(Oxon.). (D.F.T.) Reid Professor of Music in Edinburgh University. Author of *Lessons in Musical Analysis;* etc.
Music.

TOWER, SIR REGINALD THOMAS, K.C.M.G., C.V.O. (R.T.T.) Administrator of Danzig and High Commissioner of the League of Nations, 1919–20.
Danzig.

TOWNSEND, CHARLES HARRISON, F.R.I.B.A. (C.H.T.) Past-Master of the Art Workers' Guild. Late Member of Council of the Royal Institute of British Architecture. Cantor Lecturer on Mosaic.
Belcher, J.; Bentley, J. F.

TOYE, GEOFFREY. (G.T.*) Scholar and Exhibitioner, Royal College of Music. Author of *Esperance Morris Dance Book, No. 2.* Conductor, Philharmonic Societies, London and Liverpool.
Dancing.

TROTTER, WILFRED, M.S.(Lond.), F.R.C.S. (W.T.) Surgeon, University College Hospital.
Nervous System (Surgery).

TROUP, ROBERT SCOTT, M.A., C.I.E. (R.S.T.*) Professor of Forestry in the University of Oxford. Author of *The Silviculture of Indian Trees;* etc.
Forestry (in part).

TSCHAPPAT, COLONEL W. H. (U.S.Army). (W.H.T.) Author of *Ordnance Treatise, U.S.A.*
Ammunition (in part); *Ballistics* (in part).

TUTHILL, EDWARD, M.A., Ph.D. (E.T.*) Professor of History, University of Kentucky. Author of *Government of Kentucky.*
Kentucky.

VANDERGRIFT, ROLLAND A., M.A. (R.A.V.) Assistant in History in the University of California.
Los Angeles; San Francisco.

VANDERVELDE, LALLA. (L.Va.) Secretary of the *Institut des Hautes Études,* Brussels University.
Belgium (Literature).

VAN DYKE, JOHN C., L.H.D. (J.C.Van D.) Professor of the History of Art, Rutgers College. Author of *Art for Art's Sake; Meaning of Pictures; History of Painting;* etc.
Painting (United States).

VAUGHN, ERNEST VANCOURT, M.A., Ph.D. (E.V.V.) Professor of History in the University of Delaware. Author of *The Origin and Early Development of the English Universities to the Close of the 13th Century.*
Delaware.

VIALL, ETHAN. (E.Vi.) Editor of *American Machinist,* Member A.S.M.E., A.I.E.E., A.S.T.M., S.A.E. Author of *Broaches and Broaching; Electric Welding; Gas-Torch and Thermit Welding; United States Rifles and Machine Guns; United States Artillery Ammunition; Manufacture of Artillery Ammunition;* etc.
Machine Tools; Thermit and Thermit Welding; Welding (Gas Torch).

VILES, JONAS, Ph.D. (J.Vi.) Professor of American History in the University of Missouri.
Missouri.

VILLARI, LUIGI. (L.V.*) Officer of the Crown of Italy. Chevalier of St. Maurice and St. Lazarus. Italian Croce di Guerra. Chevalier of the Legion of Honour. French Croix de Guerre. British Military Cross. Member of Staff of League of Nations. Formerly attached to the Italian Foreign Office. During the war, Liaison Officer with the Allied Armies in Macedonia, and, after the Armistice, at Constantinople; and Secretary Inter-Allied Commission, Smyrna.
Italy.

VINCENT, SWALE, LL.D., D.Sc., M.D., F.R.S.E., F.R.S.C. (S.V.) Professor of Physiology in the University of London. Author of *Internal Secretion and the Ductless Glands.*
Ductless Glands.

VINOGRADOFF, SIR PAUL, M.A., D.C.L., LL.D., Dr.Hist., Dr. Juris. (P.Vi.) Corpus Professor of Jurisprudence, Oxford. Author of *Villainage in England; The Growth of the Manor; Outlines of Historical Jurisprudence;* etc. See the biographical article: VINOGRADOFF, SIR PAUL.
Benckendorff, Count; Denikin, Anton; Guchkov; Kornilov (in part); *Lenin; Milyukov; Nicholas II.; Russia; Trotsky, Lev; Tschaikovsky, N. V.; Wrangel.*

VOGEL, HON. MARTIN, A.B.(Columbia). (M.V.*) Formerly Assistant Treasurer of the United States, New York.
Liberty Loan Publicity Campaigns.

WALKER, JANE HARRIETT, L.R.C.P., L.R.C.S.E., M.D.(Brussels). (J.Wa.*) Medical Superintendent, East Anglian Maltings Farm and East Anglian Children's Sanitoria, Mayland, Suffolk. Member of Departmental Committee on Provision for Treatment of Tuberculosis, 1911–2. President, Medical Women's Federation, 1917–20. Consulting Physician, Elizabeth Garrett Anderson Hospital, London, etc.
Infantile Mortality (United Kingdom).

WALLACE, DAVID DUNCAN, A.M., Ph.D. (D.D.W.) Professor of History and Economics in Wofford College, Spartanburg, S. Carolina. Author of *Life of Henry Laurens; Civil Government of South Carolina and the United States.*
South Carolina.

WARBURTON, REV. STACEY R., B.A. (S.R.W.) Editor of *Year Book of the Churches.* Secretary of Literature of the General Board of Promotion of the Northern Baptist Convention, U.S.A.
Church History (United States).

WARD, ROBERT DE COURCY, A.M. (R.DeC.W.) Professor of Climatology, Harvard University. Author of *Climate Considered Especially in Relation to Man.*
Climate and Climatology.

WARDLE, CAPTAIN M. K. (M.K.W.)
France (in part).

WARE, MAJOR-GENERAL SIR FABIAN, K.B.E., C.B., C.M.G. (F.W.) Chevalier of the Legion of Honour. Commander of the Order of the Crown (Belgium), etc. Vice-chairman of the Imperial War Graves Commission. Formerly Editor of the *Morning Post.*
War Graves.

WARNER, ANDREW R., A.M., M.D. (A.R.W.) Executive Secretary, American Hospital Association, Superintendent Lakeside Hospital, Cleveland, Ohio, 1907–19. Member of the War Service Committee on Hospitals during the World War. President American Hospital Association, 1918–9. Joint-author of *Dispensaries.*
Hospitals (United States).

WELLS, JOSEPH, M.A. (J.We.*) Warden of Wadham College, Oxford. Author of *Oxford and its Colleges; A History of Wadham College.*
Oxford.

WERTHEIMER, EDUARD VON. (E.v.W.) Emeritus Professor of History in the University of Pressburg.
Andrassy, J. J.; Fejervary; Hungary (in part); *Kossuth, Francis; Szell, K.; Szilagy, D.; Tisza.*

WEST, JAMES E., LL.B., LL.M. (J.E.W.) Chief Scout Executive, Boy Scouts of America. Formerly Secretary of President Roosevelt's White House Conference on care of Dependent Children.
Boy Scouts (United States).

WHITE, MRS. AMBER BLANCO, O.B.E. (A.B.W.) Director, Women's Wages Section, British Ministry of Munitions, 1917–8. Member of National Whitley Council for the Civil Service, 1919–20.
Women's Employment (United Kingdom).

WHITE, COLONEL H. A. (H.A.W.*) Judge Advocate, United States Army Department.
United States (Military Law).

WHITE, LAURA A., Ph.D. (L.A.W.*) Professor of History in the University of Wyoming.
Wyoming.

WHITTON, LIEUTENANT-COLONEL FREDERICK ERNEST, C.M.G., B.A. (F.E.W.*) Late Prince of Wales's Leinster Regiment. Formerly Secretary, Historical Section, Committee of Imperial Defence. Author of *The Marne Campaign; A History of Poland; Moltke;* etc.
Frontiers, Battles of the (in part); *Guise, Battle of; Marne, Battle of the.*

WHYTE, ADAM GOWANS, B.Sc., A.I.E.E. (A.G.W.) Editor of the Electrical Press Limited. Author of *The Electrical Industry; Electricity in Locomotion; The All-Electric Age.*
Electricity Supply (United Kingdom).

WIER, JEANNE ELIZABETH, B.Bi., B.A. (J.E.W.*) Professor of History and Political Science in the University of Nevada. Executive Secretary of the Nevada Historical Society.
Nevada.

WILBUR, RAY LYMAN, A.M., M.D., LL.D. (R.L.W.) President of Leland Stanford Jr. University, Cal.
Leland Stanford Jr. University.

WILKINSON, NORMAN, O.B.E., R.I. (N.W.) Marine Painter and Etcher. Originator of Dazzle Painting (Naval Camouflage) as used by the Allied Powers in the World War. Author of *The Dardanelles.*
Camouflage (Naval).

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Negro.

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Bilharziosis; Burns and Scalds; Cancer; Fasting; Heart Disease; Immunity; Medicine and Surgery (General Progress); Tetanus; Trench Fever; Yellow Fever.

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Surveying (in part).

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Capitalism; Money Market.

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Housing (in part).

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Canada (Literature, French Canadian).

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Coöperation.

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Camouflage (Military).

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Beatty, Lord; Fisher, Lord; Jellicoe, Lord

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